

County	Sweet Grass	Upstream River Mile	438.5
Classification	UA: Unconfined anabranching	Downstream River Mile	434.7
General Location	Reed Point	Length	3.80 mi (6.12 km)

Narrative Summary

Reach A9 is located in lowermost Sweet Grass County, just upstream of the Sweet Grass/Stillwater county line near Reed Point. The reach is an Unconfined Anabranching reach type. The reach is 3.8 miles long, extending from RM 434.7 to RM 438.5. The lower reach break is the bridge crossing just north of Reed Point. This bridge was originally constructed in 1911 and rebuilt in 2000.

Reach A9 provides an excellent example of a dynamic, largely unmodified Unconfined Anabranching reach type. The stream corridor is typically one half mile wide through the reach, with significant narrowing of that corridor in the downstream direction as the river approaches the bridge at Reed Point. In the uppermost portion of the Reach (RM 437-438.5), the northern valley margin consists of an alluvial fan deposit that is currently irrigated with center pivots. Downstream, the river abuts Cretaceous-age Hell Creek Formation on the northern valley wall, which contains sandstones that tend to form steep cliffs. The reach is characterized by high displacement ratios, extensive split flow and islands, and riparian turnover. Although riparian turnover is evident, the rates of that turnover have gone down in the reach since 1976. Prior to that time (1950-1976), average turnover rates were 5.9 acres per year; from 1976 to 2001 that average rate dropped to 3.6 acres of riparian turnover per year.

Bank armor in Reach A9 consists primarily of 10,000 linear feet of riprap which drapes about 24 percent of the stream bank. About 2,000 feet of that armor was constructed since 2001. This new armor is on the right bank at RM 437.8 where the river was rapidly migrating southward toward the rail line. By the time the bank was armored, the river was within 60 feet of the tracks.

Much of the riprap in Reach A9 is located along the south bank of the river on lower end of the reach where the Yellowstone River approaches the bridge near Reed Point. This bridge marks a major narrowing of the river corridor from about 2,000 feet wide ½ mile upstream of the bridge to 360 feet at the bridge itself. The narrowing is achieved by a ~mile long section of bank armor on the right bank that on its lower end runs due north/south, which is perpendicular to the overall east/west trend of the river. This has caused the river to consolidate into a main thread and abandon an historic side channel just upstream of the bridge at the Indian Fort Fishing Access Site.

Reach A9 has experienced the loss of almost about 3,700 feet of side channel since the 1950s due to dike construction. All of the side channel loss is from one project at the upstream end of the reach, where a side channel was blocked on the north side of the river at RM 438.5.

Even though Reach A9 has experienced some side channel loss, it still supports extensive side channel length. As of 2001 there were 5.1 miles of active side channel in the 3.8 mile long reach. Large islands have persisted in the reach since 1950.

Land use in Reach A9 is predominantly agricultural, although there several hundred acres of non-agricultural uses due to the proximity of the transportation corridor as well as the town of Reed Point. Since 1950, 160 acres of agricultural land have been converted to pivot. A total of 300 acres of developed land are in the Channel Migration Zone. Most of that is in flood irrigation (250 acres), but 40 acres are in transportation. About 13 percent of the CMZ is restricted by physical features.

There is natural gas one pipeline that crosses under the Yellowstone River in Reach A9. It crosses at the upper most end of the reach at RM 438.5 and is consists of a 6 inch pipeline that is owned by Northwestern Energy.

Since 1950, Reach A9 has lost most of its forest that would be considered at low risk of cowbird infestation due to its separation from agricultural infrastructure. In 1950, about 17 acres of forest per valley mile were identified as low risk and by 2001 that forest area had been reduced to 2.5 acres due to development within the reach.

A hydrologic evaluation of flow depletions indicates that flow alterations over the last century have been moderate in this reach. The mean annual flood is estimated to have dropped from 14,000 cfs to 13,300 cfs, a drop of about 5 percent. The biggest influence has been on low flows: severe low flows described as 7Q10 (the lowest average 7-day flow anticipated every ten years) for summer months has dropped from an estimated 2,030 cfs to 1,680 cfs with human development, a reduction of 17 percent. More typical summer low flows, described as the summer 95% flow duration, have dropped from 1,760 cfs under unregulated conditions to 1,680 cfs under regulated conditions at the Livingston gage, a reduction of 4.6 percent.

The reduction in flows is evident by the contraction of the 5-year floodplain area in Reach A9 by 15 acres, or 6 percent.

CEA-Related observations in Reach A9 include:

- Reduced floodplain turnover rates since 1976
- Approximately 3,700 feet of side channel has been lost due to channel plugging between 1950 and 2011
- Meander belt encroachment at bridge crossing
- Side channel loss as part of armoring at bridge approach

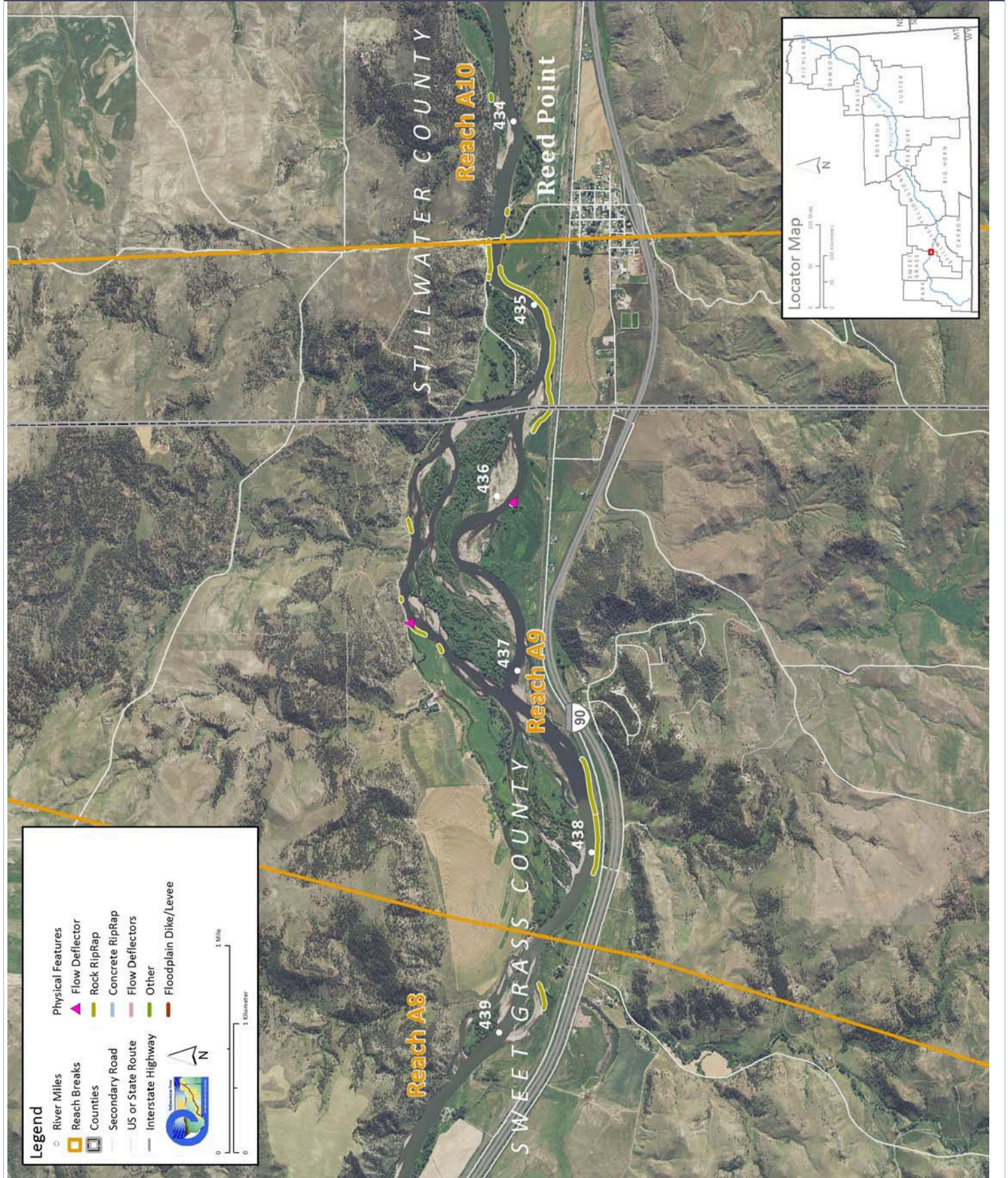
Recommended Practices (may include Yellowstone River Recommended Practices--YRRPs) for Reach A9 include:

- Side channel restoration at RM 438.5
- CMZ management due to extent of CMZ restriction (13 percent)
- Pipeline management for 6-inch natural gas pipeline that crosses under the river at RM 438.5

The following table summarizes some key CEA results that have been used to describe overall condition and types of human influences affecting the river. The values are specific to this single reach. Blanks indicate that a particular value was not available for this area. This information is consolidated from a large dataset that is presented in more detail in the full reach narrative report.

Discharge	Undev.	Developed	% Change	"Undeveloped" flows represent conditions prior to significant human development, whereas "developed" flows reflect the current condition of both consumptive and non-consumptive water use.		
2 Year (cfs)	27,100	26,300	-3.0%			
100 Year (cfs)	49,900	49,400	-1.0%			
Bankfull Channel Area (Ac)	1950	1976	1995	2001	1950-2001	Bankfull channel area is the total footprint of the river inundated at approx. the 2-year flood.
	351.0	420.9	364.2	403.1	52.1	
Physical Features	2011 Length (ft)	% of Bankline	2001-2011 Change	There are additional types of bank armor such as car bodies and steel retaining walls, but they are relatively minor.		
Rock RipRap	9,898	24.2%	2,012			
Concrete Riprap	0	0.0%	0			
Flow Deflectors	107	0.3%	107			
Total	10,005	24.4%	2,119			
Length of Side Channels Blocked (ft)	Pre-1950s	Post-1950s	Numerous side channels have been blocked by small dikes.			
	0	3,717				
Floodplain Turnover	1950 - 1976	1976 - 2001	1950-2001 In-channel riparian encroachment (negative number indicates retreat)	The rate of floodplain turnover reflects how many acres of land are eroded by the river. Turnover is associated with the creation of riparian habitat.		
Total Acres	154.6	90.0				
Acres/Year	5.9	3.6				
Acres/Year/Valley Mile	1.8	1.1	45.11 acres			
Open Bar Area	Point Bars	Bank Attached	Mid-Channel	Total	The type and extent of open sand and gravel bars reflect in-stream habitat conditions that can be important to fish, amphibians, and ground-nesting birds such as least terns.	
Change in Area '50 - '01 (Ac)						
Floodplain Isolation	Acres	% of FP	Floodplain isolation refers to area that historically was flooded, but has become isolated do to flow alterations or physical features such as levees.			
5 Year	14.9	6%				
100 Year	19.0	4%				
Restricted Migration Area	Acres	% of CMZ	Channel Migration Zone restrictions refer to the area and percent of the CMZ that has been isolated by features such as bank armor, dikes, levees, and transportation embankments.			
	150.9	13%				
Land Use	1950	2011	1950	2011	Changes in land use reflect the development of the river corridor through time. The irrigated agricultural are is a sub-set of the mapped agricultural land.	
Agricultural Land (Ac)	2,009.3	1,760.1	Flood (Ac)	462.8	450.6	
Ag. Infrastructure (Ac)	27.7	26.9	Sprinkler (Ac)	0.0	0.0	
Exurban (Ac)	0.0	67.4	Pivot (Ac)	0.0	163.4	
Urban (Ac)	15.6	48.0				
Transportation (Ac)	54.4	169.1				
1950s Riparian Vegetation Converted to a Developed Land Use (ac)	To Irrigated	To Other Use	Total Rip. Converted	% of 1950s Rip.	Changes in the extents of riparian vegetation are influenced by land use changes within the corridor.	
	16.2	0.0	16.2	5.0%		
National Wetlands Inventory	Acres	Acres per Valley Mi	Total Wetland Acres	Wetlands units summarized from National Wetlands Inventory Mapping include Riverine (typically open water sloughs), Emergent (marshes and wet meadows) and Shrub-Scrub (open bar areas with colonizing woody vegetation).		
Riverine	9.8	2.9	73.2			
Emergent	32.5	9.7				
Scrub/Shrub	30.9	9.2				
Russian Olive (2001) (Appx. 100-yr Floodplain)	Acres	%	Russian olive is considered an invasive species and its presence in the corridor is fairly recent. Its spread can be used as a general indicator of invasive plants within the corridor.			
	0.1	0.0%				
Riparian Forest at low risk of Cowbird Parasitism (Ac/Valley Mile)	1950	1976	2001	Change 1950-2011	Cowbirds are associated with agricultural and residential development, displacing native bird species by parasitizing their nests.	
	16.6	2.1	2.5	-14.2		

PHYSICAL FEATURES MAP (2011)



CHANNEL MIGRATION ZONE MAP

