FEASIBILITY STUDY TO EVALUATE AND DESIGN BEST MANAGEMENT PRACTICES TO IMPROVE GROVE GULCH WATER QUALITY

A Proposal submitted to the Butte Natural Resources Damage Restoration (BNRC)

Raja Nagisetty, Ph.D., P.E.
Assistant Professor
Department of Environmental Engineering
Montana Tech of the University of Montana, Butte, MT.

A) Grove Gulch before the confluence with the Blacktail Creek B) Grove Gulch downstream of Copper Mountain Recreation Complex (photo taken on 10/15/2015) C) In-stream detention pond upstream of Copper Mountain Recreation Complex D) Grove Gulch near Little Basin Creek Road

A. Contact Information

Raja Nagisetty, Ph.D., P.E.
Assistant Professor
RNagisetty@mtech.edu
406-496-4448
Department of Environmental Engineering
Montana Tech of the University of Montana, Butte, MT.

Authorized Official
Beverly K. Hartline, Ph.D.
Vice Chancellor for Research
grants@mtech.edu
406-496-4456
Montana Tech of the University of Montana, Butte, MT.

B. Project summary and map

TITLE: FEASIBILITY STUDY TO EVALUATE AND DESIGN BEST MANAGEMENT PRACTICES TO IMPROVE GROVE GULCH WATER QUALITY

Sponsor: Butte Natural Resources Damages Program
Location: Grove Gulch Watershed (Figure 1)
Total Dollar Amount: BNRC = $42, 932 and In-kind match = $27,150
Principal Investigator: Raja Nagisetty, Ph.D., P.E.
Beginning Date: March 1, 2017, or whenever the grant funding is available to the investigators.

The goal of the project is to restore the water quality of Grove Gulch, a tributary to Blacktail Creek, by identifying source(s) of heavy metal contamination, evaluating remedial alternatives and then identifying and designing the best alternative that could feasibly and cost effectively restore the water quality of the stream. Preliminary water quality analysis for Grove Gulch indicates that the heavy metals (arsenic, copper, iron, lead and zinc) concentrations during base flow and runoff are significantly elevated downstream of the abandoned metal milling and metal tailings repository sites. The project will be carried out in four phases – engaging stakeholders, Grove Gulch characterization, BMPs evaluation, identification & design of most cost-effective BMP. The final deliverable will be a Grove Gulch feasibility study report describing the results of all the four phases.

Figure 1. Grove Gulch watershed

B.2 Background

Silver Bow Creek (Blacktail Creek to Warm Springs Creek) is listed as impaired for arsenic, cadmium, copper, lead, mercury, zinc, nitrates, total nitrogen, total phosphorus and sedimentation/siltation in the Montana 2016 303(d) list (Montana DEQ, 2016). Grove Gulch flows approximately 6 miles before joining the Blacktail Creek east of Lexington Avenue. It drains primarily open range, a historic metal milling site (Timber Butte zinc mill) and a reclaimed mine waste repository (Copper Mountain Recreation Complex). Mine waste in the Grove Gulch watershed has led to significant inputs of metals into the stream, particularly zinc, copper, lead, arsenic, and iron. Historically, Grove Gulch has been modified to accommodate the mine waste repository (a small portion of the stream flows underground along the side of the CMRC) and a flood prevention project. A Blacktail Creek stream characterization study by Montana Bureau of Mines and Geology (MBMG) stated that the sources of Cu and Zn to the Blacktail Creek may be from bed sediments or nearby streambank sediment loading from historic Grove Gulch discharges (Tucci, 2014). Preliminary water quality sampling and laboratory analysis for Grove Gulch was performed by Garrett Craig (Montana Tech Environmental Engineering graduate student) in the summer of 2015. The data shows that the heavy metals (Arsenic, Copper, Iron,

Lead and Zinc) concentrations during base flow and runoff are significantly elevated downstream of the abandoned metal milling and metal tailings repository sites.

It is our understanding that EPA is currently evaluating a storm water retention basin (to retain sediments before they enter BTC) for Grove Gulch, but details were vague because those discussions are taking place under the confidential BPSOU consent decree negotiations. Storm water retention is only one alternative of several that could be viable, like waste removal, etc. It is unlikely though that waste removal would be considered by EPA's remedy because the wastes likely do not exceed the BPSOU human health standards for lead (1,200 mg/kg residential and 2,300 mg/kg non-residential) and arsenic (250 mg/kg, 500 mg/kg commercial and 1,000 mg/kg recreational).

It is also our understanding that EPA is not evaluating remedial measures to remove dissolved heavy metals from Grove Gulch. If the proposed project results suggest that the heavy metal concentrations exceed human health standards, then we will immediately report to the EPA and MDEQ for remedy consideration.

C. Project Goals and Objectives

The goal of the project is to restore the water quality of Grove Gulch, a tributary to Blacktail Creek, by designing the best alternative that could feasibly and cost effectively restore the water quality of the stream.

The objectives of this proposal are to:

- Identify the source of heavy metals in Grove Gulch
- Evaluate various BMPs to improve water quality and select the most effective BMP
- Design and cost estimation of the most effective BMPs, and
- Work with the Grove Gulch watershed community

D. Project Benefits

The project benefits include:

- Characterization of Grove Gulch water quality
- Grove Gulch heavy metal source identification
- The feasibility and cost-effectiveness of BMPs for Grove Gulch heavy metal treatment
- Protect Blacktail and Silver Bow Creek
- Treatment of Grove Gulch metals will significantly improve water quality of the Blacktail Creek. Treatment of pollutants in headwater streams (like Grove Gulch) is more feasible and efficient than treatment in the higher order streams (like Silver Bow Creek).

E. Project Implementation

The project work will be conducted by Dr. Nagisetty, M Tech Environmental Graduate students, Joe Griffin (Consultant, Contaminant Hydrogeologist) and MSE Technology & Applications. The project will be implemented in four phases. Public participation and water quality data collection will be involved in all four phases.

Phase I – Engaging stake holders

Dr. Nagisetty and Joe Griffin will work together to set-up a Grove Gulch Stake holders (Grove Gulch watershed community private citizens, George Grant Trout Unlimited, CTEC, Mile High Conservation District etc.,) committee. This committee will be invited for a group meeting at Montana Tech. During this meeting, we will request stake holder's feedback on this feasibility study. To update the progress of this feasibility study, additional meetings will be held as needed. Grove Gulch floodplain landowner's permission will be requested to go on to their property for sampling.

EPA is currently considering storm water detention basin to retain sediments before they enter BTC. We will co-ordinate with EPA (through Nikia Greene) and make sure that we are synergizing our efforts. In addition to the water quality data collection, the co-ordination will be extended to BMPs location and design.

Phase 2 – Grove Gulch Characterization

The objective of the Grove Gulch characterization is to collect the water quality data necessary for source identification, BMPs evaluation and the most cost-effective BMP design. The tasks in this phase will include analysis of the existing data, evaluating additional data requirements and water quality data collection. Samples will be collected of Grove Gulch stream (during base flow & runoff), stream bed & bank sediments and selected locations in the watershed (soil samples). Preliminary sample analysis will be performed at Montana Tech Environmental Engineering Lab. However, some of the samples will be sent to MSE Technology Applications for heavy metal analysis. All the analysis will be performed as per the appropriate EPA protocols.

If this phase results suggest that the heavy metal concentrations exceed human health standards then we will immediately report to the EPA and MTDEQ for remedy consideration.

Phase 3 – BMPs evaluation

Based on the data collected in phase I, various BMPs will be evaluated to improve the water quality. The BMPs will be evaluated based on the following criteria:

- Protection of human health and the environment
- Reduction of contaminant toxicity, mobility and volume
- Feasibility

- Cost-effectiveness
- Utilization of permanent solutions and alternative technologies to the maximum extent possible
- Community acceptance

Using the above criteria, most effective BMPs will be selected for Grove Gulch.

Phase 4 – Design and cost-estimation of the most beneficial BMPs

Engineering design and cost estimation will be performed for the most effective BMPs selected in phase 3. Additional data may be collected as needed for the design and cost estimation.

F. Project Schedule

Phases 1 and 2 will be completed in year 1. Phase 3 and 4 will be completed in year 2. The Grove Gulch feasibility report will be submitted at the end of the year 2.

G. Monitoring activities

The BNRC will receive a written report after the completion of each phase. A final feasibility study report will be submitted at the end of the project.

H. Project Budget (for two years)

				# of			# of	Cost
A.	SALARIES AND WAGES		**Rate**	**Months**	**BNRC**		**Months**	**Share**
		Raja Nagisetty	$11,555	2.00	$23,457		0.50	$5,864
		Graduate Student - Summer	$18.75	480	$9,000			
		Undergraduate Student - Academic Year						
		Undergraduate Student - Summer						
		Subtotal			**$32,457**			**$5,864**
B.	FRINGE BENEFITS							
		25% Faculty			$5,864			$1,466
		3% of Students/Academic Year						
		10% Students/Summer			$900			
		Subtotal			**$6,764**			**$1,466**
C.	OTHER DIRECT COSTS							
		Supplies			$1,250			
		Contracted Service/Sample Analysis			$2,461			$820
		Consultant (Joe Griffin)						$13,200
		Other/Publishing Costs						
		Subtotal			**$3,711**			**$14,020**
D.	PARTICPIANT SUPPORT COSTS							
		Graduate Student Fee Waiver ($5,800/yr)			$0			$5,800
		Subtotal			**$0**			**$5,800**
E.	TOTAL DIRECT COSTS				**$42,932**			**$27,150**

I. References:

Montana DEQ. 2016. Montana Draft 2016 Water Quality Integrated Report. Montana Dept. of Environmental Quality. Helena, MT. Available online at: http://deq.mt.gov/Water/WQPB/cwaic/reports

Tucci, N. 2014. Stream characterization of Blacktail and Silver Bow Creeks: A continuous tracer injection investigation conducted during baseflow conditions in an urban area impacted by mining: Butte, MT. Available online at: http://www.mbmg.mtech.edu/pdf-publications/ri_22.pdf

November 14, 2016

Raja Nagisetty, Ph.D., P.E.
Assistant Professor, Department of Environmental Engineering
Montana Tech of the University of Montana
1300 W. Park
St. Butte, MT
59701
Office: Eng. 328
(406) 496-4448

RE: Technical Support for the Feasibility Study – *Evaluate and Design BMPs to Improve Grove Gulch Water Quality*

Dear Raja,

I will consult 40 hours on the overall planning and data integration of the above project including the exact location of sampling sites and 80 hours on stakeholder outreach for a total of 120 hours at my consulting rate of $110/ for a total in-kind match of $13,200.

Best of Luck,

Joe Griffin, P.G.
Contaminant Hydrogeologist
406 560-6060