MEMORANDUM OF UNDERSTANDING
THE BILLINGSLEY CREEK IMPROVEMENT PROJECT

PARTIES TO THE MOU AND OBJECTIVES:

This Memorandum of Understanding (MOU) is entered into by John W. (Bill) Jones, Jr., the Idaho Department of Environmental Quality (IDEQ), and the Department of Natural Resources Conservation Service (NRCS).

This MOU sets forth a working relationship between Bill Jones, IDEQ, and NRCS to create wetlands and reduce sediment and nutrients in the Mid-Snake River.

BACKGROUND AND SCOPE OF THE MOU:

IDEQ desires to reduce sediment and nutrients in the Mid-Snake River. Bill Jones and NRCS desires to enhance and preserve fish and game habitat with the objective of improving water quality in Billingsley Creek and the Mid-Snake River. Bill Jones owns and operates farmland adjacent to Billingsley Creek and is responsible for land use activities including grazing, irrigated cropland, and recreation. Billingsley Creek is a source of sediment and nutrients in the Mid-Snake River. Funds are available to reduce sediment and nutrients in the Mid-Snake River pursuant to a Consent Order between IDEQ and Idaho Power Company, dated May 22, 1998.

The parties to the MOU intend to purchase and install materials to be used to create wetlands and restore functionality in Billingsley Creek to meet the goals of the Mid-Snake TMDL by reducing sediment and nutrients in Bill Jones's portion of Billingsley Creek and in the Mid-Snake River.

The parties have determined this project as shown in attachment A (hereinafter "the Project") when implemented will meet the goals of the Mid-Snake TMDL.

AGREEMENT:

1. Bill Jones agrees to:

   A. Obtain all necessary permits, certifications or approvals to implement the Project, including those provided by IDEQ, Idaho Department of Water Resources, United States Corp of Engineers, and consult with Idaho Department of Fish and Game as well as United States Fish & Wildlife.

   B. Contribute approximately $27,470 to materials, installation and labor for stream bank practices and fencing as described in attachment A.

   C. Construct and maintain the Project.

2. The NRCS shall:

A. Provide NRCS EQIP program cost share funds of approximately $31,500 targeted to Stream bank and Shoreline Protection Practices as described in attachment A.

B. Provide construction and management plans for the Project.

3. The IDEQ shall:

A. Provide funding, not to exceed Thirty-Five Thousand Dollars ($35,000), to pay for the cost of the purchase and installation of Fiber Rolls and Bank Stabilization Materials for the Project as described in attachment A. The funding will be provided within 30 days after the construction and installation of the materials. The IDEQ will provide the funding only if it determines that the costs are reasonable and appropriate and the Project as implemented will reduce nutrients and sediments to the Mid-Snake River and otherwise meet the intent of the Consent Order between Idaho Power and IDEQ dated May 22, 1998.

B. Provide technical assistance in the construction of the Project.

GENERAL PROVISIONS:

The term of this agreement shall be for two (2) years unless the agreement is revoked by any one of the parties following 60 days notice to the parties. This agreement may be amended or extended through mutual agreement of the parties.

DATED this 21st day of July, 2004

Idaho Department of Environmental Quality

DATED this 4 day of August, 2004

Natural Resources Conservation Service, Idaho

DATED this 2 day of August, 2004

Bill Jones

J.W. (Bill) Jones, Jr.
Landowner

Engineering Design Report
Natural Resources Conservation Service, Boise Idaho

Job:	Bill Jones Stream Enhancement
Location:	Billingsly Creek, Gooding County, ID
Authority:	CO-01 Program
Job Class:	Streambank Stabilization, III

Introduction and Location

Billingsly Creek is a spring-fed tributary to the Snake River in southern Gooding County in Idaho. The 2,700 foot section of concern has been divided into three treatment units, all of which begin and end on a geologic or man-made stable point in the channel. This report describes the analysis and proposed treatment alternatives for the middle 1,400 feet, called Section 2.

These combinations of treatments for this stream section were derived from an analysis which considered both the physical aspects of the stream such as slope, flow, and sediment transport, and the habitat needs of trout species.

The specific location of the project is in the southwest quarter of Section 30, T 7 S., R 14 E., B.M.

The landowners primary objectives are to improve trout habitat at this very popular trout fishing area. He also wants to control bank erosion and stream widening. These goals are shared by several partners in this project including US Fish and Wildlife Service and Idaho Fish and Game.

Geology and Soils

The stream is set below columnar basalt rimrock from which the headwater springs emanate. These basalt formations often intercept the channel in the form of outcrops and dikes, controlling the base elevation and often the cross section of the channel. The stream is carved into old Snake River floodplains that are now terraces and are mapped as Fathom fine sandy loam and Fathom loamy fine sand. This particular terrace is the second one above the current river channel and is approximately 200 feet above the current Snake River position.

Fisheries Habitat

This reach is bounded by a pipeline crossing at the upstream end and a bridge at the downstream end. Deep pools exist only around these features, and high fish densities are observed in these pools. The channel through section 2 is very wide with little overhanging bank or vegetation. Gravels in the channel bottom are partially embedded, mostly with fine sands. Several letters from US Fish and Wildlife Service and Idaho Department of Fish and Game Fisheries biologists indicate that narrowing the stream and limiting solar gain through the reach will improve fisheries production. These letters are in the case file. We are currently negotiating to have pre-project fish numbers and age classes identified, and to continue that monitoring after the project installation.

Hydrology
Billingsly Creek at the project area has a surface drainage area of approximately 400 acres, but this has little reflection on the spring-fed flows. Some data from an unknown source were used to construct an average monthly hydrograph. This was supplemented by two actual streamflow measurements made by US Fish and Wildlife Service. The stream appears to be rainfall driven with a zero to one month lag in the winter during high flows and driven by irrigation practices with a one to three month lag in the late summer and fall. Billingsly Creek flows increase by five to seven times at the upstream boundary of the project due a large spring inflow which is routed through a fish raising facility. There is a substantial irrigation withdrawal upstream of the project site.

Although the concept of dominant flow (Andrews, 1980; Williams, 1976) (e.g., the flow which does the most work in terms of sediment transport) has less application to a spring fed stream than to a surface runoff driven stream, it will be used in this analysis. Dominant flows appear to be on the order of 45 cfs. As the stream does not fluctuate much, peak instantaneous flows are surmised to be twice this figure, or 90 cfs. Low flows are about 20 cfs.

Hydraulics
Flows of 45 cfs were routed down the constructed channel and floodplain. Mannings 'n' was first calculated using the bed roughness approach of Dawdy (1976), and finally, back calculated from flow measurements made by US Fish and Wildlife service. Values of n ranging from 0.11 at very low flows to 0.04 at very high flows were employed and these figures were checked against Barnes (1977). The software 'XSPRO' was used to derive a stage-discharge relationship at each cross section. Flows of 45 cfs were then routed through the sections using a standard step water surface profiling procedure accounting for losses from different velocity distributions and losses from eddys (Chow, 1959). These water surface profiles show the concept of gradient reversal (Leopold, 1994), that is steeper water surface profiles over pools and flatter ones over riffles at dominant flows. Flow velocities were seldom about 2 feet per second using the water surface profile approach, and not over two feet per second using the roughness approach at a station. The constructed cross section will have rhythmic variations to enhance and reinforce pool and riffle formation.

Geomorphic Cross Section
The relationships derived by Williams (1986), and described by Church (1996) were examined to determine appropriate width, depth, and sinuosity parameters for the channel. As mentioned above, there is very little channel geometry data for spring-fed streams, so these relationships are used only as a guide. All widths described are at the dominant flow of 45 cfs, and all depths described are hydraulic, or average, depths at that flow.

Channel widths for the indicated flows, depths, and slopes ranged from 13 feet (Andrews) to 18 feet (Church). A final width of 18 feet for riffles and 13 feet for pools was selected. Current widths are between 31 and 133 feet. Depths calculated were consistent at approximately 1.5 to 1.8 feet. Maximum section depths were determined to be about 2.5 feet in pools and 1.5 feet in riffles. Current average depths are between 0.72 and 1.7 feet. Constructed depth from the thalweg to the floodplain will average 2.0 feet.

Sinuosity of this stream system should be approximately 1.1 to 1.4, and currently is 1.12. The constructed sinuosity will be 1.3. Meander geometry is a best-guess. Radius of curvature was kept intentionally tight. The reasoning is that the stream can erode the bend wider, but that there is very little building material in the form of suspended sediment to aggrade the curve to a tighter geometry.

Sediment Transport

Currently, the bed of the stream had a D_{50} of 0.04 to 0.2 inches, and these particles are classified as fine gravels. The D_{84} of the channel bed is 0.95 to 1.2 inches, or coarse gravel while the D_{16} is 0.004 inches or very fine sand. These data are from a pebble count performed by US Fish and Wildlife Service personnel. Visual observation did not indicated a heavy armoring layer on the stream bed.

The cross-section that is proposed for the stream will generate an average shear stress of approximately 0.14 lbs ft^{-2}. This will range from 0.2 lbs ft^{-2} in the pools to 0.09 lbs ft^{-2} in the riffles at dominant discharge. The dimensionless Shields stress for this bedload is 0.07, and this is consistent with this channel type (Rosgen, 1994, Andrews, 1984). This shear stress will slightly coarsen the bed of stream and will move particles averaging 0.24 inches in diameter. The selected sizes of the gravel fill will be relatively immobile in this stream.

Treatment to Achieve Desired Physical Shape and Form

Narrowing of the channel will be achieved by filling the stream channel to a prescribed cross section with gravel. The constructed floodplain will be planted with willow wattles to jump start vegetative growth, and provide some cross-floodplain roughness in the event of a high flow. The main mechanism for creating instream diversity initially will be dead tree revetments, combined with aggressive shrub and grass planting. Trees for the revetment are large enough such that the relatively mild flow regime will not float the trees.

Quantities and Costs

Project

3600	CY	Gravel floodplain fill	$18,000
500	LF	Willow Wattles	$ 1,500
1	Job	Mobilization	$ 1,560
TOTAL			$21,060

Specifications

Specific needs for the project are shown on the attached 4 drawing sheets. General specifications are included as Construction Specification 580, Streambank Stabilization.

Environmental Impacts

This project has been analyzed as an integral part of the farm conservation plan. As such it has been determined to not cause any substantial long-term impacts or cumulative effects. This documentation in the form of the site-specific practice effects worksheet and the conservation practice physical effects worksheet, and is found in the case file.

One species, the Bliss Rapids Snail may be found in the area. We will continue to work with US Fish and Wildlife Service to determine if snails are in the project area and if this design will impact their habitat. A biologic assessment will be prepared if it is necessary.

Specifically, installation of this practice may have the short term impact of increasing fine sediment load in the stream. This impact will be during the summer, and will last the duration of construction, or about two weeks. All practical measures such as clean gravel coffer dams, straw bale sediment fences, and work outside the flowing water will be employed to minimize this impact.

Long-term physical impacts will primarily consist of narrowing and deepening the stream channel. In addition, the pool-riffle structure of the stream will be reinforced, and gravels in the stream bottom will coarsen slightly. Bank vegetation, overhanging banks, and the streams access to a flood plain will be increased.

Secondary to these physical impacts will be a slight decrease in water temperature (or possibly, a decrease in the rate of warming through the section) due to decreased width, increased depth, and increased shade. This lowering of water temperature may decrease the occurrence of in-channel vegetative growth, which in turn will decrease oxygen demand in the fall when this vegetation dies and decays.

Approval and Operations and Maintenance

This job is an Engineering Job Class III. An Operation and Maintenance plan is attached. A detailed vegetative planting plan is an integral part of this design. This design is not complete until that plan is attached.

Prepared By: ______________________________
Rob Sampson, Design Engineer

Approved By: ______________________________, acting
Art Shoemaker, State Conservation Engineer

References and Citations

Andrews, E. D., 1980. Effective and Bankfull Discharges of Streams in the Yampa River Basin, Colorado and Wyoming. *Journal of Hydrology* 46: 311:330.

Barnes, H.H., 1977. Roughness Characteristics of Natural Channels, USGS Water Supply Paper 1849, USGPO, Washington D.C. 213 pp.

Chow, V. T., 1959. Open-Channel Hydraulics. McGraw-Hill, New York. 680pp.

Church, M., 1996. Channel Morphology and Typology. *in* River Flows and Channel Forms. Petts, G., and P. Calow, 1996, eds. pp. 185-202.

Dawdy, D. R., 1976. Resistance Equation for Alluvial Channel Flow. Proc. ASCE, Vol 102, No. HY10.

Knighton, D., 1984. Fluvial Forms and Processes. Edward Arnold, London. 218 pp.

Leopold, L. B., 1994. A View of the River. Harvard University Press, Cambridge, MA. 298 pp.

National Research Council, 1992. Restoration of Aquatic Ecosystems. National Academy, Washington D.C.

Natural Resources Conservation Service, 1996. Streambank and Shoreline Protection. Chapter 16, Engineering Field Handbook. USDA, Washington, D.C. 87 pp.

Petts, G., and P. Calow, 1996. River Flows and Channel Forms. Blackwell Science, Oxford. 262 pp.

Rosgen D. L., 1996. Applied River Morphology. Wildland Hydrology, Pagosa Springs, CO. 220 pp.

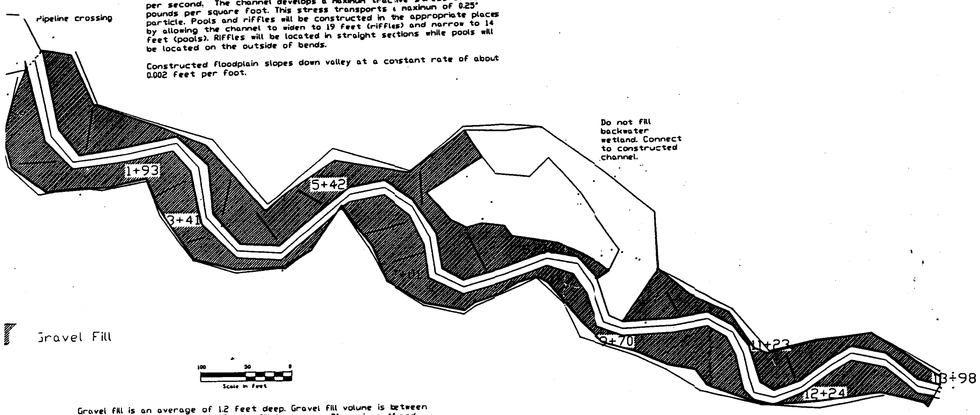
Vetrano, D. M., 1988. Unit Construction of Trout Habitat Improvement Structures for Wisconsin Coulee Streams. Wisconsin Bureau of Fisheries Management Administrative Report No. 27. Department of Natural Resources, Madison Wisconsin. 35 pp.

Williams, G. P., 1986. River Meanders and Channel Size. *Journal of Hydrology*, 88:147-164.

Williams, G. P., 1978. Bankfull Discharge of Rivers. *Water Resources Research* (14)6:1141-1154.

Constructed channel is a maximum of 2 feet deep with a 16 foot top width. The maximum flow of 45 cfs is carried at a velocity of 2.1 feet per second. The channel develops a maximum tractive stress of 0.14 pounds per square foot. This stress transports a maximum of 0.25" particle. Pools and riffles will be constructed in the appropriate places by allowing the channel to widen to 19 feet (riffles) and narrow to 14 feet (pools). Riffles will be located in straight sections while pools will be located on the outside of bends.

Constructed floodplain slopes down valley at a constant rate of about 0.002 feet per foot.



Gravel fill is an average of 1.2 feet deep. Gravel fill volume is between 3,000 and 3,600 cubic yards. Gravel fill is average 2", maximum 4" and minimum of 1/2". Gravel is clean with less than 5% fines.

Lines in gravel fill represent brush trenchs. 12" diameter willow wattles are excavated into gravel fill one foot. Trenches are spaced about every 50 feet along new channel.

Additional vegetation planting is described in the attached planting plan.

		DATE		DATE
BILL JONES SEGMENT #2 TOPOG SURVEY GOODING SWCD GOODING CO. ID.	Designed R. V. Sampson	8/01	Approved By R. V. Sampson	8/01
	Drawn R. V. Sampson	8/01	Title Acting S.C.E.	
	Traced			
USDA-NATURAL RESOURCES CONSERVATION SERVICE	Checked		Title	

CAD FILE NO.

USDA NRCS
Natural Resources Conservation Service

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Date: June 2, 2004

Cost Estimate
Bill Jones, Billingsley Creek, Segment 2
Updated from R. W. Sampson, 8/7/01

Item	Amount/Units	Unit Cost	Total Cost
Fibre Roll	3000	5.25	15,750
Delivery	3000	.30	900
Installation	3000	5.00	15,000
			31,650
Gravel			
2x2x3000	444	7.50	3,333
Haul 12 yd/load	37	70	2,593
Installation	37	120	4,440
			10,366
Dirt	2975 yds		
Haul	248	70	17,354
Rock	2975 yds		
Haul	248	70	17,354
Installation per load	496	25	12,396
			47,104
Fencing	3000	.5	1,500
		TOTAL COST	90,620

Estimate of funding application:

- DEQ/Idaho Power funding of $31,650 will be targeted to purchase and installation of Fiber Rolls and bank stabilization materials.
- NRCS EQIP program cost share funds of approximately $31,500 targeted to Streambank and Shoreline Protection Practices.
- J.W. Jones (Landowner) contribution of approximately $27,470 will be directed to remaining materials, installation and labor for Streambank practices and fencing.