TO: TECHNICAL ADVISORY COMMITTEE (TAC)

FROM: EXECUTIVE DIRECTOR'S OFFICE (EDO)

SUBJECT: ALEXANDER ET AL. (2020) DEPOSITION POTENTIAL AND FLOW-RESPONSE DYNAMICS OF EMERGENT SANDBARS IN A BRAIDED RIVER

DATE: FEBRUARY 25, 2020

In 2017, the Platte River Recovery Implementation Program (Program) published an analysis of least tern and piping plover reproductive ecology in relation to Platte River hydrology and sandbar dynamics (Farnsworth et al. 2017). That analysis focused on the potential for on-channel reproductive success in segments of the central (CPR) and lower Platte River (LPR). Estimates of the potential for reproductive success were derived using a sandbar height model that assumed a constant median sandbar height below peak stage of the formative flow event. This "depositional gap" assumption was based on sandbar measurements in the CPR and LPR following several peak flow events during the period of 2010 - 2015.

Subsequent to that investigation, Alexander et al. (2020; attached) conducted an independent analysis of LPR sandbar heights using much of the same monitoring data. Alexander developed a linear relationship between sandbar height and peak stage where the depositional gap increases with increasing peak discharge. More specifically, the gap between peak river stage and sandbar top-height diverges by approximately 2 cm per 100 cms in flow. The Farnsworth and Alexander sandbar height relationships cross at a discharge of approximately 1,000 cms (35,000 cfs) and are shown together in Figure 1.

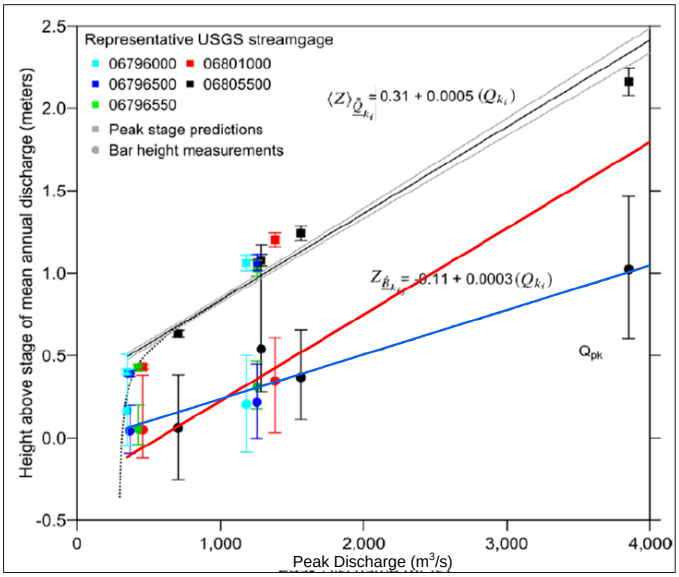

Figure 1. Comparison of sandbar heights in relation to peak discharge from Farnsworth (RED) and Alexander (BLUE). The Alexander relationship predicts higher sandbar heights relative to peak stage at formative discharges below approximately 1,000 cms (35,000 cfs).

The EDO revisited the Farnsworth LPR model, replacing the constant depositional gap with the Alexander linear regression. Use of the Alexander regression substantially increases the percentage of years when

emergent sandbar habitat is predicted to be inundated during the nesting season (Figure 2). This is due to the Alexander logistic regression predicting substantially lower sandbar heights at higher peak flow magnitudes that produce sandbars high enough to be emergent during portions of the nesting season.

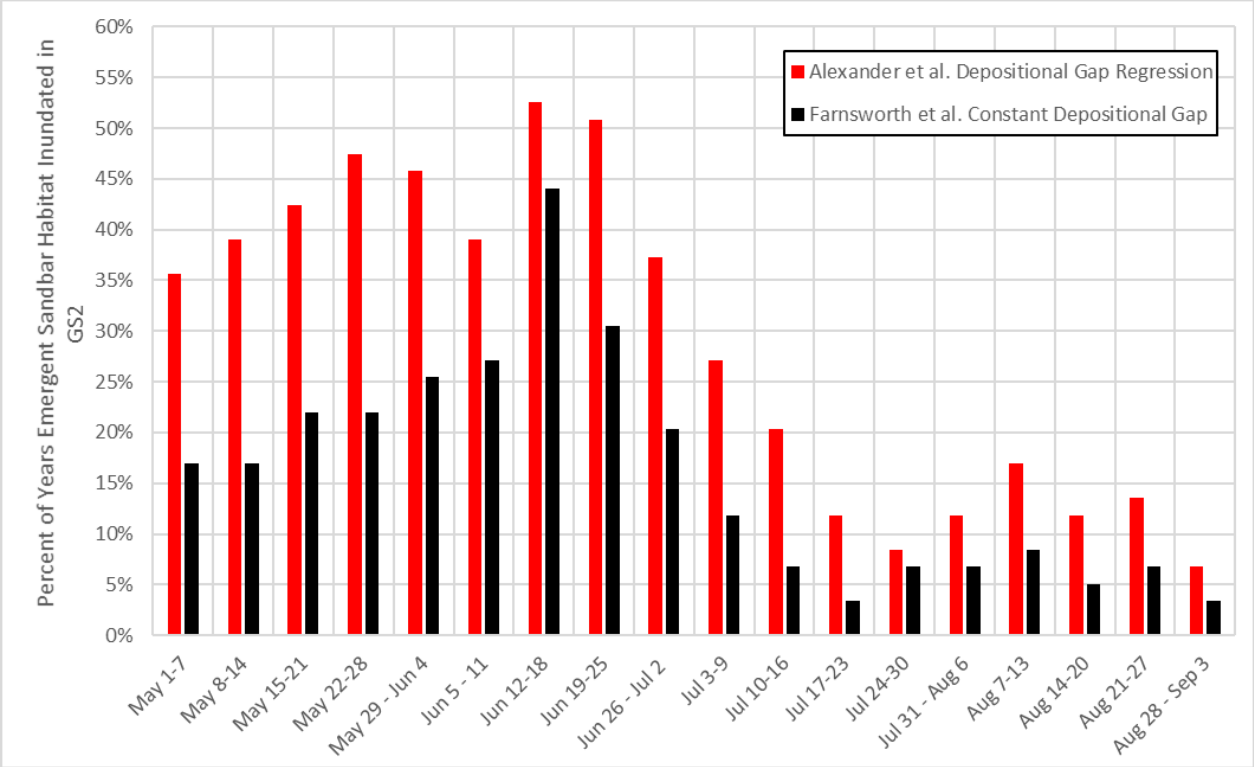

Figure 2. Comparison of predicted emergent sandbar habitat inundation in the segment of the LPR below the Elkhorn River confluence based on Farnsworth et al. (2017) and Alexander et al. (2020) sandbar height relationships.

Section 4.2. of Alexander also includes the following statement that could be interpreted as being contradictory to the results presented above:

> *Assumptions of emergent sandbar top-surface height have been controverial because of their importance in prediction of nest inundation (Catlin et al., 2010; Farnsworth et al., 2017; Jorgensen, 2009). Our findings streess the importance of accounting for changes in sandbar top-surface height with formative flood magnitude. Relative to a constant depositional gap model, or bar-height growth model indicates that predictions of indundation potential should decrease for more frequent flood return periods and increase for lower frequency return periods. While our bar-height model is an improvement over simply assuming a constant depositional gap, a more general model is needed for application across the range of physical conditions in sandy-braided rivers on Earth.*

Figure 3 below provides a visualization of the Farnsworth and Alexander bar height relationships applied to the USGS Ashland gage (06801000) stage-discharge rating curve. As indicated previously, the Alexander relationship predicts higher sandbars at formative discharges below 35,000 cfs. However, in that range of

discharges, sandbars are so low that they are inundated at the median discharge during the tern and plover nesting seasons. Sandbars that are inundated more than 50% of the time are not available for nesting. Consequently, these differences are not ecologically meaningful for terns and plovers.

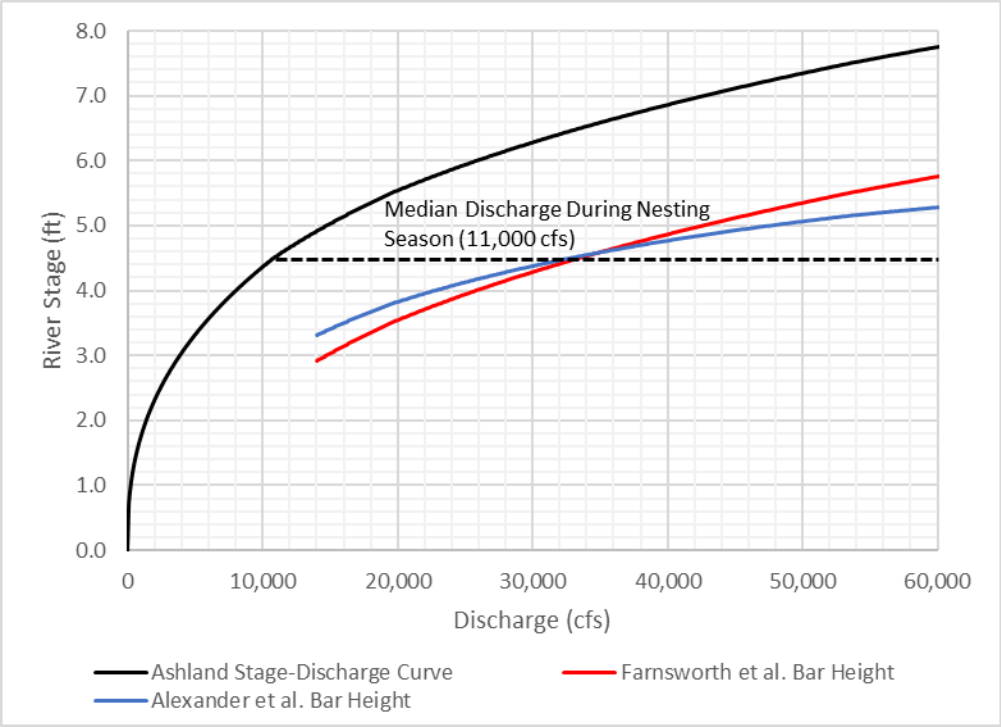

Figure 3. Comparison of Farnsworth et al. (2017) and Alexander et al. (2020) bar height relationships applied to the stage-discharge rating curve at the USGS Ashland gage (06801000) along with the median discharge (~11,000 cfs) during the tern and plover nesting seasons.