SOUTHERN NEVADA
WATER AUTHORITY

**Environmental Resources Division**

# Spring Valley Stipulation Biological Monitoring Plan 2010 Annual Report

March 2011

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Submitted to
Nevada State Engineer
and the Stipulation
Executive Committee

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## ACRONYMS

| | |
|---|---|
| AC | age class |
| ANOVA | analysis of variance |
| BLM | Bureau of Land Management |
| BWG | Biological Work Group |
| CPUE | catch-per-unit effort |
| DEM | digital elevation model |
| DOI | U.S. Department of the Interior |
| EC | Executive Committee |
| GPS | Global Positioning System |
| HMU | hydro morphological unit |
| IBMA | Initial Biological Monitoring Area |
| N/A | not applicable |
| NDOW | Nevada Department of Wildlife |
| NSE | Nevada State Engineer |
| NTU | nephelometric turbidity units |
| QA | quality assurance |
| QC | quality control |
| SNWA | Southern Nevada Water Authority |
| TRP | Technical Review Panel |
| UDWR | Utah Division of Wildlife Resources |
| USFWS | U.S. Fish and Wildlife Service |
| UTM | Universal Transverse Mercator |
| VFRM | Valley-floor Rocky Mountain |

## ABBREVIATIONS

| | |
|---|---|
| °F | degrees Fahrenheit |
| cfs | cubic feet per second |
| cm | centimeter |
| $cm^2$ | square centimeter |
| fps | feet per second |
| ft | foot |
| km | kilometer |
| L | liter |
| m | meter |

## ABBREVIATIONS (CONTINUED)

| | |
|---|---|
| mg | milligram |
| $mi^2$ | square mile |
| mm | millimeter |
| mS | millisiemens |
| µS | microsiemen |
| sec | second |

# 1.0 INTRODUCTION

This report satisfies a requirement of the Stipulation for Withdrawal of Protests signed by the U.S. Department of the Interior (DOI) and SNWA on September 8, 2006. Specifically, the Southern Nevada Water Authority (SNWA) prepared this report to satisfy the requirements of the Biological Monitoring Plan for the Spring Valley Stipulation (Plan) (Biological Work Group, 2009), which was approved by the Stipulation Executive Committee (EC) in January 2009. The biological data contained in this report were submitted to the Biological Work Group (BWG) under the Stipulation.

This plan had also been approved by the Nevada State Engineer (NSE) on January 23, 2009 under the recently-vacated NSE Ruling 5726.

## 1.1 Background

Under the recently-vacated NSE Ruling 5726 (issued April 16, 2007), SNWA had been granted groundwater rights in Spring Valley Hydrographic Basin 184 for municipal and domestic purposes under permits 54003 through 54015, inclusive, as well as 54019 and 54020. The Ruling required the development of biologic and hydrologic monitoring plans, which were approved by the NSE on January 23, 2009.

On September 8, 2006, prior to the NSE hearing for applications 54003-54020, a Stipulation for Withdrawal of Protests (Stipulation) was established between SNWA and DOI on behalf of the Bureau of Indian Affairs, Bureau of Land Management (BLM), National Park Service, and U.S. Fish and Wildlife Service (USFWS) (collectively known as the DOI Bureaus). Exhibits A and B of the Stipulation require the development of biologic and hydrologic monitoring plans. As part of the Stipulation, an EC was established to oversee the implementation of the agreement. The BWG and hydrologic Technical Review Panel (TRP), composed of representatives of parties to the stipulation, were established to develop and oversee implementation of biological and hydrologic monitoring and mitigation plans, review program data, and modify the monitoring plans, if necessary.

Since the issuance of Ruling 5726, an opinion by the Nevada Supreme Court concluded that the NSE must re-notice SNWA's original groundwater applications and reopen the protest period (Great Basin Water Network, et. al. v. NSE, et. al., June 17, 2010). The NSE subsequently released an interpretation of the opinion on July 7, 2010, indicating that once the applications are re-noticed, the hearing process will be completed within one year from the deadline for filing protests.

The Stipulation, which is specific to SNWA's water rights applications 54003-54020 in Spring Valley Hydrographic Basin, remains valid and binding. SNWA submits this annual report to the BWG and EC as required by the Stipulation, and to the NSE.

## 1.2 Major Activities Performed in 2010

Major activities associated with the Biological Monitoring Plan performed in 2010 were as follows:

- Submitted the Spring Valley Stipulation Biological Monitoring Plan 2009 Annual Report to the BWG, EC and NSE (March 2010).

- Completed spring, summer, and fall monitoring as required by the Plan, in conjunction with BIO-WEST, Inc., and KS2 Ecological Field Services, LLC:

  - Conducted aquatic monitoring in spring and fall 2010.
  - Conducted vegetation monitoring in summer 2010.
  - Conducted Big Springs Creek/Lake Creek monitoring in fall 2010.

- Applied for and received Nevada Department of Wildlife (NDOW) Scientific Collection Permits and Utah Division of Wildlife Resources (UDWR) Certificates of Registration for Collect/Possess/Release.

- Invited the BWG Federal parties and State participants to participate in field activities.

- Pursued property access for biological monitoring on private land. In 2009, property access was granted for all private lands identified in the Plan, with the exception of one spring site. In 2010, access was granted for all private lands identified in the Plan.

- Submitted the 2009 Annual Report to private landowners of monitoring sites, as requested.

- Finished development of a Relational Database Management System to ensure data integrity, security, and transparency.

- Uploaded 2009 and 2010 datasets into the secure Relational Database Management System.

- Submitted data via the data-exchange web site accessible by the NSE, EC, TRP, and BWG.

- Presented 2009 data collection efforts at the BWG annual meeting (January 11-12, 2010).

- Implemented activities outlined in Section 4.0 of the Spring Valley Stipulation Biological Monitoring Plan 2009 Annual Report (SNWA, 2010; Section 4.0, Anticipated Biological Monitoring Plan-Related Activities in 2010).

- Implemented methods changes agreed upon in the BWG annual meeting (January 11-12, 2010) during the 2010 field season.

### *1.3 Purpose and Scope*

This report provides the NSE, EC, and BWG with a summary of data collected in 2010 from biological monitoring sites as outlined in the Plan. The locations of the monitoring sites within the Initial Biological Monitoring Area (IBMA) are presented in Figure 1-1. Included in this report are summaries of data collection efforts concerning physical habitat mapping, site assessment, water quality, springsnail, macroinvertebrate, northern leopard frog (*Rana pipiens*), relict dace (*Relictus solitarius*), Big Springs Creek/Lake Creek native fish community, Pahrump poolfish (*Empetrichthys latos*), vegetation, Valley-floor Rocky Mountain juniper (VFRM juniper, *Juniperus scopulorum*; i.e., swamp cedar), and fixed station photography survey efforts.

Section 2.0 presents the status and methods for data collected under the Biological Monitoring Plan. Section 3.0 presents the results of the 2009 data collection. Section 4.0 discusses the planned activities for 2010, and Section 5.0 provides a list of references. Lastly, Appendix A through Appendix E present images, tables, and graphs of the various data discussed in the report.

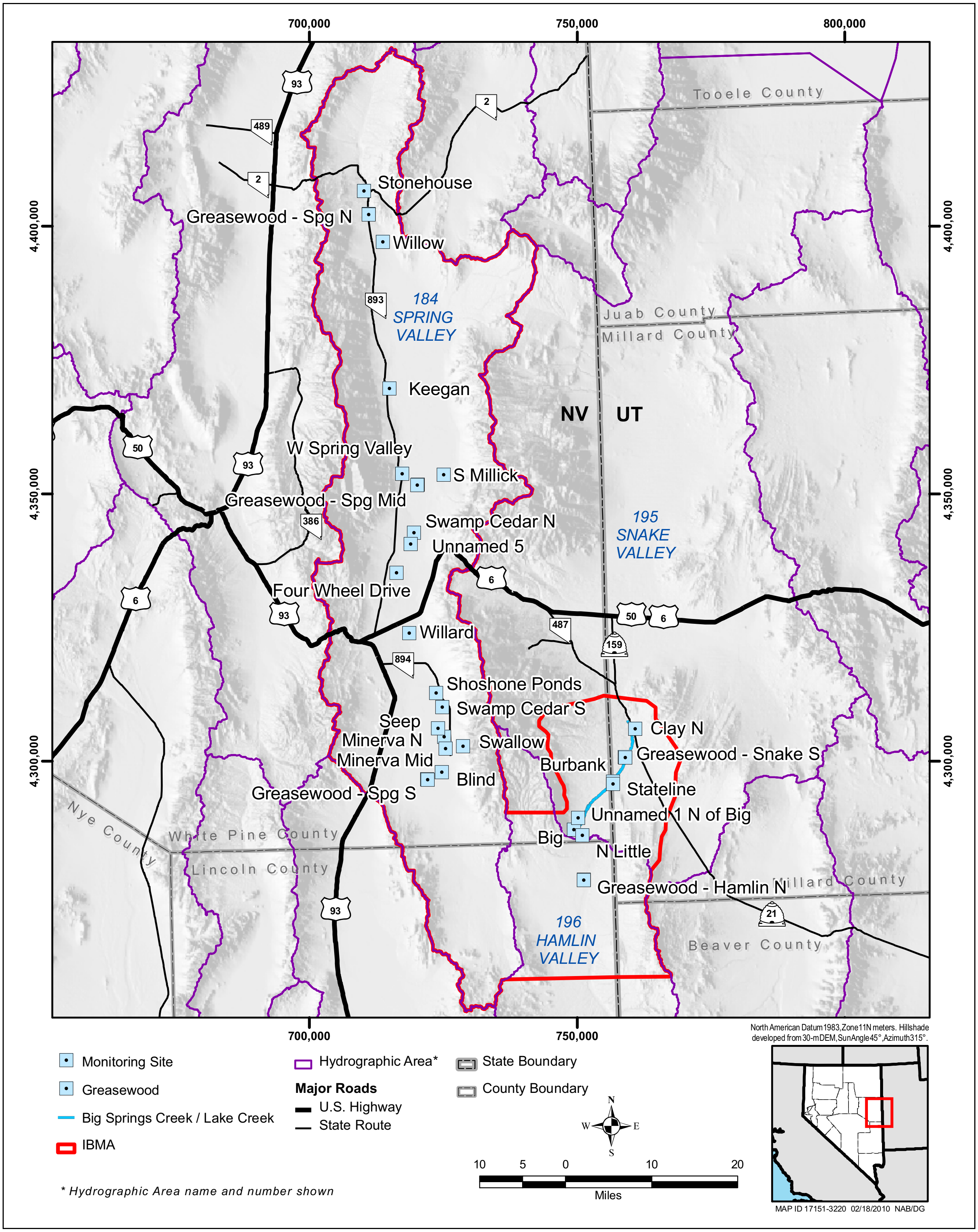



**Figure 1-1**
**Locations of Biological Monitoring Sites within the IBMA**

# 2.0 BIOLOGICAL MONITORING PROGRAM STATUS AND METHODS

This section presents the status and methods for data collected in 2010 under the Biological Monitoring Plan for the Spring Valley Stipulation (Plan) (Biological Work Group, 2009). Survey sites and methods described in the Plan and the Spring Valley Stipulation Biological Monitoring Plan 2009 Annual Report (SNWA, 2010) were followed, along with methods changes agreed upon in the BWG annual meeting on January 11-12, 2010. Detailed standard operating and chain-of-custody procedures were used in the collection and maintenance of the laboratory samples and field data. Protocols were followed to prevent the translocation of hazardous nuisance and invasive species among monitoring sites. Statistics were conducted in SYSTAT version 13.00.05.

Data were collected during the following time periods in 2010:

- March 9 through April 21: Northern leopard frog surveys
- May 3 through May 20: Spring aquatic surveys
- June 28 through August 13: Summer vegetation cover and composition survey
- August 5 and 11: Summer NDOW Pahrump poolfish survey at Shoshone Ponds
- August 3 through August 17: Summer VFRM Juniper tree survey
- August 30 through September 22: Fall aquatic surveys

## 2.1 Physical Habitat Mapping

Physical habitat mapping was conducted at all spring and pond sites during spring (May 3-12) and fall (August 30 - September 13) 2010, and at all creek reaches during fall (September 15) 2010, in accordance with the Plan. Physical-habitat-mapping monitoring sites are presented in Figure 2-1.

Physical habitat mapping was based on four categories that were combined to define habitat types: (1) hydro morphological unit (HMU: pool or channel); (2) depth (range); (3) velocity (range); and, (4) percent emergent vegetation (range). The percent emergent vegetation and velocity ranges modified for the fall 2009 survey were used (emergent vegetation: 0-30%, 30-90%, 90-100%); velocity [m/s]: 0-0.01, 0.01-0.1, 0.1-0.5, >0.5). The perimeter of each physical habitat type was recorded using a Trimble GeoXH Global Positioning System (GPS) Unit. In areas where a distinct boundaries were difficult to define (e.g., pool or channel areas that transitioned into diffuse wetlands), GPS points were taken to identify them as soft boundaries that have a greater margin of error. Areas within mapped pools and channels were used to define the number of sample points per HMU for macroinvertebrate and fish surveys.

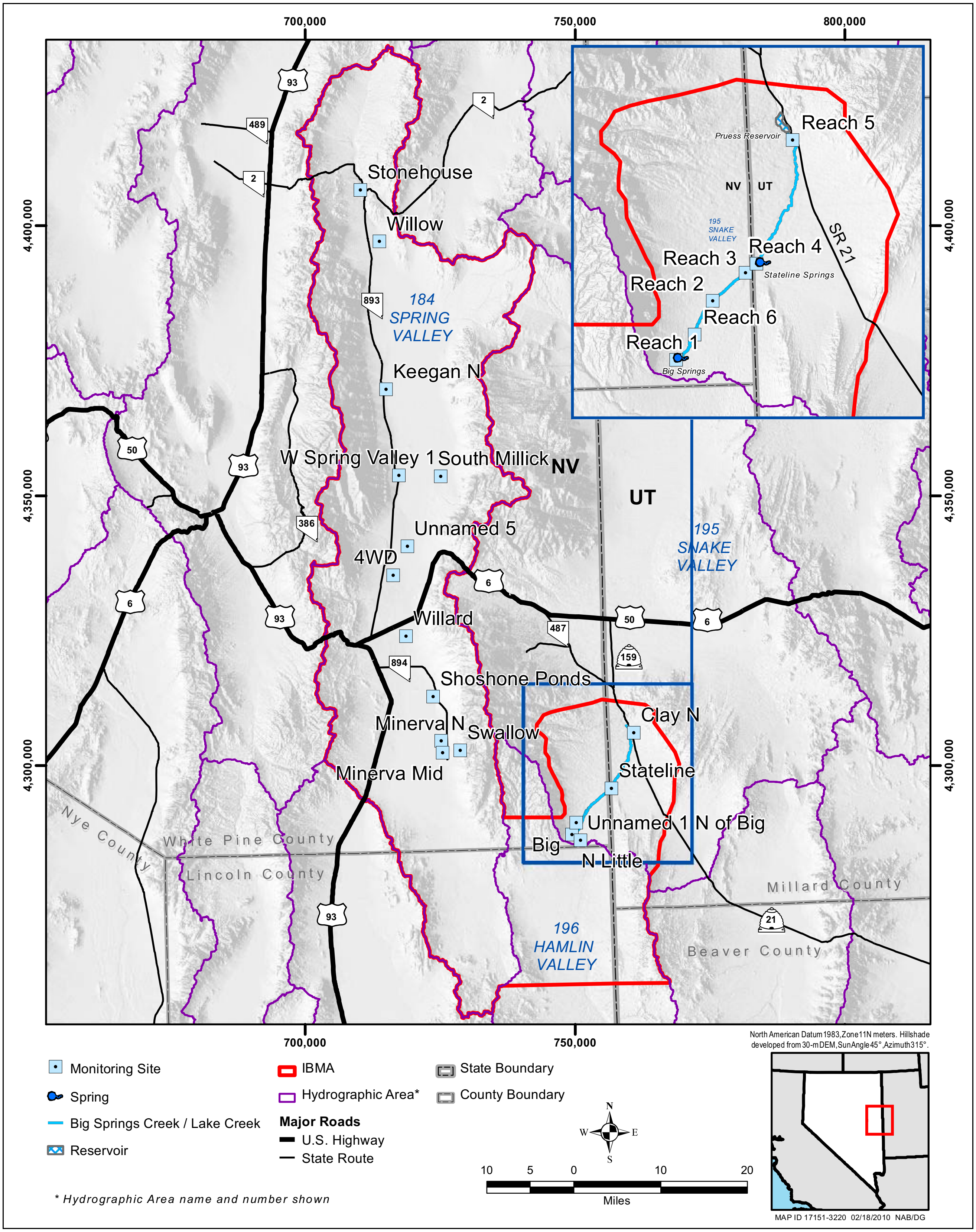



**Figure 2-1**
**Locations of Physical Habitat Mapping Monitoring Sites within the IBMA**

## 2.2 Site Assessment

Qualitative site assessments were conducted at all spring and pond sites during spring (May 3-12) and fall (August 30 - September 13) 2010, and at all creek reaches during fall (September 15) 2010, in accordance with the Plan. Site assessment monitoring sites are presented in Figure 2-2. The assessments were conducted according to Sada and Pohlmann (2006). Overall disturbance ratings are reported for each site: (1) undisturbed, (2) slightly disturbed, (3) moderately disturbed, or (4) highly disturbed.

## 2.3 Water Quality

Water-quality measurements were made at all spring sites during spring (May 10-19) and fall (September 13-22) 2010, and at all creek reaches during fall (September 20) 2010, in accordance with the Plan. All water quality monitoring sites are presented in Figure 2-3. Water-quality measurements were taken at the springhead, a designated midpoint in the springbrook, and a designated endpoint in the springbrook (as established in 2009). Additional water-quality measurements taken for the springsnail, northern leopard frog, relict dace, and Big Springs Creek/Lake Creek native fish community surveys are reported in those respective sections.

Water quality parameters measured were temperature, specific conductivity, pH, dissolved oxygen, turbidity, and velocity. Temperature, conductivity, pH, and dissolved oxygen were measured using a Hydrolab MS5 Multiprobe fitted with a Hydrolab Surveyor 4a readout. Turbidity was measured using a Hach 2100P Portable Turbidimeter. Both instruments were calibrated every morning before the field survey according to manufacturer's specifications. Water velocities were measured with a Marsh-McBirney Flo-Mate 2000 Portable Flowmeter fitted with a standard wading rod. For each parameter, means are reported and paired *t*-tests were conducted to compare years for each season.

Total nitrogen and total phosphorus samples were collected in the springhead of each spring in accordance with the Plan. Samples were collected in sterile containers provided by Weck Laboratories (CA) and stored on ice. The samples were sent via FedEx to Weck Laboratories upon return to Las Vegas from the field. For each parameter, means are reported and paired *t*-tests were conducted to compare years for each season.

One HOBO Water Temp Pro v2 temperature logger was installed in a springhead of each spring site in spring 2009, in accordance with the Plan. Five of the seven temperature loggers that were not located in fall 2009 were recovered in 2010, with the exception of Four Wheel Drive Spring and Willard Spring. Willard Spring was essentially dry in fall 2009 and was abandoned as a temperature logger site. At Four Wheel Drive Spring a second temperature logger was installed in fall 2009, but again was not recovered. Four Wheel Drive Spring was subsequently abandoned as a temperature logger site. Each logger was initially wired to a cinder half-block and placed under the block to prevent the influence of direct sunlight. In 2010, modifications were made to increase recovery and data precision, as agreed upon in the January 11-12, 2010 BWG annual meeting: (1) cinder blocks were replaced with less obvious and smaller red bricks; (2) rebar with orange caps were installed landward of difficult-to-locate loggers; and (3) effort was made to position the loggers to minimize any direct exposure to sunlight. Each logger was programmed to record once per hour, and data were downloaded to a HOBO shuttle during the spring and fall 2010 surveys.

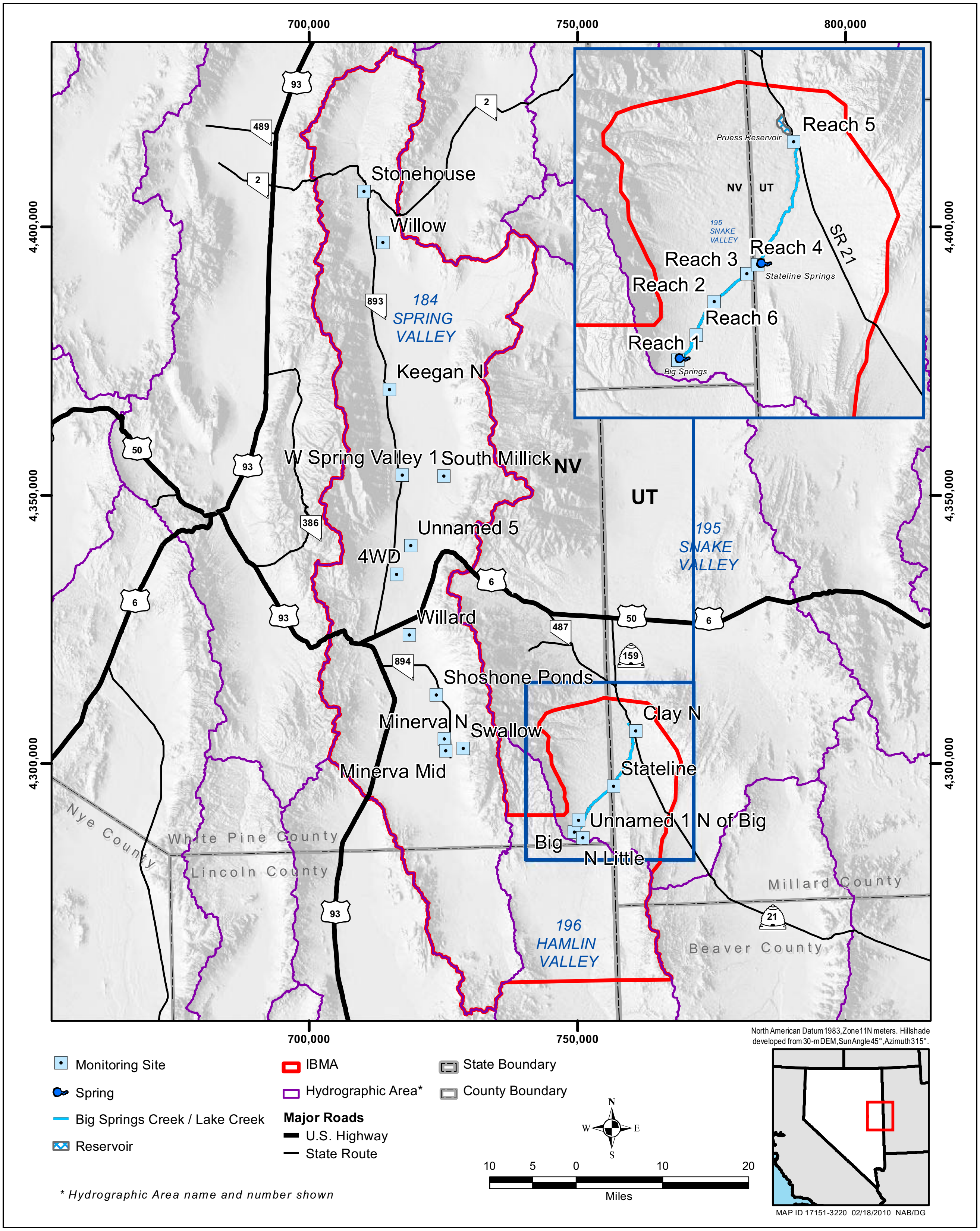



**Figure 2-2**
**Locations of Site Assessment Monitoring Sites within the IBMA**

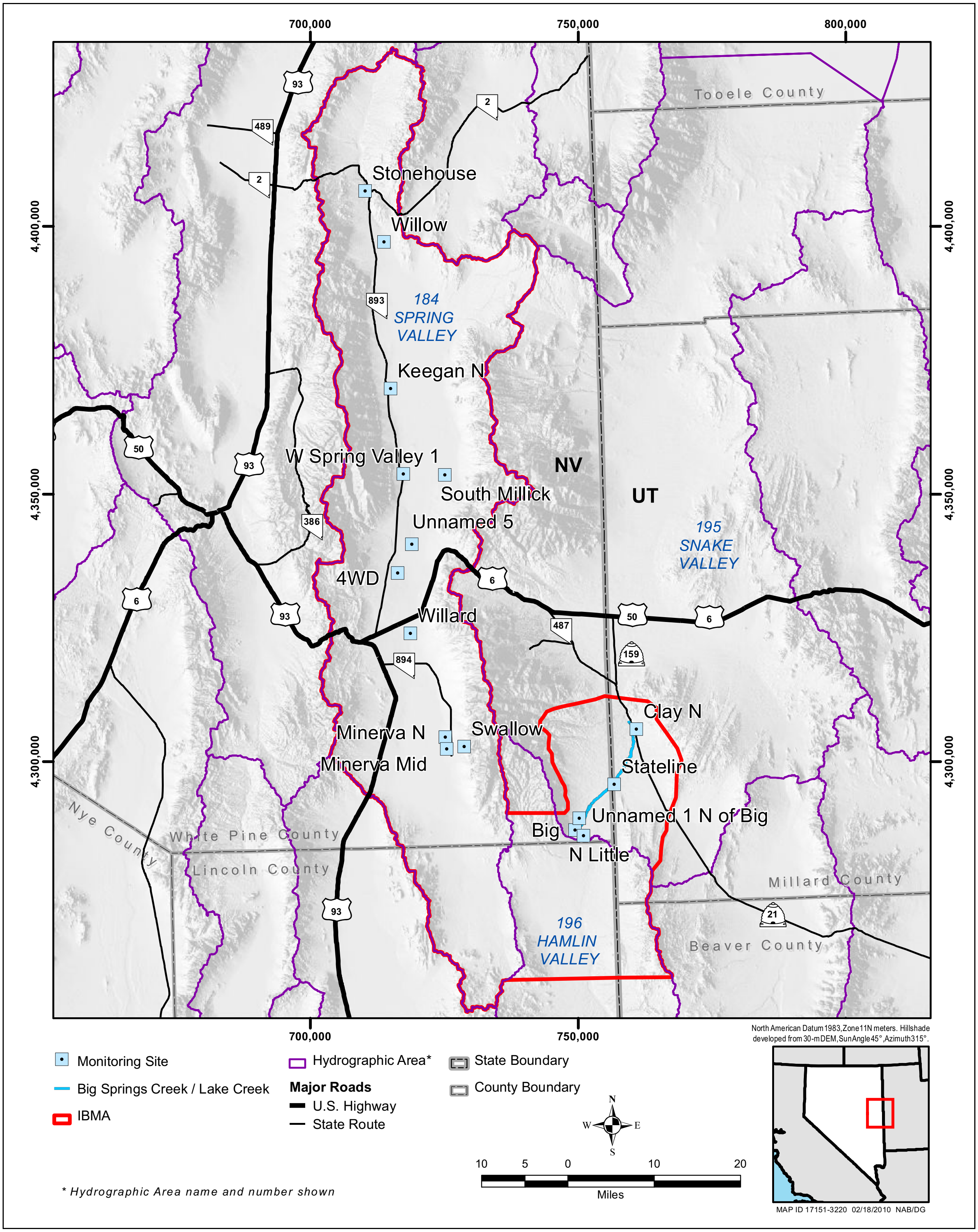



**Figure 2-3**
**Locations of Water Quality Monitoring Sites within the IBMA**

## 2.4 Springsnails

Nine springs were surveyed for springsnails during spring (May 10-19) and fall (September 13-22) 2010, in accordance with the Plan. Within the nine spring sites, a total of 14 channels were surveyed. Springsnail monitoring sites are presented in Figure 2-4.

Surveys at each site began with a systematic search along the channel for springsnail presence. Once the springsnail extent was determined, up to 20 transects $\geq$ 2.5 m apart were placed approximately equidistant from the spring source to the end of the springsnail extent, and quadrats were placed at five evenly spaced points along each transect. In springbrooks that were too narrow to accommodate five points, a minimum of three quadrats within the narrow transect were placed. A maximum of 100 points along any given springsnail extent were sampled, with one to two channels sampled per site (established in 2009). Starting downstream, springsnails were counted in each 25.0 $cm^2$ quadrat using a modified Surber sampler with a 5.0×5.0 cm frame opening and 700-micron mesh netting.

Habitat data (substrate type, presence/absence of filamentous algae and submerged vegetation, percent emergent vegetation cover, water velocity, and water depth) were collected at each quadrat. Because of dense vegetation, muddy conditions, shallow water, and rocky substrates, velocity was not measurable at some quadrats. Water quality parameters (temperature, conductivity, pH, and dissolved oxygen) were also measured at each transect. Wetted width and Universal Transverse Mercator (UTM) coordinates were also recorded at each springsnail transect.

For locations where springsnails did not occur along a linear extent (Unnamed 5 Spring and a portion of Stonehouse Spring Complex [springheads A-D]), presence/absence surveys were conducted in lieu of springsnail counts, as agreed upon in the BWG annual meeting on January 11-12, 2010. The presence/absence survey protocol established by the BWG on September 9, 2010 was followed.

Descriptive statistics are reported for springsnail extent, transects and sampling points, total and mean springsnail counts, and habitat values (water temperature, dissolved oxygen, conductivity, pH, water velocity, water depth and percent emergent vegetation cover). Mean springsnail count per sampling point (quadrat) and standard error of the mean were calculated to provide a standard way to compare springsnail count across channels and time. Because transects did not help explain variation in the linear mixed model analysis, means were calculated across quadrats.

Linear Mixed Model analysis was conducted to compare years and seasons by channel (Model: Springsnail Count = Year Season Year*Season). Restricted maximum likelihood estimation was used to fit the model. The variables *year* (categorical values 2009, 2010), *season* (categorical values spring, fall) and *year*season* were fixed effects. The variable *transect* was initially included in the first mixed model run as a random variable, but because it did not help to explain variation and reduced power it was subsequently removed from the model.

The distribution of springsnail counts along each springsnail extent in spring and fall 2009 and 2010 is shown in graphical format. Distribution is the mean springsnail count/quadrat calculated for each transect, charted from the springhead to the end of the springsnail extent. For graphing purposes, transects are assumed to be absolutely equidistant, and the first and last transect are assumed to be at the absolute start and end of the springsnail extent.

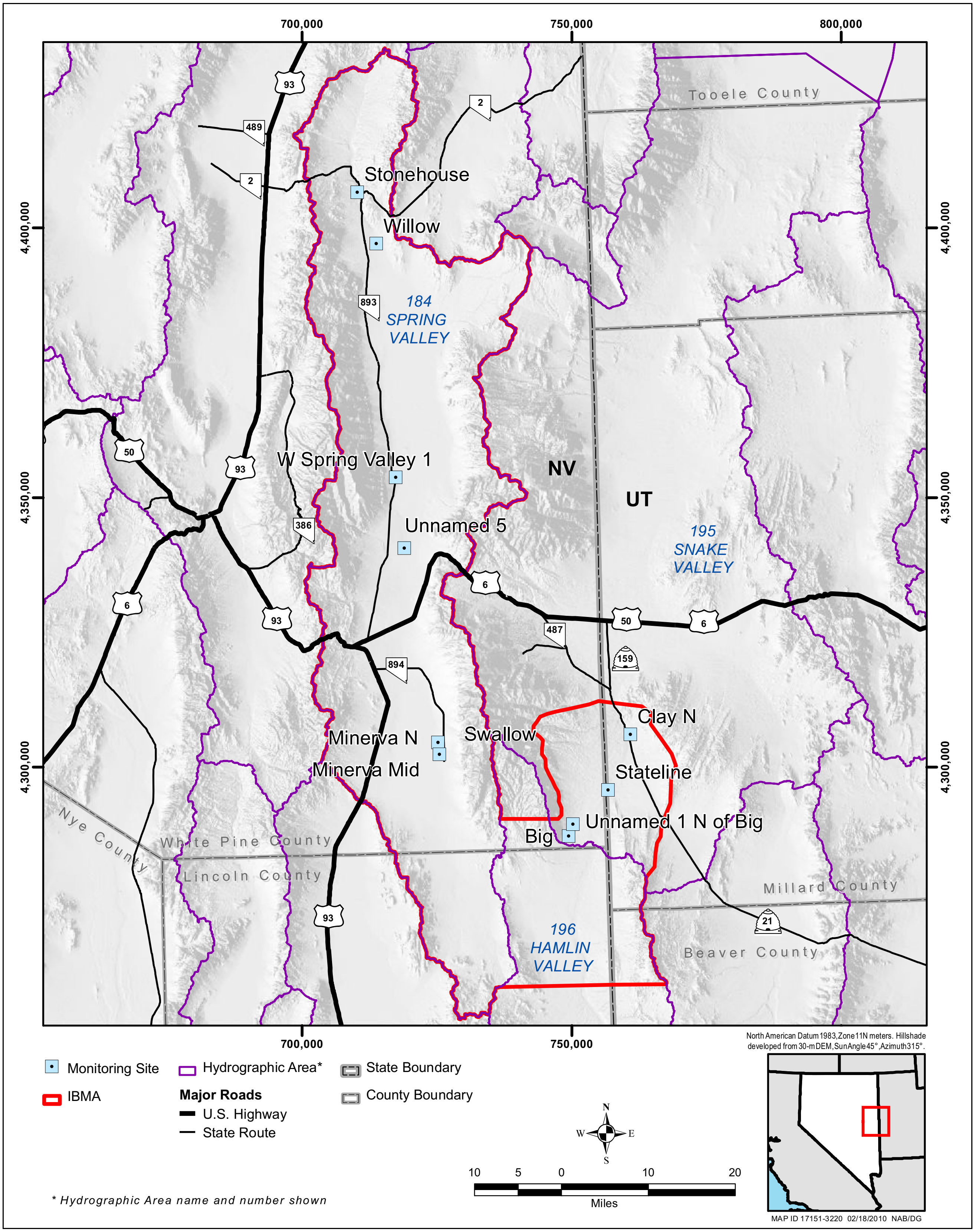



**Figure 2-4**
**Locations of Springsnail Monitoring Sites within the IBMA**

## 2.5 Macroinvertebrates

Thirteen springs were surveyed for macroinvertebrates during spring (May 10-19) and fall (September 13-22) 2010, and at all creek reaches during fall (September 20) 2010, in accordance with the Plan. Macroinvertebrate monitoring sites are presented in Figure 2-5.

Sampling followed the U.S. Environmental Protection Agency rapid bioassessment protocol, which involves 20 total samples combined into one composite sample (Barbour et al., 1999), as described in the Plan. Sampling locations were first stratified across HMUs (pools and channels) as determined by the physical habitat mapping (as described in the Plan), and within those HMUs the sampling locations were then stratified across space and micro-habitats by biologists in the field (as agreed upon in the BWG annual meeting on January 11-12, 2010). Macroinvertebrate collection began at the downstream end of the reach, and samples were collected in the form of kicks/roils, sweeps, or jabs using a D-frame net with a 250-micron mesh. Composite samples were transferred to a sample container(s) and preserved in 95% ethanol.

Labeled samples were shipped to Rhithron Associates, Inc., of Missoula, Montana (Rhithron), for identification and analysis. At the Rhithron laboratory, standard sorting protocols were applied to achieve representative subsamples of a minimum of 300 organisms. Caton subsampling devices, divided into 30 grids each approximately 5×6 cm, were used. Each individual sample was thoroughly mixed in its jar, poured out, and evenly spread into the Caton tray, and individual grids were randomly selected. The contents of each grid were examined under stereoscopic microscopes. Grid selection and examination continued until at least 300 organisms were counted and identified, with the final grid counted and identified in totality. Detailed laboratory methods are included in Appendix A.

Given the composite nature of the data collection, one set of results was provided per spring site per season, as described in the Plan. Taxa composition (taxonomic, dominant and functional), taxa richness (number of taxa), abundance (number of individuals per taxa in sample), and percent relative abundance (relative abundance of taxa within sample), and scores for various standard bioassessment metrics are included in the laboratory Metrics Reports in Appendix A.

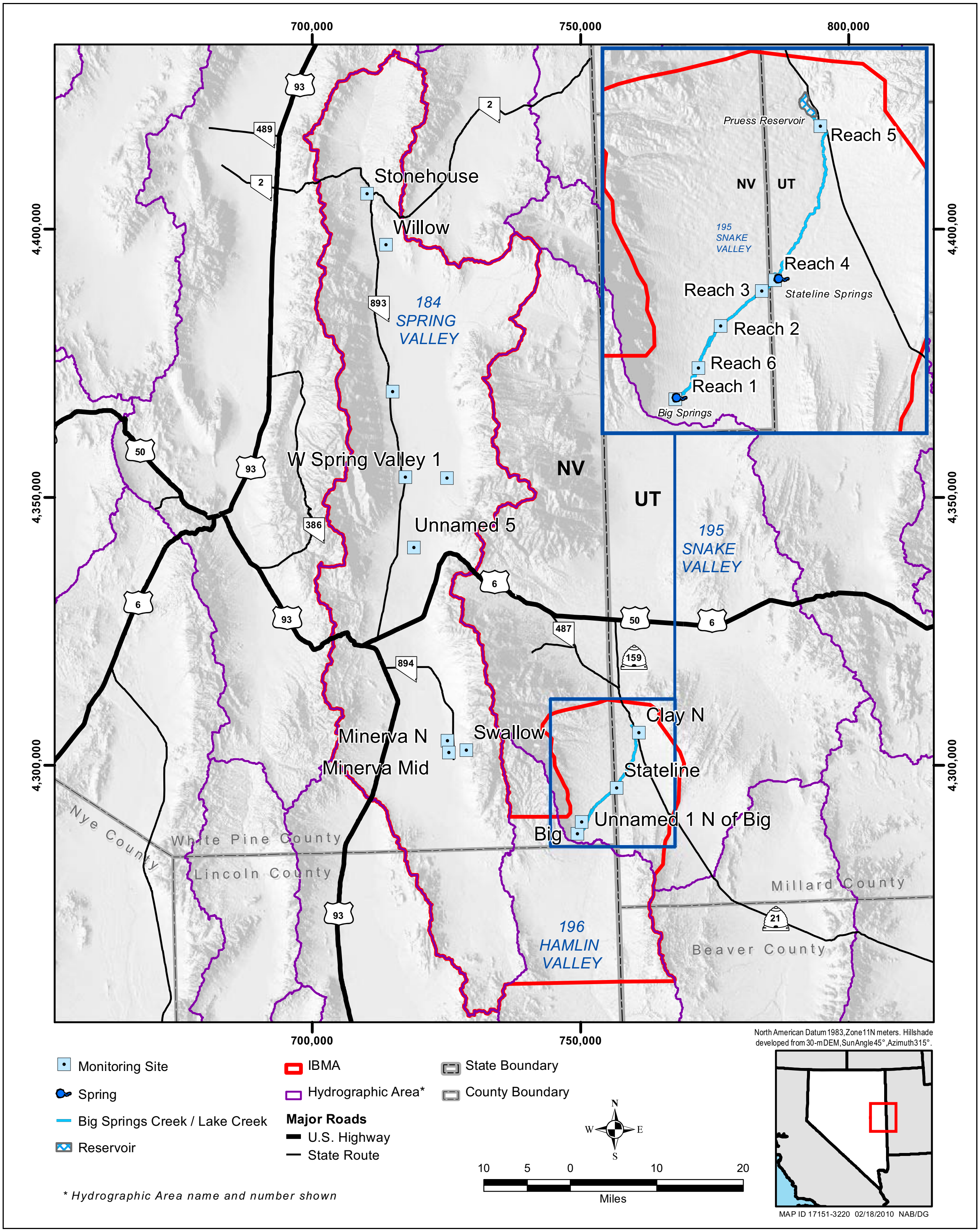



**Figure 2-5**
**Locations of Macroinvertebrate Monitoring Sites within the IBMA**

## 2.6 Northern Leopard Frog (*Rana pipiens*)

Northern leopard frog sampling was conducted at each Stipulation spring and pond site, as well as along the Big Springs Creek/Lake Creek reaches, during spring 2010 as described in the Plan. This sampling occurred in two phases. Phase one surveys were conducted to determine the presence or absence of northern leopard frogs at Stipulation sites. Phase two surveys were conducted at Stipulation sites with the confirmed presence of northern leopard frogs and focused on counting frog egg masses within the defined sampling. Northern leopard frog presence and egg mass monitoring sites are presented in Figure 2-6.

Both phase one and phase two surveys were conducted during the northern leopard frog breeding season in Spring Valley. The onset of the breeding season was determined by monitoring two sentinel sites (Unnamed 5 Spring and Shoshone Ponds) for the presence of egg masses. The sentinel sites were visited every two weeks starting on March 10, and once egg masses were documented on April 19, presence/absence surveys and egg mass surveys began at the other Stipulation sites.

Phase one surveys were conducted at Stipulation sites with no previous northern leopard frog documentation from April 21 to May 6, 2010. Surveys consisted of two to four biologists walking at a speed no greater than 20 m per minute, around and through the sampling area, including aquatic areas and immediately adjacent wetland areas, to observe northern leopard frogs, tadpoles, egg masses, or to hear calling males. The surveys' begin time and end time was noted.

Phase two surveys were conducted at seven sites with confirmed northern leopard frog presence (Keegan Spring Complex North, West Spring Valley Complex 1, Shoshone Ponds, South Millick Spring, Unnamed 5 Spring, Minerva Spring Complex Middle, and Minerva Spring Complex North) from March 10 to May 18, 2010. The surveys consisted of two to four biologists walking around and through the sampling area and immediately adjacent wetlands at a speed no greater than 20 m per minute. The surveys' begin time and end time was noted. Once an egg mass was located, it was given a unique number, marked with GPS, and flagged. If the egg mass occurred in a cluster (egg masses within one foot of each other), only one GPS point was taken at the center of the cluster. Using UDWR protocol, each egg mass was classed by age (AC 1= small, circular ova; AC 2 = kidney shaped ova; AC 3 = tailed embryos close to hatching; AC+3/hatched = hatched tadpoles; and dead = white embryos, fungus on egg mass). Once an egg mass survey was conducted at a particular site, the site was visited at 2-week intervals until at least three egg mass surveys had been conducted at the site. During subsequent visits, previously flagged egg masses were checked for development, and any new egg masses were documented.

Habitat data (water depth, distance from shoreline, and percent emergent vegetation) were collected at each egg mass upon first documentation. Percent emergent vegetation was estimated for a 0.5 m radius circle around each egg mass, as agreed upon in the BWG annual meeting on January 11-12, 2010. Water quality data (conductivity, pH, temperature, and dissolved oxygen) were collected at each breeding pool near the end of the breeding season (May 10 to May 13, 2010).

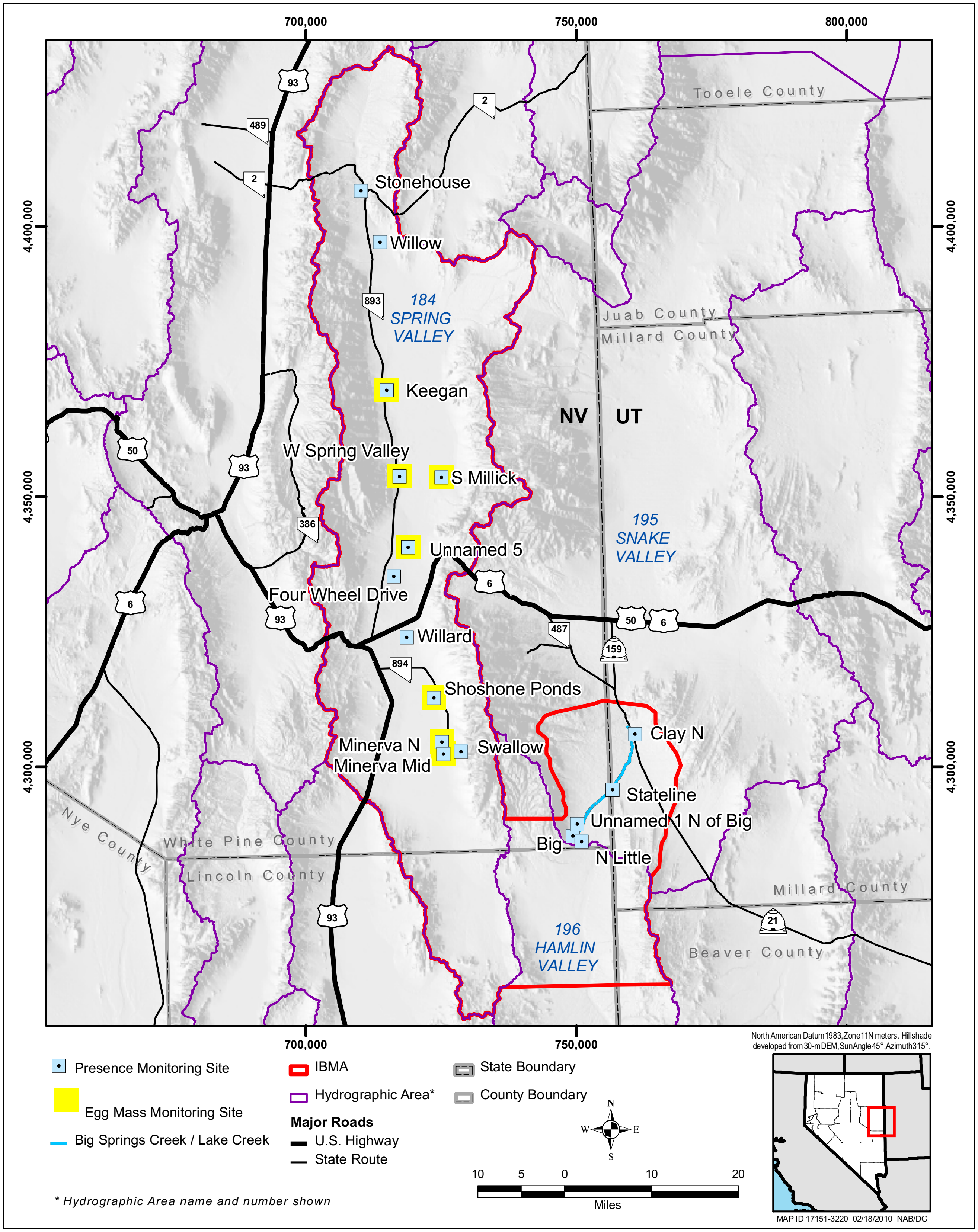



**Figure 2-6**
**Locations of Northern Leopard Frog Monitoring Sites within the IBMA**

## 2.7 Relict Dace (*Relictus solitarius*)

Relict dace were sampled at Stonehouse Spring Complex and Keegan Spring Complex North during spring (May 11-13) and fall (September 21–23) 2010, in accordance with the Plan. Relict dace were also sampled at Shoshone Ponds by NDOW in summer 2010. All three relict dace monitoring sites are presented in Figure 2-7.

### 2.7.1 Keegan and Stonehouse Spring Complexes

In spring, the pool and channel habitats of the designated sampling areas at Keegan and Stonehouse Spring Complexes were mapped (Appendix B). Sampling locations were first stratified across HMUs (pools and channels) as determined by the physical habitat mapping (as described in the Plan), and within those HMUs the sampling locations were then stratified across space and micro-habitats by biologists in the field (as agreed upon in the BWG annual meeting on January 11-12, 2010). Within each HMU, two-thirds of the minnow traps were standard 6-mm mesh (large mesh) traps and one-third were 3-mm mesh (small mesh) traps, in accordance with the Plan. Twenty-six large mesh and 13 small mesh traps were placed at Keegan Spring Complex North, and 20 large mesh and 10 small mesh traps were placed at Stonehouse Spring Complex. The small mesh traps were used to capture a full range of fish size classes for measuring fish length, as the larger mesh traps may not hold smaller fish.

At each relict dace sampling point, a Gee minnow trap baited with dry dog food was placed in water deep enough to submerge the trap entrances. All sampling points were recorded by GPS. These same points were used in the fall 2010 sampling effort. Traps were set in the afternoon, no later than three hours before sunset, and checked the next morning, no earlier than three hours after sunrise. The habitat, mesh size of the trap (small or large), time of trap placement and removal, and the weather conditions (cloud cover, wind, and air temperature) were recorded. Upon retrieval of a trap, captured relict dace were placed in a bucket and counted. Fish removed from small mesh traps were measured (in millimeters) for total length, with at least 25 randomly selected fish from each habitat type measured. To prevent recaptures, fish were not released until all traps in the immediate vicinity had been collected.

Relative abundance and age class structure were evaluated using catch-per-unit effort (CPUE) and fish lengths. General Linear Model analysis was conducted to compare seasons and HMUs (pool vs. channel) by site and year (Model: CPUE or fish length = Season HMU Season*HMU). A Tukey's Pairwise Comparisons analysis followed to conduct a multiple comparison of HMUs within and across seasons, by site and year. General Linear Model analysis was also conducted to compare years and HMUs by site and season (Model: CPUE or fish length = Year HMU Year*HMU).

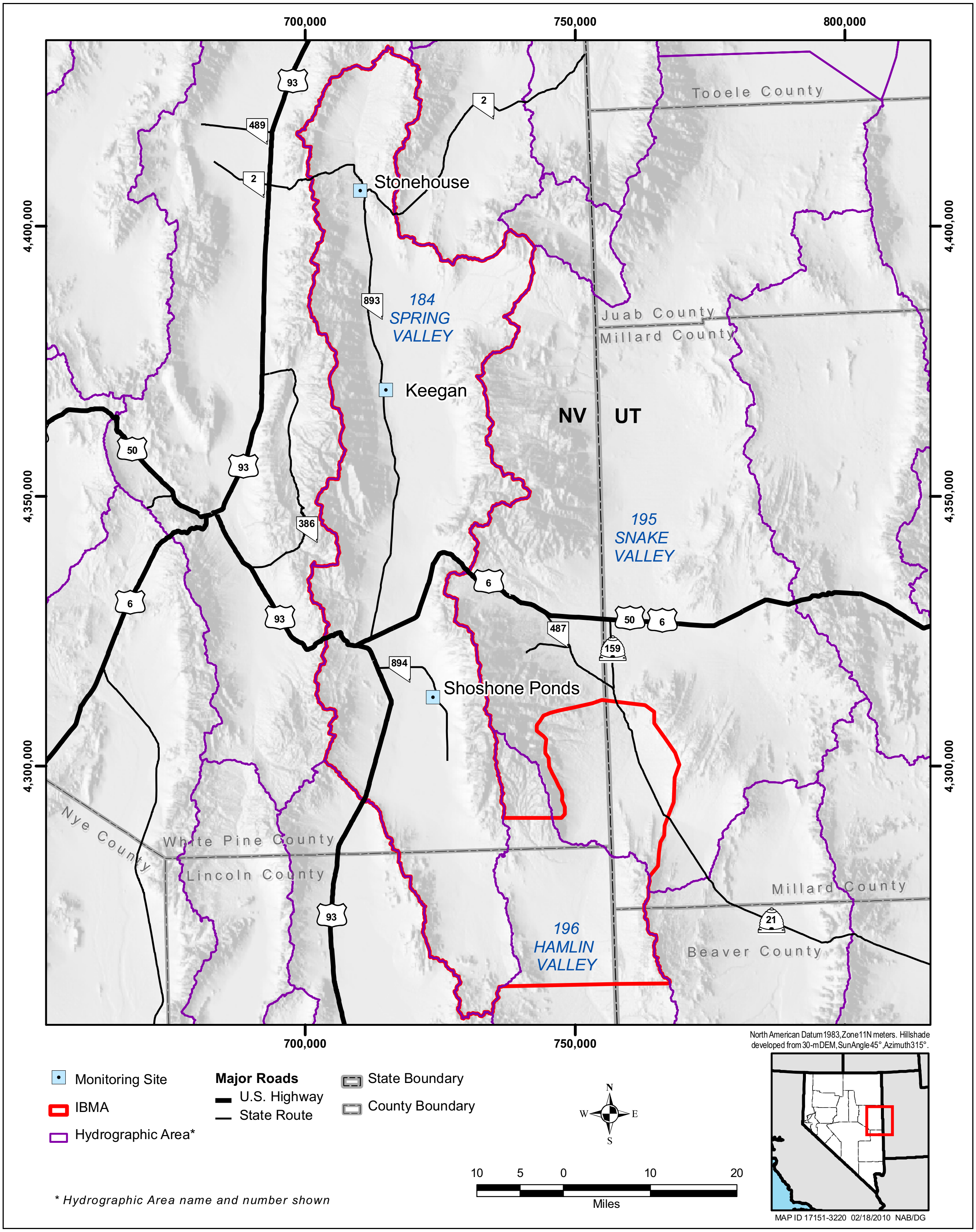



**Figure 2-7**
**Locations of Relict Dace Monitoring Sites within the IBMA**

### 2.7.2 Shoshone Ponds

NDOW leads an annual sampling effort of relict dace at Shoshone Ponds, which was integrated into the Plan. SNWA supported this effort in summer 2010. The sample area is the Fish Refugia Pond 3 (South Pond).

On August 5, 2010, relict dace were captured, measured, and marked at the Shoshone South Pond using minnow traps. On August 11, 2010, relict dace were again captured at the pond, and all marked and unmarked fish were counted. Using the mark-recapture data, a population estimate for South Pond was derived. For detailed methods, see the complete 2010 NDOW field trip report in Appendix C.

## 2.8 Pahrump Poolfish (*Empetrichthys latos*)

NDOW leads an annual sampling effort of Pahrump poolfish at Shoshone Ponds, which was integrated into the Plan. SNWA supported this effort in summer 2010. The Shoshone Pahrump poolfish monitoring site is presented in Figure 2-8. The sample area includes the Fish Refugia Ponds 1 and 2 (North and Middle Ponds) and a large stock pond.

On August 5, 2010, Pahrump poolfish were captured, measured, and marked at the Shoshone Middle, North, and Stock Ponds using minnow traps. On August 11, 2010, Pahrump poolfish were again captured at these three ponds, and all marked and unmarked fish were counted. Using the mark-recapture data, population estimates for each pond were derived. For detailed methods, see the complete 2010 NDOW field trip report in Appendix C.

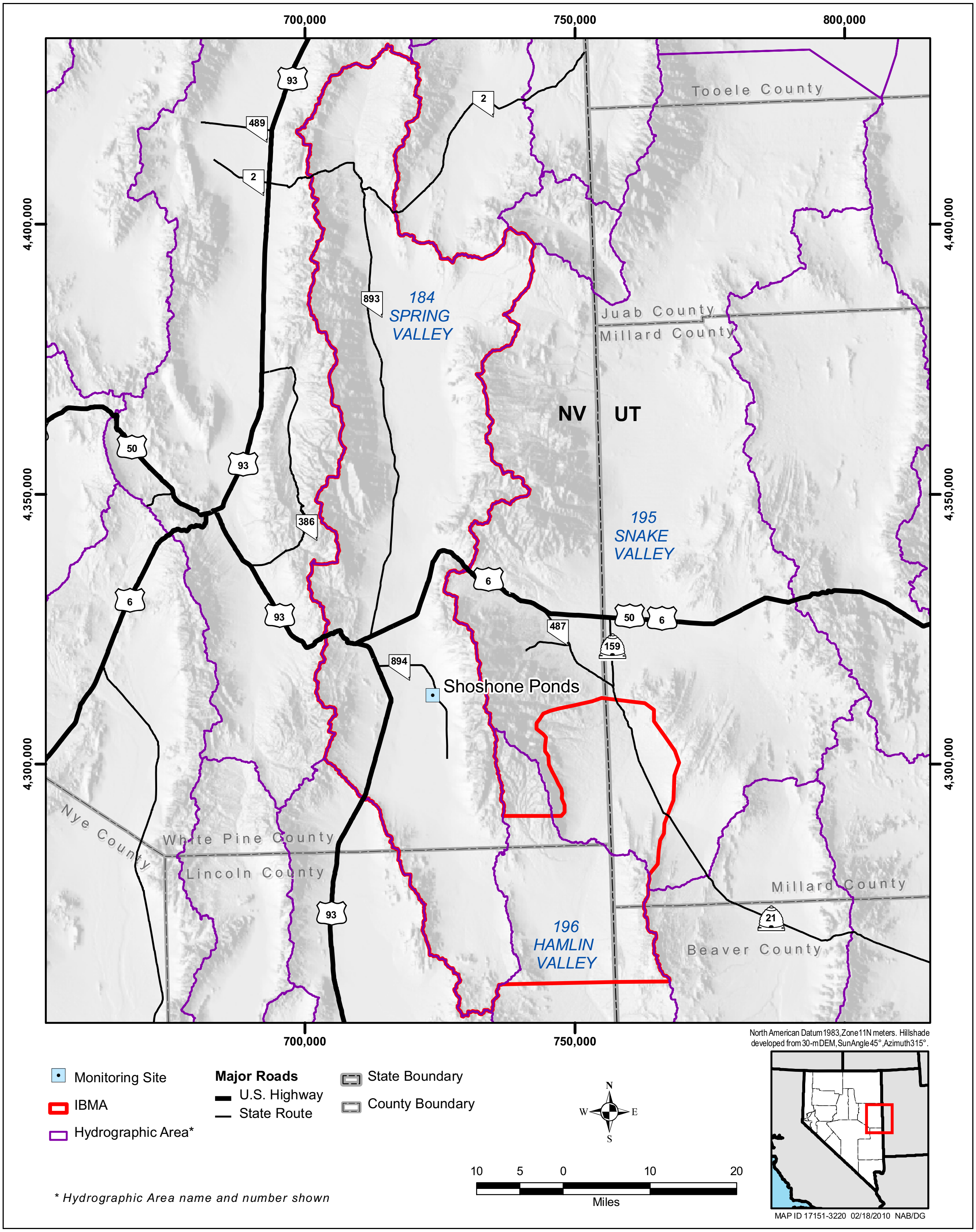



**Figure 2-8**
**Locations of Pahrump Poolfish Monitoring Sites within the IBMA**

### 2.9 Big Springs Creek/Lake Creek Native Fish Community

Fish inhabiting the Big Springs Creek/Lake Creek system were sampled by electrofishing along six permanent 100-m reaches August 31-September 1, 2010, in accordance with the Plan. The reaches include the creek outflow of Big Springs, three stretches of Big Springs Creek on BLM land, a stretch of Lake Creek along Stateline Springs, and the Lake Creek inflow to Pruess Lake.

- Reach 1 is approximately 200 m downstream from the Big Springs springhead (the Plan designated Reach 1 to originate at the springhead, but wire fencing necessitated positioning the reach 200 m downstream).
- Reach 2 is approximately 7 km downstream of Big Springs;
- Reach 3 is approximately 1.2 km upstream of Stateline Springs;
- Reach 4 is at Stateline Springs;
- Reach 5 is approximately 800 m upstream of Pruess Reservoir;
- Reach 6 is between Reaches 1 and 2. As agreed to in the January 11-12, 2010 BWG annual meeting, Reach 6 was added in an effort determine the best placement of reaches between Big Springs and Stateline Springs.

Reaches 1, 2, 3, and 6 were sampled on August 31, 2010, and Reaches 4 and 5 were sampled on September 1, 2010. The start and endpoints of each reach were marked by GPS in 2009 (reaches 1-5) and 2010 (reach 6). Creek monitoring reaches are presented in Figure 2-9.

Fish were sampled by placing a block net at the begin and endpoints of each reach to restrict fish movements into or out of the reach. A three-pass depletion survey was conducted along each reach with a backpack electrofisher (Smith Root LR-24) while three netters captured stunned fish with dip nets. After each pass, the seconds of electrofisher use were recorded, and all captured fish were identified to species and counted. Over the course of the three passes, up to 25 individuals of each fish species were measured to total length in millimeters. The fish were released below the downstream block net immediately after counting and measuring.

Upon completion of the fish sampling at each reach, habitat data were collected along five line-point transects to characterize the general habitat of the reach. The transects were placed at the 0-, 20-, 40-, 60-, and 80-m marks along each 100-m reach and ran the width of the channel. For each transect, the total transect length in centimeters (from bank to bank) was recorded, and the substrate was characterized by a presence of silt, sand, gravel, cobble, and boulder. At each transect centimeter mark, the habitat was classified as no vegetation, emergent vegetation, or submergent vegetation. Water-quality measurements (temperature, specific conductivity, pH, dissolved oxygen, turbidity, and velocity) were also taken at the middle point of each reach at the time of the water quality survey (September 20, 2010).

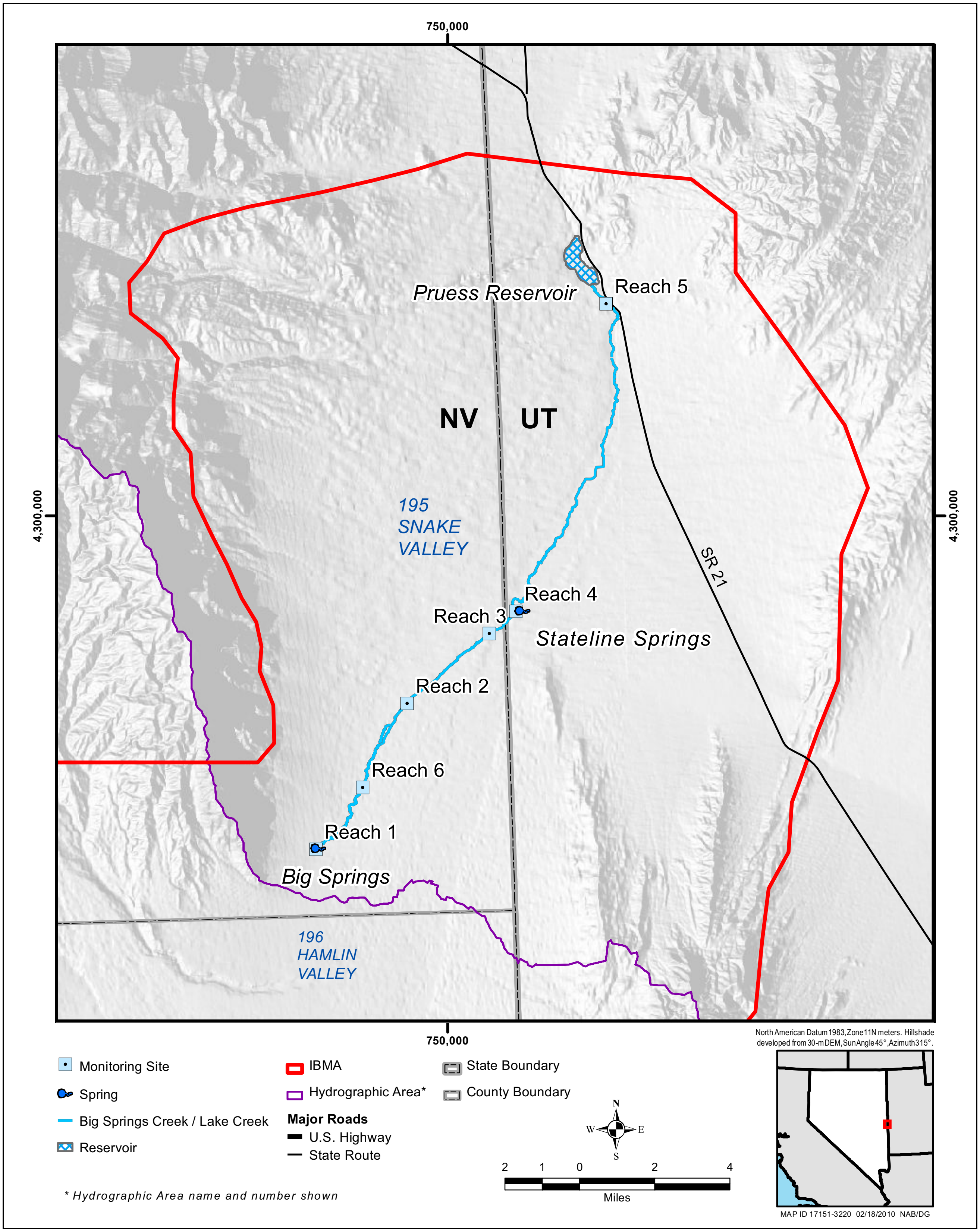



**Figure 2-9**
**Locations of Creek Native Fish Community Monitoring Reaches within the IBMA**

## 2.10 Vegetation

### 2.10.1 Field Data Collection

Vegetation cover and composition surveys were conducted at spring, wetland/meadow, phreatophytic shrubland, and valley floor Rocky Mountain (VFRM) Juniper (swamp cedar, *Juniperus scopulorum*) transects in summer (June 28 - August 13) 2010, in accordance with the Plan. Vegetation monitoring sites are presented in Figure 2-10.

Specifically, vegetation data were collected along the 158 permanent line transects and 32 permanent belt transects established in 2009, in accordance with the Plan. The 158 line transects include 70 aquatic transects (14 sites), 63 wetland/meadow transects (8 sites), and 25 phreatophytic shrubland transects (5 sites). Four of the aquatic transects are included within the lengths of longer wetland/meadow transects. Overall, the line transects varied in length from 4 to 130 m. The 32 belt transects were split between the two VFRM juniper (swamp cedar) woodlands (woodlands), and each 5×20 m belt transect contained three parallel 20-m long line transects.

- Aquatic transects are positioned across or along springheads and spring brooks (Spring and Snake valleys);
- Wetland/meadow transects are in the vicinity of springs, seeps, ponds and creeks (Spring and Snake valleys);
- Phreatophytic shrubland transects are located in greasewood (*Sarcobatus vermiculatus*)-dominated communities, stratified across five IBMA regions (Spring Valley North, Spring Valley Middle, Spring Valley South, Hamlin Valley North, and Snake Valley South);
- Woodland transects are located in the two VFRM juniper-dominated communities in Spring Valley.

Data were collected using the line intercept method, with counts taken at each 1-cm mark along the transect line and recorded, by species or taxa, for each 1-m interval. Data were taken on a multiple-hit basis where all species occurring at each 1-cm mark were counted. Multiple occurrences of the same species (i.e., different strata) at each 1-cm mark were not recorded. Open water was recorded whenever present; if vegetation, bare ground or litter could be seen beneath the water, it was also recorded. If the water was too deep to view the ground surface, litter was assumed to cover the bottom and was recorded (this occurred on productive sites with high vegetation cover, making detritus at ground surface likely). If no live plant material was present, the occurrence of bare ground or litter was recorded. A qualitative measure of soil moisture was also taken at 1-m intervals along the VFRM juniper transects. Methods for collecting VFRM juniper tree data within the belt transects are discussed in Section 2.11.

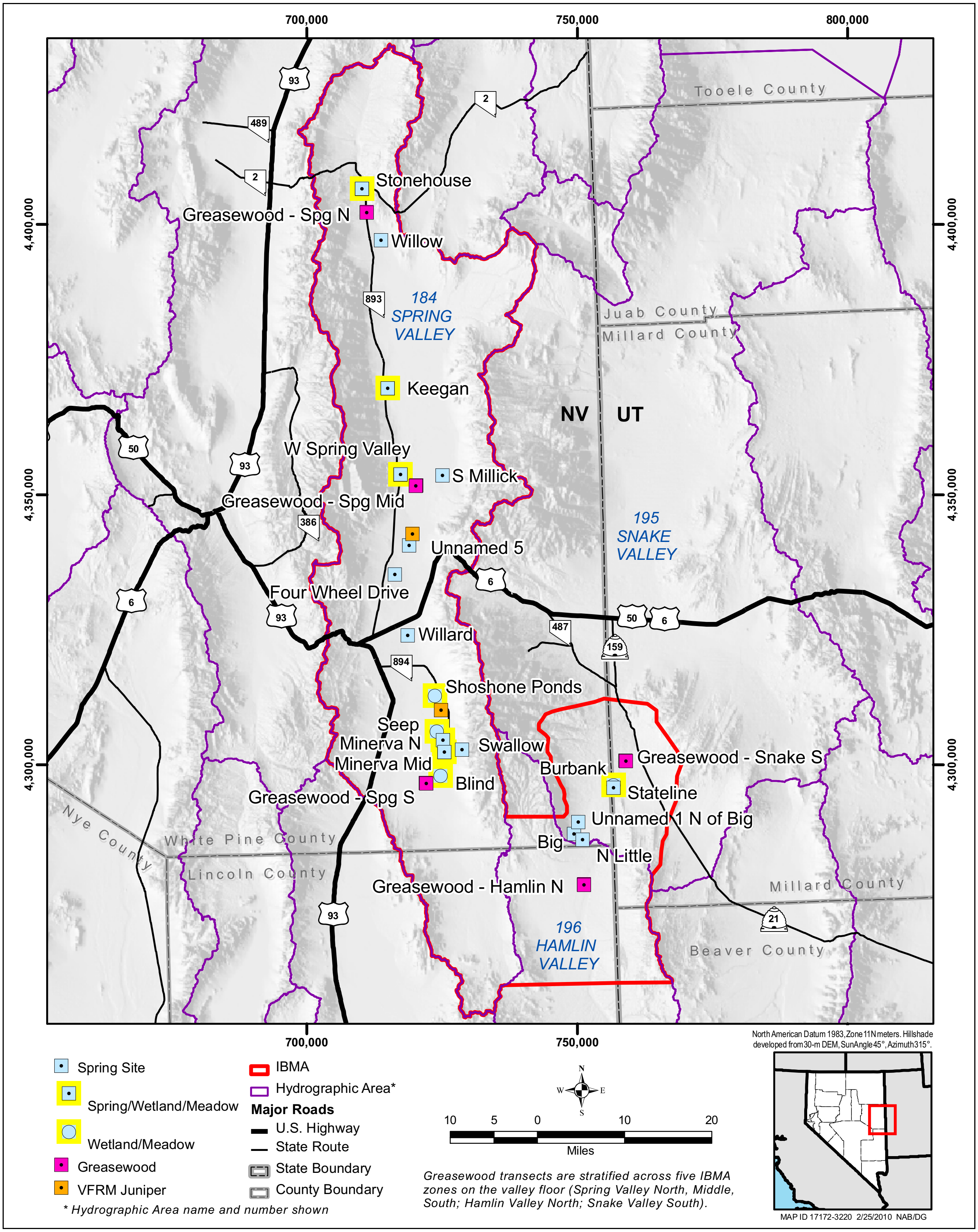



**Figure 2-10**
**Locations of Vegetation Monitoring Sites within the IBMA**

### 2.10.2 Data Analysis

#### *Vegetation Cover - First Hits and Multiple Hits*

Mean live cover multiple hits (MH) is the mean of the live cover values of all species averaged over the number of transects per site, and includes multiple hits per 1-cm mark per meter interval. Multiple hits per 1-cm mark include vegetative cover encountered from all layers (canopy, understory, ground cover) stratified, and with overlap, where the total percent cover for a given species for a 1-m interval can be greater than 100.

Mean live cover first hits (FH) is the mean of the percent of the length of each transect where live vegetation was present, averaged over the number of transects per site (i.e., first-hit counts of live vegetation, not species, only). First-hits are hits where live vegetation is the first hit encountered per 1-cm interval when viewed from above. For example, 18% mean live cover (FH) indicates a birds-eye-view would reveal 18% of the surface area as live vegetative material with the remaining 82% comprised of bare ground, litter, water, dead understory and/or dead canopy.

Although first hit was not recorded in the field, it was determined from the dataset whether live vegetation was the first hit. For each meter, first hit live vegetation was calculated by subtracting the sum of bare ground, litter, water, dead vegetation (i.e., dead during the survey but alive during the 2010 growing season), and/or dead canopy from 100 (the maximum number of first hits possible per meter interval). For transect intervals where dead vegetation or dead canopy was documented, a deduction was made on whether the dead material occurred above or below live vegetation based on the species present and/or information obtained from the field sampling team (for example, in aquatic and wetland meadow transects dead canopy occurred largely as an overstory species with vegetation understory, and therefore for most cases was assumed to be the first hit). Because it was impossible to determine what portion of the dead canopy was above or below live VFRM juniper tree vegetation, mean live cover (FH) was not calculated for the VFRM juniper (swamp cedar) transects.

#### *Number of Taxa and Mean Taxa Richness*

Total number of taxa and mean taxa richness are both reported. Total number of taxa is not independent of transect length, which varies considerably across the aquatic (spring) and wetland/meadow transects (ranging from 5-100 m). Therefore, while total number of taxa are reported, mean taxa richness was used for comparing richness across sites for the aquatic and wetland/meadow transects. Because transect lengths are equal across phreatophytic shrubland transects and across VFRM juniper transects, both total number of taxa and mean taxa richness were used for comparing richness across sites.

Total number of taxa is the total number of taxa or species observed across all transects per site. Mean taxa richness for each transect was calculated by dividing the total number of taxa by transect length (m). Mean taxa richness for each site was calculated by averaging the mean taxa richness across transects (grand mean) for each transect type. The grand mean therefore takes into account the variation between transects, and that a species may occur on more than one transect.

### *Paired t-test*

For each transect, between year differences for mean live cover (overall and for select species) was evaluated using paired *t*-tests. Species for each transect were selected for analysis based on the importance of the species to micro-communities along each transect as well as overall abundance. The most abundant or dominant species were selected based on the greatest percent mean live cover or total number of hits. Additional species with relatively low total percent mean live cover were also selected based on species dominance within micro-communities located along each transect. Both 2010 transect data and spatial heterogeneity schematic diagrams presented in the 2009 annual report (SNWA 2010, Section 3.8: Figures 3-2 through 3-47, showing distributions of dominant species along a hydrologic gradient along each transect) were used as a guide to identify which species were important to the overall and internal spatial heterogeneity (e.g., distribution patterns of micro-communities, including locally dominant species) for each transect.

For each transect, pairing was done by one meter intervals across the 2009 and 2010 datasets (e.g., transect 001, meter interval 000-001 m, 2009 and 2010 data paired; transect 001, meter interval 001-002 m, 2009 and 2010 data paired etc.). The sample size (N) for each species and total live cover was determined by the total length of the transects.

For VFRM juniper transects, means were calculated across the line transects within each belt transect, and analyses were done at the belt transect level.

### *2-Way ANOVA*

Linear Mixed Model analysis was conducted to compare years by site (Model: Mean Live Cover (MH) = Year Transect). Restricted maximum likelihood estimation was used to fit the model. The variables *year* and *transect* were fixed effects.

For the aquatic and wetland/meadow transects, analyses were conducted by site. For the phreatophytic shrubland transects, analyses were conducted by IBMA region (ass identified in the Plan: Spring Valley North, Spring Valley Middle, Spring Valley South, Hamlin Valley North, and Snake Valley South). For the VFRM juniper woodland transects, analyses were conducted by population (Swamp Cedar North and Swamp Cedar South), as well as by Dry Sites and Wet Sites within each of these populations. Transects were categorized as Dry Site or Wet Site using the understory vegetation composition to deduce typical moisture conditions.

### 2.11 Valley Floor Rocky Mountain (VFRM) Juniper (*Juniperus scopulorum*)

Juvenile and mature VFRM Junipers (swamp cedars) were surveyed within two Spring Valley valley-floor populations during summer (August 3-17) 2010, in accordance with the Plan. VFRM Junipers monitoring sites are presented in Figure 2-11. Tree counts, heights, basal circumferences, and stem length data were collected within 32 permanent belt transects (5×20 m transects, 16 transects per population) that were established in 2009. Timing of sampling was designed to correspond to the height of the growing season and the period of greatest water stress.

Counts of juvenile trees (<1 m in height) and mature trees (≥1 m in height) within each of the belt transects were recorded. Heights were recorded to the nearest centimeter for up to 25 trees per age class within each transect, using either a meter stick or a leveling rod. In transects with greater than 25 trees per age class, the subsample of 25 trees was randomly selected. Height measurements were taken for trees up to 950 cm, and any trees above that height were recorded as "greater than 950 cm". In addition to height measurements, circumference measurements (basal at ground level in cm) were taken for the same mature trees. Mature trees that were randomly selected in 2010 were tagged so that the same trees will be used in the subsample in future years. Randomly selected juvenile trees were not tagged due to practical constraints regarding the size of the trees and the size of the tags, therefore a new subsample of juvenile trees will have to be randomly selected each year.

Stem elongation data was collected for the branches tagged in 2009 (4 trees per transect and 10 tags per tree for most transects). The distance from the juncture above the tag to the tip of the leader was measured to the nearest millimeter using a measuring tape or a ruler. Stem elongation for each branch was calculated by subtracting the 2009 length from the 2010 length. Out of the original 1,249 branches tagged in 2009, 1,096 were used in the analysis this year. This difference in branch numbers tagged versus analyzed was due to either a loss of a branch tag, data collection error or possible breakage of the branch. Thirty-five tags were lost between 2009 and 2010, of which 16 (maximum number of branches that could feasibly be re-tagged) were replaced on a new branch and the length was measured. Stem elongation data is not available for tags replaced in 2010 since there is not two years of data at this time.

Negative growth from 2009 to 2010 was recorded on 169 branches of which 98 were eliminated from the data analysis. An observed margin of error was used to determine whether to include branches with negative growth in the analysis. The margin of error was calculated in 2009 by measuring 40 branches twice on the same day. The average difference for the paired measurements was ±4 mm and the greatest difference between the measurements was 11 mm. Any negative growth measurement for 2010 within the greatest margin of error (11 mm) is presumed to be within the measurement variation and included in the analysis. Any negative growth measurement outside the greatest margin of error was presumed to be an error in data collection or a branch that broke off between 2009 and 2010, and was not included in the analysis. Branches were also eliminated from analysis if they had extremely large growth measurements (>100 mm) that appear to be outside the normal range of growth. Twenty branches were eliminated from analysis due to growth measurement exceeding 100 mm as they were presumed to be the result of data collection errors. Data not used in this analysis has been retained in the database and will be available for use in future analyses.

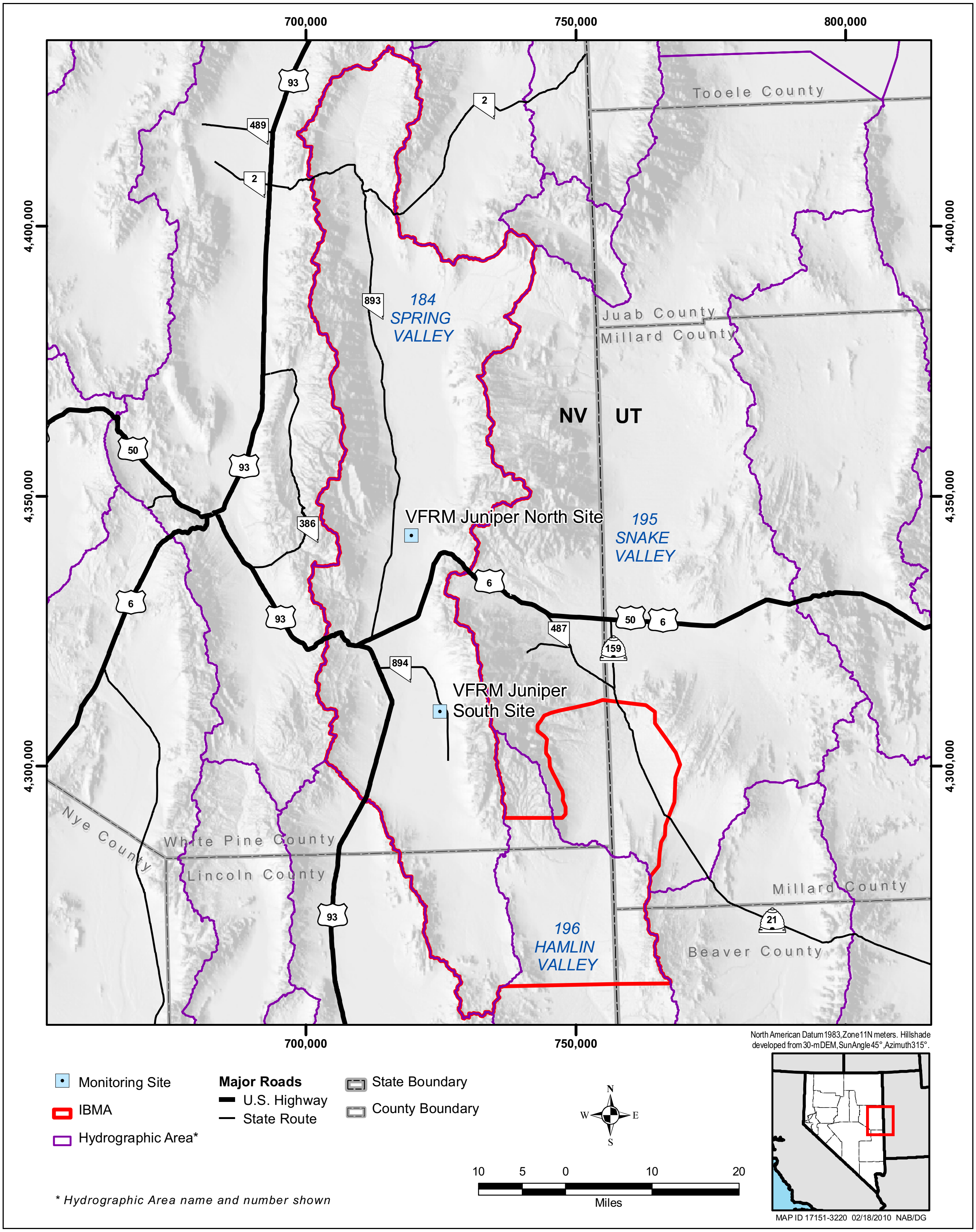



**Figure 2-11**
**Locations of VFRM Juniper Monitoring Sites within the IBMA**

## 2.12 Fixed Station Photography

Fixed station photography was conducted at all spring and pond sites during spring (May 3-12) and fall (August 30 - September 13) 2010, and at all wetland/meadow, phreatophytic shrubland, and VFRM Juniper transects during summer (June 28 - August 13) 2010, in accordance with the Plan. The fixed station photography monitoring sites are presented in Figure 2-12. At spring and pond sites, aquatic photograph stations were established in 2009 to capture representative aquatic areas where the biological surveys are being conducted. Endpoints of the vegetation transects described in Section 2.10 (spring, wetland/meadow, valley floor Rocky Mountain [VFRM] juniper [swamp cedar], and phreatophytic shrubland transects) also served as fixed photograph stations.

The number of fixed station photographs (photograph stations and directions of photographs within stations) were reduced from 2009 to increase efficiency while still capturing representative aquatic areas where the biological surveys are being conducted, as agreed upon in the January 11-12, 2010 BWG annual meeting. Permanent field markers for these stations were not removed, and all photographs taken in 2009 remain in the database. Additionally, a few new photograph stations were established in 2010. Locations of these stations were recorded with a Trimble GPS Unit (permanent markers have not been installed). The aquatic photograph stations employed in 2010 are shown in the physical habitat maps in Appendix B.

To increase repeatability of photographs across seasons, compass bearings (direction of photographs) and hard copies of photographs taken in the spring at aquatic photograph stations were used as references in the fall. At vegetation transects, photographs were taken at each transect endpoint in the direction of the opposite endpoint. Photographs were taken with a digital camera at a resolution of at least 6 mega pixels.

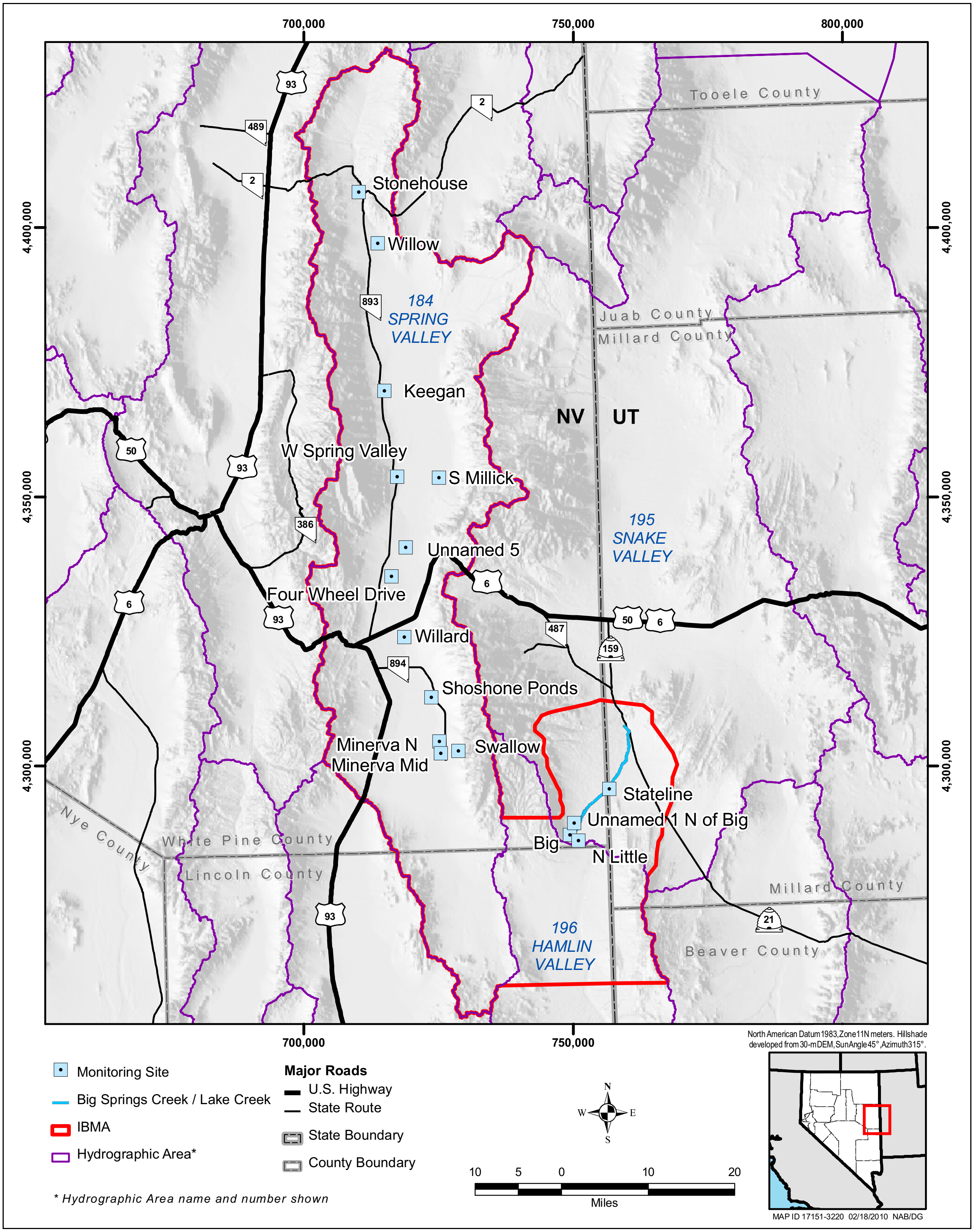



**Figure 2-12**
**Locations of Fixed Station Photography Monitoring Sites within the IBMA**

## 2.13 Data Management

A data management system was developed in 2009, in accordance with the Plan. A workflow process was designed to ensure data integrity (i.e., accuracy and consistency) from field data collection to data storage in a Relational Database Management System (Database) to data distribution. The focus was on data quality, transparency, traceability, and security.

The data management workflow is as follows:

1. Archival storage of all original data—both hardcopy data sheets and digital data files—in their original state.

2. Format all data collected in the field into standardized data sheets and geographic information system files.

3. Perform rigorous, multistep Quality Assurance/Quality Control (QA/QC) of all digital data.

4. Upload data into the Database, which requires data to pass validation rules.

5. Finalize data upon submission of the annual report each year, at which time final datasets will be provided to the NSE, EC, and BWG and made available to the public.

Archival storage is provided for all hardcopy data sheets, original and provisional digital data sheets, and provisional and final data within the database:

- Storage with limited access provides the secure storage for all hardcopy data sheets.

- A Secure Digital Repository (Repository) on a network provides storage for all original and provisional digital data files described in the data management workflow. Repository access is limited and is backed up on a regularly scheduled basis.

- An Enterprise Oracle10g Database provides secure storage for all data loaded from digital data sheets during the automated data-loading process, as well as all final data within the Database. Database access is limited and files are backed up on a regularly scheduled basis.

Provisional 2010 datasets were provided to the BWG for review. All 2009 and 2010 datasets have been finalized.

# 3.0 BIOLOGICAL MONITORING PLAN RESULTS

This section presents summary results of the Biological Monitoring Plan 2010 field effort. Final data is available upon request.

## *3.1 Physical Habitat Mapping*

Physical habitat maps were created at aquatic sites (springs, ponds, and creek reaches) in spring (May 3-12), and fall (August 30–September 13), 2010. Maps for individual sites are presented in Appendix B (Figures B-1 through B-49).

Total aquatic area by site and by HMU type are summarized in Table 3-1. Analysis, interpretations, and conclusions made from these data need to take into consideration the margin of error associated with boundary delineation, particularly when comparing area measurements. Habitat boundary accuracy varies based on the GPS accuracy and user variability associated with delineating boundaries where there was not always a clear distinction between habitat types. Further, polygons created during habitat mapping are coarse characterizations that reflect the average habitat values observed and do not attempt to capture small-scale habitat differences.

Total aquatic area for all sites in spring and fall is shown in Table 3-1 and Figure 3-1, and area by habitat type for each site is presented in Appendix B (Figures B-1 through B-49). A comparison of total aquatic area from 2009 to 2010 is shown in Table 3-2.

The following changes between seasons and years are notable. Due to the methods revisions in 2009 and the margin of error associated with data collection, 2009-2010 data are not statistically analyzed.

- Willard Spring went dry in the fall season in both 2009 and 2010.
- Willow Spring mapping showed a 40% reduction in total aquatic habitat in fall 2010 compared to spring 2010.
- West Spring Valley Complex mapping showed a 30% reduction in pool habitat in fall 2010 compared to spring 2010.
- Minerva Spring Complex North mapping showed an 80% reduction in pool habitat in fall 2010 compared to spring 2010 The pool reduction in the Minerva Spring Complex North was due to land management actions associated with irrigation. This site is composed of man-made irrigation pools and channels utilized in ranching operations.

- Across almost all sites there also appears to have been an increase in vegetation in fall 2010 compared to spring 2010 (10 of the sites had at least one polygon with a higher percent emergent vegetation cover in the fall as compared to the spring).

- There does not appear to be any overall patterns among sites in changes of total aquatic area across years or seasons.

**Table 3-1**
**Total Aquatic Area by Site and Hydromorphological Unit (Pools, Channels), 2010**

| Site | Spring 2010 | | | Fall 2010 | | |
|---|---|---|---|---|---|---|
| | Channels | Pools | Total Area | Channels | Pools | Total Area |
| Big Springs/Lake Creek Reach 1 | Not monitored in spring | | | 487 | 0 | 487 |
| Big Springs/Lake Creek Reach 2 | Not monitored in spring | | | 295 | 0 | 295 |
| Big Springs/Lake Creek Reach 3 | Not monitored in spring | | | 297 | 0 | 297 |
| Big Springs/Lake Creek Reach 4 | Not monitored in spring | | | 378 | 0 | 378 |
| Big Springs/Lake Creek Reach 5 | Not monitored in spring | | | 75 | 0 | 75 |
| Big Springs/Lake Creek Reach 6 | Not monitored in spring | | | 244 | 0 | 244 |
| Big Springs | 322 | 0 | 322 | 350 | 0 | 350 |
| Clay Spring North | 286 | 0 | 286 | 223 | 0 | 223 |
| Four Wheel Drive Spring | 181 | 171 | 352 | 149 | 205 | 354 |
| Keegan Spring Complex North | 3121 | 9000 | 12121 | 1764 | 11157 | 13921 |
| Minerva Spring Complex Middle | 478 | 158 | 636 | 577 | 169 | 746 |
| Minerva Spring Complex North | 385 | 1268 | 1653 | 908 | 241 | 1149 |
| North Little Spring | 79 | 71 | 150 | 100 | 57 | 157 |
| Shoshone Ponds | 0 | 621 | 621 | 0 | 623 | 623 |
| South Millick Spring | 1566 | 106 | 1672 | 1336 | 398 | 1734 |
| Stateline Springs | 168 | 0.0 | 168 | 137 | 10 | 147 |
| Stonehouse Spring Complex | 113 | 78 | 191 | 102 | 49 | 151 |
| Swallow Spring | 816 | 56 | 872 | 586 | 126 | 712 |
| Unnamed 1 Spring North of Big | 280 | 14 | 294 | 282 | 11 | 293 |
| Unnamed 5 Spring | 1078 | 1494 | 2572 | 1052 | 1567 | 2619 |
| West Spring Valley Complex 1 | 640 | 344 | 984 | 1292 | 242 | 1534 |
| Willard | 0 | 45 | 45 | 0 | 0 | 0 |
| Willow-NV Spring | 168 | 10 | 178 | 82 | 22 | 104 |

Areas are in square meters.

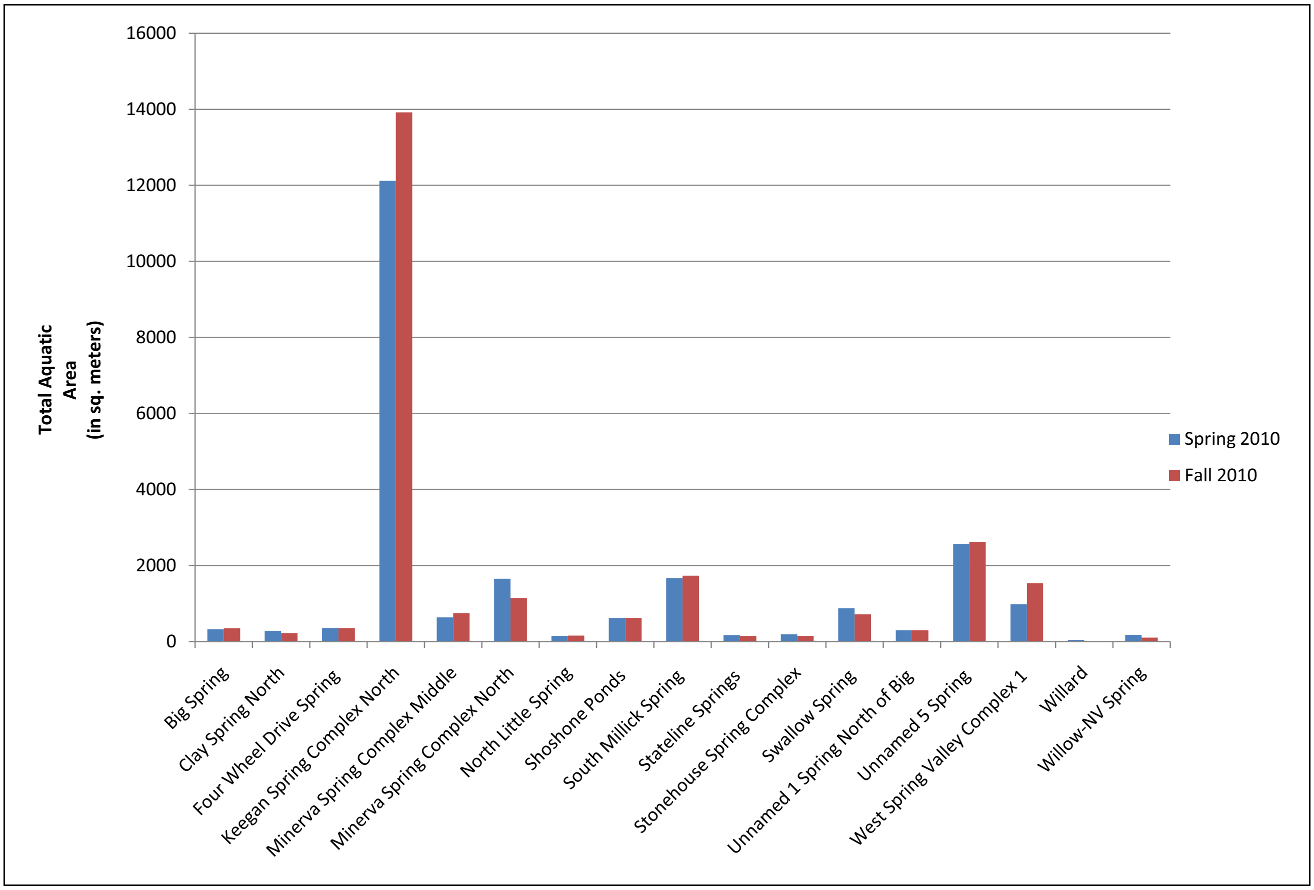



**Figure 3-1**
**Total Aquatic Area by Site for Spring and Fall 2010**

**Table 3-2**
**Percent Change in Total Aquatic Area from 2009 to 2010**

| Site | Spring 2009 | Spring 2010 | Percent Change from 2009 to 2010 | Fall 2009 | Fall 2010 | Percent Change from 2009 to 2010 |
|---|---|---|---|---|---|---|
| Big Springs/Lake Creek Reach 1 | | | | 458 | 487 | |
| Big Springs/Lake Creek Reach 2 | | | | 249 | 295 | |
| Big Springs/Lake Creek Reach 3 | | | | 245 | 297 | |
| Big Springs/Lake Creek Reach 4 | | | | 354 | 378 | |
| Big Springs/Lake Creek Reach 5 | | | | 204 | 75 | |
| Big Springs/Lake Creek Reach 6 | | | | | 244 | |
| Big Springs | 410 | 322 | -24 | 303 | 350 | 13 |
| Clay Spring | ~ | 286 | ~ | ~ | 223 | ~ |
| Four Wheel Drive Spring | 218 | 352 | 47 | 241 | 354 | 38 |
| Keegan Spring Complex North | 12184 | 12121 | -1 | 10402 | 13921 | 28 |
| Minerva Spring Complex Middle | 578 | 636 | 10 | 537 | 746 | 32 |
| Minerva Spring Complex North | 1758 | 1653 | -6 | 1560 | 1149 | -31 |
| North Little Spring | 183 | 150 | -20 | 100 | 157 | 45 |
| Shoshone Ponds | 679 | 621 | -7 | 629 | 623 | -1 |
| South Millick Spring | 1351 | 1672 | 21 | 1572 | 1734 | 10 |
| Stateline Springs | 131 | 168 | 25 | 131 | 147 | 9 |
| Stonehouse Spring Complex | 1879 | 191 | -163 | 460 | 151 | -102 |
| Swallow Spring | 902 | 872 | -3 | 809 | 712 | -13 |
| Unnamed 1 Spring North of Big | 206 | 294 | 35 | 130 | 293 | 77 |
| Unnamed 5 Spring | 2651 | 2572 | -3 | 2757 | 2619 | -5 |
| West Spring Valley Complex 1 | 1274 | 984 | -26 | 1047 | 1534 | 38 |
| Willard | 36 | 45 | 23 | 0 | 0 | |
| Willow-NV Spring | 382 | 178 | -73 | 170 | 104 | -48 |

### *3.2 Site Assessment*

Qualitative site assessments were conducted at all spring and pond sites during spring (May 3-12) and fall (August 30 - September 13) 2010, and at Big Springs Creek/Lake Creek reaches during fall (September 15) 2010. Overall disturbance ratings and presence/absence of diversion, ungulate and recreational disturbances are shown in Table 3-3 (1 = undisturbed, 2 = slightly disturbed, 3 = moderately disturbed, and 4 = highly disturbed).

At the spring and pond sites during spring 2010, 0 of 17 sites were undisturbed, 2 were slightly disturbed, 10 were moderately disturbed, and 5 were highly disturbed. Slightly lower disturbance ratings were documented in fall 2010, with 0 of 17 sites undisturbed, 5 slightly disturbed, 10 moderately disturbed, and 2 highly disturbed. The lower disturbance ratings in the fall primarily were due to an increase in vegetation (percent of the banks covered by vegetation is a rating criterion; it is also possible that increased vegetative bank cover caused ungulate use to be less apparent). Across seasons, modifications for diversion were documented at 10-11 of the spring and pond sites, recreation disturbance was documented at 11-13 sites, and ungulate use was documented at all 17 sites.

At the creek reaches during fall 2010, 0 of 6 reaches were undisturbed, 0 were slightly disturbed, 4 were moderately disturbed, and 2 were highly disturbed. Modifications for diversion were documented at 1 reach (although it is noted that there are diversions in various portions of the creek at large), recreation disturbance was documented at 1 reach, and ungulate use was documented at all 6 reaches.

Because of the difference in seasonal disturbance ratings due to vegetation growth, and because site assessments were not conducted in spring 2009, comparisons across years can only be made between fall 2009 and fall 2010. Of the 16 spring and pond sites surveyed in both fall 2009 and fall 2010, 6 maintained the same disturbance rating, 6 had a higher disturbance rating in fall 2010, and 4 had a lower rating in fall 2010 (Table 3-4). Of the 5 creek reaches surveyed in both fall 2009 and fall 2010, 1 maintained the same disturbance rating, and 4 had a higher disturbance rating in fall 2010 (Table 3-4). Although these results show slight changes in disturbance ratings from 2009 to 2010, the only major documented change in disturbance occurred at the North Minerva Complex (see discussion in Section 3.1). As these are fairly broad qualitative ratings, comments recorded as part of the data collection process should be considered to understand the root of the disturbance ratings.

## Table 3-3
## Site Assessment Summary for 2010

| Sites | Spring 2010 | | | | Fall 2010 | | | |
|---|---|---|---|---|---|---|---|---|
| | Overall Rating | Modification for Diversion | Ungulate Use | Recreation Disturbance | Overall Rating | Modification for Diversion | Ungulate Use | Recreation Disturbance |
| Big Springs/Lake Creek #1 | N/A | N/A | N/A | N/A | 4 | Yes | Yes | No |
| Big Springs/Lake Creek #2 | N/A | N/A | N/A | N/A | 3 | No | Yes | No |
| Big Springs/Lake Creek #3 | N/A | N/A | N/A | N/A | 3 | No | Yes | No |
| Big Springs/Lake Cree #4 | N/A | N/A | N/A | N/A | 4 | No | Yes | No |
| Big Springs/Lake Creek #5 | N/A | N/A | N/A | N/A | 3 | No | Yes | Yes |
| Big Springs/Lake Creek #6 | N/A | N/A | N/A | N/A | 3 | No | Yes | No |
| Big Springs \|1888 | 3 | Yes | Yes | Yes | 3 | Yes | Yes | Yes |
| Four Wheel Drive Spring \| 12216 | 4 | Yes | Yes | Yes | 2 | Yes | Yes | Yes |
| Keegan Spring Complex North \| 12217 | 3 | Yes | Yes | Yes | 4 | Yes | Yes | Yes |
| Minerva Spring Complex Middle \| 13560 | 4 | Yes | Yes | Yes | 3 | Yes | Yes | No |
| Minerva Spring Complex North \| 13561 | 4 | Yes | Yes | Yes | 4 | Yes | Yes | Yes |
| North Little Spring \| 10534 | 2 | No | Yes | No | 2 | No | Yes | No |
| Shoshone Ponds \| 13566 | 3 | Yes | Yes | Yes | 3 | Yes | Yes | Yes |
| South Millick Spring \| 13577 | 3 | No | Yes | Yes | 2 | Yes | Yes | No |
| Stateline Springs \| 13562 | 3 | No | Yes | No | 3 | No | Yes | Yes |
| Stonehouse Spring Complex \| 12220 | 3 | No | Yes | Yes | 2 | No | Yes | Yes |
| Swallow Spring \| 12208 | 3 | Yes | Yes | Yes | 3 | Yes | Yes | Yes |
| Unnamed 1 Spring North of Big \| 13565 | 3 | Yes | Yes | Yes | 3 | No | Yes | Yes |
| Unnamed 5 Spring \| 12223 | 3 | No | Yes | No | 3 | Yes | Yes | No |
| West Spring Valley Complex 1 \| 12222 | 3 | Yes | Yes | Yes | 3 | Yes | Yes | No |
| Willard Spring \| 10567 | 4 | No | Yes | No | 3 | No | Yes | No |
| Willow-NV Spring \| 13563 | 2 | No | Yes | Yes | 2 | No | Yes | Yes |
| Clay Spring North \| 11552 | 4 | Yes | Yes | Yes | 3 | Yes | Yes | Yes |

1=undisturbed, 2=slightly disturbed, 3=moderately disturbed, 4=highly disturbed; N/A = not applicable (creek reaches assessed only during fall around time of fish surveys).

## Table 3-4
## Overall Site Assessment Ratings for 2009 and 2010

| Sites | Overall Rating | | |
|---|---|---|---|
| | Fall 2009 | Spring 2010 | Fall 2010 |
| Big Springs/Lake Creek 1 | 3 | N/A | 4 |
| Big Springs/Lake Creek 2 | 2 | N/A | 3 |
| Big Springs/Lake Creek 3 | 2 | N/A | 3 |
| Big Springs/Lake Creek 4 | 2 | N/A | 4 |
| Big Springs/Lake Creek 5 | 3 | N/A | 3 |
| Big Springs/Lake Creek 6 | N/A | N/A | 3 |
| Big Springs | 3 | 3 | 3 |
| Clay Spring | N/A | 4 | 3 |
| 4WD | 2 | 4 | 2 |
| Keegan | 2 | 3 | 4 |
| Middle Minerva | 4 | 4 | 3 |
| Minerva North | 4 | 4 | 4 |
| North Little | 2 | 2 | 2 |
| Shoshone Ponds | 3 | 3 | 3 |
| South Millick | 3 | 3 | 2 |
| Stateline | 2 | 3 | 3 |
| Stonehouse | 3 | 3 | 2 |
| Swallow | 3 | 3 | 3 |
| Unnamed 1 | 2 | 3 | 3 |
| Unnamed 5 | 2 | 3 | 3 |
| West Spring Valley | 2 | 3 | 3 |
| Willard Spring | 2 | 4 | 3 |
| Willow | 3 | 2 | 2 |

1=undisturbed, 2=slightly disturbed, 3=moderately disturbed, 4=highly disturbed.
N/A = not applicable (creek reaches assessed only during fall around time of fish surveys, and access to Clay Spring was not granted until spring 2010).
Site assessments were not conducted during spring 2009.

## 3.3 Water Quality

This section provides a general overview of water-quality conditions during spring and fall sampling events in 2009 and 2010 (spring 2009: May 5-14; fall 2009: September 14-25; spring 2010: May 10-19; fall 2010: September 13-22). Water-quality data taken as part of the springsnail, northern leopard frog and relict dace surveys are presented in their respective sections. Two spring systems are not included in this report because lack of water made it impossible to collect samples on a regular basis (Willard Spring and Four Wheel Drive Spring). All collected data is available in the final database.

### 3.3.1 Standard Water Quality

Temperature, conductivity, pH, dissolved oxygen, velocity, and turbidity data were taken at springheads, midpoints, and endpoints along monitored channels. Most endpoints do not represent actual endpoints of the spring systems, but instead endpoints of designated sample areas. Springheads, midpoints and endpoints designated in 2009 were revisited in 2010.

Paired *t*-tests were performed comparing springhead, midpoint, and endpoint values for stipulation springs in Spring Valley and Snake Valley between spring 2009/2010 sample sets and fall 2009/2010 sample sets, using SYSTAT versions 13.00.05 software.

#### 3.3.1.1 Water Temperature

Water temperature in the Spring Valley monitoring sites was significantly higher in 2009 compared to 2010 for both spring and fall seasons (paired *t*-test: spring 2009 > spring 2010, $p < 0.001$; fall 2009 > 2010, $p = 0.032$) (Table 3-5). Temperatures were notably lower in the northern sites (Stonehouse, Willow, Keegan, and West Spring Valley) in spring 2010, compared to any other seasons or sites. Water temperatures ranged from the mid 40s to the upper 70s. On average, there was an increase in water temperatures with distance downstream from the springhead, during both seasons in both valleys, as would be expected as the result of solar heating during the day.

Water temperatures in Snake Valley springs also tended to be warmer in spring 2009 compared to spring of 2010, but this trend was not as apparent between the 2009 and 2010 fall seasons (paired *t*-test: spring 2009 > spring 2010, $p < 0.003$; fall 2009 < 2010, $p = 0.031$) (Table 3-6). Water temperatures ranged from the mid 50s to the upper 60s. As in Spring Valley, on average there was an increase in water temperatures with distance downstream from the springhead as would be expected as the result of solar heating during the day.

Water temperatures emanating from the springhead are determined by a combination of the ultimate water source (e.g., snowpack or rainfall), groundwater residence time, and underground travel patterns (i.e., deeper waters tend to have higher temperatures). Water temperatures in springbrooks are primarily influenced by solar radiation and can be expected to vary with season, time of day, and weather conditions. Water depth, and/or spring flow rates can also influence water temperatures.

**Table 3-5**
**Water Temperature (°F) in Spring Valley Monitoring Sites for 2009 and 2010**

| Site | Channel | Spring 2009 | | | Spring 2010 | | | Fall 2009 | | | Fall 2010 | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | Head | Mid | End | Head | Mid | End | Head | Mid | End | Head | Mid | End |
| Stonehouse Spring Complex | E | 65.3 | 67.2 | 68.6 | 55.5 | 45.9 | 47.7 | 60.8 | 70.1 | 74.7 | 58.1 | 70.3 | 72.1 |
| Willow Spring | A | 55.6 | 76.6 | 61.1 | 49.9 | 46.2 | 47.5 | 57.4 | 79.2 | 77.8 | 54.7 | 72.9 | 74.5 |
| Keegan Spring Complex | A | 53.8 | 62.4 | 73.7 | 52.4 | 52.6 | 49.6 | 53.9 | 61.5 | 64.6 | 55.1 | 65.0 | 62.8 |
| West Spring Valley Spring 1 | A | 59.8 | 67.8 | 69.1 | 51.1 | 54.1 | 52.9 | 61.7 | 57.9 | 56.8 | 59.0 | 56.3 | 56.7 |
| South Millick Spring | A | 65.4 | 62.4 | 65.3 | 53.6 | 58.4 | 58.9 | 59.5 | 59.8 | 61.9 | 55.7 | 51.6 | 50.6 |
| Unnamed 5 Spring | A | 59.8 | 64.3 | 64.8 | 56.4 | 59.8 | 56.6 | 56.5 | 59.3 | 58.7 | 57.8 | 65.2 | 67.0 |
| Minerva North Spring | A | --- | --- | --- | 55.7 | 56.3 | 55.4 | 54.9 | 61.6 | 65.7 | 55.3 | 56.3 | 55.5 |
| Minerva North Spring | B | --- | --- | --- | 57.1 | 56.3 | 56.2 | 61.3 | 67.7 | 68.2 | 55.4 | 54.3 | 57.5 |
| Minerva Middle Spring | A | 53.9 | 57.0 | 58.1 | 54.5 | 60.3 | 59.2 | 53.0 | 54.2 | 55.7 | 54.0 | 56.6 | 61.3 |
| Minerva Middle Spring | B | 54.2 | 58.5 | 59.0 | 56.4 | 57.1 | 57.9 | 55.6 | 56.2 | 56.2 | 53.9 | 56.8 | 57.5 |
| Swallow Spring | A | 48.4 | 49.3 | 54.7 | 49.9 | 52.9 | 61.1 | 50.7 | 51.6 | 55.2 | 50.6 | 51.9 | 53.4 |
| | **Means** | **57.4** | **62.8** | **63.8** | **53.9** | **54.5** | **54.8** | **56.8** | **61.7** | **63.2** | **55.4** | **59.7** | **60.8** |
| | **Paired *t*-test (P)** | **<0.001** | | | | | | **0.032** | | | | | |

Note: Water temperature was recorded at various times of day across sites and seasons (times available in final database).
Head = springhead, Mid = sampling area midpoint along channel, End = sampling area endpoint along channel.

**Table 3-6**
**Water Temperature (°F) in Snake Valley Monitoring Sites for 2009 and 2010**

| Site | Channel | Spring 2009 | | | Spring 2010 | | | Fall 2009 | | | Fall 2010 | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | Head | Mid | End | Head | Mid | End | Head | Mid | End | Head | Mid | End |
| Clay Spring North | A | --- | --- | --- | 56.7 | 59.6 | 59.5 | --- | --- | --- | 56.6 | 56.5 | 56.3 |
| Stateline Springs | A | 66.3 | 60.7 | 64.1 | 57.2 | 58.6 | 58.9 | 58.3 | 58.3 | 58.7 | 57.7 | 59.2 | 58.9 |
| Unnamed 1 Spring North of Big | A | 62.1 | 68.0 | 73.6 | 55.8 | 58.6 | 58.5 | 56.1 | 57.2 | 55.3 | 58.1 | 60.5 | 58.9 |
| Unnamed 1 Spring North of Big | B | 68.8 | 68.3 | 71.5 | 55.7 | 55.7 | 58.5 | 56.4 | 57.2 | 55.3 | 55.8 | 60.5 | 58.9 |
| Big Springs | A | 63.1 | 63.7 | 63.7 | 62.7 | 63.9 | 64.0 | 63.1 | 63.9 | 63.9 | 63.1 | 63.5 | 63.3 |
| Big Springs | B | 63.0 | 63.7 | 63.7 | 67.1 | 63.9 | 64.0 | 63.1 | 63.9 | 63.9 | 63.9 | 63.5 | 63.3 |
| North Little Spring | A | 55.9 | 60.8 | 65.4 | 55.3 | 59.9 | 60.1 | 57.9 | 56.0 | 57.1 | 56.6 | 59.4 | 57.9 |
| | **Means** | **63.2** | **64.2** | **67.0** | **59.0** | **60.1** | **60.7** | **59.2** | **59.4** | **59.0** | **59.2** | **61.1** | **60.2** |
| | **Paired *t*-test (P)** | **0.003** | | | | | | **0.031** | | | | | |

Note: Water temperature was recorded at various times of day across sites and seasons (times available in final database).
Head = springhead, Mid = sampling area midpoint along channel, End = sampling area endpoint along channel.

### *3.3.1.2 Conductivity*

Conductivity levels in Spring Valley varied between years for individual sites, but there was no overall yearly difference across sites for spring or fall (Table 3-7). Conductivity ranged from a low of 68 µS/cm at Keegan Spring Complex in spring 2010 to a high of 720 µS/cm at Stonehouse Spring Complex in spring 2009. In both 2009 and 2010, conductivity was notably lower at Keegan Spring Complex compared to any other site by order of 2-3 magnitudes. There were no apparent trends in the spatial distribution of conductivity within any given spring system.

**Table 3-7**
**Specific Conductivity (µS/cm) in Spring Valley Monitoring Sites for 2009 and 2010**

| Site | Channel | Spring 2009 | | | Spring 2010 | | | Fall 2009 | | | Fall 2010 | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | Head | Mid | End | Head | Mid | End | Head | Mid | End | Head | Mid | End |
| Stonehouse Spring Complex | E | 381 | 380 | 720 | 365 | 395 | 515 | 348 | 347 | 385 | 328 | 336 | 371 |
| Willow Spring | A | 433 | 420 | 440 | 406 | 431 | 430 | 431 | 590 | 473 | 418 | 449 | 457 |
| Keegan Spring Complex | A | 74 | 74 | 84 | 68 | 88 | 102 | 79 | 77 | 84 | 70 | 73 | 87 |
| West Spring Valley Spring 1 | A | 364 | 307 | 327 | 640 | 306 | 297 | 155 | 290 | 290 | 388 | 305 | 307 |
| South Millick Spring | A | 511 | 432 | 430 | 436 | 451 | 455 | 422 | 456 | 455 | 436 | 451 | 455 |
| Unnamed 5 Spring | A | 328 | 308 | 308 | 249 | 245 | 256 | 313 | 300 | 327 | 249 | 245 | 256 |
| Minerva North Spring | A | --- | --- | --- | 260 | 282 | 282 | 373 | 391 | 379 | 260 | 282 | 282 |
| Minerva North Spring | B | --- | --- | --- | 253 | 259 | 262 | 247 | 245 | 262 | 294 | 281 | 287 |
| Minerva Middle Spring | A | 376 | 375 | 367 | 394 | 362 | 369 | 373 | 391 | 379 | 374 | 380 | 379 |
| Minerva Middle Spring | B | 404 | 372 | 367 | 373 | 368 | 371 | 609 | 377 | 380 | 368 | 382 | 387 |
| Swallow Spring | A | 257 | 304 | 295 | 328 | 326 | 319 | 317 | 319 | 308 | 318 | 318 | 319 |
| | **Means** | **348** | **330** | **371** | **343** | **319** | **333** | **333** | **344** | **338** | **318** | **318** | **326** |
| | **Paired *t*-test (P)** | **0.814** | | | | | | **0.181** | | | | | |

Note: Conductivity was recorded at various times of day across sites and seasons (times available in final database).
Head = springhead, Mid = sampling area midpoint along channel, End = sampling area endpoint along channel.

Like Spring Valley, conductivity levels in Snake Valley varied between years for individual sites, but there was no overall yearly difference across sites for spring but there was a significant difference between the fall 2009 and 2010 ($p=0.001$) (Table 3-8). Conductivity levels in Snake Valley ranged from a low of 312 µS/cm at North Little Spring in spring 2009 to a high of 630 µS/cm at Clay Spring North in fall 2010. Like Spring Valley, there were no apparent trends in the spatial distribution of conductivity within any given spring system.

Conductivity in springbrooks is primarily determined by the amount of dissolved inorganic ions in solution. Geology of an area is mainly responsible for differences in inorganic ions in solution in groundwater and springs. Water in limestone areas is typically high in conductivity due to its characteristically high solubility rates for calcium and carbonate ions, whereas solubility in granite formations is typically low, since it is composed mostly of inert materials.

Conductivity is also influenced by a number of other factors: increasing temperature will result in increased conductivity; plant photosynthesis (i.e., nutrient and carbon dioxide utilization) can also affect conductivity in highly productive systems. Thus, temperature and photosynthesis may result in diurnal changes in conductivity, especially during the summer months, when plant productivity and water temperatures are greatest.

**Table 3-8**
**Specific Conductivity (μS/cm) in Snake Valley Monitoring Sites for 2009 and 2010**

| Site | Channel | Spring 2009 | | | Spring 2010 | | | Fall 2009 | | | Fall 2010 | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | Head | Mid | End | Head | Mid | End | Head | Mid | End | Head | Mid | End |
| Clay Spring North | A | --- | --- | --- | 603 | 601 | 604 | --- | --- | --- | 630 | 629 | 629 |
| Stateline Springs | A | 363 | 596 | 360 | 341 | 342 | 343 | 369 | 373 | 373 | 340 | 333 | 342 |
| Unnamed 1 Spring North of Big | A | 420 | 402 | 419 | 408 | 434 | 457 | 444 | 478 | 494 | 458 | 446 | 462 |
| Unnamed 1 Spring North of Big | B | 481 | 402 | 419 | 415 | 434 | 457 | 456 | 478 | 494 | 441 | 446 | 462 |
| Big Springs | A | 360 | 361 | 361 | 366 | 368 | 367 | 390 | 392 | 391 | 362 | 365 | 366 |
| Big Springs | B | 362 | 361 | 361 | 349 | 368 | 367 | 391 | 392 | 391 | 368 | 365 | 366 |
| North Little Spring | A | 323 | 312 | 338 | 368 | 343 | 380 | 388 | 385 | 463 | 445 | 347 | 368 |
| **Means without Clay** | | **385** | **406** | **376** | **375** | **382** | **395** | **406** | **416** | **434** | **402** | **384** | **394** |
| **Means with Clay** | | **385** | **406** | **376** | **407** | **413** | **425** | **406** | **416** | **434** | **435** | **419** | **428** |
| **Paired *t*-test (P)** | | **0.750** | | | | | | **0.001** | | | | | |

Note: Conductivity was recorded at various times of day across sites and seasons (times available in final database).
Because Clay Spring had relatively higher conductivity compared to any other Snake Valley site, and was not sampled in 2009, means and grand means across sites are shown with and without Clay Spring for 2010 to allow for comparison across years.
Head = springhead, Mid = sampling area midpoint along channel, End = sampling area endpoint along channel.

### *3.3.1.3 pH*

pH levels in the Spring Valley monitoring sites were significantly higher in 2009 compared to 2010 for both spring and fall seasons (paired *t*-test: spring 2009 > spring 2010, p 0.001; fall 2009 > 2010, p <0.001) (Table 3-9). Values ranged from a low of 6.17 at West Valley Spring complex in fall 2010 to a high of 9.45 at North Minerva Springs Channel B in fall 2009. On average, pH levels tended to increase between the springhead and the mid-point sampling station, and in a some cases between the mid-point and end-point sampling stations.

pH levels in the Snake Valley monitoring sites were significantly higher in spring 2009 compared to spring 2010 (paired *t*-test: p = 0.002), but did not differ between years for the fall season (paired *t*-test: p >0.548) (Table 3-10). Values ranged from a low 6.69 in Big Springs (Channel A and Channel B) and North Little Spring in spring 2010 to a high of 8.51 at North Little Spring in fall 2010.

pH is indirectly affected by solar radiation in these springs as the result of aquatic photosynthesis (both aquatic vascular plants and algae) which consume carbon dioxide during photosynthesis, resulting in an increase in pH. pH levels are reduced during the nighttime hours when carbon dioxide is released into the water by both plant and animal respiration. Thus, there is often a pronounced diurnal cycle in pH levels in these spring systems.

## Table 3-9
## pH in Spring Valley Monitoring Sites for 2009 and 2010

| Site | Channel | Spring 2009 | | | Spring 2010 | | | Fall 2009 | | | Fall 2010 | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | Head | Mid | End | Head | Mid | End | Head | Mid | End | Head | Mid | End |
| Stonehouse Spring Complex | E | 7.63 | 8.30 | 8.85 | 7.72 | 7.22 | 6.45 | 7.26 | 7.07 | 7.08 | 6.98 | 6.92 | 7.05 |
| Willow Spring | A | 7.22 | 8.35 | 7.71 | 6.99 | 7.17 | 7.09 | 7.33 | 7.32 | 7.64 | 7.36 | 7.58 | 7.85 |
| Keegan Spring Complex | A | 6.63 | 7.38 | 7.49 | 6.84 | 7.47 | 6.90 | 6.25 | 7.47 | 7.21 | 6.89 | 7.02 | 6.84 |
| West Spring Valley Spring 1 | A | 7.42 | 8.10 | 8.48 | 7.00 | 7.47 | 7.24 | 7.31 | 7.40 | 7.46 | 6.53 | 6.36 | 6.17 |
| South Millick Spring | A | 7.66 | 7.88 | 8.05 | 7.47 | 7.34 | 7.31 | 7.50 | 7.62 | 7.75 | 7.27 | 7.27 | 6.46 |
| Unnamed 5 Spring | A | 7.30 | 8.24 | 8.27 | 8.09 | 8.14 | 6.99 | 7.46 | 7.38 | 7.09 | 6.53 | 7.30 | 6.94 |
| Minerva North Spring | A | --- | --- | --- | 7.77 | 8.00 | 6.90 | 8.45 | 8.54 | 8.57 | 7.57 | 7.44 | 6.97 |
| Minerva North Spring | B | --- | --- | --- | 8.13 | 8.39 | 8.21 | 9.45 | 9.25 | 8.67 | 7.07 | 6.97 | 7.31 |
| Minerva Middle Spring | A | 7.59 | 7.70 | 7.78 | 7.22 | 7.48 | 7.61 | 8.08 | 7.71 | 8.09 | 6.53 | 6.95 | 6.43 |
| Minerva Middle Spring | B | 7.64 | 7.66 | 7.42 | 7.44 | 7.32 | 7.31 | 8.15 | 7.90 | 8.17 | 6.41 | 7.13 | 7.08 |
| Swallow Spring | A | 7.27 | 7.82 | 7.97 | 7.37 | 7.64 | 7.91 | 7.19 | 7.95 | 8.28 | 6.41 | 6.43 | 6.68 |
| **Means** | | **7.37** | **7.94** | **8.00** | **7.46** | **7.60** | **7.27** | **7.68** | **7.78** | **7.82** | **6.87** | **7.03** | **6.89** |
| **Paired *t*-test (P)** | | **0.001** | | | | | | **<0.001** | | | | | |

Note: pH was recorded at various times of day across sites and seasons (times available in final database).
Head = springhead, Mid = sampling area midpoint along channel, End = sampling area endpoint along channel.

## Table 3-10
## pH in Snake Valley Monitoring Sites for 2009 and 2010

| Site | Channel | Spring 2009 | | | Spring 2010 | | | Fall 2009 | | | Fall 2010 | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | Head | Mid | End | Head | Mid | End | Head | Mid | End | Head | Mid | End |
| Clay Spring North | A | --- | --- | --- | 7.84 | 8.05 | 8.09 | --- | --- | --- | 7.59 | 7.59 | 6.72 |
| Stateline Springs | A | 7.86 | 8.08 | 8.06 | 8.17 | 8.14 | 8.13 | 7.58 | 7.58 | 7.63 | 8.16 | 8.08 | 7.58 |
| Unnamed 1 Spring North of Big | A | 7.70 | 7.95 | 8.13 | 7.55 | 7.56 | 7.21 | 7.59 | 7.77 | 8.30 | 7.43 | 7.71 | 7.57 |
| Unnamed 1 Spring North of Big | B | 7.58 | 7.95 | 8.13 | 7.43 | 7.56 | 7.21 | 7.48 | 7.77 | 8.13 | 7.43 | 7.71 | 7.57 |
| Big Springs | A | 7.49 | 7.55 | 7.56 | 7.75 | 6.95 | 6.69 | 7.52 | 7.56 | 7.65 | 7.88 | 7.33 | 7.48 |
| Big Springs | B | 7.51 | 7.55 | 7.56 | 7.72 | 6.95 | 6.69 | 7.47 | 7.56 | 7.65 | 7.86 | 7.73 | 7.48 |
| North Little Spring | A | 7.49 | 8.12 | 8.06 | 6.87 | 7.20 | 6.69 | 7.43 | 7.76 | 7.31 | 7.11 | 8.51 | 8.29 |
| **Means** | | **7.61** | **7.87** | **7.92** | **7.58** | **7.39** | **7.10** | **7.51** | **7.67** | **7.78** | **7.54** | **7.85** | **7.66** |
| **Paired *t*-test (P)** | | **0.002** | | | | | | **0.548** | | | | | |

Note: pH was recorded at various times of day across sites and seasons (times available in final database).
Head = springhead, Mid = sampling area midpoint along channel, End = sampling area endpoint along channel.

### *3.3.1.4 Dissolved Oxygen*

Dissolved oxygen levels in the Spring Valley monitoring sites were significantly higher in fall 2010 compared to fall 2009 (paired *t*-test: $p = 0.002$). Dissolved oxygen was also generally higher at the midpoints and endpoints in spring 2010 compared to spring 2009, although there was no overall yearly difference for (paired *t*-test: $p = 0.094$) (Table 3-11). Levels ranged from a low of 1.43 mg/L in Middle Minerva Spring Channel B in fall 2009 to a high of 18.2 mg/L in Unnamed 5 Spring in fall 2010. There was a general trend toward increasing dissolved oxygen concentrations downstream of the springhead, except during the spring 2010 sampling period.

**Table 3-11**
**Dissolved Oxygen Levels (mg/L) in Spring Valley Monitoring Sites for 2009 and 2010**

| Site | Channel | Spring 2009 | | | Spring 2010 | | | Fall 2009 | | | Fall 2010 | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | **Head** | **Mid** | **End** | **Head** | **Mid** | **End** | **Head** | **Mid** | **End** | **Head** | **Mid** | **End** |
| Stonehouse Spring Complex | E | 6.08 | 11.2 | 14.6 | 9.37 | 8.90 | 12.7 | 4.53 | 4.63 | 2.43 | 12.3 | 12.0 | 15.7 |
| Willow Spring | A | 5.37 | 12.8 | 8.89 | 3.55 | 8.02 | 9.53 | 3.56 | 6.54 | 4.06 | 6.15 | 8.05 | 13.1 |
| Keegan Spring Complex | A | 11.5 | 16.6 | 13.7 | 6.94 | 11.4 | 9.97 | 5.93 | 11.2 | 8.23 | 7.58 | 11.5 | 7.94 |
| West Spring Valley Spring 1 | A | 6.13 | 7.84 | 8.88 | 9.39 | 9.15 | 11.2 | 6.31 | 7.87 | 8.82 | 8.90 | 10.2 | 11.4 |
| South Millick Spring | A | 6.60 | 8.74 | 9.57 | 7.82 | 7.62 | 8.04 | 6.79 | 7.95 | 8.28 | 8.89 | 6.12 | 9.06 |
| Unnamed 5 Spring | A | 9.37 | 14.3 | 15.4 | 8.80 | 11.1 | 10.2 | 7.46 | 7.56 | 7.36 | 8.90 | 18.2 | 13.0 |
| Minerva North Spring | A | --- | --- | --- | 8.48 | 9.19 | 9.48 | 8.01 | 7.52 | 7.28 | 9.35 | 9.50 | 9.33 |
| Minerva North Spring | B | --- | --- | --- | 15.1 | 12.3 | 9.60 | 14.6 | 10.6 | 6.21 | 5.04 | 8.42 | 10.4 |
| Minerva Middle Spring | A | 10.2 | 10.2 | 12.3 | 9.87 | 9.97 | 10.4 | 8.04 | 7.15 | 10.4 | 9.81 | 10.4 | 10.5 |
| Minerva Middle Spring | B | 5.57 | 8.21 | 10.0 | 7.75 | 9.33 | 10.3 | 7.56 | 8.26 | 5.94 | 9.28 | 6.42 | 9.78 |
| Swallow Spring | A | 8.49 | 8.72 | 8.52 | 8.74 | 9.02 | 8.20 | 7.69 | 8.55 | 8.16 | 9.34 | 9.16 | 9.18 |
| | **Means** | **7.70** | **11.0** | **11.32** | **8.71** | **9.65** | **9.97** | **7.32** | **7.98** | **7.02** | **8.69** | **10.0** | **10.9** |
| | **Paired *t*-test (P)** | **0.094** | | | | | | **0.002** | | | | | |

Note: Dissolved oxygen was recorded at various times of day across sites and seasons (times available in final database).
Head = springhead, Mid = sampling area midpoint along channel, End = sampling area endpoint along channel.

Dissolved oxygen concentrations in Snake Valley stipulation springs (Table 3-12) were typically lower than Spring Valley springs and did not show a general trend of increasing concentrations with distance downstream of the springhead. Dissolved oxygen levels ranged from a low of 2.53 mg/L at North Clay Spring in fall 2010 to a high of 10.4 mg/L at North Little Spring in spring 2010. There were no statistically significant differences in dissolved oxygen concentration between 2009 and 2010 for spring or fall (paired *t*-test: $p > 0.12$).

Dissolved oxygen levels in these spring systems can be affected by several factors. Turbulence at the air-water interface affects dissolved oxygen levels, especially in shallow spring systems. Aquatic plant and algae photosynthesis will increase dissolved oxygen concentrations, while plant and animal respiration at night will reduce dissolved oxygen concentrations. The increase in dissolved oxygen as a result of photosynthesis during daylight hours, coupled with the nighttime decrease, can result in a marked diurnal cycle in these springs.

**Table 3-12**
**Dissolved Oxygen Levels (mg/L) in Snake Valley Monitoring Sites for 2009 and 2010**

| Site | Channel | Spring 2009 | | | Spring 2010 | | | Fall 2009 | | | Fall 2010 | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | Head | Mid | End | Head | Mid | End | Head | Mid | End | Head | Mid | End |
| Clay Spring North | A | --- | --- | --- | 3.71 | 6.28 | 6.47 | 6.47 | --- | --- | 2.53 | 7.7 | 7.93 |
| Stateline Springs | A | 4.49 | 5.87 | 5.88 | 5.34 | 6.6 | 6.78 | 6.78 | 5.57 | 5.91 | 6.21 | 7.88 | 8.11 |
| Unnamed 1 Spring North of Big | A | 6.47 | 8.22 | 7.38 | 8.51 | 8.89 | 8.5 | 8.5 | 7.18 | 7.58 | 7.46 | 8.49 | 8.61 |
| Unnamed 1 Spring North of Big | B | 5.5 | 7.16 | 6.83 | 7.42 | 8.89 | 8.5 | 8.5 | 7.18 | 7.58 | 8.69 | 8.49 | 8.61 |
| Big Springs | A | 5.05 | 5.42 | 5.52 | 5.4 | 5.57 | 5.8 | 5.8 | 5.48 | 5.78 | 6.65 | 6.83 | 6.99 |
| Big Springs | B | 5.19 | 5.48 | 5.52 | 4.81 | 5.57 | 5.8 | 5.8 | 5.48 | 5.78 | 6.8 | 6.83 | 6.99 |
| North Little Spring | A | 7.21 | 10 | 7.4 | 3.28 | 10.4 | 7.07 | 7.07 | 7.7 | 7.48 | 4.31 | 10.2 | 8.6 |
| | **Means** | **5.65** | **7.03** | **6.42** | **5.50** | **7.46** | **6.99** | **6.99** | **6.43** | **6.69** | **6.09** | **8.06** | **7.98** |
| | **Paired *t*-test (P)** | **0.145** | | | | | | **0.122** | | | | | |

Note: Dissolved oxygen was recorded at various times of day across sites and seasons (times available in final database).
Head = springhead, Mid = sampling area midpoint along channel, End = sampling area endpoint along channel.

### *3.3.1.5 Velocity*

Springbrook velocities varied between springs from <0.1 ft/sec in ponded sections (e.g., West Spring Complex 1, Unnamed 5 Spring, and Willow Spring) to a high of 3.0 ft/sec at Swallow Spring. It was not possible to measure velocity at a number of sites (N/A) because of extensive aquatic vegetation and/or shallowness of the water. An acoustic Doppler velocity meter (Flow Tracker 6300 ADV), in addition to the Marsh-McBirney Flo-Mate Model 2000, was tested in several stipulation springs in spring 2010 to determine if it better enabled velocity measurements under such conditions, but as reported to the BWG it did not. Results from 2009-2010 are shown in Tables 3-13 and 3-14.

**Table 3-13**
**Springbrook Velocity (ft/sec) in Spring Valley Monitoring Sites for 2009 and 2010**

| Site | Channel | Spring 2009 | | | Spring 2010 | | | Fall 2009 | | | Fall 2010 | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | Head | Mid | End | Head | Mid | End | Head | Mid | End | Head | Mid | End |
| Stonehouse Spring Complex | E | N/A | | | <0.1 | <0.1 | <0.1 | N/A | N/A | <0.1 | <0.1 | N/A | N/A |
| Willow Spring | A | N/A | N/A | N/A | N/A | <0.1 | <0.1 | N/A | N/A | N/A | N/A | N/A | N/A |
| Keegan Spring Complex | A | 0.8 | 0.8 | <0.1 | 3.0 | 2.8 | 1.6 | 0.4 | 0.4 | 0.2 | 0.6 | 0.6 | 0.2 |
| West Spring Valley Spring 1 | A | <0.1 | 0.2 | 0.1 | <0.1 | <0.1 | <0.1 | <0.1 | <0.1 | <0.1 | <0.1 | <0.1 | 0.1 |
| South Millick Spring | A | N/A | 0.2 | 0.8 | <0.1 | 1.5 | 1.4 | N/A | 0.2 | 0.9 | N/A | 0.9 | 0.1 |
| Unnamed 5 Spring | A | <0.1 | <0.1 | 0.2 | <0.1 | <0.1 | 0.1 | <0.1 | <0.1 | 0.5 | <0.1 | <0.1 | 0.3 |
| Minerva North Spring | A | ---[a] | --- | --- | N/A | <0.1 | 0.1 | 0.7 | <0.1 | 0.1 | <0.1 | 0.2 | 0.1 |
| Minerva North Spring | B | --- | --- | --- | <0.1 | <0.1 | <0.1 | <01. | N/A | N/A | <0.1 | N/A | 0.7 |
| Minerva Middle Spring | A | | | | <0.1 | <0.1 | 0.2 | <0.1 | <0.1 | 0.1 | <0.1 | <0.1 | <0.1 |
| Minerva Middle Spring | B | N/A | N/A | <0.1 | N/A | <0.1 | <0.1 | <0.1 | 0.1 | <0.1 | N/A | <0.1 | <0.1 |
| Swallow Spring | A | 3.0 | 0.6 | 0.8 | 1.5 | 0.3 | 2.5 | 1.2 | 0.6 | 0.7 | 0.2 | 0.3 | 0.3 |

[a]Velocity not measured
N/A = Unable to measure velocity due to vegetation/shallowness.
Head = springhead, Mid = sampling area midpoint along channel, End = sampling area endpoint along channel.

**Table 3-14**
**Springbrook Velocity (ft/sec) in Snake Valley Monitoring Sites for 2009 and 2010**

| Site | Channel | Spring 2009 | | | Spring 2010 | | | Fall 2009 | | | Fall 2010 | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | Head | Mid | End | Head | Mid | End | Head | Mid | End | Head | Mid | End |
| Clay Spring North | A | ---[a] | --- | --- | 1.5 | 0.3 | 0.1 | --- | --- | --- | --- | --- | 0.1 |
| Stateline Springs | A | N/A | 1.1 | 1.2 | 0.3 | 0.8 | 0.2 | N/A | 1.7 | 0.4 | N/A | 0.1 | 0.1 |
| Unnamed 1 Spring North of Big | A | N/A | N/A | N/A | <0.1 | 0.3 | 0.2 | N/A | 0.2 | N/A | N/A | <0.1 | <0.1 |
| Unnamed 1 Spring North of Big | B | N/A | N/A | N/A | N/A | 0.3 | 0.2 | N/A | 0.2 | N/A | N/A | <0.1 | 0.1 |
| Big Springs | A | 0.7 | --- | --- | 0.1 | 1.5 | 0.4 | 0.1 | --- | 1.0 | 0.2 | 1.0 | 0.5 |
| Big Springs | B | N/A | --- | --- | 0.1 | 1.5 | 0.4 | N/A | --- | 1.0 | 0.4 | 1.0 | 0.5 |
| North Little Spring | A | <0.1 | N/A | N/A | <0.1 | N/A | N/A | <0.1 | N/A | N/A | <0.1 | N/A | N/A |

[a]Velocity not measured
N/A = Unable to measure velocity due to vegetation/shallowness.
Head = springhead, Mid = sampling area midpoint along channel, End = sampling area endpoint along channel

### *3.3.1.6 Turbidity*

Turbidity levels in Spring Valley stipulation springs are shown in Table 3-15. Although the data show significantly higher turbidity in 2010 compared to 2009 for the fall season (paired *t*-test: p = 0.003), this result should be considered with caution. Many of the high values recorded were due to difficulties in obtaining representative samples in shallow water; i.e., sediments were disturbed and contaminated the sample. Thus, many of the values are not representative of existing conditions in these springs.

**Table 3-15**
**Turbidity Levels (NTU) in Spring Valley Monitoring Sites for 2009 and 2010**

| Site | Channel | Spring 2009 | | | Spring 2010 | | | Fall 2009 | | | Fall 2010 | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | Head | Mid | End | Head | Mid | End | Head | Mid | End | Head | Mid | End |
| Stonehouse Spring Complex | E | 51.6 | 7.9 | 7.4 | 5.67 | 9.47 | 10.4 | 14.6 | 20.1 | 26.9 | 14.3 | 174 | 93.1 |
| Willow Spring | A | 3.3 | 6.8 | 6.2 | 1.0 | 258 | 25.5 | 21.5 | 40.1 | 65.8 | 131 | 25.5 | 75.2 |
| Keegan Spring Complex | A | 1.7 | 6.6 | 9.8 | 7.44 | 160 | 11.4 | 2.1 | 7.2 | 3.5 | 10.7 | 13.7 | 3.9 |
| West Spring Valley Spring 1 | A | 7 | 6 | 5 | 11.4 | 5.8 | 25.7 | 5 | 1.1 | 1 | 89.1 | 3 | 7.5 |
| South Millick Spring | A | 12.6 | 4.9 | 6.1 | 10 | 9.25 | 7.12 | 2.9 | 8.2 | 10.2 | 3.7 | 4.1 | 5.1 |
| Unnamed 5 Spring | A | 78.9 | 6.9 | 3.5 | 4.58 | 3.36 | 1.24 | 23.7 | 7.1 | 4.3 | 4 | 33 | 18 |
| Minerva North Spring | A | --- | --- | --- | 2.04 | 3.38 | 4.95 | 1.08 | 13.9 | 11.2 | 4.4 | 6.9 | 9 |
| Minerva North Spring | B | --- | --- | --- | 23.4 | 5.92 | 6.05 | 6.15 | 23.7 | 8.7 | 7.7 | 13.8 | 11.5 |
| Minerva Middle Spring | A | 1.1 | 1.5 | 1 | 3.72 | 4.86 | 12.9 | 0.8 | 1.4 | 7.2 | 75.5 | 87.8 | 72.5 |
| Minerva Middle Spring | B | 1.2 | 3.2 | 1.2 | 7.66 | 5.83 | 13.3 | 1.43 | 2.19 | 5.94 | 18.7 | 45.4 | --- |
| Swallow Spring | A | 0.9 | 0.6 | 1.9 | 0.7 | 2.27 | 2.39 | 0.2 | 0.5 | 4.2 | 17.5 | 4.8 | 10.5 |
| | **Means** | **17.6** | **4.9** | **4.7** | **7.1** | **42.6** | **11.0** | **7.2** | **11.4** | **13.5** | **34.2** | **37.5** | **30.6** |
| | **Paired *t*-test (P)** | **0.230** | | | | | | **0.003** | | | | | |

Note: Head = springhead, Mid = sampling area midpoint along channel, End = sampling area endpoint along channel.

Turbidity levels in Snake Valley stipulation springs (Table 3-16) demonstrated a general trend of increasing turbidity downstream of the springhead during three of the four seasonal sampling events. As with the values for Spring Valley springs, some turbidity values in the Snake Valley springs result from disturbance of bottom sediments when collecting samples and are not representative of actual conditions.

Turbidity levels in flowing water systems are typically influenced by two factors: (1) significant increases in flow during storm events that stir up existing bottom sediments and introduce entrained particulate matter from surface runoff; and (2) direct physical disturbance. As spring systems are fed directly by groundwater inputs, they are not particularly influenced by storm events, but they can be affected by direct disturbance, e.g., cattle or sheep. Observations during the two years of sampling suggest that turbidity in the stipulation springs is generally low and does not significantly affect these systems, except during periods of direct disturbance.

**Table 3-16**
**Turbidity Levels (NTU) in Snake Valley Monitoring Sites for 2009 and 2010**

| Site | Channel | Spring 2009 | | | Spring 2010 | | | Fall 2009 | | | Fall 2010 | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | Head | Mid | End | Head | Mid | End | Head | Mid | End | Head | Mid | End |
| Clay Spring North | A | --- | --- | --- | 0.96 | 1 | 1.18 | --- | --- | --- | 83.4 | 2.2 | 3.1 |
| Stateline Springs | A | 1.0 | 1.0 | 16 | 1.28 | 6.44 | 2.1 | 3.8 | 3.8 | 5.3 | 2.4 | 6.3 | 12.8 |
| Unnamed 1 Spring North of Big | A | 0.5 | 6.0 | 12.1 | 1.07 | 3.59 | 5.75 | 1.7 | 1.6 | 10.7 | 45.3 | 18.4 | 5.2 |
| Unnamed 1 Spring North of Big | B | 0.9 | 6.0 | 12.1 | 2.06 | 3.59 | 5.75 | 1.8 | 1.6 | 10.7 | 3.8 | 18.4 | 5.2 |
| Big Springs | A | 0.3 | 2.0 | 1.0 | 1.78 | 0.98 | 1.78 | 2.0 | 3.2 | 2.5 | 1.4 | 2.1 | 2.5 |
| Big Springs | B | 0.8 | 2.0 | 1.0 | 2.61 | 0.98 | 1.78 | 0.84 | 3.2 | 2.5 | 0.8 | 2.1 | 3.5 |
| North Little Spring | A | 4.1 | 2.1 | 34.3 | 6.48 | 19.7 | 171 | 6.3 | 12.4 | 172 | 29.6 | 4.3 | --- |
| **Means** | | **1.3** | **3.2** | **12.8** | **2.3** | **5.2** | **27.0** | **2.7** | **4.3** | **34.0** | **23.8** | **7.7** | **5.4** |
| **Paired *t*-test (P)** | | **0.344** | | | | | | **0.133** | | | | | |

Note: Head = springhead, Mid = sampling area midpoint along channel, End = sampling area endpoint along channel.

### *3.3.1.7 Standard Water Quality - Discussion*

The first two years of the stipulation monitoring program have focused on obtaining point samples at a number of sites during the spring and fall seasons to describe water quality conditions. The single exception to this sampling strategy is the continuous measurement of water temperatures at the springheads using temperature loggers. The results generated by the temperature loggers provide insights into processes that are influencing water quality in these springs over time. To wit: (1) diurnal variations in temperature are apparent to varying degrees in the stipulation springs; and (2) there are seasonal changes as well. An example of these variations can be seen in a time-series plot of temperature logger data from West Spring Valley Complex 1 (Springhead A) (Figure 3-2).

Per the Plan, temperature logger data is collected in the immediate vicinity of the springheads, where water temperatures are expected to be relatively constant over time. Thus, temperature fluctuations downstream are likely more pronounced. It is expected that the various water quality parameters

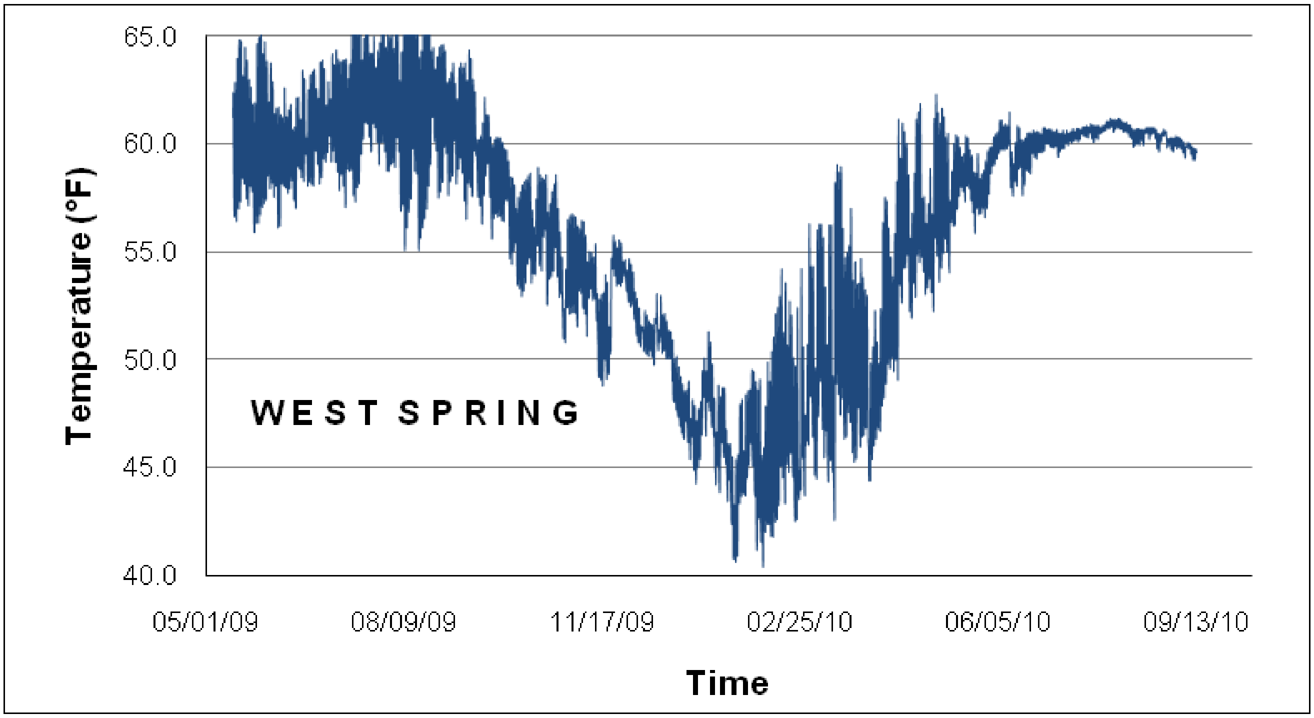



**Figure 3-2**
**Diurnal and Seasonal Variations in Temperature Logger Data from West Spring Valley Complex 1 (Springhead A)**

being collected under the Plan also exhibit diurnal fluctuations, also most likely more pronounced downstream of the springheads.

### *3.3.2 Nitrogen and Phosphorus*

Nitrogen (N) and phosphorus (P) samples were taken at one springhead per spring site. For each site, the springhead location where the nitrogen and phosphorus samples were taken coincided with one of the springheads where standard water-quality data were taken, as with well as the springhead where the temperature logger was placed.

Total nitrogen and total phosphorus appeared notably higher in 2010 compared to 2009 in both Spring and Snake valleys; however, there was no significant yearly difference for either spring or fall (paired *t*-tests: $p > 0.13$) (Tables 3-17 and 3-18). Average nutrient concentrations in Spring Valley sites were relatively higher compared with Snake Valley sites, but were not limiting in any systems.

Nutrients, especially nitrogen and phosphorus moieties, are essential for plant photosynthesis, or primary productivity. Based on the concentrations in the stipulation springs, it is evident that phosphorus would represent the potential limiting plant nutrient entering these spring systems. However, it is unlikely that these spring systems experience nutrient limitation under normal circumstances as groundwater provides a fairly constant nutrient input. Further, the springbrook sediments store large amounts of both nitrogen and phosphorus that can be released back into the water column if the springbrooks become depleted (as evidenced by select samples that were contaminated by sediments).

## Table 3-17
## Nutrient Concentrations (mg/L) in Spring Valley Monitoring Sites for 2009 and 2010

| Site | Springhead | Spring 2009 | | Spring 2010 | | Fall 2009 | | Fall 2010 | |
|---|---|---|---|---|---|---|---|---|---|
| | | Total N | Total P | Total N | Total P | Total N | Total P | Total N | Total P |
| Stonehouse Spring Complex | E | --- | --- | 3100 | 64 | 1600 | 32 | 3800 | 150 |
| Willow Spring | A | 440 | 25 | 2300 | 14 | 1340 | 120 | 180 | 28 |
| Keegan Spring Complex | A | 320 | 28 | 500 | 48 | 420 | 35 | 2900 | 330 |
| West Spring Valley Spring 1 | A | 510 | 100 | 3100 | 590 | 720 | 29 | 9400 | 1700 |
| South Millick Spring | A | 1630 | 40 | 2700 | 330 | 310 | 270 | 5600 | 700 |
| Unnamed 5 Spring | A | 1840 | 61 | 190 | 14 | 750 | 10 | 140 | 13 |
| Minerva North Spring | A | --- | --- | 390 | <10 | 440 | 22 | 700 | 16 |
| Minerva North Spring | B | 620 | <10 | 700 | <10 | 630 | 10 | 720 | 25 |
| Minerva Middle Spring | A | --- | --- | 190 | <10 | 3000 | 69 | 280 | <10 |
| | **Means** | **893** | **43** | **1463** | **119** | **1023** | **66** | **2636** | **330** |
| | | **Paired *t*-test (P)** | | | | **Paired *t*-test (P)** | | | |
| | **Total N** | **0.312** | | | | **0.209** | | | |
| | **Total P** | **0.221** | | | | **0.193** | | | |

Note: Nutrient samples were recorded at various times of day across sites and seasons (times available in final database).
Head = springhead, Mid = sampling area midpoint along channel, End = sampling area endpoint along channel.

## Table 3-18
## Nutrient Concentrations (mg/L) in Snake Valley Monitoring Sites for 2009 and 2010

| Site | Springhead | Spring 2009 | | Spring 2010 | | Fall 2009 | | Fall 2010 | |
|---|---|---|---|---|---|---|---|---|---|
| | | Total N | Total P | Total N | Total P | Total N | Total P | Total N | Total P |
| Clay Spring North | A | --- | --- | 260 | <10 | --- | --- | 820 | 100 |
| Stateline Springs | A | 580 | 12 | 550 | 21 | 680 | 16 | 1500 | <10 |
| Unnamed 1 Spring North of Big | A | 210 | <10 | 1100 | 43 | 240 | <10 | 3000 | 180 |
| Unnamed 1 Spring North of Big | B | 520 | <10 | 1900 | 18 | 670 | 22 | 1200 | 160 |
| Big Springs | A | --- | --- | 470 | 16 | 310 | 270 | 550 | 23 |
| | **Means** | **437** | **7** | **856** | **21** | **475** | **78** | **1414** | **116** |
| | | **Paired *t*-test (P)** | | | | **Paired *t*-test (P)** | | | |
| | **Total N** | **0.213** | | | | **0.152** | | | |
| | **Total P** | **0.158** | | | | **0.895** | | | |

Note: Nutrient samples were collected at various times of day across sites and seasons (times available in final database).
Head = springhead, Mid = sampling area midpoint along channel, End = sampling area endpoint along channel.

### *3.3.3 Temperature Loggers*

Time-series plots of temperature logger recordings from May 2009 to September 2010 are shown for all spring sites. These time-series plots serve mainly to demonstrate the uniqueness of the temperature regimes in each springhead, as well of some of the difficulties encountered.

#### *Spring Valley Springs*

**Stonehouse Spring Complex –** Temperature logger data for Stonehouse Spring Complex (Springhead E) are shown in Figure 3-3. A temperature logger was originally placed in Springhead A during the spring 2009 sampling event and subsequently moved to Springhead E (the site of springsnail transect surveys) during the Fall (September) 2009 sampling event. The logger was somehow disturbed in early November 2009, probably by grazing cattle. Thereafter, the logger recorded air temperatures until the spring 2010 sampling event when it was re-secured in its underwater position. The water temperature at Springhead E appears to be fairly constant around 56°F; at least during the periods water, as opposed to air, temperatures were being measured.

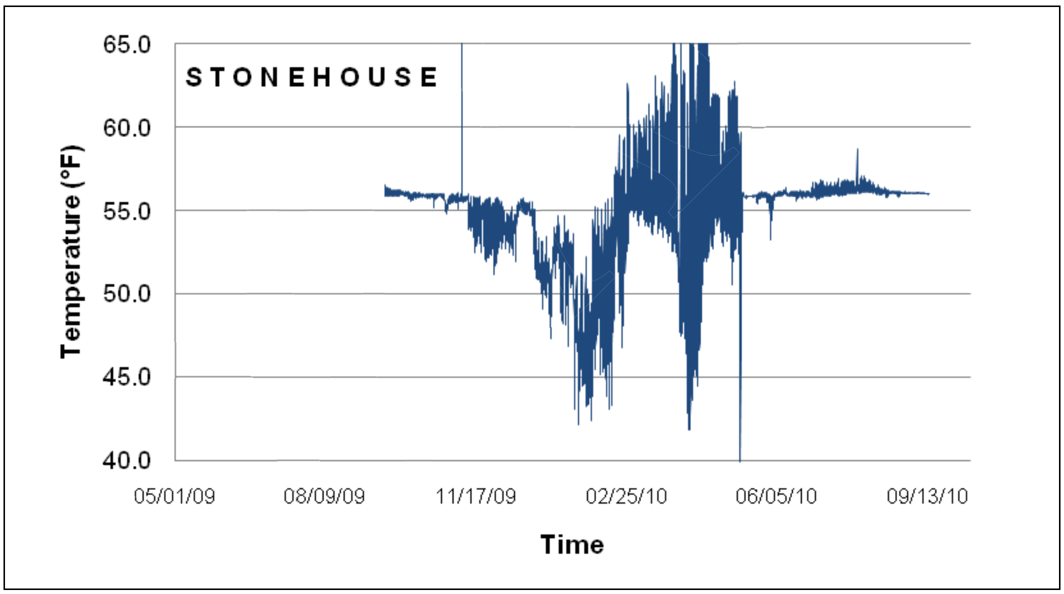



**Figure 3-3**
**Temperature Logger Data from Stonehouse Spring Complex (Springhead E)**

**Willow-NV Spring –** Temperature logger data for Willow-NV Spring (Springhead A) are shown in Figure 3-4. Water temperatures show some seasonal variation from a high of about 54°F in September to a low of about 48°F during the late spring. Water temperatures showed little diurnal variation, but the logger was somehow disturbed in early January 2010 and thereafter recorded air temperatures until the spring (May) 2010 sampling event when it was re-positioned underwater.

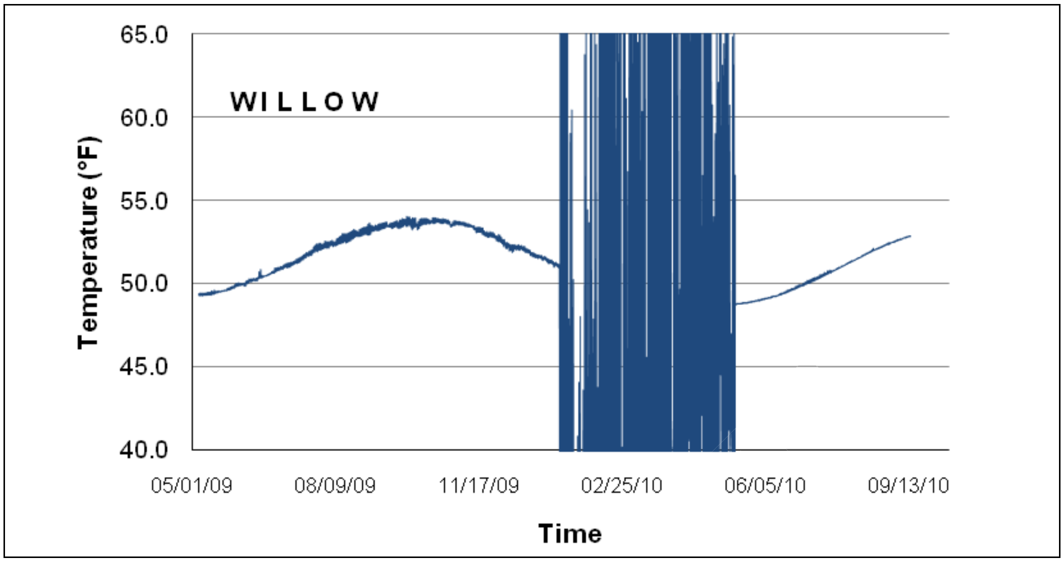



**Figure 3-4**
**Temperature Logger Data from Willow-NV Spring (Springhead A)**

**Keegan Spring Complex North –** Temperature logger data for Keegan Spring Complex North (Springhead A) are shown in Figure 3-5. This logger was placed in a riprap area just below a circular culvert that delivers the spring flow. The logger apparently became embedded in the sediments below the riprap where temperatures experience essentially no diurnal variations. The logger could not be located during the fall 2009 surveys due to heavy vegetation in this area of the spring. The logger was located during February 2010, at which time data were downloaded and the logger was repositioned in the same vicinity of the riprap area. This position appears similar to the original setting and diurnal variations in temperature became measurable once again. There appeared to be little seasonal variation in water temperatures at this site, probably because of the relatively fast flowing spring waters (2.8 - 3.0 fps).

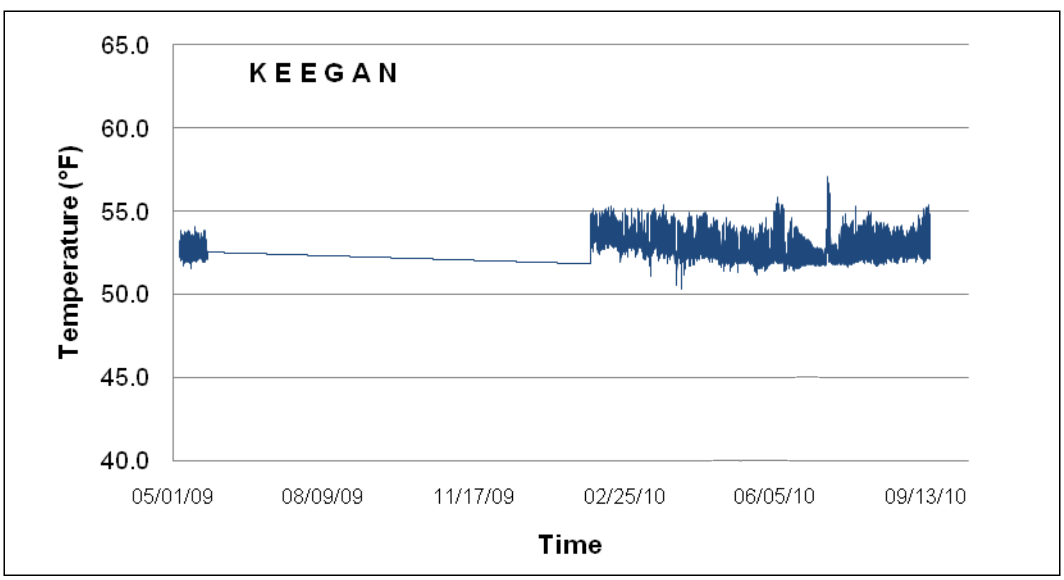



**Figure 3-5**
**Temperature Logger Data from Keegan Spring Complex North (Springhead A)**

**South Millick Spring –** Temperature logger data for South Millick Spring (Springhead A) are shown in Figure 3-6. The logger apparently was dislodged shortly after its deployment, measuring air temperatures from May 2009 to the fall (September) 2009 survey. Since then, water temperatures have demonstrated little 24-hour variation and a seasonal cycle ranging from a high of about 56°F in late October 2009 to a low of about 52°F in May 2010.

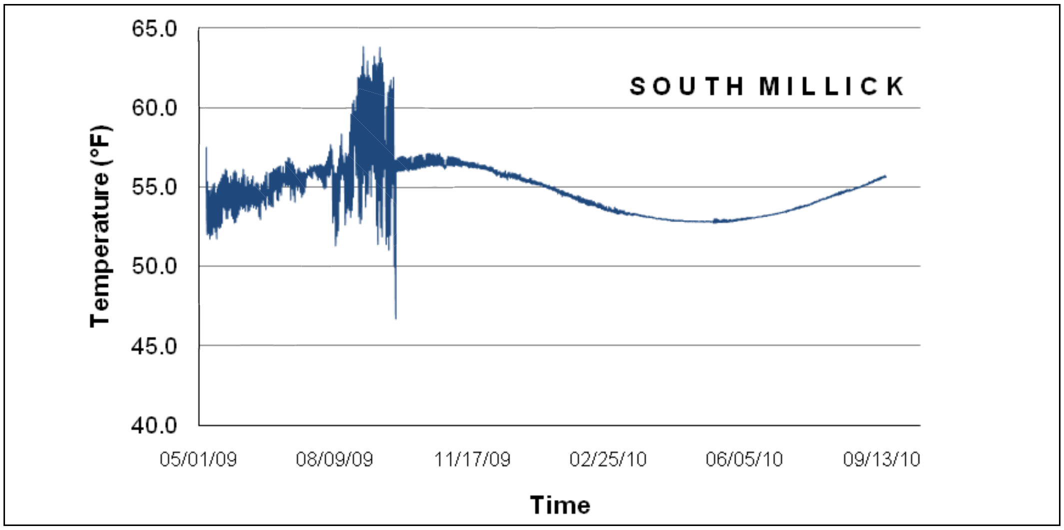



**Figure 3-6**
**Temperature Logger Data from South Millick Spring (Springhead A)**

**West Spring Valley Complex 1 –** Temperature logger data for West Spring Valley Complex 1 (Springhead A) are shown in Figure 3-7. There is considerable diurnal and seasonal variation in water temperatures at this site. Springhead A feeds directly into a relatively deep, slow-moving pool; the long retention time of water in this pool results in the observed notable diurnal and seasonal variations in water temperature. Average daily temperatures appear to range from about 62°F in the summer to a low of about 44°F in the winter.

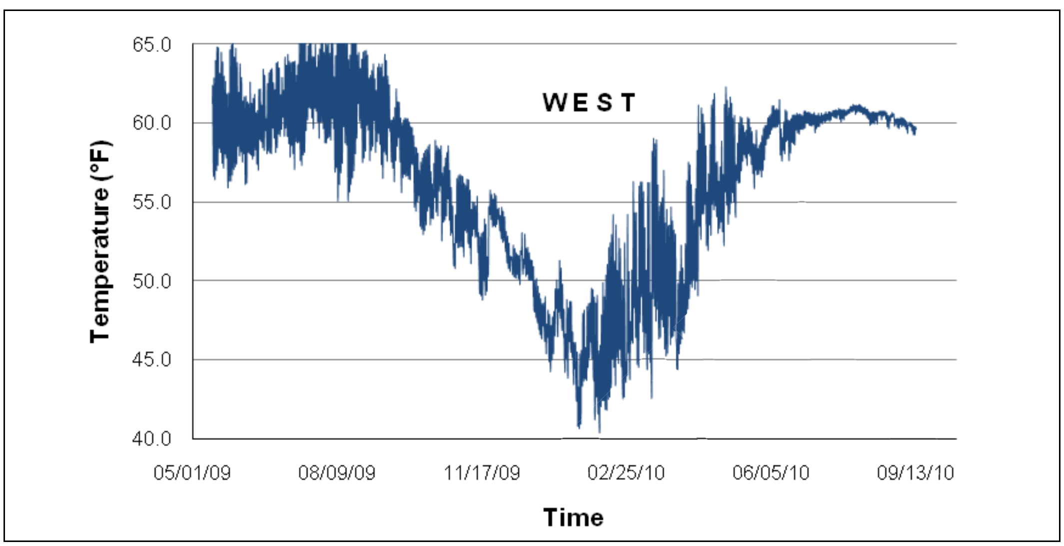



**Figure 3-7**
**Temperature Logger Data from West Spring Valley Complex 1 (Springhead A)**

**Unnamed 5 Spring –** Temperature logger data for Unnamed 5 Spring (Springhead A) are shown in Figure 3-8. Springhead A discharges into a large pool with slowly circulating water. As a result, there are noticeable diurnal changes in temperature throughout much of the year at this site. On average, seasonal temperatures appear to vary from about 54°F during the winter to about 56°F during the summer.

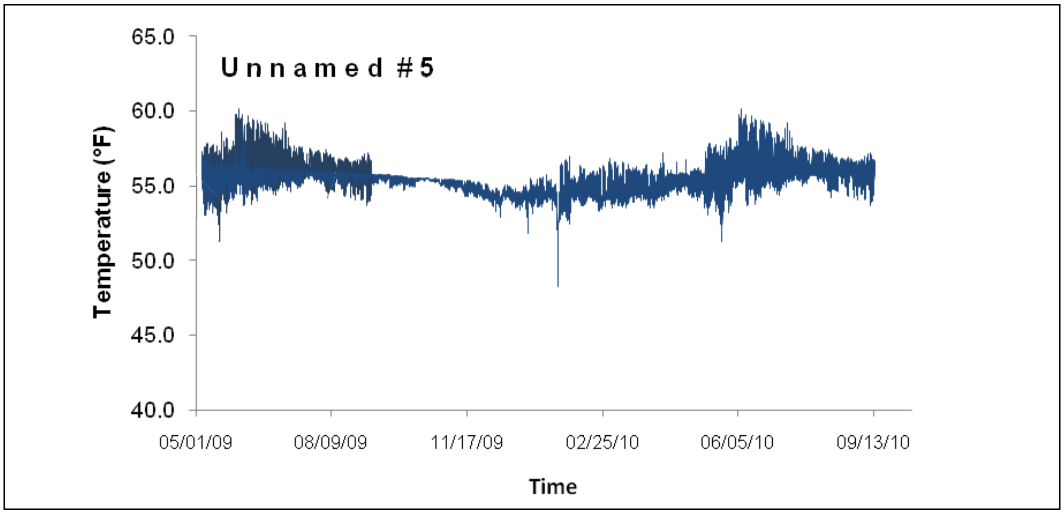



**Figure 3-8**
**Temperature Logger Data from Unnamed 5 Spring (Springhead A)**

**Swallow Spring –** Temperature logger data for Swallow Spring (Springhead A) are shown in Figure 3-9. Flow in Springhead A is relatively swift, about 0.90 to 1.2 fps (documented during water velocity sampling), and is usually well shaded by an extensive canopy of riparian vegetation, willows and cottonwoods. These characteristics minimize the daily variation in water temperature, except between late July and early September. During this period, there is some heating of these waters from the effects of direct sunlight. Seasonal temperature variation ranges from a low of about 47°F in late spring 2010 to a high of about 52°F in March 2010.

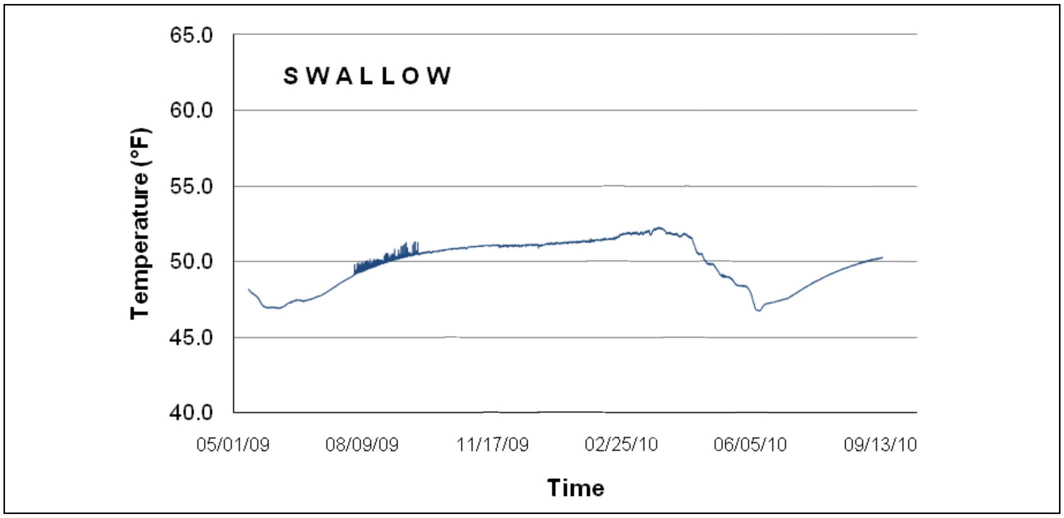



**Figure 3-9**
**Temperature Logger Data from Swallow Spring (Springhead A)**

**Minerva Spring Complex North –** Temperature logger data for Minerva Spring Complex North (Springhead A) are shown in Figure 3-10. The logger was not deployed until September 2009 (field error). The logger was placed in shallow water and displayed some diurnal temperature variation. In May 2010, shortly after the logger had been redeployed following data download, it was disturbed and began recording air temperatures. Readings suggest that the logger again became submerged for a several week period in July 2010 and then resurfaced, measuring air temperatures until the fall (September) 2010 field surveys when it was repositioned underwater.

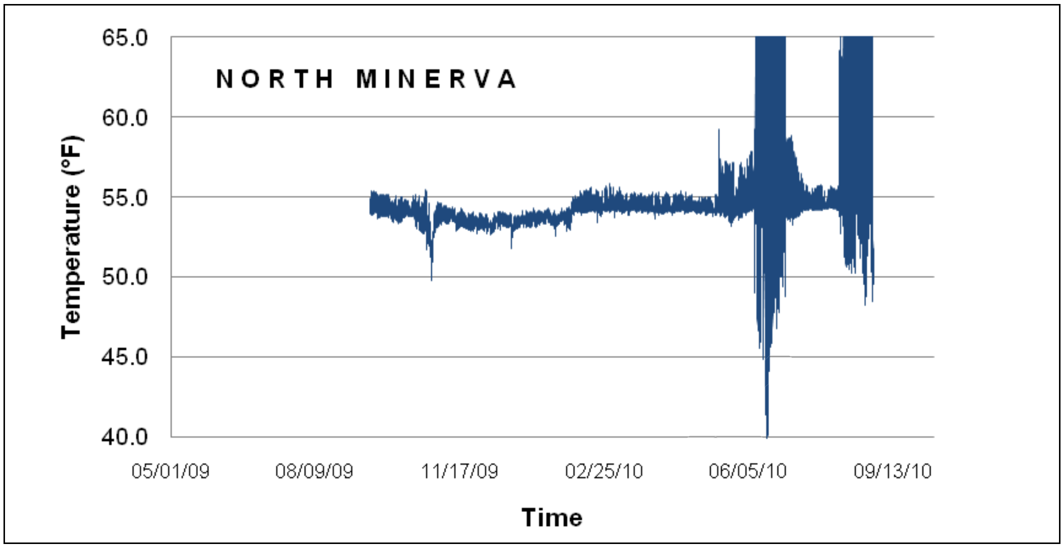



**Figure 3-10**
**Temperature Logger Data from Minerva Spring Complex North (Springhead A)**

**Minerva Spring Complex Middle –** Temperature logger data from Minerva Spring Complex Middle (Springhead A) are shown in Figure 3-11. The logger is located in Springhead A where water flows into a fairly large, slow flowing pool. The May to September 2009 data show a much smaller diurnal variation compared with the subsequent values. This change occurred after repositioning the logger following data download during the fall (September) 2009 surveys. While the logger was relocated to the general area it had been retrieved from, it is apparent from the time-series plot that the logger was subjected to increased exposure to sunlight. This result demonstrates that it is very important to minimize logger exposure to sunlight.

### *Snake Valley Springs*

**Clay Spring North –** Temperature logger data from Clay Spring North (Springhead A) are shown in Figure 3-12. Access was first granted to this private land in the spring of 2010. The data indicate that there is considerable diurnal variation in water temperatures in this spring.

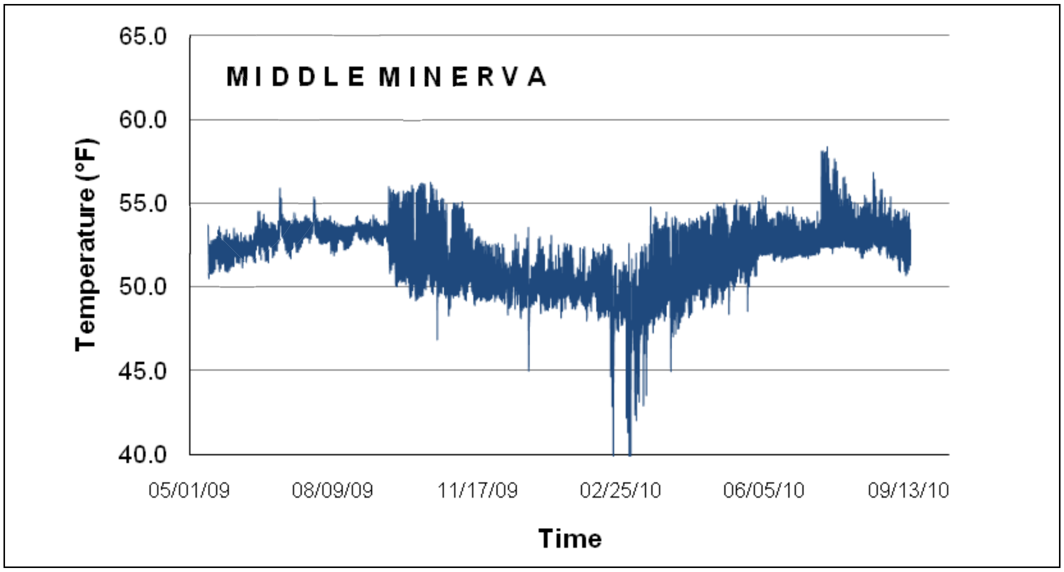



**Figure 3-11**
**Temperature Logger Data from Minerva Spring Complex Middle (Springhead A)**

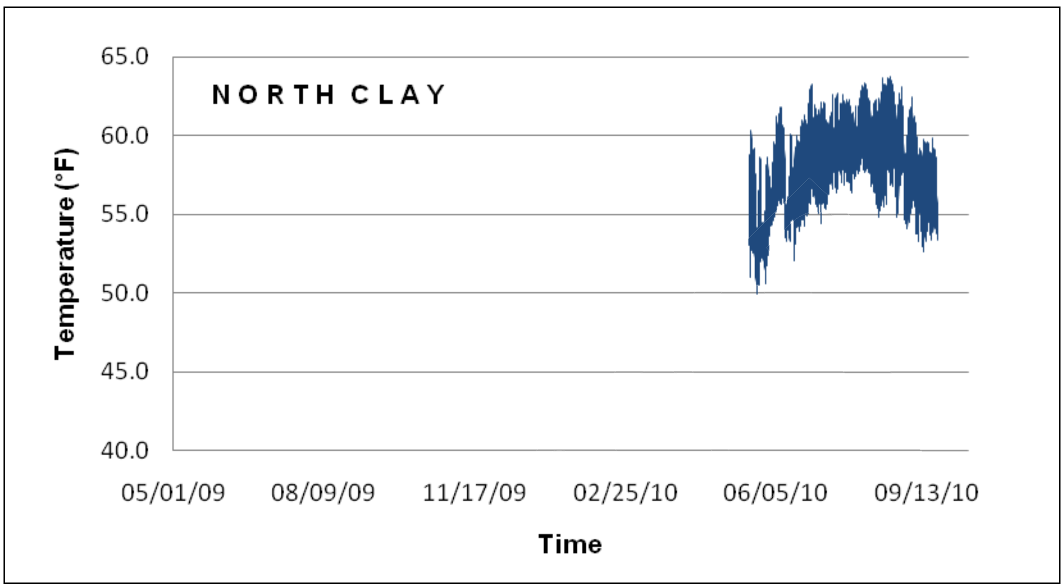



**Figure 3-12**
**Temperature Logger Data from Clay Spring North (Springhead A)**

**Stateline Springs –** Temperature logger data from Stateline Springs (Springhead A) are shown in Figure 3-13. Water temperatures typically demonstrated very little diurnal or seasonal variation. There appeared to be some disturbance to the logger starting in mid-October 2009, but it recovered by early December 2009. A second disturbance to the logger started around the third week of April 2010, and the logger eventually became completely exposed to the air. The logger was repositioned underwater upon its discovery during the spring (May) 2010 surveys.

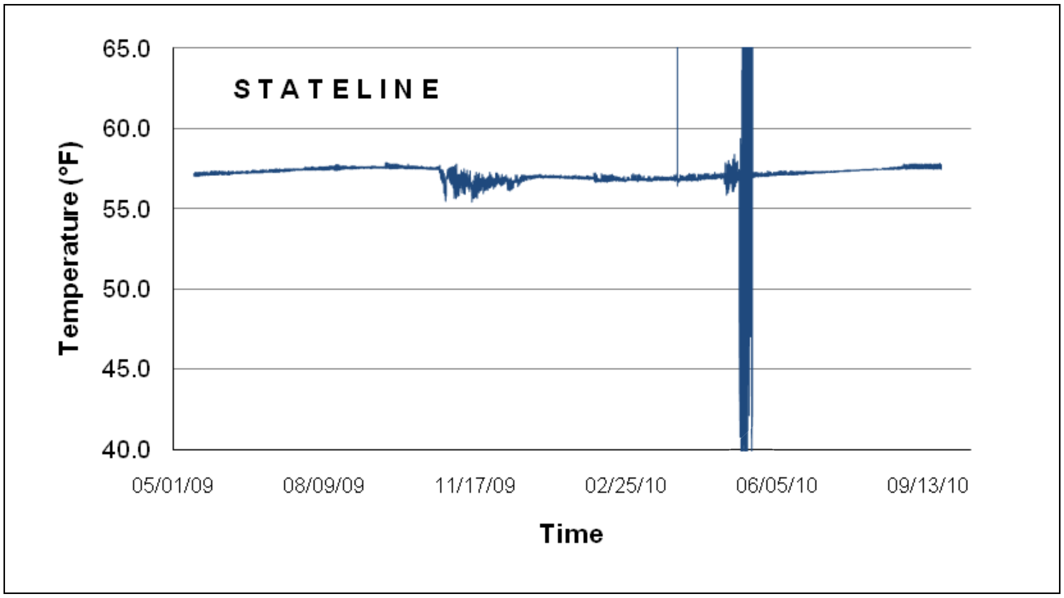



**Figure 3-13**
**Temperature Logger Data from Stateline Springs (Springhead A)**

**Unnamed 1 Spring North of Big –** Temperature logger data for Unnamed 1 Spring North of Big (Springhead A) are shown in Figure 3-14. This temperature logger appeared to be subject to air exposure both in May/June 2009 and again in March to May 2010; the logger was found out of water and resubmerged during the spring (May) 2010 surveys. Thereafter, the logger sank into the mud (where it was discovered during fall [September] 2010 surveys) and no longer measured diurnal variations in temperature. Average temperatures appeared to vary from a high of about 56°F in August 2009 to a low of about 50°F in January 2010.

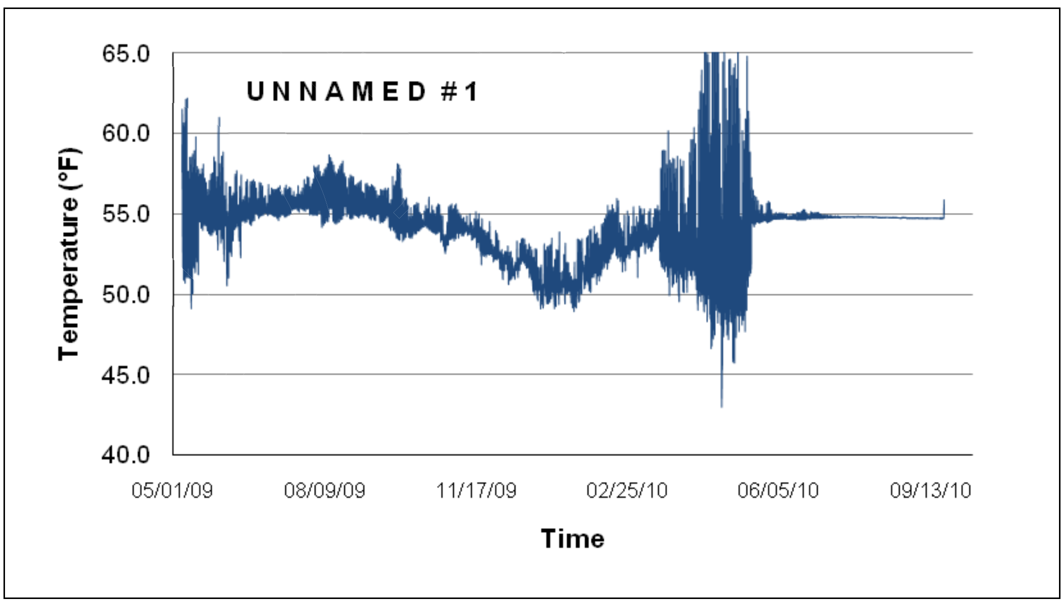



**Figure 3-14**
**Temperature Logger Data from Unnamed 1 Spring North of Big (Springhead A)**

**Big Springs –** Temperature logger data for Big Springs (Springhead B) are shown in Figure 3-15. Water temperatures are quite constant throughout much of the year and demonstrate very little diurnal variation. The lack of diurnal variation is largely due to the fast-flowing nature of the spring; up to 1.5 cfs were recorded during water velocity sampling. The diurnal variations that become apparent between September and November 2009 are likely due to increased exposure to sunlight due to the seasonal change in the solar angle of incidence.

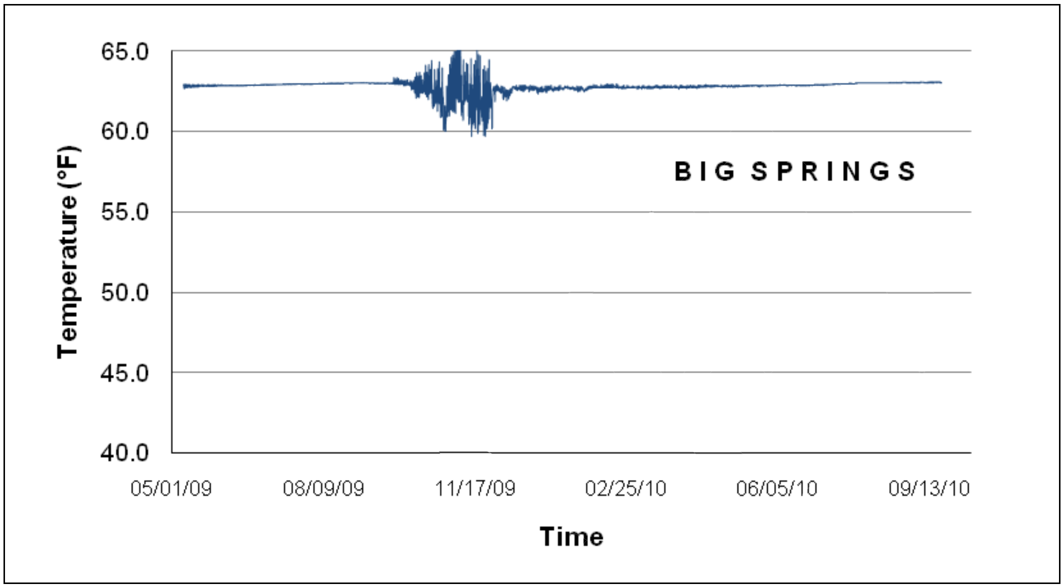



**Figure 3-15**
**Temperature Logger Data from Big Springs (Springhead B)**

**North Little Spring –** Temperature logger data for North Little Spring (Springhead A) are shown in Figure 3-16. The original temperature logger placed during the spring 2009 surveys was never recovered. A second logger was installed during fall (September) 2009 surveys and data from this logger were downloaded in February 2010. The second logger could not be located during the spring (May) 2010 surveys and was replaced with a third logger at that time. Average temperatures in North Little Spring vary from a low of about 32°F in December 2009 to a high of about 70°F in August 2010. It is apparent from the time-series plot that placement of the logger is critical in determining the real diurnal variation in temperature in this spring.

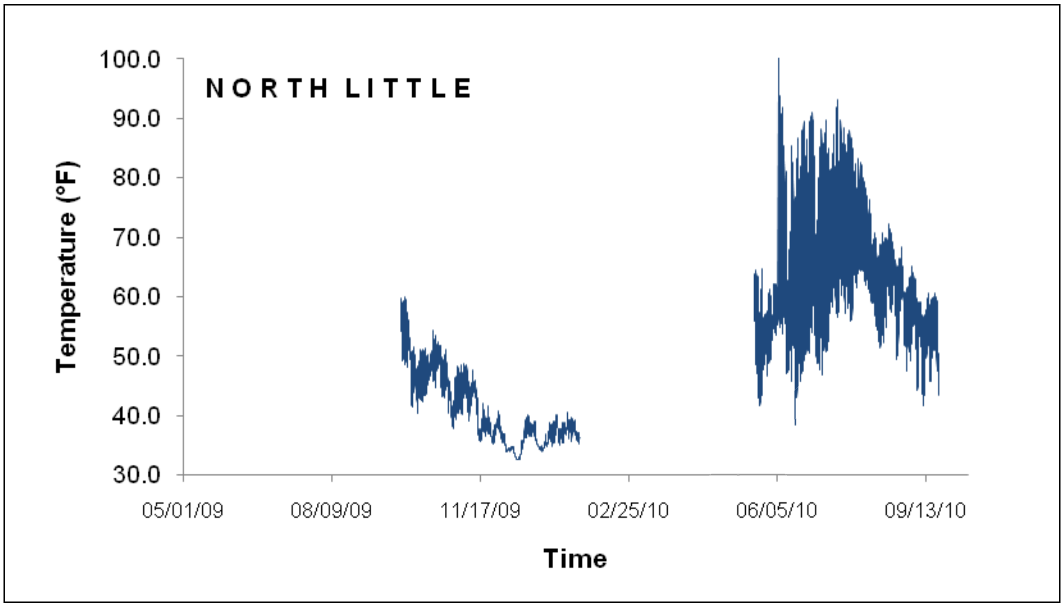



**Figure 3-16**
**Temperature Logger Data from North Little Spring (Springhead A)**

### *Temperature Logger Data - Discussion*

It is clear from the results presented above that there are two problems that continue to influence the data produced by the temperature loggers: (1) disturbance of the logger, most likely by cattle; and (2) positioning of the logger such that it has minimum exposure to sunlight. Testing of several shield designs will be undertaken in an effort to eliminate these problems. Furthermore, the temperature loggers in West Spring Valley Complex 1 and Unnamed 1 Spring North of Big may be moved from the springhead pools and repositioned at the top of the spring brook to more accurately assess water temperatures directly affecting springsnails in the upper reaches of these two spring systems.

## 3.4 Springsnails

The objectives for springsnail sampling are to monitor the seasonal and annual variation in springsnail abundance, monitor the spatial distribution of springsnails within each monitoring site, and describe habitat associations that may be governing springsnail abundance and/or distribution (per the Plan, page 5-11). In accordance with the Plan, in 2010 springsnail and springsnail habitat sampling was conducted at nine spring sites in spring (May 10-19) and fall (September 13-22). Within the nine spring sites, a total of 14 channels were surveyed.

Previous surveys have identified *Pyrgulopsis anguina* (longitudinal gland pyrg) and *Pyrgulopsis peculiaris* (bifid duct pyrg) in Big Springs, and *Pyrgulopsis anguina* in Stateline Springs and Clay Spring North (Snake Valley; BIO-WEST 2007 and 2009; UDWR 2009). *Pyrgulopsis kolobensis* (Tocquerville pyrg) previously has been identified in all Spring Valley monitoring sites (BIO-WEST 2007 and 2009).

Table 3-19 shows the following summary data: length of springsnail extent, total springsnail count (summed across sampling points [quadrats]), range of springsnail counts per quadrat, mean springsnail count per quadrat, and standard error of the mean. Number of transects and sample points (quadrats) are also provided to enable appropriate interpretation of total springsnail count. Figures 3-17 and 3-18 show springsnail counts (mean/quadrat and total across quadrats) and springsnail extent graphed by year and season for each channel. Results from a Linear Mixed Model analysis on springsnail counts comparing years and seasons (Model: Springsnail Count = Year Season Year* Season) by channel are shown in Table 3-20, and significant results are noted in Figures 3-17 and 3-18. Springsnail habitat mean values are presented in Table 3-21.

Mean springsnail count per sampling point (quadrat) and standard error of the mean were calculated to provide a standard way to compare springsnail count across channels and time, as well as to examine within-channel variation in springsnail distribution. Total springsnail count should not be used alone for comparison across sites because it is influenced, in part, by the number of transects; and number of transects is influenced, in part, by the physical length of a channel. Although mean count provides a standard metric, at times it can represent density and distribution rather than overall abundance in a channel. Mean count, total count, and extent, as well as distribution of abundance across extent, considered together provide information on relative abundance and distribution across space and time. The distribution of springsnail counts along each springsnail extent (mean springsnail count/quadrat calculated for each transect, charted from the springhead to the end of the springsnail extent) is presented in Appendix D.

### 3.4.1 Springsnail Extent

Springsnail extent varied across sampling periods by 30-55% in five channels (Stateline Channels A and B, Stonehouse Channel E, West Spring Valley Channel A, and Willow Channel A), and were relatively constant in eight channels (Table 3-19, Figures 3-17 and 3-18). There were no patterns in the direction or magnitude of change across seasons, and there was no pattern of change across years among sites. The most notable change in extent occurred at West Spring Valley Channel A, where extent ranged from 25 to 54 m (Spring 2009 and Fall 2010 extents = 46-60% of Fall 2009 and Spring 2010 extents). In Stateline Springs Channel B, springsnails were searched for but not discovered in

Fall 2009 (no standing water) or Spring 2010 (water present); although it is possible that they were present at very low levels, most likely their extent would not have been measurable.

Variations in springsnail extent may have been due, in part, to habitat conditions and population status. For example, at Stateline Springs Channel A, springsnail extent varied from 5 m (Fall 2009) to 11 m (Fall 2010), although standing water extended 11 m during all four sampling periods. Likewise, at West Spring Valley Channel A, springsnail extent varied from 25 m (Fall 2010) to 54 m (Spring 2010), although standing water extended well past the springsnail extent during all sampling periods. These results suggest that the springsnail populations were more limited in their extent during some sampling periods than others.

Variation in springsnail extent can also be influenced by the physical length of a channel. For example, Stateline Springs Channel A converged with Lake Creek 11 m from springhead A1, which constrained the springsnail extent to a possible maximum of 11 m. In comparison, Minerva Springs Complex North Channel A ran approximately 130 m, nearly 12 times longer. Because of this large difference in physical channel lengths, springsnail extent at this point appears most applicable to within-channel analysis. After more years of data are collected, across-channel or across-site analyses may become more meaningful.

### *3.4.2 Springsnail Abundance and Distribution*

Springsnail counts were significantly different across years and/or seasons in six ($p \leq 0.05$) to eight ($p \leq 0.1$) channels ($p \leq 0.05$: Clay Channel A [2010 data]), Unnamed 1 North of Big Channels A and B, West Spring Valley Channel A, and Willow Channel A; $p \leq 0.1$: Big Channel B and Minerva Middle Channel B) (Tables 3-19 and 3-20, Figures 3-17 and 3-18). Year*season interactions in four ($p \leq 0.05$) to five ($p \leq 0.1$) channels demonstrate that, like springsnail extent, there were no patterns in the direction or magnitude of change across seasons. There was also no pattern of change across years among sites. The most notable change in springsnail count occurred at West Spring Valley Complex Channel A, where mean count/quadrat ranged from 9.8 to 28.7, with Fall 2010 mean count reaching only 34% of Spring 2009 mean count; and in Unnamed 1 North of Big Channel A, where mean count/quadrat ranged from 8.62 to 28.5, with Spring 2009 mean count reaching only 30% of Fall 2009 mean count. In Stateline Springs Channel B, springsnails were searched for but not discovered in Fall 2009 (no standing water) and Spring 2010 (water present), although it is possible that they were present at low levels but not detected.

Variations in mean springsnail count may have been due, in part, to habitat conditions and population status. For example, at Unnamed 1 North of Big Channel B, mean springsnail count/quadrat ranged from 22.4-55.2 and total count across quadrats ranged from 2235-5230, but springsnail extent was relatively constant across all four sampling periods (extent range: 48 to 52 m). These results suggest that the springsnail population was more limited in abundance during some sampling periods than others.

Mean count, total count, and extent, as well as distribution of abundance across extent, considered together provide information on relative abundance and distribution across space and time. This is well demonstrated at West Spring Valley Channel A. At this site, mean springsnail count/quadrat in Spring 2009 was nearly twice that of Spring 2010, but total springsnail count across quadrats in

Spring 2009 was 73% that of Spring 2010 (Tables 3-19 and 3-20, Figures 3-17 and 3-18). The distribution graph of mean springsnail counts along the extents (Appendix D) demonstrates that the greater mean count in Spring 2009 was due, in part, to a high density of springsnails close to the springhead (mean count = 127 at the upstream transect and 99 at the second transect 5 m downstream) coupled with a relatively short extent (29 m). In comparison, in Spring 2010 the springsnails were more evenly distributed across approximately 19 m of the extent (mean count = 53 at the upstream transect and 37 at the eighth transect 19 m downstream), the extent was nearly twice as long (54 m), and 77% of the transects >21 m downstream had relatively low mean counts (≤5). These results suggest that the springsnails in Spring 2009 were more limited in their total extent, but conditions within 5 m of the springhead were good enough to support a relatively dense population area. The results also suggest that springsnails in both seasons were limited in abundance in the downstream portion of their extent.

Low counts in the downstream portion of springsnail extents were documented across almost all channels during all sampling periods (Appendix D). This suggests that springsnails in general are limited in abundance in the downstream portion of their extents. Low counts also might result in low detection rates, which can affect relative abundance and distribution results. If springsnails are present at low levels in the downstream portion of their extent but are not detected, mean count could increase and extent could decrease considerably, although total count probably would not appreciably change. Strictly following the protocol designed by the BWG (September 2010) when searching for springsnail presence and extent will decrease chance for error.

### *3.4.3 Springsnail Habitat*

Water temperature, dissolved oxygen, conductivity and pH were taken at each springsnail transect, and water velocity, water depth, and percent emergent vegetation cover were collected at each springsnail sample point. Mean springsnail habitat values by channel and sampling period are shown in Table 3-21. Presence/absence data for submergent vegetation, filamentous algae and substrates (fines, sand, gravel, cobble and boulder) are included in the database.

## Table 3-19
## Descriptive Statistics: Springsnail Extents, Transects and Sampling Points, and Total and Mean Counts for 2009 and 2010

| Hydrographic Basin Site | Channel | Year | Springsnail Extent (m)[a] | | Number of Transects | | Number of Sample Points (quadrats) | | Total Springsnail Count | | Springsnail Count Range/ quadrat | | Mean Count/ quadrat | | Standard Error of Mean | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | Spring | Fall | Spring | Fall | Spring | Fall | Spring | Fall | Spring | Fall | Spring | Fall | Spring | Fall |
| **Spring Valley** Minerva Middle | A | 2009 | 33 | 30 | 13 | 14 | 65 | 70 | 213 | 245 | 0-46 | 0-19 | 3.3 | 3.5 | 0.8 | 0.6 |
| | | 2010 | 30 | 30 | 13 | 14 | 65 | 70 | 202 | 134 | 0-22 | 0-17 | 3.1 | 1.9 | 0.6 | 0.4 |
| Minerva Middle | B | 2009 | 33 | 33 | 14 | 14 | 54 | 62 | 396 | 480 | 0-74 | 0-94 | 7.3 | 7.7 | 1.8 | 1.8 |
| | | 2010 | 37 | 36 | 18 | 18 | 82 | 88 | 303 | 539 | 0-28 | 0-99 | 3.7 | 6.1 | 0.6 | 1.3 |
| Minerva North | A | 2009 | c | 110 | c | 20 | c | 89 | c | 4470 | c | 0-304 | c | 50.2 | c | 5.1 |
| | | 2010 | 111 | 115 | 17 | 22 | 77 | 101 | 3978 | 4232 | 0-362 | 0-268 | 51.7 | 41.9 | 7.4 | 4.9 |
| Stonehouse | E | 2009 | 22 | 21 | 9 | 9 | 45 | 45 | 397 | 395 | 0-71 | 0-62 | 8.8 | 8.8 | 1.9 | 1.7 |
| | | 2010 | 31 | 30 | 15 | 13 | 70 | 63 | 648 | 169 | 0-56 | 0-33 | 9.3 | 2.7 | 1.5 | 0.6 |
| West Spring Valley | A | 2009 | 29 | 48 | 12 | 15 | 37 | 68 | 1061 | 973 | 0-163 | 0-147 | 28.7 | 14.3 | 6.7 | 3.5 |
| | | 2010 | 54 | 25 | 21 | 12 | 95 | 60 | 1448 | 585 | 0-148 | 0-80 | 15.2 | 9.8 | 2.7 | 1.5 |
| Willow | A | 2009 | 21 | 22 | 10 | 10 | 50 | 41 | 191 | 566 | 0-26 | 0-62 | 3.8 | 13.8 | 0.7 | 2.4 |
| | | 2010 | 25 | 30 | 11 | 13 | 44 | 57 | 373 | 582 | 0-57 | 0-48 | 8.5 | 10.2 | 1.9 | 1.5 |
| **Snake Valley** Big | A[b] | 2009 | 16 | 14 | 7 | 7 | 35 | 35 | 192 | 257 | 0-26 | 0-71 | 5.5 | 7.3 | 1.1 | 2.4 |
| | | 2010 | 16 | 17 | 7 | 7 | 35 | 35 | 137 | 213 | 0-55 | 0-71 | 3.9 | 6.1 | 1.6 | 2.1 |
| Big | B | 2009 | 18d | 15d | 10 | 8 | 50 | 40 | 165 | 321 | 0-15 | 0-71 | 3.3 | 8.0 | 0.5 | 2.0 |
| | | 2010 | 18d | 18d | 8 | 10 | 39 | 50 | 434 | 49 | 0-104 | 0-5 | 11.1 | 1.0 | 2.6 | 0.2 |
| Clay | A | 2009 | c | c | c | c | c | c | c | c | c | c | c | c | c | c |
| | | 2010 | 61 | 56 | 20 | 20 | 100 | 97 | 5779 | 3286 | 0-468 | 0-198 | 57.8 | 33.9 | 7.7 | 4.7 |
| Stateline | A[b] | 2009 | 8 | 5 | 3 | 3 | 15 | 15 | 48 | 77 | 0-25 | 0-21 | 3.2 | 5.1 | 1.6 | 1.8 |
| | | 2010 | 7 | 11 | 4 | 5 | 20 | 25 | 143 | 26 | 0-53 | 0-4 | 7.2 | 1.0 | 3.0 | 0.3 |
| Stateline | B | 2009 | 9 | 0e | 4 | e | 13 | e | 3 | 0e | 0-2 | 0e | 0.2 | 0e | 0.2 | e |
| | | 2010 | 0e | 8 | e | 5 | e | 24 | 0e | 9 | 0e | 0-3 | 0e | 0.4 | e | 0.2 |
| Stateline | C | 2009 | f | f | f | f | f | f | f | f | f | f | f | f | f | f |
| | | 2010 | f | 6f | f | 3f | f | 15f | f | 26f | f | 0-7f | f | 1.7f | f | 0.6f |
| Unnamed 1 N of Big | A[b] | 2009 | 59 | 57 | 20 | 20 | 100 | 100 | 862 | 2846 | 0-114 | 0-244 | 8.62 | 28.5 | 1.6 | 4.6 |
| | | 2010 | 67 | 60 | 20 | 22 | 100 | 108 | 1853 | 2899 | 0-133 | 0-134 | 18.5 | 26.8 | 2.7 | 3.3 |
| Unnamed 1 N of Big | B | 2009 | 52 | 48 | 20 | 20 | 100 | 100 | 2235 | 3085 | 0-167 | 0-227 | 22.4 | 30.9 | 3.7 | 4.1 |
| | | 2010 | 52 | 52 | 20 | 18 | 100 | 90 | 5230 | 4968 | 0-383 | 0-275 | 52.3 | 55.2 | 6.9 | 7.2 |

[a]Extents were reported incorrectly in Table 3-10 of the 2009 annual report (SNWA, 2010).
[b]Big and Unnamed 1: Channels A and B converge; springsnails in the convergence included in Channel A. Stateline: Springhead A1 and Channel A.
[c]Not surveyed (Clay Spring: access not granted; Minerva Spring Complex North: field error).
[d]Extent approximated from physical habitat map and transect UTM coordinates (not measured consistently in the field).
[e]Springsnails not discovered (Fall 2009: no water and no springsnails discovered; Spring 2010: water present but springsnails not discovered).
[f]Not surveyed in a consistent enough fashion to allow comparison across seasons. Fall 2010 data collection focused on the major path of water flow.

## Table 3-20
## Linear Mixed Model Results Comparing Springsnail Counts across Years and Seasons for Spring and Fall 2009 and 2010

Model: Springsnail count = Year Season Year*Season. Restricted maximum likelihood estimation was used to fit the linear mixed model. The variables year (2009, 2010), season (spring, fall) and year*season interaction were fixed effects.

| Site | Channel | N | Significance $p \leq 0.05$ (*), $p<0.1$ (^) | | | p value | | | F value | | | DF | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | Year | Season | Yr*Seas | Year | Season | Yr*Seas | Year | Season | Yr*Seas | Num. | Den. |
| **Spring Valley** | | | | | | | | | | | | | |
| Minerva Middle | A | 270 | | | | 0.13 | 0.4 | 0.2 | 2.31 | 0.71 | 1.50 | 1 | 266 |
| Minerva Middle | B | 286 | ^ | | | 0.06 | 0.3 | 0.5 | 3.73 | 1.09 | 0.55 | 1 | 282 |
| Minerva North | A | 267 | | | | 0.3 | 0.2 | b | 1.13 | 1.44 | b | 1 | 264 |
| Stonehouse | E | 223 | ^ | * | * | 0.06 | 0.03 | 0.03 | 3.63 | 4.96 | 4.83 | 1 | 219 |
| West Spring Valley | A | 260 | * | * | | 0.012 | 0.006 | 0.2 | 6.40 | 7.79 | 1.56 | 1 | 256 |
| Willow | A | 192 | | * | * | 0.8 | 0.001 | 0.014 | 0.10 | 12.39 | 6.15 | 1 | 188 |
| **Snake Valley** | | | | | | | | | | | | | |
| Big | A | 140 | | | | 0.5 | 0.3 | 0.9 | 0.57 | 1.16 | 0.01 | 1 | 136 |
| Big | B | 179 | | ^ | * | 0.8 | 0.07 | 0.0001 | 0.07 | 3.28 | 24.65 | 1 | 175 |
| Clay | A | 197 | | * | | a | 0.009 | a | a | 6.94 | a | 1 | 195 |
| Stateline | A | 75 | | 1 | * | 0.9 | 0.3 | 0.04 | 0.001 | 1.16 | 4.31 | 1 | 71 |
| Stateline | B | 39 | c | c | c | 0.9 | 0.9 | 0.6 | 0.02 | 0.02 | 0.34 | 1 | 35 |
| Stateline | C | d | d | d | d | d | d | d | d | d | d | d | d |
| Unnamed 1 N of Big | A | 408 | | * | ^ | 0.2 | 0.0001 | 0.08 | 1.61 | 18.59 | 3.12 | 1 | 404 |
| Unnamed 1 N of Big | B | 390 | * | | | 0.0001 | 0.3 | 0.6 | 23.30 | 1.03 | 0.25 | 1 | 386 |

[a]Not surveyed in 2009 (access not granted).
[b]Not surveyed in spring 2009 (field error).
[c]Springsnail count = 0 in Fall 2009 and Spring 2010. Lack of significance likely due to low power and statistical difficulties in handling zero counts.
[d]Not surveyed in a consistent enough fashion to allow comparison across seasons. Fall 2010 data collection focused on the major path of water flow.

## Table 3-21
## Descriptive Statistics: Springsnail Habitat Mean Values for 2009 and 2010

| Hydrographic Basis Site | Channel | Year | Water Temperature (°F) | | Conductivity (µS/cm) | | pH | | Dissolved Oxygen (%)[a] | | Water Velocity (fps)[a] | | Emergent Vegetation (%) | | Water Depth (cm) | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | Spring | Fall | Spring | Fall | Spring | Fall | Spring | Fall | Spring | Fall | Spring | Fall | Spring | Fall |
| **Spring Valley** Minerva Middle | A | 2009 | 55 | 54 | 375 | 367 | 7.67 | 8.14 | 80 | 98 | 0.3 | 0.2 | d | 59 | 7 | 11 |
| | | 2010 | 56 | 55 | 377 | 373 | 7.27 | 6.70 | 120 | 103 | 0.1 | 0.1 | 33 | 31 | 9 | 14 |
| Minerva Middle | B | 2009 | 56 | 56 | 397 | 396 | 7.71 | 8.22 | 65 | 87 | 0.01 | 0.1 | d | 54 | 4 | 5 |
| | | 2010 | 57 | 56 | 377 | 375 | 7.39 | 6.61 | 106 | 94 | 0.1 | 0.1 | 55 | 37 | 5 | 6 |
| Minerva North | A | 2009 | c | 61 | c | 283 | c | 8.57 | c | 96 | c | 0.1 | c | 75 | c | 6 |
| | | 2010 | 56 | 56 | 264 | 279 | 7.88 | 7.33 | 108 | 103 | 0.2 | 0.2 | 50 | 46 | 4 | 4 |
| Stonehouse | E | 2009 | 65 | 66 | 411 | 333 | 7.60 | 7.26 | 63 | 82 | d | d | d | 85 | 6 | 9 |
| | | 2010 | 53 | 67 | 463 | 370 | 7.14 | 6.92 | 85 | 101 | 0.02 | d | 40 | 27 | 8 | 4 |
| West Spring Valley | A | 2009 | 68 | 59 | 384 | 338 | 7.35 | 7.29 | 32 | 69 | 0.1 | 0.04 | d | 97 | 6 | 5 |
| | | 2010 | 54 | 58 | 345 | 370 | 7.18 | 6.63 | 76 | 66 | 0.2 | 0.1 | 70 | 71 | 6 | 3 |
| Willow | A | 2009 | 61 | 62 | 617 | 401 | 7.68 | 7.61 | 81 | 78 | d | d | d | 85 | 2 | 2 |
| | | 2010 | 51 | 60 | 418 | 419 | 7.32 | 7.50 | 79 | 82 | 0.02 | d | 59 | 41 | 2 | 1 |
| **Snake Valley** Big | A[b] | 2009 | 63 | 63 | 361 | 390 | 7.50 | 7.54 | 45 | 69 | 1.0 | 0.6 | d | 66 | 8 | 11 |
| | | 2010 | 63 | 63 | 366 | 363 | 7.79 | 7.69 | 70 | 76 | 0.6 | 0.6 | 61 | 49 | 15 | 10 |
| Big | B | 2009 | 63 | 63 | 362 | 392 | 7.51 | 7.49 | 44 | 68 | 0.4 | 0.4 | d | 89 | 10 | 9 |
| | | 2010 | 64 | 64 | 365 | 373 | 7.65 | 7.77 | 68 | 78 | 0.3 | 0.4 | 95 | 48 | 10 | 5 |
| Clay | A | 2009 | c | c | c | c | c | c | c | c | c | c | c | c | c | c |
| | | 2010 | 58 | 57 | 567 | 629 | 7.91 | 7.61 | 67 | 69 | 0.4 | 0.1 | 13 | 47 | 10 | 12 |
| Stateline | A[b] | 2009 | 63 | 58 | 488 | 371 | 8.02 | 7.65 | 47 | 62 | 0.5 | 0.2 | d | 75 | 4 | 5 |
| | | 2010 | 58 | 58 | 343 | 339 | 8.31 | 7.90 | 70 | 79 | 0.2 | 0.2 | 54 | 32 | 5 | 6 |
| Stateline | B | 2009 | 60 | e | 409 | e | 7.93 | e | 53 | e | 0.4 | e | d | e | 3 | e |
| | | 2010 | e | 59 | e | 343 | e | 7.6 | e | 80 | e | 0.05 | e | 50 | e | 4 |
| Stateline | C | 2009 | f | f | f | f | f | f | f | f | f | f | f | f | f | f |
| | | 2010 | f | 57 | f | 342 | f | 7.4 | f | 76 | f | 0.3 | f | 29 | f | 8 |
| Unnamed 1 N of Big | A[b] | 2009 | 65 | 56 | 408 | 455 | 7.84 | 7.76 | 55 | 83 | d | d | d | 95 | 3 | 3 |
| | | 2010 | 57 | 60 | 415 | 453 | 7.59 | 7.79 | 96 | 93 | 0.2 | d | 95 | 65 | 3 | 3 |
| Unnamed 1 N of Big | B | 2009 | 62 | 58 | 492 | 475 | 7.87 | 7.66 | 53 | 81 | d | d | d | 97 | 4 | 5 |
| | | 2010 | 58 | 61 | 430 | 446 | 7.57 | 7.71 | 98 | 103 | 0.04 | 0.1 | 88 | 55 | 3 | 4 |

[a]Dissolved oxygen >100% = supersaturated conditions. Velocity: means of recorded values (missing values - unrecordable due to field conditions).
[b]Big and Unnamed 1: Channels A and B converge; springsnails in the convergence included in Channel A. Stateline: Springhead A1 and Channel A.
[c]Not surveyed (Clay Spring: access not granted; Minerva Spring Complex North: field error).
[d]Velocity: not recordable due to field conditions. Per Plan, % shaded recorded in Spring 2009; changed to % emergent vegetation in Fall 2009.
[e]Springsnails not discovered (Fall 2009: no water and no springsnails discovered; Spring 2010: water present but springsnails not discovered).
[f]Not surveyed in a consistent enough fashion to allow comparison across seasons. Fall 2010 data collection focused on the major path of water flow.

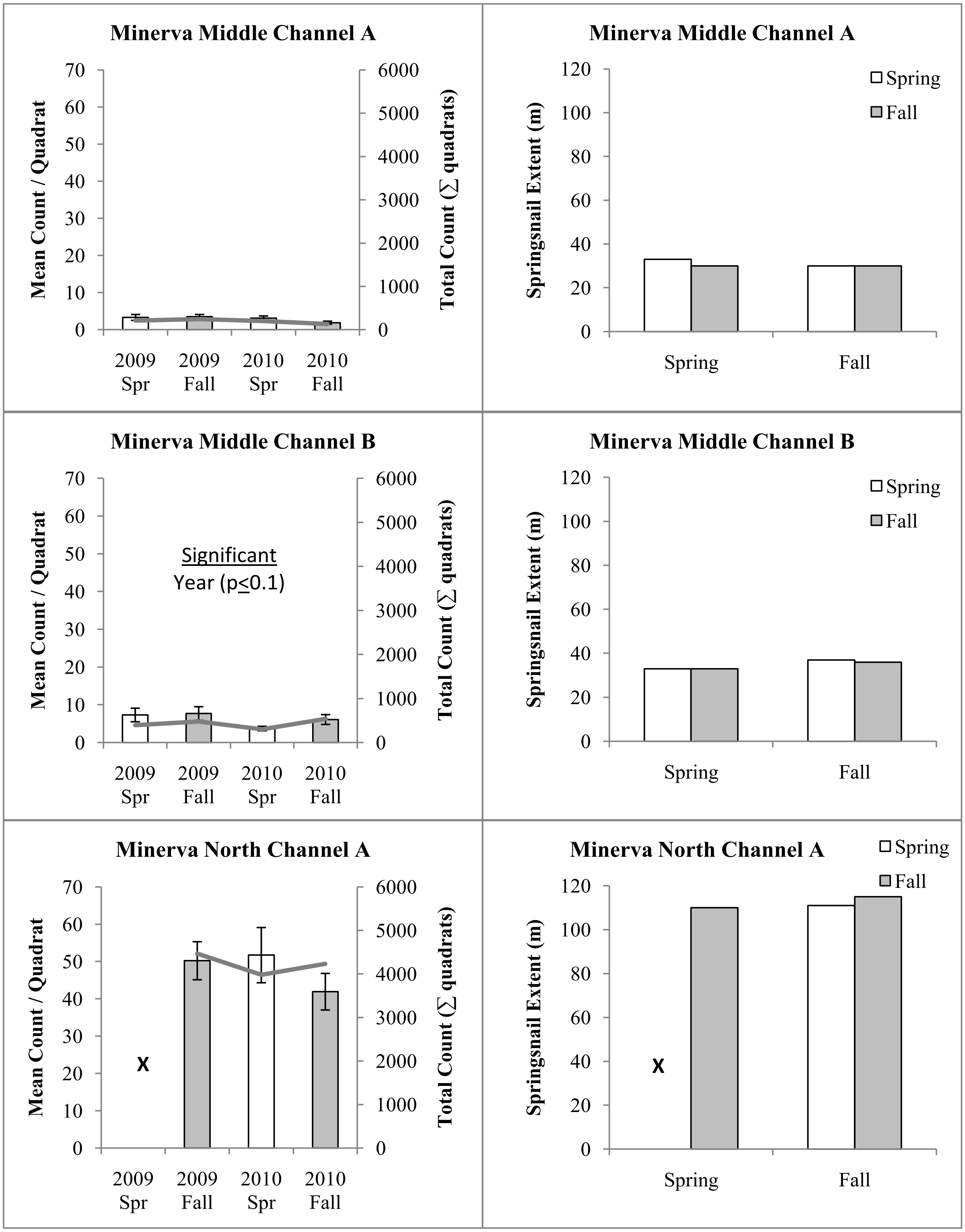



**Figure 3-17**
**Springsnail Counts (Mean = bar, Total = line) and Springsnail Extents, Spring Valley 2009 and 2010**
(Page 1 of 2)

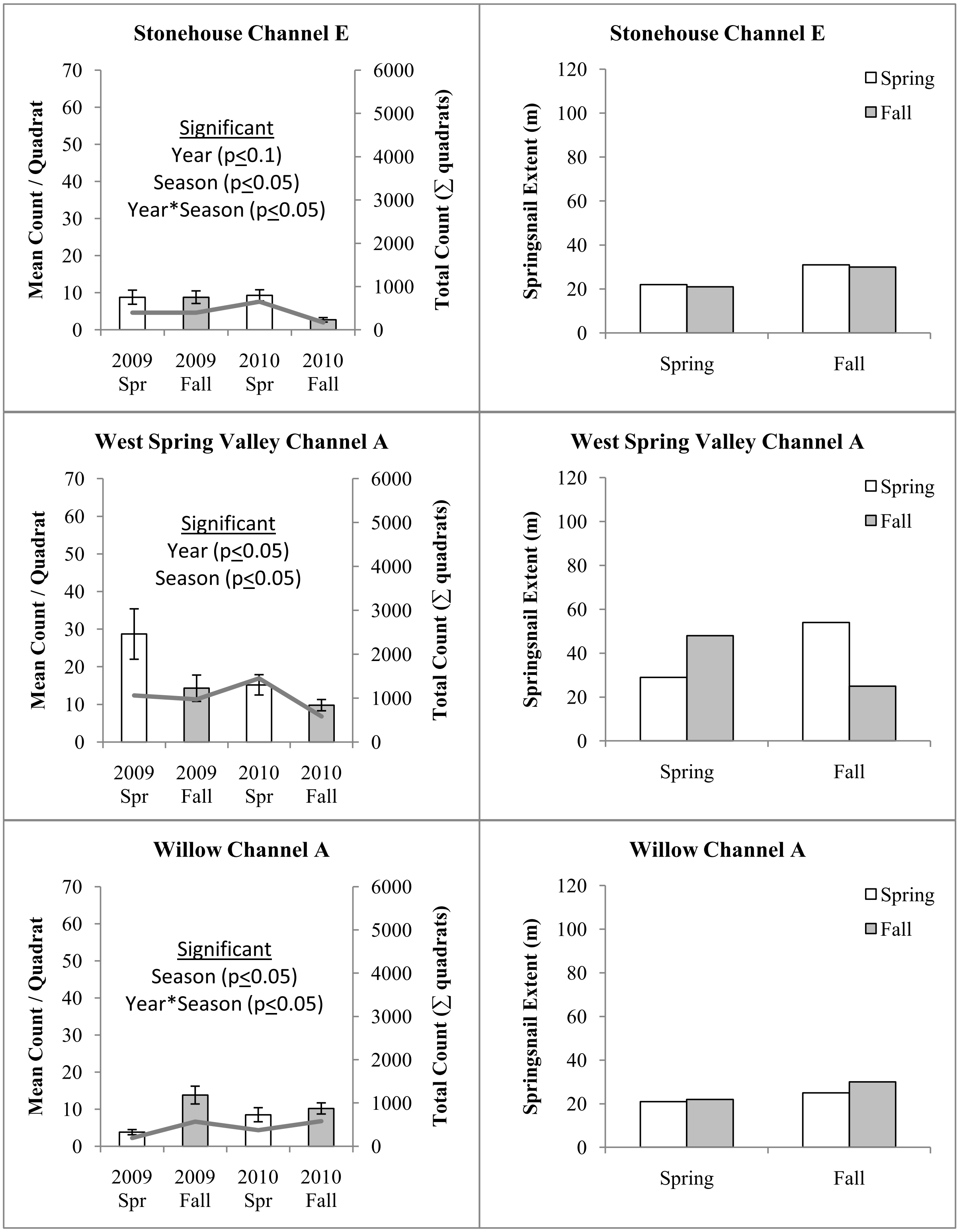
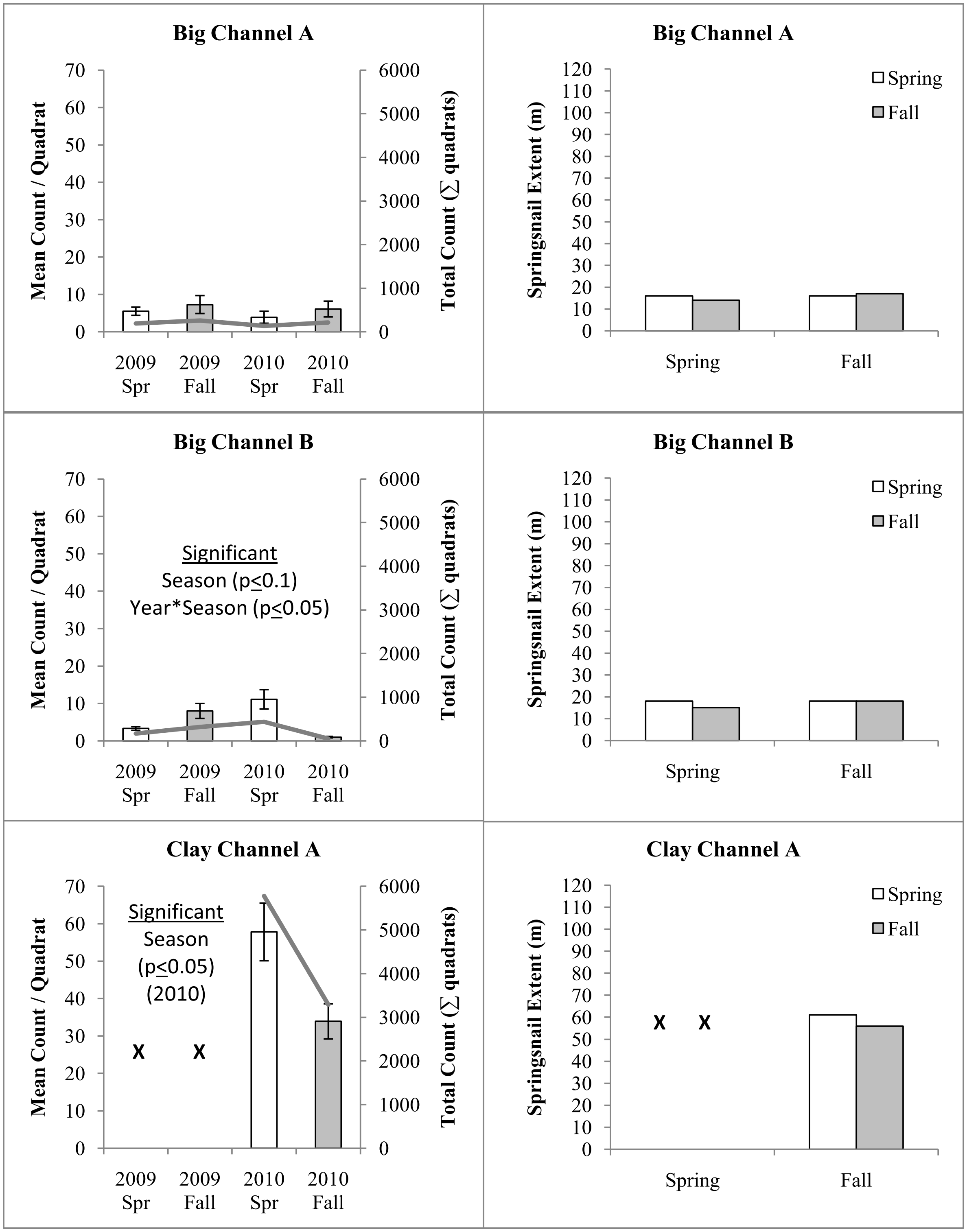



**Figure 3-17**
**Springsnail Counts (Mean = bar, Total = line) and Springsnail Extents, Spring Valley 2009 and 2010**
(Page 2 of 2)




Note: Big Springs Channel B extent approximated from physical habitat map and transect UTM coordinates.

**Figure 3-18**
**Springsnail Counts (Mean = bar, Total = line) and Springsnail Extents, Snake Valley 2009 and 2010**
(Page 1 of 2)

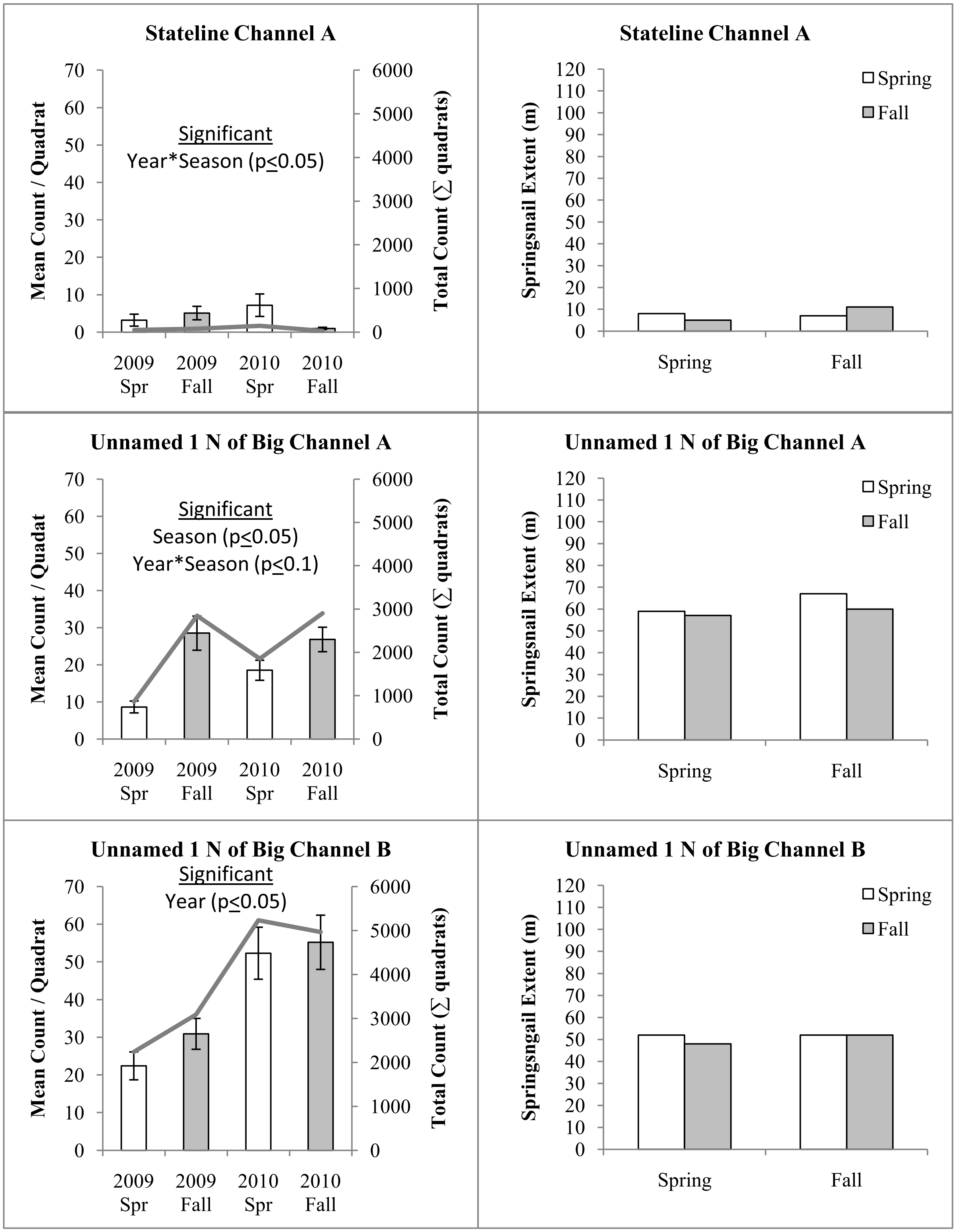



**Figure 3-18**
**Springsnail Counts (Mean = bar, Total = line) and Springsnail Extents, Snake Valley 2009 and 2010**
(Page 2 of 2)

### 3.5 Macroinvertebrates

The objective for macroinvertebrate monitoring is to ascertain the seasonal and annual variation in macroinvertebrate assemblage composition and richness over time. Potential changes in macroinvertebrate abundance and species composition would allow for the assessment of linkages between changes in habitat and water quality conditions (Biological Work Group, 2009). Thirteen springs were surveyed for macroinvertebrates during spring and fall 2009, and five Big Springs Creek/Lake Creek reaches were surveyed during the native fish community survey in fall 2009.

A complete taxa listing and metrics report for each sampling event at each spring can be found in Appendix A.

A summary of the percent relative abundance (percent of the total sample count) for non-insects, insect orders and the family *Chironomidae* for the 2009/2010 stipulation monitoring program is shown in Tables 3-22 and 3-23.

Non-insect taxa, mostly amphipods, ostracods and gastropods made up more than 74%, on average, of the macroinvertebrates sampled during both spring and fall, 2010. Similar patterns were identified in 2009, when these taxa made up more than 65% of the macroinvertebrates across seasons in almost all springs. Overall, in both 2009 and 2010, chironomids tended to be the most numerous insects in most of the springs.

For the purposes of this report, macroinvertebrate “richness” in the surveyed spring systems is simply defined as the number of taxa identified in the composited sample from any given spring system. EPT richness (i.e., the sum of Ephemeroptera, Plecoptera, and Trichoptera taxa in each composite spring sample) is often used as a measure of pollution or habitat degradation as insects in these three orders are considered sensitive to changes in the aquatic environment. Taxa and EPT richness determinations for the surveyed spring systems in spring and fall 2009 and 2010 are summarized in Table 3-24.

There were no apparent patterns in either taxa or EPT richness during the two years of surveys. Taxa richness averaged 18-22 in all seasons and years, and varied across sites (range: spring 2009 = 5-41; fall 2009 = 9-41; spring 2010 = 10-38; fall 2010 = 10-38). EPT richness was typically low, averaging 1-2 in all seasons and years (range: spring 2009 = 0-3; fall 2009 = 0-5; spring 2010 = 0-3; fall 2010 = 1-4).

## Table 3-22
## Percent Relative Abundance of Macroinvertebrates in Spring Valley Monitoring Sites for 2009 and 2010

| Spring | Year | Category | | | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | Non-Insect | | Odonata | | Ephemeroptera | | Plecoptera | | Heteroptera | | Trichoptera | | Coleoptera | | Diptera | | Chironomidae | |
| | | Spring | Fall | Spring | Fall | Spring | Fall | Spring | Fall | Spring | Fall | Spring | Fall | Spring | Fall | Spring | Fall | Spring | Fall |
| Stonehouse | 2009 | 74.0 | 96.3 | 0.3 | 1.6 | 0.0 | 0.0 | 0.0 | 0.0 | 5.7 | 0.3 | 0.0 | 0.0 | 0.3 | 0.6 | 3.3 | 0.9 | 16.3 | 0.3 |
| | 2010 | 93.4 | 93.1 | 0.0 | 0.6 | 0.3 | 0.3 | 0.0 | 0.0 | 0.0 | 0.6 | 1.9 | 0.3 | 0.3 | 0.6 | 0.3 | 0.6 | 4.1 | 3.8 |
| Willow | 2009 | 76.3 | 74.7 | 1.3 | 1.0 | 0.0 | 0.3 | 0.0 | 0.0 | 0.7 | 0.0 | 1.0 | 0.0 | 0.3 | 0.0 | 0.0 | 13.0 | 7.0 | 11.0 |
| | 2010 | 91.6 | 91.4 | 0.0 | 0.3 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.6 | 0.0 | 0.6 | 0.0 | 2.2 | 8.4 | 4.8 |
| Keegan | 2009 | 36.7 | 60.6 | 1.3 | 10.6 | 0.0 | 6.6 | 0.0 | 0.0 | 0.7 | 0.7 | 1.3 | 1.7 | 1.7 | 1.0 | 9.0 | 2.7 | 49.3 | 16.2 |
| | 2010 | 54.3 | 60.3 | 0.3 | 5.3 | 0.0 | 1.3 | 0.6 | 0.0 | 0.6 | 0.3 | 0.6 | 1.3 | 0.0 | 1.0 | 9.5 | 1.7 | 34.1 | 28.8 |
| West | 2009 | 73.7 | 69.4 | 0.7 | 0.6 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 1.3 | 2.0 | 4.1 | 5.3 | 1.0 | 18.3 | 23.7 |
| | 2010 | 89.6 | 71.9 | 0.9 | 2.3 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.7 | 0.0 | 0.7 | 0.3 | 17.7 | 5.2 | 4.5 | 4.0 | 2.3 |
| S. Millick | 2009 | 97.9 | 97.4 | 0.0 | 0.3 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 1.3 | 1.2 | 0.3 | 0.9 | 0.3 | 0.0 | 0.3 | 0.0 | 0.0 |
| | 2010 | 94.4 | 76.4 | 0.0 | 1.2 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.3 | 2.0 | 1.6 | 2.3 | 9.0 | 0.3 | 1.6 | 1.0 | 9.9 |
| Unnamed 5 | 2009 | 74.3 | 71.7 | 1.0 | 10.7 | 0.0 | 10.3 | 0.0 | 0.0 | 3.7 | 1.7 | 3.0 | 0.3 | 0.3 | 0.3 | 9.7 | 0.3 | 8.0 | 4.7 |
| | 2010 | 91.7 | 38.2 | 1.0 | 22.6 | 0.0 | 3.6 | 0.0 | 0.0 | 0.0 | 0.3 | 1.3 | 3.6 | 0.0 | 1.0 | 1.7 | 2.9 | 4.3 | 27.8 |
| N. Minerva | 2009 | ---[a] | 76.6 | --- | 11.5 | --- | 5.9 | --- | 0.0 | --- | 0.0 | --- | 0.0 | --- | 0.0 | --- | 0.0 | --- | 5.9 |
| | 2010 | 91.2 | 84.3 | 0.0 | 5.7 | 0.3 | 2.2 | 0.0 | 0.0 | 0.3 | 0.9 | 0.0 | 0.3 | 2.3 | 1.9 | 2.6 | 1.3 | 2.9 | 3.5 |
| M. Minvera | 2009 | 79.7 | 83.3 | 0.3 | 0.3 | 0.0 | 0.0 | 1.0 | 0.0 | 0.0 | 0.0 | 2.0 | 1.3 | 0.3 | 0.0 | 0.0 | 0.0 | 16.7 | 15.0 |
| | 2010 | 93.0 | 63.1 | 0.3 | 0.0 | 0.3 | 0.3 | 0.0 | 0.0 | 0.3 | 0.0 | 0.0 | 1.6 | 2.3 | 0.3 | 2.6 | 0.7 | 2.9 | 34.0 |
| Swallow | 2009 | 87.3 | 78.4 | 0.0 | 0.0 | 0.0 | 4.2 | 0.3 | 0.3 | 0.0 | 0.0 | 8.3 | 8.7 | 3.0 | 1.3 | 1.0 | 1.3 | 0.0 | 5.8 |
| | 2010 | 95.6 | 94.3 | 0.0 | 0.0 | 1.3 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 1.3 | 3.2 | 0.3 | 0.3 | 0.3 | 1.0 | 1.3 | 1.3 |
| Mean % | 2009 | 75.0 | 78.7 | 0.6 | 4.1 | 0.0 | 3.0 | 0.2 | 0.0 | 1.3 | 0.4 | 2.1 | 1.5 | 1.1 | 0.9 | 3.5 | 2.2 | 14.5 | 9.2 |
| | 2010l | 88.3 | 74.8 | 0.3 | 4.2 | 0.2 | 0.9 | 0.1 | 0.0 | 0.1 | 0.4 | 0.8 | 1.5 | 0.9 | 3.6 | 2.5 | 1.8 | 7.0 | 12.9 |

[a]Not sampled during spring 2009 sampling event.

## Table 3-23
## Percent Relative Abundance of Macroinvertebrates in Snake Valley Monitoring Sites for 2009 and 2010

| Spring | Year | Category | | | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | Non-Insect | | Odonata | | Ephemeroptera | | Plecoptera | | Heteroptera | | Trichoptera | | Coleoptera | | Diptera | | Chironomidae | |
| | | Spring | Fall | Spring | Fall | Spring | Fall | Spring | Fall | Spring | Fall | Spring | Fall | Spring | Fall | Spring | Fall | Spring | Fall |
| Clay | 2009 | ---[a] | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| | 2010 | 91.9 | 78.3 | 0.0 | 3.7 | 0.0 | 14.3 | 0.0 | 0.0 | 0.0 | 0.0 | 0.3 | 1.2 | 0.0 | 0.0 | 0.6 | 0.6 | 7.1 | 1.9 |
| Stateline | 2009 | 92.4 | 89.3 | 0.0 | 0.0 | 0.0 | 1.3 | 0.0 | 0.0 | 0.0 | 0.3 | 1.0 | 2.9 | 0.6 | 0.7 | 0.3 | 1.0 | 5.7 | 4.6 |
| | 2010 | 62.3 | 78.7 | 0.0 | 0.0 | 0.3 | 1.0 | 0.0 | 0.0 | 0.0 | 0.0 | 1.9 | 4.2 | 0.3 | 0.0 | 0.3 | 13.9 | 34.9 | 5.2 |
| Unnamed 1 | 2009 | 92.1 | 89.9 | 2.7 | 4.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 2.1 | 1.5 | 0.3 | 0.3 | 0.3 | 0.9 | 2.4 | 3.4 |
| | 2010 | 93.6 | 95.8 | 1.5 | 1.3 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.6 | 1.3 | 0.0 | 0.0 | 1.8 | 0.0 | 2.5 | 1.6 |
| Big Springs | 2009 | 77.4 | 91.5 | 0.0 | 0.7 | 0.0 | 0.3 | 0.0 | 0.0 | 7.9 | 0.0 | 1.6 | 1.3 | 0.3 | 0.0 | 1.6 | 0.0 | 17.1 | 6.2 |
| | 2010 | 81.1 | 87.4 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.3 | 0.0 | 0.3 | 1.3 | 0.3 | 0.0 | 0.3 | 0.3 | 17.7 | 11.0 |
| Mean % | 2009 | 87.3 | 90.2 | 0.9 | 1.5 | 0.0 | 0.5 | 0.0 | 0.0 | 2.6 | 0.1 | 1.6 | 1.9 | 0.4 | 0.3 | 0.7 | 0.6 | 8.4 | 4.7 |
| | 2010 | 82.2 | 85.0 | 0.4 | 1.3 | 0.1 | 3.8 | 0.0 | 0.0 | 0.1 | 0.0 | 0.8 | 2.0 | 0.2 | 0.0 | 0.8 | 3.7 | 15.5 | 4.9 |

[a]Not sampled during 2009 sampling events.

## Table 3-24
## Macroinvertebrate Taxa Richness and EPT Richness for 2009 and 2010

| Spring | Year | Taxa Richness | | EPT Richness | |
|---|---|---|---|---|---|
| | | Spring | Fall | Spring | Fall |
| Stonehouse | 2009 | 29 | 19 | 0 | 0 |
| | 2010 | 16 | 20 | 1 | 2 |
| Willow | 2009 | 32 | 20 | 2 | 1 |
| | 2010 | 11 | 23 | 0 | 2 |
| Keegan | 2009 | 41 | 41 | 2 | 2 |
| | 2010 | 38 | 34 | 2 | 2 |
| West | 2009 | 32 | 31 | 0 | 1 |
| | 2010 | 22 | 21 | 0 | 1 |
| S. Millick | 2009 | 5 | 9 | 1 | 1 |
| | 2010 | 11 | 16 | 1 | 1 |
| Unnamed 5 | 2009 | 25 | 21 | 1 | 2 |
| | 2010 | 23 | 38 | 1 | 2 |
| N. Minerva | 2009 | | 16 | | 1 |
| | 2010 | 26 | 32 | 1 | 3 |
| M. Minvera | 2009 | 16 | 19 | 3 | 2 |
| | 2010 | 15 | 15 | 2 | 2 |
| Swallow | 2009 | 12 | 20 | 2 | 4 |
| | 2010 | 10 | 10 | 3 | 1 |
| Clay | 2009 | | | | |
| | 2010 | 11 | 12 | 1 | 2 |
| Stateline | 2009 | 11 | 24 | 2 | 5 |
| | 2010 | 17 | 21 | 3 | 4 |
| Unnamed 1 | 2009 | 13 | 19 | 1 | 2 |
| | 2010 | 16 | 10 | 1 | 1 |
| Big Springs | 2009 | 22 | 18 | 3 | 4 |
| | 2010 | 12 | 13 | 1 | 1 |
| Spring Means | 2009 | 22 | 21 | 2 | 2 |
| Fall Means | 2010 | 18 | 20 | 1 | 2 |

## 3.6 Northern Leopard Frog (Rana pipiens)

Northern leopard frog monitoring determines the presence of northern leopard frogs at the Plan sites and provides information on breeding activity. Twelve sites with no previous northern leopard frog documentation (five in Spring Valley and seven in Snake Valley) were surveyed to document the presence or absence of northern leopard frog. No signs of northern leopard frog were documented at any of these twelve sites (similar to 2009) and subsequent egg mass surveys were not conducted. Northern leopard frog egg-mass surveys were conducted at the remaining seven sites with previously-documented northern leopard frog occurrence (all in Spring Valley). Egg masses were documented at three of these sites (Keegan Spring Complex North, Unnamed 5 Spring, and Minerva Spring Complex North) from April 19 to May 18, 2010. Table 3-25 summarizes all sites surveyed and presents the general results for both 2009 and 2010.

**Table 3-25**
**Northern Leopard Frog Survey Locations by Survey Type, and General Results for 2009 and 2010**

| Site | Survey Type | NLF Present? | | Egg Mass Present? | |
|---|---|---|---|---|---|
| | | 2009 | 2010 | 2009 | 2010 |
| Stonehouse Complex | Presence/Absence | No | No | No | No |
| Willow-NV Spring | Presence/Absence | No | No | No | No |
| Keegan Spring Complex North[a] | Egg Mass | Yes | Yes | Yes | Yes |
| West Spring Valley Complex 1[a] | Egg Mass | Yes | Yes | Yes | No |
| Shoshone Ponds[a] | Egg Mass | Yes | Yes | Yes | No |
| South Millick Spring[a] | Egg Mass | Yes | Yes | No | No |
| Unnamed 5 Spring[a] | Egg Mass | Yes | Yes | Yes | Yes |
| Four Wheel Drive Spring | Presence/Absence | No | No | No | No |
| Willard Spring | Presence/Absence | No | No | No | No |
| Minerva Spring Complex Middle[a] | Egg Mass | Yes | Yes | No | No |
| Minerva Spring Complex North[a] | Egg Mass | Yes | Yes | No | Yes |
| Swallow Spring | Presence/Absence | No | No | No | No |
| North Little Spring | Presence/Absence | No | No | No | No |
| Big Springs | Presence/Absence | No | No | No | No |
| Big Springs Creek | Presence/Absence | No | No | No | No |
| Unnamed 1 Spring North of Big | Presence/Absence | No | No | No | No |
| Stateline Springs | Presence/Absence | No | No | No | No |
| Clay Spring North | Presence/Absence | No | No | No | No |
| Lake Creek | Presence/Absence | No | No | No | No |

[a]Site with previously-documented northern leopard frog occurrence (BIO-WEST, 2007, 2009; SNWA, 2009).

Sentinel sites were visited prior to the expected onset of breeding in order to better ensure that egg mass surveys would commence at the start of the breeding season and overlap with the peak of the breeding season. These sentinel surveys were conducted in the same manner as presence/absence and egg mass surveys, with the goal of documenting any signs of northern leopard northern leopard frogs (egg masses, tadpoles, northern leopard frogs or calling). Unnamed 5 Spring and the Shoshone Ponds were chosen to be monitored as sentinel sites as they both had a documented northern leopard frog occurrence, evidence of northern leopard frog breeding, and a location proximal to the northern and southern Spring Valley survey locations respectively. Sentinel visits were conducted on a bi-weekly basis starting March 9, 2010.

Unnamed 5 Spring sentinel visits took place on March 10, March 23, April 6, and April 8. The additional April 8 visit was made because the majority of breeding at Unnamed 5 in 2009 appeared to have taken place within the first two weeks of April (SNWA, 2010). Sentinel visits to the Shoshone Ponds took place on March 9, March 24, and April 6. As an additional effort, Keegan Spring Complex North and West Spring Complex 1 were visited on March 23, as egg masses were documented at these sites in 2009. It was on the fifth visit to Unnamed 5 Spring (April 19) when the first 2010 egg mass was documented, at which time survey efforts switched from sentinel visits to presence/absence and egg mass visits.

### *3.6.1 Presence/Absence Surveys*

With confirmation that the breeding season had begun, Phase 1 presence or absence surveys began on April 21, 2010 at the Spring Valley and Snake Valley sites with no previous northern leopard frog documentation.

The Stonehouse Spring Complex sampling area was surveyed for the presence of northern leopard frog on April 21 with no signs of northern leopard frogs documented. Also surveyed in 2009, this was the second year for a presence/absence survey of this site as required by the Plan. This area has no northern leopard frog occurrence records in the literature or internal or external datasets, and was previously visited in 2006 and 2008 (SNWA, 2009). The area appears to have suitable habitat for northern leopard frog.

Swallow Spring was surveyed for the presence of northern leopard frogs on April 21 with no northern leopard frog sign documented. Also surveyed in 2009, this was the second year for a presence/absence survey of this site as required by the Plan. This area has no northern leopard frog occurrence records in the literature or internal or external datasets, and was previously visited in 2006 and 2008 (SNWA, 2009). The site has fast-flowing, cool water with little potential breeding habitat.

A presence/absence survey was conducted at Four Wheel Drive Spring on May 4 with no observed northern leopard frog sign. Also surveyed in 2009, this was the second year for a presence/absence survey of this site as required by the Plan. This area has no northern leopard frog occurrence records in the literature or internal or external datasets, and was previously visited on multiple occasions in 2005 and 2006 with no northern leopard frog documented (SNWA, 2009). The area appears to have suitable habitat for northern leopard frog.

Willard Spring was surveyed for the presence of northern leopard frogs on May 4. Also surveyed in 2009, this was the second year for a presence/absence survey of this site as required by the Plan. No northern leopard frog sign was documented, and no occurrence records in the literature or internal or external datasets exists for this site. The site was dry at the time of the survey, so it probably cannot support a permanent population of northern leopard frogs.

Willow Spring was surveyed for the presence of northern leopard frogs on May 4 with no frog sign documented. Also surveyed in 2009, this was the second year for a presence/absence survey of this site as required by the Plan. No occurrence record in the literature or internal or external datasets exists for this site and very little potential northern leopard frog habitat exists.

The monitoring sites in Snake Valley have no northern leopard frog occurrence records in the literature or internal or external datasets. Clay Spring North was surveyed for northern leopard frog presence on May 6 with no northern leopard frog sign documented. Also surveyed on May 6 were Lake Creek and the adjacent wetlands between Preuss Reservoir and Clay Spring North inflow (Moriah Ranch property and BLM land). Another portion of Lake Creek was surveyed on April 22 along the Stateline Springs (Dearden property), east of the Nevada border. A 3.5 km stretch of Big Springs Creek, starting at the Big Springs springhead was also surveyed on April 22 as were Unnamed 1 Spring North of Big Springs and North Little Spring. Also surveyed in 2009, this was the second year for a presence/absence survey of these sites as required by the Plan. All of these areas appear to have suitable habitat for northern leopard frog, but no signs of northern leopard frogs were documented. The landowners at Big Springs, Clay Spring North, and Clay Spring South commented that they have never seen or heard frogs on their properties. According to Kevin Wheeler of UDWR (personal communication, April 22, 2009), the landowners of the Stateline Springs property have commented that they observed some species of amphibian in the Burbank Meadows portion of Lake Creek, but this was not confirmed to be northern leopard frogs. The nearest area with confirmed recent northern leopard frog presence in Snake Valley is the Twin and Bishop springs area, which is over 64 km north of the Snake Valley sites and the IBMA.

### *3.6.2 Egg Mass Surveys*

A total of 90 egg masses were documented across three sites in Spring Valley (Unnamed 5 Spring, Keegan Spring Complex North, and Minerva Spring Complex North), with egg deposition estimated to have occurred between April 7–May 8 (Table 3-26). In comparison, in 2009 45 egg masses were documented across four sites (Unnamed 5 Spring, Keegan Spring Complex North, West Spring Valley Complex 1, and Shoshone Ponds), with egg deposition estimated to have occurred between March 27–May 6. Of all of the monitoring sites, Unnamed 5 Spring and Keegan Spring Complex North sampling areas appear to be most consistently and heavily used.

#### *Unnamed 5 Spring*

Egg mass survey visits 1-3 were conducted bi-weekly at Unnamed 5 Spring on April 19, May 4 and May 18, 2010 (Table 3-27). On the first visit on April 19, 13 egg masses (Age Class 1: 5 egg masses; Age Class 2: 8 egg masses) were documented, as well as adult and subadult northern leopard frogs (subadults from 2009 breeding season). The second visit took place on May 4, at which time no new egg masses were documented and all previously-documented egg masses had hatched; tadpoles, adult

**Table 3-26**
**Northern Leopard Frog Egg Mass Survey Results for 2009 and 2010**

| Site | Total Egg Mass Count[a] | | Survey Period | | Estimated Egg Deposition Dates | |
|---|---|---|---|---|---|---|
| | 2009 | 2010 | 2009 | 2010 | 2009 | 2010 |
| Keegan Spring Complex North[b] | 34 | 70 | 4/14-5/28 | 3/23-5/18 | 4/12-5/6 | 4/9-5/8 |
| Unnamed 5 Spring | 9 | 13 | 3/12-5/28 | 3/10-5/18 | 4/7-4/17 | 4/12–4/19 |
| Minerva Spring Complex North[b] | 0 | 7 | 4/14-5/29 | 4/21-5/17 | N/A | 4/7-4/15 |
| West Spring Valley Complex 1[b] | 1 | 0 | 4/14-5/28 | 3/23-5/18 | 4/28 | N/A |
| Shoshone Ponds | 1 | 0 | 4/8-5/28 | 3/9-5/17 | 3/27 | N/A |
| Minerva Spring Complex Middle[b] | 0 | 0 | 4/21-5/29 | 4/21-5/17 | N/A | N/A |
| South Millick Spring[b] | 0 | 0 | 4/14-5/28 | 4/21-5/18 | N/A | N/A |
| **Overall** | **45** | **90** | **3/12-5/29** | **3/9-5/18** | **3/27-5/6** | **4/7-5/8** |

[a]Based on age class data collected on the same egg masses across visits, egg masses took approximately two weeks to reach a 3+/hatched stage in 2009 and 2010. Using age class data collected when eggs were first documented in 2009 and 2010, it appears that most if not all of the breeding fell within the survey period.
[b]Northern leopard frogs have been documented and are expected to breed in the spring complex at large (outside of the sampling area).

**Table 3-27**
**Summary of Visits to Unnamed 5 Spring with the Number and Age Class (AC) of New Egg Masses Documented and Tadpoles Observed**

| Visit | Date | AC 1 | AC 2 | AC 3 | AC +3/Hatched | Tadpoles |
|---|---|---|---|---|---|---|
| Sentinel | 3/10/2010 | 0 | 0 | 0 | 0 | No |
| Sentinel | 3/23/2010 | 0 | 0 | 0 | 0 | No |
| Sentinel | 4/06/2010 | 0 | 0 | 0 | 0 | No |
| Sentinel | 4/08/2010 | 0 | 0 | 0 | 0 | No |
| Egg Mass Visit 1 | 4/19/2010 | 5 | 8 | 0 | 0 | Yes |
| Egg Mass Visit 2 | 5/04/2010 | 0 | 0 | 0 | 0 | Yes |
| Egg Mass Visit 3 | 5/18/2010 | 0 | 0 | 0 | 0 | Yes |

northern leopard frogs, and subadult northern leopard frogs were also observed. The third and final visit took place on May 18, at which time no new egg masses, tadpoles, or northern leopard frogs were observed. Table 3-27 summarizes the visits to the Unnamed 5 Spring site. Over the 2010 survey season, a total of 13 egg masses were documented at Unnamed 5 Spring, compared to 9 egg masses in 2009.

Based on the age classes of the 13 egg masses documented, it appears that breeding took place between April 12 and April 19. In 2009, breeding at this location took place from April 7 to April 17.

The general breeding area at Unnamed 5 Spring was the same as in 2009, and is located on the east side of the southern-most spring pool before the system flows into a narrow channel. This area has shallow, open water with some short emergent vegetation. The egg masses were found 0.54-m to 2.80-m from the dry shoreline and in 6.5-cm to 21.0-cm deep water with 30% to 60% emergent vegetation.

### Keegan Spring Complex North

Egg mass surveys visits 1-3 were conducted bi-weekly at Keegan Spring Complex North on April 19, May 4, and May 18, 2010 (Table 3-28). On the first visit on April 19, 68 egg masses (Age Class 1: 48 egg masses; Age Class 2: 18 egg masses; Age Class 3: 1 egg mass; and Dead: 1 egg mass) were documented, along with adult and subadult northern leopard frogs. The second visit occurred on May 4, at which time 1 new egg mass (Age Class 3) was documented. All previous egg masses had hatched and tadpoles were documented along with several adult and subadult northern leopard frogs (subadults from 2009 breeding season). The third and final visit took place on May 18, at which time 1 new egg mass (Age Class +3/hatched) was documented. Subsequent visits to the site during other Spring Valley Plan biological monitoring surveys found numerous tadpoles at both general breeding areas (described below). Table 3-28 summarizes the visits to Keegan Spring Complex North. Over the 2010 survey season, a total of 70 egg masses were documented at Keegan Spring Complex North, compared to 34 egg masses in 2009.

**Table 3-28**
**Summary of Visits to Keegan Spring Complex North with the Number of Age Class (AC) of New Egg Masses Documented and Tadpoles Observed**

| Visit | Date | AC 1 | AC 2 | AC 3 | AC +3/Hatched | Dead | Tadpoles |
|---|---|---|---|---|---|---|---|
| Sentinel | 3/23/2010 | 0 | 0 | 0 | 0 | 0 | No |
| 1 | 4/19/2010 | 48 | 18 | 1 | 0 | 1 | No |
| 2 | 5/4/2010 | 0 | 0 | 1 | 0 | 0 | Yes |
| 3 | 5/18/2010 | 0 | 0 | 0 | 1 | 0 | No |

Based on the age classes of the egg masses documented, it appears that breeding at this site took place between April 9 and May 8. In 2009, breeding took place between April 12 and May 6 at this site.

All of the egg masses documented at this location were either in the isolated pond north of the main channel (61 egg masses) or in a shallow pool connected to the main channel approximately 600 m from the spring source (9 egg masses), which were also areas used for breeding in 2009. Both breeding pools had short emergent vegetation with calm, shallow water in 2010, similar to 2009. Egg masses in the pond were found 0.54-m to 1.2-m from the dry shoreline and in 9.0-cm to 21.0-cm deep water with 25% to 60% emergent vegetation. Egg masses in the main channel pool were found 0.65-m to 2.80-m from dry shoreline and in 6.5-cm to 17.0-cm deep water with 40% to 60% emergent vegetation.

### Minerva Spring Complex North

Minerva Spring Complex North was visited on April 21, May 5, and May 17 with seven egg masses documented (Table 3-29). All seven egg masses were found on the April 21 visit, with 1 egg mass

**Table 3-29**
**Summary of Visits to Minerva Spring Complex North with the Number of Age Class (AC) of New Egg Masses Documented and Tadpoles Observed**

| Visit | Date | AC 1 | AC 2 | AC 3 | AC +3/Hatched | Tadpoles |
|---|---|---|---|---|---|---|
| 1 | 4/21/2010 | 0 | 1 | 1 | 5 | No |
| 2 | 5/5/2010 | 0 | 0 | 0 | 0 | Yes |
| 3 | 5/17/2010 | 0 | 0 | 0 | 0 | No |

(Age Class 2) documented in the man-made southern springpool and 6 egg masses (1 Age Class 3) and 5 Age Class +3/hatched) documented in the man-made northern springpool. Table 3-29 summarizes the visits to Minerva Spring Complex North. Over the 2010 survey season, a total of 7 egg masses were documented at Minerva Spring Complex North, compared to zero egg masses in 2009.

With mostly +3/hatched egg masses observed at Minerva Spring Complex North on April 21, it appears that breeding may have started on April 7 and ended on April 15. The egg masses at this site occurred 0.52-m to 2.35-m from dry shoreline and in 10-cm to 18-cm deep water with 20% to 50% emergent vegetation.

### *West Spring Valley Complex 1, South Millick Spring, Minerva Spring Complex Middle, and Shoshone Ponds*

Egg mass survey visits 1-3 were conducted bi-weekly at West Spring Valley Complex 1 on April 21, May 4, and May 18. No egg masses were documented, but adult northern leopard frogs were observed on every visit. This site had one egg mass documented in 2009. Limited northern leopard frog breeding appears to take place at this location. It is possible that most reproduction takes place at nearby West Spring Valley Complex 5 where evidence of breeding was documented by SNWA in 2008 and 2009 (SNWA, 2009).

Egg mass survey visits 1-3 were conducted bi-weekly at Shoshone Ponds on April 20, May 5 and May 17. No egg masses were documented at this location, but at least one adult northern leopard frogs was observed during the non-sentinel visits. One egg mass was documented at this location in 2009.

Minerva Spring Complex Middle was visited on April 21, May 5, and May 17 with no egg masses documented. This site also had zero egg masses documented in 2009. The continued presence of northern leopard frogs at this site suggests that breeding does occur in nearby areas, and in fact several shallow pools and a manmade pond are within 200 m of this site.

South Millick Spring was visited on April 21, May 3, and May 18 with no egg masses documented. No tadpoles were observed, but several adult northern leopard frogs were present. Absence of breeding, but presence of northern leopard frogs, including subadults, was also documented in 2009. This portion of the system consists of spring pools and a flowing channel and does not offer the shallow, still, and lightly vegetated habitat that northern leopard frogs seem to prefer for breeding.

Farther downstream in the system, there are shallow, manmade ponds and a marshy terminus where the leopard northern leopard frogs may focus their breeding activity. In 2009 the terminal marsh was visited near the end of the breeding season, but no egg masses or tadpoles were documented (SNWA, 2010).

### 3.6.3 Habitat Surveys

Habitat data collected at egg masses at the time of first sighting provide conditions under which northern leopard frogs bred, as well as possible egg deposition preferences. These data could help define the microhabitat in which egg masses are generally deposited and focus future survey efforts on appropriate breeding habitat. Table 3-30 compares the egg mass habitat data for 2009 and 2010.

**Table 3-30**
**2009 and 2010 Northern Leopard Frog Egg Mass Habitat Comparison**

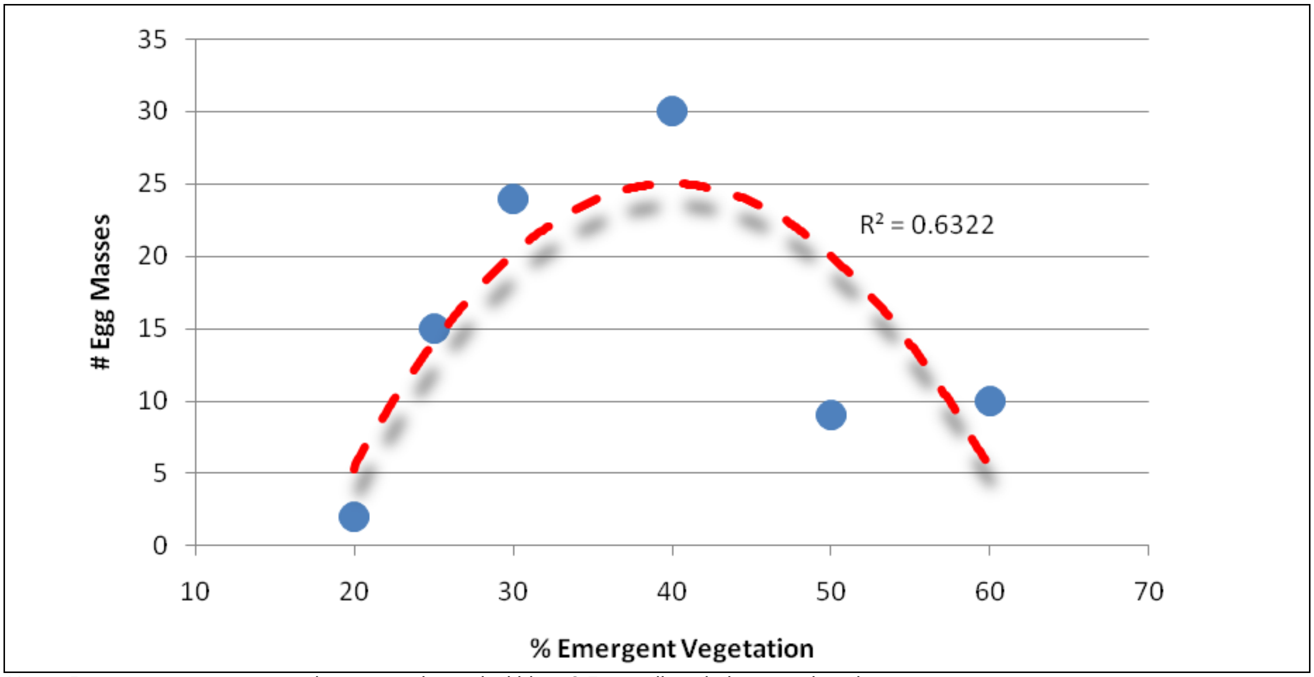
| Year | Distance to Shore (m) | Water Depth (cm) | Percent Emergent Vegetation |
|---|---|---|---|
| 2009 | $\bar{X}$ = 1.80 (SE = .20)<br>Range = 0.3-5.4 | $\bar{X}$ = 10.20 (SE = .32)<br>Range = 6.0-14.0 | --- |
| 2010 | $\bar{X}$ = 1.05 (SE = .05)<br>Range = 0.4-2.8 | $\bar{X}$ = 13.44 (SE = .39)<br>Range = 6.5-19 | $\bar{X}$ = 38.0 (SE = 1.2)<br>Range = 20-60 |

Because percent emergent vegetation data in 2009 were collected using a different protocol (linear point transects across general breeding areas), and were collected after the breeding season in 2009, they may not reflect conditions at the time of egg deposition or development and are omitted from this table.

Across all sites in 2010, egg masses occurred 0.4-m to 2.8-m from dry shoreline with a mean distance of 1.05-m (standard error = 0.05) and were in 6.5-cm to 21-cm deep water with a mean depth of 13.44-cm (standard error = 0.39). In 2009 egg masses occurred 0.3-m to 5.4-m from dry shoreline with a mean distance of 1.80-m (standard error = 0.20) and were in 6.0-cm to 14-cm deep water with a mean depth of 10.20-cm (standard error = 0.32). Compared to 2009, the 2010 egg masses were found significantly closer to dry shoreline (ANOVA, p-value = 0.00) and in significantly deeper water (ANOVA, p-value = 0.00).

The percentage of emergent vegetation in a 0.5-m radius circle around each egg mass in 2010 ranged from 20 to 60%, with a mean of 38% (SE = 1.17). Figure 3-19 shows a scatterplot of the number of egg masses documented in 2010 by percent emergent vegetation. The trendline (polynomial regression) depicts a positive correlation between changes in percent emergent vegetation and the deposition of egg masses.

Water-quality measurements were taken at each breeding pool used in 2010, with the exception of the shallow pool connected to the main channel approximately 600 m from the spring source at Keegan Spring Complex North. This location could not be accessed by the water-quality crew due to deep water blocking the access to the pool. Table 3-31 presents the water-quality measurements for each breeding pool. The measurements were taken between May 10 and May 13 during early tadpole growth.




Note: Percent emergent vegetation was estimated within a 0.5-m radius circle around each egg mass.

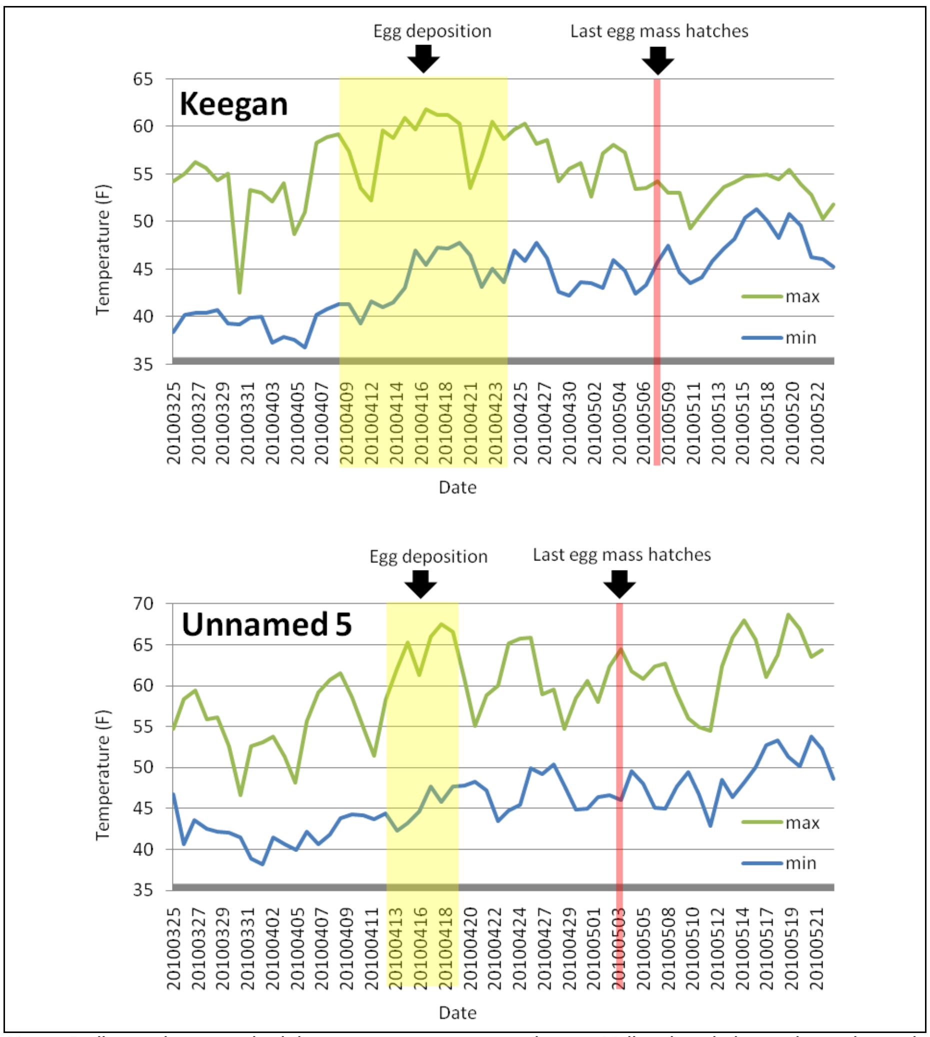
**Figure 3-19**
**Scatterplot of Number of Northern Leopard Frog Egg Masses by Percent Emergent Vegetation**

**Table 3-31**
**Water Quality Measurements for Each Northern Leopard Frog Breeding Pool**

| Transect | Date | Time | Water Temperature (°F) | Conductivity (µS/cm) | pH | Dissolved Oxygen (mg/L) | Velocity (m/sec) | Turbidity (NTU) |
|---|---|---|---|---|---|---|---|---|
| Keegan (isolated pond north of channel) | 5/11/2010 | 16:11 | 50 | 78 | 7.3 | 4.57 | 0 | 52.2 |
| Unnamed 5 | 5/10/2010 | 12:35 | 60 | 266 | 8.2 | 12.43 | 0 | 1.89 |
| Minerva North (south pool) | 5/13/2010 | 9:55 | 51 | 264 | 8.1 | 11.46 | 0 | 56.8 |
| Minerva North (north pool) | 5/13/2010 | 9:46 | 57 | 253 | 8.1 | 15.07 | 0 | 23.4 |

On March 23, 2010, temperature loggers were placed at four locations that had been used by northern leopard frogs to breed the previous year (Unnamed 5 Spring, West Spring Complex 1, and two at Keegan Spring Complex North). In 2010, northern leopard frogs bred at Unnamed 5 Spring and the two locations at the Keegan Spring Complex North. The logger at Unnamed 5 Spring was placed in the spring pool where breeding was documented in 2009, and was 4 m to 7 m from the 13 egg masses documented in 2010. The first logger at Keegan Spring Complex North was placed in the isolated pond north of the main channel where breeding was documented in 2009, and was 0.8 m to 2 m from the egg masses documented at this location in 2010. The second logger at Keegan could not be placed in the exact 2009 breeding location (shallow pool connected to the main channel approximately 600 m from the spring source) as the area was dry at the time of placement (the pool had filled by the time the northern leopard frogs began breeding). As a result, the logger was over 19 m from the egg masses deposited in the breeding pool in 2010 and therefore did not provide temperature data specific to the breeding location. The logger placed at West Spring Valley Complex 1 was placed adjacent to the 2009 breeding location because the breeding pool was dry in March 2010. This area eventually filled with water, but no breeding was documented at the West Spring Complex Valley 1 in 2010.

Figure 3-20 shows the logged temperatures for breeding pools at Unnamed 5 Spring and Keegan Spring North (isolated pond north of the main channel). The estimated dates of egg mass deposition, based on the age class of documented egg masses, are shown in yellow and appear to correspond to an increase in the minimum water temperature (Keegan: minimum water temperature during egg deposition = 39°F, maximum = 62°F; Unnamed 5 Spring: minimum = 42°F, maximum = 68°F). Also shown in Figure 3-20 is the date of the last egg mass to fully hatch at each site.




Note: Daily maximum and minimum temperatures are shown. Yellow band shows the estimated dates for the breeding events and the red line shows the date of the last egg mass to hatch.

**Figure 3-20**
**Daily Water Temperature Data for Northern Leopard Frog Breeding Pools at Keegan and Unnamed 5**

Temperature loggers appeared to provide general information about water temperatures in breeding areas during egg deposition and development, if not exact temperatures experienced by individual egg masses. The temperature logger at the isolated pond north of the main channel at Keegan Spring Complex North appears to capture the general temperature trend for the breeding area and in fact recorded a temperature of 61°F on April 19 at 1400 hrs when a spot reading at the nearest egg mass cluster recorded 63°F. The logger was in slightly deeper water than the cluster which probably accounts for the 2°F difference, but it does appear to capture the temperature trend specific to the egg mass locations. At Unnamed 5 Spring, a spot temperature reading of 66°F was taken at one of the newly discovered egg mass clusters on April 19 at 1300 hrs, and the logger recorded a temperature of 58°F at this time. Again this temperature difference (8°F) was most likely due to the logger being in deeper water than the egg masses. However, the logger did record a temperature of 67°F at 1500 hrs, so it does appear to capture the daily temperature trend for the breeding area, if not providing an exact temperature reading for the egg masses locations.

A study of breeding northern leopard frogs in Quebec, Canada found that males began calling on April 9 at 46°F, calling ceased on April 12 at 42°F, breeding commenced on April 15 with a water temperature of 46°F, and breeding continued for 10 days (Gilbert et al., 1994). It appears that northern leopard frogs in Spring Valley exhibit a similar response to temperature as egg mass deposition at Keegan and Unnamed 5 does correspond to a general increase in the recorded minimum daily water temperatures above 42°F and reaches a peak above 46°F.

### 3.6.4 Conclusion

Compared to 2009, documented egg mass numbers doubled in 2010 (2010: 90 egg masses; 2009: 45) and breeding locations were generally consistent (Unnamed 5 Spring and Keegan Spring Complex North accounted for >90% of the egg masses in both years). At Unnamed 5 Spring the same breeding pool was utilized with a 44% increase in the number of documented egg masses from 2009. The same breeding pools were also utilized at Keegan Spring Complex North, with a 106% increase in the number of documented egg masses from 2009. In 2009, no egg masses were documented at Minerva Spring Complex North, but 7 were documented in 2010. Both the Shoshone Ponds and West Spring Complex had a single egg mass documented in 2009, but none documented in 2010; however, adult northern leopard frogs were present at both sites. The doubling of egg masses in 2010 could indicate an increase in the number of breeding-age northern leopard frogs, or it could be a case of not all females breeding on an annual basis, with more females breeding in 2010 than in 2009.

It appears that the bi-weekly surveys conducted in both 2009 and 2010 captured the entire northern leopard frog breeding period (specifically egg mass deposition) at all survey sites. Based on egg mass development observations over two visits, it appears that it took approximately 14 days from deposition to full hatch at most breeding locations. This is probably an accurate estimate as several studies have shown that northern leopard frog egg masses can hatch in as little as 9 days at warmer temperatures, but generally take 13 to 20 days to hatch (Hine, 1981; Hammerson 1999; Hunter 1999; DeGraaf, 2001). However, it is does appear that the last egg mass deposited at Keegan Spring Complex North developed and hatched in approximately 11 days which was probably due to temperatures warmer than what earlier egg masses experienced. In general, the 2009 northern leopard frog breeding period in Spring Valley was April 7 to May 6, and the 2010 breeding period was April 7 to May 8. The only exception to this was Shoshone Ponds in 2009 when a single egg mass was documented on April 8 that was probably deposited around March 27. This site is warmer than the others which allowed for earlier breeding. The last documented egg mass hatched on May 18 in 2009, and the last hatched May 19 in 2010. Future bi-weekly egg mass surveys conducted between late March and mid-May should continue to capture the majority of breeding events at Spring Valley sites.

The sites with no previous northern leopard frog occurrence records were surveyed for a second year with no confirmed presence. Based on these results and the absence of historical observations, it is determined that the Stonehouse Complex, Willow Spring, Four Wheel Drive Spring, Willard Spring, Swallow Spring, North Little Spring, Big Springs, Big Springs Creek, Unnamed 1 Spring North of Big, Stateline Springs, Clay Spring North and South, and Lake Creek do not currently support a breeding population of northern leopard frog. Swallow Spring may occasionally have northern leopard frog present as it is near the breeding population at the Minerva springs, but it does not appear to offer breeding habitat and is inhabited by trout. South Millick Spring does support a breeding population of northern leopard frog, but breeding appears to occur at a currently unknown location and not within or in proximity to the sampling area. According to the Plan, if no signs of northern leopard northern leopard frogs are documented after two consecutive breeding seasons, the monitoring site is to be classified as not being used by northern leopard frog and dropped from the survey protocol. If signs of northern leopard frog are incidentally documented at one of these monitoring sites in the future, the northern leopard frog surveys at that site will be re-initiated.

## 3.7 Relict Dace (*Relictus solitarius*)

Relict dace monitoring determines the distribution of fish by size, season, and habitat within the designated Stipulation sample areas. Relict dace were sampled in the spring (May 11-13) and fall (September 21–23), 2010 at Keegan Spring Complex North and Stonehouse Spring Complex.

### 3.7.1 Keegan and Stonehouse Spring Complexes

#### 3.7.1.1 Keegan Spring Complex

Relict dace were sampled at the Keegan Spring Complex North designated sampling area in the spring and fall 2010. The sampling area included the cattail-lined ponds, 129 m of channel above the ponds, and 54 m of channel below the ponds. On May 12, 2010 (spring sampling), 39 minnow traps (26 large mesh and 13 small mesh) were set for approximately 19 hours and collected the next morning. A total of 754 relict dace were captured (Table 3-32). Fish were again sampled on September 22, 2010 (fall sampling), when 39 minnow traps (26 large mesh and 13 small mesh) were set for approximately 19 hours and collected the next morning. A total of 488 relict dace were captured (Table 3-32).

**Table 3-32**
**Keegan Spring Complex North: Relict Dace CPUE Values for the 2010 Spring and Fall Sampling**

| Season | Number of Traps | Total Number of Fish | Mean CPUE | Maximum CPUE | Minimum CPUE |
|---|---|---|---|---|---|
| Spring | 39 | 754 | 1.04 (SE=0.20) | 6.38 | 0 |
| Fall | 39 | 488 | 0.64 (SE=0.13) | 3.57 | 0 |

In both the spring and fall 2010 sampling effort, 28 minnow traps were placed in the pool habitat, and 11 minnow traps were placed in the channel habitat. The physical habitat mapping (Section 3.1) estimated that general pool habitat water depth ranged from 0.2 to >1.0 m, and general channel habitat water depth ranged from 0.2 m to approximately 0.5 m. CPUE values for season and habitat are shown in Table 3-33.

**Table 3-33**
**Keegan Spring Complex North: Relict Dace CPUE Values for the 2010 Spring and Fall Sampling by Habitat Type**

| Season | Habitat | Number of Traps | Total Number of Fish | Mean CPUE | Maximum CPUE | Minimum CPUE | Standard Error |
|---|---|---|---|---|---|---|---|
| Spring | Pool | 28 | 709 | 1.37 | 6.38 | 0 | 0.26 |
| | Channel | 11 | 45 | 0.21 | 0.65 | 0.05 | 0.05 |
| Fall | Pool | 28 | 290 | 0.53 | 3.57 | 0 | 0.14 |
| | Channel | 11 | 198 | 0.93 | 2.08 | 0.26 | 0.24 |

In the spring, 198 fish were measured with a total length range of 25 to 92 mm. The mean length of fish measured in spring 2010 was 51.5 mm (standard error = 1.1). In the fall, 273 fish were measured with a total length range of 24 to 95 mm. The mean length of fish measured in fall was 42.5 mm (standard error = 0.9). A length-frequency histogram for the Keegan Spring Complex North site by season is shown in Figure 3-21. Length frequencies are shown in 10 mm size classes except for the largest size class which covers 20 mm.

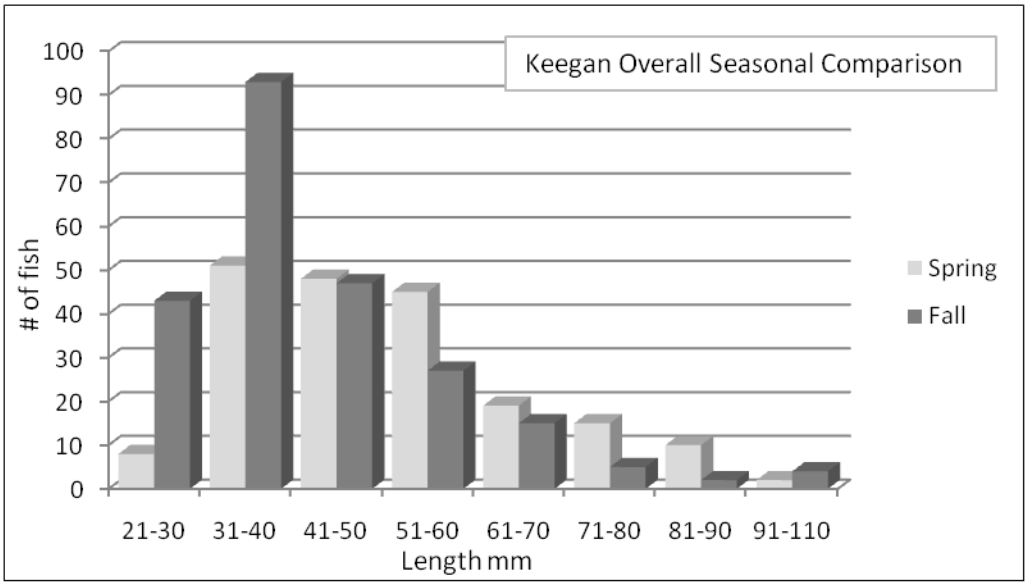
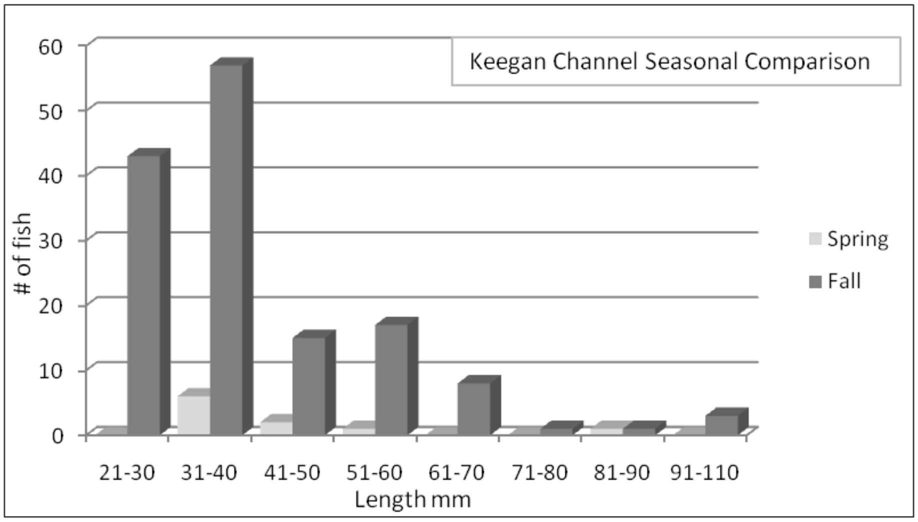



**Figure 3-21**
**The Length Frequency of Relict Dace Measured at Keegan Spring Complex North in the Spring (n=198) and Fall (n=236) of 2010**

Fish length-frequency histograms are shown for habitat and season in Figure 3-22. In the spring 2010, 188 fish were measured from the pool habitat with a length range of 25 to 92 mm and a mean length of 51.8 mm (standard error = 1.1), and 10 fish were measured from the channel habitat with a length range of 31 to 85 mm and a mean length of 44.9 mm (standard error = 45.1). In the fall 2010, 128 fish were measured from the pool habitat with a length range of 24 to 92 mm and a mean length of 43.1 mm (standard error = 1.2), and 145 fish were measured from the channel habitat with a length range of 25 to 95 mm and a mean length of 39.8 mm (standard error = 1.2).

Water-quality measurements were taken at Keegan Spring Complex North in the spring and fall 2010 at three points. Point 1 is in the channel at the northernmost point of the sampling area, Point 2 is in the pond at the middle of the sampling area, and Point 3 is in the channel at the southernmost point of the sampling area (Table 3-34).



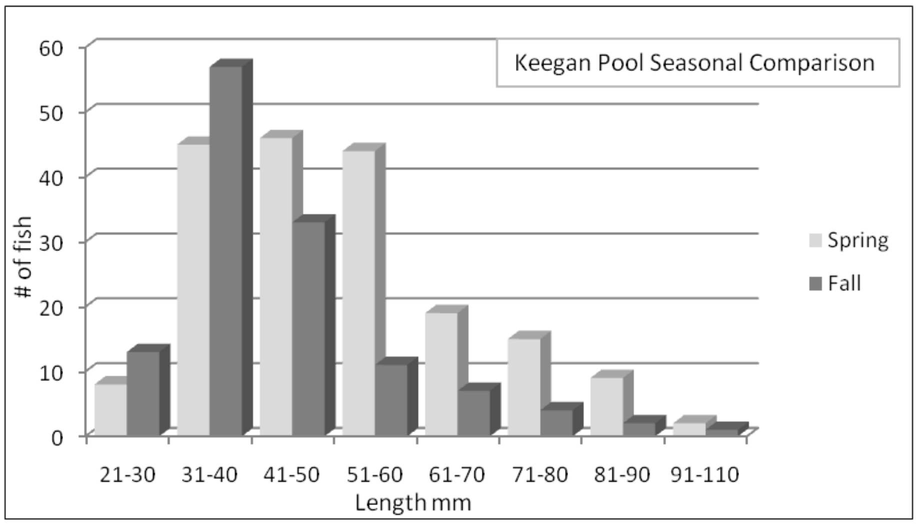




**Figure 3-22**
**The Length Frequency of Relict Dace Measured at Keegan Spring Complex North by Habitat Mapping Unit (Pool, Channel) in the Spring (Channel n=10, Pool=188) and Fall (Channel n=145, Pool n=128) of 2010**

**Table 3-34**
**Water Quality Measurements taken at Relict Dace Sampling Area at Keegan Spring Complex North**

| Season | Point | Time | Water Temperature (°F) | Conductivity (µS/cm) | pH | Dissolved Oxygen (mg/L) | Turbidity (NTU) |
|---|---|---|---|---|---|---|---|
| Spring | 1 | 1521 | 49.6 | 101 | 6.91 | 9.85 | 7.30 |
| | 2 | 1535 | 51.3 | 110 | 6.95 | 10.41 | 13.90 |
| | 3 | 1542 | 53.1 | 102 | 7.53 | 11.45 | 15.90 |
| Fall | 1 | 1217 | 63.6 | 74 | 7.01 | 6.62 | 22.7 |
| | 2 | 1207 | 59.5 | 92 | 7.02 | 111.16 | 2.9 |
| | 3 | 1204 | 60.8 | 86 | 6.78 | 7.30 | 3.6 |

### 3.7.1.2 Stonehouse Spring Complex

Relict dace were sampled in spring and fall 2010 at the Stonehouse Spring Complex. Relict dace are known to occur throughout the Stonehouse system, but sampling efforts focused on the middle of the complex where a spring feeds several pools and a channel, and on a pool at the south end of the complex. On May 11, 2010 (spring sampling), 30 minnow traps were set for approximately 19 hours and collected the next morning. A total of 628 relict dace were captured (Table 3-35). Fish were again sampled on September 21, 2009 (fall sampling), when 30 minnow traps were set for approximately 19 hours and collected the next morning. A total of 648 relict dace were captured (Table 3-35).

**Table 3-35**
**Stonehouse Spring Complex: Relict Dace**
**CPUE Values for 2010 Spring and Fall Sampling**

| Season | Number of Traps | Total Number of Fish | Mean CPUE | Maximum CPUE | Minimum CPUE |
|---|---|---|---|---|---|
| Spring | 30 | 628 | 1.14 (SE=0.27) | 5.40 | 0 |
| Fall | 30 | 648 | 1.16 (SE=0.26) | 4.67 | 0 |

In both the spring and fall 2010 sampling efforts, 12 minnow traps were placed in the pool habitat and 18 minnow traps were placed in the channel habitat. The physical habitat mapping (Section 3.1) estimated that general pool habitat water depth ranged from 0.2 to >1.0 m and the general channel habitat water depth ranged from 0.2 m to approximately 1.0 m. CPUE values for season and habitat are shown in Table 3-36.

**Table 3-36**
**Stonehouse Spring Complex: Relict Dace CPUE Values**
**for 2010 Spring and Fall Sampling by Habitat Type**

| Season | Habitat | Number of Traps | Total Number of Fish | Mean CPUE | Maximum CPUE | Minimum CPUE | Standard Error |
|---|---|---|---|---|---|---|---|
| Spring | Pool | 12 | 302 | 1.38 | 5.4 | 0.05 | 0.53 |
| | Channel | 18 | 326 | 1.64 | 3.85 | 0 | 0.39 |
| Fall | Pool | 12 | 491 | 2.21 | 4.67 | 0.22 | 0.45 |
| | Channel | 18 | 157 | 0.47 | 3.04 | 0 | 0.17 |

In the spring 2010, 162 fish were measured with a total length range of 31 to 92 mm. The mean length of the fish measured in spring was 54.5 mm (standard error = 1.1). In the fall 2010, 266 fish were measured with a total length range of 23 mm to 98 mm. The mean length of the fish measured in fall 2010 was 52.2 mm (standard error = 1.0). A length-frequency histogram by season for the Stonehouse Complex is shown in Figure 3-23.

Fish length-frequency histograms are shown for each habitat by season in Figure 3-24. In the spring 2010, 96 fish were measured from the pool habitat with a length range of 31 to 90 mm and a mean length of 54.8 mm (standard error = 1.4), and 66 fish were measured from the channel habitat with a

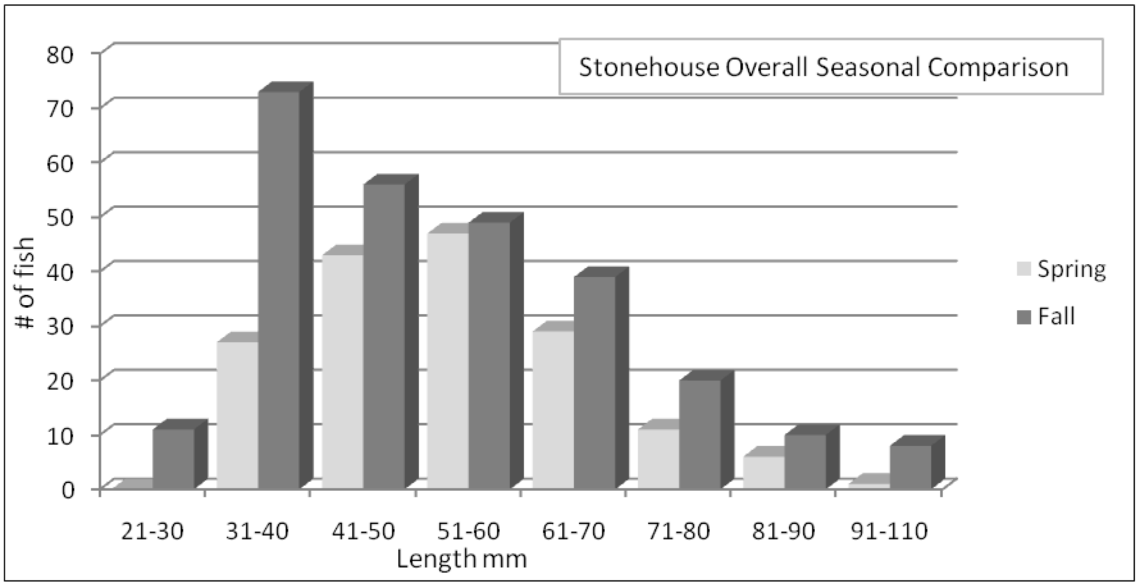



**Figure 3-23**
**The Length Frequency of Relict Dace Measured at Stonehouse Spring Complex in the Spring (n=164) and Fall (n=266) of 2010**

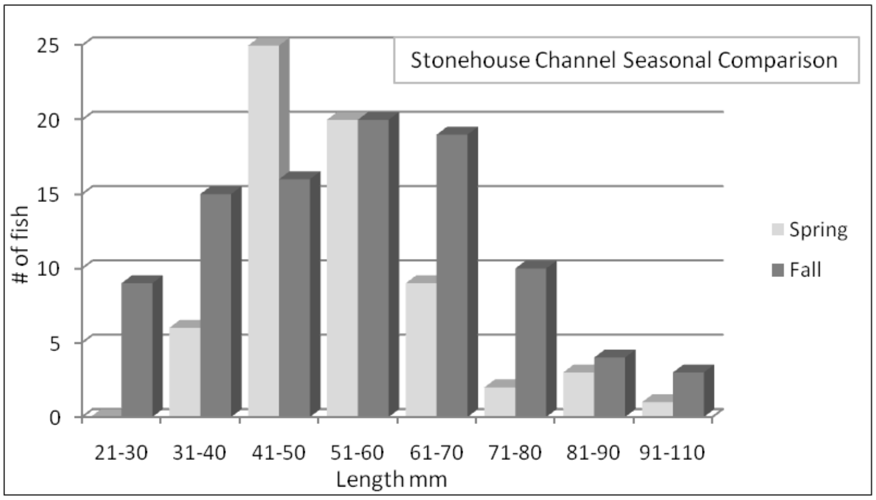
length range of 34 to 92 mm and a mean length of 54.1mm (standard error = 1.6). In the fall 2010, 170 fish were measured from the pool habitat with a length range of 30 to 98 mm and a mean length of 50.8 mm (standard error = 1.3), and 96 fish were measured from the channel habitat with a length range of 23 to 96 mm and a mean length of 54.7 mm (standard error = 1.0).

Water-quality measurements were taken at Stonehouse Complex in the spring and fall 2010 at three points. Point 1 is in the pool at the northern end of the sampling area, Point 2 is in the channel at the middle of the sampling area, and Point 3 is in the disjunct pool at the southernmost point of the sampling area (Table 3-37).

### *3.7.1.3 Discussion*

In comparing the 2010 relative abundance (CPUE) data to the 2009 data, few significant differences are observed. At Keegan Spring Complex North, the spring CPUE is significantly higher in 2009 than in 2010 ($p = .027$), but no significant difference is observed between the fall CPUE in 2009 and 2010 ($p = 0.60$). There are no significant differences observed in seasonal CPUE between years at Stonehouse Spring Complex ($p > 0.20$).

In comparing spring to fall CPUE within 2009 and 2010, again few significant differences are observed. At Keegan Spring Complex North, the CPUE is significantly higher in spring 2009 ($p = .003$), but the seasons are not significantly different in 2010 ($p = 0.80$). No seasonal differences are noted for 2009 or 2010 at Stonehouse Spring Complex ($p > 0.60$). Figure 3-25 shows the annual and seasonal CPUE comparisons for Keegan Spring Complex North and Stonehouse Spring Complex.



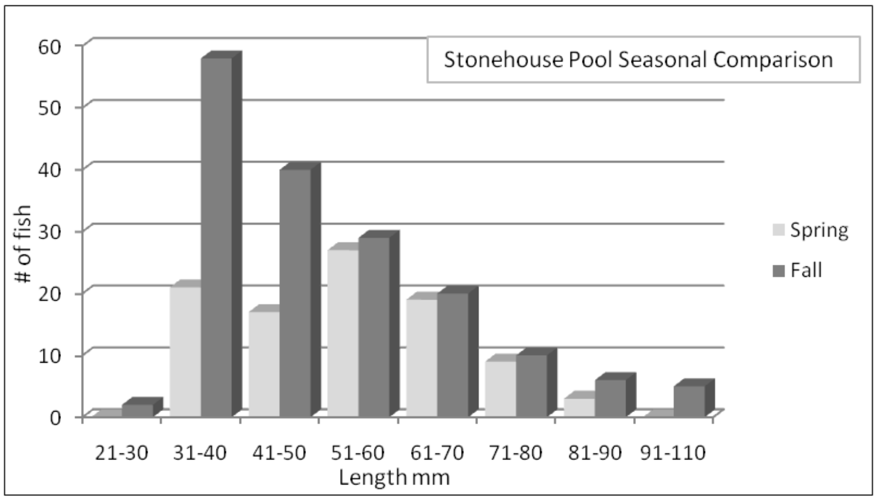
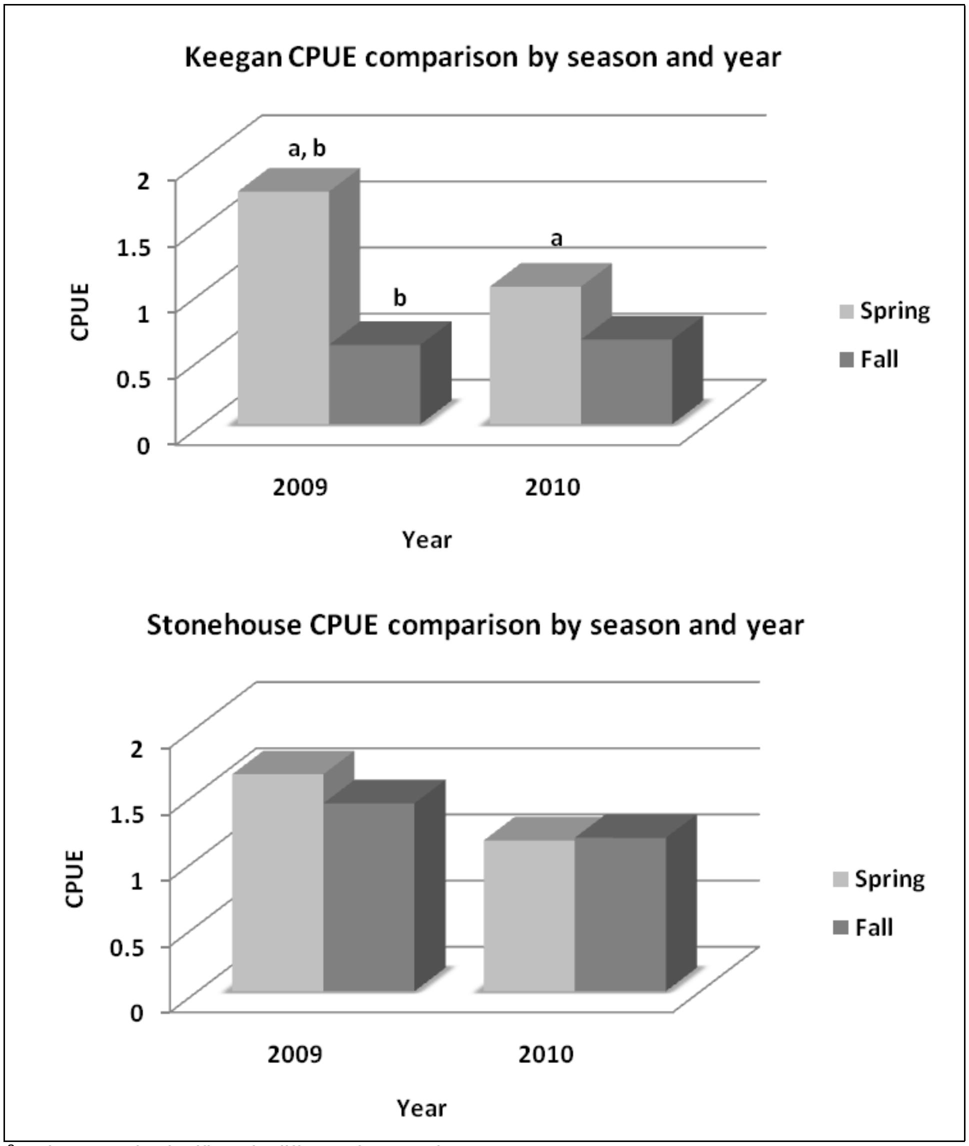




**Figure 3-24**
**The Length Frequency of Relict Dace Measured at Stonehouse Spring Complex by Habitat Mapping Unit (Pool, Channel) in the Spring (Channel n=66, Pool n=96) and Fall (Channel n=96, Pool n=70) of 2010**

**Table 3-37**
**Water Quality Measurements taken at Relict Dace Sampling Area at Stonehouse Spring Complex**

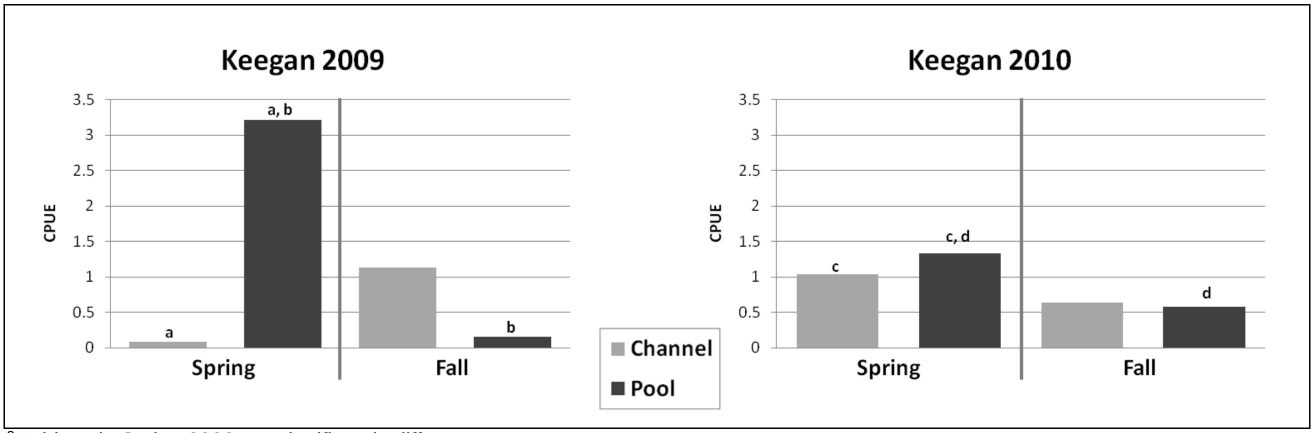
| Season | Point | Time | Water Temperature (°F) | Conductivity (µS/cm) | pH | Dissolved Oxygen (mg/L) | Turbidity (NTU) |
|---|---|---|---|---|---|---|---|
| Spring | 1 | 1058 | 49.3 | 1310 | 7.69 | 8.90 | 10.00 |
| | 2 | 1053 | 54.4 | 494 | 7.84 | 9.40 | 14.10 |
| | 3 | 1048 | 52.1 | 530 | 7.82 | 7.74 | 10.40 |
| Fall | 1 | 1158 | 79.1 | 665 | 6.43 | 3.84 | 11.0 |
| | 2 | 1204 | 62.9 | 415 | 6.59 | 10.58 | 7.3 |
| | 3 | 1240 | 73.1 | 676 | 7.68 | 26.34 | 69.0 |




[a]Spring 2009 is significantly different from Spring 2010.
[b]Spring and fall are significantly different in 2009.

**Figure 3-25**
**Relict Dace CPUE by Season and Year for**
**Keegan Spring Complex North and Stonehouse Spring Complex**

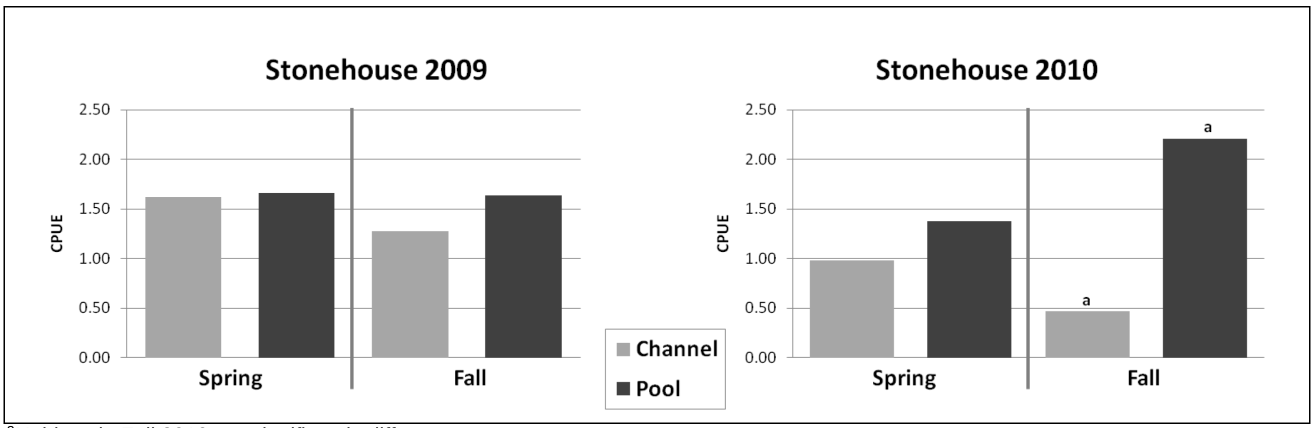
Analysis of Keegan Spring Complex North CPUE data for 2009 and 2010 shows some significant differences in seasonal habitat use (habitat*season; $p \leq 0.002$). For both years, pairwise comparisons reveal a significant difference between channel and pool habitat in the spring ($p \leq 0.008$) with the CPUE higher in the pool habitat. However, pairwise comparisons do not show a significant difference between channel and pool habitat in the fall for either year ($p \geq 0.159$). Also of significance in both years, is the difference in CPUE between spring and fall pool habitat ($p \leq 0.011$) with a higher CPUE in the spring. However, no significant difference is observed between spring and fall channel habitat for either year ($p \geq 0.135$). Figure 3-26 shows the 2009 and 2010 Keegan Spring Complex North CPUE's for season and habitat.




[a]Habitats in Spring 2009 are significantly different.
[b]Pool habitat in Spring and Fall 2009 are significantly different.
[c]Habitats in Spring 2010 are significantly different.
[d]Pool habitat in Spring and Fall 2010 are significantly different.

**Figure 3-26**
**Relict Dace CPUE by Year, Season, and Habitat for Keegan Spring Complex North**

In contrast to Keegan, analysis of Stonehouse Spring Complex CPUE data for 2009 and 2010 shows no significant differences in seasonal habitat use (habitat*season; $p = 0.716$ for 2009 and $p = 0.057$ for 2010). However, the analysis did reveal a significant difference in CPUE by habitat in 2010 ($p = 0.003$). Pairwise comparisons for 2010 show one case of significant difference in the fall where CPUE for pool habitat was significantly greater than in channel habitat ($p = 0.004$). This significant difference between habitats was not observed in 2009 or in spring 2010 ($p \geq 0.417$). Figure 3-27 shows the 2009 and 2010 Stonehouse Spring Complex CPUE's for season and habitat.




[a]Habitats in Fall 2010 are significantly different.

**Figure 3-27**
**Relict Dace CPUE by Year, Season, and Habitat for Stonehouse**

A comparison of fish length between 2009 and 2010 reveals that fish are significantly smaller in 2010 ($p = 0.000$) at Keegan Spring Complex North as well as at Stonehouse Spring Complex. A significant difference is observed in season by year interactions for both sites ($p = 0.000$) with significantly smaller fish lengths recorded in the fall of 2010 compared to fall 2009 ($p = 0.000$). However, in comparing spring 2009 to spring 2010 at Keegan Spring Complex North, fish are significantly smaller in 2009 ($p = 0.038$). No significant difference is observed at Stonehouse Spring Complex between spring 2010 and spring 2009 ($p = 0.577$).

Within the two years at Keegan Spring Complex North, significant fish length differences are observed in season and habitat interactions in 2009 ($p = 0.000$), between seasons in 2010 ($p = 0.007$), and between habitats in 2010 ($p = 0.044$). Analysis of season and habitat interactions for 2009 reveals significantly smaller fish in fall channel habitat compared to spring channel habitat ($p = 0.012$) and in spring pool habitat compared fall pool habitat ($p = 0.007$). Analysis of seasonal length differences and habitat length differences for 2010 reveals significantly smaller fish in the fall ($p = .006$) and smaller fish in channel habitat ($p = 0.043$). Within the 2009 year at Stonehouse Spring Complex, a significant fish length difference is observed between seasons ($p = 0.003$) with a smaller length in the spring. However, no significant differences between seasons are observed in 2010.

The length analysis suggests recruitment and seasonal use of habitat by juvenile fish at Keegan Spring Complex North. In June 2009 and May 2010, hundreds of larval relict dace were observed in channel habitat within the sampling area. It is likely that these juvenile fish utilize channel habitat throughout the summer and fall, and then move to pool habitat for winter and spring. This would explain the generally higher CPUE and smaller fish length in spring pool habitat and in fall channel habitat.

Recruitment is also apparent at Stonehouse Spring Complex, but it appears that juvenile fish may not be regulated to strictly channel or pool habitat. It is possible that the fish move continuously between pool and channel habitat and don't exhibit strong seasonal habitat use.

Based on the two years of sampling data, relict dace relative abundance appears to remain stable at both the Keegan Spring Complex North and the Stonehouse Spring Complex. Both sites show evidence of annual recruitment and length frequency data shows the presence of multiple size classes that suggest the presence of juvenile, young adult, and older adult fish in the population.

### *3.7.2 Shoshone Ponds*

On August 5 and 11, 2010, relict dace were marked and re-captured at the South Pond. A population estimate of 281 was derived for relict dace in the South Pond in 2010 (2009 estimate: 547). NDOW's complete field trip report for the 2010 survey is attached as Appendix C.

## *3.8 Pahrump Poolfish (Empetrichthys latos)*

On August 5 and 11, 2010, Pahrump poolfish were marked and re-captured at the Shoshone North, Middle, and Stock Ponds. The following population estimates were derived for Pahrump poolfish: Stock Pond 3,832; North Pond 116; and Middle Pond 579 (2009 estimates: Stock Pond 3,695; North Pond 191; and Middle Pond 260). NDOW's complete field trip report for the 2010 survey is attached as Appendix C.

On May 19 and June 9, 2010, a total of 1,179 Pahrump poolfish were salvaged from the springbrook below artesian Shoshone Well No. 2 and relocated to the North and Middle refuge ponds. The purpose of the salvage was to ensure that as many Pahrump poolfish as was practical were relocated to safe habitat prior to installation of a valve system and flow meter on Shoshone Well No. 2 (FWS Biological Opinion, April 16, 2010). This project was completed in order to comply with NSE conditions for granting of a BLM water right on Shoshone Well No. 2 (NSE Permit 60086), including restricting flow of Shoshone Well No. 2 to the amount permitted for wildlife beneficial use. A total of 671 individuals were relocated to the North Pond, and a total of 508 individuals were relocated to the Middle Pond at the time of salvage.

## *3.9 Big Springs Creek/Lake Creek Native Fish Community*

Native fish community monitoring along Big Springs Creek/Lake Creek determines the distribution and relative abundance of fish species by reach, the length-frequency for each species by reach, and the combined species total number for each reach.

The following results are provided for each reach:

- Species composition is presented as the percent of each species of the total fish captured;
- Relative abundance of each fish species is presented as the mean Catch Per Unit Effort (mean CPUE, or mean number of fish per electrofishing second), calculated across the three electrofishing passes; and
- Mean fish length is presented for each species.

### *3.9.1 Results by Reach*

#### *Reach 1*

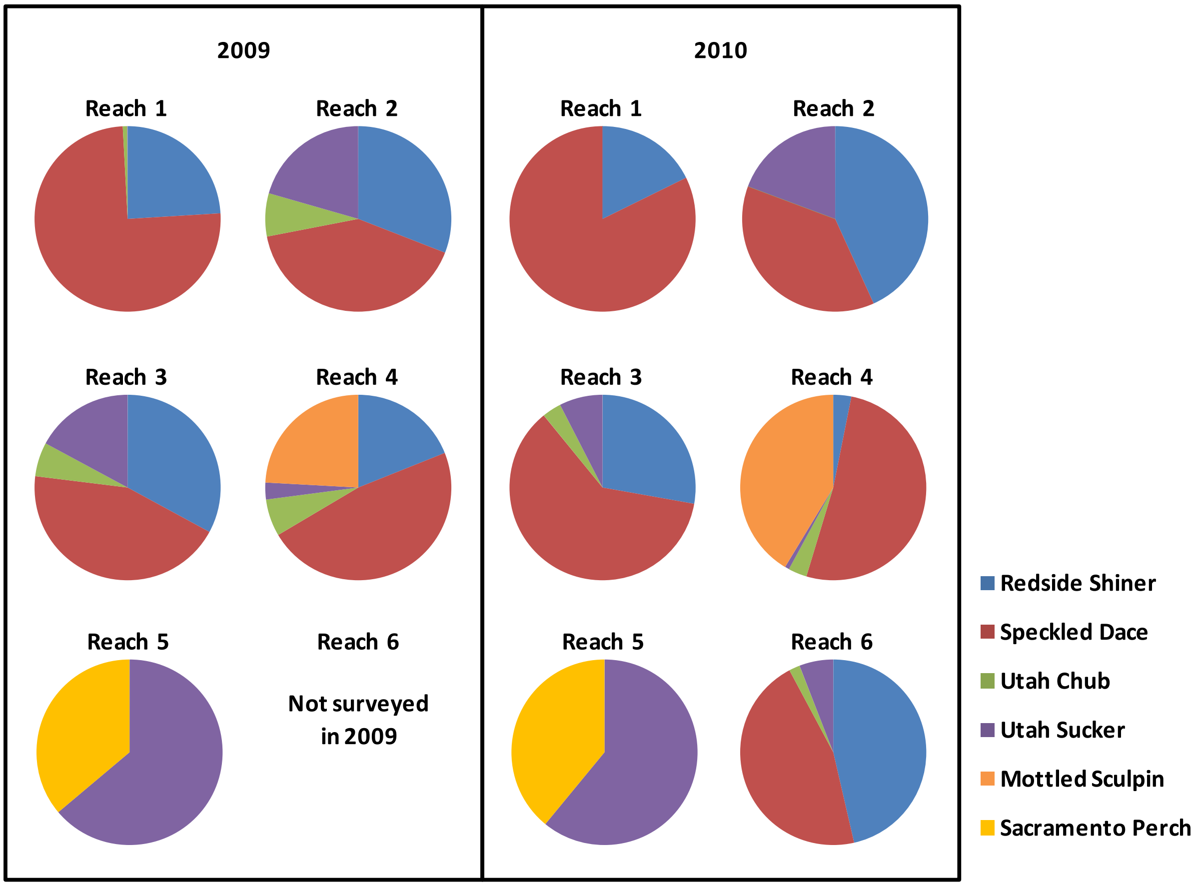
Reach 1 was electrofished for a total of 4,572 seconds over three passes. A total of 766 fish were captured with two native fish species documented: speckled dace and redside shiner. Introduced crayfish were also documented. Speckled dace was the most abundant species, with 630 individuals captured. Redside shiners numbered 136 individuals. No Utah chub or Utah sucker were captured. Of all of the reaches in 2010, Reach 1 accounted for 42% of the total fish captured.

Figure 3-28 shows the species composition for Reach 1 in 2009 and 2010, alongside the species composition for the other five reaches. Relative species abundance in Reach 1 was similar in 2009 and 2010, with speckled dace and redside shiner comprising the first and second most abundant species, respectively, and 98-100% of the CPUE (percent CPUE: redside shiner 2009 = 24%, 2010 = 18%; speckled dace 2009 = 75%, 2010 = 82%; Utah chub 2009 = 1%, 2010 = 0%; Utah sucker 2009 = <1%, 2010 = 0%).

Catch per unit effort for all species in Reach 1 was lower in 2010 than in 2009 (Figure 3-29). The mean CPUE over the three passes for redside shiner was 0.029 (standard error = 0.007) in 2010; mean CPUE was 4.4 times higher in 2009. The mean CPUE for speckled dace was 0.135 (standard error = 0.031) in 2010; mean CPUE was 2.9 times higher in 2009. Low numbers of Utah chub and Utah sucker were recorded on this reach in 2009, compared to zero in 2010.

#### *Reach 2*

Reach 2 was electrofished for a total of 3,206 seconds over three passes. A total of 40 fish were captured with three native fish species documented: redside shiner, speckled dace, and Utah sucker. Introduced crayfish were also documented. Redside shiner was the most abundant species, with 17 individuals captured. Speckled dace was the next most abundant species, with 15 individuals captured. Also captured were 8 Utah sucker. No Utah chub were captured. Of all of the reaches in 2010, Reach 2 accounted for 2% of the total fish captured.

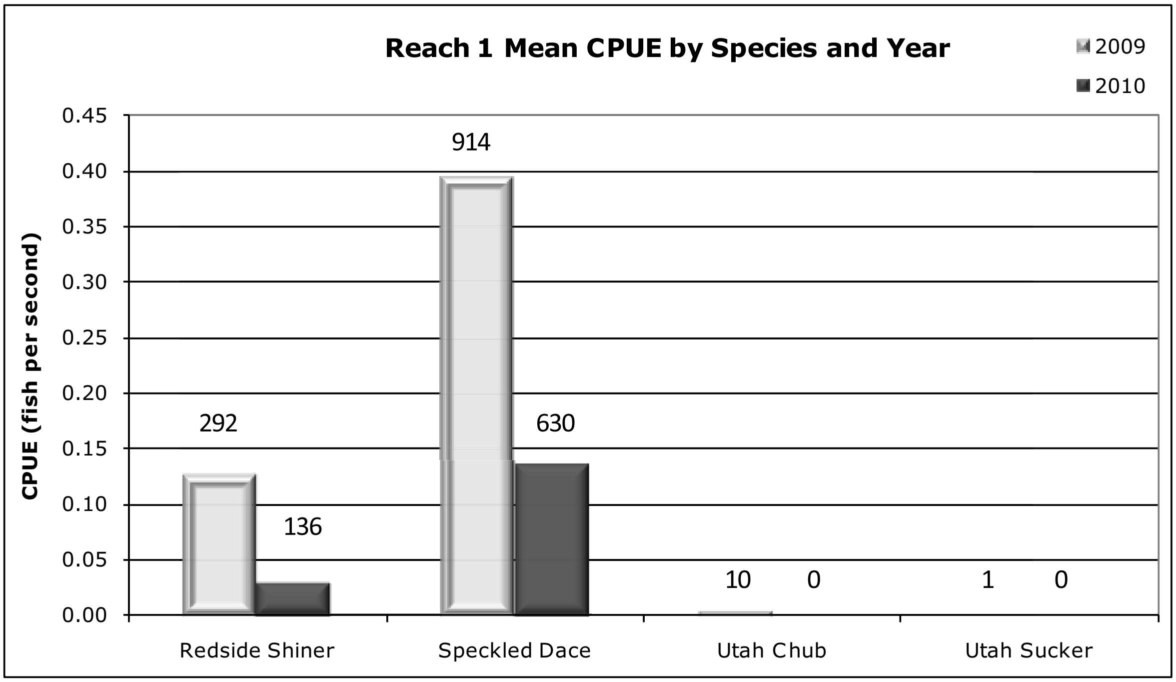



Note: Pie slices indicate percent CPUE.

**Figure 3-28**
**Fish Species Composition in Big Springs Creek/ Lake Creek Reaches 1 to 6 in 2009 and 2010**

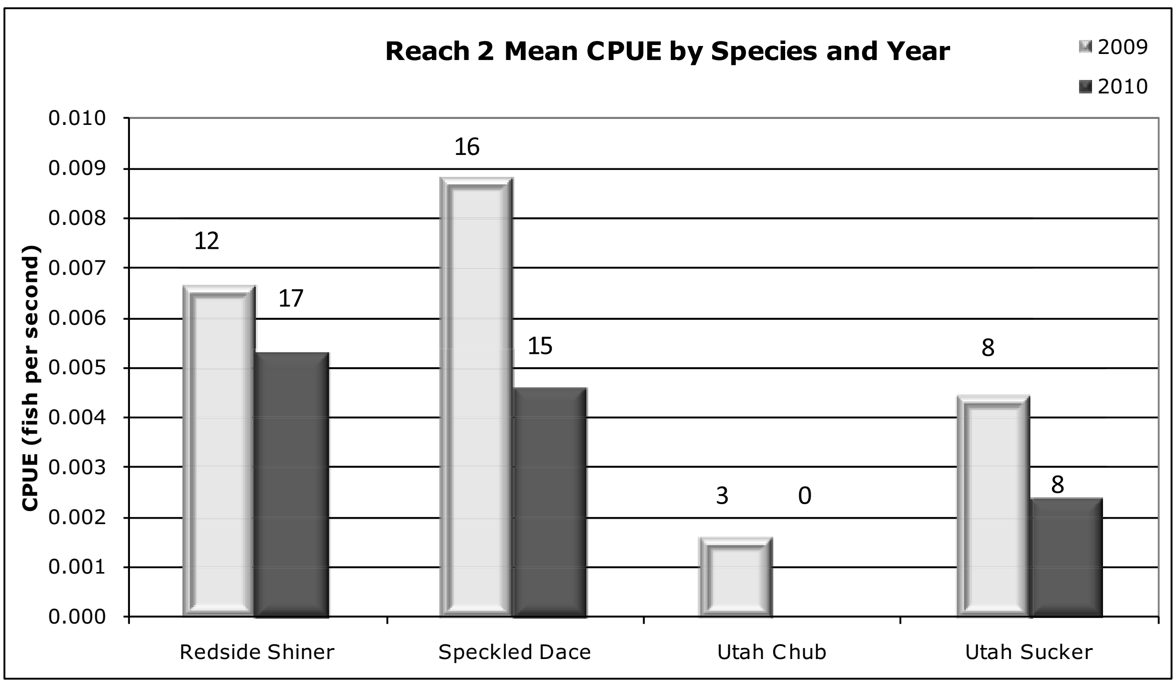
Figure 3-28 shows the species composition for Reach 2 in 2009 and 2010, alongside the species composition for the other five reaches. Relative species abundance in Reach 2 was similar in 2009 and 2010, with speckled dace and redside shiner comprising 72-80% of the CPUE, and Utah sucker comprising approximately 20% of the CPUE (percent CPUE: redside shiner 2009 = 31%, 2010 = 43%; speckled dace 2009 = 41%, 2010 = 37%; Utah chub 2009 = 8%, 2010 = 0%; Utah sucker 2009 = 21%, 2010 = 19%).

Catch per unit effort for all species in Reach 2 was lower in 2010 than in 2009 (Figure 3-30). The mean CPUE for redside shiner was 0.005 (standard error = 0.002) in 2010; mean CPUE was 1.3 times higher in 2009. The mean CPUE for speckled dace was 0.005 (standard error = 0.001) in 2010; mean CPUE was 1.9 times higher in 2009. It should be noted that total number of fish caught was greater in 2010 for redside shiner (2009: 12 fish vs 2010: 17 fish) and similar in 2010 for speckled dace (2009: 16 fish vs 2010: 15 fish), but the number of seconds electrofishing was 1.7 times greater in 2010 compared to 2009. Low numbers of Utah sucker were recorded on this reach in both 2009 and 2010. A low number of Utah chub were also recorded on this reach in 2009, compared to zero in 2010.




Note: Numbers represent total fish caught.

**Figure 3-29**
**The Relative Abundance (CPUE) of the Fishes Caught on Big Springs Creek/Lake Creek Reach 1 in 2009 and 2010**




Note: Numbers represent total fish caught.

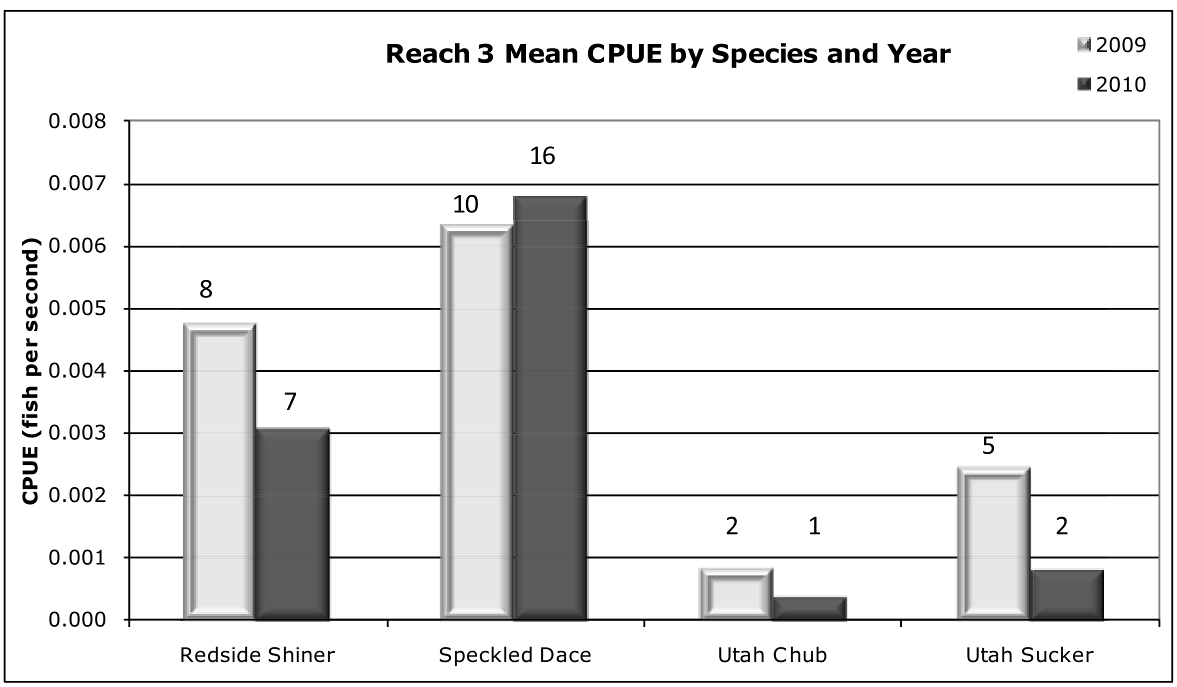
**Figure 3-30**
**The Relative Abundance (CPUE) of the Fishes Caught on Big Springs Creek/Lake Creek Reach 2 in 2009 and 2010**

### *Reach 3*

Reach 3 was electrofished for a total of 2,339 seconds over three passes. A total of 26 fish were captured with four native fish species documented: redside shiner, speckled dace, Utah chub, and Utah sucker. Introduced crayfish were also documented. Speckled dace was the most abundant species, with 16 individuals captured. Redside shiner was the next most abundant species, with 7 individuals captured. One Utah chub and two Utah suckers were also captured. Of all of the reaches in 2010, Reach 3 accounted for 1% of the total fish captured.

Figure 3-28 shows the species composition for Reach 3 in 2009 and 2010, alongside the species composition for the other five reaches. Relative species abundance in Reach 3 was similar in 2009 and 2010, with speckled dace and redside shiner comprising 77-89% of the CPUE, and Utah chub and Utah sucker comprising 11-23% of the CPUE (percent CPUE: redside shiner 2009 = 33%, 2010 = 28%; speckled dace 2009 = 44%, 2010 = 61%; Utah chub 2009 = 3%, 2010 = 4%; Utah sucker 2009 = 17%, 2010 = 8%).

The direction of change in CPUE between 2009 and 2010 in Reach 3 varied by species, but CPUE and fish numbers were generally consistent between years (Figure 3-31). The mean CPUE for redside shiner was 0.003 (standard error = 0.001) in 2010; mean CPUE was 1.5 times higher in 2009 (it should be noted, however, that the actual number of fish caught was similar – 2009 = 8 fish vs 2010 = 7 fish). The mean CPUE for speckled dace was 0.007 (standard error = 0.001) in 2010, similar to 2009. Low numbers of Utah chub and Utah sucker were recorded on this reach in 2009 and 2010.




Note: Numbers represent total fish caught.

**Figure 3-31**
**The Relative Abundance (CPUE) of the Fishes Caught on Big Springs Creek/Lake Creek Reach 3 in 2009 and 2010**

### *Reach 4*

Reach 4 was electrofished for a total of 3,380 seconds over three passes. A total of 719 fish were captured with five native fish species documented: redside shiner, speckled dace, Utah chub, Utah sucker, and mottled sculpin. Introduced crayfish were also documented. Speckled dace was the most abundant species, with 370 individuals captured. Mottled sculpin was the next most abundant species, with 295 individuals captured. Twenty-three redside shiners, 25 Utah chub, and 6 Utah sucker were also captured. Of all of the reaches in 2010, Reach 4 accounted for 40% of the total fish captured.

Figure 3-28 shows the species composition for Reach 4 in 2009 and 2010, alongside the species composition for the other five reaches. Relative species abundance in Reach 4 differed in 2010 compared to 2009. While speckled dace remained dominant (percent CPUE: 2009 = 48%, 2010 = 52%), mottled sculpin was relatively more abundant in 2010 than in 2009 (percent CPUE: 2009 = 24%, 2010 = 41%), and redside shiner was relatively less abundant in 2010 than in 2009 (percent CPUE: 2009 = 19%, 2010 = 3%). Utah chub and Utah sucker comprised the lowest numbers of Reach 4 in both 2009 and 2010 (percent CPUE: Utah chub 2009 = 6%, 2010 = 3%; Utah sucker 2009 = 3%, 2010 = 1%).

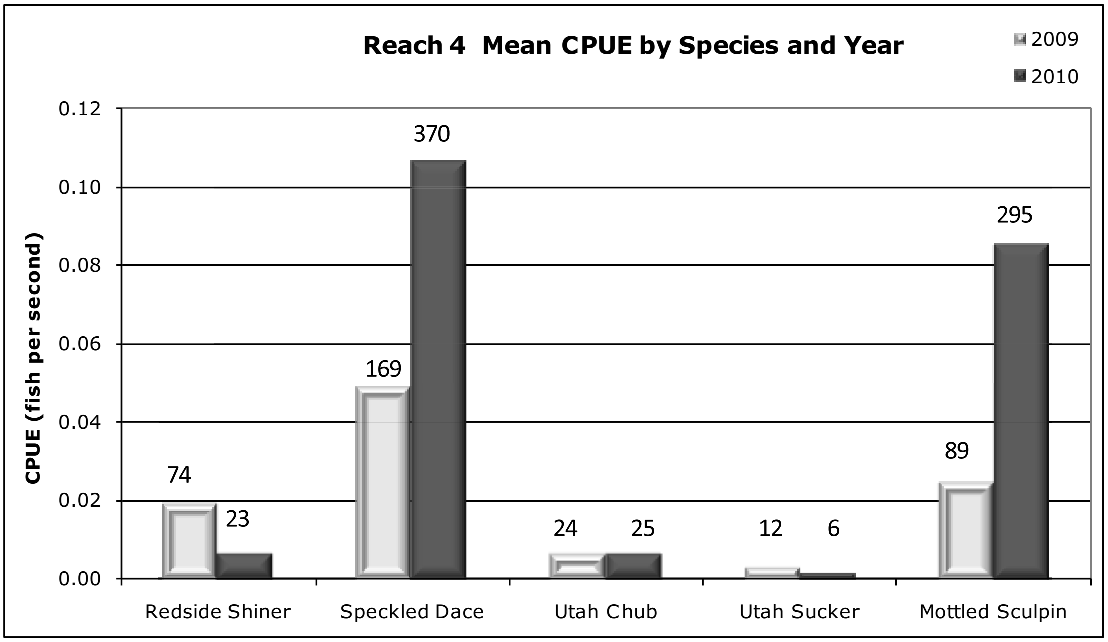
The direction of change in CPUE between 2009 and 2010 in Reach 4 varied by species (Figure 3-32). Compared to 2009, in 2010 mean CPUE decreased for redside shiner, increased for speckled dace and mottled sculpin, and remained relatively constant for Utah chub. The mean CPUE for redside shiner was 0.007 (standard error = 0.003) in 2010; mean CPUE was 3 times higher in 2009). The mean CPUE for speckled dace was 0.106 (standard error = 0.028) in 2010, 2.2 times greater than in 2009. The mean CPUE for mottled sculpin was 0.085 (standard error = 0.021) in 2010, 3.4 times greater than in 2009. The mean CPUE for Utah chub was 0.007 (standard error = 0.006) in 2010, similar to 2009. A low number of Utah sucker were recorded on this reach in both 2009 and 2010.

### *Reach 5*

Reach 5 was electrofished for a total of 2,910 seconds over three passes. A total of 104 fish were captured with one native fish species, Utah sucker, and one introduced fish species, Sacramento perch, documented. Introduced crayfish were also present. Sixty-five Utah sucker and 39 Sacramento perch were captured. Of all of the reaches in 2010, Reach 5 accounted for 6% of the total fish captured.

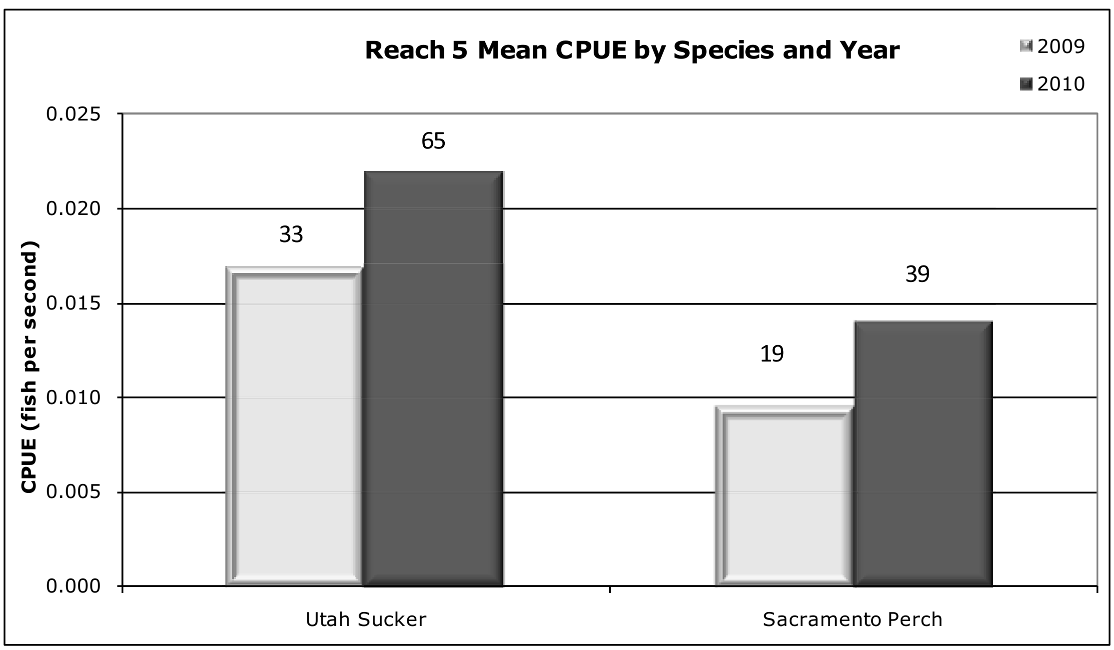
Figure 3-28 shows the species composition for Reach 5 in 2009 and 2010, alongside the species composition for the other five reaches. Relative species abundance in Reach 5 was the same in 2009 and 2010, with Utah sucker comprising the most abundant species (percent CPUE: Utah sucker 2009 = 64%, 2010 = 61%; Sacramento perch 2009 = 36%, 2010 = 39%).

Catch per unit effort for both species in Reach 5 was higher in 2010 than in 2009 (Figure 3-33). The mean CPUE for Utah sucker was 0.022 (standard error = 0.005) in 2010, 1.3 times greater than in 2009. The mean CPUE for Sacramento perch was 0.013 (standard error = 0.009) in 2010, 1.5 times greater than in 2009.




Note: Numbers represent total fish caught.

**Figure 3-32**
**The Relative Abundance (CPUE) of the Fishes Caught on Big Springs Creek/Lake Creek Reach 4 in 2009 and 2010**




Note: Numbers represent total fish caught.

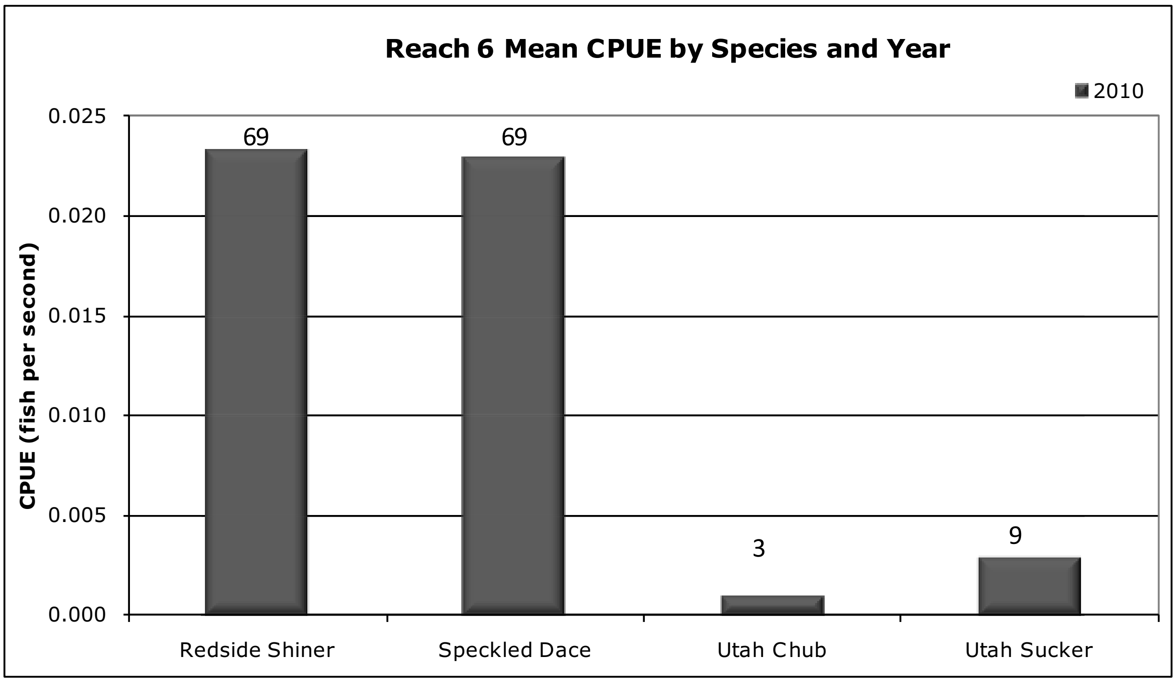
**Figure 3-33**
**The Relative Abundance (CPUE) of the Fishes Caught on Big Springs Creek/Lake Creek Reach 5 in 2009 and 2010**

### *Reach 6*

Reach 6 was electrofished for a total of 2,962 seconds over three passes. A total of 150 fish were captured with four native fish species documented: speckled dace, redside shiner, Utah chub, and Utah sucker. Introduced crayfish were also documented. Speckled dace and redside shiners were the most abundant species, with 69 of each species captured. Three Utah chub and 9 Utah sucker were also captured. Of all of the reaches in 2010, Reach 6 accounted for 8% of the total fish captured.

Figure 3-28 shows the species composition for Reach 6 in 2010 (the reach was not surveyed in 2009), alongside the species composition for the other five reaches. Speckled dace and redside shiner comprised the most abundant species, comprising 92% of the CPUE (2010 percent CPUE: redside shiner = 46%; speckled dace = 46%; Utah chub = 2%; Utah sucker = 6%).

Catch per unit effort for Reach 6 in 2010 is presented in Figure 3-34. The mean CPUE for redside shiner was 0.023 (standard error = 0.003), and the mean CPUE for speckled dace was 0.023 (standard error = 0.007). Low numbers of Utah chub and Utah sucker were recorded on this reach in 2010.




This reach was not surveyed in 2009. Numbers represent total fish caught.

**Figure 3-34**
**The Relative Abundance (CPUE) of the Fishes Caught on Big Springs Creek/Lake Creek Reach 6 in 2009 and 2010**

### 3.9.2 Relative Abundance Comparisons

Figure 3-35 shows the relative abundance (CPUE) of fishes overall for each reach per year. In both 2009 and 2010, reaches 1 and 4 had the highest total fish relative abundance. The mean fish CPUE for Reach 1 was 3.2 times higher in 2009 than in 2010 (2009: mean CPUE = 0.525, standard error = 0.082; 2010: mean CPUE = 0.164, standard error = 0.033). Conversely, the mean fish CPUE for Reach 4 was 2 times higher in 2010 than in 2009 (2009: mean CPUE = 0.103, standard error = 0.012; 2010: mean CPUE = 0.206, standard error = 0.059). Relative abundance at the other reaches remained relatively low and comparable to 2009 numbers. Reach 6 was not sampled in 2009 and the 2010 relative abundance was low compared to reaches 1 and 4, but higher compared to reaches 2 and 3. Unlike the other reaches, reaches 1 and 4 are in proximity to springheads (Reach 1 is 200 m downstream from the Big Springs springhead, and Reach 4 is at Stateline Springs).

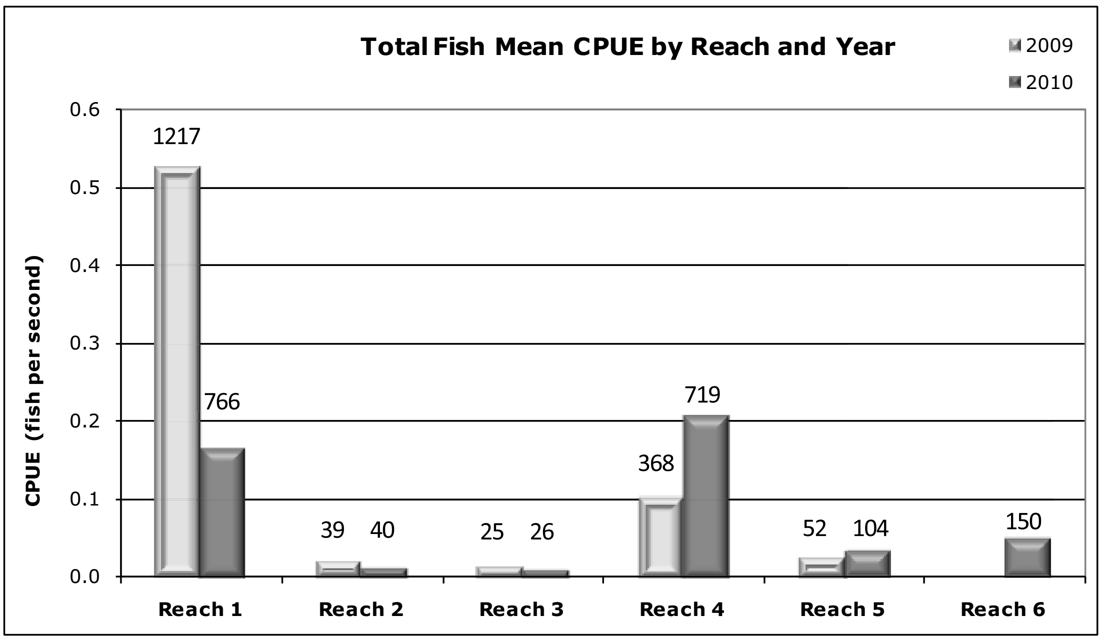



**Figure 3-35**
**A Comparison of the CPUE, Relative Abundance, of Combined Fish Species Catch by Big Springs Creek/Lake Creek Reach and Year**

### 3.9.3 Fish Lengths

Fish length data were collected at each reach on up to 25 individuals of each species. Table 3-38 provides descriptive statistics on the length data collected for each species across the six reaches. Redside shiner lengths ranged from 36 to 112 mm, with the mean length across five reaches ranging from 70.9 to 83.1 mm. Speckled dace lengths ranged from 35 to 104 mm, with the mean length across five reaches ranging from 53.8 to 71.0 mm. Utah chub lengths ranged from 64 to 181 mm, with the mean length across three reaches ranging from 105.0 to 152.0 mm. Utah sucker lengths ranged from 43 to 382 mm, with the mean length across five reaches ranging from 50.0 to 246.0 mm. Mottled sculpin lengths ranged from 29 to 90 mm, with the mean length of 52.5 mm (the species was present in only one reach).

**Table 3-38**
**Length Data for Each Native Fish Species at**
**Big Springs Creek/Lake Creek Reaches in 2010**

| Species | Reach | Total Number of Fish Measured | Minimum Length (mm) | Maximum Length (mm) | Mean Length (mm) | Standard Error |
|---|---|---|---|---|---|---|
| Redside Shiner | 1 | 25 | 55 | 89 | 72.4 | 1.8 |
| | 2 | 22 | 42 | 112 | 71.9 | 5.1 |
| | 3 | 7 | 43 | 109 | 83.1 | 9.0 |
| | 4 | 23 | 39 | 95 | 72.3 | 3.6 |
| | 6 | 25 | 36 | 108 | 70.9 | 4.3 |
| Speckled Dace | 1 | 28 | 37 | 82 | 58.0 | 2.1 |
| | 2 | 10 | 46 | 86 | 71.0 | 4.4 |
| | 3 | 16 | 45 | 104 | 67.3 | 3.3 |
| | 4 | 25 | 35 | 75 | 53.8 | 2.5 |
| | 6 | 25 | 36 | 82 | 65.0 | 2.0 |
| Utah Chub | 3 | 1 | 152 | 152 | 152 | N/A |
| | 4 | 25 | 64 | 140 | 105.0 | 3.4 |
| | 6 | 3 | 130 | 181 | 151.0 | 15.4 |
| Utah Sucker | 2 | 8 | 58 | 243 | 125.9 | 18.8 |
| | 3 | 2 | 234 | 258 | 246.0 | 12.0 |
| | 4 | 6 | 106 | 204 | 147.0 | 15.0 |
| | 5 | 25 | 43 | 55 | 50.0 | 0.6 |
| | 6 | 9 | 60 | 382 | 148.0 | 36.3 |
| Mottled Sculpin | 4 | 25 | 29 | 90 | 52.5 | 3.6 |

N/A - The standard error could not be calculated with one measurement.

### *3.9.4 Reach Habitat Comparisons*

Upon completion of the fish sampling at each reach, habitat data were collected along five transects to characterize the general habitat of the reach. Figure 3-36 shows mean percent vegetation (submergent and emergent combined, averaged across transects) by the total number of fish captured for each reach for 2010.

A total of 2,073 habitat data points were recorded for Reach 1, and the mean percent of the points that intersected vegetation (submergent and emergent) over the five transects was 38.5 percent (standard error = 8.6). The substrate was characterized by sand, gravel, cobble, and a few boulders. Physical habitat mapping (Section 3.1) reflected that the average depth of the water for this reach was less than 0.2 m and the velocity was greater than 0.5 m/sec; however, some deeper, slower velocity pockets did occur.

At Reach 2, a total of 1,505 habitat data points were recorded, and the mean percent of the points that intersected vegetation (submergent and emergent) over the five transects was 0.0%. The substrate

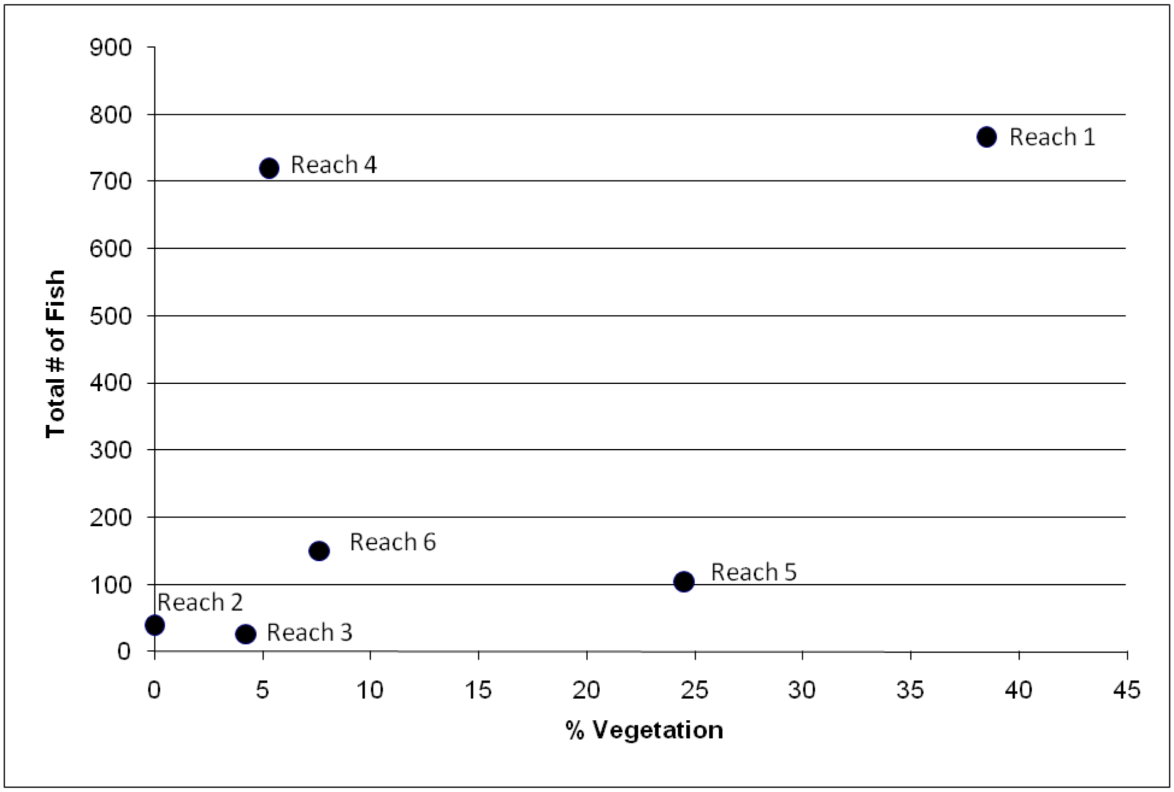



**Figure 3-36**
**Total Number of Native Fish by Mean Percent Vegetation (Emergent and Submergent Combined) for Big Springs Creek/Lake Creek Reaches (1-6)**

was characterized by silt and sand. Physical habitat mapping (Section 3.1) reflected that the average depth of the water for this reach ranged from 0.2 to 1.0 m, and the velocity was 0.1 to 0.5 m/sec.

At Reach 3, a total of 1,350 habitat data points were collected with a mean percent of intersected vegetation points of 4.2% (standard error = 2.4). The substrate was characterized by silt and gravel. Physical habitat mapping (Section 3.1) reflected that the average water depth ranged from 0.2 to 1.0 m, and the velocity ranged from 0.1 to 0.5 m/sec.

At Reach 4, a total of 1,888 data points were collected with a mean percent of intersected vegetation points of 5.3% (standard error = 2.7). The substrate was characterized by silt, sand, gravel, cobble, and boulders. Physical habitat mapping (Section 3.1) reflected that the average water depth ranged from 0.2 to 1.0 m, and velocity was greater than 0.5 m/sec.

At Reach 5, a total of 1,222 data points were collected with a mean percent of intersected vegetation points of 24.5% (standard error = 10.3). The substrate was characterized by silt and gravel. Physical habitat mapping (Section 3.1) reflected that the average water depth ranged from 0.2 to 1.0 m, and velocity ranged from 0.1 to 0.5 m/sec.

At Reach 6, a total of 1,610 habitat data points were recorded, and the mean percent of the points that intersected vegetation (submergent and emergent) over the five transects was 7.6% (standard error =

2.5). The substrate was characterized by silt and gravel. Physical habitat mapping (Section 3.1) reflected that the average depth of the water for this reach ranged from 0.2 to 1.0 m, and the velocity was 0.1 to 0.5 m/sec.

Water-quality measurements were taken three weeks following the 2010 fish data collection during the fall sampling period. Table 3-39 shows water-quality measurements for the center point of each reach. Conditions did not appear to differ to any great degree across transects. Dissolved oxygen (mg/L) and conductivity were lowest at reaches 1 and 4. Turbidity and pH were lowest at reaches 1 and 5. Water temperature was lowest at Reach 4.

**Table 3-39**
**Water Quality Measurements for Big Springs Creek/Lake Creek Reaches for 2010**

| Reach | Time | Water Temperature (°F) | Conductivity (µS/cm) | pH | Dissolved Oxygen (mg/L) | Turbidity (NTU) |
|---|---|---|---|---|---|---|
| 1 | 1349 | 64.6 | 384 | 7.38 | 9.24 | 12.9 |
| 2 | 1312 | 64.5 | 409 | 8.13 | 10.79 | 53.7 |
| 3 | 1449 | 64.7 | 411 | 8.21 | 10.8 | 63.7 |
| 4 | 1505 | 62.5 | 392 | 8.06 | 8.4 | 62.3 |
| 5 | 1535 | 65.2 | 704 | 8.00 | 10.79 | 12.6 |
| 6 | 1423 | 70.6 | 393 | 8.25 | 10.14 | 36.4 |

### *3.9.5 Conclusion*

Fish species composition, relative abundance, and mean fish lengths in 2010 were found to be generally similar to what was documented in 2009, with a few exceptions. Species composition did change on Reach 1 with the absence of Utah sucker and Utah chub in 2010. However, these two species combined had constituted less than 1% of the total fish CPUE in Reach 1 in 2009. Utah chub were also absent on Reach 2 in 2010, down from 8% of the total fish CPUE in Reach 2 in 2009. Reach 4 showed some changes in relative abundance in 2010, with redside shiner comprising 3% of the total fish CPUE, down from 20%, and mottled sculpin at 41% of the total fish CPUE, up from 24%. Mean CPUE for redside shiner and speckled dace were 3-4 times higher in Reach 1 in 2009 than in 2010, and mean CPUE for redside shiner was 3 times higher in Reach 4 in 2009 than in 2010. Conversely, mean CPUE for speckled dace and mottled sculpin were 2-3 times higher in Reach 4 in 2010 than in 2009. Mean CPUE did not appear to change to any great degree across the rest of the species in the remaining reaches. Reaches 1 and 4 continued to have the highest total combined fish species relative abundances and the majority of captured redside shiner, speckled dace, and Utah chub. Reach 4 was again the only reach with mottled sculpin.

The mean fish length for each species was generally consistent between years for each reach. However, Reach 4 speckled dace showed a smaller mean length in 2010 of 53.8 mm (standard error = 2.5) compared to 60.5 mm (standard error = 2.7) in 2009, and Reach 4 Utah chub showed a smaller mean length in 2010 of 105.0 mm (standard error = 3.4) compared to 121.0 mm (standard error = 8.7) in 2009. The mean length of Utah sucker at Reach 5 was 50.0 mm (standard error = 0.6) in 2010, which was less than the 2009 mean length of 62.3 mm (standard error = 2.7). The smaller mean lengths suggest higher numbers of juvenile fish in these reaches in 2010.

A total of 1,701 fish were recorded over reaches 1 to 5 in 2009, and 1,655 fish were recorded for the same reaches in 2010 (1,805 including Reach 6). Reaches 1 and 4 had 94% of the fish in 2009 and 82% of the fish in 2010 (82% of reaches 1-6; 89% of reaches 1-5). It is unclear if the percent vegetation recorded along each reach has an effect on fish numbers, as Reach 1 transects had a mean of 38.5% emergent vegetation, yet Reach 4 had a mean of only 5.3%. The water-quality measurements did not differ greatly across the reaches, and could not explain the uneven fish distribution. Reach 1 and Reach 4 are the only reaches with direct inflow from spring sources (Big Springs and Stateline Springs respectively), have a velocity greater than 0.5 m/sec., and have a good substrate structure that includes cobble and boulders. The remaining reaches do not have direct inflow from springs, have a velocity less than 0.5 m/sec., and appear to have less substrate structure with more siltation. A complex substrate, higher velocity, and the presence of spring inflows may provide better fish habitat in the Big Springs Creek/Lake Creek system, especially for speckled dace and mottled sculpin.

### 3.10 Vegetation

Summaries of the 2009 and 2010 vegetation data in subsequent sections are presented by transect type (aquatic [spring], wetland/meadow, phreatophytic shrubland and valley floor Rocky Mountain juniper [VFRMJ, a.k.a. swamp cedar]), as established in the Plan. Data are summarized for mean live cover multiple hits (MH), mean live cover first hit (FH), total number of taxa, and mean taxa richness. Comparisons are made at the site level by transect type by comparing mean live cover (MH) between 2009 and 2010. Similar comparisons are also made at the transect level for the most dominant species or taxa (i.e., dominant along a transect or within micro- communities along a transect; see Section 2.10.2 for more details).

A list of the plant taxa that occurred on the vegetation transects in 2009 and 2010 is presented in Appendix E (Table E-1). Appendix E, Tables E-1 through E-4 present mean live cover (MH) by species across the various transect types, along with the number of sites and number of transects where the species were encountered in 2009 and 2010.

#### 3.10.1 Aquatic (Spring) Transects

Mean live cover multiple hits (MH) overall for aquatic transects was 20% higher in 2010 than in 2009 (grand mean live cover (MH): 2009 = 80%, 2010 = 95%) (Table 3-40 and Figure 3-37). Five of the 14 sites showed a significant increase in mean live cover (MH) in 2010 (Four Wheel Drive Spring: 41% increase; Unnamed 1 Spring North of Big: 59% increase; South Millick Spring: 25% increase; Stateline Springs: 39% increase; and Keegan Spring Complex: 91% increase). Mean live cover (MH) ranged from 61% (Big Springs) to 141% (Swallow Spring) in 2010. This compares to a mean live cover (MH) in 2009 that ranged from 53% (Keegan Spring Complex) to 104% (Swallow Spring).

There did not appear to be any appreciable pattern in change in mean live cover (FH) overall from 2009 to 2010 (grand mean live cover (FH): 2009 = 72%, 2010 = 74%), but mean live cover (FH) did vary between years for various sites (Table 3-40 and Figure 3-38). Mean live cover (FH) ranged from 45% for Big Springs to 89% for Unnamed 1 Spring North of Big in 2010. This compares to a mean live cover (FH) in 2009 that ranged from 52% for Keegan Spring Complex to 92% for North Little Spring. Mean live cover first hit (FH) for aquatic transects was always lower than mean live cover (MH). The direction of change from 2009 to 2010 was usually similar between the two measures of live vegetation cover, with the exception of cover changes at West Spring Valley Complex, Unnamed 5 Spring and Willard Spring, where mean live cover (MH) increased while mean live cover (FH) decreased.

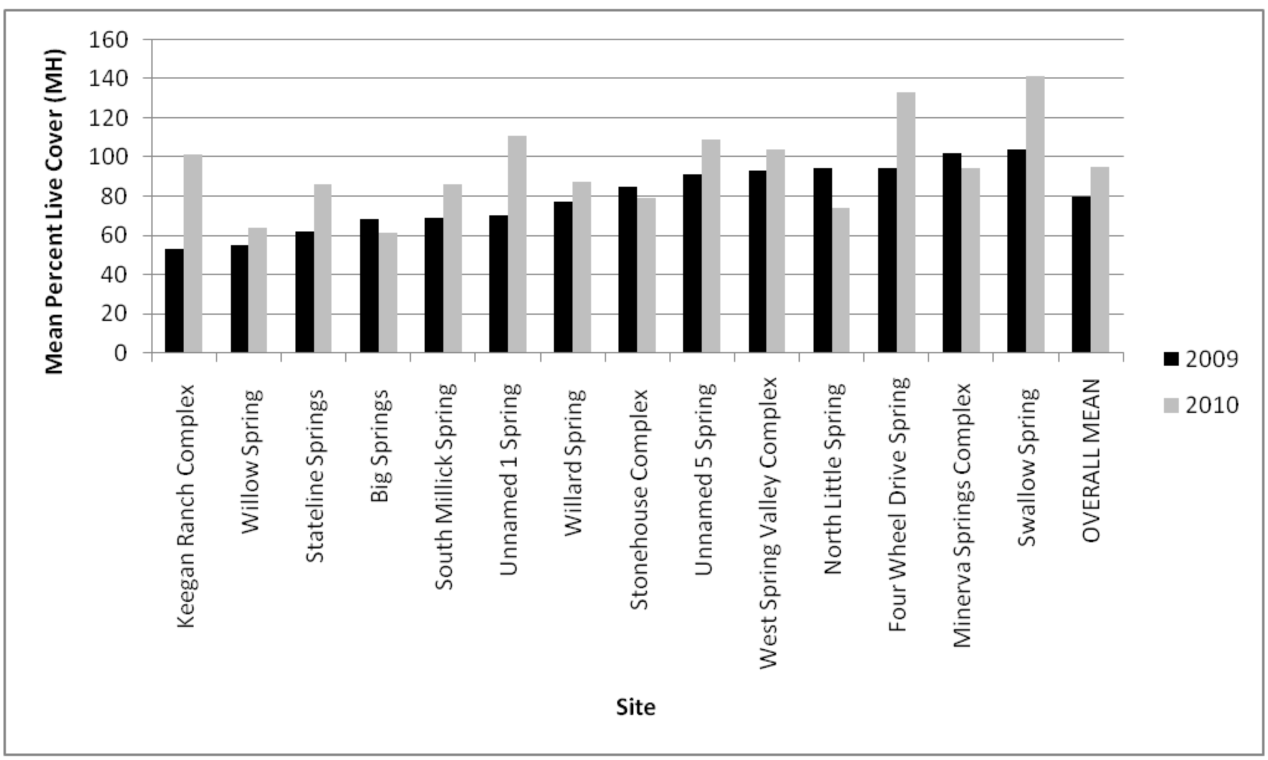
Total number of taxa overall for aquatic transects was similar in 2009 and 2010 (total: 2009 = 42, 2010 = 46), as was mean taxa richness (grand mean: 2009 = 0.9, 2010 = 1.0) (Table 3-40, and Figures 3-39 and 3-40). North Little Spring had the lowest taxa richness in both 2009 and 2010 (mean taxa richness: 2009 = 0.3, 2010 = 0.3; total number of taxa: 2009 = 20, 2010 = 25), while West Spring Valley Complex had the highest mean taxa richness in both 2009 and 2010 (mean taxa richness: 2009 = 2.6, 2010 = 3.0; total number of taxa: 2009 = 56, 2010 = 58).

**Table 3-40. Summary of Mean Live Cover Multiple Hits (MH), Mean Live Cover First Hit (FH), Total Number of Taxa and Mean Taxa Richness on the Aquatic Transects in Spring and Snake Valleys for 2009 and 2010**

Cover values are averages over all transects per site (grand mean). Total number of taxa is the total number of taxa or species observed across all transects per site. Mean taxa richness is the number of taxa divided by transect length, averaged across all transects per site (grand mean). Significance is for multiple hit (MH) cover between 2009 and 2010, and is based on an ANOVA test.

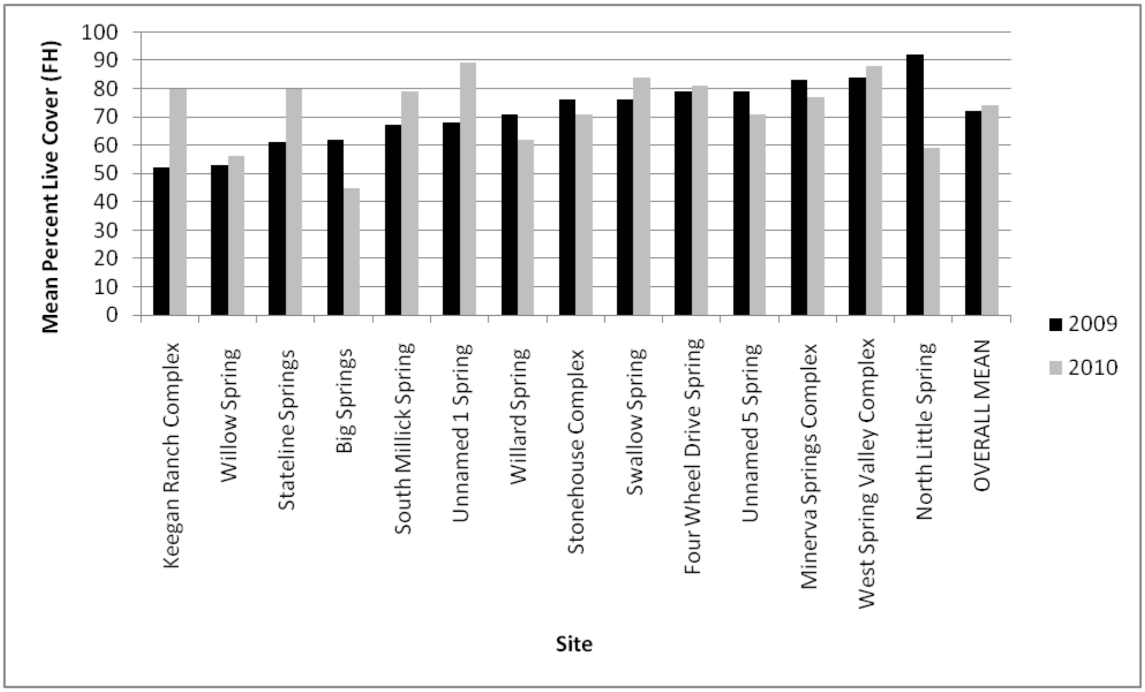
| Site | % Mean Live Cover (MH) | | P ≤0.05 | % Mean Live Cover (FH) | | Total Number of Taxa[a] | | Mean Transect Length (m) | Mean Taxa Richness | |
|---|---|---|---|---|---|---|---|---|---|---|
| | 2009 | 2010 | | 2009 | 2010 | 2009 | 2010 | | 2009 | 2010 |
| Swallow Spring | 104 | 141 | | 76 | 84 | 42 | 46 | 38 | 0.4 | 0.5 |
| Minerva Springs Complex | 102 | 94 | | 83 | 77 | 62 | 57 | 30 | 0.9 | 1.0 |
| Four Wheel Drive Spring | 94 | 133 | * | 79 | 81 | 39 | 40 | 14 | 1.1 | 1.3 |
| North Little Spring | 94 | 74 | | 92 | 59 | 20 | 25 | 25 | 0.3 | 0.3 |
| West Spring Valley Complex | 93 | 104 | | 84 | 88 | 56 | 58 | 16 | 2.6 | 3.0 |
| Unnamed 5 Spring | 91 | 109 | | 79 | 71 | 44 | 39 | 46 | 0.6 | 0.5 |
| Stonehouse Complex | 85 | 79 | | 76 | 71 | 26 | 33 | 23 | 0.5 | 0.6 |
| Willard Spring | 77 | 87 | | 71 | 62 | 47 | 38 | 34 | 0.8 | 0.7 |
| Unnamed 1 Spring | 70 | 111 | * | 68 | 89 | 44 | 48 | 30 | 0.7 | 0.8 |
| South Millick Spring | 69 | 86 | * | 67 | 79 | 39 | 36 | 22 | 1.0 | 1.1 |
| Big Springs | 68 | 61 | | 62 | 45 | 40 | 45 | 23 | 0.7 | 0.8 |
| Stateline Springs | 62 | 86 | * | 61 | 80 | 24 | 39 | 18 | 0.8 | 1.1 |
| Willow Spring | 55 | 64 | | 53 | 56 | 41 | 46 | 17 | 1.2 | 1.2 |
| Keegan Spring Complex | 53 | 101 | * | 52 | 80 | 66 | 87 | 69 | 0.4 | 0.6 |
| **GRAND MEAN** | **80** | **95** | | **72** | **74** | **42** | **46** | | **0.9** | **1.0** |

[a]Total number of taxa is not independent of transect length, which varies across transects and across sites (transect lengths range from 5 to 100 m, with a mean of 14 to 69 m). Total number of taxa in the 2009 report tables may differ than those reported in the current summary table due to species that were combined based on similar species codes (e.g. Moss/Sp. Moss) in the 2009 data analysis.



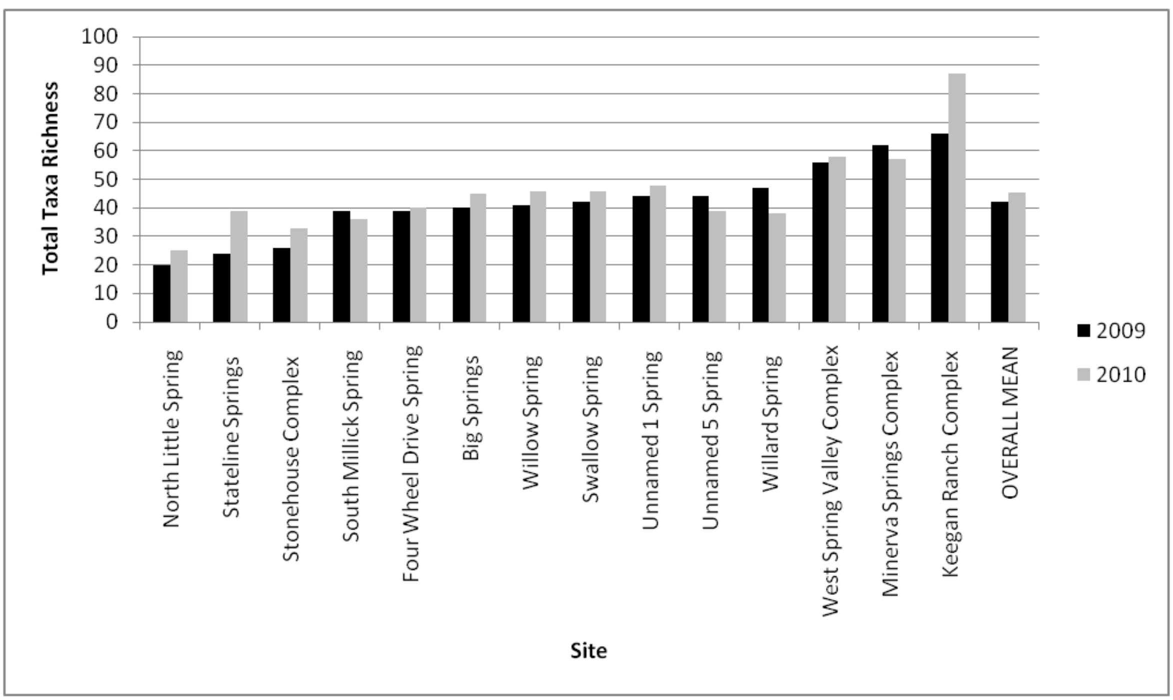

Note: Shown in ascending order based on 2009 data.

**Figure 3-37**
**Mean Live Cover Multiple Hits (MH) in 2009 and 2010 for Aquatic Sites**



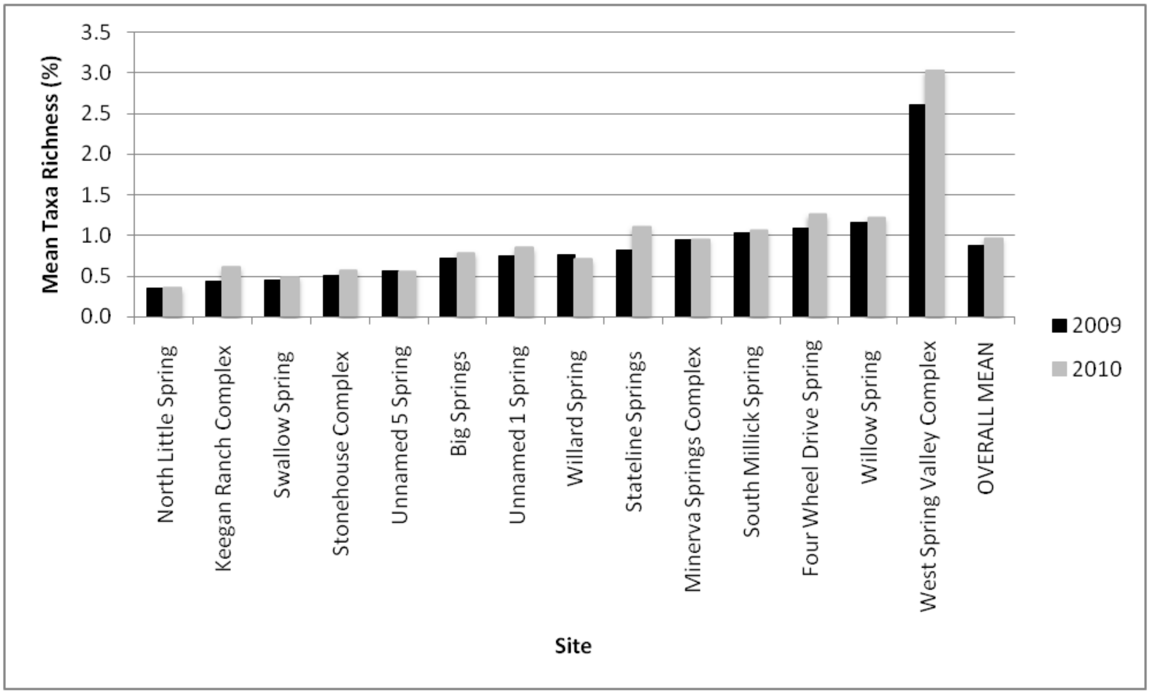

Note: Shown in ascending order based on 2009 data.

**Figure 3-38**
**Mean Live Cover First Hits (FH) in 2009 and 2010 for Aquatic Sites**




Note: Shown in ascending order based on 2009 data. Total number of taxa is not independent of transect length, which varies across transects and across sites (transect lengths range from 5-100 m, with a mean of 14.69 m)

**Figure 3-39**
**Total Number of Taxa in 2009 and 2010 for Aquatic Sites**




Note: Shown in ascending order based on 2009 data.

**Figure 3-40**
**Mean Number of Taxa (Number of Taxa Divided by Transect length, Averaged across Transects) in 2009 and 2010 for Aquatic Sites**

The live cover of some individual species or taxa changed greatly between 2009 and 2010, whereas other species cover varied little between the two years (Appendix E, Tables E-2 and E-5). Taxa that were encountered along many of the aquatic transects and that had relatively high mean percent cover within and among sites were the aquatic and wetland species *Carex nebrascensis, Berula erecta,* and *Nasturtium officinale* (Appendix E, Table E-5). Because these species are abundant and occur on many of the aquatic sites, they may be good species to monitor closely for overall aquatic vegetation changes in Spring Valley.

### *3.10.1.1 Stonehouse Spring Complex*

The Stonehouse Complex represents basin springs and seeps that occur in a relatively small, confined area. This wetland complex has some deep spring pools, shallow channels between small pools, seeps, and bog areas. The area has been historically grazed, though some areas are too deep or boggy for cattle use. This complex is the northernmost aquatic site that is being monitored in Spring Valley.

The most dominant species, by mean live cover (MH), in 2009 and 2010 on the aquatic transects at the Stonehouse Complex were *Carex simulata*, *Carex nebrascensis, Nasturtium officinale*, and *Juncus arcticus* (Table 3-41). A total of 26 and 33 taxa occurred on transects in 2009 and 2010, respectively, at the Stonehouse Complex and these values are below average compared across all aquatic sites (Table 3-40). Mean live cover (MH) averaged 85 and 79% in 2009 and 2010, respectively, and these were about average for the 14 sites.

**Table 3-41. Mean Live Cover Multiple Hits (MH) for the Most Dominant Species and Total Live Cover for Aquatic Transects at the Stonehouse Complex for 2009 and 2010**

Species are classified as to dominance along the transect as either transect dominant, transect subdominant, or microcommunity dominant. Taxa richness is indicated at the top of the table as total taxa and mean taxa for the transect. N represents the sample size for each species and the asterisk in the significance column represents a significant difference between years based on paired *t*-test comparison.

**Veg_039 N = 26 (Total Taxa for Transect: 2009 = 11; 2010 = 17) (Mean Taxa for Transect: 2009 = 0.4; 2010 = 0.7)**

| Species | Mean Live Cover (MH) 2009 | Mean Live Cover (MH) 2010 | Significance at ≤0.05 | Dominance Classification |
|---|---|---|---|---|
| *Carex simulata* | 41.15 | 20.77 | * | Transect Dominant |
| *Carex nebrascensis* | 21.96 | 18.65 | | Transect Dominant |
| *Juncus arcticus* ssp. *littoralis* | 8.23 | 4.12 | | Microcommunity Dominant |
| *Iris missouriensis* | 2.89 | 0.35 | | Microcommunity Dominant |
| *Ranunculus cymbalaria* | 0.54 | 1.73 | | Microcommunity Dominant |
| *Argentina anserina* | 0.00 | 5.58 | | Microcommunity Dominant |
| **Total Live Cover** | **78.15** | **57.42** | * | |

**Veg_040 N = 28 (Total Taxa for Transect: 2009 = 15; 2010 = 19) (Mean Taxa for Transect: 2009 = 0.5; 2010 = 0.7)**

| Species | Mean Live Cover (MH) 2009 | Mean Live Cover (MH) 2010 | Significance at ≤0.05 | Dominance Classification |
|---|---|---|---|---|
| *Carex nebrascensis* | 28.93 | 26.39 | | Transect Dominant |
| *Nasturtium officinale* | 15.61 | 0.89 | * | Transect Subdominant |
| *Juncus arcticus* ssp. *littoralis* | 12.04 | 8.89 | | Transect Subdominant |
| *Carex simulata* | 7.86 | 2.54 | * | Microcommunity Dominant |
| *Berula erecta* | 4.46 | 18.61 | * | Transect Subdominant |
| *Catabrosa aquatica* | 4.25 | 2.54 | | Microcommunity Dominant |
| *Moss* | 3.07 | 0.00 | | Microcommunity Dominant |
| *Algae* | 0.00 | 4.93 | | Microcommunity Dominant |
| *Carex praegracilis* | 0.00 | 2.79 | | Microcommunity Dominant |
| **Total Live Cover** | 80.93 | 76.11 | | |

**Veg_041 N = 21 (Total Taxa for Transect: 2009 = 11; 2010 = 14) (Mean Taxa for Transect: 2009 = 0.5; 2010 = 0.7)**

| Species | Mean Live Cover (MH) 2009 | Mean Live Cover (MH) 2010 | Significance at ≤0.05 | Dominance Classification |
|---|---|---|---|---|
| *Carex simulata* | 39.33 | 22.52 | * | Transect Dominant |
| *Juncus arcticus* ssp. *littoralis* | 13.19 | 11.91 | | Transect Subdominant |
| *Nasturtium officinale* | 11.91 | 8.48 | | Transect Subdominant |
| *Carex nebrascensis* | 9.76 | 8.29 | | Transect Subdominant |
| *Puccinellia distans* | 2.52 | 0.76 | | Microcommunity Dominant |
| *Carex praegracilis* | 0.00 | 4.10 | | Microcommunity Dominant |
| *Lemna minor* | 0.00 | 3.29 | | Microcommunity Dominant |
| *Lemna minuta* | 0.00 | 24.52 | * | Microcommunity Dominant |
| **Total Live Cover** | **81.48** | **88.86** | | |

**Veg_042 N = 30 (Total Taxa for Transect: 2009 = 6; 2010 = 8) (Mean Taxa for Transect: 2009 = 0.2; 2010 = 0.3)**

| Species | Mean Live Cover (MH) 2009 | Mean Live Cover (MH) 2010 | Significance at ≤0.05 | Dominance Classification |
|---|---|---|---|---|
| *Carex simulata* | 56.97 | 40.00 | * | Transect Dominant |
| *Carex nebrascensis* | 10.20 | 5.40 | * | Transect Subdominant |
| *Carex rostrata* | 3.83 | 5.17 | | Microcommunity Dominant |
| *Scirpus* sp. | 3.17 | 2.97 | | Microcommunity Dominant |
| *Nasturtium officinale* | 3.00 | 14.90 | * | Transect Subdominant |
| *Algae* | 0.00 | 2.10 | | Microcommunity Dominant |
| *Lemna minor* | 0.00 | 11.77 | * | Transect Subdominant |
| **Total Live Cover** | **77.87** | **82.73** | | |

**Veg_043 N = 9 (Total Taxa for Transect: 2009 = 8; 2010 = 5) (Mean Taxa for Transect: 2009 = 0.9; 2010 = 0.6)**

| Species | Mean Live Cover (MH) 2009 | Mean Live Cover (MH) 2010 | Significance at ≤0.05 | Dominance Classification |
|---|---|---|---|---|
| *Carex simulata* | 51.11 | 42.44 | | Transect Dominant |
| *Carex nebrascensis* | 27.56 | 34.33 | | Transect Dominant |
| *Eleocharis palustris* | 15.33 | 0.00 | | Transect Subdominant |
| *Nasturtium officinale* | 0.00 | 11.11 | | Transect Subdominant |
| **Total Live Cover** | **107.00** | **89.78** | | |

*Carex simulata* was the most dominant species along all but one transects (040; Table 3-41). *Carex nebrascensis* was a dominant species on all five transects, *Nasturtium officinale* was a subdominant species on four transects, and *Juncus arcticus* was a subdominant species on two transects. Most other species had a cover value of 10% or less of the mean cover for any transect.

Some changes in species or taxa were noted on permanent aquatic transects within the Stonehouse Complex between the summers of 2009 and 2010. For example, the aquatic species *Lemna* sp. and green algae had greater cover in 2010 than in 2009. *Carex nebrascensis* and *Carex simulata* both had significant ($P \leq 0.05$) decreases in cover on several transects where they were found (Table 3-41). Mean live cover (MH) of the most dominant species on the five transects, however, showed little change between the two years. However, total live cover of all species at the Stonehouse Complex did show a moderate decrease between 2009 and 2010 (Figure 3-40 and Table 3-41).

### 3.10.1.2 Willow-NV Spring

Forty-six taxa were recorded along the aquatic transects at Willow Spring in 2010. This diversity was average for the 14 sites overall. The three taxa with highest mean live cover were *Carex nebrascensis*, *Eleocharis palustris*, and *Argentina anserina*. The overall aquatic plant community at this site is relatively diverse. Total live plant cover for the five transects was one of the lowest recorded for all 14 aquatic sites.

*Carex nebrascensis* had the highest cover value on two of the transects and *Iva axillaris, Juncus arcticus*, and *Typha latifolia* were the most dominant species along one of each of the remaining transects (Table 3-42). Subdominant species included *Artemisia tridentata*, *Agrostis gigantea*, *Eleocharis palustris*, and *Carex simulata*.

Mean live cover (MH) of *Agrostis gigantea* showed some increase in 2010 on all three of the transects where it was found (Table 3-42). However the increases were not significant. *Carex nebrascensis* showed little change in cover between 2009 and 2010. *Nasturtium officinale* was an important species in 2009, but this dominance was not expressed in 2010. The cover of *Typha latifolia* declined significantly between the two years as well on the two transects where it was encountered. However the average total live cover for all species at Willow Spring increased on three of the five transects in 2010. This increase of average cover was attributed primarily to increases in cover of less dominant species.

**Table 3-42. Mean Live Cover Multiple Hits (MH) for the Most Dominant Species and Total Live Cover for the Aquatic Transects at Willow Spring for 2009 and 2010 (Page 1 of 2)**

Species are classified as to dominance along the transect as either transect dominant, transect subdominant, or microcommunity dominant. Taxa richness is indicated at the top of the table as total taxa and mean taxa for the transect. N represents the sample size for each species and the asterisk in the significance column represents a significant difference between years based on paired *t*-test comparison.

**Veg_049 N = 26 (Total Taxa for Transect: 2009 = 24; 2010 = 28) (Mean Taxa for Transect: 2009 = 0.9; 2010 = 1.1)**

| Species | Mean Live Cover (MH) 2009 | Mean Live Cover (MH) 2010 | Significance at ≤0.05 | Dominance Classification |
|---|---|---|---|---|
| *Juncus arcticus* ssp. *littoralis* | 11.39 | 17.19 | * | Transect Dominant |
| *Carex nebrascensis* | 10.46 | 16.77 | * | Transect Dominant |
| *Nasturtium officinale* | 7.23 | 0.31 | * | Microcommunity Dominant |
| *Agrostis gigantea* | 6.69 | 7.81 | | Transect Subdominant |
| *Argentina anserina* | 6.54 | 4.00 | | Microcommunity Dominant |
| *Iris missouriensis* | 5.46 | 5.77 | | Microcommunity Dominant |
| *Poa* sp. | 5.27 | 2.73 | | Microcommunity Dominant |
| *Algae* | 3.77 | 1.08 | | Microcommunity Dominant |
| *Carex praegracilis* | 3.54 | 1.23 | | Microcommunity Dominant |
| *Berula erecta* | 3.12 | 7.54 | | Microcommunity Dominant |
| *Symphyotrichum eatonii* | 0.00 | 5.15 | | Microcommunity Dominant |
| **Total Live Cover** | **77.62** | **87.04** | | |

Based on field data and the distribution of hits along the transect, species listed as *Poa pratensis* in 2009 and *Poa secunda* in 2010 were analyzed as *Poa* sp. for *t*-test analysis.

**Veg_050 N = 10 (Total Taxa for Transect: 2009 = 16; 2010 = 17) (Mean Taxa for Transect: 2009 = 1.6; 2010 = 1.7)**

| Species | Mean Live Cover (MH) 2009 | Mean Live Cover (MH) 2010 | Significance at ≤0.05 | Dominance Classification |
|---|---|---|---|---|
| *Carex nebrascensis* | 27.30 | 26.40 | | Transect Dominant |
| *Artemisia tridentata* | 14.00 | 15.90 | | Transect Subdominant |
| *Nasturtium officinale* | 8.20 | 0.00 | | Microcommunity Dominant |
| *Argentina anserina* | 8.00 | 4.50 | | Microcommunity Dominant |
| *Carex simulata* | 6.10 | 13.50 | | Transect Subdominant |
| *Eleocharis palustris* | 4.80 | 9.10 | | Transect Subdominant |
| *Chara* sp. | 3.40 | 1.40 | | Microcommunity Dominant |
| *Agrostis gigantea* | 3.20 | 8.50 | | Microcommunity Dominant |
| *Mimulus guttatus* | 1.90 | 3.50 | | Microcommunity Dominant |
| *Berula erecta* | 1.00 | 13.40 | | Transect Subdominant |
| **Total Live Cover** | **84.80** | **102.50** | * | |

**Veg_051 N = 9 (Total Taxa for Transect: 2009 = 20; 2010 = 19) (Mean Taxa for Transect: 2009 = 2.2; 2010 = 2.1)**

| Species | Mean Live Cover (MH) 2009 | Mean Live Cover (MH) 2010 | Significance at ≤0.05 | Dominance Classification |
|---|---|---|---|---|
| *Carex nebrascensis* | 24.22 | 24.44 | | Transect Dominant |
| *Eleocharis palustris* | 17.11 | 19.89 | | Transect Subdominant |
| *Artemisia tridentata* | 5.00 | 4.44 | | Microcommunity Dominant |
| *Argentina anserina* | 4.67 | 6.78 | | Microcommunity Dominant |
| *Carex simulata* | 2.33 | 0.00 | | Microcommunity Dominant |
| *Iva axillaris* | 2.22 | 6.67 | | Microcommunity Dominant |
| *Agrostis gigantea* | 1.67 | 9.78 | | Microcommunity Dominant |
| *Berula erecta* | 0.56 | 6.78 | | Microcommunity Dominant |
| **Total Live Cover** | **75.56** | **94.89** | | |

**Veg_052 N = 20 (Total Taxa for Transect: 2009 = 12; 2010 = 13) (Mean Taxa for Transect: 2009 = 0.6; 2010 = 0.7)**

| Species | Mean Live Cover (MH) 2009 | Mean Live Cover (MH) 2010 | Significance at ≤0.05 | Dominance Classification |
|---|---|---|---|---|
| *Typha latifolia* | 10.90 | 5.70 | * | Transect Dominant |
| *Argentina anserina* | 4.00 | 1.75 | | Microcommunity Dominant |
| *Bidens cernua* | 2.30 | 0.00 | | Microcommunity Dominant |
| *Chenopodium berlandieri* | 1.35 | 0.00 | | Microcommunity Dominant |
| *Distichlis spicata* | 0.05 | 0.65 | | Microcommunity Dominant |
| *Cirsium vulgare* | 0.00 | 1.35 | | Microcommunity Dominant |
| *Lactuca serriola* | 0.00 | 1.00 | | Microcommunity Dominant |
| *Mentha spicata* | 0.00 | 0.85 | | Microcommunity Dominant |
| *Potentilla biennis* | 0.00 | 1.70 | | Microcommunity Dominant |
| **Total Live Cover** | **20.90** | **15.90** | | |

Based on field data and the distribution of hits along the transect in 2009, species listed as *Typha domingensis* in 2010 was identified as *Typha latifolia* and was analyzed as *Typha latifolia* for *t*-test analysis.

**Table 3-42. Mean Live Cover Multiple Hits (MH) for the Most Dominant Species and Total Live Cover for the Aquatic Transects at Willow Spring for 2009 and 2010 (Page 2 of 2)**

**Veg_053 N = 19 (Total Taxa for Transect: 2009 = 9; 2010 = 10) (Mean Taxa for Transect: 2009 = 0.5; 2010 = 0.5)**

| Species | Mean Live Cover (MH) 2009 | Mean Live Cover (MH) 2010 | Significance at ≤0.05 | Dominance Classification |
|---|---|---|---|---|
| *Iva axillaris* | 9.74 | 15.68 | | Transect Dominant |
| *Typha latifolia* | 5.42 | 0.90 | * | Microcommunity Dominant |
| *Chenopodium berlandieri* | 3.26 | 1.42 | | Microcommunity Dominant |
| *Argentina anserina* | 1.32 | 0.21 | | Microcommunity Dominant |
| *Eleocharis palustris* | 1.16 | 0.05 | | Microcommunity Dominant |
| *Lactuca serriola* | 0.05 | 0.74 | | Microcommunity Dominant |
| *Epilobium* sp. | 0.00 | 1.00 | | Microcommunity Dominant |
| **Total Live Cover** | **21.84** | **21.00** | | |

Based on field data and the distribution of hits along the transect in 2009, species listed as *Typha domingensis* in 2010 was identified as *Typha latifolia* and was analyzed as *Typha latifolia* for *t*-test analysis.

### *3.10.1.3 Keegan Spring Complex North*

Dominant and subdominant taxa on the aquatic transects at the Keegan Spring Complex included *Carex simulata*, *Thermopsis rhombifolia*, moss, and *Typha latifolia* (Table 3-43). A total of 87 taxa occurred on the transects in 2010 and this number was the highest of the 14 sites. Mean live cover (MH) averaged 101% in 2010 and this was above average among all 14 sites (Table 3-40).

The vegetation covered by the five transects was diverse. *Carex simulata*, *Thermopsis rhombifolia* and *Typha latifolia* were three of the more dominant species on most of the five transects (Table 3-43). Other important taxa were *Argentina anserina*, *Carex praegracilis*, *Leymus triticoides*, and *Carex nebrascensis*.

Cover of the more important species increased considerably. This was particularly true for *Carex nebrascensis*, *Leymus triticoides*, *Carex stimulate*, and *Typha latifolia*. Only a few species showed decreases between 2009 and 2010.

**Table 3-43. Mean Live Cover Multiple Hits (MH) for the Most Dominant Species and Total Live Cover for the Aquatic Transects at Keegan Spring Complex for 2009 and 2010 (Page 1 of 2)**

Species are classified as to dominance along the transect as either transect dominant, transect subdominant, or microcommunity dominant. Taxa richness is indicated at the top of the table as total taxa and mean taxa for the transect. N represents the sample size for each species and the asterisk in the significance column represents a significant difference between years based on paired *t*-test comparison.

**Veg_021 N = 100 (Total Taxa for Transect: 2009 = 33; 2010 = 45) (Mean Taxa for Transect: 2009 = 0.3; 2010 = 0.5)**

| Species | Mean Live Cover (MH) 2009 | Mean Live Cover (MH) 2010 | Significance at ≤0.05 | Dominance Classification |
|---|---|---|---|---|
| *Moss* | 16.86 | 0.85 | * | Transect Subdominant |
| *Thermopsis rhombifolia* | 14.50 | 14.40 | | Transect Subdominant |
| *Carex* sp. | 10.60 | 4.76 | * | Transect Subdominant |
| *Juncus arcticus* ssp. *littoralis* | 5.13 | 3.13 | * | Microcommunity Dominant |
| *Leymus triticoides* | 4.85 | 13.61 | * | Microcommunity Dominant |
| *Veronica anagallis-aquatica* | 4.45 | 4.24 | | Microcommunity Dominant |
| *Achillea millefolium* | 4.04 | 3.49 | | Microcommunity Dominant |
| *Carex nebrascensis* | 3.21 | 6.46 | * | Microcommunity Dominant |
| *Nasturtium officinale* | 3.05 | 20.00 | * | Transect Subdominant |
| *Taraxacum officinale* | 3.03 | 3.02 | | Microcommunity Dominant |
| *Schedonorus pratensis* | 2.35 | 0.07 | | Microcommunity Dominant |
| *Agrostis gigantea* | 0.81 | 4.11 | * | Microcommunity Dominant |
| *Poa secunda* | 0.02 | 6.14 | * | Microcommunity Dominant |
| *Eleocharis rostellata* | 0.00 | 2.39 | * | Microcommunity Dominant |
| *Mimulus guttatus* | 0.00 | 10.58 | * | Microcommunity Dominant |
| **Total Live Cover** | **84.54** | **109.40** | * | |

**Veg_027 N = 100 (Total Taxa for Transect: 2009 = 21; 2010 = 37) (Mean Taxa for Transect: 2009 = 0.2; 2010 = 0.4)**

| Species | Mean Live Cover (MH) 2009 | Mean Live Cover (MH) 2010 | Significance at ≤0.05 | Dominance Classification |
|---|---|---|---|---|
| *Thermopsis rhombifolia* | 14.84 | 11.05 | * | Transect Subdominant |
| *Carex simulata* | 9.77 | 25.35 | * | Transect Subdominant |
| *Carex praegracilis* | 6.33 | 14.77 | * | Transect Subdominant |
| *Leymus triticoides* | 6.15 | 11.55 | * | Transect Subdominant |
| *Argentina anserina* | 5.80 | 8.48 | * | Transect Subdominant |
| *Carex nebrascensis* | 4.14 | 5.32 | | Microcommunity Dominant |
| *Crepis runcinata* ssp. *glauca* | 3.60 | 3.56 | | Microcommunity Dominant |
| *Juncus arcticus* ssp. *littoralis* | 3.06 | 8.41 | * | Microcommunity Dominant |
| *Taraxacum officinale* | 1.78 | 2.41 | | Microcommunity Dominant |
| *Typha latifolia* | 0.77 | 8.53 | * | Microcommunity Dominant |
| *Puccinellia lemmonii* | 0.34 | 1.65 | * | Microcommunity Dominant |
| *Hordeum jubatum* | 0.29 | 3.71 | * | Microcommunity Dominant |
| *Glaux maritima* | 0.26 | 2.40 | * | Microcommunity Dominant |
| *Hordeum brachyantherum* | 0.07 | 1.15 | * | Microcommunity Dominant |
| *Chara* sp. | 0.00 | 2.39 | * | Microcommunity Dominant |
| *Elymus trachycaulus* | 0.00 | 5.31 | * | Microcommunity Dominant |
| **Total Live Cover** | **59.95** | **126.06** | * | |

**Veg_080 N = 45 (Total Taxa for Transect: 2009 = 28; 2010 = 31) (Mean Taxa for Transect: 2009 = 0.6; 2010 = 0.7)**

| Species | Mean Live Cover (MH) 2009 | Mean Live Cover (MH) 2010 | Significance at ≤0.05 | Dominance Classification |
|---|---|---|---|---|
| *Carex* sp. | 6.49 | 7.82 | | Transect Subdominant |
| *Schoenoplectus acutus* | 3.47 | 10.71 | * | Transect Subdominant |
| *Algae* | 3.29 | 6.84 | | Microcommunity Dominant |
| *Carex nebrascensis* | 2.91 | 6.29 | * | Microcommunity Dominant |
| *Moss* | 2.49 | 9.24 | | Microcommunity Dominant |
| *Utricularia macrorhiza* | 2.24 | 3.69 | | Microcommunity Dominant |
| *Thermopsis rhombifolia* | 2.00 | 5.24 | | Microcommunity Dominant |
| *Typha latifolia* | 1.60 | 12.42 | * | Transect Subdominant |
| *Trifolium repens* | 1.58 | 2.53 | | Microcommunity Dominant |
| *Lemna minor* | 0.58 | 2.89 | * | Microcommunity Dominant |
| *Sium suave* | 0.00 | 3.60 | * | Microcommunity Dominant |
| *Sparganium emersum* | 0.00 | 19.07 | * | Transect Subdominant |
| **Total Live Cover** | **35.87** | **103.98** | * | |

Meter interval 23-24 was not sampled in 2009, so this interval was not used in *t*-test analysis. Based on field data and the distribution of hits along the transect, species listed as *Typha* or *Typha latifolia* in 2009 and *Typha* in 2010 were analyzed as *Typha latifolia* for *t*-test analysis. Based on field data and the distribution of hits along the transect, species listed as SP MOSS in 2009 and BR MOSS in 2010 were analyzed as Moss for *t*-test analysis. Based on field data and the distribution of hits along the transect, species listed as *Carex* or *Carex simulata* in 2009 and *Carex simulata* in 2010 were analyzed as *Carex* sp. for *t*-test analysis. Based on field data and the distribution of hits along the transect, species listed as Lemna in 2009 and were analyzed as *Lemna minor* for *t*-test analysis. Based on field data and the distribution of hits along the transect, species listed as *Schoenoplectus acutus* var. *acutus* in 2009 and were analyzed as *Schoenoplectus acutus* for *t*-test analysis.

**Table 3-43. Mean Live Cover Multiple Hits (MH) for the Most Dominant Species and Total Live Cover for the Aquatic Transects at Keegan Spring Complex for 2009 and 2010 (Page 2 of 2)**

**Veg_093 N = 43 (Total Taxa for Transect: 2009 = 23; 2010 = 44) (Mean Taxa for Transect: 2009 = 0.5; 2010 = 1.0)**

| Species | Mean Live Cover (MH) 2009 | Mean Live Cover (MH) 2010 | Significance at ≤0.05 | Dominance Classification |
|---|---|---|---|---|
| *Carex simulata* | 19.88 | 29.49 | * | Transect Dominant |
| *Typha latifolia* | 8.16 | 8.00 | | Transect Subdominant |
| *Carex nebrascensis* | 4.77 | 11.49 | * | Transect Subdominant |
| *Hippuris vulgaris* | 3.07 | 0.49 | | Microcommunity Dominant |
| *Juncus arcticus* ssp. *littoralis* | 1.07 | 1.19 | | Microcommunity Dominant |
| *Lemna trisulca* | 0.91 | 1.19 | | Microcommunity Dominant |
| *Galium trifidum* | 0.28 | 1.88 | * | Microcommunity Dominant |
| *Juncus nevadensis* | 0.23 | 1.44 | * | Microcommunity Dominant |
| *Sparganium emersum* | 0.00 | 2.93 | | Microcommunity Dominant |
| *Utricularia macrorhiza* | 0.00 | 9.21 | * | Microcommunity Dominant |
| **Total Live Cover** | **46.47** | **86.49** | * | |

Based on field data and the distribution of hits along the transect, species listed as *Typha* in 2010 were analyzed as *Typha latifolia* for *t*-test analysis.

**Veg_150 N = 56 (Total Taxa for Transect: 2009 = 28; 2010 = 30) (Mean Taxa for Transect: 2009 = 0.5; 2010 = 0.5)**

| Species | Mean Live Cover (MH) 2009 | Mean Live Cover (MH) 2010 | Significance at ≤0.05 | Dominance Classification |
|---|---|---|---|---|
| *Typha latifolia* | 16.57 | 42.30 | * | Transect Dominant |
| *Carex nebrascensis* | 4.61 | 4.16 | | Microcommunity Dominant |
| Algae | 2.66 | 0.00 | * | Microcommunity Dominant |
| *Trifolium repens* | 2.36 | 1.39 | | Microcommunity Dominant |
| *Schoenoplectus americanus* | 2.13 | 0.00 | * | Microcommunity Dominant |
| *Carex praegracilis* | 1.73 | 0.77 | | Microcommunity Dominant |
| *Lemna trisulca* | 1.05 | 0.89 | | Microcommunity Dominant |
| *Carex simulata* | 0.88 | 6.77 | * | Microcommunity Dominant |
| *Argentina anserina* | 0.66 | 2.18 | | Microcommunity Dominant |
| *Schoenoplectus acutus var. acutus* | 0.50 | 2.57 | * | Microcommunity Dominant |
| Moss | 0.00 | 7.93 | * | Microcommunity Dominant |
| *Poa secunda* | 0.00 | 1.80 | * | Microcommunity Dominant |
| *Sparganium angustifolium* | 0.00 | 3.52 | * | Microcommunity Dominant |
| **Total Live Cover** | **40.73** | **80.05** | * | |

Based on field data and the distribution of hits along the transect, species listed as Typha in 2009 were analyzed as *Typha latifolia* for *t*-test analysis.

### 3.10.1.4 West Spring Valley Complex 1

The most dominant species, by mean live cover (MH), on the aquatic transects at the West Spring Valley Complex were *Lemna minor, Berula erecta, Thermopsis rhombifolia, Cirsium arvense, Agrostis gigantea*, and *Carex praegracilis* (Table 3-44). A total of 58 taxa occurred on the transects in 2010 and this was a relatively high diversity, in comparison with the other sites (Table 3-40). Mean live cover (MH) increased significantly on three transects and declined significantly on only one transect. This decline in cover on one transect (088) was caused primarily by a significant decrease in cover of five important species: *Cirsium arvense, Phragmites australis, Agrostis gigantea, Schoenoplectus acutus*, and *Poa pratensis*. These shoreline and shallow water species did not do as well in 2010 compared to 2009.

**Table 3-44. Mean Live Cover Multiple Hits (MH) for the Most Dominant Species and Total Live Cover for the Aquatic Transects at West Spring Valley Complex for 2009 and 2010 (Page 1 of 2)**

Species are classified as to dominance along the transect as either transect dominant, transect subdominant, or microcommunity dominant. Taxa richness is indicated at the top of the table as total taxa and mean taxa for the transect. N represents the sample size for each species and the asterisk in the significance column represents a significant difference between years based on paired *t*-test comparison.

**Veg_086 N = 26 (Total Taxa for Transect: 2009 = 26; 2010 = 28) (Mean Taxa for Transect: 2009 = 1.0; 2010 = 1.1)**

| Species | Mean Live Cover (MH) 2009 | Mean Live Cover (MH) 2010 | Significance at ≤0.05 | Dominance Classification |
|---|---|---|---|---|
| *Thermopsis rhombifolia* | 23.00 | 21.92 | | Transect Dominant |
| *Cirsium arvense* | 12.54 | 11.69 | | Transect Subdominant |
| *Carex praegracilis* | 10.50 | 4.31 | | Transect Subdominant |
| *Lemna minor* | 10.42 | 28.89 | * | Transect Dominant |
| *Agrostis gigantea* | 8.65 | 4.08 | * | Transect Subdominant |
| *Juncus arcticus* ssp. *littoralis* | 8.42 | 6.42 | | Transect Subdominant |
| *Eleocharis rostellata* | 8.23 | 5.85 | | Transect Subdominant |
| *Carex* sp. | 5.31 | 5.08 | | Microcommunity Dominant |
| *Equisetum arvense* | 4.19 | 1.35 | | Microcommunity Dominant |
| *Berula erecta* | 3.89 | 1.08 | | Microcommunity Dominant |
| *Carex simulata* | 3.12 | 3.23 | | Microcommunity Dominant |
| *Poa secunda* | 0.04 | 6.39 | * | Microcommunity Dominant |
| **Total Live Cover** | **114.00** | **119.19** | | |

**Veg_088 N = 38 (Total Taxa for Transect: 2009 = 31; 2010 = 33) (Mean Taxa for Transect: 2009 = 0.8; 2010 = 0.9)**

| Species | Mean Live Cover (MH) 2009 | Mean Live Cover (MH) 2010 | Significance at ≤0.05 | Dominance Classification |
|---|---|---|---|---|
| *Cirsium arvense* | 20.82 | 14.61 | * | Transect Dominant |
| *Berula erecta* | 16.79 | 14.47 | | Transect Subdominant |
| *Phragmites australis* | 15.11 | 3.11 | * | Transect Subdominant |
| *Thermopsis rhombifolia* | 9.84 | 14.53 | | Transect Subdominant |
| *Carex nebrascensis* | 6.63 | 4.63 | | Transect Subdominant |
| *Lemna minor* | 6.29 | 9.87 | | Transect Subdominant |
| *Agrostis gigantea* | 5.45 | 2.58 | * | Microcommunity Dominant |
| *Schoenoplectus acutus* | 4.66 | 1.58 | * | Microcommunity Dominant |
| *Ericameria nauseosa* | 3.42 | 3.18 | | Microcommunity Dominant |
| *Juncus arcticus* ssp. *littoralis* | 3.18 | 3.50 | | Microcommunity Dominant |
| *Argentina anserina* | 2.95 | 4.58 | | Microcommunity Dominant |
| *Poa pratensis* | 1.95 | 0.24 | * | Microcommunity Dominant |
| *Schedonorus pratensis* | 1.58 | 1.40 | | Microcommunity Dominant |
| *Carex praegracilis* | 1.16 | 4.71 | * | Microcommunity Dominant |
| **Total Live Cover** | **111.55** | **94.00** | * | |

**Veg_094 N = 5 (Total Taxa for Transect: 2009 = 16; 2010 = 18) (Mean Taxa for Transect: 2009 = 3.2; 2010 = 3.6)**

| Species | Mean Live Cover (MH) 2009 | Mean Live Cover (MH) 2010 | Significance at ≤0.05 | Dominance Classification |
|---|---|---|---|---|
| *Berula erecta* | 19.80 | 12.40 | | Transect Dominant |
| *Carex praegracilis* | 14.60 | 6.40 | | Transect Subdominant |
| *Medicago polymorpha* | 7.00 | 11.80 | | Transect Subdominant |
| *Agrostis gigantea* | 6.20 | 9.60 | | Transect Subdominant |
| *Carex nebrascensis* | 6.20 | 10.20 | | Transect Subdominant |
| *Castilleja minor* ssp. *minor* | 2.80 | 2.60 | | Microcommunity Dominant |
| *Mimulus guttatus* | 1.40 | 41.20 | | Transect Subdominant |
| **Total Live Cover** | **77.20** | **116.80** | * | |

Transect length was 3-m longer in 2010, therefore data for 2010 meter interval 20-23 was not used in the analysis. Only data for 0-20 m for both years was used for *t*-test analysis.

**Table 3-44. Mean Live Cover Multiple Hits (MH) for the Most Dominant Species and Total Live Cover for the Aquatic Transects at West Spring Valley Complex for 2009 and 2010 (Page 2 of 2)**

**Veg_095 N = 5 (Total Taxa for Transect: 2009 = 23; 2010 = 25) (Mean Taxa for Transect: 2009 = 4.6; 2010 = 5.0)**

| Species | Mean Live Cover (MH) 2009 | Mean Live Cover (MH) 2010 | Significance at ≤0.05 | Dominance Classification |
|---|---|---|---|---|
| *Carex praegracilis* | 16.40 | 22.40 | | Transect Dominant |
| *Nasturtium officinale* | 11.40 | 0.00 | | Transect Subdominant |
| *Lemna minor* | 6.80 | 19.80 | | Transect Subdominant |
| *Trifolium repens* | 6.40 | 3.00 | | Microcommunity Dominant |
| *Juncus arcticus* ssp. *littoralis* | 5.00 | 0.80 | | Microcommunity Dominant |
| *Carex nebrascensis* | 4.40 | 13.20 | | Transect Subdominant |
| *Mimulus guttatus* | 4.00 | 8.00 | | Microcommunity Dominant |
| *Agrostis gigantea* | 2.60 | 5.40 | | Microcommunity Dominant |
| *Thermopsis rhombifolia* | 2.00 | 6.20 | | Microcommunity Dominant |
| *Potamogeton* sp. | 1.80 | 3.80 | | Microcommunity Dominant |
| **Total Live Cover** | **79.40** | **105.80** | * | |

Based on field data and the distribution of hits along the transect, species listed as *Lemna minor* in 2009 and *Lemna minuta* in 2010 were analyzed as *Lemna minor* for *t*-test analysis. Transect length was 1-m longer in 2010, therefore data for 2010 meter interval 20-21 was not used in the analysis. Only data for 0-20 m for both years was used for *t*-test analysis.

**Veg_096 N = 5 (Total Taxa for Transect: 2009 = 17; 2010 = 23) (Mean Taxa for Transect: 2009 = 3.4; 2010 = 4.6)**

| Species | Mean Live Cover (MH) 2009 | Mean Live Cover (MH) 2010 | Significance at ≤0.05 | Dominance Classification |
|---|---|---|---|---|
| *Lemna minor* | 20.80 | 20.40 | | Transect Dominant |
| *Agrostis gigantea* | 9.40 | 8.20 | | Transect Subdominant |
| *Elymus trachycaulus* | 8.20 | 0.00 | | Microcommunity Dominant |
| *Eleocharis rostellata* | 7.40 | 15.40 | | Transect Subdominant |
| *Iva axillaris* | 7.00 | 5.40 | | Transect Subdominant |
| *Symphyotrichum eatonii* | 6.80 | 7.00 | | Transect Subdominant |
| *Carex nebrascensis* | 5.60 | 7.20 | | Transect Subdominant |
| *Distichlis spicata* | 4.60 | 0.00 | | Microcommunity Dominant |
| *Mimulus guttatus* | 3.60 | 5.20 | | Microcommunity Dominant |
| *Leymus triticoides* | 0.40 | 8.40 | | Microcommunity Dominant |
| **Total Live Cover** | **82.60** | **111.00** | * | |

### *3.10.1.5 South Millick Spring*

The most dominant species, by mean live cover (MH), on the aquatic transects at South Millick Spring were *Berula erecta*, *Nasturtium officinale*, and *Argentina anserina* (Table 3-45). A total of 36 taxa occurred on the transects in 2010 and this was below average diversity in comparison with the other sites. Live cover (MH) was also slightly below average in comparison with the other sites (Table 3-40).

*Berula erecta* was the most abundant aquatic species on four of the transects at South Millick Spring in 2009, but declined on all four transects in 2010 (Table 3-45). *Nasturtium officinale* was abundant on one transect in 2009 and increased significantly on three transects in 2010.

*Agrostis gigantea* and *Argentina anserina* were important species that showed little change between the two years. *Carex nebrascensis* and *Juncus arcticus* increased significantly on one transect, but showed less change on the other transects where they occurred.

**Table 3-45. Mean Live Cover Multiple Hits (MH) for the Most Dominant Species and Total Live Cover for the Aquatic Transects at South Millick Spring for 2009 and 2010 (Page 1 of 2)**

Species are classified as to dominance along the transect as either transect dominant, transect subdominant, or microcommunity dominant. Taxa richness is indicated at the top of the table as total taxa and mean taxa for the transect. N represents the sample size for each species and the asterisk in the significance column represents a significant difference between years based on paired *t*-test comparison.

**Veg_016 N = 29 (Total Taxa for Transect: 2009 = 25; 2010 = 23) (Mean Taxa for Transect: 2009 = 0.9; 2010 = 0.8)**

| Species | Mean Live Cover (MH) 2009 | Mean Live Cover (MH) 2010 | Significance at ≤0.05 | Dominance Classification |
|---|---|---|---|---|
| *Nasturtium officinale* | 21.21 | 18.76 | | Transect Dominant |
| *Agrostis gigantea* | 4.79 | 4.48 | | Microcommunity Dominant |
| *Argentina anserina* | 4.28 | 3.72 | | Microcommunity Dominant |
| *Juncus arcticus* ssp. *littoralis* | 4.10 | 15.97 | * | Transect Subdominant |
| *Carex nebrascensis* | 3.48 | 9.28 | * | Microcommunity Dominant |
| *Stuckenia filiformis* ssp. *filiformis* | 2.45 | 6.83 | | Microcommunity Dominant |
| *Berula erecta* | 1.97 | 0.59 | | Microcommunity Dominant |
| *Carex simulata* | 1.55 | 2.28 | | Microcommunity Dominant |
| *Sphenopholis obtusata* | 1.31 | 2.28 | | Microcommunity Dominant |
| *Juncus nevadensis* | 1.03 | 1.90 | | Microcommunity Dominant |
| **Total Live Cover** | **50.86** | **71.07** | * | |

**Veg_017 N = 30 (Total Taxa for Transect: 2009 = 16; 2010 = 18) (Mean Taxa for Transect: 2009 = 0.5; 2010 = 0.6)**

| Species | Mean Live Cover (MH) 2009 | Mean Live Cover (MH) 2010 | Significance at ≤0.05 | Dominance Classification |
|---|---|---|---|---|
| *Berula erecta* | 54.80 | 0.47 | * | Transect Dominant |
| *Carex nebrascensis* | 7.70 | 5.33 | | Transect Subdominant |
| *Lemna minuta* | 5.57 | 1.70 | | Microcommunity Dominant |
| *Juncus nevadensis* | 5.43 | 2.90 | * | Microcommunity Dominant |
| *Agrostis gigantea* | 3.67 | 1.73 | | Microcommunity Dominant |
| *Juncus arcticus* ssp. *littoralis* | 3.17 | 1.47 | | Microcommunity Dominant |
| *Schoenoplectus acutus var. acutus* | 3.10 | 1.37 | | Microcommunity Dominant |
| *Equisetum arvense* | 0.77 | 1.57 | | Microcommunity Dominant |
| *Nasturtium officinale* | 0.40 | 78.70 | * | Transect Dominant |
| **Total Live Cover** | **88.60** | **98.00** | | |

**Veg_018 N = 23 (Total Taxa for Transect: 2009 = 18; 2010 = 18) (Mean Taxa for Transect: 2009 = 0.8; 2010 = 0.8)**

| Species | Mean Live Cover (MH) 2009 | Mean Live Cover (MH) 2010 | Significance at ≤0.05 | Dominance Classification |
|---|---|---|---|---|
| *Berula erecta* | 31.44 | 0.00 | * | Transect Dominant |
| *Stuckenia filiformis* ssp. *filiformis* | 8.04 | 0.00 | * | Microcommunity Dominant |
| *Nasturtium officinale* | 5.61 | 72.96 | * | Transect Dominant |
| *Equisetum arvense* | 2.83 | 4.30 | | Microcommunity Dominant |
| *Juncus nevadensis* | 1.83 | 3.13 | | Microcommunity Dominant |
| *Argentina anserina* | 1.78 | 1.48 | | Microcommunity Dominant |
| *Schoenoplectus acutus var. acutus* | 1.00 | 0.78 | | Microcommunity Dominant |
| *Agrostis gigantea* | 0.91 | 1.13 | | Microcommunity Dominant |
| *Leymus triticoides* | 0.70 | 0.26 | | Microcommunity Dominant |
| *Juncus arcticus* ssp. *littoralis* | 0.44 | 0.87 | | Microcommunity Dominant |
| *Lemna minuta* | 0.17 | 1.09 | | Microcommunity Dominant |
| **Total Live Cover** | **56.70** | **91.65** | * | |

**Table 3-45. Mean Live Cover Multiple Hits (MH) for the Most Dominant Species and Total Live Cover for the Aquatic Transects at South Millick Spring for 2009 and 2010 (Page 2 of 2)**

**Veg_019 N = 11 (Total Taxa for Transect: 2009 = 21; 2010 = 23) (Mean Taxa for Transect: 2009 = 1.9; 2010 = 2.1)**

| Species | Mean Live Cover (MH) 2009 | Mean Live Cover (MH) 2010 | Significance at ≤0.05 | Dominance Classification |
|---|---|---|---|---|
| *Berula erecta* | 22.73 | 0.18 | | Transect Dominant |
| *Argentina anserina* | 22.00 | 23.36 | | Transect Dominant |
| *Juncus arcticus* ssp. *littoralis* | 5.46 | 6.18 | | Microcommunity Dominant |
| *Carex praegracilis* | 4.09 | 7.73 | * | Microcommunity Dominant |
| *Distichlis spicata* | 3.36 | 3.46 | | Microcommunity Dominant |
| *Spartina gracilis* | 2.73 | 6.09 | | Microcommunity Dominant |
| *Carex nebrascensis* | 2.18 | 0.55 | | Microcommunity Dominant |
| *Equisetum arvense* | 2.09 | 2.82 | | Microcommunity Dominant |
| *Eleocharis palustris* | 0.00 | 4.00 | | Microcommunity Dominant |
| *Nasturtium officinale* | 0.00 | 26.46 | * | Transect Subdominant |
| **Total Live Cover** | **78.91** | **93.91** | * | |

**Veg_020 N = 18 (Total Taxa for Transect: 2009 = 19; 2010 = 18) (Mean Taxa for Transect: 2009 = 1.1; 2010 = 1.0)**

| Species | Mean Live Cover (MH) 2009 | Mean Live Cover (MH) 2010 | Significance at ≤0.05 | Dominance Classification |
|---|---|---|---|---|
| *Berula erecta* | 24.50 | 21.89 | | Transect Dominant |
| *Juncus nevadensis* | 13.22 | 20.94 | * | Transect Dominant |
| *Distichlis spicata* | 4.11 | 2.50 | | Microcommunity Dominant |
| *Stuckenia filiformis* ssp. *filiformis* | 4.00 | 2.94 | | Microcommunity Dominant |
| *Argentina anserina* | 3.83 | 4.17 | | Microcommunity Dominant |
| *Juncus arcticus* ssp. *littoralis* | 3.39 | 3.50 | | Microcommunity Dominant |
| *Ivesia kingii* | 3.33 | 4.67 | | Microcommunity Dominant |
| *Mimulus guttatus* | 3.11 | 3.22 | | Microcommunity Dominant |
| *Spartina gracilis* | 1.56 | 2.00 | | Microcommunity Dominant |
| *Lemna minuta* | 0.94 | 4.17 | | Microcommunity Dominant |
| **Total Live Cover** | **67.44** | **76.39** | * | |

### *3.10.1.6 Unnamed 5 Spring*

The most dominant species, by mean live cover (MH), on the aquatic transects at Unnamed 5 Spring were *Chara* sp., *Carex nebrascensis, Potamogeton* sp., and *Utricularia macrorhiza* (Table 3-46). A total of 39 taxa occurred on these transects in 2010 and this was below average diversity compared to that of the other transects. Total live cover was moderately high as compared with the other aquatic sites in Spring Valley (Table 3-40).

Sampling was conducted 9 days later in 2010 than in 2009. This probably resulted in the significant increase in algae along two of the three transects where it occurred and a reduction in *Chara* sp. The emergent pondweed *Potamogeton* sp. also had increased cover on two transects in 2010. The shoreline species of *Carex nebrascensis* showed significant increases in live cover along several transects in 2010 (Table 3-46). The overall result of increases in these most dominant species resulted in significantly greater total live cover of vegetation on three of the five transects in 2010 as compared with 2009.

**Table 3-46. Mean Live Cover Multiple Hits (MH) for the Most Dominant Species and Total Live Cover for the Aquatic Transects at Unnamed 5 Spring for 2009 and 2010 (Page 1 of 2)**

Species are classified as to dominance along the transect as either transect dominant, transect subdominant, or microcommunity dominant. Taxa richness is indicated at the top of the table as total taxa and mean taxa for the transect. N represents the sample size for each species and the asterisk in the significance column represents a significant difference between years based on paired *t*-test comparison.

**Veg_054 N = 42 (Total Taxa for Transect: 2009 = 27; 2010 = 25) (Mean Taxa for Transect: 2009 = 0.6; 2010 = 0.6)**

| Species | Mean Live Cover (MH) 2009 | Mean Live Cover (MH) 2010 | Significance at ≤0.05 | Dominance Classification |
|---|---|---|---|---|
| *Carex nebrascensis* | 28.95 | 24.41 | | Transect Dominant |
| *Potamogeton* sp. | 25.12 | 20.12 | | Transect Dominant |
| *Carex* sp. | 20.76 | 19.60 | | Transect Dominant |
| *Chara* sp. | 12.43 | 11.79 | | Transect Subdominant |
| *Berula erecta* | 7.12 | 8.21 | | Transect Subdominant |
| *Argentina anserina* | 6.12 | 2.95 | * | Microcommunity Dominant |
| *Juncus nevadensis* | 3.48 | 4.69 | | Microcommunity Dominant |
| *Eleocharis palustris* | 2.29 | 1.33 | | Microcommunity Dominant |
| *Juncus arcticus* ssp. *littoralis* | 1.71 | 1.19 | | Microcommunity Dominant |
| **Total Live Cover** | **117.93** | **104.10** | | |

Based on field data and the distribution of hits along the transect, species listed as *Carex simulata* or *Carex praegracilis* in 2009 and *Carex praegracilis* in 2010 were analyzed as *Carex* sp. for *t*-test analysis.

**Veg_055 N = 45 (Total Taxa for Transect: 2009 = 23; 2010 = 23) (Mean Taxa for Transect: 2009 = 0.5; 2010 = 0.5)**

| Species | Mean Live Cover (MH) 2009 | Mean Live Cover (MH) 2010 | Significance at ≤0.05 | Dominance Classification |
|---|---|---|---|---|
| *Chara* sp. | 39.56 | 30.87 | | Transect Dominant |
| *Carex nebrascensis* | 12.38 | 28.07 | * | Transect Dominant |
| *Eleocharis rostellata* | 2.56 | 0.00 | * | Microcommunity Dominant |
| Algae | 2.51 | 18.93 | * | Transect Subdominant |
| *Potamogeton* sp. | 2.11 | 8.09 | * | Microcommunity Dominant |
| *Berula erecta* | 1.98 | 0.76 | | Microcommunity Dominant |
| *Argentina anserina* | 1.71 | 2.11 | | Microcommunity Dominant |
| *Sparganium angustifolium* | 0.96 | 0.49 | | Microcommunity Dominant |
| *Sporobolus airoides* | 0.84 | 2.29 | | Microcommunity Dominant |
| *Poa pratensis* | 0.58 | 0.42 | | Microcommunity Dominant |
| *Puccinellia lemmonii* | 0.38 | 0.91 | | Microcommunity Dominant |
| *Eleocharis palustris* | 0.09 | 7.40 | * | Microcommunity Dominant |
| **Total Live Cover** | **70.31** | **105.91** | * | |

**Veg_056 N = 64 (Total Taxa for Transect: 2009 = 20; 2010 = 22) (Mean Taxa for Transect: 2009 = 0.3; 2010 = 0.3)**

| Species | Mean Live Cover (MH) 2009 | Mean Live Cover (MH) 2010 | Significance at ≤0.05 | Dominance Classification |
|---|---|---|---|---|
| *Chara* sp. | 43.44 | 21.36 | * | Transect Dominant |
| *Potamogeton* sp. | 24.28 | 49.67 | * | Transect Dominant |
| *Carex nebrascensis* | 9.22 | 16.14 | * | Transect Subdominant |
| *Eleocharis palustris* | 7.00 | 7.81 | | Transect Subdominant |
| *Berula erecta* | 2.63 | 3.14 | | Microcommunity Dominant |
| *Juncus nevadensis* | 1.28 | 1.77 | | Microcommunity Dominant |
| *Agrostis gigantea* | 0.83 | 0.78 | | Microcommunity Dominant |
| *Juncus arcticus* ssp. *littoralis* | 0.77 | 1.61 | | Microcommunity Dominant |
| *Argentina anserina* | 0.69 | 0.63 | | Microcommunity Dominant |
| Algae | 0.47 | 1.98 | | Microcommunity Dominant |
| **Total Live Cover** | **92.25** | **108.28** | * | |

**Table 3-46. Mean Live Cover Multiple Hits (MH) for the Most Dominant Species and Total Live Cover for the Aquatic Transects at Unnamed 5 Spring for 2009 and 2010 (Page 2 of 2)**

| Veg_057 N = 50 (Total Taxa for Transect: 2009 = 30; 2010 = 27) (Mean Taxa for Transect: 2009 = 0.6; 2010 = 0.5) | | | | |
|---|---|---|---|---|
| **Species** | **Mean Live Cover (MH) 2009** | **Mean Live Cover (MH) 2010** | **Significance at ≤0.05** | **Dominance Classification** |
| *Utricularia macrorhiza* | 32.82 | 20.60 | | Transect Dominant |
| *Carex rostrata* | 16.92 | 16.60 | | Transect Subdominant |
| Algae | 11.18 | 28.80 | * | Transect Dominant |
| *Berula erecta* | 10.44 | 0.50 | * | Transect Subdominant |
| *Eleocharis palustris* | 5.92 | 6.14 | | Transect Subdominant |
| *Sparganium angustifolium* | 5.60 | 8.66 | * | Transect Subdominant |
| *Hippuris vulgaris* | 4.24 | 4.54 | | Microcommunity Dominant |
| *Potamogeton* sp. | 3.58 | 6.80 | | Microcommunity Dominant |
| *Argentina anserina* | 3.50 | 1.76 | | Microcommunity Dominant |
| *Carex simulata* | 2.10 | 2.10 | | Microcommunity Dominant |
| *Juncus arcticus* ssp. *littoralis* | 2.06 | 3.70 | | Microcommunity Dominant |
| *Eleocharis rostellata* | 1.28 | 0.00 | | Microcommunity Dominant |
| *Chara* sp. | 1.26 | 0.04 | | Microcommunity Dominant |
| *Sporobolus airoides* | 0.88 | 1.84 | | Microcommunity Dominant |
| *Carex praegracilis* | 0.80 | 1.26 | | Microcommunity Dominant |
| *Carex nebrascensis* | 0.00 | 11.06 | * | Microcommunity Dominant |
| **Total Live Cover** | **108.14** | **117.40** | | |

| Veg_058 N = 28 (Total Taxa for Transect: 2009 = 22; 2010 = 21) (Mean Taxa for Transect: 2009 = 0.8; 2010 = 0.8) | | | | |
|---|---|---|---|---|
| **Species** | **Mean Live Cover (MH) 2009** | **Mean Live Cover (MH) 2010** | **Significance at ≤0.05** | **Dominance Classification** |
| *Utricularia macrorhiza* | 20.61 | 19.50 | | Transect Dominant |
| *Sparganium angustifolium* | 13.86 | 33.82 | * | Transect Dominant |
| *Berula erecta* | 8.00 | 1.96 | * | Transect Subdominant |
| *Hippuris vulgaris* | 5.21 | 13.43 | * | Transect Subdominant |
| *Carex nebrascensis* | 5.04 | 19.71 | * | Transect Subdominant |
| *Juncus arcticus* ssp. *littoralis* | 3.21 | 9.25 | | Transect Subdominant |
| *Agrostis gigantea* | 0.96 | 0.07 | | Microcommunity Dominant |
| *Sporobolus airoides* | 0.61 | 2.00 | | Microcommunity Dominant |
| *Eleocharis palustris* | 0.00 | 3.82 | * | Microcommunity Dominant |
| **Total Live Cover** | **66.25** | **110.64** | * | |

### *3.10.1.7 Four Wheel Drive Spring*

The dominant taxa, by mean live cover (MH), on the aquatic transects at Four Wheel Drive Spring were *Carex nebrascensis*, *Juniperus scopulorum*, *Potamogeton* sp., *Carex simulata*, and *Eleocharis palustris* (Table 3-47). A total of 40 taxa occurred on the transects in 2010 and this was below average compared with the other sites. Mean live cover (MH) was at the upper end compared with other aquatic sites (Table 3-40).

A large and significant increase in the live cover (MH) of Four Wheel Drive Spring occurred between 2009 and 2010 (Table 3-47). This resulted from small increases in growth of several emergent and submergent species at Four Wheel Drive Spring. Notably the emergent *Potamageton* sp., and *Carex nebrascensis* and algae had greater cover in 2010.

**Table 3-47. Mean Live Cover Multiple Hits (MH) for the Most Dominant Species and Total Live Cover for the Aquatic Transects at Four Wheel Drive Spring for 2009 and 2010 (Page 1 of 2)**

Species are classified as to dominance along the transect as either transect dominant, transect subdominant, or microcommunity dominant. Taxa richness is indicated at the top of the table as total taxa and mean taxa for the transect. N represents the sample size for each species and the asterisk in the significance column represents a significant difference between years based on paired *t*-test comparison.

**Veg_059 N = 14 (Total Taxa for Transect: 2009 = 20; 2010 = 21) (Mean Taxa for Transect: 2009 = 1.4; 2010 = 1.5)**

| Species | Mean Live Cover (MH) 2009 | Mean Live Cover (MH) 2010 | Significance at ≤0.05 | Dominance Classification |
|---|---|---|---|---|
| *Potamogeton* sp. | 31.93 | 40.71 | | Transect Dominant |
| *Eleocharis palustris* | 19.57 | 18.00 | | Transect Dominant |
| *Juncus nevadensis* | 14.57 | 8.07 | | Transect Subdominant |
| *Berula erecta* | 8.50 | 2.00 | | Transect Subdominant |
| *Nasturtium officinale* | 7.79 | 14.64 | | Transect Subdominant |
| *Rosa woodsii* | 6.43 | 2.86 | | Microcommunity Dominant |
| *Alisma plantago-aquatica* | 3.50 | 13.00 | * | Transect Subdominant |
| *Distichlis spicata* | 2.57 | 4.21 | | Microcommunity Dominant |
| *Bassia scoparia* | 2.36 | 0.43 | | Microcommunity Dominant |
| *Juncus arcticus* ssp. *littoralis* | 0.86 | 4.21 | | Microcommunity Dominant |
| *Chara* sp. | 0.00 | 12.00 | | Transect Subdominant |
| **Total Live Cover** | **113.71** | **140.64** | * | |

**Veg_060 N = 14 (Total Taxa for Transect: 2009 = 14; 2010 = 17) (Mean Taxa for Transect: 2009 = 1.0; 2010 = 1.2)**

| Species | Mean Live Cover (MH) 2009 | Mean Live Cover (MH) 2010 | Significance at ≤0.05 | Dominance Classification |
|---|---|---|---|---|
| *Potamogeton* sp. | 19.07 | 68.43 | * | Transect Dominant |
| *Eleocharis palustris* | 13.57 | 19.07 | | Transect Subdominant |
| *Carex nebrascensis* | 6.36 | 3.57 | | Microcommunity Dominant |
| *Berula erecta* | 3.64 | 7.93 | * | Microcommunity Dominant |
| *Alisma plantago-aquatica* | 2.36 | 7.64 | | Microcommunity Dominant |
| *Distichlis spicata* | 2.29 | 5.14 | | Microcommunity Dominant |
| *Juncus nevadensis* | 2.07 | 0.50 | | Microcommunity Dominant |
| Algae | 0.00 | 10.64 | * | Microcommunity Dominant |
| *Sagittaria cuneata* | 0.00 | 5.36 | * | Microcommunity Dominant |
| **Total Live Cover** | **54.64** | **137.21** | * | |

**Veg_061 N = 10 (Total Taxa for Transect: 2009 = 14; 2010 = 18) (Mean Taxa for Transect: 2009 = 1.4; 2010 = 1.8)**

| Species | Mean Live Cover (MH) 2009 | Mean Live Cover (MH) 2010 | Significance at ≤0.05 | Dominance Classification |
|---|---|---|---|---|
| *Carex nebrascensis* | 40.20 | 43.20 | | Transect Dominant |
| *Juniperus scopulorum* | 34.00 | 28.70 | | Transect Dominant |
| *Argentina anserina* | 9.80 | 1.10 | | Microcommunity Dominant |
| *Berula erecta* | 8.70 | 1.10 | | Microcommunity Dominant |
| *Carex simulata* | 6.50 | 11.70 | | Transect Subdominant |
| *Distichlis spicata* | 6.40 | 6.80 | | Transect Subdominant |
| *Agrostis gigantea* | 3.70 | 0.10 | | Microcommunity Dominant |
| *Typha latifolia* | 2.20 | 8.70 | | Microcommunity Dominant |
| *Epilobium* sp. | 0.50 | 8.60 | | Microcommunity Dominant |
| **Total Live Cover** | **119.30** | **125.20** | | |

**Table 3-47. Mean Live Cover Multiple Hits (MH) for the Most Dominant Species and Total Live Cover for the Aquatic Transects at Four Wheel Drive Spring for 2009 and 2010 (Page 2 of 2)**

| Species | Mean Live Cover (MH) 2009 | Mean Live Cover (MH) 2010 | Significance at ≤0.05 | Dominance Classification |
|---|---|---|---|---|
| **Veg_062 N = 17 (Total Taxa for Transect: 2009 = 14; 2010 = 14) (Mean Taxa for Transect: 2009 = 0.8; 2010 = 0.8)** | | | | |
| *Carex nebrascensis* | 42.82 | 60.94 | * | Transect Dominant |
| *Carex simulata* | 28.53 | 40.65 | * | Transect Dominant |
| *Juniperus scopulorum* | 26.47 | 25.29 | | Transect Dominant |
| *Rosa woodsii* | 16.82 | 22.71 | | Transect Subdominant |
| *Nasturtium officinale* | 3.53 | 0.00 | | Microcommunity Dominant |
| *Epilobium* sp. | 2.65 | 5.00 | | Microcommunity Dominant |
| *Typha latifolia* | 2.41 | 4.41 | | Microcommunity Dominant |
| *Berula erecta* | 2.35 | 2.77 | | Microcommunity Dominant |
| *Artemisia tridentata* | 2.06 | 7.35 | | Microcommunity Dominant |
| *Juncus nevadensis* | 1.71 | 4.94 | | Microcommunity Dominant |
| **Total Live Cover** | **133.88** | **177.41** | * | |
| **Veg_063 N = 16 (Total Taxa for Transect: 2009 = 13; 2010 = 15) (Mean Taxa for Transect: 2009 = 0.8; 2010 = 0.9)** | | | | |
| **Species** | **Mean Live Cover (MH) 2009** | **Mean Live Cover (MH) 2010** | **Significance at ≤0.05** | **Dominance Classification** |
| *Carex nebrascensis* | 18.06 | 35.06 | * | Transect Dominant |
| *Carex* sp. | 13.81 | 21.31 | | Transect Subdominant |
| *Arctium minus* | 7.06 | 4.06 | | Microcommunity Dominant |
| *Rosa woodsii* | 4.13 | 6.06 | | Microcommunity Dominant |
| *Artemisia tridentata* | 3.56 | 7.13 | | Microcommunity Dominant |
| *Epilobium* sp. | 1.50 | 0.56 | | Microcommunity Dominant |
| *Bassia scoparia* | 0.75 | 0.13 | | Microcommunity Dominant |
| *Poa secunda* | 0.00 | 3.63 | | Microcommunity Dominant |
| **Total Live Cover** | **50.88** | **83.88** | * | |

Based on field data and the distribution of hits along the transect, species listed as *Carex simulata* or *Carex* in 2009 and *Carex simulata* in 2010 were analyzed as *Carex* sp. for *t*-test analysis.

### *3.10.1.8 Willard Spring*

The dominant taxa, by mean live cover (MH), on the aquatic transects at Willard Spring in 2009 were *Carex nebrascensis, Carex praegracilis, Argentina anserina, Rorippa sinuate* and *Achillea millefolium* (Table 3-48). This was the only site where *Rorippa sinuata* was found on the transects and it was a most subdominant species on two transects (067 and 068) in 2009, but was not recorded in 2010. A total of 38 taxa occurred on the transects in 2010 and this was average compared to the other sites. Mean live cover (MH) at Willard Spring was below average for the 14 sites (Table 3-40).

Four of the five transects at Willard Spring showed significant declines in total live plant cover between 2009 and 2010 (Table 3-48). Some individual species responded differently in 2010. *Juncus arcticus* showed significant increases in cover on four of the five transects where it occurred. However, several other grasses and sedges showed slight decreases in cover between 2009 and 2010.

**Table 3-48. Mean Live Cover Multiple Hits (MH) for the Most Dominant Species and Total Live Cover for the Aquatic Transects at Willard Spring for 2009 and 2010 (Page 1 of 2)**

Species are classified as to dominance along the transect as either transect dominant, transect subdominant, or microcommunity dominant. Taxa richness is indicated at the top of the table as total taxa and mean taxa for the transect. N represents the sample size for each species and the asterisk in the significance column represents a significant difference between years based on paired *t*-test comparison.

**Veg_064 N = 18 (Total Taxa for Transect: 2009 = 25 2010 = 22 (Mean Taxa for Transect: 2009 = 1.4 2010 = 1.2**

| Species | Mean Live Cover (MH) 2009 | Mean Live Cover (MH) 2010 | Significance at ≤0.05 | Dominance Classification |
|---|---|---|---|---|
| *Achillea millefolium* | 14.39 | 13.56 | | Transect Dominant |
| *Poa pratensis* | 14.33 | 11.67 | | Transect Dominant |
| *Argentina anserina* | 11.39 | 10.94 | | Transect Subdominant |
| *Juncus nevadensis* | 8.44 | 3.44 | | Transect Subdominant |
| *Agrostis gigantea* | 7.50 | 0.00 | | Microcommunity Dominant |
| *Leymus triticoides* | 7.22 | 1.28 | * | Microcommunity Dominant |
| *Deschampsia ceaspitosa* | 4.94 | 4.44 | | Microcommunity Dominant |
| *Carex nebrascensis* | 4.39 | 4.72 | | Microcommunity Dominant |
| *Cirsium scariosum* | 3.22 | 4.17 | | Microcommunity Dominant |
| *Juncus arcticus* ssp. *littoralis* | 1.11 | 7.00 | * | Microcommunity Dominant |
| **Total Live Cover** | **90.17** | **77.50** | | |

**Veg_065 N = 33 (Total Taxa for Transect: 2009 = 30; 2010 = 25) (Mean Taxa for Transect: 2009 = 0.8; 2010 = 0.7)**

| Species | Mean Live Cover (MH) 2009 | Mean Live Cover (MH) 2010 | Significance at ≤0.05 | Dominance Classification |
|---|---|---|---|---|
| *Carex praegracilis* | 17.12 | 12.18 | | Transect Dominant |
| *Argentina anserina* | 16.58 | 13.12 | | Transect Dominant |
| *Carex simulata* | 16.00 | 0.00 | * | Transect Subdominant |
| *Carex nebrascensis* | 15.67 | 17.42 | | Transect Dominant |
| *Poa pratensis* | 7.61 | 6.18 | | Transect Subdominant |
| *Deschampsia ceaspitosa* | 6.21 | 4.30 | | Microcommunity Dominant |
| *Juncus arcticus* ssp. *littoralis* | 4.79 | 13.03 | * | Transect Subdominant |
| *Juncus nevadensis* | 4.06 | 0.49 | | Microcommunity Dominant |
| *Leymus triticoides* | 4.00 | 3.79 | | Microcommunity Dominant |
| *Achillea millefolium* | 3.76 | 2.46 | * | Microcommunity Dominant |
| **Total Live Cover** | **110.00** | **81.91** | * | |

Transect length was 3-m longer in 2010, therefore data for 2010 meter interval 20-23 was not used in the analysis. Only data for 0-20 m for both years was used for *t*-test analysis.

**Veg_066 N = 38 (Total Taxa for Transect: 2009 = 26; 2010 = 26) (Mean Taxa for Transect: 2009 = 0.7; 2010 = 0.7)**

| Species | Mean Live Cover (MH) 2009 | Mean Live Cover (MH) 2010 | Significance at ≤0.05 | Dominance Classification |
|---|---|---|---|---|
| *Carex praegracilis* | 16.90 | 5.97 | * | Transect Dominant |
| *Carex nebrascensis* | 5.63 | 22.13 | * | Transect Dominant |
| *Argentina anserina* | 4.90 | 3.76 | | Microcommunity Dominant |
| *Agrostis gigantea* | 2.66 | 0.00 | * | Microcommunity Dominant |
| *Deschampsia ceaspitosa* | 2.08 | 7.37 | * | Microcommunity Dominant |
| *Juncus nevadensis* | 1.37 | 2.87 | | Microcommunity Dominant |
| *Elymus trachycaulus* | 1.34 | 0.87 | | Microcommunity Dominant |
| *Juncus arcticus* ssp. *littoralis* | 0.87 | 6.63 | * | Microcommunity Dominant |
| *Salsola tragus* | 0.74 | 0.42 | | Microcommunity Dominant |
| *Poa pratensis* | 0.34 | 2.45 | * | Microcommunity Dominant |
| **Total Live Cover** | **41.42** | **59.71** | * | |

**Table 3-48. Mean Live Cover Multiple Hits (MH) for the Most Dominant Species and Total Live Cover for the Aquatic Transects at Willard Spring for 2009 and 2010 (Page 2 of 2)**

**Veg_067 N = 54 (Total Taxa for Transect: 2009 = 18; 2010 = 18) (Mean Taxa for Transect: 2009 = 0.3; 2010 = 0.3)**

| Species | Mean Live Cover (MH) 2009 | Mean Live Cover (MH) 2010 | Significance at ≤0.05 | Dominance Classification |
|---|---|---|---|---|
| *Carex nebrascensis* | 30.39 | 20.87 | * | Transect Dominant |
| *Hordeum jubatum* | 19.13 | 10.06 | * | Transect Subdominant |
| *Rorippa sinuata* | 17.70 | 0.00 | * | Transect Subdominant |
| *Hordeum brachyantherum* | 2.69 | 6.24 | | Microcommunity Dominant |
| *Poa pratensis* | 2.43 | 0.32 | | Microcommunity Dominant |
| *Deschampsia ceaspitosa* | 2.04 | 4.56 | | Microcommunity Dominant |
| *Juncus arcticus* ssp. *littoralis* | 0.85 | 3.76 | * | Microcommunity Dominant |
| *Argentina anserina* | 0.46 | 0.06 | | Microcommunity Dominant |
| *Epilobium* sp. | 0.44 | 6.82 | * | Microcommunity Dominant |
| *Berula erecta* | 0.00 | 6.46 | * | Microcommunity Dominant |
| **Total Live Cover** | **78.11** | **61.63** | * | |

**Veg_068 N = 26 (Total Taxa for Transect: 2009 = 15; 2010 = 15) (Mean Taxa for Transect: 2009 = 0.6; 2010 = 0.6)**

| Species | Mean Live Cover (MH) 2009 | Mean Live Cover (MH) 2010 | Significance at ≤0.05 | Dominance Classification |
|---|---|---|---|---|
| *Carex nebrascensis* | 20.69 | 9.81 | * | Transect Dominant |
| *Rorippa sinuata* | 14.50 | 0.00 | * | Transect Subdominant |
| *Carex praegracilis* | 10.27 | 7.69 | | Transect Subdominant |
| *Juncus arcticus* ssp. *littoralis* | 5.62 | 2.96 | | Microcommunity Dominant |
| *Argentina anserina* | 4.73 | 2.00 | | Microcommunity Dominant |
| *Hordeum jubatum* | 2.50 | 3.81 | | Microcommunity Dominant |
| *Puccinellia lemmonii* | 2.23 | 2.04 | | Microcommunity Dominant |
| *Hordeum brachyantherum* | 1.42 | 8.42 | * | Microcommunity Dominant |
| *Berula erecta* | 0.00 | 6.15 | * | Microcommunity Dominant |
| **Total Live Cover** | **65.42** | **46.04** | * | |

### *3.10.1.9 Minerva Spring Complex (North and Middle)*

The dominant taxa, by mean live cover (MH), on the aquatic transects at the Minerva Spring Complex in 2009 were *Potamogeton* sp., *Schedonorus pratensis*, *Carex nebrascensis*, *Rosa woodsii*, *Thermopsis rhombifolia*, *Eleocharis rostellata*, and *Nasturtium officinale* (Table 3-49). A total of 57 taxa occurred on the transects in 2010 and this was the third-highest number among the 14 sites. This site had above average live cover (MH) in 2009 and 2010 (Table 3-40).

There was a significant decrease in total live cover on two transects (004 and 006), but an increase in cover on one transect (010) in 2010 (Table 3-49). Transect 04 had the greatest decrease in cover with six species having less cover in 2010 than in 2009. Two less palatable species, *Bromus tectorum* and *Juncus arcticus*, had significantly greater cover in 2010 than 2009. The aquatic species, *Nasturtium officinale*, had greater cover in 2010 as compared with 2009.

**Table 3-49. Mean Live Cover Multiple Hits (MH) for the Most Dominant Species and Total Live Cover for the Aquatic Transects at Minerva Spring Complex (North and Middle) for 2009 and 2010 (Page 1 of 2)**

Species are classified as to dominance along the transect as either transect dominant, transect subdominant, or microcommunity dominant. Taxa richness is indicated at the top of the table as total taxa and mean taxa for the transect. N represents the sample size for each species and the asterisk in the significance column represents a significant difference between years based on paired *t*-test comparison.

**Veg_001 N = 20 (Total Taxa for Transect: 2009 = 19; 2010 = 21) (Mean Taxa for Transect: 2009 = 1.0; 2010 = 1.1)**

| Species | Mean Live Cover (MH) 2009 | Mean Live Cover (MH) 2010 | Significance at ≤0.05 | Dominance Classification |
|---|---|---|---|---|
| *Potamogeton foliosus* ssp. *foliosus* | 44.85 | 44.20 | | Transect Dominant |
| *Chara* sp. | 18.75 | 8.55 | | Transect Subdominant |
| *Distichlis spicata* | 13.60 | 1.95 | * | Transect Subdominant |
| *Carex nebrascensis* | 5.10 | 2.85 | | Microcommunity Dominant |
| *Hordeum jubatum* | 4.85 | 2.10 | | Microcommunity Dominant |
| *Berula erecta* | 4.20 | 4.10 | | Microcommunity Dominant |
| *Eleocharis palustris* | 4.20 | 1.70 | | Microcommunity Dominant |
| *Juncus arcticus* ssp. *littoralis* | 2.10 | 1.35 | | Microcommunity Dominant |
| *Agrostis gigantea* | 0.80 | 1.50 | | Microcommunity Dominant |
| *Stuckenia filiformis* ssp. *occidentalis* | 0.00 | 8.95 | * | Microcommunity Dominant |
| **Total Live Cover** | **106.75** | **86.05** | | |

Based on field data and the distribution of hits along the transect, species listed as *Potamogeton* in 2009 were analyzed as *Potamogeton foliosus* ssp. *foliosus* for *t*-test analysis.

**Veg_004 N = 60 (Total Taxa for Transect: 2009 = 35; 2010 = 26) (Mean Taxa for Transect: 2009 = 0.6; 2010 = 0.4)**

| Species | Mean Live Cover (MH) 2009 | Mean Live Cover (MH) 2010 | Significance at ≤0.05 | Dominance Classification |
|---|---|---|---|---|
| *Potamogeton* sp. | 27.25 | 26.32 | * | Transect Dominant |
| *Hordeum jubatum* | 25.80 | 4.43 | * | Transect Subdominant |
| *Schedonorus pratensis* | 11.43 | 17.65 | * | Transect Subdominant |
| *Thermopsis rhombifolia* | 10.85 | 7.25 | | Transect Subdominant |
| *Agrostis gigantea* | 10.82 | 1.23 | * | Transect Subdominant |
| *Polygonum aviculare* | 8.97 | 3.40 | * | Transect Subdominant |
| *Melilotus officinalis* | 7.57 | 0.00 | * | Microcommunity Dominant |
| *Elymus trachycaulus* | 6.82 | 0.38 | * | Microcommunity Dominant |
| *Poa pratensis* | 6.68 | 5.82 | | Transect Subdominant |
| *Carex nebrascensis* | 3.17 | 2.65 | | Microcommunity Dominant |
| *Juncus arcticus* ssp. *littoralis* | 0.53 | 2.55 | * | Microcommunity Dominant |
| *Leymus triticoides* | 0.37 | 2.33 | | Microcommunity Dominant |
| *Bromus tectorum* | 0.17 | 1.87 | * | Microcommunity Dominant |
| **Total Live Cover** | **129.90** | **82.67** | * | |

**Veg_006 N = 27 (Total Taxa for Transect: 2009 = 26; 2010 = 30) (Mean Taxa for Transect: 2009 = 0.9; 2010 = 1.1)**

| Species | Mean Live Cover (MH) 2009 | Mean Live Cover (MH) 2010 | Significance at ≤0.05 | Dominance Classification |
|---|---|---|---|---|
| *Rosa woodsii* | 32.85 | 26.44 | | Transect Dominant |
| *Schedonorus pratensis* | 27.74 | 26.11 | | Transect Dominant |
| *Thermopsis rhombifolia* | 22.37 | 17.70 | | Transect Dominant |
| *Agrostis gigantea* | 17.82 | 1.15 | * | Transect Subdominant |
| *Berula erecta* | 8.04 | 2.11 | | Microcommunity Dominant |
| *Medicago polymorpha* | 5.41 | 6.15 | | Microcommunity Dominant |
| *Leymus triticoides* | 4.59 | 0.11 | | Microcommunity Dominant |
| *Carex nebrascensis* | 3.82 | 6.19 | | Microcommunity Dominant |
| *Carex simulata* | 3.82 | 0.00 | | Microcommunity Dominant |
| *Trifolium pratense* | 3.82 | 0.63 | | Microcommunity Dominant |
| *Argentina anserina* | 2.15 | 1.52 | | Microcommunity Dominant |
| *Nasturtium officinale* | 1.89 | 5.22 | | Microcommunity Dominant |
| *Juncus arcticus* ssp. *littoralis* | 0.82 | 3.82 | * | Microcommunity Dominant |
| *Carex praegracilis* | 0.00 | 6.44 | * | Microcommunity Dominant |
| **Total Live Cover** | **146.19** | **115.33** | * | |

**Table 3-49. Mean Live Cover Multiple Hits (MH) for the Most Dominant Species and Total Live Cover for the Aquatic Transects at Minerva Spring Complex (North and Middle) for 2009 and 2010 (Page 2 of 2)**

**Veg_007 N = 20 (Total Taxa for Transect: 2009 = 28; 2010 = 26) (Mean Taxa for Transect: 2009 = 1.4; 2010 = 1.3)**

| Species | Mean Live Cover (MH) 2009 | Mean Live Cover (MH) 2010 | Significance at ≤0.05 | Dominance Classification |
|---|---|---|---|---|
| *Carex nebrascensis* | 22.70 | 22.00 | | Transect Dominant |
| *Stuckenia filiformis* ssp. *filiformis* | 19.15 | 15.55 | | Transect Subdominant |
| *Mimulus guttatus* | 8.10 | 1.60 | * | Microcommunity Dominant |
| *Juncus nevadensis* | 5.80 | 8.10 | | Microcommunity Dominant |
| Algae | 3.95 | 6.65 | | Microcommunity Dominant |
| *Nasturtium officinale* | 3.60 | 13.85 | | Microcommunity Dominant |
| *Elymus trachycaulus* | 2.80 | 0.30 | | Microcommunity Dominant |
| *Agrostis gigantea* | 2.45 | 3.65 | | Microcommunity Dominant |
| *Berula erecta* | 1.90 | 7.70 | * | Microcommunity Dominant |
| *Juncus arcticus* ssp. *littoralis* | 1.85 | 1.15 | | Microcommunity Dominant |
| **Total Live Cover** | **80.55** | **92.55** | | |

Transect length was 1-m longer in 2010, therefore data for 2010 meter interval 20-21 and was not used in *t*-test analysis. Only data for 0-20 m for both years was used for *t*-test analysis.

Veg_010 N = 21 (Total Taxa for Transect: 2009 = 18; 2010 = 19) (Mean Taxa for Transect: 2009 = 0.9; 2010 = 0.9)

| Species | Mean Live Cover (MH) 2009 | Mean Live Cover (MH) 2010 | Significance at ≤0.05 | Dominance Classification |
|---|---|---|---|---|
| *Eleocharis rostellata* | 17.14 | 27.33 | * | Transect Dominant |
| *Nasturtium officinale* | 13.62 | 22.81 | * | Transect Subdominant |
| *Carex praegracilis* | 6.91 | 9.76 | * | Transect Subdominant |
| Moss | 5.38 | 0.86 | | Microcommunity Dominant |
| *Agrostis gigantea* | 2.00 | 3.10 | | Microcommunity Dominant |
| *Juncus nevadensis* | 1.57 | 1.57 | | Microcommunity Dominant |
| *Carex simulata* | 0.24 | 1.95 | | Microcommunity Dominant |
| *Triglochin maritima* | 0.14 | 3.19 | | Microcommunity Dominant |
| *Chara* sp. | 0.00 | 16.43 | * | Transect Subdominant |
| **Total Live Cover** | **51.86** | **90.95** | * | |

### *3.10.1.10 Swallow Spring*

Swallow Spring was the only one of the 14 aquatic transect sites that was dominated by trees. *Populus angustifolia* and *Salix* sp. were the two tree species that occurred along the aquatic transects (Table 3-50). Other dominant or subdominant species included *Rosa woodsii, Nasturtium officinale, Berula erecta, Poa pratensis*, and *Rhus trilobata*. A total of 46 taxa occurred on the aquatic transects in 2010 and this was average for the 14 sites. Mean live cover (MH) at Swallow Spring exceeded 100%, and this was the highest value for the 14 sites (Table 3-40). This high cover value was the result, in large part, to the dominance of the tree *Populus angustifolia*.

*Populus angustifolia* was the dominant species on all five transects (Table 3-50). *Rosa woods*ii was the most abundant shrub species on two transects. *Berula erecta, Nasturtium officinale*, and *Veronica anagallis-aquatica* were abundant aquatic species on the transects.

*Berula erecta* showed significant increase in cover on two transects (045 and 048) during the 2010 growing season. A few other species showed positive increases on transect 044 in 2010.

**Table 3-50. Mean Live Cover Multiple Hits (MH) for the Most Dominant Species and Total Live Cover for the Aquatic Transects at Swallow Spring for 2009 and 2010 (Page 1 of 2)**

Species are classified as to dominance along the transect as either transect dominant, transect subdominant, or microcommunity dominant. Taxa richness is indicated at the top of the table as total taxa and mean taxa for the transect. N represents the sample size for each species and the asterisk in the significance column represents a significant difference between years based on paired *t*-test comparison.

**Veg_044 N = 39 (Total Taxa for Transect: 2009 = 7; 2010 = 12) (Mean Taxa for Transect: 2009 = 0.2; 2010 = 0.3)**

| Species | Mean Live Cover (MH) 2009 | Mean Live Cover (MH) 2010 | Significance at ≤0.05 | Dominance Classification |
|---|---|---|---|---|
| *Populus angustifolia* | 37.49 | 78.97 | * | Transect Dominant |
| *Salix* sp. | 26.03 | 39.00 | * | Transect Dominant |
| *Nasturtium officinale* | 15.21 | 47.33 | * | Transect Dominant |
| *Clematis ligusticifolia* | 4.77 | 13.77 | * | Transect Subdominant |
| Moss | 3.72 | 3.21 | | Microcommunity Dominant |
| *Poa pratensis* | 2.74 | 5.69 | * | Microcommunity Dominant |
| Aster | 1.10 | 0.44 | | Microcommunity Dominant |
| *Bromus tectorum* | 0.00 | 1.80 | * | Microcommunity Dominant |
| *Mimulus guttatus* | 0.00 | 5.26 | * | Microcommunity Dominant |
| *Ribes aureum var. aureum* | 0.00 | 2.49 | | Microcommunity Dominant |
| **Total Live Cover** | **91.05** | **198.69** | * | |

**Veg_045 N = 44 (Total Taxa for Transect: 2009 = 17; 2010 = 16) (Mean Taxa for Transect: 2009 = 0.4; 2010 = 0.4)**

| Species | Mean Live Cover (MH) 2009 | Mean Live Cover (MH) 2010 | Significance at ≤0.05 | Dominance Classification |
|---|---|---|---|---|
| *Populus angustifolia* | 51.36 | 41.14 | | Transect Dominant |
| *Rosa woodsii* | 21.57 | 25.96 | | Transect Dominant |
| *Rhus trilobata* | 19.96 | 9.82 | * | Transect Subdominant |
| *Berula erecta* | 5.11 | 19.16 | * | Transect Subdominant |
| Aster | 3.00 | 3.68 | | Microcommunity Dominant |
| *Nasturtium officinale* | 2.57 | 17.80 | * | Transect Subdominant |
| *Veronica anagallis-aquatica* | 2.16 | 6.02 | | Microcommunity Dominant |
| *Agrostis gigantea* | 1.91 | 0.00 | | Microcommunity Dominant |
| *Poa pratensis* | 1.07 | 2.18 | | Microcommunity Dominant |
| *Bassia scoparia* | 0.68 | 2.16 | | Microcommunity Dominant |
| **Total Live Cover** | **111.61** | **130.07** | | |

**Veg_046 N = 22 (Total Taxa for Transect: 2009 = 19; 2010 = 18) (Mean Taxa for Transect: 2009 = 0.9; 2010 = 0.8)**

| Species | Mean Live Cover (MH) 2009 | Mean Live Cover (MH) 2010 | Significance at ≤0.05 | Dominance Classification |
|---|---|---|---|---|
| *Populus angustifolia* | 59.55 | 49.46 | | Transect Dominant |
| *Rosa woodsii* | 15.64 | 14.73 | | Transect Subdominant |
| *Poa pratensis* | 14.59 | 15.86 | | Transect Subdominant |
| *Agrostis gigantea* | 7.64 | 5.32 | | Transect Subdominant |
| *Medicago polymorpha* | 3.86 | 3.00 | | Microcommunity Dominant |
| *Rhus trilobata* | 3.27 | 6.14 | | Microcommunity Dominant |
| *Berula erecta* | 1.86 | 0.68 | | Microcommunity Dominant |
| *Veronica anagallis-aquatica* | 1.82 | 10.91 | | Microcommunity Dominant |
| *Nasturtium officinale* | 1.59 | 5.32 | | Microcommunity Dominant |
| *Bromus tectorum* | 0.32 | 2.46 | | Microcommunity Dominant |
| **Total Live Cover** | **113.96** | **116.09** | | |

**Table 3-50. Mean Live Cover Multiple Hits (MH) for the Most Dominant Species and Total Live Cover for the Aquatic Transects at Swallow Spring for 2009 and 2010 (Page 2 of 2)**

| Species | Mean Live Cover (MH) 2009 | Mean Live Cover (MH) 2010 | Significance at ≤0.05 | Dominance Classification |
|---|---|---|---|---|
| **Veg_047 N = 40 (Total Taxa for Transect: 2009 = 9; 2010 = 14) (Mean Taxa for Transect: 2009 = 0.2; 2010 = 0.4)** | | | | |
| *Populus angustifolia* | 68.75 | 43.40 | * | Transect Dominant |
| *Nasturtium officinale* | 13.60 | 15.53 | | Transect Subdominant |
| *Rosa woodsii* | 7.75 | 9.35 | | Transect Subdominant |
| *Sambucus nigra* | 6.88 | 6.98 | | Transect Subdominant |
| *Urtica dioica* | 2.40 | 4.53 | | Microcommunity Dominant |
| *Bassia scoparia* | 1.55 | 19.73 | * | Transect Subdominant |
| *Bromus tectorum* | 1.38 | 1.25 | | Microcommunity Dominant |
| *Poa pratensis* | 1.08 | 2.23 | | Microcommunity Dominant |
| *Iva axillaris* | 0.70 | 0.48 | | Microcommunity Dominant |
| *Chenopodium* sp. | 0.00 | 1.45 | * | Microcommunity Dominant |
| **Total Live Cover** | **104.08** | **107.70** | | |
| **Veg_048 N = 44 (Total Taxa for Transect: 2009 = 25; 2010 = 25) (Mean Taxa for Transect: 2009 = 0.6; 2010 = 0.6)** | | | | |
| **Species** | **Mean Live Cover (MH) 2009** | **Mean Live Cover (MH) 2010** | **Significance at ≤0.05** | **Dominance Classification** |
| *Populus angustifolia* | 42.05 | 44.55 | | Transect Dominant |
| *Berula erecta* | 19.34 | 43.96 | * | Transect Dominant |
| *Poa* sp. | 9.21 | 18.80 | * | Transect Subdominant |
| *Agrostis gigantea* | 7.21 | 12.98 | * | Transect Subdominant |
| *Medicago polymorpha* | 5.64 | 7.84 | | Transect Subdominant |
| *Carex nebrascensis* | 4.75 | 2.71 | * | Microcommunity Dominant |
| *Nasturtium officinale* | 4.00 | 0.80 | | Microcommunity Dominant |
| *Veronica anagallis-aquatica* | 0.61 | 6.75 | * | Microcommunity Dominant |
| *Mimulus guttatus* | 0.30 | 3.57 | * | Microcommunity Dominant |
| *Bromus tectorum* | 0.09 | 3.30 | | Microcommunity Dominant |
| **Total Live Cover** | **99.00** | **151.32** | * | |

Based on field data and the distribution of hits along the transect, species listed as *Poa pratensis* or *Poa secunda* in 2009 and *Poa secunda* in 2010 were analyzed as *Poa* sp. for *t*-test analysis.

### *3.10.1.11 North Little Spring*

The dominant taxa, by mean live cover (MH), on the aquatic transects at North Little Spring in 2009 were *Carex nebrascensis*, *Carex* spp., *Chara* sp., and algae (Table 3-51). A total of 25 taxa occurred on the transects in 2010 and this was the lowest number of the 14 sites. Mean cover (MH) was below average compared to the other sites in 2010 (Table 3-40).

*Carex nebrascensis* was the most abundant species on four of the five transects and *Chara* sp. was the most abundant on one transect (Table 3-51). The transects were sampled one month earlier in 2010 than in 2009. The cover of *Carex nebrascensis* and *Carex* spp. declined significantly on three of the five transects in 2010. Other species cover changed very little between the two years.

**Table 3-51. Mean Live Cover Multiple Hits (MH) for the Most Dominant Species and Total Live Cover for the Aquatic Transects at North Little Spring for 2009 and 2010 (Page 1 of 2)**

Species are classified as to dominance along the transect as either transect dominant, transect subdominant, or microcommunity dominant. Taxa richness is indicated at the top of the table as total taxa and mean taxa for the transect. N represents the sample size for each species and the asterisk in the significance column represents a significant difference between years based on paired *t*-test comparison.

**Veg_174 N = 28 (Total Taxa for Transect: 2009 = 12; 2010 = 11) (Mean Taxa for Transect: 2009 = 0.4; 2010 = 0.4)**

| Species | Mean Live Cover (MH) 2009 | Mean Live Cover (MH) 2010 | Significance at ≤0.05 | Dominance Classification |
|---|---|---|---|---|
| *Carex nebrascensis* | 51.68 | 41.68 | * | Transect Dominant |
| *Carex* sp. | 39.29 | 17.50 | * | Transect Dominant |
| Algae | 20.25 | 25.36 | | Transect Dominant |
| *Berula erecta* | 5.71 | 12.75 | * | Transect Subdominant |
| *Ranunculus sceleratus* | 4.93 | 0.68 | | Microcommunity Dominant |
| *Argentina anserina* | 1.86 | 0.54 | | Microcommunity Dominant |
| *Juncus arcticus* ssp. *littoralis* | 0.71 | 1.79 | * | Microcommunity Dominant |
| **Total Live Cover** | **126.46** | **102.04** | * | |

Based on field data and the distribution of hits along the transect, species listed as *Carex praegracilis* or *Carex simulata* in 2009 and 2010 were analyzed as *Carex* sp., for *t*-test analysis.

**Veg_175 N = 17 (Total Taxa for Transect: 2009 = 10; 2010 = 8) (Mean Taxa for Transect: 2009 = 0.6; 2010 = 0.5)**

| Species | Mean Live Cover (MH) 2009 | Mean Live Cover (MH) 2010 | Significance at ≤0.05 | Dominance Classification |
|---|---|---|---|---|
| *Chara* sp. | 49.47 | 56.82 | | Transect Dominant |
| *Carex nebrascensis* | 18.65 | 9.53 | | Transect Subdominant |
| *Carex* sp. | 14.18 | 10.12 | | Transect Subdominant |
| *Berula erecta* | 2.06 | 2.29 | | Microcommunity Dominant |
| *Juncus arcticus* ssp. *littoralis* | 0.65 | 2.82 | | Microcommunity Dominant |
| **Total Live Cover** | **86.35** | **84.06** | | |

Based on field data and the distribution of hits along the transect, species listed as *Carex simulata* in 2009 and *Carex praegracilis* in 2010 were analyzed as *Carex* sp. for *t*-test analysis.

**Veg_176 N = 26 (Total Taxa for Transect: 2009 = 5; 2010 = 7) (Mean Taxa for Transect: 2009 = 0.2; 2010 = 0.3)**

| Species | Mean Live Cover (MH) 2009 | Mean Live Cover (MH) 2010 | Significance at ≤0.05 | Dominance Classification |
|---|---|---|---|---|
| *Carex nebrascensis* | 60.00 | 50.54 | * | Transect Dominant |
| *Carex* sp. | 17.04 | 9.50 | * | Transect Subdominant |
| *Eleocharis palustris* | 5.92 | 2.31 | * | Microcommunity Dominant |
| *Juncus* sp. | 1.62 | 1.62 | | Microcommunity Dominant |
| **Total Live Cover** | **85.42** | **64.62** | * | |

Based on field data and the distribution of hits along the transect, species listed as *Carex simulata* in 2009 and *Carex praegracilis* in 2010 were analyzed as *Carex* sp. for *t*-test analysis. Based on field data and the distribution of hits along the transect, species listed as *Juncus nevadensis* in 2009 and *Juncus arcticus* ssp. *littoralis* or *Juncus nevadensis* in 2010 were analyzed as *Juncus* sp. for *t*-test analysis.

**Veg_177 N = 20 (Total Taxa for Transect: 2009 = 2; 2010 = 2) (Mean Taxa for Transect: 2009 = 0.1; 2010 = 0.1)**

| Species | Mean Live Cover (MH) 2009 | Mean Live Cover (MH) 2010 | Significance at ≤0.05 | Dominance Classification |
|---|---|---|---|---|
| *Carex nebrascensis* | 33.00 | 32.10 | | Transect Dominant |
| *Carex* sp. | 23.00 | 12.60 | * | Transect Subdominant |
| **Total Live Cover** | **56.00** | **44.70** | * | |

Based on field data and the distribution of hits along the transect, species listed as *Carex simulata* in 2009 and *Carex praegracilis* in 2010 were analyzed as *Carex* sp. for *t*-test analysis.

**Table 3-51. Mean Live Cover Multiple Hits (MH) for the Most Dominant Species and Total Live Cover for the Aquatic Transects at North Little Spring for 2009 and 2010 (Page 2 of 2)**

**Veg_178 N = 33 (Total Taxa for Transect: 2009 = 14; 2010 = 16) (Mean Taxa for Transect: 2009 = 0.4; 2010 = 0.5)**

| Species | Mean Live Cover (MH) 2009 | Mean Live Cover (MH) 2010 | Significance at ≤0.05 | Dominance Classification |
|---|---|---|---|---|
| *Carex nebrascensis* | 67.18 | 36.00 | * | Transect Dominant |
| *Juncus arcticus* ssp. *littoralis* | 16.21 | 12.30 | | Transect Subdominant |
| *Carex* sp. | 9.82 | 7.79 | | Transect Subdominant |
| *Eleocharis* sp. | 8.24 | 7.03 | | Transect Subdominant |
| *Berula erecta* | 5.30 | 2.27 | | Microcommunity Dominant |
| *Rosa woodsii* | 3.85 | 1.55 | | Microcommunity Dominant |
| *Poa pratensis* | 3.27 | 3.21 | | Microcommunity Dominant |
| *Argentina anserina* | 1.82 | 2.55 | | Microcommunity Dominant |
| **Total Live Cover** | **117.88** | **74.30** | * | |

Based on field data and the distribution of hits along the transect, species listed as *Carex simulata* in 2009 and *Carex praegracilis* in 2010 were analyzed as *Carex* sp. for *t*-test analysis. Based on field data and the distribution of hits along the transect, species listed as *Eleocharis palustris* in 2009 and *Eleocharis palustris* or *Eleocharis rostellat*a in 2010 were analyzed as *Eleocharis* sp. for *t*-test analysis.

### 3.10.1.12 Big Springs

The dominant taxa, by mean live cover (MH), on the aquatic transects at Big Springs were *Nasturtium officinale*, *Eleocharis rostellata*, *Carex praegracilis*, *Schedonorus pratensis*, algae and moss (Table 3-52). A total of 45 taxa occurred on the aquatic transects in 2010 and this was average for the 14 sites. Mean live cover (MH) was the lowest for the 14 sites in 2010 (Table 3-40).

*Nasturtium officinale* was the dominant species on four of the five transects and was the second most dominant species on the one transect dominated by *Eleocharis rostellata* (Table 3-52). The second-most dominant taxa on the other four transects were *Argentina anserina*, *Schedonorus pratensis*, moss and algae.

Live cover (MH) at Big Springs declined significantly on two transects between 2009 and 2010 (Table 3-52), but the area was sampled one month earlier in 2010. Algae in the water increased significantly on one transect between 2009 and 2010. *Carex praegracilis* increased significantly on two transect (169 and 172), between 2009 and 2010. *Nasturtium officinale* decreased significantly on two transects (171 and 172) or did not change between 2009 and 2010.

**Table 3-52. Mean Live Cover Multiple Hits (MH) for the Most Dominant Species and Total Live Cover for the Aquatic Transects at Big Springs for 2009 and 2010 (Page 1 of 2)**

Species are classified as to dominance along the transect as either transect dominant, transect subdominant, or microcommunity dominant. Taxa richness is indicated at the top of the table as total taxa and mean taxa for the transect. N represents the sample size for each species and the asterisk in the significance column represents a significant difference between years based on paired *t*-test comparison.

**Veg_169 N = 24 (Total Taxa for Transect: 2009 = 18; 2010 = 17) (Mean Taxa for Transect: 2009 = 0.8; 2010 = 0.7)**

| Species | Mean Live Cover (MH) 2009 | Mean Live Cover (MH) 2010 | Significance at ≤0.05 | Dominance Classification |
|---|---|---|---|---|
| *Nasturtium officinale* | 58.54 | 70.83 | | Transect Dominant |
| *Schedonorus pratensis* | 16.33 | 16.58 | | Transect Subdominant |
| *Carex praegracilis* | 12.08 | 0.00 | * | Transect Subdominant |
| *Hordeum jubatum* | 6.08 | 1.04 | | Microcommunity Dominant |
| *Juncus arcticus* ssp. *littoralis* | 4.96 | 1.54 | * | Microcommunity Dominant |
| *Melilotus officinalis* | 4.96 | 1.13 | | Microcommunity Dominant |
| *Mimulus guttatus* | 1.29 | 5.04 | | Microcommunity Dominant |
| *Juncus nevadensis* | 0.00 | 5.63 | | Microcommunity Dominant |
| *Pascopyrum smithii* | 0.00 | 4.83 | | Microcommunity Dominant |
| **Total Live Cover** | **114.92** | **113.92** | | |

**Veg_170 N = 25 (Total Taxa for Transect: 2009 = 15; 2010 = 16) (Mean Taxa for Transect: 2009 = 0.6; 2010 = 0.6)**

| Species | Mean Live Cover (MH) 2009 | Mean Live Cover (MH) 2010 | Significance at ≤0.05 | Dominance Classification |
|---|---|---|---|---|
| *Nasturtium officinale* | 6.44 | 3.96 | | Microcommunity Dominant |
| *Argentina anserina* | 4.08 | 2.76 | | Microcommunity Dominant |
| *Juncus arcticus* ssp. *littoralis* | 3.48 | 3.92 | | Microcommunity Dominant |
| Algae | 2.52 | 17.08 | * | Transect Subdominant |
| *Glaux maritima* | 2.32 | 1.44 | | Microcommunity Dominant |
| *Distichlis spicata* | 1.80 | 0.44 | | Microcommunity Dominant |
| *Asclepias speciosa* | 1.36 | 1.32 | | Microcommunity Dominant |
| *Carex praegracilis* | 0.88 | 0.92 | | Microcommunity Dominant |
| *Grindelia squarrosa* | 0.00 | 1.68 | | Microcommunity Dominant |
| **Total Live Cover** | **26.32** | **35.96** | | |

**Veg_171 N = 28 (Total Taxa for Transect: 2009 = 15; 2010 = 18) (Mean Taxa for Transect: 2009 = 0.5; 2010 = 0.6)**

| Species | Mean Live Cover (MH) 2009 | Mean Live Cover (MH) 2010 | Significance at ≤0.05 | Dominance Classification |
|---|---|---|---|---|
| *Nasturtium officinale* | 70.18 | 30.86 | * | Transect Dominant |
| Moss | 16.00 | 0.00 | * | Transect Subdominant |
| *Eleocharis rostellata* | 7.57 | 2.96 | | Microcommunity Dominant |
| *Carex nebrascensis* | 1.71 | 1.46 | | Microcommunity Dominant |
| *Argentina anserina* | 1.61 | 0.71 | | Microcommunity Dominant |
| *Trifolium repens* | 1.46 | 0.18 | | Microcommunity Dominant |
| *Carex* sp. | 0.89 | 1.79 | | Microcommunity Dominant |
| *Pyrrocoma lanceolata* | 0.36 | 1.71 | | Microcommunity Dominant |
| Algae | 0.00 | 9.39 | * | Microcommunity Dominant |
| *Veronica anagallis-aquatica* | 0.00 | 17.96 | * | Transect Subdominant |
| **Total Live Cover** | **102.89** | **70.79** | * | |

Based on field data and the distribution of hits along the transect, species listed as *Carex praegracilis* in 2010 were analyzed as *Carex* sp. for *t*-test analysis.

**Table 3-52. Mean Live Cover Multiple Hits (MH) for the Most Dominant Species and Total Live Cover for the Aquatic Transects at Big Springs for 2009 and 2010 (Page 2 of 2)**

**Veg_172 N = 15 (Total Taxa for Transect: 2009 = 17; 2010 = 19) (Mean Taxa for Transect: 2009 = 1.1; 2010 = 1.3)**

| ***Species*** | **Mean Live Cover (MH) 2009** | **Mean Live Cover (MH) 2010** | **Significance at ≤0.05** | **Dominance Classification** |
|---|---|---|---|---|
| *Nasturtium officinale* | 16.73 | 2.60 | * | Transect Dominant |
| Algae | 9.60 | 4.07 | | Transect Subdominant |
| *Eleocharis rostellata* | 5.13 | 3.07 | | Microcommunity Dominant |
| *Carex praegracilis* | 4.20 | 7.87 | * | Microcommunity Dominant |
| *Agrostis gigantea* | 3.80 | 2.60 | | Microcommunity Dominant |
| *Aquilegia formosa* | 2.53 | 2.87 | | Microcommunity Dominant |
| *Potentilla gracilis* | 0.93 | 1.47 | | Microcommunity Dominant |
| **Total Live Cover** | **49.73** | **30.87** | * | |

**Veg_173 N = 25 (Total Taxa for Transect: 2009 = 14; 2010 = 16) (Mean Taxa for Transect: 2009 = 0.6; 2010 = 0.6)**

| **Species** | **Mean Live Cover (MH) 2009** | **Mean Live Cover (MH) 2010** | **Significance at ≤0.05** | **Dominance Classification** |
|---|---|---|---|---|
| *Eleocharis rostellata* | 15.92 | 18.04 | | Transect Dominant |
| *Nasturtium officinale* | 12.64 | 6.12 | | Transect Subdominant |
| *Potamogeton* sp. | 5.36 | 9.20 | | Transect Subdominant |
| *Epilobium ciliatum* ssp. *ciliatum* | 3.36 | 0.00 | | Microcommunity Dominant |
| *Juncus arcticus* ssp. *littoralis* | 2.20 | 1.16 | | Microcommunity Dominant |
| *Argentina anserina* | 1.60 | 3.04 | | Microcommunity Dominant |
| *Cirsium scariosum* | 0.60 | 2.00 | | Microcommunity Dominant |
| *Veronica anagallis-aquatica* | 0.00 | 11.16 | * | Microcommunity Dominant |
| **Total Live Cover** | **44.00** | **54.96** | | |

### *3.10.1.13 Unnamed 1 Spring North of Big*

The dominant taxa, by grand mean live cover (MH), on the aquatic transects at Unnamed 1 Spring in 2010 were *Nasturtium officinale, Berula erecta, Eleocharis rostellata, Carex praegracilis, Chara* sp., and moss (Table 3-53). A total of 48 taxa occurred on the transects in 2010 and this was about average for the 14 sites. Mean live cover (MH) exceeded 100% and was the third highest among the 14 sites in 2010 (Table 3-40).

There was a significant increase in average mean live cover (MH) from 2009 to 2010 on all five transects even though sampling occurred one month earlier in 2010 than in 2009 (Table 3-53). A total of ten species showed significant increases in cover between 2009 and 2010. Of the species that demonstrated increased cover between 2009 and 2010, *Eleocharis rostellata* increased on three of the five transects.

**Table 3-53. Mean Live Cover Multiple Hits (MH) for the Most Dominant Species and Total Live Cover for the Aquatic Transects at Unnamed 1 Spring North of Big for 2009 and 2010 (Page 1 of 2)**

Species are classified as to dominance along the transect as either transect dominant, transect subdominant, or microcommunity dominant. Taxa richness is indicated at the top of the table as total taxa and mean taxa for the transect. N represents the sample size for each species and the asterisk in the significance column represents a significant difference between years based on paired *t*-test comparison.

**Veg_164 N = 12 (Total Taxa for Transect: 2009 = 18; 2010 = 20) (Mean Taxa for Transect: 2009 = 1.5; 2010 = 1.7)**

| Species | Mean Live Cover (MH) 2009 | Mean Live Cover (MH) 2010 | Significance at ≤0.05 | Dominance Classification |
|---|---|---|---|---|
| *Nasturtium officinale* | 21.33 | 35.25 | | Transect Dominant |
| *Carex praegracilis* | 9.25 | 14.75 | | Transect Subdominant |
| *Distichlis spicata* | 2.42 | 6.42 | | Microcommunity Dominant |
| *Plantago major* | 2.25 | 0.50 | | Microcommunity Dominant |
| *Juncus arcticus* ssp. *littoralis* | 2.17 | 7.00 | * | Microcommunity Dominant |
| Algae | 2.08 | 0.00 | | Microcommunity Dominant |
| *Bassia scoparia* | 1.83 | 4.83 | | Microcommunity Dominant |
| *Berula erecta* | 1.83 | 4.75 | * | Microcommunity Dominant |
| *Carex nebrascensis* | 1.42 | 3.33 | | Microcommunity Dominant |
| *Mimulus guttatus* | 0.17 | 11.17 | | Transect Subdominant |
| *Poa secunda* | 0.00 | 5.25 | | Microcommunity Dominant |
| **Total Live Cover** | **53.50** | **108.00** | * | |

**Veg_165 N = 44 (Total Taxa for Transect: 2009 = 21; 2010 = 24) (Mean Taxa for Transect: 2009 = 0.5; 2010 = 0.5)**

| Species | Mean Live Cover (MH) 2009 | Mean Live Cover (MH) 2010 | Significance at ≤0.05 | Dominance Classification |
|---|---|---|---|---|
| *Nasturtium officinale* | 23.23 | 23.32 | | Transect Dominant |
| *Berula erecta* | 21.89 | 22.27 | | Transect Dominant |
| Moss | 15.41 | 18.32 | | Transect Subdominant |
| *Eleocharis rostellata* | 13.80 | 28.39 | * | Transect Subdominant |
| *Juncus arcticus* ssp. *littoralis* | 2.34 | 4.64 | | Microcommunity Dominant |
| *Carex* sp. | 2.18 | 5.98 | * | Microcommunity Dominant |
| *Carex nebrascensis* | 1.41 | 3.34 | * | Microcommunity Dominant |
| *Deschampsia ceaspitosa* | 0.89 | 2.46 | | Microcommunity Dominant |
| *Mimulus guttatus* | 0.59 | 7.41 | * | Microcommunity Dominant |
| *Juncus nevadensis* | 0.14 | 5.36 | * | Microcommunity Dominant |
| **Total Live Cover** | **84.23** | **126.68** | * | |

Based on field data and the distribution of hits along the transect, species listed as SP MOSS in 2009 were analyzed as Moss for *t*-test analysis. Based on field data and the distribution of hits along the transect, species listed as *Carex praegracilis* or *Carex simulata* in 2009 and 2010 were analyzed as *Carex* sp. for *t*-test analysis.

**Veg_166 N = 40 (Total Taxa for Transect: 2009 = 20; 2010 = 23) (Mean Taxa for Transect: 2009 = 0.5; 2010 = 0.6)**

| Species | Mean Live Cover (MH) 2009 | Mean Live Cover (MH) 2010 | Significance at ≤0.05 | Dominance Classification |
|---|---|---|---|---|
| *Berula erecta* | 43.00 | 47.93 | | Transect Dominant |
| *Eleocharis rostellata* | 8.03 | 14.13 | * | Transect Subdominant |
| *Juncus arcticus* ssp. *littoralis* | 6.43 | 5.23 | | Transect Subdominant |
| *Agrostis gigantea* | 4.20 | 1.98 | | Microcommunity Dominant |
| *Carex praegracilis* | 3.43 | 3.60 | | Microcommunity Dominant |
| *Carex nebrascensis* | 3.23 | 5.53 | * | Microcommunity Dominant |
| *Schedonorus pratensis* | 2.95 | 2.90 | | Microcommunity Dominant |
| *Nasturtium officinale* | 2.85 | 10.60 | * | Transect Subdominant |
| *Mimulus guttatus* | 2.83 | 9.58 | * | Transect Subdominant |
| *Elymus trachycaulus* | 1.35 | 1.78 | | Microcommunity Dominant |
| **Total Live Cover** | **86.60** | **116.88** | * | |

**Table 3-53. Mean Live Cover Multiple Hits (MH) for the Most Dominant Species and Total Live Cover for the Aquatic Transects at Unnamed 1 Spring North of Big for 2009 and 2010 (Page 2 of 2)**

**Veg_167 N = 26 (Total Taxa for Transect: 2009 = 17; 2010 = 18) (Mean Taxa for Transect: 2009 = 0.7; 2010 = 0.7)**

| Species | Mean Live Cover (MH) 2009 | Mean Live Cover (MH) 2010 | Significance at ≤0.05 | Dominance Classification |
|---|---|---|---|---|
| *Chara* sp. | 12.35 | 17.92 | | Transect Dominant |
| *Eleocharis rostellata* | 11.69 | 27.46 | * | Transect Dominant |
| Moss | 8.65 | 19.81 | | Transect Subdominant |
| *Berula erecta* | 5.65 | 4.19 | | Microcommunity Dominant |
| *Juncus nevadensis* | 2.04 | 9.50 | * | Microcommunity Dominant |
| *Deschampsia ceaspitosa* | 1.19 | 4.08 | | Microcommunity Dominant |
| *Leymus triticoides* | 1.12 | 1.89 | | Microcommunity Dominant |
| *Argentina anserina* | 0.81 | 2.00 | | Microcommunity Dominant |
| *Carex simulata* | 0.00 | 3.31 | * | Microcommunity Dominant |
| *Hordeum jubatum* | 0.00 | 2.89 | | Microcommunity Dominant |
| **Total Live Cover** | **50.39** | **95.85** | * | |

Based on field data and the distribution of hits along the transect, species listed as SP MOSS in 2009 were analyzed as Moss for *t*-test analysis.

**Veg_168 N = 30 (Total Taxa for Transect: 2009 = 18; 2010 = 22) (Mean Taxa for Transect: 2009 = 0.6; 2010 = 0.7)**

| Species | Mean Live Cover (MH) 2009 | Mean Live Cover (MH) 2010 | Significance at ≤0.05 | Dominance Classification |
|---|---|---|---|---|
| *Eleocharis rostellata* | 33.33 | 48.27 | * | Transect Dominant |
| Moss | 18.70 | 37.27 | * | Transect Dominant |
| *Berula erecta* | 6.30 | 9.63 | | Transect Subdominant |
| *Nasturtium officinale* | 6.13 | 0.00 | | Microcommunity Dominant |
| *Deschampsia ceaspitosa* | 0.90 | 2.70 | | Microcommunity Dominant |
| **Total Live Cover** | **69.83** | **106.10** | * | |

Based on field data and the distribution of hits along the transect, species listed as SP MOSS in 2009 were analyzed as Moss for *t*-test analysis.

### *3.10.1.14 Stateline Springs*

The dominant taxa, by mean live cover (MH), on the aquatic transects at Stateline Springs in 2010 was *Nasturtium officinale* (Table 3-54). A total of 39 taxa occurred on the aquatic transects in 2010 and this was below average among the 14 sites. Mean cover (MH) was also below average for the 14 sites for both 2009 and 2010 (Table 3-40).

*Nasturtium officinale* was the most abundant species on all five transects (Table 3-54). Greater cover on three of the five transects were found in 2010 even though the transects were sampled three weeks earlier in 2010 than in 2009. Other small but insignificant increases in cover of six to nine other species also contributed to the greater total cover observed in 2010 at Stateline Spring.

**Table 3-54. Mean Live Cover Multiple Hits (MH) for the Most Dominant Species and Total Live Cover for the Aquatic Transects at Stateline Springs for 2009 and 2010 (Page 1 of 2)**

Species are classified as to dominance along the transect as either transect dominant, transect subdominant, or microcommunity dominant. Taxa richness is indicated at the top of the table as total taxa and mean taxa for the transect. N represents the sample size for each species and the asterisk in the significance column represents a significant difference between years based on paired *t*-test comparison.

**Veg_131 N = 14 (Total Taxa for Transect: 2009 = 15; 2010 = 19) (Mean Taxa for Transect: 2009 = 1.1; 2010 = 1.4)**

| Species | Mean Live Cover (MH) 2009 | Mean Live Cover (MH) 2010 | Significance at ≤0.05 | Dominance Classification |
|---|---|---|---|---|
| *Nasturtium officinale* | 40.79 | 63.00 | * | Transect Dominant |
| *Argentina anserina* | 3.07 | 2.14 | | Microcommunity Dominant |
| *Juncus arcticus* ssp. *littoralis* | 2.93 | 3.07 | | Microcommunity Dominant |
| *Eleocharis rostellata* | 1.50 | 1.71 | | Microcommunity Dominant |
| *Carex nebrascensis* | 1.43 | 0.64 | | Microcommunity Dominant |
| *Agrostis gigantea* | 1.14 | 4.36 | | Microcommunity Dominant |
| *Melilotus officinalis* | 0.00 | 2.93 | | Microcommunity Dominant |
| **Total Live Cover** | **55.21** | **84.86** | * | |

**Veg_132 N = 22 (Total Taxa for Transect: 2009 = 13; 2010 = 19) (Mean Taxa for Transect: 2009 = 0.6; 2010 = 0.9)**

| Species | Mean Live Cover (MH) 2009 | Mean Live Cover (MH) 2010 | Significance at ≤0.05 | Dominance Classification |
|---|---|---|---|---|
| *Nasturtium officinale* | 50.09 | 56.50 | | Transect Dominant |
| Moss | 7.50 | 6.14 | | Transect Subdominant |
| *Eleocharis rostellata* | 2.77 | 3.86 | | Microcommunity Dominant |
| *Juncus arcticus* ssp. *littoralis* | 2.05 | 2.86 | | Microcommunity Dominant |
| *Carex nebrascensis* | 0.82 | 1.46 | | Microcommunity Dominant |
| *Argentina anserina* | 0.36 | 2.32 | | Microcommunity Dominant |
| *Berula erecta* | 0.36 | 1.36 | * | Microcommunity Dominant |
| *Agrostis gigantea* | 0.05 | 1.50 | | Microcommunity Dominant |
| *Mimulus guttatus* | 0.00 | 5.32 | | Microcommunity Dominant |
| **Total Live Cover** | **68.05** | **86.77** | * | |

**Veg_133 N = 24 (Total Taxa for Transect: 2009 = 10; 2010 = 20) (Mean Taxa for Transect: 2009 = 0.4; 2010 = 0.8)**

| Species | Mean Live Cover (MH) 2009 | Mean Live Cover (MH) 2010 | Significance at ≤0.05 | Dominance Classification |
|---|---|---|---|---|
| *Nasturtium officinale* | 38.00 | 62.63 | * | Transect Dominant |
| Moss | 8.83 | 1.67 | * | Microcommunity Dominant |
| *Potamogeton* sp. | 7.54 | 0.00 | | Microcommunity Dominant |
| *Eleocharis* sp. | 5.29 | 5.00 | | Microcommunity Dominant |
| *Juncus arcticus* ssp. *littoralis* | 2.04 | 3.75 | | Microcommunity Dominant |
| *Carex nebrascensis* | 1.83 | 4.25 | | Microcommunity Dominant |
| *Argentina anserina* | 0.88 | 1.58 | | Microcommunity Dominant |
| Algae | 0.00 | 3.33 | | Microcommunity Dominant |
| *Equisetum arvense* | 0.00 | 2.33 | | Microcommunity Dominant |
| **Total Live Cover** | **65.67** | **92.58** | * | |

Based on field data and the distribution of hits along the transect, species listed as *Eleocharis palustris* and *Eleocharis rostellata* in 2009 and *Eleocharis rostellata* in 2010 were analyzed as *Eleocharis* sp. for *t*-test analysis.

**Veg_134 N = 13 (Total Taxa for Transect: 2009 = 14; 2010 = 15) (Mean Taxa for Transect: 2009 = 1.1; 2010 = 1.2)**

| Species | Mean Live Cover (MH) 2009 | Mean Live Cover (MH) 2010 | Significance at ≤0.05 | Dominance Classification |
|---|---|---|---|---|
| *Nasturtium officinale* | 29.69 | 58.23 | * | Transect Dominant |
| Moss | 23.77 | 0.00 | * | Transect Subdominant |
| *Juncus arcticus* ssp. *littoralis* | 11.54 | 5.00 | | Transect Subdominant |
| *Argentina anserina* | 5.46 | 4.31 | | Microcommunity Dominant |
| *Agrostis gigantea* | 3.39 | 3.62 | | Microcommunity Dominant |
| *Pyrrocoma lanceolata* | 2.15 | 3.08 | | Microcommunity Dominant |
| Algae | 1.77 | 4.00 | | Microcommunity Dominant |
| *Eleocharis rostellata* | 0.00 | 9.00 | | Microcommunity Dominant |
| **Total Live Cover** | **81.39** | **90.23** | | |

**Table 3-54. Mean Live Cover Multiple Hits (MH) for the Most Dominant Species and Total Live Cover for the Aquatic Transects at Stateline Springs for 2009 and 2010 (Page 2 of 2)**

**Veg_135 N = 16 (Total Taxa for Transect: 2009 = 15; 2010 = 21) (Mean Taxa for Transect: 2009 = 0.9; 2010 = 1.3)**

| Species | Mean Live Cover (MH) 2009 | Mean Live Cover (MH) 2010 | Significance at ≤0.05 | Dominance Classification |
|---|---|---|---|---|
| *Nasturtium officinale* | 31.81 | 49.50 | | Transect Dominant |
| *Algae* | 4.13 | 11.56 | | Transect Subdominant |
| *Eleocharis rostellata* | 1.38 | 3.69 | | Microcommunity Dominant |
| *Cirsium scariosum* | 0.94 | 1.63 | | Microcommunity Dominant |
| *Berula erecta* | 0.50 | 1.38 | | Microcommunity Dominant |
| *Distichlis spicata* | 0.25 | 0.31 | | Microcommunity Dominant |
| **Total Live Cover** | **42.13** | **76.75** | * | |

## 3.10.2 Wetland/Meadow Transects

Mean live cover multiple hits (MH) overall for wetland/meadow transects was similar in 2009 and 2010 (grand mean live cover (MH): 2009 = 69%, 2010 = 72%) (Table 3-55 and Figure 3-41). Two of the 8 sites showed a significant increase in mean live cover (MH) in 2010 (Keegan Spring Complex: 70% increase; and Burbank Meadows: 18% increase). Mean live cover (MH) ranged from 33% (The Seep) to 104% (Keegan Spring Complex) in 2010. This compares to a mean live cover (MH) in 2009 that ranged from 41% (Shoshone Ponds) to 98% (Minerva Spring Complex).

There did not appear to be any appreciable pattern in change in mean live cover (FH) overall from 2009 to 2010 (grand mean live cover (FH): 2009 = 62%, 2010 = 63%), but mean live cover (FH) did vary between years for various sites (Table 3-55 and Figure 3-42). Mean live cover (FH) ranged from 33% (The Seep) to 85% (Keegan Spring Complex) in 2010. This compares to a mean live cover (FH) in 2009 that ranged from 39% (Shoshone Ponds) to 81% (Minerva Spring Complex). Mean live cover first hit (FH) for wetland/meadow transects was always lower than mean live cover (MH). The direction of change from 2009 to 2010 was similar between the two measures of live vegetation cover.

Total number of taxa overall for wetland/meadow was similar in 2009 and 2010 (total: 2009 = 61, 2010 = 66), as was mean taxa richness (grand mean: 2009 = 0.4, 2010 = 0.5) (Table 3-55 and Figures 3-43 and 3-44). Burbank Meadows had the lowest taxa richness in both 2009 and 2010 (mean taxa richness: 2009 = 0.2, 2010 = 0.2; total number of taxa: 2009 = 55, 2010 = 51), while Minerva Spring Complex had the highest taxa richness in both 2009 and 2010 (mean taxa richness: 2009 = 0.9, 2010 = 0.9; total number of taxa: 2009 = 82, 2010 = 78).

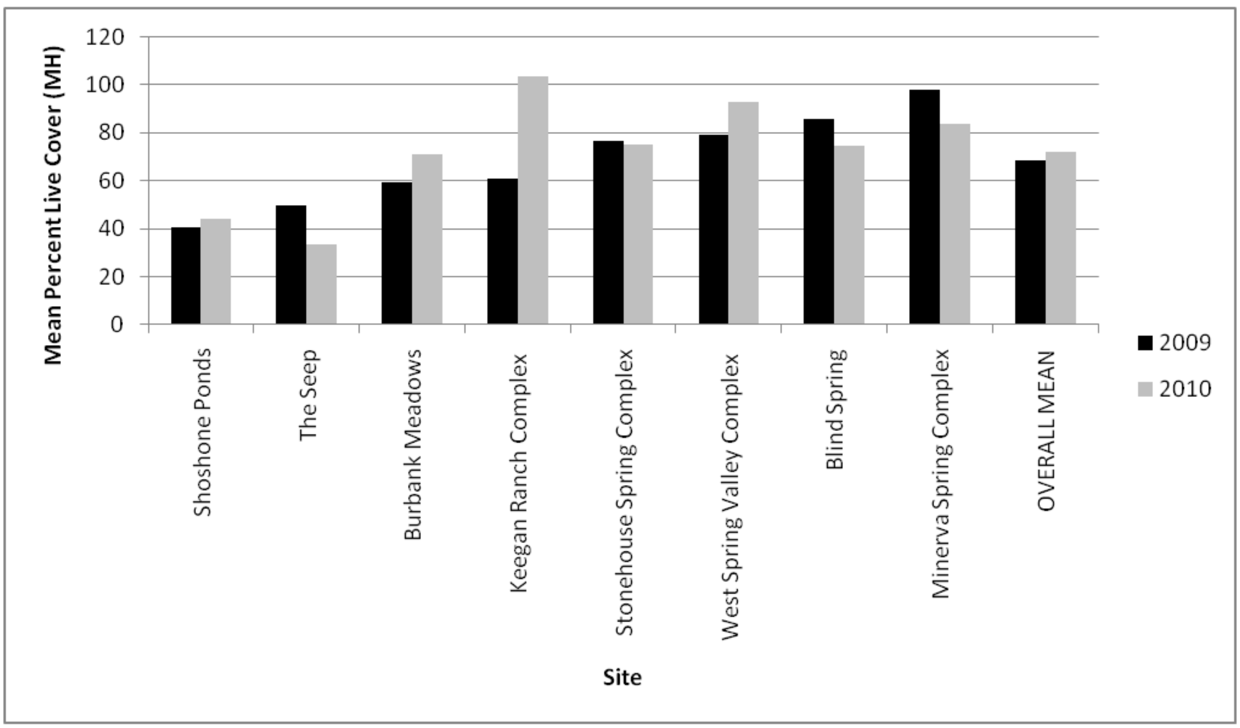
The live cover of some individual species or taxa changed greatly between 2009 and 2010, whereas other species cover varied little between the two years (Appendix E, Tables E-3 and E-6). Taxa that were encountered at many of the wetland/meadow sites (7-8 sites, of the 8 sites) and that had relatively high mean percent cover among sites were the wetland species *Carex nebrascensis*, *Carex praegracilis*, and *Juncus arcticus* (Appendix E, Table E-6). Minerva Springs Complex and at Blind Spring were noticeably different from the other wetland/meadow sites. At Minerva Springs Complex, it was the grassland species *Schedonorus pratensis*, aquatic species *Potamogeton* sp., and wetland species *Thermopsis rhombifolia* that had relatively high mean percent cover across both 2009 and 2010. At Blind Spring, the aquatic species *Utricularia macrorhiza* in particular had relatively high mean percent cover across both 2009 and 2010.

**Table 3-55. Summary of Mean Live Cover Multiple Hits (MH), Mean Live Cover First Hit (FH), Total Number of Taxa and Mean Taxa Richness on the Wetland/Meadow Transects in Spring and Snake Valleys for 2009 and 2010**

Cover values are averages over all transects per site (grand mean). Total number of taxa is the total number of taxa or species observed across all transects per site. Mean taxa richness is the number of taxa divided by transect length, averaged across all transects per site (grand mean). Significance is for multiple hit (MH) cover between 2009 and 2010, and is based on an ANOVA test.

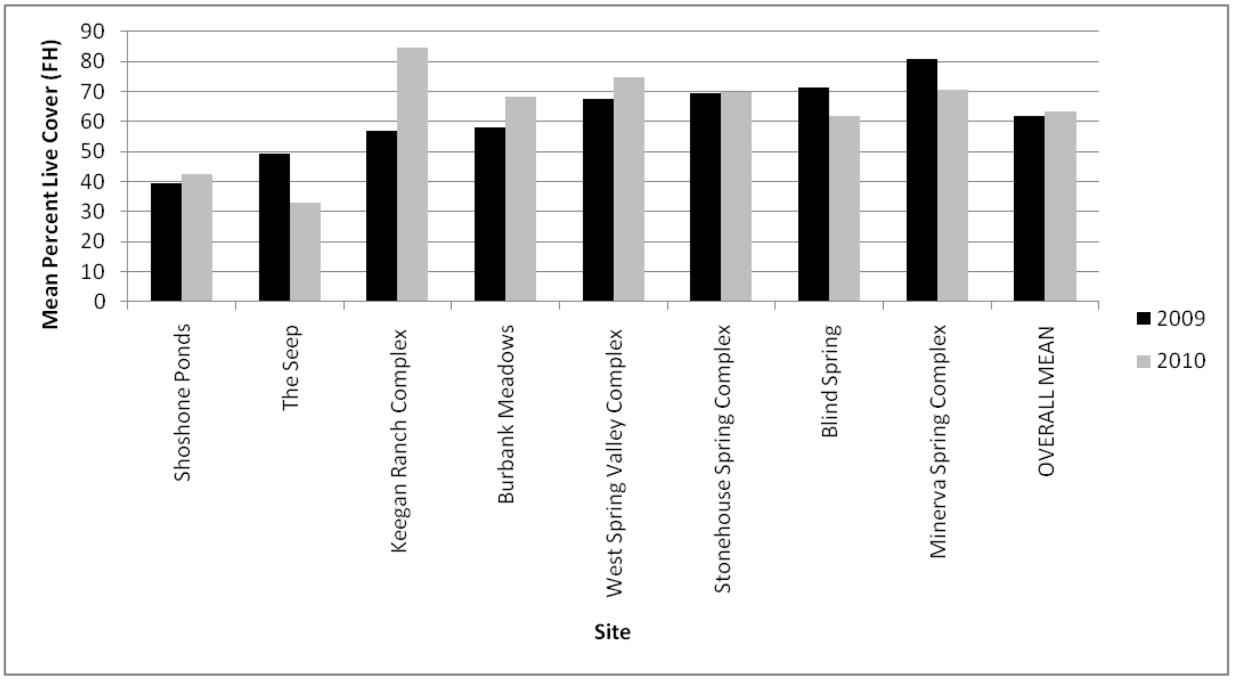
| Site | % Mean Live Cover (MH) | | P ≤0.05 | % Mean Live Cover (FH) | | Total Number of Taxa[a] | | Mean Transect Length (m) | Mean Taxa Richness | |
|---|---|---|---|---|---|---|---|---|---|---|
| | 2009 | 2010 | | 2009 | 2010 | 2009 | 2010 | | 2009 | 2010 |
| Minerva Spring Complex | 98 | 84 | | 81 | 71 | 82 | 78 | 25 | 0.9 | 0.9 |
| Blind Spring | 86 | 75 | | 71 | 62 | 34 | 30 | 34 | 0.4 | 0.5 |
| West Spring Valley Complex | 79 | 93 | | 68 | 75 | 74 | 84 | 22 | 0.8 | 0.9 |
| Stonehouse Spring Complex | 76 | 75 | | 70 | 70 | 70 | 65 | 62 | 0.3 | 0.3 |
| Keegan Spring Complex | 61 | 104 | * | 57 | 85 | 75 | 110 | 64 | 0.3 | 0.5 |
| Burbank Meadows | 60 | 71 | * | 58 | 68 | 55 | 51 | 100 | 0.2 | 0.2 |
| The Seep | 50 | 33 | | 49 | 33 | 44 | 43 | 75 | 0.3 | 0.3 |
| Shoshone Ponds | 41 | 44 | | 39 | 43 | 57 | 68 | 50 | 0.2 | 0.2 |
| **GRAND MEAN** | **69** | **72** | | **62** | **63** | **61** | **66** | | **0.4** | **0.5** |

[a]Total number of taxa is not independent of transect length, which varies across transects and across sites (transect lengths range from 22 to 130 m, with a mean of 33 to 100 m). Total number of taxa in the 2009 report tables may differ than those reported in the current summary table due to species that were combined based on similar species codes (e.g. Moss/ Sp. Moss) in the 2009 data analysis.



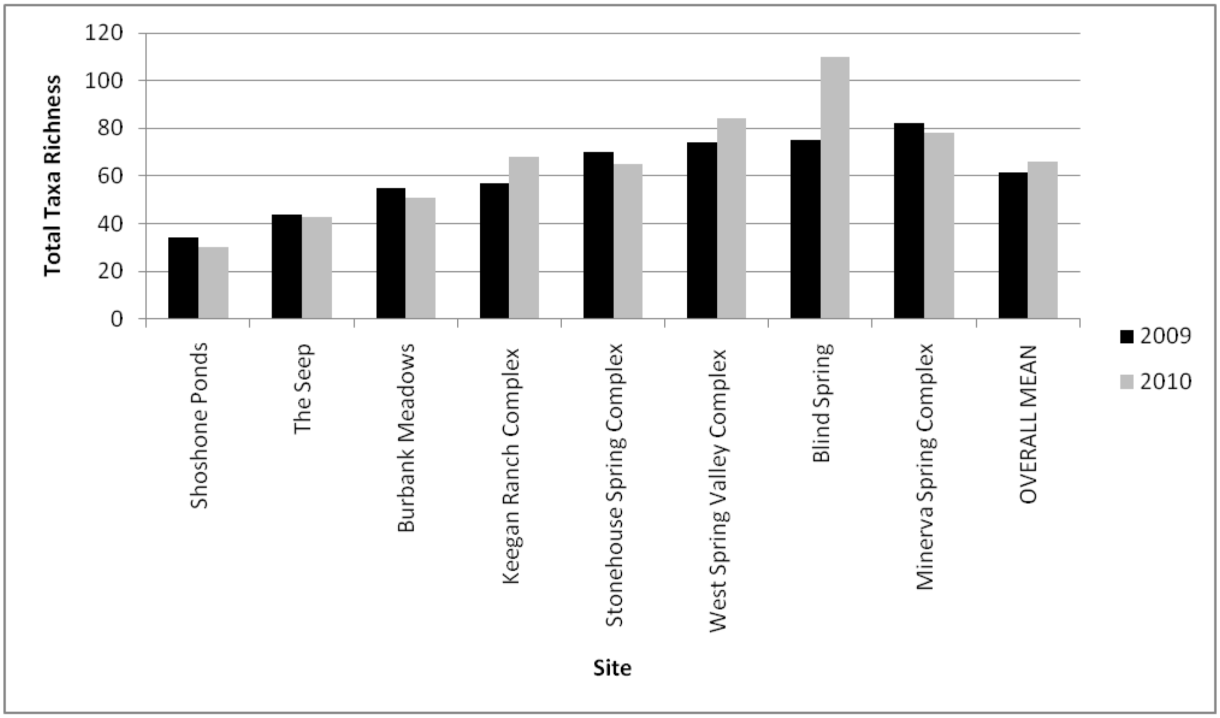

Note: Shown in ascending order based on 2009 data.

**Figure 3-41**
**Mean Live Cover Multiple Hits (MH) in 2009 and 2010 for Wetland/Meadow Sites**



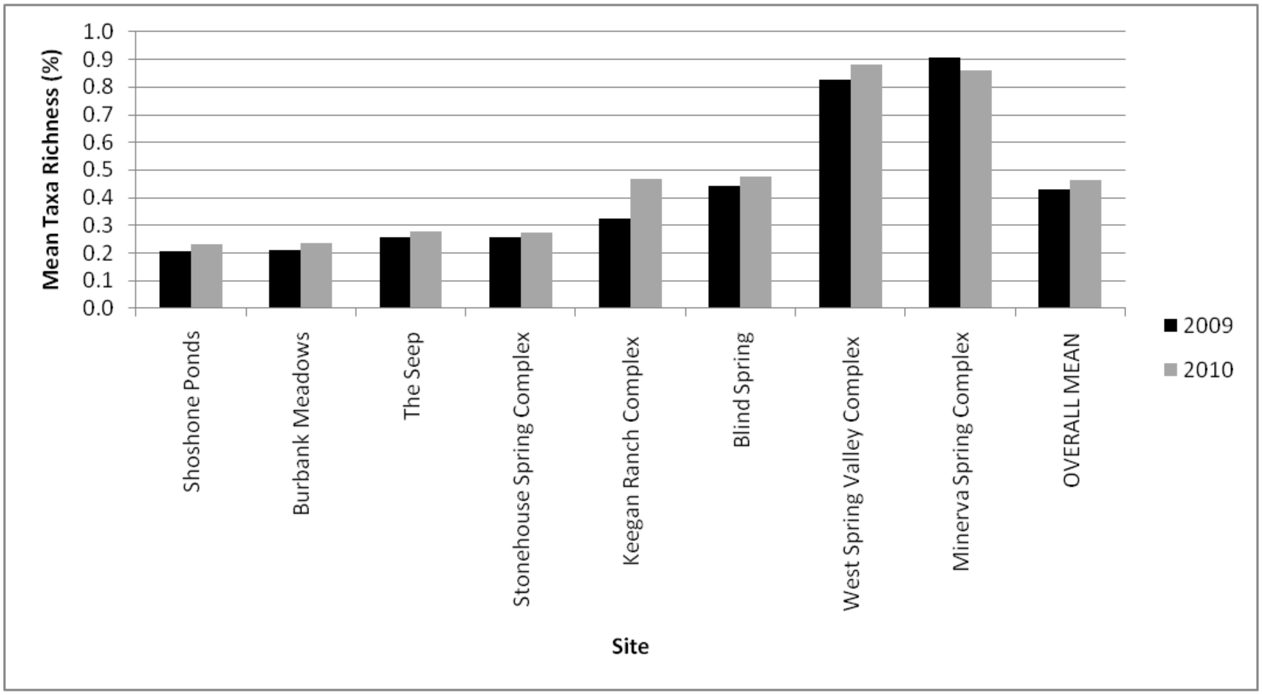

Note: Shown in ascending order based on 2009 data.

**Figure 3-42**
**Mean Live Cover First Hits (FH) in 2009 and 2010 for Wetland/Meadow Sites**




Note: Shown in ascending order based on 2009 data. Total number of taxa is not independent of transect length, which varies across transects and across sites (transect Lengths range from 5-100 m, with a mean of 14-69 m).

**Figure 3-43**
**Total Number of Taxa in 2009 and 2010 for Wetland/Meadow Sites**




Note: Shown in ascending order based on 2009 data. Total number of taxa divided by transect length, averaged across transects.

**Figure 3-44**
**Mean Number of Taxa in 2009 and 2010 for Wetland/Meadow Sites**

### *3.10.2.1 Stonehouse Spring Complex*

The most dominant species, by mean live cover (MH), on the wetland/meadow transects at the Stonehouse Complex were *Carex* sp., *Carex simulata*, *Carex nebrascensis*, *Eleocharis rostellata*, *Carex rostrata*, *Juncus arcticus* and *Eleocharis* sp. (Table 3-56). A total of 65 taxa occurred on the transects in 2010 and this total was average for the eight wetland/meadow sites. Live cover (MH) was about average for these wetland/meadow sites.

*Carex nebrascensis* and *Juncus arcticus* occurred on seven of the ten transects as a dominant or subdominant species. *Carex simulata*, *Carex* sp., *Carex rostrata*, *Carex nebrascensis*, *Eleocharis palustris*, and *Eleocharis* sp., were the most dominant species on several transects.

*Carex nebrascensis* increased significantly from 2009 to 2010 on three transects and only decreased on one of the 10 transects at the Stonehouse Complex (Table 3-56). However, a combination of *Carex* sp. made up primarily of *Carex simulata* and *Carex praegracilis* significantly declined on two transects and only increased on one transect. *Eleocharis* sp., made up of two to four different species, showed an increase in cover on two transects and a decrease in cover on one other transect. *Juncus arcticus* showed some slight increases on some transects and slight decreases on other transects between the two years.

*Nasturtium officinale* showed a large increase in cover on one transect and a drastic decline on another transect. *Argentina anserina* cover remained relatively stable on four of the five transects

**Table 3-56. Mean Live Cover Multiple Hits (MH) for the Most Dominant Species and Total Live Cover for Wetland/Meadow Transects at the Stonehouse Complex for 2009 and 2010 (Page 1 of 3)**

Species are classified as to dominance along the transect as either transect dominant, transect subdominant, or microcommunity dominant. Taxa richness is indicated at the top of the table as total taxa and mean taxa for the transect. N represents the sample size for each species and the asterisk in the significance column represents a significant difference between years based on paired *t*-test comparison.

**Veg_029 N = 102 (Total Taxa for Transect: 2009 = 26; 2010 = 36) (Mean Taxa for Transect: 2009 = 0.3; 2010 = 0.4)**

| Species | Mean Live Cover (MH) 2009 | Mean Live Cover (MH) 2010 | Significance at ≤0.05 | Dominance Classification |
|---|---|---|---|---|
| *Eleocharis rostellata* | 35.80 | 29.85 | * | Transect Dominant |
| *Carex* sp. | 21.08 | 20.37 | | Transect Dominant |
| *Juncus arcticus* ssp. *littoralis* | 8.31 | 8.64 | | Transect Subdominant |
| *Carex nebrascensis* | 4.12 | 5.16 | | Microcommunity Dominant |
| *Glaux maritima* | 3.34 | 4.64 | * | Microcommunity Dominant |
| *Eleocharis palustris* | 2.31 | 0.00 | * | Microcommunity Dominant |
| *Berula erecta* | 1.36 | 0.42 | | Microcommunity Dominant |
| *Argentina anserina* | 0.76 | 1.02 | | Microcommunity Dominant |
| *Nitrophila occidentalis* | 0.75 | 0.80 | | Microcommunity Dominant |
| *Distichlis spicata* | 0.74 | 0.83 | | Microcommunity Dominant |
| *Nasturtium officinale* | 0.00 | 2.01 | * | Microcommunity Dominant |
| **Total Live Cover** | **81.55** | **81.04** | | |

Based on field data and the distribution of hits along the transect, species listed as *Carex simulata* or *Carex praegracilis* in 2009 or 2010 were analyzed as *Carex* sp. for *t*-test analysis.

**Veg_030 N = 93 (Total Taxa for Transect: 2009 = 21; 2010 = 21) (Mean Taxa for Transect: 2009 = 0.2; 2010 = 0.2)**

| Species | Mean Live Cover (MH) 2009 | Mean Live Cover (MH) 2010 | Significance at ≤0.05 | Dominance Classification |
|---|---|---|---|---|
| *Eleocharis* sp. | 29.69 | 23.44 | * | |
| *Carex simulata* | 21.55 | 26.53 | * | Transect Dominant |
| *Juncus arcticus* ssp. *littoralis* | 13.52 | 12.67 | | Transect Subdominant |
| *Carex nebrascensis* | 13.00 | 14.67 | | Transect Subdominant |
| *Iris missouriensis* | 5.12 | 6.52 | | Transect Subdominant |
| *Triglochin maritima* | 2.41 | 2.20 | | Microcommunity Dominant |
| *Argentina anserina* | 1.24 | 1.04 | | Microcommunity Dominant |
| *Glaux maritima* | 1.19 | 1.85 | * | Microcommunity Dominant |
| **Total Live Cover** | **91.23** | **91.99** | | |

Based on field data and the distribution of hits along the transect, species listed as *Eleocharis palustris* or *Eleocharis rostellata* in 2009 and *Eleocharis parishii* or *Eleocharis rostellata* in 2010 were analyzed as *Eleocharis* sp. for *t*-test analysis.

**Veg_031 N = 100 (Total Taxa for Transect: 2009 = 27; 2010 = 28) (Mean Taxa for Transect: 2009 = 0.3; 2010 = 0.3)**

| Species | Mean Live Cover (MH) 2009 | Mean Live Cover (MH) 2010 | Significance at ≤0.05 | Dominance Classification |
|---|---|---|---|---|
| *Carex nebrascensis* | 13.10 | 12.90 | | Transect Subdominant |
| *Carex* sp. | 12.06 | 8.85 | * | Transect Subdominant |
| *Iris missouriensis* | 6.98 | 8.07 | | Transect Subdominant |
| *Argentina anserina* | 2.13 | 3.49 | * | Microcommunity Dominant |
| *Juncus arcticus* ssp. *littoralis* | 2.02 | 1.24 | * | Microcommunity Dominant |
| *Leymus triticoides* | 1.43 | 1.68 | | Microcommunity Dominant |
| *Puccinellia lemmonii* | 0.92 | 1.88 | * | Microcommunity Dominant |
| *Crepis runcinata* ssp. *glauca* | 0.72 | 0.78 | | Microcommunity Dominant |
| *Eleocharis quinqueflora* | 0.00 | 0.80 | * | Microcommunity Dominant |
| *Hesperochiron pumilus* | 0.00 | 1.43 | * | Microcommunity Dominant |
| **Total Live Cover** | **44.00** | **45.91** | | |

Based on field data and the distribution of hits along the transect, species listed as *Carex praegracilis* in 2009 and *Carex praegracilis* or *Carex simulata* in 2010 were analyzed as *Carex* sp. for *t*-test analysis.

**Table 3-56. Mean Live Cover Multiple Hits (MH) for the Most Dominant Species and Total Live Cover for Wetland/Meadow Transects at the Stonehouse Complex for 2009 and 2010 (Page 2 of 3)**

**Veg_032 N = 95 (Total Taxa for Transect: 2009 = 33; 2010 = 34) (Mean Taxa for Transect: 2009 = 0.3; 2010 = 0.4)**

| Species | Mean Live Cover (MH) 2009 | Mean Live Cover (MH) 2010 | Significance at ≤0.05 | Dominance Classification |
|---|---|---|---|---|
| *Eleocharis* sp. | 26.87 | 27.54 | | Transect Dominant |
| *Carex simulata* | 18.83 | 13.68 | * | Transect Subdominant |
| *Juncus arcticus* ssp. *littoralis* | 10.30 | 12.21 | | Transect Subdominant |
| *Carex* sp. | 9.43 | 8.71 | | Transect Subdominant |
| *Carex praegracilis* | 7.08 | 3.76 | * | Transect Subdominant |
| *Iris missouriensis* | 2.15 | 2.61 | | Microcommunity Dominant |
| *Distichlis spicata* | 1.76 | 3.74 | * | Microcommunity Dominant |
| *Leymus triticoides* | 1.26 | 1.17 | | Microcommunity Dominant |
| *Argentina anserina* | 1.06 | 2.00 | | Microcommunity Dominant |
| *Crepis runcinata* ssp. *glauca* | 0.55 | 1.27 | | Microcommunity Dominant |
| **Total Live Cover** | **86.44** | **86.58** | | |

Based on field data and the distribution of hits along the transect, species listed as *Carex rostrata* or *Carex nebrascensis* in 2009 and 2010 were analyzed as *Carex* sp. for *t*-test analysis. Based on field data and the distribution of hits along the transect, species listed as *Eleocharis palustris* in 2009 and *Eleocharis rostellata* in 2010 were analyzed as *Eleocharis* sp. for *t*-test analysis.

**Veg_033 N = 100 (Total Taxa for Transect: 2009 = 24; 2010 = 27) (Mean Taxa for Transect: 2009 = 0.2; 2010 = 0.3)**

| Species | Mean Live Cover (MH) 2009 | Mean Live Cover (MH) 2010 | Significance at ≤0.05 | Dominance Classification |
|---|---|---|---|---|
| *Carex* sp. | 55.54 | 48.95 | * | Transect Dominant |
| *Juncus arcticus* ssp. *littoralis* | 12.30 | 16.51 | * | Transect Subdominant |
| *Berula erecta* | 5.96 | 0.00 | * | Microcommunity Dominant |
| *Schoenoplectus acutus var. acutus* | 2.39 | 4.33 | * | Microcommunity Dominant |
| *Puccinellia lemmonii* | 2.07 | 0.66 | * | Microcommunity Dominant |
| *Eleocharis rostellata* | 1.46 | 0.86 | | Microcommunity Dominant |
| *Nasturtium officinale* | 0.46 | 3.32 | * | Microcommunity Dominant |
| *Lemna minuta* | 0.15 | 4.32 | * | Microcommunity Dominant |
| **Total Live Cover** | **84.54** | **84.22** | | |

Based on field data and the distribution of hits along the transect, species listed as *Carex nebrascensis*, *Carex rostrata, Carex simulata* or *Carex praegracilis* in 2009 and *Carex nebrascensis*, *Carex simulata* or *Carex praegracilis* in 2010 were analyzed as *Carex* sp. for *t*-test analysis.

**Veg_034 N = 77 (Total Taxa for Transect: 2009 = 25; 2010 = 26) (Mean Taxa for Transect: 2009 = 0.3; 2010 = 0.3)**

| Species | Mean Live Cover (MH) 2009 | Mean Live Cover (MH) 2010 | Significance at ≤0.05 | Dominance Classification |
|---|---|---|---|---|
| *Carex* sp. | 47.42 | 53.13 | | Transect Dominant |
| *Juncus arcticus* ssp. *littoralis* | 31.34 | 19.23 | * | Transect Dominant |
| *Nasturtium officinale* | 5.83 | 0.00 | * | Microcommunity Dominant |
| *Schoenoplectus acutus var. acutus* | 4.53 | 2.95 | | Microcommunity Dominant |
| *Eleocharis* sp. | 3.71 | 8.75 | * | Transect Subdominant |
| *Berula erecta* | 3.16 | 1.14 | | Microcommunity Dominant |
| Algae | 0.00 | 4.07 | * | Microcommunity Dominant |
| *Lemna minor* | 0.00 | 3.27 | * | Microcommunity Dominant |
| **Total Live Cover** | **101.79** | **98.88** | | |

Based on field data and the distribution of hits along the transect, species listed as *Carex nebrascensis* or *Carex simulata* in 2009 and *Carex nebrascensis*, *Carex rostrata*, *Carex simulata* or *Carex praegracilis* in 2010 were analyzed as *Carex* sp. for *t*-test analysis. Based on field data and the distribution of hits along the transect, species listed as *Eleocharis palustris* or *Eleocharis quinqueflora* in 2009 and *Eleocharis parishii* or *Eleocharis rostellata* in 2010 were analyzed as *Eleocharis* sp. for *t*-test analysis.

**Table 3-56. Mean Live Cover Multiple Hits (MH) for the Most Dominant Species and Total Live Cover for Wetland/Meadow Transects at the Stonehouse Complex for 2009 and 2010 (Page 3 of 3)**

**Veg_035 N = 99 (Total Taxa for Transect: 2009 = 25; 2010 = 21) (Mean Taxa for Transect: 2009 = 0.3; 2010 = 0.2)**

| Species | Mean Live Cover (MH) 2009 | Mean Live Cover (MH) 2010 | Significance at ≤0.05 | Dominance Classification |
|---|---|---|---|---|
| *Carex* sp. | 16.94 | 29.76 | * | Transect Dominant |
| *Carex nebrascensis* | 13.33 | 19.56 | * | Transect Subdominant |
| *Eleocharis* sp. | 7.84 | 11.87 | * | Transect Subdominant |
| *Juncus arcticus* ssp. *littoralis* | 5.09 | 6.08 | | Transect Subdominant |
| *Berula erecta* | 1.04 | 1.21 | | Microcommunity Dominant |
| Moss | 0.00 | 2.01 | * | Microcommunity Dominant |
| **Total Live Cover** | **46.56** | **74.72** | * | |

Based on field data and the distribution of hits along the transect, species listed as *Carex praegracilis* in 2009 and *Carex simulata* or *Carex praegracilis* in 2010 were analyzed as *Carex* sp. for *t*-test analysis. Based on field data and the distribution of hits along the transect, species listed as *Eleocharis rostellata*, *Eleocharis parishii* or *Eleocharis quinqueflora* in 2009 and *Eleocharis rostellata* in 2010 were analyzed as *Eleocharis* sp. for *t*-test analysis.

**Veg_036 N = 100 (Total Taxa for Transect: 2009 = 7; 2010 = 12) (Mean Taxa for Transect: 2009 = 0.1; 2010 = 0.1)**

| Species | Mean Live Cover (MH) 2009 | Mean Live Cover (MH) 2010 | Significance at ≤0.05 | Dominance Classification |
|---|---|---|---|---|
| *Carex simulata* | 51.25 | 44.76 | * | Transect Dominant |
| *Carex rostrata* | 31.56 | 15.97 | * | Transect Dominant |
| *Carex nebrascensis* | 9.10 | 14.04 | * | Transect Subdominant |
| *Typha latifolia* | 4.87 | 2.31 | * | Microcommunity Dominant |
| *Lemna minor* | 0.00 | 2.05 | | Microcommunity Dominant |
| **Total Live Cover** | **98.60** | **80.82** | * | |

Based on field data and the distribution of hits along the transect, species listed as *Typha* sp. in 2010 was analyzed as *Typha latifolia* for *t*-test analysis.

**Veg_037 N = 62 (Total Taxa for Transect: 2009 = 21; 2010 = 19) (Mean Taxa for Transect: 2009 = 0.3; 2010 = 0.3)**

| Species | Mean Live Cover (MH) 2009 | Mean Live Cover (MH) 2010 | Significance at ≤0.05 | Dominance Classification |
|---|---|---|---|---|
| *Carex nebrascensis* | 13.15 | 21.71 | * | Transect Subdominant |
| *Carex* sp. | 10.63 | 9.69 | | Transect Subdominant |
| *Carex rostrata* | 8.45 | 14.00 | * | Transect Subdominant |
| *Juncus arcticus* ssp. *littoralis* | 3.55 | 6.23 | | Microcommunity Dominant |
| *Leymus triticoides* | 1.42 | 1.05 | | Microcommunity Dominant |
| **Total Live Cover** | **40.50** | **58.18** | * | |

Based on field data and the distribution of hits along the transect, species listed as *Carex praegracilis* in 2009 or 2010 were ran as *Carex* sp. for *t*-test analysis.

**Veg_038 N = 78 (Total Taxa for Transect: 2009 = 20; 2010 = 21) (Mean Taxa for Transect: 2009 = 0.3; 2010 = 0.3)**

| Species | Mean Live Cover (MH) 2009 | Mean Live Cover (MH) 2010 | Significance at ≤0.05 | Dominance Classification |
|---|---|---|---|---|
| *Carex nebrascensis* | 44.94 | 26.94 | * | Transect Dominant |
| *Carex* sp. | 10.60 | 3.17 | * | Transect Subdominant |
| *Juncus arcticus* ssp. *littoralis* | 7.62 | 2.69 | * | Microcommunity Dominant |
| *Distichlis spicata* | 4.49 | 4.40 | | Microcommunity Dominant |
| *Agrostis gigantea* | 2.82 | 4.00 | | Microcommunity Dominant |
| *Puccinellia lemmonii* | 1.06 | 1.18 | | Microcommunity Dominant |
| *Argentina anserina* | 0.74 | 1.21 | | Microcommunity Dominant |
| **Total Live Cover** | **75.37** | **47.09** | * | |

Based on field data and the distribution of hits along the transect, species listed as *Carex praegracilis* or *Carex simulata* in 2009 were analyzed as *Carex* sp. for *t*-test analysis.

where it was an important species. Other species showed small changes in cover between the two years. In addition, total live cover remained similar in both years on six of the 10 transects, but increased significantly on two transects but decreased significantly on two other transects (Table 3-56).

### *3.10.2.2 Keegan Spring Complex North*

The dominant taxa, by mean live cover (MH), on the wetland/meadow transects at the Keegan Spring Complex were *Thermopsis rhombifolia*, *Carex nebrascensis*, *Carex* sp., *Argentina anserine*, *Juncus arcticus, Carex praegracilis, Carex simulate, Typha latifolia*, *Leymus triticoides* and moss. A total of 110 taxa occurred on the eight transects in 2010 and this was the highest among the eight wetland/meadow sites. Mean live cover (MH) exceeded 100% and this was well above average for the eight wetland/meadow sites.

Cover of individual species on the eight transects at the Keegan Spring Complex varied considerably between 2009 and 2010. The grasses, including *Agrostis gigantea*, *Poa* sp., *Puccinellia lemmonii*, *Leymus triticoides*, *Muhlenbergia asperifolia*, *Distichlis spicata*, *Sporobolus airoides*, and *Typha latifolia*, all showed positive increases in cover between the two years (Table 3-57). This was also true for the *Carex* sp., including *Carex nebrascensis*. Most forbs showed few changes in cover between the two years, except for some increases in cover of *Mimulus guttatus* and *Trifolium* spp.

**Table 3-57. Mean Live Cover Multiple Hits (MH) for the Most Dominant Species and Total Live Cover for Wetland/Meadow Transects at Keegan Spring Complex for 2009 and 2010 (Page 1 of 4)**

Species are classified as to dominance along the transect as either transect dominant, transect subdominant, or microcommunity dominant. Taxa richness is indicated at the top of the table as total taxa and mean taxa for the transect. N represents the sample size for each species and the asterisk in the significance column represents a significant difference between years based on paired *t*-test comparison.

**Veg_021 N = 100 (Total Taxa for Transect: 2009 = 33; 2010 = 45) (Mean Taxa for Transect: 2009 = 0.3; 2010 = 0.5)**

| Species | Mean Live Cover (MH) 2009 | Mean Live Cover (MH) 2010 | Significance at ≤0.05 | Dominance Classification |
|---|---|---|---|---|
| Moss | 16.86 | 0.85 | * | Transect Subdominant |
| *Thermopsis rhombifolia* | 14.50 | 14.40 | | Transect Subdominant |
| *Carex* sp. | 10.60 | 4.76 | * | Transect Subdominant |
| *Juncus arcticus* ssp. *littoralis* | 5.13 | 3.13 | * | Microcommunity Dominant |
| *Leymus triticoides* | 4.85 | 13.61 | * | Transect Subdominant |
| *Veronica anagallis-aquatica* | 4.45 | 4.24 | | Microcommunity Dominant |
| *Achillea millefolium* | 4.04 | 3.49 | | Microcommunity Dominant |
| *Carex nebrascensis* | 3.21 | 6.46 | * | Microcommunity Dominant |
| *Nasturtium officinale* | 3.05 | 20.00 | * | Transect Subdominant |
| *Taraxacum officinale* | 3.03 | 3.02 | | Microcommunity Dominant |
| *Schedonorus pratensis* | 2.35 | 0.07 | | Microcommunity Dominant |
| *Agrostis gigantea* | 0.81 | 4.11 | * | Microcommunity Dominant |
| *Poa secunda* | 0.02 | 6.14 | * | Microcommunity Dominant |
| *Eleocharis rostellata* | 0.00 | 2.39 | * | Microcommunity Dominant |
| *Mimulus guttatus* | 0.00 | 10.58 | * | Microcommunity Dominant |
| **Total Live Cover** | **84.54** | **109.40** | * | |

**Veg_022 N = 120 (Total Taxa for Transect: 2009 = 33; 2010 = 54) (Mean Taxa for Transect: 2009 = 0.3; 2010 = 0.5)**

| Species | Mean Live Cover (MH) 2009 | Mean Live Cover (MH) 2010 | Significance at ≤0.05 | Dominance Classification |
|---|---|---|---|---|
| *Juncus arcticus* ssp. *littoralis* | 13.42 | 14.53 | | Transect Subdominant |
| *Thermopsis rhombifolia* | 2.82 | 2.44 | | Microcommunity Dominant |
| *Carex praegracilis* | 2.75 | 2.20 | | Microcommunity Dominant |
| *Carex simulata* | 2.63 | 0.52 | * | Microcommunity Dominant |
| *Puccinellia lemmonii* | 2.60 | 0.00 | * | Microcommunity Dominant |
| *Nasturtium officinale* | 2.30 | 2.93 | | Microcommunity Dominant |
| *Argentina anserina* | 2.28 | 2.25 | | Microcommunity Dominant |
| *Hordeum jubatum* | 2.10 | 4.25 | * | Microcommunity Dominant |
| *Leymus triticoides* | 1.58 | 3.93 | * | Microcommunity Dominant |
| *Veronica anagallis-aquatica* | 1.24 | 2.07 | | Microcommunity Dominant |
| *Mimulus guttatus* | 1.18 | 5.63 | * | Microcommunity Dominant |
| *Taraxacum officinale* | 1.14 | 1.58 | | Microcommunity Dominant |
| *Carex nebrascensis* | 1.12 | 1.93 | | Microcommunity Dominant |
| *Eleocharis rostellata* | 0.79 | 1.28 | | Microcommunity Dominant |
| *Berula erecta* | 0.58 | 0.98 | | Microcommunity Dominant |
| *Poa secunda* | 0.44 | 1.72 | * | Microcommunity Dominant |
| *Agrostis gigantea* | 0.43 | 2.38 | * | Microcommunity Dominant |
| *Eleocharis quinqueflora* | 0.00 | 2.20 | * | Microcommunity Dominant |
| **Total Live Cover** | **50.23** | **71.89** | * | |

**Table 3-57. Mean Live Cover Multiple Hits (MH) for the Most Dominant Species and Total Live Cover for Wetland/Meadow Transects at Keegan Spring Complex for 2009 and 2010 (Page 2 of 4)**

**Veg_023 N = 64 (Total Taxa for Transect: 2009 = 33; 2010 = 43) (Mean Taxa for Transect: 2009 = 0.5; 2010 = 0.7)**

| Species | Mean Live Cover (MH) 2009 | Mean Live Cover (MH) 2010 | Significance at ≤0.05 | Dominance Classification |
|---|---|---|---|---|
| *Carex* sp. | 15.70 | 19.08 | | Transect Subdominant |
| *Argentina anserina* | 13.45 | 21.30 | | Transect Subdominant |
| *Thermopsis rhombifolia* | 10.52 | 20.00 | | Transect Subdominant |
| *Juncus arcticus* ssp. *littoralis* | 4.94 | 5.00 | | Microcommunity Dominant |
| *Sporobolus airoides* | 4.50 | 7.45 | | Microcommunity Dominant |
| *Distichlis spicata* | 3.88 | 5.50 | | Microcommunity Dominant |
| *Poa pratensis* | 2.00 | 4.67 | | Microcommunity Dominant |
| *Leymus triticoides* | 1.80 | 5.47 | * | Microcommunity Dominant |
| *Sparganium angustifolium* | 1.33 | 13.22 | * | Transect Subdominant |
| *Agrostis gigantea* | 0.50 | 2.64 | | Microcommunity Dominant |
| *Trifolium repens* | 0.34 | 4.34 | * | Microcommunity Dominant |
| *Sium suave* | 0.20 | 2.91 | | Microcommunity Dominant |
| **Total Live Cover** | **64.45** | **129.67** | * | |

Based on field data and the distribution of hits along the transect, species listed as *Carex nebrascensis* or *Carex praegracilis* in 2009 and *Carex nebrascensis*, *Carex simulata*, or *Carex praegracilis* in 2010 were analyzed as *Carex* sp. for *t*-test analysis.

**Veg_024 N = 99 (Total Taxa for Transect: 2009 = 27; 2010 = 49) (Mean Taxa for Transect: 2009 = 0.3; 2010 = 0.5)**

| Species | Mean Live Cover (MH) 2009 | Mean Live Cover (MH) 2010 | Significance at ≤0.05 | Dominance Classification |
|---|---|---|---|---|
| *Carex praegracilis* | 12.29 | 16.72 | * | Transect Subdominant |
| *Thermopsis rhombifolia* | 10.44 | 12.91 | | Transect Subdominant |
| *Argentina anserina* | 6.27 | 8.18 | * | Transect Subdominant |
| *Poa* sp. | 4.18 | 6.72 | * | Microcommunity Dominant |
| *Sporobolus airoides* | 3.94 | 8.63 | * | Transect Subdominant |
| *Crepis runcinata* ssp. *glauca* | 3.59 | 5.07 | * | Microcommunity Dominant |
| *Eleocharis* sp. | 3.52 | 2.12 | | Microcommunity Dominant |
| *Distichlis spicata* | 3.39 | 6.27 | * | Microcommunity Dominant |
| *Juncus arcticus* ssp. *littoralis* | 3.10 | 2.25 | | Microcommunity Dominant |
| *Leymus triticoides* | 1.70 | 4.88 | * | Microcommunity Dominant |
| *Puccinellia lemmonii* | 1.18 | 6.99 | * | Microcommunity Dominant |
| *Equisetum arvense* | 0.64 | 1.43 | * | Microcommunity Dominant |
| *Agrostis gigantea* | 0.44 | 2.44 | * | Microcommunity Dominant |
| *Spartina gracilis* | 0.00 | 3.26 | * | Microcommunity Dominant |
| **Total Live Cover** | **59.70** | **97.88** | * | |

Based on field data and the distribution of hits along the transect, species listed as *Poa secunda* in 2009 and *Poa pratensis* or *Poa secunda* in 2010 were analyzed as *Poa* sp. for *t*-test analysis. Based on field data and the distribution of hits along the transect, species listed as *Eleocharis palustris* in 2009 and *Eleocharis palustris* or *Eleocharis rostellata* in 2010 were analyzed as *Eleocharis* sp. for *t*-test analysis.

**Table 3-57. Mean Live Cover Multiple Hits (MH) for the Most Dominant Species and Total Live Cover for Wetland/Meadow Transects at Keegan Spring Complex for 2009 and 2010 (Page 3 of 4)**

**Veg_025 N = 99 (Total Taxa for Transect: 2009 = 31; 2010 = 43) (Mean Taxa for Transect: 2009 = 0.3; 2010 = 0.4)**

| Species | Mean Live Cover (MH) 2009 | Mean Live Cover (MH) 2010 | Significance at ≤0.05 | Dominance Classification |
|---|---|---|---|---|
| *Carex nebrascensis* | 14.86 | 28.12 | * | Transect Dominant |
| *Juncus arcticus* ssp. *littoralis* | 7.03 | 20.71 | * | Transect Subdominant |
| *Argentina anserina* | 6.54 | 8.47 | * | Transect Subdominant |
| *Thermopsis rhombifolia* | 5.11 | 3.74 | | Microcommunity Dominant |
| *Carex praegracilis* | 3.32 | 5.41 | * | Microcommunity Dominant |
| *Hordeum brachyantherum* | 3.13 | 2.56 | | Microcommunity Dominant |
| *Leymus triticoides* | 2.59 | 13.86 | * | Transect Subdominant |
| *Hordeum jubatum* | 2.30 | 5.98 | * | Microcommunity Dominant |
| *Ericameria nauseosa* | 1.82 | 1.10 | | Microcommunity Dominant |
| *Poa secunda* | 1.12 | 3.99 | * | Microcommunity Dominant |
| *Cirsium vulgare* | 0.96 | 0.17 | | Microcommunity Dominant |
| *Eleocharis palustris* | 0.41 | 2.09 | * | Microcommunity Dominant |
| *Muhlenbergia asperifolia* | 0.00 | 3.76 | * | Microcommunity Dominant |
| **Total Live Cover** | **55.47** | **111.11** | * | |

**Veg_026 N = 130 (Total Taxa for Transect: 2009 = 37; 2010 = 51) (Mean Taxa for Transect: 2009 = 0.3; 2010 = 0.4)**

| Species | Mean Live Cover (MH) 2009 | Mean Live Cover (MH) 2010 | Significance at ≤0.05 | Dominance Classification |
|---|---|---|---|---|
| *Carex nebrascensis* | 9.91 | 13.63 | * | Transect Subdominant |
| Moss | 9.80 | 0.99 | * | Transect Subdominant |
| *Distichlis spicata* | 6.74 | 9.00 | * | Transect Subdominant |
| *Carex simulata* | 6.09 | 9.20 | * | Transect Subdominant |
| *Argentina anserina* | 3.11 | 2.89 | | Microcommunity Dominant |
| *Carex praegracilis* | 2.91 | 3.13 | | Microcommunity Dominant |
| *Juncus arcticus* ssp. *littoralis* | 2.70 | 3.13 | | Microcommunity Dominant |
| *Sporobolus airoides* | 2.61 | 5.99 | * | Microcommunity Dominant |
| *Utricularia macrorhiza* | 2.13 | 0.72 | | Microcommunity Dominant |
| *Poa* sp. | 1.95 | 2.33 | | Microcommunity Dominant |
| Algae | 1.80 | 1.44 | | Microcommunity Dominant |
| *Schoenoplectus acutus var. acutus* | 1.35 | 0.67 | * | Microcommunity Dominant |
| *Leymus triticoides* | 1.22 | 2.94 | * | Microcommunity Dominant |
| *Spartina gracilis* | 1.21 | 0.31 | * | Microcommunity Dominant |
| *Typha latifolia* | 0.88 | 2.78 | * | Microcommunity Dominant |
| *Puccinellia lemmonii* | 0.77 | 1.19 | * | Microcommunity Dominant |
| *Ericameria nauseosa* | 0.72 | 0.25 | | Microcommunity Dominant |
| *Trifolium repens* | 0.41 | 0.62 | | Microcommunity Dominant |
| *Polygonum amphibium* | 0.00 | 2.66 | * | Microcommunity Dominant |
| **Total Live Cover** | **60.98** | **70.04** | * | |

Based on field data and the distribution of hits along the transect, species listed as *Poa secunda* in 2009 and *Poa pratensis* or *Poa secunda* in 2010 were analyzed as *Poa* sp. for *t*-test analysis.

**Table 3-57. Mean Live Cover Multiple Hits (MH) for the Most Dominant Species and Total Live Cover for Wetland/Meadow Transects at Keegan Spring Complex for 2009 and 2010 (Page 4 of 4)**

**Veg_027 N = 100 (Total Taxa for Transect: 2009 = 21; 2010 = 37) (Mean Taxa for Transect: 2009 = 0.2; 2010 = 0.4)**

| Species | Mean Live Cover (MH) 2009 | Mean Live Cover (MH) 2010 | Significance at ≤0.05 | Dominance Classification |
|---|---|---|---|---|
| *Thermopsis rhombifolia* | 14.84 | 11.05 | * | Transect Subdominant |
| *Carex simulata* | 9.77 | 25.35 | * | Transect Subdominant |
| *Carex praegracilis* | 6.33 | 14.77 | * | Transect Subdominant |
| *Leymus triticoides* | 6.15 | 11.55 | * | Transect Subdominant |
| *Argentina anserina* | 5.80 | 8.48 | * | Transect Subdominant |
| *Carex nebrascensis* | 4.14 | 5.32 | | Microcommunity Dominant |
| *Crepis runcinata* ssp. *glauca* | 3.60 | 3.56 | | Microcommunity Dominant |
| *Juncus arcticus* ssp. *littoralis* | 3.06 | 8.41 | * | Microcommunity Dominant |
| *Taraxacum officinale* | 1.78 | 2.41 | | Microcommunity Dominant |
| *Typha latifolia* | 0.77 | 8.53 | * | Microcommunity Dominant |
| *Puccinellia lemmonii* | 0.34 | 1.65 | * | Microcommunity Dominant |
| *Hordeum jubatum* | 0.29 | 3.71 | * | Microcommunity Dominant |
| *Glaux maritima* | 0.26 | 2.40 | * | Microcommunity Dominant |
| *Hordeum brachyantherum* | 0.07 | 1.15 | * | Microcommunity Dominant |
| *Chara* sp. | 0.00 | 2.39 | * | Microcommunity Dominant |
| *Elymus trachycaulus* | 0.00 | 5.31 | * | Microcommunity Dominant |
| **Total Live Cover** | **59.95** | **126.06** | * | |

**Veg_028 N = 78 (Total Taxa for Transect: 2009 = 31; 2010 = 37) (Mean Taxa for Transect: 2009 = 0.4; 2010 = 0.5)**

| Species | Mean Live Cover (MH) 2009 | Mean Live Cover (MH) 2010 | Significance at ≤0.05 | Dominance Classification |
|---|---|---|---|---|
| *Carex nebrascensis* | 11.41 | 17.77 | * | Transect Subdominant |
| *Carex* sp. | 8.56 | 16.67 | * | Transect Subdominant |
| *Typha latifolia* | 7.40 | 12.67 | * | Transect Subdominant |
| Algae | 3.30 | 1.82 | | Microcommunity Dominant |
| *Bidens cernua* | 2.81 | 3.49 | | Microcommunity Dominant |
| *Juncus arcticus* ssp. *littoralis* | 2.50 | 1.19 | * | Microcommunity Dominant |
| *Nasturtium officinale* | 1.87 | 3.19 | | Microcommunity Dominant |
| *Mimulus guttatus* | 1.44 | 3.85 | * | Microcommunity Dominant |
| *Berula erecta* | 1.01 | 6.82 | * | Microcommunity Dominant |
| *Thermopsis rhombifolia* | 0.94 | 2.80 | | Microcommunity Dominant |
| *Leymus triticoides* | 0.62 | 0.00 | | Microcommunity Dominant |
| *Juncus nevadensis* | 0.17 | 5.45 | * | Microcommunity Dominant |
| *Agrostis gigantea* | 0.00 | 5.99 | * | Microcommunity Dominant |
| *Sparganium emersum* | 0.00 | 5.12 | * | Microcommunity Dominant |
| *Trifolium* sp. | 0.00 | 6.92 | * | Microcommunity Dominant |
| **Total Live Cover** | **48.45** | **111.74** | * | |

### 3.10.2.3 West Spring Valley Complex 1

The West Spring Valley Complex is made up of several large springs forming fairly deep spring pools and channels running from the spring pools to a terminal pond. The dominant and subdominant taxa on the wetland/meadow transects at the West Spring Valley Complex were *Juncus arcticus, Eleocharis rostellata, Thermopsis rhombifolia, Cirsium arvense, Berula erecta, Carex nebrascensis, Carex* sp., *Carex praegracilis, Lemna minor, Lemna* sp., and *Agrostis gigantea* (Table 3-58). A total of 84 taxa occurred on the transects in 2010 and this total was the second highest species richness for the eight sites. Mean live cover (MH) was above average for the eight wetland/meadow sites.

Although transects were sampled almost two weeks earlier in 2010 than in 2009, total live vegetation cover was still significantly greater (P ≤0.05) in 2010 than in 2009 on five of the eight transects (Table 3-58). These increases in total cover resulted from small to moderate increases in cover of *Carex nebrascensis* and *Carex praegracilis*. There were also some increases in a few of the forbs, notably *Thermopsis rhombifolia* and *Berula erecta*.

**Table 3-58. Mean Live Cover Multiple Hits (MH) for the Most Dominant Species and Total Live Cover for Wetland/ Meadow Transects at West Spring Valley for 2009 and 2010 (Page 1 of 3)**

Species are classified as to dominance along the transect as either transect dominant, transect subdominant, or microcommunity dominant. Taxa richness is indicated at the top of the table as total taxa and mean taxa for the transect. N represents the sample size for each species and the asterisk in the significance column represents a significant difference between years based on paired *t*-test comparison.

**Veg_085 N = 27 (Total Taxa for Transect: 2009 = 36; 2010 = 27) (Mean Taxa for Transect: 2009 = 1.3; 2010 = 1.0)**

| Species | Mean Live Cover (MH) 2009 | Mean Live Cover (MH) 2010 | Significance at ≤0.05 | Dominance Classification |
|---|---|---|---|---|
| *Carex* sp. | 43.93 | 39.44 | | Transect Dominant |
| *Juncus arcticus* ssp. *littoralis* | 12.48 | 6.74 | | Transect Subdominant |
| *Berula erecta* | 10.70 | 7.85 | | Transect Subdominant |
| *Eleocharis rostellata* | 9.41 | 13.89 | | Transect Subdominant |
| *Agrostis gigantea* | 4.07 | 7.07 | | Transect Subdominant |
| *Thermopsis rhombifolia* | 4.04 | 12.56 | | Transect Subdominant |
| *Mimulus guttatus* | 4.00 | 3.15 | | Microcommunity Dominant |
| *Schoenoplectus pungens* | 1.15 | 3.07 | | Microcommunity Dominant |
| *Equisetum arvense* | 1.00 | 0.93 | | Microcommunity Dominant |
| *Epilobium ciliatum* | 0.00 | 13.07 | * | Transect Subdominant |
| *Festuca idahoensis* | 0.00 | 3.19 | | Microcommunity Dominant |
| **Total Live Cover** | **101.00** | **118.96** | * | |

Based on field data and the distribution of hits along the transect, species listed as *Carex nebrascensis*, *Carex rostrata*, *Carex simulata* or *Carex praegracilis* in 2009 and *Carex nebrascensis*, *Carex simulata* or *Carex praegracilis* in 2010 were analyzed as *Carex* sp. for *t*-test analysis.

**Veg_086 N = 26 (Total Taxa for Transect: 2009 = 26; 2010 = 28) (Mean Taxa for Transect: 2009 = 1.0; 2010 = 1.1)**

| Species | Mean Live Cover (MH) 2009 | Mean Live Cover (MH) 2010 | Significance at ≤0.05 | Dominance Classification |
|---|---|---|---|---|
| *Thermopsis rhombifolia* | 23.00 | 21.92 | | Transect Dominant |
| *Cirsium arvense* | 12.54 | 11.69 | | Transect Subdominant |
| *Carex praegracilis* | 10.50 | 4.31 | | Transect Subdominant |
| *Lemna minor* | 10.42 | 28.89 | * | Transect Subdominant |
| *Agrostis gigantea* | 8.65 | 4.08 | * | Transect Subdominant |
| *Juncus arcticus* ssp. *littoralis* | 8.42 | 6.42 | | Transect Subdominant |
| *Eleocharis rostellata* | 8.23 | 5.85 | | Transect Subdominant |
| *Carex* sp. | 5.31 | 5.08 | | Microcommunity Dominant |
| *Equisetum arvense* | 4.19 | 1.35 | | Microcommunity Dominant |
| *Berula erecta* | 3.89 | 1.08 | | Microcommunity Dominant |
| *Carex simulata* | 3.12 | 3.23 | | Microcommunity Dominant |
| *Poa secunda* | 0.04 | 6.39 | * | Microcommunity Dominant |
| **Total Live Cover** | **114.00** | **119.19** | | |

**Table 3-58. Mean Live Cover Multiple Hits (MH) for the Most Dominant Species and Total Live Cover for Wetland/ Meadow Transects at West Spring Valley for 2009 and 2010 (Page 2 of 3)**

**Veg_087 N = 54 (Total Taxa for Transect: 2009 = 31; 2010 = 41) (Mean Taxa for Transect: 2009 = 0.6; 2010 = 0.8)**

| Species | Mean Live Cover (MH) 2009 | Mean Live Cover (MH) 2010 | Significance at ≤0.05 | Dominance Classification |
|---|---|---|---|---|
| *Carex* sp. | 38.26 | 37.48 | | Transect Dominant |
| *Eleocharis rostellata* | 34.85 | 29.69 | | Transect Dominant |
| *Juncus arcticus* ssp. *littoralis* | 9.06 | 7.85 | | Transect Subdominant |
| *Thermopsis rhombifolia* | 7.56 | 9.57 | | Transect Subdominant |
| *Agrostis gigantea* | 4.96 | 4.07 | | Microcommunity Dominant |
| *Berula erecta* | 2.52 | 4.06 | | Microcommunity Dominant |
| *Distichlis spicata* | 2.44 | 0.65 | | Microcommunity Dominant |
| *Typha latifolia* | 2.43 | 3.76 | | Microcommunity Dominant |
| *Mimulus guttatus* | 2.41 | 2.22 | | Microcommunity Dominant |
| *Ericameria nauseosa* | 1.06 | 0.82 | | Microcommunity Dominant |
| *Festuca idahoensis* | 0.00 | 2.13 | | Microcommunity Dominant |
| **Total Live Cover** | **119.06** | **118.32** | | |

Based on field data and the distribution of hits along the transect, species listed as *Carex nebrascensis* in 2009 and *Carex nebrascensis*, *Carex simulata* or *Carex praegracilis* in 2010 were analyzed as *Carex* sp. for *t*-test analysis.

**Veg_088 N = 38 (Total Taxa for Transect: 2009 = 31; 2010 = 33) (Mean Taxa for Transect: 2009 = 0.8; 2010 = 0.9)**

| Species | Mean Live Cover (MH) 2009 | Mean Live Cover (MH) 2010 | Significance at ≤0.05 | Dominance Classification |
|---|---|---|---|---|
| *Cirsium arvense* | 20.82 | 14.61 | * | Transect Subdominant |
| *Berula erecta* | 16.79 | 14.47 | | Transect Subdominant |
| *Phragmites australis* | 15.11 | 3.11 | * | Transect Subdominant |
| *Thermopsis rhombifolia* | 9.84 | 14.53 | | Transect Subdominant |
| *Carex nebrascensis* | 6.63 | 4.63 | | Transect Subdominant |
| *Lemna minor* | 6.29 | 9.87 | | Transect Subdominant |
| *Agrostis gigantea* | 5.45 | 2.58 | * | Microcommunity Dominant |
| *Schoenoplectus acutus* | 4.66 | 1.58 | * | Microcommunity Dominant |
| *Ericameria nauseosa* | 3.42 | 3.18 | | Microcommunity Dominant |
| *Juncus arcticus* ssp. *littoralis* | 3.18 | 3.50 | | Microcommunity Dominant |
| *Argentina anserina* | 2.95 | 4.58 | | Microcommunity Dominant |
| *Poa pratensis* | 1.95 | 0.24 | * | Microcommunity Dominant |
| *Schedonorus pratensis* | 1.58 | 1.40 | | Microcommunity Dominant |
| *Carex praegracilis* | 1.16 | 4.71 | * | Microcommunity Dominant |
| **Total Live Cover** | **111.55** | **94.00** | * | |

**Veg_089 N = 32 (Total Taxa for Transect: 2009 = 21; 2010 = 30) (Mean Taxa for Transect: 2009 = 0.7; 2010 = 0.9)**

| Species | Mean Live Cover (MH) 2009 | Mean Live Cover (MH) 2010 | Significance at ≤0.05 | Dominance Classification |
|---|---|---|---|---|
| *Lemna* sp. | 31.53 | 31.50 | | Transect Dominant |
| *Carex nebrascensis* | 8.63 | 19.59 | * | Transect Subdominant |
| *Mimulus guttatus* | 6.72 | 14.25 | * | Transect Subdominant |
| *Berula erecta* | 5.78 | 12.44 | * | Transect Subdominant |
| *Sparganium angustifolium* | 3.25 | 3.66 | | Microcommunity Dominant |
| *Argentina anserina* | 1.53 | 3.66 | | Microcommunity Dominant |
| *Juncus* sp. | 1.38 | 10.44 | * | Transect Subdominant |
| *Schoenoplectus acutus var. acutus* | 0.84 | 2.44 | * | Microcommunity Dominant |
| *Juncus arcticus* ssp. *littoralis* | 0.53 | 1.75 | | Microcommunity Dominant |
| *Medicago polymorpha* | 0.44 | 0.09 | | Microcommunity Dominant |
| *Poa secunda* | 0.41 | 0.34 | | Microcommunity Dominant |
| Algae | 0.00 | 23.56 | * | Transect Subdominant |
| *Ericameria nauseosa* | 0.00 | 2.03 | | Microcommunity Dominant |
| **Total Live Cover** | **63.94** | **139.38** | * | |

Based on field data and the distribution of hits along the transect, species listed as *Juncus nevadensis* in 2010 were analyzed as *Juncus* sp. for *t*-test analysis. Based on field data and the distribution of hits along the transect, species listed as *Lemna minor* in 2010 were analyzed as *Lemna* sp. for *t*-test analysis. Based on field data and the distribution of hits along the transect, species listed as *Schoenoplectus acutus* in 2010 were analyzed as *Schoenoplectus acutus* var. *acutus* for *t*-test analysis.

**Table 3-58. Mean Live Cover Multiple Hits (MH) for the Most Dominant Species and Total Live Cover for Wetland/ Meadow Transects at West Spring Valley for 2009 and 2010 (Page 3 of 3)**

| Veg_090 N = 22 (Total Taxa for Transect: 2009 = 13; 2010 = 16) (Mean Taxa for Transect: 2009 = 0.6; 2010 = 0.7) | | | | |
|---|---|---|---|---|
| **Species** | **Mean Live Cover (MH) 2009** | **Mean Live Cover (MH) 2010** | **Significance at ≤0.05** | **Dominance Classification** |
| *Juncus arcticus* ssp. *littoralis* | 9.77 | 11.23 | | Transect Subdominant |
| *Carex praegracilis* | 8.86 | 16.09 | * | Transect Subdominant |
| *Cirsium arvense* | 6.05 | 6.00 | | Transect Subdominant |
| *Bromus inermis* | 5.55 | 8.18 | | Transect Subdominant |
| *Iva axillaris* | 4.46 | 4.09 | | Microcommunity Dominant |
| **Total Live Cover** | **40.46** | **54.96** | * | |

| Veg_091 N = 24 (Total Taxa for Transect: 2009 = 27; 2010 = 26) (Mean Taxa for Transect: 2009 = 1.1; 2010 = 1.1) | | | | |
|---|---|---|---|---|
| **Species** | **Mean Live Cover (MH) 2009** | **Mean Live Cover (MH) 2010** | **Significance at ≤0.05** | **Dominance Classification** |
| *Juncus arcticus* ssp. *littoralis* | 11.79 | 15.88 | * | Transect Subdominant |
| *Carex nebrascensis* | 8.71 | 11.17 | | Transect Subdominant |
| *Carex praegracilis* | 3.58 | 6.21 | * | Microcommunity Dominant |
| *Eleocharis palustris* | 3.46 | 10.71 | * | Transect Subdominant |
| *Bromus inermis* | 3.33 | 5.75 | | Microcommunity Dominant |
| *Iva axillaris* | 2.79 | 2.00 | | Microcommunity Dominant |
| *Poa pratensis* | 2.17 | 4.29 | | Microcommunity Dominant |
| *Trifolium repens* | 1.92 | 1.58 | | Microcommunity Dominant |
| *Argentina anserina* | 1.54 | 3.25 | | Microcommunity Dominant |
| *Lemna minor* | 0.79 | 0.71 | | Microcommunity Dominant |
| *Sporobolus airoides* | 0.33 | 1.13 | | Microcommunity Dominant |
| **Total Live Cover** | **51.54** | **72.21** | * | |

| Veg_092 N = 44 (Total Taxa for Transect: 2009 = 23; 2010 = 27) (Mean Taxa for Transect: 2009 = 0.5; 2010 = 0.6) | | | | |
|---|---|---|---|---|
| **Species** | **Mean Live Cover (MH) 2009** | **Mean Live Cover (MH) 2010** | **Significance at ≤0.05** | **Dominance Classification** |
| *Schoenoplectus acutus var. acutus* | 9.96 | 6.57 | * | Transect Subdominant |
| *Carex nebrascensis* | 3.46 | 4.32 | | Microcommunity Dominant |
| *Typha latifolia* | 2.50 | 2.27 | | Microcommunity Dominant |
| *Berula erecta* | 2.41 | 0.75 | | Microcommunity Dominant |
| *Cirsium arvense* | 1.46 | 1.89 | | Microcommunity Dominant |
| *Iva axillaris* | 1.09 | 1.23 | | Microcommunity Dominant |
| *Poa pratensis* | 1.02 | 0.91 | | Microcommunity Dominant |
| *Carex* sp. | 0.77 | 2.84 | * | Microcommunity Dominant |
| *Muhlenbergia* sp. | 0.34 | 1.14 | | Microcommunity Dominant |
| *Equisetum arvense* | 0.18 | 0.86 | | Microcommunity Dominant |
| **Total Live Cover** | **26.75** | **26.86** | | |

Based on field data and the distribution of hits along the transect, species listed as *Carex praegracilis* in 2010 were analyzed as *Carex* sp. for *t*-test analysis. Based on field data and the distribution of hits along the transect, species listed as *Muhlenbergia richardsonis* in 2009 and 2010 were analyzed as *Muhlenbergia* sp. for *t*-test analysis. Based on field data and the distribution of hits along the transect, species listed as *Schoenoplectus acutus* in 2010 were analyzed as *Schoenoplectus acutus* var. *acutus* for *t*-test analysis. Based on field data and the distribution of hits along the transect, species listed as *Typha* sp. in 2010 were analyzed as *Typha latifolia* for *t*-test analysis.

### *3.10.2.4 Minerva Spring Complex (North and Middle)*

The Minerva Spring Complex is made up of a number of springs and seeps that occur in various geographic positions, from hill slope to bottoms. In addition, irrigation surface water is brought into this area through ditches that originate at the base of the mountains to the east of southern Spring Valley. Flood irrigation is practiced on meadows at the south end of the valley.

A total of 78 taxa occurred on the transects in 2010 and this was the third-highest number among the eight wetland/meadow sites. This site also has the third-highest mean live cover (MH) in 2010. The dominant and subdominant taxa, by mean live cover (MH), on the seven wetland/meadow transects at the Minerva Spring Complex were *Schedonorus pratensis, Carex nebrascensis, Carex* sp., *Potamogeton* sp., *Agrostis gigantea, Elymus trachycaulus, Hordeum jubatum, Thermopsis rhombifolia*, *Rosa woodsii*, and *Eleocharis rostellata* (Table 3-59). Fifteen species on the transects showed significant decreases in cover between 2009 and 2010, whereas 13 species showed increased cover between the two years (Table 3-59).

There was a significant decrease in total live cover on three transects in 2010. Transect 004 had the greatest decrease in cover with six species having less cover in 2010 than in 2009. There was an increase in total live cover on only one transect (009) in 2010 (Table 3-59). Two less palatable species, *Bromus tectorum* and *Juncus arcticus*, had significantly greater cover in 2010 than 2009.

**Table 3-59. Mean Live Cover Multiple Hits (MH) for the Most Dominant Species and Total Live Cover for Wetland/ Meadow Transects at Minerva Spring Complex (North and Middle) for 2009 and 2010 (Page 1 of 3)**

Species are classified as to dominance along the transect as either transect dominant, transect subdominant, or microcommunity dominant. Taxa richness is indicated at the top of the table as total taxa and mean taxa for the transect. N represents the sample size for each species and the asterisk in the significance column represents a significant difference between years based on paired *t*-test comparison.

**Veg_002 N = 50 (Total Taxa for Transect: 2009 = 39; 2010 = 37) (Mean Taxa for Transect: 2009 = 0.8; 2010 = 0.7)**

| Species | Mean Live Cover (MH) 2009 | Mean Live Cover (MH) 2010 | Significance at ≤0.05 | Dominance Classification |
|---|---|---|---|---|
| *Elymus trachycaulus* | 24.00 | 17.30 | * | Transect Dominant |
| *Thermopsis rhombifolia* | 12.18 | 3.58 | * | Transect Subdominant |
| *Agrostis gigantea* | 10.34 | 10.28 | | Transect Subdominant |
| *Nasturtium officinale* | 7.20 | 0.96 | * | Microcommunity Dominant |
| *Hordeum jubatum* | 6.20 | 2.50 | * | Microcommunity Dominant |
| *Schedonorus pratensis* | 3.84 | 2.88 | | Microcommunity Dominant |
| *Achillea millefolium* | 3.22 | 3.82 | | Microcommunity Dominant |
| *Poa* sp. | 3.20 | 5.16 | | Microcommunity Dominant |
| *Medicago polymorpha* | 3.00 | 0.16 | * | Microcommunity Dominant |
| *Carex praegracilis* | 2.08 | 0.82 | | Microcommunity Dominant |
| *Juncus* sp. | 2.06 | 4.88 | * | Microcommunity Dominant |
| *Eleocharis rostellata* | 1.86 | 4.08 | * | Microcommunity Dominant |
| *Berula erecta* | 1.56 | 1.32 | | Microcommunity Dominant |
| *Carex nebrascensis* | 1.30 | 3.58 | * | Microcommunity Dominant |
| *Cirsium scariosum* | 0.38 | 2.80 | * | Microcommunity Dominant |
| *Thelesperma megapotamicum* | 0.00 | 9.52 | * | Microcommunity Dominant |
| **Total Live Cover** | **93.82** | **78.32** | * | |

Based on field data and the distribution of hits along the transect, species listed as *Poa pratensis* or *Poa secunda* in 2009 and *Poa secunda* in 2010 were analyzed as *Poa* sp. for *t*-test analysis. Based on field data and the distribution of hits along the transect, species listed as *Juncus arcticus* ssp. *littoralis* or *Juncus nevadensis* in 2009 and *Juncus arcticus* ssp. *littoralis* in 2010 were analyzed as *Juncus* sp. for *t*-test analysis.

**Table 3-59. Mean Live Cover Multiple Hits (MH) for the Most Dominant Species and Total Live Cover for Wetland/ Meadow Transects at Minerva Spring Complex (North and Middle) for 2009 and 2010 (Page 2 of 3)**

**Veg_003 N = 30 (Total Taxa for Transect: 2009 = 34; 2010 = 25) (Mean Taxa for Transect: 2009 = 1.1; 2010 = 0.8)**

| Species | Mean Live Cover (MH) 2009 | Mean Live Cover (MH) 2010 | Significance at ≤0.05 | Dominance Classification |
|---|---|---|---|---|
| *Elymus trachycaulus* | 14.50 | 9.43 | | Transect Subdominant |
| *Sporobolus airoides* | 11.03 | 12.40 | | Transect Subdominant |
| *Puccinellia lemmonii* | 7.27 | 6.13 | | Transect Subdominant |
| *Leymus triticoides* | 5.60 | 0.30 | * | Microcommunity Dominant |
| *Bassia scoparia* | 5.57 | 0.53 | * | Microcommunity Dominant |
| *Pascopyrum smithii* | 4.83 | 0.00 | * | Microcommunity Dominant |
| *Carex praegracilis* | 3.73 | 1.67 | * | Microcommunity Dominant |
| *Agrostis gigantea* | 3.03 | 2.23 | | Microcommunity Dominant |
| *Argentina anserina* | 1.80 | 0.73 | | Microcommunity Dominant |
| *Hordeum jubatum* | 1.80 | 0.00 | | Microcommunity Dominant |
| *Achillea millefolium* | 1.47 | 0.87 | | Microcommunity Dominant |
| **Total Live Cover** | **74.37** | **42.80** | * | |

**Veg_004 N = 60 (Total Taxa for Transect: 2009 = 35; 2010 = 26) (Mean Taxa for Transect: 2009 = 0.6; 2010 = 0.4)**

| Species | Mean Live Cover (MH) 2009 | Mean Live Cover (MH) 2010 | Significance at ≤0.05 | Dominance Classification |
|---|---|---|---|---|
| *Potamogeton* sp. | 27.25 | 26.32 | * | Transect Dominant |
| *Hordeum jubatum* | 25.80 | 4.43 | * | Transect Subdominant |
| *Schedonorus pratensis* | 11.43 | 17.65 | * | Transect Subdominant |
| *Thermopsis rhombifolia* | 10.85 | 7.25 | | Transect Subdominant |
| *Agrostis gigantea* | 10.82 | 1.23 | * | Transect Subdominant |
| *Polygonum aviculare* | 8.97 | 3.40 | * | Microcommunity Dominant |
| *Melilotus officinalis* | 7.57 | 0.00 | * | Microcommunity Dominant |
| *Elymus trachycaulus* | 6.82 | 0.38 | * | Microcommunity Dominant |
| *Poa pratensis* | 6.68 | 5.82 | | Transect Subdominant |
| *Carex nebrascensis* | 3.17 | 2.65 | | Microcommunity Dominant |
| *Juncus arcticus* ssp. *littoralis* | 0.53 | 2.55 | * | Microcommunity Dominant |
| *Leymus triticoides* | 0.37 | 2.33 | | Microcommunity Dominant |
| *Bromus tectorum* | 0.17 | 1.87 | * | Microcommunity Dominant |
| **Total Live Cover** | **129.90** | **82.67** | * | |

**Veg_005 N = 50 (Total Taxa for Transect: 2009 = 50; 2010 = 48) (Mean Taxa for Transect: 2009 = 1.0; 2010 = 1.0)**

| Species | Mean Live Cover (MH) 2009 | Mean Live Cover (MH) 2010 | Significance at ≤0.05 | Dominance Classification |
|---|---|---|---|---|
| *Agrostis gigantea* | 22.20 | 3.48 | * | Transect Subdominant |
| *Schedonorus pratensis* | 19.82 | 20.00 | | Transect Dominant |
| *Potamogeton* sp. | 19.06 | 19.96 | | Transect Dominant |
| *Thermopsis rhombifolia* | 8.62 | 6.78 | | Transect Subdominant |
| *Carex* sp. | 7.48 | 7.38 | | Transect Subdominant |
| *Carex nebrascensis* | 3.06 | 3.36 | | Microcommunity Dominant |
| *Leymus triticoides* | 3.02 | 0.12 | * | Microcommunity Dominant |
| *Puccinellia lemmonii* | 2.30 | 2.24 | | Microcommunity Dominant |
| *Dactylis glomerata* | 1.96 | 0.20 | | Microcommunity Dominant |
| Algae | 1.48 | 9.90 | * | Microcommunity Dominant |
| *Eleocharis palustris* | 1.12 | 2.54 | | Microcommunity Dominant |
| *Iris missouriensis* | 0.94 | 2.12 | | Microcommunity Dominant |
| *Juncus arcticus* ssp. *littoralis* | 0.50 | 4.50 | * | Microcommunity Dominant |
| *Lemna minuta* | 0.42 | 2.42 | | Microcommunity Dominant |
| **Total Live Cover** | **110.42** | **102.78** | | |

Based on field data and the distribution of hits along the transect, species listed as *Carex simulata* in 2009 and 2010 were ran as *Carex* sp. for *t*-test analysis. Based on field data and the distribution of hits along the transect, species listed as *Lemna minuta* in 2009 and *Lemna* sp. in 2010 were analyzed as *Lemna minuta* for *t*-test analysis.

**Table 3-59. Mean Live Cover Multiple Hits (MH) for the Most Dominant Species and Total Live Cover for Wetland/ Meadow Transects at Minerva Spring Complex (North and Middle) for 2009 and 2010 (Page 3 of 3)**

**Veg_006 N = 27 (Total Taxa for Transect: 2009 = 26; 2010 = 30) (Mean Taxa for Transect: 2009 = 0.9; 2010 = 1.1)**

| Species | Mean Live Cover (MH) 2009 | Mean Live Cover (MH) 2010 | Significance at ≤0.05 | Dominance Classification |
|---|---|---|---|---|
| *Rosa woodsii* | 32.85 | 26.44 | | Transect Dominant |
| *Schedonorus pratensis* | 27.74 | 26.11 | | Transect Dominant |
| *Thermopsis rhombifolia* | 22.37 | 17.70 | | Transect Dominant |
| *Agrostis gigantea* | 17.82 | 1.15 | * | Transect Subdominant |
| *Berula erecta* | 8.04 | 2.11 | | Microcommunity Dominant |
| *Medicago polymorpha* | 5.41 | 6.15 | | Microcommunity Dominant |
| *Leymus triticoides* | 4.59 | 0.11 | | Microcommunity Dominant |
| *Carex nebrascensis* | 3.82 | 6.19 | | Microcommunity Dominant |
| *Carex simulata* | 3.82 | 0.00 | | Microcommunity Dominant |
| *Trifolium pratense* | 3.82 | 0.63 | | Microcommunity Dominant |
| *Argentina anserina* | 2.15 | 1.52 | | Microcommunity Dominant |
| *Nasturtium officinale* | 1.89 | 5.22 | | Microcommunity Dominant |
| *Juncus arcticus* ssp. *littoralis* | 0.82 | 3.82 | * | Microcommunity Dominant |
| *Carex praegracilis* | 0.00 | 6.44 | * | Microcommunity Dominant |
| **Total Live Cover** | **146.19** | **115.33** | * | |

**Veg_008 N = 25 (Total Taxa for Transect: 2009 = 28; 2010 = 31) (Mean Taxa for Transect: 2009 = 1.1; 2010 = 1.2)**

| Species | Mean Live Cover (MH) 2009 | Mean Live Cover (MH) 2010 | Significance at ≤0.05 | Dominance Classification |
|---|---|---|---|---|
| *Carex nebrascensis* | 23.56 | 23.48 | | Transect Dominant |
| *Juncus arcticus* ssp. *littoralis* | 7.88 | 0.64 | * | Microcommunity Dominant |
| *Leymus triticoides* | 7.20 | 2.44 | * | Microcommunity Dominant |
| Moss | 6.80 | 2.32 | | Microcommunity Dominant |
| *Carex praegracilis* | 6.00 | 2.76 | * | Microcommunity Dominant |
| *Nasturtium officinale* | 5.84 | 5.36 | | Microcommunity Dominant |
| *Argentina anserina* | 5.48 | 3.40 | | Microcommunity Dominant |
| *Distichlis spicata* | 4.36 | 3.00 | | Microcommunity Dominant |
| *Deschampsia ceaspitosa* | 2.52 | 5.92 | * | Microcommunity Dominant |
| *Eleocharis* sp. | 2.52 | 10.60 | * | Transect Subdominant |
| *Chara* sp. | 2.08 | 0.88 | | Microcommunity Dominant |
| *Agrostis gigantea* | 1.28 | 3.80 | * | Microcommunity Dominant |
| *Potamogeton* sp. | 0.00 | 3.84 | | Microcommunity Dominant |
| **Total Live Cover** | **83.96** | **79.68** | | |

Based on field data and the distribution of hits along the transect, species listed as *Eleocharis palustris* in 2009 and *Eleocharis rostellata* in 2010 were analyzed as *Eleocharis* sp. for *t*-test analysis.

**Veg_009 N = 33 (Total Taxa for Transect: 2009 = 27; 2010 = 25) (Mean Taxa for Transect: 2009 = 0.8; 2010 = 0.8)**

| Species | Mean Live Cover (MH) 2009 | Mean Live Cover (MH) 2010 | Significance at ≤0.05 | Dominance Classification |
|---|---|---|---|---|
| *Eleocharis rostellata* | 14.27 | 28.09 | * | Transect Dominant |
| Algae | 10.42 | 0.00 | * | Microcommunity Dominant |
| *Chara* sp. | 8.03 | 10.55 | | Transect Subdominant |
| *Carex nebrascensis* | 3.88 | 10.06 | * | Transect Subdominant |
| *Agrostis gigantea* | 3.18 | 5.52 | | Microcommunity Dominant |
| *Stuckenia filiformis* ssp. *filiformis* | 2.97 | 4.58 | | Microcommunity Dominant |
| *Mimulus guttatus* | 1.12 | 2.64 | | Microcommunity Dominant |
| *Equisetum arvense* | 0.94 | 1.91 | | Microcommunity Dominant |
| *Carex praegracilis* | 0.85 | 7.85 | * | Microcommunity Dominant |
| *Juncus arcticus* ssp. *littoralis* | 0.79 | 3.33 | | Microcommunity Dominant |
| *Deschampsia ceaspitosa* | 0.46 | 4.82 | * | Microcommunity Dominant |
| *Juncus nevadensis* | 0.42 | 2.49 | | Microcommunity Dominant |
| **Total Live Cover** | **50.39** | **85.94** | * | |

### *3.10.2.5 Shoshone Ponds*

The Shoshone Ponds meadow is a relatively flat meadow to the east and north of the Shoshone ponds. The meadow is fed by an artesian well that feeds the ponds and a spring on the east side of the meadow. Juniper woodlands are invading the fringes of the meadow as is evident by seedlings and younger plants, as is the shrub *Ericameria nauseosa*.

The most dominant species, by mean live cover (MH), on the meadow transects at Shoshone Ponds were *Carex praegracilis*, *Juncus arcticus*, *Distichlis spicata*, *Argentina anserina*, *Carex nebrascensis*, *Carex* sp., *Poa* sp., *Agrostis gigantea*, and *Juniperus scopulorum* (Table 3-60). A total of 68 taxa occurred on the transects in 2010 and this total was about average for the eight sites. Mean live cover (MH) was the second-lowest for the eight wetland/meadow sites.

*Juncus arcticus* was the only species that occurred on all 10 transects at this site. *Carex praegracilis* increased on three transects, but decreased significantly on four other transects between 2009 and 2010 (Table 3-60). On the other hand, *Juncus arcticus*, increased on seven transects and decreased on two transects in 2010. It was very difficult to identify several of the *Carex* species in 2010, so some were just identified as *Carex* sp. Other species often showed small but often significant changes between the two years on some transects.

There were five significant positive increases in total live vegetation cover, and five significant decreases in total cover on the 10 permanent transects. Therefore, overall vegetation cover did not change greatly for Shoshone Meadow between 2009 and 2010.

**Table 3-60. Mean Live Cover Multiple Hits (MH) for the Most Dominant Species and Total Live Cover for Wetland/ Meadow Transects at Shoshone Ponds for 2009 and 2010 (Page 1 of 3)**

Species are classified as to dominance along the transect as either transect dominant, transect subdominant, or microcommunity dominant. Taxa richness is indicated at the top of the table as total taxa and mean taxa for the transect. N represents the sample size for each species and the asterisk in the significance column represents a significant difference between years based on paired *t*-test comparison.

**Veg_074 N = 80 (Total Taxa for Transect: 2009 = 24; 2010 = 28) (Mean Taxa for Transect: 2009 = 0.3; 2010 = 0.4)**

| Species | Mean Live Cover (MH) 2009 | Mean Live Cover (MH) 2010 | Significance at ≤0.05 | Dominance Classification |
|---|---|---|---|---|
| *Carex* sp. | 22.39 | 10.40 | * | Transect Subdominant |
| *Carex nebrascensis* | 18.15 | 14.95 | * | Transect Subdominant |
| *Juncus arcticus* ssp. *littoralis* | 7.88 | 3.20 | * | Transect Subdominant |
| *Eleocharis palustris* | 4.19 | 0.70 | * | Microcommunity Dominant |
| *Trifolium repens* | 1.59 | 0.70 | | Microcommunity Dominant |
| *Agrostis gigantea* | 1.36 | 1.53 | | Microcommunity Dominant |
| *Poa secunda* | 1.06 | 0.03 | * | Microcommunity Dominant |
| **Total Live Cover** | **60.84** | **36.33** | * | |

Based on field data and the distribution of hits along the transect, species listed as *Carex praegracilis* in 2009 were analyzed as *Carex* sp. for *t*-test analysis.

**Veg_075 N = 100 (Total Taxa for Transect: 2009 = 16; 2010 = 25) (Mean Taxa for Transect: 2009 = 0.2; 2010 = 0.3)**

| Species | Mean Live Cover (MH) 2009 | Mean Live Cover (MH) 2010 | Significance at ≤0.05 | Dominance Classification |
|---|---|---|---|---|
| *Carex* sp. | 8.84 | 13.49 | * | Transect Subdominant |
| *Juniperus scopulorum* | 8.02 | 9.29 | | Transect Subdominant |
| *Juncus arcticus* ssp. *littoralis* | 3.08 | 10.04 | * | Transect Subdominant |
| *Carex nebrascensis* | 1.95 | 2.96 | | Microcommunity Dominant |
| *Argentina anserina* | 1.53 | 0.34 | * | Microcommunity Dominant |
| *Distichlis spicata* | 1.18 | 1.29 | | Microcommunity Dominant |
| *Poa secunda* | 0.56 | 1.37 | | Microcommunity Dominant |
| **Total Live Cover** | **27.49** | **42.49** | * | |

Based on field data and the distribution of hits along the transect, species listed as *Carex praegracilis* in 2009 and *Carex praegracilis* or *Carex douglasii* in 2010 were analyzed as *Carex* sp. for *t*-test analysis.

**Veg_076 N = 100 (Total Taxa for Transect: 2009 = 15; 2010 = 10) (Mean Taxa for Transect: 2009 = 0.2; 2010 = 0.1)**

| Species | Mean Live Cover (MH) 2009 | Mean Live Cover (MH) 2010 | Significance at ≤0.05 | Dominance Classification |
|---|---|---|---|---|
| *Carex praegracilis* | 23.35 | 35.33 | * | Transect Dominant |
| *Argentina anserina* | 4.81 | 1.44 | * | Microcommunity Dominant |
| *Achillea millefolium* | 1.64 | 0.92 | | Microcommunity Dominant |
| *Juncus arcticus* ssp. *littoralis* | 0.93 | 4.51 | * | Microcommunity Dominant |
| *Muhlenbergia richardsonis* | 0.81 | 0.77 | | Microcommunity Dominant |
| *Ericameria nauseosa* | 0.18 | 1.73 | * | Microcommunity Dominant |
| **Total Live Cover** | **32.78** | **45.43** | * | |

**Veg_077 N = 100 (Total Taxa for Transect: 2009 = 14; 2010 = 10) (Mean Taxa for Transect: 2009 = 0.1; 2010 = 0.1)**

| Species | Mean Live Cover (MH) 2009 | Mean Live Cover (MH) 2010 | Significance at ≤0.05 | Dominance Classification |
|---|---|---|---|---|
| *Carex praegracilis* | 31.16 | 25.50 | * | Transect Dominant |
| *Muhlenbergia asperifolia* | 4.06 | 1.97 | * | Microcommunity Dominant |
| *Argentina anserina* | 4.00 | 1.36 | * | Microcommunity Dominant |
| *Juncus arcticus* ssp. *littoralis* | 2.91 | 2.16 | | Microcommunity Dominant |
| *Muhlenbergia richardsonis* | 1.23 | 2.66 | * | Microcommunity Dominant |
| *Poa* sp. | 0.59 | 0.27 | | Microcommunity Dominant |
| **Total Live Cover** | **45.61** | **35.65** | * | |

Based on field data and the distribution of hits along the transect, species listed as *Poa pratensis* in 2009 and *Poa secunda* in 2010 were analyzed as *Poa* sp. for *t*-test analysis.

**Table 3-60. Mean Live Cover Multiple Hits (MH) for the Most Dominant Species and Total Live Cover for Wetland/ Meadow Transects at Shoshone Ponds for 2009 and 2010 (Page 2 of 3)**

**Veg_078 N = 100 (Total Taxa for Transect: 2009 = 12; 2010 = 11) (Mean Taxa for Transect: 2009 = 0.1; 2010 = 0.1)**

| Species | Mean Live Cover (MH) 2009 | Mean Live Cover (MH) 2010 | Significance at ≤0.05 | Dominance Classification |
|---|---|---|---|---|
| *Distichlis spicata* | 18.53 | 19.46 | | Transect Dominant |
| *Juncus arcticus* ssp. *littoralis* | 3.16 | 7.36 | * | Microcommunity Dominant |
| *Carex praegracilis* | 2.88 | 5.28 | * | Microcommunity Dominant |
| *Spartina gracilis* | 2.41 | 3.30 | * | Microcommunity Dominant |
| *Ericameria nauseosa* | 0.30 | 0.63 | | Microcommunity Dominant |
| **Total Live Cover** | **29.09** | **38.35** | * | |

**Veg_079 N = 50 (Total Taxa for Transect: 2009 = 22; 2010 = 21) (Mean Taxa for Transect: 2009 = 0.4; 2010 = 0.4)**

| Species | Mean Live Cover (MH) 2009 | Mean Live Cover (MH) 2010 | Significance at ≤0.05 | Dominance Classification |
|---|---|---|---|---|
| *Agrostis gigantea* | 6.88 | 6.56 | | Transect Subdominant |
| *Eleocharis* sp. | 5.60 | 14.22 | * | Transect Subdominant |
| *Carex* sp. | 5.12 | 7.26 | | Transect Subdominant |
| *Juncus arcticus* ssp. *littoralis* | 4.78 | 9.80 | * | Transect Subdominant |
| *Trifolium repens* | 3.24 | 2.44 | | Microcommunity Dominant |
| *Carex nebrascensis* | 2.38 | 5.84 | * | Microcommunity Dominant |
| *Berula erecta* | 1.00 | 0.88 | | Microcommunity Dominant |
| *Poa pratensis* | 0.62 | 9.74 | * | Microcommunity Dominant |
| *Schedonorus pratensis* | 0.62 | 0.00 | | Microcommunity Dominant |
| Algae | 0.00 | 4.84 | * | Microcommunity Dominant |
| **Total Live Cover** | **34.32** | **69.82** | * | |

Based on field data and the distribution of hits along the transect, species listed as *Eleocharis palustris* or *Elymus trachycaulus* in 2010 were analyzed as *Eleocharis* sp. for *t*-test analysis.

**Veg_081 N = 100 (Total Taxa for Transect: 2009 = 22; 2010 = 26) (Mean Taxa for Transect: 2009 = 0.2; 2010 = 0.3)**

| Species | Mean Live Cover (MH) 2009 | Mean Live Cover (MH) 2010 | Significance at ≤0.05 | Dominance Classification |
|---|---|---|---|---|
| *Poa* sp. | 14.28 | 8.07 | * | Transect Subdominant |
| *Carex praegracilis* | 5.87 | 3.68 | * | Microcommunity Dominant |
| *Argentina anserina* | 4.92 | 2.22 | * | Microcommunity Dominant |
| *Ivesia kingii* | 3.77 | 3.19 | | Microcommunity Dominant |
| *Juncus arcticus* ssp. *littoralis* | 2.21 | 3.60 | * | Microcommunity Dominant |
| *Erigeron lonchophyllus* | 1.84 | 0.29 | * | Microcommunity Dominant |
| *Ericameria nauseosa* | 1.08 | 1.58 | * | Microcommunity Dominant |
| *Muhlenbergia richardsonis* | 0.69 | 0.54 | | Microcommunity Dominant |
| **Total Live Cover** | **38.27** | **28.06** | * | |

Based on field data and the distribution of hits along the transect, species listed as *Poa secunda* or *Puccinellia lemmonii* in 2009 and 2010 were analyzed as *Poa* sp. for *t*-test analysis.

**Veg_082 N = 100 (Total Taxa for Transect: 2009 = 14; 2010 = 15) (Mean Taxa for Transect: 2009 = 0.1; 2010 = 0.2)**

| Species | Mean Live Cover (MH) 2009 | Mean Live Cover (MH) 2010 | Significance at ≤0.05 | Dominance Classification |
|---|---|---|---|---|
| *Juncus arcticus* ssp. *littoralis* | 7.08 | 19.16 | * | Transect Subdominant |
| *Carex praegracilis* | 5.18 | 10.51 | * | Transect Subdominant |
| *Distichlis spicata* | 2.24 | 3.49 | * | Microcommunity Dominant |
| *Argentina anserina* | 1.46 | 1.81 | | Microcommunity Dominant |
| *Carex nebrascensis* | 0.89 | 1.82 | * | Microcommunity Dominant |
| *Puccinellia lemmonii* | 0.39 | 3.04 | * | Microcommunity Dominant |
| Moss | 0.00 | 5.59 | * | Microcommunity Dominant |
| *Poa secunda* | 0.00 | 2.43 | * | Microcommunity Dominant |
| **Total Live Cover** | **18.97** | **50.87** | * | |

**Table 3-60. Mean Live Cover Multiple Hits (MH) for the Most Dominant Species and Total Live Cover for Wetland/ Meadow Transects at Shoshone Ponds for 2009 and 2010 (Page 3 of 3)**

**Veg_083 N = 100 (Total Taxa for Transect: 2009 = 16; 2010 = 23) (Mean Taxa for Transect: 2009 = 0.2; 2010 = 0.2)**

| Species | Mean Live Cover (MH) 2009 | Mean Live Cover (MH) 2010 | Significance at ≤0.05 | Dominance Classification |
|---|---|---|---|---|
| *Poa* sp. | 11.77 | 10.19 | | Transect Subdominant |
| *Carex praegracilis* | 11.49 | 5.84 | * | Transect Subdominant |
| *Distichlis spicata* | 10.68 | 6.64 | * | Transect Subdominant |
| *Juncus arcticus* ssp. *littoralis* | 4.28 | 1.81 | * | Microcommunity Dominant |
| *Achillea millefolium* | 0.82 | 0.66 | | Microcommunity Dominant |
| **Total Live Cover** | **41.05** | **27.74** | * | |

Based on field data and the distribution of hits along the transect, species listed as *Puccinellia lemmonii* in 2009 and *Poa secunda* or *Puccinellia lemmonii* in 2010 were analyzed as *Poa* sp. for *t*-test analysis. Based on field data and the distribution of hits along the transect, species listed as *Carex* sp. in 2010 were analyzed as *Carex praegracilis* for *t*-test analysis.

**Veg_084 N = 100 (Total Taxa for Transect: 2009 = 24; 2010 = 33) (Mean Taxa for Transect: 2009 = 0.2; 2010 = 0.3)**

| Species | Mean Live Cover (MH) 2009 | Mean Live Cover (MH) 2010 | Significance at ≤0.05 | Dominance Classification |
|---|---|---|---|---|
| *Carex praegracilis* | 14.93 | 9.78 | * | Transect Subdominant |
| *Argentina anserina* | 12.92 | 6.62 | * | Transect Subdominant |
| *Trifolium* sp. | 11.93 | 7.09 | * | Transect Subdominant |
| *Juncus arcticus* ssp. *littoralis* | 11.22 | 8.52 | * | Transect Subdominant |
| *Juniperus scopulorum* | 4.57 | 4.82 | | Microcommunity Dominant |
| *Agrostis gigantea* | 3.78 | 4.33 | | Microcommunity Dominant |
| *Erigeron lonchophyllus* | 3.26 | 2.33 | | Microcommunity Dominant |
| *Achillea millefolium* | 2.49 | 0.88 | | Microcommunity Dominant |
| *Pyrrocoma lanceolata* | 2.41 | 2.20 | | Microcommunity Dominant |
| *Poa pratensis* | 1.36 | 4.01 | * | Microcommunity Dominant |
| *Carex nebrascensis* | 1.25 | 1.45 | | Microcommunity Dominant |
| *Cirsium scariosum* | 0.81 | 2.02 | * | Microcommunity Dominant |
| *Aster* sp. | 0.00 | 5.58 | * | Microcommunity Dominant |
| **Total Live Cover** | **73.94** | **65.48** | * | |

Based on field data and the distribution of hits along the transect, species listed as *Trifolium repens* and 2010 were analyzed as *Trifolium* sp. for *t*-test analysis

### *3.10.2.6 The Seep*

The most dominant species, by mean live cover (MH), on transects at the Seep were *Argentina anserina*, *Carex nebrascensis*, *Sporobolus airoides*, *Polygonum aviculare*, and *Carex* sp. A total of 43 taxa occurred on the transects in 2010 and this total was second-lowest species richness for the eight sites. Mean live cover (MH) was the lowest for the eight wetland/meadow sites.

Four of the taxa occurred on all five transects. *Argentina anserina* was the most dominant species on three transects and *Carex nebrascensis* was the most dominant species on two transects. *Argentina anserina* showed a significant decrease in live cover on three transects, no changes on one transect and an increase in cover on the fifth transect (Table 3-61). *Carex nebrascensis* had the same trend as was found for *Argentina anserine*. In addition, there were many other significant decreases of individual species cover between the two years. The only significant increases were noted on a couple of transects for *Juncus arcticus, Sporobolus airoides*, *Ranunculus cymbalaria* and *Cirsium scariosum*. The only significant increase in total live cover (MH) was found on transect 073 (Table 3-61). The four remaining transects all had significant decreases in total cover between 2009 and 2010.

**Table 3-61. Mean Live Cover Multiple Hits (MH) for the Most Dominant Species and Total Live Cover for Wetland/ Meadow Transects at The Seep for 2009 and 2010 (Page 1 of 2)**

Species are classified as to dominance along the transect as either transect dominant, transect subdominant, or microcommunity dominant. Taxa richness is indicated at the top of the table as total taxa and mean taxa for the transect. N represents the sample size for each species and the asterisk in the significance column represents a significant difference between years based on paired *t*-test comparison.

**Veg_069 N = 110 (Total Taxa for Transect: 2009 = 23; 2010 = 21) (Mean Taxa for Transect: 2009 = 0.2; 2010 = 0.2)**

| Species | Mean Live Cover (MH) 2009 | Mean Live Cover (MH) 2010 | Significance at ≤0.05 | Dominance Classification |
|---|---|---|---|---|
| *Argentina anserina* | 23.56 | 8.65 | * | Transect Subdominant |
| *Sporobolus airoides* | 19.66 | 7.40 | * | Transect Subdominant |
| *Carex* sp. | 7.86 | 3.99 | * | Transect Subdominant |
| *Juncus arcticus* ssp. *littoralis* | 4.36 | 3.26 | * | Microcommunity Dominant |
| *Carex nebrascensis* | 3.12 | 1.40 | * | Microcommunity Dominant |
| *Agrostis gigantea* | 2.19 | 2.42 | | Microcommunity Dominant |
| *Hordeum jubatum* | 2.03 | 0.00 | * | Microcommunity Dominant |
| *Distichlis spicata* | 1.71 | 0.90 | * | Microcommunity Dominant |
| *Puccinellia lemmonii* | 1.53 | 0.00 | * | Microcommunity Dominant |
| *Taraxacum officinale* | 1.07 | 0.41 | * | Microcommunity Dominant |
| *Aster* sp. | 0.18 | 1.43 | * | Microcommunity Dominant |
| **Total Live Cover** | **70.23** | **32.66** | * | |

Based on field data and the distribution of hits along the transect, species listed as *Carex praegracilis* in 2009 and *Carex douglasii* in 2010 were analyzed as *Carex* sp. for *t*-test analysis.

**Veg_070 N = 100 (Total Taxa for Transect: 2009 = 27; 2010 = 22) (Mean Taxa for Transect: 2009 = 0.3; 2010 = 0.2)**

| Species | Mean Live Cover (MH) 2009 | Mean Live Cover (MH) 2010 | Significance at ≤0.05 | Dominance Classification |
|---|---|---|---|---|
| *Argentina anserina* | 12.52 | 5.15 | * | Transect Subdominant |
| *Sporobolus airoides* | 7.16 | 2.81 | * | Microcommunity Dominant |
| *Polygonum aviculare* | 5.61 | 5.47 | | Microcommunity Dominant |
| *Puccinellia distans* | 5.42 | 0.00 | * | Microcommunity Dominant |
| *Carex nebrascensis* | 4.43 | 2.82 | * | Microcommunity Dominant |
| *Eleocharis* sp. | 1.31 | 0.16 | * | Microcommunity Dominant |
| *Distichlis spicata* | 1.13 | 0.69 | | Microcommunity Dominant |
| *Agrostis gigantea* | 0.98 | 0.32 | | Microcommunity Dominant |
| *Juncus arcticus* ssp. *littoralis* | 0.83 | 0.80 | | Microcommunity Dominant |
| **Total Live Cover** | **42.37** | **20.33** | * | |

Based on field data and the distribution of hits along the transect, species listed as *Eleocharis palustris* in 2009 were analyzed as *Eleocharis* sp. for *t*-test analysis.

**Veg_071 N = 100 (Total Taxa for Transect: 2009 = 24; 2010 = 27) (Mean Taxa for Transect: 2009 = 0.2; 2010 = 0.3)**

| Species | Mean Live Cover (MH) 2009 | Mean Live Cover (MH) 2010 | Significance at ≤0.05 | Dominance Classification |
|---|---|---|---|---|
| *Argentina anserina* | 12.94 | 5.75 | * | Transect Subdominant |
| *Polygonum aviculare* | 7.17 | 5.77 | | Transect Subdominant |
| *Carex nebrascensis* | 6.90 | 6.55 | | Transect Subdominant |
| *Puccinellia distans* | 3.33 | 0.79 | * | Microcommunity Dominant |
| *Agrostis gigantea* | 2.46 | 1.57 | | Microcommunity Dominant |
| *Carex* sp. | 2.42 | 1.94 | | Microcommunity Dominant |
| *Juncus arcticus* ssp. *littoralis* | 2.09 | 3.22 | * | Microcommunity Dominant |
| *Eleocharis palustris* | 1.37 | 0.53 | * | Microcommunity Dominant |
| *Erigeron lonchophyllus* | 1.02 | 0.38 | * | Microcommunity Dominant |
| *Muhlenbergia* sp. | 0.69 | 0.94 | | Microcommunity Dominant |
| *Puccinellia lemmonii* | 0.63 | 0.26 | | Microcommunity Dominant |
| **Total Live Cover** | **44.80** | **31.31** | * | |

Based on field data and the distribution of hits along the transect, species listed as *Carex praegracilis* in 2009 and *Carex praegracilis* or *Carex douglasii* in 2010 were analyzed as *Carex* sp. for *t*-test analysis. Based on field data and the distribution of hits along the transect, species listed as *Muhlenbergia richardsonis* in 2009 and 2010 were analyzed as *Muhlenbergia* sp. for *t*-test analysis.

**Table 3-61. Mean Live Cover Multiple Hits (MH) for the Most Dominant Species and Total Live Cover for Wetland/ Meadow Transects at The Seep for 2009 and 2010 (Page 2 of 2)**

**Veg_072 N = 100 (Total Taxa for Transect: 2009 = 27; 2010 = 30) (Mean Taxa for Transect: 2009 = 0.3; 2010 = 0.3)**

| Species | Mean Live Cover (MH) 2009 | Mean Live Cover (MH) 2010 | Significance at ≤0.05 | Dominance Classification |
|---|---|---|---|---|
| *Carex nebrascensis* | 10.10 | 5.74 | * | Transect Subdominant |
| *Polygonum aviculare* | 6.40 | 2.88 | * | Microcommunity Dominant |
| *Argentina anserina* | 5.48 | 4.69 | | Microcommunity Dominant |
| *Distichlis spicata* | 5.38 | 3.46 | * | Microcommunity Dominant |
| *Puccinellia lemmonii* | 4.31 | 0.00 | * | Microcommunity Dominant |
| *Hordeum jubatum* | 4.19 | 0.62 | * | Microcommunity Dominant |
| *Carex* sp. | 3.48 | 1.04 | * | Microcommunity Dominant |
| *Ivesia kingii* | 3.31 | 1.75 | * | Microcommunity Dominant |
| *Juncus arcticus* ssp. *littoralis* | 2.84 | 2.69 | | Microcommunity Dominant |
| *Spartina gracilis* | 1.90 | 0.00 | * | Microcommunity Dominant |
| *Agrostis gigantea* | 1.55 | 0.82 | | Microcommunity Dominant |
| *Sporobolus airoides* | 1.36 | 3.29 | * | Microcommunity Dominant |
| **Total Live Cover** | **56.13** | **34.32** | * | |

Based on field data and the distribution of hits along the transect, species listed as *Carex praegracilis* in 2009 and *Carex douglasii* in 2010 were analyzed as *Carex* sp. for *t*-test analysis.

**Veg_073 N = 75 (Total Taxa for Transect: 2009 = 22; 2010 = 30) (Mean Taxa for Transect: 2009 = 0.3; 2010 = 0.4)**

| Species | Mean Live Cover (MH) 2009 | Mean Live Cover (MH) 2010 | Significance at ≤0.05 | Dominance Classification |
|---|---|---|---|---|
| *Carex nebrascensis* | 9.16 | 12.29 | * | Transect Subdominant |
| *Argentina anserina* | 7.36 | 10.84 | * | Transect Subdominant |
| *Deschampsia ceaspitosa* | 4.39 | 3.88 | | Microcommunity Dominant |
| *Agrostis gigantea* | 4.29 | 3.29 | | Microcommunity Dominant |
| *Carex* sp. | 2.59 | 0.40 | * | Microcommunity Dominant |
| *Juncus bufonius* | 2.17 | 0.16 | * | Microcommunity Dominant |
| *Juncus arcticus* ssp. *littoralis* | 1.29 | 4.24 | * | Microcommunity Dominant |
| *Erigeron lonchophyllus* | 0.44 | 2.11 | * | Microcommunity Dominant |
| *Cirsium scariosum* | 0.40 | 2.35 | * | Microcommunity Dominant |
| *Ranunculus cymbalaria* | 0.20 | 1.67 | * | Microcommunity Dominant |
| **Total Live Cover** | **35.49** | **47.23** | * | |

Based on field data and the distribution of hits along the transect, species listed as *Carex praegracilis* in 2009 and *Carex douglasii* in 2010 were analyzed as *Carex* sp. for *t*-test analysis.

### *3.10.2.7 Blind Spring*

The most dominant species, by mean live cover (MH), on the wetland/meadow transects at Blind Spring were *Utricularia macrorhiza, Zannichellia palustris, Hippuris vulgaris, Sparganium angustifolium, Typha latifolia, Distichlis spicata, Carex* sp., *Eleocharis rostellata*, and *Carex simulata* (Table 3-62). A total of 30 taxa occurred on the transects in 2010 and this total was lowest species richness value for eight sites. Mean live cover (MH) was about average for the eight wetland/ meadow sites.

Five species occurred on all five of the transects: *Distichlis spicata, Eleocharis palustris, Sparganium angustifolium, Typha latifolia*, and *Utricularia macrorhiza* (Table 3-62). *Utricularia macrorhiza* was the most dominant species on all five transects.

A number of species had lower cover during 2010, but some species responded with greater cover. *Chara* sp. declined at all locations where it was present (Table 3-62). *Utricularia macrorhiza* declined significantly on three transects; whereas, it had insignificant changes on the two other transects where it was found. *Zannichellia palustris*, an aquatic perennial forb, was an abundant species on three transects in 2009, but was not even found at Blind Springs in 2010. *Sparganium angustifolium* had a significant decrease in cover on two transects in 2010, but showed little change in cover on three other transects. *Carex simulata*, on the other hand, had greater cover at locations where it was found in 2010 than it had in 2009. *Hippuris vulgaris* had a significant decline on two transects in 2010, and a significant increase on one transect where it was found in 2010.

**Table 3-62. Mean Live Cover Multiple Hits (MH) for the Most Dominant Species and Total Live Cover for Wetland/ Meadow Transects at Blind Spring for 2009 and 2010 (Page 1 of 3)**

Species are classified as to dominance along the transect as either transect dominant, transect subdominant, or microcommunity dominant. Taxa richness is indicated at the top of the table as total taxa and mean taxa for the transect. N represents the sample size for each species and the asterisk in the significance column represents a significant difference between years based on paired *t*-test comparison.

**Veg_011 N = 43 (Total Taxa for Transect: 2009 = 21; 2010 = 23) (Mean Taxa for Transect: 2009 = 0.5; 2010 = 0.5)**

| Species | Mean Live Cover (MH) 2009 | Mean Live Cover (MH) 2010 | Significance at ≤0.05 | Dominance Classification |
|---|---|---|---|---|
| *Utricularia macrorhiza* | 46.77 | 12.21 | * | Transect Dominant |
| *Distichlis spicata* | 7.28 | 5.12 | | Transect Subdominant |
| *Carex* sp. | 6.86 | 11.33 | * | Transect Subdominant |
| *Typha latifolia* | 6.40 | 4.28 | | Transect Subdominant |
| *Eleocharis palustris* | 6.23 | 5.61 | | Transect Subdominant |
| *Zannichellia palustris* | 5.47 | 0.00 | | Microcommunity Dominant |
| *Carex simulata* | 5.07 | 12.00 | * | Transect Subdominant |
| *Hippuris vulgaris* | 4.47 | 2.72 | | Microcommunity Dominant |
| *Schoenoplectus* spp. | 4.47 | 2.51 | | Microcommunity Dominant |
| *Sparganium angustifolium* | 4.37 | 3.00 | | Microcommunity Dominant |
| *Chara* sp. | 3.63 | 0.00 | * | Microcommunity Dominant |
| *Schoenoplectus acutus var. acutus* | 3.49 | 2.33 | | Microcommunity Dominant |
| *Eleocharis rostellata* | 2.79 | 11.37 | * | Transect Subdominant |
| *Mimulus guttatus* | 2.44 | 1.56 | | Microcommunity Dominant |
| **Total Live Cover** | **115.74** | **78.02** | * | |

Based on field data and the distribution of hits along the transect, species listed as *Carex rostrata* in 2009 and *Carex nebrascensis* in 2010 were analyzed as *Carex* sp. for *t*-test analysis. Based on field data and the distribution of hits along the transect, species listed as *Schoenoplectus americanus* in 2009 and *Schoenoplectus pungens* in 2010 were analyzed as *Schoenoplectus* spp. for *t*-test analysis.

**Veg_012 N = 43 (Total Taxa for Transect: 2009 = 17; 2010 = 16) (Mean Taxa for Transect: 2009 = 0.4; 2010 = 0.4)**

| Species | Mean Live Cover (MH) 2009 | Mean Live Cover (MH) 2010 | Significance at ≤0.05 | Dominance Classification |
|---|---|---|---|---|
| *Utricularia macrorhiza* | 16.86 | 19.72 | | Transect Dominant |
| *Typha latifolia* | 8.81 | 7.44 | | Transect Subdominant |
| *Hippuris vulgaris* | 6.86 | 8.40 | | Transect Subdominant |
| *Distichlis spicata* | 4.02 | 5.61 | | Microcommunity Dominant |
| *Sparganium angustifolium* | 3.88 | 3.49 | | Microcommunity Dominant |
| *Schoenoplectus acutus var. acutus* | 3.74 | 6.26 | * | Microcommunity Dominant |
| *Chara* sp. | 2.61 | 0.00 | | Microcommunity Dominant |
| *Bidens cernua* | 1.14 | 0.00 | | Microcommunity Dominant |
| *Potamogeton* sp. | 1.02 | 0.00 | | Microcommunity Dominant |
| *Carex nebrascensis* | 0.95 | 8.70 | * | Microcommunity Dominant |
| *Eleocharis palustris* | 0.58 | 3.21 | * | Microcommunity Dominant |
| *Carex simulata* | 0.00 | 2.21 | | Microcommunity Dominant |
| **Total Live Cover** | **53.47** | **71.02** | * | |

Based on field data and the distribution of hits along the transect, species listed as *Typha* sp. in 2009 and *Typha domingensis* in 2010 were analyzed as *Typha latifolia* for *t*-test analysis.

**Table 3-62. Mean Live Cover Multiple Hits (MH) for the Most Dominant Species and Total Live Cover for Wetland/ Meadow Transects at Blind Spring for 2009 and 2010 (Page 2 of 3)**

**Veg_013 N = 39 (Total Taxa for Transect: 2009 = 19; 2010 = 22) (Mean Taxa for Transect: 2009 = 0.5; 2010 = 0.6)**

| Species | Mean Live Cover (MH) 2009 | Mean Live Cover (MH) 2010 | Significance at ≤0.05 | Dominance Classification |
|---|---|---|---|---|
| *Utricularia macrorhiza* | 17.62 | 7.05 | * | Transect Subdominant |
| *Distichlis spicata* | 5.05 | 5.80 | | Microcommunity Dominant |
| *Chara* sp. | 4.62 | 0.00 | * | Microcommunity Dominant |
| *Carex simulata* | 4.46 | 9.54 | * | Transect Subdominant |
| *Schoenoplectus acutus var. acutus* | 3.56 | 3.69 | | Microcommunity Dominant |
| *Typha latifolia* | 2.49 | 2.67 | | Microcommunity Dominant |
| *Hippuris vulgaris* | 2.44 | 3.54 | * | Microcommunity Dominant |
| *Eleocharis rostellata* | 2.28 | 13.97 | * | Transect Subdominant |
| *Eleocharis palustris* | 2.00 | 1.23 | | Microcommunity Dominant |
| *Schoenoplectus pungens* | 1.95 | 3.26 | | Microcommunity Dominant |
| *Sparganium angustifolium* | 1.62 | 2.85 | | Microcommunity Dominant |
| *Bassia scoparia* | 1.44 | 4.28 | | Microcommunity Dominant |
| *Carex nebrascensis* | 0.85 | 2.54 | | Microcommunity Dominant |
| *Mimulus guttatus* | 0.31 | 3.33 | * | Microcommunity Dominant |
| **Total Live Cover** | **51.62** | **68.72** | * | |

Based on field data and the distribution of hits along the transect, species listed as *Typha* sp. or *Typha domingensis* in 2010 were analyzed as *Typha latifolia* for *t*-test analysis.

**Veg_014 N = 47 (Total Taxa for Transect: 2009 = 15; 2010 = 18) (Mean Taxa for Transect: 2009 = 0.3; 2010 = 0.4)**

| Species | Mean Live Cover (MH) 2009 | Mean Live Cover (MH) 2010 | Significance at ≤0.05 | Dominance Classification |
|---|---|---|---|---|
| *Utricularia macrorhiza* | 54.49 | 41.87 | * | Transect Dominant |
| *Zannichellia palustris* | 14.06 | 0.00 | * | Transect Subdominant |
| *Hippuris vulgaris* | 10.47 | 6.19 | * | Transect Subdominant |
| *Carex* sp. | 9.60 | 9.32 | | Transect Subdominant |
| *Sparganium angustifolium* | 8.09 | 5.26 | * | Transect Subdominant |
| *Typha latifolia* | 3.96 | 1.79 | * | Microcommunity Dominant |
| *Distichlis spicata* | 3.28 | 2.79 | | Microcommunity Dominant |
| *Schoenoplectus* sp. | 3.26 | 3.49 | | Microcommunity Dominant |
| *Bassia scoparia* | 1.92 | 0.70 | | Microcommunity Dominant |
| *Schoenoplectus acutus* var. *acutus* | 1.83 | 1.60 | | Microcommunity Dominant |
| *Chenopodium* sp. | 1.43 | 1.15 | | Microcommunity Dominant |
| *Eleocharis palustris* | 1.02 | 2.55 | | Microcommunity Dominant |
| *Sarcobatus vermiculatus* | 0.72 | 0.75 | | Microcommunity Dominant |
| **Total Live Cover** | **115.28** | **81.66** | * | |

Based on field data and the distribution of hits along the transect, species listed as *Carex rostrata* in 2009 and *Carex nebrascensis* in 2010 were analyzed as *Carex* sp. for *t*-test analysis. Based on field data and the distribution of hits along the transect, species listed as *Typha* sp. in 2010 was analyzed as *Typha latifolia* for *t*-test analysis.

**Table 3-62. Mean Live Cover Multiple Hits (MH) for the Most Dominant Species and Total Live Cover for Wetland/ Meadow Transects at Blind Spring for 2009 and 2010 (Page 3 of 3)**

**Veg_015 N = 34 (Total Taxa for Transect: 2009 = 18; 2010 = 18) (Mean Taxa for Transect: 2009 = 0.5; 2010 = 0.5)**

| Species | Mean Live Cover (MH) 2009 | Mean Live Cover (MH) 2010 | Significance at ≤0.05 | Dominance Classification |
|---|---|---|---|---|
| *Utricularia macrorhiza* | 38.29 | 39.94 | | Transect Dominant |
| *Sparganium angustifolium* | 10.82 | 5.09 | * | Transect Subdominant |
| *Zannichellia palustris* | 10.77 | 0.00 | * | Microcommunity Dominant |
| *Hippuris vulgaris* | 6.35 | 3.21 | * | Microcommunity Dominant |
| *Carex* sp. | 5.00 | 4.79 | | Microcommunity Dominant |
| *Eleocharis palustris* | 4.35 | 3.06 | * | Microcommunity Dominant |
| *Distichlis spicata* | 4.18 | 3.79 | | Microcommunity Dominant |
| *Typha latifolia* | 3.18 | 1.62 | | Microcommunity Dominant |
| *Bassia scoparia* | 2.82 | 5.32 | | Microcommunity Dominant |
| **Total Live Cover** | **92.35** | **73.50** | * | |

Based on field data and the distribution of hits along the transect, species listed as *Carex rostrata* or *Carex nebrascensis* in 2009 and *Carex nebrascensis* in 2010 were analyzed as *Carex* sp. for *t*-test analysis. Based on field data and the distribution of hits along the transect, species listed as *Typha* sp. in 2010 was analyzed as *Typha latifolia* for *t*-test analysis.

### *3.10.2.8 Burbank Meadows*

The most dominant species, by mean live cover (MH), on the wetland/meadow transects at Burbank Meadows were *Carex praegracilis, Juncus arcticus, Distichlis spicata, Argentina anserina, Puccinellia lemmonii, Leymus triticoides, Crepis runcinata, Spartina gracilis* and *Carex* sp. A total of 51 taxa occurred on the transects in 2010 and this was below average for the eight wetland/ meadow sites. Mean live cover (MH) was about average for the eight sites.

*Distichlis spicata* and *Juncus arcticus* were the only two species that occurred on all 10 transects at this site. *Leymus triticoides* occurred on nine transects, *Puccinellia lemmonii* occurred on eight transects and *Carex praegracilis* occurred on seven transects. *Distichlis spicata* was the most dominant species on three of the 10 transects at Burbank Meadows. It was also co-dominant on a number of the other transects (Table 3-63).

*Argentina anserine* had significantly greater cover in 2010 than 2009 on four transects, but had significantly less cover on three transects (Table 3-63). The two grasses, *Distichlis spicata* and *Puccinellia lemmonii*, both showed positive increases on eight and six transects, respectively. *Juncus arcticus* and *Carex praegracilis* also had greater cover on more transects in 2010 than 2009. These increases in cover resulted in significantly greater total live cover on all transects in 2010 compared to 2009.

**Table 3-63. Mean Live Cover Multiple Hits (MH) for the Most Dominant Species and Total Live Cover for Wetland/ Meadow Transects at Burbank Meadows for 2009 and 2010 (Page 1 of 3)**

Species are classified as to dominance along the transect as either transect dominant, transect subdominant, or microcommunity dominant. Taxa richness is indicated at the top of the table as total taxa and mean taxa for the transect. N represents the sample size for each species and the asterisk in the significance column represents a significant difference between years based on paired *t*-test comparison.

**Veg_139 N = 100 (Total Taxa for Transect: 2009 = 24; 2010 = 27) (Mean Taxa for Transect: 2009 = 0.2; 2010 = 0.3)**

| Species | Mean Live Cover (MH) 2009 | Mean Live Cover (MH) 2010 | Significance at ≤0.05 | Dominance Classification |
|---|---|---|---|---|
| *Juncus arcticus* ssp. *littoralis* | 9.72 | 11.50 | * | Transect Subdominant |
| *Argentina anserina* | 9.49 | 10.17 | | Transect Subdominant |
| *Distichlis spicata* | 8.27 | 13.90 | * | Transect Subdominant |
| *Carex praegracilis* | 7.43 | 9.46 | * | Transect Subdominant |
| *Leymus triticoides* | 6.95 | 8.98 | * | Transect Subdominant |
| *Trifolium* sp. | 4.21 | 2.02 | * | Microcommunity Dominant |
| *Puccinellia lemmonii* | 2.20 | 3.69 | * | Microcommunity Dominant |
| *Hymenoxys lemmonii* | 1.66 | 0.46 | * | Microcommunity Dominant |
| *Sporobolus airoides* | 1.64 | 0.99 | * | Microcommunity Dominant |
| *Poa secunda* | 0.17 | 1.58 | * | Microcommunity Dominant |
| **Total Live Cover** | **54.08** | **65.87** | * | |

**Veg_140 N = 100 (Total Taxa for Transect: 2009 = 25; 2010 = 29) (Mean Taxa for Transect: 2009 = 0.3; 2010 = 0.3)**

| Species | Mean Live Cover (MH) 2009 | Mean Live Cover (MH) 2010 | Significance at ≤0.05 | Dominance Classification |
|---|---|---|---|---|
| *Argentina anserina* | 25.23 | 18.75 | * | Transect Dominant |
| *Carex praegracilis* | 11.25 | 17.38 | * | Transect Subdominant |
| *Puccinellia lemmonii* | 7.47 | 12.43 | * | Transect Subdominant |
| *Distichlis spicata* | 6.76 | 11.62 | * | Transect Subdominant |
| *Juncus arcticus* ssp. *littoralis* | 5.28 | 4.37 | | Microcommunity Dominant |
| *Cirsium scariosum* | 2.30 | 3.38 | * | Microcommunity Dominant |
| *Crepis runcinata* ssp. *glauca* | 1.97 | 3.32 | * | Microcommunity Dominant |
| *Trifolium* sp. | 1.87 | 2.36 | | Microcommunity Dominant |
| *Leymus triticoides* | 1.46 | 0.71 | * | Microcommunity Dominant |
| *Sporobolus airoides* | 1.18 | 1.00 | | Microcommunity Dominant |
| *Glaux maritima* | 1.17 | 2.65 | * | Microcommunity Dominant |
| *Agrostis gigantea* | 0.16 | 2.02 | * | Microcommunity Dominant |
| **Total Live Cover** | **68.66** | **84.01** | * | |

Based on field data and the distribution of hits along the transect, species listed as *Trifolium fragiferum* in 2010 were analyzed as *Trifolium* sp. for *t*-test analysis.

**Veg_141 N = 100 (Total Taxa for Transect: 2009 = 21; 2010 = 26) (Mean Taxa for Transect: 2009 = 0.2; 2010 = 0.3)**

| Species | Mean Live Cover (MH) 2009 | Mean Live Cover (MH) 2010 | Significance at ≤0.05 | Dominance Classification |
|---|---|---|---|---|
| *Puccinellia lemmonii* | 15.85 | 14.26 | | Transect Subdominant |
| *Crepis runcinata* ssp. *glauca* | 13.65 | 13.96 | | Transect Subdominant |
| *Juncus arcticus* ssp. *littoralis* | 11.74 | 12.03 | | Transect Subdominant |
| *Argentina anserina* | 8.58 | 13.28 | * | Transect Subdominant |
| *Carex* sp. | 5.59 | 13.79 | * | Transect Subdominant |
| *Distichlis spicata* | 3.41 | 4.99 | * | Microcommunity Dominant |
| *Spartina gracilis* | 2.99 | 2.50 | | Microcommunity Dominant |
| *Leymus triticoides* | 2.21 | 3.69 | * | Microcommunity Dominant |
| *Glaux maritima* | 0.50 | 3.25 | * | Microcommunity Dominant |
| *Pyrrocoma lanceolata* | 0.00 | 2.72 | * | Microcommunity Dominant |
| **Total Live Cover** | **70.97** | **93.34** | * | |

Based on field data and the distribution of hits along the transect, species listed as *Carex praegracilis* in 2009 and 2010 were analyzed as *Carex* sp. for *t*-test analysis.

**Table 3-63. Mean Live Cover Multiple Hits (MH) for the Most Dominant Species and Total Live Cover for Wetland/ Meadow Transects at Burbank Meadows for 2009 and 2010 (Page 2 of 3)**

**Veg_142 N = 100 (Total Taxa for Transect: 2009 = 21; 2010 = 28) (Mean Taxa for Transect: 2009 = 0.2; 2010 = 0.3)**

| Species | Mean Live Cover (MH) 2009 | Mean Live Cover (MH) 2010 | Significance at ≤0.05 | Dominance Classification |
|---|---|---|---|---|
| *Distichlis spicata* | 12.36 | 15.42 | * | Transect Subdominant |
| *Leymus triticoides* | 9.10 | 9.82 | | Transect Subdominant |
| *Carex* sp. | 8.89 | 9.10 | | Transect Subdominant |
| *Juncus arcticus* ssp. *littoralis* | 8.82 | 5.63 | * | Transect Subdominant |
| *Hordeum jubatum* | 4.67 | 1.91 | * | Microcommunity Dominant |
| *Argentina anserina* | 4.45 | 5.76 | * | Microcommunity Dominant |
| *Trifolium* sp. | 3.65 | 7.50 | * | Microcommunity Dominant |
| *Puccinellia* sp. | 0.00 | 10.97 | | Microcommunity Dominant |
| **Total Live Cover** | **63.99** | **70.63** | * | |

Based on field data and the distribution of hits along the transect, species listed as *Carex praegracilis* in 2009 and 2010 were analyzed as *Carex* sp. for *t*-test analysis. Based on field data and the distribution of hits along the transect, species listed as *Puccinellia lemmonii* or *Puccinellia distans* in 2009 were analyzed as *Puccinellia* sp. for *t*-test analysis. Based on field data and the distribution of hits along the transect, species listed as *Trifolium fragiferum* in 2010 were analyzed as *Trifolium* sp. for *t*-test analysis.

**Veg_143 N = 100 (Total Taxa for Transect: 2009 = 25; 2010 = 27) (Mean Taxa for Transect: 2009 = 0.3; 2010 = 0.3)**

| Species | Mean Live Cover (MH) 2009 | Mean Live Cover (MH) 2010 | Significance at ≤0.05 | Dominance Classification |
|---|---|---|---|---|
| *Puccinellia lemmonii* | 14.93 | 17.15 | | Transect Subdominant |
| *Argentina anserina* | 12.74 | 9.93 | * | Transect Subdominant |
| *Carex praegracilis* | 11.76 | 13.86 | | Transect Subdominant |
| *Spartina gracilis* | 9.60 | 5.17 | * | Transect Subdominant |
| *Crepis runcinata* ssp. *glauca* | 9.54 | 6.49 | * | Transect Subdominant |
| *Juncus arcticus* ssp. *littoralis* | 7.45 | 4.06 | * | Transect Subdominant |
| *Leymus triticoides* | 4.37 | 2.80 | | Microcommunity Dominant |
| *Distichlis spicata* | 3.03 | 15.64 | * | Transect Subdominant |
| *Cirsium scariosum* | 3.00 | 3.94 | | Microcommunity Dominant |
| *Polypogon monspeliensis* | 0.78 | 0.55 | | Microcommunity Dominant |
| **Total Live Cover** | **80.69** | **85.35** | * | |

**Veg_144 N = 99 (Total Taxa for Transect: 2009 = 13; 2010 = 13) (Mean Taxa for Transect: 2009 = 0.1; 2010 = 0.1)**

| Species | Mean Live Cover (MH) 2009 | Mean Live Cover (MH) 2010 | Significance at ≤0.05 | Dominance Classification |
|---|---|---|---|---|
| *Spartina gracilis* | 13.02 | 16.57 | * | Transect Subdominant |
| *Distichlis spicata* | 6.44 | 8.30 | * | Transect Subdominant |
| *Puccinellia lemmonii* | 4.79 | 10.07 | * | Transect Subdominant |
| *Juncus arcticus* ssp. *littoralis* | 4.43 | 5.22 | | Microcommunity Dominant |
| *Leymus triticoides* | 1.25 | 1.09 | | Microcommunity Dominant |
| *Cirsium scariosum* | 0.44 | 0.18 | | Microcommunity Dominant |
| **Total Live Cover** | **31.58** | **43.66** | * | |

Meter interval 87-88 was not sampled in 2009, and was not used in *t*-test analysis.

**Table 3-63. Mean Live Cover Multiple Hits (MH) for the Most Dominant Species and Total Live Cover for Wetland/ Meadow Transects at Burbank Meadows for 2009 and 2010 (Page 3 of 3)**

| Species | Mean Live Cover (MH) 2009 | Mean Live Cover (MH) 2010 | Significance at ≤0.05 | Dominance Classification |
|---|---|---|---|---|
| **Veg_145 N = 100 (Total Taxa for Transect: 2009 = 26; 2010 = 24) (Mean Taxa for Transect: 2009 = 0.3; 2010 = 0.2)** | | | | |
| *Carex praegracilis* | 25.07 | 23.01 | | Transect Dominant |
| *Juncus arcticus* ssp. *littoralis* | 14.41 | 16.18 | | Transect Subdominant |
| *Argentina anserina* | 4.29 | 9.20 | * | Transect Subdominant |
| *Glaux maritima* | 2.35 | 3.20 | | Microcommunity Dominant |
| *Distichlis spicata* | 2.11 | 6.02 | * | Microcommunity Dominant |
| *Erigeron lonchophyllus* | 1.62 | 2.67 | * | Microcommunity Dominant |
| *Spartina gracilis* | 0.92 | 0.63 | | Microcommunity Dominant |
| *Crepis runcinata* ssp. *glauca* | 0.49 | 1.43 | * | Microcommunity Dominant |
| **Total Live Cover** | **55.94** | **68.04** | * | |
| **Veg_146 N = 100 (Total Taxa for Transect: 2009 = 20; 2010 = 22) (Mean Taxa for Transect: 2009 = 0.2; 2010 = 0.2)** | | | | |
| **Species** | **Mean Live Cover (MH) 2009** | **Mean Live Cover (MH) 2010** | **Significance at ≤0.05** | **Dominance Classification** |
| *Distichlis spicata* | 11.42 | 16.05 | * | Transect Subdominant |
| *Puccinellia lemmonii* | 5.28 | 10.25 | * | Transect Subdominant |
| *Juncus arcticus* ssp. *littoralis* | 4.28 | 5.75 | * | Microcommunity Dominant |
| *Leymus triticoides* | 4.13 | 6.50 | * | Microcommunity Dominant |
| *Carex praegracilis* | 3.38 | 4.25 | | Microcommunity Dominant |
| *Argentina anserina* | 2.00 | 3.29 | * | Microcommunity Dominant |
| *Sporobolus airoides* | 1.87 | 2.32 | | Microcommunity Dominant |
| *Spartina gracilis* | 1.77 | 3.86 | * | Microcommunity Dominant |
| **Total Live Cover** | **35.87** | **56.73** | * | |
| **Veg_147 N = 100 (Total Taxa for Transect: 2009 = 17; 2010 = 18) (Mean Taxa for Transect: 2009 = 0.2; 2010 = 0.2)** | | | | |
| **Species** | **Mean Live Cover (MH) 2009** | **Mean Live Cover (MH) 2010** | **Significance at ≤0.05** | **Dominance Classification** |
| *Carex praegracilis* | 27.99 | 25.93 | | Transect Dominant |
| *Juncus arcticus* ssp. *littoralis* | 11.35 | 14.69 | * | Transect Subdominant |
| *Leymus triticoides* | 5.80 | 8.31 | * | Transect Subdominant |
| *Argentina anserina* | 3.69 | 2.51 | * | Microcommunity Dominant |
| *Puccinellia lemmonii* | 3.15 | 6.40 | * | Microcommunity Dominant |
| *Cirsium scariosum* | 2.91 | 2.08 | | Microcommunity Dominant |
| *Hordeum jubatum* | 2.05 | 0.59 | * | Microcommunity Dominant |
| *Distichlis spicata* | 1.42 | 1.18 | | Microcommunity Dominant |
| *Bassia scoparia* | 1.05 | 1.12 | | Microcommunity Dominant |
| **Total Live Cover** | **60.85** | **64.80** | * | |
| **Veg_148 N = 99 (Total Taxa for Transect: 2009 = 20; 2010 = 21) (Mean Taxa for Transect: 2009 = 0.2; 2010 = 0.2)** | | | | |
| **Species** | **Mean Live Cover (MH) 2009** | **Mean Live Cover (MH) 2010** | **Significance at ≤0.05** | **Dominance Classification** |
| *Distichlis spicata* | 28.34 | 30.54 | | Transect Dominant |
| *Juncus arcticus* ssp. *littoralis* | 11.28 | 13.58 | * | Transect Subdominant |
| *Argentina anserina* | 5.92 | 4.96 | | Microcommunity Dominant |
| *Leymus triticoides* | 5.87 | 5.60 | | Microcommunity Dominant |
| *Crepis runcinata* ssp. *glauca* | 5.15 | 5.51 | | Microcommunity Dominant |
| *Carex praegracilis* | 4.60 | 4.39 | | Microcommunity Dominant |
| *Nitrophila occidentalis* | 3.41 | 4.37 | * | Microcommunity Dominant |
| *Puccinellia lemmonii* | 3.19 | 5.19 | * | Microcommunity Dominant |
| *Glaux maritima* | 1.71 | 2.16 | | Microcommunity Dominant |
| **Total Live Cover** | **71.04** | **79.79** | * | |

Meter interval 75-76 was not sampled in 2009, and was not used in *t*-test analysis.

### 3.10.3 Phreatophytic Shrubland Transects

Mean live cover multiple hits (MH) overall for phreatophytic shrubland transects was 35% higher in 2010 than in 2009 (grand mean live cover (MH): 2009 = 17%, 2010 = 23%) (Table 3-64 and Figure 3-45). Four of the 5 regions showed a significant increase in mean live cover (MH) in 2010 (Spring Valley North: 40% increase; Spring Valley Middle: 71% increase; Spring Valley South: 41% increase; and Hamlin Valley North: 62% increase). Mean live cover (MH) ranged from 17% (Snake Valley South) to 28% (Spring Valley North) in 2010. This compares to a mean live cover (MH) in 2009 that ranged from 13% (Hamlin Valley South) to 20% (Spring Valley North).

**Table 3-64. Summary of Mean Live Cover Multiple Hits (MH), Mean Live Cover First Hit (FH), Total Number of Taxa and Mean Taxa Richness on the Phreatophytic Shrubland Transects in Spring and Snake Valleys for 2009 and 2010**

Cover values are averages over all transects per site (grand mean). Total number of taxa is the total number of taxa or species observed across all transects per site. Mean taxa richness is the number of taxa divided by transect length, averaged across all transects per site (grand mean). Significance is for multiple hit (MH) cover between 2009 and 2010, and is based on an ANOVA test.

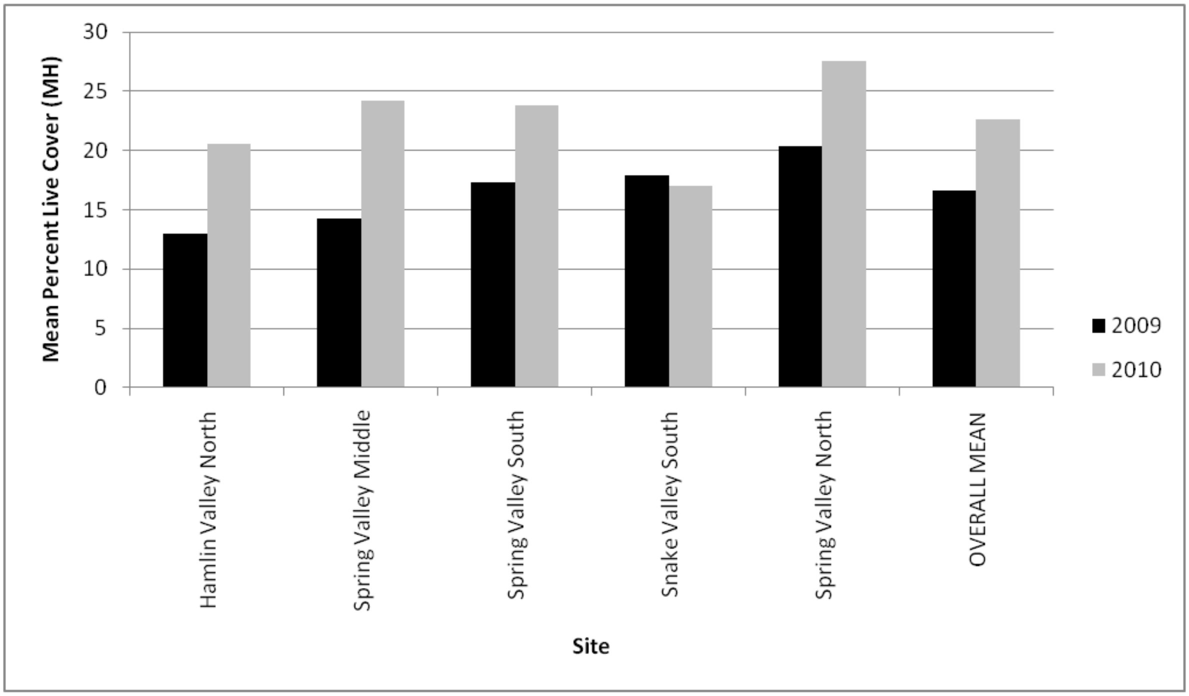
| | % Mean Live Cover (MH) | | | % Mean Live Cover (FH) | | Total Number of Taxa[a] | | Mean Transect Length (m) | Mean Taxa Richness | |
|---|---|---|---|---|---|---|---|---|---|---|
| Site | 2009 | 2010 | P ≤0.05 | 2009 | 2010 | 2009 | 2010 | | 2009 | 2010 |
| Spring Valley North | 20 | 28 | * | 20 | 27 | 12 | 23 | 100 | 0.04 | 0.09 |
| Snake Valley South | 18 | 17 | | 18 | 16 | 13 | 21 | 100 | 0.06 | 0.09 |
| Spring Valley South | 17 | 24 | * | 17 | 23 | 9 | 13 | 100 | 0.05 | 0.06 |
| Spring Valley Middle | 14 | 24 | * | 14 | 23 | 14 | 33 | 100 | 0.05 | 0.10 |
| Hamlin Valley North | 13 | 21 | * | 13 | 20 | 6 | 14 | 100 | 0.03 | 0.06 |
| **GRAND MEAN** | **17** | **23** | | **17** | **22** | **11** | **21** | | **0.05** | **0.08** |

[a]Total number of taxa in the 2009 report tables may differ than those reported in the current summary table due to species that were combined based on similar species codes (e.g. Moss/ Sp. Moss) in the 2009 data analysis.

Mean live cover first hit (FH) overall for phreatophytic shrubland transects was 29% higher in 2010 than in 2009 (grand mean live cover (FH): 2009 = 17%, 2010 = 22%) (Table 3-64 and Figure 3-46). Mean live cover (FH) ranged from 16% (Snake Valley South) to 27% (Spring Valley North) in 2010. This compares to a mean live cover (MH) in 2009 that ranged from 13% (Hamlin Valley North) to 20% (Spring Valley North). Mean live cover (FH) was very similar to mean live cover (MH), changing in the same direction and to the same degree between years for each of the regions.

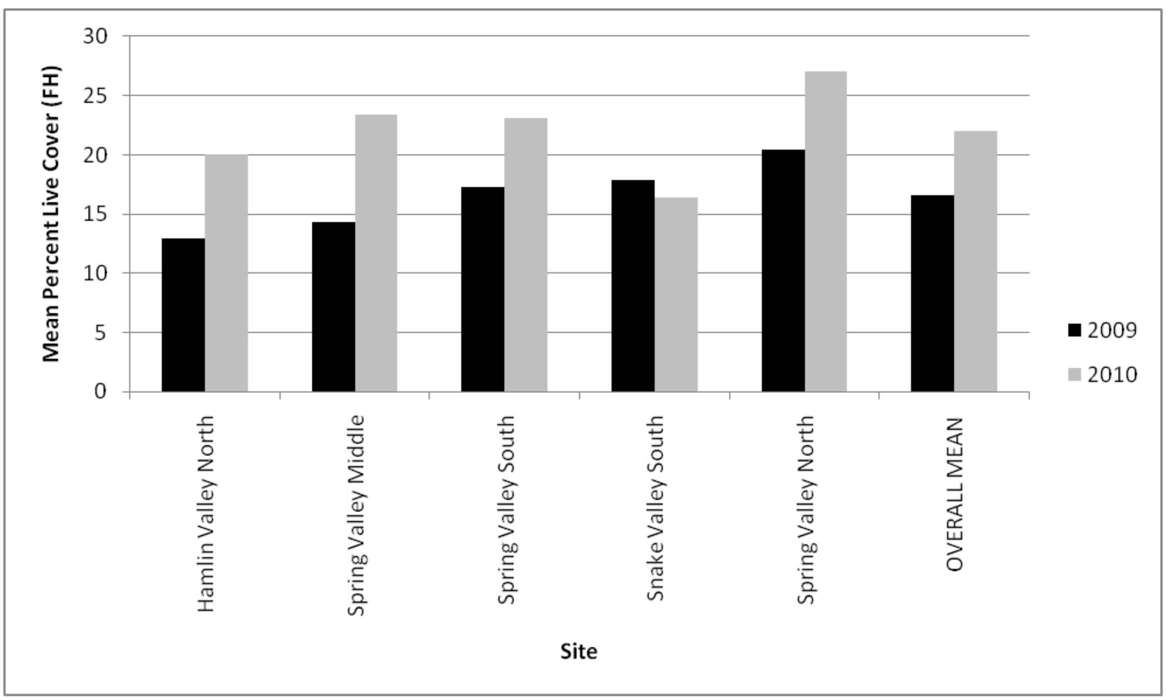
Total number of taxa overall for phreatophytic shrubland transects was 91% higher in 2010 than in 2009 (total: 2009 = 11, 2010 = 21), and mean taxa richness was 60% higher in 2010 than in 2009 (grand mean: 2009 = 0.05, 2010 = 0.08) (Table 3-64, Figures 3-47, and 3-48). [Although transect lengths are constant, the difference in total number of taxa is not the same as the difference in mean taxa richness. The grand mean for mean taxa richness takes into account the variation between transects, and that a species may occur on more than one transect]. Hamlin Valley North had the lowest taxa richness in both 2009 and 2010 (mean taxa richness: 2009 = 0.03, 2010 = 0.06; total number of taxa: 2009 = 6, 2010 = 14), while Spring Valley Middle had the highest taxa richness in both 2009 and 2010 (mean taxa richness: 2009 = 0.05, 2010 = 0.10; total number of taxa: 2009 = 14, 2010 = 33).

*Sarcobatus vermiculatus* (greasewood) was the dominant species at all of the phreatophytic shrubland transects, and there was a difference in magnitude between mean percent cover for *Sarcobatus*



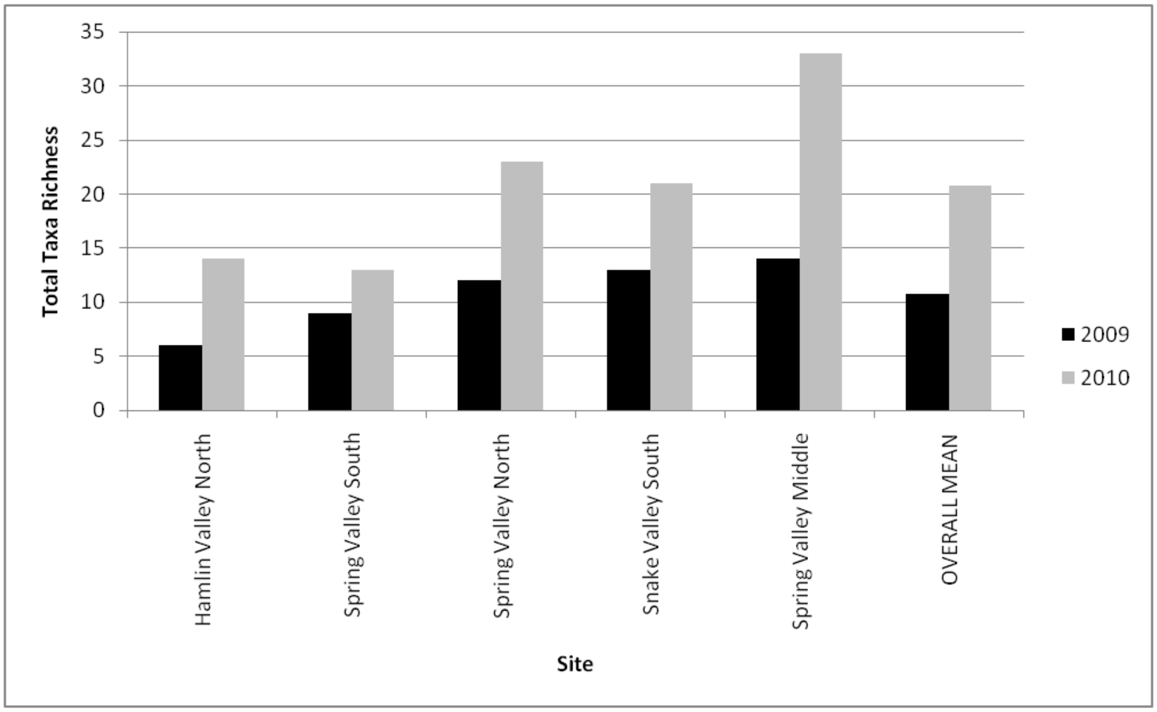

Note: Shown in ascending order based on 2009 data.

**Figure 3-45**
**Mean Live Cover Multiple Hits (MH) in 2009 and 2010 for Phreatophytic Shrubland Sites**



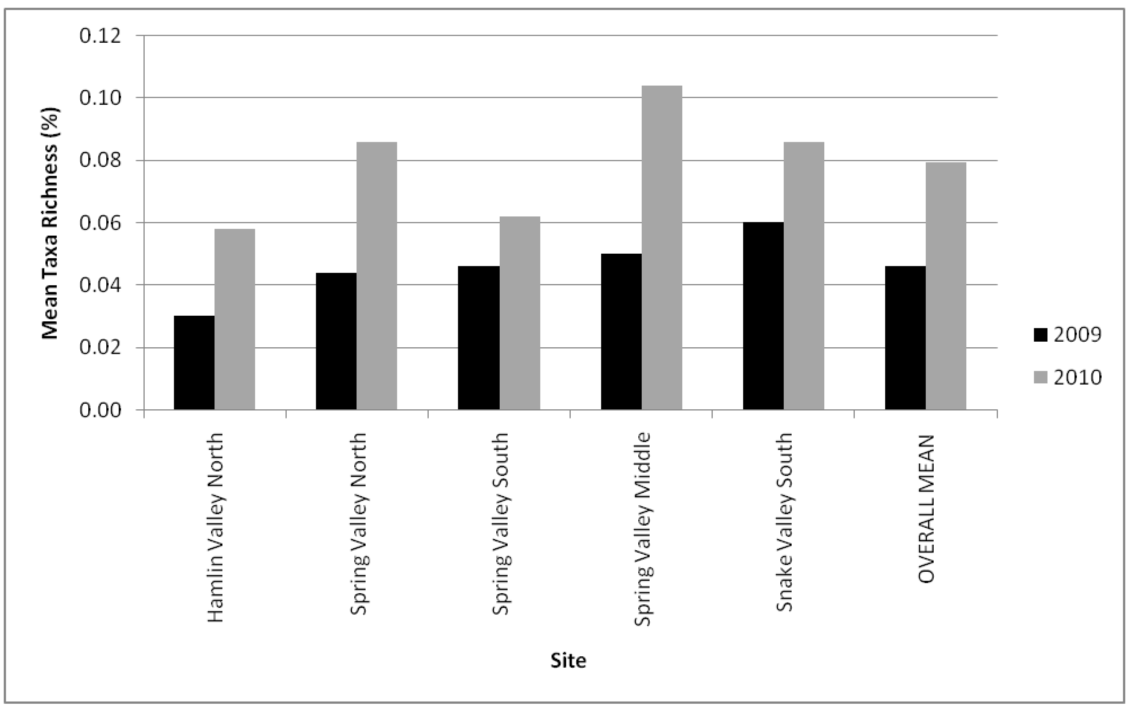

Note: Shown in ascending order based on 2009 data.

**Figure 3-46**
**Mean Live Cover First Hits (FH) in 2009 and 2010 for Phreatophytic Shrubland Sites**




Note: Shown in ascending order based on 2009 data.

**Figure 3-47**
**Total Number of Taxa in 2009 and 2010 for Phreatophytic Shrubland Sites**




Note: Shown in ascending order based on 2009 data. Total number of taxa divided by transect length, averaged across transects.

**Figure 3-48**
**Mean Number of Taxa in 2009 and 2010 for Phreatophytic Shrubland Sites**

*vermiculatus* and any other species (Table 3-65, Appendix E, Tables E-4 and E-7). Within the Spring Valley regions, the shrub species *Atriplex confertifolia, Distichlis spicata, Artemisia tridentate*, and *Ericameria nauseosa* also consistently occurred and, although mean percent cover for these four species was a great degree lower compared to *Sarcobatus vermiculatus,* it was generally higher compared to other species. *Atriplex confertifolia* also occurred within the Hamlin Valley North and Snake Valley South transects, but *Distichlis spicata*, *Artemisia tridentate*, and *Ericameria nauseosa* were absent. Because most of the live plant cover was composed of shrub species, the increase in mean live cover from 2009 to 2010 is most likely due to an increase in plant growth.

### *3.10.3.1 Greasewood Spring Valley North*

The most dominant species, by mean live cover (MH), on the phreatophytic shrubland transects at Spring Valley North in 2010 was *Sarcobatus vermiculatus* (Table 3-65). A total of 23 taxa occurred on the transects in 2010 and this total was average for the five phreatophytic shrubland sites and was substantially greater than the 12 taxa recorded in 2009. Mean live cover (MH) was above average for these phreatophytic shrubland sites.

A number of species increased significantly from 2009 to 2010 on a single transect and only one species, *Sarcobatus vermiculatus,* increased on three transects (Table 3-65). Species that showed a significant increase between 2009 and 2010 at Spring Valley North were *Distichlis spicata, Sarcobatus vermiculatus*, *Atriplex confertifolia*, *Elymus elymoides*, *Lepidium perfoliatum*, and *Descurainia Sophia*. *Halogeton glomeratus* significantly decreased on one transect in 2010. Mean live cover (MH) significantly increased from 2009 to 2010 on all five transects sampled.

**Table 3-65. Mean Live Cover Multiple Hits (MH) for the Most Dominant Species and Total Live Cover for Phreatophytic Shrubland Transects, Spring Valley North, for 2009 and 2010 (Page 1 of 2)**

Species are classified as to dominance along the transect as either transect dominant, transect subdominant, or microcommunity dominant. Taxa richness is indicated at the top of the table as total taxa and mean taxa for the transect. N represents the sample size for each species and the asterisk in the significance column represents a significant difference between years based on paired *t*-test comparison.

**Veg_153 N = 100 (Total Taxa for Transect: 2009 = 4; 2010 = 6) (Mean Taxa for Transect: 2009 = 0.04; 2010 = 0.06)**

| Species | Mean Live Cover (MH) 2009 | Mean Live Cover (MH) 2010 | Significance at ≤0.05 | Dominance Classification |
|---|---|---|---|---|
| *Sarcobatus vermiculatus* | 23.37 | 30.05 | * | Transect Dominant |
| *Ericameria nauseosa* | 0.61 | 1.92 | | Microcommunity Dominant |
| *Distichlis spicata* | 0.54 | 1.23 | * | Microcommunity Dominant |
| **Total Live Cover** | **24.54** | **33.78** | ***** | |

**Veg_154 N = 100 (Total Taxa for Transect: 2009 = 5; 2010 = 6) (Mean Taxa for Transect: 2009 = 0.05; 2010 = 0.06)**

| Species | Mean Live Cover (MH) 2009 | Mean Live Cover (MH) 2010 | Significance at ≤0.05 | Dominance Classification |
|---|---|---|---|---|
| *Sarcobatus vermiculatus* | 10.74 | 12.61 | | Transect Subdominant |
| *Atriplex confertifolia* | 1.18 | 3.17 | * | Microcommunity Dominant |
| *Artemisia tridentata* | 0.48 | 0.66 | | Microcommunity Dominant |
| *Ericameria nauseosa* | 0.48 | 1.05 | | Microcommunity Dominant |
| **Total Live Cover** | **12.90** | **17.71** | ***** | |

**Table 3-65. Mean Live Cover Multiple Hits (MH) for the Most Dominant Species and Total Live Cover for Phreatophytic Shrubland Transects, Spring Valley North, for 2009 and 2010 (Page 2 of 2)**

| Species | Mean Live Cover (MH) 2009 | Mean Live Cover (MH) 2010 | Significance at ≤0.05 | Dominance Classification |
|---|---|---|---|---|
| **Veg_157 N = 100 (Total Taxa for Transect: 2009 = 5; 2010 = 14) (Mean Taxa for Transect: 2009 = 0.05; 2010 = 0.14)** | | | | |
| *Sarcobatus vermiculatus* | 12.25 | 18.78 | * | Transect Subdominant |
| *Atriplex confertifolia* | 0.54 | 0.81 | | Microcommunity Dominant |
| *Artemisia tridentata* | 0.35 | 0.68 | | Microcommunity Dominant |
| *Chrysothamnus viscidiflorus* | 0.32 | 0.35 | | Microcommunity Dominant |
| *Elymus elymoides* | 0.00 | 0.55 | * | Microcommunity Dominant |
| **Total Live Cover** | **13.56** | **21.78** | * | |
| **Veg_158 N = 100 (Total Taxa for Transect: 2009 = 4; 2010 = 8) (Mean Taxa for Transect: 2009 = 0.04; 2010 = 0.08)** | | | | |
| **Species** | **Mean Live Cover (MH) 2009** | **Mean Live Cover (MH) 2010** | **Significance at ≤0.05** | **Dominance Classification** |
| *Sarcobatus vermiculatus* | 16.58 | 17.25 | | Transect Subdominant |
| *Artemisia tridentata* | 0.29 | 0.34 | | Microcommunity Dominant |
| *Atriplex confertifolia* | 0.08 | 0.18 | | Microcommunity Dominant |
| *Lepidium perfoliatum* | 0.00 | 2.15 | * | Microcommunity Dominant |
| **Total Live Cover** | **17.00** | **20.44** | * | |
| **Veg_185 N = 100 (Total Taxa for Transect: 2009 = 4; 2010 = 9) (Mean Taxa for Transect: 2009 = 0.04; 2010 = 0.09)** | | | | |
| **Species** | **Mean Live Cover (MH) 2009** | **Mean Live Cover (MH) 2010** | **Significance at ≤0.05** | **Dominance Classification** |
| *Sarcobatus vermiculatus* | 26.18 | 31.45 | * | Transect Dominant |
| *Halogeton glomeratus* | 7.02 | 5.15 | * | Transect Subdominant |
| *Chenopodium leptophyllum* | 0.70 | 0.23 | | Microcommunity Dominant |
| *Tetradymia spinosa* | 0.27 | 0.89 | | Microcommunity Dominant |
| *Descurainia sophia* | 0.00 | 5.81 | * | Microcommunity Dominant |
| **Total Live Cover** | **34.17** | **44.41** | * | |

### *3.10.3.2 Greasewood Spring Valley Middle*

The most dominant species, by mean live cover (MH), on the phreatophytic shrubland transects at Spring Valley Middle in 2010 was *Sarcobatus vermiculatus* (Table 3-66). A total of 33 taxa occurred on the transects in 2010 and this total was well above average for the five phreatophytic shrubland sites and was substantially greater than the 14 taxa recorded in 2009. Live cover (MH) was slightly above average for these phreatophytic shrubland sites.

As reported for Spring Valley North, a number of species increased significantly from 2009 to 2010 on a single transect and only one species, Sarcobatus vermiculatus, increased on more than one transect (four out of five transects) (Table 3-66). Species that showed a significant increase between 2009 and 2010 at Spring Valley Middle were *Erodium cicutarium*, *Eriastrum diffusum*, *Sarcobatus vermiculatus*, *Suaeda moquinii*, *Distichlis spicata*, *Suaeda calceoliformis*, and *Iva axillaris*. *Chenopodium incanum* significantly decreased on one transect in 2010. Mean live cover (MH) significantly increased from 2009 to 2010 on four of the five transects sampled.

**Table 3-66. Mean Live Cover Multiple Hits (MH) for the Most Dominant Species and Total Live Cover for Phreatophytic Shrubland Transects, Spring Valley Middle, for 2009 and 2010**

Species are classified as to dominance along the transect as either transect dominant, transect subdominant, or microcommunity dominant. Taxa richness is indicated at the top of the table as total taxa and mean taxa for the transect. N represents the sample size for each species and the asterisk in the significance column represents a significant difference between years based on paired *t*-test comparison.

**Veg_151 N = 100 (Total Taxa for Transect: 2009 = 4; 2010 = 11) (Mean Taxa for Transect: 2009 = 0.04; 2010 = 0.11)**

| Species | Mean Live Cover (MH) 2009 | Mean Live Cover (MH) 2010 | Significance at ≤0.05 | Dominance Classification |
|---|---|---|---|---|
| *Sarcobatus vermiculatus* | 9.88 | 8.89 | | Transect Subdominant |
| *Artemisia tridentata* | 6.42 | 5.83 | | Transect Subdominant |
| *Chenopodium incanum* | 0.87 | 0.00 | * | Microcommunity Dominant |
| *Erodium cicutarium* | 0.00 | 4.61 | * | Microcommunity Dominant |
| *Lappula occidentalis* var. *cupulata* | 0.00 | 1.52 | * | Microcommunity Dominant |
| **Total Live Cover** | **17.30** | **21.60** | | |

**Veg_152 N = 100 (Total Taxa for Transect: 2009 = 5; 2010 = 12) (Mean Taxa for Transect: 2009 = 0.05; 2010 = 0.12)**

| Species | Mean Live Cover (MH) 2009 | Mean Live Cover (MH) 2010 | Significance at ≤0.05 | Dominance Classification |
|---|---|---|---|---|
| *Sarcobatus vermiculatus* | 15.89 | 25.35 | * | Transect Dominant |
| *Suaeda moquinii* | 2.19 | 4.83 | * | Microcommunity Dominant |
| *Atriplex confertifolia* | 0.55 | 0.68 | | Microcommunity Dominant |
| *Artemisia tridentata* | 0.54 | 0.40 | | Microcommunity Dominant |
| *Tetradymia spinosa* | 0.19 | 0.55 | | Microcommunity Dominant |
| *Eriastrum diffusum* | **0.00** | **2.52** | ***** | Microcommunity Dominant |
| **Total Live Cover** | **19.36** | **34.86** | ***** | |

**Veg_155 N = 100 (Total Taxa for Transect: 2009 = 7; 2010 = 13) (Mean Taxa for Transect: 2009 = 0.07; 2010 = 0.13)**

| Species | Mean Live Cover (MH) 2009 | Mean Live Cover (MH) 2010 | Significance at ≤0.05 | Dominance Classification |
|---|---|---|---|---|
| *Sarcobatus vermiculatus* | 9.35 | 15.53 | * | Transect Subdominant |
| *Sporobolus airoides* | 1.03 | 1.40 | | Microcommunity Dominant |
| *Distichlis spicata* | 0.69 | 1.65 | * | Microcommunity Dominant |
| *Artemisia tridentata* | 0.44 | 0.99 | | Microcommunity Dominant |
| *Atriplex confertifolia* | 0.40 | 0.81 | | Microcommunity Dominant |
| **Total Live Cover** | **11.98** | **21.80** | ***** | |

**Veg_156 N = 100 (Total Taxa for Transect: 2009 = 5; 2010 = 6) (Mean Taxa for Transect: 2009 = 0.05; 2010 = 0.06)**

| Species | Mean Live Cover (MH) 2009 | Mean Live Cover (MH) 2010 | Significance at ≤0.05 | Dominance Classification |
|---|---|---|---|---|
| *Sarcobatus vermiculatus* | 16.51 | 23.98 | * | Transect Dominant |
| *Atriplex confertifolia* | 1.11 | 1.39 | | Microcommunity Dominant |
| *Suaeda moquinii* | 1.11 | 1.21 | | Microcommunity Dominant |
| *Suaeda calceoliformis* | 0.00 | 1.24 | * | Microcommunity Dominant |
| **Total Live Cover** | **18.87** | **27.86** | ***** | |

**Veg_184 N = 100 (Total Taxa for Transect: 2009 = 4; 2010 = 10) (Mean Taxa for Transect: 2009 = 0.04; 2010 = 0.10)**

| Species | Mean Live Cover (MH) 2009 | Mean Live Cover (MH) 2010 | Significance at ≤0.05 | Dominance Classification |
|---|---|---|---|---|
| *Sarcobatus vermiculatus* | 3.37 | 11.42 | * | Transect Subdominant |
| *Ericameria nauseosa* | 0.49 | 1.31 | | Microcommunity Dominant |
| *Iva axillaris* | 0.46 | 1.37 | * | Microcommunity Dominant |
| **Total Live Cover** | **4.33** | **14.72** | ***** | |

### 3.10.3.3 Greasewood Spring Valley South

The most dominant species, by mean live cover (MH), on the phreatophytic shrubland transects at Spring Valley South in 2010 was *Sarcobatus vermiculatus* (Table 3-67). A total of 13 taxa occurred on the transects in 2010 and this total was well below average for the five phreatophytic shrubland sites and was slightly greater than the 9 taxa recorded in 2009. Mean live cover (MH) was slightly above average for these phreatophytic shrubland sites.

A number of species increased significantly from 2009 to 2010 on a single transect and two species, *Sarcobatus vermiculatus* and *Ericameria nauseosa*, increased on more than one transect (Table 3-67). Species that showed a significant increase between 2009 and 2010 at Spring Valley South were *Distichlis spicata*, *Atriplex confertifolia*, *Elymus elymoides*, *Sarcobatus vermiculatus*, *Ericameria nauseosa*, and *Artemisia tridentata*. There were no species that showed a significant decrease between 2009 and 2010. Mean Live Cover (MH) significantly increased from 2009 to 2010 on all five transects sampled.

**Table 3-67. Mean Live Cover Multiple Hits (MH) for the Most Dominant Species and Total Live Cover for Phreatophytic Shrubland Transects, Spring Valley South, for 2009 and 2010 (Page 1 of 2)**

Species are classified as to dominance along the transect as either transect dominant, transect subdominant, or microcommunity dominant. Taxa richness is indicated at the top of the table as total taxa and mean taxa for the transect. N represents the sample size for each species and the asterisk in the significance column represents a significant difference between years based on paired *t*-test comparison.

| Species | Mean Live Cover (MH) 2009 | Mean Live Cover (MH) 2010 | Significance at ≤0.05 | Dominance Classification |
|---|---|---|---|---|
| **Veg_130 N = 100 (Total Taxa for Transect: 2009 = 5; 2010 = 7) (Mean Taxa for Transect: 2009 = 0.05; 2010 = 0.07)** | | | | |
| *Sarcobatus vermiculatus* | 11.46 | 12.17 | | Transect Subdominant |
| *Distichlis spicata* | 5.35 | 8.19 | * | Transect Subdominant |
| *Ericameria nauseosa* | 0.70 | 0.68 | | Microcommunity Dominant |
| *Atriplex confertifolia* | 0.64 | 0.87 | | Microcommunity Dominant |
| **Total Live Cover** | **18.18** | **22.08** | * | |
| **Veg_136 N = 100 (Total Taxa for Transect: 2009 = 2; 2010 = 3) (Mean Taxa for Transect: 2009 = 0.02; 2010 = 0.03)** | | | | |
| *Sarcobatus vermiculatus* | 15.58 | 19.09 | * | Transect Subdominant |
| *Atriplex confertifolia* | 1.32 | 2.91 | * | Microcommunity Dominant |
| *Elymus elymoides* | 0.00 | 0.32 | * | Microcommunity Dominant |
| **Total Live Cover** | **16.90** | **22.32** | * | |
| **Veg_137 N = 100 (Total Taxa for Transect: 2009 = 8; 2010 = 9) (Mean Taxa for Transect: 2009 = 0.08; 2010 = 0.09)** | | | | |
| *Sarcobatus vermiculatus* | 19.76 | 20.75 | | Transect Dominant |
| *Suaeda* sp. | 2.78 | 5.11 | * | Microcommunity Dominant |
| *Atriplex confertifolia* | 2.00 | 1.64 | | Microcommunity Dominant |
| *Distichlis spicata* | 1.83 | 2.21 | | Microcommunity Dominant |
| *Ericameria nauseosa* | 0.97 | 1.56 | * | Microcommunity Dominant |
| *Bassia scoparia* | 0.82 | 0.51 | | Microcommunity Dominant |
| *Sporobolus airoides* | 0.46 | 0.61 | | Microcommunity Dominant |
| **Total Live Cover** | **28.64** | **32.49** | * | |

**Table 3-67. Mean Live Cover Multiple Hits (MH) for the Most Dominant Species and Total Live Cover for Phreatophytic Shrubland Transects, Spring Valley South, for 2009 and 2010 (Page 2 of 2)**

| Veg_138 N = 100 (Total Taxa for Transect: 2009 = 5; 2010 = 8) (Mean Taxa for Transect: 2009 = 0.05; 2010 = 0.08) | | | | |
|---|---|---|---|---|
| **Species** | **Mean Live Cover (MH) 2009** | **Mean Live Cover (MH) 2010** | **Significance at ≤0.05** | **Dominance Classification** |
| *Sarcobatus vermiculatus* | 6.85 | 12.93 | * | Transect Subdominant |
| *Ericameria nauseosa* | 1.66 | 2.78 | * | Microcommunity Dominant |
| *Distichlis spicata* | 0.99 | 1.19 | | Microcommunity Dominant |
| *Suaeda moquinii* | 0.00 | 2.55 | * | Microcommunity Dominant |
| **Total Live Cover** | **9.87** | **21.09** | * | |
| **Veg_149 N = 100 (Total Taxa for Transect: 2009 = 3; 2010 = 4) (Mean Taxa for Transect: 2009 = 0.03; 2010 = 0.04)** | | | | |
| **Species** | **Mean Live Cover (MH) 2009** | **Mean Live Cover (MH) 2010** | **Significance at ≤0.05** | **Dominance Classification** |
| *Sarcobatus vermiculatus* | 10.65 | 16.53 | * | Transect Subdominant |
| *Artemisia tridentata* | 1.63 | 3.52 | * | Microcommunity Dominant |
| *Atriplex confertifolia* | 0.50 | 0.87 | | Microcommunity Dominant |
| **Total Live Cover** | **12.78** | **21.00** | * | |

### 3.10.3.4 Greasewood Hamlin Valley North

The most dominant species, by mean live cover (MH), on the phreatophytic shrubland transects at Hamlin Valley North in 2010 were *Sarcobatus vermiculatus* and *Grayia spinosa* (Table 3-68). A total of 14 taxa occurred on the transects in 2010 and this total was well below average for the five phreatophytic shrubland sites and was greater than the 6 taxa recorded in 2009. Mean live cover (MH) was slightly below average for these phreatophytic shrubland sites.

A number of species increased significantly from 2009 to 2010 on a single transect and three species, *Sarcobatus vermiculatus*, *Atriplex confertifolia*, and *Halogeton glomeratus* increased on more than one transect (Table 3-68). Species that showed a significant increase between 2009 and 2010 at Hamlin Valley North were *Atriplex confertifolia*, *Elymus elymoides*, *Sarcobatus vermiculatus*, *Halogeton glomeratus*, *Grayia spinosa*, and *Picrothamnus desertorum*. There were no species that showed a significant decrease between 2009 and 2010. Mean live cover (MH) significantly increased from 2009 to 2010 on four of the five transects sampled.

**Table 3-68. Mean Live Cover Multiple Hits (MH) for the Most Dominant Species and Total Live Cover for Phreatophytic Shrubland Transects, Hamlin Valley North, for 2009 and 2010**

Species are classified as to dominance along the transect as either transect dominant, transect subdominant, or microcommunity dominant. Taxa richness is indicated at the top of the table as total taxa and mean taxa for the transect. N represents the sample size for each species and the asterisk in the significance column represents a significant difference between years based on paired *t*-test comparison.

**Veg_159 N = 100 (Total Taxa for Transect: 2009 = 3; 2010 = 7) (Mean Taxa for Transect: 2009 = 0.03; 2010 = 0.07)**

| Species | Mean Live Cover (MH) 2009 | Mean Live Cover (MH) 2010 | Significance at ≤0.05 | Dominance Classification |
|---|---|---|---|---|
| *Sarcobatus vermiculatus* | 16.51 | 19.95 | * | Transect Subdominant |
| *Atriplex confertifolia* | 0.48 | 1.33 | * | Microcommunity Dominant |
| *Elymus elymoides* | 0.00 | 0.76 | * | Microcommunity Dominant |
| **Total Live Cover** | **17.03** | **22.43** | * | |

**Veg_160 N = 100 (Total Taxa for Transect: 2009 = 2; 2010 = 3) (Mean Taxa for Transect: 2009 = 0.02; 2010 = 0.03)**

| Species | Mean Live Cover (MH) 2009 | Mean Live Cover (MH) 2010 | Significance at ≤0.05 | Dominance Classification |
|---|---|---|---|---|
| *Sarcobatus vermiculatus* | 3.11 | 8.45 | * | Microcommunity Dominant |
| *Atriplex confertifolia* | 1.22 | 1.72 | | Microcommunity Dominant |
| **Total Live Cover** | **4.33** | **10.32** | * | |

**Veg_161 N = 100 (Total Taxa for Transect: 2009 = 2; 2010 = 4) (Mean Taxa for Transect: 2009 = 0.02; 2010 = 0.04)**

| Species | Mean Live Cover (MH) 2009 | Mean Live Cover (MH) 2010 | Significance at ≤0.05 | Dominance Classification |
|---|---|---|---|---|
| *Sarcobatus vermiculatus* | 5.50 | 13.72 | * | Transect Subdominant |
| *Atriplex confertifolia* | 0.61 | 1.33 | * | Microcommunity Dominant |
| **Total Live Cover** | **6.11** | **15.13** | * | |

**Veg_162 N = 100 (Total Taxa for Transect: 2009 = 2; 2010 = 7) (Mean Taxa for Transect: 2009 = 0.02; 2010 = 0.07)**

| Species | Mean Live Cover (MH) 2009 | Mean Live Cover (MH) 2010 | Significance at ≤0.05 | Dominance Classification |
|---|---|---|---|---|
| *Sarcobatus vermiculatus* | 23.86 | 25.43 | | Transect Dominant |
| *Atriplex confertifolia* | 0.09 | 0.34 | | Microcommunity Dominant |
| *Halogeton glomeratus* | 0.00 | 0.97 | * | Microcommunity Dominant |
| **Total Live Cover** | **23.95** | **27.47** | | |

**Veg_163 N = 100 (Total Taxa for Transect: 2009 = 6; 2010 = 8) (Mean Taxa for Transect: 2009 = 0.06; 2010 = 0.08)**

| Species | Mean Live Cover (MH) 2009 | Mean Live Cover (MH) 2010 | Significance at ≤0.05 | Dominance Classification |
|---|---|---|---|---|
| *Sarcobatus vermiculatus* | 8.19 | 12.62 | * | Transect Subdominant |
| *Grayia spinosa* | 3.83 | 9.66 | * | Transect Subdominant |
| *Halogeton glomeratus* | 0.75 | 2.91 | * | Microcommunity Dominant |
| *Picrothamnus desertorum* | 0.31 | 1.22 | * | Microcommunity Dominant |
| **Total Live Cover** | **13.14** | **27.48** | * | |

### 3.10.3.5 Greasewood Snake Valley South

The most dominant species, by mean live cover (MH), on the phreatophytic shrubland transects at Snake Valley South in 2010 was *Sarcobatus vermiculatus* (Table 3-69). A total of 21 taxa occurred on the transects in 2010 and this total was average for the five phreatophytic shrubland sites and was greater than the 13 taxa recorded in 2009. Mean live cover (MH) was below average for these phreatophytic shrubland sites.

A number of species increased significantly from 2009 to 2010 on a single transect and one species, *Chrysothamnus humilis*, increased on three transects (Table 3-69). Species that showed a significant increase between 2009 and 2010 at Snake Valley South were *Chrysothamnus humilis*, *Achnatherum hymenoides*, *Halogeton glomeratus*, *Bassia americana*, and *Picrothamnus desertorum*. There were also two species that showed a significant decrease between 2009 and 2010, which included *Sarcobatus vermiculatus* and *Gutierrezia sarothrae*. Mean live cover (MH) showed no change on four of the five transects and significantly decreased from 2009 to 2010 on one transect sampled.

**Table 3-69. Mean Live Cover Multiple Hits (MH) for the Most Dominant Species and Total Live Cover for Phreatophytic Shrubland Transects, Snake Valley South, for 2009 and 2010 (Page 1 of 2)**

Species are classified as to dominance along the transect as either transect dominant, transect subdominant, or microcommunity dominant. Taxa richness is indicated at the top of the table as total taxa and mean taxa for the transect. N represents the sample size for each species and the asterisk in the significance column represents a significant difference between years based on paired *t*-test comparison.

| Species | Mean Live Cover (MH) 2009 | Mean Live Cover (MH) 2010 | Significance at ≤0.05 | Dominance Classification |
|---|---|---|---|---|
| **Veg_179 N = 100 (Total Taxa for Transect: 2009 = 6; 2010 = 11) (Mean Taxa for Transect: 2009 = 0.06; 2010 = 0.11)** | | | | |
| *Sarcobatus vermiculatus* | 26.90 | 27.04 | | Transect Dominant |
| *Tetradymia spinosa* | 1.42 | 0.00 | * | Microcommunity Dominant |
| *Halogeton glomeratus* | 0.23 | 0.41 | | Microcommunity Dominant |
| **Total Live Cover** | **29.22** | **29.57** | | |
| **Veg_180 N = 100 (Total Taxa for Transect: 2009 = 4; 2010 = 4) (Mean Taxa for Transect: 2009 = 0.04; 2010 = 0.04)** | | | | |
| **Species** | **Mean Live Cover (MH) 2009** | **Mean Live Cover (MH) 2010** | **Significance at ≤0.05** | **Dominance Classification** |
| *Sarcobatus vermiculatus* | 16.33 | 14.36 | * | Transect Subdominant |
| *Bassia americana* | 2.12 | 2.65 | | Microcommunity Dominant |
| *Atriplex confertifolia* | 0.42 | 0.72 | | Microcommunity Dominant |
| **Total Live Cover** | **19.08** | **17.95** | | |
| **Veg_181 N = 100 (Total Taxa for Transect: 2009 = 4; 2010 = 9) (Mean Taxa for Transect: 2009 = 0.04; 2010 = 0.09)** | | | | |
| **Species** | **Mean Live Cover (MH) 2009** | **Mean Live Cover (MH) 2010** | **Significance at ≤0.05** | **Dominance Classification** |
| *Sarcobatus vermiculatus* | 11.73 | 9.60 | | Transect Subdominant |
| *Gutierrezia sarothrae* | 1.45 | 0.00 | * | Microcommunity Dominant |
| *Atriplex confertifolia* | 0.92 | 0.89 | | Microcommunity Dominant |
| *Chrysothamnus humilis* | 0.00 | 1.05 | * | Microcommunity Dominant |
| **Total Live Cover** | **14.52** | **12.97** | | |

**Table 3-69. Mean Live Cover Multiple Hits (MH) for the Most Dominant Species and Total Live Cover for Phreatophytic Shrubland Transects, Snake Valley South, for 2009 and 2010 (Page 2 of 2)**

| Species | Mean Live Cover (MH) 2009 | Mean Live Cover (MH) 2010 | Significance at ≤0.05 | Dominance Classification |
|---|---|---|---|---|
| **Veg_182 N = 100 (Total Taxa for Transect: 2009 = 7; 2010 = 10) (Mean Taxa for Transect: 2009 = 0.07; 2010 = 0.10)** | | | | |
| *Sarcobatus vermiculatus* | 10.11 | 9.80 | | Transect Subdominant |
| *Gutierrezia sarothrae* | 1.14 | 0.00 | * | Microcommunity Dominant |
| *Atriplex confertifolia* | 0.75 | 0.53 | | Microcommunity Dominant |
| *Picrothamnus desertorum* | 0.34 | 0.92 | | Microcommunity Dominant |
| *Achnatherum hymenoides* | 0.16 | 0.89 | * | Microcommunity Dominant |
| *Halogeton glomeratus* | 0.09 | 0.50 | * | Microcommunity Dominant |
| *Chrysothamnus humilis* | 0.00 | 1.05 | * | Microcommunity Dominant |
| **Total Live Cover** | **12.62** | **14.13** | | |
| **Veg_183 N = 100 (Total Taxa for Transect: 2009 = 9; 2010 = 9) (Mean Taxa for Transect: 2009 = 0.09; 2010 = 0.09)** | | | | |
| **Species** | **Mean Live Cover (MH) 2009** | **Mean Live Cover (MH) 2010** | **Significance at ≤0.05** | **Dominance Classification** |
| *Sarcobatus vermiculatus* | 11.91 | 6.94 | * | Transect Subdominant |
| *Gutierrezia sarothrae* | 0.64 | 0.00 | | Microcommunity Dominant |
| *Picrothamnus desertorum* | 0.55 | 1.22 | * | Microcommunity Dominant |
| *Atriplex confertifolia* | 0.50 | 0.38 | | Microcommunity Dominant |
| *Bassia americana* | 0.00 | 0.54 | * | Microcommunity Dominant |
| *Chenopodium humilis* | 0.00 | 0.68 | * | Microcommunity Dominant |
| **Total Live Cover** | **14.50** | **10.21** | * | |

### *3.10.4 VFRM Juniper Transects*

For the VFRM juniper woodland transects, analyses were run on the two VFRM juniper woodland populations (Swamp Cedar North and Swamp Cedar South), as well as on Dry Sites and Wet Sites within each of the populations. Transects were categorized as Dry Site or Wet Site by using the understory vegetation composition to deduce typical moisture conditions (Swamp Cedar North: 8 Dry Sites, 8 Wet Sites; Swamp Cedar South: 8 Dry Sites, 8 Wet Sites).

Mean live cover multiple hits (MH) overall for VFRM juniper woodland transects differed slightly from 2009 to 2010 (grand mean: 2009 = 65%, 2010 = 71%) (Table 3-70 and Figure 3-49). One of the two populations showed a significant increase in mean live cover (MH) in 2010 (Swamp Cedar North: 13% increase). The biggest difference in mean live cover (MH) between 2009 and 2010 was seen in the Swamp Cedar North – Wet Sites, which increased 16% in 2010 (2009: 83%, 2010: 96%).

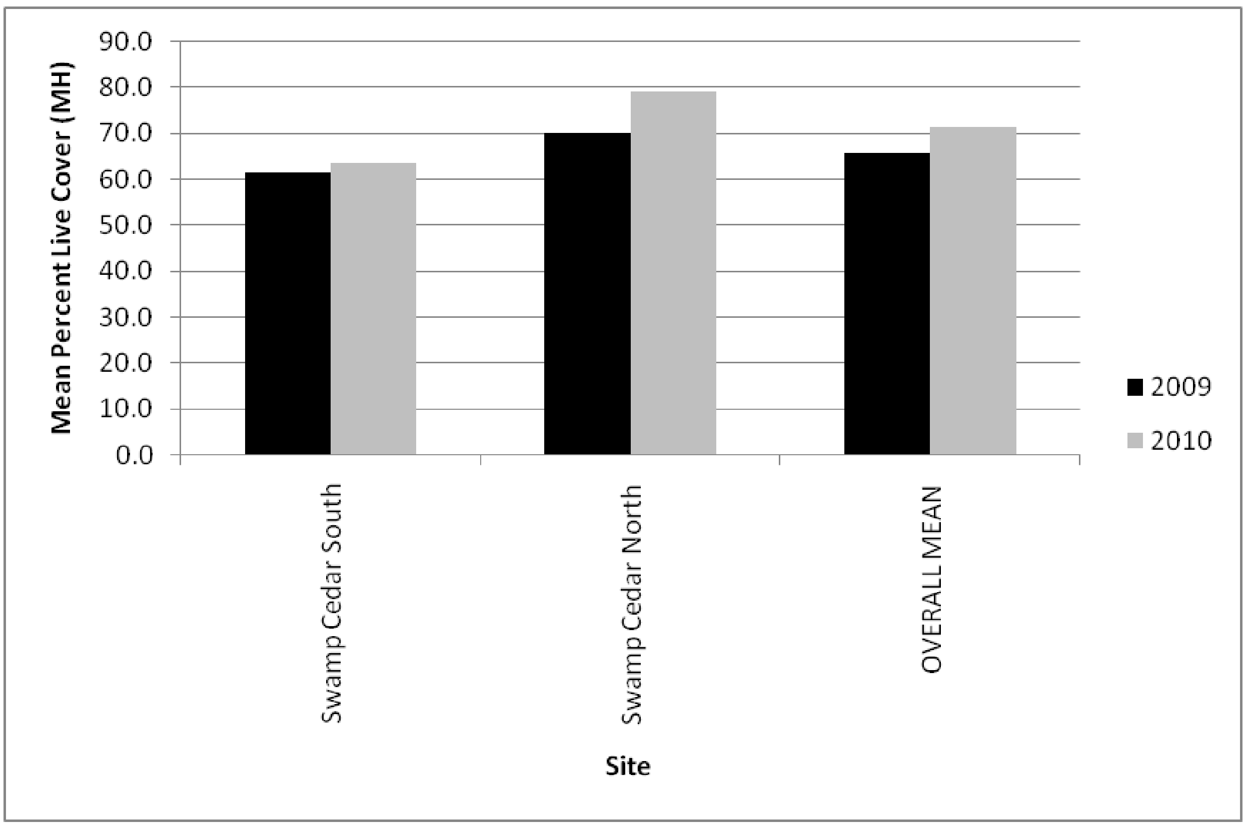
Mean live cover (MH) at Swamp Cedar North was 15-25% higher than at Swamp Cedar South in both 2009 and 2010 (grand mean: Swamp Cedar North 2009 = 70%, 2010 = 79%; Swamp Cedar South 2009 = 61%, 2010 = 63%) (Table 3-70 and Figure 3-50). Across populations, mean live cover (MH) was 64-70% higher at Wet Sites than at Dry Sites in both 2009 and 2010 (grand mean: Dry Sites 2009 = 50%, 2010 = 53%; Wet Sites 2009 = 81%, 2010 = 90%). Swamp Cedar South – Dry Sites had the lowest mean live cover (MH) in both 2009 and 2010 (grand mean: 2009 = 43%, 2010 = 43%), while Swamp Cedar North – Wet Sites had the highest mean live cover (MH) in both 2009 and 2010 (grand mean: 2009 = 83%, 2010 = 96%).

**Table 3-70. Summary of Mean Live Cover Multiple Hits (MH), Total Number of Taxa and Mean Taxa Richness on the VFRM Woodland Belt Transects in Spring Valley for 2009 and 2010**

Cover values are averages over all transects per site (grand mean). Total number of taxa is the total number of taxa or species observed across all transects per site. Mean taxa richness is the number of taxa divided by transect length, averaged across all transects per site (grand mean). Significance is for multiple hit (MH) cover between 2009 and 2010, and is based on an ANOVA test.

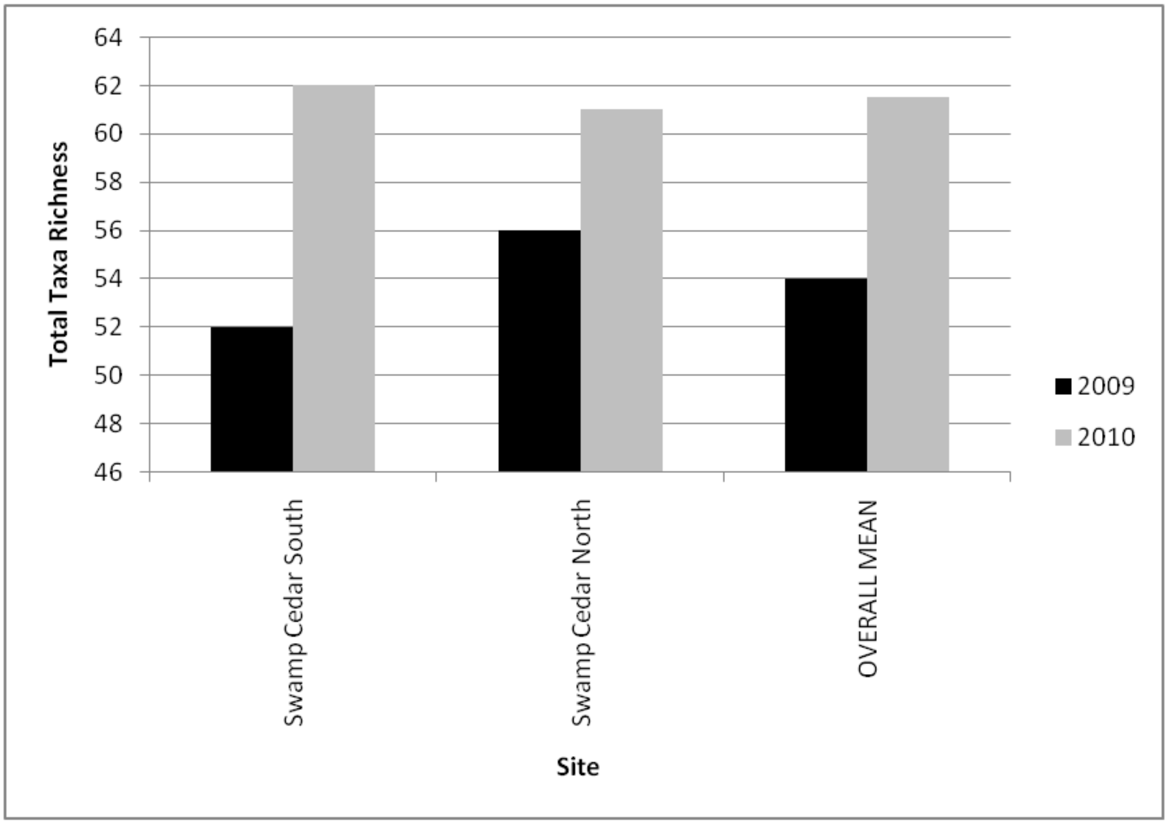
| Site | % Mean Live Cover (MH) 2009 | % Mean Live Cover (MH) 2010 | P ≤0.05 | Total Number of Taxa[a] 2009 | Total Number of Taxa[a] 2010 | Mean Transect Length (m)[b] | Mean Taxa Richness 2009 | Mean Taxa Richness 2010 |
|---|---|---|---|---|---|---|---|---|
| **Swamp Cedar North** | **70** | **79** | | | | | | |
| **Overall** | 56 | 62 | * | **56** | **61** | 20 | **0.8** | **0.9** |
| Dry Sites | 83 | 96 | | 27 | 34 | 20 | 0.7 | 0.8 |
| Wet Sites | | | | 48 | 52 | 20 | 0.9 | 1.1 |
| **Swamp Cedar South** | **61** | **63** | | | | | | |
| **Overall** | 43 | 43 | | **52** | **62** | 20 | **0.5** | **0.6** |
| Dry Sites | 79 | 83 | | 21 | 19 | 20 | 0.4 | 0.4 |
| Wet Sites | | | | 46 | 56 | 20 | 0.6 | 0.7 |
| | **65** | **71** | | | | | | |
| **GRAND MEAN** | **70** | **79** | | **54** | **62** | | **0.6** | **0.7** |

[a]Total number of taxa in the 2009 report tables may differ than those reported in the current summary table due to species that were combined based on similar species codes (e.g. Moss/ Sp. Moss) in the 2009 data analysis.
[b]Analysis were done at the belt transect level.




Note: Shown in ascending order based on 2009 data.

**Figure 3-49**
**Mean Live Cover Multiple Hits (MH) in 2009 and 2010 for VFRM Juniper Woodland Sites**

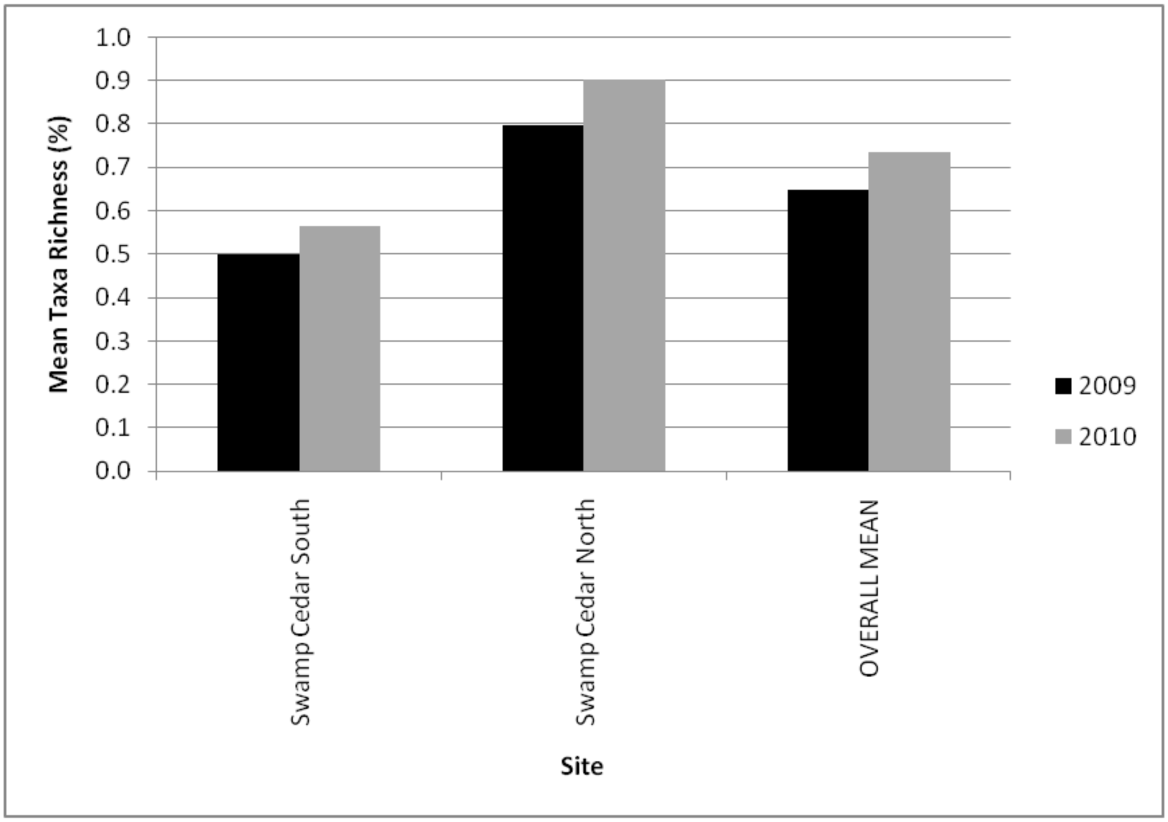



Note: Shown in ascending order based on 2009 data.

**Figure 3-50**
**Total Number of Taxa in 2009 and 2010 for VFRM Juniper Woodland Sites**

Total number of taxa overall for VFRM juniper woodland transects was 15% higher in 2010 than in 2009 (total: 2009 = 54, 2010 = 62), and mean taxa richness was 17% higher in 2010 than in 2009 (grand mean: 2009 = 0.6, 2010 = 0.7) (Table 3-70, Figures 3-50 and 3-51). Most notable is the increase in total number of taxa in 2010 for Swamp Cedar North – Dry Sites (26% increase) and Swamp Cedar South – Wet Sites (22% increase), and the increase in mean taxa richness in 2010 for Swamp Cedar North – Wet Sites (22% increase).

Mean taxa richness was 50-60% higher at Swamp Cedar North than at Swamp Cedar South in both 2009 and 2010 (grand mean: Swamp Cedar North 2009 = 0.8, 2010 = 0.9%; Swamp Cedar South 2009 = 0.5, 2010 = 0.6), although total number of taxa did not appreciably differ (total: Swamp Cedar North 2009 = 56, 2010 = 61; Swamp Cedar South 2009 = 52, 2010 = 62) (Table 3-70, Figures 3-50 and 3-51). Across populations, mean taxa richness was 36-50% higher at Wet Sites than at Dry Sites in both 2009 and 2010 (grand mean: Dry Sites 2009 = 0.6, 2010 = 0.6; Wet Sites 2009 = 0.8, 2010 = 0.9). Swamp Cedar South – Dry Sites had the lowest taxa richness in both 2009 and 2010 (mean taxa richness: 2009 = 0.4, 2010 = 0.4; total number of taxa: 2009 = 21, 2010 = 19), while Swamp Cedar North – Wet Sites had the highest taxa richness in both 2009 and 2010 (mean taxa richness: 2009 = 0.9, 2010 = 1.1; total number of taxa: 2009 = 48, 2010 = 52).




Note: Shown in ascending order based on 2009 data. Total number of taxa divided by transect length, averaged across transects.

**Figure 3-51**
**Mean Number of Taxa in 2009 and 2010 for VFRM Juniper Woodland Sites**

The live cover of some individual species or taxa changed greatly between 2009 and 2010, whereas other species cover varied little between the two years (Appendix E, Table E-8). *Juniperus scopulorum* (VFRM juniper, or swamp cedar) was the dominant species at all of the VFRM juniper woodland transects, and there was a difference in magnitude between mean percent cover for *Juniperus scopulorum* and any other species (Table 3-70 and Appendix E, Table E-8). Across populations, *Juniperus scopulorum* had 37% greater mean percent cover at Wet Sites compared to Dry Sites in both 2009 and 2010 (grand mean: Wet Sites 2009 = 54%, 2010 = 56%; Dry Sites 2009 = 40%, 2010 = 41%). The grassland species *Sporobolus airoides* also consistently occurred across both populations and, although mean percent cover for this species was a great degree lower compared to *Juniperus scopulorum*, it was generally higher compared to the other understory species (Appendix E, Table E-8). In the Swamp Cedar North population, the shrub species *Ericameria nauseosa* and the grassland species *Leymus triticoides* and *Puccinellia lemmonii* were also common with relatively higher mean percent cover compared to the other understory species. The Swamp Cedar South population had less understory than the Swamp Cedar North population in both 2009 and 2010; this was especially true on the Swamp Cedar South – Dry Sites.

### 3.10.4.1 Swamp Cedar North Wet Sites

Overstory cover of *Juniperus scopulorum* showed an increase on five transects between 2009 and 2010 at the wet VFRM juniper woodland sites in Swamp Cedar North. A total of 11 understory species had significant changes in mean live cover (MH) between 2009 and 2010 (Table 3-71). Eight of these species had increases in cover in 2010, and only three species had less cover in 2010. Understory species that had more cover in 2010 included *Puccinellia lemmonii*, *Distichlis spicata*, *Poa* sp., *Spartina gracilis*, *Atriplex micrantha*, *Leymus triticoides*, *Bassia scoparia*, and *Poa secunda*. Understory species that had less cover in 2010 than in 2009 included A*rgentina anserine*, *Sporobolus airoides*, and *Crepis runcinata*.

**Table 3-71. Mean Live Cover Multiple Hits (MH) for the Most Dominant Species and Total Live Cover for the VFRM Juniper Woodland Belt Transects at Swamp Cedar North Wet Sites, 2009 and 2010 (Page 1 of 2)**

Species are classified as to dominance along the transect as either transect dominant, transect subdominant, or microcommunity dominant. Taxa richness is indicated at the top of the table as total taxa and mean taxa for the transect. N represents the sample size for each species and the asterisk in the significance column represents a significant difference between years based on paired *t*-test comparison.

**Veg_098 N = 20 (Total Taxa for Transect: 2009 = 20; 2010 = 26) (Mean Taxa for Transect: 2009 = 1.0; 2010 = 1.3)**

| Species | Mean Live Cover (MH) 2009 | Mean Live Cover (MH) 2010 | Significance at ≤0.05 | Dominance Classification |
|---|---|---|---|---|
| *Juniperus scopulorum* | 65.30 | 71.23 | * | Transect Dominant |
| *Puccinellia lemmonii* | 8.32 | 14.30 | * | Transect Subdominant |
| *Distichlis spicata* | 6.28 | 9.38 | * | Transect Subdominant |
| *Pyrrocoma lanceolata* | 5.98 | 5.90 | | Transect Subdominant |
| *Carex* sp. | 3.78 | 3.92 | | Microcommunity Dominant |
| **Total Live Cover** | **108.37** | **125.05** | * | |

Based on field data and the distribution of hits along the transect, species listed as *Carex praegracilis* in 2009 and *Carex parryana* in 2010 were analyzed as *Carex* sp. for *t*-test analysis.

**Veg_104 N = 20 (Total Taxa for Transect: 2009 = 24; 2010 = 27) (Mean Taxa for Transect: 2009 = 1.2; 2010 = 1.4)**

| Species | Mean Live Cover (MH) 2009 | Mean Live Cover (MH) 2010 | Significance at ≤0.05 | Dominance Classification |
|---|---|---|---|---|
| *Juniperus scopulorum* | 31.82 | 34.58 | | Transect Dominant |
| *Poa* sp. | 6.22 | 9.13 | * | Transect Subdominant |
| *Spartina gracilis* | 6.22 | 5.83 | | Transect Subdominant |
| *Equisetum arvense* | 2.20 | 2.57 | | Microcommunity Dominant |
| *Argentina anserina* | 1.78 | 0.23 | * | Microcommunity Dominant |
| *Rosa woodsii* | 1.48 | 1.67 | | Microcommunity Dominant |
| *Ericameria nauseosa* | 0.72 | 1.17 | | Microcommunity Dominant |
| **Total Live Cover** | **57.63** | **63.82** | * | |

Based on field data and the distribution of hits along the transect, species listed as *Puccinellia lemmonii* in 2009 and *Poa secunda* in 2010 were analyzed as *Poa* sp. for *t*-test analysis.

**Veg_105 N = 20 (Total Taxa for Transect: 2009 = 16; 2010 = 15) (Mean Taxa for Transect: 2009 = 0.8; 2010 = 0.8)**

| Species | Mean Live Cover (MH) 2009 | Mean Live Cover (MH) 2010 | Significance at ≤0.05 | Dominance Classification |
|---|---|---|---|---|
| *Juniperus scopulorum* | 43.57 | 43.17 | | Transect Dominant |
| *Ericameria nauseosa* | 4.80 | 2.90 | | Microcommunity Dominant |
| *Sporobolus airoides* | 4.38 | 2.25 | * | Microcommunity Dominant |
| **Total Live Cover** | **55.80** | **51.93** | * | |

**Table 3-71. Mean Live Cover Multiple Hits (MH) for the Most Dominant Species and Total Live Cover for the VFRM Juniper Woodland Belt Transects at Swamp Cedar North Wet Sites, 2009 and 2010 (Page 2 of 2)**

**Veg_107 N = 20 (Total Taxa for Transect: 2009 = 16; 2010 = 21) (Mean Taxa for Transect: 2009 = 0.8; 2010 = 1.1)**

| Species | Mean Live Cover (MH) 2009 | Mean Live Cover (MH) 2010 | Significance at ≤0.05 | Dominance Classification |
|---|---|---|---|---|
| *Juniperus scopulorum* | 54.38 | 57.85 | | Transect Dominant |
| *Leymus triticoides* | 31.32 | 48.88 | * | Transect Dominant |
| *Bassia scoparia* | 5.63 | 5.68 | | Transect Subdominant |
| *Poa* sp. | 2.98 | 4.83 | | Microcommunity Dominant |
| *Atriplex micrantha* | 0.10 | 5.72 | * | Microcommunity Dominant |
| **Total Live Cover** | **98.52** | **127.22** | * | |

Based on field data and the distribution of hits along the transect, species listed as *Poa secunda* or *Puccinellia lemmonii* in 2009 and *Poa pratensis* or *Poa secunda* in 2010 were analyzed as *Poa* sp. for *t*-test analysis.

**Veg_108 N = 20 (Total Taxa for Transect: 2009 = 19; 2010 = 20) (Mean Taxa for Transect: 2009 = 1.0; 2010 = 1.0)**

| Species | Mean Live Cover (MH) 2009 | Mean Live Cover (MH) 2010 | Significance at ≤0.05 | Dominance Classification |
|---|---|---|---|---|
| *Juniperus scopulorum* | 51.53 | 59.33 | * | Transect Dominant |
| *Leymus triticoides* | 15.85 | 15.55 | | Transect Subdominant |
| *Sporobolus airoides* | 10.02 | 11.87 | | Transect Subdominant |
| *Spartina gracilis* | 4.68 | 2.42 | | Microcommunity Dominant |
| *Poa* sp. | 3.02 | 8.53 | * | Microcommunity Dominant |
| *Bassia scoparia* | 2.33 | 7.83 | * | Microcommunity Dominant |
| *Sarcobatus vermiculatus* | 1.88 | 0.92 | | Microcommunity Dominant |
| **Total Live Cover** | **95.00** | **113.28** | * | |

Based on field data and the distribution of hits along the transect, species listed as *Puccinellia lemmonii* in 2009 and *Poa secunda* or *Puccinellia lemmonii* in 2010 were analyzed as *Poa* sp. for *t*-test analysis.

**Veg_110 N = 20 (Total Taxa for Transect: 2009 = 19; 2010 = 21) (Mean Taxa for Transect: 2009 = 1.0; 2010 = 1.1)**

| Species | Mean Live Cover (MH) 2009 | Mean Live Cover (MH) 2010 | Significance at ≤0.05 | Dominance Classification |
|---|---|---|---|---|
| *Juniperus scopulorum* | 163.15 | 173.10 | * | Transect Dominant |
| *Leymus triticoides* | 62.35 | 68.35 | | Transect Dominant |
| *Distichlis spicata* | 32.35 | 37.55 | | Transect Dominant |
| *Poa* sp. | 17.10 | 17.65 | | Transect Subdominant |
| *Nitrophila occidentalis* | 14.40 | 10.40 | | Transect Subdominant |
| *Sarcobatus vermiculatus* | 12.10 | 11.10 | | Transect Subdominant |
| *Ericameria nauseosa* | 8.45 | 5.90 | | Transect Subdominant |
| *Crepis runcinata* ssp. *glauca* | 6.05 | 4.25 | * | Transect Subdominant |
| **Total Live Cover** | **108.63** | **114.20** | | |

Based on field data and the distribution of hits along the transect, species listed as *Poa secunda* or *Puccinellia lemmonii* in 2009 and *Poa secunda* or *Puccinellia lemmonii* in 2010 were analyzed as *Poa* sp. for *t*-test analysis.

**Veg_111 N = 20 (Total Taxa for Transect: 2009 = 19; 2010 = 21) (Mean Taxa for Transect: 2009 = 1.0; 2010 = 1.1)**

| Species | Mean Live Cover (MH) 2009 | Mean Live Cover (MH) 2010 | Significance at ≤0.05 | Dominance Classification |
|---|---|---|---|---|
| *Juniperus scopulorum* | 56.17 | 61.17 | * | Transect Dominant |
| *Leymus triticoides* | 8.92 | 10.38 | | Transect Subdominant |
| *Spartina gracilis* | 4.12 | 6.92 | * | Transect Subdominant |
| *Equisetum arvense* | 3.03 | 3.05 | | Microcommunity Dominant |
| *Dodecatheon pulchellum* | 2.35 | 2.62 | | Microcommunity Dominant |
| **Total Live Cover** | **87.20** | **99.22** | * | |

**Veg_112 N = 20 (Total Taxa for Transect: 2009 = 12; 2010 = 17) (Mean Taxa for Transect: 2009 = 0.6; 2010 = 0.9)**

| Species | Mean Live Cover (MH) 2009 | Mean Live Cover (MH) 2010 | Significance at ≤0.05 | Dominance Classification |
|---|---|---|---|---|
| *Juniperus scopulorum* | 39.88 | 47.23 | * | Transect Dominant |
| *Puccinellia lemmonii* | 10.22 | 15.90 | * | Transect Subdominant |
| *Sporobolus airoides* | 2.90 | 2.83 | | Microcommunity Dominant |
| *Ericameria nauseosa* | 2.68 | 3.12 | | Microcommunity Dominant |
| *Poa secunda* | 0.00 | 2.78 | * | Microcommunity Dominant |
| **Total Live Cover** | **56.97** | **73.48** | * | |

### 3.10.4.2 Swamp Cedar North Dry Sites

In contrast to changes observed among cover of individual species and mean live cover (MH) on wet sites in Swamp Cedar North, cover changes on drier sites were not as many and fewer species were involved. Only six understory species showed significant changes in cover on drier areas of Spring Valley North. Increases of cover between 2009 and 2010 occurred for *Ericameria nauseosa*, *Sporobolus airoides*, *Leymus triticoides*, *Poa secunda*, and *Hymenoxys lemonii*, and *Poa* sp. (Table 3-72). However, *Poa secunda* also had a decrease in cover on one belt transect between the two years. The overstory canopy of *Juniperus scopulorum* had increased cover on two transects between the two years. Total live cover of all vegetation increased significantly on four belt transects and did not change on the remaining transects in this same period (Table 3-72).

**Table 3-72. Mean Live Cover Multiple Hits (MH) for the Most Dominant Species and Total Live Cover for the VFRM Juniper Woodland Belt Transects at Swamp Cedar North Dry Sites, 2009 and 2010 (Page 1 of 2)**

Species are classified as to dominance along the transect as either transect dominant, transect subdominant, or microcommunity dominant. Taxa richness is indicated at the top of the table as total taxa and mean taxa for the transect. N represents the sample size for each species and the asterisk in the significance column represents a significant difference between years based on paired *t*-test comparison.

**Veg_099 N = 20 (Total Taxa for Transect: 2009 = 12; 2010 = 14) (Mean Taxa for Transect: 2009 = 0.6; 2010 = 0.7)**

| Species | Mean Live Cover (MH) 2009 | Mean Live Cover (MH) 2010 | Significance at ≤0.05 | Dominance Classification |
|---|---|---|---|---|
| *Juniperus scopulorum* | 38.88 | 45.33 | * | Transect Dominant |
| *Ericameria nauseosa* | 7.98 | 5.57 | * | Transect Subdominant |
| **Total Live Cover** | **50.75** | **55.37** | * | |

**Veg_100 N = 20 (Total Taxa for Transect: 2009 = 11; 2010 = 12) (Mean Taxa for Transect: 2009 = 0.6; 2010 = 0.6)**

| Species | Mean Live Cover (MH) 2009 | Mean Live Cover (MH) 2010 | Significance at ≤0.05 | Dominance Classification |
|---|---|---|---|---|
| *Juniperus scopulorum* | 43.23 | 42.83 | | Transect Dominant |
| *Ericameria nauseosa* | 4.45 | 3.23 | | Microcommunity Dominant |
| *Poa* sp. | 1.80 | 1.60 | | Microcommunity Dominant |
| *Leymus triticoides* | 1.78 | 3.90 | * | Microcommunity Dominant |
| **Total Live Cover** | **53.42** | **53.98** | | |

Based on field data and the distribution of hits along the transect, species listed as *Puccinellia lemmonii* in 2009 and *Poa secunda* in 2010 were analyzed as *Poa* sp. for *t*-test analysis.

**Veg_101 N = 20 (Total Taxa for Transect: 2009 = 14; 2010 = 17) (Mean Taxa for Transect: 2009 = 0.7; 2010 = 0.9)**

| Species | Mean Live Cover (MH) 2009 | Mean Live Cover (MH) 2010 | Significance at ≤0.05 | Dominance Classification |
|---|---|---|---|---|
| *Juniperus scopulorum* | 37.85 | 41.67 | | Transect Dominant |
| *Ericameria nauseosa* | 2.95 | 7.25 | * | Microcommunity Dominant |
| *Sporobolus airoides* | 1.58 | 4.92 | * | Microcommunity Dominant |
| *Poa secunda* | 1.00 | 4.38 | * | Microcommunity Dominant |
| **Total Live Cover** | **45.43** | **60.92** | * | |

**Veg_102 N = 20 (Total Taxa for Transect: 2009 = 13; 2010 = 14) (Mean Taxa for Transect: 2009 = 0.7; 2010 = 0.7)**

| Species | Mean Live Cover (MH) 2009 | Mean Live Cover (MH) 2010 | Significance at ≤0.05 | Dominance Classification |
|---|---|---|---|---|
| *Juniperus scopulorum* | 49.70 | 46.38 | | Transect Dominant |
| *Ericameria nauseosa* | 4.97 | 6.38 | | Transect Subdominant |
| *Poa* sp. | 4.48 | 5.55 | | Transect Subdominant |
| *Sporobolus airoides* | 4.13 | 6.87 | * | Transect Subdominant |
| *Cirsium scariosum* | 2.02 | 1.15 | | Microcommunity Dominant |
| *Leymus triticoides* | 1.98 | 3.13 | | Microcommunity Dominant |
| *Hymenoxys lemmonii* | 1.43 | 2.13 | * | Microcommunity Dominant |
| **Total Live Cover** | **69.52** | **73.75** | | |

**Table 3-72. Mean Live Cover Multiple Hits (MH) for the Most Dominant Species and Total Live Cover for the VFRM Juniper Woodland Belt Transects at Swamp Cedar North Dry Sites, 2009 and 2010 (Page 2 of 2)**

Based on field data and the distribution of hits along the transect, species listed as *Puccinellia lemmonii* in 2009 and *Poa secunda* in 2010 were analyzed as *Poa* sp. for *t*-test analysis.

**Veg_103 N = 20 (Total Taxa for Transect: 2009 = 18; 2010 = 15) (Mean Taxa for Transect: 2009 = 0.9; 2010 = 0.8)**

| Species | Mean Live Cover (MH) 2009 | Mean Live Cover (MH) 2010 | Significance at ≤0.05 | Dominance Classification |
|---|---|---|---|---|
| *Juniperus scopulorum* | 48.67 | 51.97 | | Transect Dominant |
| *Sporobolus airoides* | 10.97 | 9.40 | * | Transect Subdominant |
| *Poa* sp. | 3.28 | 3.68 | | Microcommunity Dominant |
| *Ericameria nauseosa* | 1.25 | 1.30 | | Microcommunity Dominant |
| *Sarcobatus vermiculatus* | 0.63 | 1.13 | | Microcommunity Dominant |
| **Total Live Cover** | **66.92** | **69.65** | | |

Based on field data and the distribution of hits along the transect, species listed as *Puccinellia lemmonii* in 2009 and *Poa secunda* in 2010 were analyzed as *Poa* sp. for *t*-test analysis.

**Veg_106 N = 20 (Total Taxa for Transect: 2009 = 11; 2010 = 14) (Mean Taxa for Transect: 2009 = 0.6; 2010 = 0.7)**

| Species | Mean Live Cover (MH) 2009 | Mean Live Cover (MH) 2010 | Significance at ≤0.05 | Dominance Classification |
|---|---|---|---|---|
| *Juniperus scopulorum* | 28.25 | 24.83 | | Transect Dominant |
| *Ericameria nauseosa* | 9.27 | 13.45 | * | Transect Subdominant |
| *Sporobolus airoides* | 4.50 | 6.25 | | Transect Subdominant |
| *Poa* sp. | 1.75 | 2.63 | | Microcommunity Dominant |
| *Sarcobatus vermiculatus* | 1.63 | 2.83 | | Microcommunity Dominant |
| **Total Live Cover** | **46.55** | **53.10** | | |

Based on field data and the distribution of hits along the transect, species listed as *Puccinellia lemmonii* in 2009 and *Poa secunda* in 2010 were analyzed as *Poa* sp. for *t*-test analysis.

**Veg_109 N = 20 (Total Taxa for Transect: 2009 = 16; 2010 = 18) (Mean Taxa for Transect: 2009 = 0.8; 2010 = 0.9)**

| Species | Mean Live Cover (MH) 2009 | Mean Live Cover (MH) 2010 | Significance at ≤0.05 | Dominance Classification |
|---|---|---|---|---|
| *Juniperus scopulorum* | 54.82 | 58.15 | | Transect Dominant |
| *Sporobolus airoides* | 6.05 | 6.52 | | Transect Subdominant |
| *Poa* sp. | 1.18 | 4.47 | * | Microcommunity Dominant |
| *Ericameria nauseosa* | 0.78 | 2.00 | | Microcommunity Dominant |
| **Total Live Cover** | **65.30** | **74.05** | * | |

Based on field data and the distribution of hits along the transect, species listed as *Puccinellia lemmonii* in 2009 and *Poa secunda* or *Puccinellia lemmonii* in 2010 were analyzed as *Poa* sp. for *t*-test analysis.

**Veg_113 N = 20 (Total Taxa for Transect: 2009 = 15; 2010 = 17) (Mean Taxa for Transect: 2009 = 0.8; 2010 = 0.9)**

| Species | Mean Live Cover (MH) 2009 | Mean Live Cover (MH) 2010 | Significance at ≤0.05 | Dominance Classification |
|---|---|---|---|---|
| *Juniperus scopulorum* | 31.75 | 36.50 | * | Transect Dominant |
| *Sporobolus airoides* | 4.45 | 7.18 | * | Transect Subdominant |
| *Artemisia tridentata* | 2.68 | 3.72 | | Microcommunity Dominant |
| *Ericameria nauseosa* | 1.82 | 2.00 | | Microcommunity Dominant |
| *Poa* sp. | 1.27 | 2.87 | | Microcommunity Dominant |
| *Carex praegracilis* | 0.93 | 1.08 | | Microcommunity Dominant |
| *Cordylanthus ramosus* | 0.07 | 0.93 | | Microcommunity Dominant |
| **Total Live Cover** | **44.90** | **57.08** | * | |

Based on field data and the distribution of hits along the transect, species listed as *Puccinellia lemmonii* in 2009 and *Poa secunda* in 2010 were analyzed as *Poa* sp. for *t*-test analysis.

### 3.10.4.3 Swamp Cedar South Wet Sites

Eleven species had significant changes occur in mean live cover (MH) between 2009 and 2010 on wet sites in Swamp Cedar South (Table 3-73). The overstory species *Juniperus scopulorum* showed a decrease in cover on one transect between 2009 and 2010 and showed little change on the remaining belt transects. A total of nine species had increases in mean live cover (MH) between 2009 and 2010 and included *Sporobolus airoides, Muhlenbergia richardsonis, Ericameria nauseosa, Distichlis spicata, Agrostis gigantea, Cirsium* sp., *Schedonorus pratensis* and *Poa* sp. *Sporobolus airoides* also declined in cover on one belt transect between 2009 and 2010. Total live cover had significant increases between 2009 and 2010 on three transects and had significant declines on another three transects (Table 3-73). Therefore, the net effect of cover changes of vegetation between 2009 and 2010 in wet areas of VFRM juniper woodland communities was to the slight upside in Swamp Cedar South.

**Table 3-73. Mean Live Cover Multiple Hits (MH) for the Most Dominant Species and Total Live Cover for the VFRM Juniper Woodland Belt Transects at Swamp Cedar South Wet Sites, 2009 and 2010 (Page 1 of 2)**

Species are classified as to dominance along the transect as either transect dominant, transect subdominant, or microcommunity dominant. Taxa richness is indicated at the top of the table as total taxa and mean taxa for the transect. N represents the sample size for each species and the asterisk in the significance column represents a significant difference between years based on paired *t*-test comparison.

**Veg_115 N = 20 (Total Taxa for Transect: 2009 = 12; 2010 = 13) (Mean Taxa for Transect: 2009 = 0.6; 2010 = 0.7)**

| Species | Mean Live Cover (MH) 2009 | Mean Live Cover (MH) 2010 | Significance at ≤0.05 | Dominance Classification |
|---|---|---|---|---|
| *Juniperus scopulorum* | 54.08 | 55.18 | | Transect Dominant |
| *Poa pratensis* | 12.75 | 6.13 | * | Transect Subdominant |
| *Carex praegracilis* | 9.32 | 10.47 | | Transect Subdominant |
| *Trifolium* sp. | 3.32 | 0.65 | | Microcommunity Dominant |
| **Total Live Cover** | **88.20** | **79.92** | * | |

**Veg_122 N = 20 (Total Taxa for Transect: 2009 = 10; 2010 = 10) (Mean Taxa for Transect: 2009 = 0.5; 2010 = 0.5)**

| Species | Mean Live Cover (MH) 2009 | Mean Live Cover (MH) 2010 | Significance at ≤0.05 | Dominance Classification |
|---|---|---|---|---|
| *Juniperus scopulorum* | 56.58 | 53.47 | | Transect Dominant |
| *Sporobolus airoides* | 1.82 | 1.95 | | Microcommunity Dominant |
| **Total Live Cover** | **59.05** | **55.78** | | |

**Veg_123 N = 20 (Total Taxa for Transect: 2009 = 7; 2010 = 10) (Mean Taxa for Transect: 2009 = 0.4; 2010 = 0.5)**

| Species | Mean Live Cover (MH) 2009 | Mean Live Cover (MH) 2010 | Significance at ≤0.05 | Dominance Classification |
|---|---|---|---|---|
| *Juniperus scopulorum* | 52.58 | 49.63 | | Transect Dominant |
| *Sporobolus airoides* | 6.62 | 5.03 | * | Transect Subdominant |
| *Artemisia tridentata* | 2.05 | 2.00 | | Microcommunity Dominant |
| **Total Live Cover** | **63.18** | **58.70** | * | |

**Veg_124 N = 20 (Total Taxa for Transect: 2009 = 8; 2010 = 10) (Mean Taxa for Transect: 2009 = 0.4; 2010 = 0.5)**

| Species | Mean Live Cover (MH) 2009 | Mean Live Cover (MH) 2010 | Significance at ≤0.05 | Dominance Classification |
|---|---|---|---|---|
| *Juniperus scopulorum* | 77.17 | 66.57 | * | Transect Dominant |
| *Sporobolus airoides* | 1.27 | 1.60 | | Microcommunity Dominant |
| *Muhlenbergia richardsonis* | 0.82 | 1.62 | * | Microcommunity Dominant |
| **Total Live Cover** | **80.45** | **70.63** | * | |

**Table 3-73. Mean Live Cover Multiple Hits (MH) for the Most Dominant Species and Total Live Cover for the VFRM Juniper Woodland Belt Transects at Swamp Cedar South Wet Sites, 2009 and 2010 (Page 2 of 2)**

**Veg_125 N = 20 (Total Taxa for Transect: 2009 = 12; 2010 = 17) (Mean Taxa for Transect: 2009 = 0.6; 2010 = 0.9)**

| Species | Mean Live Cover (MH) 2009 | Mean Live Cover (MH) 2010 | Significance at ≤0.05 | Dominance Classification |
|---|---|---|---|---|
| *Juniperus scopulorum* | 58.50 | 56.67 | | Transect Dominant |
| *Ericameria nauseosa* | 7.40 | 13.48 | * | Transect Subdominant |
| *Distichlis spicata* | 6.75 | 13.02 | * | Transect Subdominant |
| *Sporobolus airoides* | 5.42 | 4.88 | | Microcommunity Dominant |
| *Sarcobatus vermiculatus* | 1.02 | 3.02 | * | Microcommunity Dominant |
| **Total Live Cover** | **82.92** | **98.85** | * | |

**Veg_126 N = 20 (Total Taxa for Transect: 2009 = 23; 2010 = 29) (Mean Taxa for Transect: 2009 = 1.2; 2010 = 1.5)**

| Species | Mean Live Cover (MH) 2009 | Mean Live Cover (MH) 2010 | Significance at ≤0.05 | Dominance Classification |
|---|---|---|---|---|
| *Juniperus scopulorum* | 86.67 | 86.08 | | Transect Dominant |
| *Carex* sp. | 10.25 | 9.98 | | Transect Subdominant |
| *Agrostis gigantea* | 7.03 | 15.32 | * | Transect Subdominant |
| *Rosa woodsii* | 6.47 | 6.45 | | Transect Subdominant |
| *Poa pratensis* | 5.37 | 3.57 | | Microcommunity Dominant |
| *Cirsium* sp. | 4.78 | 15.92 | * | Microcommunity Dominant |
| *Schedonorus pratensis* | 2.00 | 4.55 | * | Microcommunity Dominant |
| **Total Live Cover** | **126.80** | **146.15** | * | |

Based on field data and the distribution of hits along the transect, species listed as *Cirsium scariosum* in 2009 and *Cirsium vulgare* in 2010 were analyzed as *Cirsium* sp. for *t*-test analysis. Based on field data and the distribution of hits along the transect, species listed as *Carex praegracilis* or *Carex nebrascensis* in 2009 were analyzed as *Carex* sp. for *t*-test analysis.

**Veg_127 N = 20 (Total Taxa for Transect: 2009 = 13; 2010 = 12) (Mean Taxa for Transect: 2009 = 0.7; 2010 = 0.6)**

| Species | Mean Live Cover (MH) 2009 | Mean Live Cover (MH) 2010 | Significance at ≤0.05 | Dominance Classification |
|---|---|---|---|---|
| *Juniperus scopulorum* | 34.72 | 39.83 | | Transect Dominant |
| *Bassia scoparia* | 17.03 | 16.25 | | Transect Subdominant |
| *Sporobolus airoides* | 8.03 | 12.80 | * | Transect Subdominant |
| *Distichlis spicata* | 6.47 | 12.88 | * | Transect Subdominant |
| *Ericameria nauseosa* | 3.37 | 4.45 | | Microcommunity Dominant |
| **Total Live Cover** | **72.73** | **89.82** | * | |

**Veg_128 N = 20 (Total Taxa for Transect: 2009 = 18; 2010 = 17) (Mean Taxa for Transect: 2009 = 0.9; 2010 = 0.9)**

| Species | Mean Live Cover (MH) 2009 | Mean Live Cover (MH) 2010 | Significance at ≤0.05 | Dominance Classification |
|---|---|---|---|---|
| *Juniperus scopulorum* | 53.90 | 54.77 | | Transect Dominant |
| *Poa* sp. | 4.12 | 5.92 | * | Microcommunity Dominant |
| *Sporobolus airoides* | 1.48 | 1.05 | | Microcommunity Dominant |
| **Total Live Cover** | **63.18** | **64.65** | | |

Based on field data and the distribution of hits along the transect, species listed as *Poa secunda* or *Puccinellia lemmonii* in 2009 and *Poa secunda* in 2010 were analyzed as *Poa* sp. for *t*-test analysis.

### 3.10.4.4 Swamp Cedar South Dry Sites

No cover changes between 2009 and 2010 were found at dry sites in Swamp Cedar South (Table 3-74). *Juniperus scopulorum* was again the transect dominant on all belt transects and *Artemisia tridentata* was a transect subdominant on one belt transect (118). Total live cover did not change on any belt transect between the two years of sampling and the grand mean cover (MH) for the Swamp Cedar South dry sites was the same (43%) for both years (Table 3-74).

**Table 3-74. Mean Live Cover Multiple Hits (MH) for the Most Dominant Species and Total Live Cover for the VFRM Juniper Woodland Belt Transects at Swamp Cedar South Dry Sites, 2009 and 2010 (Page 1 of 2)**

Species are classified as to dominance along the transect as either transect dominant, transect subdominant, or microcommunity dominant. Taxa richness is indicated at the top of the table as total taxa and mean taxa for the transect. N represents the sample size for each species and the asterisk in the significance column represents a significant difference between years based on paired *t*-test comparison.

| Species | Mean Live Cover (MH) 2009 | Mean Live Cover (MH) 2010 | Significance at ≤0.05 | Dominance Classification |
|---|---|---|---|---|
| **Veg_114 N = 20 (Total Taxa for Transect: 2009 = 4; 2010 = 6) (Mean Taxa for Transect: 2009 = 0.2; 2010 = 0.3)** | | | | |
| *Juniperus scopulorum* | 51.63 | 51.05 | | Transect Dominant |
| *Sporobolus airoides* | 1.12 | 1.27 | | Microcommunity Dominant |
| **Total Live Cover** | **53.12** | **52.87** | | |
| **Veg_116 N = 20 (Total Taxa for Transect: 2009 = 7; 2010 = 8) (Mean Taxa for Transect: 2009 = 0.4; 2010 = 0.4)** | | | | |
| *Juniperus scopulorum* | 40.37 | 42.63 | | Transect Dominant |
| *Artemisia tridentata* | 5.93 | 6.13 | | Transect Subdominant |
| **Total Live Cover** | **47.35** | **49.50** | | |
| **Veg_117 N = 20 (Total Taxa for Transect: 2009 = 8; 2010 = 9) (Mean Taxa for Transect: 2009 = 0.4; 2010 = 0.5)** | | | | |
| *Juniperus scopulorum* | 52.08 | 50.52 | | Transect Dominant |
| *Ericameria nauseosa* | 2.63 | 3.17 | | Microcommunity Dominant |
| **Total Live Cover** | **55.55** | **54.63** | | |
| **Veg_118 N = 20 (Total Taxa for Transect: 2009 = 6; 2010 = 7) (Mean Taxa for Transect: 2009 = 0.3; 2010 = 0.4)** | | | | |
| *Juniperus scopulorum* | 34.22 | 36.00 | | Transect Dominant |
| *Artemisia tridentata* | 7.21 | 8.65 | | Transect Subdominant |
| *Sarcobatus vermiculatus* | 3.47 | 2.32 | | Microcommunity Dominant |
| *Sporobolus airoides* | 2.15 | 1.55 | | Microcommunity Dominant |
| **Total Live Cover** | **47.81** | **48.45** | | |
| Transect was 1-m longer in 2010, therefore interval 20-21 in 2010 was not included in *t*-test analysis. | | | | |
| **Veg_119 N = 20 (Total Taxa for Transect: 2009 = 5; 2010 = 8) (Mean Taxa for Transect: 2009 = 0.3; 2010 = 0.4)** | | | | |
| *Juniperus scopulorum* | 30.52 | 29.43 | | Transect Dominant |
| *Ericameria nauseosa* | 0.97 | 0.75 | | Microcommunity Dominant |
| *Artemisia tridentata* | 0.92 | 0.35 | | Microcommunity Dominant |
| **Total Live Cover** | **32.67** | **30.92** | | |

**Table 3-74. Mean Live Cover Multiple Hits (MH) for the Most Dominant Species and Total Live Cover for the VFRM Juniper Woodland Belt Transects at Swamp Cedar South Dry Sites, 2009 and 2010 (Page 2 of 2)**

**Veg_120 N = 20 (Total Taxa for Transect: 2009 = 10; 2010 = 9) (Mean Taxa for Transect: 2009 = 0.5; 2010 = 0.5)**

| Species | Mean Live Cover (MH) 2009 | Mean Live Cover (MH) 2010 | Significance at ≤0.05 | Dominance Classification |
|---|---|---|---|---|
| *Juniperus scopulorum* | 25.85 | 27.37 | | Transect Dominant |
| *Ericameria nauseosa* | 5.20 | 4.98 | | Microcommunity Dominant |
| *Artemisia tridentata* | 2.82 | 2.52 | | Microcommunity Dominant |
| *Sporobolus airoides* | 1.98 | 1.53 | | Microcommunity Dominant |
| *Sarcobatus vermiculatus* | 0.70 | 1.00 | | Microcommunity Dominant |
| **Total Live Cover** | **37.32** | **38.37** | | |

**Veg_121 N = 20 (Total Taxa for Transect: 2009 = 6; 2010 = 5) (Mean Taxa for Transect: 2009 = 0.3; 2010 = 0.3)**

| Species | Mean Live Cover (MH) 2009 | Mean Live Cover (MH) 2010 | Significance at ≤0.05 | Dominance Classification |
|---|---|---|---|---|
| *Juniperus scopulorum* | 45.00 | 48.05 | | Transect Dominant |
| *Sporobolus airoides* | 2.28 | 1.53 | | Microcommunity Dominant |
| **Total Live Cover** | **47.93** | **50.63** | | |

**Veg_129 N = 20 (Total Taxa for Transect: 2009 = 11; 2010 = 11) (Mean Taxa for Transect: 2009 = 0.6; 2010 = 0.6)**

| Species | Mean Live Cover (MH) 2009 | Mean Live Cover (MH) 2010 | Significance at ≤0.05 | Dominance Classification |
|---|---|---|---|---|
| *Juniperus scopulorum* | 20.50 | 21.12 | | Transect Dominant |
| *Sporobolus airoides* | 1.38 | 1.60 | | Microcommunity Dominant |
| *Ericameria nauseosa* | 0.03 | 0.73 | | Microcommunity Dominant |
| **Total Live Cover** | **23.12** | **24.30** | | |

### 3.11 Valley Floor Rocky Mountain (VFRM) Juniper (*Juniperus scopulorum*)

Data collected at the 32 VFRM Juniper transects are summarized in Table 3-75, Figures 3-52 through 3-56. Juvenile tree counts per transect ranged from 0 to 727, with a mean juvenile tree count across all transects of 57. The data suggest recent seedling establishment has been stronger in the southern population (northern population mean juvenile tree count = 16; southern population, mean = 98), although these means did not have a statistically significant difference (p-value >0.1). Mature tree counts did not statistically vary across populations. Mature tree counts per transect ranged from 2 to 135, with a mean mature tree count across all transects of 12 (northern population, mean = 10; southern population, mean = 15).

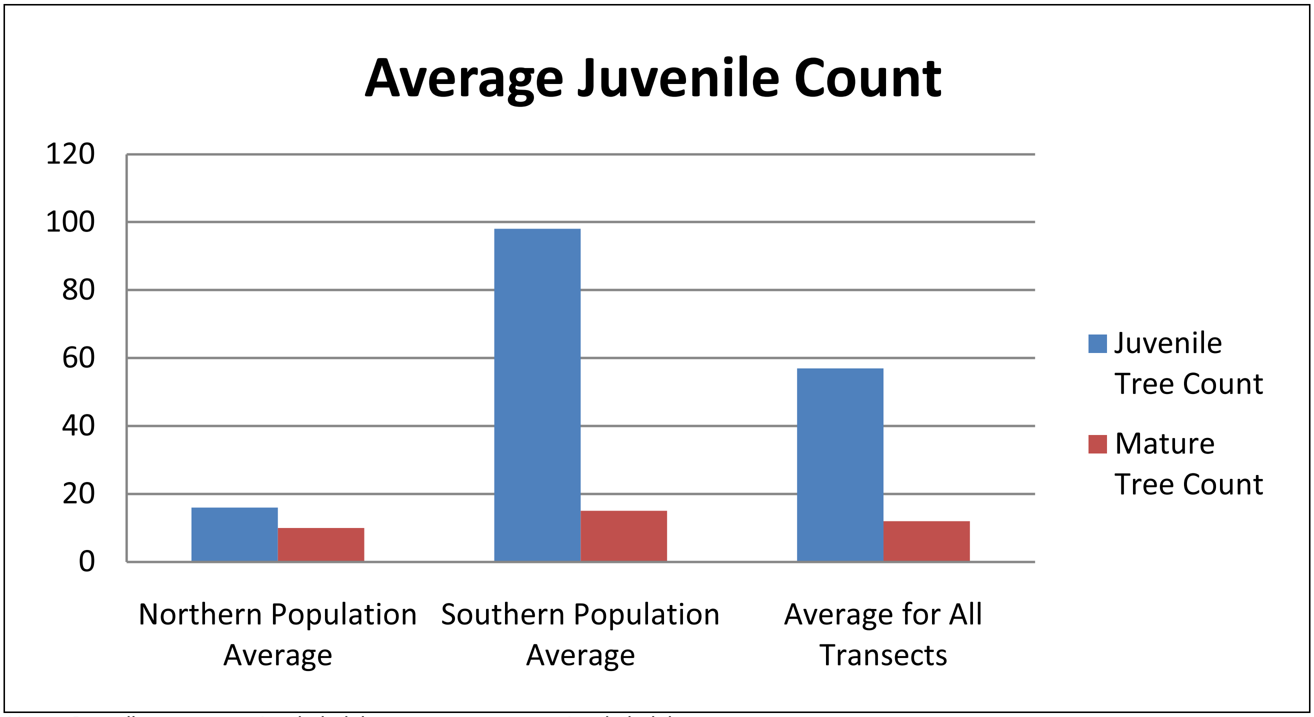
Juvenile tree height did not statistically vary across populations. There was a mean juvenile tree height across all transects of 16 cm (northern population, mean = 14 cm; southern population, mean = 18 cm). Juvenile tree height analyzed in a paired *t*-test by transect was not significantly different from 2009 to 2010. The mean mature tree height across all transects was 543 cm (northern population, mean = 514 cm; southern population, mean = 567 cm). Although, the northern population mean is lower than the southern, the northern and southern populations were not significantly different (p-value >0.1). In the northern population, the majority of mature trees with smaller heights were observed in Transect 114, which had a mean mature tree height of 210 cm. Mature trees near this height, 210 cm, were not often found in any of the other transects. Average mature tree height by transects was slightly higher in 2010 than in 2009 (594 and 563, respectively) (paired *t*-test, p-value <0.03). No significant difference was found in mature tree circumference measurements from 2010 to 2009 or between the northern and southern populations. Additional years of data collection and the tagging of mature trees for height and circumference measurements to allow for a more specific paired *t*-test, should give the analysis for these measurement additional power in the future.

Paired *t*-tests of the stem elongation data showed a significant difference between the 2009 and 2010 branch lengths (p-value <0.00). The mean stem elongation for all transects was 12 mm. The mean stem elongation for the northern population was 14 mm and the southern population was 10 mm. A *t*-test between the northern and southern populations showed that growth was significantly different between the two populations (p-value <0.00).

The intent of collecting VFRM Juniper tree measurements is to monitor growth and reproduction. The southern population had higher tree counts for both juvenile and mature trees and higher tree heights for both juvenile and mature trees. However, the northern population experienced higher growth regarding stem elongation than the southern population.

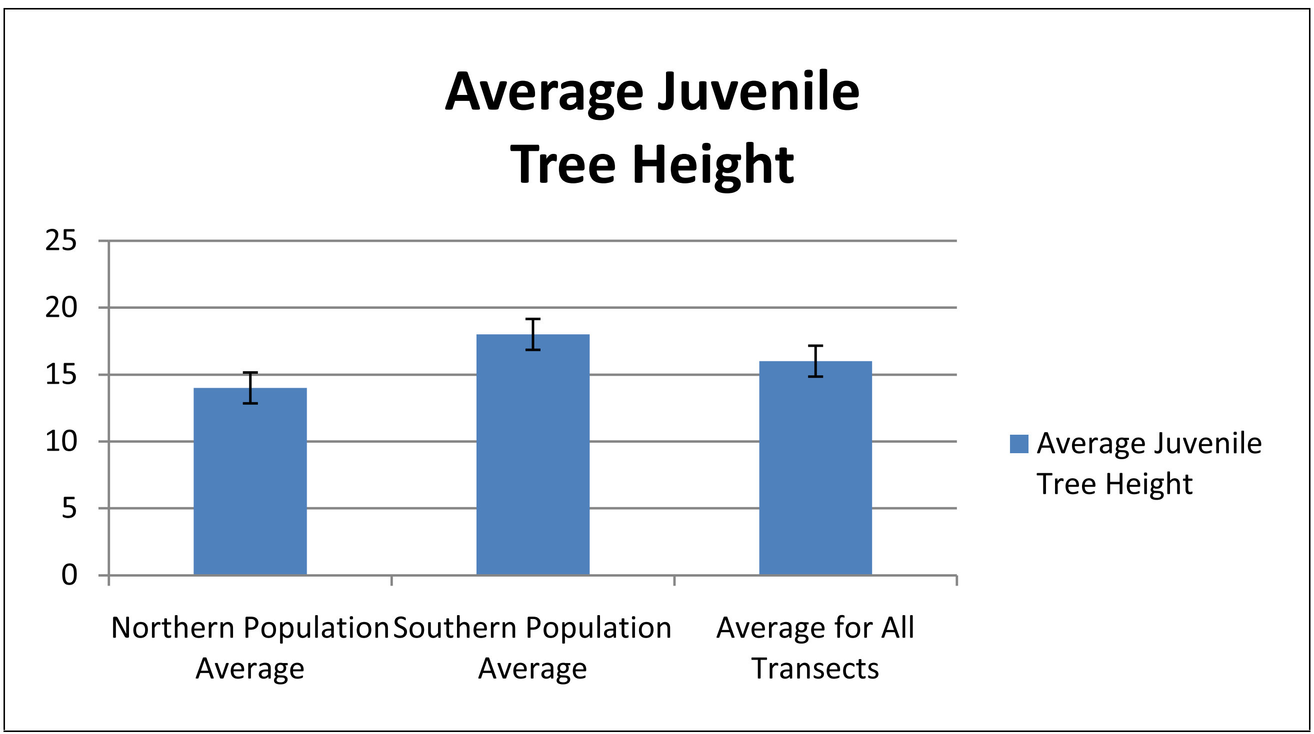
**Table 3-75**
**VFRM Juniper Summary Table**

| Population | Transect Number | Juvenile Tree Count | Mature Tree Count | Average Juvenile Tree Height | Average Mature Tree Height | Average Circumference of Mature Trees | Average Stem Elongation |
|---|---|---|---|---|---|---|---|
| Northern | 98 | 0 | 4 | N/A | 510.0 | 277.0 | 13.8 |
| Northern | 99 | 0 | 3 | N/A | 511.3 | 174.0 | 15.7 |
| Northern | 100 | 0 | 2 | N/A | 640.0 | 267.0 | 11.4 |
| Northern | 101 | 43 | 4 | 7.2 | 654.0 | 195.0 | 18.7 |
| Northern | 102 | 84 | 3 | 6.2 | 657.3 | 205.0 | 14.1 |
| Northern | 103 | 16 | 2 | 16.4 | 664.0 | 226.5 | 10.1 |
| Northern | 104 | 15 | 82 | 56.7 | 210.4 | 26.6 | 16.9 |
| Northern | 105 | 48 | 3 | 6.4 | 655.7 | 206.0 | 10.2 |
| Northern | 106 | 0 | 3 | N/A | 421.7 | 112.0 | 23.3 |
| Northern | 107 | 0 | 3 | N/A | 614.0 | 157.7 | 22.4 |
| Northern | 108 | 44 | 5 | 5.2 | 559.8 | 165.0 | 8.6 |
| Northern | 109 | 0 | 10 | N/A | 625.3 | 68.8 | 13.7 |
| Northern | 110 | 0 | 11 | N/A | 689.1 | 110.6 | 10.6 |
| Northern | 111 | 0 | 9 | N/A | 832.8 | 118.5 | 8 |
| Northern | 112 | 0 | 6 | N/A | 528.0 | 150.4 | 9.7 |
| Northern | 113 | 0 | 7 | N/A | 423.3 | 131.8 | 8.8 |
| Southern | 114 | 0 | 2 | N/A | 729.0 | 272.5 | 16.1 |
| Southern | 115 | 727 | 135 | 42.3 | 297.3 | 55.6 | 15.1 |
| Southern | 116 | 0 | 6 | N/A | 432.0 | 99.3 | 16.8 |
| Southern | 117 | 78 | 11 | 18.6 | 405.9 | 77.0 | 12.7 |
| Southern | 118 | 14 | 3 | 25.2 | 576.7 | 216.7 | 11.7 |
| Southern | 119 | 0 | 9 | N/A | 431.9 | 69.9 | 9.3 |
| Southern | 120 | 0 | 8 | N/A | 506.5 | 83.8 | 7.3 |
| Southern | 121 | 11 | 8 | 12.2 | 531.6 | 80.4 | 6.3 |
| Southern | 122 | 1 | 19 | N/A | 733.3 | 63.5 | 1.9 |
| Southern | 123 | 3 | 4 | 5.7 | 741.3 | 147.8 | 12 |
| Southern | 124 | 444 | 9 | 6.08 | 874.8 | 127.2 | 7.8 |
| Southern | 125 | 0 | 5 | N/A | 890.0 | 135.2 | 13.1 |
| Southern | 126 | 268 | 8 | 11.7 | 846.4 | 175.6 | 17.2 |
| Southern | 127 | 0 | 5 | N/A | 724.8 | 185.2 | 6.7 |
| Southern | 128 | 1 | 4 | N/A | 628.5 | 184.3 | 4.1 |
| Southern | 129 | 15 | 5 | 7.1 | 448.4 | 96.6 | 3.9 |
| **Northern Population Average** | | **16** | **10** | **14** | **514** | **162.0** | **14** |
| **Southern Population Average** | | **98** | **15** | **18** | **567** | **129.4** | **10** |
| **Average for All Transects** | | **57** | **12** | **16** | **543** | **145.7** | **12** |



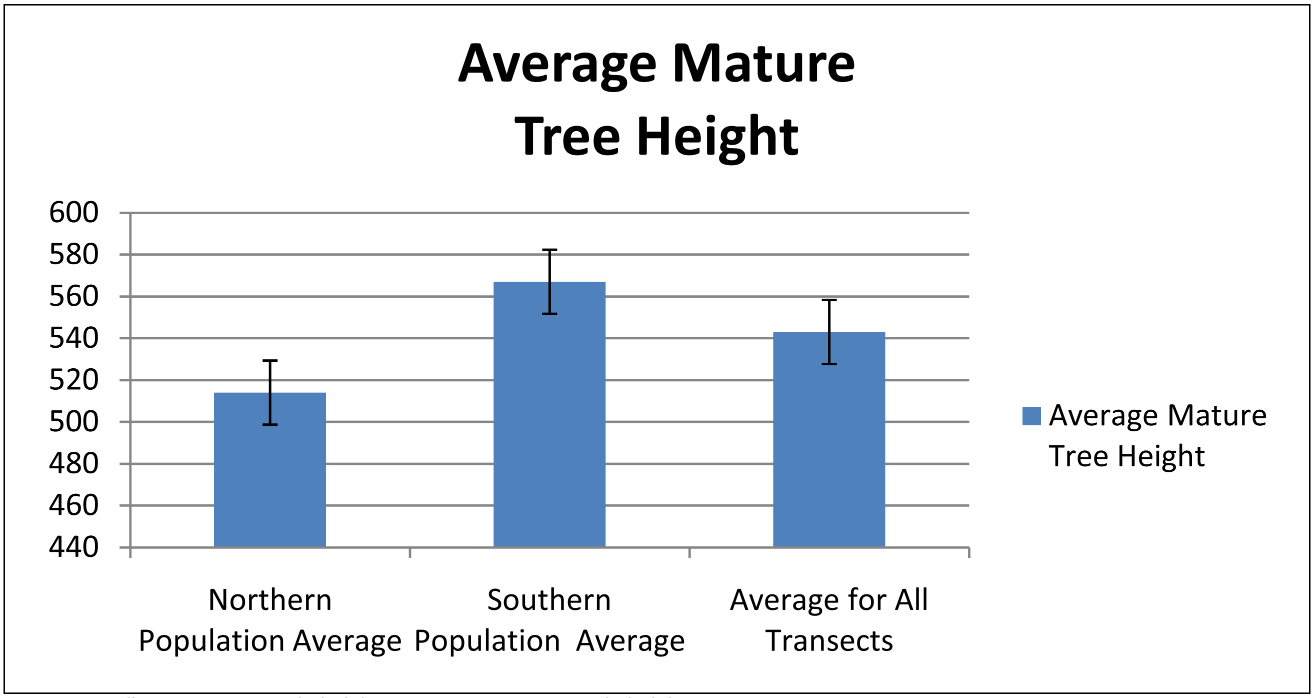

Note: Juvenile trees are <1 m in height, mature tress are ≥1 m in height.

**Figure 3-52**
**VFRM Juniper Tree Count**



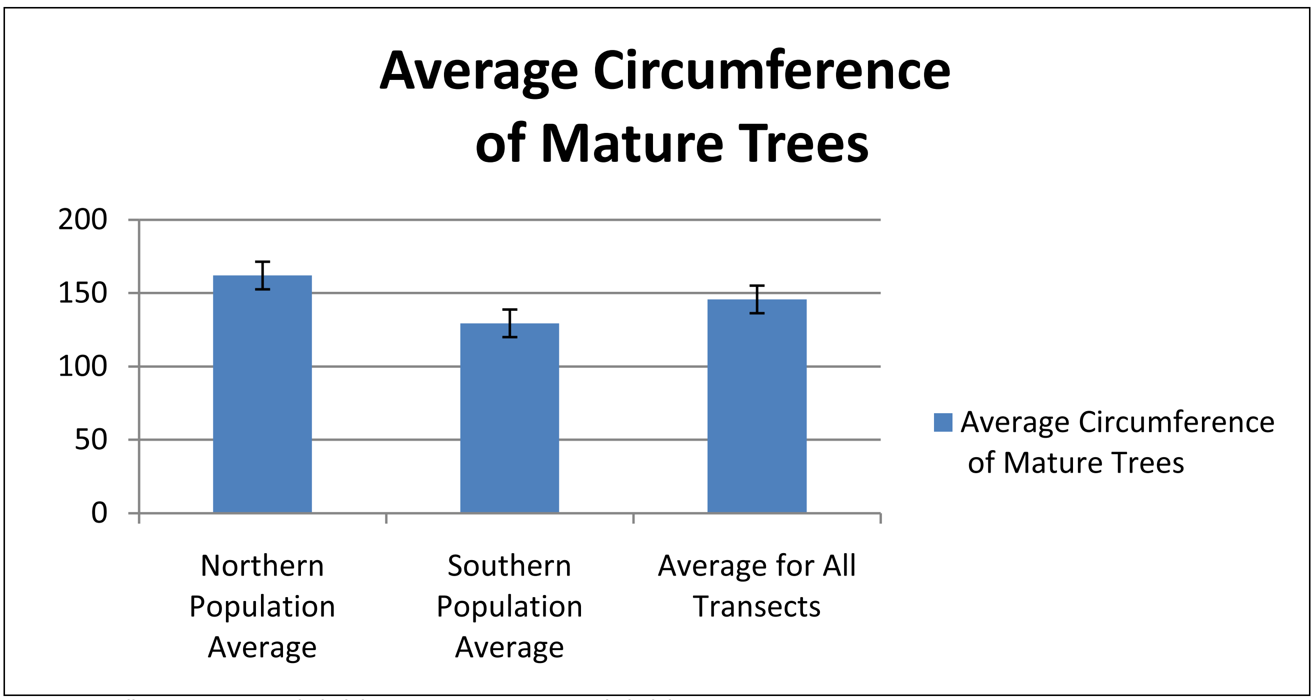

Note: Juvenile trees are <1 m in height, mature tress are ≥1 m in height.

**Figure 3-53**
**VFRM Juniper Juvenile Tree Height**



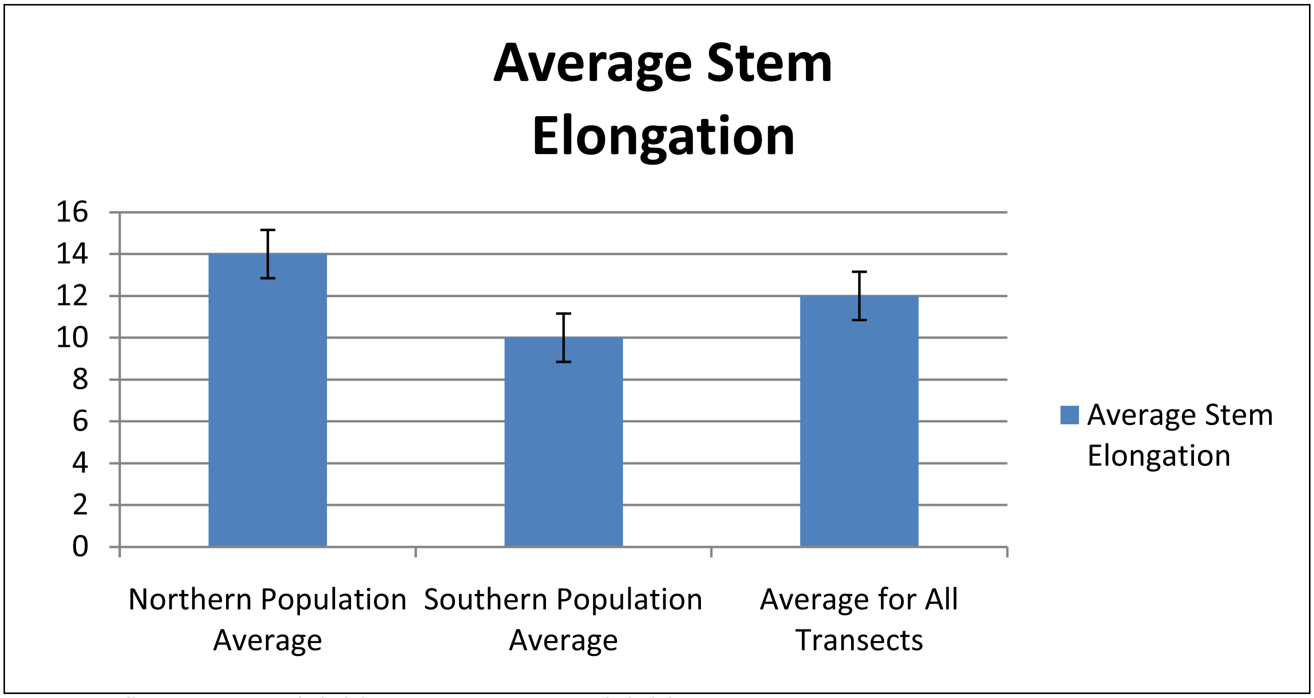

Note: Juvenile trees are <1 m in height, mature tress are ≥1 m in height.

**Figure 3-54**
**VFRM Juniper Mature Tree Height**




Note: Juvenile trees are <1 m in height, mature tress are ≥1 m in height.

**Figure 3-55**
**VFRM Juniper Mature Tree Circumference**




Note: Juvenile trees are <1 m in height, mature tress are ≥1 m in height.

**Figure 3-56**
**VFRM Juniper Stem Elongation**

## *3.12 Fixed Station Photography*

Photographs taken in 2010 are available upon request.

# 4.0 ANTICIPATED BIOLOGICAL MONITORING PLAN-RELATED ACTIVITIES FOR 2011

In 2011, the BWG will begin an evaluation of the Plan. SNWA efforts to support BWG Plan evaluation and future revision may include 2009-2010 data exploration, testing of field methods and sampling designs, and targeted studies to better clarify relationships between indicators and usefulness of indicators.

In accordance with the Plan, an SNWA Data Management Plan detailing data management and storage (described briefly in Section 2.13) will be finalized.

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# Appendix A

# Macroinvertebrate Metric Results

(as provided by Rhithron Laboratories)

**Analysis of biological samples:**
**Technical summary of methods and quality assurance procedures**
**Prepared for Southern Nevada Watershed Authority**
**Allen Cattell, Project Manager**
**August 5, 2010**

by
W. Bollman, Chief Biologist
Rhithron Associates, Inc.
Missoula, Montana

**METHODS**

*Sample processing*

Thirteen macroinvertebrate samples in 27 jars were delivered to Rhithron's laboratory facility in Missoula, Montana on June 23, 2010. All sample jars arrived in good condition. An inventory document containing sample identification information was provided by the Southern Nevada Watershed Authority (SNWA) Project Manager. Upon arrival, samples were unpacked and examined, and checked against the SNWA inventory. An inventory spreadsheet was created and sent to the SNWA Project Manager. This spreadsheet included project code and internal laboratory identification numbers and was verified by the SNWA Project Manager prior to upload into the Rhithron database.

Standard sorting protocols were applied to achieve representative subsamples of a minimum of 300 organisms. Caton sub-sampling devices (Caton 1991), divided into 30 grids, each approximately 5 cm by 6 cm were used. Each individual sample was thoroughly mixed in its jar(s), poured out and evenly spread into the Caton tray, and individual grids were randomly selected. The contents of each grid were examined under stereoscopic microscopes using 10x-30x magnification. All aquatic invertebrates from each selected grid were sorted from the substrate, and placed in 95% ethanol for subsequent identification. Grid selection, examination, and sorting continued until at least 300 organisms were sorted. The final grid was completely sorted of all organisms. All unsorted sample fractions were retained and stored at the Rhithron laboratory.

Organisms were individually examined by certified taxonomists, using 10x – 80x stereoscopic dissecting scopes (Leica S8E and S6E) and identified to the lowest possible level consistent with California Department of Fish and Game Standard Taxonomic Effort (CAMLnet 2003), using appropriate published taxonomic references and keys. The CAMLnet taxonomic effort criteria are recommended by the Nevada Department of Environmental Protection (Karen Vargas, NDEP, personal communication.) However, a finer taxonomic resolution was applied to midges (Diptera: Chironomidae), which were identified to genus.

Midges were carefully morphotyped using 10x – 80x stereoscopic dissecting microscopes (Leica S8E and S6E) and representative specimens were slide mounted and examined at 200x – 1000x magnification using an Olympus BX 51 compound microscope. Slide mounted organisms were archived at the Rhithron laboratory.

Identification, counts, life stages, and information about the condition of specimens were recorded on bench sheets. Organisms that could not be identified to the taxonomic targets because of immaturity, poor condition, or lack of complete current regionally-applicable published keys were left at appropriate taxonomic levels that were coarser than those specified. To obtain accuracy in richness measures, these organisms were designated as "not unique" if other specimens from the same group could be taken to target levels. Organisms designated as "unique" were those that could be definitively distinguished from other organisms in the sample. Identified organisms were preserved in 95% ethanol in labeled vials, and archived at the Rhithron laboratory.

**Macroinvertebrate Survey for Spring 2010; Laboratory Methods and Quality Control Procedures**
(Page 1 of 3)

*Quality control procedures*

Quality control procedures for initial sample processing and subsampling involved checking sorting efficiency. These checks were conducted on 100% of the samples by independent observers who microscopically re-examined at least 20% of sorted substrate from each sample. Quality control procedures for each sample proceeded as follows:

The quality control technician poured the sorted substrate from a processed sample out into a Caton tray, redistributing the substrate so that 20% of it could be accurately lifted out by removing entire grids in a random fashion. Grids were selected, and re-examined until 20% of the substrate was re-sorted. All organisms that were missed were counted and this number was added to the total number obtained in the original sort. Sorting efficiency was evaluated by applying the following calculation:

$$SE = \frac{n_1}{n_1 + n_2} \times 100$$

where: SE is the sorting efficiency, expressed as a percentage, $n_1$ is the total number of specimens in the first sort, and $n_2$ is the total number of specimens expected in the second sort, based on the results of the re-sorted 20%.

Quality control procedures for taxonomic determinations of invertebrates involved checking accuracy, precision and enumeration. Two samples were randomly selected and all organisms re-identified and counted by an independent taxonomist. Taxa lists and enumerations were compared by calculating a Bray-Curtis similarity statistic (Bray and Curtis 1957) for each selected sample. Routinely, discrepancies between the original identifications and the QC identifications are discussed among the taxonomists, and necessary rectifications to the data are made. Discrepancies that cannot be rectified by discussions are routinely sent out to taxonomic specialists for identification.

One taxon in these samples was not identifiable to target level, because it is not described in the taxonomic literature. These specimens were sent to taxonomic specialists for identification. The taxon was assigned a provisional laboratory identifier, until definitive identifications could be made. This was: Hydroptilidae sp. (RAI Taxon # 0001), 4 specimens in sample SNWA10CW012, Stateline Springs, STL: Sample 503-504.

*Data analysis*

Taxa lists and counts for each sample were constructed. Standard metric calculations for aquatic invertebrate assemblages were made using Rhithron's customized database software. Electronic spreadsheets containing identification and metric data were formatted following specifications made by the SNWA Project Manager.

**RESULTS**

*Quality Control Procedures*

Results of quality control procedures for subsampling and taxonomy are given in Table 1. Sorting efficiency averaged 97.19%, taxonomic precision for identification and enumeration averaged 97.29% for the randomly selected QA samples, and data entry efficiency averaged 100% for the project. These similarity statistics fall within acceptable industry criteria (Stribling et al. 2003).

*Data analysis*

Taxa lists and counts, and values and scores for various standard bioassessment metrics and indices calculated by Rhithron are given in the appendix. Electronic spreadsheets were provided to the SNWA Project Manager via e-mail.

**Macroinvertebrate Survey for Spring 2010; Laboratory Methods and Quality Control Procedures**
(Page 2 of 3)

**Table 1.** *Results of internal quality control procedures for subsampling and taxonomy.* Southern Nevada Watershed Authority, Spring 2010.

| Rhithron ID | Site Name | Sorting efficiency | Bray-Curtis similarity for taxonomy and enumeration |
|---|---|---|---|
| SNWA10CW001 | KR: Sample 59-60 | 92.87% | |
| SNWA10CW002 | MSS: Sample 657-658 | 96.96% | |
| SNWA10CW003 | MS North: Sample 403-404 | 98.46% | |
| SNWA10CW004 | SM: Sample 154-155 | 96.91% | |
| SNWA10CW005 | ST: Sample 10-12 | 91.20% | 96.94% |
| SNWA10CW006 | SS: Sample 356 | 100.00% | |
| SNWA10CW007 | U5: Sample 108-111 | 100.00% | 97.63% |
| SNWA10CW008 | WV: Sample 309-311 | 100.00% | |
| SNWA10CW009 | WS: Sample 257 | 95.57% | |
| SNWA10CW010 | UN: Sample 455 | 97.00% | |
| SNWA10CW011 | BS: Sample 555 | 99.07% | |
| SNWA10CW012 | STL: Sample 503-504 | 98.46% | |
| SNWA10CW013 | CSN: Sample 701-703 | 97.00% | |

## REFERENCES

Bray, J. R. and J. T. Curtis. 1957. An ordination of upland forest communities of southern Wisconsin. Ecological Monographs 27: 325-349.

CAMLnet. 2003. List of Californian Macroinvertebrate Taxa and Standard Taxonomic Effort. Revision date: 27 January 2003.

Caton, L. W. 1991. Improving subsampling methods for the EPA's "Rapid Bioassessment" benthic protocols. Bulletin of the North American Benthological Society. 8(3): 317-319.

Stribling, J.B., S.R Moulton II and G.T. Lester. 2003. Determining the quality of taxonomic data. J.N. Am. Benthol. Soc. 22(4): 621-631.

**Analysis of biological samples:**
**Technical summary of methods and quality assurance procedures**
**Prepared for Southern Nevada Watershed Authority**
**Allen Cattell, Project Manager**
**January 28, 2011**



by
W. Bollman, Chief Biologist
Rhithron Associates, Inc.
Missoula, Montana

## METHODS

*Sample processing*

Nineteen macroinvertebrate samples in 34 jars were delivered to Rhithron's laboratory facility in Missoula, Montana on November 11, 2010. All sample jars arrived in good condition. An inventory document containing sample identification information was provided by the Southern Nevada Watershed Authority (SNWA) Project Manager. Upon arrival, samples were unpacked and examined, and checked against the SNWA inventory. An inventory spreadsheet was created and sent to the SNWA Project Manager. This spreadsheet included project code and internal laboratory identification numbers and was verified by the SNWA Project Manager prior to upload into the Rhithron database.

Standard sorting protocols were applied to achieve representative subsamples of a minimum of 300 organisms. Caton sub-sampling devices (Caton 1991), divided into 30 grids, each approximately 5 cm by 6 cm were used. Each individual sample was thoroughly mixed in its jar(s), poured out and evenly spread into the Caton tray, and individual grids were randomly selected. The contents of each grid were examined under stereoscopic microscopes using 10x-30x magnification. All aquatic invertebrates from each selected grid were sorted from the substrate, and placed in 95% ethanol for subsequent identification. Grid selection, examination, and sorting continued until at least 300 organisms were sorted. The final grid was completely sorted of all organisms. All unsorted sample fractions were retained and stored at the Rhithron laboratory.

Organisms were individually examined by certified taxonomists, using 10x – 80x stereoscopic dissecting scopes (Leica S8E and S6E) and identified to the lowest possible level consistent with California Department of Fish and Game Standard Taxonomic Effort (CAMLnet 2003), using appropriate published taxonomic references and keys. The CAMLnet taxonomic effort criteria are recommended by the Nevada Department of Environmental Protection (Karen Vargas, NDEP, personal communication.) However, a finer taxonomic resolution was applied to midges (Diptera: Chironomidae), which were identified to genus.

Midges were carefully morphotyped using 10x – 80x stereoscopic dissecting microscopes (Leica S8E and S6E) and representative specimens were slide mounted and examined at 200x – 1000x magnification using an Olympus BX 51 compound microscope. Slide mounted organisms were archived at the Rhithron laboratory.

Identification, counts, life stages, and information about the condition of specimens were recorded on bench sheets. Organisms that could not be identified to the taxonomic targets because of immaturity, poor condition, or lack of complete current regionally-applicable published keys were left at appropriate taxonomic levels that were coarser than those specified. To obtain accuracy in richness measures, these organisms were designated as "not unique" if other specimens from the same group could be taken to target levels. Organisms designated as "unique" were those that could be definitively distinguished from other organisms in the sample. Identified organisms were preserved in 95% ethanol in labeled vials, and archived at the Rhithron laboratory.

*Quality control procedures*

Quality control procedures for initial sample processing and subsampling involved checking sorting efficiency. These checks were conducted on 100% of the samples by independent observers who microscopically re-examined at least 20% of sorted substrate from each sample. Quality control procedures for each sample proceeded as follows:

The quality control technician poured the sorted substrate from a processed sample out into a Caton tray, redistributing the substrate so that 20% of it could be accurately lifted out by removing entire grids in a random fashion. Grids were selected, and re-examined until 20% of the substrate was re-sorted. All organisms that were missed were counted and this number was added to the total number obtained in the original sort. Sorting efficiency was evaluated by applying the following calculation:

$$SE = \frac{n_1}{n_1 + n_2} \times 100$$

where: SE is the sorting efficiency, expressed as a percentage, $n_1$ is the total number of specimens in the first sort, and $n_2$ is the total number of specimens expected in the second sort, based on the results of the re-sorted 20%.

Quality control procedures for taxonomic determinations of invertebrates involved checking accuracy, precision and enumeration. Two samples were randomly selected and all organisms re-identified and counted by an independent taxonomist. Taxa lists and enumerations were compared by calculating a Bray-Curtis similarity statistic (Bray and Curtis 1957) for each selected sample. Routinely, discrepancies between the original identifications and the QC identifications are discussed among the taxonomists, and necessary rectifications to the data are made. Discrepancies that cannot be rectified by discussions are routinely sent out to taxonomic specialists for identification.

One taxon in these samples was not identifiable to target level, because it is not described in the taxonomic literature. These specimens were sent to taxonomic specialists for identification. The taxon was assigned a provisional laboratory identifier, until definitive identifications could be made. This was: Hydroptilidae sp. (RAI Taxon # 0001), 23 specimens total in 7 different samples.

*Data analysis*

Taxa lists and counts for each sample were constructed. Standard metric calculations for aquatic invertebrate assemblages were made using Rhithron's customized database software. Electronic spreadsheets containing identification and metric data were formatted following specifications made by the SNWA Project Manager.

**RESULTS**

*Quality Control Procedures*

Results of quality control procedures for subsampling and taxonomy are given in Table 1. Sorting efficiency averaged 96.54%, taxonomic precision for identification and enumeration averaged 96.41% for the randomly selected QA samples, and data entry efficiency averaged 100% for the project. These similarity statistics fall within acceptable industry criteria (Stribling et al. 2003).

*Data analysis*

Taxa lists and counts, and values and scores for various standard bioassessment metrics and indices calculated by Rhithron are given in the appendix. Electronic spreadsheets were provided to the SNWA Project Manager via e-mail.

**Table 1.** *Results of internal quality control procedures for subsampling and taxonomy.* Southern Nevada Watershed Authority, Fall 2010.

| Rhithron ID | Site Name | Sorting efficiency | Bray-Curtis similarity for taxonomy and enumeration |
|---|---|---|---|
| SNWA10CW2001 | ST: Sample 13-17 | 95.54% | |
| SNWA10CW2002 | KR: Sample 61-65 | 94.03% | |
| SNWA10CW2003 | U5: Sample 112 | 100.00% | |
| SNWA10CW2004 | SM: Sample 156-158 | 100.00% | |
| SNWA10CW2005 | WS: Sample 258 | 91.50% | |
| SNWA10CW2006 | WV: Sample 312-314 | 94.04% | |
| SNWA10CW2007 | SS: Sample 357 | 100.00% | 97.63% |
| SNWA10CW2008 | MS-North: Sample 405-406 | 92.83% | 95.19% |
| SNWA10CW2009 | UN: Sample 456 | 99.68% | |
| SNWA10CW2010 | STL: Sample 505 | 96.97% | |
| SNWA10CW2011 | BS: Sample 556 | 94.20% | |
| SNWA10CW2012 | MSS: Sample 659-661 | 97.00% | |
| SNWA10CW2013 | CSN: Sample 704 | 97.60% | |
| SNWA10CW2014 | CC Reach 1: Sample 614 | 91.14% | |
| SNWA10CW2015 | CC Reach 2: Sample 617 | 100.00% | |
| SNWA10CW2016 | CC Reach 3: Sample 620 | 100.00% | |
| SNWA10CW2017 | CC Reach 4: Sample 623 | 94.18% | |
| SNWA10CW2018 | CC Reach 5: Sample 626 | 100.00% | |
| SNWA10CW2019 | CC Reach 6: Sample 629 | 95.60% | |

## REFERENCES


Bray, J. R. and J. T. Curtis. 1957. An ordination of upland forest communities of southern Wisconsin. Ecological Monographs 27: 325-349.

CAMLnet. 2003. List of Californian Macroinvertebrate Taxa and Standard Taxonomic Effort. Revision date: 27 January 2003.

Caton, L. W. 1991. Improving subsampling methods for the EPA's "Rapid Bioassessment" benthic protocols. Bulletin of the North American Benthological Society. 8(3): 317-319.

Stribling, J.B., S.R Moulton II and G.T. Lester. 2003. Determining the quality of taxonomic data. J.N. Am. Benthol. Soc. 22(4): 621-631.

# Metrics Report

**Project ID:** SNWA10CW2
**RAI No.:** SNWA10CW2014
**Sta. Name:** CC Reach 1: Sample 614
**Client ID:** Big Spring Creek/Lake Creek
**STORET ID:**
**Coll. Date:**

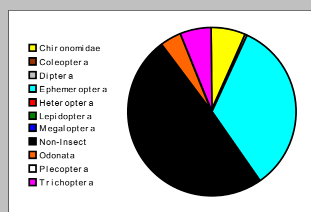
### *Abundance Measures*

**Sample Count:** 320
**Sample Abundance:** 9,600.00 3.33% of sample used

**Coll. Procedure:**
**Sample Notes:** Fall 2010

### *Taxonomic Composition*

| Category | R | A | PRA |
|---|---|---|---|
| Non-Insect | 4 | 158 | 49.38% |
| Odonata | 2 | 13 | 4.06% |
| Ephemeroptera | 3 | 106 | 33.13% |
| Plecoptera | | | |
| Heteroptera | | | |
| Megaloptera | | | |
| Trichoptera | 4 | 20 | 6.25% |
| Lepidoptera | | | |
| Coleoptera | | | |
| Diptera | 2 | 2 | 0.63% |
| Chironomidae | 7 | 21 | 6.56% |

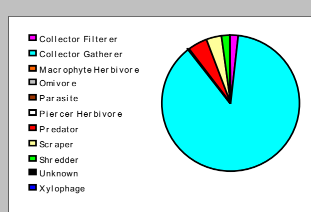



### *Dominant Taxa*

| Category | A | PRA |
|---|---|---|
| Hyalella | 142 | 44.38% |
| Fallceon | 82 | 25.63% |
| Baetis tricaudatus | 19 | 5.94% |
| Protoptila | 11 | 3.44% |
| Ostracoda | 10 | 3.13% |
| Coenagrionidae | 10 | 3.13% |
| Eukiefferiella Claripennis Gr. | 6 | 1.88% |
| Hydropsyche | 5 | 1.56% |
| Tricorythodes | 4 | 1.25% |
| Thienemanniella | 4 | 1.25% |
| Amphipoda | 4 | 1.25% |
| Orthocladius | 3 | 0.94% |
| Hydroptilidae sp. (RAI Taxon # 00 | 3 | 0.94% |
| Cricotopus (Cricotopus) | 3 | 0.94% |
| Aeshnidae | 3 | 0.94% |

### *Functional Composition*

| Category | R | A | PRA |
|---|---|---|---|
| Predator | 4 | 15 | 4.69% |
| Parasite | | | |
| Collector Gatherer | 11 | 280 | 87.50% |
| Collector Filterer | 2 | 6 | 1.88% |
| Macrophyte Herbivore | | | |
| Piercer Herbivore | | | |
| Xylophage | | | |
| Scraper | 2 | 12 | 3.75% |
| Shredder | 2 | 6 | 1.88% |
| Omivore | 1 | 1 | 0.31% |
| Unknown | | | |

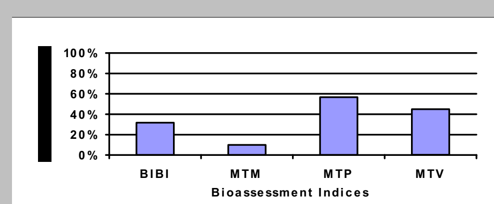



### *Metric Values and Scores*

| Metric | Value | BIBI | MTP | MTV | MTM |
|---|---|---|---|---|---|
| *Composition* | | | | | |
| Taxa Richness | 22 | 3 | 2 | | 1 |
| Non-Insect Percent | 49.38% | | | | |
| E Richness | 3 | 1 | | 1 | |
| P Richness | 0 | 1 | | 0 | |
| T Richness | 4 | 1 | | 2 | |
| EPT Richness | 7 | | 2 | | 0 |
| EPT Percent | 39.38% | | 2 | | 0 |
| Oligochaeta+Hirudinea Percent | 0.31% | | | | |
| Baetidae/Ephemeroptera | 0.962 | | | | |
| Hydropsychidae/Trichoptera | 0.250 | | | | |
| *Dominance* | | | | | |
| Dominant Taxon Percent | 44.38% | | 2 | | 1 |
| Dominant Taxa (2) Percent | 70.00% | | | | |
| Dominant Taxa (3) Percent | 75.94% | 1 | | | |
| Dominant Taxa (10) Percent | 91.56% | | | | |
| *Diversity* | | | | | |
| Shannon H (loge) | 1.787 | | | | |
| Shannon H (log2) | 2.578 | | 2 | | |
| Margalef D | 3.657 | | | | |
| Simpson D | 0.282 | | | | |
| Evenness | 0.091 | | | | |
| *Function* | | | | | |
| Predator Richness | 4 | | 2 | | |
| Predator Percent | 4.69% | 1 | | | |
| Filterer Richness | 2 | | | | |
| Filterer Percent | 1.88% | | | 3 | |
| Collector Percent | 89.38% | | 1 | | 0 |
| Scraper+Shredder Percent | 5.63% | | 1 | | 0 |
| Scraper/Filterer | 2.000 | | | | |
| Scraper/Scraper+Filterer | 0.667 | | | | |
| *Habit* | | | | | |
| Burrower Richness | 1 | | | | |
| Burrower Percent | 0.31% | | | | |
| Swimmer Richness | 2 | | | | |
| Swimmer Percent | 31.88% | | | | |
| Clinger Richness | 5 | 1 | | | |
| Clinger Percent | 6.56% | | | | |
| *Characteristics* | | | | | |
| Cold Stenotherm Richness | 0 | | | | |
| Cold Stenotherm Percent | 0.00% | | | | |
| Hemoglobin Bearer Richness | | | | | |
| Hemoglobin Bearer Percent | | | | | |
| Air Breather Richness | 0 | | | | |
| Air Breather Percent | 0.00% | | | | |
| *Voltinism* | | | | | |
| Univoltine Richness | 9 | | | | |
| Semivoltine Richness | 1 | 1 | | | |
| Multivoltine Percent | 41.56% | | 2 | | |
| *Tolerance* | | | | | |
| Sediment Tolerant Richness | 2 | | | | |
| Sediment Tolerant Percent | 1.56% | | | | |
| Sediment Sensitive Richness | 0 | | | | |
| Sediment Sensitive Percent | 0.00% | | | | |
| Metals Tolerance Index | 3.359 | | | | |
| Pollution Sensitive Richness | 0 | 1 | | 0 | |
| Pollution Tolerant Percent | 5.63% | 5 | | 2 | |
| Hilsenhoff Biotic Index | 6.397 | | 1 | | 0 |
| Intolerant Percent | 3.75% | | | | |
| Supertolerant Percent | 50.31% | | | | |
| CTQa | 92.133 | | | | |

### *Bioassessment Indices*

| BioIndex | Description | Score | Pct | Rating |
|---|---|---|---|---|
| BIBI | B-IBI (Karr et al.) | 16 | 32.00% | |
| MTP | Montana DEQ Plains (Bukantis 1998) | 17 | 56.67% | Slight |
| MTV | Montana Revised Valleys/Foothills (Bollman 1998) | 8 | 44.44% | Moderate |
| MTM | Montana DEQ Mountains (Bukantis 1998) | 2 | 9.52% | Severe |




**Friday, January 28, 2011**

**Figure A-1**
**Fall 2010 Macroinvertebrate Metric Results for Big Springs Creek/Lake Creek Reach 1**

# Metrics Report

**Project ID:** SNWA10CW2
**RAI No.:** SNWA10CW2015
**Sta. Name:** CC Reach 2: Sample 617
**Client ID:** Big Spring Creek/Lake Creek
**STORET ID:**
**Coll. Date:**

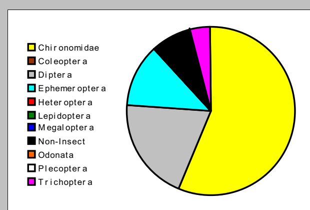
### Abundance Measures

**Sample Count:** 25
**Sample Abundance:** 25.00 100.00% of sample used

**Coll. Procedure:**
**Sample Notes:** Fall 2010

### Taxonomic Composition

| Category | R | A | PRA |
|---|---|---|---|
| Non-Insect | 1 | 2 | 8.00% |
| Odonata | | | |
| Ephemeroptera | 2 | 3 | 12.00% |
| Plecoptera | | | |
| Heteroptera | | | |
| Megaloptera | | | |
| Trichoptera | 1 | 1 | 4.00% |
| Lepidoptera | | | |
| Coleoptera | | | |
| Diptera | 2 | 5 | 20.00% |
| Chironomidae | 5 | 14 | 56.00% |

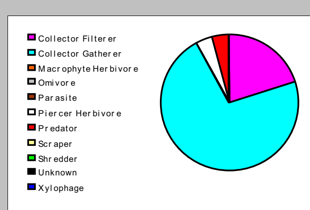



### Dominant Taxa

| Category | A | PRA |
|---|---|---|
| Cladotanytarsus | 6 | 24.00% |
| Simulium | 4 | 16.00% |
| Orthocladius | 3 | 12.00% |
| Parakiefferiella | 2 | 8.00% |
| Hyalella | 2 | 8.00% |
| Fallceon | 2 | 8.00% |
| Tanytarsini | 1 | 4.00% |
| Odontomyia / Hedriodiscus | 1 | 4.00% |
| Hydroptila | 1 | 4.00% |
| Cryptochironomus | 1 | 4.00% |
| Chaetocladius | 1 | 4.00% |
| Baetis | 1 | 4.00% |

### Functional Composition

| Category | R | A | PRA |
|---|---|---|---|
| Predator | 1 | 1 | 4.00% |
| Parasite | | | |
| Collector Gatherer | 8 | 18 | 72.00% |
| Collector Filterer | 1 | 5 | 20.00% |
| Macrophyte Herbivore | | | |
| Piercer Herbivore | 1 | 1 | 4.00% |
| Xylophage | | | |
| Scraper | | | |
| Shredder | | | |
| Omivore | | | |
| Unknown | | | |

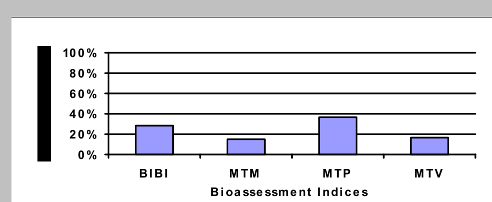



### Metric Values and Scores

| Metric | Value | BIBI | MTP | MTV | MTM |
|---|---|---|---|---|---|
| *Composition* | | | | | |
| Taxa Richness | 11 | 1 | 0 | | 0 |
| Non-Insect Percent | 8.00% | | | | |
| E Richness | 2 | 1 | | 1 | |
| P Richness | 0 | 1 | | 0 | |
| T Richness | 1 | 1 | | 0 | |
| EPT Richness | 3 | | 1 | | 0 |
| EPT Percent | 16.00% | | 1 | | 0 |
| Oligochaeta+Hirudinea Percent | | | | | |
| Baetidae/Ephemeroptera | 1.000 | | | | |
| Hydropsychidae/Trichoptera | 0.000 | | | | |
| *Dominance* | | | | | |
| Dominant Taxon Percent | 24.00% | | 3 | | 3 |
| Dominant Taxa (2) Percent | 40.00% | | | | |
| Dominant Taxa (3) Percent | 52.00% | 3 | | | |
| Dominant Taxa (10) Percent | 92.00% | | | | |
| *Diversity* | | | | | |
| Shannon H (loge) | 2.188 | | | | |
| Shannon H (log2) | 3.157 | | 3 | | |
| Margalef D | 3.147 | | | | |
| Simpson D | 0.098 | | | | |
| Evenness | 0.104 | | | | |
| *Function* | | | | | |
| Predator Richness | 1 | | 0 | | |
| Predator Percent | 4.00% | 1 | | | |
| Filterer Richness | 1 | | | | |
| Filterer Percent | 20.00% | | | 1 | |
| Collector Percent | 92.00% | | 1 | | 0 |
| Scraper+Shredder Percent | 0.00% | | 0 | | 0 |
| Scraper/Filterer | 0.000 | | | | |
| Scraper/Scraper+Filterer | 0.000 | | | | |
| *Habit* | | | | | |
| Burrower Richness | 0 | | | | |
| Burrower Percent | 0.00% | | | | |
| Swimmer Richness | 2 | | | | |
| Swimmer Percent | 12.00% | | | | |
| Clinger Richness | 2 | 1 | | | |
| Clinger Percent | 20.00% | | | | |
| *Characteristics* | | | | | |
| Cold Stenotherm Richness | 0 | | | | |
| Cold Stenotherm Percent | 0.00% | | | | |
| Hemoglobin Bearer Richness | 1 | | | | |
| Hemoglobin Bearer Percent | 4.00% | | | | |
| Air Breather Richness | 0 | | | | |
| Air Breather Percent | 0.00% | | | | |
| *Voltinism* | | | | | |
| Univoltine Richness | 2 | | | | |
| Semivoltine Richness | 0 | 1 | | | |
| Multivoltine Percent | 72.00% | | 1 | | |
| *Tolerance* | | | | | |
| Sediment Tolerant Richness | 0 | | | | |
| Sediment Tolerant Percent | 0.00% | | | | |
| Sediment Sensitive Richness | 0 | | | | |
| Sediment Sensitive Percent | 0.00% | | | | |
| Metals Tolerance Index | 4.000 | | | | |
| Pollution Sensitive Richness | 0 | 1 | | 0 | |
| Pollution Tolerant Percent | 32.00% | 3 | | 1 | |
| Hilsenhoff Biotic Index | 6.375 | | 1 | | 0 |
| Intolerant Percent | 0.00% | | | | |
| Supertolerant Percent | 12.00% | | | | |
| CTQa | 103.500 | | | | |

### Bioassessment Indices

| BioIndex | Description | Score | Pct | Rating |
|---|---|---|---|---|
| BIBI | B-IBI (Karr et al.) | 14 | 28.00% | |
| MTP | Montana DEQ Plains (Bukantis 1998) | 11 | 36.67% | Moderate |
| MTV | Montana Revised Valleys/Foothills (Bollman 1998) | 3 | 16.67% | Severe |
| MTM | Montana DEQ Mountains (Bukantis 1998) | 3 | 14.29% | Severe |




Friday, January 28, 2011

**Figure A-2**
**Fall 2010 Macroinvertebrate Metric Results for Big Springs Creek/Lake Creek Reach 2**

# Metrics Report

**Project ID:** SNWA10CW2
**RAI No.:** SNWA10CW2016
**Sta. Name:** CC Reach 3: Sample 620
**Client ID:** Big Spring Creek/Lake Creek
**STORET ID:**
**Coll. Date:**

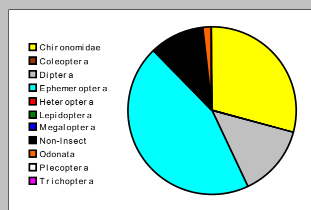
## *Abundance Measures*

**Sample Count:** 65
**Sample Abundance:** 65.00 100.00% of sample used

**Coll. Procedure:**
**Sample Notes:** Fall 2010

## *Taxonomic Composition*

| Category | R | A | PRA |
|---|---|---|---|
| Non-Insect | 3 | 7 | 10.77% |
| Odonata | 1 | 1 | 1.54% |
| Ephemeroptera | 4 | 29 | 44.62% |
| Plecoptera | | | |
| Heteroptera | | | |
| Megaloptera | | | |
| Trichoptera | | | |
| Lepidoptera | | | |
| Coleoptera | | | |
| Diptera | 1 | 9 | 13.85% |
| Chironomidae | 8 | 19 | 29.23% |

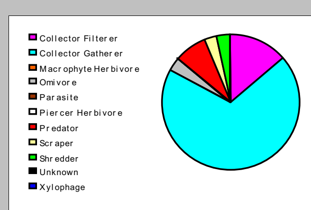



## *Dominant Taxa*

| Category | A | PRA |
|---|---|---|
| Baetis tricaudatus | 16 | 24.62% |
| Simulium | 9 | 13.85% |
| Tricorythodes | 5 | 7.69% |
| Fallceon | 5 | 7.69% |
| Thienemanniella | 4 | 6.15% |
| Cladotanytarsus | 4 | 6.15% |
| Hyalella | 3 | 4.62% |
| Cryptochironomus | 3 | 4.62% |
| Baetidae | 3 | 4.62% |
| Phaenopsectra | 2 | 3.08% |
| Parakiefferiella | 2 | 3.08% |
| Oligochaeta | 2 | 3.08% |
| Cambaridae | 2 | 3.08% |
| Polypedilum | 1 | 1.54% |
| Pentaneura | 1 | 1.54% |

## *Functional Composition*

| Category | R | A | PRA |
|---|---|---|---|
| Predator | 3 | 5 | 7.69% |
| Parasite | | | |
| Collector Gatherer | 9 | 45 | 69.23% |
| Collector Filterer | 1 | 9 | 13.85% |
| Macrophyte Herbivore | | | |
| Piercer Herbivore | | | |
| Xylophage | | | |
| Scraper | 1 | 2 | 3.08% |
| Shredder | 2 | 2 | 3.08% |
| Omivore | 1 | 2 | 3.08% |
| Unknown | | | |

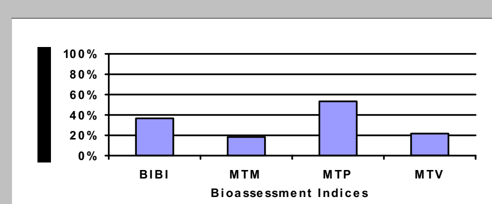



## *Metric Values and Scores*

| Metric | Value | BIBI | MTP | MTV | MTM |
|---|---|---|---|---|---|
| *Composition* | | | | | |
| Taxa Richness | 17 | 1 | 1 | | 0 |
| Non-Insect Percent | 10.77% | | | | |
| E Richness | 4 | 1 | | 2 | |
| P Richness | 0 | 1 | | 0 | |
| T Richness | 0 | 1 | | 0 | |
| EPT Richness | 4 | | 1 | | 0 |
| EPT Percent | 44.62% | | 2 | | 1 |
| Oligochaeta+Hirudinea Percent | 3.08% | | | | |
| Baetidae/Ephemeroptera | 0.828 | | | | |
| Hydropsychidae/Trichoptera | 0.000 | | | | |
| *Dominance* | | | | | |
| Dominant Taxon Percent | 24.62% | | 3 | | 3 |
| Dominant Taxa (2) Percent | 38.46% | | | | |
| Dominant Taxa (3) Percent | 46.15% | 5 | | | |
| Dominant Taxa (10) Percent | 83.08% | | | | |
| *Diversity* | | | | | |
| Shannon H (loge) | 2.472 | | | | |
| Shannon H (log2) | 3.567 | | 3 | | |
| Margalef D | 3.877 | | | | |
| Simpson D | 0.104 | | | | |
| Evenness | 0.077 | | | | |
| *Function* | | | | | |
| Predator Richness | 3 | | 1 | | |
| Predator Percent | 7.69% | 1 | | | |
| Filterer Richness | 1 | | | | |
| Filterer Percent | 13.85% | | | 1 | |
| Collector Percent | 83.08% | | 1 | | 0 |
| Scraper+Shredder Percent | 6.15% | | 1 | | 0 |
| Scraper/Filterer | 0.222 | | | | |
| Scraper/Scraper+Filterer | 0.182 | | | | |
| *Habit* | | | | | |
| Burrower Richness | 1 | | | | |
| Burrower Percent | 1.54% | | | | |
| Swimmer Richness | 2 | | | | |
| Swimmer Percent | 32.31% | | | | |
| Clinger Richness | 3 | 1 | | | |
| Clinger Percent | 18.46% | | | | |
| *Characteristics* | | | | | |
| Cold Stenotherm Richness | 0 | | | | |
| Cold Stenotherm Percent | 0.00% | | | | |
| Hemoglobin Bearer Richness | 3 | | | | |
| Hemoglobin Bearer Percent | 9.23% | | | | |
| Air Breather Richness | 0 | | | | |
| Air Breather Percent | 0.00% | | | | |
| *Voltinism* | | | | | |
| Univoltine Richness | 4 | | | | |
| Semivoltine Richness | 2 | 1 | | | |
| Multivoltine Percent | 66.15% | | 1 | | |
| *Tolerance* | | | | | |
| Sediment Tolerant Richness | 2 | | | | |
| Sediment Tolerant Percent | 10.77% | | | | |
| Sediment Sensitive Richness | 0 | | | | |
| Sediment Sensitive Percent | 0.00% | | | | |
| Metals Tolerance Index | 4.396 | | | | |
| Pollution Sensitive Richness | 0 | 1 | | 0 | |
| Pollution Tolerant Percent | 18.46% | 5 | | 1 | |
| Hilsenhoff Biotic Index | 5.546 | | 2 | | 0 |
| Intolerant Percent | 0.00% | | | | |
| Supertolerant Percent | 12.31% | | | | |
| CTQa | 102.462 | | | | |

## *Bioassessment Indices*

| BioIndex | Description | Score | Pct | Rating |
|---|---|---|---|---|
| BIBI | B-IBI (Karr et al.) | 18 | 36.00% | |
| MTP | Montana DEQ Plains (Bukantis 1998) | 16 | 53.33% | Moderate |
| MTV | Montana Revised Valleys/Foothills (Bollman 1998) | 4 | 22.22% | Moderate |
| MTM | Montana DEQ Mountains (Bukantis 1998) | 4 | 19.05% | Severe |




**Friday, January 28, 2011**

**Figure A-3**
**Fall 2010 Macroinvertebrate Metric Results for Big Springs Creek/Lake Creek Reach 3**

# Metrics Report

**Project ID:** SNWA10CW2
**RAI No.:** SNWA10CW2017
**Sta. Name:** CC Reach 4: Sample 623
**Client ID:** Big Spring Creek/Lake Creek
**STORET ID:**
**Coll. Date:**

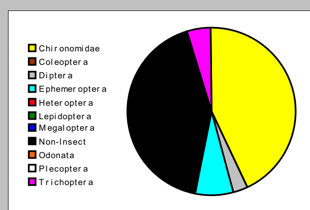
### Abundance Measures

**Sample Count:** 329
**Sample Abundance:** 822.50 40.00% of sample used

**Coll. Procedure:**
**Sample Notes:** Fall 2010

### Taxonomic Composition

| Category | R | A | PRA |
|---|---|---|---|
| Non-Insect | 9 | 139 | 42.25% |
| Odonata | | | |
| Ephemeroptera | 3 | 24 | 7.29% |
| Plecoptera | | | |
| Heteroptera | | | |
| Megaloptera | | | |
| Trichoptera | 3 | 15 | 4.56% |
| Lepidoptera | | | |
| Coleoptera | | | |
| Diptera | 4 | 10 | 3.04% |
| Chironomidae | 13 | 141 | 42.86% |

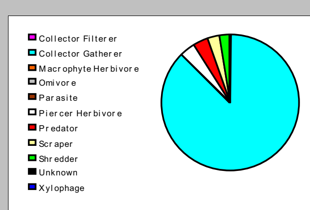



### Dominant Taxa

| Category | A | PRA |
|---|---|---|
| Ostracoda | 89 | 27.05% |
| Orthocladius | 71 | 21.58% |
| Parakiefferiella | 29 | 8.81% |
| Oligochaeta | 21 | 6.38% |
| Hyalella | 19 | 5.78% |
| Tricorythodes | 15 | 4.56% |
| Cladotanytarsus | 15 | 4.56% |
| Oxyethira | 12 | 3.65% |
| Baetis | 7 | 2.13% |
| Ceratopogoninae | 5 | 1.52% |
| Thienemanniella | 4 | 1.22% |
| Cladopelma | 4 | 1.22% |
| Phaenopsectra | 3 | 0.91% |
| Ephydridae | 3 | 0.91% |
| Cricotopus (Cricotopus) | 3 | 0.91% |

### Functional Composition

| Category | R | A | PRA |
|---|---|---|---|
| Predator | 5 | 12 | 3.65% |
| Parasite | | | |
| Collector Gatherer | 17 | 287 | 87.23% |
| Collector Filterer | 1 | 1 | 0.30% |
| Macrophyte Herbivore | | | |
| Piercer Herbivore | 1 | 12 | 3.65% |
| Xylophage | | | |
| Scraper | 5 | 10 | 3.04% |
| Shredder | 3 | 7 | 2.13% |
| Omivore | | | |
| Unknown | | | |

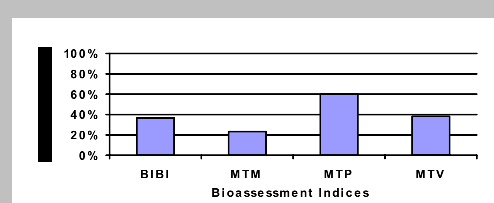



### Metric Values and Scores

| Metric | Value | BIBI | MTP | MTV | MTM |
|---|---|---|---|---|---|
| *Composition* | | | | | |
| Taxa Richness | 32 | 3 | 3 | | 3 |
| Non-Insect Percent | 42.25% | | | | |
| E Richness | 3 | 1 | | 1 | |
| P Richness | 0 | 1 | | 0 | |
| T Richness | 3 | 1 | | 2 | |
| EPT Richness | 6 | | 2 | | 0 |
| EPT Percent | 11.85% | | 1 | | 0 |
| Oligochaeta+Hirudinea Percent | 6.38% | | | | |
| Baetidae/Ephemeroptera | 0.375 | | | | |
| Hydropsychidae/Trichoptera | 0.000 | | | | |
| *Dominance* | | | | | |
| Dominant Taxon Percent | 27.05% | | 3 | | 2 |
| Dominant Taxa (2) Percent | 48.63% | | | | |
| Dominant Taxa (3) Percent | 57.45% | 3 | | | |
| Dominant Taxa (10) Percent | 86.02% | | | | |
| *Diversity* | | | | | |
| Shannon H (loge) | 2.462 | | | | |
| Shannon H (log2) | 3.552 | | 3 | | |
| Margalef D | 5.354 | | | | |
| Simpson D | 0.141 | | | | |
| Evenness | 0.067 | | | | |
| *Function* | | | | | |
| Predator Richness | 5 | | 2 | | |
| Predator Percent | 3.65% | 1 | | | |
| Filterer Richness | 1 | | | | |
| Filterer Percent | 0.30% | | | 3 | |
| Collector Percent | 87.54% | | 1 | | 0 |
| Scraper+Shredder Percent | 5.17% | | 1 | | 0 |
| Scraper/Filterer | 10.000 | | | | |
| Scraper/Scraper+Filterer | 0.909 | | | | |
| *Habit* | | | | | |
| Burrower Richness | 4 | | | | |
| Burrower Percent | 3.34% | | | | |
| Swimmer Richness | 2 | | | | |
| Swimmer Percent | 2.74% | | | | |
| Clinger Richness | 4 | 1 | | | |
| Clinger Percent | 2.74% | | | | |
| *Characteristics* | | | | | |
| Cold Stenotherm Richness | 0 | | | | |
| Cold Stenotherm Percent | 0.00% | | | | |
| Hemoglobin Bearer Richness | 6 | | | | |
| Hemoglobin Bearer Percent | 4.86% | | | | |
| Air Breather Richness | 0 | | | | |
| Air Breather Percent | 0.00% | | | | |
| *Voltinism* | | | | | |
| Univoltine Richness | 12 | | | | |
| Semivoltine Richness | 0 | 1 | | | |
| Multivoltine Percent | 76.60% | | 1 | | |
| *Tolerance* | | | | | |
| Sediment Tolerant Richness | 4 | | | | |
| Sediment Tolerant Percent | 12.16% | | | | |
| Sediment Sensitive Richness | 1 | | | | |
| Sediment Sensitive Percent | 0.30% | | | | |
| Metals Tolerance Index | 4.056 | | | | |
| Pollution Sensitive Richness | 0 | 1 | | 0 | |
| Pollution Tolerant Percent | 17.02% | 5 | | 1 | |
| Hilsenhoff Biotic Index | 6.870 | | 1 | | 0 |
| Intolerant Percent | 0.30% | | | | |
| Supertolerant Percent | 44.07% | | | | |
| CTQa | 102.545 | | | | |

### Bioassessment Indices

| BioIndex | Description | Score | Pct | Rating |
|---|---|---|---|---|
| BIBI | B-IBI (Karr et al.) | 18 | 36.00% | |
| MTP | Montana DEQ Plains (Bukantis 1998) | 18 | 60.00% | Slight |
| MTV | Montana Revised Valleys/Foothills (Bollman 1998) | 7 | 38.89% | Moderate |
| MTM | Montana DEQ Mountains (Bukantis 1998) | 5 | 23.81% | Moderate |




Friday, January 28, 2011

**Figure A-4**
**Fall 2010 Macroinvertebrate Metric Results for Big Springs Creek/Lake Creek Reach 4**

# Metrics Report

**Project ID:** SNWA10CW2
**RAI No.:** SNWA10CW2018
**Sta. Name:** CC Reach 5: Sample 626
**Client ID:** Big Spring Creek/Lake Creek
**STORET ID:**
**Coll. Date:**

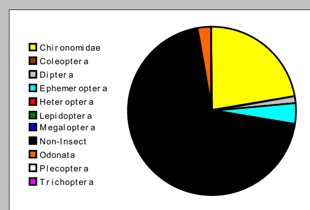
### *Abundance Measures*

**Sample Count:** 76
**Sample Abundance:** 76.00 100.00% of sample used

**Coll. Procedure:**
**Sample Notes:** Fall 2010

### *Taxonomic Composition*

| Category | R | A | PRA |
|---|---|---|---|
| Non-Insect | 5 | 53 | 69.74% |
| Odonata | 2 | 2 | 2.63% |
| Ephemeroptera | 2 | 3 | 3.95% |
| Plecoptera | | | |
| Heteroptera | | | |
| Megaloptera | | | |
| Trichoptera | | | |
| Lepidoptera | | | |
| Coleoptera | | | |
| Diptera | 1 | 1 | 1.32% |
| Chironomidae | 4 | 17 | 22.37% |

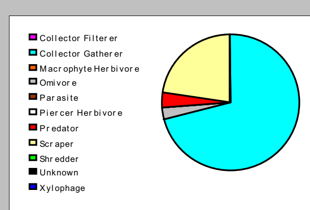



### *Dominant Taxa*

| Category | A | PRA |
|---|---|---|
| Hyalella | 17 | 22.37% |
| Ferrissia | 17 | 22.37% |
| Ostracoda | 15 | 19.74% |
| Orthocladius | 14 | 18.42% |
| Tricorythodes | 2 | 2.63% |
| Orconectes | 2 | 2.63% |
| Oligochaeta | 2 | 2.63% |
| Pseudochironomus | 1 | 1.32% |
| Coenagrionidae | 1 | 1.32% |
| Cladotanytarsus | 1 | 1.32% |
| Chironomus | 1 | 1.32% |
| Ceratopogoninae | 1 | 1.32% |
| Baetidae | 1 | 1.32% |
| Argia | 1 | 1.32% |

### *Functional Composition*

| Category | R | A | PRA |
|---|---|---|---|
| Predator | 3 | 3 | 3.95% |
| Parasite | | | |
| Collector Gatherer | 9 | 54 | 71.05% |
| Collector Filterer | | | |
| Macrophyte Herbivore | | | |
| Piercer Herbivore | | | |
| Xylophage | | | |
| Scraper | 1 | 17 | 22.37% |
| Shredder | | | |
| Omivore | 1 | 2 | 2.63% |
| Unknown | | | |

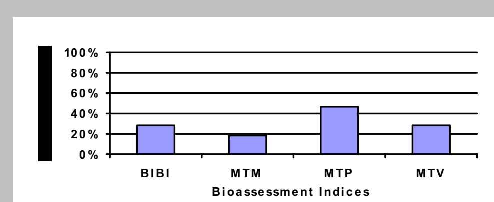



### *Metric Values and Scores*

| Metric | Value | BIBI | MTP | MTV | MTM |
|---|---|---|---|---|---|
| *Composition* | | | | | |
| Taxa Richness | 14 | 1 | 1 | | 0 |
| Non-Insect Percent | 69.74% | | | | |
| E Richness | 2 | 1 | | 1 | |
| P Richness | 0 | 1 | | 0 | |
| T Richness | 0 | 1 | | 0 | |
| EPT Richness | 2 | | 0 | | 0 |
| EPT Percent | 3.95% | | 0 | | 0 |
| Oligochaeta+Hirudinea Percent | 2.63% | | | | |
| Baetidae/Ephemeroptera | 0.333 | | | | |
| Hydropsychidae/Trichoptera | 0.000 | | | | |
| *Dominance* | | | | | |
| Dominant Taxon Percent | 22.37% | | 3 | | 3 |
| Dominant Taxa (2) Percent | 44.74% | | | | |
| Dominant Taxa (3) Percent | 64.47% | 3 | | | |
| Dominant Taxa (10) Percent | 94.74% | | | | |
| *Diversity* | | | | | |
| Shannon H (loge) | 1.988 | | | | |
| Shannon H (log2) | 2.868 | | 2 | | |
| Margalef D | 3.002 | | | | |
| Simpson D | 0.165 | | | | |
| Evenness | 0.107 | | | | |
| *Function* | | | | | |
| Predator Richness | 3 | | 1 | | |
| Predator Percent | 3.95% | 1 | | | |
| Filterer Richness | 0 | | | | |
| Filterer Percent | 0.00% | | | 3 | |
| Collector Percent | 71.05% | | 2 | | 1 |
| Scraper+Shredder Percent | 22.37% | | 2 | | 0 |
| Scraper/Filterer | 0.000 | | | | |
| Scraper/Scraper+Filterer | 0.000 | | | | |
| *Habit* | | | | | |
| Burrower Richness | 2 | | | | |
| Burrower Percent | 2.63% | | | | |
| Swimmer Richness | 0 | | | | |
| Swimmer Percent | 0.00% | | | | |
| Clinger Richness | 1 | 1 | | | |
| Clinger Percent | 22.37% | | | | |
| *Characteristics* | | | | | |
| Cold Stenotherm Richness | 0 | | | | |
| Cold Stenotherm Percent | 0.00% | | | | |
| Hemoglobin Bearer Richness | 2 | | | | |
| Hemoglobin Bearer Percent | 2.63% | | | | |
| Air Breather Richness | 0 | | | | |
| Air Breather Percent | 0.00% | | | | |
| *Voltinism* | | | | | |
| Univoltine Richness | 7 | | | | |
| Semivoltine Richness | 1 | 1 | | | |
| Multivoltine Percent | 43.42% | | 2 | | |
| *Tolerance* | | | | | |
| Sediment Tolerant Richness | 3 | | | | |
| Sediment Tolerant Percent | 27.63% | | | | |
| Sediment Sensitive Richness | 0 | | | | |
| Sediment Sensitive Percent | 0.00% | | | | |
| Metals Tolerance Index | 2.982 | | | | |
| Pollution Sensitive Richness | 0 | 1 | | 0 | |
| Pollution Tolerant Percent | 30.26% | 3 | | 1 | |
| Hilsenhoff Biotic Index | 6.947 | | 1 | | 0 |
| Intolerant Percent | 0.00% | | | | |
| Supertolerant Percent | 46.05% | | | | |
| CTQa | 104.727 | | | | |

### *Bioassessment Indices*

| BioIndex | Description | Score | Pct | Rating |
|---|---|---|---|---|
| BIBI | B-IBI (Karr et al.) | 14 | 28.00% | |
| MTP | Montana DEQ Plains (Bukantis 1998) | 14 | 46.67% | Moderate |
| MTV | Montana Revised Valleys/Foothills (Bollman 1998) | 5 | 27.78% | Moderate |
| MTM | Montana DEQ Mountains (Bukantis 1998) | 4 | 19.05% | Severe |




**Friday, January 28, 2011**

**Figure A-5**
**Fall 2010 Macroinvertebrate Metric Results for Big Springs Creek/Lake Creek Reach 5**

# Metrics Report

**Project ID:** SNWA10CW2
**RAI No.:** SNWA10CW2019
**Sta. Name:** CC Reach 6: Sample 629
**Client ID:** Big Spring Creek/Lake Creek
**STORET ID:**
**Coll. Date:**

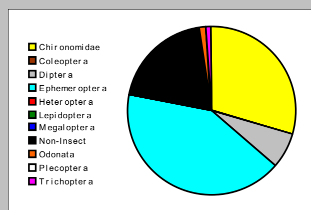
### Abundance Measures

**Sample Count:** 306
**Sample Abundance:** 336.88 90.83% of sample used

**Coll. Procedure:**
**Sample Notes:** Fall 2010

### Taxonomic Composition

| Category | R | A | PRA |
|---|---|---|---|
| Non-Insect | 4 | 61 | 19.93% |
| Odonata | 2 | 4 | 1.31% |
| Ephemeroptera | 3 | 127 | 41.50% |
| Plecoptera | | | |
| Heteroptera | | | |
| Megaloptera | | | |
| Trichoptera | 3 | 3 | 0.98% |
| Lepidoptera | | | |
| Coleoptera | | | |
| Diptera | 1 | 21 | 6.86% |
| Chironomidae | 7 | 90 | 29.41% |

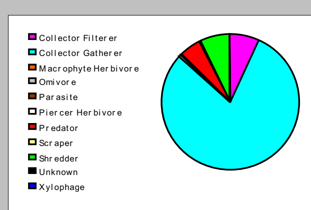



### Dominant Taxa

| Category | A | PRA |
|---|---|---|
| Baetis tricaudatus | 83 | 27.12% |
| Hyalella | 48 | 15.69% |
| Orthocladius | 28 | 9.15% |
| Tricorythodes | 26 | 8.50% |
| Simulium | 21 | 6.86% |
| Cricotopus (Cricotopus) | 18 | 5.88% |
| Thienemanniella | 16 | 5.23% |
| Cryptochironomus | 11 | 3.59% |
| Oligochaeta | 10 | 3.27% |
| Fallceon | 9 | 2.94% |
| Baetidae | 9 | 2.94% |
| Paratanytarsus | 4 | 1.31% |
| Parametriocnemus | 4 | 1.31% |
| Orthocladiinae | 4 | 1.31% |
| Parakiefferiella | 3 | 0.98% |

### Functional Composition

| Category | R | A | PRA |
|---|---|---|---|
| Predator | 3 | 15 | 4.90% |
| Parasite | | | |
| Collector Gatherer | 10 | 244 | 79.74% |
| Collector Filterer | 1 | 21 | 6.86% |
| Macrophyte Herbivore | | | |
| Piercer Herbivore | 1 | 1 | 0.33% |
| Xylophage | | | |
| Scraper | 2 | 2 | 0.65% |
| Shredder | 2 | 21 | 6.86% |
| Omivore | 1 | 2 | 0.65% |
| Unknown | | | |

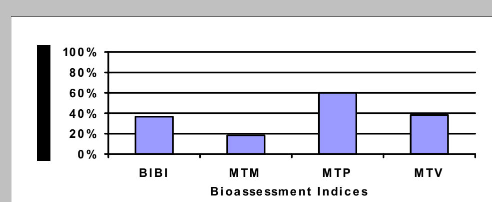



### Metric Values and Scores

| Metric | Value | BIBI | MTP | MTV | MTM |
|---|---|---|---|---|---|
| *Composition* | | | | | |
| Taxa Richness | 20 | 3 | 2 | | 1 |
| Non-Insect Percent | 19.93% | | | | |
| E Richness | 3 | 1 | | 1 | |
| P Richness | 0 | 1 | | 0 | |
| T Richness | 3 | 1 | | 2 | |
| EPT Richness | 6 | | 2 | | 0 |
| EPT Percent | 42.48% | | 2 | | 1 |
| Oligochaeta+Hirudinea Percent | 3.27% | | | | |
| Baetidae/Ephemeroptera | 0.795 | | | | |
| Hydropsychidae/Trichoptera | 0.000 | | | | |
| *Dominance* | | | | | |
| Dominant Taxon Percent | 27.12% | | 3 | | 2 |
| Dominant Taxa (2) Percent | 42.81% | | | | |
| Dominant Taxa (3) Percent | 51.96% | 3 | | | |
| Dominant Taxa (10) Percent | 88.24% | | | | |
| *Diversity* | | | | | |
| Shannon H (loge) | 2.297 | | | | |
| Shannon H (log2) | 3.314 | | 3 | | |
| Margalef D | 3.359 | | | | |
| Simpson D | 0.142 | | | | |
| Evenness | 0.081 | | | | |
| *Function* | | | | | |
| Predator Richness | 3 | | 1 | | |
| Predator Percent | 4.90% | 1 | | | |
| Filterer Richness | 1 | | | | |
| Filterer Percent | 6.86% | | | 2 | |
| Collector Percent | 86.60% | | 1 | | 0 |
| Scraper+Shredder Percent | 7.52% | | 1 | | 0 |
| Scraper/Filterer | 0.095 | | | | |
| Scraper/Scraper+Filterer | 0.087 | | | | |
| *Habit* | | | | | |
| Burrower Richness | 1 | | | | |
| Burrower Percent | 0.65% | | | | |
| Swimmer Richness | 2 | | | | |
| Swimmer Percent | 30.07% | | | | |
| Clinger Richness | 3 | 1 | | | |
| Clinger Percent | 13.73% | | | | |
| *Characteristics* | | | | | |
| Cold Stenotherm Richness | 0 | | | | |
| Cold Stenotherm Percent | 0.00% | | | | |
| Hemoglobin Bearer Richness | 1 | | | | |
| Hemoglobin Bearer Percent | 3.59% | | | | |
| Air Breather Richness | 0 | | | | |
| Air Breather Percent | 0.00% | | | | |
| *Voltinism* | | | | | |
| Univoltine Richness | 7 | | | | |
| Semivoltine Richness | 2 | 1 | | | |
| Multivoltine Percent | 62.75% | | 1 | | |
| *Tolerance* | | | | | |
| Sediment Tolerant Richness | 4 | | | | |
| Sediment Tolerant Percent | 12.75% | | | | |
| Sediment Sensitive Richness | 0 | | | | |
| Sediment Sensitive Percent | 0.00% | | | | |
| Metals Tolerance Index | 4.389 | | | | |
| Pollution Sensitive Richness | 1 | 1 | | 1 | |
| Pollution Tolerant Percent | 14.05% | 5 | | 1 | |
| Hilsenhoff Biotic Index | 5.754 | | 2 | | 0 |
| Intolerant Percent | 0.33% | | | | |
| Supertolerant Percent | 22.55% | | | | |
| CTQa | 105.429 | | | | |

### Bioassessment Indices

| BioIndex | Description | Score | Pct | Rating |
|---|---|---|---|---|
| BIBI | B-IBI (Karr et al.) | 18 | 36.00% | |
| MTP | Montana DEQ Plains (Bukantis 1998) | 18 | 60.00% | Slight |
| MTV | Montana Revised Valleys/Foothills (Bollman 1998) | 7 | 38.89% | Moderate |
| MTM | Montana DEQ Mountains (Bukantis 1998) | 4 | 19.05% | Severe |




Friday, January 28, 2011

**Figure A-6**
**Fall 2010 Macroinvertebrate Metric Results for Big Springs Creek/Lake Creek Reach 6**

# Metrics Report

**Project ID:** SNWA10CW
**RAI No.:** SNWA10CW011
**Sta. Name:** BS: Sample 555
**Client ID:** Big Springs
**STORET ID:**
**Coll. Date:**

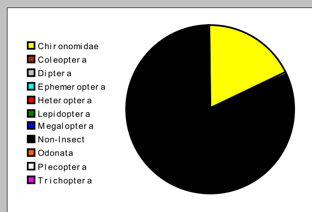
## Abundance Measures

| | | |
|---|---|---|
| **Sample Count:** | 317 | |
| **Sample Abundance:** | 3,804.00 | 8.33% of sample used |

**Coll. Procedure:**
**Sample Notes:** Spring 2010

## Taxonomic Composition

| Category | R | A | PRA |
|---|---|---|---|
| Non-Insect | 3 | 257 | 81.07% |
| Odonata | | | |
| Ephemeroptera | | | |
| Plecoptera | | | |
| Heteroptera | 1 | 1 | 0.32% |
| Megaloptera | | | |
| Trichoptera | 1 | 1 | 0.32% |
| Lepidoptera | | | |
| Coleoptera | 1 | 1 | 0.32% |
| Diptera | 1 | 1 | 0.32% |
| Chironomidae | 5 | 56 | 17.67% |

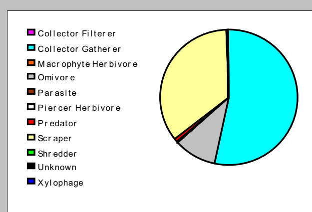



## Dominant Taxa

| Category | A | PRA |
|---|---|---|
| Hyalella | 145 | 45.74% |
| Hydrobiidae | 111 | 35.02% |
| Metriocnemus | 33 | 10.41% |
| Thienemanniella | 14 | 4.42% |
| Limnophyes | 5 | 1.58% |
| Eukiefferiella Claripennis Gr. | 2 | 0.63% |
| Orthocladiinae | 1 | 0.32% |
| Ochrotrichia | 1 | 0.32% |
| Hydrophilidae | 1 | 0.32% |
| Gyraulus | 1 | 0.32% |
| Ephydridae | 1 | 0.32% |
| Cricotopus (Cricotopus) | 1 | 0.32% |
| Ambrysus | 1 | 0.32% |

## Functional Composition

| Category | R | A | PRA |
|---|---|---|---|
| Predator | 2 | 2 | 0.63% |
| Parasite | | | |
| Collector Gatherer | 5 | 168 | 53.00% |
| Collector Filterer | | | |
| Macrophyte Herbivore | | | |
| Piercer Herbivore | 1 | 1 | 0.32% |
| Xylophage | | | |
| Scraper | 2 | 112 | 35.33% |
| Shredder | 1 | 1 | 0.32% |
| Omivore | 1 | 33 | 10.41% |
| Unknown | | | |

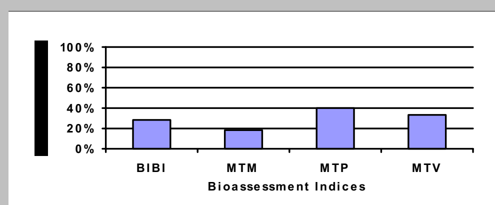



## Metric Values and Scores

| Metric | Value | BIBI | MTP | MTV | MTM |
|---|---|---|---|---|---|
| *Composition* | | | | | |
| Taxa Richness | 12 | 1 | 1 | | 0 |
| Non-Insect Percent | 81.07% | | | | |
| E Richness | 0 | 1 | | 0 | |
| P Richness | 0 | 1 | | 0 | |
| T Richness | 1 | 1 | | 0 | |
| EPT Richness | 1 | | 0 | | 0 |
| EPT Percent | 0.32% | | 0 | | 0 |
| Oligochaeta+Hirudinea Percent | | | | | |
| Baetidae/Ephemeroptera | 0.000 | | | | |
| Hydropsychidae/Trichoptera | 0.000 | | | | |
| *Dominance* | | | | | |
| Dominant Taxon Percent | 45.74% | | 1 | | 0 |
| Dominant Taxa (2) Percent | 80.76% | | | | |
| Dominant Taxa (3) Percent | 91.17% | 1 | | | |
| Dominant Taxa (10) Percent | 99.05% | | | | |
| *Diversity* | | | | | |
| Shannon H (loge) | 1.306 | | | | |
| Shannon H (log2) | 1.884 | | 1 | | |
| Margalef D | 1.911 | | | | |
| Simpson D | 0.345 | | | | |
| Evenness | 0.131 | | | | |
| *Function* | | | | | |
| Predator Richness | 2 | | 0 | | |
| Predator Percent | 0.63% | 1 | | | |
| Filterer Richness | 0 | | | | |
| Filterer Percent | 0.00% | | | 3 | |
| Collector Percent | 53.00% | | 3 | | 3 |
| Scraper+Shredder Percent | 35.65% | | 3 | | 1 |
| Scraper/Filterer | 0.000 | | | | |
| Scraper/Scraper+Filterer | 0.000 | | | | |
| *Habit* | | | | | |
| Burrower Richness | 1 | | | | |
| Burrower Percent | 10.41% | | | | |
| Swimmer Richness | 0 | | | | |
| Swimmer Percent | 0.00% | | | | |
| Clinger Richness | 3 | 1 | | | |
| Clinger Percent | 0.95% | | | | |
| *Characteristics* | | | | | |
| Cold Stenotherm Richness | 0 | | | | |
| Cold Stenotherm Percent | 0.00% | | | | |
| Hemoglobin Bearer Richness | 1 | | | | |
| Hemoglobin Bearer Percent | 0.32% | | | | |
| Air Breather Richness | 1 | | | | |
| Air Breather Percent | 0.32% | | | | |
| *Voltinism* | | | | | |
| Univoltine Richness | 5 | | | | |
| Semivoltine Richness | 1 | 1 | | | |
| Multivoltine Percent | 17.98% | | 3 | | |
| *Tolerance* | | | | | |
| Sediment Tolerant Richness | 1 | | | | |
| Sediment Tolerant Percent | 0.32% | | | | |
| Sediment Sensitive Richness | 0 | | | | |
| Sediment Sensitive Percent | 0.00% | | | | |
| Metals Tolerance Index | 3.110 | | | | |
| Pollution Sensitive Richness | 0 | 1 | | 0 | |
| Pollution Tolerant Percent | 2.21% | 5 | | 3 | |
| Hilsenhoff Biotic Index | 7.650 | | 0 | | 0 |
| Intolerant Percent | 0.00% | | | | |
| Supertolerant Percent | 83.28% | | | | |
| CTQa | 100.000 | | | | |

## Bioassessment Indices

| BioIndex | Description | Score | Pct | Rating |
|---|---|---|---|---|
| BIBI | B-IBI (Karr et al.) | 14 | 28.00% | |
| MTP | Montana DEQ Plains (Bukantis 1998) | 12 | 40.00% | Moderate |
| MTV | Montana Revised Valleys/Foothills (Bollman 1998) | 6 | 33.33% | Moderate |
| MTM | Montana DEQ Mountains (Bukantis 1998) | 4 | 19.05% | Severe |




**Thursday, August 05, 2010**

**Figure A-7**
**Spring 2010 Macroinvertebrate Metric Results for Big Springs**

# Metrics Report

**Project ID:** SNWA10CW2
**RAI No.:** SNWA10CW2011
**Sta. Name:** BS: Sample 556
**Client ID:** Big Springs
**STORET ID:**
**Coll. Date:**

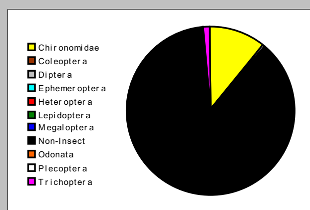
### Abundance Measures

**Sample Count:** 309
**Sample Abundance:** 2,060.00 15.00% of sample used

**Coll. Procedure:**
**Sample Notes:** Fall 2010

### Taxonomic Composition

| Category | R | A | PRA |
|---|---|---|---|
| Non-Insect | 4 | 270 | 87.38% |
| Odonata | | | |
| Ephemeroptera | | | |
| Plecoptera | | | |
| Heteroptera | | | |
| Megaloptera | | | |
| Trichoptera | 1 | 4 | 1.29% |
| Lepidoptera | | | |
| Coleoptera | | | |
| Diptera | 1 | 1 | 0.32% |
| Chironomidae | 7 | 34 | 11.00% |

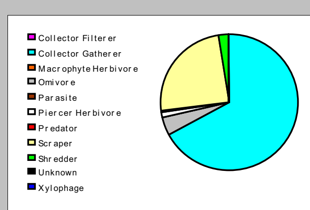



### Dominant Taxa

| Category | A | PRA |
|---|---|---|
| Hyalella | 194 | 62.78% |
| Hydrobiidae | 74 | 23.95% |
| Metriocnemus | 14 | 4.53% |
| Cricotopus (Cricotopus) | 8 | 2.59% |
| Limnophyes | 5 | 1.62% |
| Oxyethira | 4 | 1.29% |
| Orthocladius | 3 | 0.97% |
| Thienemanniella | 2 | 0.65% |
| Sperchon | 1 | 0.32% |
| Paraphaenocladius | 1 | 0.32% |
| Forcipomyia | 1 | 0.32% |
| Eukiefferiella Claripennis Gr. | 1 | 0.32% |
| Copepoda | 1 | 0.32% |

### Functional Composition

| Category | R | A | PRA |
|---|---|---|---|
| Predator | 1 | 1 | 0.32% |
| Parasite | | | |
| Collector Gatherer | 7 | 207 | 66.99% |
| Collector Filterer | | | |
| Macrophyte Herbivore | | | |
| Piercer Herbivore | 1 | 4 | 1.29% |
| Xylophage | | | |
| Scraper | 2 | 75 | 24.27% |
| Shredder | 1 | 8 | 2.59% |
| Omivore | 1 | 14 | 4.53% |
| Unknown | | | |

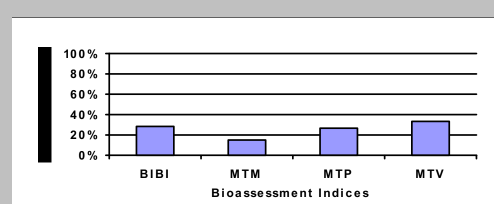



### Metric Values and Scores

| Metric | Value | BIBI | MTP | MTV | MTM |
|---|---|---|---|---|---|
| *Composition* | | | | | |
| Taxa Richness | 13 | 1 | 1 | | 0 |
| Non-Insect Percent | 87.38% | | | | |
| E Richness | 0 | 1 | | 0 | |
| P Richness | 0 | 1 | | 0 | |
| T Richness | 1 | 1 | | 0 | |
| EPT Richness | 1 | | 0 | | 0 |
| EPT Percent | 1.29% | | 0 | | 0 |
| Oligochaeta+Hirudinea Percent | | | | | |
| Baetidae/Ephemeroptera | 0.000 | | | | |
| Hydropsychidae/Trichoptera | 0.000 | | | | |
| *Dominance* | | | | | |
| Dominant Taxon Percent | 62.78% | | 0 | | 0 |
| Dominant Taxa (2) Percent | 86.73% | | | | |
| Dominant Taxa (3) Percent | 91.26% | 1 | | | |
| Dominant Taxa (10) Percent | 99.03% | | | | |
| *Diversity* | | | | | |
| Shannon H (loge) | 1.149 | | | | |
| Shannon H (log2) | 1.658 | | 0 | | |
| Margalef D | 2.094 | | | | |
| Simpson D | 0.456 | | | | |
| Evenness | 0.108 | | | | |
| *Function* | | | | | |
| Predator Richness | 1 | | 0 | | |
| Predator Percent | 0.32% | 1 | | | |
| Filterer Richness | 0 | | | | |
| Filterer Percent | 0.00% | | | 3 | |
| Collector Percent | 66.99% | | 2 | | 2 |
| Scraper+Shredder Percent | 26.86% | | 2 | | 1 |
| Scraper/Filterer | 0.000 | | | | |
| Scraper/Scraper+Filterer | 0.000 | | | | |
| *Habit* | | | | | |
| Burrower Richness | 1 | | | | |
| Burrower Percent | 4.53% | | | | |
| Swimmer Richness | 0 | | | | |
| Swimmer Percent | 0.00% | | | | |
| Clinger Richness | 1 | 1 | | | |
| Clinger Percent | 2.59% | | | | |
| *Characteristics* | | | | | |
| Cold Stenotherm Richness | 0 | | | | |
| Cold Stenotherm Percent | 0.00% | | | | |
| Hemoglobin Bearer Richness | 1 | | | | |
| Hemoglobin Bearer Percent | 0.32% | | | | |
| Air Breather Richness | 0 | | | | |
| Air Breather Percent | 0.00% | | | | |
| *Voltinism* | | | | | |
| Univoltine Richness | 3 | | | | |
| Semivoltine Richness | 0 | 1 | | | |
| Multivoltine Percent | 12.95% | | 3 | | |
| *Tolerance* | | | | | |
| Sediment Tolerant Richness | 0 | | | | |
| Sediment Tolerant Percent | 0.00% | | | | |
| Sediment Sensitive Richness | 0 | | | | |
| Sediment Sensitive Percent | 0.00% | | | | |
| Metals Tolerance Index | 3.025 | | | | |
| Pollution Sensitive Richness | 0 | 1 | | 0 | |
| Pollution Tolerant Percent | 2.91% | 5 | | 3 | |
| Hilsenhoff Biotic Index | 7.766 | | 0 | | 0 |
| Intolerant Percent | 0.00% | | | | |
| Supertolerant Percent | 89.00% | | | | |
| CTQa | 108.000 | | | | |

### Bioassessment Indices

| BioIndex | Description | Score | Pct | Rating |
|---|---|---|---|---|
| BIBI | B-IBI (Karr et al.) | 14 | 28.00% | |
| MTP | Montana DEQ Plains (Bukantis 1998) | 8 | 26.67% | Moderate |
| MTV | Montana Revised Valleys/Foothills (Bollman 1998) | 6 | 33.33% | Moderate |
| MTM | Montana DEQ Mountains (Bukantis 1998) | 3 | 14.29% | Severe |




Friday, January 28, 2011

**Figure A-8**
**Fall 2010 Macroinvertebrate Metric Results for Big Springs**

# Metrics Report

**Project ID:** SNWA10CW
**RAI No.:** SNWA10CW001
**Sta. Name:** KR: Sample 59-60
**Client ID:** Keegan Spring
**STORET ID:**
**Coll. Date:**

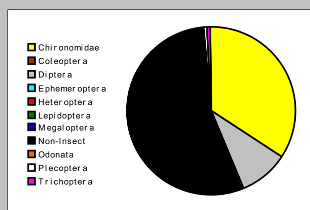
### Abundance Measures

**Sample Count:** 317
**Sample Abundance:** 317.00 100.00% of sample used

**Coll. Procedure:**
**Sample Notes:** Spring 2010

### Taxonomic Composition

| Category | R | A | PRA |
|---|---|---|---|
| Non-Insect | 12 | 172 | 54.26% |
| Odonata | 1 | 1 | 0.32% |
| Ephemeroptera | | | |
| Plecoptera | 1 | 2 | 0.63% |
| Heteroptera | 1 | 2 | 0.63% |
| Megaloptera | | | |
| Trichoptera | 1 | 2 | 0.63% |
| Lepidoptera | | | |
| Coleoptera | | | |
| Diptera | 4 | 30 | 9.46% |
| Chironomidae | 18 | 108 | 34.07% |

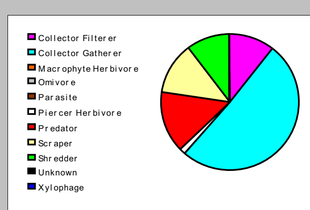



### Dominant Taxa

| Category | A | PRA |
|---|---|---|
| Hyalella | 59 | 18.61% |
| Paratendipes | 43 | 13.56% |
| Sphaeriidae | 33 | 10.41% |
| Gammarus | 25 | 7.89% |
| Ceratopogoninae | 19 | 5.99% |
| Hydrobiidae | 18 | 5.68% |
| Gyraulus | 11 | 3.47% |
| Thienemanniella | 10 | 3.15% |
| Chaetocladius | 9 | 2.84% |
| Cladopelma | 7 | 2.21% |
| Stagnicola | 6 | 1.89% |
| Procladius | 6 | 1.89% |
| Oligochaeta | 6 | 1.89% |
| Ablabesmyia | 6 | 1.89% |
| Corynoneura | 5 | 1.58% |

### Functional Composition

| Category | R | A | PRA |
|---|---|---|---|
| Predator | 12 | 46 | 14.51% |
| Parasite | | | |
| Collector Gatherer | 15 | 161 | 50.79% |
| Collector Filterer | 2 | 34 | 10.73% |
| Macrophyte Herbivore | | | |
| Piercer Herbivore | 2 | 4 | 1.26% |
| Xylophage | | | |
| Scraper | 4 | 39 | 12.30% |
| Shredder | 3 | 33 | 10.41% |
| Omivore | | | |
| Unknown | | | |

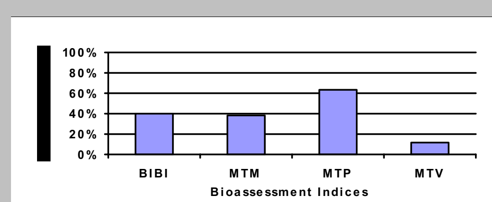



### Metric Values and Scores

| Metric | Value | BIBI | MTP | MTV | MTM |
|---|---|---|---|---|---|
| *Composition* | | | | | |
| Taxa Richness | 38 | 3 | 3 | | 3 |
| Non-Insect Percent | 54.26% | | | | |
| E Richness | 0 | 1 | | 0 | |
| P Richness | 1 | 1 | | 1 | |
| T Richness | 1 | 1 | | 0 | |
| EPT Richness | 2 | | 0 | | 0 |
| EPT Percent | 1.26% | | 0 | | 0 |
| Oligochaeta+Hirudinea Percent | 3.47% | | | | |
| Baetidae/Ephemeroptera | 0.000 | | | | |
| Hydropsychidae/Trichoptera | 0.000 | | | | |
| *Dominance* | | | | | |
| Dominant Taxon Percent | 18.61% | | 3 | | 3 |
| Dominant Taxa (2) Percent | 32.18% | | | | |
| Dominant Taxa (3) Percent | 42.59% | 5 | | | |
| Dominant Taxa (10) Percent | 73.82% | | | | |
| *Diversity* | | | | | |
| Shannon H (loge) | 2.899 | | | | |
| Shannon H (log2) | 4.182 | | 3 | | |
| Margalef D | 6.446 | | | | |
| Simpson D | 0.084 | | | | |
| Evenness | 0.051 | | | | |
| *Function* | | | | | |
| Predator Richness | 12 | | 3 | | |
| Predator Percent | 14.51% | 3 | | | |
| Filterer Richness | 2 | | | | |
| Filterer Percent | 10.73% | | | 1 | |
| Collector Percent | 61.51% | | 2 | | 2 |
| Scraper+Shredder Percent | 22.71% | | 2 | | 0 |
| Scraper/Filterer | 1.147 | | | | |
| Scraper/Scraper+Filterer | 0.534 | | | | |
| *Habit* | | | | | |
| Burrower Richness | 4 | | | | |
| Burrower Percent | 23.03% | | | | |
| Swimmer Richness | 2 | | | | |
| Swimmer Percent | 0.95% | | | | |
| Clinger Richness | 4 | 1 | | | |
| Clinger Percent | 3.47% | | | | |
| *Characteristics* | | | | | |
| Cold Stenotherm Richness | 0 | | | | |
| Cold Stenotherm Percent | 0.00% | | | | |
| Hemoglobin Bearer Richness | 8 | | | | |
| Hemoglobin Bearer Percent | 25.87% | | | | |
| Air Breather Richness | 0 | | | | |
| Air Breather Percent | 0.00% | | | | |
| *Voltinism* | | | | | |
| Univoltine Richness | 16 | | | | |
| Semivoltine Richness | 0 | 1 | | | |
| Multivoltine Percent | 35.96% | | 3 | | |
| *Tolerance* | | | | | |
| Sediment Tolerant Richness | 3 | | | | |
| Sediment Tolerant Percent | 7.26% | | | | |
| Sediment Sensitive Richness | 0 | | | | |
| Sediment Sensitive Percent | 0.00% | | | | |
| Metals Tolerance Index | 3.092 | | | | |
| Pollution Sensitive Richness | 0 | 1 | | 0 | |
| Pollution Tolerant Percent | 36.59% | 3 | | 0 | |
| Hilsenhoff Biotic Index | 7.567 | | 0 | | 0 |
| Intolerant Percent | 0.63% | | | | |
| Supertolerant Percent | 66.25% | | | | |
| CTQa | 106.000 | | | | |

### Bioassessment Indices

| BioIndex | Description | Score | Pct | Rating |
|---|---|---|---|---|
| BIBI | B-IBI (Karr et al.) | 20 | 40.00% | |
| MTP | Montana DEQ Plains (Bukantis 1998) | 19 | 63.33% | Slight |
| MTV | Montana Revised Valleys/Foothills (Bollman 1998) | 2 | 11.11% | Severe |
| MTM | Montana DEQ Mountains (Bukantis 1998) | 8 | 38.10% | Moderate |




**Thursday, August 05, 2010**

**Figure A-9**
**Spring 2010 Macroinvertebrate Metric Results for Keegan**

# Metrics Report

**Project ID:** SNWA10CW2
**RAI No.:** SNWA10CW2002
**Sta. Name:** KR: Sample 61-65
**Client ID:** Keegan Ranch Spring
**STORET ID:**
**Coll. Date:**

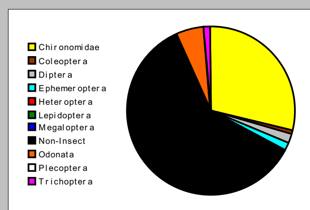
### Abundance Measures

**Sample Count:** 302
**Sample Abundance:** 2,265.00 13.33% of sample used

**Coll. Procedure:**
**Sample Notes:** Fall 2010

### Taxonomic Composition

| Category | R | A | PRA |
|---|---|---|---|
| Non-Insect | 9 | 182 | 60.26% |
| Odonata | 2 | 16 | 5.30% |
| Ephemeroptera | 1 | 4 | 1.32% |
| Plecoptera | | | |
| Heteroptera | 1 | 1 | 0.33% |
| Megaloptera | | | |
| Trichoptera | 1 | 4 | 1.32% |
| Lepidoptera | | | |
| Coleoptera | 2 | 3 | 0.99% |
| Diptera | 4 | 5 | 1.66% |
| Chironomidae | 14 | 87 | 28.81% |

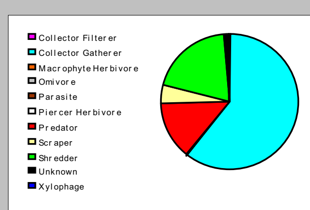



### Dominant Taxa

| Category | A | PRA |
|---|---|---|
| Hyalella | 126 | 41.72% |
| Cricotopus (Cricotopus) | 47 | 15.56% |
| Amphipoda | 35 | 11.59% |
| Coenagrionidae | 15 | 4.97% |
| Radotanypus | 14 | 4.64% |
| Physa | 6 | 1.99% |
| Gammarus | 6 | 1.99% |
| Thienemanniella | 4 | 1.32% |
| Derotanypus | 4 | 1.32% |
| Callibaetis | 4 | 1.32% |
| Agrypnia | 4 | 1.32% |
| Acricotopus | 3 | 0.99% |
| Zavrelimyia | 2 | 0.66% |
| Lymnaeidae | 2 | 0.66% |
| Larsia | 2 | 0.66% |

### Functional Composition

| Category | R | A | PRA |
|---|---|---|---|
| Predator | 11 | 42 | 13.91% |
| Parasite | | | |
| Collector Gatherer | 12 | 181 | 59.93% |
| Collector Filterer | 1 | 2 | 0.66% |
| Macrophyte Herbivore | | | |
| Piercer Herbivore | 1 | 1 | 0.33% |
| Xylophage | | | |
| Scraper | 4 | 12 | 3.97% |
| Shredder | 4 | 60 | 19.87% |
| Omivore | | | |
| Unknown | 1 | 4 | 1.32% |

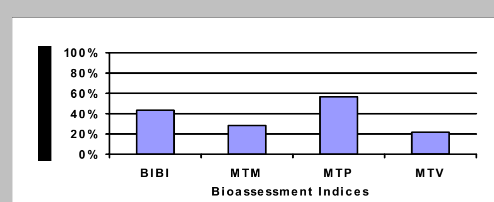



### Metric Values and Scores

| Metric | Value | BIBI | MTP | MTV | MTM |
|---|---|---|---|---|---|
| *Composition* | | | | | |
| Taxa Richness | 34 | 3 | 3 | | 3 |
| Non-Insect Percent | 60.26% | | | | |
| E Richness | 1 | 1 | | 0 | |
| P Richness | 0 | 1 | | 0 | |
| T Richness | 1 | 1 | | 0 | |
| EPT Richness | 2 | | 0 | | 0 |
| EPT Percent | 2.65% | | 0 | | 0 |
| Oligochaeta+Hirudinea Percent | 0.33% | | | | |
| Baetidae/Ephemeroptera | 1.000 | | | | |
| Hydropsychidae/Trichoptera | 0.000 | | | | |
| *Dominance* | | | | | |
| Dominant Taxon Percent | 41.72% | | 2 | | 1 |
| Dominant Taxa (2) Percent | 57.28% | | | | |
| Dominant Taxa (3) Percent | 68.87% | 3 | | | |
| Dominant Taxa (10) Percent | 86.42% | | | | |
| *Diversity* | | | | | |
| Shannon H (loge) | 2.057 | | | | |
| Shannon H (log2) | 2.967 | | 2 | | |
| Margalef D | 5.922 | | | | |
| Simpson D | 0.267 | | | | |
| Evenness | 0.072 | | | | |
| *Function* | | | | | |
| Predator Richness | 11 | | 3 | | |
| Predator Percent | 13.91% | 3 | | | |
| Filterer Richness | 1 | | | | |
| Filterer Percent | 0.66% | | | 3 | |
| Collector Percent | 60.60% | | 2 | | 2 |
| Scraper+Shredder Percent | 23.84% | | 2 | | 0 |
| Scraper/Filterer | 6.000 | | | | |
| Scraper/Scraper+Filterer | 0.857 | | | | |
| *Habit* | | | | | |
| Burrower Richness | 3 | | | | |
| Burrower Percent | 0.99% | | | | |
| Swimmer Richness | 5 | | | | |
| Swimmer Percent | 3.31% | | | | |
| Clinger Richness | 3 | 1 | | | |
| Clinger Percent | 16.89% | | | | |
| *Characteristics* | | | | | |
| Cold Stenotherm Richness | 0 | | | | |
| Cold Stenotherm Percent | 0.00% | | | | |
| Hemoglobin Bearer Richness | 6 | | | | |
| Hemoglobin Bearer Percent | 6.62% | | | | |
| Air Breather Richness | 2 | | | | |
| Air Breather Percent | 0.99% | | | | |
| *Voltinism* | | | | | |
| Univoltine Richness | 13 | | | | |
| Semivoltine Richness | 3 | 3 | | | |
| Multivoltine Percent | 29.14% | | 3 | | |
| *Tolerance* | | | | | |
| Sediment Tolerant Richness | 2 | | | | |
| Sediment Tolerant Percent | 1.66% | | | | |
| Sediment Sensitive Richness | 0 | | | | |
| Sediment Sensitive Percent | 0.00% | | | | |
| Metals Tolerance Index | 2.977 | | | | |
| Pollution Sensitive Richness | 0 | 1 | | 0 | |
| Pollution Tolerant Percent | 14.57% | 5 | | 1 | |
| Hilsenhoff Biotic Index | 7.010 | | 0 | | 0 |
| Intolerant Percent | 0.00% | | | | |
| Supertolerant Percent | 50.00% | | | | |
| CTQa | 104.211 | | | | |

### Bioassessment Indices

| BioIndex | Description | Score | Pct | Rating |
|---|---|---|---|---|
| BIBI | B-IBI (Karr et al.) | 22 | 44.00% | |
| MTP | Montana DEQ Plains (Bukantis 1998) | 17 | 56.67% | Slight |
| MTV | Montana Revised Valleys/Foothills (Bollman 1998) | 4 | 22.22% | Moderate |
| MTM | Montana DEQ Mountains (Bukantis 1998) | 6 | 28.57% | Moderate |




Friday, January 28, 2011

**Figure A-10**
**Fall 2010 Macroinvertebrate Metric Results for Keegan**

# Metrics Report

**Project ID:** SNWA10CW
**RAI No.:** SNWA10CW002
**Sta. Name:** MSS: Sample 657-658
**Client ID:** Middle Minerva Spring
**STORET ID:**
**Coll. Date:**

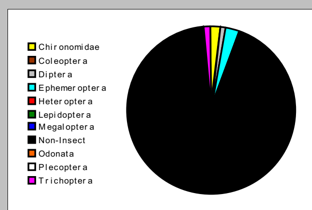
### *Abundance Measures*

**Sample Count:** 329
**Sample Abundance:** 2,467.50 13.33% of sample used

**Coll. Procedure:**
**Sample Notes:** Spring 2010

### *Taxonomic Composition*

| Category | R | A | PRA |
|---|---|---|---|
| Non-Insect | 7 | 306 | 93.01% |
| Odonata | | | |
| Ephemeroptera | 1 | 8 | 2.43% |
| Plecoptera | | | |
| Heteroptera | | | |
| Megaloptera | | | |
| Trichoptera | 1 | 5 | 1.52% |
| Lepidoptera | | | |
| Coleoptera | | | |
| Diptera | 1 | 4 | 1.22% |
| Chironomidae | 5 | 6 | 1.82% |

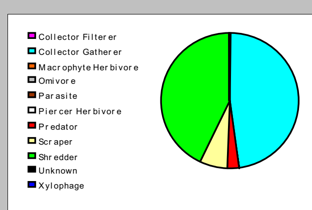



### *Dominant Taxa*

| Category | A | PRA |
|---|---|---|
| Gammarus | 136 | 41.34% |
| Ostracoda | 83 | 25.23% |
| Hyalella | 63 | 19.15% |
| Hydrobiidae | 19 | 5.78% |
| Hesperophylax | 4 | 1.22% |
| Ephemerellidae | 3 | 0.91% |
| Ephemerella infrequens | 3 | 0.91% |
| Paratendipes | 2 | 0.61% |
| Glossiphoniidae | 2 | 0.61% |
| Ephemerella | 2 | 0.61% |
| Ceratopogoninae | 2 | 0.61% |
| Ceratopogonidae | 2 | 0.61% |
| Limnephilidae | 1 | 0.30% |
| Acricotopus | 1 | 0.30% |
| Acari | 1 | 0.30% |

### *Functional Composition*

| Category | R | A | PRA |
|---|---|---|---|
| Predator | 5 | 10 | 3.04% |
| Parasite | | | |
| Collector Gatherer | 5 | 155 | 47.11% |
| Collector Filterer | 1 | 1 | 0.30% |
| Macrophyte Herbivore | | | |
| Piercer Herbivore | | | |
| Xylophage | | | |
| Scraper | 1 | 21 | 6.38% |
| Shredder | 3 | 142 | 43.16% |
| Omivore | | | |
| Unknown | | | |

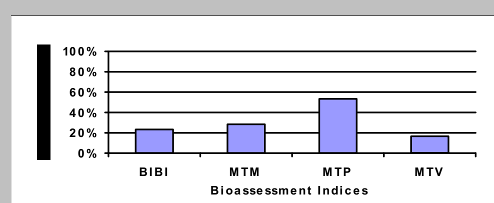



### *Metric Values and Scores*

| Metric | Value | BIBI | MTP | MTV | MTM |
|---|---|---|---|---|---|
| *Composition* | | | | | |
| Taxa Richness | 15 | 1 | 1 | | 0 |
| Non-Insect Percent | 93.01% | | | | |
| E Richness | 1 | 1 | | 0 | |
| P Richness | 0 | 1 | | 0 | |
| T Richness | 1 | 1 | | 0 | |
| EPT Richness | 2 | | 0 | | 0 |
| EPT Percent | 3.95% | | 0 | | 0 |
| Oligochaeta+Hirudinea Percent | 0.61% | | | | |
| Baetidae/Ephemeroptera | 0.000 | | | | |
| Hydropsychidae/Trichoptera | 0.000 | | | | |
| *Dominance* | | | | | |
| Dominant Taxon Percent | 41.34% | | 2 | | 1 |
| Dominant Taxa (2) Percent | 66.57% | | | | |
| Dominant Taxa (3) Percent | 85.71% | 1 | | | |
| Dominant Taxa (10) Percent | 96.35% | | | | |
| *Diversity* | | | | | |
| Shannon H (loge) | 1.503 | | | | |
| Shannon H (log2) | 2.169 | | 1 | | |
| Margalef D | 2.427 | | | | |
| Simpson D | 0.288 | | | | |
| Evenness | 0.118 | | | | |
| *Function* | | | | | |
| Predator Richness | 5 | | 2 | | |
| Predator Percent | 3.04% | 1 | | | |
| Filterer Richness | 1 | | | | |
| Filterer Percent | 0.30% | | | 3 | |
| Collector Percent | 47.42% | | 3 | | 3 |
| Scraper+Shredder Percent | 49.54% | | 3 | | 2 |
| Scraper/Filterer | 21.000 | | | | |
| Scraper/Scraper+Filterer | 0.955 | | | | |
| *Habit* | | | | | |
| Burrower Richness | 2 | | | | |
| Burrower Percent | 1.22% | | | | |
| Swimmer Richness | 0 | | | | |
| Swimmer Percent | 0.00% | | | | |
| Clinger Richness | 2 | 1 | | | |
| Clinger Percent | 2.74% | | | | |
| *Characteristics* | | | | | |
| Cold Stenotherm Richness | 0 | | | | |
| Cold Stenotherm Percent | 0.00% | | | | |
| Hemoglobin Bearer Richness | 2 | | | | |
| Hemoglobin Bearer Percent | 0.91% | | | | |
| Air Breather Richness | 0 | | | | |
| Air Breather Percent | 0.00% | | | | |
| *Voltinism* | | | | | |
| Univoltine Richness | 8 | | | | |
| Semivoltine Richness | 0 | 1 | | | |
| Multivoltine Percent | 27.66% | | 3 | | |
| *Tolerance* | | | | | |
| Sediment Tolerant Richness | 0 | | | | |
| Sediment Tolerant Percent | 0.00% | | | | |
| Sediment Sensitive Richness | 0 | | | | |
| Sediment Sensitive Percent | 0.00% | | | | |
| Metals Tolerance Index | 1.734 | | | | |
| Pollution Sensitive Richness | 0 | 1 | | 0 | |
| Pollution Tolerant Percent | 43.47% | 3 | | 0 | |
| Hilsenhoff Biotic Index | 6.088 | | 1 | | 0 |
| Intolerant Percent | 2.43% | | | | |
| Supertolerant Percent | 52.58% | | | | |
| CTQa | 108.000 | | | | |

### *Bioassessment Indices*

| BioIndex | Description | Score | Pct | Rating |
|---|---|---|---|---|
| BIBI | B-IBI (Karr et al.) | 12 | 24.00% | |
| MTP | Montana DEQ Plains (Bukantis 1998) | 16 | 53.33% | Moderate |
| MTV | Montana Revised Valleys/Foothills (Bollman 1998) | 3 | 16.67% | Severe |
| MTM | Montana DEQ Mountains (Bukantis 1998) | 6 | 28.57% | Moderate |




**Thursday, August 05, 2010**

**Figure A-11**
**Spring 2010 Macroinvertebrate Metric Results for Minerva Middle**

# Metrics Report

**Project ID:** SNWA10CW2
**RAI No.:** SNWA10CW2012
**Sta. Name:** MSS: Sample 659-661
**Client ID:** Minerva Spring Complex Middle
**STORET ID:**
**Coll. Date:**

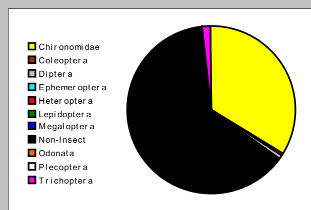
## *Abundance Measures*

**Sample Count:** 306
**Sample Abundance:** 2,824.62 10.83% of sample used

**Coll. Procedure:**
**Sample Notes:** Fall 2010

## *Taxonomic Composition*

| Category | R | A | PRA |
|---|---|---|---|
| Non-Insect | 4 | 193 | 63.07% |
| Odonata | | | |
| Ephemeroptera | 1 | 1 | 0.33% |
| Plecoptera | | | |
| Heteroptera | | | |
| Megaloptera | | | |
| Trichoptera | 1 | 5 | 1.63% |
| Lepidoptera | | | |
| Coleoptera | 1 | 1 | 0.33% |
| Diptera | 1 | 2 | 0.65% |
| Chironomidae | 7 | 104 | 33.99% |

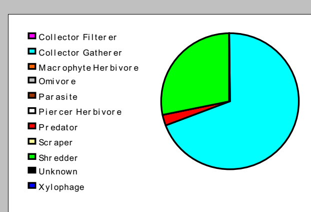



## *Dominant Taxa*

| Category | A | PRA |
|---|---|---|
| Ostracoda | 127 | 41.50% |
| Gammarus | 54 | 17.65% |
| Thienemanniella | 48 | 15.69% |
| Cricotopus (Isocladius) | 27 | 8.82% |
| Orthocladius | 17 | 5.56% |
| Amphipoda | 10 | 3.27% |
| Micropsectra | 4 | 1.31% |
| Hydatophylax | 4 | 1.31% |
| Apsectrotanypus | 4 | 1.31% |
| Corynoneura | 3 | 0.98% |
| Serromyia | 2 | 0.65% |
| Oligochaeta | 1 | 0.33% |
| Liodessus | 1 | 0.33% |
| Limnophyes | 1 | 0.33% |
| Limnephilidae | 1 | 0.33% |

## *Functional Composition*

| Category | R | A | PRA |
|---|---|---|---|
| Predator | 4 | 8 | 2.61% |
| Parasite | | | |
| Collector Gatherer | 8 | 212 | 69.28% |
| Collector Filterer | | | |
| Macrophyte Herbivore | | | |
| Piercer Herbivore | | | |
| Xylophage | | | |
| Scraper | | | |
| Shredder | 3 | 86 | 28.10% |
| Omivore | | | |
| Unknown | | | |

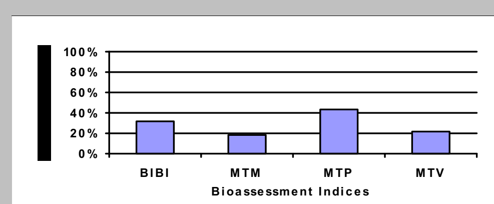



## *Metric Values and Scores*

| Metric | Value | BIBI | MTP | MTV | MTM |
|---|---|---|---|---|---|
| *Composition* | | | | | |
| Taxa Richness | 15 | 1 | 1 | | 0 |
| Non-Insect Percent | 63.07% | | | | |
| E Richness | 1 | 1 | | 0 | |
| P Richness | 0 | 1 | | 0 | |
| T Richness | 1 | 1 | | 0 | |
| EPT Richness | 2 | | 0 | | 0 |
| EPT Percent | 1.96% | | 0 | | 0 |
| Oligochaeta+Hirudinea Percent | 0.65% | | | | |
| Baetidae/Ephemeroptera | 1.000 | | | | |
| Hydropsychidae/Trichoptera | 0.000 | | | | |
| *Dominance* | | | | | |
| Dominant Taxon Percent | 41.50% | | 2 | | 1 |
| Dominant Taxa (2) Percent | 59.15% | | | | |
| Dominant Taxa (3) Percent | 74.84% | 3 | | | |
| Dominant Taxa (10) Percent | 97.39% | | | | |
| *Diversity* | | | | | |
| Shannon H (loge) | 1.704 | | | | |
| Shannon H (log2) | 2.459 | | 2 | | |
| Margalef D | 2.462 | | | | |
| Simpson D | 0.255 | | | | |
| Evenness | 0.109 | | | | |
| *Function* | | | | | |
| Predator Richness | 4 | | 2 | | |
| Predator Percent | 2.61% | 1 | | | |
| Filterer Richness | 0 | | | | |
| Filterer Percent | 0.00% | | | 3 | |
| Collector Percent | 69.28% | | 2 | | 2 |
| Scraper+Shredder Percent | 28.10% | | 2 | | 1 |
| Scraper/Filterer | 0.000 | | | | |
| Scraper/Scraper+Filterer | 0.000 | | | | |
| *Habit* | | | | | |
| Burrower Richness | 2 | | | | |
| Burrower Percent | 1.96% | | | | |
| Swimmer Richness | 2 | | | | |
| Swimmer Percent | 0.65% | | | | |
| Clinger Richness | 2 | 1 | | | |
| Clinger Percent | 10.13% | | | | |
| *Characteristics* | | | | | |
| Cold Stenotherm Richness | 0 | | | | |
| Cold Stenotherm Percent | 0.00% | | | | |
| Hemoglobin Bearer Richness | 1 | | | | |
| Hemoglobin Bearer Percent | 1.31% | | | | |
| Air Breather Richness | 1 | | | | |
| Air Breather Percent | 0.33% | | | | |
| *Voltinism* | | | | | |
| Univoltine Richness | 4 | | | | |
| Semivoltine Richness | 1 | 1 | | | |
| Multivoltine Percent | 75.82% | | 1 | | |
| *Tolerance* | | | | | |
| Sediment Tolerant Richness | 1 | | | | |
| Sediment Tolerant Percent | 0.33% | | | | |
| Sediment Sensitive Richness | 0 | | | | |
| Sediment Sensitive Percent | 0.00% | | | | |
| Metals Tolerance Index | 2.750 | | | | |
| Pollution Sensitive Richness | 0 | 1 | | 0 | |
| Pollution Tolerant Percent | 18.63% | 5 | | 1 | |
| Hilsenhoff Biotic Index | 6.477 | | 1 | | 0 |
| Intolerant Percent | 1.31% | | | | |
| Supertolerant Percent | 44.12% | | | | |
| CTQa | 104.400 | | | | |

## *Bioassessment Indices*

| BioIndex | Description | Score | Pct | Rating |
|---|---|---|---|---|
| BIBI | B-IBI (Karr et al.) | 16 | 32.00% | |
| MTP | Montana DEQ Plains (Bukantis 1998) | 13 | 43.33% | Moderate |
| MTV | Montana Revised Valleys/Foothills (Bollman 1998) | 4 | 22.22% | Moderate |
| MTM | Montana DEQ Mountains (Bukantis 1998) | 4 | 19.05% | Severe |




**Friday, January 28, 2011**

**Figure A-12**
**Fall 2010 Macroinvertebrate Metric Results for Minerva Middle**

# Metrics Report

**Project ID:** SNWA10CW
**RAI No.:** SNWA10CW003
**Sta. Name:** MS North: Sample 403-404
**Client ID:** North Minerva Spring
**STORET ID:**
**Coll. Date:**

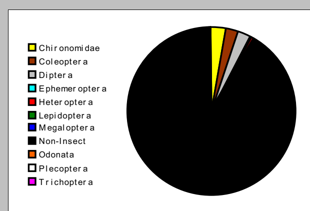
### Abundance Measures

**Sample Count:** 307
**Sample Abundance:** 2,302.50 13.33% of sample used

**Coll. Procedure:**
**Sample Notes:** Spring 2010

### Taxonomic Composition

| Category | R | A | PRA |
|---|---|---|---|
| Non-Insect | 9 | 280 | 91.21% |
| Odonata | 1 | 1 | 0.33% |
| Ephemeroptera | 1 | 1 | 0.33% |
| Plecoptera | | | |
| Heteroptera | 1 | 1 | 0.33% |
| Megaloptera | | | |
| Trichoptera | | | |
| Lepidoptera | | | |
| Coleoptera | 3 | 7 | 2.28% |
| Diptera | 4 | 8 | 2.61% |
| Chironomidae | 7 | 9 | 2.93% |

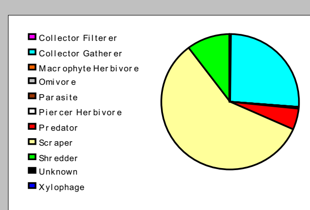



### Dominant Taxa

| Category | A | PRA |
|---|---|---|
| Hydrobiidae | 173 | 56.35% |
| Ostracoda | 41 | 13.36% |
| Hyalella | 28 | 9.12% |
| Gammarus | 27 | 8.79% |
| Lymnaeidae | 5 | 1.63% |
| Ceratopogoninae | 5 | 1.63% |
| Liodessus | 3 | 0.98% |
| Peltodytes | 2 | 0.65% |
| Oligochaeta | 2 | 0.65% |
| Cricotopus (Isocladius) | 2 | 0.65% |
| Chaetocladius | 2 | 0.65% |
| Ephemerellidae | 1 | 0.33% |
| Enallagma | 1 | 0.33% |
| Dytiscidae | 1 | 0.33% |
| Bezzia / Palpomyia | 1 | 0.33% |

### Functional Composition

| Category | R | A | PRA |
|---|---|---|---|
| Predator | 7 | 14 | 4.56% |
| Parasite | 1 | 1 | 0.33% |
| Collector Gatherer | 9 | 78 | 25.41% |
| Collector Filterer | 2 | 2 | 0.65% |
| Macrophyte Herbivore | | | |
| Piercer Herbivore | 1 | 1 | 0.33% |
| Xylophage | | | |
| Scraper | 3 | 180 | 58.63% |
| Shredder | 3 | 31 | 10.10% |
| Omivore | | | |
| Unknown | | | |

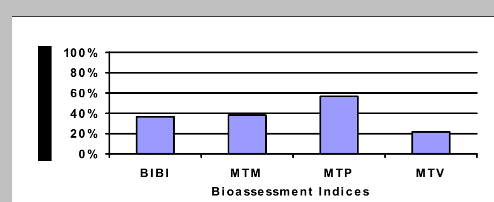



### Metric Values and Scores

| Metric | Value | BIBI | MTP | MTV | MTM |
|---|---|---|---|---|---|
| *Composition* | | | | | |
| Taxa Richness | 26 | 3 | 3 | | 2 |
| Non-Insect Percent | 91.21% | | | | |
| E Richness | 1 | 1 | | 0 | |
| P Richness | 0 | 1 | | 0 | |
| T Richness | 0 | 1 | | 0 | |
| EPT Richness | 1 | | 0 | | 0 |
| EPT Percent | 0.33% | | 0 | | 0 |
| Oligochaeta+Hirudinea Percent | 0.65% | | | | |
| Baetidae/Ephemeroptera | 0.000 | | | | |
| Hydropsychidae/Trichoptera | 0.000 | | | | |
| *Dominance* | | | | | |
| Dominant Taxon Percent | 56.35% | | 1 | | 0 |
| Dominant Taxa (2) Percent | 69.71% | | | | |
| Dominant Taxa (3) Percent | 78.83% | 1 | | | |
| Dominant Taxa (10) Percent | 93.81% | | | | |
| *Diversity* | | | | | |
| Shannon H (loge) | 1.578 | | | | |
| Shannon H (log2) | 2.276 | | 1 | | |
| Margalef D | 4.381 | | | | |
| Simpson D | 0.364 | | | | |
| Evenness | 0.081 | | | | |
| *Function* | | | | | |
| Predator Richness | 7 | | 3 | | |
| Predator Percent | 4.56% | 1 | | | |
| Filterer Richness | 2 | | | | |
| Filterer Percent | 0.65% | | | 3 | |
| Collector Percent | 26.06% | | 3 | | 3 |
| Scraper+Shredder Percent | 68.73% | | 3 | | 3 |
| Scraper/Filterer | 90.000 | | | | |
| Scraper/Scraper+Filterer | 0.989 | | | | |
| *Habit* | | | | | |
| Burrower Richness | 3 | | | | |
| Burrower Percent | 2.28% | | | | |
| Swimmer Richness | 3 | | | | |
| Swimmer Percent | 1.95% | | | | |
| Clinger Richness | 4 | 1 | | | |
| Clinger Percent | 1.63% | | | | |
| *Characteristics* | | | | | |
| Cold Stenotherm Richness | 0 | | | | |
| Cold Stenotherm Percent | 0.00% | | | | |
| Hemoglobin Bearer Richness | 3 | | | | |
| Hemoglobin Bearer Percent | 0.98% | | | | |
| Air Breather Richness | 2 | | | | |
| Air Breather Percent | 1.63% | | | | |
| *Voltinism* | | | | | |
| Univoltine Richness | 13 | | | | |
| Semivoltine Richness | 3 | 3 | | | |
| Multivoltine Percent | 16.94% | | 3 | | |
| *Tolerance* | | | | | |
| Sediment Tolerant Richness | 3 | | | | |
| Sediment Tolerant Percent | 2.93% | | | | |
| Sediment Sensitive Richness | 0 | | | | |
| Sediment Sensitive Percent | 0.00% | | | | |
| Metals Tolerance Index | 2.419 | | | | |
| Pollution Sensitive Richness | 0 | 1 | | 0 | |
| Pollution Tolerant Percent | 12.70% | 5 | | 1 | |
| Hilsenhoff Biotic Index | 7.418 | | 0 | | 0 |
| Intolerant Percent | 0.33% | | | | |
| Supertolerant Percent | 80.46% | | | | |
| CTQa | 108.000 | | | | |

### Bioassessment Indices

| BioIndex | Description | Score | Pct | Rating |
|---|---|---|---|---|
| BIBI | B-IBI (Karr et al.) | 18 | 36.00% | |
| MTP | Montana DEQ Plains (Bukantis 1998) | 17 | 56.67% | Slight |
| MTV | Montana Revised Valleys/Foothills (Bollman 1998) | 4 | 22.22% | Moderate |
| MTM | Montana DEQ Mountains (Bukantis 1998) | 8 | 38.10% | Moderate |




**Thursday, August 05, 2010**

**Figure A-13**
**Spring 2010 Macroinvertebrate Metric Results for Minerva North**

# Metrics Report

**Project ID:** SNWA10CW2
**RAI No.:** SNWA10CW2008
**Sta. Name:** MS-North: Sample 405-406
**Client ID:** Minerva Spring Complex North
**STORET ID:**
**Coll. Date:**

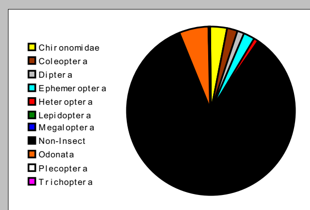
### Abundance Measures

**Sample Count:** 318
**Sample Abundance:** 2,385.00 13.33% of sample used

**Coll. Procedure:**
**Sample Notes:** Fall 2010

### Taxonomic Composition

| Category | R | A | PRA |
|---|---|---|---|
| Non-Insect | 12 | 268 | 84.28% |
| Odonata | 2 | 18 | 5.66% |
| Ephemeroptera | 2 | 7 | 2.20% |
| Plecoptera | | | |
| Heteroptera | 1 | 3 | 0.94% |
| Megaloptera | | | |
| Trichoptera | 1 | 1 | 0.31% |
| Lepidoptera | | | |
| Coleoptera | 3 | 6 | 1.89% |
| Diptera | 4 | 4 | 1.26% |
| Chironomidae | 7 | 11 | 3.46% |

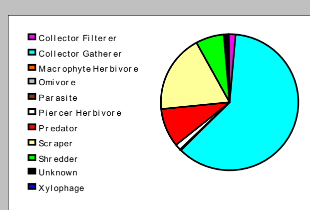



### Dominant Taxa

| Category | A | PRA |
|---|---|---|
| Ostracoda | 104 | 32.70% |
| Hyalella | 54 | 16.98% |
| Hydrobiidae | 52 | 16.35% |
| Gammarus | 22 | 6.92% |
| Coenagrionidae | 17 | 5.35% |
| Amphipoda | 14 | 4.40% |
| Copepoda | 6 | 1.89% |
| Callibaetis | 6 | 1.89% |
| Derotanypus | 4 | 1.26% |
| Cladocera | 4 | 1.26% |
| Thyas | 3 | 0.94% |
| Sperchonopsis | 3 | 0.94% |
| Optioservus | 3 | 0.94% |
| Hesperocorixa | 3 | 0.94% |
| Gyraulus | 3 | 0.94% |

### Functional Composition

| Category | R | A | PRA |
|---|---|---|---|
| Predator | 8 | 29 | 9.12% |
| Parasite | | | |
| Collector Gatherer | 13 | 194 | 61.01% |
| Collector Filterer | 2 | 5 | 1.57% |
| Macrophyte Herbivore | | | |
| Piercer Herbivore | 2 | 4 | 1.26% |
| Xylophage | | | |
| Scraper | 4 | 59 | 18.55% |
| Shredder | 1 | 22 | 6.92% |
| Omivore | 1 | 1 | 0.31% |
| Unknown | 1 | 4 | 1.26% |

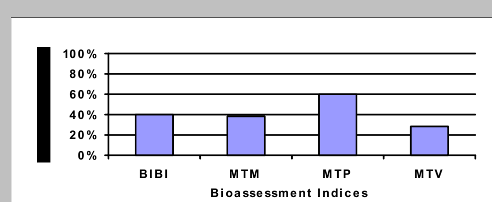



### Metric Values and Scores

| Metric | Value | BIBI | MTP | MTV | MTM |
|---|---|---|---|---|---|
| *Composition* | | | | | |
| Taxa Richness | 32 | 3 | 3 | | 3 |
| Non-Insect Percent | 84.28% | | | | |
| E Richness | 2 | 1 | | 1 | |
| P Richness | 0 | 1 | | 0 | |
| T Richness | 1 | 1 | | 0 | |
| EPT Richness | 3 | | 1 | | 0 |
| EPT Percent | 2.52% | | 0 | | 0 |
| Oligochaeta+Hirudinea Percent | 0.31% | | | | |
| Baetidae/Ephemeroptera | 0.857 | | | | |
| Hydropsychidae/Trichoptera | 0.000 | | | | |
| *Dominance* | | | | | |
| Dominant Taxon Percent | 32.70% | | 2 | | 2 |
| Dominant Taxa (2) Percent | 49.69% | | | | |
| Dominant Taxa (3) Percent | 66.04% | 3 | | | |
| Dominant Taxa (10) Percent | 88.99% | | | | |
| *Diversity* | | | | | |
| Shannon H (loge) | 2.191 | | | | |
| Shannon H (log2) | 3.161 | | 3 | | |
| Margalef D | 5.422 | | | | |
| Simpson D | 0.185 | | | | |
| Evenness | 0.076 | | | | |
| *Function* | | | | | |
| Predator Richness | 8 | | 3 | | |
| Predator Percent | 9.12% | 1 | | | |
| Filterer Richness | 2 | | | | |
| Filterer Percent | 1.57% | | | 3 | |
| Collector Percent | 62.58% | | 2 | | 2 |
| Scraper+Shredder Percent | 25.47% | | 2 | | 1 |
| Scraper/Filterer | 11.800 | | | | |
| Scraper/Scraper+Filterer | 0.922 | | | | |
| *Habit* | | | | | |
| Burrower Richness | 2 | | | | |
| Burrower Percent | 0.63% | | | | |
| Swimmer Richness | 3 | | | | |
| Swimmer Percent | 3.46% | | | | |
| Clinger Richness | 4 | 1 | | | |
| Clinger Percent | 1.89% | | | | |
| *Characteristics* | | | | | |
| Cold Stenotherm Richness | 0 | | | | |
| Cold Stenotherm Percent | 0.00% | | | | |
| Hemoglobin Bearer Richness | 3 | | | | |
| Hemoglobin Bearer Percent | 1.57% | | | | |
| Air Breather Richness | 1 | | | | |
| Air Breather Percent | 0.63% | | | | |
| *Voltinism* | | | | | |
| Univoltine Richness | 11 | | | | |
| Semivoltine Richness | 4 | 3 | | | |
| Multivoltine Percent | 41.82% | | 2 | | |
| *Tolerance* | | | | | |
| Sediment Tolerant Richness | 2 | | | | |
| Sediment Tolerant Percent | 1.26% | | | | |
| Sediment Sensitive Richness | 0 | | | | |
| Sediment Sensitive Percent | 0.00% | | | | |
| Metals Tolerance Index | 2.625 | | | | |
| Pollution Sensitive Richness | 0 | 1 | | 0 | |
| Pollution Tolerant Percent | 16.98% | 5 | | 1 | |
| Hilsenhoff Biotic Index | 7.328 | | 0 | | 0 |
| Intolerant Percent | 0.63% | | | | |
| Supertolerant Percent | 73.58% | | | | |
| CTQa | 101.333 | | | | |

### Bioassessment Indices

| BioIndex | Description | Score | Pct | Rating |
|---|---|---|---|---|
| BIBI | B-IBI (Karr et al.) | 20 | 40.00% | |
| MTP | Montana DEQ Plains (Bukantis 1998) | 18 | 60.00% | Slight |
| MTV | Montana Revised Valleys/Foothills (Bollman 1998) | 5 | 27.78% | Moderate |
| MTM | Montana DEQ Mountains (Bukantis 1998) | 8 | 38.10% | Moderate |




**Friday, January 28, 2011**

**Figure A-14**
**Fall 2010 Macroinvertebrate Metric Results for Minerva North**

# Metrics Report

**Project ID:** SNWA10CW
**RAI No.:** SNWA10CW004
**Sta. Name:** SM: Sample 154-155
**Client ID:** South Millick Spring
**STORET ID:**
**Coll. Date:**

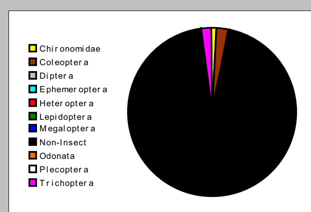
### Abundance Measures

**Sample Count:** 302
**Sample Abundance:** 476.84 63.33% of sample used

**Coll. Procedure:**
**Sample Notes:** Spring 2010

### Taxonomic Composition

| Category | R | A | PRA |
|---|---|---|---|
| Non-Insect | 7 | 285 | 94.37% |
| Odonata | | | |
| Ephemeroptera | | | |
| Plecoptera | | | |
| Heteroptera | | | |
| Megaloptera | | | |
| Trichoptera | 1 | 6 | 1.99% |
| Lepidoptera | | | |
| Coleoptera | 1 | 7 | 2.32% |
| Diptera | 1 | 1 | 0.33% |
| Chironomidae | 1 | 3 | 0.99% |

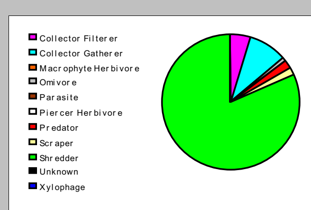



### Dominant Taxa

| Category | A | PRA |
|---|---|---|
| Gammarus | 240 | 79.47% |
| Hyalella | 19 | 6.29% |
| Sphaeriidae | 15 | 4.97% |
| Elmidae | 6 | 1.99% |
| Limnephilus | 5 | 1.66% |
| Physidae | 4 | 1.32% |
| Metriocnemus | 3 | 0.99% |
| Glossiphoniidae | 3 | 0.99% |
| Theromyzon | 1 | 0.33% |
| Limnephilidae | 1 | 0.33% |
| Hydrobiidae | 1 | 0.33% |
| Fossaria | 1 | 0.33% |
| Cleptelmis addenda | 1 | 0.33% |
| Ceratopogoninae | 1 | 0.33% |
| Amphipoda | 1 | 0.33% |

### Functional Composition

| Category | R | A | PRA |
|---|---|---|---|
| Predator | 2 | 5 | 1.66% |
| Parasite | | | |
| Collector Gatherer | 2 | 27 | 8.94% |
| Collector Filterer | 1 | 15 | 4.97% |
| Macrophyte Herbivore | | | |
| Piercer Herbivore | | | |
| Xylophage | | | |
| Scraper | 3 | 6 | 1.99% |
| Shredder | 2 | 246 | 81.46% |
| Omivore | 1 | 3 | 0.99% |
| Unknown | | | |

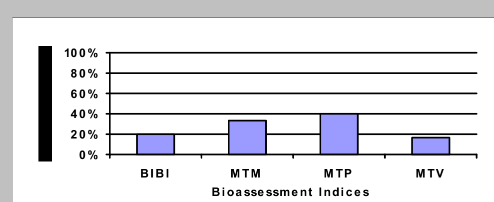



### Metric Values and Scores

| Metric | Value | BIBI | MTP | MTV | MTM |
|---|---|---|---|---|---|
| *Composition* | | | | | |
| Taxa Richness | 11 | 1 | 0 | | 0 |
| Non-Insect Percent | 94.37% | | | | |
| E Richness | 0 | 1 | | 0 | |
| P Richness | 0 | 1 | | 0 | |
| T Richness | 1 | 1 | | 0 | |
| EPT Richness | 1 | | 0 | | 0 |
| EPT Percent | 1.99% | | 0 | | 0 |
| Oligochaeta+Hirudinea Percent | 1.32% | | | | |
| Baetidae/Ephemeroptera | 0.000 | | | | |
| Hydropsychidae/Trichoptera | 0.000 | | | | |
| *Dominance* | | | | | |
| Dominant Taxon Percent | 79.47% | | 0 | | 0 |
| Dominant Taxa (2) Percent | 85.76% | | | | |
| Dominant Taxa (3) Percent | 90.73% | 1 | | | |
| Dominant Taxa (10) Percent | 98.34% | | | | |
| *Diversity* | | | | | |
| Shannon H (loge) | 0.763 | | | | |
| Shannon H (log2) | 1.101 | | 0 | | |
| Margalef D | 1.763 | | | | |
| Simpson D | 0.687 | | | | |
| Evenness | 0.064 | | | | |
| *Function* | | | | | |
| Predator Richness | 2 | | 0 | | |
| Predator Percent | 1.66% | 1 | | | |
| Filterer Richness | 1 | | | | |
| Filterer Percent | 4.97% | | | 3 | |
| Collector Percent | 13.91% | | 3 | | 3 |
| Scraper+Shredder Percent | 83.44% | | 3 | | 3 |
| Scraper/Filterer | 0.400 | | | | |
| Scraper/Scraper+Filterer | 0.286 | | | | |
| *Habit* | | | | | |
| Burrower Richness | 2 | | | | |
| Burrower Percent | 1.32% | | | | |
| Swimmer Richness | 0 | | | | |
| Swimmer Percent | 0.00% | | | | |
| Clinger Richness | 1 | 1 | | | |
| Clinger Percent | 2.32% | | | | |
| *Characteristics* | | | | | |
| Cold Stenotherm Richness | 0 | | | | |
| Cold Stenotherm Percent | 0.00% | | | | |
| Hemoglobin Bearer Richness | | | | | |
| Hemoglobin Bearer Percent | | | | | |
| Air Breather Richness | 0 | | | | |
| Air Breather Percent | 0.00% | | | | |
| *Voltinism* | | | | | |
| Univoltine Richness | 9 | | | | |
| Semivoltine Richness | 1 | 1 | | | |
| Multivoltine Percent | 0.99% | | 3 | | |
| *Tolerance* | | | | | |
| Sediment Tolerant Richness | 1 | | | | |
| Sediment Tolerant Percent | 0.33% | | | | |
| Sediment Sensitive Richness | 0 | | | | |
| Sediment Sensitive Percent | 0.00% | | | | |
| Metals Tolerance Index | 1.330 | | | | |
| Pollution Sensitive Richness | 0 | 1 | | 0 | |
| Pollution Tolerant Percent | 82.78% | 1 | | 0 | |
| Hilsenhoff Biotic Index | 4.599 | | 3 | | 1 |
| Intolerant Percent | 0.00% | | | | |
| Supertolerant Percent | 14.24% | | | | |
| CTQa | 107.500 | | | | |

### Bioassessment Indices

| BioIndex | Description | Score | Pct | Rating |
|---|---|---|---|---|
| BIBI | B-IBI (Karr et al.) | 10 | 20.00% | |
| MTP | Montana DEQ Plains (Bukantis 1998) | 12 | 40.00% | Moderate |
| MTV | Montana Revised Valleys/Foothills (Bollman 1998) | 3 | 16.67% | Severe |
| MTM | Montana DEQ Mountains (Bukantis 1998) | 7 | 33.33% | Moderate |




**Thursday, August 05, 2010**

**Figure A-15**
**Spring 2010 Macroinvertebrate Metric Results for South Millick**

# Metrics Report

**Project ID:** SNWA10CW2
**RAI No.:** SNWA10CW2004
**Sta. Name:** SM: Sample 156-158
**Client ID:** South Millick Spring
**STORET ID:**
**Coll. Date:**

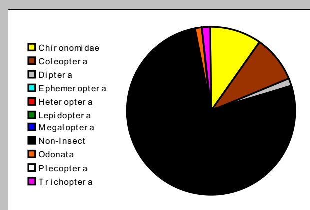
## Abundance Measures

**Sample Count:** 322
**Sample Abundance:** 4,830.00 6.67% of sample used

**Coll. Procedure:**
**Sample Notes:** Fall 2010

## Taxonomic Composition

| Category | R | A | PRA |
|---|---|---|---|
| Non-Insect | 5 | 246 | 76.40% |
| Odonata | 2 | 4 | 1.24% |
| Ephemeroptera | | | |
| Plecoptera | | | |
| Heteroptera | 1 | 1 | 0.31% |
| Megaloptera | | | |
| Trichoptera | 1 | 5 | 1.55% |
| Lepidoptera | | | |
| Coleoptera | 1 | 29 | 9.01% |
| Diptera | 3 | 5 | 1.55% |
| Chironomidae | 3 | 32 | 9.94% |

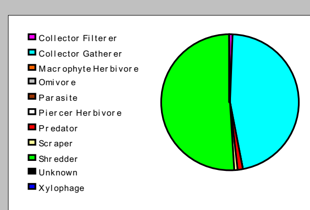



## Dominant Taxa

| Category | A | PRA |
|---|---|---|
| Gammarus | 160 | 49.69% |
| Amphipoda | 47 | 14.60% |
| Hyalella | 34 | 10.56% |
| Corynoneura | 29 | 9.01% |
| Cleptelmis addenda | 29 | 9.01% |
| Pericoma / Telmatoscopus | 3 | 0.93% |
| Limnephilus | 3 | 0.93% |
| Argia | 3 | 0.93% |
| Sphaeriidae | 2 | 0.62% |
| Physa | 2 | 0.62% |
| Limnophyes | 2 | 0.62% |
| Limnephilidae | 2 | 0.62% |
| Ephydridae | 1 | 0.31% |
| Copepoda | 1 | 0.31% |
| Coenagrionidae | 1 | 0.31% |

## Functional Composition

| Category | R | A | PRA |
|---|---|---|---|
| Predator | 3 | 5 | 1.55% |
| Parasite | | | |
| Collector Gatherer | 8 | 147 | 45.65% |
| Collector Filterer | 2 | 3 | 0.93% |
| Macrophyte Herbivore | | | |
| Piercer Herbivore | | | |
| Xylophage | | | |
| Scraper | 1 | 2 | 0.62% |
| Shredder | 2 | 165 | 51.24% |
| Omivore | | | |
| Unknown | | | |

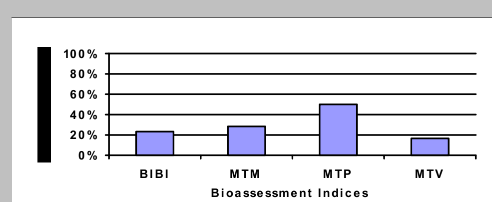



## Metric Values and Scores

| Metric | Value | BIBI | MTP | MTV | MTM |
|---|---|---|---|---|---|
| *Composition* | | | | | |
| Taxa Richness | 16 | 1 | 1 | | 0 |
| Non-Insect Percent | 76.40% | | | | |
| E Richness | 0 | 1 | | 0 | |
| P Richness | 0 | 1 | | 0 | |
| T Richness | 1 | 1 | | 0 | |
| EPT Richness | 1 | | 0 | | 0 |
| EPT Percent | 1.55% | | 0 | | 0 |
| Oligochaeta+Hirudinea Percent | | | | | |
| Baetidae/Ephemeroptera | 0.000 | | | | |
| Hydropsychidae/Trichoptera | 0.000 | | | | |
| *Dominance* | | | | | |
| Dominant Taxon Percent | 49.69% | | 1 | | 0 |
| Dominant Taxa (2) Percent | 64.29% | | | | |
| Dominant Taxa (3) Percent | 74.84% | 3 | | | |
| Dominant Taxa (10) Percent | 96.89% | | | | |
| *Diversity* | | | | | |
| Shannon H (loge) | 1.242 | | | | |
| Shannon H (log2) | 1.791 | | 0 | | |
| Margalef D | 2.727 | | | | |
| Simpson D | 0.458 | | | | |
| Evenness | 0.091 | | | | |
| *Function* | | | | | |
| Predator Richness | 3 | | 1 | | |
| Predator Percent | 1.55% | 1 | | | |
| Filterer Richness | 2 | | | | |
| Filterer Percent | 0.93% | | | 3 | |
| Collector Percent | 46.58% | | 3 | | 3 |
| Scraper+Shredder Percent | 51.86% | | 3 | | 2 |
| Scraper/Filterer | 0.667 | | | | |
| Scraper/Scraper+Filterer | 0.400 | | | | |
| *Habit* | | | | | |
| Burrower Richness | 2 | | | | |
| Burrower Percent | 1.24% | | | | |
| Swimmer Richness | 1 | | | | |
| Swimmer Percent | 0.31% | | | | |
| Clinger Richness | 2 | 1 | | | |
| Clinger Percent | 9.32% | | | | |
| *Characteristics* | | | | | |
| Cold Stenotherm Richness | 0 | | | | |
| Cold Stenotherm Percent | 0.00% | | | | |
| Hemoglobin Bearer Richness | 1 | | | | |
| Hemoglobin Bearer Percent | 0.31% | | | | |
| Air Breather Richness | 0 | | | | |
| Air Breather Percent | 0.00% | | | | |
| *Voltinism* | | | | | |
| Univoltine Richness | 10 | | | | |
| Semivoltine Richness | 1 | 1 | | | |
| Multivoltine Percent | 10.25% | | 3 | | |
| *Tolerance* | | | | | |
| Sediment Tolerant Richness | 0 | | | | |
| Sediment Tolerant Percent | 0.00% | | | | |
| Sediment Sensitive Richness | 0 | | | | |
| Sediment Sensitive Percent | 0.00% | | | | |
| Metals Tolerance Index | 1.774 | | | | |
| Pollution Sensitive Richness | 0 | 1 | | 0 | |
| Pollution Tolerant Percent | 53.11% | 1 | | 0 | |
| Hilsenhoff Biotic Index | 4.814 | | 3 | | 1 |
| Intolerant Percent | 0.00% | | | | |
| Supertolerant Percent | 12.73% | | | | |
| CTQa | 107.636 | | | | |

## Bioassessment Indices

| BioIndex | Description | Score | Pct | Rating |
|---|---|---|---|---|
| BIBI | B-IBI (Karr et al.) | 12 | 24.00% | |
| MTP | Montana DEQ Plains (Bukantis 1998) | 15 | 50.00% | Moderate |
| MTV | Montana Revised Valleys/Foothills (Bollman 1998) | 3 | 16.67% | Severe |
| MTM | Montana DEQ Mountains (Bukantis 1998) | 6 | 28.57% | Moderate |




Friday, January 28, 2011

**Figure A-16**
**Fall 2010 Macroinvertebrate Metric Results for South Millick**

# Metrics Report

**Project ID:** SNWA10CW
**RAI No.:** SNWA10CW012
**Sta. Name:** STL: Sample 503-504
**Client ID:** Stateline Springs
**STORET ID:**
**Coll. Date:**

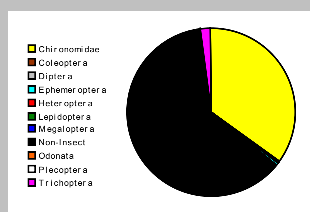
### Abundance Measures

**Sample Count:** 318
**Sample Abundance:** 2,385.00 13.33% of sample used

**Coll. Procedure:**
**Sample Notes:** Spring 2010

### Taxonomic Composition

| Category | R | A | PRA |
|---|---|---|---|
| Non-Insect | 5 | 198 | 62.26% |
| Odonata | | | |
| Ephemeroptera | 1 | 1 | 0.31% |
| Plecoptera | | | |
| Heteroptera | | | |
| Megaloptera | | | |
| Trichoptera | 2 | 6 | 1.89% |
| Lepidoptera | | | |
| Coleoptera | 1 | 1 | 0.31% |
| Diptera | 1 | 1 | 0.31% |
| Chironomidae | 7 | 111 | 34.91% |

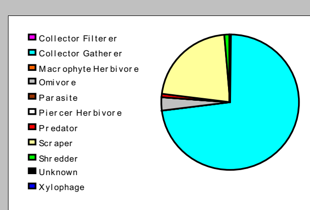



### Dominant Taxa

| Category | A | PRA |
|---|---|---|
| Hyalella | 83 | 26.10% |
| Hydrobiidae | 61 | 19.18% |
| Ostracoda | 47 | 14.78% |
| Chaetocladius | 47 | 14.78% |
| Thienemanniella | 45 | 14.15% |
| Metriocnemus | 11 | 3.46% |
| Physidae | 6 | 1.89% |
| Paracladius | 5 | 1.57% |
| Hydroptilidae sp. (RAI Taxon # 00 | 4 | 1.26% |
| Helicopsyche | 2 | 0.63% |
| Oligochaeta | 1 | 0.31% |
| Microtendipes | 1 | 0.31% |
| Limnophyes | 1 | 0.31% |
| Eukiefferiella Pseudomontana Gr. | 1 | 0.31% |
| Ceratopogoninae | 1 | 0.31% |

### Functional Composition

| Category | R | A | PRA |
|---|---|---|---|
| Predator | 2 | 2 | 0.63% |
| Parasite | | | |
| Collector Gatherer | 9 | 231 | 72.64% |
| Collector Filterer | 1 | 1 | 0.31% |
| Macrophyte Herbivore | | | |
| Piercer Herbivore | | | |
| Xylophage | | | |
| Scraper | 3 | 69 | 21.70% |
| Shredder | 1 | 4 | 1.26% |
| Omivore | 1 | 11 | 3.46% |
| Unknown | | | |

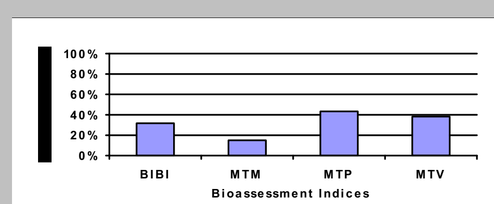



### Metric Values and Scores

| Metric | Value | BIBI | MTP | MTV | MTM |
|---|---|---|---|---|---|
| *Composition* | | | | | |
| Taxa Richness | 17 | 1 | 1 | | 0 |
| Non-Insect Percent | 62.26% | | | | |
| E Richness | 1 | 1 | | 0 | |
| P Richness | 0 | 1 | | 0 | |
| T Richness | 2 | 1 | | 1 | |
| EPT Richness | 3 | | 1 | | 0 |
| EPT Percent | 2.20% | | 0 | | 0 |
| Oligochaeta+Hirudinea Percent | 0.31% | | | | |
| Baetidae/Ephemeroptera | 1.000 | | | | |
| Hydropsychidae/Trichoptera | 0.000 | | | | |
| *Dominance* | | | | | |
| Dominant Taxon Percent | 26.10% | | 3 | | 2 |
| Dominant Taxa (2) Percent | 45.28% | | | | |
| Dominant Taxa (3) Percent | 60.06% | 3 | | | |
| Dominant Taxa (10) Percent | 97.80% | | | | |
| *Diversity* | | | | | |
| Shannon H (loge) | 1.980 | | | | |
| Shannon H (log2) | 2.856 | | 2 | | |
| Margalef D | 2.777 | | | | |
| Simpson D | 0.168 | | | | |
| Evenness | 0.100 | | | | |
| *Function* | | | | | |
| Predator Richness | 2 | | 0 | | |
| Predator Percent | 0.63% | 1 | | | |
| Filterer Richness | 1 | | | | |
| Filterer Percent | 0.31% | | | 3 | |
| Collector Percent | 72.96% | | 2 | | 1 |
| Scraper+Shredder Percent | 22.96% | | 2 | | 0 |
| Scraper/Filterer | 69.000 | | | | |
| Scraper/Scraper+Filterer | 0.986 | | | | |
| *Habit* | | | | | |
| Burrower Richness | 2 | | | | |
| Burrower Percent | 3.77% | | | | |
| Swimmer Richness | 1 | | | | |
| Swimmer Percent | 0.31% | | | | |
| Clinger Richness | 2 | 1 | | | |
| Clinger Percent | 0.94% | | | | |
| *Characteristics* | | | | | |
| Cold Stenotherm Richness | 0 | | | | |
| Cold Stenotherm Percent | 0.00% | | | | |
| Hemoglobin Bearer Richness | 1 | | | | |
| Hemoglobin Bearer Percent | 0.31% | | | | |
| Air Breather Richness | 0 | | | | |
| Air Breather Percent | 0.00% | | | | |
| *Voltinism* | | | | | |
| Univoltine Richness | 6 | | | | |
| Semivoltine Richness | 0 | 1 | | | |
| Multivoltine Percent | 50.00% | | 2 | | |
| *Tolerance* | | | | | |
| Sediment Tolerant Richness | 1 | | | | |
| Sediment Tolerant Percent | 0.31% | | | | |
| Sediment Sensitive Richness | 0 | | | | |
| Sediment Sensitive Percent | 0.00% | | | | |
| Metals Tolerance Index | 3.324 | | | | |
| Pollution Sensitive Richness | 0 | 1 | | 0 | |
| Pollution Tolerant Percent | 3.14% | 5 | | 3 | |
| Hilsenhoff Biotic Index | 7.284 | | 0 | | 0 |
| Intolerant Percent | 0.31% | | | | |
| Supertolerant Percent | 64.47% | | | | |
| CTQa | 93.273 | | | | |

### Bioassessment Indices

| BioIndex | Description | Score | Pct | Rating |
|---|---|---|---|---|
| BIBI | B-IBI (Karr et al.) | 16 | 32.00% | |
| MTP | Montana DEQ Plains (Bukantis 1998) | 13 | 43.33% | Moderate |
| MTV | Montana Revised Valleys/Foothills (Bollman 1998) | 7 | 38.89% | Moderate |
| MTM | Montana DEQ Mountains (Bukantis 1998) | 3 | 14.29% | Severe |




**Thursday, August 05, 2010**

**Figure A-17**
**Spring 2010 Macroinvertebrate Metric Results for Stateline**

# Metrics Report

**Project ID:** SNWA10CW2
**RAI No.:** SNWA10CW2010
**Sta. Name:** STL: Sample 505
**Client ID:** Stateline Springs
**STORET ID:**
**Coll. Date:**

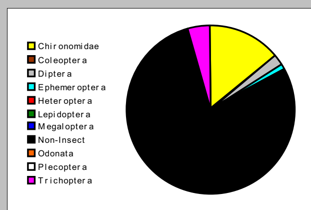
### Abundance Measures

**Sample Count:** 310
**Sample Abundance:** 9,300.00 3.33% of sample used

**Coll. Procedure:**
**Sample Notes:** Fall 2010

### Taxonomic Composition

| Category | R | A | PRA |
|---|---|---|---|
| Non-Insect | 6 | 244 | 78.71% |
| Odonata | | | |
| Ephemeroptera | 1 | 3 | 0.97% |
| Plecoptera | | | |
| Heteroptera | | | |
| Megaloptera | | | |
| Trichoptera | 3 | 13 | 4.19% |
| Lepidoptera | | | |
| Coleoptera | | | |
| Diptera | 4 | 7 | 2.26% |
| Chironomidae | 7 | 43 | 13.87% |

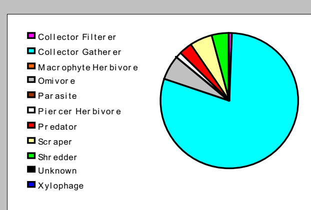



### Dominant Taxa

| Category | A | PRA |
|---|---|---|
| Hyalella | 138 | 44.52% |
| Oligochaeta | 46 | 14.84% |
| Ostracoda | 44 | 14.19% |
| Metriocnemus | 18 | 5.81% |
| Physa | 12 | 3.87% |
| Thienemanniella | 9 | 2.90% |
| Hydroptilidae sp. (RAI Taxon # 00 | 8 | 2.58% |
| Pentaneura | 7 | 2.26% |
| Cricotopus (Isocladius) | 4 | 1.29% |
| Simulium | 3 | 0.97% |
| Oxyethira | 3 | 0.97% |
| Hydrobiidae | 3 | 0.97% |
| Fallceon | 3 | 0.97% |
| Paratanytarsus | 2 | 0.65% |
| Apedilum | 2 | 0.65% |

### Functional Composition

| Category | R | A | PRA |
|---|---|---|---|
| Predator | 3 | 10 | 3.23% |
| Parasite | | | |
| Collector Gatherer | 9 | 246 | 79.35% |
| Collector Filterer | 1 | 3 | 0.97% |
| Macrophyte Herbivore | | | |
| Piercer Herbivore | 1 | 4 | 1.29% |
| Xylophage | | | |
| Scraper | 3 | 16 | 5.16% |
| Shredder | 3 | 13 | 4.19% |
| Omivore | 1 | 18 | 5.81% |
| Unknown | | | |

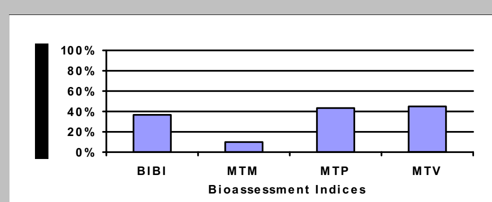



### Metric Values and Scores

| Metric | Value | BIBI | MTP | MTV | MTM |
|---|---|---|---|---|---|
| *Composition* | | | | | |
| Taxa Richness | 21 | 3 | 2 | | 1 |
| Non-Insect Percent | 78.71% | | | | |
| E Richness | 1 | 1 | | 0 | |
| P Richness | 0 | 1 | | 0 | |
| T Richness | 3 | 1 | | 2 | |
| EPT Richness | 4 | | 1 | | 0 |
| EPT Percent | 5.16% | | 0 | | 0 |
| Oligochaeta+Hirudinea Percent | 14.84% | | | | |
| Baetidae/Ephemeroptera | 1.000 | | | | |
| Hydropsychidae/Trichoptera | 0.000 | | | | |
| *Dominance* | | | | | |
| Dominant Taxon Percent | 44.52% | | 2 | | 1 |
| Dominant Taxa (2) Percent | 59.35% | | | | |
| Dominant Taxa (3) Percent | 73.55% | 3 | | | |
| Dominant Taxa (10) Percent | 93.23% | | | | |
| *Diversity* | | | | | |
| Shannon H (loge) | 1.923 | | | | |
| Shannon H (log2) | 2.775 | | 2 | | |
| Margalef D | 3.488 | | | | |
| Simpson D | 0.247 | | | | |
| Evenness | 0.088 | | | | |
| *Function* | | | | | |
| Predator Richness | 3 | | 1 | | |
| Predator Percent | 3.23% | 1 | | | |
| Filterer Richness | 1 | | | | |
| Filterer Percent | 0.97% | | | 3 | |
| Collector Percent | 80.32% | | 1 | | 0 |
| Scraper+Shredder Percent | 9.35% | | 1 | | 0 |
| Scraper/Filterer | 5.333 | | | | |
| Scraper/Scraper+Filterer | 0.842 | | | | |
| *Habit* | | | | | |
| Burrower Richness | 3 | | | | |
| Burrower Percent | 6.45% | | | | |
| Swimmer Richness | 1 | | | | |
| Swimmer Percent | 0.97% | | | | |
| Clinger Richness | 4 | 1 | | | |
| Clinger Percent | 3.23% | | | | |
| *Characteristics* | | | | | |
| Cold Stenotherm Richness | 0 | | | | |
| Cold Stenotherm Percent | 0.00% | | | | |
| Hemoglobin Bearer Richness | 1 | | | | |
| Hemoglobin Bearer Percent | 0.65% | | | | |
| Air Breather Richness | 1 | | | | |
| Air Breather Percent | 0.32% | | | | |
| *Voltinism* | | | | | |
| Univoltine Richness | 9 | | | | |
| Semivoltine Richness | 0 | 1 | | | |
| Multivoltine Percent | 30.32% | | 3 | | |
| *Tolerance* | | | | | |
| Sediment Tolerant Richness | 2 | | | | |
| Sediment Tolerant Percent | 15.16% | | | | |
| Sediment Sensitive Richness | 0 | | | | |
| Sediment Sensitive Percent | 0.00% | | | | |
| Metals Tolerance Index | 3.012 | | | | |
| Pollution Sensitive Richness | 0 | 1 | | 0 | |
| Pollution Tolerant Percent | 4.84% | 5 | | 3 | |
| Hilsenhoff Biotic Index | 7.863 | | 0 | | 0 |
| Intolerant Percent | 0.32% | | | | |
| Supertolerant Percent | 78.39% | | | | |
| CTQa | 105.231 | | | | |

### Bioassessment Indices

| BioIndex | Description | Score | Pct | Rating |
|---|---|---|---|---|
| BIBI | B-IBI (Karr et al.) | 18 | 36.00% | |
| MTP | Montana DEQ Plains (Bukantis 1998) | 13 | 43.33% | Moderate |
| MTV | Montana Revised Valleys/Foothills (Bollman 1998) | 8 | 44.44% | Moderate |
| MTM | Montana DEQ Mountains (Bukantis 1998) | 2 | 9.52% | Severe |




Friday, January 28, 2011

**Figure A-18**
**Fall 2010 Macroinvertebrate Metric Results for Stateline**

# Metrics Report

**Project ID:** SNWA10CW
**RAI No.:** SNWA10CW005
**Sta. Name:** ST: Sample 10-12
**Client ID:** Stonehouse Spring
**STORET ID:**
**Coll. Date:**

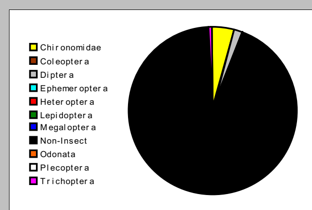
### Abundance Measures

**Sample Count:** 320
**Sample Abundance:** 1,828.57 17.50% of sample used

**Coll. Procedure:**
**Sample Notes:** Spring 2010

### Taxonomic Composition

| Category | R | A | PRA |
|---|---|---|---|
| Non-Insect | 8 | 299 | 93.44% |
| Odonata | | | |
| Ephemeroptera | | | |
| Plecoptera | | | |
| Heteroptera | | | |
| Megaloptera | | | |
| Trichoptera | 1 | 2 | 0.63% |
| Lepidoptera | | | |
| Coleoptera | | | |
| Diptera | 3 | 6 | 1.88% |
| Chironomidae | 4 | 13 | 4.06% |

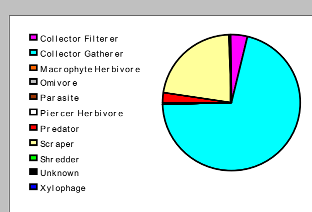



### Dominant Taxa

| Category | A | PRA |
|---|---|---|
| Hyalella | 168 | 52.50% |
| Hydrobiidae | 69 | 21.56% |
| Ostracoda | 37 | 11.56% |
| Sphaeriidae | 13 | 4.06% |
| Paratendipes | 8 | 2.50% |
| Amphipoda | 7 | 2.19% |
| Ceratopogoninae | 3 | 0.94% |
| Oxyethira | 2 | 0.63% |
| Micropsectra | 2 | 0.63% |
| Glossiphoniidae | 2 | 0.63% |
| Chaetocladius | 2 | 0.63% |
| Hydryphantes | 1 | 0.31% |
| Gammarus | 1 | 0.31% |
| Ephydridae | 1 | 0.31% |
| Ceratopogonidae | 1 | 0.31% |

### Functional Composition

| Category | R | A | PRA |
|---|---|---|---|
| Predator | 4 | 8 | 2.50% |
| Parasite | | | |
| Collector Gatherer | 6 | 225 | 70.31% |
| Collector Filterer | 1 | 13 | 4.06% |
| Macrophyte Herbivore | | | |
| Piercer Herbivore | 1 | 2 | 0.63% |
| Xylophage | | | |
| Scraper | 2 | 70 | 21.88% |
| Shredder | 2 | 2 | 0.63% |
| Omivore | | | |
| Unknown | | | |

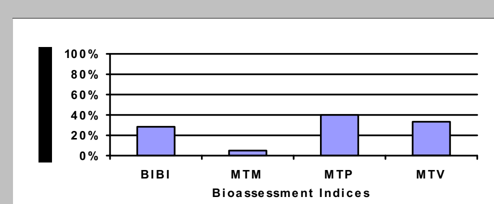



### Metric Values and Scores

| Metric | Value | BIBI | MTP | MTV | MTM |
|---|---|---|---|---|---|
| *Composition* | | | | | |
| Taxa Richness | 16 | 1 | 1 | | 0 |
| Non-Insect Percent | 93.44% | | | | |
| E Richness | 0 | 1 | | 0 | |
| P Richness | 0 | 1 | | 0 | |
| T Richness | 1 | 1 | | 0 | |
| EPT Richness | 1 | | 0 | | 0 |
| EPT Percent | 0.63% | | 0 | | 0 |
| Oligochaeta+Hirudinea Percent | 0.63% | | | | |
| Baetidae/Ephemeroptera | 0.000 | | | | |
| Hydropsychidae/Trichoptera | 0.000 | | | | |
| *Dominance* | | | | | |
| Dominant Taxon Percent | 52.50% | | 1 | | 0 |
| Dominant Taxa (2) Percent | 74.06% | | | | |
| Dominant Taxa (3) Percent | 85.63% | 1 | | | |
| Dominant Taxa (10) Percent | 97.19% | | | | |
| *Diversity* | | | | | |
| Shannon H (loge) | 1.431 | | | | |
| Shannon H (log2) | 2.064 | | 1 | | |
| Margalef D | 2.612 | | | | |
| Simpson D | 0.354 | | | | |
| Evenness | 0.106 | | | | |
| *Function* | | | | | |
| Predator Richness | 4 | | 2 | | |
| Predator Percent | 2.50% | 1 | | | |
| Filterer Richness | 1 | | | | |
| Filterer Percent | 4.06% | | | 3 | |
| Collector Percent | 74.38% | | 2 | | 1 |
| Scraper+Shredder Percent | 22.50% | | 2 | | 0 |
| Scraper/Filterer | 5.385 | | | | |
| Scraper/Scraper+Filterer | 0.843 | | | | |
| *Habit* | | | | | |
| Burrower Richness | 2 | | | | |
| Burrower Percent | 3.44% | | | | |
| Swimmer Richness | 0 | | | | |
| Swimmer Percent | 0.00% | | | | |
| Clinger Richness | 1 | 1 | | | |
| Clinger Percent | 0.31% | | | | |
| *Characteristics* | | | | | |
| Cold Stenotherm Richness | 0 | | | | |
| Cold Stenotherm Percent | 0.00% | | | | |
| Hemoglobin Bearer Richness | 1 | | | | |
| Hemoglobin Bearer Percent | 2.50% | | | | |
| Air Breather Richness | 1 | | | | |
| Air Breather Percent | 0.31% | | | | |
| *Voltinism* | | | | | |
| Univoltine Richness | 9 | | | | |
| Semivoltine Richness | 0 | 1 | | | |
| Multivoltine Percent | 16.25% | | 3 | | |
| *Tolerance* | | | | | |
| Sediment Tolerant Richness | 0 | | | | |
| Sediment Tolerant Percent | 0.00% | | | | |
| Sediment Sensitive Richness | 0 | | | | |
| Sediment Sensitive Percent | 0.00% | | | | |
| Metals Tolerance Index | 2.995 | | | | |
| Pollution Sensitive Richness | 0 | 1 | | 0 | |
| Pollution Tolerant Percent | 4.06% | 5 | | 3 | |
| Hilsenhoff Biotic Index | 7.846 | | 0 | | 0 |
| Intolerant Percent | 0.00% | | | | |
| Supertolerant Percent | 93.13% | | | | |
| CTQa | 108.000 | | | | |

### Bioassessment Indices

| BioIndex | Description | Score | Pct | Rating |
|---|---|---|---|---|
| BIBI | B-IBI (Karr et al.) | 14 | 28.00% | |
| MTP | Montana DEQ Plains (Bukantis 1998) | 12 | 40.00% | Moderate |
| MTV | Montana Revised Valleys/Foothills (Bollman 1998) | 6 | 33.33% | Moderate |
| MTM | Montana DEQ Mountains (Bukantis 1998) | 1 | 4.76% | Severe |




**Thursday, August 05, 2010**

**Figure A-19**
**Spring 2010 Macroinvertebrate Metric Results for Stonehouse**

# Metrics Report

**Project ID:** SNWA10CW2
**RAI No.:** SNWA10CW2001
**Sta. Name:** ST: Sample 13-17
**Client ID:** Stonehouse Spring
**STORET ID:**
**Coll. Date:**

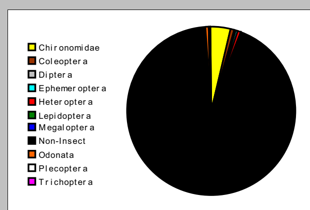
## Abundance Measures

**Sample Count:** 319
**Sample Abundance:** 1,914.00 16.67% of sample used

**Coll. Procedure:**
**Sample Notes:** Fall 2010

## Taxonomic Composition

| Category | R | A | PRA |
|---|---|---|---|
| Non-Insect | 6 | 297 | 93.10% |
| Odonata | 1 | 2 | 0.63% |
| Ephemeroptera | 1 | 1 | 0.31% |
| Plecoptera | | | |
| Heteroptera | 1 | 2 | 0.63% |
| Megaloptera | | | |
| Trichoptera | 1 | 1 | 0.31% |
| Lepidoptera | | | |
| Coleoptera | 2 | 2 | 0.63% |
| Diptera | 2 | 2 | 0.63% |
| Chironomidae | 6 | 12 | 3.76% |

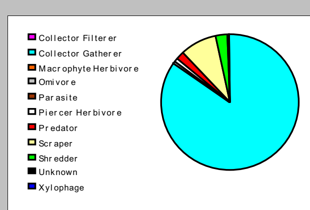



## Dominant Taxa

| Category | A | PRA |
|---|---|---|
| Hyalella | 254 | 79.62% |
| Hydrobiidae | 21 | 6.58% |
| Ostracoda | 10 | 3.13% |
| Physa | 7 | 2.19% |
| Gammarus | 4 | 1.25% |
| Cricotopus (Isocladius) | 4 | 1.25% |
| Metriocnemus | 2 | 0.63% |
| Limnophyes | 2 | 0.63% |
| Corixidae | 2 | 0.63% |
| Acricotopus | 2 | 0.63% |
| Sciomyzidae | 1 | 0.31% |
| Dytiscidae | 1 | 0.31% |
| Derotanypus | 1 | 0.31% |
| Argia | 1 | 0.31% |
| Apedilum | 1 | 0.31% |

## Functional Composition

| Category | R | A | PRA |
|---|---|---|---|
| Predator | 5 | 6 | 1.88% |
| Parasite | | | |
| Collector Gatherer | 6 | 270 | 84.64% |
| Collector Filterer | | | |
| Macrophyte Herbivore | | | |
| Piercer Herbivore | 2 | 3 | 0.94% |
| Xylophage | | | |
| Scraper | 2 | 28 | 8.78% |
| Shredder | 3 | 9 | 2.82% |
| Omnivore | 1 | 2 | 0.63% |
| Unknown | 1 | 1 | 0.31% |

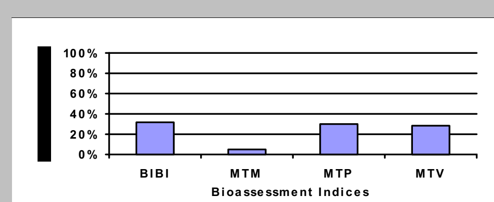



## Metric Values and Scores

| Metric | Value | BIBI | MTP | MTV | MTM |
|---|---|---|---|---|---|
| *Composition* | | | | | |
| Taxa Richness | 20 | 3 | 2 | | 1 |
| Non-Insect Percent | 93.10% | | | | |
| E Richness | 1 | 1 | | 0 | |
| P Richness | 0 | 1 | | 0 | |
| T Richness | 1 | 1 | | 0 | |
| EPT Richness | 2 | | 0 | | 0 |
| EPT Percent | 0.63% | | 0 | | 0 |
| Oligochaeta+Hirudinea Percent | 0.31% | | | | |
| Baetidae/Ephemeroptera | 0.000 | | | | |
| Hydropsychidae/Trichoptera | 0.000 | | | | |
| *Dominance* | | | | | |
| Dominant Taxon Percent | 79.62% | | 0 | | 0 |
| Dominant Taxa (2) Percent | 86.21% | | | | |
| Dominant Taxa (3) Percent | 89.34% | 1 | | | |
| Dominant Taxa (10) Percent | 96.55% | | | | |
| *Diversity* | | | | | |
| Shannon H (loge) | 0.971 | | | | |
| Shannon H (log2) | 1.400 | | 0 | | |
| Margalef D | 3.297 | | | | |
| Simpson D | 0.643 | | | | |
| Evenness | 0.054 | | | | |
| *Function* | | | | | |
| Predator Richness | 5 | | 2 | | |
| Predator Percent | 1.88% | 1 | | | |
| Filterer Richness | 0 | | | | |
| Filterer Percent | 0.00% | | | 3 | |
| Collector Percent | 84.64% | | 1 | | 0 |
| Scraper+Shredder Percent | 11.60% | | 1 | | 0 |
| Scraper/Filterer | 0.000 | | | | |
| Scraper/Scraper+Filterer | 0.000 | | | | |
| *Habit* | | | | | |
| Burrower Richness | 1 | | | | |
| Burrower Percent | 0.63% | | | | |
| Swimmer Richness | 3 | | | | |
| Swimmer Percent | 1.25% | | | | |
| Clinger Richness | 1 | 1 | | | |
| Clinger Percent | 1.25% | | | | |
| *Characteristics* | | | | | |
| Cold Stenotherm Richness | 0 | | | | |
| Cold Stenotherm Percent | 0.00% | | | | |
| Hemoglobin Bearer Richness | 1 | | | | |
| Hemoglobin Bearer Percent | 0.31% | | | | |
| Air Breather Richness | 1 | | | | |
| Air Breather Percent | 0.31% | | | | |
| *Voltinism* | | | | | |
| Univoltine Richness | 10 | | | | |
| Semivoltine Richness | 2 | 1 | | | |
| Multivoltine Percent | 6.90% | | 3 | | |
| *Tolerance* | | | | | |
| Sediment Tolerant Richness | 0 | | | | |
| Sediment Tolerant Percent | 0.00% | | | | |
| Sediment Sensitive Richness | 0 | | | | |
| Sediment Sensitive Percent | 0.00% | | | | |
| Metals Tolerance Index | 3.008 | | | | |
| Pollution Sensitive Richness | 0 | 1 | | 0 | |
| Pollution Tolerant Percent | 5.96% | 5 | | 2 | |
| Hilsenhoff Biotic Index | 7.896 | | 0 | | 0 |
| Intolerant Percent | 0.00% | | | | |
| Supertolerant Percent | 93.73% | | | | |
| CTQa | 102.167 | | | | |

## Bioassessment Indices

| BioIndex | Description | Score | Pct | Rating |
|---|---|---|---|---|
| BIBI | B-IBI (Karr et al.) | 16 | 32.00% | |
| MTP | Montana DEQ Plains (Bukantis 1998) | 9 | 30.00% | Moderate |
| MTV | Montana Revised Valleys/Foothills (Bollman 1998) | 5 | 27.78% | Moderate |
| MTM | Montana DEQ Mountains (Bukantis 1998) | 1 | 4.76% | Severe |




Friday, January 28, 2011

**Figure A-20**
**Fall 2010 Macroinvertebrate Metric Results for Stonehouse**

# Metrics Report

**Project ID:** SNWA10CW
**RAI No.:** SNWA10CW006
**Sta. Name:** SS: Sample 356
**Client ID:** Swallow Spring
**STORET ID:**
**Coll. Date:**

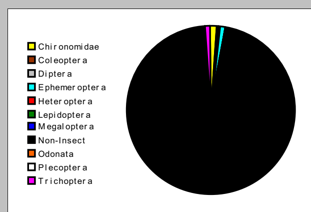
### Abundance Measures

**Sample Count:** 320
**Sample Abundance:** 43,885.71 0.73% of sample used

**Coll. Procedure:**
**Sample Notes:** Spring 2010

### Taxonomic Composition

| Category | R | A | PRA |
|---|---|---|---|
| Non-Insect | 3 | 306 | 95.63% |
| Odonata | | | |
| Ephemeroptera | 2 | 4 | 1.25% |
| Plecoptera | | | |
| Heteroptera | | | |
| Megaloptera | | | |
| Trichoptera | 1 | 4 | 1.25% |
| Lepidoptera | | | |
| Coleoptera | 1 | 1 | 0.31% |
| Diptera | 1 | 1 | 0.31% |
| Chironomidae | 2 | 4 | 1.25% |

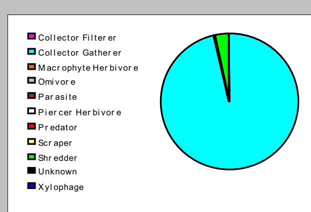



### Dominant Taxa

| Category | A | PRA |
|---|---|---|
| Ostracoda | 299 | 93.44% |
| Gammarus | 6 | 1.88% |
| Lepidostoma | 4 | 1.25% |
| Thienemanniella | 3 | 0.94% |
| Ephemerellidae | 2 | 0.63% |
| Baetis adonis | 2 | 0.63% |
| Heterotrissocladius | 1 | 0.31% |
| Heterlimnius | 1 | 0.31% |
| Ceratopogoninae | 1 | 0.31% |
| Acari | 1 | 0.31% |

### Functional Composition

| Category | R | A | PRA |
|---|---|---|---|
| Predator | 2 | 2 | 0.63% |
| Parasite | | | |
| Collector Gatherer | 6 | 308 | 96.25% |
| Collector Filterer | | | |
| Macrophyte Herbivore | | | |
| Piercer Herbivore | | | |
| Xylophage | | | |
| Scraper | | | |
| Shredder | 2 | 10 | 3.13% |
| Omivore | | | |
| Unknown | | | |

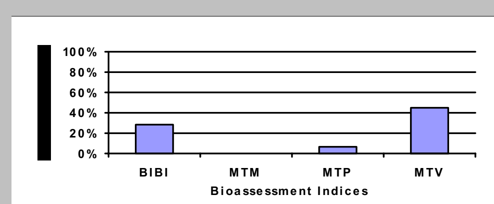



### Metric Values and Scores

| Metric | Value | BIBI | MTP | MTV | MTM |
|---|---|---|---|---|---|
| *Composition* | | | | | |
| Taxa Richness | 10 | 1 | 0 | | 0 |
| Non-Insect Percent | 95.63% | | | | |
| E Richness | 2 | 1 | | 1 | |
| P Richness | 0 | 1 | | 0 | |
| T Richness | 1 | 1 | | 0 | |
| EPT Richness | 3 | | 1 | | 0 |
| EPT Percent | 2.50% | | 0 | | 0 |
| Oligochaeta+Hirudinea Percent | | | | | |
| Baetidae/Ephemeroptera | 0.500 | | | | |
| Hydropsychidae/Trichoptera | 0.000 | | | | |
| *Dominance* | | | | | |
| Dominant Taxon Percent | 93.44% | | 0 | | 0 |
| Dominant Taxa (2) Percent | 95.31% | | | | |
| Dominant Taxa (3) Percent | 96.56% | 1 | | | |
| Dominant Taxa (10) Percent | 100.00% | | | | |
| *Diversity* | | | | | |
| Shannon H (loge) | 0.372 | | | | |
| Shannon H (log2) | 0.537 | | 0 | | |
| Margalef D | 1.560 | | | | |
| Simpson D | 0.873 | | | | |
| Evenness | 0.027 | | | | |
| *Function* | | | | | |
| Predator Richness | 2 | | 0 | | |
| Predator Percent | 0.63% | 1 | | | |
| Filterer Richness | 0 | | | | |
| Filterer Percent | 0.00% | | | 3 | |
| Collector Percent | 96.25% | | 0 | | 0 |
| Scraper+Shredder Percent | 3.13% | | 1 | | 0 |
| Scraper/Filterer | 0.000 | | | | |
| Scraper/Scraper+Filterer | 0.000 | | | | |
| *Habit* | | | | | |
| Burrower Richness | 1 | | | | |
| Burrower Percent | 0.31% | | | | |
| Swimmer Richness | 0 | | | | |
| Swimmer Percent | 0.00% | | | | |
| Clinger Richness | 2 | 1 | | | |
| Clinger Percent | 0.94% | | | | |
| *Characteristics* | | | | | |
| Cold Stenotherm Richness | 0 | | | | |
| Cold Stenotherm Percent | 0.00% | | | | |
| Hemoglobin Bearer Richness | | | | | |
| Hemoglobin Bearer Percent | | | | | |
| Air Breather Richness | 0 | | | | |
| Air Breather Percent | 0.00% | | | | |
| *Voltinism* | | | | | |
| Univoltine Richness | 4 | | | | |
| Semivoltine Richness | 1 | 1 | | | |
| Multivoltine Percent | 95.00% | | 0 | | |
| *Tolerance* | | | | | |
| Sediment Tolerant Richness | 0 | | | | |
| Sediment Tolerant Percent | 0.00% | | | | |
| Sediment Sensitive Richness | 0 | | | | |
| Sediment Sensitive Percent | 0.00% | | | | |
| Metals Tolerance Index | 2.125 | | | | |
| Pollution Sensitive Richness | 1 | 1 | | 1 | |
| Pollution Tolerant Percent | 1.88% | 5 | | 3 | |
| Hilsenhoff Biotic Index | 7.717 | | 0 | | 0 |
| Intolerant Percent | 2.19% | | | | |
| Supertolerant Percent | 93.44% | | | | |
| CTQa | 94.571 | | | | |

### Bioassessment Indices

| BioIndex | Description | Score | Pct | Rating |
|---|---|---|---|---|
| BIBI | B-IBI (Karr et al.) | 14 | 28.00% | |
| MTP | Montana DEQ Plains (Bukantis 1998) | 2 | 6.67% | Severe |
| MTV | Montana Revised Valleys/Foothills (Bollman 1998) | 8 | 44.44% | Moderate |
| MTM | Montana DEQ Mountains (Bukantis 1998) | 0 | 0.00% | Severe |




**Thursday, August 05, 2010**

**Figure A-21**
**Spring 2010 Macroinvertebrate Metric Results for Swallow**

# Metrics Report

**Project ID:** SNWA10CW2
**RAI No.:** SNWA10CW2007
**Sta. Name:** SS: Sample 357
**Client ID:** Swallow Spring
**STORET ID:**
**Coll. Date:**

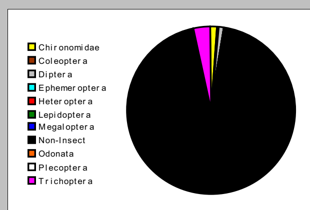
### Abundance Measures

**Sample Count:** 313
**Sample Abundance:** 10,731.43 2.92% of sample used

**Coll. Procedure:**
**Sample Notes:** Fall 2010

### Taxonomic Composition

| Category | R | A | PRA |
|---|---|---|---|
| Non-Insect | 5 | 295 | 94.25% |
| Odonata | | | |
| Ephemeroptera | | | |
| Plecoptera | | | |
| Heteroptera | | | |
| Megaloptera | | | |
| Trichoptera | 1 | 10 | 3.19% |
| Lepidoptera | | | |
| Coleoptera | 1 | 1 | 0.32% |
| Diptera | 1 | 3 | 0.96% |
| Chironomidae | 2 | 4 | 1.28% |

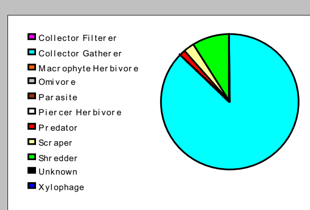



### Dominant Taxa

| Category | A | PRA |
|---|---|---|
| Ostracoda | 264 | 84.35% |
| Gammarus | 17 | 5.43% |
| Lepidostoma | 10 | 3.19% |
| Hydrobiidae | 9 | 2.88% |
| Thyas | 4 | 1.28% |
| Thienemanniella | 3 | 0.96% |
| Dixella | 2 | 0.64% |
| Limnophyes | 1 | 0.32% |
| Heterlimnius | 1 | 0.32% |
| Dixidae | 1 | 0.32% |
| Copepoda | 1 | 0.32% |

### Functional Composition

| Category | R | A | PRA |
|---|---|---|---|
| Predator | 1 | 4 | 1.28% |
| Parasite | | | |
| Collector Gatherer | 6 | 273 | 87.22% |
| Collector Filterer | | | |
| Macrophyte Herbivore | | | |
| Piercer Herbivore | | | |
| Xylophage | | | |
| Scraper | 1 | 9 | 2.88% |
| Shredder | 2 | 27 | 8.63% |
| Omivore | | | |
| Unknown | | | |

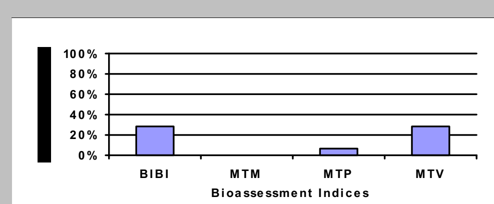



### Metric Values and Scores

| Metric | Value | BIBI | MTP | MTV | MTM |
|---|---|---|---|---|---|
| *Composition* | | | | | |
| Taxa Richness | 10 | 1 | 0 | | 0 |
| Non-Insect Percent | 94.25% | | | | |
| E Richness | 0 | 1 | | 0 | |
| P Richness | 0 | 1 | | 0 | |
| T Richness | 1 | 1 | | 0 | |
| EPT Richness | 1 | | 0 | | 0 |
| EPT Percent | 3.19% | | 0 | | 0 |
| Oligochaeta+Hirudinea Percent | | | | | |
| Baetidae/Ephemeroptera | 0.000 | | | | |
| Hydropsychidae/Trichoptera | 0.000 | | | | |
| *Dominance* | | | | | |
| Dominant Taxon Percent | 84.35% | | 0 | | 0 |
| Dominant Taxa (2) Percent | 89.78% | | | | |
| Dominant Taxa (3) Percent | 92.97% | 1 | | | |
| Dominant Taxa (10) Percent | 99.68% | | | | |
| *Diversity* | | | | | |
| Shannon H (loge) | 0.701 | | | | |
| Shannon H (log2) | 1.011 | | 0 | | |
| Margalef D | 1.567 | | | | |
| Simpson D | 0.720 | | | | |
| Evenness | 0.059 | | | | |
| *Function* | | | | | |
| Predator Richness | 1 | | 0 | | |
| Predator Percent | 1.28% | 1 | | | |
| Filterer Richness | 0 | | | | |
| Filterer Percent | 0.00% | | | 3 | |
| Collector Percent | 87.22% | | 1 | | 0 |
| Scraper+Shredder Percent | 11.50% | | 1 | | 0 |
| Scraper/Filterer | 0.000 | | | | |
| Scraper/Scraper+Filterer | 0.000 | | | | |
| *Habit* | | | | | |
| Burrower Richness | 0 | | | | |
| Burrower Percent | 0.00% | | | | |
| Swimmer Richness | 1 | | | | |
| Swimmer Percent | 0.96% | | | | |
| Clinger Richness | 1 | 1 | | | |
| Clinger Percent | 0.32% | | | | |
| *Characteristics* | | | | | |
| Cold Stenotherm Richness | 0 | | | | |
| Cold Stenotherm Percent | 0.00% | | | | |
| Hemoglobin Bearer Richness | | | | | |
| Hemoglobin Bearer Percent | | | | | |
| Air Breather Richness | 0 | | | | |
| Air Breather Percent | 0.00% | | | | |
| *Voltinism* | | | | | |
| Univoltine Richness | 4 | | | | |
| Semivoltine Richness | 1 | 1 | | | |
| Multivoltine Percent | 85.94% | | 0 | | |
| *Tolerance* | | | | | |
| Sediment Tolerant Richness | 0 | | | | |
| Sediment Tolerant Percent | 0.00% | | | | |
| Sediment Sensitive Richness | 0 | | | | |
| Sediment Sensitive Percent | 0.00% | | | | |
| Metals Tolerance Index | 1.355 | | | | |
| Pollution Sensitive Richness | 0 | 1 | | 0 | |
| Pollution Tolerant Percent | 5.75% | 5 | | 2 | |
| Hilsenhoff Biotic Index | 7.479 | | 0 | | 0 |
| Intolerant Percent | 3.19% | | | | |
| Supertolerant Percent | 87.86% | | | | |
| CTQa | 94.571 | | | | |

### Bioassessment Indices

| BioIndex | Description | Score | Pct | Rating |
|---|---|---|---|---|
| BIBI | B-IBI (Karr et al.) | 14 | 28.00% | |
| MTP | Montana DEQ Plains (Bukantis 1998) | 2 | 6.67% | Severe |
| MTV | Montana Revised Valleys/Foothills (Bollman 1998) | 5 | 27.78% | Moderate |
| MTM | Montana DEQ Mountains (Bukantis 1998) | 0 | 0.00% | Severe |




**Friday, January 28, 2011**

**Figure A-22**
**Fall 2010 Macroinvertebrate Metric Results for Swallow**

# Metrics Report

**Project ID:** SNWA10CW
**RAI No.:** SNWA10CW010
**Sta. Name:** UN: Sample 455
**Client ID:** Unnamed #1 Spring
**STORET ID:**
**Coll. Date:**

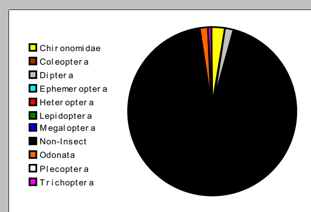
## Abundance Measures

**Sample Count:** 326
**Sample Abundance:** 2,794.29 11.67% of sample used

**Coll. Procedure:**
**Sample Notes:** Spring 2010

## Taxonomic Composition

| Category | R | A | PRA |
|---|---|---|---|
| Non-Insect | 8 | 305 | 93.56% |
| Odonata | 1 | 5 | 1.53% |
| Ephemeroptera | | | |
| Plecoptera | | | |
| Heteroptera | | | |
| Megaloptera | | | |
| Trichoptera | 1 | 2 | 0.61% |
| Lepidoptera | | | |
| Coleoptera | | | |
| Diptera | 2 | 6 | 1.84% |
| Chironomidae | 4 | 8 | 2.45% |

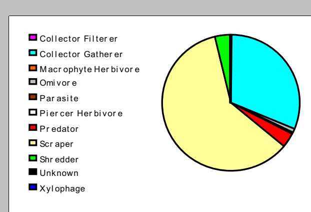



## Dominant Taxa

| Category | A | PRA |
|---|---|---|
| Hydrobiidae | 193 | 59.20% |
| Hyalella | 58 | 17.79% |
| Ostracoda | 37 | 11.35% |
| Gammarus | 11 | 3.37% |
| Sciomyzidae | 5 | 1.53% |
| Argia | 5 | 1.53% |
| Physidae | 3 | 0.92% |
| Metriocnemus | 3 | 0.92% |
| Chaetocladius | 3 | 0.92% |
| Ochrotrichia | 2 | 0.61% |
| Pseudosuccinea | 1 | 0.31% |
| Pseudochironomus | 1 | 0.31% |
| Polypedilum | 1 | 0.31% |
| Oligochaeta | 1 | 0.31% |
| Ceratopogoninae | 1 | 0.31% |

## Functional Composition

| Category | R | A | PRA |
|---|---|---|---|
| Predator | 3 | 11 | 3.37% |
| Parasite | | | |
| Collector Gatherer | 5 | 100 | 30.67% |
| Collector Filterer | 1 | 1 | 0.31% |
| Macrophyte Herbivore | | | |
| Piercer Herbivore | 1 | 2 | 0.61% |
| Xylophage | | | |
| Scraper | 3 | 197 | 60.43% |
| Shredder | 2 | 12 | 3.68% |
| Omivore | 1 | 3 | 0.92% |
| Unknown | | | |

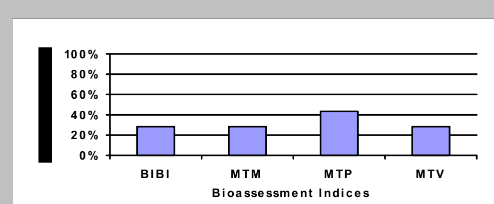



## Metric Values and Scores

| Metric | Value | BIBI | MTP | MTV | MTM |
|---|---|---|---|---|---|
| *Composition* | | | | | |
| Taxa Richness | 16 | 1 | 1 | | 0 |
| Non-Insect Percent | 93.56% | | | | |
| E Richness | 0 | 1 | | 0 | |
| P Richness | 0 | 1 | | 0 | |
| T Richness | 1 | 1 | | 0 | |
| EPT Richness | 1 | | 0 | | 0 |
| EPT Percent | 0.61% | | 0 | | 0 |
| Oligochaeta+Hirudinea Percent | 0.31% | | | | |
| Baetidae/Ephemeroptera | 0.000 | | | | |
| Hydropsychidae/Trichoptera | 0.000 | | | | |
| *Dominance* | | | | | |
| Dominant Taxon Percent | 59.20% | | 1 | | 0 |
| Dominant Taxa (2) Percent | 76.99% | | | | |
| Dominant Taxa (3) Percent | 88.34% | 1 | | | |
| Dominant Taxa (10) Percent | 98.16% | | | | |
| *Diversity* | | | | | |
| Shannon H (loge) | 1.374 | | | | |
| Shannon H (log2) | 1.982 | | 1 | | |
| Margalef D | 2.592 | | | | |
| Simpson D | 0.395 | | | | |
| Evenness | 0.099 | | | | |
| *Function* | | | | | |
| Predator Richness | 3 | | 1 | | |
| Predator Percent | 3.37% | 1 | | | |
| Filterer Richness | 1 | | | | |
| Filterer Percent | 0.31% | | | 3 | |
| Collector Percent | 30.98% | | 3 | | 3 |
| Scraper+Shredder Percent | 64.11% | | 3 | | 3 |
| Scraper/Filterer | 197.000 | | | | |
| Scraper/Scraper+Filterer | 0.995 | | | | |
| *Habit* | | | | | |
| Burrower Richness | 3 | | | | |
| Burrower Percent | 1.53% | | | | |
| Swimmer Richness | 0 | | | | |
| Swimmer Percent | 0.00% | | | | |
| Clinger Richness | 3 | 1 | | | |
| Clinger Percent | 2.45% | | | | |
| *Characteristics* | | | | | |
| Cold Stenotherm Richness | 0 | | | | |
| Cold Stenotherm Percent | 0.00% | | | | |
| Hemoglobin Bearer Richness | 2 | | | | |
| Hemoglobin Bearer Percent | 0.61% | | | | |
| Air Breather Richness | 0 | | | | |
| Air Breather Percent | 0.00% | | | | |
| *Voltinism* | | | | | |
| Univoltine Richness | 9 | | | | |
| Semivoltine Richness | 0 | 1 | | | |
| Multivoltine Percent | 14.42% | | 3 | | |
| *Tolerance* | | | | | |
| Sediment Tolerant Richness | 1 | | | | |
| Sediment Tolerant Percent | 0.31% | | | | |
| Sediment Sensitive Richness | 0 | | | | |
| Sediment Sensitive Percent | 0.00% | | | | |
| Metals Tolerance Index | 2.756 | | | | |
| Pollution Sensitive Richness | 0 | 1 | | 0 | |
| Pollution Tolerant Percent | 6.44% | 5 | | 2 | |
| Hilsenhoff Biotic Index | 7.736 | | 0 | | 0 |
| Intolerant Percent | 0.00% | | | | |
| Supertolerant Percent | 89.88% | | | | |
| CTQa | 108.154 | | | | |

## Bioassessment Indices

| BioIndex | Description | Score | Pct | Rating |
|---|---|---|---|---|
| BIBI | B-IBI (Karr et al.) | 14 | 28.00% | |
| MTP | Montana DEQ Plains (Bukantis 1998) | 13 | 43.33% | Moderate |
| MTV | Montana Revised Valleys/Foothills (Bollman 1998) | 5 | 27.78% | Moderate |
| MTM | Montana DEQ Mountains (Bukantis 1998) | 6 | 28.57% | Moderate |




Thursday, August 05, 2010

**Figure A-23**
**Spring 2010 Macroinvertebrate Metric Results for Unnamed 1 North of Big**

# Metrics Report

**Project ID:** SNWA10CW2
**RAI No.:** SNWA10CW2009
**Sta. Name:** UN: Sample 456
**Client ID:** Unnamed 1 Spring North of Big
**STORET ID:**
**Coll. Date:**

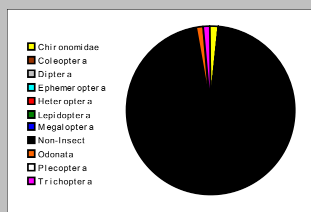
## Abundance Measures

**Sample Count:** 311
**Sample Abundance:** 18,660.00 1.67% of sample used

**Coll. Procedure:**
**Sample Notes:** Fall 2010

## Taxonomic Composition

| Category | R | A | PRA |
|---|---|---|---|
| Non-Insect | 5 | 298 | 95.82% |
| Odonata | 1 | 4 | 1.29% |
| Ephemeroptera | | | |
| Plecoptera | | | |
| Heteroptera | | | |
| Megaloptera | | | |
| Trichoptera | 1 | 4 | 1.29% |
| Lepidoptera | | | |
| Coleoptera | | | |
| Diptera | | | |
| Chironomidae | 3 | 5 | 1.61% |

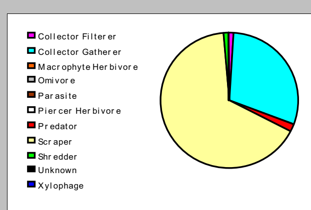



## Dominant Taxa

| Category | A | PRA |
|---|---|---|
| Hydrobiidae | 204 | 65.59% |
| Ostracoda | 53 | 17.04% |
| Hyalella | 26 | 8.36% |
| Amphipoda | 8 | 2.57% |
| Sphaeriidae | 4 | 1.29% |
| Hydroptilidae sp. (RAI Taxon # 00 | 4 | 1.29% |
| Aeshnidae | 4 | 1.29% |
| Physa | 3 | 0.96% |
| Orthocladiinae | 2 | 0.64% |
| Radotanypus | 1 | 0.32% |
| Pseudochironomus | 1 | 0.32% |
| Chaetocladius | 1 | 0.32% |

## Functional Composition

| Category | R | A | PRA |
|---|---|---|---|
| Predator | 2 | 5 | 1.61% |
| Parasite | | | |
| Collector Gatherer | 4 | 91 | 29.26% |
| Collector Filterer | 1 | 4 | 1.29% |
| Macrophyte Herbivore | | | |
| Piercer Herbivore | | | |
| Xylophage | | | |
| Scraper | 2 | 207 | 66.56% |
| Shredder | 1 | 4 | 1.29% |
| Omivore | | | |
| Unknown | | | |

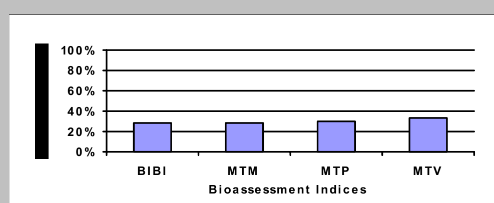



## Metric Values and Scores

| Metric | Value | BIBI | MTP | MTV | MTM |
|---|---|---|---|---|---|
| *Composition* | | | | | |
| Taxa Richness | 10 | 1 | 0 | | 0 |
| Non-Insect Percent | 95.82% | | | | |
| E Richness | 0 | 1 | | 0 | |
| P Richness | 0 | 1 | | 0 | |
| T Richness | 1 | 1 | | 0 | |
| EPT Richness | 1 | | 0 | | 0 |
| EPT Percent | 1.29% | | 0 | | 0 |
| Oligochaeta+Hirudinea Percent | | | | | |
| Baetidae/Ephemeroptera | 0.000 | | | | |
| Hydropsychidae/Trichoptera | 0.000 | | | | |
| *Dominance* | | | | | |
| Dominant Taxon Percent | 65.59% | | 0 | | 0 |
| Dominant Taxa (2) Percent | 82.64% | | | | |
| Dominant Taxa (3) Percent | 91.00% | 1 | | | |
| Dominant Taxa (10) Percent | 99.36% | | | | |
| *Diversity* | | | | | |
| Shannon H (loge) | 1.056 | | | | |
| Shannon H (log2) | 1.524 | | 0 | | |
| Margalef D | 1.577 | | | | |
| Simpson D | 0.497 | | | | |
| Evenness | 0.110 | | | | |
| *Function* | | | | | |
| Predator Richness | 2 | | 0 | | |
| Predator Percent | 1.61% | 1 | | | |
| Filterer Richness | 1 | | | | |
| Filterer Percent | 1.29% | | | 3 | |
| Collector Percent | 30.55% | | 3 | | 3 |
| Scraper+Shredder Percent | 67.85% | | 3 | | 3 |
| Scraper/Filterer | 51.750 | | | | |
| Scraper/Scraper+Filterer | 0.981 | | | | |
| *Habit* | | | | | |
| Burrower Richness | 1 | | | | |
| Burrower Percent | 0.32% | | | | |
| Swimmer Richness | 0 | | | | |
| Swimmer Percent | 0.00% | | | | |
| Clinger Richness | 0 | 1 | | | |
| Clinger Percent | 0.00% | | | | |
| *Characteristics* | | | | | |
| Cold Stenotherm Richness | 0 | | | | |
| Cold Stenotherm Percent | 0.00% | | | | |
| Hemoglobin Bearer Richness | 2 | | | | |
| Hemoglobin Bearer Percent | 0.64% | | | | |
| Air Breather Richness | 0 | | | | |
| Air Breather Percent | 0.00% | | | | |
| *Voltinism* | | | | | |
| Univoltine Richness | 4 | | | | |
| Semivoltine Richness | 1 | 1 | | | |
| Multivoltine Percent | 18.65% | | 3 | | |
| *Tolerance* | | | | | |
| Sediment Tolerant Richness | 0 | | | | |
| Sediment Tolerant Percent | 0.00% | | | | |
| Sediment Sensitive Richness | 0 | | | | |
| Sediment Sensitive Percent | 0.00% | | | | |
| Metals Tolerance Index | 3.032 | | | | |
| Pollution Sensitive Richness | 0 | 1 | | 0 | |
| Pollution Tolerant Percent | 2.25% | 5 | | 3 | |
| Hilsenhoff Biotic Index | 7.824 | | 0 | | 0 |
| Intolerant Percent | 0.00% | | | | |
| Supertolerant Percent | 93.25% | | | | |
| CTQa | 100.800 | | | | |

## Bioassessment Indices

| BioIndex | Description | Score | Pct | Rating |
|---|---|---|---|---|
| BIBI | B-IBI (Karr et al.) | 14 | 28.00% | |
| MTP | Montana DEQ Plains (Bukantis 1998) | 9 | 30.00% | Moderate |
| MTV | Montana Revised Valleys/Foothills (Bollman 1998) | 6 | 33.33% | Moderate |
| MTM | Montana DEQ Mountains (Bukantis 1998) | 6 | 28.57% | Moderate |




Friday, January 28, 2011

**Figure A-24**
**Fall 2010 Macroinvertebrate Metric Results for Unnamed 1 North of Big**

# Metrics Report

**Project ID:** SNWA10CW
**RAI No.:** SNWA10CW007
**Sta. Name:** U5: Sample 108-111
**Client ID:** Unnamed #5 Spring
**STORET ID:**
**Coll. Date:**

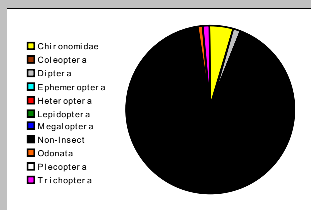
### *Abundance Measures*

**Sample Count:** 300
**Sample Abundance:** 1,714.29 17.50% of sample used

**Coll. Procedure:**
**Sample Notes:** Spring 2010

### *Taxonomic Composition*

| Category | R | A | PRA |
|---|---|---|---|
| Non-Insect | 8 | 275 | 91.67% |
| Odonata | 2 | 3 | 1.00% |
| Ephemeroptera | | | |
| Plecoptera | | | |
| Heteroptera | | | |
| Megaloptera | | | |
| Trichoptera | 1 | 4 | 1.33% |
| Lepidoptera | | | |
| Coleoptera | | | |
| Diptera | 2 | 5 | 1.67% |
| Chironomidae | 10 | 13 | 4.33% |

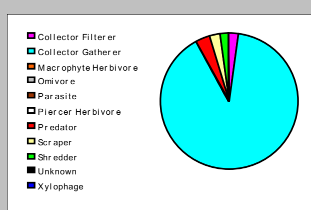



### *Dominant Taxa*

| Category | A | PRA |
|---|---|---|
| Ostracoda | 132 | 44.00% |
| Hyalella | 128 | 42.67% |
| Sphaeriidae | 6 | 2.00% |
| Physidae | 4 | 1.33% |
| Limnephilidae | 4 | 1.33% |
| Procladius | 3 | 1.00% |
| Dasyhelea | 2 | 0.67% |
| Coenagrionidae | 2 | 0.67% |
| Ceratopogoninae | 2 | 0.67% |
| Planorbidae | 1 | 0.33% |
| Paratendipes | 1 | 0.33% |
| Paratanytarsus | 1 | 0.33% |
| Paramerina | 1 | 0.33% |
| Helobdella stagnalis | 1 | 0.33% |
| Gyraulus | 1 | 0.33% |

### *Functional Composition*

| Category | R | A | PRA |
|---|---|---|---|
| Predator | 5 | 10 | 3.33% |
| Parasite | | | |
| Collector Gatherer | 11 | 270 | 90.00% |
| Collector Filterer | 1 | 7 | 2.33% |
| Macrophyte Herbivore | | | |
| Piercer Herbivore | | | |
| Xylophage | | | |
| Scraper | 3 | 7 | 2.33% |
| Shredder | 3 | 6 | 2.00% |
| Omivore | | | |
| Unknown | | | |

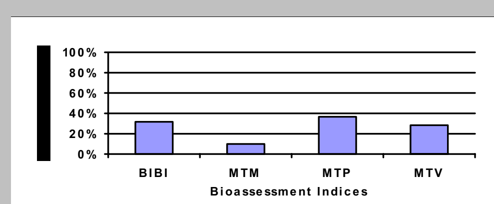



### *Metric Values and Scores*

| Metric | Value | BIBI | MTP | MTV | MTM |
|---|---|---|---|---|---|
| *Composition* | | | | | |
| Taxa Richness | 23 | 3 | 2 | | 1 |
| Non-Insect Percent | 91.67% | | | | |
| E Richness | 0 | 1 | | 0 | |
| P Richness | 0 | 1 | | 0 | |
| T Richness | 1 | 1 | | 0 | |
| EPT Richness | 1 | | 0 | | 0 |
| EPT Percent | 1.33% | | 0 | | 0 |
| Oligochaeta+Hirudinea Percent | 0.33% | | | | |
| Baetidae/Ephemeroptera | 0.000 | | | | |
| Hydropsychidae/Trichoptera | 0.000 | | | | |
| *Dominance* | | | | | |
| Dominant Taxon Percent | 44.00% | | 2 | | 1 |
| Dominant Taxa (2) Percent | 86.67% | | | | |
| Dominant Taxa (3) Percent | 88.67% | 1 | | | |
| Dominant Taxa (10) Percent | 94.67% | | | | |
| *Diversity* | | | | | |
| Shannon H (loge) | 1.320 | | | | |
| Shannon H (log2) | 1.905 | | 1 | | |
| Margalef D | 3.866 | | | | |
| Simpson D | 0.385 | | | | |
| Evenness | 0.103 | | | | |
| *Function* | | | | | |
| Predator Richness | 5 | | 2 | | |
| Predator Percent | 3.33% | 1 | | | |
| Filterer Richness | 1 | | | | |
| Filterer Percent | 2.33% | | | 3 | |
| Collector Percent | 92.33% | | 1 | | 0 |
| Scraper+Shredder Percent | 4.33% | | 1 | | 0 |
| Scraper/Filterer | 1.000 | | | | |
| Scraper/Scraper+Filterer | 0.500 | | | | |
| *Habit* | | | | | |
| Burrower Richness | 4 | | | | |
| Burrower Percent | 2.00% | | | | |
| Swimmer Richness | 0 | | | | |
| Swimmer Percent | 0.00% | | | | |
| Clinger Richness | 2 | 1 | | | |
| Clinger Percent | 0.67% | | | | |
| *Characteristics* | | | | | |
| Cold Stenotherm Richness | 0 | | | | |
| Cold Stenotherm Percent | 0.00% | | | | |
| Hemoglobin Bearer Richness | 8 | | | | |
| Hemoglobin Bearer Percent | 3.67% | | | | |
| Air Breather Richness | 0 | | | | |
| Air Breather Percent | 0.00% | | | | |
| *Voltinism* | | | | | |
| Univoltine Richness | 11 | | | | |
| Semivoltine Richness | 0 | 1 | | | |
| Multivoltine Percent | 48.33% | | 2 | | |
| *Tolerance* | | | | | |
| Sediment Tolerant Richness | 1 | | | | |
| Sediment Tolerant Percent | 0.67% | | | | |
| Sediment Sensitive Richness | 0 | | | | |
| Sediment Sensitive Percent | 0.00% | | | | |
| Metals Tolerance Index | 3.058 | | | | |
| Pollution Sensitive Richness | 0 | 1 | | 0 | |
| Pollution Tolerant Percent | 5.67% | 5 | | 2 | |
| Hilsenhoff Biotic Index | 7.875 | | 0 | | 0 |
| Intolerant Percent | 0.00% | | | | |
| Supertolerant Percent | 93.00% | | | | |
| CTQa | 108.000 | | | | |

### *Bioassessment Indices*

| BioIndex | Description | Score | Pct | Rating |
|---|---|---|---|---|
| BIBI | B-IBI (Karr et al.) | 16 | 32.00% | |
| MTP | Montana DEQ Plains (Bukantis 1998) | 11 | 36.67% | Moderate |
| MTV | Montana Revised Valleys/Foothills (Bollman 1998) | 5 | 27.78% | Moderate |
| MTM | Montana DEQ Mountains (Bukantis 1998) | 2 | 9.52% | Severe |




**Thursday, August 05, 2010**

**Figure A-25**
**Spring 2010 Macroinvertebrate Metric Results for Unnamed 5**

# Metrics Report

**Project ID:** SNWA10CW2
**RAI No.:** SNWA10CW2003
**Sta. Name:** U5: Sample 112
**Client ID:** Unnamed 5
**STORET ID:**
**Coll. Date:**

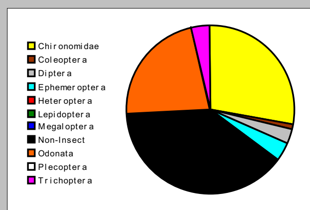
### Abundance Measures

**Sample Count:** 306
**Sample Abundance:** 2,622.86 11.67% of sample used

**Coll. Procedure:**
**Sample Notes:** Fall 2010

### Taxonomic Composition

| Category | R | A | PRA |
|---|---|---|---|
| Non-Insect | 10 | 117 | 38.24% |
| Odonata | 3 | 69 | 22.55% |
| Ephemeroptera | 1 | 11 | 3.59% |
| Plecoptera | | | |
| Heteroptera | 1 | 1 | 0.33% |
| Megaloptera | | | |
| Trichoptera | 1 | 11 | 3.59% |
| Lepidoptera | | | |
| Coleoptera | 2 | 3 | 0.98% |
| Diptera | 5 | 9 | 2.94% |
| Chironomidae | 15 | 85 | 27.78% |

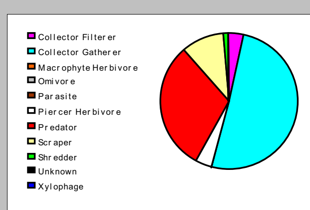



### Dominant Taxa

| Category | A | PRA |
|---|---|---|
| Coenagrionidae | 61 | 19.93% |
| Hyalella | 45 | 14.71% |
| Ostracoda | 31 | 10.13% |
| Gyraulus | 24 | 7.84% |
| Tanypodinae | 15 | 4.90% |
| Pseudochironomus | 15 | 4.90% |
| Orthocladius | 15 | 4.90% |
| Callibaetis | 11 | 3.59% |
| Oxyethira | 10 | 3.27% |
| Acricotopus | 9 | 2.94% |
| Argia | 7 | 2.29% |
| Sphaeriidae | 5 | 1.63% |
| Paratanytarsus | 5 | 1.63% |
| Corynoneura | 5 | 1.63% |
| Hydrobiidae | 4 | 1.31% |

### Functional Composition

| Category | R | A | PRA |
|---|---|---|---|
| Predator | 11 | 94 | 30.72% |
| Parasite | | | |
| Collector Gatherer | 17 | 155 | 50.65% |
| Collector Filterer | 4 | 11 | 3.59% |
| Macrophyte Herbivore | | | |
| Piercer Herbivore | 1 | 11 | 3.59% |
| Xylophage | | | |
| Scraper | 3 | 32 | 10.46% |
| Shredder | 2 | 3 | 0.98% |
| Omivore | | | |
| Unknown | | | |

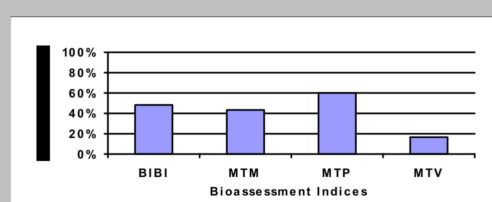



### Metric Values and Scores

| Metric | Value | BIBI | MTP | MTV | MTM |
|---|---|---|---|---|---|
| *Composition* | | | | | |
| Taxa Richness | 38 | 3 | 3 | | 3 |
| Non-Insect Percent | 38.24% | | | | |
| E Richness | 1 | 1 | | 0 | |
| P Richness | 0 | 1 | | 0 | |
| T Richness | 1 | 1 | | 0 | |
| EPT Richness | 2 | | 0 | | 0 |
| EPT Percent | 7.19% | | 0 | | 0 |
| Oligochaeta+Hirudinea Percent | 0.33% | | | | |
| Baetidae/Ephemeroptera | 1.000 | | | | |
| Hydropsychidae/Trichoptera | 0.000 | | | | |
| *Dominance* | | | | | |
| Dominant Taxon Percent | 19.93% | | 3 | | 3 |
| Dominant Taxa (2) Percent | 34.64% | | | | |
| Dominant Taxa (3) Percent | 44.77% | 5 | | | |
| Dominant Taxa (10) Percent | 77.12% | | | | |
| *Diversity* | | | | | |
| Shannon H (loge) | 2.762 | | | | |
| Shannon H (log2) | 3.984 | | 3 | | |
| Margalef D | 6.550 | | | | |
| Simpson D | 0.099 | | | | |
| Evenness | 0.055 | | | | |
| *Function* | | | | | |
| Predator Richness | 11 | | 3 | | |
| Predator Percent | 30.72% | 5 | | | |
| Filterer Richness | 4 | | | | |
| Filterer Percent | 3.59% | | | 3 | |
| Collector Percent | 54.25% | | 3 | | 3 |
| Scraper+Shredder Percent | 11.44% | | 1 | | 0 |
| Scraper/Filterer | 2.909 | | | | |
| Scraper/Scraper+Filterer | 0.744 | | | | |
| *Habit* | | | | | |
| Burrower Richness | 4 | | | | |
| Burrower Percent | 6.54% | | | | |
| Swimmer Richness | 4 | | | | |
| Swimmer Percent | 5.56% | | | | |
| Clinger Richness | 2 | 1 | | | |
| Clinger Percent | 0.98% | | | | |
| *Characteristics* | | | | | |
| Cold Stenotherm Richness | 0 | | | | |
| Cold Stenotherm Percent | 0.00% | | | | |
| Hemoglobin Bearer Richness | 8 | | | | |
| Hemoglobin Bearer Percent | 16.01% | | | | |
| Air Breather Richness | 2 | | | | |
| Air Breather Percent | 0.98% | | | | |
| *Voltinism* | | | | | |
| Univoltine Richness | 14 | | | | |
| Semivoltine Richness | 3 | 3 | | | |
| Multivoltine Percent | 45.75% | | 2 | | |
| *Tolerance* | | | | | |
| Sediment Tolerant Richness | 2 | | | | |
| Sediment Tolerant Percent | 8.17% | | | | |
| Sediment Sensitive Richness | 0 | | | | |
| Sediment Sensitive Percent | 0.00% | | | | |
| Metals Tolerance Index | 3.112 | | | | |
| Pollution Sensitive Richness | 0 | 1 | | 0 | |
| Pollution Tolerant Percent | 41.83% | 3 | | 0 | |
| Hilsenhoff Biotic Index | 7.169 | | 0 | | 0 |
| Intolerant Percent | 0.00% | | | | |
| Supertolerant Percent | 47.39% | | | | |
| CTQa | 105.333 | | | | |

### Bioassessment Indices

| BioIndex | Description | Score | Pct | Rating |
|---|---|---|---|---|
| BIBI | B-IBI (Karr et al.) | 24 | 48.00% | |
| MTP | Montana DEQ Plains (Bukantis 1998) | 18 | 60.00% | Slight |
| MTV | Montana Revised Valleys/Foothills (Bollman 1998) | 3 | 16.67% | Severe |
| MTM | Montana DEQ Mountains (Bukantis 1998) | 9 | 42.86% | Moderate |




**Friday, January 28, 2011**

**Figure A-26**
**Fall 2010 Macroinvertebrate Metric Results for Unnamed 5**

# Metrics Report

**Project ID:** SNWA10CW
**RAI No.:** SNWA10CW008
**Sta. Name:** WV: Sample 309-311
**Client ID:** West Spring Complex
**STORET ID:**
**Coll. Date:**

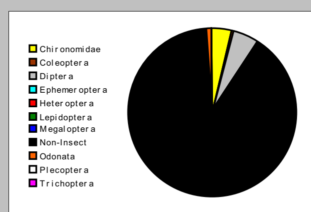
### *Abundance Measures*

**Sample Count:** 328
**Sample Abundance:** 2,186.67 15.00% of sample used

**Coll. Procedure:**
**Sample Notes:** Spring 2010

### *Taxonomic Composition*

| Category | R | A | PRA |
|---|---|---|---|
| Non-Insect | 10 | 294 | 89.63% |
| Odonata | 1 | 3 | 0.91% |
| Ephemeroptera | | | |
| Plecoptera | | | |
| Heteroptera | | | |
| Megaloptera | | | |
| Trichoptera | | | |
| Lepidoptera | | | |
| Coleoptera | 1 | 1 | 0.30% |
| Diptera | 2 | 17 | 5.18% |
| Chironomidae | 8 | 13 | 3.96% |

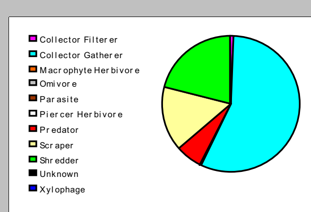



### *Dominant Taxa*

| Category | A | PRA |
|---|---|---|
| Ostracoda | 133 | 40.55% |
| Gammarus | 65 | 19.82% |
| Hyalella | 36 | 10.98% |
| Hydrobiidae | 26 | 7.93% |
| Physidae | 19 | 5.79% |
| Ceratopogoninae | 11 | 3.35% |
| Bezzia / Palpomyia | 5 | 1.52% |
| Glossiphoniidae | 4 | 1.22% |
| Stagnicola | 3 | 0.91% |
| Sphaeriidae | 3 | 0.91% |
| Coenagrionidae | 3 | 0.91% |
| Chaetocladius | 3 | 0.91% |
| Tanypodinae | 2 | 0.61% |
| Cricotopus (Cricotopus) | 2 | 0.61% |
| Amphipoda | 2 | 0.61% |

### *Functional Composition*

| Category | R | A | PRA |
|---|---|---|---|
| Predator | 3 | 20 | 6.10% |
| Parasite | 1 | 1 | 0.30% |
| Collector Gatherer | 9 | 184 | 56.10% |
| Collector Filterer | 1 | 3 | 0.91% |
| Macrophyte Herbivore | | | |
| Piercer Herbivore | | | |
| Xylophage | | | |
| Scraper | 4 | 50 | 15.24% |
| Shredder | 3 | 69 | 21.04% |
| Omivore | 1 | 1 | 0.30% |
| Unknown | | | |

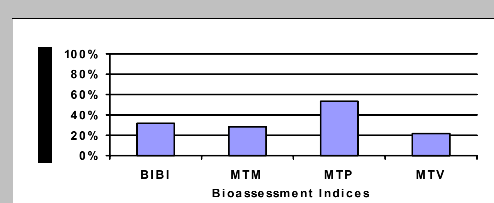



### *Metric Values and Scores*

| Metric | Value | BIBI | MTP | MTV | MTM |
|---|---|---|---|---|---|
| *Composition* | | | | | |
| Taxa Richness | 22 | 3 | 2 | | 1 |
| Non-Insect Percent | 89.63% | | | | |
| E Richness | 0 | 1 | | 0 | |
| P Richness | 0 | 1 | | 0 | |
| T Richness | 0 | 1 | | 0 | |
| EPT Richness | 0 | | 0 | | 0 |
| EPT Percent | 0.00% | | 0 | | 0 |
| Oligochaeta+Hirudinea Percent | 1.22% | | | | |
| Baetidae/Ephemeroptera | 0.000 | | | | |
| Hydropsychidae/Trichoptera | 0.000 | | | | |
| *Dominance* | | | | | |
| Dominant Taxon Percent | 40.55% | | 2 | | 1 |
| Dominant Taxa (2) Percent | 60.37% | | | | |
| Dominant Taxa (3) Percent | 71.34% | 3 | | | |
| Dominant Taxa (10) Percent | 92.99% | | | | |
| *Diversity* | | | | | |
| Shannon H (loge) | 1.868 | | | | |
| Shannon H (log2) | 2.695 | | 2 | | |
| Margalef D | 3.651 | | | | |
| Simpson D | 0.243 | | | | |
| Evenness | 0.091 | | | | |
| *Function* | | | | | |
| Predator Richness | 3 | | 1 | | |
| Predator Percent | 6.10% | 1 | | | |
| Filterer Richness | 1 | | | | |
| Filterer Percent | 0.91% | | | 3 | |
| Collector Percent | 57.01% | | 3 | | 3 |
| Scraper+Shredder Percent | 36.28% | | 3 | | 1 |
| Scraper/Filterer | 16.667 | | | | |
| Scraper/Scraper+Filterer | 0.943 | | | | |
| *Habit* | | | | | |
| Burrower Richness | 4 | | | | |
| Burrower Percent | 5.79% | | | | |
| Swimmer Richness | 0 | | | | |
| Swimmer Percent | 0.00% | | | | |
| Clinger Richness | 2 | 1 | | | |
| Clinger Percent | 1.22% | | | | |
| *Characteristics* | | | | | |
| Cold Stenotherm Richness | 0 | | | | |
| Cold Stenotherm Percent | 0.00% | | | | |
| Hemoglobin Bearer Richness | 4 | | | | |
| Hemoglobin Bearer Percent | 1.83% | | | | |
| Air Breather Richness | 1 | | | | |
| Air Breather Percent | 0.30% | | | | |
| *Voltinism* | | | | | |
| Univoltine Richness | 11 | | | | |
| Semivoltine Richness | 1 | 1 | | | |
| Multivoltine Percent | 44.82% | | 2 | | |
| *Tolerance* | | | | | |
| Sediment Tolerant Richness | 2 | | | | |
| Sediment Tolerant Percent | 1.52% | | | | |
| Sediment Sensitive Richness | 0 | | | | |
| Sediment Sensitive Percent | 0.00% | | | | |
| Metals Tolerance Index | 2.278 | | | | |
| Pollution Sensitive Richness | 0 | 1 | | 0 | |
| Pollution Tolerant Percent | 28.66% | 3 | | 1 | |
| Hilsenhoff Biotic Index | 6.997 | | 1 | | 0 |
| Intolerant Percent | 0.00% | | | | |
| Supertolerant Percent | 68.60% | | | | |
| CTQa | 108.000 | | | | |

### *Bioassessment Indices*

| BioIndex | Description | Score | Pct | Rating |
|---|---|---|---|---|
| BIBI | B-IBI (Karr et al.) | 16 | 32.00% | |
| MTP | Montana DEQ Plains (Bukantis 1998) | 16 | 53.33% | Moderate |
| MTV | Montana Revised Valleys/Foothills (Bollman 1998) | 4 | 22.22% | Moderate |
| MTM | Montana DEQ Mountains (Bukantis 1998) | 6 | 28.57% | Moderate |




**Thursday, August 05, 2010**

**Figure A-27**
**Spring 2010 Macroinvertebrate Metric Results for West Spring Valley Complex**

# Metrics Report

**Project ID:** SNWA10CW2
**RAI No.:** SNWA10CW2006
**Sta. Name:** WV: Sample 312-314
**Client ID:** West Spring Valley Complex
**STORET ID:**
**Coll. Date:**

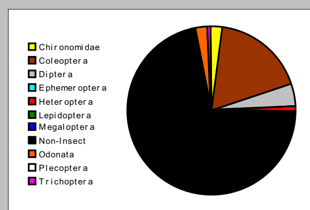
### Abundance Measures

**Sample Count:** 310
**Sample Abundance:** 1,328.57 23.33% of sample used

**Coll. Procedure:**
**Sample Notes:** Fall 2010

### Taxonomic Composition

| Category | R | A | PRA |
|---|---|---|---|
| Non-Insect | 7 | 223 | 71.94% |
| Odonata | 1 | 7 | 2.26% |
| Ephemeroptera | | | |
| Plecoptera | | | |
| Heteroptera | 2 | 2 | 0.65% |
| Megaloptera | | | |
| Trichoptera | 1 | 2 | 0.65% |
| Lepidoptera | | | |
| Coleoptera | 7 | 55 | 17.74% |
| Diptera | 1 | 14 | 4.52% |
| Chironomidae | 2 | 7 | 2.26% |

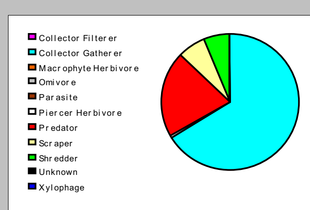



### Dominant Taxa

| Category | A | PRA |
|---|---|---|
| Hyalella | 106 | 34.19% |
| Ostracoda | 51 | 16.45% |
| Liodessus | 41 | 13.23% |
| Amphipoda | 28 | 9.03% |
| Gammarus | 17 | 5.48% |
| Ephydridae | 14 | 4.52% |
| Hydrobiidae | 13 | 4.19% |
| Paracymus | 7 | 2.26% |
| Orthocladius | 6 | 1.94% |
| Physa | 5 | 1.61% |
| Argia | 5 | 1.61% |
| Tropisternus | 2 | 0.65% |
| Fossaria | 2 | 0.65% |
| Coenagrionidae | 2 | 0.65% |
| Notonecta | 1 | 0.32% |

### Functional Composition

| Category | R | A | PRA |
|---|---|---|---|
| Predator | 9 | 63 | 20.32% |
| Parasite | | | |
| Collector Gatherer | 4 | 205 | 66.13% |
| Collector Filterer | | | |
| Macrophyte Herbivore | | | |
| Piercer Herbivore | 1 | 2 | 0.65% |
| Xylophage | | | |
| Scraper | 4 | 21 | 6.77% |
| Shredder | 3 | 19 | 6.13% |
| Omivore | | | |
| Unknown | | | |

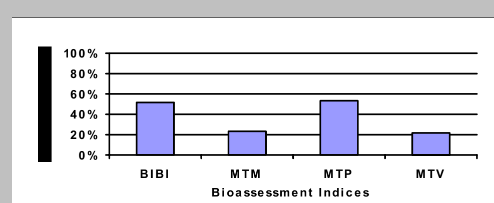



### Metric Values and Scores

| Metric | Value | BIBI | MTP | MTV | MTM |
|---|---|---|---|---|---|
| *Composition* | | | | | |
| Taxa Richness | 21 | 3 | 2 | | 1 |
| Non-Insect Percent | 71.94% | | | | |
| E Richness | 0 | 1 | | 0 | |
| P Richness | 0 | 1 | | 0 | |
| T Richness | 1 | 1 | | 0 | |
| EPT Richness | 1 | | 0 | | 0 |
| EPT Percent | 0.65% | | 0 | | 0 |
| Oligochaeta+Hirudinea Percent | | | | | |
| Baetidae/Ephemeroptera | 0.000 | | | | |
| Hydropsychidae/Trichoptera | 0.000 | | | | |
| *Dominance* | | | | | |
| Dominant Taxon Percent | 34.19% | | 2 | | 2 |
| Dominant Taxa (2) Percent | 50.65% | | | | |
| Dominant Taxa (3) Percent | 63.87% | 3 | | | |
| Dominant Taxa (10) Percent | 92.90% | | | | |
| *Diversity* | | | | | |
| Shannon H (loge) | 1.999 | | | | |
| Shannon H (log2) | 2.884 | | 2 | | |
| Margalef D | 3.554 | | | | |
| Simpson D | 0.208 | | | | |
| Evenness | 0.089 | | | | |
| *Function* | | | | | |
| Predator Richness | 9 | | 3 | | |
| Predator Percent | 20.32% | 5 | | | |
| Filterer Richness | 0 | | | | |
| Filterer Percent | 0.00% | | | 3 | |
| Collector Percent | 66.13% | | 2 | | 2 |
| Scraper+Shredder Percent | 12.90% | | 1 | | 0 |
| Scraper/Filterer | 0.000 | | | | |
| Scraper/Scraper+Filterer | 0.000 | | | | |
| *Habit* | | | | | |
| Burrower Richness | 2 | | | | |
| Burrower Percent | 6.77% | | | | |
| Swimmer Richness | 8 | | | | |
| Swimmer Percent | 15.81% | | | | |
| Clinger Richness | 0 | 1 | | | |
| Clinger Percent | 0.32% | | | | |
| *Characteristics* | | | | | |
| Cold Stenotherm Richness | 0 | | | | |
| Cold Stenotherm Percent | 0.00% | | | | |
| Hemoglobin Bearer Richness | 2 | | | | |
| Hemoglobin Bearer Percent | 0.65% | | | | |
| Air Breather Richness | 6 | | | | |
| Air Breather Percent | 17.42% | | | | |
| *Voltinism* | | | | | |
| Univoltine Richness | 10 | | | | |
| Semivoltine Richness | 7 | 5 | | | |
| Multivoltine Percent | 19.03% | | 3 | | |
| *Tolerance* | | | | | |
| Sediment Tolerant Richness | 2 | | | | |
| Sediment Tolerant Percent | 0.97% | | | | |
| Sediment Sensitive Richness | 0 | | | | |
| Sediment Sensitive Percent | 0.00% | | | | |
| Metals Tolerance Index | 2.913 | | | | |
| Pollution Sensitive Richness | 0 | 1 | | 0 | |
| Pollution Tolerant Percent | 10.97% | 5 | | 1 | |
| Hilsenhoff Biotic Index | 6.693 | | 1 | | 0 |
| Intolerant Percent | 0.00% | | | | |
| Supertolerant Percent | 57.10% | | | | |
| CTQa | 100.000 | | | | |

### Bioassessment Indices

| BioIndex | Description | Score | Pct | Rating |
|---|---|---|---|---|
| BIBI | B-IBI (Karr et al.) | 26 | 52.00% | |
| MTP | Montana DEQ Plains (Bukantis 1998) | 16 | 53.33% | Moderate |
| MTV | Montana Revised Valleys/Foothills (Bollman 1998) | 4 | 22.22% | Moderate |
| MTM | Montana DEQ Mountains (Bukantis 1998) | 5 | 23.81% | Moderate |




Friday, January 28, 2011

**Figure A-28**
**Fall 2010 Macroinvertebrate Metric Results for West Spring Valley Complex**

# Metrics Report

**Project ID:** SNWA10CW
**RAI No.:** SNWA10CW009
**Sta. Name:** WS: Sample 257
**Client ID:** Willow Spring
**STORET ID:**
**Coll. Date:**

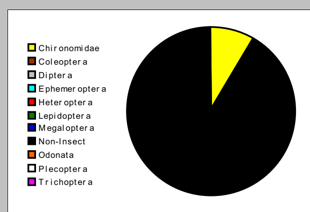
## *Abundance Measures*

**Sample Count:** 321
**Sample Abundance:** 1,926.00 16.67% of sample used

**Coll. Procedure:**
**Sample Notes:** Spring 2010

## *Taxonomic Composition*

| Category | R | A | PRA |
|---|---|---|---|
| Non-Insect | 6 | 294 | 91.59% |
| Odonata | | | |
| Ephemeroptera | | | |
| Plecoptera | | | |
| Heteroptera | | | |
| Megaloptera | | | |
| Trichoptera | | | |
| Lepidoptera | | | |
| Coleoptera | | | |
| Diptera | | | |
| Chironomidae | 5 | 27 | 8.41% |

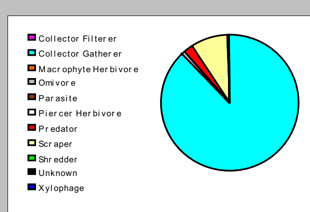



## *Dominant Taxa*

| Category | A | PRA |
|---|---|---|
| Hyalella | 221 | 68.85% |
| Ostracoda | 40 | 12.46% |
| Hydrobiidae | 27 | 8.41% |
| Chaetocladius | 21 | 6.54% |
| Arrenurus | 4 | 1.25% |
| Metriocnemus | 2 | 0.62% |
| Apsectrotanypus | 2 | 0.62% |
| Thienemannimyia Gr. | 1 | 0.31% |
| Polypedilum | 1 | 0.31% |
| Fossaria | 1 | 0.31% |
| Erpobdellidae | 1 | 0.31% |

## *Functional Composition*

| Category | R | A | PRA |
|---|---|---|---|
| Predator | 4 | 8 | 2.49% |
| Parasite | | | |
| Collector Gatherer | 3 | 282 | 87.85% |
| Collector Filterer | | | |
| Macrophyte Herbivore | | | |
| Piercer Herbivore | | | |
| Xylophage | | | |
| Scraper | 2 | 28 | 8.72% |
| Shredder | 1 | 1 | 0.31% |
| Omivore | 1 | 2 | 0.62% |
| Unknown | | | |

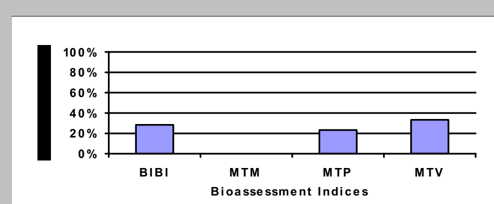



## *Metric Values and Scores*

| Metric | Value | BIBI | MTP | MTV | MTM |
|---|---|---|---|---|---|
| *Composition* | | | | | |
| Taxa Richness | 11 | 1 | 0 | | 0 |
| Non-Insect Percent | 91.59% | | | | |
| E Richness | 0 | 1 | | 0 | |
| P Richness | 0 | 1 | | 0 | |
| T Richness | 0 | 1 | | 0 | |
| EPT Richness | 0 | | 0 | | 0 |
| EPT Percent | 0.00% | | 0 | | 0 |
| Oligochaeta+Hirudinea Percent | 0.31% | | | | |
| Baetidae/Ephemeroptera | 0.000 | | | | |
| Hydropsychidae/Trichoptera | 0.000 | | | | |
| *Dominance* | | | | | |
| Dominant Taxon Percent | 68.85% | | 0 | | 0 |
| Dominant Taxa (2) Percent | 81.31% | | | | |
| Dominant Taxa (3) Percent | 89.72% | 1 | | | |
| Dominant Taxa (10) Percent | 99.69% | | | | |
| *Diversity* | | | | | |
| Shannon H (loge) | 1.093 | | | | |
| Shannon H (log2) | 1.577 | | 0 | | |
| Margalef D | 1.733 | | | | |
| Simpson D | 0.500 | | | | |
| Evenness | 0.100 | | | | |
| *Function* | | | | | |
| Predator Richness | 4 | | 2 | | |
| Predator Percent | 2.49% | 1 | | | |
| Filterer Richness | 0 | | | | |
| Filterer Percent | 0.00% | | | 3 | |
| Collector Percent | 87.85% | | 1 | | 0 |
| Scraper+Shredder Percent | 9.03% | | 1 | | 0 |
| Scraper/Filterer | 0.000 | | | | |
| Scraper/Scraper+Filterer | 0.000 | | | | |
| *Habit* | | | | | |
| Burrower Richness | 2 | | | | |
| Burrower Percent | 1.25% | | | | |
| Swimmer Richness | 0 | | | | |
| Swimmer Percent | 0.00% | | | | |
| Clinger Richness | 1 | 1 | | | |
| Clinger Percent | 0.31% | | | | |
| *Characteristics* | | | | | |
| Cold Stenotherm Richness | 0 | | | | |
| Cold Stenotherm Percent | 0.00% | | | | |
| Hemoglobin Bearer Richness | 2 | | | | |
| Hemoglobin Bearer Percent | 0.93% | | | | |
| Air Breather Richness | 0 | | | | |
| Air Breather Percent | 0.00% | | | | |
| *Voltinism* | | | | | |
| Univoltine Richness | 3 | | | | |
| Semivoltine Richness | 0 | 1 | | | |
| Multivoltine Percent | 22.12% | | 3 | | |
| *Tolerance* | | | | | |
| Sediment Tolerant Richness | 1 | | | | |
| Sediment Tolerant Percent | 0.31% | | | | |
| Sediment Sensitive Richness | 0 | | | | |
| Sediment Sensitive Percent | 0.00% | | | | |
| Metals Tolerance Index | 3.009 | | | | |
| Pollution Sensitive Richness | 0 | 1 | | 0 | |
| Pollution Tolerant Percent | 0.31% | 5 | | 3 | |
| Hilsenhoff Biotic Index | 7.833 | | 0 | | 0 |
| Intolerant Percent | 0.00% | | | | |
| Supertolerant Percent | 90.65% | | | | |
| CTQa | 108.000 | | | | |

## *Bioassessment Indices*

| BioIndex | Description | Score | Pct | Rating |
|---|---|---|---|---|
| BIBI | B-IBI (Karr et al.) | 14 | 28.00% | |
| MTP | Montana DEQ Plains (Bukantis 1998) | 7 | 23.33% | Moderate |
| MTV | Montana Revised Valleys/Foothills (Bollman 1998) | 6 | 33.33% | Moderate |
| MTM | Montana DEQ Mountains (Bukantis 1998) | 0 | 0.00% | Severe |




**Thursday, August 05, 2010**

**Figure A-29**
**Spring 2010 Macroinvertebrate Metric Results for Willow**

# Metrics Report

**Project ID:** SNWA10CW2
**RAI No.:** SNWA10CW2005
**Sta. Name:** WS: Sample 258
**Client ID:** Willow Spring
**STORET ID:**
**Coll. Date:**

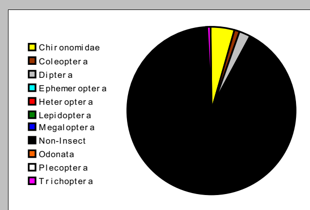
### Abundance Measures

**Sample Count:** 312
**Sample Abundance:** 1,337.14 23.33% of sample used

**Coll. Procedure:**
**Sample Notes:** Fall 2010

### Taxonomic Composition

| Category | R | A | PRA |
|---|---|---|---|
| Non-Insect | 6 | 285 | 91.35% |
| Odonata | 1 | 1 | 0.32% |
| Ephemeroptera | | | |
| Plecoptera | | | |
| Heteroptera | | | |
| Megaloptera | | | |
| Trichoptera | 2 | 2 | 0.64% |
| Lepidoptera | | | |
| Coleoptera | 2 | 2 | 0.64% |
| Diptera | 3 | 7 | 2.24% |
| Chironomidae | 9 | 15 | 4.81% |

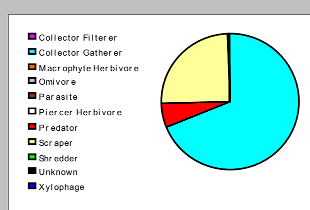



### Dominant Taxa

| Category | A | PRA |
|---|---|---|
| Hyalella | 165 | 52.88% |
| Hydrobiidae | 77 | 24.68% |
| Ostracoda | 38 | 12.18% |
| Radotanypus | 5 | 1.60% |
| Ceratopogoninae | 5 | 1.60% |
| Pseudochironomus | 2 | 0.64% |
| Orthocladius | 2 | 0.64% |
| Erpobdellidae | 2 | 0.64% |
| Thienemannimyia Gr. | 1 | 0.32% |
| Stratiomyidae | 1 | 0.32% |
| Pionidae | 1 | 0.32% |
| Micropsectra | 1 | 0.32% |
| Limnophyes | 1 | 0.32% |
| Lepidostoma | 1 | 0.32% |
| Heterotrissocladius | 1 | 0.32% |

### Functional Composition

| Category | R | A | PRA |
|---|---|---|---|
| Predator | 9 | 18 | 5.77% |
| Parasite | | | |
| Collector Gatherer | 11 | 215 | 68.91% |
| Collector Filterer | | | |
| Macrophyte Herbivore | | | |
| Piercer Herbivore | | | |
| Xylophage | | | |
| Scraper | 2 | 78 | 25.00% |
| Shredder | 1 | 1 | 0.32% |
| Omivore | | | |
| Unknown | | | |

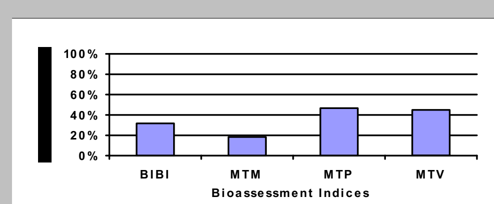



### Metric Values and Scores

| Metric | Value | BIBI | MTP | MTV | MTM |
|---|---|---|---|---|---|
| *Composition* | | | | | |
| Taxa Richness | 23 | 3 | 2 | | 1 |
| Non-Insect Percent | 91.35% | | | | |
| E Richness | 0 | 1 | | 0 | |
| P Richness | 0 | 1 | | 0 | |
| T Richness | 2 | 1 | | 1 | |
| EPT Richness | 2 | | 0 | | 0 |
| EPT Percent | 0.64% | | 0 | | 0 |
| Oligochaeta+Hirudinea Percent | 0.96% | | | | |
| Baetidae/Ephemeroptera | 0.000 | | | | |
| Hydropsychidae/Trichoptera | 0.000 | | | | |
| *Dominance* | | | | | |
| Dominant Taxon Percent | 52.88% | | 1 | | 0 |
| Dominant Taxa (2) Percent | 77.56% | | | | |
| Dominant Taxa (3) Percent | 89.74% | 1 | | | |
| Dominant Taxa (10) Percent | 95.51% | | | | |
| *Diversity* | | | | | |
| Shannon H (loge) | 1.446 | | | | |
| Shannon H (log2) | 2.086 | | 1 | | |
| Margalef D | 3.833 | | | | |
| Simpson D | 0.356 | | | | |
| Evenness | 0.095 | | | | |
| *Function* | | | | | |
| Predator Richness | 9 | | 3 | | |
| Predator Percent | 5.77% | 1 | | | |
| Filterer Richness | 0 | | | | |
| Filterer Percent | 0.00% | | | 3 | |
| Collector Percent | 68.91% | | 2 | | 2 |
| Scraper+Shredder Percent | 25.32% | | 2 | | 1 |
| Scraper/Filterer | 0.000 | | | | |
| Scraper/Scraper+Filterer | 0.000 | | | | |
| *Habit* | | | | | |
| Burrower Richness | 3 | | | | |
| Burrower Percent | 1.28% | | | | |
| Swimmer Richness | 1 | | | | |
| Swimmer Percent | 0.32% | | | | |
| Clinger Richness | 3 | 1 | | | |
| Clinger Percent | 0.96% | | | | |
| *Characteristics* | | | | | |
| Cold Stenotherm Richness | 0 | | | | |
| Cold Stenotherm Percent | 0.00% | | | | |
| Hemoglobin Bearer Richness | 3 | | | | |
| Hemoglobin Bearer Percent | 2.56% | | | | |
| Air Breather Richness | 2 | | | | |
| Air Breather Percent | 0.64% | | | | |
| *Voltinism* | | | | | |
| Univoltine Richness | 9 | | | | |
| Semivoltine Richness | 2 | 1 | | | |
| Multivoltine Percent | 16.99% | | 3 | | |
| *Tolerance* | | | | | |
| Sediment Tolerant Richness | 0 | | | | |
| Sediment Tolerant Percent | 0.00% | | | | |
| Sediment Sensitive Richness | 0 | | | | |
| Sediment Sensitive Percent | 0.00% | | | | |
| Metals Tolerance Index | 3.055 | | | | |
| Pollution Sensitive Richness | 1 | 1 | | 1 | |
| Pollution Tolerant Percent | 1.28% | 5 | | 3 | |
| Hilsenhoff Biotic Index | 7.768 | | 0 | | 0 |
| Intolerant Percent | 0.96% | | | | |
| Supertolerant Percent | 91.35% | | | | |
| CTQa | 101.733 | | | | |

### Bioassessment Indices

| BioIndex | Description | Score | Pct | Rating |
|---|---|---|---|---|
| BIBI | B-IBI (Karr et al.) | 16 | 32.00% | |
| MTP | Montana DEQ Plains (Bukantis 1998) | 14 | 46.67% | Moderate |
| MTV | Montana Revised Valleys/Foothills (Bollman 1998) | 8 | 44.44% | Moderate |
| MTM | Montana DEQ Mountains (Bukantis 1998) | 4 | 19.05% | Severe |




**Friday, January 28, 2011**

**Figure A-30**
**Fall 2010 Macroinvertebrate Metric Results for Willow**

# Appendix B

# Physical Habitat
# Maps and Associated Data for Aquatic Sites
# (Springs, Ponds, and Creek Reaches)

# B.1.0 INTRODUCTION

Physical habitat polygons and water quality sample points (springhead, midpoint, endpoint) are shown for spring and fall 2010, with fixed photography stations and permanent vegetation transects overlaid on both seasonal maps. Underlying imagery is NAIP 1-meter Aerial Imagery (USDA-FSA, 2006). Exact locations of northern leopard frog presence surveys, egg masses and breeding habitat transects; relict dace traps; Pahrump poolfish surveys; and springsnail transects are not depicted due to the sensitive nature of the biological data. Areal calculations were made from digitized physical habitat map polygons in ArcMap 9.3.1 (ESRI).

**Table B-1**
**Fall 2010 Mapped Area at Creek Reaches Summarized by Physical Habitat Type**

| Site | HMU | Depth (m) | Velocity (m/sec) | Emergent Vegetation (% Cover) | Area ($m^2$) |
|---|---|---|---|---|---|
| Big Springs/Lake Creek Reach #1 | Channel | <0.2 | >0.5 | 30 - 90 | 487 |
| Big Springs/Lake Creek Reach #2 | Channel | 0.2 - 1 | 0.1 - 0.5 | <30 | 295 |
| Big Springs/Lake Creek Reach #3 | Channel | 0.2 - 1 | 0.1 - 0.5 | <30 | 297 |
| Big Springs/Lake Creek Reach #4 | Channel | 0.2 - 1 | >0.5 | <30 | 378 |
| Big Springs/Lake Creek Reach #5[a] | Channel | <0.2 | 0.1 - 0.5 | <30 | 75 |
| Big Springs/Lake Creek Reach #6[a] | Channel | 0.2 - 1 | >0.5 | <30 | 244 |

Note: Interpretations and conclusions made from this data need to take into consideration the margin of error associated with boundary demarcation and associated area measurements.
[a]Reaches 5 and 6 were not mapped to the full extent due to an error in the field. Only 40 meters of Reach 5 were mapped and only 86 meters of Reach 6 were mapped.

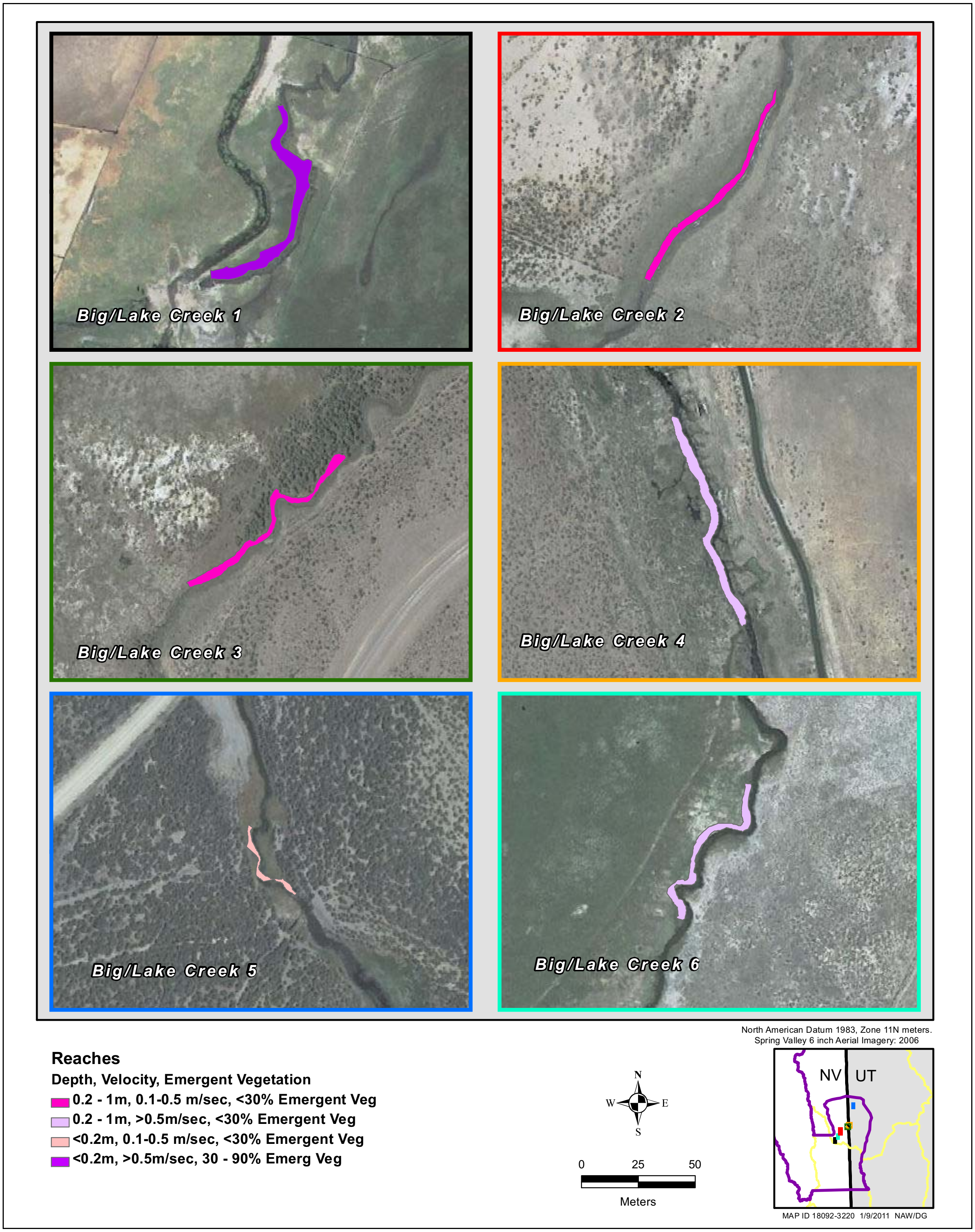



**Figure B-1**
**Creek Reaches Physical Habitat Map Fall 2010**

## Table B-2
## Spring 2010 Mapped Area at Big Springs Summarized by Physical Habitat Type, HMU Type, and Total Aquatic Mapped Area

| HMU | Depth (m) | Velocity (m/sec) | Emergent Vegetation (% Cover) | Area ($m^2$) |
|---|---|---|---|---|
| Channel | <0.2 | 0.1 - 0.5 | 30 - 90 | 155 |
| Channel | 0.2 - 1 | 0.1 - 0.5 | <30 | 167 |
| | | | **Total Channels** | **322** |
| | | | **Total Pools** | **0.0** |
| | | | **Total Aquatic Area** | **322** |

Note: Interpretations and conclusions made from this data need to take into consideration the margin of error associated with boundary demarcation and associated area measurements.

## Table B-3
## Fall 2010 Mapped Area at Big Springs Summarized by Physical Habitat Type, HMU Type, and Total Aquatic Mapped Area

| HMU | Depth (m) | Velocity (m/sec) | Emergent Vegetation (% Cover) | Area ($m^2$) |
|---|---|---|---|---|
| Channel | <0.2 | 0.01 - 0.1 | >90 | 46 |
| Channel | <0.2 | 0.1 - 0.5 | >90 | 68 |
| Channel | <0.2 | 0.1 - 0.5 | <30 | 40 |
| Channel | 0.2 - 1 | 0.1 - 0.5 | <30 | 63 |
| Channel | 0.2 - 1 | 0.01 - 0.1 | <30 | 133 |
| | | | **Total Channels** | **350** |
| | | | **Total Pools** | **0.0** |
| | | | **Total Aquatic Area** | **350** |

Note: Interpretations and conclusions made from this data need to take into consideration the margin of error associated with boundary demarcation and associated area measurements.

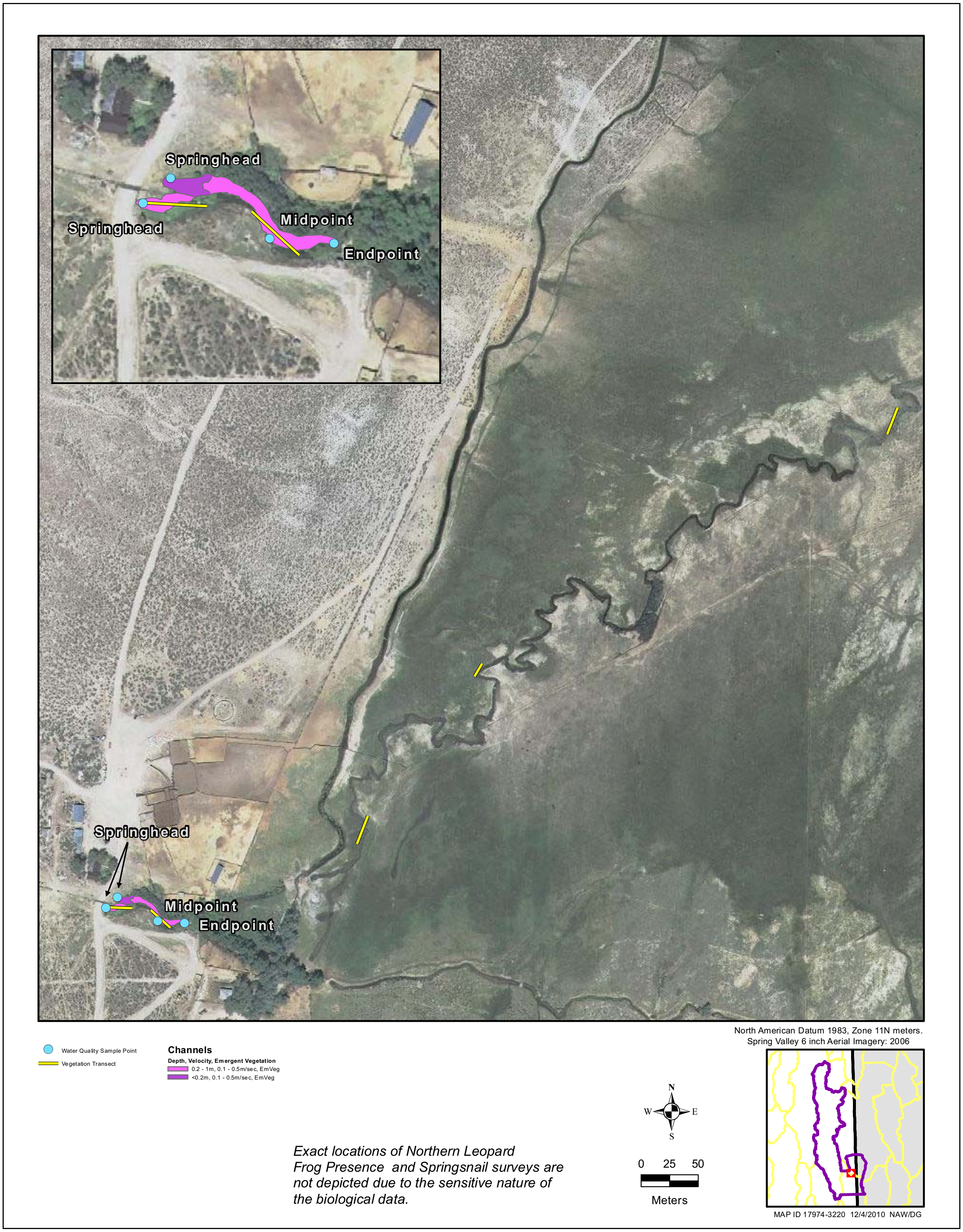



**Figure B-2**
**Big Springs Physical Habitat Map for Spring 2010**

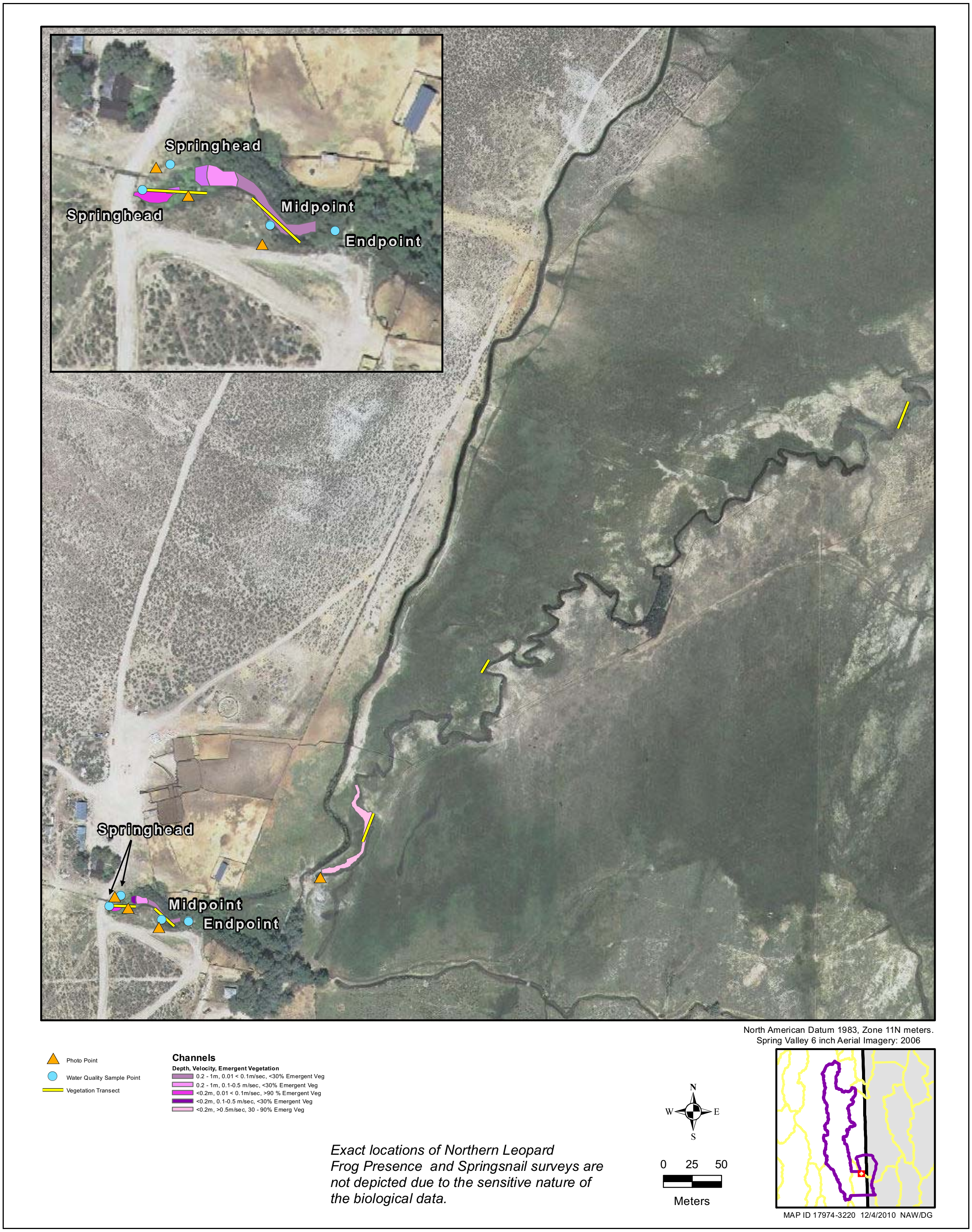



**Figure B-3**
**Big Springs Physical Habitat Map for Fall 2010**

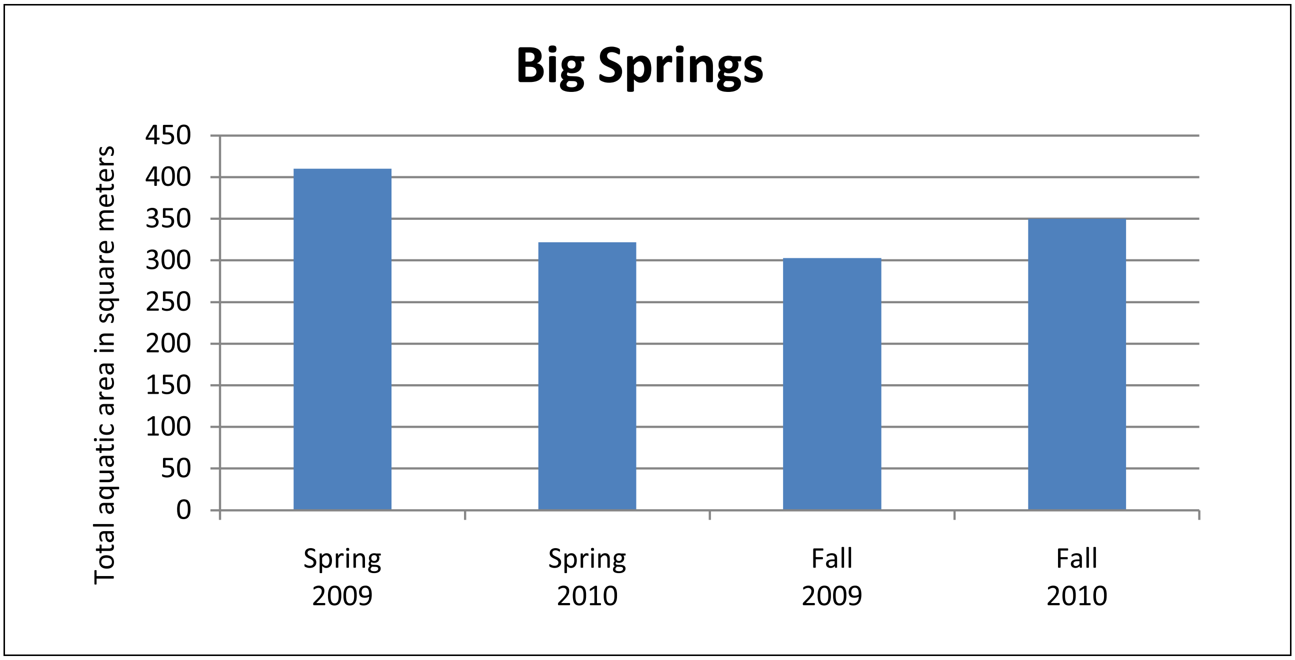



**Figure B-4**
**Total Aquatic Area by Season for 2009 and 2010 at Big Springs**

**Table B-4**
**Spring 2010 Mapped Area at Clay Spring Summarized by Physical Habitat Type, HMU Type, and Total Aquatic Mapped Area**

| HMU | Depth (m) | Velocity (m/sec) | Emergent Vegetation (% Cover) | Area ($m^2$) |
|---|---|---|---|---|
| Channel | <0.2 | <0.01 | 30 - 90 | 70 |
| Channel | <0.2 | 0.01 - 0.1 | <30 | 95 |
| Channel | <0.2 | 0.1 - 0.5 | <30 | 121 |
| | | | **Total Channels** | **286** |
| | | | **Total Pools** | **0.0** |
| | | | **Total Aquatic Area** | **286** |

Note: Interpretations and conclusions made from this data need to take into consideration the margin of error associated with boundary demarcation and associated area measurements.

**Table B-5**
**Fall 2010 Mapped Area at Clay Spring Summarized by Physical Habitat Type, HMU Type, and Total Aquatic Mapped Area**

| HMU | Depth (m) | Velocity (m/sec) | Emergent Vegetation (% Cover) | Area ($m^2$) |
|---|---|---|---|---|
| Channel | <0.2 | 0.1 - 0.5 | <30 | 109 |
| Channel | 0.2 - 1 | 0.01 - 0.1 | 30 - 90 | 114 |
| | | | **Total Channels** | **223** |
| | | | **Total Pools** | **0.0** |
| | | | **Total Aquatic Area** | **223** |

Note: Interpretations and conclusions made from this data need to take into consideration the margin of error associated with boundary demarcation and associated area measurements.


**Figure B-5**
**Clay Spring Physical Habitat Map for Spring 2010**

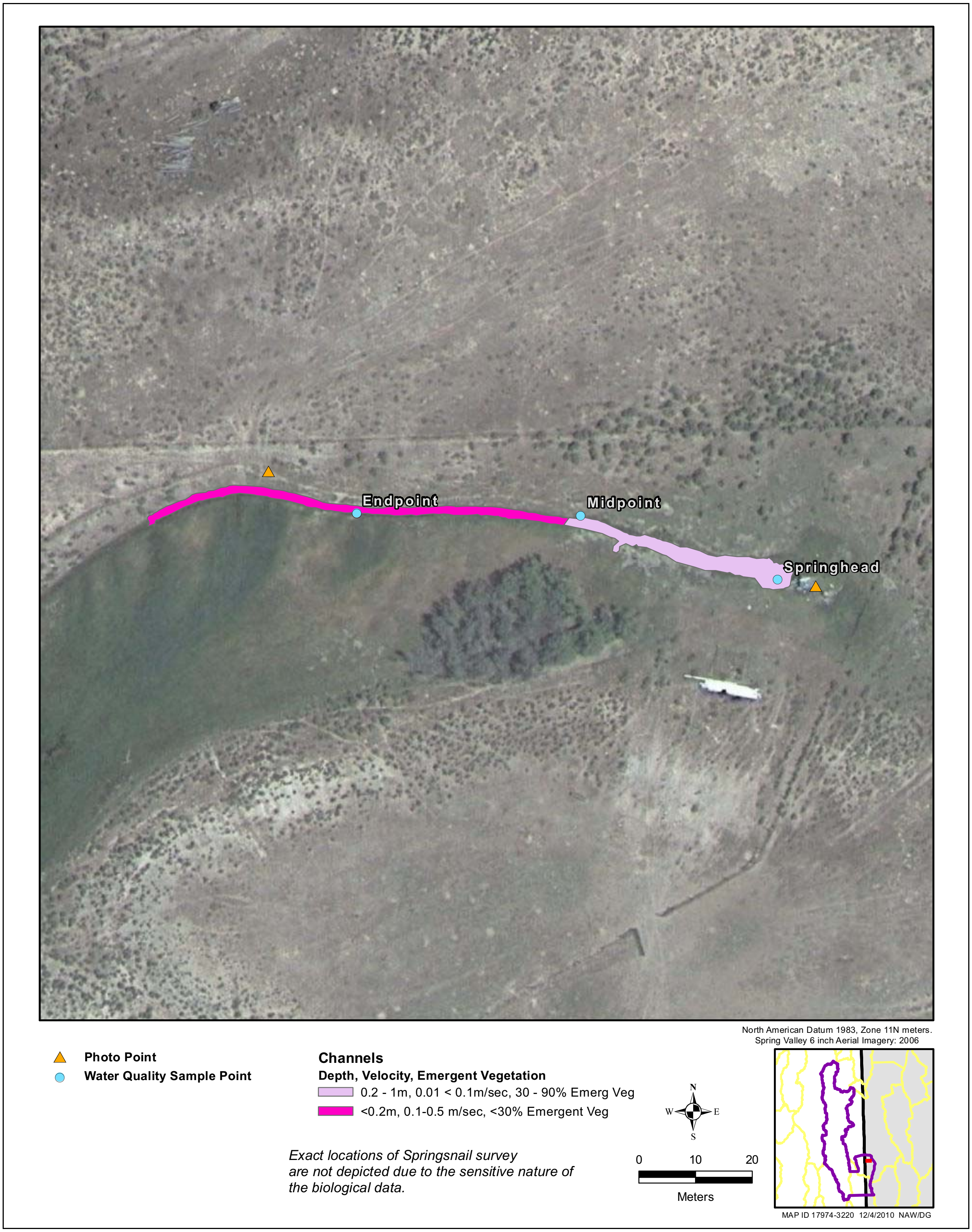



**Figure B-6**
**Clay Spring Physical Habitat Map for Fall 2010**

**Access to Clay Spring was not granted in 2009.**

## Table B-6
## Spring 2010 Mapped Area at Four Wheel Drive Spring Summarized by Physical Habitat Type, HMU Type, and Total Aquatic Mapped Area

| HMU | Depth (m) | Velocity (m/sec) | Emergent Vegetation (% Cover) | Area ($m^2$) |
|---|---|---|---|---|
| Pool | 0.2 - 1 | <0.01 | <30 | 171 |
| Channel | <0.2 | <0.01 | 30 - 90 | 181 |
| | | | **Total Channels** | **181** |
| | | | **Total Pools** | **171** |
| | | | **Total Aquatic Area** | **352** |

Note: Interpretations and conclusions made from this data need to take into consideration the margin of error associated with boundary demarcation and associated area measurements.

## Table B-7
## Fall 2010 Mapped Area at Four Wheel Drive Spring Summarized by Physical Habitat Type, HMU Type, and Total Aquatic Mapped Area

| HMU | Depth (m) | Velocity (m/sec) | Emergent Vegetation (% Cover) | Area ($m^2$) |
|---|---|---|---|---|
| Pool | 0.2 - 1 | <0.01 | >90 | 205 |
| Channel | <0.2 | N/A | >90 | 149 |
| | | | **Total Channels** | **149** |
| | | | **Total Pools** | **205** |
| | | | **Total Aquatic Area** | **354** |

N/A = Not applicable – unable to measure velocity due to shallow or muddy water, extensive aquatic vegetation, or wind.
Note: Interpretations and conclusions made from this data need to take into consideration the margin of error associated with boundary demarcation and associated area measurements.

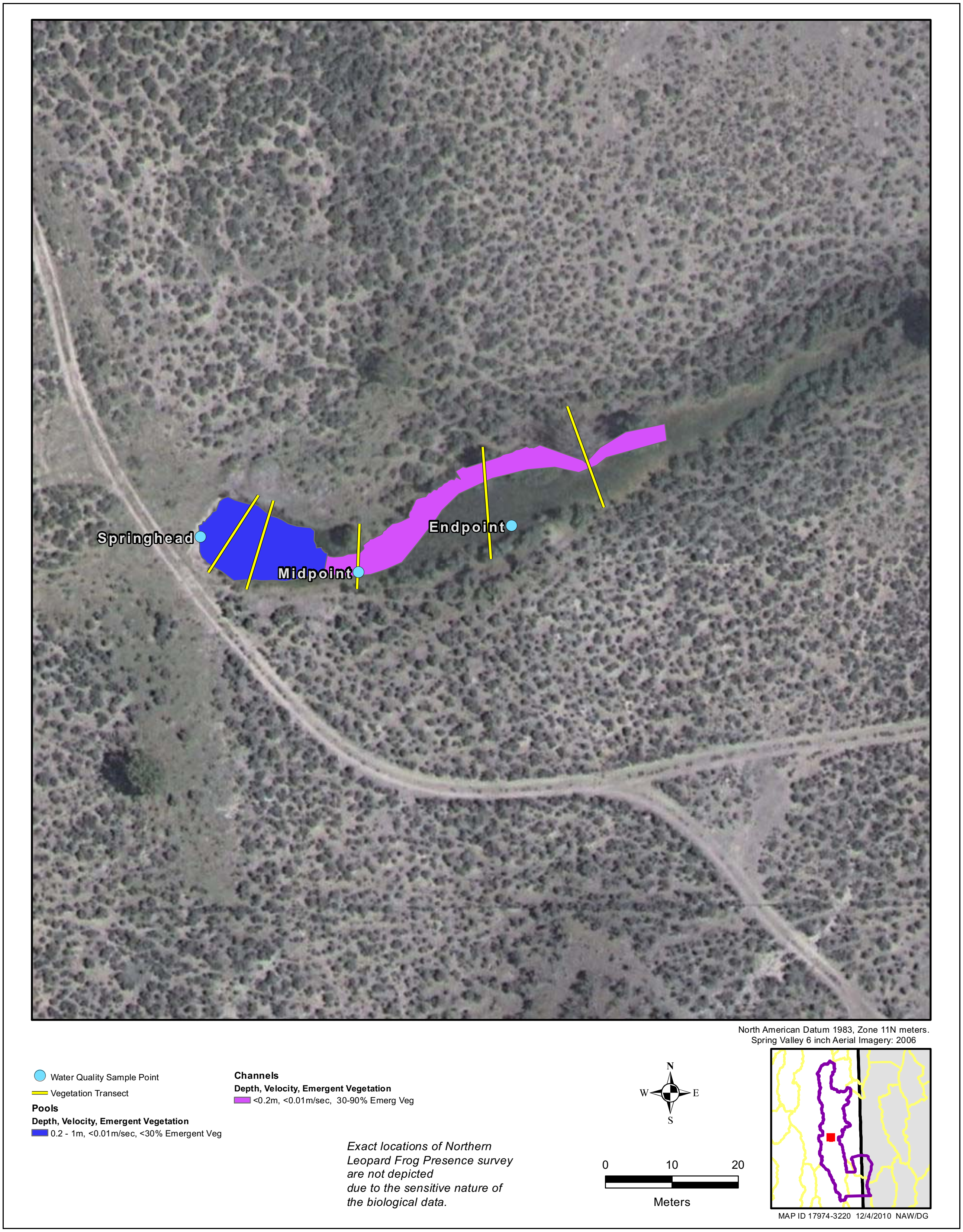



**Figure B-7**
**Four Wheel Drive Spring Physical Habitat Map for Spring 2010**

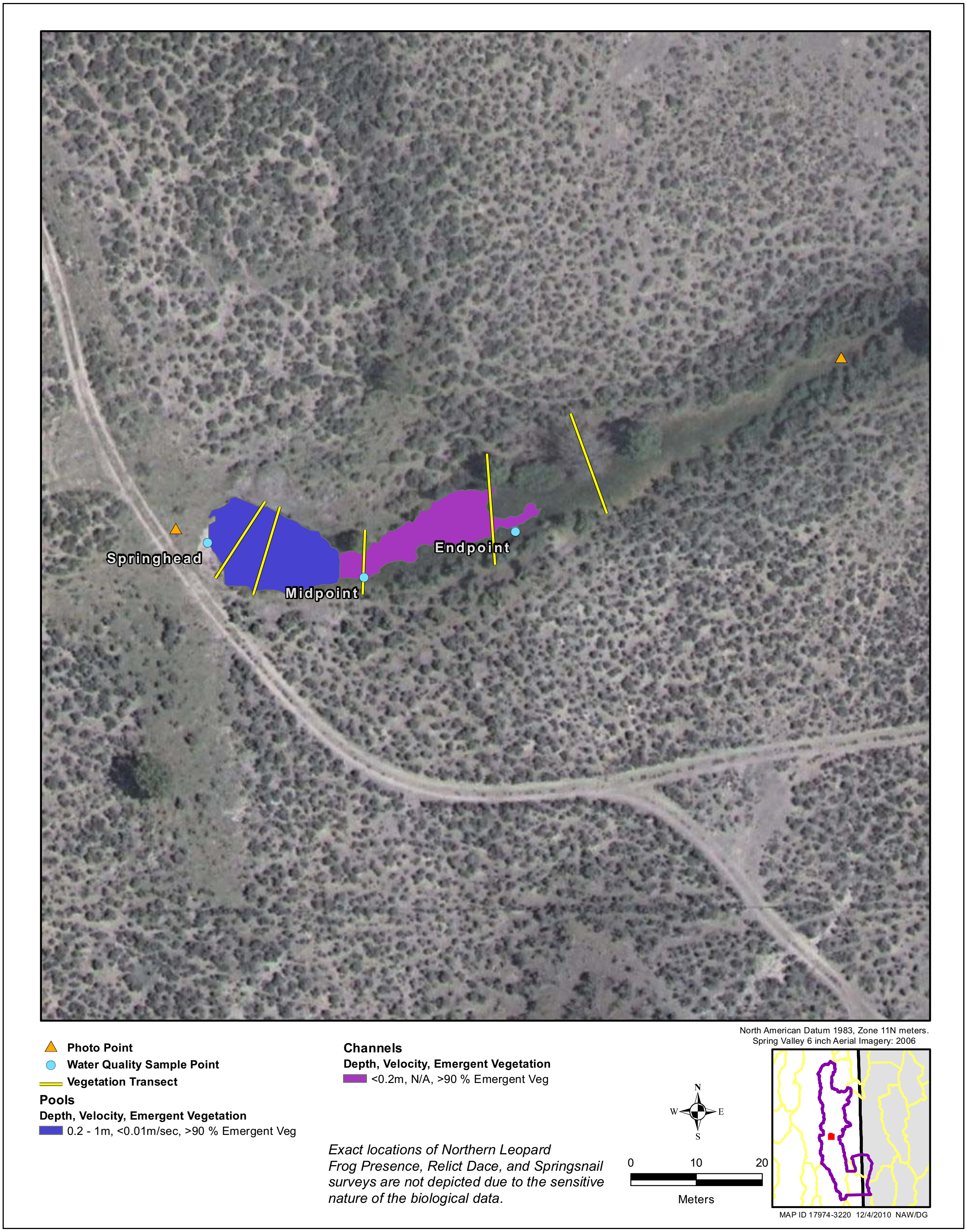



**Figure B-8**
**Four Wheel Drive Spring Physical Habitat Map for Fall 2010**

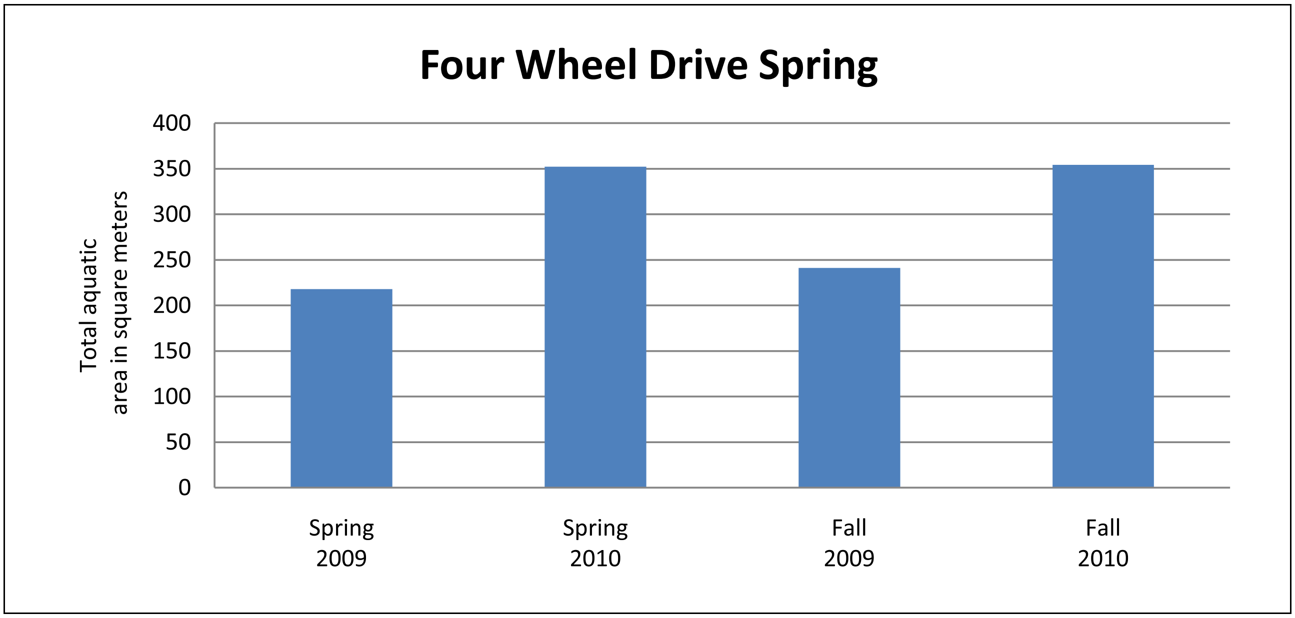



**Figure B-9**
**Total Aquatic Area by Season for 2009 and 2010 at Four Wheel Drive**

## Table B-8
## Spring 2010 Mapped Area at Keegan Spring Complex North Summarized by Physical Habitat Type, HMU Type, and Total Aquatic Mapped Area

| HMU | Depth (m) | Velocity (m/sec) | Emergent Vegetation (% Cover) | Area ($m^2$) |
|---|---|---|---|---|
| Channel | <0.2 | 0.01 - 0.1 | 30 - 90 | 366 |
| Channel | <0.2 | 0.1 - 0.5 | <30 | 1022 |
| Channel | 0.2 - 1 | <0.01 | 30 - 90 | 18 |
| Channel | 0.2 - 1 | 0.01 - 0.1 | <30 | 466 |
| Channel | 0.2 - 1 | 0.01 - 0.1 | 30 - 90 | 1104 |
| Channel | 0.2 - 1 | 0.1 - 0.5 | <30 | 145 |
| Pool | <0.2 | <0.01 | 30 - 90 | 4830 |
| Pool | >1 | <0.01 | <30 | 905. |
| Pool | 0.2 - 1 | <0.01 | <30 | 222 |
| Pool | 0.2 - 1 | <0.01 | 30 - 90 | 3043 |
| | | | **Total Channels** | **3121** |
| | | | **Total Pools** | **9000** |
| | | | **Total Aquatic Area** | **12121** |

Note: Interpretations and conclusions made from this data need to take into consideration the margin of error associated with boundary demarcation and associated area measurements.

## Table B-9
## Fall 2010 Mapped Area at Keegan Spring Complex North Summarized by Physical Habitat Type, HMU Type, and Total Aquatic Mapped Area

| HMU | Depth (m) | Velocity (m/sec) | Emergent Vegetation (% Cover) | Area ($m^2$) |
|---|---|---|---|---|
| Channel | <0.2 | <0.01 | 30 - 90 | 171 |
| Channel | <0.2 | 0.01 - 0.1 | 30 - 90 | 192 |
| Channel | <0.2 | 0.1 - 0.5 | <30 | 1191 |
| Channel | <0.2 | 0.1 - 0.5 | 30 - 90 | 204 |
| Channel | 0.2 - 1 | 0.01 - 0.1 | <30 | 46 |
| Channel | 0.2 - 1 | 0.01 - 0.1 | 30 - 90 | 960 |
| Pool | >1 | <0.01 | <30 | 132 |
| Pool | 0.2 - 1 | <0.01 | <30 | 1058 |
| Pool | 0.2 - 1 | <0.01 | >90 | 3387 |
| Pool | 0.2 - 1 | <0.01 | 30 - 90 | 6580 |
| | | | **Total Channels** | **2764** |
| | | | **Total Pools** | **11157** |
| | | | **Total Aquatic Area** | **13921** |

Note: Interpretations and conclusions made from this data need to take into consideration the margin of error associated with boundary demarcation and associated area measurements.

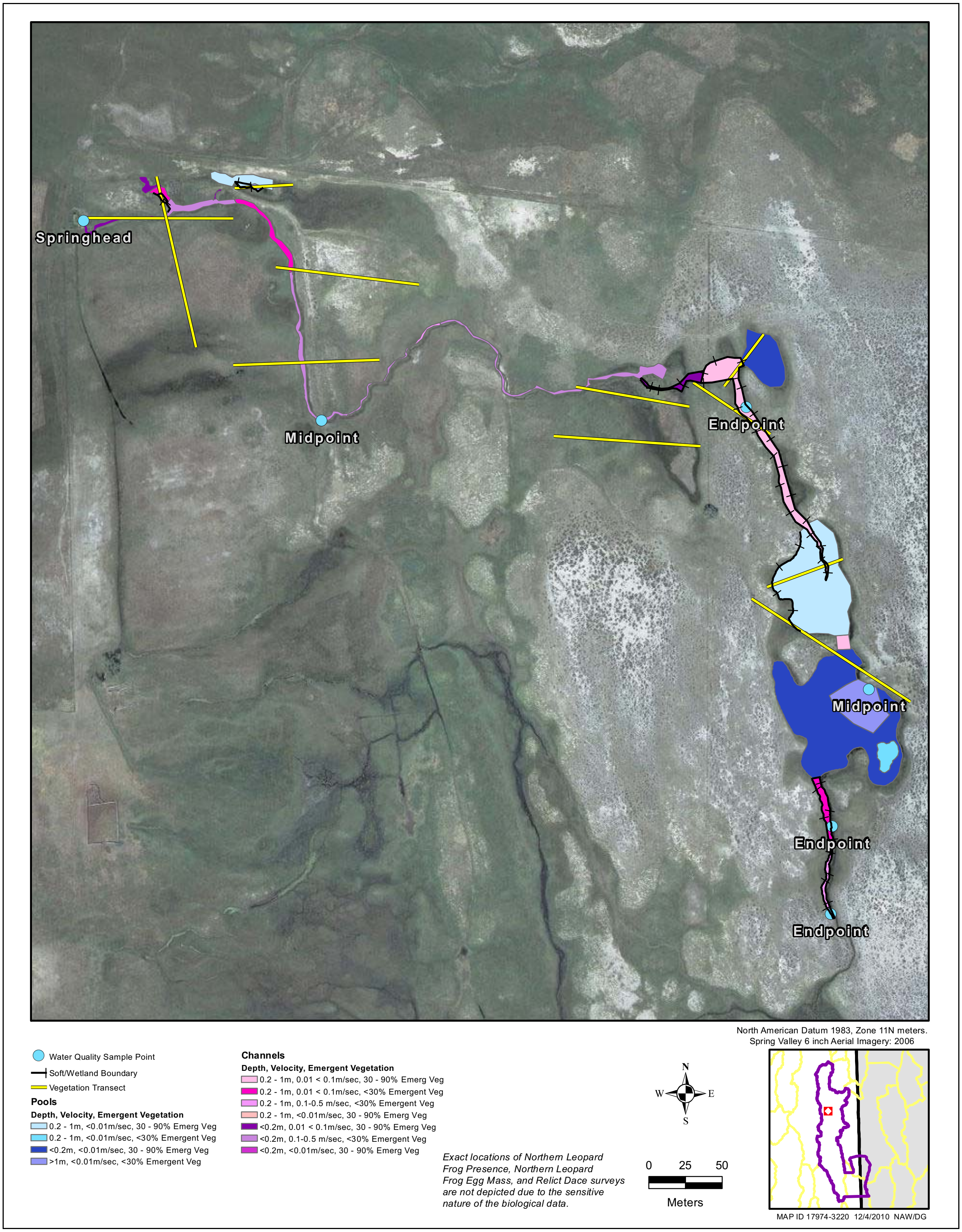



**Figure B-10**
**Keegan Spring Complex North Physical Habitat Map for Spring 2010**

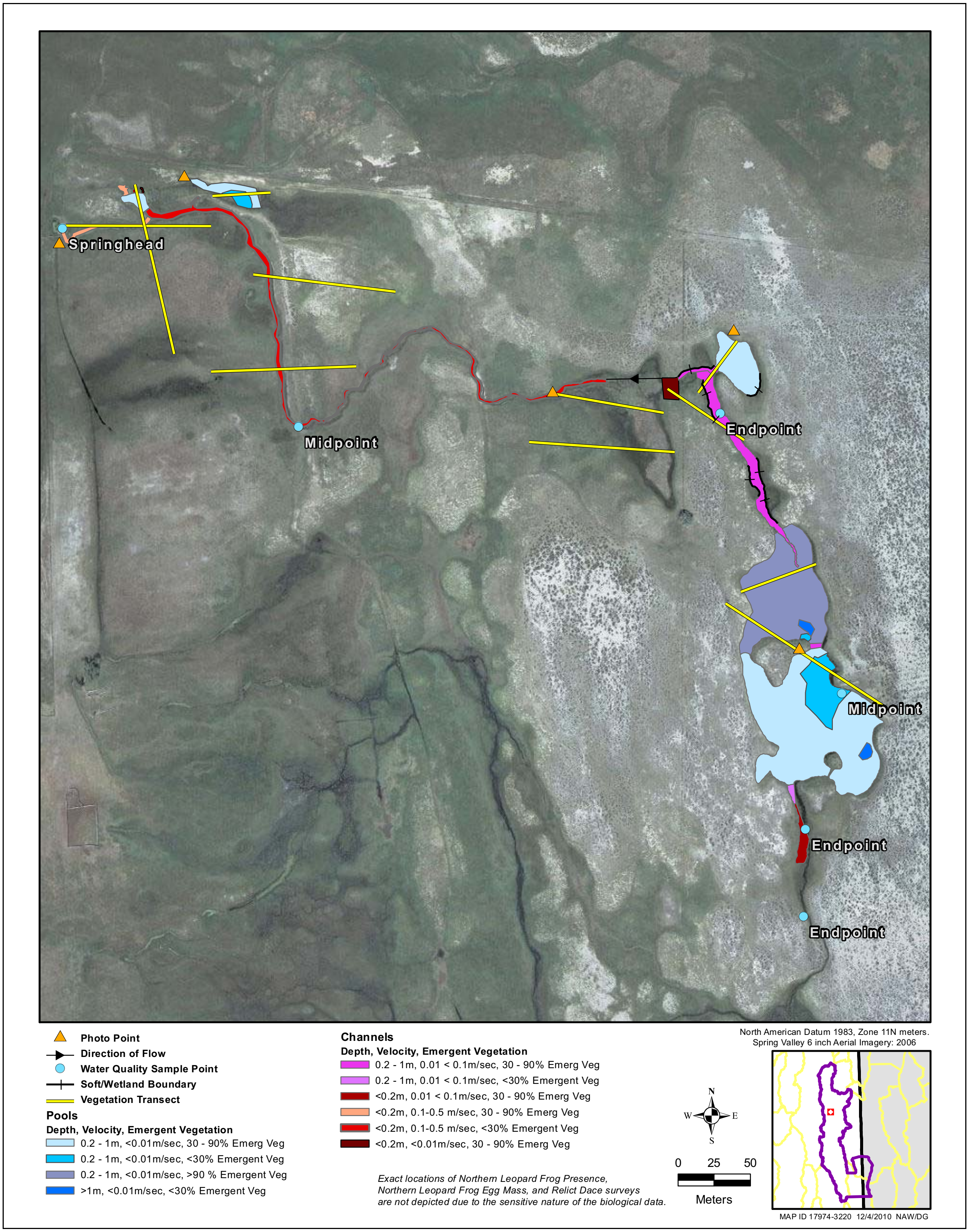



**Figure B-11**
**Keegan Spring Complex North Physical Habitat Map for Fall 2010**

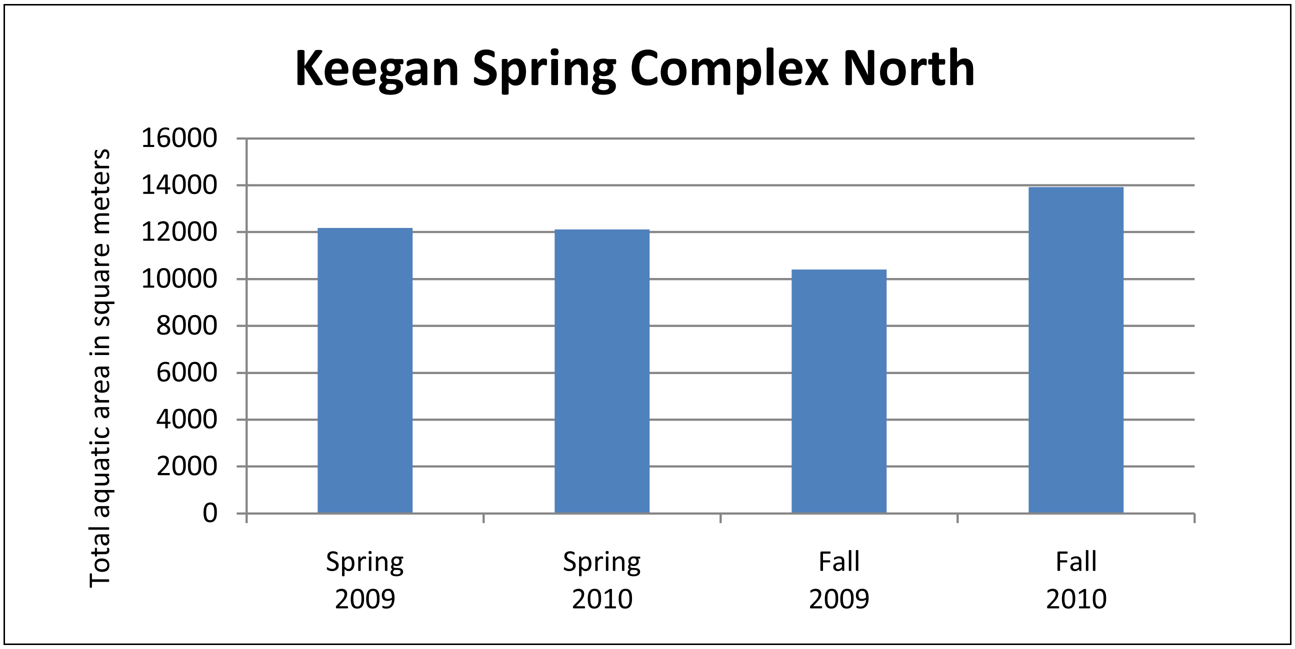



**Figure B-12**
**Total Aquatic Area by Season for 2009 and 2010 at Keegan Spring Complex North**

## Table B-10
## Spring 2010 Mapped Area at Minerva Spring Complex (Middle) Summarized by Physical Habitat Type, HMU Type, and Total Aquatic Mapped Area

| HMU | Depth (m) | Velocity (m/sec) | Emergent Vegetation (% Cover) | Area ($m^2$) |
|---|---|---|---|---|
| Channel | <0.2 | 0.01 - 0.1 | <30 | 11 |
| Channel | <0.2 | 0.01 - 0.1 | 30 - 90 | 69 |
| Channel | <0.2 | 0.1 - 0.5 | <30 | 25 |
| Channel | <0.2 | 0.1 - 0.5 | 30 - 90 | 19 |
| Channel | <0.2 | N/A | 30 - 90 | 19 |
| Channel | 0.2 - 1 | 0.01 - 0.1 | 30 - 90 | 293 |
| Channel | 0.2 - 1 | 0.1 - 0.5 | 30 - 90 | 42 |
| Pool | <0.2 | <0.01 | 30 - 90 | 32 |
| Pool | 0.2 - 1 | <0.01 | 30 - 90 | 126 |
| | | | **Total Channels** | **478** |
| | | | **Total Pools** | **158** |
| | | | **Total Aquatic Area** | **636** |

N/A = Not applicable – unable to measure velocity due to shallow or muddy water, extensive aquatic vegetation, or wind.
Note: Interpretations and conclusions made from this data need to take into consideration the margin of error associated with boundary demarcation and associated area measurements.

## Table B-11
## Fall 2010 Mapped Area at Minerva Spring Complex (Middle) Summarized by Physical Habitat Type, HMU Type, and Total Aquatic Mapped Area

| HMU | Depth (m) | Velocity (m/sec) | Emergent Vegetation (% Cover) | Area ($m^2$) |
|---|---|---|---|---|
| Channel | <0.2 | <0.01 | 30 - 90 | 169 |
| Channel | <0.2 | 0.01 - 0.1 | <30 | 45 |
| Channel | <0.2 | 0.01 - 0.1 | 30 - 90 | 90 |
| Channel | <0.2 | 0.1 - 0.5 | 30 - 90 | 18 |
| Channel | <0.2 | N/A | 30 - 90 | 20 |
| Channel | 0.2 - 1 | 0.01 - 0.1 | 30 - 90 | 235 |
| Pool | <0.2 | <0.01 | 30 - 90 | 28 |
| Pool | 0.2 - 1 | <0.01 | <30 | 30 |
| Pool | 0.2 - 1 | <0.01 | 30 - 90 | 111 |
| | | | **Total Channels** | **577** |
| | | | **Total Pools** | **169** |
| | | | **Total Aquatic Area** | **746** |

N/A = Not applicable – unable to measure velocity due to shallow or muddy water, extensive aquatic vegetation, or wind.
Note: Interpretations and conclusions made from this data need to take into consideration the margin of error associated with boundary demarcation and associated area measurements.

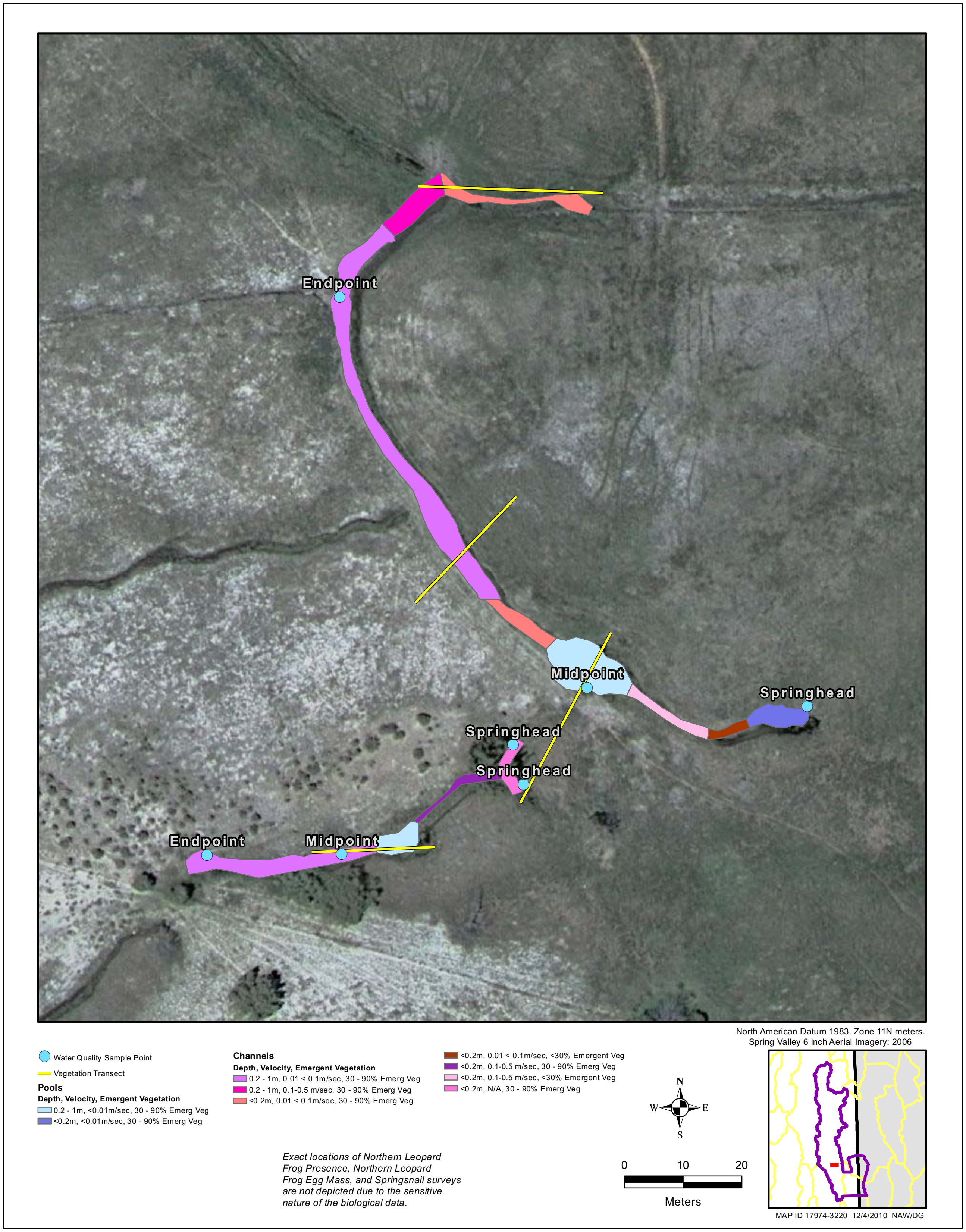



**Figure B-13**
**Minerva Spring Complex Middle Physical Habitat Map for Spring 2010**

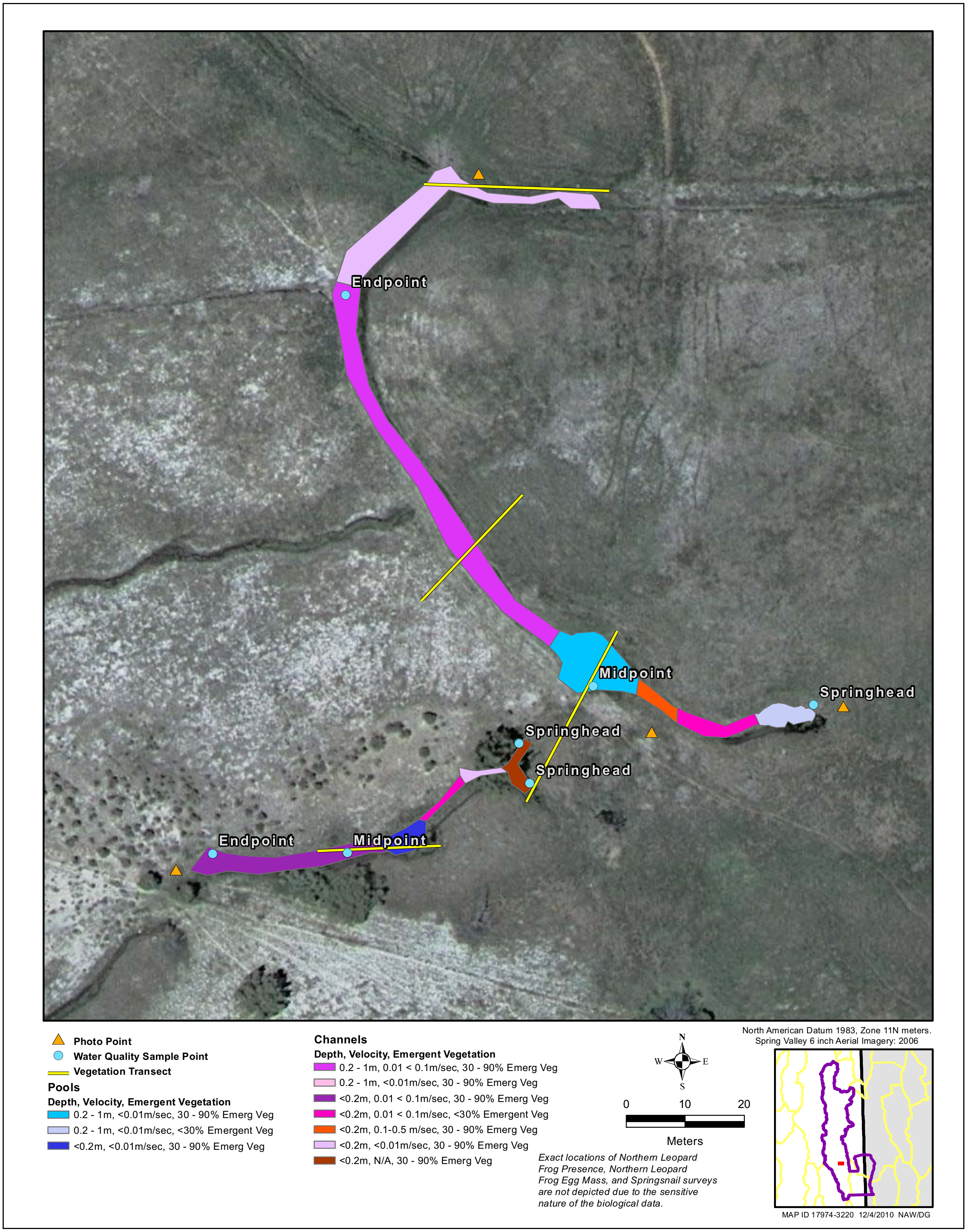



**Figure B-14**
**Minerva Spring Complex Middle Physical Habitat Map for Fall 2010**

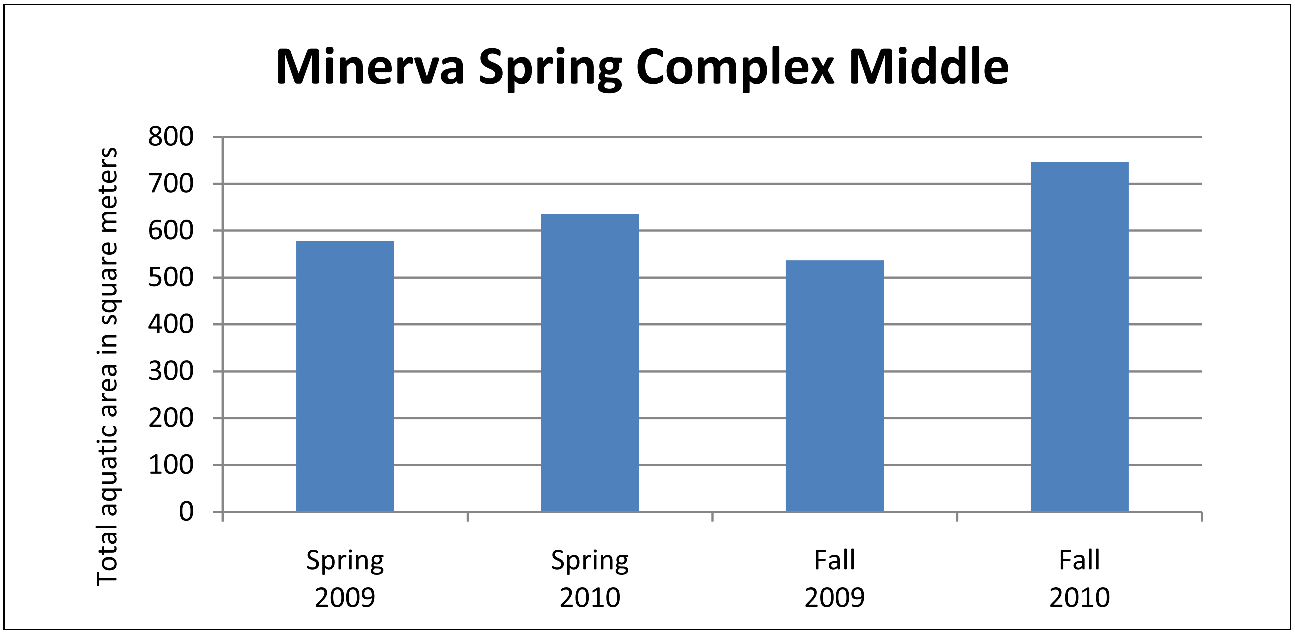



**Figure B-15**
**Total Aquatic Area by Season for 2009 and 2010 at Minerva Spring Complex Middle**

## Table B-12
## Spring 2010 Mapped Area at Minerva Spring Complex (North) Summarized by Physical Habitat Type, HMU Type, and Total Aquatic Mapped Area

| HMU | Depth (m) | Velocity (m/sec) | Emergent Vegetation (% Cover) | Area ($m^2$) |
|---|---|---|---|---|
| Channel | <0.2 | 0.01 - 0.1 | 30 - 90 | 215 |
| Channel | <0.2 | 0.1 - 0.5 | <30 | 24 |
| Channel | <0.2 | 0.1 - 0.5 | 30 - 90 | 133 |
| Channel | <0.2 | N/A | >90 | 13 |
| Pool | <0.2 | <0.01 | >90 | 61 |
| Pool | >1 | <0.01 | <30 | 974 |
| Pool | 0.2 - 1 | <0.01 | <30 | 233 |
| | | | **Total Channels** | **385** |
| | | | **Total Pools** | **1268** |
| | | | **Total Aquatic Area** | **1653** |

N/A = Not applicable – unable to measure velocity due to shallow or muddy water, extensive aquatic vegetation, or wind.
Note: Interpretations and conclusions made from this data need to take into consideration the margin of error associated with boundary demarcation and associated area measurements.

## Table B-13
## Fall 2010 Mapped Area at Minerva Spring Complex (North) Summarized by Physical Habitat Type, HMU Type, and Total Aquatic Mapped Area

| HMU | Depth (m) | Velocity (m/sec) | Emergent Vegetation (% Cover) | Area ($m^2$) |
|---|---|---|---|---|
| Channel | <0.2 | <0.01 | >90 | 51 |
| Channel | <0.2 | <0.01 | 30 - 90 | 83 |
| Channel | <0.2 | 0.01 - 0.1 | <30 | 202 |
| Channel | <0.2 | 0.01 - 0.1 | >90 | 203 |
| Channel | <0.2 | 0.01 - 0.1 | 30 - 90 | 188 |
| Channel | <0.2 | 0.1 - 0.5 | <30 | 181 |
| Pool | 0.2 - 1 | <0.01 | <30 | 241 |
| | | | **Total Channels** | **908** |
| | | | **Total Pools**[a] | **241** |
| | | | **Total Aquatic Area** | **1149** |

Note: Interpretations and conclusions made from this data need to take into consideration the margin of error associated with boundary demarcation and associated area measurements.
[a]This drastic change in area for Pools is due to a change in the large (depth >1 m) pool at North Minerva (see Figure B-17). In the fall this area had been drained for ranching operations and was no longer a pool but a series of channels.

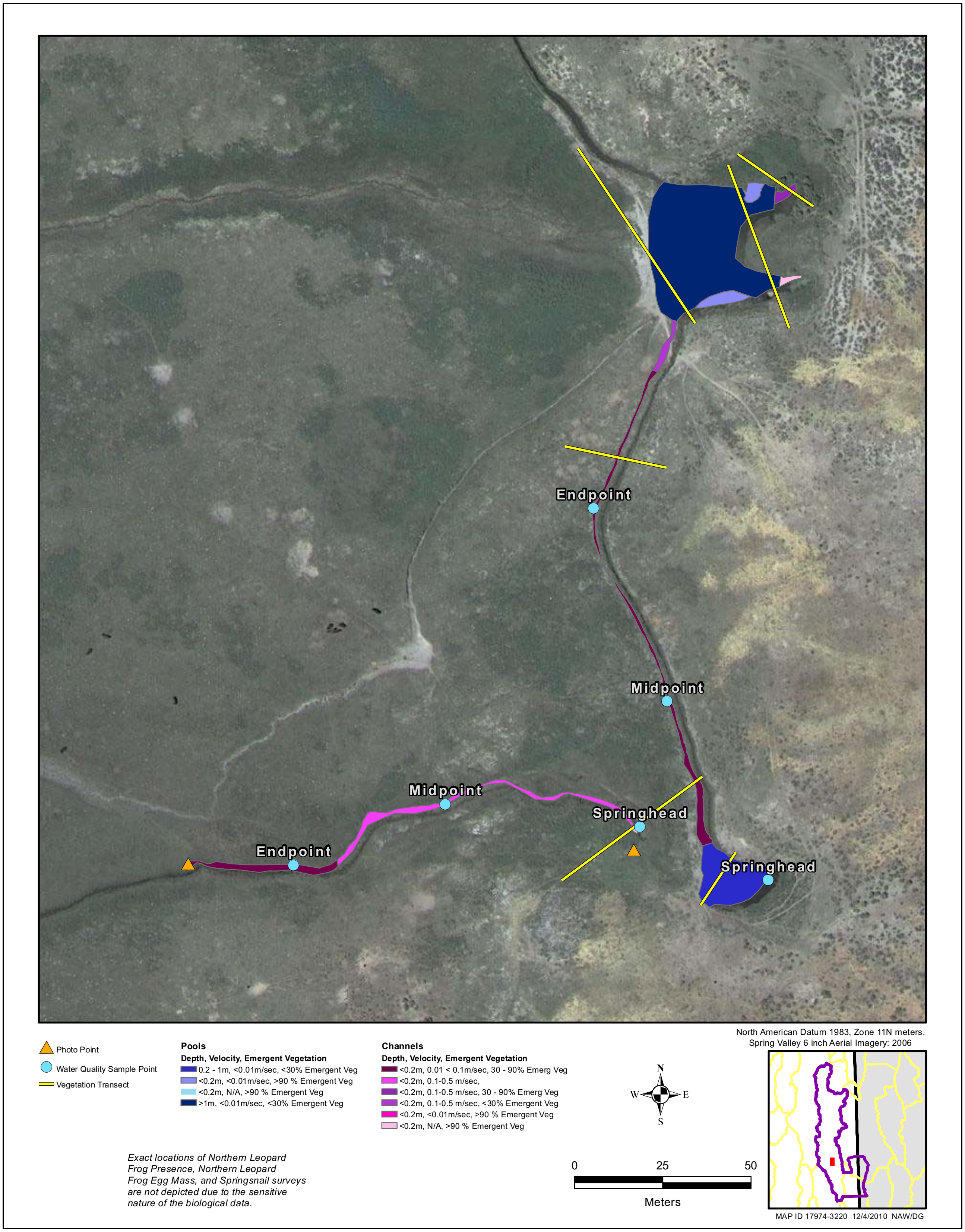



**Figure B-16**
**Minerva Spring Complex North Physical Habitat Map for Spring 2010**

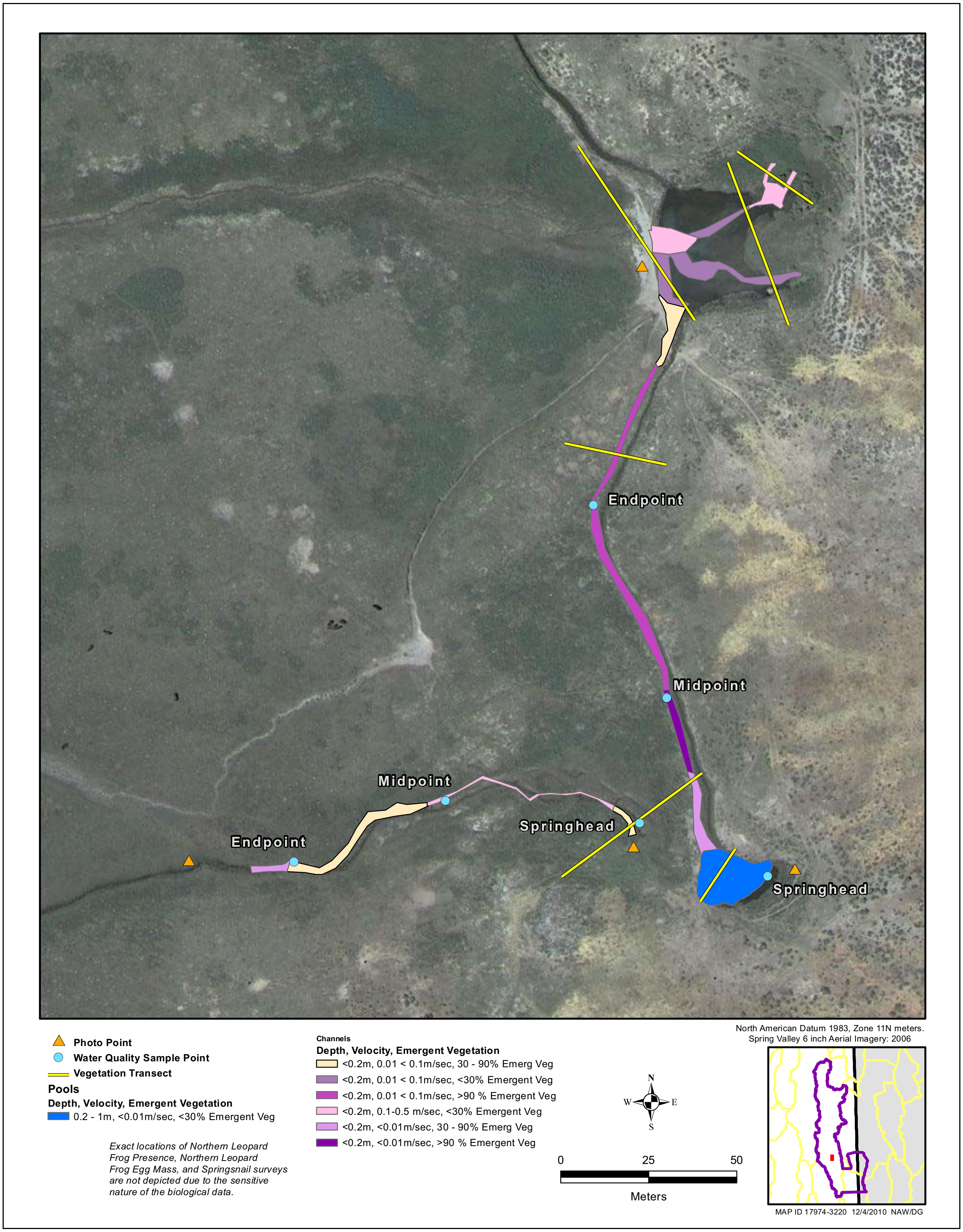



**Figure B-17**
**Minerva Spring Complex North Physical Habitat Map for Fall 2010**

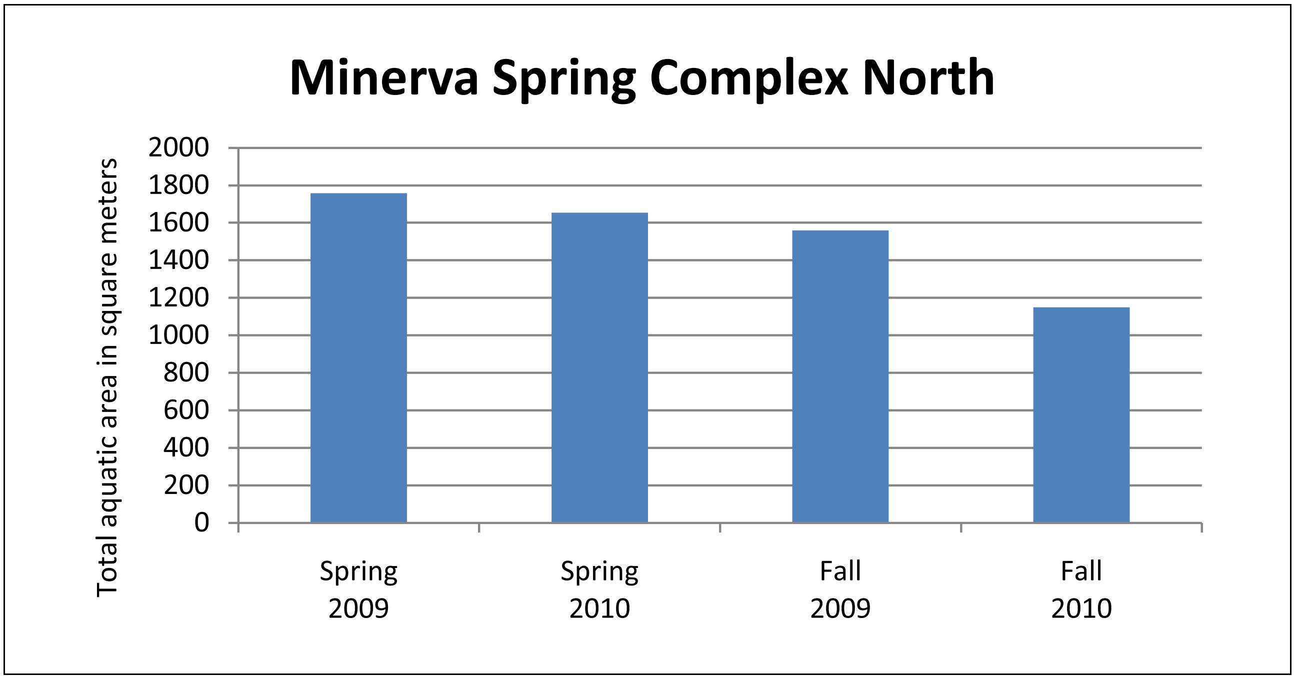



**Figure B-18**
**Total Aquatic Area by Season for 2009 and 2010 at Minerva Spring Complex North**

**Table B-14**
**Spring 2010 Mapped Area at North Little Spring Summarized by Physical Habitat Type, HMU Type, and Total Aquatic Mapped Area**

| HMU | Depth (m) | Velocity (m/sec) | Emergent Vegetation (% Cover) | Area ($m^2$) |
|---|---|---|---|---|
| Channel | <0.2 | <0.01 | 30 - 90 | 79 |
| Pool | 0.2 - 1 | <0.01 | <30 | 71 |
| | | | **Total Aquatic Area** | **150** |

Note: Interpretations and conclusions made from this data need to take into consideration the margin of error associated with boundary demarcation and associated area measurements.

**Table B-15**
**Fall 2010 Mapped Area at North Little Spring Summarized by Physical Habitat Type, HMU Type, and Total Aquatic Mapped Area**

| HMU | Depth (m) | Velocity (m/sec) | Emergent Vegetation (% Cover) | Area ($m^2$) |
|---|---|---|---|---|
| Channel | <0.2 | <0.01 | >90 | 100 |
| Pool | >1 | <0.01 | <30 | 57 |
| | | | **Total Aquatic Area** | **157** |

Note: Interpretations and conclusions made from this data need to take into consideration the margin of error associated with boundary demarcation and associated area measurements.

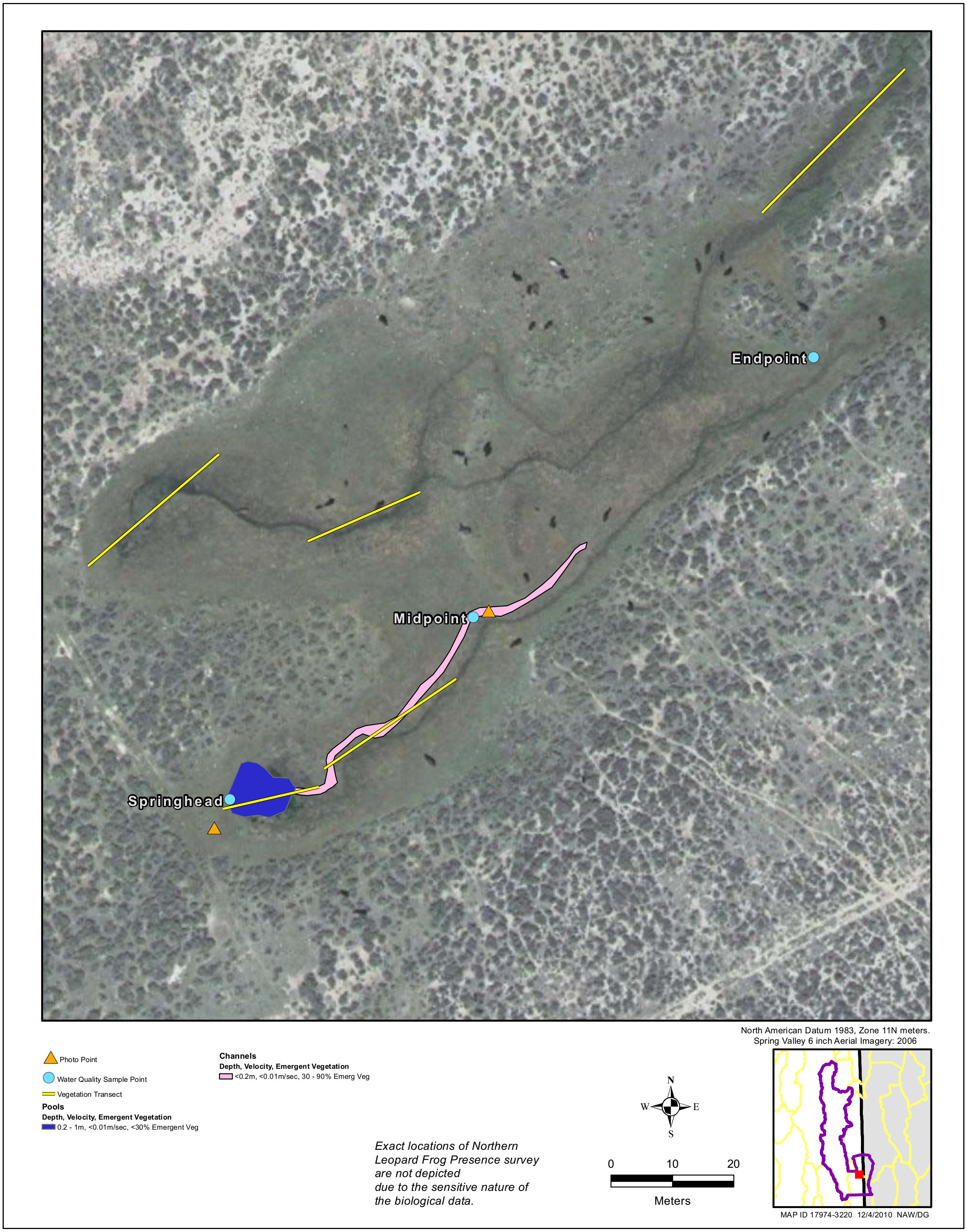



**Figure B-19**
**North Little Physical Habitat Map for Spring 2010**

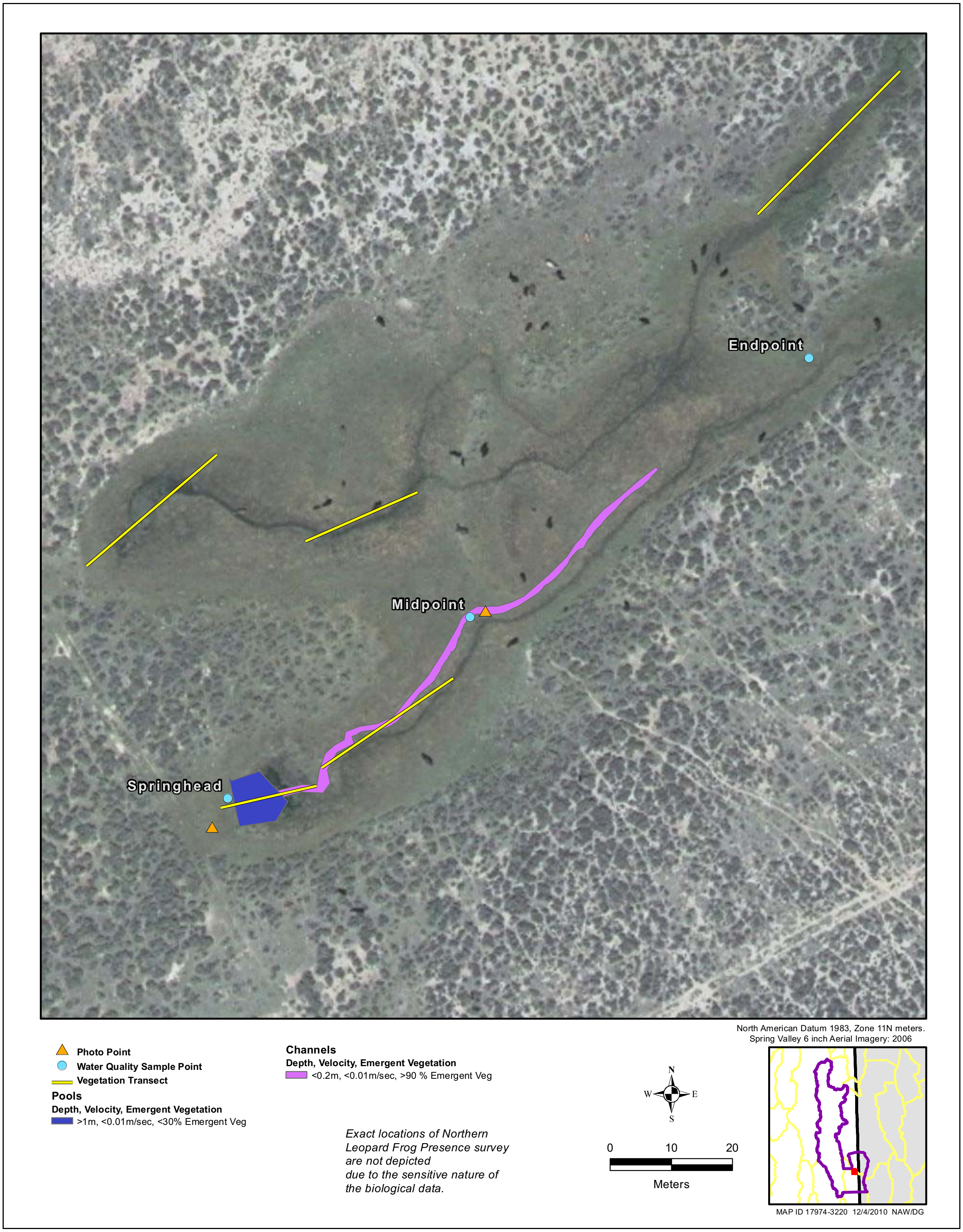



**Figure B-20**
**North Little Physical Habitat Map for Fall 2010**

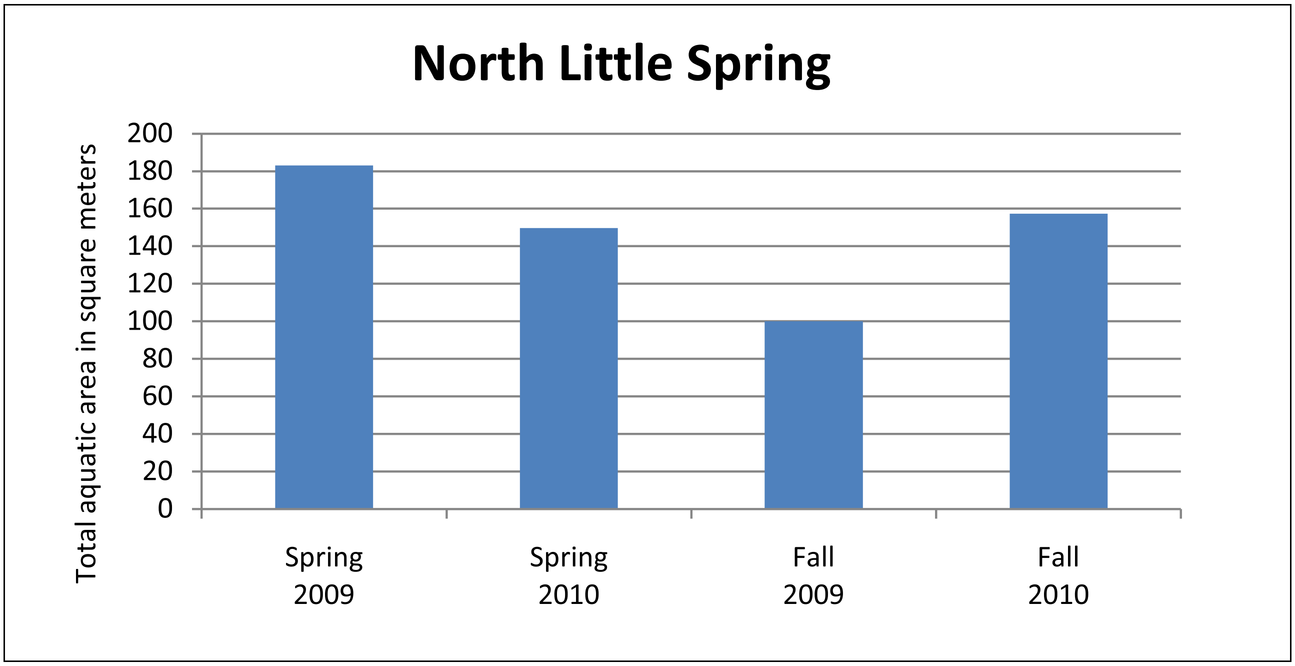



**Figure B-21**
**Total Aquatic Area by Season for 2009 and 2010 at North Little Spring**

## Table B-16
## Spring 2010 Mapped Area at Shoshone Ponds Summarized by Physical Habitat Type, HMU Type, and Total Aquatic Mapped Area

| HMU | Depth (m) | Velocity (m/sec) | Emergent Vegetation (% Cover) | Area ($m^2$) |
|---|---|---|---|---|
| Pool | N/A | N/A | <30 | 621 |

N/A = Not applicable – unable to measure velocity due to shallow or muddy water, extensive aquatic vegetation, or wind.
Note: Interpretations and conclusions made from this data need to take into consideration the margin of error associated with boundary demarcation and associated area measurements.

## Table B-17
## Fall 2010 Mapped Area at Shoshone Ponds Summarized by Physical Habitat Type, HMU Type, and Total Aquatic Mapped Area

| HMU | Depth (m) | Velocity (m/sec) | Emergent Vegetation (% Cover) | Area ($m^2$) |
|---|---|---|---|---|
| Pool | >1 | N/A | <30 | 623 |

N/A = Not applicable – unable to measure velocity due to shallow or muddy water, extensive aquatic vegetation, or wind.
Note: Interpretations and conclusions made from this data need to take into consideration the margin of error associated with boundary demarcation and associated area measurements.

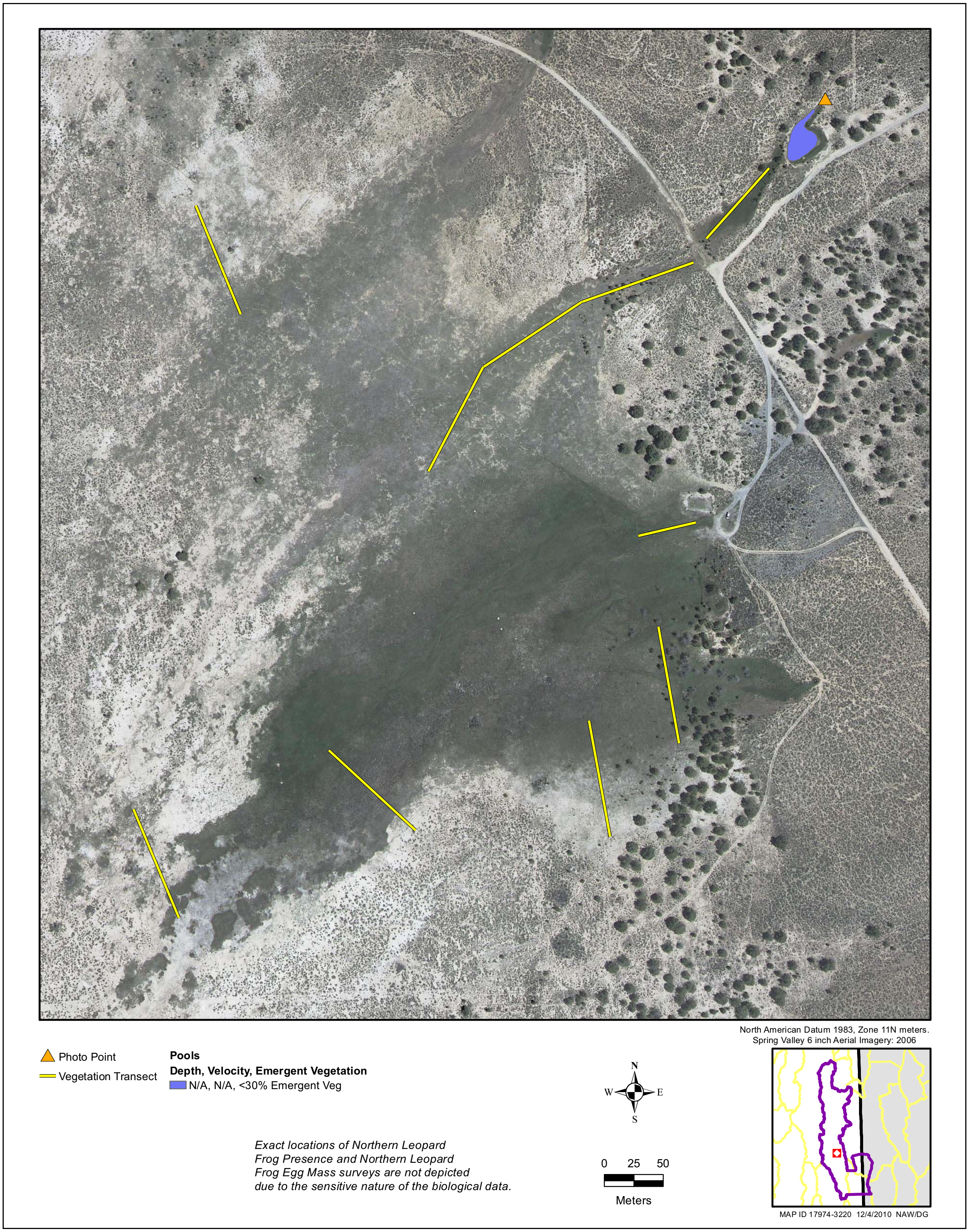



**Figure B-22**
**Shoshone Ponds Physical Habitat Map for Spring 2010**

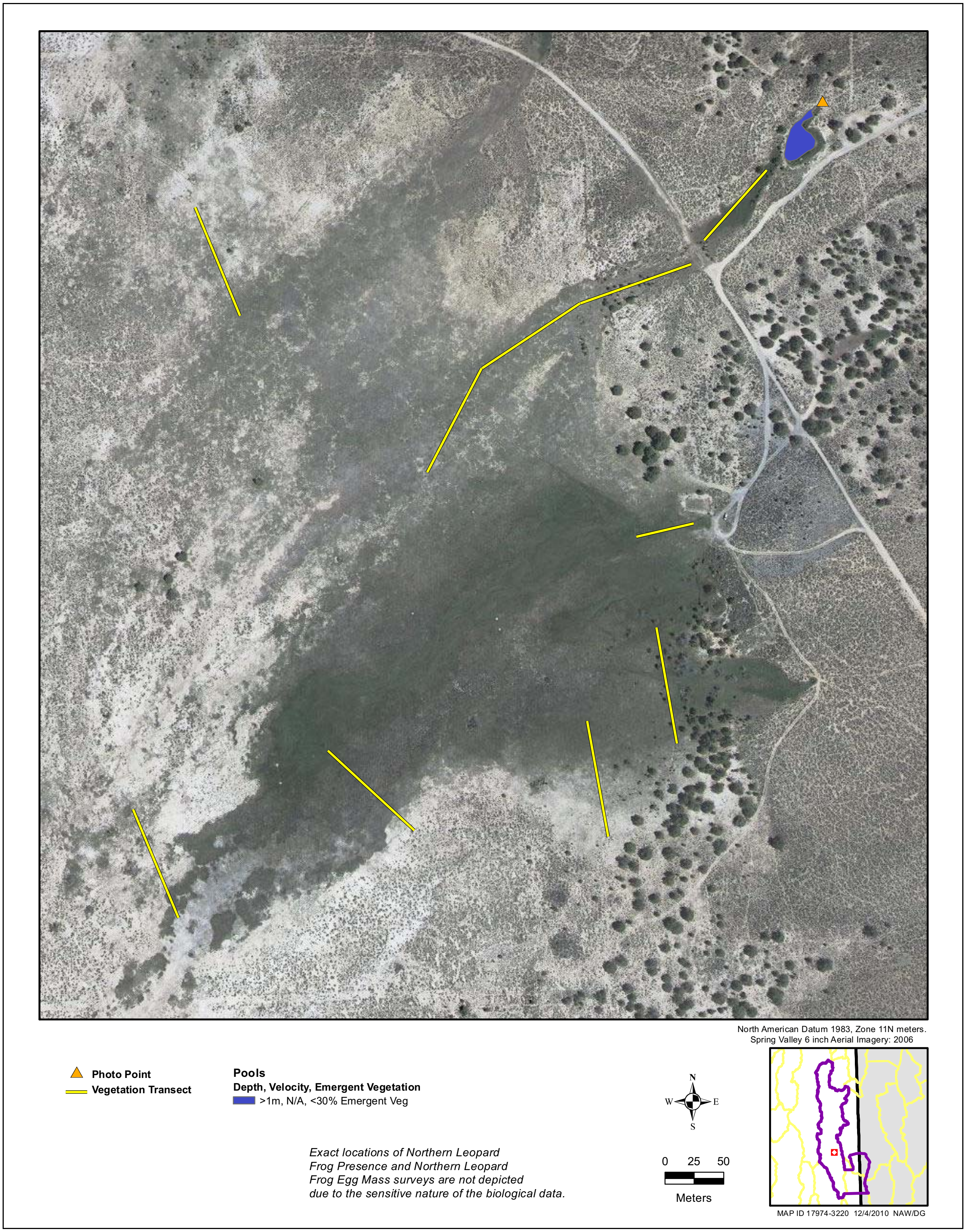



**Figure B-23**
**Shoshone Ponds Physical Habitat Map for Fall 2010**

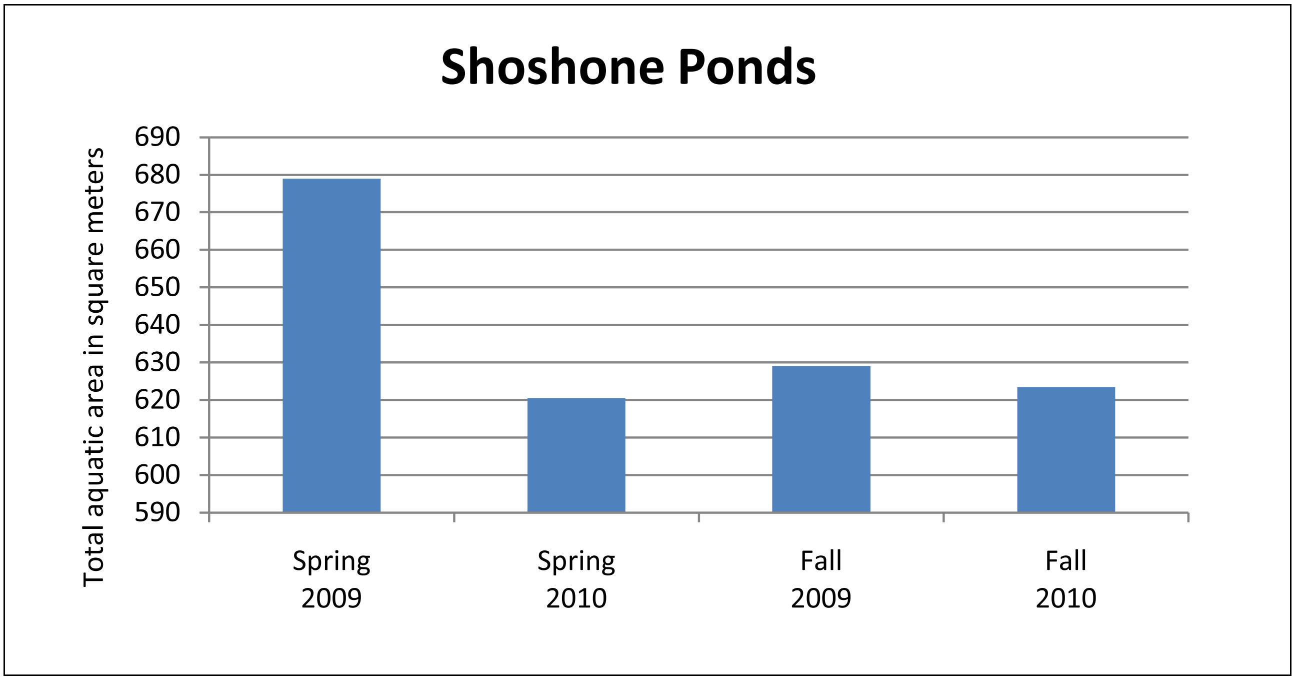



**Figure B-24**
**Total Aquatic Area by Season for 2009 and 2010 at Shoshone Ponds**

## Table B-18
## Spring 2010 Mapped Area at South Millick Spring Summarized by Physical Habitat Type, HMU Type, and Total Aquatic Mapped Area

| HMU | Depth (m) | Velocity (m/sec) | Emergent Vegetation (% Cover) | Area ($m^2$) |
|---|---|---|---|---|
| Channel | <0.2 | <0.01 | <30 | 55 |
| Channel | <0.2 | <0.01 | 30 - 90 | 23 |
| Channel | <0.2 | N/A | >90 | 49 |
| Channel | 0.2 - 1 | <0.01 | >90 | 55 |
| Channel | 0.2 - 1 | 0.01 - 0.1 | <30 | 95 |
| Channel | 0.2 - 1 | 0.01 - 0.1 | >90 | 78 |
| Channel | 0.2 - 1 | 0.01 - 0.1 | 30 - 90 | 754 |
| Channel | 0.2 - 1 | 0.1 - 0.5 | 30 - 90 | 457 |
| Pool | <0.2 | <0.01 | 30 - 90 | 106 |
| | | | **Total Channels** | **1566** |
| | | | **Total Pools** | **106** |
| | | | **Total Aquatic Area** | **1672** |

N/A = Not applicable – unable to measure velocity due to shallow or muddy water, extensive aquatic vegetation, or wind.
Note: Interpretations and conclusions made from this data need to take into consideration the margin of error associated with boundary demarcation and associated area measurements.

Note:

## Table B-19
## Fall 2010 Mapped Area at South Millick Spring Summarized by Physical Habitat Type, HMU Type, and Total Aquatic Mapped Area

| HMU | Depth (m) | Velocity (m/sec) | Emergent Vegetation (% Cover) | Area ($m^2$) |
|---|---|---|---|---|
| Channel | <0.2 | <0.01 | >90 | 40 |
| Channel | 0.2 - 1 | <0.01 | <30 | 61 |
| Channel | 0.2 - 1 | <0.01 | >90 | 472 |
| Channel | 0.2 - 1 | <0.01 | 30 - 90 | 134 |
| Channel | 0.2 - 1 | 0.01 - 0.1 | >90 | 152 |
| Channel | 0.2 - 1 | 0.01 - 0.1 | 30 - 90 | 258 |
| Channel | 0.2 - 1 | 0.1 - 0.5 | 30 - 90 | 219 |
| Pool | <0.2 | <0.01 | >90 | 81 |
| Pool | 0.2 - 1 | <0.01 | <30 | 117 |
| Pool | 0.2 - 1 | <0.01 | >90 | 58 |
| Pool | 0.2 - 1 | <0.01 | 30 - 90 | 142 |
| | | | **Total Channels** | **1336** |
| | | | **Total Pools** | **398** |
| | | | **Total Aquatic Area** | **1734** |

Note: Interpretations and conclusions made from this data need to take into consideration the margin of error associated with boundary demarcation and associated area measurements.

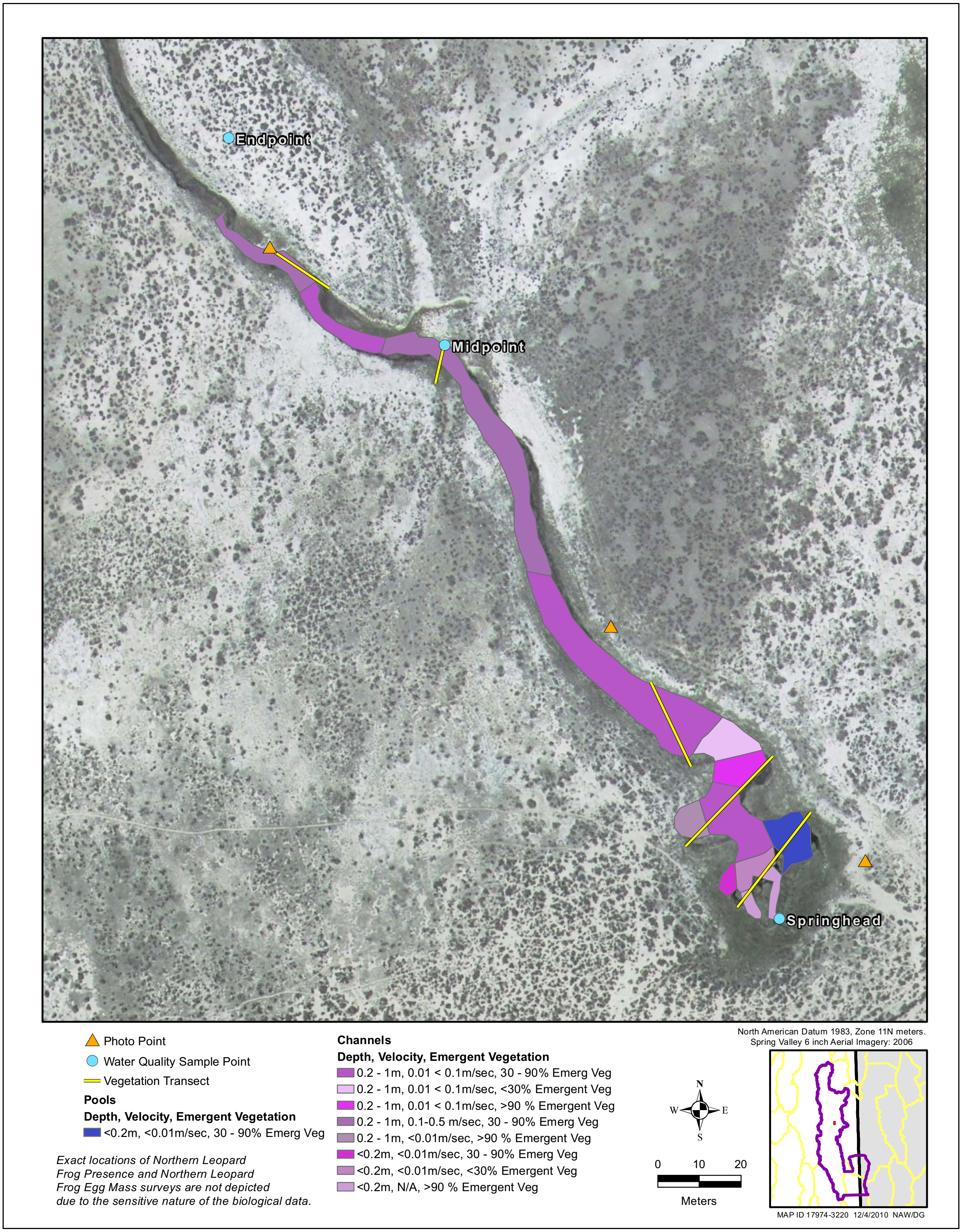



**Figure B-25**
**South Millick Physical Habitat Map for Spring 2010**

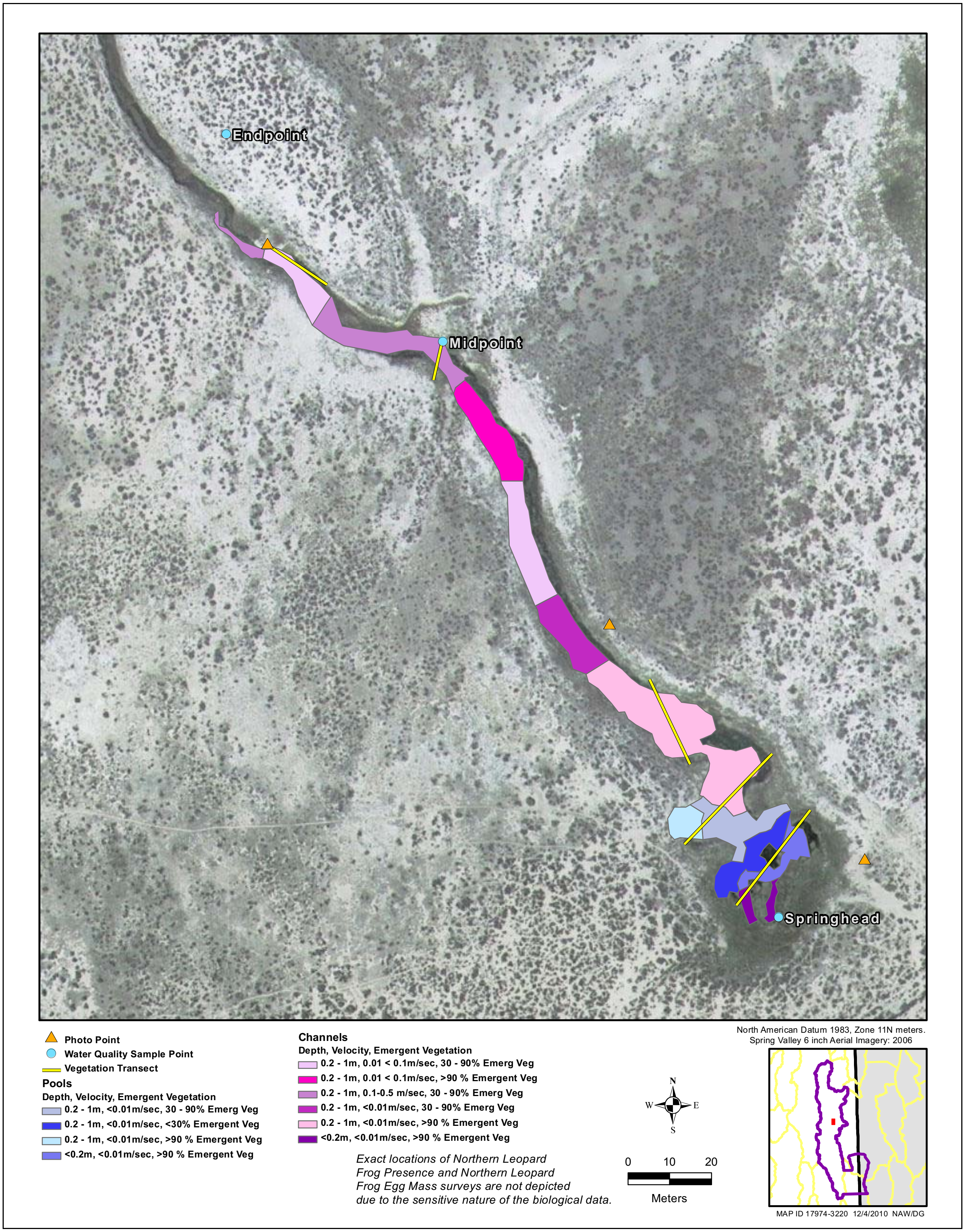



**Figure B-26**
**South Millick Physical Habitat Map for Fall 2010**

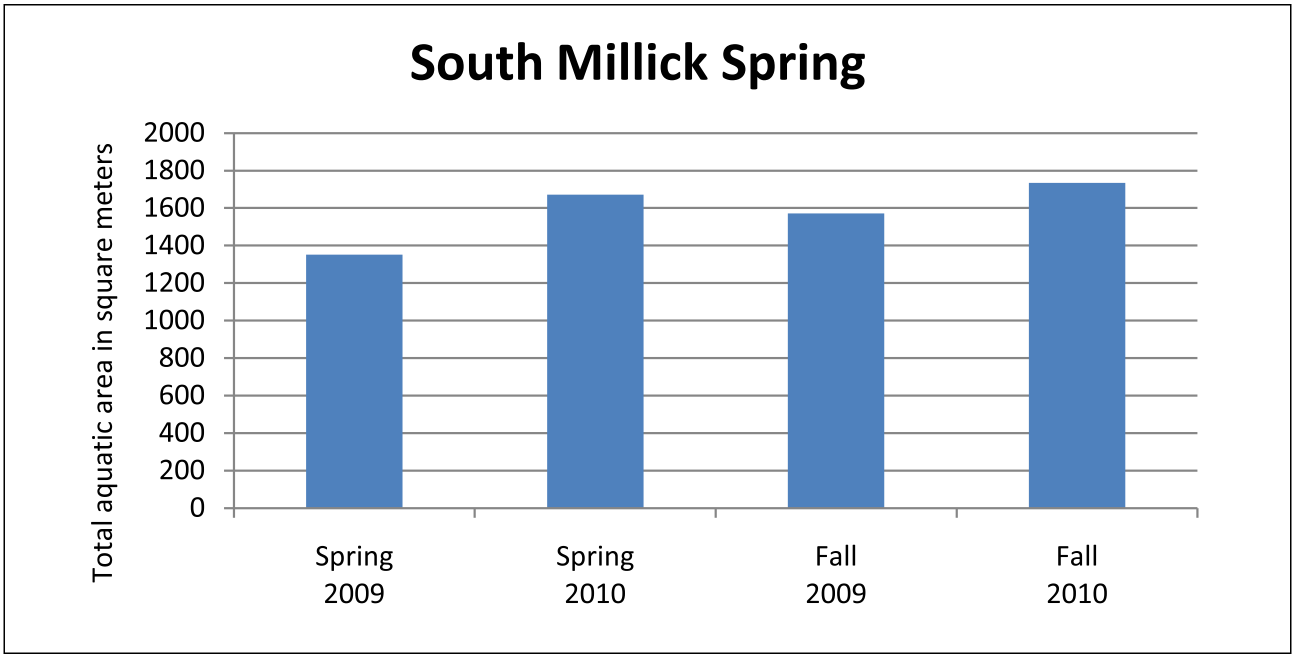



**Figure B-27**
**Total Aquatic Area by Season for 2009 and 2010 at South Millick Spring**

## Table B-20
## Spring 2010 Mapped Area at Stateline Springs Summarized by Physical Habitat Type, HMU Type, and Total Aquatic Mapped Area

| HMU | Depth (m) | Velocity (m/sec) | Emergent Vegetation (% Cover) | Area ($m^2$) |
|---|---|---|---|---|
| Channel | <0.2 | 0.01 - 0.1 | 30 - 90 | 145 |
| Channel | <0.2 | 0.1 - 0.5 | 30 - 90 | 17 |
| Channel | <0.2 | 0.1 - 0.5 | <30 | 6 |
| | | | **Total Channels** | **168** |
| | | | **Total Pools** | **0.0** |
| | | | **Total Aquatic Area** | **168** |

Note: Interpretations and conclusions made from this data need to take into consideration the margin of error associated with boundary demarcation and associated area measurements.

## Table B-21
## Fall 2010 Mapped Area at Stateline Springs Summarized by Physical Habitat Type, HMU Type, and Total Aquatic Mapped Area

| HMU | Depth (m) | Velocity (m/sec) | Emergent Vegetation (% Cover) | Area ($m^2$) |
|---|---|---|---|---|
| Channel | <0.2 | 0.01 - 0.1 | >90 | 108 |
| Channel | <0.2 | 0.1 - 0.5 | 30 - 90 | 29 |
| Pool | <0.2 | <0.01 | 30 - 90 | 10 |
| | | | **Total Channels** | **137** |
| | | | **Total Pools**[a] | **10** |
| | | | **Total Aquatic Area** | **147** |

Note: Interpretations and conclusions made from this data need to take into consideration the margin of error associated with boundary demarcation and associated area measurements.
[a]Channel G at Stateline was not mapped in fall 2010 due to an error in the field.

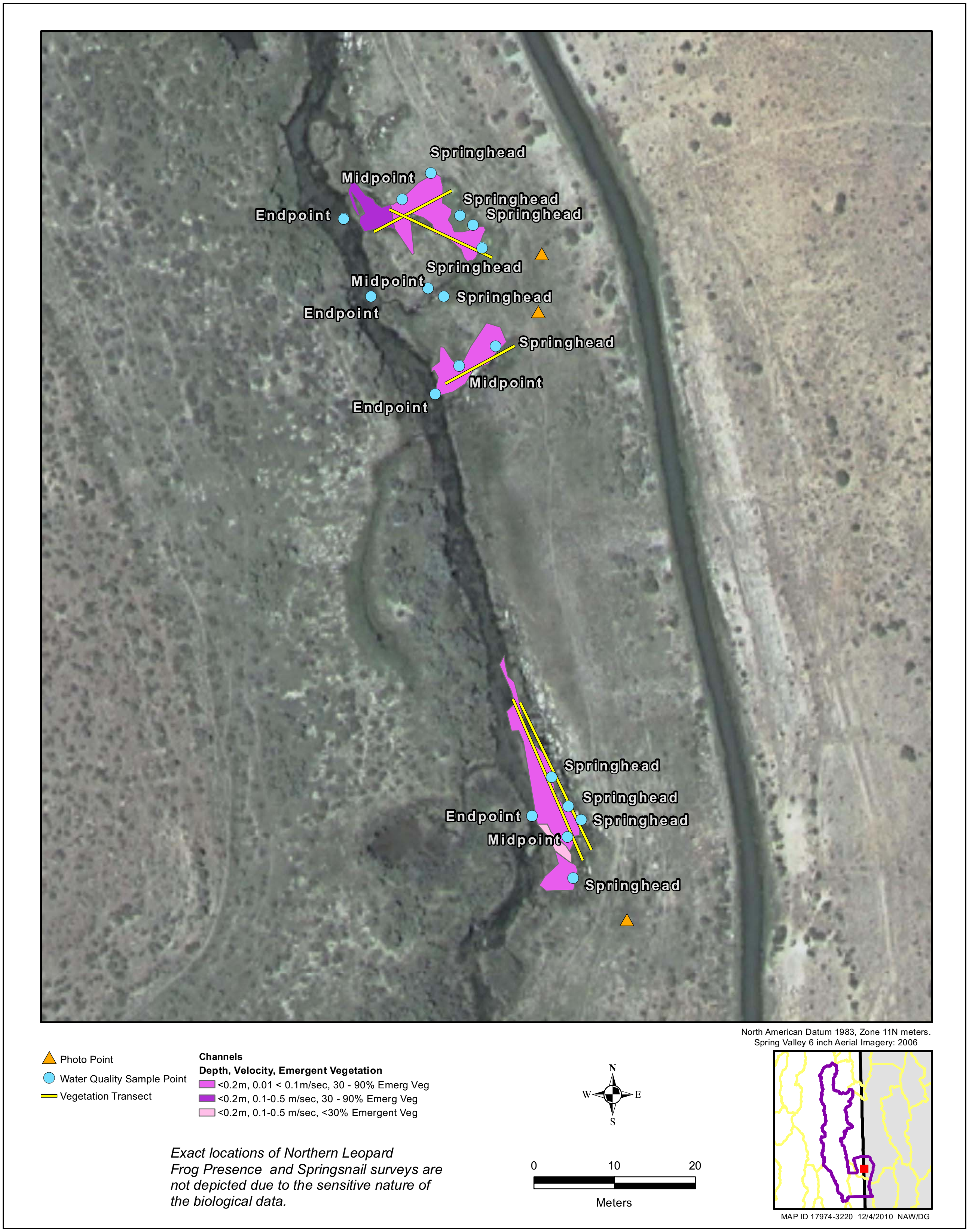



**Figure B-28**
**Stateline Springs Physical Habitat Map for Spring 2010**

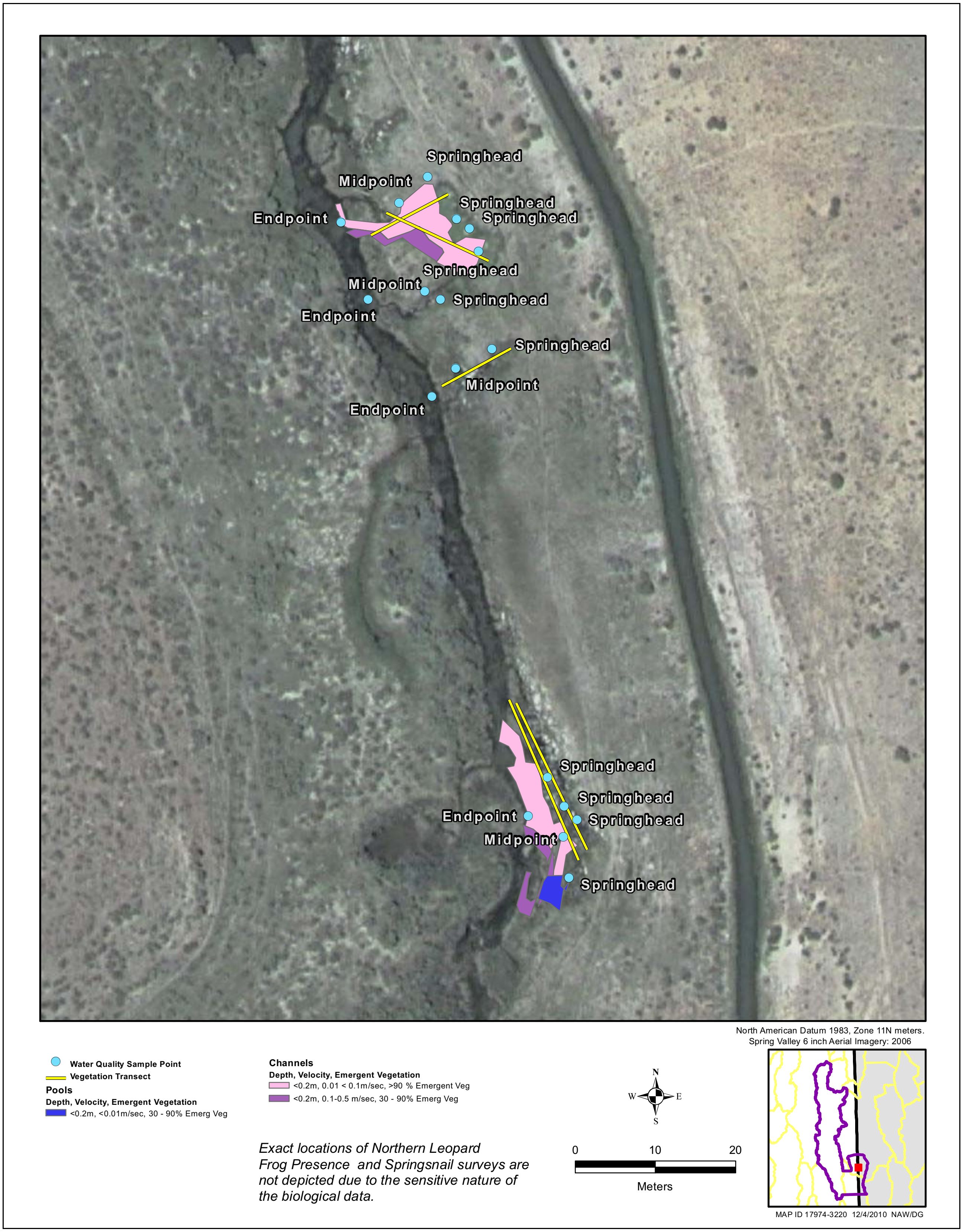



**Figure B-29**
**Stateline Springs Physical Habitat Map for Fall 2010**

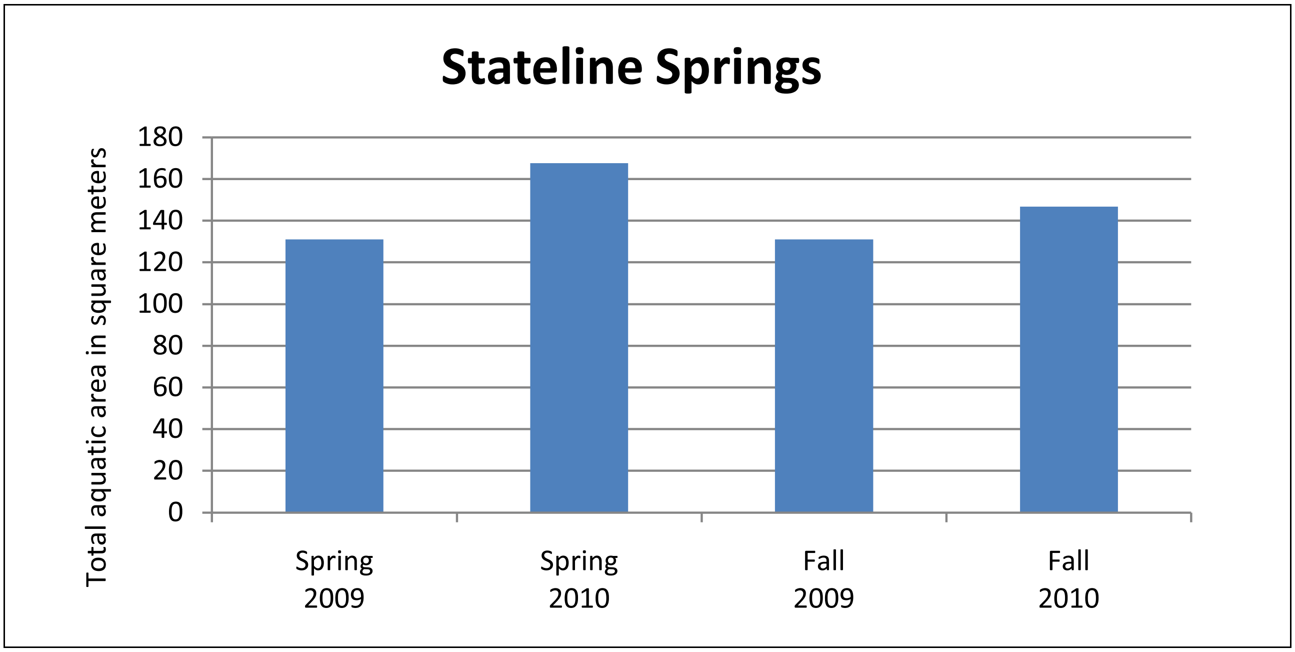



**Figure B-30**
**Total Aquatic Area by Season for 2009 and 2010 at Stateline Springs**

## Table B-22
## Spring 2010 Mapped Area at Stonehouse Spring Complex Summarized by Physical Habitat Type, HMU Type, and Total Aquatic Mapped Area

| HMU | Depth (m) | Velocity (m/sec) | Emergent Vegetation (% Cover) | Area ($m^2$) |
|---|---|---|---|---|
| Channel | <0.2 | <0.01 | 30 - 90 | 36 |
| Channel | <0.2 | 0.01 - 0.1 | 30 - 90 | 77 |
| Pool | 0.2 - 1 | <0.01 | <30 | 78 |
| | | | **Total Channels** | **113** |
| | | | **Total Pools** | **78** |
| | | | **Total Aquatic Area** | **191** |

Note: Interpretations and conclusions made from this data need to take into consideration the margin of error associated with boundary demarcation and associated area measurements.

## Table B-23
## Fall 2010 Mapped Area at Stonehouse Spring Complex Summarized by Physical Habitat Type, HMU Type, and Total Aquatic Mapped Area

| HMU | Depth (m) | Velocity (m/sec) | Emergent Vegetation (% Cover) | Area ($m^2$) |
|---|---|---|---|---|
| Channel | <0.2 | <0.01 | 30 - 90 | 64 |
| Channel | <0.2 | 0.01 - 0.1 | 30 - 90 | 38 |
| Pool | 0.2 - 1 | <0.01 | <30 | 49 |
| | | | **Total Channels** | **102** |
| | | | **Total Pools** | **49** |
| | | | **Total Aquatic Area** | **151** |

Note: Interpretations and conclusions made from this data need to take into consideration the margin of error associated with boundary demarcation and associated area measurements.

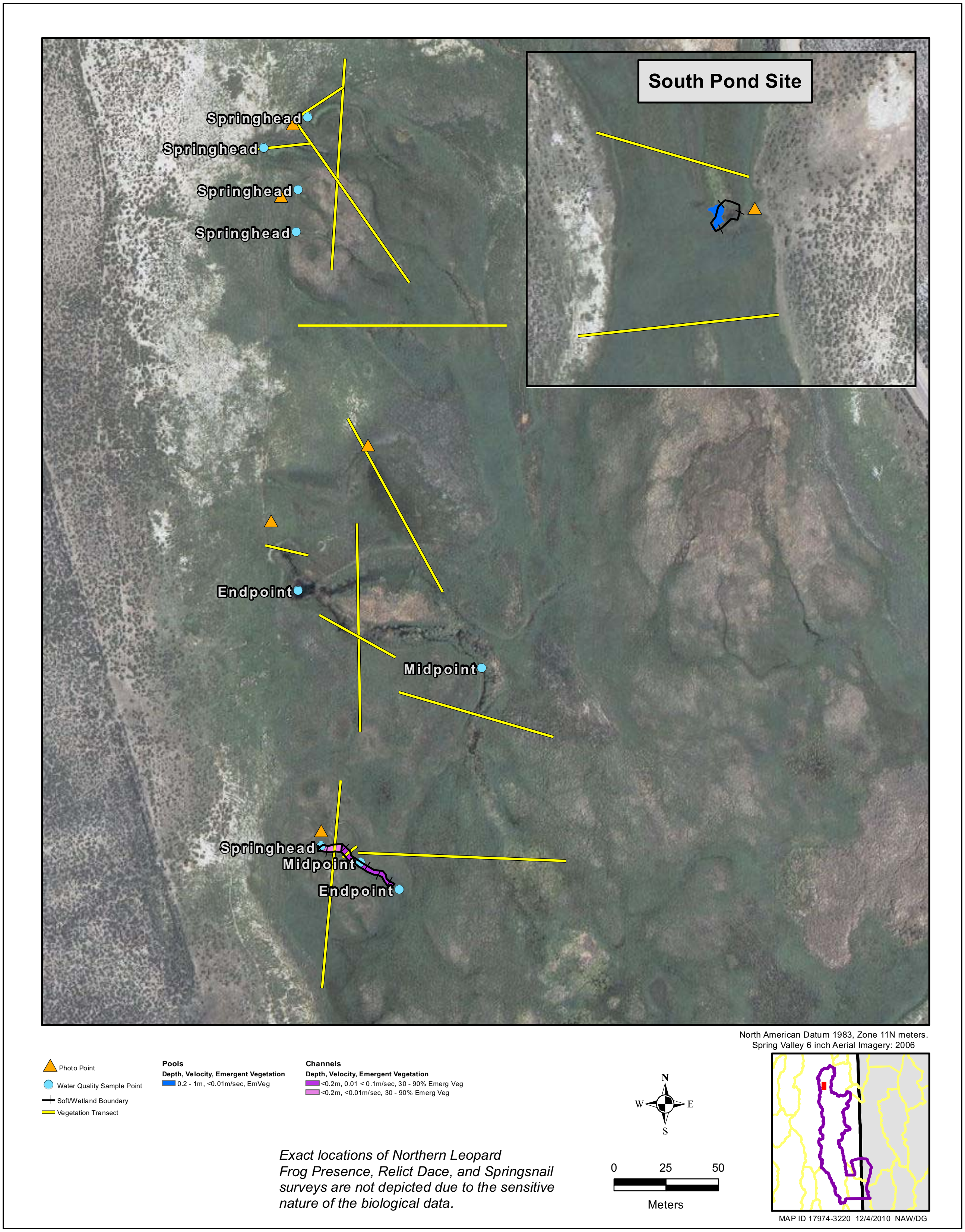



**Figure B-31**
**Stonehouse Physical Habitat Map for Spring 2010**

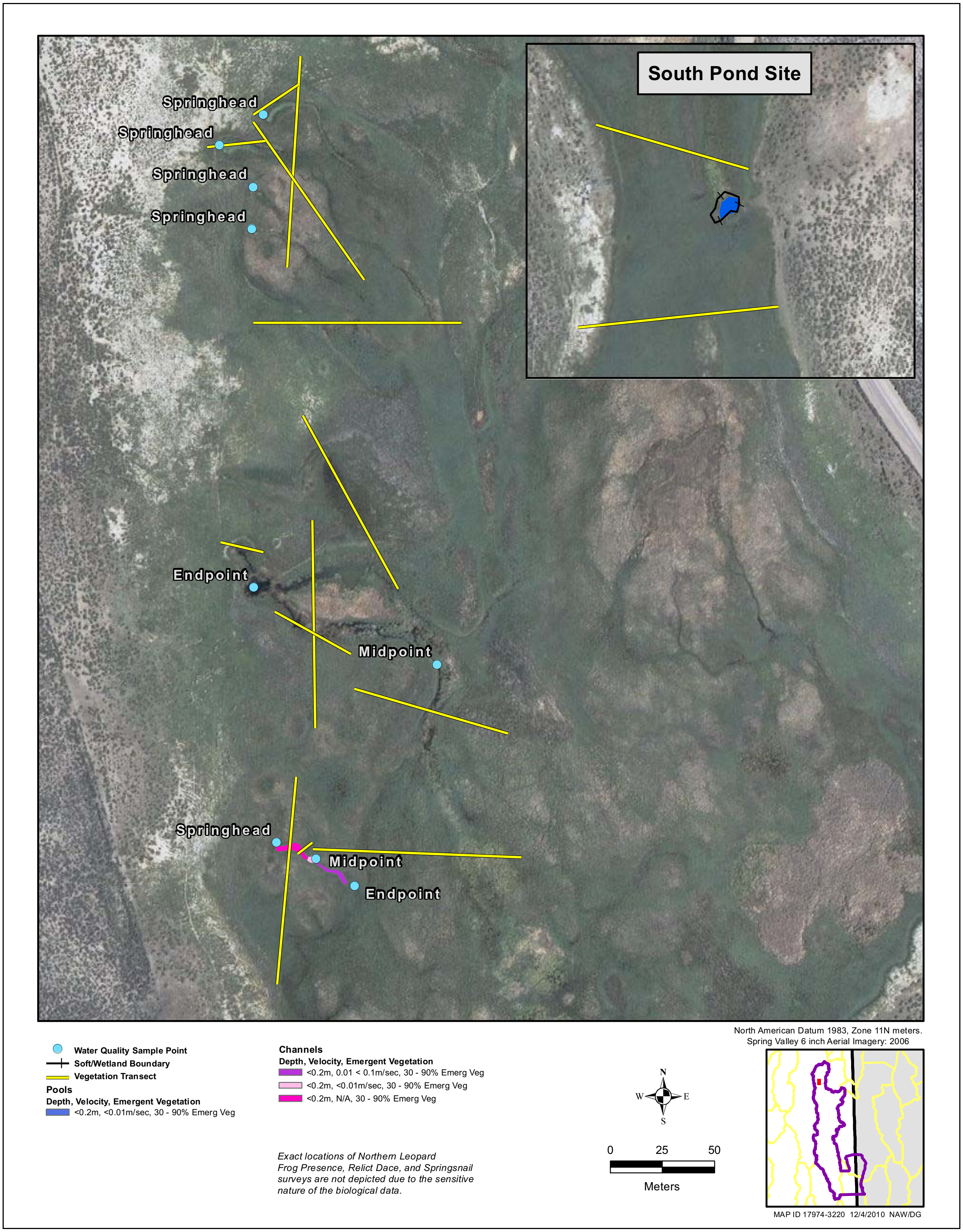



**Figure B-32**
**Stonehouse Physical Habitat Map for Fall 2010**

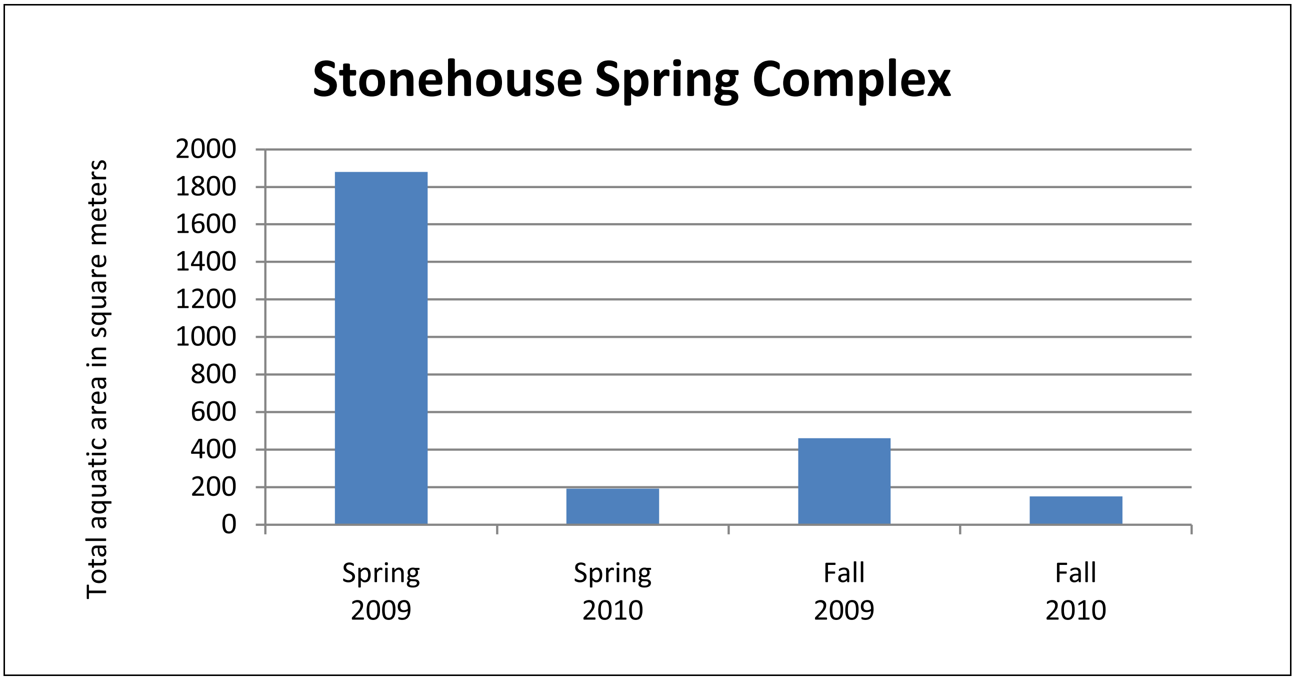



**Figure B-33**
**Total Aquatic Area by Season for 2009 and 2010 at Stonehouse**

**Table B-24**
**Spring 2010 Mapped Area at Swallow Spring Summarized by Physical Habitat Type, HMU Type, and Total Aquatic Mapped Area**

| HMU | Depth (m) | Velocity (m/sec) | Emergent Vegetation (% Cover) | Area ($m^2$) |
|---|---|---|---|---|
| Channel | <0.2 | >0.5 | 30 - 90 | 125 |
| Channel | <0.2 | 0.01 - 0.1 | 30 - 90 | 170 |
| Channel | <0.2 | 0.1 - 0.5 | 30 - 90 | 493 |
| Channel | 0.2 - 1 | 0.01 - 0.1 | 30 - 90 | 28 |
| Pool | 0.2 - 1 | <0.01 | >90 | 56 |
| | | | **Total Channels** | **816** |
| | | | **Total Pools** | **56** |
| | | | **Total Aquatic Area** | **872** |

Note: Interpretations and conclusions made from this data need to take into consideration the margin of error associated with boundary demarcation and associated area measurements.

**Table B-25**
**Fall 2010 Mapped Area at Swallow Spring Summarized by Physical Habitat Type, HMU Type, and Total Aquatic Mapped Area**

| HMU | Depth (m) | Velocity (m/sec) | Emergent Vegetation (% Cover) | Area ($m^2$) |
|---|---|---|---|---|
| Channel | <0.2 | >0.5 | <30 | 4 |
| Channel | <0.2 | >0.5 | 30 - 90 | 108 |
| Channel | <0.2 | 0.1 - 0.5 | <30 | 99 |
| Channel | <0.2 | 0.1 - 0.5 | >90 | 72 |
| Channel | <0.2 | 0.1 - 0.5 | 30 - 90 | 301 |
| Channel | <0.2 | N/A | 30 - 90 | 2 |
| Pool | 0.2 - 1 | <0.01 | >90 | 126 |
| | | | **Total Channels** | **586** |
| | | | **Total Pools** | **126** |
| | | | **Total Aquatic Area** | **712** |

N/A = Not applicable – unable to measure velocity due to shallow or muddy water, extensive aquatic vegetation, or wind.
Note: Interpretations and conclusions made from this data need to take into consideration the margin of error associated with boundary demarcation and associated area measurements.


**Figure B-34**
**Swallow Creek Physical Habitat Map for Spring 2010**


**Figure B-35**
**Swallow Creek Physical Habitat Map for Fall 2010**

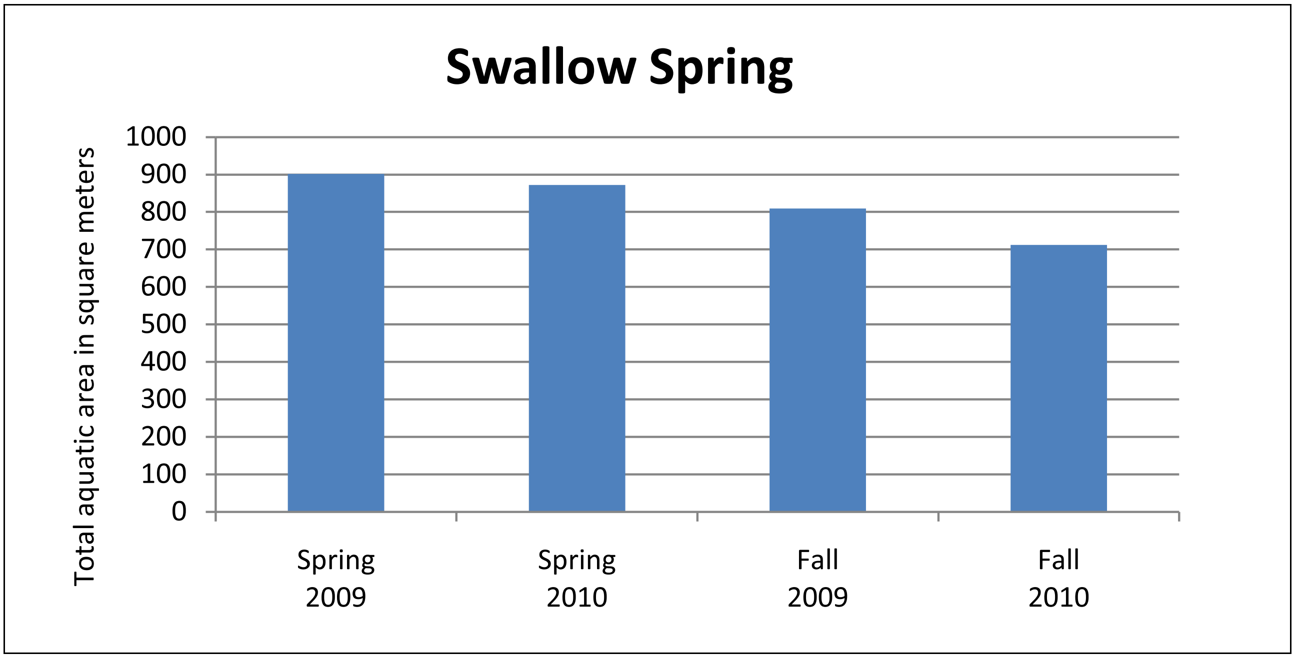



**Figure B-36**
**Total Aquatic Area by Season for 2009 and 2010 at Swallow Spring**

**Table B-26**
**Spring 2010 Mapped Area at Unnamed 1 Spring North of Big Summarized by Physical Habitat Type, HMU Type, and Total Aquatic Mapped Area**

| HMU | Depth (m) | Velocity (m/sec) | Emergent Vegetation (% Cover) | Area ($m^2$) |
|---|---|---|---|---|
| Channel | <0.2 | <0.01 | >90 | 201 |
| Channel | <0.2 | 0.01 - 0.1 | 30 - 90 | 78 |
| Pool | <0.2 | <0.01 | 30 - 90 | 14 |
| | | | **Total Channels** | **280** |
| | | | **Total Pools** | **14** |
| | | | **Total Aquatic Area** | **294** |

Note: Interpretations and conclusions made from this data need to take into consideration the margin of error associated with boundary demarcation and associated area measurements.

**Table B-27**
**Fall 2010 Mapped Area at Unnamed 1 Spring North of Big Summarized by Physical Habitat Type, HMU Type, and Total Aquatic Mapped Area**

| HMU | Depth (m) | Velocity (m/sec) | Emergent Vegetation (% Cover) | Area ($m^2$) |
|---|---|---|---|---|
| Channel | <0.2 | <0.01 | <30 | 8 |
| Channel | <0.2 | <0.01 | 30 - 90 | 76 |
| Channel | <0.2 | 0.01 - 0.1 | 30 - 90 | 198 |
| Pool | <0.2 | <0.01 | >90 | 11 |
| | | | **Total Channels** | **282** |
| | | | **Total Pools** | **11** |
| | | | **Total Aquatic Area** | **293** |

Note: Interpretations and conclusions made from this data need to take into consideration the margin of error associated with boundary demarcation and associated area measurements.

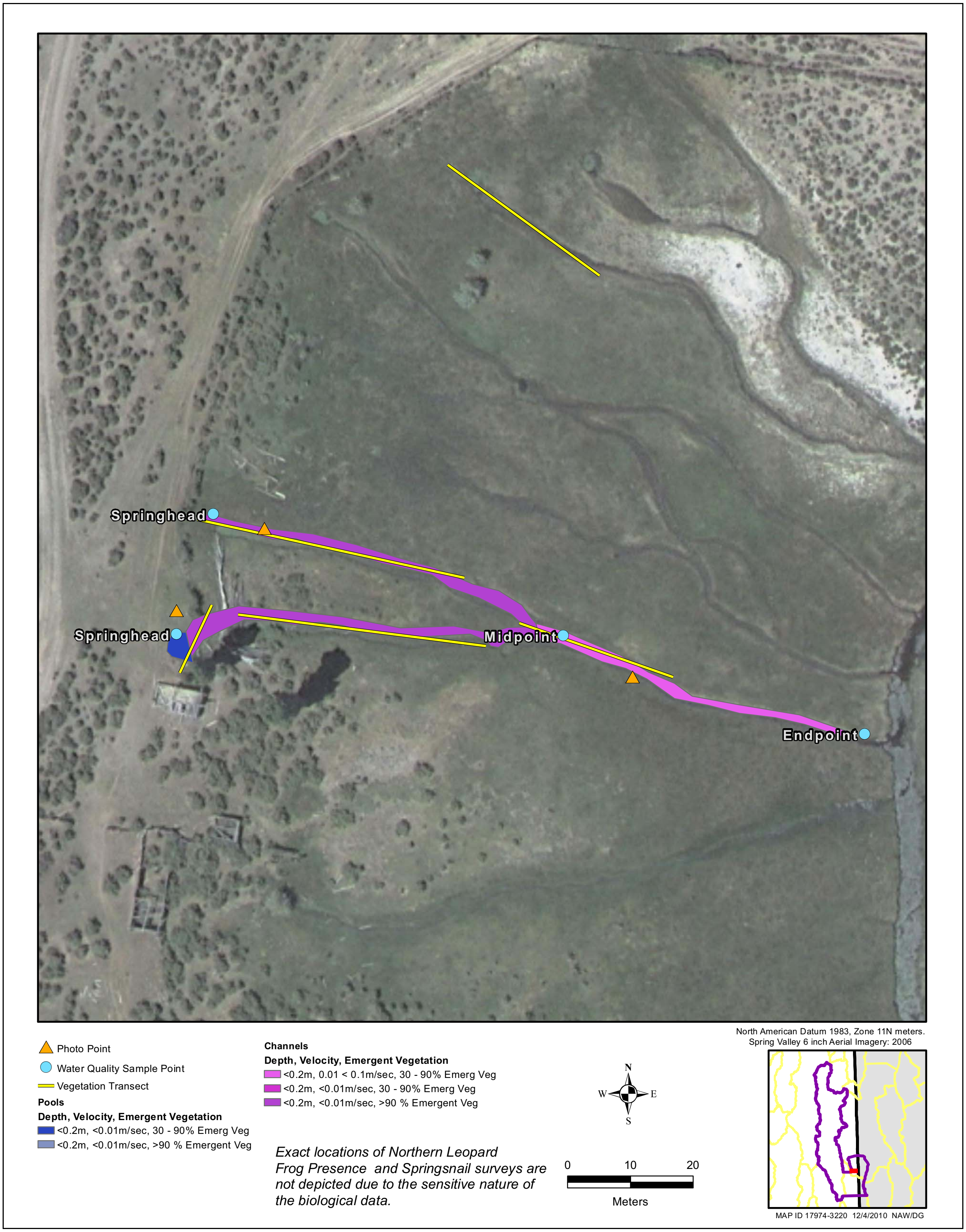



**Figure B-37**
**Unnamed 1 Spring North of Big Physical Habitat Map for Spring 2010**

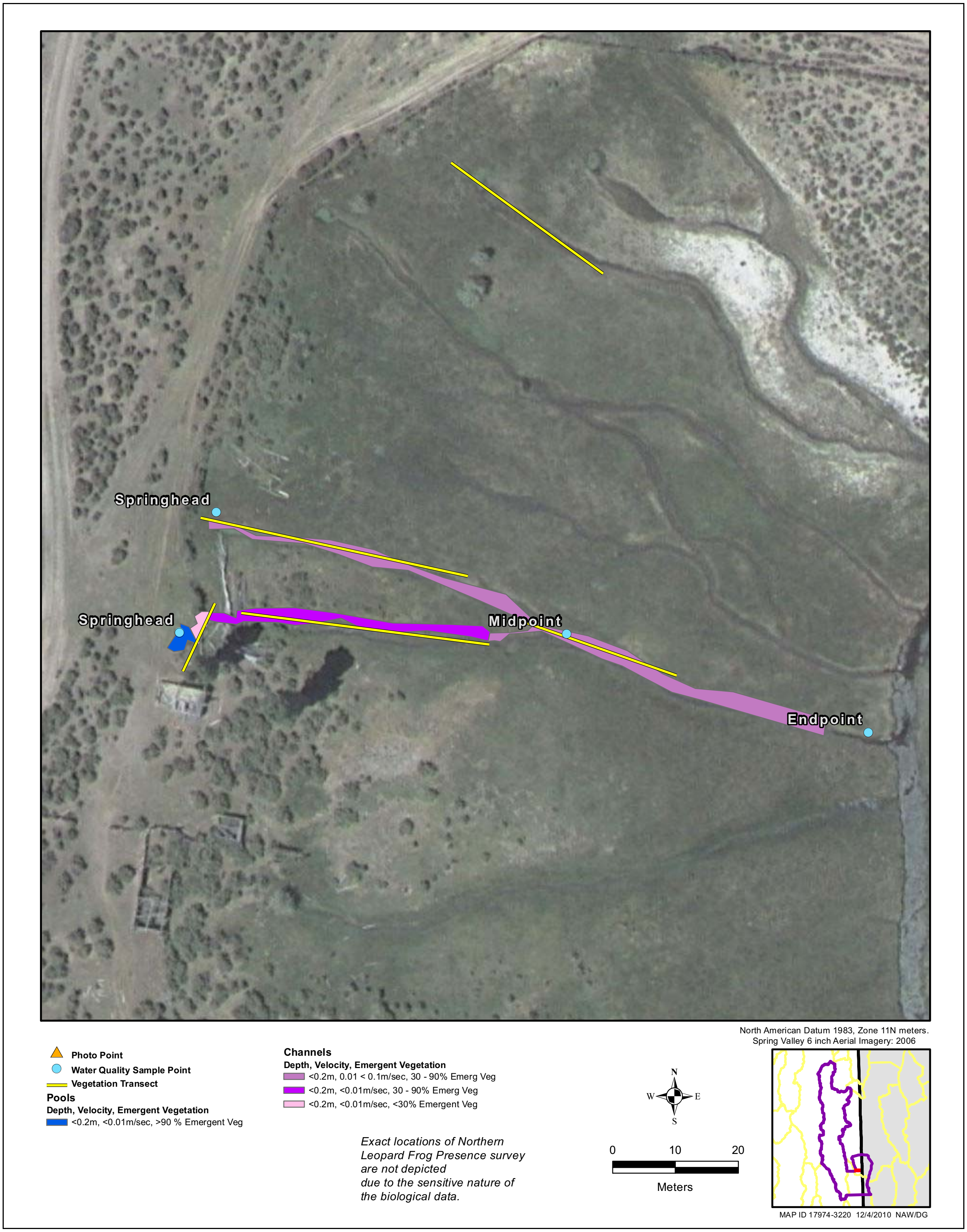



**Figure B-38**
**Unnamed 1 Spring North of Big Physical Habitat Map for Fall 2010**

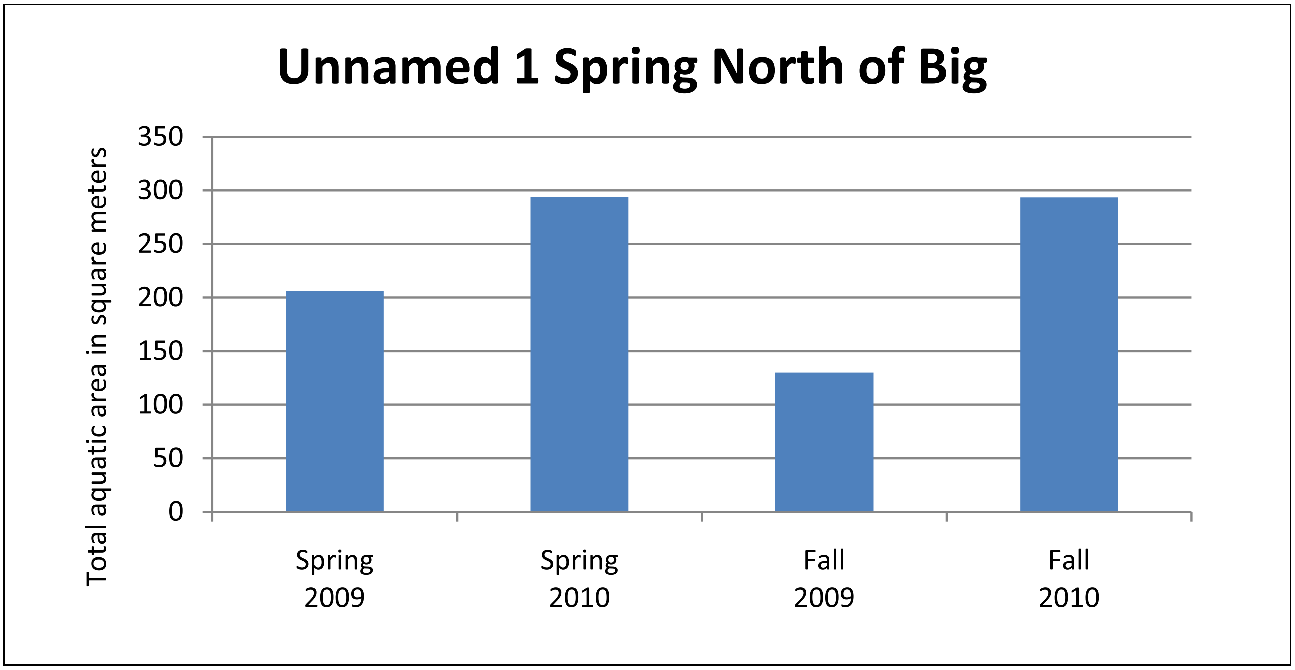



**Figure B-39**
**Total Aquatic Area by Season for 2009 and 2010 at Unnamed 1 Spring North of Big**

## Table B-28
## Spring 2010 Mapped Area at Unnamed 5 Summarized by Physical Habitat Type, HMU Type, and Total Aquatic Mapped Area

| HMU | Depth (m) | Velocity (m/sec) | Emergent Vegetation (% Cover) | Area ($m^2$) |
|---|---|---|---|---|
| Channel | <0.2 | <0.01 | 30 - 90 | 368 |
| Channel | <0.2 | 0.01 - 0.1 | 30 - 90 | 710 |
| Pool | <0.2 | <0.01 | 30 - 90 | 615 |
| Pool | 0.2 - 1 | <0.01 | >90 | 879 |
| | | | **Total Channels** | **1078** |
| | | | **Total Pools** | **1494** |
| | | | **Total Aquatic Area** | **2572** |

Note: Interpretations and conclusions made from this data need to take into consideration the margin of error associated with boundary demarcation and associated area measurements.

## Table B-29
## Fall 2010 Mapped Area at Unnamed 5 Summarized by Physical Habitat Type, HMU Type, and Total Aquatic Mapped Area

| HMU | Depth (m) | Velocity (m/sec) | Emergent Vegetation (% Cover) | Area ($m^2$) |
|---|---|---|---|---|
| Channel | <0.2 | <0.01 | >90 | 814 |
| Channel | <0.2 | <0.01 | 30 - 90 | 56 |
| Channel | <0.2 | 0.01 - 0.1 | 30 - 90 | 120 |
| Channel | <0.2 | 0.01 - 0.1 | 30 - 90 | 62 |
| Pool | <0.2 | <0.01 | 30 - 90 | 701 |
| Pool | 0.2 - 1 | <0.01 | 30 - 90 | 866 |
| | | | **Total Channels** | **1052** |
| | | | **Total Pools** | **1567** |
| | | | **Total Aquatic Area** | **2619** |

Note: Interpretations and conclusions made from this data need to take into consideration the margin of error associated with boundary demarcation and associated area measurements.

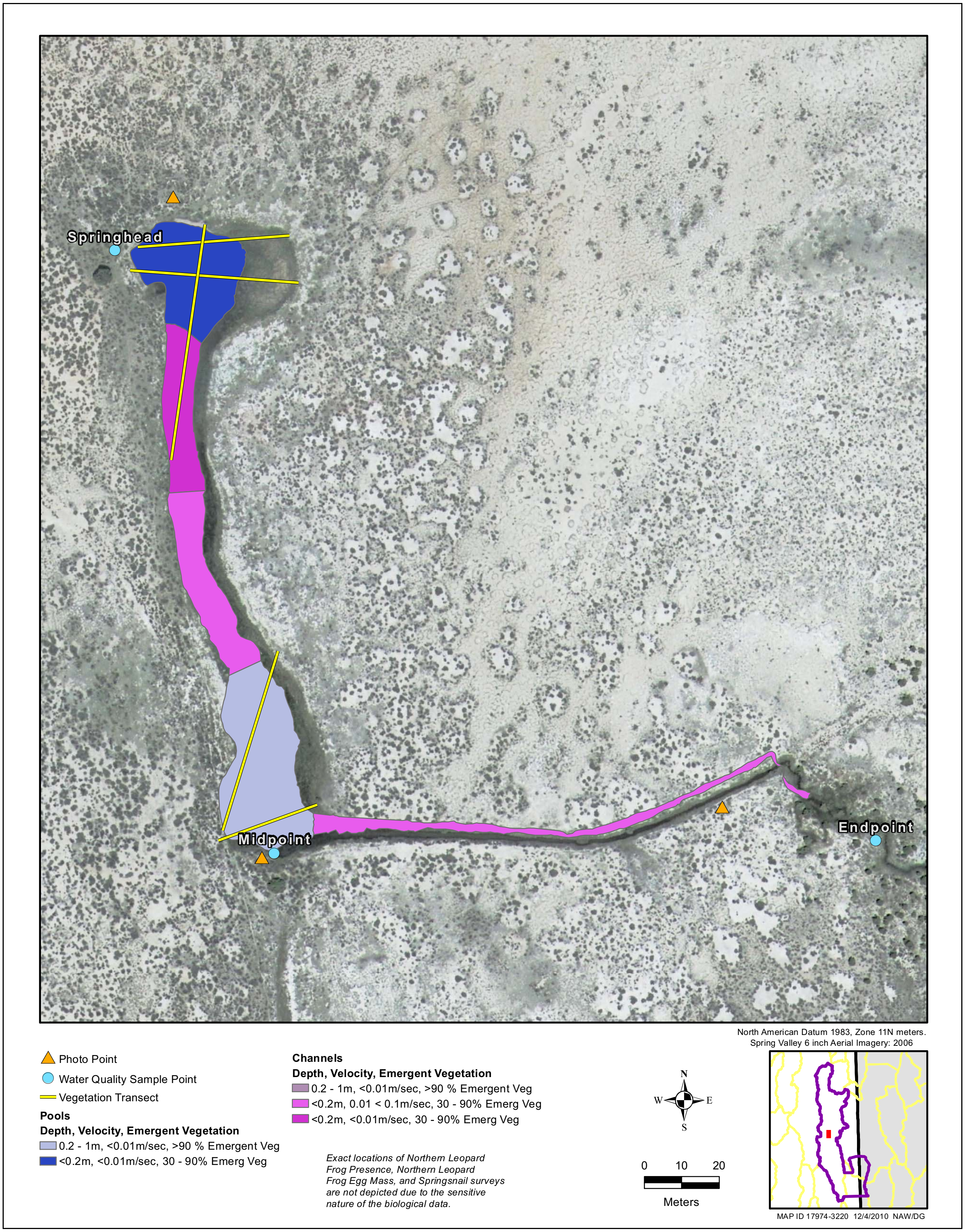



**Figure B-40**
**Unnamed 5 Physical Habitat Map for Spring 2010**

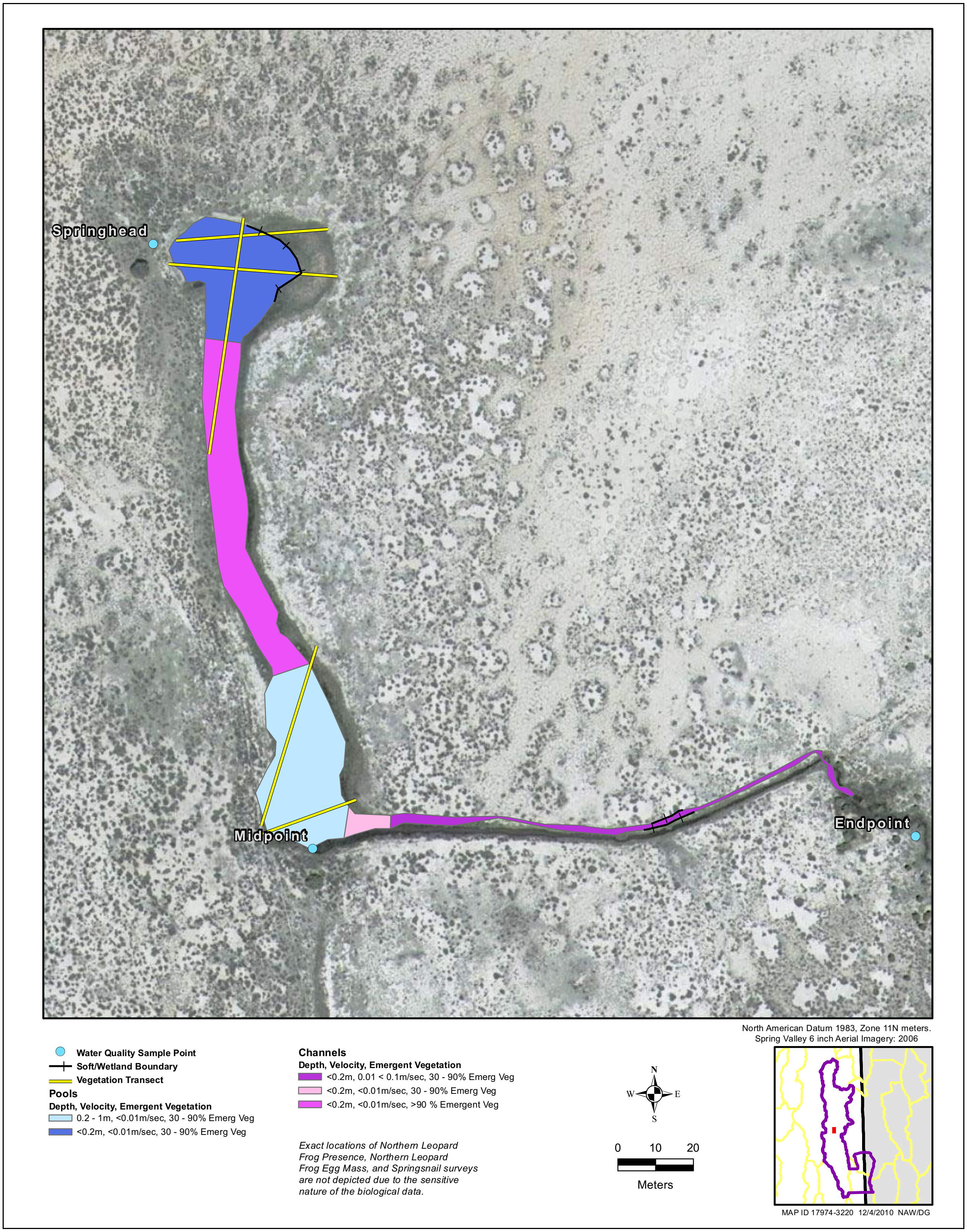



**Figure B-41**
**Unnamed 5 Physical Habitat Map for Fall 2010**

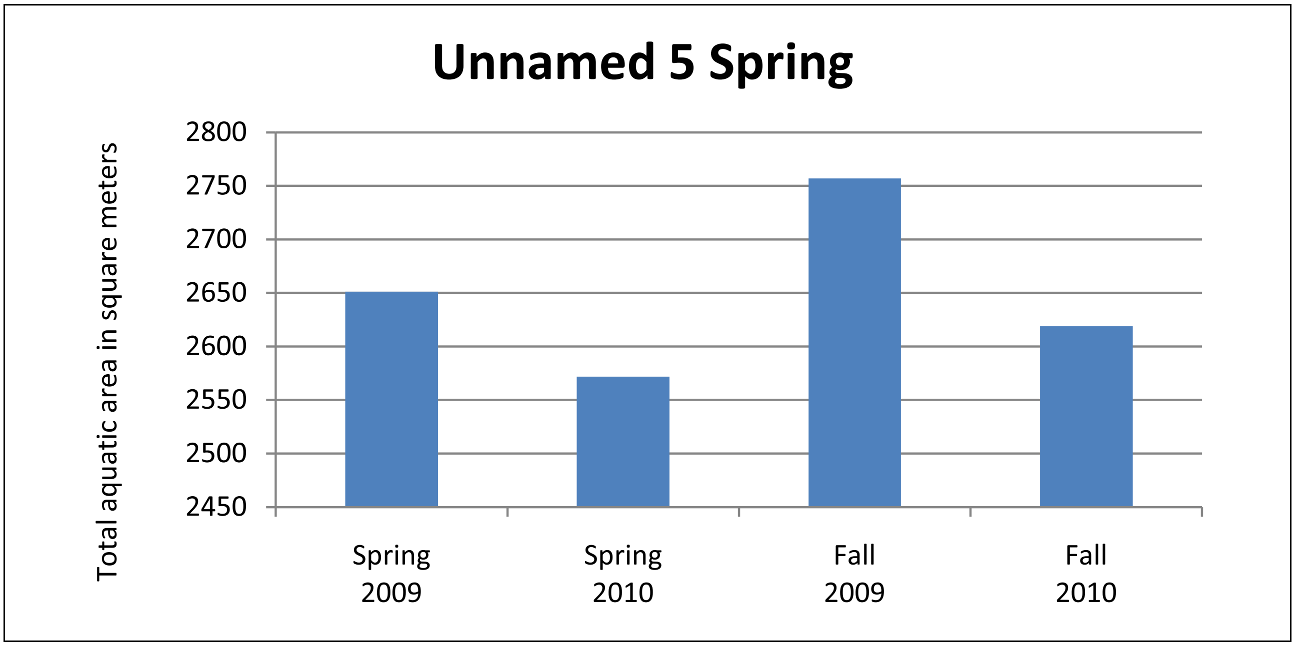



**Figure B-42**
**Total Aquatic Area by Season for 2009 and 2010 at Unnamed 5**

## Table B-30
## Spring 2010 Mapped Area at West Spring Valley Complex 1 Summarized by Physical Habitat Type, HMU Type, and Total Aquatic Mapped Area

| HMU | Depth (m) | Velocity (m/sec) | Emergent Vegetation (% Cover) | Area ($m^2$) |
|---|---|---|---|---|
| Channel | <0.2 | 0.01 - 0.1 | <30 | 203 |
| Channel | <0.2 | 0.01 - 0.1 | >90 | 27 |
| Channel | <0.2 | 0.01 - 0.1 | 30 - 90 | 353 |
| Channel | <0.2 | 0.1 - 0.5 | <30 | 36 |
| Channel | <0.2 | N/A | >90 | 21 |
| Pool | <0.2 | <0.01 | <30 | 51 |
| Pool | <0.2 | <0.01 | >90 | 134 |
| Pool | <0.2 | N/A | >90 | 9 |
| Pool | >1 | <0.01 | <30 | 81 |
| Pool | 0.2 - 1 | <0.01 | <30 | 69 |
| | | | **Total Channels** | **640** |
| | | | **Total Pools** | **344** |
| | | | **Total Aquatic Area** | **984** |

N/A = Not applicable – unable to measure velocity due to shallow or muddy water, extensive aquatic vegetation, or wind.
Note: Interpretations and conclusions made from this data need to take into consideration the margin of error associated with boundary demarcation and associated area measurements.

## Table B-31
## Fall 2010 Mapped Area at West Spring Valley Complex 1 Summarized by Physical Habitat Type, HMU Type, and Total Aquatic Mapped Area

| HMU | Depth (m) | Velocity (m/sec) | Emergent Vegetation (% Cover) | Area ($m^2$) |
|---|---|---|---|---|
| Channel | <0.2 | <0.01 | >90 | 10 |
| Channel | <0.2 | 0.01 - 0.1 | <30 | 872 |
| Channel | <0.2 | 0.01 - 0.1 | >90 | 261 |
| Channel | <0.2 | 0.01 - 0.1 | 30 - 90 | 37 |
| Channel | <0.2 | 0.1 - 0.5 | <30 | 65 |
| Channel | 0.2 - 1 | 0.01 - 0.1 | <30 | 47 |
| Pool | <0.2 | <0.01 | >90 | 83 |
| Pool | <0.2 | N/A | >90 | 4 |
| Pool | >1 | <0.01 | <30 | 96 |
| Pool | 0.2 - 1 | <0.01 | <30 | 59 |
| | | | **Total Channels** | **1292** |
| | | | **Total Pools** | **242** |
| | | | **Total Aquatic Area** | **1534** |

N/A = Not applicable – unable to measure velocity due to shallow or muddy water, extensive aquatic vegetation, or wind.
Note: Interpretations and conclusions made from this data need to take into consideration the margin of error associated with boundary demarcation and associated area measurements.
Between the spring and fall mapping excavation work was completed along the banks of some of the channels. As a result some areas were more channelized than in the Spring and had decreased vegetation cover, increased velocity and one channel continued further downstream.

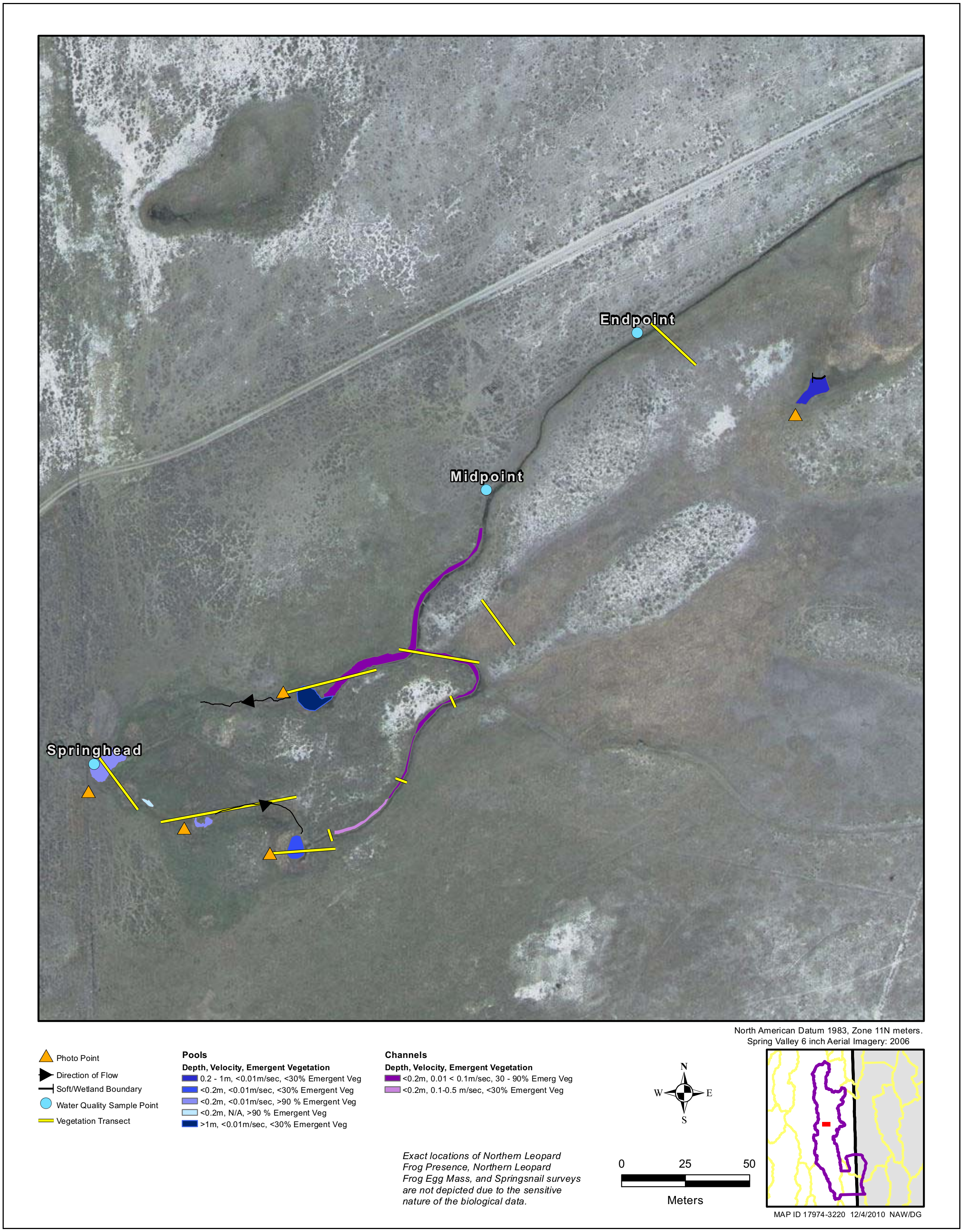



**Figure B-43**
**West Spring Valley Complex 1 Physical Habitat Map for Spring 2010**

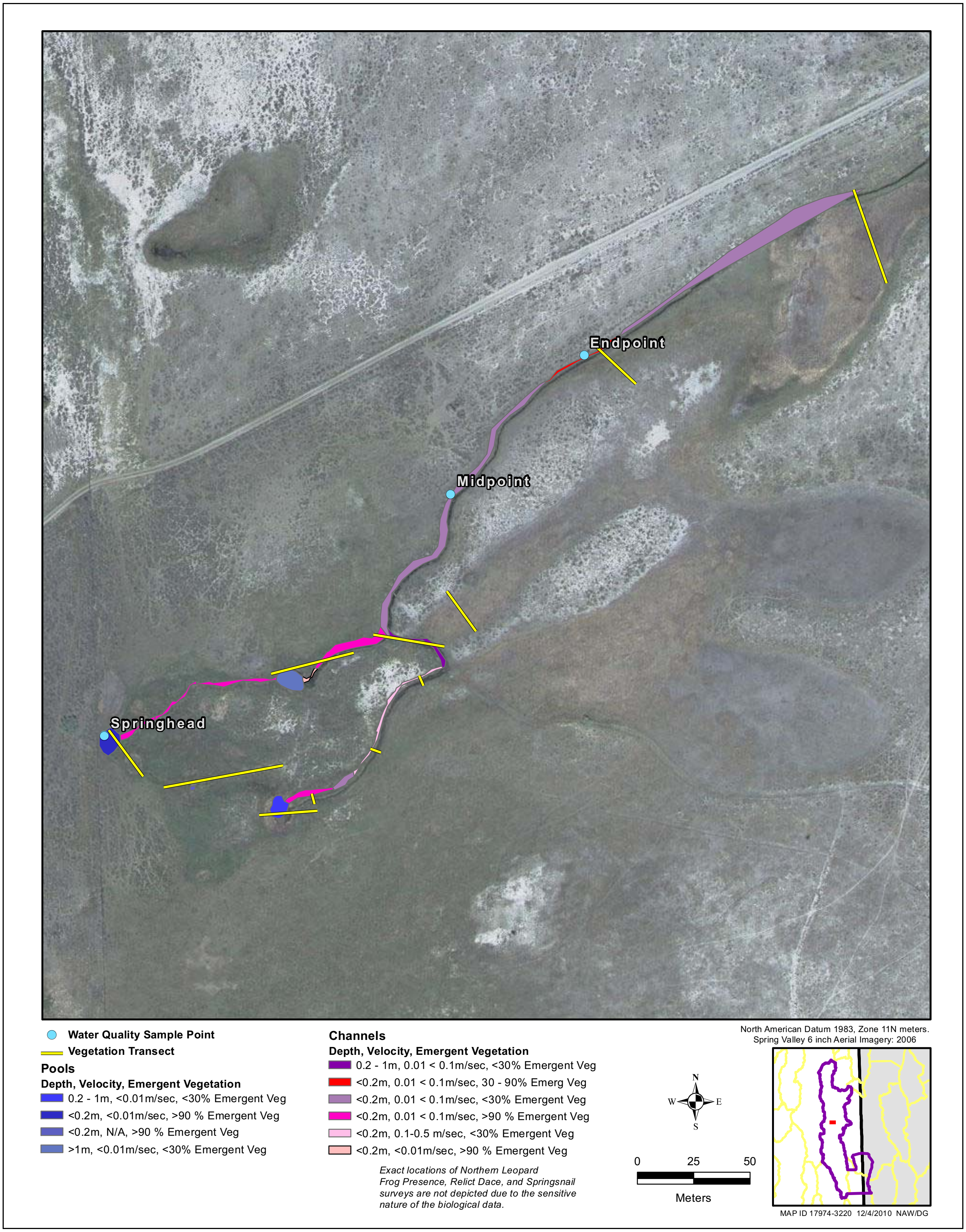



**Figure B-44**
**West Spring Valley Complex 1 Physical Habitat Map for Fall 2010**

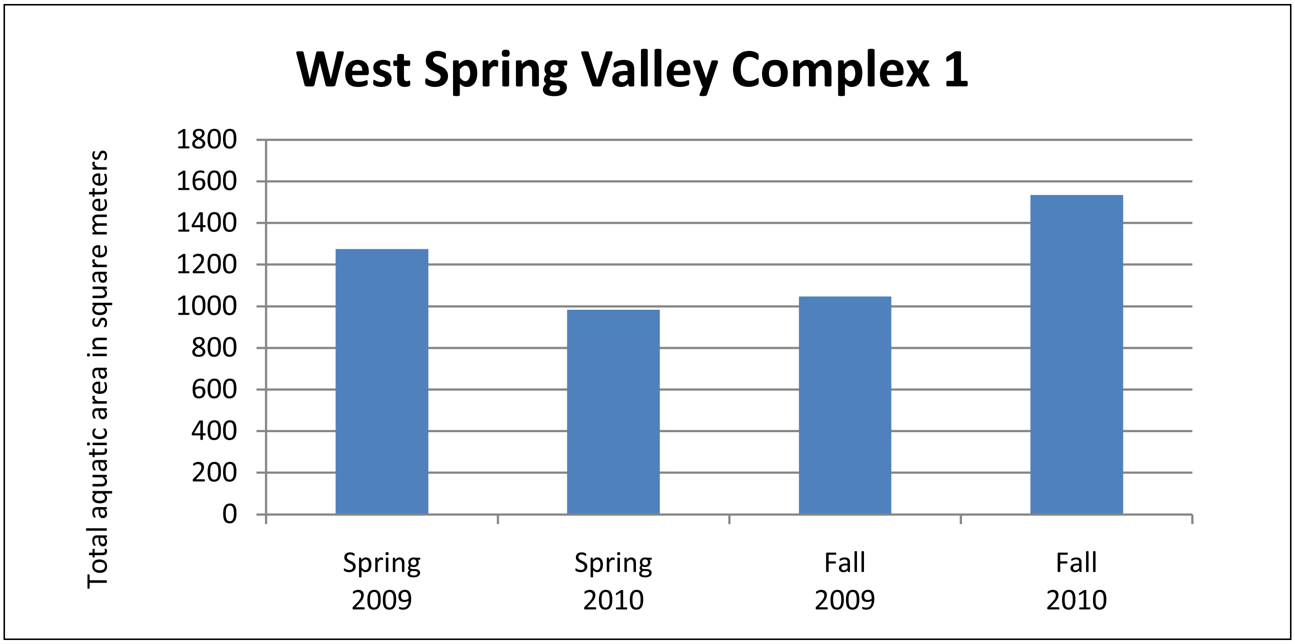



**Figure B-45**
**Total Aquatic Area by Season for 2009 and 2010 at West Spring Valley Complex 1**

**Table B-32**
**Spring 2010 Mapped Area at Willard Spring Summarized by Physical Habitat Type, HMU Type, and Total Aquatic Mapped Area**

| HMU | Depth (m) | Velocity (m/sec) | Emergent Vegetation (% Cover) | Area ($m^2$) |
|---|---|---|---|---|
| Pool | <0.2 | <0.01 | 30 - 90 | 45 |
| | | | **Total Channels** | **0** |
| | | | **Total Pools** | **45** |
| | | | **Total Aquatic Area** | **45** |

Note: Interpretations and conclusions made from this data need to take into consideration the margin of error associated with boundary demarcation and associated area measurements.

**Willard Spring was dry in the fall season.**

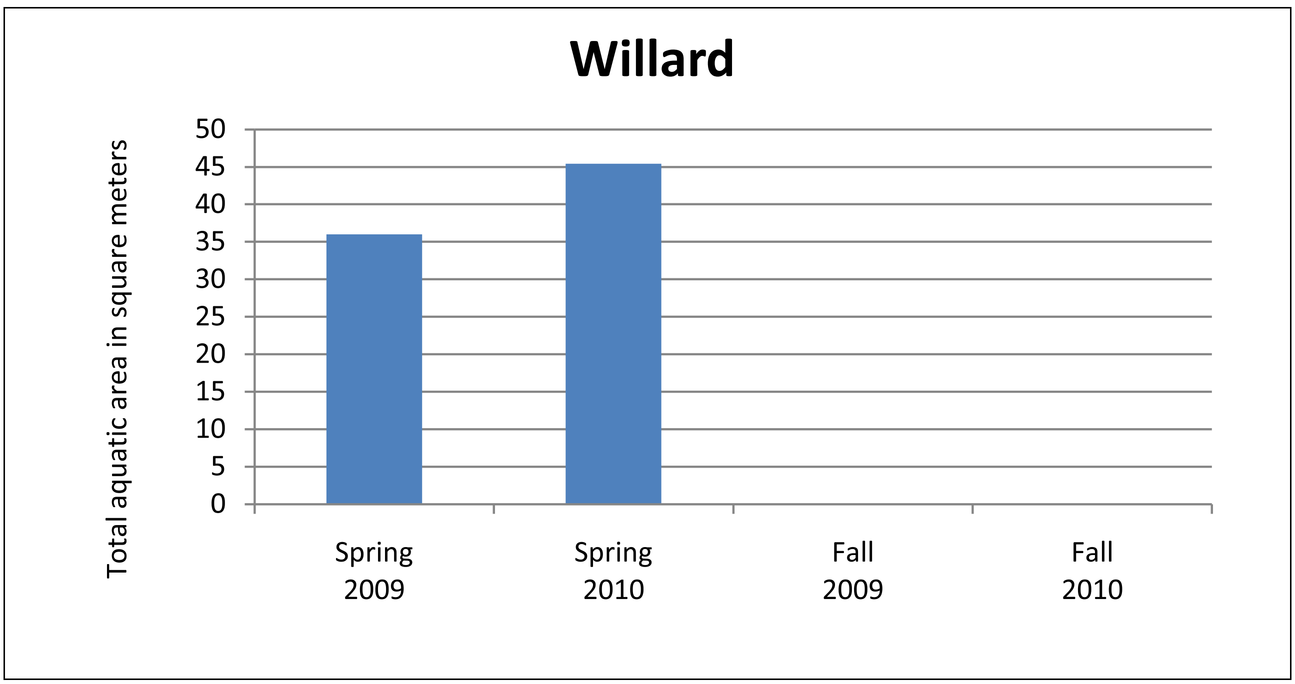



**Figure B-46**
**Total Aquatic Area by Season for 2009 and 2010 at Willard Spring**

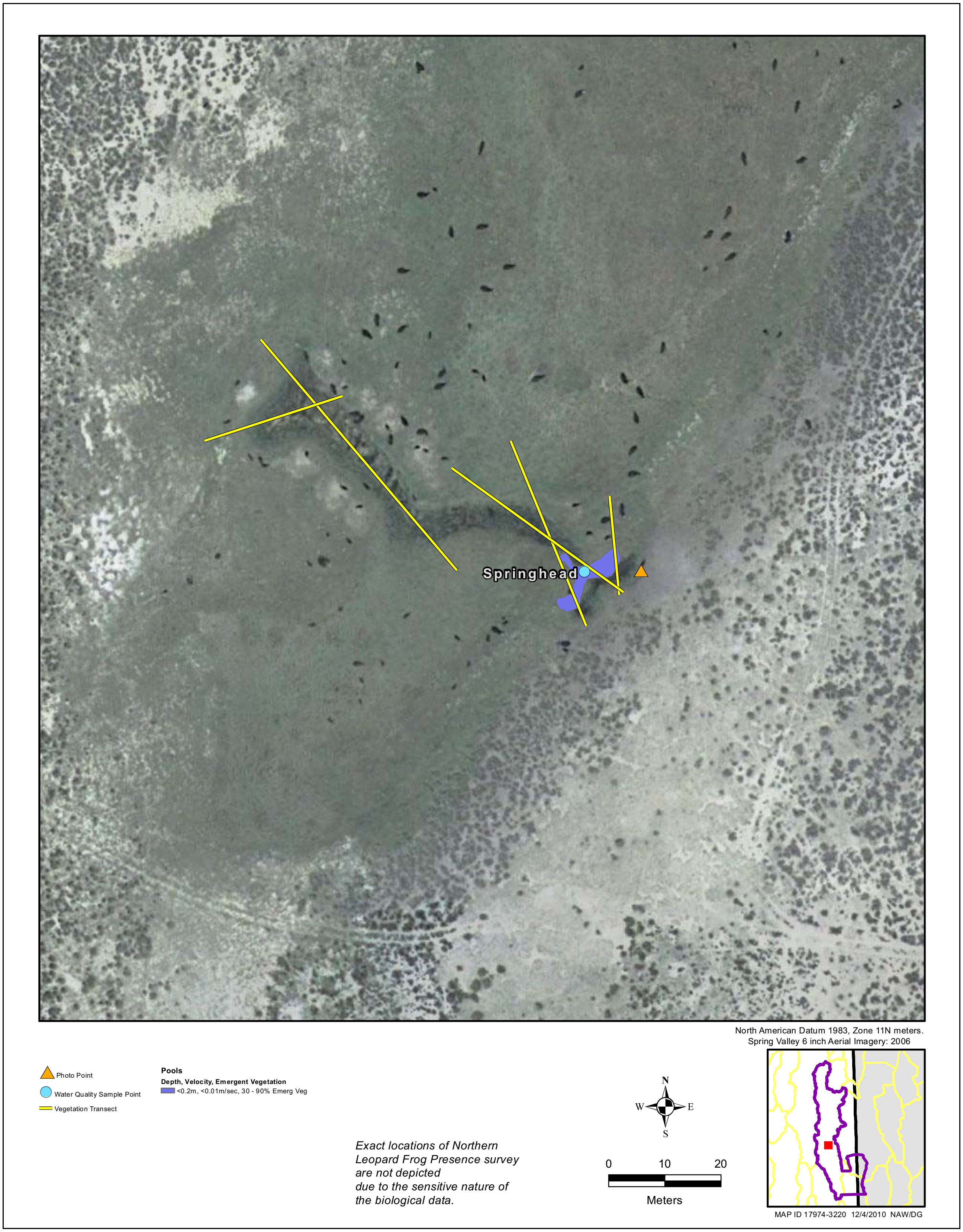



**Figure B-47**
**Willard Physical Habitat Map for Spring 2010**

## Table B-33
## Spring 2010 Mapped Area at Willow Spring Summarized by Physical Habitat Type, HMU Type, and Total Aquatic Mapped Area

| HMU | Depth (m) | Velocity (m/sec) | Emergent Vegetation (% Cover) | Area ($m^2$) |
|---|---|---|---|---|
| Channel | <0.2 | N/A | 30 - 90 | 11 |
| Channel | <0.2 | 0.01 - 0.1 | 30 - 90 | 25 |
| Channel | <0.2 | <0.01 | 30 - 90 | 132 |
| Pool | <0.2 | <0.01 | 30 - 90 | 10 |
| | | | **Total Channels** | **168** |
| | | | **Total Pools** | **10** |
| | | | **Total Aquatic Area** | **178** |

N/A = Not applicable – unable to measure velocity due to shallow or muddy water, extensive aquatic vegetation, or wind.
Note: Interpretations and conclusions made from this data need to take into consideration the margin of error associated with boundary demarcation and associated area measurements.

## Table B-34
## Fall 2010 Mapped Area at Willow Spring Summarized by Physical Habitat Type, HMU Type, and Total Aquatic Mapped Area

| HMU | Depth (m) | Velocity (m/sec) | Emergent Vegetation (% Cover) | Area ($m^2$) |
|---|---|---|---|---|
| Channel | <0.2 | 0.01 - 0.1 | 30 - 90 | 16 |
| Channel | <0.2 | N/A | 30 - 90 | 6 |
| Channel | <0.2 | N/A | >90 | 60 |
| Pool | <0.2 | <0.01 | <30 | 6 |
| Pool | <0.2 | <0.01 | >90 | 16 |
| | | | **Total Channels** | **82** |
| | | | **Total Pools** | **22** |
| | | | **Total Aquatic Area** | **104** |

N/A = Not applicable – unable to measure velocity due to shallow or muddy water, extensive aquatic vegetation, or wind.
Note: Interpretations and conclusions made from this data need to take into consideration the margin of error associated with boundary demarcation and associated area measurements.

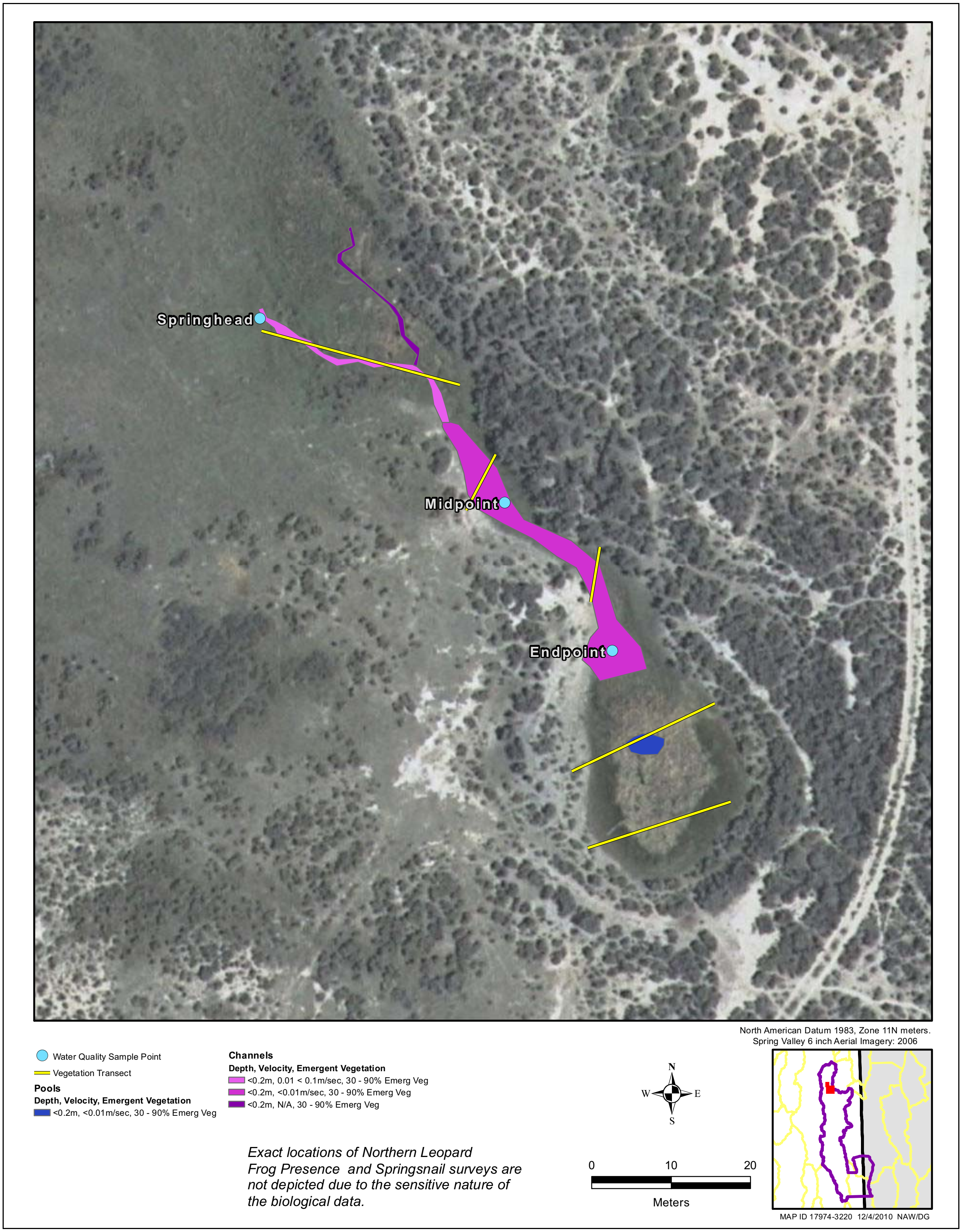



**Figure B-48**
**Willow Spring Physical Habitat Map for Spring 2010**

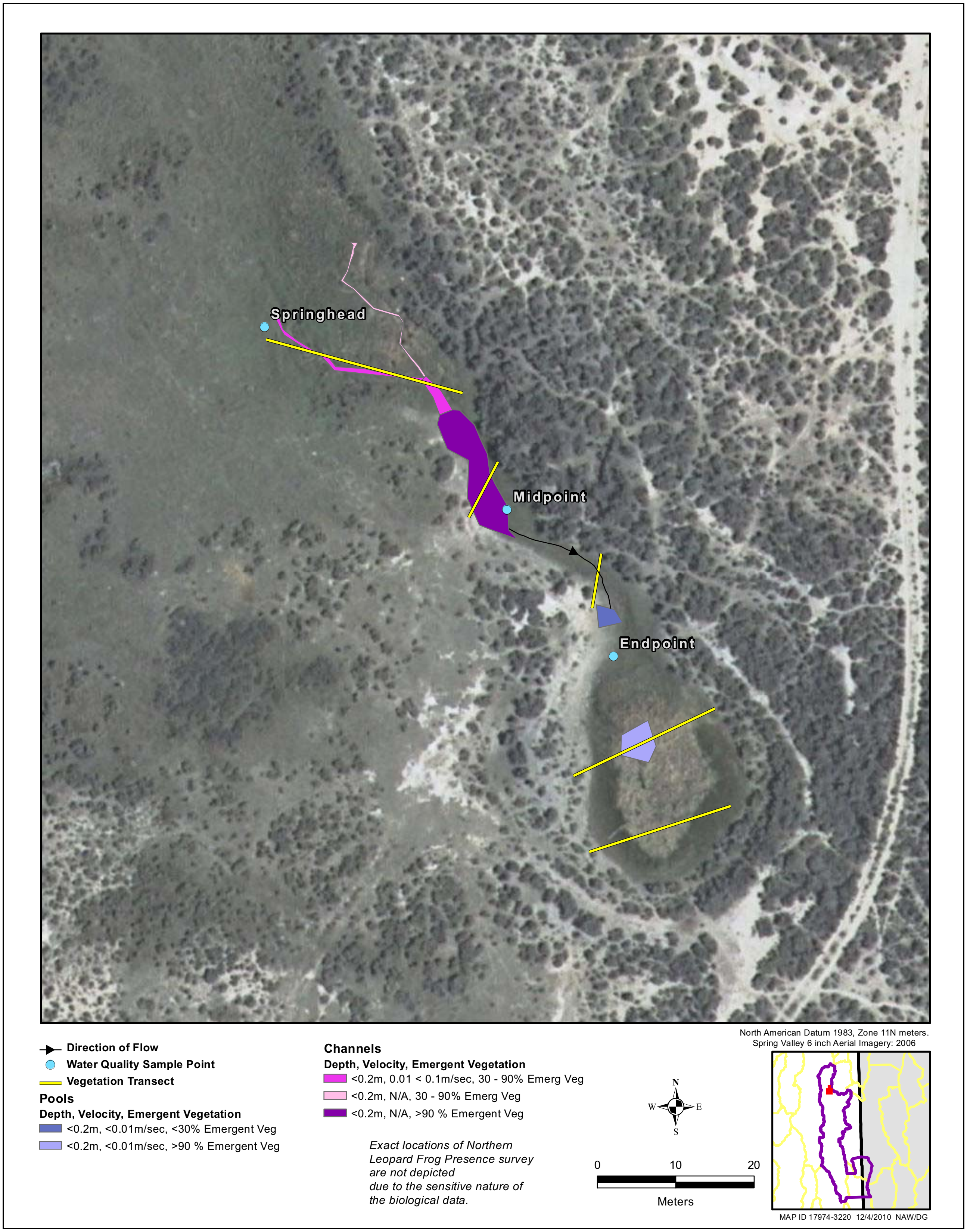



**Figure B-49**
**Willow Spring Physical Habitat Map for Fall 2010**

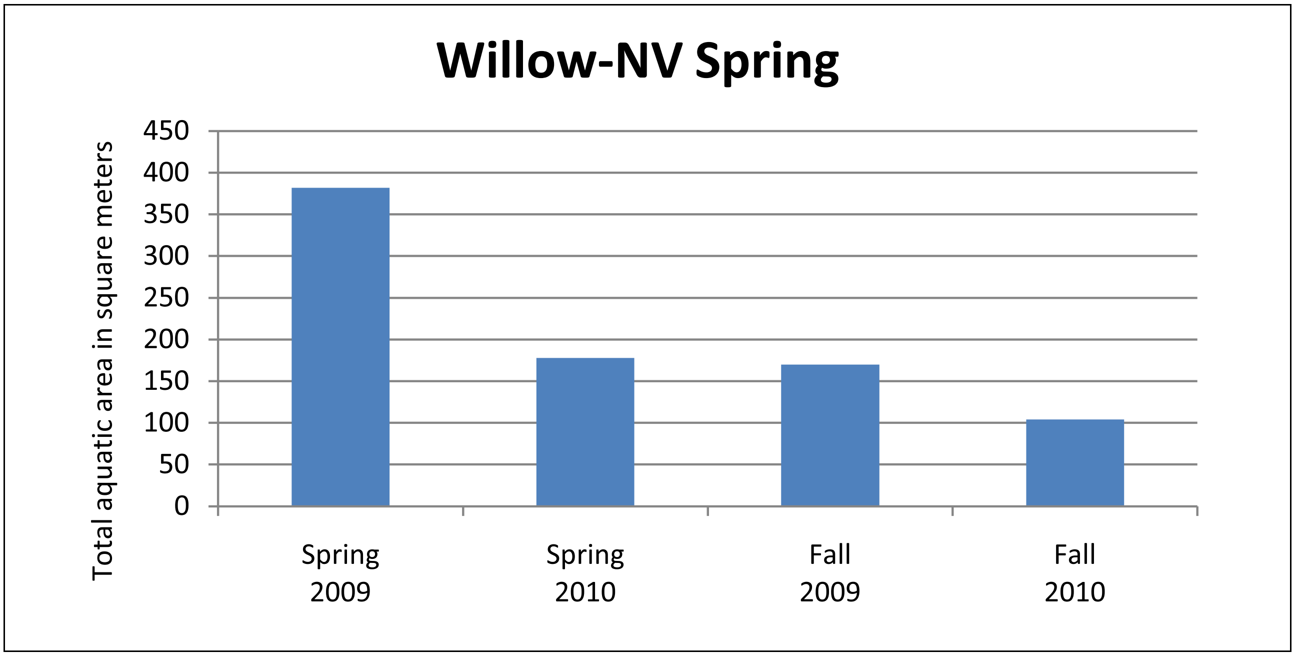



**Figure B-50**
**Total Aquatic Area by Season for 2009 and 2010 at Willow Spring**

# Appendix C

# Nevada Department of Wildlife 2010 Native Fish and Amphibians Field Trip Report for Shoshone Ponds

**NEVADA DEPARTMENT OF WILDLIFE**
**NATIVE FISH AND AMPHIBIANS**
**FIELD TRIP REPORT**

DATE(S): 5 and 11 August, 2010
LOCATION(S): Shoshone Ponds, White Pine County, NV
PURPOSE(S): To estimate the population sizes of Pahrump poolfish and relict dace
PERSONNEL: Aaron Ambos, Tereza Jezkova, Mark Beckstrand, Shawn Goodchild, Kevin Guadalupe.
PREPARED BY: Kevin Guadalupe and Brian Hobbs

INTRODUCTION

In 1972 Ely District of the BLM constructed warm water ponds in eastern Nevada with the intent of providing habitat for endangered species. On 13 August 1976, 50 Manse Ranch Pahrump poolfish (*Empetrichthys latos latos*) were transplanted into one of the ponds. Relict dace (*Relictus solitarius*) was introduced to one of the four ponds in December 1977. Currently, Pahrump poolfish exist in the three northern most ponds and Relict dace exist in the most southern pond of the refuge. Population estimates are conducted annually at this refuge.

METHODS

On 5 August, 19 standard Gee Minnow 0.64 cm mesh traps and one exotic 0.32 cm mesh trap without bait were set around the perimeter of the upper stock pond, Shoshone Pond, White Pine County at 08:45 hours. Four standard traps and one exotic trap were set around the perimeter of each of the three lower Shoshone Ponds at 09:00 hours. The traps were allowed to fish three hours before they were pulled. All of the fish in the exotic traps were measured and each fish greater than 30 millimeters (mm) was marked with an oblique clip on the caudal fin before release.

On 11 August, 20 standard traps without bait were set in the stock pond at 09:00 hours. Five standard traps without bait were set along the perimeter of each of the three lower ponds at 09:15 hours. Traps were allowed to fish approximately three hours before they were pulled. Each fish caught was examined for marks, tallied, and released. Water chemistry data was taken at two locations at the stock pond and at one location at the three fenced in ponds with a YSI 85 (Table 4).

A population estimate was calculated using Peterson's estimator: MC/R. Where M=number of individuals marked, C=number of individuals captured and R=number of individuals recaptured. Approximate 95% confidence intervals were determined using a table appropriate to the Poisson distribution, after the method described in Ricker (1975).

RESULTS

The majority of the Pahrump poolfish captured were caught in the stock pond (Table 1).

Poolfish population estimates in the middle and stock ponds have increased from last year's estimate, while the estimate in the north pond decreased (Figure 1, 2, 3).
The population estimate for Relict dace is lower than last year's estimate but once again was hampered by a low number of recaptures (Figure 4).

The north pond population continues to look unhealthy with only one solid age class (Figure 5). Poolfish populations in the Middle and stock ponds appear healthy with multiple age classes represented (Figure 6 and 7).

Relict Dace recapture remains low, giving high error when estimating population (Figure 4).

DISCUSSION

The poolfish population at Shoshone Ponds remains stable despite a decrease in the north pond population. The relict dace population remains difficult to effectively sample due to trap avoidance during the recapture phase of the survey, resulting in high error in estimation. As in previous years, multiple sizes of northern leopard frogs, *Rana pipiens*, were observed around the perimeter of the middle pond.

Water level in the north pond was below the weed line during both visits, creating a muddy bank encircling the pond. This is likely being caused by water leakage from a broken pipe that supplies water to the ponds. North pond water temperature in 2009 was 25.5 °C compared to 19.2 °C in 2010, contributing to unfavorable habitat conditions. Historically, Pahrump poolfish existed in warm springs varying from 23.3°C to 25.3°C (La Rivers 1962). NDOW is currently working on making repairs to this well which should improve conditions in the north pond.

Plans to enlarge the exclosure and incorporate the flowing well pond immediately north are still ongoing and should be completed within the next few years. This work should create additional habitat for the poolfish and further secure the habitat into the future. The relict dace population will likely have to be moved to another location or added to an existing population. Fish salvaged from the flowing well pond were relocated to the middle and north pond, and some fish still persist in this stream. Transplanting fish between Spring Mountain Ranch, and Corn Creek Pahrump poolfish populations to prevent genetic isolation between populations will take place in fall/winter 2010/2011. Surveys will be conducted again in summer 2011.

LITERATURE CITED

La Rivers, I. 1962. *Fishes and Fisheries of Nevada*. Nevada State Fish and Game Commission. 525 pp.

Ricker WE. 1975. *Computation and Interpretation of Biological Statistics of Fish Populations*. Bulletin of the Fisheries Research Board of Canada. 191: 382 pp.

Table 1. Mark-recapture data for Shoshone Ponds, White Pine County, NV, 2010.

| Location | Species | M | C | R | CPUE M | CPUE C | Estimate |
|---|---|---|---|---|---|---|---|
| North Pond | *E. l. latos* | 104 | 28 | 25 | 4.89 | 1.60 | 79<**116**<180 |
| Middle Pond | *E. l. latos* | 300 | 195 | 101 | 12.63 | 10.40 | 477<**579**<704 |
| South Pond | *R. solitarius* | 131 | 15 | 7 | 5.82 | 0.79 | 136<**281**<702 |
| Stock Pond | *E. l. latos* | 634 | 272 | 45 | 10.60 | 4.53 | 2865<**3832**<5257 |

Table 2: Summary of length data for Pahrump poolfish, *E. l. latos*, 2010.

| Location | Average | Median | Mode | Minimum | Maximum |
|---|---|---|---|---|---|
| North Pond | 33 | 33 | 29 | 27 | 40 |
| Middle Pond | 37 | 37 | 40 | 28 | 58 |
| Stock Pond | 42 | 40 | 34 | 30 | 61 |

Table 3: Relict dace, *Relictus solitarius,* length data, 2010.

| Location | Average | Median | Mode | Minimum | Maximum |
|---|---|---|---|---|---|
| South Pond | 43 | 42 | 40 | 38 | 53 |

Table 4: Water Quality parameters 2010.

| Location | DO (mg/L) | DO (% Sat.) | Conductivity/ Specific (µS) | Salinity (ppt) | Temperature (°C) |
|---|---|---|---|---|---|
| Stock pond (source) | 10.36 | 115.3 | 104 | 0.1 | 20.6 |
| North pond | 10.92 | 117.2 | 190 | 0.1 | 19.2 |
| Middle pond | 10.10 | 115.2 | 164 | 0.1 | 22.2 |
| South pond | 10.30 | 122.5 | 156 | 0.1 | 23.6 |

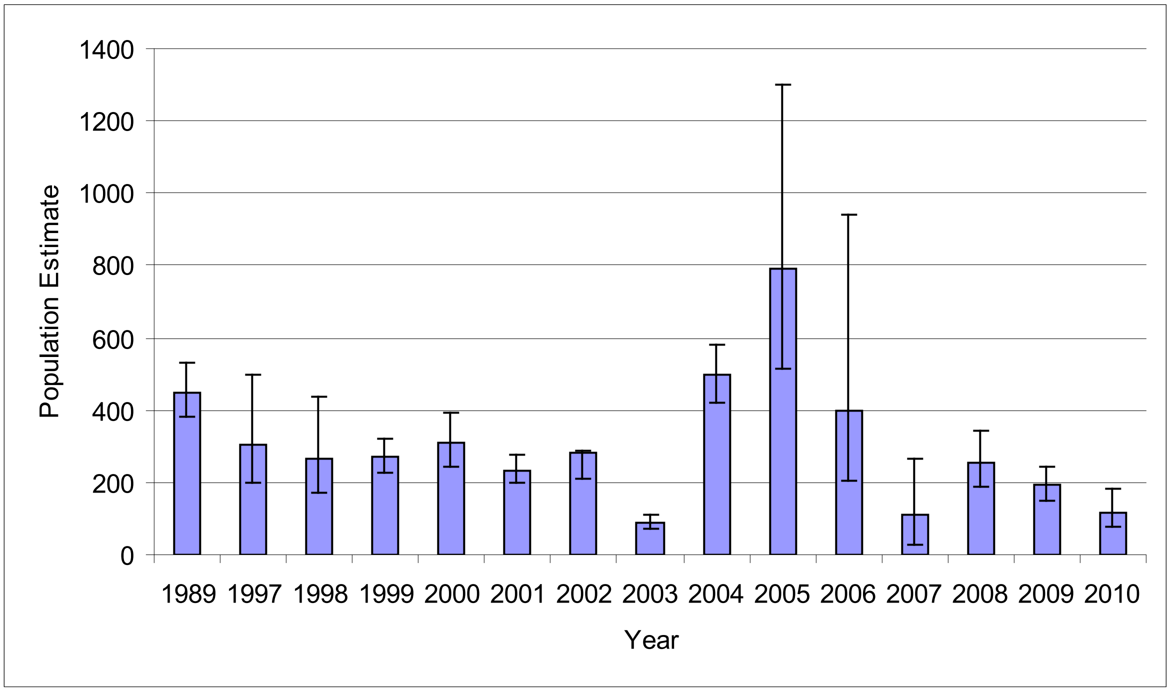



Figure 1. Population Estimates for Pahrump poolfish at Shoshone Ponds north pond 1989-Present.

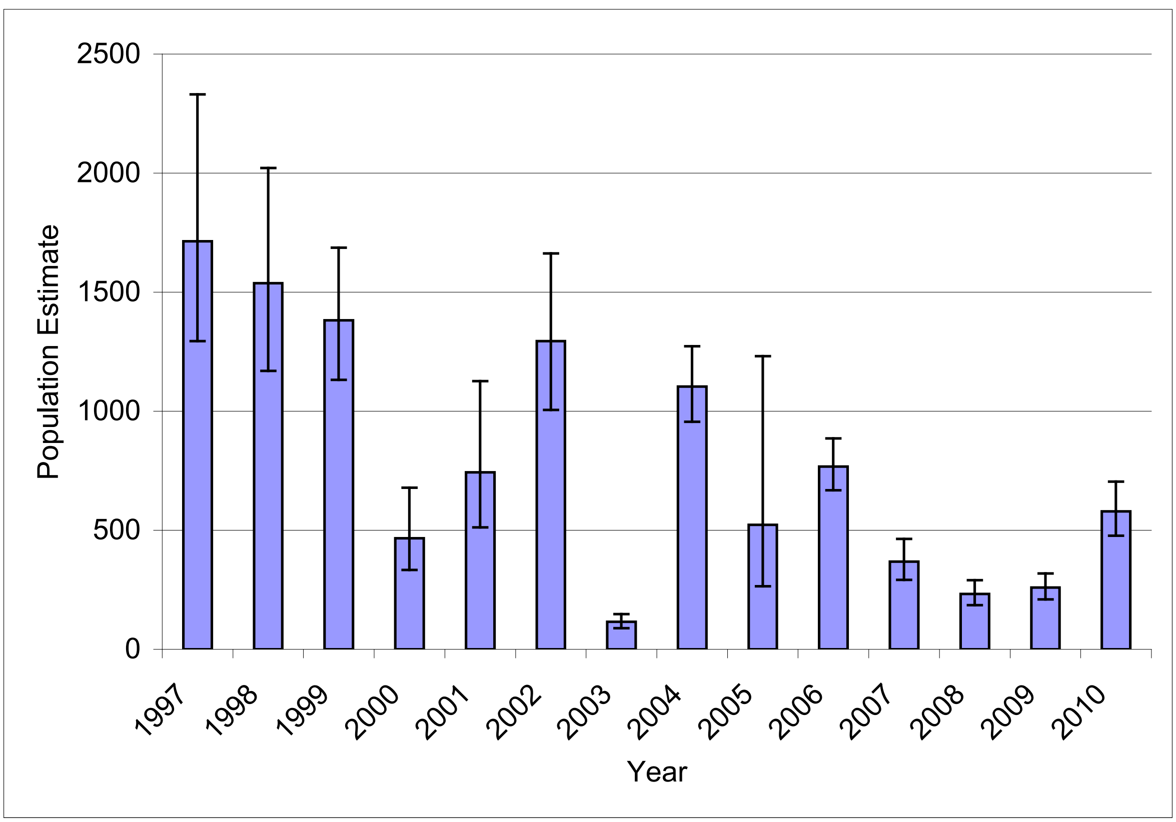



Figure 2. Population Estimates for Pahrump poolfish at Shoshone Ponds middle pond 1997-Present.

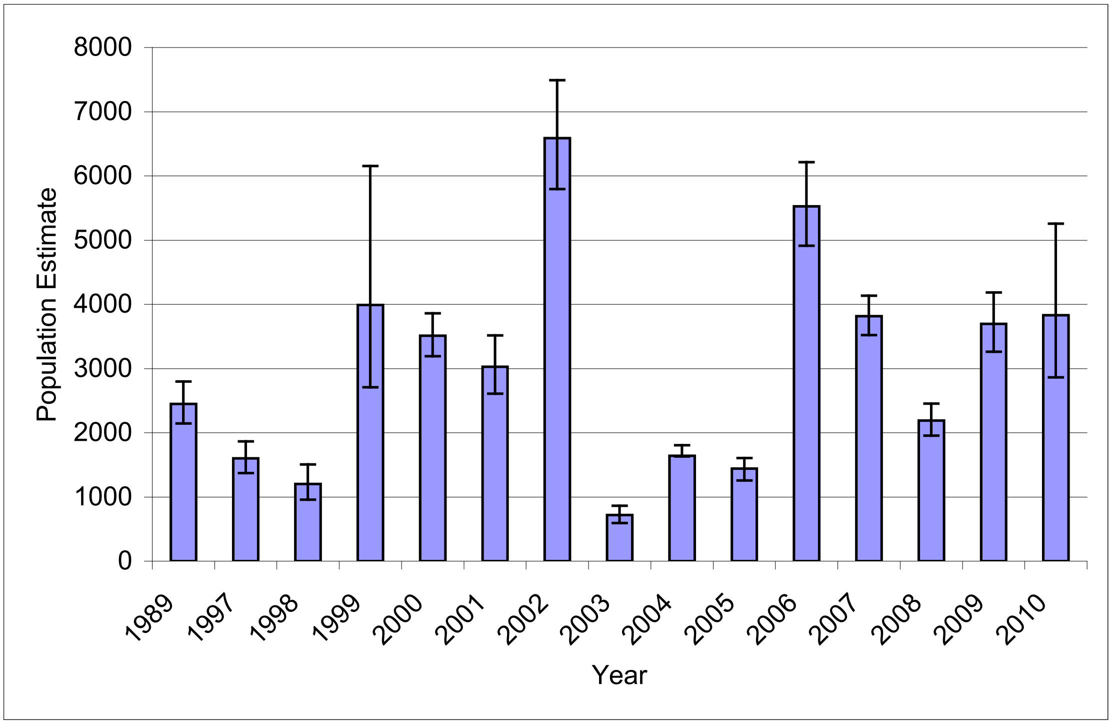



Figure 3. Population Estimates for Pahrump poolfish at Shoshone Ponds stock pond 1989-Present.

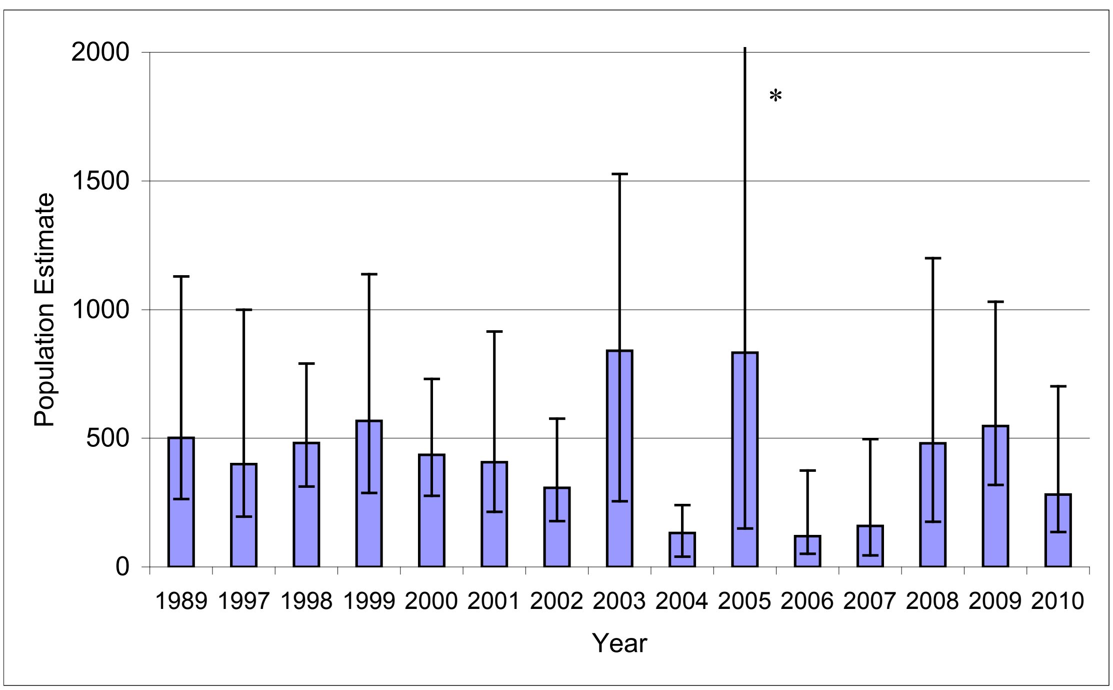



Figure 4. Population Estimates for Relict dace at the South Pond, Shoshone Ponds 1989-Present.
* Population estimate 2005 showed error bars >7000 due to low recapture rate consistent with South Pond.

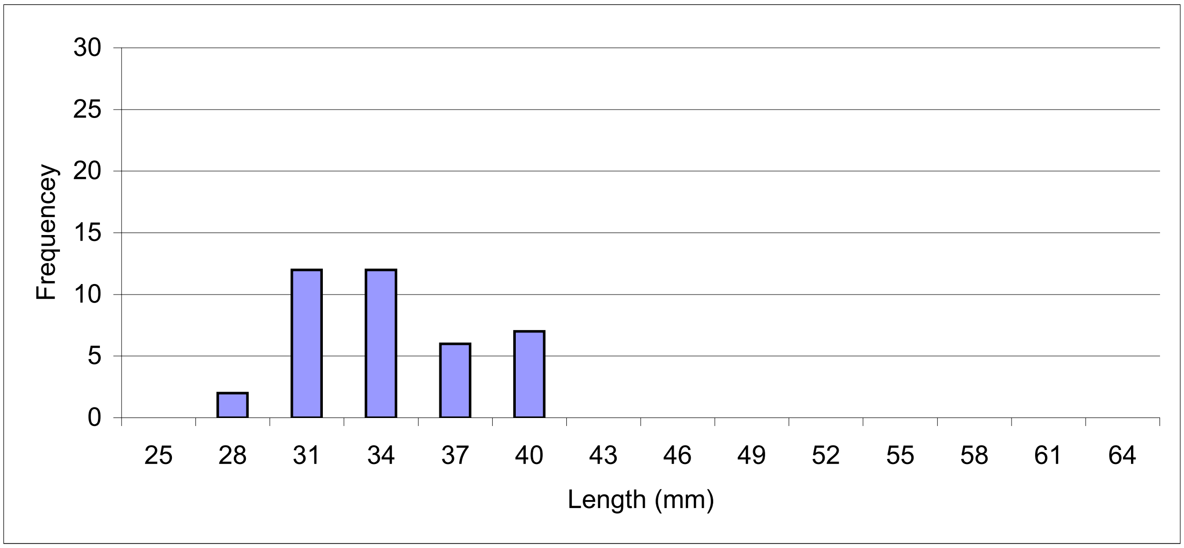



Figure 5. Length for Pahrump poolfish at Shoshone Ponds north pond, 2010.

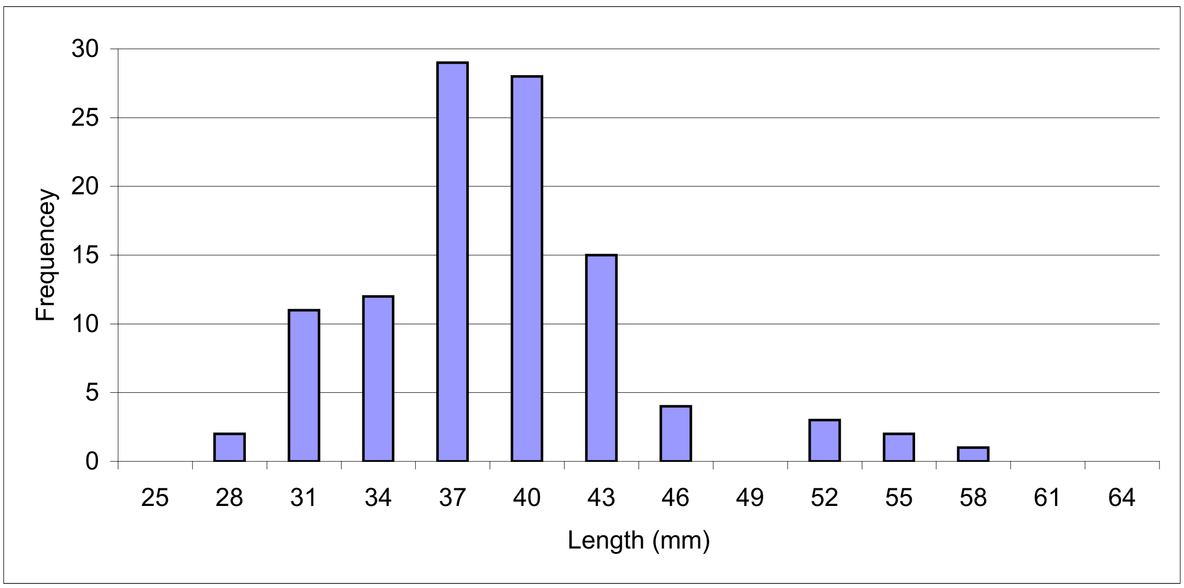



Figure 6. Length of Pahrump poolfish at Shoshone Ponds middle pond, 2010.

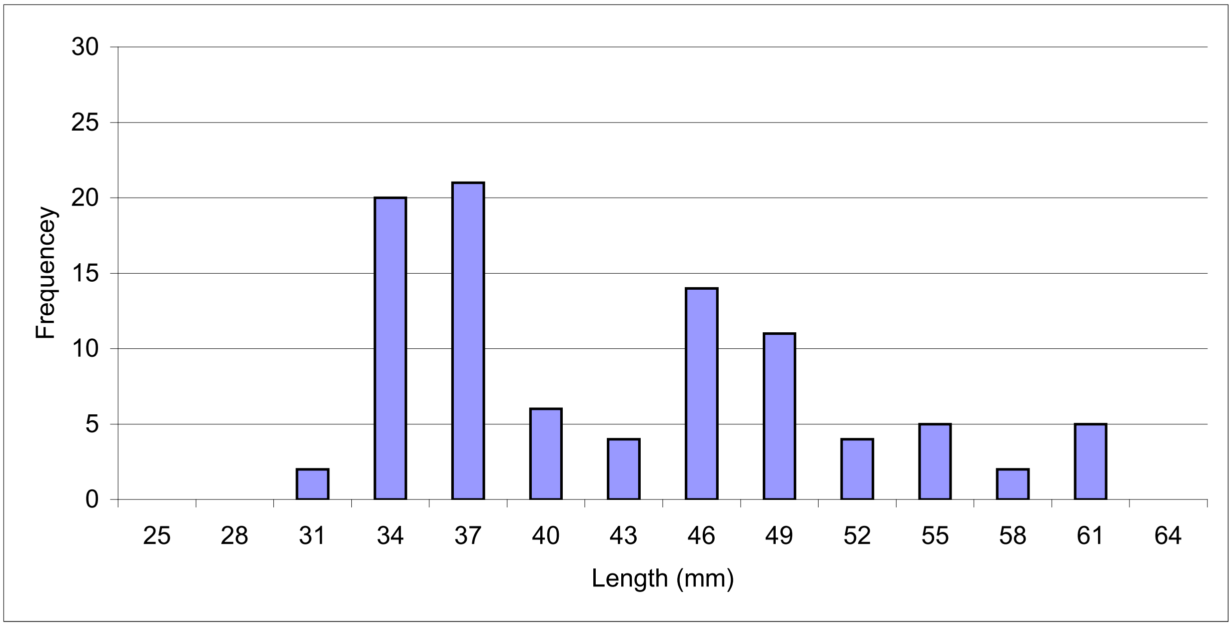



Figure 7. Length of Pahrump poolfish at Shoshone Ponds Stock pond, 2010.

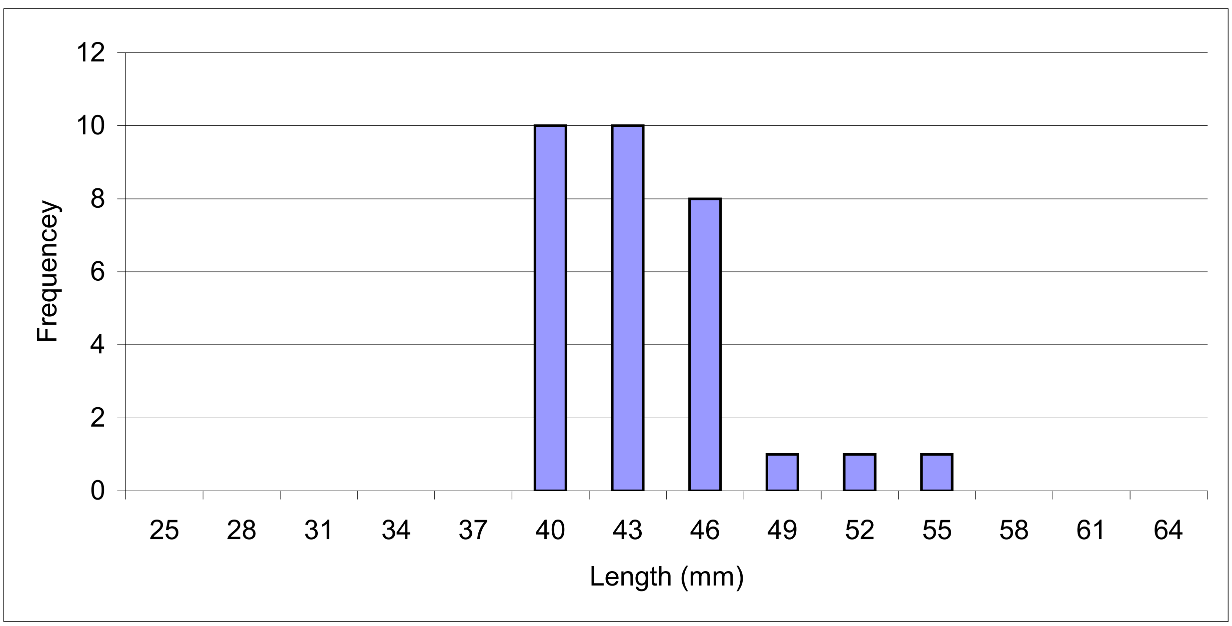



Figure 8. Length of Relict dace at Shoshone Ponds, South pond, 2010.

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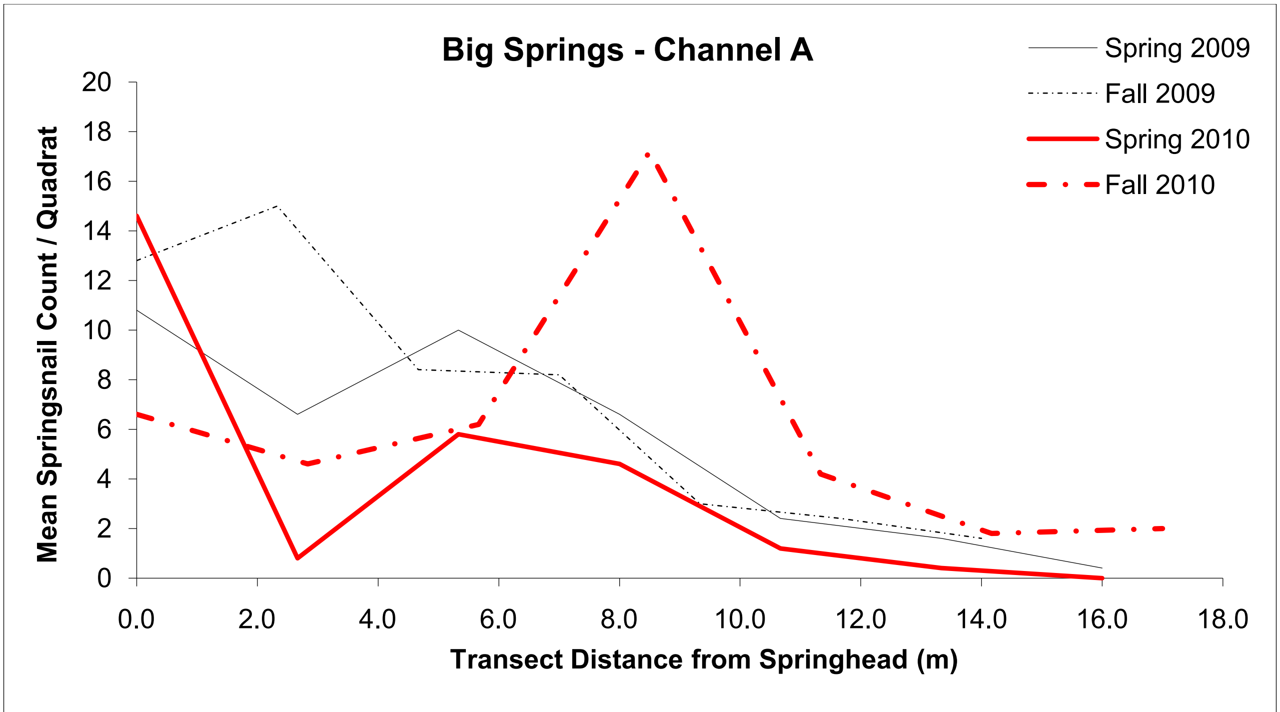
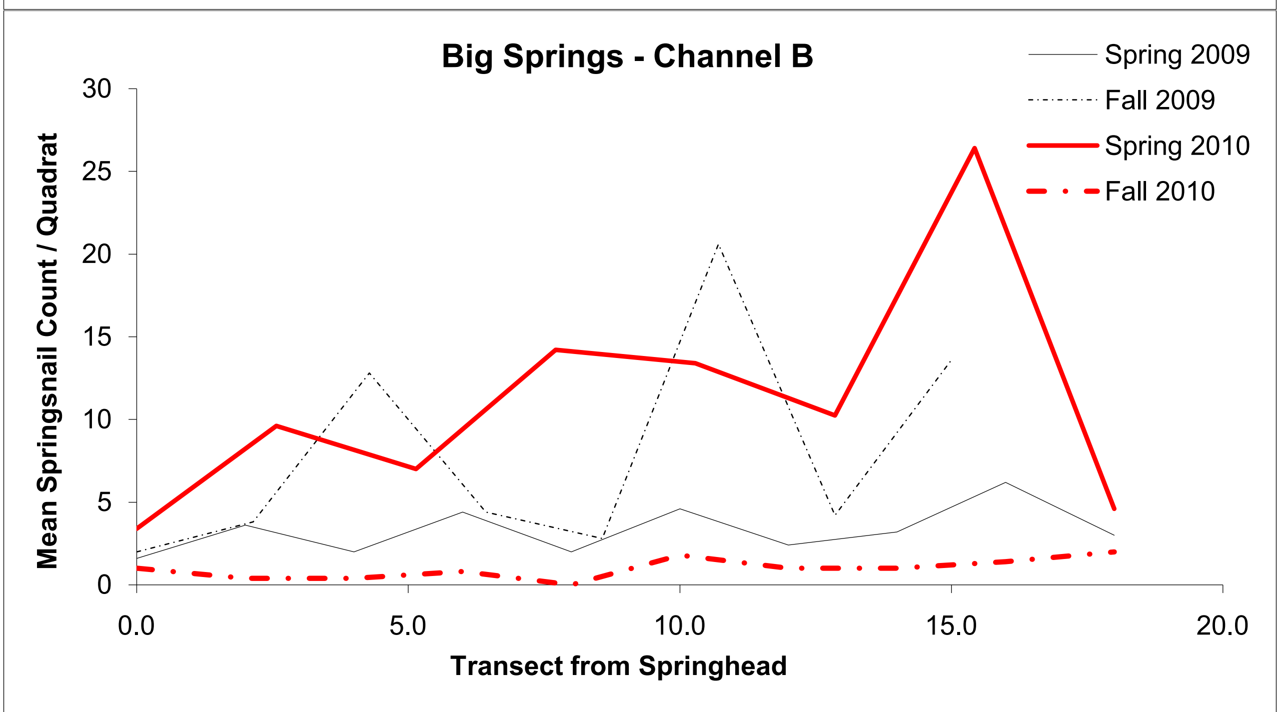
# Appendix D

# Distribution of Springsnail Counts along Springsnail Extents, Spring and Fall 2009 and 2010

# D.1.0 INTRODUCTION

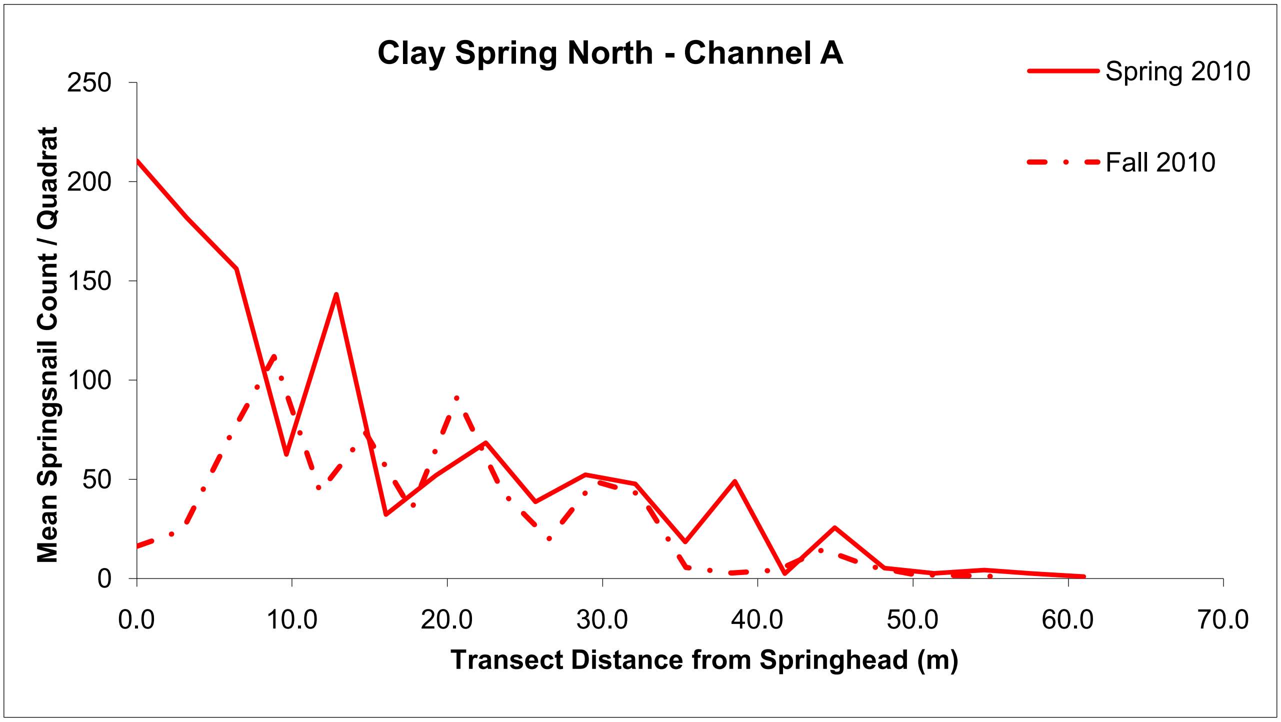
Springsnail distribution shown in the following figures is the mean springsnail count/quadrat calculated for each transect, charted from the springhead to the end of the springsnail extent. Transects were established in the field by determining the springsnail extent and placing flags approximately equidistant down the extent, placing no more than 20 transects per channel no less than 2.5 m apart. For graphing purposes, transects are assumed to be absolutely equidistant, and the first and last transect are assumed to be at the absolute start and end of the springsnail extent.



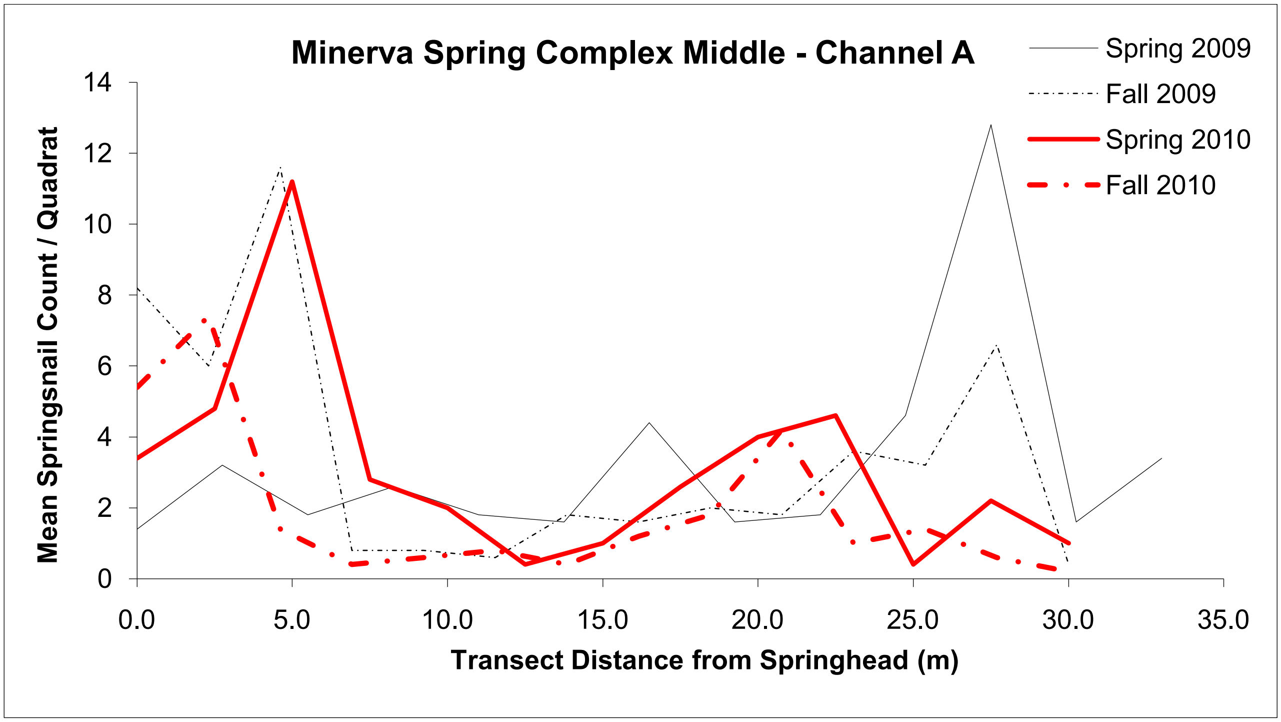

Note: Big Springs Channels A and B converge. Springsnails in the convergence are included in Channel A (and not Channel B). The springsnail extent in Channel B was approximated from the physical habitat map and transect UTM coordinates because extent was not measured consistently in the field. In spring 2009 and spring and fall 2010, springsnails in Channel B extended past the convergence point, and the extent is approximated at 18 m (the length of the Channel B). In fall 2009, springsnails in Channel B stopped occurring prior to the convergence point; GPS points taken at the springsnail transects suggest the extent was approximately 15 m.

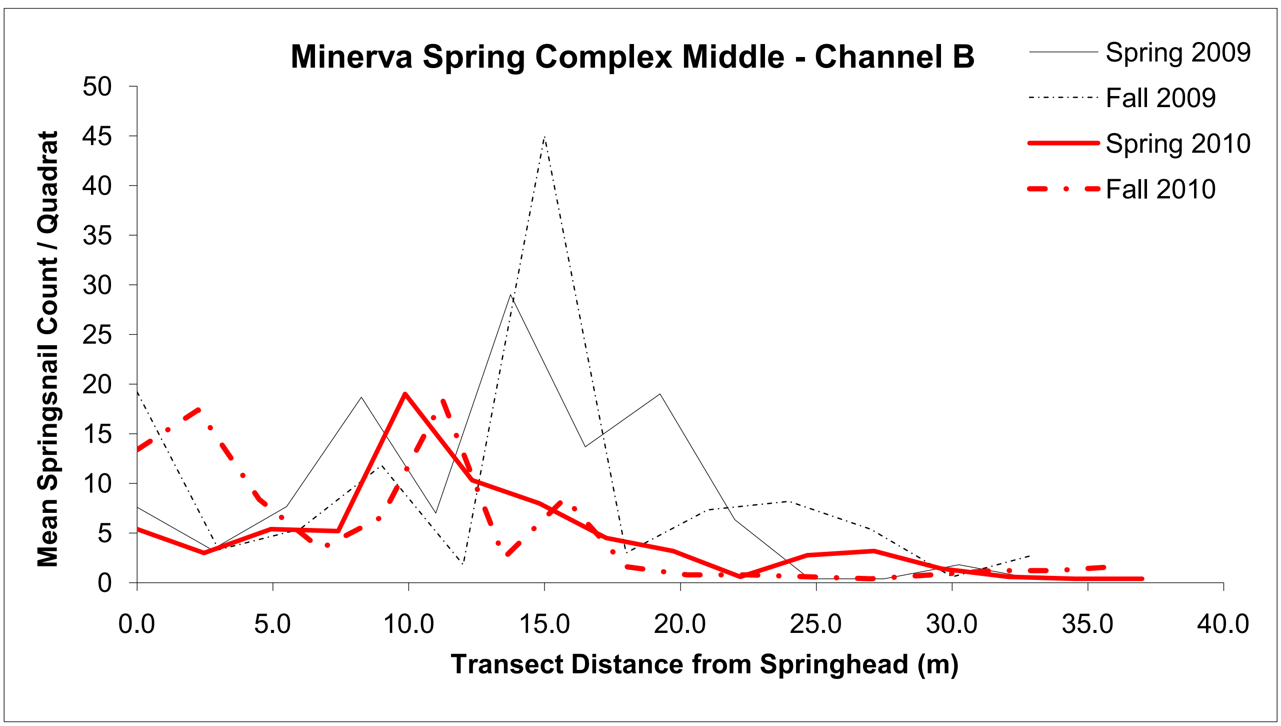
**Figure D-1**
**Springsnail Distribution at Big Springs - Channels A and B 2009 and 2010**




Note: Clay Spring North was not surveyed in 2009 (access not granted).

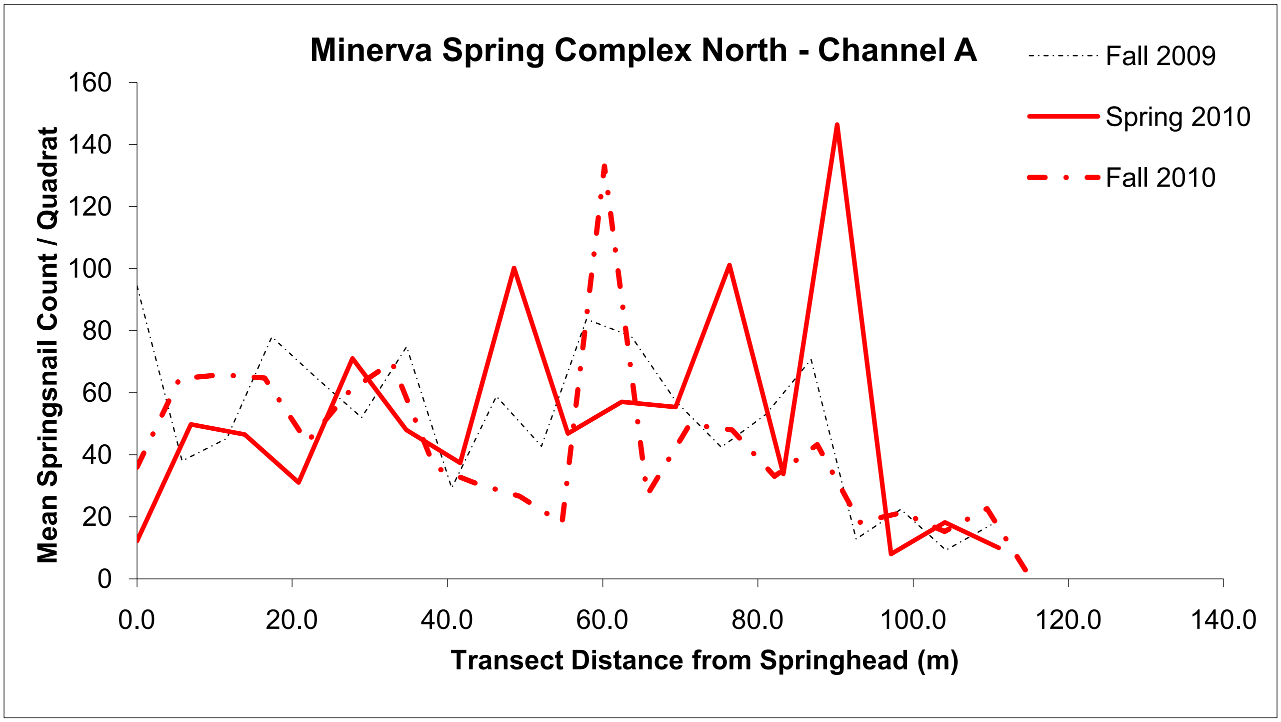
**Figure D-2**
**Springsnail Distribution at Clay Spring North - Channel A, 2010**



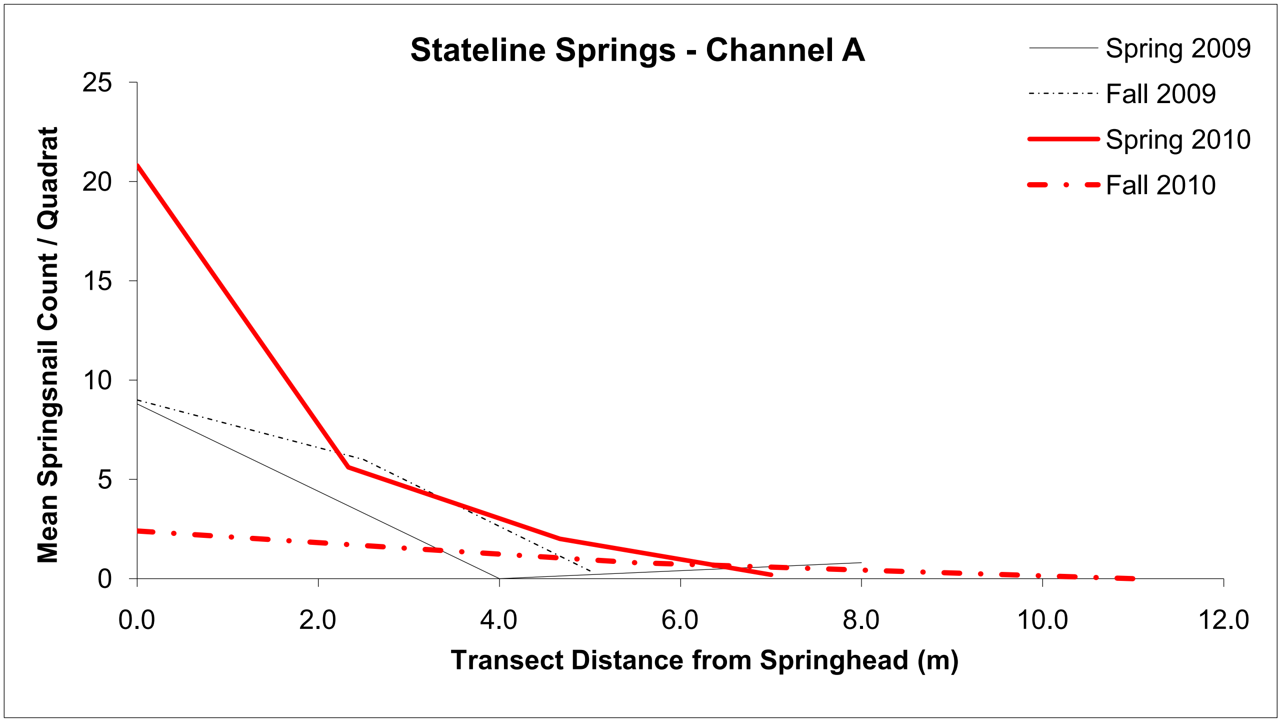

Note: Channels A and B are nearby but separate flows. For Channel B, springhead C and Channel B data are shown (springhead B not shown).

**Figure D-3**
**Springsnail Distribution at Minerva Spring Complex Middle - Channels A and B, 2009 and 2010**



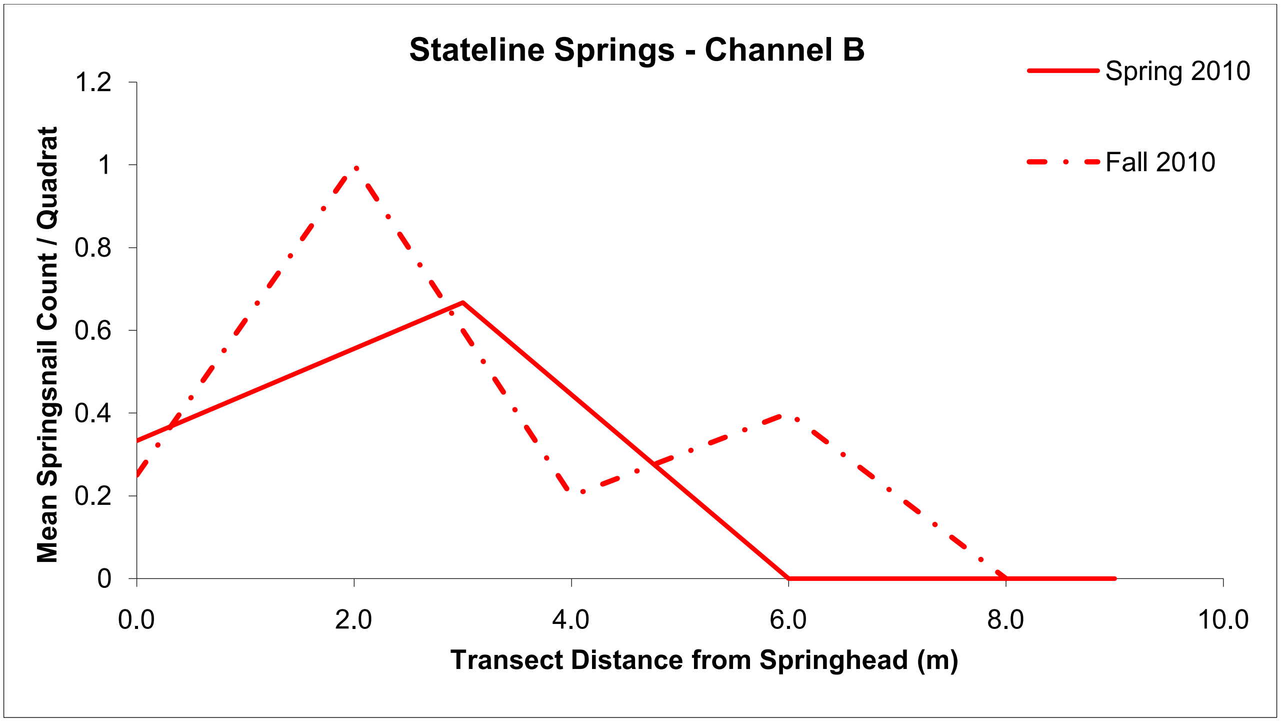

Note: Minerva Spring Complex North was not surveyed in 2009 (field error).

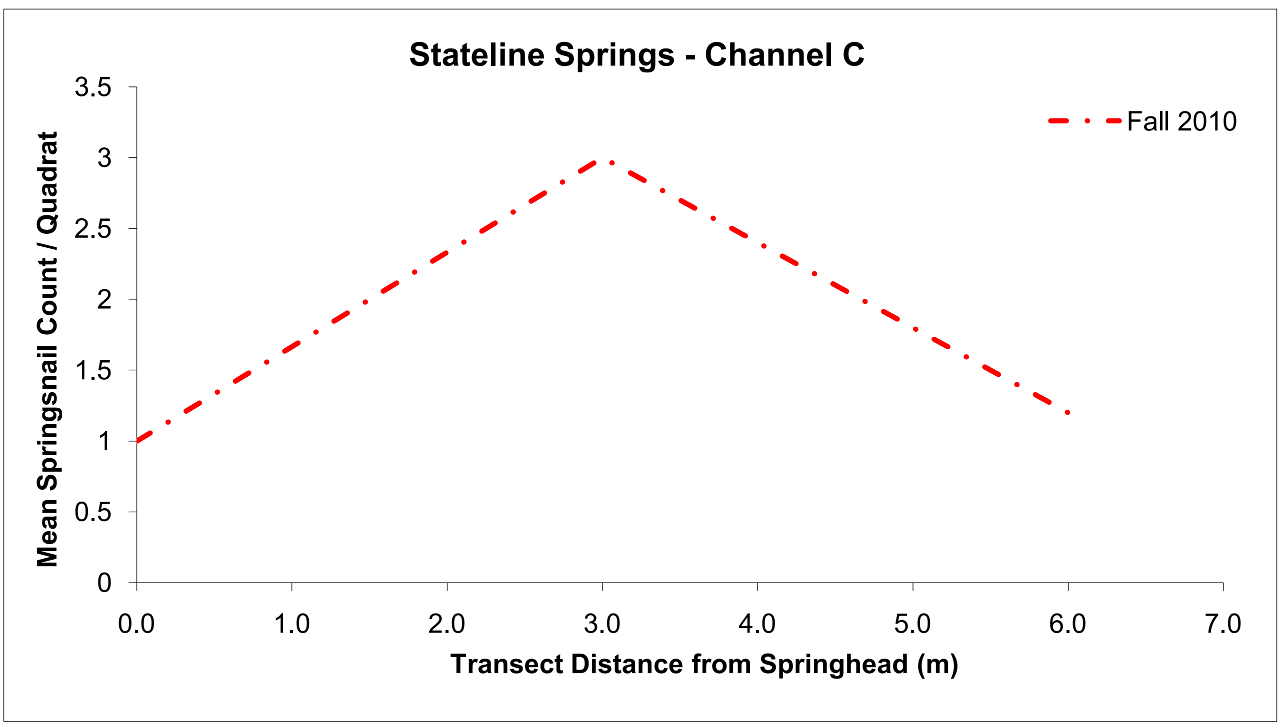
**Figure D-4**
**Springsnail Distribution at Minerva Spring Complex North - Channel A, 2009 and 2010**




Note: Stateline Springs Complex Springhead A1 and Channel A. Springheads A2 through A4 not shown.

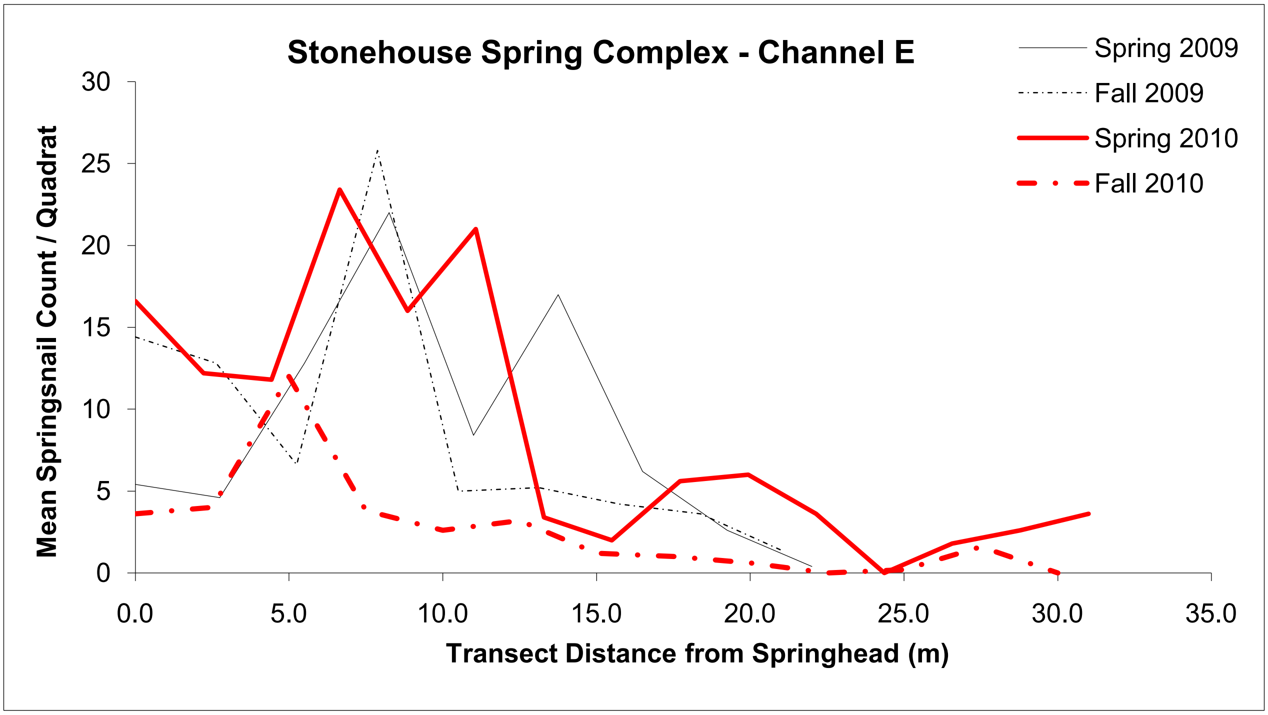
**Figure D-5**
**Springsnail Distribution at Stateline Springs - Channel A, 2009 and 2010**



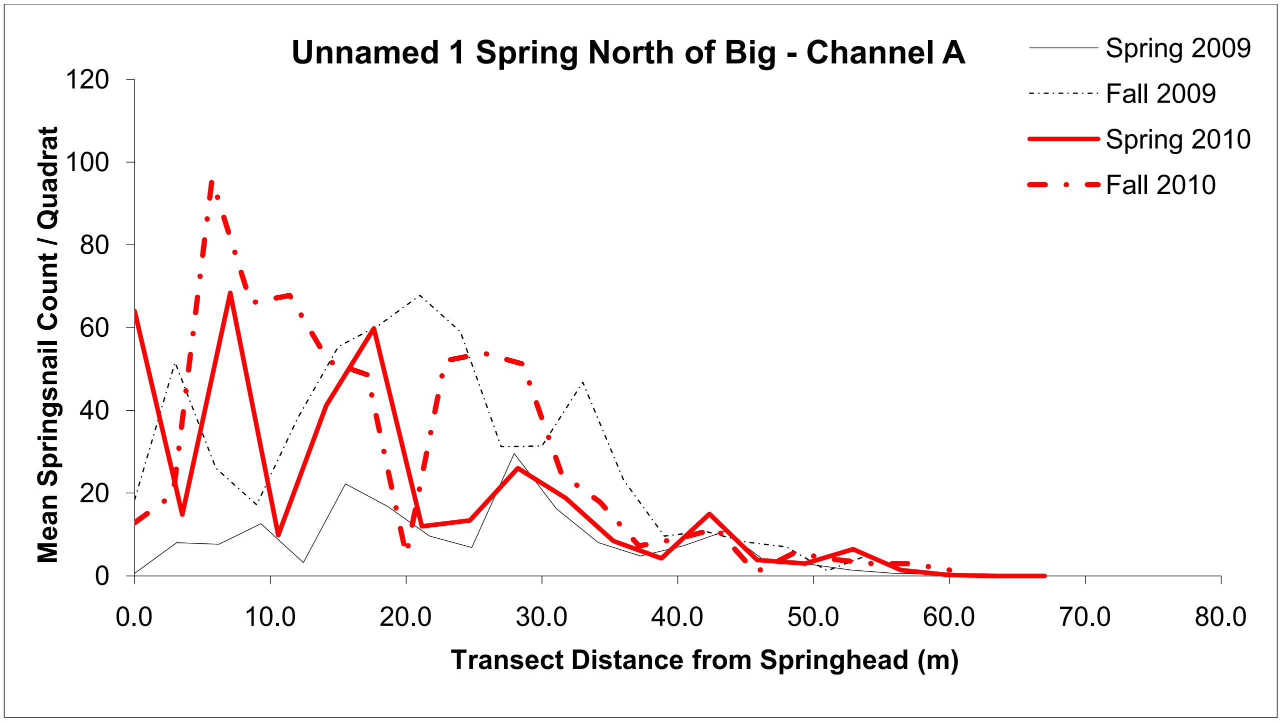

Note: Fall 2009 - no standing water; springsnails searched for but not discovered. Spring 2010 - standing water; springsnails searched for but not discovered. Channel C was not surveyed in a consistent enough fashion to allow comparison across seasons. Fall 2010 data collection focused on the major path of water flow.

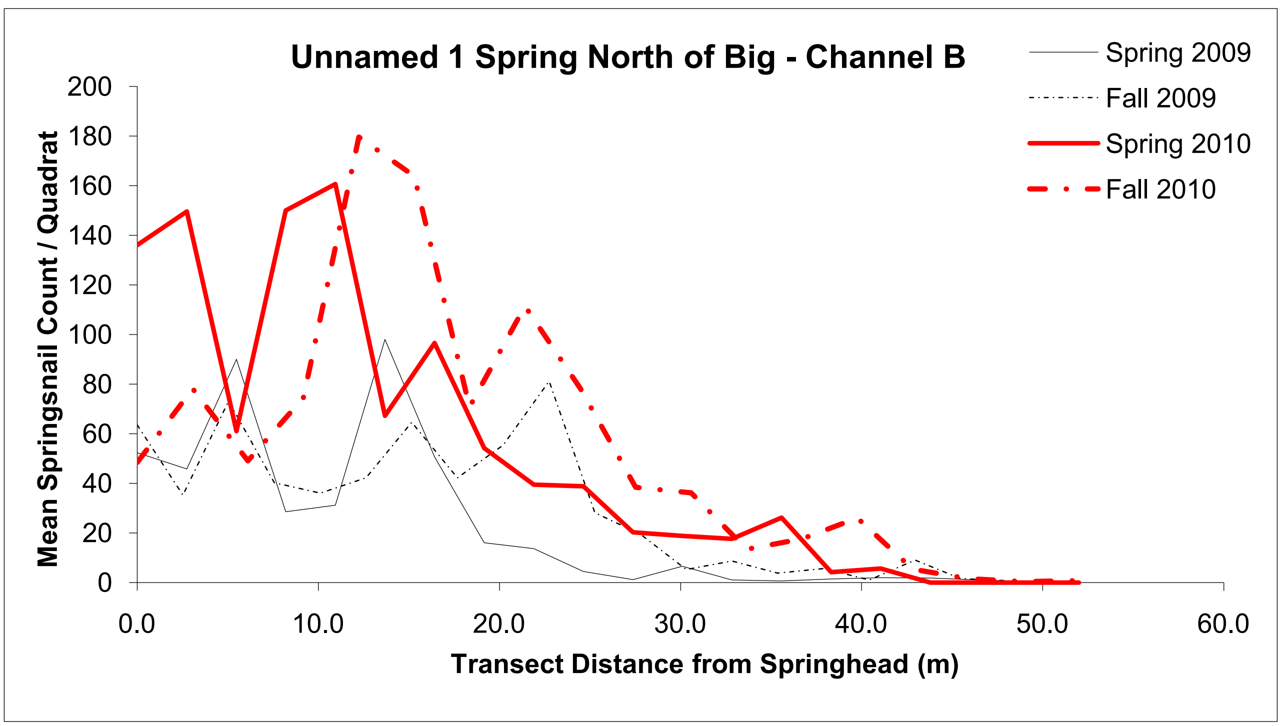
**Figure D-6**
**Springsnail Distribution at Stateline Springs - Channels B and C, 2009 and 2010**




Note: Channel E is south of and not connected to springhead A-D (presence/absence surveys; not shown).

**Figure D-7**
**Springsnail Distribution at Stonehouse Spring Complex - Channel E, 2009 and 2010**




Note: Unnamed 1 Spring North of Big Channels A and B converge. Springsnails in the convergence are included in Channel A (and not Channel B)

**Figure D-8**
**Springsnail Distribution at Unnamed 1 Spring North of Big - Channels A and B, 2009 and 2010**

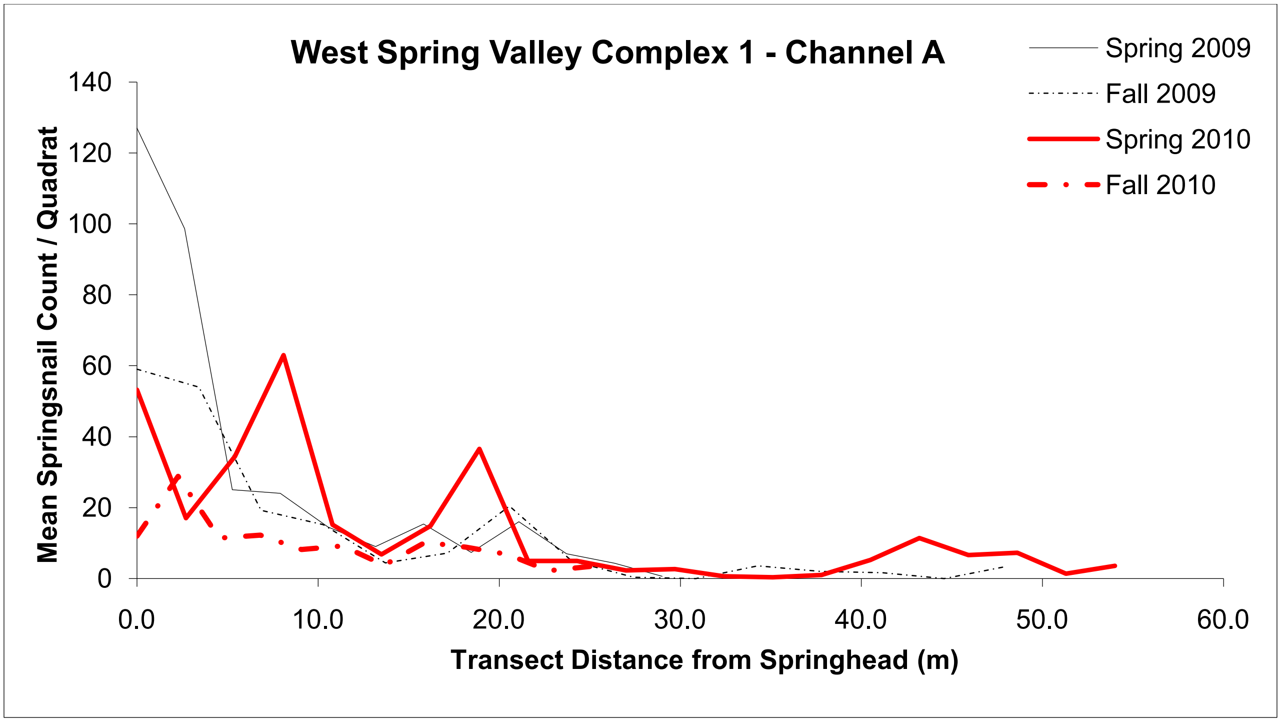



**Figure D-9**
**Springsnail Distribution at West Spring Valley Complex 1 - Channel A, 2009 and 2010**

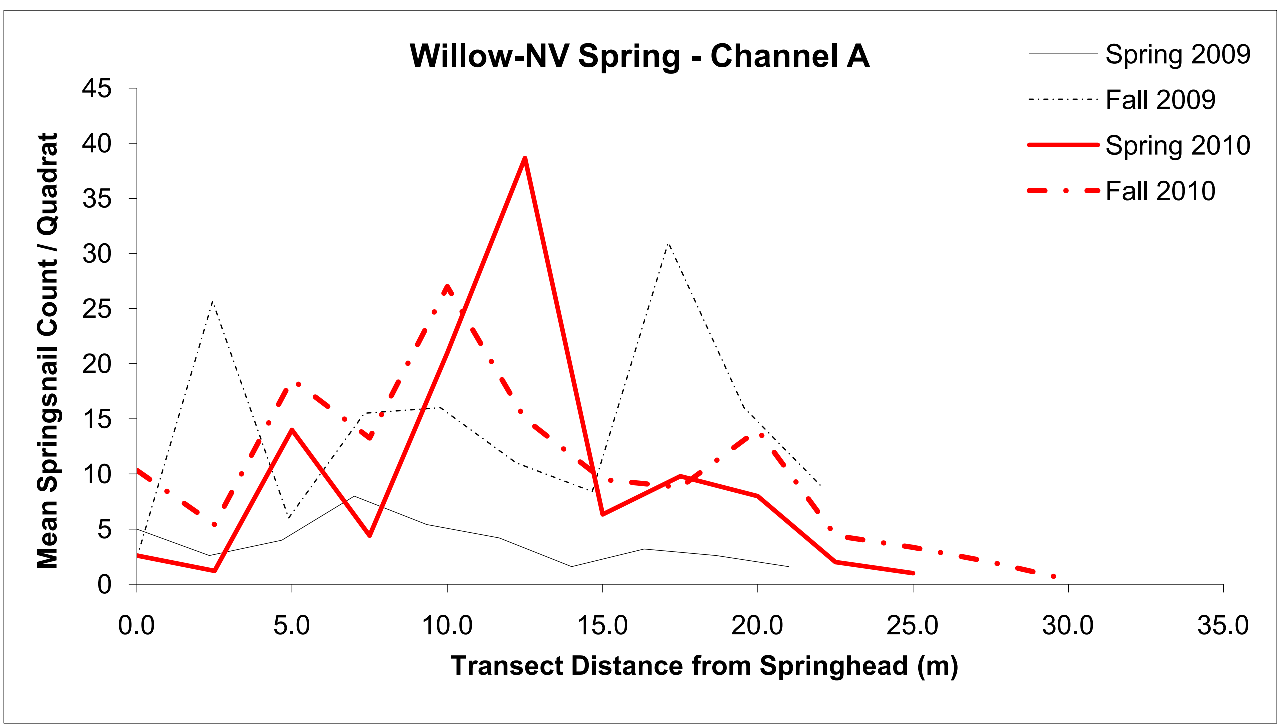



**Figure D-10**
**Springsnail Distribution at Willow-NV Spring - Channel A, 2009 and 2010**

# Appendix E

# Vegetation Cover and Composition Result Tables

# E.1.0 INTRODUCTION

The following tables are included in this appendix:

- Scientific Names, Common Names, and Synonyms of Plant Taxa Encountered on the Vegetation Transects in 2009 and 2010 and which Transect Types the Taxa Occurred In.
- Taxa Mean Percent Cover (MH), Number of Sites Where Present, and Number of Transects Where Present, 2009 and 2010 (by transect type).
- Mean Percent Cover (MH), of Document Plant Taxa, 2009 and 2010 (by transect type).

**Table E-1**
**Scientific Names, Common Names, and Synonyms of Plant Taxa Encountered on the Vegetation Transects in 2009 and 2010 and Which Transect Types the Taxa Occurred In**
(Page 1 of 7)

| Scientific Name | Common Name | USDA Code | Transect Type | | | |
|---|---|---|---|---|---|---|
| | | | AQ | WM | PS | SC |
| *Achillea millefolium* | yarrow | ACMI2 | X | X | | X |
| *Achnatherum hymenoides* | Indian ricegrass | ACHY | | | **X** | **X** |
| *Agoseris glauca var. glauca* | pale agoseris | AGGLG | X | X | | |
| *Agrostis gigantea* | creeping bent | AGGI2 | X | X | | X |
| *Algae* | algae | ALGAE | X | X | | |
| *Alisma plantago-aquatica* | European waterplantain | ALPL | X | | | |
| *Angelica* sp. | angelica | ANGEL | X | | | |
| *Aquilegia formosa* | California columbine | AQFO | X | X | | X |
| *Arctium minus* | common burdock | ARMI2 | X | | | |
| *Argentina anserina* | silverweed cinquefoil | ARAN7 | X | X | | X |
| *Artemisia tridentata* | big sagebrush | ARTR2 | X | X | X | X |
| *Asclepias speciosa* | showy milkweed | ASSP | X | X | | |
| *Aster* | aster | ASTER | X | X | | X |
| *Astragalus* sp. | milkvetch | ASTRA | X | X | | X |
| *Astragalus convallarius* | timber milkvetch | ASCO12 | | | | X |
| *Atriplex* sp. | saltbush | ATRIP | | X | | |
| *Atriplex canescens* | fourwing saltbush | ATCA2 | | | X | |
| *Atriplex confertifolia* | shadscale | ATCO | | | X | X |
| *Atriplex micrantha* | twoscale saltbush | ATMI2 | X | X | | X |
| *Atriplex rosea* | tumbling saltweed | ATRO | | | | X |
| *Atriplex serenana* | bractscale | ATSE2 | X | X | X | X |
| *Atriplex truncata* | wedgescale | ATTR | | X | | X |
| *Bassia americana* | greenmolly | BAAM4 | | | X | |
| *Bassia scoparia* | kochia | BASC5 | X | X | X | X |
| *Berula erecta* | water parsnip | BEER | X | X | | |
| *Bidens cernua* | nooding beggarsticks | BICE | X | X | | |
| *Boragaceae* sp. | borage | BORAG | | X | | |
| Branched moss | Branched moss | BR MOSS | X | X | | |
| *Bromus* sp. | Brome | BROMU | X | X | | |
| *Bromus inermis* | smooth brome | BRIN2 | X | X | | |
| *Bromus tectorum* | cheatgrass | BRTE | X | X | X | X |
| *Cardaria draba* | pepperweed whitetop | CADR | X | X | | |
| *Carduus nutans* | musk thistle | CANU4 | | X | | |
| *Carex* sp. | sedge | CAREX | X | X | | X |
| *Carex aurea* | golden sedge | CAAU3 | X | X | | |
| *Carex douglasii* | Douglas sedge | CADO2 | | X | | |
| *Carex nebrascensis* | Nebraska sedge | CANE2 | X | X | | X |
| *Carex parryana* | | CAPA18 | | | | X |
| *Carex praegracilis* | fieldclustered sedge | CAPR5 | X | X | | X |
| *Carex rostrata* | beaked sedge | CARO6 | X | X | | |
| *Carex simulata* | analogne sedge | CASI2 | X | X | | X |

**Table E-1**
**Scientific Names, Common Names, and Synonyms of Plant Taxa Encountered on the Vegetation Transects in 2009 and 2010 and Which Transect Types the Taxa Occurred In**
(Page 2 of 7)

| Scientific Name | Common Name | USDA Code | Transect Type | | | |
|---|---|---|---|---|---|---|
| | | | AQ | WM | PS | SC |
| *Castilleja minor* ssp. *minor* | Indian paintbrush | CAMIM6 | X | X | | X |
| *Catabrosa aquatica* | brookgrass | CAAQ3 | X | X | | |
| *Caulanthus* sp. | wild cabbage | CAULA | | | | X |
| *Centaurium exaltatum* | Nevada centaury | CEEX | | X | | X |
| *Ceratocephala testiculata* | curveseed butterwort | CETE5 | X | X | | |
| *Chara Algae* | stonewort, chara | CHARA | X | X | | |
| *Chenopodium* | lambsquarters | CHENO | X | X | X | X |
| *Chenopodium berlandieri* | pitseed lambsquarters | CHBE4 | X | X | | |
| *Chenopodium glaucum* | oakleaf goosefoot | CHGL3 | X | | | |
| *Chenopodium humile* | low goosefoot | CHHU | | X | X | |
| *Chenopodium incanum* | mariola | CHIN2 | X | | X | |
| *Chenopodium leptophyllum* | narrowleaf lambsquarters | CHLE4 | | | X | |
| *Chrysothamnus humilis* | Truckee rabbitbrush | CHHU2 | | | X | |
| *Chrysothamnus viscidiflorus* | green rabbitbrush | CHVI8 | | | X | X |
| *Chrysothamnus viscidiflorus* ssp. *puberulus* | yellow rabbitbrush | CHVIP4 | | | X | |
| *Cirsium* sp. | thistle | CIRSI | | | | X |
| *Cirsium arvense* | Canada thistle | CIAR4 | X | X | | |
| *Cirsium scariosum* | elk thistle | CISC2 | X | X | | X |
| *Cirsium vulgare* | bull thistle | CIVU | X | X | | X |
| *Clematis ligusticifolia var. ligusticifolia* | western virginsbower | CLLIL2 | X | | | |
| *Cleomella plocasperma* | greasewood cleomella | CLPL2 | | | X | X |
| *Comandra umbellata* | bastard toadflax | COUM | | | | X |
| *Conium maculatum* | poison hemlock | COMA2 | | X | | |
| *Convolvulus arvensis* | bindweed | COAR4 | X | X | | |
| *Conyza canadensis* | Canada horseweed | COCA5 | | X | | X |
| *Cordylanthus ramosus* | birds beak | CORA5 | | | X | X |
| *Crepis runcinata* ssp. *glauca* | hawksbeard | CRRUG | X | X | | X |
| *Cryptantha circumscissa* | cushion cryptantha | CRCI2 | | | X | |
| *Cryptantha scoparia* | Pinyon Desert cryptantha | CRSC2 | | | X | |
| *Dactylis glomerata* | orchardgrass | DAGL | | X | | X |
| *Deschampsia ceaspitosa* | tufted hairgrass | DECE | X | X | | |
| *Descurainia pinnata* | western tansymustard | DEPI | | X | X | |
| *Descurainia sophia* | flexweed tansymustard | DESO2 | X | X | X | X |
| *Distichlis spicata* | saltgrass | DISP | X | X | X | X |
| *Dodecatheon* sp. | shootingstar | DODEC | | X | | |
| *Dodecatheon pulchellum* | shootingstar | DOPU | | X | | X |
| *Downingia laeta* | downingia | DOLA2 | | X | | |
| *Draba* sp. | Draba | DRABA | | X | | |
| *Elaeagnus angustifolia* | Russian olive | ELAN | X | X | | |
| *Eleocharis* sp. | spikerush | ELEOC | X | X | | |
| *Eleocharis palustris* | creeping spikerush | ELPA3 | X | X | | |

**Table E-1**
**Scientific Names, Common Names, and Synonyms of Plant Taxa Encountered on the Vegetation Transects in 2009 and 2010 and Which Transect Types the Taxa Occurred In**
(Page 3 of 7)

| Scientific Name | Common Name | USDA Code | Transect Type | | | |
|---|---|---|---|---|---|---|
| | | | AQ | WM | PS | SC |
| *Eleocharis parishii* | Parish's spikerush | ELPA4 | | X | | |
| *Eleocharis quinqueflora* | fewflowered spikerush | ELQU2 | X | X | | |
| *Eleocharis rostellata* | beaked spikerush | ELRO2 | X | X | | |
| *Elymus elymoides* | squirreltail | ELEL5 | X | X | X | X |
| *Elymus trachycaulus* | slender wheatgrass | ELTR7 | X | X | | X |
| *Ephedra nevadensis* | Nevada jointfir | EPNE | | | X | |
| *Ephedra viridis* | green Mormon tea | EPVI | | | X | |
| *Epilobium* sp. | willowherb, fireweed | EPILO | X | X | | |
| *Epilobium ciliatum* | purpleleaf willowherb | EPCI | X | X | | |
| *Epilobium ciliatum* ssp. *ciliatum* | fringed willowherb | EPCIC | X | X | | |
| *Equisetum arvense* | field horsetail | EQAR | X | X | | X |
| *Eriastrum diffusum* | miniature woollystar | ERDI2 | | | X | |
| *Ericameria nauseosa* | rubber rabbitbrush | ERNA10 | X | X | X | X |
| *Erigeron lonchophyllus* | spearleaf fleabane | ERLO | X | X | | X |
| *Eriogonum* sp. | buckwheat | ERIOG | | X | | |
| *Eriogonum cernuum* | nodding wildbuckwheat | ERCE2 | | | | X |
| *Eriogonum microthecum* | slender buckwheat | ERMI4 | | | | X |
| *Erodium cicutarium* | redstem stork's bill | ERCI6 | | | X | |
| *Festuca* sp. | fescue | FESTU | X | | | |
| *Festuca idahoensis* | Idaho fescue | FEID | X | X | | |
| *Festuca sororia* | ravine fescue | FESO | | X | | |
| *Galium trifidum* | small bedstraw | GATR2 | X | X | | |
| *Gayophytum* | groundsmoke | GAYOP | | | X | |
| *Gentianella amarella* | annual gentian | GEAM3 | X | | | X |
| *Gilia* sp. | gilia | GILIA | | | X | |
| *Glaux maritima* | sea milkwort | GLMA | X | X | | X |
| *Grayia spinosa* | spiny hopsage | GRSP | | | X | |
| *Grindelia squarrosa* | curlycup gumweed | GRSQ | X | | | |
| *Gutierrezia sarothrae* | snakeweed | GUSA2 | | | X | X |
| *Halogeton glomeratus* | halogeton | HAGL | X | | X | |
| *Helianthus nuttallii* | Nuttall sunflower | HENU | X | X | | |
| *Hesperochiron pumilus* | evening centaur | HEPU6 | X | X | | |
| *Heterotheca villosa* | hairy false goldenaster | HEVI4 | X | | | |
| *Hippuris vulgaris* | common marestail | HIVU2 | X | X | | |
| *Hordeum brachyantherum* | meadow barley | HOBR2 | X | X | | |
| *Hordeum jubatum* | foxtail barley | HOJU | X | X | X | X |
| *Hymenopappus filifolius var. nanus* | hymenopappus | HYFIN | | | | X |
| *Hymenoxys lemmonii* | Lemmon actinia | HYLE | X | X | | X |
| *Ipomopsis aggregata* ssp. *aggregata* | scarlet gilia | IPAGA3 | | | | X |
| *Iris missouriensis* | Rocky Mountain iris | IRMI | X | X | | X |
| *Iva axillaris* | sumpweed | IVAX | X | X | X | X |

**Table E-1**
**Scientific Names, Common Names, and Synonyms of Plant Taxa Encountered on the Vegetation Transects in 2009 and 2010 and Which Transect Types the Taxa Occurred In**
(Page 4 of 7)

| Scientific Name | Common Name | USDA Code | Transect Type | | | |
|---|---|---|---|---|---|---|
| | | | AQ | WM | PS | SC |
| *Ivesia kingii* | alkali ivesia | IVKI | X | X | | X |
| *Juncus* sp. | rush | JUNCU | X | X | | |
| *Juncus arcticus* ssp. *littoralis* | Baltic rush | JUARL | X | X | | X |
| *Juncus articulatus* | jointleaf rush | JUAR4 | X | X | | |
| *Juncus bufonius* | toad rush | JUBU | | X | | |
| *Juncus ensifolius* | swordleaf rush | JUEN | X | | | |
| *Juncus longistylis* | longstyle rush | JULO | X | X | | |
| *Juncus nevadensis* | Nevada rush | JUNE | X | X | | X |
| *Juncus saximontanus* | Rocky Mountain rush | JUSA | X | | | |
| *Juncus torreyi* | Torrey rush | JUTO | X | X | | |
| *Juniperus scopulorum* | Rocky Mountain juniper | JUSC2 | X | X | | X |
| *Krascheninnikovia lanata* | winterfat | KRLA2 | | | X | |
| *Lactuca serriola* | prickly lettuce | LASE | X | X | X | X |
| *Lactuca tatarica var. pulchella* | blue lettuce | LATAP | | X | | |
| *Lappula occidentalis var. cupulata* | flatspine stickseed | LAOCC | | | X | |
| *Lemna* sp. | duckweed | LEMNA | X | X | | |
| *Lemna minor* | common duckweed | LEMI3 | X | X | | |
| *Lemna minuta* | least duckweed | LEMI6 | X | X | | |
| *Lemna trisulca* | star duckweed | LETR | X | X | | X |
| *Lepidium campestre* | field pepperweed | LECA5 | X | X | | |
| *Lepidium densiflorum* | common pepperweed | LEDE | | | X | |
| *Lepidium perfoliatum* | clasping pepperweed | LEPE2 | | X | X | |
| *Leymus cinereus* | basin wildrye | LECI4 | X | X | | X |
| *Leymus triticoides* | creeping wildrye | LETR5 | X | X | X | X |
| *Limosella aquatica* | water mudwort | LIAQ | | X | | |
| *Linanthus pungens* | flaxflower | LIPU11 | X | | | |
| *Lupinus* sp. | lupine | LUPIN | X | X | | |
| *Machaeranthera carnosa var. carnosa* | alkali aster | MACAC5 | | | X | |
| *Maianthemum racemosum* ssp. *racemosum* | scurvy berry | MARAR | X | | | X |
| *Maianthemum stellatum* | starry false lily of the valley | MAST4 | | | | X |
| *Medicago polymorpha* | California burclover | MEPO3 | X | X | | X |
| *Melilotus officinalis* | sweetclover | MEOF | X | X | | X |
| *Mentha arvensis* | field mint | MEAR4 | X | X | | |
| *Mentha spicata* | spear mint | MESP3 | X | X | | |
| *Mentzelia nitens* | shining blazingstar | MENI2 | | | X | |
| *Mimulus guttatus* | common monkeyflower | MIGU | X | X | | |
| Moss | moss | MOSS | X | X | | X |
| *Muhlenbergia* sp. | muhly | MUHLE | | X | | |
| *Muhlenbergia asperifolia* | alkali muhly | MUAS | X | X | | X |
| *Muhlenbergia richardsonis* | mat muhly | MURI | X | X | | X |
| *Mushroom* | mushroom | MUSHROOM | | X | | |

**Table E-1**
**Scientific Names, Common Names, and Synonyms of Plant Taxa Encountered on the Vegetation Transects in 2009 and 2010 and Which Transect Types the Taxa Occurred In**
(Page 5 of 7)

| Scientific Name | Common Name | USDA Code | Transect Type | | | |
|---|---|---|---|---|---|---|
| | | | AQ | WM | PS | SC |
| *Musineon* sp. | wildparsley | MUSIN | | | | X |
| *Musineon divaricatum* | leafy wildparsley | MUDI | | | | X |
| *Myriophyllum verticillatum* | parrotfeather | MYVE3 | X | X | | |
| *Nasturtium officinale* | watercress | NAOF | X | X | | |
| *Nitrophila occidentalis* | alkali pink | NIOC2 | X | X | | X |
| *Opuntia* sp. | pricklypear | OPUNT | | | X | |
| *Opuntia polyacantha* | plains pricklypear | OPPO | | | X | |
| *Orchid* | orchid | ORCHI2 | X | | | |
| *Pascopyrum smithii* | western wheatgrass | PASM | X | X | | |
| *Phacelia peirsoniana* | handsome phacelia | PHPE2 | | | | X |
| *Phalaris arundinacea* | reed canarygrass | PHAR3 | | X | | |
| *Phleum pratense* | timothy | PHPR3 | X | X | | |
| *Phlox pulvinata* | tufted phlox | PHPU5 | | | | X |
| *Phragmites australis* | common reed | PHAU7 | X | X | | |
| *Picrothamnus desertorum* | budsage | PIDE4 | | | X | |
| *Plagiobothrys* | popcornflower | PLAGI | | X | | |
| *Plagiobothrys scouleri* | popcorn flower | PLSC2 | | X | | |
| *Plantago major* | common plantain | PLMA2 | X | X | | X |
| *Poa* sp. | bluegrass | POA | X | X | | |
| *Poa pratensis* | Kentucky bluegrass | POPR | X | X | | X |
| *Poa secunda* | Sandberg bluegrass | POSE | X | X | X | X |
| *Polygonum* sp. | knotweed | POLYG4 | X | X | | |
| *Polygonum amphibium* | water knotweed | POAM8 | X | X | | |
| *Polygonum argyrocoleon* | silversheath knotweed | POAR5 | X | X | | |
| *Polygonum aviculare* | prostrate knotweed | POAV | X | X | | X |
| *Polygonum ramosissimum* | bushy knotweed | PORA3 | X | X | | |
| *Polypogon monspeliensis* | rabbitsfoot grass | POMO5 | X | X | X | |
| *Populus angustifolia* | narrowleaf poplar | POAN3 | X | | | |
| *Potamogeton* sp. | pondweed | POTAM | X | X | | |
| *Potamogeton foliosus* ssp. *foliosus* | leafy pondweed | POFOF4 | X | | | |
| *Potentilla biennis* | biennial cinquefoil | POBI7 | X | | | |
| *Potentilla gracilis* | Northwest cinquefoil | POGR9 | X | X | | |
| *Potentilla hippiana* | horse cinquefoil | POHI6 | X | X | | |
| *Potentilla pensylvanica var. pensylvanica* | Pennsylvania cinquefoil | POPEP5 | X | X | | |
| *Puccinellia* sp. | alkaligrass | PUCCI | | X | | |
| *Puccinellia distans* | weeping alkaligrass | PUDI | X | X | | |
| *Puccinellia lemmonii* | Lemmon alkaligrass | PULE | X | X | X | X |
| *Pyrrocoma lanceolata* | lanceleaf goldenweed | PYLA | X | X | | X |
| *Raillardella argentea* | silky raillardella | RAAR | | | | X |
| *Ranunculus aquatilis* | water crowfoot | RAAQ | X | | | |
| *Ranunculus cymbalaria* | shore buttercup | RACY | X | X | | X |

**Table E-1**
**Scientific Names, Common Names, and Synonyms of Plant Taxa Encountered on the Vegetation Transects in 2009 and 2010 and Which Transect Types the Taxa Occurred In**
(Page 6 of 7)

| Scientific Name | Common Name | USDA Code | Transect Type AQ | WM | PS | SC |
|---|---|---|---|---|---|---|
| *Ranunculus sceleratus* | blister buttercup | RASC3 | X | X | | |
| *Rhus trilobata* | skunkbush | RHTR | X | | | |
| *Ribes* sp. | currant | RIBES | X | | | |
| *Ribes aureum var. aureum* | golden currant | RIAUA | X | | | |
| *Rorippa sinuata* | spreading watercress | ROSI2 | X | | | |
| *Rosa woodsii* | Woods rose | ROWO | X | X | | X |
| *Rumex crispus* | curly dock | RUCR | X | X | | |
| *Sagittaria cuneata* | duckpotato arrowhead | SACU | X | X | | |
| *Salix* sp. | willow | SALIX | X | | | |
| *Salsola tragus* | Russian thistle | SATR12 | X | | X | |
| *Sambucus nigra* | European elder | SANI4 | X | | | |
| *Sarcobatus vermiculatus* | greasewood | SAVE4 | X | X | X | X |
| *Schedonorus pratensis* | meadow fescue | SCPR4 | X | X | | X |
| *Schoenoplectus acutus* | tule bulrush | SCAC3 | X | X | | |
| *Schoenoplectus acutus var. acutus* | hardstem bulrush | SCACA | X | X | | |
| *Schoenoplectus americanus* | American bulrush | SCAM6 | X | X | | |
| *Schoenoplectus pungens* | common threesquare | SCPU10 | X | X | | |
| *Schoenoplectus pungens var. longispicatus* | common threesquare | SCPUL4 | | X | | |
| *Sida neomexicana* | New Mexico sida | SINE | X | X | | |
| *Sidalcea neomexicana* | salt spring checkerbloom | SINE3 | X | X | | |
| *Sisymbrium altissimum* | tall tumblemustard | SIAL2 | X | | | |
| *Sisyrinchium halophilum* | alkali blueeyedgrass | SIHA2 | X | X | | X |
| *Sium suave* | hemlock waterparsnip | SISU2 | X | X | | |
| *Solidago* sp. | goldenrod | SOLID | X | X | | |
| *Solidago nana* | baby goldenrod | SONA | | X | | X |
| *Sparganium emersum* | European bur-reed | SPEM2 | X | X | | |
| *Sparganium angustifolium* | giant burreed | SPAN2/speu | X | X | | |
| *Spartina gracilis* | alkali cordgrass | SPGR | X | X | | X |
| *Sphaeralcea ambigua* | desert globemallow | SPAM2 | | | X | |
| *Sphaeralcea coccinea* | orange globemallow | SPCO | | | X | |
| Sphagnum Moss | sphagnum moss | SP MOSS | X | X | | |
| *Sphenopholis obtusata* | prairie wedgescale | SPOB | X | X | | |
| *Sporobolus airoides* | alkali sacaton | SPAI | X | X | X | X |
| *Sporobolus cryptandrus* | sand dropseed | SPCR | | | X | |
| *Stellaria longipes* | longstalk starwort | STLO2 | X | X | | |
| *Stuckenia filiformis* | slender-leaved pondweed | STFI6 | | X | | |
| *Stuckenia filiformis* ssp. *filiformis* | fineleaf pondweed | STFIF | X | X | | |
| *Stuckenia filiformis* ssp. *occidentalis* | western fineleaf pondweed | STFIO | X | | | |
| *Suaeda calceoliformis* | horned seablite | SUCA2 | | X | X | X |
| *Suaeda moquinii* | bush seepweed | SUMO | | | X | X |
| *Symphyotrichum eatonii* | Eaton aster | SYEA2 | X | X | | X |

**Table E-1**
**Scientific Names, Common Names, and Synonyms of Plant Taxa Encountered on the Vegetation Transects in 2009 and 2010 and Which Transect Types the Taxa Occurred In**
(Page 7 of 7)

| Scientific Name | Common Name | USDA Code | Transect Type | | | |
|---|---|---|---|---|---|---|
| | | | AQ | WM | PS | SC |
| *Symphyotrichum spathulatum var. intermedium* | western aster | SYSPI | X | X | | |
| *Symphyotrichum spathulatum var. spathulatum* | western aster | SYSPS | X | X | | X |
| *Tanacetum balsamita* | costmary | TABA | X | | | |
| *Taraxacum officinale* | dandelion | TAOF | X | X | | X |
| *Tetradymia glabrata* | littleleaf horsebrush | TEGL | | | X | |
| *Tetradymia spinosa* | spiny horsebrush | TESP2 | | | X | |
| *Thelesperma megapotamicum* | Hopi tea greenthread | THME | | X | | |
| *Thelypodium sagittatum* ssp. *sagittatum* | arrow thelypody | THSAS | | | | X |
| *Thermopsis rhombifolia* | golden thermopsis | THRH | X | X | | |
| *Thinopyrum ponticum* | tall wheatgrass | THPO7 | | X | | |
| *Tragopogon dubius* | yellow salsify | TRDU | X | X | | |
| *Trifolium* sp. | clover | TRIFO | X | X | | X |
| *Trifolium fragiferum* | strawberry clover | TRFR2 | X | X | | |
| *Trifolium hybridum* | Alsike clover | TRHY | X | X | | |
| *Trifolium longipes* | longstalk clover | TRLO | X | X | | |
| *Trifolium pratense* | red clover | TRPR2 | X | X | | |
| *Trifolium repens* | white clover | TRRE3 | X | X | | X |
| *Triglochin so,* | arrowgrass | TRIGL | | X | | |
| *Triglochin concinna* | arrowgrass | TRCO19 | | X | | |
| *Triglochin maritima* | seaside arrowgrass | TRMA20 | X | X | | X |
| *Triglochin palustris* | marsh arrowgrass | TRPA28 | | X | | |
| *Typha* sp. | cattail | TYPHA | X | X | | |
| *Typha domingensis* | southern cattail | TYDO | X | X | | |
| *Typha latifolia* | common cattail | TYLA | X | X | | |
| *Unknown Large* | Unknown Large | UNK LARGE | X | | | |
| *Urtica dioica* | stinging nettle | URDI | X | | | |
| *Utricularia macrorhiza* | bladderwort | UTMA | X | X | | |
| *Utricularia minor* | lesser bladderwort | UTMI | | X | | |
| *Verbascum thapsus* | mullein | VETH | X | | | |
| *Verbena bracteata* | rose verbena | VEBR | | X | | |
| *Veronica anagallis-aquatica* | water speedwell | VEAN2 | X | X | | |
| *Veronica peregrina* L. ssp. *xalapensis* | hairy purslane speedwell | VEPEX2 | | | | X |
| *Vesicarpa potentilloides var. nitrophilum* | fivefinger chickensage | VEPON | | | | X |
| *Viola nephrophylla* | northern bog violet | VINE | X | X | | |
| *Xanthium strumarium* | cocklebur | XAST | X | X | | |
| *Zannichellia palustris* | horned poolmat | ZAPA | X | X | | |
| *Zigadenus elegans* | mountain deathcamus | ZIEL2 | | X | | |
| *Zigadenus paniculatus* | foothill deathcamas | ZIPA2 | | X | | |

AQ = aquatic, WM = Wetland/Meadow, PS = Phreatophytic shrubland, SC = Swamp Cedar

## Table E-2
## Taxa Mean Percent Cover (MH), Number of Sites Where Present, and Number of Transects Where Present along Aquatic Transects in Spring and Snake Valleys for 2009 and 2010
(Page 1 of 4)

| Species or Taxa | Mean Cover (%) | | Number of Sites Where Present | | Number of Transects Where Present | |
|---|---|---|---|---|---|---|
| | 2009 | 2010 | 2009 | 2010 | 2009 | 2010 |
| *Achillea millefolium* | 0.3 | 0.4 | 5 | 4 | 7 | 6 |
| *Agoseris glauca var. glauca* | 0.1 | t | 3 | 1 | 3 | 1 |
| *Agrostis gigantea* | 2.1 | 2.1 | 13 | 13 | 42 | 46 |
| *Algae* | 1.1 | 2.5 | 9 | 10 | 19 | 27 |
| *Alisma plantago-aquatica* | 0.1 | 0.3 | 1 | 1 | 2 | 2 |
| *Angelica* sp. | t | t | 1 | 2 | 1 | 2 |
| *Aquilegia formosa* | 0.1 | 0.1 | 3 | 2 | 4 | 3 |
| *Arctium minus* | 0.1 | 0.1 | 1 | 1 | 1 | 1 |
| *Argentina anserina* | 2.2 | 2.3 | 12 | 13 | 48 | 49 |
| *Artemisia tridentata* | 0.4 | 0.5 | 2 | 2 | 4 | 5 |
| *Asclepias speciosa* | t | t | 1 | 1 | 1 | 1 |
| *Aster* | 0.1 | 0.1 | 2 | 5 | 4 | 6 |
| *Astragalus* sp. | -- | t | -- | 1 | -- | 1 |
| *Atriplex micrantha* | t | t | 1 | 3 | 2 | 5 |
| *Atriplex serenana* | t | -- | 1 | -- | 2 | -- |
| *Bassia scoparia* | 0.2 | 0.4 | 6 | 5 | 11 | 9 |
| *Berula erecta* | 5.5 | 5.0 | 14 | 14 | 50 | 52 |
| *Bidens cernua* | 0.1 | 0.1 | 2 | 2 | 3 | 3 |
| Branched moss | -- | 0.1 | -- | 1 | -- | 1 |
| *Bromus* sp. | -- | t | -- | 1 | -- | 1 |
| *Bromus inermis* | t | t | 1 | 1 | 2 | 1 |
| *Bromus tectorum* | t | 0.2 | 4 | 4 | 6 | 9 |
| *Cardaria draba* | t | t | 2 | 1 | 2 | 2 |
| *Carex* sp. | 0.7 | t | 9 | 2 | 12 | 2 |
| *Carex aurea* | t | t | 1 | 1 | 1 | 1 |
| *Carex nebrascensis* | 10.6 | 11.8 | 14 | 14 | 64 | 63 |
| *Carex praegracilis* | 2.1 | 3.9 | 12 | 13 | 34 | 48 |
| *Carex rostrata* | 0.5 | 0.3 | 3 | 2 | 5 | 3 |
| *Carex simulata* | 5.9 | 4.8 | 10 | 10 | 28 | 23 |
| *Castilleja minor* ssp. *minor* | t | t | 1 | 1 | 1 | 2 |
| *Catabrosa aquatica* | 0.1 | t | 1 | 1 | 2 | 1 |
| *Ceratocephala testiculata* | -- | t | -- | 1 | -- | 1 |
| *Chara* sp. | 2.7 | 2.7 | 7 | 8 | 12 | 14 |
| *Chenopodium* | 0.1 | t | 4 | 2 | 4 | 2 |
| *Chenopodium berlandieri* | 0.1 | t | 1 | 1 | 2 | 1 |
| *Chenopodium glaucum* | -- | t | -- | 1 | -- | 1 |
| *Chenopodium incanum* | t | -- | 1 | -- | 1 | -- |
| *Cirsium arvense* | 0.5 | 0.8 | 1 | 1 | 3 | 3 |
| *Cirsium scariosum* | 0.2 | 0.4 | 9 | 10 | 17 | 23 |
| *Cirsium vulgare* | 0.1 | t | 4 | 2 | 5 | 5 |
| *Clematis ligusticifolia var. ligusticifolia* | 0.1 | 0.2 | 1 | 1 | 1 | 1 |
| *Convolvulus arvensis* | t | t | 2 | 1 | 2 | 1 |
| *Crepis runcinata* ssp. *glauca* | 0.1 | 0.1 | 4 | 5 | 5 | 7 |
| *Deschampsia cespitosa* | 0.3 | 0.6 | 3 | 7 | 9 | 20 |
| *Descurainia sophia* | t | t | 3 | 4 | 3 | 6 |
| *Distichlis spicata* | 0.7 | 0.6 | 12 | 11 | 24 | 23 |
| *Elaeagnus angustifolia* | t | -- | 1 | -- | 1 | -- |

**Table E-2**
**Taxa Mean Percent Cover (MH), Number of Sites Where Present, and Number of Transects Where Present along Aquatic Transects in Spring and Snake Valleys for 2009 and 2010**
(Page 2 of 4)

| Species or Taxa | Mean Cover (%) | | Number of Sites Where Present | | Number of Transects Where Present | |
|---|---|---|---|---|---|---|
| | 2009 | 2010 | 2009 | 2010 | 2009 | 2010 |
| *Eleocharis palustris* | 1.8 | 1.7 | 12 | 9 | 31 | 26 |
| *Eleocharis rostellata* | 2 | 3.3 | 6 | 8 | 19 | 21 |
| *Eleocharis* sp. | t | t | 3 | 2 | 3 | 2 |
| *Eleocharis quinqueflora* | -- | t | -- | 2 | -- | 2 |
| *Elymus elymoides* | -- | t | -- | 1 | -- | 1 |
| *Elymus trachycaulus* | 0.3 | 0.3 | 5 | 8 | 7 | 16 |
| *Epilobium ciliatum* | 0.1 | 0.1 | 6 | 3 | 8 | 6 |
| *Epilobium* sp. | 0.1 | 0.4 | 7 | 10 | 16 | 17 |
| *Equisetum arvense* | 0.3 | 0.5 | 11 | 10 | 32 | 35 |
| *Ericameria nauseosa* | 0.1 | 0.2 | 6 | 7 | 7 | 10 |
| *Erigeron lonchophyllus* | t | t | 5 | 5 | 6 | 7 |
| *Festuca* sp. | -- | t | -- | 1 | -- | 1 |
| *Festuca idahoensis* | -- | t | -- | 1 | -- | 2 |
| *Galium trifidum* | t | 0.1 | 2 | 2 | 3 | 4 |
| *Gentianella amarelle* | t | -- | 1 | -- | 1 | -- |
| *Glaux maritima* | 0.1 | 0.2 | 8 | 10 | 14 | 18 |
| *Grindelia squarrosa* | t | t | 1 | 1 | 1 | 1 |
| *Halogeton glomeratus* | t | -- | 1 | -- | 1 | -- |
| *Helianthus nuttallii* | t | t | 2 | 1 | 3 | 1 |
| *Hesperochiron pumilus* | -- | t | -- | 1 | -- | 1 |
| *Heterotheca villosa* | -- | t | -- | 1 | -- | 1 |
| *Hippuris vulgaris* | 0.2 | 0.3 | 3 | 2 | 8 | 8 |
| *Hordeum brachyantherum* | 0.1 | 0.3 | 4 | 4 | 9 | 8 |
| *Hordeum jubatum* | 0.9 | 0.6 | 6 | 7 | 12 | 19 |
| *Hymenoxys lemmonii* | 0.1 | 0.1 | 3 | 4 | 5 | 7 |
| *Iris missouriensis* | 0.2 | 0.1 | 3 | 3 | 6 | 6 |
| *Iva axillaris* | 0.3 | 0.5 | 3 | 3 | 7 | 9 |
| *Ivesia kingii* | 0.1 | 0.1 | 2 | 3 | 3 | 3 |
| *Juncus* sp. | t | t | 1 | 2 | 1 | 2 |
| *Juncus articulatus* | -- | t | -- | 1 | -- | 2 |
| *Juncus arcticus* ssp. *littoralis* | 2.6 | 3.6 | 14 | 14 | 56 | 58 |
| *Juncus ensifolius* | -- | t | -- | 1 | -- | 1 |
| *Juncus longistylis* | -- | t | -- | 2 | -- | 3 |
| *Juncus nevadensis* | 1.1 | 1.5 | 9 | 11 | 26 | 35 |
| *Juncus saximontanus* | t | -- | 1 | -- | 1 | -- |
| *Juncus torreyi* | t | t | 4 | 3 | 4 | 9 |
| *Juniperus scopulorum* | 0.9 | 0.8 | 1 | 1 | 2 | 2 |
| *Lactuca serriola* | t | 0.1 | 1 | 4 | 1 | 6 |
| *Lemna* sp. | 0.1 | t | 4 | 2 | 4 | 2 |
| *Lemna minor* | 0.6 | 2.1 | 3 | 6 | 6 | 19 |
| *Lemna minuta* | 0.1 | 0.5 | 2 | 2 | 5 | 6 |
| *Lemna trisulca* | t | t | 2 | 1 | 3 | 2 |
| *Lepidium campestre* | -- | t | -- | 1 | -- | 2 |
| *Leymus cinereus* | -- | t | -- | 1 | -- | 1 |
| *Leymus triticoides* | 0.5 | 1.2 | 11 | 12 | 30 | 29 |
| *Lianthus pungens* | t | -- | 1 | -- | 1 | -- |
| *Lupinus* sp. | -- | t | -- | 1 | -- | 1 |

**Table E-2**
**Taxa Mean Percent Cover (MH), Number of Sites Where Present, and Number of Transects Where Present along Aquatic Transects in Spring and Snake Valleys for 2009 and 2010**
(Page 3 of 4)

| Species or Taxa | Mean Cover (%) | | Number of Sites Where Present | | Number of Transects Where Present | |
|---|---|---|---|---|---|---|
| | 2009 | 2010 | 2009 | 2010 | 2009 | 2010 |
| *Maianthemum racemosum* ssp.*amplexicaule* | t | t | 1 | 1 | 1 | 1 |
| *Medicago polymorpha* | 0.3 | 0.4 | 4 | 3 | 7 | 4 |
| *Melilotus officinalis* | 0.2 | 0.1 | 5 | 4 | 9 | 8 |
| *Mentha arvensis* | -- | t | -- | 2 | -- | 2 |
| *Mentha spicata* | 0.1 | t | 3 | 1 | 4 | 2 |
| *Mimulus guttatus* | 0.6 | 1.9 | 13 | 13 | 33 | 40 |
| Moss | 2.1 | 1.5 | 10 | 11 | 23 | 20 |
| *Muhlenbergia asperifolia* | t | t | 1 | 2 | 2 | 3 |
| *Muhlenbergia richardsonis* | 0.1 | t | 9 | 2 | 10 | 2 |
| *Myriophyllum verticillatum* | t | t | 1 | 2 | 1 | 2 |
| *Nasturtium officinale* | 8.1 | 12.7 | 12 | 10 | 40 | 32 |
| *Nitrophila occidentalis* | -- | t | -- | 1 | -- | 1 |
| *Orchid* | -- | t | -- | 1 | -- | 1 |
| *Pascopyrum smithii* | -- | 0.2 | -- | 2 | -- | 4 |
| *Phleum pratense* | t | 0.1 | 3 | 3 | 4 | 5 |
| *Phragmites australis* | 0.2 | 0.1 | 1 | 1 | 1 | 1 |
| *Plantago major* | 0.1 | t | 2 | 3 | 2 | 4 |
| *Poa pratensis* | 1.3 | 1.1 | 12 | 10 | 31 | 19 |
| *Poa secunda* | 0.1 | 1.1 | 3 | 10 | 4 | 21 |
| *Poa* sp. | t | -- | 1 | -- | 1 | -- |
| *Polygonum* | -- | t | -- | 1 | -- | 1 |
| *Polygonum amphibium* | -- | t | -- | 1 | -- | 1 |
| *Polygonum argyrocoleon* | -- | 0.1 | -- | 1 | -- | 1 |
| *Polygonum aviculare* | 0.2 | 0.1 | 5 | 3 | 8 | 5 |
| *Polygonum ramosissimum* | -- | t | -- | 1 | -- | 1 |
| *Polypogon monspeliensis* | t | 0.1 | 4 | 5 | 6 | 8 |
| *Populus angustifolia* | 2.7 | 3.7 | 1 | 1 | 5 | 5 |
| *Potamogeton* sp. | 2.8 | 4.0 | 7 | 6 | 17 | 14 |
| *Potamogeton foliosus* ssp. *foliosus* | -- | 0.6 | -- | 1 | -- | 1 |
| *Potentilla biennis* | -- | t | -- | 1 | -- | 1 |
| *Potentilla gracilis* | t | t | 2 | 3 | 2 | 4 |
| *Potentilla hippiana* | t | -- | 1 | -- | 1 | -- |
| *Potentilla pensylvanica* | t | -- | 1 | -- | 2 | -- |
| *Puccinellia distans* | 0.1 | t | 1 | 3 | 3 | 4 |
| *Puccinellia lemmonii* | 0.1 | 0.2 | 6 | 7 | 14 | 13 |
| *Pyrrocoma lanceolata* | 0.1 | 0.2 | 5 | 11 | 6 | 26 |
| *Ranunculus aquatilis* | t | -- | 2 | -- | 2 | -- |
| *Ranunculus cymbalaria* | t | t | 4 | 3 | 4 | 5 |
| *Ranunculus sceleratus* | 0.1 | 0.1 | 6 | 10 | 10 | 16 |
| *Rhus trilobata* | 0.4 | 0.2 | 2 | 1 | 3 | 2 |
| *Ribes* sp. | t | 0.1 | 1 | 1 | 1 | 2 |
| *Ribes aureum var. aureum* | -- | t | -- | 1 | -- | 1 |
| *Rorippa sinuata* | 0.5 | -- | 1 | -- | 2 | -- |
| *Rosa woodsii* | 1.8 | 2.0 | 7 | 7 | 14 | 13 |
| *Rumex crispus* | 0.1 | 0.1 | 5 | 6 | 6 | 11 |
| *Sagittaria cuneata* | t | 0.1 | 1 | 3 | 1 | 4 |
| *Salix* sp. | 0.4 | 0.6 | 1 | 1 | 1 | 1 |

**Table E-2**
**Taxa Mean Percent Cover (MH), Number of Sites Where Present, and Number of Transects Where Present along Aquatic Transects in Spring and Snake Valleys for 2009 and 2010**
(Page 4 of 4)

| Species or Taxa | Mean Cover (%) | | Number of Sites Where Present | | Number of Transects Where Present | |
|---|---|---|---|---|---|---|
| | 2009 | 2010 | 2009 | 2010 | 2009 | 2010 |
| *Salsola tragus* | t | t | 1 | 1 | 2 | 2 |
| *Sambucus nigra* | 0.1 | 0.1 | 1 | 1 | 1 | 1 |
| *Sarcobatus vermiculatus* | -- | t | -- | 1 | -- | 1 |
| *Schedonorus pratensis* | 1 | 1.7 | 6 | 7 | 13 | 15 |
| *Schoenoplectus acutus* | 0.7 | 0.1 | 4 | 3 | 11 | 5 |
| *Schoenoplectus americanus* | 0.1 | t | 6 | 3 | 9 | 3 |
| *Schoenoplectus pungens* | t | 0.1 | 2 | 5 | 3 | 7 |
| *Sidalcea neomexicana* | t | t | 1 | 1 | 1 | 2 |
| *Sisymbrium altissimum* | -- | t | -- | 1 | -- | 1 |
| *Sisyrinchium halophilum* | 0.1 | 0.1 | 9 | 10 | 19 | 20 |
| *Sium suave* | t | 0.1 | 1 | 1 | 1 | 2 |
| *Solidago* sp. | t | -- | 4 | -- | 4 | -- |
| *Sparganium emersum* | -- | 0.3 | -- | 1 | -- | 2 |
| *Sparganium eurycarpum* | 0.4 | 0.7 | 5 | 4 | 10 | 8 |
| *Spartina gracilis* | 0.1 | 0.1 | 3 | 4 | 5 | 5 |
| Sphagnum Moss | -- | 0.1 | -- | 1 | -- | 1 |
| *Sphenopholis obtusata* | 0.1 | t | 3 | 3 | 6 | 4 |
| *Sporobolus airoides* | 0.1 | 0.2 | 3 | 4 | 8 | 10 |
| *Stellaria longipes* | -- | t | -- | 1 | -- | 2 |
| *Stuckenia filiformis* | 0.5 | 0.2 | 3 | 2 | 7 | 3 |
| *Symphyotrichum eatonii* | 0.2 | 0.3 | 4 | 3 | 12 | 5 |
| *Symphyotrichum spathulatum* | t | t | 1 | 1 | 4 | 2 |
| *Tanacetum balsamita* | -- | t | -- | 1 | -- | 1 |
| *Taraxacum officinale* | 0.2 | 0.3 | 8 | 10 | 20 | 24 |
| *Thermopsis rhombifolia* | 1.5 | 2.9 | 5 | 5 | 13 | 12 |
| *Tragopogon dubius* | -- | t | -- | 1 | -- | 1 |
| *Trifolium fragiferum* | t | t | 1 | 2 | 1 | 2 |
| *Trifolium hybridum* | t | -- | 2 | -- | 2 | -- |
| *Trifolium longipes* | -- | t | -- | 1 | -- | 1 |
| *Trifolium pratense* | 0.1 | t | 1 | 1 | 4 | 2 |
| *Trifolium repens* | 0.2 | 0.2 | 5 | 5 | 11 | 9 |
| *Trifolium* sp. | t | 0.1 | 1 | 4 | 1 | 7 |
| *Triglochin maritima* | t | t | 1 | 3 | 1 | 3 |
| *Typha latifolia* | 0.7 | 1.4 | 4 | 5 | 9 | 9 |
| *Urtica dioica* | t | 0.1 | 1 | 1 | 1 | 1 |
| *Utricularia macrorhiza* | 0.8 | 0.8 | 2 | 2 | 4 | 6 |
| *Verbascum thapsus* | t | t | 1 | 1 | 1 | 1 |
| *Veronica anagallis-aquatica* | 0.2 | 0.9 | 6 | 7 | 10 | 13 |
| *Viola nephrophylla* | t | 0.1 | 1 | 3 | 1 | 4 |
| *Xanthium strumarium* | t | -- | 1 | -- | 1 | -- |
| *Zannichellia palustris* | t | t | 1 | 1 | 1 | 1 |
| *Unknown* | t | -- | 1 | -- | 1 | -- |

t = trace
-- Not found

**Table E-3**
**Taxa Mean Percent Cover (MH), Number of Sites Where Present, and Number of Transects Where Present on the Wetland/Meadow Sites for 2009 and 2010**
(Page 1 of 5)

| Species or Taxa | Mean Cover (%) | | Number of Sites Where Present | | Number of Transects Where Present | |
|---|---|---|---|---|---|---|
| | 2009 | 2010 | 2009 | 2010 | 2009 | 2010 |
| *Achillea millefolium* | 0.3 | 0.3 | 5 | 4 | 19 | 16 |
| *Agoseris glauca var. glauca* | t | t | 2 | 2 | 2 | 2 |
| *Agrostis gigantea* | 2.2 | 1.8 | 7 | 7 | 42 | 41 |
| *Algae* | 0.5 | 0.9 | 4 | 6 | 11 | 21 |
| *Aquilegia formosa* | 0.1 | t | 1 | 1 | 4 | 3 |
| *Argentina anserina* | 3.9 | 3.7 | 7 | 8 | 52 | 56 |
| *Artemisia tridentata* | t | t | 2 | 2 | 3 | 3 |
| *Asclepias speciosa* | t | -- | 2 | -- | 2 | -- |
| *Aster* | t | 0.3 | 5 | 7 | 9 | 22 |
| *Astragalus* sp. | t | t | 1 | 2 | 2 | 2 |
| *Atriplex* sp. | t | -- | 1 | -- | 1 | -- |
| *Atriplex micrantha* | t | t | 1 | 2 | 4 | 3 |
| *Atriplex serenana* | -- | 0.1 | -- | 1 | -- | 4 |
| *Atriplex truncata* | t | -- | 1 | -- | 1 | -- |
| *Bassia scoparia* | 0.3 | 0.4 | 5 | 4 | 12 | 9 |
| *Berula erecta* | 1.1 | 1.2 | 7 | 5 | 25 | 25 |
| *Bidens cernua* | t | 0.1 | 2 | 1 | 4 | 3 |
| *Boraginaceae* sp. | -- | t | -- | 1 | -- | 1 |
| Branched moss | -- | 0.1 | -- | 1 | -- | 2 |
| *Bromus* sp. | -- | t | -- | 1 | -- | 2 |
| *Bromus inermis* | 0.2 | 0.2 | 1 | 1 | 4 | 4 |
| *Bromus tectorum* | t | 0.1 | 3 | 4 | 5 | 6 |
| *Cardaria draba* | t | -- | 1 | -- | 1 | -- |
| *Carduus nutans* | 0.1 | -- | 1 | -- | 4 | -- |
| *Carex* sp. | 1.3 | 0.7 | 5 | 6 | 11 | 16 |
| *Carex aurea* | t | t | 1 | 1 | 1 | 2 |
| *Carex douglasii* | t | 0.2 | 1 | 4 | 1 | 9 |
| *Carex nebrascensis* | 5.3 | 8.2 | 8 | 8 | 47 | 51 |
| *Carex praegracilis* | 4.9 | 5.9 | 7 | 7 | 51 | 49 |
| *Carex rostrata* | 1.6 | 0.5 | 3 | 1 | 10 | 4 |
| *Carex simulata* | 3.1 | 4.0 | 5 | 5 | 20 | 23 |
| *Castilleja minor* | t | -- | 1 | -- | 2 | -- |
| *Castilleja minor* ssp. *minor* | -- | t | -- | 1 | -- | 2 |
| *Catabrosa aquatica* | t | t | 1 | 1 | 3 | 3 |
| *Centaurium exaltatum* | t | t | 2 | 2 | 2 | 2 |
| *Ceratocephala testiculata* | -- | t | -- | 1 | -- | 2 |
| *Chara* sp. | 0.5 | 0.3 | 4 | 2 | 8 | 4 |
| *Chenopodium berlandieri* | t | -- | 1 | -- | 1 | -- |
| *Chenopodium* sp. | 0.1 | 0.1 | 3 | 1 | 5 | 3 |

**Table E-3**
**Taxa Mean Percent Cover (MH), Number of Sites Where Present, and Number of Transects Where Present on the Wetland/Meadow Sites for 2009 and 2010**
(Page 2 of 5)

| Species or Taxa | Mean Cover (%) | | Number of Sites Where Present | | Number of Transects Where Present | |
|---|---|---|---|---|---|---|
| | 2009 | 2010 | 2009 | 2010 | 2009 | 2010 |
| *Chenopodium humile* | -- | t | -- | 1 | -- | 1 |
| *Cirsium arvense* | 0.7 | 1.0 | 1 | 1 | 7 | 6 |
| *Cirsium scariosum* | 0.3 | 0.5 | 6 | 6 | 30 | 33 |
| *Cirsium vulgare* | 0.1 | t | 4 | 2 | 7 | 7 |
| *Conium maculatum* | t | -- | 1 | -- | 1 | -- |
| *Convolvulus arvensis* | t | t | 1 | 1 | 1 | 1 |
| *Conyza canadensis* | -- | t | -- | 1 | -- | 1 |
| *Crepis runcinata* | 0.6 | 0.7 | 6 | 7 | 24 | 25 |
| *Dactylis glomerata* | t | t | 1 | 1 | 1 | 1 |
| *Deschampsia cespitosa* | 0.3 | 0.6 | 5 | 6 | 16 | 25 |
| *Descurainia pinnata* | -- | t | -- | 1 | -- | 2 |
| *Descurainia sophia* | t | t | 2 | 2 | 3 | 4 |
| *Distichlis spicata* | 2.7 | 3.2 | 8 | 8 | 41 | 43 |
| *Dodecatheon* sp. | -- | t | -- | 1 | -- | 1 |
| *Dodecatheon pulchellum* | t | t | 1 | 2 | 1 | 3 |
| *Downingia laeta* | t | -- | 1 | -- | 1 | -- |
| *Draba* sp. | -- | t | -- | 1 | -- | 1 |
| *Elaeagnus angustifolia* | -- | t | -- | 1 | -- | 2 |
| *Eleocharis palustris* | 1.4 | 1.1 | 8 | 8 | 33 | 24 |
| *Eleocharis parishii* | -- | 0.1 | -- | 3 | -- | 5 |
| *Eleocharis quinqueflora* | 0.1 | 0.1 | 1 | 2 | 2 | 5 |
| *Eleocharis rostellata* | 2 | 3.6 | 6 | 6 | 15 | 18 |
| *Eleocharis* sp. | 0.1 | t | 3 | 4 | 3 | 7 |
| *Elymus elymoides* | t | -- | 1 | -- | 1 | -- |
| *Elymus trachycaulus* | 0.9 | 0.8 | 4 | 6 | 10 | 22 |
| *Epilobium ciliatum* | 0.1 | 0.3 | 1 | 3 | 4 | 5 |
| *Epilobium* sp. | 0.1 | 0.1 | 4 | 4 | 8 | 13 |
| *Equisetum arvense* | 0.3 | 0.3 | 7 | 5 | 24 | 25 |
| *Ericameria nauseosa* | 0.1 | 0.3 | 5 | 5 | 14 | 19 |
| *Erigeron lonchophyllus* | 0.1 | 0.2 | 6 | 7 | 28 | 20 |
| *Eriogonum* sp. | -- | t | -- | 2 | -- | 2 |
| *Festuca idahoensis* | -- | 0.2 | -- | 2 | -- | 6 |
| *Festuca sororia* | t | -- | 1 | -- | 1 | -- |
| *Galium trifidum* | t | t | 1 | 2 | 1 | 3 |
| *Glaux maritima* | 0.2 | 0.4 | 5 | 5 | 21 | 27 |
| *Helianthus nuttallii* | t | 0.1 | 2 | 1 | 5 | 1 |
| *Hesperochiron pumilus* | t | t | 1 | 2 | 3 | 4 |
| *Hippuris vulgaris* | 0.8 | 0.6 | 3 | 3 | 11 | 12 |
| *Hordeum brachyantherum* | 0.3 | 0.2 | 5 | 5 | 19 | 17 |

**Table E-3**
**Taxa Mean Percent Cover (MH), Number of Sites Where Present, and Number of Transects Where Present on the Wetland/Meadow Sites for 2009 and 2010**
(Page 3 of 5)

| Species or Taxa | Mean Cover (%) | | Number of Sites Where Present | | Number of Transects Where Present | |
|---|---|---|---|---|---|---|
| | 2009 | 2010 | 2009 | 2010 | 2009 | 2010 |
| *Hordeum jubatum* | 1 | 0.6 | 6 | 7 | 28 | 30 |
| *Hymenoxys lemmonii* | t | t | 2 | 2 | 4 | 3 |
| *Iris missouriensis* | 0.3 | 0.3 | 4 | 4 | 13 | 13 |
| *Iva axillaris* | 0.2 | 0.1 | 2 | 4 | 5 | 7 |
| *Ivesia kingii* | 0.2 | 0.1 | 4 | 4 | 8 | 10 |
| *Juncus arcticus* ssp. *littoralis* | 4.9 | 6.0 | 8 | 8 | 59 | 61 |
| *Juncus articulatus* | -- | t | -- | 1 | -- | 2 |
| *Juncus bufonius* | 0.1 | t | 1 | 1 | 2 | 1 |
| *Juncus longistylis* | t | t | 1 | 2 | 1 | 4 |
| *Juncus nevadensis* | 0.2 | 0.5 | 6 | 6 | 18 | 26 |
| *Juncus* sp. | t | -- | 1 | -- | 1 | -- |
| *Juncus torreyi* | -- | t | -- | 4 | -- | 7 |
| *Juniperus scopulorum* | 0.2 | 0.2 | 1 | 1 | 5 | 5 |
| *Lactuca serriola* | t | t | 1 | 2 | 2 | 6 |
| *Lactuca tatarica var. pulchella* | -- | t | -- | 1 | -- | 1 |
| *Lemna* sp. | 0.5 | 0.1 | 3 | 3 | 4 | 3 |
| *Lemna minor* | 0.3 | 1.9 | 2 | 4 | 5 | 16 |
| *Lemna minuta* | t | 0.1 | 1 | 1 | 1 | 2 |
| *Lemna trisulca* | t | t | 1 | 2 | 1 | 3 |
| *Lepidium campestre* | -- | t | -- | 1 | -- | 3 |
| *Lepidium perfoliatum* | -- | t | -- | 1 | -- | 1 |
| *Leymus cinereus* | -- | t | -- | 1 | -- | 1 |
| *Leymus triticoides* | 1.4 | 2.2 | 7 | 7 | 44 | 43 |
| *Limosella aquatica* | t | -- | 1 | -- | 2 | -- |
| *Lupinus* sp. | -- | t | -- | 1 | -- | 1 |
| *Medicago polymorpha* | 0.2 | 0.3 | 4 | 3 | 9 | 7 |
| *Melilotus officinalis* | 0.2 | t | 3 | 1 | 6 | 1 |
| *Mentha arvensis* | t | -- | 1 | -- | 1 | -- |
| *Mentha spicata* | t | -- | 1 | -- | 1 | -- |
| *Mimulus guttatus* | 0.4 | 1.1 | 6 | 5 | 19 | 20 |
| Moss | 0.7 | 0.3 | 6 | 6 | 12 | 17 |
| *Muhlenbergia* sp. | -- | 0.1 | -- | 4 | -- | 9 |
| *Muhlenbergia asperifolia* | 0.1 | 0.2 | 5 | 6 | 18 | 18 |
| *Muhlenbergia richardsonis* | 0.2 | 0.1 | 5 | 6 | 21 | 17 |
| *Mushroom* | -- | t | -- | 1 | -- | 1 |
| *Myriophyllum verticillatum* | t | 0.1 | 1 | 2 | 2 | 3 |
| *Nasturtium officinale* | 0.5 | 1.1 | 5 | 4 | 17 | 15 |
| *Nitrophila occidentalis* | 0.1 | 0.1 | 4 | 4 | 12 | 15 |
| *Pascopyrum smithii* | 0.1 | t | 1 | 1 | 1 | 1 |

**Table E-3**
**Taxa Mean Percent Cover (MH), Number of Sites Where Present, and Number of Transects Where Present on the Wetland/Meadow Sites for 2009 and 2010**
(Page 4 of 5)

| Species or Taxa | Mean Cover (%) | | Number of Sites Where Present | | Number of Transects Where Present | |
|---|---|---|---|---|---|---|
| | 2009 | 2010 | 2009 | 2010 | 2009 | 2010 |
| *Phalaris arundinacea* | t | t | 1 | 1 | 1 | 1 |
| *Phleum pratense* | t | t | 3 | 3 | 5 | 6 |
| *Phragmites australis* | 0.2 | 0.1 | 1 | 1 | 1 | 1 |
| *Plagiobothrys* sp. | -- | t | -- | 1 | -- | 1 |
| *Plagiobothrys scouleri* | t | t | 1 | 1 | 1 | 2 |
| *Plantago major* | t | t | 3 | 3 | 6 | 5 |
| *Poa pratensis* | 0.8 | 0.7 | 7 | 7 | 38 | 21 |
| *Poa secunda* | t | 1.0 | 3 | 7 | 4 | 30 |
| *Poa* sp. | t | t | 2 | 1 | 2 | 1 |
| *Polygonum amphibium* | -- | t | -- | 1 | -- | 2 |
| *Polygonum argyrocoleon* | -- | 0.1 | -- | 1 | -- | 1 |
| *Polygonum aviculare* | 0.6 | 0.5 | 4 | 6 | 7 | 11 |
| *Polygonum* sp. | t | t | 1 | 1 | 1 | 1 |
| *Polygonum ramosissimum* | -- | t | -- | 2 | -- | 2 |
| *Polypogon monspeliensis* | t | 0.1 | 2 | 4 | 2 | 9 |
| *Potamogeton* sp. | 0.9 | 1.4 | 3 | 2 | 8 | 4 |
| *Potentilla gracilis* | t | t | 2 | 2 | 3 | 4 |
| *Potentilla hippiana* | t | -- | 2 | -- | 3 | -- |
| *Potentilla pensylvanica* | t | -- | 2 | -- | 4 | -- |
| *Puccinellia* sp. | -- | 0.1 | -- | 1 | -- | 1 |
| *Puccinellia distans* | 0.3 | t | 5 | 2 | 11 | 6 |
| *Puccinellia lemmonii* | 1.7 | 1.6 | 7 | 7 | 37 | 34 |
| *Pyrrocoma lanceolata* | 0.2 | 0.3 | 7 | 7 | 27 | 42 |
| *Ranunculus cymbalaria* | t | 0.1 | 5 | 7 | 8 | 20 |
| *Ranunculus sceleratus* | 0.1 | t | 7 | 5 | 19 | 11 |
| *Rosa woodsii* | 0.6 | 0.9 | 1 | 1 | 1 | 1 |
| *Rumex crispus* | 0.1 | 0.1 | 3 | 4 | 7 | 9 |
| *Sagittaria cuneata* | 0.1 | 0.1 | 2 | 1 | 6 | 5 |
| *Sarcobatus vermiculatus* | t | t | 4 | 2 | 4 | 2 |
| *Schedonorus pratensis* | 1.2 | 2.1 | 5 | 4 | 11 | 13 |
| *Schoenoplectus acutus* | 0.7 | 0.7 | 4 | 5 | 13 | 13 |
| *Schoenoplectus americanus* | 0.3 | -- | 4 | -- | 9 | -- |
| *Schoenoplectus pungens* | 0.1 | 0.4 | 6 | 7 | 10 | 17 |
| *Sida neomexicana* | t | t | 2 | 1 | 4 | 1 |
| *Sidalcea neomexicana* | -- | t | -- | 1 | -- | 3 |
| *Sisyrinchium halophilum* | 0.1 | 0.1 | 5 | 6 | 20 | 20 |
| *Sium suave* | t | t | 1 | 1 | 1 | 1 |
| *Solidago nana* | t | t | 1 | 1 | 1 | 1 |
| *Solidago* sp. | t | -- | 2 | -- | 5 | -- |

## Table E-3
## Taxa Mean Percent Cover (MH), Number of Sites Where Present, and Number of Transects Where Present on the Wetland/Meadow Sites for 2009 and 2010
(Page 5 of 5)

| Species or Taxa | Mean Cover (%) | | Number of Sites Where Present | | Number of Transects Where Present | |
|---|---|---|---|---|---|---|
| | 2009 | 2010 | 2009 | 2010 | 2009 | 2010 |
| *Sparganium emersum* | -- | 0.1 | -- | 1 | -- | 1 |
| *Sparganium eurycarpum* | 0.1 | 0.8 | 2 | 4 | 4 | 11 |
| *Spartina gracilis* | 0.5 | 0.5 | 5 | 5 | 12 | 15 |
| Sphagnum Moss | -- | 0.1 | -- | 2 | -- | 3 |
| *Sphenopholis obtusata* | t | t | 3 | 3 | 6 | 9 |
| *Sporobolus airoides* | 1.2 | 1.0 | 6 | 6 | 16 | 19 |
| *Stellaria longipes* | t | t | 1 | 2 | 1 | 6 |
| *Stuckenia filiformis* | 0.1 | 0.1 | 2 | 2 | 2 | 2 |
| *Suaeda calceoliformis* | -- | t | -- | 1 | -- | 3 |
| *Symphyotrichum eatonii* | 0.1 | 0.1 | 4 | 3 | 14 | 10 |
| *Symphyotrichum spathulatum* | -- | t | -- | 3 | -- | 6 |
| *Taraxacum officinale* | 0.2 | 0.4 | 6 | 7 | 32 | 31 |
| *Thelesperma megapotamicum* | -- | 0.2 | -- | 1 | -- | 1 |
| *Thermopsis rhombifolia* | 2.6 | 4.0 | 3 | 3 | 16 | 17 |
| *Thinopyrum ponticum* | t | -- | 1 | -- | 2 | -- |
| *Tragopogon dubius* | -- | t | -- | 1 | -- | 2 |
| *Trifolium fragiferum* | 0.1 | 0.1 | 3 | 4 | 6 | 7 |
| *Trifolium hybridum* | t | t | 2 | 1 | 4 | 1 |
| *Trifolium longipes* | -- | t | -- | 1 | -- | 2 |
| *Trifolium pratense* | 0.1 | t | 2 | 3 | 7 | 6 |
| *Trifolium repens* | 0.4 | 0.3 | 6 | 5 | 19 | 12 |
| *Trifolium* sp. | 0.2 | 0.3 | 2 | 5 | 7 | 17 |
| *Triglochin concinna* | t | t | 2 | 1 | 2 | 2 |
| *Triglochin maritima* | 0.1 | 0.1 | 4 | 5 | 11 | 19 |
| *Triglochin palustris* | t | t | 1 | 1 | 1 | 1 |
| *Triglochin* sp. | t | t | 1 | 1 | 3 | 2 |
| *Typha latifolia* | 0.9 | 1.2 | 4 | 9 | 14 | 16 |
| *Utricularia macrorhiza* | 4.4 | 3.1 | 2 | 2 | 6 | 8 |
| *Utricularia minor* | -- | t | -- | 1 | -- | 1 |
| *Verbena bracteata* | t | t | 1 | 1 | 1 | 3 |
| *Veronica anagallis-aquatica* | 0.1 | 0.2 | 4 | 4 | 10 | 10 |
| *Viola nephrophylla* | 0.1 | 0.2 | 3 | 4 | 6 | 10 |
| *Xanthium strumarium* | t | -- | 1 | -- | 1 | -- |
| *Zannichellia palustris* | 0.8 | t | 2 | 1 | 8 | 3 |
| *Zigadenus elegans* | t | -- | 1 | -- | 1 | -- |
| *Zigadenus paniculatus* | -- | t | -- | 1 | -- | 1 |

t = Trace
-- Not found

**Table E-4**
**Taxa Mean Percent Cover (MH), Number of Sites Where Present, and Number of Transects Where Present on the Phreatophytic Shrubland Sites for 2009 and 2010**
(Page 1 of 2)

| Species or Taxa | Mean Cover (%) | | Number of Sites Where Present | | Number of Transects Where Present | |
|---|---|---|---|---|---|---|
| | 2009 | 2010 | 2009 | 2010 | 2009 | 2010 |
| *Achnatherum hymenoides* | t | 0.1 | 1 | 3 | 2 | 5 |
| *Artemisia tridentata* | 0.4 | 0.5 | 3 | 3 | 7 | 7 |
| *Atriplex canescens* | t | t | 1 | 1 | 2 | 1 |
| *Atriplex confertifolia* | 0.5 | 0.9 | 5 | 5 | 21 | 22 |
| *Atriplex serenana* | -- | t | -- | 1 | -- | 2 |
| *Bassia americana* | 0.1 | 0.2 | 1 | 2 | 2 | 6 |
| *Bassia scoparia* | t | 0.1 | 1 | 3 | 2 | 4 |
| *Bromus tectorum* | -- | t | -- | 3 | -- | 6 |
| *Chenopodium humile* | -- | t | -- | 1 | -- | 1 |
| *Chenopodium incanum* | t | t | 1 | 1 | 1 | 1 |
| *Chenopodium leptophyllum* | t | t | 1 | 3 | 1 | 4 |
| *Chenopodium* sp. | t | -- | 1 | -- | 1 | -- |
| *Chrysothamnus humilis* | -- | 0.1 | -- | 1 | -- | 2 |
| *Chrysothamnus viscidiflorus* | t | -- | 2 | -- | 2 | -- |
| *Chrysothamnus viscidiflorus* ssp. *puberulus* | -- | t | -- | 1 | -- | 1 |
| *Cleomella plocasperma* | -- | t | -- | 1 | -- | 1 |
| *Cordylanthus ramosus* | -- | t | -- | 1 | -- | 1 |
| *Cryptantha circumscissa* | -- | t | -- | 1 | -- | 1 |
| *Cryptantha scoparia* | -- | t | -- | 1 | -- | 1 |
| *Descurainia pinnata* | -- | t | -- | 1 | -- | 2 |
| *Descurainia sophia* | t | 0.3 | 1 | 3 | 1 | 4 |
| *Distichlis spicata* | 0.4 | 0.6 | 3 | 3 | 7 | 7 |
| *Elymus elymoides* | t | 0.2 | 2 | 5 | 2 | 15 |
| *Ephedra nevadensis* | -- | t | -- | 1 | -- | 1 |
| *Ephedra viridis* | t | -- | 1 | -- | 1 | -- |
| *Eriastrum diffusum* | -- | 0.1 | -- | 1 | -- | 1 |
| *Ericameria nauseosa* | 0.2 | 0.4 | 3 | 3 | 6 | 7 |
| *Erodium cicutarium* | -- | 0.2 | -- | 1 | -- | 1 |
| *Gayophytum* | -- | t | -- | 1 | -- | 1 |
| *Gilia* sp. | -- | t | -- | 2 | -- | 2 |
| *Grayia spinosa* | 0.2 | 0.4 | 3 | 3 | 3 | 3 |
| *Gutierrezia sarothrae* | 0.1 | -- | 1 | -- | 3 | -- |

**Table E-4**
**Taxa Mean Percent Cover (MH), Number of Sites Where Present, and Number of Transects Where Present on the Phreatophytic Shrubland Sites for 2009 and 2010**
(Page 2 of 2)

| Species or Taxa | Mean Cover (%) | | Number of Sites Where Present | | Number of Transects Where Present | |
|---|---|---|---|---|---|---|
| | 2009 | 2010 | 2009 | 2010 | 2009 | 2010 |
| *Halogeton glomeratus* | 0.3 | 0.4 | 3 | 3 | 6 | 10 |
| *Hordeum jubatum* | -- | t | -- | 1 | -- | 1 |
| *Iva axillaris* | t | 0.1 | 1 | 1 | 1 | 1 |
| *Krascheninnikovia lanata* | 0.1 | t | 1 | 1 | 2 | 1 |
| *Lactuca serriola* | -- | t | -- | 1 | -- | 1 |
| *Lappula occidentalis var. cupulata* | -- | 0.1 | -- | 4 | -- | 8 |
| *Lepidium densiflorum* | -- | t | -- | 1 | -- | 1 |
| *Lepidium perfoliatum* | -- | 0.1 | -- | 1 | -- | 1 |
| *Leymus triticoides* | -- | t | -- | 1 | -- | 1 |
| *Machaeranthera carnosa* | t | -- | 1 | -- | 1 | -- |
| *Machaeranthera carnosa var. carnosa* | -- | t | -- | 1 | -- | 1 |
| *Mentzelia nitens* | -- | t | -- | 2 | -- | 4 |
| *Opuntia* sp. | -- | t | -- | 2 | -- | 3 |
| *Opuntia polyacantha* | -- | t | -- | 2 | -- | 2 |
| *Picrothamnus desertorum* | 0.1 | 0.1 | 2 | 3 | 3 | 4 |
| *Poa secunda* | t | t | 1 | 1 | 1 | 1 |
| *Polypogon monspeliensis* | -- | t | -- | 1 | -- | 1 |
| *Puccinellia lemmonii* | -- | t | -- | 1 | -- | 1 |
| *Salsola tragus* | -- | t | -- | 1 | -- | 1 |
| *Sarcobatus vermiculatus* | 13.7 | 17.0 | 5 | 5 | 25 | 25 |
| *Sphaeralcea ambigua* | -- | t | -- | 1 | -- | 1 |
| *Sphaeralcea coccinea* | t | t | 1 | 1 | 1 | 1 |
| *Sporobolus airoides* | 0.1 | 0.1 | 2 | 2 | 3 | 3 |
| *Sporobolus cryptandrus* | -- | t | -- | 1 | -- | 1 |
| *Suaeda calceoliformis* | 0.1 | t | 1 | 1 | 1 | 1 |
| *Suaeda moquinii* | 0.1 | 0.6 | 2 | 4 | 3 | 6 |
| *Tetradymia glabrata* | -- | t | -- | 2 | -- | 2 |
| *Tetradymia spinosa* | 0.1 | 0.1 | 3 | 3 | 4 | 5 |

t = Trace
-- Not found

## Table E-5
### Mean Percent Cover (MH) of Dominant Taxa along Aquatic Transects for 2009 and 2010 at the 14 Aquatic Sites in Spring and Snake Valleys
(Page 1 of 6)

| Species or Taxa | Big Springs | | Four Wheel Drive | | Keegan | | Minerva | | North Little | | South Millick | | Stateline | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | 2009 | 2010 | 2009 | 2010 | 2009 | 2010 | 2009 | 2010 | 2009 | 2010 | 2009 | 2010 | 2009 | 2010 |
| *Achillea millefolium* | --- | --- | --- | --- | 0.8 | 1.4 | t | 0.1 | --- | --- | --- | --- | --- | --- |
| *Agrostis gigantean* | 1.5 | 0.9 | 1.1 | 0.5 | 0.5 | 2.3 | 6.7 | 2.7 | --- | --- | 2.1 | 1.7 | 1.0 | 2.3 |
| *Algae* | 2.4 | 6.1 | --- | 2.8 | 1.2 | 1.8 | 1.1 | 1.9 | 4.1 | 5.1 | --- | --- | 1.4 | 4.5 |
| *Alisma plantago-aquatica* | --- | --- | 1.2 | 4.1 | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| *Arctium minus* | --- | --- | 1.4 | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| *Argentina anserine* | 1.7 | 1.6 | 2.0 | 0.2 | 1.7 | 4.7 | 0.6 | 0.9 | 0.8 | 0.9 | 6.5 | 6.6 | 2.0 | 2.1 |
| *Artemisia tridentata* | --- | --- | 1.1 | 3.5 | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| *Bassia scoparia* | --- | 0.2 | --- | 0.1 | --- | --- | --- | --- | --- | --- | --- | --- | --- | T |
| *Berula erecta* | 0.1 | 0.2 | 4.6 | 2.8 | 0.2 | 0.7 | 2.8 | 3.2 | 2.8 | 3.6 | 27.1 | 4.6 | 0.6 | 0.7 |
| Branched moss | --- | --- | --- | --- | --- | 1.8 | --- | --- | --- | --- | --- | --- | --- | --- |
| *Bromus tectorum* | --- | t | --- | --- | --- | --- | --- | 0.7 | --- | --- | --- | --- | --- | --- |
| *Carex nebrascensis* | 0.9 | 0.6 | 21.9 | 29.1 | 3.9 | 9.1 | 7.2 | 8.6 | 46.1 | 34.0 | 2.8 | 3.3 | 0.9 | 1.4 |
| *Carex praegracilis* | 3.5 | 2.1 | t | 0.4 | 3.0 | 8.2 | 1.5 | 5.8 | 3.6 | 10.5 | 0.9 | 2.0 | --- | 0.1 |
| *Carex rostrata* | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| *Carex simulate* | --- | --- | 7.9 | 14.7 | 6.9 | 18.9 | 1.0 | 0.4 | 17.1 | 1.0 | 0.5 | 0.5 | --- | --- |
| *Carex* sp. | 0.2 | --- | 1.9 | --- | 1.4 | --- | --- | --- | --- | --- | 0.3 | --- | --- | --- |
| *Catabrosa aquatic* | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| *Chara* sp. | --- | --- | --- | 2.4 | 0.2 | 1.0 | 3.8 | 5.6 | 9.9 | 11.4 | --- | 0.1 | --- | --- |
| *Cirsium arvense* | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| *Cirsium scariosum* | 0.2 | 0.6 | --- | --- | 0.2 | 0.6 | 0.1 | --- | --- | --- | 0.3 | 0.6 | 0.2 | 0.5 |
| *Cirsium vulgare* | --- | --- | --- | --- | 0.3 | --- | t | --- | --- | --- | 0.2 | --- | --- | --- |
| *Clematis ligusticifolia var. ligusticifolia* | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| *Deschampsia caespitosa* | --- | 0.1 | --- | --- | --- | 0.7 | --- | 0.9 | --- | --- | --- | --- | --- | T |
| *Distichlis spicata* | 0.4 | 0.1 | 2.3 | 3.3 | 0.1 | 0.2 | 2.7 | 0.4 | --- | --- | 1.5 | 1.2 | 0.1 | 0.2 |
| *Eleocharis palustris* | --- | --- | 6.6 | 7.5 | 0.2 | 0.3 | 1.4 | 2.0 | 2.9 | 0.9 | t | 1.0 | 1.1 | --- |
| *Eleocharis rostellata* | 5.7 | 4.8 | --- | --- | --- | 1.0 | 3.7 | 5.6 | --- | 0.8 | --- | --- | 1.2 | 4.7 |
| *Elymus trachycaulus* | --- | --- | --- | --- | --- | 2.2 | 1.9 | 0.2 | --- | --- | t | --- | --- | 0.2 |
| *Epilobium* | --- | --- | --- | 2.8 | --- | 0.4 | --- | --- | --- | t | --- | t | --- | T |

**Table E-5**
**Mean Percent Cover (MH) of Dominant Taxa along Aquatic Transects for 2009 and 2010 at the 14 Aquatic Sites in Spring and Snake Valleys**
(Page 2 of 6)

| Species or Taxa | Big Springs | | Four Wheel Drive | | Keegan | | Minerva | | North Little | | South Millick | | Stateline | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | 2009 | 2010 | 2009 | 2010 | 2009 | 2010 | 2009 | 2010 | 2009 | 2010 | 2009 | 2010 | 2009 | 2010 |
| *Epilobium ciliatum* | --- | --- | --- | --- | --- | 0.5 | --- | --- | --- | --- | --- | --- | --- | --- |
| *Equisetum arvense* | t | t | t | --- | t | 0.3 | 0.1 | 0.3 | --- | --- | 1.5 | 2.1 | 0.2 | 1.0 |
| *Ericameria nauseosa* | --- | --- | --- | 0.5 | --- | 0.3 | --- | 0.4 | --- | --- | --- | --- | --- | 0.5 |
| *Glaux maritime* | --- | 0.3 | --- | --- | --- | 1.0 | --- | --- | --- | 0.3 | --- | 0.1 | --- | 0.2 |
| *Hippuris vulgaris* | --- | --- | --- | --- | 1.1 | 0.2 | --- | --- | --- | --- | --- | --- | --- | --- |
| *Hordeum brachyantherum* | --- | --- | --- | --- | 0.1 | 0.6 | 0.2 | t | --- | --- | --- | --- | --- | --- |
| *Hordeum jubatum* | 1.2 | 0.2 | --- | --- | 0.1 | 1.7 | 6.2 | 2.2 | --- | --- | --- | --- | --- | --- |
| *Iris missouriensis* | --- | --- | --- | --- | 0.1 | 0.2 | --- | --- | --- | --- | --- | --- | --- | --- |
| *Iva axillaris* | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| *Juncus arcticus* ssp. *littoralis* | 2.4 | 1.8 | 0.2 | 1.0 | 2.3 | 5.3 | 1.1 | 3.4 | 3.5 | 3.7 | 3.3 | 5.6 | 3.7 | 3.1 |
| *Juncus nevadensis* | --- | 1.1 | 3.7 | 3.5 | 0.1 | 1.0 | 1.7 | 2.3 | 0.3 | t | 4.3 | 5.9 | --- | 0.1 |
| *Juniperus scopulorum* | --- | --- | 12.1 | 10.8 | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| *Lemna minor* | --- | 0.1 | --- | 1.2 | --- | 1.1 | t | 0.1 | --- | --- | --- | --- | --- | --- |
| *Lemna minuta* | --- | --- | --- | --- | 0.2 | --- | --- | --- | --- | --- | 1.6 | 2.1 | --- | --- |
| *Leymus triticoides* | 0.8 | 0.4 | 0.1 | 0.2 | 2.3 | 10.3 | 1.0 | 1.1 | --- | --- | 0.3 | 0.2 | t | T |
| *Medicago polymorpha* | --- | --- | --- | --- | --- | --- | 1.0 | 2.5 | --- | --- | --- | --- | --- | --- |
| *Melilotus officinalis* | 1.0 | --- | --- | --- | t | --- | 1.8 | --- | --- | --- | --- | --- | --- | --- |
| *Mimulus guttatus* | 0.3 | 1.0 | 0.4 | 0.8 | 0.1 | 4.3 | 1.7 | 0.5 | 0.3 | 0.1 | 0.6 | 1.0 | --- | 1.2 |
| Moss | 3.3 | 0.1 | 0.7 | 0.3 | 3.9 | 1.9 | 1.2 | 0.2 | --- | --- | --- | --- | 8.6 | 1.6 |
| *Nasturtium officinale* | 32.9 | 21.8 | 2.3 | 2.9 | 0.6 | 8.0 | 4.1 | 9.3 | --- | --- | 5.4 | 39.4 | 38.1 | 58.0 |
| *Pascopyrum smithii* | --- | 1.4 | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| *Phragmites australis* | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| *Poa pratensis* | 0.9 | 0.1 | 0.2 | --- | 1.1 | 0.2 | 1.6 | 2.3 | 0.7 | 0.6 | 0.1 | 0.2 | --- | --- |
| *Poa secunda* | --- | 1.2 | --- | 0.8 | --- | 3.2 | --- | 1.0 | --- | --- | --- | 0.1 | --- | --- |
| *Polygonum aviculare* | --- | --- | --- | --- | --- | t | 2.0 | 1.4 | --- | --- | --- | --- | --- | --- |
| *Populus angustifolia* | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| *Potamogeton foliosus* ssp. *foliosus* | --- | --- | --- | --- | --- | --- | --- | 8.8 | --- | --- | --- | --- | --- | --- |
| *Potamogeton* sp. | 1.1 | 2.0 | 10.2 | 21.8 | 0.4 | --- | 14.5 | 13.5 | --- | --- | --- | 0.4 | 1.7 | --- |

**Table E-5**
**Mean Percent Cover (MH) of Dominant Taxa along Aquatic Transects for 2009 and 2010 at the 14 Aquatic Sites in Spring and Snake Valleys**
(Page 3 of 6)

| Species or Taxa | Big Springs | | Four Wheel Drive | | Keegan | | Minerva | | North Little | | South Millick | | Stateline | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | 2009 | 2010 | 2009 | 2010 | 2009 | 2010 | 2009 | 2010 | 2009 | 2010 | 2009 | 2010 | 2009 | 2010 |
| *Ranunculus sceleratus* | --- | --- | --- | --- | --- | --- | t | --- | 1.0 | --- | --- | --- | --- | --- |
| *Rhus trilobata* | --- | --- | 0.2 | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| *Ribes* sp. | --- | --- | --- | 1.1 | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| *Rorippa sinuate* | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| *Rosa woodsii* | 0.2 | t | 6.0 | 6.3 | --- | --- | 6.5 | 10.6 | 0.8 | 0.3 | --- | --- | --- | --- |
| *Sagittaria cuneata* | --- | --- | --- | 1.2 | --- | t | --- | --- | --- | t | --- | --- | --- | --- |
| *Salix* sp. | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| *Sambucus nigra* | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| *Schedonorus pratensis* | 3.3 | 3.3 | --- | T | 0.5 | t | 7.9 | 17.6 | --- | --- | --- | --- | --- | --- |
| *Schoenoplectus acutus* | --- | --- | --- | --- | 0.8 | 2.1 | --- | --- | --- | --- | 7.8 | --- | --- | --- |
| *Sium suave* | --- | --- | --- | --- | --- | 1.0 | --- | --- | --- | --- | --- | --- | --- | --- |
| *Sparganium emersum* | --- | --- | --- | --- | --- | 4.4 | --- | --- | --- | --- | --- | --- | --- | --- |
| *Sparganium angustifolium* | --- | --- | --- | --- | 0.2 | 0.7 | 0.1 | 0.1 | --- | --- | --- | --- | --- | --- |
| *Spartina gracilis* | --- | 0.1 | --- | --- | --- | --- | --- | --- | --- | --- | --- | 1.6 | --- | 0.2 |
| *Sporobolus airoides* | --- | --- | --- | 1.2 | --- | t | --- | --- | --- | --- | --- | --- | --- | 0.2 |
| *Stuckenia filiformis* | --- | --- | --- | --- | 0.1 | --- | 3.8 | --- | --- | --- | 3.7 | --- | --- | --- |
| *Stuckenia filiformis* ssp. *filiformis* | --- | --- | --- | --- | --- | t | --- | --- | --- | --- | --- | 2.0 | --- | --- |
| *Stuckenia filiformis* ssp. *occidentalis* | --- | --- | --- | --- | --- | --- | --- | 1.8 | --- | --- | --- | --- | --- | --- |
| *Symphyotrichum eatonii* | --- | --- | --- | --- | --- | 0.2 | 0.1 | --- | --- | --- | 0.2 | --- | --- | --- |
| *Taraxacum officinale* | --- | --- | --- | --- | 1.0 | 2.2 | 0.1 | 0.2 | --- | --- | --- | --- | --- | 0.2 |
| *Thermopsis rhombifolia* | --- | --- | 0.7 | 0.5 | 6.2 | 11.2 | 6.5 | 10.0 | --- | --- | --- | --- | --- | --- |
| *Trifolium pretense* | --- | --- | --- | --- | --- | --- | 1.2 | --- | --- | --- | --- | --- | --- | --- |
| *Trifolium repens* | 0.3 | t | --- | --- | 1.1 | 1.5 | t | --- | --- | --- | --- | --- | --- | --- |
| *Typha latifolia* | --- | --- | 0.9 | 2.6 | 5.4 | 15.9 | --- | --- | --- | --- | --- | --- | --- | --- |
| *Utricularia macrorhiza* | --- | --- | --- | --- | 0.4 | 2.6 | --- | --- | --- | --- | --- | --- | --- | --- |
| *Veronica anagallis-aquatica* | --- | 6.0 | --- | T | --- | 1.7 | --- | 0.6 | --- | 0.0 | --- | --- | --- | --- |
| *Viola nephrophylla* | --- | t | --- | --- | --- | --- | --- | 0.3 | --- | --- | --- | --- | --- | --- |

**Table E-5**
**Mean Percent Cover (MH) of Dominant Taxa along Aquatic Transects for 2009 and 2010 at the 14 Aquatic Sites in Spring and Snake Valleys**
(Page 4 of 6)

| Species and Taxa | Stonehouse | | Swallow | | Unnamed 1 | | Unnamed 5 | | West Spring Valley | | Willard | | Willow Spring | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | 2009 | 2010 | 2009 | 2010 | 2009 | 2010 | 2009 | 2010 | 2009 | 2010 | 2009 | 2010 | 2009 | 2010 |
| *Achillea millefolium* | --- | --- | t | 0.1 | --- | --- | --- | --- | 0.1 | --- | 3.6 | 3.4 | --- | --- |
| *Agrostis gigantean* | t | 0.3 | 3.3 | 3.7 | 2.1 | 1.6 | 0.5 | 0.7 | 6.5 | 6.8 | 2.2 | 0.1 | 2.3 | 5.2 |
| *Algae* | 0.4 | 1.7 | --- | --- | 0.4 | --- | 3.4 | 10.5 | --- | 0.6 | --- | --- | 0.8 | 0.2 |
| *Alisma plantago-aquatica* | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| *Arctium minus* | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| *Argentina anserine* | --- | 1.1 | --- | --- | 0.2 | 0.5 | 2.8 | 2.0 | 0.9 | 2.8 | 6.4 | 6.0 | 4.9 | 3.4 |
| *Artemisia tridentata* | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | 3.8 | 4.1 |
| *Bassia scoparia* | --- | --- | --- | 4.4 | --- | 1.0 | --- | --- | --- | --- | --- | --- | --- | --- |
| *Berula erecta* | 1.8 | 3.8 | 5.3 | 12.8 | 16.0 | 17.8 | 6.0 | 2.9 | 8.7 | 8.5 | 0.4 | 2.8 | 0.7 | 5.5 |
| Branched moss | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| *Bromus tectorum* | --- | --- | --- | 1.8 | --- | --- | --- | --- | --- | --- | --- | 0.2 | --- | --- |
| *Carex nebrascensis* | 19.7 | 18.6 | 1.0 | 0.6 | 1.4 | 2.7 | 11.1 | 19.9 | 4.6 | 8.6 | 15.8 | 15.0 | 11.2 | 13.6 |
| *Carex praegracilis* | --- | 1.4 | 0.2 | --- | 1.2 | 3.8 | 0.4 | 4.4 | 5.7 | 9.7 | 8.9 | 6.1 | 0.7 | 0.2 |
| *Carex rostrata* | 1.5 | 1.4 | --- | --- | --- | --- | 3.4 | 3.3 | 1.4 | --- | --- | --- | --- | --- |
| *Carex simulate* | 39.3 | 25.7 | --- | --- | --- | 2.0 | 4.4 | 0.8 | 0.7 | 1.3 | 2.9 | --- | 1.7 | 2.7 |
| *Carex* sp. | --- | --- | t | --- | 2.2 | --- | 0.1 | --- | 2.9 | --- | 0.1 | --- | --- | --- |
| *Catabrosa aquatic* | 1.2 | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| *Chara* sp. | --- | --- | 0.2 | --- | 2.5 | 3.6 | 19.3 | 12.9 | --- | --- | --- | --- | 1.3 | 0.3 |
| *Cirsium arvense* | --- | --- | --- | --- | --- | --- | --- | --- | 7.0 | 11.4 | --- | --- | --- | --- |
| *Cirsium scariosum* | --- | 0.1 | --- | --- | 0.1 | 0.3 | 0.1 | 0.1 | --- | 1.3 | 1.0 | 1.3 | 0.1 | 0.1 |
| *Cirsium vulgare* | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | 1.0 | --- |
| *Clematis ligusticifolia var. ligusticifolia* | --- | --- | 1.0 | 2.8 | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| *Deschampsia caespitosa* | t | 0.1 | --- | --- | 0.6 | 2.0 | --- | --- | --- | --- | 3.4 | 4.2 | --- | --- |
| *Distichlis spicata* | t | --- | --- | --- | 0.5 | 1.3 | 0.1 | 0.1 | 0.9 | 1.0 | 0.2 | 0.3 | 0.3 | 0.6 |
| *Eleocharis palustris* | 3.9 | 0.3 | t | --- | 0.1 | --- | 3.1 | 5.3 | 0.3 | 0.3 | --- | --- | 5.2 | 6.6 |
| *Eleocharis rostellata* | --- | 0.5 | --- | --- | 13.4 | 24.1 | 1.1 | --- | 3.1 | 4.9 | --- | --- | --- | --- |
| *Elymus trachycaulus* | --- | t | --- | --- | 0.3 | 0.5 | --- | --- | 1.6 | 0.7 | 0.3 | 0.6 | --- | 0.0 |
| *Epilobium* sp. | --- | --- | --- | --- | --- | t | --- | t | --- | 0.6 | --- | 1.5 | --- | 0.2 |

**Table E-5**
**Mean Percent Cover (MH) of Dominant Taxa along Aquatic Transects for 2009 and 2010 at the 14 Aquatic Sites in Spring and Snake Valleys**
(Page 5 of 6)

| Species and Taxa | Stonehouse | | Swallow | | Unnamed 1 | | Unnamed 5 | | West Spring Valley | | Willard | | Willow Spring | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | 2009 | 2010 | 2009 | 2010 | 2009 | 2010 | 2009 | 2010 | 2009 | 2010 | 2009 | 2010 | 2009 | 2010 |
| *Epilobium ciliatum* | --- | --- | --- | --- | --- | --- | --- | --- | --- | 1.3 | --- | --- | --- | t |
| *Equisetum arvense* | --- | --- | --- | --- | 0.1 | 0.1 | 0.2 | 0.2 | 1.2 | 1.4 | 0.7 | 0.5 | 0.4 | 0.5 |
| *Ericameria nauseosa* | --- | --- | --- | --- | --- | --- | --- | --- | --- | 1.3 | --- | 0.1 | --- | 0.4 |
| *Glaux maritime* | --- | 0.1 | --- | --- | --- | 0.4 | --- | t | --- | --- | --- | t | --- | 0.3 |
| *Hippuris vulgaris* | --- | --- | --- | --- | --- | --- | 2.1 | 3.9 | --- | --- | 0.1 | --- | --- | --- |
| *Hordeum brachyantherum* | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | 1.1 | 3.0 | 0.2 | 0.2 |
| *Hordeum jubatum* | --- | --- | --- | 0.2 | 0.1 | 0.6 | --- | --- | t | 0.3 | 4.6 | 3.0 | --- | --- |
| *Iris missouriensis* | 0.9 | 0.4 | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | 1.2 | 1.4 |
| *Iva axillaris* | --- | --- | 0.2 | 0.2 | --- | --- | --- | --- | 1.5 | 2.2 | --- | --- | 2.5 | 4.9 |
| *Juncus arcticus* ssp. *littoralis* | 7.2 | 5.0 | 0.2 | 0.1 | 2.4 | 3.4 | 1.6 | 3.3 | 3.9 | 4.9 | 2.6 | 6.7 | 2.3 | 3.5 |
| *Juncus nevadensis* | --- | --- | --- | --- | 0.5 | 3.1 | 1.4 | 1.4 | 0.8 | 1.4 | 2.7 | 1.4 | --- | --- |
| *Juniperus scopulorum* | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| *Lemna minor* | --- | 3.3 | --- | --- | 0.1 | --- | --- | --- | 8.9 | 22.9 | --- | --- | --- | --- |
| *Lemna minuta* | --- | 4.9 | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| *Leymus triticoides* | 0.1 | --- | --- | t | 0.2 | 0.4 | 0.1 | 0.2 | 0.3 | 2.5 | 2.4 | 1.3 | --- | t |
| *Medicago polymorpha* | --- | --- | 1.9 | 2.2 | t | --- | --- | --- | 1.4 | 1.5 | --- | --- | --- | --- |
| *Melilotus officinalis* | --- | --- | t | --- | --- | --- | --- | --- | t | --- | --- | --- | --- | --- |
| *Mimulus guttatus* | 0.1 | 0.5 | 0.1 | 1.8 | 1.0 | 5.8 | 0.1 | 0.3 | 2.2 | 8.5 | 0.2 | --- | 1.0 | 1.4 |
| Moss | 0.6 | 0.1 | 1.0 | 0.7 | 8.9 | 15.1 | 0.4 | t | --- | 0.2 | --- | --- | 0.2 | 1.2 |
| *Nasturtium officinale* | 6.1 | 7.1 | 7.4 | 17.4 | 10.9 | 13.8 | --- | --- | 2.3 | --- | 0.2 | --- | 3.4 | 0.1 |
| *Pascopyrum smithii* | --- | --- | --- | --- | --- | 1.2 | --- | --- | --- | --- | --- | --- | --- | --- |
| *Phragmites australis* | --- | --- | --- | --- | --- | --- | --- | --- | 3.0 | 1.2 | --- | --- | --- | --- |
| *Poa pratensis* | --- | --- | 4.7 | 5.2 | 0.1 | 0.3 | 0.2 | 0.1 | 3.0 | 2.1 | 5.0 | 4.1 | 1.1 | --- |
| *Poa secunda* | --- | --- | 1.3 | 3.8 | --- | 1.1 | t | 0.5 | t | 3.6 | --- | --- | --- | 0.6 |
| *Polygonum aviculare* | --- | --- | --- | --- | --- | --- | t | --- | t | --- | 0.3 | 0.2 | t | --- |
| *Populus angustifolia* | --- | --- | 51.9 | 51.5 | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| *Potamogeton foliosus* ssp. *foliosus* | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| *Potamogeton* sp. | --- | --- | --- | --- | --- | --- | 11.1 | 17.0 | 0.4 | 1.1 | --- | --- | --- | --- |

**Table E-5**
**Mean Percent Cover (MH) of Dominant Taxa along Aquatic Transects for 2009 and 2010 at the 14 Aquatic Sites in Spring and Snake Valleys**
(Page 6 of 6)

| Species and Taxa | Stonehouse | | Swallow | | Unnamed 1 | | Unnamed 5 | | West Spring Valley | | Willard | | Willow Spring | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | 2009 | 2010 | 2009 | 2010 | 2009 | 2010 | 2009 | 2010 | 2009 | 2010 | 2009 | 2010 | 2009 | 2010 |
| *Ranunculus sceleratus* | 0.2 | --- | --- | --- | --- | --- | t | --- | --- | --- | t | --- | 0.5 | --- |
| *Rhus trilobata* | --- | --- | 4.7 | 3.2 | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| *Ribes* sp. | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| *Rorippa sinuate* | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | 6.4 | --- | --- | --- |
| *Rosa woodsii* | --- | --- | 9.0 | 10.0 | 0.1 | 0.3 | --- | --- | --- | --- | --- | --- | 1.9 | 1.1 |
| *Sagittaria cuneata* | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| *Salix* sp. | --- | --- | 5.2 | 7.8 | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| *Sambucus nigra* | --- | --- | 1.4 | 1.4 | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| *Schedonorus pratensis* | 0.1 | --- | --- | 0.1 | 1.3 | 0.9 | --- | --- | 1.2 | 1.8 | --- | --- | --- | --- |
| *Schoenoplectus acutus* | t | 0.6 | --- | --- | --- | --- | --- | --- | 1.1 | 0.6 | --- | --- | --- | --- |
| *Sium suave* | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| *Sparganium emersum* | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| *Sparganium angustifolium* | --- | --- | 0.1 | --- | --- | --- | 4.4 | 9.0 | 0.6 | 0.2 | --- | --- | --- | --- |
| *Spartina gracilis* | --- | --- | --- | --- | --- | t | --- | --- | --- | --- | --- | --- | --- | --- |
| *Sporobolus airoides* | --- | --- | --- | --- | --- | --- | --- | 1.5 | --- | --- | --- | --- | --- | --- |
| *Stuckenia filiformis* | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| *Stuckenia filiformis* ssp. *filiformis* | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| *Stuckenia filiformis* ssp. *occidentalis* | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| *Symphyotrichum eatonii* | --- | --- | --- | --- | --- | --- | 0.3 | --- | 1.7 | 2.6 | --- | --- | --- | 1.0 |
| *Taraxacum officinale* | --- | t | 0.2 | 0.1 | 0.1 | 0.3 | t | t | 0.7 | 0.2 | 1.3 | 1.0 | t | 0.1 |
| *Thermopsis rhombifolia* | --- | --- | --- | --- | --- | --- | --- | --- | 7.4 | 18.1 | 0.5 | 1.1 | --- | --- |
| *Trifolium pretense* | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| *Trifolium repens* | --- | --- | --- | --- | --- | 0.6 | 0.3 | t | 1.3 | 0.6 | --- | --- | --- | --- |
| *Typha latifolia* | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | 3.3 | 1.3 |
| *Utricularia macrorhiza* | --- | --- | --- | --- | --- | --- | 11.1 | 8.1 | --- | --- | --- | --- | --- | --- |
| *Veronica anagallis-aquatica* | --- | --- | --- | 4.7 | --- | t | --- | --- | --- | --- | --- | --- | --- | --- |
| *Viola nephrophylla* | --- | --- | --- | --- | --- | --- | --- | --- | --- | 1.0 | --- | --- | --- | --- |

Note: Mean percent cover is the mean percent cover per transect for each species, averaged over the number of transects per site (the grand mean).
A “t” indicates a trace amount (≤0.05%).
Dashed lines (---) indicate that the taxa was not present at that site (cover = 0).

## Table E-6
## Mean Percent Cover (MH) of Dominant Plant Taxa on Wetland/Meadow Transects for 2009 and 2010 at the Eight Wetland/Meadow Sites in Spring and Snake Valleys
(Page 1 of 6)

| | Blind Spring | | Burbank Meadows | | Keegan Spring Complex (North) | | Minerva Spring Complex | | Shoshone Ponds | | Stonehouse Spring Complex | | The Seep | | West Spring Valley Complex #1 | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **Species** | **2009** | **2010** | **2009** | **2010** | **2009** | **2010** | **2009** | **2010** | **2009** | **2010** | **2009** | **2010** | **2009** | **2010** | **2009** | **2010** |
| *Achillea millefolium* | --- | --- | --- | --- | 0.50 | 0.94 | 0.90 | 0.83 | 0.70 | 0.35 | --- | --- | t | --- | 0.20 | 0.06 |
| *Agoseris glauca var. glauca* | --- | --- | --- | --- | --- | t | --- | --- | --- | 0.00 | --- | --- | --- | --- | --- | --- |
| *Agrostis gigantean* | --- | --- | 0.50 | 0.23 | 0.30 | 3.01 | 9.70 | 4.30 | 1.30 | 1.28 | 0.60 | 0.58 | 2.30 | 1.68 | 3.20 | 3.62 |
| *Algae* | --- | 0.65 | --- | --- | 1.00 | 0.93 | 1.90 | 1.48 | --- | 0.48 | 0.10 | 0.73 | --- | --- | 0.80 | 2.95 |
| *Aquilegia formosa* | --- | --- | --- | --- | --- | --- | --- | 0.10 | --- | --- | --- | --- | --- | --- | --- | --- |
| *Argentina anserine* | --- | t | 7.60 | 7.78 | 4.90 | 7.83 | 1.50 | 1.37 | 3.10 | 1.66 | 0.70 | 1.07 | 12.40 | 7.02 | 0.90 | 2.85 |
| *Artemisia tridentata* | --- | --- | --- | --- | --- | --- | --- | --- | --- | t | --- | --- | --- | t | --- | --- |
| *Aster* sp. | --- | --- | --- | 0.18 | --- | 0.21 | --- | t | --- | 0.77 | --- | t | --- | 0.81 | --- | 0.36 |
| *Astragalus* sp. | --- | --- | --- | --- | --- | t | --- | --- | --- | --- | --- | --- | --- | --- | --- | 0.06 |
| *Atriplex micrantha* | --- | --- | --- | --- | --- | t | --- | --- | --- | --- | --- | --- | --- | --- | --- | 0.32 |
| *Atriplex serenana* | --- | 0.44 | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| *Bassia scoparia* | 1.60 | 2.59 | 0.10 | 0.11 | --- | --- | 0.90 | 0.10 | --- | --- | --- | --- | t | --- | t | t |
| *Berula erecta* | --- | --- | t | --- | 0.20 | 1.43 | 1.60 | 1.07 | 0.10 | 0.12 | 1.30 | 0.32 | t | --- | 5.30 | 7.02 |
| *Bidens cernua* | --- | --- | --- | --- | --- | 0.45 | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| *Boragaceae* | --- | --- | --- | --- | --- | --- | --- | --- | --- | t | --- | --- | --- | --- | --- | --- |
| Branched moss | --- | --- | --- | --- | --- | 0.51 | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| *Bromus* sp. | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | 0.12 |
| *Bromus inermis* | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | 1.20 | 1.96 |
| *Bromus tectorum* | --- | --- | --- | t | --- | --- | --- | 0.59 | --- | t | --- | --- | --- | --- | --- | 0.12 |
| *Carex* sp. | --- | --- | --- | 1.71 | 1.70 | t | 0.60 | 0.45 | 0.50 | 2.57 | 2.60 | 0.78 | --- | 0.17 | 4.70 | --- |
| *Carex aurea* | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | 0.05 | --- | --- | --- | --- |
| *Carex douglasii* | --- | --- | --- | --- | --- | t | --- | --- | --- | 0.47 | --- | --- | --- | 1.02 | --- | 0.05 |
| *Carex nebrascensis* | 0.40 | 7.33 | t | 0.08 | 6.50 | 12.13 | 5.00 | 8.31 | 2.50 | 2.70 | 16.20 | 17.57 | 6.70 | 5.76 | 5.10 | 11.80 |
| *Carex praegracilis* | --- | --- | 10.70 | 10.49 | 4.60 | 9.05 | 1.90 | 3.97 | 12.60 | 9.72 | 2.80 | 5.06 | 3.30 | 0.30 | 3.60 | 8.95 |
| *Carex rostrata* | 4.30 | --- | --- | --- | --- | --- | --- | --- | --- | --- | 5.10 | 3.90 | --- | --- | 3.00 | --- |
| *Carex simulate* | 2.10 | 5.25 | --- | --- | 2.80 | 9.95 | 1.00 | 0.60 | --- | --- | 16.70 | 14.44 | --- | --- | 2.00 | 2.07 |
| *Castilleja minor* ssp. *minor* | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | 0.04 |
| *Catabrosa aquatic* | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | 0.08 | --- | --- | --- | --- |
| *Centaurium exaltatum* | --- | --- | --- | --- | --- | t | --- | --- | --- | t | --- | --- | --- | --- | --- | --- |
| *Ceratocephala testiculata* | --- | --- | --- | --- | --- | --- | --- | --- | --- | 0.10 | --- | --- | --- | --- | --- | --- |

## Table E-6
## Mean Percent Cover (MH) of Dominant Plant Taxa on Wetland/Meadow Transects for 2009 and 2010 at the Eight Wetland/Meadow Sites in Spring and Snake Valleys
(Page 2 of 6)

| Species | Blind Spring | | Burbank Meadows | | Keegan Spring Complex (North) | | Minerva Spring Complex | | Shoshone Ponds | | Stonehouse Spring Complex | | The Seep | | West Spring Valley Complex #1 | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | 2009 | 2010 | 2009 | 2010 | 2009 | 2010 | 2009 | 2010 | 2009 | 2010 | 2009 | 2010 | 2009 | 2010 | 2009 | 2010 |
| *Chara* sp. | 2.20 | --- | --- | --- | 0.20 | 0.60 | 1.70 | 1.64 | --- | --- | t | --- | --- | --- | --- | --- |
| *Chenopodium* sp. | --- | 0.65 | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| *Chenopodium humile* | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | 0.07 | --- | --- | --- | --- |
| *Cirsium arvense* | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | 5.50 | 7.73 |
| *Cirsium scariosum* | --- | --- | 1.10 | 1.35 | 0.20 | 0.43 | 0.30 | 0.65 | 0.10 | 0.25 | t | 0.07 | 0.30 | 0.91 | --- | --- |
| *Cirsium vulgare* | --- | --- | --- | --- | --- | 0.22 | --- | --- | --- | --- | --- | --- | --- | --- | --- | 0.10 |
| *Convolvulus arvensis* | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | 0.16 |
| *Conyza canadensis* | --- | --- | --- | --- | --- | --- | --- | --- | --- | t | --- | --- | --- | --- | --- | --- |
| *Crepis runcinata* ssp. *glauca* | --- | --- | 3.20 | 3.27 | 1.00 | 1.67 | 0.20 | 0.11 | 0.10 | t | 0.20 | 0.22 | --- | t | t | t |
| *Dactylis glomerata* | --- | --- | --- | --- | --- | --- | --- | t | --- | --- | --- | --- | --- | --- | --- | --- |
| *Deschampsia caespitosa* | --- | --- | t | t | t | 0.73 | 0.50 | 2.36 | --- | --- | 0.20 | 0.12 | 1.30 | 1.09 | --- | 0.20 |
| *Descurainia pinnata* | --- | --- | --- | --- | --- | --- | --- | --- | --- | t | --- | --- | --- | --- | --- | --- |
| *Descurainia sophia* | --- | --- | --- | --- | --- | --- | --- | 0.05 | --- | t | --- | --- | --- | --- | --- | --- |
| *Distichlis spicata* | 4.60 | 4.62 | 8.40 | 12.37 | 1.90 | 2.62 | 0.80 | 0.68 | 3.30 | 3.14 | 0.80 | 1.01 | 1.70 | 1.07 | 0.40 | 0.24 |
| *Dodecatheon* sp. | --- | --- | --- | --- | --- | --- | --- | t | --- | --- | --- | --- | --- | --- | --- | --- |
| *Dodecatheon pulchellum* | --- | --- | --- | 0.19 | --- | --- | --- | --- | --- | t | --- | --- | --- | --- | --- | --- |
| *Draba* sp. | --- | --- | --- | --- | --- | --- | --- | --- | --- | t | --- | --- | --- | --- | --- | --- |
| *Elaeagnus angustifolia* | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | 0.19 |
| *Eleocharis* sp. | --- | --- | t | t | --- | t | --- | --- | 0.50 | --- | t | t | --- | t | --- | --- |
| *Eleocharis palustris* | 2.80 | 3.13 | t | t | 1.00 | 1.11 | 0.90 | 1.51 | 0.40 | 1.42 | 4.60 | 0.07 | 0.60 | 0.12 | 0.60 | 1.75 |
| *Eleocharis parishii* | --- | --- | --- | 0.16 | --- | t | --- | --- | --- | --- | --- | 0.77 | --- | --- | --- | --- |
| *Eleocharis quinqueflora* | --- | --- | --- | --- | --- | 0.63 | --- | --- | --- | --- | --- | 0.16 | --- | --- | --- | --- |
| *Eleocharis rostellata* | 1.00 | 5.07 | --- | t | 0.10 | 1.02 | 2.50 | 6.11 | --- | --- | 5.90 | 9.47 | t | --- | 6.60 | 6.91 |
| *Elymus trachycaulus* | --- | --- | 0.10 | 0.26 | --- | 1.46 | 6.50 | 4.08 | --- | 0.10 | t | 0.05 | --- | --- | t | 0.37 |
| *Epilobium* sp. | --- | t | --- | --- | --- | 0.43 | --- | t | --- | --- | --- | --- | --- | --- | --- | 0.60 |
| *Epilobium ciliatum* | --- | --- | --- | --- | --- | 0.05 | --- | --- | --- | --- | --- | t | --- | --- | --- | 2.65 |
| *Equisetum arvense* | --- | --- | t | --- | 0.10 | 0.51 | 0.40 | 0.60 | t | t | t | --- | t | 0.06 | 1.50 | 1.10 |
| *Ericameria nauseosa* | --- | --- | --- | --- | --- | 0.39 | --- | t | --- | 0.53 | --- | --- | --- | 0.24 | --- | 1.27 |
| *Erigeron lonchophyllus* | --- | --- | 0.20 | 0.40 | t | t | 0.10 | 0.06 | 0.60 | 0.27 | t | 0.05 | 0.50 | 0.65 | --- | 0.15 |

**Table E-6**
**Mean Percent Cover (MH) of Dominant Plant Taxa on Wetland/Meadow Transects for 2009 and 2010 at the Eight Wetland/Meadow Sites in Spring and Snake Valleys**
(Page 3 of 6)

| Species | Blind Spring | | Burbank Meadows | | Keegan Spring Complex (North) | | Minerva Spring Complex | | Shoshone Ponds | | Stonehouse Spring Complex | | The Seep | | West Spring Valley Complex #1 | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | 2009 | 2010 | 2009 | 2010 | 2009 | 2010 | 2009 | 2010 | 2009 | 2010 | 2009 | 2010 | 2009 | 2010 | 2009 | 2010 |
| *Eriogonum* sp. | --- | --- | --- | t | --- | --- | --- | --- | --- | t | --- | --- | --- | --- | --- | --- |
| *Festuca idahoensis* | --- | --- | --- | --- | --- | 0.74 | --- | --- | --- | --- | --- | --- | --- | --- | --- | 0.66 |
| *Galium trifidum* | --- | --- | --- | --- | --- | 0.13 | --- | --- | --- | --- | --- | --- | --- | --- | --- | t |
| *Glaux maritime* | --- | --- | 0.70 | 1.25 | 0.10 | 0.71 | t | t | 0.10 | 0.07 | 0.70 | 0.96 | --- | --- | --- | --- |
| *Helianthus nuttallii* | --- | --- | --- | --- | --- | --- | --- | 0.40 | --- | --- | --- | --- | --- | --- | --- | --- |
| *Hesperochiron pumilus* | --- | --- | --- | --- | --- | --- | --- | --- | --- | 0.08 | --- | 0.20 | --- | --- | --- | --- |
| *Hippuris vulgaris* | 6.10 | 4.81 | --- | --- | 0.10 | t | --- | --- | --- | --- | 0.10 | 0.06 | --- | --- | --- | --- |
| *Hordeum brachyantherum* | --- | --- | 0.10 | 0.10 | 0.60 | 0.83 | 0.20 | t | 0.10 | 0.18 | 1.30 | 0.11 | --- | --- | --- | --- |
| *Hordeum jubatum* | --- | 0.06 | 0.90 | 0.40 | 0.60 | 2.54 | 4.90 | 1.66 | --- | --- | t | t | 1.40 | 0.14 | t | 0.12 |
| *Hymenoxys lemmonii* | --- | --- | --- | 0.05 | --- | --- | --- | --- | --- | 0.10 | --- | --- | --- | --- | --- | --- |
| *Iris missouriensis* | --- | --- | 0.10 | --- | 0.20 | 0.24 | 0.20 | 0.35 | --- | --- | 1.50 | 1.81 | --- | --- | --- | t |
| *Iva axillaris* | 0.10 | 0.11 | --- | --- | --- | --- | --- | --- | --- | t | --- | --- | --- | t | 1.10 | 0.91 |
| *Ivesia kingie* | --- | --- | t | t | 0.10 | 0.08 | --- | --- | 0.40 | 0.35 | --- | --- | 0.70 | 0.37 | --- | --- |
| *Juncus arcticus* ssp. *littoralis* | t | 0.04 | 8.90 | 9.29 | 5.30 | 8.71 | 1.60 | 3.70 | 4.80 | 7.02 | 9.40 | 8.60 | 2.30 | 2.84 | 7.00 | 7.98 |
| *Juncus bufonius* | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | 0.50 | t | --- | --- |
| *Juncus longistylis* | --- | --- | --- | --- | --- | 0.12 | --- | --- | --- | t | --- | --- | --- | --- | --- | --- |
| *Juncus nevadensis* | --- | --- | --- | --- | --- | 1.22 | --- | 0.99 | --- | t | --- | t | --- | 0.32 | --- | 1.73 |
| *Juncus torreyi* | --- | t | --- | --- | --- | --- | --- | 0.05 | --- | --- | --- | --- | --- | t | --- | t |
| *Juniperus scopulorum* | --- | --- | --- | --- | --- | --- | --- | --- | 1.40 | 1.49 | --- | --- | --- | --- | --- | --- |
| *Lactuca serriola* | --- | --- | --- | --- | --- | t | --- | --- | --- | --- | --- | --- | --- | --- | --- | 0.20 |
| *Lactuca tatarica var. pulchella* | --- | --- | --- | --- | --- | t | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| *Lemna* sp. | --- | --- | --- | --- | 0.10 | 0.05 | --- | 0.35 | --- | --- | 0.30 | --- | --- | --- | 3.90 | 0.09 |
| *Lemna minor* | --- | --- | --- | --- | --- | 0.52 | --- | t | --- | --- | t | 0.63 | --- | --- | 2.20 | 13.78 |
| *Lemna minuta* | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | 0.51 | --- | --- | --- | --- |
| *Lemna trisulca* | --- | --- | --- | --- | --- | t | --- | --- | --- | --- | --- | --- | --- | --- | --- | 0.00 |
| *Lepidium campestre* | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | 0.35 |
| *Lepidium perfoliatum* | --- | --- | --- | --- | --- | --- | --- | --- | --- | t | --- | --- | --- | --- | --- | --- |
| *Leymus cinereus* | --- | --- | --- | --- | --- | t | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| *Leymus triticoides* | --- | --- | 4.20 | 4.79 | 2.60 | 10.16 | 2.90 | 1.11 | 0.20 | 0.10 | 0.60 | 0.75 | 0.60 | 0.23 | 0.20 | 0.47 |
| *Lupinus* sp. | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | t |

**Table E-6**
**Mean Percent Cover (MH) of Dominant Plant Taxa on Wetland/Meadow Transects for 2009 and 2010 at the Eight Wetland/Meadow Sites in Spring and Snake Valleys**
(Page 4 of 6)

| Species | Blind Spring | | Burbank Meadows | | Keegan Spring Complex (North) | | Minerva Spring Complex | | Shoshone Ponds | | Stonehouse Spring Complex | | The Seep | | West Spring Valley Complex #1 | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | 2009 | 2010 | 2009 | 2010 | 2009 | 2010 | 2009 | 2010 | 2009 | 2010 | 2009 | 2010 | 2009 | 2010 | 2009 | 2010 |
| *Medicago polymorpha* | --- | --- | --- | --- | --- | --- | 1.30 | 2.04 | 0.10 | 0.08 | --- | --- | t | --- | 0.10 | t |
| *Melilotus officinalis* | --- | --- | --- | --- | t | --- | 1.60 | 0.06 | --- | --- | --- | --- | --- | --- | t | --- |
| *Mimulus guttatus* | 0.50 | 0.98 | --- | --- | 0.40 | 3.88 | 0.40 | 0.52 | t | --- | 0.10 | 0.07 | --- | --- | 1.90 | 3.19 |
| Moss | 0.70 | t | --- | --- | 3.60 | 0.49 | 1.20 | 0.39 | 0.10 | 0.60 | 0.10 | 0.42 | --- | --- | 0.10 | 0.41 |
| *Muhlenbergia* sp. | --- | --- | --- | --- | --- | t | --- | --- | --- | 0.22 | --- | --- | --- | 0.54 | --- | 0.07 |
| *Muhlenbergia asperifolia* | --- | --- | 0.10 | t | --- | 0.95 | 0.10 | 0.19 | 0.50 | 0.24 | --- | 0.05 | 0.20 | --- | t | 0.13 |
| *Muhlenbergia richardsonis* | --- | --- | --- | t | 0.40 | 0.24 | t | --- | 0.40 | 0.40 | --- | 0.05 | 0.30 | t | 0.10 | 0.18 |
| *Mushroom* | --- | --- | --- | --- | --- | t | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| *Myriophyllum verticillatum* | --- | --- | --- | --- | --- | --- | --- | 0.54 | --- | --- | --- | --- | --- | --- | --- | 0.17 |
| *Nasturtium officinale* | --- | --- | --- | --- | 0.90 | 5.78 | 2.20 | 2.47 | 0.10 | 0.20 | 0.70 | 0.54 | --- | --- | 0.10 | --- |
| *Nitrophila occidentalis* | --- | --- | --- | 0.70 | --- | 0.15 | --- | --- | --- | t | --- | 0.11 | --- | --- | --- | --- |
| *Pascopyrum smithii* | --- | --- | --- | --- | --- | t | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| *Phalaris arundinacea* | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | t | --- | --- | --- | --- |
| *Phleum pretense* | --- | --- | --- | --- | --- | 0.11 | --- | t | --- | --- | --- | --- | --- | --- | --- | 0.18 |
| *Phragmites australis* | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | 1.90 | 0.78 |
| *Plagiobothrys* sp. | --- | --- | --- | --- | --- | --- | --- | --- | --- | 0.09 | --- | --- | --- | --- | --- | --- |
| *Plagiobothrys scouleri* | --- | --- | --- | t | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| *Plantago major* | --- | --- | --- | 0.05 | --- | --- | --- | --- | --- | 0.06 | --- | --- | --- | t | --- | --- |
| *Poa* sp. | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | t | --- | --- |
| *Poa pratensis* | --- | --- | 0.10 | t | 1.90 | 1.48 | 2.00 | 1.94 | 0.50 | 1.42 | 0.10 | t | 0.10 | t | 1.70 | 0.71 |
| *Poa secunda* | --- | --- | --- | 0.17 | --- | 2.92 | --- | 1.43 | --- | 1.56 | --- | t | --- | 0.26 | --- | 1.91 |
| *Polygonum* sp. | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | 0.07 |
| *Polygonum amphibium* | --- | --- | --- | --- | --- | 0.35 | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| *Polygonum argyrocoleon* | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | 0.57 |
| *Polygonum aviculare* | --- | 0.07 | t | t | --- | t | 1.30 | 0.97 | --- | t | --- | --- | 3.80 | 2.85 | t | --- |
| *Polygonum ramosissimum* | --- | --- | --- | --- | --- | t | --- | --- | --- | --- | --- | --- | --- | --- | --- | t |
| *Polypogon monspeliensis* | --- | 0.38 | --- | 0.13 | --- | t | --- | --- | --- | --- | --- | --- | --- | --- | --- | 0.05 |
| *Potamogeton* sp. | 0.30 | --- | 0.10 | --- | --- | 0.05 | 6.60 | 10.92 | --- | --- | --- | --- | --- | --- | --- | --- |
| *Potentilla gracilis* | --- | --- | --- | --- | --- | 0.05 | --- | --- | --- | 0.05 | --- | --- | --- | --- | --- | --- |

**Table E-6**
**Mean Percent Cover (MH) of Dominant Plant Taxa on Wetland/Meadow Transects for 2009 and 2010 at the Eight Wetland/Meadow Sites in Spring and Snake Valleys**
(Page 5 of 6)

| Species | Blind Spring | | Burbank Meadows | | Keegan Spring Complex (North) | | Minerva Spring Complex | | Shoshone Ponds | | Stonehouse Spring Complex | | The Seep | | West Spring Valley Complex #1 | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | 2009 | 2010 | 2009 | 2010 | 2009 | 2010 | 2009 | 2010 | 2009 | 2010 | 2009 | 2010 | 2009 | 2010 | 2009 | 2010 |
| *Puccinellia* sp. | --- | --- | --- | 1.10 | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| *Puccinellia distans* | t | --- | 0.20 | --- | --- | --- | t | --- | --- | --- | 0.20 | 0.13 | 1.80 | 0.24 | --- | --- |
| *Puccinellia lemmonii* | --- | --- | 6.40 | 8.01 | 0.70 | 1.78 | 1.50 | 1.25 | 2.70 | 1.18 | 0.50 | 0.53 | 1.30 | 0.05 | 0.10 | 0.26 |
| *Pyrrocoma lanceolata* | --- | --- | 0.10 | 0.59 | 0.10 | 0.15 | 0.30 | 0.60 | 0.40 | 0.35 | 0.10 | 0.37 | 0.10 | 0.16 | 0.10 | 0.48 |
| *Ranunculus cymbalaria* | --- | 0.18 | --- | 0.07 | --- | t | --- | t | --- | t | --- | 0.16 | --- | 0.49 | --- | --- |
| *Ranunculus sceleratus* | --- | --- | --- | t | --- | t | --- | t | --- | --- | --- | 0.11 | --- | --- | --- | t |
| *Rosa woodsii* | --- | --- | --- | --- | --- | --- | 4.60 | 7.56 | --- | --- | --- | --- | --- | --- | --- | --- |
| *Rumex crispus* | --- | --- | --- | --- | --- | 0.14 | --- | 0.28 | --- | --- | --- | --- | --- | t | --- | 0.38 |
| *Sagittaria cuneata* | --- | 0.52 | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| *Sarcobatus vermiculatus* | --- | 0.15 | --- | --- | --- | 0.06 | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| *Schedonorus pratensis* | --- | --- | --- | t | 0.30 | t | 8.80 | 15.77 | 0.10 | --- | t | --- | --- | --- | 0.50 | 0.64 |
| *Schoenoplectus acutus* | 2.80 | 3.10 | --- | --- | 0.20 | 0.10 | --- | --- | --- | --- | 0.70 | 0.73 | --- | --- | 1.90 | 1.52 |
| *Schoenoplectus americanus* | 2.10 | --- | --- | --- | t | --- | --- | --- | --- | --- | t | --- | --- | --- | t | --- |
| *Schoenoplectus pungens* | --- | 2.71 | --- | --- | --- | t | --- | 0.41 | --- | t | --- | 0.10 | --- | --- | --- | 0.42 |
| *Sida neomexicana* | --- | --- | --- | --- | --- | t | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| *Sidalcea neomexicana* | --- | --- | --- | --- | --- | 0.30 | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| *Sisyrinchium halophilum* | --- | --- | --- | 0.10 | --- | t | --- | t | --- | 0.08 | --- | --- | --- | 0.35 | --- | t |
| *Sium suave* | --- | --- | --- | --- | --- | 0.36 | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| *Solidago nana* | --- | --- | --- | --- | --- | --- | --- | t | --- | --- | --- | --- | --- | --- | --- | --- |
| *Sparganium emersum* | --- | --- | --- | --- | --- | 0.64 | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| *Sparganium angustifolium* | 5.80 | 3.94 | --- | --- | 0.20 | 1.66 | --- | 0.14 | --- | --- | --- | --- | --- | --- | 0.40 | 0.46 |
| *Spartina gracilis* | --- | --- | 2.80 | 2.89 | 0.20 | 0.64 | 0.20 | 0.11 | 0.30 | 0.33 | --- | t | 0.40 | --- | --- | --- |
| Sphagnum Moss | --- | --- | --- | --- | --- | 0.81 | --- | --- | --- | --- | --- | 0.07 | --- | --- | --- | --- |
| *Sphenopholis obtusata* | --- | --- | --- | 0.09 | --- | 0.06 | --- | --- | --- | t | --- | --- | --- | --- | --- | --- |
| *Sporobolus airoides* | --- | --- | 0.50 | 0.47 | 1.40 | 2.76 | 1.80 | 1.93 | t | t | --- | --- | 5.70 | 2.70 | 0.30 | 0.28 |
| *Stellaria longipes* | --- | --- | --- | --- | --- | 0.10 | --- | --- | --- | --- | --- | --- | --- | --- | --- | t |
| *Stuckenia filiformis* | --- | t | --- | --- | --- | --- | --- | 0.65 | --- | --- | --- | --- | --- | --- | --- | --- |
| *Suaeda calceoliformis* | --- | --- | --- | t | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| *Symphyotrichum eatonii* | --- | --- | --- | --- | --- | 0.28 | --- | t | --- | --- | --- | --- | --- | --- | --- | 0.48 |
| *Symphyotrichum spathulatum* | --- | --- | --- | --- | --- | 0.08 | --- | --- | --- | --- | --- | 0.07 | --- | --- | --- | --- |

## Table E-6
## Mean Percent Cover (MH) of Dominant Plant Taxa on Wetland/Meadow Transects for 2009 and 2010 at the Eight Wetland/Meadow Sites in Spring and Snake Valleys
(Page 6 of 6)

| Species | Blind Spring | | Burbank Meadows | | Keegan Spring Complex (North) | | Minerva Spring Complex | | Shoshone Ponds | | Stonehouse Spring Complex | | The Seep | | West Spring Valley Complex #1 | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | 2009 | 2010 | 2009 | 2010 | 2009 | 2010 | 2009 | 2010 | 2009 | 2010 | 2009 | 2010 | 2009 | 2010 | 2009 | 2010 |
| *Taraxacum officinale* | --- | --- | 0.10 | 0.22 | 0.90 | 1.85 | 0.10 | 0.22 | 0.20 | 0.26 | --- | t | 0.40 | 0.35 | 0.20 | t |
| *Thelesperma megapotamicum* | --- | --- | --- | --- | --- | --- | --- | 1.36 | --- | --- | --- | --- | --- | --- | --- | --- |
| *Thermopsis rhombifolia* | --- | --- | --- | --- | 7.40 | 11.59 | 7.70 | 8.69 | --- | --- | --- | --- | --- | --- | 5.60 | 11.88 |
| *Tragopogon dubius* | --- | --- | --- | --- | --- | t | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| *Trifolium* sp. | --- | --- | 0.90 | 0.67 | 0.30 | 1.12 | --- | 0.59 | --- | 0.28 | --- | --- | --- | --- | --- | t |
| *Trifolium fragiferum* | --- | --- | --- | 0.75 | --- | t | --- | 0.08 | --- | --- | --- | --- | --- | --- | --- | 0.13 |
| *Trifolium hybridum* | --- | --- | --- | --- | --- | --- | --- | t | --- | --- | --- | --- | --- | --- | --- | --- |
| *Trifolium longipes* | --- | --- | --- | --- | --- | 0.26 | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| *Trifolium pretense* | --- | --- | --- | --- | --- | t | 1.10 | 0.23 | --- | --- | --- | --- | --- | --- | t | t |
| *Trifolium repens* | --- | --- | t | --- | 0.70 | 1.11 | 0.30 | 0.11 | 1.70 | 0.82 | 0.10 | 0.05 | --- | --- | 0.20 | 0.20 |
| *Triglochin* sp. | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | t | --- | --- | --- | --- |
| *Triglochin concinna* | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | 0.06 | --- | --- | --- | --- |
| *Triglochin maritime* | --- | --- | --- | 0.46 | --- | t | --- | 0.15 | --- | --- | --- | 0.48 | --- | --- | --- | t |
| *Triglochin palustris* | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | t | --- | --- | --- | --- |
| *Typha latifolia* | 5.00 | 3.56 | --- | --- | 1.10 | 4.06 | --- | --- | --- | --- | 0.50 | 0.27 | --- | --- | 0.60 | 0.84 |
| *Utricularia macrorhiza* | 34.80 | 24.16 | --- | --- | 0.30 | 0.25 | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| *Utricularia minor* | --- | --- | --- | --- | --- | 0.08 | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| *Verbena bracteata* | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | t | --- | --- |
| *Veronica anagallis-aquatica* | --- | --- | --- | --- | 0.80 | 1.33 | 0.10 | 0.37 | t | 0.19 | --- | --- | 0.10 | t | --- | --- |
| *Viola nephrophylla* | --- | --- | --- | --- | --- | t | --- | 0.28 | --- | --- | --- | --- | --- | 0.05 | --- | 0.91 |
| *Zannichellia palustris* | 6.20 | --- | --- | --- | --- | --- | --- | --- | --- | --- | 0.10 | 0.13 | --- | --- | --- | --- |
| *Zigadenus paniculatus* | --- | --- | --- | --- | --- | --- | --- | --- | --- | 0.05 | --- | --- | --- | --- | --- | --- |

Note: Mean percent cover is the mean percent cover per transect for each species, averaged over the number of transects per site (the grand mean).
A "t" indicates a trace amount (≤0.05%).
Dashed lines (---) indicate that the taxa was not present at that site (cover = 0).

**Table E-7**
**Mean Percent Cover (MH) of Dominant Plant Taxa along Greasewood - Dominated Phreatophytic Shrubland Transects for 2009 and 2010 within the Five IBMA Zones in Spring, Hamlin and Snake Valleys**
(Page 1 of 2)

| Species | Spring Valley North | | Spring Valley Middle | | Spring Valley South | | Hamlin Valley North | | Snake Valley South | |
|---|---|---|---|---|---|---|---|---|---|---|
| | 2009 | 2010 | 2009 | 2010 | 2009 | 2010 | 2009 | 2010 | 2009 | 2010 |
| *Achnatherum hymenoides* | --- | --- | --- | t | --- | --- | --- | t | t | 0.22 |
| *Artemisia tridentata* | 0.20 | 0.34 | 1.50 | 1.44 | 0.30 | 0.70 | --- | --- | --- | --- |
| *Atriplex canescens* | --- | --- | --- | --- | --- | --- | --- | --- | 0.20 | 0.16 |
| *Atriplex confertifolia* | 0.40 | 0.94 | 0.40 | 0.58 | 0.90 | 1.35 | 0.50 | 0.96 | 0.50 | 0.50 |
| *Atriplex serenana* | --- | --- | --- | --- | --- | 0.05 | --- | --- | --- | --- |
| *Bassia americana* | --- | --- | --- | t | --- | --- | --- | --- | 0.40 | 0.83 |
| *Bassia scoparia* | --- | t | --- | t | 0.20 | 0.25 | --- | --- | --- | --- |
| *Bromus tectorum* | --- | t | --- | t | --- | --- | --- | --- | --- | 0.06 |
| *Chenopodium humile* | --- | --- | --- | --- | --- | --- | --- | --- | --- | 0.14 |
| *Chenopodium incanum* | --- | --- | 0.20 | t | --- | --- | --- | --- | --- | --- |
| *Chenopodium leptophyllum* | 0.10 | 0.05 | --- | --- | --- | --- | --- | t | --- | t |
| *Chenopodium* sp. | --- | --- | --- | --- | t | --- | --- | --- | --- | --- |
| *Chrysothamnus humilis* | --- | --- | --- | --- | --- | --- | --- | --- | --- | 0.42 |
| *Chrysothamnus viscidiflorus* | 0.10 | --- | t | --- | --- | --- | --- | --- | --- | --- |
| *Chrysothamnus viscidiflorus* ssp,. *puberulus* | --- | 0.07 | --- | --- | --- | --- | --- | --- | --- | --- |
| *Cleomella plocasperma* | --- | --- | --- | --- | --- | t | --- | --- | --- | --- |
| *Cordylanthus ramosus* | --- | --- | --- | --- | --- | 0.06 | --- | --- | --- | --- |
| *Cryptantha circumscissa* | --- | --- | --- | --- | --- | --- | --- | --- | --- | t |
| *Cryptantha scoparia* | --- | t | --- | --- | --- | --- | --- | --- | --- | --- |
| *Descurainia pinnata* | --- | 0.05 | --- | --- | --- | --- | --- | --- | --- | --- |
| *Descurainia sophia* | t | 1.16 | --- | 0.10 | --- | --- | --- | t | --- | --- |
| *Distichlis spicata* | 0.10 | 0.25 | 0.10 | 0.34 | 1.60 | 2.32 | --- | --- | --- | --- |
| *Elymus elymoides* | --- | 0.33 | t | 0.11 | --- | 0.09 | t | 0.21 | --- | t |
| *Ephedra nevadensis* | --- | --- | --- | --- | --- | --- | --- | --- | --- | t |
| *Ephedra viridis* | --- | --- | --- | --- | --- | --- | --- | --- | t | --- |
| *Eriastrum diffusum* | --- | --- | --- | 0.50 | --- | --- | --- | --- | --- | --- |
| *Ericameria nauseosa* | 0.20 | 0.59 | 0.10 | 0.31 | 0.70 | 1.00 | --- | --- | --- | --- |
| *Erodium cicutarium* | --- | --- | --- | 0.92 | --- | --- | --- | --- | --- | --- |
| *Gayophytum* | --- | t | --- | --- | --- | --- | --- | --- | --- | --- |
| *Gilia* sp. | --- | t | --- | --- | --- | --- | --- | --- | --- | 0.11 |
| *Grayia spinosa* | t | t | t | t | --- | --- | 0.80 | 1.93 | --- | --- |
| *Gutierrezia sarothrae* | --- | --- | --- | --- | --- | --- | --- | --- | 0.60 | --- |
| *Halogeton glomeratus* | 1.40 | 1.03 | --- | --- | --- | --- | 0.20 | 0.86 | --- | 0.23 |

**Table E-7**
**Mean Percent Cover (MH) of Dominant Plant Taxa along Greasewood - Dominated Phreatophytic Shrubland Transects for 2009 and 2010 within the Five IBMA Zones in Spring, Hamlin and Snake Valleys**
(Page 2 of 2)

| Species | Spring Valley North | | Spring Valley Middle | | Spring Valley South | | Hamlin Valley North | | Snake Valley South | |
|---|---|---|---|---|---|---|---|---|---|---|
| | 2009 | 2010 | 2009 | 2010 | 2009 | 2010 | 2009 | 2010 | 2009 | 2010 |
| *Hordeum jubatum* | --- | --- | --- | t | --- | --- | --- | --- | --- | --- |
| *Iva axillaris* | --- | --- | 0.10 | 0.27 | --- | --- | --- | --- | --- | --- |
| *Krascheninnikovia lanata* | --- | --- | --- | --- | --- | --- | --- | t | 0.20 | --- |
| *Lactuca serriola* | --- | --- | --- | t | --- | --- | --- | --- | --- | --- |
| *Lappula occidentalis var. cupulata* | --- | t | --- | 0.33 | --- | --- | --- | 0.11 | --- | t |
| *Lepidium densiflorum* | --- | --- | --- | t | --- | --- | --- | --- | --- | --- |
| *Lepidium perfoliatum* | --- | 0.43 | --- | --- | --- | --- | --- | --- | --- | --- |
| *Leymus triticoides* | --- | --- | --- | --- | --- | t | --- | --- | --- | --- |
| *Machaeranthera carnosa* | --- | --- | t | --- | --- | --- | --- | --- | --- | --- |
| *Machaeranthera carnosa var. carnosa* | --- | --- | --- | t | --- | --- | --- | --- | --- | --- |
| *Mentzelia nitens* | --- | --- | --- | 0.06 | --- | --- | --- | 0.14 | --- | --- |
| *Opuntia* sp. | --- | t | --- | --- | --- | --- | --- | --- | --- | t |
| *Opuntia polyacantha* | --- | t | --- | t | --- | --- | --- | --- | --- | --- |
| *Picrothamnus desertorum* | --- | --- | --- | t | --- | --- | 0.10 | 0.24 | 0.20 | 0.43 |
| *Poa secunda* | t | t | --- | --- | --- | --- | --- | --- | --- | --- |
| *Polypogon monspeliensis* | --- | --- | --- | t | --- | --- | --- | --- | --- | --- |
| *Puccinellia lemmonii* | --- | --- | --- | t | --- | --- | --- | --- | --- | --- |
| *Salsola tragus* | --- | --- | --- | t | --- | --- | --- | --- | --- | --- |
| *Sarcobatus vermiculatus* | 17.80 | 22.03 | 11.00 | 17.03 | 12.90 | 16.29 | 11.40 | 16.03 | 15.40 | 13.55 |
| *Sphaeralcea ambigua* | --- | --- | --- | t | --- | --- | --- | --- | --- | --- |
| *Sphaeralcea coccinea* | --- | --- | --- | --- | --- | --- | --- | --- | t | t |
| *Sporobolus airoides* | t | --- | 0.20 | 0.28 | 0.10 | 0.15 | --- | --- | --- | --- |
| *Sporobolus cryptandrus* | --- | --- | --- | t | --- | --- | --- | --- | --- | --- |
| *Suaeda calceoliformis* | --- | --- | --- | 0.25 | 0.60 | --- | --- | --- | --- | --- |
| *Suaeda moquinii* | --- | --- | 0.70 | 1.21 | --- | 1.53 | --- | t | t | t |
| *Tetradymia glabrata* | --- | --- | --- | --- | --- | --- | --- | t | --- | 0.08 |
| *Tetradymia spinosa* | 0.10 | 0.18 | t | 0.16 | --- | --- | --- | --- | 0.30 | 0.06 |

Note: Mean percent cover is the mean percent cover per transect for each species, averaged over the number of transects per site (the grand mean).
A "t" indicates a trace amount (≤0.05%).
Dashed lines (---) indicate that the taxa was not present at that site (cover = 0).

## Table E-8
## Mean Percent Cover (MH) of Dominant Plant Taxa on Valley-Floor Rocky Mountain (VFRM) Juniper Woodland Belt Transects for 2009 and 2010 at Two Populations in Spring Valley
(Page 1 of 4)

| Species | Mean Over All Transects | | Swamp Cedar North | | | | | | Swamp Cedar South | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | Grand Mean | | Wet Sites | | Dry Sites | | Grand Mean | | Wet Sites | | Dry Sites | |
| | 2009 | 2010 | 2009 | 2010 | 2009 | 2010 | 2009 | 2010 | 2009 | 2010 | 2009 | 2010 | 2009 | 2010 |
| *Achillea millefolium* | 0.1 | 0.1 | --- | t | --- | t | --- | t | 0.2 | 0.2 | 0.3 | 0.4 | --- | --- |
| *Achnatherum hymenoides* | t | t | --- | t | --- | t | --- | --- | t | t | --- | t | t | t |
| *Agrostis gigantean* | 0.2 | 0.5 | --- | --- | --- | --- | --- | --- | 0.5 | 1.0 | 0.9 | 1.9 | --- | --- |
| *Aquilegia formosa* | t | --- | --- | --- | --- | --- | --- | --- | t | --- | t | --- | --- | --- |
| *Argentina anserine* | 0.1 | t | 0.1 | t | 0.2 | 0.1 | --- | --- | t | t | 0.1 | t | --- | --- |
| *Artemisia tridentate* | 0.7 | 0.8 | 0.2 | 0.3 | --- | --- | 0.3 | 0.5 | 1.2 | 1.3 | 0.3 | 0.3 | 2.1 | 2.3 |
| *Aster* | --- | t | --- | 0.1 | --- | 0.1 | --- | --- | --- | t | --- | t | --- | --- |
| *Astragalus* sp. | t | t | 0.1 | t | 0.1 | t | t | --- | --- | --- | --- | --- | --- | --- |
| *Astragalus convallarius* | t | --- | --- | --- | --- | --- | --- | --- | t | --- | t | --- | --- | --- |
| *Atriplex confertifolia* | --- | t | --- | t | --- | --- | --- | t | --- | --- | --- | --- | --- | --- |
| *Atriplex micrantha* | t | 0.2 | t | 0.5 | t | 0.9 | --- | --- | t | t | 0.1 | t | --- | --- |
| *Atriplex rosea* | --- | t | --- | --- | --- | --- | --- | --- | --- | t | --- | 0.1 | --- | --- |
| *Atriplex serenana* | t | t | t | t | --- | --- | t | t | --- | --- | --- | --- | --- | --- |
| *Atriplex truncate* | t | 0.1 | 0.1 | 0.1 | 0.2 | 0.1 | 0.1 | 0.1 | t | t | t | 0.1 | --- | --- |
| *Bassia scoparia* | 0.8 | 1.0 | 0.5 | 0.9 | 1.0 | 1.7 | --- | --- | 1.2 | 1.2 | 2.4 | 2.4 | --- | --- |
| *Bromus tectorum* | t | t | t | t | t | 0.1 | --- | t | --- | --- | --- | --- | --- | --- |
| *Carex* sp. | 0.1 | 0.1 | 0.1 | 0.1 | 0.2 | 0.1 | --- | --- | T | 0.1 | T | 0.1 | t | --- |
| *Carex nebrascensis* | 0.1 | t | t | --- | t | --- | --- | --- | 0.1 | 0.1 | 0.2 | 0.1 | --- | --- |
| *Carex parryana* | --- | t | --- | 0.1 | --- | 0.1 | --- | --- | --- | --- | --- | --- | --- | --- |
| *Carex praegracilis* | 0.7 | 0.8 | 0.2 | 0.3 | 0.3 | 0.4 | 0.1 | 0.1 | 1.3 | 1.2 | 2.4 | 2.5 | 0.1 | --- |
| *Carex simulate* | t | --- | t | --- | t | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| *Castilleja minor* ssp. *minor* | --- | t | --- | t | --- | t | --- | --- | --- | --- | --- | --- | --- | --- |
| *Caulanthus* sp. | t | --- | --- | --- | --- | --- | --- | --- | t | --- | t | --- | --- | --- |
| *Centaurium exaltatum* | t | t | t | t | t | t | --- | --- | --- | --- | --- | --- | --- | --- |
| *Chenopodium* sp. | t | --- | t | --- | t | --- | --- | --- | t | --- | t | --- | --- | --- |
| *Chrysothamnus viscidiflorus* | t | --- | --- | --- | --- | --- | --- | --- | t | --- | --- | --- | --- | --- |

**Table E-8**
**Mean Percent Cover (MH) of Dominant Plant Taxa on Valley-Floor Rocky Mountain (VFRM) Juniper Woodland Belt Transects for 2009 and 2010 at Two Populations in Spring Valley**
(Page 2 of 4)

| Species | Mean Over All Transects | | Swamp Cedar North | | | | | | Swamp Cedar South | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | Grand Mean | | Wet Sites | | Dry Sites | | Grand Mean | | Wet Sites | | Dry Sites | |
| | 2009 | 2010 | 2009 | 2010 | 2009 | 2010 | 2009 | 2010 | 2009 | 2010 | 2009 | 2010 | 2009 | 2010 |
| *Cirsium* sp. | --- | t | --- | --- | --- | --- | --- | --- | --- | t | --- | t | --- | --- |
| *Cirsium scariosum* | 0.4 | 0.2 | 0.6 | 0.4 | 0.7 | 0.4 | 0.4 | 0.3 | 0.3 | t | 0.5 | t | --- | --- |
| *Cirsium vulgare* | t | 0.5 | --- | --- | --- | --- | --- | --- | 0.1 | 1.0 | 0.1 | 2.0 | --- | --- |
| *Cleomella plocasperma* | t | t | t | --- | t | --- | --- | --- | t | t | t | 0.1 | --- | --- |
| *Comandra umbellate* | t | t | t | t | --- | --- | t | t | --- | --- | --- | --- | --- | --- |
| *Conyza canadensis* | t | t | --- | --- | --- | --- | --- | --- | t | t | t | t | --- | --- |
| *Cordylanthus ramosus* | t | 0.1 | t | 0.1 | --- | --- | t | 0.3 | --- | --- | --- | --- | --- | --- |
| *Crepis runcinata* ssp. *glauca* | 0.1 | 0.1 | 0.3 | 0.3 | 0.6 | 0.5 | --- | --- | --- | t | --- | t | --- | --- |
| *Dactylis glomerata* | --- | t | --- | --- | --- | --- | --- | --- | --- | t | --- | t | --- | --- |
| *Descurainia sophia* | t | t | t | t | t | t | --- | t | --- | --- | --- | --- | --- | --- |
| *Distichlis spicata* | 1.2 | 1.7 | 1.4 | 1.6 | 2.5 | 3.0 | 0.3 | 0.3 | 0.9 | 1.7 | 1.7 | 3.3 | 0.2 | 0.2 |
| *Dodecatheon pulchellum* | 0.2 | 0.1 | 0.5 | 0.2 | 0.9 | 0.4 | t | --- | --- | --- | --- | --- | --- | --- |
| *Elymus elymoides* | t | 0.1 | t | 0.1 | --- | t | t | 0.2 | --- | t | --- | t | --- | t |
| *Elymus trachycaulus* | --- | 0.1 | --- | 0.1 | --- | 0.2 | --- | t | --- | t | --- | t | --- | --- |
| *Equisetum arvense* | 0.3 | 0.3 | 0.5 | 0.5 | 0.9 | 0.9 | 0.1 | 0.1 | 0.1 | t | 0.1 | 0.1 | --- | --- |
| *Ericameria nauseosa* | 2.0 | 2.5 | 2.8 | 3.2 | 1.4 | 1.1 | 4.2 | 5.2 | 1.2 | 1.8 | 1.4 | 2.3 | 1.1 | 1.3 |
| *Erigeron lonchophyllus* | --- | t | --- | --- | --- | --- | --- | --- | --- | t | --- | t | --- | --- |
| *Eriogonum cernuum* | t | t | --- | --- | --- | --- | --- | --- | t | t | --- | --- | t | t |
| *Eriogonum microthecum* | --- | t | --- | --- | --- | --- | --- | --- | --- | t | --- | --- | --- | t |
| *Gentianella amarelle* | t | t | t | t | 0.1 | t | --- | --- | --- | --- | --- | --- | --- | --- |
| *Glaux maritime* | t | t | t | t | t | t | --- | --- | --- | --- | --- | --- | --- | --- |
| *Gutierrezia sarothrae* | --- | t | --- | --- | --- | --- | --- | --- | --- | t | --- | --- | --- | t |
| *Hordeum jubatum* | t | t | t | --- | --- | --- | t | --- | t | t | --- | t | t | --- |
| *Hymenopappus filifolius* | t | --- | t | --- | t | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| *Hymenoxys lemmonii* | 0.2 | 0.3 | 0.4 | 0.6 | 0.4 | 0.6 | 0.4 | 0.6 | t | t | t | 0.1 | t | --- |
| *Ipomopsis aggregate* | t | --- | --- | --- | --- | --- | --- | --- | t | --- | t | --- | --- | --- |

## Table E-8
## Mean Percent Cover (MH) of Dominant Plant Taxa on Valley-Floor Rocky Mountain (VFRM) Juniper Woodland Belt Transects for 2009 and 2010 at Two Populations in Spring Valley
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| Species | Mean Over All Transects | | Swamp Cedar North | | | | | | Swamp Cedar South | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | Grand Mean | | Wet Sites | | Dry Sites | | Grand Mean | | Wet Sites | | Dry Sites | |
| | 2009 | 2010 | 2009 | 2010 | 2009 | 2010 | 2009 | 2010 | 2009 | 2010 | 2009 | 2010 | 2009 | 2010 |
| *Iris missouriensis* | t | 0.1 | 0.1 | 0.1 | 0.1 | 0.3 | --- | --- | t | t | t | t | --- | --- |
| *Iva axillaris* | t | --- | t | --- | t | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| *Ivesia kingie* | 0.1 | 0.1 | 0.2 | 0.2 | 0.3 | 0.3 | t | t | --- | t | --- | --- | t | t |
| *Juncus arcticus* ssp. *littoralis* | 0.3 | 0.4 | 0.4 | 0.5 | 0.7 | 0.7 | 0.1 | 0.2 | 0.3 | 0.3 | 0.5 | 0.6 | 0.1 | 0.1 |
| *Juncus nevadensis* | --- | t | --- | --- | --- | --- | --- | --- | --- | t | --- | t | --- | --- |
| *Juniperus scopulorum* | 47.0 | 48.4 | 45.7 | 48.8 | 49.6 | 54.0 | 41.7 | 43.5 | 48.4 | 48.0 | 59.3 | 57.8 | 37.6 | 38.3 |
| *Lactuca serriola* | t | t | t | t | t | t | --- | --- | --- | --- | --- | --- | --- | --- |
| *Leymus cinereus* | t | t | --- | --- | --- | --- | --- | --- | t | t | --- | --- | t | t |
| *Leymus triticoides* | 3.0 | 3.7 | 5.6 | 7.2 | 10.3 | 13.0 | 0.8 | 1.3 | 0.3 | 0.3 | 0.7 | 0.6 | t | t |
| *Maianthemum racemosum* | 0.1 | --- | 0.2 | --- | 0.3 | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| *Maianthemum stellatum* | --- | 0.1 | --- | 0.1 | --- | 0.2 | --- | --- | --- | --- | --- | --- | --- | --- |
| *Medicago polymorpha* | t | t | --- | --- | --- | --- | --- | --- | t | t | t | 0.1 | --- | --- |
| *Melilotus officinalis* | t | t | --- | --- | --- | --- | --- | --- | t | t | t | t | --- | --- |
| Moss | --- | t | --- | --- | --- | --- | --- | --- | --- | t | --- | t | --- | --- |
| *Muhlenbergia asperifolia* | t | t | t | 0.1 | 0.1 | 0.1 | --- | --- | --- | --- | --- | --- | --- | --- |
| *Muhlenbergia richardsonis* | t | 0.1 | t | 0.1 | 0.1 | 0.2 | --- | --- | 0.1 | 0.1 | 0.1 | 0.2 | --- | --- |
| *Musineon* sp. | --- | t | --- | t | --- | t | --- | t | --- | --- | --- | --- | --- | --- |
| *Musineon divaricatum* | t | --- | t | --- | t | --- | 0.1 | --- | t | --- | t | --- | --- | --- |
| *Nitrophila occidentalis* | 0.2 | 0.2 | 0.3 | 0.3 | 0.7 | 0.6 | --- | --- | --- | --- | --- | --- | --- | --- |
| *Phacelia peirsoniana* | --- | t | --- | t | --- | --- | --- | t | --- | --- | --- | --- | --- | --- |
| *Phlox pulvinata* | t | t | t | t | --- | --- | t | t | --- | t | --- | t | --- | t |
| *Plantago major* | --- | t | --- | --- | --- | --- | --- | --- | --- | t | --- | 0.1 | --- | --- |
| *Poa pratensis* | 0.6 | 0.4 | 0.1 | 0.3 | 0.1 | 0.6 | --- | --- | 1.1 | 0.6 | 2.3 | 1.2 | --- | --- |
| *Poa secunda* | 0.3 | 1.5 | 0.4 | 2.5 | 0.4 | 1.9 | 0.4 | 3.0 | 0.1 | 0.5 | 0.2 | 0.8 | t | 0.2 |
| *Polygonum aviculare* | t | --- | --- | --- | --- | --- | --- | --- | t | --- | t | --- | --- | --- |
| *Puccinellia lemmonii* | 1.6 | 1.6 | 2.9 | 3.2 | 4.4 | 6.2 | 1.5 | 0.2 | 0.2 | t | 0.4 | t | 0.1 | --- |

**Table E-8**
**Mean Percent Cover (MH) of Dominant Plant Taxa on Valley-Floor Rocky Mountain (VFRM) Juniper Woodland Belt Transects for 2009 and 2010 at Two Populations in Spring Valley**
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| Species | Mean Over All Transects | | Swamp Cedar North | | | | | | Swamp Cedar South | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | Grand Mean | | Wet Sites | | Dry Sites | | Grand Mean | | Wet Sites | | Dry Sites | |
| | 2009 | 2010 | 2009 | 2010 | 2009 | 2010 | 2009 | 2010 | 2009 | 2010 | 2009 | 2010 | 2009 | 2010 |
| *Pyrrocoma lanceolata* | 0.4 | 0.4 | 0.7 | 0.7 | 1.3 | 1.2 | 0.2 | 0.1 | t | t | 0.1 | 0.1 | t | --- |
| *Raillardella argentea* | t | t | --- | --- | --- | --- | --- | --- | t | t | t | t | --- | --- |
| *Ranunculus cymbalaria* | --- | t | --- | --- | --- | --- | --- | --- | --- | t | --- | t | --- | --- |
| *Rosa woodsii* | 0.2 | 0.3 | 0.1 | 0.1 | 0.2 | 0.2 | --- | --- | 0.4 | 0.4 | 0.8 | 0.8 | --- | --- |
| *Sarcobatus vermiculatus* | 0.5 | 0.5 | 0.5 | 0.6 | 0.8 | 0.6 | 0.3 | 0.5 | 0.4 | 0.5 | 0.2 | 0.5 | 0.6 | 0.4 |
| *Schedonorus pratensis* | 0.1 | 0.1 | --- | --- | --- | --- | --- | --- | 0.1 | 0.3 | 0.3 | 0.6 | --- | --- |
| *Sisyrinchium halophilum* | 0.1 | t | 0.1 | t | 0.2 | 0.1 | --- | --- | --- | t | --- | t | --- | --- |
| *Solidago nana* | t | t | t | 0.1 | 0.1 | 0.1 | --- | t | --- | --- | --- | --- | --- | --- |
| *Spartina gracilis* | 0.7 | 0.6 | 1.1 | 1.1 | 2.2 | 2.1 | 0.1 | 0.1 | 0.2 | 0.2 | 0.3 | 0.2 | 0.1 | 0.1 |
| *Sporobolus airoides* | 2.6 | 3.0 | 3.1 | 3.8 | 2.0 | 2.3 | 4.2 | 5.3 | 2.1 | 2.2 | 3.1 | 3.4 | 1.2 | 1.0 |
| *Suaeda calceoliformis* | --- | t | --- | 0.1 | --- | --- | --- | 0.1 | --- | t | --- | t | --- | --- |
| *Suaeda moquinii* | --- | t | --- | t | --- | t | --- | --- | --- | --- | --- | --- | --- | --- |
| *Symphyotrichum eatonii* | t | 0.1 | t | 0.1 | 0.1 | 0.2 | --- | --- | t | t | t | t | --- | --- |
| *Symphyotrichum spathulatum* | t | --- | --- | --- | --- | --- | --- | --- | t | --- | t | --- | --- | --- |
| *Taraxacum officinale* | 0.1 | t | --- | t | --- | t | --- | --- | 0.2 | t | 0.5 | t | --- | --- |
| *Thelypodium sagittatum* ssp. *sagittatum* | --- | t | --- | t | --- | t | --- | t | --- | t | --- | --- | --- | t |
| *Trifolium* sp. | --- | t | --- | --- | --- | --- | --- | --- | --- | t | --- | 0.1 | --- | --- |
| *Trifolium repens* | 0.1 | --- | --- | --- | --- | --- | --- | --- | 0.2 | --- | 0.4 | --- | --- | --- |
| *Triglochin maritime* | t | t | t | t | t | t | --- | --- | --- | --- | --- | --- | --- | --- |
| *Veronica peregrine* ssp. *xalapensis* | --- | t | --- | --- | --- | --- | --- | --- | --- | t | --- | t | --- | --- |
| *Vesicarpa potentilloides var. nitrophilum* | --- | t | --- | t | --- | --- | --- | t | --- | --- | --- | --- | --- | --- |
| **Total Live Cover** | **65.2** | **71.3** | **69.3** | **79.1** | **83.5** | **96.0** | **55.3** | **62.2** | **61.2** | **63.5** | **79.7** | **83.1** | **43.2** | **43.9** |

Note: Mean percent cover is the mean percent cover per transect for each species, averaged over the number of transects per site (the grand mean).
A "t" indicates a trace amount (≤0.05%).
Dashed lines (---) indicate that the taxa was not present at that site (cover = 0).

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