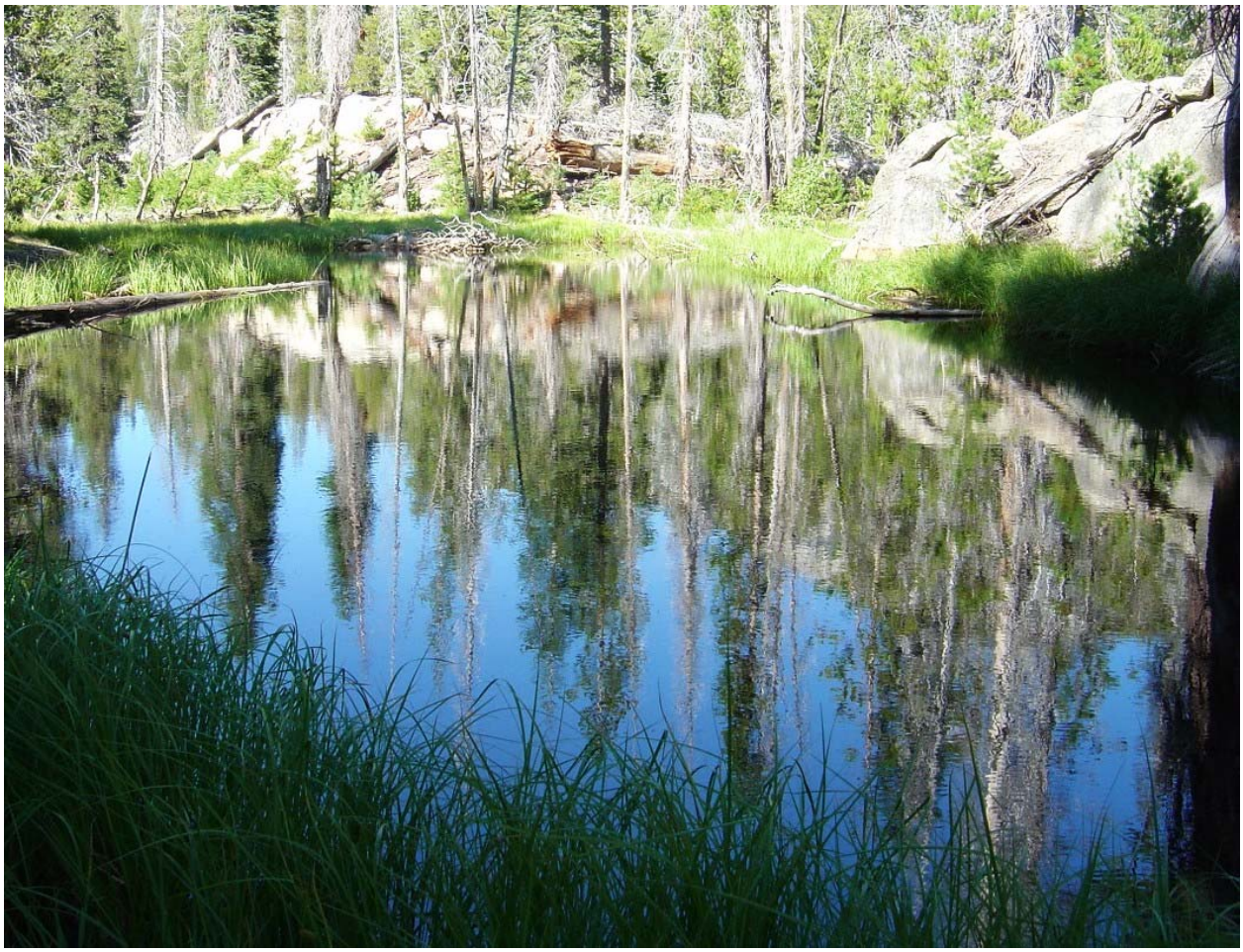
Devils Postpile National Monument
Wetland Inventory and Condition Assessment



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Table of Contents

1.0 Introduction 1

2.0 Study Area: Devils Postpile National Monument 7

3.0 Wetland Mapping and Assessment Methods 11

4.0 Results 23

5.0 Discussion 37

6.0 Conclusions and Recommendations 41

7.0 References 45

Appendix A: Cowardin Classification System 47
Appendix B: California Rapid Assessment Method Classification System 48
Appendix C: List of Field Equipment 49
Appendix D: CRAM 4.2.2 Field Guidelines for Wetland Scoring 50
Appendix E: DEPO 2006 Wetland Delineation and Assessment Data 69
Appendix F: Devils Postpile National Monument Wetland Maps 93
Appendix G: Photographs of Devils Postpile National Monument CRAM Wetlands . . 107

Table 1: Relationship between Wetland Functions and CRAM Attributes 4
Table 2: System for Converting CRAM Letter Scores to Numeric Values 20
Table 3: Number and Size of DEPO Cowardin Wetlands Field Mapped in 2006 23
Table 4: Dominant Plant Species Observed in Cowardin Wetlands at DEPO 25
Table 5: Field-mapped and NWI-mapped Cowardin Wetlands at DEPO 27
Table 6: Number and Size of CRAM Wetlands Assessed at DEPO in 2006 28
Table 7: Relationship of Cowardin Wetland Polygons and CRAM Wetland Polygons . 29
Table 8: CRAM Wetland Condition Scores and Numbers of Stressors 31
Table 9: Summary of CRAM Wetland Condition Scores and Numbers of Stressors . . 31
Table 10: Summary of CRAM Wetland Condition Scores for Individual Attributes 33
Table 11: Summary of Condition of DEPO Wetlands Relative to Desired Condition . . . 35
Table 12: Range of CRAM Scores and Number of Stressors by Condition Class 35

Figure 1: Size Distribution of DEPO Cowardin Wetlands Field Mapped in 2006 23
Figure 2: CRAM Wetland Condition Scores and Number of Stressors Observed 32
Figure 3: CRAM Wetland Condition Scores by Wetland Size 32
Figure 4: CRAM Individual Attribute Scores by Wetland Type 33
Figure 5: Averaged Physical and Biological Structure Scores for DEPO Wetlands 34
Figure 6: Condition of DEPO Wetland Acres Relative to Desired Condition 35

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Executive Summary

Wetlands are keystone ecosystems that provide a unique suite of ecological services. Wetlands can mitigate flood pulses, recharge aquifers, improve water quality, and provide habitat to flora and fauna. Despite this, wetlands are a threatened habitat; landowners in the 19th and 20th century drained and altered wetlands across the West. This degradation has made in-tact wetlands on public lands even more important to maintaining regional ecological integrity. Threats to wetlands inspired mandates that direct federal agencies to protect wetlands, including the National Environmental Policy Act, the Clean Water Act, Executive Order 11990, and National Park Service (NPS) policies. NPS policies also require parks to obtain data regarding the extent, type, and condition of the wetlands in their care.

In 2006 the NPS Water Resources Division provided funds to assist selected small parks in the Pacific West Region with obtaining wetland information. Funding supported a regional wetland biologist to visit a set of ten small parks to field map and classify park wetlands and assess the ecological health - or condition - of these wetlands. This report is one of a set of eight documents, each focused on one or more individual park units, summarizing the effort.

Project staff visited Devils Postpile National Monument (DEPO) in August and September 2006 to field-map and classify park wetlands according to the Cowardin wetland classification system. Project staff compared these field-derived data with earlier Fish and Wildlife Service National Wetland Inventory (NWI) maps drawn from interpretation of aerial photography. Project staff mapped forty-three wetlands at DEPO covering nearly sixty acres; whereas NWI had identified fifty-eight wetlands on approximately thirty-five acres. This project identified six wetland classes while NWI had categorized DEPO wetlands into five classes.

Project staff used the California Rapid Assessment Method for Wetlands and Riparian Areas (CRAM) 4.2.2 to assess the condition of mapped wetlands. In the field project staff evaluated four attributes – landscape context, hydrology, biotic structure, and physical structure – of each park wetland by answering a series of questions based on single-visit observations of each site. Answers to these questions created a score for each wetland, indicating its condition or ecological value. Project staff created a suggested description of desired condition for Monument wetlands and considered each mapped wetland's CRAM score, degree of anthropogenic stress, and other observations to categorize the wetland as in desired condition, good condition, or poor condition relative to the standard. The project concluded that overall 37% of DEPO's wetland acres achieve desired condition, 63% are in good condition, and less than 0.05% are in poor condition. Although Depressional wetlands, by acreage, generally conform to the Monument's ideal (58% in desired condition), the only two DEPO wetlands in poor condition also fall into this wetland class. Most Riverine wetland acres (71%) are in good condition while almost all (99%) of the Monument's Seep/Slope wetland acreage achieves desired condition.

Project staff also noted anthropogenic disturbances in wetlands that may adversely affect wetland health and function. Evidence of fire, passive recreation, and active recreation are the three most common stressors at DEPO. Future actions that resource managers can take to maintain or improve park wetland conditions include: appropriately directing visitor traffic, removing invasive non-native plants, surveying for rare species, and monitoring changes in surface water and wetland extent.

1.0 Introduction

1.1 Importance of Wetlands

Wetlands are keystone ecosystems: an estimated 46% of US endangered and threatened species and 50% of all bird species require wetland habitat (USFWS 2006). Some ecologists call wetlands biological supermarkets because they support complex food webs. Wetlands are also called kidneys of the land because they regulate the quantity and quality of water moving through a landscape (Mitsch and Gosselink 2002).

Ecological services provided by wetlands are commonly referred to as wetland functions. The US Environmental Protection Agency (USEPA 2006) identifies some critical wetland functions as:

- Fish and wildlife habitat
- Natural water quality improvement
- Flood storage
- Shoreline erosion protection
- Opportunities for recreation and aesthetic appreciation
- Natural products

The EPA also concludes that:

> Wetlands are among the most productive ecosystems in the world, comparable to rain forests and coral reefs. They also are a source of substantial biodiversity in supporting numerous species from all of the major groups of organisms – from microbes to mammals. (USEPA 2006)

Wetland function can be degraded by human activities. For example, throughout much of the Western United States wetlands have been drained to create grazing or agricultural lands. These actions reduce the land's ability to support wildlife, provide water quality benefits, and store floodwaters. By some estimates 90% of Western wetlands have been converted to upland habitat (Dahl 1990). Even where wetlands persist in the West these are often so altered as to shift wetland type, with consequent changes in ecological functions provided by those wetlands.

Because most of the wetlands in the West now have diminished function relative to their pre-nineteenth century conditions, those protected in National Parks have increased ecological significance. Wetlands found in National Parks often provide critical habitat for wetland species, provide feeding habitat on migratory flyways, and export invertebrate-fattened fish to streams, lakes, and nearshore marine ecosystems. In addition, park wetlands provide flood storage, water quality improvement, and groundwater recharge functions for park-adjacent human communities; these ecological services may be unavailable where nearby park wetlands are degraded.

1.2 National Park Service Wetlands Policy

Because of the high value of these habitats, directives requiring protection of National Park Service (NPS) wetland resources are found in the NPS Organic Act, the National Environmental Policy Act, the federal Clean Water Act, the federal Rivers and Harbors Appropriation Act, presidential Executive Order 11990, NPS Director's Order #77-1 (NPS 2002), and the NPS Management Policies (NPS 2006). Species protection laws, such as federal and state Endangered Species Acts, often compel the NPS to prevent degradation of wetland habitat.

For example, the 2006 NPS Management Policies Section 4.6.5 states that:

> The Service will (1) provide leadership and take action to prevent the destruction, loss, or degradation of wetlands; (2) preserve and enhance the natural and beneficial values of wetlands; and (3) avoid direct and indirect support of new construction in wetlands unless there are no practicable alternatives and the proposed action includes all practicable measures to minimize harm to wetlands.
>
> The Service will implement a "no net loss of wetlands" policy. In addition, the Service will strive to achieve a longer-term goal of net gain of wetlands across the national park system through restoration of previously degraded or destroyed wetlands. When natural wetland characteristics or functions have been degraded or lost due to previous or ongoing human actions, the Service will, to the extent practicable, restore them to pre-disturbance conditions.
>
> *The Service will conduct or obtain parkwide wetland inventories to help ensure proper planning with respect to the management and protection of wetland resources.* Additional, more detailed wetland inventories will be conducted in areas that are proposed for development or are otherwise susceptible to degradation or loss due to human activities.
>
> When practicable, the Service will not simply protect but will seek to enhance natural wetland values by using them for educational, recreational, scientific, and similar purposes that do not disrupt natural wetland functions. For proposed new development or other new activities, plans, or programs that are either located in or otherwise could have adverse impacts on wetlands, the Service will employ the following sequence:
>
> - Avoid adverse wetland impacts to the extent practicable.
> - Minimize impacts that cannot be avoided.
> - Compensate for remaining unavoidable adverse wetland impacts by restoring wetlands that have been previously destroyed or degraded.
>
> (NPS 2006; emphasis added)

1.3 Pacific West Region Wetlands Mapping and Assessment Project

Smaller parks can have difficulty complying with mandates to obtain and report information about wetlands. Resource managers in these parks often recognize the deficiencies in their knowledge base but lack the resources to acquire information about the extent, distribution, classification and condition of the wetlands in their care. Consequently, numerous managers seek funding for individual park-specific wetlands assessments. This park-by-park approach presents multiple problems including:

- Dissimilar wetland inventory efforts conducted at local scales cannot be aggregated to regional and national scales, *and*

- When projects obtain funding one at a time, staff training and protocol development for each project results in duplication of effort.

In Fiscal Year 2006 the NPS Water Resources Division and the Pacific West Region embarked on a program to pool wetland mapping efforts for ten smaller parks within the Pacific West Region. Parks included in the program are:

- Big Hole National Battlefield
- Devils Postpile National Monument
- Hagerman Fossil Beds National Monument
- John Day Fossil Beds National Monument
- Kaloko-Honokohau National Historical Park
- Lewis and Clark National Historical Park
- Oregon Caves National Monument
- Pinnacles National Monument
- Pu'uhonua o Honaunau National Historical Park
- Pu'ukohola Heiau National Historic Site

Project staff chose these parks for inclusion in the inventory based on a set of inquiries from Pacific West Regional staff to in-park managers. These inquiries first focused on small parks in the region and then selected parks based on managers' need for and interest in wetlands maps, and parks' abilities to provide support for project staff such as assistance from local resource specialists and housing for project staff.

The program field-mapped and classified all wetlands in each park, or within a designated portion of each park, and reported on the condition of the mapped wetlands. The resulting datasets can be used by parks to better understand and convey information about park wetland functions and the number, size, type, and condition of park wetlands, and for the purpose of improving management of NPS natural resources. Although the program focused on providing new park-specific information to park managers, project staff also sought to understand the value of older wetlands datasets - often based on photo-interpretation of aerial imagery - in comparison with project field surveys.

Maps in this report are not formal US Army Corps of Engineers wetland delineations. When parks propose projects that have potential to degrade wetland resources they must acquire site-specific wetland delineations that meet the requirements of the federal Clean Water Act and NPS Procedural Manual for Wetlands (NPS 2008).

Field work for this program draws heavily on two documents. The first of these, the NPS Procedural Manual for Wetlands (NPS 2008), provides guidelines for mapping and classifying park wetlands. The NPS updated this document in 2008; however the mapping and classification standards remained consistent with previous versions. The second protocol, the California Rapid Assessment Method for Wetlands and Riparian Areas (CRAM) 4.2.2 (Collins *et al.* 2006), supplies tools to evaluate the condition or ecological value of park wetlands.

CRAM is an office-and-field protocol that asks an observer a series of questions to characterize the condition of four universal wetland attributes: landscape context, hydrology, biotic structure, and physical structure. For each of these attributes CRAM asks field observers to evaluate several sub-components – or metrics – which, considered together, indicate the condition of the attribute. Observers assign a letter grade to each metric by choosing from a set of three to four narrative descriptions of an increasingly structurally-complex, highly organized, and/or ecologically intact state of that wetland characteristic. Observers later combine the metrics grades to produce a single score for each of the four attributes for each wetland. Attribute scores are then combined to create a CRAM score for each wetland. These scores are expected to have a positive correlation with wetland integrity, value, and function (Table 1).

Table 1. Relationship between Wetland Functions and CRAM Attributes (adapted from Collins *et al.* 2006)

	Wetland Functions					
Wetland Attributes	Recharge ground-water	Filter water	Maintain plant and animal habitat	Cycle nutrients	Mitigate flood pulses	Export organic carbon
Buffer and Landscape	✓	✓	✓	✓	✓	
Hydrology	✓	✓	✓	✓	✓	✓
Physical Structure		✓	✓	✓	✓	
Biotic Structure		✓	✓	✓	✓	✓

For each target park project staff:

- Compiled previously-documented information on wetlands in the targeted parks. Sources of information included aerial photographs, US Fish and Wildlife Service National Wetlands Inventory maps, vegetation maps, US Geological Survey topographic maps, soils maps, park management documents, and previous studies.

- Created a map of all wetlands within the park boundary or, for larger parks, within a park-identified subset of the entire park. This inventory identified all wetlands greater than the minimum mapping unit of 0.1 acre and classified these wetlands according to the Cowardin classification for wetlands (Cowardin *et al.* 1979).

- Compared wetland maps created through this project with older wetland maps created from aerial imagery at coarser resolutions and remote sensing data in order to better understand errors of omission, commission, and misclassification.

- With local managers, described a desired condition for park wetlands, and evaluated the condition of park wetlands against that standard – classifying each park wetland as in desired condition, good condition, or poor condition.

- Provided opportunities to park staff to learn about wetland mapping, classification, and assessment methods.

- Recommended future actions to help the park protect wetland resources.

The program was overseen by Pacific West Region Aquatic Ecologist Marie Denn and NPS Water Resources Division Wetland Program Lead Joel Wagner. Wetland Ecologist Donna Shorrock conducted park and project coordination and completed in-park fieldwork, data recording, and map production. The two-year project was funded by the NPS Water Resources Division.

2.0 Study Area: Devils Postpile National Monument

2.1 General Park Description

Devils Postpile National Monument (DEPO) protects 798 acres along the Middle Fork of the San Joaquin River on the west slope of the Sierra Nevada in Madera County, California. The Monument sits thirteen miles west of the mountain resort town of Mammoth Lakes. The trapezoid-shaped boundary – approximately ½-mile (0.8 kilometers) wide by 2.5 miles (4.1 kilometers) long – is surrounded entirely by the Inyo National Forest. The Monument falls within the lower Sierran subalpine zone, and ranges in elevation from about 7,200 feet (2,200 meters) above sea level at the southern end of the Monument to about 8,200 feet (2,500 meters) on surrounding peaks.

The Monument's landscapes are dominated by steep slopes covered with lodgepole pine (*Pinus contorta*) forests mixed with meadows and montane chaparral. Jeffrey pine (*Pinus jeffreyi*), Western white pine (*Pinus monticola*), mountain juniper (*Juniperus occidentalis* var. *australis*), and quaking aspen (*Populus tremuloides*) are locally common. Precipitation recorded in Mammoth Lakes since 1993 averages 211 inches (537 centimeters) total snowfall and 23 inches (60 centimeters) total rainfall. Average annual low and high temperatures for this same time period ranged from 29˚F (-2˚C) to 57˚F (14˚C). Extreme temperatures reached -12˚F (-24˚C) and 91˚F (33˚C).

2.2 Park Significance

President Howard Taft created the Monument in 1911 to conserve a basalt columnar formation known as the Devils Postpile and the 100-foot cascade of Rainbow Falls on the Middle Fork of the San Joaquin River. The Devils Postpile formation displays unusual symmetry and ranks as one of the world's finest examples of columnar-jointed basalt. Its 60-foot columns are the remnants of lava that flowed down the valley of the San Joaquin River less than 100,000 years ago. About 20,000 years ago a glacier carved away a portion of the fractured lava mass and exposed a tower of columns resembling a giant pipe organ (NPS 2007).

2.3 Administrative History

The lands now encompassed by the Monument first came under federal protection as a part of Yosemite National Park at the time of that park's establishment in 1890. At that time Yosemite was administered by the US War Department. In 1905 Congress redrew Yosemite's boundaries to exclude five hundred square miles of the Park, including those lands that now comprise DEPO, and placed these lands under jurisdiction of the US Forest Service. Five years later in 1910, in response to plans for a dam on the San Joaquin River that would have inundated the Postpile, conservation groups and individuals including John Muir began a campaign to better protect the Devils Postpile formation. They petitioned the President and the Secretaries of Agriculture and Interior to preserve the Postpile as a national monument. President Howard Taft created Devils Postpile National Monument on July 6, 1911 under the authority of the 1906 Antiquities Act.

Early national monuments such as DEPO, designated before the creation of the NPS in 1916, came under the jurisdiction of a variety of federal and local agencies. The US

Forest Service initially administered DEPO, although the Monument was little visited due to lack of an access road. In 1933 the National Park Service assumed administration of the Monument and assigned its management to Yosemite National Park. Yosemite provided a summer ranger for the Monument annually until World War II when funding and staff shortages caused the NPS to return management to the more-local Inyo National Forest. In 1952 the NPS resumed management of the Monument (Hartesveldt 1952).

2.4 Watersheds and Water Resources

Devils Postpile National Monument sits on the west slope of the Sierra Nevada mountain range and receives precipitation from the Pacific winter storms which provide most of the state's water. The Monument is bisected along its length by the middle fork of the San Joaquin River. The San Joaquin, one of the great arteries of the state, is strongly seasonal due to the high influence of the annual snowpack. The river yields most of its discharge (58%) in spring and summer months (May through July), almost one-third of its discharge in winter to spring months (February through April), and very little of its flow in early winter (November through January) and late summer (August through October) (9% and 6% respectively) (SNEP 1996). The river has a rocky and sandy bottom within the park, depending on the gradient, and supports lotic habitats ranging from calm, deep trout-bearing pools to stunning cascades. River-side vegetation includes herbaceous perennials in low-gradient stretches and patchy alder stands clinging to rocks along the cascades.

The river feeds the high groundwater table on its floodplain, supporting the Monument's expanses of Palustrine (freshwater marsh) Emergent and Palustrine Scrub-shrub wetland habitat. The Palustrine Emergent wetland habitats exhibit high net productivity and high species diversity and provide important physical and chemical functions such as nutrient uptake, sediment trapping, and habitat for wildlife (NPS 2007). Researchers at DEPO have found that these wet meadows support the highest diversity of terrestrial invertebrates per unit area recorded in the Sierra (Holmquist 2006). The Palustrine Scrub-shrub wetlands interlaced with the wet meadows on the floodplains provide habitat structure and forage for migratory birds, local mammals, and invertebrates. At DEPO the stressors of greatest concern to river and floodplain habitats are climate change, altered fire regimes, air pollution (*i.e.* nitrogen and pesticide deposition), and local impacts from visitor use and park operations (NPS 2007).

Away from the river, on the pumice-soil hill slopes, small spring fed Depressional and Seep wetlands support islands of hydrophytic flora scattered on the xeric slopes; these wetland vegetation communities and the persistent high ground and surface water provide forage, cover, and moisture for resident fauna and migratory animals traveling between upland habitats.

The Sierra Nevada Ecosystem Project (SNEP) Report to Congress (SNEP 1996) describes aquatic and riparian ecosystems as the most altered and impaired habitats in the Sierra Nevada. Although SNEP estimates that 17% of Sierran plant species, 21 vertebrate species, and all aquatic invertebrate species are dependent on wet systems, 67 types of aquatic habitat categorized by SNEP are declining in quality and abundance; many are at risk of disappearing completely. Degradation of aquatic systems can be traced to excessive sedimentation (due to watershed logging and grazing); increases in impervious surfaces including roads; vegetation and geomorphic changes due to historic

and present grazing; and water quality degradation due to historic mining. SNEP predicts that small aquatic habitats (*e.g.,* springs, intermittent streams) are more vulnerable to degradation from local land use than larger water bodies (*e.g.,* larger lakes and perennial rivers).

The Monument's watershed lands still display ample evidence of the 1992 Rainbow Fire, which burned approximately 655 acres of the Monument's 798 acres with varying degrees of severity (Caprio *et al.* 2006). Continuing effects include charred standing snags, a high density of large woody debris, lack of a well developed organic soil layer on slopes, and a more open conifer canopy than would otherwise be expected. All of these factors are most evident in areas which burned with high severity.

2.5 Relevant Datasets

Devils Postpile National Monument has a wealth of topographic and natural history information relevant to wetland inventory and assessment. Base maps for the Monument include US Geologic Survey Mammoth Mountain and Crystal Craig 1:24,000 topographic maps with 40-foot contour lines (USGS 1992a and 1992b) and the US Department of Agriculture one-meter resolution compressed county mosaic National Agriculture Imagery Program (NAIP) natural color aerial photographs of the Monument (USDA 2005). US Fish and Wildlife National Wetland Inventory maps (USFWS 2006) and US Department of Agriculture Natural Resources Conservation Service soil maps (USDA 1995) provide baseline information for identifying potential wetland locations. The Monument's vascular plant inventory (Arnett and Haultain 2005) is invaluable for assessing wetland plant communities. The National Park Service Water Resources Division Horizon Report (NPS 1998) for the Monument provides information about the Monument's surface water quality and quantity.

3.0 Wetland Mapping and Assessment Methods

3.1 Protocol Overview

This project sought to inventory Devils Postpile National Monument wetlands and to assess the ecological condition of those wetlands. In addition this project suggests a definition for desired condition for DEPO wetlands and compared all assessed wetlands against that standard. Finally, the project compared field-derived wetlands inventory results with National Wetland Inventory datasets.

3.1.1 Wetland Inventory

Project staff mapped wetlands in the Monument using the US Army Corps of Engineers mapping protocol (Environmental Laboratories 1987), which is the standard for wetland delineations under Section 404 of the Clean Water Act. The Corps protocol considers a site a wetland when three field characteristics are present: wetland hydrology, hydrophytic vegetation, and hydric soil.

However, the NPS has also adopted the US Fish and Wildlife Service wetland *classification* system (Cowardin *et al.* 1979) that includes some ecological systems which exhibit wetland hydrology but lack either hydric soil or hydrophytic vegetation due to natural physical or chemical characteristics such as wave action, swift current, or high salinity. Although these areas do not meet the Corps three-parameter requirements for wetlands (the Corps regulates many of these one- or two-parameter systems not as wetlands but as Waters of the United States), this project mapped these areas as wetlands because they provide wetland ecological functions. Examples of these systems include unvegetated stream shallows, and vegetated rocky shorelines.

Project staff classified all mapped wetlands according to the Cowardin classification system (see Appendix A), which categorizes wetlands based on their geomorphic, hydrologic, and vegetation characteristics. This mapping and classification protocol is consistent with NPS Procedural Manual #77-1 (NPS 2008), the National Park Service guidance for wetlands.

Because this project adopted the Cowardin classification system, its wetland maps are conceptually compatible with the US Fish and Wildlife National Wetland Inventory (NWI) maps. However, NWI maps are derived primarily from interpretation of aerial photographs. The goal of the NWI program differed from the goal of this project. NWI's goals are:

> . . . not to map all wetlands and deepwater habitats of the United States, but rather to use aerial photo-interpretation techniques to produce thematic maps that show, in most cases, the larger ones and types that can be identified by such techniques. The objective was to provide better geospatial information on wetlands than found on the U.S. Geological Survey topographic maps. It was not the intent of the NWI to produce maps that show exact wetland boundaries comparable to boundaries derived from ground surveys. Boundaries are therefore generalized in most cases. Consequently, the quality of the wetland data is variable mainly due to source photography, ease or difficulty of interpreting

> specific wetland types, and survey methods (*e.g.*, level of field effort and state-of-the-art of wetland delineation). (USFWS 2006)

Maps derived from on-the-ground surveys can be more accurate and precise than NWI maps. The mapping accuracy goal for this project is a wetland boundary accurate within a 6-foot (1.8-meter) band, roughly corresponding to the width of the thinnest blue line on a US Geological Survey 1:24,000 topographic map. NWI maps may have similar precision for some wetland polygons where sharp wetland boundaries are visible on aerial photographs. However, most wetland margins exhibit a gradual transition from wetland to upland; therefore, maps created from interpretation of aerial photography can be imprecise. Furthermore, NWI maps can overlook wetlands (errors of omission), particularly those under tree cover, misclassify wetlands, and map areas as wetland that are in fact upland habitat (errors of commission). The error rates of misclassification and commission for this field-based project are assumed to be low-to-none, although that assumption is untested. The omission error is unknown.

The project's field mapping technique is not wholly consistent with Corps three-parameter delineation method; therefore, maps created for this project are not by themselves sufficient for compliance with section 404 of the Clean Water Act. Furthermore, this project's inventory includes wetlands that may be considered non-jurisdictional (*i.e.,* not subject to the Clean Water Act) under a 2001 US Supreme Court decision that removed isolated wetlands from federal jurisdiction and the 2006 court decisions for the Rapanos *v*. United States and Carbell *v*. United States legal proceedings that excluded many headwater streams and wetlands. This project's intention is to inventory all park wetlands that are described by the Cowardin classification system, regardless of their nexus to navigable waters and whether they were created naturally or artificially (*i.e.,* whether or not these wetlands are jurisdictional under the Clean Water Act). While this inventory provides a tool for use in park facility planning (*e.g.,* avoiding wetland impacts), for conducting wetland condition assessments, and for wetland resource management, proposed actions that would have adverse impacts on wetlands may require more precise wetland delineation work to fully satisfy wetland compliance requirements of Section 404 of the Clean Water Act and NPS Director's Order 77-1.

The default minimum mapping unit for the project is 0.1 acre (405 square meters). Field staff did not map isolated wetlands smaller than 0.1 acre unless they observed ecological reasons to include these units in the inventory, such as high habitat value. Similarly, when field staff observed small (less than 0.1 acre) patches of a wetland type within a larger wetland of a different type (*e.g.,* a small patch of Palustrine Scrub-shrub wetland within a larger unit of Palustrine Emergent wetland) observers did not map these as separate units and instead incorporated their acreage into the larger polygon. The result of the inventory effort is a map of all wetlands greater than 0.1 acre delineated and classified by field staff into Cowardin wetland types.

3.1.2 Wetland Condition Assessment

The inventory described above does not include any assessment of wetland condition or health. Ecologists may conceptually agree that some wetlands have higher ecological integrity and complexity than others, and may be able to come to agreement on the relative health of a wetland based on a rapid site visit. However, ecologists do not have a common definition or measuring tool to quantify this concept even within a specific habitat type, such as wetlands (Young and Sanzone 2002). Furthermore, the very language is poorly defined: many ecologists use the term natural resource condition synonymously with resource health, integrity, and quality (Adamus and Bartlett 2008), while other ecologists specify different habitat qualities with each of these terms. The National Park Service often compares the health or condition of natural resources against a set of criteria for desired condition, which may include ecological measures combined with management goals (Eckert 2008).

Frequently projects that intend to improve or restore wetland conditions at a site conduct intensive quantitative monitoring of plant species or communities, faunal species or communities, and physical parameters, in order to document post-project change. However, these quantitative approaches are generally not feasible for landscape-scale assessments. Qualitative or semi-quantitative methodologies allow ecologists to document their rapid observations and professional judgments of habitat health by separating out, for separate assessment, visible components of a wetland which indicate its health – such as hydrologic regime, vegetation community nativity, structural complexity, and anthropogenic disturbance. These rapid-assessment methodologies generally ask observers a set of structured questions about the observable characteristics of the habitat, and then summarize the observations to a condition score or judgment.

The *inventory* portion of this project mapped and described individual wetland polygons based on hydrology, landscape position, and vegetation structure under the Cowardin system as is advocated by NPS policy. For example, the project mapped wetlands dominated by short herbaceous vegetation on the San Joaquin floodplain – Cowardin Palustrine Emergent – separately from adjacent areas dominated by shrubby stands of willow – Cowardin Palustrine Scrub-shrub (see Appendix A for the Cowardin classification scheme). However, for the *condition assessment* portion of this project, field staff lumped together wetlands based on their hydrogeomorphology only. For the floodplain example given above – instead of assessing several polygons mapped by hydrology, landscape position, *and* vegetation – this project combined these units into one Riverine polygon for wetland condition assessment (see Appendix B for this coarser-level classification scheme). This application of a coarse mapping scale for assessment purposes reflects that wetland condition and function attributes emerge at a broader scale than that of the individual vegetation stand.

3.1.2.1 California Rapid Assessment Method General Description

In order to assess the condition of wetlands at DEPO project staff applied a recently-developed rapid assessment protocol, the California Rapid Assessment Method (CRAM) for Wetlands and Riparian Areas (Collins *et al.* 2006). Two California entities, the San Francisco Estuary Institute and Southern California Coastal Water Research Project, developed the protocol with funding from the US Environmental Protection Agency. The authors intend CRAM to be a defensible and repeatable method able to perform in

wetlands in a variety of habitats across California. CRAM may also be a useful tool for evaluating wetlands in other Western states.

CRAM developers conducted a review of the protocol to assess the performance of CRAM in diverse habitats and to test its susceptibility to observer bias and time-of-year sensitivity. This review also evaluated the distribution of the data derived from use of the protocol, asking questions such as: are the data normally distributed? are they skewed high or low? Based on this review CRAM developers revised the protocol to create a method that is more resistant to observer bias and is generally applicable to a broad range of wetland types (Clark *et al.* 2006). However, the developers caution that CRAM awards higher scores to wetlands with naturally-high vegetative and physical complexity; wetlands with little topographic variation and relatively few plant species receive low CRAM scores even if these factors are natural and not due to anthropogenic stress.

Developers intend CRAM to assess wetlands within a great range of anthropogenic influence – including remnant wetlands in urban landscapes, created or restored mitigation wetlands, and wetlands in natural settings. Consequently, the CRAM condition assessment score may not reflect subtle but critical differences between wetlands with generally high integrity, such as many of the wetlands in National Park Service units. This limitation may impair CRAM's utility as a tool for targeting park wetlands for restoration or for monitoring wetland health over time. In order to differentiate subtle differences between wetlands – but retain the ability to compare CRAM scores of NPS- and non-NPS wetlands – this project added additional intermediary scores to the grading scale.

CRAM scores for a wetland can range from 25 (poor condition) to 100 (excellent condition). The scoring system is described below in section 3.2.2.4.

3.1.2.2 California Rapid Assessment Method Protocol

The CRAM classification system disregards some of the more detailed classification layers found in Cowardin, and places wetlands into broad categories based on water source and landscape position (*i.e.*, hydrogeomorphology) (see Appendix B). For this project, field staff first mapped the wetland boundary and assigned the polygon to a detailed-level Cowardin class based on vegetation and substrate type. Then field staff reclassified mapped wetlands into the more broadly-classed CRAM wetlands – such as Depressional, Riverine, or Seep/Slope – for the CRAM condition assessment.

CRAM requires field observers to define an area within each wetland that will be assessed with the CRAM protocol. For small wetlands, this Assessment Area (AA) may simply be the entire CRAM wetland. For larger wetland polygons for which field observers cannot rapidly assess the entire system, CRAM requires observers to select a portion of the wetland to represent the entire habitat. This AA should be large enough to encompass much of the variability and diversity of the entire wetland or wetland complex, include wetland areas impacted similarly by hydrologic controls or general water and/or soil condition, and be small enough that observers can assess its condition in two to four hours (see Collins *et al.* 2006 Section 3.5 for further description of selecting the AA).

After determining a wetland's CRAM type and defining the Assessment Area, field staff conducted the assessment by evaluating the protocol's set of observable metrics

indicating wetland condition. These metrics are conceptually grouped into four wetland attributes:

- Buffer and Landscape Context,
- Hydrology,
- Physical Structure, *and*
- Biotic Structure.

While these four attributes are the same for all wetlands, metrics vary with wetland type; the protocol addresses a different set observable metrics for each CRAM wetland type.

Observers noted any visible anthropogenic influences or stressors in the Assessment Area and adjacent lands. Finally, to complement the assessment project staff documented representative conditions of each Cowardin wetland with a digital five-megapixel camera (see Appendix G).

3.1.3 Desired Condition for Wetlands

The National Park Service Director's Order for wetlands (NPS 77-1) directs NPS managers to allow no net loss of wetlands on park lands. In addition, the Department of Interior Strategic Plan asks parks to maintain wetlands in – or restore wetlands to – desired condition. The Strategic Plan does not provide specific criteria for defining desired condition but allows parks to create individually tailored criteria.

In order to characterize individual DEPO wetlands as in desired condition, good condition, or poor condition project staff created a suggested definition of desired condition for wetlands. Wetlands at DEPO are in desired condition if they meet the following criteria:

> Wetlands in desired condition overwhelmingly exhibit natural hydrology, unaltered physical structure, and a native vegetation community. They are surrounded on all sides by wetland or upland habitats with high ecological integrity. Few signs of intensive human activity are visible within or adjacent to these wetlands.

Managers and wetland scientists place particular value on wetlands with high degree of native biodiversity, both floral and faunal, but recognize that some wetlands with poor native biodiversity may also meet the criteria for desired condition - evidently natural condition - given above.

3.2 Description of Work

3.2.1 Pre-field Work

In the months leading up to the field assessment, the project field biologist worked with local managers to determine the best time for fieldwork. CRAM suggests that fieldwork be conducted during the growing season, ideally when wetland plants are flowering but not during high water (Collins *et al.* 2006). For this project field staff also considered park staff and housing availability when choosing dates for the surveys.

After arriving at the Monument but before initiating fieldwork the field staff conducted reviews of existing information regarding DEPO wetlands. Monument and project staff reviewed maps, aerial and satellite imagery, written reports, and management documents. Project staff compiled data particularly applicable for wetland inventories including US Geological Survey 7.5-minute topographic maps (USGS 1992a and 1992b), previous vegetation studies (*e.g.,* Arnett and Haultain 2005), Natural Resource Conservation Service soil maps (USDA 1995), National Wetland Inventory maps (USFWS 2006), and one-meter resolution National Agriculture Imagery Program (NAIP) aerial photographs (USDA 2005).

Project staff interviewed Monument managers in order to tailor the mapping and assessment project to DEPO's management needs. Project also staff consulted Monument rangers to identify access routes to potential wetlands. In addition, Monument employees provided observations regarding inter-annual variability in precipitation, temperature, plant phenology, and duration and frequency of flooding. Monument employees also assisted the field staff with determining a systematic and efficient way to approach surveying with consideration of personnel safety, plant phenology, and access to potential wetland sites.

3.2.2 Field Tasks

Although field tasks for inventory, classification, and condition assessment are described separately below field observers collected data for these three efforts simultaneously. See Appendix C for a list of field equipment.

3.2.2.1 General Data Collection Methodology

The CRAM protocol recommends a two-person team for field data collection. Project staff enlisted field assistance from Monument employees knowledgeable about local wetland plants and hydrology. Surveying with multiple people increases assessment efficiency, expands the team's knowledge base, reduces observer bias, and improves safety. In addition, collaboration between project and park staff enabled an exchange of information: project staff acquainted park members with potential methodology for future wetlands monitoring while park staff provided project staff with site-intensive natural and cultural resource knowledge about the area.

3.2.2.2 Wetland Delineation

Project staff visited all sites in the Monument that appeared to support wetland habitat based on conversations with employees and/or review of written materials. A few of these sites did not support wetlands. At the sites that did, project staff first walked around the site to observe all wetland habitat and assess the structural and biotic patchiness. In addition, during this initial walk-around field staff confirmed that the identified wetlands exhibited wetland hydrology and also hydrophytic vegetation and/or hydric soils.

If a site demonstrated wetland hydrology, as evidenced by field indicators defined by the US Army Corps of Engineers (Corps) wetland delineation manual (Environmental Laboratory 1987), project staff evaluated its vegetation and/or soil properties. To establish predominance of hydrophytic vegetation, project staff listed all dominant plant species in the potential wetland area according to the Corps 50/20 rule. All dominant species within the potential wetland are listed and described with respect to relative cover up to 50% of the total relative cover for the wetland, and then any additional dominant species (above the 50% threshold) with 20% or greater relative cover by themselves are also listed. Project staff evaluated the wetland status of these dominant plants by consulting a regional wetland plant listing (Reed 1988). As per the Corps wetland delineation manual any plant listed as facultative, facultative wetland, or obligate is classified as a hydrophyte. Any site dominated by hydrophytic vegetation and exhibiting wetland hydrology meets the project's wetland status criteria. Where wetland vegetation dominance was not definitive, project staff examined soils, looking for hydric indicators as outlined in the Corps delineation manual.

For each wetland, project staff recorded the season of the assessment, possible water sources for the wetland or wetland complex, any hydrologic alterations observed, geographic coordinates, vegetation cover metrics, the number of nonnative plant species, and whether or not the site was saturated for more than seven consecutive days in a given calendar year (based on pre-fieldwork assessments and observers' best judgment).

Project staff then mapped (drew) boundaries around wetlands greater than 0.1 acres in size on color printouts of high-resolution National Agriculture Imagery Program (NAIP) aerial photographs (USDA 2005). Later project staff input the hand-mapped wetland polygons into ArcGIS 9.1 via heads-up digitization.

3.2.2.3 Classification and Nomenclature of Park Wetlands

After locating and mapping the boundary of each wetland unit greater that 0.1 acre in extent project staff classified and mapped each wetland polygon by the Cowardin classification scheme (Appendix A). Then project staff reclassified and remapped each wetland complex according to the CRAM classification scheme (Appendix B), which is coarser than the Cowardin system. This double-classification was necessary to meet project goals of providing both a) NPS standard Cowardin-classified wetland maps, and b) CRAM-based wetland condition assessments.

3.2.2.3.1 Nomenclature for CRAM Wetland Polygons

After mapping the boundaries of a CRAM wetland polygon project staff assigned the polygon a unique code. CRAM wetland polygons often incorporate more than one Cowardin wetland, because CRAM does not distinguish separate units based on vegetation type.

CRAM polygon codes consist of:

- A CRAM wetland class (*e.g.*, R: Riverine, L: Lacustrine, SS: Seep/Slope), *and*
- A number applied sequentially indicating how many wetlands of this type have been assessed in the Monument.

For example, R04 represents the 4th mapped CRAM Riverine wetland at DEPO. Occasionally, the data sets skip numbers in the sequence. This occurred when project staff originally mapped an area as two separate wetlands, then determined on further investigation that, because two adjacent wetlands polygons fell into the same class, they should be combined as one mapping unit.

3.2.2.3.2 Nomenclature for Cowardin Wetland Polygons

After assigning a CRAM code to a wetland polygon, project staff then assigned unique codes to all the Cowardin wetland polygons identified within the CRAM polygon. Cowardin codes for this project begin with identification of the parent CRAM polygon (*e.g.,* R04) and then identify the Cowardin characteristics of the wetland: landscape position, water source, and dominant vegetation community.

Cowardin polygon codes consist of:

- Three to four characters representing the parent CRAM polygon (*e.g.,* R04),
- A one or two-letter code representing the Cowardin system (*e.g.*, P: Palustrine; L: Lacustrine, R: Riverine)
- A two-letter code representing the Cowardin class (*e.g.*, FO: Forested wetland; EM: Emergent wetland), *and*
- A number indicating how many wetlands of this type have been assessed in the Monument.

For example, R04-PEM01 represents the first Palustrine Emergent wetland polygon mapped within the larger CRAM Riverine wetland polygon named R04. Each CRAM wetland polygon may include one or more Cowardin polygons. As with the CRAM-classified polygons, occasionally, these data sets skip numbers in the sequence due to boundary adjustments based on field characteristics.

A polygon mapped as a CRAM wetland type (*e.g.,* Riverine, Depressional, Seep/Slope) may have been remapped under a different Cowardin landscape position and water source. For example, a unit classified as Riverine under CRAM may be classified as Palustrine under the Cowardin system. See Collins *et al.* 2006 and Cowardin *et al.* 1979 for complete descriptions of classification criteria for each system.

3.2.2.4 California Rapid Assessment Method Condition Assessment

During the initial site walk-through described in section 3.2.2.2 above project staff gathered information needed to conduct the CRAM assessment. This information includes dominant plants present, vegetation community structural complexity, topographic complexity of the site, and visible anthropogenic stressors. Also, during the initial walk-through project staff designated an Assessment Area, as required by the CRAM protocol. Wetlands evaluated at DEPO during the 2006 field season were small enough that each entire wetland was identified as the Assessment Area.

Project staff then consulted the CRAM 4.2.2 manual's list of metrics to be scored for the type of CRAM wetland being evaluated (*i.e.*, Riverine, Depressional, or Seep/Slope). Project staff used the CRAM's Field Guidelines Scoring Wetland Metrics (see Appendix D) to assign each metric a letter grade (A, B, C, or D) to indicate the wetland's condition with respect to that metric. For example, for a CRAM Riverine wetland, CRAM asks the observer to rate the condition of "Structural Patch Richness." The observer assigns a grade of A if more than twelve of the possible patch types - topographic and biotic structures identified in the User's Manual - are evident in the Assessment Area, a grade of B if nine to eleven of the possible patch types are evident, a score of C if six to eight of the possible patch types are evident, and a score of D if fewer than five of the possible patch types are evident.

Some CRAM metrics have complex scoring criteria, asking the observer to consider several factors in order to assign a score. For example, for the metric "buffer condition" a wetland with "abundant native vegetation and little to no cover of non-native plants, with intact soils, and little or no trash or refuse" scores an A; while a wetland with all of these factors somewhat degraded scores a B. Often sites exhibited degradation of some but not all of the characteristics listed. In these instances, project staff assigned an intermediary grade, such as A-, to more accurately represent the condition of the wetland.

After assigning the wetland a letter grade for all CRAM metrics, project staff recorded the presence or absence of anthropogenic stressors based on CRAM's stressor checklist.

CRAM field data, both tabular and spatial data, can be electronically collected, stored and transmitted using CRAM software on a tablet or laptop in the field. These data can then be directly uploaded to the CRAM website, for permanent storage and comparison with other CRAM-assessed wetlands. Alternately, the CRAM website accepts manual entry of data originally collected on paper field forms and maps. However, this project did not make use of the CRAM software or website; instead, project staff recorded data on paper data sheets in the field then later entered tabular data into a Microsoft Access database.

3.2.3 Post-fieldwork Tasks

When possible project staff entered all tabular data into the project Microsoft Access database and digitized all spatial data in ArcGIS 9.1 daily. This created a backup to the paper field datasheets, prevented a backlog of work, and provided an opportunity to correct any errors or omissions with an additional site visit.

Project staff converted the CRAM alphabetic grades into numeric scores (Table 2), and combined these to produce a single, overall score for the wetland. Higher scores indicate either higher ecological integrity or higher habitat value.

Table 2. System for Converting CRAM Letter Scores to Numeric Values (adapted from Collins *et al.* 2006)

CRAM Letter Score	Converted Numeric Score
A	12
A-	11
B	9
B-	8
C+	7
C	6
C-	5
D	3

Project staff then aggregated these scores for each CRAM wetland according to the method described in the CRAM 4.2.2 Manual (Collins *et al.* 2006). With the exception of the metrics describing the attribute "Landscape Context and Buffer," the raw metric scores were simply summed within each of the other three broad attribute categories ("Hydrology," "Physical Structure," and "Biotic Structure"). Metrics describing the attribute "Landscape Context and Buffer" were combined according to the following formula:

$$\frac{\{(\text{Buffer condition})*[(\%\text{ AA with buffer})*(\text{Buffer width})]^{-2}\}^{-2} + (\text{Connectivity})}{2}$$

The resulting raw scores for each attribute (one score for each attribute "Landscape Context and Buffer," "Hydrology," "Physical Structure," and "Biotic Structure") were then converted to a percentage of the maximum possible score achievable for each attribute, by dividing each raw score by the maximum possible score for each attribute and multiplying the result by 100 . The four attribute scores for each wetland, expressed as percentages, were then averaged to obtain an overall condition score for each CRAM-classified wetland (see Collins *et al.* 2006).

Project staff then considered each assessed wetland against the desired condition criteria described in section 3.1.3 above using the overall CRAM score for the wetland, individual attribute and metric scores for the wetland, numbers of stressors observed in the wetland, and professional judgment. Project staff then characterized each wetland as either:

- In **desired condition** – wholly meeting the park criteria for high-quality wetlands. Although these wetlands may exhibit the highest CRAM scores for the Monument, they also may score poorly for one or more CRAM attribute. Project staff ranked some low-scoring wetlands as in desired condition - when poor scores appeared to reflect a natural lack of physical or biological complexity.

- In **good condition** – generally meeting the park criteria for high-quality wetlands but exhibiting one or several factors that disqualify the wetland from wholly meeting the criteria. In general, for DEPO wetlands in good condition

improvement of the degraded characteristics, through active or passive management, could bring the wetland into desired condition.

- In **poor condition** – wetlands that diverged significantly from the park criteria for high-quality wetlands. These wetlands generally exhibited low CRAM scores and one or more visible anthropogenic stressors.

Project staff assigned a condition category to individual wetlands based on professional judgment. These ratings are intended to help interpret CRAM scores and convey project staff's overall assessment of the wetland. They are a one-time assessment and not intended to be the foundation for future monitoring efforts.

4.0 Results

4.1 Wetland Inventory

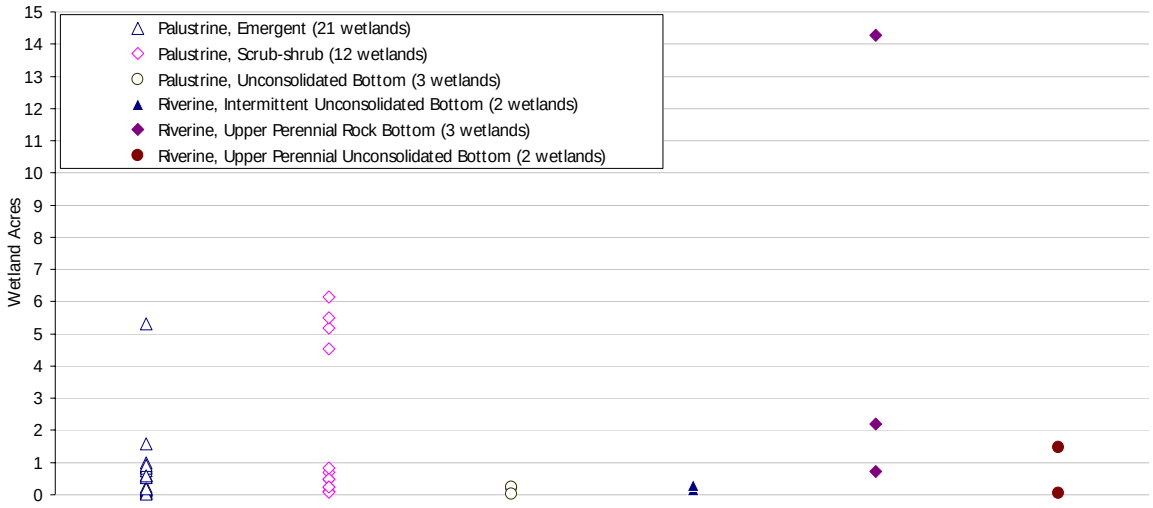
4.1.1 Cowardin Wetlands

In August and September 2006 project and park staff mapped and inventoried 43 Cowardin wetlands on just under 60 acres at Devils Postpile National Monument (Table 3, Figure 1, and Appendix E). These wetlands comprise 7.5% of the Monument's 798 acres. They fall into two Cowardin wetland Systems: Palustrine and Riverine.

Table 3. Number and Size of DEPO Cowardin Wetlands Field Mapped in 2006

System	Sub-system, Class	Polygons	Acres
Palustrine	Emergent Vegetation	21	15.36
Palustrine	Scrub-Shrub	12	24.51
Palustrine	Unconsolidated Bottom	3	0.56
Riverine	Intermittent Unconsolidated Bottom	2	0.44
Riverine	Upper Perennial Rock Bottom	3	17.21
Riverine	Upper Perennial Unconsolidated Bottom	2	1.48
Total		*43*	*59.56*

Figure 1. Size Distribution of DEPO Cowardin Wetlands Field Mapped in 2006



DEPO supports a greater acreage of Palustrine Scrub-shrub wetlands (24.51 acres) than any other Cowardin class but has more individual Palustrine Emergent wetland units (21). Polygons mapped as Riverine Upper Perennial Rock Bottom wetlands, second in acreage (17.21), represent the bed and banks of the San Joaquin River. DEPO supports only three habitat units of Palustrine Unconsolidated Bottom wetlands on 0.56 acres and only two Riverine Intermittent Unconsolidated Bottom wetlands on 0.44 acres.

In order to verify that mapped Cowardin wetland polygons exhibited a preponderance of hydrophytic vegetation project staff noted all dominant species and their wetland indicator status according to Reed (1988). The resulting list of dominant plant species in DEPO Cowardin wetlands (Table 4) is descriptive rather than exhaustive.

Table 4. Dominant plant species observed in Cowardin wetlands at DEPO

Plant	Wetland Indicator Status (Reed 1988)	Number of DEPO Cowardin Wetlands Plant is Dominant
Palustrine Emergent		
Carex vesicaria var. *vesicaria*	OBL	9
Glyceria elata	OBL	7
Juncus sp.	*not listed in Reed 1988*	7
Calamagrostis canadensis	FACW+	6
Hordeum brachenatherum	FACW	6
Carex sp.	*not listed in Reed 1988*	5
Elymus trachycaulus	*not listed in Reed 1988*	5
Mimulus guttatus	OBL	5
Pinus contorta	FAC	5
Mimulus moschatus	OBL	4
Muhlenbergia sp.	*not listed in Reed 1988*	4
Perideridia parishii ssp. *latifolia*	*not listed in Reed 1988*	4
Salix sp.	*not listed in Reed 1988*	4
Senecio triangularis	OBL	4
Solidago canadensis ssp. *elongata*	FACU	4
Veronica americana	OBL	4
Alnus incana	FACW	3
Carex lanuginosa	OBL	3
Pteridium aquilinum	FACU	3
Salix lemmonii	OBL	3
Veratrum californicum	OBL	3
Acontium columbianum	FACW	2
Calamagrostis stricta ssp. *expansa*	*not listed in Reed 1988*	2
Carex eleocharis	*	2
Carex nebrascensis	OBL	2
Carex ovalis	*	2
Juncus balticus	OBL	2
Juncus nevadensis	FACW	2
Lupinus polyphyllus	FACW	2
Poa pratensis	FACU	2
Scirpus microcarpus	OBL	2
Smilicina racemosa	FAC	2
Thalictrum fendleri var. *fendleri*	FACU	2
Allium sp.	*not listed in Reed 1988*	1
Artemesia douglasiana	FACW	1
Bromus sp.	*not listed in Reed 1988*	1
Calamagrostis sp.	*not listed in Reed 1988*	1
Deschampsia elongata	FACW	1
Dodecatheon jefferii	FACW	1
Elymus glaucus	FACU	1
Epilobium ciliatum	FACW	1
Epilobium sp.	*not listed in Reed 1988*	1
Equisetum arvense	FAC	1
Equisetum laevigatum	FACW	1
Gentianopsis holopetala	OBL	1
Lotus oblongifolius	OBL	1
Mimulus primuloides	OBL	1
Mimulus sp.	*not listed in Reed 1988*	1
Pedicularis sp.	*not listed in Reed 1988*	1
Populus tremuolides	FAC+	1
Ribes cereum var. *cereum*	NI	1
Ribes roezlii var. *roezlii*	*not listed in Reed 1988*	1
Trifolium sp.	*not listed in Reed 1988*	1
Typha sp.	*not listed in Reed 1988*	1
Palustrine Scrub-shrub		
Alnus incana	FACW	11
Calamagrostis canadensis	FACW+	6
Glyceria elata	OBL	6
Salix lemmonii	OBL	6
Scirpus microcarpus	OBL	4

Thalictrum fendleri var. *fendleri*	FACU	4
Circaea alpina	FACW	3
Pinus contorta	FAC	3
Solidago canadensis ssp. *elongata*	FACU	3
Equisetum arvense	FAC	2
Lupinus polyphyllus	FACW	2
Poa pratensis	FACU	2
Populus tremuolides	FAC+	2
Salix lasiolepis	*	2
Acontium columbianum	FACW	1
Artemesia douglasiana	FACW	1
Bromus sp.	*not listed in Reed 1988*	1
Carex lanatus	*	1
Carex lanuginosa	OBL	1
Carex sp.	*not listed in Reed 1988*	1
Cornus serocea ssp. *sericea*	*not listed in Reed 1988*	1
Dodecatheon jefferii	FACW	1
Elymus glaucus	FACU	1
Juncus sp.	*not listed in Reed 1988*	1
Populus balsamifera ssp. *trichocarpa*	FACW	1
Pteridium aquilinum	FACU	1
Salix sp.	*not listed in Reed 1988*	1
Senecio triangularis	OBL	1
Stachys albens	OBL	1
Palustrine Unconsolidated Bottom		
Carex nebrascensis	OBL	1
Carex ovalis	*	1
Dodecatheon jefferii	FACW	1
Hordeum brachenatherum	FACW	1
Juncus sp.	*not listed in Reed 1988*	1
Riverine Upper Perennial Rock Bottom		
Salix lemmonii	OBL	1
Riverine Upper Perennial Unconsolidated Bottom		
Artemesia douglasiana	FACW	2
Achillea millefloruum	FACU	1
Cirsium andersonii	*not listed in Reed 1988*	1
Elymus glaucus	FACU	1
Elymus trachycaulus	*not listed in Reed 1988*	1
Lupinus polyphyllus	FACW	1

* Plant not listed in Devils Postpile vascular plant inventory (Arnett and Haultain 2005); may be a misidentification.

4.1.2 Comparison with National Wetland Inventory Maps

Project staff compared the 2006 field-derived wetland maps with US Fish and Wildlife Service National Wetland Inventory (NWI) maps – which are based on interpretation of aerial photographs. The comparison of NWI and field-mapped data is confounded by differing mapping conventions: where NWI maps frequently represent linear wetland features – such as rivers and river floodplains – as narrow lines, the 2006 field project represented all wetlands as polygons. However, despite difficulties in directly comparing maps with different conventions, this project attempted to characterize general patterns in the differences in maps produced by the two efforts. Overall, where the 2006 project staff mapped 43 wetlands on 60 acres at DEPO, NWI mapped 58 wetlands on 35 acres (Table 5 and Appendix E).

The NWI effort overlooked all Unconsolidated Bottom wetlands – both Palustrine and Riverine – observed by project staff in 2006, although the absolute acreage of these omitted wetlands is very small (2.04 acres).

The NWI effort had very high rates of omission for all Riverine wetlands in general, mapping only 1.26 acres, where field observers mapped 19.13 acres. This difference in acreage is largely a result of different map conventions. However, the NWI effort did overlook a San Joaquin River tributary which is under forest cover (CRAM polygon R06). Where NWI did map Riverine wetlands on the banks of the San Joaquin River it subdivided wetlands into many separate lengths; the 2006 field project combined immediately-adjacent wetlands into single polygons.

NWI maps exhibited moderately high rates of omission (66%) for Palustrine Scrub-shrub wetlands, overlooking 16.97 acres of these wetlands; where these wetlands were mapped they were generally misclassified as Palustrine Forested.

Overall, the NWI effort failed to identify 42% of areas mapped as wetlands by field biologists in 2006.

Table 5. Field-mapped and NWI-mapped Cowardin Wetlands at DEPO

	Project Wetlands		**NWI Wetlands**		
	Polygons	Acres	Polygons	Acres	NWI omission (acres)
Palustrine Emergent Vegetation	21	15.36	16	13.41	13%
Palustrine Scrub-Shrub	12	24.51	8	8.44	66%
Palustrine Unconsolidated Bottom	3	0.56	-	-	100%
Palustrine Forested	-	-	3	11.67	
Riverine Intermittent Streambed	2	0.44	1	0.02	95%
Riverine Upper Perennial Rock Bottom	3	17.21	30	1.24	93%
Riverine Upper Perennial Unconsolidated Bottom	2	1.48	-	-	100%
Total	*43*	*59.56*	*58*	*34.78*	*42%*

4.2 Wetland Condition Assessment

Project staff conducted condition assessments on the CRAM wetland polygons mapped. Wetland assessment scores presented here are semi-quantitative rather than quantitative – that is, field biologists categorized wetland characteristics into non-linear, description-based grading systems rather than obtaining numeric measurements based on true linear or logarithmic scales. Project staff then converted these grades to a numerical system to show ranking (high to low values). However, because these relative ranks are not on linear scales, medians rather than averages are presented to describe central tendencies. Also, although acreages and numbers of stressors reported here are numeric and linear, medians are reported for these characteristics as well, for consistent data presentation.

4.2.1 Overall Condition Assessment Scores

Project staff classified DEPO wetlands into three CRAM wetland types: Depressional, Riverine, and Seep/Slope (Table 6).

Table 6. Number and Size of CRAM Wetlands Assessed at DEPO in 2006

CRAM Type	Polygons	Acres
Depressional	8	3.19
Riverine	11	50.57
Seep/Slope	4	5.81
Total	*23*	*59.56*

Because the CRAM classification scheme identifies wetlands only by the broad characteristics of landscape position and hydrology, and disregards dominant vegetation form, project staff frequently combined two or more Cowardin wetlands into a single CRAM polygon. The 43 field-mapped Cowardin wetlands at DEPO mapped as 23 CRAM wetland polygons (Table 7).

Project staff assessed the condition of these CRAM-classified polygons using the CRAM 4.2.2 manual and scoring criteria (see Appendix D); CRAM condition scores for individual wetland polygons fell in a range between 69 and 90 (Tables 8 and 9) out of a possible score of 100.

Table 7. Relationship of Cowardin Wetland Polygons and CRAM Wetland Polygons

Cowardin Polygon	Cowardin Type	Acres	CRAM Polygon	CRAM Type	Acres
D01-PEM01	Palustrine Emergent	0.16	D01	Depressional	0.16
D02-PEM01	Palustrine Emergent	0.62	D02	Depressional	0.62
D03-PEM01	Palustrine Emergent	0.59	D03	Depressional	0.80
D03-PUB01	Palustrine Unconsolidated Bottom	0.21			
D04-PSS01	Palustrine Scrub-shrub	0.49	D04	Depressional	0.49
D05-PEM01	Palustrine Emergent	0.58	D05	Depressional	0.58
D06-PEM01	Palustrine Emergent	0.08	D06	Depressional	0.31
D06-PUB01	Palustrine Unconsolidated Bottom	0.23			
D07-PEM01	Palustrine Emergent	0.18	D07	Depressional	0.18
D08-PEM01	Palustrine Emergent	0.05	D08	Depressional	0.05
R01-PEM01	Palustrine Emergent	5.30	R01	Riverine	33.16
R01-PEM02	Palustrine Emergent	0.76			
R01-RRB01	Riverine Upper Perennial Rock Bottom	14.28			
R01-PSS01	Palustrine Scrub-shrub	5.19			
R01-PSS02	Palustrine Scrub-shrub	6.14			
R01-RUB01	Riverine Upper Perennial Unconsolidated Bottom	1.48			
R02-PEM01	Palustrine Emergent	0.86	R02	Riverine	0.86
R03-PEM01	Palustrine Emergent	0.14	R03	Riverine	0.14
R04-RRB01	Riverine Upper Perennial Rock Bottom	0.73	R04	Riverine	6.22
R04-PSS01	Palustrine Scrub-shrub	5.49			
R05-PEM01	Palustrine Emergent	0.23	R05	Riverine	0.23
R06-RRB01	Riverine Upper Perennial Rock Bottom	2.20	R06	Riverine	2.20
R08-PEM01	Palustrine Emergent	0.17	R08	Riverine	1.70
R08-PEM02	Palustrine Emergent	0.82			
R08-PSS01	Palustrine Scrub-shrub	0.70			
R09-PEM01	Palustrine Emergent	0.91	R09	Riverine	4.21
R09-PEM02	Palustrine Emergent	1.57			
R09-PEM03	Palustrine Emergent	0.55			
R09-PSS01	Palustrine Scrub-shrub	0.49			
R09-PSS02	Palustrine Scrub-shrub	0.10			
R09-PSS03	Palustrine Scrub-shrub	0.23			
R09-PSS04	Palustrine Scrub-shrub	0.08			
R09-PSS05	Palustrine Scrub-shrub	0.23			
R09-RUB01	Riverine Upper Perennial Unconsolidated Bottom	0.05			
R10-PEM01	Palustrine Emergent	0.58	R10	Riverine	0.73
R10-RUB01	Riverine Intermittent Unconsolidated Bottom	0.15			
R11-RUB01	Riverine Intermittent Unconsolidated Bottom	0.30	R11	Riverine	0.30
R12-PSS01	Palustrine Scrub-shrub	0.82	R12	Riverine	0.82
SS01-PUB01	Palustrine Unconsolidated Bottom	0.04	SS01	Seep/Slope	0.04
SS02-PEM01	Palustrine Emergent	0.03	SS02	Seep/Slope	0.03
SS04-PEM01	Palustrine Emergent	1.00	SS04	Seep/Slope	5.54
SS04-PSS01	Palustrine Scrub-shrub	4.54			
SS05-PEM01	Palustrine Emergent	0.20	SS05	Seep/Slope	0.20

CRAM identifies 53 possible anthropogenic stressors that may be visible to observers and that may adversely affect wetland function and value (Collins et *al.* 2006). Project staff observed 15 of these stressors at DEPO:

- Passive recreation (19 wetlands)
- Active recreation (11 wetlands)
- Evidence of fire (9 wetlands)
- Flow obstructions (3 wetlands)
- Non-point source discharges (3 wetlands)
- Levees, roads (2 wetlands)
- Biological resource extraction or stocking (2 wetlands)

- Development (2 wetlands)
- Evidence of flood (2 wetlands)
- Excessive sediment from watershed (2 wetlands)
- Intensive human visitation (2 wetlands)
- Ranching (2 wetlands)
- Grazing, intensive herbivory (1 wetland)
- Removal of woody debris (1 wetland)
- Trash or refuse (1 wetland)

Project staff observed evidence of passive and active recreation and evidence of severe fire more frequently than other stressors. Seven wetlands at DEPO exhibited only one of these stressors, while the most-stressed wetland exhibited eight stressors (Tables 8 and 9).

Although a premise of CRAM is that lower condition scores may result from anthropogenic stress, CRAM scores at DEPO exhibited no relationship with number of observed stressors (Figure 2). Also, because the CRAM assessment protocol gives higher scores to more physically- and biotically-complex wetlands, project staff expected to see a positive correlation between wetland size and CRAM score on the assumption that larger wetlands may naturally exhibit higher structural complexity. No strong correlation is evident (Figure 3).

Table 8. CRAM Wetland Condition Scores and Numbers of Stressors

CRAM Polygon	Acres	CRAM Score	Number of Stressors
D08	0.05	69	1
D06	0.31	71	2
D03	0.80	73	1
D07	0.18	73	1
D02	0.62	74	4
D01	0.16	75	1
R01	33.16	78	4
R06	2.20	78	3
D04	0.49	79	8
R05	0.23	79	4
R10	0.73	79	4
R12	0.82	80	3
R09	4.21	81	2
SS01	0.04	81	4
D05	0.58	83	1
SS04	5.54	83	1
R02	0.86	85	2
R03	0.14	85	1
R08	1.69	85	2
SS02	0.03	85	2
SS05	0.20	85	3
R11	0.30	86	4
R04	6.22	90	4

Table 9. Summary of CRAM Wetland Condition Scores and Numbers of Stressors

		Acres		**CRAM Score**		**Number of Stressors**	
	n	Median	Range	Median	Range	Median	Range
Depressional	8	**0.4**	*(0.05 - 0.80)*	**73.5**	*(69 - 83)*	**1**	*(1 - 8)*
Riverine	11	**0.86**	*(0.14 - 33.16)*	**81**	*(78 - 90)*	**3**	*(1 - 4)*
Seep/Slope	4	**0.12**	*(0.03 - 5.54)*	**84**	*(81 - 85)*	**2.5**	*(1 - 4)*

Figure 2. CRAM Wetland Condition Scores and Number of Stressors Observed

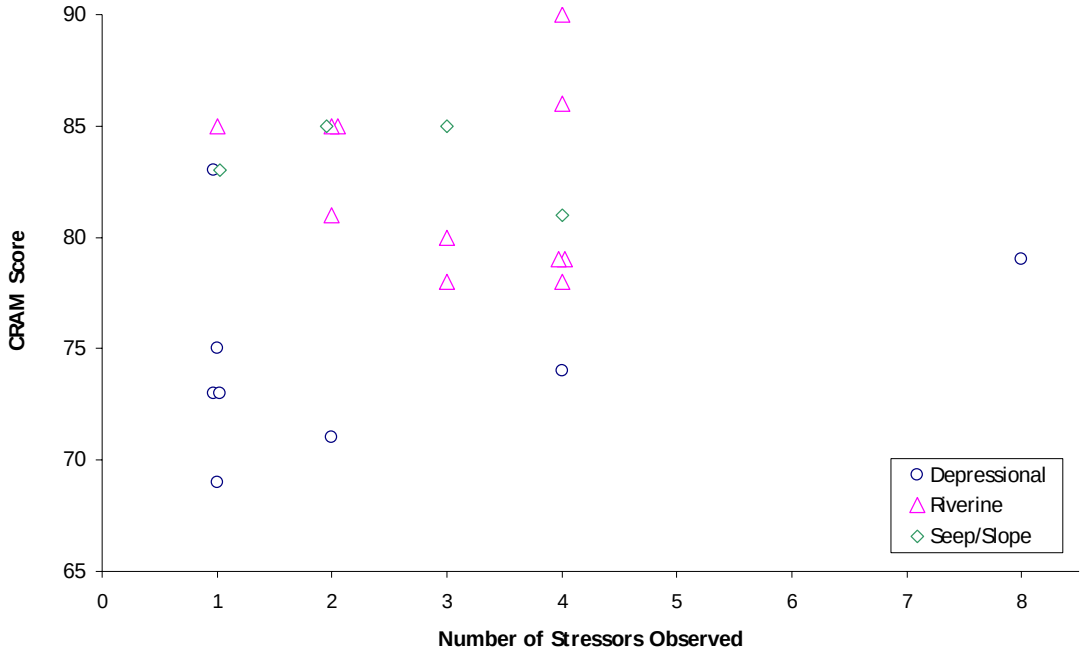
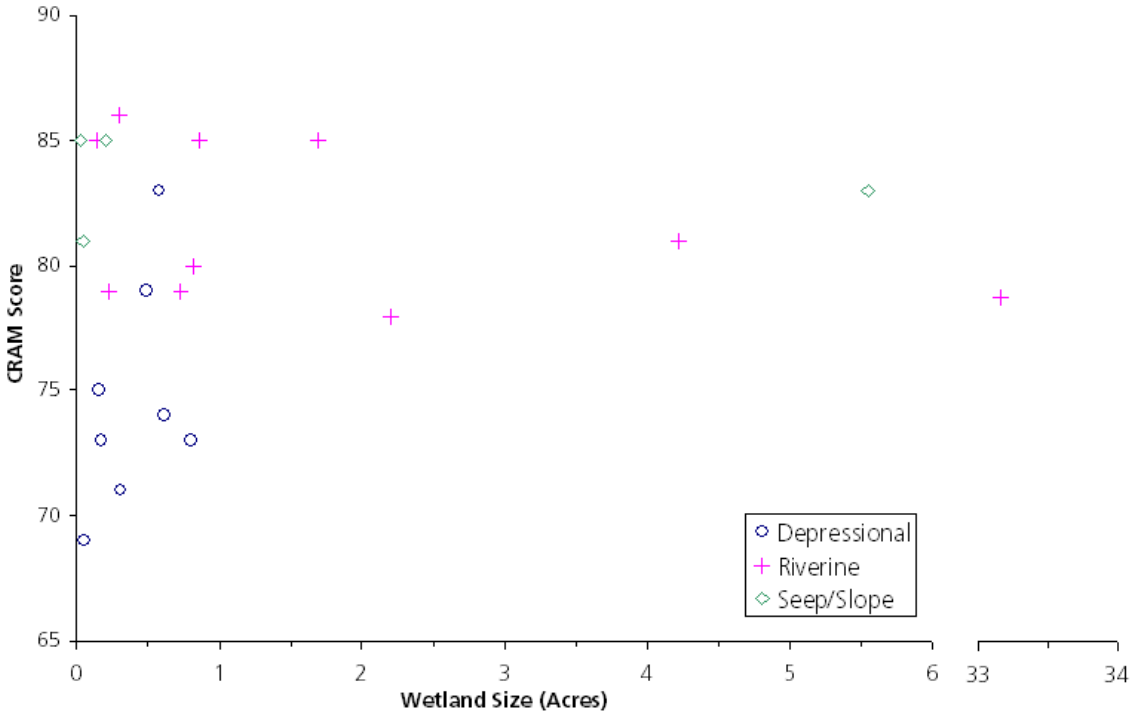


Figure 3. CRAM Wetland Condition Scores by Wetland Size



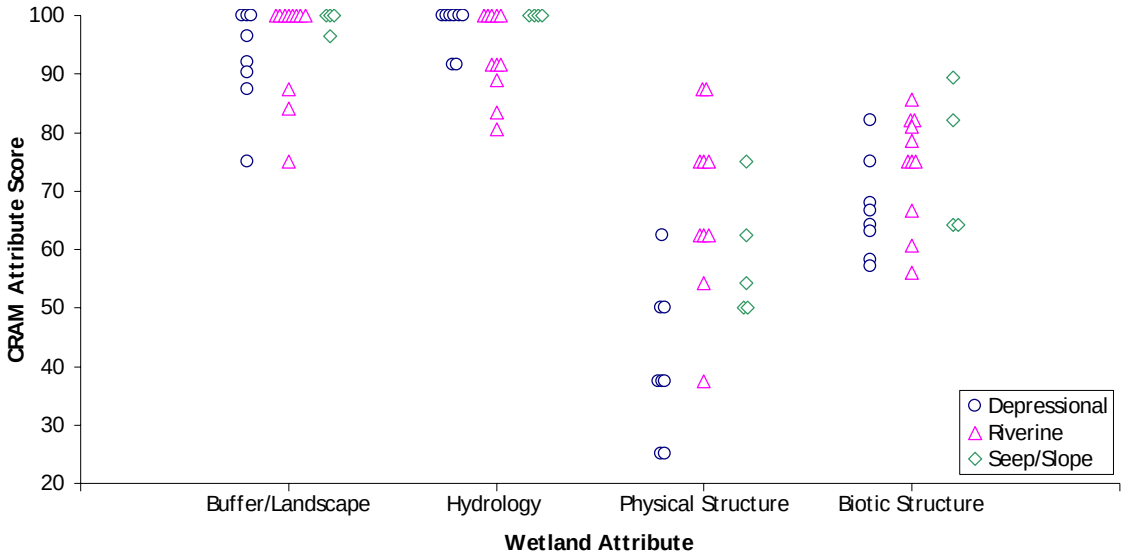
4.2.2 Individual Attribute Scores

For all wetlands at DEPO "Buffer and Landscape Context" and "Hydrology" attributes ranked highly, reflecting DEPO's predominantly natural setting (Table 10 and Figure 4). As found for all wetlands in Pacific West Regional parks included in this project "Physical Structure" and "Biotic Structure" attributes scored lower over all than "Buffer" and "Hydrology" attributes.

Table 10. Summary of CRAM Wetland Condition Scores for Individual Attributes (Median, Low, and High scores)

	Buffer and Landscape		**Hydrology**		**Physical Structure**		**Biotic Structure**	
	Median	Range	Median	Range	Median	Range	Median	Range
Depressional	**94**	*(75 - 100)*	**100**	*(92 - 100)*	**38**	*(25 - 63)*	**63**	*(57 - 68)*
Riverine	**100**	*(75 - 100)*	**92**	*(81 - 100)*	**63**	*(38 - 88)*	**88**	*(61 - 86)*
Seep/Slope	**100**	*(97 - 100)*	**100**	*(100)*	**56**	*(50 - 75)*	**75**	*(64 -89)*

Figure 4. CRAM Individual Attribute Scores by Wetland Type


100
90
80
70
60
50
40
30
20
CRAM Attribute Score
Buffer/Landscape
Hydrology
Physical Structure
Biotic Structure
Wetland Attribute
Depressional
Riverine
Seep/Slope

4.2.3 Wetlands in Desired Condition

Project staff considered CRAM attribute and overall wetland scores and number and degree of anthropogenic stressors, and also used professional judgment to characterize DEPO's CRAM wetlands relative to the desired condition criteria described in section 3.1.3 above. Because the Monument's wetlands exhibit high scores and little variation for "Buffer and Landscape Context" and "Hydrology" attributes (Figure 4), project staff evaluated "Physical Structure" and "Biotic Structure" scores for CRAM wetlands to help differentiate wetlands in desired, good, and poor condition (Figure 5).

Fifteen of the Monument's 23 wetlands (about 37% the Monument's wetland acres) are in desired condition (Table 11 and Figure 5). Six wetlands (representing about 63% of the Monument's wetland acres) are in good condition, while two wetlands representing less than 0.4% of the Monument's wetland acreage are in poor condition.

The Monument's Seep/Slope wetlands best conform to desired condition: over 99% of these wetlands (by acres) achieve desired conditions at DEPO. The remaining 1% of DEPO's Seep/Slope wetland acreage is in good condition. CRAM Riverine wetlands at DEPO exhibit greater divergence from desired condition: about 29% of DEPO's Riverine wetland acres achieve desired condition, and over two-thirds of these acres (71%) are in good condition. Of the Depressional wetland acres at DEPO, about 58% achieve desired condition and 35% are in good condition. Although this is the only wetland type at DEPO exhibiting poor condition (7% of Depressional wetland acres), the absolute acreage wetlands in poor condition is minimal (0.23 acre).

Figure 5. Averaged Physical and Biological Structure Scores for DEPO Wetlands

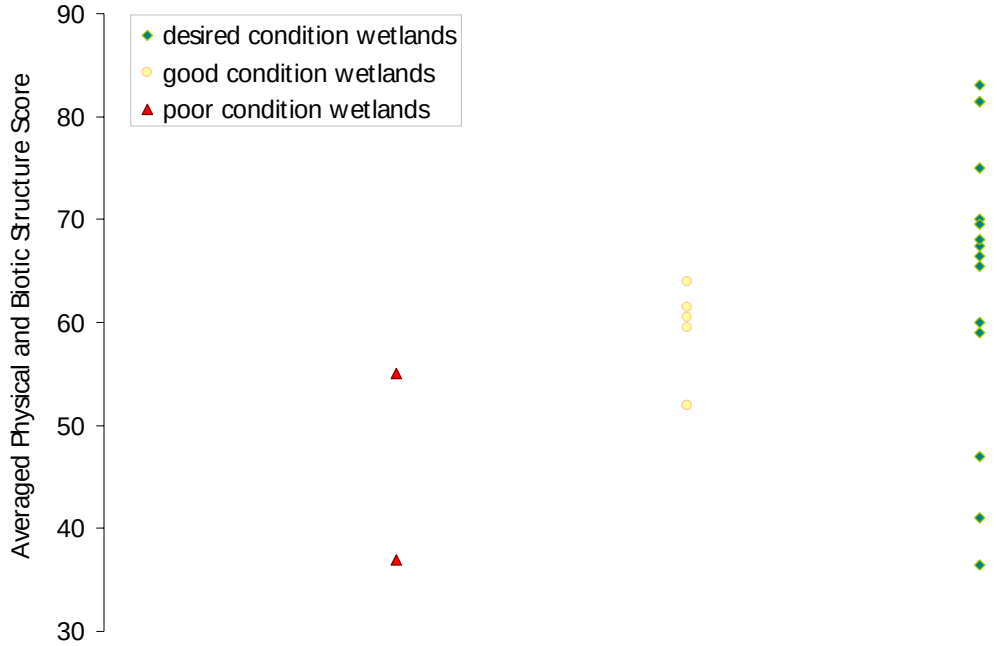
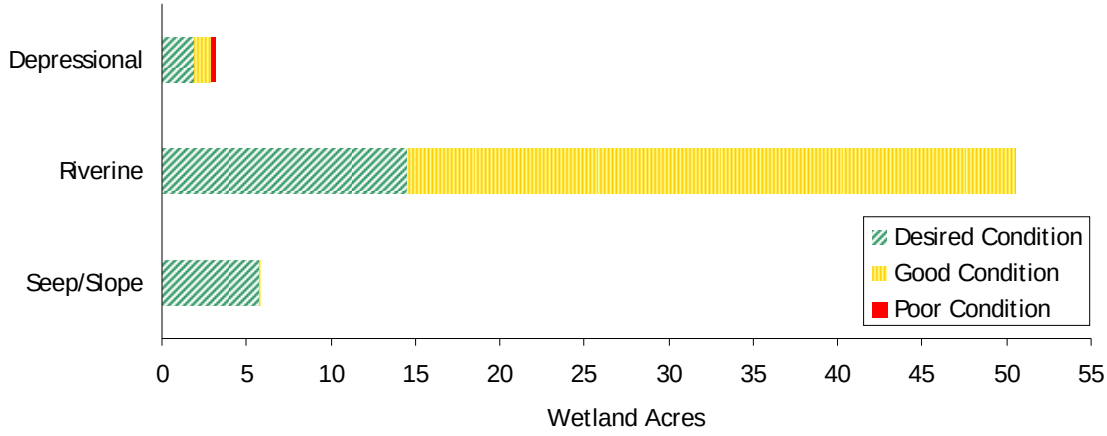


Table 11. Summary of Condition of DEPO Wetlands Relative to Desired Condition

			Desired Condition		Good Condition		Poor Condition	
Type	n	Acres	n	Acres	n	Acres	n	Acres
Depressional	8	3.19	4	1.85	2	1.11	2	0.23
Riverine	11	50.56	8	14.47	3	36.09	-	-
Seep/Slope	4	5.81	3	5.77	1	0.04	-	-
Total	*23*	*59.56*	*15*	*22.09*	*6*	*37.24*	*2*	*0.23*

Figure 6. Condition of DEPO Wetland Acres Relative to Desired Condition



In general, high-scoring wetlands with fewer observed stressors achieved desired condition, as should be expected, as these factors were taken into consideration when assigning wetlands to condition classes , however there is considerable overlap in scores and numbers of stressors between condition categories (Table 12).

Table 12. Range of CRAM Scores and Number of Stressors by Condition Class

	Range of overall CRAM Scores	Range of Number of Stressors
Desired	71- 90	1 - 4
Good	74 - 81	3 - 8
Poor	69 - 73	1

5.0 Discussion

Overall, wetlands at Devils Postpile National Monument are in excellent condition due to the overwhelmingly natural watershed above the park and the light human footprint imposed on Monument lands during nearly a century of conservation. Plant communities in the Monument's wetlands are largely native and water sources in the Monument are predominantly natural and unmodified. The most commonly-observed local anthropogenic stressors on natural resources at DEPO are continuing evidence of the 1992 Rainbow wildfire and active and passive recreation – including day hikers, backpackers, car campers, stock packers, fishermen, and nearby ranchers and hunters.

5.1 Comparison of Field-derived Maps and National Wetland Inventory Data

The greatest discrepancy in extent of wetland acres mapped by NWI and the 2006 field effort arises from mapping conventions: the broad, coarse NWI maps mapped linear wetland features (*i.e.,* rivers and river floodplains) as lines rather than polygons. When examined closely – at the scale of DEPO's 798 acres – these line features severely under-estimate the amount of land surface covered by wetland. The 2006 field-mapping project mapped all wetlands as polygons, providing a better representation of the total acreage of DEPO's wetland habitat.

Maps derived from the NWI effort and the 2006 field project also show differences in wetland types. NWI maps include three Palustrine Forested wetlands at DEPO, while field observers found none of this type. One of the NWI's Palustrine Forested wetland polygons occurs in an area burned during the 1992 Rainbow Fire, which produced considerable changes to species composition and structure. The 2006 field mapping protocol mapped this unit as Palustrine Scrub-shrub (polygon R04-PSS01). This may represent a true change in wetland type from forested to scrub-shrub due to the wildfire. The remaining two Palustrine Forested wetlands identified by NWI are immediately adjacent to the San Joaquin River; the 2006 field project mapped these alder wetlands as scrub-shrub. On-the-ground field observers determined that these alder stands are too short to meet the Cowardin criteria for forested wetlands, where interpreters of aerial photographers producing NWI maps had to extrapolate from much coarser information.

Another discrepancy between field-derived wetlands maps and NWI: NWI did not map Riverine Perennial Unconsolidated Bottom wetlands at DEPO. Field observers mapped two wetlands of this type – together covering less than one and one-half acres – as they were able to differentiate the finer substrates of the sand bars in the San Joaquin River from the main channel's rocky bottom. For some management concerns distinguishing these substrate units within DEPO's Riverine system is unimportant. However, for some efforts – such as understanding and managing in-channel biota – inventories of the distribution and diversity of channel substrate characteristics may be useful.

Finally, the 2006 field project mapped many more distinct and isolated Palustrine wetlands than the NWI effort (36 *vs.* 24, on 40.43 acres *vs.* 21.85 acres). Most Palustrine wetlands at DEPO are small, and some are under the conifer or broadleaf tree canopy. These may not have been visible on imagery available at the time the NWI project mapped DEPO's wetlands. One of the Palustrine wetlands overlooked by the broad-scale NWI maps is Soda Springs on the banks of the San Joaquin River near park

headquarters (polygon SS01-PUB01). This wetland polygon exhibits unusual water quality properties and may support rare species.

5.2 CRAM Wetland Condition Scores

CRAM wetland condition scores at DEPO ranged from 69 to 90. To evaluate the utility of CRAM as a tool to evaluate the potential effects of habitat-improvement actions (*e.g.*, eradication of non-native plant species in wetlands and corresponding buffer areas) project staff altered individual metric scores to reflect potential improvements that might result from management. Overall CRAM scores improved only marginally. Consequently, even though a wetland scoring 90 out of a possible score of 100 may not achieve the highest functions described in the CRAM grading system, natural conditions may preclude any DEPO wetlands achieving scores much higher than ninety.

At DEPO, the deviations from perfect scores overwhelmingly concentrated in “Physical Structure” and “Biotic Structure” metrics, such as topographic complexity, number of habitat patches, vertical biotic structure, and amount of organic matter accumulation. In particular, DEPO’s small Depressional wetlands exhibited a (potentially natural) compositional and organizational simplicity that resulted in very low scores for physical and biotic structure.

DEPO wetlands scored highly with respect to “Buffer and Landscape Context” and “Hydrology” metrics, such as excellent buffer condition and extent, natural water sources, and natural hydrologic connectivity to surrounding lands and waters. These metrics are included in the CRAM protocol to call out wetland degradation associated with urbanized watersheds; unsurprisingly, wetlands at DEPO and many other national parks score highly in these attributes.

CRAM developers acknowledge that the protocol assigns higher scores to larger, more complex wetlands regardless of ecological integrity or anthropogenic stress. The developers consciously created a bias favoring complexity, with the rationale that the diversity and degree of wetland ecological services increases with structural complexity and size (Collins *et al.* 2006). However, at DEPO wetland acreage does not correlate with overall CRAM scores or individual metrics tracking structural complexity. This lack of correlation may be due to the predominantly small size of DEPO’s wetlands; these systems may not surpass a size threshold above which microhabitats can develop. In addition, DEPO’s short growing season, relatively high elevation, landscape position near the watershed’s headwaters, and recent glaciation may limit wetland physical and biotic complexity.

5.3 Desired Condition for Wetlands

This project evaluated all twenty-three of the Monument’s CRAM wetlands relative to the criteria for desired condition for DEPO wetlands (as suggested in section 3.1.3)

Fifteen of the Monument’s 23 wetlands achieve desired condition; these represent about 37% of the wetland acres mapped at DEPO. Only two wetlands are in poor condition, on 0.23 acres (covering one third of one percent of DEPO’s wetlands); these appear to be degraded from deforestation in watershed due to the 1992 Rainbow Fire. Field observers noted apparently degraded physical and biological structure, and concluded that these wetlands do not meet the criterion from the definition above: “Wetlands . . .

overwhelmingly exhibit natural . . . physical structure." After completion the condition assessment project staff found that the two poor-condition wetlands fall in the area mapped as having burned most severely during the Rainbow Fire (Caprio *et al.* 2006).

There is considerable overlap in CRAM scores among the condition classes. Of particular note, the desired condition class includes some of the lowest scoring wetlands (*e.g.,* D01 and D03). These low-scoring Depressional wetlands are small, often isolated from other water bodies, structurally and biotically simple, and overwhelmingly dominated by one or two sedge species – especially *Carex vesicaria* var. *vesicaria.* However, these simple systems are most-likely functioning at their potential: they are free of non-native invasive plant species, they not overly impacted by active or passive recreation, and project staff made several wildlife sightings in these wetlands during the 2006 surveys. Therefore, although low-scoring, these functioning wetlands are considered in desired condition relative to the criteria presented in section 3.1.3 of this document.

5.4 Relationship between Stressors and Condition Assessment Scores

Although project staff expected to find an inverse relationship between wetland function and number of stressors, little correlation is evident. Project staff also observed this lack of correlation at other NPS Pacific West Region parks included in the survey.

The purpose of documenting stressors is to identify human activities that may degrade wetland condition, and to suggest management action that may improve wetland condition. However, either CRAM is not a sensitive enough tool to detect ecological degradation due to observed stressors or the local stressors observed in NPS wetlands in the West are too minor in number and degree to cause any ecologically-significant perturbation from natural conditions. In other words, project staff do not know whether 1) observed stressors cause real degradation of wetlands that CRAM cannot detect (*i.e.,* given a better measuring tool, observers could quantify degradation), or 2) the effects of the observed "stressors" are ecologically unimportant (*i.e.,* not forcing a wetland out of its range of natural variation). Alternately, the anthropogenic stressors most effecting DEPO wetlands may not be observable by project staff, either because they occur at larger or smaller scales than are noted by field observers, and/or because they occurred in the past.

CRAM developers present four assumptions regarding wetland stressors:

- Single or multiple stressors may negatively impact wetland condition,
- Increasing numbers of stressors will cause wetland condition to decline,
- Increasing stressor intensity and/or proximity will result in further deterioration of wetland condition, and
- Chronic or ongoing stress on wetland will further increase decline of condition (Collins *et al.* 2006, page 85).

The latter two assumptions are not tested in the CRAM protocol. Development of an explicit algorithm to weight and/or quantify intensity, proximity, and longevity of each stressor – to replace the "Number of Stressors" metric – might better reveal patterns relating wetland condition and anthropogenic stress.

6.0 Conclusions and Recommendations

The Monument's wetlands – particularly those on the San Joaquin River floodplain – are generally of very high quality and in good condition. They exhibit little-to-no local anthropogenic hydrologic alteration and have large lightly-degraded buffers. According to interviews with park staff and other watershed land managers, wetlands within the Monument have been subjected to very few anthropogenic stressors - such as cattle and stockpack animal grazing and logging of adjacent uplands - relative to other wetlands along the Middle Fork of the San Joaquin.

However, some DEPO wetlands – particularly isolated Depressional wetlands on higher slopes – exhibit low taxonomic and topographic diversity. It is possible that the recent wildfire at DEPO reset some of these wetlands to an earlier successional stage. The fires may have reduced plant diversity in isolated wetlands by burning and by changing soil and hydrology characteristics. Fires may also have damped natural topographic variation in these wetlands through accelerated sediment mobilization from denuded hillslopes. However, it is also possible that these wetlands are naturally simple – reflecting influences such as climate, elevation, soil condition, and relatively recent glaciation – which may limit biotic and physical complexity. These wetlands may function at their highest current potential, but score poorly due to a short growing season and/or poor soil development that restrict plant diversity and microhabitat development. Since non-complex, low-scoring systems at DEPO may arise from natural processes rather than local anthropogenic alteration, these wetlands may not be targets for habitat enhancement actions. Project staff did observe positive wetland functions at many of these wetlands; for example, despite the local well-draining pumice soils, many of the Depressional wetlands exhibiting poor vegetation diversity maintained surface water late into the dry Sierra summer. Project staff observed amphibians, reptiles, and birds using this habitat. Project staff do not recommend any management actions particular to these low-diversity wetlands.

Non-native biota – including plants, animals, and pathogens – can disrupt wetland structure and functions. Impacts from non-native biota can include reduced native biodiversity, impaired nutrient cycling, disrupted food webs, structural changes to ecological processes and physical characteristics, and degraded habitat quality for threatened or endangered species. DEPO wetlands are degraded by invasions of Kentucky bluegrass (*Poa pratensis*) and potentially by other non-native grasses including non-native *Bromus* species. National Park Service invasive species management emphasizes introduction-prevention and early-detection of noxious biota. Potential vectors for introduction of non-native plant species that may impact wetlands include pack stock; potential vectors for introductions of non-native animal species that may impact wetlands, particularly invertebrates, may be waders and other equipment designed for use in water.

Specific Recommendations for Monument managers:

- **Carefully direct visitor traffic.** Park managers may consider directing foot and livestock traffic away from more disturbance-prone habitats such as wet meadows and riparian forests to more resilient habitats such as bedrock outcrops. Livestock and foot traffic should be excluded from sensitive wildlife habitat areas - including riparian forests and sandbars utilized by nesting and

foraging birds. Managers may consider attempting to limit introductions of noxious plants and animals though additional targeted resource education programs for day visitors, campers, and stock users.

- **Responsibly remove invasive non-native plant species.** When removing exotic plants in and around Monument aquatic resources, managers should consult with regional Integrated Pest Management specialists to determine the appropriate tool to achieve reductions in noxious weed populations while minimizing environmental damage. Utmost caution to prevent entry of herbicides into surface water and groundwater should be used.

- **Survey for sensitive species.** The Monument's isolated Seep/Slope and Depressional wetlands may harbor uncommon species. Managers may consider pursuing funding for biotic inventories of these habitats. In particular, an all-taxa inventory of Soda Spring - which has unusual chemistry for the watershed - may reveal rare species.

- **Evaluate vulnerabilities of groundwater-fed wetlands.** Seep/Slope and some Depressional wetlands at DEPO are apparently fed by groundwater. This water may derive locally from recent rainfall on higher slopes which has temporarily traveled underground then reemerged downslope. The water may be older - transported from other basins via subsurface rock fractures - and/or may be locally-derived water that has been stored for long duration within the bedrock. The age and source of the groundwater strongly influences the permanence, vulnerability to climate change induced hydrologic modification, and vulnerability to anthropogenic water withdrawals of these isolated wetlands. Although many of these wetlands exhibit poor physical and biological complexity, project staff observed plants and animals dependent on these habitats.

- **Continue to evaluate Monument wetland and water resources.** Ongoing evaluation of DEPO wetlands at a landscape scale may identify resource degradation from local causes (*e.g.,* livestock use) or non-local causes (*e.g.,* changing hydrology in response to regional changes in climate). The fieldwork documented in this report could be reproduced in ten years to provide information to managers about long-term changes in wetland extent and condition. This future evaluation would, necessarily, provide only a coarse-scale assessment of change because methods used in this assessment are not designed for precise repeatability. In particular, assessments of whether individual wetlands are in desired, good, or poor condition described in this report are not highly repeatable because they are based on a combination of CRAM scores, observed stressors, and professional judgment. Also, the CRAM protocol used in 2006 for this assessment is now outdated; future wetland biologists should use the most current version of CRAM available at the time of the fieldwork.

However, re-mapping and re-evaluating DEPO's wetlands in ten years will provide updated information to managers and may illuminate landscape-scale changes. Because wetland resources at DEPO are now field-mapped, wetlands inventoried for this project could be revisited, remapped, and reassessed in approximately one month

by one wetland ecologist and one biological technician. This would include a week for preparation, a week for fieldwork, and two weeks for reporting.

One of the greatest challenges in interpreting observed changes to Monument wetlands in the future will be a lack of local hydrological monitoring. Managers and scientists will be able to better understand long-term ecological trends with data from a permanent river stage monitoring gage accompanied by periodic river-channel surveys and river velocity measures. These data would allow hydrologists to accurately report long-term changes in the amount of water in the San Joaquin River, which is the primary water source for most of the large wetlands in the Monument.

Monitoring individual wetlands for appropriate response variables should be undertaken whenever park managers initiate actions that may adversely or beneficially impact wetlands such as such as restoration, changes in visitor management, or modification of facilities. Response variables that may be monitored to evaluate effects of management actions include: groundwater elevation, wetland extent, wetland floral diversity and abundance, wetland faunal diversity and abundance. Groundwater monitoring will yield much more useful information when accompanied by long-term river stage monitoring.

To increase the utility of future monitoring efforts (either quantitative, semi-quantitative, or qualitative), the park may wish to explore intra-annual (*i.e.,* seasonal) variations in wetland characteristics. A number of wetlands in the Monument are seasonal with hydrologic sources strongly dependent on snowpack. Because of their ephemeral nature, these wetlands may be more susceptible to the effects of climate change, particularly if precipitation, especially in the form of snowfall, diminishes as temperatures elevate in the future.

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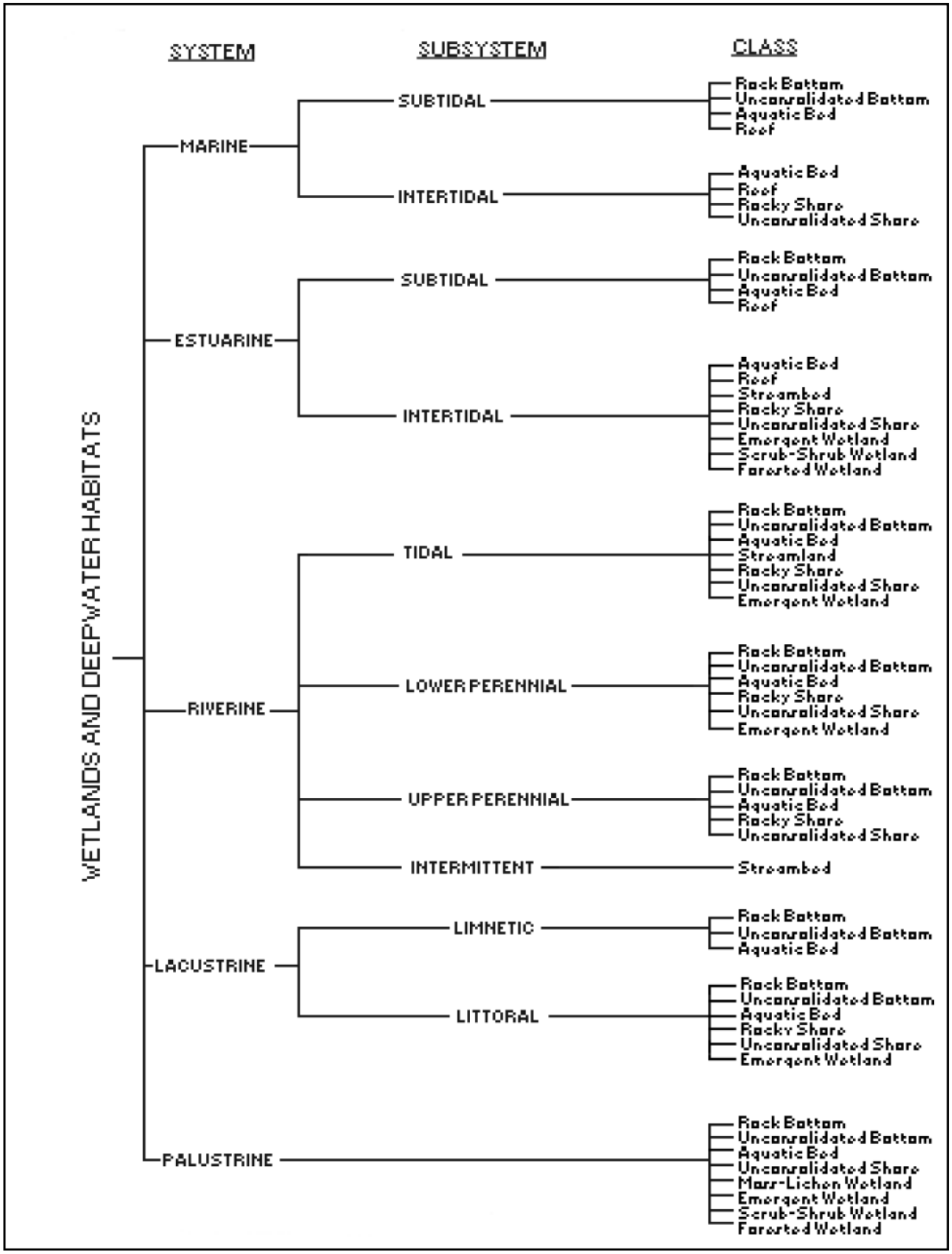
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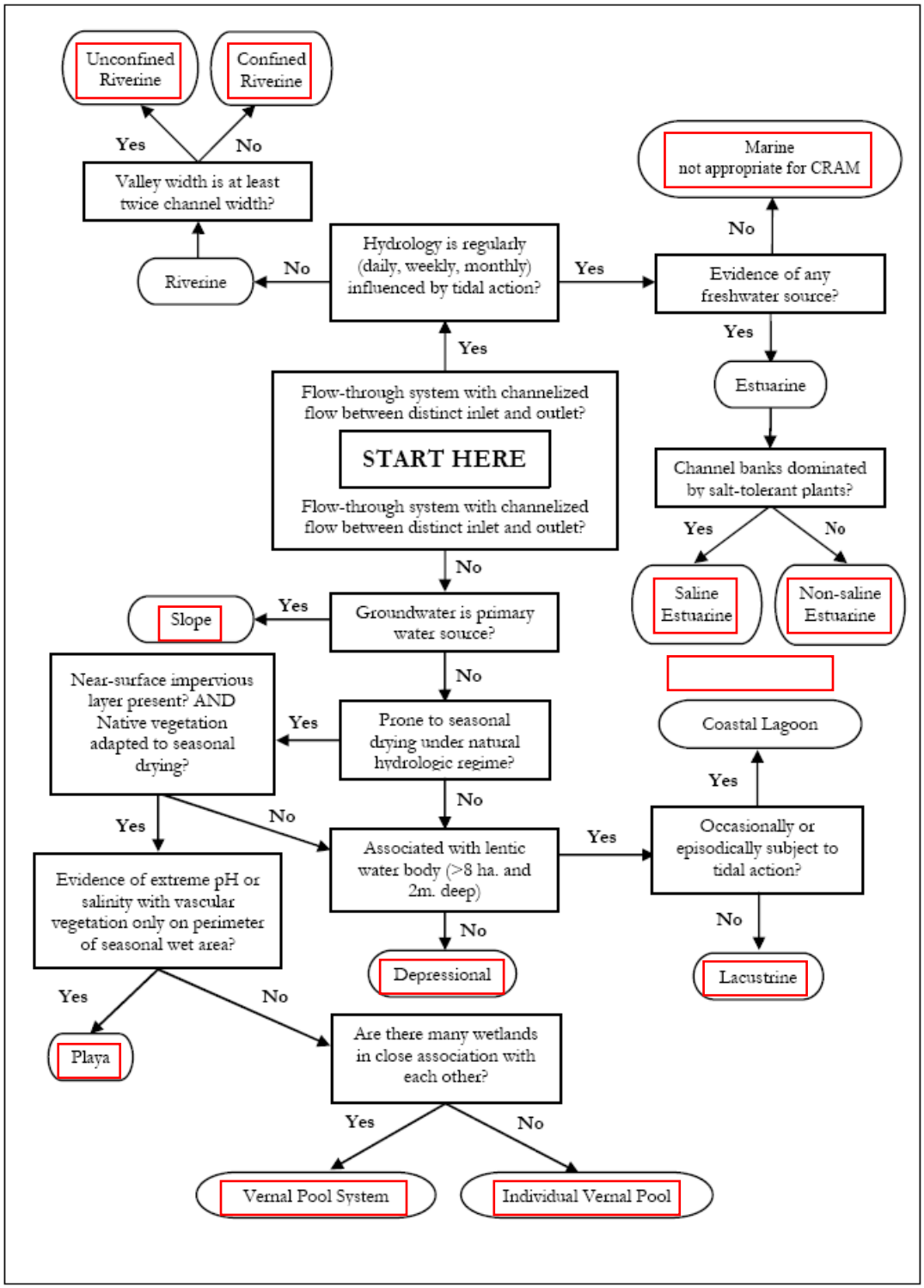
Appendix A:

Cowardin Classification System (from Cowardin *et al.* 1979)



Appendix B:

California Rapid Assessment Method Classification System (from Collins *et al.* 2006)



Appendix C:
List of Field Equipment

- CRAM 4.2.2 Manual (www.cramwetlands.org)
- Ruler
- GPS unit
- Camera
- Notebook
- Plant keys, floras and/or lists that will aid in identifying plants
- To classify wetlands in the delineation process, documentation or knowledge of Cowardin classification as defined in the US Fish and Wildlife document, Classification of wetlands and deepwater habitats of the United States found at http://www.fws.gov/nwi/Pubs_Reports/Class_Manual/class_titlepg.htm
- Local maps, especially vegetation maps, National Wetlands Inventory maps, soil survey maps, maps with park roads, trails, hydrology, etc., aerial imagery, topographic maps
- Park radio
- Soil testing materials:
    - Munsell Soil Color Charts (Kollmorgen Instruments Corporation. 1994. Munsell soil color charts. Windsor, New York.)
    - Sturdy straight-shooter shovel
    - Soil probe (optional)
    - Water (for wetting soil, if necessary)
    - Soil Survey Maps (if possible)
- Water resistant paper
- Data recording tools:
    - Option 1: paper maps or aerial photos, for hand delineating wetland datasheets
    - Option 2: Table computer loaded with CRAM software. Equipment and polygons for later digitizing in a GIS software package; and paper software standards at www.cramwetlands.org

Appendix D:

CRAM Manual 4.2.2 Field Guidelines for Wetland Scoring

The project scored DEPO wetlands according to the instructions in the California Rapid Assessment Method Field Manual version 4.2.2 (Collins *et al.* 2006). The four first field sheets – documenting wetland location, class, vegetation structure, and visible anthropogenic stressors – are applicable to all wetland types. Following the data sheets used for all wetlands, the appendix reproduces the data sheets used to evaluate Depressional, Riverine, and Seep/Slope CRAM wetlands at DEPO in August and September 2006.

content	page
Field Guidelines for Wetland Scoring: All Wetlands Sheets	51
Field Guidelines for Wetland Scoring: Depressional Wetlands	55
Field Guidelines for Wetland Scoring: Riverine Wetlands	60
Field Guidelines for Wetland Scoring: Seep/Slope Wetlands	64

Field Guidelines for Wetland Scoring:
All Wetlands Sheet 1

Park:	Surveyors :	Date:
Source Code:	Site name:	Time to complete:
NPS Wetland Polygon Code(s):		
Number of wetland polygons within class:		

Height Classes for Assessing Vertical Biotic Structure Wetland

System	Height		
	Short	Medium	Tall
Depressional, Slope and Seep, Lagoon, and Estuarine	< .3 m	0.3 – 1 m	> 1 m

Plant layers and their dominance by native species

	Plant Layer				
	Aquatic/Semi-aquatic		Terrestrial/Riparian		
	Submergent	Emergent (all)	Short	Medium	Tall
Mark if layer present (covers at least 5% of suitable habitat area)					
Mark if dominated by native species (at least 50% of the layer is represented by natives)					
Total number of layers present					
Percent of layers dominated by native species					

Field Guidelines for Wetland Scoring:
All Wetlands Sheet 2

Plant Community Composition Worksheet: Co-dominant species richness
(a dominant species represents ≥10% relative cover)

Submergent Aquatic/Semi-aquatic		Tall Terrestrial/Riparian
Emergent Aquatic/Semi-aquatic		**Medium Terrestrial/Riparian**
Short Terrestrial/Riparian		
Total number of co-dominant species for all layers combined		
Percent of co-dominant species that are native		

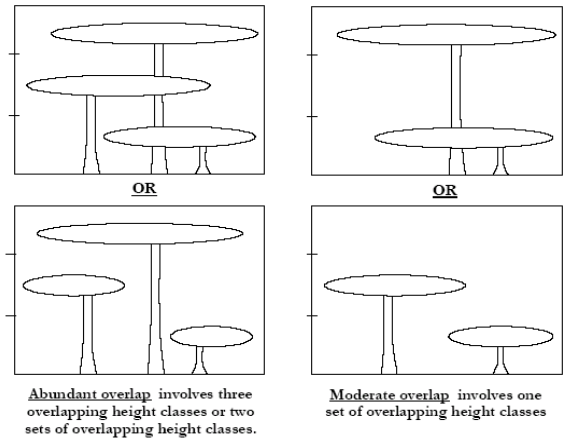


Figure 4.4: Schematic of abundant and moderate vertical interspersion of plant layers.

Field Guidelines for Wetland Scoring:
All Wetlands Sheet 3

CRAM STRESSORS DATA SHEETS

HYDROLOGY	Check if present and likely to affect AA negatively?	Considered to be significant stressor or impact?
Point Source (PS) Discharges (POTW, other non-stormwater discharge)		
Non-point Source (Non-PS) Discharges (urban runoff, farm drainage)		
Flow diversions or unnatural inflows		
Dams (reservoirs, detention basins, recharge basins)		
Flow obstructions (culverts, paved stream crossings)		
Weir/drop structure, tide gates		
Dredged inlet/channel		
Engineered channel (riprap, armored channel bank, bed)		
Dike/levees		
Groundwater extraction		
Ditches (borrow, agricultural drainage, mosquito control, etc.)		
Comments		

ABIOTIC STRUCTURE	Check if present and likely to affect AA negatively?	Considered to be significant stressor or impact?
Filling or dumping of sediment or soils **(N/A for restoration areas)**		
Grading/ compaction **(N/A for restoration areas)**		
Plowing/Discing **(N/A for restoration areas)**		
Resource extraction (sediment, gravel, oil and/or gas)		
Vegetation management		
Excessive sediment or organic debris from watershed		
Excessive runoff from watershed		
Nutrient impaired (PS or Non-PS pollution)		
Heavy metal impaired (PS or Non-PS pollution)		
Pesticides or trace organics impaired (PS or Non-PS pollution)		
Bacteria and pathogens impaired (PS or Non-PS pollution)		
Trash or refuse		
Comments		

Field Guidelines for Wetland Scoring:
All Wetlands Sheet 4

CRAM STRESSORS DATA SHEETS (cont'd)

BIOTIC STRUCTURE	Check if present and likely to affect AA negatively?	Considered to be significant stressor or impact?
Mowing, grazing, excessive herbivory (within AA)		
Excessive human visitation		
Predation and habitat destruction by non-native vertebrates (e.g., *Virginia opossum* and domestic predators (e.g., feral pets)		
Tree cutting/sapling removal		
Removal of woody debris		
Treatment of non-native and nuisance plant species		
Pesticide application or vector control		
Evidence of fire		
Evidence of flood		
Biological resource extraction or stocking (fisheries, aquaculture)		
Excessive organic debris in matrix (for vernal pools)		
Lack of vegetation management to conserve natural resources		
Lack of appropriate treatment of invasive plant species adjacent to AA or buffer		
Comments		

ADJACENT LAND USE	Check if present and likely to affect AA negatively?	Considered to be significant stressor or impact?
Urban residential		
Industrial/commercial		
Military training/Air traffic		
Dryland farming		
Intensive row-crop agriculture		
Orchards/nurseries		
Commercial feedlots		
Dairies		
Ranching (enclosed livestock grazing or horse paddock or feedlot)		
Transportation corridor		
Rangeland (livestock rangeland also managed for native vegetation)		
Sports fields and urban parklands (golf courses, soccer fields, etc.)		
Passive Recreation (bird-watching, hiking, etc.)		
Active Recreation (off-road vehicles, mountain biking, hunting, fishing)		
Physical resource extraction (rock, sediment, oil/gas)		
Biological resource extraction (aquaculture, commercial fisheries)		
Comments		

Field Guidelines for Wetland Scoring:
Depressional Wetlands Sheet 1

WETLAND CLASS: Depressional		
BUFFER and LANDSCAPE CONTEXT		
Landscape Connectivity	A	At least some portion of three or more other areas of water-dependent habitat (other wetlands of the same class, wetlands of different classes, lakes, streams, lagoons, etc.) exists within a 500-m zone surrounding the wetland being assessed, with no intervening barriers to wildlife movement.
	B	At least some portion of two areas of water-dependent habitat exists within a 500-m zone surrounding the wetland being assessed, with no intervening barriers to wildlife movement.
	C	At least some portion of one other area of water-dependent habitat exists within a 500-m zone surrounding the wetland being assessed, with no intervening barriers to wildlife movement.
	D	The 500-m zone surrounding the wetland does not contain any other areas of water-dependent habitat.
Percent of AA with Buffer	A	Buffer is > 75 - 100% of AA perimeter.
	B	Buffer is > 50 - 75% of AA perimeter.
	C	Buffer is 25 - 50% of AA perimeter.
	D	Buffer is < 25% of AA perimeter.
Average Buffer Width	A	Average buffer width of AA is ≥ 200 m.
	B	Average buffer width of AA is 100 – 199 m.
	C	Average buffer width of AA is 50 – 99 m.
	D	Average buffer width of AA is 0 - 49 m.
Buffer Condition	A	Buffer for AA is characterized by abundant native vegetation and little to no cover of non-native plants, with intact soils, and little or no trash or refuse.
	B	Buffer for AA is characterized by moderate cover of native vegetation, moderate cover of non-native plants, intact or moderately disrupted soils, moderate or lesser amounts of trash or refuse, and minor intensity of human visitation or recreation.
	C	Buffer for AA is characterized by a prevalence of non-native plants, and either moderate or extensive soil disruption, moderate or greater amounts of trash or refuse, and moderate intensity of human visitation or recreation.
	D	Buffer for AA is characterized by barren ground and highly compacted or otherwise disrupted soils, with moderate or greater amounts of trash or refuse, and moderate or greater intensity of human visitation or recreation; OR there is no buffer present.

Field Guidelines for Wetland Scoring:
Depressional Wetlands Sheet 2

WETLAND CLASS: Depressional (cont'd)		
HYDROLOGY		
Water Source	A	Dry-season freshwater source for AA is precipitation, groundwater, and/or natural runoff, or an adjacent freshwater body. There is no indication of direct artificial water sources. Land use in the local drainage area of the AA is primarily open space or low density, passive uses. No large point sources discharge into or adjacent to the AA.
	B	Dry-season freshwater source is mostly natural, but AA directly receives occasional or small amounts of inflow from anthropogenic sources. Indications of anthropogenic input include developed land or irrigated agricultural land (< 20%) in the immediate drainage area of the AA, or the presence of small stormdrains or other local discharges emptying into the AA. No large point sources discharge into or adjacent to the AA.
	C	Dry-season freshwater source is primarily urban runoff, direct irrigation, pumped water, artificially impounded water, or other artificial hydrology. Indications of substantial artificial hydrology include > 20% developed or irrigated agricultural land adjacent to the AA, and the presence of major point sources that discharge into or adjacent to the AA. OR Dry season freshwater flow exists but has been substantially diminished by known diversions of water or other withdrawals directly from the AA, its encompassing wetland, or from areas adjacent to the AA or its wetland.
	D	Natural, dry-season or end-of-wet-season sources of freshwater have been eliminated based on the following indicators: observable diversion of all dry-season flow, etc., and predominance of xeric vegetation (see Table 4.7b). (NOTE: Ephemeral streams that naturally lack water should not be penalized).
Hydroperiod or Channel Stability	A	Hydroperiod of the AA is characterized by natural patterns of filling or inundation and drying or drawdown.
	B	The filling or inundation patterns in the AA are of greater magnitude or duration than would be expected under natural conditions, but thereafter, the AA is subject to natural drawdown or drying.
	C	Hydroperiod of the AA is characterized by natural patterns of filling or inundation, but thereafter, is subject to more rapid or extreme drawdown or drying, as compared to more natural wetlands.
	D	The filling or inundation patterns in the AA are of substantially lower magnitude or duration than would be expected under natural conditions, but thereafter, the AA is subject to natural drawdown or drying.
	E	Both the filling/inundation and drawdown/drying of the AA deviate from natural conditions (either increased or decreased in magnitude and/or duration).

Field Guidelines for Wetland Scoring:
Depressional Wetlands Sheet 3

WETLAND CLASS: Depressional (cont'd)		
Hydrologic Connectivity	A	Rising water in the AA has unrestricted access to adjacent upland, without levees, excessively high banks, artificial walls, or other obstructions to the lateral movement of flood flows.
	B	Lateral excursion of rising waters in the AA is partially restricted by unnatural features, such as levees or excessively high banks, but less than 50% of the AA is restricted by barriers to drainage. Restrictions may be intermittent along the AA, or the restrictions may occur only along one bank or shore. Flood flows may exceed the obstructions, but drainage back to the wetland is incomplete due to impoundment.
	C	Lateral excursion of rising waters in the AA is partially restricted by unnatural features, such as levees or excessively high banks, and 50-90% of the AA is restricted by barriers to drainage. Flood flows may exceed the obstructions, but drainage back to the wetland is incomplete due to impoundment.
	D	All water stages in the AA are contained within artificial banks, levees, sea walls, or comparable features, or greater than 90% of wetland is restricted by barriers to drainage. There is essentially no hydrologic connection to adjacent uplands.
PHYSICAL STRUCTURE		
Structural Patch Richness	A	>10 of the possible patch types are evident in the AA.
	B	7 – 9 of the possible patch types are evident in the AA.
	C	4 – 6 of the possible patch types are evident in the AA.
	D	<3 of the possible patch types are evident in the AA.
Topographic Complexity	A	AA as viewed along cross-sections has a variety of slopes, or elevations, that are characterized by different moisture gradients. Each sub-slope contains physical patch types or features that contribute to irregularity in height, edges, or surface of the AA and to complex topography overall.
	B	AA has a variety of slopes, or elevations, that are characterized by different moisture gradients; however, each sub-slope lacks many physical patch types, such that the slopes or elevation zones tend to be regular and uniform.
	C	AA has a single, uniform slope or elevation. However that slope, or elevation, has a variety of physical patch types.
	D	AA has a single, uniform slope, or elevation, with few physical patch types.

Field Guidelines for Wetland Scoring:
Depressional Wetlands Sheet 4

WETLAND CLASS: Depressional (cont'd)		
BIOTIC STRUCTURE		
Organic Matter Accumulation	A	The AA is characterized by an abundance of fine organic matter in topographic lows, along high-water shorelines, and across vegetated plains. There is a range of kinds of organic matter representing all the visible stages of processing, from whole plant parts to fine detritus.
	B	The AA is characterized by a moderate amount of fine organic matter in a patchy distribution. There is some matter of various sizes, but new materials seem much more prevalent than old materials. Litter layers, duff layers, and leaf piles in pools or topographic lows are thin.
	C	The AA is characterized by occasional small amounts of coarse organic debris, such as leaf litter or thatch, with only traces of fine debris, and with little evidence of organic matter recruitment.
	D	The AA contains essentially no significant amounts of coarse plant debris, and only scant amounts of fine debris.
Interspersion and Zonation	A	Wetland has a high degree of plan-view interspersion.
	B	Wetland has a moderate degree of plan-view interspersion.
	C	Wetland has a low degree of plan-view interspersion.
	D	Wetland has essentially no plan-view interspersion.
Number of Plant Layers Present	A	4 – 5 layers are present.
	B	2 - 3 layers are present.
	C	1 layer is present.
	D	No layers are present.
Percent of Layers Dominated by Native Species	A	75 – 100%
	B	50 – 74%
	C	35 – 49%
	D	0 – 34%

Field Guidelines for Wetland Scoring:
Depressional Wetlands Sheet 5

WETLAND CLASS: Depressional (cont'd)		
Number of Co-dominant Species	A	≥ 7 codominant species
	B	5 – 6 codominant species
	C	3 – 4 codominant species
	D	0 – 2 codominant species
Percent of Co-dominants that are Native	A	90 – 100%
	B	80 – 89%
	C	50 – 79%
	D	0 – 49%
Vertical Biotic Structure	A	About 75 – 100 % of the vegetated area of the AA supports 4 plant layers.
	B	About 50 – 75 % of vegetated area of the AA supports 4 plant layers, or more than 75 % of the area supports 3 plant layers.
	C	About 25 – 50 % of the vegetated area supports 4 plant layers, or 50 - 75 % of the area supports 3 plant layers.
	D	Less than 25 % of the vegetated area of the AA supports 4 height classes, or less than 50 % of the area supports 3 plant layers.

Field Guidelines for Wetland Scoring:
Riverine Wetlands Sheet 1

WETLAND CLASS: Riverine		
BUFFER and LANDSCAPE CONTEXT		
Landscape Connectivity	A	There is contiguous riparian habitat of at least 500 m at both ends of the AA (upstream and downstream)
	B	There is contiguous riparian habitat of at least 500 m at either the upstream or downstream end of the AA.
	C	Neither end of the AA has contiguous riparian habitat of at least 500 m.
Percent of AA with Buffer	A	Buffer is > 75 - 100% of AA perimeter.
	B	Buffer is > 50 - 75% of AA perimeter.
	C	Buffer is 25 - 50% of AA perimeter.
	D	Buffer is < 25% of AA perimeter.
Average Buffer Width	A	Average buffer width of AA is ≥ 200 m.
	B	Average buffer width of AA is 100 – 199 m.
	C	Average buffer width of AA is 50 – 99 m.
	D	Average buffer width of AA is 0 - 49 m.
Buffer Condition	A	Buffer for AA is characterized by abundant native vegetation and little to no cover of non-native plants, with intact soils, and little or no trash or refuse.
	B	Buffer for AA is characterized by moderate cover of native vegetation, moderate cover of non-native plants, intact or moderately disrupted soils, moderate or lesser amounts of trash or refuse, and minor intensity of human visitation or recreation.
	C	Buffer for AA is characterized by a prevalence of non-native plants, and either moderate or extensive soil disruption, moderate or greater amounts of trash or refuse, and moderate intensity of human visitation or recreation.
	D	Buffer for AA is characterized by barren ground and highly compacted or otherwise disrupted soils, with moderate or greater amounts of trash or refuse, and moderate or greater intensity of human visitation or recreation; OR there is no buffer present.

Field Guidelines for Wetland Scoring:
Riverine Wetlands Sheet 2

WETLAND CLASS: Riverine (cont'd)		
HYDROLOGY		
Water Source	A	Dry-season freshwater source for AA is precipitation, groundwater, and/or natural runoff, or an adjacent freshwater body. There is no indication of direct artificial water sources. Land use in the local drainage area of the AA is primarily open space or low density, passive uses. No large point sources discharge into or adjacent to the AA.
	B	Dry-season freshwater source is mostly natural, but AA directly receives occasional or small amounts of inflow from anthropogenic sources. Indications of anthropogenic input include developed land or irrigated agricultural land (< 20%) in the immediate drainage area of the AA, or the presence of small stormdrains or other local discharges emptying into the AA. No large point sources discharge into or adjacent to the AA.
	C	Dry-season freshwater source is primarily urban runoff, direct irrigation, pumped water, artificially impounded water, or other artificial hydrology. Indications of substantial artificial hydrology include > 20% developed or irrigated agricultural land adjacent to the AA, and the presence of major point sources that discharge into or adjacent to the AA. OR Dry season freshwater flow exists but has been substantially diminished by known diversions of water or other withdrawals directly from the AA, its encompassing wetland, or from areas adjacent to the AA or its wetland.
	D	Natural, dry-season or end-of-wet-season sources of freshwater have been eliminated based on the following indicators: observable diversion of all dry-season flow, etc., and predominance of xeric vegetation (see Table 4.7b). (NOTE: Ephemeral streams that naturally lack water should not be penalized).
Hydroperiod or Channel Stability	A	Most of the channel through the AA is characterized by equilibrium conditions, with no evidence of severe aggradation or degradation (based on the field indicators listed in Table 4.8).
	B	Most of the channel through the AA is characterized by some aggradation or degradation, none of which is severe, and the channel seems to be approaching an equilibrium form (based on the field indicators listed in Table 4.8).
	C	There is evidence of severe aggradation or degradation of most of the channel through the AA (based on the field indicators listed in Table 4.8).
	D	Concrete, or otherwise artificially hardened, channels Artificially hardened concrete channels in most of the channel through the AA (based on the field indicators listed in Table 4.8).

Field Guidelines for Wetland Scoring:
Riverine Wetlands Sheet 3

WETLAND CLASS: Riverine (cont'd)		
BIOTIC STRUCTURE		
Organic Matter Accumulation (***Unconfined***)	A	The AA is characterized by an abundance of fine organic matter in topographic lows, along high-water shorelines, and across vegetated plains. There is a range of kinds of organic matter representing all the visible stages of processing, from whole plant parts to fine detritus.
	B	The AA is characterized by a moderate amount of fine organic matter in a patchy distribution. There is some matter of various sizes, but new materials seem much more prevalent than old materials. Litter layers, duff layers, and leaf piles in pools or topographic lows are thin.
	C	The AA is characterized by occasional small amounts of coarse organic debris, such as leaf litter or thatch, with only traces of fine debris, and with little evidence of organic matter recruitment.
	D	The AA contains essentially no significant amounts of coarse plant debris, and only scant amounts of fine debris.
Organic Matter Accumulation (***Confined***)	A	The AA is characterized by a moderate amount of fine organic matter in a patchy distribution. There is some matter of various sizes, but new materials seem much more prevalent than old materials. Litter layers, duff layers, and leaf piles in pools or topographic lows are thin.
	B	The AA is characterized by occasional small amounts of coarse organic debris, such as leaf litter or thatch, with only traces of fine debris, and with little evidence of organic matter recruitment.
	C	The AA contains essentially no significant amounts of coarse plant debris, and only scant amounts of fine debris.
Interspersion and Zonation	A	Wetland has a high degree of plan-view interspersion.
	B	Wetland has a moderate degree of plan-view interspersion.
	C	Wetland has a low degree of plan-view interspersion.
	D	Wetland has essentially no plan-view interspersion.
Number of Plant Layers Present	A	4 – 5 layers are present.
	B	3 layers are present.
	C	2 layers are present.
	D	0 – 1 layer is present.

Field Guidelines for Wetland Scoring:
Riverine Wetlands Sheet 4

WETLAND CLASS: Riverine (cont'd)		
Percent of Layers Dominated by Native Species ***(Unconfined)***	A	75 – 100%
	B	50 – 74%
	C	35 – 49%
	D	0 – 34%
Percent of Layers Dominated by Native Species ***(Confined)***	A	75 – 100%
	B	50 – 74%
	C	25 – 49%
	D	0 – 24%
Number of Co-dominant Species ***(Unconfined)***	A	≥ 12 codominant species
	B	7 – 11 codominant species
	C	4 – 6 codominant species
	D	0 – 3 codominant species
Number of Co-dominant Species ***(Confined)***	A	≥ 12 codominant species
	B	8 – 11 codominant species
	C	5 – 7 codominant species
	D	0 – 4 codominant species
Percent of Co-dominants that are Native ***(Unconfined)***	A	90 – 100%
	B	70 – 89%
	C	40 – 69%
	D	0 – 39%
Percent of Co-dominants that are Native ***(Confined)***	A	90 – 100%
	B	70 – 89%
	C	30 – 69%
	D	0 – 29%

Field Guidelines for Wetland Scoring:
Seep/Slope Wetlands Sheet 1

WETLAND CLASS: Seeps and Springs		
BUFFER and LANDSCAPE CONTEXT		
Landscape Connectivity	A	At least some portion of three or more other areas of water-dependent habitat (other wetlands of the same class, wetlands of different classes, lakes, streams, lagoons, etc.) exists within a 500-m zone surrounding the wetland being assessed, with no intervening barriers to wildlife movement.
	B	At least some portion of two areas of water-dependent habitat exists within a 500-m zone surrounding the wetland being assessed, with no intervening barriers to wildlife movement.
	C	At least some portion of one other area of water-dependent habitat exists within a 500-m zone surrounding the wetland being assessed, with no intervening barriers to wildlife movement.
	D	The 500-m zone surrounding the wetland does not contain any other areas of water-dependent habitat.
Percent of AA with Buffer	A	Buffer is > 75 - 100% of AA perimeter.
	B	Buffer is > 50 - 75% of AA perimeter.
	C	Buffer is 25 - 50% of AA perimeter.
	D	Buffer is < 25% of AA perimeter.
Average Buffer Width	A	Average buffer width of AA is ≥ 200 m.
	B	Average buffer width of AA is 100 – 199 m.
	C	Average buffer width of AA is 50 – 99 m.
	D	Average buffer width of AA is 0 - 49 m.
Buffer Condition	A	Buffer for AA is characterized by abundant native vegetation and little to no cover of non-native plants, with intact soils, and little or no trash or refuse.
	B	Buffer for AA is characterized by moderate cover of native vegetation, moderate cover of non-native plants, intact or moderately disrupted soils, moderate or lesser amounts of trash or refuse, and minor intensity of human visitation or recreation.
	C	Buffer for AA is characterized by a prevalence of non-native plants, and either moderate or extensive soil disruption, moderate or greater amounts of trash or refuse, and moderate intensity of human visitation or recreation.
	D	Buffer for AA is characterized by barren ground and highly compacted or otherwise disrupted soils, with moderate or greater amounts of trash or refuse, and moderate or greater intensity of human visitation or recreation; OR there is no buffer present.

Field Guidelines for Wetland Scoring:
Seep/Slope Wetlands Sheet 2

WETLAND CLASS: Seeps and Springs (cont'd)		
HYDROLOGY		
Water Source	A	Dry-season freshwater source for AA is precipitation, groundwater, and/or natural runoff, or an adjacent freshwater body. There is no indication of direct artificial water sources. Land use in the local drainage area of the AA is primarily open space or low density, passive uses. No large point sources discharge into or adjacent to the AA.
	B	Dry-season freshwater source is mostly natural, but AA directly receives occasional or small amounts of inflow from anthropogenic sources. Indications of anthropogenic input include developed land or irrigated agricultural land (< 20%) in the immediate drainage area of the AA, or the presence of small stormdrains or other local discharges emptying into the AA. No large point sources discharge into or adjacent to the AA.
	C	Dry-season freshwater source is primarily urban runoff, direct irrigation, pumped water, artificially impounded water, or other artificial hydrology. Indications of substantial artificial hydrology include > 20% developed or irrigated agricultural land adjacent to the AA, and the presence of major point sources that discharge into or adjacent to the AA. OR Dry season freshwater flow exists but has been substantially diminished by known diversions of water or other withdrawals directly from the AA, its encompassing wetland, or from areas adjacent to the AA or its wetland.
	D	Natural, dry-season or end-of-wet-season sources of freshwater have been eliminated based on the following indicators: observable diversion of all dry-season flow, etc., and predominance of xeric vegetation (see Table 4.7b). (NOTE: Ephemeral streams that naturally lack water should not be penalized).
Hydroperiod or Channel Stability	A	Hydroperiod of the AA is characterized by natural patterns of filling or inundation and drying or drawdown.
	B	The filling or inundation patterns in the AA are of greater magnitude or duration than would be expected under natural conditions, but thereafter, the AA is subject to natural drawdown or drying.
	C	Hydroperiod of the AA is characterized by natural patterns of filling or inundation, but thereafter, is subject to more rapid or extreme drawdown or drying, as compared to more natural wetlands.
	D	The filling or inundation patterns in the AA are of substantially lower magnitude or duration than would be expected under natural conditions, but thereafter, the AA is subject to natural drawdown or drying.
	E	Both the filling/inundation and drawdown/drying of the AA deviate from natural conditions (either increased or decreased in magnitude and/or duration).

Field Guidelines for Wetland Scoring:
Seep/Slope Wetlands Sheet 2

WETLAND CLASS: Seeps and Springs (cont'd)		
Hydrologic Connectivity	A	Rising water in the AA has unrestricted access to adjacent upland, without levees, excessively high banks, artificial walls, or other obstructions to the lateral movement of flood flows.
	B	Lateral excursion of rising waters in the AA is partially restricted by unnatural features, such as levees or excessively high banks, but less than 50% of the AA is restricted by barriers to drainage. Restrictions may be intermittent along the AA, or the restrictions may occur only along one bank or shore. Flood flows may exceed the obstructions, but drainage back to the wetland is incomplete due to impoundment.
	C	Lateral excursion of rising waters in the AA is partially restricted by unnatural features, such as levees or excessively high banks, and 50-90% of the AA is restricted by barriers to drainage. Flood flows may exceed the obstructions, but drainage back to the wetland is incomplete due to impoundment.
	D	All water stages in the AA are contained within artificial banks, levees, sea walls, or comparable features, or greater than 90% of wetland is restricted by barriers to drainage. There is essentially no hydrologic connection to adjacent uplands.

Field Guidelines for Wetland Scoring: Seep/Slope Wetlands Sheet 3

WETLAND CLASS: Seeps and Springs (cont'd)		
Structural Patch Richness	A	>7 of the possible patch types are evident in the AA.
	B	5 – 6 of the possible patch types are evident in the AA.
	C	3 – 4 of the possible patch types are evident in the AA.
	D	<2 of the possible patch types are evident in the AA.
Topographic Complexity	A	AA as viewed along cross-sections has a variety of slopes, or elevations, that are characterized by different moisture gradients. Each sub-slope contains physical patch types or features that contribute to irregularity in height, edges, or surface of the AA and to complex topography overall.
	B	AA has a variety of slopes, or elevations, that are characterized by different moisture gradients; however, each sub-slope lacks many physical patch types, such that the slopes or elevation zones tend to be regular and uniform.
	C	AA has a single, uniform slope or elevation. However that slope, or elevation, has a variety of physical patch types.
	D	AA has a single, uniform slope, or elevation, with few physical patch types.
BIOTIC STRUCTURE		
Organic Matter Accumulation	A	The AA is characterized by an abundance of fine organic matter in topographic lows, along high-water shorelines, and across vegetated plains. There is a range of kinds of organic matter representing all the visible stages of processing, from whole plant parts to fine detritus.
	B	The AA is characterized by a moderate amount of fine organic matter in a patchy distribution. There is some matter of various sizes, but new materials seem much more prevalent than old materials. Litter layers, duff layers, and leaf piles in pools or topographic lows are thin.
	C	The AA is characterized by occasional small amounts of coarse organic debris, such as leaf litter or thatch, with only traces of fine debris, and with little evidence of organic matter recruitment.
	D	The AA contains essentially no significant amounts of coarse plant debris, and only scant amounts of fine debris.
Interspersion and Zonation	A	Wetland has a high degree of plan-view interspersion.
	B	Wetland has a moderate degree of plan-view interspersion.
	C	Wetland has a low degree of plan-view interspersion.
	D	Wetland has essentially no plan-view interspersion.

Field Guidelines for Wetland Scoring: Seep/Slope Wetlands Sheet 4

WETLAND CLASS: Seeps and Springs (cont'd)		
Number of Plant Layers Present	A	4 – 5 layers are present.
	B	2 - 3 layers are present.
	C	1 layer is present.
	D	No layers are present.
Percent of Layers Dominated by Native Species	A	75 – 100%
	B	50 – 74%
	C	35 – 49%
	D	0 – 34%
Number of Co-dominant Species	A	≥ 7 codominant species
	B	5 – 6 codominant species
	C	3 – 4 codominant species
	D	0 – 2 codominant species
Percent of Co-dominants that are Native	A	90 – 100%
	B	80 – 89%
	C	50 – 79%
	D	0 – 49%
Vertical Biotic Structure	A	More than 50 % of the vegetated area of the AA supports abundant overlap of height classes (see Figure 4.4).
	B	More than 50 % of the area supports at least moderate overlap of height classes.
	C	25 – 50 % of the vegetated AA supports at least moderate overlap of plant layers, **or** three plant layers are well represented in the AA but there is little to no overlap.
	D	Less than 25% of the vegetated AA supports moderate overlap of height classes, **or** two layers are well represented with little overlap, **or** AA is sparsely vegetated overall.

Appendix E:
Devils Postpile National Monument Wetland Delineation and Assessment Data

The following pages present the transcribed raw data from the 2006 wetland inventory and condition assessment at Devils Postpile National Monument. The first set of sheets – the Wetland Delineation and Assessment Datasheets – provide information about each Cowardin wetland unit mapped. Following this set of datasheets, a single 11-inch by 17-inch sheet documents condition assessment scores for each CRAM wetland identified at DEPO in 2006. This sheet provides grades for individual metrics for each wetland (*e.g.,* Hydrology, or Buffer Condition), and then the summary of the scores as a number given as a percentage of a perfect – that is, 100% – score. This sheet also presents the overall condition score for each CRAM wetland, the number of anthropogenic stressors observed by project staff, and the state of the wetland relative to the Monument's desired condition for wetlands.

Devils Postpile Wetland Delineation and Assessment Data

Cowardin Code: D01-PEM01
Site name: JMT/Old SJR Junction
Cowardin Type: Palustrine Emergent

Date surveyed: 8/10/2006
UTM coordinates: 315899 easting, 4165201 northing
Recent precipitation at time of survey? ☐
Wetland hydrology indicators: Standing Water; Saturation in upper 12 inches

Possible hydrologic sources:
- ☑ Direct Precipitation
- ☐ Headwater Flooding
- ☐ Backwater Flooding
- ☑ Surface Water
- ☑ Groundwater
- ☐ Tides
- ☐ Altered Water Source

Hydrologic alteration:
- ☐ Dams
- ☐ Levees
- ☐ Channelization
- ☐ Ditches
- ☐ IrrigationPipe
- ☐ Culverts
- ☐ Filling

Is the site inundated or saturated for more than ten consecutive days during the ye: Yes

Vegetation:

	Tree	Shrub	Herbaceous plant
cover class	0	1 (<1%)	6 (76-100%)
height class	8 (Not applicabl	2 (0.5m-2m)	1 (<0.5m)

Number of dominant plant species: 1
Non-native plant species cover: 0
Total number of non-native plant species: 0

Wetland classification:
NWI classification: Palustrine Emergent
Water regime: C1
Water regime modifiers:
CRAM system classificaiton: Depressional

does the site support a prevalance of hydrophytic plants? ☑
does the site exhibit wetland hydrology? ☑
are hydric soils present at the site? ☐

Field comments: Meadow covered with standing water ("a pond") one month prior to observation;
Surveyors: Shorrock, D.

Devils Postpile Wetland Delineation and Assessment Data

Cowardin Code: D02-PEM01
Site name: Residence Meadow
Cowardin Type: Palustrine Emergent

Date surveyed: 8/11/2006
UTM coordinates: 316094 easting, 4166751 northing
Recent precipitation at time of survey? ☐
Wetland hydrology indicators: Sediment deposits

Possible hydrologic sources:
- ☑ Direct Precipitation
- ☐ Headwater Flooding
- ☐ Backwater Flooding
- ☑ Surface Water
- ☑ Groundwater
- ☐ Tides
- ☐ Altered Water Source

Hydrologic alteration:
- ☐ Dams
- ☐ Levees
- ☑ Channelization
- ☐ Ditches
- ☐ IrrigationPipe
- ☑ Culverts
- ☐ Filling

Is the site inundated or saturated for more than ten consecutive days during the ye: Yes

Vegetation:

	Tree	Shrub	Herbaceous plant
cover class	0	3a (6-15%)	6 (76-100%)
height class	8 (Not applicabl	3 (2m-5m)	1 (<0.5m)

Number of dominant plant species: 5
Non-native plant species cover: 2
Total number of non-native plant species: 1

Wetland classification:
NWI classification: Palustrine Emergent
Water regime: C3
Water regime modifiers:
CRAM system classificaiton: Depressional

does the site support a prevalance of hydrophytic plants? ☑
does the site exhibit wetland hydrology? ☐
are hydric soils present at the site? ☐

Field comments: Observations from park staff that this meadow was inundated for 2+ weeks; soils no longe saturated - mostly pumice; PICO encroachment
Surveyors: Shorrock, D.

Devils Postpile Wetland Delineation and Assessment Data

Cowardin Code: D03-PEM01
Site name: West of Arch Bridge
Cowardin Type: Palustrine Emergent

Date surveyed: 8/14/2006
UTM coordinates: 315979 easting, 4165051 northing
Recent precipitation at time of survey? ☐
Wetland hydrology indicators: Standing Water; Saturation in upper 12 inches; Drainage patterns

Possible hydrologic sources:
- ☑ Direct Precipitation
- ☐ Headwater Flooding
- ☐ Backwater Flooding
- ☑ Surface Water
- ☑ Groundwater
- ☐ Tides
- ☐ Altered Water Source

Hydrologic alteration:
- ☐ Dams
- ☐ Levees
- ☐ Channelization
- ☐ Ditches
- ☐ IrrigationPipe
- ☐ Culverts
- ☐ Filling

Is the site inundated or saturated for more than ten consecutive days during the ye: Yes

Vegetation:

	Tree	Shrub	Herbaceous plant
cover class	0	4 (26-50%)	5 (51-75%)
height class	8 (Not applicabl	2 (0.5m-2m)	1 (<0.5m)

Number of dominant plant species: 1
Non-native plant species cover: 0
Total number of non-native plant species: 0

Wetland classification:
NWI classification: Palustrine Emergent
Water regime: F
Water regime modifiers:
CRAM system classificaiton: Depressional

does the site support a prevalance of hydrophytic plants? ☑
does the site exhibit wetland hydrology? ☑
are hydric soils present at the site? ☐

Field comments: Lots of dead and down debris, may wildlife spp. present - snails, dragonflies, tadpoles, aquatic insects, birds; edges lined with PINCON;
Surveyors: Shorrock, D.

Devils Postpile Wetland Delineation and Assessment Data

Cowardin Code: D03-PUB01
Site name: West of Arch Bridge
Cowardin Type: Palustrine Unconsolidated Bottom

Date surveyed: 8/14/2006
UTM coordinates: 316032 easting, 4165195 northing
Recent precipitation at time of survey? ☐
Wetland hydrology indicators: Standing Water; Sediment deposits; Drift lines

Possible hydrologic sources:
- ☑ Direct Precipitation
- ☐ Headwater Flooding
- ☐ Backwater Flooding
- ☑ Surface Water
- ☑ Groundwater
- ☐ Tides
- ☐ Altered Water Source

Hydrologic alteration:
- ☐ Dams
- ☐ Levees
- ☐ Channelization
- ☐ Ditches
- ☐ IrrigationPipe
- ☐ Culverts
- ☐ Filling

Is the site inundated or saturated for more than ten consecutive days during the ye: Yes

Vegetation:

	Tree	Shrub	Herbaceous plant
cover class	0	3a (6-15%)	3b (16-25%)
height class	8 (Not applicabl	2 (0.5m-2m)	1 (<0.5m)

Number of dominant plant species: 1
Non-native plant species cover: 0
Total number of non-native plant species: 0

Wetland classification:
NWI classification: Palustrine Unconsolidated Bottom
Water regime: F
Water regime modifiers:
CRAM system classificaiton: Depressional

does the site support a prevalance of hydrophytic plants? ☑
does the site exhibit wetland hydrology? ☑
are hydric soils present at the site? ☐

Field comments: Similar to EM01 - more standing, open water
Surveyors: Shorrock, D.

Devils Postpile Wetland Delineation and Assessment Data

Cowardin Code: D04-PSS01
Site name: Campground
Cowardin Type: Palustrine Scrub-shrub

Date surveyed: 9/7/2006
UTM coordinates: 315956 easting, 4167001 northing
Recent precipitation at time of survey? ☐
Wetland hydrology indicators: Standing Water; Saturation in upper 12 inches; Sediment deposits

Possible hydrologic sources			
☑ Direct Precipitation	☑ Surface Water	☐ Altered Water Source
☐ Headwater Flooding	☑ Groundwater	
☐ Backwater Flooding	☐ Tides	

Hydrologic alteration			
☐ Dams	☐ Ditches	☐ Filling
☐ Levees	☐ IrrigationPipe	
☐ Channelization	☐ Culverts	

Is the site inundated or saturated for more than ten consecutive days during the ye: Yes

Vegetation	Tree	Shrub	Herbaceous plant
	cover clas 3a (6-15%)	cover clas 4 (26-50%)	cover clas 5 (51-75%)
	height clas 5 (15m-35m)	height clas 2 (0.5m-2m)	height clas 1 (<0.5m)

Number of dominant plant species	6
Non-native plant species cover	0
Total number of non-native plant species	0

Wetland classification	
NWI classification	Palustrine Scrub-shrub
Water regime	F
Water regime modifiers	
CRAM system classificaiton	Depressional

does the site support a prevalance of hydrophytic plants?	☑
does the site exhibit wetland hydrology?	☑
are hydric soils present at the site?	☐

Field comments: Wetland sits in between A&B loops of campground; higher areas support PICO; may receive flows from river at peak; culvert below AA where some willows grow; wetland tape off before that point

Surveyors: Shorrock, D.

Devils Postpile Wetland Delineation and Assessment Data

Cowardin Code: D05-PEM01
Site name: Eastern Postpile Boundary
Cowardin Type: Palustrine Emergent

Date surveyed: 8/16/2006
UTM coordinates: 316178 easting, 4165803 northing
Recent precipitation at time of survey? ☐
Wetland hydrology indicators: Standing Water; Drainage patterns; Sediment deposits

Possible hydrologic sources			
☑ Direct Precipitation	☑ Surface Water	☐ Altered Water Source
☐ Headwater Flooding	☑ Groundwater	
☐ Backwater Flooding	☐ Tides	

Hydrologic alteration			
☐ Dams	☐ Ditches	☐ Filling
☐ Levees	☐ IrrigationPipe	
☐ Channelization	☐ Culverts	

Is the site inundated or saturated for more than ten consecutive days during the ye: Yes

Vegetation	Tree	Shrub	Herbaceous plant
	cover clas 2 (1-5%)	cover clas 2 (1-5%)	cover clas 6 (76-100%)
	height clas 4 (5m-15m)	height clas 2 (0.5m-2m)	height clas 2 (.5-2m)

Number of dominant plant species	3
Non-native plant species cover	0
Total number of non-native plant species	0

Wetland classification	
NWI classification	Palustrine Emergent
Water regime	F
Water regime modifiers	
CRAM system classificaiton	Depressional

does the site support a prevalance of hydrophytic plants?	☑
does the site exhibit wetland hydrology?	☑
are hydric soils present at the site?	☐

Field comments: Typha not expected at this location/elevation - planted here intentionally?? Southern half o wetland on Forest Service land; many downed logs

Surveyors: Shorrock, D.

Devils Postpile Wetland Delineation and Assessment Data

Cowardin Code	D06-PEM01
Site name	King Creek Hidden Lake
Cowardin Type	Palustrine Emergent

Date surveyed	9/9/2006
UTM coordinates	315555 easting 4165896 northing
Recent precipitation at time of survey?	☐
Wetland hydrology indicators	Saturation in upper 12 inches

Possible hydrologic sources	☑ Direct Precipitation	☑ Surface Water	☐ Altered Water Source
	☐ Headwater Flooding	☑ Groundwater	
	☐ Backwater Flooding	☐ Tides	
Hydrologic alteration	☐ Dams	☐ Ditches	☐ Filling
	☐ Levees	☐ IrrigationPipe	
	☐ Channelization	☐ Culverts	

Is the site inundated or saturated for more than ten consecutive days during the ye: Yes

Vegetation	Tree	Shrub	Herbaceous plant
	cover clas 0	cover clas 2 (1-5%)	cover clas 3b (16-25%)
	height clas 8 (Not applicabl	height clas 2 (0.5m-2m)	height clas 1 (<0.5m)

Number of dominant plant species	6
Non-native plant species cover	0
Total number of non-native plant species	0

Wetland classification		
	NWI classification	Palustrine Emergent
	Water regime	B2/B3
	Water regime modifiers	
	CRAM system classificaiton	Depressional

does the site support a prevalance of hydrophytic plants?	☑
does the site exhibit wetland hydrology?	☑
are hydric soils present at the site?	☐

Field comments	
Surveyors	Shorrock, D.

Devils Postpile Wetland Delineation and Assessment Data

Cowardin Code	D06-PUB01
Site name	King Creek Hidden Lake
Cowardin Type	Palustrine Unconsolidated Bottom

Date surveyed	9/9/2006
UTM coordinates	315562 easting 4165892 northing
Recent precipitation at time of survey?	☐
Wetland hydrology indicators	Standing Water Saturation in upper 12 inches Drift lines

Possible hydrologic sources	☑ Direct Precipitation	☑ Surface Water	☐ Altered Water Source
	☐ Headwater Flooding	☑ Groundwater	
	☐ Backwater Flooding	☐ Tides	
Hydrologic alteration	☐ Dams	☐ Ditches	☐ Filling
	☐ Levees	☐ IrrigationPipe	
	☐ Channelization	☐ Culverts	

Is the site inundated or saturated for more than ten consecutive days during the ye: Yes

Vegetation	Tree	Shrub	Herbaceous plant
	cover clas 0	cover clas 0	cover clas 0
	height clas 8 (Not applicabl	height clas 0	height clas 0

Number of dominant plant species	0
Non-native plant species cover	0
Total number of non-native plant species	0

Wetland classification		
	NWI classification	Palustrine Unconsolidated Bottom
	Water regime	F
	Water regime modifiers	
	CRAM system classificaiton	Depressional

does the site support a prevalance of hydrophytic plants?	☐
does the site exhibit wetland hydrology?	☑
are hydric soils present at the site?	☐

Field comments	
Surveyors	Shorrock, D.

Devils Postpile Wetland Delineation and Assessment Data

Cowardin Code: D07-PEM01
Site name: Buttresses
Cowardin Type: Palustrine Emergent

Date surveyed: 9/15/2006
UTM coordinates: 315502 easting, 4164312 northing
Recent precipitation at time of survey? ☐
Wetland hydrology indicators: Saturation in upper 12 inches; Drainage patterns; Sediment deposits

Possible hydrologic sources:
- ☑ Direct Precipitation
- ☐ Headwater Flooding
- ☐ Backwater Flooding
- ☑ Surface Water
- ☐ Groundwater
- ☐ Tides
- ☐ Altered Water Source

Hydrologic alteration:
- ☐ Dams
- ☐ Levees
- ☐ Channelization
- ☐ Ditches
- ☐ IrrigationPipe
- ☐ Culverts
- ☐ Filling

Is the site inundated or saturated for more than ten consecutive days during the ye: Yes

Vegetation:

	Tree	Shrub	Herbaceous plant
cover class	0	3a (6-15%)	6 (76-100%)
height class	8 (Not applicabl	2 (0.5m-2m)	2 (.5-2m)

Number of dominant plant species: 2
Non-native plant species cover: 0
Total number of non-native plant species: 0

Wetland classification:
- NWI classification: Palustrine Emergent
- Water regime: C3
- Water regime modifiers:
- CRAM system classificaiton: Depressional

- does the site support a prevalance of hydrophytic plants? ☑
- does the site exhibit wetland hydrology? ☑
- are hydric soils present at the site? ☐

Field comments:
Surveyors: Shorrock, D.

Devils Postpile Wetland Delineation and Assessment Data

Cowardin Code: D08-PEM01
Site name: Buttress Drainage
Cowardin Type: Palustrine Emergent

Date surveyed: 9/15/2006
UTM coordinates: 315640 easting, 4164398 northing
Recent precipitation at time of survey? ☐
Wetland hydrology indicators: Sediment deposits; Drainage patterns

Possible hydrologic sources:
- ☑ Direct Precipitation
- ☑ Headwater Flooding
- ☐ Backwater Flooding
- ☑ Surface Water
- ☐ Groundwater
- ☐ Tides
- ☐ Altered Water Source

Hydrologic alteration:
- ☐ Dams
- ☐ Levees
- ☐ Channelization
- ☐ Ditches
- ☐ IrrigationPipe
- ☐ Culverts
- ☐ Filling

Is the site inundated or saturated for more than ten consecutive days during the ye: Unknown

Vegetation:

	Tree	Shrub	Herbaceous plant
cover class	0	2 (1-5%)	5 (51-75%)
height class	8 (Not applicabl	2 (0.5m-2m)	1 (<0.5m)

Number of dominant plant species: 4
Non-native plant species cover: 0
Total number of non-native plant species: 0

Wetland classification:
- NWI classification: Palustrine Emergent
- Water regime: C2
- Water regime modifiers:
- CRAM system classificaiton: Depressional

- does the site support a prevalance of hydrophytic plants? ☑
- does the site exhibit wetland hydrology? ☑
- are hydric soils present at the site? ☐

Field comments: wetland atop buttresses; water likely collects from spring snow melt run-off; appeared that AA had been dry for at least several weeks
Surveyors: Shorrock, D.

Devils Postpile Wetland Delineation and Assessment Data

Cowardin Code: R01-PEM01
Site name: Soda Spring Meadow
Cowardin Type: Palustrine Emergent

Date surveyed: 8/8/2006
UTM coordinates: 315901 easting, 4166595 northing
Recent precipitation at time of survey? ☑
Wetland hydrology indicators: Saturation in upper 12 inches; Standing Water; Drift lines

Possible hydrologic sources:
☑ Direct Precipitation ☑ Surface Water ☐ Altered Water Source
☐ Headwater Flooding ☐ Groundwater
☐ Backwater Flooding ☐ Tides

Hydrologic alteration:
☐ Dams ☐ Ditches ☐ Filling
☐ Levees ☐ IrrigationPipe
☐ Channelization ☐ Culverts

Is the site inundated or saturated for more than ten consecutive days during the ye: Yes

Vegetation

	Tree	Shrub	Herbaceous plant
cover class	0	3b (16-25%)	6 (76-100%)
height class	8 (Not applicabl	2 (0.5m-2m)	1 (<0.5m)

Number of dominant plant species: 2
Non-native plant species cover: 0
Total number of non-native plant species: 0

Wetland classification:
NWI classification: Palustrine Emergent
Water regime: B2
Water regime modifiers:
CRAM system classificaiton: Riverine

does the site support a prevalance of hydrophytic plants? ☑
does the site exhibit wetland hydrology? ☑
are hydric soils present at the site? ☐

Field comments: Extensive meadow alon San Joaquin River included meadow inundated by river when flov are high from snow melt run-off. Groundwater run-off from slopes and snow melt also likel contribute as water sources.

Surveyors: Shorrock, D.

Devils Postpile Wetland Delineation and Assessment Data

Cowardin Code: R01-PEM02
Site name: Weather Station Meadow
Cowardin Type: Palustrine Emergent

Date surveyed: 8/11/2006
UTM coordinates: 316012 easting, 4166738 northing
Recent precipitation at time of survey? ☐
Wetland hydrology indicators: Sediment deposits; Drift lines

Possible hydrologic sources:
☑ Direct Precipitation ☑ Surface Water ☐ Altered Water Source
☐ Headwater Flooding ☑ Groundwater
☐ Backwater Flooding ☐ Tides

Hydrologic alteration:
☐ Dams ☐ Ditches ☐ Filling
☐ Levees ☐ IrrigationPipe
☐ Channelization ☐ Culverts

Is the site inundated or saturated for more than ten consecutive days during the ye: Yes

Vegetation

	Tree	Shrub	Herbaceous plant
cover class	0	0	6 (76-100%)
height class	8 (Not applicabl	0	2 (.5-2m)

Number of dominant plant species: 3
Non-native plant species cover: 3a
Total number of non-native plant species: 1

Wetland classification:
NWI classification: Palustrine Emergent
Water regime: C3
Water regime modifiers:
CRAM system classificaiton: Riverine

does the site support a prevalance of hydrophytic plants? ☑
does the site exhibit wetland hydrology? ☑
are hydric soils present at the site? ☐

Field comments: Meadow east of willows lining channel - raised trail to the east subject of much study re: obstructed flow; channel obvious where river jumps bank and flows through during high flc

Surveyors: Shorrock, D.

Devils Postpile Wetland Delineation and Assessment Data

Cowardin Code: R01-PSS01
Site name: Soda Spring Willow Patch
Cowardin Type: Palustrine Scrub-shrub

Date surveyed: 8/11/2006
UTM coordinates: 316084 easting, 4166685 northing
Recent precipitation at time of survey? ☐
Wetland hydrology indicators: Standing Water; Saturation in upper 12 inches; Drift lines

Possible hydrologic sources:
- ☑ Direct Precipitation
- ☐ Headwater Flooding
- ☐ Backwater Flooding
- ☑ Surface Water
- ☑ Groundwater
- ☐ Tides
- ☐ Altered Water Source

Hydrologic alteration:
- ☐ Dams
- ☐ Levees
- ☐ Channelization
- ☐ Ditches
- ☐ IrrigationPipe
- ☑ Culverts
- ☐ Filling

Is the site inundated or saturated for more than ten consecutive days during the ye: Yes

Vegetation:

	Tree	Shrub	Herbaceous plant
cover class	0	5 (51-75%)	5 (51-75%)
height class	8 (Not applicabl	3 (2m-5m)	1 (<0.5m)

Number of dominant plant species	5
Non-native plant species cover	2
Total number of non-native plant species	1

Wetland classification:

NWI classification	Palustrine Scrub-shrub
Water regime	C2
Water regime modifiers	
CRAM system classificaiton	Riverine

does the site support a prevalance of hydrophytic plants?	☑
does the site exhibit wetland hydrology?	☑
are hydric soils present at the site?	☐

Field comments:
Surveyors: Shorrock, D.

Devils Postpile Wetland Delineation and Assessment Data

Cowardin Code: R01-PSS02
Site name: Arch Bridge
Cowardin Type: Palustrine Scrub-shrub

Date surveyed: 9/14/2006
UTM coordinates: 316122 easting, 4165118 northing
Recent precipitation at time of survey? ☐
Wetland hydrology indicators: Sediment deposits; Drift lines; Saturation in upper 12 inches

Possible hydrologic sources:
- ☑ Direct Precipitation
- ☐ Headwater Flooding
- ☐ Backwater Flooding
- ☑ Surface Water
- ☑ Groundwater
- ☐ Tides
- ☐ Altered Water Source

Hydrologic alteration:
- ☐ Dams
- ☐ Levees
- ☐ Channelization
- ☐ Ditches
- ☐ IrrigationPipe
- ☐ Culverts
- ☐ Filling

Is the site inundated or saturated for more than ten consecutive days during the ye: Unknown

Vegetation:

	Tree	Shrub	Herbaceous plant
cover class	3a (6-15%)	6 (76-100%)	2 (1-5%)
height class	4 (5m-15m)	3 (2m-5m)	1 (<0.5m)

Number of dominant plant species	2
Non-native plant species cover	0
Total number of non-native plant species	0

Wetland classification:

NWI classification	Palustrine Scrub-shrub
Water regime	B3
Water regime modifiers	
CRAM system classificaiton	Riverine

does the site support a prevalance of hydrophytic plants?	☑
does the site exhibit wetland hydrology?	☑
are hydric soils present at the site?	☐

Field comments: narrow, steep rocky slopes - little soil development; AA may be scoured every few years, younger community
Surveyors: Shorrock, D.

Devils Postpile Wetland Delineation and Assessment Data

Cowardin Code: R01-RRB01
Site name: Soda Springs Meadow
Cowardin Type: Riverine Upper Perennial Rock Bottom

Date surveyed: 9/13/2006
UTM coordinates: 316014 easting, 4166693 northing
Recent precipitation at time of survey? ☐
Wetland hydrology indicators: Standing Water; Saturation in upper 12 inches; Drainage patterns
Possible hydrologic sources: ☑ Direct Precipitation; ☑ Surface Water; ☐ Altered Water Source; ☐ Headwater Flooding; ☐ Groundwater; ☐ Backwater Flooding; ☐ Tides
Hydrologic alteration: ☐ Dams; ☐ Ditches; ☐ Filling; ☐ Levees; ☐ IrrigationPipe; ☐ Channelization; ☐ Culverts
Is the site inundated or saturated for more than ten consecutive days during the ye: Yes

Vegetation

Tree	Shrub	Herbaceous plant
cover clas 0	cover clas 0	cover clas 0
height clas 8 (Not applicabl	height clas 0	height clas 0

Number of dominant plant species: 0
Non-native plant species cover: 0
Total number of non-native plant species: 0

Wetland classification
NWI classification: Riverine Upper Perennial Rock Bottom
Water regime: H
Water regime modifiers: cobble
CRAM system classificaiton: Riverine

does the site support a prevalance of hydrophytic plants? ☐
does the site exhibit wetland hydrology? ☑
are hydric soils present at the site? ☐

Field comments: some vegetation on point bars - < 10%
Surveyors: Shorrock, D., Parsons, L.

Devils Postpile Wetland Delineation and Assessment Data

Cowardin Code: R01-RUB01
Site name: SJR Unvegetated Point Bars
Cowardin Type: Riverine Upper Perennial Unconsolidated Bottom

Date surveyed: 10/13/2006
UTM coordinates: 315942 easting, 4166697 northing
Recent precipitation at time of survey? ☐
Wetland hydrology indicators: Sediment deposits; Drift lines; Drainage patterns
Possible hydrologic sources: ☑ Direct Precipitation; ☑ Surface Water; ☐ Altered Water Source; ☐ Headwater Flooding; ☐ Groundwater; ☐ Backwater Flooding; ☐ Tides
Hydrologic alteration: ☐ Dams; ☐ Ditches; ☐ Filling; ☐ Levees; ☐ IrrigationPipe; ☐ Channelization; ☐ Culverts
Is the site inundated or saturated for more than ten consecutive days during the ye: Unknown

Vegetation

Tree	Shrub	Herbaceous plant
cover clas 0	cover clas 0	cover clas 0
height clas 8 (Not applicabl	height clas 0	height clas 0

Number of dominant plant species: 0
Non-native plant species cover: 0
Total number of non-native plant species: 0

Wetland classification
NWI classification: Riverine Upper Perennial Unconsolidated Bottom
Water regime: B1
Water regime modifiers:
CRAM system classificaiton: Riverine

does the site support a prevalance of hydrophytic plants? ☐
does the site exhibit wetland hydrology? ☑
are hydric soils present at the site? ☐

Field comments: this form is written up to apply to banks of deposition (sand and gravel) along unconstricte reaches of SJR
Surveyors: Shorrock, D.

Devils Postpile Wetland Delineation and Assessment Data

Cowardin Code: R02-PEM01
Site name: Old SJR Channel
Cowardin Type: Palustrine Emergent

Date surveyed: 8/10/2006
UTM coordinates: 315808 easting, 4165119 northing
Recent precipitation at time of survey? ☐
Wetland hydrology indicators: Standing Water; Saturation in upper 12 inches

Possible hydrologic sources:
- ☑ Direct Precipitation
- ☐ Headwater Flooding
- ☐ Backwater Flooding
- ☑ Surface Water
- ☑ Groundwater
- ☐ Tides
- ☐ Altered Water Source

Hydrologic alteration:
- ☐ Dams
- ☐ Levees
- ☐ Channelization
- ☐ Ditches
- ☐ IrrigationPipe
- ☐ Culverts
- ☐ Filling

Is the site inundated or saturated for more than ten consecutive days during the ye: Yes

Vegetation:

	Tree	Shrub	Herbaceous plant
cover class	2 (1-5%)	2 (1-5%)	6 (76-100%)
height class	4 (5m-15m)	2 (0.5m-2m)	2 (.5-2m)

Number of dominant plant species: 5
Non-native plant species cover: 0
Total number of non-native plant species: 0

Wetland classification:
NWI classification: Palustrine Emergent
Water regime: F
Water regime modifiers:
CRAM system classificaiton: Riverine

does the site support a prevalance of hydrophytic plants? ☑
does the site exhibit wetland hydrology? ☑
are hydric soils present at the site? ☐

Field comments:
Surveyors: Shorrock, D.

Devils Postpile Wetland Delineation and Assessment Data

Cowardin Code: R03-PEM01
Site name: North of D03
Cowardin Type: Palustrine Emergent

Date surveyed: 8/14/2006
UTM coordinates: 316063 easting, 4165282 northing
Recent precipitation at time of survey? ☐
Wetland hydrology indicators: Saturation in upper 12 inches; Sediment deposits; Drift lines

Possible hydrologic sources:
- ☑ Direct Precipitation
- ☐ Headwater Flooding
- ☐ Backwater Flooding
- ☑ Surface Water
- ☑ Groundwater
- ☐ Tides
- ☐ Altered Water Source

Hydrologic alteration:
- ☐ Dams
- ☐ Levees
- ☐ Channelization
- ☐ Ditches
- ☐ IrrigationPipe
- ☐ Culverts
- ☐ Filling

Is the site inundated or saturated for more than ten consecutive days during the ye: Yes

Vegetation:

	Tree	Shrub	Herbaceous plant
cover class	0	2 (1-5%)	6 (76-100%)
height class	8 (Not applicabl	2 (0.5m-2m)	1 (<0.5m)

Number of dominant plant species: 4
Non-native plant species cover: 0
Total number of non-native plant species: 0

Wetland classification:
NWI classification: Palustrine Emergent
Water regime: C3
Water regime modifiers:
CRAM system classificaiton: Riverine

does the site support a prevalance of hydrophytic plants? ☑
does the site exhibit wetland hydrology? ☑
are hydric soils present at the site? ☐

Field comments: Wetland hydrology ends at edge of firlodgepole stand - channel continues to river edge +- 20m
Surveyors: Shorrock, D.

Devils Postpile Wetland Delineation and Assessment Data

Cowardin Code: R04-PSS01
Site name: Alligator Creek
Cowardin Type: Palustrine Scrub-shrub

Date surveyed: 8/15/2006
UTM coordinates: 315322 easting, 4163380 northing
Recent precipitation at time of survey? ☐
Wetland hydrology indicators: Standing Water; Drift lines; Drainage patterns

Possible hydrologic sources:
- ☑ Direct Precipitation
- ☐ Headwater Flooding
- ☐ Backwater Flooding
- ☑ Surface Water
- ☑ Groundwater
- ☐ Tides
- ☐ Altered Water Source

Hydrologic alteration:
- ☐ Dams
- ☐ Levees
- ☐ Channelization
- ☐ Ditches
- ☐ IrrigationPipe
- ☐ Culverts
- ☐ Filling

Is the site inundated or saturated for more than ten consecutive days during the ye: Yes

Vegetation:

	Tree	Shrub	Herbaceous plant
cover class	2 (1-5%)	5 (51-75%)	5 (51-75%)
height class	4 (5m-15m)	3 (2m-5m)	2 (.5-2m)

Number of dominant plant species	4
Non-native plant species cover	0
Total number of non-native plant species	0

Wetland classification:

NWI classification	Palustrine Scrub-shrub
Water regime	F/B3
Water regime modifiers	
CRAM system classificaiton	Riverine

does the site support a prevalance of hydrophytic plants?	☑
does the site exhibit wetland hydrology?	☑
are hydric soils present at the site?	☐

Field comments: Alligator Creek empties into San Joaquin at one end of AA; Kings Creek joins Alligator Creek near top of AA; large cobble deposited on west bank (below confluence w/KC); copious amounts of woody debris forming many pools; bare patches between alder stands
Surveyors: Shorrock, D.

Devils Postpile Wetland Delineation and Assessment Data

Cowardin Code: R04-RRB01
Site name: Alligator Creek Channel
Cowardin Type: Riverine Upper Perennial Rock Bottom

Date surveyed: 8/15/2006
UTM coordinates: 315332 easting, 4163403 northing
Recent precipitation at time of survey? ☐
Wetland hydrology indicators: Standing Water; Drainage patterns; Drift lines

Possible hydrologic sources:
- ☑ Direct Precipitation
- ☐ Headwater Flooding
- ☐ Backwater Flooding
- ☑ Surface Water
- ☐ Groundwater
- ☐ Tides
- ☐ Altered Water Source

Hydrologic alteration:
- ☐ Dams
- ☐ Levees
- ☐ Channelization
- ☐ Ditches
- ☐ IrrigationPipe
- ☐ Culverts
- ☐ Filling

Is the site inundated or saturated for more than ten consecutive days during the ye: Yes

Vegetation:

	Tree	Shrub	Herbaceous plant
cover class	0	0	0
height class	8 (Not applicabl	0	1 (<0.5m)

Number of dominant plant species	0
Non-native plant species cover	0
Total number of non-native plant species	0

Wetland classification:

NWI classification	Riverine Upper Perennial Rock Bottom
Water regime	H
Water regime modifiers	
CRAM system classificaiton	Riverine

does the site support a prevalance of hydrophytic plants?	☐
does the site exhibit wetland hydrology?	☑
are hydric soils present at the site?	☐

Field comments: patches of unconsolidated bottom in this river channel
Surveyors: Shorrock, D.

Devils Postpile Wetland Delineation and Assessment Data

Cowardin Code: R05-PEM01
Site name: Alligator Creek Drainage
Cowardin Type: Palustrine Emergent

Date surveyed	8/15/2006
UTM coordinates	315419 easting 4164040 northing
Recent precipitation at time of survey?	☐
Wetland hydrology indicators	Standing Water Saturation in upper 12 inches Drift lines
Possible hydrologic sources	☑ Direct Precipitation; ☑ Surface Water; ☐ Altered Water Source ☐ Headwater Flooding; ☑ Groundwater ☐ Backwater Flooding; ☐ Tides
Hydrologic alteration	☐ Dams; ☐ Ditches; ☐ Filling ☐ Levees; ☐ IrrigationPipe ☐ Channelization; ☐ Culverts
Is the site inundated or saturated for more than ten consecutive days during the ye	Yes

Vegetation	Tree	Shrub	Herbaceous plant
	cover class 2 (1-5%)	cover class 4 (26-50%)	cover class 5 (51-75%)
	height class 5 (15m-35m)	height class 2 (0.5m-2m)	height class 1 (<0.5m)

Number of dominant plant species	5
Non-native plant species cover	0
Total number of non-native plant species	0

Wetland classification	
NWI classification	Palustrine Emergent
Water regime	C2
Water regime modifiers	
CRAM system classificaiton	Riverine

does the site support a prevalance of hydrophytic plants?	☑
does the site exhibit wetland hydrology?	☑
are hydric soils present at the site?	☐

Field comments	Steep gradient channel; water sometimes flows underground w/no surface water - many pocket holes; widens in flatter areas - forms several channels - almost seep/spring-like
Surveyors	Shorrock, D.

Devils Postpile Wetland Delineation and Assessment Data

Cowardin Code: R06-RRB01
Site name: Northern Tributary
Cowardin Type: Riverine Upper Perennial Rock Bottom

Date surveyed	9/7/2006
UTM coordinates	315692 easting 4167091 northing
Recent precipitation at time of survey?	☐
Wetland hydrology indicators	Standing Water Water marks/stained leaves
Possible hydrologic sources	☑ Direct Precipitation; ☑ Surface Water; ☐ Altered Water Source ☐ Headwater Flooding; ☐ Groundwater ☐ Backwater Flooding; ☐ Tides
Hydrologic alteration	☐ Dams; ☐ Ditches; ☐ Filling ☐ Levees; ☐ IrrigationPipe ☐ Channelization; ☐ Culverts
Is the site inundated or saturated for more than ten consecutive days during the ye	Yes

Vegetation	Tree	Shrub	Herbaceous plant
	cover class 0	cover class 1 (<1%)	cover class 2 (1-5%)
	height class 8 (Not applicabl	height class 1	height class 1 (<0.5m)

Number of dominant plant species	1
Non-native plant species cover	0
Total number of non-native plant species	0

Wetland classification	
NWI classification	Riverine Upper Perennial Rock Bottom
Water regime	C2/F
Water regime modifiers	
CRAM system classificaiton	Riverine

does the site support a prevalance of hydrophytic plants?	☐
does the site exhibit wetland hydrology?	☑
are hydric soils present at the site?	☐

Field comments	Channel and surrounding floodplain mostly basalt columns and bedrock; almost no veg present (no soil); fish in pools; Alder stands grow where soil has developed on flatter gradients; water flows intermittently throughout AA;
Surveyors	Shorrock, D.

Devils Postpile Wetland Delineation and Assessment Data

Cowardin Code: R08-PEM01
Site name: King Creek
Cowardin Type: Palustrine Emergent

Date surveyed: 9/8/2006
UTM coordinates: 315432 easting, 4165719 northing
Recent precipitation at time of survey? ☐
Wetland hydrology indicators: Saturation in upper 12 inches; Sediment deposits; Drift lines

Possible hydrologic sources			
☑ Direct Precipitation	☑ Surface Water	☐ Altered Water Source
☐ Headwater Flooding	☑ Groundwater	
☐ Backwater Flooding	☐ Tides	

Hydrologic alteration			
☐ Dams	☐ Ditches	☐ Filling
☐ Levees	☐ IrrigationPipe	
☐ Channelization	☐ Culverts	

Is the site inundated or saturated for more than ten consecutive days during the ye: Yes

Vegetation	Tree	Shrub	Herbaceous plant
	cover clas 0	cover clas 2 (1-5%)	cover clas 5 (51-75%)
	height clas 8 (Not applicabl	height clas 2 (0.5m-2m)	height clas 2 (.5-2m)

Number of dominant plant species	4
Non-native plant species cover	0
Total number of non-native plant species	0

Wetland classification	
NWI classification	Palustrine Emergent
Water regime	B
Water regime modifiers	
CRAM system classificaiton	Riverine

does the site support a prevalance of hydrophytic plants?	☑
does the site exhibit wetland hydrology?	☑
are hydric soils present at the site?	☐

Field comments:
Surveyors: Shorrock, D.

Devils Postpile Wetland Delineation and Assessment Data

Cowardin Code: R08-PEM02
Site name: King Creek Drainage
Cowardin Type: Palustrine Emergent

Date surveyed: 9/11/2006
UTM coordinates: 315768 easting, 4165818 northing
Recent precipitation at time of survey? ☐
Wetland hydrology indicators: Standing Water; Sediment deposits; Drift lines

Possible hydrologic sources			
☑ Direct Precipitation	☑ Surface Water	☐ Altered Water Source
☐ Headwater Flooding	☑ Groundwater	
☐ Backwater Flooding	☐ Tides	

Hydrologic alteration			
☐ Dams	☐ Ditches	☐ Filling
☐ Levees	☐ IrrigationPipe	
☐ Channelization	☐ Culverts	

Is the site inundated or saturated for more than ten consecutive days during the ye: Yes

Vegetation	Tree	Shrub	Herbaceous plant
	cover clas 0	cover clas 2 (1-5%)	cover clas 5 (51-75%)
	height clas 8 (Not applicabl	height clas 2 (0.5m-2m)	height clas 1 (<0.5m)

Number of dominant plant species	5
Non-native plant species cover	0
Total number of non-native plant species	0

Wetland classification	
NWI classification	Palustrine Emergent
Water regime	B2
Water regime modifiers	
CRAM system classificaiton	Riverine

does the site support a prevalance of hydrophytic plants?	☑
does the site exhibit wetland hydrology?	☑
are hydric soils present at the site?	☐

Field comments: wetland occurs along steep drainage - bedrock and large boulders common - little veg in these stretches, but pools aplenty
Surveyors: Shorrock, D.

Devils Postpile Wetland Delineation and Assessment Data

Cowardin Code: R08-PSS01
Site name: King Creek
Cowardin Type: Palustrine Scrub-shrub

Date surveyed: 9/8/2006
UTM coordinates: 315559 easting, 4165822 northing
Recent precipitation at time of survey? ☐
Wetland hydrology indicators: Standing Water; Saturation in upper 12 inches

Possible hydrologic sources:
- ☑ Direct Precipitation
- ☐ Headwater Flooding
- ☐ Backwater Flooding
- ☑ Surface Water
- ☑ Groundwater
- ☐ Tides
- ☐ Altered Water Source

Hydrologic alteration:
- ☐ Dams
- ☐ Levees
- ☐ Channelization
- ☐ Ditches
- ☐ IrrigationPipe
- ☐ Culverts
- ☐ Filling

Is the site inundated or saturated for more than ten consecutive days during the ye: Yes

Vegetation:

	Tree	Shrub	Herbaceous plant
cover class	1 (<1%)	6 (76-100%)	4 (26-50%)
height class	5 (15m-35m)	3 (2m-5m)	2 (.5-2m)

Number of dominant plant species	4
Non-native plant species cover	0
Total number of non-native plant species	0

Wetland classification:

NWI classification	Palustrine Scrub-shrub
Water regime	B
Water regime modifiers	
CRAM system classificaiton	Riverine

does the site support a prevalance of hydrophytic plants?	☑
does the site exhibit wetland hydrology?	☑
are hydric soils present at the site?	☐

Field comments:
Surveyors: Shorrock, D.

Devils Postpile Wetland Delineation and Assessment Data

Cowardin Code: R09-PEM01
Site name: Old SJR channel
Cowardin Type: Palustrine Emergent

Date surveyed: 9/11/2006
UTM coordinates: 315925 easting, 4164733 northing
Recent precipitation at time of survey? ☐
Wetland hydrology indicators: Standing Water; Saturation in upper 12 inches; Sediment deposits

Possible hydrologic sources:
- ☑ Direct Precipitation
- ☐ Headwater Flooding
- ☐ Backwater Flooding
- ☑ Surface Water
- ☑ Groundwater
- ☐ Tides
- ☐ Altered Water Source

Hydrologic alteration:
- ☐ Dams
- ☐ Levees
- ☐ Channelization
- ☐ Ditches
- ☐ IrrigationPipe
- ☐ Culverts
- ☐ Filling

Is the site inundated or saturated for more than ten consecutive days during the ye: Yes

Vegetation:

	Tree	Shrub	Herbaceous plant
cover class	1 (<1%)	2 (1-5%)	6 (76-100%)
height class	4 (5m-15m)	2 (0.5m-2m)	1 (<0.5m)

Number of dominant plant species	10
Non-native plant species cover	0
Total number of non-native plant species	0

Wetland classification:

NWI classification	Palustrine Emergent
Water regime	C3
Water regime modifiers	
CRAM system classificaiton	Riverine

does the site support a prevalance of hydrophytic plants?	☑
does the site exhibit wetland hydrology?	☑
are hydric soils present at the site?	☐

Field comments: wetland contains small channels that are still saturated in most areas - only small pools of surface water remain; most of the AA is floodplain from these creeks - prob. Receive groundwater and run-off inputs; PICO islands; PICO w/wet feet not doing well
Surveyors: Shorrock, D.

Devils Postpile Wetland Delineation and Assessment Data

Cowardin Code: R09-PEM02
Site name: Old SJR channel
Cowardin Type: Palustrine Emergent

Date surveyed: 9/11/2006
UTM coordinates: 315836 easting, 4164510 northing
Recent precipitation at time of survey? ☐
Wetland hydrology indicators: Standing Water; Saturation in upper 12 inches; Water marks/stained leaves

Possible hydrologic sources:
- ☑ Direct Precipitation
- ☐ Headwater Flooding
- ☐ Backwater Flooding
- ☑ Surface Water
- ☑ Groundwater
- ☐ Tides
- ☐ Altered Water Source

Hydrologic alteration:
- ☐ Dams
- ☐ Levees
- ☐ Channelization
- ☐ Ditches
- ☐ IrrigationPipe
- ☐ Culverts
- ☐ Filling

Is the site inundated or saturated for more than ten consecutive days during the ye: Yes

Vegetation:

	Tree	Shrub	Herbaceous plant
cover class	0	2 (1-5%)	6 (76-100%)
height class	8 (Not applicabl	2 (0.5m-2m)	1 (<0.5m)

Number of dominant plant species: 6
Non-native plant species cover: 3b
Total number of non-native plant species: 1

Wetland classification:
- NWI classification: Palustrine Emergent
- Water regime: H/Ab
- Water regime modifiers:
- CRAM system classificaiton: Riverine

- does the site support a prevalance of hydrophytic plants? ☑
- does the site exhibit wetland hydrology? ☑
- are hydric soils present at the site? ☐

Field comments: this large unit encompasses several different types of wetlands varying apparently in the degree of flooding & saturation; the most common spp of ezch of these wetland habitats are listed above; more complete habitat description attached

Surveyors: Shorrock, D.

Devils Postpile Wetland Delineation and Assessment Data

Cowardin Code: R09-PEM03
Site name: Old SJR channel
Cowardin Type: Palustrine Emergent

Date surveyed: 9/11/2006
UTM coordinates: 315786 easting, 4164028 northing
Recent precipitation at time of survey? ☐
Wetland hydrology indicators: Standing Water; Saturation in upper 12 inches; Water marks/stained leaves

Possible hydrologic sources:
- ☑ Direct Precipitation
- ☑ Headwater Flooding
- ☐ Backwater Flooding
- ☑ Surface Water
- ☑ Groundwater
- ☐ Tides
- ☐ Altered Water Source

Hydrologic alteration:
- ☐ Dams
- ☐ Levees
- ☐ Channelization
- ☐ Ditches
- ☐ IrrigationPipe
- ☐ Culverts
- ☐ Filling

Is the site inundated or saturated for more than ten consecutive days during the ye: Yes

Vegetation:

	Tree	Shrub	Herbaceous plant
cover class	0	6 (76-100%)	6 (76-100%)
height class	8 (Not applicabl	2 (0.5m-2m)	1 (<0.5m)

Number of dominant plant species: 7
Non-native plant species cover: 0
Total number of non-native plant species: 0

Wetland classification:
- NWI classification: Palustrine Emergent
- Water regime: Ab
- Water regime modifiers:
- CRAM system classificaiton: Riverine

- does the site support a prevalance of hydrophytic plants? ☑
- does the site exhibit wetland hydrology? ☑
- are hydric soils present at the site? ☐

Field comments: meadow narrows into confined channel; drier wetland; habitat stream flow still present is minimal & goes subsurface for short stretch where pumicy-sand substrate is present; channel then drops sharply thru short riparian sect. w/aspen/shrubs to wetter sec

Surveyors: Shorrock, D.

Devils Postpile Wetland Delineation and Assessment Data

Cowardin Code: R09-PSS01
Site name: Old SJR channel
Cowardin Type: Palustrine Scrub-shrub

Date surveyed: 9/11/2006
UTM coordinates: 315830 easting, 4164693 northing
Recent precipitation at time of survey? ☐
Wetland hydrology indicators: Standing Water; Saturation in upper 12 inches; Water marks/stained leaves

Possible hydrologic sources:
- ☑ Direct Precipitation
- ☐ Headwater Flooding
- ☐ Backwater Flooding
- ☑ Surface Water
- ☑ Groundwater
- ☐ Tides
- ☐ Altered Water Source

Hydrologic alteration:
- ☐ Dams
- ☐ Levees
- ☐ Channelization
- ☐ Ditches
- ☐ IrrigationPipe
- ☐ Culverts
- ☐ Filling

Is the site inundated or saturated for more than ten consecutive days during the ye: Yes

Vegetation:

Tree	Shrub	Herbaceous plant
cover clas 6 (76-100%)	cover clas 0	cover clas 4 (26-50%)
height clas 2&3 (0.5m-5m)	height clas 0	height clas 1 (<0.5m)

Number of dominant plant species	8
Non-native plant species cover	0
Total number of non-native plant species	0

Wetland classification:

NWI classification	Palustrine Scrub-shrub
Water regime	H/Ab
Water regime modifiers	
CRAM system classificaiton	Riverine

- does the site support a prevalance of hydrophytic plants? ☑
- does the site exhibit wetland hydrology? ☑
- are hydric soils present at the site? ☐

Field comments:
Surveyors: Shorrock, D., Parsons, L.

Devils Postpile Wetland Delineation and Assessment Data

Cowardin Code: R09-PSS02
Site name: Old SJR channel
Cowardin Type: Palustrine Scrub-shrub

Date surveyed: 9/11/2006
UTM coordinates: 315811 easting, 4164610 northing
Recent precipitation at time of survey? ☐
Wetland hydrology indicators: Sediment deposits

Possible hydrologic sources:
- ☑ Direct Precipitation
- ☐ Headwater Flooding
- ☐ Backwater Flooding
- ☑ Surface Water
- ☑ Groundwater
- ☐ Tides
- ☐ Altered Water Source

Hydrologic alteration:
- ☐ Dams
- ☐ Levees
- ☐ Channelization
- ☐ Ditches
- ☐ IrrigationPipe
- ☐ Culverts
- ☐ Filling

Is the site inundated or saturated for more than ten consecutive days during the ye: Unknown

Vegetation:

Tree	Shrub	Herbaceous plant
cover clas 0	cover clas 6 (76-100%)	cover clas 5 (51-75%)
height clas 8 (Not applicabl	height clas 3 (2m-5m)	height clas 2 (.5-2m)

Number of dominant plant species	3
Non-native plant species cover	0
Total number of non-native plant species	0

Wetland classification:

NWI classification	Palustrine Scrub-shrub
Water regime	C2
Water regime modifiers	
CRAM system classificaiton	Riverine

- does the site support a prevalance of hydrophytic plants? ☑
- does the site exhibit wetland hydrology? ☐
- are hydric soils present at the site? ☐

Field comments: wetland hydrologic indicators not strong, but presence of alder indicates significant water source
Surveyors: Shorrock, D., Parsons, L.

Devils Postpile Wetland Delineation and Assessment Data

Cowardin Code: R09-PSS03
Site name: Old SJR side drainage
Cowardin Type: Palustrine Scrub-shrub

Date surveyed: 9/11/2006
UTM coordinates: 315754 easting, 4164626 northing
Recent precipitation at time of survey? ☐
Wetland hydrology indicators: Saturation in upper 12 inches; Sediment deposits

Possible hydrologic sources:
- ☑ Direct Precipitation
- ☐ Headwater Flooding
- ☐ Backwater Flooding
- ☑ Surface Water
- ☑ Groundwater
- ☐ Tides
- ☐ Altered Water Source

Hydrologic alteration:
- ☐ Dams
- ☐ Levees
- ☐ Channelization
- ☐ Ditches
- ☐ IrrigationPipe
- ☐ Culverts
- ☐ Filling

Is the site inundated or saturated for more than ten consecutive days during the ye: Yes

Vegetation:

	Tree	Shrub	Herbaceous plant
cover class	0	6 (76-100%)	4 (26-50%)
height class	8 (Not applicabl	2 (0.5m-2m)	1 (<0.5m)

Number of dominant plant species: 3
Non-native plant species cover: 0
Total number of non-native plant species: 0

Wetland classification:
NWI classification: Palustrine Scrub-shrub
Water regime: B2
Water regime modifiers:
CRAM system classificaiton: Riverine

does the site support a prevalance of hydrophytic plants? ☑
does the site exhibit wetland hydrology? ☑
are hydric soils present at the site? ☐

Field comments: water still flowing in steep drainage dominated by alder; understory not overly dense, diverse or dominated by wetland spp.
Surveyors: Shorrock, D.

Devils Postpile Wetland Delineation and Assessment Data

Cowardin Code: R09-PSS04
Site name: Old SJR channel
Cowardin Type: Palustrine Scrub-shrub

Date surveyed: 9/11/2006
UTM coordinates: 315801 easting, 4164453 northing
Recent precipitation at time of survey? ☐
Wetland hydrology indicators: Saturation in upper 12 inches

Possible hydrologic sources:
- ☑ Direct Precipitation
- ☐ Headwater Flooding
- ☐ Backwater Flooding
- ☑ Surface Water
- ☑ Groundwater
- ☐ Tides
- ☐ Altered Water Source

Hydrologic alteration:
- ☐ Dams
- ☐ Levees
- ☐ Channelization
- ☐ Ditches
- ☐ IrrigationPipe
- ☐ Culverts
- ☐ Filling

Is the site inundated or saturated for more than ten consecutive days during the ye: Yes

Vegetation:

	Tree	Shrub	Herbaceous plant
cover class	0	6 (76-100%)	6 (76-100%)
height class	8 (Not applicabl	3 (2m-5m)	2 (.5-2m)

Number of dominant plant species: 2
Non-native plant species cover: 0
Total number of non-native plant species: 0

Wetland classification:
NWI classification: Palustrine Scrub-shrub
Water regime: C2
Water regime modifiers:
CRAM system classificaiton: Riverine

does the site support a prevalance of hydrophytic plants? ☑
does the site exhibit wetland hydrology? ☑
are hydric soils present at the site? ☐

Field comments:
Surveyors: Shorrock, D., Parsons, L.

Devils Postpile Wetland Delineation and Assessment Data

Cowardin Code: R09-PSS05
Site name: Old SJR channel
Cowardin Type: Palustrine Scrub-shrub

Date surveyed: 9/11/2006
UTM coordinates: 315773 easting, 4164193 northing
Recent precipitation at time of survey? ☐
Wetland hydrology indicators: Saturation in upper 12 inches; Sediment deposits; Algal mats

Possible hydrologic sources:
- ☑ Direct Precipitation
- ☐ Headwater Flooding
- ☐ Backwater Flooding
- ☑ Surface Water
- ☑ Groundwater
- ☐ Tides
- ☐ Altered Water Source

Hydrologic alteration:
- ☐ Dams
- ☐ Levees
- ☐ Channelization
- ☐ Ditches
- ☐ IrrigationPipe
- ☐ Culverts
- ☐ Filling

Is the site inundated or saturated for more than ten consecutive days during the ye: Yes

Vegetation:

	Tree	Shrub	Herbaceous plant
cover class	0	5 (51-75%)	6 (76-100%)
height class	8 (Not applicabl	3 (2m-5m)	2 (.5-2m)

Number of dominant plant species: 5
Non-native plant species cover: 0
Total number of non-native plant species: 0

Wetland classification:
- NWI classification: Palustrine Scrub-shrub
- Water regime: C2
- Water regime modifiers:
- CRAM system classificaiton: Riverine

- does the site support a prevalance of hydrophytic plants? ☑
- does the site exhibit wetland hydrology? ☑
- are hydric soils present at the site? ☐

Field comments:
Surveyors: Shorrock, D., Parsons, L.

Devils Postpile Wetland Delineation and Assessment Data

Cowardin Code: R09-RUB01
Site name: Old SJR channel
Cowardin Type: Riverine Upper Perennial Unconsolidated Bottom

Date surveyed: 9/11/2006
UTM coordinates: 315763 easting, 4163731 northing
Recent precipitation at time of survey? ☐
Wetland hydrology indicators: Drainage patterns

Possible hydrologic sources:
- ☑ Direct Precipitation
- ☑ Headwater Flooding
- ☑ Backwater Flooding
- ☑ Surface Water
- ☑ Groundwater
- ☐ Tides
- ☐ Altered Water Source

Hydrologic alteration:
- ☐ Dams
- ☐ Levees
- ☐ Channelization
- ☐ Ditches
- ☐ IrrigationPipe
- ☐ Culverts
- ☐ Filling

Is the site inundated or saturated for more than ten consecutive days during the ye: Yes

Vegetation:

	Tree	Shrub	Herbaceous plant
cover class	0	0	4 (26-50%)
height class	8 (Not applicabl	0	1 (<0.5m)

Number of dominant plant species: 1
Non-native plant species cover: 0
Total number of non-native plant species: 0

Wetland classification:
- NWI classification: Riverine Upper Perennial Unconsolidated Bottom
- Water regime: A
- Water regime modifiers:
- CRAM system classificaiton: Riverine

- does the site support a prevalance of hydrophytic plants? ☐
- does the site exhibit wetland hydrology? ☑
- are hydric soils present at the site? ☐

Field comments: downstream portion of drainage before connects to SJR; clearly defined bed and bank, bu prevalence of pumice sand bottom probably encourages hi loss of water to gw table, making this a losing reach; discourages ponding; upland spp in ch estab when dry
Surveyors: Shorrock, D., Parsons, L.

Devils Postpile Wetland Delineation and Assessment Data

Cowardin Code: R10-PEM01
Site name: Meadow across from Creek Cr.
Cowardin Type: Palustrine Emergent

Date surveyed: 9/12/2006
UTM coordinates: 315722 easting, 4165515 northing
Recent precipitation at time of survey? ☐
Wetland hydrology indicators: Water marks/stained leaves; Drainage patterns

Possible hydrologic sources:
- ☑ Direct Precipitation
- ☑ Surface Water
- ☐ Altered Water Source
- ☐ Headwater Flooding
- ☐ Groundwater
- ☐ Backwater Flooding
- ☐ Tides

Hydrologic alteration:
- ☐ Dams
- ☐ Ditches
- ☐ Filling
- ☐ Levees
- ☐ IrrigationPipe
- ☐ Channelization
- ☐ Culverts

Is the site inundated or saturated for more than ten consecutive days during the ye: Yes

Vegetation:

	Tree	Shrub	Herbaceous plant
cover clas	0	0	6 (76-100%)
height clas	8 (Not applicabl	0	2 (.5-2m)

Number of dominant plant species: 2
Non-native plant species cover: 2
Total number of non-native plant species: 2

Wetland classification:
- NWI classification: Palustrine Emergent
- Water regime: Ab
- Water regime modifiers:
- CRAM system classificaiton: Depressional

- does the site support a prevalance of hydrophytic plants? ☑
- does the site exhibit wetland hydrology? ☑
- are hydric soils present at the site? ☐

Field comments: small meadow in depressional basin in flat area @ top of slope; run-off from surrounding slopes slows into basin + flow from very small upslope drainage; water likely ponds only very temporarily w/sort period of soil saturation based upon plant community

Surveyors: Shorrock, D., Parsons, L.

Devils Postpile Wetland Delineation and Assessment Data

Cowardin Code: R10-RUB03
Site name: Drainage across from Creek Cr falls
Cowardin Type: Riverine Upper Perennial Unconsolidated Bottom

Date surveyed: 9/12/2006
UTM coordinates: 315892 easting, 4165542 northing
Recent precipitation at time of survey? ☐
Wetland hydrology indicators: Drift lines; Drainage patterns

Possible hydrologic sources:
- ☑ Direct Precipitation
- ☑ Surface Water
- ☐ Altered Water Source
- ☐ Headwater Flooding
- ☑ Groundwater
- ☐ Backwater Flooding
- ☐ Tides

Hydrologic alteration:
- ☐ Dams
- ☐ Ditches
- ☐ Filling
- ☐ Levees
- ☐ IrrigationPipe
- ☐ Channelization
- ☐ Culverts

Is the site inundated or saturated for more than ten consecutive days during the ye: Unknown

Vegetation:

	Tree	Shrub	Herbaceous plant
cover clas	0	0	3b (16-25%)
height clas	8 (Not applicabl	0	1 (<0.5m)

Number of dominant plant species: 2
Non-native plant species cover: 0
Total number of non-native plant species: 0

Wetland classification:
- NWI classification: Riverine Upper Perennial Unconsolidated Bottom
- Water regime: A
- Water regime modifiers:
- CRAM system classificaiton: Riverine

- does the site support a prevalance of hydrophytic plants? ☐
- does the site exhibit wetland hydrology? ☐
- are hydric soils present at the site? ☐

Field comments: channel forms at level terrace at base of steep slope into which several drainages empty into in addition to slope run-off; water is likely present for 2 wks+ from snowmelt; however, this is not long enough to create hydric soils; pumice substrate

Surveyors: Shorrock, D., Parsons, L.

Devils Postpile Wetland Delineation and Assessment Data

Cowardin Code R11-RUB01
Site name Small Drainage crossing JMT/PCT
Cowardin Type Riverine Upper Perennial Unconsolidated Bottom

Date surveyed	9/12/2006
UTM coordinates	315812 easting 4165987 northing
Recent precipitation at time of survey?	☐
Wetland hydrology indicators	Standing Water Drift lines Drainage patterns
Possible hydrologic sources	☑ Direct Precipitation; ☑ Surface Water; ☐ Altered Water Source ☑ Headwater Flooding; ☑ Groundwater ☐ Backwater Flooding; ☐ Tides
Hydrologic alteration	☐ Dams; ☐ Ditches; ☐ Filling ☐ Levees; ☐ IrrigationPipe ☐ Channelization; ☐ Culverts several small bridges across drainage @ 2 trail crossings
Is the site inundated or saturated for more than ten consecutive days during the ye	Unknown

Vegetation	Tree	Shrub	Herbaceous plant
	cover clas 0	cover clas 0	cover clas 0
	height clas 8 (Not applicabl	height clas 0	height clas 0

Number of dominant plant species	0
Non-native plant species cover	0
Total number of non-native plant species	0

Wetland classification	
NWI classification	Riverine Upper Perennial Unconsolidated Bottom
Water regime	A
Water regime modifiers	
CRAM system classificaiton	Riverine

does the site support a prevalance of hydrophytic plants?	☐
does the site exhibit wetland hydrology?	☐
are hydric soils present at the site?	☐

Field comments	sm. drainage to SJR w/defined b&b; presence of sm bridges attests to flow present for several mths; depending on how bridges constructed, may have sedimented on upstream side due to past fire, natural geologic instability; drain. meanders due to boulder s
Surveyors	Shorrock, D., Parsons, L.

Devils Postpile Wetland Delineation and Assessment Data

Cowardin Code R12-PSS01
Site name Creek Creek floodplain
Cowardin Type Palustrine Scrub-shrub

Date surveyed	9/14/2006
UTM coordinates	316083 easting 4165610 northing
Recent precipitation at time of survey?	☑
Wetland hydrology indicators	Saturation in upper 12 inches Sediment deposits
Possible hydrologic sources	☑ Direct Precipitation; ☑ Surface Water; ☐ Altered Water Source ☐ Headwater Flooding; ☑ Groundwater ☑ Backwater Flooding; ☐ Tides
Hydrologic alteration	☐ Dams; ☐ Ditches; ☐ Filling ☐ Levees; ☐ IrrigationPipe ☐ Channelization; ☐ Culverts
Is the site inundated or saturated for more than ten consecutive days during the ye	Unknown

Vegetation	Tree	Shrub	Herbaceous plant
	cover clas 2 (1-5%)	cover clas 6 (76-100%)	cover clas 5 (51-75%)
	height clas 4 (5m-15m)	height clas 2 (0.5m-2m)	height clas 1 (<0.5m)

Number of dominant plant species	8
Non-native plant species cover	0
Total number of non-native plant species	0

Wetland classification	
NWI classification	Palustrine Scrub-shrub
Water regime	B2
Water regime modifiers	
CRAM system classificaiton	Riverine

does the site support a prevalance of hydrophytic plants?	☑
does the site exhibit wetland hydrology?	☑
are hydric soils present at the site?	☐

Field comments	pockets of backwater flooding formed small clearings of EM wetlands (SCIMIC, CALCAN, SALLEM, PINCON); otherwise dense alder lines the channel defining narrow SS wetland
Surveyors	Shorrock, D.

Devils Postpile Wetland Delineation and Assessment Data

Cowardin Code: SS01-PUB01
Site name: Soda Spring
Cowardin Type: Palustrine Unconsolidated Bottom

Date surveyed	8/8/2006
UTM coordinates	315921 easting 4166536 northing
Recent precipitation at time of survey?	☑
Wetland hydrology indicators	Standing Water Water marks/stained leaves Sediment deposits
Possible hydrologic sources	☑ Direct Precipitation; ☑ Surface Water; ☐ Altered Water Source; ☐ Headwater Flooding; ☑ Groundwater; ☐ Backwater Flooding; ☐ Tides
Hydrologic alteration	☐ Dams; ☐ Ditches; ☐ Filling; ☐ Levees; ☐ IrrigationPipe; ☐ Channelization; ☐ Culverts
Is the site inundated or saturated for more than ten consecutive days during the ye	Yes

Vegetation	Tree	Shrub	Herbaceous plant
	cover clas 0	cover clas 0	cover clas 5 (51-75%)
	height clas 8 (Not applicabl	height clas 0	height clas 1 (<0.5m)

Number of dominant plant species	1
Non-native plant species cover	0
Total number of non-native plant species	0

Wetland classification	
NWI classification	Palustrine Unconsolidated Bottom
Water regime	F/G
Water regime modifiers	
CRAM system classificaiton	Seeps, Springs, and Slope

does the site support a prevalance of hydrophytic plants?	☑
does the site exhibit wetland hydrology?	☑
are hydric soils present at the site?	☐

Field comments	Spring in and adjacent to San Joaquin River; channels that hold water from the spring (& river?) likely formed due to this juxtaposition; area receives steady visitation from anglers and visitors (close to trail);
Surveyors	Shorrock, D., H. Banks, M. Denn

Devils Postpile Wetland Delineation and Assessment Data

Cowardin Code: SS02-PEM01
Site name: Old SJR Spring
Cowardin Type: Palustrine Emergent

Date surveyed	8/10/2006
UTM coordinates	315835 easting 4165003 northing
Recent precipitation at time of survey?	☐
Wetland hydrology indicators	Standing Water Saturation in upper 12 inches
Possible hydrologic sources	☑ Direct Precipitation; ☐ Surface Water; ☐ Altered Water Source; ☐ Headwater Flooding; ☑ Groundwater; ☐ Backwater Flooding; ☐ Tides
Hydrologic alteration	☐ Dams; ☐ Ditches; ☐ Filling; ☐ Levees; ☐ IrrigationPipe; ☐ Channelization; ☐ Culverts
Is the site inundated or saturated for more than ten consecutive days during the ye	Yes

Vegetation	Tree	Shrub	Herbaceous plant
	cover clas 0	cover clas 0	cover clas 4 (26-50%)
	height clas 8 (Not applicabl	height clas 0	height clas 1 (<0.5m)

Number of dominant plant species	1
Non-native plant species cover	0
Total number of non-native plant species	0

Wetland classification	
NWI classification	Palustrine Emergent
Water regime	F/G
Water regime modifiers	
CRAM system classificaiton	Seeps, Springs, and Slope

does the site support a prevalance of hydrophytic plants?	☑
does the site exhibit wetland hydrology?	☑
are hydric soils present at the site?	☐

Field comments	small spring adjacent to riverine system in Old San Joaquin channel
Surveyors	Shorrock, D.

Devils Postpile Wetland Delineation and Assessment Data

Cowardin Code: SS04-PEM01
Site name: Alligator Creek Meadow
Cowardin Type: Palustrine Emergent

Date surveyed	8/15/2006
UTM coordinates	315322 easting 4163737 northing
Recent precipitation at time of survey?	☐
Wetland hydrology indicators	Standing Water Saturation in upper 12 inches

Possible hydrologic sources

☑ Direct Precipitation	☑ Surface Water	☐ Alterered Water Source
☐ Headwater Flooding	☑ Groundwater	
☐ Backwater Flooding	☐ Tides	

Hydrologic alteration

☐ Dams	☐ Ditches	☐ Filling
☐ Levees	☐ IrrigationPipe	
☐ Channelization	☐ Culverts	

Is the site inundated or saturated for more than ten consecutive days during the ye: Yes

Vegetation

Tree	Shrub	Herbaceous plant
cover clas 0	cover clas 3a (6-15%)	cover clas 6 (76-100%)
height clas 8 (Not applicabl	height clas 2 (0.5m-2m)	height clas 2 (.5-2m)

Number of dominant plant species	3
Non-native plant species cover	0
Total number of non-native plant species	0

Wetland classification

NWI classification	Palustrine Emergent
Water regime	F
Water regime modifiers	
CRAM system classificaiton	Seeps, Springs, and Slope

does the site support a prevalance of hydrophytic plants?	☑
does the site exhibit wetland hydrology?	☑
are hydric soils present at the site?	☐

Field comments: Large graminoid dominated meadow with standing water mostly throughout; a few channe run through it; lined with alder and willow; Alligator Creek on west side of large rock outcrc bordering wetland

Surveyors: Shorrock, D.

Devils Postpile Wetland Delineation and Assessment Data

Cowardin Code: SS04-PSS01
Site name: Alligator Creek Shrub
Cowardin Type: Palustrine Scrub-shrub

Date surveyed	8/15/2006
UTM coordinates	315320 easting 4163859 northing
Recent precipitation at time of survey?	☐
Wetland hydrology indicators	Standing Water Saturation in upper 12 inches

Possible hydrologic sources

☑ Direct Precipitation	☑ Surface Water	☐ Alterered Water Source
☐ Headwater Flooding	☑ Groundwater	
☐ Backwater Flooding	☐ Tides	

Hydrologic alteration

☐ Dams	☐ Ditches	☐ Filling
☐ Levees	☐ IrrigationPipe	
☐ Channelization	☐ Culverts	

Is the site inundated or saturated for more than ten consecutive days during the ye: Yes

Vegetation

Tree	Shrub	Herbaceous plant
cover clas 2 (1-5%)	cover clas 5 (51-75%)	cover clas 5 (51-75%)
height clas 4 (5m-15m)	height clas 3 (2m-5m)	height clas 2 (.5-2m)

Number of dominant plant species	5
Non-native plant species cover	0
Total number of non-native plant species	0

Wetland classification

NWI classification	Palustrine Scrub-shrub
Water regime	C2
Water regime modifiers	
CRAM system classificaiton	Seeps, Springs, and Slope

does the site support a prevalance of hydrophytic plants?	☐
does the site exhibit wetland hydrology?	☐
are hydric soils present at the site?	☐

Field comments:

Surveyors: Shorrock, D.

Devils Postpile Wetland Delineation and Assessment Data

Cowardin Code: SS05-PEM01

Site name: King Creek

Cowardin Type: Palustrine Emergent

Date surveyed	9/8/2006
UTM coordinates	315407 easting 4165737 northing
Recent precipitation at time of survey?	☐
Wetland hydrology indicators	Standing Water Saturation in upper 12 inches Sediment deposits
Possible hydrologic sources	☑ Direct Precipitation; ☑ Surface Water; ☐ Alterered Water Source ☐ Headwater Flooding; ☑ Groundwater ☐ Backwater Flooding; ☐ Tides
Hydrologic alteration	☐ Dams; ☐ Ditches; ☐ Filling ☐ Levees; ☐ IrrigationPipe ☐ Channelization; ☐ Culverts
Is the site inundated or saturated for more than ten consecutive days during the ye	Yes

Vegetation	Tree	Shrub	Herbaceous plant
	cover class 2 (1-5%)	cover class 2 (1-5%)	cover class 6 (76-100%)
	height class 4 (5m-15m)	height class 2 (0.5m-2m)	height class 2 (.5-2m)

Number of dominant plant species	7
Non-native plant species cover	0
Total number of non-native plant species	0

Wetland classification		
	NWI classification	Palustrine Emergent
	Water regime	F
	Water regime modifiers	
	CRAM system classificaiton	Seeps, Springs, and Slope

does the site support a prevelance of hydrophytic plants?	☑
does the site exhibit wetland hydrology?	☑
are hydric soils present at the site?	☐

Field comments	seep that narrows into a defined, single channel in a drainage - becomes riverine (CRAM)
Surveyors	Shorrock, D.

Devils Postpile National Monument 2006 CRAM Wetland Conditon Assessment

CRAM Wetland Type: Depressional

	Overall Conditon Score	Number of Stressors Observed	Conditon Relative to Desired	Buffer and Landscpe Context					Hydrology				Physical Structure			Biotic Structure							
				Landscape Connectivity	% of AA w/Buffer	Buffer Width	Buffer Condition	Summary Score	Water Source	Hydro-period	Hydrologic Connectivity	Summary Score	Patch Richness	Topo Complexity	Summary Score	Organic Debris	# of Plant Layers	Layers of Native Spp.	Co-dominant Spp	NativeCo-dominants	Interspersion Zonation	Vertical Structure	Summary Score
D01	75	1	desired	A	A	A	A	100	A	A	A	100	D	C	38	A	B	A	D	A	D	D	56
D02	74	4	good	A	A	C	A-	90	A-	A-	A-	92	D	C	38	C	B	A	B	A	A	D	66
D03	73	1	desired	A	A	B	A	97	A	A	A	100	D	C	38	C+	B	A	D	A	D	D	44
D04	79	8	good	A	A	C	A	92	B	A	A	92	C	C	50	A	B	A	B	A	A	D	78
D05	83	1	desired	A	A	A	A	100	A	A	A	100	B	C	63	D	A	A	C	A	C	C	72
D06	71	2	desired	A	A	A	A	100	A	A	A	100	D	D	25	C	C	A	D	A	C	D	48
D07	73	1	poor	C	A	A	A	75	A	A	A	100	C	C	50	A	B	A	D	A	C-	D	60
D08	69	1	poor	B	A	A	A	88	A	A	A	100	D	D	25	C-	B	A	C	A	C	D	49

CRAM Wetland Type: Riverine

	Overall Conditon Score	Number of Stressors Observed	Conditon Relative to Desired	Buffer and Landscpe Context					Hydrology				Physical Structure			Biotic Structure							
				Landscape Connectivity	% of AA w/Buffer	Buffer Width	Buffer Condition	Summary Score	Water Source	Hydro-period	Hydrologic Connectivity	Summary Score	Patch Richness	Topo Complexity	Summary Score	Organic Debris	# of Plant Layers	Layers of Native Spp.	Co-dominant Spp	NativeCo-dominants	Interspersion Zonation	Vertical Structure	Summary Score
R01	78	4	good	A	A	A	A	100	A	A	C	89	B	C	63	B	B	A	D	A	C-	C	60
R02	85	2	desired	B	A	A	A	88	A	A	B	89	B	A	88	C	C	A	C	A	A	B	75
R03	85	1	desired	B	A	B	A	84	A	A	A	100	C	A	75	A	C	A	C	A	A	B	88
R04	90	4	desired	A	A	A	A	100	A	B	A	92	A	B	88	B	A	A	C	A	C	A	78
R05	79	4	desired	C	A	A	A	75	A	A	A	100	D	A	63	A	B	A	C	A	C	B	77
R06	78	3	good	A	A	A	A	100	A	B+	C+	81	C	A	75	C-	C	A	D	A	C	D	46
R08	85	2	desired	A	A	A	A	100	A	A	B	89	C	A	75	B	C	A	C	A	B	B	75
R09	81	2	desired	A	A	A	A	100	A	A	A	100	D	C	38	B	A	A	B	A	B	B	80
R10	79	4	good	A	A	A	A	100	A	A	A	100	C	C+	54	C	C	A	C	A	C	D	50
R11	86	4	desired	A	A	A	A	100	A	A	A	100	C	B	63	A	B	A	B	A	B-	C	76
R12	80	3	desired	A	A	A	A	100	A	A	B-	89	C	C+	54	C	B	A	B	A	C	B	66

CRAM Wetland Type: Seep/Slope

	Overall Conditon Score	Number of Stressors Observed	Conditon Relative to Desired	Buffer and Landscpe Context					Hydrology				Physical Structure			Biotic Structure							
				Landscape Connectivity	% of AA w/Buffer	Buffer Width	Buffer Condition	Summary Score	Water Source	Hydro-period	Hydrologic Connectivity	Summary Score	Patch Richness	Topo Complexity	Summary Score	Organic Debris	# of Plant Layers	Layers of Native Spp.	Co-dominant Spp	NativeCo-dominants	Interspersion Zonation	Vertical Structure	Summary Score
SS01	81	4	good	A	A	B	A	97	A	A	A	100	C	B	63	B	B	A	D	A	C	D	56
SS02	85	2	desired	A	A	A	A	100	A	A	A	100	C	A	75	D	B	A	D	A	B	C	56
SS04	83	1	desired	A	A	A	A	100	A	A	A	100	C	C	50	A	B	A	C	A	B	B	83
SS05	85	3	desired	A	A	A	A	100	A	A	A	100	C	C	50	A	B	A	A	A	B	B	86

Appendix F:
Devils Postpile National Monument Wetland Maps

This project produced one park-wide overview map of all park Cowardin wetlands and three smaller-scale maps zoomed to portions of the park. Project staff overlaid these on black-and-white landscape images (DOQs).

The project also created maps of these same wetlands displayed in the CRAM classification system, over US Geologic Survey 1:24,000 topographic maps (DRGs). Finally, the project redrew these CRAM polygons, color-coded by wetland condition, over DOQs.

content page

DEPO National Wetland Inventory 94

DEPO Cowardin Wetlands 95

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Cowardin Wetlands, Northern DEPO 96

Cowardin Wetlands, Central DEPO 97

Cowardin Wetlands, Southern DEPO 98

DEPO CRAM Wetlands 99

CRAM Wetlands, Northern DEPO 100

CRAM Wetlands, Central DEPO 101

CRAM Wetlands, Southern DEPO 102

DEPO CRAM Wetlands by Condition 103

CRAM Wetlands by Condition, Northern DEPO 104

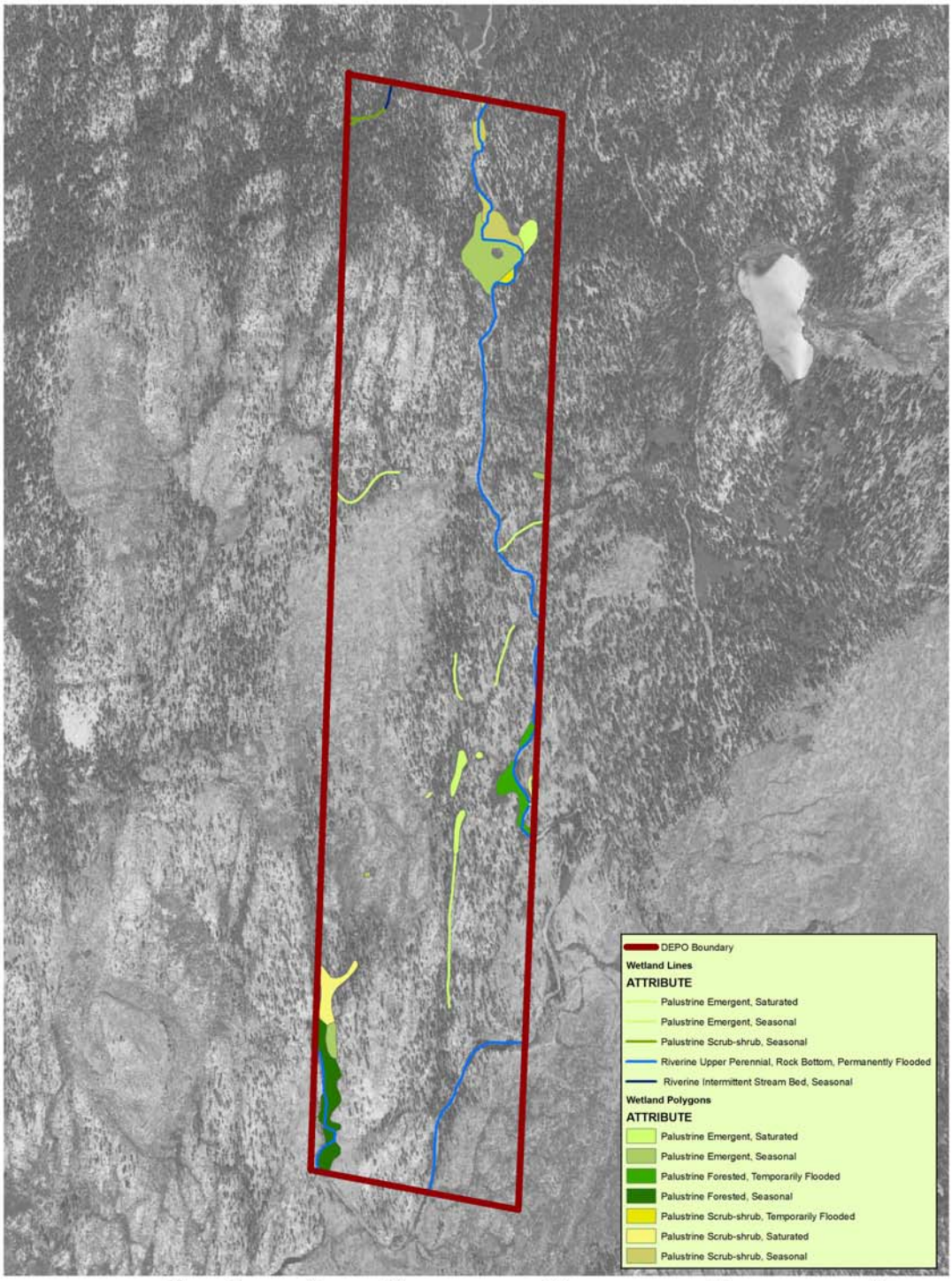
CRAM Wetlands by Condition, Central DEPO 105

CRAM Wetlands by Condition, Southern DEPO 106

Devils Postpile National Monument
California

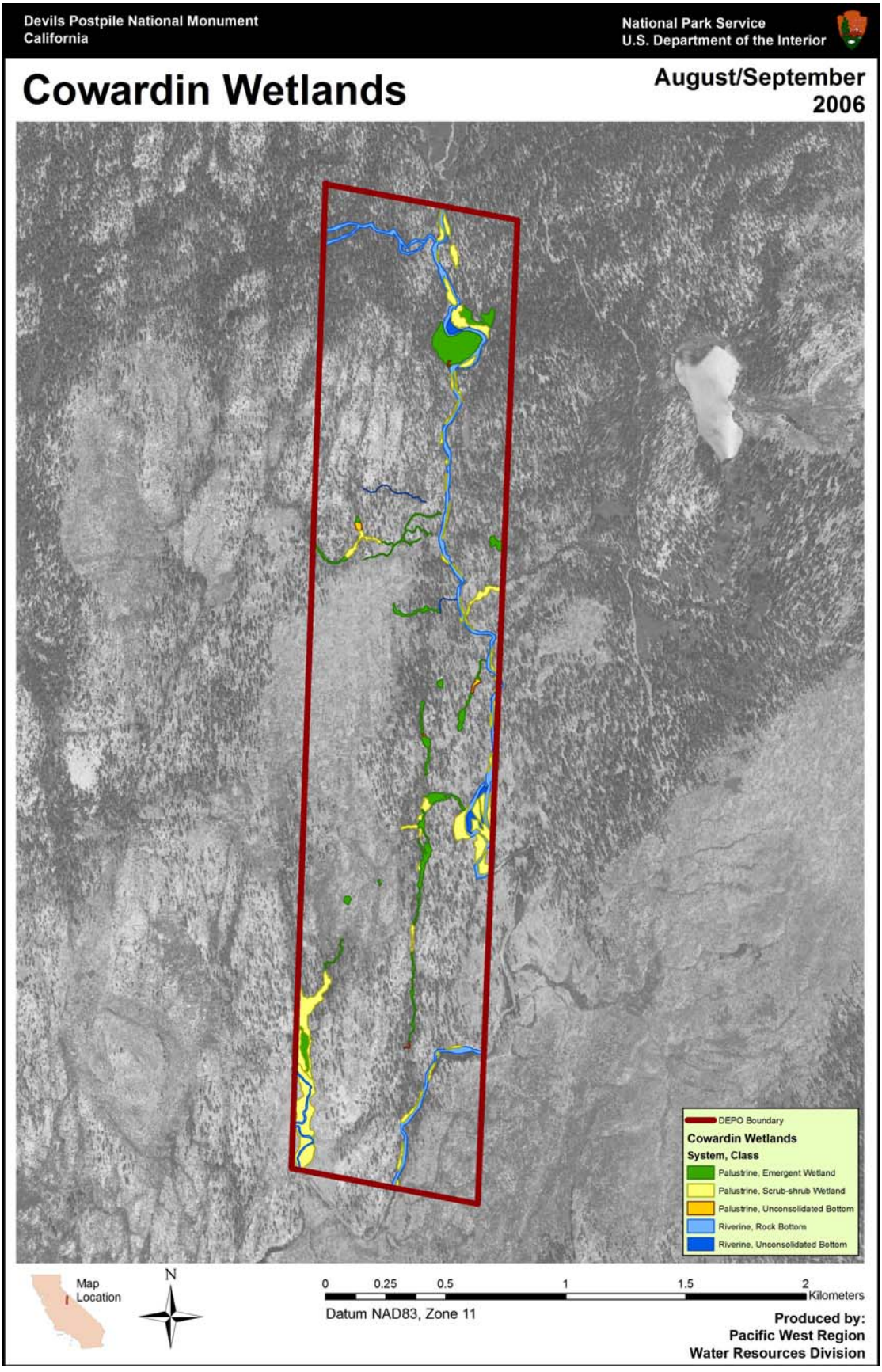
National Park Service
U.S. Department of the Interior

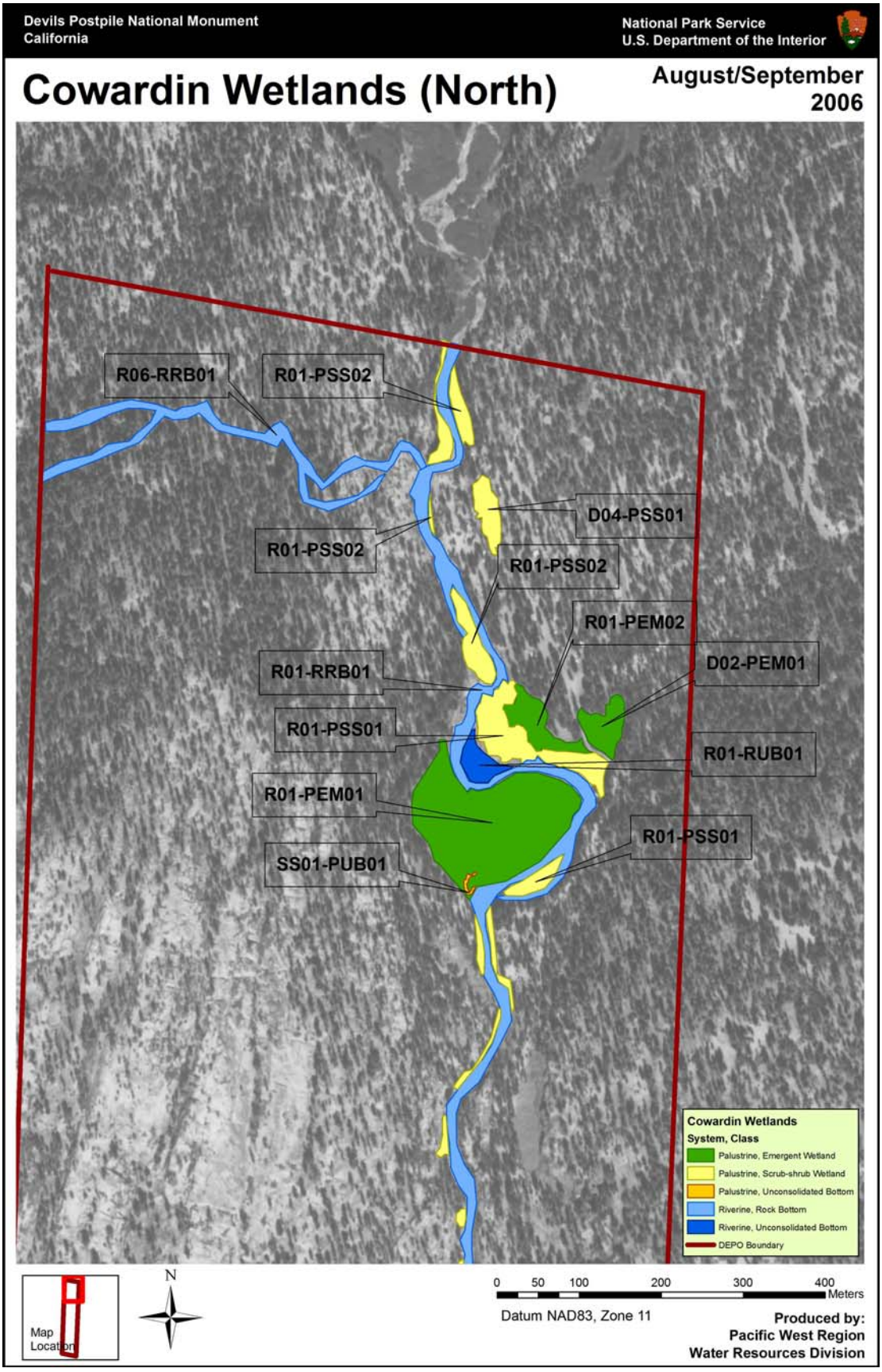
National Wetlands Inventory

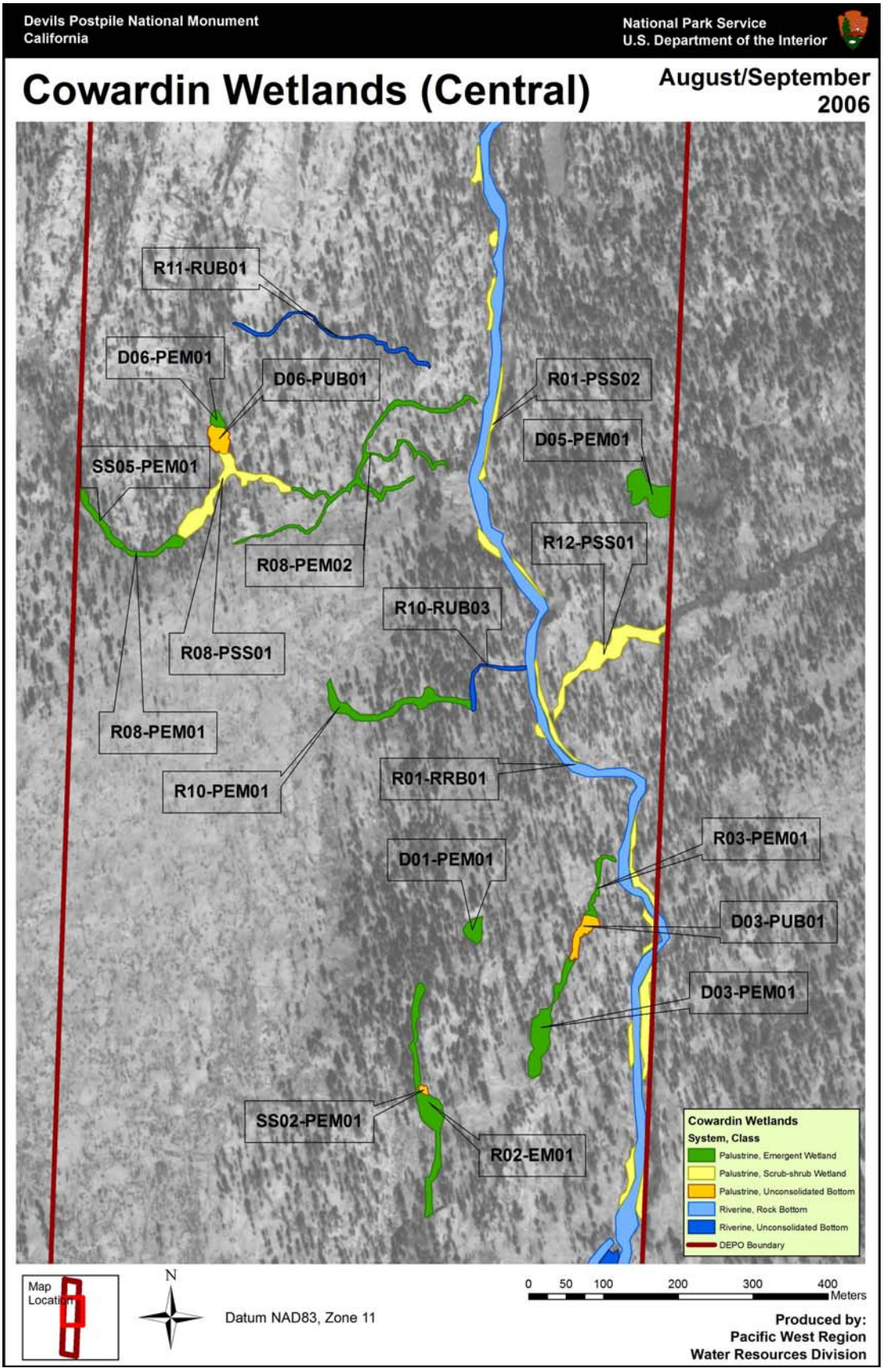


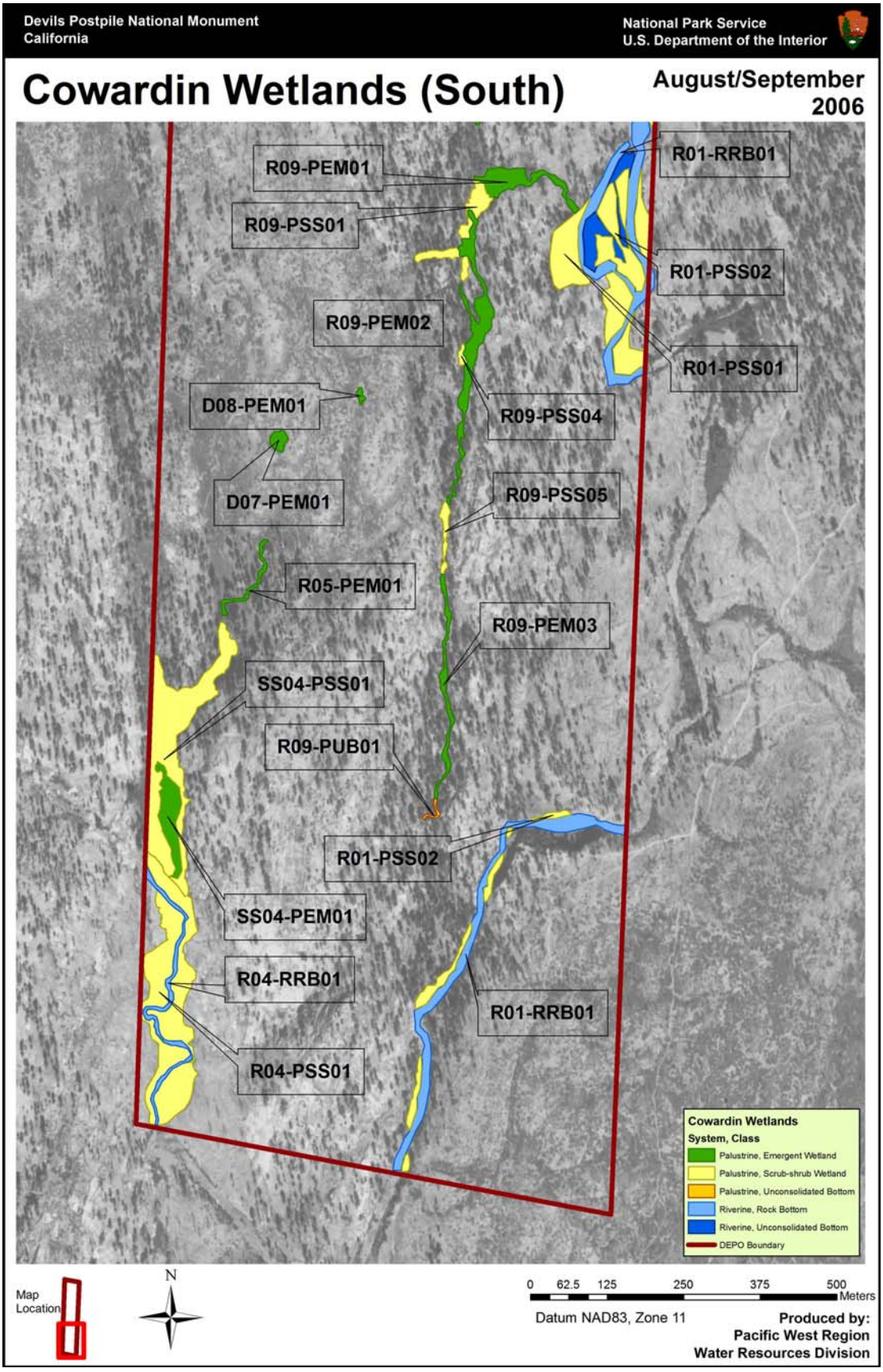
Wetland Polygons Created by:
US Fish and Wildlife Service
National Wetlands Inventory

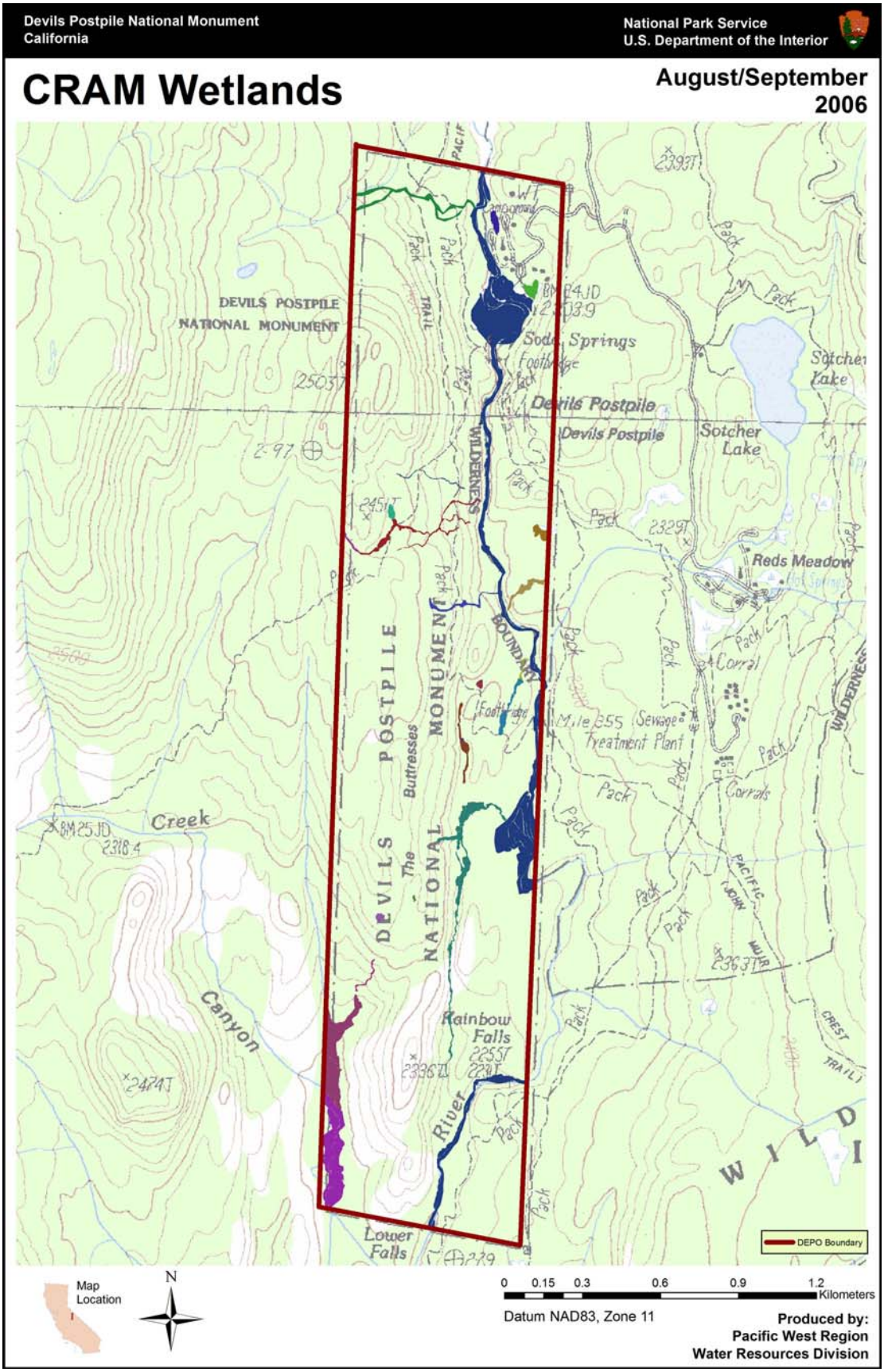
Map Produced by:
NPS Pacific West Region
Water Resources Division

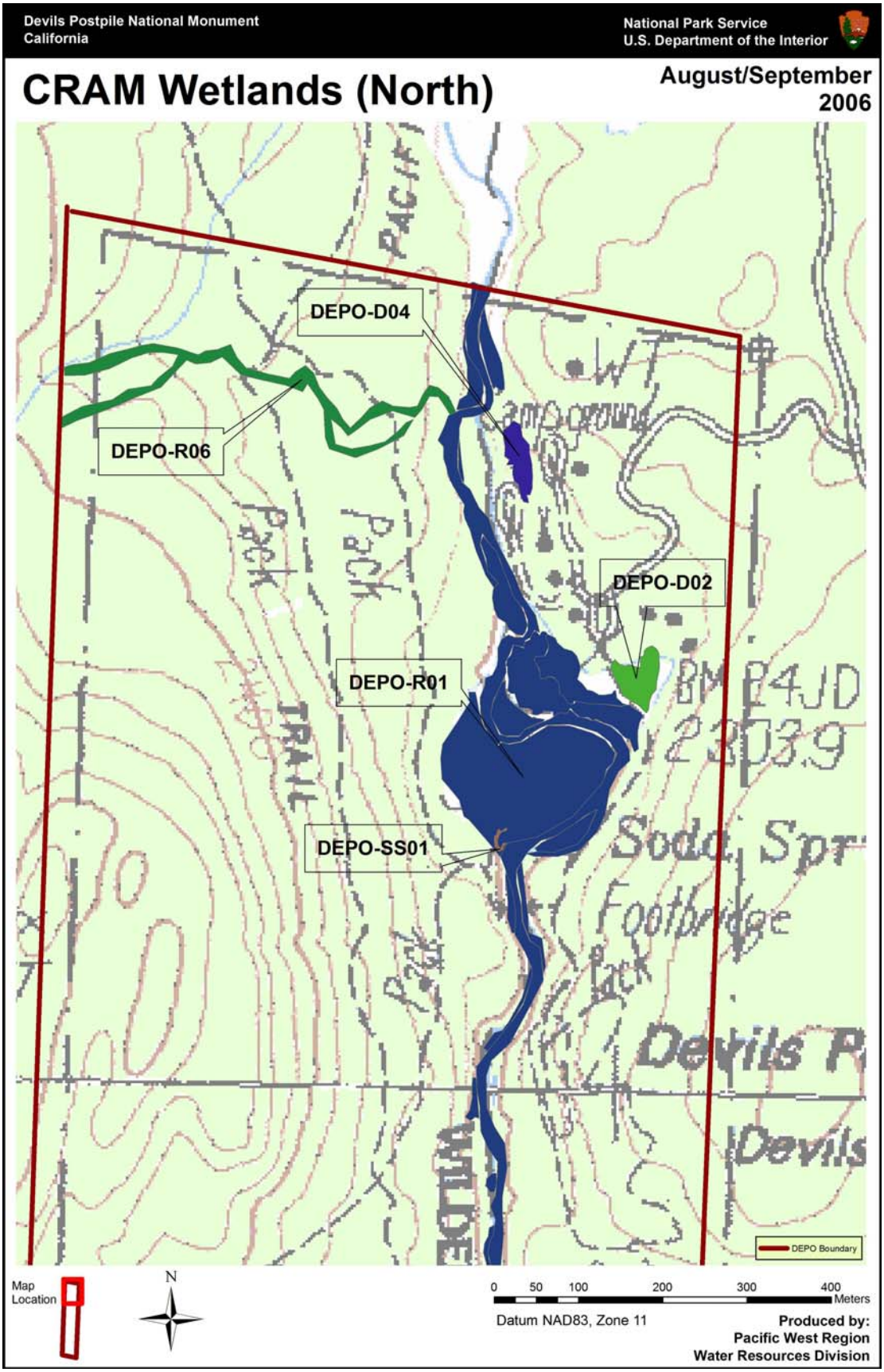

Devils Postpile National Monument
California
National Park Service
U.S. Department of the Interior
Cowardin Wetlands
August/September
2006
DEPO Boundary
Cowardin Wetlands
System, Class
Palustrine, Emergent Wetland
Palustrine, Scrub-shrub Wetland
Palustrine, Unconsolidated Bottom
Riverine, Rock Bottom
Riverine, Unconsolidated Bottom
Map
Location
N
0
0.25
0.5
1
1.5
2
Kilometers
Datum NAD83, Zone 11
Produced by:
Pacific West Region
Water Resources Division

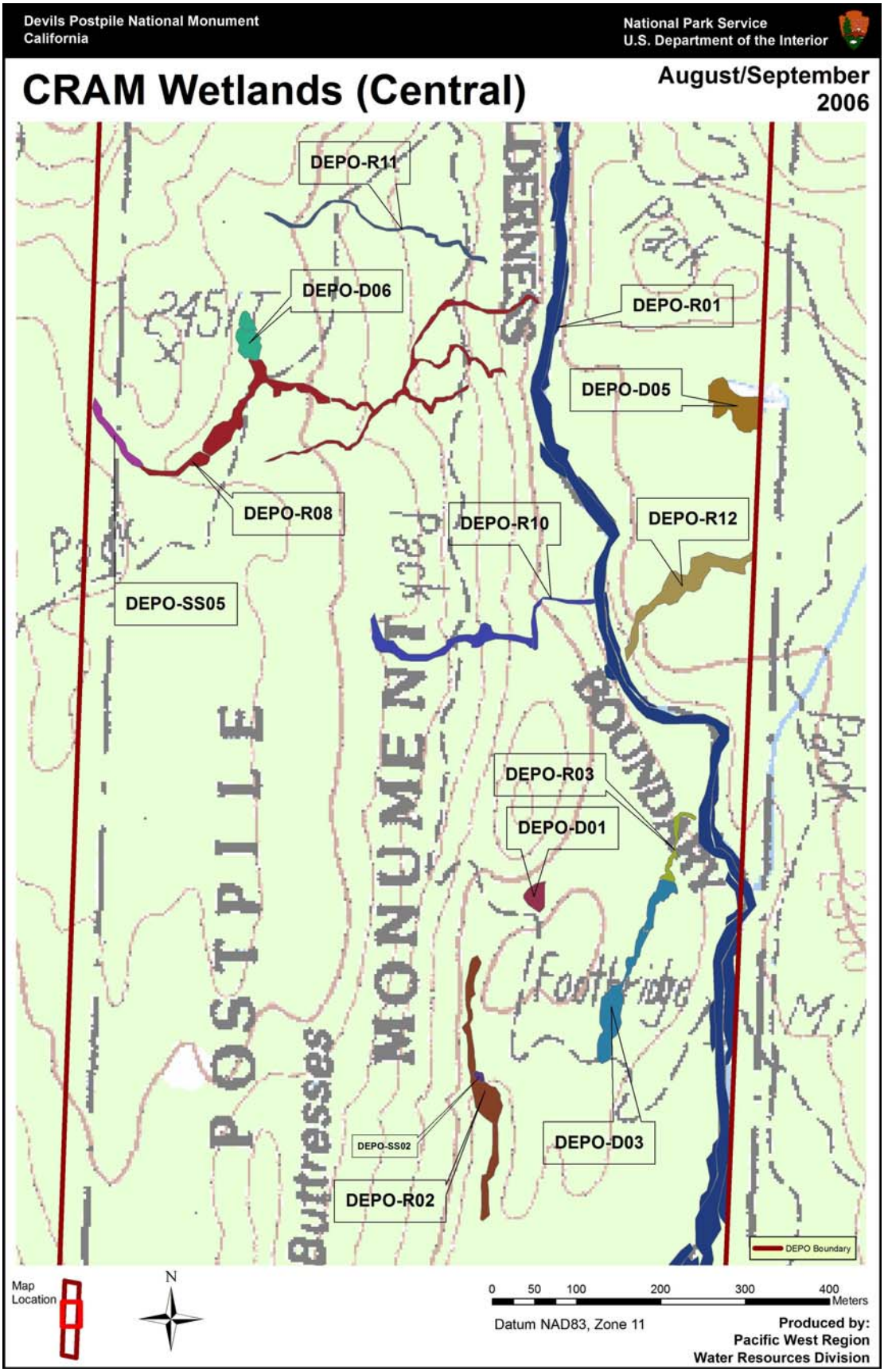

Devils Postpile National Monument
California
National Park Service
U.S. Department of the Interior
Cowardin Wetlands (North)
August/September
2006
R06-RRB01
R01-PSS02
D04-PSS01
R01-PSS02
R01-PSS02
R01-PEM02
R01-RRB01
D02-PEM01
R01-PSS01
R01-RUB01
R01-PEM01
R01-PSS01
SS01-PUB01
Cowardin Wetlands
System, Class
Palustrine, Emergent Wetland
Palustrine, Scrub-shrub Wetland
Palustrine, Unconsolidated Bottom
Riverine, Rock Bottom
Riverine, Unconsolidated Bottom
DEPO Boundary
Map Location
N
0 50 100 200 300 400
Meters
Datum NAD83, Zone 11
Produced by:
Pacific West Region
Water Resources Division

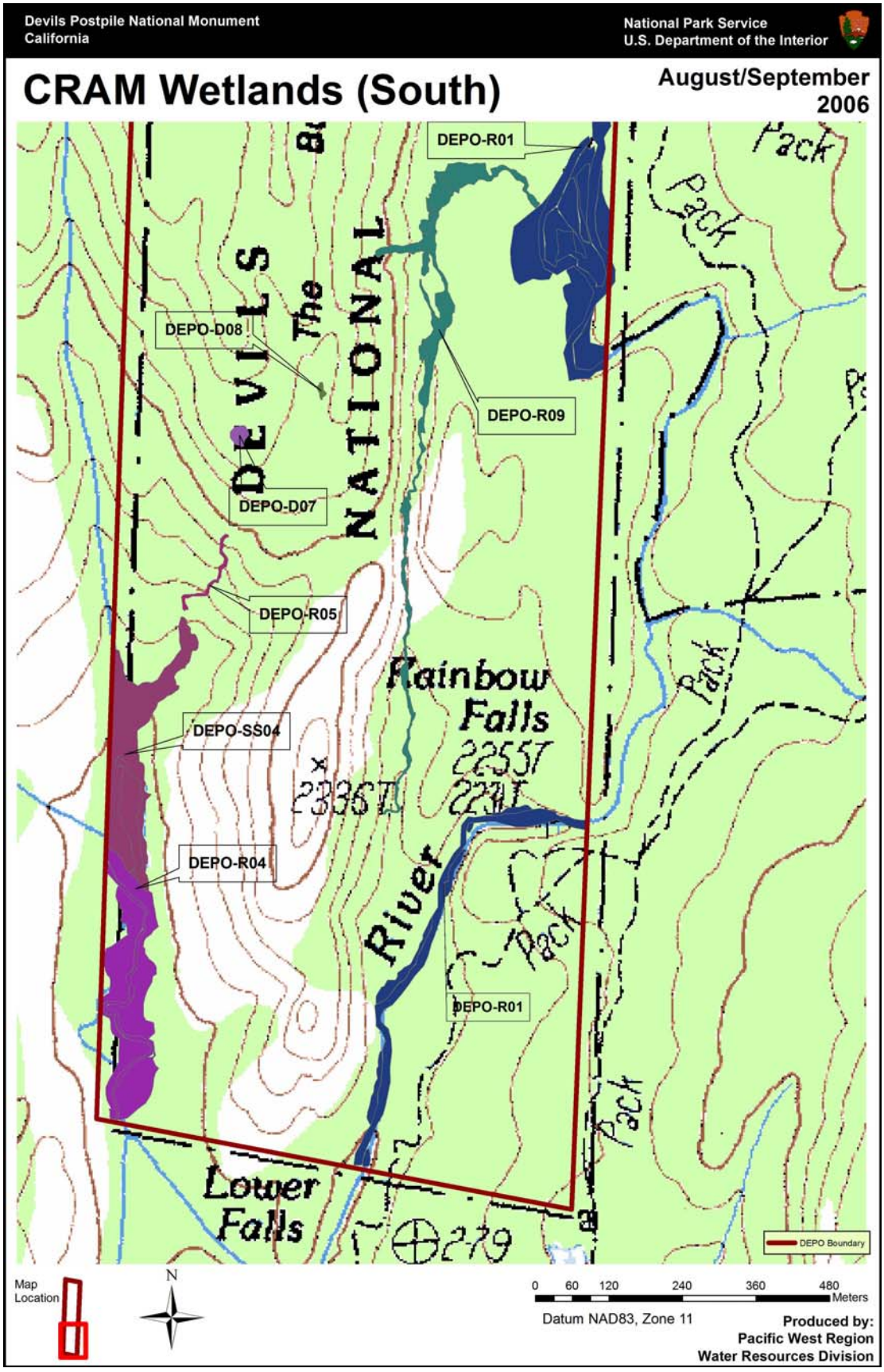

Devils Postpile National Monument
California
National Park Service
U.S. Department of the Interior
Cowardin Wetlands (Central)
August/September
2006
R11-RUB01
D06-PEM01
D06-PUB01
R01-PSS02
D05-PEM01
SS05-PEM01
R12-PSS01
R08-PEM02
R10-RUB03
R08-PSS01
R08-PEM01
R10-PEM01
R01-RRB01
R03-PEM01
D01-PEM01
D03-PUB01
D03-PEM01
SS02-PEM01
R02-EM01
Cowardin Wetlands
System, Class
Palustrine, Emergent Wetland
Palustrine, Scrub-shrub Wetland
Palustrine, Unconsolidated Bottom
Riverine, Rock Bottom
Riverine, Unconsolidated Bottom
DEPO Boundary
Map Location
N
Datum NAD83, Zone 11
0 50 100 200 300 400
Meters
Produced by:
Pacific West Region
Water Resources Division

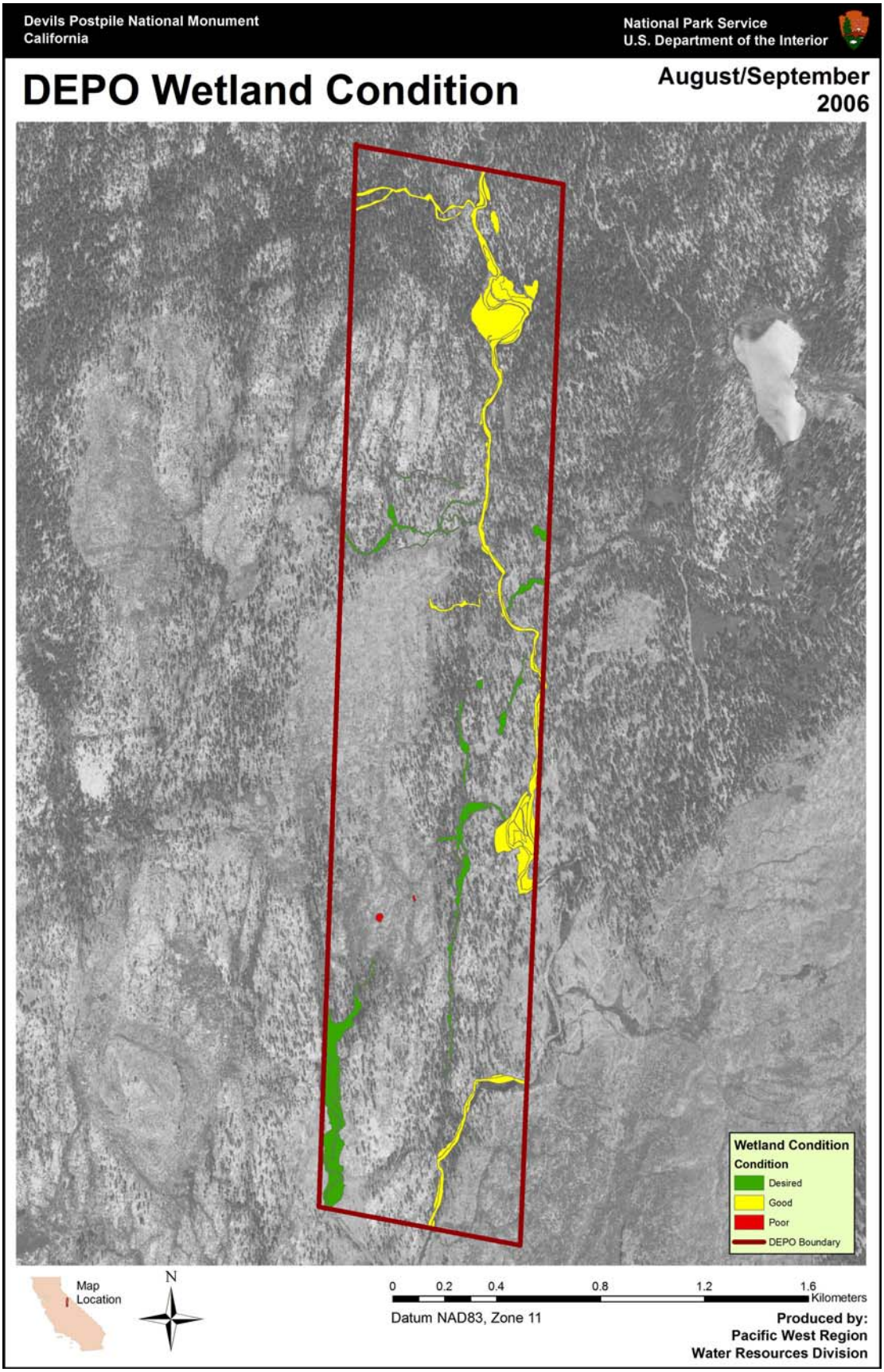

Devils Postpile National Monument
California
National Park Service
U.S. Department of the Interior
Cowardin Wetlands (South)
August/September
2006
R09-PEM01
R09-PSS01
R09-PEM02
D08-PEM01
D07-PEM01
R05-PEM01
SS04-PSS01
R09-PUB01
SS04-PEM01
R04-RRB01
R04-PSS01
R01-RRB01
R01-PSS02
R01-PSS01
R09-PSS04
R09-PSS05
R09-PEM03
R01-PSS02
R01-RRB01
Cowardin Wetlands
System, Class
Palustrine, Emergent Wetland
Palustrine, Scrub-shrub Wetland
Palustrine, Unconsolidated Bottom
Riverine, Rock Bottom
Riverine, Unconsolidated Bottom
DEPO Boundary
Map Location
N
0 62.5 125 250 375 500
Meters
Datum NAD83, Zone 11
Produced by:
Pacific West Region
Water Resources Division

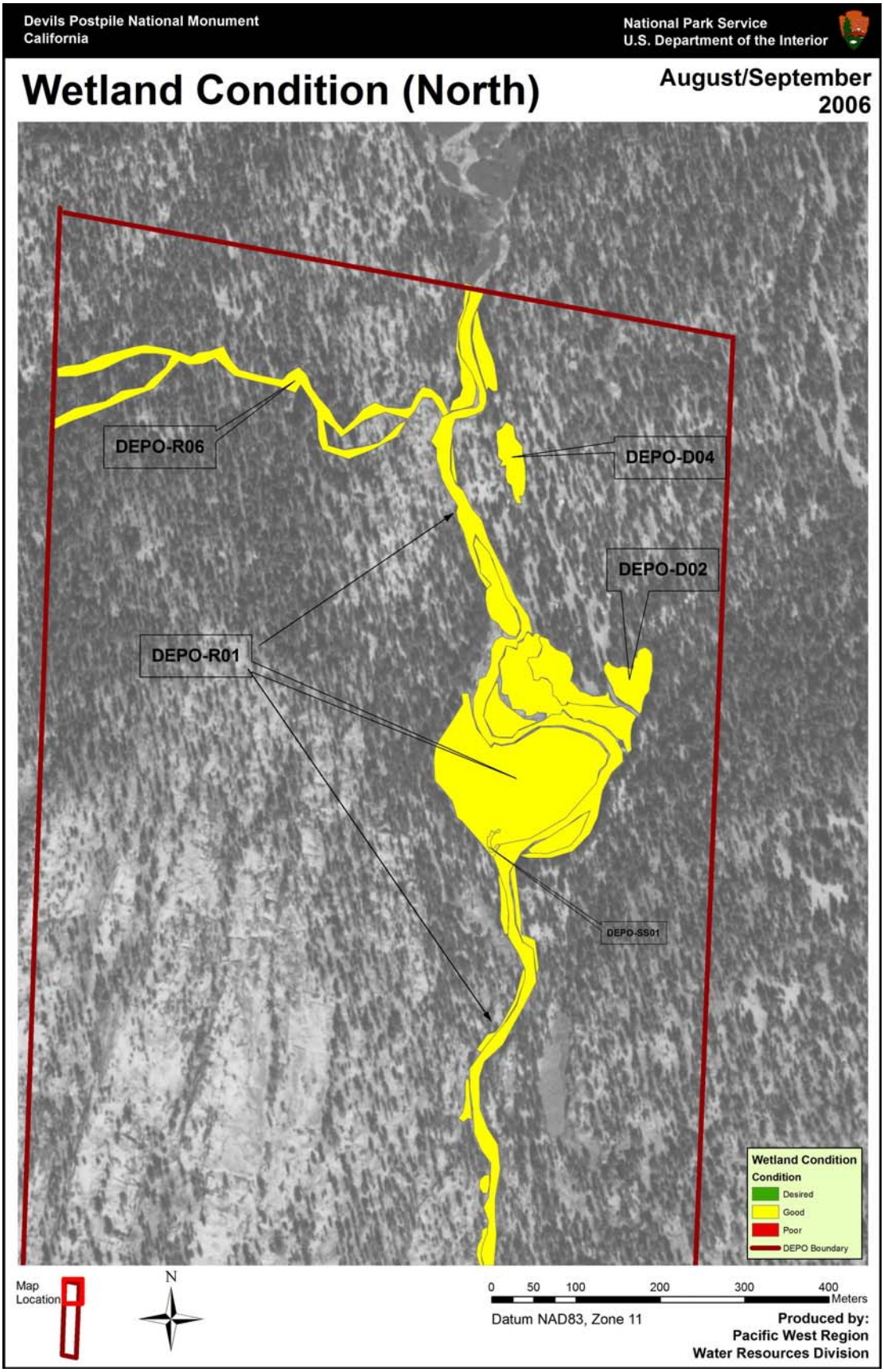

Devils Postpile National Monument
California
National Park Service
U.S. Department of the Interior
CRAM Wetlands
August/September
2006
DEVILS POSTPILE
NATIONAL MONUMENT
Soda Springs
Devils Postpile
Sotcher Lake
Reds Meadow
Mile 55 Sewage Treatment Plant
Corrals
Creek
Canyon
Rainbow Falls
River
Lower Falls
WILDERNESS
BOUNDARY
Buttresses
The DEVILS POSTPILE NATIONAL MONUMENT
PACIFIC CREST TRAIL
DEPO Boundary
Map Location
N
0 0.15 0.3 0.6 0.9 1.2
Kilometers
Datum NAD83, Zone 11
Produced by:
Pacific West Region
Water Resources Division

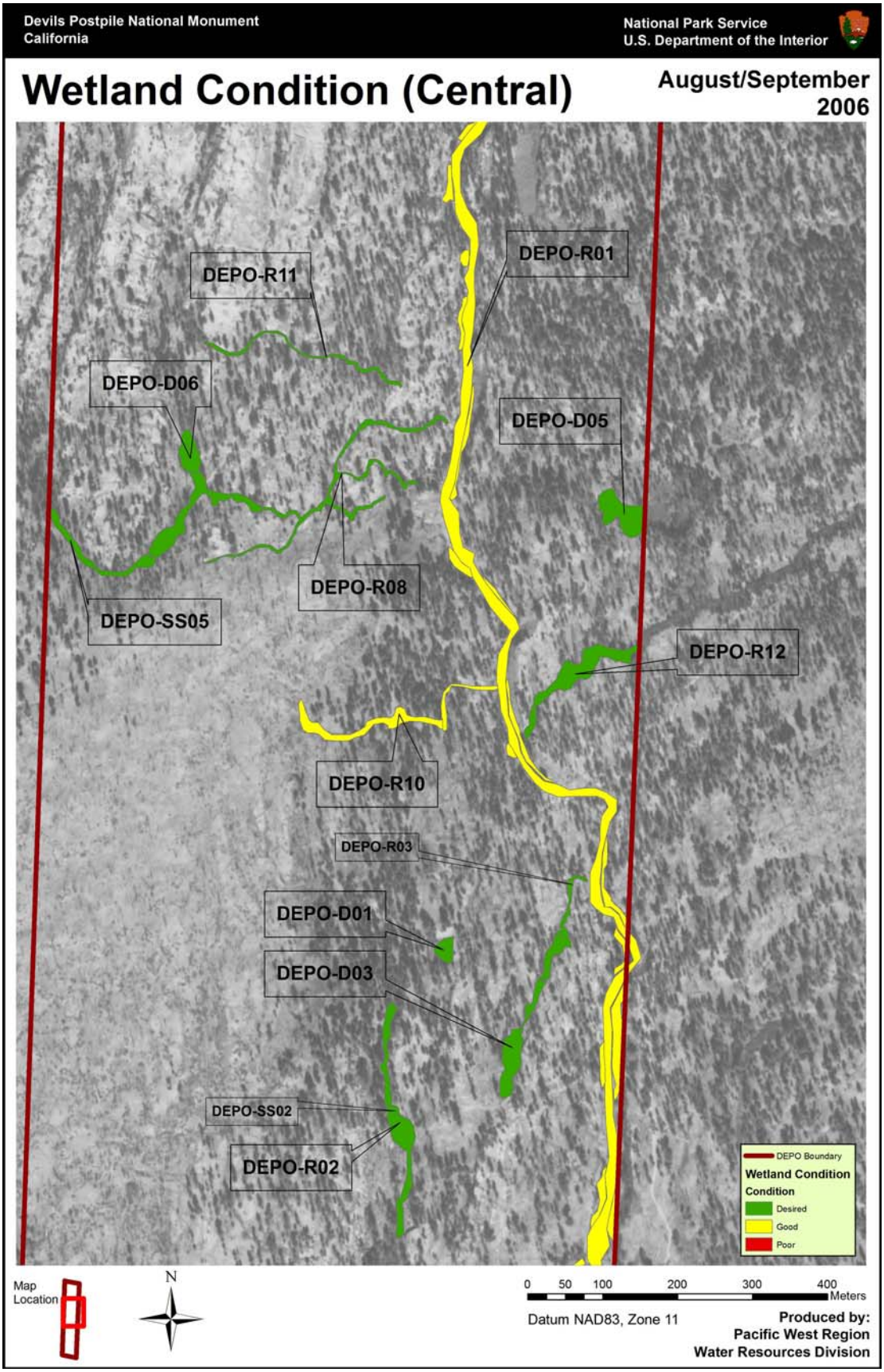

Devils Postpile National Monument
California
National Park Service
U.S. Department of the Interior
CRAM Wetlands (North)
August/September
2006
DEPO-D04
DEPO-R06
DEPO-D02
DEPO-R01
DEPO-SS01
DEPO Boundary
Map
Location
N
0 50 100 200 300 400
Meters
Datum NAD83, Zone 11
Produced by:
Pacific West Region
Water Resources Division

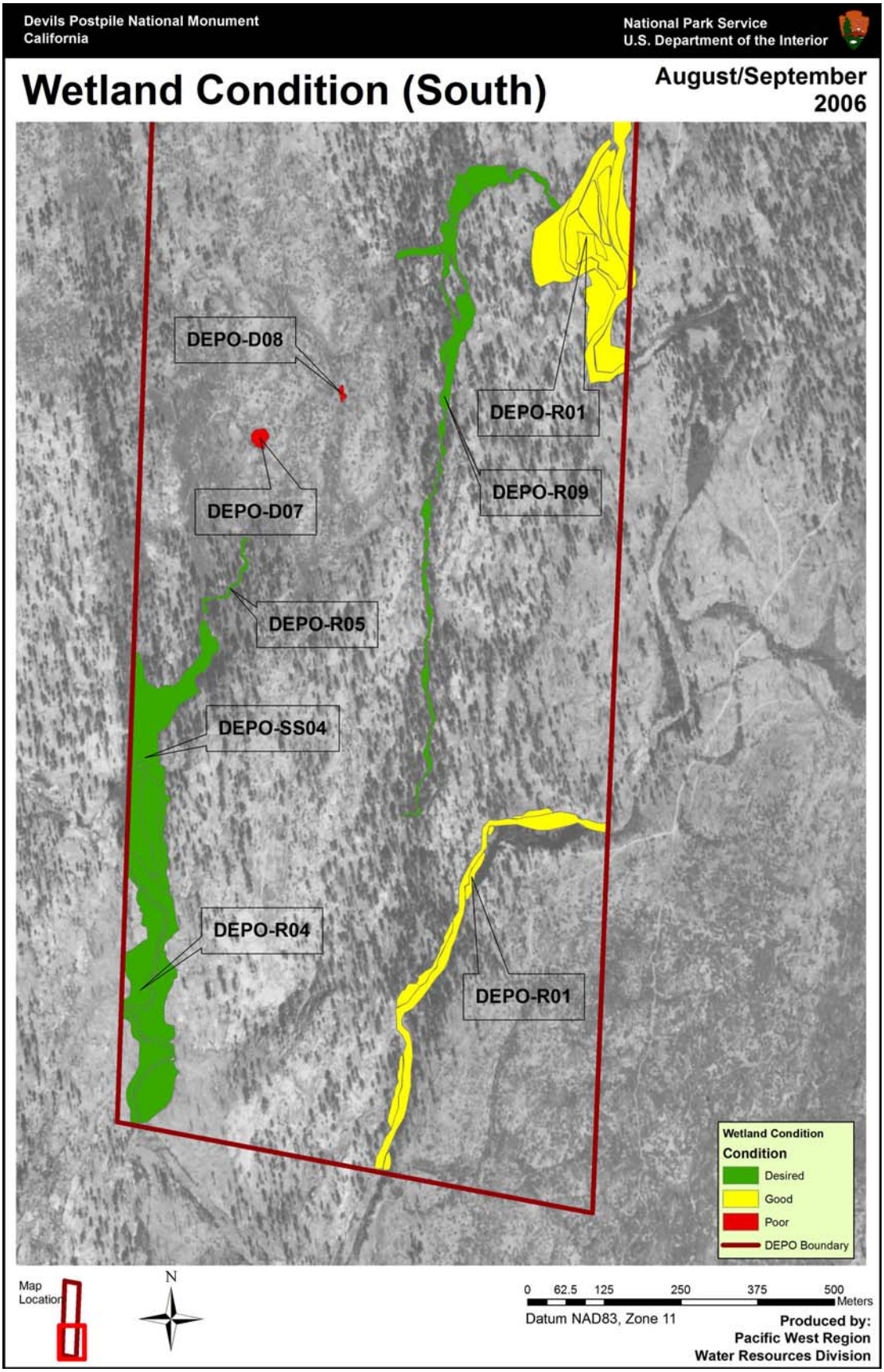

Devils Postpile National Monument
California
National Park Service
U.S. Department of the Interior
CRAM Wetlands (Central)
August/September
2006
DEPO-R11
DEPO-D06
DEPO-R01
DEPO-D05
DEPO-R08
DEPO-R10
DEPO-R12
DEPO-SS05
DEPO-R03
DEPO-D01
DEPO-SS02
DEPO-D03
DEPO-R02
DEPO Boundary
Map Location
N
0 50 100 200 300 400 Meters
Datum NAD83, Zone 11
Produced by:
Pacific West Region
Water Resources Division


Devils Postpile National Monument
California
National Park Service
U.S. Department of the Interior
CRAM Wetlands (South)
August/September
2006
DEPO-R01
DEPO-D08
DEPO-R09
DEPO-D07
DEPO-R05
DEPO-SS04
DEPO-R04
DEPO-R01
DEVILS
The
NATIONAL
Rainbow
Falls
River
Lower
Falls
Pack
DEPO Boundary
Map
Location
N
0 60 120 240 360 480
Meters
Datum NAD83, Zone 11
Produced by:
Pacific West Region
Water Resources Division


Devils Postpile National Monument
California
National Park Service
U.S. Department of the Interior
DEPO Wetland Condition
August/September
2006
Wetland Condition
Condition
Desired
Good
Poor
DEPO Boundary
Map
Location
N
0
0.2
0.4
0.8
1.2
1.6
Kilometers
Datum NAD83, Zone 11
Produced by:
Pacific West Region
Water Resources Division


Devils Postpile National Monument
California
National Park Service
U.S. Department of the Interior
Wetland Condition (North)
August/September
2006
DEPO-R06
DEPO-D04
DEPO-D02
DEPO-R01
DEPO-SS01
Wetland Condition
Condition
Desired
Good
Poor
DEPO Boundary
Map
Location
N
0 50 100 200 300 400
Meters
Datum NAD83, Zone 11
Produced by:
Pacific West Region
Water Resources Division


Devils Postpile National Monument
California
National Park Service
U.S. Department of the Interior
Wetland Condition (Central)
August/September
2006
DEPO-R11
DEPO-R01
DEPO-D06
DEPO-D05
DEPO-R08
DEPO-SS05
DEPO-R12
DEPO-R10
DEPO-R03
DEPO-D01
DEPO-D03
DEPO-SS02
DEPO-R02
DEPO Boundary
Wetland Condition
Condition
Desired
Good
Poor
Map Location
N
0 50 100 200 300 400
Meters
Datum NAD83, Zone 11
Produced by:
Pacific West Region
Water Resources Division


Devils Postpile National Monument
California
National Park Service
U.S. Department of the Interior
Wetland Condition (South)
August/September
2006
DEPO-D08
DEPO-R01
DEPO-D07
DEPO-R09
DEPO-R05
DEPO-SS04
DEPO-R04
DEPO-R01
Wetland Condition
Condition
Desired
Good
Poor
DEPO Boundary
Map
Location
N
0 62.5 125 250 375 500
Meters
Datum NAD83, Zone 11
Produced by:
Pacific West Region
Water Resources Division

Appendix G:
Photographs of Devils Postpile National Monument CRAM Wetlands

This appendix presents photos of representative conditions of all CRAM wetlands mapped at Devils Postpile National Monument in August and September 2006. All photos were created with a 5.0 megapixel digital camera by National Park Service biologist Donna Shorrock.

The CRAM polygon code identifies each CRAM wetland (*e.g.,* R04) (see maps in Appendix F for locations); several photos are presented for most CRAM polygons. The CRAM code identifies each wetland as falling into either the Depressional (D), Riverine (R), or Seep/Slope (SS) CRAM class. Numbers in the code assign a unique identifier to each wetland. In addition, the Cowardin wetland code, presented in parentheses after each wetland's CRAM code, identifies the Cowardin wetland type depicted: Palustrine Emergent (PEM), Palustrine Scrub-shrub (PSS), Palustrine Unconsolidated Bottom (PUB) Riverine Upper Perennial Unconsolidated Bottom (RUB), and Riverine Rock Bottom (RRB).

page

Photographs of CRAM Depressional Wetlands at DEPO 108

Photographs of CRAM Riverine Wetlands at DEPO 120

Photographs of CRAM Seep/Slope Wetlands at DEPO 183



D01 (PEM01) AUGUST 10, 2006



D01 (PEM01) AUGUST 10, 2006



D02 (PEM01) AUGUST 11, 2006



D02 (PEM01) AUGUST 11, 2006



D03 (PEM01) AUGUST 15, 2006



D03 (PEM01 and PUB01) AUGUST 15, 2006



D03 (PEM01) AUGUST 15, 2006



D03 (PEM01 and PUB01) AUGUST 15, 2006



D03 (PUB01) AUGUST 15, 2006



D03 (PEM01 and PUB01) AUGUST 15, 2006



D03 (PEM01 and PUB01) AUGUST 15, 2006



D04 (PSS01) SEPTEMBER 7, 2006



D04 (PSS01) SEPTEMBER 7, 2006



D04 (PSS01) SEPTEMBER 7, 2006



D04 (PSS01) SEPTEMBER 7, 2006



D05 (PEM01) AUGUST 23, 2006



D05 (PEM01) AUGUST 23, 2006



D05 (PEM01) AUGUST 23, 2006



D05 (PEM01) AUGUST 23, 2006



D06 (PEM01) SEPTEMBER 9, 2006



D06 (PUB01) SEPTEMBER 9, 2006



D07 (PEM01) SEPTEMBER 15, 2006



D07 (PEM01) SEPTEMBER 15, 2006



D08 (PEM01) SEPTEMBER 15, 2006



R01 (PEM01) AUGUST 10, 2006



R01 (PEM01, RRB01, and RUB01) AUGUST 10, 2006



R01 (PEM02 and SS01) AUGUST 10, 2006



R01 (PEM02 and SS02) AUGUST 10, 2006



R01 (PSS01 and RUB01) AUGUST 10, 2006



R01 (PSS02) SEPTPEMBER 14, 2006



R01 (PSS02 and RRB01) SEPTPEMBER 14, 2006



R01 (PSS02 and RRB01) SEPTPEMBER 14, 2006



R01 (PSS02 and RRB01) SEPTPEMBER 14, 2006



R02 (PEM01) AUGUST 10, 2006



R02 (PEM01) AUGUST 10, 2006



R02 (PEM01) AUGUST 10, 2006



R02 (PEM01) AUGUST 10, 2006



R02 (PEM01) AUGUST 10, 2006



R03 (PEM01) AUGUST 15, 2006



R03 (PEM01) AUGUST 15, 2006



R04 (RRB01) AUGUST 15, 2006



R04 (RRB01) AUGUST 15, 2006



R04 (RRB01 and PSS01) AUGUST 15, 2006



R04 (RRB01 and PSS01) AUGUST 15, 2006



R04 (RRB01 and PSS01) AUGUST 15, 2006



R04 (RRB01 and PSS01) AUGUST 15, 2006



R04 (RRB01 and PSS01) AUGUST 15, 2006



R04 (RRB01 and PSS01) AUGUST 15, 2006



R04 (RRB01 and PSS01) AUGUST 15, 2006



R05 (PEM01) AUGUST 15, 2006



R05 (PEM01) AUGUST 15, 2006



R05 (PEM01) AUGUST 15, 2006



R05 (PEM01) AUGUST 15, 2006



R05 (PEM01) AUGUST 15, 2006



R06 (RRB01) SEPTPEMBER 7, 2006



R06 (RRB01) SEPTPEMBER 7, 2006



R06 (RRB01) SEPTPEMBER 7, 2006



R06 (RRB01) SEPTPEMBER 7, 2006



R06 (RRB01) SEPTPEMBER 7, 2006



R06 (RRB01) SEPTPEMBER 7, 2006



R06 (RRB01) SEPTPEMBER 7, 2006



R06 (RRB01) SEPTPEMBER 7, 2006



R08 (PEM01) SEPTPEMBER 9, 2006



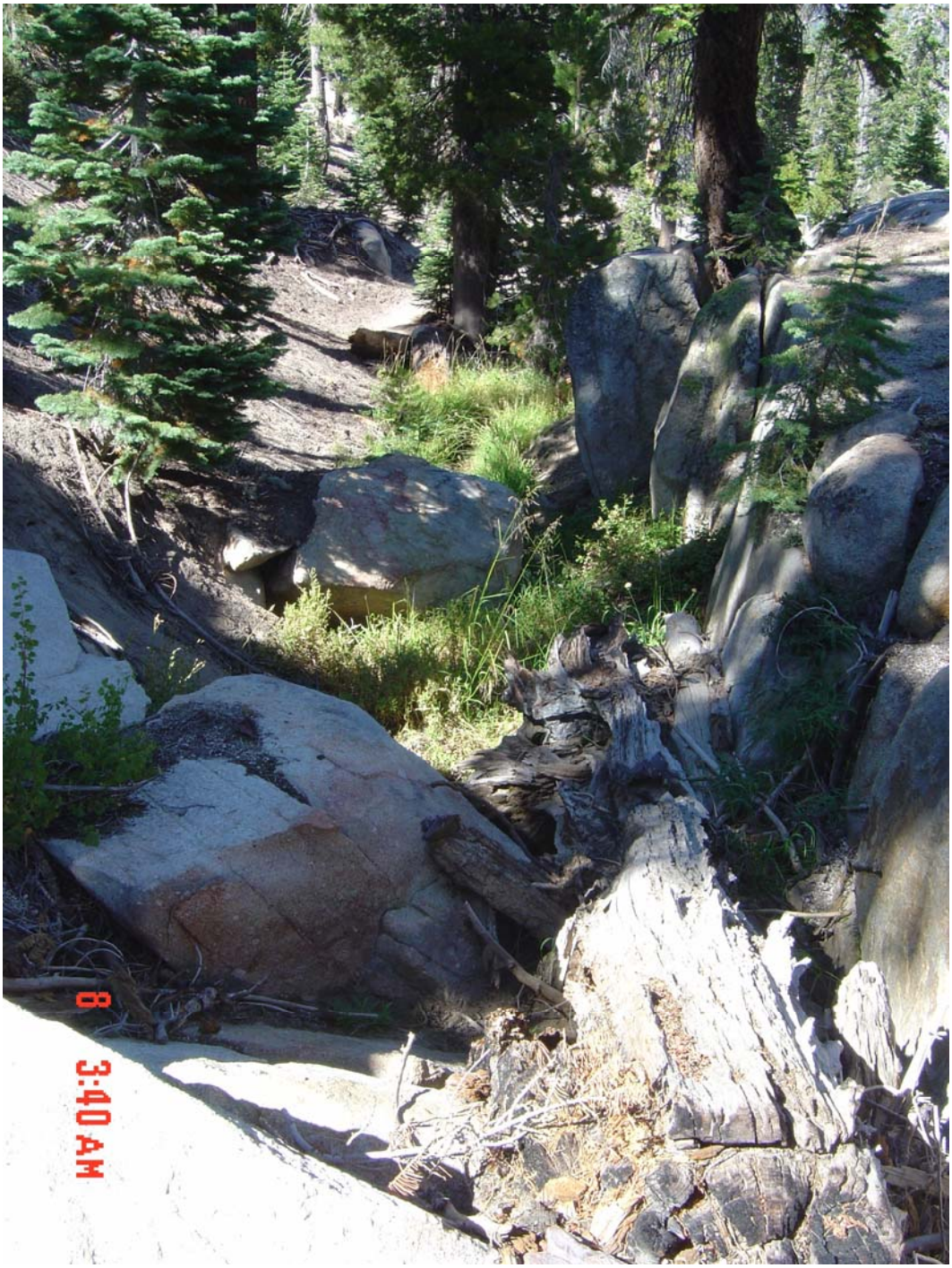
R08 (PEM01) SEPTPEMBER 9, 2006



R08 (PEM01) SEPTPEMBER 9, 2006



R08 (PEM01) SEPTPEMBER 9, 2006



R08 (PEM02) SEPTPEMBER 9, 2006



R08 (PEM02) SEPTPEMBER 9, 2006



R08 (PEM02) SEPTPEMBER 9, 2006



R08 (PEM02) SEPTPEMBER 9, 2006



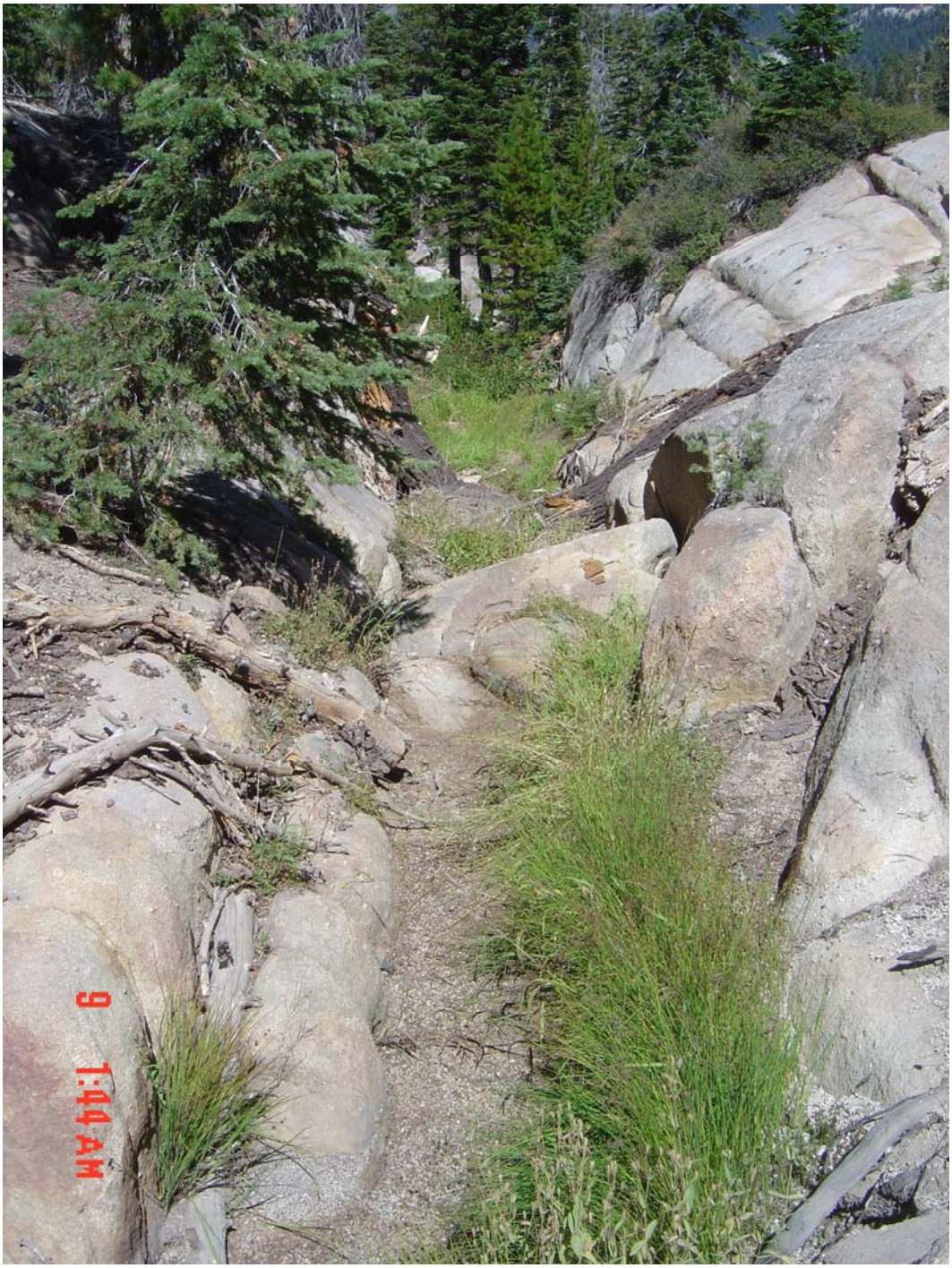
R08 (PEM02) SEPTPEMBER 9, 2006



R08 (PEM02) SEPTPEMBER 9, 2006



R08 (PEM02) SEPTPEMBER 9, 2006



R08 (PEM02) SEPTPEMBER 9, 2006



R08 (PEM02) SEPTPEMBER 9, 2006



R08 (PEM02) SEPTPEMBER 9, 2006



R08 (PSS01) SEPTPEMBER 9, 2006



R08 (PSS01) SEPTPEMBER 9, 2006



R09 (PEM01) SEPTPEMBER 11, 2006



R09 (PEM01) SEPTPEMBER 11, 2006



R09 (PEM01) SEPTPEMBER 11, 2006



R09 (PEM01) SEPTPEMBER 11, 2006



R09 (PEM01) SEPTPEMBER 11, 2006



R09 (PEM01) SEPTPEMBER 11, 2006



R09 (PEM02) SEPTPEMBER 11, 2006



R09 (PEM02) SEPTPEMBER 11, 2006



R09 (PEM02) SEPTPEMBER 11, 2006



R09 (PEM02) SEPTPEMBER 11, 2006



R09 (PEM02) SEPTPEMBER 11, 2006



R09 (PEM02) SEPTPEMBER 11, 2006



R09 (PEM02) SEPTPEMBER 11, 2006



R09 (PEM02) SEPTPEMBER 11, 2006



R09 (PEM02) SEPTPEMBER 11, 2006



R09 (PEM02) SEPTPEMBER 11, 2006



R09 (PEM02) SEPTPEMBER 11, 2006



R09 (PEM03) SEPTPEMBER 11, 2006



R09 (PEM03) SEPTPEMBER 11, 2006



R09 (PEM03) SEPTPEMBER 11, 2006



R09 (PEM03) SEPTPEMBER 11, 2006



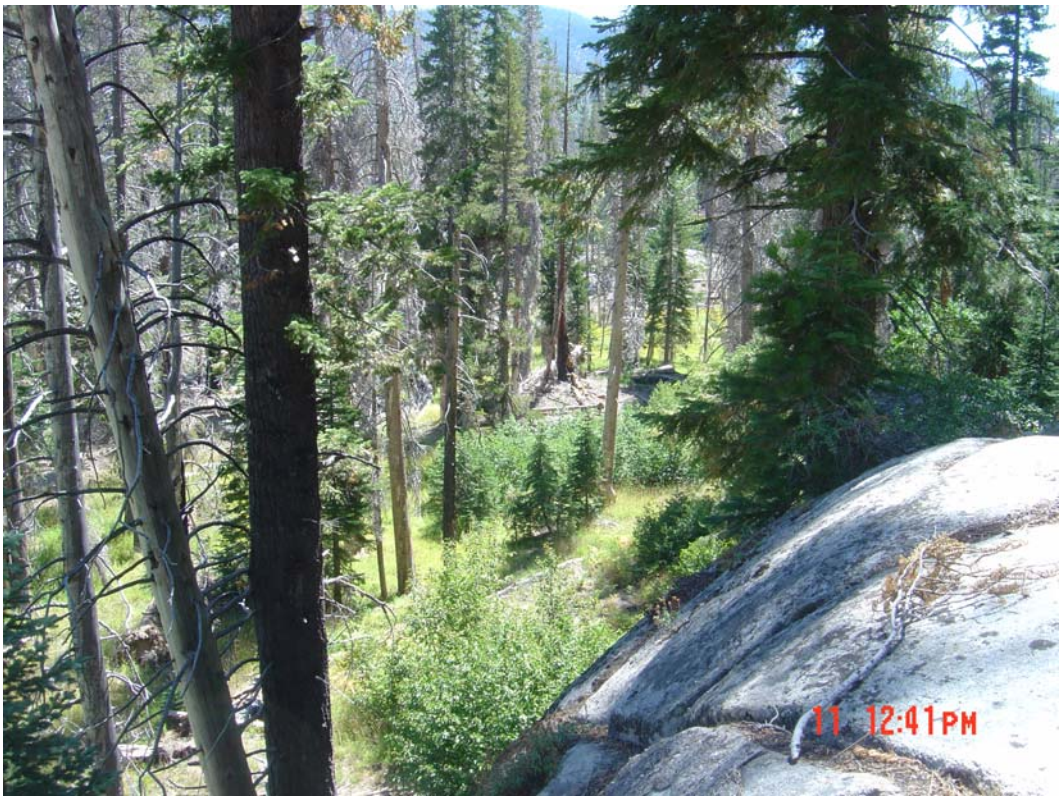
R09 (PSS01) SEPTPEMBER 11, 2006



R09 (PSS02) SEPTPEMBER 11, 2006



R09 (PSS02) SEPTPEMBER 11, 2006



R09 (PSS02) SEPTPEMBER 11, 2006



R09 (PSS02) SEPTPEMBER 11, 2006



R09 (PSS03) SEPTPEMBER 11, 2006



R09 (PSS03) SEPTPEMBER 11, 2006



R09 (PSS03) SEPTPEMBER 11, 2006



R09 (PSS04) SEPTPEMBER 11, 2006



R09 (PSS04) SEPTPEMBER 11, 2006



R09 (PSS05) SEPTPEMBER 11, 2006



R09 (PSS05) SEPTPEMBER 11, 2006



R09 (PSS05) SEPTPEMBER 11, 2006



R09 (PSS05) SEPTPEMBER 11, 2006



R09 (PSS05) SEPTPEMBER 11, 2006



R09 (PSS05) SEPTPEMBER 11, 2006



R10 (PEM01) SEPTEMBER 12, 2006



R10 (PEM01) SEPTEMBER 12, 2006



R11 (RUB01) SEPTEMBER 12, 2006



R11 (RUB01) SEPTEMBER 12, 2006



R11 (RUB01) SEPTEMBER 12, 2006



R11 (RUB01) SEPTEMBER 12, 2006



R11 (RUB01) SEPTEMBER 12, 2006



R11 (RUB01) SEPTEMBER 12, 2006



R11-14 SEPTEMBER 12, 2006



R12 (PSS01) SEPTEMBER 14, 2006



R12 (PSS01) SEPTEMBER 14, 2006



R12 (PSS01) SEPTEMBER 14, 2006



R12 (PSS01) SEPTEMBER 14, 2006



SS01 (PUB01) (*pictured:* Soda Spring) AUGUST 8, 2006



SS01 (PUB01) (*pictured:* Soda Spring) AUGUST 8, 2006



SS01 (PUB01) (*pictured:* Soda Spring) AUGUST 8, 2006



SS01 (PUB01) (*pictured:* Soda Spring) AUGUST 8, 2006



SS02 (PEM01) AUGUST 10, 2006



SS04 (PEM01) AUGUST 15, 2006



SS04 (PSS01) AUGUST 15, 2006



SS05 (PEM01) SEPTEMBER 9, 2006



SS05 (PEM01) SEPTEMBER 9, 2006



SS05 (PEM01) SEPTEMBER 9, 2006



SS05 (PEM01) SEPTEMBER 9, 2006