County	Dawson	**Upstream River Mile**	81.4
Classification	PCA: Partially confined anabranching	**Downstream River Mile**	71.1
General Location	Intake	**Length**	10.30 mi (16.58 km)
General Comments	To Intake		

Narrative Summary

Reach D8 is located in Dawson County, and includes Intake Diversion Dam. The reach is a Partly Confined Anabranching reach type, indicating distinct side channels around forested islands, and some valley wall influence on the active channel. Intake Diversion Dam is located on the lower end of the reach at RM 73.

The primary form of bank stabilization in Reach D8 is rock riprap, with 4,576 feet or 1.9 percent of the total bankline mapped as armored in 2011. All of the bank armor in Reach D8 is protecting either Intake Diversion or the railroad grade; the majority (3,178 feet) is against the rail line. In the uppermost part of the reach at RM 81L, over 1,500 feet of flow deflectors were flanked between 2001 and 2011. At RM 77L, the river has flanked two sections of rock riprap protecting the rail line, forming two large scallops in the bank that currently threaten to undermine the toe of the railroad embankment.

The largest diversion dam on the Yellowstone River is Intake Diversion Dam at RM 73. Construction of the dam began in 1905, in response to authorization under the Reclamation Act of 1902 (http://www.fws.gov/yellowstonerivercoordinator/Intake.html). Intake Dam was completed in 1911 and is used to irrigate 50,000 acres of land in eastern Montana and western North Dakota. The original dam crest was 12 feet above the river bed; and the structure stretches 700 feet across the river. With a diversion capacity of 1,200 cfs, it feeds Intake Canal and a ~225 mile network of lateral canals that distribute water to approximately 500 farms. Fish passage issues at this structure are currently being addressed by the Bureau Reclamation, US Army Corps of Engineers, MT Fish Wildlife and Parks, US Fish and Wildlife Service, and Lower Yellowstone Irrigation District.

Reach D8 has lost almost three miles of side channel length since 1950, and none of this loss is attributable to floodplain dikes. Similar to other reaches in the lower Yellowstone River valley, side channel loss has occurred to both intentional blockages, as well as lost connectivity due to flow alterations. Flow alterations have also resulted in lost connectivity to the 5-year floodplain; development in the basin has resulted in the isolation of 58 percent of the historic 5-year floodplain.

There are 110 acres of sprinkler irrigation and 19 acres of exurban land in the Channel Migration Zone in Reach D8, making these areas especially susceptible to threats of river erosion.

There has been a net increase of woody riparian vegetation in Reach D8 of approximately 210 acres since 1950, indicating riparian colonization of open gravel bars and channel margins.

There are about 10 acres of mapped Russian olive in the reach.

Reach D8 was sampled as part of the avian study. A total of 21 species were identified in the reach, including the Red-headed Woodpecker, which is a Species of Concern.

A hydrologic evaluation of flow depletions indicates that flow alterations over the last century have been major in this reach. The magnitude of the 100-year flood is now 128,000 cfs, which 12 percent lower than it was pre-development (145,000 cfs). The 2-year flood, which strongly influences overall channel form, has dropped by 22 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 4,630 cfs to 2,520 cfs with human development, a reduction of 46 percent. More typical summer low flows, described as the summer 95% flow duration, have dropped from 6,810 cfs under unregulated conditions to 3,030 cfs under regulated conditions, a reduction of 55 percent.

Seasonal low flows have increased by 78 percent in the winter and 62 percent in the fall. Both fall and winter base flows are currently about 3,500 cfs.

CEA-Related observations in Reach D8 include:
•Passive loss of side channels with flow alterations
•Low avian species richness
•Passive loss of 5-year floodplain area

Recommended Practices (may include Yellowstone River Recommended Practices--YRRPs) for Reach D8 include:
•Flanked bank armor removal at RM 77L and RM 81L
•Fish Passage Practices at Intake Diversion Dam (RM 73)
•Watercraft Passage PRACTICE at Intake Diversion Dam (RM 73)
•Irrigation Structure Management at Intake Diversion Dam (RM 73)
•Russian olive removal

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): Sidney

Flood History

Year	Date	Flow on Date	Return Interval
1978	May 23	111,000	10-25 yr
1912	Mar 29	114,000	10-25 yr
1944	Jun 21	120,000	10-25 yr
2011	May 24	124,000	10-25 yr
1918	Jun 20	126,000	25-50 yr
1943	Mar 29	132,000	25-50 yr
1923	Oct 3	134,000	25-50 yr
1952	Mar 31	138,000	25-50 yr
1921	Jun 21	159,000	100-yr

	Downstream Gage	Upstream Gage
Gage No	6329500	6309000
Location	Sidney	Miles City
Period of Record	1911-2015	1929-2015
Distance To (miles)	40.3	102.6

Discharge

	1.01 Yr	2 Yr	5 Yr	10 Yr	50 Yr	100 Yr	500 Yr	7Q10 Summer	95% Sum. Duration
Unregulated		69,500	89,700	103,000	132,000	145,000	175,000	4,630	6,810
Regulated		54,200	74,300	87,400	116,000	128,000	155,000	2,520	3,030
% Change		-22.01%	-17.17%	-15.15%	-12.12%	-11.72%	-11.43%	-45.57%	-55.51%

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	67,500	25,000	7,000
	Regulated	52,100	14,800	5,100
	% Change	**-23%**	**-41%**	**-27%**
Summer	Unregulated	47,400	14,800	6,810
	Regulated	35,200	8,740	3,030
	% Change	**-26%**	**-41%**	**-56%**
Fall	Unregulated	9,820	5,920	2,000
	Regulated	11,200	7,410	3,560
	% Change	**14%**	**25%**	**78%**
Winter	Unregulated	15,000	5,410	2,120
	Regulated	15,600	6,580	3,450
	% Change	**4%**	**22%**	**63%**
Annual	Unregulated	49,800	8,890	2,820
	Regulated	37,100	8,010	3,590
	% Change	**-26%**	**-10%**	**27%**

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	6329500	2750
1976	USCOE	9-Oct-76	B/W	1:24,000	6329500	9580
1995	USGS DOQQ	8/8/96 - 6/12/96	B/W		6329500	52600
2001	NRCS	August 2-8, 2001	CIR	1:24,000	6329500	4000
2004	Merrick	5/20/2004 - 6/3/04	Color	1:15,840	6329500	5070
2005	NAIP	07/14/2005	color	1-meter pixels	6329500	15900
2009	NAIP	7/11/2009	Color	1-meter pixels	6329500	32600
2011	USCOE	October 2012	color	1-ft pixel	6329500	9030
2011	NAIP	7/21/2011	Color	1-meter pixels	6329500	46600
2011	NAIP	7/20/2011	Color	1-meter pixels	6329500	48800
2013	NAIP	07/27/2013	color	1-meter pixels	6329500	

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	4,140	3.9%	4,576	4.3%	435
	Flow Deflectors	122	0.1%	0	0.0%	-122
	Between Flow Deflectors	641	0.6%	0	0.0%	-641
	Feature Type Totals	**4,904**	**4.6%**	**4,576**	**4.3%**	**-328**
Floodplain Control						
	Floodplain Dike/Levee	519	0.5%	319	0.3%	-200
	Feature Type Totals	**519**	**0.5%**	**319**	**0.3%**	**-200**
	Reach Totals	**5,423**	**5.1%**	**4,895**	**4.6%**	**-528**

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
Flow Deflectors/Between FDs	0	764	0	0	0	0	0	0
Rock RipRap	0	0	961	0	0	3,178	0	0
Totals	**0**	**764**	**961**	**0**	**0**	**3,178**	**0**	**0**

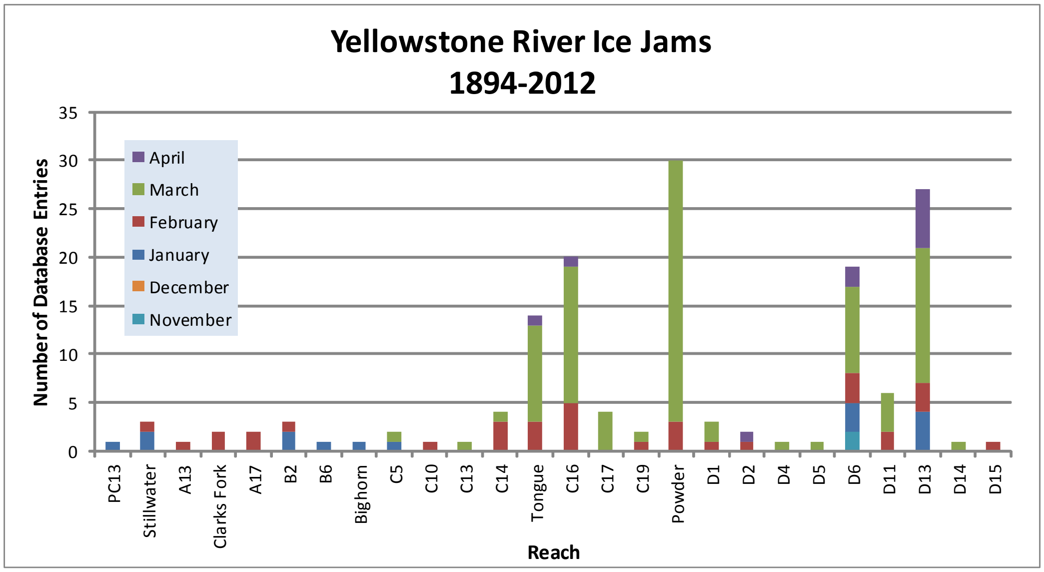
Bankline/Floodplain Inventory: Time Series

The Human Impacts Timeline assessed physical feature development through time for Yellowstone, Stillwater, and Dawson Counties.

Feature Class	Feature Type	Sum of Feature Length (ft) 1950	1976	1995	2001	2004	2005
Irrigation							
	In Channel Diversion	669	669	669	669	669	669
	Floodplain Dike/Levee	5,268	5,268	5,268	5,268	5,268	5,268
	Totals	**5,936**	**5,936**	**5,936**	**5,936**	**5,936**	**5,936**
Other Off Channel							
	Floodplain Dike/Levee	478	478	478	478	478	478
	Totals	**478**	**478**	**478**	**478**	**478**	**478**
Stream Stabilization							
	Rock RipRap	962	2,562	2,562	3,433	3,433	3,433
	Flow Deflector	0	0	0	0	734	734
	Totals	**962**	**2,562**	**2,562**	**3,433**	**4,168**	**4,168**
Transportation Encroachment							
	Railroad	10,300	10,300	10,300	10,300	10,300	10,300
	County Road	4,206	4,206	4,206	4,206	4,206	4,206
	Totals	**14,506**	**14,506**	**14,506**	**14,506**	**14,506**	**14,506**

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.



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	55,112	53,812	1.98	1950 to 1976:	9.19%
1976	54,712	63,359	2.16	1976 to 1995:	5.96%
1995	53,646	69,029	2.29	1995 to 2001:	-1.33%
2001	53,643	67,389	2.26	1950 to 2001:	14.16%
Change 1950 - 2001	**-1,470**	**13,577**	**0.28**		

Length of Side Channels Blocked

Pre-1950s (ft)	0
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.)	61	1.6%		
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	38	1.0%		
Abandoned Railroad	0	0.0%		
Transportation (Interstate and other roads)	0	0.0%		
Total Not Isolated (Ac)	3746		1729	
Total Floodplain Area (Ac)	3845		2342	
Total Isolated (Ac)	**99**	**2.6%**	**613**	**57.7%**

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
274	549	4,130	44	1%	1,067	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
RipRap			
	Railroad	28	0.5%
	Totals	**28**	**0.5%**

Land Uses within the CMZ (Acres)

Flood Irrigation	Sprinkler Irrigation	Pivot Irrigation	Urban/ ExUrban	Trans- portation
213.7	109.0	0.0	19.4	16.4

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	29	29	29	29	0.3%	0.3%	0.3%	0.3%
	Agricultural Roads	0	0	0	0	0.0%	0.0%	0.0%	0.0%
	Other Infrastructure	11	54	86	88	0.1%	0.6%	1.0%	1.0%
	Totals	**40**	**83**	**115**	**117**	**0.5%**	**1.0%**	**1.3%**	**1.4%**
Agricultural Land									
	Non-Irrigated	5,278	5,010	4,746	4,639	61.4%	58.3%	55.2%	54.0%
	Irrigated	51	331	592	615	0.6%	3.8%	6.9%	7.2%
	Totals	**5,329**	**5,341**	**5,338**	**5,253**	**62.0%**	**62.1%**	**62.1%**	**61.1%**
Channel									
	Channel	3,070	3,024	2,971	3,054	35.7%	35.2%	34.6%	35.5%
	Totals	**3,070**	**3,024**	**2,971**	**3,054**	**35.7%**	**35.2%**	**34.6%**	**35.5%**
ExUrban									
	ExUrban Other	0	0	21	21	0.0%	0.0%	0.2%	0.2%
	ExUrban Undeveloped	0	0	0	0	0.0%	0.0%	0.0%	0.0%
	ExUrban Industrial	17	36	36	36	0.2%	0.4%	0.4%	0.4%
	ExUrban Commercial	0	0	0	0	0.0%	0.0%	0.0%	0.0%
	ExUrban Residential	0	0	0	0	0.0%	0.0%	0.0%	0.0%
	Totals	**17**	**36**	**56**	**56**	**0.2%**	**0.4%**	**0.7%**	**0.7%**
Transportation									
	Public Road	95	69	71	71	1.1%	0.8%	0.8%	0.8%
	Interstate	0	0	0	0	0.0%	0.0%	0.0%	0.0%
	Railroad	45	44	44	44	0.5%	0.5%	0.5%	0.5%
	Totals	**140**	**113**	**116**	**116**	**1.6%**	**1.3%**	**1.3%**	**1.3%**
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	7	8	157	164	0.1%	0.2%	2.9%	3.1%	0.0%	2.8%	0.2%	3.0%
	Pivot	0	0	157	180	0.0%	0.0%	2.9%	3.4%	0.0%	2.9%	0.5%	3.4%
	Flood	44	322	278	271	0.8%	6.0%	5.2%	5.2%	5.2%	-0.8%	-0.1%	4.3%
	Totals	**51**	**331**	**592**	**615**	**1.0%**	**6.2%**	**11.1%**	**11.7%**	**5.2%**	**4.9%**	**0.6%**	**10.7%**

Non-Irrigated													
	Multi-Use	4,732	4,285	3,801	3,693	88.8%	80.2%	71.2%	70.3%	-8.6%	-9.0%	-0.9%	-18.5%
	Hay/Pasture	546	724	945	946	10.2%	13.6%	17.7%	18.0%	3.3%	4.1%	0.3%	7.8%
	Totals	**5,278**	**5,010**	**4,746**	**4,639**	**99.0%**	**93.8%**	**88.9%**	**88.3%**	**-5.2%**	**-4.9%**	**-0.6%**	**-10.7%**

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	0.2	1.2	1.3	3.4	2.8	3.0	2.7	8.5	2.1
Max	186.4	197.8	271.2	110.6	400.1	301.4	100.9	103.7	106.7
Average	31.7	23.8	43.9	41.4	70.6	51.6	26.9	53.9	29.1
Sum	1,491.5	1,240.2	1,184.8	994.8	1,483.3	1,444.0	430.9	269.3	203.4

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)	172.8
Channel to Riparian (acres)	380.3
Riparian Encroachment (acres)	**207.5**

Riparian Recruitment

Creation of riparian areas between 1950s and 2001.

1950s Channel Mapped as 2011 Riparian (Ac)	403.3
1950s Floodplain Mapped as 2011 Channel (Ac)	32.0
Total Recruitment (1950s to 2011)(Ac)	**435.2**

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	13.7	46.2	24.3	0.0	**84.2**
Acres/Valley Mile	2.0	6.6	3.5	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	9.70	0.18%	1.32	0.04	5.84	1.92

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	501.8	362.7	12.2%
Rip Rap Bottom	20.9	21.3	0.7%
Rip Rap Margin	64.5	59.0	2.0%
Terrace Pool	51.4	43.2	1.5%
Secondary Channel	106.4	42.3	1.4%
Secondary Channel (Seasonal)	198.9	173.7	5.8%
Channel Crossover	288.7	258.5	8.7%
Point Bar		86.4	2.9%
Side Bar		76.7	2.6%
Mid-channel Bar		40.6	1.4%
Island	1,695.9	1,695.9	57.0%
Dry Channel		71.7	2.4%
Dam Influenced	51.5	43.9	1.5%

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.

Bird Species Observed in Reach/Region

Species of Concern   Potential Species of Concern

Reach	Region	
☑	☑	American Robin
☐	☑	American Crow
☑	☑	American Goldfinch
☑	☑	American Kestrel
☐	☑	American Redstart
☐	☑	Bald Eagle
☐	☐	Baltimore Oriole
☐	☐	Barn Swallow
☐	☑	Belted Kingfisher
☐	☑	Black-billed Cuckoo
☐	☑	Black-billed Magpie
☑	☑	Black-capped Chickadee
☐	☑	Black-and-white Warbler
☐	☑	Black-headed Grosbeak
☐	☑	Blue Jay
☐	☑	Bobolink
☑	☑	Brewer's Blackbird
☐	☑	Brown-headed Cowbird
☐	☐	Brown Creeper
☐	☑	Brown Thrasher
☐	☑	Bullock's Oriole
☐	☐	Canada Goose
☑	☑	Cedar Waxwing
☐	☑	Chimney Swift

Reach	Region	
☐	☑	Chipping Sparrow
☐	☑	Clay-collared Sparrow
☐	☐	Cliff Swallow
☑	☑	Common Grackle
☐	☐	Common Merganser
☐	☑	Common Nighthawk
☐	☐	Common Raven
☑	☑	Common Yellowthroat
☐	☑	Cooper's Hawk
☐	☑	Dickcissel
☑	☑	Downy Woodpecker
☐	☑	Eastern Bluebird
☑	☑	Eastern Kingbird
☐	☐	Eurasian Collared-dove
☑	☑	European Starling
☐	☑	Field Sparrow
☐	☑	Franklin's Gull
☐	☑	Grasshopper Sparrow
☐	☑	Gray Catbird
☐	☑	Great Blue Heron
☐	☑	Great Horned Owl
☐	☑	Hairy Woodpecker
☐	☐	House Finch
☑	☑	House Wren

Reach	Region	
☐	☑	Killdeer
☐	☐	Lark Bunting
☐	☑	Lark Sparrow
☑	☑	Lazuli Bunting
☑	☑	Least Flycatcher
☐	☑	Mallard
☐	☐	Mountain Bluebird
☑	☑	Mourning Dove
☑	☑	Northern Flicker
☐	☑	Orchard Oriole
☐	☐	Osprey
☐	☑	Ovenbird
☐	☑	Plumbeous Vireo
☑	☑	Red-headed Woodpecker
☐	☐	Red-naped Sapsucker
☐	☑	Red Crossbill
☐	☑	Ring-necked Pheasant
☐	☑	Red-tailed hawk
☐	☑	Rock Dove
☑	☑	Red-winged Blackbird
☑	☑	Red-eyed Vireo
☐	☑	Red-breasted Grosbeak
☐	☐	Say's Phoebe
☐	☑	Savannah Sparrow

Reach	Region	
☐	☑	Song Sparrow
☐	☑	Spotted Sandpiper
☐	☑	Spotted Towhee
☐	☐	Sharp-shinned Hawk
☐	☐	Swainson's Thrush
☐	☐	Sandhill Crane
☐	☑	Tree Swallow
☐	☐	Turkey Vulture
☐	☐	Upland Sandpiper
☐	☐	Vesper Sparrow
☐	☐	Violet-green Swallow
☑	☑	Warbling Vireo
☐	☑	Western Kingbird
☐	☑	Western Meadowlark
☑	☑	Western Wood-pewee
☐	☑	White-breasted Nuthatch
☐	☐	White-throated Swift
☐	☑	Wild Turkey
☐	☑	Wood Duck
☐	☑	Yellow-bellied Sapsucker
☐	☑	Yellow-billed Cuckoo
☐	☑	Yellow-breasted Chat
☐	☐	Yellow-headed Blackbird
☐	☑	Yellow Warbler

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 D

A review of the interview data for the segment, Missouri River to Powder River, suggests that people in this area engage in four primary discussions when asked about the Yellowstone River. First, the notion of Eastern Montana is not simply a geographic reference. It is a defining concept that captures the agricultural roots and the cultural values of the people living in the study segment, and the river is an essential element within their notion of Eastern Montana. Second, the river is discussed as a wholesome recreational outlet. However, shifting landownership is noted as an important change in the recreational context. Third, even though agricultural practices are viewed as the mainstay of the local economies, many participants discuss the long-term economic viability of their communities as a concern. Industrial and residential developments along the river's edge are seemingly remote possibilities and are generally discussed with references to flood plain restrictions and the stability of nearby dikes. Finally, discussions of managing the river are limited, but a variety of opinions are offered regarding bank erosion and stabilization techniques.