APPENDIX B

RECOMMENDATIONS FOR WETLAND CREATION IN WYOMING
(McKinstry 1993)

INTRODUCTION

Wetland creation is quickly gaining acceptance as a tool for mitigation of wetland losses. Most wetland scientists realize that wetland duplication and even simulation is impossible (Zedler and Weller 1990). The overall recommendation of most wetland scientists is to improve goal setting by beginning the mitigation process with a thorough evaluation of functions that will be lost when the wetland is destroyed or modified. Wetland creation can then focus on replacing the functions of the wetland and not the wetland itself.

The process of creating or reclaiming wetlands should involve at least four steps:

1) Setting general (large-scale or region-wide) goals. Usually these are loosely stated and may be somewhat ambiguous. Examples might include "maintain regional biodiversity," "improve water quality," "enhance fish and wildlife habitat," or "reduce shoreline erosion." For this step the kinds of information needed include: (a) broad surveys of species distributions, and knowledge of the relationships of species and their biotic and abiotic habitats and; (b) general models of wetland functions such as waste removal, hydrologic regimes, nutrient cycling, and soil and water chemistry. The restoration/creation process does not include baseline studies of wetland ecosystem functioning, i.e. the dynamics of the wetland. Permits may require inventories, but these are rarely more than "snapshots" of the ecosystem, i.e. one-time characterization of structure.

2) Specifying project objectives and implementation procedures. The targets here are usually biological ones- with waterfowl, fisheries, endangered species, and/or selected vegetation types to be enhanced or exotic and pest species to be removed. The types of information needed at this step include: (a) plant and animal population ecology, (b) autecology, (c) species-habitat relationships, and (d) hydrologic models of existing and future wetlands.

3) Construction. Designs for wetlands should mimic natural systems and provide flexibility for unforeseen events. The goal is to complete construction within deadlines, at projected costs, and within specification of project plans. Often, problems occur and changes in project plans must be made in order to complete the job. If possible these problems should be anticipated and alternative plans made so that project goals are still met. Expertise needed at this stage includes physical site preparation, farming methods, and construction management.

4) Assessing how well the project matches the goals. Mandatory monitoring (a minimum of three years is recommended) should be identified as a known cost. Monitoring plans and on-site sampling are needed to characterize the effectiveness of restored, enhanced, or created wetlands. Here sampling designs and statistics become important.

Failure to adequately address any of the above steps can lead to reduced wetland function or even complete project failure. The evaluation of wetlands created in association with Abandoned Mine Land restoration activities in northeast Wyoming has led to specific suggestions that are recommended for future wetland creation projects and for future use of the Hayden-Wing et al. (1987) model. While these suggestions are not all inclusive, I feel that my research, and that of others, supports the following recommendations.

FACTORS IMPORTANT TO WETLAND CREATION

Wetland Complexes

Wetland creation is often focused toward replacement of single wetlands. This stems from the desire to mitigate for single wetland destruction. While this may fulfill legislative requirements and mitigation goals, it does not meet the needs of all wildlife using the wetland. This study showed that the number of wetlands located within 1 km of a study wetland and the distance to the nearest wetland were both important to the use of that wetland by waterfowl. Other authors have had similar results. Rumble and Flake (1983), studying waterfowl use of wetlands in South Dakota, noted that duck use, particularly brood numbers, was higher on wetlands that were located within complexes. Mack and Flake (1980) also found that the number of wetlands located within a basin was positively associated with use by dabbling ducks. Northern pintails and blue-winged teal may be especially attracted to wetlands located within a complex (Lokemoen 1973).

Wetland complexes provide variable habitat to both different species, and for various life stages (Ruwaldt et al. 1979). Diving ducks require large, deep, stable bodies of water with extensive stands of emergent vegetation (Allen 1986, Bellrose 1976, Lokemoen 1966). Puddle ducks require shallow, ephemeral, wetlands for breeding, and larger, more permanent wetlands with emergent and submersed cover for brood rearing (Stewart and Kantrud 1973, Patterson 1976, Ruwaldt et al. 1979). Wetland complexes, if planned properly, can provide habitat for these various needs. In addition, high numbers of wetlands within a basin can insure more permanent water during periods of drought, offer alternative use sites when birds are disturbed, and provide dependable food supplies.

Optimum wetland density is difficult to define but my results suggest that a minimum of five wetlands are needed to form a complex. The value of wetland complexes has been studied by few researchers and those that have examined their importance have not recommended specific densities. One exception was Lokemoen et al. (1984) who suggested that the best waterfowl habitats contained between 12 and 40 wetlands/km^2. While creating this many wetlands may seem to be a difficult goal to achieve in itself, alternatives do exist. One alternative might involve the creation of wetlands in areas that have some wetland resources but could be greatly enhanced with the addition of new wetlands. Another alternative could include the formulation of long

range goals for a number of wetlands to be created in a specific area. Both of these alternatives would be feasible, and perhaps even encouraged, under the current wetland banking proposal.

It is important to remember that isolated wetlands do provide valuable habitat for many species of both plants and animals. The importance of wetland complexes has been documented in waterfowl but similar studies have not been carried out to examine their importance to other species. A determination should be made at the beginning of any wetland creation project to decide if the goals of the project would best be met by wetland complexes or isolated wetlands.

Wetland Size

My results showed that wetland size was the most common variable selected for use of a wetland by waterfowl. My results suggest that waterfowl use was greatest on ponds >1.2 ha. While smaller wetlands (<0.5 ha) were used by waterfowl, research has shown that ponds >0.5 ha attract more birds and more birds/ha than smaller wetlands (Hudson 1983). Lokemoen (1973) found that minimum pond size should be 0.6 ha. Belanger and Couture (1988) determined that ponds should be larger than 0.5 ha and have sinuous shorelines for maximum waterfowl use. Leschisin et al. (1992) examined waterfowl use on constructed wetlands in northwest Minnesota and found that surface area >0.5 ha was the most important factor determining waterfowl use. For natural habitats, bird species richness has been found to increase with wetland area, but to level off for areas >4 ha (Williams 1985).

An important consideration when planning wetland creation is the estimation of wetland size. Results from this study indicate that wetland sizing is difficult to predict and is usually overestimated. This becomes especially important when wetlands are being designed in the 0.4 to 1.0 ha range. Wetland creation is expensive, but correcting for wetlands that do not meet size requirements is more expensive. Wetlands should be built a minimum 20 percent larger than that required for "like size mitigation." Increasing the size of a planned wetland will create a buffer to unplanned or unknown factors such as reduced precipitation, increased evapotranspiration, or ambiguous hydrology.

Vegetation

Submersed and emergent vegetation are important to waterfowl for a variety of reasons. Direct food sources, indirect food sources as substrates for other organisms, protection from predation, and visual obscurity during breeding seasons are some of the many reasons that waterfowl use ponds with abundant emergent and submersed vegetation (Evans and Kerbs 1977, Flake at al. 1977, Krull 1970, Mack and Flake 1980). Wetlands that were created in association with bentonite mining and Wyoming Abandoned Mine Land operations were not planted with wetland plants. Many of the ponds, three years after construction, were devoid of vegetation. Wetlands such as these, isolated from other wetland systems, will take longer to vegetate and therefore longer to be productive unless an effort is made to propagate them with plants. Wetland plant propagation will vary from region to region, and even within regions, depending on soil types, hydrologic regimes, and nutrient cycling. While little research has been conducted on establishing wetland plants at newly created wetlands, a lot can be learned from examining natural

or older wetlands in the same vicinity. Future research on wetland creation should focus on establishing vegetation communities.

WETLAND HABITAT VALUE MODEL

This study showed that the Hayden-Wing et al. (1987) Wetland Habitat Value Model was useful at predicting wetland use by migrating and breeding waterfowl. Pre-construction estimates of Wetland Habitat Values were 22% higher than post-construction estimates of habitat created. Future use of the model should reflect this fact and any wetlands destroyed should be mitigated with wetlands created with values at least 20% greater.

Submersed vegetation is not a variable currently included in the Hayden-Wing et al. (1987) model. As reviewed above, submersed vegetation is an important factor influencing wetland use by waterfowl. While submersed vegetation coverage is a difficult variable to predict, its importance justifies that it be included in the model. Combined with proper elevation contours, plant propagation efforts could be included in the Wetland Habitat Value model and be required for future wetland creation project acceptances.

Record Keeping

Wetland evaluation approaches including post-project monitoring must be tailored to the specific project and interested parties. This requires expertise and creativity from project designers and reviewers. Qualified wetland scientists, with knowledge of wetland ecology, hydrology, wildlife, and an appreciation for practical considerations must be involved in the design and execution of evaluation efforts.

Records pertaining to all aspects of a wetland creation/restoration project should be readily available and well maintained. Poor record keeping can limit the amount of information that is available for future studies or for follow-up evaluations. Both successes and failures should be well documented so that future time and money are well spent.

Conclusions

At the current level of knowledge, it is infeasible to demand 100% replacement of destroyed wetlands. As wetland creation continues, more studies are needed to evaluate specific wetland functions. Habitat use by many wetland vertebrates is relatively well understood. What is now needed are methods to create the habitat that these species require. Specific areas where future research could be directed include: (1) wetland plant propagation, (2) wetland hydrology regimes, (3) nutrient cycling, (4) species colonization rates, and (5) species interactions.

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