Reach #3 - Lotic Checklist

Name of Riparian-Wetland Area:	**Missouri River**		
Date:	**Visited 4 days - Checklist on 7/14/2010 (Revisited 9/7/2010)**	Segment/Reach ID:	**Reach #3 - River Mile 49 (Lonetree Coulee) to 86 (Above PN Bridge)**
ID Team Observers:	**X** C. Krause, Hydrologist **X** V. Shea, Rangeland Management Specialist **X** A. Northerner, Range Technician (Riparian) **X** M. Forsyth, Rangeland Management Specialist **X** J. Peters, Wildlife Biologist **X** A. Ehlert, Range Technician __ M. Philbin, Hydrologist **X** J. Sorlie, Soil Scientist __C. Meier, Soil Scientist **X** W. Elmore, Ecologist **X** S. Smith, Riparian/Rangeland Management Specialist & National Riparian Service Team Leader		
Assessment Procedures:	During February 2-4, 2010, interdisciplinary (ID) Team members met with National Riparian Service Team staff, former BLM National Operations Center surface water specialist, USGS scientist, and University of Montana scientist to gain a common understanding of what is already known and review existing information. Preliminary reach breaks were agreed upon, potential and capability descriptions were discussed, and written descriptions were developed. Predetermined stops were chosen for each reach based upon sites that were representative of larger reaches of river based upon geomorphic and vegetative characteristics, unique or critical areas, grazing allotments, and reach breaks. BLM staff has been monitoring sites on the Upper Missouri since 1990 using the Upper Missouri National Wild and Scenic River (UMNWSR) monitoring form. Depending on site location, sites are monitored on a one, three, or five year cycle. In some instances over 20 years of photographs and documentation exist and this information was heavily used in stop location selection because of the reference material available. Interested parties, grazing permittees, and stakeholders were invited to participate every day of the assessment in July. Each day began with a review of the potential descriptions for the reach. The entire reach was examined by the ID Team by boat with stops at the predetermined locations. At each stop the inundating discharges, flood frequency curves and zone locations were reviewed as necessary. Photograph and GPS documentation of the site was completed and soil pits were dug and documented. Vegetation lists were completed for each zone. At the completion of each stop the ID Team discussed their individual notes and observations. Once each reach was looked at from top to bottom the checklist was completed. The ID Team stopped at twelve locations on public land, seven on the north side and five along the south side of the Missouri River. The group determined that these locations are representative of the riparian-wetland plant communities occurring within Reach #3. Common names for plants will be used throughout this document. For scientific names refer to the plant lists or Appendix A. Species diversity information (plant list) was collected at each stop for Zones 1 and 2. In addition, plant lists were filled out for one relic site in Zone 3 with a mature cottonwood stand and one site in Zone 3 with a perched water table containing an overstory of boxelder and green ash. The following 17 questions were answered using the methodology described in Technical Reference 1737-15.		

Definitions:
Zone 1 - from the scour line (the lower limit of sod-forming or perennial vegetation on depositional banks) to bankfull discharge (the stream discharge generally considered to be the single discharge that is most effective for moving sediment, forming or removing bars, and forming or changing bends and meanders, all of which result in the average morphological characteristics of channels). Bankfull on this reach of the Missouri River roughly coincides with the 2-year return interval discharge, approximately 23,000 cubic feet per second (cfs) (flood frequency analysis based on period of record at Virgelle gage post completion of Tiber Dam in 1956 (total period of record is 1935-2010)).

Zone 2 - from bankfull to approximately the stage associated with 60,000 cfs, which is about a 10-year return interval pre Tiber Dam or a 30-year return interval post Tiber Dam (flood frequency analysis based on period of record pre and post completion of Tiber Dam in 1956 at Virgelle gage (total period of record is 1935-2010)). This intermediate zone is between the frequently wetted area along the river and upland areas found on older, more elevated river terraces. This zone is dominated by plants that are equally likely to occur in wetlands or non-wetlands.

Zone 3 – from approximately the stage associated with 60,000 cfs, which is about a 10-year return interval pre Tiber Dam or a 30-year return interval post Tiber Dam (flood frequency analysis based on period of record pre and post completion of Tiber Dam in 1956 at Virgelle gage (total period of record is 1935-2010)) to the uplands. This zone is very infrequently flooded but may contain relic riparian species such as mature cottonwoods that were established at lower elevations before the surface was moved higher through sediment accretion.

It is important to note that because the function of the river is dictated largely by attributes and process in Zones 1 and 2, the assessment was focused on conditions observed in these zones.

Wetland Indicator Status Categories:
OBL (Obligate Wetland) - Occurs almost always under natural conditions in wetlands.
FACW (Facultative Wetland) - Usually occur in wetland but occasionally found in non-wetlands.
FAC (Facultative) - Equally likely to occur in wetlands or non-wetlands.
FACU (Facultative Upland) - Usually occur in non-wetlands but occasionally found on wetlands.
UPL (Obligate Upland) - Occur almost always under natural conditions in non-wetlands.

The vegetation section of the PFC checklist focuses on the age class, diversity and amount of *"riparian-wetland"* vegetation present along a reach within Zone 1 and 2. The term "*riparian-wetland"* refers primarily to facultative wetland and obligate wetland plants or those that usually or almost always occur in wetland areas. It is important to note that even though plains cottonwood and green ash are considered facultative plants, meaning they are equally likely to occur in wetland or non-wetland areas, for this assessment they were considered together with other riparian-wetland vegetation and used by the ID Team for completing the PFC checklist. Both plants, and especially plains cottonwood, were found within Zone 1 and 2 and are important in determining the processes and functionality of the Upper Missouri River.

Plant Composition:
Dominant - this term was used to describe plants having a canopy cover greater than 25% or when only a single plant occurred within an assessment area. If the canopy cover of two or more plants made up most of the assessment area, and they were of about equal value, each was noted as a dominant plant.

Vegetation Stability Class Rating:
1 to 3 = Low; 4 to 6 = Medium; 7 to 10 = High
(taken from Appendix H, Monitoring Stream Channels and Riparian Vegetation-Multiple Indicators, Interagency Technical Bulletin, Version 5.0, April 2008)

Soils
Redoximorphic (redox) features – include gray layers and gray mottles, both of which occur when iron compounds are reduced by soil microbes in anaerobic soils. Iron, in its reduced form, is mobile and can be carried in the ground-water solution. When the iron and its brown color are thus removed, the soils show the gray color of their sand particles. The anaerobic, reduced zones can be recognized by their gray, blue, or blue-gray color. The mobilized iron tends to collect in

aerobic zones within the soil where it oxidizes, or combines with additional oxygen, to form splotches of bright red-orange color called mottles. The mottles are most prevalent in the zones of fluctuating water and help mark the seasonal high water table (BLM Technical Reference 17317-19 – Riparian-Wetland Soils).

POTENTIAL: Prior to the Pleistocene, the Missouri River flowed northeast into the Hudson Bay (Wayne et al., 1991). Continental glaciation resulted in the river being pushed southward, thereby draining into the Mississippi River. River Reach #3 is located in the relatively young postglacial channel which according to Scott et al. (1997), exhibits low sinuosity and is constrained by a narrow valley. See Figures 1 & 2 – Reach #3 - River Mile 49 (Lonetree Coulee) to 86 (Above PN Bridge) Map 1 & 2.

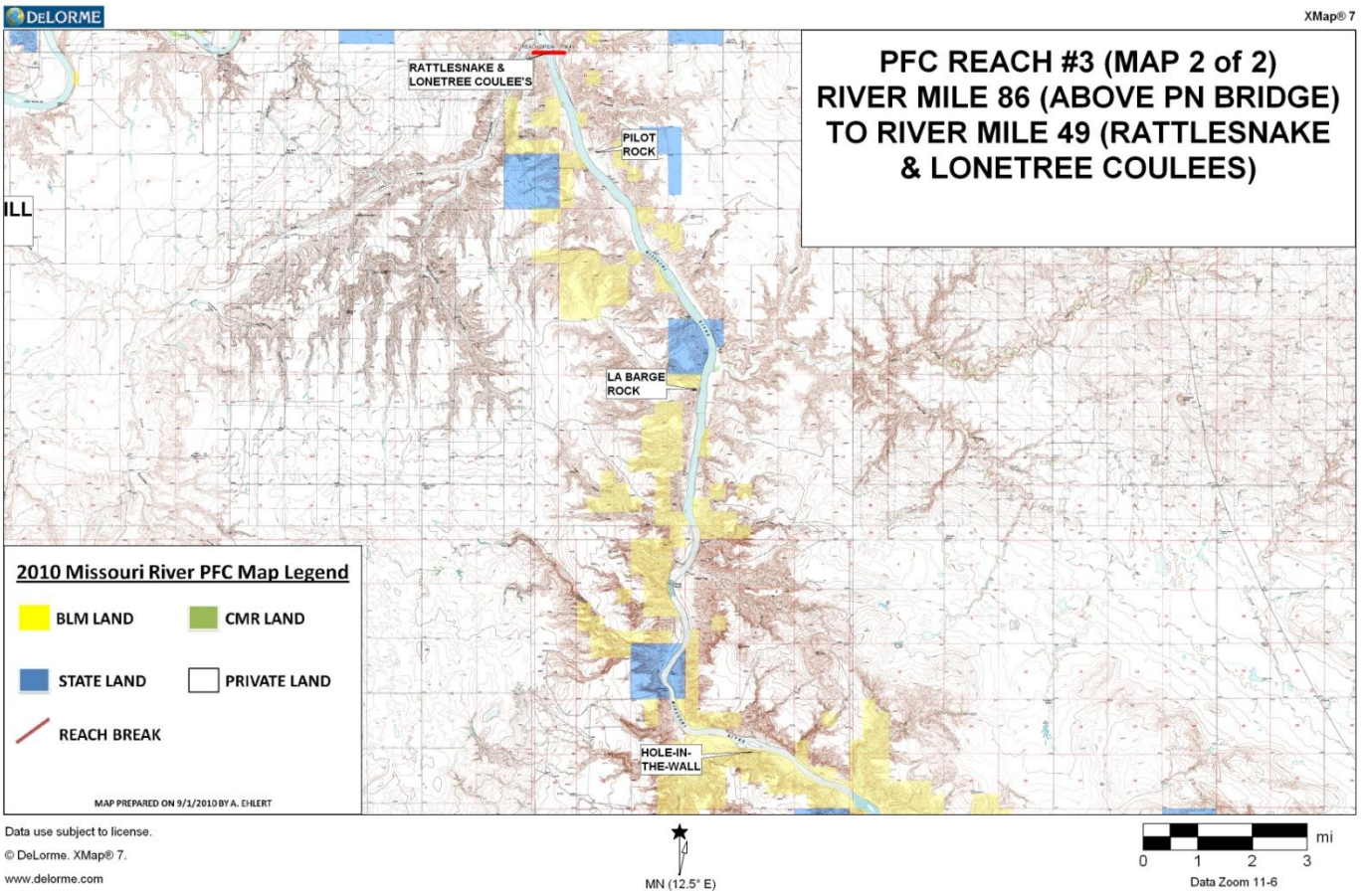


Figure 1 – Reach #3 - River Mile 49 (Lonetree Coulee) to 86 (Above PN Bridge) Map 2

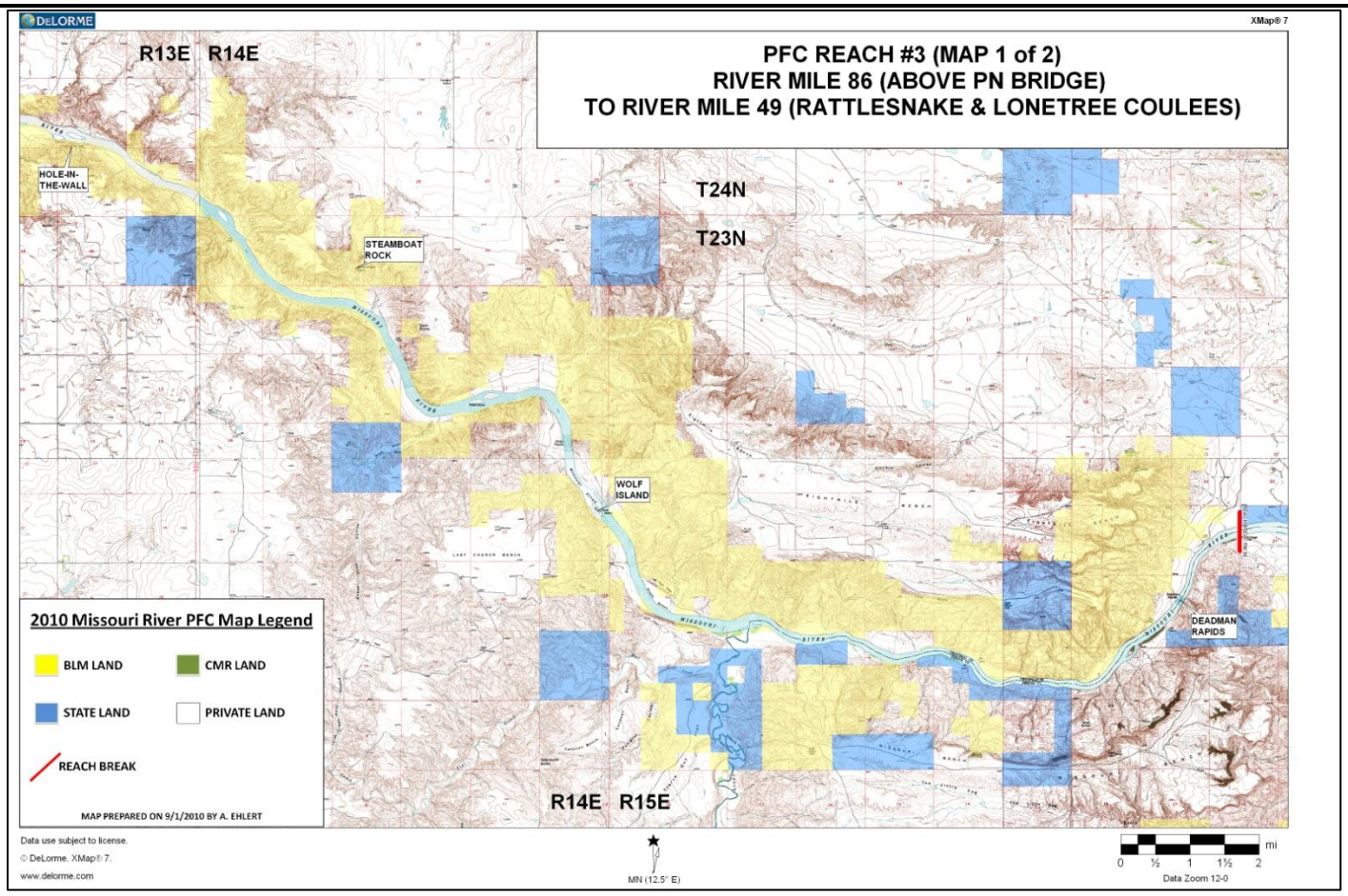


Figure 2 – Reach #3 - River Mile 49 (Lonetree Coulee) to 86 (Above PN Bridge) Map 1

Scott and Auble (2002) describe the postglacial Missouri River channel between Virgelle and Landusky as a series of entrenched meanders constrained by exposures of sandstone and shale badlands. At potential, the channel would be broadly characterized by a Rosgen F-type channel (Rosgen, 1996). Rosgen F channels are often found on entrenched landforms in highly weathered material (Rosgen, 1996). Furthermore, comparisons of detailed maps from the 1890s from the Missouri River Commission indicate that little channel migration has occurred in the last 100 years (Scott et al., 1997). The channel has also been vertically stable during that time period. Scott et al. (1997) plotted stage at peak discharge for the Fort Benton gage prior to and after the construction of Canyon Ferry Dam. The period of record at the Fort Benton and Virgelle gages goes back to 1890 and 1935 respectively. The stage-peak discharge relations have been relatively stable through the period of record at the gages. Even though a process of channel narrowing may have been initiated since the 1800's (Scott and Auble, 2002), narrowing would not have been significant enough to change the classification of the channel. Although a stable stage-discharge relation associated with channel narrowing would generally indicate a deeper channel, it is not necessarily an indicator of vertical instability.

Rosgen F-type channels can be described as entrenched, meandering, riffle/pool channel on low gradients with high width/depth ratios (Rosgen, 1996). Entrenchment ratios are typically less than 1.4, which means that the flood prone width/bankfull width is less than 1.4. Scott and Auble (2002) describe the postglacial channel width as only slightly less than the valley width. Channel slopes are generally less than 0.02, and bankfull width/depth ratios are greater than 12. See Figures 3 & 4 – Reach #3 - River Mile 49 (Lonetree Coulee) to 86 (Above PN Bridge) Map 1 & 2 - Aerial View.

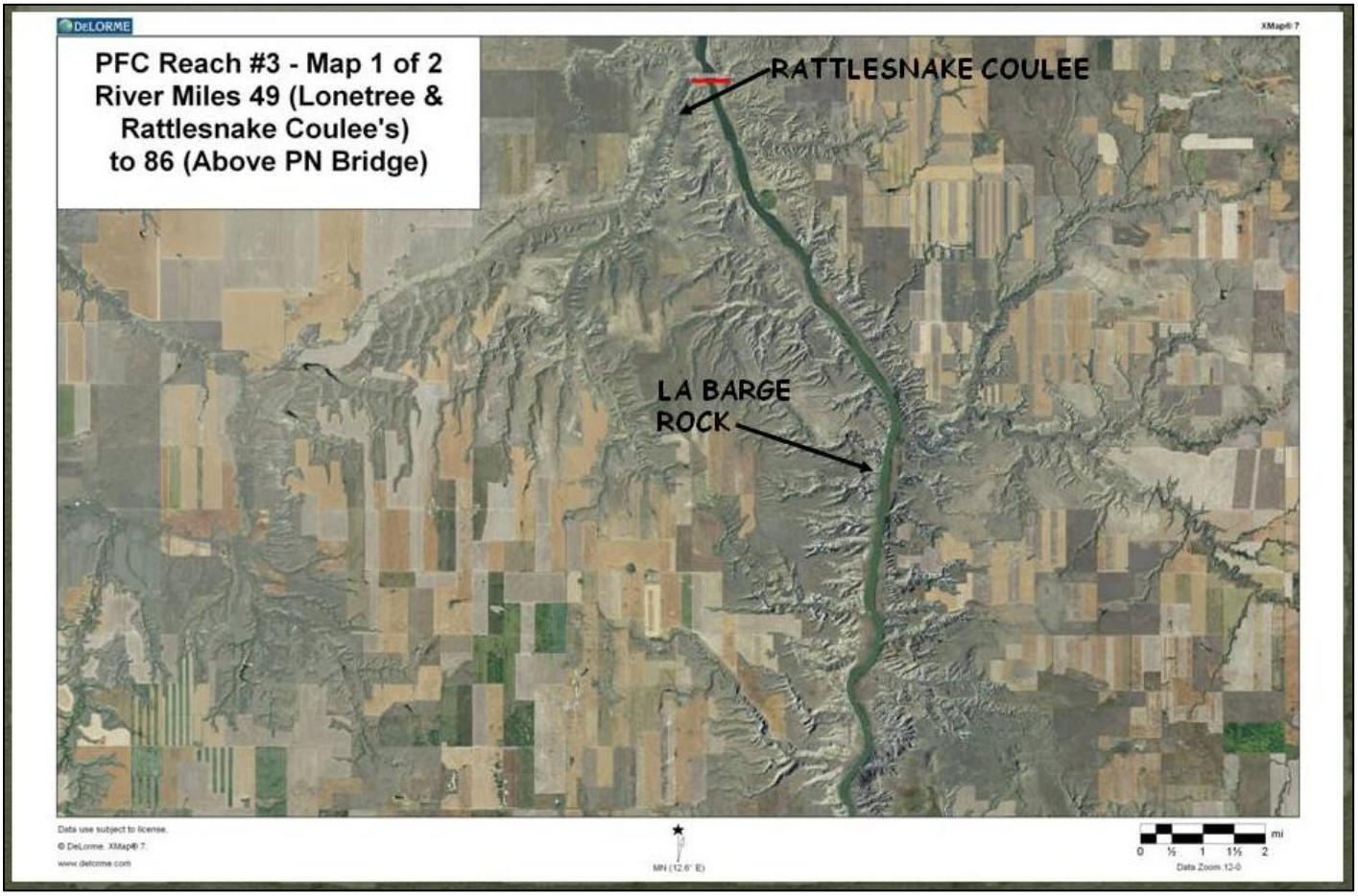


Figure 3 – Reach #3 - River Mile 49 (Lonetree Coulee) to 86 (Above PN Bridge) Map 1 - Aerial View

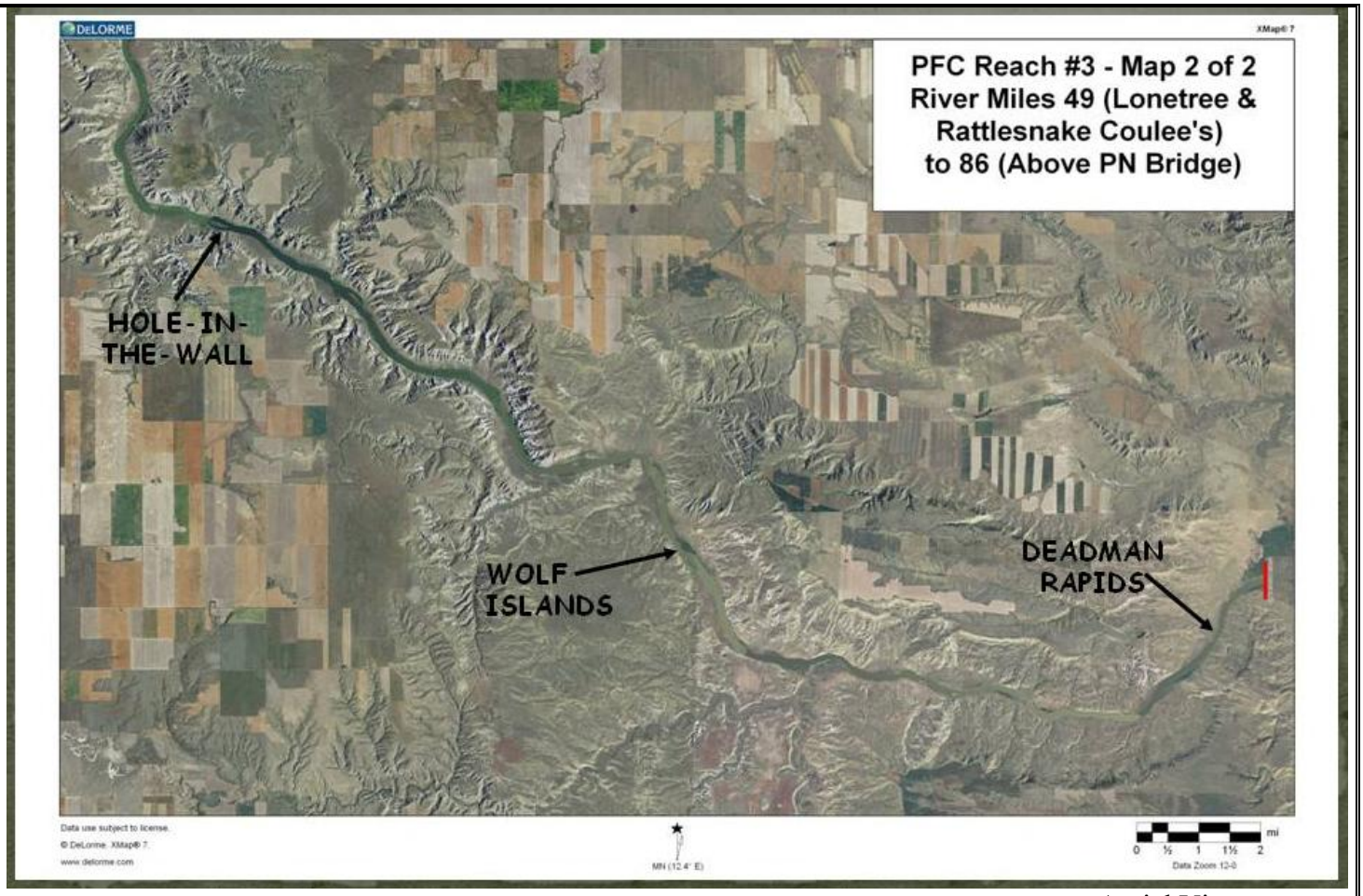


Figure 4 – Reach #3 - River Mile 49 (Lonetree Coulee) to 86 (Above PN Bridge) Map 2 - Aerial View

River Reach 49 to 86 is highly confined by landform and sinuosity values are barely greater than one in many locations. The reach is primarily a transport reach as opposed to a deposition reach. As a result, depositional features and floodplain development are limited primarily to locations where transport capacity is exceeded by materials from side drainages and a few small islands. Although these features make up small percentages of the reach, they are important for providing floodplain functions and riparian values. Because of the lower sinuosity and steeper gradient the river has the capacity to move most materials from side drainages, so depositional areas are extremely limited and are found primarily by large tributaries. In contrast, in the lower portions of the constrained reach of the Missouri below Sturgeon Island, sinuosity increases and the gradient decreases. As a result, depositional zones are found more frequently and are associated with smaller tributaries.

Channel morphology and distribution of riparian vegetation would be strongly influenced by landform and climate through this reach. Bare moist sites suitable for cottonwood recruitment are most often met through flow induced channel change (Auble et al., 2005). Hansen (1989) describes four depositional sites which are suitable for the recruitment of pioneering species such as plains cottonwood and willow species. They are depositional zones such as point bars, side bars, mid-channel bars, and delta bars. Through this constrained reach few of these features exist, although delta bars are typically present at the mouth of large tributary junctions. Since meandering and channel narrowing are limited through this reach, flood deposition is the controlling process for the establishment of woody vegetation. This results in vegetation community patterns of small numbers of linear, even–aged stands and establishment surface of mature trees well above channel bed elevation (Scott et al., 1997).

Because of the climate of northcentral Montana, which includes very cold temperatures, snow, and rapid warm up from "Chinook" winds, mechanical ice drives occur. The influence on riparian vegetation is substantial as vegetation between the 2- and 9- year return interval flood stage is subjected to intense physical disturbance (Scott and Auble, 2002). Depending on the flow and ice regime of prior years, seedling, sapling, and pole size cottonwoods may be found across a

range of elevations. However, Scott and Auble (2002) found that all trees had established 1.75 meters above the lower limit of perennial vegetation.

Although ice drives strongly influence vegetative patterns through this constrained reach, unconstrained zones within the larger constrained zones do occur. They can be found near tributary junctions, channel islands, and overflow channels (Scott and Auble, 2002). In these unconstrained portions recruitment of trees is less dependent on the large flood pulses because with the lateral movement and sediment aggradation, established trees are removed from the zone where they receive more frequent physical disturbance (Scott and Auble, 2002). See Figure 5 – Mouth of Eagle Creek.

Figure 5 - Mouth of Eagle Creek

Mid-channel bars, or islands, provide very important functions and values within the highly confined F-channel types of the Upper Missouri. Whereas the main river is laterally very static, islands are very dynamic and are constantly moving within the channel. As such, they function as small, unconstrained areas, and the recruitment of trees is less dependent on the large flood pulses for the above mentioned reasons. Because floodplain development is limited on the main channel streambanks, islands provide important floodprone areas within the highly constrained reaches of the Upper Missouri.

As sediment aggrades and depositional features mature, the potential exists for more mesic riparian species. According to Hansen (1989), as the alluvial material matures, there is a corresponding change in soil parameters, which provides a more suitable environment for tree species such as green ash and boxelder. Hansen (1989) describes a successional path of pioneer species such as plains cottonwood and sandbar willow followed by an understory of green ash, boxelder, chokecherry, and red-osier dogwood. Rivers which are free to move back and forth across their floodplain result in stands of vegetation in various stages of succession (Hansen, 1989). However, physical sites capable of creating these conditions would be limited within this laterally constrained reach, and the linear stands of cottonwood may establish too high and be too open for the arid climate of the Missouri Breaks, thereby supporting drier ecological site types. The presence of cottonwood trees may not indicate that the moisture availability and physical site characteristics requirements are met for shallower rooted understory species. Understory species may tend to establish as small micro sites in locations that receive both fine sediments and overland flow from the uplands. This can create small sites with clay lenses that perch water tables, which may be more conducive to the establishment of understory sites (personal communication, M. Scott (USGS) and M. Merigliano (University of Montana)). A cooperative study with the University of Montana started in 2010, looking at site conditions for late-seral, riparian woody plants on the Upper Missouri, and will provide further information.

Most streambank miles through the reach would be dominated by herbaceous vegetation. Species would include a variety of Carex, Juncus, Scirpus, and Eleocharis species. The fore mentioned species would be located within Zone 1, would be frequently inundated and subject to ice, and be within close proximity of summer low water levels. These species tend to be located between the 2-year flood stage and the low water level (personal observation). During periods of low flow, they are very effective at capturing sediment. However, they can be vulnerable to high shear-stress, buried by sediment, or completely removed by high flow or ice depending on conditions that year.

Historical accounts also contribute to the description of potential within this reach including the 1890s map by the Missouri River Commission and accounts from the Lewis and Clark expedition from 1804 to 1806. At a location above Arrow Creek, which is within this river reach, they state "there is now no timber on the hills, and only a few scattering cottonwood, ash, boxelder, and willows along the water."

LIMITING FACTORS: Two significant dams regulate flows on the Upper Missouri River through the Wild and Scenic reach, Canyon Ferry Dam on the Missouri and Tiber Dam on the Marias. Although the frequency of flood pulses and the timing of a snow melt dominated hydrograph has not changed, the magnitude of large peak flows has been reduced from 40 to 50% as a result of regulation (Bovee and Scott, 2001). Examination of post dam recruitment patterns of cottonwood identified that all stands originating in the post dam period occurred within unconstrained channel reaches (Scott and Auble, 2002). Reduction in the magnitude of peak flows has resulted in establishment of stems at lower elevations that are subject to more frequent disturbance. If patterns continue, cottonwood recruitment would be limited to unconstrained reaches. In River Miles 49 to 86, this effect will be most noticeable because of the lack of unconstrained reaches. The figure below shows typical existing landform, channel, and vegetative characteristics of Reach #3. See Figure 6 – Typical Existing Conditions on Reach #3 - River Mile 49 (Lonetree Coulee) to 86 (Above PN Bridge).

Figure 6 – Typical Existing Conditions on Reach #3 - River Mile 49 (Lonetree Coulee) to 86 (Above PN Bridge)

The possibility does exist that the capability of this reach, in terms of flow regime, may move closer to potential. Bureau of Land Management (BLM), Bureau of Reclamation (BOR), U.S. Army Corps of Engineers (USACE), and other groups and organizations have been investigating the potential for augmenting flow releases from reservoirs to mimic natural flow regimes. Social and economic constraints will not allow for a completely natural flow regime, but efforts to increase peak flows would change the capability of this system and river reach closer to potential.

A key factor affecting potential is the decrease in the magnitude of fluvial disturbances on the Upper Missouri River associated with both climatic shift and dams. A shift from wetter conditions in the mid to late 1800s combined with the effect of flow regulation has resulted in a process of channel narrowing (Scott and Auble, 2002). This affect has resulted in establishment of cottonwood trees as existing back channels have filled in. Currently, this increase in trees has mitigated the effects of the loss of trees from higher surfaces, and current amounts cottonwood forest are similar to cottonwood forest in 1890 (personal communication, G. Auble (USGS) and M. Scott (USGS)). However, this is a one-time response as the channel would not be capable of narrowing indefinitely.

Vegetation potential on the Upper Missouri River is also influenced by non-native plants and invasive weed species. Evidence exists that direct competition between native plants and areas dominated by exotic plants (non-native and invasive weeds) can result in the disappearance of native species. Kudray (2004) found reduced species richness was most strongly correlated with greater exotic herbaceous cover and also had a negative correlation with native woody species richness.

Five invasive weed species were documented by Kudray (2004) within the Upper Missouri River including: leafy spurge, Canada thistle, spotted knapweed, diffuse knapweed, and houndstongue. If control methods are found for the above listed weeds, particularly leafy spurge and knapweed, the capability could change. However, even with aggressive control strategies, it is highly unlikely that these weeds would be removed from the system.

The history of the establishment and spread of invasive weed species along the Missouri River within the Monument is very similar to other western rivers although probably more recent. Vegetation inventories completed in 1975 and 1976, which included the river corridor, major tributaries and adjacent upland areas, did not document any infestations of invasive weed species on public land (George Hirschenberger, retired BLM, personal communication). However, by 1983 the BLM had identified areas between Coal Banks Landing and the Fred Robinson Bridge where invasive weed species, mainly leafy spurge, were becoming established along the river corridor. These areas were widely dispersed and small in size and density. In that year BLM personnel chemically treated an estimated 20 acres of leafy spurge and Canada thistle on public land (John Fahlgren, retired BLM, personal communication). By 2001, compiling information collected from surveys conducted over several years, the size of infested acres on public land had grown to 615 acres. The number of new invasive weed species had also grown considerably, from two in 1983 to over 10 in 2001. Again in 2010 the BLM completed a survey for invasive weed species along the entire river corridor from Fort Benton to the boundary of the Charles M. Russell Wildlife Refuge. As Table 1 below indicates, the acres infested on public land (Zones 1 - 3) more than doubled, increasing from 615 acres in 2001 to 1,363 acres in 2010.

Table 1 - Invasive Weed Species of Concern Found Along the Missouri River

Common Name	2001 BLM Infested Acres	2010 BLM Infested Acres	Difference
Russian Knapweed	370	322	-48
Common Burdock	Not Mapped	2	
Hoary Cress	2	Trace Amount	-2
Spotted Knapweed	19	46	27
Canada Thistle***	14	280	266
Field Bindweed***	Trace Amount	9	9
Poison Hemlock***	Trace Amount	11	11
Houndstongue***	Trace Amount	40	40
Russian Olive	Not Mapped	62	
Leafy Spurge	198	586	388
Perennial Pepperweed	12	5	-7
Dalmatian Toadflax	Trace Amount	Trace Amount	0
Salt Cedar	Trace Amount	Trace Amount	0
Total Acres	**615**	**1363**	**748**
*** *Species were not completely documented in earlier surveys*			

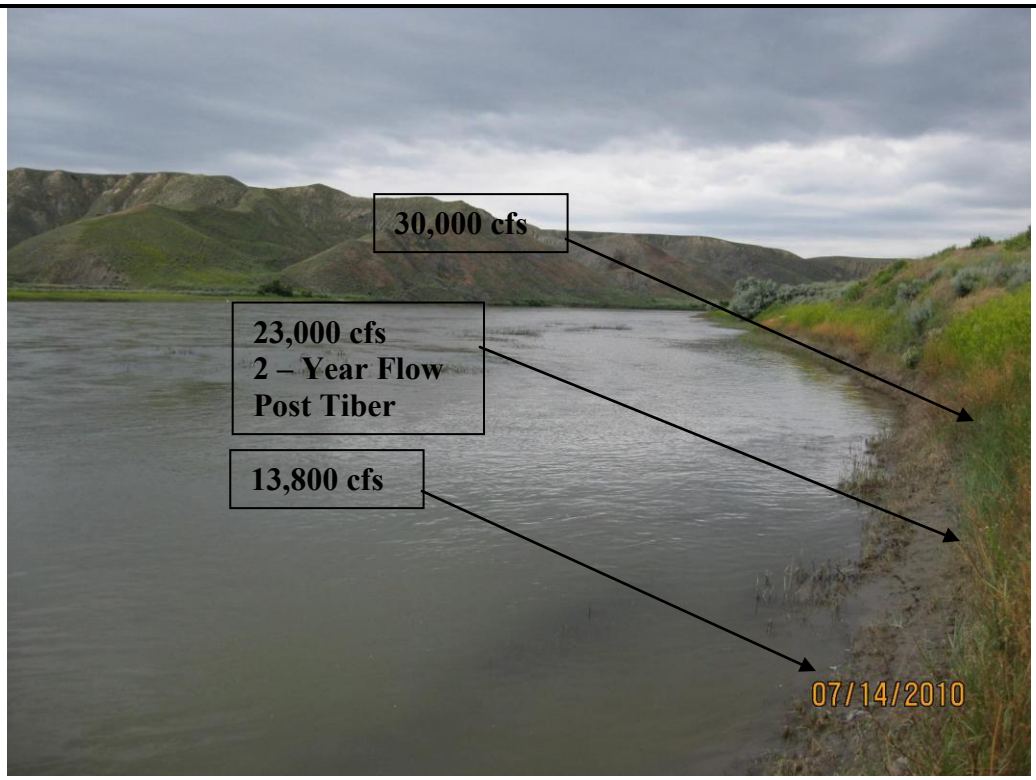
In evaluating the health and functionality of riparian ecosystems, the kind, amount and density of vegetation plays an important role. Healthy native plant communities capture sediment aiding in floodplain development and provide a deep-binding root mass protecting banks against ice damage and water erosion. These areas are also very prone to establishment of invasive weeds and non-native plants. Invasive weeds prefer highly disturbed sites such as river banks, roadsides and camping areas. Once established, invasive weeds often out-compete and displace native vegetation creating a single species plant community often resulting in increased soil erosion, an altered nutrient cycle, and reduced biological diversity (Sheley et al., 1999).

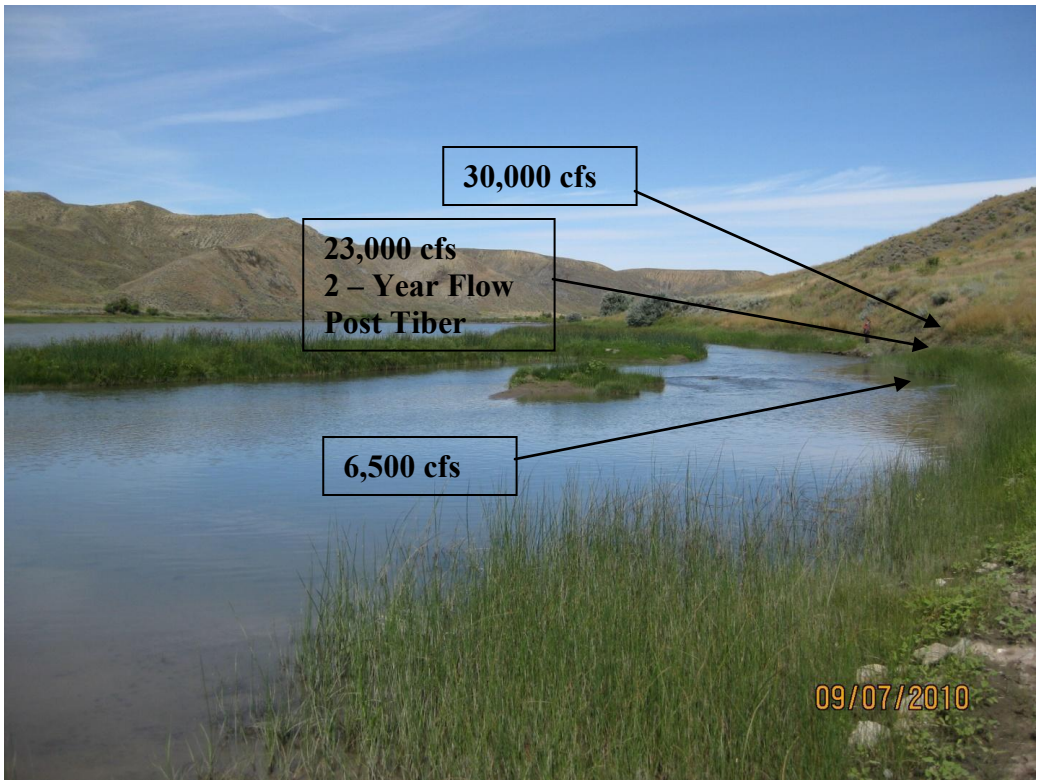
Non-native grass species are common and abundant, especially in Zone 2 (personal observation). These include smooth brome, Kentucky bluegrass, quackgrass, crested wheatgrass, and annual bromes. Smooth brome is aggressive, competitive and can exclude all other species (Kudray, 2004). Smooth brome occurred in 69 percent of Kudray's plots.

Control methods and the capability of the BLM to economically control non-native grasses are limited.

Kudray (2004) indicated that Russian olive was the only well established non-native woody species occurring along the river. Following his study seven small infestations of salt cedar have been discovered; one at Hole in the Wall and at six sites between the PN Bridge and the CMR boundary. Salt cedar is an evergreen shrub or small tree that can quickly invade disturbed areas, rapidly spread, form dense thickets and outcompete and replace native species. The plants were removed and no other plants have been discovered during follow-up visits to the sites. Russian olive can have significant affects on riparian forests. According to Lesica and Miles (2001), Russian olive can displace native trees and shrubs and form monotypic stands, especially where the riparian zone is less dynamic. There is the possibility of Russian olive becoming the dominant or co-dominant tree on the Upper Missouri (personal communication, G. Auble (USGS)). Along the upper half of the Missouri River, which is mostly private land, it may be socially and economically impractical to control invasions of Russian olive. However, along the lower half of the Missouri River, which is largely public land, the opportunity to control Russian olive and limit its spread and establishment is still a viable option.

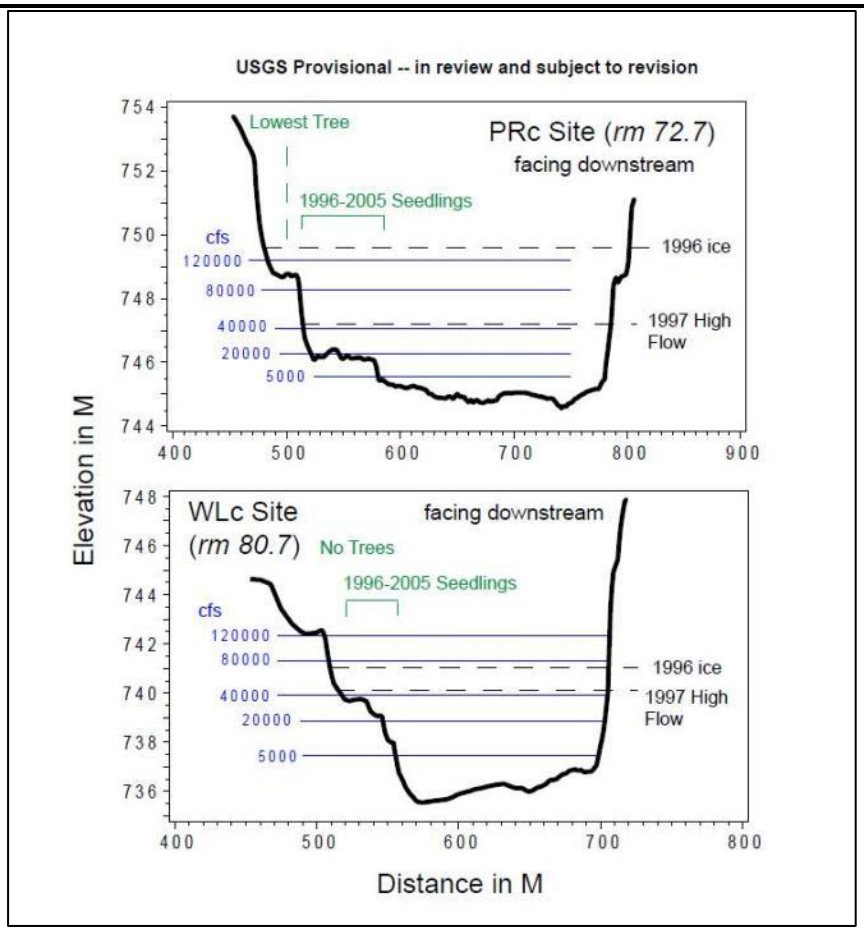
Yes	No	N/A	HYDROLOGICAL
X			1) Floodplain above bankfull is inundated in "relatively frequent" events **Rationale for Answer** The river channel attributes and function are within a relative range of historic conditions both vertically and morphologically. A reach scale channel narrowing process has decreased the width of the active channel, which without a corresponding decrease in channel elevation would result in greater flood prone area. During the period of record (1935-2010), the stage-peak discharge relation at the Virgelle gage has been relatively stable, thereby indicating that the river has not downcut. Although a stable stage-discharge relation accompanied by channel narrowing would indicate a deeper channel, it may not be an indicator of vertical instability as much as the channel reaching a new equilibrium. The take home message is that flows of certain magnitudes inundate similar elevations as historically. Relative to the potential channel morphology of a Rosgen F-channel type, no physical channel or flood plain characteristics prohibit access to the floodplain. Evidence of floodplain inundation was also present with rack lines of debris and soils exhibiting frequently inundated and redox conditions. Because of the potential channel morphology of a Rosgen F channel (box shaped), limited floodprone areas exist. However, small areas such as the mouth of large tributaries and islands were inundated frequently although these areas make up very small percentages of the reach. Because of the lower sinuosity and transport nature of this reach there is limited floodplain development. Most building areas are located below the 2-year discharge in the active channel.





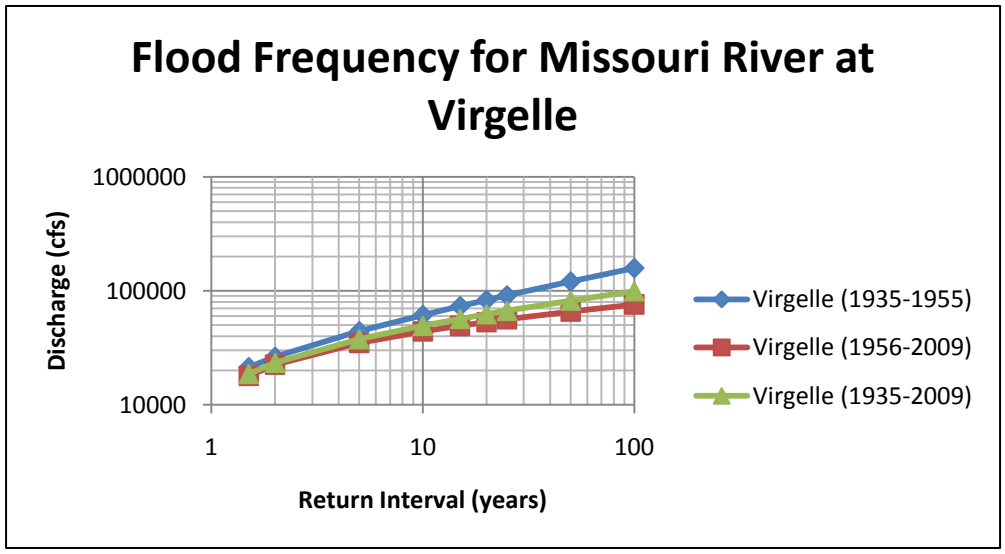
Inundating Discharges of Streamside Zones in Reach #3

Canyon Ferry Dam and Tiber Dam do regulate flows through this reach; however, the effect on "relatively frequent" events such as 2 to 5 year return intervals is less than the shift in flooding frequency of much larger events, which may be important for ecological processes such as cottonwood recruitment.



Channel Cross Sections at Pablo Rapids (RM 72.7) and The Wall (RM 80.7) (USGS Provisional – in review and subject to revision)

Limited floodprone areas exist because of the F-channel type, and the floodplain areas in the above cross sections are associated with depositional zones near tributary junctions. Although they make up very small percentages of the reach as a whole, based upon the flood frequency curves for the Virgelle gage, they are inundated frequently.

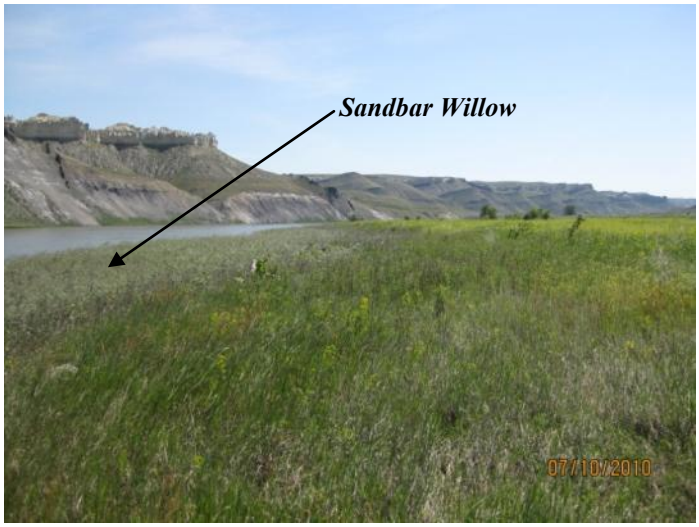


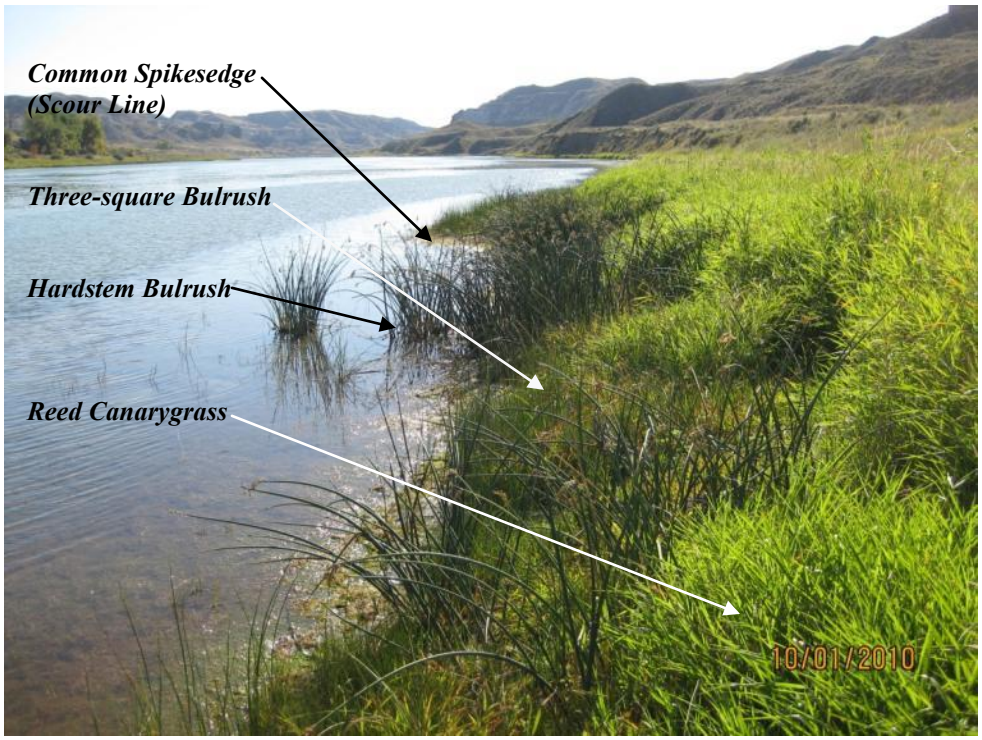
Flood Frequency Curves for the Virgelle Gage

			Redoximorphic (redox) features indicating that the soils undergo periodic saturation were prevalent in both Zones 1 and 2 except on the steep erosive bends of the river. Redox features were observed from the soil surface to within 20 inches of the soil surface. The depth to these features increases as the distance from the active channel increases. The redox features observed were reduced soil matrices in Zone 1 and redox concentrations and depletions in both Zones 1 and 2.
		X	2) Where beaver dams are present are they active and stable **Rationale for Answer** Although beavers are present on the Missouri River, beavers on the Missouri do not build dams that affect channel morphology, floodplain hydrology, or alter water-table elevations.
X			3) Sinuosity, width/depth ratio, and gradient are in balance with the landscape setting (i.e., landform, geology, and bioclimatic region) **Rationale for Answer** Examination of the 1890 Missouri River Commission map, 1950's, 1980's and 2006 imagery has shown a decrease in channel width in all reaches of the UMNWSR. However, the ensuing change in width/depth ratios would not have changed the classification of the river channel. Furthermore, there have been no significant vertical shifts in the stage-peak discharge relationship at the Virgelle gage, which would indicate vertical changes in the river. The river channel attributes and function are within a relative range of historic conditions both vertically and morphologically. Sinuosity within Reach #3 is barely larger than one. As a result, higher gradients increase the transport capacity of the reach and depositional areas are infrequent. This is as expected relative to the potential for the reach considering it is in the post-glacial channel.
X			4) Riparian-wetland area is widening or has achieved potential extent **Rationale for Answer** A process of channel narrowing occurring over the last century has resulted in riparian species such as cottonwood, becoming established on sites that were previously within the active channel. Keep in mind that the channel will not be capable of narrowing indefinitely and this may be a one-time response as the channel approaches a new equilibrium. As riparian-wetland vegetation establishes on zones that were at one time frequently flooded, subsequent sediment deposition moves them higher and drier, thereby decreasing the flooding frequency of these sites. Although there has been a net decrease in river channel, the amount of riparian-wetland area may be similar to past extents. Areas where floodplain development was occurring, such as delta bars at the mouths of tributaries and islands, were vegetating with riparian-wetland vegetation. These zones are small relative to the reach, but would be leading to small increases in the size of the riparian-wetland area.
X			5) Upland watershed is not contributing to riparian-wetland degradation **Rationale for Answer**

			Existing channel morphology and channel forming process did not indicate a large change in the amount of water or sediment supplied by the watershed. No evidence existed of excessive sediment deposition or scour/erosion from sediment "hungry" waters due to dam released waters. Substrate particle sizes ranged from cobble and gravel in higher shear-stress zones to very fine in lower shear-stress areas such as depositional zones. This indicates that the reach is capable of processing the water and sediment provided by the watershed. Conversely, homogeneity of the particle size distributions would indicate that the stream is no longer capable of moving its sediment load or that a change in stream energy has occurred and recent stream discharges are capable of moving a greater percentage of substrate materials. Reach #3 is primarily a transport reach. As such, it is processing sediment supplied by the watershed and depositional zones are few. Depositional areas were primarily located where side tributaries were large enough to supply enough materials to overcome the river's capability to move it. The river had the sediment transport competence and capacity to move most materials supplied by smaller tributaries. This condition is as expected based upon the potential sinuosity and gradient for the channel.

Yes	No	N/A	VEGETATION
X			6) Diverse age-class distribution of riparian-wetland vegetation (recruitment for maintenance/recovery) **Rationale for Answer** At eleven of the twelve stops, herbaceous riparian plant communities were commonly found on public land occupying Zone 1. The dominant plants present in this zone reproduce and spread primarily by rhizomes. This is typical of reed canarygrass, field and rough horsetail, hardstem and three-square bulrush and common spikesedge, which was located along the scour line. Reed canarygrass was the dominant riparian-wetland plant at five of the sites visited and present at eleven of the twelve sites. Although considered native to the Upper Missouri River ecosystem, reed canarygrass has become weedy or invasive in some areas. One factor determining its frequency and abundance within a plant community seems to be dependent on the season and level of grazing by livestock. Reed canarygrass is more palatable in the spring and early summer. Areas excluded from grazing, as well as light stocking rates or fall use, appeared to have a higher proportion of reed canarygrass.  ***Continuous, linear and dense stand of reed canarygrass (bright green color) bordered by a hardstem bulrush community.***

			The herbaceous riparian-wetland plants and plant communities at these sites were continuous, spreading from underground roots and colonizing depositional surfaces. Within Zone 1, dense communities of these rhizomatous herbaceous plants were common, indicating they are well established and expanding and thus exhibiting multiple "age-classes." Of the twelve sites assessed, only one (Hole in the Wall) was dominated by sandbar willow estimated to range from 30% to 50% canopy cover. Also called coyote willow, sandbar willow can form dense stands by spreading underground roots (rhizomes) and re-sprouts easily if the stems are damaged or removed. Its ability to spread and form dense stands is one measure of a diverse age class. At other sites, sandbar and yellow willow were the most common shrubs occurring in Zone 1 and 2. These two plants were found only in trace amounts in the seedling and sapling stage and many were re-sprouting from the base following damage from ice and beaver.  ***Dense stand of sandbar willow (tributary junction) below Hole in the Wall recreation site.*** Plains cottonwood seedlings and saplings and green ash and peachleaf willow saplings were commonly found in Zone 1 and 2 but only in trace amounts. Many of the plants have developed a multi-stemmed growth form following removal of the main stem by beaver and ice damage.
X			7) Diverse composition of riparian-wetland vegetation (for maintenance/recovery) (*species present*) **Rationale for Answer** Zone 1 contained a diverse combination of herbaceous riparian-wetland plants and communities. Common spikesedge and needle spikerush occurred along the scour line. Three-square, hardstem and alkali bulrush, alkali cordgrass, rough horsetail, woolly sedge, Baltic rush and reed canarygrass were established on the depositional surfaces. Where reed canarygrass was the more dominant riparian-wetland species, other more desirable species were present in much smaller amounts. The shrub community included sandbar and yellow willow. Both willows occurred only in trace amounts through most of the reach. Ice damage and buried plants from sediment deposits are impacting their growth and survival. Many of the sandbar willow plants, which can spread

			rapidly by underground roots, are recovering by re-sprouting after ice and deposition events. The dominant riparian tree species in Zone 1 and 2 was plains cottonwood. Also present were green ash and peachleaf willow (although present only in trace amounts). Noxious weeds, including Canada thistle, leafy spurge, Russian and spotted knapweed, field bindweed, houndstongue and perennial pepperweed, were found at all twelve stops. Other invasive weeds and non-native species present included common burdock, common mullein, creeping meadow foxtail, cheatgrass or downy brome, Japanese brome, quackgrass, Kentucky bluegrass, red top and smooth brome. Although not the dominant species found at the twelve scheduled stops, invasive weeds and non-native plants comprise a high percentage of the plants found within Zone 1 and 2. Russian olive, an invasive perennial tree or multi-stemmed shrub, was found at five of the twelve stops.  ***Representative riparian herbaceous community found within Reach #3.***
X			8) Species present indicate maintenance of riparian-wetland soil moisture characteristics **Rationale for Answer** Redoximorphic (redox) features indicating that the soils undergo periodic saturation were prevalent in both Zones 1 and 2 except on the steep erosive bends of the river. Redox features were observed from the soil surface to within 20 inches of the soil surface. The depth to these features increases as the distance from the active channel increases. The redox features observed were reduced soil matrices in Zone 1 and redox concentrations and depletions in both Zones 1 and 2. Zone 1 is dominated by plants and plant communities consisting of obligate (OBL) and

			facultative wetland (FACW) plants. Plants noted include hardstem, alkali and three-square bulrush, common spikesedge and needle spikerush, reed canarygrass, alkali cordgrass, rough horsetail, woolly sedge, Baltic rush and sandbar, peachleaf and yellow willow. The majority of riparian-wetland plants are growing below bankfull in Zone 1. Zone 2 is not flooded often enough or long enough to support OBL and FACW plant species.
X			9) Streambank vegetation is comprised of those plants or plant communities that have root masses capable of withstanding high stream flow events (*community types present*) **Rationale for Answer** Zone 1 is capturing sediment and is vegetated with riparian-wetland plants and plant communities with medium to high stability ratings. The OBL and FACW species noted along the reach with medium to high stability class ratings include sandbar, yellow and peachleaf willow, reed canarygrass, alkali cordgrass, alkali, hardstem and three-square bulrush, common spikesedge, rough horsetail, needle spikerush, Baltic rush and woolly sedge. The latter three species were present only in small amounts. In combination, willows, grasses and grass-like plants (sedges, rushes, spikerush) are excellent bank stabilizers. Because their rooting characteristics are different and they become intertwined, they complement one another and add strength to water and ice scoured areas along the river bank. These areas are slowly building and no unusual erosion activity was noted.
X			10) Riparian-wetland plants exhibit high vigor **Rationale for Answer** Depending on the duration of annual high flows, streambanks can be submerged for a considerable portion of the growing season. In 2010, most of Zone 1 was inundated until late July. Hardstem and three-square bulrush and reed canarygrass were observed to be emerging through deposited sediment and standing water indicating that plants are well established and possess enough stored energy in roots to initiate and maintain growth during prolonged periods of flooding. Hardstem and three-square bulrush and reed canarygrass plants were observed to be tall, robust and have good coloration despite being under water. Several of these sites were checked and photographed again in September and October after water levels dropped and exposed more of the bank. In support of earlier findings, the riparian-wetland plants were robust, had good coloration, had flowered and produced seed and had rapidly grown when compared to earlier pictures. Trees and shrubs exhibited a multi-stemmed growth form (re-sprouting from the base of the plant) and showed signs of mortality from repeated removal of stems by beaver and damage by ice. Upriver from "The Wall" primitive boat camp, woody plants have been dying out over the last eight to ten years. The site is not flooded frequently enough to maintain the moisture requirements needed for willow and cottonwood survival. Also, the soils in this area are more porous reducing the water-holding capacity.  ***In July portions of Zone 1 and 2 were under water during high flows.***

			 ***October photograph showing response of riparian vegetation after water levels dropped.***
X			11) Adequate riparian-wetland vegetative cover present to protect banks and dissipate energy during high flows (*enough*) **Rationale for Answer** The plants, plant groupings and community types observed in Zone 1 were well developed and the depositional surfaces well vegetated with riparian-wetland plants that have medium to high stability ratings. The amount of bare areas observed was normal and naturally occurring from recent sediment deposits and scouring from water and ice. Sites are still capturing sediment and building with little evidence of bank instability (cutting/slumping).  ***Bare areas from fresh sediment deposited after high flows were common throughout the reach.***
		X	12) Plant communities are an adequate source of coarse and/or large woody material (for maintenance/recovery) **Rationale for Answer** Large woody material is present within the reach; however, it is not required for function. During the steamboat era, a significant amount of woody material was pulled from the Missouri River to aid in navigation. Nevertheless, not only did the river fail to degrade (downcut) as a result of this activity, but it also narrowed during the past century. Although woody material is not a driver for function on the Upper Missouri, it can play an important role in small areas for floodplain development, energy dissipation, and aquatic habitat.

Yes	No	N/A	EROSION DEPOSITION
X			13) Floodplain and channel characteristics (i.e., rocks, overflow channels, coarse and/or large woody material) adequate to dissipate energy **Rationale for Answer** The channel morphology and floodplain areas are as expected relative to potential; the river is very constrained in this reach with very few meanders, oxbows, overflow channels, floodplains, and islands. However relative to the F-channel type (box shape) and low sinuosity, more depositional features, back channels, and islands, existed than one would expect. The depositional areas on BLM lands were well vegetated with riparian vegetation. The increased roughness of these areas results in energy loss in the channel due to friction loss. Depositional zones were where expected (mid-channel bars and tributary junctions). Although they make up a very small percentage of the reach, new depositional zones were vegetated with pioneer species such as cottonwood and streambank willow, which provide a functional role. These species are generally the first to establish on depositional zones of coarse material. Because these species are currently established on low elevation surfaces that are subject to frequent disturbance from floods and ice, they may never become mature individuals. However, due to their stiffer stems relative to herbaceous plants, they are able to trap woody material and organic matter, and subsequently fine-grained sediment, which leads to more conducive environments for sedge/rush communities and maturation of the floodplain. The increase in organic material also leads to increased water-holding capacity of the floodplain. Because of the Rosgen F-type channel, floodplain areas are still somewhat limited in extent. Mid-channel bars provide a large portion of floodplain. Although small in area, these features provide important energy dissipation in F-type channels.
		X	14) Point bars are revegetating with riparian-wetland vegetation **Rationale for Answer** The reach has very low sinuosity. Although there are entrenched meanders, there are no point bars. Depositional areas do exist at tributary junctions and mid-channel bars. These sites are vegetating with riparian-wetland species.
X			15) Lateral stream movement is associated with natural sinuosity **Rationale for Answer** Examination of the 1890 Missouri River Commission map, 1950's, 1980's and 2006 imagery has shown a decrease in channel width in all reaches of the UMNWSR. However, the ensuing change in width/depth ratios would not have changed the classification of the river channel. Furthermore, there have been no significant vertical shifts in the stage-peak discharge relationship at the Virgelle gage, which would indicate vertical changes in the river. Although there are entrenched meanders within the reach, very little lateral channel movement is occurring.

X			16) System is vertically stable (*not downcutting*) **Rationale for Answer** A reach scale channel narrowing process has decreased the width of the active channel, which without a corresponding decrease in channel elevation would result in greater flood prone area. During the period of record (1935-2010), the stage-peak discharge relation at the Virgelle gage has been relatively stable, thereby indicating that the river has not downcut. Although a stable stage-discharge relation accompanied by channel narrowing would indicate a deeper channel, it may not be an indicator of vertical instability as much as the channel reaching a new equilibrium. The take home message is that flows of certain magnitudes inundate similar elevations as historically.
X			17) Stream is in balance with the water and sediment being supplied by the watershed (i.e., no excessive erosion or deposition) **Rationale for Answer** Existing channel morphology and channel forming process did not indicate a large change in the amount of water or sediment supplied by the watershed. No evidence existed of excessive sediment deposition or scour/erosion from sediment "hungry" waters due to dam released waters. Substrate particle sizes ranged from cobble and gravel in higher shear-stress zones to very fine in lower shear-stress areas such as depositional zones. This indicates that the reach is capable of processing the water and sediment provided by the watershed. Conversely, homogeneity of the particle-size distributions would indicate that the stream is no longer capable of moving its sediment load or that a change in stream energy has occurred and recent stream discharges are capable of moving a greater percentage of substrate materials. Reach #3 is primarily a transport reach. As such, it is processing sediment supplied by the watershed and depositional zones are few. Depositional areas were primarily located where side tributaries were large enough to supply enough materials to overcome the river's capability to move it. The river had the sediment transport competence and capacity to move most materials supplied by smaller tributaries. This condition is as expected based upon the potential sinuosity and gradient for the channel.

Remarks (Reach #3)

General Comments

From Coal Banks to Grand Island, approximately 2% of cottonwood trees are less than 10 years old, 7% are 10 to 25, 31% are 25 to 50, 34% are 50 to 114, and 24% are greater than 114 years old (unpublished USGS data, in review and subject to revision). Spatial and temporal variability in the recruitment of trees means that there is no reasonable expectation of constant total area or stable age distributions (unpublished USGS data, in review and subject to revision). The process of channel narrowing that has been occurring since the late 1800s has resulted in establishment of cottonwood trees as existing back channels have filled in. This increase in trees has mitigated the effects of the loss of trees from higher surfaces, and current amounts of cottonwood forest are similar to cottonwood forest in 1890 (unpublished USGS data, in review and subject to revision). However, without a change in flow regimes on the UMNWSR, the amount of cottonwood forest will decrease, and this effect will be most noticeable in the confined portions of the river.

Soils Summary

Zone 1 is within the active channel that is saturated/flooded with a two-year return interval flow. Soils within this zone undergo continuous or periodic saturation. This zone is most often in a reduced state resulting from the soils being saturated and virtually free of elemental oxygen (anaerobic). The soils matrix is reduced and low chroma/high value colors (gleyed/gray) are observed. When the water table drops and the soils dry out, prominent redoximorphic (redox) features such as iron concentrations and depletions, are found to the surface of the soil profile.

Overall for the reach, fines are kept in suspension in this zone due to the higher stream energy, so gravel and cobble settle out. A series of depositional events have stratified soil textures in the upper 20 inches, ranging from loamy sands to sandy clay loams (approximately 12 to 25 percent clay) with many gravels and cobbles. Below 20 inches are mainly sands, gravels, and cobbles.

Zone 2 is on the floodplain above Zone 1 and is within the 10 year (pre dams) and 20 to 30 year (post dams) floodplain, which is periodically saturated during less frequent flood events. As the river and water table levels rise and fall, the soil alternates between reduced and oxidized states. Reduction occurs during saturation with water and oxidation occurs when the soil is not saturated (USDA-NRCS 2010).

Evidence of this fluctuation is indicated by the presence of redox features within the upper 20 inches of the soil profile, which commonly include rust colored iron concentrations in the matrix, along roots and pores, and gray colored iron depletions throughout the soil matrix. The soil matrix is not reduced. The depth to redox features increases as the distance from the active channel increases. Redox features are not always present on some outside meanders because they are eroding faster than the features can form.

As the river rises during flooding events and reaches the floodplain (above bankfull) stream energy is dissipated resulting in finer textured material settling out of suspension in depositional zones. Soil textures are stratified resulting from depositional events and predominately range from sandy loam to sandy clay loams (approximately 15 to 25 percent clay) with thin layers of finer textured materials.

Zone 3 is on terraces above Zone 2. This zone is not frequently flooded; therefore, indicators (redox features) of recent soil wetting are not observed.

Although this zone is not frequently flooded by summer stages, it is frequently scoured by ice resulting from spring thaw ice jams resulting in areas of bare soil. Rock fragments ranging in size from gravel to stones can be deposited by ice at higher elevations than river summer flows are capable of depositing.

Soil textures in this zone range from loamy sands to clayey dependent on what type of material was deposited during past flood events and/or the parent material found on the adjacent uplands.

Vegetation

Of the twelve stops on public land, eleven were herbaceous riparian-wetland plant communities dominated mostly by reed canarygrass, hardstem and three-square bulrush and common spikesedge. Their presence indicates the importance of these plants in vegetating and stabilizing depositional areas.

Other than the sandbar willow community at the Hole in the Wall site, where a large depositional surface was created below a tributary junction, only trace amounts of woody plants were found in Zone 1 and 2. Depositional areas below tributary junctions seem to provide the best opportunity for recruitment and establishment of woody plants. However, these sites are still being formed in the zones receiving the most disturbance from ice, water scouring and deposits of sediment.

The abundance and size of sandbar willow on some sites is sparse and small. The ID Team identified impacts from ice damage, sediment deposits that bury plants, scouring by water and removal by beaver as causes for their size and appearance.

Noxious weeds occurred at all twelve stops; present were leafy spurge, Canada thistle, perennial pepperweed, field bindweed, houndstongue and Russian and spotted knapweed. Russian olive, a regulated plant by the State of Montana, occurred at five of the twelve stops.

Invasive grasses made up a higher percentage of the vegetative canopy cover within Zone 2; present were reed canarygrass, quackgrass, creeping meadow foxtail, Kentucky bluegrass, Japanese brome, cheatgrass or downy brome, red top and smooth brome.

The ID Team raised concerns about the abundance of reed canarygrass within Reach #3 and its aggressive nature. Reed canarygrass was the dominant riparian-wetland plant at five of the stops and was present at eleven of the stops. Within Reach #3 reed canarygrass appears to invade or increase in lightly grazed areas, areas without grazing, and in areas with fall use.

Woody plants and the presence of newly germinated cottonwood seedlings were tied to fresh alluvial deposits of sandy loam material. Cottonwood seedlings and saplings were observed to be growing on clayey soils underlain with a gravel substrate. Where the soil surface was clay, there was no germination occurring.

Extensive beaver damage was noted at seven of the twelve stops. With only trace amounts of woody plants within Zone 1 and 2, beavers and ice damage are impacting their survival.

The green ash/boxelder community at North Stop #2 is unique and not a representative riparian plant community within Reach #3. These site types, which are uncommon along the river, are referred to as "perched water tables". They are located at higher elevations above the river and are strongly influenced by adjacent upland areas. At this site, ice has bulldozed a berm in front of the trees trapping water flowing off upland areas. Moisture is stored longer into the growing season and through hot, dry periods supporting a more diverse vegetation community.

Perched water table at North Stop #2.

Example of berm "bulldozed" by ice at Dark Butte primitive boat camp. Note the height above the river.

Yellow and white sweetclover, both non-native species, were very prominent in this reach and found at all twelve stops. It was more notable within Zone 2 on disturbed sites impacted by flooding and ice, and at some sites has formed dense monocultures.

The ID Team noted the importance of early colonizing species (pioneer), such as plains cottonwood and sandbar willow, in stabilizing deposition areas. These species can be the first to establish on newly forming surfaces and have attributes that allow other plants to quickly occupy sites. Sandbar willow spreads easily by underground roots (rhizomes) and tends to grow in thickets. Plains cottonwood however, lacks the ability to produce root suckers, although shoot suckering is common (Rood et al. 1994). Because plains cottonwood establishes at locations that are the most susceptible to disturbance, they are unlikely to survive and grow into mature trees.

The ID Team spent additional time reviewing the condition of riparian areas on three public land river bottoms at North Stop #4, #5 and #6. BLM has received comments regarding how the area is currently grazed and what impact it may be having on riparian vegetation. The ID Team collected information at each stop, discussed the riparian potential, their condition, and what, if any, management changes might be needed. The ID Team noted the composition and structure of riparian communities on the three river bottoms was similar to what was found at other stops throughout the reach. Herbaceous riparian communities were the dominant type found in Zone 1 with only trace amounts of woody species. The areas were narrow and linear, and on many sites steep, with little potential for further riparian development. Woody species are located in the active channel and at a position next to the river where they are exposed to ice damage, sediment deposition and scouring during high flows. While there were no checklist items that would influence a "no" response at these sites, the ID Team agreed there may be opportunities to improve management by increasing use in upland areas, developing off-site water sources to draw livestock away from the river, controlling livestock with drift fences and changing the season of use.

Wildlife Information

All stops along this reach showed abundant use of habitat by wildlife. Raptors are utilizing large cottonwoods for nesting structure near the river. There are abundant migratory bird species throughout the reach, with highest density in mature woodland sites with good understory, which are not located near public use sites (campsites). Recreational impacts to wildlife from campsites in important wildlife habitat occur as traffic causes soil compaction, spreads invasive non-native plants, and causes disturbance to nesting, resting or feeding by wildlife species. There is heavy use of cottonwood and some willow by beaver, with light overall browsing and localized heavy use by deer on several woody species (See explanation next paragraph). Small herbaceous riparian sites show impacts from concentrations of Canada geese overgrazing (indicated by abundance of droppings, tracks, and shed feathers).

Use of woody species by big game was determined by clean shearing off of leaders, the absence of grazing, or even presence of livestock at most locations visited. Cattle leave abundant signs, including tracks, droppings, and mechanical

damage to woody species when they have grazed an area. Livestock grazing on woody species tend to tear ends off stems and mechanically damage additional stems, leaving a ragged appearance. Deer generally browse on smaller diameter leaders with clean cuts and small amounts of bark tearing. While one clean bite does not guarantee it was not livestock use, observation of multiple stems on same and adjacent woody species, tracks and animal droppings in area will usually confirm class of animal utilizing browse. The difficulty is in "quantifying" livestock vs. wildlife use in areas where both have been feeding.

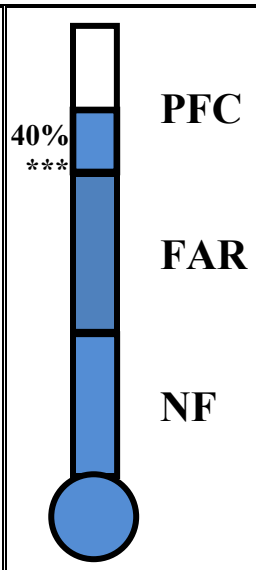
Grazing Allotments

North Side - White Rocks #06426; Piedras #06425; Jurenka #06481; Blazek #06424; Dark Butte #06215; Pablo Rapids #06216; Sneath Common #06218; Deadman Rapids #06221

South Side – Rattlesnake Coulee #09714; White Rocks #09838; Kipps Rapids #09729; Hole-in-the-Wall #09799; Dammel #09687; Sheep Shed Coulee #19837; PN Sag #15123

SUMMARY DETERMINATION: The public land through this reach rated in Proper Functioning Condition. In summary, key attributes and processes responsible for the rating of Proper Functioning Condition were adequate riparian-wetland species diversity, age class, vigor, cover of riparian-wetland plants with medium to high stability ratings on the streambanks, stable streambanks, and channel attributes and functions within the range of conditions appropriate for this reach.

Invasive weeds and non-native grasses were identified as the basis for not attaining a higher ecological status. Because invasive weeds and non-native plants compete with and often displace native riparian-wetland plants, they may reach a level where they affect the functional condition of the Missouri River through changes in vegetation composition, structure and streambank stability.

Functional Rating		**Are factors contributing to unacceptable conditions outside the control of the manager?**
_X_ Proper Functioning Condition ___ Functional - At Risk ___ Nonfunctional ___ Unknown **Trend for Functional - At Risk:** ___ Upward ___ Downward ___ Not Apparent		Yes ___ No _X_ **If yes, what are those factors?** ___ Flow regulations ___ Mining activities ___ Upstream channel conditions ___ Channelization ___ Road encroachment ___ Oil field water discharge ___ Augmented flows ___ Other (specify)

(Revised 1998) (5/2008)

Appendix A – Plant List for Reaches #1-#6

Common Name	***Scientific Name***	**AKA Name(s)**
alfalfa	*Medicago sativa*	
alkali bulrush	*Scirpus maritimus*	Saltmarsh Bulrush
alkali cordgrass	*Spartina gracilis*	
Baltic rush	*Juncus balticus*	
black medic	*Medicago lupulina*	
boxelder	*Acer negundo*	
Canada thistle	*Cirsium arvense*	
cheatgrass	*Bromus tectorum*	downy brome
chokecherry	*Prunus virginiana*	
common burdock	*Arctium*	
common cattail	*Typha latifolia*	broadleaf cattail, cattail
common mullein	*Verbascum thapsus*	
common reed	*Phragmites australis*	
common spikesedge	*Eleocharis palustris*	common spikerush
creeping meadow foxtail	*Alopecurus arundinaceus*	
crested wheatgrass	*Agropyron cristatum*	
diffuse knapweed	*Centaurea diffusa*	
field bindweed	*Convolvulus arvensis*	creeping jenny, morning glory
green ash	*Fraxinus pennsylvanica*	
golden currant	*Ribes aureum*	
hardstem bulrush	*Scirpus acutus*	
houndstongue	*Cynoglossum officinale*	
Japanese brome	*Bromus japonicas*	
Kentucky bluegrass	*Poa pratensis*	
leafy spurge	*Euphorbia esula*	
narrow-leaf cottonwood	*Populus angustifolia*	
needle spikerush	*Eleocharis acicularis*	
peachleaf willow	*Salix amygdaloides*	
perennial pepperweed	*Lepidium latifolium*	
plains cottonwood	*Populus deltoides*	great plains cottonwood
poison hemlock	*Conium maculatum*	
quackgrass	*Agropyron repens*	
red-osier dogwood	*Cornus stolonifera*	
red top	*Agrostis gigantean (alba)*	
reed canarygrass	*Phalaris arundinacea*	
rough horsetail	*Equisetum hyemale*	scouringrush horsetail
Russian knapweed	*Centaurea maculosa*	
Russian olive	*Elaeagnus angustifolia*	
Sandbar willow	*Salix exigua*	coyote willow
showy milkweed	*Asclepias speciosa*	
small-fruit bulrush	*Scirpus microcarpus*	
smooth brome	*Bromus inermis*	

Common Name	***Scientific Name***	**AKA Name(s)**
spotted knapweed	*Centaurea repens*	
three-square bulrush	*Scirpus pungens*	
water birch	*Betula occidentalis*	
western snowberry	*Symphoricarpos occidentalis*	
White stem gooseberry	*Ribes inerme*	
white sweetclover	*Melilotus alba*	
woolly sedge	*Carex lanuginosa (pellita)*	
yellow willow	*Salix lutea*	
Yellow sweetclover	*Melilotus officinalis*	

Appendix B – References for Reaches #1-#6

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