Nest Initiation Flow Alternatives Summary

At the March 8, 2016 GC meeting, Compass and EDO were charged by the GC to develop more detailed flow management options for the nest initiation period to explore whether alternatives exist that use water more efficiently than maintaining established target flows in all years. Specifically, the GC suggested considering using water for nest initiation flows during the plover nesting period only, using nest initiation flows in only certain types of hydrologic years, and designing flow strategies that could be paired well with the Moving Complexes Approach to on-channel habitat construction currently being considered. This summary describes several alternative flow management schemes developed by Compass and the EDO.

Flow Alternatives

Flow alternatives are summarized in Table 1. Part of the charge to the EDO and Compass was to evaluate the benefits of using of water in different hydrologic year types to understand what the most efficient uses of water are for plover productivity. In order to mimic actual real-time decision making, EDO developed a set of alternatives that use early season conditions (hydrologic conditions in April, denoted by “APR”) as flow management decision triggers.

Table 1. Flow management alternatives developed by EDO. Each alternative describes flow augmentation for only the plover nest initiation period. TF = target flow.

Flow Alternatives	Description
None	No augmentation during plover nest initiation
ALL TF	1,200 cfs target during wet and normal years, 800 cfs during dry years
W TF	1,200 cfs target during wet years
N TF	1,200 cfs target during normal years
D TF	800 cfs target during dry years
D 1,200	1,200 cfs target during dry years
W APR	1,200 cfs target in years when mean April discharge > 2,000 cfs (wettest 1/3)
N APR	1,200 cfs target in years April discharge < 2,000 cfs & > 1,200 cfs (normal)
D APR 800	800 cfs target in years April discharge <1,200 cfs (dryest 1/4)
D APR 1,200	1,200 cfs target in years April discharge <1,200 cfs (dryest 1/4)
N&D APR 1,200	1,200 cfs target in years April discharge <2,000 cfs (dryest 2/3)
Post Flood	1,200 cfs target in years following natural habitat formation @ 15,000 cfs

We used the Tern and Plover Habitat model to evaluate the effect of each flow management alternative on the total number of plover fledglings over 50 years. Because some of the flow alternatives use water in many years while others use water less often, we estimated the mean annual augmentation volume in each year an alternative would be active (i.e., each year in which water would be used) (Figure 1). We also estimated the proportion of years in which water would be used (Figure 2).

Key Lessons

1. **The number of added fledglings is small relative to the total number produced.** Using the MCA alternative as the on-channel baseline, Figure 1 shows the proportional increase in fledglings produced over 50 years relative to the annual augmented volume, averaged over

those years in which the alternative is "active" (for example, D TF shows the average volume augmented in dry years). All alternatives produce less than a 2% increase, and the majority of alternatives produce less than a 1% increase. For context, the baseline number of fledglings (without flow augmentation) is 1305. The number of incremental fledglings produced via flow augmentation ranges between 2 and 29 over the 50-year simulation period. The corresponding incremental average breeding pairs ranges between 0 and 1 breeding pair per year.

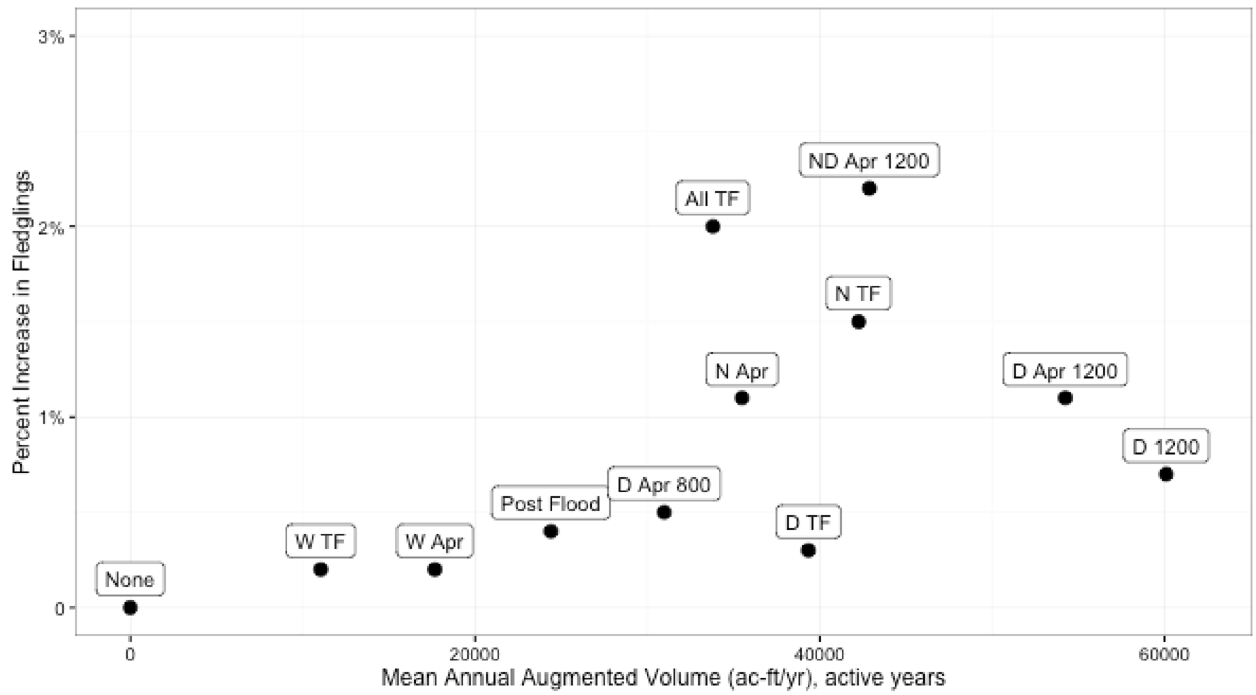

Figure 1. Benefits to plover fledglings and annual water cost for each alternative developed by EDO. "Active years" refers to those years in which the alternative calls for water to be used.

2. **Alternatives that use water infrequently leave more opportunity for using water in other years for other purposes, even if those alternatives use lots of water in the years when they're active.** For example, the All TF alternative uses roughly the same amount of water as the N Apr alternative in years when it's active. However, All TF augments flow in 80% of years, where N Apr augments flow in only 40% of years (shown in Figure 2). Because all of these alternatives use a significant proportion of the controllable Program water, releasing flows for multiple purposes (e.g., for SDHF or for Whooping Crane target flows) in any single year is restricted to wet years (see *Alternative Uses of Water*, below). This suggests that the opportunity cost associated with using water for plovers might be more closely represented by the frequency of using water rather than by the volume – therefore, the alternatives that use water less frequently have a lower opportunity cost.

3. **There are no clear winners.** Alternatives that use more water more frequently provide a greater increase in fledglings. However, there are differences in efficiency depending on hydrologic year type that may be useful to consider (Figure 3). Post-flood flow augmentation provides the greatest efficiency in terms of acre-feet of water per additional fledgling. The higher efficiency of this alternative is due to the relatively low amount of water required to

reach 1200 cfs in years following wet flood years (because those years also tend to be wet), and also because this alternative is only active in years where additional, naturally-formed habitat exists in addition to the regularly maintained MCA islands.

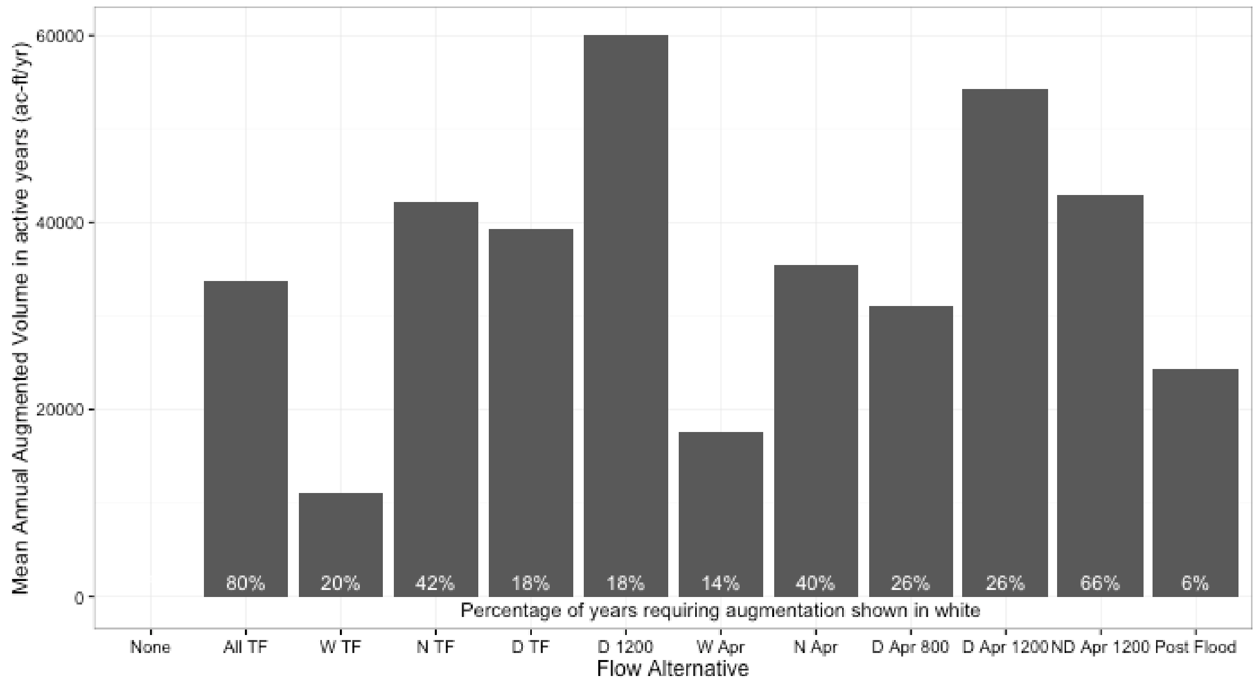

Figure 2. Mean annual augmented volume and proportion of years requiring augmentation for each alternative.

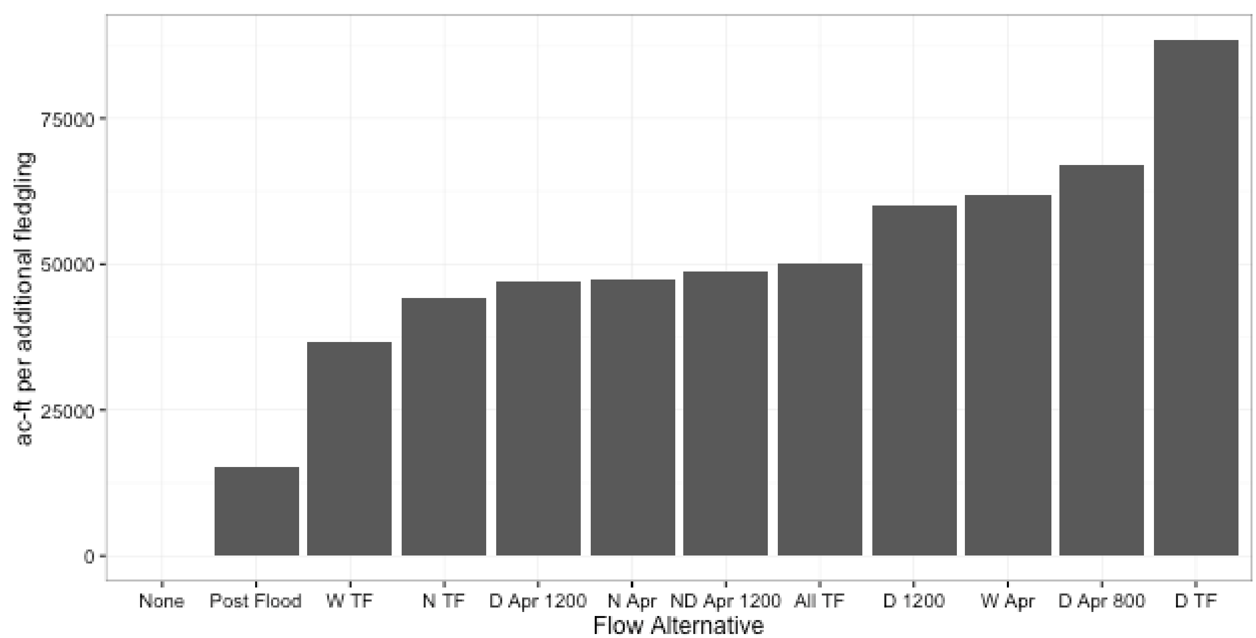

Figure 3. Efficiency of water use for plover nest initiation, in terms of acre-feet per additional fledgling.

Alternative Uses of Flow

At the request of the GC, the EDO evaluated alternative uses of water to help provide context for GC members evaluating the opportunity cost associated with using water for tern and plover nest initiation flows. SDHF (for maintaining channel width) and target flows for Whooping Cranes were identified as the two primary alternative uses (Table 2). It is important to note that while the costs are well understood, the realization of the hypothesized benefits is much less certain.

The key message from this analysis is that in normal and dry years, using flow for more than one purpose is not likely to be possible. Therefore, in most years, trade-offs exist between (at least) these three competing uses, and consideration of using flow for nest initiation flows should be made in light of the costs and potential benefits of these other uses.

Table 2. Two alternative uses of water and their costs and qualitative benefits. Benefits are taken from the USFWS target flow documents.

Alternative Uses	Costs	*ac-ft*	*%*	Hypothesized Benefits
SDHF (Apr. 2 to Apr. 8)	Wet Years: Normal years: Dry years:	32,356 50,286 58,356	29% 52% 84%	• Maintain wide, unvegetated channel • Maintain soil moisture in lowland grasslands • Maintain backwaters and side channels
Whooping Crane Target Flows (Spring and Fall)	Wet Years: Normal years: Dry years:	54,600 90,859 66,727	48% 95% 96%	• Optimize whooping crane channel roosting habitat availability in the AHR based on the USFWS CR4 habitat model.

Discussion Questions:

Does the GC support the conclusions of the TAC? The TAC agreed on the following conclusions/recommendations for the GC:

- That the release of water for plover nest initiation flows is not generally justified on the basis of the estimated benefits for plovers;
- That such releases should in general (in the absence of special circumstances) be considered a lower priority than releases for other purposes (no specific special circumstances were identified);
- That the most efficient use of water for plovers occurs in years immediately after a flood year when there is new naturally-formed habitat;
- That if water is released for plovers, even under the most favorable conditions, the benefits, if any, would not be measurable.