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NWI Project ID: R06Y22P06
Project Title or Area: DEQ_Gallatin_2021

Project Information

The Ecological Mapping, Monitoring, and Assessment (EMMA) group of the O'Connor Center for the Rocky Mountain West at the University of Montana is a leading contributor of wetland and riparian mapping in the West. The EMMA group provides direct support to partner agencies to help them assess the effectiveness of land management actions and report on the ecological health of public land resources. The R06Y22P06 project was funded by the Montana Department of Environmental Quality (DEQ) and the U.S. Environmental Protection Agency (EPA) for mapping of wetland and riparian habitat in the Gallatin Valley of southwest Montana.

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The project area consists of seven adjacent 1:24,000 USGS quads across Gallatin County in the greater Gallatin Gateway and Bozeman area of southwestern Montana (Figure 1): Nixon Gulch, Horseshoe Creek, Manhattan, Belgrade, Miser Creek, Bozeman Hot Springs, and Bozeman.

Digitization and Classification

Wetland identification was conducted via heads-up digitization using ArcMap (ESRI, v. 10.6.1) on natural color and Color Infrared (CIR) National Agriculture Imagery Program (NAIP) imagery (Table 2) and ancillary data listed below. Color infrared is the primary imagery type used to accentuate vegetative wetland features and saturated soils. Field reconnaissance was conducted in Nixon Gulch and Manhattan quads on August 3, 2022, to verify wetland mapping classification.

Digitizing scale: 1:4,500
Target Mapping Unit (TMU): 0.1- 0.25 acres
Classification standards:

- Cowardin wetland classification (FGDC 2013)
- USFWS Riparian classification (USFWS 2019)
- No uplands classification
- NWI Version: 2.0

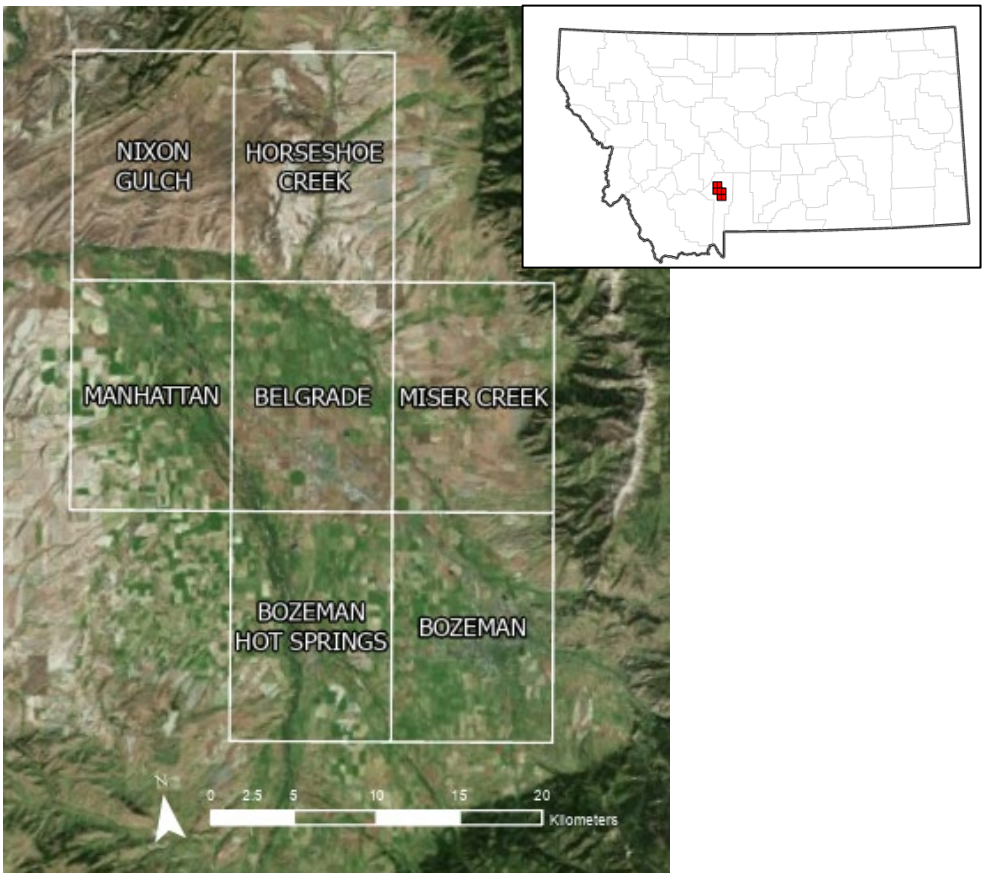

Figure 1. The seven mapping quads in southwestern Montana included in the DEQ Gallatin 2021 project area encompass developed farmland and undeveloped foothills and mountains.

Data

Orthoimagery

Heads-up digitization occurred on 2021 NAIP orthoimagery, with additional years of NAIP natural color and CIR imagery used to assist mapping decision-making listed below in Table 2.

Table 2. Source imagery used for mapping project R06Y22P06.

Year	Imagery	Acquired	Resolution
2021 (basemap)	NAIP Natural Color/CIR	Summer	0.60 m
2019	NAIP Natural Color/CIR	Summer	0.60 m
2017	NAIP Natural Color/CIR	Summer	0.60 m

Collateral Imagery
Google Earth Pro Imagery (acquired in various years between 1997 and 2022)
Hexagon HxGN Content Program (2017 30cm resolution CIR imagery subscription service)
Field imagery

Ancillary data
24k National Hydrography Data (NHD)
24k USGS Topographic Maps
10m Digital Elevation Model (DEM - based on the National Elevation Dataset)
USDA Web Soil Survey
Springs Stewardship Institute spring points

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 lies entirely within the Middle Rockies Level III ecoregion and the majority in the semiarid Townsend Basin Level IV Ecoregion comprising floodplains, streams terraces, alluvial fans, and hills (Table 3; Omernik 1987).

Table 3. Level IV Ecoregions comprising the mapping area for project R06Y22P06.

Level IV Ecoregion	Description	Approximate % Project Area
Townsend Basin (17w)	The broad, semiarid, largely treeless Townsend Basin lies east of the Continental Divide and contains floodplains, stream terraces, alluvial fans, and hills. It is mostly composed of Quaternary alluvium and Tertiary valley fill. Elevations tend to be lower and the growing season longer than in the Shield-Smith Valleys (43t) or the surrounding mountains. The climate of this ecoregion is drier than the valleys west of the Continental Divide but wetter than the Dry Intermontane Sagebrush Valleys (17aa) to the southwest. Potential natural vegetation consists of foothills prairie and grama-needlegrass-wheatgrass, unlike the forests and sagebrush steppe of surrounding ecoregions. Today, cropland, rangeland, and urban-suburban-industrial development occur.	85%
Townsend-Horseshoe-London Sedimentary Hills (17y)	The partially wooded Townsend-Horseshoe-London Sedimentary Hills ecoregion lies in the rain shadow of the Elkhorn Mountains and is rather dry. It is largely composed of Mesozoic and Paleozoic sedimentary rock; limestone is common and both caverns and dry valleys occur. The Townsend-Horseshoe-London Sedimentary Hills (17y) ecoregion is lithologically distinct from the nearby Dry Gneissic-Schistose-Volcanic Hills (17ab) and related stream quality, surficial water availability, and aquatic biota are also different. Elevations range from about 4,000 to 8,200 feet and are intermediate between the higher, forested Northern Rockies (15) and the lower Townsend Basin (17w). Grazing, logging, and mining are the common land uses.	14%
Gneissic-Schistose Forested Mountains (17l)	The rugged, glaciated Gneissic-Schistose Forested Mountains ecoregion is wet and mostly forested. Ecoregion 17l is characteristically underlain by Precambrian pre-Belt gneiss and schist and rock outcrops occur. Its streams are generally clearer and have lower concentrations of dissolved calcium and magnesium than those in the lithologically distinct Absaroka-Gallatin Volcanic Mountains (17i). Low stream flows occur during drought and freezing periods. Typically, there is only a short time lag between rainfall and runoff peak and, consequently, storm hydrographs are flashy. Average annual precipitation ranges from less than 20 to 100 inches; maximums are much greater than those of the Eastern Gravelly Mountains (17d) but less than those of the higher Alpine Zone (17h). The climax vegetation is mapped as subalpine fir and Douglas-fir forests. Recreation and logging are the common land uses in the Gneissic-Schistose Forested Mountains (17l) and some grazing also occurs.	1%

Climate

Elevation in the project area ranges from approximately 1,254 m (4,114 ft.) in the lowlands of Nixon Gulch quad to 2,100 m (6,889 ft.) in the foothills and mountains of Miser Creek quad. In general, this region is characterized by hot summers, cold winters, and large fluctuations in daily temperature (WRCC, 2022). Average winter temperatures range between 11°F and 33°F (-11°C to 0.5°C) and summer temperatures range between 47°F and 81°F (8°C to 27°C). Annual average precipitation for this project area is 13.43 inches (34 cm).

Vegetation, Soils, and Land Use

In western Montana, Douglas fir (*Pseudotsuga menziesii*) and lodgepole pine (*Pinus contorta*) forests are dominant dry forest species. Along river bottoms, cottonwoods (*Populus spp*.), willows (*Salix spp*.), and Russian olive (*Elaeagnus angustifolia*) comprise the overstory (Figure 2). Most of the project area comprises mollisols, evidence of the agricultural land within the historical floodplain around the cities of Belgrade and Bozeman (Figure 1). Predominant land uses include livestock grazing, timber harvest, and recreation (e.g. ATV use, hiking, fishing, and horseback riding). Typical land uses are primarily livestock grazing, crop production or urban/suburban development. Irrigation plays an important role in the valleys, supporting production of agricultural products such as alfalfa, wheat and barley (Nesser et al., 1997; Woods et al., 2002; Lesica 2012; Vance and Luna, 2017).

Table 4. List of common wetland and riparian plant species in western Montana (OBL= Obligate, FACW= Facultative Wetland).

Species	**Common Name**	**Wetland Indicator Status**
Carex spp.	Sedge species	OBL
Juncus spp.	Rush species	OBL
Salix spp. Amygdaloides	Salix species	FACW
Elaeagnus angustifolia	Russian olive	FACU
Populus angustifolia	Narrowleaf cottonwood	FACW
Populus fremontii	Fremont cottonwood	FAC
Eleocharis palustris	Common spikerush	OBL
Distichlis spicata	Saltgrass	FAC
Phragmites australis	Phragmites	FACW
Schoenoplectus acutus	Hardstem bulrush	OBL
Typha spp.	Cattails	OBL
Tamarix ramosissima	Saltcedar/Tamarisk	FAC
Cornus sericea	Red Osier dogwood	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 Riparian 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 PUBF/Gh (palustrine, unconsolidated bottom, semi-permanently flooded/intermittently exposed, impounded). Drier stock ponds were typically mapped as PEM1A/Ch (temporarily/seasonally flooded).

Irrigated wetlands

Irrigation and the movement of water via ditches is a very common practice in this part of Montana. Many irrigation ditches leak water across the landscape, which may result in persistent hydrophytes and wetland characteristics over time. Irrigated fields are often very difficult to distinguish from wetlands due to the presence of flooding or saturation during the growing season when irrigation is active. Multiple years of imagery were evaluated to determine if saturation was consistent across many years and to determine whether or not features should be mapped as wetland. Most irrigation-influenced wetlands are mapped as PEM1C (seasonally flooded) or PEM1B (seasonally saturated).

Agricultural canals/irrigation ditches

Excavated ditches used for agricultural purposes are typically mapped as R4SBCx. Most irrigation ditches in this part of Montana 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.

Description of habitats

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 NWI Wetlands Mapping website. Wetland classification codes and representative corresponding community type(s) in this project include:

PEM

Palustrine, Emergent

Palustrine emergent wetlands (Figure 3) consist of temporarily and seasonally flooded wet meadows dominated by native sedges (*Carex spp*.), rushes (*Juncus spp*.), and spikerushes (*Eleocharis sp*.), and nonnative pasture grasses such as Kentucky bluegrass (*Poa pratensis*). Saturated emergent wetlands are dominated by sedge species (Figure 2) such as Northwest Territory sedge (*Carex utriculata*) and water sedge (*C. aquatilis*). Semipermanently flooded sites may dominated by bulrushes (*Schoenoplectus spp., Scirpus spp*.) or cattail (*Typha spp*.). Reed canary grass (*Phalaris arundinacea*) is common on disturbed sites (Table 4).

Figure 2. Sedge (*Carex spp*.) dominating an area of Palustrine Emergent (PEM) vegetation in the Gallatin Valley project area.

PSS

Palustrine, Scrub-Shrub

Palustrine scrub-shrub wetlands consist of temporarily flooded, seasonally flooded, and saturated shrublands (Figure 3) dominated by several willow species including Bebb willow (*Salix bebbiana*) and sandbar willow (*S. exigua*). Other shrubs include gray alder (*Alnus incana*) and red osier dogwood (*Cornus sericea*) (Table 4).

PAB and **PUB**

Palustrine, Aquatic Bed and *Palustrine, Unconsolidated Bottom*

Palustrine aquatic bed and palustrine unconsolidated bottom wetlands are associated with ponds (Figure 3). Pond vegetation is variable and often strongly zoned. In shallow areas, vegetation is similar to the species occurring in flooded emergent wetlands. Deeper water areas have submerged or floating species such as coontail (*Ceratophyllum demersum*), pondweed (*Potamogeton pectinatus*), waterweed (*Elodea spp*.), stonewort (*Chara spp*.), and duckweed (*Lemna spp*.) (Table 4).

R3US

Upper-perennial Riverine, Unconsolidated Shore

Upper perennial riverine (R3) wetlands occur within the active channel of lower order streams and rivers with high gradient, little to moderate floodplain development, and course substrates such as cobbles and stones. Examples in the project area are the Madison River and the Gallatin River (Figure 3).

R4SB

Intermittent stream, Stream Bed

Intermittent streams (R4) are stream channels that only have surface flow during a portion of the year. They also include excavated ditches and canals used for irrigation within valleys. Streams with no water visible in the imagery but with minor floodplain development and/or some sources of groundwater from springs or seeps were typically classified as temporarily flooded (R4SBA) (Figure 3). 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).

Riparian

Riparian scrub-shrub areas streams are dominated by common chokecherry (*Prunus virginiana*), Russian olive (*Elaeagnus angustifolia*) western snowberry (*Symphoricarpos occidentalis*), or wood's rose (*Rosa woodsii*). The herbaceous layer is largely dominated by non-native pasture grasses, particularly Kentucky bluegrass (*Poa pratensis*), smooth brome (*Bromus inermis*), and common timothy (*Phleum pretense*), though the forb American licorice (*Glycyrrhiza lepidota*) may be present (Table 4). Riparian forested areas are dominated by black cottonwood (*Populus trichocarpa*) with some Douglas-fir (*Pseudotsuga menziesii*) and Englemann spruce (*Picea angelmannii*). Much of the riparian forested areas are along the Gallatin River in the project area.

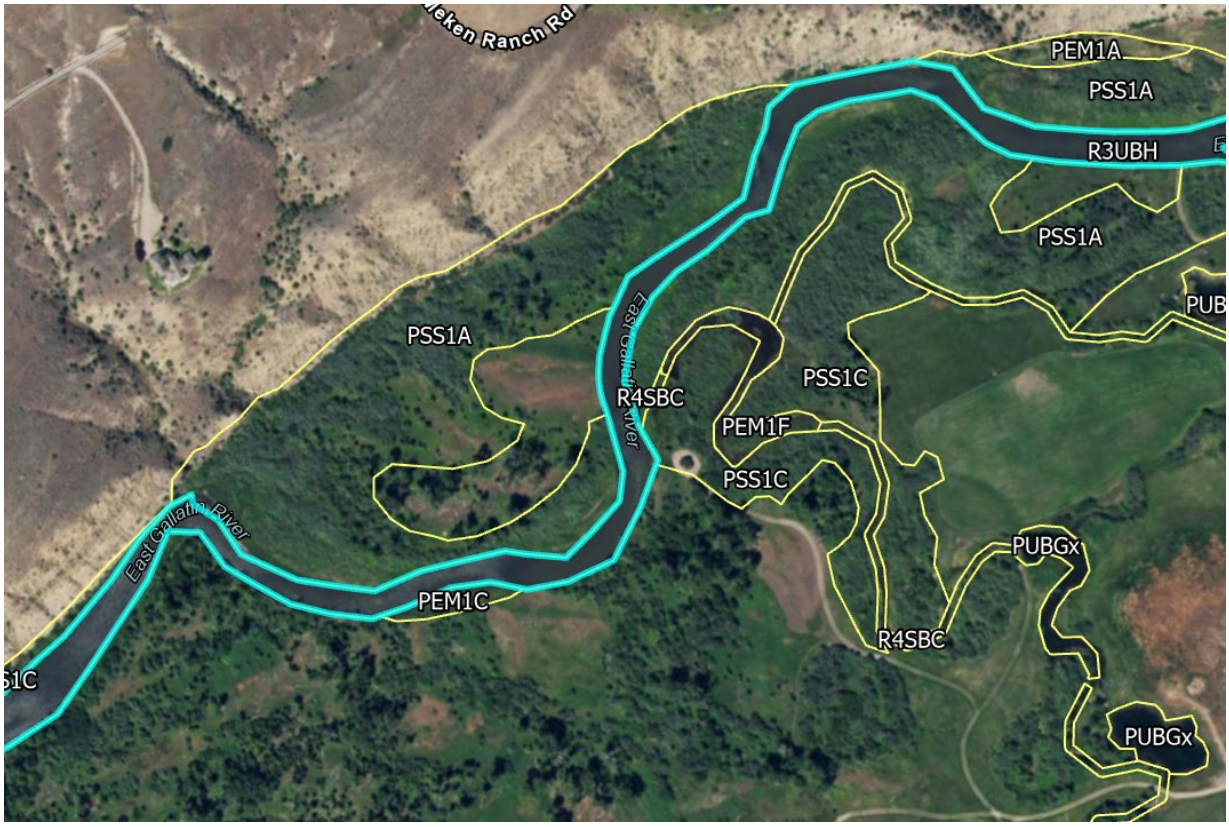

Figure 3. Classification of Upper-perennial Riverine (R3), Intermittent stream (R4), Palustrine Emergent (PEM), Palustrine Scrub-Shrub (PSS), and Palustrine Unconsolidated Bottom (PUB) near the East Gallatin River in the Nixon Gulch quad. The NAIP basemap imagery shown is at 1:4,505 scale.

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