

Appendix 1: Biological Monitoring

1.1. Biological Monitoring

The intent of the biological monitoring considered here, is to collect a suite of ecologically informative data, at Key Areas of Biological Concern (KABCs), for the purpose of providing an early-warning indication as to whether, in combination with the hydrologic monitoring component, SNWA groundwater development in Snake Valley is causing adverse effects. A detailed biological monitoring plan will be developed during the Initial Period and implemented and modified as appropriate throughout the Baseline Period and Operational Period. This plan will differentiate monitoring efforts in the Tier I and II monitoring areas, and identify data types and collection methods that: 1) contribute to the characterization of the current ("baseline") condition of groundwater-influenced ecosystems within the KABCs; 2) establish the range of variability for monitored parameters in the KABCs prior to groundwater withdrawal by SNWA; 3) assess the response of groundwater-influenced ecosystems in the KABCs to groundwater withdrawal by SNWA; 4) give early warning prior to adverse effects to groundwater-influenced ecosystems in the KABCs due to groundwater withdrawal by SNWA; 5) identify research needs; 6) develop criteria and make recommendations to the Management Committee (MC) when a course of action shall be taken to avoid adverse effects; and 7) prior to the end of the baseline data collection period, develop and recommend to the MC a refined biological monitoring plan.

SNWA and Utah Division of Wildlife Resources (UDWR) will work cooperatively to implement this plan in a cost effective and efficient manner. Collection of monitoring data shall be performed by UDWR, SNWA, or a mutually agreed to third party. Utah commits to fund monitoring of Columbia spotted frog and least chub in the Tier I and Tier II monitoring areas as is currently being conducted. It is the intent of the Parties that the capital and operating costs of implementing biological monitoring plan components beyond the current UDWR effort will be primarily borne by SNWA.

1.1.1 Biological Monitoring Plan Development

The TWG intends to use The Nature Conservancy's Conservation Action Planning (CAP) process, or a similar process, to develop a detailed biological monitoring plan. The CAP process was successfully utilized to develop the Spring Valley Stipulation Biological Monitoring Plan, and it is expected to be advantageous here. Specifically, this process will help the TWG to: 1) identify key ecological attributes (KEAs) essential to the long-term viability of the groundwater-influenced ecosystems within the KABCs; 2) identify indicators to assess each KEA, including those that may be used to predict potential adverse effects and/or show early warning of effects from SNWA's groundwater development; 3) integrate the existing UDWR monitoring into this plan; and 4) develop conceptual models of the groundwater-influenced ecosystems as necessary and appropriate.

1.1.2 Existing UDWR Monitoring

UDWR currently conducts annual monitoring for Columbia spotted frog and least chub in the Tier I and Tier II monitoring areas. Columbia spotted frog monitoring consists of Visual Encounter Surveys targeting egg masses to determine the breeding population size (number of

adults contributing to reproduction). Least chub monitoring consists of monitoring size class frequency within each population to assess health of population and determine success of recruitment of new individuals into the population. Northern leopard frog, sub-globose snake pyrg, and longitudinal gland pyrg are not currently monitored. California floater, longitudinal gland pyrg, and the five native fish species in the Big Spring complex will be monitored as part of the Spring Valley biological monitoring plan.

1.2. Tier I Biological Monitoring

The main objectives of biological monitoring in the Tier I monitoring area are to provide early warning of adverse effects to groundwater-influenced ecosystems and to track ecosystem response as management response actions are implemented. As stated above, KABCs were identified to focus the monitoring approach and were based on the presence of groundwater-influenced ecosystems, which support Species of Greatest Conservation Need (Utah Comprehensive Wildlife Conservation Strategy 2006) and/or contain phreatophytic vegetation having some potential to degrade air quality if significantly affected by groundwater development. Specific KABCs in the Tier I Monitoring Area, and their associated sensitive species, are identified in Table 1.1. Biological monitoring will augment existing UDWR efforts and will include population level monitoring of these sensitive species (Conservation Targets), or their surrogates, at representative locations within the KABCs. Monitoring of selected KEAs will coincide with the population level monitoring to track habitat condition relative to SNWA groundwater development. In the phreatophytic plant community south of Gandy Salt Marsh, a sufficient number of permanent transects will be established and annually sampled to track composition and cover at the alliance level. Monitoring sites or different species to track may be added or deleted based upon compelling scientific evidence regarding the ecosystem’s response to SNWA groundwater development.

Table 1.1. Key areas of Biological Concern within the Tier I monitoring area and associated Species of Greatest Conservation Need.

Spring / Stream Name	Columbia spotted frog ¹	Least chub ¹	Northern leopard frog ¹	California floater ^{1,3}	Sub-globose snake pyrg ¹	Longitudinal gland pyrg ^{1,2}	Five native fishes: Spring Valley Mon. Plan ²
Miller Spring	X	X					
Leland Harris Spring Complex	X	X					
Gandy Marsh	X	X	X				
Bishop Springs Complex							
Foote Spring	X	X	X				
Twin Springs	X	X	X				
Central Spring	X	X	X				
Warm Springs at Gandy					X		
Beck Springs	X						
Lake Creek						X	X

Spring / Stream Name	Columbia spotted frog ¹	Least chub ¹	Northern leopard frog ¹	California floater ^{1,3}	Sub-globose snake pyrg ¹	Longitudinal gland pyrg ^{1,2}	Five native fishes: Spring Valley Mon. Plan ²
Clay Spring						X	X
Pruess Lake				X			
Phreatophytic Vegetation South of Gandy Salt Marsh ⁴							

¹ SGCN = Species of Greatest Conservation Need, Utah Comprehensive Wildlife Conservation Strategy. ² Five native Bonneville Basin fish species and springsnail found in Big Spring complex and being monitored as part of the Spring Valley Biological Monitoring Plan. ³ California floater at Pruess Lake (terminus of Big Spring complex) is addressed as part of the Spring Valley Biological Monitoring Plan. ⁴ This vegetation will be monitored to address air quality concerns.

1.3. Tier II Biologic Monitoring

The KABCs listed in Table 1.2 have been identified for monitoring based on the presence of Species of Greatest Conservation Need (Utah Comprehensive Wildlife Conservation Strategy 2006) (Table 1.2). UDWR currently conducts annual monitoring for Columbia spotted frog and least chub populations, where present, in KABCs in the Tier II monitoring area. Current monitoring methods for these species are consistent with those used in the Tier I monitoring area. Monitoring sites and different species may be added or deleted, and monitoring effort may be adjusted based upon compelling scientific evidence regarding the effects of SNWA groundwater development. 1.1 (second paragraph) states who is responsible for funding monitoring, it does not need to be restated.

Table 1.2. Key Areas of Biological Concern within the Tier II Monitoring Area and associated Species of Greatest Conservation Need.

Spring / Stream Name	Columbia spotted frog ¹	Least chub ¹	Northern leopard frog ¹	California floater ¹	Utah chub ¹
Fish Springs		X	X		X
Tule Valley					
Coyote	X				
Willow	X				
North Tule	X				
South Tule	X				
Redden Spring				X	X

¹ Species of Greatest Conservation Need, Utah Comprehensive Wildlife Conservation Strategy.