

<b>County</b>	Sweet Grass	<b>Upstream River Mile</b>	453.3
<b>Classification</b>	PCB: Partially confined braided	<b>Downstream River Mile</b>	443.6
<b>General Location</b>	Greycliff	<b>Length</b>	9.70 mi (15.61 km)

### Narrative Summary

Reach A7 is approximately 9.7 miles long, and is at Greycliff. The reach is classified as Partially Confined Braided (PCB), which indicates some valley wall influences on river form and relatively extensive gravel bars and low flow channel complexity. Within this reach, the river intermittently follows the northern bluff line of the river valley which is comprised of Cretaceous-age Hell Creek Formation sandstones and mudstones. The other side of the river valley consists of low floodplain and terrace deposits. In several places, such as at Greycliff Bridge, the terrace toe is sandstone. Several tributaries enter the river in this reach, including Sweet Grass Creek and Deer Creek.

Similar to other reaches in Region A, the overall footprint of the river channel has increased in size since 1950. In 1950, the channel footprint was 613 acres but by 2001 it had expanded to 723 acres.

As of 2011, about 12 percent of the banks in Reach A7 were armored, and most of that bank protection is rock riprap (11,254 feet). There are also 1,500 feet of flow deflectors in the reach. Between 2001 and 2011, about 2,400 feet of riprap and 230 feet of flow deflectors were constructed. There are also minor amounts of gabions and steel retaining wall in the reach.

Reach A7 has experienced the loss of thousands of feet of side channels both pre- and post- 1950. Prior the collection of the 1950s imagery, a channel that was almost a mile long was blocked in multiple places. The land that this blocked side channel is about ½ mile downstream of the Greycliff Bridge on the right bank and is part of the Pelican Fishing Access Site. Currently, only the downstream portion of this channel has good definition; the upper end has largely decayed. Since 1950, side channels have been blocked at RM 445 and RM 452. Both of these side channels were relatively small features that flowed on the south side of the river corridor. In total, 4,600 feet of channel were blocked post-1950. Since 1950 there has been a net loss of about 9,000 feet of side channel in the reach, indicating some passive loss as well as loss due to blockages.

In contrast to the general trend on the river, floodplain turnover rates in Reach A7 have increased since 1976. From 1950-1976 the average floodplain turnover rate in this reach was 3.4 acres per year, and from 1976-2001, that rate had increased to 5.5 acres per year.

Land use in Reach A7 is predominantly agricultural, although there almost 140 acres of exurban development on the low terraces between the river and I-90. Transportation infrastructure also comprises almost 300 acres of the mapping footprint. Most of the agricultural land is non-irrigated, although there are 1,500 acres of ground under flood irrigation, 225 acres under sprinkler and another 914 acres under pivot. A total of 267 acres of developed land are in the Channel Migration Zone. Most of that is in flood irrigation (196 acres), but 51 acres are in pivot. At RM 450, pivots extend to the active streambank on both sides of the river. About 10 percent of the CMZ is restricted by physical features.

Reach A7 has seen 5 percent (33 acres) of its riparian corridor converted to developed land uses since 1950. Most of that (23 acres) was conversion to irrigation. Currently, there are about 26 acres of land under pivot irrigation within the mapped 5-year floodplain.

Reach A7 was sampled as part of the avian study. The average species richness in Reach A7 was 9.9, which indicates the average number of species observed during site visits to the reach in cottonwood habitats. The average species richness for sites evaluated is 8. One bird Species of Concern (SOC), the Bobolink, was identified in the reach. Three bird species identified by the Montana Natural Heritage Program as Potential Species of Concern (PSOC) were also found, including the Chimney Swift, Dickcissel, and Ovenbird.

On area in Reach A7 that has become persistently problematic is the Greycliff Bridge at RM 448.5. Bank migration upstream of the bridge has approached 1,000 feet of lateral movement since 1950. Bank armor has been flanked and now sits in the middle of the river. The county road that lies in the CMZ has been threatened; it was treated with buried revetment that has become exposed in recent years. Efforts are ongoing to develop an optimal strategy to funnel the river meanderbelt through the bridge without disrupting sediment transport patterns and causing accelerated erosion.

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 13,200 cfs to 12,700 cfs, a drop of about 4 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 2,000 cfs to 1,670 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 A7 by 62 acres, or 25 percent.

CEA-Related observations in Reach A7 include:

- Flanking of armor and accelerated erosion behind.
- Side Channel Blockage
- Contraction of 5-year floodplain due to flow alterations.

Recommended Practices (may include Yellowstone River Recommended Practices--YRRPs) for Reach A7 include:

- Side channel restoration RM 452, RM 447.9, RM 445
- Bank armor removal upstream of Greycliff Bridge

- CMZ management due to encroachment of pivots

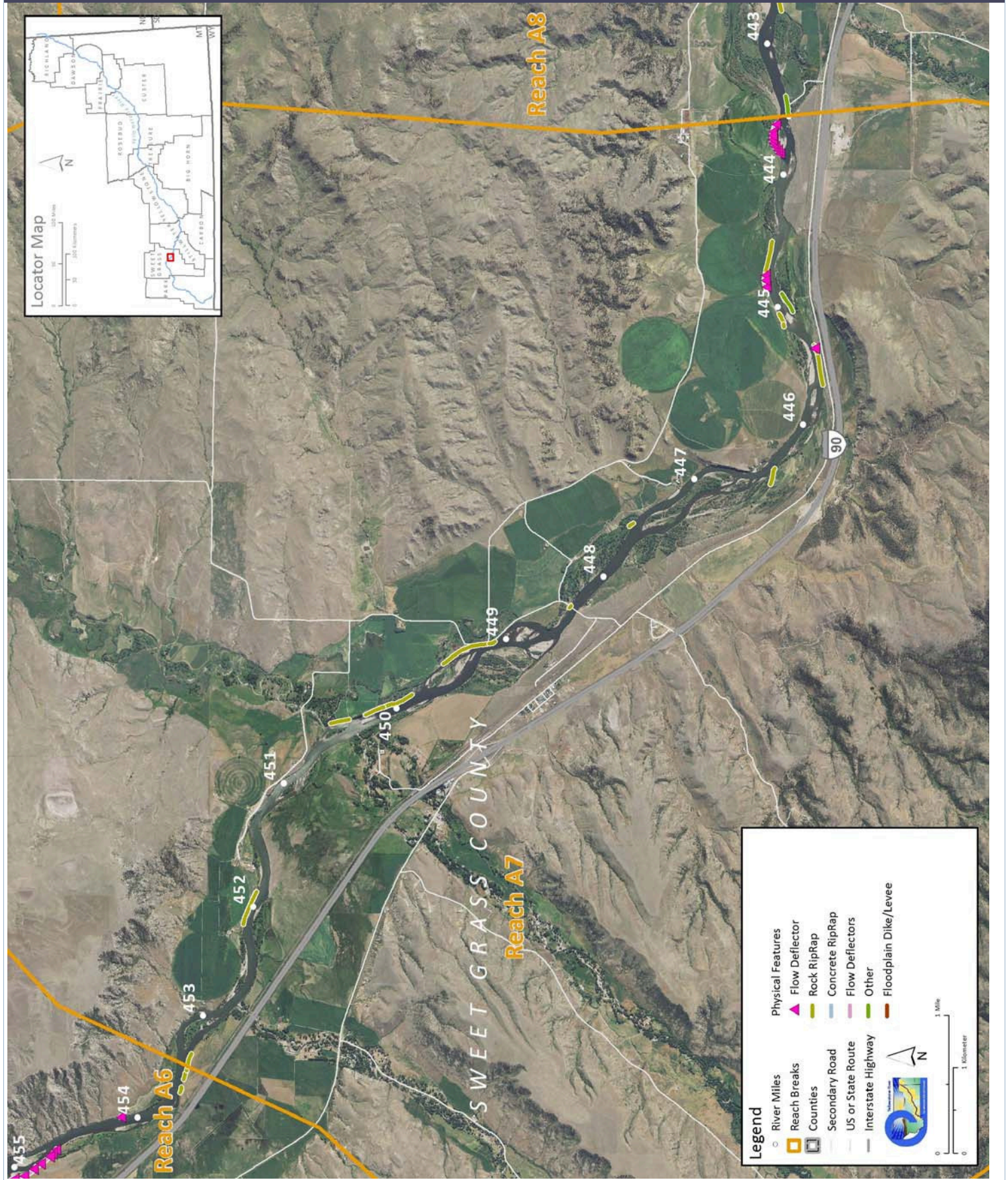


The following table summarizes some key CEA results that have been used to describe overall condition and types of human influences affecting the river. The values are specific to this single reach. Blanks indicate that a particular value was not available for this area. This information is consolidated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

<b>Discharge</b>	<b>Undev.</b>	<b>Developed</b>	<b>% Change</b>	<b>"Undeveloped" flows represent conditions prior to significant human development, whereas "developed" flows reflect the current condition of both consumptive and non-consumptive water use.</b>		
2 Year (cfs)	25,600	25,100	-2.0%			
100 Year (cfs)	47,400	47,100	-0.6%			
<b>Bankfull Channel Area (Ac)</b>	<b>1950</b>	<b>1976</b>	<b>1995</b>	<b>2001</b>	<b>1950-2001</b>	<b>Bankfull channel area is the total footprint of the river inundated at approx. the 2-year flood.</b>
	613.3	627.0	632.6	722.7	109.3	
<b>Physical Features</b>	<b>2011 Length (ft)</b>	<b>% of Bankline</b>	<b>2001-2011 Change</b>	<b>There are additional types of bank armor such as car bodies and steel retaining walls, but they are relatively minor.</b>		
Rock Riprap	11,254	10.8%	2,338			
Concrete Riprap	0	0.0%	0			
Flow Deflectors	1,507	1.4%	226			
<b>Total</b>	<b>12,761</b>	<b>12.2%</b>	<b>2,564</b>			
<b>Length of Side Channels Blocked (ft)</b>	<b>Pre-1950s</b>	<b>Post-1950s</b>	<b>Numerous side channels have been blocked by small dikes.</b>			
	4,756	4,610				
<b>Floodplain Turnover</b>	<b>1950 - 1976</b>	<b>1976 - 2001</b>	<b>1950-2001 In-channel riparian encroachment (negative number indicates retreat)</b>	<b>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.</b>		
Total Acres	89.2	138.5	-3.83 acres			
Acres/Year	3.4	5.5				
Acres/Year/Valley Mile	0.4	0.6				
<b>Open Bar Area</b>	<b>Point Bars</b>	<b>Bank Attached</b>	<b>Mid-Channel</b>	<b>Total</b>	<b>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.</b>	
<b>Change in Area '50 - '01 (Ac)</b>						
<b>Floodplain Isolation</b>	<b>Acres</b>	<b>% of FP</b>	<b>Floodplain isolation refers to area that historically was flooded, but has become isolated do to flow alterations or physical features such as levees.</b>			
5 Year	62.2	25%				
100 Year	12.6	2%				
<b>Restricted Migration Area</b>	<b>Acres</b>	<b>% of CMZ</b>	<b>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.</b>			
	164.2	10%				
<b>Land Use</b>	<b>1950</b>	<b>2011</b>	<b>1950</b>	<b>2011</b>	<b>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.</b>	
Agricultural Land (Ac)	5,652.9	5,154.6	Flood (Ac)	2,027.4	1,465.8	
Ag. Infrastructure (Ac)	77.6	167.7	Sprinkler (Ac)	0.0	224.5	
Exurban (Ac)	17.2	138.4	Pivot (Ac)	0.0	913.8	
Urban (Ac)	0.0	0.0				
Transportation (Ac)	110.1	295.9				
<b>1950s Riparian Vegetation Converted to a Developed Land Use (ac)</b>	<b>To Irrigated</b>	<b>To Other Use</b>	<b>Total Rip. Converted</b>	<b>% of 1950s Rip.</b>	<b>Changes in the extents of riparian vegetation are influenced by land use changes within the corridor.</b>	
	22.8	9.7	32.5	5.0%		
<b>National Wetlands Inventory</b>	<b>Acres</b>	<b>Acres per Valley Mi</b>	<b>Total Wetland Acres</b>	<b>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).</b>		
Riverine	14.1	1.6	<b>113.2</b>			
Emergent	56.6	6.2				
Scrub/Shrub	42.5	4.7				
<b>Russian Olive (2001) (Appx. 100-yr Floodplain)</b>	<b>Acres</b>	<b>%</b>	<b>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.</b>			
	0.5	0.0%				
<b>Riparian Forest at low risk of Cowbird Parasitism (Ac/Valley Mile)</b>	<b>1950</b>	<b>1976</b>	<b>2001</b>	<b>Change 1950-2011</b>	<b>Cowbirds are associated with agricultural and residential development, displacing native bird species by parasitizing their nests.</b>	
	9.0	1.3	0.0	-9.0		



## PHYSICAL FEATURES MAP (2011)





## CHANNEL MIGRATION ZONE MAP

