

County	Park	Upstream River Mile	535
Classification	PCA: Partially confined anabranching	Downstream River Mile	529
General Location	Six Mile Cr to Grey Owl	Length	6.00 mi (9.66 km)

Narrative Summary

Reach PC7 extends from the mouth of Six Mile Creek to the Grey Owl fishing access site. It is six miles long and is classified as a Partially Confined Anabranching (PCA) channel type. This indicates that the reach supports side channels and wooded islands, and intermittently flows along the edge of the stream corridor. The relatively complex reach type is evidenced by the relative broad Channel Migration Zone (CMZ) footprint, which is typically about 1500 to 2500 feet wide in this reach. In comparison, Reach PC6 just upstream has a CMZ that is typically about 500 feet wide. There are a total of 1,171 acres of stream corridor within the CMZ in Reach PC7. About 6 percent of that area has been restricted by bank armor.

Reach PC7 has over 8,800 feet of rock riprap and 550 feet of flow deflectors, which collectively armors about 15 percent of the total bankline. Of those 9,350 feet of armor, about 350 feet were constructed since 2001. Since 1950, one side channel that is 2,950 feet long was blocked by a dike at RM 532. This isolated channel is located just upstream of the Emigrant Bridge on the east floodplain, and has been identified as a potential side channel restoration area. In the upstream portion of the reach at RM 534, the Park Branch Canal diverts water from a long side channel that has been active since at least the 1950s.

Land use conversions in Reach PC7 have seen a reduction in flood irrigation that has been accompanied by about 67 acres of development of sprinkler and pivot irrigation systems. That said, this reach has experienced major exurban growth, from 0 acres in 1950 to 298 acres in 2011. Most of that growth reflects rural subdivision development on the glacial outwash terraces above the active stream corridor. There is one boat ramp on the right bank just above the Emigrant Bridge at the Emigrant Fishing Access Site, and just below the bridge, there is a ~72 acre fishing access site without boating facilities on the west side of the river (Emigrant West).

Reach PC7 contains over 200 acres of emergent wetlands, many of which appear to be associated with groundwater seepage from the base of the glacial terraces on the east side of the river, and ditch seepage on the west side of the river. These areas tend to be utilized as non-irrigated hay/pasture ground.

About 1.5 acres of Russian olive have been mapped in Reach PC7, which is a dramatic increase relative to upstream reaches.

This area of the upper Yellowstone River has seen three severe floods in the last 20 years. The 1996 and 1997 floods were very damaging, early-June events that peaked at 37,100 and 38,000 cfs, respectively. At the time, these were considered to be sequential 100-year floods. Then in late June of 2011, the river peaked at 40,600 cfs, which is currently the flood of record at Livingston. This flood exceeded a 100-year event, with both the 1996/1997 events considered to have exceeded a 75-year flood.

A hydrologic evaluation of flow depletions indicates that flow alterations over the last century have been relatively small in this reach. 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 1,340 cfs to 1,320 cfs with human development, a reduction of 1.5 percent.

CEA-Related observations in Reach PC7 include:

- Conversion of agricultural land to exurban development
- Post-1950s side channel blockage with identified restoration potential
- Sharp increase in Russian olive extent relative to upstream reaches

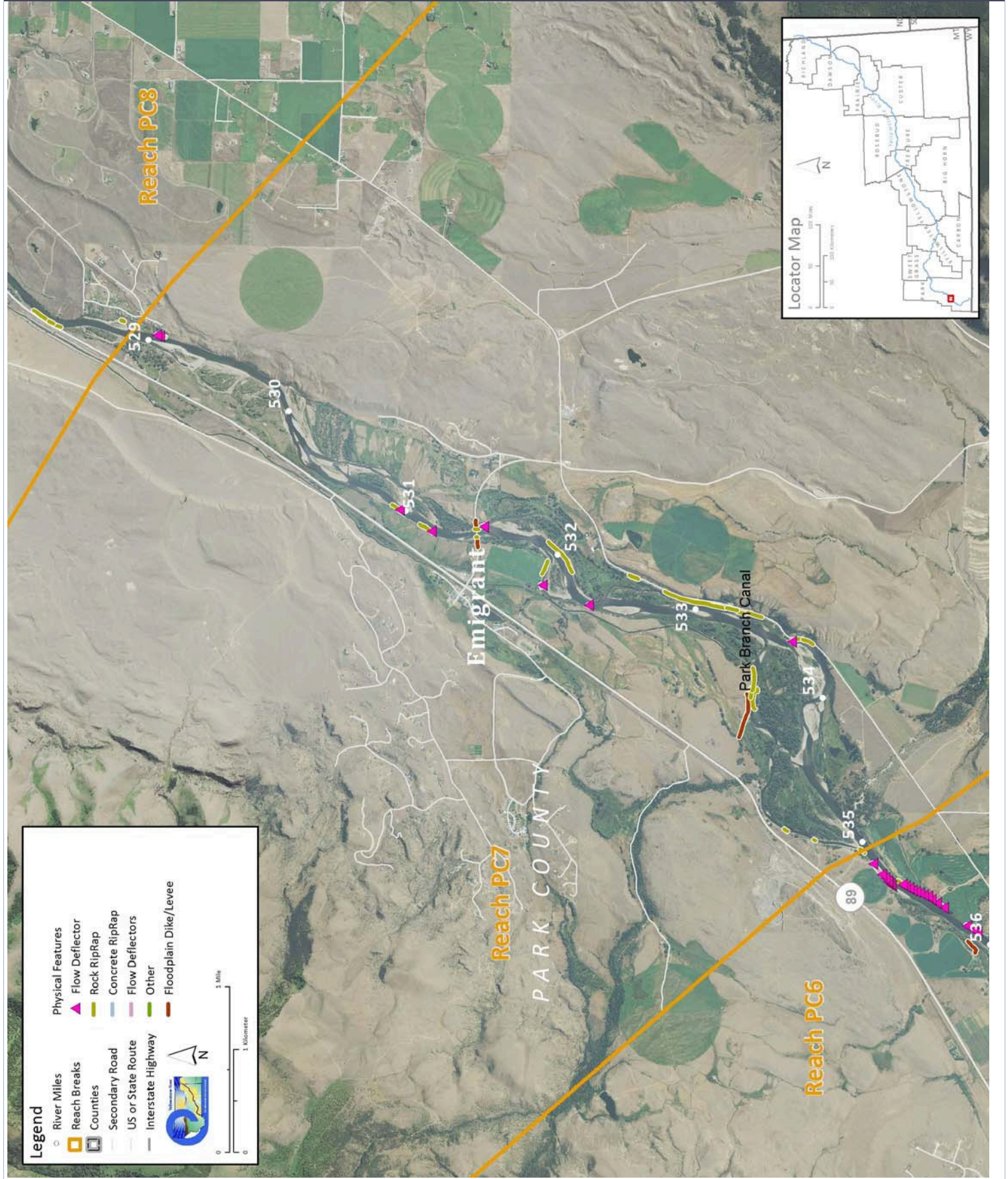
Recommended Practices (may include Yellowstone River Recommended Practices--YRRPs) for Reach PC7 include:

- Side Channel Restoration at RM 532R.
- Diversion Infrastructure Management at Park Branch Canal, RM 535.5
- 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)	19,100	19,000	-0.5%			
100 Year (cfs)	36,000	36,000	0.0%			
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.
	468.5			449.4	-19.1	
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	8,840	13.6%	301			
Concrete Riprap	0	0.0%	0			
Flow Deflectors	556	0.9%	54			
Total	9,396	14.4%	354			
Length of Side Channels Blocked (ft)	Pre-1950s	Post-1950s	Numerous side channels have been blocked by small dikes.			
	0	2,950				
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 Acres/Year/Valley Mile			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						
100 Year						
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.			
	74.3	6%				
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)	1,902.0	1,508.7	Flood (Ac)	414.7	170.0	
Ag. Infrastructure (Ac)	60.5	95.1	Sprinkler (Ac)	0.0	50.5	
Exurban (Ac)	24.9	297.7	Pivot (Ac)	0.0	16.9	
Urban (Ac)	0.0	0.0				
Transportation (Ac)	38.7	58.5				
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.	
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	12.1	2.1	328.5			
Emergent	203.9	36.0				
Scrub/Shrub	112.5	19.9				
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.			
	1.5	0.2%				
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.	

PHYSICAL FEATURES MAP (2011)



CHANNEL MIGRATION ZONE MAP

