COVER SHEET FOR GRANT PROPOSALS

State Board of Education

SBOE PROPOSAL NUMBER: (to be assigned by SBOE)	AMOUNT REQUESTED: **$20,900**

TITLE OF PROPOSED PROJECT:

PROTOTYPE DEVELOPMENT OF A LOW COST THERMAL SCOUR-DEPOSITION CHAIN

SPECIFIC PROJECT FOCUS:

There are 600,000 bridges in the United States and of those, 60% of failing bridges are caused by the erosion of the ground foundation, called scouring. Additionally, monitoring streambed evolution over time is an essential component of effective river and watershed management. However, currently available technologies rely on mechanical tools such as the scour chain and its variations such as ring rods, which can record only maximum scour, or expensive equipment such as acoustic or sonar technology, which may measure scour and deposition continuously. Sonar is typically mounted over the stream to measure topographical variation of the streambed. Pressure sensors have also been used. They measure the pressure of the bed material to determine scour-deposition. Additionally, the temperature properties of fiber optic (Bless method) where light velocity changes within the fiber can be used to detect the position of the streambed sediment. Limitations of these technologies include the costs and the difficulty of deploying a large array of sensors such that a distributed erosion-deposition pattern can be obtained. Here, we developed a new instrument for measuring scour and deposition in the streambed based on temperature differences induced by daily temperature fluctuations between surface and streambed waters.

This project will finalize the development of a new low-cost tool for continuous monitoring of scour and deposition. We reached level 4 with last year support and with this year support we expect to reach level 7. We have secured support from the Hydro-Foundation for salary and tuition and fee for the graduate student and we are seeking additional support for developing and testing the field prototype.

PROJECT START DATE: July 01, 2014	PROJECT END DATE: June 30, 2015
NAME OF INSTITUTION: UNIVERSITY OF IDAHO	DEPARTMENT: CIVIL ENGINEERING
ADDRESS: 322 E. FRONT ST., SUITE 340, BOISE ID-83702	
E-MAIL ADDRESS: DTONINA@UIDAHO.EDU	PHONE NUMBER: (208) 364-6194

	NAME:	TITLE:	SIGNATURE:
PROJECT DIRECTOR/PRINCIPAL INVESTIGATOR	DANIELE TONINA	ASSISTANT PROFESSOR	[signature]
CO-PRINCIPAL INVESTIGATOR			

NAME OF PARTNERING COMPANY:	COMPANY REPRESENTATIVE NAME:

	NAME:	SIGNATURE:
Authorized Organizational Representative	Polly J. Knutson Director of Research Administration	[signature]

SUMMARY PROPOSAL BUDGET

Name of Institution: UNIVERSITY OF IDAHO
Name of Project Director: DANIELE TONINA

A. PERSONNEL COST (Faculty, Staff, Visiting Professors, Post-Doctoral Associates, Graduate/Undergraduate Students, Other)

Name/ Title	Salary/Rate of Pay	Fringe	Dollar Amount Requested
DANIELE TONINA/ ASSISTANT PROFESSOR	$ 2,000 / $48/hr	0.35	$2,700
TIMOTHY DEWEESE / GRADUATE STUDENT	$5,000 / $23/hr	0.03	$5,200
BOB BASHAM / LAB MANAGER	$2,400 / $30/hr	0.39	$3,400

% OF TOTAL BUDGET: 54% SUBTOTAL: $11,300

B. EQUIPMENT: (List each item with a cost in excess of $1000.00.)

Item/Description	Dollar Amount Requested
MATERIAL FOR BUILDING THE PROTOTYPE (include: temperature sensors, High density plastic pipe, electrical wire, data logger, ARDUINO circuit board, radio transmitter)	$3,500
SUBTOTAL:	$3,500

G. TRAVEL:

Dates of Travel (from/to)	No. of Persons	Total Days	Transportation	Lodging	Per Diem	Dollar Amount Requested
conference	2	8	$1,200	$2,000 + Conference Fee $1, 300	$784	$5,300
field	2	3	$800 (rental car plus gas)	0	0	$800
					SUBTOTAL:	$6,100

H. Participant Support Costs:	Dollar Amount Requested
1. Stipends	
4. Other	
SUBTOTAL:	

I. Other Direct Costs:		Dollar Amount Requested
1. Materials and Supplies		
2. Publication Costs/Page Charges		
3. Consultant Services (Include Travel Expenses)		
4. Computer Services		
5. Subcontracts		
6. Other (specify nature & breakdown if over $1000)		
	SUBTOTAL:	$0
J. Total Costs: (Add subtotals, sections A through I)	TOTAL:	$20,900
K. Amount Requested:	TOTAL:	$20,900
Project Director's Signature:	Date: 06.16.2014	

INSTITUTIONAL AND OTHER SECTOR SUPPORT
(add additional pages as necessary)

A. INSTITUTIONAL / OTHER SECTOR DOLLARS	
Source / Description	Amount
Hydro foundation/ this award support the salary of a graduate student ($19,500) and the tuition and fee ($10,000). The award has been awarded on May 2014	**$29,500**

B. FACULTY / STAFF POSITIONS

Description

DANIELE TONINA / ASSISTANT PROFESSOR **MENTORING AND ADVISING GRADUATE STUDENT**

C. CAPITAL EQUIPMENT

Description

D. FACILITIES & INSTRUMENTATION (Description)

SBOE Idaho Incubation Fund Program Proposal

PROTOTYPE DEVELOPMENT OF A LOW COST THERMAL SCOUR-DEPOSITION CHAIN

1. INSTITUTION: University of Idaho

2. FACULTY MEMBER DIRECTING PROJECT: Project Director: Daniele Tonina, Assistant Professor, Center for Ecohydraulics Research, Department of Civil Engineering, 322 E Front suite 341, Boise ID-83702.

3. PREVIOUS GAP APPLICATION FOR THIS TECHNOLOGY: Yes

a. Awarded in 2013

b. The previous GAP funding allowed the testing of the technology in a controlled environment and the design of a field prototype bringing the technology to level 4. This grant will finalize the field prototype development and will take the technology to level 7.

4. EXECUTIVE SUMMARY: Streambed morphology is constantly evolving in response to scour and deposition processes. These processes affect engineering structures such as bridge piers, levee foundations, and structure footings. They also affect ecological processes; hence they are important considerations in restoration, enhancement and improvement projects for streams and rivers. Monitoring streambed evolution over time is an essential component of effective river and watershed management. Existing scour-deposition monitoring technology limitations include cost and difficulty in deployment such that a distributed erosion-deposition pattern can be obtained. New technologies which provide affordable, real time scour-deposition data are desired. Here, we propose to continue temperature scour chain technology development, which started using Idaho Incubation Fund (GAP) funding awarded in 2013. The temperature scour chain measures scour and deposition in the streambed based on temperature differences induced by daily temperature fluctuations between surface and streambed waters. Previous GAP funding brought the technology from readiness level 2 to 4, and continuation of funding will take the technology to level 7. We will continue advancement of temperature scour chain development, including addition of wireless data communication. The new instrument will have several applications: 1) Monitor streambed elevation changes: scour and deposition processes in real time 2) Quantify streambed sediment thermal properties. 3) Monitor streambed benthic thermal regime 4) Monitor connectivity between the stream and aquifer; 5) Provide wireless data transmission for scour-deposition monitoring in real time. Thus, the new instrument has the potential to be an integrated tool for monitoring riverine systems. It has the potential to be deployed around bridge piers and along levees to construct continuous spatio-temporal maps for streambed evolution. This proposal requests incubation funds to support additional development of additional prototypes and their testing in the field.

5. “GAP” PROJECT OBJECTIVES AND TOTAL AMOUNT REQUESTED: We are seeking **$20,900** of incubation funds to conduct prototype developing and testing. The prototype will advance the scour technology and riverine habitat monitoring technology. Specific project objectives will be to develop a set of wireless communication capable field prototypes and test their sensitivity to scour and depositional processes under different climate conditions (e.g., winter and summer) to understand the limitation of the prototypes. The objectives are: 1) Develop a set of wireless capable prototypes to be deployed in the field. 2) Develop a user interface for ease in monitoring real time scour-deposition in an office or laboratory setting. 3) Interact with different agencies, which may use the new tool: 1. US Forest Service, 2. Bureau of Reclamation, 3. Department of Transportation, Federal Highway Administration (FHWA), 4. US Geological Survey.

6. PROJECT RELATIONSHIP TO HOME INSTITUTION PRIORITIES: This project fits well with the priorities of the UI and aligns with the newly re-defined Idaho Water Resources Institute, which integrates water related issues. It also fits with the mission and strategic plan of the UI Boise Center to provide a technology transfer and improve the competence of professionals in the State of Idaho.

7. POTENTIAL IMPACT TO IDAHO ECONOMY: There are a number of potential impacts to Idaho's economy that commercialization of this product could provide. River related tourist activities such as fishing and white water rafting are a significant portion of the Idaho economy. Reliable transportation infrastructure supports tourist activities, and providing a safe network of roads and bridges to access Idaho's riverine tourist environments is a responsibility of the Idaho Department of Transportation and the U.S. Forest Service. Lastly, stream restoration is a $1 billion per year industry (Bernhardt et al., Science Magazine, Vol. 308, 2005) with a high density of projects occurring in Idaho and the Pacific Northwest. Important to all of these interests is a method that can be used to continuously monitor scour and deposition since these processes relate to areas such as fish habitat quality and post-project restoration monitoring. This new tool has the potential to provide a low-cost instrument that could be widely used in monitoring Idaho streams. This grant would create the possibility for manufacturing the equipment and the installation of the tools in streams. This would also improve our ability to monitor bridge piers and improve bridge safety, and cost savings by using this tool could be reinvested elsewhere in the Idaho economy. Additionally, this tool will be applicable to monitoring canals for seepage and erosion.

8. MARKET OPPORTUNITY:

a. **Need project would address:** This new technology has the potential to transform the monitoring of riverine systems. This technology addresses the need for inexpensive and easy-to-deploy tools to monitor streambed evolution (scour-deposition) and stream-aquifer connectivity continuously.

b. **Applications and markets for the technology:** The new instrument could be used for several applications:

   1. Information on sediment transport and scour-deposition processes, engineering application for bridge pier scour mitigation, levee and apron scour, erosion in canals, and monitor the impact of watershed management on sediment transport. Over 500,000 American bridges are located on or over rivers, streams, lakes, and oceans. According to New York State Department of Transportation (DOT), 22 bridges have failed per year due to scour conditions between 1966 and 2005. If one bridge span (many bridges have multiple spans) costs \$560,000, loss per year would be at least 22 × \$560,000 = \$12,320,000 nationally.
   2. Temperature gradient within the streambed for aquatic habitat quality monitoring. River restoration is a \$1 Billion industry.
   3. Quantify the connectivity between surface and subsurface waters. This may provide information on stream-aquifer recharge and quantify seepage from canals.
   4. Thermal properties of the streambed sediment.

c. **Product description, potential market audience, competition, and market barriers:** The product would be a new scour-deposition probe, which can also measure streambed sediment thermal properties and stream-aquifer connectivity. The potential market audience is any agency, consultancy company, irrigation districts, and NGO that manage and monitor river or canal systems. There is still considerable research in developing new technology to monitor scour. Thus, this tool will be particularly attractive to the Department of Transportation, which monitors scours at bridge piers. This new probe has the potential to provide a reliable and cheap monitoring system for scour. Most of the available technology does not provide a continuous record of erosion and deposition and does not provide information about the thermal properties of the streambed sediment. The most common technique for measuring scour is the scour-chain, which only records maximum scour over the course of the high flow season.

Table 1. Types of fixed scour-monitoring instruments

Sounding Rods	Driven or Buried Rods	Sonar Devices	Other Buried Devices
BRISCO[1] Monitor	Horseshoe Collar Magnetic Collar Piezo-Electric Probes Heat Dissipation Gage Photo-Electric Cells Trip Switch Probes Conductance Probes	Single Transducer Systems Multiple Transducer Systems Scanning Sonar Systems	Radio Transmitters Buried Chains Pressure Transducers

It is time consuming to install and difficult to extract from the streambed sediment. Other instruments were developed for scour around bridge piers and they are mostly variations of the scour-chain with a mechanical component that slides to the scour elevation. These methods include those reported in Table 1 from Mueller D S. Summary of Fixed Instrumentation for Field Measurement of Scour and Deposition Proceedings, Federal Interagency Workshop, "Sediment Technology for the 21'st Century," St. Petersburg, FL, February 17-19, 1998" and reported in the National Cooperative Highway Research Program, NCHRP. Report 396-instrumentation for measuring scour at bridge piers and abutments. Transportation Board and National Research Council, 1997. Driven/buried-rod scour monitors have a rod driven or buried into the streambed. Instruments are divided into two general classes: a) a sensor mounted in a collar that slides down the rod and b) sensors mounted directly on the side of the rod. The former can measure only maximum scour and not subsequent deposition or its timing. The latter may use piezo-electric probes, heat-dissipation gage, photo-electric cells, and conductance probes and can measure both scour and deposition. Acoustic or sonar technology may measure scour and deposition continuously. Sonar is mounted over the stream and uses the Doppler effect to measure variation of the streambed. Pressure sensors have been used and measure the pressure of the bed material to determine scour-deposition.

Table 2. Competitor attribute (source DOT 2010)

Instrument	Cost (Dollars Per Device)	Positive Attributes	Negative Attributes
Manual Magnetic Sliding Collar	$3,600	Easy to Install and Use, Relatively Inexpensive	Very Susceptible to Debris
Sonar	$17,500	Continuous Monitoring, Easy Telemetry, Indirect Measurement	Somewhat Susceptible to Debris
Float-Out Devices	-	Not Susceptible to Debris	Lack Ability to Check Operation of Device
Automatic Sliding Collars	-	Signaled Scour Event	-
Tilt Sensors	-	Not Susceptible to Debris, Easy Installation	Requires Partial Failure, Requires Characterization of Normal Bridge Movement
Sonar	$40,000	Telemetry, Indirect Measurement, No Moving Parts	Expensive Installation and Maintenance
Sonar	$17,000	Telemetry, Indirect Measurement, Ability to Move Out of Water Easily, Continuous Monitoring	Somewhat Susceptible to Debris
Sonar Tilt Sensors	$15,000	Allowed Bridge to Stay Open	Very Susceptible to Debris
Sonar	$40,000	Telemetry, Indirect Measurement	Expensive Installation and Maintenance
Time Domain Reflectometers	$30,000	No Portion of Instrument Extends Through Water Surface, No Moving Parts, Cheap After Data Analysis Portion of Instrument is Purchased, Continuous Monitoring.	No Vendors, In Research Phase, Requires Signal Analysis
Float-Out Devices	-	Not Susceptible to Debris	Difficult Installation in Wet Streams
Tilt Sensors	-	Not Susceptible to Debris	Requires Partial Failure, Requires Characterization of Normal Bridge Movement
Sonar	$12,000	-	Requires Maintenance
Float-Out Devices	-	Easy Installation in Dry Beds and Riprap	Difficult to Maintain, Would Rather Use Other Countermeasure, Vandalism, False Alarms
Piezoelectric	-	Use to Reject Overestimates of Scour	Conduit Susceptible to Debris
Pneumatic Scour Detection System	-	Very Robust, Vandal Resistant	Difficult to Automate, Uncertain about Ability to Locate Depth of Live Bed Scour After Event

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Use of temperature properties of fiber optic (Bless method) (Manzoni. S. Crotti G., Ballio F., Cigada A., Inzoli F., Colombo E., 2011, Bless: A fiber optic sedimeter, Flow Measurement and Instrumentation, 22, pp:447-455) used the change in velocity within the fiber optic of light to detect the position of the streambed sediment. Limitations of these technologies include deployment costs and the difficulty of deploying a large network of sensors such that a distributed erosion-deposition pattern can be obtained (**Table 2**). Our equipment can continuously record streambed variations (both erosion and deposition) at several locations within the streambed at low-cost. It is easy to install and to retrieve from the field.

The field deployment will test comparable attributes to competing sensors. Differential advantages of this method are affordability and versatility. The prototype is estimated to cost less than $300 to manufacture and an expected market price could be $900, which still offers a drastically more affordable product than what competitors charge. Production process will be kept at a minimum cost rate by utilizing existing manufacturing facilities, which generated the prototype tool. The device is versatile and adaptable to different bridge and riverine scenarios. Other attributes are yet to be determined by field deployment.

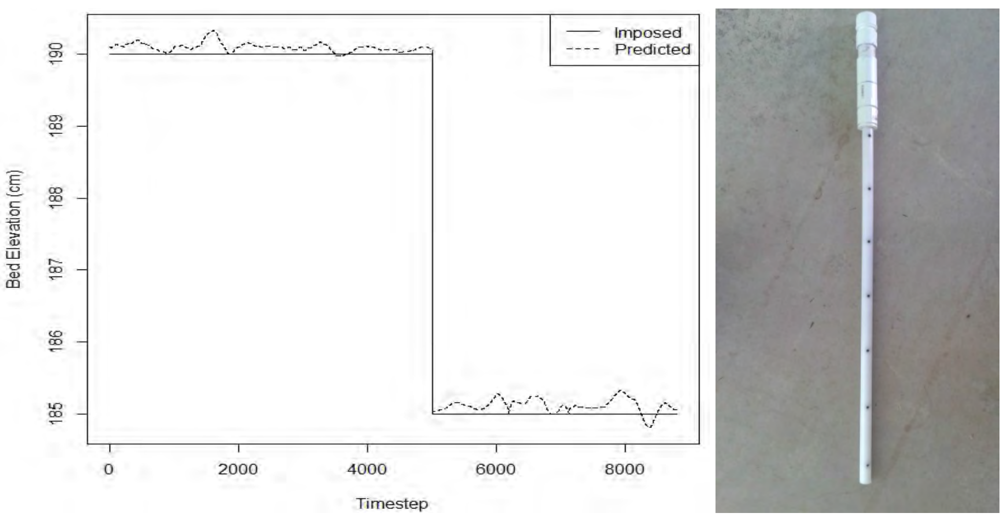

Figure 1. a) predicted vs. imposed bed elevation in the laboratory scour tank and b) field prototype.

<u>9.</u> <u>TECHNOLOGY</u>:

a. **Current state of technology:** Development using previous GAP funding has advanced technology from technology readiness level (TRL) 2 to 4, with level 5 currently underway. We developed a controlled laboratory experiment which mimics streambed processes, including temperature cycling, groundwater flux, and streambed scour-deposition. With this model, we have demonstrated strong tracking of bed scour using the predictive technology under multiple conditions of flux and temperature signal type (Figure 1). In addition, beta testing was performed on the preliminary prototype designed for field application.

We developed a field prototype, with capability of additional wireless communication technology. Stand-alone prototypes have been installed in the South Fork Boise River for beta testing, where significant scour is expected in association with recent alluvial deposits in the system. These prototypes log probe temperature data to a Micro SD card, and may be downloaded periodically without removal of the probe itself. Growth potential with additional funding could take this technology from TRL 4 to 7, where the prototype and its wireless communication system are demonstrated in an operational environment.

b. **Product and market need/intellectual property status:** There is a strong need to develop an economical and easy-to-use tool able to measure streambed evolution. This technology will answer the need of practitioners and managers involved in watershed management. Irrigation districts have the need to monitor seepage from the canals and erosion.

A case number has been assigned to this technology through the UI Office of Technology Transfer and we plan to move forward with a patent application.

c. Who developed technology and with what funding: The technology was originally developed/discovered by Dr. Daniele Tonina, Dr Charles H. Luce and recent graduate student Frank Gariglio as an outgrowth of a project partially funded by US Forest Service. Timothy DeWeese, the graduate student working on the project, has developed laboratory experiments and field probes using GAP funding awarded in 2013. The technology and associated lab and field work contributed significantly to acquisition of a research award from the Hydro Research Foundation. This award provides 13 months of stipend for Mr. DeWeese and his graduate research on this temperature scour chain project.

d. **Steps to bring the technology to market:** 1) complete field prototype testing under real conditions 2) add wireless communication technology to the field data logger 3) partner with ITD to use the field prototype and added wireless data communication at 4 bridges coupled with their software, Bridge Watcher 4) implement the UI business students' award winning business plan for commercialization of the method.

10. COMMERCIALIZATION PARTNERS: Commercial partners: Our goal is to prove the effectiveness of the method. We then can continue working with the previous University of Idaho student business group or contact companies such as "onset HOBO Data logger" (http://www.onsetcomp.com/), "Campbell Scientific" (http://www.campbellsci.com/) "Omega Engineering" (http://www.omega.com/) and National Instruments (http://www.ni.com/) to develop and commercialize the product.

11. SPECIFIC PROJECT PLAN AND USE OF FUNDS: We plan to complete the development of additional wireless communication capable field prototypes and to test them in the field and in a laboratory setting. Wireless capability allows transmission of real time bed temperature data to an office or laboratory for real time scour monitoring. This will require design of new prototypes (3 months), laboratory testing (3 months) and field testing (6 months). This additional development will advance the technology to TRL 7. We plan to accomplish this working with Tim DeWeese, the full time graduate student previously working on this project.

Proposed budget:

Personnel	Role on Project	Salary Requested	Fringe Benefits	Totals
Daniele Tonina	Principal Investigator	$2,000	$700	$2,700
Charlie H. Luce	Senior Personnel	$0	$0	$0
Frank Gariglio	Senior Personnel	$0	$0	$0
Timothy DeWeese	Graduate Student	$5,000	$200	$5,200
William Basham	Lab manager	$2,400	$1000	$3,400

Subtotals	$9,400	$1,900	$11,300
Travel			
Field travel			$800
Conference Travel			$5,300
Material for construction and testing the technology			$3,500
Total Project Costs			**$20,900**

Funds requested will support the project director ($48/hr for 40hr plus benefits at 35%) to oversee laboratory trial and assist with field trials. No salary is requested for Dr. C. Luce or F. Gariglio. Timothy DeWeese will be partially supported at the current graduate rate ($23/hr for 4 hrs/wk, plus benefits at 3%) over 12 months to conduct lab and field experiments. Lab manager support ($30/hr for 80hr plus benefits at 39%) will help optimize prototype development. The lab experiments will be conducted with a small plastic box similar to a constant head permeameter where fluxes, water temperature and sediment depth can be rigorously monitored. The field experiments will be conducted in the South Fork of the Boise River. Material and supply costs and equipment costs (temperature sensors, material to build the probes, cellular transmitter and data logger, $3,500) associated are included. Travel support to the field (rental car and fuel, $800) is requested and to present the technology to conferences (airfare, lodging, conference fee and per diem, $5,300).

12. INSTITUTIONAL AND OTHER SECTOR SUPPORT: Throughout this project, we will work closely with the Office of Technology Transfer to protect the UI's Intellectual property. In addition, we also have public sector support. The partner is the US Forest Service and consulting engineering firms such as CH2M HILL. The project will be also supported by the Hydro Foundation grant which supports the graduate student ($29,500).

13. *APPENDICES:*

APPENDIX A: FACILITIES AND EQUIPMENT: University of Idaho, Center for Ecohydraulics

The hydraulic flume is designed within the CER streamlab facility and it includes a state of the art instrumentation platform. Stereoscopic PIV, ADV, laser based bathymetry systems, acoustic bathymetry system and object tracking system are installed on a three-axis instrumentation platform. CER also maintains a Hydroinformatics Computational Core that supports the Idaho Experimental Watershed Network (a cyber-center for coordinating the research in four geographically distributed watersheds in Idaho in collaboration with Boise State University), and HIS Server and other collaborative data warehouse projects such as the National River Restoration Science Synthesis.

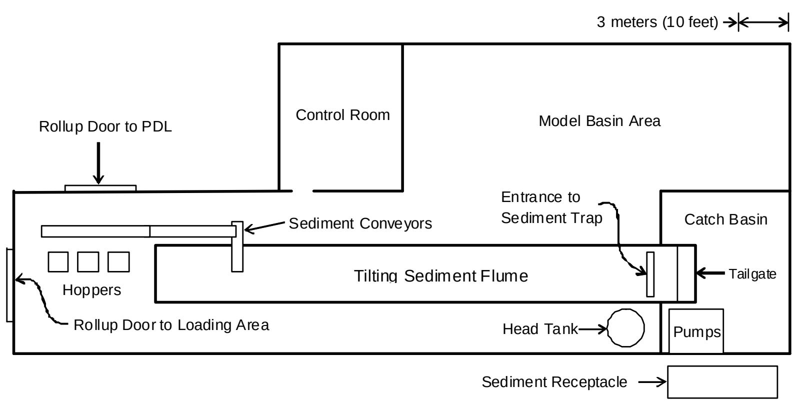

Figure 1: CER streamlab floor plan

The machine shop includes (Figure 2):

CNC machines

The PDL has a Bridgeport CNC lathe and a Haas VF-3 machining center. The use of these machines is by supervision only. These machines can do very complex cutting of most materials. Drawings of the required part can be done in almost any modeling software (2D drawing or 3D model). Once you have your drawing done, the lab manager can assist you with transforming the drawing into machine code that will cut out what you desire. It is good to consult the lab manager as soon as possible in the modeling phase, as there are good and bad ways to approach the modeling process. The lab has MasterCAM and SolidWorks which are installed on one computer.

Metalworking Machines

There is a vertical mill in the PDL, it is a Sharp model. The mill is used for precision metal working such as drilling, slotting, and facing. It operates like a drill press, except the user is able to move the bed that the work piece is clamped to very precisely in increments of 1/1000th of an inch. There is also a horizontal band saw which is used to rough cut large pieces of metal.

Woodworking

The PDL lab contains most common woodworking tools:1. Table saw, 2. Sliding compound miter saw, 3. Vertical band saw, 4. Several hand saws (miter saw, jig saw, circular saw), 5. Drill press, 6. Belt/Disc sander. 7. Nail gun, 8. Orbital sander, 9. Basic hand tools (screw drivers, hammers, etc…), 10. Various clamps, 11. Measuring tools (tape measure, carpenter's square, rulers, etc…)

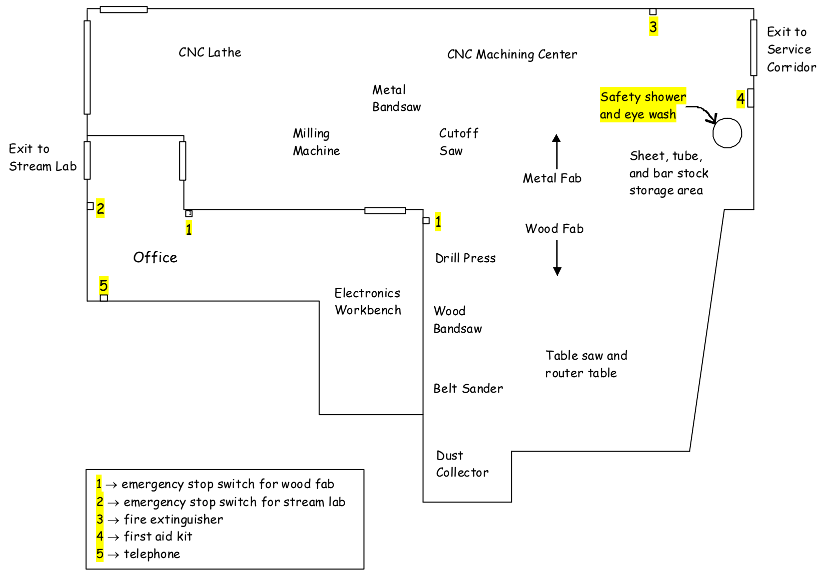

Figure 2: Machine shop: product development laboratory floor map.

APPENDIX B: BIOGRAPHICAL SKETCHING AND INDIVIDUAL SUPPORT:

CURRICULUM VITAE

NAME: Daniele Tonina **DATE:** May 1, 2014

RANK OR TITLE: Assistant Professor

DEPARTMENT: Civil Engineering

Affiliate faculty to the Department of Biological and Agricultural Engineering

OFFICE LOCATION AND CAMPUS ZIP: 322 E. Front St. Suite 340, Boise ID 83702

OFFICE PHONE: 208-364-6194

FAX: 208-322-4425

EMAIL: dtonina@uidaho.edu

WEB: http://www.uidaho.edu/engr/ce/faculty/tonina

DATE OF FIRST EMPLOYMENT AT UI: February 2001

DATE OF TENURE: Untenured

DATE OF PRESENT RANK OR TITLE: February 2009

EDUCATION BEYOND HIGH SCHOOL:

Degrees:

Ph.D., University of Idaho, Boise, Idaho, December 2005, Civil Engineering
Combined M.S. B.A., University of Trento, Trento, Italy, July 2000, Land and Environmental Engineering

Certificates and Licenses:

Professional Engineer (PE) in the State of Idaho; member number P-13836
Professional Engineer (PE) in Italy; member number 2146

EXPERIENCE:

Academic:

Assistant Professor, University of Idaho, Boise, 2009-Present
Researcher, University of Trento, Trento, 2008-2009
Post-doctoral researcher, University of California (supervisor: W.E. Dietrich), Berkeley, 2006-2008
Research Assistant, University of Idaho (supervisor: J.M. Buffington), Boise, 2001-2005

TEACHING ACCOMPLISHMENTS:

Areas of Specialization: hydrology, surface and subsurface waters, aquatic habitat, ecohydraulics

Courses Taught:

Aquatic habitat modeling, CE 526
Environmental hydrodynamics, CE 554
In-channel vegetation management, CE 504 (co-taught with Dr. Peter Goodwin)
Advances in waveform analysis, CE 502
Advanced topics in aquatic habitat modeling, CE 504
Sedimentation engineering, CE 521 (co-taught with Dr. Peter Goodwin)
River Restoration, CE504 (co-taught with Dr. Elowyn Yager)
Surface subsurface water interaction, CE 504
Fluid Mechanics, Engr. 330 (Boise State University)

Students Advised:

Undergraduate Students:

Beeson, Christina, (Boise State University) undergraduate research assistant, summer and fall 2013
Micheletty, Paul, (Boise State University) undergraduate research assistant, summer and fall 2011
Haynes, Christopher (Boise State University) undergraduate research assistant, summer 2011
Riley, Kerry (Boise State University) undergraduate research assistant, summer 2011

Graduates:

Advised to completion of degree, major professor:

Marzadri, Alessandra,	Ph.D., Civil Engineering, University of Trento, Italy, (co-advisor with Drs. A. Bellin and M. Tubino)	[2007-2010]
Conner, Jeff,	M.S., Civil Engineering,	[2009-2011]
Glenn, Jill,	M.S., Civil Engineering,	[2010-2011]
Gariglio, Frank,	M.S., Civil Engineering,	[2010-2012]
Carnie, Ryan,	M.S., Civil Engineering,	[2010-2012]
Kinnear, Matthew,	M.S., Geography, University of British Columbia, Canada, (co-advisor with Dr M. Hassan)	[2011-2012]
Reeder, William J.,	M.S., Civil Engineering,	[2010-2012]

In Progress:

Nayegandhi, Amar,	Ph.D., Civil Engineering,	[2010-2014WD]
Reeder, William J.,	Ph.D., Civil Engineering,	[2012-present]
Sohrabi, Mohammad,	Ph.D., Civil Engineering,	[2012-present]
Sangki, Lee,	Ph.D., Civil Engineering,	[2013-present]
Kelsey, Leah G.,	M.S., Civil Engineering,	[2011-present]
Davis-Butts, Kresta,	M.S., Civil Engineering,	[2012-present]
Syms, J. Channing,	M.S., Civil Engineering,	[2012-present]
DeWeese, Timothy,	M.S., Civil Engineering,	[2013-present]

Co-advisor

Gökdemir, Çağrı,	PhD., at University of Trento, Italy,	[2011-present]

Post doctoral researchers:

Goode, Jaime,	[2010-2013]

Marzadri, Alessandra, [2011-present]
Benjankar, Rohan M., [2012-present]

Member of graduate committee:

Tranmer, Andrew,	Ph.D., Civil Engineering,	[completed]
Reader, Jeff,	Ph.D., CNR,	[2010-2012WD]
Schoenfelder, Jeffrey,		M.S.,
Mechanical Engineering,		[completed]
Hocut, Christopher,	M.S., Mechanical Engineering,	[completed]
Cernick, Angelina,	M.S., Water of the West,	[completed]
Zobot, Hattie,	M.S., Civil Engineering,	[completed]
Monsalve, Angel	Ph.D., Civil Engineering,	[2012-present]
Kenworthy, Megan	Ph.D., Civil Engineering,	[2011-present]

Courses Developed:

Aquatic habitat modeling, CE 526
Environmental Hydrodynamics, CE 504
In-channel vegetation management, CE 504 (co-developed with Dr. Peter Goodwin)
Advances in waveform analysis, CE 504
Advanced topics in aquatic habitat modeling, CE 504
Sedimentation Engineering, CE 521 (developed the experimental portion for spring 2012 and half of the lectures)
Surface Subsurface water interaction, CE 504
River Restoration, CE504 (developed the design portion of the course)

Non-Credit Classes, Presentations, Workshops, Seminars, Invited Lectures, etc.:

Guest lecture for the course WR 506 Interdisciplinary Methods in Water Resources (Fall 2012);
Hydrology and Hydraulics courses for PE examination review yearly since 2009;

SCHOLARSHIP ACCOMPLISHMENTS:

Publications, Exhibitions, Performances, Recitals (* denotes student):

Refereed Journals:

[25] Li, R., Chen, Q., **Tonina, D.**, Cai, D., (in-press), Effects of upstream reservoir regulation on the hydrological regime and fish habitats of the Lijiang River, China, *Ecological Engineering*, doi: 10.1016/j.ecoleng.2014.04.021.

[24] Hassan, M.A., **Tonina, D.**, Beckie, R.D., Kinnear*, M., (2013), Hyporheic fluxes in steep headwater streams with step-pool morphologies, *Hydrological Processes*, doi:10.1002/hyp.10155

[23] McKean, J., **Tonina, D.,** Bohn, C., Wright, C., (2014), Effects of bathymetric lidar errors on flow properties predicted with a multi-dimensional hydraulic model, *Journal of Geophysical Research: Earth Surface*,119, 3, 644-664, doi: 10.1002/2013JF002897

[22] **Tonina**, **D.**, Gariglio*, F., and C. H. Luce (2014), Quantifying streambed deposition and scour from stream and hyporheic water temperature time series, *Water Resources Research*, 50, 1, 287-292, doi:10.1002/2013WR014567.

[21] Marzadri, A., **Tonina**, **D.**, and Bellin, A., (2013) Quantifying the importance of daily stream water temperature fluctuations on the hyporheic thermal regime: Implication for dissolved oxygen dynamics, *Journal of Hydrology*. 507, 241-248, doi:10.1016/j.jhydrol.2013.10.030

[20] Maturana*, O., **Tonina, D.**, McKean, J.A., Buffington, J.M., Luce, C.H., and Caamaño, D., (2013), Effects of pulse versus chronic sand inputs on salmonid spawning habitat in a low-gradient gravel-bed river, *Earth Surfaces and Landform Processes*, doi: 10.1002/esp.3491

[19] Gariglio*, F., **Tonina**, **D.**, and C. H. Luce (2013), Spatio-temporal variability of hyporheic exchange through a pool-riffle-pool sequence, *Water Resources Research,* 49, 11, 7185-7204, doi: 10.1002/wrcr.20419.

[18] McKean, J. and **Tonina, D.,** (2013), Bed stability in unconfined gravel bed mountain streams: With implications for salmon spawning viability in future climates, *Journal of Geophysical Research: Earth Surface*, 118, doi:10.1002/jgrf.20092.

[17] Conner*, Jeff T. and **Tonina, D.,** (2013), Effect of cross-section interpolated bathymetry on 2D hydrodynamic model results in a large river, *Earth Surface Processes and Landforms*, doi: 10.1002/esp.3458

[16] Benjankar, R., Koenig, F., **Tonina, D.,** (2013), Comparison of hydromorphological assessment methods: Application to the Boise River, USA, *Journal of Hydrology*, 492, pp. 128-138

[15] Marzadri*, A., **Tonina**, **D.**, and Bellin, A. (2013), Effects of stream morphodynamics on hyporheic zone thermal regime, Water Resour. Res., 49, doi:10.1002/wrcr.20199.

[14] Goode, J.R., Buffington, J.M., **Tonina, D**., Isaak, D., Thurow, R., Luce, C., Wenger, S., Nagel, D., Tetzlaff, D., Soulsby, C. (2013), Potential effects of climate change on streambed scour and risks to salmon survival in mountain basins, *Hydrological Processes*, 27, 5, pp. 750-765, Invited, Special Issue doi:10.1002/hyp.9728. **(1 citation)**

[13] Luce, C. H., **Tonina, D.**, Gariglio*, F., and Applebee, R. (2013), Solutions for the diurnally forced advection-diffusion equation to estimate bulk fluid velocity and diffusivity in streambeds from temperature time series, *Water Resour. Res*., 49, doi:10.1029/2012WR012380. **(1 citation)**

[12] Marzadri*, A., **Tonina, D.**, and Bellin, A., (2012), Morphodynamic controls on redox conditions and on nitrogen dynamics within the hyporheic zone: Application to gravel bed rivers with alternate-bar morphology, *Journal of Geophysical Research* 117, G00N10, doi:10.1029/2012JG001966. **(1 citation)**

[11] Marzadri*, A., **Tonina, D.**, and Bellin, A., (2011), A semi-analytical three-dimensional process-based model for hyporheic nitrogen dynamics in gravel bed rivers, *Water Resources Research* 47, W11518, doi:10.1029/2011WR010583. **(14 citations)**

[10] **Tonina, D.,** and Buffington, J.M., (2011) Effects of stream discharge, alluvial depth and bar amplitude on hyporheic flow in pool-riffle channels, *Water Resources Research,* 47, W08508, doi:10.1029/2010WR009140. **(15 citations)**

[9] Marzadri[*], A., **Tonina, D.,** Bellin, A., Vignoli, G., Tubino, M., (2010) Effects of bar topography on hyporheic flow in gravel-bed rivers, *Water Resources Research*, 46, W07531, doi:10.1029/2009WR008285. **(3 citations)**

[8] **Tonina, D.,** and Buffington, J.M., (2009), Effects of salmon redds on river hydraulics and hyporheic flow in gravel-bed rivers, *Canadian Journal of Fisheries and Aquatic Sciences*, 66, 12, pp. 2157-2173. **(18 citations)**

[7] McKean, J., Nagel, D., **Tonina, D.**, Bailey, P., Wright, C. W., Bohn, C., Nayegandhi, A., (2009), Remote sensing of channels and riparian zones with a narrow-beam aquatic-terrestrial Lidar, *Remote Sensing*, 1, 4, pp. 1065-1096. **(36 citations)**

[6] **Tonina, D.**, and Buffington, J.M., (2009), Hyporheic exchange in mountain rivers I: Mechanics and measuring hyporheic exchange, *Geography Compass*, 3, 3, pp. 1063-1086. **(38 citation)**

[5] Buffington, J.M., and **Tonina, D.,** (2009), Hyporheic exchange in mountain rivers II: Effects of channel morphology on mechanics, scales, and rates of exchange, *Geography Compass*, 3, 3, pp. 1038-1062. **(47 citations)**

[4] **Tonina D.,** Luce, C., Clayton, S.R., Alì, S.Md., Barry, J.J., Rieman, B., Goodwin, P., Buffington, J.M., Berenbrock, C., (2008), Hydrological response to timber harvest in northern Idaho: Implications for channel scour and persistence of salmonids, *Journal of Hydrological Processes*, 22. **(19 citations)**

[3] **Tonina, D.,** and Bellin, A., (2008), The influence of pore scale dispersion, formation heterogeneity, source size, and sampling volume on the concentration of conservative tracers, *Advances in Water Resources*, 31. **(17 citations)**

[2] Bellin, A., and **Tonina D.,** (2007), Probability density function of non-reactive solute concentration in heterogeneous porous formations, *Journal of Contaminant Hydrology*, 94, 1, pp. 109-125. **(41 citations)**

[1] **Tonina, D.,** and Buffington, J.M., (2007), Hyporheic exchange in gravel-bed rivers with pool-riffle morphology: Laboratory experiments and three-dimensional modeling, *Water Resources Research*, 43, W01421, doi:10.1029/2005WR004328. (**100 citations**)

Peer Reviewed/Evaluated Conference Proceedings:

[9] Marzadri, A, Reeder[*], W. J., **Tonina, D.,** and Bellin, A., (2013), Dune morphology control on redox conditions within the hyporheic zone, *in Proceedings of* 35th IAHR World Congress 2013, Sept 8-13, 2013, Chengdu, China, Tsinghua University Press, Beijing (*59% acceptance ratio*).

[8] **Tonina, D.,** Luce, C.H., Gariglio[*], F.P. (2013), Monitoring the spatiotemporal changes of the hyporheic zone: Changes in fluxes, thermal regime and streambed surface elevations, *in Proceedings of* 35th IAHR World Congress 2013, Sept 8-13, 2013, Chengdu, China, Tsinghua University Press, Beijing (*59% acceptance ratio*).

[7] Benjankar, R.M., Tranmer[*], A., Tiedemann[*], M.G., **Tonina, D.**, and Goodwin, P. (2013), Analysis of an impact of different discharge scenarios on the thermal regime of the stream below the Dead Wood Reservoir in the central Idaho, USA, *in Proceedings of* 35th IAHR World Congress 2013, Sept 8-13, 2013, Chengdu, China, Tsinghua University Press, Beijing (*59% acceptance ratio*).

[6] Tranmer[*], A., **Tonina, D.**, Goodwin, P., Benjankar, R.M., and Tiedemann[*], M.G., (2013), Stream power changes in an alluvial canyon - Deadwood River, USA, *in*

Proceedings of 35th IAHR World Congress 2013, Sept 8-13, 2013, Chengdu, China, Tsinghua University Press, Beijing (*59% acceptance ratio*).

[5] Marzadri, A., **Tonina, D.,** Bellin, A., (2012), Effect of hyporheic fluxes on streambed pore water temperature, *in Proceedings of* 10th International Conference on Hydroinformatics HIC 2012, 4th-8th July 2012, Hamburg, Germany. (*68% acceptance ratio*).

[4] Marzadri, A., **Tonina, D.,** McKean, J., Tiedemann*, M. G. (2012), Hyporheic exchange along a river bel;ow a dam, *in Proceedings of* 9th International Symposium on Ecohydraulics ISE 2012, 17th-21th September 2012, Vienna, Austria. (*70% acceptance ratio*).

[3] **Tonina, D.,** Marzadri*, A., Bellin, A., (2011), Effect of hyporheic flows induced by alternate bars on benthic oxygen uptake, *in Proceedings of* 34th IAHR World Congress 2011, 26th June-1st July 2011, pp:3129-3137, Brisbane, Australia. (*70% acceptance ratio*).

[2] **Tonina, D.,** McKean, J.A., Tang, C., and Goodwin, P. (2011), New tools for aquatic habitat modeling, *in Proceedings of* 34th IAHR World Congress 2011, 26th June-1st July 2011, pp: 3137-3144, Brisbane, Australia. (*70% acceptance ratio*)

[1] **Tonina, D.,** and McKean, J.A., (2010), Climate change impact on low-gradient salmonid spawning reaches in central Idaho, *in Proceedings of* 9th International Conference on Hydroinformatics 2010, 7th-11th September 2010, Tianjin, China. (*71% acceptance ratio*)

Books and Book Chapter:

[2] **Tonina, D.**, (2012), Surface water and streambed sediment interaction: The hyporheic exchange, in *Fluid mechanics of environmental interfaces* Eds.Gualtieri C. and Mihailovic D. T., Taylor and Francis, pp 500. ISBN-13: 978-0415621564.

[1] **Tonina, D.** and Klaus Jorde, (2013), Hydraulic modeling approaches for ecohydraulics studies: 3D, 2D, 1D and non-numerical modeling, in *Ecohydraulics: an integrated approach*, Eds. Maddock I., Harby A., Kemp P. and Wood P., J. Wiley and Sons. ISBN: 978-0-470-97600-5. pp.31-60.

Patents:

[1] U.S. Patent Application No. 13/890,919 for method and apparatus for monitoring waterbed environment using temperature measurements

Works currently in review:

Tonina, D., Marzadri, A., Bellin, A., Benthic uptake rate due to hyporheic exchange: Effects of streambed morphology for constant and sinusoidally variable nutrient loads, *Water Research*

Hassan M., **Tonina D.**, Does sockeye salmon spawning activity enhance bed mobility in small creeks? in review with *Journal of Geophysical Research: Earth Surface*.

Li R., Chen, Q, **Tonina**, **D.**, Changes of river hydrological and fish habitat features incurred bydue to upstream reservoir regulation in Lijiang River, China, in review with *Ecological Engineering*

Benjankar,R., Burke, M., Yager, E., **Tonina**, **D.**, Egger, G., Rood, S.B., Merz, N., Development of a spatially-distributed hydroecological model to simulate cottonwood seedling recruitment along rivers, in review with *Ecological Engineering*

Benjankar, R., **Tonina**, **D.**, McKean, J. One-dimensional and two-dimensional hydrodynamic modeling derived flow properties: Impacts on aquatic habitat quality, in review with *Earth Surface Processes and Landforms.*

Marzadri, A., **Tonina**, **D.**, Bellin, A., Tank., J.L., Nitrous Oxide emissions from river networks depend on stream morphology, in review with *Geophysical Research Letters*.

Abstracts and Presentations:

Sohrabi*, M., Benjankar, R.M., Isaak, D., Wenger, S., **Tonina, D.**, 2013, *Estimation of Daily Stream Temperatures in a Mountain River Network*, EOS, AGU Trans., 94

Hassan, M.A., **Tonina, D.**, Beckie, R.D., Kinnear*, M., 2013, Hyporheic fluxes in steep headwater streams with step-pool morphologies, EOS, AGU Trans., 94

Gokdemir*, C., Heppell, K., **Tonina, D.**, Harvey, G., Bellin, A., 2013, *Numerical model of hyporheic exchange and reactive transport dynamics from the perspective of residence time on upwelling and downwelling zones at River Bure, UK*, EOS, AGU Trans., 94

Benjankar, R.M., Sohrabi*, M., **Tonina, D.**, Jim A. McKean, 2013, *Differences in aquatic habitat quality as an impact of one- and two-dimensional hydrodynamic model simulated flow variables*, EOS, AGU Trans., 94

McKean, J.A., **Tonina, D.,** 2013, *Sediment Mobility in Unconfined Spawning Reaches: With Implications for Climate Change*, EOS, AGU Trans., 94

Tonina, D., Luce, C. H., and Gariglio, F*. 2013, *Quantifying streambed deposition and scour from stream and hyporheic water temperature time series*, EOS, AGU Trans., 94.

Reeder*, W.J., Quick*, A.M., Farrell*, T.B., Feris, K.P., Benner, S.G., **Tonina, D.**, 2013 *Dissolved oxygen concentration profiles in the hyporheic zone through the use of a high density fiber optic measurement network*, EOS, AGU Trans., 94.

Quick*, A.M., Farrell*, T.B., Reeder*, W.J., Feris, K.P., **Tonina, D.**, Benner, S.G., 2013 *Modeling hyporheic flow paths to quantify nitrous oxide production in stream sediments*, EOS, AGU Trans., 94.

Farrell*, T.B., Quick*, A.M., Reeder*, W.J., **Tonina, D.**, Benner, S.G., Feris, K.P., 2013, *Carbon availability and the distribution of denitrifying organisms influence N_2O production in the hyporheic zone*, EOS, AGU Trans., 94.

Marzadri, A., **Tonina, D.**, Bellin, A., 2013, *Morphology control on hyporheic zone hydrodynamics: implication on redox and thermal regimes* (**Invited**) EOS, AGU Trans., 94.

Reeder*, W.J., Carnie*, R., Gariglio*, F., **Tonina, D.**, McKean, J., Isaak, D., Tang, C., 2013, *Modeling Aquatic Habitat Under Climate Variability*, Western Division of the American Fisheries Society, Boise, Idaho.

Bellin, A., Marzadri, A., **Tonina, D.** 2013, *Hyporheic processes and the Lagrangian framework: Dimensionless numbers for morphological, thermal and biogeochemical controls*, EGU Spring meeting, Vienna, (Austria).

Luce, C. H., **Tonina, D.**, Gariglio*, F. and Applebee, R. 2013, *Solutions for the diurnally forced advection-diffusion equation to estimate bulk fluid velocity and diffusivity in streambeds from temperature time series*, EGU Spring meeting, Vienna, (Austria).

Tonina, D., Luce, C. H., and Gariglio, F*. 2013, *A novel theoretical approach to monitor spatio-temporal variation of streambed elevation from hyporheic temperature time series*, EGU Spring meeting, Vienna, (Austria).

Goode, J.R., J. M. Buffington, **D. Tonina**, D. Isaak, R. Thurow, C. Luce, S. Wenger, D. Nagel, D. Tetzlaff, C. Soulsby (2012), *Field data drives modeling predictions of climate change effects on incubating salmonids*, 43rd Annual Binghamton Geomorphology Symposium: The field tradition in geomorphology, Jackson, WY.

Goode, J.R., J. M. Buffington, **D. Tonina**, D. Isaak, S. Wenger, R. Thurow, C. Luce, D. Nagel, D. Tetzlaff, C. Soulsby (2012), *Effects of climate change on streambed scour and risks to salmonid survival in snow-dominated mountain basins*. Northern Watershed Ecosystem Response to Climate Change (NORTH-WATCH), Workshop V: Catchments of the future North: towards science for management in the 21st century, Potsdam, Germany, May 21-25, 2012.

Goode, J.R., J. M. Buffington, D. Isaak, **D. Tonina,** R. Thurow, C. Luce, S. Wenger, D. Nagel, (2012), *Scour Power: Potential climate change risks for incubating salmonids in the Middle Fork of the Salmon River, Idaho*, Western Division American Fisheries Society, Jackson, WY.

Goode, J.R., J. M. Buffington, D. Tonina, D. Isaak, R. Thurow, C. Luce, S. Wenger, D. Nagel, D. Tetzlaff, C. Soulsby, 2012 (**Invited**), *Predicting climate change risks for incubating salmonids in mountain streams*, Northern Rivers Institute, University of Aberdeen, Scotland.

Tonina, D., Luce, C. H., and Gariglio, F*. 2012*, A novel theoretical approach: from hyporheic temperature time series to streambed scour*, EOS, AGU Trans., 93.

Reeder*, J.W., McKean, J.A., and **Tonina D.** 2012, *Automatic and objective detection of shallow landslides from lidar-derived, high-resolution digital elevation models using wavelet transform*, EOS, AGU Trans., 93.

Jackson, T.R., Haggerty, R., Apte, S.V., Budwig, R., and **Tonina D.** 2012, *Laboratory experiments of roughness effects on the lateral surface transient storage mean residence time in small streams*, EOS, AGU Trans., 93.

Marzadri*, A., **Tonina, D.**, Bellin, A. 2012. *A new dimensionless number for redox conditions within the hyporheic zone: morphological and biogeochemical controls.* EOS, AGU Trans., 93.

Luce, C. H., **Tonina, D.**, Gariglio, F*. and Applebee, R. 2012, *Solutions for the diurnally forced advection-diffusion equation to estimate bulk fluid velocity and diffusivity in streambeds from temperature time series*. EOS, AGU Trans., 93.

Hassan, M. and **D. Tonina**, 2012, *The footprint of salmonids on river morphology*, EOS, AGU Trans., 93.

Marzadri*, A., **Tonina, D.**, Bellin, A. 2011. *Modeling nitrogen cycle at the surface-subsurface water interface.* EOS, AGU Trans., 92.

McKean, J., **Tonina, D.**, Marzadri, A., Tiedemann, M. 2011 (**Invited**), *analyses of bed topography and hyporheic exchange using a high-resolution bathymetric lidar*, EOS, AGU Trans., 92.

Conner*, J. and **D. Tonina**, 2011, *Effect of cross-section interpolated bathymetry on 2D hydrodynamic results in a large river system*, EOS, AGU Trans., 92.

Gariglio*, F., **Tonina**, **D.**, Luce, Charlie 2011, *Quantifying Hyporheic Exchange Over a Long Time Scale Using Heat as a Tracer in Bear Valley Creek, Idaho, USA*, EOS, AGU Trans., 92.

Goode, J.R., Buffington, J.M., Isaak, D.J, **Tonina, D.,** Tetslaff, D., Souldby, C., Tockner, K., Thurow, R.F., Luce, C., Wenger, S., Nagel, D., 2011. *Climate-driven changes in*

scour regime and risks to salmonid survival in the Middle Fork Salmon River, Idaho. EOS, AGU Trans., 92.

Tonina D., McKean, J., Isaak, D., Tang, C., 2011, *new techniques for aquatic habitat modeling,* 141st Annual Meeting American Fisheries Society.

Hassan, M. and D. **Tonina D.**, 2011 (**Invited**), *salmon as geomorphic agents in gravel-bed rivers*, 141st Annual Meeting American Fisheries Society.

Marzadri*, A., **Tonina, D**., Bellin, A. 2011. *A semi-analytical three-dimensional process-based model for hyporheic dissolved oxygen and nitrogen dynamics in gravel bed rivers.* 2011 EGU Spring meeting.

Glenn*, J., **Tonina, D**., Fiddler, F. Morehead, M. 2011. E*ffects of cross-section location and interpolation methods on the accuracy of 3d bathymetric surfaces.* 2011 Boise State University Graduate Student Research Symposium.

Gariglio*, F., **Tonina, D**., Luce, C. 2011. *Hyporheic water temperature and fluxes.* 2011 Boise State University Graduate Student Research Symposium.

Goode, J.R., Buffington, J.M., Isaak, D.J, **Tonina, D.,** Tetslaff, D., Souldby, C., Tockner, K., Thurow, R.F., Luce, C., Wenger, S., Nagel, D., 2010. *Climate-driven changes in scour regime and risks to salmonid survival in the Middle Fork Salmon River, Idaho.* EOS, AGU Trans., 91.

Marzadri*, A., **Tonina, D**., Bellin, A. 2010. *a process based model to predict hyporheic flow induced by alternate bars.* EOS, AGU Trans., 91.

McKean, J., Thurow, R., **Tonina, D.,** Isaak, D., Bphn, C. 2010. *Changes in side-channel salmon rearing habitat associated with climatically-induced summer flow declines in a mountain stream.* EOS, AGU Trans., 91.

Maturana*, O., **Tonina, D.,** McKean, J.A., Caamano, D., Link, O., Buffington, J.M., Luce, C., 2010. *Transport of pulse and chronic inputs of sand and its effects on salmonids spawning habitat in Bear Valley Creek, Idaho, USA.* EOS, AGU Trans., 91.

Marzadri*, A., **Tonina, D**., Bellin, A. 2010. *Heat transport model within the hyporheic zone.* 2010 EGU Spring meeting.

McKean, J., Wright, C, **Tonina, D.** 2010. *Working through the water: Stream bathymetry with the Experimental Advanced Airborne Research Lidar (EAARL).* 2010 GSA annual meeting.

Tonina, D., McKean, J., Maturana*, O.R., Luce, C., Buffington, J. 2009. (**Invited**). N*ew tools for stream morpho-dynamic modeling.* EOS, AGU Trans., 90.

Marzadri*, A., **Tonina, D**., Bellin, A. 2009. *Modeling temperature within the hyporheic zone*. EOS, AGU Trans., 90.

Wheaton, J., McKean, J., **Tonina, D.**, Garrard, C. 2009. *Implications of geomorphic change on salmonid habitat using a narrow beam terrestrial-aquatic Lidar and dem uncertainty accounting.* EOS, AGU Trans., 90.

Tonina, D., Bellin, A., Marzadri*, A. 2008. *Modeling fine sediment infiltration within the hyporheic zone*. EOS, AGU Trans., 89.

Marzadri*, A., **Tonina, D**., Bellin, A. 2008. *Quantifying the role of the hyporheic zone of gravel bed rivers in the nitrogen cycle*. EOS, AGU Trans., 89.

McKean, J.; **Tonina, D.;** Bohn, C.; Wright, C. 2008. *Effects of bathymetric lidar errors on hydraulic models*. EOS, AGU Trans., 89.

Tonina, D., McKean, J.A., Buffington, J. M., Luce, C., and Dietrich E. W. 2007. *Numerical model to analyze the effects of sediment supply on river morphology and streambed characteristics*. EOS, AGU Trans., 88.

Bellin, A., **Tonina D**. 2007. *Probability density function of non-reactive solute concentrations in heterogeneous porous formations*. EOS, AGU Trans., 88.

Buffington, J.M. and **Tonina, D.** 2007. *Effects of channel type on hyporheic exchange in mountain river basins: a Process hierarchy*. EOS, AGU Trans., 88.

McKean, J.A., Wright, W., **Tonina, D.,** Isaak, D., and Bohn, C. 2007. *High resolution mapping and monitoring of channel and floodplain topography with a narrow-beam terrestrial-aquatic lidar*. EOS, AGU Trans., 88.

Tonina, D., Luce, C., Clayton, S.R., Alì, S.Md., Barry, J.J., Rieman, B., Goodwin, P., Buffington, J.M., and Berenbrock, C. 2006. *Hydrological Response to Timber Harvest in Northern Idaho: Implications for Channel Scour and Persistence of Salmonids*. EOS, AGU Trans., 87.

Tonina, D., and Buffington, J.M. 2005. *Effects of salmon redds on river hydraulics and hyporheic flow in gravel-bed rivers*. EOS, AGU Trans., 86.

Tonina, D., and Buffington, J.M. 2004. A 3D *Model For Hyporheic Exchange in Gravel-Bed Rivers With Pool-Riffle Morphology*. EOS, AGU Trans., 85.

Tonina, D., and Buffington, J.M. 2003. *Effects of discharge on hyporheic flow in a pool-riffle channel: Implications for aquatic habitat*. EOS, AGU Trans., 84.

Tonina, D., and Bellin, A. 2002. *The influence of source size and sampling volume on the concentration pdf of conservative tracers released in heterogeneous formations*. EOS, AGU Trans., 83.

Seminar and Invited Speaker

8th Int'l Gravel Bed River Workshop will take place in Kyoto and the Japanese Alps during 14-18 September, 2015.

University Polytechnic Madrid (UPM), April 25, 2013, Surface subsurface exchange.

University of Concepcion and University La Catolica de la Santissima Concepcion, January 18, 2013, Nitrogen processes within the hyporheic zone.

34th IAHR world meeting, 2011 Young professional workshop, Challenges facing water engineers and scientists.

Boise City Club, Advances in remote sensing for detecting river bathymetry, May 2011

Boise River Workshop, October 2011. Urban Rivers Management

Hydrologic Synthesis Capstone Symposium, University of British Columbia, August 2010. Morphodynamic Controls on Hyporheic Exchange in Gravel Bed Rivers with Alternate-bar Morphology.

Utah State University, April 2010. Hyporheic flows in mountain streams: Hierarchy, hydraulics and nitrogen cycle.

Rocky Mountain Research Station, April 2008. Fine sediment transport and infiltration in gravel bed rivers.

Saint Anthony Falls Laboratory, May 2007. Fine sediment transport in gravel bed rivers.

University of California, Berkeley, May 2006. Introduction to the intra-gravel flow paths and hyporheic zone.

University of Trento, 8 January 2004. Interaction between river morphology and intra-gravel flow paths within the hyporheic zone.

External Grants and Contracts Awarded:

PI, Collaborative Research: Understanding the role of hyporheic processes on nitrous oxide emissions, National Science Foundation, 2014-2016, $265,000.
PI, South Fork of the Boise River sediment transport modeling, US Bureau of Reclamation, 2014-2014, $17,800.
PI, Prototype development of low cost thermal scour-deposition chain, Idaho State Board of Education, 2013-2014, $45,750.
PI, Fuel, fire and watershed response, US Forest Service, 2013-2018, $21,395.
Co-PI, Acquisition of Advanced Computing Server, National Science Foundation, 2012-2015, $300,000.
PI, South Fork of the Boise River Hydrodynamic modeling, US Bureau of Reclamation, 2012-2016, $333,000.
PI, Study of Sedimentation Processes in Silver Creek, The Nature Conservancy, 2012, $7,900.
PI, Collaborative Research: Novel interdisciplinary flume experiments to investigate the role of the hyporheic zone in greenhouse gas generation, National Science Foundation, 2012-2014 $490,000.
PI, Climate Change in Mountain Basins, Modification, USFS, $18,000
Co-PI, Improving Adult Pacific Lamprey Passage and Survival at Lower Columbia River Dams, US Army Corps of Engineers; $1,000,000 of which $244,000 is for CER, 2012-2015
PI, In-channel vegetation management, Boise River Flood Control District 10, 2011, $5,000
PI, Wetland river thermal connection, US Bureau of Reclamation, 2011-2013, $28,000
PI, Effect of fire on fuel, US Forest Service, 2010-2011, $ 16,000.
PI, Modeling and measuring the effects of fire and climate change on water resources, US Forest Service, 2010-2014, $ 85,000.
Co-PI, Deadwood River Project: Reservoir Operations Flexibility Investigation. US Bureau of Reclamation, $ 438,000.
PI, Extension: Effect of Climate Change on Watershed Condition and Salmon Habitat in Mountain Basins, US Forest Service, 2010-2011, $ 39,000.
PI, Effect of Climate Change on Watershed Condition and Salmon Habitat in Mountain Basins, US Forest Service, 2009-2012, $ 186,000.

Internal Grants and Contracts Awarded:

PI: University of Idaho Start up augmentation award, 2013, $31,000
PI, See Through the Water, University of Idaho Seed Grant, 2011-2012, $12,000.
PI, EPSCoR Research Experience for Undergraduate, $5,100, 2013.

Honors and Awards:

2014 Research New Spotlight: *Interpore Newsletter Research Spotlight* (https://www.interpore.org/news/e-newsletters/archive/view/listid-5-nonmembersnewsletterflashnews/mailid-108-interpore-newsletter-2014-54).
2014 Invited by Dr. Quiwen Chen, member of the Chinese Academy of Science to visit their ecohydraulics laboratories in Beijing and Nanjing, China.
2013 Cover figure for *Water Resources Research Journal*, Vol 49, No 11.
2013 Finalist for Strazzabosco Engineering Award.
2012 Cover figure for *Water Resources Research Journal*, Vol 47, No 11.
2012 Research News Spotlight in *Here We Have Idaho*, May 2012 issue.

2012 Outstanding Young Faculty Award of the College of Engineering, University of Idaho.
2005 Outstanding Student Paper Award AGU Annual meeting.
2005 Outstanding Graduate Student Award of University of Idaho.
1997 Erasmus exchange student at the University of Sheffield (UK) in the Civil and Structural Engineering Department.

SERVICE:

Major Committee Assignments:

University of Idaho
- Information Technology Committee. since 2014
- Graduate Student Council (substituting Dr. Mary Gardiner) fall 2014

University of Idaho, Boise Campus:
- Boise Center Technology Committee, since 2011

University of Idaho, Department of Civil engineering:
- Graduate Admissions Committee, since 2011
- Student Appeal Committee, since 2011
- Professional Science Master, Ecohydraulics Track Advisor, since 2011
- Senior Biologist Search Committee, in 2010

Professional and Scholarly Organizations:

Associate Editor Water Resources Research (2013-present)
NSF Proposal Review Panel for the Engineering Sustainability program (2013)
American Geophysical Union Fall Meeting session co-sponsor (Dec. 2009 (1 session hyporheic flow), Dec. 2011(1 session remote sensing of river bathymetry), Dec. 2013 (2 sessions: 1. hyporheic flow and 2. Remote sensing of river bathymetry)).

Reviewer of proposals for
- National Science Foundation since 2010
- University of Puerto Rico Sea Grant College Program (2010)
- Italian Ministry of Education and University since 2010
- Water Resources Research Institute (WRRI) of University of North Carolina (2011)

Reviewer of articles for the scientific journals:
- Water Resources Research, since 2007
- International Water Association, since 2007
- Hydrological Processes, since 2010
- Journal of the American Water Resources Association, since 2005
- River Research and Applications, since 2007
- Environmental Management, since 2011
- The Environmentalist, Wiley and Son., since 2012
- Journal of Hydraulics Engineering, ASCE, since 2012
- Journal of Geophysical Research-Earth Surfaces, since 2012
- Journal of Geophysical Research-Bioscience, since 2011
- Freshwater since 2013

Member of
- American Geophysical Union, since 2000
- Professional Engineer State of Idaho, since 2009
- Guild of Italian Professional Engineers, since 2000
- American Society of Civil Engineers, ASCE, since 2013
- International Association for Hydro-Environment Engineering and Research, IAHR, since 2009

Outreach Service:

Classes, Workshops, Seminars, Share Fairs and Tours Organized:

Aquatic habitat modeling workshop at the University Polytechnic Madrid (UPM), 25 hrs course, April 22-25, 2013.

Organize tours of the University of Idaho Boise Center, several times per year since 2012

Instructor for the Hydrology and Hydraulics courses for PE examination review, yearly since 2009;

Facilitate the approval of the cooperative agreement between the University of Idaho and the University of Trento (Italy).

Developed a relationship with the Boise Watershed Educational Center and the Flood Control District 10.

Involved in the Boise Watershed Council for developing and strengthening academic partnership among Universities and local, state and national agencies in the Boise area.

Represented the Center for Ecohydraulics Research at the Boise City Club meeting. 2010

Wrote a newspaper article for boosting University of Idaho presence in greater Boise area, 2010

Re-instated the International Association for Hydro-Environment Engineering and Research (IAHR) Idaho Young Professionals and I am currently the faculty liaison. 2010

Invited speaker at the "Vandal Academic Moment" for the University of Idaho Alumni Association to strengthen University of Idaho presence in Boise, 2011.

Advisor for the Henry’s Fork outlet project for the Sedimentation Engineering class (2010, taught by Dr. P. Goodwin), which is part of a new set of classes aiming at using graduate classes to help solve pressing state problems (CE 504 In-channel vegetation management).

Biosketch: Charles H. Luce

Research Hydrologist
USDA Forest Service
Rocky Mountain Research Station
322 E Front St., Ste. 401, Boise, ID 83702

Phone: 208-373-4382
Fax: 208-373-4391
E-mail: cluce@fs.fed.us

Education

Ph.D.	Civil Engineering	Utah State University	2000
M.S.	Forest Hydrology	University of Washington	1990
B.S.	Forest Management	University of Washington	1986, *Magna Cum Laude*

Professional Experience

1998-Present: Research Hydrologist, Rocky Mountain Research Station, Boise, Idaho.
1991-1998: Research Hydrologist, Intermountain Research Station, Moscow, Idaho.

Awards and Honors

USDA Forest Service Rocky Mountain Research Station, Best Scientific Publication 2009
Water Resources Research Editors' Citation for Excellence in Refereeing, 2003
Certificate of Merit, USDA Forest Service Intermountain Research Station,1991.
Xi Sigma Pi National Scholarship, 1985
Scottish Rite Foundation of Washington Scholarship, 1983 & 1984

Patents

Magnetostrictive Precipitation Gage, Patent No.: US 6,490,917 B1, December 10, 2002
Method for Sensing Evaporation of a Liquid, Pat. No.: US 6,789,417 B2, September 14, 2004.

Refereed Journal Articles

Luce, Charles, J. Abatzoglou, Z. Holden. 2013. The missing mountain water: reduced zonal wind speeds decrease orographic enhancement in the Pacific Northwest USA, Science. 342(6164): 1360 - 1364.

Goode, J. R., C. H. Luce, and J. M. Buffington. 2012. Enhanced sediment delivery in a changing climate in semi-arid mountain basins: Implications for water resource management and aquatic habitat in the northern Rocky Mountains. Geomorphology 139-140: 1-15.

Wenger, S.J.; Isaak, D.J.; Luce, C.H.; Neville, H.M.; Fausch, K.D.; Dunham, J.B.; Dauwalter, D.C.; Young, M.K.; Elsner, M.M.; Rieman, B.E.; Hamlet, A.F.; Williams, J.E. 2011. Flow regime, temperture, and biotic interactions drive differential declines of trout species under climate change. Proceedings of the National Academy of Science (PNAS). 108(34): 14175-14180.

Holden, Z.A., J.T. Abatzoglou, L.S. Baggett, and C.H. Luce, 2011, Empirical downscaling of daily minimum air temperature at very fine resolutions in complex terrain. Agric. Forest Meteorol., 151: 1066-1073, doi:10.1016/j.agrformet.2011.03.011

Luce, C.H. and D.G. Tarboton. 2010. Evaluation of alternative formulae for calculation of surface temperature in snowmelt models using frequency analysis of temperature observations. Hydrology and Earth System Sciences, 14(3):535-543.

Frank Gariglio

EDUCATION

University of Idaho – Boise, ID ***August 2010 – May 2012***

M.S. Civil Engineering – Center for Ecohydraulics Research
Institutional GPA: 4.00

Colorado State University – Fort Collins, CO ***August 2003 – May 2007***

B.S. Civil Engineering – Concentration in Soil and Water Resources, Summa cum Laude
Institutional GPA: 3.96

PRESENTATIONS/PUBLICATIONS

- Tonina, D., **Gariglio, F**., and C. H. Luce (2014), Quantifying streambed deposition and scour from stream and hyporheic water temperature time series, *Water Resources Research*, 50, 1, 287-292, doi:10.1002/2013WR014567.
- **Gariglio**, **F**., Tonina, D**.**, and C. H. Luce (2013), Spatio-temporal variability of hyporheic exchange through a pool-riffle-pool sequence, *Water Resources Research*, 49, 11, 7185-7204, doi: 10.1002/wrcr.20419.
- Luce, C. H., Tonina, D., **Gariglio, F**. and Applebee, R. (2013), Solutions for the diurnally forced advection-diffusion equation to estimate bulk fluid velocity and diffusivity in streambeds from temperature time series, *Water Resour. Res.*, 49,doi:10.1029/2012WR012380.
- Reeder, W.J.; **Gariglio, F.P**. Effects of vegetation in channels: vegetation interactions with channel processes and potential application to the Lower Boise River. River Restoration Northwest Symposium, 2012 (presentation).
- **Gariglio, F.P**.; Tonina, D.; Luce, C.H. Quantifying hyporheic exchange over a long time scale using heat as a tracer in Bear Valley Creek, Idaho, USA. River Restoration Northwest Symposium, 2012 (poster).
- **Gariglio, F.P.;** Tonina, D.; Luce, C.H. Quantifying hyporheic exchange over a long time scale using heat as a tracer in Bear Valley Creek, Idaho, USA. American Geophysical Union Fall Meeting, 2011 (presentation).
- **Gariglio, F.P**.; Tonina, D.; Luce, C.H. Quantifying hyporheic exchange over a long time scale using heat as a tracer in Bear Valley Creek, Idaho, USA. University of Idaho Engineering Expo, 2011 (poster).
- Axness, D.; **Gariglio, F.P.** Elk Creek dam fish passage corridor phase I and II. River Restoration Northwest Symposium, 2010 (presentation).

EXPERIENCE

Water Resource Engineer Intern – CH2M HILL – Boise, ID ***January 2012 – Present***

- Analyze and interpret hydrologic and hydraulic designs of stream restoration projects
- Assist with restoration project monitoring plan development and agency permitting process
- Develop GIS based databases for river restoration projects

Graduate Research Assistant – University of Idaho – Boise, ID August 2010 – Present

- Implement analytical solutions to hydrologic systems to further understanding of hyporheic flow and ecological function of the hyporheic zone
- Work as part of a multi-disciplinary team to integrate detailed hydraulic modeling, future climate scenarios and bioenergetic growth modeling into a study of Chinook salmon spawning and rearing life stages under varying climate conditions
- Provide scientific support for local community project studying effects of woody debris in urban Boise River corridor; Present scientific findings to a wide variety of private, state, federal, and other stakeholders
- Volunteer for additional projects and field work to assist other graduate student research projects
- Assist in the creation of a student chapter of the International Association of Hydro-Environment Engineering and Research at the main Moscow campus and Boise remote campus

Engineer-in-Training – McMillen, LLC – Boise, ID October 2007 – August 2010

- Work on multi-disciplinary teams to complete stream restoration projects within the Northwest region
- Actively participate in community events and volunteer for programs such as Future City to engage young children in the field of engineering

Research Assistant – Colorado State Univ. – Fort Collins, CO September 2006 – May 2007

- Conduct research planning and maintenance of research facility at physical hydraulic modeling laboratory
- Participate in Chi Epsilon and Tau Beta Pi engineering honors societies

PROFESSIONAL ASSOCIATIONS

- Treasurer for International Association of Hydro-Environment Engineering and Research University of Idaho Student Chapter
- Member American Geophysical Union
- Member Chi Epsilon Engineering Honors Society
- Member Tau Beta Pi Engineering Honors Society

Timothy R. DeWeese
(208) 867-7118, deweesetim@gmail.com
3919 W. Neel St, Boise, ID 83705

Objective

To continually obtain and advance scientific knowledge in water resource science and engineering while working toward professional engineering licensure.

Education

Master of Science in Civil Engineering, Ecohydraulics May 2015
University of Idaho, Boise, ID **4.0 GPA**
Hydro Research Foundation Research Award (2014-2015)
Graduate Research Assistantship (2013-2014)

Bachelor of Science in Civil Engineering May 2013
Boise State University, Boise, ID **3.9 GPA**
Engineer-In-Training
College of Engineering Student Award for Excellence

Associate of Applied Science Automotive Technology June 2001
Portland Community College, Portland, OR **4.0 GPA**
ASE Master Certification, **GM Goodwrench Leadership Award, 2001**

Course Work

- Aquatic habitat modeling
- Hydrologic modeling
- Environmental hydrodynamics
- Fluvial geomorphology
- GIS for water resources
- Hydraulics
- Water treatment design
- Wastewater treatment design
- AutoCAD Civil 3D fundamentals

Computer and Engineering Skills

- Microsoft Office: Word, Excel, PowerPoint
- MATLAB
- AutoCAD Civil 3D
- ArcGIS
- 1D and 2D hydraulic modeling
- Verbal and written communication skills
- Detail oriented
- Teamwork and leadership skills
- Exceptional work ethic
- Motivated self-starter

Experience

Graduate Research Assistant September 2013 – present
University of Idaho, Boise, Idaho
Department of Civil Engineering, Center for Ecohydraulics Research

- Designed and performed experiment for streambed temperature scour-deposition relationship
- Personally developed temperature probe prototype for scour-deposition measurement
- Apply prototype to live stream during Spring 2014 run-off season
- Completing Master of Science degree with published thesis

Research Assistant July 2013 – August 2013
Boise State University, Boise, Idaho
Department of Civil Engineering

- Literature research in water resource and changing ecosystem modeling
- Improved hydraulic flume design in civil engineering laboratory
- Performed predictive modeling using GIS and alternative futures analysis

Civil Engineering Technician May 2012 – Aug 2012
and May 2011 – Dec 2011

USDA Forest Service, Boise, Idaho
Boise National Forest

- Utilized hydraulic and hydrologic models for culvert crossing design
- Prepared design drawings using AutoCAD Civil 3D
- Collected field data
- Performed site surveys and construction site staking with Total Station and other instruments
- Inspected construction work in progress to ensure compliance with contract and specifications
- Developed contract plans and engineers cost estimates through team collaboration
- Completed technical reports from forest road safety analysis data
- Performed multiple road condition surveys and maintained database

Civil Engineering Technician May 2010 – Aug 2010
USDA Forest Service, Twin Falls, Idaho
Sawtooth National Forest

- Designed and inspected road washout repair including stream restoration components
- Performed submittal reviews
- Inspected construction work in progress to ensure compliance with contract specifications
- Performed building condition surveys and maintained database
- Completed a technical report for operation and maintenance of solar power supply facilities

Automotive Service Technician September 2002 – February 2009
Edmark Superstore, Nampa, ID

- Established professional communication and teamwork skills
- Honed leadership skills though mentoring new technicians
- Continuously improved troubleshooting and problem solving abilities
- Utilized attention to detail in critical diagnostic and repair processes
- Obtained professional certification and actively worked to continue education

Automotive Service Technician Apprentice June 1998 – August 2002
Larsen Motor Company, McMinnville, OR

- Learned patience, perseverance and attention to detail essential for success
- Worked with valuable mentors to learn best practice on the job
- Completed apprenticeship and employment commitment

Activities

- Member International Association for Hydro-Environment Engineering and Research (IAHR), current
- Member, Treasure Valley Alumni Chapter, Tau Beta Pi National Engineering Honor Society, current
- **President**, Idaho Gamma Chapter, Tau Beta Pi National Engineering Honor Society, 2012 – 2013
- National Science Foundation Scholar, 2009 – 2013
- Member ASCE Student Chapter

APPENDIX C: LETTER OF SUPPORT

United States Department of Agriculture | Forest Service | Washington Office | 14th & Independence SW, P.O. Box 96090, Washington, DC 20090-6090

June 16, 2014

Daniele Tonina
Assistant Professor
Department of Civil Engineering
Center for Ecohydraulics Research
University of Idaho
322 E. Front Street, suite 340
Boise, Idaho 83702

Dear Daniele,

I am writing to strongly support the "Scour Sensor" proposal that has been submitted to the Incubation Fund Program grant proposal process.

I believe that this technology provides a technique that is not currently available to continuously track erosion and deposition as well as information about the thermal properties of the sediment. Currently, the most commonly used technique is the scour chain. This method, however, has limitations as it only records maximum scour and no deposition. Additionally, it is time consuming to install and difficult to extract from stream bed sediment.

Erosion and deposition affect structure such as a bridge piers, dams, levee foundations, apron footings, marine structures, and canal seepage which can in turn affect bridge safety. In order to properly monitor aquatic habitat, it is critical to monitor temperature gradient within a stream bed. Thus the inability of the scour chain to monitor temperature changes prevents accurate understanding of the impact of erosion and deposition on structural safety.

The University of Idaho and the USDA Forest Service (Rocky Mountain Research Station in Boise, Idaho) jointly developed the Scour Sensor to overcome these issues with the scour chain. The inventors filed a patent application on May 9, 2013 titled, "Low Cost Thermal Scour Deposition Chain" (U.S. Patent Application Serial Number 13/890.919 filed on May 9, 2013, based on U.S. Provisional application Number 60/644,580 filed on May 9, 2012).

The invention creates a new methodology by which the effects of erosion and deposition can be measured. It extracts the thermal properties of the stream bed material and the scour depth and deposition thickness from a temperature time series, taking advantage of daily temperature fluctuations. As a result of their research, the joint team developed a new scour-deposition probe and thermal streambed sour-deposition monitor that can monitor stream bed evolution (both scour and deposition processes) and stream-aquifer connectivity. The device can be produced inexpensively as it is simple, portable and uses readily available temperature sensors. Additionally it can easily be operated by field personnel.

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A grant from the Incubation Fund Program would quickly advance the development of this technology. They have already completed the theoretical framework. However, the probe still needs systematic and rigorous testing. There are now four prototypes in the South Fork of Boise River to monitor scour and deposition. The researchers will monitor the changes during the summer high flows and will download the data in September. The team is also working on developing a probe with remote access such that data can be downloaded via cellular connection, thereby allowing the continuous monitoring of the process. The support of the Incubation Fund Program would assist in providing necessary materials to complete the testing being done this summer. Additionally funding would also provide for miscellaneous costs such as travel and lodging. Supporting this team of researchers is the most effective way to allow this innovative product to advance to commercialization. A product with potential impact such as this one should be given the opportunity to be pursued and developed.

Commercialization of viable and innovative technologies will only strengthen Idaho's economic growth. Facilitating and accelerating the transfer of technology out of research facilities and into the private sector is the proper use of university capabilities to enhance industry technologies. This invention could be appealing to any company selling temperature probes as it adds another form of functionality to their instruments. I strongly urge you to consider this proposal and the positive impact that these developments could have on the commercial market.

Sincerely,

Janet L Stockhausen
USDA Forest Service Patent Advisor
1 Gifford Pinchot Drive
Madison, WI 53726-2398
608.231.9502 (ph)
608.231.9508 (fax)
jstockhausen@fs.fed.us

Dr. Daniele Tonina
Assistant Professor
Center for Ecohydraulics
Research
Civil Engineering Department
University of Idaho
322 East Front Street, suite 340
Boise, ID 83702
USA

June 15, 2014

Dr. Charles Luce
Rocky Mountain Research Station
US Forest Service
322 East Front Street, suite 401
Boise, ID 83702
USA

Re: letter of collaboration for the research project "prototype development of a low cost thermal scour-deposition chain" for the SBOE Idaho Incubation Fund Program Proposal

Dear Dr. Tonina,

This letter confirms the intention of the U.S. Forest Service Rocky Mountain Research Station to collaborate in further development and testing of the thermal scour-deposition chain.

The Boise Science Aquatic Lab of the US Forest Service Rocky Mountain Research Station is very interested with this research on developirg a new technology for monitoring streambed elevation changes continuously. The new technology has the potential to simultaneously monitoring streambed elevation, temperature and stream-aquifer connectivity, all important quantities for aquatic ecology. Preliminary testing under controlled scour and deposition sequences shows very good results with uncertainty within 20% of the prescribed treatment.

The developing technology is important 'or monitoring bridge piers and improving bridge safety and for quantifying the impact of watershed management and of restoration projects on stream morphology and aquatic habitat. Additionally, this technology provides temperature information and stream-aquifer fluxes, which are important ecological parameters. Consequently, this technology could be of great interest for monitoring streams.

We support the proposed activities providing additional collaboration in development, finding information on possible test beds, helping in applying it in the field and providing help in transferring it to the public.

Sincerely

Charles Luce
Research Hydrologist