

<b>County</b>	Stillwater	<b>Upstream River Mile</b>	400
<b>Classification</b>	PCA: Partially confined anabranching	<b>Downstream River Mile</b>	392.4
<b>General Location</b>	Park City	<b>Length</b>	7.60 mi (12.23 km)

## Narrative Summary

Reach A16 is 7.6 miles long and is located just south of Park City. The reach is a Partially Confined Anabranching reach type, indicating some valley wall influences as well as relatively extensive forested islands. The partial geologic confinement within Reach A16 is created by interbedded sandstone and shale. In addition, both low and high alluvial terraces intermittently form the active river corridor margin.

Approximately 9 percent of the bankline in Reach A16 is armored, and the armor is almost entirely rock riprap, some short sections of concrete armor and flow deflectors. The armor is located almost entirely on the northern corridor margin, against terrace margins. Its use is split evenly between protecting agricultural and exurban residential land uses. On the upstream end of the reach, rock armor protects the Italian Ditch Diversion and Canal, which divert water on the north bank of the river at RM 400. Over four miles of floodplain dikes have been mapped in the reach, most of which follow ditches on the north floodplain.

Although there is no evidence that side channels have been intentionally blocked off in Reach A16, there has still been a net loss of over a mile of side channel since 1950. Similar to most reaches in Region A, the loss of side channels has been accompanied by an overall increase in the total channel footprint; since 1950, the bankfull channel area of Reach A16 has increased by 40 acres.

Land use in Reach A16 is almost entirely agricultural, although there are almost 300 acres of urban/exurban development in the mapping footprint. There are corrals that are part of an animal handling facility within 1,000 feet of an abandoned river swale at RM 395. Over a thousand acres under of ground in Reach A16 are under flood irrigation, and about 11 are in pivot. About 150 acres of developed land are in the Channel Migration Zone, and almost 40 acres of that is in urban/exurban development. About 6 percent of the total CMZ is restricted by bank armor and dikes.

There is one pipeline crossing in Reach A16. It crosses under the river at RM 396.7 and consists of a 24 inch crude oil pipeline that is owned by Kinder Morgan Pipelines. This pipeline was horizontally drilled during its installation.

Reach A16 was sampled as part of the avian study. The average species richness in Reach A16 was 8.5, which indicates the average number of species observed during site visits to the reach in cottonwood habitats. The average species richness for all sites evaluated is 8. An average of one cowbird was observed during the field sampling visits. Reach A16 has lost about one half of its riparian forest considered at low risk of cowbird parasitism since 1950. At that time, there were about 12 acres of forest per valley mile considered to be isolated enough from agricultural infrastructure and urban/exurban development to be considered at low risk. By 2011, about 6.6 acres considered low risk remained.

There are over 250 acres of mapped wetland in the reach, with most of that emergent marshes and wet meadows. Many of these wetland areas occupy old river swales on the floodplain north of the river, or abandoned channels in the active corridor.

The reach has extensive Russian olive, with almost 30 acres of mapped footprint in 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 16,900 cfs to 15,500 cfs, a drop of about 8 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 2,310 cfs to 1,780 cfs with human development, a reduction of 23 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.

CEA-Related observations in Reach A16 include:

- Passive loss of over a mile of side channel
- Russian olive colonization in abandoned side channels
- Emergent wetland development in abandoned side channels

Recommended Practices (may include Yellowstone River Recommended Practices--YRRPs) for Reach A16 include:

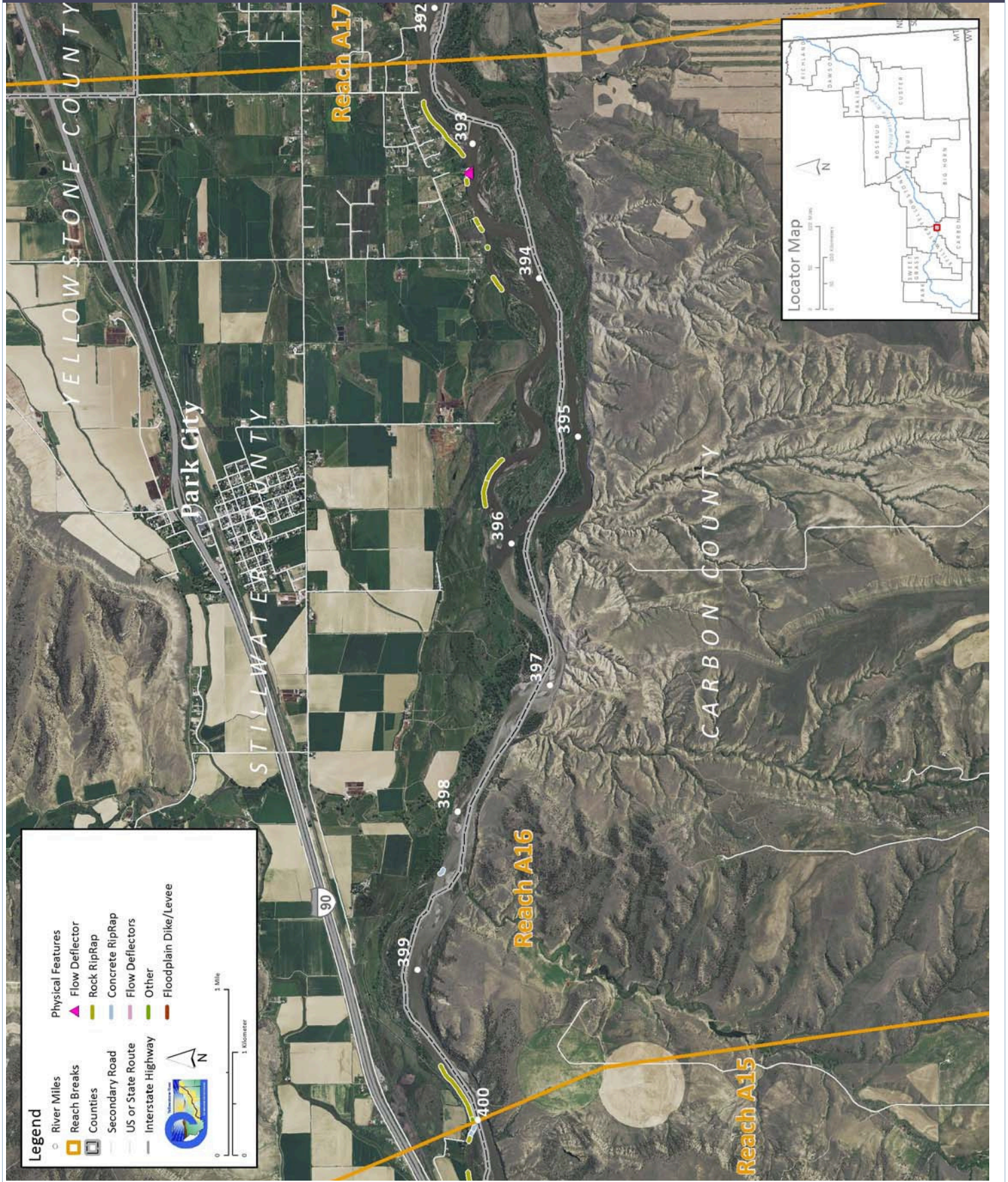
- Diversion structure management at Italian Ditch Diversion RM 400
- Nutrient management at corrals that are part of an animal handling facility at RM 395.
- Russian olive removal (29 acres)
- Wetland management/restoration due to extent of mapped emergent wetland (214 acres emergent, 270 acres total wetland)

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)	32,200	30,600	-5.0%			
100 Year (cfs)	58,600	57,600	-1.7%			
<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>
	746.5	772.1	676.5	812.6	66.1	
<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	6,789	8.4%	2,351			
Concrete Riprap	9	0.0%	-158			
Flow Deflectors	128	0.2%	128			
<b>Total</b>	<b>6,926</b>	<b>8.5%</b>	<b>2,321</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>			
	0	0				
<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	203.1	214.4	-4.96 acres			
Acres/Year	7.8	8.6				
Acres/Year/Valley Mile	1.2	1.3				
<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	42.3	13%				
100 Year	0.0	0%				
<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>			
	104.4	5%				
<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)	4,008.9	3,532.8	Flood (Ac)	1,587.8	1,095.2	
Ag. Infrastructure (Ac)	70.7	132.8	Sprinkler (Ac)	0.0	0.0	
Exurban (Ac)	0.0	268.0	Pivot (Ac)	0.0	10.6	
Urban (Ac)	0.0	0.0				
Transportation (Ac)	21.5	73.5				
<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>	
	7.2	3.5	10.6	1.0%		
<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	10.7	1.6	<b>268.0</b>			
Emergent	214.0	32.0				
Scrub/Shrub	43.3	6.5				
<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>			
	28.7	1.8%				
<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>	
	12.1	14.5	6.6	-5.5		



## PHYSICAL FEATURES MAP (2011)





## CHANNEL MIGRATION ZONE MAP

