County	Custer	**Upstream River Mile**	177.3
Classification	CS: Confined straight	**Downstream River Mile**	166.2
General Location	Kinsey Bridge	**Length**	11.10 mi (17.86 km)
General Comments	Confined		

Narrative Summary

Reach C19 is 11.1 miles long and is located downstream of Miles City at Kinsey Bridge. It is a Confined Straight reach type, as the river flows over steep bedrock shelves that create a series of rapids between Miles City and a few miles below Kinsey Bridge.

There are approximately 4,000 feet of rock riprap in the reach, about one third of which was built since 2001. All of the armor is protecting the rail line on the south side of the river. By 1950 over three miles of side channels had been blocked off by small floodplain dikes in Reach C19. These old side channels are on both sides of the river just upstream of Kinsey Bridge. Bank migration rates are very low in the reach, and as a result the Channel Migration Zone (CMZ) is unusually narrow.

The Kinsey Main Canal diversion and pump station are located on the left bank at RM 175. The site consists of a rock diversion that extends about 200 feet into the river at an upstream angle to deflect flows into an excavated approach channel and pumping station. Kinsey Bridge is located at RM 172.1 and consists of a Steel multi-beam structure that was built in 1907 for the Milwaukee Railroad, but now supports County Road 62. It is just over 1,000 feet long and has four spans.

The 2001 physical features inventory also identified 7,200 feet of bedrock outcrop in the reach. A total of five discreet sets of rapids were mapped in the reach, including Buffalo Shoals (RM 176 and RM 177), Matthew Rapids (RM 174.5), and two unnamed rapids upstream and downstream of Kinsey Bridge at RM 172.5 and RM 171, respectively.

On the downstream end of the reach, an 8-inch Cenex pipeline that carries petroleum products flows parallel to the river on the landward side of the active BNSF rail line. The pipeline is about 400 feet away from the active riverbank at RM 166.5, but the fact that the rail line sits between the pipeline and the river suggests that its risk of exposure is low.

Between 1950 and 2001 there was about 89 net acres of riparian encroachment into the channel, and the bankfull channel area decreased by ~100 acres, indicating a diminishing river size over the last half-century. This trend is common below the mouth of the Bighorn River, where flow alterations have reduced peak flows and cause the active river channel to shrink. Consumptive water uses, primarily associated with irrigation, have contributed to the reduced flows.

About 13 percent of the total 100-year floodplain has become isolated due to human development, and most of the isolation appears to be due to flow alterations rather than floodplain dikes. The 5-year floodplain is even more affected; 55 percent of the historic 5-year floodplain is no longer inundated at that frequency.

Two ice jams have been reported in Reach C19; one in March of 1994 at RM 168 and the other in February of 1997 at RM 174. No damages were reported.

Land use is dominated by agriculture (~4,700 acres), with 326 acres of pivot irrigation development since 1950. There is one Fishing Access Site at Kinsey Bridge. There are two animal handling facilities north of the river that are within several hundred feet of the streambank; both are downstream of Kinsey Bridge, at RM 166.2 and RM 167.8.

There are 254 acres of Russian olive in the reach, most of which is on the north side of the river away from the bluff line to the south. Russian olive comprises almost 30 percent of all of the mapped shrubs in the reach. There are notably high concentrations of Russian olive in one of the abandoned side channels that is located on the left bank just downstream from the Kinsey Main Canal diversion.

A hydrologic evaluation of flow depletions indicates that flow alterations over the last century have been major in this reach. 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 5,080 cfs to 3,150 cfs with human development, a reduction of 38 percent. More typical summer low flows, described as the summer 95% flow duration, have dropped from 6,740 cfs under unregulated conditions to 3,510 cfs under regulated conditions, a reduction of 48 percent.

CEA-Related observations in Reach C19 include:
•Side channel blockages pre-1950
•Russian olive colonization, especially in blocked side channels
•Armoring needs by the railroad on the south bluff line
•Low natural rates of bank movement in reach with extensive bedrock exposure and rapids

Recommended Practices (may include Yellowstone River Recommended Practices--YRRPs) for Reach C19 include:
•Side channel reactivation at RM 175L and RM 174R
•Russian olive removal
•Nutrient management at animal handling facilities at RM 166.2L and RM 167.8L

PHYSICAL FEATURES MAP (2011)

HYDROLOGIC SUMMARY

Hydrologic data available for the Reach Narratives include data from representative gaging stations, modeling from the COE from the Big Horn river upstream, and modeling by the USGS for the Big Horn River to the Missouri River confluence. Gaging stations that best represent the watershed area within any reach are used to describe the flood history within the reach. Hydrology modeling results generated for all reaches provides unregulated and regulated flow values. Seasonal and annual flow duration data generated by the USGS are available for reaches C10 through D13.

Gage Representation (Gage-Based): Miles City

Flood History

Year	Date	Flow on Date	Return Interval
1974	Jun 22	75,400	10-25 yr
1997	Jun 15	83,300	10-25 yr
1943	Jun 26	83,700	10-25 yr
2011	May 24	85,400	10-25 yr
1944	Jun 19	96,300	50-100 yr
1978	May 22	102,000	50-100 yr

	Downstream Gage	Upstream Gage
Gage No	6329500	6309000
Location	Sidney	Miles City
Period of Record	1911-2015	1929-2015
Distance To (miles)	135.4	6.7

Discharge

	1.01 Yr	2 Yr	5 Yr	10 Yr	50 Yr	100 Yr	500 Yr	7Q10 Summer	95% Sum. Duration
Unregulated		63,700	79,500	89,400	110,000	119,000	138,000	5,080	6,740
Regulated		48,500	63,300	72,100	89,400	96,100	110,000	3,150	3,510
% Change		-23.86%	-20.38%	-19.35%	-18.73%	-19.24%	-20.29%	-37.99%	-47.92%

Flow Duration

Streamflow, in ft3/s, which was equaled or exceeded for indicated percent of time

Note that these statistics are only available from Reach C10 downstream. See the USGS report for detailed information.

Season		5%	50%	95%
Spring	Unregulated	62,300	23,400	6,460
	Regulated	48,000	14,000	4,660
	% Change	**-23%**	**-40%**	**-28%**
Summer	Unregulated	44,400	14,000	6,740
	Regulated	33,400	8,570	3,510
	% Change	**-25%**	**-39%**	**-48%**
Fall	Unregulated	9,410	5,750	2,320
	Regulated	10,800	7,120	3,740
	% Change	**15%**	**24%**	**61%**
Winter	Unregulated	12,500	5,180	2,080
	Regulated	13,200	6,250	3,340
	% Change	**6%**	**21%**	**61%**
Annual	Unregulated	46,900	8,330	2,870
	Regulated	35,000	7,660	3,740
	% Change	**-25%**	**-8%**	**30%**

AERIAL PHOTOGRAPHY

A variety of aerial photographic sources provide the basis for much of the Cumulative Effects Assessment analysis. The table below lists the air photos compiled for the reach and the associated discharge at the most representative USGS gaging station.

	Source	Acquisition Date	Type	Scale	Gage	Discharge
1950	USGS-EROS	26-Aug-49	B/W	1:14,800	6309000	3620
1976	USCOE	29-Sep-76	B/W	1:24,000	6309000	9520
1995	USGS DOQQ	8/1/96 - 8/25/97	B/W		6309000	15400
2001	NRCS	August 2-8, 2001	CIR	1:24,000	6309000	3500
2005	NAIP	08/05/2005	color	1-meter pixels	6309000	5620
2005	NAIP	08/04/2005	color	1-meter pixels	6309000	5550
2005	NAIP	07/08/2005	color	1-meter pixels	6309000	18800
2007	Woolpert	10/15/2007 - 11/2/0007	Color			
2009	NAIP	7/17/2009	Color	1-meter pixels	6309000	23300
2011	USCOE	October 2012	color	1-ft pixel	6309000	8100
2011	NAIP	7/16/2011	Color	1-meter pixels	6309000	57900
2013	NAIP	07/19/2013	color	1-meter pixels	6309000	

PHYSICAL FEATURES

Several efforts to capture the types and extents of physical features in the corridor have been generated by the CEA study. The 2001 Physical Features Inventory was performed through helicopter/video Rapid Aerial Assessment by the NRCS (NRCS, 2001) and did not include Park County. This inventory includes point and linear features that represent bank armor, irrigation structures, transportation encroachments, and areas of accelerated erosion. Bank armor mapped in the 2001 inventory only reflects features on the active channel margin, and thus excludes off-channel features on historic side channels. Some floodplain restriction features such as dikes and levees in the 2001 Physical Features Inventory may extend well beyond the active channel. In 2013, the 2001 inventory was revised to include Park County. At that time, some attribute inconsistencies in the original data were addressed. This dataset was then updated to reflect conditions in the 2011 NAIP imagery.

For Stillwater, Yellowstone and Dawson Counties, a Physical Features Timeline was generated that includes additional mapping based on aerial photography and assigns approximate dates of feature construction based on observed presence/absence in historic imagery between the 1950s and 2005 (DTM and AGI, 2008). The Physical Features Timeline contains features that were not mapped in the 2001 inventory (e.g. bank armor abandoned in floodplain areas by 2001). As such the total bank armor extent in the 2005 data is commonly greater than that identified in 2001 or 2013.

Note: As the goal for each physical features mapping effort were different, with differing mapping extents, there will be descrepancies between total feature lengths (e.g. length of rock riprap) in each data set.

2001 and 2011 Physical Features Bankline Inventories

Feature Class	Feature Type	2001 Length (ft)	% of Bankline	2011 Length (ft)	% of Bankline	2001-2011 Change
Stream Stabilization						
	Rock RipRap	2,569	2.2%	4,043	3.4%	1,475
	Feature Type Totals	**2,569**	**2.2%**	**4,043**	**3.4%**	**1,475**
Other In Channel						
	Bedrock Outcrop	7,237	6.2%	7,237	6.2%	0
	Feature Type Totals	**7,237**	**6.2%**	**7,237**	**6.2%**	**0**
	Reach Totals	**9,806**	**8.3%**	**11,280**	**9.6%**	**1,475**

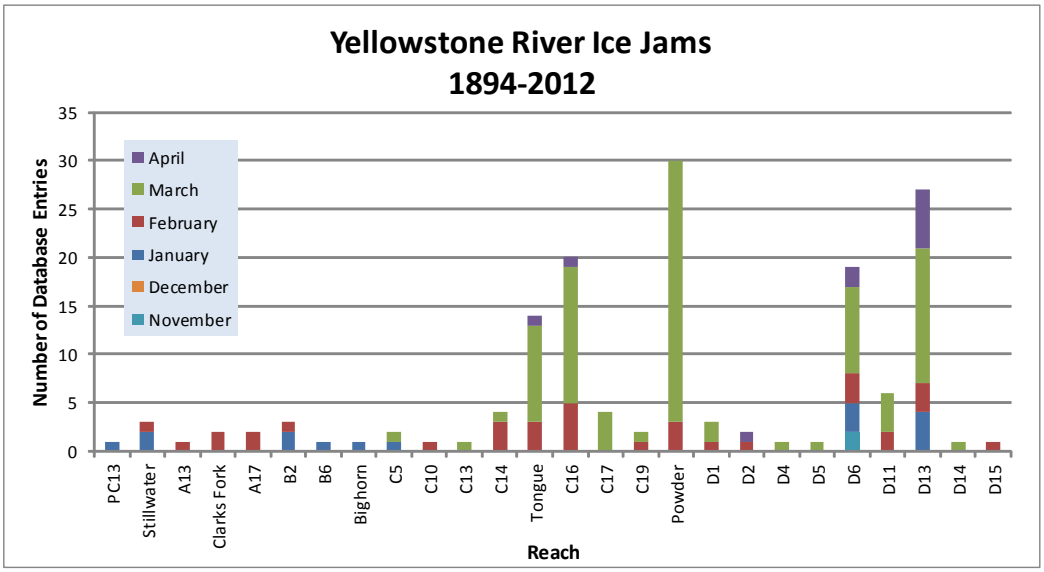
Intent of Bank Protection: 2001

The 2001 bank protection features were assessed for the 'intent' of what they protect.

Feature Type	Irrigated	Non-Irrig.	Ag. Infrastr.	Road	Interstate	Railroad	Urban	Exurban
Rock RipRap	0	0	0	0	0	2,568	0	0
Totals	**0**	**0**	**0**	**0**	**0**	**2,568**	**0**	**0**

ICE JAMS

Ice jam data were obtained from the National Ice Jam Database maintained by the Ice Engineering Group at Army Corps of Engineers Cold Regions Research and Engineering Laboratory (https://rsgis.crrel.usace.army.mil/icejam/). From this database, Yellowstone River ice jams are summarized by reach in the Yellowstone River Historic Events Timeline (DTM and AGI, 2008b). The basic information for each ice jam is presented as a list of events. The graph represents the number of database entries for a reach. Note that a single jam event may have multiple entries.



Jam Date	Jam Type	River Mile	Damages
3/5/1994	NA	168	?
2/19/1997	NA	174	?

GEOMORPHIC

The geomorphology data presented below consist of measured changes in Braiding Parameter since 1950 and blocked side channels. Braiding parameter is a measure of the total length of side channels relative to that of the main channel. The braiding parameter is calculated as the sum of anabranching and primary channel lengths divided by the primary channel length. Secondary channels within the bankfull margins are a function of flow stage and hence were not included in the braiding parameter calculation. If a reach has a braiding parameter of 3, then the total bankfull channel length is three times that of the main channel. The mean braiding parameter measured for all 88 reaches is 1.8.

Blocked side channels that were either plugged with a small dike or cutoff by larger features such as a levee or road prism were identified for the pre and post-1950s eras.

Additional geomorphic parameters are discussed in more detail in the study report and appendices.

Braiding (Bankfull)

	Primary Chan. Length (ft)	Anab. Ch. Length (ft)	Bankfull Braiding Parameter		% Change in Braiding
1950	58,436	4,394	1.08	1950 to 1976:	4.37%
1976	58,444	7,142	1.12	1976 to 1995:	0.97%
1995	58,737	7,818	1.13	1995 to 2001:	5.77%
2001	58,737	11,656	1.20	1950 to 2001:	11.46%
Change 1950 - 2001	**301**	**7,262**	**0.12**		

Length of Side Channels Blocked

Pre-1950s (ft)	17,355
Post-1950s (ft)	0

HYDRAULICS

Available hydraulic information includes county-based HEC-RAS modeling efforts by the Army Corps of Engineers with the exclusion of Park County. Floodplain modeling was performed for four conditions representing a developed and undeveloped floodplain, and unregulated and regulated flows for the 1.5, 2, 5, 10, 20, 50, 100, 200, and 500-year events. Park County has limited FEMA hydraulic modeling and was not included in the analysis.

The results of HEC-RAS modeling for the 5 and 100-year flood events were assessed to compare the extents of inundated area for the pristine (undeveloped floodplain, unregulated flows) and developed (developed floodplain, regulated flows) conditions. The data sets provided for each flow condition were unioned in the GIS to identify areas where the inundated extent differed. These area areas of human-caused floodplain isolation due to either flow alterations or physical features such as levees. For the 100-year flood event, isolated areas greater than 5 acres were attributed with the interpreted reason for isolation (railroad, levee, etc.). The resulting values are presented as acres and percent of the pristine floodplain that has been isolated. The pristine floodplain is defined as the total floodplain footprint minus the area of the mapped 2001 bankfull channel (mapped islands were included in the floodplain area).

Floodplain Isolation

	100-Year		5-Year	
	Isolated Acres	% of Floodplain	Isolated Acres	% of Floodplain
Non-Structural (hydrology, geomorphic, etc.)	86	13.0%		
Agriculture (generally relates to field boundaries)	0	0.0%		
Agriculture (isloated by canal or large ditch)	0	0.0%		
Levee/Riprap (protecting agricultural lands)	0	0.0%		
Levee/Riprap (protecting urban, industrial, etc.)	0	0.0%		
Railroad	0	0.0%		
Abandoned Railroad	0	0.0%		
Transportation (Interstate and other roads)	0	0.0%		
Total Not Isolated (Ac)	573		1254	
Total Floodplain Area (Ac)	659		1370	
Total Isolated (Ac)	**86**	**13.0%**	**116**	**54.7%**

The 5-year floodplain is a good allegory for the extent of the riparian zone. Thus, irrigated areas within the 5-year floodplain tend to represent riparian zones that have been converted to agrigulture and may result in additional bank protection to protect the agricultural production and irrigation infrastructure.

	Flood	Sprinkler	Pivot	Total
Irrigated Acres within the 5 Year Flooplain:	0	0	0	**0**

CHANNEL MIGRATION ZONE

A series of Channel Migration Maps were developed for the Yellowstone River from Gardiner to its mouth in McKenzie County, North Dakota (Thatcher, Swindell, and Boyd, 2009). These maps and their accompanying report can be accessed from the YRCDC Website. The channel migration zone (CMZ) developed for the Yellowstone River is defined as a composite area made up of the existing channel, the historic channel since 1950 (Historic Migration Zone, or HMZ), and an Erosion Buffer that encompasses areas prone to channel erosion over the next 100 years. Areas within this CMZ that have been isolated by constructed features such as armor or floodplain dikes are attributed as "Restricted Migration Areas" (RMA). Beyond the CMZ boundaries, outlying areas that pose risks of channel avulsion are identified as "Avulsion Potential Zones".

Mean 50-Yr Migration Distance (ft)	Erosion Buffer (ft)	Total CMZ Acreage	Restricted CMZ Acreage	% Restricted Migration Area	Total AHZ Acreage	Restricted AHZ Acreage	% Restricted Avulsion Area
93	186	1,670	3	0%	467	0	0%

2011 Restricted Migration Area Summary

Note that these data reflect the observed conditions in the 2011 aerial photography (NAIP for Park and Sweet Grass Counties, COE for the rest of the river).

Reason for Restriction	Land Use Protected	RMA Acres	Percent of CMZ
Road/Railroad Prism			
	Railroad	3	0.1%
	Totals	**3**	**0.1%**

Land Uses within the CMZ (Acres)

Flood Irrigation	Sprinkler Irrigation	Pivot Irrigation	Urban/ ExUrban	Trans-portation
53.5	0.0	0.0	1.8	5.1

LAND USE

Land uses were mapped from aerial photography Gardiner to the confluence of the Missouri River in North Dakota for four time periods: 1950s, 1976, 2001, and 2011. Mapping was performed at approximately 1:6,000 to ensure consistent mapping across all data sets. Typically, if a feature could not be easily mapped at the target mapping scale, it was not separated out from the adjacent land use.

A four-tiered system was used to allow analysis at a variety of levels. Tier 1 breaks land use into Agricultural and Non-Agricultural uses. Tier two subdivided uses into productive Agricultural Land and Infrastructure for the Agricultural land, and Urban, Exurban and Transportation categories for the Non-Agricultural land. Tier three further breaks down land uses into more refined categories such as Irrigated or Non-Irrigated and Residential, Commercial, or Industrial. Finally, Tier 4 focuses primarily on the productive agricultural lands, identifying the type of irrigation (Pivot, Sprinkler or Flood).

Land Use Timeline - Tiers 2 and 3

		Acres				% of Reach Area			
Feature Class	Feature Type	1950	1976	2001	2011	1950	1976	2001	2011
Agricultural Infrastructure									
	Canal	0	0	0	0	0.0%	0.0%	0.0%	0.0%
	Agricultural Roads	0	0	0	0	0.0%	0.0%	0.0%	0.0%
	Other Infrastructure	179	283	371	363	1.6%	2.5%	3.2%	3.2%
	Totals	**179**	**283**	**371**	**363**	**1.6%**	**2.5%**	**3.2%**	**3.2%**
Agricultural Land									
	Non-Irrigated	5,367	5,300	5,058	5,141	47.0%	46.4%	44.3%	45.0%
	Irrigated	4,385	4,374	4,544	4,451	38.4%	38.3%	39.8%	38.9%
	Totals	**9,753**	**9,674**	**9,601**	**9,592**	**85.3%**	**84.7%**	**84.0%**	**83.9%**
Channel									
	Channel	1,284	1,242	1,193	1,210	11.2%	10.9%	10.4%	10.6%
	Totals	**1,284**	**1,242**	**1,193**	**1,210**	**11.2%**	**10.9%**	**10.4%**	**10.6%**
ExUrban									
	ExUrban Other	0	0	0	0	0.0%	0.0%	0.0%	0.0%
	ExUrban Undeveloped	0	0	0	0	0.0%	0.0%	0.0%	0.0%
	ExUrban Industrial	0	0	0	0	0.0%	0.0%	0.0%	0.0%
	ExUrban Commercial	0	0	0	0	0.0%	0.0%	0.0%	0.0%
	ExUrban Residential	0	0	12	12	0.0%	0.0%	0.1%	0.1%
	Totals	**0**	**0**	**12**	**12**	**0.0%**	**0.0%**	**0.1%**	**0.1%**
Transportation									
	Public Road	84	100	131	131	0.7%	0.9%	1.1%	1.1%
	Interstate	0	0	56	56	0.0%	0.0%	0.5%	0.5%
	Railroad	129	129	65	65	1.1%	1.1%	0.6%	0.6%
	Totals	**213**	**229**	**252**	**252**	**1.9%**	**2.0%**	**2.2%**	**2.2%**
Urban									
	Urban Other	0	0	0	0	0.0%	0.0%	0.0%	0.0%
	Urban Residential	0	0	0	0	0.0%	0.0%	0.0%	0.0%
	Urban Commercial	0	0	0	0	0.0%	0.0%	0.0%	0.0%
	Urban Undeveloped	0	0	0	0	0.0%	0.0%	0.0%	0.0%
	Urban Industrial	0	0	0	0	0.0%	0.0%	0.0%	0.0%
	Totals	**0**	**0**	**0**	**0**	**0.0%**	**0.0%**	**0.0%**	**0.0%**

Land Use Timeline - Tiers 3 and 4

		Acres				% of Reach Area				Change Between Years (% of Agricultural Land)			
Feature Class	Feature Type	1950	1976	2001	2011	1950	1976	2001	2011	'50-76	'76-01	'01-11	'50-11
Irrigated													
	Sprinkler	0	0	0	0	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
	Pivot	0	0	171	326	0.0%	0.0%	1.8%	3.4%	0.0%	1.8%	1.6%	3.4%
	Flood	4,385	4,374	4,373	4,125	45.0%	45.2%	45.5%	43.0%	0.2%	0.3%	-2.5%	-2.0%
	Totals	**4,385**	**4,374**	**4,544**	**4,451**	**45.0%**	**45.2%**	**47.3%**	**46.4%**	**0.2%**	**2.1%**	**-0.9%**	**1.4%**

Non-Irrigated

Multi-Use	4,461	5,138	4,972	5,026	45.7%	53.1%	51.8%	52.4%	7.4%	-1.3%	0.6%	6.7%
Hay/Pasture	906	162	85	115	9.3%	1.7%	0.9%	1.2%	-7.6%	-0.8%	0.3%	-8.1%
Totals	**5,367**	**5,300**	**5,058**	**5,141**	**55.0%**	**54.8%**	**52.7%**	**53.6%**	**-0.2%**	**-2.1%**	**0.9%**	**-1.4%**

RIPARIAN

Riparian mapping data are derived from the Yellowstone River Riparian Vegetation Mapping study (DTM/AGI 2008). This study coarsely mapped the riparian vegetation communities using 1950's, 1976-1977, and 2001 aerial imagery in a GIS environment. The polygons are digitized at a scale of approximately 1:7,500, with a minimum mapping unit of approximately 10 acres. The goal of the delineation was to capture areas of similar vegetation structure as they appeared on the aerial imagery, while maintaining a consistent scale.

The "Riparian Turnover" values quantify the total area within the active channel area that converted from either woody vegetation to open bar or water, or from open bar or water to woody vegetation. A comparison of these values allows some consideration of overall riparian encroachment into the river corridor from 1950 to 2001.

Riparian Mapping

	Shrub (Acres)			Closed Timber (Acres)			Open Timber (Acres)		
Statistic	1950	1976	2001	1950	1976	2001	1950	1976	2001
Min	0.0	0.5	0.9	1.2	0.9	0.5	0.7	1.2	2.3
Max	85.1	143.2	157.7	57.0	12.1	10.7	51.6	20.4	11.4
Average	11.7	14.8	16.9	23.2	5.1	3.9	11.1	5.0	6.8
Sum	408.9	489.7	573.5	139.5	56.1	78.8	165.9	55.2	61.4

Riparian Turnover

Conversion of riparian areas to channel, or from channel to riparian between the 1950's and 2001 data set.

Riparian to Channel (acres)	17.9
Channel to Riparian (acres)	106.8
Riparian Encroachment (acres)	**88.9**

Riparian Recruitment

Creation of riparian areas between 1950s and 2001.

1950s Channel Mapped as 2011 Riparian (Ac)	159.2
1950s Floodplain Mapped as 2011 Channel (Ac)	22.6
Total Recruitment (1950s to 2011)(Ac)	**181.8**

WETLANDS

Wetland areas were mapped to National Wetland Inventory standards by the Montana Natural Heritage Program. Palustrine wetlands within the mapped 100-year inundation boundary were extracted and summarized into four categories: Riverine (Unconsolidated Bottom - UB, Aquatic Bed - AB, and Unconsolidated Shore - US), Emergent - EM, Scrub-Shrub - SS, and Forested - FO.

	Riverine	Emergent	Scrub/Shrub	Forested	Total
Mapped Acres	16.1	165.2	12.2	0.0	**193.5**
Acres/Valley Mile	1.5	15.4	1.1	0.0	

RUSSIAN OLIVE

Russian olive is considered an invasive species and its presence in the Yellowstone River corridor is fairly recent. As such, its spread can be used as a general indicator of invasive plants within the corridor. It has the added benefit of being easily identified in multi-spectral aerial photography, making it possible to inventory large areas using remote techniques.

In 2011, Natural Resources Conservation Service (NRCS) in Bozeman, MT conducted an inventory of Russian olive locations in the Yellowstone River watershed. This study utilized the Feature Analyst extension within ArcGIS to interpret multi-spectral 2008 NAIP imagery for the presence of Russian olive. The resulting analysis was converted from raster format to a polygon ESRI shape file for distribution and further analysis within a GIS environment.

This work scope was tasked with integrating the resulting Russian olive inventory into the Yellowstone River Conservation Districts Council (YRCDC) Cumulative Effects Assessment (CEA) GIS and associated reach-based database. Additionally, analysis of Russian olive within the corridor was conducted to characterize its distribution in throughout the corridor and its association with other corridor data sets.

	Floodplain Area (Ac)	% of Floodplain	Other Area (Ac)	Inside RMA (Ac)	Inside '50s Channel (Ac)	Inside 50s Island (Ac)
Russian Olive in Reach	254.13	4.98%	128.46	0.73	24.24	1.27

FISHERIES SUMMARY

Fisheries data available for the Reach Narratives include low-flow and high-flow habitat mapping of 2001 conditions for 406 miles of river, extending from the mouth upstream to a point approximately 8 miles upstream of Park City. Habitat mapping was performed remotely on the 2001 CIR aerial photography utilizing habitat classifications developed by Montana Fish, Wildlife, and Parks (DTM 2009). Historic habitat mapping using the 1950's imagery is limited to Reach B1 (high-flow) and D9 (low and high-flow).

Fisheries field sampling data have been provided by Ann Marie Reinhold (MSU). In this study, the Yellowstone River from Park City to Sidney was divided into five segments. Within each segment, fish were sampled in reaches modified by riprap ("treatment reaches") and relatively unmodified reaches ("control reaches"). Fish sampling was conducted during summer and autumn of 2009, 2010, and 2011. Boat electrofishing, trammel nets, mini-fyke nets and bag seines were used to collect data from river bends.

Fish presence data is only presented for those reaches that were sampled.

The Low Flow Habitat Mapping followed schema deveoped by Montana Fish Wildlife and Parks to identify key habitat units for certain aquatic species.

Low Flow Fisheries Habitat Mapping

	2001 (Acres)		
Habitat	Bankfull	Low Flow	% of Low Flow
Scour Pool	381.7	350.0	29.3%
Rip Rap Margin	109.0	97.2	8.1%
Bluff Pool	212.0	144.5	12.1%
Secondary Channel	25.2	25.2	2.1%
Secondary Channel (Seasonal)	50.1	49.1	4.1%
Channel Crossover	376.7	265.0	22.2%
Point Bar		50.5	4.2%
Side Bar		100.2	8.4%
Mid-channel Bar		31.2	2.6%
Island	38.1	38.1	3.2%
Dry Channel		41.8	3.5%

AVIAN

Birds were sampled in 2006 and 2007 by Danielle Jones of Montana State University. Point count methods were used at 304 randomly chosen sites in 21 braided or anabranching reaches. Each site was visited multiple times within a season, and sites were visited in both years. Birds were sampled in grassland, shrubland, and cottonwood forest habitats. Additional bird data was collected by Amy Cilimburg of Montana Audubon in summer 2012. High priority areas for data collection were identified with the assistance of the YRCDC Technical Advisory Committee. The Audubon methodology recorded data for a wider variety of bird species relative to the MSU study, including raptors and waterfowl.

CULTURAL INVENTORY SUMMARY

The Yellowstone River Cultural Inventory - 2006 documents the variety and intensity of different perspectives and values held by people who share the Yellowstone River. Between May and November of 2006, a total of 313 individuals participated in the study. They represented agricultural, civic, recreational, or residential interest groups. Also, individuals from the Crow and the Northern Cheyenne tribes were included.
There are three particular goals associated with the investigation. The first goal is to document how the people of the Yellowstone River describe the physical character of the river and how they think the physical processes, such as floods and erosion, should be managed. Within this goal, efforts have been made to document participants' views regarding the many different bank stabilization techniques employed by landowners. The second goal is to document the degree to which the riparian zone associated with the river is recognized and valued by the participants. The third goal is to document concerns regarding the management of the river's resources. Special attention is given to the ways in which residents from diverse geographical settings and diverse interest groups view river management and uses. The results illustrate the commonalities of thought and the complexities of concerns expressed by those who share the resources of the Yellowstone River.

Summary of Cultural Views in Region C

In the study segment, Powder River to Big Horn River, three conversations emerged across the four interest groups. The first conversation focuses on the "familiar way of life." The conversation exposes a local identity that is tied to agriculture and to traditional forms of recreation, such as hunting and fishing. When asked if the familiar management practices are sufficient in terms of sharing the river's resources, some locals express concerns. The second conversation explicitly acknowledges that the demand for recreational access to the river's resources is in its infancy in terms of representing a problem. The third conversation focuses on controlling the river with rip-rap and dikes.