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Mormon Island Wet Meadow Restoration Report (Husker Highway & US-281/34 Mitigation; USACE Proj. No.: NWO-2005-11444-WEH) – 11/30/2021

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Project Progress Report
In August of 2018 the Crane Trust reached an agreement with Prataria Ventures LLC to mitigate the loss of a 0.47-acre palustrine wetland associated with the construction of a hospital near the intersection of Highway 281 and Husker Highway, Grand Island, Nebraska, USA (Project No.: NWO-2005-11444-WEH). Permitting was facilitated by Olsson Associates (Lincoln, NE; https://www.olsson.com/) and the project was approved by the U.S. Army Corps of Engineers (USACE), Omaha District Office. The former USACE project manager for this mitigation was Jolene Hulsing. On 19 August 2019 the Crane Trust completed a 1.89-acre wet meadow restoration which included the decommissioning of a gravel/dirt road bisecting a relict wet meadow (40.794784°N, -98.435756°W; 581 m elev.). Restoration efforts included sediment removal and redistribution as well as seeding with native local ecotype vascular plant seed sourced from the Prairie Plains Resource Institute (Aurora, Nebraska; https://www.prairieplains.org/). The Crane Trust will be conducting annual post-restoration monitoring of the site for a period of 5 years. A short report will be provided both to the USACE Omaha Office and Prataria Ventures LLC via Chief Industries following each year's assessment by December 1st.

Site vegetation and substrate conditions were assessed pre-restoration on 9 August 2018, again post-restoration on 15 June 2020, and most recently on 16 June 2021 by Crane Trust staff. This report will assess standard vegetation-based metrics of site quality (Floristic Quality Index; Swink and Wilhelm 1994, Lopez and Siobhan Fennessy 2002) and wetland status (Wetland Indicator Status; Tiner et al. 2016), make records of soil disturbance, note wetland hydrology indicators (e.g., soil saturation), and provide repeat landscape photos of the site (Figures 1-4).

Vegetation data was collected through standard techniques including quadrat ocular cover estimation and point-line intercept methods along a geolocated 100-m transect centered on the wetland restoration where the road has been removed (Symstad et al. 2008). We measured depth to groundwater at the restoration site using a 1.1-m length hand auger with a 5-cm diameter drill head on 7 May and 21 June 2021. Depths were measured at 0, 60, and 100 m along a 100-m transect parallel to the vegetation survey line (bearing of 354°).

Depth to groundwater averaged 22.3±6.2 cm ($\bar{x}$±*se*) at the site on 7 May 2021 and ranged from 11.5 to 33.0 cm across samples. Depth to groundwater increased significantly by 21 June 2021 to 52.7±3.8 cm, as a result of relatively dry conditions locally. On average, the groundwater measurements from 7 May 2021 met the threshold of being ≤12.0 inches (≤30.5 cm) from the soil's surface during the growing season, which is a standard often employed for wetland determination (Tiner et al. 2016). Moreover, depth to groundwater likely increased from March to May considering the regular seasonal patterns of regional wet meadows, indicating that groundwater depths had likely been close (i.e., ≤30.5 cm) to the soil's surface for a significant period of the growing season (Brinley Buckley et al. 2021). Continued increases in depth to groundwater moving from the spring into summer months is also typical of wet meadows in the Central Platte River Valley of Nebraska (Brinley Buckley et al. 2021). There were no signs of human-induced soil disturbances at the site aside from a light walking trail resultant from field surveys conducted by graduate students during the summer. Students were asked to vary their paths more frequently during next year's surveys.

Species richness decreased at the site compared to one year ago, but it was still higher than pre-restoration circumstances (Table 1). Similarly reflecting drier conditions, the vegetation-based weighted wetland indicator score (WIS) for 2021 increased by 10.8% compared to 2020 results, but remained 8.6% lower than pre-restoration conditions (Table 1). The weighted WIS continued to be indicative of wetland conditions as it was well below the 3.0-threshold used to delineate wetland from non-wetland habitats (Tiner 2016). Vegetative cover below 0.5 m height increased to 84% in 2021 compared to last year's estimate of 66%, indicating a decrease in bare ground resultant from restoration efforts and continued recovery (Table 1). The dominant vegetation association shifted from including an exotic-invasive codominant associated with uplands (i.e., Tall Fescue, *S. arundinaceus*) pre-restoration in 2018 to including predominantly native species indicative of wetlands (e.g., Common Threesquare, *Schoenoplectus pungens*) as dominant species in 2020, and dominant species remained relatively unchanged in 2021 (Table 1, 2). Though species richness decreased, it appeared that this reflected a loss of native annuals (e.g., *Juncus bufonius*) which was accompanied by a commensurate increase in native perennial graminoid cover (e.g., *Panicum virgatum*; Table 1, 2). About 85% of species detected were listed as native (N) or both native and invasive (B) per the USDA Plants Database (https://plants.usda.gov/), while about 71% were exclusively listed as "native" species (Table 2). The weighted mean coefficient of conservatism (C-value) for the site was similar in 2021 (4.04) and 2022 (4.06), while the standard mean C-value was slightly higher in 2020 (4.09) than 2021 (3.96). Standard Floristic Quality Index measures decreased a bit from 2020 (23.35) to 2021 (20.20), but remained above most thresholds of restoration success and broadly indicated that the wetland is in fair-good condition (Swink and Wilhelm 1994, Milburn et al. 2007).

Taken together, preliminary data suggests the restoration has been initially successful. We expect

wetland function and quality to continue to improve as the restoration matures. Particularly, we expect the percent vegetative cover below 0.5 m height to increase annually until stabilized, demonstrating some fluctuations with management. It is likely that the site will continue to transition from supporting a substantial number of annual species to predominantly supporting perennial ones. Finally, floristic quality and vegetation composition will continue to fluctuate with environmental conditions, but we expect these metrics to generally improve over time. We will issue another report by December 1st 2022. Please feel free to contact our team with any questions or comments related to the project via email (acaven@cranetrust.org, bkrohn@cranetrust.org) or phone (605-252-8007, 308-224-9653).

Resources

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Swink, F. and G.S. Wilhelm. 1994. Plants of the Chicago Region, 4th ed. Indiana Academy of Science, Indianapolis, IN, USA.

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Table 1. Restoration status, species richness, weighted wetland indicator score, percent vegetative cover under 0.5 m in height, and the dominant species association at the time of assessment in 2018, 2020, and 2021.

Year	Restoration Status	Species Richness	wt. Wetland Ind. Status	% Cover < 0.5 m	Dom. Spp. Association
2018	Unrestored Road	32	2.57	100%	*Carex* spp. / *Schedonorus arundinaceus* / *Schoenoplectus pungens*
2020	Restored Wet Meadow Y1	43	2.12	66%	*Schoenoplectus pungens* / *Eleocharis erythropoda* / *Carex emoryi*
2021	Restored Wet Meadow Y2	34	2.35	84%	*Schoenoplectus pungens* / *Eleocharis erythropoda* / *Carex* spp.

Table 2. Species detected via quadrat ocular cover estimation surveys of the restored site on 16 June 2021 presented with their average cover, wetland indicator status (0-5; obligate wetland to upland), coefficients of conservatism (C-val.; 0-10) for use in calculating floristic quality indices, and status as "native" (N), "exotic" (E), or "both" (B) in the USDA plants database.

Species	**Ave. Cover**	**WIS**	**C-val.**	**Native/Exotic**
Agrostis stolonifera	1.5	2	*	E
Ambrosia artemisiifolia	3	4	*	B
Apocynum cannabinum	0.5	3	2	N
Asclepias incarnata	0.5	2	4	N
Calamagrostis stricta	1.5	2	6	N
Carex emoryi	1	1	5	N
Carex praegracilis	1.5	2	4	N
Carex spp.	5.5	2	5	N
Carex meadii	0.5	3	6	N
Carex vulpinoidea	1	2	4	N
Cornus drummondii	0.5	3	3	N
Distichlis spicata	2.5	2	3	N
Echinochloa crus-galli	2.5	3	*	E
Eleocharis erythropoda	10	2	5	N
Equisetum laevigatum	1.5	3	4	N
Helianthus maximiliani	1.5	4	4	N
Hordeum jubatum	5	2	1	N
Juncus dudleyi	4	2	5	N
Melilotus officinalis	0.5	4	*	E
Muhlenbergia asperifolia	0.5	2	5	N
Panicum virgatum	6	3	4	N
Phalaris arundinacea	3	2	*	B
Phyla lanceolata	2.5	2	3	N
Poa pratensis	5	4	*	B
Populus deltoides ssp. monilifera	0.5	3	3	N
Salix amygdaloides	0.5	2	4	N
Schedonorus arundinaceus	4.5	4	*	E
Schoenoplectus pungens	15	1	4	N
Solidago canadensis	1.5	4	2	N
Spartina pectinata	1.5	2	5	N
Sphenopholis obtusata	2	3	5	N
Symphyotrichum lanceolatum	1	2	3	N
Taraxacum officinale	0.5	4	*	E
Vernonia fasciculata	0.5	3	4	N

Figure 1. Photo of road targeted for wetland restoration taken on 9 August 2018.

Figure 2. Photo of restoration about two months after soil work and reseeding taken on 17 October 2019.

Figure 3. Photo of restoration taken on 15 June 2020 as soil and vegetation were assessed. Saturated soils with high organic content are visible from this photo where White-tailed Deer (*Odocoileus virginianus*) hoof prints are discernable in the soft substrate.

Figure 4. Photo of restoration taken on 16 June 2021 as vegetation was assessed. It is visually apparent that conditions were slightly drier at the site compared to the previous year (2020), and some bare ground has persisted within the restoration, likely because of these conditions.