County	Stillwater	**Upstream River Mile**	417.3
Classification	PCA: Partially confined anabranching	**Downstream River Mile**	413.7
General Location	Columbus	**Length**	3.60 mi (5.79 km)
General Comments	Example of an impacted valley bottom crossover area		

Narrative Summary

Reach A13 is 3.6 miles long and is located at Columbus. The reach is a Partially Confined Anabranching (PCA) reach type, indicating some valley wall influence and relatively extensive forested islands. Reach A13 marks an abrupt widening in the river valley as the erosion resistant sandstone cliffs of the Hell Creek Formation transition downstream into the more erodible Bearpaw Shale. The reach is urbanized with most development concentrated on the north side of the river. Migration rates since 1950 have been moderate in this reach largely due to extensive bank armoring.

Similar to other reaches in Region A, the overall footprint of the river channel has increased in size since 1950. In 1950, the channel footprint was 258 acres but by 2001 it had expanded to 327 acres. This was accompanied by a net loss of about 40 acres of riparian area to channel during that same timeframe.

About 28 percent of the banks in Reach A13 are armored, with the majority of that armor being rock riprap. Reach A13 has almost 3,000 feet of concrete riprap, reflecting an abrupt increase in the use of concrete as armor relative to upstream. The concrete is on the north bank of the river just upstream of the Columbus Bridge. Between 2001 and 2011, there was a gain of about 2,800 feet of rock riprap in the reach; most of this was on the north side of the river adjacent to town.

Land use in Reach A13 is predominantly agricultural, although there are over 600 acres of exurban/exurban development within the mapping footprint. Approximately one half of the agricultural land is in flood irrigation (600 acres). No other types of irrigation were mapped in the reach. A total of 133 acres of developed land are in the Channel Migration Zone, and about half of that is in urban/exurban development. About 13 percent of the CMZ is isolated by physical features, most of which is armor protecting the railroad in Columbus.

About 18 percent of the historic 100-year floodplain has become isolated from the river due primarily to the downstream shadow caused by the Columbus Bridge embankment on the north side of the river.

There is one pipeline crossing in Reach A13, a natural gas crossing called the Lake Basin-Absarokee Line owned by NW energy. The pipeline crosses the river at RM 417.

One ice jam has been recorded in this reach. On February 6, 1996, an ice jam break-up was reported to cause local flooding.

There are corrals that are part of an animal handling facility in the reach, north of the river at RM 414.

Riparian mapping in Reach A13 shows a reduction of about 50 acres of closed timber in the reach since 1950.

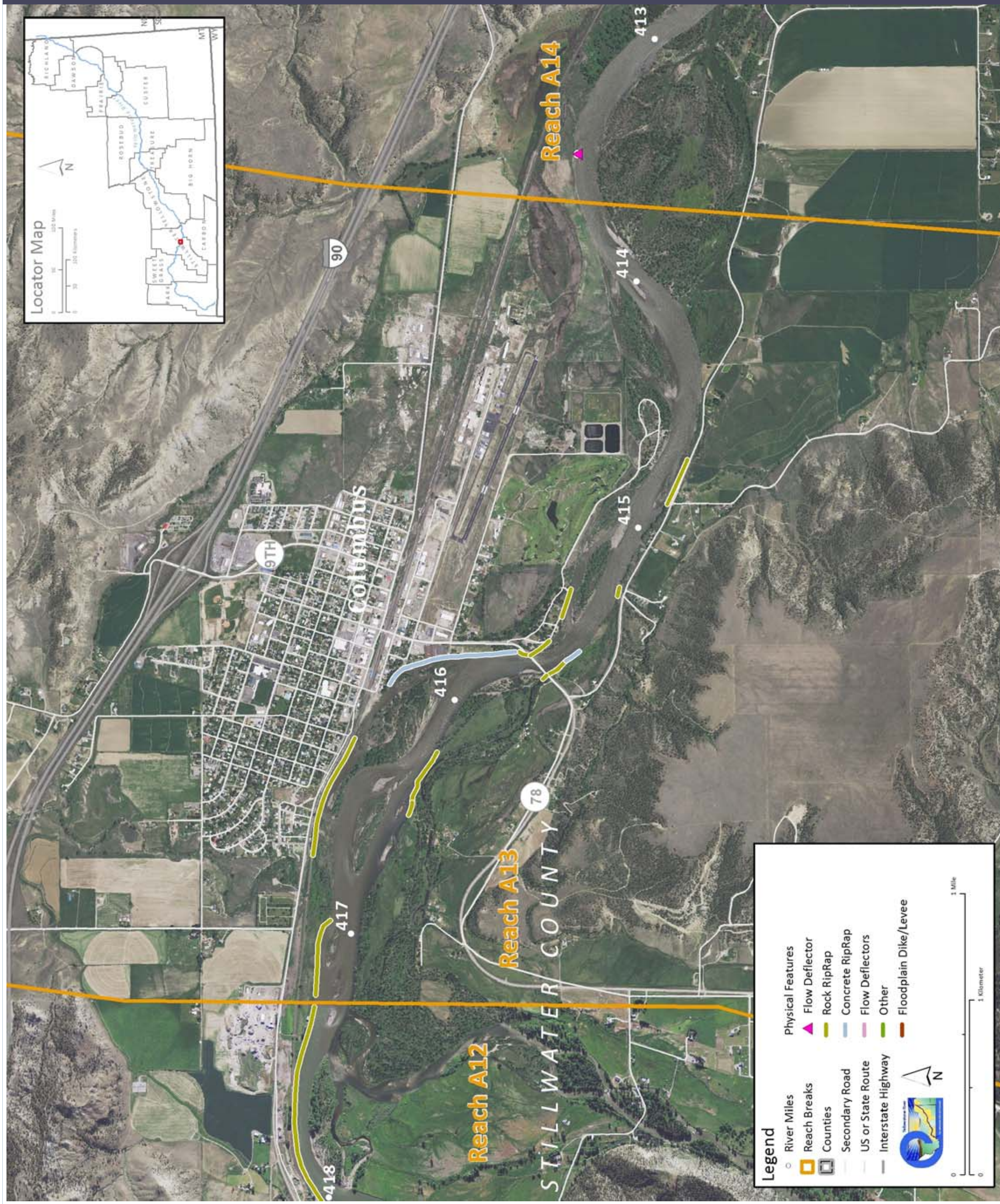
Reach A13 has approximately 5 acres of mapped Russian olive, which is spread out both within the riparian corridor and through the town of Columbus. There are also over 100 acres of mapped wetland in the each, most of which is emergent marshes and wet meadows.

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 14,400 cfs to 13,600 cfs, a drop of about 6 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 2,270 cfs to 1,760 cfs with human development, a reduction of 22 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 A13 include:
•A jump in the use of concrete armor relative to upstream
•Armoring associated with urbanization
•Urban/Exurban development in CMZ

Recommended Practices (may include Yellowstone River Recommended Practices--YRRPs) for Reach A13 include:
•CMZ management at Columbus due to high level of encroachment
•Nutrient management at corrals at RM 414
•Bank Stabilization Recommended Practices due to extent of armoring in reach (28 percent)
•Russian olive removal (5 acres)
•Pipeline management (natural gas) for main river crossing at RM 417
•Wetland restoration/management due to extent of mapped wetland (110 acres)

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): Livingston

Flood History

Year	Date	Flow on Date	Return Interval
1971	Jun 23	29,200	10-25 yr
1902	Jun 11	30,100	10-25 yr
1943	Jun 20	30,600	10-25 yr
1974	Jun 17	36,300	50-100 yr
1996	Jun 10	37,100	50-100 yr
1997	Jun 6	38,000	50-100 yr
2011	Jun 30	40,600	>100-yr

	Downstream Gage	Upstream Gage
Gage No	6214500	6192500
Location	Billings	Livingston
Period of Record	1929-2015	1929-2015
Distance To (miles)	49.3	89.3

Discharge

	1.01 Yr	2 Yr	5 Yr	10 Yr	50 Yr	100 Yr	500 Yr	7Q10 Summer	95% Sum. Duration
Unregulated	16,200	31,000	38,600	43,300	52,700	56,600	65,200	2,270	1,760
Regulated	15,100	29,800	37,500	42,300	51,900	55,900	64,800	1,760	1,680
% Change	-6.79%	-3.87%	-2.85%	-2.31%	-1.52%	-1.24%	-0.61%	-22.47%	-4.55%

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	22-May-51	B/W	1:28,400	6192500	10600
1976	USCOE	28-Sep-76	B/W	1:24,000	6192500	2560
1995	USGS DOQQ	9/10/96 - 8/28/97	B/W		6192500	4430
2001	NRCS	August 2-8, 2001	CIR	1:24,000	6192500	2000
2004	Merrick	14-May-04	Color	1:15,840	6192500	4520
2005	NAIP	07/15/2005	color	1-meter pixels	6192500	5000
2009	NAIP	7/7/2009	Color	1-meter pixels	6192500	11300
2011	USCOE	October 2012	color	1-ft pixel	6192500	2530
2011	NAIP	7/24/2011	Color	1-meter pixels	6192500	13100
2013	NAIP	06/15/2013	color	1-meter pixels	6192500	

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	5,092	13.4%	7,875	20.7%	2,783
	Concrete RipRap	2,837	7.5%	2,837	7.5%	0
	Feature Type Totals	**7,929**	**20.9%**	**10,712**	**28.2%**	**2,783**
	Reach Totals	**7,929**	**20.9%**	**10,712**	**28.2%**	**2,783**

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
Concrete RipRap	0	0	0	1,571	0	0	0	1,269
Rock RipRap	0	285	0	1,998	0	1,476	0	544
Totals	**0**	**285**	**0**	**3,569**	**0**	**1,476**	**0**	**1,814**

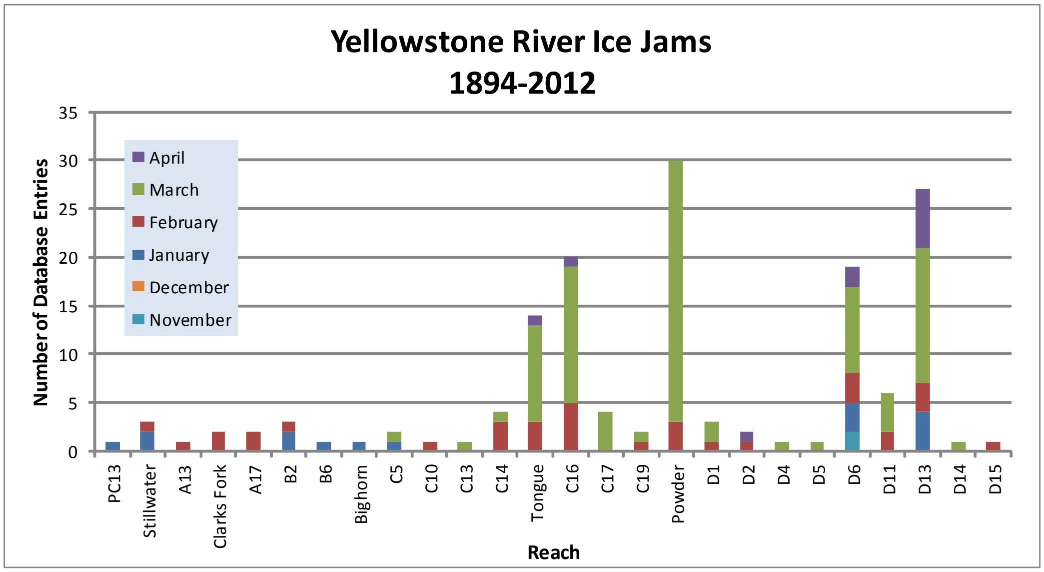
Bankline/Floodplain Inventory: Time Series

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

		Sum of Feature Length (ft)					
Feature Class	Feature Type	1950	1976	1995	2001	2004	2005
Other							
	Floodplain Dike/Levee	0	2,395	4,675	4,675	4,675	4,675
	Totals	**0**	**2,395**	**4,675**	**4,675**	**4,675**	**4,675**
Other Off Channel							
	Floodplain Dike/Levee	0	666	666	666	666	666
	Totals	**0**	**666**	**666**	**666**	**666**	**666**
Stream Stabilization							
	Rock RipRap	3,406	4,993	6,634	8,187	8,187	8,187
	Concrete RipRap	0	0	2,822	2,822	2,822	2,822
	Totals	**3,406**	**4,993**	**9,457**	**11,010**	**11,010**	**11,010**
Transportation Encroachment							
	Railroad	6,127	6,127	6,127	6,127	6,127	6,127
	County Road	7,931	5,756	5,756	5,756	5,756	5,756
	Bridge Approach	2,975	1,749	1,749	1,749	1,749	1,749
	Totals	**17,032**	**13,632**	**13,632**	**13,632**	**13,632**	**13,632**

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
2/6/1996	Break-up	416	Flooding

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	19,288	17,765	1.92	1950 to 1976:	4.32%
1976	18,865	18,941	2.00	1976 to 1995:	3.73%
1995	18,891	20,378	2.08	1995 to 2001:	-3.21%
2001	18,980	19,208	2.01	1950 to 2001:	4.74%
Change 1950 - 2001	**-308**	**1,443**	**0.09**		

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.)	0	0.0%		
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)	72	18.3%		
Total Not Isolated (Ac)	321		403	
Total Floodplain Area (Ac)	393		414	
Total Isolated (Ac)	**72**	**18.3%**	**11**	**12.7%**

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:	1	0	0	**1**

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
172	343	654	108	17%	106	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			
	Urban Other	19	2.5%
RipRap			
	Urban Commercial	20	2.7%
	Railroad	44	5.8%
	Non-Irrigated	7	0.9%
	Irrigated	10	1.3%
	Totals	**101**	**13.3%**

Land Uses within the CMZ (Acres)

Flood Irrigation	Sprinkler Irrigation	Pivot Irrigation	Urban/ ExUrban	Trans-portation
56.1	0.0	0.0	61.9	14.6

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	44	92	82	79	1.8%	3.7%	3.3%	3.2%
	Totals	**44**	**92**	**82**	**79**	**1.8%**	**3.7%**	**3.3%**	**3.2%**
Agricultural Land									
	Non-Irrigated	1,092	1,117	763	733	43.7%	44.7%	30.5%	29.3%
	Irrigated	686	520	581	599	27.5%	20.8%	23.2%	24.0%
	Totals	**1,778**	**1,637**	**1,344**	**1,332**	**71.2%**	**65.5%**	**53.8%**	**53.3%**
Channel									
	Channel	325	353	380	390	13.0%	14.1%	15.2%	15.6%
	Totals	**325**	**353**	**380**	**390**	**13.0%**	**14.1%**	**15.2%**	**15.6%**
ExUrban									
	ExUrban Other	1	19	19	128	0.1%	0.8%	0.8%	5.1%
	ExUrban Undeveloped	12	17	41	14	0.5%	0.7%	1.6%	0.6%
	ExUrban Industrial	0	0	9	58	0.0%	0.0%	0.4%	2.3%
	ExUrban Commercial	0	0	0	0	0.0%	0.0%	0.0%	0.0%
	ExUrban Residential	0	17	42	46	0.0%	0.7%	1.7%	1.8%
	Totals	**13**	**53**	**110**	**246**	**0.5%**	**2.1%**	**4.4%**	**9.8%**
Transportation									
	Public Road	50	48	48	48	2.0%	1.9%	1.9%	1.9%
	Interstate	0	0	0	0	0.0%	0.0%	0.0%	0.0%
	Railroad	18	18	18	18	0.7%	0.7%	0.7%	0.7%
	Totals	**68**	**66**	**66**	**67**	**2.7%**	**2.6%**	**2.6%**	**2.7%**
Urban									
	Urban Other	10	9	107	9	0.4%	0.4%	4.3%	0.4%
	Urban Residential	103	113	138	153	4.1%	4.5%	5.5%	6.1%
	Urban Commercial	59	58	57	57	2.4%	2.3%	2.3%	2.3%
	Urban Undeveloped	9	4	16	4	0.4%	0.1%	0.6%	0.1%
	Urban Industrial	89	114	198	161	3.6%	4.6%	7.9%	6.5%
	Totals	**271**	**298**	**516**	**385**	**10.8%**	**11.9%**	**20.7%**	**15.4%**

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	41	41	0	0.0%	2.5%	3.0%	0.0%	2.5%	0.5%	-3.0%	0.0%
	Pivot	0	0	0	0	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
	Flood	686	479	540	599	38.6%	29.3%	40.2%	45.0%	-9.3%	10.9%	4.8%	6.4%
	Totals	**686**	**520**	**581**	**599**	**38.6%**	**31.8%**	**43.2%**	**45.0%**	**-6.8%**	**11.4%**	**1.8%**	**6.4%**

Non-Irrigated

Multi-Use	804	710	621	578	45.2%	43.3%	46.2%	43.4%	-1.9%	2.9%	-2.9%	-1.9%
Hay/Pasture	288	407	142	155	16.2%	24.9%	10.6%	11.7%	8.7%	-14.3%	1.1%	-4.5%
Totals	**1,092**	**1,117**	**763**	**733**	**61.4%**	**68.2%**	**56.8%**	**55.0%**	**6.8%**	**-11.4%**	**-1.8%**	**-6.4%**

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	0.7	1.6	2.6	0.0	2.6	5.9	2.5	6.2	4.7
Max	22.3	9.7	15.1	85.9	100.0	102.3	20.6	34.0	4.7
Average	14.4	5.6	8.9	24.2	28.4	31.2	10.3	20.1	4.7
Sum	71.8	22.5	44.6	290.9	256.0	249.8	31.0	40.2	4.7

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)	83.2
Channel to Riparian (acres)	44.6
Riparian Encroachment (acres)	**-38.6**

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	18.1	75.8	16.2	0.0	**110.1**
Acres/Valley Mile	5.7	23.8	5.1	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	4.96	1.09%	8.78	0.30	0.90	0.41

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.

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 A

In the study segment, Laurel to Springdale, three themes emerge as dominant across the four interest groups. One theme focuses on the changing riverbank profile as more and more residential homes are built on the river's edge. The second theme focuses on the river as a powerful and dynamic physical entity. The third is about the changing social profiles of their communities and how those changes influence user practices.