Poindexter Slough Fishery Restoration

Preliminary Engineering Report

Prepared for:

<u>Beaverhead Watershed Committee</u>
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Submitted by:

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Project Identification

Poindexter Slough is located in Beaverhead County, 3 miles south of Dillon Montana on Highway 41. The project area comprises the entire channel from its departure with the Beaverhead River at latitude 45˚ 9' 45.7" N and longitude 112˚ 41' 46.0" W to its confluence with the Beaverhead at 45˚ 11' 47.9" N and 112˚ 40' 42.0" W. Figure 1 shows the location of the project site. The proposed work is a design and construction project that will improve the fishery by greatly increasing deep pool habitat and will improve water quality by reducing sedimentation.

Appendix A of this report includes detailed aerial maps, cross-sections, profiles, conceptual designs, and photograph locations. Appendix B includes photographs of the project site. Please review and refer to these appendices as needed.

Project History and Related Work

Poindexter Slough is a spring-fed tributary to the Beaverhead River and has a total channel length of approximately 4.73 miles. The upper 1.53 miles (Station 169+00 to 250+00) of Poindexter Slough are located on private property, while the lower 3.20 miles are located on public lands. This makes Poindexter Slough one of the few valley bottom springs creeks open to public fishing in southwest Montana (Oswald 2009). Because of the close proximity to the city of Dillon, the slough is used heavily by the public. The primary game fish are brown trout and mountain whitefish (Oswald 2009).

Montana Fish, Wildlife & Parks (FWP) has conducted periodic fish population surveys of Poindexter Slough (Oswald 2006, 2007). Some results of these surveys are summarized later in this technical report. Other relevant work includes a memorandum of understanding between the US Bureau of Reclamation (BOR) and FWP signed in 2006 to examine opportunities to improve the environmental health of the Beaverhead River as it relates to flow management at Clark Canyon Reservoir. Efforts resulting from this memorandum may include:

1. studying different minimum winter flow releases from the dam depending on the water year (drought conditions, average year, wet year);
2. studying the potential of a dedicated reservoir storage in order to accomplish higher river flows during naturally low-flow months in all years, and especially in average and drought years;
3. studying different minimum threshold reservoir pool levels, depending on the water year (drought conditions, average year, wet year);
4. studying the potential of a dedicated reservoir storage in order to accomplish short-term, bankfull events in average and wet years;
5. working with water users to dedicate reservoir storage to river flows that result from the investment in efficiency in the management and delivery of irrigation water.

If implemented, these proposed changes could have significant positive implications for Poindexter Slough.

In addition, Montana State University (MSU) extension staff conducted a flow study of the Beaverhead River - including Poindexter Slough - to develop a water budget (Bauder et al 2004). This study included continuous flow measurements at four locations relevant to Poindexter Slough for the May 12 through October 12, 2004 irrigation season.

Finally, a total maximum daily load (TMDL) plan is under development by the Beaverhead Watershed Committee and Montana Department of Environmental Quality (DEQ) The TMDL effort is currently on hold due to manpower shortages, but when completed, it is expected the TMDL document will identify Poindexter Slough as impaired by sediment and flow alterations. The TMDL will likely support restoration measures to improve water quality in Poindexter Slough.

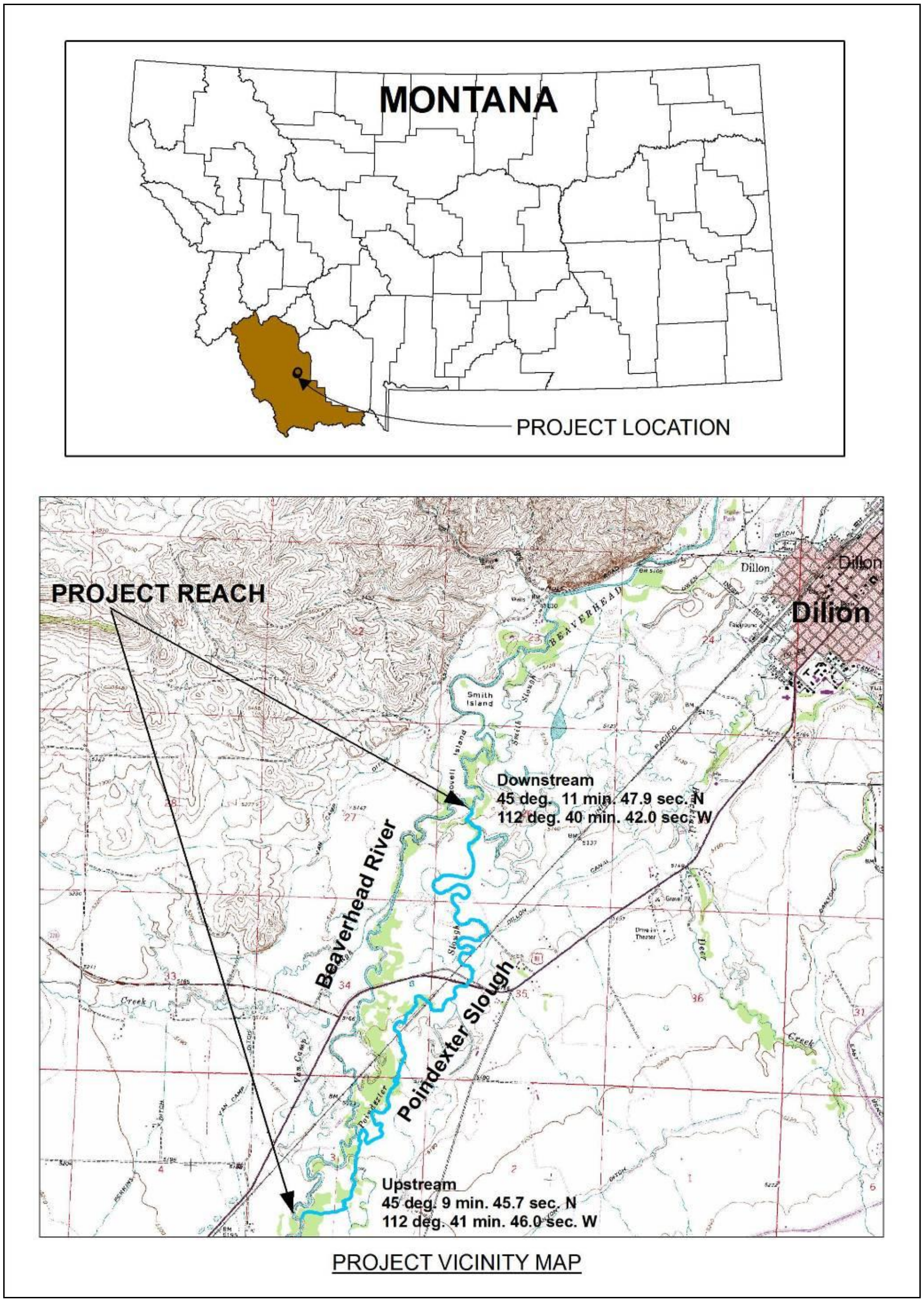

Figure 1. Location map for Poindexter Slough.

Project Purpose

The purpose of the project is to restore renewable resources by improving fish habitat and water quality in Poindexter Slough. The project as proposed will also improve riparian habitat and reduce stream temperatures.

To achieve this purpose, the following steps will be taken:

1. Assess current conditions and limiting factors to develop conceptual plans and costs (this document fulfills this step).
2. Acquire funding from grant sources.
3. Contract with a design firm to develop final designs, specifications, and construction costs; and to provide construction oversight services.
4. Acquire all local, state, and federal permits required for the project.
5. Implement grazing management practices.
6. Contract with an equipment firm to provide labor, equipment, materials, and fabrication.
7. Conduct post-project monitoring to evaluate whether objectives were met and identify any maintenance needs.

Renewable Resource Current Condition

Hydrology

Although Poindexter Slough is considered to be a spring creek, the majority of flow Poindexter Slough receives is surface water diverted from the Beaverhead through a headgate at Station 250+00 (Figure 2). The maximum amount of flow this headgate can convey is approximately 55 cubic feet per second (cfs). However, the headgate is generally operated at a much lower flow. During the 2004 irrigation season (May 12 through October 12) for example, flow diverted into Poindexter Slough averaged 22.5 cfs (Bauder et al 2004). Water that is diverted into Poindexter Slough is typically withdrawn again by the Dillon Canal at Station 111+00 (Figure 3). During the 2004 irrigation season, flow withdrawn from Poindexter Slough to the Dillon Canal averaged 26.5 cfs. Under the current operating scenario, the upper section of Poindexter Slough (Station 111+00 to 250+00) serves as conveyance to the Dillon Canal.

Figure 2. Headgate at the upstream end of Poindexter Slough (Station 250+00).

Poindexter Slough is an historic side channel of the Beaverhead River. At one time, Poindexter Slough conveyed the entire flow of the river, but now it is isolated from the Beaverhead River and flows entering the slough are controlled. Similarly, flows in the Beaverhead River are controlled by Clark Canyon Dam, which is operated as a storage reservoir for irrigation. The dam typically stores winter and spring runoff flows, then releases stored water during the irrigation season. Consequently, flows in the Beaverhead tend to be quite low during winter and spring months when water is stored, lack the peak in spring flows typical of snowmelt dominated hydrology, but are sustained at higher-than-normal levels for the remainder of the summer/fall irrigation season. The upper section of Poindexter Slough from Station 111+00 to 250+00 mirrors this flow regime.

Figure 3. Dillon Canal headgate where irrigation flows are withdrawn from Poindexter Slough (Station 111+00)

Flows in the lower 2.10 miles of Poindexter Slough (downstream of Station 111+00) are limited to excess flow from the irrigation system (Figure 4) and any groundwater that replenishes the stream. By the time Poindexter Slough re-joins the Beaverhead River at Station 0+00, groundwater may account for approximately 15 to 16 cfs of flow. During the 2004 irrigation season, flow at the mouth of Poindexter Slough (Station 0+00) averaged 13.8 cfs (Bauder et al 2004). However, in low water years, flows as low as 6 cfs have been observed at the mouth of Poindexter Slough (Oswald 2006).

Figure 4. Pin and plank control structure at Station 111+00 that allows water to flow to the lower reaches of Poindexter Slough. Note this structure typically has weir boards in place during the irrigation season and allows less flow to pass.

Geomorphology

From Station 232+00 to 250+00 (0.34 miles), Poindexter Slough is a man-made irrigation ditch. This section of channel is typically U-shaped with berms on both sides. The bed profile is relatively flat with several high spots that could be excavated to allow more flow to be diverted through the headgate.

The remainder of Poindexter Slough downstream of Station 232+00 flows in a natural channel that exhibits morphological characteristics typical of a stream that is oversized relative to channel forming flows. Channel forming flows are those discharges most responsible for maintaining channel shape through the processes of scour and deposition. In many streams dominated by snowmelt hydrology, these flows recur every 1.5 to 2.0 years and often coincide with discharges that reach the tops of the banks, or bankfull. Bankfull discharge is also referred to as the channel forming flow because it is the discharge that moves the largest volume of bed and bank material and, therefore, is most responsible for forming and maintaining channel shape.

Bankfull flow for Poindexter Slough is estimated to be approximately 500 cfs. However, Poindexter Slough rarely receives bankfull flows (except during extremely high water years) for the following reasons:

1. the operating plan for Clark Canyon Dam does not allow for regular releases of bankfull discharges to the Beaverhead River, so high spring flows are not available to Poindexter Slough; and
2. flow in Poindexter Slough is isolated from the Beaverhead River and controlled by a headgate that is too small to convey bankfull flows even if they were available.

In response to the absence of bankfull discharges, Poindexter Slough has developed a wide, shallow channel cross-section with average width:depth ratios of 51.31 for riffles and 26.33 for pools. This is because the stream no longer has the energy needed to scour and maintain bed features such as pools. Instead, the channel now consists mostly of riffles and runs. In some locations the stream is developing a smaller, inset channel that corresponds to the 55 cfs limit of flow that can be diverted through the irrigation headgate. The channel still lacks diverse bed forms in these locations.

The effect of low flows is also evident in the channel profile, which is relatively flat. This is often referred to as a plane bed morphology, referring to the lack of variable depths along the length of the channel. Indeed, the average pool depth was 1.22 feet, with only two pools exceeding 2 feet deep in 7100 feet of stream channel. The frequency of pools was also low with one pool occurring every 300 feet of channel on average. Many of these pools were less than 1 foot deep. Similarly, banks along Poindexter Slough tend to be stable in part due to a lack of erosive flows and in part due to grazing management.

Habitat improvements were made to a section of Poindexter Slough from Station 169+00 to 232+00 (private land) in the early 1980s. The work consisted of installing various passive habitat improvement structures such as wing deflectors, k-dams, and rock vanes. These measures somewhat increased the depth and frequency of pools. However, passive improvement measures such as these are no longer used because they are only moderately effective and are not self-sustaining. A section of Poindexter Slough within the habitat improvement reach did exhibit better cross-section characteristics. This section was between Stations 197+00 and 171+00 and had width:depth ratios of 32.84 for riffles and 13.99 for pools. However, these dimensions were still wider and shallower than the width:depth ratios of 12 to 20 for riffles and 8 to 12 for pools typically found in streams that are appropriately sized relative to channel forming (bankfull) flows. These width:depth ratios are summarized below:

	Riffle	Pool
Impaired reaches of Poindexter Slough	51.31	26.33
Improved reaches of Poindexter Slough	32.84	13.99
Target values for reference reaches	12 to 20	8 to 12

The pin and plank control structure (Figure 4) at the Dillon Canal headgate creates a backwater in Poindexter Slough that extends upstream approximately 1700 feet (between stations 111+00 and 128+00. This section of Poindexter Slough has develop a very high width:depth ratio and has resulted in significant deposition of fine sediment on the stream bed. The backwater effect could be eliminated during non-irrigation season by replacing the control structure and installing new structure with a lower floor elevation.

The section of Poindexter Slough from of the Dillon Canal diversion downstream to the confluence with the Beaverhead is relatively low gradient and is strongly influenced by beaver dams. In February 2010 beaver dams in this reach created three backwatered reaches inundating a total of 3700 feet of channel. The dams tend to accumulate fine sediment and increase water temperatures in the summer when flows are low.

Riparian Condition

Riparian conditions along Poindexter Slough differ primarily between the private and state owned lands. The private land is used for grazing by high densities of livestock for a short duration in winter. This management strategy prevents forage from being over utilized and protects the stream banks from erosion. However, this management strategy is also preventing the recruitment of young willows, resulting in a stand of mature and decadent willows that are not being replaced over time. This is problematic on stream banks where the gradual loss of willows reduces overhead cover for fish and increases the likelihood of erosion.

The state-owned reaches of Poindexter Slough have not been grazed for a long period of time. Willow recruitment is good and there is a continuum of willow age classes from saplings to mature and decadent willows. However, other forage (e.g. grasses, sedges) is dominated by a large amount of residual plant matter that reduces productivity and encourages weeds.

Fishery

Not surprisingly, Montana Fish, Wildlife & Parks has documented a steady decline in the fishery of Poindexter Slough over the past two decades. Brown trout recruitment decreased significantly in the 1990s concurrent with the discovery of whirling disease in Poindexter Slough (Oswald 2006). More recently, brown trout populations have declined as a result of flow management, drought, and loss of habitat due to sedimentation. High spring runoff flows no longer scour pool habitat, replenish spawning beds, or transport fine sediment from the stream bed. The lack of scouring flows also reduces habitat for aquatic insects as the stream bed becomes infiltrated or covered by fine sediment. In addition, overhead vegetative cover is gradually disappearing due to poor recruitment on private land.

It is instructive to note that the *minimum* instream flow recommended by FWP to maintain aquatic life in Poindexter Slough is 58 cfs (Oswald 2006). This flow can only be achieved with the headgate wide open and no flow diverted for the Dillon Canal.

The declining fish population has been noted by area fishermen and guides, with fewer and fewer anglers visiting Poindexter Slough to fish. This is counter to the recent strong increases in angling pressure on most publicly accessible fishing water in Montana. The formerly excellent trout fishery in Poindexter Slough will require intervention to restore habitat and improve opportunities for anglers. This would help to relieve fishing pressure on other nearby streams.

Project Goals and Objectives

The primary goal of the proposed project is to significantly improve the public fishery in Poindexter Slough. This would include increasing the quantity and depth of high quality deep pool habitat, restoring appropriate width:depth ratios for riffles and pools, removal or isolation of fine sediment deposits from the stream bed, and encouraging natural recruitment of willows and other woody riparian vegetation along Poindexter Slough. These improvements will have the added benefit of reducing thermal loading, reducing habitat for *Tubifex tubifex* (the intermediate host for whirling disease), and increasing aquatic insect populations.

Specifically, the project seeks to achieve the following objectives:
Objective 1: Increase the density of deep pool habitat to 1 pool every 5 to 7 bankfull channel widths;
Objective 2: Increase maximum pool depth to 0.20 times bankfull width;
Objective 3: Restore riffle width:depth ratios to 12 to 20;
Objective 4: Restore pool width:depth ratios to 8 to 12;
Objective 5: Eliminate fine sediment from riffles and the outside banks and beds of pools; and
Objective 6: Improve woody riparian vegetation by modifying current grazing practices and transplanting willows along banks lacking woody cover.

Alternatives, Costs, and Benefits

Several alternative actions are presented to meet the desired outcome of the project. These include:

1. No action (natural recovery)
2. Flow augmentation
3. Channel restoration
4. Channel restoration with flow augmentation

Costs for each alternative were developed based on recent, similar projects. Costs include final design and construction but do not include administrative costs. These alternatives and estimated costs are evaluated in detail below.

Alternative 1: No Action (Natural Recovery)

The no action alternative would allow natural forces to shape and restore the channel over time. This alternative may work for the channel downstream of Station 111+00, where flow is dominated by groundwater. The channel may eventually become narrower but this will take a long time to occur. By comparison, Thompson Creek near Bozeman has been fenced and allowed to naturally recover from similar impairments for the past 25 years. Thompson Creek has become somewhat narrower and riparian vegetation is in good condition, but the bed is still covered by fine sediment and pool habitat is completely lacking. This slow outcome is likely for the downstream reach of Poindexter Slough as well. For Poindexter Slough upstream of Station 111+00, the no action alternative will do little to address the continued imbalance between channel dimensions and flows (no spring runoff, extended higher than normal flows during summer). Consequently, habitat conditions are likely to remain poor.

Alternative 1 Estimated Cost: $0

Alternative 1 Cost/Benefit Analysis

Advantages

1. No cost.
2. No environmental impacts associated with implementation.
3. No permits required.
4. The spring creek character of lower Poindexter Slough (below Dillon Canal) would be retained.

Disadvantages

1. Natural channel processes will not restore habitat to the upper reaches of Poindexter Slough and the lower reaches will take several decades if not longer to recover.
2. Continuation of the current grazing management practices on private land will lead to a loss of woody riparian vegetation as shrubs become decadent and die.

Meet Project Objectives?

Objective 1: Increase the density of deep pool habitat to 1 pool every 5 to 7 bankfull channel widths.	**No**
Objective 2: Increase maximum pool depth to 0.20 times bankfull width.	**No**
Objective 3: Restore riffle width:depth ratios to 12 to 20.	**No**
Objective 4: Restore pool width:depth ratios to 8 to 12.	**No**
Objective 5: Eliminate fine sediment from riffles and the outside banks and beds of pools.	**No**
Objective 6: Improve woody riparian vegetation by modifying current grazing practices and transplanting willows along banks lacking woody cover.	**No**

Alternative 2: Flow Augmentation

Alternative 2 would address project objectives by establishing a minimum year-round base flow (FWP recommends 58 cfs) in addition to running periodic flushing flows through Poindexter Slough to mimic spring runoff and maintain channel form and function. This would require supplementing irrigation flow with additional water diverted from the Beaverhead River. The potential to release spring flushing flows from Clark Canyon Reservoir is being studied by BOR and FWP. Such releases would greatly improve opportunities to also route flushing flows through Poindexter Slough.

Restoring Poindexter Slough with minimum base flows and periodic flushing flows would require determining the magnitude and duration of flows needed to move fine sediment. Methods such as those presented in Schmidt et al (2004) provide a means for estimating flushing flows. These methods were developed to meet the needs of water users by specifying flushing flows only in above average water years. Once a flushing flow magnitude is determined, the existing diversion at Station 250+00 would need to be replaced with a larger structure or a second diversion to accommodate the added flow. Alternatively, the historic diversion structure near Station 216+00 could be re-established to provide flushing flows. An operation plan would also be needed with a designated individual or agency responsible for operating the headgate in good water years.

The pin and plank control structure at the Dillon Canal headgate would be replaced with a wider structure installed at a lower elevation. This will reduce the backwater that extends upstream of the diversion. The structure would be designed to operate in the same way as the existing control.

Eroding stream banks would need to be stabilized and revegetated prior to implementing this alternative. In addition, a new grazing management plan would be implemented for private land to promote recruitment of woody riparian vegetation and willows would be transplanted on barren banks to improve cover. Adequate fencing already exists to manage grazing.

Alternative 2 Estimated Cost

Item	Qty	Unit	Unit Price		Cost
Install headgate @ Sta. 250+00	1	each	$ 16,860.00	$	16,860.00
Replace blow off control @ Sta. 111+00	1	each	$ 18,000.00	$	18,000.00
Stabilize eroding banks	1500	ft	$ 5.00	$	7,500.00
Transplant willows	2000	ft	$ 7.00	$	14,000.00
Grazing management plan	1	each	$ 750.00	$	750.00
			Subtotal	**$**	**57,110.00**
			Contingency 20%	$	11,422.00
			Subtotal	**$**	**68,532.00**
			Design 17%	$	11,650.44
			Permitting 8%	$	5,482.56
			Oversight 7%	$	4,797.24
			Subtotal	**$**	**21,930.24**
			TOTAL	**$**	**90,462.24**

Alternative 2 Cost/Benefit Analysis

Advantages

1. Moderate cost.
2. Avoids mechanical manipulation of the stream channel.
3. Mimics natural sediment scour, transport, and deposition processes.

Disadvantages

1. Flushing flows may require water rights.
2. Flows may be available less frequently than needed to maintain habitat and flush sediment.
3. Sediment flushed from Poindexter Slough would be transported to the Beaverhead River.
4. It may take very large flows to restore deep pool habitat.
5. Flushing flows will increase the potential for bank erosion.

Meet Project Objectives?

Objective	Meets?
Objective 1: Increase the density of deep pool habitat to 1 pool every 5 to 7 bankfull channel widths.	**?**
Objective 2: Increase maximum pool depth to 0.20 times bankfull width.	**?**
Objective 3: Restore riffle width:depth ratios to 12 to 20.	**?**
Objective 4: Restore pool width:depth ratios to 8 to 12	**Yes**
Objective 5: Eliminate fine sediment from riffles and the outside banks and beds of pools.	**Yes**
Objective 6: Improve woody riparian vegetation by modifying current grazing practices and transplanting willows along banks lacking woody cover.	**Yes**

Alternative 3: Channel Restoration

Trout habitat in Poindexter Slough would be improved in Alternative 3 by constructing pools and using the excavated bed material to narrow the channel. Sod mats and willow clumps borrowed from on-site sources would be used to narrow the channel and revegetate banks. A new grazing management plan would be implemented for private land to promote recruitment of woody riparian vegetation. Adequate fencing already exists to manage grazing. Willows would be transplanted to barren stream banks to improve cover. The photos below illustrate a similar project immediately before and after construction.

Narrowing the channel will increase the competency of Poindexter Slough to transport sediment. In addition, by excavating pools and utilizing the sediment and substrate material to build vegetated banks and narrow the channel, most of the fine sediment will be removed or isolated from flow. This will help maintain clean bed substrates and will greatly benefit aquatic macroinvertebrate production and spawning opportunities for trout. Narrowing the channel will also promote the development of undercut banks, which will increase limited instream cover for fish.

Narrowing the stream channel and improving riparian cover will result in a more stable temperature regime (cooler summer and warmer winter temperatures). Decreasing the width to depth ratio will reduce the total

Before: Stream over wide and shallow, poor fishery, sediment-laden, lack of pools and cover (4/20/09)

Fence Post reference point

After: Stream narrowed, riffle/pool habitat enhanced (4/22/09)
Note meandering plan form.

surface area of the creek exposed to solar radiation. Channel narrowing will also decrease the residence time of water in the channel, which will further reduce thermal fluctuations. A more stable temperature regime will improve productivity of macroinvertebrates and fish.

Constructed pools will provide critical spawning and rearing habitat for resident and fluvial trout. Poindexter Slough is an important reproductive stream for brown trout from the Beaverhead River. Spawning habitat is currently severely impaired in the lower reaches of the project area due to high fine sediment loads and a lack of pool habitat.

Alternative 3 Estimated Cost

Item	Qty	Unit	Unit Price	Cost
Construct pool habitat	23800	ft	$ 2.00	$ 47,600.00
Reduce channel width with sod mats	18500	ft	$ 5.50	$ 101,750.00
Stabilize eroding banks	1500	ft	$ 5.00	$ 7,500.00
Transplant willows	2000	ft	$ 7.00	$ 14,000.00
Replace blow off control @ Sta. 111+00	1	each	$ 18,000.00	$ 18,000.00
Grazing management plan	1	each	$ 750.00	$ 750.00
			Subtotal	**$ 189,600.00**
			Contingency 20%	$ 37,920.00
			Subtotal	**$ 227,520.00**
			Design 10%	$ 22,752.00
			Permitting 2%	$ 4,550.40
			Oversight 15%	$ 34,128.00
			Subtotal	**$ 61,430.40**
			TOTAL	**$ 288,950.40**

Alternative 3 Cost/Benefit Analysis

Advantages	Disadvantages	Meet Project Objectives?	
1. Provides more control over project outcome through active versus passive approach.	1. Higher cost.	Objective 1: Increase the density of deep pool habitat to 1 pool every 5 to 7 bankfull channel widths.	**Yes**
2. Habitat benefits are realized immediately.	2. Temporary disturbance to stream corridor.	Objective 2: Increase maximum pool depth to 0.20 times bankfull width.	**Yes**
3. Allows for larger, deeper pool habitat to be created (optimal).	3. Without flushing flows, bed substrate may still become infiltrated by fine sediment.	Objective 3: Restore riffle width:depth ratios to 12 to 20.	**Yes**
4. Sediment is removed from transport (tied up in new banks)		Objective 4: Restore pool width:depth ratios to 8 to 12	**Yes**
5. Does not require changes in water rights.		Objective 5: Eliminate fine sediment from riffles and the outside banks and beds of pools.	**Yes**
		Objective 6: Improve woody riparian vegetation by modifying current grazing practices and transplanting willows along banks lacking woody cover.	**Yes**

Alternative 4: Channel Restoration with Flow Augmentation

This alternative combines alternatives 2 and 3. The primary reason to combine them is to incorporate the benefits of flushing flows in Alternative 2 to maintain and rejuvenate habitat features created in Alternative 3. This combination would ensure Poindexter Slough remains a viable, productive fishery.

Alternative 4 Estimated Cost

Item	Qty	Unit	Unit Price		Cost	
Construct pool habitat	23800	ft	$	2.00	$	47,600.00
Reduce channel width with sod mats	18500	ft	$	5.50	$	101,750.00
Stabilize eroding banks	1500	ft	$	5.00	$	7,500.00
Transplant willows	2000	ft	$	7.00	$	14,000.00
Install headgate @ Sta. 250+00	1	each	$	16,860.00	$	16,860.00
Replace blow off control @ Sta. 111+00	1	each	$	18,000.00	$	18,000.00
Grazing management plan	1	each	$	750.00	$	750.00
				Subtotal	**$**	**206,460.00**
				Contingency 20%	$	41,292.00
				Subtotal	**$**	**247,752.00**
				Design 12%	$	29,730.24
				Permitting 2%	$	4,955.04
				Oversight 15%	$	37,162.80
				Subtotal	**$**	**71,848.08**
				TOTAL	**$**	**319,600.08**

Alternative 4 Cost/Benefit Analysis

Advantages	Disadvantages	Meet Project Objectives?	
1. Provides more control over project outcome through active versus passive approach.	1. Highest cost.	Objective 1: Increase the density of deep pool habitat to 1 pool every 5 to 7 bankfull channel widths.	**Yes**
2. Habitat benefits are realized immediately.	2. Temporary disturbance to stream corridor.	Objective 2: Increase maximum pool depth to 0.20 times bankfull width.	**Yes**
3. Allows for larger, deeper pool habitat to be created (optimal).	3. Flushing flows may require water rights.	Objective 3: Restore riffle width:depth ratios to 12 to 20.	**Yes**
4. Sediment is removed from transport (tied up in new banks)		Objective 4: Restore pool width:depth ratios to 8 to 12	**Yes**
		Objective 5: Eliminate fine sediment from riffles and the outside banks and beds of pools.	**Yes**
		Objective 6: Improve woody riparian vegetation by modifying current grazing practices and transplanting willows along banks lacking woody cover.	**Yes**

Preferred Alternative

The four alternatives to restore Poindexter Slough were presented to BWC. Alternatives 1 and 2 were rejected because they do not meet the project's goals and objectives. Alternatives 3 and 4 both meet the goals and objectives, but Alternative 4 has the added benefit of providing minimum base flows and periodic flushing flows to support and maintain restored habitat in Poindexter Slough. The estimated cost to provide the benefits associated with flow augmentation are relatively low, so Alternative 4: Channel Restoration with Flow Augmentation was selected by the BWC as the preferred alternative.

Project Implementation Plan

The Poindexter Slough restoration project will be sponsored and managed by the Beaverhead Watershed Committee. BWC will subcontract engineering and construction services. Specific tasks needed to complete the project are described in the following sections.

Phasing

Grant Acquisition

The project will be funded by grants and in-kind matching funds. This preliminary engineering report was developed as part of a grant proposal for the Renewable Resource Grant and Loan Program (RRGL) administered by Montana Department of Natural Resources and Conservation (DNRC). These materials (engineering report and RRGL proposal) will be used by BWC to prepare proposals for other grant sources. The comprehensive nature of the RRGL grant application process will provide suitable information for completing all other grant applications without the need for further analysis or technical expertise. Potential grant sources include:

Grant Source	Grant	Application Deadline
Orvis	Orvis Conservation Grant Program	May 1, 2010
Montana Department of Natural Resources and Conservation	Renewable Resource Grant and Loan Program	May 15, 2010
Montana Fish, Wildlife & Parks	Montana Future Fisheries Improvement Program (FFIP)	June 1, 2010
Montana Department of Natural Resources and Conservation	Watershed Planning Assistance Grants	July 2010
Montana Department of Environmental Quality	319 Grant Program	September 25, 2010
US Fish and Wildlife Service	North American Wetlands Conservation Act (NAWCA) Grant	October 28, 2010
Jackson Hole One Fly Foundation and National Fish and Wildlife Foundation	Stream Improvement Program	February 2011
US Environmental Protection Agency	5 Star Restoration Program	February 2011
Trout Unlimited	Embrace-A-Stream	Unknown
US Fish and Wildlife Service	Partners for Fish and Wildlife Program	Not Applicable

Supplemental Flow Investigation

As previously described, the project would benefit from (but is not reliant on) obtaining supplemental flows to help transport sediment and maintain instream habitat. BWC will establish a subcommittee to explore the potential for supplementing flows in Poindexter Slough. Ideally, the subcommittee will seek to implement a minimum, year-round instream flow of 58 cfs as recommended by FWP (Oswald 2006), with the option of periodically supplementing this minimum flow with an additional 50 to 100 cfs to flush sediment and maintain spawning beds in good water years. The subcommittee with work with local irrigators, FWP, and DNRC to determine whether flow augmentation is feasible.

Flow augmentation will influence final design because larger flows will require a large channel cross-section. However, the cost to design a larger versus a smaller channel will be the same. Similarly, construction costs are not expected to change significantly with the final size of the stream channel. Consequently, the outcome of the subcommittee's investigation is not likely to affect the estimated final design or construction costs of the project.

Final Design

A qualified stream restoration design consultant will be retained to develop final designs for the project. Final designs will include additional field surveys, hydrology and hydraulics analyses, and preparation of final design drawings and bid specifications. The completed final design and bid package will be suitable for procuring construction bids, estimate construction costs, and acquiring all necessary permits for the project.

Permitting

The project will require the following permits:

	Permit	Issuing Agency
1.	Clean Water Act (404) Permit	US Army Corps of Engineers
2.	Montana Natural Streambed and Land Preservation Act (310 Permit)	Beaverhead Conservation District
3.	Short-term Water Quality Standard for Turbidity (318 Authorization)	Montana DEQ
4.	Stormwater Discharge General Permits	Montana DEQ
5.	Montana Floodplain and Floodway Management Act	Montana DNRC
6.	Water Right Permit and Change Authorization (only needed if flows are augmented)	Montana DNRC

All permits will be acquired by BWC with technical assistance provided by the design engineering consultant.

Construction

Construction services will be provided by a qualified excavation contractor through an open, competitive bidding process. Construction services will include providing labor, equipment, materials, and fabrication to complete the project as designed. Prospective bidders will be required to provide proof of substantial experience completing large stream restoration projects.

Construction oversight will be provided by the design engineer contractor. Oversight will include documentation of construction progress, assurance of proper installation, design modifications, and processing pay requests and change orders.

Post-project Monitoring and Maintenance

The project will be monitored annually for a period of 3 years following completion of construction. Monitoring will be performed by BWC staff and volunteers and will include inspecting channel stability, surveying permanent cross-sections, estimating fine sediment, monitoring installed vegetation, and redd counts. In addition, FWP will be asked to conduct post-project fish population estimates. These data will be evaluated for annually to determine whether project goals are being met and to identify potential maintenance needs. Maintenance items will be scheduled for repair and will be funded through additional grant funds as needed unless they are the result of design or installation errors, in which case they will be corrected by the design contractor and/or construction contractor.

Staffing and Budget

The table on the following page presents a proposed staffing and grant acquisition plan to implement and fund the project.

Completion Schedule

A timeline for completing the project is proposed in the following table:

TASK	SCHEDULE
Grant Acquisition	May 2010 - May 2011
Orvis Conservation Grant Program	May 1, 2010
DNRC Renewable Resource Grant and Loan Program	May 15, 2010
FWP Future Fisheries Improvement Program	June 1, 2010
NDNRC Watershed Planning Assistance Grants	July 1, 2010
US FWS Partners for Fish and Wildlife Program	August 1, 2010
TU Embrace-A-Stream	August 1, 2010
DEQ 319 Grant	September 25, 2010
US FWS North American Wetlands Conservation Act (NAWCA) Grant	October 28, 2010
Jackson Hole One-Fly Stream Improvement Program	February 1, 2011
US EPA 5 Star Restoration Program	February 1, 2011
Supplemental Flow Investigation	April 2010 - May 2011
Final Design	March - June 2011
Permitting	July - September 2011
Construction	February - April 2012
Post-project Monitoring and Maintenance	April 2012 - September 2014

FUNDING PLAN

Task	Staffing	Source	Funds Needed	Secured?
Grant Acquisition				
RRGL Grant	Engineering Consultant	DNRC RRGL Planning Grant	$25,000	Yes
Other Grants	BWC Staff	DNRC Watershed Planning Assistance Grants	$5,000	No
Supplemental Flow Investigation	BWC Staff	DNRC Watershed Planning Assistance Grants	$5,000	No
	Agencies	In-Kind Match	$5,000	No
Final Design	Engineering Consultant	DNRC RRGL Grant	$29,500	No
Permitting	BWC	In-Kind Match	$2,000	No
	Engineering Consultant	DNRC RRGL Grant	$2,000	No
Construction	Construction Contractor	Future Fisheries Improvement Program Grant	$95,000	No
	Construction Contractor	Jackson Hole One Fly Foundation	$15,000	No
	Construction Contractor	US FWS Partners for Fish and Wildlife	$15,000	No
	Construction Contractor	Orvis Conservation Grant Program	$25,000	No
	Construction Contractor	Trout Unlimited Embrace-A-Stream	$10,000	No
	Construction Contractor	US EPA 5 Star Restoration Program	$30,000	No
	Construction Contractor	US FWS NAWCA Grant	$30,000	No
	Construction Contractor	DNRC RRGL Grant	$40,000	No
	Engineering Consultant	DNRC RRGL Grant	$18,500	No
	BCW Staff	DNRC RRGL Grant	$10,000	No
Post-project Monitoring and Maintenance	BCW Staff	DEQ 319 Grant	$15,000	No
	BCW Staff	Future Fisheries Improvement Program Grant	$5,000	No

SUMMARY BY FUNDING SOURCE

Source	Funds Needed	Secured?
DNRC RRGL Planning Grant	$25,000	Yes
DNRC Watershed Planning Assistance Grants	$10,000	No
DNRC RRGL Grant	$100,000	No
Future Fisheries Improvement Program Grant	$100,000	No
Jackson Hole One Fly Foundation	$15,000	No
US FWS Partners for Fish and Wildlife	$15,000	No
Orvis Conservation Grant Program	$25,000	No
Trout Unlimited Embrace-A-Stream	$10,000	No
US EPA 5 Star Restoration Program	$30,000	No
US FWS NAWCA Grant	$30,000	No
DEQ 319 Grant	$15,000	No
In-Kind Match	$7,000	No
TOTAL:	**$382,000**	**No**

Literature Cited

Oswald, R.A. 2006. Inventory and survey of selected stream fisheries of the Red Rock, Ruby, and Beaverhead river drainages of southwest Montana, 2003-2006. Job Prog. Rpt., Fed. Aid in Fish and Wild. Rest., Proj. Nos. F-113-R-3, F-113-R-4, F-113-R-6. 55 pp

Oswald, R.A. 2007. Inventory and survey of sport fisheries of Clark Canyon and Ruby River Reservoirs in southwest Montana, 2004-2007. Job Prog. Rpt., Fed. Aid in Fish and Wild. Rest., Proj. Nos. F-113-R-3, F-113-R-4, F-113-R-6. 40 pp

Oswald, R.A. 2009. Population trend analysis and executive summary for selected stream fisheries of the Big Hole, Red Rock, Ruby, and Beaverhead rivers of southwest Montana, 2006-2008. Job Prog. Rpt., Fed. Aid in Fish and Wild. Rest., Proj. Nos. F-113-R-6, F-113-R-7, F-113-R-8.

Schmidt, Larry J.; Potyondy, John P. 2004. Quantifying channel maintenance instream flows: an approach for gravel-bed streams in the Western United States. Gen. Tech. Rep. RMRS-GTR-128. Fort Collins, CO: U.S. Department of Agriculture, Forest Service, Rocky Mountain Research Station. 33 p.

Appendix A: Conceptual Design Sheets

Appendix B: Site Photographs

(The locations where photos were taken are provided in Sheets 18 – 20 of Appendix A.

Photo # 5396

Photo # 5395

Photo # 5394

Photo # 5393

Photo # 5392

Photo # 5391

Photo # 5390

Photo # 5389

Photo # 5388

Photo # 5387

Photo # 5386

Photo # 5385

Photo # 5384

Photo # 5383

Photo # 5382

Photo # 5381

Photo # 5380

Photo # 5379

Photo # 5378

Photo # 5377

Photo # 5376

Photo # 5375

Photo # 5374

Photo # 5373

Photo # 5372

Photo # 5371

Photo # 5370

Photo # 5369

Photo # 5368

Photo # 5367

Photo # 5366

Photo # 5365

Photo # 53764

Photo # 5363

Photo # 5362

Photo # 5361


Photo # 5360


Photo # 5359


Photo # 5358


Photo # 5357


Photo # 5356


Photo # 5355

Photo # 5354

Photo # 5354

Photo # 5352

Photo # 5351

Photo # 5350

Photo # 5349

Photo # 5348

Photo # 5347

Photo # 5346

Photo # 53545

Photo # 5344

Photo # 5343

Photo # 5342

Photo # 5341

Photo # 5340

Photo # 53539