



Spring Wetland Flora Inventory — Black Canyon of the Gunnison National Park

Survey Report



A wetland surveyed at Black Canyon of the Gunnison National Park.
IRONWOOD CONSULTING

Spring wetland flora inventory — Black Canyon of the Gunnison National Park: Survey report

Science Report NPS/SR—2024/158

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Abstract

This report provides the results from the 2021 spring wetland flora inventory at Black Canyon of the Gunnison National Park. In total, seven National Park Service units within the Northern Colorado Plateau Network determined the need to evaluate and map spring and wetland conditions based on the presence/absence of perennial obligate and facultative wetland plant species known to occur in the parks. Mapping spring and wetland areas for each park provides a baseline measure of areas sensitive to drying that can be used to monitor change over time. The overall objective of the project was to establish a baseline for the area and the condition of wetlands, seeps, and springs to provide supporting evidence for any future claims of impairment resulting from groundwater management actions.

Survey results at Black Canyon of the Gunnison National Park identified and inventoried springs and wetlands at 4 of 20 survey sites. This report summarizes the results at these four sites, including spring type identification, dominant herbaceous plant species present, average plant cover, wildlife sign frequency and observation, and wetland feature map figures.

List of Terms

°: degrees

%: percent

ac: acre

BLCA: Black Canyon of the Gunnison National Park

BRCA: Bryce Canyon National Park

CARE: Capitol Reef National Park

CEBR: Cedar Breaks National Monument

cm: centimeters

CNHP: Colorado Natural Heritage Program

COLM: Colorado National Monument

CURE: Curecanti National Recreation Area

DINO: Dinosaur National Monument

FAC: facultative plant

FACU: facultative upland plant

FACW: facultative wetland plant

ft: feet

GDE: groundwater-dependent ecosystem

GIS: geographic information systems

GPS: Global Positioning System

m: meter

NCPN: Northern Colorado Plateau Network

NPS: National Park Service

OBL: obligate wetland plant

m²: square meter

UPL: upland plant

USACE: U.S. Army Corps of Engineers

USDA: U.S. Department of Agriculture

UTM: Universal Transverse Mercator

Introduction

Project Background

Small water sources, such as springs and wetlands in intermountain parks, are often of resource management concern. This is because they provide unique resources and habitat for plants and wildlife, and they may be vulnerable to developments outside of park boundaries and to climate change. Some of these resources also have or could have special protections through water rights agreements with states. However, measuring the hydrology of these water sources can be difficult because they often have diffuse to low flow.

Seven National Park Service (NPS) units (or parks) within the Northern Colorado Plateau Network (NCPN) determined the need to evaluate and map spring and wetland conditions based on the presence/absence of perennial obligate (OBL) and facultative wetland (FACW) plant species known to occur in the parks. Mapping spring and wetland areas for each park provides a baseline measurement of areas sensitive to drying that can be used to monitor change over time.

Project Objective, Goals, and Parameters

The overall objective of the project was to establish baseline conditions for the area and condition of wetlands, seeps, and springs to provide supporting evidence for future water rights filings and/or claims of impairment resulting from groundwater management actions. While impairment is determined by state engineers, establishing a baseline where decreases in OBL and FACW species can be measured will help the NPS and its co-managers document impairment. The approach used during the surveys described in this report was developed as an indicator of impairment in coordination with the NPS Water Resources Division.

The project's goals included:

- Document the presence/absence of wetland vascular plant species (OBL and FACW) within seven NCPN parks.
- Map spring and wetland areas defined as those with more than 50 percent (%) perennial wetland (OBL and FACW) herbaceous and shrub plant cover.
- Take representative photos of the spring and wetland areas. When provided by the parks, these may have included rematches of historic photos.

Project parameters that defined the scope of the work and specified criteria for data collection and deliverables included:

- Conducting standardized fixed-area surveys for target species using standard sampling techniques that sufficiently detected target species and measured percent cover.
- Sampling ensured all prioritized sites were investigated.
- Plot placement included replication and was sufficient to detect the presence of targeted wetland species and determine the perimeter of wetlands as defined by >50% cover of target species.

- When conditions allowed, the perimeter of the area with greater than 50% perennial wetland (OBL and FACW) herbaceous and shrub plant cover was mapped with sub-meter accuracy. However, there were areas in canyons that did not have sufficient sky view to receive a satellite signal for sub-meter accuracy, and these were mapped using the best Global Positioning System (GPS) accuracy available.
- Cover of wetland trees, such as cottonwoods without underlying wetland herbs and shrubs, was excluded from the perimeter.
- In spring systems feeding an extensive stream-type riparian area, the survey area was capped at 50 meters (m) downstream from the spring orifice for the purposes of this inventory.
- For sites too large to sample effectively or efficiently, or if more than one wetland polygon was present at a site, only a portion of the site was selected for sampling. This was typically the largest wetland polygon, the most mesic polygon, and/or the polygon that included a spring orifice.
- Observation data were summarized and reported by site (i.e., wetland area, perimeter length, and wetland species diversity).
- Specimens were not collected, unless necessary to verify plant species identification. When collected, they were destroyed during analysis.
- Ancillary data at each site were related to specific park needs (determined prior to commencing field work). Some of the parks requested additional simple metrics be collected at a site that did not require additional expertise and were not expected to require a significant amount of additional time to record. The NCPN identified three preliminary data categories to be included in the data collection: (a) presence of animal use at sites; (b) impacts from recreation; and (c) presence of spring development structures.

Project Locations

Mapping took place at seven parks and national monuments in Utah and Colorado served by the NCPN, including:

- Black Canyon of the Gunnison National Park (BLCA)
- Bryce Canyon National Park (BRCA)
- Capitol Reef National Park (CARE)
- Cedar Breaks National Monument (CEBR)
- Colorado National Monument (COLM)
- Curecanti National Recreation Area (CURE)
- Dinosaur National Monument (DINO)

This report describes the approach and summarizes the results of the mapping and surveys conducted at BLCA. The priority survey sites were identified by BLCA staff, and most required verification to

inform the potential for adjudication of diligence rights on their sources. The priority sites are found in Figure 1 and Table 1.

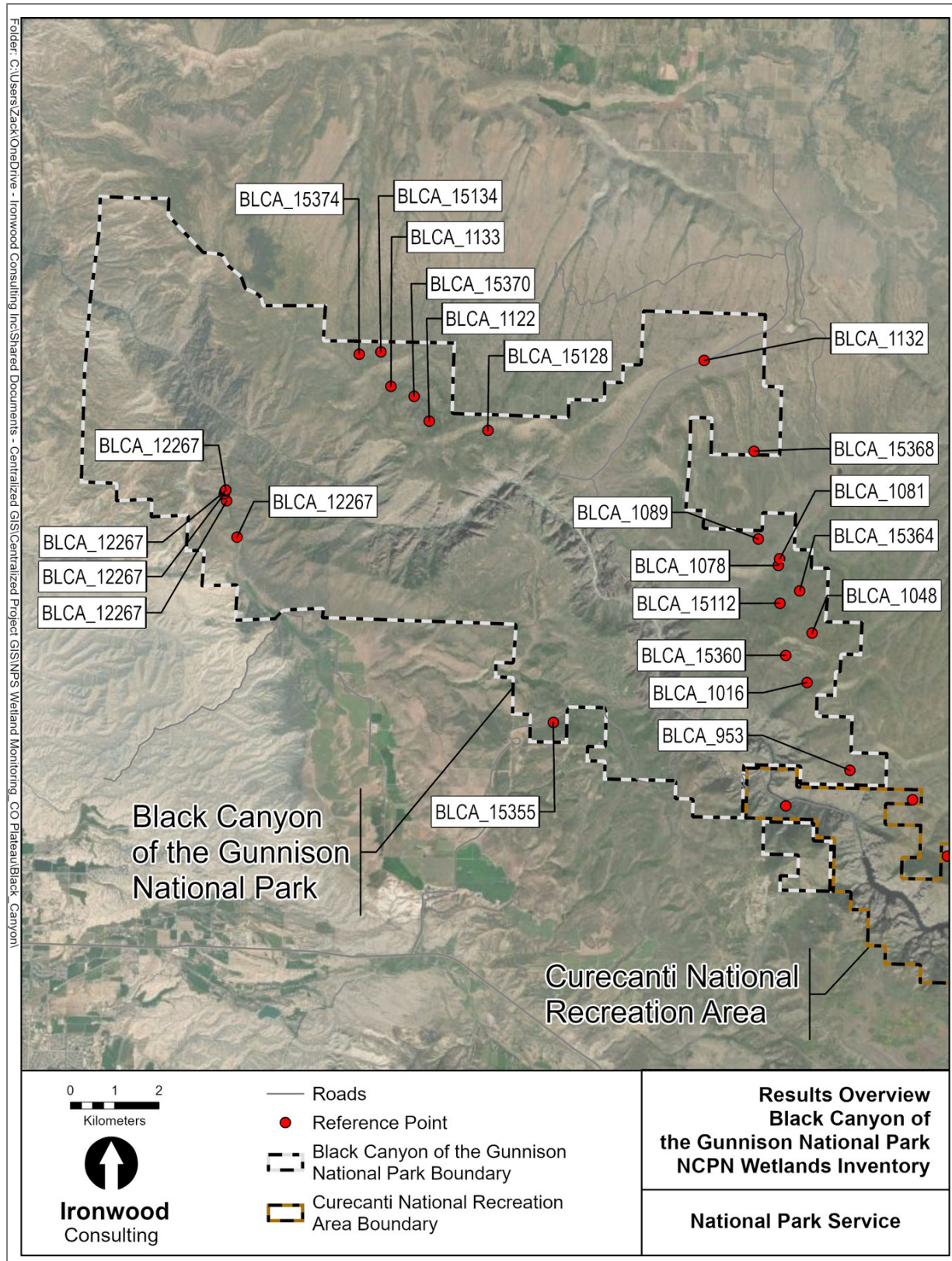


Figure 1. Black Canyon of the Gunnison National Park Overview with Priority Survey Areas.

Table 1. Black Canyon of the Gunnison National Park priority survey sites.

Site ID	Priority	Area (acres)
BLCA 953	1	0.198
BLCA 1016	1	0.119
BLCA 1081	1	0.192
BLCA 1089	1	0.204
BLCA 1122	1	0.160
BLCA 1133	1	0.275
BLCA 15128	1	0.277
BLCA 15134	1	0.120
BLCA 15368	1	0.123
BLCA 15370	1	0.213
BLCA 15374	1	0.091
BLCA 1048	2	0.148
BLCA 1078	2	0.259
BLCA 1132	2	0.276
BLCA 11215	2	5.031
BLCA 12267	2	4.746
BLCA 15112	2	0.306
BLCA 15355	2	0.197
BLCA 15360	2	0.607
BLCA 15364	2	0.224
BLCA 15372	2	0.375

Methods and Materials

Ironwood completed a project work plan (Ironwood 2021a) that detailed the survey methods, including project locations, staffing roles, project schedules, equipment and materials, pre-field coordination and geospatial analyses, data management protocols, and injury and illness prevention plans. Field methods, data management practices, and analysis methods are outlined below.

Geographic information systems (GIS) data provided by the NPS were used to analyze the location, number, and, if possible, the rough size of seeps, springs, and wetlands to be mapped and evaluated (Figure 1, Table 1). Each survey site was assigned a unique general identification code.

Prior to field work, project maps and tables identifying priority wetlands/springs were prepared using GIS data provided by the NPS. Maps were prepared at a scale of 1:1000 and included topographic lines, labels for prominent landmarks and geographic features, waterbodies, roads, and recent aerial photograph backgrounds. Large (24 inch x 36 inch) printed maps were provided to field staff for navigation and field planning. Digital maps were also created in ArcGIS Field Maps.

Ironwood created a data collection interface using ArcGIS Field Maps and Pendragon that was compatible with cell phones and tablets in the field for all data points outlined in the Data Management Section of this report. Field crews used tablets in the field that stored data locally and connected to cloud storage when in cellular service, so data were regularly backed-up and available for initial review and quality assurance/quality control.

Goal 1: Documenting Wetland Species

The field procedure for documenting wetland species at each survey site was a modified version of the U.S. Department of Agriculture (USDA) Groundwater-Dependent Ecosystem (GDE) Level II Methodology (used whenever a groundwater-dependent wetland was present; USDA and USFS 2012). The protocol was intended to describe a site's general condition, monitor major changes over time, and make comparisons among sites of a certain type or within a specific region. The protocol was not intended for evaluating certain wetlands within the floodplains of surface water bodies, such as hanging gardens and riparian areas.

The full protocol, with redlined non-applicable text, is available in the Ironwood Work Plan (Ironwood 2021a); modifications are described below.

Groundwater-Dependent Ecosystem Level II Methodology

The vegetation components of the GDE Level II protocol were used when collecting associated vegetation data for sites identified as groundwater-dependent wetlands.

During the site evaluation, collected data included location, slope, aspect, elevation, surrounding (non-wetland) vegetation, geologic setting, surface material (no soil samples were taken), groundwater source characterization, and plant species composition. The GDE type was determined using the dichotomous key from Stevens et al. 2021. Photos of the site were taken per the GDE Level

II protocol, and a detailed, scaled map of the wetland was subsequently completed in the office using sub-meter GPS data collected in the field.

Transects to evaluate species composition were established following the methods outlined in the GDE Level II protocol, with modifications described below.

The wetland perimeter was mapped (see Goal 2: Mapping Springs and Wetlands) and the area and long axis of the wetland were determined. Each end of the long axis was marked using a sub-meter GPS and labeled “Long Axis Start” and “Long Axis End.” A fiberglass measuring tape was run between these two points, with the origin at the Long Axis Start. Transects were oriented perpendicular to the bearing of the long axis, with the transect origin placed on the left side of the long axis, as viewed from standing at the Long Axis Start and facing the Long Axis End. Compass bearings were determined at all sites using a declination of 10 degrees (°) east. The first transect began near the Long Axis Start and was placed perpendicular to the long axis line. Quadrats were then placed at regular intervals along each transect. Transect and quadrat intervals are outlined in Table 2.

Table 2. Criteria for determining quadrat number and interval using the GDE Level II protocol.

Size of GDE (m ²) ^A	Transect Interval (m)	Quadrat Interval (m)
< 20	1.5	1.0
20 to 40	2.0	2.0
40 to 80	3.0	2.0
80 to 150	3.0	2.0
150 to 250	4.0	3.0
250 to 500	5.0	4.0
500 to 750	6.0	5.0
750 to 1,000	7.0	6.0
1,000 to 1,500	8.0	7.0
1,500 to 2,500	10.0	9.0
2,500 to 4,000	12.0	10.0
4,000 to 6,000	16.0	12.0
6,000 to 8,000	18.0	14.0
8,000 to 10,000	20.0	16.0
> 10,000 ^B	—	Divide into smaller units

^A Square meter (m²).

^B Sites larger than 10,000 m² required too many quadrats to sample during a single day. Depending on the purpose of the inventory, these sites may need to be divided to facilitate inventory.

In each quadrat, visual cover was measured for each plant species using a 0.5-square meter (m²) quadrat at a quantity and interval determined by the area of the wetland after mapping the wetland boundary (Table 2). A cut-level was used when recording visual cover estimates. Plants within the

quadrat with visually estimated cover below the 1% cut-level were not recorded. Quadrats were placed along the left side of the perpendicular transect tape, as determined by looking down the transect from its origin. A random number generator was used to determine a value between 0.0 m and the quadrat interval distance (minus 0.5 m) when placing the first quadrat. The quadrat started at the point corresponding to the distance number along the transect and extended 0.5 m beyond this point. After the first quadrat was randomly located, the set interval was used for all subsequent quadrats until the entire quadrat could no longer fit inside the wetland boundary along that transect. This process was repeated for each transect. The total number of transects at BLCA survey sites using this methodology ranged from 5 to 16, and the total number of quadrats at each site ranged from 6 to 44. Details about the number of transects and quadrats used at each GDE site are found in the BLCA data deliverable.

A combination of line intercept and spherical densiometer methods were implemented to determine woody species cover and composition. When present, live woody plant cover was collected using line intercept sampling along each transect as described in the GDE Level II protocol. Overstory cover of live and dead woody plants greater than 4 ft in height and other cover (e.g., canyon walls) were recorded using a spherical densiometer at 3 locations along each transect: 1) at the transect origin, 2) at the transect end, and 3) at the center quadrat of the transect for transects longer than 15 m, or in the center of the transect line for transects less than 15 m. Non-plant groundcover was visually estimated within the quadrat. Additional plant species observed within the wetland that were not captured in the quadrats or the line intercept were noted on the data form. If more than one wetland polygon was mapped at a site, a single polygon was selected to establish a GDE transect, which was typically the largest polygon, the most mesic polygon, and/or the polygon that included a spring orifice.

Goal 2: Mapping Springs and Wetlands

To meet Goal 2, wetland boundaries were mapped using the vegetation section of the U.S. Army Corps of Engineers (USACE) Wetland Vegetation Dominance Test (USACE 2008). The data form provided a rubric for determining if hydrophytic vegetation (defined as having a wetland indicator status of OBL and/or FACW according to the 2020 USACE Wetland Indicator Status [USACE 2020] for the Western Mountains, Valleys, and Coast Region) met or surpassed the absolute cover threshold to be considered a wetland through a quantitative dominance test.

The dominance test was used to determine where hydrophytic vegetation transitioned to upland vegetation cover, and thus to identify the boundary of the wetland. Wetland and upland species at the wetland boundaries were identified, and absolute cover composition was quantitatively determined in the field. If more than one wetland polygon was present at a site, each was mapped separately. A gap in wetland vegetation cover greater than 5 m² was used to determine when a wetland ended, and another began.

The following guidelines were observed when mapping wetlands:

- The site was assessed upon arrival to determine how to minimize damage to soils, plants, and hydrologic processes during the survey. If necessary, an approach to collecting data was devised to avoid damaging soils.
- Upon arrival at each site, a polygon was mapped with sub-meter accuracy (when possible) within ArcGIS Field Maps along the boundary between the wetland and upland vegetation communities using the USACE Dominance Test. Wetland areas were represented by having greater than 50% OBL and/or FACW absolute plant cover by herbaceous and shrub species. Upland areas included greater than 50% facultative (FAC), facultative upland (FACU), and/or upland (UPL) absolute plant cover. Cover of wetland trees such as cottonwoods without underlying wetland herbs and shrubs were excluded from the perimeter.
- Each crew mapped the wetland boundary using an Eos Arrow 100 sub-meter GPS receiver connected to a Bluetooth-enabled device to input field data into the data dictionary. The ArcGIS Field Maps application was used to calculate the area (in m²) and the length at the long axis of the wetland. This determined the perpendicular transect locations and microplot quantity and placement using the USDA Forest Service GDE Level II protocol. The polygon also served as the wetland delineation deliverable required of all sampled seeps/springs/wetlands under this contract.
- If a site failed the USACE Dominance Test (i.e., less than or equal to 50% OBL and/or FACW absolute plant cover) and no wetland characteristics were observed, a walk-through of the site with photos was conducted. In addition, a single transect with three herbaceous vegetation cover quadrats using the modified GDE Level II Protocol through the most mesic part of the feature was carried out; no delineation was performed.
- At CEBR and BRCA, each end of the long axis of the polygon determined where the capped aluminum conduit permanent plot pins were set. Additional monuments were added if the long axis distance exceeded 100 m or if there were distinct bends (“doglegs”). An additional monument was added for every additional 100 m the transect extended and/or when the long axis trajectory changed at the bend. Each aluminum conduit cap was scribed with the site name. The depth of the monument below ground was between 12 and 18 inches. The height of the monument above ground did not exceed 12 inches.
- At all other parks (BLCA, CARE, COLM, CURE, and DINO), no permanent monuments were used at the sites. Sub-meter GPS data were collected according to the specifications at each end of the long axis (Table 3). Additional points were taken if the long axis exceeded 100 m, or if there were distinct doglegs.

Table 3. GPS settings and accuracy parameters.

Parameter	Setting
Accuracy	75 centimeters (cm)
GPS Averaging	OFF (if averaging a non-monumented point, turn ON and average 30 points)
95% Confidence	OFF
Streaming	46 cm
Photo Upload Size	Large
Related Type	Filtered; Show Related Type set to "OFF"
Offset	None
Snapping	OFF
Provider	Eos Positioning Systems # 1830#### (series specific to the device)
Antenna Ht.	1.5 m
Profile	Default (GCS WGS 1984)
Units	Metric
Coordinates	UTM
Distance	Meters
Area	Square meters

Non-wetland Negative Data

At sites where the absolute plant cover of OBL or FACW species was less than 50% and wetland characteristics were not present, then field staff did not complete the GDE Level II survey protocol. If hydrologic features were present (e.g., spring orifices or flowing channels), these features were mapped; however, no wetland delineation was conducted.

If neither wetland characteristics nor other evidence of a spring were present, then the site was documented as negative data and no GDE Level II survey occurred. Instead, field staff took photos facing each cardinal direction standing at the center of the site. At non-GDE sites that were identified as potential springs, a single transect was placed running through the most mesic part of the site. Three 0.5-m² quadrats were spaced evenly along the transect and herbaceous cover data were visually estimated within each quadrat. No wetland delineation was conducted.

GPS Settings and Accuracy

Sub-meter GPS mapping was acquired for mapped wetlands whenever adequate satellite reception was available, with a few exceptions. The GPS parameters listed below (Table 3) were used to ensure accurate and consistent boundary mapping. Eos Arrow 100 receivers were used to achieve sub-meter accuracy whenever possible. The mapping interface used was the ArcGIS Field Maps app with the data parameter setting options indicated below. When difficult satellite constellation or topography (e.g., narrow canyon) precluded sub-meter data collection, an accuracy setting requirement was modified, as necessary. In these instances, a less accurate polyline or point was achieved.

Goal 3: Representative Photos

As part of the methods discussed above, multiple photos were taken at each wetland following guidance outlined in the respective methods found in the GDE Level II protocol (Ironwood 2021b). Additional photos may have included overall landscape context photos and a representative photo along the wetland boundary. All photos were taken using the geo-referencing application Solocator, which provided a copy of each photo with Universal Transverse Mercator (UTM) location, aspect, elevation, date, time, project name, and a brief description. The description field described anything notable about the subject of the photo.

All photos were saved in jpeg format, labeled, and backed up each evening. Photo labels included:

- Park abbreviation
- Survey site name abbreviation
- Description of photo
- Date of photo
- Project description

An example of a labeled photo is, “BLCA_ID123_Description_MMDD2021_NCPN Seeps and Springs Inventory.jpeg.”

Other Park-specific Metrics

In addition to completing one of the methodologies previously described, this section includes the metrics that were evaluated and the data that were collected during the site visits.

Wildlife and Livestock Usage Metric

The presence of target animal scat and/or tracks observed within the quadrats was recorded and the frequency of each type was calculated. Target animal species included moose, elk, deer, sheep, bear, mountain lion, bison, and recent cattle signs. Incidental observations of target species, humans, and aquatic vertebrates were noted.

Wildlife usage data were collected at all six park units using the methodology in the work plan (Ironwood 2021a).

Recreation Impacts Metric

Any campsites, vehicle tracks, and human footpaths (social trails) within 100 ft of the site were also noted. After the site was evaluated, qualitative management indicator tools for recreation impacts were used to assess the site.

Recreation impact data were collected using the qualitative management indicator tool for recreation outlined in the GDE Level II protocol in the work plan (Ironwood 2021a).

Spring Development Metric

The data collection methods included categorical data for spring development, if present. Categories included fences, tanks, pipes, dams, windmills, pumps, spring boxes, trenches and ditches, and others (described). Point data were taken at the approximate center point for each structure or development encountered. Spring development data were collected at all park units.

BLCA and CURE Specific Metrics

BLCA and CURE requested additional analysis of collected data. The Colorado Natural Heritage Program's (CNHP) Ecological Integrity Assessment for Colorado Wetlands Field Manual, Version 2.1, provided a ranking system for plot data that broadly scores wetland integrity (Lemly et al. 2016). This protocol was used to assign two separate metrics, each producing a rank score that shows wetland integrity (shown in Table 4 and Table 5).

- Metric V1: Native Plant Species Cover (Relative) – From plot data, this is simply calculated by dividing the total cover of native species by the total cover of all species.
- Metric V2: Invasive Nonnative Plant Species Cover (Absolute) – From plot data, this is simply calculated by summing the total cover of nonnative species in the sample unit. CNHP uses the Colorado Noxious Weed list in addition to burning bush (*Kochia scoparia*) and Russian thistle (*Salsola tragus*) to define “invasive nonnative species”.

Table 4. Ranking system for metric V1: native plant species cover (relative).

Rank	Score	State
Excellent (A)	4	Assessment area contains > 99% relative cover of native plant species
Good (B)	3	Assessment area contains 95–99% relative cover of native plant species
Fair (C)	2	Assessment area contains 85–95% relative cover of native plant species
Fairly Poor (C-)	1.5	Assessment area contains 60–85% relative cover of native plant species
Poor (D)	1	Assessment area contains < 60% relative cover of native plant species

Table 5. Ranking system for metric V2: invasive nonnative species cover (absolute).

Rank	Score	State
Excellent (A)	4	Invasive nonnative species absent from all strata
Good (B)	3	Invasive nonnative species present, but sporadic (< 4% absolute cover)
Fair (C)	2	Invasive nonnative species somewhat abundant (4–10% absolute cover)
Fairly Poor (C-)	1.5	Invasive nonnative species abundant (11–30% absolute cover)
Poor (D)	1	Assessment area contains < 60% absolute cover of native plant species

Data Management

All data were recorded electronically on the application interface designed for the project using ArcGIS Field Maps and Pendragon on field tablets. Data were uploaded to the cloud storage at the end of the workday or when cellular or internet service was available. All photos were saved, labeled, and backed-up each evening.

Spatial Data

Spatial data collected during the surveys included wetland boundary mapping, site evaluations, and photos. Spatial field data collection equipment included:

- **Recreational-grade GPS units:** Each crew member carried a GPS unit that was capable of 5 m or greater accuracy, such as a handheld Garmin unit or smartphone GPS application, that was used to navigate to sites and collect tracks.
- **Sub-meter GPS units:** Each team had an Eos Arrow 100 sub-meter GPS receiver that was used with a Bluetooth-enabled device to input field data into the data dictionary. The Eos Arrow 100 is a mapping-grade GPS unit that can achieve accuracy at the sub-meter scale.
- **Data collection interface:** ArcGIS Field Maps was used to collect spatial data and transfer it to cloud storage. An interface was created for cell phones and tablets in the field for all data collection. The data collection interface was available offline when cell service was not available, and data were uploaded to the cloud storage upon re-entering cell service.

Tabular Data

Tabular data included species lists, photo lists, and geospatial metadata. Tabular data included all fields necessary, so data were broadly useful, including dates, UTM coordinates, descriptions, associated files, data types, observers, survey sites, species, etc. All plant species lists included USDA PLANTS database codes (USDA and NRCS 2023). Tabular data were compiled after the field data collection was completed from digital data forms.

Data Accuracy and Quality

To ensure data were collected accurately, all botanists and botany technicians were trained in data collection methodology. A botanist or botany technician was assigned the role of Data Collection Lead for each team. This person was tasked with reviewing the data fields for accuracy and completeness. A different crew member was assigned the role of filling out and keeping the species list.

The Project Manager and/or the Assistant Project Manager was present in the field during all data collection activities to help ensure that the workplan was followed and that data documentation adhered to the NPS requirements. At the end of each field day, data were reviewed in the field by the Project Manager or Assistant Project Manager to ensure completeness, accuracy, and quality. If data errors were detected, the GIS/Data Lead contacted the Project Manager and/or Assistant Project Manager, and the data were corrected and re-reviewed by the GIS/Data Lead.

Results

Surveys took place between July 20 and August 2, 2021. Of the 20 surveyed areas, 4 were identified as GDE sites with evidence of springs present (Table 6, Appendix A).

Table 6. List of surveyed sites identifying site type and primary GDE type (if applicable).

Site Name	Site Type	Primary GDE Type
BLCA 1048	GDE	Hypocrene
BLCA 1078	GDE	Hypocrene
BLCA 1081	GDE	Hypocrene
BLCA 1089	GDE	Hypocrene
BLCA 1016	Non-GDE	–
BLCA 1122	Non-GDE	–
BLCA 1132	Non-GDE	–
BLCA 1133	Non-GDE	–
BLCA 11215	Non-GDE	–
BLCA 12267	Non-GDE	–
BLCA 15112	Non-GDE	–
BLCA 15128	Non-GDE	–
BLCA 15134	Non-GDE	–
BLCA 15355	Non-GDE	–
BLCA 15360	Non-GDE	–
BLCA 15364	Non-GDE	–
BLCA 15368	Non-GDE	–
BLCA 15370	Non-GDE	–
BLCA 15374	Non-GDE	–
BLCA 15372	Non-GDE	–

The dominant herbaceous species reported in the GDE herbaceous vegetation quadrat summary tables were determined using the USACE Dominance Test. Only OBL and FACW plants were considered vegetative wetland indicators for this project.

BLCA 1048

BLCA 1048 was located at an elevation of approximately 2,715 m, with an overall northwest (338°) aspect and moderate slope variability across the site. Wetland vegetation provided evidence of groundwater. The primary spring type was characterized as hypocrene. This GDE site included a total wetland area of 0.06 acre (ac; 227.7 m²) and 60.5 m of wetland perimeter (Figure 2, Appendix B).

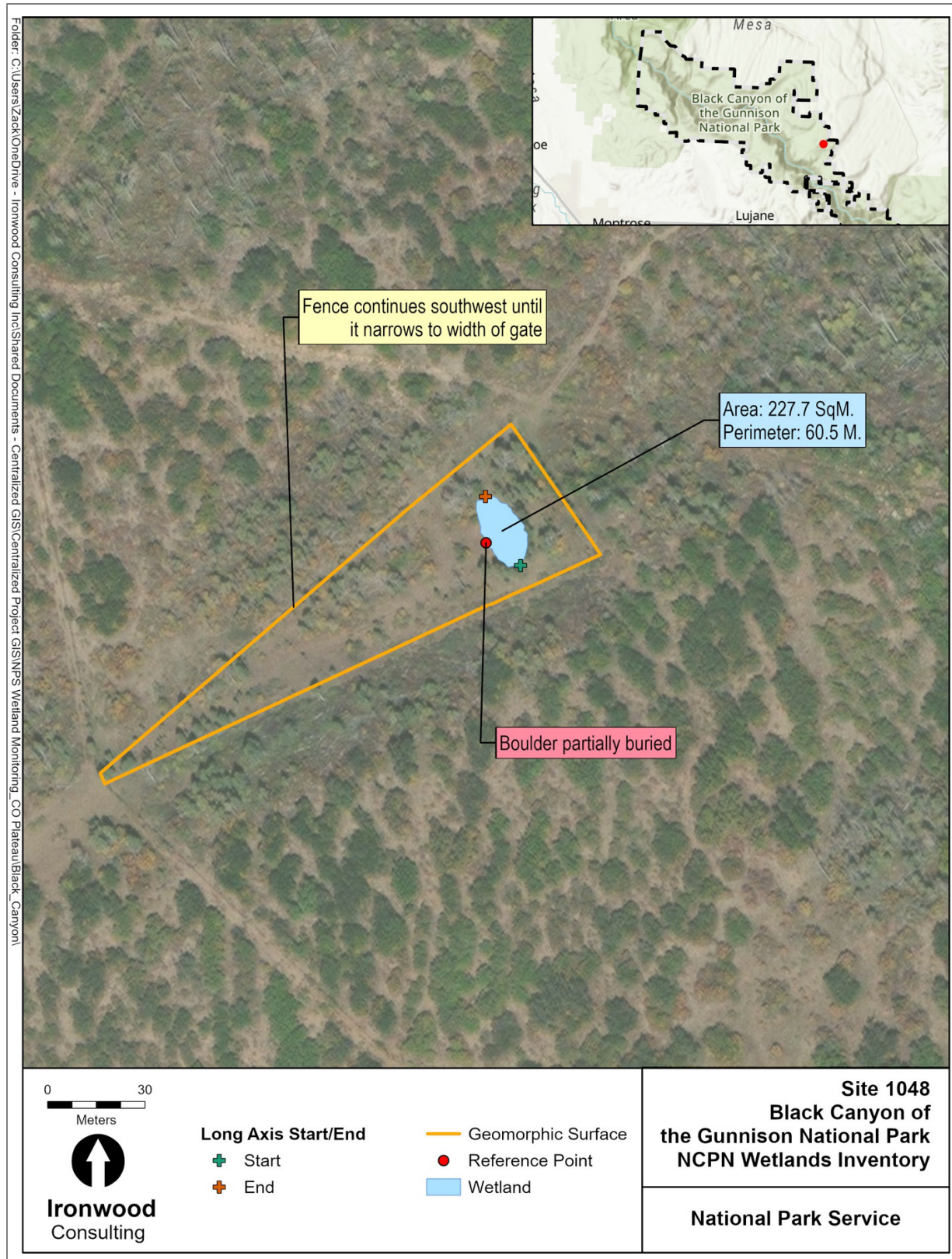


Figure 2. Wetland mapping for BLCA 1048.

Thirteen plant taxa were recorded during the GDE Level II survey, including five taxa captured in herbaceous vegetation quadrats (Table 7, Appendix D). Total average herbaceous cover was 54.0%. The dominant herbaceous wetland plant was common spikerush (*Eleocharis palustris*) with 51.8% average cover. Ground cover included soil, litter, boulder, and basal with 64.5%, 27.6%, 3.9%, and 3.9% average corner hits, respectively (Table 8). There was no woody line intercept cover.

Table 7. Herbaceous vegetation quadrat data for BLCA 1048. Bryophytes not included in totals.

Species	Common Name	Native Status ^A	Wetland Code	Average Absolute Cover (%)	Average Relative Cover (%)	Frequency (%)
<i>Eleocharis palustris</i>	common spikerush	N	OBL	51.8	96.0	100
<i>Juncus balticus</i> var. <i>montanus</i>	Baltic rush	N	FACW	1.3	2.4	5
<i>Polygonum aviculare</i>	yard knotweed	I	FAC	0.5	1.0	21
<i>Alisma triviale</i>	northern water-plantain	N	OBL	0.2	0.4	5
<i>Myosurus minimus</i>	tiny mouse-tail	N	OBL	0.1	0.2	5
Bryophytes	moss	–	–	–	–	–
Total	–	–	–	54.0	–	–
50% of Total	–	–	–	27.0	–	–
20% of Total	–	–	–	10.8	–	–
Total Native Plant (Metric V1)	–	–	–	–	99.0	–
Total Noxious Weed (Metric V2)	–	–	–	–	–	–

^A I: Introduced; N: Native; NOX: Colorado Noxious Weed (CDA 2023; USDA and NRCS 2023).

Table 8. Groundcover quadrat data for BLCA 1048.

Groundcover Type	Average Corner Hits (%)
Bryophyte	–
Gravel	–
Cobble	–
Stone	–
Boulder	3.9
Bedrock	–
Basal	3.9
Litter	27.6
Water	–
Wood	–
Soil	64.5

Table 8 (continued). Groundcover quadrat data for BLCA 1048.

Groundcover Type	Average Corner Hits (%)
Total	100.0

The non-native plants bulbous bluegrass (*Poa bulbosa*), Canada bluegrass (*Poa compressa*), common dandelion (*Taraxacum officinale*), timothy (*Phleum pratense*), and yard knotweed (*Polygonum aviculare*) were present. The noxious weeds Canada thistle (*Cirsium arvense*) and Russian knapweed (*Acroptilon repens*) also occurred at the site.

According to the herbaceous vegetation quadrat data, this site included 99.0% average relative cover of native plants and was ranked as Good according to the CNHP Ecological Integrity Assessment Metric V1. Since no noxious plants were captured by the herbaceous quadrats, it ranked as Excellent according to Metric V2. However, the increased presence of Canada thistle and Russian knapweed at the wetland margins suggests that the adjacent habitat had a visually estimated V2 rank of Fair.

No recreation impacts were observed. Signs of historic spring developments included fencing and pipes. The piping entered the wetland at its northwest end but was not flowing during the survey. Signs of cattle were observed within the herbaceous quadrats with 5% frequency (Appendix C). Bear, elk, and cow scat were also noted outside of the quadrats.

BLCA 1078

BLCA 1078 was located at an elevation of approximately 2,495 m, with an overall northwest (314°) aspect and low slope variability across the site. Wetland vegetation provided evidence of groundwater. The spring type was characterized as hypocrene. This GDE site included a total wetland area and perimeter of 0.07 ac (265.5 m²) and 369.7 m, respectively (Figure 3, Figure 4, Appendix B).

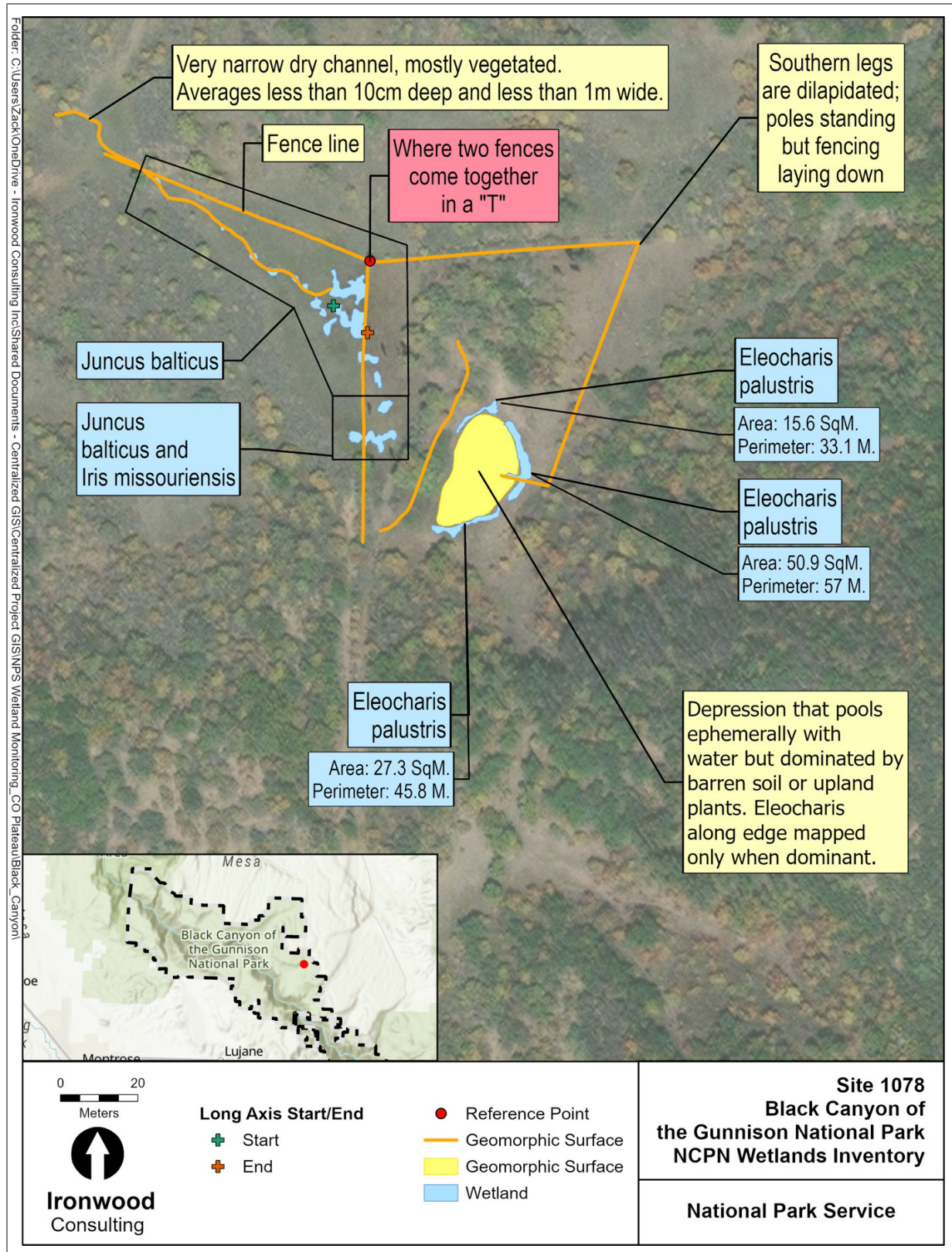


Figure 3. Wetland mapping for BLCA 1078.

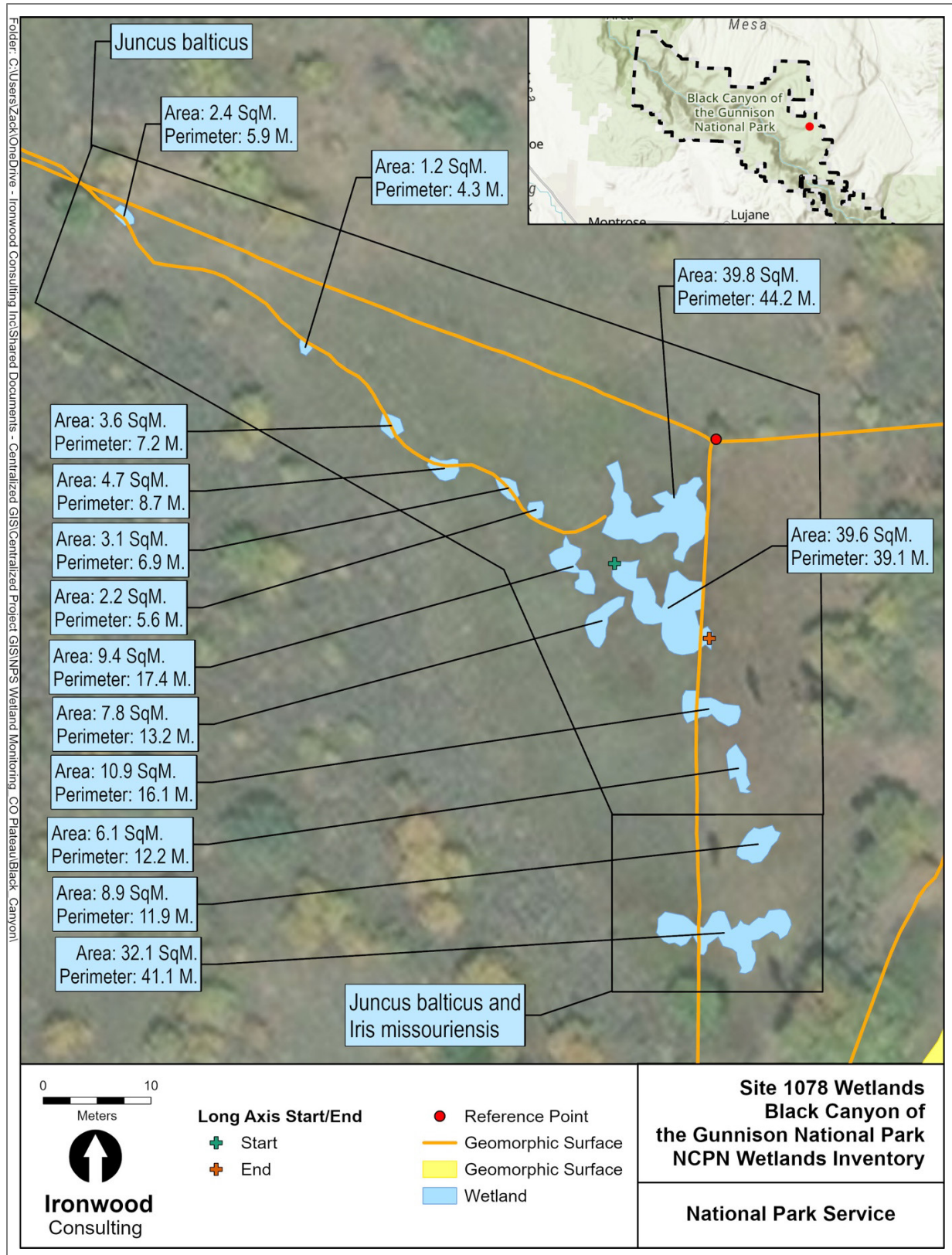


Figure 4. Wetland mapping for BLCA 1078 associated wetlands.

Seventeen plant taxa were encountered during the GDE Level II survey, including three taxa captured inside the herbaceous vegetation quadrats (Table 9, Appendix D). The total average herbaceous cover was 39.8%. The dominant herbaceous wetland plant was Baltic rush (*Juncus balticus* var. *montanus*) with 39.5% average cover. Groundcover included litter and soil with 85.0% and 15.0% average corner hits, respectively (Table 10). There was no woody line intercept cover.

Table 9. Herbaceous vegetation quadrat data for BLCA 1078. Bryophytes not included in totals.

Species	Common Name	Native Status ^A	Wetland Code	Average Absolute Cover (%)	Average Relative Cover (%)	Frequency (%)
<i>Juncus balticus</i> var. <i>montanus</i>	Baltic sedge	N	FACW	39.5	99.2	100
<i>Eurybia glauca</i>	blueleaf aster	N	UPL	0.2	0.5	20
<i>Taraxacum officinale</i>	common dandelion	I	FACU	0.1	0.3	10
Bryophytes	moss	–	–	–	–	–
Total	–	–	–	39.8	–	–
50% of Total	–	–	–	19.9	–	–
20% of Total	–	–	–	8.0	–	–
Total Native Plant (Metric V1)	–	–	–	–	99.7	–
Total Noxious Weed (Metric V2)	–	–	–	–	–	–

^A I: Introduced; N: Native; NOX: Colorado Noxious Weed (CDA 2023; USDA and NRCS 2023).

Table 10. Groundcover quadrat data for BLCA 1078.

Groundcover Type	Average Corner Hits (%)
Bryophyte	–
Gravel	–
Cobble	–
Stone	–
Boulder	–
Bedrock	–
Basal	–
Litter	85.0
Water	–
Wood	–
Soil	15.0
Total	100.0

The non-native plants recorded were common dandelion, prickly lettuce (*Lactuca serriola*), smooth brome (*Bromus inermis*), timothy, and yard knotweed. The noxious weeds Canada thistle, field bindweed (*Convolvulus arvensis*), musk thistle (*Carduus nutans*), and whitetop (*Cardaria draba*) were also present.

According to the herbaceous vegetation quadrat data, this site included 99.7% average relative cover of native plants and was ranked as Good according to the CNHP Ecological Integrity Assessment Metric V1. Since no noxious plants were captured by the herbaceous quadrats, it was ranked as Excellent according to Metric V2. However, the presence of Canada thistle, field bindweed, musk thistle, and whitetop scattered within the wetland and at the margins suggests that the overall habitat had a visually estimated V2 rank of Good.

No recreational impacts were observed. This site had an earthen dam that caused ephemeral pooling and appeared to function as a stock pond when standing water was present. However, there was no standing water during the survey. Cattle scat was observed with 20% frequency within the herbaceous quadrats (Appendix C). Cattle scat was also observed outside of the quadrats at this site.

BLCA 1081

BLCA 1081 was located at an elevation of approximately 2,490 m, with an overall northwest (290°) aspect and moderate slope variability across the site. Wetland vegetation provided evidence of groundwater. The spring type was characterized as hypocrene. This site included a total wetland area and perimeter length of 0.04 ac (151.3 m²) and 169.5 m, respectively (Figure 5, Appendix B).

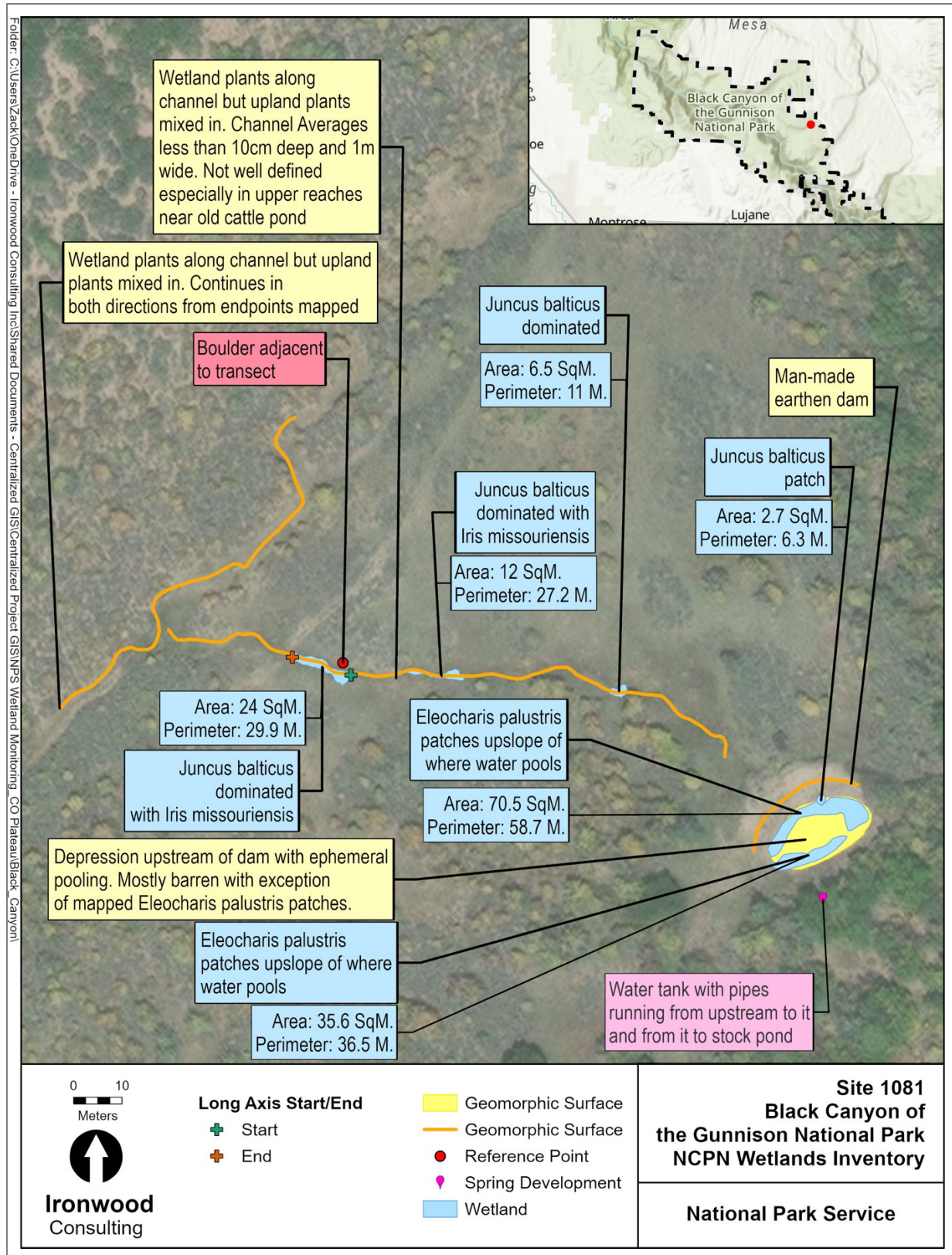


Figure 5. Wetland mapping for BLCA 1081.

A total of 13 plant taxa were documented, including 8 taxa captured by the herbaceous vegetation quadrats (Table 11, Appendix D). Total herbaceous cover averaged 25.3%. The dominant wetland plant was Baltic rush with 23.3% average cover. The average groundcover included litter, soil, and stone with 66.7%, 29.2%, and 4.2% average corner hits, respectively (Table 12). There was no woody line intercept cover.

Table 11. Herbaceous vegetation quadrat data for BLCA 1081. Bryophytes not included in totals.

Species	Common Name	Native Status ^A	Wetland Code	Average Absolute Cover (%)	Average Relative Cover (%)	Frequency (%)
<i>Juncus balticus</i> var. <i>montanus</i>	Baltic rush	N	FACW	23.3	92.1	100
<i>Hordeum brachyantherum</i>	meadow barley	N	FACW	0.7	2.6	17
<i>Carex</i> sp.	sedge	–	–	0.3	1.3	3
<i>Phleum pratense</i>	timothy	I	FAC	0.3	1.3	33.
<i>Iris missouriensis</i>	Rocky Mountain iris	N	FACW	0.2	0.7	17
<i>Pascopyrum smithii</i>	Western wheatgrass	N	FACU	0.2	0.7	17
<i>Polygonum aviculare</i>	yard knotweed	I	FAC	0.2	0.7	17
<i>Taraxacum officinale</i>	common dandelion	I	FACU	0.2	0.7	17
Bryophytes	moss	–	–	–	–	–
Total	–	–	–	25.3	–	–
50% of Total	–	–	–	12.7	–	–
20% of Total	–	–	–	5.1	–	–
Total Native Plant (Metric V1)	–	–	–	–	97.4	–
Total Noxious Weed (Metric V2)	–	–	–	–	–	–

^A I: Introduced; N: Native; NOX: Colorado Noxious Weed (CDA 2023; USDA and NRCS 2023).

Table 12. Groundcover quadrat data for BLCA 1081.

Groundcover Type	Average Corner Hits (%)
Bryophyte	–
Gravel	–
Cobble	–
Stone	4.2
Boulder	–
Bedrock	–
Basal	–
Litter	66.7

Table 12 (continued). Groundcover quadrat data for BLCA 1081.

Groundcover Type	Average Corner Hits (%)
Water	–
Wood	–
Soil	29.2
Total	100.0

The non-native plant species common dandelion, Kentucky bluegrass (*Poa pratensis*), and timothy occurred at this site. The noxious species Canada thistle, musk thistle, and whitetop were also present.

According to the herbaceous vegetation quadrat data, this site included 97.4% average relative cover of native plants and was ranked as Good according to the CNHP Ecological Integrity Assessment Metric V1. Unidentified taxa that were assumed to be native species were included in the total tally for relative plant cover. Since no noxious plants were captured by the herbaceous quadrats, it was ranked as Excellent according to Metric V2. However, the presence of Canada thistle, musk thistle, and whitetop scattered within the wetland and at the margins suggests that the overall habitat had a visually estimated V2 rank of Good.

No recreation impacts were observed at the site. Spring developments consisting of an earthen dam, pipes, and a metal water tank were present. This site appeared to function as a stock pond when water pooled ephemerally below the dam. Cattle scat was observed within the herbaceous quadrats with 33% frequency (Appendix C).

BLCA 1089

BLCA 1089 was located at an elevation of approximately 2,547 m, with an overall northwest (342°) aspect and low slope variability across the site. Wetland vegetation provided evidence of groundwater. The spring type was characterized as hypocrene. This GDE site included a total wetland area and perimeter of 0.09 ac (365.5 m²) and 177.0 m, respectively (Figure 6, Appendix B).

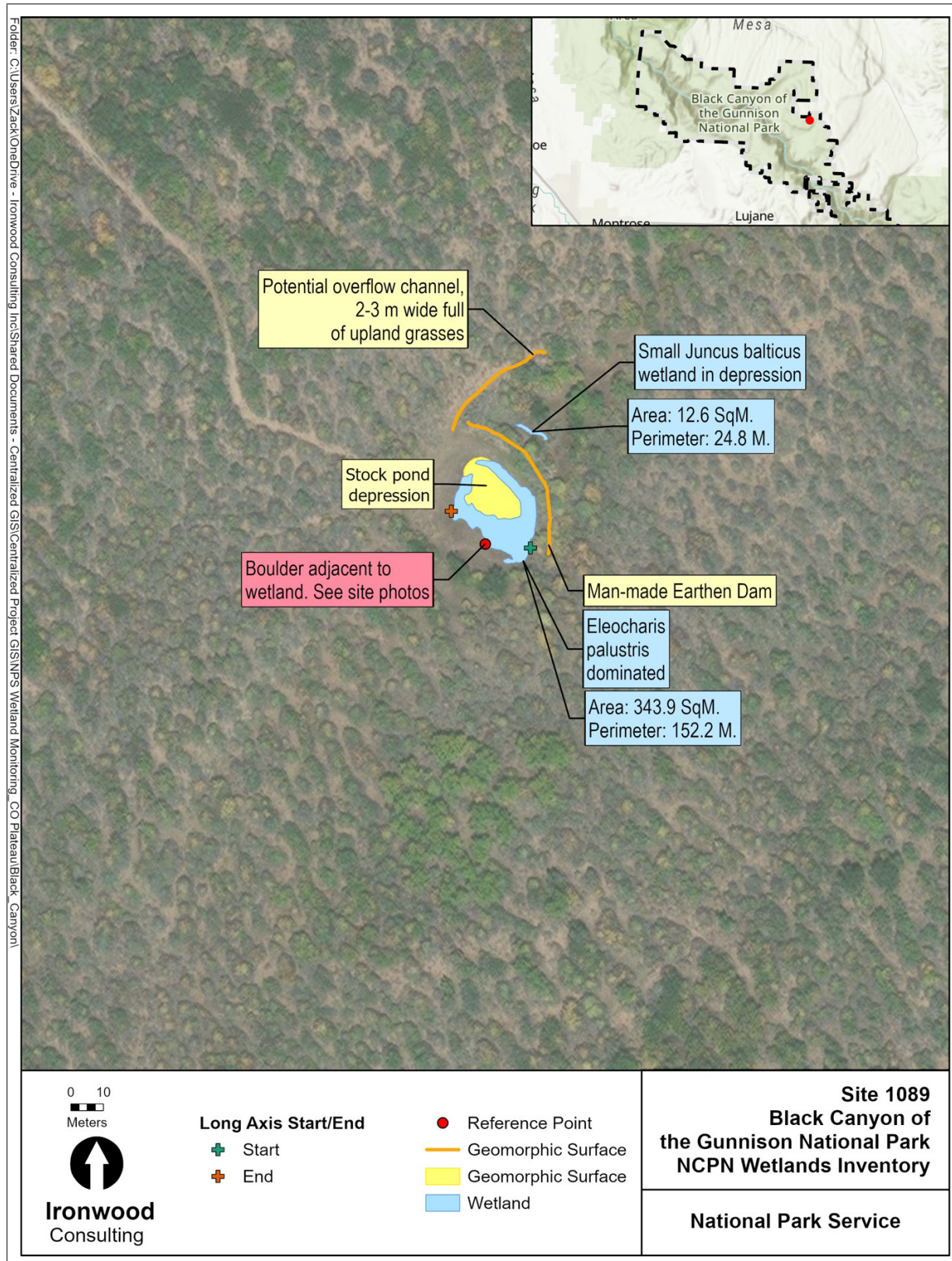


Figure 6. Wetland mapping for BLCA 1089.

Eleven plant taxa were documented during the GDE Level II survey, including two taxa captured in herbaceous vegetation quadrats (Table 13, Appendix D). Total average herbaceous cover was 12.3%. The dominant herbaceous wetland plant was common spikerush with 11.8% average cover. Groundcover included litter, soil, and basal with 60.0%, 37.5%, and 2.5% average corner hits, respectively (Table 14). There was no woody line intercept cover.

Table 13. Herbaceous vegetation quadrat data for BLCA 1089. Bryophytes not included in totals.

Species	Common Name	Native Status ^A	Wetland Code	Average Absolute Cover (%)	Average Relative Cover (%)	Frequency (%)
<i>Eleocharis palustris</i>	common spikerush	N	OBL	11.8	95.9	100
<i>Cirsium arvense</i>	Canada thistle	NOX	FAC	0.5	4.1	10
Bryophytes	moss	–	–	–	–	–
Total	–	–	–	12.3	–	–
50% of Total	–	–	–	6.2	–	–
20% of Total	–	–	–	2.3	–	–
Total Native Plant (Metric V1)	–	–	–	–	95.9	–
Total Noxious Weed (Metric V2)	–	–	–	0.5	–	–

^A I: Introduced; N: Native; NOX: Colorado Noxious Weed (CDA 2023; USDA and NRCS 2023).

Table 14. Groundcover quadrat data for BLCA 1089.

Groundcover Type	Average Corner Hits (%)
Bryophyte	–
Gravel	–
Cobble	–
Stone	–
Boulder	–
Bedrock	–
Basal	2.5
Litter	60.0
Water	–
Wood	–
Soil	37.5
Total	100.0

The non-native plant species detected at this site included common dandelion, prickly lettuce, timothy, and yard knotweed. The noxious plants Canada thistle and whitetop were also present.

According to the herbaceous vegetation quadrat data, this site included 95.9% average relative cover of native plants and was ranked as Good according to the CNHP Ecological Integrity Assessment Metric V1. Canada thistle had an average absolute cover of 0.5%, resulting in a rank of Good according to Metric V2. Musk thistle and whitetop occurred near the wetland margins, giving the overall surrounding habitat a visually estimated V2 rank of Good.

No recreation impacts were observed. An earthen dam enabled this site to function as an ephemeral livestock tank when water pooled. There was no surface water during the survey. Cow, elk, and rabbit scat were observed, each with 10% frequency within the vegetation quadrats (Appendix C). Deer and elk signs were observed outside of the quadrats.

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Appendix A: GDE Site Summary Table Locality Details

Table 15 summarizes the locality details of each site.

Table 15. GDE Site Summary Table Locality Details.

Site Name	Datum	UTM Zone	Long Axis Start Easting	Long Axis Start Northing	Long Axis End Easting	Long Axis End Northing	Reference Point Easting	Reference Point Northing	Aspect at Reference Point (°)	Elevation at Reference Point (m)	Reference Point Notes	Dogleg in Long Axis?	Herbaceous Quadrat Cut-level
1048	NAD83	13	270065	4270770	270054	4270792	270054	4270778	338	2,715	Boulder adjacent to depression. See site photos.	No	< 1% Not Recorded
1078	NAD83	13	269302	4272293	269293	4272300	269302	4272311	314	2,495	Point where 2 fences come together in a “T”.	No	< 1% Not Recorded
1081	NAD83	13	269335	4272457	269323	4272461	269333	4272459	290	2,491	Boulder adjacent to the mapped wetland with GDE long axis.	No	< 1% Not Recorded
1089	NAD83	13	268861	4272910	268837	4272921	268847	4272911	288	2,491	Boulder adjacent to GDE long axis.	No	< 1% Not Recorded

Appendix B: GDE Site Summary Table Wetland Feature

Table 16 summarizes each site.

Table 16. GDE Site Summary Table Wetland Feature.

Site Name	Site Type	Primary GDE Type	Secondary GDE Type	Total Wetland Area (ac)	Total Wetland Area (m²)	Total Wetland Perimeter Length (m)	Total Orifices	Number of Mapped Channels	Length of Mapped Channel (m)	Mapped Channel Type (if observed)	Wetland/Channel Description	Total Wetted Area (ac)	Total Wetted Length (m)
1048	Spring	Hypocrene	–	0.06	227.7	60.5	–	–	–	–	–	–	–
1078	Spring	Hypocrene	–	0.07	265.5	369.7	–	1	92.1	Runoff dominated	There is a dry channel outside wetland. See map for details.	–	–
1081	Spring	Hypocrene	–	0.04	151.3	169.5	–	2	222.1	Runoff dominated	Vegetated channel averaging less than 10 cm deep and 1 m wide. Not well-defined in most areas	–	–
1089	Spring	Hypocrene	–	0.09	356.5	177.0	–	1	39.0	Runoff dominated	–	–	–

Appendix C: GDE Site Wildlife Summary Table

Tables 17 and 18 show the animal signs found inside and outside quadrats.

Table 17. Percent frequency of scat or tracks found inside vegetation quadrats.

Animal Category	Animal Type	1048	1078	1081	1089	Total Sites Observed
Wildlife	Elk	–	–	–	10	1
Wildlife	Rabbit	–	–	–	10	1
Livestock	Cow	5	20	33	10	4

Table 18. Animal sign (scat or tracks) observed outside vegetation transects. X indicates a presence.

Animal Category	Animal Type	1048	1078	1081	1089	Total Sites Observed
Wildlife	Bear	X	–	–	–	1
Wildlife	Deer	–	–	–	X	1
Wildlife	Elk	X	–	–	X	2
Livestock	Cow	X	X	–	–	2

Appendix D: GDE Site Vascular Plant Inventory List

Table 19 shows the vascular plant list from the inventory.

Table 19. GDE Site Vascular Plant Inventory List. An “X” indicates presence.

Species	Common Name	Wetland Code	Native Status ^A	BLCA 1048	BLCA 1078	BLCA 1081	BLCA 1089
<i>Achillea millefolium</i>	common yarrow	FACU	N	X	X	X	X
<i>Acroptilon repens</i>	Russian knapweed	UPL	NOX-B	X	–	–	–
<i>Alisma triviale</i>	northern water plantain	OBL	N	X	–	–	–
<i>Bromus inermis</i>	smooth brome	UPL	I	–	X	–	–
<i>Cardaria draba</i>	whitetop	UPL	NOX-B	–	X	X	X
<i>Carduus nutans</i>	musk thistle	UPL	NOX-B	–	X	X	–
<i>Carex</i> sp.	sedge	–	–	–	–	X	–
<i>Chenopodium</i> sp.	lambsquarter	–	–	–	–	–	X
<i>Cirsium arvense</i>	Canada thistle	FAC	NOX-B	X	X	X	X
<i>Convolvulus arvensis</i>	field bindweed	UPL	NOX-C	–	X	–	–
<i>Eleocharis palustris</i>	common spikerush	OBL	N	X	–	–	X
<i>Epilobium brachycarpum</i>	autumn willow-herb	FAC	N	–	X	–	X
<i>Erigeron</i> sp.	daisy	–	–	–	X	–	–
<i>Eurybia glauca</i>	gray aster	UPL	N	–	X	–	–
<i>Hordeum brachyantherum</i>	meadow barley	FACW	N	X	–	X	–
<i>Iris missouriensis</i>	Rocky Mountain iris	FACW	N	–	–	X	–
<i>Juncus balticus</i> var. <i>montanus</i>	Baltic rush	FACW	N	X	X	X	–
<i>Juncus</i> sp.	rush	–	–	–	X	–	–
<i>Lactuca serriola</i>	prickly lettuce	FACU	I	–	X	–	X
<i>Madia glomerata</i>	mountain tarweed	FACU	N	–	X	–	–
<i>Myosurus minimus</i>	tiny mouse-tail	OBL	N	X	–	–	X
<i>Pascopyrum smithii</i>	western wheatgrass	FACU	N	–	X	X	–
<i>Phleum pratense</i>	timothy	FAC	I	X	X	X	X
<i>Poa bulbosa</i>	bulbous bluegrass	FACU	I	X	–	–	–
<i>Poa compressa</i>	Canada bluegrass	FACU	I	X	–	–	–
<i>Poa pratensis</i>	Kentucky bluegrass	FAC	I, N	–	–	X	–
<i>Polygonum aviculare</i>	yard knotweed	FAC	I	X	X	X	X
<i>Taraxacum officinale</i>	common dandelion	FACU	I	X	X	X	X

^A I: Introduced; N: Native; NOX-B: Colorado Noxious Weed List B; NOX-C: Colorado Noxious Weed List C (CDA 2023; USDA and NRCS 2023).

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