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# **TECHNICAL COMMITTEE**

## **FEDERAL INTERAGENCY SEDIMENTATION PROJECT**

### **Spring Meeting Summary**

**May 17-19, 2011**

May 17 – USGS WA Water Science Center, Tacoma, WA

May 18-19, Peninsula College, Port Angeles, WA

The Spring meeting of the Technical Committee (TC), Federal Interagency Sedimentation Project (FISP), took place in Tacoma and Port Angeles, Washington, on May 17-19, 2011. Two field trips took place during the meeting:

- May 17: USGS streamgaging station, Puyallup River near Puyallup, WA (12101500) to demonstrate the deployment of the LISST-SL for measuring suspended-sediment particle sizes and concentrations, as well as the prototype US P-6 point sampler and
- May 19: Elwha River cross-channel bedload-impact plate assembly, followed by tour of Elwha and Glines Canyon Dams (slated for removal beginning September 2011).

The meeting agenda, which was followed fairly closely, is reproduced in Appendix 1.

#### **ATTENDEES (IN PERSON AND BY WEBEX):**

- Joe Schubauer-Berigan, representing EPA (via WebEx)
- John Potyondy, FS, member (via WebEx after May 17 morning).
- Karl Eriksen, Seattle, COE, acting alternate (in person May 17; WebEx thereafter)
- Roger Kuhnle, ARS, member
- Rob Hildale, BR, member
- Mark Landers, USGS, Chief, Federal Interagency Sedimentation Project
- Johnny Wheat, USGS-HIF, guest
- Matthieu Marineau, USGS, Tacoma, WA, guest (parts of each day)
- John R. Gray, USGS, member and TC Chair

A list of post-2003 agency TC chairs is provided in appendix 2.

Karl Eriksen, representing the COE at a TC meeting for the first time, was asked to provide perspectives on the Seattle COE District and sediment. He obliged, to wit:

“Sediment deposition is aggravating flood problems on numerous river in the Seattle District. We have several General Investigation studies underway that involve sediment evaluations. Suspended-sediment deposition is occurring in the Skagit River and we have worked with the USGS to measure suspended sediment during flood

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conditions. We have also worked with the USGS to measure bedload transport on the White and Skokomish Rivers to better understand the role of bedload on deposition on those rivers. We have experimented with high-concentration suspended-sediment releases from our Howard Hansen dam on the Green River. Those experiments have included standard suspended-sediment depth-integrating sampling and continuous measurements taken with a LISST instrument.”

### **MEETING CONTRIBUTORS (IN CHRONOLOGICAL ORDER):**

Presentations on FISP-supported projects and other endeavors germane to the FISP were provided by:

- Chris Curran, USGS, Tacoma, WA (May 17, in person) (not available 7/8/2011)
- Brandon McElroy, USGS, Columbia, MO (May 18, via WebEx)
- Mark Jakubauskas, University of Kansas, Lawrence (May 18, via WebEx) (not available 7/8/2011)
- Scott Wright, USGS, Sacramento, CA (May 18, via WebEx)
- Pat Rasmussen, USGS, Lawrence, KS (May 18, via WebEx) (not available 7/8/2011)

Their PowerPoint presentations are available by clicking the above names.

### **SYNOPSIS OF RELEVANT OUTCOMES:**

1. **FALL 2011 TC MEETING:** November 9-10 (possibly starting on the afternoon of Nov. 8) at the USGS Science Center in Flagstaff, Arizona, with Nov. 8 and 11 being travel days.
2. **FALL 2010 TC MEETING MINUTES:** The minutes of the Nov. 8 meeting were approved unanimously with the stipulation that proper reference be made to the US P-6 sampler (and not US “D-6” sampler as some dimwit referred to it as).
3. **FISP PROGRESS AND PLANS, OCTOBER 2010-APRIL 2011:** The FISP Chief moderated a discussion of FISP progress and plans, which are described in a memorandum dated May 2, 2011, which is reproduced herein as appendix 3. The key activities and progress are:
  - Transition from retired FISP Chief Broderick Davis (Vicksburg) to current Chief Mark Landers (Atlanta)
  - Prepare a draft FISP Memorandum of Understanding (MOU)
  - Implement FISP-funded research
  - Conduct FISP Research
  - Develop proposed research theme and plan for 2012
  - Provide technical support, presentations, and training
  - Redesign FISP web site
  - Redesign FISP booth and display used at workshops and conferences
  - Acquire and test new US P-6 point sampler
  - Manage budget and interface with USGS HIF for FISP-HIF sampler sales and support

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4. **FISP WEBSITE:** The FISP Chief presented the new FISP website ([water.usgs.gov/fisp](http://water.usgs.gov/fisp)) to the TC. The overall layout and content were considered a major improvement over the previous website. The site has a much improved presentation of the FISP sampler and equipment catalog, and improved and extended references and background information. The new website will have a section on FISP Sponsored research with links to past and current research projects. This new section has not been populated with content as yet. The TC approved the website design and plans.

Because the new FISP website is hosted by the USGS, USGS website display rules must be followed, including having the USGS logo appear in the upper left-hand corner of the home page with no other agency logos on the same line. After some discussion, it was resolved that the ‘letter of the law’ could be met by simply listing other agencies in the same line to the right of the USGS logo. After the meeting, we have found that this USGS rule is not bendable. All contributing agency logos are now listed on the second row of the website. If this is not acceptable, then in the future we will have to find an alternate web host.

**FISP BUDGET:** The FISP Budget for the 2011 fiscal year through May 1, as sent to the TC prior to the meeting, was discussed and approved. Sales of FISP HIF equipment was about \$26,500 for the first 6 months, compared to the \$25,000 estimated in the budget. The budget appears as appendix 4.

5. **FISP RENTALS:** The question was raised, “does FISP benefit financially or in any other way from HIF rental of sediment equipment?” Johnny Wheat will look into this upon return to HIF.

It was agreed that the Elwha and TR-2 bedload samplers should be stocked by the HIF. John Gray noted that two colleagues have locally built TR-2’s (not sure about Elwha sampler fabrication): Steve Holnbeck, USGS, Montana, who has had a TR-2 fabricated by a local machine shop; and Smokey Pittman, Graham Matthews and Associates, who has fabricated his own TR-2.

Rickly Hydrological Company markets a #210 TR-2, and a #160 Elwha sampler. However, equipment purchased directly from any vender may not have the same geometry and sampling characteristics of FISP samplers. Only instruments and equipment sold or evaluated by the HIF can be guaranteed to meet HIF standardized specifications.

6. **US D-96 BAG SAMPLER:** The isokinetic performance of the US D-96 needs to be reassessed by the FISP in light of information contained in a draft USGS report on the subject. The draft report indicates a time-dependent change in intake rates in some fluvial conditions that may be at least partly dependent on factors other than the streamflow velocity incident at the intake nozzle.
7. **LISST-SL:** The field-testing plan, preliminary results to date, and demonstration of the LISST-SL being funded this year by the FISP was presented to the TC by the USGS IL, and USGS WA water science center staffs. The TC also agreed on the need for identification of criteria on which the LISST-SL will be evaluated toward formal acceptance or rejection. It was determined that the device should be:
- evaluated only within clearly identified performance ranges (instrument-specific and relative to the range of conditions under which it is evaluated). This includes limits associated with particle sizes and concentrations (volumetric; by mass units if sediment density is known); velocity; and instrument weight.

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- b. accepted or rejected for use in point mode, or in point and depth-integration mode. If the latter, the caveat that the slower of two transit-rate criteria would apply: The 0.4-transit-rate rule, or instrument-specific limitations in adjusting to varying velocities with time and/or depth (which, in turn, are partly dependent on the vertical velocity distribution in the measuring section).
  - c. Published suggested performance criteria for measuring volumetric particle sizes and concentrations should be considered by the TC and used as-is or duly modified by the TC for use in the evaluation. See pages 7-9, section 1.1.2, in *Sedimentology of Aqueous Systems* ([http://water.usgs.gov/osw/techniques/sed\\_aq\\_sys\\_chap\\_1\\_pdf\\_from\\_wb\\_3\\_16\\_2010.pdf](http://water.usgs.gov/osw/techniques/sed_aq_sys_chap_1_pdf_from_wb_3_16_2010.pdf)), and particularly table 1.1 on page 9.
  - d. Deployable after a reasonable amount of preparation and time.

Hence, any TC approval of the LISST-SL should be consistent with the approval process and criteria for other FISP isokinetic samplers, that being the instruments' limitations be clearly described.

8. **PROPOSED FISP RESEARCH PLAN, FY2012:** The FISP research plan for FY2012, submitted to the TC by the FISP Chief prior to this meeting, was presented and discussed in detail. This research plan is attached as Appendix 5. Sediment surrogate research has been the primary theme of FISP research (and research by the FISP Chief) in recent years. However, quantified accuracy of physical samples is more important than ever during the continued development phase for sediment surrogates. Quantified accuracy ranges for FISP physical samplers are foundational to the sediment data they collect, to risk-based decisions, and to calibration and verification of surrogate methods. Further documentation of physical sampler accuracy also is needed to state acceptance criteria for suspended sediment data, as discussed in the Fall 2010 TC meeting. The evaluation and verification of accuracy of FISP physical sediment samplers, proposed as the FISP priority research theme for FY 2012, was unanimously approved. The research plan will use literature review, computational fluid dynamic modeling, laboratory testing, and field evaluation. The scope of the samplers tested will be limited in FY 2012 to one or two samplers, to include the US D-96 bag sampler.
9. **CALL FOR PROPOSALS:** Proposals for FISP-sponsored research and development efforts are due to the Technical Committee at least 4 weeks in advance of the scheduled date for the Fall meeting. The call for proposals (complete with guidelines on project themes and proposal formats) should be distributed at least 6 weeks before the due date. See appendix 6 for draft research priorities for the FY2012 Call for Proposals.
10. **FISP EQUIPMENT PROCURMENT, SALES, AND QA:** Johnny Wheat of USGS HIF made a presentation describing activities of USGS HIF in FISP equipment procurement, sales, repair, and quality assurance. The mold for the DH-48 is broken, and would be costly to replace. The TC agreed to rely on re-purchased and repaired DH-48s to supply needs for the next few years, with potential transition to the DH-81 only if supplies run out.
12. **USGS TURBIDITY “PROTOCOL”:** The FISP Chief will lead drafting of a FISP memorandum indicating that the TC approves and “embraces” the suspended-sediment discharge computational

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method based on turbidity and streamflow discrete and time-series data described in USGS Techniques and Methods report 3 C4, “Guidelines and Procedures for Computing Time-Series Suspended-Sediment and Loads from In-Stream Turbidity-Sensor and Streamflow Data.” See: <http://pubs.usgs.gov/tm/tm3c4/>.

**13. MEMORANDUM OF UNDERSTANDING:** The MOU was considered generally acceptable, although concern on the mode of succession for the chair (and vice chair) remained unresolved. John Potyondy agreed to edit the MOU for – hopefully – final review by the TC (and did so on May 19). If the presently identified leadership succession scheme is accepted, the following will be added after lines 308-311: “An attempt to rotate the TC Chair position among member agencies will be made.” Additionally, it was recommended to add:

- a. Add reference to the “currently employing agency.”
- b. A statement that the MOU will be with the employing agency.

**14. AGENCY CONTRIBUTIONS:** Because the MOU has yet to be finalized, it has yet to be signed. According to an email from the COE’s Jerry Webb, the COE has agreed to allocate \$10,000 to the FISP from the ERDC in Vicksburg. EPA has not contributed to the FISP for some years.

**15. VICE CHAIR:** Roger Kuhnle agreed to be the TC Vice Chair in FY2011 and, by dint of the nearly finalized MOU – and assuming it is approved more or less as-is – Roger will become chair in FY2012. See appendix 2 for the list of TC chairs since 2004.

**16. PROJECT REVIEWS:** Presentations on the following FISP projects by the following principal investigators were made by Webex or in person: Tim Straub and Chris Curran, “LISST-SL”; Brandon McElroy, “Bedload and bed-material load fluxes by repeat bathymetric data”; Mark Jakubauskas, “Extraction of reservoir pre-impoundment surfaces from acoustic echosounder data”; Scott A. Wright, “Suspended-sediment characteristics by acoustic methods”; Jim Chambers, “Acoustic measurement of suspended fine particles in a fluvial environment by attenuation.” Rob Hildale and Jim Chambers described their bedload-impact plate project during the May 19 Elwha River field trip.

Progress on the projects ranged from satisfactory to impressive. Scott A. Wright responded, “Absolutely” when asked if he thought the hydroacoustic technology was ready for large-scale operational deployment. A protocol to estimate suspended-sediment concentrations from hydroacoustics signals is being drafted.

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## APPENDIX 1: Agenda, Federal Interagency Sedimentation Program Technical Committee Meeting

Tuesday May 17<sup>th</sup> 9:00am

USGS WA Water Science Center, Tacoma

- >Welcome, Introductions, Review of Agenda (9:00-9:30am) Gray
- > LISST-SL Testing Plan and Experience in WA (9:30-10:00am) Curran

Field Demo LISST-SL and US-P-6; [Puyallup River nr Puyallup, WA \(12101500\)](#) (10:00-12:00)

Lunch (12:00-1:00pm)

### Progress of FISP 2011 Research Projects

- > LISST-SL Testing Plan and Experience in Illinois (1:00-1:45)\* -WebEx- Straub
- >Other LISST Devices (100X, Streamside) Results (1:45 -2:10) Landers
- >TC Discussion of history of FISP support for LISST technology; and current status, opportunities, FISP goals, and future directions (2:10-2:45) TC
- >Break (2:45-3:00)
- >Overview Progress, Plans, and Budget of FISP 2011 (3:00-3:45) Landers
- >US P-6 Sampler Memo, Acquisition, and Testing (3:45-4:15) Landers

### Travel 2 hours to Port Angeles

- >Tues Dinner Discussion: Strategies to Build Sediment Monitoring Programs TC

Wednesday May 18<sup>th</sup>

Peninsula College, Port Angeles, WA

- >Presentation & Discussion of FISP-Sponsored Research Goals for 2012 – (8:00-8:45) Landers
- >Presentation and Discussion of new FISP Website (8:45-9:00) Landers
- >FISP-HIF: instrument purchases, stock, testing, QA, sales, & repairs (9:00-9:30) Wheat
- >Discussion of FISP MOU (9:30-10:30) TC

>Break 10:15-10:30

### Progress of FISP 2010 and 2011 Research Projects

- Bed-load and Bed-material-load fluxes by repeat bathymetric data (10:30-11:00am)\* McElroy
- Extraction of Reservoir Pre-Impoundment Surfaces from Acoustic Echosounder Data  
(U. Kansas, Kansas Biological Survey) (11:00-11:30)\* Jakubauskas
- Suspended Sediment Concentration and Size by Acoustic Surrogates (11:30-12:00) Landers

Lunch (12:00-1:00pm)

- Suspended Sediment Characteristics by Acoustic Methods (1:00-1:20)\* Wright
- Bed Material Particle Size Distribution from Digital Imagery (1:20-1:30)\* Wright

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|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------|
| BedLoad Impact Plates (1:30-2:00)                                                                                                                                                                                                                            | Hilldale  |
| Methods for computing SSC and Loads using Turbidity (2:00-2:30)                                                                                                                                                                                              | Rasmussen |
| Should FISP issue Technical Memo approving USGS Techniques and Methods Manual 3-C4 "Guidelines and procedures for computing time-series suspended sediment concentrations and loads from in-stream turbidity sensor and streamflow data" ? (2:30-3:00)Kuhnle |           |
| Discussion and final approval of research priorities & plan for FISP Chief (3:00-3:30)                                                                                                                                                                       | Gray      |
| Discussion and final approval of call for proposals for 2012 (issues are the call itself (description of topics, etc.) and how it is announced) (3:30-4:00) Potyondy                                                                                         |           |
| Discussion of Concept to Build FISP-SOS-...-Sediment Web Support Site (4:00-4:30)                                                                                                                                                                            | Landers   |

#### Thursday May 19<sup>th</sup>

Acoustic Measurement of Suspended Fine Particles In A Fluvial Environment By Attenuation Review of history of FISP supported work, status, and products (8:00-8:45am) Chambers

#### FIELD TRIP

Elwha River and Dams 8:45am-12:30pm

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## **APPENDIX 2: List of Technical Committee Agency Chairs since 2004 (compiled by Mark Landers, May 2011)**

2004, USGS; 2005, BLM; 2006, ARS; 2007, COE; 2008, BR; 2009 and 2010, FS; 2011, USGS



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## **APPENDIX 3: Memorandum, Progress and Plans, Federal Interagency Sedimentation Project, October 2010 to April 2011**

**May 2, 2011**

**To: Federal Interagency Sedimentation Project Technical Committee**

**From: Mark Landers, Federal Interagency Sedimentation Project Chief**

**Subject: Progress and Plans of Federal Interagency Sedimentation Project, October 2010 to April 2011**

This memorandum is to provide a very brief outline of progress and activities in the Federal Interagency Sedimentation Program (FISP) to the Technical Committee (TC) since our Fall 2010 meeting. It has been a good, if somewhat overwhelming first few months for this new FISP Chief; with more needs, opportunities, and vision than resources (time, talent, treasure). However, we have made significant progress and, as a team, have the real opportunity to impact sediment science in the future. You will be asked to discuss and review many of these topics at our Spring meeting this month

### **Key Activities and Progress October 2010 – May 2011**

1.) Transition of FISP Chiefs and Centers from Brod Davis (Vicksburg) to Mark Landers (Atlanta)  
Prior and new FISP Chief worked together at the ERDC and USGS HIF transferring information, files, equipment, contacts, and best wishes. Shut down and distribution of all facilities and equipment at ERDC and establish storage area in Atlanta. A complete set of “legacy” samplers was assembled and transported to the USGS HIF for safe storage. Brod has been a continuing resource via phone to advise and consult.

2.) Preparation of Draft Memorandum of Understanding (MOU) for FISP  
Steve Blanchard, John Gray, and FISP Chief revised the draft MOU after several iterations. This draft MOU was sent to TC members in early February for their review and finalization before obtaining agency signatures.

3.) Implementation of FISP-funded research  
At our prior meeting, we reviewed and ranked seventeen submitted research proposals, and selected 5 of these for possible funding. FISP was able to fund three of these top five proposals. I have interacted with each of the project researchers and they are obtaining very valuable results. I have arranged for each project to present interim findings to the TC at our May 2011 meeting. Most of the funding for these projects has been transferred. We also provided no-cost project extensions two of the 2010 projects (NCPA and Kansas Biological Survey). As noted in the minutes of the prior TC meeting, the top ranked 2011 proposals which were funded are:

- Bedload and bed material load by repeat bathymetric surveys (Abraham and McElroy)
- Acoustic backscatter/attenuation discrimination of particle size with in-situ particle-size measurement (Carpenter and Chambers)
- Field testing and evaluation of LISST-SL (Straub –IL, and Curran–WA)
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4.) Conduct FISP Research

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Ongoing research by the FISP Chief is focused on developing methods for computation of suspended sediment concentration and loads using normalized hydroacoustic backscatter and attenuation. Research is progressing, with all calibration data sets and laboratory results obtained, representing over 250 concurrent samples collected during 5 flood events. Methods development is progressing, with focus now on using multi-frequency results to indicate sediment size characteristics. Computation of sediment concentration and loads by turbidity is near completion. Evaluation of using LISST-Streamside results also is near completion. Sediment-hydroacoustic methods were taught at a USGS workshop to 50 participants in April 2011. Plans are to focus on concluding research and submitting results for publication in coming months, and to have all of this research complete by end of 2011.

#### 5.) Develop Proposed Research Theme and Plan for 2012

Evaluate past research and current needs and opportunities to develop a research theme for the upcoming year. See separate communication for the draft proposal which is submitted to the TC for our Spring 2011 meeting.

#### 6.) Technical Support, Presentations, and Training

FISP Chief has provided technical support for sediment sampling, monitoring and computation. This technical support is provided in response to contacts, calls, and emails from federal, commercial, and academic sediment practitioners. I planned, led, and conducted a Workshop on Suspended Sediment Surrogates for the USGS National Surface Water Conference. This 4 hour workshop was attended by 50 students and covered methods using turbidity, hydro-acoustics, and laser-diffraction. At the Sediment Field Data Techniques course, I taught sections on physical sampler principles and acoustic surrogate methods. I have made 3 presentations on FISP and sediment surrogate technologies and methods at 2 conferences. I have reviewed 4 journal articles and 2 technical reports.

#### 7.) FISP Web Site Redesign

The FISP Web site needs significant redesign, and needs to have its host site relocated. I have developed a new general design and am working with USGS, OSW web designer to get the new web site completed. A draft of this new web site will be available for review by the TC at the Spring meeting. The new web site will make it easier for users to find and learn about (a) FISP supported samplers and supporting equipment; (b) FISP supported research and results; and (c) other sediment monitoring and research activities. Comments will be obtained and revisions made. We hope to announce the completed, new FISP Web site by the end of May 2011, and close the old web site down.

#### 8.) Redesign FISP Booth and Display at Water Conferences

The FISP Booth is being redesigned to display FISP products, research, and results using physical samplers, posters, and a rolling slide presentation. A booth was displayed at the USGS National SW Conference in April, and a significant redesign should be completed for Display at the USGS Data Conference in June 2011.

#### 9.) Acquire and test new US P-6 Point Sampler

Worked with Carnett Technologies and USGS HIF to obtain the first US P-6 sampler, as instructed and approved by the TC at the Fall 2010 meeting. The unit was delivered to the FISP at our Tampa National SW Conference, but did not operate correctly when tested. The sampler was returned to Carnett Technologies and

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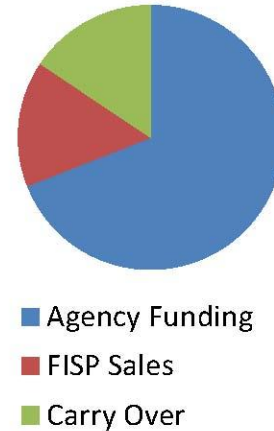
after finding the problem it is being tested at USGS HIF week of May 2<sup>nd</sup>. Results of these tests and a field demonstration of the US P-6 are planned for the Spring TC meeting.

10.)       Manage Budget and Interface with USGS HIF for FISP-HIF Sampler Sales and Support  
The FISP budget, income, and expenditures are presented separately. Sampler sales, repairs, and quality assurance testing is ongoing at the Hydrologic Instrumentation Facility which partners with FISP in these critical activities. I have been learning from the excellent staff at the HIF and developing this partnership. A presentation on sampler quality assurance, repairs, and sales will be provided at the Spring TC meeting.

## APPENDIX 4: FISP 2011 Budget

| Budgeted Income Source       | Budgeted Income  | Estimated Actual Income |
|------------------------------|------------------|-------------------------|
| Carry Over                   | \$57,959         | \$50,871                |
| US Bur Rec Carry Over        | \$13,119         | \$13,119                |
| US Bureau of Reclamation     | \$24,000         | \$21,120                |
| US Bureau of Land Management | \$10,000         | \$10,000                |
| USACE -directly to Abraham   | \$10,000         | \$10,000                |
| USDA Forest Service          | \$10,000         | \$10,000                |
| ARS                          | \$18,452         | \$18,452                |
| USGS                         | \$130,000        | \$142,052               |
| FISP-HIF Sales 25%: Oct-Mar  | \$25,000         | \$26,498                |
| FISP-HIF Sales 25%: Apr-Sep  | \$25,000         | \$14,000                |
| <b>Total</b>                 | <b>\$323,530</b> | <b>\$316,112</b>        |

**FISP FY11 Funding**



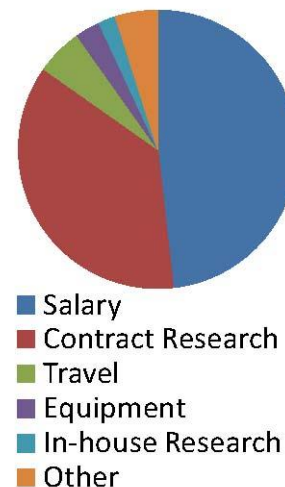
### FY 2011 Funding: Budgeted and Actual

#### Projected

| Budgeted Expense Category       | Budgeted Expense | Projected Actual Expense |
|---------------------------------|------------------|--------------------------|
| Salary                          | \$ 130,000       | \$142,052                |
| Overhead (USGS 12 pct)          | \$ 8,694         | \$8,694                  |
| Travel                          | \$ 15,000        | \$16,500                 |
| Conferences and Exhibits        | \$ 2,500         | \$3,500                  |
| Supplies and Equipment          | \$ 3,500         | \$8,500                  |
| Vehicles (Fuel and maintenance) | \$ 1,000         | \$1,000                  |
| Shipping and Communication      | \$ 5,000         | \$750                    |
| In-house research               | \$ 10,000        | \$6,000                  |
| Contract research               | \$ 148,836       | \$107,800                |
|                                 | <b>\$324,530</b> | <b>\$294,796</b>         |

#### Expenses: Budgeted and

**FISP FY11 Funding**



#### Actual

#### Notes:

- >Cost of new P-6 not included in budgeted expenditures: \$7,738 (under Equipment)
- >Conference costs higher for booth renewal
- >FISP-HIF Sales 25%: FY10 \$63K; FY09 \$76K; FY08 \$50.7K; FY07 \$33.5K; FY06 \$21.6.
- > In addition to USGS contribution for salary, \$35,970 was paid out to retiring FISP Chief for accumulated leave. Paid by USGS Office of Surface Water, outside of FISP Budget.

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## **APPENDIX 5: Draft FISP Research Plan for FY2012**

As the field of sediment surrogate technologies and sediment-related issues grows, it is important to provide some focus from year to year to the Federal Interagency Sedimentation Project (FISP) Research Plan. This brief, draft research plan addresses the theme and plan for research for the FISP Project Chief for fiscal year 2012. The draft plan is not presented here in detail with literature references; but those can be provided. Please carefully review this draft research plan and priorities before the Spring 2011 Technical Committee (TC) meeting in May. If it is the consensus of the TC to pursue this research theme, then the scope and details will be worked out as a team.

### **Draft FISP Research Plan for 2012**

This document is to propose a priority research theme for FY 2012, and a research plan outline, as is required of the FISP Chief per the Memorandum of Understanding. In the first 3 months as the FISP Chief, I've thought a lot about research priorities for 2012. As you know, surrogate metrics of suspended sediment has been the focus of my research for the past several years and this will continue through most of 2011. So there is no lack of interest or vision on my part for sediment surrogate instrumentation and methods. Working with our 2011 project awardees and many folks in your agencies these last few months has broadened that vision.

However, quantified accuracy of physical samples is more important than ever during the continued development phase for sediment surrogates. Quantified accuracy ranges for FISP physical samplers are foundational to the sediment data they collect, to risk-based decisions, and to calibration and verification of surrogate methods. Further documentation of physical sampler accuracy also is needed to state acceptance criteria for suspended sediment data, as discussed in the Fall 2010 TC meeting. A secondary reason for this research focus are field data and a draft report indicating that the D-96 sampler does not sample isokinetically in certain flow conditions. (Published reports and other ongoing field data show the D-96 to sample isokinetically.)

The 2007 FISP Report TT (J. Skinner) summarized previous FISP studies to quantify sample concentration accuracy for a rigid-body and a bag sampler for three velocity-depth conditions for sediment grain sizes of 0.45, 0.15, 0.06, and 0.01 millimeters. The Skinner (2007) report did not summarize or extend results for the effects of fluid temperature, fluid flow structure, sediment density, sampler nozzle size variations (manufacturing tolerances), sample container percent full, or other factors. Although FISP Report TT (Skinner, 2007) made good progress in summarizing and quantifying sampler accuracy from prior studies, there is no statement of or method to quantify the accuracy of FISP samplers for other fluid, sediment, and sampler conditions; and the Skinner (2007) report may not be directly applicable to specific FISP samplers.

The evaluation and verification of accuracy of FISP physical sediment samplers is proposed as the FISP priority research theme for FY 2012. The questions that would be addressed are the accuracies of samples collected under a range of fluid, sediment, and sediment sampler conditions. Accuracy would be assessed in terms of hydraulic efficiency, derived sediment concentration, and derived sediment size and density. The

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research would be pursued using literature review and summary; theoretical computational modeling; laboratory testing; and field data summary. This research is essential to quantify physically sampled sediment data accuracy and accuracy of sediment surrogates based on physical sampler accuracy. The results will verify and extend existing information (primarily in FISP reports) on sampler accuracy and more explicitly define the limiting fluid and sediment conditions where a representative sample may be collected.

## **Scope**

The recommended scope is limited to suspended-sediment samplers. The scope for 2012 may be limited to one depth-integrating rigid bottle sampler and one bag sampler (minimum scope, depending on TC thoughts and funding). The extent to which results from these selected samplers are representative of other samplers also will be addressed in the research. The ambient fluid conditions for which sampler accuracy will be assessed include velocity, turbulence, and temperature. The suspended sediment conditions to be assessed include concentration and particle density. If possible, we will also evaluate the effects of sediment size distribution. The sediment sampler conditions to be assessed include nozzle size, percent full rigid bottle, and percent full bag container.

## **Methods**

### Literature Review

The literature review and summary, particularly from the FISP reports, would be conducted by the FISP Chief. Past laboratory and field testing of samplers is extensive and the data are thorough on most conditions. Data from extensive testing of FISP-approved samplers are documented in FISP reports and some unpublished files. These data are particularly thorough for a wide range of fluid velocity. Test results for a range of temperature conditions and sediment sizes (up to 450 microns) are also documented in FISP reports. The extensive data in the literature will be summarized and will be used to determine where additional research is needed. Field data will also be summarized for further comparison of the literature, laboratory, and modeling results.

### Laboratory Testing

Laboratory tests are well suited to extending the temperature tests that are documented in the literature. The proposal suggested would test a rigid body and bag sampler with 3 different nozzle sizes over a range of temperatures from about 0.5 to 32 degrees centigrade. The USGS Hydrologic Instrumentation Facility of the USGS has a temperature control chamber large enough to contain a small flume that may work for these tests. The issue for using this approach is building a flume that has the cross section and steady flow within the sampler chamber. It may be necessary to use a smaller bag sampler (DH-2) in this setting. Testing of other factors such as fluid velocity and percent full of sample container can be easily conducted in laboratory flumes or tow tanks.

### Theoretical Computational Modeling

Computational Fluid Dynamic (CFD) Modeling has matured rapidly over the last decade, allowing for much higher spatial and temporal resolutions and explicit solutions of the controlling equations. It has been used to track individual sediment particles in turbulent flow fields around bridge piers, for example. I have had several meetings to discuss this research with a leading CFD modeler at Georgia Tech. This draft text for this component of the research will be discussed and refined by the TC, we choose this overall research theme for FY 2012.

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This research will be conducted using an advanced Computational Fluid Dynamic (CFD) approach namely, Large Eddy Simulation (LES). The concept of LES is to simulate explicitly the large-scale structures (large eddies) that are directly affected by the geometry and boundaries and are therefore unique to the problem at hand. The smaller eddies are more universal, and their effect on the large-scale motion is specified by a small number of nearly universal parameters. There are several advantages of using LES for above stated problem: First of all, LES offers a substantial increase in accuracy over time-averaged approaches, particularly when large scale turbulent structures dominate the flow and the related mass and momentum transfer processes. Secondly, a time-dependent simulation approach for the hydrodynamics is preferred since sediment particles or solutes are always exposed to the instantaneous flow field rather than to the time-averaged flow. Hence, LES combined with a solute transport or with a Lagrangian particle model will provide reliable predictions to assess the accuracy of physical sediment samplers. LES requires substantially higher spatial and temporal resolution and is carried out on high-performance computers. The high spatial resolution ensures that small (and important) geometrical details, such as the nozzle design, are accurately accounted for.

#### Scope of CFD Modeling

The research in year one is limited to a single rigid-body and one bag sampler to be specified by the FISP Technical Committee. The scope will be limited to the following range of conditions:

- 2 different Re numbers (either vary depth or approach velocity)
- 4 different sediment concentrations (or sediment sizes)
- 1 Sample design (including sample container type, rigid-body or bag)
- 2 sample volumes and/or percentage sampler container filled

This is a total of 16 simulations which is easily doable within one year. One additional parameter would then double the effort and make the schedule very tight.

#### Budget and Timeline

1 year – \$57,000, which includes 1 Grad student (12 months), summer salary (professor; 0.5 month), and tuition.

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## APPENDIX 6: Draft FISP Research Priorities for FY 2012 Call for Proposals

The call for proposals for the last several years has stated that: “Proposals are solicited that (1) identify, develop, or test emerging surrogate technologies or methodologies, or (2) provide improvements to physical samplers.” This broad statement may provide proposals in areas that the TC had not considered; but it also may allow for a very large number of proposals and little priority for ranking them. The Technical Committee will discuss and determine the extent to which the FISP call for proposals should provide explicit directions and priorities for topics. I have focused the list on topics related to acoustic surrogates for suspended sediment, because this topic has great promise and we are getting closer to usable, repeatable methods. However, I do not have stringent convictions that this is preferable to other important topical areas. Please evaluate and add to this list of potential topics, from which we can select a prioritized subset for the call for proposals.

In each of these topics, particular value will be given to those with data rich concurrent physical samples, and including statements of methods, accuracy and limitations.

- Acoustic surrogates to compute sediment concentration and flux
- Multi-frequency acoustic surrogates to estimate sediment concentration and size characteristics
- Mapping sediment concentration using acoustic Doppler current profilers
- Appropriate acoustic frequencies for specific sediment size ranges
- Comparability and considerations of mass versus volumetric suspended concentrations and size distributions (as for laser-diffraction measurements with physical measurements)
- Mapping suspended sediment concentrations in various stream cross section and flow conditions (as we now have a method to readily do this using the LISST-SL)
- Dave Rubin’s bed-material grain-size optical technology
- Surrogate bedload monitoring