Revisit and Condition Assessment of Targeted Riparian Areas on the Routt National Forest

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Colorado Natural Heritage Program
Colorado State University
Fort Collins, CO 80523

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Prepared for:

USDA Forest Service
Medicine Bow - Routt National Forests and
Thunder Basin National Grassland
2468 Jackson Street
Laramie, WY 82070

Prepared by:

Laurie Gilligan and Joanna Lemly
Colorado Natural Heritage Program
Warner College of Natural Resources
Colorado State University
Fort Collins, Colorado 80523

Cover photographs: Top left – Wetland riparian shrubland, Bottom left – Non-wetland riparian woodland.

All photos taken by Colorado Natural Heritage Program Staff.

EXECUTIVE SUMMARY

The Colorado Natural Heritage Program (CNHP) conducted an ecological characterization and condition assessment of selected riparian areas within the Hahns Peak/Bears Ears Ranger District of the Routt National Forests (RNF) during the summer of 2011. Prior to the field assessment, National Wetland Inventory (NWI) maps for the RNF originally created by U.S. Fish and Wildlife Service in the 1980s and previously available only on paper were converted to digital data. Both tasks were carried out by CNHP through a Challenge Cost Share Agreement between CNHP and RNF.

During field assessments, 17 targeted riparian areas were resampled from a pool of sites originally visited by CNHP in the 1990s. Field methods used in 2011 follow the Ecological Integrity Assessment (EIA) Framework developed by NatureServe and the Natural Heritage Network. The 2011 surveys provide a thorough characterization of each wetland, including a comprehensive species list, soil profile description, condition assessment, and detail of potential anthropogenic stressors. The assessments serve to document potential change in the ecological communities over time, verify the wetland mapping, and evaluate current ecological condition and potential threats in the resampled riparian areas.

The 17 wetlands and riparian areas surveyed in the 2011on the RNF had excellent or good overall EIA ranks. The biotic condition component of sites surveyed displayed the most variable conditions. In some resampled sites, biotic condition improved since the 1990s, while in others the condition was downgraded. *Breea arvense,* a B-listed noxious weed of Colorado, may be increasing in cover in the RNF. Effects from light grazing may also be negatively impacting native plant communities. However, one measure of biotic condition, Mean C, was often higher in the 2011 surveys, indicating overall plant communities were improving in at least some sites.

The data and final report provided from these surveys will benefit the U.S. Forest Service by increasing the available information about RNF's wetland resource. Efforts to map wetlands and riparian areas in the RNF provide only an initial estimate of the extent and distribution of wetlands. Field surveys augment these spatial data with riparian characterizations and condition assessments. With this additional sampling, the U.S. Forest Service is better prepared to address the management of wetlands and riparian areas on the RNF with updated information about the most important threats they face. Information about riparian condition and potential threats is particularly vital at this time as National Forests across the Western U.S. confront massive ecological change occurring due to the mountain pine beetle epidemic.

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1.0 INTRODUCTION

1.1 Project Background and Objectives

In response to changing ecological conditions caused by anthropogenic influences and the mountain pine beetle epidemic, there is heightened interest in the status of wetland and riparian areas on U.S. Forest Service (USFS) lands. Scientifically grounded information is integral to protection, restoration, and management of aquatic resources, as decisions are more successful when backed with data. In particular, documenting change in condition over time highlights trends and can alert managers to sites where potential action is needed.

In the early 1990s, the Colorado Natural Heritage Program (CNHP) collected vegetation and environmental data in riparian areas throughout the Routt National Forest (RNF) as part of a statewide effort to classify riparian vegetation communities (Kittel and Lederer 1993; Kettler and McMuller 1996). Nearly twenty years have passed since that data collection took place. In 2010, CNHP partnered with Colorado Parks and Wildlife (CPW) on a U.S. Environmental Protection Agency (EPA) funded probabilistic survey of wetland condition within the North Platte River Basin, including portions of the RNF (Lemly and Gilligan 2012). Several riparian areas on the RNF were included in the North Platte project and data from those sites were shared with USFS resource specialists. Prior to conducting field sampling for the North Platte project, CNHP and CPW converted existing paper U.S. Fish and Wildlife Service (USFWS) National Wetland Inventory (NWI) maps into geo-rectified digital data suitable for use in a geographic information system (GIS). All digital NWI data for the RNF were also shared with the USFS.

Motivated by new data produced through the North Platte project and by the desire to revisit sites surveyed in the 1990s, USFS and CNHP entered into a Challenge Cost Share Agreement in 2010 with two primary goals: 1) to convert NWI paper maps to digital data for all areas of the RNF not included in the North Platte project and 2) to revisit 10–20 riparian areas from the 1990s studies and assess their condition using the same protocols as the North Platte project. This report describes results from the revisit and condition assessment of targeted sites.

Through the Challenge Cost Share Agreement, 17 riparian areas were surveyed on the RNF in 2011 to document their ecological condition, record observed threats and stressors, and relate their current condition to any documented change that took place since the initial 1990s surveys. Combining the 17 sites surveyed in 2011 with the 33 sites surveyed in the 2010 North Platte project, a total of 50 wetland and riparian sites have been surveyed on the RNF with CNHP's current condition assessment protocols. These assessments of wetland and riparian areas are useful to understand current conditions and prioritize management actions, such as logging for beetle-kill, adaptive grazing management, and restoration of modified hydrologic functioning. Data from RNF and other USFS lands indicate that Colorado's National Forests support higher integrity wetlands than nearby wetlands managed by other entities (Lemly et al. 2011; Lemly and Gilligan 2012). Often these ecosystems provide high quality wildlife habitat and intact migration corridors. But in some instances, human pressures threaten to degrade the condition of important wetland and riparian areas. Data from this study will contribute key information to better understand which ecological attributes of the surveyed sites are healthy and which are at risk or experiencing degradation.

The project objectives were to:

1) Characterize the vegetation and assess the condition of 10-20 riparian areas on the Hahns Peak / Bears Ears Ranger District of the RNF surveyed previously by CNHP. Condition assessment methods followed the Ecological Integrity Assessment (EIA) Framework.

2) Document changes observed since the sites were first surveyed by CNHP in the 1990s.

3) Provide the USFS with electronic data from all wetlands surveyed. These data include detailed species lists, soil profiles, condition assessment metrics, and documentation of major threats.

1.2 Ecological Integrity Assessment and Ecological System Classification

The Ecological Integrity Assessments (EIA) Framework was developed by NatureServe[1] and ecologists from several Natural Heritage Programs across the country (Faber-Langendoen et al. 2006; Faber-Langendoen et al. 2008a). The framework shares characteristics of established wetland assessment methods. such as the California Rapid Assessment Method for Wetlands (Collins et al. 2008) and the Ohio Rapid Assessment Method (Ohio EPA 2001). The EIA Framework evaluates wetland condition based on a multi-metric index. Biotic and abiotic metrics are selected to measure the integrity of key wetland attributes within four major categories:

1) Landscape context
2) Biotic condition
3) Hydrologic condition
4) Physiochemical condition.

Using field and GIS data, each metric is rated according to deviation from its natural range of variability, defined based on the current understanding of wetlands from pre-European settlement to today. This is determined using the range of variability observed in reference wetlands (those with no or minimal human disturbance) that exist on the landscape today. Where field data are lacking or no reference condition wetlands remain, information from the literature is also used to define historic reference condition. The further a metric deviates from its natural range of variability, the lower the rating it receives. Numeric and narrative criteria define rating thresholds for each metric. Once metrics are rated, scores are rolled up into the four major categories. Ratings for these four categories are then rolled up into an overall EIA score. For ease of communication, category scores and the overall EIA score are converted to ranks following the ranges shown in Table 1. The scores and ranks can be used to track change and progress toward meeting management goals and objectives.

EIA metrics and ratings are specific to Ecological Systems. The Ecological System classification (Comer et al. 2003) is a component of the International Vegetation Classification System (Grossman et al. 1998, NatureServe 2004, Faber-Langendoen et al. 2009), developed by NatureServe and the Natural Heritage Network. It provides a finer scale of resolution than traditional wetland classification systems such as the USFWS's Cowardin classification (Cowardin et al. 1979) and the hydrogeomorphic (HGM) classification system (Brinson 1993), but a coarser-scale than individual

[1] NatureServe is a non-profit conservation organization whose mission is to provide the scientific basis for effective conservation action. For more information about NatureServe, see their website: www.natureserve.org.

plant associations. The Ecological System approach uses both biotic (structure and floristics) and abiotic (hydrogeomorphic template, elevation, soil chemistry, etc.) criteria to define units. These classes allow for greater specificity in developing conceptual models of the natural variability and stressors of an ecological system and the thresholds that relate to impacts of stressors. A key to wetland and riparian are Ecological Systems in the Rocky Mountains is presented in Appendix A.

With past funding from EPA Region 8 and CPW, CNHP developed EIA protocols for seven Ecological Systems in the Southern Rocky Mountain Ecoregion (Rocchio 2006a-g), field tested one set of these protocols (Lemly and Rocchio 2009), and refined the protocols through river basin scale wetland condition assessment in the Rio Grande Headwaters (Lemly et al. 2011) and the North Platte River Basin (Lemly and Gilligan 2012). CNHP's EIA methods can be carried out at various levels of intensity. [2] For this study, Level 2 rapid assessment protocols were used.

[2] EPA´s National Wetlands Monitoring Workgroup has endorsed the concept of a Level 1, 2, 3 approach to monitoring. Level 1 (landscape assessment) relies on coarse, landscape scale inventory information, typically gathered through remote sensing and preferably stored in, or convertible to, a geographic information system (GIS) format. Level 2 (rapid assessment) is at the specific wetland site scale, using relatively simple, rapid protocols. Level 3 (intensive site assessment) uses intensive research-derived, multi-metric indices of biological integrity. For more information, see http://www.epa.gov/owow/wetlands/pdf/techfram.pdf.

Table 1. Definition of Ecological Integrity Assessment ratings. Modified from Faber-Langendoen et al. 2008b.

Rank Value	Description
A	**Reference Condition (No or Minimal Human Impact):** Wetland functions within the bounds of natural disturbance regimes. The surrounding landscape contains natural habitats that are essentially unfragmented with little to no stressors; vegetation structure and composition are within the natural range of variation, nonnative species are essentially absent, and a comprehensive set of key species are present; soil properties and hydrological functions are intact. Management should focus on preservation and protection.
B	**Slight Deviation from Reference:** Wetland predominantly functions within the bounds of natural disturbance regimes. The surrounding landscape contains largely natural habitats that are minimally fragmented with few stressors; vegetation structure and composition deviate slightly from the natural range of variation, nonnative species and noxious weeds are present in minor amounts, and most key species are present; soils properties and hydrology are only slightly altered. Management should focus on the prevention of further alteration.
C	**Moderate Deviation from Reference:** Wetland has a number of unfavorable characteristics. The surrounding landscape is moderately fragmented with several stressors; the vegetation structure and composition is somewhat outside the natural range of variation, nonnative species and noxious weeds may have a sizeable presence or moderately negative impacts, and many key species are absent; soil properties and hydrology are altered. Management would be needed to maintain or restore certain ecological attributes.
D	**Significant Deviation from Reference:** Wetland has severely altered characteristics. The surrounding landscape contains little natural habitat and is very fragmented; the vegetation structure and composition are well beyond their natural range of variation, nonnative species and noxious weeds exert a strong negative impact, and most key species are absent; soil properties and hydrology are severely altered. There may be little long term conservation value without restoration, and such restoration may be difficult or uncertain.

2.0 STUDY AREA

The study area included wetland and riparian areas within the Hahns Peak / Bears Ears Ranger District of the Routt National Forest (Figure 1), which is now administered as part of the Medicine Bow – Routt National Forests and Thunder Basin National Grasslands. The District's climate is characterized by short summers and long, cold, snowy winters, with lows of freezing temperatures for all months of the year (WRCC 2012). Surveyed sites were located in either Routt or Moffatt counties, within the Upper Yampa or Little Snake watersheds in northwest Colorado, west of the Continental Divide. Sites were surveyed along drainages in the rolling foothills of the Elkhead Mountains, on shrubland and meadow parks, and on forested riparian zones. Drainages surveyed flow into Grizzly Creek, Slater Creek, West Prong South Fork Slater Creek, Elkhead Creek, North Fork Elkhead Creek, and Little Cottonwood Creek.

Significant historic disturbances in the District include beetle mortality, fire, and human land use effects from logging, grazing, and recreation. Portions of the study area experienced spruce beetle (*Dendroctonus rufipennis*) outbreaks in 1850 and 1945–1952 (Bunin 1975; Kettler and McMullen 1996), and some areas are currently experiencing mortality from the mountain pine beetle (*Dendroctonus ponderosae*). Sheep grazing began in the RNF in 1907 (Kettler and McMullen 1996) and was later followed by cattle grazing; both types of grazing continue today.

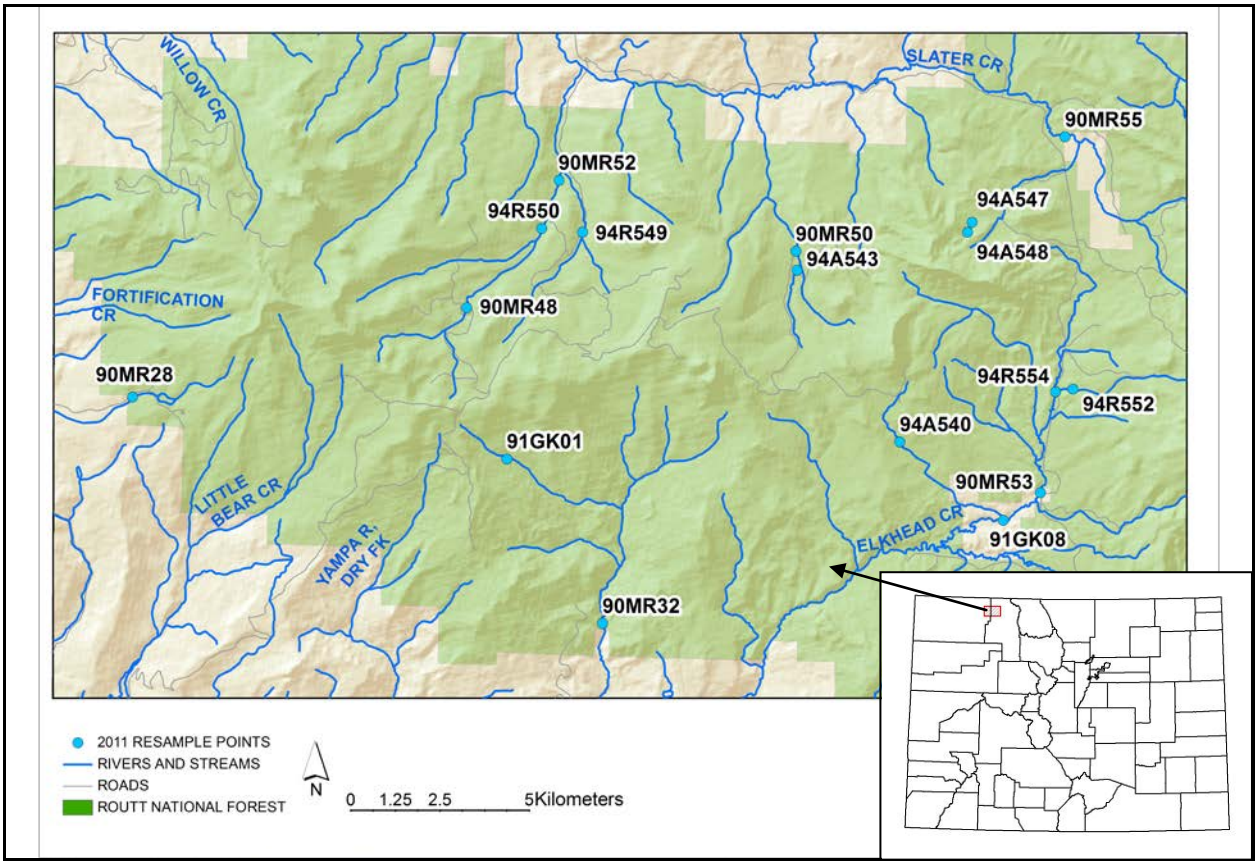

Figure 1. Name and location of the resampled wetland and riparian plots located in the Hahns Peak / Bears Ears Ranger District of the Routt National Forests. Inset map of the state of Colorado outlines the study area in red.

3.0 METHODS

Methods used in this project follow the EIA Framework for a Level 2 wetland condition assessment. Further details on the EIA methodology are available in Lemly and Gilligan (2012).

3.1 Targeted Vegetation Plots

This study targeted riparian vegetation plots within the Hahns Peak / Bears Ears Ranger District of the RNF that were initially surveyed by CNHP in the 1990s. USFS staff identified 24 vegetation plots from the 1990s surveys as priorities for resampling. While the 1990s vegetation plots used line-intercept transects, this study used 1,000–5,000 m^2 assessment area (AA) polygons around the riparian vegetation (see Section 3.2.3). The sites sampled in this study integrated the location of the 1990s vegetation plots into AA polygons. In some instances, two or more 1990s vegetation plots were located in the same riparian area, but targeted different small-patch plant associations. Level 2 EIA methods are not exclusive to one plant association, so in those situations, the 2011 AA represented more than one 1990s vegetation plot. This occurred in five instances. As a result, 22 of the 24 potential locations were sampled within the 17 surveys conducted in 2011. All points designated as high priority were successfully sampled. For safety reasons, surveys excluded areas with water > 1 m deep.

3.2 Field Methods

A rapid Level 2 assessment using CNHP's EIA methodology was carried out at all sites. This method takes ~2–3 hours at each site plus several hours for species identification out of the field. Vegetation data were collected using rapid field methods that allow us to calculate metrics from the Floristic Quality Assessment for Colorado Wetlands (Rocchio 2007). More detail on the EIA Level 2 protocol and a comparison to 1990s protocol follows below. See Appendix B for a copy of the field form.

3.2.1 Wetlands vs. Riparian Areas

CNHP's EIA methodology has been developed specifically to assess wetlands, as defined by USFWS for use in NWI mapping:

> *"Wetlands are lands transitional between terrestrial and aquatic systems where the water table is usually at or near the surface or the land is covered by shallow water. For purposes of this classification wetlands must have one or more of the following attributes: (1) at least periodically, the land supports predominantly hydrophytes; (2) the substrate is predominantly undrained hydric soil; and (3) the substrate is nonsoil and is saturated with water or covered by shallow water at some time during the growing season of each year* (Cowardin et al. 1979)."

The initial 1990s vegetation surveys included a broader range of riparian communities, including those that bordered or included upland areas. In contrast to the definition of wetlands, riparian areas are defined by USFWS as:

> *"Riparian areas are plant communities contiguous to and affected by surface and subsurface hydrologic features of perennial or intermitted lotic and lentic water bodies (rivers, streams, lakes, or drainage ways). Riparian areas have one of both of the following characteristics: 1) distinctively different vegetation species than adjacent areas, and 2) species similar to adjacent areas but exhibiting more vigorous or robust growth forms. Riparian areas are usually transitional between wetland and upland* (USFWS 2009)."

Riparian areas can include wetlands, but can also include upland vegetation that is affected by surface or subsurface flow. Some of the targeted 1990s vegetation plots were in riparian areas that did not meet the USFWS definition of a wetland. Where a resample site included a wetland area large enough to meet the AA size criteria, the AA was comprised solely of the wetland portion of the riparian zone. Where the wetland area within a resample site was < 0.1 ha or where the entire riparian zone did not meet the wetland definition, the AA included non-wetland riparian zones. If a transect from the 1990s surveys fell outside both the wetland and riparian zones in an upland, it was not included in our 2011 assessment area and instead was evaluated as part of the 500 m site buffer. Dominant plant communities (including upland communities) observed within 100 m of the AA were listed on the data form under 'Natural Cover within a 100 m Envelope.'

Inclusion of non-wetland riparian areas in the 2011 Level 2 EIA analyses used the untested assumption that the non-wetland riparian areas function similarly enough to the wetland riparian areas that their condition could be adequately assessed with the wetland EIA methodology for the purposes of this study. In the future, to assess the condition of riparian areas specifically, EIA metrics and condition thresholds may be adjusted to best represent the integrity of riparian systems and processes.

3.2.2 Point Relocation

In 2011, the CNHP field crew resurveyed areas they decided best represented location and plant community information described in the 1990s vegetation plots. In some instances, one resampled plot represented more than one 1990s vegetation plot, and the resample plot ID was chosen from the initial vegetation plot ID that appeared most similar to the plot surveyed in 2011. Due to changes in sample design from the 1990s riparian surveys to the 2011 EIA surveys, it was not always clear when the resampled plots covered area that overlapped with more than one plot from the 1990s. At times, the 1990s plot code naming system appeared to attribute more than one code to the same initial plot.

Exact UTM coordinates were not recorded during the initial 1990s surveys, so were estimated from field maps and notes. To accommodate error that resulted from estimated coordinates, once in the field, the 2011 field crew adjusted the location of the AA to the location that best represented the area depicted on the 1990s data sheets. Annotated topographic maps, drawings, and species lists on the 1990s data sheets were used to identify the species communities surveyed. Care should be taken when directly comparing specific plot details from the 1990s to 2011 because these plot relocations were approximated. Table 2 details a crosswalk of the old plots surveyed to the resampled points, to the best of our knowledge. Appendix D details how each resurveyed plot was identified to best represent the old plot data.

Table 2. Crosswalk of Plot IDs surveyed in 2011 to Plot IDs surveyed in the 1990s.

Resample Plot ID (2011)	Plot ID from 1990s	Other Plot IDs from 1990s	Resample Plot ID (2011)	Plot ID from 1990s	Other Plot IDs from 1990s
90MR28	90MR28		91GK01	91GK01	
90MR32	90MR31			92GK01	
	90MR32		91GK08	91GK08	
90MR48	90MR48		94A540	94A540	94MA15
	90MR49		94A543	94A543	
90MR50	90MR50		94A547	94A547	94MA18
90MR52	90MR51		94A548	94A548	94MA19
	90MR52		94R549	94R549	94GR19
90MR53	90MR53		94R550	94R550	94GR20
90MR55	90MR55		94R552	94R552	94GR21
	90MR56		94R554	94R554	94GR22

3.2.3 Defining the Assessment Area

The basis of the EIA method is the identification and establishment of an assessment area (AA) around the boundary of the wetland/riparian area (or portion of the wetland/riparian area) targeted for sampling and analysis. Sample points were selected from a set of 24 vegetation plots initially surveyed by CNHP in the 1990s and identified as high or low priority for resample by RNF.

There were differences between the 1990s riparian and wetland sampling methodology and the 2011 methodology used to resample each point. The initial plot surveys conducted in the 1990s primarily followed a line-intercept transect design. Various vegetation subplots were sampled along transects and each subplot area was confined to a single plant association. In contrast, resample plots characterized a circular or free-form AA polygon instead of a transect, and only one vegetation plot data represented the entire AA. Rather than confine the AA to one plant association as in the 1990s, the 2011 AA represented the wetland area in one (or as part of one) Ecological System. The Ecological System classification was used to confine the AA to stay consistent with current CNHP EIA methodology, and because the evaluation of Mean C (a biotic condition EIA metric) is specific to Ecological System. The dominant plant association at each sample point was determined post-field to facilitate comparisons with the 1990s data.

At each sample point, the AA was defined as an area of the same Ecological System in a 0.1–0.5 ha polygon surrounding the target point. Where possible, the AA was delineated as a 40 m radius circle representing the wetland/riparian area around the point. During data processing, the actual area of each AA was delineated in GIS based on field notes and GPS data in order to calculate estimates for total wetland/riparian area sampled.

Once at the target sample point, field crew members determined the appropriate dimensions of the AA. This determination was made by first estimating the approximate boundaries of the wetland/riparian area within the potential AA. Readily observable ecological criteria such as vegetation, soil, and hydrological characteristics were used to define wetland/riparian boundaries. The second step was to delineate the targeted Ecological System present within the

wetland/riparian boundary. Because field methods vary by Ecological System, the assessment was focused on one Ecological System type. If an Ecological System patch was less than its minimum size, it was considered an inclusion within the type in which it is embedded (e.g., a small herbaceous sedge patch within a larger matrix of willow shrubs was not considered a separate wet meadow but an inclusion within a riparian shrubland).

3.2.4 Classification and Description of the AA

Once the AA was established, standard site variables were collected from each sample location and are included in the 2011 CNHP-RNF tabular data package. These include:

- UTM coordinates at four locations around the AA
- Elevation, slope, and aspect
- Place name, county, and land ownership
- Ecological System classification (Comer et al. 2003)
- HGM classification (Brinson 1993)
- Cowardin classification (Cowardin et al. 1979)
- Vegetation zones within the AA
- Description of onsite and adjacent ecological processes and land use
- Description of general site characteristics and a site drawing
- At least four photos were taken at each site along the edge of the AA looking in towards the site (Figure 2).
- Additional photos were taken as need to document the wetland and surrounding landscape.

Figure 2. Example AA photos.

3.2.5 Ecological Integrity Assessment Metrics

For every target sample point surveyed, an EIA field form was filled out according to Ecological System and HGM Class (Appendix B). EIA metrics used in the Routt 2011 resample study are summarized in Table 3. Metric narrative ratings and scoring formulas are included as Appendix C.

Table 3. Final EIA metrics used for the Routt 2011 resample project.

Ecological Categories	Key Ecological Attributes	Indicators and Metrics
Landscape Context	Landscape Connectivity	1a. Percent Unfragmented Landscape 1b. Riparian Corridor Continuity
	Buffer	1c. Buffer Extent 1d. Average Buffer Width 1e. Buffer Condition of Vegetation and Soils
Biotic Condition	Community Composition	2a. Relative Cover Native Plant Species 2b. Absolute Cover Noxious Weeds 2c. Absolute Cover Aggressive Native Species 2d. Mean C
	Community structure	2e. Native Woody Regeneration[1] 2f. Browse on Woody Species[1] 2g. Litter Accumulation 2h. Patch Interspersion
Physiochemical Condition	Physiochemistry	3a. Substrate / Soil Disturbance 3b. Water Quality – Turbidity, Pollutants 3c. Water Quality – Algal Growth
Hydrologic Condition	Hydrology	4a. Water Source 4b. Hydrologic Connectivity 4c. Hydroperiod Alteration 4d. Channel Stability 4e. Bank Stability 4f. Beaver Activity[2]

[1] Only applied to sites where woody species are naturally common.
[2] Only applied to sites where beaver activity is expected.

3.2.6 Vegetation Data Collection

Vegetation data were collected in a plotless sample design that included walking throughout the AA and conducting a species search in all representative areas, while avoiding upland edges. Efforts were made to capture heterogeneity within the plot and to ensure adequate representation of local micro-variations in the floristic data produced by features such as hummocks, water tracks, side-channels, pools, wetland edge, micro-topography, etc. Species observed within the AA were identified and listed on the field form and the overall cover within the AA was visually estimated using cover classes identified on the data sheets (Peet et al. 1998). The search for species was limited to no more than one hour to minimize the amount of time spent at the site. Nomenclature for all plant species followed Weber and Wittman (2001a, 2001b) and all species were recorded on the field form using the fully spelled out scientific name. Unknown species were entered on the field form with a descriptive name and individual samples were collected by the field crew. The crew did not collect unknowns when they were suspected to be federally or state listed species, or rare plants of the RNF.

3.2.7 Soil Profile Descriptions and Groundwater Chemistry

At least two soil pits were dug within each AA with a 40-cm sharp shooter shovel in area(s) that represented the dominant vegetation type(s). Pits were dug to one shovel length depth (35 to 40 cm) when possible and only slightly larger than the width of the shovel on all sides to minimize disturbance to the ground surface. A bucket auger was used to examine the soil deeper in the profile if needed to find hydric soil indicators. Because of difficulty digging soil pits in areas with deep standing water, if standing water was a significant part of the AA, crews concentrated on areas near the water's edge.

Following guidance in the ACOE *Regional Supplement* (ACOE 2008) and the Natural Resources Conservation Service (NRCS) *Field Indicators of Hydric Soils in the United States* (NRCS 2010), crews identified and described each distinct layer in the soil profile. For each layer, the following information was recorded: 1) color (based on a Munsell Soil Color Chart) of the matrix and any redoximorphic concentrations (mottles and oxidized root channels) and depletions; 2) the soil texture; and 3) any specifics about the concentration of roots, the presence of gravel or cobble, or any usual features to the soil. Based on the characteristics, the crew identified which, if any, hydric soil indicators occur at the pit. Soil data are reported in the 2011 CNHP-RNF tabular data package.

Groundwater parameters were measured in pits where groundwater was visible. Crews allowed the pit to sit until water appeared to reach equilibrium with the soil conditions before measuring groundwater parameters. Once the pit equilibrated as much as possible, crews measured the distance to saturated soil and to free water. Free water was an approximation of the groundwater table, but in some cases may not represent the true groundwater table because it can take many hours for a water table to equilibrate. If free water was not observed, crews noted whether the pit was dry or if it appeared to be slowly filling. If groundwater was evident in the pit, pH, EC, and temperature were measured using a using a Hanna Instruments hand-held meter (Model # HI98129).

3.3 Data Management

To efficiently store and analyze data collected from the wetland condition assessment, a Microsoft Access™ database was built by a database specialist at CNHP. EIA metrics and vegetation data were entered into the database at the completion of the field season. To eliminate spelling errors, a pre-defined species list was used for species entry. Unknown or ambiguous species (e.g., *Carex* sp.) were entered into the database, but not included in data analysis. Site species lists are reported in the 2011 CNHP-RNF tabular data package.

The species table from the Floristic Quality Assessment of Colorado Wetlands (FQA: Rocchio 2007) was used as the pre-defined species list and to populate life history traits, wetland indicator status, and C-values in the database for each species in each plot. The FQA species table was updated and modified when converted to Microsoft Access™ in 2008 and species primary nomenclature now follows Weber and Wittmann (2001a, 2001b), though all names are cross-referenced to the nationally accepted names in the U.S. Department of Agriculture's PLANTS Database[3]. Life history traits and cover data were used to calculate FQA metric values using Visual Basic queries

[3] PLANTS National Database can be accessed at the following website: http://plants.usda.gov. The National nomenclature in the Colorado FQA is based on a download from the website in January 2008.

programmed in the database. Calculations made by the queries were randomly checked to ensure that the queries were constructed correctly.

3.4 Data Analysis

3.4.1 Comparison of NWI Mapping and Field-Assigned Cowardin Classification

Cowardin classifications recorded in the field were compared with the digital NWI mapping. Comparisons were made for both the center point of the AA and the majority of the AA. Not all surveyed sites were mapped in NWI. Riparian areas that do not meet the USFWS definition of a wetland would not be mapped in NWI, which specifically targets wetlands.

3.4.2 Characterization of Wetland/Riparian Vegetation

To characterize vegetation communities in the Routt National Forest plots surveyed, vegetation composition was reported through summary statistics and the identification of plant associations within the resampled AAs.

3.4.3 Level 2 FQA and EIA Analysis

For all sites sampled, vegetation data collected with the Level 2 protocols were used to calculate FQA metrics (Rocchio 2007). One FQA metric (Mean C) is included in the Biotic Condition category of the EIA protocol and represents perhaps the single strongest measures of biotic wetland condition (Lemly and Rocchio 2009). EIA metrics were used to calculate Level 2 scores and ranks for each site visited in the RNF, following the scoring formulas presented in Appendix C. Scores and ranks were calculated for each major ecological category, as well as the overall Ecological Integrity score. FQA and EIA scores were calculated at the site level. Results are presented in tables and graphs that depict the range of ranks observed in the field. Field notes from 2011 and the 1990s pertaining to site specific stressors are presented in Appendix D. Raw data for each site, including site specific classification and EIA component metric values are reported in the 2011 CNHP-RNF tabular data package.

3.4.4 Comparison of 2011 and 1990 Vegetation Data

Vegetation data collected in 2011 were compared with vegetation data from the 1990s plots. For these comparisons, we relied on the electronic version of the data that was entered into CNHP's Wetland and Riparian Plot database in the 1990s for the riparian vegetation classification project. One important caveat to note is that not all species on the paper data forms were included in the 1990s database, particularly taxa identified only to the genus or family level. This caveat should be considered when comparing the 1990s and 2011 species lists.

4.0 RESULTS

4.1 Resampled Riparian Sites

The 17 wetland and riparian areas resampled included 12 riparian shrublands and 5 riparian woodland Ecological Systems. All high priority target sites were resampled. All sites sampled were located on a riparian area, characterized by their proximity to a river and by presence of some hydrophytic vegetation, and so they are collectively referred to as "riparian" sites or zones. Some sites were also true wetlands, dominated by hydrophytic vegetation, hydric soils, and possessing wetland hydrology, but not all were.

The previous long winter, record snowpack, and delayed snowmelt had a dynamic effect on many of the riparian areas sampled in 2011. Signs of beaver use, such as dam remnants and bark-stripped trees, were present in or near most of the resampled sites and were in the AA or 500m buffer in 10 sites. Many beaver dams appeared to have been washed out within the past year, and only two sites had intact beaver dams remaining in or adjacent to the AA. Erosion and high levels of sedimentation resulted from the high flows, which made it difficult to detect how much disturbance occurred from flooding and natural processes versus from anthropogenic stressors such as grazing or altered hydrology. There was no mention of late snowmelt and heavy water flows from the 1990s surveys.

The late spring and shorter summer also resulted in various livestock-owners taking an off-year to not graze their animals in the forest. In the 1990s, grazing was regularly recorded, with animals actively grazing at the time of survey. In 2011, many riparian sites had not yet experienced grazing that year, were just beginning to be grazed, or no longer experienced grazing. Summaries comparing stressors for each site is included in Appendix D.

4.2 NWI Mapping vs. Field-Assigned Cowardin Classification

Riparian areas surveyed were either classified in NWI mapping as Palustrine Scrub-Shrub (PSS) or as Riverine features (R). In the Cowardin classification, Riverine features are actual river and stream beds, and should not include the surrounding wetlands. As several of the riparian areas targeted were narrow riparian zones without wetland formation, it was not surprising that the only NWI mapping at or near these sites was of the streams themselves.

Eight of 17 sites did not have their center point mapped in NWI and four sites did not have any of their AA mapped (Table 4). Given the number of changes in stream paths from high flows in 2010 and 2011, and the naturally dynamic nature of riparian areas, this was also not surprising. Linear NWI features are best used for identifying the presence of a wetland type in the general area and for estimating total acreage, rather than exact location of a stream at any given point on the ground.

Reasons for inconsistencies between ground-truthed Cowardin Classification were variable (Table 5, NWI maps in Appendix D). Some PSS wetlands were mismapped in NWI as linear (R) stream features, but in those cases Palustrine features were often mapped nearby. In those cases, changes may have occurred in the stream path and wetland zones since the original NWI mapping, or the wetland area was not detected at the time of mapping. Shrub physiognomy (PSS) was correctly identified in NWI when mapped, unless it was mapped as an R feature (i.e., shrubs were not

mapped as herbaceous vegetation, etc.). Stream features were always mapped as (R) features if they were detected in the original mapping. The accuracy of the NWI water regime mapping varied from the ground-truthing, but degree of saturation is difficult to identify digitally on linear NWI features. Overall, NWI mapping identified presence of a riparian feature in the vicinity of the AA in all but one case, but the NWI mapped and ground-truthed Cowardin feature codes often did not correspond exactly due to changing river patterns, the coarse scale at which linear features were recorded from the original NWI maps, and potential error.

Table 4. Comparison of field-assigned Cowardin classification and NWI mapping.

Point Code	Field-Assigned Cowardin Code	NWI Cowardin Code at AA Center Point	NWI Cowardin Code in Majority of AA
90MR28	PSSAb	R3UBF	R3UBF, PABF, PSSA
90MR32	PSSC	out of mapped area	out of mapped area, R3UBG nearby
90MR48	riparian area	out of mapped area	R3UBG
90MR50	PSSB	R3UBG	R3UBG
90MR52	PSSCb	R3UBG	R3UBG, adjacent beaver area = PSSA
90MR53	PSSAb	R3UBG	PSSA
90MR55	PSSA	out of mapped area	R3UBG
91GK01	riparian area	out of mapped area	out of mapped area, R4SBC nearby
91GK08	PSSA	out of mapped area	PSSA
94A540	PSSB	PSSA	PSSA
94A543	PSSC	R3UBG	PSSA
94A547	riparian area	out of mapped area	out of mapped area, R3UBF ~100m away
94A548	PFOC	out of mapped area	R3UBF
94R549	PSSA and riparian area	out of mapped area	R3UBG
94R550	riparian area	R3UBG	R3UBG
94R552	PSSCb	PSSB	PSSB
94R554	PSSA	R3UBG	PSSA

Table 5. Reason for discrepency between field-assigned Cowardin classification and NWI mapping.

Point Code	Mapping Correct?	Description of inconsistencies between NWI and ground-truthed codes
90MR28	In some areas (PSSA zone)	Dynamic site, stream changed position and beaver dams breached in past year, aerial photo from GIS world imagery shows dams still intact. Dam position and channel position also changed between year of NWI mapping and 2009 aerial imagery.
90MR32	No	Area surveyed not mapped except for SE end of AA, NWI mapped area was nearby stream. Wetland may not have been evident at scale of NWI mapping, or stream may have changed position since NWI mapping.
90MR48	Yes	---
90MR50	No, but correct nearby	Mapped as stream. Correctly mapped as PSSB ~50m N of AA boundary, but incorrectly mapped in surveyed wetland.
90MR52	No	Area surveyed not mapped by NWI. Dynamic site, may not have been as vegetated by willows at time of NWI mapping, or wetland may have been overlooked. Site experienced recent major flooding that shifted channel above site, so 2009 imagery is likely outdated from time of survey.
90MR53	Yes	Correct except for water regime code.
90MR55	No, but correct nearby	Similar shrubland mapped correctly nearby, but AA shrub wetland not mapped in NWI.
91GK01	No, but correct nearby	Channel too narrow to see from aerial imagery. NWI mapping follows stream depicted on quad.
91GK08	Yes	---
94A540	Yes	Correct except for water regime code. Area mapped with NWI is narrower than actual wetland area.
94A543	Yes	Correct except for water regime code.
94A547	No, but correct nearby	Upstream of beginning of stream reach mapped by NWI. Downstream is mapped correctly.
94A548	No	NWI mapping did not detect wetland area, perhaps due to mapping scale, only mapped as stream.
94R549	In some areas (R-zone).	Dynamic site, site experienced recent major flooding and 2009 imagery may be outdated. But borderline/transitional between riparian and wetland – difficult to classify as one category, survey area included some relict terraces, some stream and some wetland.
94R550	Yes	---
94R552	Yes	Correct except for water regime code.
94R554	Yes	---

4.3 Characterization of Riparian Vegetation

Riparian shrublands surveyed were generally dominated by Booth's willow (*Salix boothii*), mixed willow (*Salix* spp.), or alder (*Alnus incana* ssp. *tenuifolia*). Riparian woodlands were generally dominated by either Engelmann spruce (*Picea engelmannii*), subalpine fir (*Abies lasiocarpa*), or both. Co-dominant species varied from a mixed understory of sedge, grass, and forb cover, to other shrub species such as red osier dogwood (*Swida* [syn: *Cornus*] *sericea*), to sparse vegetation comprised of field horsetail (*Equisetum arvense*) interspersed along deposits of gravel and fine sediment. The dominant plant associations encountered at each site in both the 1990s and 2011 surveyes are listed in Table 6.

Table 6. Comparison of dominant USNVC plant association in each plot between 1990s surveys and 2011 resample. Plots in parenthesis were surveyed separately in the 1990s and were sampled either together in 2011 or were part of the 2011 AA buffer.

Point Code	**Plant Association**	
Survey Year	1990s	2011
90MR28	Alnus incana ssp. tenuifolia / Mesic forb shrubland	Alnus incana ssp. tenuifolia / Mesic forb shrubland
(90MR31)	Alnus incana ssp. tenuifolia - Cornus sericea shrubland	Alnus incana ssp. tenuifolia / Cornus sericea shrubland
90MR32	Populus angustifolia – Picea pungens/ Alnus incana woodland	
90MR48	Abies lasiocarpa – Picea engelmannii / Equisetum arvense forest	Picea engelmannii / Equisetum arvense forest
90MR49	Carex aquatilis herbaceous vegetation	
90MR50	Salix wolfii / Mesic forb Shrubland	Salix wolfii / Mesic forb shrubland
(90MR51)	Picea pungens / Alnus incana ssp. tenuifolia woodland	
90MR52	Salix boothii / Mesic forb shrubland	Salix boothii / Mesic forb shrubland
90MR53	Salix boothii / Mesic forb shrubland	Salix boothii / Mesic forb shrubland
90MR55	Salix boothii / Mesic forb shrubland	Salix geyeriana / Mesic forb shrubland
(90MR56)	Carex vesicaria herbaceous vegetation	
91GK01	Picea pungens / Alnus incana ssp. tenuifolia woodland	Picea engelmannii / Equisetum arvense forest
(92GK01)	Abies lasiocarpa – Picea engelmannii / Mertensia ciliata forest	
91GK08	Salix boothii / Mesic forb shrubland	Salix boothii / Mesic forb shrubland
94A540	Alnus incana ssp. tenuifolia / Mesic forb shrubland	Alnus incana ssp. tenuifolia / Mesic forb shrubland
94A543	Salix wolfii / Mesic forb shrubland	Salix wolfii / Mesic forb shrubland
94A547	Alnus incana ssp. tenuifolia / Mesic forb shrubland	Picea engelmannii/Equisetum arvense forest
94A548	Calamagrostis Canadensis western herbaceous vegetation	Abies lasiocarpa - Picea engelmannii/ Calamagrostis canadensis forest
94R549	Alnus incana ssp. tenuifolia / Mesic forb shrubland	Alnus incana ssp. tenuifolia / Salix drummondiana shrubland
94R550	Abies lasiocarpa – Picea engelmannii / Equisetum arvense forest	Picea engelmannii/Equisetum arvense forest

Point Code	Plant Association	
Survey Year	1990s	2011
94R552	Salix boothii / Mesic forb shrubland	Salix boothii / Mesic forb shrubland
94R554	Salix boothii / Mesic forb shrubland	Salix boothii / Mesic forb shrubland

Within the 17 riparian sites resurveyed in 2011, 297 individual plant taxa were encountered. This number includes 24 taxa identified only to the genus and four taxa identified only to the family level because they were found either early or late in the season and lacked the required floristic parts for identification. Discounting those taxa, 269 species were identified to the species level. Sedges (*Carex* spp.) were the most diverse genus found in the survey, with 23 individual species identified. Ten species of rush (*Juncus* spp.) and eight species of willows (*Salix* spp.) were identified. Of the 269 species identified to species level, 249 (92.5%) were native species and 20 were non-native species. Non-native species cover within AAs never surpassed the 5-10% cover class.

Based on the electronic species lists available, a total of 135 plants were identified to species within the 1990s plots. This represents less than half of the 269 species identified in 2011. This is likely due to 1) different survey methods (line-transect vs. AA polygon) and 2) the taxa from the 1990s plots identified only to genus or family level that were not included in the electronic data. Species richness recorded in the initial 1990s surveys ranged from 6–37 (mean = 22) species and 2011 surveys had 24–91 (mean = 65) species.

Table 7. Ten most common species recorded in 1990s riparian vegetation plots.

Scientific Name	Occurrences (in 23 plots)	Rank	Wetland Indicator Status	Native Status	C-Value
Taraxacum officinale	18	1	FACU+	Non-native	0
Equisetum arvense	17	2	FAC+	Native	4
Geranium richardsonii	17	3	FACU	Native	6
Fragaria virginiana ssp. *glauca*	17	4	FACU	Native	5
Achillea lanulosa	14	5	FACU	Native	4
Mertensia ciliata	13	6	OBL	Native	7
Senecio triangularis	13	7	OBL	Native	7
Calamagrostis canadensis	12	8	OBL	Native	6
Heracleum sphondylium ssp. *montanum*	12	9	FACW-	Native	6
Vicia americana var. *americana*	12	10	UPL	Native	5

Table 7 lists the top ten most common species found in the 1990s vegetation plots and Table 8 lists the top ten most common species found in 2011. The tables include the wetland indicator status, nativity status, and C-value of all species. Vegetation within the targeted riparian areas did not appear to have changed dramatically between survey years as the common species observed were similar between the initial and resample years. Six out of the top ten species in both lists were the same. For either list, the remaining top ten species occurred in at least ten sites in both years. The only exceptions were *Carex microptera,* which was observed in 16 plots in 2011 and only five in the 1990s. However, the 1990s lists included far less sedge diversity, which may indicate that crews spent less time identifying sedges in the 1990s. *Prunella vulgaris* was also commonly identified in

2011, but was included in the species list of only one 1990s plot. The two most common species encountered across sites in both initial and resample surveys were *Taraxacum officinale* and *Equisetum arvense*. Out of the top ten, only *Taraxacum officinale* (common dandelion) is a non-native species. Most of the other top ten species are native species with mid-range C-values, indicating they can tolerate low levels of disturbance. Common species observed in the riparian surveys included both wetland and upland species. Across both datasets, species recorded were evenly divided among the wetland indicator codes of OBL, FACW, FAC, and FACU, with 15–22% of species in each category. Only 2–4% of species were designated true upland species.

Table 8. Ten most common species recorded in 2011 resampled riparian areas.

Scientific Name	Occurrences (in 17 plots)	Rank	Wetland Indicator Status	Native Status	C-Value
Equisetum arvense	17	1	FAC+	Native	4
Taraxacum officinale	16	2	FACU+	Non-native	0
Carex microptera	16	3	FAC	Native	unassigned
Vicia americana	16	4	UPL	Native	5
Fragaria virginiana ssp. *glauca*	15	5	FACU	Native	5
Geranium richardsonii	15	6	FACU	Native	6
Alnus incana ssp. *tenuifolia*	14	7	FACW	Native	6
Carex aquatilis	14	8	OBL	Native	6
Achillea lanulosa	14	9	FACU	Native	4
Prunella vulgaris	14	10	FACU	Native	4

4.4 Floristic Quality Assessment

Vegetation surveys were conducted in the 17 wetland/riparian areas sampled in 2011 and FQA metrics were calculated for all sites. Mean C values ranged from 4.63–6.72 (Table 9; Figure 3) across sampled sites, with an overall average Mean C of 5.55. These values span a broad range of biotic conditions, with their values representing a range of "A" to "D" condition scores for the riparian shrubland and woodland wetland types. Average Mean C scores tended to increase as elevation increased (Figure 3). Mean C can be a strong measure of wetland condition, but in dynamic systems, Mean C values are also associated with levels of natural disturbance. Areas with higher levels of natural disturbance tend to have lower C-values than areas with more stable disturbance regimes. In the particularly high flow years of 2010-2011, many sites experienced large disturbances such as beaver dam blowouts, and high gravel and sediment movement and deposition. Re-examination of site Mean C during more stable water years will help assess whether the sites with "D"-ranked Mean C still support vegetation communities representing lower quality riparian areas (due to anthropogenic disturbance) or whether they had an atypical number of disturbance-mediated species present at the time of survey due to the dynamic year. Non-wetland riparian areas may also naturally be more dynamic than the riparian wetlands the Mean C rank thresholds were developed from. With these factors in mind, comparisons of Mean C within the same sites over time and across similar systems can provide valuable information about changes in plant community integrity in the RNF. In addition to Mean C, the FQA methodology includes a number of different metrics that can be evaluated to gauge biotic condition. Table 9 shows values of each FQA metric by plot.

Table 9. FQA metrics of sites resampled in 2011.

Point Code	Total species richness	Native species richness	Non-native species richness	% Non-native	Mean C of all species	Mean C of native species	Cover-weighted Mean C of all species	Cover-weighted Mean C of native species	FQI of all species	FQI of native species	Cover-weighted FQI of all species	Cover-weighted FQI of native species	Adjusted FQI	Adjusted cover-weighted FQI
90MR28	79	67	9	16.3	4.99	5.67	4.71	5.65	43.19	46.04	40.80	45.88	53.16	52.97
90MR32	61	49	9	15.1	4.82	5.73	5.03	5.96	36.42	39.69	37.96	41.30	52.57	54.70
90MR48	43	40	2	0.7	6.32	6.64	5.84	5.88	40.45	41.47	37.39	36.74	64.77	57.38
90MR50	77	70	6	4.2	5.80	6.31	6.43	6.71	49.87	52.02	55.30	55.35	60.48	64.35
90MR52	86	76	6	3.5	5.73	6.21	5.89	6.12	50.61	52.68	52.02	51.89	59.65	58.76
90MR53	54	46	7	18.8	5.02	5.80	5.12	6.31	36.19	38.91	36.94	42.36	53.96	58.74
90MR55	77	64	7	19.2	5.31	5.93	4.99	6.21	43.49	45.96	40.82	48.09	56.15	58.75
91GK01	69	68	1	0.3	6.35	6.45	5.54	5.56	51.58	51.97	45.00	44.82	63.97	55.16
91GK08	73	60	9	19.8	5.03	5.85	5.01	6.35	40.25	43.42	40.06	47.12	54.27	58.90
94A540	60	52	5	4.1	5.28	5.82	5.55	5.79	38.78	40.71	40.77	40.52	55.41	55.14
94A543	91	76	11	19.2	5.35	6.17	5.16	6.42	48.74	52.33	46.99	54.45	57.44	59.76
94A547	44	42	0	3.1	6.72	6.72	5.45	5.45	41.95	41.95	34.01	34.01	67.18	54.46
94A548	56	50	4	5.8	5.70	6.16	5.91	6.10	41.48	43.14	43.03	42.69	59.26	58.64
94R549	87	76	8	0.6	5.52	6.12	5.44	5.79	49.67	52.32	48.98	49.45	58.13	54.94
94R550	62	58	2	5.8	6.36	6.59	5.29	5.32	48.45	49.31	40.27	39.80	64.75	52.26
94R552	73	61	6	15	5.45	6.00	5.55	5.90	43.91	46.09	44.74	45.35	57.16	56.25
94R554	58	43	7	16.3	4.63	5.41	5.16	6.08	32.04	34.67	35.72	38.95	50.04	56.23

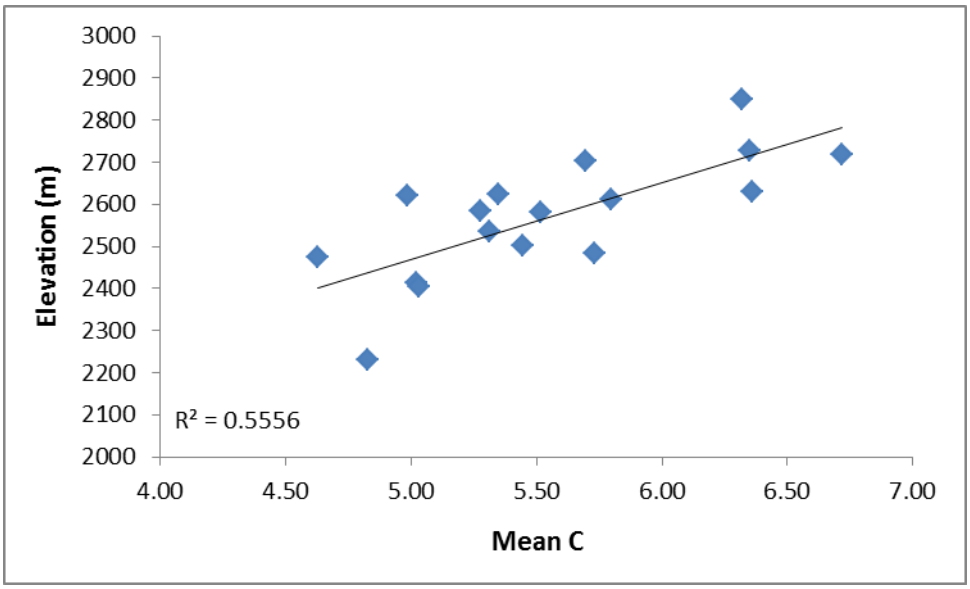

Figure 3. Mean C vs. elevation in meters.

4.5 Ecological Integrity Assessment

Level 2 condition scores were calculated for wetlands resampled in 2011 based on the EIA methodology. Scores were also calculated for riparian areas sampled, although CNHP EIA metric thresholds were developed to rank the condition of wetland areas. Overall site scores ranged from 3.75–4.97 out of a 1–5 possible range. For ease of discussion, EIA scores are translated into a 4-tiered ranking system of A, B, C, and D based on the scoring thresholds outlined in Appendix C. These ranks can be interpreted as:

- A = Reference (no or minimal human impact)
- B = Slight deviation from reference
- C = Moderate deviation from reference
- D = Significant or severe deviation from reference

Consistent with wetlands surveyed in RNF in 2010 (Lemly and Gilligan 2012), the lowest overall ranked wetland (or riparian area) surveyed in 2011 was still a "B", and 6 of the 17 sites were "A" ranked and considered excellent condition. The lack of "C" and "D" overall ranks indicates that the riparian sites in this project's study area were generally in good condition.

To explore the details of the EIA scores, it is important to look at the component ranks of landscape context, biotic condition, hydrologic condition and physiognomic condition. Components of EIA ranks often have a 4-tiered ranking system, although a few individual metrics of the EIA component ranks have a 5-tiered system that splits D-ranks to D and E. Table 10 shows the range of ranks within each of these component categories.

One riparian site received "A" ranks in all components, and the remaining sites contained at least one component rank in "B" condition. The only component ranks in "C" condition occurred in the biotic group. The lower biotic scores observed when compared to other EIA component categories is similar to results from the field test of the Riparian Shrubland EIA protocol (Lemly and Rocchio

2009) and the 2010 North Platte River Basin survey (Lemly and Gilligan 2012). Metrics within the biotic category generally integrate the cumulative effects of numerous stressors on multiple scales. The landscape context and abiotic categories depict condition at either a large scale (landscape context and hydrologic condition) or a site-level scale (physiochemical condition), and therefore each category only captures a slice of the overall condition.

Table 10. Component EIA ranks of 2011 resample sites.

Point Code	Landscape Rank	Biotic Rank	Physiochemical Rank	Hydrologic Rank	Overall Rank
90MR28	B	C	B	B	B
90MR32	A	C	A	B	B
90MR48	B	A	A	B	A
90MR50	A	B	A	B	B
90MR52	A	B	A	A	A
90MR53	B	C	B	A	B
90MR55	B	B	A	B	B
91GK01	A	A	A	B	A
91GK08	A	C	B	A	B
94A540	A	B	A	A	B
94A543	B	B	B	A	B
94A547	A	A	A	A	A
94A548	A	B	A	A	A
94R549	B	B	B	B	B
94R550	A	A	A	A	A
94R552	A	B	A	A	B
94R554	B	C	A	B	B

To further examine the plant community condition, biotic metric ranks from sites surveyed in 2011 were compared to ranks from the 1990s surveys (Table 11). Although the field crew attempted to make the locations of the initial and resampled survey areas as similar as possible, comparisons between vegetation communities for analyses of change over time should be made at a general level. Component ranks associated with biotic metric values are presented to facilitate these coarse comparisons. Only four of the resampled sites (90MR28, 94A540, 94A543, 94R554) had lower Mean C values in 2011 than in the 1990s, indicating a net positive change over time (even if slight) in overall plant community composition for most sites. However, across sites, the mean C of the 30 most commonly occurring plants was not statistically different between the 1990s and 2011 data ($p > 0.50$, 2 sample t-test), and thus there were no clear changes in overall plant community composition across the entire study area. Two of the four individual sites that showed a decrease in their Mean C experienced recent flooding, and one of the others did not have 1990s data sheet notes or an annotated map to help relocate the original site (the site location was inferred by the closest wetland point to the GPS point).

Recorded presence of the noxious weed *Breea arvensis* (Canada thistle, syn. *Cirsium arvense*) increased since the initial surveys, and the species appears to be spreading. In the 1990s it was

recorded in three sites, and in 2011 it was present in 11 AAs, including eight new sites. It is possible that *Breea arvensis* did occur more frequently in the 1990s, but was not identified to the species level. Several 1990s data sheets listed *Cirsium* sp., which could have been *Breea arvense.* In the 1990s other noxious weeds were also recorded, but in 2011 *Breea arvensis* was the only noxious species recorded in the AAs. It was possible that the other noxious species recorded in the 1990s were still present in the area outside of the resampled AAs. Percent cover of native species remained similar overall, but improved rank in four sites (90MR52, 90MR53, 91GK08, 94A547) and decreased the rank in four sites (90MR28, 90MR32, 94R552, 94R554).

Table 11. Comparison between 1990s surveys and 2011 resample surveys of component biotic metric values and ranks. Plots in parenthesis were surveyed separately in initial surveys; and were sampled either together in the 2011 resample or were part of the 2011 AA buffer.

Point Code	Biotic Metric					
	Mean C		% Native Cover		% Noxious Cover[1]	
Survey Year	1990s	2011	1990s	2011	1990s	2011
90MR28	5.60/B	4.98/D	98.7/B	83.7/C	0/A	7.5/C
(90MR31)	4.71/D	4.82/D	95.3/B	84.9/C	0/A	0.5/B
90MR32	5.22/C		98.1/B		0/A	
90MR48	6.21/A	6.31/A	100/A	99.3/A	0/A	0/A
90MR49	5.66/B		100/A		0/A	
90MR50	5.29/C	5.79/B	97.8/B	95.8/B	1/B[2]	0.5/B
(90MR51)	5.32/C		91.3/C		10/C[3]	
90MR52	3.90/E	5.73/B	71.0/D	96.5/B	6/C[4]	1.5/B
90MR53	3.95/E	5.01/C	75.8/D	81.2/C	1/B	7.5/C
90MR55	4.50/D	5.31/C	98.2/B	80.8/C	1/B[2]	0/A
(90MR56)	4.16/D		62.3/D		0/A	
91GK01	6.31/A	6.34/A	100/A	99.7/A	0/A	0/A
(92GK01)	3.92/E		92.0/C		1/B[5]	
91GK08	4.45/D	5.03/C	63.7/D	80.2/C	10/C[3]	7.5/C
94A540	5.81/B	5.27/C	98.8/B	95.9/B	0/A	1.5/B
94A543	5.69/B	5.34/C	93.3/C	80.8/C	0/A	0/A
94A547	6.17/A	6.71/A	98.7/B	100/A	0/A	0/A
94A548	5.41/C	5.69/B	96.3/B	96.9/B	0/A	1.5/B
94R549	4.86/D	5.51/B	88.1/C	94.2/C	1/B	1.5/B
94R550	6.14/A	6.36/A	99.3/A	99.4/A	0/A	0/A
94R552	5.26/C	5.44/C	97.5/B	94.2/C	0/A	1.5/B
94R554	4.90/D	4.62/D	97.8/B	85.0/C	0/A	7.5/C

[1] All noxious cover percentages refer to *Breea arvensis* unless otherwise noted. [2] *Anisantha tectorum* only. [3] *Elytrigia repens* only. [4]*Breea arvensis* (=1%) and *Elytrigia repens* (=5%) recorded. [5] *Arctium minus* only.

4.6 Land Use and Stressors

Anthropogenic land uses were recorded in AAs and in their 500m buffer to evaluate if certain uses were consistently present throughout the area (Table 12). The most common uses observed were light grazing and dirt roads in the AA buffer. Few land uses were observed within the AAs except for light grazing. Potential anthropogenic land uses that were not observed in the AA or 500 m AA buffer included: paved roads/parking lots, mining, oil/gas wells, tilled agriculture, intensively managed golf/sports fields, vegetation chaining/cabling/rotochopping/clearcut, heavy grazing, logging with 50-75% tree removal, untilled agriculture/hayfield/orchard, dam sites and disturbed reservoir shorelines, moderate grazing, haying of native grasslands. It should be noted that some of these land uses were observed outside of the 500 m buffer, such as reservoirs and paved roads, that may influence the assessment area from a greater distance. Fewer land uses were observed in the wetland assessment plots (AA) than in the surrounding 500m buffer (which could include both wetland/riparian and upland land cover), but this may have been partly related to that the wetland AA had to include ≥ 90% wetland/riparian land cover, and some of the land uses such as roads would be incompatible with wetland area.

Table 12. Anthropogenic uses recorded in 2011 resample sites.

Land Use	# plots with stressor observed in AA	# plots with stressor observed in 500m buffer
Intense recreation	-	1
Moderate recreation	-	1
Light recreation	1	2
Domestic or commercially developed buildings	-	3
Selective logging	1	4
Unpaved roads	-	10
Light grazing	10	13
No recorded anthropogenic land uses present	3	1

Stressors specific to the vegetation, physiochemistry, and hydrology and natural disturbances that may affect site condition were recorded for each site. (Details reported in the 2011 CNHP-RNF data package). Common vegetation disturbances in the AAs included light grazing/browse (10 sites), or light recreation/human visitation (2 sites). Beetle-killed conifers were present in two 500m buffers but not in any assessment areas. One AA had a substantial portion of non-native grasses, indicating it may have historically been an old field. Common physiochemical disturbances in the AA were signs of erosion (13 sites) and sedimentation (9 sites), but it was frequently noted that these were due to flooding and natural dynamics. Some sites were experiencing entrenchment and should be monitored for further erosion (Appendix D). Livestock or native ungulates created light soil compaction in limited areas of the AA in 6 sites, and created light compaction effects throughout the AA in 2 sites. Hydrologic stressors were not common in the RNF, with only 5 sites containing minor disturbances that may affect the AA from either up or downstream. These disturbances included presence of small ditches (3 sites), potential runoff from roads (2 sites), and a reservoir upstream (1 site).

5.0 DISCUSSION

Overall, the 17 riparian areas resurveyed in 2011 on the Hahns Peak / Bears Ears Ranger District of the RNF were rated in excellent or good condition. The biotic component of sites displayed the most variable conditions, while landscape context, hydrology, and physiochemical condition were all rated high. Compared to surveys conducted in the 1990s, biotic condition improved over time in many sites, and in others the condition was downgraded. *Breea arvense,* a B-listed noxious weed of Colorado, may be increasing in cover in the District. In the 1990s *Breea arvensis* was recorded in three sites, while in 2011 it was present in 11. However, Mean C's increased more often than they decresed in the 2011 surveys, indicating overall plant communities were improving in at least some sites. Heavy flooding, like what occurred following the 2010-2011 winter, can increase the colonization of annual and weedy species. Revisiting sites with low biotic scores after stable water years will help determine if the biotic condition is in fact degrading over time in those sites.

Effects from light grazing may also be negatively impacting native plant communities. Grazing was often noted to be a threat in the 1990s surveys but appeared to only have minor or transient effects in the 2011 surveys. Grazing was generally not found to prohibit woody regeneration in 2011, despite that light browse effects were frequently noted in surveyed sites. Livestock were typically observed in sites during the 1990s surveys, in contrast to the 2011 surveys when animals were only occasionally observed in the AA. Grazing effects may have appeared more severe when animals were actively using an area. It could not be determined from comparison of notes on the data sheets whether the combination of heavy flooding and sediment movement in 2011 may have obscured long-term impacts of grazing, or if sites were recovering from overgrazing since the 1990s surveys.

Most resampled sites experienced disturbances in some parts of their AA, however, disturbances were generally light, few, and varied between sites, resulting in overall good condition scores. Further examination of erosion and sedimentation after a less dynamic year would help inform whether site riparian hydrology was properly functioning in the RNF, or if erosion and sedimentation processes are degrading site conditions.

The overall site condition recorded and presence of stressors appeared similar between initial and resample surveys. If the area was noted to be fairly pristine during the initial survey, that quality was also observed in the resample. Sites with more stressors, such as presence of non-natives and invasive plants, also often had similar results in the resample. The heavy snowpack and late snowmelt of 2011 resulted in a dynamic water year that created sedimentation and scouring and was hard on beaver habitat. This resulted in differences in physical properties between initial and resampled sites.

While the 17 surveyed sites were generally in good condition, the common stressors described above may indicate risk for future degradation, including the spread *of Breea arvense*, potential grazing effects, and streambank erosion. Due to the effects a high water year can have on these processes, and given that the 2011 field team did not have enough information available from the 1990s surveys to exactly duplicate the initial study design, we cannot definitively say whether each resurveyed site experienced improvement or degradation. Given these caveats, one way to

prioritize restoration funds for forest management is to begin considering restoration in sites with overall condition ranks of "B"s (Table 10). Their metric component ranks and scores indicate which site attributes could use improvement, and the species lists and stressor notes in Appendix D give detail on recorded change between sample years at these sites.

These findings provide scientifically-grounded information for long term monitoring and management of wetland and riparian areas in the Routt National Forest. The associated tabular dataset will provide detailed, location-specific data about plant community composition, potential stressors, and ecological integrity in the sites surveyed, and will be valuable for assessing long term change in the forest.

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APPENDIX A: Field Key to Wetland and Riparian Ecological Systems of Montana, Wyoming, Utah, and Colorado

1a. Wetland defined by groundwater inflows and peat (organic soil) accumulation of at least 40 cm. Vegetation can be woody or herbaceous. If the wetland occurs within a mosaic of non-peat forming wetland or riparian systems, then the patch must be at least 0.1 hectares (0.25 acres). If the wetland occurs as an isolated patch surrounded by upland, then there is no minimum size criteria. ..... **Rocky Mountain Subalpine-Montane Fen**

1b. Wetland does not have at least 40 cm of peat (organic soil) accumulation or occupies an area less than 0.1 hectares (0.25 acres) within a mosaic of other non-peat forming wetland or riparian systems **2**

2a. Total woody canopy cover generally 25% or more within the overall wetland/riparian area. Any purely herbaceous patches are less than 0.5 hectares and occur within a matrix of woody vegetation. Note: Relictual woody vegetation such as standing dead trees and shrubs are included here..... **GO TO KEY A: Woodland and Shrubland Ecological Systems**

2b. Total woody canopy cover generally less than 25% within the overall wetland/riparian area. Any woody vegetation patches are less than 0.5 hectares and occur within a matrix of herbaceous wetland vegetation **3**

3a. Total vegetation canopy cover generally 10% or more ..... **GO TO KEY B: Herbaceous Ecological Systems**

3b. Total vegetation canopy cover generally less than 10% ..... **GO TO KEY C: Sparse Vegetation**

KEY A: Woodland and Shrubland Ecological Systems

1a. Woody wetland associated with any stream channel, including ephemeral, intermittent, or perennial (Riverine HGM Class) **2**

1b. Woody wetland associated with the discharge of groundwater to the surface or fed by snowmelt or precipitation. This system often occurs on slopes, lakeshores, or around ponds. Sites may experience overland flow but no channel formation. (Slope, Flat, Lacustrine, or Depressional HGM Classes) **9**

2a. Riparian woodlands and shrublands of the montane or subalpine zone (refer to lifezone table) **3**

2b. Riparian woodlands and shrublands of the plains, foothills, or lower montane zone (refer to lifezone table) **4**

3a. Montane or subalpine riparian woodlands (canopy dominated by trees). This system occurs as a narrow streamside forest lining small, confined low- to mid-order streams. Common tree species include *Abies lasiocarpa*, *Picea engelmannii*, *Pseudotsuga menziesii*, and *Populus tremuloides*..... **Rocky Mountain Subalpine-Montane Riparian Woodland**

3b. Montane or subalpine riparian shrublands (canopy dominated by shrubs with sparse or no tree cover). Within the Riverine HGM Class, this system occurs as either a narrow band of shrubs lining streambanks of steep V-shaped canyons *or* as a wide, extensive shrub stand on alluvial terraces in low-gradient valley bottoms (sometimes referred to as a shrub carr). Beaver activity is common within the wider occurrences. Species of *Salix*, *Alnus*, or *Betula* are typically dominant..... **Rocky Mountain Subalpine-Montane Riparian Shrubland**

4a. Riparian woodlands and shrublands of the foothills or lower montane zones of the Northern, Middle, and Southern Rockies, Wyoming Basin, Wasatch and Uinta Mountains, and Great Basin **5**

4b. Riparian woodlands and shrublands of the Northwestern or Western Great Plains of eastern Montana, central Wyoming, or northeastern Colorado **7**

5a. Foothill or lower montane riparian woodlands and shrublands associated with mountain ranges of the Northern Rockies in northwestern Montana. This type *excludes* island mountain ranges east of the Continental Divide in Montana. *Populus balsamifera* ssp. *trichocarpa* is typically the canopy dominant in woodlands. Other common tree species include *Populus tremuloides*, *Betula papyifera*, *Betula occidentalis*, and *Picea glauca*. Shrub understory species include *Cornus sericea*, *Acer glabrum*, *Alnus incana*, *Oplopanax horridus*, and *Symphoricarpos albus*. Areas of riparian shrubland and open wet meadow are common..... .....**Northern Rocky Mountain Lower Montane Riparian Woodland and Shrubland**

5b. Foothill or lower montane riparian woodlands and shrublands of other mountain regions..... **6**

6a. Foothill or lower montane riparian woodlands and shrublands associated with mountain ranges of the Southern and Middle Rockies, Wyoming Basin, and Wasatch and Uinta Mountains. This type also includes island mountain ranges in central and eastern Montana. Woodlands are dominated by *Populus* spp. including *Populus angustifolia*, *Populus balsamifera* ssp. *trichocarpa*, *Populus deltoides*, and *Populus fremontii*. Common shrub species include *Salix* spp., *Alnus incana*, *Crataegus* spp., *Cornus sericea*, and *Betula occidentalis*.....**Rocky Mountain Lower Montane-Foothill Riparian Woodland and Shrubland**

6b. Foothill or lower montane riparian woodlands and shrublands associated with mountain ranges of the Great Basin in Utah. Woodlands are dominated by *Abies concolor*, *Populus angustifolia*, *Populus balsamifera* ssp. *trichocarpa*, *Populus fremontii*, and *Pseudotsuga menziesii*. Important shrub species include *Artemisia cana*, *Betula occidentalis*, *Cornus sericea*, *Salix exigua*, *Salix lutea*, *Salix lemmonii*, and *Salix lasiolepis*..... **Great Basin Foothill and Lower Montane Riparian Woodland and Shrubland**

7a. Woodlands and shrublands of draws and ravines associated with permanent or ephemeral streams, steep north-facing slopes, or canyon bottoms that do not experience flooding. Common tree species include *Fraxinus* spp., *Acer negundo*, *Populus tremuloides*, and *Ulmus* spp. Important shrub species include *Crataegus* spp., *Prunus virginiana*, *Rhus* spp., *Rosa woodsii*, *Symphoricarpos occidentalis*, and *Shepherdia argentea*. ....**Western Great Plains Wooded Draw and Ravine**

7b. Woodlands and shrublands of small to large streams and rivers of the Northwestern or Western Great Plains. Overall vegetation is lusher than above and includes more wetland indicator species. Dominant species include *Populus balsamifera* ssp. *trichocarpa*, *Populus deltoides*, and *Salix* spp. **8**

8a. Woodlands and shrublands of riparian areas of medium and small rivers and streams with little or no floodplain development and typically flashy hydrology..... .....**Northwestern/Western Great Plains Riparian**

8b. Woodlands and shrublands of riparian areas along medium and large rivers with extensive floodplain development and periodic flooding..... **Northwestern/Western Great Plains Floodplain**

9a. Woody wetland associated with small, shallow ponds in northwestern Montana. Ponds are ringed by trees including *Populus balsamifera* ssp. *trichocarpa*, *Populus tremuloides*, *Betula papyrifera*, *Abies grandis*, *Abies lasiocarpa*, *Picea engelmannii*, *Pinus contorta*, and *Pseudotsuga menziesii*. Typical shrub species include *Cornus sericea*, *Amelanchier alnifolia*, and *Salix* spp. ..... **Northern Rocky Mountain Wooded Vernal Pool**

9b. Woody wetland associated with the discharge of groundwater to the surface, or sites with overland flow but no channel formation. **10**

10a. Coniferous woodlands associated with poorly drained soils that are saturated year round or seasonally flooded. Soils can be woody peat but tend toward mineral. Common tree species include *Thuja plicata*, *Tsuga heterophylla*, and *Picea engelmannii*. Common species of the herbaceous understory include *Mitella* spp., *Calamagrostis* spp., and *Equisetum arvense* ....**Northern Rocky Mountain Conifer Swamp**

10b. Woody wetlands dominated by shrubs..... **11**

11a. Subalpine to montane shrubby wetlands that occur around seeps, fens, lakes, and isolated springs on slopes away from valley bottoms. This system can also occur within a mosaic of multiple shrub- and herb-dominated communities within snowmelt-fed basins. Vegetation dominated by species of *Salix*, *Alnus*, or *Betula.* Within Slope, Flat, Lacustrine, or Depressional HGM Classes, this system has a similar species composition as occurrences within the Riverine HGM Class, but occurs in different landscape settings ..... **Rocky Mountain Subalpine-Montane Riparian Shrubland**

11b. Lower foothills to valley bottom shrublands restricted to temporarily or intermittently flooded drainages or flats and dominated by *Sarcobatus vermiculatus* ..... **Inter-Mountain Basins Greasewood Flat**

KEY B: Herbaceous Wetland Ecological Systems

1a. Herbaceous wetlands of the Northwestern Glaciated Plains, Northwestern Great Plains, or Western Great Plains regions of eastern Montana, central Wyoming, or northeastern Colorado **2**

1b. Herbaceous wetlands of other regions **5**

2a. Wetland occurs as a complex of depressional wetlands within the glaciated plains of northern Montana. Typical species include *Schoenoplectus* spp. and *Typha latifolia* on wetter, semi-permanently flooded sites, and *Eleocharis* spp., *Pascopyrum smithii*, and *Hordeum jubatum* on drier, temporarily flooded sites ..... **Great Plains Prairie Pothole**

2b. Wetland does not occur as a complex of depressional wetlands within the glaciated plains of Montana **3**

3a. Depressional wetlands in the Western Great Plains with saline soils. Salt encrustations can occur on the surface. Species are typically salt-tolerant such as *Distichlis spicata*, *Puccinellia* spp., *Salicornia* spp., and *Schoenoplectus maritimus* ..... **Western Great Plains Saline Depression Wetland**

3b. Depressional wetlands in the Western Great Plains with obvious vegetation zonation dominated by emergent herbaceous vegetation, including *Eleocharis* spp., *Schoenoplectus* spp., *Phalaris arundinacea*, *Calamagrostis canadensis*, *Hordeum jubatum*, and *Pascopyrum smithii* **4**

4a. Depressional wetlands in the Western Great Plains associated with open basins that have an obvious connection to the groundwater table. This system can also occur along stream margins where it is linked to the basin via groundwater flow. Typical plant species include species of *Typha*, *Carex*, *Schoenoplectus*, *Eleocharis*, *Juncus*, and floating genera such as *Potamogeton*, *Sagittaria*, and *Ceratophyllum*.. ..... **Western Great Plains Open Freshwater Depression Wetland**

4b. Depressional wetlands in the Western Great Plains primarily within upland basins having an impermeable layer such as dense clay. Recharge is typically via precipitation and runoff, so this system typically lacks a groundwater connection. Wetlands in this system tend to have standing water for a shorter duration than Western Great Plains Open Freshwater Depression Wetlands. Common species include *Eleocharis* spp., *Hordeum jubatum*, and *Pascopyrum smithii* ..... **Western Great Plains Closed Depression Wetland**

5a. Small (<0.1 ha) depressional, herbaceous wetlands occurring within dune fields of the Great Basin, Wyoming Basin, and other small inter-montane basins ..... **Inter-Mountain Basins Interdunal Swale Wetland**

5b. Herbaceous wetlands not associated with dune fields **6**

6a. Depressional wetlands occurring in areas with alkaline to saline clay soils with hardpans. Salt encrustations can occur on the surface. Species are typically salt-tolerant such as *Distichlis spicata*, *Puccinellia* spp., *Leymus* sp., *Poa secunda*, *Salicornia* spp., and *Schoenoplectus maritimus*. Communities within this system often occur in alkaline basins and swales and along the drawdown zones of lakes and ponds. ..... **Inter-Mountain Basins Alkaline Closed Depression**

6b. Herbaceous wetlands not associated with alkaline to saline hardpan clay soils. **7**

7a. Wetlands with a permanent water source throughout all or most of the year. Water is at or above the surface throughout the growing season, except in drought years. This system can occur around ponds, as fringes around lakes and along slow-moving streams and rivers. The vegetation is dominated by common emergent and floating leaved species including species of *Scirpus*, *Schoenoplectus*, *Typha*, *Juncus*, *Carex*, *Potamogeton*, *Polygonum*, and *Nuphar*. ..... **Western North American Emergent Marsh**

7b. Herbaceous wetlands associated with a high water table or overland flow, but typically lacking standing water. Sites with *no channel formation* are typically associated with snowmelt and not subjected to high disturbance events such as flooding (Slope HGM Class). Sites *associated with a stream channel* are more tightly connected to overbank flooding from the stream channel than with snowmelt and groundwater discharge and may be subjected to high disturbance events such as flooding (Riverine HGM Class). Vegetation is dominated by herbaceous species; typically graminoids have the highest canopy cover including *Carex* spp., *Calamagrostis* spp., and *Deschampsia caespitosa* ..... **Rocky Mountain Alpine-Montane Wet Meadow**

KEY C: Sparsely Vegetated Ecological Systems

1a. Sites are restricted to drainages with a variety of sparse or patchy vegetation including *Sarcobatus vermiculatus*, *Ericameria nauseosa*, *Artemisia cana*, *Artemisia tridentata*, *Grayia spinosa*, *Distichlis spicata*, and *Sporobolus airoides*. ..... **Inter-Mountain Basins Wash**

1b. Sites occur on barren or sparsely vegetated playas that are intermittently flooded and may remain dry for several years. Soil is typically saline, and salt encrustrations are common. Plant species are salt-tolerant and can include *Sarcobatus vermiculatus*, *Distichlis spicata*, and *Atriplex* spp. ..... **Inter-Mountain Basins Playa**

Appendix A, Table 1: General life zones found in Colorado, Montana, Wyoming, and Utah. Note that elevations at which a life zone begins and ends is dependent upon latitude, aspect, and topographic variation.

	Colorado		Montana		Wyoming		Utah	
Life Zone	Elevation range (feet)	Dominant vegetation	Elevation range (feet)	Dominant vegetation	Elevation range (feet)	Dominant vegetation	Elevation range (feet)	Dominant vegetation
Foothills - Lower Montane	<5,500-8,000	Gambel oak, pinon-juniper, sagebrush in foothills to ponderosa pine, Douglas-fir in lower montane	<4,000-6,000	bunchgrasses, ponderosa pine, juniper, sagebrush	>5,000-6,000	bunchgrasses, ponderosa pine, juniper, sagebrush	<5,500-8,000	pinyon-juniper woodlands, oak-maple shrublands.
Montane	8,000-9,500	Douglas-fir, lodgepole pine, aspen	>4,500-7,600	Douglas-fir, spruce, cedar, lodgepole pine	6,000-7,600	Douglas-fir, spruce, lodgepole pine	8,000-9,500	lodgepole pine, ponderosa pine, aspen, Douglas-fir
Subalpine	9,500-11,500	subalpine fir, Engelmann spruce	5,000-8,800	subalpine fir, Engelmann spruce	7,600-10,000	subalpine fir, Engelmann spruce	>9,500	spruce-fir
Alpine	>11,500	grassland/tundra	>6,000-8,800	grassland/tundra	>10,000	grassland/tundra	>11,200	grassland/tundra

APPENDIX B: 2011 Level 2 EIA Condition Assessment Field Forms

2011 CNHP RAPID WETLAND CONDITION ASSESSMENT FIELD FORM

LOCATION AND GENERAL INFORMATION

Point Code: _____ Site Name: _____ LEVEL 2 ASSESSMENT

Date: _____ Surveyors: _____

General Location: _____ County: _____

General Ownership: _____ Specific Ownership: _____

Directions to Point and Access Comments:

GPS COORDINATES OF TARGET POINT AND ASSESSMENT AREA (NAD 83 UTM Zone _____)

Point WP #: _____ UTM E: ___ ___ ___ ___ ___ ___ UTM N: ___ ___ ___ ___ ___ ___ ___ Error (+/-): _____

Elevation (m):	Slope 1 (deg):	Aspect 1 (deg):
Point is: ____Within target population ____ Not within target population, but within 60 m of target population	AA is: ____ Centered at point ____ Not centered at point, but includes point ____ Shifted, point outside	Dimensions of AA: ____40 m radius circle ____Rectangle, width_____ length:_____ ____Other, describe and take a GPS Track

AA-Center (Circle AAs Only) WP #: _____ UTM E: ___ ___ ___ ___ ___ ___ UTM N: ___ ___ ___ ___ ___ ___ ___ Error (+/-): _____

AA-1 WP #: _____ UTM E: ___ ___ ___ ___ ___ ___ UTM N: ___ ___ ___ ___ ___ ___ ___ Error (+/-): _____

AA-2 WP #: _____ UTM E: ___ ___ ___ ___ ___ ___ UTM N: ___ ___ ___ ___ ___ ___ ___ Error (+/-): _____

AA-3 WP #: _____ UTM E: ___ ___ ___ ___ ___ ___ UTM N: ___ ___ ___ ___ ___ ___ ___ Error (+/-): _____

AA-4 WP #: _____ UTM E: ___ ___ ___ ___ ___ ___ UTM N: ___ ___ ___ ___ ___ ___ ___ Error (+/-): _____

AA-Track Track Name: _____ Comments: _____

AA Placement and Dimensions Comments:

PHOTOS OF ASSESSMENT AREA (Taken at four points on edge of AA looking in. Record WPs of each photo in table above.)

AA-1 Photo #: _____ Aspect: _____

AA-2 Photo #: _____ Aspect: _____

AA-3 Photo #: _____ Aspect: _____

AA-4 Photo #: _____ Aspect: _____

Additional AA Photos and Comments:

(Note range of photo numbers and explain particular photos of interest)

Point Code_____

ENVIRONMENTAL DESCRIPTION AND CLASSIFICATION OF ASSESSMENT AREA

Non-target Inclusions

% AA with > 1m standing water: _____

% AA with upland inclusions: _____

Wetland origin

____ Natural feature with minimal alteration

____ Natural feature, but altered or augmented by modification

____ Non-natural feature created by management action

Ecological System (see manual for key and rules on inclusions and pick *only one*) Conf: High Med Low

Cowardin Classification (pick *one each*) Conf: High Med Low

System and Class:		Water Regime:		Modifier (optional):	
____ PEM	____ PAB	____ A	____ F	____ b	____ h
____ PSS	____ PUB	____ B	____ G	____ x	____ f
____ PFO	____ PUS	____ C	____ H	____ d	

HGM Class (pick *only one*) Conf: High Med Low

____Riverine* ____Lacustrine Fringe

____Depressional ____ Slope

____ Flats ____ Unknown

**Specific classification and metrics apply to the Riverine HGM Class*

***RIVERINE SPECIFIC* CLASSIFICATION OF THE ASSESSMENT AREA**

Confined vs. Unconfined Valley Setting

Estimated Valley Width (m): _____

Estimated Bankfull Width (m): _____

____Confined Valley Setting (valley width < 2x bankfull width)

____Unconfined Valley Setting (valley width ≥ 2x bankfull width)

AA Proximity to Channel

_____ AA includes the channel and both banks

_____ AA is adjacent to or near the channel (< 50 m) and evaluation includes one or both banks

_____ AA is > 50 m from the channel and banks were not evaluated

Stream Depth at Time of Survey (if evaluated)

_____ Wadeable

_____ Non-wadeable

BIOTIC AND ABIOTIC ZONES WITHIN THE ASSESSMENT AREA (See manual for rules and definitions. Mark each zone on the site sketch.)

Zone 1 Life Form / Type_____ Dom spp: _____ % of AA: _____

Zone 2 Life Form / Type_____ Dom spp: _____ % of AA: _____

Zone 3 Life Form / Type_____ Dom spp: _____ % of AA: _____

Zone 4 Life Form / Type_____ Dom spp: _____ % of AA: _____

Zone 5 Life Form / Type_____ Dom spp: _____ % of AA: _____

ENVIRONMENTAL AND CLASSIFICATION COMMENTS

** Include reason for medium or low confidence on classification**

Is AA representative of larger wetland (note if AA is entire wetland):

Point Code_____

ASSESSMENT AREA DRAWING

Add north arrow and approx scale bar. Document vegetation zones, inflows and outflows, and indicate direction of drainage. Include sketch of vegetation plot and soil pit placement.

ASSESSMENT AREA DESCRIPTION AND COMMENTS

Note wildlife species observed:

Point Code_____

VEGETATION PLOT GROUND COVER AND VERTICAL STRATA			
		Module →	R
Cover Classes 1: trace 2: <1% 3: 1–<2% 4: 2–<5% 5: 5–<10% 6: 10–<25% 7: 25–<50% 8: 50–<75% 9: 75–<95% 10: >95%			
		Cover Class (unless otherwise noted) →	C
Ground Cover			
Cover of water (any depth, vegetated or not, standing or flowing)			
Set 1 (sum= 100%)	Cover of shallow water <20 cm / Mean depth of most shallow water (cm)		/
	Cover of deep water >20 cm / Mean depth of most deep water (cm)		/
Set 2 (sum= 100%)	Cover of open water with no vegetation		
	Cover of water with submergent or floating aquatic vegetation		
	Cover of water with emergent vegetation		
Cover of exposed bare ground* – soil / sand / sediment			
Cover of exposed bare ground – gravel / cobble (~2–250 mm)			
Cover of exposed bare ground – bedrock / rock / boulder (>250 mm)			
Cover of litter (all cover, including under water or vegetation)			
Depth of litter (cm) – average of 4 non-trampled locations where litter occurs			
Predominant litter type (C = coniferous, E = broadleaf evergreen, D = deciduous, S = sod/thatch, F = forb)			
Cover of standing dead trees (>5 cm diameter at breast height)			
Cover of standing dead shrubs or small trees (<5 cm diameter at breast height)			
Cover of downed coarse woody debris (fallen trees, rotting logs, >5 cm diameter)			
Cover of downed fine woody debris (<5 cm diameter)			
Cover bryophytes (all cover, including under vegetation or litter cover)			
Cover lichens (all cover, including under vegetation or litter cover)			
Cover algae (all cover, including under vegetation or litter cover)			
*Bare ground has no vegetation/litter/water cover.			
Height Classes 1: <0.5 m 2: 0.5–1m 3: 1–2 m 4: 2–5 m 5: 5–10 m 6: 10–15 m 7: 15–20 m 8: 20–35 m 9: 35–50 m 10: >50 m			
		Cover / Height →	C / H
Vertical Vegetation Strata (Live or very recently dead with leaves/needles/herbaceous)			
(T1) Dominant canopy trees (>5 m and > 30% cover)			
(T2) Sub-canopy trees (> 5m but < dominant canopy height) or trees with sparse cover			
(S1) Tall shrubs or older tree saplings (2–5 m)			
(S2) Short shrubs or young tree saplings (0.5–2 m)			
(S3) Dwarf shrubs or tree seedlings (<0.5 m; includes short Vaccinium sp, etc.)			
(HT) Herbaceous total			
(H1) Graminoids			
(H2) Forbs			
(H3) Ferns and fern allies			
(AQ) Submergent or floating aquatics			

Point Code________________

VEGETATION PLOT SPECIES TABLE

Cover Classes 1: trace 2: <1% 3: 1–<2% 4: 2–<5% 5: 5–<10% 6: 10–<25% 7: 25–<50% 8: 50–<75% 9: 75–<95% 10: >95%

Coll #	Scientific Name or Pseudonym (if repeated/common pseudonym, mark with *)	Cover Class	Photo #'s

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Point Code__________________

VEGETATION PLOT SPECIES TABLE			
Cover Classes 1: trace 2: <1% 3: 1–<2% 4: 2–<5% 5: 5–<10% 6: 10–<25% 7: 25–<50% 8: 50–<75% 9: 75–<95% 10: >95%			
Coll #	Scientific Name or Pseudonym (if repeated/common pseudonym, mark with *)	Cover Class	Photo #'s

Point Code_____

SOIL PROFILE DESCRIPTION – SOIL PIT 1 **Time pit dug:** _____ **Time water depth observed:** _____ **Photo #s** _____ **GPS Waypoint** _____ **(mark on site sketch)**

Soil survey unit: _____ Soil pit matches soil survey unit? ☐ Yes ☐ No Explain in comments.

Depth to saturated soil (cm): _____ Depth to free water (cm): _____ ☐ Not observed* Groundwater pH: _____ EC: _____ Temp: _____

Horizon (optional)	Depth (cm)	Matrix Color (moist)	Redox Concentrations Color (moist)	%	Redox Depletions Color (moist)	%	Texture	Remarks

Hydric Soil Indicators: See field manual for descriptions and check all that apply to pit.

____Histosol (A1)
____Histic Epipedon (A2/A3)
____Mucky Mineral (S1/F1)
____Hydrogen Sulfide Odor (A4)
____Gleyed Matrix (S4/F2)
____Depleted Matrix (A11/A12/F3)
____Redox Concentrations (S5/F6/F8)
____Redox Depletions (S6/F7)

Comments:

*If free water is not observed in pit, circle: A. Pit is filling slowly OR B. Pit appears dry

SOIL PROFILE DESCRIPTION – SOIL PIT 2 **Time pit dug:** _____ **Time water depth observed:** _____ **Photo #s** _____ **GPS Waypoint** _____ **(mark on site sketch)**

Soil survey unit: _____ Soil pit matches soil survey unit? ☐ Yes ☐ No Explain in comments.

Depth to saturated soil (cm): _____ Depth to free water (cm): _____ ☐ Not observed* Groundwater pH: _____ EC: _____ Temp: _____

Horizon (optional)	Depth (cm)	Matrix Color (moist)	Redox Concentrations Color (moist)	%	Redox Depletions Color (moist)	%	Texture	Remarks

Hydric Soil Indicators: See field manual for descriptions and check all that apply to pit.

____Histosol (A1)
____Histic Epipedon (A2/A3)
____Mucky Mineral (S1/F1)
____Hydrogen Sulfide Odor (A4)
____Gleyed Matrix (S4/F2)
____Depleted Matrix (A11/A12/F3)
____Redox Concentrations (S5/F6/F8)
____Redox Depletions (S6/F7)

Comments:

*If free water is not observed in pit, circle: A. Pit is filling slowly OR B. Pit appears dry

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Point Code_____

LEVEL 2 ECOLOGICAL INTEGRITY ASSESSMENT FOR SOUTHERN ROCKY MOUNTAIN WETLANDS

1. LANDSCAPE CONTEXT METRICS – Check the applicable box.

1a. LANDSCAPE FRAGMENTATION		
Select the statement that best describes the **landscape fragmentation** within a 500 m envelope surrounding the AA. To determine, identify the largest unfragmented block *that includes the AA* within the 500 m envelope and estimate its percent of the total envelope. Well-traveled dirt roads and major canals count as fragmentation, but hiking trails, hayfields, fences and small ditches can be included in unfragmented blocks (see definitions).	Intact: AA embedded in >90–100% unfragmented, natural landscape.	
	Variegated: AA embedded in >60–90% unfragmented, natural landscape.	
	Fragmented: AA embedded in >20–60% unfragmented, natural landscape.	
	Relictual: AA embedded in ≤20% unfragmented, natural landscape.	
1b. RIPARIAN CORRIDOR CONTINUITY *(RIVERINE WETLANDS ONLY)*		
For riverine wetlands, select the statement that best describes the **riparian corridor continuity** within 500 m upstream and downstream of the AA. To determine, identify any non-buffer patches (see definitions) within the riparian corridor (natural geomorphic floodplain) both upstream and downstream of the AA. Estimate the percentage of the riparian corridor they occupy. *For AAs on one side of a very large river channel (~20 m width),* only consider the riparian corridor on that side of the channel.	Intact: >95–100% natural habitat within the riparian corridor both upstream and downstream.	
	Variegated: >80–95% natural within the riparian corridor both upstream and downstream.	
	Fragmented: >50–80% natural habitat within the riparian corridor both upstream and downstream.	
	Relictual: ≤50% natural habitat within the riparian corridor both upstream and downstream.	
Landscape fragmentation and riparian corridor continuity comments:		
1c. BUFFER EXTENT		
Select the statement that best describes the **extent of buffer land cover** surrounding the AA. To determine, estimate the percent of the AA surrounded by buffer land covers (see definitions). Each segment must be ≥ 25 m wide and ≥ 5 long. *For AAs on one side of a very large river channel (~20 m width),* only consider the buffer on that side of the channel.	Buffer land covers surround >100% of the AA.	
	Buffer land covers surround >75–<100% of the AA.	
	Buffer land covers surround >50–75% of the AA.	
	Buffer land covers surround >25–50% of the AA.	
	Buffer land covers surround ≤25% of the AA.	
1d. BUFFER WIDTH		
Select the statement that best describes the **buffer width**. To determine, estimate width (up to 200 m from AA) at eight evenly spaced intervals. *For AAs on one side of a very large river channel (~20 m width),* only estimate buffer width on that side of the channel.		
1: _____ 5: _____ 2: _____ 6: _____ 3: _____ 7: _____ 4: _____ 8: _____ *Average width:* _____	Average buffer width is >200 m	
	Average buffer width is >100–200 m	
	Average buffer width is >50–100 m	
	Average buffer width is >25–50 m	
	Average buffer width is ≤25 m OR no buffer exists	

Point Code_____

1e. BUFFER CONDITION

Select the statement that best describes the **buffer condition.** Select one statement per columns. Only consider the actual buffer measured in metrics 1c and 1d.

Abundant (≥95%) relative cover native vegetation and little or no (<5%) cover of non-native plants.		Intact soils, little or no trash or refuse, and no evidence of human visitation.	
Substantial (≥75–95%) relative cover of native vegetation and low (5–25%) cover of non-native plants.		Intact or moderately disrupted soils, moderate or lesser amounts of trash, OR minor intensity of human visitation or recreation.	
Moderate (≥50–75%) relative cover of native vegetation.		Moderate or extensive soil disruption, moderate or greater amounts of trash, OR moderate intensity of human use.	
Low (<50%) relative cover of native vegetation OR no buffer exists.		Barren ground and highly compacted or otherwise disrupted soils, moderate or greater amounts of trash, moderate or greater intensity of human use, OR no buffer exists.	

Buffer comments:

1f. LANDSCAPE STRESSORS AND ONSITE AND SURROUNDING LAND USE (For use in the Human Disturbance Index)

Using the table below, estimate the percent of each **landscape stressor within a 500 m envelope** of the AA. Independent percentages can overlap (e.g., light grazing can occur along with moderate recreation). In addition, estimate the cumulative % of land uses within the 500 m envelope and the AA. Start at the top of the list and only record the most severe stressor in areas where two or more land uses overlap. The total for both cumulative columns should = 100%.

Landscape stressor/ land use categories	*Independent % within 500 m Envelope*	*Cumulative % of Land Use within 500 m Envelope*	*Cumulative % of Land Use within AA*
Paved roads, parking lots, railroad tracks			
Domestic or commercially developed buildings			
Gravel pit operation, open pit mining, strip mining			
Unpaved roads (e.g., driveway, tractor trail, 4-wheel drive roads)			
Mining (other than gravel, open pit, and strip mining), abandoned mines			
Resource extraction (oil and gas wells and surrounding footprint)			
Agriculture – tilled crop production			
Intensively managed golf courses, sports fields, urban parks, expansive lawns			
Vegetation conversion (chaining, cabling, rotochopping, or clear-cutting of woody veg)			
Heavy grazing/browse by livestock or native ungulates			
Intense recreation or human visitation (ATV use / camping / popular fishing spot, etc.)			
Logging or tree removal with 50-75% of trees >50 cm dbh removed			
Agriculture – permanent crop (hay pasture, vineyard, orchard, tree plantation)			
Dam sites and flood disturbed shorelines around water storage reservoirs			
Recent old fields and other disturbed fallow lands dominated by non-native species			
Moderate grazing/browse by livestock or native ungulates			
Moderate recreation or human visitation (high-use trail)			
Selective logging or tree removal with <50% of trees >50 cm dbh removed			
Light grazing/browse by livestock or native ungulates			
Light recreation or human visitation (low-use trail)			
Haying of native grassland (land not dominated by non-native hay grasses)			
Fallow with no history of grazing or human use in past 10 years (primarily native veg)	NA		
Natural area / land managed for natural vegetation	NA		
Beetle-killed conifers		NA	NA
Evidence of recent fire (<5 years old, still very apparent on vegetation, little regrowth)		NA	NA
Other:			

Landscape stressor comments:

Point Code_____

1g. NATURAL COVER WITHIN A 100 M ENVELOPE (Supplemental Information)			
Using the table below, estimate the percent cover of each **natural cover type within a 100 m envelope** of the AA. Natural cover is not restricted to native vegetation; it could contain a mix of native and non-native vegetation. This measure applies to the entire 100 m envelope and not just buffer land covers. Estimate the total combined cover and wetland and upland cover separately.			
Natural Cover Type	*Total % Cover*	*Upland % Cover*	*Wetland % Cover*
Total non-natural cover (development, row crops, feed lots, etc).			
Total natural cover (breakdown by type below)			
A. Deciduous forest			
B. Coniferous forest			
C. Mixed forest type (neither deciduous nor coniferous trees dominate)			
D. Shrubland			
E. Perennial herbaceous (includes passively managed hay)			
F. Annual herbaceous or disturbed bare (generally weedy)			
G. Naturally bare (open water, rock, snow/ice)			
Natural cover comments (and note the dominant species from above): A. B. C. D. E. F. G.			

2. VEGETATION CONDITION METRICS – Check the applicable box.

2a-d. VEGETATION COMPOSITION	
Vegetation composition metrics will be calculated out of the field based on the species list and cover values. To aid data interpretation, provide comments on composition and **list noxious species identified in field:**	
2e. REGENERATION OF NATIVE WOODY SPECIES	
Select the statement that best describes the **regeneration of native woody species** within the AA.	
Woody species are naturally uncommon or absent.	**N/A**
All age classes of desirable (native) woody riparian species present.	
Age classes restricted to mature individuals and young sprouts. Middle age groups absent.	
Stand comprised of mainly mature species.	
Woody species predominantly consist of decadent or dying individuals or AA has >5% canopy cover of Russian Olive and/or Salt Cedar.	
Regeneration comments:	

Point Code_____

2f. BROWSE ON WOODY SPECIES		
Select the statement that best describes the **extent of browse on woody species** within the AA. Pay more attention to second year or older stems as heavily browse individuals may produce large or prolific resprouts each year as a response to winter browse pressure.	Woody species are naturally uncommon or absent	**N/A**
	<5% of stems are browsed.	
	5–25% of stems are browsed.	
	25–50% of stems are browsed.	
	>50% of stems are browsed.	
Browse comments:		

2g. HERBACEOUS / DECIDUOUS LITTER ACCUMULATION	
Select the statement that best describes **herbaceous and/or deciduous litter accumulation** within the AA.	
AA characterized by moderate amount of fine or coarse litter. New growth is more prevalent than previous years'. Litter and duff layers in pools and topographic lows are thin. Organic matter is neither lacking nor excessive.	
AA characterized by small amounts of litter with little plant recruitment OR litter is somewhat excessive.	
AA lacks litter OR litter is extensive and limiting new growth.	
Herbaceous / deciduous litter accumulation comments:	

2h. STRUCTURAL PATCH TYPES WITHIN THE ASSESSMENT AREA

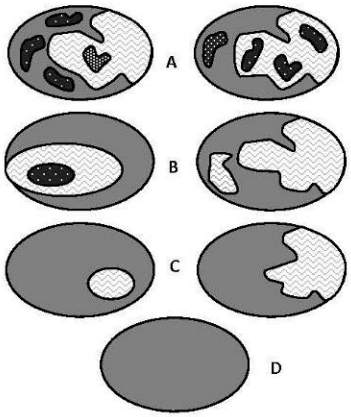
Using the following worksheet, mark all structural patch types that occur within or adjacent to the AA. Check all those that occur and record photo numbers if taken. See the field manual for patch type definitions.

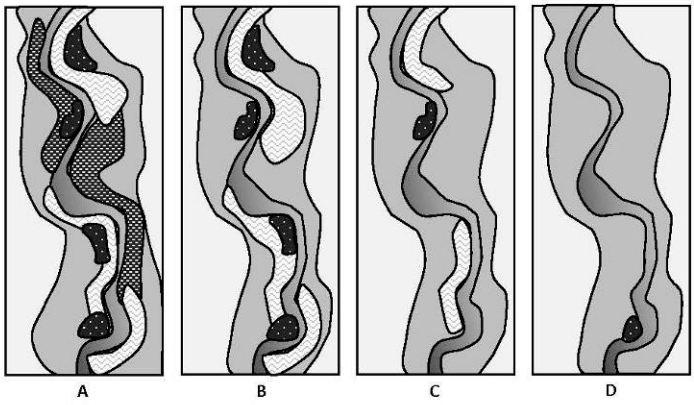
Patch type	*Photo #'s*	*Patch type*	*Photo #'s*
Open water - river / stream		Point bar	
Open water - tributary / secondary channel		Interfluve on floodplain	
Open water - oxbow / backwater channel		Bank slumps or undercut banks in channel or along shoreline	
Open water - rivulets / streamlet / small channel		Adjacent or onsite seep / spring	
Open water - ditch or canal		Animal mounds or burrows	
Open water - pond or lake (>1000 m^2)		Mudflat	
Open water - pools (<1000 m^2)		Salt flat / alkali flat	
Open water - beaver pond		Hummock / tussock (naturally formed)	
Active beaver dam		Water tracks / hollow	
Beaver canal		Floating mat	
Debris jams / woody debris in channel		Marl / Limonite bed	
Pools in stream		Other:	
Riffles in stream		Other:	
Structural patch types comments:			

Point Code_____

2i. HORIZONTAL INTERSPERSION OF VEGETATION ZONES

Refer to diagrams below and select the statement that best describes the **horizontal interspersion of biotic and abiotic zones** within the AA. Rules for defining zones are in the field manual. Include zones of open water when evaluating interspersion.	High degree of horizontal interspersion: AA characterized by a very complex array of nested or interspersed vegetation zones with no single dominant zone.	
	Moderate degree of horizontal interspersion: AA characterized by a moderate array of nested or interspersed vegetation zones with no single dominant zone.	
	Low degree of horizontal interspersion: AA characterized by a simple array of nested or interspersed vegetation zones. One zone may dominate others.	
	No horizontal interspersion: AA characterized by one dominant vegetation zone.	





Horizontal interspersion comments (note if interspersion is not related to wetland integrity such as in *Carex*-dominated fens):

2j. VEGETATION STRESSORS WITHN THE AA

Using the table below, estimate the independent scope of each vegetation stressor within the AA. Independent scopes can overlap (e.g., light grazing can occur along with moderate recreation). ***Scope rating: 1 = 1–10%, 2 = >10–25%, 3 = >25–50%, 4 = >50–75%, 5 = >75%.***

Vegetation stressor categories	*Scope*
Unpaved Roads (e.g., driveway, tractor trail, 4-wheel drive roads)	
Vegetation conversion (chaining, cabling, rotochopping, clearcut)	
Logging or tree removal with 50-75% of trees >50 cm dbh removed	
Selective logging or tree removal with <50% of trees >50 cm dbh removed	
Heavy grazing/browse by livestock or native ungulates	
Moderate grazing/browse by livestock or native ungulates	
Light grazing/browse by livestock or native ungulates	
Intense recreation or human visitation (ATV use / camping / popular fishing spot, etc.)	
Moderate recreation or human visitation (high-use trail)	
Light recreation or human visitation (low-use trail)	
Recent old fields and other disturbed fallow lands dominated by exotic species	
Haying of native grassland	
Beetle-killed conifers	
Evidence of recent fire (<5 years old)	
Other:	

Vegetation stressor comments:

Point Code_____

3. *PHYSIOCHEMICAL METRICS – Check the applicable box.*

3a. SUBSTRATE / SOIL DISTURBANCE	
Select the statement below that best describes **disturbance to the substrate or soil** within the AA.	
No soil disturbance within AA. Little bare soil OR bare soil areas are limited to naturally caused disturbances such as flood deposition or game trails OR soil is naturally bare (e.g., playas). No pugging or soil compaction.	
Minimal soil disturbance within AA. Some amount of bare soil, pugging, or compaction present due to human causes, but the extent and impact is minimal. The depth of disturbance is limited to only a few inches and does not show evidence of ponding or channeling water. Any disturbance is likely to recover within a few years after the disturbance is removed.	
Moderate soil disturbance within AA. Bare soil areas due to human causes are common and will be slow to recover. There may be pugging due to livestock resulting in several inches of soil disturbance. ORVs or other machinery may have left some shallow ruts. Damage is not excessive and the site will recover to potential with the removal of degrading human influences and moderate recovery times.	
Substantial soil disturbance within AA. Bare soil areas substantially degrade the site due to altered hydrology or other long-lasting impacts. Deep ruts from ORVs or machinery may be present, or livestock pugging and/or trails are widespread. Water, if present, would be channeled or ponded. The site will not recover without restoration and/or long recovery times.	
Substrate / soil comments and photo #'s:	

3b. WATER QUALITY - SURFACE WATER TURBIDITY / POLLUTANTS	
Select the statement that best describes the **turbidity or evidence or pollutants** in surface water within the AA.	
No visual evidence of degraded water quality. No visual evidence of turbidity or other pollutants.	
Some negative water quality indicators are present, but limited to small and localized areas within the wetland. Water is slightly cloudy, but there is no obvious source of sedimentation or other pollutants.	
Water is cloudy or has unnatural oil sheen, but the bottom is still visible. Sources of water quality degradation are apparent (identify in comments below). *Note: If the sheen breaks apart when you run your finger through it, it is a natural bacterial process and not water pollution.*	
Water is milky and/or muddy or has unnatural oil sheen. The bottom is difficult to see. There are obvious sources of water quality degradation (identify in comments below). *Note: If the sheen breaks apart when you run your finger through it, it is a natural bacterial process and not water pollution.*	
Surface water turbidity / pollutants comments and photo #'s:	

3c. WATER QUALITY - ALGAL GROWTH	
Select the statement that best describes **algal growth** within surface water in the AA.	
Water is clear with minimal algal growth.	
Algal growth is limited to small and localized areas of the wetland. Water may have a greenish tint or cloudiness.	
Algal growth occurs in moderate to large patches throughout the AA. Water may have a moderate greenish tint or sheen. Sources of water quality degradation are apparent (identify in comments below).	
Algal mats are extensive, blocking light to the bottom. Water may have a strong greenish tint and the bottom is difficult to see. There are obvious sources of water quality degradation (identify in comments below).	
Algal growth comments and photo #'s: If naturally occurring algae is present, describe and record % of total algae that is due to natural processes.	

Point Code_____

3d. PHYSIOCHEMICAL STRESSORS WITHIN THE AA	
Using the table below, estimate the independent scope of each physiochemical stressor within the AA. Independent scopes can overlap (e.g., soil compaction can occur with trash or refuse). ***Scope rating: 1 = 1–10%, 2 = >10–25%, 3 = >25–50%, 4 = >50–75%, 5 = >75%.***	
Physiochemical stressor categories	*Scope*
Erosion	
Sedimentation	
Current plowing or disking	
Historic plowing or disking (evident by abrupt A horizon boundary at plow depth)	
Substrate removal (excavation)	
Filling or dumping of sediment	
Trash or refuse dumping	
Compaction and soil disturbance by livestock or native ungulates	
Compaction and soil disturbance by human use (trails, ORV use, camping)	
Mining activities, current or historic	
Obvious point source of water pollutants (note source in comments)	
Non-point sources of water pollutants, such as agricultural fields, urban runoff, feedlots, etc.	
Other:	
Physiochemical stressor comments:	

4. HYDROLOGY METRICS – Check the applicable box.

4a. WATER SOURCES / INPUTS		
Select the statement below that best describes the **water sources** feeding the AA during the growing season. Check off all *major* water sources in the table to the right. If the dominant water source is evident, mark it with a star.	_____ Overbank flooding _____ Alluvial / hyporheic flow _____ Groundwater discharge _____ Precipitation _____ Snowmelt	_____ Natural surface flow _____ Irrigation run-off / ditches _____ Urban run-off / culverts _____ Pipes (directly feeding wetland) _____ Other:
Sources are precipitation, groundwater, natural runoff, or natural flow from an adjacent freshwater body, or the AA naturally lacks water in the growing season. There is no indication that growing season conditions are controlled by artificial water sources.		
Sources are mostly natural, but also obviously include occasional or small effects of modified hydrology (e.g., developed land or irrigated agricultural land that comprises less than 20% of the immediate drainage basin within about 2 km upstream of the AA, presence of a few small stormdrains or scattered homes with septic systems). No large point sources or dams control the overall hydrology.		
Sources are primarily from anthropogenic sources (e.g., urban runoff, direct irrigation, pumped water, artificially impounded water, or another artificial hydrology). Indications of substantial artificial hydrology include developed or irrigated agricultural land that comprises more than 20% of the immediate drainage basin within about 2 km upstream of the AA, or the presence of major drainage point source discharges that obviously control the hydrology of the AA.		
Natural sources have been **eliminated** based on the following indicators: impoundment of all wet season inflows, diversions of all dry-season inflows, predominance of xeric vegetation, etc.		
Water source comments :		

4b. HYDROPERIOD	
Select the statement below that best describes the **hydroperiod** within the AA (extent and duration of inundation and/or saturation). Search the AA and 500 m envelope for hydrologic stressors (see list below). Use best professional judgment to determine the overall condition of the hydroperiod.	
Hydroperiod is characterized by natural patterns of filling or inundation and drying or drawdowns.	
Hydroperiod filling or inundation patterns deviate slightly from natural conditions due to presence of stressors such as small ditches or diversions, berms or roads at/near grade, pugging, or minor flow additions.	

Point Code_____

Hydroperiod filling or inundation and drying patterns deviate moderately from natural conditions due to presence of stressors such as 1-3ft deep ditches or diversions, two lane roads, roads with culverts adequate for stream flow, moderate pugging, or moderate flow additions.	
Hydroperiod filling or inundation and drawdown of the AA deviate substantially from natural conditions from high intensity alterations such as a 4-lane highway, large dikes, > 3ft diversions or ditches capable of lowering water table, large amount of fill, artificial groundwater pumping, or heavy flow additions.	
Hydroperiod comments :	

4c. HYDROLOGIC CONNECTIVITY

Select the statement below that best describes the **hydrologic connectivity**. *Rating criteria is different for naturally isolated fens than for other wetlands.*

Rising water has unrestricted access to adjacent areas without levees or other obstructions to the lateral movement of flood waters and no artificial connectivity with the surrounding water bodies. Channel, if present, is not entrenched (see entrenchment ratio on following page).	
Unnatural features such as levees or road grades limit the amount of adjacent transition zone or the lateral movement of floodwaters, relative to what is expected for the setting, but limitations exist for <50% of the AA boundary. Restrictions may be intermittent along the margins of the AA, or they may occur only along one bank or shore. Channel, if present, is somewhat entrenched. If naturally isolated fen, non-natural connectivity (i.e. ditching) can cause drying.	
The amount of adjacent transition zone or the lateral movement of flood waters to and from the AA is limited, relative to what is expected for the setting, by unnatural features such as levees or road grades, for 50–90% of the boundary of the AA. Flood flows may exceed the obstructions, but drainage out of the AA is probably obstructed. Channel, if present, is moderately entrenched. If fen, peat body is drying.	
The amount of adjacent transition zone or the lateral movement of flood waters is limited, relative to what is expected for the setting, by unnatural features such as levees or road grades, for >90% of the boundary of the AA. Channel, if present, is severely entrenched. If fen, peat body is drying substantially.	
Hydrologic connectivity comments:	

4d. HYDROLOGY STRESSORS WITHIN A 500 M ENVELOPE

Using the table below, mark the severity of each **hydrology stressor within a 500 m envelope of the AA**. Mark whether the stressor is present upstream/slope or downstream/slope of the AA. If known alteration occurs further upstream than 500 m, please explain in comments below.

Hydrology stressor categories	*Upstream / Upslope*	*Downstream / Downslope*
Dam / reservoir		
Impoundment / stock pond		
Spring box diverting water from wetland		
Pumps, diversions, ditches that move water *out of* the wetland		
Pumps, diversions, ditches that move water *into* the wetland		
Berms, dikes, levees that hold water in the wetland		
Weir or drop structure that impounds water and controls energy of flow		
Observed or potential agricultural runoff		
Observed or potential urban runoff		
Flow obstructions into or out of wetland (roads without culverts)		
Dredged inlet or outlet channel		
Engineered inlet or outlet channel (e.g., riprap)		
Other:		
Other:		
Hydrology stressor comments:		

Point Code_____

5. *OPTIONAL RIVERINE HYDROLOGY METRICS (use when channel is within ~50 m)*

5a. RIVERINE CHANNEL STABILITY

Select the statement below that best describes **channel stability** within or near the AA. To determine, visually survey the AA for field indicators of channel equilibrium, aggradation or degradation listed in the table below. Check "Y" for all that apply and "N" for those not observed. Use best professional judgment to determine the overall channel stability.

Condition	*Field Indicators*		
	Y	N	
Indicators of Channel Equilibrium	☐	☐	The channel (or multiple channels in braided systems) has a well-defined usual high water line or bankfull stage that is clearly indicated by an obvious floodplain, topographic bench that represents an abrupt change in the cross-sectional profile of the channel throughout most of the site.
	☐	☐	The usual high water line or bank full stage corresponds to the lower limit of riparian vascular vegetation.
	☐	☐	Leaf litter, thatch, wrack, and/or mosses exist in most pools.
	☐	☐	The channel contains embedded woody debris of the size and amount consistent with what is available in the riparian area.
	☐	☐	There is little or no active undercutting or burial of riparian vegetation.
	☐	☐	There is little evidence of recent deposition of cobble or very coarse gravel on the floodplain, although recent sandy deposits may be evident.
	☐	☐	There are no densely vegetated mid-channel bars and/or point bars.
	☐	☐	The spacing between pools in the channel tends to be 5-7 channel widths.
	☐	☐	The larger bed material supports abundant periphyton.
Indicators of Active Aggradation	☐	☐	The channel through the site lacks a well-defined usual high water line.
	☐	☐	There is an active floodplain with fresh splays of sediment covering older soils or recent vegetation.
	☐	☐	There are partially buried tree trunks or shrubs.
	☐	☐	Cobbles and/or coarse gravels have recently been deposited on the floodplain.
	☐	☐	There is a lack of in-channel pools, their spacing is greater than 5-7 channel widths, or many pools seem to be filling with sediment.
	☐	☐	There are partially buried, or sediment-choked, culverts.
	☐	☐	Transitional or upland vegetation is encroaching into the channel throughout most of the site.
	☐	☐	The bed material is loose and mostly devoid of periphyton.
Indicators of Active Degradation	☐	☐	The channel through the site is characterized by deeply undercut banks with exposed living roots of trees or shrubs.
	☐	☐	There are abundant bank slides or slumps, or the banks are uniformly scoured and unvegetated.
	☐	☐	Riparian vegetation declining in stature or vigor, and/or riparian trees and shrubs may be falling into channel.
	☐	☐	Abundant organic debris has accumulated on what seems to be the historical floodplain, indicating that flows no longer reach the floodplain.
	☐	☐	The channel bed appears scoured to bedrock or dense clay.
	☐	☐	The channel bed lacks fine-grained sediment.
	☐	☐	Recently active flow pathways appear to have coalesced into one channel (i.e. a previously braided system is no longer braided).
	☐	☐	There are one or more nick points along the channel, indicating headward erosion of the channel bed.

RATING CRITERIA FOR ALL RIVERINE WETLANDS	
Most of the channel within or near the AA is characterized by equilibrium conditions, with little evidence of aggradation or degradation. Streambanks dominated (>90% cover) by stabilizing plant species, including trees, shrubs, herbs.	
Most of the channel within or near the AA is characterized by some aggradation or degradation, none of which is severe, and the channel seems to be approaching an equilibrium form. Streambanks have 70–90% cover of stabilizing plant species, but some bare areas occur.	
There is evidence of severe aggradation or degradation of most of the channel within or near the AA or the channel is artificially hardened through less than half of the AA. Streambanks have 50–70% cover of stabilizing plant species within several bare areas.	
The channel is concrete or otherwise artificially hardened through most of the AA. Streambanks have <50% cover of stabilizing plant species.	

Channel stability comments: (note if channel is unstable due to beaver or natural processes)

Point Code_____

5b. RIVERINE ENTRENCHMENT RATIO (optional guide for if stream may be entrenched)

Using the following worksheet, calculate the average **entrenchment ratio** for the channel. The steps should be conducted for each of three cross sections located in or adjacent to the AA at the approximate mid-points along straight riffles or glides, away from deep pools or meander bends. *Do not attempt to measure this for non-wadeable streams!*

Steps	*Replicate cross-sections* →	*1*	*2*	*3*
1. Estimate bankfull width.	If the stream is entrenched, the height of bankfull flow is identified as a scour line, narrow bench, or the top of active point bars well below the top of apparent channel banks. If the stream is not entrenched, bankfull stage can correspond to the elevation of a broader floodplain with indicative riparian vegetation. Estimate or measure the distance between the right and left bankfull contours.			
2. Estimate max bankfull depth.	Imagine a line between right and left bankfull contours. Estimate or measure the height of the line above the thalweg (the deepest part of the channel).			
3. Estimate flood prone height.	Double the estimate of maximum bankfull depth from Step 2.			
4. Estimate flood prone width.	Imagine a level line having a height equal to the flood prone depth from Step 3. Note the location of the new height on the channel bank. Estimate the width of the channel at the flood prone height.			
5. Calculate entrenchment.	Divide the flood prone width (Step 4) by the max bankfull width (Step 1).			
6. Calculate average entrenchment	Average the results of Step 5 for all three cross-sections and enter it here.			

RATING CRITERIA FOR CONFINED RIVERINE WETLANDS		RATING CRITERIA FOR UNCONFINED RIVERINE WETLANDS	
Entrenchment ratio >2.0.		Entrenchment ratio >2.2.	
Entrenchment ratio 1.6–2.0.		Entrenchment ratio 1.9–2.2.	
Entrenchment ratio 1.2–1.5.		Entrenchment ratio 1.5–1.8.	
Entrenchment ratio <1.2.		Entrenchment ratio <1.5.	

Entrenchment ratio comments:

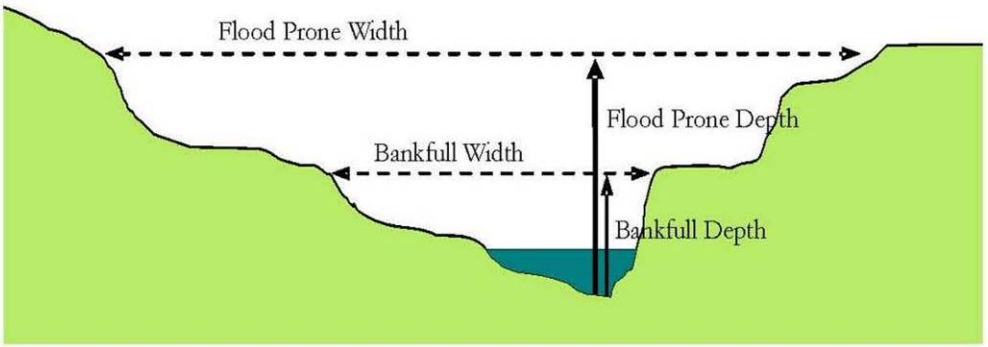


Illustration from Collins *et al.* 2008. California Rapid Assessment Method for Wetlands v 5.0.2

APPENDIX C: Ecological Integrity Assessment (EIA) Metric Rating Criteria and Scoring Formulas for 2011 RNF Riparian Surveys

	Key Ecological Attribute	Indicator / Metric	Metric Rating Criteria				
		Rank / Score	**A / 5**	**B / 4**	**C / 3**	**D / 1 –OR– D / 2 and E / 1**	
		Interpretation	**Reference (No or Minimal Human Impact)**	**Slight Deviation from Reference**	**Moderate Deviation from Reference**	**Significant Deviation from Reference**	
LANDSCAPE CONTEXT	**Landscape Connectivity**	*1a. Landscape Fragmentation within 500 m*	Embedded in >90% unfragmented, natural landscape.	Embedded in >60–90% unfragmented, natural landscape.	Embedded in >20–60% unfragmented, natural landscape.	Embedded in ≤20% unfragmented, natural landscape.	
		1b. Riparian Corridor Continuity within 500 m	>90% natural habitat upstream and downstream	>60–90% natural habitat upstream and downstream	>20–60% natural habitat upstream and downstream	≤20 natural habitat upstream and down-stream	
	Buffer	*1c. Buffer Extent*	Buffer at least 5 m wide surrounds 100% of AA	Buffer at least 5 m wide surrounds >75–<100% of AA	Buffer at least 5 m wide surrounds >50–75% of AA	Buffer at least 5 m wide surrounds >25–50% of AA	Buffer at least 5 m wide surrounds ≤25% of AA
		1d. Buffer Width	Average buffer width is >200 m	Average buffer width is >100–200 m	Average buffer width is >50–100 m	Average buffer width is ≤50 m or no buffer exists	
		1e. Buffer Condition – Vegetation	Abundant (>95%) cover native vegetation, little or no (<5%) cover of non-native plants, intact soils.	Substantial (75–95%) cover of native vegetation, low (5–25%) cover of non-native plants.	Moderate (25–50%) cover of non-native plants.	Dominant (>50%) cover of non-native plants.	
		1f. Buffer Condition – Soils	Intact soils with little-no trash, negligible intensity of human use.	Intact or moderately disrupted soils, moderate –lesser trash, OR minor intensity of human use.	Moderate-extensive soil disruption, moderate of greater amounts of trash, OR moderate intensity of human use.	Barren ground and highly compacted or disrupted soils, moderate-greater amounts of trash, moderate-greater intensity of human use, OR no buffer.	

	Key Ecological Attribute	Indicator / Metric	Metric Rating Criteria				
		Rank / Score	**A / 5**	**B / 4**	**C / 3**	**D / 1 –OR– D / 2 and E / 1**	
		Interpretation	**Reference (No or Minimal Human Impact)**	**Slight Deviation from Reference**	**Moderate Deviation from Reference**	**Significant or Severe Deviation from Reference**	
BIOTIC CONDITION	**Community Composition**[1]	*2a. Relative Cover Native Plant Species*	Relative cover native plants > 99%	Relative cover native plants >95-99%	Relative cover native plants >80-95%	Relative cover native plants >50-80%	Relative cover native plants ≤50%
		2b. Absolute Cover Noxious Weeds	Absolute cover noxious weeds = 0%	Absolute cover noxious weeds >0-3%	Absolute cover noxious weeds >3-10%	Absolute cover noxious weeds >10% noxious	
		2c. Absolute Cover Aggressive Native Species	<10% cattail or <5% reed canary grass or giant reed grass	10-25% cattail or 5-10% reed canary grass or giant reed grass	>25-50% cattail or 10-25% reed canary grass or giant reed grass	>50% cattail or >25% reed canary grass or giant reed grass	
		2d. Mean C[2]	Mean C > 6.0	Mean C > 5.5-6.0	Mean C >5.0-5.5	Mean C >4.0-5.0	Mean C ≤ 4.0
	Community Structure	*2e. Regeneration of Native Woody Species* [3]	All age classes present (N/A if woody sp. naturally uncommon/absent)	No middle age groups, others present	No young-middle age groups, mature present	Woody sp. mainly decadent and dying or >5% cover Tamarisk or Russian Olive	
		2g. Browse on Woody Species[3]	<5% of stems are browsed.	5-<25% of stems are browsed.	25-50% of stems are browsed.	>50% of stems are browsed.	
		2h. Litter Accumulation	Moderate litter and duff and organic matter, neither lacking nor excessive.		Small amounts of litter with little plant recruitment, or excessive litter.	AA lacks litter completely, or excessive litter that limits new growth.	
		2i. Structural Complexity	Horizontal structure consists of a very complex array of nested and/or interspersed, irregular biotic and abiotic patches with no single dominant patch type.	Horizontal structure consists of a moderate array of biotic and abiotic patches with no single dominant patch type.	Horizontal structure consists of a simple array of biotic and abiotic patches.	Horizontal structure consists of one dominant patch type and thus has relatively no interspersion.	

[1] All community composition metrics are derived from the vegetation species list and cover data. These metrics are not shown on the field forms.
[2] Mean C thresholds apply to specific Ecological Systems. Only the range for riparian shrublands and woodlands shown.
[3] Only applied to sites with where woody species are naturally common.

	Indicator / Metric	Metric Rating Criteria			
	Rank / Score	**A / 5**	**B / 4**	**C / 3**	**D / 1**
	Interpretation	**Reference (No or Minimal Human Impact)**	**Slight Deviation from Reference**	**Moderate Deviation from Reference**	**Significant Deviation from Reference**
HYDROLOGIC CONDITION	*3a. Water Source*	Sources are precipitation, groundwater, natural runoff, or natural flow from an adjacent freshwater body, or the AA naturally lacks water in the growing season. There is no indication that growing season conditions are controlled by artificial water sources.	Sources are mostly natural, but also obviously include occasional or small effects of modified hydrology (e.g., developed land or irrigated agricultural land that comprises less than 20% of the immediate drainage basin within about 2 km upstream of the AA, presence of a few small storm drains or scattered homes with septic systems). No large point sources or dams control the overall hydrology.	Sources are primarily from anthropogenic sources (e.g., urban runoff, direct irrigation, pumped water, artificially impounded water, or another artificial hydrology). Indications of artificial hydrology include developed or irrigated agricultural land that comprises more than 20% of the immediate drainage basin within about 2 km upstream of the AA, or the presence of major drainage point source discharges that obviously control the hydrology.	Natural sources have been eliminated based on the following indicators: impoundment of all wet season inflows, diversions of all dry-season inflows, predominance of xeric vegetation, etc.
	3b. Hydrologic Connectivity	Rising water has unrestricted access to adjacent areas without levees or other obstructions to the lateral movement of flood waters, if stream present, not entrenched.	Unnatural features such as levees or road grades limit the lateral movement of floodwaters, relative to what is expected for the setting, but limitations exist for <50% of the AA boundary. Restrictions may be intermittent along the margins of the AA, or they may occur only along one bank or shore. If stream present, slightly entrenched.	The lateral movement of flood waters to and from the AA is limited, relative to what is expected for the setting, by unnatural features such as levees or road grades, for 50–90% of the boundary of the AA. Flood flows may exceed the obstructions, but drainage out of the AA is probably obstructed. If stream present, moderately entrenched.	The lateral movement of flood waters is limited, relative to what is expected for the setting, by unnatural features such as levees or road grades, for >90% of the boundary of the AA. If stream present, very entrenched.
	3c. Alteration to Hydroperiod *(where water retention and diversion data is not applicable)*	Hydroperiod is characterized by natural patterns of filling or inundation and drying or drawdowns with no alterations.	Filling and drying patterns deviate slightly from natural conditions due to presence of stressors such as small ditches or diversions, berms or roads at/near grade, pugging, or minor flow additions.	Filling and drying patterns deviate moderately from natural conditions due to presence of stressors such as 1-3ft deep ditches or diversions, two lane roads, roads with culverts adequate for stream flow, moderate pugging, or moderate flow additions.	Filling and drying patterns deviate substantially from natural conditions due to high intensity alterations such as a 4-lane highway, large dikes, > 3ft diversions or ditches capable of lowering water table, large amount of fill, artificial groundwater pumping, or heavy flow additions.
	3d. Upstream Water Retention *(where water retention and diversion data is applicable)*	<5% of watershed drains to water storage facility.	5–20% of watershed drains to water storage facility.	20–50% of watershed drains to water storage facility.	>50% of watershed drains to water storage facility.

HYDROLOGIC CONDITION	*3e. Water Diversions and/or Additions* *(where water retention and diversion data is applicable)*	No upstream or onsite water diversions or additions present.	Few diversions/additions present or impacts minor relative to contributing watershed size. Minor impact to local hydrology.	Many diversions/additions present or impact moderate relative to contributing watershed size. Major impact to local hydrology.	Diversions/additions very numerous or impacts high relative to contributing watershed size. Local hydrology drastically altered.
	3f. Bank Stability	Most of the channel through the AA is characterized by equilibrium conditions, with little evidence of aggradation or degradation. Streambanks dominated (>90% cover) by stabilizing plant species, including trees, shrubs, herbs.	Most of the channel through the AA is characterized by some aggradation or degradation, none of which is severe, and the channel seems to be approaching an equilibrium form. Streambanks have 70–90% cover of stabilizing plant species.	There is evidence of severe aggradation or degradation of most of the channel through the AA or the channel is artificially hardened through less than half of the AA. Streambanks have 50–70% cover of stabilizing plant species.	The channel is concrete or otherwise artificially hardened through most of the AA. Streambanks have <50% cover of stabilizing plant species.
	3g. Beaver Activity[1]	Active or recent beaver sign present. Beaver currently active within the area.	Only old beaver sign present. No evidence of recent or new beaver activity despite available food resources and habitat. (Score = 3)		No beaver sign present.

[1] Only applied to sites with where beaver activity is expected.

PHYSIOCHEMICAL CONDITION	*4a. Water Quality*	No visual evidence of degraded water quality. No visual evidence of turbidity or other pollutants.	Some negative water quality indicators are present, but limited to small and localized areas within the wetland. Water is slightly cloudy, but there is no obvious source of sedimentation or other pollutants.	Water is cloudy or has unnatural oil sheen (natural bacterial sheens break apart upon contact), but the bottom is still visible. Sources of water quality degradation are apparent.	Water is milky and/or muddy or has unnatural oil sheen (natural bacterial sheens break apart upon contact). The bottom is difficult to see and there are obvious sources of water quality degradation.
	4b. Algal Growth	Water is clear with minimal algal growth.	Algal growth is limited to small and localized areas of the wetland. Water may have a greenish tint or cloudiness.	Algal growth occurs in moderate to large patches throughout the AA. Water may have a moderate greenish tint or sheen. Sources of water quality degradation are apparent.	Algal mats are extensive, blocking light to the bottom. Water may have a strong greenish tint and the bottom is difficult to see. There are obvious sources of water quality degradation.
	4c. Substrate / Soil Disturbance	No apparent modifications, or bare soil areas limited to naturally caused disturbances such as flood deposition or game trails.	Past anthropogenic modifications, but recovered; OR recent but minor anthropogenic modifications.	Recovering OR recent and moderate anthropogenic modifications.	Recent and severe anthropogenic modifications.

EIA Scoring Formula (for Riverine HGM wetlands):

Landscape Context Score: $(1a * 0.1) + (1b * 0.3) + ([(1c*1d)^{1/2} * (1e + 1f)/2]^{1/2} * 0.6)$

Biotic Condition Score: $(2a * 0.2) + ([2b \text{ OR } 2c^{1}] * 0.2) + (2d * 0.4) + (2e^{2} * 0.05) + (2f^{2} * 0.05) + (2g^{3} * [0.05 \text{ OR } 0.1]) + (2h^{3} * [0.05 \text{ OR } 0.1])$

Hydrologic Condition Score A[4]: $(3a * 0.2) + (3b * 0.2) + ([3d*3e]^{1/2} * 0.4) + (3f * 0.1) + (3g * 0.1)$

Hydrologic Condition Score B[4]: $(3a * 0.2) + (3b * 0.2) + (3c* 0.4) + (3f * 0.1) + (3g * 0.1)$

Physiochemistry Condition Score: $(4a * 0.25) + (4b * 0.25) + (4c * 0.5)$

[1] Lowest value from 2b or 2c is used. [2] If 2e or 2f is NA, not included in formula. [3] If 2e and 2f is NA, use 0.1 for 2g and 2h weights
[4] A - Score is used where water retention and diversion data is applicable, B - score is used where data are not applicable.

Overall EIA Score: (Landscape Context Score * 0.2) + (Biotic Condition Score * 0.4) + (Hydrology Score * 0.3) + (Physiochemical Score * 0.1)

Overall Score to Rank Conversion:

A = 4.5 – 5.0
B = 3.5 – <4.5
C = 2.5 – <3.5
D = 1.0 – <2.5

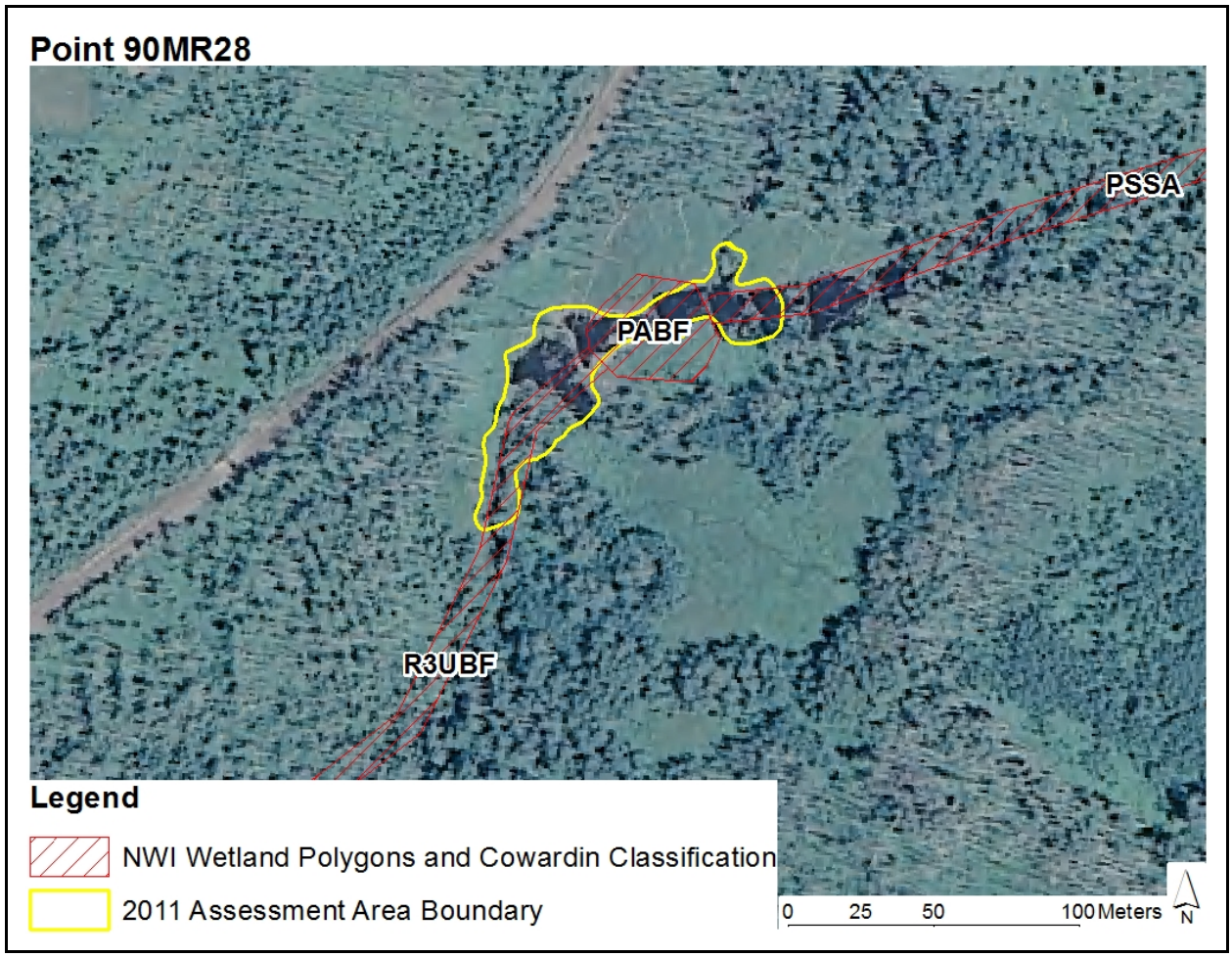
APPENDIX D: 2011 RNF Riparian Survey Details, Site Photos, Point Location, Species and Stressor Notes

90MR28

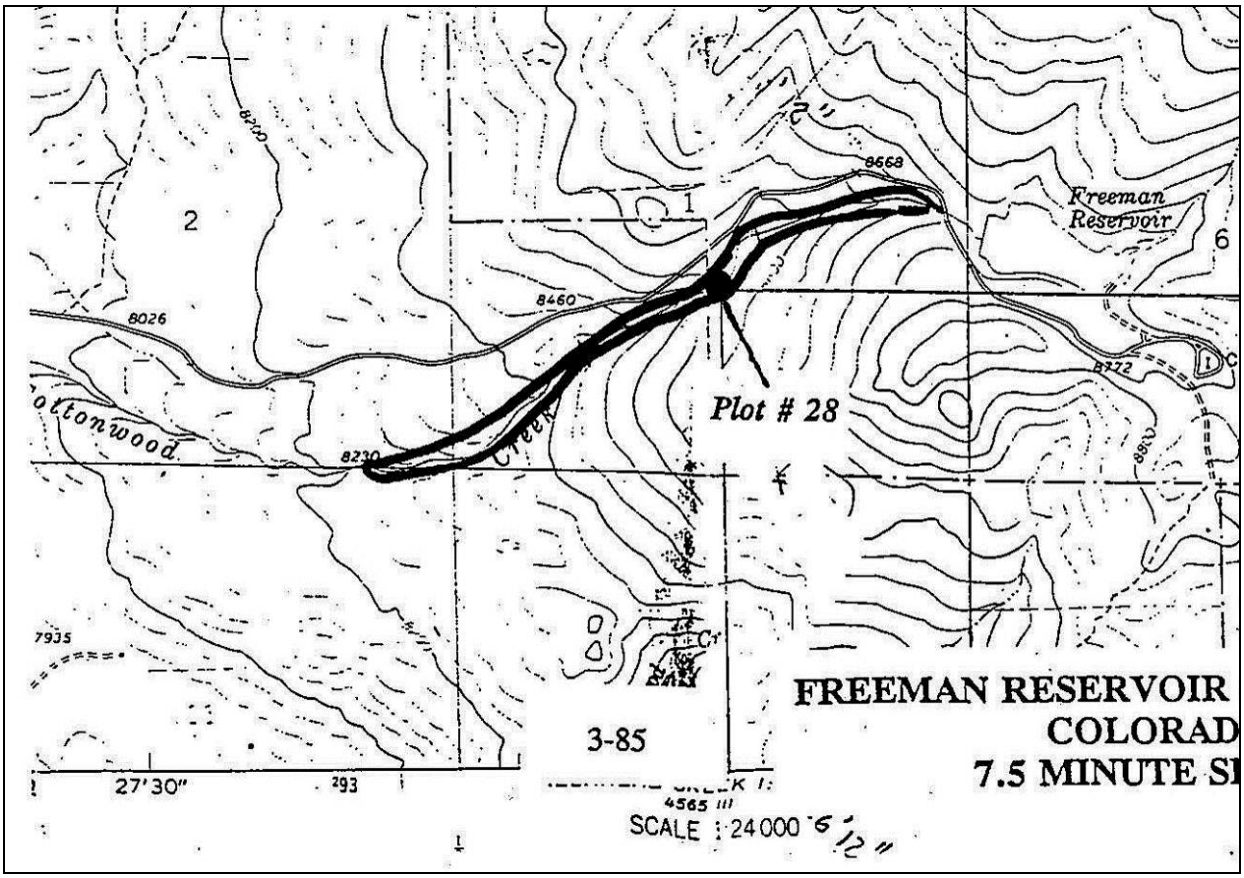
General Location: Cottonwood Creek near Freeman Reservoir

Initial Survey: 8/9/90 Resurvey: 8/8/11

Survey detail: Identified area to survey using GPS waypoint, which was in upland. Navigated to stream that was similar to annotated topographic map. Surveyed linear riparian area along Cottonwood Creek with two systems – 1) *Alnus incana*-lined channel and 2) multiple beaver dams recently blown out and not yet completely colonized by much herbaceous plant cover. New shallow channel cut through old pond beds. Prolific rotting smell (likely dead animal) along entire AA could be beaver mortality.



Aerial photo of 90MR28 Assessment Area surveyed in 2011, shown with digitized NWI mapping.



Location of 90MR28 plot from 1990 shown on Freeman Reservoir Quadrangle as Plot #28. Annotated map is scanned from old data sheet.

Photos of plot 90MR28 from 2011 survey.

Stressor note comparison:

1990: Sheep recently through the area and paths throughout. Loss of water/flooding to reservoir listed as threat, as well as sheep grazing. No mention of beaver activity.

2011: *Breea arvensis* (5-10% in AA) present along edge of old pond level, and also in 500m buffer (but less than in AA). Before dam blowout, several connected beaver ponds along stream. Disturbed patches in buffer indicate some grazing in area, but extensive changes to system after flooding would have covered these effects. Water quality and algae indicators show degradation in limited, localized areas of wetland. Upstream reservoir alters natural hydrology.

2011 Plant List: 90MR28

Achillea lanulosa
Aconitum columbianum
Agastache urticifolia
Alnus incana ssp. *tenuifolia*
Alopecurus aequalis
Anaphalis margaritacea
Arnica parryi
Aster foliaceus
Breea arvensis
Calamagrostis canadensis
Carex aquatilis
Carex athrostachya
Carex exsiccata
Carex lanuginosa
Carex microptera
Carex raynoldsii
Castilleja miniata
Chamerion danielsii
Cirsium centaureae
Collomia linearis
Conioselinum scopulorum
Dactylis glomerata
Distegia involucrata
Dugaldia hoopesii
Eleocharis acicularis
Eleocharis macrostachya
Elymus glaucus
Epilobium ciliatum
Equisetum arvense
Erigeron elatior

1990s Plant List: 90MR28

Achillea lanulosa
Aconitum columbianum
Actaea rubra ssp. *arguta*
Alnus incana ssp. *tenuifolia*
Carex hoodii
Distegia involucrata
Elymus glaucus
Equisetum arvense
Fragaria virginiana ssp. *glauca*
Geranium richardsonii
Glyceria elata
Heracleum sphondylium ssp. montanum
Ligusticum porteri
Mentha arvensis
Mertensia ciliata
Osmorhiza depauperata
Phleum pratense
Poa palustris
Populus tremuloides
Rubacer parviflorum
Senecio triangularis
Streptopus fassettii
Taraxacum officinale
Thalictrum fendleri
Urtica gracilis

2011 Plant List: 90MR28 cont.

Erythronium grandiflorum
Fragaria virginiana ssp. *glauca*
Galium septentrionale
Geranium richardsonii
Geum macrophyllum var. *perincisum*
Glyceria borealis
Glyceria grandis
Gnaphalium uliginosum
Heracleum sphondylium ssp. *montanum*
Juncus confusus
Juncus ensifolius
Madia glomerata
Mentha arvensis
Mertensia ciliata
Mimulus moschatus
Phleum pratense
Plantago major
Poa pratensis
Poaceae
Polygonum douglasii
Populus tremuloides
Potentilla pulcherrima
Prunella vulgaris
Pyrrocoma crocea
Ranunculus uncinatus
Rorippa teres
Rosa woodsii
Rubus idaeus ssp. *melanolasius*
Rumex aquaticus ssp. *occidentalis*
Salix drummondiana
Salix lucida ssp. *lasiandra*
Scirpus microcarpus
Sidalcea candida
Spergula arvensis
Streptopus fassettii
Symphoricarpos rotundifolius
Taraxacum officinale
Thalictrum fendleri
Thermopsis montana
Torreyochloa pauciflora
Tragopogon sp.
Trifolium repens

2011 Plant List: 90MR28 cont.

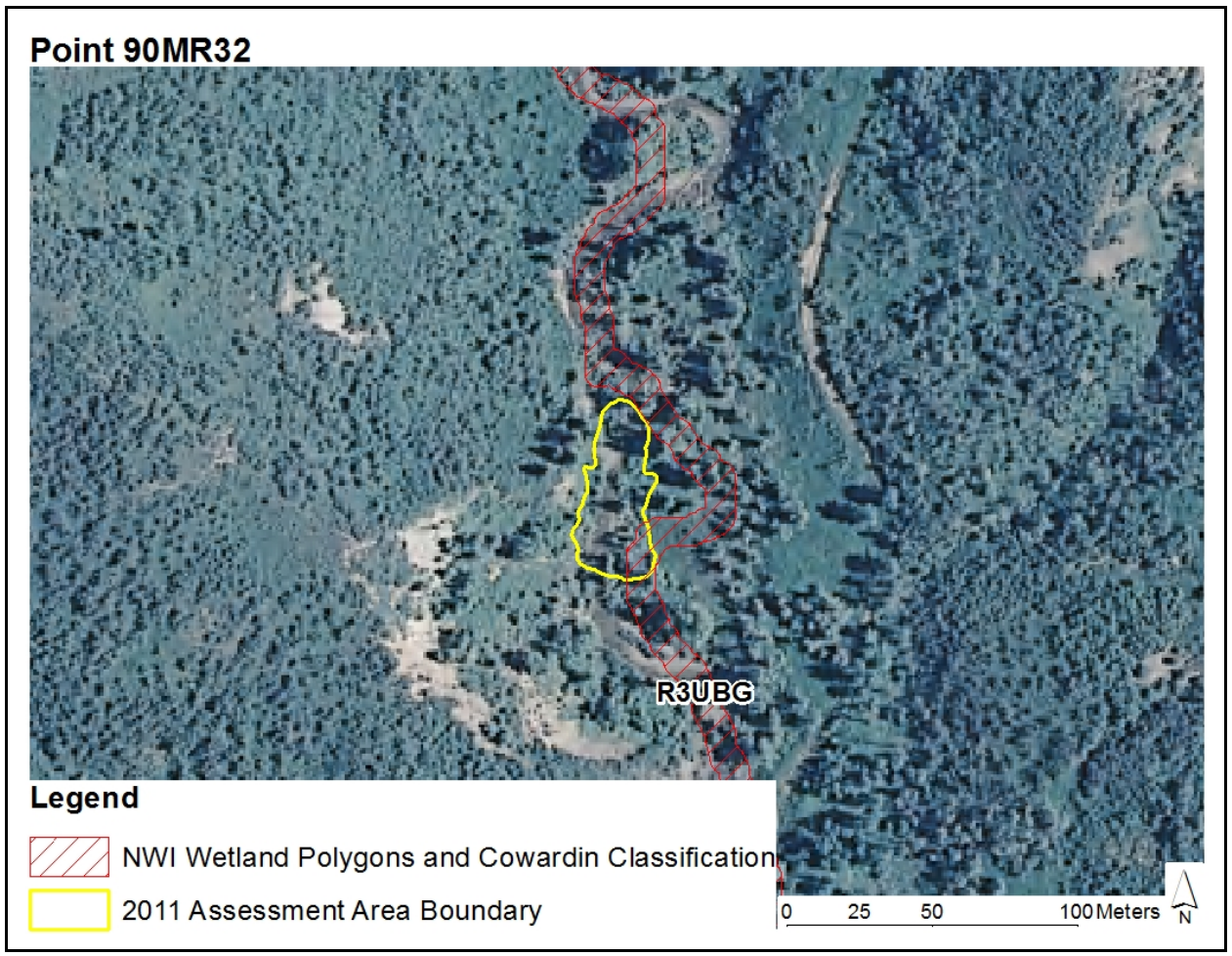
Unknown forb
Urtica gracilis
Valeriana occidentalis
Veratrum tenuipetalum
Veronica americana
Veronica nutans
Vicia americana

90MR32 (90MR31)

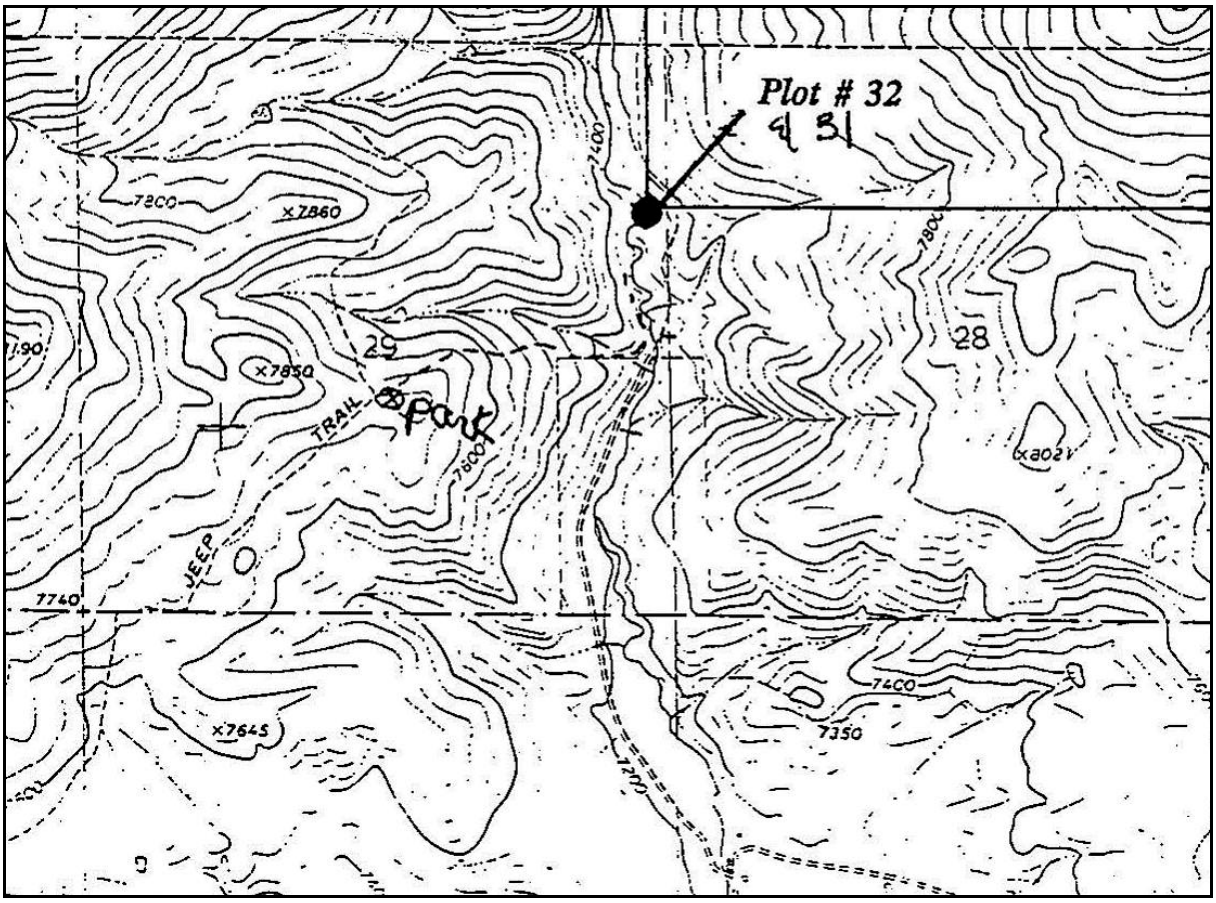
General Location: N Fork Elkhead Creek

Initial Survey: 8/10/90 Resurvey: 8/4/11

Survey detail: Identified area to survey using GPS waypoint, which was above stream. Navigated to point along Elkhead Creek using topographic map. Area surveyed in 2011 appears similar to hand drawing obs. (subplot) #1 from 1990 along stream, but grades into obs. #2. *Alnus incana – Swida (Cornus) sericea* shrubland with *Carex*/grass understory along cobble boulder channel.



Aerial photo of 90MR32 Assessment Area surveyed in 2011, shown with digitized NWI mapping.



Location of 90MR32 plot from 1990 shown on Slide Mountain Quadrangle as Plot #32. Annotated map is scanned from old data sheet.

Photos of plot 90MR32 from 2011 survey.

Stressor note comparison:

1994: Diverse community with lush understory and few exotic spp. Sheep and cattle graze adjacent upland area and effects are obvious.

2011: *Phleum pratense* in AA (5-10%) and in buffer (5-25%). No evidence of domestic grazing, but evidence of native ungulate use (tracks). Minor bank slumping, cause unknown (perhaps historic grazing, ungulate use, or associated with annual flooding).

2011 Plant List: 90MR32

Achillea lanulosa
Agrostis gigantea
Alnus incana ssp. tenuifolia
Amelanchier alnifolia
Angelica ampla
Arnica cordifolia
Asteraceae
Breea arvensis
Bromopsis canadensis
Calochortus gunnisonii
Campanula rotundifolia
Carex aquatilis
Carex lanuginosa
Carex microptera
Castilleja sulphurea
Dactylis glomerata
Distegia involucrata
Epilobium ciliatum
Epilobium leptophyllum
Equisetum arvense
Erigeron speciosus
Galium septentrionale
Galium triflorum
Geranium richardsonii
Glyceria elata
Hippochaete laevigata
Juncus confusus
Juncus longistylis
Juncus saximontanus
Juncus tracyi
Lupinus argenteus
Maianthemum stellatum
Osmorhiza sp.

1990s Plant List: 90MR31

Achillea lanulosa
Agrostis gigantea
Alnus incana ssp. *tenuifolia*
Amelanchier alnifolia
Carex lanuginosa
Elymus glaucus
Equisetum arvense
Fragaria virginiana ssp. *glauca*
Geranium richardsonii
Hippochaete hyemalis
Ligusticum porteri
Maianthemum stellatum
Osmorhiza depauperata
Phleum pratense
Picea pungens
Poa pratensis
Populus angustifolia
Rudbeckia ampla
Swida sericea
Taraxacum officinale
Thalictrum fendleri

1990s Plant List: 90MR32

Achillea lanulosa
Amelanchier alnifolia
Crataegus rivularis
Distegia involucrata
Elymus glaucus
Equisetum arvense
Fragaria virginiana ssp. *glauca*
Galium septentrionale
Geranium richardsonii
Heracleum sphondylium ssp. *montanum*

2011 Plant List: 90MR32 cont.

Perideridia gairdneri ssp. *borealis*
Phleum pratense
Picea pungens
Piperia unalascensis
Plantago major
Poa palustris
Poa pratensis
Populus angustifolia
Potentilla pensylvanica
Potentilla pulcherrima
Prunella vulgaris
Quercus gambelii
Rosa woodsii
Rudbeckia ampla
Salix eriocephala
Salix geyeriana
Salix lucida ssp*. lasiandra*
Scirpus pallidus
Senecio spartioides
Swida sericea
Symphoricarpos rotundifolius
Taraxacum officinale
Thalictrum fendleri
Thermopsis montana
Trifolium hybridum
Trifolium repens
Vicia americana
Viola sp.

1990s Plant List: 90MR32 cont.

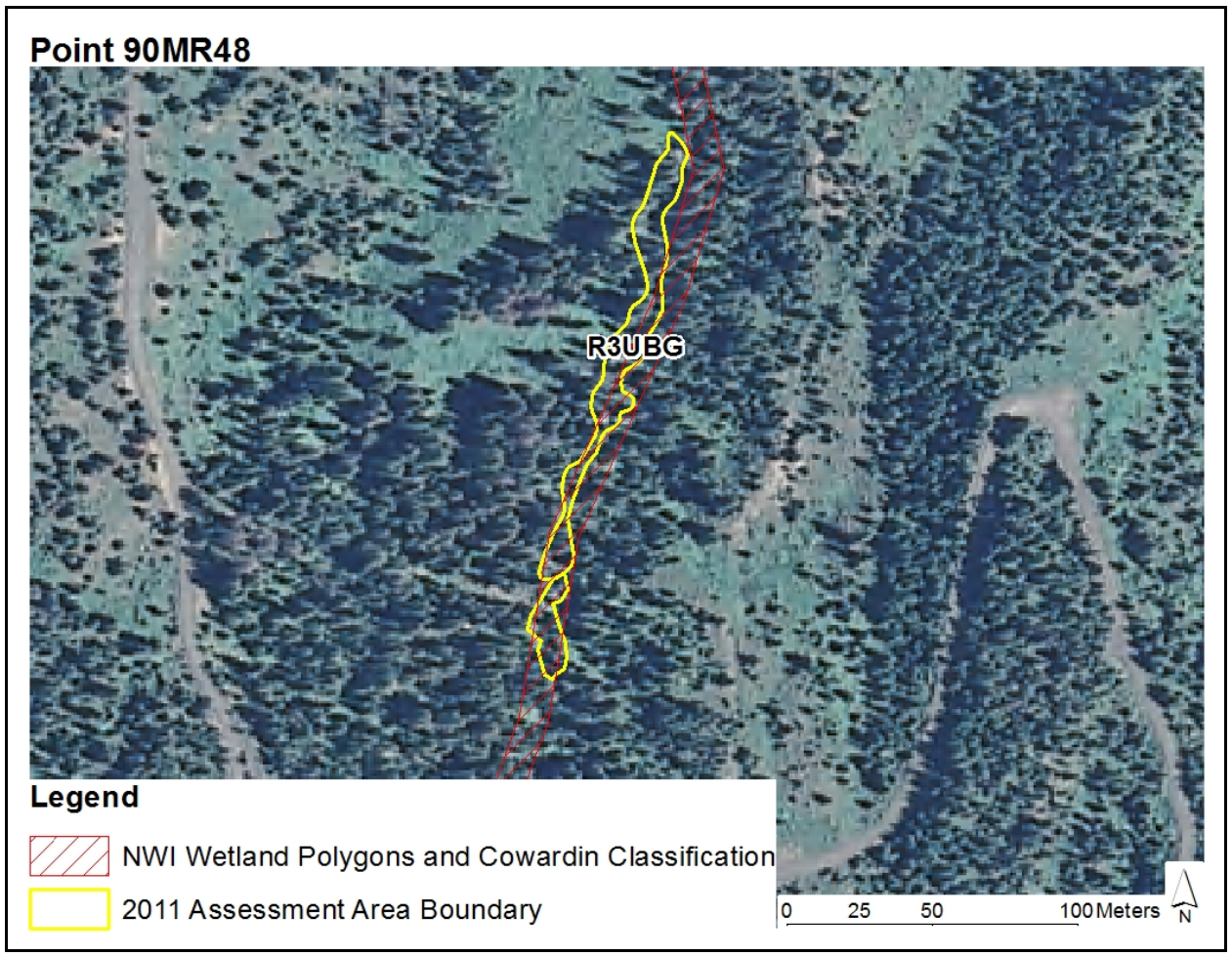
Hippochaete hyemalis
Ligusticum porteri
Maianthemum stellatum
Osmorhiza depauperata
Phleum pratense
Picea pungens
Poa pratensis
Populus angustifolia
Rosa woodsii
Rubus idaeus ssp. *melanolasius*
Rudbeckia ampla
Streptopus fassettii
Swida sericea
Taraxacum officinale
Thalictrum fendleri
Vicia americana
Viola scopulorum

90MR48 (90MR49)

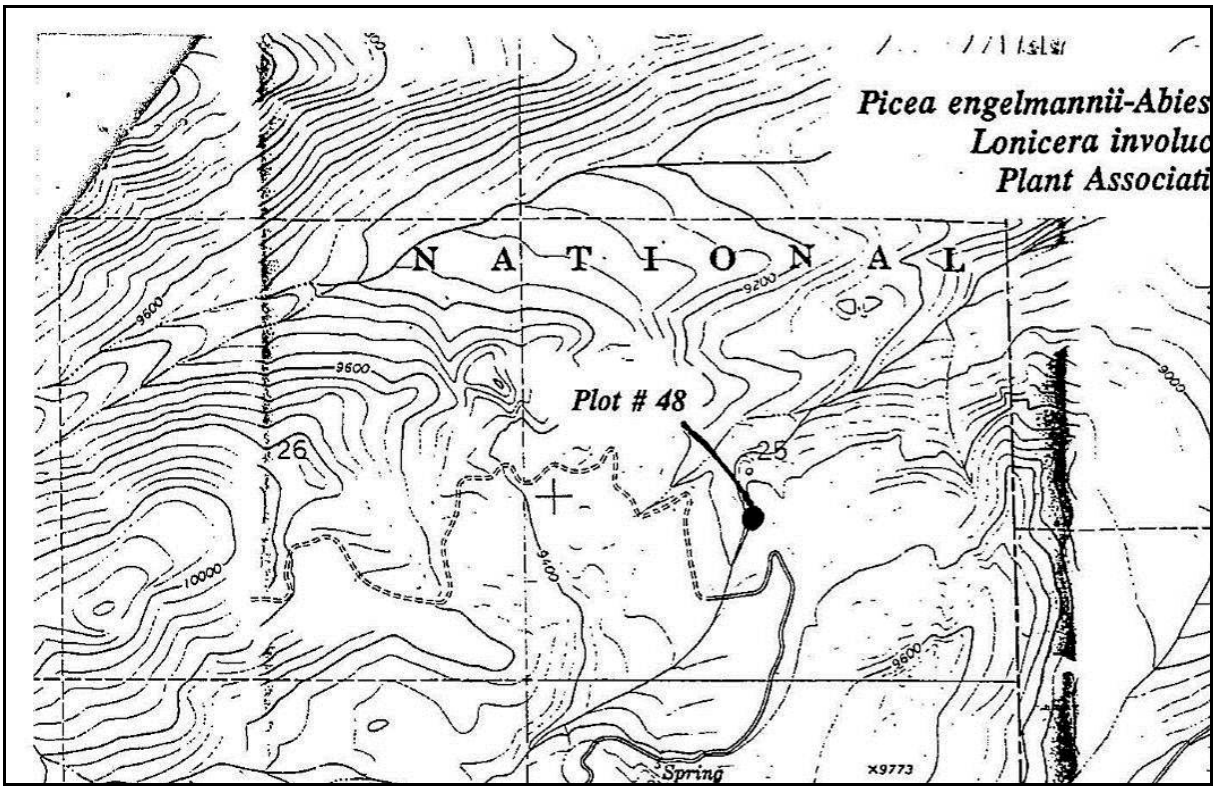
General Location: W Prong Creek

Initial Survey: 8/23/90 Resurvey: 8/7/11

Survey detail: Identified area to survey using annotated topographic map. Surveyed forested (*Picea, Abies*) riparian area on both sides of narrow stream and along seep inputs bordering stream (seep species list addendum in database labeled 90MR49). Area surveyed in 2011 appears similar to hand drawing obs. (subplot) #1 from 1990, but seeps overlap with #2.



Aerial photo of 90MR48 Assessment Area surveyed in 2011, shown with digitized NWI mapping.



Location of 90MR48 plot from 1990 shown on Buck Point Quadrangle as Plot #48. Annotated map is scanned from old data sheet.

Photos of plot 90MR48 from 2011 survey.

Stressor note comparison:

1990: Heavy sheep grazing could degrade site, sheep and cattle listed as threats. Watershed drains area of previous burn and wood cut within 10m of plot. Stream has been stabilized with logs creating pools/riffles, which was probably severely damaged by erosion from burn following logging.

2011: Contains some placed logs for restoration ~20+ yr ago. Soil currently looks good but historic logging/management. No evidence of grazing. Management footprint mentioned in 1990 has largely disappeared. Entrenched upstream closer to road but not in AA. Intact plant communities.

2011 Plant List: 90MR48

Abies bifolia
Aconitum columbianum
Alnus incana ssp. *tenuifolia*
Anticlea elegans
Arnica cordifolia
Arnica mollis
Calamagrostis canadensis
Carex angustior
Carex aquatilis
Carex microptera
Castilleja miniata
Chamerion danielsii
Clementsia rhodantha
Distegia involucrata
Elymus glaucus
Epilobium sp.
Equisetum arvense
Erigeron peregrinus ssp. *callianthemus*
Fragaria virginiana ssp. *glauca*
Geranium richardsonii
Juncus drummondii
Lathyrus leucanthus
Limnorchis dilatata ssp. *albiflora*
Luzula parviflora
Mertensia ciliata
Micranthes odontoloma
Osmorhiza chilensis
Oxypolis fendleri
Pedicularis bracteosa ssp. *paysoniana*
Pedicularis groenlandica
Pedicularis racemosa ssp. *alba*

1990s Plant List: 90MR48

Abies bifolia
Aconitum columbianum
Calamagrostis canadensis
Carex aquatilis
Chamerion danielsii
Distegia involucrata
Equisetum arvense
Fragaria virginiana ssp. glauca
Geranium richardsonii
Juncus arcticus ssp. ater
Mertensia ciliata
Micranthes odontoloma
Osmorhiza depauperata
Picea engelmannii
Psychrophila leptosepala
Pyrola rotundifolia ssp. asarifolia
Senecio triangularis
Streptopus fassettii
Vaccinium scoparium

1990s Plant List: 90MR49

Calamagrostis canadensis
Carex aquatilis
Chamerion danielsii
Equisetum arvense
Psychrophila leptosepala
Senecio triangularis

2011 Plant List: 90MR48 cont.

Phleum commutatum
Picea engelmannii
Poa leptocoma
Psychrophila leptosepala
Pyrola minor
Pyrola rotundifolia ssp. *asarifolia*
Ribes inerme
Senecio triangularis
Streptopus fassettii
Taraxacum officinale
Trifolium repens
Vaccinium scoparium

2011 Plant List: 90MR49 seep addendum

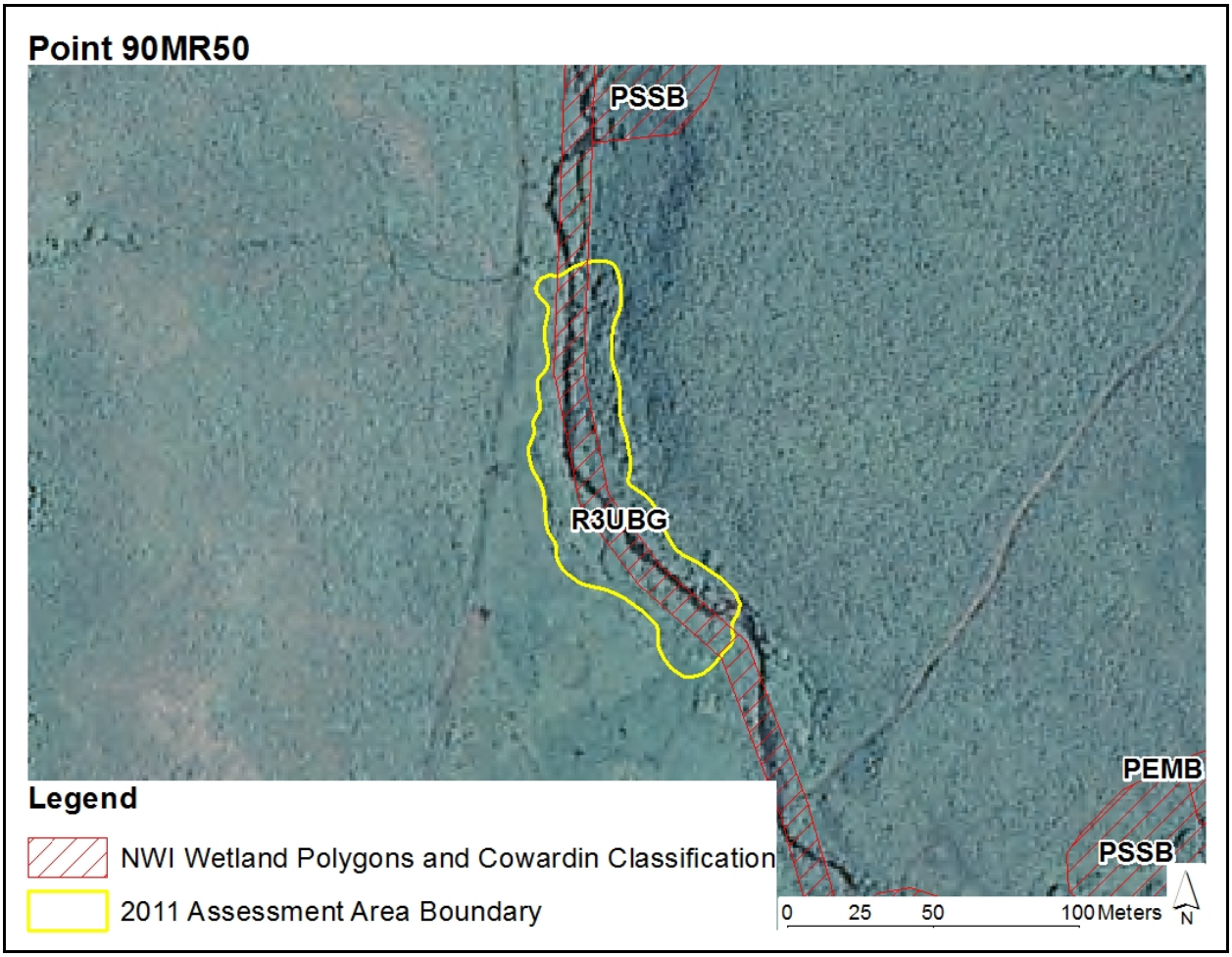
Abies bifolia
Aconitum columbianum
Arnica mollis
Carex angustior
Carex aquatilis
Castilleja miniata
Chamerion danielsii
Clementsia rhodantha
Equisetum arvense
Erigeron glabellus ssp. *pubescens*
Limnorchis dilatata ssp. *albiflora*
Luzula parviflora
Mertensia ciliata
Micranthes odontoloma
Mitella pentandra
Oxypolis fendleri
Pedicularis bracteosa ssp. paysoniana
Picea engelmannii
Psychrophila leptosepala
Senecio triangularis
Streptopus fassettii
Thalictrum fendleri
Vaccinium scoparium
Viola scopulorum

90MR50

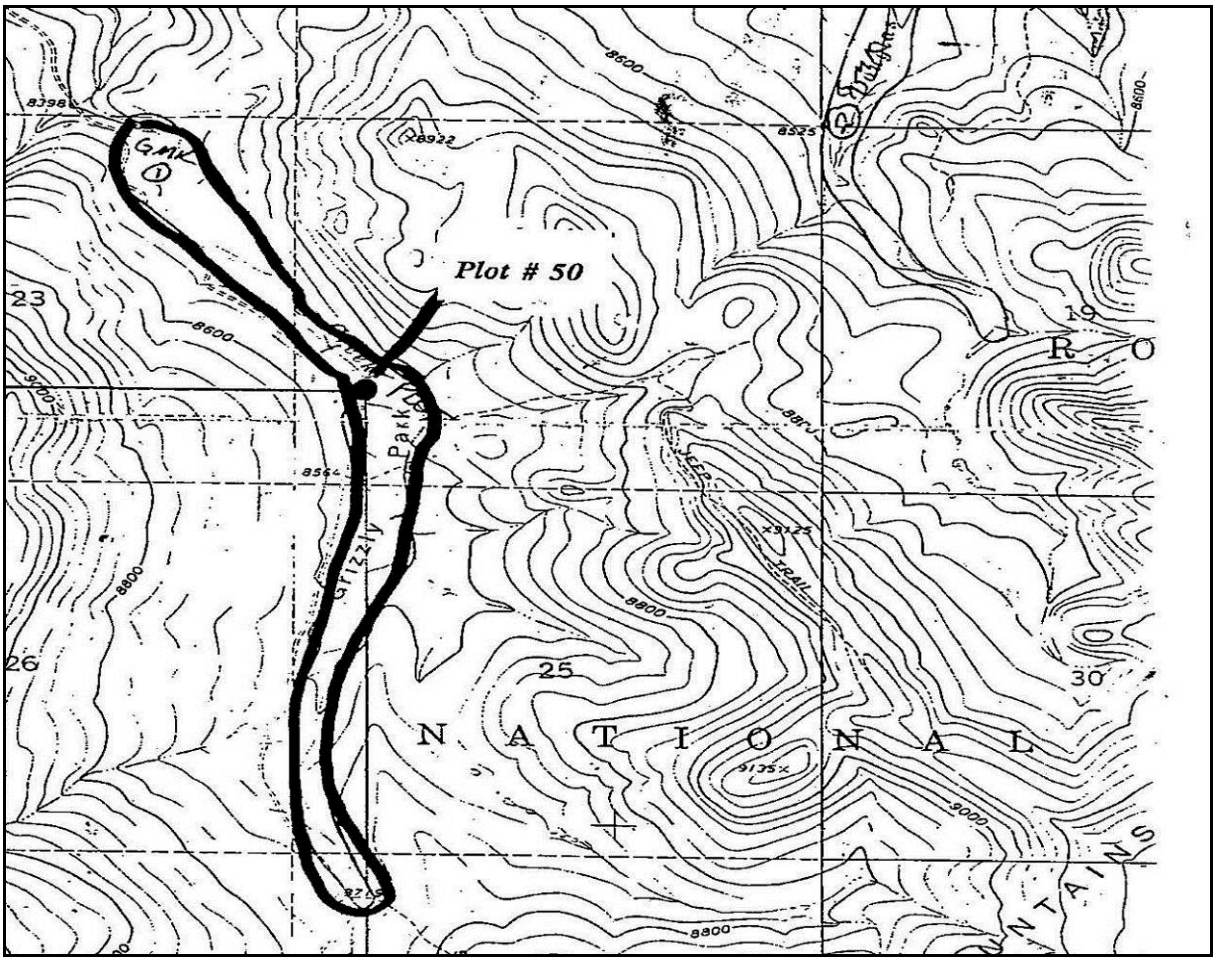
General Location: Grizzly Creek Park, downstream of 94A543

Initial Survey: 8/23/90 Resurvey: 8/6/11

Survey detail: Exact location of initial 1990 survey unclear, more than one area shown on topographic map (used "Plot 50" location instead of GMK 1 or 2). No mention of abundant hillside seeps. Placed plot in Grizzly Creek Park, before *Salix* riparian corridor narrowed (similar to one of points drawn on topographic map). AA in *Salix wolfii/boothii* narrow shrubland, with most of vegetation dependent on seeps from upslope. East slope has more pronounced seeps and areas with >60 cm organic soil (peat). In other areas, soil mixed mineral-organic, pools above channel level. Occasional thin sand lenses in peat from flooding.



Aerial photo of 90MR50 Assessment Area surveyed in 2011, shown with digitized NWI mapping.



Location of 90MR50 plot from 1990 shown on Bears Ears Peaks Quadrangle. Annotated map is scanned from old data sheet.

Photos of plot 90MR50 from 2011 survey.

Stressor note comparison:

1990: Active beaver in vicinity. Willows dense, diverse, healthy. Some exotics. Intensive grazing and loss of beaver listed as threats. Evidence of beaver, probably sheep and elk.

2011: Erosion in one area on upstream end of AA, causes unknown, channel appears to be incising slowly. Willows with dense understory. Beetle kill in 500 m buffer to E, W side of buffer currently healthy. Road on map is old and vegetated. Light grazing throughout AA and buffer (evident from cow paddies) but livestock not compacting AA soil. *Phleum pratense* and *Breea arvensis* present in 500m buffer (<5% cover). Nice wetland, but livestock use could potentially have adverse effects.

2011 Plant List: 90MR50

Achillea lanulosa
Aconitum columbianum
Alnus incana ssp. tenuifolia
Androsace filiformis
Angelica pinnata
Arnica mollis
Aster laevis var. *geyeri*
Bistorta bistortoides
Breea arvensis
Bromopsis canadensis
Bromus hordeaceus
Calamagrostis canadensis
Cardamine breweri
Cardamine cordifolia
Carex aquatilis
Carex aurea
Carex festivella
Carex foenea
Carex jonesii
Carex lanuginosa
Carex utriculata
Carex vesicaria
Castilleja miniata
Cerastium strictum
Cirsium scariosum
Conioselinum scopulorum
Critesion brachyantherum
Danthonia intermedia
Deschampsia cespitosa
Elymus glaucus
Epilobium hornemannii
Equisetum arvense

1990s Plant List: 90MR50

Achillea lanulosa
Aconitum columbianum
Anisantha tectorum
Aster foliaceus
Calamagrostis canadensis
Cardamine cordifolia
Carex aquatilis
Carex hoodii
Elymus trachycaulus ssp. *andinus*
Equisetum arvense
Fragaria virginiana ssp. glauca
Geranium richardsonii
Geum macrophyllum var. *perincisum*
Heracleum sphondylium ssp. *montanum*
Ligusticum porteri
Mertensia ciliata
Phleum pratense
Poa palustris
Psychrophila leptosepala
Salix boothii
Salix wolfii
Senecio triangularis
Taraxacum officinale
Vicia americana

2011 Plant List: 90MR50 cont.

Erigeron glabellus ssp. *pubescens*
Erythrocoma triflora
Fragaria virginiana ssp. *glauca*
Galium septentrionale
Gentianella acuta
Geranium richardsonii
Geum macrophyllum var. *perincisum*
Hierochloë hirta ssp. *arctica*
Juncus confusus
Juncus tracyi
Limnorchis dilatata ssp. *albiflora*
Lupinus argenteus
Mertensia ciliata
Micranthes odontoloma
Mimulus moschatus
Oxypolis fendleri
Pedicularis groenlandica
Penstemon rydbergii
Pentaphylloides floribunda
Perideridia gairdneri ssp. *borealis*
Phleum commutatum
Phleum pratense
Pneumonanthe parryi
Potentilla gracilis
Potentilla pulcherrima
Prunella vulgaris
Psychrophila leptosepala
Ranunculus uncinatus
Rorippa sp.
Rumex aquaticus ssp. *occidentalis*
Salix boothii
Salix geyeriana
Salix lucida ssp. *lasiandra*
Salix wolfii
Senecio crassulus
Senecio triangularis
Solidago multiradiata
Stellaria longifolia
Swertia perennis
Taraxacum officinale
Torreyochloa pauciflora
Trifolium hybridum

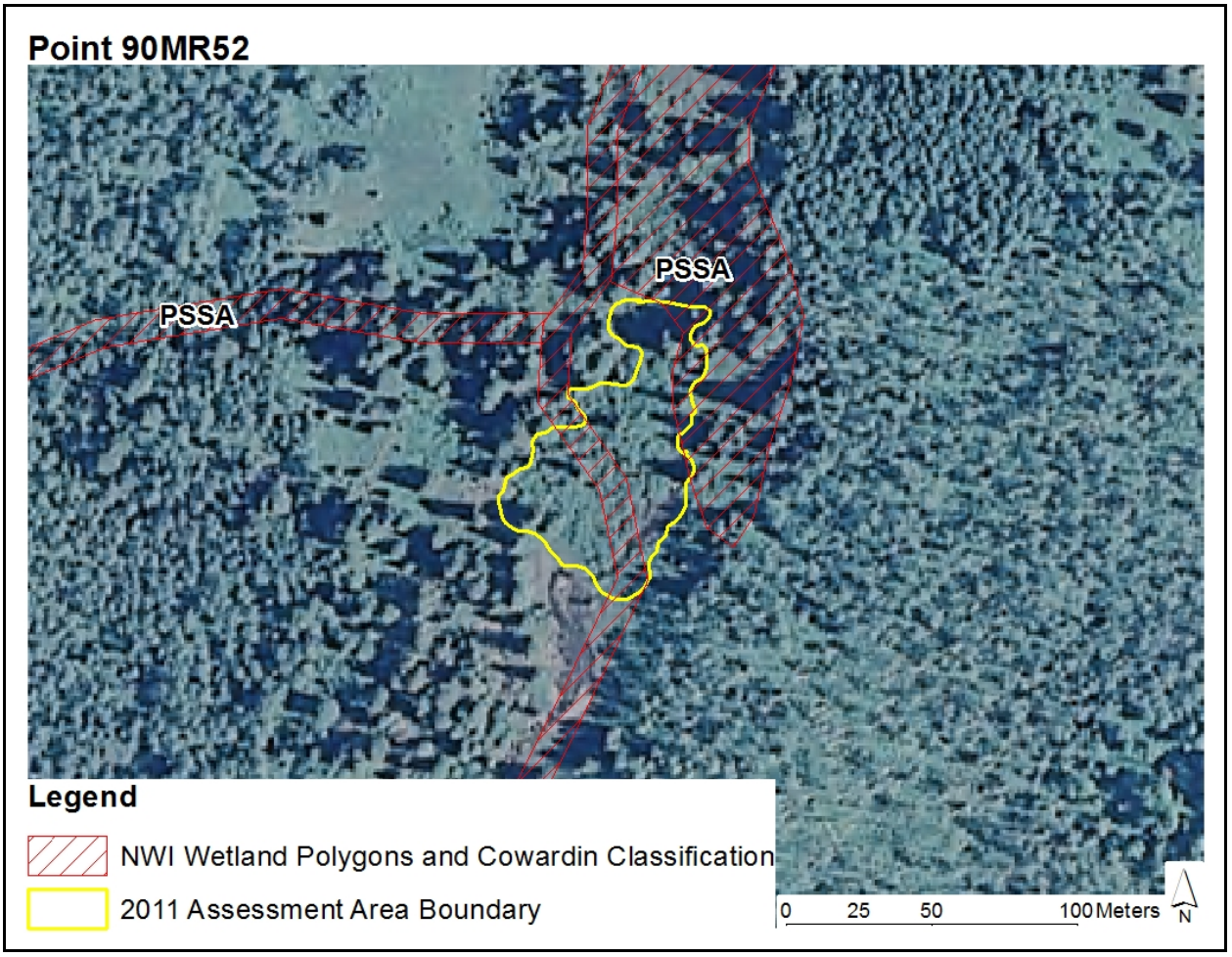
2011 Plant List: 90MR50 cont.
Veratrum tenuipetalum
Veronica nutans
Vicia americana

90MR52 (90MR51)

General Location: Confluence of Slater Creek, W Prong South Fork

Initial Survey: 8/24/90 Resurvey: 8/7/11

Survey detail: Identified area to survey using GPS waypoint, which was in aspen. Navigated down to stream that was similar to annotated topographic map. Area surveyed in 2011 appears similar to hand drawing obs. (subplot) #2 from 1990. Recently insized channel that experienced massive flood and upstream beaver dam blowout (flushed out all coarse woody debris), new sedimentation supports diverse annuals. Mixed *Salix* and *Alnus* riparian shrubland with large cobbles recently scoured by flood.



Aerial photo of 90MR52 Assessment Area surveyed in 2011, shown with digitized NWI mapping.

Location of 90MR52 plot from 1990 shown on Buck Point Quadrangle as Plot #S39. Annotated map is scanned from old data sheet.

Photos of plot 90MR52 from 2011 survey.

Stressor note comparison:

1990: Area has obviously been heavily utilized by livestock, continued heavy livestock use a threat. Beaver ponds above and below site. Willows have been browsed. Exotics, *Phleum pratense* = 20%. Trees sappy, woodpecker holes that may be evidence of bark beetle.

2011: Relict beaver ponds fully vegetated and dams anchored by 20 yr alders. *Taraxacum, Phleum, Breea* in aspen buffer understory (25-50% total 500m buffer cover). *Breea arvensis* and *Taraxacum* each 1-2% in AA and *Phleum pratense* <1% in AA. Entire area lightly grazed and doesn't obviously go to AA but livestock likely travelled there (no barriers). Woody spp regenerating and no note of browse (<5%). Lots downed aspen in buffer (maybe Sudden Aspen Death?). Channel bank now deeply incised.

2011 Plant List: 90MR52

Abies bifolia
Achillea lanulosa
Aconitum columbianum
Agoseris sp.
Alnus incana ssp. *tenuifolia*
Amelanchier alnifolia
Androsace septentrionalis
Arnica cordifolia
Arnica fulgens
Arnica mollis
Aster sp.
Breea arvensis
Bromopsis canadensis
Calamagrostis canadensis
Cardamine breweri
Carex aquatilis
Carex geyeri
Carex microptera
Carex pachystachya
Carex raynoldsii
Carex utriculata
Castilleja rhexifolia
Cerastium strictum
Cirsium centaureae
Conioselinum scopulorum
Corallorhiza maculata
Delphinium barbeyi
Distegia involucrata
Elymus glaucus
Epilobium ciliatum

1990s Plant List: 90MR51

Achillea lanulosa
Actaea rubra ssp. *arguta*
Alnus incana ssp. *tenuifolia*
Calamagrostis canadensis
Chamerion danielsii
Cinna latifolia
Elytrigia repens
Equisetum arvense
Fragaria virginiana ssp. *glauca*
Galium septentrionale
Geranium richardsonii
Geum macrophyllum var. *perincisum*
Glyceria elata
Heracleum sphondylium ssp. *montanum*
Maianthemum stellatum
Mertensia ciliata
Osmorhiza depauperata
Picea pungens
Poa palustris
Poa pratensis
Ribes inerme
Ribes montigenum
Rosa woodsii
Rubacer parviflorum
Rubus idaeus ssp. *melanolasius*
Salix drummondiana
Salix geyeriana
Senecio triangularis
Taraxacum officinale
Thalictrum fendleri

2011 Plant List: 90MR52 cont.

Equisetum arvense
Erigeron elatior
Fragaria virginiana ssp. *glauca*
Galium septentrionale
Galium triflorum
Geranium richardsonii
Geum macrophyllum var. *perincisum*
Glyceria borealis
Heracleum sphondylium ssp. *montanum*
Hippochaete hyemalis
Juncus arcticus ssp. *ater*
Juncus mertensianus
Juncus tracyi
Lathyrus
Limnorchis dilatata ssp. *albiflora*
Lupinus argenteus
Luzula parviflora
Maianthemum stellatum
Mentha arvensis
Mertensia ciliata
Micranthes odontoloma
Mimulus floribundus
Mimulus moschatus
Mitella pentandra
Neolepia campestris
Orthilia secunda
Osmorhiza depauperata
Oxypolis fendleri
Perideridia gairdneri ssp. *borealis*
Phleum commutatum
Phleum pratense
Picea engelmannii
Picea pungens
Poa palustris
Poa pratensis
Populus angustifolia
Prunella vulgaris
Ribes inerme
Rubus idaeus ssp. *melanolasius*
Sagina saginoides
Salix boothii
Salix drummondiana

1990s Plant List: 90MR51 cont.

Vicia americana

1990s Plant List: 90MR52

Achillea lanulosa
Agrostis gigantea
Alnus incana ssp. *tenuifolia*
Breea arvensis
Carex hoodii
Elytrigia repens
Equisetum arvense
Fragaria virginiana ssp. *glauca*
Geranium richardsonii
Geum macrophyllum var. *perincisum*
Heracleum sphondylium ssp. *montanum*
Juncus saximontanus
Phleum pratense
Poa palustris
Poa pratensis
Salix boothii
Salix geyeriana
Solidago canadensis
Taraxacum officinale
Vicia americana

2011 Plant List: 90MR52 cont.

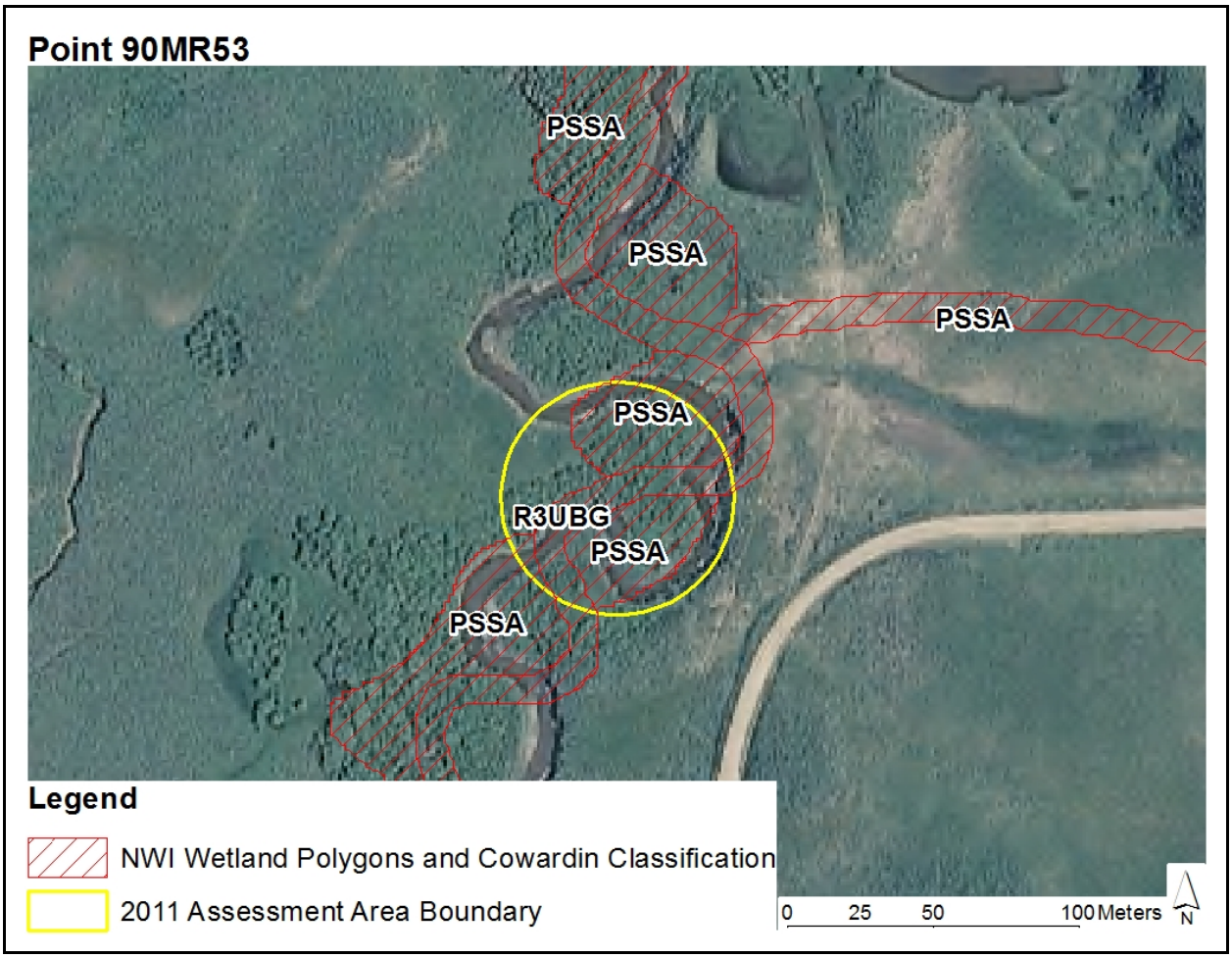
Salix lucida ssp. *lasiandra*
Scirpus microcarpus
Senecio triangularis
Stellaria obtusa
Streptopus fassettii
Taraxacum officinale
Thalictrum fendleri
Thermopsis montana
Trisetum spicatum
Turritis glabra
Veratrum tenuipetalum
Veronica americana
Vicia americana
Viola sp.

90MR53

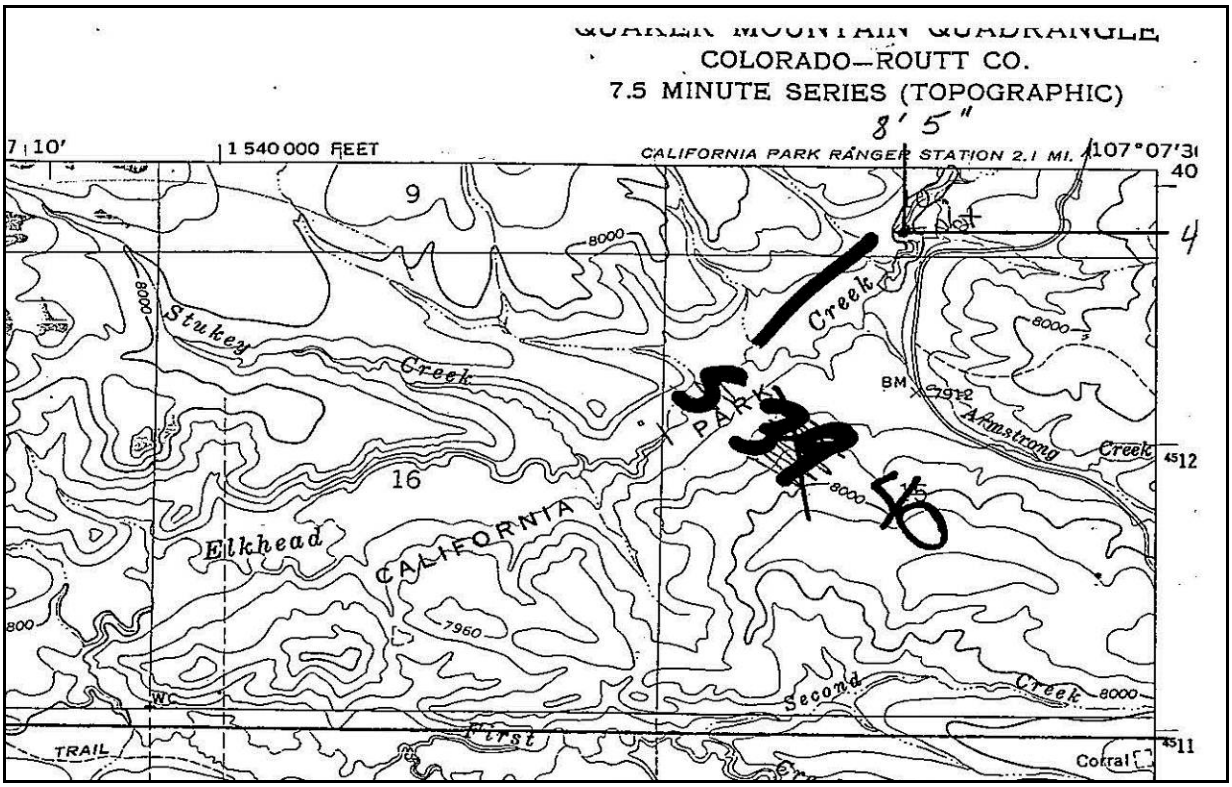
General Location: Elkhead Creek, CA Park just N of where Armstrong Creek intersects with Elkhead.

Initial Survey: 8/25/90 Resurvey: 7/28/11

Survey detail: Identified area to survey using GPS waypoint, which was upland adjacent to road, navigated directly to where stream was closest to road and used that point as AA edge. AA is *Salix boothii* riparian shrubland. Location surveyed appears similar to plot in 1990.



Aerial photo of 90MR53 Assessment Area surveyed in 2011, shown with digitized NWI mapping.



Location of 90MR53 plot from 1990 shown on Quaker Mountain Quadrangle as Plot #S40. Annotated map is scanned from old data sheet.

Photos of plot 90MR53 from 2011 survey.

Stressor note comparison:

1990: Willows browsed, cattle present in area, areas grazed and trampled. Grazing is a threat, exotics present due to grazing. Beaver present up and down creek.

2011: New beaver dam observed, incomplete. Animal tracks throughout site, may be from cattle. Cattle grazing observed in area and sheep grazing observed nearby, but all grazing in AA and buffer described as light. Animals were moved frequently during our several day stay in California Park. Some algal growth noted in localized wetland areas, photographed. Bank erosion and incision. Some evidence of light soil disturbance and compaction. Some good quality plant zones along bank, though *Breea arvensis* recorded in AA (5-10% absolute cover), and moderate (50-75% relative cover) native vegetation in buffer.

2011 Plant List: 90MR53

Achillea lanulosa
Alnus incana ssp. *tenuifolia*
Asteraceae sp.
Breea arvensis
Bromopsis inermis
Bromopsis porteri
Carex aquatilis
Carex aurea
Carex lanuginosa
Carex microptera
Carex praegracilis
Carex utriculata
Castilleja miniata
Eleocharis macrostachya
Eleocharis quinqueflora
Elymus trachycaulus
Equisetum arvense
Erigeron glabellus ssp. *pubescens*
Fragaria virginiana ssp. *glauca*
Galium septentrionale
Geranium richardsonii
Halerpestes cymbalaria ssp. *saximontana*
Hierochloë hirta ssp. *arctica*
Hippochaete laevigata
Juncus arcticus ssp. *ater*
Juncus longistylis
Juncus tracyi
Ligularia bigelovii var. *hallii*
Limnorchis dilatata ssp. *albiflora*

1990s Plant List: 90MR53

Agrostis gigantea
Aster foliaceus
Breea arvensis
Bromopsis inermis
Cardamine cordifolia
Carex aquatilis
Carex nebrascensis
Equisetum arvense
Fragaria virginiana ssp. *glauca*
Geranium richardsonii
Hippochaete hyemalis
Maianthemum stellatum
Phleum pratense
Poa palustris
Poa pratensis
Rudbeckia ampla
Salix boothii
Salix lucida ssp. *lasiandra*
Salix wolfii
Solidago canadensis
Taraxacum officinale
Trifolium hybridum
Vicia americana

2011 Plant List: 90MR53 cont.

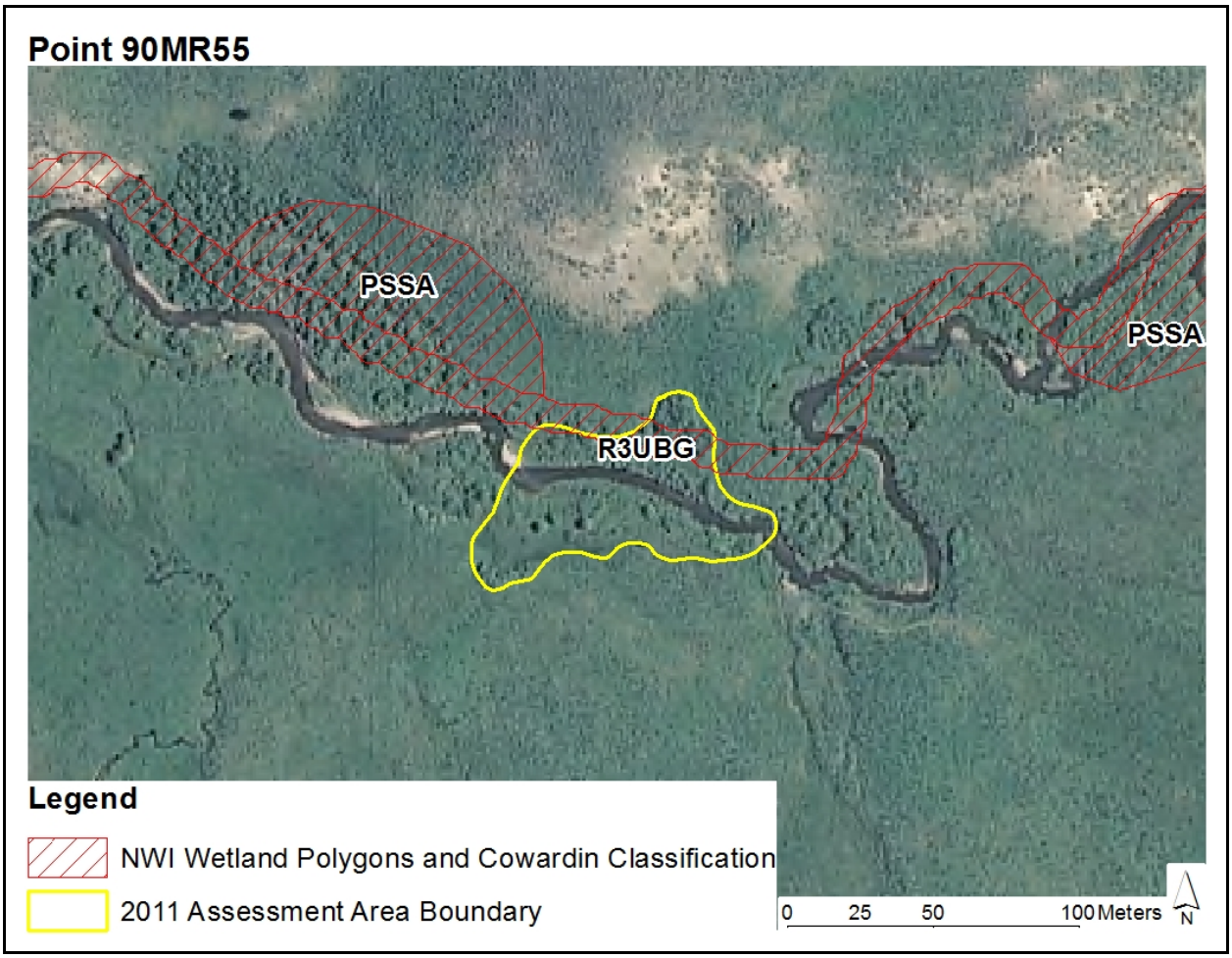
Lupinus argenteus
Maianthemum stellatum
Packera pseudaurea
Pedicularis groenlandica
Pentaphylloides floribunda
Perideridia gairdneri ssp. *borealis*
Phleum pratense
Poa pratensis
Potentilla pensylvanica
Prunella vulgaris
Rudbeckia ampla
Salix boothii
Salix lucida ssp. *lasiandra*
Salix wolfii
Scirpus microcarpus
Seriphidium canum
Solidago canadensis
Taraxacum officinale
Thalictrum fendleri
Thermopsis montana
Trifolium hybridum
Trifolium longipes
Trifolium repens
Valeriana edulis
Vicia americana

90MR56 (90MR55)

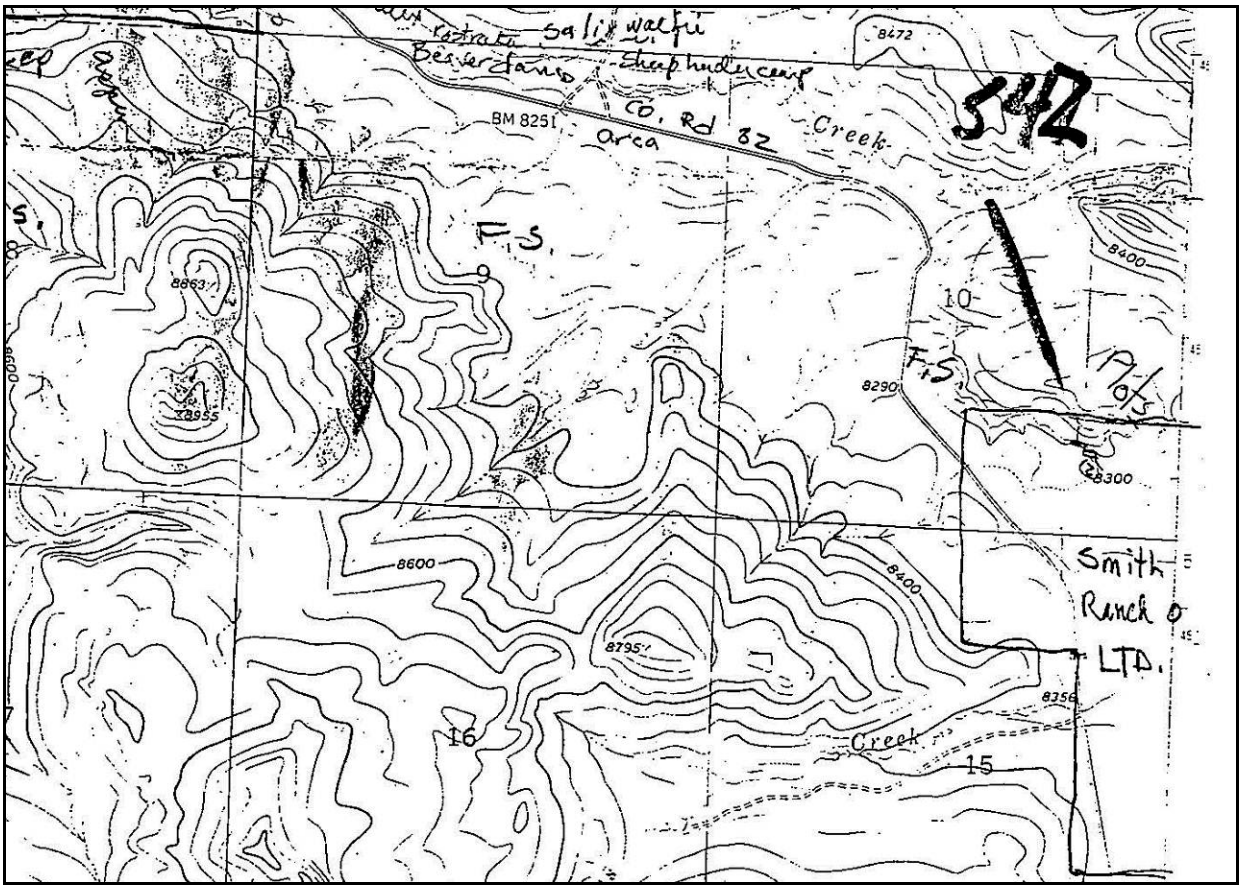
General Location: Slater Park along Slater Creek.

Initial Survey: 8/26/90 Resurvey: 7/30/11

Survey detail: Identified area to survey using annotated topographic map and hand drawings on old field form. AA encompasses both obs. (subplot) #'s 1 and 2 from 1994. Surveyed riparian willow shrub wetland on both sides of Slater Creek.



Aerial photo of 90MR55 Assessment Area surveyed in 2011, shown with digitized NWI mapping.



Location of 90MR55 plot from 1990 shown on Bears Ears Peaks Quadrangle as Plot #S42. Annotated map is scanned from old data sheet.

Photos of plot 90MR55 from 2011 survey.

Stressor note comparison:

1990: Some exotics observed. Large complex of historic beaver dams, some still active. Trail in general area. Has been grazed/browsed.

2011: Some willow browse, affecting height classes (25-50%) browsed, but all age classes still present. Buffers have <25% cover *Phleum pratense* and occasional *Breea arvense,* and in AA *Phleum* is 10-25% cover. Buffer and AA likely grazed (no animals observed), but no signs of grazing yet this year. A few willows on terrace above stream have grazed mushroom shape, streamside willows not mushroomed. Area was historically ditched but ditches appear unused at time of survey. Some erosion at streambanks, no beaver activity observed. Trail still present.

2011 Plant List: 90MR55

Achillea lanulosa
Agrostis scabra
Alopecurus aequalis
Androsace filiformis
Antennaria corymbosa
Asteraceae sp.
Bistorta bistortoides
Brassicaceae
Bromelica spectabilis
Bromopsis sp.
Calamagrostis canadensis
Campanula rotundifolia
Carex aquatilis
Carex microptera
Carex pachystachya
Carex praegracilis
Carex utriculata
Carex vesicaria
Castilleja miniata
Castilleja rhexifolia
Castilleja sulphurea
Cirsium sp.
Conioselinum scopulorum
Danthonia californica
Danthonia intermedia
Deschampsia cespitosa
Eleocharis acicularis
Eleocharis macrostachya
Elymus trachycaulus
Epilobium ciliatum

1990s Plant List: 90MR55

Achillea lanulosa
Anisantha tectorum
Aster foliaceus
Elymus trachycaulus ssp. *andinus*
Fragaria virginiana ssp. *glauca*
Geum macrophyllum var. *perincisum*
Mertensia ciliata
Phleum pratense
Poa palustris
Potentilla gracilis
Salix boothii
Salix geyeriana
Salix wolfii
Sidalcea candida
Taraxacum officinale
Thalictrum fendleri
Urtica gracilis
Vicia americana

1990s Plant List: 90MR56

Aster foliaceus
Calamagrostis stricta
Carex aquatilis
Carex vesicaria
Fragaria virginiana ssp. *glauca*
Geum macrophyllum var. *perincisum*
Pentaphylloides floribunda
Phleum pratense
Poa palustris

2011 Plant List: 90MR55 cont.

Equisetum arvense
Erigeron glabellus ssp. *pubescens*
Erigeron subtrinervis
Eriogonum sp.
Festuca idahoensis
Fragaria virginiana ssp. *glauca*
Galium septentrionale
Galium trifidum ssp. *subbiflorum*
Geum rivale
Gnaphalium uliginosum
Hierochloë hirta ssp. *arctica*
Juncus sp.
Juncus arcticus ssp. *ater*
Juncus tracyi
Mentha arvensis
Pedicularis groenlandica
Penstemon rydbergii
Pentaphylloides floribunda
Perideridia gairdneri ssp. *borealis*
Phleum pratense
Poa palustris
Poa pratensis
Potentilla gracilis
Prunella vulgaris
Ranunculus abortivus ssp. *acrolasius*
Ranunculus gmelinii var. *hookeri*
Ranunculus macauleyi
Ranunculus uncinatus
Rumex crispus
Salix boothii
Salix geyeriana
Salix wolfii
Scirpus microcarpus
Solidago canadensis
Sparganium angustifolium
Stellaria longifolia
Taraxacum officinale
Thalictrum fendleri
Thermopsis montana
Torreyochloa pauciflora
Trifolium hybridum
Trifolium longipes

1990s Plant List: 90MR56 cont.

Potentilla gracilis
Taraxacum officinale
Thalictrum fendleri

2011 Plant List: 90MR55 cont.

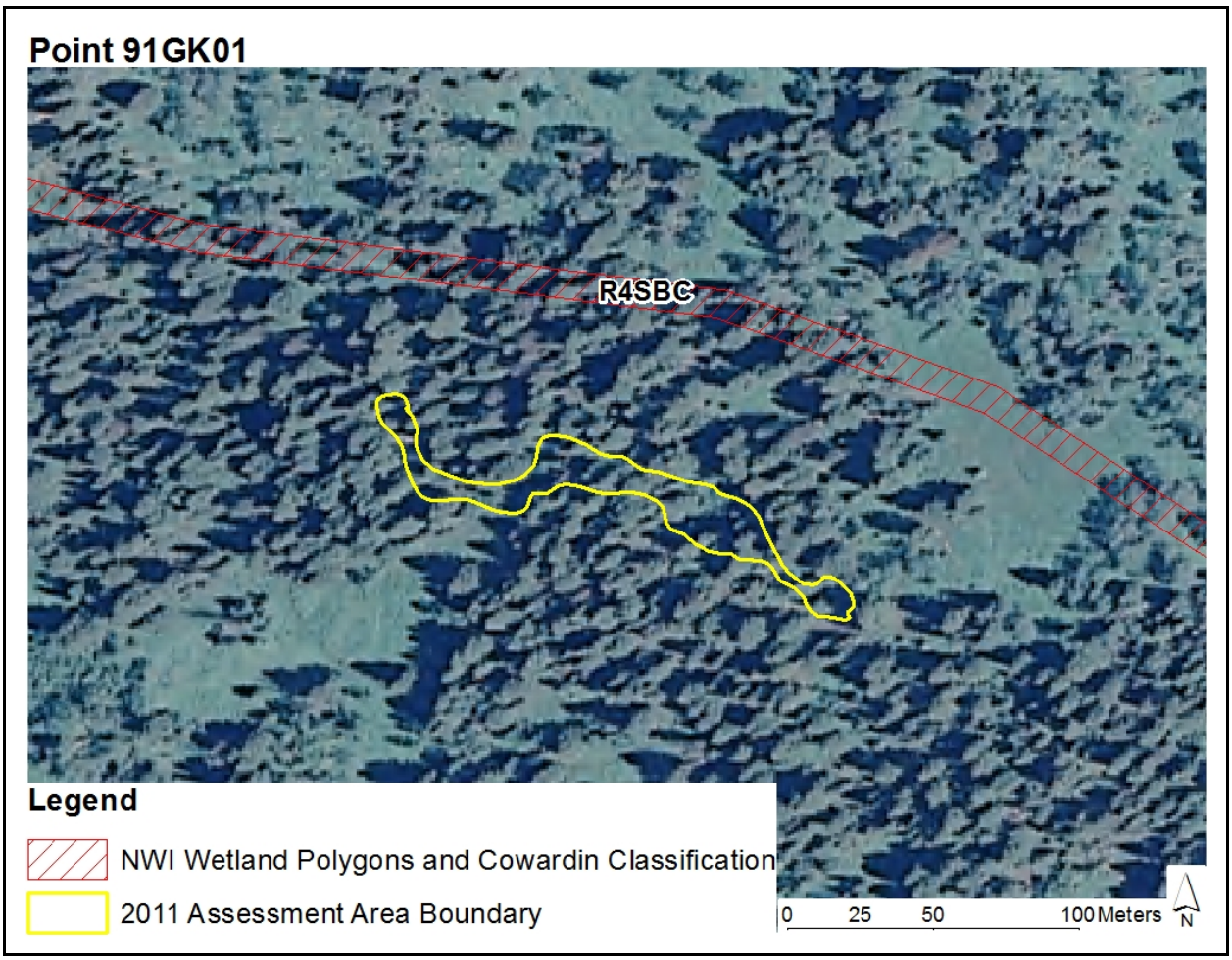
Trifolium repens
Trisetum wolfii
Valeriana occidentalis
Veronica nutans
Vicia americana

91GK01

General Location: Sawmill Creek

Initial Survey: 7/25/91 Resurvey: 8/8/11

Survey detail: Identified area to survey using GPS waypoint, which was in forest. Navigated down to stream at closest point to original GPS point uphill. AA is *Picea engelmannii/Abies* forested steep narrow channel riparian area, interspersed with *Alnus* and *Sambucus* shrubs. There was no annotated topographic map from 1991 data sheets for this point.



Aerial photo of 91GK01 Assessment Area surveyed in 2011, shown with digitized NWI mapping.

Photos of plot 91GK01 from 2011 survey.

Stressor note comparison:

1991: Overall rating = A, no initial data sheets from 1991, so environmental data limited. Plant list represents good community. Note they called *Picea pungens*, we called *Picea engelmannii* (future surveys will need to check sp.)

2011: *Pseudostellaria* was consistently unhealthy, possibly due to alternate host for rust associated with witches broom. Good native plant cover, including in buffer. Some of buffer logged, and general area lightly grazed, but streamside likely too steep for grazing. Otherwise riparian area in good condition.

2011 Plant List: 91GK01

Abies bifolia
Achillea lanulosa
Aconitum columbianum
Actaea rubra ssp. *arguta*
Agastache urticifolia
Alnus incana ssp. *tenuifolia*
Arnica cordifolia
Arnica parryi
Aster foliaceus
Bromelica spectabilis
Bromopsis canadensis
Calamagrostis canadensis
Cardamine breweri
Carex angustior
Carex geyeri
Carex microptera
Chamerion danielsii

1990s Plant List: 91GK01

Abies bifolia
Aconitum columbianum
Alnus incana ssp. tenuifolia
Cinna latifolia
Delphinium barbeyi
Elymus glaucus
Equisetum arvense
Fragaria virginiana ssp. *glauca*
Geranium richardsonii
Geum macrophyllum var. *perincisum*
Heracleum sphondylium ssp. *montanum*
Maianthemum amplexicaule
Mertensia ciliata
Micranthes odontoloma
Osmorhiza depauperata
Picea pungens
Pseudostellaria jamesiana

2011 Plant List: 91GK01 cont.
Cicuta douglasii
Cirsium centaureae
Conioselinum scopulorum
Delphinium barbeyi
Distegia involucrata
Elymus glaucus
Epilobium leptocarpum
Equisetum arvense
Erigeron elatior
Erigeron peregrinus ssp. *callianthemus*
Fragaria virginiana ssp. *glauca*
Galium septentrionale
Galium triflorum
Geranium richardsonii
Geum macrophyllum var. perincisum
Glyceria elata
Goodyera oblongifolia
Heracleum sphondylium ssp. *montanum*
Hydrophyllum capitatum
Juncus mertensianus
Lathyrus leucanthus
Limnorchis dilatata ssp. *albiflora*
Listera cordata ssp. *nephrophylla*
Luzula parviflora
Maianthemum amplexicaule
Mertensia ciliata
Micranthes odontoloma
Mimulus floribundus
Mitella pentandra
Osmorhiza depauperata
Oxypolis fendleri
Pedicularis bracteosa ssp. *paysoniana*
Penstemon whippleanus
Picea engelmannii
Poa leptocoma
Populus tremuloides
Prunella vulgaris
Pseudostellaria jamesiana
Ranunculus uncinatus
Rosa woodsii
Rubacer parviflorum
Rubus idaeus ssp. *melanolasius*

1990s Plant List: 91GK01 cont.
Senecio triangularis
Thalictrum fendleri

1990s Plant List: 92GK01
Achillea lanulosa
Arctium minus
Artemisia ludoviciana
Betula fontinalis
Bromopsis inermis
Chrysothamnus nauseosus ssp. graveolens
Clematis ligusticifolia
Crataegus rivularis
Juncus arcticus ssp. *ater*
Phragmites australis
Populus angustifolia
Ribes aureum
Rosa woodsii
Salix exigua

2011 Plant List: 91GK01 cont.

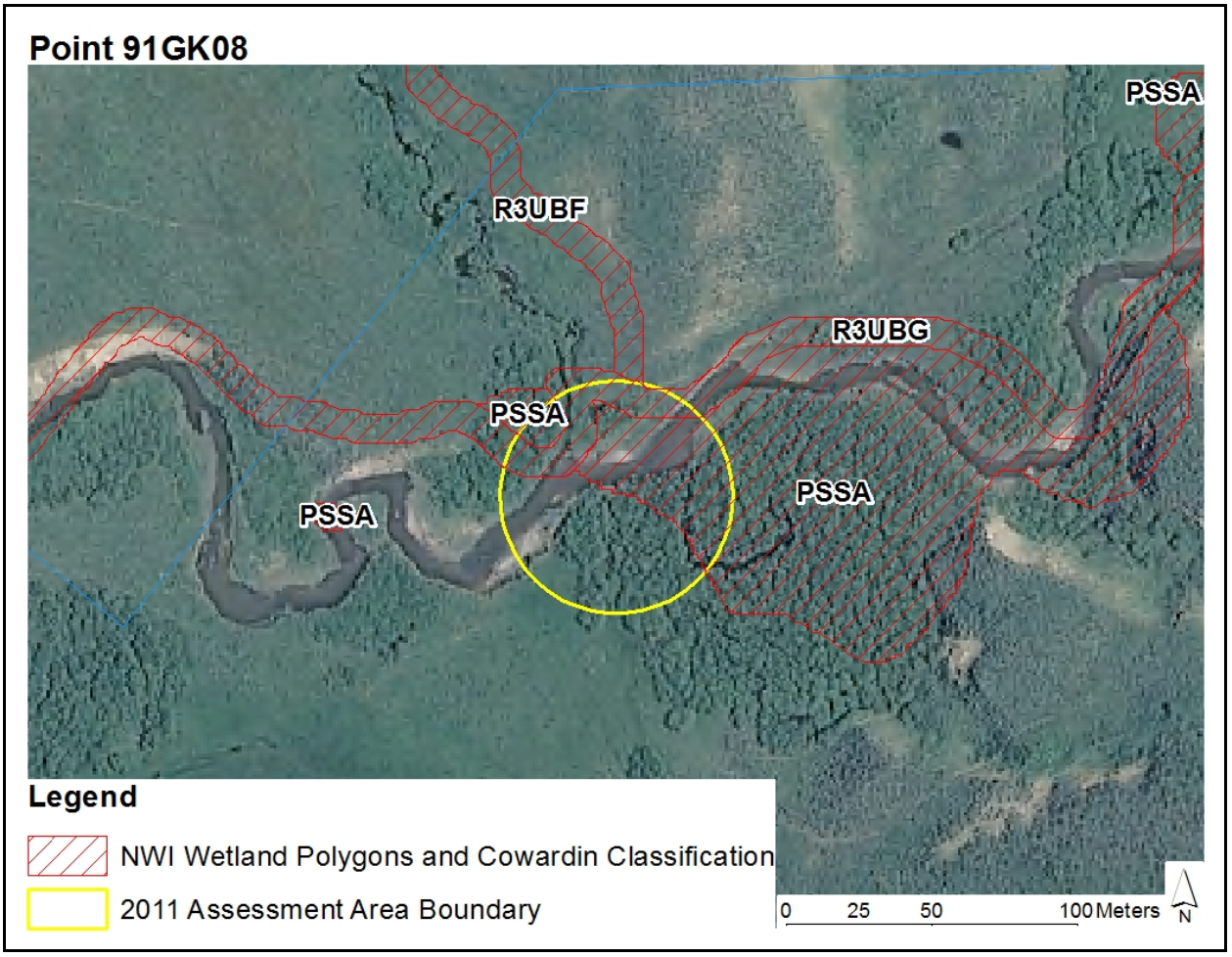
Sambucus microbotrys
Senecio integerrimus
Senecio triangularis
Streptopus fassettii
Taraxacum officinale
Thalictrum fendleri
Vaccinium myrtillus ssp. *oreophilum*
Veratrum tenuipetalum
Vicia americana
Viola scopulorum

91GK08 (94GR22)

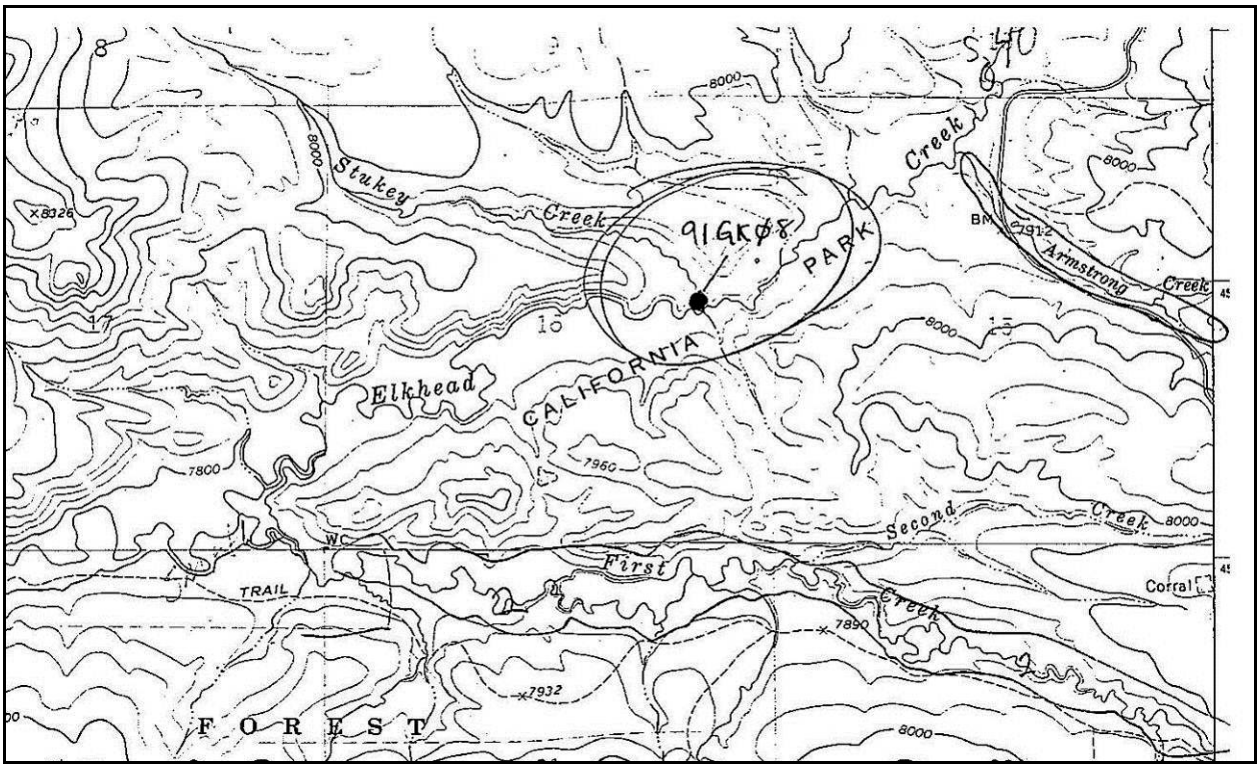
General Location: Intersection of Stuckey Creek and Elkhead Creek in California Park.

Initial Survey: 7/31/91 Resurvey: 7/27/11

Survey detail: Note that in AA photos (from data package) placard is incorrectly labeled 90MR53, with date 7/27/11. Marti Aiken met us for this site survey. Identified area to survey using annotated topographic map, labeling 91GK01. Area surveyed in 2011 best matches hand drawing obs. (subplot) #1 from 1991. Surveyed riparian willow shrub wetland on both sides of Elkhead Creek at intersection with Stuckey Creek. *Salix boothii* is dominant willow with mesic forb understory, AA surveyed borders wet meadow.



Aerial photo of 91GK08 Assessment Area surveyed in 2011, shown with digitized NWI mapping.



Location of 91GK08 plot from 1991 shown on Quaker Mountain Quadrangle as Plot #91GK08. Annotated map is scanned from old data sheet.

Photos of plot 91GK08 from 2011 survey.

Stressor note comparison:

1991: Beavers dams listed, but noted not to be immediate vicinity. Cattle trampled bank and heavy grazing listed as a threat. Many exotics.

2011: High structural patch diversity along stream included backwater channels, gravel bars, mudflats, and small streamlet paths interspersing along willows – evidence of a beaver-influenced system. Broken dams present upstream, and beaver appeared active not long ago, but no intact beaver dams present now. Evidence of native ungulate use (deer and elk scat and tracks). Paths appear too large to be formed by native ungulates, probably influenced by cattle (no animals observed). *Breea arvense, Phleum pratense,* and *Taraxacum officinale* common (each with 5-10% cover class). 500m buffer has substantial non-native vegetation (50-75% native). Signs of light grazing/browse present in 100% of AA and 500m buffer. Willows regenerating and browse is light-moderate (5-25%).

2011 Plant List: 91GK08

Acetosella paucifolia
Achillea lanulosa
Agoseris glauca
Alnus incana ssp. *tenuifolia*
Alopecurus aequalis
Androsace filiformis
Angelica pinnata
Antennaria rosea
Aster laevis var. *geyeri*
Brassicaceae
Breea arvensis
Bromus sp.
Carex aquatilis
Carex athrostachya
Carex illota
Carex lanuginosa
Carex microptera
Carex praegracilis
Carex utriculata
Carex vesicaria
Castilleja miniata
Coeloglossum viride ssp. *bracteatum*
Conioselinum scopulorum
Critesion brachyantherum
Deschampsia cespitosa
Distegia involucrata
Elymus trachycaulus

1990s Plant List: 91GK08

Achillea lanulosa
Elytrigia repens
Equisetum arvense
Fragaria virginiana ssp. *glauca*
Galium septentrionale
Geranium richardsonii
Juncus arcticus ssp. *ater*
Maianthemum stellatum
Packera cana
Pentaphylloides floribunda
Phleum commutatum
Poa pratensis
Potentilla gracilis
Rudbeckia ampla
Salix boothii
Salix wolfii
Taraxacum officinale
Thalictrum fendleri
Trifolium pratense
Vicia americana

2011 Plant List: 91GK08 cont.

Equisetum arvense
Erigeron subtrinervis
Festuca sp.
Fragaria virginiana ssp. *glauca*
Galium septentrionale
Galium trifidum ssp. *subbiflorum*
Geum macrophyllum var. *perincisum*
Halerpestes cymbalaria ssp. *saximontana*
Hierochloë hirta ssp. *arctica*
Juncus arcticus ssp. *ater*
Juncus longistylis
Juncus tracyi
Limnorchis dilatata ssp. *albiflora*
Madia glomerata
Maianthemum stellatum
Mentha arvensis
Oxypolis fendleri
Pedicularis groenlandica
Penstemon rydbergii
Pentaphylloides floribunda
Perideridia gairdneri ssp. *borealis*
Phleum pratense
Poa pratensis
Polygonaceae
Potentilla gracilis
Potentilla pulcherrima
Prunella vulgaris
Ranunculus macounii
Rudbeckia ampla
Rumex crispus
Salix boothii
Salix lucida ssp. *lasiandra*
Salix wolfii
Scirpus microcarpus
Senecio integerrimus
Seriphidium canum
Solidago canadensis
Stachys palustris ssp. *pilosa*
Taraxacum officinale
Thalictrum fendleri
Thermopsis montana
Trifolium hybridum

2011 Plant List: 91GK08 cont.

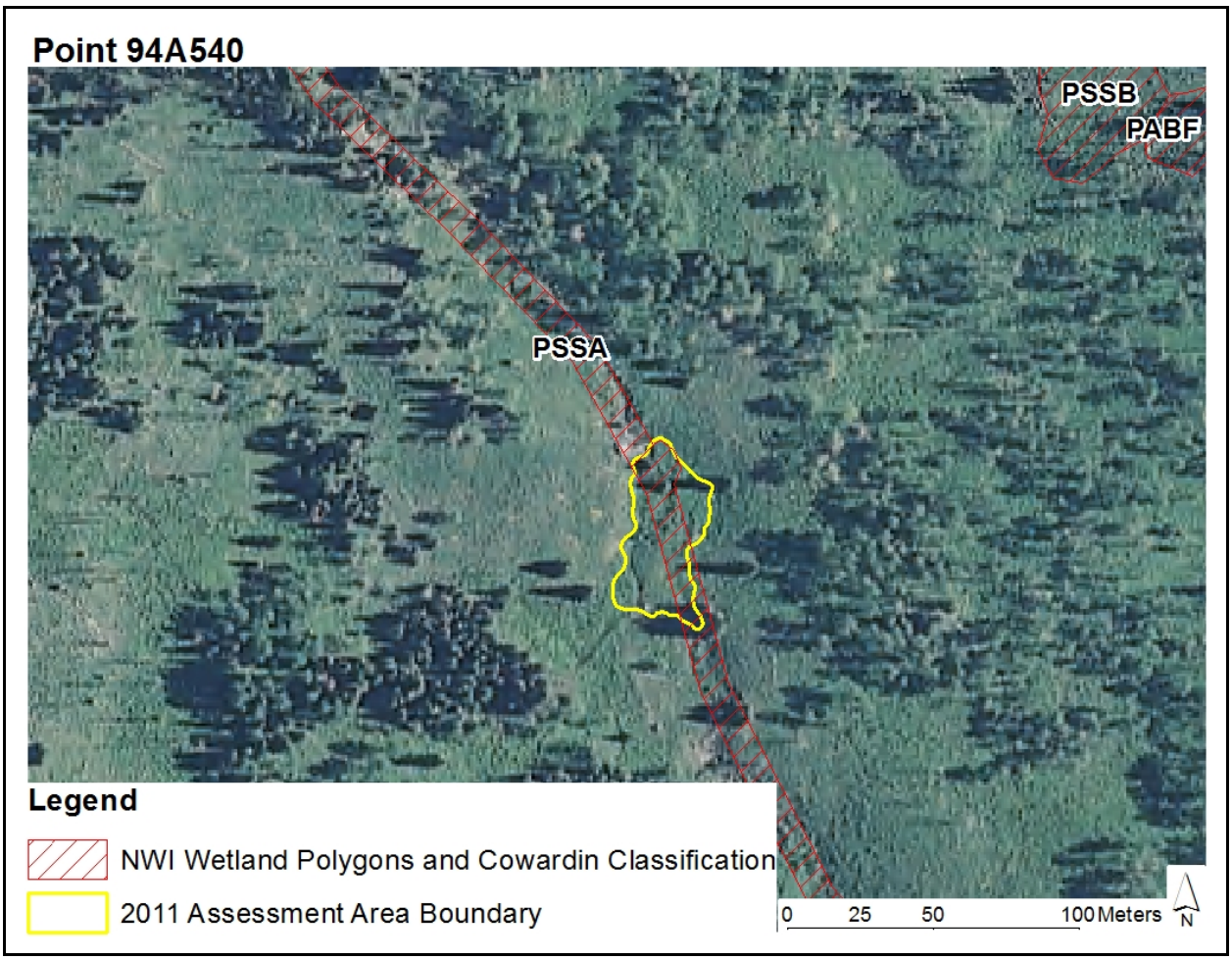
Trifolium longipes
Trifolium repens
Veratrum tenuipetalum
Vicia americana

94A540 (94MA15)

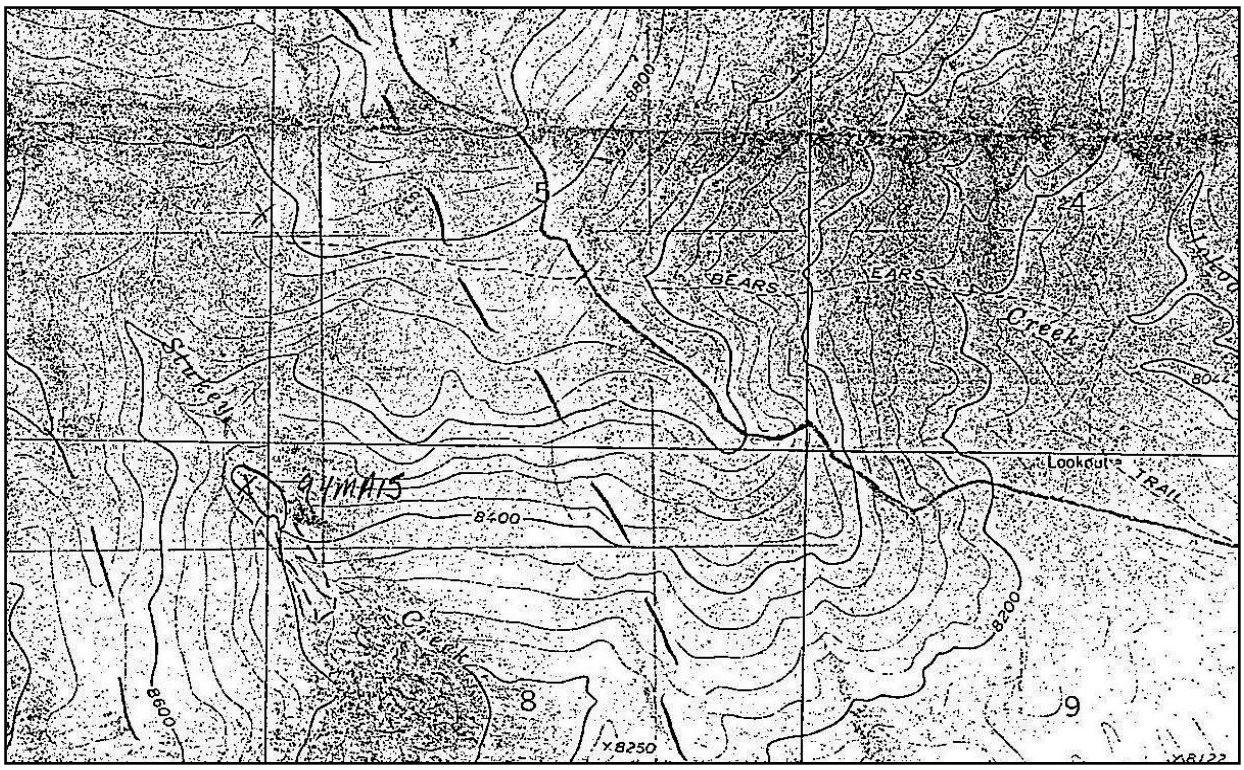
General Location: Stuckey Creek W of CA Park.

Initial Survey: 7/12/94 Resurvey: 7/28/11

Survey detail: Identified area to survey using GPS waypoint, which was 80m above stream. Navigated directly down to Stuckey Creek. AA includes narrow *Alnus incana* shrub wetland with *Calamagrostis*/*Carex*/mesic forb herbaceous areas, interspersed with seeps. Area surveyed in 2011 appears similar to hand drawing obs. (subplot) #'s 2 and 3 from 1994.



Aerial photo of 94A540 Assessment Area surveyed in 2011, shown with digitized NWI mapping.



Location of 94A540 plot from 1994 shown on Bears Ears Peaks Quadrangle as Plot #94MA15. Annotated map is scanned from old data sheet.

Photos of plot 94A540 from 2011 survey.

Stressor note comparison:

1994: Threats listed include logging in offsite area, presence of *Cirsium* sp, *Veratrum, Taraxicum*; heavy hunter use, and possibly grazing on upper portion.

2011: Sheep and elk observed within 1 km of site and no barriers to reaching site, but no signs of grazing in AA.

No issues observed from logging or hunters. *Breea arvensis* recorded in AA (1-2% absolute cover), 5-25% (cover class) relative cover non-natives (spp not listed) in buffer.

2011 Plant List: 94A540

Abies bifolia
Achillea lanulosa
Aconitum columbianum
Agastache urticifolia
Agoseris aurantiaca
Alnus incana ssp. *tenuifolia*
Breea arvensis
Bromelica spectabilis
Bromopsis inermis
Calamagrostis canadensis
Cardamine breweri
Carex aquatilis
Carex hoodii
Carex microptera
Carex neurophora
Carex utriculata
Coeloglossum viride ssp. *bracteatum*
Collomia linearis
Conioselinum scopulorum
Descurainia incana
Distegia involucrata
Elymus glaucus
Epilobium sp.
Equisetum arvense
Fragaria virginiana ssp. *glauca*
Galium septentrionale
Galium triflorum
Geranium richardsonii
Geum macrophyllum var. *perincisum*
Glyceria elata
Hackelia floribunda
Heracleum sphondylium ssp. *montanum*

1990s Plant List: 94A540

Abies bifolia
Achillea lanulosa
Alnus incana ssp. *tenuifolia*
Arnica cordifolia
Bromopsis inermis
Calamagrostis canadensis
Carex aquatilis
Carex microptera
Chaenactis douglasii
Equisetum arvense
Erigeron elatior
Erigeron peregrinus ssp. *callianthemus*
Fragaria virginiana ssp. *glauca*
Galium triflorum
Geranium richardsonii
Glyceria elata
Heracleum sphondylium ssp. *montanum*
Mertensia ciliata
Micranthes odontoloma
Mitella pentandra
Orthilia secunda
Osmorhiza depauperata
Oxypolis fendleri
Picea engelmannii
Rubus idaeus ssp. *melanolasius*
Senecio triangularis
Streptopus fassettii
Taraxacum officinale
Viola macloskeyi ssp. *pallens*

2011 Plant List: 94A540 cont.

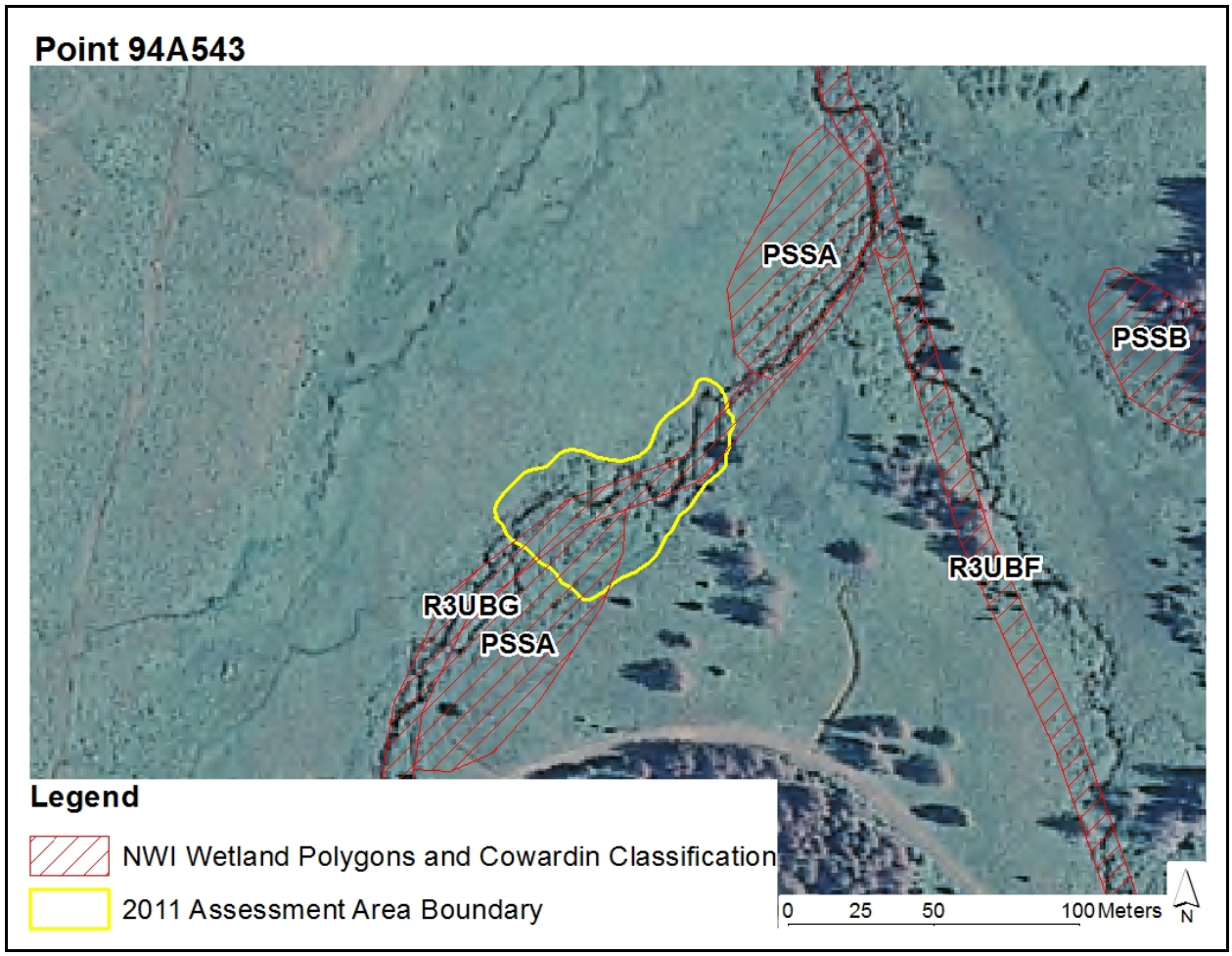
Juncus saximontanus
Limnorchis dilatata ssp. *albiflora*
Lupinus argenteus
Mentha arvensis
Mertensia ciliata
Micranthes odontoloma
Mimulus moschatus
Neolepia campestris
Osmorhiza depauperata
Pedicularis groenlandica
Picea engelmannii
Poa pratensis
Potentilla pulcherrima
Prunella vulgaris
Ranunculus uncinatus
Rudbeckia ampla
Rumex sp.
Rumex aquaticus ssp. *occidentalis*
Scirpus microcarpus
Senecio triangularis
Taraxacum officinale
Thalictrum fendleri
Urtica gracilis
Valeriana occidentalis
Veratrum tenuipetalum
Veronica nutans
Vicia americana
Viola sp.

94A543

General Location: Grizzly Creek Park, above confluence on Grizzly Creek.

Initial Survey 1994 Resurvey: 8/6/11

Survey detail: Identified area to survey using GPS waypoint. Navigated down to Grizzly Creek from waypoint. AA is *Salix boothii* and *wolfii* shrubland with many side channels. There were no original data forms or annotated topographic maps from 1994 for this point.



Aerial photo of 94A543 Assessment Area surveyed in 2011, shown with digitized NWI mapping.

Photos of plot 94A543 from 2011 survey.

Stressor note comparison:

1994: *Taraxacum* present (6%) and *Phleum* (1%). Site quality = 'B', limited environmental information reported.

2011: Some erosion areas where channel meets meadow. Beetle kill in buffer mainly to SE. *Phleum pratense* 5-10% cover in AA and *Taraxacum* 1-2%, *Phleum* and other nonnatives with 5-25% cover in 500m buffer. Stream crosses road 2 times without buffer, will add road sediment to stream. Old (light) browse of *Salix wolfii* (but *S. boothii* appears not browsed) in AA, and assumed in buffer as well (5-25% stems browsed). Some algae growth in slow moving areas of stream. Microtopography allows for botanical interspersion.

2011 Plant List: 94A543

Achillea lanulosa
Aconitum columbianum
Allium sp.
Alnus incana ssp. *tenuifolia*
Androsace filiformis
Angelica pinnata
Antennaria corymbosa
Aster laevis var. *geyeri*
Bistorta bistortoides
Calamagrostis canadensis
Cardamine cordifolia
Carex angustior
Carex aquatilis
Carex ebenea
Carex hoodii

1990s Plant List: 94A543

Achillea lanulosa
Androsace filiformis
Bromopsis inermis
Calamagrostis canadensis
Cardamine cordifolia
Carex aquatilis
Carex microptera
Carex utriculata
Castilleja miniata
Conioselinum scopulorum
Fragaria virginiana ssp. *glauca*
Galium trifidum ssp. *subbiflorum*
Geranium richardsonii
Geum macrophyllum var. *perincisum*
Glyceria elata

2011 Plant List: 94A543 cont.

Carex lanuginosa
Carex microptera
Carex vesicaria
Castilleja miniata
Cerastium strictum
Ceratochloa carinata
Cirsium scariosum
Conioselinum scopulorum
Critesion brachyantherum
Dactylis glomerata
Danthonia intermedia
Deschampsia cespitosa
Draba sp.
Elymus glaucus
Elymus trachycaulus
Epilobium sp.
Epilobium ciliatum
Equisetum arvense
Erigeron elatior
Erigeron glabellus ssp. *pubescens*
Erythrocoma triflora
Festuca idahoensis
Fragaria virginiana ssp. glauca
Galium septentrionale
Geranium richardsonii
Geum macrophyllum var. *perincisum*
Glyceria borealis
Heracleum sphondylium ssp. *montanum*
Hierochloë hirta ssp. *arctica*
Juncus sp.
Juncus confusus
Juncus longistylis
Juncus tracyi
Luzula comosa
Luzula parviflora
Madia glomerata
Mertensia ciliata
Pedicularis groenlandica
Penstemon rydbergii
Pentaphylloides floribunda
Perideridia gairdneri ssp. *borealis*
Phleum commutatum

1990s Plant List: 94A543 cont.

Heracleum sphondylium ssp. *montanum*
Luzula parviflora
Mertensia ciliata
Noccaea montana
Oxypolis fendleri
Pedicularis groenlandica
Phleum commutatum
Phleum pratense
Poa pratensis
Psychrophila leptosepala
Salix boothii
Salix wolfii
Senecio triangularis
Taraxacum officinale
Thalictrum fendleri
Trifolium longipes
Veronica americana
Veronica nutans
Vicia americana

2011 Plant List: 94A543 cont.

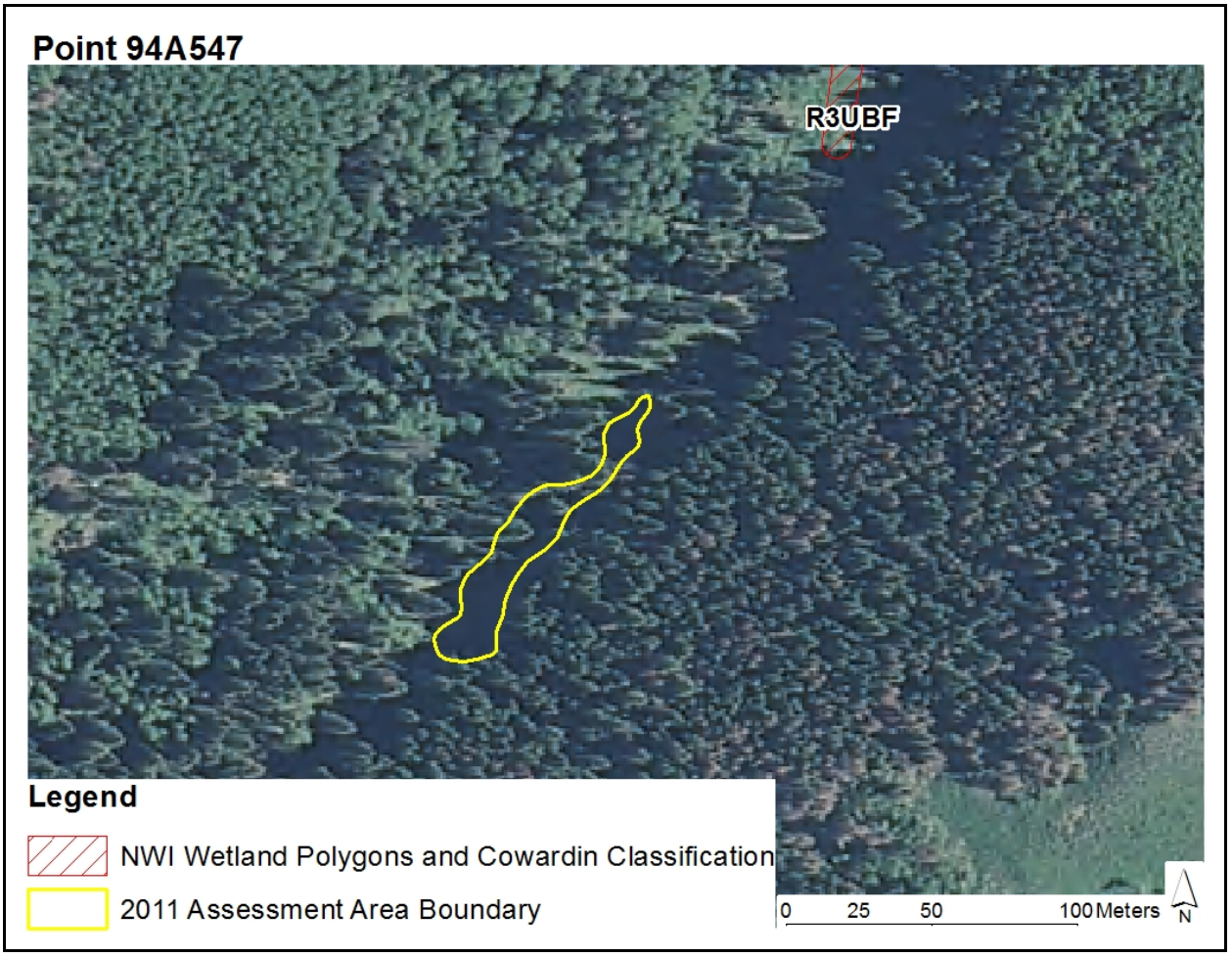
Phleum pratense
Pinus contorta var. *latifolia*
Pneumonanthe parryi
Poa pratensis
Poa secunda
Polygonum douglasii
Polygonum polygaloides ssp. *kelloggii*
Potentilla gracilis
Potentilla pulcherrima
Prunella vulgaris
Psychrophila leptosepala
Ranunculus uncinatus
Rumex crispus
Salix boothii
Salix lucida ssp. *lasiandra*
Salix wolfii
Senecio crassulus
Senecio triangularis
Seriphidium canum
Solidago multiradiata
Spergula arvensis
Stellaria longifolia
Taraxacum officinale
Thermopsis montana
Trifolium hybridum
Trifolium longipes
Trifolium repens
Trisetum spicatum
Valeriana edulis
Valeriana occidentalis
Veratrum tenuipetalum
Veronica americana
Veronica nutans
Vicia americana

94A547 (94MA18?)

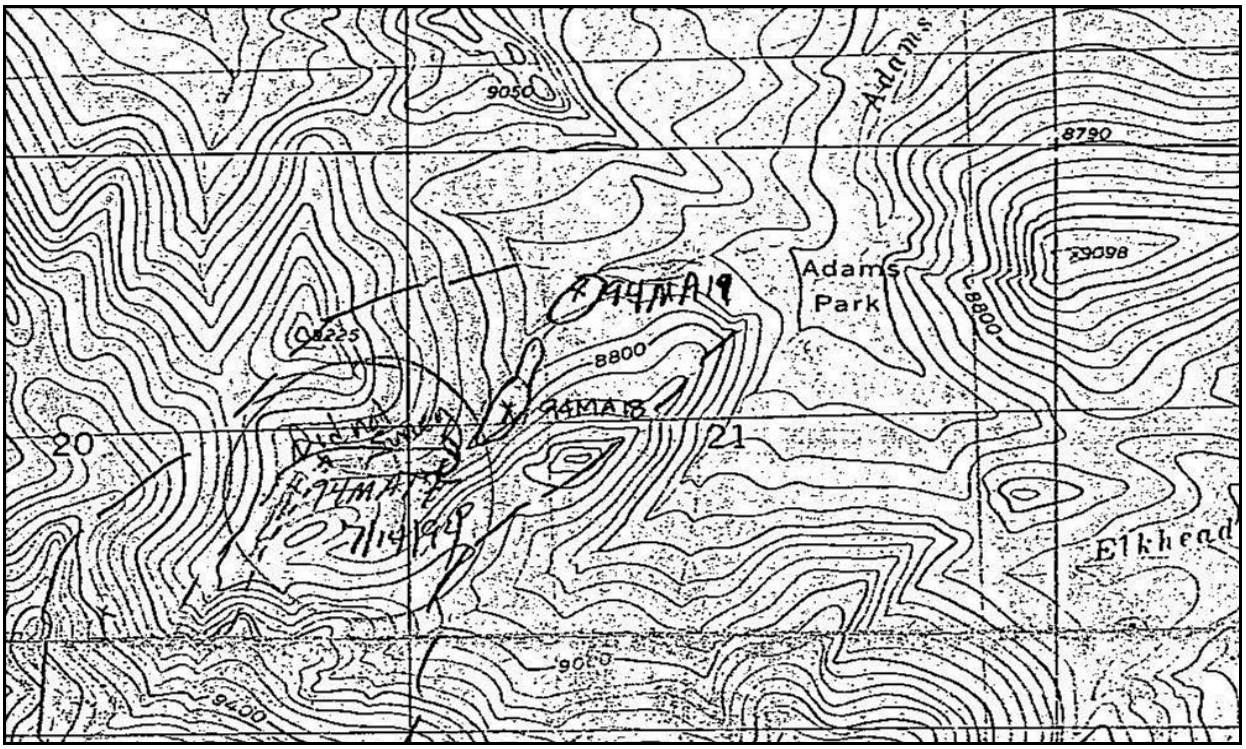
General Location: Along small stream W of Adams Park.

Initial Survey: 7/14/94 Resurvey: 7/29/11

Survey detail: Identified area to survey using GPS waypoint, which was 100m above stream. Navigated directly down to Stuckey Creek. Low confidence in direct matchup between initial survey location and resurvey because not clear which resurvey point matches initial survey point best. Area surveyed in 2011 appears similar to hand drawing obs. (subplot) #'s 2 and 3 from 1994. This point is few hundred meters upstream from resurvey point 94A548. Narrow forested riparian area, with *Equisetum* as dominant understory with some bank seeps.



Aerial photo of 94A547 Assessment Area surveyed in 2011, shown with digitized NWI mapping.



Location of 94A547 plot from 1994 shown on Bears Ears Peaks Quadrangle as Plot #94MA18. Annotated map is scanned from old data sheet.

Photos of plot 94A547 from 2011 survey.

<u>Stressor note comparison:</u>

1994: No threats listed, remote location mentioned to explain lack of threat.

2011: Minimal threats noted, overall good condition, minor browse (<5%).

2011 Plant List: 94A547

Abies bifolia
Aconitum columbianum
Alnus incana ssp. *tenuifolia*
Arnica cordifolia
Bromelica spectabilis
Calamagrostis canadensis
Cardamine cordifolia
Carex aquatilis
Carex microptera
Carex utriculata
Epilobium sp.
Equisetum arvense
Erigeron elatior
Erigeron peregrinus ssp. *callianthemus*
Galium triflorum
Geranium richardsonii
Geum macrophyllum var. *perincisum*
Glyceria elata
Heracleum sphondylium ssp. *montanum*
Hydrophyllum capitatum
Juncus nevadensis
Juncus parryi
Juncus tracyi
Limnorchis dilatata ssp. *albiflora*
Luzula parviflora
Mertensia ciliata
Micranthes odontoloma
Mitella pentandra
Moneses uniflora
Nemophila breviflora
Osmorhiza depauperata
Pedicularis bracteosa ssp. *paysoniana*
Picea engelmannii
Senecio triangularis
Streptopus fassettii
Thalictrum fendleri
Trillium ovatum
Unknown forb
Vaccinium myrtillus ssp. *oreophilum*
Veratrum tenuipetalum
Veronica nutans
Vicia americana

1990s Plant List: 94A547

Abies bifolia
Alnus incana ssp. *tenuifolia*
Arnica cordifolia
Calamagrostis canadensis
Cardamine cordifolia
Carex aquatilis
Carex microptera
Carex utriculata
Elymus glaucus
Equisetum arvense
Galium triflorum
Geranium richardsonii
Geum macrophyllum var. *perincisum*
Glyceria elata
Juncus drummondii
Juncus mertensianus
Mertensia ciliata
Micranthes odontoloma
Mitella pentandra
Osmorhiza depauperata
Phleum commutatum
Ranunculus uncinatus
Senecio triangularis
Taraxacum officinale
Viola macloskeyi ssp. *pallens*

2011 Plant List: 94A547 cont.

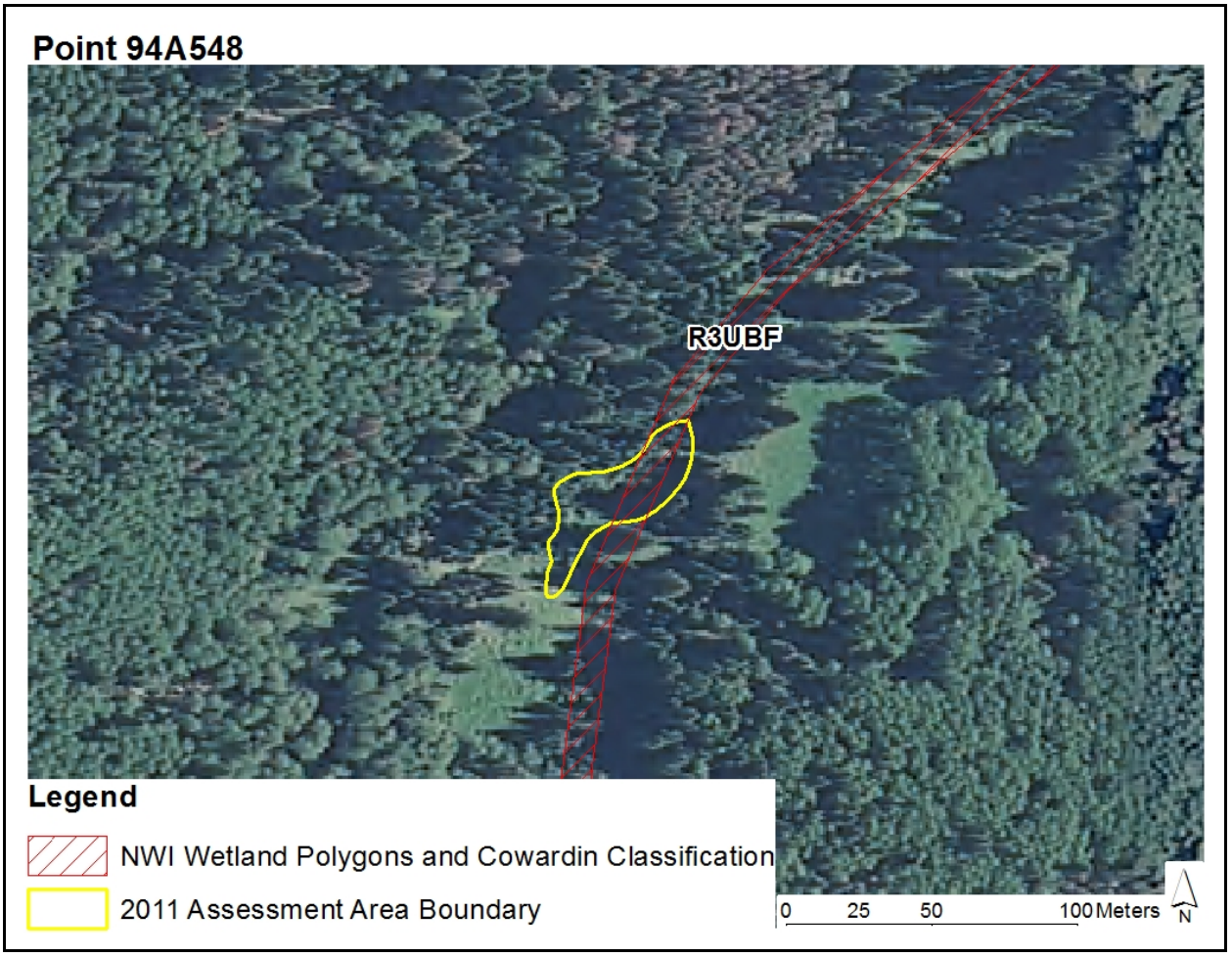
Viola renifolia var. *brainerdii*
Viola rydbergii

94A548 (94MA19?)

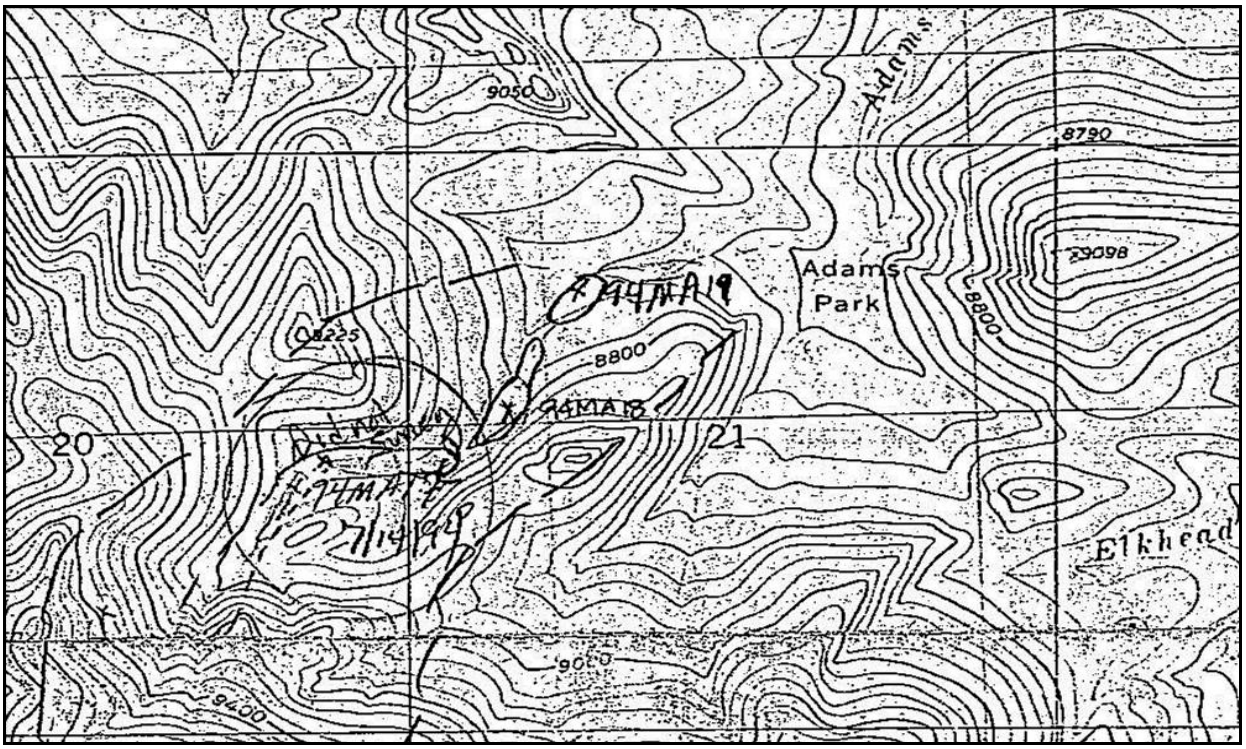
General Location: Along small stream W of Adams Park.

Initial Survey: 7/14/94 Resurvey: 7/29/11

Survey detail: Identified area to survey using GPS waypoint, which was 100m above stream. Navigated directly down to drainage. Low confidence in direct matchup between initial survey location and resurvey because not clear which resurvey point matches initial survey point best. Area surveyed in 2011 appears similar to hand drawing obs. (subplot) #'s 2 and 3 from 1994. This point is few hundred meters downstream from resurvey point 94A547. Narrow forested riparian area, with *Picea/Alnus/Calamagrostis* spp dominant, interspersed with open slope seeps.



Aerial photo of 94A548 Assessment Area surveyed in 2011, shown with digitized NWI mapping.



Location of 94A548 plot from 1994 shown on Bears Ears Peaks Quadrangle as Plot #94MA19. Annotated map is scanned from old data sheet.

Photos of plot 94A548 from 2011 survey.

Stressor note comparison:

1994: Some exotics observed. Large complex of historic beaver dams, some still active. Trail in general area.

2011: Abundant historic and some present beaver activity in area, mostly historic. Historic beaver dams repositioned as jams, photographed. Some non-natives in buffer (5-25%), *Breea arvensis* 1-2% in AA. Minor browse noted (<5%), likely ungulates. Some undercut banks, attributed to natural causes of heavy flows and beaver dam blowouts. Trail still present.

2011 Plant List: 94A548

Abies bifolia
Achillea lanulosa
Aconitum columbianum
Agastache urticifolia
Agoseris aurantiaca
Alnus incana ssp. *tenuifolia*
Androsace septentrionalis
Arnica parryi
Boechera drummondii
Breea arvensis
Bromelica spectabilis
Calamagrostis sp.
Calamagrostis canadensis
Cardamine cordifolia
Carex aquatilis
Carex jonesii
Carex microptera
Carex occidentalis
Carex utriculata
Cerastium strictum
Chamerion danielsii
Distegia involucrata
Eleocharis macrostachya
Elymus glaucus
Epilobium sp.
Equisetum arvense
Fragaria virginiana ssp. *glauca*
Galium triflorum
Geranium richardsonii
Geum macrophyllum var. *perincisum*
Heracleum sphondylium ssp. *montanum*
Juncus arcticus ssp. *ater*
Juncus tracyi

1990s Plant List: 94A548

Androsace filiformis
Bromopsis porteri
Calamagrostis canadensis
Cardamine cordifolia
Carex aquatilis
Carex microptera
Carex utriculata
Elymus glaucus
Equisetum arvense
Galeopsis bifida
Geum macrophyllum var. perincisum
Glyceria elata
Heracleum sphondylium ssp. montanum
Juncus arcticus ssp. *ater*
Juncus ensifolius
Mertensia ciliata
Mimulus moschatus
Noccaea montana
Osmorhiza depauperata
Poa pratensis
Ranunculus uncinatus
Rudbeckia ampla
Senecio triangularis
Taraxacum officinale
Veronica americana

2011 Plant List: 94A548 cont.

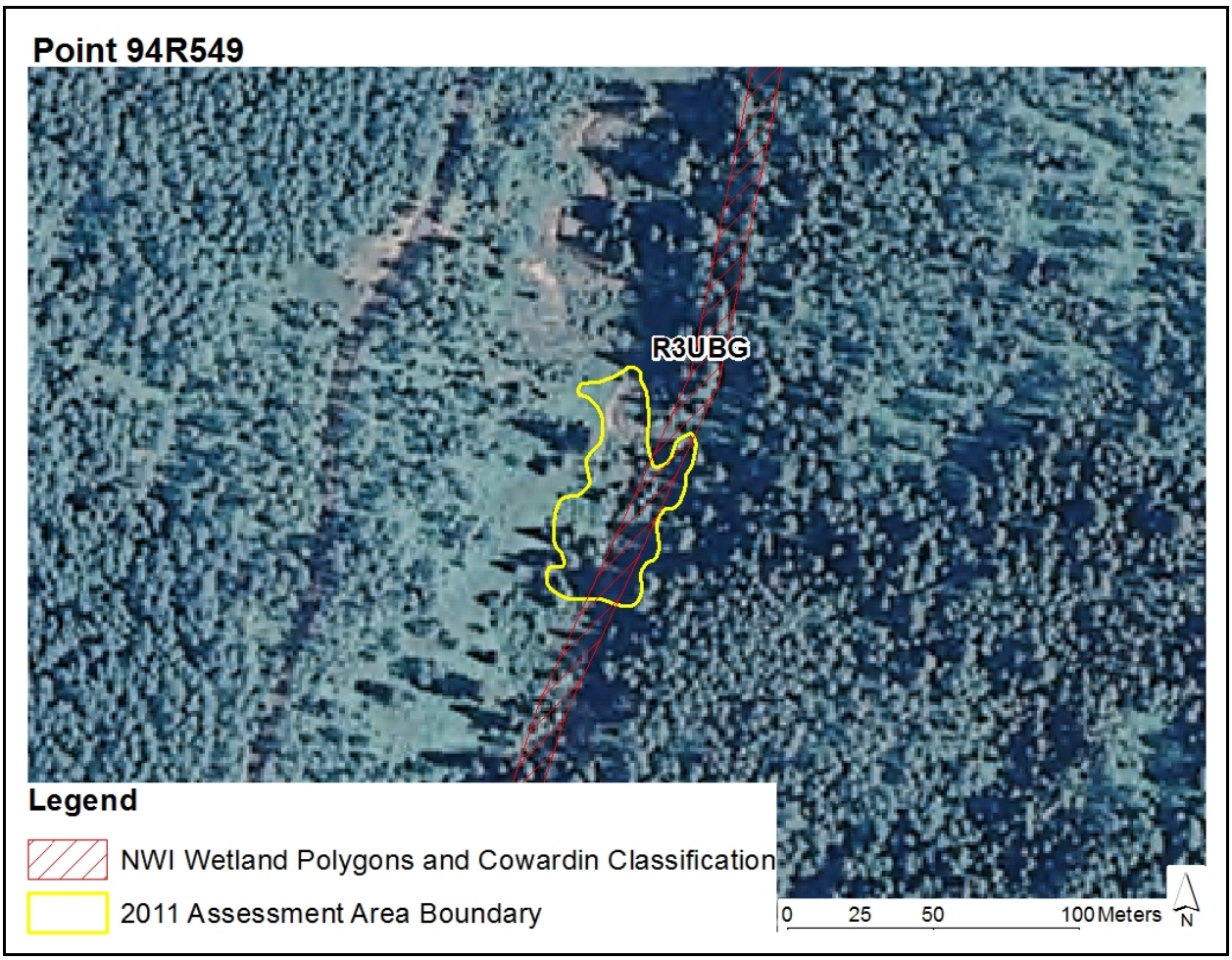
Lathyrus leucanthus
Limnorchis dilatata ssp. *albiflora*
Luzula parviflora
Maianthemum stellatum
Mertensia ciliata
Micranthes odontoloma
Mitella pentandra
Neolepia campestris
Osmorhiza depauperata
Phleum pratense
Picea engelmannii
Populus tremuloides
Potentilla pensylvanica
Ranunculus uncinatus
Salix monticola
Senecio triangularis
Taraxacum officinale
Thermopsis montana
Valeriana occidentalis
Veratrum tenuipetalum
Veronica nutans
Vicia americana
Viola renifolia var. *brainerdii*

94R549 (94GR19)

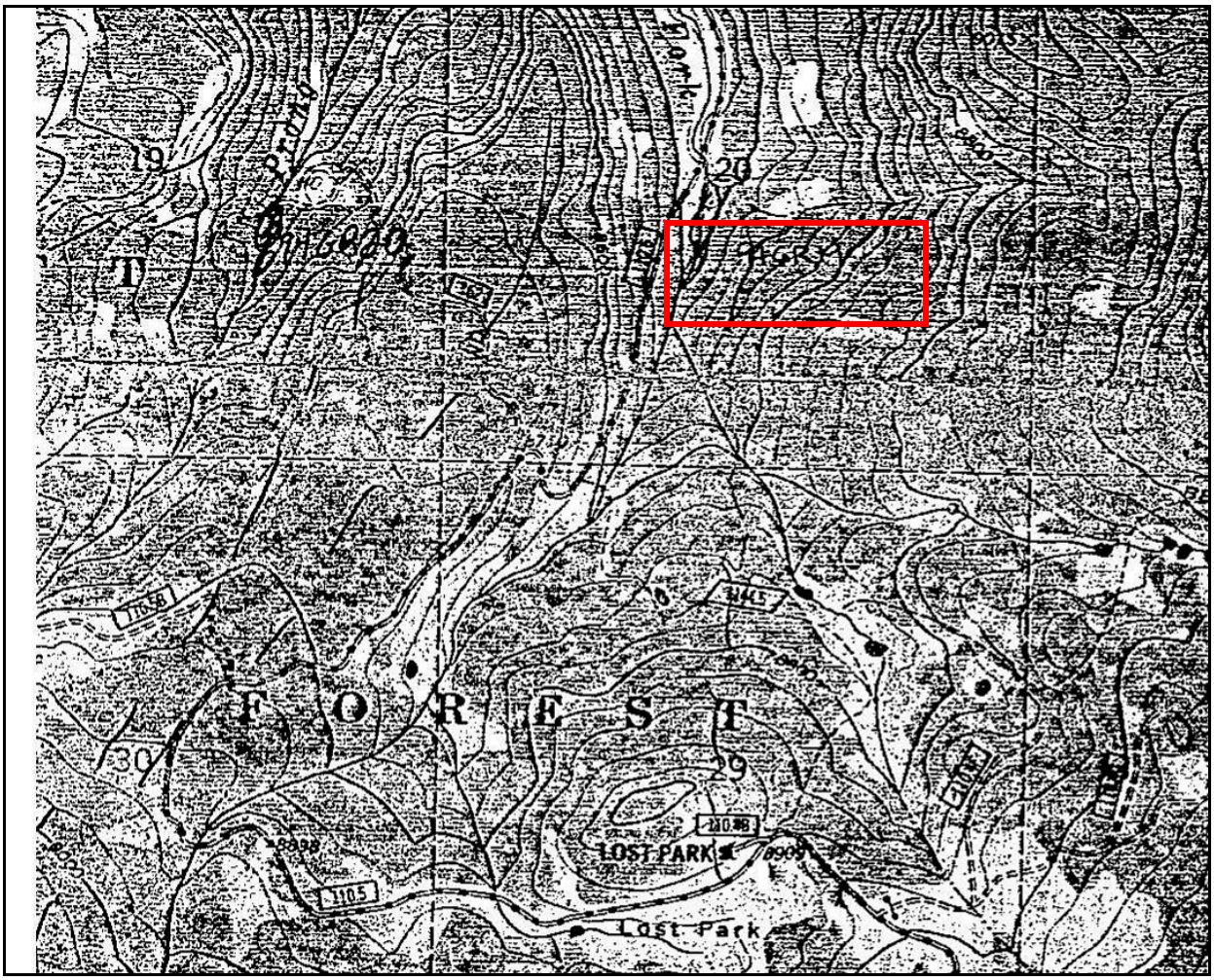
General Location: S Fork Slater Creek

Initial Survey: 7/13/94 Resurvey: 8/5/11

Survey detail: Identified area to survey using GPS waypoint and navigated to closest point on floodplain, which seemed similar to annotated topographic map. AA is mixed *Salix* riparian shrubland with overstory of canopy trees. Diverse site with much microtopography, moist soil area and Salix maintained with side channels.



Aerial photo of 94R549 Assessment Area surveyed in 2011, shown with digitized NWI mapping.



Location of 94R549 plot from 1994 shown on Buck Point Quadrangle as Plot #94GR19. Point is outlined in red box. Annotated map is scanned from old data sheet.

Photos of plot 94R549 from 2011 survey.

Stressor note comparison:

1994: Cattle coming upstream, cattle grazing downstream have tremendous adverse impacts on riparian area in lower section of creek. W slope banks slump in areas, stream meanders and cuts at W side of bank. *Cirsium, Trifolium, Poa pratensis, Taraxacum* recorded.

2011: Non-hydric soils on relict bank terrace with willows on west side, may eventually kill vegetation if water does not flood willow area over time. Some dead shrubs and erosion in AA. Sheep browsing in AA, moved fairly continuously in and out of site (browsing tops off plants), so grazing described as light in AA and buffer. High degree of vegetation interspersion. *Breea arvensis* prolific in areas (only 1-2% in AA), some *Phleum pratense*, 25-50% non-native vegetation in 500m buffer. Moderate soil disruption in 500m buffer. Woody species with 25-50% of stems browsed but all ages of regeneration present. No cattle observed, soil disruption could be due to historic cattle.

2011 Plant List: 94R549

Abies bifolia
Acetosella paucifolia
Achillea lanulosa
Aconitum columbianum
Agastache urticifolia
Alnus incana ssp. *tenuifolia*
Androsace filiformis
Androsace septentrionalis
Antennaria rosea
Arnica cordifolia
Arnica mollis
Breea arvensis
Bromus hordeaceus
Calamagrostis canadensis
Cardamine breweri
Cardamine cordifolia
Carex angustior
Carex aquatilis
Carex geyeri
Carex microptera
Carex utriculata
Castilleja miniata
Cerastium strictum
Cirsium centaureae
Conioselinum scopulorum
Descurainia incana
Distegia involucrata
Draba sp.

1990s Plant List: 94R549

Abies bifolia
Achillea lanulosa
Alnus incana ssp. *tenuifolia*
Androsace filiformis
Breea arvensis
Calamagrostis canadensis
Cardamine cordifolia
Carex aquatilis
Carex jonesii
Carex utriculata
Distegia involucrata
Elymus elymoides
Equisetum arvense
Fragaria virginiana ssp. *glauca*
Galeopsis bifida
Galium spurium
Galium trifidum ssp. *subbiflorum*
Geranium richardsonii
Geum macrophyllum var. *perincisum*
Juncus tracyi
Mertensia ciliata
Mitella pentandra
Oxypolis fendleri
Phleum pratense
Picea engelmannii
Poa pratensis
Prunella vulgaris
Ranunculus uncinatus

2011 Plant List: 94R549 cont.

Elymus glaucus
Elymus trachycaulus
Epilobium ciliatum
Equisetum arvense
Erigeron elatior
Erigeron formosissimus
Erigeron speciosus
Fragaria virginiana ssp. *glauca*
Galium septentrionale
Galium triflorum
Geranium richardsonii
Geum macrophyllum var. *perincisum*
Glyceria borealis
Glyceria elata
Halerpestes cymbalaria ssp. *saximontana*
Heracleum sphondylium ssp. *montanum*
Juncus confusus
Juncus drummondii
Juncus tracyi
Limnorchis dilatata ssp. *albiflora*
Lupinus argenteus
Luzula parviflora
Mertensia ciliata
Micranthes odontoloma
Mimulus moschatus
Mitella pentandra
Moehringia lateriflora
Neolepia campestris
Osmorhiza depauperata
Pedicularis bracteosa ssp. *paysoniana*
Pedicularis groenlandica
Phleum commutatum
Phleum pratense
Picea pungens
Plantago sp.
Plantago lanceolata
Poa leptocoma
Polygonum douglasii
Populus tremuloides
Potentilla gracilis
Potentilla pulcherrima
Prunella vulgaris

1990s Plant List: 94R549 cont.

Salix drummondiana
Salix exigua
Salix lucida ssp. *lasiandra*
Salix monticola
Senecio triangularis
Taraxacum officinale
Trifolium repens
Veronica americana
Veronica nutans
Vicia americana
Viola macloskeyi ssp. *pallens*

2011 Plant List: 94R549 cont.

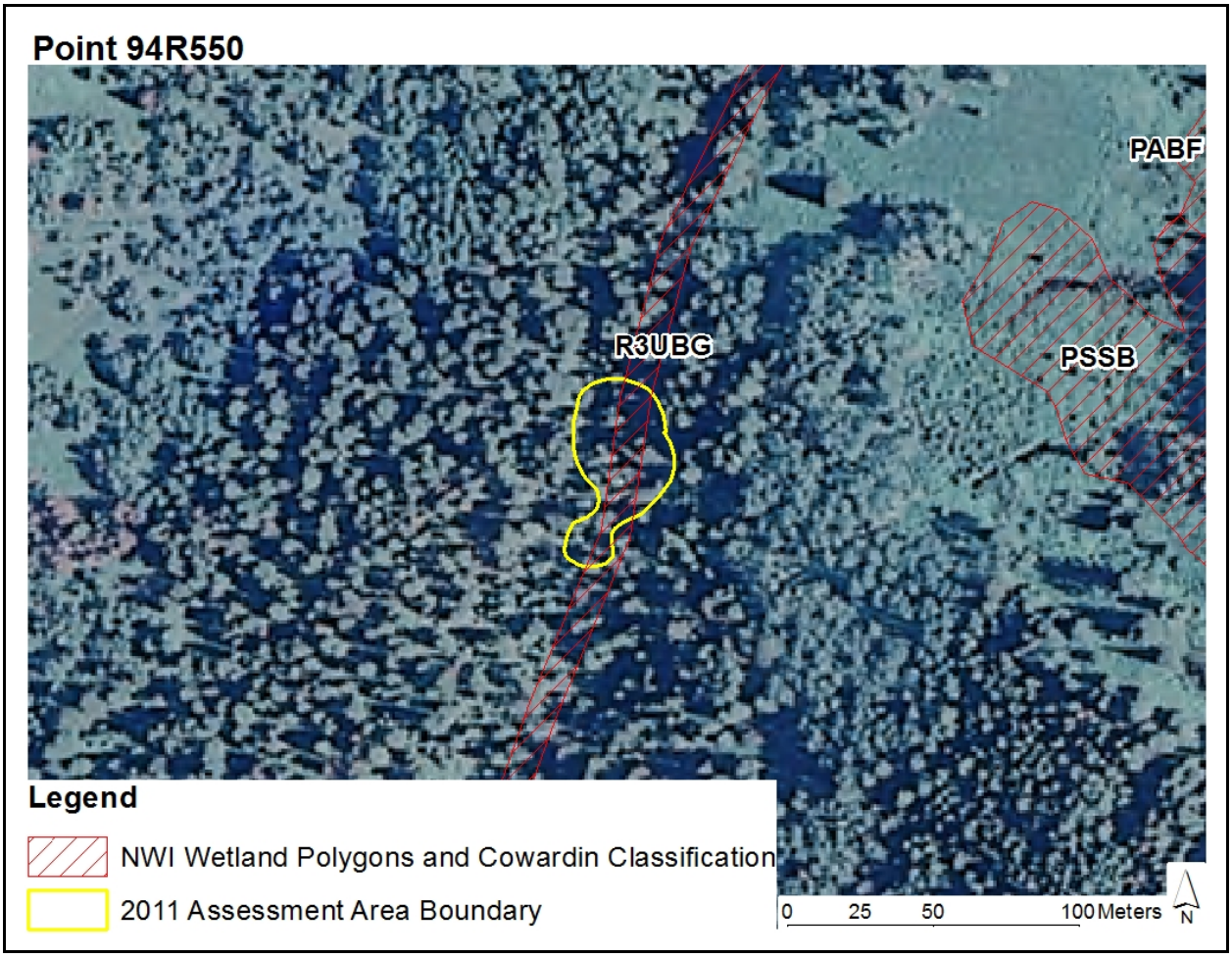
Ranunculus uncinatus
Rubus idaeus ssp. *melanolasius*
Salix boothii
Salix drummondiana
Salix lucida ssp. *lasiandra*
Senecio triangularis
Stellaria longifolia
Taraxacum officinale
Thalictrum fendleri
Thermopsis montana
Trifolium hybridum
Trifolium repens
Valeriana occidentalis
Veratrum tenuipetalum
Veronica nutans
Vicia americana
Viola sp.

94R550 (94GR20)

General Location: W Fork Prong Creek, ~100m upstream from Trail 1144 intersection.

Initial Survey: 7/13/94 Resurvey: 8/5/11

Survey detail: Identified area to survey using description on field form (point bar upstream from Trail 1144 and W Fork Prong Creek intersection). AA is riparian forest of *Abies* and *Picea* along braided stream, small seep areas on W side of AA. Very dynamic system, new large-sized gravel deposits from heavy flow spring.



Aerial photo of 94R550 Assessment Area surveyed in 2011, shown with digitized NWI mapping.

Location of 94R550 plot from 1994 shown on Buck Point Quadrangle as Plot #94GR20. Point is outlined with red box. Annotated map is scanned from old data sheet.

Photos of plot 94R550 from 2011 survey.

Stressor note comparison:

1994: Grazing and overgrazing on W slope showing lost vegetation, trampling, and cattle trails. Logging upstream but not sure if in this drainage. *Taraxicum* recorded.

2011: Some grazing and trampling on periphery of buffer (no animals observed) but no grazing effects observed in AA. Sediment deposits associated from dynamic water year. Beaver up and downstream but not in AA. Good quality vegetation community.

2011 Plant List: 94R550

Abies bifolia
Achillea lanulosa
Aconitum columbianum
Alnus incana ssp. *tenuifolia*
Arnica cordifolia
Asteraceae sp.
Bromopsis canadensis
Cardamine breweri
Carex angustior
Carex deweyana
Carex disperma
Carex geyeri
Carex microptera
Carex raynoldsii
Castilleja miniata
Chamerion danielsii
Cinna latifolia
Corallorhiza maculata
Distegia involucrata
Elymus glaucus
Epilobium hornemannii
Equisetum arvense
Erigeron elatior
Fragaria virginiana ssp. *glauca*
Galium septentrionale
Galium triflorum
Geranium richardsonii
Geum macrophyllum var. *perincisum*
Glyceria elata
Gymnocarpium dryopteris
Heracleum sphondylium ssp. *montanum*
Juncus mertensianus
Limnorchis dilatata ssp. *albiflora*

1990s Plant List: 94R550

Abies bifolia
Alnus incana ssp. *tenuifolia*
Arnica cordifolia
Bromopsis canadensis
Calamagrostis canadensis
Carex microptera
Distegia involucrata
Equisetum arvense
Erigeron peregrinus ssp. *callianthemus*
Galium triflorum
Geranium richardsonii
Geum macrophyllum var. *perincisum*
Glyceria elata
Heracleum sphondylium ssp. *montanum*
Juncus arcticus ssp. *ater*
Juncus mertensianus
Mertensia ciliata
Micranthes odontoloma
Mitella pentandra
Orthilia secunda
Osmorhiza depauperata
Oxypolis fendleri
Picea engelmannii
Psychrophila leptosepala
Ribes lacustre
Senecio triangularis
Taraxacum officinale
Vicia americana
Viola macloskeyi ssp. *pallens*

2011 Plant List: 94R550 cont.

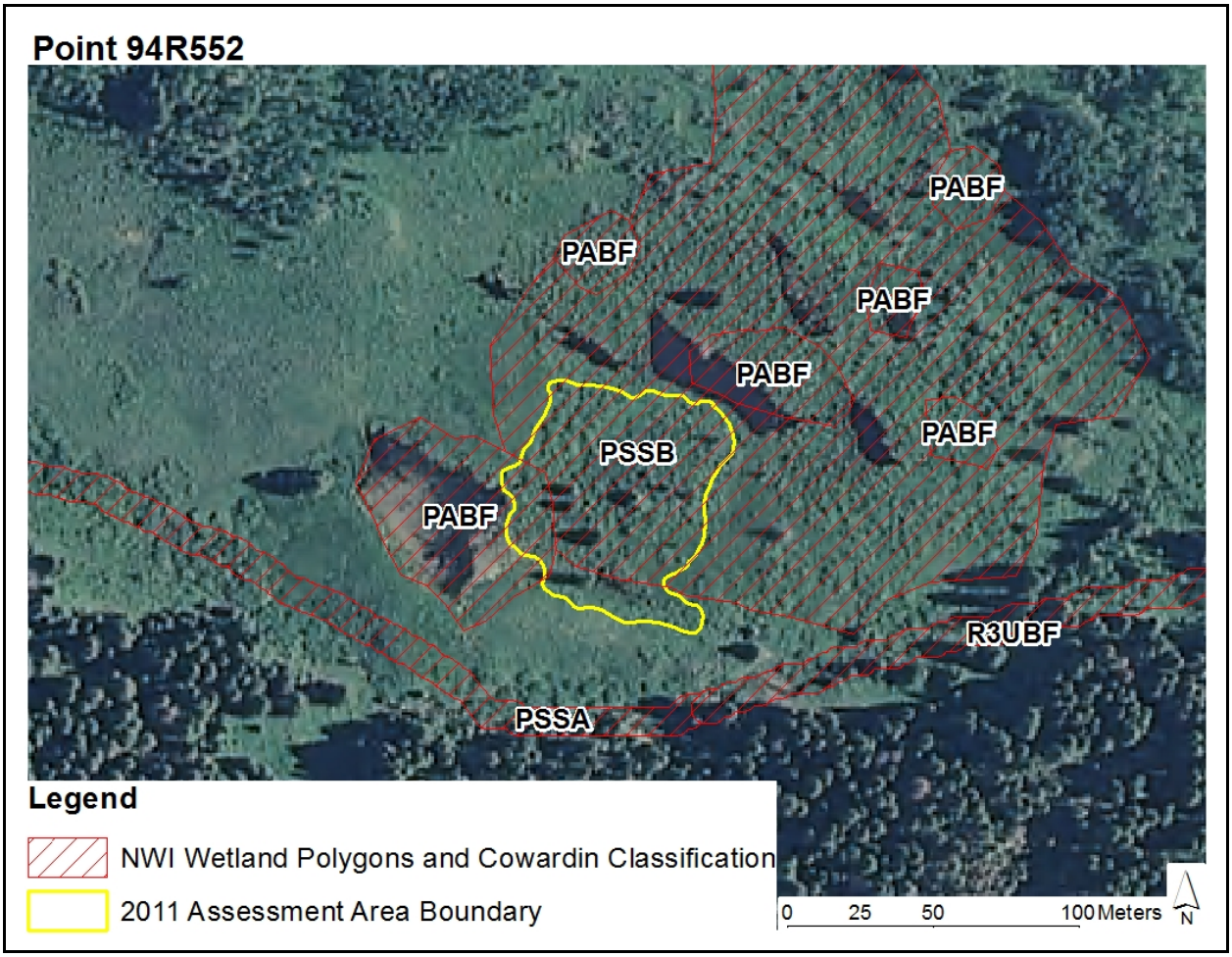
Luzula parviflora
Maianthemum stellatum
Mertensia ciliata
Micranthes odontoloma
Mitella pentandra
Moneses uniflora
Orthilia secunda
Osmorhiza depauperata
Oxypolis fendleri
Picea engelmannii
Poa palustris
Polygonaceae
Prunella vulgaris
Psychrophila leptosepala
Pyrola minor
Pyrola rotundifolia ssp. *asarifolia*
Ribes inerme
Rosa woodsii
Rubacer parviflorum
Rubus idaeus ssp. *melanolasius*
Sambucus microbotrys
Senecio triangularis
Streptopus fassettii
Taraxacum officinale
Thalictrum fendleri
Trifolium repens
Vaccinium myrtillus ssp. *oreophilum*
Vicia americana
Viola scopulorum

94R552 (94GR21)

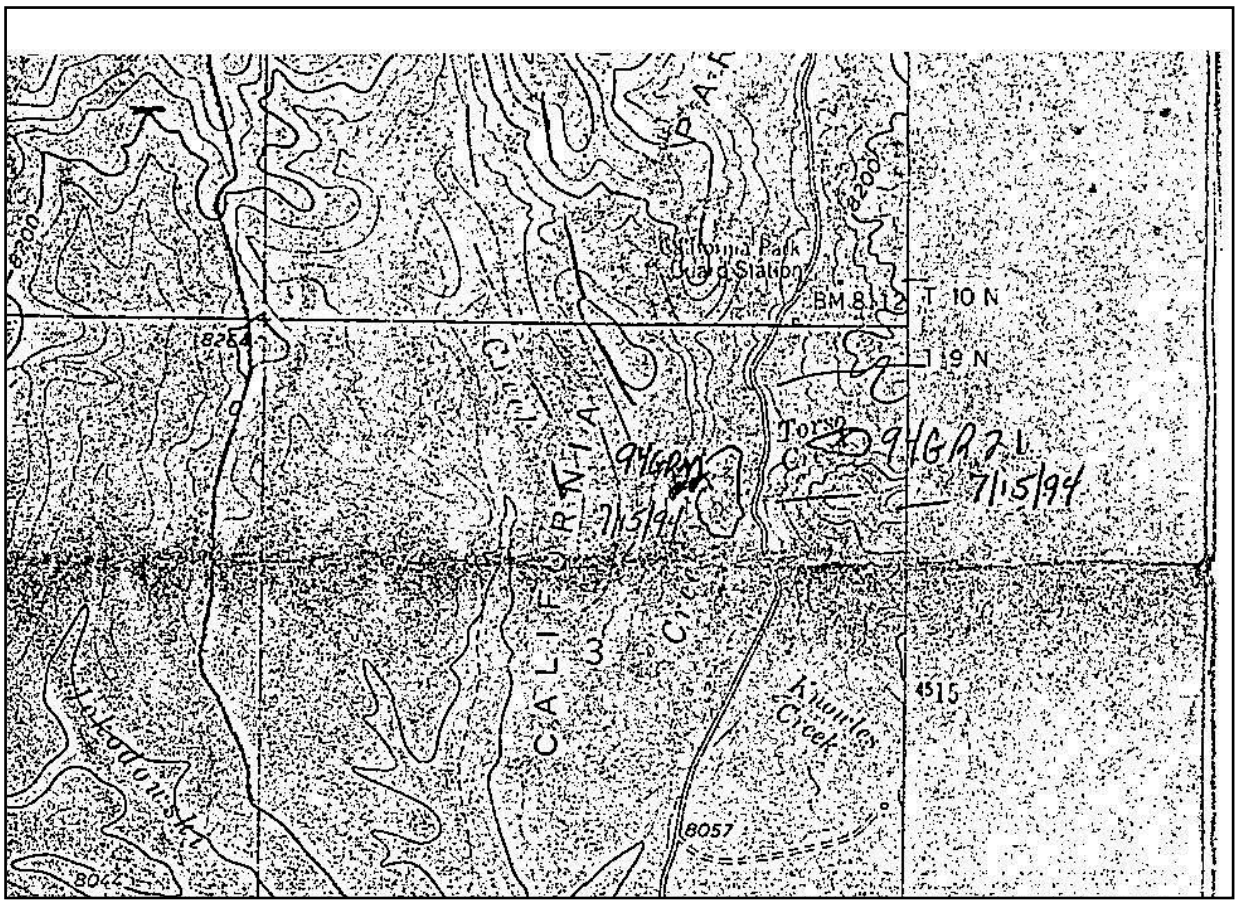
General Location: ~0.5 mi S of California Park Guard Station, ~400m upstream from small creek.

Initial Survey: 7/15/94 Resurvey: 7/25/11

Survey detail: Identified area to survey using hand drawn maps. Wetland area surveyed in 1994 was too large for EIA survey methods. EIA methods also treat Torso Creek riparian area differently than beaver wetland complex – surveyed beaver complex of willow and mixed graminoid/herb wetland. Dominant willow = *Salix boothii*. Surveyed area does not include larger stream (Torso Creek). Area surveyed in 2011 best matches hand drawing obs. (subplot) #3 from 1994. Small channels connect beaver ponds (intact this year), slope is saturated and receives groundwater input, but small channels connecting beaver ponds likely overbank in spring.



Aerial photo of 94R552 Assessment Area surveyed in 2011, shown with digitized NWI mapping.



Location of 94R552 plot from 1994 shown on Bears Ears Peaks Quadrangle as Plot #94GR21. Annotated map is scanned from old data sheet.

Photos of plot 94R552 from 2011 survey.

Stressor note comparison:

1994: Willows regenerating. Sheep grazing, livestock trails, some exotics, *Taraxicum*. Grazing listed as a threat.

2011: Willows regenerating and browsed (<5%), but effects appear minor and were attributed to natural causes (beaver). Signs of (no animals observed) light grazing noted in 500m envelope surrounding AA. No grazing trails noted around beaver ponds. Grazing does not appear to be more than light threat to wetland at time of survey. *Breea (Cirsium) arvense* present (1-2% cover class) in wetland AA and <5% in 500m buffer. *Taraxicum* <1% in wetland AA. Amphibians photographed and other aquatic life noted on field form. High plant and structural patch diversity, typical of beaver complexes.

2011 Plant List: 94R552

Achillea lanulosa
Aconitum columbianum
Agastache urticifolia
Alopecurus aequalis
Angelica ampla
Asteraceae sp.
Breea arvensis
Bromopsis inermis
Calamagrostis canadensis
Cardamine pensylvanica
Carex aquatilis
Carex aurea
Carex lanuginosa
Carex microptera
Carex utriculata
Castilleja miniata
Castilleja sulphurea
Cerastium beeringianum ssp. *earlei*
Chamerion danielsii
Collomia linearis
Conioselinum scopulorum
Deschampsia cespitosa
Descurainia incana
Distegia involucrata
Elymus glaucus
Epilobium sp.
Equisetum arvense
Erigeron elatior
Fragaria virginiana ssp. *glauca*

1990s Plant List: 94R552

Achillea lanulosa
Aconitum columbianum
Alnus incana ssp. *tenuifolia*
Bromopsis inermis
Calamagrostis canadensis
Carex utriculata
Elymus glaucus
Fragaria virginiana ssp. *glauca*
Galeopsis bifida
Geranium richardsonii
Heracleum sphondylium ssp. *montanum*
Ligularia bigelovii var. *hallii*
Oxypolis fendleri
Ribes inerme
Salix boothii
Salix geyeriana
Salix planifolia
Salix wolfii
Senecio triangularis
Taraxacum officinale
Thalictrum fendleri
Urtica gracilis
Vicia americana

2011 Plant List: 94R552 cont.

Galium aparine
Galium septentrionale
Geranium richardsonii
Geum macrophyllum var. *perincisum*
Glyceria borealis
Glyceria elata
Heracleum sphondylium ssp. montanum
Hippuris vulgaris
Juncus saximontanus
Lemna turionifera
Ligularia bigelovii var. *hallii*
Limnorchis dilatata ssp. albiflora
Lupinus sp.
Maianthemum stellatum
Mertensia ciliata
Mimulus moschatus
Moehringia lateriflora
Oxypolis fendleri
Pedicularis bracteosa ssp*. paysoniana*
Pedicularis groenlandica
Phleum pratense
Picea engelmannii
Poa palustris
Poa pratensis
Potamogeton
Potentilla gracilis
Prunella vulgaris
Ranunculus alismifolius var. montanus
Ranunculus gmelinii var. *hookeri*
Rumex sp.
Salix boothii
Salix planifolia
Scirpus microcarpus
Senecio triangularis
Solidago multiradiata
Sparganium emersum
Symphoricarpos sp.
Taraxacum officinale
Thalictrum fendleri
Thermopsis montana
Urtica gracilis
Veratrum tenuipetalum

2011 Plant List: 94R552 cont.

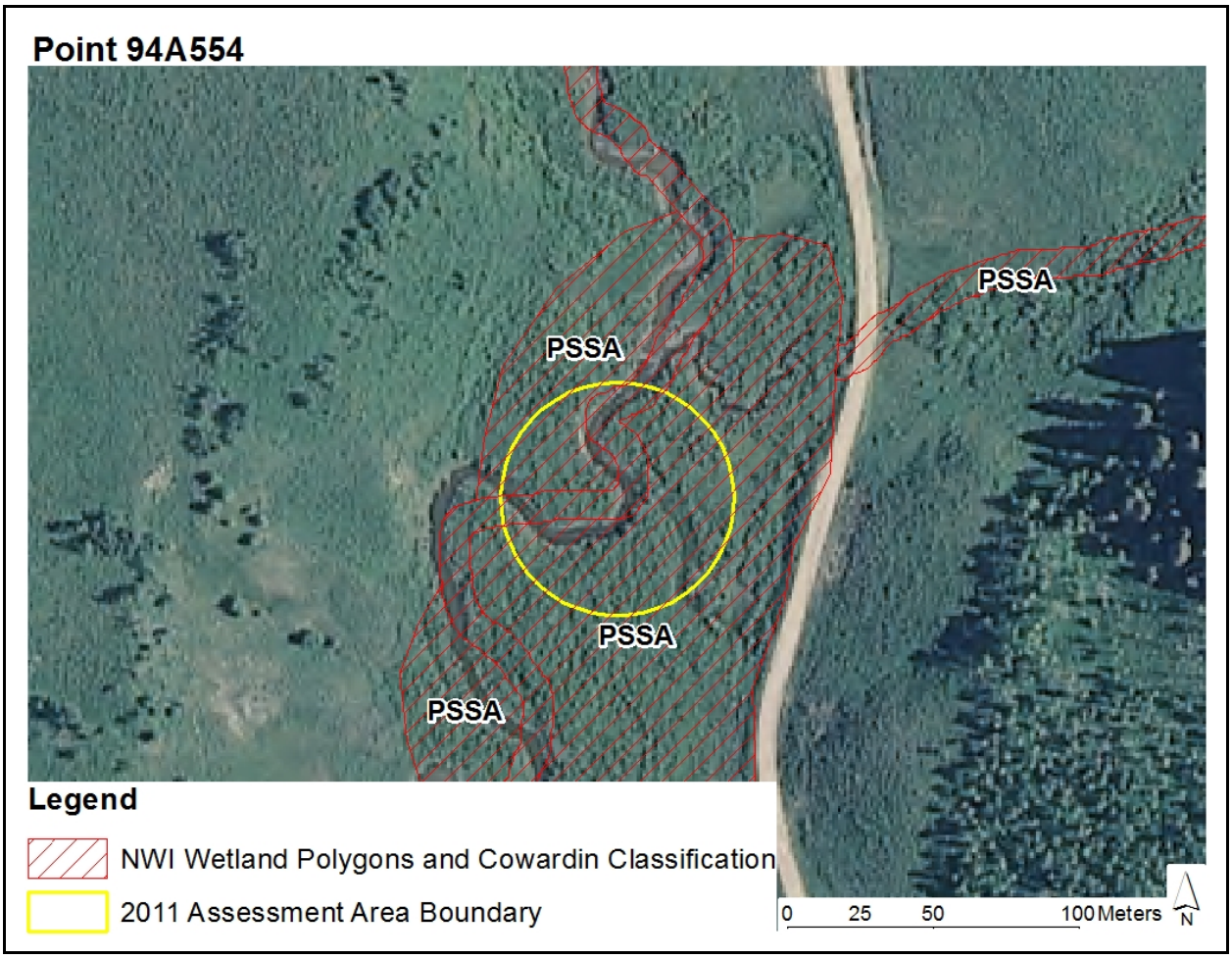
Veronica americana
Vicia americana

94R554 (94GR22)

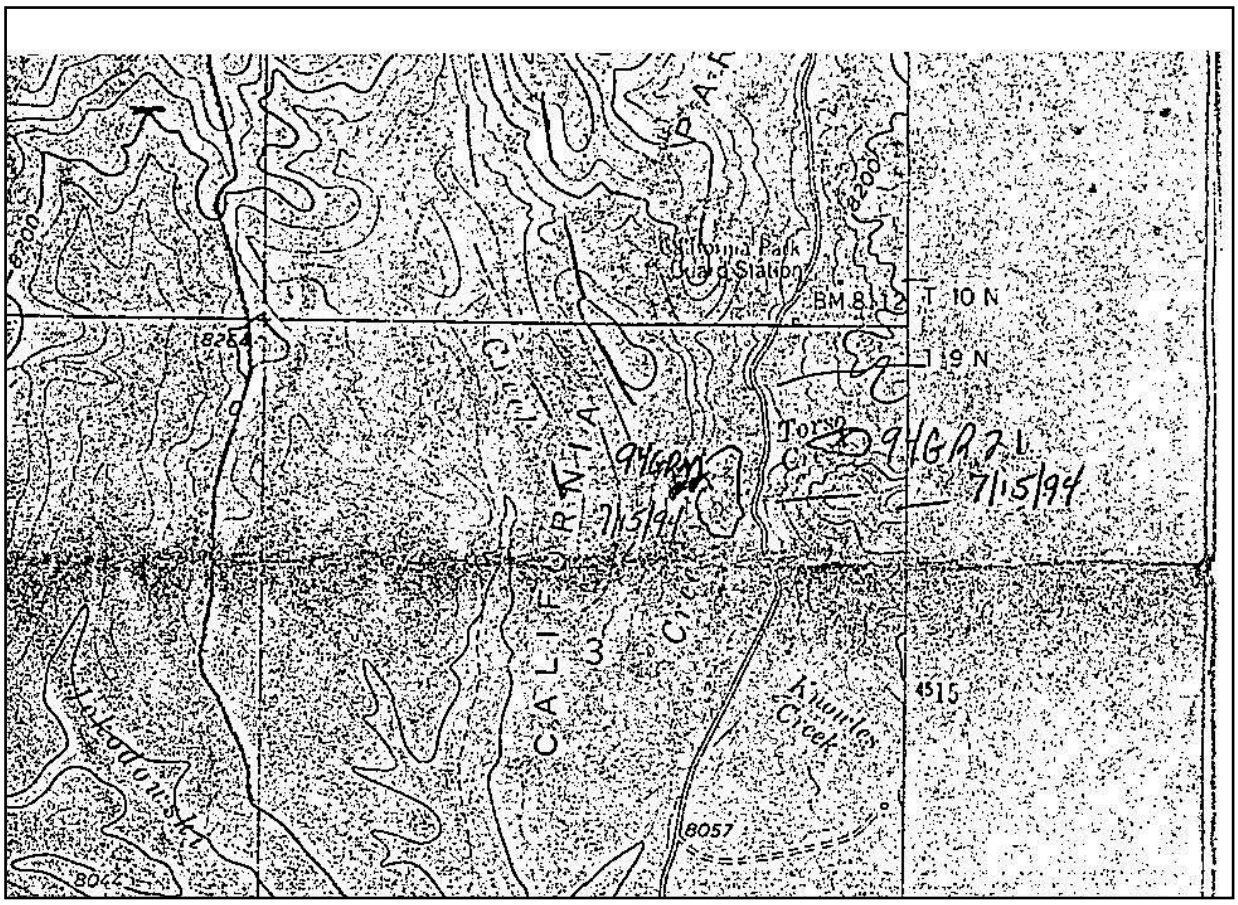
General Location: ~1 km S of California Park Guard Station, along Elkhead Creek.

Initial Survey: 7/15/94 Resurvey: 7/26/11

Survey detail: Identified area to survey using description on field form (50 m downstream of the confluence of Torso Creek and Elk Creek). Area surveyed in 2011 best matches hand drawing obs. (subplot) #3 from 1994. Surveyed riparian willow shrubland on both sides of Elkhead Creek. A *Salix boothii* shrub wetland interspersed with *Carex* vegetated swales and upland *Lupinus/Trifolium* understory. Channel is incised ~2m.



Aerial photo of 94A554 Assessment Area surveyed in 2011, shown with digitized NWI mapping.



Location of 94A554 plot from 1994 shown on Bears Ears Peaks Quadrangle as Plot #94GR22. Annotated map is scanned from old data sheet.

Photos of plot 94A554 from 2011 survey.

Stressor note comparison:

1994: Beaver activity present at time of survey. Grazing listed as a threat and associated with killing vegetation and stream bank degradation. *Cirsium* sp. recorded, from 0-30% along transect lines – may have been either *Cirsium centaurae* and/or *Breea arvense*.

2011: Evidence of recent beaver activity present (dam remnants); although upstream beaver dam blew out this year, so beaver not currently present. Evidence of native ungulate or livestock traffic (no animals observed). *Breea arvensis* common (5-10% cover class) and other weeds present but not in dense stands. Weeds and soil disruption in 500m buffer associated with road cuts and culverts. Signs of light grazing/browse present in 100% of AA and at least 20% of 500m buffer. Willows regenerating and browse is light (<5%) where occurs. Stream entrenched on 1 side, but because not on both sides - is difficult to determine how much disruption to hydrologic connectivity is natural or due to anthropogenic effects. Stream does appear entrenched despite good "entrenchment ratio" number. Landslide nearby is photographed.

2011 Plant List: 94A554

Agastache urticifolia
Alopecurus aequalis
Alsinaceae sp.
Androsace filiformis
Angelica ampla
Arnica sp.
Asteraceae
Breea arvensis
Bromopsis canadensis
Carex athrostachya
Carex lanuginosa
Carex microptera
Carex utriculata
Castilleja rhexifolia
Castilleja sulphurea
Cirsium sp.
Cirsium centaureae
Collomia linearis
Critesion brachyantherum
Deschampsia cespitosa
Eleocharis macrostachya
Eleocharis quinqueflora
Elymus glaucus
Elymus trachycaulus
Equisetum arvense
Erigeron speciosus

1990s Plant List: 94A554

Achillea lanulosa
Calamagrostis canadensis
Carex aquatilis
Carex limosa
Carex utriculata
Chaenactis douglasii
Equisetum arvense
Erigeron subtrinervis
Fragaria virginiana ssp. *glauca*
Geranium richardsonii
Geum macrophyllum var. *perincisum*
Heracleum sphondylium ssp. *montanum*
Ligularia bigelovii var. *hallii*
Mertensia ciliata
Poa pratensis
Salix boothii
Sidalcea candida
Solidago canadensis
Taraxacum officinale
Trifolium hybridum
Urtica gracilis
Valeriana occidentalis
Vicia americana

2011 Plant List: 94A554 cont.

Fragaria virginiana ssp. *glauca*
Geranium richardsonii
Geum macrophyllum var. *perincisum*
Heracleum sphondylium ssp*. montanum*
Juncus tracyi
Ligularia bigelovii var. *hallii*
Lupinus argenteus
Madia glomerata
Mentha arvensis
Neolepia campestris
Osmorhiza
Penstemon rydbergii
Perideridia gairdneri ssp. *borealis*
Phleum pratense
Poa palustris
Poa pratensis
Polygonaceae
Potentilla pulcherrima
Prunella vulgaris
Ranunculus macounii
Ribes inerme
Rumex sp.
Salix boothii
Scirpus microcarpus
Seriphidium canum
Solidago canadensis
Symphoricarpos
Taraxacum officinale
Thalictrum fendleri
Trifolium hybridum
Veronica catenata
Vicia americana