

County	Custer	Upstream River Mile	185
Classification	PCS: Partially confined straight	Downstream River Mile	180.5
General Location	Miles City; Tongue River confluence	Length	4.50 mi (7.24 km)

Narrative Summary

Reach C17 is 4.5 miles long and is in Miles City. Through town the Yellowstone River is a Partially Confined Reach type as the river flows on the north edge of town against high bluffs of the Fort Union Formation.

As of 2011 there were just under two miles of armor protecting 21 percent of the total bankline in Reach C17, including 7,300 feet of rock riprap, 2,400 feet of concrete riprap, and less than a hundred feet of flow deflectors. Over 2,700 feet of rock riprap has been constructed in the reach since 2001. Most of the armor is on the right bank through town. The rock riprap is protecting either urban areas (2,540 feet) the railroad (2,040 feet), or agricultural lands (2,400 feet). The concrete riprap is all protecting agricultural land. Reach C17 also has over three miles of mapped floodplain dikes and levees, much of which is the Miles City Levee that is on the right bank of the river through town.

Prior to 1950, about 1,500 feet of side channel was blocked in Reach C17. This channel was actually the lowermost part of the Tongue River, which was re-routed to the Yellowstone and abandoned through what is now Miles City.

Ice jams have been a major issue in Miles City. The ice jam database records 24 ice jams in Reach C17 between 1934 and 2011. Most of the jams occurred in March, with a few in February and one in April in 1950. Damages associated with the jams include damages to the Miles City dike, damaged water gages, flooding, and evacuations.

The levees in Miles City coupled with flow alterations have isolated 683 acres, or 74 percent of the 100-year floodplain in the reach. Isolation of the 5-year floodplain has been similar; 286 acres or 78 percent of the 5-year floodplain has become isolated at that frequency event. Most of the 5-year floodplain isolation is along the historic Tongue River channel that has been cut off from the river.

Bank armor and levees on the south side of the river has narrowed the natural Channel Migration Zone of the river. About 540 acres which represents 40 percent of the total CMZ has become restricted by physical features.

One dump site was mapped on the right bank just below the Highway 59 Bridge at RM 184.

As an urban reach, the riparian corridor had already been largely impacted by 1950. Since then, however, almost 100 acres of additional riparian area has been cleared, representing 23 percent of the entire 1950s riparian footprint. With this clearing, the reach has seen a substantial loss of forest area considered at low risk of cowbird parasitism. In 1950, the reach had 9.1 acres of such forest per valley mile and by 2001 that forest extent had dropped to 0 acres per valley mile.

A hydrologic evaluation of flow depletions indicates that flow alterations over the last century have been major in this reach. The 100-year flood has dropped by 19 percent and the 2-year flood, which strongly influences overall channel form, has dropped by 24 percent. Low flows have also been impacted; severe low flows described as 7Q10 (the lowest average 7-day flow anticipated every ten years) for summer months has dropped from an estimated 5,100 cfs to 3,180 cfs with human development, a reduction of 37 percent. More typical summer low flows, described as the summer 95% flow duration, have dropped from 6,730 cfs under unregulated conditions to 3,530 cfs under regulated conditions, a reduction of 48 percent.

Fall and winter base flows have increased in Reach C17 by about 60 percent.

CEA-Related observations in Reach C17 include:

- Side channel blockage with urbanization
- Extensive armoring with urbanization

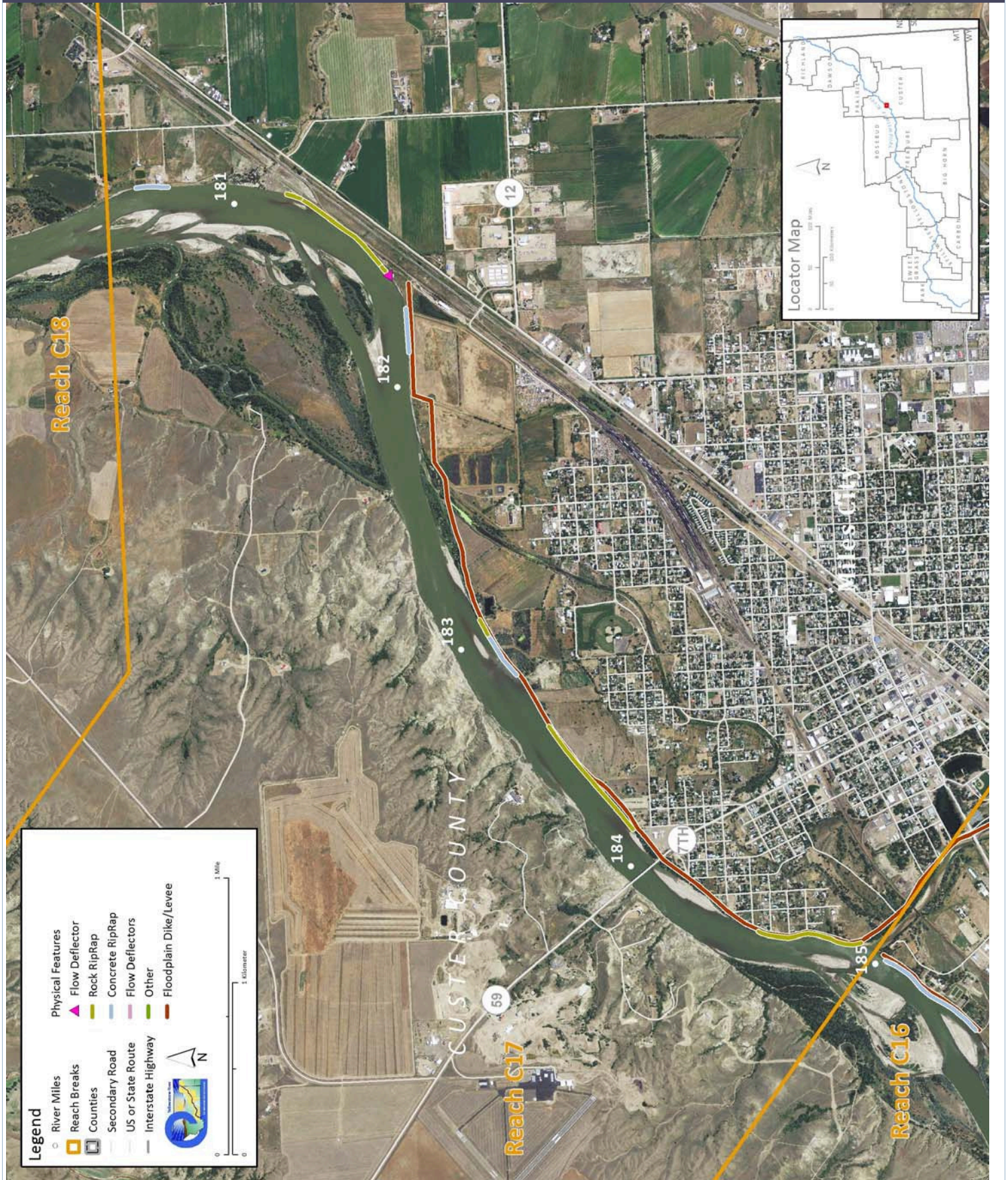
Recommended Practices (may include Yellowstone River Recommended Practices--YRRPs) for Reach C17 include:

- CMZ Management due to extent of CMZ restriction (41 percent)
- Dump removal on right bank at RM 184R
- Russian olive removal

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)	63,400	48,200	-24.0%			
100 Year (cfs)	117,000	94,400	-19.3%			
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.
	485.6	470.6	452.1	455.9	-29.7	
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	7,294	15.5%	2,714			
Concrete Riprap	2,397	5.1%	-3			
Flow Deflectors	92	0.2%	92			
Total	9,784	20.8%	2,803			
Length of Side Channels Blocked (ft)	Pre-1950s	Post-1950s	Numerous side channels have been blocked by small dikes.			
	1,466	0				
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	32.5	34.8	50.08 acres			
Acres/Year	1.2	1.4				
Acres/Year/Valley Mile	0.3	0.3				
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)	2.3	26.2	0	28.6		
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	258.5	78%				
100 Year	682.7	74%				
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.			
	540.1	40%				
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)	2,011.1	1,539.5	Flood (Ac)	824.7	609.4	
Ag. Infrastructure (Ac)	31.4	65.2	Sprinkler (Ac)	0.0	0.0	
Exurban (Ac)	30.2	477.1	Pivot (Ac)	0.0	0.0	
Urban (Ac)	1,177.2	1,212.0				
Transportation (Ac)	86.6	61.2				
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.	
	21.6	75.5	97.1	23.0%		
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	18.5	4.6	67.6			
Emergent	48.4	12.0				
Scrub/Shrub	0.7	0.2				
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.			
	66.5	2.6%				
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.	
	9.1	2.6	0.0	-9.1		

PHYSICAL FEATURES MAP (2011)



CHANNEL MIGRATION ZONE MAP

