County	Park	**Upstream River Mile**	546.8
Classification	CM: Confined meandering	**Downstream River Mile**	543.2
General Location	Carbella to Hwy 89 Br.	**Length**	3.60 mi (5.79 km)

Narrative Summary

Reach PC4 extends from Carbella to the Highway 89 Bridge at Point of Rocks in the upper Paradise Valley. The reach is classified as confined meandering, indicating that it has some sinuosity, yet migration rates are low due to lateral confinement.

Flow deflectors and rock riprap cover about 800 feet of bankline in Reach PC4, which is about 2 percent of the total streambank length. All of this armor was in place prior to 2001.

Similar to other reaches in Park County, the extent of flood irrigation has dropped in the reach since 1950, and the amount of sprinkler and pivot irrigation has increased. Reach PC4 has seen a net expansion of about 150 acres of irrigated lands since 1950, with about half of the expansion into sprinkler irrigation and the other half into pivot.

Reach PC4 marks the entrance of the Yellowstone River into the Paradise Valley. This is geomorphically indicated by the onset of point bar formation and sediment storage in the channel. One large bar deposit located about ¾ mile of the Highway 89 bridge has driven almost 300 feet of bank movement since 1950. As result, the Channel Migration Zone area in this reach has expanded relative to upstream, with an erosion buffer of 258 feet assigned to the alluvial edge of the river. Reach PC4 also has over 2,000 feet of active side channels.

This area of the upper Yellowstone River basin experienced three severe floods in the last 20 years. The largest floods were in 1996 and 1997, when the 32,200 cfs peak flow measured at the Corwin Springs gage exceeded a 100-year flood for those two years in a row. The 1974 and 2011 floods were major as well, with both events exceeding 30,000 cfs. The Corwin Springs gage is located upstream of Reach PC4 at the Corwin Springs Bridge.

CEA-Related observations in Reach PC4 include:
- Increased bank migration and Channel Migration Zone area entering Paradise Valley
- Net expansion of irrigated lands

No reach-specific Practices have been identified for this reach.

Yellowstone River Reach Narratives — Reach PC4

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
2 Year (cfs)	19,100	19,000	-0.5%
100 Year (cfs)	36,000	36,000	0.0%

"Undeveloped" flows represent conditions prior to significant human development, whereas "developed" flows reflect the current condition of both consumptive and non-consumptive water use.

Bankfull Channel Area (Ac)

1950	1976	1995	2001	1950-2001
180.7			163.9	-16.8

Bankful channel area is the total footprint of the river inundated at approx. the 2-year flood.

Physical Features

	2011 Length (ft)	% of Bankline	2001-2011 Change
Rock RipRap	367	1.0%	0
Concrete Riprap	0	0.0%	0
Flow Deflectors	434	1.1%	0
Total	**801**	**2.1%**	**0**

There are additional types of bank armor such as car bodies and steel retaining walls, but they are relatively minor.

Length of Side Channels Blocked (ft)

Pre-1950s	Post-1950s
0	0

Numerous side channels have been blocked by small dikes.

Floodplain Turnover

	1950 - 1976	1976 - 2001	1950-2001 In-channel riparian encroachment (negative number indicates retreat)
Total Acres			acres
Acres/Year			
Acres/Year/Valley Mile			

The rate of floodplain turnover reflects how many acres of land are eroded by the river. Tunover is associated with the creation of riparian habitat.

Open Bar Area

	Point Bars	Bank Attached	Mid-Channel	Total
Change in Area '50 - '01 (Ac)				

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.

Floodplain Isolation

	Acres	% of FP
5 Year		
100 Year		

Floodplain isolation refers to area that historically was flooded, but has become isolated do to flow alterations or physical features such as levees.

Restricted Migration Area

Acres	% of CMZ
2.7	1%

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.

Land Use

	1950	2011
Agricultural Land (Ac)	1,471.0	1,442.7
Ag. Infrastructure (Ac)	8.0	3.8
Exurban (Ac)	0.0	23.2
Urban (Ac)	0.0	0.0
Transportation (Ac)	29.4	43.6

	1950	2011
Flood (Ac)	62.7	8.6
Sprinkler (Ac)	0.0	84.6
Pivot (Ac)	0.0	96.7

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.

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
Riverine	0.0	0.0
Emergent	5.5	1.7
Scrub/Shrub	25.0	7.6

Total Wetland Acres: **30.5**

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).

Russian Olive (2001) (Appx. 100-yr Floodplain)

Acres	%
0.0	0.0%

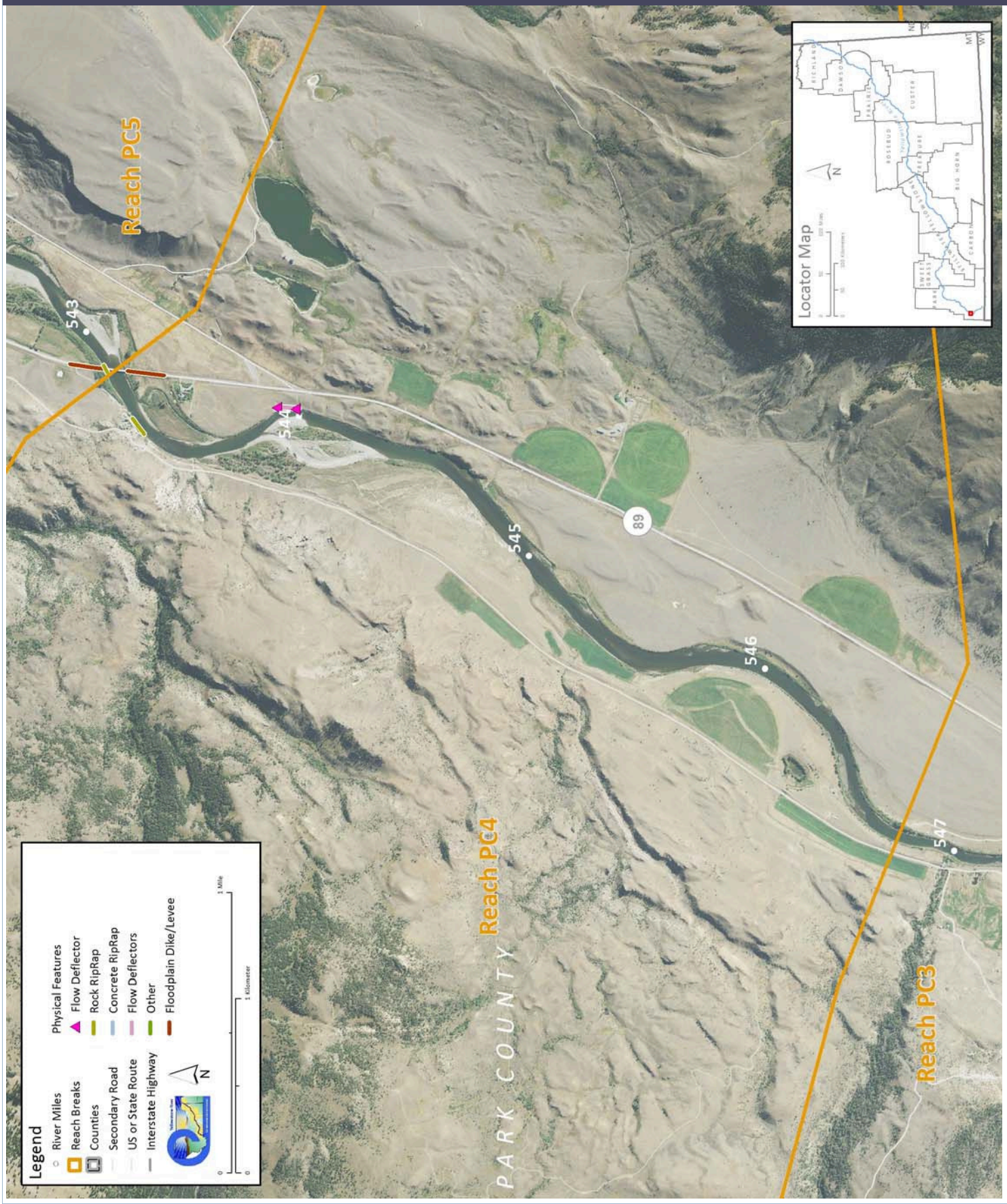
Russian olive is considered an invasive species and its presence in the corridor is fairly recent. Its spread can be used as a general indicator of invasive plants within the corridor.

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