Progress report: Submitted in the form of a GitHub repository that summarizes:

# A. Stakeholder’s type(s) of water uses, current problem(s), stakeholder objectives, and results of an institutional analysis

## Objectives:

“the goal for the habitat program at Bear River Migratory Bird Refuge will be to provide a spatial and temporal distribution of habitats to meet breeding, feeding and resting needs for species using the refuge with an emphasis on the priority species (USFWS 1997).”

To achieve that goal, the habitat should consist of a complex of wetland types with varying water depths, diverse plant communities and an abundance of aquatic invertebrates for foraging, resting and staging birds

## Water Uses

* In a normal water year, Bear River Refuge has the capacity to meet the habitat needs for the priority species and groups. A complex of different wetland habitat types are provided through the manipulation of water levels in the impounded units and by directing flow-through waters into unimpounded units (units 6-10).
* During low water years, however, the Refuge is likely to focus on the needs of spring and fall migrants as the availability and timing of river flows are a limiting factor. In summer months with low river inflow, the Refuge is unable to keep water levels stable to offset losses due to evaporation.

Residual snow recharges the Bear River watershed which supplies the water to the Refuge throughout the summer. Reliable and sufficient fresh-water supply is necessary to sustain the long term health of the Bear River delta.

Duck hunting clubs acquired lands within the delta, some required extensive diking a water control programs to maintain and develop their hunting area. Sportsmen recognized the need for conservation measures when increases in hunting, loss of waterfowl to botulism, and demand for water for irrigation power projects, and diminishing wetland habitat became evident.

## Land Uses

*Wetland units* – 29,259 acres within the refuge are wetlands. Wetland is a general habitat type used to describe lands were saturation with water is the dominant factor determining the nature of soil development and the types of plant and animal communities living in the soil and on its surface.

* Deep submergent – (2,500 acres) submerged marshes with 18-36 inches of water
* Shallow submergent – (8,700 acres) submerged marshes with 4-18 inches of water
* Deep emergent – (2,800 acres) emergent marshes with 12-24 inches of water
* Mid-depth emergent – (6,600 acres) emergent marshes with 8-12 inches of water
* Shallow emergent – (8,659 acres) emergent marshes with 2-8 inches of water

*Saltair Mudflats* – 38,064 acres of the refuge are mudflats. Saltair mudflats consist of strongly saline soils and are nearly barren of vegetation.

* Vegetated mudflat – (31,213 acres) xmudflat with up to 2 inches of surface water during seasonal high river flows or heavy precipitation events.
* Unvegetated mudflat – (6,852 acres) receive small amounts of sheet water from snow melt or occasional rainfall events.

*Semiwet fresh streambank* – riparian habitat along stream bank zone (45.5 acres). About 15 feet wide along the bear river channel, Reeder and Whistler canals.

*Semi-desert alkali knoll* – (511 acres) Scattered knolls that rise abruptly from the surrounding landscape of mudflat habitat.

*Salt Meadow* – (2,625 acres) Vegetative community comprising salt meadow habitat consists of sedges, rushes and saltgrass. Forbes and shrubs are currently missing in this habitat.

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| --- | --- | --- |
| **Vegetative community** | **Ideal Conditions** | **Actual Conditions** |
| Grasses and grass likes | 65-75% | 74% |
| Forbs | 10% | 0% |
| Shrubs | 1-3% | 0% |
| Emergent marsh | - | 21% |
| Non-native grass | - | 4% |
| Noxious weed | - | 1% |

*Alkali Bottom* - (973 acres) Salt and alkali tolerant grasses.

|  |  |  |
| --- | --- | --- |
| **Vegetative community** | **Ideal Conditions** | **Actual Conditions** |
| Grasses and grass likes | 60% | 35% |
| Forbs | 5% | 4% |
| Shrubs | 5% | 1% |
| Bare ground | 30% | -% |
| Non-native grass | - | 60% |

*Wet meadow* – (374 acres/ goal of 876) Predominantly sedges and rushes.

|  |  |  |
| --- | --- | --- |
| **Vegetative community** | **Ideal Conditions** | **Actual Conditions** |
| Grasses and grass likes | 80% | 4% |
| Forbs | 5% | - |
| Shrubs | 1% | - |
| Rush and sedges | - | 91% |
| Bare ground | 14% | - |
| Non-native grass | - | 1% |
| Noxious weed | - | 5% |

*Dikes* – (791 acres/ 96 miles) Provide most of the upland habitat over the western two-thirds of the refuge.

## Current Problems

### Past problems:

* 45,000 acres of freshwater and estuarine marshes in the 1840s to a few scattered marshes totaling less than 3,000 acres by the early 1900s.
* botulism among flocks developed from loss of marsh acreage and subsequent high concentration of waterfowl into the few remaining wet acres.
* 1980s Flood:
  + upland waterfowl species have been slow to reestablish population levels. High mammalian and avian predator populations are thought to be the major contributing factor to low nesting density and success rates.
  + Noxious and invasive species have become more abundant
  + Pest species such as carp can limit productivity of some wetland units by uprooting vegetation while foraging for food.

### 2004 HMP Habitat Management Strategies

Wetlands

* Strategy 1. Manage water and soil salinity
  + 1a. Flushing units
  + 1b. Maintaining water levels
  + 1c. Drawdown
* Strategy 2. Manage water clarity
  + 2a. Restrict carp
  + 2b. Reduce silt loading
* Strategy 3. Control aquatic vegetation community composition
  + 3a.Manage water depts.
  + 3b. Match salinity levels with tolerance ranges of desired macrophytes
  + 3c. Set back succession
    - 3c.i. Periodic drawdown
    - 3c.ii. Prescribed fire or mechanized equipment
    - 3c.iii. Encourage muskrat colonization
* Strategy 4. Manage aquatic invertebrate abundance and diversity.
  + 4a. Manage for a diversity of wetland types
  + 4b. Prohibit pesticide use.
* Strategy 5. Protect and maintain structures and levees.

Saltair Mudflat

* Strategy 1. No Management action
* Strategy 2. Spring drawdown
* Strategy 3. Construction of contour furrows

Wet Meadow

* Strategy 1. Maintain water supply
* Strategy 2. Prescribed grazing

### 2004 Management Strategy Constraints

Wetland

* Strategy 1. The refuge holds a state-certified water right with a priority date of 1928 for 1,000 cfs from Jan 1-Dec 31. The flow amount is rarely available in late summer.
* Strategy 2b. Refuge may need to take advantage of high river flows, regardless of the silt load, if precipitation forecasts are low.
* Strategy 3. Depends on the amount and timing of water from the Bear River
* Strategy 4. Depends on the amount and timing of water from the Bear River

Saltair Mudflat

* Strategy 2. Unable to re-fill the unit due to lack of water or a poor clarity of water upon refill.

## Results of an institutional analysis

* By 1931, over 50 miles of dikes and numerous canals were constructed to impound water in five large units each 5,000 acres. The impoundments created the capacity to manage water levels to encourage growth by aquatic vegetation and increase food production of waterfowl. The impounded wetlands also provided open freshwater habitat for nesting waterbirds during the critical summer months when marshes would normally dry up.

# B. Available data on stakeholder water demands in the basin

* Water Rights held by Bear River Migratory Bird Refuge (all sources). (*Table 3-2, Downard, 2010)*
* Utah Division of Water Rights (2009) online database

# C. Quantitative metric(s) to be used to evaluate the extent to which a management alternative meets the stakeholder’s objective(s)

## Brainstorm ideas…?

* Water flows
* Waterfowl nests per species
* Waterbird/raptor survey/ general bird survey
* Yearly snowpack analysis to determine management alternatives
  + http://www.nrcs.usda.gov/wps/portal/nrcs/detail/ut/snow/products/data/?cid=nrcs141p2\_034237

# D. The proposed management alternative(s)

* Groundwater conjunctive use
* On-site storage
* Purchase more rights
* Water reuse

# E. Major findings to date and future steps (for the remainder of the semester)

## Findings:

### Data

* Water Rights held by Bear River Migratory Bird Refuge (all sources). (*Table 3-2, Downard, 2010)*
* Bear River Migratory Bird Refuge Water Rights vs. Bear River Stream Discharge, by Month Over the Last Decade, the Last Major Drought Year (2004) and Last Major Flood Year (1984). (*Table 3-3, Downard, 2010)*
* Data used to complete ILO-3

## Future Steps:

* Use the 10 steps for rational planning (see notes)
* Confirm Delivery Targets
* Evaluate Proposed alternatives
* Building a WEAP model

Presenting work in the format of a GitHub repository will help facilitate communication

among group members and make group work and results available to the rest of the class,

future classes, and others. See the River Basin Planning Class Wiki for examples of

student projects for prior classes I have taught.

Test