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Assessment and Sediment-Based Design of Stream Restorations: A Short Course

UNIVERSITY OF LOUISVILLE.
STREAM INSTITUTE

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Arthur C. Parola, Jr., Ph.D., PE, Professor of Civil and Environmental Engineering at the University of Louisville and Director of the Stream Institute (ULSI), was the principal investigator. He developed and guided the development of training materials and led the Natural Channel Design Working Group meetings.

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Eric Somerville, U.S. Environmental Protection Agency, Region 4, presented a course lecture on stream and riparian habitat and habitat assessment forms.

The following 45 individuals served as members of the Natural Channel Design Working Group:

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Contents

Tables

Executive Summary

Sediment assessment is an important component in the development of both TMDLs and stream restorations. Provision of basic sediment assessment knowledge would assist state and federal agency personnel in determining how and where to best spend scarce resources in order to effectively address impairments. Developers and environmental practitioners could also benefit from an increased awareness and understanding of the importance of conducting watershed assessments and understanding stream systems on a watershed basis. Likewise, a sediment-based restoration design workshop offered to water resources practitioners and managers would facilitate the effective use of stream restoration design to not only stabilize stream reaches but also reduce downstream sediment problems and improve upstream channel stability.

The goal of this project was to improve the state of knowledge and practice of watershed assessment and management and the use of stream restoration to improve water quality and stream habitat on a watershed scale. The objectives established to meet this goal were threefold: (1) the development and delivery of a 4-day workshop on the assessment of sediment impairment on a watershed scale, offered to a minimum of 20 water resources managers and practitioners involved in conceptual or detailed design of stream restorations, including state and federal government agency personnel, environmental consultants, developers, and non-governmental organizations; (2) the development and delivery of a 6-day workshop on the design of stream restorations to reduce sediment impairment, offered to the same participants as the assessment workshop; and (3) the continued provision of a forum for the Natural Channel Design Working Group (NCDWG) to exchange natural channel design and channel restoration assessment concepts and their applications to Kentucky streams.

To accomplish these objectives, the following tasks were completed for the workshops: (1) Field reconnaissance was conducted to identify locations to be used for all workshop field exercises and collect information for use in preparing training manuals; (2) Mapping and other supporting data were collected; (3) Workshop agendas, advertisements, applications, and venues were planned and organized; (4) Workshop materials were developed, organized, submitted to Kentucky Division of Water (KDOW) for approval; (5) Workshops were conducted to deliver technical training to admitted participants; (6) A survey of the training session participants was developed and administered to evaluate the effectiveness of the workshops; (7) Natural channel design techniques likely to be effective for conditions specific to Kentucky were selected to support focused NCDWG discussions of current stream stability and stream habitat problems and current restoration projects; (8) NCDWG meetings and/or field trips were held approximately bimonthly.

The course was delivered in three parts to 28 participants. Part 1 (*Assessment of Sediment Loads and Habitat Impairments*) provided an introduction to the design concepts to be covered in Parts 2 and 3. Lectures, class exercises, and fieldwork illustrated techniques for assessing sediment sources and loads and for identifying important geomorphic processes occurring on a wa-

tershed scale and their impact on stream stability, bank erosion, sediment supply, and stream habitat. At the conclusion of this segment, participants developed conceptual design alternatives and presented them to the class. Parts 2 and 3 (*Sediment-Based Design of Stream Restorations*) covered techniques for completing detailed assessments (bed material load, site geotechnical characteristics, and groundwater and channel hydrology) and using them for design. Students were also introduced to the application of two-dimensional flow modeling to floodplain and channel design. Lectures, class exercises, and fieldwork guided participants through the development of design alternatives and important components of a detailed design for a section of a stream and floodplain restoration. Course evaluations were extremely positive, with an overall average rating of 4 out of 5.

The NCDWG was extremely successful as a forum for the transfer of fundamental knowledge, procedures, and problems related to water resource conditions specific to Kentucky. The forum maintained consistently high interest and participation of state and federal agency professionals, and it became a resource on which agency personnel relied for efficient and effective acquisition and exchange of much-needed information and solutions. A total of 23 meetings were held; these included 5 lectures and field trips to 26 sites. Attendance at each of the meetings varied between 7 and 21 participants, with an average of 13 participants, not including various invited guests.

Assessment and Sediment-Based Design of Stream Restorations: A Short Course

By Arthur C. Parola, Jr., and Chandra Hansen

1. Introduction

1.1 BACKGROUND

Modifications of land and waterways for water crossings and roadways, urban development, agriculture, silviculture, logging, mining, livestock grazing, and other uses often change watershed characteristics. These changes, as well as direct modifications to streams—especially channel straightening, channel dredging, and removal of woody debris—degrade stream habitat, alter aquatic and riparian ecosystems, and cause channel instability in the form of channel incision and associated bank erosion that reduces channel variability and releases sediments into channel systems to be deposited downstream (e.g., see Parola et al. 2007; Mastin 2009). In Kentucky, these sediments are one of the leading causes of stream impairment (KDOW 2004).

Section 303(d) of the Clean Water Act requires states to identify pollutants causing impairment. For each impaired water body, states must develop a total maximum daily load (TMDL) for the water body by determining (1) the assimilative capacity of the receiving stream, (2) the current point and nonpoint source inputs, and (3) the pollutant reductions needed to meet water quality standards. Because stream morphological processes can contribute significantly to the development of sediment impairments, understanding them is important for the accurate identification and remediation of sediment impairments. Some wetland stream systems, for example, naturally include silt beds; therefore, classifying them as impaired for the occurrence of silt in the streambed would be inappropriate. A better understanding of stream morphological processes and sediment transport will permit some streams listed as sediment impaired on the 303(d) to be de-listed and scarce funds targeted for optimal water quality benefit.

Morphological assessment is also critical for the selection of stream reaches that can benefit from restoration and for effective restoration design. Stream restoration is an effective means of mitigating erosion and instability resulting from past and current human activity and channel modifications (see Parola and Vesely 2005). Assessment for sediment can facilitate the mitigation of impairments on a watershed scale by allowing the strategic selection of stream reaches whose restoration could propagate improvements to other areas of the watershed. In watersheds where existing conditions arising from past land development and channel modifications preclude wholesale restoration, for example, morphological assessment of stream systems could be used to quantify the most significant causes of physical degradation and siltation. The most sig-

nificant contributors to sediment problems could then be targeted for the application of BMPs that include stream restoration.

Incorporation of sediment transport into channel design could also provide an effective means for reducing sediment and nutrient loads. One of the methods available for managing sediment is the integration of wetlands with stream restorations. The strategic locating of stream and wetland restoration projects, based on an understanding of morphological processes, could provide a cost-effective mechanism for the reduction of sediment loads, the improvement of water quality and stream habitat, and an increased retention of floodwaters.

Sediment assessment, including the evaluation of the contribution of bank erosion to siltation problems in the watershed, is also an important component in the development of both TMDLs and stream restorations. Streams create and maintain their shape through erosion, transport, and deposition of their sediment load. A channel design method that accounted for sediment load would improve channel long-term stability. Currently, however, the practical application of sediment transport processes in restorations is limited.

Stream restorations are currently designed to stabilize streams and improve habitat. Nearly all current methods for stream restoration are based on reference reach approaches. Reference reaches are often located in watersheds that are remote or different from the watershed of the restoration reach. Sediment transport in the proposed restoration reach is likely to be significantly different from the reference reach. Methods are available, however, for the incorporation of sediment transport into design that accounts for the differences between reference and project reaches.

As the knowledge and techniques applied to watershed management continue to be refined, water resources managers and practitioners will benefit from opportunities to receive and exchange information about the application of those principles. Two means of facilitating that training and transfer of knowledge are the support of workshops and the continued support of the Natural Channel Design Working Group (NCDWG). Technical training workshops that provide basic sediment assessment knowledge will strengthen the ability of state and federal agency personnel to determine how and where to best spend scarce resources in order to effectively address sediment impairments. An improved state of knowledge of assessment of sediment impaired systems would facilitate the accurate identification of water bodies impaired by sediment and also permit a more efficient application of best management practices (BMPs) to mitigate sediment problems. Likewise, planners and environmental practitioners will benefit from an increased awareness and understanding of the importance of incorporating sediment transport processes into design.

The second means of technology transfer, the NCDWG, was originally conceived as a forum for the transfer of fundamental knowledge, procedures, and problems related to water resource conditions specific to Kentucky. The forum has been extremely successful and continues to maintain consistently high interest and participation of state and federal agency professionals, who benefit from the opportunity the forum provides to link accepted and emerging theories with the conditions and problems they encounter in practice. The NCDWG has become a resource on which agency personnel rely for efficient and effective acquisition and exchange of much-needed information and solutions.

1.2 PROJECT PURPOSE AND SCOPE

The goal of this project was to improve (1) the state of knowledge and practice of watershed assessment and management and (2) the use of stream restoration to improve water quality and stream habitat on a watershed scale. The objectives established to meet this goal were threefold:

1. Develop and deliver a 4-day workshop on the assessment of sediment loads and habitat impairments, offered to a minimum of 20 water resources managers and practitioners involved in conceptual or detailed design of stream restorations, including state and federal government agency personnel, environmental consultants, developers, and non-governmental organizations.
2. Develop and deliver a 6-day workshop on the design of stream restorations based on sediment loads, offered to the same participants as the assessment workshop.
3. Continue to provide a forum for the NCDWG to exchange natural channel design and channel restoration assessment concepts and their applications to Kentucky streams.

These objectives were achieved by completing the following tasks:

1. Field reconnaissance was conducted to identify locations to be used for all workshop field exercises and collect information for use in preparing training manuals.
2. Mapping and other supporting data were collected.
3. Workshop agendas, advertisements, applications, and venues were planned and organized.
4. Workshop materials were developed, organized, submitted to Kentucky Division of Water (KDOW) for approval.
5. Workshops were conducted to deliver technical training to admitted participants.
6. A survey of the training session participants was developed and administered to evaluate the effectiveness of the workshops.
7. Natural channel design techniques likely to be effective for conditions specific to Kentucky were selected to support focused NCDWG discussions of current stream stability and stream habitat problems and current restoration projects.
8. NCDWG meetings and/or field trips were held approximately bi-monthly (once every two months).

This project led to the development and delivery of a sediment-based restoration design short course to water resources practitioners and managers and environmental consultants. This technology transfer will facilitate the effective use of stream restoration design to not only stabilize restored stream reaches but also reduce downstream sediment problems and improve upstream channel stability. The project also continued the NCDWG, which provided the means to share the knowledge and perspectives about Kentucky stream morphology and ecology necessary for effective restoration.

A portion of the non-federal match was provided by the Kentucky Department of Fish and Wildlife Resources (KDFWR) from an in-lieu fee stream and wetland restoration project on Slabcamp Creek and Stonecoal Branch in Rowan County, Kentucky. The University of Louisville Stream Institute was responsible for the assessment, restoration, design, and monitoring of the project. It was one of four sites selected for collection of data for the course, and the stream restoration concepts and principles employed for the project were provided in the course training materials. The project also was used as a demonstration site in both the course and the NCDWG. Reductions in watershed annual pollutant loads are attributable to the NPS project in proportion

to the contributed match, which amounted to 4.17% of the restoration project's projected cost. Therefore, of the total sediment load reduction of 382.7 tons/year that is estimated for the restoration project (USEPA 2010), 15.96 tons/year can be attributed to this NPS project.

2. Materials and Methods

2.1 WORKSHOP DEVELOPMENT AND DELIVERY

Ten days of workshops were developed as a single short course to be offered to professionals involved in conceptual design, detailed design, or review of stream restorations. Targeted participants included environmental consultants; representatives of non-profit agencies; and government agency personnel. The short course was developed as two segments, one for assessment and one for design.

Data Collection

Site Selection

Sites were selected for which course participants could effectively assess sediment loads and habitat impairments and develop a stream restoration design. Potential watersheds and stream reaches to be used in the course were restricted to the central part of the state to minimize the amount of time needed to transition between the classroom and the field. Additional considerations in site selection were data availability, watershed size, and participant access during workshops. Watersheds/sites for which existing sediment data had been collected through monitoring and/or design projects were given higher priority than those for which data were not available. The selected sites were either part of a larger watershed being evaluated for sediment loads so that data would be available to supplement the data collected by participants during the course, or the selected watershed was small enough to permit sufficient data collection prior to and during the workshop for participants to assess sediment loads and habitat impairments.

Four sites were selected for collection of data for the course: South Fork Curry's Fork in La Grange, Oldham County; Slabcamp Creek watershed in the Daniel Boone National Forest, Rowan County; Mill Creek in Lexington, Fayette County; and Harrison Fork and Wilson Creek at Bernheim Arboretum and Research Forest, Nelson County. Two additional sites were selected for demonstration of supplemental information and techniques: Mill Branch in Knox County and Dix River tributaries in Crab Orchard, Lincoln County. All six were stream restoration sites in various stages of design, construction, or monitoring by ULSI.

Remote and Field Data Collection

Remote data and field data were collected to assemble and develop site assessment and lecture materials. Mapping and other spatial data sets for selected sites were extensively reviewed and assembled. These included topographic maps, contemporary and historic aerial photographs, land-use maps and descriptions, historic maps, soil and geology maps, road maps, and other similar information. Field reconnaissance activities included visual observations and more complex quantitative geomorphic assessments and data collection. For detailed illustrations of these assessment and data collection procedures, see the indicated tabbed sections of the course notebook (Appendix D):

- Identification of sources of sediment and impairments (Tabs 1–3)

- Assessment of the geomorphic response of systems to impairments and their physiographic settings (Tab 1)
- Collection and analysis of sediment transport, in-channel flow, groundwater, and other data (Tabs 5 and 8)
- Development of two-dimensional models of existing and designed terrains to evaluate potential flooding effects on stream restorations (Tab 6)
- Integration of these findings to address sediment loads and habitat impairments (Tab 9)

These remote and field data were complemented by data collected by the Stream Institute for restoration designs at each of the four data sites (Tab 5). The combination of these data provided a comprehensive dataset for participants to use to develop a practice restoration design (Tab 9).

Planning

A course agenda, announcement, application, and registration form (Appendix B) were developed and submitted to KDOW for approval. In October 2010, the announcement was posted online and distributed via email, and the application was posted online as an electronic form.

Course Announcement

The ULSI project manager worked with the KDOW technical advisor to distribute the advertisement to targeted participants:

- NCDWG members, including employees of Kentucky Department of Fish and Wildlife Resources (KDFWR), Kentucky Division of Water, Kentucky Transportation Cabinet (KYTC), US Army Corps of Engineers, US Fish and Wildlife Service, and US Forest Service
- Other mailing lists of NCDWG members
- KDOW Water Quality Certification (WQC) Section contact list for consultants
- Kentucky Association of Mitigation Managers
- Consultants contracted by KDFWR's in-lieu fee mitigation program and by KYTC

Applications for Admission

A total of 71 applications were received for the course. These were ranked by the principal investigator, ULSI project manager, and KDOW technical advisor according to how closely they met the screening criteria: priority in selection of participants was given to private consultants and federal, state and local agency personnel who regulate, conduct or assist in Kentucky stream restorations. Enrollment was limited to 30 participants who could commit to attending the full 10-day course. The class was limited to 30 so that the staff of the institute would be able to guide participants through the design procedure. A total of 30 applicants were selected, and the remaining 41 were waitlisted according to how closely they matched the screening criteria. Notifications were emailed to all applicants to inform them of their admission status.

Course Registration

Admitted applicants were asked to confirm their attendance within five weeks by completing an electronic registration form. After a series of cancellations and substitutions from the waiting list and another 3 cancellations in late March (some of these were due to agencies' federal budget issues), a total of 28 participants were registered. Because several days were usually required to arrange for substitutions from the waitlist and only one week remained before the start of the workshop at the time of those late cancellations, we did not attempt to fill those three spaces with

other waitlisted applicants. One of the 28 registrants was Eric Somerville from EPA Region 4; he agreed to serve as an instructor by presenting, assisting less experienced participants, and adding commentary during the workshop.

Course Listserv and Website

A listserv was established to facilitate email communication with and between registrants, and a course roster was distributed after permission to share contact information was obtained from each registrant. A website was created to communicate information about the course to registrants. The website included meeting location, a preliminary schedule, required supplies, and lodging recommendations (Appendix B). Subsequent updates to the website, such as reading suggestions, were also posted to the listserv.

Production of Materials

The course was designed to be delivered in three parts, each of which would culminate in presentations by student groups of their conceptual or detailed stream restoration designs (see agenda in Appendix B). A proposed outline of the course notebook was submitted to KDOW for approval, and a draft course notebook was subsequently developed and approved. Teaching materials, including course notebooks, were developed to provide a combination of lectures, class exercises, and fieldwork. Data collected prior to the training was assembled into components that were combined with data collected during workshop field exercises and applied by participants in the development of a practice stream restoration design.

Course Evaluations

At the conclusions of Parts 1, 2, and 3, participants were asked to complete surveys to evaluate the content, format, and delivery of the course (Appendix C). Evaluation forms approved by KDOW were posted online as electronic forms for Parts 1 and 2, and notifications were emailed to all participants to request that they complete the surveys. Reminders were sent every 1−2 weeks until 27 of 28 participants had submitted an evaluation for Part 1 and 21 of 27 participants completed the evaluation for Part 2. Part 3 evaluations were completed in class on the last day of the course by all 26 people who finished the entire course.

2.2 NCDWG COORDINATION

A listserv was established to facilitate email communication with and between NCDWG members. Dates for about six meetings per year were selected annually and announced via the listserv at the beginning of the year. Meeting agendas were established based on suggestions from the group members for field trips or lectures. Agendas were distributed to the listserv approximately one month before each meeting. A typical lecture meeting followed this agenda:

1. Presentation by team member with illustrative exercises
2. Discussion of presentation
3. Sharing of information about projects or restoration activities, manuals, books, or articles

3. Results and Discussion

3.1 SHORT COURSE

Course participants learned to apply the assessment and design techniques that have been implemented by the University of Louisville Stream Institute in several Kentucky stream and wetland restorations. In these restorations, floodplains and stream channels are reconstructed to reestablish the historic surface and subsurface processes that were disrupted at the sites by human-imposed changes to the watershed's hillslopes, valleys, and stream channels. These self-sustaining restorations have the capacity to adjust to changes in the watershed; they are able to maintain grade control and stable habitat without being constrained to a fixed form that would be necessitated by structures commonly installed to direct flow through the channel. Other objectives addressed by these techniques have included

- Increase in volume and duration of groundwater storage in the valley, surface water storage in the floodplain, and base flow in the channel
- Re-creation of dynamic hydroperiod of floodplain inundation
- Facilitation of hyporheic flow around and under the channel
- Increase in potential for reduction in TMDL pollutants (e.g., through nutrient processing and storage of fine sediments)
- Reduction in delivery of fine and coarse sediments to downstream reaches
- Improvement of habitat for rare, threatened, or endangered species
- Facilitation of aquatic organism passage
- Colonization of riparian area by volunteer wetland vegetation species

The course was delivered in three parts:

Part 1 (*Assessment of Sediment Loads and Habitat Impairments*) was offered Monday through Thursday, April 4−7, 2011. This 4-day segment provided an introduction to the design concepts to be covered in Parts 2 and 3. Lectures, class exercises, and fieldwork illustrated techniques for assessing sediment sources and loads and for identifying important geomorphic processes occurring on a watershed scale and their impact on stream stability, bank erosion, sediment supply, and stream habitat. At the conclusion of this segment, participants developed conceptual design alternatives and presented them to the class. Completion of Part 1 was a prerequisite for Parts 2 and 3.

Parts 2 and 3 (*Sediment-Based Design of Stream Restorations*) were delivered over two periods: Monday through Thursday, June 6−9, 2011, and Tuesday through Wednesday, July 12−13, 2011. These two parts covered techniques for completing detailed assessments (bed material load, site geotechnical characteristics, and groundwater and channel hydrology) and using them for design. Students were also introduced to the application of two-dimensional flow modeling to floodplain and channel design. Lectures, class exercises, and fieldwork guided participants through the development of design alternatives and important components of a detailed design for a section of a stream and floodplain restoration.

The training was provided by the principal investigator and several additional staff members of the Stream Institute who are specialists in the fields of geomorphology, hydrology, characterization and transport of sediments, natural channel forms and design, and water quality. Lectures

were primarily delivered by the principal investigator. Staff members were available to help participants to complete exercises. The format included a total of three-and-a-half days of field data collection and site visits and six-and-a-half days of classroom instruction, activities and lecture, including presentations from participant workgroups.

Course Participants

Course participants included a broad range of personnel from both government and private sectors (Table 3.1). Of the 28 participants, all but two completed the full 10 days of training. Those two, one from US EPA and one from a non-profit agency, had work-related conflicts and left the course early. A certificate of completion of 70 professional development hours was provided only to those who attend the entire training.

Table 3.1 Short Course Participants and Organizations

Agency/Organization Represented	No. Enrolled
KY Department of Fish and Wildlife Resources (KDFWR)	5
KY Division of Water (KDOW)	4
Lexington-Fayette Urban County Government (LFUCG)	1
USDA Forest Service (USFS)	2
US Environmental Protection Agency, Region 4 (USEPA)	1
US Fish and Wildlife Service (USFWS)	2
Non-profit agency	1
Private consultants	12
Total	**28**

Many participants had been trained as engineers, biologists, or ecologists. All participants indicated multiple fields of work, including various combinations of biology/ecology, engineering, forestry, geography/geology, hydrology; other fields included soil science, permitting/ compliance, and botany. The types of stream related projects participants identified as something they currently work on or expect to work on were also diverse, though some types of projects were more common than others. More than 90% of the participants identified stream habitat improvement and water quality improvement as types of stream related projects they currently work on or expect to work on following the training. All but two had some knowledge of stream geomorphology and functions prior to taking the course.

Course Evaluations

Participants evaluated all components of the course, including lectures, practice exercises, field trips, and group work. Based on both quantitative and written responses, the primary findings of the course evaluations (Appendix C) are as follows:

- **Satisfaction with the training was high**. Both the median and mean rating of all responses to all evaluation questions was 4 out of 5. The value of each part of the course was consistently rated 4 (above average) or 5 (very high) by most participants, and most indicated that they would be able to apply at least some of what they learned to their work. The training succeeded in meeting or exceeding the expectations of most of the participants, who also indicated that they were very satisfied with the course and that they would be very likely to recommend it if it were offered again.

- **The instructional value of the lectures, exercises, and site visits was high.** The evaluation questionnaire asked participants to rate the instructional value of every presentation, group exercise, and site visit and on a scale from 1 to 5, where 1 was very low and 5 was very high. Of the 43 different activities, all but 6 were rated 4 (above average) or 5 (very high) by the majority of respondents. The presentations by guest lecturers and staff tended to be rated as 3 (average).
- **Multiple topics were identified by participants as being most beneficial**. Site visits were cited most often as the most beneficial. One recommendation made by several participants to improve site visits was that site observations/evaluations be discussed while at the site rather than waiting until the next day. Also cited as particularly beneficial were those sessions addressing calculations of various design parameters, those that called for hands-on participation, and those that exposed participants to concepts with which they were unfamiliar. Few presentations or activities were cited as least beneficial. Those most frequently cited as least beneficial included presentations by guest lecturers and staff and discussion of group exercises. Some group presentations seemed redundant because multiple groups presented on the same site and the sites were already familiar to everyone because they had been visited before the design exercise.
- **Experience levels of participants may have influenced their ability to understand the material**. More than 75% of participants agreed or strongly agreed that the example exercises were clear and easy to follow. Some participants, however, felt that the amount of information was too much for them to comprehend in the time available. This may have been a result of the relative lack of experience and computation skills of some participants compared to others.
- **Repetition, clearer organization of concepts, and/or a slower pace could improve learning and retention of information**. Eleven participants expressed a desire for concepts to be more clearly organized. Individuals offered suggestions such as providing an initial framework, overview, or flowchart to help them organize seemingly disparate concepts as they received them. By Part 3, comments on organization were much more positive: 12 respondents expressed appreciation for the organization of Part 3 presentations and exercises, and 2 suggested that concepts presented in Parts 1 and 2 should be similarly organized. Scheduling the three parts of the course closer together could also help participants to retain the information between classes.
- **Presentations were an engaging and effective means of helping participants to understand the material**. Everyone agreed or strongly agreed that the presentations kept them focused and interested. All but one participant agreed or strongly agreed that the presentations were clear and easy to follow, and most (86%) agreed or strongly agreed that the amount of information presented was appropriate.
- **Satisfaction with group work was very mixed**. At least 6 respondents found group work and exchange to be very helpful, but 14 also found it to be inefficient and suggested that less time be spent on group work or that more of the exercises be done independently as they were during the presentations. Eight people suggested that the group objectives for each exercise be communicated more clearly.

At least 15 respondents felt that the mix of different areas of expertise (e.g., biology, engineering, regulatory, consulting) was a benefit, but 8 respondents cited difficulty with group dynamics. The instructor and assistants did observe during the course that some participants tended to dominate the group, and everyone did not get an equal opportunity to contribute and learn from the group exercises.

3.2 NCDWG

NCDWG Participants

The NCDWG was originally established in 1999 as a multidisciplinary forum for interagency communication and technology exchange. Prior to this current project, representatives to the NCDWG had been invited from state and federal agencies and institutions that conduct watershed assessments, design stream restorations, or regulate stream restoration projects within the Commonwealth. Those original invitees were selected based on an evaluation of their level of interest, their level of expertise, and the amount of time they could contribute to the working group. While some of those founding members still participate, many others have retired or relocated, and the personnel hired to replace them have been added to the group at the request of their supervisors.

New and continuing members who attended meetings during the project period represented one municipal agency, four state and four federal agencies, one non-governmental organization, and one public higher education institution (Table 3.2). These individuals included biologists, botanists, water resources engineers, forest hydrologists, highway engineers, and bioengineers with varying levels of knowledge of and experience with the ecology and geomorphology of Kentucky streams.

Table 3.2 NCDWG Participants and Organizations

Agency/Organization Represented	No. Attendees
KY Department of Fish and Wildlife Resources (KDFWR)	9
KY Division of Water (KDOW)	11
KY State Nature Preserves Commission (KSNPC)	1
KY Transportation Cabinet, Division of Environmental Analysis (KYTC-DEA)	2
Lexington-Fayette Urban County Government (LFUCG)	1
The Nature Conservancy of Kentucky (TNC-KY)	1
University of Louisville Stream Institute (ULSI)	9
US Army Corps of Engineers (USACE)	1
USDA Natural Resources Conservation Service (NRCS)	2
USDA Forest Service (USFS)	4
US Fish and Wildlife Service (USFWS)	4
Total	**45**

NCDWG Meetings

The NCDWG met approximately bi-monthly (six times per year) from February 2009 through September 2012 at the Kentucky Department of Environmental Protection offices in Frankfort and at stream restoration sites. A total of 23 meetings were held; these included 5 lectures and field trips to 26 sites (Table 3.3). Attendance at each of the meetings varied be-

tween 7 and 21 participants, with an average of 13 participants, not including various invited guests.

Table 3.3 NCDWG Field Trips and Lectures Shading indicates lectures; all others were field trips

	Meeting Date	Meeting Site	County	Site/Lecture Description
1	02/26/09	Terry's Branch	Knott	KDFWR in-lieu fee stream restoration mitigation site
		Bluegrass Station	Fayette	KYTC stream restoration mitigation site
2	03/26/09	Brushy Creek	Greenup	KDFWR in-lieu fee stream restoration mitigation site
		Kinniconick Creek	Lewis	KDFWR in-lieu fee stream restoration mitigation site
3	04/30/09	Pumphrey	Pulaski	KYTC stream restoration mitigation site
4	05/28/09	E. Fork Little Sandy	Lawrence	KDFWR in-lieu fee stream restoration mitigation site
		Upper Laurel Creek	Lawrence	KDFWR in-lieu fee stream restoration mitigation site
5	08/27/09	Mill Creek	Fayette	KDFWR in-lieu fee urban stream restoration mitigation site designed by ULSI
6	*12/03/09*	*KDEP*		*Design Considerations for Variation of Sediment Loads*
7	04/29/10	Dix River tributaries	Lincoln	KYTC stream restoration mitigation site designed by ULSI
8	05/27/10	Mill Branch	Knox	USFWS stream and wetland restoration site for threatened blackside dace. Design by ULSI.
9	*07/29/10*	*Bernheim*		*Groundwater and Restoration of Hydrologic Functions*
		Harrison Fork	Nelson	Groundwater monitoring at a KDFWR in-lieu fee mitigation site to be designed by ULSI.
10	*08/26/10*	*KDEP*		*Use of Hydraulic Models in Restoration Design*
11	*09/30/10*	*KDEP*		*Upstream and Downstream Transitions in Stream Restoration*
12	10/21/10	Beaver Cr	Harrison	KYTC stream restoration mitigation site
13	04/28/11	Guy Cove	Breathitt	KDFWR in-lieu fee stream restoration mitigation site on a hollow fill in Robinson Forest.
14	06/30/11	Slabcamp Creek	Rowan	KDFWR in-lieu fee stream restoration mitigation site designed by ULSI
15	07/28/11	E. Fork Indian Creek	Menifee	KDFWR in-lieu fee crossing/dam removal and stream restoration mitigation site (design phase)
16	*08/25/11*	*KDEP*		*Dendrogeomorphology*
17	10/27/11	Dog Slaughter Creek	Laurel	Culverts and fish passage for blackside dace in the DBNF.
18	12/01/11	Clay's Mill	Fayette	Urban stream restoration in Lexington, KY (under construction)
		UT of S Elkhorn Cr	Fayette	Urban stream restoration at Montessori Middle School of Kentucky to be designed by ULSI
		Mill Creek	Fayette	KDFWR in-lieu fee urban stream restoration mitigation site designed by ULSI
19	02/23/12	Clear Creek	Bath	Prospective stream restoration to prevent soil from a slide from entering Clear Creek and Clear Creek Lake.
		Rebel Trace	Bath	Concrete plank low-water crossings installed to replace culverts
		Salt Lick Cr	Bath	Concrete plank low-water crossings installed to replace culverts
20	03/29/12	World of Golf	Campbell	NKU in-lieu fee urban stream restoration mitigation site
		Boone Woods	Campbell	NKU in-lieu fee urban stream restoration mitigation site
21	05/31/12	Jessamine Cr	Jessamine	Water quality monitoring and stream restoration concepts for a KY special use suburban stream.
22	07/26/12	S. Fork Curry's Fork	Oldham	KDFWR in-lieu fee stream restoration mitigation site designed by ULSI
23	09/27/12	Town Branch	Fayette	KYTC urban stream restoration mitigation site

A high priority of the group was the sharing and distribution of information on current stream stability and stream habitat problems and current restoration projects. Emphasis during each meeting was placed on developing a fundamental understanding of stream conditions within the

Commonwealth; principles of open channel hydraulics; bank stability and channel adjustment mechanisms; data collection and interpretation procedures; and linking stream morphology and ecological function. These concepts were used as a foundation for understanding sediment mobility and transport; sediment sampling procedures and analysis; utilization of stream gage station data; advanced channel adjustment mechanisms; and additional data collection and interpretation procedures.

At site visits, members were encouraged to present and discuss information from current restoration sites regarding stream physical impairment problems, construction issues, site evaluation and restoration methods and documents, and other topics relevant to natural channel design. The group visited several large stream restorations projects, allowing participants to see construction at various stages, from layout to final seeding and installation of post-construction erosion control measures. The participants also had an opportunity to examine different methods of construction for different types of floodplains and channels. One of these sites was a ULSI stream restoration project on South Fork Curry's Fork in Oldham County, Kentucky, which had been visited in multiple NCDWG meetings prior to this project for field demonstrations of natural channel design concepts and techniques during many of its stages: conducting assessments, designing the restoration, and obtaining permits. The return visit to this site during the project period provided NCDWG participants with the opportunity to view the construction of the restoration.

4. Conclusions

The interest expressed by agency personnel and private consultants in expanding their knowledge and practice of sediment assessment and stream restoration far exceeded the limits of this project and strongly indicates the need for additional training opportunities, including continuation of the NCDWG. The number of qualified applicants for the short course was more than double the capacity, and all participants indicated they would recommend the course if it were offered again. ULSI has received additional inquiries about another offering of the course since it concluded. Participants also indicated they would like the opportunity to take a follow-up course on more advanced topics, such as two-dimensional modeling.

4.1 PROJECT MEASURES OF SUCCESS

Project success was to be measured according to four criteria:

1. Number of people receiving technical training (i.e., the number of participants in Parts 1, 2, and 3 of the course).
2. Participants' evaluations of the training.
3. Attendance levels at the bi-monthly NCDWG meetings and field demonstrations.
4. The increased level of awareness of the cause and effect of activities within a watershed on stream stability and the use of stream restoration to improve water quality and stream habitat on a watershed scale. This criterion is to be a long-term measurement rather than being measured during the project period.

According to each of the above criteria, the project was a success. The initial course enrollment of 28 was well over the required minimum of 20, and 26 of the 28 participants completed the entire course. Course evaluations were extremely positive, with an overall average rating of 4 out of 5. Participants expressed some expectation that the course would be even better the next

time it is offered, and they made several suggestions that would benefit future participants (see Sections 3.1 and 4.2 and Appendix C).

Interest and participation in the NCDWG remains high: an average of 13 members attended each meeting. All of the agencies that were represented in the group during this project have committed to continuing their participation in future meetings and activities. NCDWG meetings and/or field trips facilitated the focused discussion of current stream stability and stream habitat problems and current restoration projects. This supported inter-agency exchange of knowledge of natural channel design and channel restoration assessment concepts and their applications to Kentucky streams.

4.2 LESSONS LEARNED AND RECOMMENDATIONS

Short Course

The following considerations, in addition to those described in Section 3.1, might be incorporated into future courses that are similar to the one offered for this project:

1. **Site visits are a valuable component of the training and are a strong complement to the classroom components**. Site visits were cited most often as one of the most beneficial components of the course. Participants appreciated the opportunity to see and discuss the implementation of concepts and techniques that were addressed in the classroom.
2. **Experience levels among participants may be an important factor in levels of satisfaction with the training**. Because the type of training being offered was relatively unique and new, it was offered to a broad spectrum of people involved in stream restoration. Although the course announcement strongly recommended a working knowledge of engineering concepts and methods, no previous experience or training was required, and some participants were surprised that they had difficulty keeping up with unfamiliar terminology and calculations. Others were bored during exercises because they had to listen to explanations of computations familiar to them, and they had to wait for less computationally skilled individuals to attempt and often only partially complete activities. One option for improving satisfaction of attendees could be the development and delivery of two separate training courses: one for those with beginner skill levels, and one for those with advanced skill levels.
3. **The value of group work may vary among different participants**. The mix of different areas of expertise (e.g., biology, engineering, regulatory, consulting) was valuable to most participants, but some people found the group work to be more beneficial than others. The development of conceptual designs seemed to be an unfamiliar practice to some participants, and many appeared to not initially understand the value of them. Many participants also felt that the group presentations were redundant because the same sites and/or ideas were discussed by each group. Some options for improving satisfaction with group work might include a class discussion of the objectives of the exercise prior to starting it to ensure that all participants understand them and will have an opportunity to contribute; having each group evaluate one other conceptual design before any are presented to allow everyone to develop a design, have it reviewed and questioned, and review and evaluate a design of a different site as well; and/or having participants create detailed designs for the same sites as their conceptual designs to see how the two processes are related.

NCDWG

The NCDWG was conceived as a forum for the transfer of fundamental knowledge, procedures, and problems related to water resource conditions specific to Kentucky. The forum was extremely successful and maintained consistently high interest and participation of state and federal agency professionals. These personnel and their agencies benefitted from the opportunity the forum provided to link accepted and emerging theories with the conditions and problems they encounter in practice.

The NCDWG has become a resource on which agency personnel rely for efficient and effective acquisition and exchange of much-needed information and solutions. As the knowledge and techniques applied to watershed management continue to be refined, water resources managers and practitioners would benefit from opportunities to receive and exchange information about the application of those principles. The continued support of the Natural Channel Design (NCD) working group would be an efficient means of facilitating the continued exchange and transfer of information about the knowledge and techniques applied to watershed management. Participants unanimously indicated that they would maintain their participation in the group if offered the opportunity.

References

Kentucky Division of Water (KDOW). 2004. 303(d) list of waters for Kentucky final draft. Environmental and Public Protection Cabinet. Frankfort, KY.

Mastin CC. 2009. A quantitative assessment of channelization in the Appalachian Highland region. M.Eng. thesis. Department of Civil and Environmental Engineering, University of Louisville, Louisville, KY.

Parola AC, Vesely WS, Croasdaile MA, Hansen C, and Jones MS. 2007. Geomorphic Characteristics of Streams in the Bluegrass Physiographic Region of Kentucky. Project Final Report for Kentucky Division of Water NPS 00-10, University of Louisville Stream Institute, Louisville, KY, 60 pp.

Parola AC and Vesely WS. 2005. Wilson Creek Valley Restoration: Transformation of a Bedrock Channel to an Alluvial Stream. AGU Jt. Assem. Suppl. 86(18):Abstract NB31C-05.

US Environmental Protection Agency (USEPA). 2010. Spreadsheet tool for the estimation of pollutant load (STEPL) version 4.1. Developed by Tetra Tech, Inc., Fairfax, VA for USEPA. Available at http://it.tetratech-ffx.com/stepl/models$docs.htm, accessed Jan2013.

Appendices

Financial and Administrative Closeout | A

PROJECT OUTPUTS

Milestone	Expected Begin Date	Expected End Date	Actual Begin Date	Actual End Date
1. Submit outline of lengthy draft materials (esp. notebook) to the Division of Water, Nonpoint Source (NPS) Section, for approval.	Duration	Duration		
2. Submit all draft materials for NPS program approval.	Duration	Duration		
3. Submit annual reports and/or participate in Division of Water sponsored NPS conference(s) if requested by KDOW.	Duration	Duration		
4. Conduct bi-monthly NCD working group meetings (6/yr).	Jul 2008	Sept 2012	Jan 2009	Sep 2012
5. Collect mapping and other supporting data.	Jul 2008	Jul 2011	Jan 2009	Jul 2011
6. Conduct field reconnaissance for Workshops 1 and 2.	Jul 2008	Jul 2011	Jan 2009	Jul 2011
7. Plan Workshop 1.	Jul 2008	Apr 2011	Jan 2009	Apr 2011
8. Develop and organize Workshop 1 materials, including submission of workshop materials for NPS program approval.	Jul 2008	Apr 2011	Jul 2008	Apr 2011
9. Conduct Workshop 1.	Apr 2011	Apr 2011	Apr 2011	Apr 2011
10. Evaluate Workshop 1.	Apr 2011	Apr 2011	Apr 2011	Jun 2011
11. Plan Workshop 2.	Jul 2008	Jul 2011	Aug 2009	Jul 2011
12. Develop and organize Workshop 2 materials, including submission of workshop materials for NPS program approval.	Jul 2008	Jul 2011	Jul 2008	Jul 2011
13. Conduct Workshop 2.	Jun 2011	Jul 2011	Jun 2011	Jul 2011
14. Evaluate Workshop 2.	Jun 2011	Jul 2011	Jun 2011	Jul 2011
15. Request most current guidelines for final report.	Jun 2012	Jun 2012	Jun 2012	Jun 2012
16. Submit three copies of final report and all deliverables produced by this project.	Oct 2012	Dec 2012	Nov 2012	Dec 2012

DETAILED BUDGET

Original Detailed Budget

Budget Categories	Section 319(h)	Non-Federal Match	Total
Personnel	$ 164,467	$ 86,947	**$ 251,414**
Supplies	11,650	—	**11,650**
Equipment	7,907	—	**7,907**
Travel	13,057	—	**13,057**
Contractual	40,985	—	**40,985**
Operating Costs	59,841	72,911	**132,752**
Other	—	38,766	**38,766**
Total	**$ 297,907**	**$ 198,624**	**$ 496,531**

Revised Detailed Budget

Budget Categories	Section 319(h)	Non-Federal Match	Total	Final Expenditures Total	319(h)	Match
Personnel	$ 206,372	$ 46,288	**$ 252,660**	**$ 251,565.99**	$ 205,277.91	46,288.08
Supplies	5,439	—	**5,439**	**5,464.21**	5,464.21	—
Equipment	20,528	—	**20,528**	**20,528.65**	20,528.65	—
Travel	5,340	—	**5,340**	**6,407.90**	6,407.90	—
Contractual	—	—	**—**	**—**	—	—
Operating Costs	60,028	73,012	**133,040**	**133,039.92**	60,028.34	73,011.58
Other	200	79,305	**79,505**	**79,504.99**	199.99	79,305.00
Total	**$ 297,907**	**$ 198,605**	**$ 496,512**	**$ 496,511.66**	**$ 297,907.00**	**$ 198,604.66**

The budget was revised in October 2010, when the match and project totals were reduced by $19 each to correct a miscalculation in the original contract. Other budget categories—personnel, supplies, equipment, contractual, operating, and other—were adjusted to allow the use of ULSI personnel in place of external consultants, the purchase of additional equipment, and the simplification of third-party match contributions. In August 2011, remaining funds were reallocated to personnel to support an additional year of NCDWG meetings.

The University of Louisville Research Foundation (ULRF) was reimbursed $297,007.00. All dollars were spent; there were no excess project funds to reallocate. The project did generate overmatch of $142.95 provided by ULRF. The overmatch was not posted to the grant.

EQUIPMENT SUMMARY

Type of Equipment	Units	Cost 319(h)	Match	Total
Optoma TX7155 projector	1	$ 1,007.30	—	$ 1,007.30
Earthmate GPS	1	526.77	—	526.77
Water purification system	1	625.00	—	625.00
Gradex particle size analyzer	1	999.60	—	999.60
Low-profile velocity sensor	1	955.00	—	955.00
Argonaut	1	7,000.00	—	7,000.00
SMS v10.1 TUFLOW interface and model	1	3,425.00	—	3,425.00
GMS v7.1 Modflow transport package	1	2,875.00	—	2,875.00
Aerial photos	1	1,340.01	—	1,340.01
Nikon D300s camera and accessories	1	1,774.97	—	1,774.97
Total		**$ 20,528.65**	**$ 0.00**	**$ 20,528.65**

None of the equipment purchased has a current fair market value exceeding $5,000.

SPECIAL GRANT CONDITIONS

Two grant conditions were applicable to this project and were met as follows:

Material Review Condition. An outline of the course was reviewed and approved by KDOW prior to expending funds on first draft development of the course notebook. Final drafts of all printed materials (course announcement, application, agenda, training materials, and course evaluations) were submitted to KDOW for review and approval prior to final product development.

Project Partners Condition. No federal funds were used as match. All project partners were contacted to obtain their commitment to participate prior to submitting an application. Letters of support were provided by all listed partners.

Project Exhibits | B

See the succeeding pages for exhibits of the following materials that were distributed via the course website (http://louisville.edu/speed/civil/si/2011course) or email, except as noted:

1. Announcement
2. Application
3. Registration form
4. Information for registrants
5. Agenda (distributed in class)
6. Certificate of completion (distributed in class)

2011 Short Course: Assessment and Sediment-Based Design of Stream Restorations

Course Description
Participants will learn assessment and design techniques that have been implemented by the University of Louisville Stream Institute in several Kentucky stream and wetland restorations. In these restorations, floodplains and stream channels were reconstructed to reestablish the historic surface and subsurface processes that were disrupted at the sites by human-imposed changes to the watershed's hillslopes, valleys, and stream channels. These self-sustaining restorations have the capacity to adjust to changes in the watershed; they are able to maintain grade control and stable habitat without being constrained to a fixed form that would be necessitated by structures commonly installed to direct flow through the channel. Other objectives addressed by these techniques have included

- Increase in volume and duration of groundwater storage in the valley, surface water storage in the floodplain, and base flow in the channel
- Re-creation of dynamic hydroperiod of floodplain inundation
- Facilitation of hyporheic flow around and under the channel
- Increase in potential for reduction in TMDL pollutants (e.g., through nutrient processing and storage of fine sediments)
- Reduction in delivery of fine and coarse sediments to downstream reaches
- Improvement of habitat for rare, threatened, or endangered species
- Facilitation of aquatic organism passage
- Colonization of riparian area by volunteer wetland vegetation species

Agenda
The course will be delivered in three parts:

Part 1: Assessment of Sediment Loads and Habitat Impairments. Part 1 will be offered Monday through Thursday, **April 4-7**, **2011**. This 4-day segment will provide an introduction to the design concepts to be covered in Parts 2 and 3. Lectures, class exercises, and fieldwork will illustrate techniques for assessing sediment sources and loads and for identifying important geomorphic processes occurring on a watershed scale and their impact on stream stability, bank erosion, sediment supply, and stream habitat. At the conclusion of this segment, participants will develop conceptual design alternatives.

Parts 2 and 3: Sediment-Based Design of Stream Restorations. Parts 2 and 3 will be delivered over two 3-day periods: Tuesday through Thursday, **June 7-9**, **2011**, and Tuesday through Thursday, **July 12-14**, **2011**. Completion of Part 1 is a prerequisite for Parts 2 and 3. These two parts will cover techniques for completing detailed assessments (bed material load, site geotechnical characteristics, and groundwater and channel hydrology) and using them for design. Students will also be introduced to the application of two-dimensional flow modeling to floodplain and channel design. Lectures, class exercises, and fieldwork will guide participants through the development of design alternatives and important components of a detailed design for a section of a stream and floodplain restoration.

Who Should Attend
The 10-day course is intended for professionals involved in conceptual design, detailed design, or review of stream restorations. Likely participants include environmental consultants; representatives of non-profit agencies; and government agency personnel. Previous completion of other short courses is not required; the course content will be significantly different from most other available restoration courses. Due to the technical content of the course, however, a working knowledge of engineering concepts and methods is recommended but not required.

Instructors
Dr. Art Parola, PE, Director of the Stream Institute and Professor of Civil and Environmental Engineering at the University of Louisville, will lead the course along with specialists in the fields of geomorphology, characterization and transport of sediments, natural channel forms and design, and water quality.

Cost
The registration fee will be waived for government employees. For all other registrants, the fee for the course will be $1795 and will include tuition, course materials, and transportation to field sites.

Location
Meeting and fieldtrip locations will be primarily in or near the central Kentucky cities of Frankfort, La Grange, Lexington, and Louisville.

Professional Development
Participants will be eligible for 70 professional development hours. A certificate of completion will be provided only to those who attend the entire training.

Application
Enrollment will be limited to 30 participants who can commit to attending the full 10-day course (Parts 1-3). Go to http://louisville.edu/speed/civil/si/2011course/apply to submit an application by December 1, 2010.

Applicants will be notified by December 20, 2010, of their acceptance. Registration forms and payment will be due by February 1, 2011.

This work is funded in part by a grant from the US Environmental Protection Agency under Section 319(h) of the Clean Water Act through the Kentucky Division of Water to the University of Louisville Research Foundation (Grant #C9994861-07).

2011 Short Course: Assessment and Sediment-Based Design of Stream Restorations

Application (due no later than December 1, 2010)

Please submit the following information in order to apply for the 2011 short course offered by the University of Louisville Stream Institute. Because space in the course is limited, your responses may be used to determine whether we can offer you admission. You will be notified via email by December 20, 2010, of your admission status, and we will maintain a waiting list for any applicants we are initially unable to accommodate.

Dec 1	Deadline for application
Dec 20	Notification of acceptance
Feb 1	Deadline for registration and payment
Mar 15	Last day to cancel with partial refund
Apr 4	First day of class

1. Title (Dr., Mr., Ms. etc.)
2. First name
3. Last name
4. Organization
5. Job title
6. Email address
7. Daytime phone
8. Fax number
9. Which of the following best describes your type of employer?
   - □ Education
   - □ Government
   - □ Non-profit agency
   - □ Private company
   - □ Self-employed
   - □ Other (please specify): _____

10. Which of the following describe your field of work? Check all that apply and rank only the checked categories in order from most applicable (1) to least applicable.

    Rank
    - □ _____ Biology/Ecology
    - □ _____ Engineering
    - □ _____ Forestry
    - □ _____ Geography/Geology
    - □ _____ Hydrology
    - □ _____ Other (please specify) _____

11. List/describe your prior education, training, and experience in stream restoration.

12. On which of the following types of stream-related projects do you currently work or expect to work following this training? Check all that apply, and rank only the checked categories in order from most applicable (1) to least applicable.

	Rank	
□	_____	Channel relocation
□	_____	Channel restoration
□	_____	Bridge installation
□	_____	Culvert installation
□	_____	Stream habitat improvement
□	_____	Water quality improvement
□	_____	Implementation of best management practices
□	_____	Preparing/reviewing project plans for agency approval

13. Rate your current level of knowledge of stream geomorphology and function on a scale of 1-5, with 1 = very little or none (novice) and 5 = a great deal (expert).

1	2	3	4	5
Very little (novice)				A great deal (expert)

14. What skills would you most like to improve by taking this course?

15. Please check the box to indicate your agreement with the following statement:
    - □ This application is supported by my employer/supervisor, and I would be able to attend the training in its entirety.

Comments:

This work is funded in part by a grant from the US Environmental Protection Agency under Section 319(h) of the Clean Water Act through the Kentucky Division of Water to the University of Louisville Research Foundation (Grant #C9994861-07).

2011 Short Course Registration

Assessment and Sediment-Based Design of Stream Restorations

Note: Because space in the course is limited, registration is open only to those individuals who applied and were admitted. Registration forms and payment are due no later than **February 1, 2011**.

Please submit the following information in order to register for the 2011 short course offered by the University of Louisville Stream Institute.

Feb 1	Deadline for registration and payment
Mar 15	Last day to cancel with partial refund
Apr 4	First day of class

1. Title
2. First name
3. Last name
4. Job title
5. Organization
6. Work address (line 1)
7. Work address (line 2)
8. Work address (line 3)
9. City
10. State
11. Zip code
12. Daytime phone
13. Evening phone

14. Email address
    Your email address will be used to confirm receipt of your registration form and payment and to distribute additional course information.

15. Some meals and snacks will be provided during the training. Please indicate your dietary restrictions, if any.

    __ I do not have any dietary restrictions.

16. Please describe any accessibility needs that you have.

    __ I do not have any accessibility needs.

17. Professional development credit
    If you would like to receive a certificate of completion for 70 hours of professional development credit or other purposes, please provide your PE license number or other personal information that you would like for us to include on it. Certificates will be provided only to those participants who attend the course in its entirety.

    __ I would like a certificate but it does not need to include any personal information other than my name.
    __ I do not need a certificate.

18. Emergency contacts
    Please provide contact information for two people that we may notify in case of an emergency.

Contact #1	Contact #2
Name	Name
Address	Address
Cell phone	Cell phone
Other phone	Other phone
Relationship to you	Relationship to you

Additional emergency information

19. Payment in the form of a check or money order for $1795.00 made **payable to the University of Louisville Research Foundation, Inc.**, should be delivered to

    Ms. Chandra Hansen
    Stream Institute
    Dept. of Civil and Environmental Engineering
    University of Louisville
    Louisville, KY 40292

    Please reference the registrant's name with the payment. Sorry, credit cards are not accepted.

Cancellation Policy

Cancellations must be requested in writing and will be effective upon our confirmation of their receipt. Submission by email is preferred. Cancellations received on or before **March 15, 2011**, will be refunded the amount received less a $300 administrative fee. Cancellations received after March 15, 2011, will forfeit the full registration fee. If cancellation becomes necessary, substitution in lieu of cancellation is strongly recommended. To facilitate course preparation, substitutions must be approved by us prior to April 4, 2011. Substitutions will not be permitted after that date.

Payment and registration status:
__ My notification of admission indicated that payment of the registration fee is required. I understand that my registration is incomplete until payment is submitted. I will be enrolled only if my payment is received in full by February 1, 2011, and I will receive a confirmation of my payment by email.
__ My notification of admission indicated that my registration fee is waived based on my status as a civil servant. I understand that I will be enrolled upon successful submission of this form.

20. This training will be intensive, and attendance at all training sessions is required.
    If you are not sure about your ability to complete the entire 10 days of training, please notify us so that a waitlisted applicant may participate.

    __ I agree to attend each of the 10 course days (April 4-7, June 7-9, and July 12-14) in full, and my registration has been approved by my employer/supervisor.

Comments: Would you like to tell us anything else?

You should automatically receive an email message confirming receipt of your registration form.

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Information for Registrants

2011 Short Course: Assessment and Sediment-Based Design of Stream Restorations

Location

Department of Environmental Protection (DEP)
Commissioner's Office
300 Fair Oaks [map]
Frankfort, KY 40601

Open parking is available in the lots to the left of or behind the building. We will meet in the building's large conference room.

Course Schedule

The course will be delivered in three segments (April, June, and July). Each segment will include both classroom sessions and field work. View the schedule. **Participants are expected to attend all sessions in each segment, including some evenings**.

NOTE: Dates for Parts 2 and 3 have been revised. Part 2 will be offered Monday through Thursday, June 6-9, 2011. Part 2 will be Tuesday and Wednesday, July 12-13, 2011.

Recommended Reading

The following articles provide an introduction to some of the concepts that will be addressed in the course:

1. Kentucky Department of Environmental Protection (KDEP). 2008. Methods for assessing biological integrity of surface waters. Kentucky Department of Environmental Protection, Division of Water, Frankfort, KY. We will use Chapter 5 Habitat Assessment. (130 KB)
2. Montgomery DR, Abbe TB, Peterson NP, Buffington JM, Schmidt K, and Stock JD. 1996. Distribution of bedrock and alluvial channels in forested mountain drainage basins. Nature (London) 381:587–589. (0.68 MB)
3. Parola AC, Vesely WS, Croasdaile MA, Hansen C, and Jones MS. 2007. Geomorphic characteristics of streams in the Bluegrass physiographic region of Kentucky. Project final report for Kentucky Division of Water NPS 00-10, University of Louisville Stream Institute, Louisville, KY, 60 pp. (4.2 MB)
4. Wohl E and Merritts DJ. 2007. What is a natural river? Geography Compass 1:871–900. (2.4 MB)

Supplies

Walks at *field sites* may be moderately strenuous, and most sites will not have restroom facilities. For field visits, bring the following:

Required

- Hip waders, rain gear, and other clothes to be comfortable walking in streams. (Hip waders are recommended, but knee boots might suffice.)

If Possible

- Digital camera for field observations.

Suggested

- Clipboard. (You will receive forms to fill out in the field. If you don't have a clipboard, we have several to loan.)
- Small bag for carrying pens/pencils, some small tools we will provide, water bottle, snack, camera, bug spray, sunscreen, etc.

For *classroom sessions,* bring the following:

Required

- Scientific calculator with x^y and y root (x) functions. Be sure you know how to use those functions. For example, you should be able to compute Q given Q = (1.49/n)*A*(R^0.67)*(S^0.5).
- Pencils and erasers.

If Possible

- Laptop computer with Excel and PowerPoint (or equivalent software).
- USB (jump) drive to facilitate data sharing.

Travel

Participants should make their own travel arrangements to and from Frankfort. Transportation between the DEP classroom and field sites will be provided.

Lodging

Participants can make their own lodging arrangements. The Capital Plaza Hotel is near the DEP classroom and is within walking distance of shops and cafes in historic downtown Frankfort. Several other hotels are located within a 20-minute drive of the DEP classroom.

This work is funded in part by a grant from the US Environmental Protection Agency under Section 319(h) of the Clean Water Act through the Kentucky Division of Water to the University of Louisville Research Foundation (Grant #C9994861-07).

UofL Stream Institute
2011 Short Course: Assessment and Sediment-Based Design of Stream Restorations

Schedule (Revised 19 Apr 2011)

Segment 1. Watershed Assessment, Site Assessment, and Conceptual Design

	M, Apr 4	Tu, Apr 5	W, Apr 6	Th, Apr 7
7:30 – 8:00a	Check-in			
8:00 – 12:00n	Classroom	Site visits	Classroom	Classroom
12:00 – 12:30p	Lunch break		Lunch break	Lunch break
12:30 – 4:30p	Classroom		Classroom	Classroom
4:30 – 6:00p				
6:00 – 8:30p				

Segment 2. Detailed Site Assessment for Restoration Design

	M, Jun 6	Tu, Jun 7	W, Jun 8	Th, Jun 9
7:30 – 8:00a	Check-in			
8:00 – 12:00n	Classroom	Site visits*	Classroom	Site visits*
12:00 – 12:30p	Lunch break		Lunch break	
12:30 – 6:00p	Classroom		Classroom	
6:00 – 8:30p				

* We will try to get you back to your vehicles by 8:00P or earlier, but please plan to be out until 8:30P.

Segment 3. Integrated Floodplain and Channel Design

	Tu, Jul 12	W, Jul 13
7:30 – 8:00a	Check-in	
8:00 – 12:00n	Classroom	Classroom
12:00 – 12:30p	Lunch break	Lunch break
12:30 – 5:00p	Classroom	Classroom
5:00 – 6:00p		

Agenda

PART 1: ASSESSMENT OF SEDIMENT LOADS AND HABITAT IMPAIRMENTS

M, April 4 — Day 1: Introduction

8:00A – 6:30P

1. Stream habitat and morphology
2. Stream dynamics
3. Legacy effects
4. Introduction to restoration
5. Stream and floodplain stability
6. Boundary shear stress
7. Sediment transport, storage, and controls
8. Optional evening session: collection methods for conceptual design data

T, April 5 [field] — Day 2: Site Evaluations

8:00A – 8:00P

1. Mill Creek site evaluation, habitat
2. Slabcamp stream restoration site

W, April 6 — Day 3: Sediment Supply and Floodplain Stress

8:00A – noon **[fld]**
noon – 5:30P

1. Site visit: construction of Town Branch, Winchester
2. Assessment of sediment supply
3. Required floodplain width
4. Introduction of conceptual design sites
   - EKCF-1 site
   - EKCF-2 site
   - Bluegrass site

Th, April 7 — Day 4: Conceptual Design Workshop

8:00A – 4:30P

1. Conceptual design workshop
   - EKCF-1 site
   - EKCF-2 site
   - Bluegrass site
2. Student presentations of conceptual designs

PARTS 2 AND 3: SEDIMENT-BASED DESIGN OF STREAM RESTORATIONS

M, June 6 — Day 5: Bedload Data Collection and Analysis

8:00A – 6:00P

1. Review Part 1
   a. Floodplain width and boundary shear stress in channel and on floodplain
   b. Critical shear stress for controls
2. Review Mill Creek site evaluation
3. Part 2 introduction: stream restoration design procedure
4. Sediment characteristics, mobility, and critical shear stress
   a. Non-uniform sediment
   b. Characterizing sediment load
   c. Initial motion of sediment load
   d. Relation of sediment load to channel flow
5. Sediment transport station (STS) analysis
   a. Pit traps
   b. Pressure transducers
   c. Impact sensor
   d. Correlation with nearby gage
   e. Excel practice
      - Bedload transport curve
      - Flow duration curve
      - Annual load
6. Introduction of South Fork Curry's Fork (SFCF) site (no handout)

T, June 7 [field] **Day 6: Site Evaluations and Detailed Data Collection**

8:00A – 8:30P*

* We will try to get you back to your vehicles by 8:00P or earlier, but please plan to be out until 8:30P.

1. SFCF – detailed data
   a. Conceptual design site examination
   b. Discussion of detailed site data
      i. Sediment
      ii. Groundwater
   c. 2-D modeling of existing conditions
   d. Examination of reaches for each group
2. Harrison Fork
   a. Low flow and groundwater interaction
   b. Piezometer installation discussion and examination
3. Wilson Creek
   a. Examination
   b. 2-D model stress comparison

W, June 8 [field] **Day 7: Site Evaluations**

8:00A – 6:00P* or 8:30P

* Those who do not want to visit the Dix River site will return early, arriving in Frankfort by 6:00P or earlier.

1. Mill Branch
   a. Threatened species – blackside dace
   b. Fish passage – pool culvert
   c. Sediment load attenuation
   d. Woody debris habitat, lateral control, and bed control
   e. Wetlands for water treatment
   f. Tributary confluences
2. Dix River tributaries*
   a. Zero-load stream
   b. Tributary confluences
   c. Integrated wetland and stream design
   d. Control of invasive plants

Th, June 9 **Day 8: Detailed Data Assessment Workshop**

8:00A – 6:00P

1. Conceptual design workshop: SFCF
2. Student presentations of SFCF conceptual designs
3. Groundwater assessment
   a. Valley groundwater system
   b. Groundwater surface water connectivity
   c. Low-flow and groundwater level duration
4. Piezometer installation
5. Channel and valley groundwater interaction workshop
   a. Harrison Fork valley cross section and piezometer data
   b. Pool depth duration curve (Excel)
   c. GW duration curve (Excel)
6. Mill Branch pre-restoration
7. Dix River floodplain pre-restoration
8. Mill Branch site evaluation review (no handout)

T, July 12 **Day 9: Detailed Design Workshop**

8:00A – 6:00P

1. Review of important principles (no handout)
2. SFCF detailed design

W, July 13 **Day 10: Detailed Design Workshop**

8:00A – 5:00P

1. SFCF detailed design (cont'd.)
2. Restoration transitions
3. Additional restoration techniques

Arthur C. Parola, Jr.
Director, UofL Stream Institute

COURSE COMPLETION CERTIFICATE

Participant Name	PE Number	State

Course Title: Assessment and Sediment-Based Design of Stream Restorations		
Course Location: 300 Fair Oaks, Frankfort, KY, 40601		
Course Dates: 04-Apr-2011 07-Jun-2011 05-Apr-2011 08-Jun-2011 06-Apr-2011 09-Jun-2011 07-Apr-2011 12-Jul-2011 06-Jun-2011 13-Jul-2011	Dates Attended:	
Total Hours Offered: 80	Total Hours Completed:	Course Successfully Completed: ☒ Yes ☐ No
Course Provider: Arthur C. Parola, Jr., PhD, PE		

Signature of Course Provider	Date: July 13, 2011
Signature of Participant	Date: July 13, 2011

Other Information

This non-credit course (description on reverse) was offered for professional development only.

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Assessment and Sediment-Based Design of Stream Restorations

Course Description
Participants were introduced to assessment and design techniques that have been implemented by the University of Louisville Stream Institute in several Kentucky stream and wetland restorations. In these restorations, floodplains and stream channels were reconstructed to reestablish the historic surface and subsurface processes that were disrupted at the sites by human-imposed changes to the watershed's hillslopes, valleys, and stream channels. These self-sustaining restorations have the capacity to adjust to changes in the watershed; they are able to maintain grade control and stable habitat without being constrained to a fixed form that would be necessitated by structures commonly installed to direct flow through the channel. Other objectives addressed by these techniques have included

- Increase in volume and duration of groundwater storage in the valley, surface water storage in the floodplain, and base flow in the channel
- Re-creation of dynamic hydroperiod of floodplain inundation
- Facilitation of hyporheic flow around and under the channel
- Increase in potential for reduction in TMDL pollutants (e.g., through nutrient processing and storage of fine sediments)
- Reduction in delivery of fine and coarse sediments to downstream reaches
- Improvement of habitat for rare, threatened, or endangered species
- Facilitation of aquatic organism passage
- Colonization of riparian area by volunteer wetland vegetation species

The course was delivered in three parts:

Part 1: Assessment of Sediment Loads and Habitat Impairments. Part 1 was offered Monday through Thursday, **April 4-7**, **2011**. This 4-day segment provided an introduction to the design concepts covered in Parts 2 and 3. Lectures, class exercises, and fieldwork illustrated techniques for assessing sediment sources and loads and for identifying important geomorphic processes occurring on a watershed scale and their impact on stream stability, bank erosion, sediment supply, and stream habitat. At the conclusion of this segment, participants developed conceptual design alternatives.

Parts 2 and 3: Sediment-Based Design of Stream Restorations. Parts 2 and 3 were delivered over two 2-to-4-day periods: Monday through Thursday, **June 6-9**, **2011**, and Tuesday through Wednesday, **July 12-13**, **2011**. Completion of Part 1 was a prerequisite for Parts 2 and 3. These two parts covered techniques for completing detailed assessments (bed material load, site geotechnical characteristics, and groundwater and channel hydrology) and using them for design. Students were also introduced to the application of two-dimensional flow modeling to floodplain and channel design. Lectures, class exercises, and fieldwork guided participants through the development of design alternatives and important components of a detailed design for a section of a stream and floodplain restoration.

This work was funded in part by a grant from the US Environmental Protection Agency under Section 319(h) of the Clean Water Act through the Kentucky Division of Water to the University of Louisville Research Foundation (Grant #C9994861-07).

Participant Evaluations | C

SUMMARY OF COURSE EVALUATION RESPONSES FOR PART 1, APRIL 2011

Participants were asked to complete a 9-question evaluation of the quality and effectiveness of Part 1 of the course. All but one (27 of 28) of the participants submitted an evaluation. The following are summaries of responses to all closed-ended questions and complete verbatim responses to all open-ended questions. Respondents 1−12 were employed in the private sector; all others were government (and one non-governmental organization).

1. Please enter a seven-digit number of your choice. Please make a note of the number in your course notebook or other location for future reference. We will ask you to re-enter the same number in July so that we can associate your anonymous responses to these questions with those you will provide in the July evaluation. Therefore, you should choose a number that is unlikely to be repeated by another respondent (i.e., do not use sequences or patterns like 1234567, 1357911, 2222222, etc.).

Responses omitted. The seven-digit number was requested to allow the anonymous responses to Part 1 evaluations to be related to those for Parts 2 and 3.

2. Rate the instructional value of each of the presentations and activities. What things in particular helped or did not help you to understand or learn the material?

	Very Low	Below Average	Average	Above Average	Very High	Rating Average
a. Day 1: Habitat Parameters	0.00% 0	7.40% 2	37.00% 10	**44.40% 12**	11.10% 3	3.59
b. Day 1: Stream Dynamics	0.00% 0	7.40% 2	14.80% 4	**51.90% 14**	25.90% 7	3.96
c. Day 1: Legacy Effects	0.00% 0	7.40% 2	14.80% 4	**51.90% 14**	25.90% 7	3.96
d. Day 1: Introduction to Stream Restoration	0.00% 0	0.00% 0	25.90% 7	**51.90% 14**	22.20% 6	3.96
e. Day 1 Exercise: Wilson Creek Valley Cross Section	0.00% 0	3.80% 1	26.90% 7	**53.80% 14**	15.40% 4	3.81
f. Day 1: Stream and Floodplain Stability	0.00% 0	7.40% 2	22.20% 6	**40.70% 11**	29.60% 8	3.93
g. Day 1: Boundary Shear Stress	0.00% 0	0.00% 0	14.80% 4	**44.40% 12**	40.70% 11	4.26
h. Day 1 Exercise: Stress Calculations	0.00% 0	0.00% 0	23.10% 6	**42.30% 11**	34.60% 9	4.12
i. Day 1: Sediment Transport, Storage, and Controls	0.00% 0	4.00% 1	24.00% 6	**40.00% 10**	32.00% 8	4.00
j. Day 1: Data Collection for Conceptual Design	0.00% 0	7.70% 2	**46.20% 12**	38.50% 10	7.70% 2	3.46
k. Day 2: Mill Creek Site Visit	0.00% 0	0.00% 0	30.80% 8	23.10% 6	**46.20% 12**	4.15
l. Day 2: Mill Creek Site Evaluation	0.00% 0	7.70% 2	**42.30% 11**	23.10% 6	26.90% 7	3.69
m. Day 2: Slabcamp Site Visit	0.00% 0	0.00% 0	18.50% 5	29.60% 8	**51.90% 14**	4.33
n. Day 2: Slabcamp Site Evaluation	0.00% 0	7.40% 2	29.60% 8	29.60% 8	**33.30% 9**	3.89
o. Day 3: Winchester Site Construction	0.00% 0	0.00% 0	26.90% 7	**42.30% 11**	30.80% 8	4.04
p. Day 3: Assessment of Sediment Supply	0.00% 0	3.70% 1	33.30% 9	**44.40% 12**	18.50% 5	3.78
q. Day 3: Required Floodplain Width	0.00% 0	0.00% 0	18.50% 5	**51.90% 14**	29.60% 8	4.11
r. Day 3 Exercise: Stress Calculations	0.00% 0	0.00% 0	14.80% 4	**51.90% 14**	33.30% 9	4.19
s. Day 3: Presentation of Conceptual Design Sites	3.70% 1	7.40% 2	37.00% 10	**40.70% 11**	11.10% 3	3.48
t. Day 4: Conceptual Design Workshop	0.00% 0	3.70% 1	18.50% 5	**59.30% 16**	18.50% 5	3.93
u. Day 4: Presentation of Conceptual Designs	0.00% 0	14.80% 4	25.90% 7	**55.60% 15**	3.70% 1	3.48

R05 Thought the presentations should have been time limited. To much common knowledge being shared in methods and general info.

R08 I would like to have heard a little more detail on the designs and the actual costs of the projects (design and constuction).

R09 Biggest plus: really good command of material by Dr. Art. Sediment issues got a little confusing and mayeb a little more time in those categories would help.

R13 N/A

R18 I would like to have reviewed our site evaluations completed in the field at the Mill Creek, Slabcamp, and Winchester sites.

R20 I would recommend a little more time going through how to evaluate some of the parameters. I was a little lost how to evaluate the Mill Creek site in the field without some guidance. Also, the pace of the calculations was a little jarring for me when doing a conceptual design. Without the engineers in the group I would have needed more time to run the numbers. That being said, I am not an engineer so these things were probably not an issue for those folks.

R22 The presentation given on habitat by the US EPA individual on the first day could be improved. This explains the lower score for habitat.

R24 I got a lot out of our first week together, particularly when we had to design our own stream restorations and do the calculations. Trial by fire is what it felt like, but after being forced to do it within our teams, I really got what was going on.

R25 * more info is needed on the stream dynamics and how to control lateral and vertical instability (IMO). * Good field trip sites - but the travel time kills learning time.

R26 Tools provided are useful. Would like to see comparison of techniques, different ways to estimate critical shear stress (for example) to include more variables.

R27 I felt it would have been much more beneficial if Dr. Parola would have taken each scenario and worked through as design with the class.

3. Which of the presentations and activities did you find <u>least beneficial</u> (choose one or more) and <u>most beneficial</u> (choose one or more)? Why?

	Least Beneficial	Most Beneficial	Response Count
a. Day 1: Habitat Parameters	40.00% 6	60.00% 9	15
b. Day 1: Stream Dynamics	0.00% 0	100.00% 12	12
c. Day 1: Legacy Effects	12.50% 2	87.50% 14	16
d. Day 1: Introduction to Stream Restoration	18.80% 3	81.30% 13	16
e. Day 1 Exercise: Wilson Creek Valley Cross Section	16.70% 2	83.30% 10	12
f. Day 1: Stream and Floodplain Stability	6.70% 1	93.30% 14	15
g. Day 1: Boundary Shear Stress	5.90% 1	**94.10% 16**	17
h. Day 1 Exercise: Stress Calculations	6.70% 1	93.30% 14	15
i. Day 1: Sediment Transport, Storage, and Controls	7.10% 1	92.90% 13	14
j. Day 1: Data Collection for Conceptual Design	42.90% 6	57.10% 8	14
k. Day 2: Mill Creek Site Visit	0.00% 0	**100.00% 16**	16
l. Day 2: Mill Creek Site Evaluation	30.80% 4	69.20% 9	13
m. Day 2: Slabcamp Site Visit	0.00% 0	**100.00% 20**	20
n. Day 2: Slabcamp Site Evaluation	26.70% 4	73.30% 11	15
o. Day 3: Winchester Site Construction	21.10% 4	78.90% 15	19
p. Day 3: Assessment of Sediment Supply	14.30% 2	85.70% 12	14
q. Day 3: Required Floodplain Width	0.00% 0	**100.00% 17**	17
r. Day 3 Exercise: Stress Calculations	0.00% 0	**100.00% 14**	14
s. Day 3: Presentation of Conceptual Design Sites	**53.80% 7**	46.20% 6	13
t. Day 4: Conceptual Design Workshop	33.30% 5	66.70% 10	15
u. Day 4: Presentation of Conceptual Designs	**64.30% 9**	35.70% 5	14

R08 I was already very familiar with surveying streams and we did not actually survey anything. Others likely found it helpful. The site visits were very good and allowed visual learning. We were able to look and ask questions too, so that was helpful.

R09 All provided benefit - I just checked ones that stood out to me as expanding my grasp of issues and approaches. These all had key nuggets of practical application that were well illustrated and framed.

R13 N/A

R14 Seems like everyone wants to design, but it's really not that easy. Design excercises in classes often lead folks to believe they can do on their own - not good.

R15 Site Evaluations & Data Collection for Conceptual Design need to be covered in the classroom to give definitions and examples for people that haven't gathered data in the field first.

R16 All site visits were very informative - and reinforced classroom discussions; conceptual design site discussion was too brief, too fast

R24 Data Collection was a bit off base. Unless we're actively doing it, talking about it isn't very effective.

4. Rate your agreement with the following statements about the lectures:

	Strongly Disagree	Disagree	Neutral	Agree	Strongly Agree	Rating Average
a. Presentations were clear and easy to follow.	0.00%	3.70%	3.70%	**70.40%**	22.20%	4.11
	0	1	1	**19**	6	
b. Example exercises were clear and easy to follow.	0.00%	3.70%	7.40%	**77.80%**	11.10%	3.96
	0	1	2	**21**	3	
c. The presentations kept me focused and interested.	0.00%	0.00%	0.00%	**74.10%**	25.90%	4.26
	0	0	0	**20**	7	
d. The amount of information presented was appropriate.	0.00%	0.00%	11.10%	**70.40%**	18.50%	4.07
	0	0	3	**19**	5	
e. Questions were adequately addressed.	0.00%	7.40%	22.20%	**44.40%**	25.90%	3.89
	0	2	6	**12**	7	

R09 See comments under 6.
R13 N/A
R18 I would have liked to have seen how to collect data in the field for various calculations such as for BSS, riffle and pebble counts, and other variables.
R20 A lot of stuff coming at you at once, some of it was too fast for me to catch all of it.

5. Rate how valuable the course was to you:

	Very Low	Below Average	Average	Above Average	Very High	Rating Average
a. The value to you of this course overall.	0.00%	0.00%	15.40%	**50.00%**	34.60%	4.19
	0	0	4	**13**	9	
b. The value of this course compared with other courses of similar length and content that you have attended.	0.00%	3.70%	29.60%	25.90%	**40.70%**	4.04
	0	1	8	7	**11**	
c. The likelihood that you would recommend this course if it were to be offered again.	0.00%	0.00%	3.70%	44.40%	**51.90%**	4.48
	0	0	1	12	**14**	

R09 Good compact information (so far); time efficient
R13 N/A

6. Rate your level of satisfaction with the planning and coordination of the course:

	Very Low	Below Average	Average	Above Average	Very High	Rating Average
a. The usefulness of the information provided to you about how to prepare for the course.	0.00%	3.70%	**37.00%**	**37.00%**	22.20%	3.78
	0	1	**10**	**10**	6	
b. How well Part 1 matched your expectations based on the course announcement.	0.00%	0.00%	29.60%	**44.40%**	25.90%	3.96
	0	0	8	**12**	7	
c. The usefulness of the handouts to you (e.g., content, format, organization) during the training.	0.00%	3.70%	22.20%	**48.10%**	25.90%	3.96
	0	1	6	**13**	7	
d. The usefulness of the handouts to you (e.g., content, format, organization) as reference material in the future.	0.00%	0.00%	22.20%	**40.70%**	37.00%	4.15
	0	0	6	**11**	10	
e. The adequacy of the classroom facilities for the group.	0.00%	0.00%	25.90%	**44.40%**	29.60%	4.04
	0	0	7	**12**	8	
f. The adequacy of the classroom location for the group.	0.00%	0.00%	25.90%	**44.40%**	29.60%	4.04
	0	0	7	**12**	8	
g. The convenience of the four-day schedule for Part 1 (to be followed by six additional days of training in two parts).	0.00%	0.00%	37.00%	**44.40%**	18.50%	3.81
	0	0	10	**12**	5	
h. The amount of time spent in the classroom.	0.00%	3.70%	33.30%	**40.70%**	22.20%	3.81
	0	1	9	**11**	6	
i. The amount of time spent in the field.	0.00%	0.00%	11.10%	**59.30%**	29.60%	4.19
	0	0	3	**16**	8	

R09 It would find it better if all slides and images were inlcuded in handouts because that is how I organize my notes, and how I refer to in future. Some things were out of order, During classroom presentations suggest leave lioght on (I think that is what we voted on but someone keeps turning them off) - the projectors are plenty bright and when the lights are off it is hard to see the printed materialor yoru notes (I note that a number of attendees dont even take notes - I wonder if they had to write a check to attend! ;)) I would even suggest suggest not closing the blinds undess there is direct sunlight problem - again the projector images are plenty bright and it would keep the room from feeling so tomb-like over course of a long day. Clasroom could use better air cirulation but nothing you can do about that! Food and snacks were great and thoughtful.
R11 The course is doing an excellent job trying to cover all skill levels. One suggestion would be to have references for equations in the handout material, so if people want to do more on their own they would know where to look. I do think more time in the classroom would be helpful for some. Alot of times our group felt rushed.
R13 N/A
R20 Providing some conceptual framework (maybe previewing some of the handouts) would have been useful for me.
R25 Logistics of travel time is a negative. I'd like to visit some proposed sites as well as completed sites too.

7. Please tell us how (i.e., types of activities, projects, or responsibilities) you plan to apply what you learned in Part 1 of the course.

R03 I have already applied some of the theories to a wetland creation project we are currently working on.
R05 Don't really know, I was asked to take the by my supervisor.
R06 I plan to incorporate the active channel boundary shear stress and the floodplain shear stress into future stream restoration projects.
R07 Applying stress calculations to current stream relocation project.
R08 I will use or consider some of the design criteria, thoughts, and techniques on future stream restoration projects that I design. I plan to present some of the material and concepts from the course to my coworkers.
R09 I do consulting work, often with state DOT's realted to env impact and mitigaiton work, so that is where I will hopefully apply some of this information.
R10 I plan to rethink my stream restoration practices and implement some of the ideas from the workshop.
R11 -- I will share what I have learned with others at my firm. -- This course gives me another way to approach projects when starting conceptual design.
R12 quick stress & width computations
R13 Through biological site assessments (use of RBP)...This course will help me to better understand what I'm looking at when assessing whether or not a stream meets its requirements.
R14 design review project selection
R15 Landcape and legacy perspectives are now more apparent to me esp. regarding floodplain etc.
R16 It will allow me to do a better job in evaluating habitat conditions of streams with rare fishes; and I will more understanding of how stream restoration projects are developed and designed.
R17 I will use them along with many tools to locate, assess, and manage restoration projects.
R19 Evaluating sites for projects. Review of design plans.
R20 Stream habitat evaulations
R21 Design Reviews
R22 I have been using this information to design and review other individuals designs for stream restoration projects.
R23 Writing RFPs for stream restoration projects - will incorporate techniques taught and require 100-year analyses, and possibly 2-D modeling.
R24 I plan on using this information to help restore the hydrology on reclaimed mined sites across the DBNF.
R25 I'd like to be confident that when I collect data, that it is useful. During the site visits, I noticed instream sediment buckets but it was not discussed. I would like to know what others use for instrumentations and data collection too.
R26 Will apply to design plan reviews and conceptual design.
R27 Stream restoration in Cherokee Park, Louisville, Ky.

8. Please evaluate your experience working with your group. Was the group a good size? Was it well-balanced in areas of expertise? Did it offer adequate opportunity for you to participate and contribute? Would you want to work with the same group again?

R03 It was a good size and well-balances. I would enjoy working with the same group again.
R04 Liked the group activity and the pre-selected groups to provide a variety of backgrounds. I felt there was adequate opportunity for me to participate and contribute. I hope veryone is the group had the same feeling of participation. I believe there was alot of discussion on each of the tasks and review of the classroom material as we went through the exercise. I would work with the group again.
R05 The group I was in worked well together and staying with the group is fine with me.
R06 I thought the groop sizes were good. I enjoyed working with the group and would work with them again.
R07 I had a very positive experience with this group. The group was large enough to have a good cross section of expertise but small enough to work well together. I felt like everyone had the opportunity to participate and cpntribute.
R08 Our group was a little small and distracted so it was difficult to be as productive as I would have liked. The group was balanced pretty well, but maybe not as well as some of the larger groups. I had plenty opportunity to participate. I would like to see us switch up the groups so we can work with and learn from other people. Each time we are in a group setting we learn what each different person looks at or considers during a conceptual design, which would likely be a little different with different groups.
R09 Good all around - good effort on organizing by UL folks I think. One person in my group was not too dialed in but that happens. Yes.
R10 My group was a good size and worked very well together. I'd like to keep the same group intact throughout the next two series of meetings. Our expertises were well balanced.
R11 1) Yes 2) Yes 3) Yes 4) Yes
R12 Great group, highly engaged. Good size and well balanced. Would like to rotate groups to work with others.
R13 I really enjoyed the group I worked with. It had a good mix of biologists and engineers so that both sides (biological and geophysical) of the stream restoration project were understood.
R14 good experience, could ave been smaller ok, but not larger.
R15 Group was a good size, the expertise was not well-balanced and some people just took over and only looked at the project from a narrow scope (engineering and calculations) and weren't inclusive. I would not want to work with some of the same people again because I didn't get anything out of the exercise.
R16 I enjoyed the group exercise. Everyone contributed - and all seemed to listen to each person's ideas/questions. Size was appropriate.
R17 The group was a good size and well balanced, but did [not] always communicate well.
R18 The group experience was great. I feel it provided us with a real-world experience since most of us work in teams on a daily basis in our careers. The groups were a good size and they were balanced in areas of expertise. I felt like I was able to participate and was able to learn from my other group members. I would want to work with the same group again.
R19 OK, but felt little left out when engineer/designers could move forward with those parts of exercise that I struggled with.
R20 The group exercise was fine. As mentioned, the pace of the calculations was a bit quick. The math wasn't hard to understand, I will need more time to digest all of it.
R22 Yes for all questions.

R23 It was fine.
R24 I very much enjoyed working within my group, and the overall group of the class. Good mix of folks. Our group had a perfect balance of expertise, opportunity to participate/contribute, and I would like to work with the same group again.
R25 It may be too large. Since you have several helpers - it may be more efficient to setup stations on site visits and then have Dr. Parola discuss the big picture after each station.
R26 Group was good, had trouble with the level of information supplied to complete the exercises. Would have liked to collect data ourselves for this type of exercise.
R27 I feel like this was a wasted day. There was one totally inattentive group member who was away from the group most of the time.

9. How would you improve Part 1 of the course? Do you have any other comments or suggestions?

R03 The group presentations at the end of Day 4 got long. I would maybe suggest limiting each to a certain amount of time or having time for each group to meet with the professor before or after the presentation to go over more of the detailed questions and discussions.
R05 Thought the class was very well prepared. I saw no real problem, you actually went out of your way to provide a van for the Lexington group which I think is going above and beyond (I met in Frankfort).
R06 I thought Part 1 was good and look forward to the next two parts.
R07 I was pleased with it. I have no suggestions for improvements.
R08 Give a more wholistic picture of some topics, such as sediment transport evaluation. Even if you say somthing like..."We use several different techniques/methods to gather sediment data for our design reaches... Today (or this week) we are discussing/considering X for conceptual design purposes. During our next session we will explore how and why we also...regarding sediment transport of streams in Kentucky."
R10 No comments or suggestions
R11 Not at this time -- Maybe less field time for the beginning of the course --> or more if same. Maybe practicing more of the techniques. Seemed like spent alot of time just walking around.
R12 No sugguestions for improvement at this point, was a great intro.
R13 I think that it accomplished what it needed to.
R14 It was slightly scattered. Hard to explain, but could have been more rigorously stuctured, more deliberately orgnized. Maybe more orderly. Seemed like we jumped around some. OK for me because I felt like I knew a lot coming into it, but for someone with very little baseline knowledge could have been very very challenging.
R15 Cover more basics in Part 1.
R16 No suggestions - good job.
R17 No comments
R18 I would like to go over our evaluations we completed in the field while they were still fresh in our minds. I think we should have disscussed the evaluation forms either in the field directly after the assessment or the following morning in the classroom. Also, I would like to see breifly how to collect data that will be used in the calculations we learned. Such as: how to complete riffle and pebble counts, floodplain width, floodplain slope, bankfull flow, etc. I realize this may be redundant for many people in the class, but it may be helpful to see were inconsistencies lie in data collection as well as ensure all class participants understand the measurements being taken.
R19 Site evaluations should be completed immediately following field trips.
R20 See above responses. Also, maybe picking a visit to a non-restored stream (maybe Benson Creek in Frankfort) and point out issues with it before we would do the stream evaul. of a restored stream.
R22 Spend more time on the formulas.
R23 I think the evaluations during the site visits would be more helpful if we had groups led by a person with experience - maybe a sheet filled out by Institute staff as an example at the end for future reference.
R26 Send evaluations out earlier for better feedback (I know im filling this out super late, but id say the next week after the workshop would be good). You provided lunch everyday, which was great, but is a lot of extra work for you all. This is something you could easily cut out in the future.
R27 Work through actual projects from design to construction.

SUMMARY OF COURSE EVALUATION RESPONSES FOR PART 2, JUNE 2011

Participants were asked to complete a 9-question evaluation of the quality and effectiveness of Part 2 of the course. All but six (21 of 27) of the Part 2 participants submitted an evaluation. The following are summaries of responses to all closed-ended questions and complete verbatim responses to all open-ended questions. Respondents 1−12 were employed in the private sector; all others were government (and one non-governmental organization).

1. Please re-enter the seven-digit number from Question 1 in your evaluation of Part 1.

Responses omitted. The seven-digit number was requested to allow the anonymous responses to Part 1 evaluations to be related to those for Parts 2 and 3.

2. Rate the instructional value of each of the presentations and activities. Use the comments section below to tell us which things in particular helped or did not help you to understand or learn the material.

	Very Low	Below Average	Average	Above Average	Very High	Rating Average
a. Day 5: Sediment characteristics, mobility, and critical shear stress	0.00% 0	0.00% 0	9.50% 2	**76.20%** **16**	14.30% 3	4.05
b. Day 5: Sediment transport station (STS) analysis	0.00% 0	0.00% 0	28.60% 6	**57.10%** **12**	14.30% 3	3.86
c. Day 5: South Fork Curry's Fork site introduction	0.00% 0	4.80% 1	**52.40%** **11**	42.90% 9	0.00% 0	3.38
d. Day 6: South Fork Curry's Fork data collection	0.00% 0	4.80% 1	28.60% 6	**66.70%** **14**	0.00% 0	3.62
e. Day 6: Harrison Fork site visit	0.00% 0	0.00% 0	28.60% 6	**61.90%** **13**	9.50% 2	3.81
f. Day 6: Wilson Creek site visit	0.00% 0	0.00% 0	38.10% 8	**57.10%** **12**	4.80% 1	3.67
g. Day 7: Mill Branch site visit/evaluation	0.00% 0	0.00% 0	15.00% 3	**65.00%** **13**	20.00% 4	4.05
h. Day 7: Dix River floodplain site visit	0.00% 0	0.00% 0	35.30% 6	**41.20%** **7**	23.50% 4	3.88
i. Day 8: Conceptual design workshop	0.00% 0	4.80% 1	**57.10%** **12**	33.30% 7	4.80% 1	3.38
j. Day 8: Presentation/discussion of conceptual designs	0.00% 0	10.50% 2	**63.20%** **12**	26.30% 5	0.00% 0	3.16
k. Day 8: Groundwater assessment and stream restoration	0.00% 0	0.00% 0	25.00% 5	**55.00%** **11**	20.00% 4	3.95
l. Day 8: Piezometer installation in a stream valley	0.00% 0	0.00% 0	40.00% 8	**50.00%** **10**	10.00% 2	3.7
m. Day 8 Exercise: Channel and valley groundwater interaction	0.00% 0	0.00% 0	35.00% 7	**50.00%** **10**	15.00% 3	3.8
n. Day 8: Mill Branch restoration	0.00% 0	0.00% 0	35.00% 7	**55.00%** **11**	10.00% 2	3.75
o. Day 8: Dix River floodplain restoration	0.00% 0	0.00% 0	38.90% 7	**50.00%** **9**	11.10% 2	3.72
p. Day 8: Mill Branch site evaluation review/discussion	0.00% 0	0.00% 0	35.00% 7	**55.00%** **11**	10.00% 2	3.75

R05 It may be just me, non-engineer, numbers and formulas are not an everyday occurrance so I was constantly behind on understanding the formulas. It would be nice to slow down when covering the basic for new formulas. I believe the engineers don't comprehend the biological processes as fast I do.

R16 Day 5 review a bit quick - more review would have helped.

R20 Great course. My comments below relate to the need for more redundancy of formulae and instructions. From the participant point of view, we are getting a lot of new things thrown at us quickly so some framework to help codify these things in our heads would help. One thing that would have been very helpful to participants working to do a channel design would have been a sheet with all the formulas listed, so we wouldn't have to try and flip through the book and find them. Also, the formula sheet could be designed in a flowchart fashion: step 1, channel stress evaulations (formulae), step 2: floodplain stress calculation, etc. When it got to the stages of the actual restoration, we spent a lot of time flipping through the book. Also - a guidance sheet for the site evaulation of Curry's Fork would have been helpful (step 1: locate areas of bedload mvmt), step 2: assess riffles, do a 400 pebble count, step 3...). Until folks learn the actual workflow, there are a lot of related but seemingly disparate concepts to throw together. Our group got there and kind of floundered for awhile trying to put all the things we were supposed to measure together.

3. Which of the presentations and activities did you find <u>least beneficial</u> (choose one or more) and <u>most beneficial</u> (choose one or more)? In the comments section, please tell us what you found particularly helpful or unhelpful in the components you chose.

	Least Beneficial	Most Beneficial	Response Count
a. Day 5: Sediment characteristics, mobility, and critical shear stress	0.00% 0	**100.00% 17**	17
b. Day 5: Sediment transport station (STS) analysis	8.30% 1	91.70% 11	12
c. Day 5: South Fork Curry's Fork site introduction	60.00% 3	40.00% 2	5
d. Day 6: South Fork Curry's Fork data collection	22.20% 2	77.80% 7	9
e. Day 6: Harrison Fork site visit	14.30% 1	85.70% 6	7
f. Day 6: Wilson Creek site visit	30.00% 3	70.00% 7	10
g. Day 7: Mill Branch site visit/evaluation	11.10% 1	88.90% 8	9
h. Day 7: Dix River floodplain site visit	37.50% 3	62.50% 5	8
i. Day 8: Conceptual design workshop	38.50% 5	61.50% 8	13
j. Day 8: Presentation/discussion of conceptual designs	**87.50% 7**	12.50% 1	8
k. Day 8: Groundwater assessment and stream restoration	0.00% 0	**100.00% 11**	11
l. Day 8: Piezometer installation in a stream valley	50.00% 5	50.00% 5	10
m. Day 8 Exercise: Channel and valley groundwater interaction	9.10% 1	90.90% 10	11
n. Day 8: Mill Branch restoration	20.00% 1	80.00% 4	5
o. Day 8: Dix River floodplain restoration	40.00% 2	60.00% 3	5
p. Day 8: Mill Branch site evaluation review/discussion	57.10% 4	42.90% 3	7

R05 The piexometer installation was informational and important, but I just seem me doing any projects that would allow data to be collected for that much time. Our projects are on a much shorter time frame.
R08 site visits are very valuable
R09 see item 2 (redundant it seems)
R14 I chose the design workshop as the least beneficial becasue I feel like there is some degree of disjuct, like the information presented could be more organized and slower, so that there is full understanding of why we are doing certain things, and exactly when they apply or don't.
R16 Site visits were very informative - we were able to listen Art describe the various components of the restoration while seeing the actual sites. Presentations were very rushed - not all teams reported - difficult to learn much from each.

4. Rate your agreement with the following statements about the lectures:

	Strongly Disagree	Disagree	Neutral	Agree	Strongly Agree	Rating Average
a. Presentations were clear and easy to follow.	0.00% 0	0.00% 0	9.50% 2	**76.20% 16**	14.30% 3	4.05
b. Example exercises were clear and easy to follow.	0.00% 0	4.80% 1	23.80% 5	**52.40% 11**	19.00% 4	3.86
c. The presentations kept me focused and interested.	0.00% 0	0.00% 0	4.80% 1	**76.20% 16**	19.00% 4	4.14
d. The amount of information presented was appropriate.	0.00% 0	4.80% 1	9.50% 2	**66.70% 14**	19.00% 4	4
e. Questions were adequately addressed.	0.00% 0	0.00% 0	23.80% 5	**52.40% 11**	23.80% 5	4

R05 See comments on question 2.
R19 I would rather see the emphasis is on everyone understanding the concepts, with some appropriate calcualtions, rather than performing the calcualtions (usually by those with laptops and good at data analysis) in a group setting. I often feel like a spectator, and I just want to understand what's going on, not being able to perform the calculations in class.
R20 See above - everything was very good, just a lot of volume to assimilate at once.

5. Rate how valuable the course was to you:

	Very Low	Below Average	Average	Above Average	Very High	Rating Average
a. The value to you of this course overall.	0.00% 0	0.00% 0	14.30% 3	**47.60% 10**	38.10% 8	4.24
b. The value of this course compared with other courses of similar length and content that you have attended.	0.00% 0	0.00% 0	33.30% 7	**38.10% 8**	28.60% 6	3.95
c. The likelihood that you would recommend this course if it were to be offered again.	0.00% 0	0.00% 0	14.30% 3	**42.90% 9**	**42.90% 9**	4.29

No comments were offered by respondents.

6. Rate your level of satisfaction with the planning and coordination of the course:

	Very Low	Below Average	Average	Above Average	Very High	Rating Average
a. The usefulness of the information provided to you about how to prepare for the course.	0.00% 0	4.80% 1	33.30% 7	**42.90% 9**	19.00% 4	3.76
b. How well Part 2 matched your expectations based on the course announcement and Part 1.	0.00% 0	0.00% 0	40.00% 8	**45.00% 9**	15.00% 3	3.75
c. The usefulness of the handouts to you (e.g., content, format, organization) during the training.	0.00% 0	0.00% 0	14.30% 3	**66.70% 14**	19.00% 4	4.05
d. The usefulness of the handouts to you (e.g., content, format, organization) as reference material in the future.	0.00% 0	0.00% 0	23.80% 5	**57.10% 12**	19.00% 4	3.95
e. The adequacy of the classroom facilities for the group.	0.00% 0	0.00% 0	28.60% 6	**47.60% 10**	23.80% 5	3.95
f. The adequacy of the classroom location for the group.	0.00% 0	0.00% 0	23.80% 5	**52.40% 11**	23.80% 5	4
g. The convenience of the four-day schedule for Part 2 content.	0.00% 0	4.80% 1	38.10% 8	**47.60% 10**	9.50% 2	3.62
h. The amount of time spent in the classroom.	0.00% 0	0.00% 0	**52.40% 11**	38.10% 8	9.50% 2	3.57
i. The amount of time spent in the field.	0.00% 0	0.00% 0	33.30% 7	**57.10% 12**	9.50% 2	3.76

R09 lead time, please.
R13 N/A
R14 It would be nice to squeez the class in tight for the presentations, and then be able to spread out for the group excercises. When everyone is spread all over the place in lecture - you get a lot of peple having side conversations or it's just not as easy to concentrate - especially if the presenter has to look and talk all over a llarge room for 100 people, when there is only 20-30 there.
R19 The student presentors need to take some presentation training. It is sorely lacking.
R21 a) any lack of prep is do to my time schedule not the course organizers or instructor

7. Please tell us how (i.e., types of activities, projects, or responsibilities) you plan to apply what you learned in Part 2 of the course.

R05 Not exactly sure as of yet. I apply what I have learned in how I go about evaluating streams. I do not look at streams the same as I once did and my degree is in freshwater biology / ecology.
R06 I hope to incorporate some of the data collection and analysis techniques in future stream restoration projects.
R07 I will be able to use this material to work on stream restoration projects in my current positon
R08 projects and presentaitons to restoration in company
R09 design
R10 Just to use them in future stream and wetland restoration projects
R12 Bedload impact sensor data analysis.
R13 sediment transport during stream assessments
R14 to apply groundwater consideration to pre-design projects, budgeting
R15 Looking for designs and background research.
R16 It will help me understand analyses and techniques used in restoration activities for federally listed or at-risk fishes and mussels. It will also help address potential threats (excessive sedimentation) to those species.
R17 Plan to use in project selection.
R19 Including gw into data collection and design Keeping stresses low Designing for large storms, not just bankfull events

8. If the course were to be offered again, what would you recommend keeping the same as it was in this version (i.e., what worked well)? Why?

R05 What works well for me is the exercises. I learn and retain more by doing.
R06 The site visits are good. I feel some additional time in the classroom would be beneficial.
R07 I am very impressed with the quality of this course. I recommend that you offer it again. I do not have any suggestions for improving the course.

R08 Continue to have several site visits for visual observation and learning, which clarifies classroom learning.
R09 basic classroom/field structure
R10 The sites visits of course are necessary to provide a visual representation of what did and didn't work. What doesn't work is as important as what does work. The effect of the groundwater dams is fascinating, albeit very simple in application.
R12 See the sites and applying the data.
R13 Not having any background in stream restoration, it would be hard for me to take on a stream restoration project. I would suggest an approach on how to begin planning for a stream restoration, what data to collect, and how to analyze that data (in a flow chart state of mind).
R14 keep it similar, but refine
R15 Site vists because they are very imformative and interesting. Presentations showing the design and construction of the stream restorations.
R16 It was a little tough to remember all the info from Part 1 and apply it in Part 2. Busy schedules simply didn't allow me the opportunity to review the material. If the sessions were a bit closer together, it would have helped.
R17 The site visits were helpful as related to lecture subject matter.
R27 No. I would liked to have spent more time going through a variety of projects from concept to final design drawings including all calculations. Working together in groups was a huge waste of valuable time. I would liked to have spent more time learning how to evaluate a streams geomorphological history.

9. If the course were to be offered again, what would you recommend changing to improve Part 2? Why? Do you have any other comments or suggestions?

R02 Should have added a day or reduced the field time. There were either too many sites and/or too remote from our location (in my humble opinion). Also, with respect to the Conceptual Design Exercise, it would have been beneficial to me for Dr. Parola to run through an example first, to solidify the steps and procedures.
R05 Spend a little less time explaining the overall picture so more time can be spent working through the exercises. Again this all goes back to some of us need a little more time to absorb the formulas.
R06 I would like to see more time spent on designing the groundwater dams.
R07 No recommendations for improvement. I am impressed with the course as is.
R08 Try to allow a little more time for the designs and try to clarify what you want each group to prepare to present on their designs. I would also make Part 2 and Part 3 each 3 days, with one day of field visits each time.
R09 add urban area challenges
R10 Can't think of anything.
R12 Would like to hear more about lessons learned. How and why design methods changed over the period of the projects. What spurred these changes.
R13 N/A
R14 think a lot about the order and timing of the presentations and the information therein. It would maybe be good to spend a decent amount of time preparing the attendees for the information upcoming - so everything can stay neat and organized. Getting paper form of presentations right before or during the lecture, and then some slides or order aren't the same is confusing.
R15 Talking about the background and history of each site before or during the visit to give context. Less group time and presentations and calculations. Cover and involve more biology/ecology.
R16 More review of Part 1.
R17 No
R27 Discussions in the field need to be more organized. I felt like I probably missed out on some good dicussion depending on my proximity to Dr. Parola while in the field.

SUMMARY OF COURSE EVALUATION RESPONSES FOR PART 3, JULY 2011

Participants were asked to complete a 10-question evaluation of the quality and effectiveness of Part 3 of the course and Parts 1−3 collectively. All 26 of the Part 3 participants submitted an evaluation. The following are summaries of responses to all closed-ended questions and complete verbatim responses to all open-ended questions. Respondents 1−12 were employed in the private sector; all others were government (and one non-governmental organization). Because eight Respondents (R10, R15, R17, R18, R20, R24, R25, and R26) did not answer Question 1 in the Part 3 evaluation, their written comments may not be correctly identified. This uncertainty is denoted by an asterisk (e.g., R10*).

1. Please provide the seven-digit number from Question 1 in your evaluations of Parts 1 and 2.

Responses omitted. The seven-digit number was requested to allow the anonymous responses to Part 1 evaluations to be related to those for Parts 2 and 3.

2. Rate the instructional value of each of the presentations and activities. Use the comments section below to tell us which things in particular helped or did not help you to understand or learn the material.

	Very Low	Below Average	Average	Above Average	Very High	Rating Average
a. Day 9: Review	0.00%	0.00%	16.00%	**52.00%**	32.00%	4.16
	0	0	4	**13**	8	
b. Day 9: SFCF design (lecture and practice)	0.00%	0.00%	8.00%	**48.00%**	44.00%	4.36
	0	0	2	**12**	11	
c. Day 9: SFCF design (group exercise)	0.00%	4.00%	12.00%	**52.00%**	32.00%	4.12
	0	1	3	**13**	8	
d. Day 10: Discussion of SFCF design group exercise	0.00%	3.80%	**38.50%**	26.90%	30.80%	3.85
	0	1	**10**	7	8	
e. Day 10: Restoration transitions	0.00%	0.00%	22.20%	**44.40%**	33.30%	4.11
	0	0	4	**8**	6	
f. Day 10: Additional restoration techniques	0.00%	5.60%	16.70%	33.30%	**44.40%**	4.17
	0	1	3	6	**8**	

R05 The lecture and practice was the most beneficial exercise because it gave each of [us] time to work with equations at our own pace. Some get equations faster than others.
R06 I felt the presentation of the step-by-step instructions on designing the stream channel was very helpful.
R07 This course was very beneficial. It introduces new approaches to stream restoration that are not taught in other courses. The concepts involve easy to follow calculations that can be supplemented by good judgement and practical experience.
R08 Very good. The content of this class "Part 3" was more clear than before.
R09 Good collection of various considerations in context. Some materials not quite "finished," but still ok --> helps teach. But could have been better.
R11 The techniques were more concise this time.
R13 Liked working as a group and working through entire process.
R14 Very good commentary with each lecture, lectures themselves could be refined some.
R16 Especially, the review session at the beginning of Day 9 was VERY helpful. Also -- step-by-step instruction on restoration design was effective -- easy to understand.
R17* Individually, as I am unfamiliar with engineering drawings/rulers/CAD drawings, the conceptual drawing of SFCF was difficult. I found the group exercise with engineering folks much more helpful.
R19 Day 9 was best of 10-d class.
R24* I really enjoyed the things we learned on Day 9.
R25* Our group was too slow to get focused -- I'd wish instructors could have directed the group to complete specific tasks.

3. Which of the presentations and activities did you find <u>least beneficial</u> (choose one or more) and <u>most beneficial</u> (choose one or more)? In the comments section, please tell us what you found particularly helpful or unhelpful in the components you chose.

	Least Beneficial	Most Beneficial	Response Count
a. Day 9: Review	13.30%	86.70%	15
	2	13	
b. Day 9: SFCF design (lecture and practice)	4.80%	**95.20%**	21
	1	**20**	
c. Day 9: SFCF design (group exercise)	27.80%	72.20%	18
	5	13	
d. Day 10: Discussion of SFCF design group exercise	**65.00%**	35.00%	20
	13	7	
e. Day 10: Restoration transitions	10.00%	90.00%	10
	1	9	
f. Day 10: Additional restoration techniques	12.50%	87.50%	8
	1	7	

R04 Transition topic was a great idea, but the slides/presentation need work. I ended up confused.
R07 I felt like there was an excellent balance between lecture and group exercise.
R08 [SFCF design (group exercise) was] good, just less beneficial than the discussions. Good job.
R09 Transitions handouts and slides not as effective as I would have liked or expected (and a little confusing/disorganized). Screen not always same as handout.
R13 All beneficial.
R14 Discussion of group exercises was rushed but maybe not all that necessary anyway. Resto techniques/transitions very beneficial and well placed. Addressed many common problem areas, relevant every project.
R16 See above.
R21 All beneficial. The classroom practice & lecture were excellent! very beneficial.
R24* There was a lot of repetition in the Day 10 discussion.
R25* The SFCF design on Tuesday (1st day) was useful since it followed a very specific protocol with proper supplemental info on equations.

4. If Part 3 of the course were to be offered again, what would you recommend keeping the same as it was in this version (i.e., what worked well)? Why?

R01 Keep the step by step design method. Very useful and organized.
R02 Yes, overall.
R03 Enjoyed going through the full design process step-by-step; provided a better understanding of the concepts.
R04 The first day -- it was specific and actually showed you how to do something.
R05 I would like to see the lecture and practice in part 2 and then reviewed in part 3. This gives people time to comprehend and ask questions is [if] some part of the exercise was not understood.
R06 I would keep the step-by-step instructions on design within the presentation.
R07 I was pleased with the way it was organized and presented.
R08 Keep most all of it the same. It brought everything together pretty well. In parts 1 & 2 I felt like pieces of the puzzle were missing. Walking the class through the design steps 1st was very helpful.
R09 Basic class/fieldwork structure. Appreciated effort on town and snacks both in class and in field. Art's attitude and enthusiasm in teaching was a great plus.
R10* Review was good -- group exercises are very helpful -- a month between classes allows you to forget quickly.
R11 Yes. Group discussion help teach & learn at the same time. Get ideas from others I wouldn't think of on my own -- ie collaboration.
R12 More focus on creating/analyzing 2-D models.
R13 All of Day 9 was helpful.
R14 Keep same -- if desired could incorporate a formal presentation by groups -- but only if group activity more refined.
R15* Working through the design as an exercise via a lecture and small self or smaller group practices from Art et al.
R16 Reviews of SFCF design lecture -- well organized, easy to follow.
R17* The group project went well -- as mentioned, I didn't put together all of the concepts when tasked with doing the individual conceptual design. Again, I also think having a page reiterating all of the formulas would prevent flipping through all the handouts (or, make the handouts numbered and have an index where you could quickly find it).
R18* Yes, I would keep it the same.
R19 Worked well; not much group data analysis required.
R20* The lecture and practice portion of SFCF design was much more beneficial than the group work.
R21 Yes.
R23 I think too much time was spent in group exercises. Doing problem solving via lecture -- Art going through examples -- I think is more helpful.
R24* Everything, except when the group exercises are distributed more diversity of sites would be helpful so that everyone doesn't say the same thing 3xs. The individual exercise on Day 9 was particularly helpful in learning the actual design technique.
R25* Same as #3 (above).
R26* More individual exercises, less group work.

5. If the course were to be offered again, what would you recommend changing to improve Part 3? Why?

R02 Larger groups for the group exercise, or simply make it individual.
R03 Maybe include a little more step-by-step walk through of the profile generation worksheet in Excel. Several people seemed very confused at first.
R04 The group work went on way too long on the last day.
R05 See comments in #4, other than that I thought it went well.
R06 I would recommend an additional day to spend more time on the design of the floodplain, groundwater dams, wetlands.
R07 During the review process several items were covered multiple times. It would be helpful to have one summary document.
R08 Not sure.
R09 1. Post group planforms up on RH wall, and everyone move (stand) from group to group so design features can be illustrated/pointed to. 2. Provide Art with overhead projection that can show markup/sketches to help illustrate his talk.
R10* Nothing.
R11 Would be nice to work on detailed design on more than one site -- ie steep vs flat -- urban vs rural so can see how different parameters change design. How about coastal plain? Prairie?
R12 A more advanced class would benefit me that blends in 2-D modeling aspects.
R14 See previous comment.
R15* Less time in group -- not productive, or smaller groups with less time. More examples of projects, working through design steps via lecture and lessons learned -- more focus on design principles.
R17* See #4 comments.
R18* I would not recommend any changes.
R20* Less time in group with more overall discussion.
R21 One sheet with formulas needed for conceptual design would be helpful.
R23 Less group exercise -- more individual exercise and/or lecture-based.
R24* See #4.
R25* I think it would be useful to keep the review if the duration btwn the Part 2 & 3 remained the same. If the time span was shortened, the review probably could be dropped.

Please consider the <u>entire course (Parts 1, 2, and 3)</u> in your responses to the remaining evaluation questions.

6. Rate your agreement with the following statements about the lectures:

	Strongly Disagree	Disagree	Neutral	Agree	Strongly Agree	Rating Average
a. Presentations were clear and easy to follow.	0.00%	0.00%	3.80%	**73.10%**	23.10%	4.19
	0	0	1	**19**	6	
b. Example exercises were clear and easy to follow.	0.00%	0.00%	23.10%	**57.70%**	19.20%	3.96
	0	0	6	**15**	5	
c. The presentations kept me focused and interested.	0.00%	0.00%	0.00%	**76.90%**	23.10%	4.23
	0	0	0	**20**	6	
d. The amount of information presented was appropriate.	0.00%	0.00%	0.00%	**73.10%**	26.90%	4.27
	0	0	0	**19**	7	
e. Questions were adequately addressed.	0.00%	0.00%	11.50%	**50.00%**	38.50%	4.27
	0	0	3	**13**	10	

R05 Because questions were adequately addressed and generally lead to other questions, this at times made "clear and easy to follow" not so clear. It is a catch 22 and I would stick with answering questions adequately main focus.
R07 A job well done.
R08 Part 3 was more clear than Parts 1 and 2.
R09 Some questions did not get "brought in" to rest of group in answers/discussion.
R10* I feel the course was well organized and had ample real evidence of the working principles.
R14 Work to refine, clarify presentations.
R17* Huge learning curve of stream engineering concepts/techniques for me as a biologist (I've never seen an engineering map of a stream before this class).
R21 Group exercises are sometimes difficult but beneficial.
R24* More explanation of how to create the surrounding topography would be helpful. I'm still a little confused about how to do that correctly.
R25* Overall, good -- but still could be tweaked to improve.

7. Rate how valuable the course was to you:

	Very Low	Below Average	Average	Above Average	Very High	Rating Average
a. The value to you of this course overall.	0.00%	0.00%	3.80%	**61.50%**	34.60%	4.31
	0	0	1	**16**	9	
b. The value of this course compared with other courses of similar length and content that you have attended.	0.00%	0.00%	23.10%	**42.30%**	34.60%	4.12
	0	0	6	**11**	9	
c. The likelihood that you would recommend this course if it were to be offered again.	0.00%	0.00%	11.50%	34.60%	**53.80%**	4.42
	0	0	3	9	**14**	

R07 I would highly recommend this course to anyone interested in improving their knowledge of stream restoration design.
R08 This was a good course and I think the second time it is taught it will be better since some of the kinks will work out.

R09 Cost is a big consideration.
R10* The course was not intimidating in fact the opposite. It made me look at stream restoration more creatively.
R24* This has been a great course, speaking from a non-engineer POV.

8. Rate your level of satisfaction with the planning and coordination of the course:

	Very Low	Below Average	Average	Above Average	Very High	Rating Average
a. The usefulness of the information provided to you about how to prepare for the course.	0.00% 0	0.00% 0	**50.00%** **13**	15.40% 4	34.60% 9	3.85
b. How well the course matched your expectations based on the course announcement.	0.00% 0	4.00% 1	28.00% 7	**36.00%** **9**	32.00% 8	3.96
c. The usefulness of the handouts to you (e.g., content, format, organization) during the training.	0.00% 0	0.00% 0	23.10% 6	**46.20%** **12**	30.80% 8	4.08
d. The usefulness of the handouts to you (e.g., content, format, organization) as reference material in the future.	0.00% 0	0.00% 0	19.20% 5	**50.00%** **13**	30.80% 8	4.12
e. The adequacy of the classroom facilities for the group.	0.00% 0	3.80% 1	23.10% 6	34.60% 9	**38.50%** **10**	4.08
f. The adequacy of the classroom location for the group.	0.00% 0	3.80% 1	19.20% 5	**42.30%** **11**	34.60% 9	4.08
g. The convenience of the schedule.	0.00% 0	7.70% 2	23.10% 6	**42.30%** **11**	26.90% 7	3.88
h. The amount of time spent in the classroom.	0.00% 0	3.80% 1	**42.30%** **11**	26.90% 7	26.90% 7	3.77
i. The amount of time spent in the field.	0.00% 0	3.80% 1	**38.50%** **10**	30.80% 8	26.90% 7	3.81

R07 Again, balanced & appropriate presentation.
R08 [Classroom lacked] Internet.
R09 Lots of handouts, well done (and a lot to do). Good sturdy notebook appreciated. Conditions of housekeeping and cleanliness outside of classroom a little surprising.
R10* Class was centrally located for most everyone.
R11 Would like to know a bit more about 2-d modeling, running sediment calcs. Reference where eqs come from. Give a concise summary of steps involved w/ eqn so don't have to flip through manual every time.
R14 Reduce need for out-of-class work -- UNLESS class is designed clearly to occupy more time, homework, etc. (This is HARD to do UNLESS location not near homes of attendees.)
R17* Some background on engineering concepts beforehand would be good for biologists in this course.
R22 Excellent handouts. Great to see projects in the field.
R23 Schedule made work difficult.
R24* Classroom got hot & humid during the 2nd session.
R25* Ideally, some topics could have been reiterated or initiated in field. I expected more coverage of low-gradient, incised and sandy soil reaches.
R26* Send out example exercises/scenarios prior to lectures would help.

9. Many of you indicated that the conceptual design group exercises and group presentations/discussion of the conceptual designs in Parts 1 and 2 were the least beneficial components of the course, but you didn't say why that was. What didn't you like about them? What would have made the conceptual design exercises (or any other parts of the course) more useful or valuable to you?

R02 To run-through an example prior to breaking into groups.
R03 The groups worked at different paces and some groups finished significantly before others. May help to have more defined instructions in the future. The presentations sometimes went on for a long time and became tedious and did not hold my attention.
R04 Good question, but I am not sure why the group exercises were the least beneficial part. I am one of the ones that did not like them. Example materials for the group work was excellent. Possibly the class participants were too close to one another -- you are not going to tell someone from KYF&WS what you really think when they are the ones that control you getting your next job.
R05 Many of the discussions were the same and so it became boring later on. Sorry, no real ideas on how to improve this aspect, it may be a something we just have to live with.
R06 I think more time should have been spent discussing the process of the conceptual design before turning the groups loose to conduct the designs.
R07 I was not someone who felt those items were not beneficial.
R08 More clearly explained and outlined what was expected like in Part 3. Explain to the group that the specific exercise in Part 1 is only touching on the edge of the project work. Maybe list what you recommend to be considered or collected in preliminary AND say why. * Using more universal language regarding streams is helpful and prevents some confusion.
R09 I liked them -- valuable.
R10* I feel they were most useful. Application of concepts is essential and group interaction allows you to see problems through everyone's eyes.
R11 I think if we had sites for the group exercises that we hadn't visited, the designs would have been more innovative and fun.
R12 Group exercises were fine with me.
R13 Seemed like the cart was before the horse. I like how we worked through the process this time and maybe that would be more beneficial as a first time process.

R14 Group exercises are difficult to conduct in a multi-group setting -- especially when incorporating new information and learning along with variable skill sets among group members. The last group exercise was best among all group activities. The key to improving similar activities and exercises in future should be to have very very very clear instructions and goals (to the point of redundancy).
R15* Too much time and too many people in the groups -- conceptual design exercises could be done via lectures & presentations from Art et al. -- which were the best in class & field. Some people know more & some know less.
R16 I was OK with the conceptual exercise; however, perhaps an example (group-wide) conceptual design could have presented first, followed by a group exercise.
R17* See previous comments -- provide some background about how to read engineering maps, understanding how to develop contours, etc. Overall a great class!
R18* I felt like they were beneficial, but possibly spend less time on them. The group presentations seemed to take up a lot of the course time. A few short group exercises would suffice.
R19 I did provide previously.
R20* I think the group exercises are less beneficial than working through with the entire class with discussion. The group work was beneficial at times, but there maybe needs to be a little less amount of time spent in groups.
R21 Group dynamics are difficult. The classroom lecture & exercise was great -- not sure but perhaps doing this first would help.
R22 The conceptual design group exercises were very important to my understanding of what was being taught in the class. They added to what was presented and should not be changed.
R23 Too many cooks in the kitchen -- group dynamics require a leader or it doesn't get done -- but that inhibits everybody from really getting what they're doing. Also a lot of it is stuff people know how to do but is time consuming (e.g. computing cross-sections, contours etc.) so too much time is spent doing busy work. I think the course could have been shortened by 2 days and accomplished the same amount of knowledge.
R24* Some people talk too much & monopolize the "discussion" & it gets boring fast.
R25* As a biologist -- I had no issues w/ conceptual exercises but the group of engineers kept trying to use equations when it was not required. Again -- keeping a group focused on specific tasks and restate what is NOT the engineering needs.
R26* Not enough baseline info. Needed to better define objectives/exact information we needed to focus on.

10. How satisfied are you with your experience in the course? How well did it meet or not meet your expectations? How worthwhile was it to you? Do you have any other comments or suggestions?

R01 Very satisfied.
R02 I am satisfied with the course and the information will be useful to me.
R03 The course was very beneficial to me and I found it worthwhile to attend. It was a little frustrating at points because of the different experience levels, but I did enjoy the mix of biologists and engineers. It was also nice to have a mix of consultants and people from regulatory agencies.
R04 Very satisfied with the class.
R05 I am very satisfied and glad I had the opportunity to attend. How worthwhile will depend on how much opportunity I get to use this information.
R06 I really enjoyed the course and plan to use the process as another tool during stream restoration design.
R07 Very satisfied. Expectations met and then some. Extremely worthwhile.
R08 This was a good course. It met my expectations, not necessarily exceeded. I would recommend it to someone else. Thanks!
R09 Overall, very good, with an asterisk*: * This course was pretty expensive to me, both in fee outlay, and in time lost to income producing work. (I do not get paid for being here.) On other side, more than once I heard gov't attendees (state and fed) counting up comp time due from course. So you might want to think more about equity and how "invested" people are. Maybe private sector should be free and gov't employees should pay fee ... might help balance!
R10* Very satisfied. Very worthwhile. My expectations were met and in turn I expect more from myself.
R11 It was good. Met my expectations and was worth my time.
R12 Very satisfied. Add a Level 2 for advanced topics. Did I mention 2-D modeling training?
R13 Satisfied, met my expectations, yes.
R14 This course was very worthwhile to me, however my expectations were not to learn to design streams. It succeeded in giving me insight and confidence in new and alternative methods/considerations for stream design. As a 1st shot at a relatively complex subject course I thought this course was VERY effective. I think much of content very relative and mostly presented well. Sometimes a bit unclear or unorganized but basically kinks to be worked out with repetition.
R15* Satisfied -- A little too much time spent in group exercises could have been spent elsewhere -- met expectations -- worthwhile to see projects & go over a few concepts. Thanks for your time & patience.
R16 Very satisfied -- met or exceeded my expectations. It will help me "do my job" better -- evaluate streams more effectively.
R17* I learned a tremendous amount in the class. Create an index for the material, have it organized when the folders are handed out -- will make referencing things from previous sessions much quicker.
R18* Class was worthwhile & it did meet my expectations. I felt like I learned a lot from this course.
R20* The course was definitely worthwhile and brought some aspects of restoration that may not always be considered.
R21 Very worthwhile -- great course -- incredible amount of information in a short timeframe. Great job!
R22 Very satisfied. I am amazed at what I learned. The class exceeded my expectations. I have been using what I learned to design new wetland and stream restoration projects. The concepts will help these projects to be successful. Thanks for the meals and snacks, nice thing to do. The best class I have taken in over 30 years working for the government. I will use this information each day to better manage public lands.
R23 Very worthwhile -- will definitely help my organization avoid bad stream designs and help us get much better results from our consultants. The faster these approaches get out to the design community the better it will be.
R25* OK, mostly met expectation; and worthwhile. (Less the previous comments.) I'd suggest rotating group members, but keep a balance btwn bio vs eng.
R26* Certainly worthwhile. Met expectations, provided a well-rounded perspective on conceptual design. I think course will get better over time. - Field practice installing piezometers &/or staff gages. - Exercises sent out btwn sessions to help participants prepare for the next session. - Good workshop / very useful approach. - 2-D modeling course would be helpful.

Project Deliverables | D

Three copies of the course notebook were submitted with this report. The notebook includes the course agenda, printed copies of slides from the PowerPoint presentations, field data collection forms, in-class handouts, and a glossary of terms.