Energy Development
Siting Recommendations for Playas

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Background and Identification of Interaction with Energy Development[1]

Playas are round, shallow, clay-lined wetlands found throughout the short- and mixed-grass prairie region. Precipitation and associated runoff is the sole source of water for playas (Smith 2003). Once a playa has filled it may remain wet for several months, eventually drying out to start the process all over again. The hydroperiod of individual playas is highly variable over time and differs amongst playas. A study in Texas found that, on average, in January a playa has water in 1 out of 11 years (Johnson et al. 2009).

Playas provide benefit to the High Plains (Ogallala) Aquifer by allowing percolation of surface water through the clay layer of soil in the basin (Gurdak and Roe 2010). Recharge through playa basins occurs at a rate 1 to 2 orders of magnitude greater than through inter-playa areas (Gurdak and Roe 2010).

Playas are integral habitat in the western Great Plains region for a wide variety of taxa, especially wetland birds. Where playas are the only source of nearby surface water, they can attract many species of wildlife, often in high concentrations (Smith 2003). Wet playas are known to be habitat for amphibians, a taxon which is experiencing world-wide declines (Cariveau et al. 2007, Cariveau and Johnson 2007), and reptiles such as the yellow mud turtle (Smith 2003). Bats are known to feed on emerging insects at wet playas (Smith 2003). Waterfowl (e.g., ducks and geese), shorebirds (e.g., plovers, rails, sandpipers) and waterbirds (e.g., cranes), as well as the birds that prey on them (e.g., raptors), use inundated playas during migration as stopover points for feeding and resting.

The highly variable playa hydroperiods result in highly variable wildlife use from playa to playa and over time (Smith 2003). The fact that a playa may be dry at any one point in time should not be used to infer lack of wildlife use. For example, playas may be dry for many years and then fill with water during a rain event and subsequently host many birds and other wildlife species.

Where studies have been completed, high quality maps of playas (http://pljv.org/playa-maps) are available. As of this writing approximately 70,000 playas have been mapped in the western Great Plains region. The distribution of playas varies across the region; playas are sparsely distributed in some areas and clustered in other areas. These high density clusters of playas have been shown to host significantly greater numbers of waterfowl than other areas (Brennan 2006, Cariveau and Pavlacky 2008, Webb et al. 2010). In areas with few playas, large isolated playas can serve as stepping stone wetlands which connect playa clusters for feeding waterfowl (Moon 2004).

Placement of energy infrastructure in playas may reduce water-holding capacity, reduce or degrade habitat for wetland dependent species, and limit the hydrologic function of the playas (either directly within a playa or among a cluster of playas). Energy development (oil and gas, solar, and wind energy) and associated infrastructure such as pads, access roads, and distribution lines on or near playas, playa clusters, or large isolated playas may have adverse direct and indirect effects upon wildlife habitat and

[1]Note: This is a biological document based on existing research and the experience of PLJV Scientists. The recommendations are not based on information provided by regulatory agencies and existing statutes. We recommend that energy developers contact appropriate state and federal agencies for regulatory guidance.

waterfowl and other wetland birds. Proximity of infrastructure to playas may directly affect avian mortality as birds move among playas by increasing the risk of collision mortality. Nearby development may also indirectly impact avian species through the constant disturbance related to increased human activity and persistent noise in the area. For example, persistent negative effects have been found to occur in several bird species up to 600m from wind turbines (Langston and Pullan 2003). In the case of wind development, there is a paucity of data regarding the risk of avian collisions with turbines in the vicinity of playas. Current conclusions in this BMP are based on the data from more thoroughly-studied birds that use playas, such as cranes, that have a high collision risk with tall structures. In addition, playa habitat areas may be directly affected by development of access roads, construction of turbine foundations, and installation of new power lines. Placing energy infrastructure in playas may also directly negatively impact playa aquifer recharge and playa biodiversity function. Scientific studies have documented the recharge to the Ogallala aquifer through playas and the negative impacts of puncturing the clay layer in the playa basin[2]. Modified playa basins lose their hydroperiod and cease to function properly, which could affect birds, amphibians, and other wildlife through habitat loss. Habitat may also be indirectly affected similarly to the birds themselves, through the persistent disturbance attributable to noise and an increase in human activity.

Identifying Playas and Creating the Playa Clusters Map

Playa Lakes Joint Venture can provide GIS data for the location of known playas at the state and county level (http://pljv.org/playa-maps). These data do not necessarily reflect all playas on the landscape. For example, in Nebraska, National Wetlands Inventory (NWI) maps identify playas with 91% accuracy (Cariveau et al. 2007), but in Colorado accuracy varies from 33 to 54% (Cariveau and Johnson 2007). Because of this, field verification is an important part of documentation in addition to remote assessment using spatial data.

In response to demand for spatially explicit information and guidance regarding playa conservation, the Playa Lakes Joint Venture (PLJV) developed the Playa Clusters map. The Playa Cluster map is intended for use by multiple stakeholder groups including natural resource professionals, land managers, and developers, providing them with spatially explicit data depicting where high densities of playas exist that may attract high numbers of waterfowl and associated wildlife.

Playa clusters were defined using a kernel density analysis that identified areas with either high playa density or high playa surface area, according to duck abundance data collected on playas. These measures were used to define playa clusters because multiple research studies have cited positive relationships between playa density and the total surface area of playas and duck abundance (Brennan 2006, Cariveau and Pavlacky 2008, Webb et al. 2010). Data from Cariveau and Pavlacky (2008), a study which was conducted on playas in northeast Colorado, were analyzed to determine quantitative

[2] Clay layer depth and thickness are highly variable and dependent upon on playa size, location, soil-type and other local conditions. Depth of Randall clay generally is from more than 14 feet in playa lake proper to less than 12 inches at rim (Smith, S.J., B.A. Stewart, A.N. Sharpley, J.W. Naney, T. McDonald, M.G. Hickey, and J.M. Sweeten. 1993. Nitrate and other nutrients associated with playa storage of feedlot wastes. Report for Texas Agricultural Extension Service, College Station, TX. 21 pp.)

thresholds for playa point density and surface area density at which duck abundance increased (Pavlacky unpublished data). The study found that duck abundance increased when playa density in the surrounding 2km area (the estimated minimal dispersal distance of Northern Pintails as observed in south-central Nebraska[3]) reached 0.55 playas/km^2 or when playa surface area density in the surrounding 2km area reached 0.55%/km^2. Playas that met these criteria were identified and the original density thresholds were transformed into analogous thresholds for kernel density by choosing values of kernel density that captured 95% of the high density and high surface area density playas. Ultimately kernel density thresholds were used to delineate playa clusters from the kernel density surface.

Playas that are isolated within their cluster and that exceed 22.97 acres in size have sufficient surface area to be defined as a Large Isolated Playa. These playas are thought to be important in three ways: 1) as stepping stone wetlands which connect playa clusters for feeding waterfowl (Moon 2004), 2) as playas that are likely to provide more water for longer periods of time than most playas because of their larger size, and thus provide important reliable reservoirs for migratory species including the pronghorn (Duncan et al. 2016), 3) as resting and foraging habitat for migrating waterfowl, shorebirds and other avian species (Brennan 2006, Cariveau et al. 2007, Cariveau and Pavlacky 2008, Webb et al. 2010).

Siting Recommendations[4]

Conduct surveys for playas in areas where playas are known or may exist.

1) Review spatial data for mapped playas and playa clusters. 2) Perform a site evaluation to confirm existence and location of existing or unmapped playas. Confirmation is best done on site using soils data and other playa characteristics (e.g. hydrology, soils, and plants). Developers should work with experts knowledgeable about playas to determine playa locations and appropriate conservation measures.

Avoid playa clusters.

A recent network analysis of playas across the southern Great Plains demonstrates that to maintain connectivity and functioning of the playa network, at least 40% of playas need to remain present and functioning on the landscape (Albanese and Haukos 2015). Because most playas are already affected by at least one of: accumulated sediments, pits, ditches, roads and other modifications, it is important to prevent activities that further impact playa clusters. Therefore, we recommend avoiding all playa clusters when developing new energy infrastructure.

A convex hull is the simplest and most straightforward way to determine the impact of a wind farm on playas and playa clusters. Based on a set of input points, a convex hull is the smallest convex polygon that contains all of the points. The figure below illustrates a convex hull drawn around a set of points

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[3] Daily movements of Northern Pintails are 3.72 – 5.73 km (2.3 – 3.6 miles). During the hunting season movements increase to 6.74 – 9.4 km (4.2 – 5.8 miles). (Moon, J.A. 2004. Survival, Movements and Habitat Use of Female Northern Pintails in the Playa Lakes Region. M.S. Thesis, Texas Tech University. 216 p.)

[4] Typical guidance follows the pattern of avoid, minimize and mitigate. In this document we diverge from this structure and do not include a minimize category because in our opinion, the playa clusters function as a collective unit of playas. Therefore, if development occurs within the cluster, the integrity of that cluster is compromised. Regarding mitigation or offsets, PLJV is developing recommendations, which will be completed soon and available in a separate document.

representing wind turbines. In this example any playas that intersect the convex hull would be considered to be impacted by the wind farm.

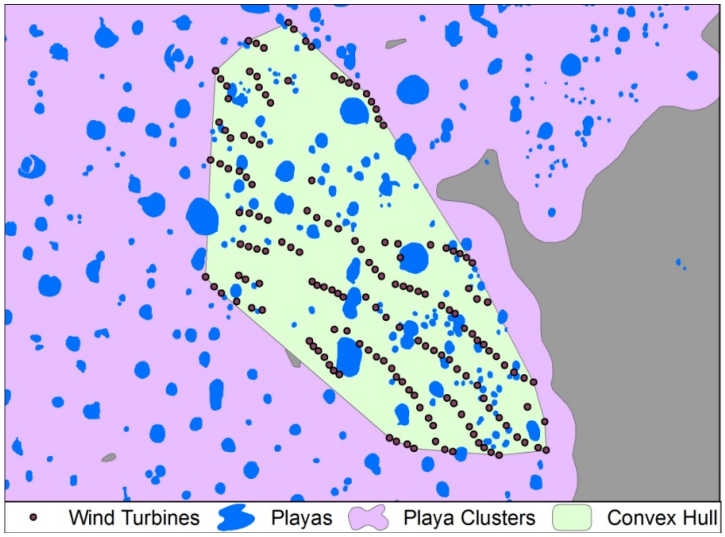

Figure 1. Playas within the convex hull polygon are impacted by turbine development. Development should seek to avoid impacting playa clusters.

Development within confirmed playas or playa clusters and large isolated playas as defined by the Playa Lakes Joint Venture and described above should be avoided.

Typical guidance follows the pattern of avoid, minimize and mitigate. In this document we diverge from this structure – the following recommendations do not include a minimize category because in our opinion, the playa clusters function as a collective unit of playas. Therefore, if development occurs within the cluster, the integrity of that cluster is compromised. Consultation with and use of the playa clusters map can help to satisfy Tier 1 and Tier 2 Developer/Operator requirements outlined in the USFWS Land-Based Wind Energy Guidelines. Use of the DSS can also help minimize taking violations under the Migratory Bird Treaty Act and the Bald and Golden Eagle Protection Act, as the relatively large concentrations of waterfowl found at playa clusters can attract bald eagles. For further recommendations regarding mitigation or offsets, PLJV is developing a separate document, which will be completed soon. The complexity of the mitigation strategies and the amount of detail required to faithfully explain them requires a separate document so as to avoid exhausting extension of this one.

Literature Cited

Albanese, G. and D. Haukos. 2015. Development of conservation and climate adaptation strategies for wetlands in the Great Plains region. Final Report to Great Plains Landscape Conservation Cooperative

Bartuszevige, A.M., D.C. Pavlacky, L. Burris, and K. Herbener. 2012. Inundation of playa wetlands in the western Great Plains relative to landcover context. Wetlands 32:1103-1113.

Brennan, E. K. 2006. Local and landscape variables influencing migratory bird abundance, diversity, behavior, and community structure in Rainwater Basin wetlands. Doctoral dissertation, Texas Tech University.

Cariveau, A.B. and L. Johnson. 2007. Assessment and conservation of playas in eastern Colorado: Neotropical Migratory Bird Conservation Act Final Report to the United States Fish and Wildlife Service, Rocky Mountain Bird Observatory, Brighton, CO, 42pp.

Cariveau, A.B. and D. Pavlacky. 2008. Assessment and conservation of playas in eastern Colorado: Final report to the Colorado Division of Wildlife, Playa Lakes Joint Venture, United States Environmental Protection Agency, and United States Fish and Wildlife Service. Rocky Mountain Bird Observatory, Brighton CO. 117 pp.

Cariveau, A.B. and D. Pavlacky. 2009. Floristic quality assessment and wildlife habitat assessment of playas in eastern Colorado: final report to the United States Environmental Protection Agency and the Colorado Division of Wildlife, Rocky Mountain Bird Observatory, Brighton, CO, 97 pp.

Cariveau, A.B., L.A. Johnson, and R.A. Sparks. 2007. Biological inventory and evaluation of conservation strategies in southwest playa wetlands: Final report to the Nebraska Game and Parks Commission and the Playa Lakes Joint Venture. Rocky Mountain Bird Observatory, Brighton, CO, 44pp.

Cariveau, A.B., D.C. Pavlacky, Jr., A.A. Bishop, and T.G. LaGrange. 2011. Effects of surrounding land use on playa inundation following intense rainfall. Wetlands 31:65-73.

Duncan, N.P., Kahl, S.S., Gray, S.S., Salice, C.J. and Stevens, R.D., 2016. Pronghorn habitat suitability in the Texas Panhandle. The Journal of Wildlife Management, 80(8), pp.1471-1478.

Gurdak, J.J. and C.D. Roe. 2010. Recharge rates and chemistry beneath playas of the High Plains Aquifer, USA. Hydrogeology Journal 18:1747-1772.

Johnson, W.P., M.B. Rice, D.A. Haukos, and P.P. Thorpe. 2009. Midwinter occurrence of inundated playa wetlands in the Texas High Plains. Abstract to North American Duck Symposium, Toronto, Ontario, Canada.

Langston, R. and Pullan, J.D., 2003. Windfarms and Birds: An Analysis of the Effects of Windfarms on Birds, and Guidance on Environmental Assessment Criteria and Site Selection Issues: Report. RSPB.

Moon, J. A. 2004. Survival, Movements and Habitat Use of Female Northern Pintails in the Playa Lakes Region. M.S. Thesis. Texas Tech University, Lubbock, TX, USA.

Smith, L.M. 2003. Playas of the Great Plains. University of Texas Press, Austin, TX.

U.S. Fish and Wildlife Service. 2012. Land-Based Wind Energy Guidelines. OMB Control No, 1018-0148.

Webb, E. B., Smith, L., Vrtiska, M. P., LaGrange, T. G. 2010. Effects of local and landscape variable on wetland bird habitat use during migration through the Rainwater Basin. Journal of Wildlife Management 74(1).