April 10, 2024
Subject: Much of KCPD property should be protected wetlands
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I have degrees in entomology and renewable natural resources, served as the director and entomologist for the Moab Mosquito Abatement District (which included the present Kane Creek Preservation and Development [KCPD] property) from 1994 through 2016, and have published research in the subjects of medical entomology and insect systematics, taxonomy, and ecology.

To determine if and to what extent wetlands were present on the KCPD property, two surveys were conducted: ALM and Associates Inc contracted with Intermountain Ecosystems LLC (IE) to conduct a wetland delineation survey in 2017; and Kane Springs LLC contracted with SME Environmental Inc (SME) to conduct a aquatic resources delineation survey in 2019. Four sample sites were studied on 8 August 2017 by IE, and five sites were studied on 9–10 October 2019 by SME. Both surveys found facultative wetland plants ("FACW") and "hydrophytic vegetation", indicated that soil and vegetation were not significantly disturbed, but did not indicate they found biotic crusts, aquatic invertebrates, or aerial imagery showing inundation of the property. Their conclusions were that wetlands were not present within the KCPD project area (Intermountain Ecosystems LLC report of January 2018; SME Environmental Inc report SME# 190046 of October 2019).

To the contrary, the KCPD bottomland property proposed for development has had soil and vegetation significantly disturbed by plowing and mowing for weed control, has been shown inundated in aerial imagery (primary wetlands indicator B7), has had biotic crusts (primary wetlands indicator B12), and has ephemeral-wetland-dependent aquatic invertebrates (primary wetlands indicator B13). Furthermore, the timing of the IE and SME studies reduced the prospects for finding evidence of ephemeral wetlands. In addition, most of the property has had intermittent direct surface connection with a water of the United States (the Colorado River). (See also Appendix A on page 10 for an excerpt from the National Academies of Science, which explains the characterization and importance of especially shallow or intermittently flooded wetlands.)

Inundation visible on aerial imagery (primary indicator B7)

A Google Earth image of 14 September 2011 (Figure 8) shows residual river water inundation on the KCPD property and direct surface connection with the Colorado River more than three months after the river's peak flow on 9 June; however, none of the IE or SME reports I found indicated that inundation of the property was visible on aerial imagery.

Presence of biotic crusts (primary indicator B12)

In various years during my tenure with the Mosquito District 1994–2016, I observed biotic crusts (primary indicator B12) like those figured in Appendix B, page 11 (excerpted figures 26–28 and 30 from page 71 of the Regional Supplement to the Corps of Engineers Wetland Delineation Manual: Arid West Region, Version 2.0 (September 2008) https://usace.contentdm.oclc.org/utils/getfile/collection/p266001coll1/id/7627 [henceforth referenced as USACE manual]) on portions of the KCPD property after river inundation and dry-down. None of the IE or SME reports I found indicated they found biotic crusts.

Presence of aquatic invertebrates (primary indicator B13)

None of the IE or SME reports I found indicated they found aquatic invertebrates; however, I observed aquatic invertebrates in all of the river- and stormwater-flooded portions of the property. Specific invertebrates variously observed during the earlier stages of flooding included the crustaceans Ostracoda (seed shrimp), Copepoda (copepods), and Branchiopoda (fairy shrimp, water fleas, clam shrimp, tadpole shrimp), and insects of the family Culicidae (mosquitoes, specifically *Aedes vexans* and *Aedes melanimon*). These invertebrates I observed before direct river flooding are adapted to and dependent on ephemeral wetlands. They produce desiccation and heat resistant eggs that can remain viable through dry periods that may last up to ten years for the mosquitoes and for decades or centuries for the crustaceans. Some of the eggs hatch when the habitat is reflooded, releasing the immatures into the water to mature and produce eggs for the next dry-down/flood cycle. Indeed, they require habitat dry-down and cannot reproduce and survive more than a generation in a habitat that is continuously flooded.

I also commonly observed other aquatic insects as the floodwaters lingered, including various Odonata (dragonflies and damselflies), Trichoptera (caddisflies), Dytiscidae (predaceous diving beetles), Hydrophilidae (water scavenger beetles), Notonectidae (backswimmer bugs), Corixidae (water boatmen), Belostomatidae (giant water bugs), Gerridae (water striders), Tabanidae (horse and deer flies), Chironomidae (non-biting midges), Dixidae (meniscus midges), and standing water mosquitoes (notably *Culex tarsalis* and *Anopheles freeborni*). These groups are generally not ephemeral-wetland-dependent, usually migrate into the wetlands after flooding, and either die-out or leave the habitat when it dries down; however, some caddisfly, beetle, and midge species are ephemeral-wetland-dependent and have desiccation-resistant eggs or can otherwise diapause in the habitat through dry periods.

Study timings reduced the likelihood of finding aquatic invertebrates

On the five wetland determination data forms I found that were prepared by SME in 2019, “no” was answered to “Are climatic / hydrologic conditions on the site typical for this time of year?” and explained by “According the U.S. Drought Monitor, Eastern Utah is in a moderate to severe drought (USDA, October 8, 2019)”. And, on the four wetland determination data forms I found that were prepared by IE in 2017, “yes” was answered to the same question without explanation, despite the US Drought Monitor indicating all of Grand County as “abnormally dry” on 8 August 2017 (https://droughtmonitor.unl.edu/Maps/MapArchive.aspx, accessed 19 Mar 2024). “Abnormally dry” is not “typical”, a distinction I think relevant to the conclusions of the 2017 survey.

Furthermore, 2017 was a below average water year on the Colorado River, with a peak flow of only ~26,200 cfs on 10 June that reduced to 4,940 cfs on the 8 August sampling date. Also, the flood flow of ~40,000 cfs on 10 June 2019 had reduced 4 months later to ~3400 cfs by the 9–10 October sampling dates (CLRU1 river gauge data). The timing of these wetlands surveys greatly reduced the chance of finding evidence of ephemeral wetlands at the sampling locations: the 2017 survey having been done late in a moderately low water and abnormally dry year; and the 2019 survey having been done at the end of a moderate flood season in a moderate to severe drought year. If the 2019 survey had been done early in the flooding, I am certain that ephemeral-wetlands-dependent aquatic invertebrates would have been found.

In addition, detection of invertebrates in a dry ephemeral wetland often requires techniques such as detecting eggs by floatation and microscopic examination, or by wetting a sufficiently large sample and observing hatching and emergence of the species present, which can take anywhere from minutes to days, depending on the species, other biotic factors, and on soil and water temperature and chemistry. None of the IE or SME reports I found indicated they did these kinds of surveys, which would likely have found aquatic invertebrates.

Vegetation, soil, and hydrology have been significantly disturbed

Much of the bottomland property has been plowed or disced for noxious weed control. This kind of disturbance can have significant impacts on soil, vegetation, and hydrology and potentially remove or otherwise disguise critical wetland indicators. As examples: if ephemeral-wetland-dependent aquatic invertebrate eggs are buried too deeply, the eggs can hatch when flooded, but the hatchlings cannot move up into the water column before they die; and, disturbances that break-up or stir the soil—such as plowing or disking—open up the soil to allow predation on invertebrate eggs by terrestrial invertebrates such as ants and mites. All of the IE and SME reports I found indicated that the investigators determined that the vegetation, soil, and hydrology were not significantly disturbed, even though the SME PP12 photo shows what appears to be plowing or discing (SME Environmental Inc report SME# 190046, page 6 of their Appendix C). Furthermore, special considerations and procedures for areas that have been subjected to significant disturbance are described more than a dozen times in the USACE manual (https://usace.contentdm.oclc.org/utils/getfile/collection/p266001coll1/id/7627). The forms used by SME and presented in the USACE manual include the note that indicators of hydrophytic vegetation, hydric soil, and wetland hydrology must be present "unless disturbed or problematic", suggesting that disturbances should be considered by discounting the need for those indicators for identifying a wetland. Because disturbance was not identified on the survey forms I found, and the note itself is not on the forms used by IE, I question if disturbance was considered in the assessments.

However, the IE report I found indicated "yes" to soil being "naturally problematic" at the four sample sites (the SME report forms I found do not indicate vegetation, soil, or hydrology being naturally problematic). But, without explanation, I don't know what the naturally problematic soil refers to, if it relates to soil disturbance, or if it affected the report's conclusions.

Direct surface connection with waters of the United States

A recent United States Supreme Court decision (Sackett v. EPA) decided that for wetlands to have federal protection, they must have a surface water connection with waters of the United States. I personally observed flooded areas of the property having such direct connections to the Colorado River (a water of the United States) several times when its flow approached 40,000 cfs at the CLRU1 river gauge: first as direct backflow northward from the mouth of Pritchett Canyon; then through levee failures caused by seepage and erosion, and by backflow into and overtopping of stormwater drainage ditches as the river flow approached 50,000 cfs. Figures 1–7 show flooding on 25 May 2023 with the river flowing at ~36,500 cfs, down from a peak of ~40,700 cfs on 19 May. Figure 8 shows the 14 September 2011 river floodwater remaining after a peak flow of ~49,000 cfs on 9 June. (CLRU1 river gauge data accessed 20 Mar 2024.)

I observed natural levee failures in 1995 and 2011, which allowed river water to directly flood large portions of the property. (Levee failures occurred in other flood years, but I did not observe them as they were happening.) The Google Earth image of 14 September 2011 (Figure 8, B and inset) clearly shows an opening in the levee with a semicircular sediment fan inside the property, which is proof of direct Colorado River water flooding into the property. Furthermore, areas that are flooded only by groundwater upwelling (which is a direct subsurface connection with the river) tend to dry down, as the river water recedes, at about the same rate as when they flooded, depending on the rates of the river rising and falling. In contrast, areas that are flooded directly by silty Colorado River water retain their water much longer because the silt and clay carried in the water seal the bottom of the flooded basins. The facts that the flood ponds had fish (personal observation), that the ponds still existed more than 14 weeks after the 2011 49,000 cfs river peak and 4 weeks after river flow dropped to the 14 September flow rate of ~5,100 cfs (Figures 8 and 9), and that at least the northern pond maintained a synchronous elevation with the river for more than 14 weeks (both at 1206 m elevation on 14 September) are proof of sustained direct river surface connections with flooded portions of the property.

Summary

In conclusion, the findings of facultative wetland plants and hydrophytic vegetation combined with the primary indicators of aerial imagery, biotic crusts, and ephemeral-wetland-dependent aquatic invertebrates, along with the intermittent direct river surface connection that allows fish harborage, feeding, and spawning, indicate that significant portions of the property should be considered ephemeral wetlands and be restored and protected as such.

Figures

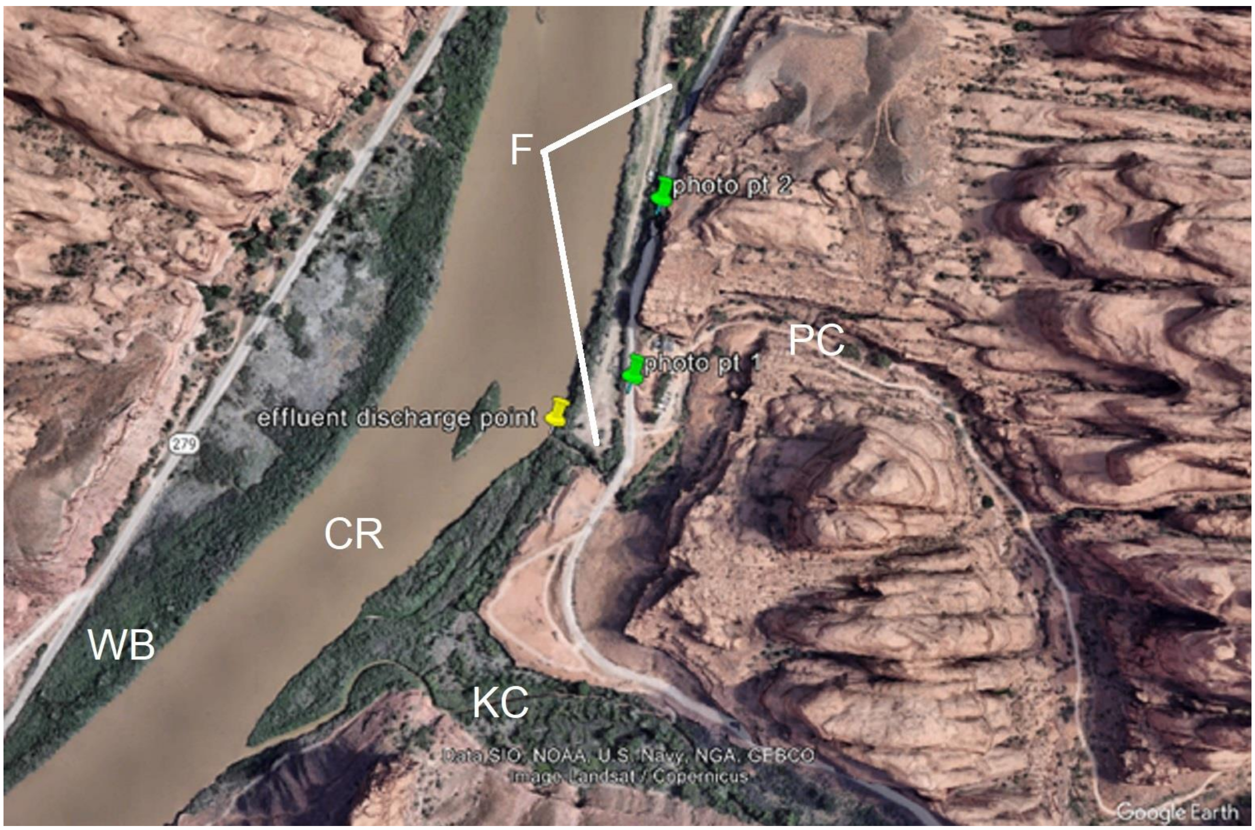

Figure 1. Google Earth image showing the approximate location from where the photograph in Figure 2 was taken (green marker, photo pt 1), the exact location from where the photograph in Figure 3 was taken (green marker, photo pt 2), Williams Bottom (WB), Colorado River (CR), Pritchett Canyon (PC), Kane Creek (KC), and extent of flooding on KCPD property on 25 May 2023 (F).

Figure 2. Photograph of flooded KCPD property looking SW from approximately “photo pt 1” in Figure 1, on 25 May 2023. The river (R) can be seen through the trees. The mouth of Pritchett Canyon is in the trees in the upper left.

Figure 3. Photograph of flooded KCPD property looking WNW from the location indicated in the Google Earth image Figure 2 as “photo pt 2” on 25 May 2023, where river floodwater inundated this portion of Kane Creek Road in 1995 and was up to the pavement in 2011.

Figure 4. Photograph of flooded KCPD property looking NW from approximately "photo pt 1" in Figure 2, on 25 May 2023.

Figure 5. Photograph of flooded KCPD property looking SSW from halfway between "photo pt 1" and "photo pt 2" in Figure 2, on 25 May 2023.

Figure 6. Photograph of flooded KCPD property looking N from halfway between "photo pt 1" and "photo pt 2" in Figure 2, on 25 May 2023.

Figure 7. Photograph of flooded KCPD property looking W from near "photo pt 2" in Figure 2, on 25 May 2023.

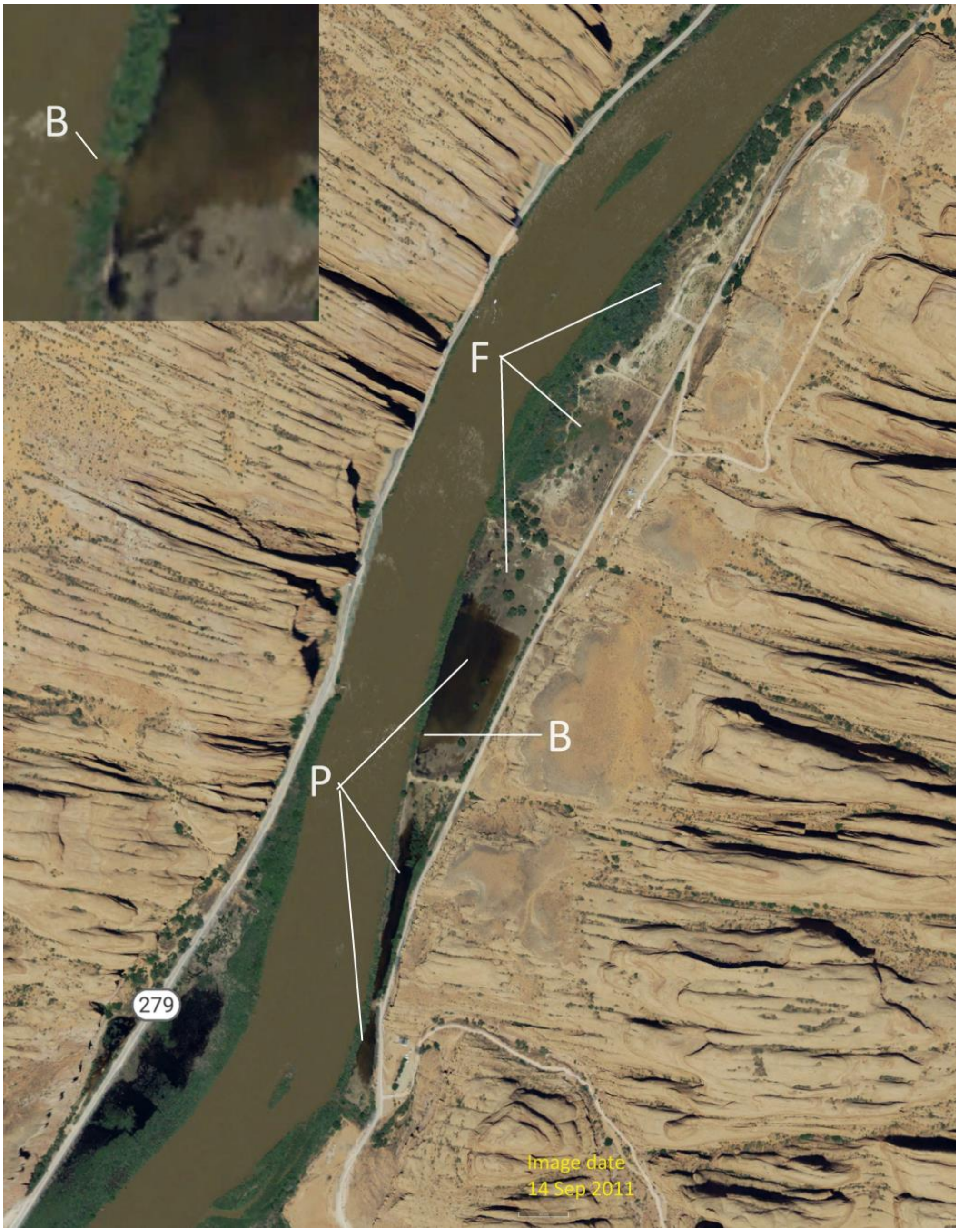

Figure 8. Google Earth image of 14 September 2011 showing Colorado River from Moonflower Canyon to the mouth of Kane Creek 14 weeks after a peak flow of ~49,000 cfs on 9 June at the CRLU1 gauge. Much of the ground is still saturated in the lighter gray areas (F) in the northern portions of the property that had surface floodwater a month earlier. The dark brown areas (P) in the southern portion are ponds left from direct river flooding. Direct river flooding after groundwater upwelling was caused by early northward flow from the mouth of Pritchett Canyon into the southern-most area and from later flow into the more northern areas through levee failures and through backfilling and overtopping of stormwater drainage ditches. One of the levee failures (B) is distinctly visible with its sediment fan immediately inside the property (magnified inset image in upper left). After the breach, both the pond and adjacent river surfaces had synchronous levels, which on 14 September was 1206 m elevation.

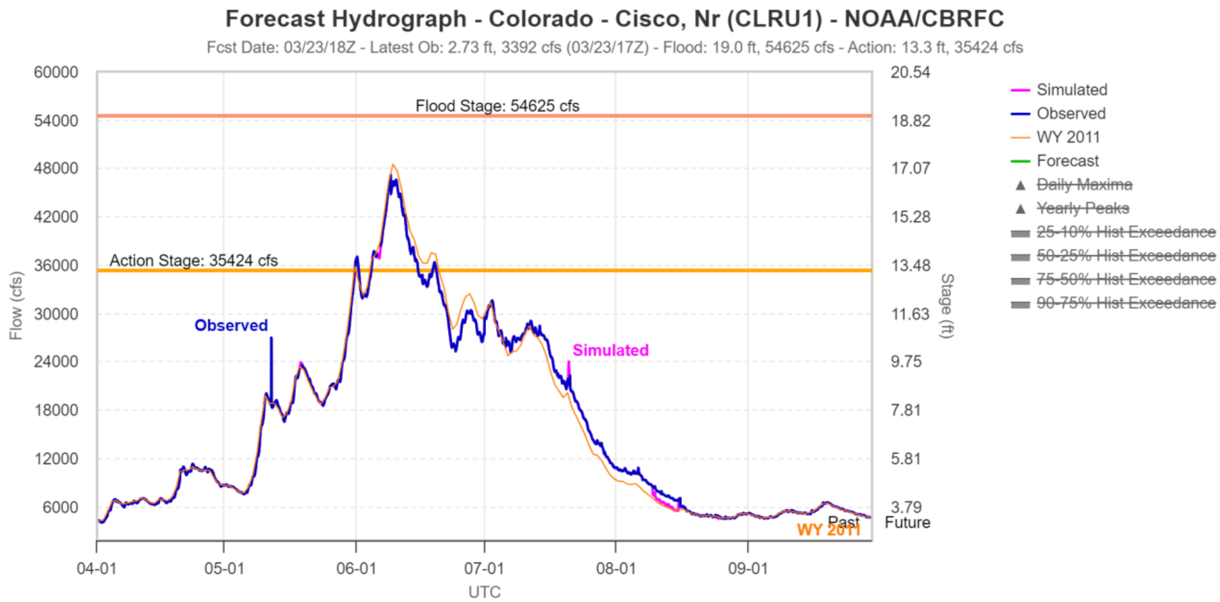

Figure 9. Colorado River CLRU1 hydrograph for 1 Apr 2011 to 30 September 2011 (downloaded 23 Mar 2024 from https://www.cbrfc.noaa.gov). The seasonal peak flow was 49,000 cfs on 9 June; and the flow was ~5,100 cfs 14 weeks later on 14 September, the date of the Google Earth image in Figure 8.

Appendix A

Excerpted from: National Research Council. 1995. *Wetlands: Characteristics and Boundaries*, Washington, DC: The National Academies Press, p. 156–157. https://doi.org/10.17226/4766

ESPECIALLY SHALLOW OR INTERMITTENTLY FLOODED WETLANDS

In some portions of the United States, including the arid West, annual rainfall is especially variable in total amount and in timing. Because wetlands in these areas may become completely dry for several years, the concept of average conditions can be difficult to apply. For example, Zedler (Bedford et al., 1992) showed that for San Diego, California, only 21 years out of 140 had total rainfall within 90-110% of the long-term average.

Because wetlands are important in meeting CWA goals, then the wettest of wetlands might seem to be the areas most in need of protection. Landscape position and other factors are also important, however. For example, wetlands in zones that flood only intermittently could be among the most important for storing flood waters; their capacity to reduce peak discharge would be negligible if they were always full.

It is sometimes difficult for the regulated public to understand how sites that are often dry can be classified as wetlands. Part of the reason, as explained in Chapters 2 and 5, is that intermittently flooded wetlands have a distinctive, water-dependent biota. Temporary wetlands support a variety of invertebrates, algae, or mosses that can persist over dry intervals as propagules (seeds, ephippia, spores). Propagules of these organisms are absent in uplands. Some upland plants and animals can colonize a wetland during prolonged dry periods, but the wetland biota will return with the water. For example, California's vernal pool fairy shrimp (*Branchinecta sandiegoensis*) can hatch within 48 hours and can complete its life cycle within 2 weeks (King et al., 1993; Simovich, 1993). Only about 15% of the eggs hatch at a time; if the first inundation period is short, a second wetting stimulates additional hatching. In this way, populations can be sustained even where inundation is brief and intermittent. During the long, dry summers, these same pools can be dry. They do not support extensive upland vegetation, however, because there is too much water for its establishment in the wet season and not enough in the dry season.

The dependence of fish species on temporarily wet habitats is discussed by Finger and Stewart (1987), who document a decline in spring-spawning sunfishes of southeastern Missouri after the reduction of spring flooding. Seasonally flooded bottomlands greatly increase the feeding areas for fish, as has been shown for the Atchafalaya Basin, in Louisiana. Lambou (1990) noted that 54% of the 95 finfish species use wooded areas of the basin for reproduction arid 56% use them for feeding. The total harvest attributable to overflow areas was nearly 51,300 lbs/sq. mile (9,000 kg/km2) per year of finfish and nearly 400,000 lbs/sq. mile (70,000 kg/km2) per year of crawfish. Junk et al. (1989) report a strong relationship between the extent of accessible floodplain and fishery yields and production. During the rising floodwater period, fish take advantage of food and shelter in riparian wetlands.

Shallow wetlands could be especially valuable in maintenance of water quality because of their high ratio of sediment surface relative to water volume. For example, wetlands in Minnesota are more effective in removing suspended solids, total phosphorus, and ammonia during high flows when waters cover more of the higher-elevation areas of the wetland, while nitrate removal is more effective during low flow (Johnston et al., 1990).

Wetlands that are intermittently dry can retain wetland characteristics only if they are protected from physical alteration when dry. Delineation of intermittently dry wetlands can be justified by the same rationale as for other wetlands, and can follow the same methodology as delineation of other wetlands.

Appendix B

These images show the kinds of biotic crusts I observed after flooding and dry-down on the KCPD property.
Excerpted from: ERDC/EL TR-08-28, Regional Supplement to the Corps of Engineers Wetland Delineation Manual: Arid West Region (Version 2.0), page 71.
https://usace.contentdm.oclc.org/utils/getfile/collection/p266001coll1/id/7627

Figure 26. Ponding-remnant biotic crusts on the surfaces of mud-crack polygons. Biotic crusts often have up-turned edges with the surface layer darker than the underlying material.

Figure 27. Ponding-remnant biotic crust showing polygons and curls detached from the underlying sediments.

Figure 28. Ponding-remnant biotic crust, showing dried algal caps on a domed mud-crack surface.

Figure 30. Remains of floating algal material in a seasonally inundated *Juncus*-dominated marsh.