# COVER SHEET FOR GRANT PROPOSALS

State Board of Education

| SBOE PROPOSAL NUMBER: (to be assigned by SBOE) | AMOUNT REQUESTED: $46,800 |
|---|---|

TITLE OF PROPOSED PROJECT: PROTOTYPE DEVELOPMENTF A LOW COST THERMAL SCOUR-DEPOSITION CHAIN

SPECIFIC PROJECT FOCUS:
Development of a New Tool to Measure Scour and Deposition in Real Time

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 fibre optic (Bless method) where light velocity changes within the fibre 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 propose to develop and test 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.

| PROJECT START DATE: 07/01/2013 | PROJECT END DATE:06/30/2014 |
|---|---|
| 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 | |
| CO-PRINCIPAL INVESTIGATOR | | | |

NAME OF PARTNERING COMPANY: CH2MHILL | COMPANY REPRESENTATIVE NAME: Frank Gariglio

NAME: FRANK GARIGLIO SIGNATURE:

| Authorized Organizational Representative | | |
|---|---|---|
| | | |
| | Polly J Knutson, Director<br>Office of Sponsored Programs<br>University of Idaho | |

## 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 | $1,900 / $45.77/hr | 33.66% | 2,500 |
| GRADUATE STUDENT | $23,900 / $23/hr | 3% | 24,700 |
| | | | |
| | | | |
| | | | |
| | | | |
| | | | |

| % OF TOTAL BUDGET: | 52% | SUBTOTAL: | $24,700 |
|---|---|---|---|

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

| Item/Description | Dollar Amount Requested |
|---|---|
| MATERIAL FOR BUILDING THE PROTOTYPE (include: termistor, TIBIT, PVC pipe, electrical wire, data logger) | $3,000 |
| LAB BOX FOR TESTING (include: Pump, plastic box, sediment, piping) | $3,000 |
| | |
| | |
| | |
| | |
| | |
| | |
| SUBTOTAL: | $6,000 |

G. TRAVEL:

| Dates of Travel (from/to) | No. of Persons | Total Days | Transportation | Lodging | Per Diem | Dollar Amount Requested |
|---|---|---|---|---|---|---|
| TO THE FIELD | 2 | 2 | CAR | | | $600 |
| CONFERENCE (fee $490 per person) | 2 | 8 | $ 800 | $1,920 | $980 | 4,400 |
| | | | | | | |
| SUBTOTAL: | | | | | | $5,000 |

H. Participant Support Costs:

| | Dollar Amount Requested |
|---|---|
| 1. Stipends | |
| 4. Other Tuition and Fees for the graduate student | $8,600 |
| SUBTOTAL: | $8,600 |

| 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: | |
| J. Total Costs: (Add subtotals, sections A through I) TOTAL: | $46,800 |
| | |
| K. Amount Requested: TOTAL: | $46,800 |
| Project Director's Signature: | Date: 05/06/2013 |

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

| A. INSTITUTIONAL / OTHER SECTOR DOLLARS | |
|---|---|
| Source / Description | Amount |
| | |
| | |
| **B. FACULTY / STAFF POSITIONS** | |
| Description | |
| | |
| | |
| **C. CAPITAL EQUIPMENT** | |
| Description | |
| | |
| | |
| **D. FACILITIES & INSTRUMENTATION (Description)** | |
| | |
| | |

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| E-MAIL ADDRESS: DTONINA@UIDAHO.EDU | PHONE NUMBER: (208) 364-6194 |

| | NAME: | TITLE: | SIGNATURE: |
|---|---|---|---|
| PROJECT DIRECTOR/PRINCIPAL INVESTIGATOR | DANIELE TONINA | ASSISTANT PROFESSOR | |
| CO-PRINCIPAL INVESTIGATOR | | | |

| NAME OF PARTNERING COMPANY: CH2MHILL | COMPANY REPRESENTATIVE NAME: Frank Gariglio |
|---|---|

NAME: FRANK GARIGLIO SIGNATURE:

| Authorized Organizational Representative | Jack McIver, VP ORED | |
|---|---|---|
| | | |
| | | |

## 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 |
|---|---|---|---|
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| GRADUATE STUDENT | $23,900 / $23/hr | 3% | 24,700 |
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| % OF TOTAL BUDGET: | 52% | SUBTOTAL: | $24,700 |
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| CONFERENCE (fee $490 per person) | 2 | 8 | $ 800 | $1,920 | $980 | 4,400 |
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| | Dollar Amount Requested |
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| 4. Other Tuition and Fees for the graduate student | $8,600 |
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| 1. Materials and Supplies | |
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| 3. Consultant Services (Include Travel Expenses) | |
| 4. Computer Services | |
| 5. Subcontracts | |
| 6. Other (specify nature & breakdown if over $1000) | |
| **SUBTOTAL:** | |
| J. Total Costs: (Add subtotals, sections A through I) **TOTAL:** | **$46,800** |
| K. Amount Requested: **TOTAL:** | **$46,800** |
| Project Director's Signature: | Date: 05/06/2013 |

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

A. INSTITUTIONAL / OTHER SECTOR DOLLARS

| Source / Description | Amount |
|---|---|
| | |
| | |

B. FACULTY / STAFF POSITIONS

| Description |
|---|
| |
| |

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. Charles H. Luce, at the US Forest service, and Frank Gariglio, at CH2M HILL, will be PIs on this project.

**3. PREVIOUS GAP APPLICATION FOR THIS TECHNOLOGY**: None

**4. EXECUTIVE SUMMARY:** Streambed morphology is in constant evolution causing scour and depositional processes. These processes affect engineering structures such as bridge piers, levee foundations, structure footings, ecological processes in addition to restoration, enhancement and improvement projects for streams and rivers. Thus, 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 fibre optic (Bless method) where light velocity changes within the fibre 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 propose to develop and test 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. 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

Thus, the new instrument has the potential to be an integrated tool for monitoring riverine systems. Furthermore, 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 the development of the prototype and its testing in the field.

**5. "GAP" PROJECT OBJECTIVES AND TOTAL AMOUNT REQUESTED:** We are seeking **$46,800** 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 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 prototypes will differ in the way the thermal signal is recoded and analyzed. The objectives are:

1. Develop a set of prototypes to be deployed in the field. The first set of prototypes will measure the actual temperature within the streambed.

2. Develop a second set of prototypes that will measure temperature differential within the streambed instead of segregated analysis of the temperature signal.
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 INTITUTION 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. 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 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. PARTNERSHIPS OR NEW COMPANY CREATION:** The focus will be to strengthen the partnership with the US Forest Service, which may use the instrument to monitor streams for sediment transport. Additionally the PI will work to establish new partnership with Idaho Department of Transportation for testing of the equipment. Private engineering companies, such as CH2MHILL, which could be interested in using the tool to monitor river restoration projects, infrastructure installations, or for risk assessment monitoring of levees. The tool could also be used to investigate erosion and deposition processes (and subsequently the overall fate of sediment) for contaminated sediments at environmental remediation (i.e. Superfund) sites.

**9. 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 cheap and easy-to-deploy tools to monitor streambed evolution (scour-deposition) and stream-aquifer connectivity.

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

1. Information on sediment transport and scour-deposition processes, engineering application for monitoring bridge piers, levee and apron scour, erosion in canals, and monitor the impact of watershed management on sediment transport.

2. Temperature gradient within the streambed for aquatic habitat quality monitoring.

3. Quantify the connectivity between surface and subsurface waters. This may provide information on stream-aquifer recharge. Quantify seepage from canals.

4. Thermal properties of the streambed sediment.

**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. 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. 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 1.** Types of fixed scour-monitoring instruments

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

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. 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.

## 10. TECHNOLOGY:

a. **Current state of technology:** We tested a prototype in a stream to see if the technology may track scour deposition. Figure 1 shows the change in scour-deposition events measured and predicted with the new method. The technology has been tested directly by comparing measured scour-deposition with the value predicted by the prototype in 1 stream under an imposed scour and deposition sequence. We just completed level 2 of the Technology Readiness Level (TRL) and this grant could advance the technology development to level 5.

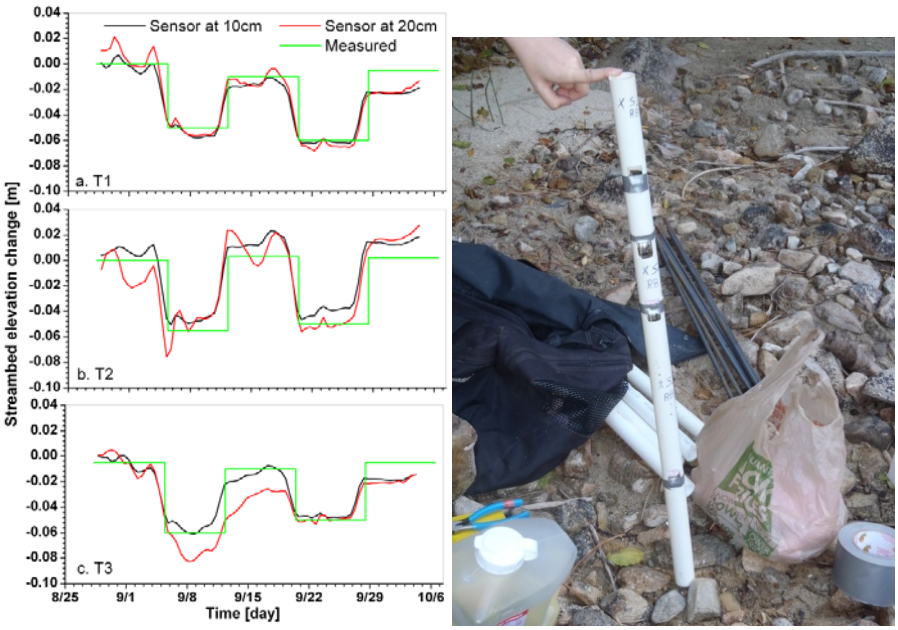


Figure 1: a. Comparison between measured (green line) and predicted with sensor at 10 and 20cm scour. Prototype of the new tool.

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. **Potential customers:** Potential customers are any agency monitoring river systems, scour and deposition processes and private companies working on river management. These customers may include: US Forest Service, Bureau of Reclamation, US Army Corps of Engineers, US Geological Survey, transportation departments, engineering and river management consultants, NOAA, and irrigation districts.

**d. Who developed technology and with what funding:** The technology was developed/discovered by Dr. Daniele Tonina, Dr Charles H. Luce and recent graduate student Frank Gariglio. This technology has been an outgrowth of a project partially funded by US Forest Service and by the startup package of Dr Daniele Tonina.

## 11. COMMERCIALIZATION PARTNERS:

**Commercial partners:** Our goal is to prove the effectiveness of the method and then contact company 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.

## 12. SPECIFIC PROJECT PLAN AND USE OF FUNDS:

We plan to complete the development of new prototypes and to test them in the field and in a laboratory setting to develop the best design. This will require design of new prototypes (3 months), laboratory testing (6 months) and field testing (3 months). We are planning to do this with the help of a full-time graduate student.

**Proposed budget:**

| Personnel | Role on Project | Salary Requested | Fringe Benefits | Totals |
|---|---|---|---|---|
| Daniele Tonina | Principal Investigator | $1,900 | $600 | $2,500 |
| Charlie H. Luce | Senior Personnel | $0 | $0 | $0 |
| Frank Gariglio | Senior Personnel | $0 | $0 | $0 |

| | | | | |
|---|---|---|---|---|
| TBD | Graduate Student | $23,900 | $800 | $24,700 |
| **Subtotals** | | **$25,800** | **$1,400** | **$27,200** |
| **Travel** | | | | |
| Field travel | | | | $600 |
| Conference Travel | | | | $4,400 |
| Material for construction and testing the technology | | | | $6,000 |
| **Trustee Benefits** | | | | $8,600 |
| **Total Project Costs** | | | | **$46,800** |

Funds requested will support the project director ($45.77/hr for 40hr plus benefits at 33.66%) to oversee laboratory trial and assist with field trials. No salary is requested for Dr. C. Luce or Frank Gariglio. A graduate student will be supported at the current graduate rate ($23/hr for 20 hrs/wk, plus tuition and fee $8,600) for 12 months to conduct lab and field experiments. 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 a natural stream nearby Boise (eg. Dry Creek). Material and supply costs and equipment costs (temperature sensors, pump, sediment, material to build the testing box, and data logger, $6,000) associated are included. Travel support to the field (rental car and fuel, $600) is requested and to present the technology to conferences (airfare, lodging, conference fee and per diem, $4,400).

## 13. EDUCATION AND OUTREACH:

This project will educate a graduate student and initiate him/her to research. This is a unique opportunity to work in collaboration with the US Forest Service researchers, University faculty and Consultant engineers. The outreach component will include presentations at the US Forest Service meeting.

**14. 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 potentially consulting engineering firms such as CH2M HILL.

## 15. *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.

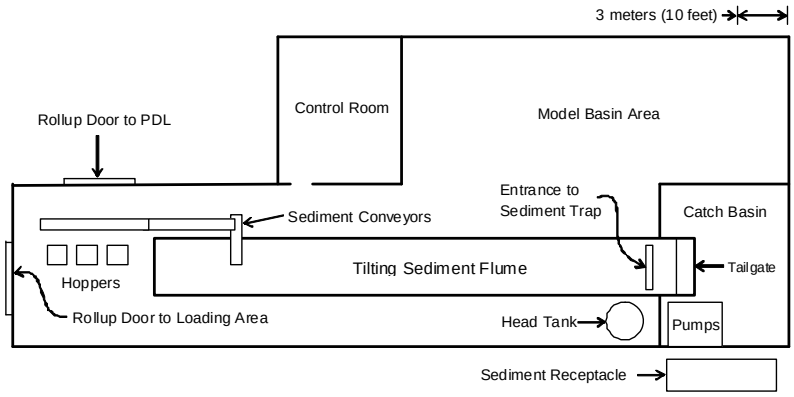


**Figure 1:** CER streamlab floor plan

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…)

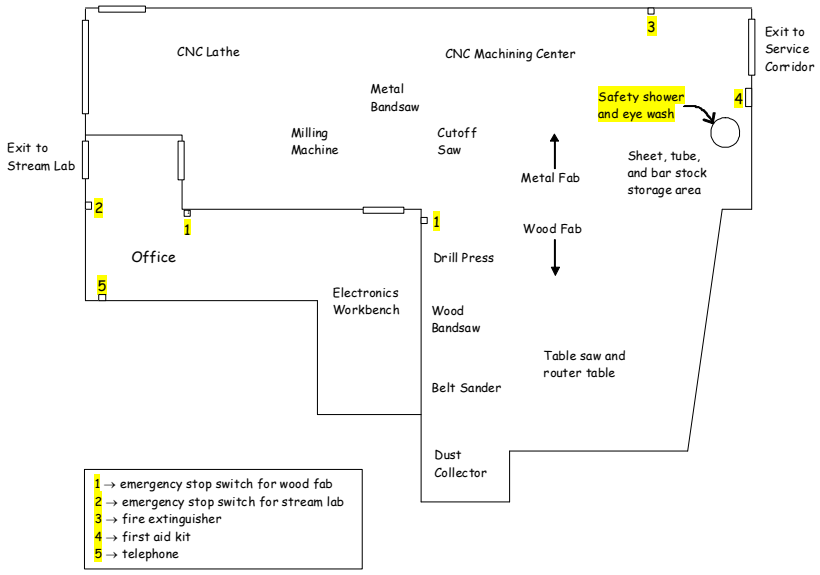


**Figure 2: Machine shop: product development laboratory floor map**.

## APPENDIX B: BIOGRAPHICAL SKETCHING AND INDIVIDUAL SUPPORT:

### CURRICULUM VITAE

**NAME:** Daniele Tonina **DATE:** April 26, 2012

**RANK OR TITLE:** Assistant Professor

**DEPARTMENT:** Civil 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

### 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, hydraulics

**Courses Taught:**

Aquatic habitat modeling, CE 526
Environmental hydrodynamics, CE 504
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 512 (co-taught with Dr. Peter Goodwin)
Fluid Mechanics, Engr. 330 (Boise State University)

**Students Advised:**

**Graduates:**

Advised to completion of degree, major professor:

| | | |
|---|---|---|
| Marzadri, Alessandra, Ph.D., Civil Engineering University of Trento, Trento, Italy (co-advisor with Drs. Alberto Bellin and Marco Tubino, University of Trento) | | [2007-2010] |
| Conner, Jeff, | M.S., Civil Engineering, | [2009-2011] |
| Glenn, Jill, | M.S., Civil Engineering, | [2010-2011] |

In Progress:

| | | |
|---|---|---|
| Nayegandhi, Amar, | PhD., Civil Engineering, | [2010-present] |
| Reeder, William J., | M.S., Civil Engineering, | [2010-present] |
| Gariglio, Frank, | M.S., Civil Engineering, | [2010-present] |
| Carnie, Ryan, | M.S., Civil Engineering, | [2010-present] |
| Kelsey, Leah, | M.S., Civil Engineering, | [2011-present] |

Co-advisor

| | | |
|---|---|---|
| Gökdemir, Çağrı, | PhD., at University of Trento, Italy, | [2011-present] |
| Kinnear, Matthew, | M.S., at University of British Columbia, Canada, | [2011-present] |

**Post doctoral researchers:**

| | |
|---|---|
| Goode, Jaime, | [2010-present] |
| Marzadri, Alessandra, | [2011-present] |

**Member of graduate committee:**

| | | |
|---|---|---|
| Tranmer, Andrew, | Ph.D., Civil Engineering | [2009-present] |
| Reader, Jeff, | Ph.D, CNR | [2010-present] |
| Schoenfelder, Jeffrey, | | M.S., |
| Mechanical Engineering. | | [completed] |
| Hocut, Christopher, | M.S., Mechanical Engineering | [completed] |
| Cernick, Angelina, | M.S., Water of the West | [2011-present] |
| Zobot, Hattie, | M.S. 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

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

Hydrology and Hydraulics courses for PE examination review since 2009;

2010 Hydrologic Synthesis Capstone Symposium, University of British Columbia, Vancouver, Canada, August 2010;
Utah State University, Logan, Utah, April 2010;
University of Idaho, Boise, Idaho, March 2008;
Rocky Mountain Research Station, Boise, Idaho April 2008;
Saint Anthony Falls Laboratory, Minneapolis, Minnesota, May 2007;
University of California, Berkeley, California, May 2006;
University of Trento, Trento, Italy, 8 January 2004.

## SCHOLARSHIP ACCOMPLISHMENTS:

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

### Refereed Journals:

Koenig, F., Benjankar, R., **Tonina, D**., (2013), Comparison of hydromorphological assessment methods: Application to the Boise River, USA, Journal of Hydrology,

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.

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

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.

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.

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.

**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.

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.

**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. **(5 citation)**

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. **(9 citation)**

**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. **(15 citation)**

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. **(18 citation)**

**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. **(11 citation)**

**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. **(5 citation)**

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. **(19 citations)**

**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. (**46 citations**)

**Peer Reviewed/Evaluated Conference Proceedings:**

**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*).

**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*)

**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*)

**Works currently in review:**

McKean, J., **Tonina, D.,** Bohn, C., Wright, C., Effects of bathymetric Lidar errors on hydraulic models, in review with Water Resources Research.

Gariglio*, F., **D. Tonina**, Luce, Charlie 2011, *Spatio-temporal variability of hyporheic exchange through a pool-riffle-pool sequence, in review with Water Resource Research*

Maturana, O.*, **Tonina, D.**, McKean, J.A., Buffington, J.M., Luce, C.H., and Caamaño, D., Effects of pulse versus chronic sand inputs on salmonid spawning habitat in a low-gradient gravel-bed river.

**Abstracts and Presentations:**

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. and **D. Tonina**, 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**

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: Novel interdisciplinary flume experiments to investigate the role of the hyporheic zone in greenhouse gas generation, National Science Foundation, $490,000.
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, See Through the Water, University of Idaho Seed Grant, 2011-2012, $12,000.

**Honors and Awards:**

Invited author for the book chapter: Hyporheic exchange, in *Fluid mechanics of environmental interfaces* Eds.Gualtieri C. and Mihailovic D. T., Taylor and Francis.
Invited author with Dr. K. Jorde for the book chapter: 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
Invited to serve on the Research Evaluation Committee (CIVR) of the Italian research production.
Invited to serve on PRIN Review Panel.
2012 College of Engineering Outstanding Young Faculty, University of Idaho
2005 Outstanding Student Paper Award AGU Annual meeting.
2005 Outstanding Graduate Student Award of University of Idaho.
Erasmus exchange student at the University of Sheffield (UK) in the Civil and Structural Engineering Department.

## SERVICE:

**Major Committee Assignments:**

University of Idaho, Department of Civil engineering:
Graduate Admissions Committee,

Student Appeal Committee,
Professional Science Master, Track Advisor,
Senior Biologist Search Committee,
University of Idaho, Boise Campus:
Boise Center Technology Committee,

**Professional and Scholarly Organizations:**

Reviewer of proposals for
National Science Foundation
University of Puerto Rico Sea Grant College Program
Italian Ministry of Education and University
Water Resources Research Institute (WRRI) of University of North Carolina
Reviewer of articles for the scientific journals:
Water Resources Research,
International Water Association,
Geophysical Research Letters,
Hydrological Processes,
Journal of the American Water Resources Association,
River Research and Applications,
Environmental Management,
The Environmentalist, Wiley and Son.
Journal of Hydraulics Engineering, ASCE
Journal of Geophysical Research-Earth Surfaces
Journal of Geophysical Research-Bioscience
Freshwater
Member of
American Geophysical Union,
Professional Engineer State of Idaho
Guild of Italian Professional Engineers

**Outreach Service:**

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

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
Wrote a newspaper article for boosting University of Idaho presence in greater Boise area.
Re-established the Idaho Student Chapter of IAHR.
Prepared a seminar on water resources and engineering applications for the UoI ASCE Student group
Invited speaker at the "Vandal Academic Moment" for the University of Idaho Alumni Association to strengthen University of Idaho presence in Boise.

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 class 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

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

Tonina, D., Luce, C.H., Clayton, S., Alì, M.D., Barry, J.J., Rieman, B.E., Goodwin, P., Buffington, J.M., Berenbrock, C., 2008, Hydrological Response to Timber Harvest in Northern Idaho: Implications for Channel Scour and Persistence of Salmonids, Hydrological Processes, 22(17):3223-3235.

**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

- Gariglio*, F., D. Tonina, Luce, Charlie (In-review), Spatio-temporal variability of hyporheic exchange through a pool-riffle-pool sequence, in review with *Water Resource Research*
- 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

## APPENDIX C: LETTER OF SUPPORT

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

May 1, 2013

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

**Re: letter of support 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,

The Boise Science Aquatic Lab of the US Forest Service Rocky Mountain Research Station is very interested with this research on developing a new technology for monitoring streambed elevation changing continuously. The new technology has the potential to simultaneously monitoring: 1. Streambed elevation, temperature and stream aquifer connectivity, all important quantities for stream management. Preliminary testing under controlled scour and deposition sequences shows very good results with uncertainty within 20% of the prescribed treatment.

Scour and deposition are important processes that affect aquatic habitat, stream ecology and river morphology. It is important for monitoring bridge piers and improving bridge safety and for quantifying the impact of watershed management and of restoration projects on stream morphology. 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.

Thus, we will support the proposed activities providing information on possible test beds, helping in applying it in the field and providing help in transferring it to the public.

Sincerely,

Frank McCormick