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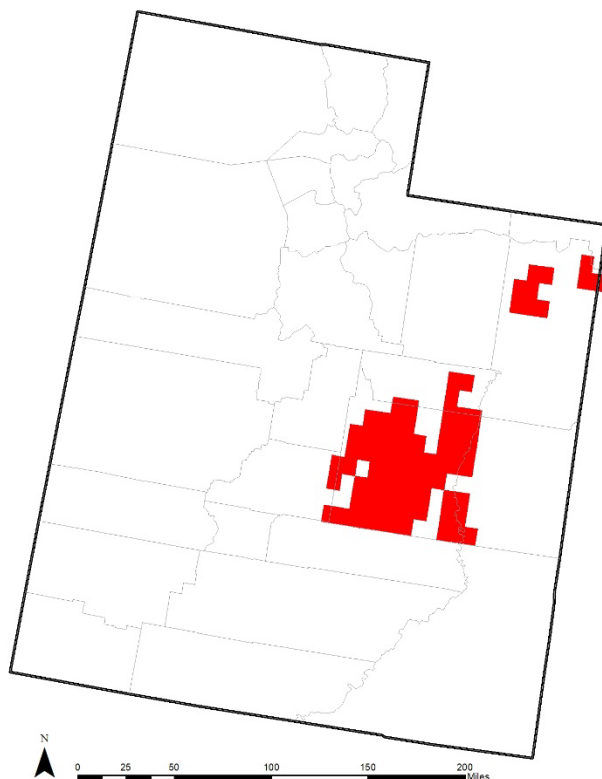
The [Ecological Mapping, Monitoring and Analysis](#) (EMMA) group is part of the [O'Connor Center for the Rocky Mountain West](#) at the [University of Montana](#). The EMMA group supports informed management of public lands in the West. EMMA's team of trained ecologists and biologists collect data in upland, wetland, and aquatic habitats, using protocols developed by our own team and by partner agencies. Our GIS and data specialists map wetlands and riparian areas and assist EMMA scientists with data analysis. We provide direct support to partner agencies to help them answer questions about the effectiveness of land management actions and report on the ecological health of public land resources. As part of our commitment to science-based public lands management, we provide professional development opportunities for early-career scientists who are interested in pursuing applied science careers in agencies or universities.

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Supplemental Map Information (User Report)

Project ID: R06Y20P09_BLM_2019

Project Title or Area: UT BLM 2019



Source Imagery:

Mapping is based on 2018 National Agriculture Imagery Program (NAIP) imagery. Color infrared (CIR) is the primary imagery type used to accentuate vegetative wetland features and saturated soils. Additional years of imagery used to assist mapping decision-making are listed below in Table 1.

Table 1. Source imagery used for mapping project R06Y20P09.

Year	Imagery	Acquired	Resolution
2006	NAIP Natural Color	Summer	1 m
2009	NAIP Natural Color/CIR	Summer	1 m
2011	NAIP Natural Color/CIR	Summer	1 m
2014	NAIP Natural Color/CIR	Summer	1 m
2016	NAIP Natural Color/CIR	Summer	1 m
2018	NAIP Natural Color/CIR	Summer	0.6 m

Collateral Data:

Imagery:

- [Google Earth Pro Imagery](#) (acquired in various years between 1997 and 2019)
- [Hexagon HxGN Content Program](#) (2017 30cm resolution CIR imagery subscription service)
- [Black & White Digital Ortho Quarter Quads \(DOQQs\)](#) (acquired between 1990 and 2003)

Ancillary data:

- 24k National Hydrography Data (NHD)
- 24k USGS Topographic Maps
- 10m Digital Elevation Model (DEM - based on the National Elevation Dataset)
- USGS LiDAR Point Cloud (2019) derived hillshade and canopy height DEMs
- USDA Web Soil Survey

Inventory Method:

Wetland delineation was accomplished via “heads up” digitizing at a scale of 1:4,500 using ESRI’s ArcMap 10.6.1 over 2018 NAIP imagery and ancillary data listed above. The NAIP 2018 aerial photo interpretation was completed by Montana Natural Heritage Program and University of Montana’s Ecological Mapping, Monitoring, and Analysis (EMMA) group wetland staff. Field reconnaissance was conducted in Greasewood Draw, Arsons Garden, Old Woman Wash, Bottleneck Peak, Bob Hill Knoll, Buckhorn Reservoir, Chimney Rock, Cliff, and Woodside quads in September 2020 to field verify wetland mapping classifications.

Classification:

- Cowardin wetland classification (Cowardin, et al 1979; Federal Geographic Data Committee 2013)
- USFWS Riparian classification (USFWS 2019)
- No uplands classification

Data Limitations:

Regional convention limits attribution of wetlands polygons to the class level for non-vegetated wetlands and restricts the use of modifiers to one water regime and one special modifier. Mono-interpretation of imagery may have resulted in the misinterpretation of land cover types. The imagery encompasses a ‘snapshot in time’ on a single day, usually in mid-summer, thus water regimes are assigned by assuming the average can be ascertained by using all years of imagery.

This mapping product is an estimation of where wetlands and riparian features may be on the landscape and is not intended to be used as an actual representation of on-the-ground conditions for regulatory purposes. All wetland and riparian mapping represent photo interpretation from aerial imagery.

General description of the Project Area:

GEOGRAPHY: The project area consists of 79 1:24,000 USGS quads that span across the following six counties in eastern Utah: Uintah, Daggett, Carbon, Emery, Grand, and Sevier (Appendix A). The project lies primarily within the Colorado Plateaus Level III ecoregion, with the extreme westernmost portion falling within the Wasatch and Uinta Mountains Level III ecoregion. These are further divided into the following nine Level IV ecoregions (Table 2, Omernik 1987):

Table 2. Level IV Ecoregions for the Project Area.

Level IV Ecoregion	Description	Approximate % Project Area
Semiarid Benchlands and Canyonlands	Broad benches and mesas covered with grass, shrubs, and woodland. Bedrock exposures common. Low escarpments separate remnant mesa tops and narrow canyons from surrounding benches.	35
Shale Deserts and Sedimentary Basins	Sparsely vegetated benches, low rounded hills, and badlands. Deep arroyos are carved where surface water concentrates.	29
Escarpments	Rugged, remote, and varied landscape comprised of deeply-dissected cliff-bench complexes that rise from the deserts and canyonlands to forested mountain rims.	14
Sand Deserts	Arid, nearly level landscape with shifting sand dunes and exposed sandstone bedrock.	10
Uinta Basin Floor	Large, arid basin enclosed by the Uinta Mountains and Tavaputs Plateau. Receives abundant stream runoff from the mountains.	5
Northern Uinta Basin Slopes	Foothill region characterized by mountain-fed streams entrenched within benches.	3
Arid Canyonlands	The Arid Canyonlands are bounded by nearly vertical, canyon walls that separate it from adjacent, higher benchlands. Exposed bedrock is common.	2
Wasatch Montane Zone	Partially glaciated. Consists of forested mountains and plateaus underlain by sedimentary and metamorphic rocks. Perennial streams provide water to lower, more arid regions	1
Mid-Elevation Uinta Mountains	Glaciated and forested. Deep canyons contain many perennial streams that are fed by meltwater from the high Uinta Mountains and provide water to lower, more arid ecoregions.	<1

CLIMATE: Elevation in the project area ranges from approximately 4,000 feet (1,219 m) in the Green River lowlands to approximately 10,000 feet (3,048 m) in the Wasatch Mountains. In general, the region is characterized by hot summers, relatively cool winters, and large fluctuations in daily temperature (U.S. Climate Data, USFWS 1995). Average January temperatures range between 7°F and 30°F (-14°C to -1°C) and average July temperatures range between 53°F and 90°F (12°C to 32°C; Western Regional Climate Center). Annual precipitation ranges from 4 - 15 inches (10 - 38 cm) in the Colorado Plateau to 15 - 25 inches (38 - 63 cm) in the foothills of the Wasatch and Uinta Mountains. Annual evapotranspiration ranges from 5 - 16 inches (12 - 40 cm) per year in the region, with an inverse relationship with precipitation. Precipitation is highest in the late summer when afternoon thunderstorms are common (Banner et al. 2009).

VEGETATION, SOILS, AND LAND USE: The majority of the project area is a sparsely vegetated, semi-desert landscape. Aridisols, Entisols, and Mollisols are the major soil types. Within the project area, these soils are generally shallow, clayey, and contain salts and gypsum (Banner et al. 2009). Big sagebrush (*Artemisia tridentata*), saltbush (*Atriplex* spp.), greasewood (*Sarcobatus vermiculatus*), blackbrush (*Coleogyne ramosissima*), and Mormon tea (*Ephedra viridis*) are dominant over extensive areas. Cottonwoods (*Populus* spp.) and shrubs such as netleaf hackberry (*Celtis reticulata*) and various willow species (*Salix* spp.) grow along many of the permanent streams in the region (USFWS 1995, Utah Division of Wildlife Resources 2020). The non-natives Russian olive (*Elaeagnus angustifolia*) and tamarisk (*Tamarix ramosissima*) are increasingly found along riparian corridors as well (Larese-Casanova 2014). Livestock grazing and crop production of alfalfa are the primary land uses (Banner et al. 2009; Utah Division of Water Resources 2019). Recreation activities such as boating, hiking and all-terrain vehicle use are common in this area.

Description of wetland habitats within the project area:

Only major classes of wetlands are represented here. A more detailed description of [wetland and Riparian classification](#), as well as other information regarding wetland mapping are available on the MTNHP [Wetland and Riparian Mapping Center website](#). Wetland classification codes and representative corresponding community types in this project include:

R3UB and R4SB: Upper perennial riverine (R3) features are relatively rare within the project area and are often associated with higher order streams and rivers such as the San Rafael, Price, and Green Rivers. Intermittent streams (R4) flow temporarily or seasonally. Streams with no visible water or riparian vegetation were classified as intermittently flooded (R4SBJ). Streams with limited water visible in the imagery and/or associated springs or seeps were typically classified as temporarily flooded (R4SBA). Streams with some standing water visible in the imagery, yet still designated as intermittent in the National Hydrography Dataset (NHD), were classified as R4SBC (seasonally flooded).

PEM: Palustrine emergent wetlands consist of temporarily flooded (PEM1A), seasonally flooded (PEM1C), saturated (PEM1B), seasonally flooded-saturated (PEM1E), and semi-permanently flooded (PEM1F). Saturated and seasonally flooded-saturated emergent wetlands are often associated with a spring or seep. Dominant vegetation in emergent wetlands includes native sedges (*Carex* spp.), rushes (*Juncus* spp.), and spikerushes (*Eleocharis* spp.), as well as nonnatives such as the common reed (*Phragmites australis*). Saline depressions may also be found in this area, which support salt-tolerant vegetation such as inland saltgrass (*Distichlis spicata*) and Hardstem bulrush (*Schoenoplectus acutus*; Larese-Casanova 2014, USFWS 1995).

PSS: Palustrine scrub-shrub wetlands consist of temporarily flooded (PSS1A), seasonally flooded (PSS1C), saturated (PSS1B), and seasonally flooded-saturated (PSS1E) shrublands. Saturated and seasonally flooded-saturated wetlands are often associated with a spring or seep. Most wetland shrublands are dominated by willow (*Salix* spp.). Other shrubs in the region include species tolerant of saline soils, including greasewood (*Sarcobatus vermiculatus*), shadscale (*Atriplex confertifolia*), and

iodinebush (*Allenrolfea occidentalis*; Larese-Casanova 2014; Utah Division of Water Resources 2019).

PFO: Palustrine forested wetlands demarcate locations with known spring features where trees—often cottonwood (*Populus* spp.), alder (*Alnus* spp.), or aspen (*Populus tremuloides*)—are the dominant over-story vegetation (Larese-Casanova 2014; USFWS 1995).

L1UB and L2UB: Lacustrine limnetic and lacustrine littoral unconsolidated bottom wetlands within this region are primarily associated with reservoirs.

PAB, PUB: A majority of the palustrine aquatic bed and unconsolidated bottom features within the project area are impoundments on intermittent streams or springs that were excavated to supply water for livestock or irrigation. Most stock ponds were classified as PUBFh (semi-permanently flooded, impounded) or PUSCh (seasonally flooded, impounded) if no water was present in 2018 imagery.

Descriptions of other habitats:

Rp: Riparian forests are communities are largely comprised of narrow-leaf cottonwood (*Populus angustifolia*), Fremont cottonwood (*Populus fremontii*), and the non-natives Russian olive (*Elaeagnus angustifolia*) and tamarisk (*Tamarix ramosissima*). Riparian scrub-shrub areas are dominated by various willow species including the booth willow (*Salix boothii*), netleaf hackberry (*Celtis reticulata*), and red osier dogwood (*Cornus sericea*; (Larese-Casanova, 2014).

Table 3. Common wetland and riparian plant species with [indicator status](#) (Culver & Lemly 2013):

Genus species	Common Name	Wetland Indicator Status
<i>Carex</i> spp.	Sedge species	Obligate (OBL)
<i>Juncus</i> spp.	Rush species	Obligate (OBL)
<i>Salix amygdaloides</i>	Peachleaf willow	Facultative Wetland (FACW)
<i>Salix boothii</i>	Booth’s willow	Facultative Wetland (FACW)
<i>Elaeagnus angustifolia</i>	Russian olive	Facultative Upland (FACU)
<i>Populus angustifolia</i>	Narrowleaf cottonwood	Facultative Wetland (FACW)
<i>Populus fremontii</i>	Fremont cottonwood	Facultative (FAC)
<i>Eleocharis palustris</i>	Common spikerush	Obligate (OBL)
<i>Distichlis spicata</i>	Saltgrass	Facultative (FAC)
<i>Phragmites australis</i>	Phragmites	Facultative Wetland (FACW)
<i>Schoenoplectus acutus</i>	Hardstem bulrush	Obligate (OBL)
<i>Carex nebrascensis</i>	Nebraska sedge	Obligate (OBL)
<i>Typha</i> spp.	Cattails	Obligate (OBL)
<i>Schoenoplectus maritimus</i>	Alkali bulrush	Obligate (OBL)
<i>Sarcobatus vermiculatus</i>	Greasewood	Facultative (FAC)
<i>Tamarix ramosissima</i>	Saltcedar/Tamarisk	Facultative (FAC)
<i>Cornus sericea</i>	Red Osier dogwood	Facultative Wetland (FACW)

Regional specialized conventions:

Floodplains: Vegetation in floodplains with streams or rivers that are incised, regulated, or have other alterations to a normal flooding regime are typically mapped as Riparian, as are areas with soils that are sandy, cobbly, or otherwise indicated as well-drained. Russian olive-dominated floodplains are also mapped Rp because they thrive in areas with a high water table but are not common in palustrine wetlands in arid West. Features associated with streams and rivers with minor to moderate floodplain development, old channel meander scars, and toe-of-slope wetlands may be mapped as palustrine if saturation and/or ponding is evident in the imagery, beaver are present, or ancillary soils information indicate a high percentage of hydric soils. Vegetation in narrow stream valleys with little to no floodplain development are typically not mapped, unless springs are present.

Impounded ponds: Many intermittent streams are impounded and springs may be excavated or piped to stock tanks to supply water for livestock. Most stock ponds were classified as PUBFh (palustrine, unconsolidated bottom, semi-permanently flooded, impounded). Drier stock ponds were typically mapped as PEM1Ah (temporarily flooded) or PEM1Ch (seasonally flooded) if persistent vegetation was observed in the imagery.

Agricultural canals/irrigation ditches: excavated ditches used for agricultural purposes are typically mapped as R4SBCx. Most irrigation ditches in this part of Utah flow seasonally during the growing season (approximately May-August/September depending on water availability). Ditches that appear not to be in use are mapped as R4SBax or R4SBJx.

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Appendix A. UT BLM 2019 quads mapped (79).

Quad Name	State	County
Crouse Reservoir	UT	Uintah/Daggett
Dry Fork	UT	Uintah
Steinaker Reservoir	UT	Uintah
Island Park	UT	Uintah
Jones Hole	UT/CO	Uintah
Lapoint	UT	Uintah
Vernal SE	UT	Uintah
Vernal NW	UT	Uintah
Fort Duchesne	UT	Uintah
Vernal SW	UT	Uintah
Patmos Head	UT	Carbon
Bruin Point	UT	Carbon
Twin Hollow	UT	Carbon
Chandler Falls	UT	Carbon/Emery
Elmo	UT	Carbon/Emery
Olsen Reservoir	UT	Carbon/Emery
Lila Point	UT	Carbon/Emery
Lighthouse Canyon	UT	Carbon/Emery/Grand/Uintah
Turtle Canyon	UT	Emery
Red Point	UT	Emery
Huntington	UT	Emery
Cleveland	UT	Emery
Cow Flats	UT	Emery
Woodside	UT	Emery
Three Fords Canyon	UT	Grand/Emery
Jenny Canyon	UT	Emery
The Cap	UT	Emery
Castle Dale	UT	Emery
Hadden Holes	UT	Emery
Buckhorn Reservoir	UT	Emery
Bob Hill Knoll	UT	Emery
Chimney Rock	UT	Emery
Cliff	UT	Emery
Butler Canyon	UT	Grand/Emery
Bottleneck Peak	UT	Emery
Ferron	UT	Emery
Molen	UT	Emery

Horn Silver Gulch	UT	Emery
Sids Mountain	UT	Emery
Devils Hole	UT	Emery
Desert	UT	Emery
Mexican Mountain	UT	Emery
Tusher Canyon	UT	Grand/Emery
Blue Castle Butte	UT	Grand/Emery
Emery West	UT	Emery/Sevier
Emery East	UT	Emery
Jessies Twist	UT	Emery
Sid And Charley	UT	Emery
The Blocks	UT	Emery
The Wickiup	UT	Emery
Drowned Hole Draw	UT	Emery
Spotted Wolf Canyon	UT	Emery
Walker Flat	UT	Emery/Sevier
Greasewood Draw	UT	Emery
Big Bend Draw	UT	Emery
Copper Globe	UT	Emery
San Rafael Knob	UT	Emery
Twin Knolls	UT	Emery
Arsons Garden	UT	Emery
Green River SE	UT	Grand/Emery
Horse Bench East	UT	Grand/Emery
Moonshine Wash	UT	Emery
Ireland Mesa	UT	Emery
Tomsich Butte	UT	Emery
Horse Valley	UT	Emery
Temple Mountain	UT	Emery
Old Woman Wash	UT	Emery
Crows Nest Spring	UT	Emery
Tenmile Point	UT	Grand/Emery
Solomons Temple	UT	Emery/Sevier
Keg Knoll	UT	Emery
Salvation Creek	UT	Emery
The Frying Pan	UT	Emery
Hunt Draw	UT	Emery
Little Wild Horse Mesa	UT	Emery
Goblin Valley	UT	Emery

Gilson Butte	UT	Emery
Bowknot Bend	UT	Grand/Emery
Mineral Canyon	UT	Grand/Emery