UTAH DEPARTMENT of ENVIRONMENTAL QUALITY
WATER QUALITY

Handouts – Great Salt Lake Wetlands CAP Workshop I

- Agenda
- Maps: Eastside Wetlands and Management Areas
- Utah's Narrative Standard and Designated Beneficial Uses
- Wetland Targets: Description/Nested Targets/Beneficial Uses
- Breakout Group Instruction Sheet #1: Key Ecological Attributes & Indicators
- KEAs & Indicators Summary Table/Matrix – for all three Targets
- KEAs, Indicators & Comments for each Target
- "Straw dog" of KEAs, indicators & ratings for the 3 targets
- Breakout Group Instruction Sheet #2: Narrative Ratings
- Breakout Group Instruction Sheet #3: Current Health Ratings
- Breakout Group Instruction Sheet #4: Threats Exercise: Stresses and Sources

Great Salt Lake Wetlands CAP Workshop I
March 21 & 22, 2018, 9:00am – 5:00pm
Agenda

Meeting Location:
Utah Division of Water Quality, Board Room, 195 North 1950 West, Salt Lake City

CAP Workshops Objectives:

1. Provide "hands on" advice and assistance to Utah DWQ on developing beneficial uses and narrative water quality standards for Great Salt Lake's wetlands.

2. Explore other conservation action strategies (May Workshop) – beyond water quality standards – that might be developed and applied by stakeholders to enhance the Lake's wetlands health and/or to abate potential future threats to beneficial uses, with a geo-graphic focus on eastside GSL wetlands in Bear River Bay, Gilbert Bay and Farmington Bay.

Agenda: Wednesday, March 21

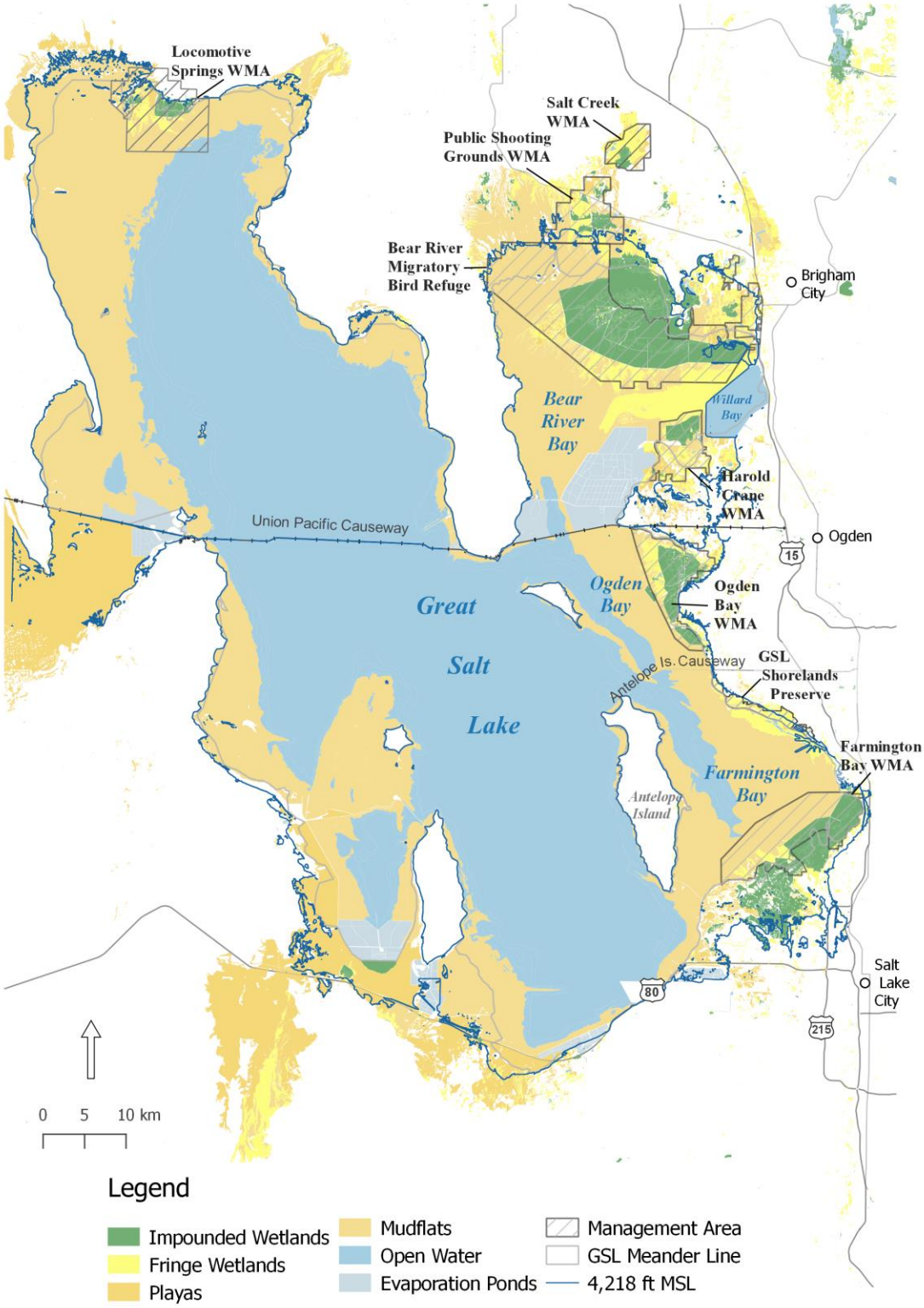
Item No.	Time	Agenda Item
1	9:00 – 9:45	Welcome, Introductions, Expected Outcomes, Ground Rules
2	9:45 – 10:15	Background of Previous GSL Wetlands CAP Workshops and Overview of Where the Process is Heading
3	10:15 – 10:30	Overview of CAP
		Break
4	10:45 – 12:00	Wetland Targets & Nested Targets – Review "Straw Dog" Description and Maps – Questions, Discussion & Suggestions
	12:00 – 1:00	*Lunch will be provided*
5	1:00 – 3:00	Key Ecological Attributes (KEAs) and Indicators – Review "Straw Dog" for Wetland Targets – Small Working Groups
		Break
6	3:15 – 4:15	Small Group Reports & Large Group Discussion on KEAs & Indicators
7	4:15 – 5:00	Recap of Day 1 Findings, Questions & Issues; Preview Day 2 Tasks; Interim Evaluation

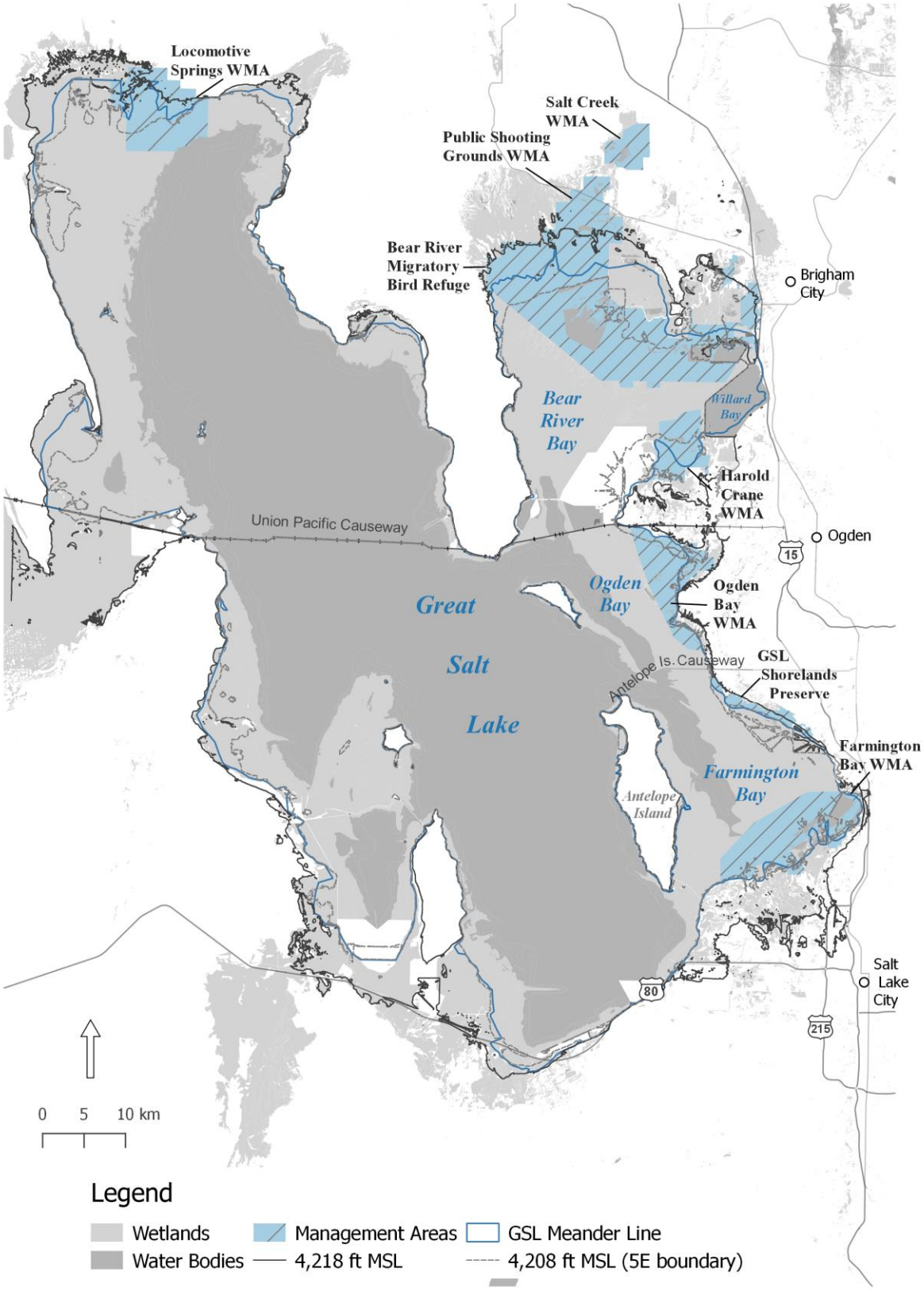
Item No.	Time	Agenda Item
8	5:00 pm	Adjourn

Agenda: Thursday, March 22

Item No.	Time	Agenda Item
1	9:00 – 9:30	Review Day 1 Outcomes; Any Overnight 2nd Thoughts; Day 2 Tasks
2	9:30 – 12:00	Develop Narrative KEA Ratings – Small Working Groups *(short break midway)*
	12:00 – 1:00	*Lunch will be provided*
3	1:00 – 1:45	Small Group Reports & Large Group Discussion on Narrative Ratings
4	1:45 –2:45	Develop Preliminary Current Health Ratings for Wetlands in 3 Bays – Small Working Groups
	2:45 – 3:00	*Break*
5	3:00 – 3:30	Report on Preliminary Current Health Ratings
6	3:30 – 4:30	Threats (Stresses & Sources of Stress) – Preliminary Rankings for 3 Bays – Small Working Groups
7	4:30 – 5:00	Recap of Day 2 Findings, Questions & Issues; Preview Dates & Tasks for May Workshop; Interim Evaluation
8	5:00	Adjourn

Maps of Great Salt Lake Eastside Wetlands & Management Areas




Locomotive Springs WMA
Salt Creek WMA
Public Shooting Grounds WMA
Bear River Migratory Bird Refuge
Brigham City
Bear River Bay
Willard Bay
Harold Crane WMA
Union Pacific Causeway
Ogden
15
Ogden Bay
Ogden Bay WMA
Great Salt Lake
Antelope Is. Causeway
GSL Shorelands Preserve
Farmington Bay WMA
Farmington Bay
Antelope Island
Salt Lake City
80
215
0 5 10 km
Legend
Wetlands
Water Bodies
Management Areas
4,218 ft MSL
GSL Meander Line
4,208 ft MSL (5E boundary)

Utah's Narrative Standard
Utah Administrative Code (UAC) R317-2-7.2 Narrative Standards

It shall be unlawful, and a violation of these rules, for any person to discharge or place any waste or other substance in such a way as will be or may become offensive such as unnatural deposits, floating debris, oil, scum or other nuisances such as color, odor or taste; or cause conditions which produce undesirable aquatic life or which produce objectionable tastes in edible aquatic organisms; or result in concentrations or combinations of substances which produce undesirable physiological responses in desirable resident fish, or other desirable aquatic life, or undesirable human health effects, as determined by bioassay or other tests performed in accordance with standard procedures; or determined by biological assessments in Subsection R317-2-7.3.

Utah's Beneficial Use Designations - UAC R217-2-6

Class 2 -- Protected for recreational use and aesthetics.

Class 2A -- frequent primary contact recreation (swimming)

Class 2B -- infrequent primary contact recreation, secondary contact recreation (wading)

Class 3 -- Protected for use by aquatic wildlife.

Class 3A -- cold water species of game fish, including their food chain.

Class 3B -- warm water species of game fish, including their food chain.

Class 3C -- nongame fish and other aquatic life, including their food chain.

Class 3D -- waterfowl, shore birds and other water-oriented wildlife not included in Classes 3A, 3B, or 3C, including their food chain.

Class 3E -- Severely habitat-limited waters

Class 5 -- The Great Salt Lake.

a. Class 5A Gilbert Bay - frequent primary and secondary contact recreation, waterfowl, shore birds and other water-oriented wildlife including their necessary food chain.

b. Class 5B Gunnison Bay (*all bays have the same use*)

c. Class 5C Bear River Bay

d. Class 5D Farmington Bay

e. Class 5E Transitional Waters along the Shoreline of the Great Salt Lake

Geographical Boundary -- All waters below approximately 4,208-foot elevation to the current lake elevation of the open water of the Great Salt Lake; areas of these transitional waters change corresponding to the fluctuation of open water elevation.

Beneficial Uses -- Protected for infrequent primary and secondary contact recreation, waterfowl, shore birds and other water-oriented wildlife including their necessary food chain.

GSL Wetlands: Conservation Targets & Nested Targets

Target	Description	Nested Targets
Impounded Wetlands	Impounded wetlands are large, primarily open water wetlands that are typically managed to grow submerged aquatic vegetation (SAV), which provides forage and shelter for migratory birds and habitat for macroinvertebrates and fish. These wetlands are diked and equipped with water control structures that alter the inflow and outflow of water to deepen and extend flooding. Elevation and hydrologic gradients within impounded wetlands support multiple wetland types, from deeply flooded submergent wetlands to shallow flooded meadows. Impounded wetlands do not include evaporation ponds.	*Waterfowl:* Dabbling and diving ducks, geese, and swans feed in SAV-dominated wetlands and nest in emergent and meadow wetlands. Species of interest include *Cinnamon Teal, Redheads*, and *Tundra Swans*. *Shorebirds:* Shorebirds forage and build floating nests in the shallow waters and nest along dikes. Significant populations of *American Avocets, Black-necked Stilts,* and *Wilson's Phalaropes* found in this system. *Waterbirds*: Deeper water is foraging habitat for piscivorous birds, including significant populations of *American White Pelicans, Great Blue Herons,* and *Snowy Egrets.* Islands provide protected nesting habitat for colonial birds like *Franklin's Gulls* and *Black* and *Forster's Terns*.
Fringe Wetlands (formerly Un-impounded Marsh Complex)	Fringe wetlands are large, shallow, intermittently to semi-permanently flooded wetlands dominated by a mix of emergent and submerged aquatic vegetation (SAV). Spatial and temporal variation in salinity and hydrology create a mosaic of habitat types in fringe wetlands. Mudflats, playas, meadows, emergent marsh, and submergent wetlands can be found in fringe complexes. Fringe wetlands can also be divided into high and low fringe based on their elevation – high fringe are irregularly inundated by the lake and experience dry conditions when lake levels are low, whereas low fringe may remain inundated for many years.	*Waterfowl*: The mix of emergent and submergent vegetation provides nesting and foraging habitat for large and small waterfowl. Support significant nesting populations of *Cinnamon Teal*. *Shorebirds*: meadow habitat provides foraging habitat for shorebirds. Large populations of *Black-necked Stilts* and *American Avocets* feed here. *Waterbirds*: Fringe wetlands provide breeding and foraging habitat for a portion of the largest global breeding population of *White-faced Ibis*
Playas and Mudflats	Playas and mudflats are temporarily flooded saline wetlands created by inter-annual or seasonal lake water fluctuations. These flat, depressional wetlands dominate the GSL shoreline and support communities of freshwater and saltwater macroinvertebrates that provide seasonal food for tens of thousands of migratory shorebirds, gulls, and waterfowl. Mudflats occur in closest proximity to the open waters of GSL, are almost devoid of vegetation, yet remain important for nesting birds. Playas are dominated by halophytic ('salt-loving') plant species that vary in composition based on varying freshwater inputs. The specific locations of these habitats changes as GSL expands and contracts.	Waterfowl: Short halophyte vegetation provides foraging habitat for migrating waterfowl, including *Canada geese*. *Shorebirds*: Expansive flat and salty playas and mudflats provide breeding and foraging habitat for many types of shorebirds. Significant populations of *Snowy Plovers, Black-necked Stilts, American Avocets, Long-Billed Dowitchers, Marbled Godwits, Western Sandpipers,* and *Long-billed Curlews* feed or nest here.

Breakout Group Exercise #1: Key Ecological Attributes & Indicators

Objective: Provide "hands on" advice and assistance to Utah DWQ on developing beneficial uses and narrative water quality criteria for GSL wetlands.

Tasks:

1. Review summary matrix of key ecological attributes (KEAs)/indicators for the wetland system target(s) – recommend any additions, deletions and amendments.
2. Dive deeper into the proposed Indicators - recommend any additions, deletions and amendments. Add any comments.
3. Meet with your "sister" group and seek to reach consensus on KEAs & Indicators

Handouts:

- Summary matrix of key ecological attributes/indicators for the 3 wetland systems.
- Detailed Indicators & Comments for each Target.

Hints

- The KEA is what's important for a target's long-term health; the Indicator is how you measure that attribute
- Criteria for Attributes and Indicators:
  - ✓ Very important to health of the nested targets
  - ✓ May provide early warning of adverse effects (e.g., conditions to avoid)
  - ✓ Indicators that are feasible to measure
  - ✓ Narrative rating criteria that are feasible to develop
  - ✓ A parsimonious number of KEAs - avoid redundancy & desirable but less critical factors

GSL Wetlands – Proposed Key Ecological Attributes & Indicators

Key Ecological Attribute and Indicator	Impounded Wetlands	Fringe Wetlands	Playas & Mudflats
Hydrology – Timing & quantity	☑	☑	☑
Chemical Regime - Toxic substances	☑	☑	☑
Nutrient regime – Availability & cycling	☑	☑	☑
Macroinvertebrates - composition & biomass	☑	☑	☑
Plants – Composition & diversity	☑	☑	☑
Plants – SAV cover & condition	☑		
Size		☑	☑

Nested Targets' Habitat Requirements

Guild	Type and Example	Feeding Needs	Nesting Needs
Waterfowl	Diving Waterfowl (Redhead Duck)	Macroinvertebrates, Tubers in *Impounded* Wetlands	Emergent Vegetation in *Impounded* Wetlands
	Dabbling Waterfowl (Canada Goose)	Macroinvertebrates, Leaves, Seeds in *Impounded* Wetlands	Meadow Vegetation in *Impounded* or Fringe Wetlands
Shorebirds	Large Shorebirds (American Avocet)	Macroinvertebrates in *Impounded*, Fringe or Playas	Playa and Mudflats
	Small Shorebirds (Snowy Plover)	Macroinvertebrates in Fringe Wetlands or Playas	Playa and Mudflats
Waterbirds	Piscivorous Birds (Great Blue Heron)	Fish in *Impounded* Wetlands	Islands near *Impounded* Wetlands
	Colonial Birds (White-faced Ibis)	Macroinvertebrates in *Impounded*, Fringe, or Playa Wetlands	Meadow Vegetation in Fringe Wetlands

GSL Wetlands – Proposed Indicators

Impounded Wetland Target		
Key Ecological Attribute	**Indicator**	**Comments**
Hydrologic Regime	Water available to maintain adequate residence time and flush ponds	
Hydrologic regime	Flood timing and depth adequate to maintain multiple habitat types	Habitat types: submergent, tall and short emergent, meadow, playa, and mudflat
Chemical Regime	Toxic substances remain below concentrations toxic to aquatic life	
Nutrient regime	Soil and water nutrient bioavailability favor native plant community	
Macroinvertebrates	Healthy macroinvertebrate population supportive of fish, waterfowl, and other birds	
Macroinvertebrates	Food supply supportive of fish, waterfowl, and other birds	
Plants	Dominance of native plant species	
Plants	SAV seeds and tubers supportive of fish, waterfowl, and other birds	
Plants	Healthy SAV Community supportive of waterfowl and other birds	

Fringe Wetland Target		
Key Ecological Attribute	**Indicator**	**Comments**
Hydrologic Regime	Flood timing and depth adequate to maintain multiple habitat types	Habitat types: submergent, tall and short emergent, meadow, playa, and mudflat
Chemical Regime	Toxic substances remain below concentrations toxic to aquatic life	
Nutrient regime	Soil and water nutrient bioavailability favor native plant community	
Macroinvertebrates	Healthy macroinvertebrate population supportive of waterfowl, shorebirds, and waterbirds	
Macroinvertebrates	Food supply supportive of waterfowl, shorebirds, and waterbirds	
Plants	Dominance of native plant species	
Size	Wetland area below 4,218 ft MSL	4,218 ft MSL was the ecosystem elevation boundary for the GSL Health Assessment

Playa & Mudflat Target		
Key Ecological Attribute	**Indicator**	**Comments**
Hydrologic regime	Annual flooding or saturation supportive of shorebird needs	
Hydrologic Regime	Diversity of salinity conditions, topography, and hydrology	
Chemical Regime	Toxic substances remain below concentrations toxic to wildlife	
Nutrient regime	Nutrient cycling between soil, water, plant, and animal pools	
Macroinvertebrates	Healthy macroinvertebrate population that includes diversity of functional feeding groups supportive of shorebirds	
Macroinvertebrates	Biomass supportive of shorebirds and other birds	
Plants	Healthy native halophytes vegetation community in playas	
Size	Habitat within 100-m of surface water	Snowy plovers, a hemispheric species of concern, requires habitat within 100 meters of surface water

“Straw Dog” Ratings – Great Salt Lake Wetland Systems

Conservation Target: Impounded Wetlands

Key Attribute	Indicator	Poor	Fair	Good	Very Good	Comments
Hydrologic Regime	Water available to maintain adequate residence time and flush ponds	Severe, early drawdown in multiple years		Spring and late summer flooding and flushing		BRMBR Habitat Management Plan has guidance on the timing of flooding and flushing
Hydrologic regime	Flood timing and depth adequate to maintain multiple habitat types	Brief or absent flooding over multiple years		Deep (>18 inches) flooding during spring & fall to maintain submergent habitat		BRMBR Habitat Management Plan has guidance on flooding depth and timing for multiple habitat types
Chemical Regime	Toxic substances remain below concentrations toxic to aquatic life	Substances at concentration that is toxic to people, or aquatic life		Ambient concentrations of toxic substances at or below thresholds toxic to aquatic life		Utah Administrative Code R317 Table 2.14.2 lists toxic substance criteria for aquatic life
Nutrient regime	Soil and water nutrient bioavailability favor native plant community	Nitrogen & phosphorus concentrations in the water is in the highest 75th percentile for wetland type; large algal mats		Nitrogen & phosphorus concentration in the water is in the lowest 50th percentile for that wetland type; no large algal mats		UDWQ Impounded Wetland report shows the distribution of nitrogen concentrations (Fig 25) based on four surveys of impounded wetlands
Macro-invertebrates	Healthy macroinvertebrate population supportive of waterfowl and other birds	Plant-associated Macroinvertebrate Index (PMI) score in the bottom 25th percentile		PMI score in the top 50th percentile		UDWQ Impounded Wetland report describes the Plant-associated Macroinvertebrate Index and distribution of scores (Fig 17)
Macro-invertebrates	Food supply supportive of fish, waterfowl, and other birds	Low biomass(g/m^2) of desirable functional groups		Adequate biomass g/m^2 of desirable functional groups		Previous CAP meetings suggested 1.5-2.5 g/m^2 was indicative of good conditions and biomass below 0.5 g/m^2 showed poor conditions. Suggested excluding gastropods from consideration.

<table>
<tr><th>Key Attribute</th><th>Indicator</th><th>Poor</th><th>Fair</th><th>Good</th><th>Very Good</th><th>Comments</th></tr>
<tr><td>Plants</td><td>Dominance of native plant species</td><td>Native cover <50%</td><td></td><td>Native cover >75%of vegetated area</td><td></td><td></td></tr>
<tr><td>Plants</td><td>SAV seeds and tubers supportive of fish, waterfowl, and other water birds</td><td>Low druplet and tuber biomass, low branch density and few attached leaves</td><td></td><td>High druplet and tuber biomass, high branch density and leaf attachment</td><td></td><td>Previous CAP meetings suggested the following rating thresholds:
<table><tr><th></th><th>Good</th><th>Poor</th></tr><tr><td>Druplet biomass (g/m^2)</td><td>20-29</td><td><5</td></tr><tr><td>Tuber biomass (g/m^2)</td><td>12-24</td><td><2.5</td></tr><tr><td>Branch density (per m^2)</td><td>35,000 - 59,000</td><td><10,000</td></tr></table></td></tr>
<tr><td>Plants</td><td>Healthy SAV Community supportive of waterfowl and other water birds</td><td>Peak SAV cover over very little (e.g. 25%) %</td><td></td><td>Peak SAV cover over most of spatial extent (e.g. 75%) of open water area%</td><td></td><td>Several studies have been done on SAV condition and cover: UDWQ Impounded Wetland report , UDWQ Willard Spur summary, and FBWMA Phase I Ecological Assessment</td></tr>
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Conservation Target: Fringe Wetlands

Key Attribute	Indicator	Poor	Fair	Good	Very Good	Comments
Hydrologic Regime	Flood timing and depth adequate to maintain multiple habitat types	Brief or absent flooding over multiple years leads to dominance of mudflat or upland types		Annual flooding maintains a balance of five habitat types		BRMBR Habitat Management Plan has guidance on flooding depth and timing for multiple habitat types. Willard Spur summary describes structural changes with hydrologic isolation
Chemical Regime	Toxic substances remain below concentrations toxic to aquatic life	Substances at concentration that is toxic to people, or aquatic life		Ambient concentrations of toxic substances at or below thresholds toxic to aquatic life		Utah Administrative Code R317 Table 2.14.2 lists toxic substance criteria for aquatic life
Nutrient regime	Soil and water nutrient bioavailability favor native plant community	Nitrogen & phosphorus concentrations in the highest 75th percentile for wetland type; large algal mats		Nitrogen & phosphorus concentration in the lowest 50th percentile for that wetland type; no large algal mats		UDWQ Fringe Wetland report (Table 17) shows the summary statistics of nitrogen and phosphorus from a survey of fringe wetlands
Macro-invertebrates	Healthy macroinvertebrate population supportive of waterfowl, shorebirds, and waterbirds	Low diversity of functional feeding groups		High diversity of functional feeding groups		UDWQ Fringe Wetland report (Table 10) lists the macroinvertebrate taxa found in fringe wetlands; Table 11 summarizes macroinvertebrate community data
Macro-invertebrates	Food supply supportive of waterfowl, shorebirds, and waterbirds	Low biomass(g/m^2) of desirable functional groups		Adequate biomass(g/m^2) of desirable functional groups		Previous CAP meetings suggested 1.5-2.5 g/m^2 was indicative of good conditions and biomass below 0.5 g/m^2 showed poor conditions. Suggested excluding gastropods from consideration.
Plants	Dominance of native plant species	Native cover <50%		Native cover >75%of vegetated area		UDWQ Fringe Wetland report (Figure 5) shows the relative cover of invasive plant species in surveyed wetlands

Key Attribute	Indicator	Poor	Fair	Good	Very Good	Comments
Size	Wetland area below 4,218 ft MSL	Decreased acreage below 4,218 ft MSL		Adequate annually flooded acreage below 4,218 ft. MSL		Previous CAP suggested 8,000-11,000 acres was indicative of good conditions and <6,000 acres showed poor conditions

Conservation Target: Playas & Mudflats

Key Attribute	Indicator	Poor	Fair	Good	Very Good	Comments
Hydrologic regime	Annual flooding or saturation supportive of shorebird needs	<25% flooding or saturation during May		>75% flooding or saturation during May		Previous CAPs suggested May flooding was most indicative of a healthy hydroperiod
Hydrologic Regime	Diversity of salinity conditions, topography, and hydrology	Absence of flooding for multiple years, homogenous salinity and dry soils		Periodic flooding maintains a gradient of salinity and soil moisture conditions		Peer-reviewed studies of playa wetlands in migratory bird flyways found precipitation, surface water, and groundwater maintain complexes of hypersaline to freshwater habitats in less human-impacted wetlands
Chemical Regime	Toxic substances remain below concentrations toxic to wildlife	Substances at concentration that is toxic to people, or aquatic life		Ambient concentrations of toxic substances at or below thresholds toxic to aquatic life		EPA has developed guidance for screening toxic substances in soils as well as water: https://www.epa.gov/risk/regional-screening-levels-rsls-users-guide-november-2017
Nutrient regime	Nutrient cycling between soil, water, plant, and animal pools	Nitrogen and phosphorus accumulate in soils		Nitrogen and phosphorus regularly cycle from water to soils to plants or macroinvertebrates		Peer-reviewed studies of playa wetlands in migratory bird flyways found temporary pulses of flooding stimulate cycling of nitrogen and phosphorus between water, soils, and organisms caused by oxygen-free soils, plant growth, and bug hatches.
Macro-invertebrates	Healthy macroinvertebrate population that includes diversity of functional feeding groups supportive of shorebirds	Low diversity of functional feeding groups		High diversity of functional feeding groups		In order to support large populations of shorebirds with diverse feeding strategies playas and mudflats should also have diverse macroinvertebrate populations

Key Attribute	Indicator	Poor	Fair	Good	Very Good	Comments
Macro-invertebrates	Biomass supportive of shorebirds and other birds	Low biomass(g/m^2) of desirable functional groups		Adequate biomass (g/m^2) of desirable functional groups		
Plants	Healthy native halophytes vegetation community in playas	Native halophytes <50% of vegetated area cover		Native halophytes >75% of vegetated area cover		Wetland Plants of Great Salt Lake (USU Extension) lists native and introduced playa species
Size	Habitat within 100m of surface water	Decreased area inadequate to support GSL Snowy plover populations		Adequate area to support GSL Snowy plover populations		Previous CAP suggested 18,000 - 23,000 acres was adequate for good conditions and <13,000 acres indicated poor condition

Breakout Group Exercise #2: Key Ecological Attributes – Narrative Ratings

Objective: Provide "hands on" advice and assistance to Utah DWQ on developing narrative water quality criteria for GSL wetlands.

Tasks:

1. Amend table to incorporate any additions, deletions or amendments from Exercise #1.
2. Dive deep into the narrative ratings – recommend additions and amendments.
3. Meet with your "sister" group and seek consensus

Handouts:

- Detailed "straw" dog of key ecological attributes, indicators & ratings for the 3 wetland systems.

Hints

- Focus on the "Good" & "Poor" narrative ratings (see below); these are the key benchmarks
- Avoid using numbers in the narrative unless they can be scientifically supported; however numbers can be used illustratively – such as "almost all (e.g. ~90%)"
- Rating Scale
  - ***Poor - Imminent Loss***: Allowing the factor to remain in this condition for an extended period will make restoration or preventing extirpation practically impossible.
  - ***Fair – Vulnerable***: The factor lies outside of its range of acceptable variation & requires human intervention. If unchecked, the target will be vulnerable to serious degradation.
  - ***Good - Minimum Integrity***: The factor is functioning within its range of acceptable variation; it may require some human intervention
  - ***Very Good - Optimal Integrity***: The factor is functioning at an ecologically desirable status, and requires little human intervention – i.e., "Mother Nature's" condition.

Breakout Group Exercise #3: Current Health Ratings

Objective: Provide "hands on" advice and assistance to Utah DWQ on developing narrative water quality criteria for GSL wetlands.

Tasks:

1. Assign Current Health Ratings for the 3 targets in the 3 eastside Bays (Farmington, Ogden & Bear River).

Handouts:

- Previous materials
- Maps
- "Voting" sheet handout

Hints

- Rating Scale
  - ***Poor - Imminent Loss***: Allowing the factor to remain in this condition for an extended period will make restoration or preventing extirpation practically impossible.
  - ***Fair – Vulnerable***: The factor lies outside of its range of acceptable variation & requires human intervention. If unchecked, the target will be vulnerable to serious degradation.
  - ***Good - Minimum Integrity***: The factor is functioning within its range of acceptable variation; it may require some human intervention
  - ***Very Good - Optimal Integrity***: The factor is functioning at an ecologically desirable status, and requires little human intervention – i.e., "Mother Nature's" condition.

Breakout Group Exercise #4: Stresses & Sources of Stress

Objective: An assessment of the group's greatest concerns regarding potential sources of stress to GSL wetlands beneficial uses over the next 10 years.

Tasks:

1. Rank the Severity and Scope of each Stress (altered KEA) for your target in each of three bays. (see handout worksheet)
2. Any additions to Sources (group)
3. Each participant check five (5) boxes of the Threat Worksheet that you think represent the greatest sources of stress for each target in your bay over the next 10 years. You may check more than one box in a column, or in a row, if you wish.

Hints

- "Threats" are the combination of a Sources of Stress
- ***Stresses*** are the "mirror image" of a Key Ecological Attribute (KEA)
- ***Sources*** are the human causes of a Stress
- Stresses and Source may be…
  - ✓ Historic - these are already reflected in a degraded KEA, and therefore are not ranked
  - ✓ Current and Ongoing - may stay the same or get worse
  - ✓ Future – focus of the threat assessment
- Stress: How much will the KEA be degraded – e.g., from "Good" to "Poor"
- Assess the projected contribution of the source to a given stress
  - Multiple sources may contribute & more than one source might be "High"
- Consider threats that are "reasonably likely to occur" over the next 10 years
  - If the impact occurs more than 10 years away, but the source is activated within 10 years, then it falls within the 10 year window – e.g., invasive species, policy decision
  - Climate change brings lots of complexity
    - Only consider climate change if there are strategies you might need to deploy now
    - Don't try to distinguish between natural and human-caused climate change
- Challenges
  - How to rank very uncertain threats – e.g., improbable but potentially very harmful
    - "How much sleep do you lose" thinking about this threat: Nightmare = Very High; Bad Dream = High; Troubled Sleep = Medium

Stress Ranking Guidelines

Severity of Damage *-- what level of damage can reasonably be expected within 10 years under current circumstances (given the continuation of the existing management/conservation situation)*

Very High	The stress is likely to *destroy or eliminate* the conservation target over some portion of the target's occurrence at the site
High	The stress is likely to *seriously degrade* the conservation target over some portion of the target's occurrence at the site
Medium	The stress is likely to *moderately degrade* the conservation target over some portion of the target's occurrence at the site
Low	The stress is likely to *only slightly impair* the conservation target over some portion of the target's occurrence at the site

Scope of Damage *– what is the geographic scope of impact on the conservation target at the site that can reasonably be expected within 10 years under current circumstances (given the continuation of the existing situation)*

Very High	The stress is likely to be *very widespread or pervasive in its scope*, and affect the conservation target *throughout the target's occurrences the site*
High	The stress is likely to be *widespread in its scope*, and affect the conservation target at *many of its locations* at the site
Medium	The stress is likely to be *localized in its scope*, and affect the conservation target at *some of the target's locations* at the site
Low	The stress is likely to be *very localized in its scope*, and affect the conservation target at a *limited portion of the target's location* at the site

Overall Stress Ranking Chart

↓ Scope	---------- Severity ----------			
	Very High	**High**	**Medium**	**Low**
Very High	*Very High*	*High*	*Medium*	*Low*
High	*High*	*High*	*Medium*	*Low*
Medium	*Medium*	*Medium*	*Medium*	*Low*
Low	*Low*	*Low*	*Low*	-

Source-of-Stress Ranking Guidelines

Contribution *– Expected contribution of the source, acting alone, to the stress (as determined in the stress assessment) under current circumstances (i.e., given the continuation of the existing management/ conservation situation)*

Very High	The source is a *very large* contributor of the particular stress
High	The source is a *large* contributor of the particular stress
Medium	The source is a *moderate* contributor of the particular stress
Low	The source is a *low* contributor of the particular stress

Threat Ranking Chart

		---------- *Source* ----------			
		Very High	**High**	**Medium**	**Low**
---- *Stress* ----	**Very High**	*Very High*	*Very High*	*High*	*Medium*
	High	*High*	*High*	*Medium*	*Low*
	Medium	*Medium*	*Medium*	*Low*	*Low*
	Low	*Low*	*Low*	*Low*	--

Note: the Threat Rank for a given source of stress can be no higher than the rank of the stress.

UTAH DEPARTMENT of ENVIRONMENTAL QUALITY
WATER QUALITY

Handouts – Great Salt Lake Wetlands CAP Workshop I Day 2

- Revised KEAs & Indicators Summary Table/Matrix – for all three Targets
- Revised KEAs, Indicators & Comments for each Target
- Threats worksheet

GSL Wetlands – Revised Indicators

Impounded Wetlands Target		
Key Ecological Attribute	**Indicator**	**Comments**
Hydrologic Regime	Water available to meet management objectives, including: residence time, pond flushing, habitat size, and habitat diversity.	Habitat types: submergent, tall and short emergent, meadow, playa, and mudflat
Chemical Regime	Exotic substances remain below levels deleterious to aquatic life	
Chemical Regime	Tissue concentrations of important bioaccumulation toxics remain below deleterious concentrations.	
Chemical Regime	Algal mats or toxic	
Nutrient Regime	Nutrient bioavailability favor native plant communities or community types.	
Aquatic Biota	Invasive organism abundance does not adversely affect the populations of native organisms.	
Recreational Uses	Algal mats or toxic algae concentrations do not impede recreational uses.	
Macroinvertebrates	Healthy macroinvertebrate diversity relative to seasonal changes and naturally occurring salinity gradients.	
Macroinvertebrates	Adequate macroinvertebrate biomass to support management bird use objectives for the pond.	
Plants	Dominance of native plant species	
Plants	SAV seeds and tubers supportive of fish, waterfowl, and other birds	
Plants	Healthy plant community (submerged and emergent) that provides adequate habitat structure to support waterfowl and other birds.	

Fringe Wetland Target		
Key Ecological Attribute	**Indicator**	**Comments**
Hydrologic Regime	Timing and depth of water adequate to maintain multiple habitat types	Habitat types: submergent, tall and short emergent, meadow, playa, and mudflat; *important to consider the water source to fringe wetland systems*
Chemical Regime	Substances remain below concentrations harmful to aquatic life	*In addition to conventionally defined 'toxics', also consider emerging contaminants (PPCPs, etc.) as was a more fundamental chemical components such as the range salinity levels encountered within the system*
Chemical Regime	*Salinity levels sufficient to support and maintain sensitive habitat types*	
Nutrient Regime	Nutrient bioavailability favors native plant communities	*Both soil and water nutrient-bioavailability may be needed for proper assessment*
Macro-invertebrates	Diverse macroinvertebrate communities supportive of waterfowl, shorebirds, and waterbirds	*Will need to be mindful that specific diversity goals for particular habitat types are strongly affected by salinity, vegetation, and hydrologic covariates*
Macro-invertebrates	Food supply supportive of waterfowl, shorebirds, and waterbirds	*Acknowledge that macroinvertebrate biomass in fringe wetland systems is notoriously difficult to measure*
Plants	Dominance of native plant species that maintain various habitat types among wetland complexes	*Idea here was to incorporate a scale-dependent view that large patches of possibly low-diversity habitat types need to be balanced by a wide range of habitat types within and across GSL basins*
Plants	*Extensive monotypic stands of invasive* Phragmites australis *are absent*	*This indicator is added to highlight the importance of the very significant threat that establishment and expansion of invasive-Phragmites stands represents to fringe wetland habitat types {Alternatively, this indicator could be incorporated as a measurable component of the above Plant-related indicator}*
Size	Area of fringe wetlands supports sufficient diversity of habitat types between 4,218 ft MSL and GSL-margin, relative to climatic conditions	4,218 ft MSL was the ecosystem elevation boundary for the GSL Health Assessment

Playa & Mudflat Target		
Key Ecological Attribute	**Indicator**	**Comments**
Hydrologic regime	Patterns of flooding and drying supportive of shorebird needs	Multi-year, annual, and season timing is important
Hydrologic regime	Habitat near fresh or brackish water	Young shorebirds require nearby fresh/brackish water
Chemical Regime	Toxic substances remain below concentrations toxic to wildlife (shorebirds & their food web)	
Chemical Regime	Salinity within a range supportive of shorebirds' food web	Range is important; too fresh or too salty is poor
Nutrient regime	Nutrient cycling between soil, water, plants, macroinvertebrates and birds	
Macroinvertebrates	Biomass supportive of shorebirds and other birds	Biomass is most important
Macroinvertebrates	Diversity supportive of resilience and shorebirds	
Plants	Both bare ground and vegetated area present; vegetated area dominated by native halophytes	Bare ground and vegetated area are important

Revised Ratings – Great Salt Lake Wetland Systems

Conservation Target: Impounded Wetlands

Key Attribute	Indicator	Poor	Fair	Good	Very Good	Comments
Hydrologic Regime	Water available to meet management objectives, including: residence time, pond flushing, habitat size, and habitat diversity.	Severe, early drawdown in multiple years		Spring and late summer flooding and flushing		BRMBR Habitat Management Plan has guidance on the timing of flooding and flushing
Chemical Regime	Exotic substances remain below levels deleterious to aquatic life					
Chemical Regime	Tissue concentrations of important bioaccumulation toxics remain below deleterious concentrations.	Substances at concentration that is toxic to people, or aquatic life		Ambient concentrations of toxic substances at or below thresholds toxic to aquatic life		Utah Administrative Code R317 Table 2.14.2 lists toxic substance criteria for aquatic life
Chemical Regime	Algal mats or toxic					
Nutrient Regime	Nutrient bioavailability favor native plant communities or community types.	Nitrogen & phosphorus concentrations in the water is in the highest 75th percentile for wetland type; large algal mats		Nitrogen & phosphorus concentration in the water is in the lowest 50th percentile for that wetland type; no large algal mats		UDWQ Impounded Wetland report shows the distribution of nitrogen concentrations (Fig 25) based on four surveys of impounded wetlands
Aquatic Biota	Invasive organism abundance does not adversely affect the populations of native organisms.					
Recreational Uses	Algal mats or toxic algae concentrations do not impede recreational uses.					

<table>
<tr><th>Key Attribute</th><th>Indicator</th><th>Poor</th><th>Fair</th><th>Good</th><th>Very Good</th><th>Comments</th></tr>
<tr><td>Macroinvertebrates</td><td>Healthy macroinvertebrate diversity relative to seasonal changes and naturally occurring salinity gradients.</td><td>Plant-associated Macroinvertebrate Index (PMI) score in the bottom 25th percentile</td><td></td><td>PMI score in the top 50th percentile</td><td></td><td>UDWQ Impounded Wetland report describes the Plant-associated Macroinvertebrate Index and distribution of scores (Fig 17)</td></tr>
<tr><td>Macroinvertebrates</td><td>Adequate macroinvertebrate biomass to support management bird use objectives for the pond.</td><td>Low biomass(g/m^2) of desirable functional groups</td><td></td><td>Adequate biomass g/m^2 of desirable functional groups</td><td></td><td>Previous CAP meetings suggested 1.5-2.5 g/m^2 was indicative of good conditions and biomass below 0.5 g/m^2 showed poor conditions. Suggested excluding gastropods</td></tr>
<tr><td>Plants</td><td>Dominance of native plant species</td><td>Native cover <50%</td><td></td><td>Native cover >75%of vegetated area</td><td></td><td></td></tr>
<tr><td>Plants</td><td>SAV seeds and tubers supportive of fish, waterfowl, and other birds</td><td>Low druplet and tuber biomass, low branch density and few attached leaves</td><td></td><td>High druplet and tuber biomass, high branch density and leaf attachment</td><td></td><td>Previous CAP meetings suggested the following thresholds:
<table><tr><th></th><th>Good</th><th>Poor</th></tr><tr><td>Druplet biomass (g/m^2)</td><td>20-29</td><td><5</td></tr><tr><td>Tuber biomass (g/m^2)</td><td>12-24</td><td><2.5</td></tr><tr><td>Branch density (per m^2)</td><td>35,000 - 59,000</td><td><10,000</td></tr></table></td></tr>
<tr><td>Plants</td><td>Healthy plant community (submerged and emergent) that provides adequate habitat structure to support waterfowl and other birds.</td><td>Peak SAV cover over very little (e.g. 25%) %</td><td></td><td>Peak SAV cover over most of spatial extent (e.g. 75%) of open water area%</td><td></td><td>Several studies have been done on SAV condition and cover: UDWQ Impounded Wetland report , UDWQ Willard Spur summary, and FBWMA Phase I Ecological Assessment</td></tr>
<tr><td>Hydrologic regime</td><td>Flood timing and depth adequate to maintain multiple habitat types</td><td>Brief or absent flooding over multiple years</td><td></td><td>Deep (>18 inches) flooding during spring & fall to maintain submergent habitat</td><td></td><td>BRMBR Habitat Management Plan has guidance on flooding depth and timing for multiple habitat types</td></tr>
</table>

Conservation Target: Fringe Wetlands

Key Attribute	Indicator	Poor	Fair	Good	Very Good	Comments
Hydrologic Regime	Timing and depth of water adequate to maintain multiple habitat types	Brief or absent flooding over multiple years leads to dominance of mudflat or upland types		Annual flooding maintains a balance of five habitat types		BRMBR Habitat Management Plan has guidance on flooding depth and timing for multiple habitat types. Willard Spur summary describes structural changes with hydrologic isolation
Chemical Regime	Substances remain below concentrations harmful to aquatic life	Substances at concentration that is toxic to people, or aquatic life		Ambient concentrations of toxic substances at or below thresholds toxic to aquatic life		Utah Administrative Code R317 Table 2.14.2 lists toxic substance criteria for aquatic life
Chemical Regime	*Salinity levels sufficient to support and maintain sensitive habitat types*					
Nutrient regime	Nutrient bioavailability favors native plant communities	Nitrogen & phosphorus concentrations in the highest 75th percentile for wetland type; large algal mats		Nitrogen & phosphorus concentration in the lowest 50th percentile for that wetland type; no large algal mats		UDWQ Fringe Wetland report (Table 17) shows the summary statistics of nitrogen and phosphorus from a survey of fringe wetlands
Macro-invertebrates	Diverse macroinvertebrate communities supportive of waterfowl, shorebirds, and waterbirds	Low diversity of functional feeding groups		High diversity of functional feeding groups		UDWQ Fringe Wetland report (Table 10) lists the macroinvertebrate taxa found in fringe wetlands; Table 11 summarizes macroinvertebrate community data
Macro-invertebrates	Food supply supportive of waterfowl, shorebirds, and waterbirds	Low biomass(g/m^2) of desirable functional groups		Adequate biomass(g/m^2) of desirable functional groups		Previous CAP meetings suggested 1.5-2.5 g/m^2 was indicative of good conditions and biomass below 0.5 g/m^2 showed poor conditions. Suggested excluding gastropods from consideration.
Plants	Dominance of native plant species that maintain various habitat types among wetland complexes	Native cover <50%		Native cover >75%of vegetated area		UDWQ Fringe Wetland report (Figure 5) shows the relative cover of invasive plant species in surveyed wetlands

Key Attribute	Indicator	Poor	Fair	Good	Very Good	Comments
Plants	*Extensive monotypic stands of invasive* Phragmites australis *are absent*					
Size	Area of fringe wetlands supports sufficient diversity of habitat types between 4,218 ft MSL and GSL-margin, relative to climatic conditions	Decreased acreage below 4,218 ft MSL		Adequate annually flooded acreage below 4,218 ft. MSL		Previous CAP suggested 8,000-11,000 acres was indicative of good conditions and <6,000 acres showed poor conditions

Conservation Target: Playas & Mudflats

Key Attribute	Indicator	Poor	Fair	Good	Very Good	Comments
Hydrologic regime	Patterns of flooding and drying supportive of shorebird needs	Multiple years of no flooding		Inter-annual, annual, and seasonal patterns of flooding and drying present		Previous CAPs suggested May flooding was most indicative of a healthy hydroperiod
Hydrologic regime	Habitat near fresh or brackish water	Decreased area inadequate to support GSL shorebird populations		Adequate area to support GSL shorebird populations		Previous CAP suggested 18,000 - 23,000 acres was adequate for good conditions and <13,000 acres indicated poor condition
Chemical Regime	Toxic substances remain below concentrations toxic to wildlife (shorebirds & their food web)	Substances at concentration that is toxic to people, or aquatic life		Ambient concentrations of toxic substances at or below thresholds toxic to aquatic life		EPA has developed Ecological Soil Screening Levels of some toxic contaminants: https://www.epa.gov/risk/ecological-soil-screening-level-eco-ssl-guidance-and-documents
Chemical Regime	Salinity within a range supportive of shorebirds' food web					
Nutrient regime	Nutrient cycling between soil, water, plants, macroinvertebrates and birds	Nitrogen and phosphorus accumulate in soils		Nitrogen and phosphorus regularly cycle from water to soils to plants, macroinvertebrates, and birds		Peer-reviewed studies of playa wetlands in migratory bird flyways found temporary pulses of flooding stimulate cycling of nitrogen and phosphorus between water, soils, and organisms caused by oxygen-free soils, plant growth, and bug hatches.
Macroinvertebrates	Biomass supportive of shorebirds and other birds	Low biomass(g/m^2) of desirable functional groups		Adequate biomass (g/m^2) of desirable functional groups		

Key Attribute	Indicator	Poor	Fair	Good	Very Good	Comments
Macroinvertebrates	Diversity supportive of resilience and shorebirds	Low diversity of functional feeding groups		High diversity of functional feeding groups		In order to support large populations of shorebirds with diverse feeding strategies playas and mudflats should also have diverse macroinvertebrate populations
Plants	Both bare ground and vegetated area present; vegetated area dominated by native halophytes	Native halophytes <50% of vegetated area cover		Native halophytes >75% of vegetated area cover		Wetland Plants of Great Salt Lake (USU Extension) lists native and introduced playa species
Hydrologic Regime	Diversity of salinity conditions, topography, and hydrology	Absence of flooding for multiple years, homogenous salinity and dry soils		Periodic flooding maintains a gradient of salinity and soil moisture conditions		Peer-reviewed studies of playa wetlands in migratory bird flyways found precipitation, surface water, and groundwater maintain complexes of hypersaline to freshwater habitats in less human-impacted wetlands

Threats Worksheet: Target: Bay:

Stresses	Rank Stresses			Rank Sources of Stress (VH, H, M, L)								
	Rank Severity (VH, H, M, L)	Rank Scope (VH, H, M, L)	Overall Stress Rank	Point Source Dis-charges	Up-stream Water With-drawal	Manage-ment of Dams and Diversions	Invasive species	Land Use Con-version	Other Nonpoint Sources			
Altered hydrologic regime												
Excessive toxicity												
Excessive nutrients												
Reduced macro-invertebrate diversity, abundance or biomass												
Altered composition of native plant species or diversity of plant communities												
Altered SAV cover/condition (impounded)												
Reduced size (fringe/playas)												