SACRAMENTO MUNICIPAL UTILITY DISTRICT
UPPER AMERICAN RIVER PROJECT
(FERC Project No. 2101)

and

PACIFIC GAS AND ELECTRIC COMPANY
CHILI BAR PROJECT
(FERC Project No. 2155)

CHANNEL MORPHOLOGY
TECHNICAL REPORT

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Description

2.1 Channel Morphology Study Plan

This study is designed to provide information regarding the geomorphologic condition of river reaches downstream of Sacramento Municipal Utility District's (SMUD) Upper American River Project (UARP) and Pacific Gas and Electric Company's Chili Bar Project using the Rosgen methodology. The overall approach is to perform Rosgen Level I classification of all river reaches downstream of dams using available maps and photographs, and then to refine this typing by conducting Rosgen Level II classification and Level III condition assessment in sensitive reaches using site-specific measurements. Should any of the reaches seem impaired (e.g., excess sediment, lack of bedload sediment, excessive scouring or channel entrenchment, lack of or excess large woody debris (LWD), poor riparian vegetation, etc.), additional studies will be considered. Field data will only be collected in 2002 unless results indicate additional sampling is warranted.

2.1.1 Pertinent Issue Questions

This Channel Morphology Study Plan addresses the following Aquatic/Water Issue Questions:

5. What effects do project features and operations have on fluvial geomorphology and stream habitat?
6. What are the physical attributes (i.e., available pools and presence of large debris) of the Project? How have they been affected by the Project? What habitat is provided by those attributes (habitat mapping)?
19. Do project features affect distribution of large wood in streams? Do they comply with Forest Service standards?
23. What Project flows affect recruitment and reproduction of riparian plants?
34. How are the Project operations affecting gravel recruitment (related to spawning and macroinvertebrate habitat)?
48. Does operation of the Project affect stream bank stability?
61. Does the existing minimum stream flow requirements adequately protect the fluvial geomorphological processes?

2.1.2 Background

Effects of dams and flow regulation on channel morphology are expected to be more pronounced in alluvial reaches that have bed and banks composed of fluvially-derived sediment, as compared to bedrock channels that remain relatively unaltered due to high sediment transport capacities and resistant substrate (Montgomery and Buffington 1993). Alluvial reaches are characterized by fluvial transport of sediment over a variety of bed morphologies. At the reach-level, channel slope, sediment supply, transport capacity, and (LWD) loading are key determinants of channel form. Broad-level channel classification based on channel slope and confinement can be used to identify "sensitive reaches. "Sensitive reaches" are unconfined, low-gradient alluvial reaches where channel response to changes in sediment supply or transport dynamics is most likely to occur. Detailed field surveys in sensitive reaches downstream of the dams can be used to identify and quantify the effects of the dams and the altered flow regime on channel morphology.

2.1.3 Study Objectives

The study objectives are to identify:

- potential sensitive reaches downstream of the UARP's and Chili Bar Project's dams
- effects of the projects on channel morphology, sediment transport, and LWD dynamics, loading, and function in sensitive downstream reaches
- feasible measures to sustain geomorphic processes such as sediment transport and LWD loading that support aquatic and riparian habitat diversity in downstream reaches.

2.1.4 Study Area

The study area will include all stream reaches identified by the Aquatics TWG. This includes the downstream reaches of all UARP dams and Chili Bar Dam.

2.1.5 Information Needed From Other Relicensing Studies

Information needed from other studies includes: 1) the effects of flow regulation and diversion on flow conditions in the channel, which is necessary for developing hypotheses of anticipated effects of the projects on channel morphology and identifying potential field survey reaches, from the Hydrology Study; 2) results from water quality and turbidity studies from survey and existing data; and 3) the results of the Riparian Vegetation Study to assess linkages between geomorphic processes (and the effects of the Project on geomorphic process) and riparian vegetation. Bathymetric data from UARP reservoirs will also be made available for analysis. Information from the Channel Morphology Study may be useful in the Riparian Vegetation Study, Amphibians and Aquatic Reptiles Study, Aquatic Bioassessment Study, and the Water Quality Study. Information regarding blockage of connectivity of tributaries and side channels from the instream flow habitat mapping will be needed.

2.1.6 Study Methods And Schedule

The study methods will include the following sequential steps:

Rosgen Level I Classification - The first phase will include a Rosgen Level I classification based on available topographic and geologic data. The purpose of the Level I classification is to provide a broad characterization that integrates the landform and fluvial features of valley morphology with channel relief, pattern, shape, and dimension for all stream reaches (Rosgen 1994). The initial evaluation will use material such as low-altitude video of channels in the area of the projects available from SMUD or other sources; USGS maps, historic and current aerial photographs, topographic and geologic maps as well as other available data for rivers affected by the projects to determine channel slope, approximate channel width and cross sectional form, and channel planform morphology (e.g., sinuosity and channel form, etc.). This information is needed to classify all reaches into Rosgen Level I types. The purpose of the Level I classification is to identify potential sensitive reaches and to predict anticipated reach-level morphology in alluvial (non-bedrock) reaches in all Rosgen channel types. Sensitive reaches will be delineated based upon their slope, channel confinement, and bed and bank sediment composition (e.g., alluvial versus bedrock). Using the Rosgen Level I classification, sensitive reaches could occur in type B, C, D, E, and F channels. Based on the results of the Level I effort, a recommendation will be made to the Aquatic TWG regarding the sampling locations for Level II surveys.

Rosgen Level II Typing - Locations for Rosgen Level II surveys will be determined based upon the Level I classification. While the number and distribution of potential sites is unknown at this time, at least one study site will be analyzed in each reach. A study site will be approximately 20 to 30 bankfull widths, where appropriate, in length with upper and lower boundaries geo-referenced. If there is more than one potential study site in each reach, the study site where channel response to operation of the projects is most likely will be analyzed. Additional sites (e.g., near recreation areas) may be considered. Interested parties from the Aquatics TWG and Plenary Group will be invited to visit the sites in the field to concur with or modify the selected survey sites. Level II field surveys will include, but not be limited to, measurements of 1) longitudinal profile (water surface and thalweg), 2) valley width, 3) approximately three monumented channel cross sections (including bankfull indicators, thalweg, water's edge, flood-prone area, where identifiable), and 4) pebble counts (Wolman 1954). Cross sections will be established with a sufficient number of verticals to clearly depict channel geometry (Harrelson, et al. 1994). Each transect will be photo-documented. Wherever possible, study sites for this effort will coincide with instream flow study sites. Based on the results of the Level II effort, a recommendation will be made to the Aquatic TWG regarding the sampling locations for Level III surveys.

Rosgen Level III Condition – It is anticipated that a Rosgen Level III condition analysis will be performed at a subset of the Level II study sites. The Level III analysis will include the following data collection elements: 1) bed surface texture based on facies mapping (stratification and delineation of channel bed features based on particle sizes and organization), 2) sediment deposition in pools will be assessed using an appropriate method (e.g., V*, S*, Q*) (USFS 1997, Lisle and Hilton 1992, Hilton and Lisle 1993). In each reach examined as part of the Level III analysis, large woody debris (LWD) loading in the active channel will be measured and the geomorphic and ecological function of the LWD will be examined. For the purpose of this analysis, LWD is defined as in the USFS Region 5 Stream Condition Inventory (SCI) protocol: all pieces of wood lying within the bankfull width of the channel that measures one half bankfull width or longer. Wood must be both downed, and with a portion lying within the bankfull channel, and dead or dying to be considered LWD. This will involve dividing the LWD into size classes and tallying the total number of LWD pieces in each size class in the reach. Because some LWD can be suspended over the channel or are too small to alter bed morphology, the interaction between LWD and the bed will be assessed. LWD, as a biological component, will be examined during the habitat mapping component of the instream flow study.

Additional Investigations – Depending upon the results of the above evaluations, additional studies may be conducted in some specific areas (e.g. Rosgen Level IV sediment budget).

It is expected that Rosgen Level I classification will occur in spring/early summer 2002. Selection of Rosgen Level II and III sampling sites and fieldwork will occur in summer 2002/2003. Note that interested parties from the Aquatics TWG and Plenary Group will be invited to visit the sites in the field to concur with or modify the selected survey sites before any fieldwork is conducted. Data analysis will occur in fall 2002/2003, and the results of the study will be presented to the Aquatic TWG in late 2002/2003. Should the data indicate that additional investigation is warranted in specific area (i.e., additional surveys, including identifying reference reaches to help isolate Project impacts, this study plan will be amended, in consultation with the Aquatics/Water TWG and Plenary Group, to include data gathering and analysis in these specific problem areas in 2003.

2.1.7 Analysis

The results would be used to describe the existing channel conditions and to identify effects of the projects on channel morphology. The magnitude of sediment trapping by the reservoirs will be estimated. An incipient motion analysis will be performed using Shield's (and associated sensitivity analysis) equation (also perform sensitivity analyses in conjunction with opportunistic flow events) for each Level III study site. Potential problem areas (excess sediment, lack of bedload sediment, excessive scouring or channel entrenchment, lack or excess of LWD, poor riparian vegetation, etc.) will be identified, and potential mitigation measures will be evaluated.

2.1.8 Study Output

A presentation on the preliminary results from the study will be made to the Aquatics TWG and the Plenary Group in late 2002. The ultimate study output will be a written report that includes the issues addressed, objectives, study area including sampling locations, methods, analysis, results, discussion and conclusions. The report will be prepared in a format so that it can easily be incorporated into SMUD's draft environmental assessment report that will be submitted to FERC with SMUD's application for a new license.

2.1.9 Preliminary Estimated Study Cost

A preliminary study cost estimate will be prepared after the Plenary Group approves this study plan.

2.1.10 TWG Endorsement

The Aquatics TWG approved this plan for the UARP on February 28, 2002. The participants at the meeting who said they could "live with" this study plan were BLM, PCWA, CSPA, SWRCB, USFS and SMUD. None of the participants at the meeting said they could not "live with" this study plan except for the PG&E participant who said PG&E would defer at this time since the plan did not include the Chili Bar Project and downstream. At the April 3, 2002 Plenary Group meeting, the plan was directed back to the Aquatic TWG to include the area below Chili Bar. At the April 11, 2002 Aquatic TWG meeting, the TWG approved the study plan. The participants at the meeting who said they could "live with" this study plan were BLM, SWRCB, USFS, PG&E, Camp Lotus, and SMUD. None of the participants at the meeting said they could not "live with" this study plan, except that PG&E said it needed management approval. PG&E obtained this approval as of April 30, 2002.

On May 1, 2002 the following participants gave Plenary Group approval to the plan: USFS, BLM, USFWS, Taxpayers of El Dorado County, Friends of El Dorado County, Camp Lotus, El Dorado County Water Agency, El Dorado County, Placer County Water Agency, California Department of Fish and Game, California State Water Resources Control Board, Pacific Gas and Electric and Friends of the River. None of the participants at the meeting said they could not "live with" this study plan.

2.1.11 Literature Cited

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Wolman, G. M. 1954. A method of sampling coarse river-bed material. Transactions of the American Geophysical Union 35: 951-956.

<u>AQUATICS TWG NOTE:</u>

1. *This study area will be revisited once SMUD and the USFS reach agreement regarding responsibility for and potential Project actions in "Defense and Threat" zones as defined in the Forest Service Plan Amendment EIS and Record of Decision*

CHANNEL MORPHOLOGY TECHNICAL REPORT

SUMMARY

This technical report characterizes channel morphology and describes existing geomorphic functions in streams affected by the Sacramento Municipal Utility District's (SMUD) Upper American River Project (UARP) and Pacific Gas and Electric's (PG&E) Chili Bar Project.

Study results presented here reflect hierarchical studies conducted between 2002 and 2004. The initial studies involved a broad geomorphic characterization (Rosgen Level I) of the stream reaches affected by the two projects, including the Reach Downstream of Chili Bar. These results were used to identify potential response reaches. Response reaches are most likely to show effects from alterations to hydrology or sediment supply and are defined by Montgomery and Buffington (1998) as reaches with: 1) low slope (<4 percent); predominantly alluvial bed and banks (cobble-gravel facies or finer); and 3) plane bed or pool-riffle morphology.

Morphological description (Rosgen Level II) and channel condition assessment (Rosgen Level III) sites were selected in potential response reaches identified from the results of geomorphic characterization. In conjunction with the Aquatics Technical Work Group (TWG), 16 sites were selected for morphological description and/or channel condition assessment, including 4 sites in the Reach Downstream of Chili Bar. Low altitude aerial photographs and video footage taken during a helicopter flyover of the study area were used for site selection.

The channel morphological description and channel condition assessment revealed seven response sites in the UARP area, and one response site in the Reach Downstream of Chili Bar. Channels at these sites primarily exhibited pool-riffle morphology with well-developed floodplains. The following sites were designated response sites:

- Rubicon Dam Reach Site;
- Loon Lake Dam Reach Upper Site;
- Loon Lake Dam Reach Middle Site;
- Loon Lake Dam Reach Lower Site;
- Robbs Peak Dam Reach Site;
- Ice House Dam Reach Upper Site;
- Ice House Dam Reach Lower Site; and
- Upper Coloma Site in the Reach Downstream of Chili Bar.

The remaining five sites in the UARP and three sites in the Reach Downstream of Chili Bar were categorized as transport sites because they all occur in reaches where bedrock outcrops control channel morphology and sediment transport dynamics (Montgomery and Buffington 1993).

In order to evaluate the magnitude of flows that would mobilize the current bed material, Shields stress and bedload transport were evaluated for six response sites in the UARP and one response site in the Reach Downstream of Chili Bar, using the *EASI* (Enhanced Acronym Series with Interface) model. The results indicate that incipient bed mobility occurs between:

- 168-189 cubic feet per second (cfs) for the Rubicon Dam Reach Site;
- 86-326 cfs for the Loon Lake Dam Reach Middle Site;
- 940-1,241 cfs for the Loon Lake Dam Reach Lower Site;
- 917-1,568 cfs for the Robbs Peak Dam Site;
- 185-393 cfs for the Ice House Dam Reach Upper Site;
- 531-775 cfs for the Ice House Dam Reach Lower Site; and

- 1,703-4,317 cfs for the Lower Coloma Site in the Reach Downstream of Chili Bar.

The Loon Lake Dam Reach Upper Site was excluded from the Shields stress and bedload transport evaluation because dominant grain sizes in the channel bed are too small. Bedrock outcrops and boulders at all remaining project sites preclude an accurate assessment of Shields stress due to the influence of large flow obstructions on flow dynamics and sediment transport.

1.0 INTRODUCTION

This technical report is one in a series of reports prepared by Devine Tarbell and Associates, Inc., and Stillwater Sciences for the Sacramento Municipal Utility District (SMUD) and Pacific Gas and Electric Company (PG&E) (jointly referred to as the Licensees) to support the relicensings of SMUD's Upper American River Project (UARP) and PG&E's Chili Bar Project. The Licensees intend to append this technical report to their respective applications to the Federal Energy Regulatory Commission (FERC) for new licenses. This report addresses the existing geomorphic form and function of streams in UARP reaches and the Reach Downstream of Chili Bar. This report includes the following sections:

- **BACKGROUND** – Includes when the applicable study plan was approved by the UARP Relicensing Plenary Group; a brief description of the issue questions addressed, in part, by the study plan; the objectives of the study plan; and the study area. In addition, requests by resource agencies for additions to and modifications of this technical report are described in this section.
- **METHODS** – A description of the methods used in the study, including a listing of study sites.
- **RESULTS** – A description of the most important data results. Raw data, where copious and detailed model results are provided in a separate compact disc (CD) for additional data analysis and review by interested parties.
- **SUMMARY** – A brief discussion of the results.
- **LITERATURE CITED** – A listing of all literature cited in the report.

This technical report does not include a detailed description of the UARP Alternative Licensing Process (ALP) or the project, which can be found in the following sections of the Licensee's application for a new license: The UARP Relicensing Process, Exhibit A (Project Description), Exhibit B (Project Operations), and Exhibit C (Construction).

In addition, this technical report does not include a discussion regarding the effects of the projects on channel morphology or associated environmental resources, nor does the report include a discussion of appropriate protection, mitigation, and enhancement measures. An impacts discussion regarding the UARP is included in the applicant-prepared preliminary draft environmental assessment (PDEA) document, which is part of the Licensee's application for a new license. Development of resource measures will occur in settlement discussions, which will commence in 2004, and will be reported on in the PDEA.

2.0 BACKGROUND

2.1 Channel Morphology Study Plan

The Channel Morphology Study Plan was developed and approved by the Aquatic Technical Working Group (TWG) on April 11, 2002. The UARP Relicensing Plenary Group approved the study plan on May 1, 2002. This study plan was designed to address, in part, the following issue questions developed by the UARP Relicensing Plenary Group:

Issue Question 5. What effects do project features and operations have on fluvial geomorphology and stream habitat?

Issue Question 6. What are the physical attributes (e.g., available pools and presence of large debris) of the projects? How have they been affected by the projects? What habitat is provided by those attributes (habitat mapping)?

Issue Question 19. Do project features affect distribution of large wood in streams? Do they comply with Forest Service standards?

Issue Question 23. What project flows affect recruitment and reproduction of riparian plants?

Issue Question 34. How are the project operations affecting gravel recruitment (related to spawning and macroinvertebrate habitat)?

Issue Question 48. Does the operation of the projects affect stream bank stability?

Issue Question 61. Do the existing minimum stream flow requirements adequately protect the fluvial geomorphologic processes?

Specifically, the objectives of the study plan were to identify:

- Potential response reaches within the UARP and in the Reach Downstream of Chili Bar.
- The effects of the projects on channel morphology: sediment transport and LWD dynamics, loading, and function in response downstream reaches.
- Feasible measures to sustain geomorphic processes (e.g., sediment transport and LWD loading) that support aquatic and riparian habitat diversity in downstream reaches.

As described above, this technical report does not include a comprehensive impacts assessment of the UARP and Chili Bar Project on channel morphology. This assessment will be done during settlement discussions. Therefore, the portions of the Issue Questions and objectives that pertain to impacts analysis are not addressed in detail in this report.

The study area included all reaches affected by the two projects identified by the Aquatics TWG, including the Reach Downstream of Chili Bar.

In general, the methods approved by the UARP Relicensing Plenary Group included the application of channel morphology methods proposed by Rosgen (1996). Specifically, these methods included:

- Level I Geomorphic Characterization;
- Level II Morphological Description;
- Level III Channel Condition Assessment; and
- Additional Investigations depending on the results of the previous steps.

The results of the study would be used to describe the existing channel conditions and to identify potential problem areas (excess sediment, lack of bedload sediment, excessive scouring or channel entrenchment, lack or excess of LWD, poor riparian vegetation, etc.).

2.2 Water Year Type

The information in this subsection is provided for informational purposes, as requested by agencies. The derivation of water year types is described in the *Water Quality Technical Report*. Table 2.2-1 presents water year types for the period that is pertinent to this *Channel Morphology Technical Report*.

Table 2.2-1. Water year types applied to individual months of years 2001-2004.*

Year	Jan	Feb	Mar	Apr	May	June	July	Aug	Sep	Oct	Nov	Dec
2001	AN	D	D	D	D	D	D	D	D	D	D	D
2002	D	BN	BN	BN	BN	BN	BN	BN	BN	BN	BN	BN
2003	BN	BN	BN	D	BN	BN	BN	BN	BN	BN	BN	BN
2004	BN	BN	BN	BN	BN	BN	BN	BN	BN	-	-	-

*CD=Critically Dry; D=Dry; BN=Below Normal; AN=Above Normal; W=Wet

2.3 Agency Requested Information

In a letter dated December 17, 2003, the agencies requested that SMUD provide the following information with regard to channel morphology:

- Geographic Information Systems (GIS) map with validated channel classification of project-affected reaches, with the locations of Level II and III analysis sites delineated (This information is included in Appendix B of this *Channel Morphology Technical Report.*);
- Global Positioning System (GPS) coordinates of sites (Appendix F);
- Field survey methodology (Section 3.3);
- Level II and III data sheets with all survey information (Appendices G-L);
- Incipient motion analysis (Section 4.3);

- Field site visits to validate methods (e.g., bank full determination) (visits conducted to Ice House Dam Reach and Robbs Peak Dam Reach on June 23, 2004; to Loon Lake Dam Reach on July 12, 2004; to Slab Creek Dam Reach and Reach Downstream of Chili Bar on July 13, 2004);
- Field site photos (Appendix F);
- Aerial photography and videography conducted for the projects (previously provided on CD and DVD to TWG participants); and
- Review of this information to determine if additional field work is needed to complete Level III analysis and possibly Level IV analysis.

3.0 METHODS

The overall approach of this study involved geomorphic characterization (Rosgen Level I) of all river reaches downstream of dams using available maps and photographs, followed by morphological description (Rosgen Level II) and channel condition assessment (Rosgen Level III) in response reaches using site-specific measurements (Rosgen 1996). In addition, a bed incipient motion analysis is presented for each geomorphology site, where applicable, using Shields equation (Shields 1936).

Effects of dams and flow regulation on channel morphology are expected to be more pronounced in response reaches. Response reaches are reaches that are the most likely to show an impact from alterations to hydrology or sediment supply and are defined by Montgomery and Buffington (1998) as reaches with: 1) low slope (<4 percent); 2) predominantly alluvial bed and banks (cobble-gravel facies or finer); and 3) plane bed or pool-riffle morphology. Bedrock channels, or reaches with clasts comparable in size to depth of flow, remain relatively unaltered due to high sediment transport capacities and resistant substrate. Broad-level channel classification based on channel slope and confinement can be used to identify response reaches. Detailed field surveys are used to characterize channel morphology and describe existing geomorphic functions at response sites downstream of UARP and Chili Bar Project dams. These data may be used to identify and quantify the effects of changes in discharge and sediment regime on channel morphology.

3.1 Geomorphic Characterization

The first step in the channel morphology assessment included a geomorphic characterization (Level I) of stream reaches based on available data (Rosgen 1996). In this classification system, reaches are subdivided and assigned a letter designation based on the following channel attributes:

- Slope
- Planform (sinuosity)
- Entrenchment
- Valley type
- Landforms/soil type

Appendix A contains a schematic of the classification system (Rosgen 1996) depicting the channel form and associated metrics for each of the channel types in the Rosgen classification system.

Five primary data sources were used for the initial Level I channel characterization:

- United States Geological Survey (USGS) 1:24,000 topographic maps
- Channel slope data generated from a GIS
- Geologic maps
- Aerial photographs
- Video footage from helicopter aerial shoot.

Initially, USGS 1:24,000 topographic maps were evaluated to identify associations between topography and the processes that form them. These were used to determine the valley types within the study area, as defined by Rosgen (1996).

Next, channel slope data were generated from 1:24,000 USGS topographic maps and used as the basis for initial channel classification. Reach-scale gradients for all of the stream reaches were generated based on digitized and vectorized USGS 1:24,000 topographic separates. For this analysis, contour and stream network layers were used to generate the reach gradients at a 40-foot contour interval. The precision of the channel gradient data sets are the same as the USGS 1:24,000 topographic maps, which are generated from aerial photographic interpretation.

Geologic maps (Saucedo and Wagner 1992, Jenkins 1932) provided the locations of important changes in lithology, and provided an overall geologic context for analyzing field data.

Color aerial photographs taken in August 2002 at base flows for that season were orthorectified (1 foot = 1 pixel) and converted to a suitable format for use in GIS. Aerial photographs and low altitude (tree-top level) video coverage (August and October 2002) from a helicopter were used to define alluvial stream sections and to refine the slope-based channel geomorphic characterization.

In addition to these primary data sources, field data from coincidental habitat mapping, macroinvertebrate, and resident fish population surveys were used to determine the habitat type (low gradient riffle, run, pool, etc.) and the dominant bed material where these survey sites overlapped with the selected geomorphology study sites.

The purpose of the geomorphic characterization was to provide a broad classification that integrated valley morphology with channel relief, pattern, shape, and dimension for all stream reaches (Rosgen 1996). This information was used to identify potential response reaches. Potential response reaches were delineated based upon their slope, channel confinement, and bed and bank sediment composition (e.g., alluvial versus bedrock); these reaches occurred in Rosgen B, C, D, E, and F channel types.

3.2 Identify and Select Morphological Description and Channel Condition Assessment Sites

3.2.1 Identification of Potential Morphological Description and Channel Condition Assessment Sites

Morphological description (Level II) and channel condition assessment (Level III) sites were selected in consultation with the Aquatic TWG based on results of the geomorphic characterization (Level I). Wherever possible, sites were selected in response reaches. Survey sites were selected with the following characteristics:

- alluvial channel;
- slopes less than four percent (4%);
- well developed floodplains;
- accessible by field crews;
- coincide with the instream flow or other sites whenever possible; and
- sites where the channel is not confined by bedrock banks or valley walls.

In reaches where there was more than one potential survey site, the site where channel response to project operation is most likely to be evident was selected. The upstream-most response site in a stream reach was selected to measure potential scour below UARP or Chili Bar Project dams, and because effects of the projects can be more difficult to observe as new sources of sediment and water enter from tributaries downstream of a dam. Additional sites on some stream reaches were selected in the lower portion of the reach, where the combination of reduced peak flows and potentially increased sediment supply from tributaries can cause excess fine sediment deposition. In cases where the entire reach is confined by valley walls, survey sites were selected based on the presence of developed floodplains and continuous deposition of alluvial sediment.

3.2.2 Selection of Morphological Description and Channel Condition Assessment Sites

After geomorphic characterization (Level I), low altitude aerial photos and video footage conducted during a helicopter flyover of the study area were reviewed to confirm or reject potential sites.

3.2.2.1 Sites of the UARP

A total of 12 UARP sites were selected for morphological description (Level II) in conjunction with the Aquatics TWG on February 6, 2003. Each of these sites was also used for any channel condition assessment. UARP survey sites ranged from an elevation of 6,140 feet on the Rubicon River to 1,114 feet on the SFAR near the confluence of Rock Creek. Table 3.2-1 includes the list of Level II and III sites. Figure 3.2-1 is a summary map showing the locations of the Level II and III sites. Complete site maps are in Appendix B. Locations are also plotted on reach-scale longitudinal profile graphs in Appendix C.

Table 3.2-1. Sites for the UARP and the Reach Downstream of Chili Bar.

Site Code	Project Reach	Stream	Site Description	Rosgen Level	Length (feet)	Elevation (feet)	UTM (NAD 27) Upper End		UTM (NAD 27) Lower End	
							Easting	Northing	Easting	Northing
UPPER AMERICAN RIVER PROJECT AREA										
RD-G1	Rubicon Dam	Rubicon River	Rubicon Dam Reach Site	II and III	500	6,140	740129	4320854	740107	4320964
LL-G1	Loon Lake Dam	Gerle Creek	Upper Loon Lake Dam Reach Site	II and III	400	6,150	732038	4321014	731917	4321065
LL-G2	Loon Lake Dam	Gerle Creek	Middle Loon Lake Dam Reach Site	II and III	700	5,900	729615	4321280	729409	4321268
LL-G3	Loon Lake Dam	Gerle Creek	Lower Loon Lake Dam Reach Site	II and III	600	5,340	726848	4318075	726748	4317963
GC-G1	Gerle Creek Dam	Gerle Creek	Gerle Creek Dam Reach Site	II and III	800	5,020	725971	4314928	725814	4314817
RPD-G1	Robbs Peak Dam	South Fork Rubicon River	Robbs Peak Dam Reach Site	II and III	900	5,130	725810	4314102	725643	4313979
IH-G1	Ice House Dam	South Fork Silver Creek	Upper Ice House Dam Reach Site	II and III	1,200	5,190	727497	4299547	727289	4299300
IH-G2	Ice House Dam	South Fork Silver Creek	Lower Ice House Dam Reach Site	II and III	1,300	4,665	722203	4301833	722142	4302103
JD-G1	Junction Dam	Silver Creek	Junction Dam Reach Site	II and III	820	4,200	*	*	*	*
CD-G1	Camino Dam	Silver Creek	Camino Dam Reach Site	II and III	700	2,380	710325	4298451	710194	4298291
SFAR-G1	SF American	SF American	SF American River Reach Site	II and III	520	1,980	708402	4296421	708253	4296406
SC-G1	Slab Creek Dam	SF American	Slab Creek Dam Reach Site	II and III	650	1,114	693510	4294895	693338	4294848
REACH DOWNSTREAM OF CHILI BAR										
CB-G1	Upper Subreach	SF American	Upper Canyon Site	II	1,000	840	686944	4293491	687153	4293697
CB-G2	Middle Subreach	SF American	Upper Coloma Site	II and III	650	764	684924	4295468	684751	4295494
CB-G3	Middle Subreach	SF American	Lower Coloma Site	II and III	700	680	680615	4297466	680466	4297595
CB-G4	Lower Subreach	SF American	Gorge Site	II	600	502	674040	4293233	673908	4293156

* Poor satellite signal

3.2.2.2 Sites in the Reach Downstream of Chili Bar

In consultation with the Aquatics TWG on September 4, 2003, four sites were selected for morphological description (Level II) in the Reach Downstream of Chili Bar. Of these, only two were selected for channel condition assessment (Level III). Sites that were not chosen for channel condition assessment (Level III) were located in areas where the river is confined within a steep bedrock gorge with bedrock and large boulder channel substrate and few alluvial deposits. Survey sites in the Reach Downstream of Chili Bar ranged from an elevation of 840 feet to 502 feet on the SFAR. Table 3.2-1 includes the list of Level II and III sites. Figure 3.2-1 is a summary map showing the locations of the Level II and III sites. Complete site maps are in Appendix B. Locations are also plotted on reach-scale longitudinal profile graphs in Appendix C.

3.3 Morphological Description and Channel Condition Assessment

Morphological description (Level II) and channel condition assessment (Level III) data were collected following the survey methodologies and protocols listed below. During each visit, standardized Level II and Level III data sheets were completed. Appendix D includes sample datasheets.

3.3.1 Morphological Description Surveys

Morphological description (Level II) field surveys included, but were not limited to, the following site-scale measurements:

- longitudinal profile (water surface and thalweg);
- approximately three monumented channel cross-sections, each surveyed at intervals sufficient to clearly depict channel geometry (Harrelson *et al*. 1994);
- pebble counts of channel substrate at cross-sections (Wolman 1954); and
- bankfull indicators, thalweg, water's edge, and flood-prone areas were delineated where identifiable.

Each cross-section was photo-documented and any observations of potential anthropogenic influences on the channel were recorded, including excess fine sediment, excessively coarse channel bed, or channel incision. A site was approximately 20 to 30 bankfull widths in length, where appropriate, with upper and lower boundaries geo-referenced. Nine sites were less than 20 to 30 channel widths long. These sites were short (<20 bankfull widths long) alluvial sections with bedrock channels immediately upstream and downstream.

The elevation of bankfull discharge was estimated at each site. Bankfull discharge is the flow rate at which the water surface is at the floodplain level, or the elevation of the top of channel banks (Leopold 1994). This discharge is thought to have morphological significance because it represents the breakpoint between active channel formation and floodplain formation (Copeland *et al.* 2000). Much research has focused on the concept of a single representative discharge, sometimes referred to as the channel-forming or dominant discharge, which may be used to determine stable channel geometry (Wolman and Miller 1960, Emmett 1975, Pickup and Warner 1976, Andrews 1980, Richards 1982, Ashmore and Day 1988, Leopold 1994, Nash 1994, Knighton 1998, Biedenharn *et al.* 2000, Copeland *et al.* 2000, Doyle *et al.* in review). Past research has shown that bankfull discharge (Q_{bf}) may approximate the channel-forming discharge in stable, alluvial channels (Wolman and Miller 1960, Emmett 1975, Andrews 1980, Leopold 1994). In the context of the Rosgen approach, bankfull discharge is "the single most important parameter used in Level II classifications" (Rosgen 1996). Therefore, a meaningful evaluation of the delineative criteria set forth in the Rosgen stream classification system, and its implications for channel maintenance in the UARP and the Reach Downstream of Chili Bar, depends on the successful determination of bankfull discharge from field surveys. In the field component of this study, bankfull elevations were estimated from field indicators, including:

- topographic breaks;
- top of bar surfaces;
- distinct changes in vegetation; and
- obvious differences in grain size distributions at the surface (Leopold 1994).

Establishing "reference" sites upstream of the reservoirs is advised to compare delineative criteria and verify bankfull stage elevations between sites of the same type (Rosgen 1996). Few candidates for such sites exist in the UARP or the Reach Downstream of Chili Bar, because many of the upstream areas are bedrock dominated, non-alluvial transport reaches. Those that do exist are not comparable in character to the sites within the study areas. Thus, reference reaches were not established in the context of this study.

There are several important caveats concerning the definition and interpretation of bankfull discharge. First, field estimations of bankfull are generally difficult to make given the number of different criteria in common use to define bankfull stage, none of which appear to be universally applicable and/or free of subjectivity (Leopold *et al.* 1992, Leopold 1994, Copeland *et al.* 2000). Identification of bankfull indicators in the field should only be performed in stream channels that are stable and alluvial (Knighton 1998, Copeland *et al.* 2000). Thus, channels that are not stable, in the sense that they are adjusting to present or past human disturbance (e.g. dam construction, road building, instream mining), may not be good candidates for reliable bankfull estimation. Likewise, channels that deviate from the self-forming, alluvial channels typical of lowland, flat regions of a watershed, are also less likely to display clear bankfull indicators. As an alternative to bankfull, research has shown that the channel-forming discharge in alluvial channels may correlate best with the *effective* discharge (Q_{eff}), or the discharge that transports the largest fraction of the average annual bed-material load (Pickup and Warner 1976, Richards 1982, Ashmore and Day 1988, Nash 1994, Biedenharn *et al.* 2000, Copeland *et al.* 2000, Doyle *et al.* in review).

Bedrock and boulder dominated mountain streams adjust according to a wide range of flows that mobilize both coarse and fine boundary sediments (Nolan *et al*. 1987, Wohl 2000, McBain and Trush 2004). Rapid variations in valley width, channel cross-sectional form, slope, substrate composition, and other roughness elements, such as the presence or absence of vegetation or woody debris, contribute to the high variability of both velocity and channel dimensions in mountain environments (Wohl 2000). Therefore, indirect calculations of discharge (e.g., by Manning (1889) or Chezy (1769) equations (as presented in Knighton 1998)) may be imprecise given the complexity of grain, form, free-surface and boundary roughness in these environments. Further, the assumptions of downstream hydraulic geometry (e.g., empirical relations that assume that discharge (Q) is the dominant independent variable (Leopold and Maddock 1953)), on which the concept of a single channel forming discharge is based, may be less applicable in mountain rivers that are strongly influenced by non-fluvial processes (e.g., debris flows, landslides, glaciers), bedrock control, and/or large woody debris (McBain and Trush 2004, Wohl *et al*. 2004). Thus, field estimated bankfull elevations in these systems will naturally vary according to local controls over relatively short distances along a stream's longitudinal profile. There may also be few bankfull indicators along mountain streams: floodplain surfaces "are most prominent along low-gradient, meandering reaches…" and "are often hard or impossible to identify along steeper mountain streams" (Harrelson *et al.* 1994). This is because the rough channel boundaries and high transport capacity typical of these systems often leave little or no trace of a floodplain deposit.

Stream channels within the UARP and the Reach Downstream of Chili Bar are all strongly influenced by the underlying metamorphic and igneous complex that creates the Sierra Nevada range and foothills. Segments of these channels with alluvial deposits have been distinguished from those that are entirely bedrock controlled as potential "response" sites, where Level II and III channel morphology surveys were completed. Yet, as described by McBain and Trush (2004), these are "highly dynamic depositional environments" where large-scale geomorphic controls such as bedrock and boulders control the deposition of finer material as "nested" features. The significance of various flow thresholds and the existence of downstream hydraulic relationships are being studied in bedrock dominated and mountain channels, but show few significant correlations (Wohl *et al*. 2004, Wohl in review). In addition, it is important to note that the alluvial deposits that do occur in the UARP and Reach Downstream of Chili Bar may still be adjusting to changes to sediment and discharge regime under the recent 40-60 years of dam regulation. Considering all of the above, field estimates of bankfull level indicators may be expected to be highly variable over short reaches of channel, and potentially unreliable in some reaches. These factors combine to make estimates of bankfull discharge highly variable for most sites in the UARP and the Reach Downstream of Chili Bar. To obtain some understanding of the variability involved in the discharge estimates, and the meaningfulness of the field bankfull indicators, the study results are discussed in the context of current and pre-regulation hydrology in Section 4.4 of this report.

In some cases, field conditions precluded collecting cross-section survey data across the entire channel width at the flood-prone elevation, due to particularly wide floodplains, flood elevations above the upper terrace surfaces, thick vegetation, steep slopes, or other factors. In these cases, surveyor observations, extrapolated slope angle data, field notes, and/or site photographs were used to estimate the flood-prone width as accurately as possible. Slope extrapolations were typically based on the slope angles defined by the last few surveyed points. In most cases, potential errors from flood-prone width estimates would not affect channel classification because cross-section survey data (or on-site observations) had already documented a sufficiently wide flood-prone width to place the cross-section in the highest entrenchment ratio category (floodplain width/bankfull width greater than 2.2). In a few cases where the calculated entrenchment ratio was less than 2.2, there was very high confidence in the flood-prone width estimate.

3.3.2 Channel Condition Assessment

Channel condition assessment (Level III) data were collected at all 12 sites in the UARP and two sites in the Reach Downstream of Chili Bar. The following data were collected:

- bed surface texture based on facies mapping (stratification and delineation of channel bed features based on surface particle sizes and organization);
- sediment deposition in pools using the V* method (USFS 1997, Lisle and Hilton 1992, Hilton and Lisle 1993), where possible and applicable;
- streambank and channel condition and stability;
- riparian vegetation condition and potential;
- depositional features, meander pattern, and debris jam condition; and
- large woody debris (LWD) loading and function.

Pool selection for the V* method is based on the process described by Hilton and Lisle (1992, 1993). Hilton and Lisle suggest that the usefulness of V* is limited to channels with:

- a wide range in particle size between armor layers and fine sediment in pools;
- a single thread;
- pool-riffle morphology;
- stable banks;
- bed gradient less than 5%;
- pools that can be waded; and
- where significant volumes of fine sediment can be deposited in pools.

Field measurements should be taken during low-flow periods, when identifying the residual pool is easier. Pools should have a depth of at least 0.3 meters and a volume of at least 0.3 m^3. The size range of fine sediment varies by stream, but fine sediment typically consists of sand and small pebbles, but may include silt to medium pebbles. Fine sediments are distinguished from the coarser substrates in pools because fines are not armored, are distinctly finer than the rest of the bed, and easily penetrable with a metal rod (Lisle and Hilton 1993).

In practice, measurable fine sediment deposits were not observed in any pool for the sites in the UARP or the Reach Downstream of Chili Bar. In addition, several stream channels were plane-bedded, characterized by long stretches of relatively planar channel bed with a distinct lack of well-defined bedforms, and thus did not contain well-defined pools (as required for the V* method). As such, V* measurements were not taken at any site. Recognizing that the characterization of fine sediment accumulation in stream channels can be a useful guide in interpreting both geomorphic and biologic processes, field site visits were conducted with US Forest Service and SMUD personnel to determine an appropriate method to apply at response sites within the project areas. The effects of tributary inputs were discussed, yet it was determined that tributary influences were not easily identifiable at the channel surface, nor did an effective method exist to sufficiently address the balance between fine and coarse sediments in the main channel. Instead, it was proposed that surveys of riffle embeddedness would be performed at all but one response site, where a baseline quantification of fine sediment would be estimated. Embeddedness is the degree to which fine sediments surround coarse substrates on the surface of a streambed, and is often thought to indicate the level of substrate mobility as well as available habitat space for fish and macroinvertebrates. Embeddedness surveys require an appropriate method, as defined in the literature (Sylte and Fischenich 2002). Methods can include, but are not limited to, the following:

1. Visually estimate embeddedness to determine the percentage of surface area of the larger-sized particles covered by fine sediment.
2. A subset of relatively large particle sizes (site-specific) can be randomly selected and the percentage (to the nearest 10 percent) of each particle's height that is buried in the fine sediment can be noted by the extent of discoloration on the particle surface.
3. Fine sediment that is causing embeddedness can be characterized by visual estimation, or pebble count where possible.
4. Photographs of the substrate can be taken for further evaluation in the office.

The following methods are possible alternatives to V* in the UARP and the Reach Downstream of Chili Bar:

- embeddedness surveys at riffle locations at response sites – Rubicon Dam Reach, Loon Lake Dam Reach Middle and Lower sites, Robbs Peak Dam Reach, Ice House Dam Reach Upper and Lower sites, and the Upper Coloma Site in the Reach Downstream of Chili Bar; and
- sediment depth probing with a long metal rod or auger could be used to characterize overall fine sediment accumulation at the Loon Lake Dam Reach Upper Site.

At the remaining sites (Gerle Creek Dam, Junction Dam Reach, Camino Dam Reach, SFAR Reach, and Slab Creek Dam Reach in the UARP; and the Upper Canyon, Lower Coloma, and Gorge sites in the Reach Downstream of Chili Bar), the very low volumes of fine sediment present make alternative measurements of fine sediment accumulation unnecessary. Additional detail on the rationale for additional fine sediment assessment in each reach is provided in the results section.

LWD was defined according to the USFS Region 5 Stream Condition Inventory (SCI) protocol as all pieces of wood lying within the bankfull width of the channel that measured one half bankfull width or longer, with a minimum diameter of 6 inches. Only dead or dying, downed wood, with a portion lying within the bankfull channel was considered LWD. This involved dividing the LWD into size classes and tallying the total number of LWD pieces in each size class at each site. Key pieces of LWD were determined using the following criteria:

1. All pieces with length greater than 1.2 times the bankfull channel width; or
2. Pieces meeting criterion 1 and with diameters > 24 inches.

Because some LWD was suspended over the channel or was too small to alter bed morphology, the interaction between LWD and the bed was qualitatively assessed. A more detailed assessment of LWD is presented in the *Stream Habitat Mapping Technical Report.*

3.4 Channel Bed Mobility

A bed incipient motion analysis is presented for each geomorphology site, where applicable, using Shields equation (Shields 1936). The *EASI* (Enhanced Acronym Series with Interface) model, which implements the surface-based bedload equation of Parker (1990a, b), was used to evaluate normalized Shields stress and bedload transport based on cross-section, channel gradient, surface grain size distribution, and discharge input parameters. A more detailed description of the model and assumptions is included in Appendix M.

4.0 RESULTS

Maps with the geomorphic characterization (Level I) results are in Appendix B. Reach-scale longitudinal profiles with slope graphs are in Appendix C. In addition, each site was photo-documented and GPS coordinates were recorded for each cross-section and longitudinal profile. One representative photograph for each of the three cross-sections at every site can be found in Appendix E, and a table of GPS coordinates and a complete photographic record, including index, are included in Appendix F (on separate CD). For some sites, an alphanumeric channel type could not be designated based on every metric of the delineative criteria (e.g., entrenchment ratio, width/depth ratio, and sinuosity), as proposed by Rosgen (1996) (Appendix A). In these cases, an appropriate channel type was assigned based on the preponderance of data.

4.1 Results for the UARP

Morphological description (Level II) and channel condition assessment (Level III) data were collected for 12 sites in the UARP. Table 4.1-1 presents a summary of channel characteristics and data analysis results for the UARP. Appendix G includes longitudinal profile data, cross-section data, and pebble count tables for each site. Longitudinal profiles, cross-sections, and pebble count plots for each site are located in Appendix H. Level III data can be found in Appendix I. Facies maps for the UARP reaches can be found in Appendix O. All UARP geological setting descriptions are based on those previously presented in the Project Operation and Resource Utilization Section of the Initial Information Package, or IIP (SMUD 2001).

4.1.1 Rubicon Dam Reach Site (Geomorphology Site RD-G1)

Setting
The 4.1-mile-long Rubicon Dam Reach on Rubicon River extends from the base of Rubicon Dam (elevation 6,548 feet) downstream to the confluence with Miller Creek (elevation 6,030 feet), and has a mean gradient of approximately 0.019 (1.9 percent). There is a 1.5-mile, low-gradient meadow (at Rubicon Springs) at the lower end of the reach and another short, lower gradient section of river just upstream of the meadow. No major tributaries enter this reach.

The Rubicon River drains a glaciated watershed, much of which is designated as wilderness, and flows through many sections of exposed granite and steep, confined bedrock chutes. Approximately 75 percent of the watershed is underlain by Mesozoic granitic and dioritic rocks. The remainder consists of the Miocene Mehrten Formation, glacial moraine deposits, and minor outcrops of the Jurassic metasedimentary rocks of the Sailor Canyon Formation.

Morphological Description and Channel Condition Assessment
Morphological description (Level II) and channel condition assessment (Level III) data were collected along a 500-feet section of the Rubicon River located approximately 1.6 miles below Rubicon Reservoir at an approximate elevation of 6,140 feet (Figure 3.2-1). The site is located downstream of a narrow canyon, where the river enters a wide alluvial valley.

A mature conifer forest grows along the channel and on moderately steep (30-40 percent) valley slopes. The banks are well vegetated with thick grasses and deciduous understory. Survey measurements indicate that the channel at this site is an F4 channel type, with a moderate channel entrenchment (1.1-1.7), high width-to-depth ratio (41-125), local bed slope of 0.007 (0.7 percent), and a gravel-dominated substrate. This site is comprised of well vegetated, lateral and mid-channel gravel bars and has irregular meanders (S=1.12) with pool-riffle morphology. Raw banks of up to 12 inches were observed, but there was no evidence of recent sediment deposition or bar development. Woody debris was sparse in flood-prone areas. Key LWD pieces that span the channel were not observed at this site at the time of the survey.

V* measurements were not taken because fine sediment deposits were not observed in the pools at the site. Between the pools, cross-section pebble counts indicate that small gravel (<8 mm along the middle axis) accounts for an estimated 3-10% of the surface bed material, while sand and smaller portions (<2 mm along the middle axis) account for 12-15%. The frequency of dominant and subdominant substrates over the entire length of the Rubicon Dam Reach, as reported in the Stream Habitat Technical Report (July 2004), indicate a low-to-moderate presence of gravel, sand, and silt (2-17%). These data indicate at least a moderate presence of fine material, despite observations that fines have not accumulated in discrete patches on top of the channel bed in pools. Following site visits to selected locations with SMUD and USFS representatives, it was agreed that embeddedness surveys at riffle locations were a possible alternative to the V* method to better characterize the balance between fine and coarse sediment at this site.

Table 4.1-1. UARP geomorphic data summary table.

		Channel Geometry									Particle Size Distribution (mm)							Channel Type			Incipient Motion (cfs)
Site	XS	Mean Local Slope	S	W_{bf} (feet)	W_{fp} (feet)	D_{bf} max (feet)	D_{bf} mean (feet)	D_{fp} (feet)	W_{bf}/D_{bf}	E	D_{90}	D_{84}	D_{65}	D_{50}	D_{35}	D_{16}	D_{10}	Level II	Morph-ology	Type	
Rubicon Dam Reach (RD-G1)	Upper	0.007	1.12	73	122*	2.8	1.8	5.6	41	1.7*	82	60	43	30	22	11	1	F4	Pool-riffle	Response	168
	Middle			60	78	2.2	1.3	4.3	46	1.3	109	93	54	34	20	6	<1				189
	Lower			75	83	1.4	0.6	2.8	125	1.1	82	67	43	31	18	5	<1				184
Upper Loon Lake Dam Reach (LL-G1)	Upper	0.007	1.25	22	300*	3.4	2.2	6.9	10	14*	--	--	--	*3.5*	--	--	--	E5	Pool-riffle	Response	NA
	Middle			34	224*	4.9	3.9	9.8	9	6.6*	--	--	--	*0.3*	--	--	--				
	Lower			23	125*	3.7	2.9	7.4	8	5.4*	--	--	--	*3.0*	--	--	--				
Middle Loon Lake Dam Reach (LL-G2)	Upper	0.013	1.05	54	294*	2.6	1.6	5.2	34	5.4*	245	148	103	40	31	17	13	C3	Plane-bed	Response	149
	Middle			38	350*	2.6	1.3	5.3	29	9.3*	270	172	104	74	44	14	8				86
	Lower			51	400*	2.1	1.1	4.2	46	7.8*	200	170	110	90	70	40	30				326
Lower Loon Lake Dam Reach (LL-G3)	Upper	0.005	1.18	97	280*	4.2	1.4	8.3	69	2.9*	110	95	70	50	35	10	1	C3	Pool-riffle	Response	940
	Middle			56	218.0	3.1	1.6	6.1	35	3.9	170	135	85	68	49	10	1				1241
	Lower			45	387*	3.5	2.2	6.9	20	8.5*	390	205	155	125	76	4	2				1057
Gerle Creek Dam Reach (GC-G1)	Upper	0.008	1.02	30	58*	4.3	1.2	8.6	25*	1.9	*1310*	*1165*	*650*	*18*	*2.9*	*2.4*	*2.3*	B2c	Bedrock/ Plane-bed	Transport	NA
	Middle			33	81	4.3	2.7	8.7	12	2.4	350	250	110	75	52	30	25	B3c	Bedrock/ Pool-riffle		
	Lower			15	172*	3.0	1.9	6.0	8	12*	83	75	65	50	35	18	12				
Robbs Peak Dam Reach (RPD-G1)	Upper	0.002	1.00	28	115	2.2	1.6	4.4	18	4.1	96	79	57	39	24	1	1	C4	Plane-bed/ Pool-riffle	Response	1568
	Middle			39	82	2.0	1.2	4.0	33	2.1	85	63	49	40	27	12	5				917
	Lower			39	94	3.4	2.4	6.7	16	2.4	143	78	41	28	16	1	1				1017
Upper Ice	Upper	0.002	1.03	53	133	2.7	1.5	5.4	35	2.5	32	29	20	16	11	2	1	C4	Plane-	Response	393

Table 4.1-1. UARP geomorphic data summary table.

		Channel Geometry									Particle Size Distribution (mm)							Channel Type			Incipient Motion (cfs)
Site	**XS**	**Mean Local Slope**	**S**	**W_{bf}** (feet)	**W_{fp}** (feet)	**D_{bf}** max (feet)	**D_{bf}** mean (feet)	**D_{fp}** (feet)	**W_{bf}/D_{bf}**	**E**	**D_{90}**	**D_{84}**	**D_{65}**	**D_{50}**	**D_{35}**	**D_{16}**	**D_{10}**	**Level II**	**Morph-ology**	**Type**	
House Dam Reach (IH-G1)	Middle			64	320*	3.9	1.7	7.7	38	5.0*	23	19	11	9	5	1	1		bed		320
	Lower			51	177*	5.0	2.7	10	19	3.5*	33	25	16	10	3	1	1				185
Lower Ice House Dam Reach (IH-G2)	Upper	0.006	1.18	124	251*	6.6	3.3	13	38	2*	*150*	*145*	*55*	*40*	*30*	*1*	*1*	C3	Plane-bed	Response	497
	Middle			62	206	3.3	2.1	6.7	30	3.3	*325*	*265*	*130*	*85*	*45*	*20*	*15*				775
	Lower			57	180	5.1	2.9	10	20	3.1	*175*	*130*	*85*	*40*	*15*	*1*	*1*				531
Junction Dam Reach (JD-G1)	Upper	0.013	1.04	75	92	3.5	1.8	6.9	42	1.2	*350*	*210*	*125*	*100*	*80*	*52*	*46*	B3c	Bedrock/ Plane bed	Transport	NA
	Middle			60	82	3.0	1.6	6.1	38	1.4	*120*	*112*	*83*	*60*	*42*	*23*	*18*				
	Lower			44	93	3.6	2.2	7.3	20	2.1	*115*	*107*	*84*	*69*	*57*	*45*	*38*				
Camino Dam Reach (CD-G1)	Upper	0.016	1.03	73	90	5.0	2.8	10	26	1.2	173	156	90	71	58	45	34	B3c	Bedrock/ Pool-riffle	Transport	NA
	Middle			89	120	7.8	4.1	16	22	1.3	*159*	*140*	*113*	*81*	*64*	*46*	*38*				
	Lower			77	120*	6.0	3.1	12	25	1.6*	*207*	*181*	*92*	*72*	*54*	*38*	*25*				
SFAR Reach (SFAR-G1)	Upper	0.009	1.02	80	148*	11	5.9	21	14	1.9*	300	280	163	128	104	59	23	B3c	Bedrock/ Pool-riffle	Transport	NA
	Middle			95	117	8.6	5.4	17	18	1.2	300	270	135	104	85	47	37				
	Lower			110	132	12	4.3	24	26	1.2	291	225	145	117	85	53	35				
Slab Creek Dam Reach (SC-G1)	Upper	0.028	1.03	111	159	4.4	2.3	8.9	48	1.4	600	450	310	240	190	130	115	B3	Bedrock/ Plane bed	Transport	NA
	Middle			71	162	5.6	2.9	11	24	2.3	410	370	240	179	150	100	85				
	Lower			62	106	4.8	2.9	9.7	21	1.7	460	395	220	190	145	90	80				

XS = Cross-section
S = Sinuosity
W/D = width/depth ratio
E = entrenchment ratio
fp = refers to floodprone width and/or depth
bf = refers to bankfull width and/or depth
D_{90} = bed particle size where 90 percent is finer
NA = Not Applicable (see text)
*Values based on estimated elevations (see text)
Counts with <100 particles, or no counts performed (see text)

4.1.2 Loon Lake Dam Reach Sites (Geomorphology Sites LL-G1, LL-G2, LL-G3)

Setting

The 8.9-mile Loon Lake Dam Reach on Gerle Creek extends downstream from the base of Loon Lake Dam (elevation 6,310 feet) to the normal high water line of Gerle Reservoir (elevation 5,231 feet), and has a mean gradient of approximately 0.023 (2.3 percent). Major tributaries along this reach include Jerrett, Barts, Dellar, and Rocky Basin creeks.

The Gerle Creek watershed is underlain by Mesozoic granitic and dioritic rocks, glacial moraine deposits, and minor outcrops of the Jurassic metasedimentary rocks of the Sailor Canyon Formation. Gerle Creek drains Loon Lake Reservoir and flows initially to the west through a wide and swampy Holocene alluvial valley (Neck Meadow and Gerle Meadow) that is surrounded by moderately sloping and glaciated hillsides. This upper subreach meandering across the alluvial valley is approximately five miles long. Between Johnny's Hill and Gerle Creek Reservoir (located at the confluence of Angel and Gerle creeks), the river flows along a lithologic contact between granitic rocks and glacial till deposits. This lower subreach is approximately three miles long.

Morphological Description and Channel Condition Assessment

Morphological description (Level II) and channel condition assessment (Level III) data were collected at three sites (Upper, Middle, and Lower) along Gerle Creek downstream of Loon Lake Dam. The 400-feet-long Upper Site is located about 0.5 miles downstream of Loon Lake Dam at an approximate elevation of 6,150 feet (Figure 3.2-1). The 700-feet-long Middle Site is located approximately 2.7 miles downstream of Loon Lake Dam at an elevation of 5,900 feet. Physical Habitat Simulation (PHABSIM) sites are located approximately 0.5 miles up and downstream of this site. The 600-feet-long Lower Site is located about 7.5 miles downstream from Loon Lake Dam at an elevation of approximately 5,340 feet. A PHABSIM site is located approximately 0.25 miles downstream from this site.

Upper Site (Geomorphology Site LL-G1): At this site, the valley is wide and the creek flows within a densely vegetated mountain meadow. Young and mature conifers grow together on low-lying banks along the channel and into the surrounding meadow. The floodplain is characterized by vegetated point and lateral bars, regular meanders (S=1.25), and subtle pool-riffle morphology. Survey measurements indicate that the channel at this site is an E5 channel type with very little entrenchment (5.4-14) and a low width-to-depth ratio (8-10). The average local bed slope is 0.007 (0.7 percent) and bed material is primarily fine to coarse sand. Thin silt deposits (0.04-0.20 inches) were observed over the entire channel bed. Several larger silt deposits of unknown thickness were noted behind flow obstructions and along the channel margins. Abundant medium to large sized woody debris occupies up to 30 percent of the active cross-sectional area. Several key pieces of LWD span the channel and act as velocity refuge, creating lateral scour pools. An estimated 30-50 percent of the active channel cross-section has been influenced by deposition and scour at obstructions, constrictions, and bends.

Although extensive fine sediment deposits were observed at this site, V* is not an appropriate method to use at this site due to the lack of distinct pool-riffle control points and the contiguous nature of the fine sediments that make up the channel bed. Depth sounding via a long metal rod or auger to estimate and characterize overall fine sediment accumulation at this site is a possible alternative to V*. Such data could be considered a baseline for comparison to future measurements and promote a better understanding of the balance between sediment supply and transport capacity at this location.

Middle Site (Geomorphology Site LL-G2): This site is located immediately downstream of the confluence with Jerrett Creek at the head of a densely vegetated mountain meadow (Gerle Meadow), downstream of a steeper reach. A largely mature conifer forest grows on low-lying banks along the channel and into the surrounding meadow. The floodplain is characterized by a wide, straight channel with few meanders (S=1.05) and numerous lateral bars. Banks are well vegetated and low lying. Survey measurements indicate a C3 channel type with little entrenchment (5.4-9.3); high width-to-depth ratio (29-46); average local bed slope of 0.013 (1.3 percent); and bed material primarily comprised of small cobble. This site is characterized by plane-bed morphology with little bedform definition. Abundant medium to large sized woody debris was observed as single pieces and in jams. Many key pieces of LWD spanned the channel, although only a small number of these influenced channel morphology. Local scour, incision, fine sediment deposition, and/or enlargement of the channel were not observed. Many side channels were noted, commonly vegetated with grasses and herbaceous plants.

V* measurements were not taken because fine sediment deposits were not observed in the pools at the site. Cross-section pebble counts indicate that fine gravel (<8 mm along the middle axis) accounts for an estimated 1-5% of the surface bed material, while sand and smaller portions (<2 mm along the middle axis) account for 1-5%. The frequency of dominant and subdominant substrates over the entire length of the Loon Lake Dam Reach, as reported in the Stream Habitat Technical Report (July 2004), indicate a moderate presence of gravel, sand, and silt (8-22%). These data indicate a at least a moderate presence of fine material, despite observations that fines are not located in discrete patches on top of the channel bed in pools. Following site visits to selected locations with SMUD and USFS representatives, it was agreed that embeddedness surveys at riffle locations were a possible alternative to the V* method to better characterize the balance between fine and coarse sediment at this site.

Lower Site (Geomorphology Site LL-G3): This site is located in a shallow valley downstream of the Ice House (Wentworth Springs) Road Bridge. Valley slopes are moderately steep (30-40 percent) with no evidence of historical or recent mass wasting episodes. A mature conifer forest with a moderately dense understory occupies the valley floor and side slopes at the site. Dense riparian vegetation, from large trees to small brush, covers the banks. The channel is characterized by pool-riffle morphology with point bar formation resulting in regular meanders (S=1.18). Survey measurements indicate a C3 channel type. The channel is slightly entrenched (2.9-8.5) with a high width-to-depth ratio (20-69), average local bed slope of 0.005 (0.5 percent), and bed material comprised primarily of cobble and gravel. Several high-flow side channels and debris jams were observed above the bankfull elevation along the right bank. Medium to large sized woody debris is present in the bankfull channel. One key piece of large woody debris (LWD) created a plunge pool with reduced flow velocity. Isolated areas of recent scour and deposition were observed at the time of the survey, indicating that the channel is geomorphically active.

V* measurements were not taken because fine sediment deposits were not observed in the pools at the site. Sand is present in low-velocity and less turbulent pockets along the channel margins. Cross-section pebble counts indicate that fine gravel (<8 mm along the middle axis) accounts for an estimated 0-4% of the surface bed material, while sand and smaller portions (<2 mm along the middle axis) account for 10-15%. The frequency of dominant and subdominant substrates over the entire length of the Loon Lake Dam Reach, as reported in the Stream Habitat Technical Report in July 2004, indicate a moderate presence of gravel, sand, and silt (8-22%). These data indicate a at least a moderate presence of fine material, despite observations that fines are not located in discrete patches on top of the channel bed in pools. Following site visits to selected locations with SMUD and USFS representatives, it was agreed that embeddedness surveys at riffle locations were a possible alternative to the V* method to better characterize the balance between fine and coarse sediment at this site.

4.1.3 Gerle Creek Dam Reach Site (Geomorphology Site GC-G1)

Setting
The 1.1-mile-long Gerle Creek Dam Reach on Gerle Creek extends from the base of Gerle Creek Dam (elevation 5,182 feet) to the confluence with the South Fork Rubicon River (SFRR) (elevation 4,980 feet), and has a mean gradient of approximately 0.035 (3.5 percent).

The Gerle Creek watershed is underlain by Mesozoic granitic and dioritic rocks, glacial moraine deposits, and minor outcrops of Jurassic metasedimentary rocks of the Sailor Canyon Formation. The creek is confined in a narrow canyon with vertical canyon walls near Gerle Creek Dam. The 0.5-mile section below Gerle Creek Dam is scoured to granitic bedrock and boulders. The channel in the lower portion of the reach is less confined and valley walls are less steep.

Morphological Description and Channel Condition Assessment
Morphological description (Level II) and channel condition assessment data (Level III) were collected along an 800-feet section of Gerle Creek, approximately 0.8 mile below Gerle Creek Reservoir at an elevation of 5,020 feet (Figure 3.2-1). A PHABSIM site is located approximately 0.1 mile upstream from this site.

At this site, valley slopes are gentle (<30 percent) and there is no evidence of active or historical mass wasting along the channel margins. High brush, grass, and annual forbs densely occupy the banks of the low-water flow channel. Survey measurements indicate a B2c channel type at the upper cross-section and B3c channel types at the lower two cross-sections. The channel is moderately to slightly entrenched (1.9-12), has a moderate to high width-to-depth ratio (8-25) and a mean local bed slope of 0.008 (0.8 percent). Substrate is dominated by boulders at the upper cross-section and cobble at the two lower cross-sections. Bedrock and boulders form a straight, narrow channel (S=1.02) with discontinuous plane-bed morphology. Woody debris was sparse within the bankfull channel and flood-prone areas. Key LWD pieces that span the channel were not observed along at this site.

Most of the medium grained and finer sediment fractions are absent, although one fine sediment deposit was observed in the tail end of a large pool near the lower cross-section. No fine sediment was observed deposited on the channel bed, suggesting that these grain size fractions are scoured and that transport capacity exceeds fine sediment supply. As a result, V* measurements are not applicable at this site.

4.1.4 Robbs Peak Dam Reach Site (Geomorphology Site RPD-G1)

Setting
The 5.6-mile-long Robbs Peak Dam Reach on SFRR extends from the base of Robbs Peak Forebay (elevation 5,205 feet) downstream to the confluence with Rubicon River (3,540 feet), and has a mean gradient of approximately 0.055 (5.5 percent). Major tributaries to this reach include Gerle and South creeks.

The SFRR watershed is underlain by Mesozoic granitic rocks, glacial moraine deposits, minor outcrops of the Miocene Mehrten Formation, Jurassic metasedimentary rocks of the Sailor Canyon Formation, and Paleozoic metasedimentary rocks. Upstream of the Gerle Creek confluence, the river flows through a glaciated, low relief granitic landscape. Downstream of the Gerle Creek confluence, the river is characterized by progressive entrenchment within the surrounding canyon. For the first two miles, the river is confined by moderate granitic canyon slopes. A contact between granitic and Paleozoic metasedimentary rocks marks a transition from the moderate canyon to a deep gorge with 1,500-feet walls.

Morphological Description and Channel Condition Assessment
Morphological descriptions (Level II) and channel condition assessment data (Level III) were collected along a 900-foot section of the SFRR, approximately 0.5 mile below Robbs Peak Forebay at an elevation of 5,130 feet (Figure 3.2-1). In order to avoid effects from upstream project facilities on Gerle Creek, this site is located upstream of the SFRR/Gerle Creek confluence. A PHABSIM site is located approximately 0.1 mile downstream of the site.

At this site, valley slopes are gentle (<30 percent) with relatively high plant density and vigor, and there was evidence of infrequent mass wasting episodes. The floodplain is characterized by irregular meanders (S=1.00) with numerous mid-channel bars and overflow channels. The mid-channel cobble bars and streambanks are heavily vegetated with willows, and small conifers are growing on recently scoured surfaces. Survey measurements indicate a C4 channel type with slight entrenchment (2.1-4.1), high width-to-depth ratio (16-33), mean local bed slope of 0.002 (0.2 percent), and gravel-dominated substrate. Coarse sands also represent a moderate fraction of the surface grain size distribution. This site exhibits primarily plane-bed and pool-riffle morphology. Woody debris is absent from the low-flow channel, but medium to large sized woody debris (e.g., large limbs, branches, small logs, and/or portions of trees) occupied up to 10 to 30 percent of the active cross-sectional area above the low-flow wetted perimeter. Key LWD pieces that span the channel were not observed at this site.

V* measurements were not taken because fine sediment deposits were not observed in the pools at the site. Cross-section pebble counts indicate that fine gravel (<8 mm along the middle axis) accounts for an estimated 1-4% of the surface bed material, while sand and smaller portions (<2 mm along the middle axis) account for 8-25%. On the ground habitat mapping was not performed for the Robbs Peak Dam Reach, so reach-long estimates of substrate composition are not available. The pebble count data indicate at least a moderate presence of fine material, despite observations that fines are not located in discrete patches on top of the channel bed in pools. Following site visits to selected locations with SMUD and USFS representatives, it was agreed that embeddedness surveys at riffle locations were a possible alternative to the V* method to better characterize the balance between fine and coarse sediment at this site.

4.1.5 Ice House Dam Reach Sites (Geomorphology Sites IH-G1, IH-G2)

Setting
The 11.5-miles-long Ice House Dam Reach on South Fork Silver Creek (SFSC) extends from the base of Ice House Dam (elevation 5,300 feet) to the normal high water line of Junction Reservoir (elevation 4,460 feet), and has a mean gradient of approximately 0.014 (1.4 percent). The reach is characterized by moderate valley walls that confine the channel to a narrow floodplain. Peavine Creek, Winmiller Ravine, and Big Hill Canyon are the three major tributaries in this reach.

SFSC is located in the southeastern portion of the project area and is underlain by Mesozoic granitic rocks, Paleozoic metasedimentary rocks, glacial moraine deposits, and Miocene Mehrten Formation rocks. Downstream of Ice House Reservoir, SFSC flows through a steep, granitic canyon that transitions into a deep gorge as the lithology shifts to Paleozoic metasedimentary rocks near the Silver Creek Campground. In 1992, the Cleveland Fire burned approximately 75 percent of the watershed (24,000 acres) downstream of Ice House Reservoir (USDA 1993).

Morphological Description and Channel Condition Assessment
Morphological descriptions (Level II) and channel condition assessment data (Level II) were collected at two sites (Upper and Lower) along SFSC downstream of Ice House Reservoir. The 1,200-feet-long Upper Site is located approximately 1.5 miles downstream from the Ice House Reservoir at the Silver Creek Campground (Figure 3.2-1). PHABSIM studies were completed approximately 0.1 mile downstream of this site. The approximate elevation of the site is 5,190 feet. This site was not affected by the Cleveland Fire. The 1,300-feet-long Lower Site is located approximately 8.6 miles downstream of Ice House Reservoir at an elevation of approximately 4,665 feet. Again, a PHABSIM site is located approximately 0.1 mile downstream from this site. The Lower Site burned during the Cleveland Fire.

Upper Site (Geomorphology Site IH-G1): At this site, valley slopes are gentle (<30 percent) with no evidence of recent major mass wasting episodes. The channel is characterized by plane-bed morphology, regular meander and point bar formation (S=1.03), banks stabilized by vegetation, and frequent terrace surfaces ranging from 10-16 feet above the estimated bankfull elevation. Survey measurements indicate a C4 channel type that is slightly entrenched (2.5-5) with high width-to-depth ratio (19-38) and an average local bed slope of 0.002 (0.2 percent). Bed material is primarily unconsolidated coarse sand and gravel that forms frequent bars along the channel margins. Local zones of bank scour and recent bar deposition suggest that sediment transport may occur regularly at moderate flows, and that the channel is likely sensitive to changes in discharge and sediment supply. Medium to small sized woody debris was present in moderate amounts, but has a limited effect on channel morphology. The lower section of this site contains several key LWD pieces that span the channel. These LWD pieces are firmly embedded, form backwater pools, act as instream cover, and effectively reduce flow velocity.

Fine sediment deposits were observed only on the floodplain surfaces, not in the base flow active channel. Residual pool filling measurements (V*) were not taken at this site because of the dominant plane-bed morphology, which lack distinct bedforms required by V*. Cross-section pebble counts indicate that fine gravel (<8 mm along the middle axis) accounts for an estimated 10-20% of the surface bed material, while sand and smaller portions (<2 mm along the middle axis) account for 15-27%. The frequency of dominant and subdominant substrates over the entire length of the Ice House Dam Reach, as reported in the Stream Habitat Technical Report in July 2004, indicate a low-to-moderate presence of gravel, sand, and silt (1-15%). These data indicate at least a moderate presence of fine material, despite observations that fines have not accumulated in discrete patches on top of the channel bed in well-defined pools. Following site visits to selected locations with SMUD and USFS representatives, it was agreed that embeddedness surveys at riffle locations were a possible alternative to the V* method to better characterize the balance between fine and coarse sediment at this site.

Lower Site (Geomorphology Site IH-G2): This site is within the burned section of Ice House Dam Reach. The historically dominant conifer forest is slowly recovering on valley hillslopes that are primarily covered with dead wood and litter from the recent fires. The channel banks, which have been re-colonized by willow and alder, exhibit small amounts of erosion. This site exhibits primarily plane-bed morphology (S=1.18). Survey measurements indicate a C3 channel type that is slightly entrenched (2-3.3) with a high width-to-depth ratio (20-38) and an average local bed slope of 0.006 (0.6 percent). Although two medium-sized log jams and many pieces of LWD were observed at this site, most of the wood is only touching the wetted channel and is perched up on boulders and channel banks. There were no key pieces observed at this site.

Grain size distributions indicate that coarse gravel and small cobble are the dominant size classes in the main channel, although field observations suggest that the channel is highly embedded. Recent sand deposits are present on floodplains and terraces, and moderate deposition of new gravel and coarse sand was apparent on old and new bars. Thin silt deposits were observed over the entire bed within the active channel. More extensive silt deposits of unknown thickness were noted behind flow obstructions and along the channel margins. No discrete deep deposits were observed. Residual pool filling measurements (V*) were not taken at this site because of the dominant plane-bed morphology, which lack distinct bedforms required by V*. Cross-section pebble counts indicate that fine gravel (<8 mm along the middle axis) accounts for an estimated 2-8% of the surface bed material, while sand and smaller portions (<2 mm along the middle axis) account for 0-25%.

The frequency of dominant and subdominant substrates over the entire length of the Ice House Dam Reach, as reported in the Stream Habitat Technical Report in July 2004, indicate a low-to-moderate presence of gravel, sand, and silt (1-15%). These data indicate a moderate presence of fine material, despite observations that fines have not accumulated in discrete patches on top of the channel bed in well-defined pools. Following site visits to selected locations with SMUD and USFS representatives, it was agreed that embeddedness surveys at riffle locations were a possible alternative to the V* method to better characterize the balance between fine and coarse sediment at this site.

4.1.6 Junction Dam Reach Site (Geomorphology Site JD-G1)

Setting

The 8.3-miles-long Junction Dam Reach on Silver Creek extends from the base of Junction Dam (elevation 4,300 feet) to the normal high water line of Camino Reservoir (elevation 2,195 feet), and the mean gradient is approximately 0.032 (3.2 percent). Major tributaries to this reach include Gray House Creek, Bear Creek, Davis Creek, and Onion Creek.

The watershed in the Junction Dam Reach is underlain by Paleozoic metasedimentary rocks and rocks of the Mehrten Formation. Silver Creek enters Paleozoic metasedimentary rocks just above Junction Dam and flows through a steep and highly confined gorge for most its course prior to the confluence with the SFAR.

Morphological Description and Channel Condition Assessment

Morphological descriptions (Level II) and channel condition assessment data (Level III) were collected along an 820-feet section of Silver Creek about 1.5 miles downstream from the base of Junction Dam at an approximate elevation of 4,200 feet (Figure 3.2-1). PHABSIM studies were also completed at this site.

At this site, valley slopes are steep (>60 percent) with a mature conifer forest occupying steep bedrock banks. The valley lies perpendicular to the strike of a high-grade metamorphic complex, creating cascades and riffles where flow encounters more resistant bedrock layers (S=1.04). The riparian zone is relatively narrow, with a few alder saplings established on the low water shoreline and infrequent lateral bar deposits. Survey measurements indicate a B3c channel type, with moderate entrenchment (1.2-2.1), high width-to-depth ratio (20-42), mean local bed slope of 0.013 (1.3 percent), and a cobble-dominated substrate. This site is primarily bedrock controlled with discontinuous plane-bed morphology and little to no LWD in the active channel.

Gravel exists in the matrix beneath the cobble armor layer and pockets of gravel are deposited in the low velocity zones on the downstream sides of large flow obstructions and along the channel margins. No fine sediment (silt/sand) was observed deposited on the channel bed surface in the main flow paths or in pools, suggesting that these grain size fractions are scoured and that transport capacity exceeds fine sediment supply. As a result, V* measurements are not applicable at this site.

4.1.7 Camino Dam Reach Site (Geomorphology Site CD-G1)

Setting

The 6.2-miles-long Camino Dam Reach on Silver Creek extends from the base of Camino Dam (elevation 2,810 feet) to the confluence of Silver Creek and the SFAR (elevation 2,055 feet), and has a mean gradient is approximately 0.023 (2.3 percent). The primary tributary to this reach is Round Tent Canyon.

Below Camino Dam, Silver Creek enters Paleozoic metasedimentary rocks of the Mehrten Formation and flows through a steep and highly confined gorge for most its course prior to the confluence with the SFAR. Camino Reservoir is located in the gorge area between the Jaybird and Round Tent canyon tributaries.

Morphological Description and Channel Condition Assessment

Morphological descriptions (Level II) and channel condition assessment data (Level III) were collected along a 700-feet section of Silver Creek about 3.5 miles downstream of Camino Reservoir and 2.75 miles upstream from the confluence with the SFAR (near the Camino Tunnel Adit) (Figure 3.2-1). The approximate elevation of the site is 2,380 feet.

At this site, valley slopes are moderately steep (40-60 percent), show evidence of infrequent episodes of mass wasting in the past, and confine the flow to a relatively narrow channel with low sinuosity (S=1.03). General vegetative vigor and density is low, suggesting a shallow, discontinuous root mass. The riparian zone is narrow, with low plant diversity and density. Channel character and hydraulics are primarily controlled by large flow obstructions created by frequent bedrock outcrops and large boulders. Survey measurements indicate a B3c channel type with moderate entrenchment (1.2-1.6), high width-to-depth ratio (22-26), average local bed slope of 0.016 (1.6 percent), and cobble-dominated substrate. This site is primarily bedrock controlled with steep riffles and intermittent pools. This site has coarse substrate with little LWD present within the active channel.

Gravel exists in the matrix beneath the cobble armor layer and pockets of gravel are deposited in the low velocity zones on the downstream sides of large flow obstructions and along the channel margins. No fine sediment (silt/sand) was observed deposited on the channel bed surface in the main flow paths or in pools, suggesting that these grain size fractions are scoured and that transport capacity exceeds fine sediment supply. As a result, V* measurements are not applicable at this site.

4.1.8 South Fork American River Reach Site (Geomorphology Site SFAR-G1)

Setting

The 2.8-miles-long SFAR Reach on SFAR extends from the confluence with Silver Creek (elevation 2,040 feet) to the normal high water line of Slab Creek Reservoir (elevation 1,850 feet), and has a mean gradient of 0.012 (1.2 percent). Bedrock walls confine the river in this narrow canyon and there are a few locations with floodplains on both sides of the channel. There are no major tributaries to the river in this reach.

The SFAR is underlain by Mesozoic granitic rocks, Paleozoic metasedimentary rocks, rocks of the Miocene Mehrten Formation, and glacial moraine deposits. From its confluence with Silver Creek to Slab Creek Dam, the river flows through a deep canyon composed of Paleozoic metasedimentary rocks. Steep valley slopes and bedrock walls confine the channel from bank to bank in many sections of the river in this area.

Morphological Description and Channel Condition Assessment
Morphological descriptions (Level II) and channel condition assessment data (Level III) were collected along a 520-feet section of the SFAR located approximately 2.2 miles upstream from the normal high water line of Slab Creek Reservoir at an elevation of 1,980 feet (Figure 3.2-1). The upstream portion of the SFAR above the Silver Creek confluence is out of the project area.

At this site, valley slopes are moderately steep (40-60 percent) and sparsely vegetated. Evidence of frequent or large mass wasting episodes that annually deliver sediment to the channel was observed. Bedrock and boulders form a straight, narrow channel (S=1.02) with coarse boulder and cobble point bars. Riparian vegetation is poorly established due to the lack of fine sediment deposition and steep bedrock banks. Survey measurements indicate a B3c channel type with high to moderate entrenchment (1.2-1.9), high width-to-depth ratio (14-26), average local bed slope of 0.009 (0.9 percent), and cobble-dominated substrate. Although the pebble counts indicate a cobble channel bed, field observations suggest this is only a thin layer covering boulders and bedrock. This site is primarily bedrock controlled with steep riffles and intermittent pools. There is little evidence of bank erosion. Little to no LWD is present within the active channel.

Gravel exists in the matrix beneath the cobble armor layer and pockets of gravel are deposited in the low velocity zones on the downstream sides of large flow obstructions and along the channel margins. No fine sediment (silt/sand) was observed deposited on the channel bed surface in the main flow paths or in pools, suggesting that these grain size fractions are scoured and that transport capacity exceeds fine sediment supply. As a result, V* measurements are not applicable at this site.

4.1.9 Slab Creek Dam Reach Site (Geomorphology Site SC-G1)

Setting
The 8.0-miles-long Slab Creek Dam Reach on the SFAR extends from the base of Slab Creek Dam (elevation 1,620 feet) to the normal high water line of Chili Bar Reservoir (elevation 990 feet), and has a mean gradient of approximately 0.015 (1.5 percent). Bedrock walls confine the river in this narrow canyon and there are few locations with floodplains on both sides of the channel. The largest alluvial deposits of sediments are located on the inside of meander bends or in pools forming isolated breaks in the steep river gradient. Tributaries to the SFAR along this reach include Redbird Creek, Iowa Canyon, South Canyon, Mosquito Creek, Jaybird Creek, Rock Creek, and White Rock Creek.

The lithology of the SFAR includes Mesozoic granitic rocks, Paleozoic metasedimentary rocks, Miocene debris deposits, and Pleistocene glacial moraine deposits. Downstream of the Slab Creek Dam, the lithology changes from Paleozoic metasedimentary rocks to Mesozoic granitic rocks, with lithology changing back to metasedimentary rocks at the Rock Creek confluence.

Morphological Description and Channel Condition Assessment

Morphological descriptions (Level II) and channel condition assessment data (Level III) were collected along a 650-feet section of the SFAR between the confluences of Jaybird Creek and Rock Creek, nearly 4.6 miles below Slab Creek Dam. The approximate elevation at the site is 1,114 feet (Figure 3.2-1). The site is approximately 0.1 mile upstream from the lower Slab Creek fish survey and PHABSIM sites and approximately 1.75 miles downstream of the benthic macroinvertebrate site. At the Slab Creek fish survey sites, only the upper segment had considerable gravel (30 percent) and cobble (40 percent) bed material. Neither of the macroinvertebrate sampling sites had continuous alluvial deposits in the Slab Creek Dam Reach.

At this site, valley slopes are steep (>60 percent), sparsely vegetated, and show evidence of infrequent mass wasting episodes. Bedrock and boulders form a straight, narrow channel (S=1.03) with coarse boulder and cobble point bars. Riparian vegetation is poorly established due to the lack of fine sediment deposition and steep bedrock banks. Survey measurements indicate that the channel at this site is a B3 channel type, with moderate to slight entrenchment (1.4-2.3), a high width-to-depth ratio (21-48), an average local bed slope of 0.028 (2.8 percent), and a cobble dominated substrate. Although the pebble counts indicate a cobble channel bed, field observations suggest this is only a thin layer covering boulders and bedrock. Local channel morphology includes bedrock and plane-bed environments, with little to no LWD present within the active channel. There is little evidence of bank erosion.

Gravel exists in the matrix beneath the cobble armor layer and pockets of gravel are deposited in the low velocity zones on the downstream sides of large flow obstructions and along the channel margins. No fine sediment (silt/sand) was observed deposited on the channel bed surface in the main flow paths or in pools, suggesting that these grain size fractions are scoured and that transport capacity exceeds fine sediment supply. As a result, V* measurements are not applicable at this site.

4.2 Results for the Reach Downstream of Chili Bar

Morphological description (Level II) surveys were conducted for four sites in the Reach Downstream of Chili Bar. Of these, channel condition assessment (Level III) data were collected for the two sites in the Middle Subreach. Table 4.2-1 presents a summary of channel characteristics and data analysis results for the Reach Downstream of Chili Bar. Appendix J includes longitudinal profile data, cross-section data, and pebble count tables for each site. Longitudinal profiles, cross-sections, and pebble count plots for each site are located in Appendix K. Level III data can be found in Appendix L. Facies maps for the Reach Downstream of Chili Bar can be found in Appendix P.

Setting
The 19.1-miles-long Reach Downstream of Chili Bar extends from the base of Chili Bar Dam (elevation 964 feet) to the normal high water line of Folsom Reservoir (elevation 466 feet), and has a mean channel gradient of approximately 0.005 (0.5 percent). The main tributaries to the SFAR along this reach, in the downstream direction, include Dutch Creek, Granite Creek, Jacobs Creek, Greenwood Creek, Hastings Creek, Norton Ravine, and Weber Creek.

This reach can be broken down into three distinct subreaches: Upper Subreach (Upper Canyon site), Middle Subreach (Upper and Lower Coloma sites), and Lower Subreach (Gorge site). The Upper Subreach is characterized by a higher channel gradient, long rapids, steep canyon walls, and few noteworthy alluvial deposits. The Middle Subreach lies in a broad, gently sloping valley and the channel is comparatively wider, more sinuous, and has more developed floodplains. Sections of the Middle Subreach have been mined for gold using suction dredges, which removed the original channel bottom and deposited dredger tailings in piles on the banks of the river. Suction dredging altered the channel morphology by removing coarse sediment and leaving behind large boulders, resulting in an artificially deepened channel. Portions of the Middle Subreach were excluded from consideration for a site because gold dredging greatly altered channel morphology. In the Lower Subreach, the regional slope increases again and the river enters a confining canyon. Here, the majority of the channel is formed in bedrock or boulders and depositional zones are typically found in areas where the canyon bottom widens.

Table 4.2-1. Reach Downstream of Chili Bar geomorphic data summary table.

			Channel Geometry									Particle Size Distribution (mm)							Channel Type			Incipient Motion (cfs)
Site	Sub-reach	XS	Mean Local Slope	S	W_{bf} (feet)	W_{fp} (feet)	D_{bf} max (feet)	D_{bf} mean (feet)	D_{fp} (feet)	W_{bf}/D_{bf}	E	D_{90}	D_{84}	D_{65}	D_{50}	D_{35}	D_{16}	D_{10}	Level II	Morph-ology	Type	
Upper Canyon (CB-G1)	Upper	Upper	0.01	1.00	268	340	9.2	5.3	19	51	1.3	300	230	134	89	60	34	25	F3	Bedrock/ Plane-bed	Transport	NA
		Middle			194	337	10	6.2	21	31	1.7	284	220	149	92	65	35	23				
		Lower			238	345*	12	8.0	23	30	1.4*	384	290	139	90	70	40	32				
Upper Coloma (CB-G2)	Middle	Upper	0.007	1.20	265	377*	7.8	4.8	16	55	1.4*	290	243	135	104	79	51	42	C3	Pool-riffle	Response	4,317
		Middle			205	415*	9.5	3.6	19	57	2*	295	246	158	122	103	71	62				1,703
		Lower			143	420	9.4	4.1	19	35	2.9	384	284	200	158	128	89	71				2,061
Lower Coloma (CB-G3)		Upper	0.009	1.20	217	378	5.9	4.4	12	49	1.7	192	169	113	84	56	7	1	C3	Pool-riffle	Transport	NA
		Middle			178	363	8.2	4.7	17	38	2.0	*240*	*211*	*146*	*108*	*81*	*45*	*25*				
		Lower			185	370*	9.7	5.2	19	36	2*	251	211	154	125	102	52	45				
Gorge (CB-G4)	Lower	Upper	0.006	1.00	300	457*	9.8	3.7	20	81	1.5*	155	132	94	66	52	33	23	F3	Pool-riffle	Transport	NA
		Middle			309	396	6.6	5.5	13	56	1.3	168	150	110	90	67	52	42				
		Lower			245	356	8.8	4.8	18	51	1.5	259	175	119	88	74	56	50				

XS = Cross-section; S = Sinuosity; W/D = width/depth ratio; E = entrenchment ratio; fp = refers to floodprone width and/or depth; bf = refers to bankfull width and/or depth; D_{90} = bed particle size where 90 percent is finer; NA = Not Applicable (see text); *Values based on estimated elevations (see text); *Counts with <100 particles, or no counts performed* (see text)

The lithology of the SFAR from the confluence with Rock Creek (just upstream of Chili Bar Reservoir) to Folsom Lake includes Mesozoic granitic rocks and Paleozoic metasedimentary rocks. The lithology at the Rock Creek confluence is composed of late Silurian metasedimentary rocks of the Shoo Fly Complex. The lithology changes downstream to late-Permian to early-Triassic metasedimentary rocks of the Calaveras Complex. As the SFAR flows through the town of Coloma, it also passes through a Mesozoic granite inclusion from the Sierra Nevada batholith before changing back to the Calaveras Complex lithology. Downstream of Highway 50, the lithology changes to Jurassic metasedimentary rocks of the Western Jurassic terrane. Serpentine rock masses also occur where the SFAR enters into Folsom Lake (Alt and Hyndman 2000; Norris and Webb 1990).

Morphological Description and Channel Condition Assessment Analysis

Level II Analysis: Channel morphology was described at four sites in the Reach Downstream of Chili Bar. The Upper Canyon Site was chosen as the representative channel type for the Upper Subreach. The 1,000-feet-long site is located about 2.2 miles downstream from the base of Chili Bar Dam at an elevation of approximately 840 feet above sea level (Figure 3.2-1). The “Flume” Flow Fluctuation Study Site is co-located at this site. Two representative sites were chosen for the long Middle Subreach. The Upper Coloma Site is located in the alluvial transition zone between the steep, confined Upper Subreach and low-gradient, less confined Middle Subreach. This 650-feet-long site is located about 5.1 miles downstream from the base of Chili Bar Dam, and lies at an elevation of 764 feet. The Lower Coloma Site is located in a broad valley downstream of the historical gold dredging activities. This 700-feet-long site is located about 9.3 miles downstream from the base of Chili Bar Dam, and lies at an elevation of about 680 feet. The “Camp Lotus” Flow Fluctuation Study Site is co-located at this site. Lastly, the Gorge Site is located in the Lower Subreach, where steep canyon walls confine the river into a narrow channel, high-gradient channel. This 600-feet-long site is approximately 17.5 miles downstream from the base of Chili Bar Dam and lies at an elevation of about 502 feet. The “Weber Creek” Flow Fluctuation Study Site is located approximately one mile downstream from this site.

Level III Analysis: Results of the geomorphic characterization (Level I) indicate that the Upper and Lower Subreaches of the Reach Downstream of Chili Bar cannot be classified as response reaches, as defined in Section 3.0 of this report. Therefore channel condition assessment (Level III) data were only collected at the Upper and Lower Coloma Sites in the Middle Subreach of the Reach Downstream of Chili Bar.

4.2.1 Upper Canyon Site (Geomorphology Site CB-G1)

At this site, the channel is deeply incised within gently rolling terrain of the Sierran foothills. Valley slopes are steep (>60 percent) with numerous bedrock outcrops. Portions of the hillslopes are un-vegetated and observational evidence suggests that the hillslopes are susceptible to occasional landslides and mass wasting. A thin forest occupies the surrounding hillslopes, although much of the ground below the trees is barren. Moderately vegetated banks consist of cobble, gravel, and sand. Survey measurements indicate a F3 channel type with a moderately entrenched channel (1.3-1.7), high width-to-depth ratio (30-51), average local bed slope of 0.01 (1.0 percent), and cobble-dominated substrate. Although the pebble counts indicate a cobble channel bed, field observations suggest this is only a thin layer covering boulders and bedrock. The relatively coarse substrate is covered with black algae. Higher flows have created an overflow channel and cobble bar on the right bank. The channel at this site exhibits an irregular meander pattern (S=1.00) with little to no LWD present within the flood-prone area. Local channel morphology includes bedrock and plane-bed environments. There is little evidence of bank erosion.

Gravel exists in the matrix beneath the cobble armor layer and pockets of gravel are deposited in the low velocity zones on the downstream sides of large flow obstructions and along the channel margins. No fine sediment (silt/sand) was observed deposited on the channel bed surface in the main flow paths or in pools, suggesting that these grain size fractions are scoured and that transport capacity exceeds fine sediment supply. As a result, V* measurements are not applicable at this site.

4.2.2 Upper Coloma Site (Geomorphology Site CB-G2)

At the Upper Coloma Site, valley slopes are moderately steep (40-60 percent) and exhibit evidence of episodic mass wasting. Vegetative vigor and density is largely controlled by aspect. The north facing slopes support greater floral density and diversity due to greater soil moisture retention during the summer and winter months. South facing slopes that are mostly dry throughout portions of the winter and the entire summer do not support a wide range or density of plant life. Survey measurements indicate a C3 channel type with a slightly entrenched channel (1.4-2.9), high width-to-depth ratio (35-57), average local bed slope of 0.007 (0.7 percent), and cobble-dominated substrate. This channel at this site is characterized by irregular meanders (S=1.20) and pool-riffle sequences with little signs of recent erosion or deposition. A vegetated, mid-channel bar divides the low flow into two channels at the upper end of the site. The channel bed, bar, and banks consist of cobble, boulders, gravel and sand (in order of dominance). Small bedrock outcrops occur along the banks at the upper and lower end of this site. The banks and tops of bars are moderately vegetated. The main channel lies as much as 7-10 feet below the level of surrounding alluvial fill at the downstream end of the site. All sizes of woody debris are essentially absent from within the bankfull channel and flood-prone areas.

A few small sand and silt deposits were observed in low-velocity, less turbulent pockets along the channel margins. No deposits were observed in the one pool evident at the site. Therefore, no V* measurements were taken. Cross-section pebble counts indicate that small gravel (<8 mm along the middle axis) accounts for an estimated 0-2% of the surface bed material, and sand and smaller portions (<2 mm along the middle axis) similarly account for 0-2%. On-the-ground habitat mapping was not performed for the Reach Downstream of Chili Bar, so reach-long estimates of substrate composition are not available. Although field observations and survey data indicate that very little fine sediment is deposited on the channel bed at this site, fines were observed in the matrix of the coarse substrate. An embeddedness survey across the riffle located at this site may improve our understanding of the balance between fine and coarse sediment and, ultimately, the balance between sediment supply and transport capacity at this location.

4.2.3 Lower Coloma Site (Geomorphology Site CB-G3)

At the Lower Coloma Site, valley slopes are gentle (<30 percent) and do not appear to supply sediment to the channel through mass wasting processes. Numerous private, residential lots are located close to the banks on either side of the main channel. Hillsides are moderately vegetated with grasses, shrubs, and trees where human development has not modified the natural vegetation patterns. Riparian vegetation was sparse to dense along the channel margins, ranging from low lying grasses and shrubs to overhead bushes and trees. A dense wall of bramble (i.e., blackberry bushes) occupied the alluvial bar along the river right bank, and several private lawns extended down to or near the bankfull elevation on the left bank. Survey measurements indicate a C3 channel type with a slight entrenchment (1.7-2.0), high width-to-depth ratio (36-49), average local bed slope of 0.009 (0.9 percent), and cobble-dominated substrate. Bedrock outcrops occur along the banks at the upper and lower end of this site, and sparse boulders occur in the main channel. The channel at this site is characterized by regular meanders (S=1.20), point bars, and pool-riffle sequences with little signs of recent erosion. Similar bedrock outcrops exist throughout the channel at this site. The main channel lies as much as 10-16 feet below the level of surrounding boulder banks and alluvial fill at the downstream end of the site. Small to medium pieces of woody debris occur within the bankfull channel.

Gravel exists in the matrix beneath the cobble armor layer and pockets of gravel are deposited in the low velocity zones on the downstream sides of large flow obstructions and along the channel margins. Anecdotal evidence suggests that a large sand bar has formed in a pool at the upstream end of the site over recent years. This pool is created by flow separation around a large bedrock outcrop projecting into the channel from the left bank. No other fine sediment (silt/sand) deposits were observed on the channel bed surface in the main flow paths or in pools, suggesting that these grain size fractions are scoured and that transport capacity exceeds fine sediment supply. As a result, V* measurements are not applicable at this site.

4.2.4 Gorge Site (Geomorphology Site CB-G4)

At this site, the channel is deeply incised within gently rolling terrain of the Sierra foothills. Valley slopes are moderately steep (40-60 percent) and exhibit evidence of mass wasting. This site is located in an alluvial depositional zone confined on the upstream and downstream ends by a narrow gorge (S=1.00). Hillslopes are moderately vegetated with grasses, shrubs, and trees. Willows, alders, and other riparian vegetation grow along the banks, but cobble bars surfaces are generally un-vegetated. Survey measurements indicate a F3 channel type with a moderate entrenchment (1.3-1.5), high width-to-depth ratio (51-81), average local bed slope of 0.006 (0.6 percent), and cobble-dominated substrate. A vegetated, mid-channel bar divides the low flow into two channels. The channel bed, bar, and banks consist of cobble, gravel, sand, and occasional boulders (in order of dominance). Sand beaches exist along the margins of the pools at the upper end of this site. Channel bed material is loosely packed and bright with little to no evidence of algal growth. The main channel lies as much as 10-16 feet below the level of surrounding alluvial fill at the downstream end of the site. All sizes of woody debris are essentially absent from within the bankfull channel and flood-prone areas. The Gorge Site is located in an alluvial section of the canyon, which is unusual for the Lower Subreach. Most of the subreach is characterized by a bedrock gorge with large boulder riffles, small cascades, irregular meanders and pool-riffle morphology. Channel morphology and sediment dynamics within the gorge are very similar to the characteristics described for the Upper Canyon Site.

Gravel exists in the matrix beneath the cobble armor layer and pockets of gravel are deposited in the low velocity zones on the downstream sides of large flow obstructions and along the channel margins. No fine sediment (silt/sand) was observed deposited on the channel bed surface in the main flow paths or in pools, suggesting that these grain size fractions are scoured and that transport capacity exceeds fine sediment supply. As a result, V* measurements are not applicable at this site.

4.3 Channel Bed Mobility

Channel survey data were used to evaluate Shields stress and sediment transport capacities at the geomorphology sites. The *EASI* (Enhanced Acronym Series with Interface) model was used to evaluate normalized Shields stress and bedload transport based on cross-section, channel gradient, surface grain size distribution, and discharge input parameters. A more detailed description of the model is included in Appendix M.

The *EASI* model was created primarily to address gravel transport. Grain size distributions in the UARP and the Reach Downstream of Chili Bar indicate that many grain size classes exist, outside the gravel range. Thus, transport flows must be considered carefully and as rough estimations rather than absolute values.

Although bed mobility and sediment transport rate is a topic of great interest to land managers, methods to determine the critical elements of incipient motion are still being developed for the wide range of channel types that occur in the stream reaches. Unfortunately, bed mobility is still difficult or impossible to accurately predict for many channel types using existing numerical modeling approaches, including channels with:

- steep gradient;
- rough, confined, thin or nonexistent alluvial cover over bedrock; and
- highly variable sediment sources.

In general, shear stress in the transport reaches within the UARP and in the Reach Downstream of Chili Bar dissipates over hydraulic jumps as flow encounters large boulders and/or bedrock. Pockets of sediment may be protected by these large flow obstructions despite a transport capacity that exceeds sediment supply. The dominant source of energy for sediment entrainment in these settings originates from random turbulence associated with flow separation that varies widely over short spatial and temporal scales. Predictions are further complicated by large variations in particle shape, size, and packing over small spatial scales. These conditions preclude an accurate evaluation of incipient motion using Shields stress equations (or any other available predictive numerical method) because existing models do not adequately address the extreme variability in hydraulic conditions near the stream bed, the bed material characteristics, or the size and availability of sediment supply. Field observations indicate that many of the study sites in the study area are comprised of these channel types. Study sites in the UARP where morphology precludes an accurate assessment of Shields stress include:

- Gerle Creek Dam Reach Site;
- Junction Dam Reach Site;
- Camino Dam Reach Site;
- S.F. American River Reach Site; and
- Slab Creek Dam Reach Site.

Study sites in the Reach Downstream of Chili Bar where morphology precludes an accurate assessment of Shields stress include:

- Upper Canyon Site;
- Lower Coloma Site; and
- Gorge Site.

The Loon Lake Dam Reach Upper Site was also considered for the analysis, but dominant channel particle size was too small for the model, a stipulation of the underlying Parker equations.

Normalized Shields stress and a bedload transport rating curve were determined for six response sites in the UARP and one response site in the Reach Downstream of Chili Bar (Tables 4.1-1 and 4.2-1). The longitudinal profiles, cross-sections, and grain size distributions for these sites are shown in Appendices G, H, J, and K. *EASI* modeling results for Shields stress and bedload transport rating curves are provided in Appendix N. Incipient bed mobility corresponds to a normalized Shields stress equaling unity (1). The corresponding discharge is the flow at which particles on the channel bed, large or small, begin to mobilize based on the concept of equal mobility (Parker *et al.* 1982, Andrews 1983). Particles of different sizes mobilize at the same discharge because they are inter-locked, and smaller particles are protected by the hiding and protrusion effects of the larger ones.

4.4 Bankfull Flow Analysis

Channel morphology survey results indicate that field measurements of the bankfull elevation, a measurement upon which much of the Rosgen analysis depends, showed large variability between sites and between cross-sections within sites. As already discussed in Section 3.3.1, this may be due to the problems encountered while attempting to estimate bankfull discharge, especially in bedrock dominated environments like those of the UARP and in the Reach Downstream of Chili Bar. In order to better understand the significance of bankfull flows in the vicinity of the UARP and Reach Downstream of Chili Bar, historic flow data were used from the Technical Report on Hydrology (February 2004) to compare both pre- and post-regulation 1.5-year floods with bankfull discharges calculated using field data at the 8 designated response sites. These comparisons were not made for the 8 designated transport sites due to the large influence of structural controls and their non-alluvial nature.

Assumptions regarding recurrence interval relations were used to compare field estimates of bankfull discharge with the hydrologic record. Annual maximum instantaneous flood peaks from regulated and unregulated periods of record were used to calculate the 1.5-year flood discharge for the response sites (Appendix Q). Where data were not available, unregulated discharge records from nearby watersheds with similar drainage areas and characteristics were used to estimate unregulated accretions downstream of reservoirs and/or pre-regulation flows. The 1.5-year recurrence interval has been shown to correspond to bankfull discharge for many stable, alluvial streams (Leopold 1994). However, it should be noted that recurrence intervals for bankfull discharge can be intrinsically different between channels, and often do not fall within the 1-2.5-year range that is commonly considered bankfull (Copeland *et al.* 2000).

Bankfull discharges and mean bankfull elevations measured in the field were compared to those based on recurrence intervals for both regulated and unregulated hydrology at each site (Appendix Q). The Manning equation was used to calculate a representative bankfull discharge for each cross-section using field data, and also to solve for the mean bankfull depth of each cross-section based on recurrence interval discharge estimates from each response site (Knighton 1998). Roughness coefficients, “n”, were estimated using the results of five empirical relations and one additive equation (Cowan 1956) commonly used for mountain rivers (Wohl 2000). Estimates generated using the five empirical relations were averaged and compared to the additive method, or Cowan’s method. In most cases, the roughness “n” value selected for use in the Manning equation represents the mean of the results obtained using Cowan’s method and the average obtained using empirical relations. At sites or cross-sections where the influence of large flow obstructions (e.g.; LWD or in-channel vegetation) was great, the value estimated with Cowan’s method was used.

Results of the comparison at each site suggest that field estimations of bankfull may be classified into three distinct groups (Table 4.4-1). The first group (1) consists of those cross-sections at a site where field estimated bankfull elevations primarily correspond with the estimated 1.5-year flood under the regulated hydrology. The second (2) consists of cross-sections at a site where bankfull elevations estimated in the field primarily correspond with the estimated 1.5-year flood under the pre-regulated hydrology. And, the third group (3) consists of those cross-sections at a site where there is little or no correspondence between field estimations of bankfull and the regulated or unregulated flows with 1.5-year recurrence interval. An interpretation is presented for each site below.

Table 4.4-1. Results of bankfull discharge comparisons.[1]

Response Site	XS	Group No. 1	Field Q_{bf} (cfs)	Regulated $Q_{1.5}$ (cfs)	Pre-regulated $Q_{1.5}$ (cfs)	D_{bfmean} (feet)		
						Field	Regulated	Unregulated
Rubicon Dam Reach (RD-G1)	Upper	1	630			1.8	1.82	2.83
	Middle	3	317	665	1,386	1.3	2.01	3.13
	Lower	3	124			0.6	1.73	2.69
Upper Loon Lake Dam	Upper	2	219			2.2	0.77	2.07
	Middle	3	620	40	208	3.9	0.73	1.97

Table 4.4-1. Results of bankfull discharge comparisons.[1]

Response Site	XS	Group No. 1	Field Q_{bf} (cfs)	Regulated $Q_{1.5}$ (cfs)	Pre-regulated $Q_{1.5}$ (cfs)	D_{bfmean} (feet)		
						Field	Regulated	Unregulated
Reach (LL-G1)	Lower	2	228			2.9	0.95	2.57
Middle Loon Lake Dam Reach (LL-G2)	Upper	2	399			1.6	0.94	1.40
	Middle	1	206	174	343	1.3	1.21	1.82
	Lower	3	259			1.1	0.92	1.38
Lower Loon Lake Dam Reach (LL-G3)	Upper	3	329			1.4	2.09	2.47
	Middle	3	326	510	678	1.6	2.11	2.50
	Lower	1	409			2.2	2.48	2.94
Robbs Peak Dam Reach (RPD-G1)	Upper	1	98			1.6	1.75	3.66
	Middle	1	89	116	395	1.2	1.39	2.91
	Lower	2	342			2.4	1.19	2.49
Upper Ice House Dam Reach (IH-G1)	Upper	1	250			1.5	1.22	2.74
	Middle	3	334	176	674	1.7	1.09	2.44
	Lower	2	566			2.7	1.30	2.92
Lower Ice House Dam Reach (IH-G2)	Upper	3	2,783			3.3	1.11	1.70
	Middle	1	564	488	986	2.1	1.86	2.83
	Lower	2	1125			2.9	1.74	2.66
Reach Downstream of Chili Bar								
Upper Coloma (CB-G2)	Upper	3	12,434			4.8	2.99	3.03
	Middle	1,2	5,495	5,667	5,813	3.6	3.54	3.60
	Lower	1,2	5,069			4.1	4.40	4.46

[1]Group #1: Q_{bf} corresponds with regulated $Q_{1.5}$
Group #2: Q_{bf} corresponds with pre-regulated $Q_{1.5}$
Group #3: Inconclusive

$Q_{1.5}$ = 1.5-year recurrence flood based on hydrology records
D_{bfmean} = average bankfull depth
Q_{bf} = bankfull discharge based on field measurements

At the Rubicon Dam Reach Site, field estimated bankfull discharge and elevation for the upper cross-section (Group #1) corresponds well with the 1.5-year flood under the regulated hydrology. Field measurements at both the middle and lower cross-sections (Group #3) underestimate mean bankfull elevations, and consequently discharge, when compared to those calculated using the regulated and unregulated hydrology. This may indicate that bankfull indicators are not well defined or entirely absent at these cross-sections because of the difficulties associated with measuring bankfull in mountainous and primarily bedrock controlled systems, as previously discussed in Section 3.3.1. Cross-section plots and the field photographs of both the middle and lower cross-sections suggest several explanations for the observed differences. The plot for the middle cross-section shows another possible slope break on the left bank that is slightly higher than the slope break on the right bank selected as the top-of-bank indicator. This higher slope break may be the true top-of-bank indicator, which would account for the underestimation. The cross-section plot at the lower cross-section shows a bar surface on the right bank that is much lower than other bars used as the top-of-bank indicator shown on either the upper or middle cross-sections. It is possible that this lower surface was mistaken for the top-of-bank indicator at the lower cross-section, which resulted in a bankfull discharge calculation that was too low.

At the Loon Lake Dam Reach Upper Site, field estimated bankfull discharges and elevations for both the upper and lower cross-sections (Group #2) correspond well with the 1.5-year flood under the unregulated hydrology. Field measurements at the middle cross-section (Group #3) overestimate mean bankfull elevation, and consequently discharge, when compared to those calculated using the regulated and unregulated hydrology. This may indicate that bankfull indicators are not well defined or entirely absent at this cross-section because of the difficulties associated with measuring bankfull in mountainous and primarily bedrock controlled systems, as previously discussed in Section 3.3.1. Cross-section plots suggest that field estimations of bankfull elevation occur at similar surfaces at all cross-section locations. Photographs of the middle cross-section show that large flow obstructions, such as large woody debris and vegetation, may locally influence channel dimensions. Scour associated with flow hydraulics around these obstructions may have created a pool at this cross-section and resulted in larger cross-sectional area and lower local slope, both of which may contribute to an overestimation of discharge.

At the Loon Lake Dam Reach Middle Site, field estimated bankfull discharges and elevations for both the upper and middle cross-sections (Groups #2 and #1) correspond well with the 1.5-year flood under the unregulated and regulated hydrology, respectively. Field measurements of bankfull elevation at the lower cross-section (Group #3) are between both regulated and unregulated bankfull calculations. This may indicate that bankfull indicators are not well defined or entirely absent at this cross-section because of the difficulties associated with measuring bankfull in mountainous and primarily bedrock controlled systems, as previously discussed in Section 3.3.1. Cross-section plots and photographs indicate that the meadow surface is highly irregular at this location. As a result, it is evident that there are several top-of-bank surfaces to select from in the field. In addition, as unregulated accretions occur along Gerle Creek, the hydrologic impact of Loon Lake Dam decreases. Accretion estimates confirm the diminishing effect of the dam, as the regulated and unregulated 1.5-year floods are similar. Thus, the geomorphic effects of floods during the regulated and unregulated periods are difficult to differentiate. This may also account for a field estimate that lies between the regulated and unregulated discharge estimates.

At the Loon Lake Dam Reach Lower Site, field estimated bankfull discharge and elevation for the lower cross-section (Group #1) corresponds well with the 1.5-year flood under the regulated hydrology. Field measurements at the upper and middle cross-sections (Group #3) underestimate bankfull elevation, and consequently discharge, when compared to those calculated using the regulated and unregulated hydrology. This may indicate that bankfull indicators are not well defined or entirely absent at these cross-sections because of the difficulties associated with measuring bankfull in mountainous and primarily bedrock controlled systems, as previously discussed in Section 3.3.1. Cross-section plots and photographs indicate that the floodplain surface is highly irregular at this location. As a result, it is evident that there are several top-of-bank elevations to select from in the field. Also, the effect of the estimated accretion is the highest of all sites on Gerle Creek below Loon Lake Dam. Accretion estimates are based on unregulated hydrology in nearby basins, and thus the effect of any discrepancies between the estimate and the true accretion increases with drainage area below Loon Lake Dam. As such, the accretion estimates become less reliable for the lower site, and may contribute to the differences in mean bankfull depth and discharge calculations.

At the Robbs Peak Dam Reach Site, field estimated bankfull discharges and elevations for both the upper and middle cross-sections (Group #1) correspond well with the 1.5-year flood under the regulated hydrology, while the lower cross-section (Group #2) corresponds well with the 1.5-year flood under the unregulated regime. Cross-section plots indicate that the top-of-bank surface is above the estimated bankfull elevations at all cross-section locations, suggesting that the channel may have incised historically, although there are no significant indications of continuing channel incision. Photographs indicate that vegetation is growing well within the historic floodplain at the upper and middle cross-sections, which may have been more active during the pre-regulated period.

At the Ice House Dam Reach Upper Site, field estimated bankfull discharges and elevations for both the upper and lower cross-sections (Groups #1 and #2) correspond well with the 1.5-year flood under the regulated and unregulated hydrology, respectively. Field measurements of bankfull elevation at the middle cross-section (Group #3) are between both regulated and unregulated bankfull calculations. This may indicate that bankfull indicators are not well defined or entirely absent at this cross-section because of the difficulties associated with measuring bankfull in mountainous and primarily bedrock controlled systems, as previously discussed in Section 3.3.1. Cross-section plots and the field photographs of the middle cross-section suggest bankfull elevation was estimated below a primary slope break on the left bank. There are no noticeable slope breaks on the right bank. This may contribute to the difficulty in determining the field indicators of the 1.5-year flood at this cross-section.

At the Ice House Dam Reach Lower Site, field estimated bankfull discharges and elevations for both the middle and lower cross-sections (Groups #1 and #2) correspond well with the 1.5-year flood under the regulated and unregulated hydrology, respectively. Field measurements at the upper cross-section (Group #3) overestimate mean bankfull elevation, and consequently discharge, when compared to those calculated using the regulated and unregulated hydrology. This may indicate that bankfull indicators are not well defined or entirely absent at this cross-section because of the difficulties associated with measuring bankfull in mountainous and primarily bedrock controlled systems, as previously discussed in Section 3.3.1. Cross-section plots indicate that the bankfull indicators found at the lower two cross-sections were not found at the upper cross-section. A higher bankfull indicator was selected at the upper cross-section, which yielded a higher mean depth and cross-sectional area. Photographs confirm that there are few indicators along the relatively steep banks of the upper cross-section. Thus, discharge was probably overestimated because indicators of the 1.5-year flood were not clear at the upper cross-section.

The Upper Coloma Site was the only response site in the Reach Below Chili Bar. Because the difference between the estimated 1.5-year flood pre- and post regulation is relatively small, field estimated bankfull discharge and elevations at the middle and lower cross-sections (Groups #1 and #2) may correspond with either the 1.5-year flood under the regulated or unregulated hydrology. Field measurements at the upper cross-section (Group #3) overestimate mean bankfull elevation, and consequently discharge, when compared to those calculated using the regulated and unregulated hydrology. This may indicate that bankfull indicators are not well defined or entirely absent at this cross-section because of the difficulties associated with measuring bankfull in mountainous and primarily bedrock controlled systems, as previously discussed in Section 3.3.1. The conditions here are similar to those at the lower site of the Upper Ice House Dam Reach. Cross-section plots indicate that the top-of-bank bankfull indicators found at the lower two cross-sections were not found at the upper cross-section. A higher bankfull indicator was selected at the upper cross-section, which yielded a higher mean depth and cross-sectional area. Photographs confirm that there are few indicators along the relatively steep banks of the upper cross-section. Thus, discharge was probably overestimated because indicators of the 1.5-year flood were not clear at the upper cross-section.

In conclusion, the variability in the results of the comparisons of both pre- and post- regulation 1.5-year floods with bankfull discharges estimated using field data at the eight designated response sites demonstrates that a single channel forming discharge is difficult to define in bedrock controlled, mountainous settings. Furthermore, it supports the argument that channel form in these channels may not only reflect present hydrology and sediment regimes, but are also almost certainly shaped by sweeping large-scale controls that exist in these settings (e.g.; structural controls, infrequent hydrologic events and sediment input, and/or discharges that occurred under different climatic regimes). Many of effects of these influences are previously discussed in Section 3.3.1 of this report. The key elements of these are summarized below:

1) Response channels in the UARP and the Reach Downstream of Chili Bar may not be self-forming and alluvial, as commonly defined (i.e., stream channels with mobile boundaries entirely composed of alluvium, where sediment supply equals or exceeds available transport capacity). Frequently occurring discharges may have less effect on modern channel form than episodic sediment delivery from mass wasting, infrequent-high magnitude events caused by rain-on-snow events, and the influences of underlying bedrock geology. Many of the response channels are bedrock channels with relatively thin cover of alluvial material. The cover is thick enough to be show limited bedrock outcropping at the channel surface, but is not free of the influences of the underlying structure.

2) Large-scale controls effect local variations in valley width, channel cross-sectional form, slope, substrate composition, and other roughness elements, such as the presence or absence of vegetation or woody debris, and contribute to the high variability of both velocity and channel dimensions at the sites in the UARP and the Reach Downstream of Chili Bar. These effects are not easily quantified by many widely accepted geomorphic methods and tools, most of which were developed along stable, alluvial channels in lowland environments and provide the foundation for downstream hydraulic geometry relationships, indirect discharge calculations, and sediment transport models.

3) Channels that are regulated, such as those found in the UARP and the Reach Downstream of Chili Bar, may often show evidence of multiple geomorphic regimes and may not be stable. Pre- and post-regulation geomorphic indicators may be hard to differentiate in regulated systems, as shown in this analysis. Furthermore, the reaches at these sites may still be adjusting towards a new equilibrium based on the historic changes in the supply of sediment and water. As discussed in Section 3.3.1, channels that are not stable may not be good candidates for reliable bankfull estimation.

4) Finally, as McBain and Trush have highlighted in their 2004 article in Stream Notes, Sierra Nevadan streams, such as those found within the UARP and the Reach Downstream of Chili Bar, are complex and highly dynamic systems that may require a new approach in consideration of the underlying controls.

5.0 DISCUSSION

In this section, sites are discussed in the context of channel morphology and type (Tables 4.1-1 and 4.2-1). In order to permit a process-based discussion of each alphanumeric channel type observed in this study, each site was further sub-divided according to dominant channel morphology and type using the Montgomery and Buffington (1993, 1997, and 1998) system. Stream channels within a watershed can be divided into several categories according to the transport processes that dominate; a given reach may primarily generate, transport, or temporarily store sediment as it moves downstream. Channel response to changes in sediment supply and transport varies greatly depending on the dominant processes within a given reach. Although adjustments to alteration to flow and/or sediment supply may be complex, certain channel morphologies (e.g., colluvial, bedrock, cascade, and step-pool) are generally resilient and insensitive to these changes. These reaches are generally classified as source or supply-limited transport channel types. Along the same continuum, some channel morphologies (e.g., pool-riffle and regime morphologies) exhibit a wide range of potential responses to these changes and are most affected. These reaches are generally classified as transport-limited response channel types. Channels with plane-bed morphology are transitional in the spectrum and may either be transport or response type reaches depending on site-specific slope, confinement, and sediment supply. Plane-bed channels are characterized by long stretches of relatively planar channel bed with occasional channel spanning rapids, and a distinct lack of well-defined bedforms.

In this study, all observed B channel types were categorized as transport sites because they all occur in reaches where bedrock outcrops control channel morphology. Most observed C and all observed E channel types were categorized as response sites because these channels primarily exhibited pool-riffle morphology. Observed F channel types were either response or transport sites depending on local slope, bedrock influence, floodplain development, and bedform. Below, each channel type is discussed according to its relative sensitivity to changes in discharge and/or sediment supply, as either transport or response (Montgomery and Buffington 1993, 1998).

5.1 Transport Sites of the UARP

5.1.1 B Channel Type

All the designated transport sites within the UARP are classified as B channel types. This includes the Gerle Creek Dam Reach (B2c/B3c), Junction Dam Reach (B3c), Camino Dam Reach (B3c), SFAR Reach (B3c), and Slab Creek Dam Reach (B3) sites. All are moderately entrenched systems confined in structurally controlled, steep valleys. In most cases, narrow valleys form a narrow bedrock-controlled channel. Although pebble counts indicate a cobble channel bed, field observations show that numerous boulders and/or bedrock outcrops exist at each of these sites. Field observations also suggest that most of the boulders do not appear to be fluvially derived; rather, they were probably delivered to the mainstem by local slope failures, glacial processes, or glacial outwash floods. These large boulders essentially act as bedrock, as they appear to be stable even during extreme flow events. The hydraulics associated with flow around and over the top of large flow obstructions may control sediment transport and particle entrainment in these streams, particularly for sand and gravel. In most cases, the cobble substrate forms a veneer on top of a bedrock bed with gravel and finer material accumulating only in low-velocity pockets behind large flow obstructions and along the channel margins. Very little sediment is deposited in the riffles or pools, and lateral bar development is poor to nonexistent. Occasional alluvial deposits do occur where gradient or valley confinement decreases, and the channel widens (e.g., lower Gerle Creek). LWD was observed at the Gerle Creek Dam Reach Site (79 pieces/mile) and the Camino Dam Reach Site (8 pieces/mile), but did not appear to influence channel dynamics. LWD likely had a limited influence on channel morphology at these sites, as it was easily transported through these relatively, deep and straight sections. Fine sediment supply may have increased along the SFAR due to increased hillslope erosion following the 1992 Cleveland Fire (USDA 1993). No evidence of increased sediment supply was observed at the downstream SFAR Reach Site.

5.2 Transport Sites of the Reach Downstream of Chili Bar

5.2.1 F Channel Type

In general, F channel types are described as “deeply entrenched” within “highly weathered bedrock or depositional soils involving a combination of river downcutting and uplift of valley walls” (Rosgen 1996). Survey data and photographs confirm that the Upper Canyon (F3) and Gorge (F3) Sites are incised in the rolling terrain of the Sierra foothills and are structurally controlled by underlying bedrock lithology.

Upper Canyon Site: At the Upper Canyon Site (F3), a veneer of predominantly coarse cobble on the channel bed is covered with abundant, black algal growth. The lack of bright surfaces in the bed material at this site indicates that regular entrainment of the dominant substrate grain sizes does not occur under the current discharge regime. No major gravel or sand deposits were noted within the bankfull channel, suggesting that either supply in this size range is extremely low, or fine bed material is quickly transported downstream. The only considerable depositional feature at this site is a large lateral cobble bar and overflow channel on the right bank, suggesting that the river is capable of transporting coarse material during high flows. Structural controls (e.g., slope, and channel confinement) have likely prevented alluvial deposition and floodplain development at this site since the last glaciation. No LWD was observed at this site. Due to the relatively high flows and a large upstream drainage area of this site, it is not likely that LWD historically played a large role in channel dynamics.

Gorge Site: Like the river channel at the Upper Canyon Site, the Gorge Site (F3) is deeply incised within the surrounding bedrock. This site is located where a temporary alluvial deposit has formed at a slope break within a narrow gorge where tributaries enter from both sides and the valley has widened. Like the Upper Coloma Site, a vegetated mid-channel bar divides the low flow into two channels, creating a riffle. Two small bedrock outcrops are located along the margins of the channel, and constrict flow at the tail of the riffle. No signs of rapid erosion or deposition were observed in the channel or along the banks. Few sand and silt deposits were observed in the low-velocity zones at the tail end of pools, although a large sand bar is located just above this site on the left bank. Grain size distributions are coarse and highly sorted, indicating that the finer portions may be transported downstream, including most classes of gravel. Cobble is loosely packed and surfaces are bright, indicating that the bed is mobilized on a regular basis. Flows under the current discharge regime may be incising into the cobble fill at this site, with as much as 10-13 feet of separation between the active channel and former floodplain at the downstream end of the site. No LWD was observed at this site. Due to the relatively high flows and a large upstream drainage area at the site, it is not likely that LWD has historically played a large role in channel dynamics. Although the site was established on alluvial fill, it is strongly influenced by the steep bedrock valley, which is representative of most of the Lower Subreach of the SFAR. The Lower Subreach is primarily characterized by a bedrock gorge with large boulder riffles, small cascades, irregular meanders and pool-riffle morphology. Channel morphology and sediment dynamics within the gorge are very similar to the characteristics described for the Upper Canyon Site.

5.2.2 C Channel Type

Although C channel types are often found in response reaches, bedrock control limits the ability of some channels within this class to act as a response reach. The Lower Coloma Site (C3) was categorized as a transport site because of local bedrock influence. Although the channel bed at this site is predominantly alluvial cobble deposits, several large bedrock outcrops protrude into the main flow from the left bank, strongly influencing channel flow hydraulics. In addition, many large boulders, which may be locally derived from bedrock sources, are located in the channel and along the banks. No signs of rapid erosion or deposition were observed in the channel or along the banks. A few small sand and silt deposits were observed in the low-velocity zones at the tail end of pools. Grain size distributions are highly sorted and very coarse, indicating that the finer portions may be preferentially transported downstream, including most classes of gravel. Cobble in the channel bed is slightly embedded and surfaces are mostly dull, indicating that the bed is stable and rarely mobilized. Survey evidence indicates that rare, high flows appear to be incising into the cobble fill at this site, with as much as 10-13 feet of separation between the active channel and former floodplain at the downstream end of the site. Small amounts of LWD were observed at this site (23 pieces/mile). Due to the relatively high flows and a large upstream drainage area at this site, it is not likely that LWD has played a large role in channel dynamics throughout recent history.

5.3 Response Sites of the UARP

5.3.1 F Channel Type

The stream channel at the Rubicon Dam Reach Site (F4) is deeply incised within the surrounding terrain. Currently, the channel at this site has a well-defined pool-riffle sequence with stable, vegetated depositional bars. Banks are well vegetated and relatively stable, with few signs of erosion. Channel substrate exhibits a mixture of dull and bright surfaces, indicating that sediment transport of the bed material may occur regularly at moderate flows. Thus, unlike the F3 channel type at the Upper Canyon and Gorge Sites downstream of Chili Bar, this site has been designated a response site and is likely transport limited. Although a small amount of LWD was observed at this high elevation site at the time of the survey (11 pieces/mile), it did not appear to greatly affect channel morphology.

5.3.2 E Channel Type

E channel types are considered to be “hydraulically efficient” channel forms, typically maintaining high sediment transport capacities with stable beds (Rosgen 1996). Extensive riparian vegetation usually stabilizes the banks with dense root masses. These characteristics appear to hold true for the only E channel type in this study, the upper site (E5) in the Loon Lake Dam Reach. This is the only site within the study area where dominant grain size was sand or finer. Fine sediment is likely supplied by incision into the wide meadow fill that the channel is formed in, and surface erosion from surrounding granitic hillslopes. In addition, this site has the highest sinuosity of all the project sites. This is probably because the site lies in a large, unconfined valley with relatively flat topography, allowing the channel to meander freely. Bedrock confinement at the downstream end of the valley likely exerts limits on valley and channel gradient. Evidence of scour and deposition were observed in the field and it was estimated that as much as 50 percent of the active channel area has been influenced by deposits and scour from obstructions, constrictions, and bends. In addition, silt deposits over sandy substrate and signs of overbank flooding were observed. Medium and large woody debris may be an important influence on channel morphology and bank stability at this site. Observations indicate that there is a large build up of LWD in the active channel (832 pieces/mile), which adds roughness and affects sediment storage. This is the highest LWD loading of all the project sites. Large key pieces of woody debris are embedded in the channel and create habitat for fish and other aquatic organisms.

5.3.3 C Channel Type

All C channel types within the UARP were formed from alluvial deposition and were categorized as response sites. These sites were located along stream sections that typically had well developed floodplains and primarily exhibited pool-riffle configuration. Alluvial channels exhibit a wide range of responses to changes in upstream watershed conditions, flow, and sediment supply (Rosgen 1996). For this reason, each response C channel type is discussed separately, including the Loon Lake Dam Reach Middle and Lower Sites (C3); the Robbs Peak Dam Reach Site (C4); and the Ice House Dam Reach Upper (C4) and Lower (C3) Sites.

Loon Lake Dam Reach Middle Site: While both the Loon Lake Dam Reach Middle Site and the Loon Lake Dam Reach Upper Site are located in meadow environments, the two sites are very different. The gradient at the middle site is about double the upper site, and sinuosity is markedly lower than the upstream site. Numerous lateral bars with bright surface grains indicate that sediment transport may occur regularly at moderate flows. In addition, many side channels were noted in the field, suggesting regular overbank flow and migration, or avulsion, of the main channel. Several debris jams and numerous key pieces of LWD created areas of scour and deposition in the channel (264 pieces/mile), suggesting that wood may affect channel morphology at this site.

Loon Lake Dam Reach Lower Site: Unlike the Loon Lake Dam Reach Middle Site, the Loon Lake Dam Reach Lower Site is located within a narrower valley and has distinct pool-riffle sequences. Evidence of sediment transport was more notable at this site. Sand deposits were observed in low velocity zones behind larger obstructions and along channel margins. Incision was also noted, with raw banks up to 12 inches high. An estimated 30-50 percent of the channel area is believed to be influenced by erosion and deposition at obstructions, around bends, or at constrictions. These observations may indicate that LWD has a greater effect on channel morphology at this site, despite having lower frequency (79 pieces/mile) than the two upstream sites.

Robbs Peak Dam Reach Site: At the Robbs Peak Dam Reach Site, dense willows grow on numerous bars within the bankfull channel area. Several small conifers were also noted growing on recently scoured surfaces and mid-channel bars. Field observations indicate that vegetation encroachment may be causing the channel to avulse between side channels at high flows. Bank erosion up to two feet high with exposed root mats and active sloughing were observed. Sand and gravel surfaces in the channel beds are mostly dull, suggesting gravel transport occurs only during higher flows. Although several debris jams with evidence of lateral channel erosion were observed upstream from the site, only a few pieces of LWD were noted at this site (12 pieces/mile).

Ice House Dam Reach Upper Site: At this site, lateral gravel bars are prevalent but sparsely vegetated. Several observed raw banks and bar deposits indicate that sediment transport occurs regularly, yet moderate to high levels of sand and fine gravel in the bars, stream banks, and channel bed suggest that supply from the banks and upstream sources may exceed transport capacity. Despite this, there were no signs of excessive incision and/or aggradation at the time of the survey. Moderate amounts of LWD were present at this site (57 pieces/mile).

Ice House Dam Reach Lower Site: The Ice House Dam Reach Lower Site is within the burned area from the 1992 Cleveland Fire. High fine sediment loads were expected to enter the main channel from the surrounding valley slopes (USDA 1993). Riparian vegetation recovered well along the banks, acting as a buffer between the barren hillslopes and the stream channel. Channel sediments are highly embedded, with mostly dull surfaces. A layer of sand covers the bed, with larger deposits noted behind flow obstructions and in the lower gradient portions at the site. Abundant sand deposits were also noted on the floodplains and terrace surfaces. Regulated spill from the upstream dam may not be sufficient to transport the additional sediment added from the effects of the fire. A few raw cut banks of up to 1 foot in height were observed in association with woody debris present in the channel. Two log jams and a great amount of LWD were seen at this site (236 pieces/mile). Although some local scour (1-1.5 feet) and sand deposits were seen associated with the wood, this did not appear to strongly affect channel morphology.

5.4 Response Sites of the Reach Downstream of Chili Bar

5.4.1 C Channel Type

The only C channel type in the Reach Downstream of Chili Bar that is formed from alluvial deposition is the Upper Coloma Site (C3). The SFAR at this site flows over cobble and small boulder alluvial fill. Two very small bedrock outcrops are located along the margins of the channel, but do not appear to affect flow dynamics at this site. No major signs of ongoing erosion or deposition were observed in the channel or along the banks. Few sand and silt deposits were observed in the low-velocity zones at the tail end of pools. Grain size distributions are well sorted, indicating that the finer portions may be transported downstream, including most classes of gravel. The cobble channel bed is slightly embedded and surfaces are mostly dull, indicating a stable bed that is rarely mobilized. Survey evidence indicates, however, that rare high flows cause incision into the cobble fill, with as much as 7-10 feet of separation between the active channel and former floodplain at the downstream end of the site. Interviews with a riverside property owner at this site confirm that the SFAR occasionally flows “brown” with sediment during “large floods,” and that mid-channel bars have changed position “several times” (Haney, pers. comm., 2003). No LWD was observed at this site. Due to the relatively high flows and a large upstream drainage area, it is not likely that LWD has played a large role in channel dynamics throughout recent history.

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FIGURE

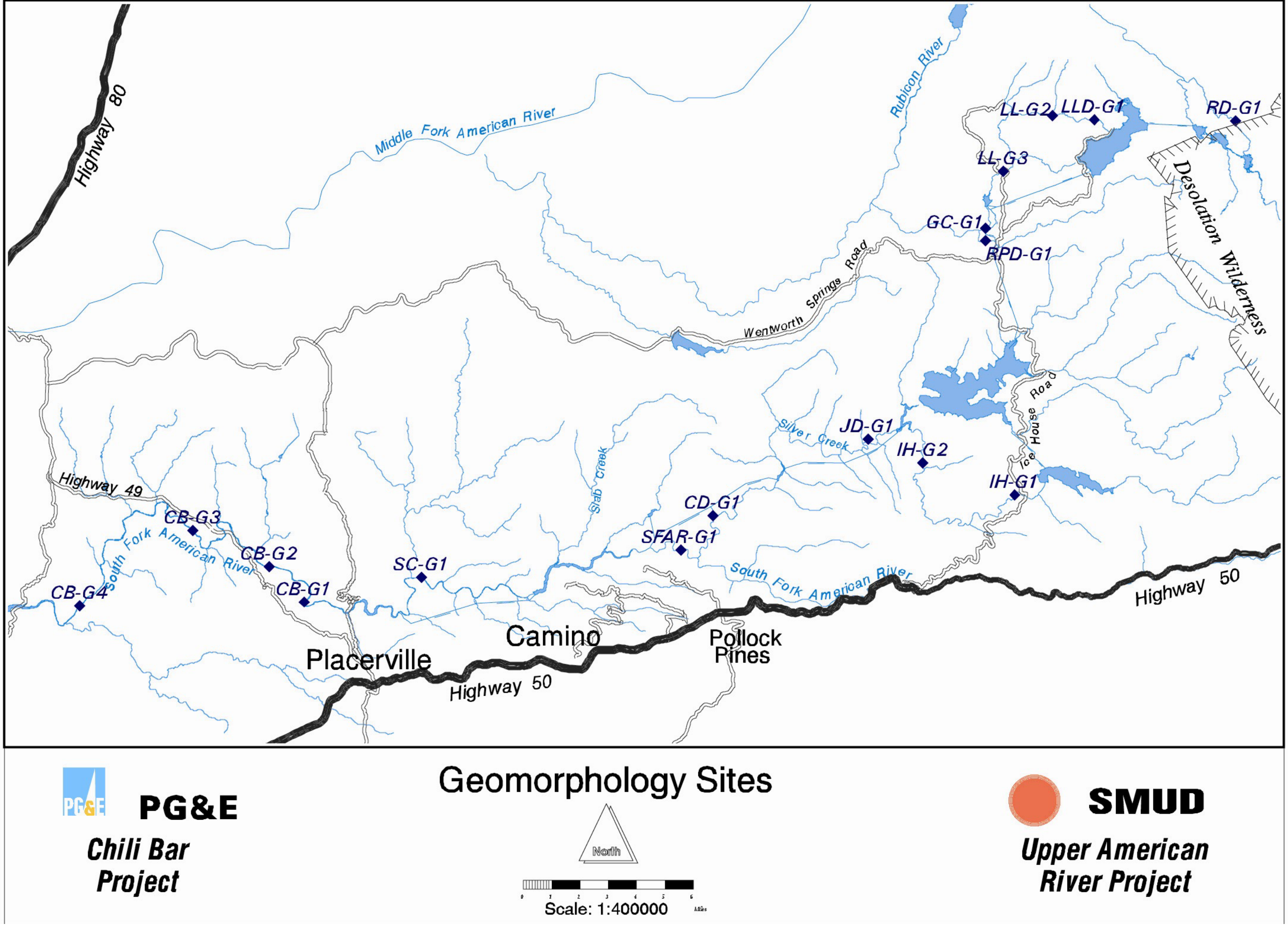
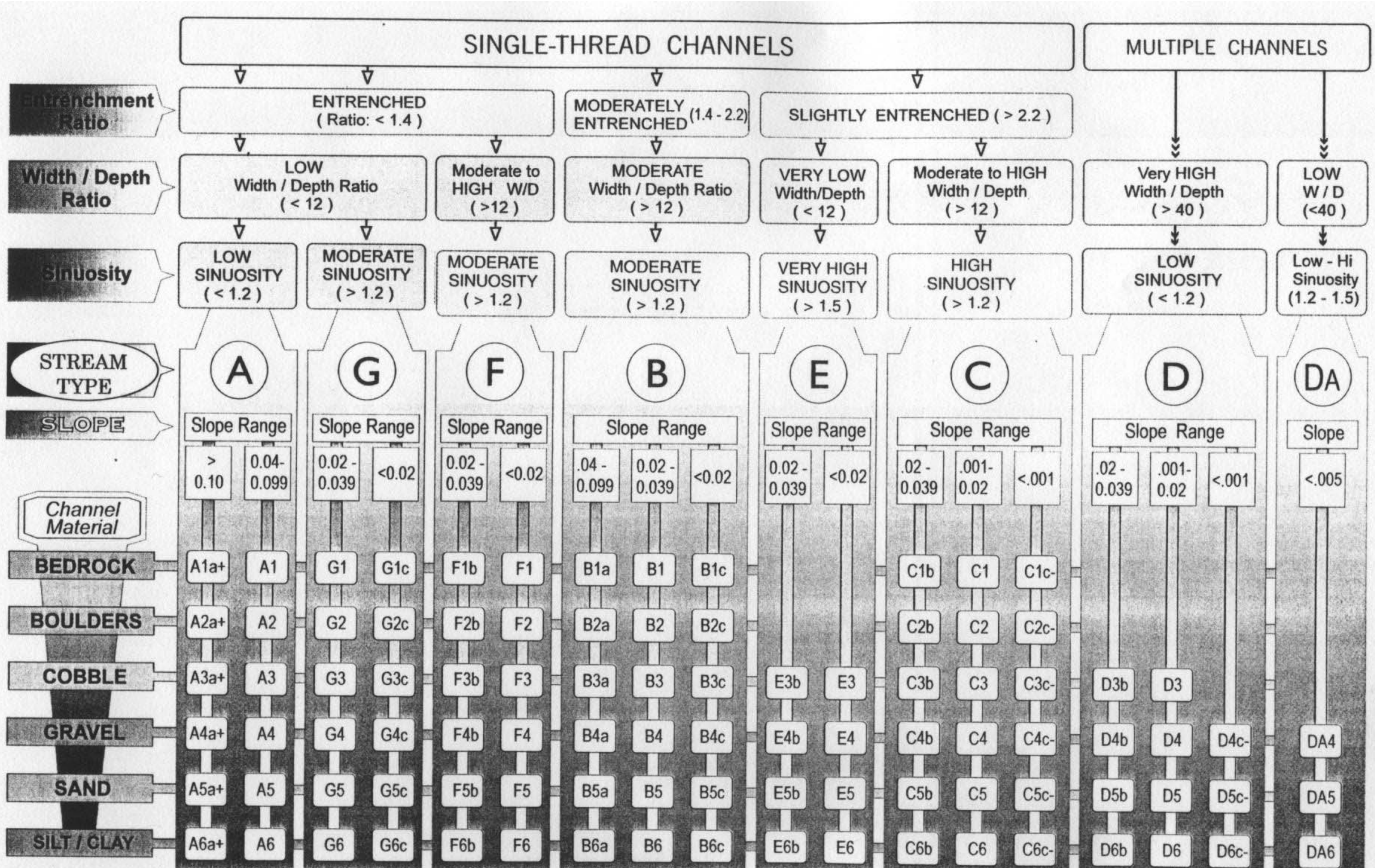


Figure 3.2-1. Summary map showing the locations of the geomorphology sites.

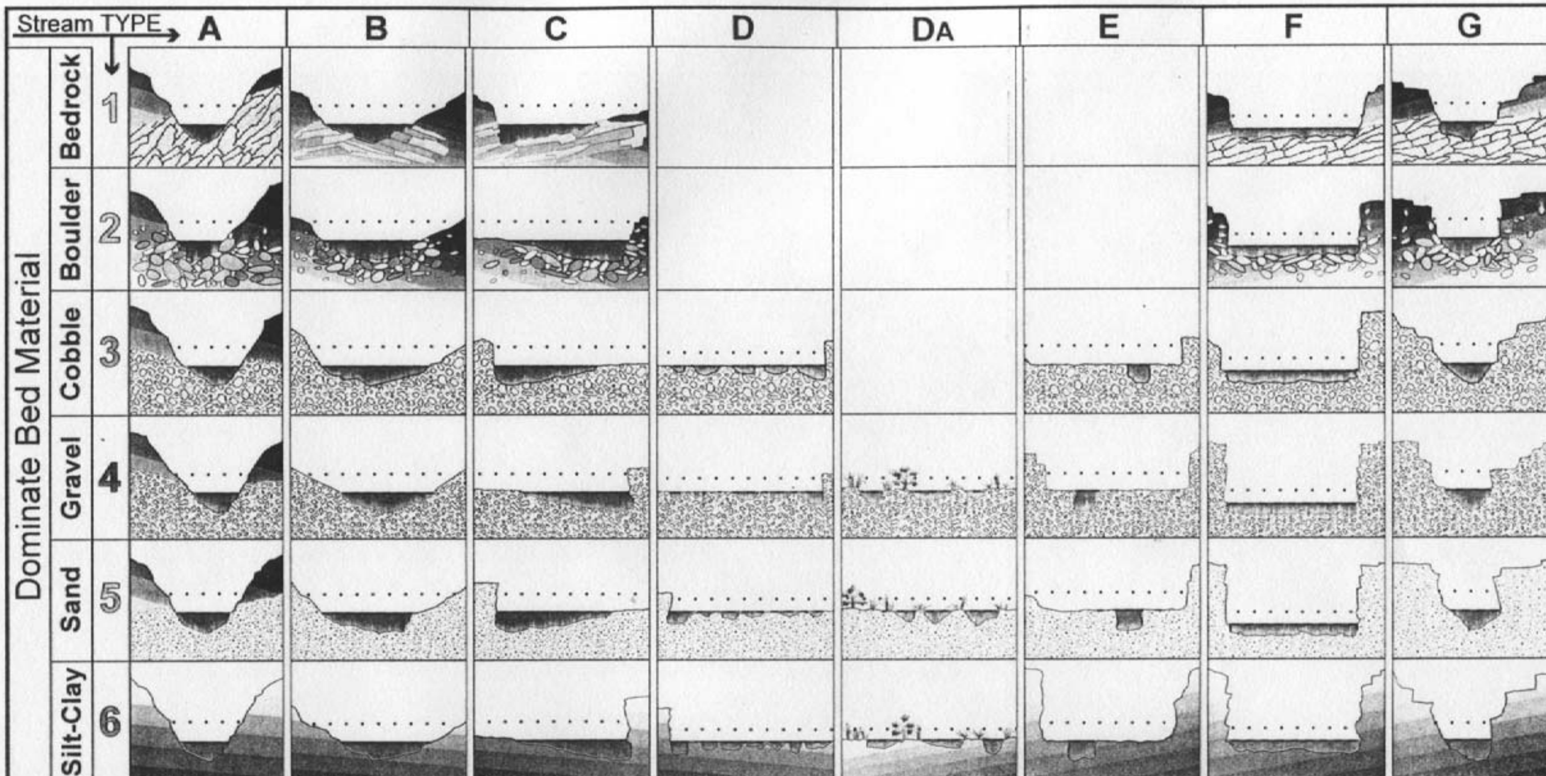
APPENDIX A

ROSGEN STREAM CLASSIFICATION SYSTEM



KEY to the *ROSGEN* CLASSIFICATION of NATURAL RIVERS. As a function of the "*continuum of physical variables*" within stream reaches, values of ***Entrenchment*** and ***Sinuosity*** ratios can vary by +/- 0.2 units; while values for ***Width / Depth*** ratios can vary by +/- 2.0 units.

(after Rosgen, 1996)



Stream TYPE	A	B	C	D	DA	E	F	G
Entrchmnt.	< 1.4	1.4 - 2.2	> 2.2	n/a	> 4.0	> 2.2	< 1.4	< 1.4
W/D Ratio	< 12	> 12	> 12	> 40	< 40	< 12	> 12	< 12
Sinuosity	1 - 1.2	> 1.2	> 1.2	n/a	variable	>1.5	> 1.2	>1.2
Slope	.04-.099	.02-.039	< .02	< .04	< .005	< .02	< .02	.02-.039

(after Rosgen, 1996)

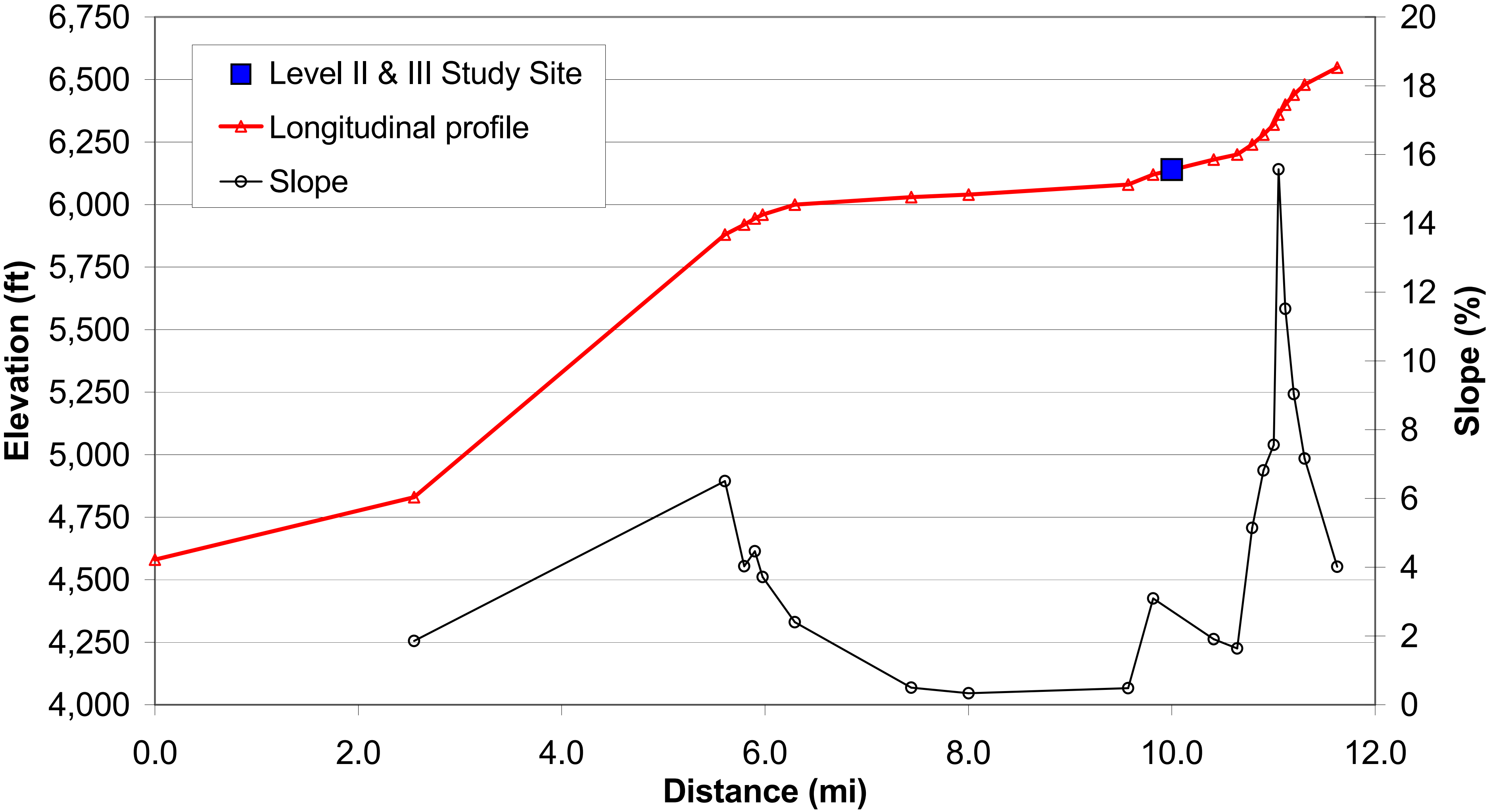
APPENDIX B

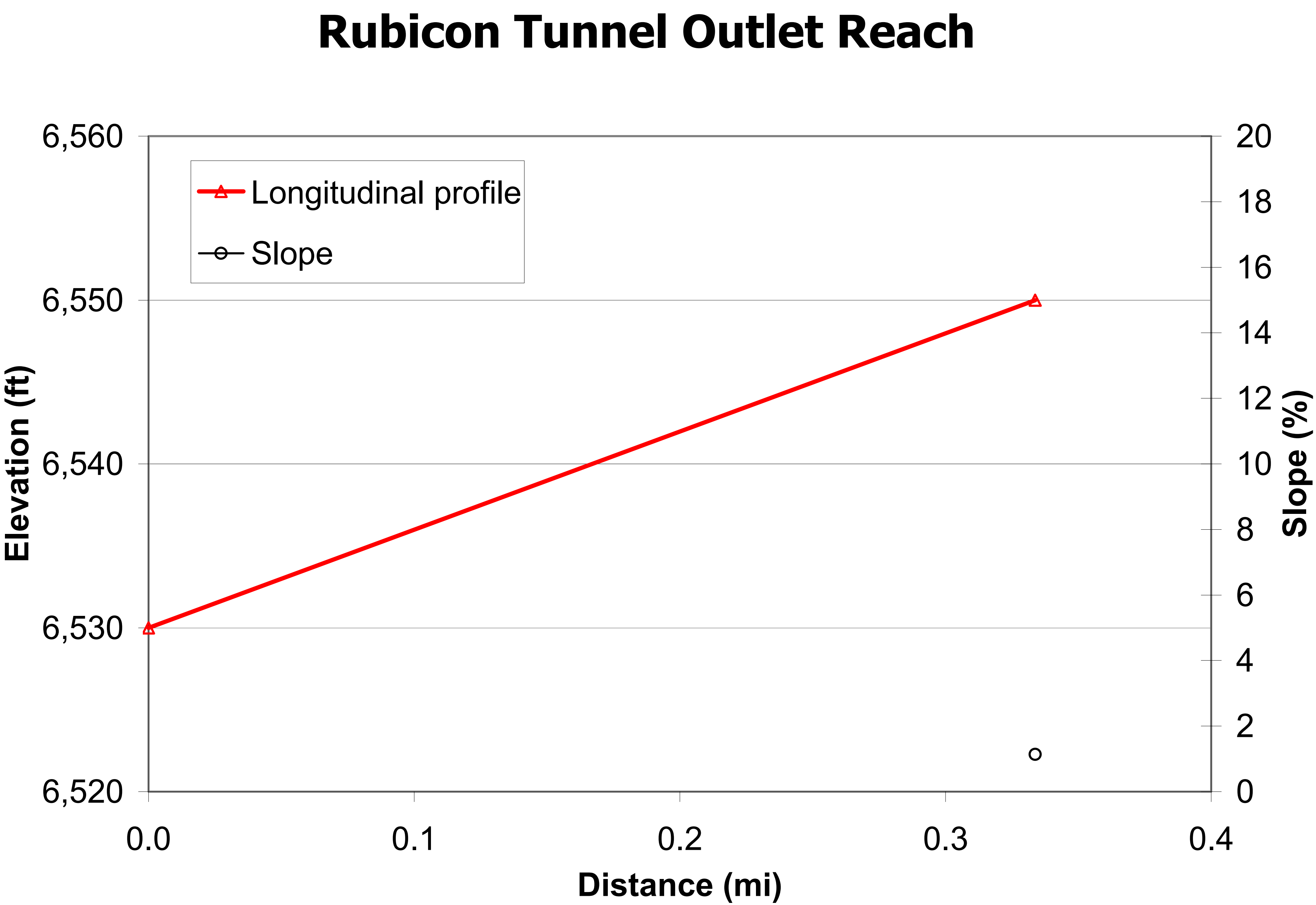
LEVEL II/III SITE MAPS WITH LEVEL I STREAM TYPE DELINEATION

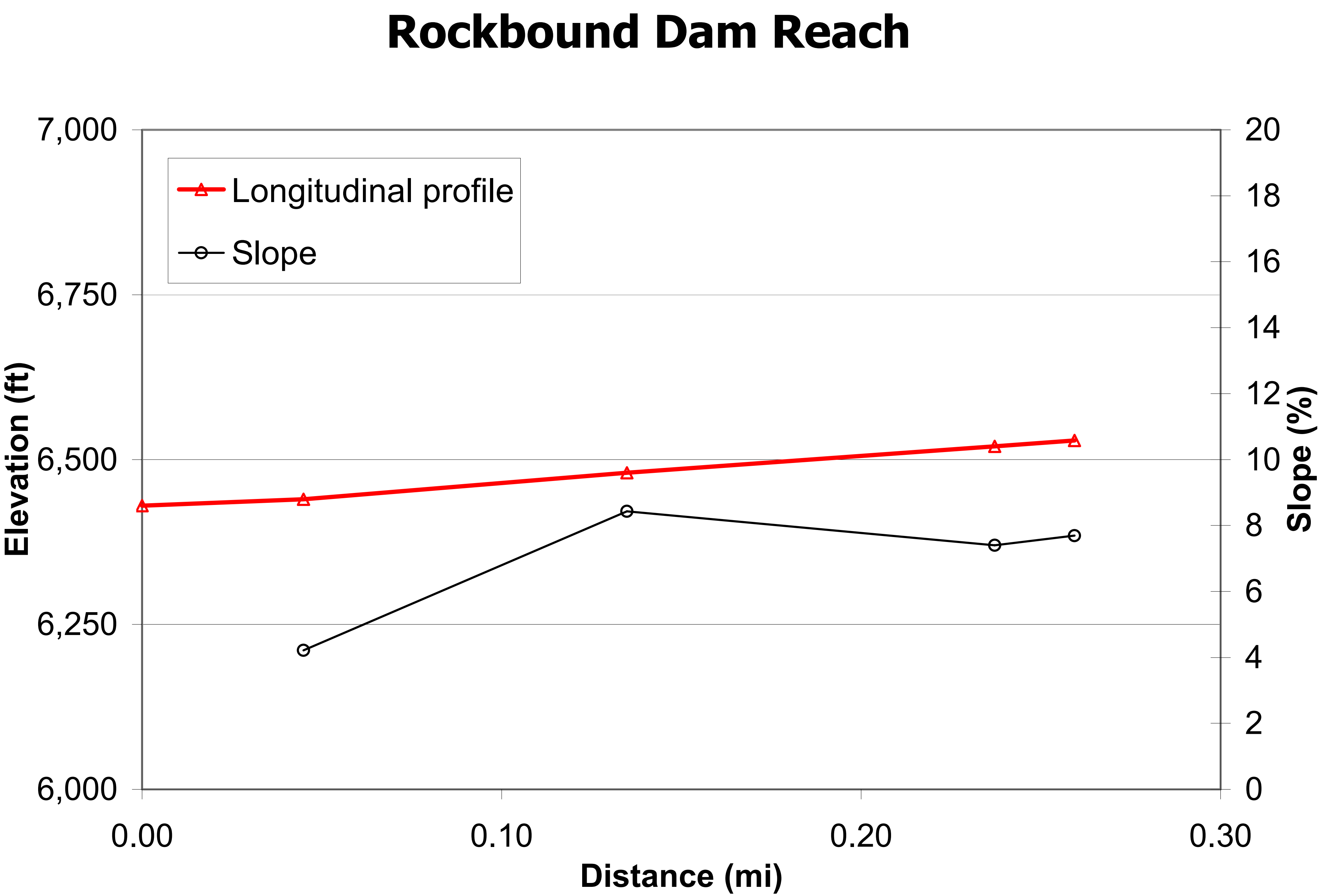
APPENDIX C

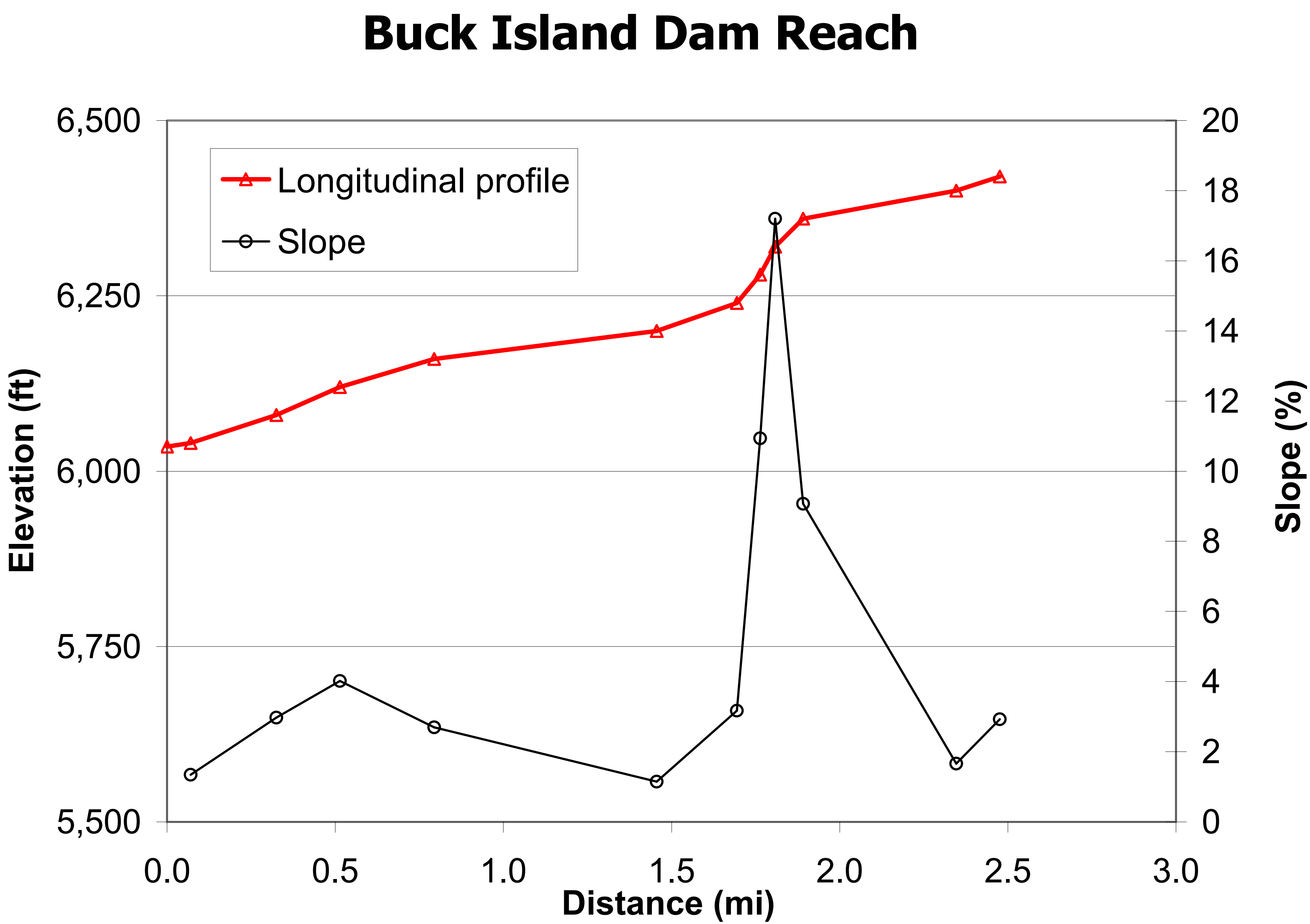
REACH-SCALE LONGITUDINAL PROFILE PLOTS FOR LEVEL II/III SITES

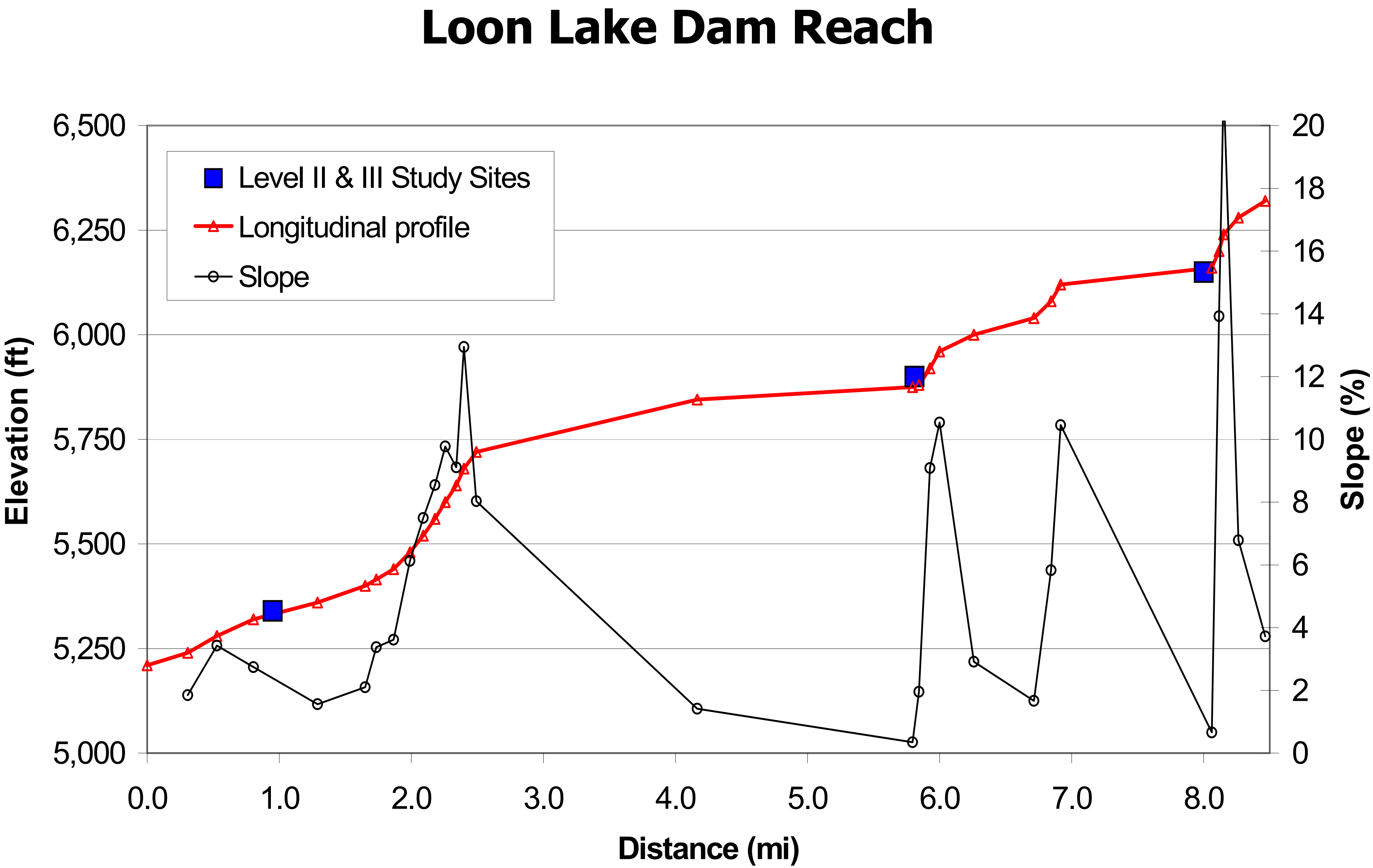
Rubicon Dam Reach



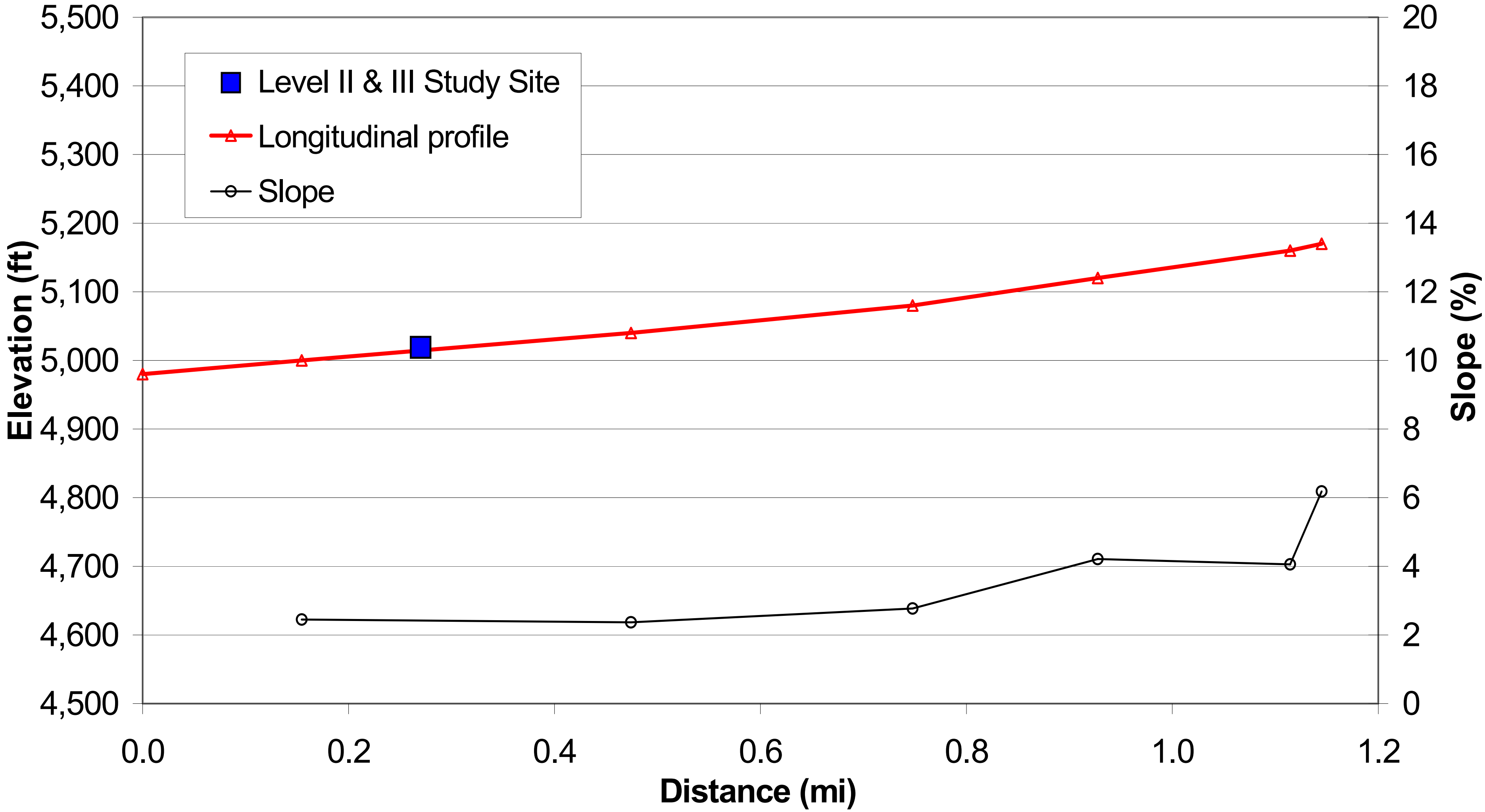

Rubicon Tunnel Outlet Reach
Longitudinal profile
Slope
Elevation (ft)
6,560
6,550
6,540
6,530
6,520
Slope (%)
20
18
16
14
12
10
8
6
4
2
0
0.0
0.1
0.2
0.3
0.4
Distance (mi)


Rockbound Dam Reach
Longitudinal profile
Slope
Elevation (ft)
7,000
6,750
6,500
6,250
6,000
Slope (%)
20
18
16
14
12
10
8
6
4
2
0
0.00
0.10
0.20
0.30
Distance (mi)

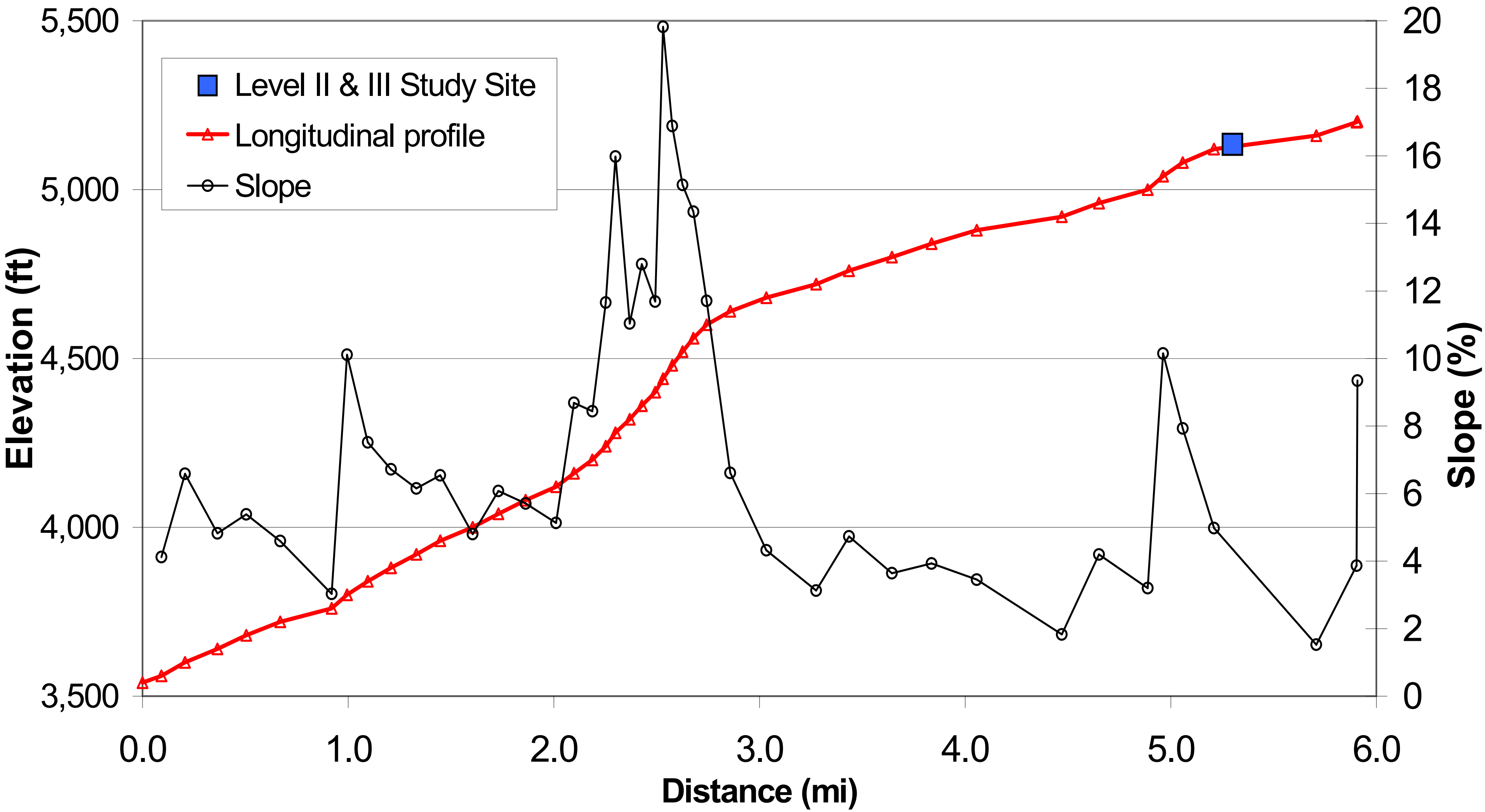

Buck Island Dam Reach
Longitudinal profile
Slope
Elevation (ft)
6,500
6,250
6,000
5,750
5,500
Slope (%)
20
18
16
14
12
10
8
6
4
2
0
0.0
0.5
1.0
1.5
2.0
2.5
3.0
Distance (mi)

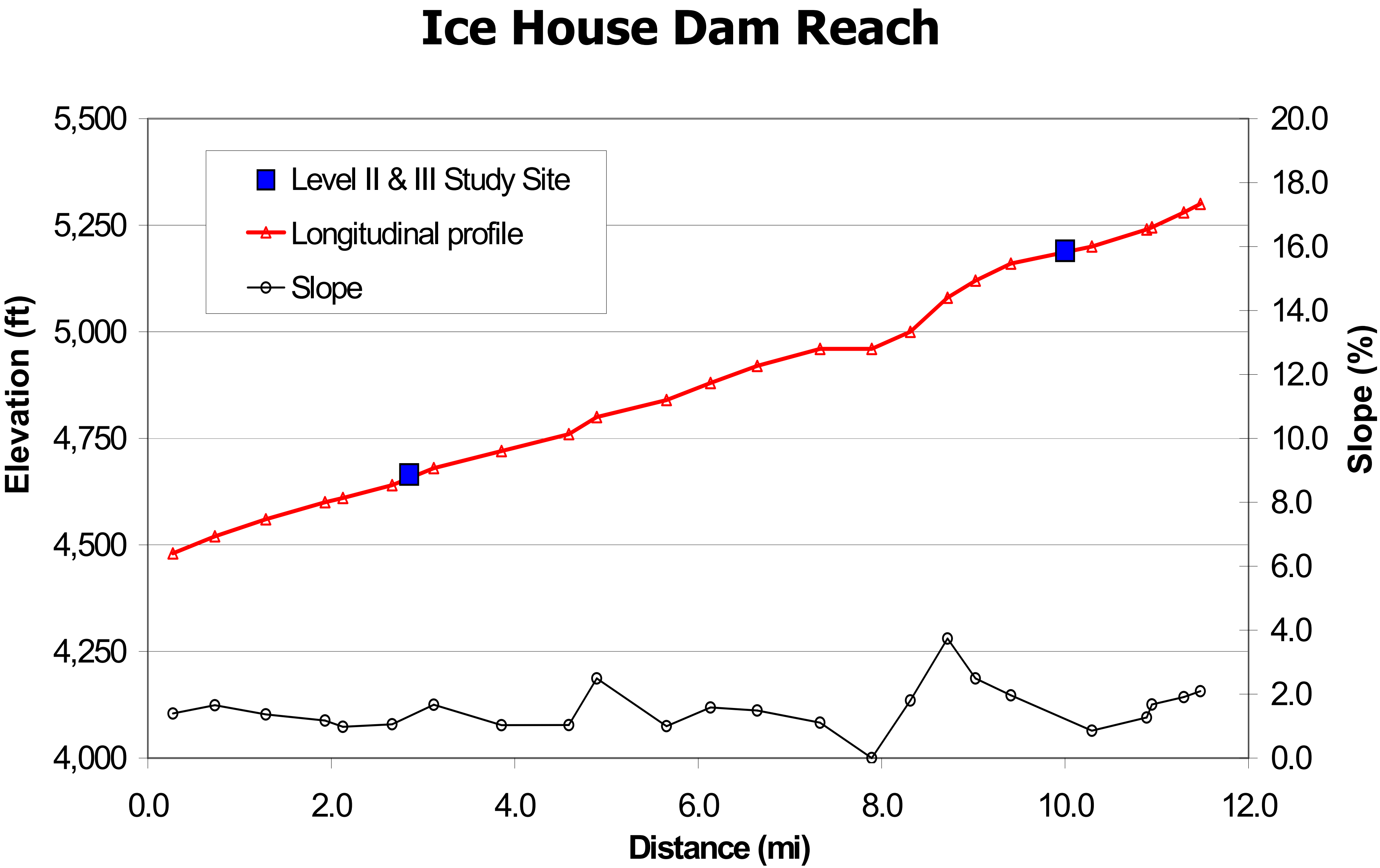

Loon Lake Dam Reach
Level II & III Study Sites
Longitudinal profile
Slope
Elevation (ft)
6,500
6,250
6,000
5,750
5,500
5,250
5,000
Slope (%)
20
18
16
14
12
10
8
6
4
2
0
0.0
1.0
2.0
3.0
4.0
5.0
6.0
7.0
8.0
Distance (mi)

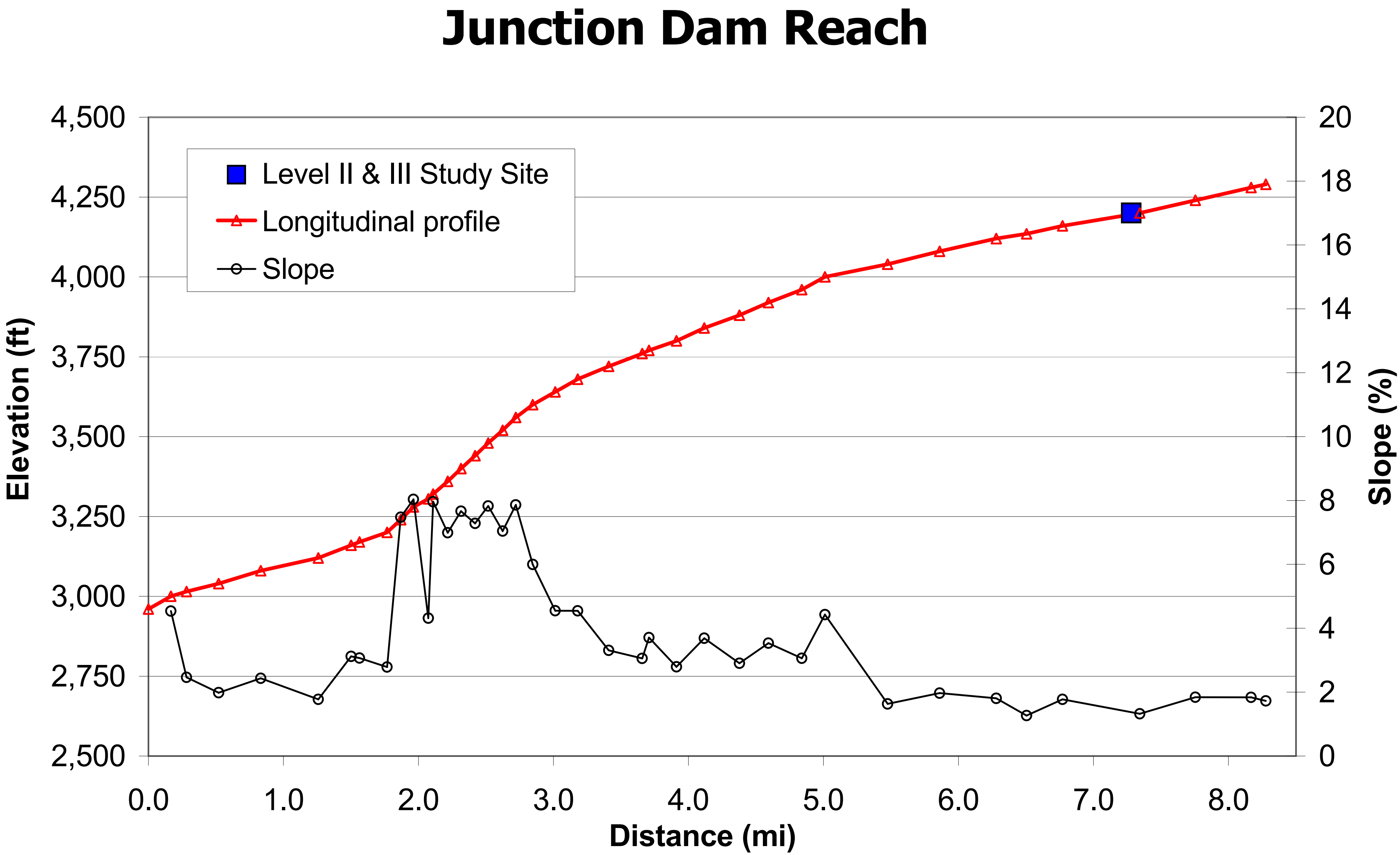
Gerle Creek Dam Reach



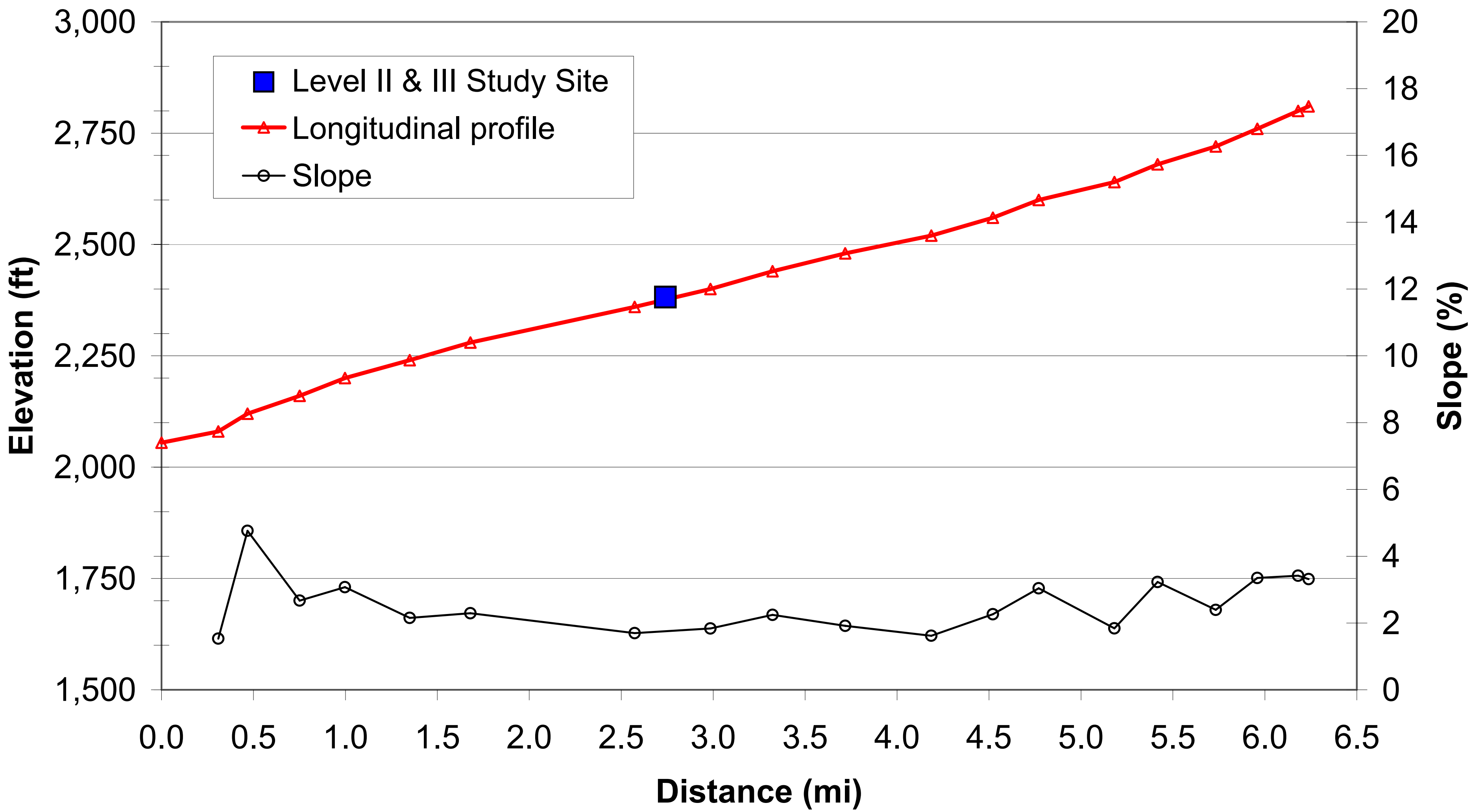
Robbs Peak Dam Reach

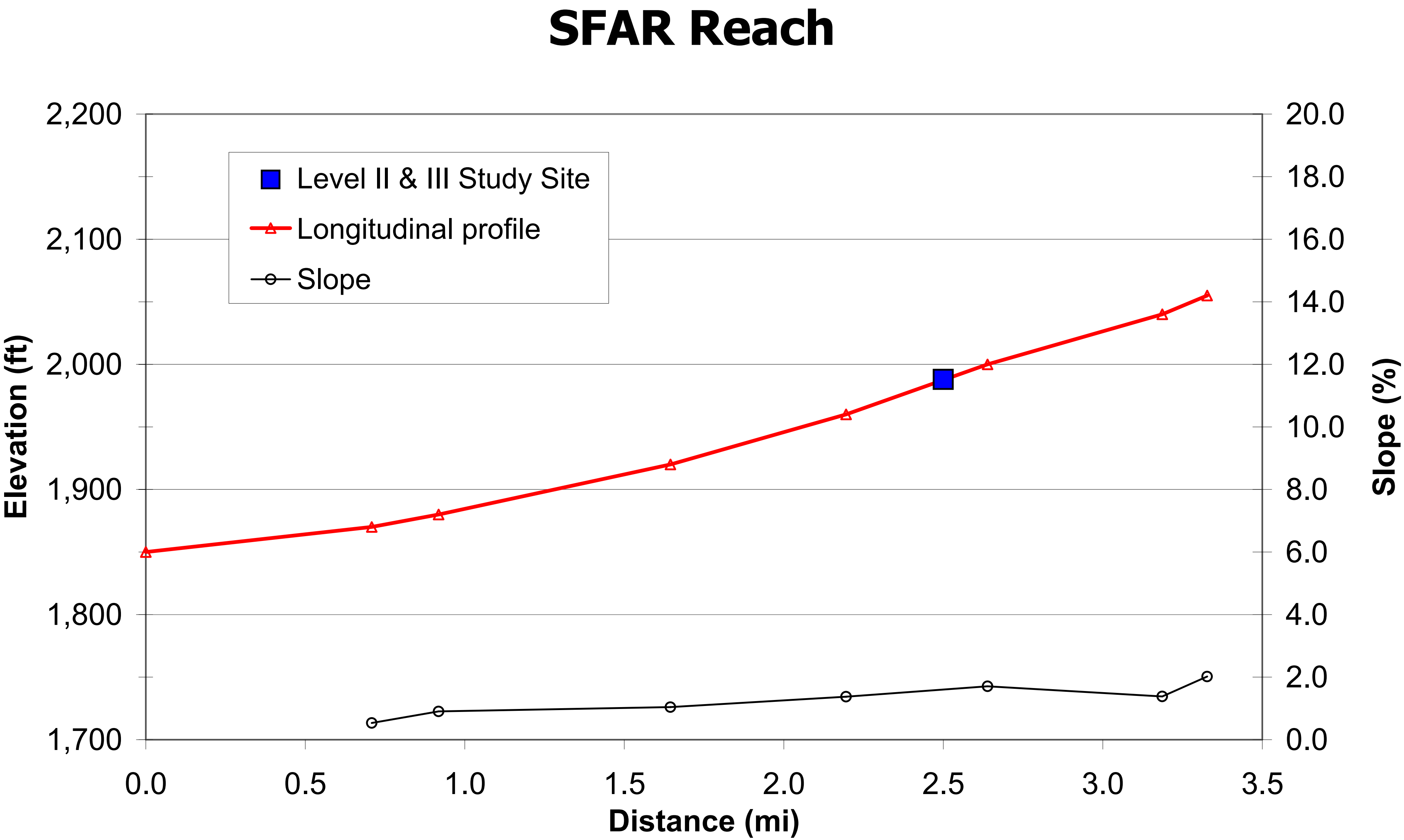



Ice House Dam Reach
5,500
5,250
5,000
4,750
4,500
4,250
4,000
Elevation (ft)
20.0
18.0
16.0
14.0
12.0
10.0
8.0
6.0
4.0
2.0
0.0
Slope (%)
Level II & III Study Site
Longitudinal profile
Slope
0.0
2.0
4.0
6.0
8.0
10.0
12.0
Distance (mi)

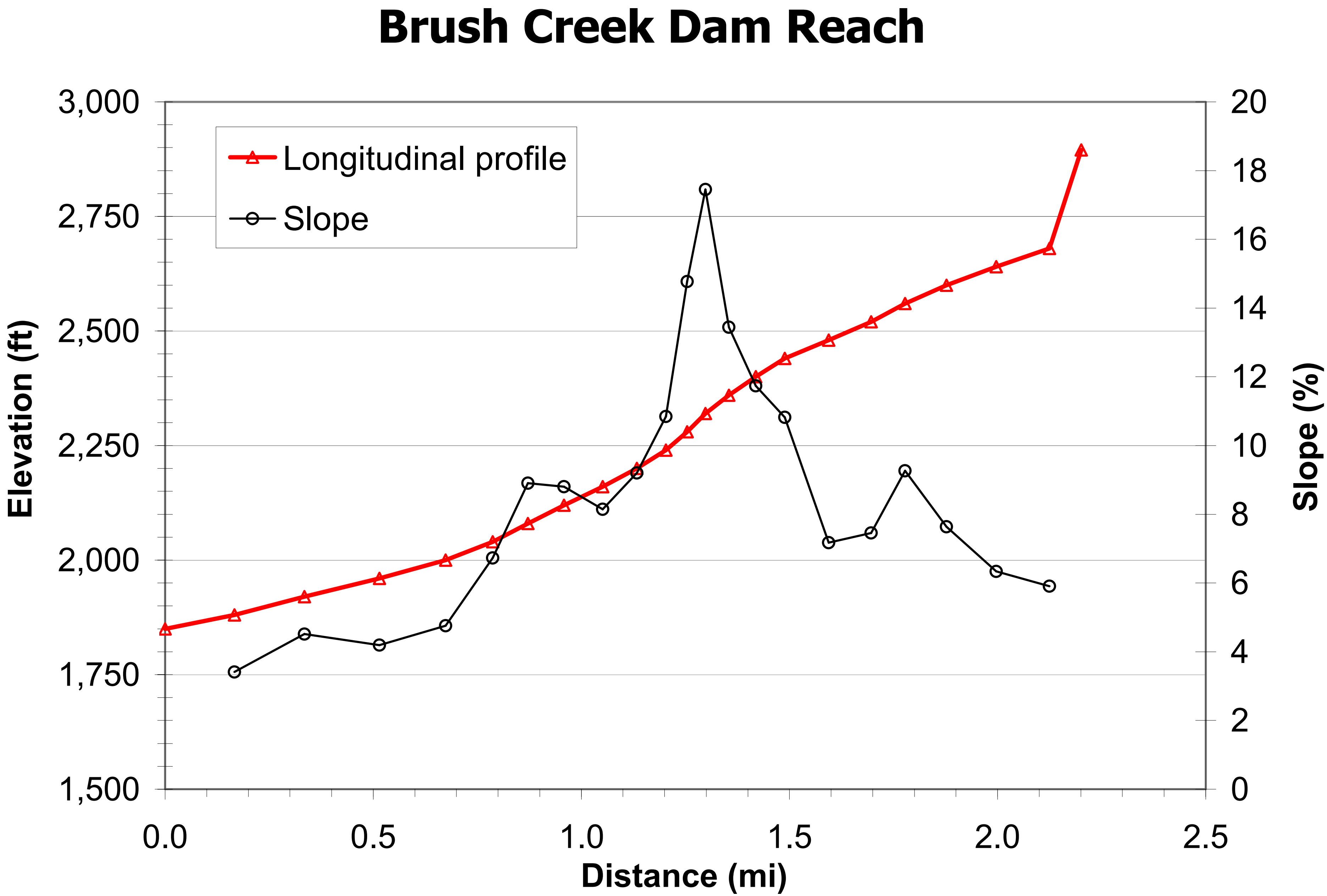

Junction Dam Reach
4,500
4,250
4,000
3,750
3,500
3,250
3,000
2,750
2,500
Elevation (ft)
20
18
16
14
12
10
8
6
4
2
0
Slope (%)
Level II & III Study Site
Longitudinal profile
Slope
0.0
1.0
2.0
3.0
4.0
5.0
6.0
7.0
8.0
Distance (mi)

Camino Dam Reach



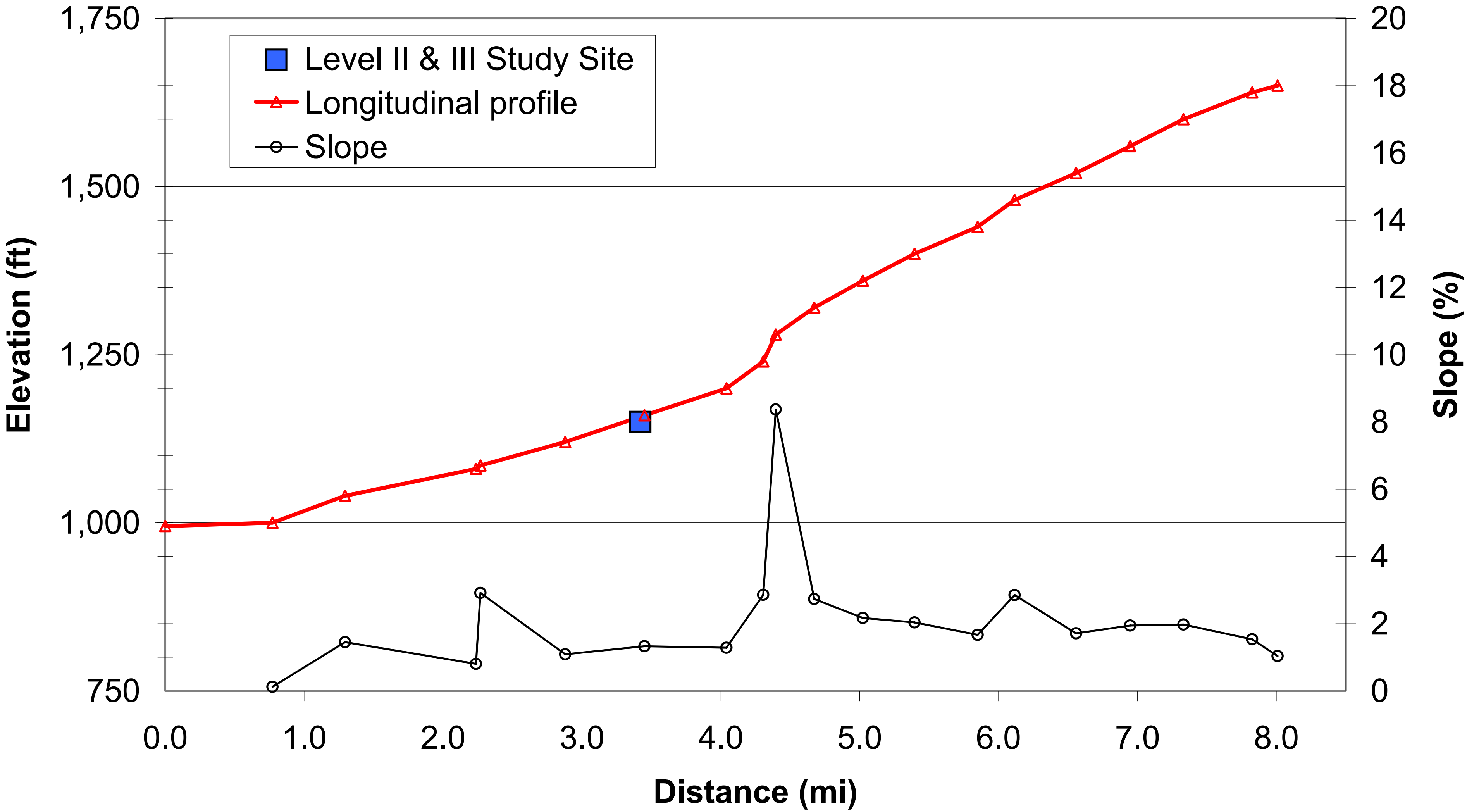


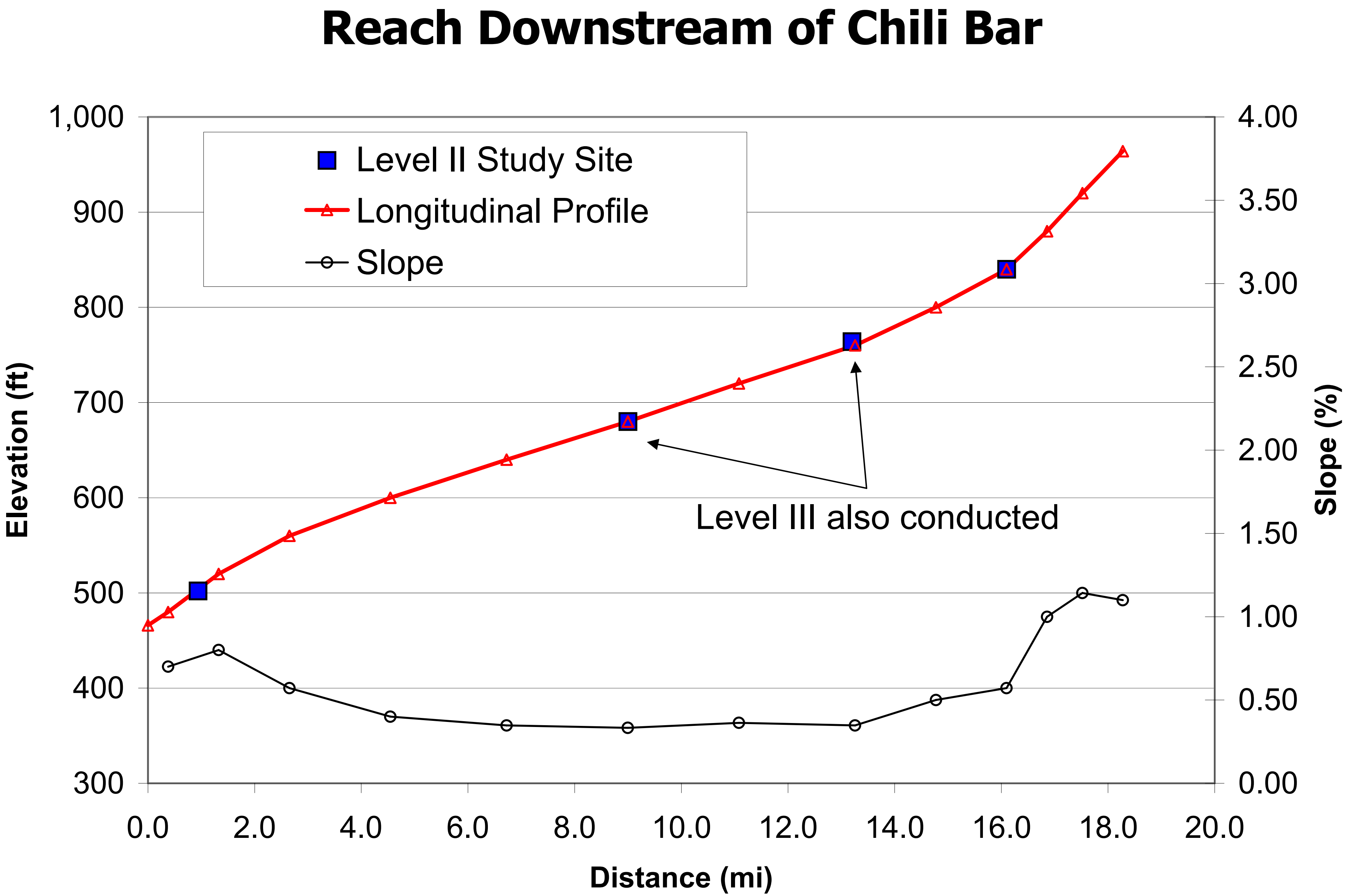
SFAR Reach
Level II & III Study Site
Longitudinal profile
Slope
Elevation (ft)
2,200
2,100
2,000
1,900
1,800
1,700
Slope (%)
20.0
18.0
16.0
14.0
12.0
10.0
8.0
6.0
4.0
2.0
0.0
0.0
0.5
1.0
1.5
2.0
2.5
3.0
3.5
Distance (mi)



Brush Creek Dam Reach
Longitudinal profile
Slope
Elevation (ft)
Slope (%)
Distance (mi)
3,000
2,750
2,500
2,250
2,000
1,750
1,500
20
18
16
14
12
10
8
6
4
2
0
0.0
0.5
1.0
1.5
2.0
2.5

Slab Creek Dam Reach




Reach Downstream of Chili Bar
Level II Study Site
Longitudinal Profile
Slope
Level III also conducted
Elevation (ft)
Slope (%)
Distance (mi)
1,000
900
800
700
600
500
400
300
4.00
3.50
3.00
2.50
2.00
1.50
1.00
0.50
0.00
0.0
2.0
4.0
6.0
8.0
10.0
12.0
14.0
16.0
18.0
20.0

APPENDIX D

SAMPLE LEVEL II/III FIELD DATA SHEETS

Data Sheet Checklist	**PROJECT CODE: ______ TASK CODE:______________** Page ___ of ___

Study Reach Name: ____ **Crew Initials**: ______________

Date: ______/_______/_______
month day year

Checklist of data sheets required for each site

☐ Longitudinal Profile

☐ Upper Cross Section

☐ Middle Cross Section

☐ Lower Cross Section

☐ Bank Erosion and Riparian Vegetation

☐ Facies Map

☐ LWD Frequency

☐ LWD Key Pieces

☐ Pebble Count

☐ Pfankuch 1

☐ Pfankuch 2

☐ Photo Log

☐ Rosgen Level III

☐ V*

Add observations for each channel characteristic addressed in the data sheets in the notes section on each data sheet.

QA Check:_________________________

Photo Log

PROJECT CODE: ______ TASK CODE:_______________
Page ______ of _________

Study Reach Name: ____ **Crew Initials**: ________________

Date: ______/_______/_______
month day year

Film Exp. #	Roll	Digital Img. #	Notes

QA Check:____________________________

Longitudinal Profile

PROJECT CODE: ______ **TASK CODE:**________________
Page ______ of _________

Study Reach Name: ____ **Crew Initials**: __________________

Units: __________________

GPS Reading Upstream:______________________________ **Downstream:** ______________________________

Date: ______/_______/_______ **Start Time**: __________ **Stop Time**: __________
month day year (24-hour clock) (24-hour clock)

HI	BS	FS	STA	Notes

QA Check:______________________________

Cross Section

PROJECT CODE: ______ **TASK CODE:**______________
Page ______ of _________

Study Reach Name: ____ **Crew Initials**:________________

Location on Longitudinal Profile: ___________ Upper / Middle / Lower x-sect. **Units:** ________________

GPS Reading at LB Endpin:______________________ **GPS Reading at RB Endpin:**______________________

Date: ______/_______/_______ **Start Time**: __________ **Stop Time**: __________
month day year (24-hour clock) (24-hour clock)

HI	BS	FS	STA	Notes

QA Check:___________________________

Pebble Count Data Sheet

PROJECT CODE: ____________ TASK CODE ______

Page ______ of ______

Study reach Name: ________________________________ Crew Initials: ______________

Date: ___ / ___ / ___ Start time: _________ End time: _________
(month) (day) (year)

Pebble count location on long profile: _________ Shape of pebbles: (circle one) Angular Subangular Well Rounded

Cross section: (circle one) upper middle lower

Width of intermediate axis in mm: Cobble Embeddedness: (circle one) <= 35% >35%

	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20
1																				
2																				
3																				
4																				
5																				

Notes: ______________________

Pebble count location on long profile: _________ Shape of pebbles: (circle one) Angular Subangular Well Rounded

Cross section: (circle one) upper middle lower

Width of intermediate axis in mm: Cobble Embeddedness: (circle one) <= 35% >35%

	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20
1																				
2																				
3																				
4																				
5																				

Notes: ______________________

Pebble count location on long profile: _________ Shape of pebbles: (circle one) Angular Subangular Well Rounded

Cross section: (circle one) upper middle lower

Width of intermediate axis in mm: Cobble Embeddedness: (circle one) <= 35% >35%

	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20
1																				
2																				
3																				
4																				
5																				

Notes: ______________________

QA Check ____________

Facies Map Data Sheet

PROJECT CODE:__________ TASK CODE ______

Page _____ of _____

Study reach Name:____________________________ Crew Initials: ____________

Date: ___ / ___ / ___ Start time: ________ End time: ________

(month) (day) (year)

33 rows x 30 columns Each cell equals _____ X _____ QA Check__________

Rosgen Level III Data Sheet	PROJECT CODE: ________ TASK CODE ____	Page ____ of ____

Study reach Name: ______________________ Crew Initials: __________

Date: ___ / ___ / ___ Start time: ________ End time: ________
(month) (day) (year)

Depositional Features (circle one)

B-1 point bars

B-2 pt. bars w/ few mid channel bars

B-3 many mid channel bars

B-4 side bars

B-5 diagonal bars

B-6 main branching w/ many mid channel bars and islands

B-7 mixed side bar and mid channel bars exceeding 2-3X width

B-8 delta bars

Description: ______________________

Meander Pattern (circle one)

M-1 regular meander

M-2 tortuous meander

M-3 irregular meander

M-4 truncated meander

M-5 unconfined me. scrolls

M-6 confine me. scrolls

M-7 distorted me. loops

M-8 irregular with oxbows

Description: ______________________

STREAM CHANNEL DEBRIS/BLOCKAGES (circle one)

Description/Extent		Materials, which upon placement into the active channel or floodprone area may cause and adjustment in channel dimensions or conditions, due to influences on the existing flow regime
D-1	None	Minor amounts of small, floatable material
D-2	Infrequent	Debris consists of small, easily moved, floatable material; i.e. leaves, needles, small limbs, twigs, etc..
D-3	Moderate	Increasing frequency of small to medium sized material, i.e. large limbs, branches, small logs that when accumulated effect 10% or less of the active channel cross-sectional area.
D-4	Numerous	Significant buildup of medium to large sized materials, i.e. large limbs, branches, small logs, or portions of trees that may occupy 10 to 30% of the active cross-sectional area.
D-5	Extensive	Debris "dams" of predominantly larger materials, i.e. branches, logs, trees, etc., occupying 30 to 50% of the active channel cross-section, often extending across the width of the active channel.
D-6	Dominating	Large, somewhat continuous debris "dams," extensive in nature and occupying over 50% of the active channel cross-section. Such accumulations may divert water into floodprone areas and form fish migration barriers, even when flows are at less than bankfull.
D-7	Beaver Dams - Few	An infrequent number of dams spaced such that normal streamflow and expected channel conditions exist in the reaches between dams.
D-8	Beaver Dams - Frequent	Frequency of dams is such that backwater conditions exist for channel reaches between structures; where streamflow velocities are reduced and channel dimensions or conditions are influenced.
D-9	Beaver Dams - Abandoned	Numerous abandoned dams, many of which have filled with sediment and/or breached, initiating a series of channel adjustments such as bank erosion, lateral migration, evulsion, aggradations and degradation.
D-10	Human Influences	Structures, facilities, or materials related to land uses or development located within the floodprone area, such as diversions or low-head dams, controlled by-pass channels, velocity control structures, and various transportation encroachments that have influence on the existing flow regime, such that significant channel

Notes: ______________________

QA Check ________

Channel Stability (Pfankuch)

PROJECT CODE: ______ **TASK CODE:**_______________

Page ___ of ___

Study Reach Name: ____ **Crew Initials**: _______________

Date: ______/_______/_______ **Start Time**: __________ **Stop Time**: __________

month day year (24-hour clock) (24-hour clock)

		Category	(circle one for each of the four options for each category)	
Upper Banks	1	Landform slope	Bank slope gradient <30%	2
			Bank slope gradient 30-40%	4
			Bank slope gradient 40-60%	6
			Bank slope gradient 60+%	8
	2	Mass wasting	No evidence of past or future mass wasting	3
			Infrequent. Most likely healed over. Low future potential	6
			Frequent or large, causing sediment nearly year long	9
			Frequent or large causing sediment nearly year long or imminent danger of same	12
	3	Debris jam potential	Essentially absent from immediate channel area	2
			Present, but mostly small twigs and limbs	4
			Moderate to heavy amounts, mostly larger sizes	6
			Moderate to heavy amounts, predominately lager sizes	8
	4	Vegetative bank protection	90%+ plant density. Vigor and variety suggest a deep, dense soil binding root mass	3
			70-90% density. Fewer species or less vigor suggest less dense or deep root mass	6
			<50-70% density. Lower vigor and fewer species from a shallow, discontinuous root mass	9
			<50% density, fewer species and less vigor indicate poor, discontinuous and shallow root mass	12
Lower Banks	5	Channel capacity	Ample for present plus some increases. Peak flows contained. W/D ration <7	1
			Adequate. Bank overflows rare. W/D ratio 8-15	2
			Barely contains present peaks. Occasional overbank floods. W/D ratio 15 to 25	3
			Inadequate. Overbank flows common. W/D ratio >25	4
	6	Bank rock content	65%+ with large angular boulders. 12″+ common.	2
			40-65%. Mostly small boulders to cobbles 6-12″	4
			20-40%. With most in the 3-6″ diameter class	6
			20% rock fragments of gravel sizes, 1-3″ or less	8
	7	Obstructions to flow	Rocks and logs firmly embedded. Flow pattern w/out cutting or deposition. Stable Bed	2
			Some present causing erosive cross currents and minor pool filling. Obstructions newer and less firm	4
			Moderately frequent, unstable obstructions move with high flows causing bank cutting and pool filling	6
			Sediment traps full, channel migration occurring	
	8	Cutting	Little or none. Infrequent raw banks less than 6″	4
			Some, intermittently at outcurves and constrictions. Raw banks may be up to 12″	6
			Significant. Cuts 12-24″ high. Root mat overhangs and sloughing evident	12
			Almost continuous cuts, some over 24″ high. Failure of overhangs frequent	16
	9	Deposition	Little or no enlargement of channel or point bars	4
			Some new bar increase, mostly from coarse gravel	8
			Moderate deposition of new gravel and course sand on old and some new bars	12
			Extensive deposits of predominately fine particles. Accelerated bar development	16

Notes:

QA Check:______________________________

Channel Stability (Pfankuch)

PROJECT CODE: ______ **TASK CODE:**_______________

Study Reach Name: ____ **Crew Initials**: _______________

Date: ______/_______/_______ **Start Time**: __________ **Stop Time**: __________

month day year (24-hour clock) (24-hour clock)

Bottom	10	Rock angularity	Sharp edges and corners. Plane surfaces rough.	1
			Rounded corners and edges, surfaces smooth, flat	2
			Corners and edges well rounded in two dimensions	3
			Well rounded in all dimensions, surfaces smooth	4
	11	Brightness	Surfaces dull, dark, or stained. Generally not bright	1
			Mostly dull, but may have <35% bright surfaces	2
			Mixture dull and bright, ie 35-65% mixture range	3
			Predominately bright, 65% exposed or scoured surfaces	4
	12	Consolidation of particles	Assorted sizes tightly packed or overlapping	2
			Moderately packed with some overlapping	4
			Mostly loose assortment with no apparent overlap	6
			No packing evident. Loose assortment easily moved	8
	13	Bottom size distribution	No size change evident. Stable mater. 80-100%	4
			Distribution shift light. Stable material 50-80%	8
			Moderate changes in sizes. Stable materials 20-50%	12
			Marked distribution change. Stable materials 0-20%	16
	14	Scouring and deposition	<5% of bottom affected by scour or deposition	6
			5-30% affected. Scour at constrictions and where grades steepen. Some deposition in pools	12
			30-50% affected. Deposits and scour at obstructions, constrictions, and bends. Some filling of pools	18
			More than 50% of the bottom in a state of flux or change nearly year long	24
	15	Aquatic vegetation	Abundant growth moss-like, dark green perennial. In swift water too.	1
			Common. Algae forms in low velocity and pool areas. Moss here too	2
			Present but spotty, mostly in backwater. Seasonal algae growth makes rocks slick	3
			Perennial types scare or absent. Yellow-green, short term bloom may be present	4

Notes:

QA Check:______________________________

LWD Frequency

PROJECT CODE: ______ **TASK CODE:**_______________

Page ______ of _________

Study Reach Name: ____ **Crew Initials**: ________________________

Date: ______/_______/_______ (month / day / year) **Start Time**: __________ (24-hour clock) **Stop Time**: __________ (24-hour clock)

Tally as "R" if rootwad attached

Diameter Class	**Length Class**				
	3–10 ft (0.9–3.0 m)	**10–25 ft (3.1–7.6 m)**	**25–50 ft (7.7–15.2 m)**	**50–75 ft (15.3–22.9 m)**	**>75 ft (>23 m)**
6–12 in (10–30 cm)					
12–24 in (31–60 cm)					
24–36 in (61–90 cm)					
>36 in (>90 cm)					

Comments: ____

QA Check: _______________

LWD Key Pieces Information

Page ______ of ________

Perform for 100 m of stream or reach length, whichever is greater. **Criteria for Determining Key Pieces to be Measured** (circle which used): (1) all pieces with length > 1.2 times bankfull channel width OR (2) pieces meeting criteria 1 and having diameters > 2.14 (BFW) + 26.43 cm OR (3) pieces meeting criteria 1 and with diameters > 24 in

KEY PIECE ATTRIBUTE	KEY PIECE NUMBER											
	1	2	3	4	5	6	7	8	9	10	11	12
Location on longitudinal profile												
Diameter (cm)												
Length (m)												
rootwad attached												
LOCATION IN BANKFULL CHANNEL AREA												
< 25% of piece length in bankfull channel												
25-50% of piece length in bankfull channel												
50-75% of piece length in bankfull channel												
75-100% of piece length in bankfull channel												
ORIENTATION												
Perpendicular												
angled downstream												
angled upstream												
parallel or near parallel to channel												
FUNCTION IN CHANNEL												
located in bankfull channel, but not influencing channel mor associated with pool habitat												
associated with, but not creating pool habitat												
acting as complex instream cover (has attached rootwad or intact branches)												
acting as velocity refuge												
associated with LWD jam (3 or more key pieces)												
piece is acting as sediment storage site												
piece appears to be stable in stream channel*												
POOL FORMATION												
forming dammed pool												
forming plunge pool												
forming lateral scour pool												
forming backwater pool												
pool surface area (m^2) associated with piece(s) (L x W)												
ADDITIONAL INFORMATION (OPTIONAL)												
decay class (1 = sound, limbs present; 2 = bark loose or abse surface slightly rotted; 3 = surface extensively rotted, center												
tree species (C = conifer, D = deciduous, U = unknown)												
input mechanism (W=windthrow, B=bank undercutting, D=debris flow, L=landslide, M=tree mortality, U=unkn)												

*Rootwad present, piece stabilized at more than one point by banks or channel obstructions, end anchored by streambed or bank burial, pegged by standing trees, spanning

Bank Erosion and Vegetation

PROJECT CODE: ______ TASK CODE:_______________

Page ___ of ___

Study Reach Name: ____ **Crew Initials**: _______________

Date: ______/_______/_______ (month day year) **Start Time**: __________ (24-hour clock) **Stop Time**: __________ (24-hour clock)

BANK EROSION POTNETIAL
(if banks are bedrock or composed of boulders, do not fill out this table)

	Bank a	Bank b	Bank c	Bank d
Bank height				
Bankfull height				
Root depth				
Root density (%)				
Bank Angle (degrees)				
Surface Protection (%)				
% of total study reach				

BANK MATERIAL: (circle one)

Bedrock Boulders

Cobble Gravel w/o sand

Gravel w/mod. sand

Gravel w/high sand

Sand Silt/clay

STRATIFICATION OF UNSTABLE LAYERS IN THE BANKS (below bankfull): circle one top of bank middle of bank bottom of bank

SEDIMENT SUPPLY: circle one Extreme Very High High Moderate Low

VERTICAL STREAMBED STABILITY: circle one Aggrading Degrading Stable

BANK AND CHANNEL BED CONDITION NOTES:

RIPARIAN VEGETATION				
	DENSITY (circle all that apply)			
VEGETATION TYPE	LOW	MOD.	HIGH	NOTES
Bare	1	1	1	
Forbs only	2a	2b		
Annual Grass w/ forbes	3a	3b	3c	
Perennial grass	4a	4b	4c	
Rhizomatous grasses (bluegrass, Grass like plants, sedges, rushes)	5a	5b	5c	
Low brush	6a	6b	6c	
High brush	7a	7b	7c	
Combination grass/brush	8a	8b	8c	
Deciduous overstory	9a	9b	9c	
Deciduous w/brush/grass understory	10a	10b	10c	
Perennial overstory	11a	11b	11c	
Wetland vegetation community	Bog	Fern	Marsh	

VEGETATION NOTES (composition, vigor, density, and potential):

QA Check:_____________________________

V* Measurements

PROJECT CODE:______________
Page ______ of _________

Study Reach: _______________________________________ **Crew Initials**:_________________________

Date: ______/_______/_______ **Start Time**: __________ **Stop Time**: __________
month day year (24-hour clock) (24-hour clock)

	Pool Sketch (outline residual pool, fines, and location of depth measurements)	Residual pool units ( )		Fine deposit units ( )				
pool head location on long profile	U/S ---flow→ D/S	L			a	b	c	d
				L				
		W		W				
Riffle crest depth (ft)		Dmax		D[1]				
pool head location on long profile	U/S ---flow→ D/S	L			a	b	c	d
				L				
		W		W				
Riffle crest depth (ft)		Dmax		D[1]				
pool head location on long profile	U/S ---flow→ D/S	L			a	b	c	d
				L				
		W		W				
Riffle crest depth (ft)		Dmax		D[1]				
pool head location on long profile	U/S ---flow→ D/S	L			a	b	c	d
				L				
		W		W				
Riffle crest depth (ft)		Dmax		D[1]				

1. take 5 depth measurements

QA Check_________

APPENDIX E

REPRESENTATIVE PHOTOGRAPHS

APPENDIX E
REPRESENTATIVE PHOTOGRAPHS
PHOTO INDEX

APPENDIX F

SITE PHOTOGRAPHS (COMPLETE SET, BY REACH) AND GPS COORDINATES

(Provided on CD)

Technical Report - 2003
Photo Index

Site:	UARP Rubicon Dam Reach Site (RD-G1)

Photo Number	Photo Description
650	Upper cross-section (1), looking downstream toward bottom of site
651	Middle cross-section (2), looking at river-left bank from river-right bank
652	Middle cross-section (2), looking at river-right bank from river-left bank
653	Middle cross-section (2), looking upstream
654	Middle cross-section (2), looking downstream
655	Lower cross-section (3), looking at river-left bank from river-right bank
656	Lower cross-section (3), looking at river-right bank from river-left bank
657	Lower cross-section (3), looking upstream
658	Lower cross-section (3), looking downstream
659	Upper cross-section (1), looking at river-left bank from river-right bank
660	Upper cross-section (1), looking at river-right bank from river-left bank
661	Upper cross-section (1), looking upstream
662	Upper cross-section (1), looking downstream

Technical Report - 2003
Photo Index

Site:	UARP Loon Lake Dam Reach Upper Site (LL-G1)

Photo Number	Photo Description
1322	Lower cross-section (3), looking from river-left bank to river-right bank
1323	Lower cross-section (3), looking downstream
1326	Lower cross-section (3), looking from river-right bank to river-left bank
1327	Middle cross-section (2), looking from river-left bank to river-right bank
1328	Middle cross-section (2), looking upstream
1329	Middle cross-section (2), looking downstream
1330	Middle cross-section (2), looking from river-right bank to river-left bank
1331	Upper cross-section (1), looking upstream
1332	Upper cross-section (1), looking from river-left bank to river-right bank
1333	Upper cross-section (1), looking downstream
1334	Upper cross-section (1), looking from river-right bank to river-left bank
1335	Lower cross-section (3), looking upstream

Technical Report - 2003
Photo Index

Site:	UARP Loon Lake Dam Reach Middle Site (LL-G2)

Photo Number	Photo Description
495	Upper cross-section (1), looking from river-left bank head pin at river-right bank with surveyor
496	Upper cross-section (1), looking from river-right bank turning point at river-left bank
497	Upper cross-section (1), looking from river-right bank edge of wetted channel at river-left bank with surveyor
498	Upper cross-section (1), looking from river-left bank head pin at river-right bank
499	Approximately 40 feet upstream of upper cross-section (1) looking downstream
501	Upper cross-section (1), looking from river-right bank turning point at river-left bank with surveyor
502	From 40 feet downstream of middle cross-section (2) looking upstream at upper cross-section (1) with surveyor
503	Middle cross-section (2), looking from river-left bank head pin at river-right bank
504	upstream
505	Middle cross-section (2), looking from river-right bank turning point at river-left bank
506	Middle cross-section (2), looking from river-right bank at 66 feet on tape looking at river-left bank with surveyor
507	Middle cross-section (2), Looking from 30 feet upstream of Cross-section 2 toward downstream
508	Surveyor drawing site at Upper cross-section (1)
509	Surveyor at auto level on mid channel bar/log jam - upstream of lower cross-section (3)
510	Surveyor with tape downstream of lower cross-section (3)
511	Looking upstream at mid channel bar below log jam with forced side channel with surveyor
512	Looking downstream at river-left bank forced side channel just upstream end of reach
513	Looking downstream at end of reach with log jam forcing side channels in background
514	Lower cross-section (3), looking at river-left bank pin (far away) from river-right bank
515	Lower cross-section (3), looking upstream at cross-section tape
516	Lower cross-section (3), looking at river-right bank pin (back by surveyor) from river-left bank
517	Lower cross-section (3), looking downstream at cross-section tape

Technical Report - 2003
Photo Index

Site:	UARP Loon Lake Dam Reach Lower Site (LL-G3)

Photo Number	Photo Description
518	Upper cross-section (1), looking at river-right bank pin from river-left bank
519	Upper cross-section (1), looking upstream at cross-section tape
520	Upper cross-section (1), looking at river-left bank pin from river-right bank
521	Upper cross-section (1), looking downstream at cross-section tape from river-left bank
522	Top of reach looking upstream from river-left bank
523	Middle cross-section (2), looking at river-right bank pin from river-left bank
524	Middle cross-section (2), looking downstream from river-left bank - note level location
525	Bench mark 1
526	Middle cross-section (2), looking downstream from river-left bank
527	Middle cross-section (2), looking upstream from river-left bank
528	Middle cross-section (2), looking toward river-left bank from river-right bank - note rod in channel
529	Lower cross-section (3), river-left bank head pin (flagged)
530	Near bottom of long profile with surveyor and rod for scale
531	Lower cross-section (3), looking upstream at cross-section tape
532	Lower cross-section (3), looking downstream at cross-section tape
533	Lower cross-section (3), looking at river-left bank from river-right bank - note surveyor and level)
534	Lower cross-section (3), looking at river-right bank from river-left bank
535	Lower cross-section (3), looking at river-right bank from river-left bank

Technical Report - 2003
Photo Index

Site:	UARP Gerle Creek Dam Reach Site (GC-G1)

Photo Number	
81	Upper cross-section (1), river-right bank looking at river-left bank with surveyor and stadia rod
82	Upstream of upper cross-section (1) looking downstream with surveyor and stadia rod
83	Upper cross-section (1), river-left bank looking at river-right bank with surveyor and stadia rod
84	Downstream of Upper cross-section (1) looking upstream with surveyor and stadia rod
85	Surveyor with survey equipment
89	Middle cross-section (2), river-left bank looking at river-right bank
90	Upstream of middle cross-section (2) looking downstream with surveyor
91	Middle cross-section (2), river-right bank looking at river-left bank
92	Downstream of middle cross-section (2) looking upstream.
93	Close-up of river-right bank gravel cobble deposit
94	Close-up shot of river-right bank
95	Downstream of lower cross-section (3) looking upstream
96	Downstream of lower cross-section (3) looking upstream at right channel with surveyor
97	Upstream of lower cross-section (3) looking downstream at right channel with surveyor
98	Upstream of lower cross-section (3) looking downstream at right channel with surveyor
99	Lower cross-section (3), river-right bank looking toward river-left bank with surveyor
100	Lower cross-section (3), river-left bank looking at river-right bank with surveyor
102	Lower cross-section (3), river-right bank looking at river-left bank with surveyor
103	Surveyor taking notes

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Site:	UARP Robbs Peak Dam Reach Site (RPD-G1)

Photo Number	Photo Description
2	Looking upstream at upper cross-section (1)
3	Upper cross-section (1), looking toward river-left bank - note surveyor and level
4	Upper cross-section (1), looking downstream at right edge
5	Upper cross-section (1), looking downstream at left edge cross-section - note large bar
6	Upper cross-section (1), looking toward river-right bank from river-left bank end pin
7	Upper cross-section (1) looking at river-right bank from instrument
8	Middle cross-section (2) looking at river-right bank from behind surveyor and instrument
9	Middle cross-section (2) looking downstream
10	Middle cross-section (2) looking downstream - note upstream cross-section flagging
11	Middle cross-section (2) looking at river-left bank from intermediate river-right bank pin
12	Middle cross-section (2) looking at river-left bank from river-right bank end pin
13	Middle cross-section (2) looking upstream from river-left bank - note long profile tape with surveyor
14	Lower cross-section (3) looking at river-right bank from river-left bank end pin
15	Lower cross-section (3) looking downstream
16	Lower cross-section (3) looking downstream from long profile
17	Lower cross-section (3) looking at river-left bank from river-right bank end pin
18	Lower cross-section (3) looking upstream with surveyor for scale

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Site:	UARP Ice House Dam Reach Upper Site (IH-G1)

Photo Number	Photo Description
35	Upper cross-section (1) looking from river-left bank to river-right bank with surveyor and stadia rod
36	Upper cross-section (1) looking from river-right bank to river-left bank with surveyor and stadia rod
37	Upper cross-section (1) looking upstream from mid-channel with surveyor and stadia rod
38	Upper cross-section (1) looking downstream from mid-channel with surveyor and stadia rod
39	Middle cross-section (2) looking from river-left bank to river-right bank with surveyor and stadia rod
40	Middle cross-section (2) looking from river-right bank to river-left bank with surveyor and stadia rod
41	Middle cross-section (2) looking upstream from mid-channel with surveyor and stadia rod
42	Middle cross-section (2) looking downstream from mid-channel with surveyor and stadia rod
43	Lower cross-section (3) looking from river-left bank to river-right bank with surveyor and stadia rod
44	Lower cross-section (3) looking from river-right bank to river-left bank with surveyor and stadia rod
45	Lower cross-section (3) looking upstream from mid-channel with surveyor and stadia rod
46	Lower cross-section (3) looking downstream from river-right bank with surveyor and stadia rod

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Site:	UARP Ice House Dam Reach Lower Site (IH-G2)

Photo Number	Photo Description
49	Upper cross-section (1), from river-left bank looking toward river-right bank with surveyor and stadia rod
50	Upper cross-section (1), looking downstream
51	Upper cross-section (1), looking downstream from river-left bank
52	Upper cross-section (1), looking upstream from river-left bank with surveyor and stadia rod
53	Upper cross-section (1), looking upstream from river-left bank with surveyor and stadia rod
54	Upper cross-section (1), looking from river-right bank toward river-left bank with surveyor
56	Middle cross-section (2), looking toward river-right bank from river-left bank with surveyor and stadia rod
57	Middle cross-section (2), looking downstream from river-left bank with surveyor and stadia rod
58	Middle cross-section (2), looking upstream from river-right bank with surveyor and stadia rod
59	Middle cross-section (2), looking toward river-left bank from river-right bank with surveyor and stadia rod
62	Lower cross-section (3), looking upstream from river-right bank
63	Lower cross-section (3), looking toward river-right bank from river-left bank

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Site:	UARP Junction Dam Reach Site (JD-G1)

Photo Number	Photo Description
69	Upper cross-section (1), looking at river-right bank from river-left bank with surveyor for scale
70	Upper cross-section (1), looking downstream from river-left bank with surveyor for scale
71	Upper cross-section (1), looking at river-left bank from river-left bank with surveyor for scale
72	Upper cross-section (1), looking upstream from river-right bank with surveyor for scale
73	Middle cross-section (2), looking downstream toward river-left bank from river-right bank with surveyor and stadia rod
74	Middle cross-section (2), looking toward river-left bank from river-right bank pin with surveyor and stadia rod
75	Middle cross-section (2), looking upstream at river-left bank from river-right bank with surveyor and stadia rod
76	Middle cross-section (2), looking at river-right bank from river-left bank pin with surveyor and stadia rod
77	Lower cross-section (3), looking downstream from river-right bank with surveyor and stadia rod
78	Lower cross-section (3), looking at river-left bank from river-right bank pin with surveyor and stadia rod
79	Lower cross-section (3), looking upstream from river-right bank with surveyor and stadia rod
80	Lower cross-section (3), looking at river-right bank from river-left bank pin with surveyor and stadia rod

Site:	UARP Camino Dam Reach Site (CD-G1)

Photo Number	Photo Description
570	Upper cross-section, looking from river right bank at river left bank pin, upper cross-section with surveyor
571	Cobble in upper cross-section with surveyor for scale
572	Upper cross-section, looking from channel at river left bank; note, bedrock wall
573	Upper cross-section, looking at river left bank pin below bedrock wall (note flagging)
574	Upper cross-section, looking from river left bank pin at river right bank pin with surveyor for scale
575	Upper cross-section, looking at river right bank pin from bank full indicator (note flagging)
576	Upper cross-section, looking at river right bank pin
577	Looking downstream from upstream end of longitudinal profile
578	Looking upstream from upstream end of longitudinal profile from river left bank
579	Looking upstream from upstream end of longitudinal profile from river right bank
580	Middle cross-section, looking at river-left bank pin
581	Middle cross-section, looking at river-right bank pin
582	Middle cross-section, looking downstream from river-left bank
583	Middle cross-section, looking upstream from river-left bank
584	Lower cross-section, looking at river-left bank pin
585	Lower cross-section, looking river-right bank pin with surveyor
586	Lower cross-section looking downstream from river-left bank
587	Lower cross-section, looking upstream from river-left bank
588	Pebble count at upper cross-section with surveyor for scale
589	Pebble count at middle cross-section with surveyor for scale
590	Pebble count at lower cross-section with surveyor for scale

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Site:	UARP S. F. American Reach Site (SFAR-G1)

Photo Number	Photo Description
942	Upper cross-section (1), above riffle looking from center of river to river-right bank and pin
943	Upper cross-section (1), above riffle looking from center of river to river-left bank and pin with surveyor for scale
944	Upper cross-section (1), above riffle looking from center of river upstream
945	Upper cross-section (1), above riffle looking from center of river downstream
946	From top of study reach looking downstream
947	From top of study reach looking upstream
989	On river-right bank, looking downstream at lower cross-section
990	On river-right bank, looking at lower cross-section at river-left bank pin with surveyor
991	On river-right bank, looking at lower cross-section at river-right bank pin
992	On river-right bank, looking upstream from lower cross-section
993	On river-right bank, looking downstream from lower cross-section

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Site:	UARP Slab Creek Dam Reach Site (SC-G1)

Roll-	Photo Description
1-19	Looking upstream at upper cross-section (1) toward river-right bank
1-20	Looking upstream at upper cross-section (1) toward river-left bank
1-21	Upper cross-section (1), looking downstream toward river-left bank
1-22	Upper cross-section (1), looking downstream toward river-right bank
1-23	Upper cross-section (1), looking at river-left bank pin from river-right bank
1-24	Upper cross-section (1), close-up of river-right bank pin
2-1	Upper cross-section (1), looking at river-right bank pin from river-left bank pin
2-2	Upper cross-section (1), close-up of river-left bank pin
2-3	Middle cross-section (2), looking at river-right bank pin from river-left bank
2-4	Middle cross-section (2), close-up of river-left bank pin (orange spray - painted nail)
2-5	Middle cross-section (2), looking downstream toward river-left bank
2-6	Middle cross-section (2), looking downstream toward river-right bank
2-7	Middle cross-section (2), looking upstream toward river-right bank
2-8	Middle cross-section (2), looking upstream toward river-left bank
2-9	Middle cross-section (2), looking at river-left bank pin from river-right bank pin
2-10	Middle cross-section (2), close-up of river-left bank pin (orange spray - painted nail)
2-11	Lower cross-section (3), looking at river-left bank pin from river-right bank pin
2-12	Lower cross-section (3), close-up of river-right bank pin (spray - painted rebar)
2-13	scale
2-14	Lower cross-section (3), looking upstream toward river-left bank pin
2-15	Lower cross-section (3), looking downstream toward river-left bank pin
2-16	Lower cross-section (3), looking upstream toward river-right bank pin
2-17	Lower cross-section (3), looking at river-right bank pin from river-left bank
2-18	Lower cross-section (3), close-up of river-left bank pin (spray - painted rebar)
2-19	Looking upstream at riffle just below middle cross-section 2

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Site:	Chili Bar Upper Canyon Site (CB-G1)

Photo Number	Photo Description
978	Upper cross-section (1), looking toward river-right bank from river-left bank - note surveyor with stadia rod in channel
979	Upper cross-section (1), looking upstream from river-left bank
980	Upper cross-section (1), looking downstream from river-left bank
981	Middle cross-section (2), from river-right bank looking toward river-left bank with surveyor
982	Middle cross-section (2), close-up of river-right bank pin
983	Middle cross-section (2), close-up of river-left bank pin
984	Middle cross-section (2), from river-left bank looking toward river-right bank
CB-G1-204	Lower cross-section (3), downstream from a boulder in the channel, showing cross section tape
CB-G1-205	Lower cross-section (3), river-right bank from a boulder in the channel, showing cross section tape
CB-G1-206	Lower cross-section (3), upstream from a boulder in the channel
CB-G1-207	Lower cross-section (3), view of river-right bank from river-left bank water's edge along cross section tape with surveyor
CB-G1-208	Lower cross-section (3), view of river-left bank from near river-left bank water's edge - showing auto level location near branch pile at right mid-photo
CB-G1-209	surveyor at benchmark 1 on river-left bank
CB-G1-210	Middle cross-section (3), surveyor at auto level on river-left bank

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Site:	Chili Bar Upper Coloma Site (CB-G2)

Photo Number	Photo Description
CB-G2-211	Upper cross-section, early morning looking upstream
CB-G2-212	Lower cross-section, looking at river-right pin from approximately fifty feet away
CB-G2-213	Lower cross-section, from river-right bank riparian vegetation looking back toward river-right bank pin
CB-G2-214	Lower cross-section, looking upstream from river-right bank
CB-G2-215	Lower cross-section, looking downstream from river-right bank
CB-G2-216	Lower cross-section, from active channel bank looking toward river-left bank pin
CB-G2-217	Lower cross-section, from floodplain terrace looking toward river-left bank pin
CB-G2-218	Lower cross-section, from historic floodplain terrace toward river-left bank pin (close-up)
CB-G2-219	Upper cross-section, looking toward river-right bank from estimated bank-full
CB-G2-220	Upper cross-section, from river-right bank looking upstream
CB-G2-221	Upper cross-section, from river-right bank looking downstream
CB-G2-222	Upper cross-section island, looking toward river-left bank pin - island separates two channels of river
CB-G2-223	Upper cross-section, from river-left bank looking toward river-left bank pin
CB-G2-224	Upper cross-section, from river-left bank estimated bank-full looking toward river-left bank pin
CB-G2-225	Upper cross-section, looking at river-left bank pin
CB-G2-226	Upriver from upper cross-section, river-left bank
CB-G2-227	Downriver from upper cross-section, river-left bank
CB-G2-228	Middle cross-section from river-left bank looking toward river-left bank pin
CB-G2-254	Middle cross-section, from river-left bank terrace looking toward river-left bank pin
CB-G2-255	Middle cross-section river-left bank pin close-up
CB-G2-256	Middle cross-section, from river-left bank looking upstream
CB-G2-257	Middle cross-section, from river-left bank looking downstream
CB-G2-258	Middle cross-section, from river-right bank looking toward river-right bank pin
CB-G2-259	Middle cross-section, from near edge of active floodplain looking toward river-right bank pin

Site:	Chili Bar Lower Coloma Site (CB-G3)

Photo Number	Photo Description
CB-G3-229	Middle cross-section (2), river-right bank pin - close-up
CB-G3-230	Middle cross-section (2), river-right bank pin
CB-G3-231	Middle cross-section (2), looking from river-right bank toward river-left bank
CB-G3-232	Middle cross-section (2), from river-left bank looking toward river-right bank with surveyor holding stadia rod
CB-G3-233	Middle cross-section (2), looking at river-left bank pin from the river
CB-G3-234	Middle cross-section (2), looking downstream from river-left bank
CB-G3-235	Middle cross-section (2), looking upstream from river-left bank
CB-G3-236	Middle cross-section (2), close-up of river-left bank pin
CB-G3-237	Middle cross-section (2), close-up of river-left bank pin with boulder and tree
CB-G3-238	Lower cross-section (3) looking at river-left bank from river-right bank with surveyor in channel
CB-G3-239	Lower cross-section (3) with surveyor at tripod on river-right bank
CB-G3-240	Lower cross-section (3), looking upstream from river-right bank - note flagging on tape
CB-G3-241	Lower cross-section (3), river-right bank pin at base of cedar tree
CB-G3-242	Lower cross-section (3), looking from river-right bank to river-left bank with level set-up
CB-G3-243	Lower cross-section (3), from river-right bank looking downstream with surveyor
CB-G3-244	Lower cross-section (3), from river-left bank looking at river-left bank pin
CB-G3-245	Lower cross-section (3), looking at river-left bank pin from river
CB-G3-246	Lower cross-section (3) looking from river-left bank toward river-right bank
CB-G3-263	Upper cross-section (1), from river-right bank looking toward channel with surveyor
CB-G3-264	Upper cross-section (1), looking at river-right bank pin and level set-up
CB-G3-265	Bench mark 1 near upper cross-section (1) (to right of clipboard)
CB-G3-266	Bench Mark 1 close-up (metal pipe)
CB-G3-267	Upper cross-section (1), looking upstream at river-right bank side channel
CB-G3-268	Upper cross-section (1), looking from river-right bank to river-left bank
CB-G3-269	Upper cross-section (1), looking downstream from river-right bank
CB-G3-270	Upper cross-section (1), looking upstream from mid-channel
CB-G3-271	Upper cross-section (1), looking upstream from river-left bank
CB-G3-273	Upper cross-section (1), looking at river-left bank pin

Site:	Chili Bar Lower Coloma Study Site (CB-G3) continued

Number	Photo Description
CB-G3-274	Upper cross-section (1), end of river-left bank survey with surveyor
CB-G3-275	Upper cross-section (1) , looking toward river-right bank from river-left bank backwater

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Site:	Chili Bar Gorge Site (CB-G4)

Photo Number	Photo Description
948	Looking upstream from point bar
949	Looking toward river-right bank from point bar
950	Looking downstream from point bar with surveyor for scale
951	Top of long profile looking downstream from river-left bank
952	Upper cross-section, river-left bank looking toward river-right bank with surveyor holding stadia rod
953	Upper cross-section, river-left bank looking toward river-right bank with surveyor holding stadia rod
954	Upper cross-section, from mid-channel bar looking toward river-left bank
955	Upper cross-section, from mid-channel bar looking river-right bank with surveyor for scale
956	Upper cross-section, from mid-channel bar looking downstream
957	Middle cross-section, from mid-channel looking river-left bank
958	Middle cross-section, from mid-channel looking toward river-right bank
959	Middle cross-section, from mid-channel looking upstream
960	Middle cross-section, from mid-channel looking downstream
961	Middle cross-section, from mid-channel looking upstream at side channel
962	Middle cross-section, from mid-channel looking downstream at side channel
963	Pebble count by surveyor at upper cross-section
964	Pebble count at upper cross-section side channel by surveyor
965	Lower cross-section pebble count by surveyor
966	Lower cross-section pebble count by surveyor
967	Downstream cross-section, looking at river-left bank pin
968	Downstream cross-section, looking toward river-left bank pin from river-left stream bank
969	Downstream cross-section, looking toward river-right bank pin from river-left bank
970	Downstream Cross-section, looking upstream from river-left bank
971	Downstream cross-section, looking downstream from river-left bank
972	Lower cross-section, looking downstream with surveyor
973	Lower cross-section, looking toward river-right bank from river-left bank
974	Lower cross-section, looking toward river-left bank with surveyor and stadia rod

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Site:	Chili Bar Gorge Study Site (CB-G4) continued

Number	Photo Description
975	From river-right bank looking toward river-left bank with surveyor
976	From river-right bank looking toward river-left bank with surveyor
977	Lower cross-section, close-up of river-right bank pin

APPENDIX G

DATA SETS: LONGITUDINAL PROFILE DATA, CROSS-SECTION DATA, AND PEBBLE COUNT TABLES FOR THE UARP

UARP:
Rubicon Dam Reach Site (RD-G1)
Loon Lake Dam Reach Upper Site (LL-G1)
Loon Lake Dam Reach Middle Site (LL-G2)
Loon Lake Dam Reach Lower Site (LL-G3)
Gerle Creek Dam Reach Site (GC-G1)
Robbs Peak Dam Reach Site (RPD-G1)
Ice House Dam Reach Upper Site (IH-G1)
Ice House Dam Reach Lower Site (IH-G2)
Junction Dam Reach Site (JD-G1)
Camino Dam Reach Site (CD-G1)
S. F. American Reach Site (SFAR-G1)
Slab Creek Dam Reach Site (SC-G1)

Rubicon Dam Reach Site (RD-G1) long profile (p. 1 of 2)

HI	BS	FS	STA	WSE	ELEV	Water depth (ft)	Bed material	Notes
105.22	5.22				100.00			Root on tree. R.E.W. (arbitrary elevation =100 ft)
		10.38	17.10	95.59	94.84	0.75	sand	mid-pool
		10.21	24.80	95.57	95.01	0.56	sand	
		10.02	32.00	95.55	95.20	0.35	cobble	
		9.99	39.70	95.48	95.23	0.25	cobble	head of riffle
		10.12	46.00	95.44	95.10	0.34	gravel	
		10.29	53.90	95.34	94.93	0.41	gravel	
		10.67	61.50	95.14	94.55	0.59	cobble	
		10.72	68.50	95.12	94.50	0.62	gravel	
		10.59	75.60	95.15	94.63	0.52	cobble	
		10.75	82.10	95.10	94.47	0.63	cobble	
		10.88	85.50	95.04	94.34	0.70	gravel	at upstream XS(#1)
	5.22							Root on tree. R.E.W.
		11.16	93.00	94.81	94.06	0.75	cobble	
		11.04	101.20	94.66	94.18	0.48	cobble	
		11.46	110.00	94.49	93.76	0.73	cobble	
		11.59	118.40	94.14	93.63	0.51	cobble	
		11.41	126.40	95.12	93.81	1.31	cobble	
		11.89	133.80	94.13	93.33	0.80	cobble	
		11.95	140.40	94.12	93.27	0.85	cobble	
		11.54	148.10	94.11	93.68	0.43	cobble	
		11.77	155.80	93.91	93.45	0.46	cobble	tail of riffle
		12.62	162.90	93.84	92.60	1.24	boulder	head of pool
		14.18	170.80	93.90	91.04	2.86	bedrock	
		14.04	178.40	93.90	91.18	2.72	bedrock	
		14.60	185.50	93.87	90.62	3.25	cobble	
		14.29	193.70	93.89	90.93	2.96	bedrock	
		13.39	205.00	93.88	91.83	2.05	boulder	
		13.85	213.00	93.91	91.37	2.54	cobble	
		13.12	220.30	93.88	92.10	1.78	cobble	
		12.20	230.00	93.90	93.02	0.88	gravel	
		11.62	237.10	93.90	93.60	0.30	gravel	
		11.65	243.00	93.89	93.57	0.32	gravel	head of riffle
		11.68	250.00	93.82	93.54	0.28	sand	
		11.91	259.40	93.79	93.31	0.48	gravel	middle XS (#2)
		9.73			95.49			shot to rock in mid channel pool

Rubicon Dam Reach Site (RD-G1) long profile (p. 2 of 2)

HI	BS	FS	STA	WSE	ELEV	Water depth (ft)	Bed material	Notes
New day 8/26/03								
101.53	6.04				95.49			rock in middle of stream (pool) from 8/25/03 survey *NB - Add these stations to last station on 8/25
		8.32	256.20	93.81	93.21	0.60	gravel	in riffle
		8.26	259.40	93.75	93.27	0.48	gravel	at XS 2 (middle XS)
		8.23	266.40	93.63	93.30	0.33	gravel	
		8.30	273.70	93.48	93.23	0.25	gravel	
		8.55	280.40	93.35	92.98	0.37	gravel	
		8.78	287.20	93.28	92.75	0.53	gravel	
		8.79	294.40	93.24	92.74	0.50	gravel	
		8.87	302.80	93.14	92.66	0.48	gravel	
		8.91	309.50	93.08	92.62	0.46	gravel	
		9.09	316.90	93.04	92.44	0.60	gravel	
		8.90	324.30	92.99	92.63	0.36	gravel	
		8.24			93.29			rock on REW
104.23	10.94							rock on REW
		11.69	330.60	92.96	92.54	0.42	gravel	
		11.69	338.40	92.94	92.54	0.40	gravel	
		12.05	346.30	92.89	92.18	0.71	gravel	
		11.84	352.20	92.92	92.39	0.53	gravel	
		11.71	359.30	92.86	92.52	0.34	gravel	
		11.68	362.80	92.82	92.55	0.27	gravel	at XS 3 (lower XS)
104.28	10.99							rock on REW
		11.98	369.60	92.67	92.30	0.37	gravel	
		12.01	376.60	92.63	92.27	0.36	gravel	
		12.35	383.80	92.63	91.93	0.70	sand	
		12.31	390.60	92.62	91.97	0.65	gravel	
		12.19	397.40	92.61	92.09	0.52	gravel	
		12.25	404.30	92.59	92.03	0.56	gravel	
		12.13	411.30	92.60	92.15	0.45	gravel	
		12.08	418.80	92.55	92.20	0.35	gravel	
		12.03	425.00	92.49	92.25	0.24	cobble	
		12.19	432.90	92.29	92.09	0.20	cobble	
		12.42	440.40	92.13	91.86	0.27	sand	
		12.60	447.90	91.98	91.68	0.30	sand	end of riffle
	10.99							rock on REW (reshoot)

Rubicon Dam Reach Site (RD-G1) upper cross-section

HI	BS	FS	STA	ELEV	WD	Bed material	Notes
105.22	5.22			100.00			root on tree REW
		5.12					top of pin RB
		5.49	0.20	99.73			base of pin RB
		6.15	4.70	99.07		silt	top of terrace
		8.06	8.30	97.16			bankfull elevation RB
		10.23	13.10	94.99	0.00		REW
		10.22	15.00	95.00	0.01	bedrock	
		10.32	17.00	94.90	0.15	bedrock	
		10.89	19.20	94.33	0.68	cobble	
		10.45	21.50	94.77	0.15	cobble	
		10.62	24.00	94.60	0.19	cobble	
		10.28	26.40	94.94	0.04	gravel	
		10.30	28.80	94.92	0.11	gravel	
		10.26	30.70	94.96	0.05	gravel	
		10.17	31.30	95.05	0.00	gravel	LEW
		9.88	35.30	95.34		cobble bar	
		10.26	39.10	94.96	0.00		REW, high flow channel
		10.78	41.30	94.44	0.47	cobble/gravel	
		11.45	43.80	93.77	0.15	cobble	
		11.05	46.50	94.17	0.76	cobble	
		10.71	48.85	94.51	0.42	cobble	
		10.31	49.90	94.91	0.00		LEW high flow channel
		9.80	52.80	95.42		on gravel bar	
		9.33	60.00	95.89		gravel bar	
		9.19	67.00	96.03		gravel bar	
		8.45	74.10	96.77		gravel bar	
		8.08	81.40	97.14		gravel bar	
		8.57	88.10	96.65			edge of second high flow channel
		8.72	92.40	96.50			
		8.22	97.00	97.00			
		6.54	102.50	98.68			
		5.55	104.90	99.67			
		5.36	108.00	99.86			
		5.41	111.20	99.81			base of pin, LB
		5.08					top of pin, LB

Rubicon Dam Reach Site (RD-G1) middle cross-section

HI	BS	FS	STA	ELEV	WD	Bed material	Notes
101.53	6.04			95.49			rock in middle of stream (in pool) - from 8/25 survey
		2.35	0.60				top of pin LB
		2.61	0.60	98.92			base of pin LB
		3.82	8.20	97.71		sand/silt	top of terrace
		4.69	12.00	96.84			
		5.56	16.00	95.97			
		6.01	20.70	95.52			bankfull elevation, LB
		7.70	23.50	93.83	0.00		LEW
		7.94	25.10	93.59	0.16	cobble	
		8.10	27.00	93.43	0.33	gravel	
		8.12	29.10	93.41	0.35	gravel	
		8.26	31.10	93.27	0.48	gravel	
		8.27	33.20	93.26	0.49	gravel	
		8.29	35.20	93.24	0.51	gravel	
		8.18	36.90	93.35	0.41	cobble	
		7.99	39.10	93.54	0.24	gravel	
		7.89	41.30	93.64	0.16	gravel	
		7.82	43.70	93.71	0.07	gravel	
		7.90	45.60	93.63	0.20	gravel	
		7.90	47.00	93.63	0.23	cobble	
		8.08	48.90	93.45	0.40	cobble	
		8.03	51.30	93.50	0.35	cobble	
		7.92	53.20	93.61	0.22	cobble	
		7.97	55.50	93.56	0.26	cobble	
		7.81	57.60	93.72			REW
		6.68	64.20	94.85		gravel bar	on gravel bar
		6.31	71.80	95.22			
		6.22	78.00	95.31			
		6.23	80.50	95.30			bankfull elevation
		4.06	85.20	97.47			
		3.69	88.50	97.84			top of terrace, RB
		2.14	94.60	99.39			base of pin, RB
		1.86					top of pin, RB

Rubicon Dam Reach Site (RD-G1) lower cross-section

HI	BS	FS	STA	ELEV	WD	Bed material	Notes
104.28	10.99			93.29			rock on REW
		3.60	5.30				top of pin LB
		3.82	5.30	100.46			base of pin LB
		4.34	9.30	99.94		silt/sand	top of left terrace
		5.98	14.10	98.30			on slope
		9.95	18.90	94.33			bankfull elevation LB
		11.50	24.10	92.78	0.00		LEW
		12.01	27.10	92.27	0.45	gravel	
		12.01	29.20	92.27	0.45	gravel	
		11.89	31.30	92.39	0.30	gravel	
		11.78	33.30	92.50	0.22	gravel	
		11.72	35.00	92.56	0.24	gravel	
		11.65	37.00	92.63	0.23	gravel	
		11.69	39.00	92.59	0.29	gravel	
		11.76	41.00	92.52	0.38	gravel	
		11.77	43.20	92.51	0.40	gravel	
		11.75	45.30	92.53	0.38	gravel	
		11.73	47.70	92.55	0.36	sand	
		11.69	50.40	92.59	0.35	sand	
		11.63	53.00	92.65	0.26	sand	
		11.49	55.10	92.79	0.11	sand	
		11.50	57.10	92.78	0.15	cobble	
		11.24	59.50	93.04	0.00		REW
		10.79	66.00	93.49		gravel bar	on gravel bar
		10.97	73.60	93.31			
		9.91	80.00	94.37			
		9.26	84.30	95.02			
		10.15	89.90	94.13			
		9.77	93.50	94.51			bankfull elevation
		9.19	99.90	95.09			
		7.83	102.70	96.45			
		6.15	107.30	98.13			
		4.81	111.00	99.47			
		4.61	115.20	99.67			base of pin RB
		4.34					top of pin RB

Rubicon Dam Reach Site (RD-G1) pebble count summary

Modified Wolman Pebble Count (mm), Rubicon Reach

Particle Description	Upper Class Boundary (mm)	Rosgen Particle Size	XS #1	XS #2	XS #3	Total	Item %	Cum %
Very coarse sand (unmeasured)	<2	6	13	16	15	44	15%	15%
Very coarse sand (measured)	2	5	0	0	0	0	0%	15%
Very Fine Gravel	4	4	2	0	1	3	1%	16%
Fine Gravel	8		1	4	7	12	4%	20%
Medium Gravel	16		10	10	7	27	9%	29%
Coarse Gravel	32		28	19	21	68	23%	51%
Very Coarse Gravel	64		31	22	31	84	28%	79%
Small Cobble	128	3	13	24	17	54	18%	97%
Large Cobble	256		2	5	1	8	3%	100%
Small Boulder	512	2	0	0	0	0	0%	100%
Medium Boulder	1024		0	0	0	0	0%	100%
Large Boulder	2048		0	0	0	0	0%	100%
Very Large Boulder	4096		0	0	0	0	0%	100%
Bedrock	>4096	1	0	0	0	0	0%	100%
		Total	100	100	100	300	100%	

Loon Lake Dam Reach Upper Site (LL-G1) long profile

HI	BS	FS	STA	Water depth (ft)	Elev	WSE	Notes
100.50	0.50		BM		100.00		Assumed elevation BM = 100'
		14.45	0.00	2.37	86.05	88.42	d/s of multi-thread channels thru meadow
		13.89	25.00	1.80	86.61	88.41	
		16.25	50.00	4.13	84.25	88.38	
		14.36	75.00	2.24	86.14	88.38	
		14.38	125.00	2.23	86.12	88.35	Skipped 100' - no visibility
		14.19	150.00	2.03	86.31	88.34	
		16.00	175.00	3.02	84.50	87.52	
		15.49	200.00	3.31	85.01	88.32	
101.25	1.25	0.50					TP 1 on BM
							no vis 225-300
		16.93	300.00	4.00	84.32	88.32	maybe backwater at STA 300
							325 upstr end of outcrop
		17.40	325.00	4.49	83.85	88.34	
		16.34	350.00	3.40	84.91	88.31	TW on bedrock
		17.05	375.00	4.13	84.20	88.33	
		18.05	400.00	5.07	83.20	88.27	
		1.25	BM				BM close

Loon Lake Dam Reach Upper Site (LL-G1) upper cross-section

HI	BS	FS	STA	ELEV	Notes
105.99	5.99		BM 1		Meadow surface is heavily vegetated w/ stand of even-aged lodgepoles. No elev. change from 75' out from river (to base of BR slope)
		16.30	0.00		Top of RB EP
		16.40	0.00	89.59	Base of RB EP
		16.44	2.50	89.55	
		16.68	5.00	89.31	
		17.37	7.00	88.62	right edge of water - (backwater stagnant pool)
		18.21	9.60	87.78	(depth = 0.9)
		18.40	11.00	87.59	
		17.43	13.40	88.56	left edge water (backwater pool)
		16.83	17.20	89.16	
		16.19	20.50	89.80	
		15.95	22.50	90.04	
		15.91	25.00	90.08	
		16.18	25.90	89.81	
		16.77	26.00	89.22	RB bankfull
		17.25	26.10	88.74	
		17.71	26.50	88.28	REW
		18.70	27.50	87.29	
		19.44	29.70	86.55	
		20.38	30.40	85.61	
		20.57	32.50	85.42	
		20.35	35.00	85.64	
		20.03	37.00	85.96	
		19.81	38.00	86.18	
		19.79	39.70	86.20	
		19.74	41.00	86.25	
		19.35	42.30	86.64	
		18.00	43.80	87.99	
		17.95	44.20	88.04	(LEW = 45.5)
		17.58	45.80	88.41	lower bankfull estimate
		17.40	47.00	88.59	upper BF estimate (LB)
		16.91	48.50	89.08	
		16.54	49.80	89.45	
		16.78	52.00	89.21	
		16.82	53.00	89.17	
		16.63	55.00	89.36	
		16.05	57.00	89.94	
		15.93	58.80	90.06	LB Top of pin
		16.04	58.80	89.95	LB Bottom of pin
		5.99	BM 1		(Loop closed)
103.00	3.00		BM 1		moved instrument
					Meadow surface continues to the left at same slope. Valley wall is hundreds of feet away.

Loon Lake Dam Reach Upper Site (LL-G1) middle cross-section

HI	BS	FS	STA	ELEV	Notes
103.00		12.48	0.00		top of RB EP
		12.68	0.00	90.32	bottom of RB EP
		12.89	-10.00	90.11	
		13.30	-17.00	89.70	foot (toe) of BR valley wall
		10.16	-22.00	92.84	BR (BR continues at same slope to the right)
		12.84	3.00	90.16	
		13.15	3.50	89.85	
		14.14	4.00	88.86	RB bankfull
		14.80	4.20	88.20	REW / overhang over rootball of conifer - 6')
		16.05	4.50	86.95	
		18.30	7.00	84.70	
		18.65	10.20	84.35	
		18.55	13.00	84.45	
		18.44	16.00	84.56	
		18.16	19.00	84.84	
		18.09	21.00	84.91	
		18.69	23.00	84.31	
		18.95	25.00	84.05	
		18.97	27.00	84.03	
		18.71	29.00	84.29	
		18.40	31.00	84.60	
		17.10	33.00	85.90	
		16.29	35.00	86.71	
		15.45	37.00	87.55	
		14.75	37.40	88.25	LEW
		14.33	37.50	88.67	
		14.01	38.10	88.99	LB BF est.
		13.54	39.10	89.46	
		13.30	39.90	89.70	LB base of pin
		13.09	39.90		LB top of pin
		12.74	44.00	90.26	at elevation of meadow (approximately)

Loon Lake Dam Reach Upper Site (LL-G1) lower cross-section

HI	BS	FS	STA	ELEV	Notes
103.00		12.98	0.00	90.02	Top of RB EP
		13.28	0.00	89.72	RB EP (bottom)
		13.13	-6.00	89.87	
		13.22	-10.00	89.78	
		13.47	-16.00	89.53	
		13.00	-20.00	90.00	toe of BR valley wall
		7.43	-30.00	95.57	BR; slope continues to the right)
		13.73	3.00	89.27	
		14.10	5.50	88.90	
		13.93	7.50	89.07	
		13.69	9.50	89.31	
		13.60	11.00	89.40	
		13.80	12.00	89.20	
		14.41	13.00	88.59	RB BF est.
		14.81	14.00	88.19	REW
		15.93	14.50	87.07	
		16.68	15.50	86.32	
		17.43	17.00	85.57	
		17.89	19.00	85.11	
		17.82	20.00	85.18	
		17.67	21.00	85.33	
		17.56	22.00	85.44	
		17.40	23.00	85.60	
		17.18	24.00	85.82	
		17.22	25.00	85.78	
		17.46	26.00	85.54	
		17.46	27.00	85.54	
		17.51	28.00	85.49	
		17.76	30.00	85.24	
		17.46	31.00	85.54	
		17.91	32.00	85.09	
		17.00	33.00	86.00	
		16.28	34.00	86.72	
		15.60	35.00	87.40	
		15.12	36.00	87.88	
		14.75	36.40	88.25	LEW (undercut)
		13.99	36.20	89.01	LB BF (outer edge of overhang)
		13.40	37.00	89.60	
		12.93	38.50	90.07	
		12.80	39.50	90.20	
103.00		12.75	40.50	90.25	
		12.81	41.60	90.19	LB bottom of pin
		12.71	41.60	90.29	LB top of pin - at elevation of meadow - continues for 50' to the left.
	3.00		BM 1		LOOP CLOSED

Loon Lake Dam Reach Middle Site (LL-G2) long profile (p. 1 of 2)

HI	BS	FS	STA	ELEV	Water depth (ft)	WSE	Notes
107.76	7.76		BM1	100.00			pin in base of tree near XS 2
		8.89	0.00	98.87	1.90	100.77	
		8.45	15.00	99.31	1.20	100.51	top of LGR
		9.34	30.00	98.42	1.60	100.02	
		9.56	45.00	98.20	1.85	100.05	
		10.03	60.00	97.73	1.60	99.33	
		10.11	75.00	97.65	1.50	99.15	XS1@STA 78
		10.75	90.00	97.01	1.50	98.51	
		11.14	97.00	96.62	2.45	99.07	
		10.46	110.00	97.30	1.00	98.30	
		10.93	125.00	96.83	1.00	97.83	
		11.72	140.00	96.04	1.20	97.24	
		12.14	155.00	95.62	1.40	97.02	
		12.21	170.00	95.55	1.50	97.05	
		7.76	BM1				
103.32	3.32		BM1(turn)	100.00			
		4.76	BM2	98.56			pin in base of tree D/S of XS2
		7.71	173.00	95.61	1.30	96.91	XS2
		8.15	190.00	95.17	1.60	96.77	
		8.35	205.00	94.97	1.50	96.47	
		4.76	BM2	98.56			
	3.32		BM1				
101.43		2.87	BM2(turn)	98.56			
		6.82	220.00	94.61	1.65	96.26	
		7.10	235.00	94.33	1.52	95.85	
		7.23	250.00	94.20	1.62	95.82	
		7.40	265.00	94.03	1.75	95.78	
		7.25	276.00	94.18	1.46	95.64	
		7.20	291.00	94.23	1.30	95.53	
		7.67	306.00	93.76	1.56	95.32	
		8.51	321.00	92.92	2.29	95.21	
		8.66	336.00	92.77	2.51	95.28	
		8.18	351.00	93.25	2.02	95.27	
		8.14	355.00	93.29	1.80	95.09	edge of log jam
		2.44	356.00	98.99	2.00	100.99	top of log
		8.29	357.00	93.14			
		4.04	358.50	97.39	can't read		top of log
		8.31	360.00	93.12	1.85	94.97	
		3.69	362.00	97.74			top of log
		8.32	362.00	93.11	1.83	94.94	
		3.44	366.00	97.99			top of tree
		8.29	367.00	93.14	1.45	94.59	end of log jam

Loon Lake Dam Reach Middle Site (LL-G2) long profile (p. 2 of 2)

HI	BS	FS	STA	ELEV	Water depth (ft)	WSE	Notes
101.43		8.25	376.00	93.18	1.21	94.39	
		5.70	BM3	95.73			pin in base of large snag, on LB D/S of woodjam
		2.88	BM2				
100.35	4.62		BM3(turn)	95.73			
		7.74	391.00	92.61	1.22	93.83	
		9.14	406.00	91.21	2.17	93.38	
		9.99	421.00	90.36	3.04	93.40	
		9.63	436.00	90.72	2.65	93.37	LWD jam w/small mid-channel bar & side channel
		8.52	451.00	91.83	1.54	93.37	
		7.92	466.00	92.43	0.88	93.31	
		8.66	481.00	91.69	1.48	93.17	
		9.95	496.00	90.40	2.34	92.74	~ end of bar
		9.76	511.00	90.59	2.16	92.75	
		9.04	526.00	91.31	1.36	92.67	
		9.47	541.00	90.88	1.52	92.40	
		9.41	556.00	90.94	1.35	92.29	
		9.88	571.00	90.47	1.76	92.23	~ XS 3 location
		9.76	581.00	90.59	1.62	92.21	
		10.06	596.00	90.29	1.85	92.14	
		10.10	611.00	90.25	1.90	92.15	
		9.92	626.00	90.43	1.73	92.16	
		9.67	641.00	90.68	1.45	92.13	
		9.63	656.00	90.72	1.40	92.12	
		9.94	671.00	90.41	1.73	92.14	side channel starts on LB beginning of meadow
		9.97	686.00	90.38	1.75	92.13	
		10.38	701.00	89.97	2.17	92.14	
		10.51	704.00	89.84	2.30	92.14	spanner LWD - can see on air photo
		6.08	BM4	94.27			
		4.62	BM3	95.73			
101.35	5.62		BM3(turn)	95.73			
		2.79	BM2	98.56			
103.66	5.10		BM2(turn)	98.56			
		3.67	BM1	99.99			Loop Closed: error of 0.01

Loon Lake Dam Reach Middle Site (LL-G2) upper cross-section

HI	BS	FS	STA	WD	ELEV	Notes
107.76		3.31	LB HP		104.45	top of LB HP
		4.24	0.00		103.52	base of LB HP
		5.31	9.00		102.45	in snowmelt runoff channel
		5.71	17.00		102.05	edge of LWD jam
		5.18	20.60		102.58	top of log, LWD jam (undercut)
		6.69	22.00		101.07	upper BF est, 3' off XS tape
		10.90	22.60		96.86	lower BF est, 3' off XS tape
		8.41	21.00		99.35	next to LWD jam, undercut
		8.65	28.00	0.00	99.11	LEW
		8.14	30.00		99.62	top of BLD
		9.55	31.00		98.21	edge of BLD
		10.17	33.00		97.59	
		9.72	35.00		98.04	
		9.83	37.00		97.93	
		9.25	39.00		98.51	
		9.43	41.00		98.33	
		9.82	43.00		97.94	
		9.23	45.00		98.53	
		9.75	47.00		98.01	
		9.99	49.00		97.77	
		9.84	51.00		97.92	
		9.53	52.50		98.23	
		8.77	53.60		98.99	small island edge of water
		8.26	54.00		99.50	top of BLD
		8.85	55.20		98.91	small island edge of water
		9.26	56.30		98.50	
		8.77	58.00		98.99	
		7.90	59.00		99.86	top of BLD
		8.85	60.20		98.91	edge of BLD
		8.72	63.40	0.00	99.04	RB edge of water
		8.60	68.00		99.16	edge of log
		8.08	68.50		99.68	top of log
		8.87	69.00		98.89	in stagnant backwater
		7.98	74.00		99.78	lower BF estimate
		7.28	77.00		100.48	top of log, upper BF estimate
		8.10	81.00		99.66	
		7.49	83.00		100.27	on log
		8.05	87.00		99.71	
		8.75	92.00		99.01	in stagnant water
		8.21	97.00		99.55	base of RB EP
		7.09	RB EP		100.67	top of pin
		3.31	LB HP		104.45	top of LB HP
		7.76	BM1		100.00	pin in base of tree near XS2.

Loon Lake Dam Reach Middle Site (LL-G2) middle cross-section

HI	BS	FS	STA	WD	ELEV	Notes
103.32		4.18	LB HP		99.14	top of LB HP
		4.58	0.00		98.74	base of LB HP
		4.55	10.00		98.77	
		4.98	20.00		98.34	
		4.97	27.00		98.35	upper BF estimate
		5.74	29.60		97.58	lower BF estimate
		6.43	32.60	0.00	96.89	LEW
		7.31	35.00		96.01	
		6.92	37.00		96.40	on small BLD
		7.47	39.00		95.85	
		7.71	41.00		95.61	
		7.64	43.00		95.68	
		7.94	45.30		95.38	edge of BLD
		6.24	47.00		97.08	top of BLD
		7.23	48.50		96.09	edge of BLD
		7.21	50.50		96.11	
		6.97	52.50		96.35	
		6.15	54.50		97.17	top of BLD
		6.75	56.50		96.57	
		6.37	58.50	0.00	96.95	REW
		5.47	62.50		97.85	lower BF estimate
		5.03	69.00		98.29	upper BF estimate
		4.75	74.00		98.57	
		4.87	80.60		98.45	base of RB EP
		4.55	RB EP		98.77	top of RB EP
		4.76	BM2		98.56	
		3.32	BM1		100.00	
		4.01	-5.00		99.31	past LB HP
		4.16	-10.00		99.16	
		3.16	-15.00		100.16	
		3.89	-19.50		99.43	
		3.60	-25.00		99.72	
		3.64	-30.00		99.68	
		3.85	-34.50		99.47	edge of 2 dead trees
		1.10	-36.00		102.22	top of log
		4.19	-37.00		99.13	edge of log, in large rootwad hole
		4.40	-43.00		98.92	base of 9-ft. diameter rootwad
		4.18	LB HP		99.14	
		4.55	RB EP		98.77	top of RB EP
		4.91	80.60		98.41	bottom of RB EP
		4.93	85.00		98.39	past RB EP
		4.82	90.00		98.50	past RB EP
		5.13	95.00		98.19	
		5.75	98.50	0.00	97.57	edge of stagnant water
		6.28	100.00		97.04	
		5.58	104.00		97.74	
		6.25	105.00		97.07	
		6.00	110.00		97.32	
		6.00	111.00	0.00	97.32	edge of stagnant water
		3.32	BM1			
		4.76	BM2			

Loon Lake Dam Reach Middle Site (LL-G2) lower cross-section

HI	BS	FS	STA	ELEV	WD	Notes
98.03	3.76		BM4	94.27		
		4.13	0.00	93.90		LTOP
		4.52	0.00	93.51		LBOP
		4.79	10.00	93.24		
		5.60	16.00	92.43	0.00	Edge of sm backwater
		7.22	18.00	90.81		
		7.18	21.00	90.85		
		6.09	23.50	91.94	0.00	Edge of water
		5.42	24.80	92.61		Next to log
		3.62	25.60	94.41		Top of log
		4.89	31.00	93.14		
		4.94	41.00	93.09		
		5.49	45.00	92.54		
		5.75	50.00	92.28		
		5.43	55.00	92.60		
		5.19	60.00	92.84		
		5.27	62.00	92.76		
		5.03	64.00	93.00		Upper BF estimate
		5.02	66.00	93.01		
		5.17	68.00	92.86		Lower BF estimate
		5.20	70.20	92.83		
		5.76	73.20	92.27	0.00	LEW
		6.55	74.00	91.48		
		6.55	76.00	91.48		
		6.48	78.00	91.55		
		6.23	80.00	91.80		
		5.94	82.00	92.09		On vegetated island, just under water; possible bar
		5.79	84.00	92.24		On vegetated island, just under water; possible bar
		6.22	86.00	91.81		
		6.55	88.00	91.48		
		6.56	90.00	91.47		
		6.81	92.00	91.22		
		6.87	94.00	91.16		
		7.07	96.00	90.96		
		6.94	98.00	91.09		
		6.83	100.00	91.20		
		6.87	102.00	91.16		
		6.80	104.00	91.23		
		6.39	106.00	91.64		
		5.96	106.60	92.07	0.00	REW
		3.35	108.00	94.68		top of log
		5.14	109.00	92.89		Next to log
		4.78	111.00	93.25		
		4.91	113.00	93.12		Lower BF estimate
		4.82	115.00	93.21		
		4.93	117.00	93.10		
		4.79	119.00	93.24		
		4.73	121.00	93.30		Upper BF estimate
		4.69	125.00	93.34		
		4.76	130.00	93.27		
		4.45	135.00	93.58		
		4.53	140.00	93.50		
		4.48	145.00	93.55		
		4.37	150.00	93.66		
		4.29	155.00	93.74		
		4.45	160.00	93.58		
		4.39	170.00	93.64		
		5.17	180.00	92.86		
		5.14	190.00	92.89		
		5.68	195.70	92.35	0.00	Edge of stagnant water
		5.92	198.50	92.11		
		5.68	201.50	92.35	0.00	Edge of stagnant water
		4.84	203.80	93.19		Base of RB pin
		4.45	203.80	93.58		RTOP
		4.13	0.00	93.90		LTOP
		3.76	BM4	94.27		

Loon Lake Dam Reach Middle Site (LL-G2) pebble count summary

Modified Wolman Pebble Count (mm), Middle Loon Lake

Particle Description	Upper Class Boundary (mm)	Rosgen Particle Size	XS #1	XS #2	XS #3	Total	Item %	Cum %
Very coarse sand (unmeasured)	<2	6	2	4	3	9	3%	3%
Very coarse sand (measured)	2	5	0	0	0	0	0%	3%
Very Fine Gravel	4	4	0	3	0	3	1%	4%
Fine Gravel	8		3	4	0	7	2%	6%
Medium Gravel	16		11	7	0	18	6%	12%
Coarse Gravel	32		12	12	10	34	11%	24%
Very Coarse Gravel	64		21	17	19	57	19%	43%
Small Cobble	128	3	30	27	37	94	31%	74%
Large Cobble	256		14	16	27	57	19%	93%
Small Boulder	512	2	6	9	4	19	6%	99%
Medium Boulder	1024		1	1	0	2	1%	100%
Large Boulder	2048		0	0	0	0	0%	100%
Very Large Boulder	4096		0	0	0	0	0%	100%
Bedrock	>4096	1	0	0	0	0	0%	100%
		Total	100	100	100	300	100%	

Loon Lake Dam Reach Lower Site (LL-G3) long profile

HI	BS	FS	STA	WSE	ELEV	Water depth (ft)	Notes
106.03	6.03		BM1		100.00		pin on LB between XS1 and XS2 pins
		17.69	0.00	92.70	88.34	4.36	
		16.67	10.00	92.71	89.36	3.35	
		16.39	20.00	92.70	89.64	3.06	beginning of pool tailout
		17.45	30.00	92.71	88.58	4.13	undercut bank area-deeper
		17.37	40.00	92.69	88.66	4.03	undercut bank area-deeper
		16.98	50.00	92.69	89.05	3.64	near beginning of debris jam
		16.55	60.00	92.67	89.48	3.19	at beginning of debris jam
		16.32	68.00	92.67	89.71	2.96	next to log
		10.75	68.50		95.28		top of log
		16.44	70.10	92.68	89.59	3.09	next to log
		12.20	70.50		93.83		top of log
		16.12	73.00	92.67	89.91	2.76	next to log
		12.90	74.00		93.13		top of log
		15.75	80.00	93.66	90.28	3.38	
		16.65	95.00	92.64	89.38	3.26	
		16.16	101.00	92.79	89.87	2.92	XS1
		15.04	113.00	92.63	90.99	1.64	top of boulder stream crossing
		15.22	125.00	91.74	90.81	0.93	
	6.03		BM1				
104.87	4.87		BM1				
		14.95	137.00	92.23	91.08	1.15	bottom of riffle
		15.43	147.00	92.10	90.60	1.50	
		15.34	171.00	92.09	90.69	1.40	
		14.90	180.00	92.13	91.13	1.00	top of small riffle
		15.85	193.00	91.48	90.18	1.30	bottom of riffle
		16.61	208.00	91.42	89.42	2.00	
		17.52	221.00	91.36	88.51	2.85	
		16.23	236.00	91.40	89.80	1.60	
		15.80	251.00	91.38	90.23	1.15	top of small riffle
			258.00				XS2
		16.00	266.00	91.28	90.03	1.25	
		16.58	281.00	90.95	89.45	1.50	
		17.23	296.00	91.00	88.80	2.20	
		17.36	311.00	90.97	88.67	2.30	
		16.83	326.00	91.00	89.20	1.80	
		17.39	341.00	90.94	88.64	2.30	top of boulder cascade
		16.54	349.00	90.89	89.49	1.40	
		18.08	366.00	89.65	87.95	1.70	bottom of boulder cascade
		19.16	381.00	89.57	86.87	2.70	
		19.62	396.00	89.51	86.41	3.10	
	4.87		BM1				
		7.76	BM2		97.11		
98.74	1.63		BM2		97.11		
		12.39	411.00	88.35	86.35	2.00	
		12.12	426.00	88.27	86.62	1.65	
		11.88	441.00	88.21	86.86	1.35	
		11.53	456.00	88.16	87.21	0.95	
		12.41	471.00	87.93	86.33	1.60	
		12.53	486.00	87.61	86.21	1.40	
			487.80	0.00			XS3
		13.13	501.00	87.61	85.61	2.00	
		12.03	516.00	87.56	86.71	0.85	
		12.57	531.00	87.47	86.17	1.30	
		12.56	546.00	87.33	86.18	1.15	
		12.53	561.00	87.61	86.21	1.40	
		12.32	576.00	87.92	86.42	1.50	
		13.13	591.00	87.11	85.61	1.50	top of boulder cascade
		13.61	606.00		85.13		
	1.63		BM2				

Loon Lake Dam Reach Lower Site (LL-G3) upper cross-section (p. 1 of 2)

HI	BS	FS	STA	ELEV	Notes
106.03	6.03		BM1		
		0.48	LB HP	105.55	top of LB HP
		0.67	0.00	105.36	
		3.55	10.00	102.48	
		7.72	20.00	98.31	
		10.98	30.00	95.05	
		11.92	40.00	94.11	upper bankfull estimate
		12.44	42.00	93.59	
		12.68	44.00	93.35	
		12.50	46.00	93.53	
		12.67	48.00	93.36	
		12.68	50.00	93.35	
		12.72	52.00	93.31	
		12.28	55.00	93.75	
		12.08	60.00	93.95	
		11.90	65.00	94.13	
		11.71	70.00	94.32	
		11.94	75.00	94.09	
		12.10	80.00	93.93	
		11.53	85.00	94.50	
		11.44	90.00	94.59	
		11.53	95.00	94.50	
		12.00	100.00	94.03	
		12.08	102.00	93.95	lower bankfull estimate
		12.22	104.00	93.81	on root
		12.02	106.00	94.01	
		12.48	108.00	93.55	
		13.09	110.00	92.94	
		13.06	112.00	92.97	
		13.27	114.00	92.76	
		13.32	116.00	92.71	LB edge of water
		13.52	118.00	92.51	
		13.79	120.00	92.24	
		13.88	122.00	92.15	
		14.07	124.00	91.96	
		14.08	126.00	91.95	
		14.28	127.80	91.75	next to log
		11.32	128.20	94.71	top of log
		15.07	130.00	90.96	next to log

Loon Lake Dam Reach Lower Site (LL-G3) upper cross-section (p. 2 of 2)

HI	BS	FS	STA	ELEV	Notes
106.03		15.39	132.00	90.64	
		15.97	134.00	90.06	
		15.94	136.00	90.09	
		16.14	138.00	89.89	
		16.04	140.00	89.99	
		15.93	142.00	90.10	
		15.97	144.00	90.06	
		15.56	146.00	90.47	
		15.59	148.00	90.44	
		15.80	150.00	90.23	
		15.74	152.00	90.29	
		13.26	154.00	92.77	top of BLDR
		13.49	156.30	92.54	REW
		12.30	159.30	93.73	lower BF estimate
		12.38	160.00	93.65	
		11.51	162.00	94.52	
		12.33	164.00	93.70	
		11.22	166.00	94.81	
		11.16	168.00	94.87	upper BF estimate
		11.18	170.00	94.85	
		11.87	175.00	94.16	
		10.94	180.00	95.09	
		10.17	185.00	95.86	
		9.71	RB EP	96.32	top of RB EP
		9.93	186.60	96.10	bottom of RB EP
		0.45	LB HP	105.58	
		6.00	BM1	100.03	
		0.48	LB HP	105.55	
		6.03	BM1	100.00	

Loon Lake Dam Reach Lower Site (LL-G3) middle cross-section (p. 1 of 2)

HI	BS	FS	STA	ELEV	Bed material	Notes
104.87	4.87		BM1			
		3.47	0.00	101.40		t.o. LB pin
		3.93	0.00	100.94		b.o. LB pin
		7.36	10.00	97.51		
		9.63	20.00	95.24		
		10.84	30.00	94.03		
		12.64	36.80	92.23	edge of LB cobble bar	
		12.52	46.00	92.35	cobble bar	
		12.35	50.00	92.52	cobble bar	
		12.33	60.00	92.54	cobble bar	
		12.59	70.00	92.28	cobble bar	
		12.87	74.00	92.00		upper bankfull estimate
		13.61	80.00	91.26		
		14.16	83.40	90.71		lower bankfull estimate
		13.94	85.00	90.93		
		14.09	87.00	90.78		
		14.08	89.00	90.79		
		14.39	91.00	90.48		
		14.57	92.80	90.30		left edge of water
		14.89	94.00	89.98		
		15.05	96.00	89.82		
		15.29	98.00	89.58		
		15.54	100.00	89.33		
		15.39	102.00	89.48		
		15.38	104.00	89.49		
		15.59	106.00	89.28		
		15.54	108.00	89.33		
		15.96	110.00	88.91		
		16.15	112.00	88.72		
		16.29	114.00	88.58		
		16.40	116.00	88.47		thalweg
		16.20	117.40	88.67		edge of muddy/silty overflow channel

Loon Lake Dam Reach Lower Site (LL-G3) middle cross-section (p. 2 of 2)

HI	BS	FS	STA	ELEV	Bed material	Notes
104.87		15.44	119.00	89.43		
		15.37	121.00	89.50		
		15.43	123.00	89.44		
		15.76	125.00	89.11		
		14.86	127.50	90.01		right edge of water
		14.52	129.00	90.35		
		13.92	131.00	90.95		lower bankfull estimate
		13.59	133.00	91.28		
		13.25	135.00	91.62		
		12.69	137.00	92.18		
		12.09	139.00	92.78		upper bankfull estimate
		12.10	145.00	92.77		
		11.99	152.70	92.88		edge of debris jam 1
		8.50	163.00	96.37		t.o. debris jam 1
		11.36	172.50	93.51		backside of debris jam 1
		11.06	177.00	93.81		
		11.44	181.00	93.43		edge of GR mound
		10.96	184.00	93.91		t.o. GR mound
		11.21	186.00	93.66		back edge of GR mound/front of debris jam 2
		9.56	190.20	95.31		t.o. debris jam 2
		12.24	197.00	92.63		back of debris jam 2
		12.99	206.50	91.88		edge of debris jam 3
		10.25	211.50	94.62		t.o. debris jam 3
		12.34	214.30	92.53		back of debris jam 3
		12.19	220.00	92.68		
		11.96	230.00	92.91		
		10.85	240.00	94.02		
		9.56	241.80	95.31		t.o. RB pin
		10.43	241.80	94.44		b.o. RB pin
	3.47		0.00			t.o. LB pin
	4.87		BM1			close XS loop

Loon Lake Dam Reach Lower Site (LL-G3)
lower cross-section

HI	BS	FS	STA	ELEV	Bed material	Notes
100.37	1.63		BM2			
		0.29	0.00	100.08		LTOP
		0.49	0.00	99.88		LBOP
		4.29	6.00	96.08		
		5.78	10.00	94.59		
		5.22	13.00	95.15		Top of lg. boulder 1
		8.45	14.00	91.92		Bottom of lg. boulder 1
		9.43	18.00	90.94		Edge of boulder 2
		8.88	19.50	91.49		Top of boulder 2
		8.83	16.00	91.54		upper BF estimate (on boulder)
		9.43	20.30	90.94		lower BF estimate (on boulder)
		10.36	20.50	90.01		Edge of boulder 2
		11.15	22.00	89.22		LEW
		11.77	24.00	88.60		
		10.57	26.00	89.80		Top of boulder 3
		12.33	29.00	88.04		Edge of boulder 3
		12.32	30.00	88.05		
		12.57	32.00	87.80		between two boulders
		12.54	34.00	87.83		
		12.68	36.00	87.69		
		12.65	38.00	87.72		
		12.33	40.00	88.04		
		11.75	42.00	88.62		
		11.43	44.00	88.94		
		11.51	46.00	88.86		
		11.61	48.00	88.76		
		11.62	50.00	88.75		
		11.37	52.00	89.00		
		10.83	54.00	89.54		top of sm. Veg. sand mound
		10.96	56.00	89.41		
		10.94	58.00	89.43		REW
		9.97	60.00	90.40		lower BF est.; sand and gravel
		8.93	65.00	91.44	sand and gravel	
		8.93	66.50	91.44		upper BF estimate
		7.93	70.00	92.44		
		7.46	78.50	92.91	on sand	
		7.53	80.00	92.84	on sand	
		8.13	86.00	92.24	sand	
		7.89	90.00	92.48		
		6.66	100.00	93.71	sand and organics	
		7.64	110.00	92.73	cobble/gravel	
		6.63	120.00	93.74	sand	
		6.05	130.00	94.32		
		7.63	140.00	92.74	on cobble	
		7.73	150.00	92.64	sand and cobble	
		8.96	155.00	91.41		edge of overflow channel
		8.73	160.00	91.64		
		9.21	165.00	91.16		
		9.15	170.00	91.22		
		8.76	175.00	91.61		
		8.22	180.00	92.15		
		7.67	189.90	92.70		RBOP
		7.40	189.90	92.97		RTOP
		0.28	0.00	100.09		LTOP (error of 0.01)
	1.63		BM2			

Loon Lake Dam Reach Lower Site (LL-G3) pebble count summary

Modified Wolman Pebble Count (mm), Loon Lake Lower

Particle Description	Upper Class Boundary (mm)	Rosgen Particle Size	XS #1	XS #2	XS #3	Total	Item %	Cum %
Very coarse sand (unmeasured)	<2	6	15	12	0	27	9%	9%
Very coarse sand (measured)	2	5	0	4	11	15	5%	14%
Very Fine Gravel	4	4	1	0	7	8	3%	17%
Fine Gravel	8		0	0	2	2	1%	17%
Medium Gravel	16		6	2	3	11	4%	21%
Coarse Gravel	32		12	4	6	22	7%	28%
Very Coarse Gravel	64		26	27	4	57	19%	47%
Small Cobble	128	3	33	34	19	86	29%	76%
Large Cobble	256		7	13	34	54	18%	94%
Small Boulder	512	2	0	2	10	12	4%	98%
Medium Boulder	1024		0	2	4	6	2%	100%
Large Boulder	2048		0	0	0	0	0%	100%
Very Large Boulder	4096		0	0	0	0	0%	100%
Bedrock	>4096	1	0	0	0	0	0%	100%
		Total	100	100	100	300	100%	

Gerle Creek Dam Reach Site (GC-G1) long profile

HI	BS	FS	STA	Elevation	WSE	Notes/Water depth	
100	7.31					Benchmark: Orange X on boulder crest. Midchannel top of pool	
107.31		8.67	14	98.64	103.16	4.52	
		10.55	21	96.76	103.17	6.41	
		5.04	23	102.27	103.07	0.8	
		6.86	27	100.45	102.95	2.5	
		5.04	35	102.27	102.91	0.64	
		7.8	50	99.51	103.81	4.3	
		6.65	61	100.66	102.54	1.88	
		7.25	76	100.06	103.36	3.3	
		6.81	99	100.5	102.24	1.74	
			101				Cross sect. #1 at station 101
117	17	15.83	117	101.17	102.27	1.1	Changed location. Shoot back to bench mark.
		15.64	131	101.36	102.31	0.95	
		19.4	144	97.6	101.06	3.46	
		18.81	156	98.19	101.17	2.98	
		19.6	176	97.4	101.03	3.63	
		18.22	195	98.78	101	2.22	
		17.91	207	99.09	100.98	1.89	
		16.93	221	100.07	100.94	0.87	
		19.48	239	97.52	100.37	2.85	
		17.38	258	99.62	100.26	0.64	
		20.89	276	96.11	97.33	1.22	
		22.14	298	94.86	96.7	1.84	
110.43	10.43						moved equip: benchmark rock at about 300 on long profile.
		16.73	309	93.7	96.64	2.94	
		16.87	322	93.56	96.79	3.23	where x-sec 2 intersects long profile
		15.56	329	94.87	96.68	1.81	
		19.24	344	91.19	96.68	5.49	
		17.82	354	92.61	96.72	4.11	
		16.31	380	94.12	96.72	2.6	
		17.3	405	93.13	96.74	3.61	
		17	436	93.43	96.71	3.28	
		17.83	453	92.6	96.63	4.03	
		18.79	474	91.64	96.68	5.04	
		17.02	492	93.41	96.74	3.33	
		14.24	515	96.19	96.67	0.48	
		15	528	95.43	96.11	0.68	
		15.77	546	94.66	96.02	1.36	where x-sec 3 (lower) intersects long profile
		15.3	559	95.13	95.92	0.79	
		15.64	573	94.79	95.68	0.89	
		15.77	587	94.66	95.31	0.65	
		16.17	600	94.26	95.06	0.8	
		16.19	611	94.24	94.74	0.5	
		16.46	625	93.97	94.42	0.45	
		17.88	640	92.55	94.44	1.89	
		18.35	652	92.08	94.39	2.31	
		19.04	681	91.39	94.33	2.94	
		18.21	716	92.22	94.36	2.14	
		16.94	745	93.49	94.26	0.77	
		17.92	770	92.51	93.74	1.23	
		18.2	783	92.23	93.13	0.9	End of long profile

Gerle Creek Dam Reach Site (GC-G1) upper cross-section

HI	BS	FS	STA	ELEV	Notes
100	7.31				Benchmark: Orange "x" on crest of boulder mid-channel. Top of large pool.
107.31					
			0		Cross-section #1
117		10.75	0	106.25	QA Benchmark = 7.30, moved equipment. Rod leaning slightly towards me on top of pin
		11.1	0	105.9	Off pin, on ground
		11.22	1.8	105.78	
		11.57	5	105.43	
		11.87	6.7	105.13	
		13.04	7	103.96	
		13.85	9	103.15	
		14.22	10	102.78	Upper bankfull estimate
		14.36	11	102.64	Lower bankfull estimate
		14.72	12	102.28	Right edge of water
		15.1	13	101.9	
		15.9	15	101.1	
		15.37	17	101.63	
		16.33	19	100.67	
		15.26	21	101.74	
		15.07	23	101.93	
		14.69	25	102.31	
		16.83	27	100.17	
		15.36	29	101.64	
		15.48	31	101.52	Cross section occurs at 103 along long profile
		15.01	33	101.99	
		18.85	35	98.15	
		16.18	37	100.82	
		16.08	39	100.92	
		14.53	41	102.47	
		14.83	43	102.17	
		14.84	39.2	102.16	Left edge of water
		14.45	45	102.55	
		14.32	47	102.68	
		13.73	49	103.27	
		12.03	51	104.97	
		10.97	53	106.03	
		9.93	55	107.07	
		9.56	57	107.44	Bottom of left pin.
		9.49	57	107.51	Top of left bank pin. No bankful indicators on LB

Gerle Creek Dam Reach Site (GC-G1) middle cross-section

HI	BS	FS	STA	ELEV	Notes
100	9.26				Same benchmark as 5/20/03.
109.26		8.42	0	100.84	LB top of pin.
		9.14	0	100.12	Bottom of LB pin.
		7.78	-10	101.48	
		5.9	-16.6	103.36	
		7.81	-20.4	101.45	
		5.01	-30	104.25	
		9.03	1.7	100.23	
		10.75	2	98.51	Upper bankfull estimate.
		11.8	3.2	97.46	Lower bankfull estimate.
		12.35	5	96.91	
		12.55	6	96.71	Left edge of water.
		13.26	7.9	96	
		13.77	9.7	95.49	
		14.25	12.9	95.01	
		14.74	16.6	94.52	
		14.5	21.9	94.76	
		15.31	23.4	93.95	
		15.59	24.9	93.67	
		15.48	25.5	93.78	
		14.95	26.6	94.31	
		14.73	28.4	94.53	
		14.75	30.5	94.51	
		12.8	33	96.46	
		12.54	33.5	96.72	Right edge of water.
		11.44	35	97.82	Lower bankfull estimate.
		11.08	36.6	98.18	Upper bankfull estimate.
		10.55	38.3	98.71	
		10.77	39.7	98.49	
		10.73	40.8	98.53	
		8.93	41.8	100.33	
		9.68	43.6	99.58	Left edge of cobble gravel deposit
		9.79	46.2	99.47	
		9.3	49.2	99.96	
		9.54	52.3	99.72	
		9.34	54.3	99.92	Right edge of gravel cobble deposit
		8.92	56.5	100.34	
		8.39	58	100.87	
		8.12	60.5	101.14	Base of RB pin
		7.72	60.5	101.54	Top of RB pin.
		6.95	68.2	102.31	
		5.39	76.4	103.87	

Gerle Creek Dam Reach Site (GC-G1) lower cross-section

HI	BS	FS	STA	ELEV	Notes
100	10		0.2	100.16	Pin is at 0.2 ft. 1.9 ft above elevation of station 3.8. Elevation of top of pin is 0.1 above elevation of large root where bottom of pin is located.
110		11.74	3.8	98.26	
		10.09	-1.6	99.91	
		9.93	-9	100.07	
		12.06	6.5	97.94	
		11.82	9	98.18	Fine organic flotsam (flood debris) on bank
		12.3	11.4	97.7	
		12.26	13.7	97.74	Upper bankfull.
		12.88	15.1	97.12	Lower bankfull.
		13.09	15.9	96.91	Top of exposed roots.
		14.01	15.5	95.99	Left edge of water. Little overhang.
		14.63	16.2	95.37	
		15.15	18.2	94.85	
		15.3	20.4	94.7	
		15.08	22.7	94.92	
		14.17	25	95.83	Top of boulder
		14.18	26.2	95.82	Top of boulder
		14.02	26.7	95.98	Right edge of water
		12.83	22.1	97.17	
		12.28	29.4	97.72	Upper bankfull estimate. Cobble gravel aluvial deposit at pool tailout, since RB edge of water
		12.86	32	97.14	
		13.3	34.3	96.7	
		13.67	36.5	96.33	High flow channel across this deposit.
		13.13	38.9	96.87	
		12.65	41.4	97.35	
		12.37	45.6	97.63	
		12.37	49	97.63	
		12.19	53.7	97.81	
		12.88	56.5	97.12	
		13.56	58.6	96.44	
		13.97	59.3	96.03	Left edge of water.
		14.24	60.2	95.76	
		14.04	60.7	95.96	Right edge of water.
		13.31	62.7	96.69	
		13.32	64.5	96.68	
		13.56	65.2	96.44	Left edge of water.
		13.81	65.8	96.19	
		13.59	69.1	96.41	
		13.55	72.9	96.45	
		13.45	77.8	96.55	
		13.34	81	96.66	Right edge of water. Flow is pouring from RB to LB diagonally on side (right) channel
		12.97	84	97.03	
		12.43	86.6	97.57	
		12.36	88.3	97.64	Upper bankfull estimate. Left base of large log.
		8.99	89.5	101.01	Top of large log.
		10.09	90.5	99.91	Small woody debris pile on right side of large log.
		9.35	92.9	100.65	Top of RB pin.
		11.64	93.2	98.36	Ground surface below RB pin. Right base of small LWD jam pile. Right base of small pine tree where RB pin is nailed.
		11.88	103.7	98.12	
		11.07	124.7	98.93	
		10.02	130	99.98	END

Gerle Creek Dam Reach Site (GC-G1) pebble count summary

Modified Wolman Pebble Count (mm), Gerle Creek Dam Reach

Particle Description	Upper Class Boundary (mm)	Rosgen Particle Size	XS #1	XS #2	XS #3	Total	Item %	Cum %
Very coarse sand (unmeasured)	<2	6	0	0	0	0	0%	0%
Very coarse sand (measured)	2	5	1	1	3	5	2%	2%
Very Fine Gravel	4	4	21	1	2	24	8%	10%
Fine Gravel	8		1	0	1	2	1%	10%
Medium Gravel	16		0	4	9	13	4%	15%
Coarse Gravel	32		6	11	18	35	12%	26%
Very Coarse Gravel	64		1	23	27	51	17%	43%
Small Cobble	128	3	0	29	36	65	22%	65%
Large Cobble	256		0	17	4	21	7%	72%
Small Boulder	512	2	3	8	0	11	4%	76%
Medium Boulder	1024		11	5	0	16	5%	81%
Large Boulder	2048		10	1	0	11	4%	85%
Very Large Boulder	4096		0	0	0	0	0%	85%
Bedrock	>4096	1	46	0	0	46	15%	100%

Robbs Peak Dam Reach Site (RPD-G1) long profile (p. 1 of 2)

HI	BS	FS	STA	Water depth (ft)	ELEV	WSE	Notes
106.65		9.81	8.60	4.65	96.84	101.49	
		10.16	22.90	2.87	96.49	99.36	
		9.69	40.80	2.37	96.96	99.33	
	6.65		BM 1			0.00	QC check
		9.15	60.30	1.87	97.50	99.37	
		8.84	71.70	1.56	97.81	99.37	
		8.17	78.30	0.80	98.48	99.28	
		7.86	82.40	0.50	98.79	99.29	top of riffle (channel split)
		7.89	86.60	0.54	98.76	99.30	
		8.27	109.50	0.57	98.38	98.95	
		8.51	120.60	0.67	98.14	98.81	
		9.04	135.90	0.91	97.61	98.52	
		9.22	147.30	1.05	97.43	98.48	just above confluence w/ side channel
		9.24	158.30	1.03	97.41	98.44	
		9.87	169.10	1.61	96.78	98.39	at confluence w/ split channel
		9.00	185.40	0.70	97.65	98.35	riffle-like unit
		9.47	195.50	1.09	97.18	98.27	at XS1 (PHABSIM XS5)
		9.25	216.50	0.78	97.40	98.18	
		10.64	232.70	2.18	96.01	98.19	at PHABSIM XS4
		10.05	265.60	1.60	96.60	98.20	
		10.03	281.40	1.52	96.62	98.14	
		10.05	289.00	1.56	96.60	98.16	
		5.41	BM3		101.24	101.24	BM - pin in LB gravel bar (flagged)
		7.02	BM2		99.63	99.63	BM - pin in LB gravel bar (flagged)
		7.02	BM2		99.63	99.63	QC check - Elevation of BM2 = 99.63
		5.41	BM3		101.24	101.24	QC check - Elevation of BM3 = 101.24
		6.65	BM1		100.00	100.00	QC Check
	3.49		BM3				moved station
	5.07		BM2				moved station
	3.49		BM3				QC Check
	5.07		BM2				QC Check
104.73		8.00	304.00	1.46	96.73	98.19	
		6.95	322.00	0.37	97.78	98.15	
		7.67	332.90	1.09	97.06	98.15	
		7.16	345.70	0.54	97.57	98.11	top of riffle
		8.23	366.30	1.13	96.50	97.63	
		8.37	380.90	1.26	96.36	97.62	
		9.15	404.00	2.02	95.58	97.60	
		10.24	417.20	3.13	94.49	97.62	
		8.46	437.70	1.35	96.27	97.62	
		7.85	456.20	1.70	96.88	98.58	top of riffle
		8.22	468.10	0.57	96.51	97.08	PHABSIM XS1
		9.25	491.00	1.15	95.48	96.63	
		10.45	506.50	2.24	94.28	96.52	
		10.43	521.80	2.30	94.30	96.60	
		9.35	539.00	1.09	95.38	96.47	
		10.56	557.10	2.18	94.17	96.35	
		11.57	574.90	3.36	93.16	96.52	
		3.49				0.00	BM 3 - QC Check
		5.07				0.00	BM 2 - QC Check

Robbs Peak Dam Reach Site (RPD-G1) long profile (p. 2 of 2)

HI	BS	FS	STA	Water depth (ft)	ELEV	WSE	Notes
	9.02		BM2			0.00	Moved level; Elev. BM 2 = 99.63
	9.02		BM2			0.00	Moved level
108.68	7.44		BM3			0.00	Moved level; Elev. BM 3 = 101.24
	7.44		BM3			0.00	Moved level
	9.02		BM2			0.00	Moved level
						0.00	Note: backsights to BMs result in 0.03 error.
						0.00	* Using BM 3 as our TP, again
108.68		14.97	589.00	2.47	93.71	96.18	
		14.41	600.00	2.13	94.27	96.40	
		9.03	BM 2			0.00	QC Check (rod was tilted)
		9.02	BM 2			0.00	QC Check
		9.04	BM 2			0.00	QC Check
		7.44	BM 3			0.00	QC Check (same reading as before)
		9.04	BM2			0.00	QC Check
		14.17	615.00	1.89	94.51	96.40	
		13.92	630.00	1.66	94.76	96.42	
		13.52	650.00	1.27	95.16	96.43	
		13.44	670.00	1.18	95.24	96.42	
		13.45	690.00	1.18	95.23	96.41	debris caught on tree at 8' on rod (hi flow? evidence)
		12.80	700.40	0.41	95.88	96.29	top of riffle
		14.28	720.00	1.35	94.40	95.75	
		14.47	740.00	1.54	94.21	95.75	
		13.88	760.00	0.96	94.80	95.76	
		14.19	780.00	1.20	94.49	95.69	
		14.10	800.00	1.13	94.58	95.71	
		14.48	820.00	1.39	94.20	95.59	
		14.33	840.00	1.21	94.35	95.56	
		15.17	860.00	2.09	93.51	95.60	scour next to BLDR
		15.50	880.00	2.42	93.18	95.60	
		13.54	906.00	0.40	95.14	95.54	top of riffle
		9.04	BM 2			0.00	QA Check
		7.44	BM 3			0.00	QA Check
	10.95		BM 5				Moved level - closing out level loop
	11.49		BM 4				
	9.17		BM 2				
	7.62		BM 3				
107.51	6.27		BM 3				
	7.51		BM 1				

Robbs Peak Dam Reach Site (RPD-G1) upper cross-section

HI	BS	FS	STA	ELEV	Notes
	6.65				BM 1=nail in left bank u/s of XS1 (flagged)
106.65	6.65				BM 1
		1.52	0.80		Top of LB EP
		1.52	0.80		Top of LB EP
		1.91	0.80	104.74	Bottom of LB EP
		2.87	7.60	103.78	
		3.51	15.50	103.14	
		5.04	19.70	101.61	
		5.41	24.50	101.24	
		3.35	31.20	103.30	
		4.19	36.50	102.46	
		4.11	39.70	102.54	
		5.03	43.20	101.62	edge of side channel
		5.55	53.10	101.10	
		5.85	63.20	100.80	
		5.69	64.80	100.96	
		6.22	68.10	100.43	
		5.61	72.70	101.04	
		6.48	79.30	100.17	
		5.83	83.70	100.82	
		6.26	88.90	100.39	
		6.57	95.70	100.08	
		7.23	100.10	99.42	
		7.44	104.20	99.21	Top of ledge
		8.18	105.10	98.47	left edge of water (side channel)
		8.82	107.90	97.83	
		9.49	111.70	97.16	
		9.70	116.10	96.95	
		8.75	118.70	97.90	right edge of side channel (undercut bank, not WSEL)
		7.15	119.40	99.50	Top of ledge
		5.85	123.20	100.80	
		6.40	125.60	100.25	high bankfull estimate
		7.78	128.10	98.87	
		7.29	127.00	99.36	lower bankfull estimate *use this BF elevation
		8.33	130.60	98.32	edge of water - left bank (main channel)
		8.68	133.30	97.97	
		8.95	135.80	97.70	
		9.17	140.00	97.48	
		9.41	144.60	97.24	
		9.21	149.90	97.44	
		8.66	154.10	97.99	right edge of channel (undercut bank, not WSEL); Note: XS is not perpendicular to low flow
		7.61	154.30	99.04	bankfull? Undercut bank
		6.41	154.90	100.24	Top of ledge
		5.18	156.90	101.47	
		4.55	159.80	102.10	
		3.99	164.30	102.66	
		3.06	169.60	103.59	bottom of RB EP
		2.69	169.60		top of RB EP
		1.52	0.80		top of LB EP (QC Check)

Robbs Peak Dam Reach Site (RPD-G1) middle cross-section

HI	BS	FS	STA	ELEV	Notes
108.68		4.49	0.30		top of LB EP
		4.89	0.30	103.79	base of LB EP
		6.43	10.00	102.25	
		7.17	20.00	101.51	
		7.56	30.60	101.12	
		8.29	37.50	100.39	
		8.53	45.00	100.15	
		8.86	54.00	99.82	
		9.72	58.00	98.96	
		10.76	59.90	97.92	bankfull (?)
		11.71	62.10	96.97	left edge of water
		12.37	66.00	96.31	
		12.09	70.00	96.59	
		12.05	72.40	96.63	
		11.97	74.40	96.71	
		11.97	76.40	96.71	
		11.73	78.80	96.95	right edge water
		11.04	81.50	97.64	
		11.39	82.60	97.29	
		11.43	85.70	97.25	
		11.04	88.80	97.64	
		10.65	94.20	98.03	
		10.55	97.70	98.13	
		9.89	100.30	98.79	bankfull (?)
		10.08	104.40	98.60	
		8.86	109.40	99.82	
		8.56	112.70	100.12	
		9.15	113.70	99.53	
		9.53	115.10	99.15	
		8.80	117.20	99.88	bankfull (?)
		7.62	120.50	101.06	
		6.51	124.00	102.17	
		5.86	128.80	102.82	bottom of RB pin
		5.53	128.80	103.15	top of RB pin
		5.53	128.80	103.15	QC Check
		4.49	0.30	104.19	top of LB EP - QC Check
	9.02		BM 2	108.68	QC Check
	9.02		BM 2	108.68	QC Check
		5.53	128.80	103.15	top of RB pin
		6.07	139.00	102.61	
		10.65	147.20	98.03	
		11.30	153.90	97.38	
		10.41	163.00	98.27	
		8.81	176.10	99.87	
		9.39	190.00	99.29	
		9.10	210.00	99.58	
		8.07	251.00	100.61	
		7.04	274.20	101.64	base of RB EP
		6.89	274.20		top of pin (RB EP)
		4.49	0.30		top of LB EP - QC Check

Robbs Peak Dam Reach Site (RPD-G1) lower cross-section

HI	BS	FS	STA	ELEV	Notes
108.68		10.79	BM 5		pin in RB near XS 3; Elev BM 5 = 108.68-10.79=97.89
		11.29	BM 4		pin in RB near STA 600 on LP. FS Probably wrong(?)
		11.29	BM 4		QC Check; Elev BM 4 = 108.68-11.29=97.39. FS Probably wrong(?)
		9.03	BM 2		QC Check
		7.44	BM 3		QC Check
	8.47		BM 4		
	8.47		BM 4		
	7.97		BM 5		
	7.97		BM 5		Using BM 5 as TP (BM 4 was obscured)
106.86		0.49	0.50		top of LB EP
		0.76	0.50	106.10	base of LB EP
		1.70	3.00	105.16	top of boulder
		2.32	5.70	104.54	boulder
		4.50	7.90	102.36	bottom of boulder
		5.21	12.60	101.65	
		6.43	15.90	100.43	top of ledge
		7.73	16.90	99.13	bottom of root mass (bankfull?)
		8.62	18.10	98.24	
		9.46	19.10	97.40	left edge of water
		9.67	19.20	97.19	
		10.42	22.00	96.44	
		10.77	26.00	96.09	
		10.95	28.30	95.91	thalweg (?)
		10.45	31.00	96.41	
		10.34	35.50	96.52	
		10.67	38.50	96.19	
		10.77	42.30	96.09	
		10.66	44.90	96.20	edge of boulder
		9.53	45.80	97.33	top of boulder
		11.46	46.90	95.40	scour around boulder
		11.42	50.00	95.44	scour around boulder
		10.19	53.00	96.67	
		9.75	54.10	97.11	
		9.45	54.40	97.41	right edge water
		8.61	55.00	98.25	
		8.00	56.20	98.86	bottom of boulder
		6.63	57.00	100.23	top of boulder
		6.03	58.30	100.83	
		8.46	55.80	98.40	bankfull (more confident than LB BF)
		5.74	64.50	101.12	
		5.55	72.90	101.31	
		6.26	80.10	100.60	
		6.19	86.10	100.67	edge of log jam
		4.85	100.00	102.01	back edge of log jam
		4.33	109.20	102.53	
		5.86	116.10	101.00	
		5.97	123.70	100.89	
		4.19	126.50	102.67	base of pin (RB EP)
		3.94	126.50		top of pin (RB EP)
		0.49	0.50		top of LB EP (QC Check)
		7.98	BM 5		QC Check
		8.47	BM 4		QC Check, Close of Survey

Robbs Peak Dam Reach Site (RPD-G1) pebble count summary

Modified Wolman Pebble Count (mm), Robbs Peak Dam Reach

Particle Description	Upper Class Boundary (mm)	Rosgen Particle Size	XS #1	XS #2	XS #3	Total	Item %	Cum %
Very coarse sand (unmeasured)	<2	6	12	9	26	47	16%	16%
Very coarse sand (measured)	2	5	15	0	0	15	5%	21%
Very Fine Gravel	4	4	1	1	0	2	1%	21%
Fine Gravel	8		2	2	1	5	2%	23%
Medium Gravel	16		2	8	10	20	7%	30%
Coarse Gravel	32		17	25	20	62	21%	50%
Very Coarse Gravel	64		25	39	23	87	29%	79%
Small Cobble	128	3	24	13	8	45	15%	94%
Large Cobble	256		2	3	10	15	5%	99%
Small Boulder	512	2	0	0	1	1	0%	100%
Medium Boulder	1024		0	0	1	1	0%	100%
Large Boulder	2048		0	0	0	0	0%	100%
Very Large Boulder	4096		0	0	0	0	0%	100%
Bedrock	>4096	1	0	0	0	0	0%	100%
		Total	100	100	100	300	100%	

Ice House Dam Reach Upper Site (IH-G1) long profile

HI	BS	FS	STA	Water depth (ft)	Revised Station	Water Surface Elevation	Bed Elevation	Notes
102.61	2.61							Bench M. 100.00 FT (top of boulder RB)
		9.27	0.00	2.59	0.00	95.93	93.34	Start of pool
		9.26	34.00	2.64	34.00	95.99	93.35	
		10.41	59.00	3.81	59.00	96.01	92.20	uniform bed, widely spaced interval
		10.97	90.00	5.42	90.00	97.06	91.64	*Max P.D.
		10.55	150.00	4.76	150.00	96.82	92.06	
		9.50	180.00	2.88	180.00	95.99	93.11	
		8.11	219.00	1.96	219.00	96.46	94.50	start of RIF (crest)
		7.53	255.00	1.22	255.00	96.30	95.08	
		8.41	278.00	1.83	278.00	96.03	94.20	
		8.15	299.00	1.10	299.00	95.56	94.46	
		8.68	3+29	1.62	329.00	95.55	93.93	XS 1 location
		8.42	3+60	1.34	360.00	95.53	94.19	
		9.76	3+80	2.70	380.00	95.55	92.85	
		8.34	3+98	1.20	398.00	95.47	94.27	Head of Mchannel bar, tape goes RR
		8.55	3+120	1.38	420.00	95.44	94.06	
		9.25	3+136	2.04	436.00	95.40	93.36	
		9.10	3+151	1.84	451.00	95.35	93.51	
		8.40	3+178	1.10	478.00	95.31	94.21	
		8.65	3+200	1.24	500.00	95.20	93.96	D/S end of MCH bar
		9.36	3+230	1.83	530.00	95.08	93.25	
		9.04	3+259	1.42	559.00	94.99	93.57	
		10.29	3+279	2.60	579.00	94.92	92.32	
		10.09	3+285	2.40	585.00	94.92	92.52	XS2 location
		9.64	3+300	2.20	600.00	95.17	92.97	
	TP1A, 4.72	4.72					97.89	TP 1A
	TP1B, 4.92	4.92					97.69	TP 1B
100.71	3.02							TP 1B
100.70	2.81							TP 1A
100.70		7.54	6+10	1.80	610.00	94.96	93.16	
		7.29	6+34	1.60	634.00	95.01	93.41	
		7.78	6+65	2.02	665.00	94.94	92.92	
		6.85	6+131	1.08	731.00	94.93	93.85	
		7.18	6+166	1.30	766.00	94.82	93.52	
		8.29	6+204	2.31	804.00	94.72	92.41	
		9.31	6+233	3.20	833.00	94.59	91.39	
		8.30	6+253	1.96	853.00	94.36	92.40	
		9.43	6+271	3.05	871.00	94.32	91.27	
		9.10	6+289.5	2.70	889.50	94.30	91.60	
100.70		(TP2A) 3.21					97.49	TP2A
		(TP2B) 4.49					96.21	TP2B
102.67	5.18 (TP2A)							
102.67	6.46 (TP2B)							Tied off at 287 so 9 starts at 6+287
102.67		10.74	9+18	2.28	905.00	94.21	91.93	
		10.43	9+31	1.91	918.00	94.15	92.24	
		9.75	9+63	1.05	950.00	93.97	92.92	
		10.69	9+87	2.00	974.00	93.98	91.98	
		12.09	9+100	3.33	987.00	93.91	90.58	
		11.20	9+112	2.43	999.00	93.90	91.47	
		10.22	9+124	1.35	1011.00	93.80	92.45	
		11.08	9+150	2.20	1037.00	93.79	91.59	
		11.50	9+172	2.40	1059.00	93.57	91.17	
		10.58	9+197	1.43	1084.00	93.52	92.09	
		12.32	9+206	3.00	1093.00	93.35	90.35	
		12.44	9+214	3.10	1101.00	93.33	90.23	
		11.30	9+227	2.03	1114.00	93.40	91.37	
		10.85	9+233	1.56	1120.00	93.38	91.82	
		11.20	9+259	1.89	1146.00	93.36	91.47	
		11.00	9+278	1.64	1165.00	93.31	91.67	
		11.57	9+300	1.55	1187.00	92.65	91.10	
102.67		TP 3 (7.53)					95.14	TP3
102.00	6.86 (TP 3)							TP3
102.00	BM	2.37 (BM)						Closing error = 0.37

Ice House Dam Reach Upper Site (IH-G1) upper cross-section

HI	BS	FS	STA	Elevation	Notes
102.61		1.41	213.00	101.20	TOPi, RB
		1.69	213.00	100.92	BOPin
		1.78	210.00	100.83	
		3.43	205.00	99.18	
		3.84	200.00	98.77	
		3.95	195.00	98.66	
		4.40	190.00	98.21	
		4.64	186.00	97.97	
		4.22	180.00	98.39	
		4.74	175.00	97.87	
		5.00	171.70	97.61	
		5.78	167.50	96.83	Upper bankfull estimate
		6.43	164.50	96.18	Lower bankfull estimate
		7.10	161.80	95.51	R edge of water
		7.44	159.50	95.17	emergent veg
		8.39	157.70	94.22	sand
		8.72	155.00	93.89	Thalweg?
		8.52	153.10	94.09	R base of root wad
		6.94	152.40	95.67	top of root wad
		8.43	150.90	94.18	Left base of root wad
		8.25	146.00	94.36	
		8.14	141.00	94.47	
		7.92	135.00	94.69	
		7.65	131.00	94.96	emergent veg
		7.13	125.50	95.48	left edge of water
		6.89	122.20	95.72	
		6.52	118.50	96.09	Lower bankfull estimate (gravel bar medium starting of water edge left)
		5.90	112.50	96.71	
		5.31	107.00	97.30	Upper bankfull estimate
		4.88	97.40	97.73	
		4.81	85.50	97.80	
		4.66	82.50	97.95	gravel sand transition
		4.09	77.20	98.52	
		3.19	72.20	99.42	
		3.22	59.00	99.39	
		2.62	51.00	99.99	
		1.81	37.00	100.80	
		1.73	19.00	100.88	
		1.65	0.00	100.96	at left bottom pin
		1.37	0.00	101.24	at left top of pin
102.61		1.89	-14.00	100.72	
		2.19	-43.00	100.42	
		1.88	-77.00	100.73	R edge of water (old channel?)
		3.09	-93.00	99.52	
		2.69	-115.00	99.92	L. edge of water
		1.58	-120.00	101.03	
		4.08	-131.40	98.53	slope continues indefinitely

Ice House Dam Reach Upper Site (IH-G1) middle cross-section

HI	BS	FS	STA	Elevation	Notes
100.70					
		1.26	0.00	99.44	1.15 below base of LB pin (BOP)
		0.51	0.00		0.51 is height of pin at 0 (TOP)
		1.28	20.50	99.42	
		2.22	30.00	98.48	
		2.76	35.00	97.94	
		4.19	40.30	96.51	
		4.46	44.40	96.24	Upper bankfull estimate
		4.67	50.00	96.03	
		4.93	53.50	95.77	Lower bankfull estimate
		5.05	59.50	95.65	
		5.15	66.00	95.55	
		5.76	67.70	94.94	Left edge of water
		6.75	70.40	93.95	
		6.67	72.00	94.03	
		6.24	77.30	94.46	
		5.99	84.70	94.71	
		6.41	90.90	94.29	
		7.53	95.00	93.17	
		8.31	100.00	92.39	Thalweg
		8.32	101.00	92.38	Left base of BLDR
		5.48	103.40	95.22	Crest of BLDR
		7.80	105.00	92.90	Right base of BLDR/Left edge of 2nd BLDR
		6.02	106.10	94.68	Crest of BLDR
		5.69	110.80	95.01	Right edge of water
		4.67	112.00	96.03	Lower bankfull estimate
		3.72	114.70	96.98	Upper bankfull estimate
		2.48	118.00	98.22	
		1.60	124.00	99.10	
		0.83	131.50	99.87	Base of RB pin
		0.49	131.50		Top of RB pin

Ice House Dam Reach Upper Site (IH-G1) lower cross-section

HI	BS	FS	STA	Elevation	Notes
			6+287		
102.67			6+290		XS 3 is at 290
		2.02	0.00		Top of pin, LB (most of LB covered w/ snow, try to reach dirt)
		2.39	0.00	100.28	Bottom LB pin (most of LB covered w/ snow, try to reach dirt)
		3.84	10.30	98.83	
		4.23	21.20	98.44	
		5.56	33.30	97.11	
		5.65	45.00	97.02	Top of LB - high bankfull
		6.23	45.90	96.44	Low bankfull
		7.53	46.40	95.14	Bottom LB
		8.13	48.20	94.54	
		8.11	49.80	94.56	Left edge of water in small BKW
		9.34	53.30	93.33	
		9.57	57.00	93.10	
		9.57	59.70	93.10	
		8.47	60.00	94.20	Right edge of water in BKW/alcove
		7.88	60.90	94.79	root mass
		8.78	62.40	93.89	In main channel
		9.52	65.60	93.15	
		10.26	67.40	92.41	
		10.58	69.30	92.09	
		11.20	73.20	91.47	Thalweg
		10.85	76.40	91.82	
		9.87	78.50	92.80	
		9.31	79.60	93.36	
		8.55	81.80	94.12	right edge of water
		7.82	85.00	94.85	
		7.51	88.00	95.16	
		7.24	92.20	95.43	
		6.89	94.60	95.78	Lower bankfull estimate
		5.89	98.00	96.78	Upper bankfull estimate
		5.78	103.10	96.89	
		6.75	108.80	95.92	
		6.60	112.00	96.07	
		6.11	114.40	96.56	
		6.53	123.40	96.14	
		7.38	131.20	95.29	
		7.54	135.70	95.13	
		7.16	142.00	95.51	
		6.29	147.00	96.38	
		4.67	153.00	98.00	
		2.31	159.80	100.36	
		1.90	162.50	100.77	RB bottom of pin
		1.58	162.50		RB top of pin

Ice House Dam Reach Upper Site (IH-G1) pebble count summary

Modified Wolman Pebble Count (mm), Upper Ice House Dam Reach

Particle Description	Upper Class Boundary (mm)	Rosgen Particle Size	XS #1	XS #2	XS #3	Total	Item %	Cum %
Very coarse sand (unmeasured)	<2	6	14	19	24	57	19%	19%
Very coarse sand (measured)	2	5	3	6	4	13	4%	23%
Very Fine Gravel	4	4	3	9	12	24	8%	31%
Fine Gravel	8		8	13	7	28	9%	41%
Medium Gravel	16		25	34	18	77	26%	66%
Coarse Gravel	32		38	15	24	77	26%	92%
Very Coarse Gravel	64		8	0	11	19	6%	98%
Small Cobble	128	3	1	0	0	1	0%	99%
Large Cobble	256		0	0	0	0	0%	99%
Small Boulder	512	2	0	2	0	2	1%	99%
Medium Boulder	1024		0	2	0	2	1%	100%
Large Boulder	2048		0	0	0	0	0%	100%
Very Large Boulder	4096		0	0	0	0	0%	100%
Bedrock	>4096	1	0	0	0	0	0%	100%
		Total	100	100	100	300	100%	

Ice House Dam Reach Lower Site (IH-G2) long profile

HI	BS	FS	STA	NEW STA	WSE	ELEV	Water depth (ft)	Notes
	2.83		BM (100)					See back of data sheet
102.83								
		18.59	TP1			84.24		Top of LB pin for XS1 ht of TP1=84.24
89.49	5.25							BS to TP1
		12.35	5.00	5.00	78.84	77.14	1.70	
		13.19	25.00	25.00	78.77	76.30	2.47	
		13.05	45.00	45.00	78.79	76.44	2.35	
		13.50	66.00	66.00	78.23	75.99	2.24	
		13.69	105.00	105.00	78.72	75.80	2.92	
		13.04	131.00	131.00	78.76	76.45	2.31	
		12.85	162.00	162.00	78.72	76.64	2.08	
		13.08	199.00	199.00		76.41		XS 1 (PHABSIM XS 6)
		12.92	215.00	215.00	78.66	76.57	2.09	
		13.39	252.00	252.00	78.58	76.10	2.48	
		13.05	284.00	284.00	78.49	76.44	2.05	
		13.04	300.00	300.00	78.45	76.45	2.00	
		12.95	341.00	341.00	77.89	76.54	1.35	
86.65	2.41		TP 1					height of TP1=84.24
		10.28	363.50	363.50	77.57	76.37	1.20	XS 2 (PHABSIM XS 4)
		11.18	386.00	386.00	77.37	75.47	1.90	
		11.83	408.00	408.00	77.25	74.82	2.43	
		12.11	432.00	432.00	77.22	74.54	2.68	
		11.06	467.00	467.00	77.17	75.59	1.58	
		11.21	507.00	507.00	77.03	75.44	1.59	
		11.22	526.00	526.00	76.92	75.43	1.49	
		11.91	547.00	547.00	76.67	74.74	1.93	
		6.80	TP 3			79.85		Top of LB pin HT TP 3 = 79.85
82.80	2.95							
		8.18	570.00	570.00	76.44	74.62	1.82	
		8.15	594.00	594.00	76.13	74.65	1.48	
		8.23	617.00	617.00	75.71	74.57	1.14	
		9.00	645.00	645.00	75.00	73.80	1.20	near small LB trib (access to site)
		10.14	668.00	668.00	74.29	72.66	1.63	
		10.75	683.00	683.00	73.75	72.05	1.70	
		12.04	703.00	703.00	73.26	70.76	2.50	
		11.52	727.00	727.00	73.04	71.28	1.76	
		11.90	749.00	749.00	72.67	70.90	1.77	
		11.94	780.00	780.00	72.18	70.86	1.32	
		12.45	807.00	807.00	72.05	70.35	1.70	
82.80		13.19	826.00	826.00	72.14	69.61	2.53	
		13.00	847.00	847.00	72.00	69.80	2.20	
		13.67	870.00	870.00	72.03	69.13	2.90	
		13.26	900.00	900.00	71.96	69.54	2.42	
		4.59	TP 4			78.21		Spray paint on RB
83.48	5.27							height of TP 4 = 78.21
			900+262	1162.00				XS 3 (PHABSIM XS 1)
		13.76	900+282	1182.00	71.98	69.72	2.26	
		14.30	900+300	1200.00	71.99	69.18	2.81	
		14.08	1200+25	1225.00	71.93	69.40	2.53	
		14.10	1200+47	1247.00	71.80	69.38	2.42	
		13.85	1200+73	1273.00	71.73	69.63	2.10	
		13.79	1200+109	1309.00	71.54	69.69	1.85	
								Slope decreases slightly for 150 ft downstream, then steepens, as the river impinges on the left bank, and turns to the right.
		3.92	TP 5					TP 5 (on LB) Ht of TP 5=79.56
100.17	20.61		TP 5					TP 5 (on LB) Ht of TP 5=79.56
		0.18	BM					BM = 100 so level loop error = 0.01

Ice House Dam Reach Lower Site (IH-G2)
upper cross-section (p. 1 of 2)

HI	BS	FS	STA	ELEV	Notes
89.49		3.96	-10.00	85.53	
		2.34	-20.00	87.15	
		1.14	-30.00	88.35	Slope continues at same rate above these points
		5.25	0.00	84.24	Top of LB EP
		5.74	0.00	83.75	Base of pin (LB EP)
		6.59	8.00	82.90	Channel (hi-flow)
		6.80	13.40	82.69	
		6.00	17.00	83.49	bar (hi-flow)
		5.88	29.20	83.61	bar
		6.44	28.50	83.05	
		6.17	39.40	83.32	
		5.80	49.00	83.69	
		5.93	58.00	83.56	
		6.41	64.00	83.08	
		6.19	73.00	83.30	
		6.99	76.00	82.50	
		7.28	83.00	82.21	
		7.31	91.00	82.18	
		7.09	99.00	82.40	
		7.36	106.00	82.13	
		7.73	112.00	81.76	
		8.31	117.00	81.18	
		8.46	120.70	81.03	Base of LB pin
		8.25	120.70	81.24	Top of LB pin
		8.61	123.00	80.88	
		8.70	125.00	80.79	
		9.02	127.00	80.47	
		9.22	129.00	80.27	
		9.27	131.00	80.22	Boulder
		9.43	133.00	80.06	BLDR
		10.09	135.00	79.40	BLDR
		10.75	135.10	78.74	base of BLDR
		10.87	135.40	78.62	left edge water
		11.50	137.00	77.99	
		12.33	139.00	77.16	
		13.20	141.00	76.29	
		13.13	143.00	76.36	
		12.98	145.00	76.51	
		12.95	147.00	76.54	

Ice House Dam Reach Lower Site (IH-G2) upper cross-section (p.2 of 2)

HI	BS	FS	STA	ELEV	Notes
89.49		12.78	149.00	76.71	
		12.81	151.00	76.68	
		12.64	153.00	76.85	
		12.43	155.00	77.06	
		12.40	157.00	77.09	
		12.50	159.00	76.99	
		12.80	161.00	76.69	
		12.82	163.00	76.67	
		13.05	165.00	76.44	
		12.91	167.00	76.58	
		12.40	169.00	77.09	
		12.25	171.00	77.24	
		12.46	173.00	77.03	
		12.05	175.00	77.44	
		12.20	177.00	77.29	
		12.33	179.00	77.16	
		12.62	181.00	76.87	
		12.41	183.00	77.08	
		12.40	185.00	77.09	
		12.01	187.00	77.48	
		11.56	188.70	77.93	
		10.85	188.80	78.64	Right edge of water
		9.53	189.00	79.96	top RB
		8.19	191.00	81.30	
		7.85	192.60	81.64	bottom of RB pin
		7.66	192.60	81.83	top of RB pin
		7.21	197.00	82.28	
		6.71	199.00	82.78	
		5.29	203.40	84.20	
		3.65	206.20	85.84	
		2.33	208.60	87.16	

Ice House Dam Reach Lower Site (IH-G2) middle cross-section (p. 1 of 2)

HI	BS	FS	STA	ELEV	Notes
86.65		0.41	0.00	86.24	LB top of endpin
		0.54	0.00	86.11	LB bottom (base) of EP
		2.09	10.00	84.56	
		3.50	18.00	83.15	
		4.21	23.00	82.44	
		4.17	32.00	82.48	
		5.25	39.00	81.40	
		5.80	44.00	80.85	channel (hi-flow)
		5.95	49.00	80.70	other side of channel
		5.14	53.30	81.51	
		5.30	67.00	81.35	
		5.92	70.00	80.73	hi-flow channel
		5.73	75.70	80.92	
		4.98	80.50	81.67	
		4.03	95.50	82.62	
		6.00	114.00	80.65	
		6.35	122.00	80.30	
		6.33	139.00	80.32	
		4.38	146.60	82.27	top of LB pin (in tree stump)
		4.55	146.60	82.10	base of LB pin (in tree stump)
		6.71	148.00	79.94	base of tree stump
		6.96	150.00	79.69	
		7.90	152.00	78.75	outer edge of large rootwad
		7.89	154.00	78.76	
		6.99	156.00	79.66	
		6.66	158.00	79.99	
		6.78	160.00	79.87	
		7.12	162.00	79.53	
		7.00	164.00	79.65	
		7.21	166.00	79.44	
		7.29	168.00	79.36	upper bankfull (LB)
		7.94	170.00	78.71	lower bankfull
		8.30	172.00	78.35	
		8.40	174.00	78.25	
		8.63	176.00	78.02	
		8.75	176.50	77.90	left edge water
		9.37	178.00	77.28	
		9.74	180.00	76.91	
		9.50	182.00	77.15	
		9.45	184.00	77.20	
		9.55	186.00	77.10	
		9.81	188.00	76.84	

Ice House Dam Reach Lower Site (IH-G2) middle cross-section (p. 2 of 2)

HI	BS	FS	STA	ELEV	Notes
86.65		9.86	190.00	76.79	
		10.06	192.00	76.59	
		8.81	194.00	77.84	sub-aerial BLDR
		10.19	194.50	76.46	Right edge BLDR
		9.82	192.50	76.83	Left edge BLDR
		10.20	196.00	76.45	
		10.22	198.00	76.43	
		10.11	200.00	76.54	
		10.21	202.00	76.44	
		10.24	204.00	76.41	
		10.47	206.00	76.18	
		10.34	208.00	76.31	
		10.15	210.00	76.50	
		10.39	212.00	76.26	
		10.52	214.00	76.13	
		10.56	216.00	76.09	
		10.52	218.00	76.13	
		11.02	220.00	75.63	
		9.94	222.00	76.71	
		9.75	224.00	76.90	
		9.33	226.00	77.32	
		9.08	228.00	77.57	
		8.75	229.50	77.90	right edge water
		7.75	231.00	78.90	bankfull (estimated)
		7.60	232.00	79.05	
		6.77	234.00	79.88	
		5.24	236.00	81.41	
		4.53	238.00	82.12	
		4.19	238.80	82.46	RB, base of pin
		4.10	238.80	82.55	RB, top of pin
		4.01	240.50	82.64	
		1.72	244.00	84.93	

Ice House Dam Reach Lower Site (IH-G2) lower cross-section (p. 1 of 2)

HI	BS	FS	STA	ELEV	Notes
83.48		5.75	0.00	77.73	Top of LB EP
		5.94	0.00	77.54	Bottom of LB EP
		0.25	-10.00	83.23	Slope continues at that steepness, up LB
		7.63	4.00	75.85	
		9.23	4.70	74.25	
		9.59	6.20	73.89	
		10.23	7.10	73.25	upper bankfull estimate
		10.79	8.60	72.69	lower bankfull estimate
		10.97	9.00	72.51	
		11.41	11.00	72.07	
		11.43	12.30	72.05	left edge water
		11.75	13.00	71.73	
		12.01	15.00	71.47	
		12.39	17.00	71.09	
		12.68	19.00	70.80	
		12.88	21.00	70.60	
		12.97	23.00	70.51	
		14.39	25.00	69.09	
		14.83	27.00	68.65	
		15.00	29.00	68.48	
		14.76	31.00	68.72	
		13.74	33.00	69.74	
		13.90	35.00	69.58	
		13.99	37.00	69.49	
		13.94	39.00	69.54	
		13.16	41.00	70.32	
		13.07	43.00	70.41	
		13.25	45.00	70.23	
		13.34	47.00	70.14	
		12.95	49.00	70.53	
		12.31	51.00	71.17	
		12.17	53.00	71.31	
		12.50	55.00	70.98	
		12.67	57.00	70.81	
		12.54	59.00	70.94	
		11.54	61.00	71.94	right edge water
		11.00	62.60	72.48	
		10.13	63.00	73.35	lower bankfull (RB)
		9.09	65.00	74.39	
		8.82	66.00	74.66	upper BF (bankfull)
		8.22	67.00	75.26	
		7.66	69.00	75.82	

Ice House Dam Reach Lower Site (IH-G2)
lower cross-section (p. 2 of 2)

HI	BS	FS	STA	ELEV	Notes
83.48		7.02	71.00	76.46	
		6.29	73.00	77.19	
		5.73	75.00	77.75	
		4.78	76.40	78.70	top of RB pin (in snag)
		5.54	76.40	77.94	base of snag ground sfc at base of snag
		5.00	81.00	78.48	high terrace (w/ manzanita) - w/ lots of duff
		5.07	88.60	78.41	
		5.36	100.30	78.12	sandy ground surface (recent deposits - hi water mark)
		6.48	104.80	77.00	
		7.52	108.30	75.96	high flow channel
		8.20	117.50	75.28	
		7.93	128.00	75.55	
		7.52	139.00	75.96	
		7.35	145.30	76.13	
		6.40	152.80	77.08	(right edge of side channel - CO/GR)
		5.74	157.00	77.74	sand
		5.26	166.50	78.22	sand
		5.15	173.00	78.33	sand
		4.70	180.30	78.78	
		0.41	200.00	83.07	

Ice House Dam Reach Lower Site (IH-G2) pebble count summary

Modified Wolman Pebble Count (mm), Lower Ice House Dam Reach

Particle Description	Upper Class Boundary (mm)	Rosgen Particle Size	XS #1	XS #2	XS #3	Total	Item %	Cum %
Very coarse sand (unmeasured)	<2	6	16	0	6	22	7%	7%
Very coarse sand (measured)	2	5	1	1	18	20	7%	14%
Very Fine Gravel	4	4	0	3	0	3	1%	15%
Fine Gravel	8		1	3	1	5	2%	17%
Medium Gravel	16		4	5	5	14	5%	21%
Coarse Gravel	32		11	10	12	33	11%	32%
Very Coarse Gravel	64		30	17	9	56	19%	51%
Small Cobble	128	3	9	20	20	49	16%	67%
Large Cobble	256		10	18	8	36	12%	79%
Small Boulder	512	2	4	15	5	24	8%	87%
Medium Boulder	1024		2	0	0	2	1%	88%
Large Boulder	2048		0	1	0	1	0%	88%
Very Large Boulder	4096		0	0	0	0	0%	88%
Bedrock	>4096	1	12	7	16	35	12%	100%
		Total	100	100	100	300	100%	

Junction Dam Reach Site (JD-G1) long profile data (p.1 of 2)

HI	BS	FS	STA	Water depth (ft)	WSEL (ft)	Bed Elevation (ft)	Notes
	8.27		BM1				Benchmark: spray paint on bedrock just u/s of XS1; 5/18
108.27		12.75	5.00	2.40	97.92	95.52	
		12.48	30.00	2.10	97.89	95.79	
		12.04	50.00	1.75	97.98	96.23	
		11.58	81.00	1.11	97.80	96.69	
		13.00	96.00	2.50	97.77	95.27	
		12.84	114.00	2.10	97.53	95.43	
		12.70	126.00	1.62	97.19	95.57	
		12.24	141.00	1.38	97.41	96.03	
		12.14	151.00	1.74	97.87	96.13	
		14.19	161.00	2.57	96.65	94.08	
		12.63	181.00	1.40	97.04	95.64	XS @ STA 195
		13.24	201.00	1.20	96.23	95.03	
		16.23	216.00	3.33	95.37	92.04	
		14.88	230.00	2.05	95.44	93.39	
		14.10	260.00	1.12	95.29	94.17	
		15.75	276.00	1.80	94.32	92.52	
		16.19	289.00	1.85	93.93	92.08	
		15.77	300.00	1.10	93.60	92.50	
101.74	1.74		BM1				19-May
		9.62	317.00	1.04	93.16	92.12	
		11.63	336.00	2.20	92.31	90.11	
		12.06	355.00	1.96	91.64	89.68	
		12.71	368.00	2.62	91.65	89.03	
		12.40	390.00	2.28	91.62	89.34	
		11.02	418.30	0.86	91.58	90.72	XS 2 location
		8.70					turning point 1

Junction Dam Reach Site (JD-G1)
long profile data (p. 2 of 2)

HI	BS	FS	STA	Water depth (ft)	WSEL (ft)	Bed Elevation (ft)	Notes
98.41	5.37						TP1; autolevel in new position DS
		8.98	430.00	1.76	91.19	89.43	
		8.85	451.00	1.68	91.24	89.56	
		8.38	466.00	0.92	90.95	90.03	
		9.94	477.00	2.38	90.85	88.47	
		10.08	484.00	2.41	90.74	88.33	
		10.76	498.00	3.09	90.74	87.65	
		9.87	513.00	2.21	90.75	88.54	
		8.78	521.00	0.97	90.60	89.63	
		11.48	526.00	2.50	89.43	86.93	
		12.23	540.00	3.36	89.54	86.18	
		13.33	560.00	4.44	89.52	85.08	
		12.51	571.00	3.64	89.54	85.90	
		11.87	578.00	2.98	89.52	86.54	
		13.09	593.00	4.25	89.57	85.32	
		9.95	613.00	1.00	89.46	88.46	
		11.32	636.00	1.56	88.65	87.09	
		11.82	651.00	2.10	88.69	86.59	XS 3 location
		9.53					TP 2
97.43	8.55						TP 2, auto level @ new position DS
		10.49	670.00	1.75	88.69	86.94	
		9.71	701.00	0.74	88.46	87.72	
		11.76	708.00	2.43	88.10	85.67	
		12.33	716.00	3.00	88.10	85.10	
		10.72	725.00	1.07	87.78	86.71	
		11.01	736.00	1.42	87.84	86.42	
		11.24	756.00	1.42	87.61	86.19	
		12.21	764.00	2.04	87.26	85.22	
		13.13	780.00	2.95	87.25	84.30	
		12.11	797.00	1.66	86.98	85.32	
		12.33	805.00	1.95	87.05	85.10	
		12.63	828.00	2.45	87.25	84.80	end of site and long profile
	4.39						TP1 - close out
101.93	8.89						TP1 - close out gun@ new position
	1.94						BM 1 - close out
99.99							CLOSED OUT

Junction Dam Reach Site (JD-G1)
upper cross-section

HI	BS	FS	STA	Elevation	Notes
108.27		2.04	0.40		top of LB endpin - nail pounded into u/s side of cedar
		6.23	1.00	102.04	base of cedar
		7.01	4.70	101.26	
		7.73	8.00	100.54	
		9.75	11.00	98.52	
		9.85	13.30	98.42	
		10.96	15.80	97.31	upper bankfull estimate
		10.73	18.50	97.54	lower bankfull estimate
		11.57	21.00	96.70	left edge of water
		12.02	24.60	96.25	
		12.41	28.80	95.86	
		12.56	33.10	95.71	
		12.66	36.70	95.61	
		13.39	39.00	94.88	
		12.97	42.50	95.30	left edge of boulder
		9.73	45.00	98.54	top of boulder
		12.50	45.80	95.77	right edge of boulder
		13.04	49.50	95.23	
		13.84	51.00	94.43	
		14.26	52.30	94.01	
		13.78	53.30	94.49	left edge boulder
		11.40	54.10	96.87	top of boulder
		10.97	57.30	97.30	top of boulder
		13.73	60.70	94.54	
		13.53	64.70	94.74	
		13.27	70.00	95.00	
		12.88	74.00	95.39	
		12.88	78.20	95.39	
		12.92	83.00	95.35	
		12.10	89.20	96.17	right edge water
		11.20	90.50	97.07	lower bankfull estimate
		10.35	92.80	97.92	upper bankfull estimate
		8.77	94.10	99.50	
		7.93	97.50	100.34	
		6.10	99.70	102.17	
		4.54	103.10	103.73	
		1.88	107.90	106.39	LB top of pin
		2.10	107.90	106.17	LB bottom of pin

Junction Dam Reach Site (JD-G1)
middle cross-section

HI	BS	FS	STA	Elevation	Notes
98.41		0.65	0.30		t.o. [top of] LB pin, BR vertical for 15' @ pin
		2.45	0.70	95.96	b.o. [bottom of] LB pin
		5.48	3.30	92.93	BR - bankfull
		4.97	7.10	93.44	Crest of GR deposit - bankfull
		5.72	10.50	92.69	Lower bankfull estimate; GR deposit
		6.79	15.20	91.62	Left edge of water
		7.76	18.60	90.65	Left edge of BO
		6.79	20.70	91.62	t.o. BO
		8.38	22.80	90.03	right edge of BO
		8.31	23.60	90.10	left edge of BO
		7.19	25.00	91.22	t.o. BO/ right edge of next BO
		4.20	25.50	94.21	t.o. BO
		4.03	27.50	94.38	t.o. BO
		8.48	32.10	89.93	CO/GR
		8.43	35.00	89.98	CO/GR
		8.11	38.40	90.30	BR
		7.95	39.70	90.46	BR
		7.59	42.10	90.82	GR over BR
		7.75	45.50	90.66	BR
		7.75	49.60	90.66	CO/GR
		7.11	53.90	91.30	CO/GR
		6.73	58.60	91.68	Right edge of water
		6.20	61.10	92.21	GR bar
		5.98	63.40	92.43	GR bar
		5.89	66.00	92.52	GR bar lower bankfull estimate
		5.13	68.70	93.28	GR bar upper bankfull estimate
		3.93	71.60	94.48	GR bar
		3.23	74.20	95.18	GR bar
		3.37	77.00	95.04	GR bar
		3.13	79.60	95.28	GR bar
		3.36	81.60	95.05	Left edge of BR
		2.17	83.10	96.24	BR
		1.05	88.00	97.36	BR
		1.26	89.60	97.15	b.o. pin; BR on right bank vertical for 5' @ pin
		1.55	89.60		t.o. pin

Junction Dam Reach Site (JD-G1)
lower cross-section

HI	BS	FS	STA	ELEVATION	Notes
97.43		2.41	0.00		t.o. LB pin BR-vertical bank
		3.04	-0.50	94.39	b.o. LB pin BR-vertical bank
		8.09	1.80	89.34	BR
		8.60	5.40	88.83	GR deposit
		8.06	8.60	89.37	GR deposit
		7.46	12.60	89.97	GR deposit bankfull estimate
		7.95	15.60	89.48	GR deposit
		8.75	18.00	88.68	right edge of GR/ left edge of water
		9.52	20.60	87.91	BR
		8.89	26.60	88.54	BR
		8.65	31.00	88.78	BR
		10.60	32.40	86.83	CO/GR
		11.01	36.30	86.42	CO/GR
		10.25	40.30	87.18	CO/GR
		10.06	46.00	87.37	CO/GR
		9.73	48.90	87.70	CO/GR
		8.72	52.40	88.71	right edge of water; GR bar dep.
		7.67	55.20	89.76	GR right bank bar; lower bankfull estimate
		6.89	58.40	90.54	upper bankfull estimate; GR bar deposits
		6.73	62.00	90.70	GR bar deposit
		7.28	65.60	90.15	contact between CO and GR deposits
		7.43	69.30	90.00	CO bar deposit
		6.79	73.70	90.64	CO bar deposit
		5.81	76.30	91.62	CO bar deposit
		5.21	85.00	92.22	SA
		4.71	89.40	92.72	SA
		4.44	91.30	92.99	SA
		3.58	93.30	93.85	BO colluvium
		1.30	95.50	96.13	BO colluvium
		1.60	97.30	95.83	b.o. RB pin
		0.54	96.80	96.89	t.o. RB pin; BO slope above pin @ 45 degrees.

Junction Dam Reach Site (JD-G1) pebble count summary

Modified Wolman Pebble Count (mm), Junction Dam Reach

Particle Description	Upper Class Boundary (mm)	Rosgen Particle Size	XS #1	XS #2	XS #3	Total	Item %	Cum %
Very coarse sand (unmeasured)	<2	6	0	0	0	0	0%	0%
Very coarse sand (measured)	2	5	0	0	0	0	0%	0%
Very Fine Gravel	4	4	0	0	0	0	0%	0%
Fine Gravel	8		0	0	0	0	0%	0%
Medium Gravel	16		0	8	0	8	3%	3%
Coarse Gravel	32		5	18	6	29	10%	12%
Very Coarse Gravel	64		18	24	34	76	25%	38%
Small Cobble	128	3	36	38	46	120	40%	78%
Large Cobble	256		20	4	4	28	9%	87%
Small Boulder	512	2	6	3	0	9	3%	90%
Medium Boulder	1024		5	2	0	7	2%	92%
Large Boulder	2048		1	0	0	1	0%	93%
Very Large Boulder	4096		0	0	0	0	0%	93%
Bedrock	>4096	1	9	3	10	22	7%	100%
		Total	100	100	100	300	100%	

Camino Dam Reach Site (CD-G1) long profile

HI	BS	FS	STA	Water depth (ft)	WSE	Elev	Notes
	5.86						Benchmark arbitrary elevation = 100.00 (Same as BM#1?)
105.86							
		13.79	0.00	1.80	93.87	92.07	Head of pool, boulder
		17.11	20.00	5.15	93.90	88.75	cobble
		16.44	27.00	4.44	93.86	89.42	cobble
		15.19	40.00	3.22	93.89	90.67	
		20.80	70.00	8.81	93.87	85.06	gravel on bedrock
		20.51	90.00	8.50	93.85	85.35	bedrock
		16.45	115.00	4.45	93.86	89.41	bedrock
		16.26	128.00	4.23	93.83	89.60	cobble
		13.52	142.90	1.62	93.96	92.34	upper XS (tailpool), cobble
	5.86						
		14.40				91.46	Turning point 1
		12.73	149.00	0.75	93.88	93.13	top of step/run, bedrock
		15.69	172.00	2.40	92.57	90.17	bedrock
		14.49	179.00	0.76	92.13	91.37	bedrock
		20.52	237.00	5.23	90.57	85.34	boulder
		20.43	269.00	4.43	89.86	85.43	head of pool/below cascade, bedrock
		18.64	293.00	2.63	89.85	87.22	in pool, boulder

8/13/2003 - Long profile Day 2 (new O.S.)

HI	BS	FS	STA	Water depth (ft)	WSE	Elev	Notes
	5.80						Turning point 1
97.26		11.14	316.00	3.64	89.76	86.12	in pool, bedrock
		8.86	341.00	1.37	89.77	88.40	tail of pool/top cascade, boulder
		12.09	368.00	2.38	87.55	85.17	tail of cascade, cobble
		12.89	397.00	3.13	87.50	84.37	pool, gravel
		10.68	413.00	0.82	87.40	86.58	tail of pool, bedrock
		16.68	428.00	5.71	86.29	80.58	pool, bedrock
		14.32	494.00	3.35	86.29	82.94	tail of pool, cobble
		11.78	518.00	0.70	86.18	85.48	top of cascade, bedrock
			530.00				middle XS location
		14.22	538.00	2.20	85.24	83.04	bottom of cascade, bedrock
		15.05	583.00	3.04	85.25	82.21	in run, bedrock
		14.48	623.00	2.08	84.86	82.78	lower XS riffle, boulder
		15.04	653.00	1.69	83.91	82.22	bottom of riffle, cobble
		15.84	668.00	2.54	83.96	81.42	pool, bedrock
	5.80						turning point #1 (check)

Camino Dam Reach Site (CD-G1) upper cross-section

HI	BS	FS	STA	WD	ELEV	Bed material	Notes
		-15.50	-6.00		121.31	bedrock	estimated about 25 ft to top of bedrock terrace from base of pin
		9.50	0.00		96.31	cobble	base of pin -- cobble (approx. bankfull indicator)
		8.61	0.00		97.20	cobble	top of pin
		10.37	5.00		95.44	cobble	
		11.42	10.00		94.39	cobble	
		12.16	13.30	0.00	93.65	cobble	L.E.W.
		13.22	16.20	1.25	92.59	gravel	
		13.86	20.50	1.83	91.95	cobble	
		13.37	26.60	1.40	92.44	bedrock	
		12.79	30.00	0.81	93.02	bedrock	
		14.43	34.00	2.41	91.38	cobble	
		13.78	39.00	1.76	92.03	cobble	
		13.87	43.00	1.89	91.94	cobble	
		13.87	47.00	1.93	91.94	bedrock	
		12.81	49.00	0.81	93.00	bedrock	
		9.61	51.70		96.20	boulder	
		12.99	54.00	0.62	92.82	bedrock	
		12.35	58.00	0.00	93.46	bedrock	R.E.W.
		10.86	62.20		94.95	bedrock	
		10.14	67.70		95.67	bedrock	
		9.27	73.00		96.54	bedrock	in vegetation, approx. bankfull indicator
		7.41	78.00		98.40	boulder	in vegetation
		5.27	85.00		100.54	boulder	
		3.79	90.70		102.02	boulder	
		1.96	94.90		103.85	boulder	base of pin
		1.28	94.90		104.53	boulder	top of pin
105.81	5.81				100.00		B.M.#1

Camino Dam Reach Site (CD-G1) middle cross-section

HI	BS	FS	STA	WD	ELEV	Bed material	Notes
107.16	12.80				94.36		Turning point #1
		-2.79	-6.00		109.95	bedrock	estimated +10 ft from base of pin ~ top of bedrock ledge
		5.85	0.00		101.31		top of pin LB
		7.21	0.00		99.95		base of pin LB
		9.14	4.50		98.02	bedrock	
		14.41	8.50		92.75	bedrock	
		12.39	9.70		94.77	bedrock	
		12.83	12.00		94.33	gravel	approx. bankfull indicator
		15.28	26.00		91.88	gravel	
		16.38	33.20		90.78	bedrock	
		18.10	42.50		89.06	gravel	
		17.24	43.00		89.92	bedrock	
		18.66	51.50	0.37	88.50	bedrock	L.E.W.
		18.85	56.40	0.63	88.31	boulder	
		18.50	60.60	0.28	88.66	cobble	
		17.23	63.20		89.93	bedrock	
		17.99	69.50		89.17	bedrock	
		20.43	71.60	1.60	86.73	bedrock	
		20.52	73.80	1.98	86.64	boulder	
		19.61	77.00	1.19	87.55	bedrock	
		17.26	77.60	0.00	89.90	bedrock	R.E.W.
		16.01	93.40		91.15	bedrock	
		12.53	101.40		94.63	cobble	
		7.30	114.00		99.86	cobble	
		3.83	121.80		103.33		base of pin RB
		3.09	121.80		104.07		top of pin
	12.80						tuning point #1 (check)

Camino Dam Reach Site (CD-G1) lower cross-section

HI	BS	FS	STA	WD	ELEV	Bed material	Notes
101.41	7.05				94.36		turning point #1
		1.14	0.00		100.27		top of pin L.B.
		2.09	0.00		99.32		bottom of pin L.B.
		4.28	7.50		97.13	bedrock	
		7.40	13.20		94.01	gravel	
		9.35	25.50		92.06	gravel	
		10.97	35.00		90.44	gravel	
		10.77	40.80		90.64	bedrock	
		12.13	47.50		89.28	bedrock	
		15.16	48.30	0.37	86.25	bedrock	L.E.W.
		14.79	54.00	1.05	86.62	bedrock	
		14.32	58.20	0.67	87.09	gravel	
		12.98	60.90		88.43	bedrock	
		15.44	65.50	1.73	85.97	boulder	
		15.51	67.80	1.77	85.90	cobble	
		14.92	70.20	1.13	86.49	cobble	
		13.93	73.30	0.31	87.48	cobble	
		13.89	76.10	0.15	87.52	cobble	R.E.W.
		12.68	78.40		88.73	boulder	
		13.02	84.50		88.39	cobble	
		12.68	91.20		88.73	cobble	
		10.87	94.40		90.54	bedrock	
		9.61	102.40		91.80	bedrock	approx. bankfull indicator
		8.86	109.50		92.55	bedrock	
		5.41	115.30		96.00		base of pin R.B.
		4.32			97.09		top of pin R.B.
	7.05						turning point #1 (check)

Camino Dam Reach Site (CD-G1) pebble count summary

Modified Wolman Pebble Count (mm), Camino Reach

Particle Description	Upper Class Boundary (mm)	Rosgen Particle Size	XS #1	XS #2	XS #3	Total	Item %	Cum %
Very coarse sand (unmeasured)	<2	6	0	0	0	0	0%	0%
Very coarse sand (measured)	2	5	0	0	0	0	0%	0%
Very Fine Gravel	4	4	1	0	0	1	0%	0%
Fine Gravel	8		1	0	0	1	0%	1%
Medium Gravel	16		0	0	5	5	2%	2%
Coarse Gravel	32		6	6	8	20	7%	9%
Very Coarse Gravel	64		37	29	31	97	32%	41%
Small Cobble	128	3	36	41	29	106	35%	77%
Large Cobble	256		19	18	19	56	19%	95%
Small Boulder	512	2	0	3	4	7	2%	98%
Medium Boulder	1024		0	0	2	2	1%	98%
Large Boulder	2048		0	0	0	0	0%	98%
Very Large Boulder	4096		0	0	0	0	0%	98%
Bedrock	>4096	1	0	3	2	5	2%	100%
		Total	100	100	100	300	100%	

S. F. American Reach Site (SFAR-G1)
long profile (p. 1 of 2)

HI	BS	FS	Water depth (ft)	STA	WSE	ELEV	Bed material	Notes
104.32	4.32							B.M. #1 (from O.S. #2)
		9.76	3.52	7.00	98.08	94.56	sand, boulder	mid pool
		9.46	3.23	14.00	98.09	94.86		
		9.61	3.38	24.00	98.09	94.71		
		10.23	4.00	34.00	98.09	94.09		
		10.15	3.91	44.00	98.08	94.17	sand, large cobble, small boulder	
		10.41	4.18	54.00	98.09	93.91		
		10.28	4.05	64.00	98.09	94.04		
		10.28	4.05	74.00	98.09	94.04		
		10.14	3.90	84.00	98.08	94.18	sand	
		10.30	4.08	94.00	98.10	94.02		
		10.13	3.90	104.00	98.09	94.19	sand/boulder/large cobble	
		10.10	3.87	114.00	98.09	94.22		
		9.79	3.55	124.00	98.08	94.53		
		9.70	3.45	134.00	98.07	94.62		
		9.21	2.96	144.00	98.07	95.11		
		9.21	2.95	154.00	98.06	95.11		
		8.99	2.76	164.00	98.09	95.33		tail of pool/head of riffle
		9.29	3.02	174.00	98.05	95.03		
		9.21	2.96	184.00	98.07	95.11		
		8.93	2.66	197.00	98.05	95.39		at upper XS(#1)
		8.71	2.46	207.30	98.07	95.61	cobble/small boulder	
		8.63	2.38	217.00	98.07	95.69		
		8.68	2.40	227.00	98.04	95.64		
		8.32	1.96	237.00	97.96	96.00		
		8.31	1.88	247.00	97.89	96.01		
		8.34	1.82	254.40	97.80	95.98		middle XS (#2)
		9.02	1.90	264.40	97.20	95.30	boulder	
		8.77	1.50	274.00	97.05	95.55		
		9.06	1.48	284.30	96.74	95.26		
		9.71	1.40	294.00	96.01	94.61		
		10.11	1.80	300.00	96.01	94.21		

S. F. American Reach Site (SFAR-G1)
long profile (p. 2 of 2)

NEW DAY 10/23/03, continuation from 10/10/03 survey

HI	BS	FS	Water depth (ft)	STA	WSE	ELEV	Bed material	Notes
106.02	4.06					101.96		B.M.#3 (outcrop on RB D/S lower XS#3)
		9.78	1.68	254.40	97.92	96.24		Middle XS(#2)
		10.03	1.76	261.40	97.75	95.99	boulder/bedrock	
		10.51	2.13	267.90	97.64	95.51		top of step
		10.53	1.81	276.90	97.30	95.49		
		10.59	1.48	286.40	96.91	95.43		
		11.40	1.80	296.40	96.42	94.62		bottom of step
		12.01	2.60	308.40	96.61	94.01		in run
		12.94	3.36	316.40	96.44	93.08		
		13.06	3.45	326.40	96.41	92.96		
		12.33	2.60	334.40	96.29	93.69	boulder/sand/cobble	
		13.20	3.40	345.40	96.22	92.82		
		13.79	4.00	353.40	96.23	92.23		Lower XS(#3)
		13.85	3.98	362.40	96.15	92.17		
		14.92	4.85	372.40	95.95	91.10		
		15.08	5.14	382.40	96.08	90.94		
		14.88	4.96	392.40	96.10	91.14		top of boulder drop
		15.86	5.70	402.40	95.86	90.16		bottom ofdrop/start of boulder run
		16.20	5.80	411.40	95.62	89.82		
		14.15	3.84	422.40	95.71	91.87		
		13.36	3.00	432.40	95.66	92.66		
		15.99	5.15	442.40	95.18	90.03		
		14.20	3.20	452.40	95.02	91.82		
		13.48	2.20	459.40	94.74	92.54		
		14.14	2.70	469.40	94.58	91.88		
		15.82	4.10	479.40	94.30	90.20		
		16.30	4.14	492.40	93.86	89.72		
		17.30	5.50	502.40	94.22	88.72		
		16.62	4.70	512.40	94.10	89.40		
		16.16	4.30	522.40	94.16	89.86		
		4.06				101.96		B.M.#3

S. F. American Reach Site (SFAR-G1)
upper cross-section

HI	BS	FS	STA	WD	ELEV	Bed material	Notes
119.63	19.63						B.M.#1 (rock outcrop on LB near start of thalweg survey)
		2.71	152.90		116.92		top of pin LB
		3.57	152.90		116.06		bottom of pin LB (floodprone elevation)
		4.41	148.00		115.22	bedrock	
		11.97	140.00		107.66	bedrock	
		14.10	135.00		105.53	bedrock	estimated bankfull elevation
		18.67	127.00		100.96		
		20.50	122.00		99.13		
		21.62	121.10	0.00	98.01		L.E.W.
		23.56	116.00		96.07	small boulder, large cobble	
		24.07	110.00		95.56		
		24.18	106.00		95.45		
		24.30	102.00		95.33		
		24.34	99.00		95.29		
		24.36	93.00		95.27		
		24.56	88.00		95.07		
		23.73	84.00		95.90		
		22.68	79.00		96.95		
		23.22	74.00		96.41		
		21.79	69.00		97.84		
		21.59	68.30	0.00	98.04		R.E.W.
		20.34	63.00		99.29	sand bar	on veg. sand bar
		20.02	56.00		99.61		
		13.71	54.90		105.92	bedrock	estimated bankfull elevation
		11.13	49.00		108.50		
		9.42	41.00		110.21		
		7.87	34.00		111.76		
		7.05	25.00		112.58		
		5.20	16.00		114.43		bottom of pin RB
		4.16	16.00		115.47		top of pin RB
		19.64			99.99		B.M.#1

S. F. American Reach Site (SFAR-G1)
middle cross-section

HI	BS	FS	STA	WD	ELEV	Bed material	Notes
120.27	17.92				102.35		B.M. #2 (from O.S. #3)
		0.59	147.30		119.68	bedrock	t.o.p. LB
		2.06	147.30		118.21		b.o.p. LB
		8.36	138.00		111.91		
		16.15	128.00		104.12		estimated bankfull elevation
		19.10	118.00		101.17		
		22.21	109.20	0.00	98.06		LEW
		23.97	102.00		96.30	large cobble	
		24.22	95.00		96.05		
120.24	17.89						B.M. #2 (from O.S.#3) (knocked station? Set new HI)
		24.23	88.00		96.01		
		24.20	84.00		96.04		
		22.56	81.10	0.00	97.68		REW
		21.89	73.00		98.35	bedrock	
		21.11	63.00		99.13		
		20.54	53.00		99.70		
		18.91	43.70		101.33		
		15.24	33.00		105.00		bankfull?
		8.56	26.00		111.68		
		5.92	20.00		114.32		
		4.37	15.40		115.87		b.o.p. RB
		3.71			116.53		t.o.p. RB
		17.89			102.35		B.M. #2 (from O.S. #3)

S. F. American Reach Site (SFAR-G1)
lower cross-section

HI	BS	FS	STA	WD	ELEV	Bed material	Notes
120.20	3.28				116.92		t.o.p. LB Upper XS
		0.15	1.20		120.05		t.o.p. RB
		0.77	1.20		119.43		b.o.p. RB
		1.54	6.00		118.66	bedrock slope	
		5.22	11.00		114.98		
		7.79	15.00		112.41		
		9.75	20.00		110.45		
		14.00	25.00		106.20		bankfull estimate (sand deposit on bedrock)
		15.04	30.00		105.16		
		15.26	35.00		104.94		
		16.75	40.00		103.45	bedrock/boulder	
		18.62	45.00		101.58		
		18.93	50.00		101.27		
		14.28	55.00		105.92	on boulder	
		12.90	60.00		107.30	on bedrock outcrop	
		13.97	65.00		106.23		
		15.62	70.00		104.58		
		16.92	75.00		103.28		
		18.75	80.00		101.45		
		23.05	85.00		97.15		
		24.03	86.10	0.00	96.17		R.E.W. (11:18AM)
		18.24			101.96		B.M.#3 (on RB outcrop D/S of lower XS)
106.00	4.04						B.M.#3 (from new O.S.)
		11.84	88.20		94.16		
		13.49	93.00	2.62	92.51	sand/bedrock/boulder	
		13.78	98.00		92.22		
		12.15	103.00		93.85		
		11.26	108.00		94.74		
		10.50	112.00		95.50		
		9.81	115.80	0.00	96.19		L.E.W. (11:42AM)
		9.07	118.00		96.93		
		7.57	123.00		98.43	boulder/cobble bar	
		5.91	128.00		100.09		
		4.82	132.00		101.18		
		3.89	135.00		102.11		bankfull estimate
		3.96			102.04		B.M.#4 (on LB outcrop U/S of lower XS)
120.18	18.14						B.M.#4 (from new O.S.)
		12.27	137.00		107.91		
		4.22	141.30		115.96		b.o.p. LB
		3.11			117.07		t.o.p. LB
		18.14			102.04		B.M. #4
		18.23			101.95		B.M. #3
		0.14			120.04		t.o.p. RB

S. F. American Reach Site (SFAR-G1)
pebble count summary

Modified Wolman Pebble Count (mm), South Fork American River Reach

Particle Description	Upper Class Boundary (mm)	Rosgen Particle Size	XS #1	XS #2	XS #3	Total	Item %	Cum %
Very coarse sand (unmeasured)	<2	6	4	0	3	7	2%	2%
Very coarse sand (measured)	2	5	2	0	1	3	1%	3%
Very Fine Gravel	4	4	0	1	0	1	0%	4%
Fine Gravel	8		1	1	1	3	1%	5%
Medium Gravel	16		0	0	1	1	0%	5%
Coarse Gravel	32		5	6	4	15	5%	10%
Very Coarse Gravel	64		7	20	15	42	14%	24%
Small Cobble	128	3	32	33	35	100	33%	57%
Large Cobble	256		32	22	29	83	28%	85%
Small Boulder	512	2	17	17	11	45	15%	100%
Medium Boulder	1024		0	0	0	0	0%	100%
Large Boulder	2048		0	0	0	0	0%	100%
Very Large Boulder	4096		0	0	0	0	0%	100%
Bedrock	>4096	1	0	0	0	0	0%	100%
		Total	100	100	100	300	100%	

Slab Creek Dam Reach Site (SC-G1) long profile

HI	BS	FS	STA	Water depth (ft)	Notes
112.56	12.56				BM1 - spray paint on rock
		12.96	0.00	2.10	t.o. riffle
		14.54	25.00	2.85	
		14.43	52.00	2.60	
		15.05	69.00	3.07	
		14.98	85.00	2.80	XS 1 just d.s. at STA 92.5
		15.59	109.00	2.50	t.o. riffle
		15.68	123.00	1.70	
		16.39	141.00	1.73	
		16.52	152.00	1.30	
		18.20	165.00	2.20	
		18.45	182.00	2.95	b.o. riffle
		22.53	202.00	5.76	t.o. pool
		19.86	222.00	3.15	
		19.18	242.00	2.18	
		19.33	262.00	1.75	
		20.82	280.00	1.95	XS 2 just d.s. at STA 300
	12.56				BM 1 - very top of rock - close out long profile
	12.56				BM 1 - BS to move instrument
		17.56			BM 2 - shot to move instrument
	9.42				BM 1 - gun in new location
	14.38				BM 2 - gun in new location
	14.39				BM 2 - gun in new location
109.42	9.42				BM 1 - gun in new location
105.22	5.22				BM 1 - to start 2nd long. Section 5/23; 5/23; +300 ft
	10.16				BM 2 - to start 2nd long. Section 5/23; 5/23; +300 ft
		13.49	317.00	1.60	t.o.riffle
		13.92	329.00	1.30	
		15.44	349.00	1.80	
		15.68	368.00	1.50	
		16.84	390.00	1.60	
		18.10	406.00	2.50	b.o. riffle
		18.51	427.00	2.72	
		18.76	447.00	3.00	
		19.45	467.00	3.59	
		19.84	488.00	4.05	
		18.53	508.00	2.70	
		17.90	530.00	1.90	XS 3 just u.s. at 520
		18.40	551.00	2.30	
		19.49	564.00	3.35	
		17.91	588.00	1.70	t.o. riffle
		11.80			BM 3
	5.22				BM 1 - to close out 2nd long section
105.22	10.17				BM 2 - to close out 2nd long section
	11.79				BM 3 - to start 3rd long section
		11.36			BM 4 - to move gun
	4.48				BM 4 - gun in new location
	4.93				BM 3 - gun in new location
98.34		14.31	600.00	3.79	(+600 ft)
		13.37	620.00	1.90	
		13.77	630.00	2.50	t.o. step
		16.63	643.00	3.70	b.o. step
					long, deep pool after STA 643.0. Pool is ~300 ft long until next small riffle
	4.48				BM 4 - to close out 3rd long section
105.25	11.39				BM 4 - to close out long profile
	5.25				BM 1 - to close out long profile

Slab Creek Dam Reach Site (SC-G1) upper cross-section

HI	BS	FS	STA	Notes
112.56	12.56			BM 1
		1.86	2.90	spray paint at edge of rock BR
		4.54	9.10	BR
		7.16	10.00	BR
		9.19	12.50	BR
		10.95	13.00	CO/BO
		10.91	23.00	CO/BO
		10.83	31.00	CO/BO; upper bankfull estimate?
		11.89	34.50	
		12.13	44.50	
		11.61	47.30	
		12.20	50.00	in low water among BO's
		12.00	56.00	
		11.85	61.30	edge of BO
		9.89	63.10	t.o. BO
		10.01	65.80	t.o. BO
		12.14	67.40	edge of BO
		12.32	75.30	
		12.27	80.60	left edge of water
		13.20	84.20	
		12.85	85.70	
		13.66	89.60	
		13.53	94.00	
		14.28	96.00	
		13.96	99.10	edge of BO
		11.65	102.30	t.o. BO
		14.37	103.30	edge of BO
		14.43	108.50	
		14.21	110.30	
		12.25	112.60	t.o. BO
		13.88	114.70	edge of BO
		14.68	117.90	thalweg
		12.78	119.40	t.o. BO
		14.61	123.00	edge of BO
		15.19	126.00	scour hole
		15.19	130.20	
		14.75	134.50	
		13.70	138.00	
		12.18	139.30	Right edge if water, on BO
		10.68	141.60	t.o. BO
		11.47	144.20	Bankfull estimate, hard to distinguish b/c of Bos
112.56		11.16	149.60	
		11.16	152.60	
		9.33	154.00	t.o. BO
		10.64	155.20	b.o. BO
		10.81	159.40	
		7.56	161.00	t.o. BO
		10.45	166.50	b.o. BO
		8.70	168.70	t.o. BO
		5.06	169.50	edge of large BO
		4.01	170.80	right bank pin = spray painted dot
	1.86		2.90	close out (check-marked)
	12.56			BM 1 close out (check-marked)

Slab Creek Dam Reach Site (SC-G1) middle cross-section

HI	BS	FS	STA	Notes
109.42		3.05	0.60	t.o. pin - LB
		3.26	0.60	next to pin - LB; BR
		5.94	7.70	BR
		7.44	10.70	edge of BR
		8.20	20.00	CO
		9.59	30.20	CO
		10.60	33.00	CO
		11.31	40.70	CO
		11.72	49.50	
		11.35	53.50	
		12.05	64.00	
		12.80	67.80	Bankfull estimate
		14.24	70.90	
		14.78	76.40	
		15.78	77.50	Left edge of water
		16.84	82.50	
		17.25	84.30	
		17.55	89.00	
		17.39	90.60	edge of BO
		16.58	92.00	t.o. BO
		16.71	94.00	t.o. BO
		17.74	95.50	edge of BO
		17.73	100.00	
		17.95	104.00	
		18.36	108.00	thalweg
		17.80	112.00	
		17.00	115.40	(can't give right edge of water: undercut bank)
		14.95	116.00	BO
		11.43	121.00	t.o. BO
		14.05	122.20	
		13.95	128.00	next to BO
		11.24	129.50	t.o. BO
		13.18	130.60	next to BO (can't determine RB bankfull)
		13.33	137.80	
		12.30	140.30	
		9.26	142.00	BO
		6.21	147.60	t.o. BO
		9.74	149.00	next to BO
		9.23	156.90	
		7.43	155.00	BO
		7.81	166.40	
109.42		7.45	171.40	
		4.05	185.00	
		1.63	193.20	
		0.18	197.30	
		0.18-2.33	203.00	t.o. RB pin
	3.05		0.60	Close out (check-marked)
	9.42			BM 1 Close-out (check-marked)

Slab Creek Dam Reach Site (SC-G1) lower cross-section

HI	BS	FS	STA	Notes
105.22		2.09	0.20	t.o. LB pin
		2.95	0.20	next to LB pin
		4.71	4.20	talus
		6.22	6.20	talus
		7.90	12.40	edge of active channel estimate
		6.80	14.00	t.o. BO
		8.56	15.70	
		10.12	20.00	
		10.92	23.70	
		8.99	24.20	t.o. BO
		10.33	27.40	t.o. BO
		13.82	27.90	b.o. BO; bankfull estimate
		14.71	33.70	
		15.15	36.00	
		13.93	37.40	t.o. BO
		15.97	38.10	left edge of water; water depth = 0.17 ft
		16.17	39.90	
		17.45	41.90	
		18.46	43.30	
		18.53	45.00	
		17.62	50.70	
		15.96	53.20	t.o. BO
		17.30	54.80	
		14.64	55.30	t.o. BO
		14.50	56.20	t.o. BO
		16.39	58.10	BO
		17.78	60.00	b.o. BO
		17.53	61.50	
		15.93	63.70	BO
		16.88	65.30	BO
		18.61	66.30	
		17.97	68.80	
		18.05	72.70	
		17.20	78.50	
		16.84	81.80	
		15.95	83.60	Right edge of water
		14.71	88.90	
		13.71	89.20	BO; bankfull estimate
		13.28	91.40	BO
		14.15	91.80	
		14.00	99.10	
105.22		13.31	103.40	GR
		11.69	104.60	BO
		10.82	109.50	BO
		11.72	109.70	edge of BO
		11.84	115.40	
		10.21	117.00	BO
		11.01	119.00	
		10.95	122.50	
		10.19	126.80	
		9.24	129.60	
		7.03	131.00	BO
		6.61	135.00	BO
		5.61	137.60	BO
		7.24	138.00	next to BO
		5.37	143.00	
		3.61	147.90	next to RB pin
		2.96	147.90	t.o. pin
	11.78			BM 3 - to close out XS 3
	2.09			LB pin - to close out XS 3

Slab Creek Dam Reach Site (SC-G1)
pebble count summary

Modified Wolman Pebble Count (mm), Slab Creek Dam Reach

Particle Description	Upper Class Boundary (mm)	Rosgen Particle Size	XS #1	XS #2	XS #3	Total	Item %	Cum %
Very coarse sand (unmeasured)	<2	6	0	0	0	0	0%	0%
Very coarse sand (measured)	2	5	0	0	0	0	0%	0%
Very Fine Gravel	4	4	0	0	0	0	0%	0%
Fine Gravel	8		0	0	0	0	0%	0%
Medium Gravel	16		0	0	0	0	0%	0%
Coarse Gravel	32		0	2	2	4	1%	1%
Very Coarse Gravel	64		3	3	3	9	3%	4%
Small Cobble	128	3	12	24	26	62	21%	25%
Large Cobble	256		37	39	40	116	39%	64%
Small Boulder	512	2	34	27	21	82	27%	91%
Medium Boulder	1024		14	4	8	26	9%	100%
Large Boulder	2048		0	1	0	1	0%	100%
Very Large Boulder	4096		0	0	0	0	0%	100%
Bedrock	>4096	1	0	0	0	0	0%	100%
		Total	100	100	100	300	100%	

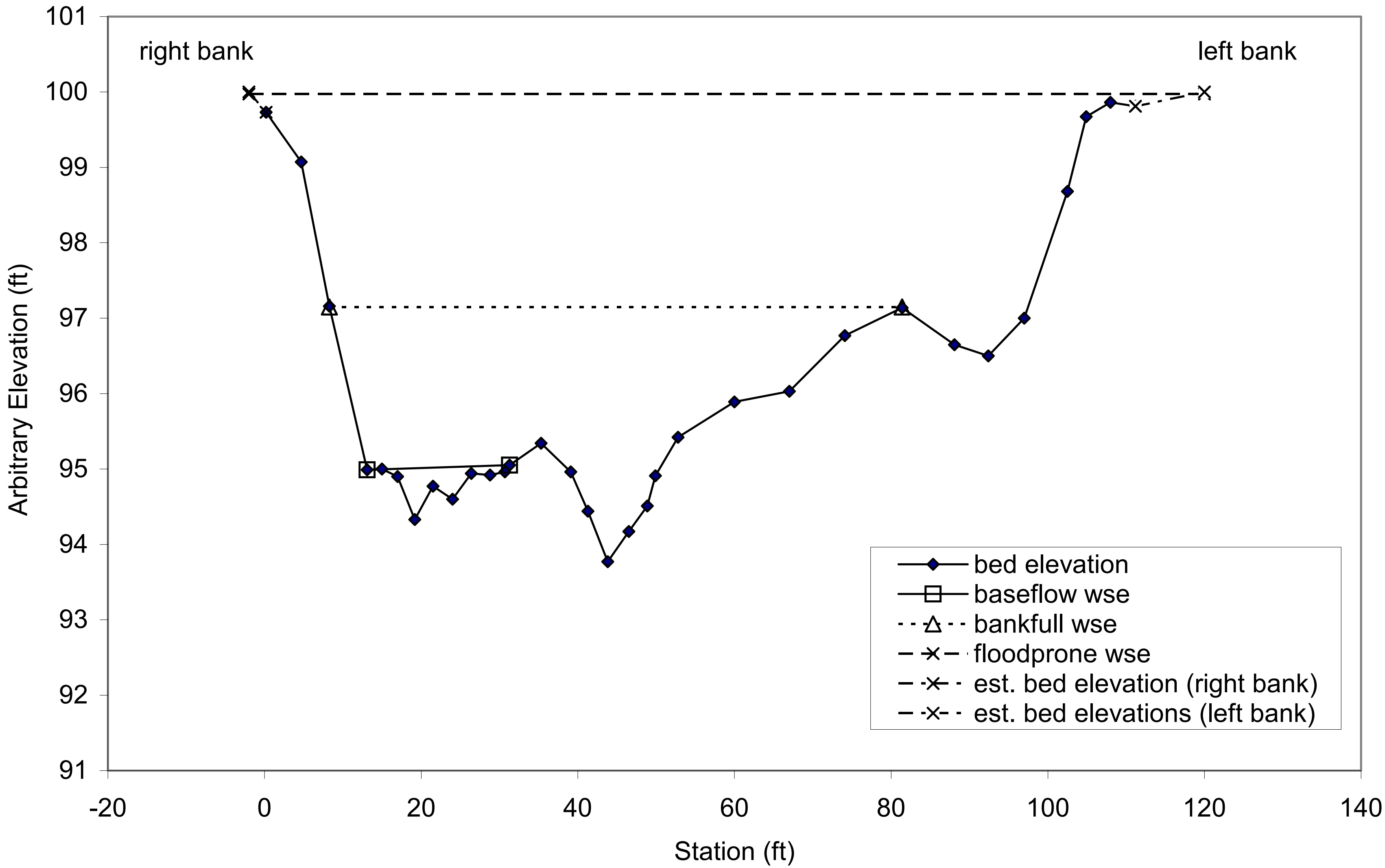
APPENDIX H

GRAPHS: LONGITUDINAL PROFILES, CROSS-SECTIONS, AND PEBBLE COUNT PLOTS FOR THE UARP

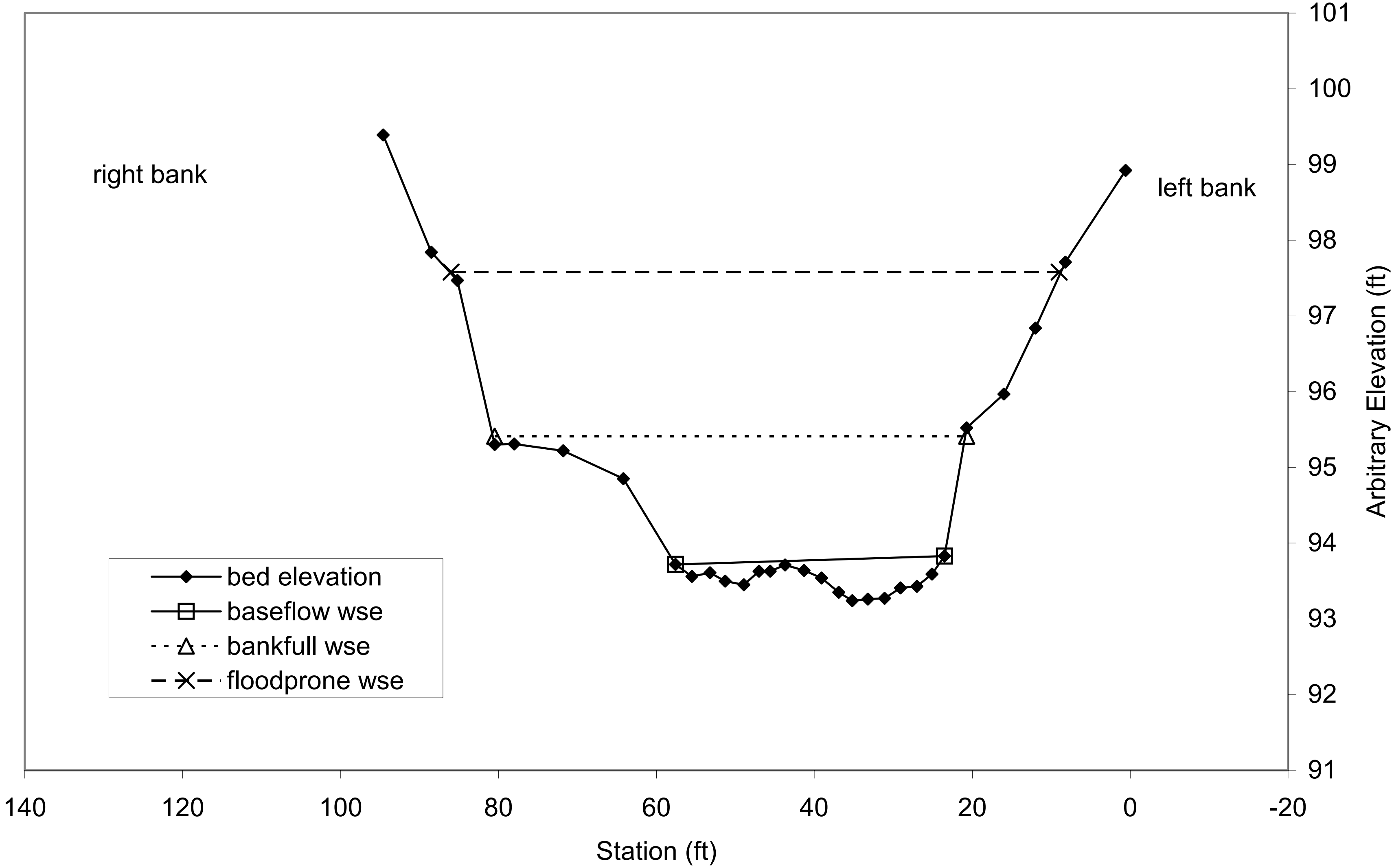
UARP:
Rubicon Dam Reach Site (RD-G1)
Loon Lake Dam Reach Upper Site (LL-G1)
Loon Lake Dam Reach Middle Site (LL-G2)
Loon Lake Dam Reach Lower Site (LL-G3)
Gerle Creek Dam Reach Site (GC-G1)
Robbs Peak Dam Reach Site (RPD-G1)
Ice House Dam Reach Upper Site (IH-G1)
Ice House Dam Reach Lower Site (IH-G2)
Junction Dam Reach Site (JD-G1)
Camino Dam Reach Site (CD-G1)
S. F. American Reach Site (SFAR-G1)
Slab Creek Dam Reach Site (SC-G1)

Rubicon Dam Reach Site (RD-G1) long profile

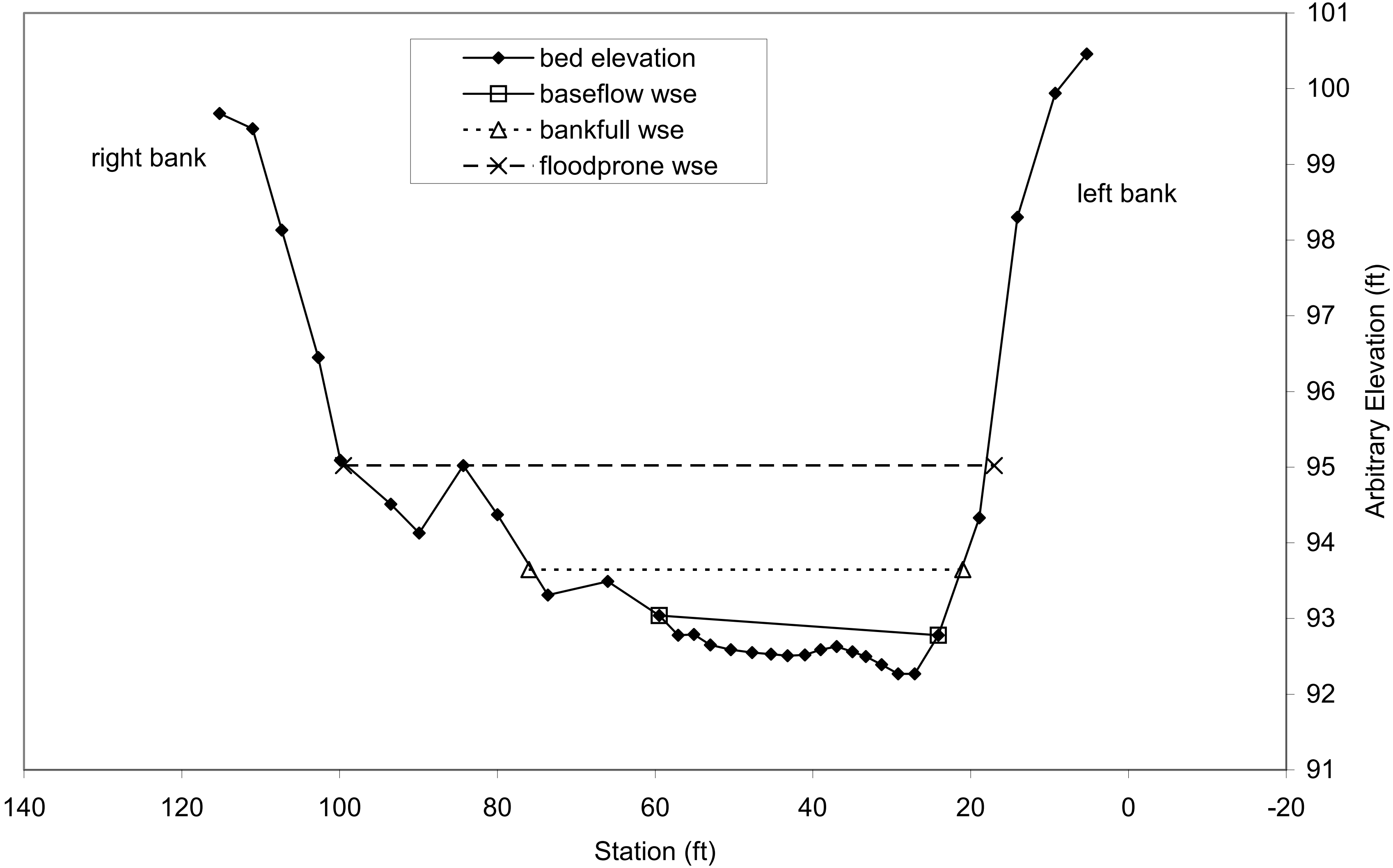
Rubicon Dam Reach Site (RD-G1) upper cross-section



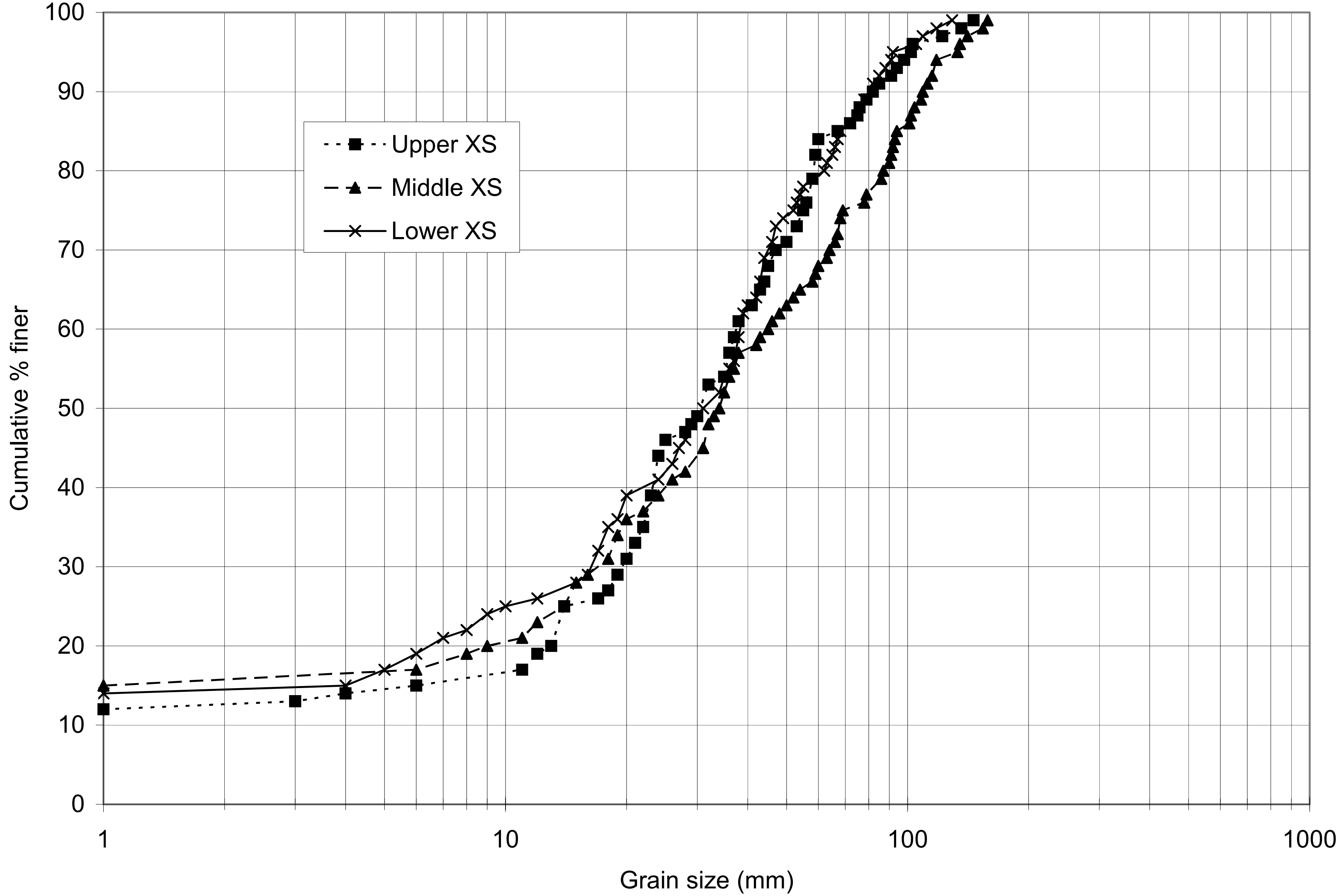
Rubicon Dam Reach Site (RD-G1) middle cross-section



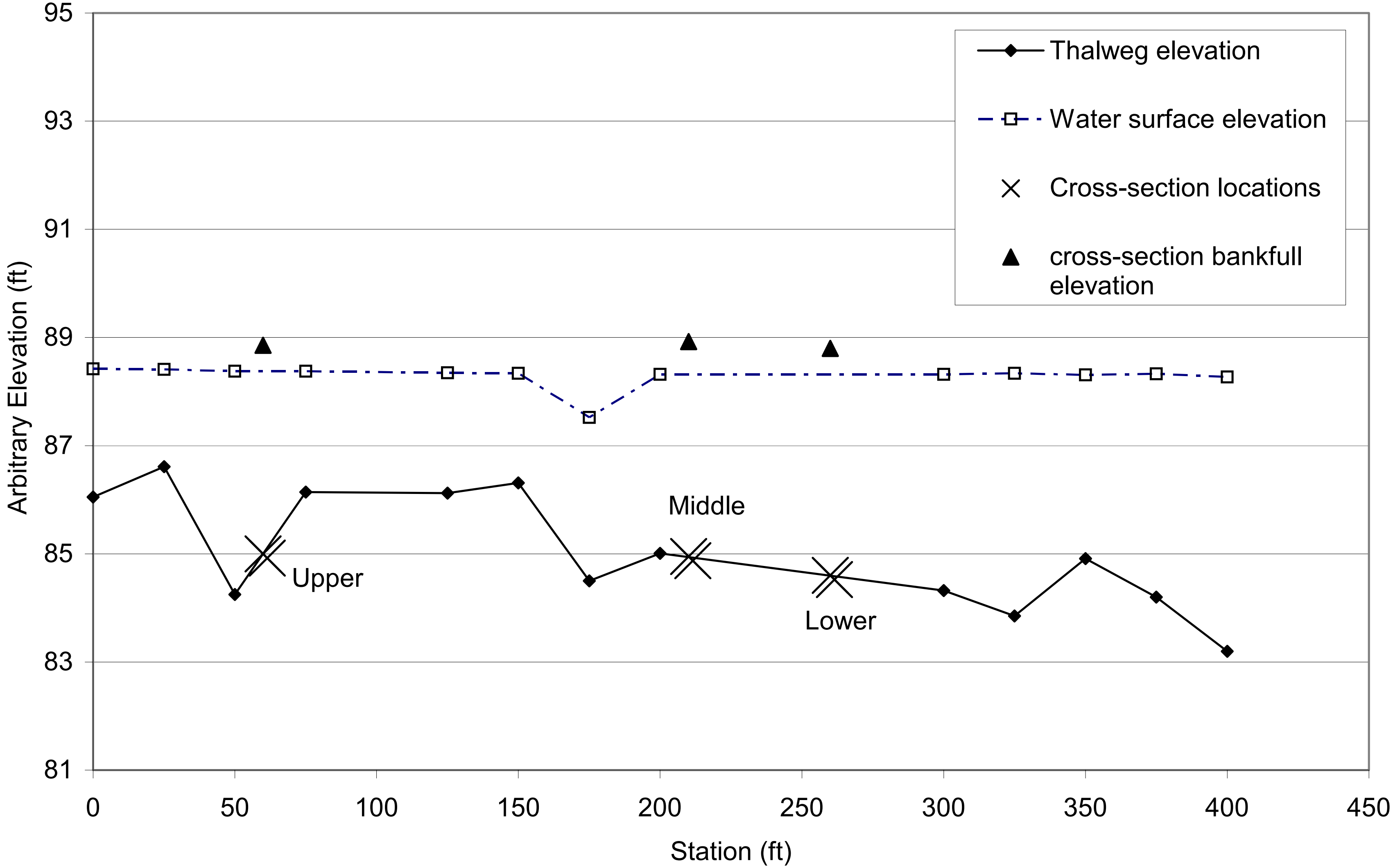
Rubicon Dam Reach Site (RD-G1) lower cross-section



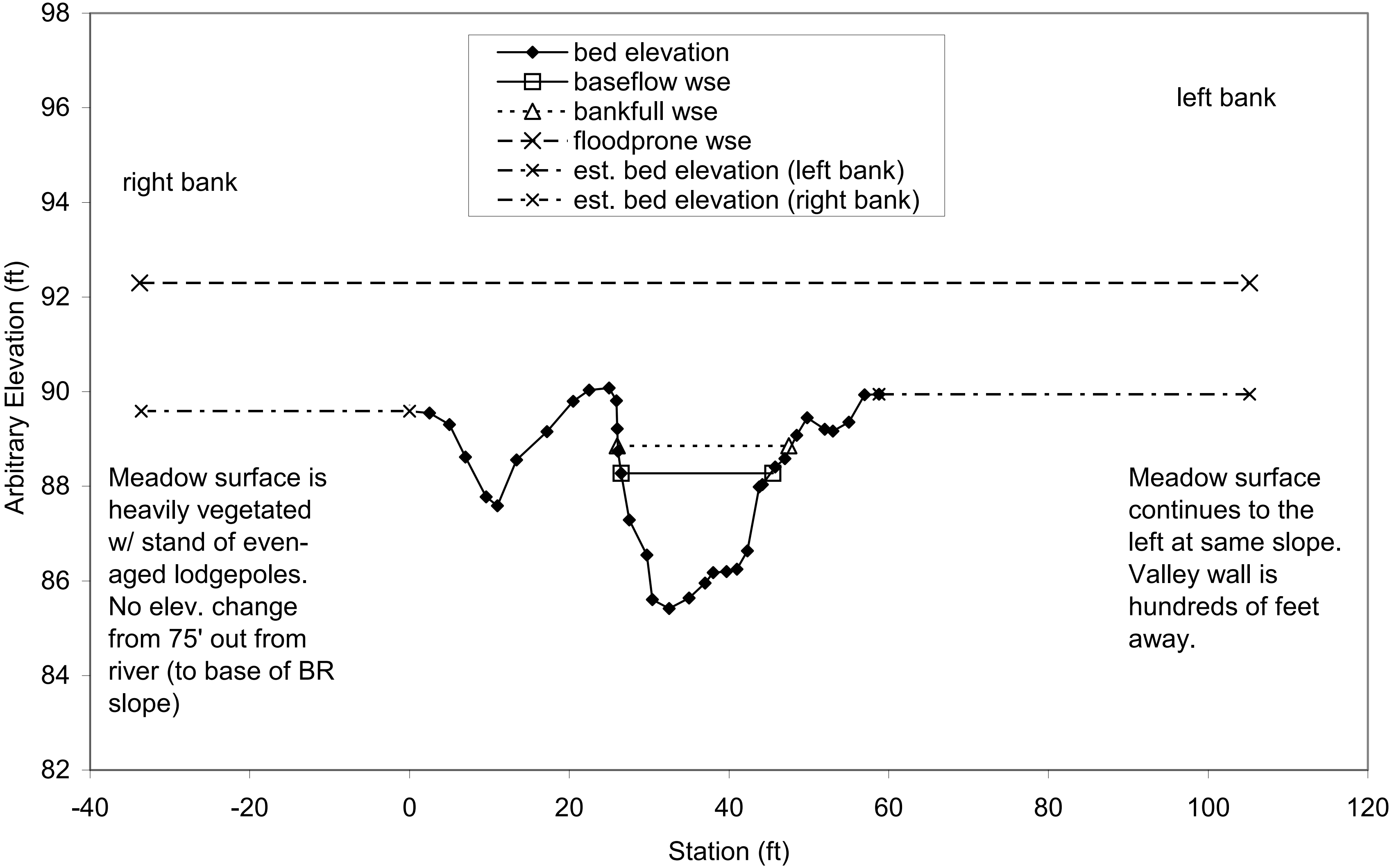
Rubicon Dam Reach Site (RD-G1) pebble count



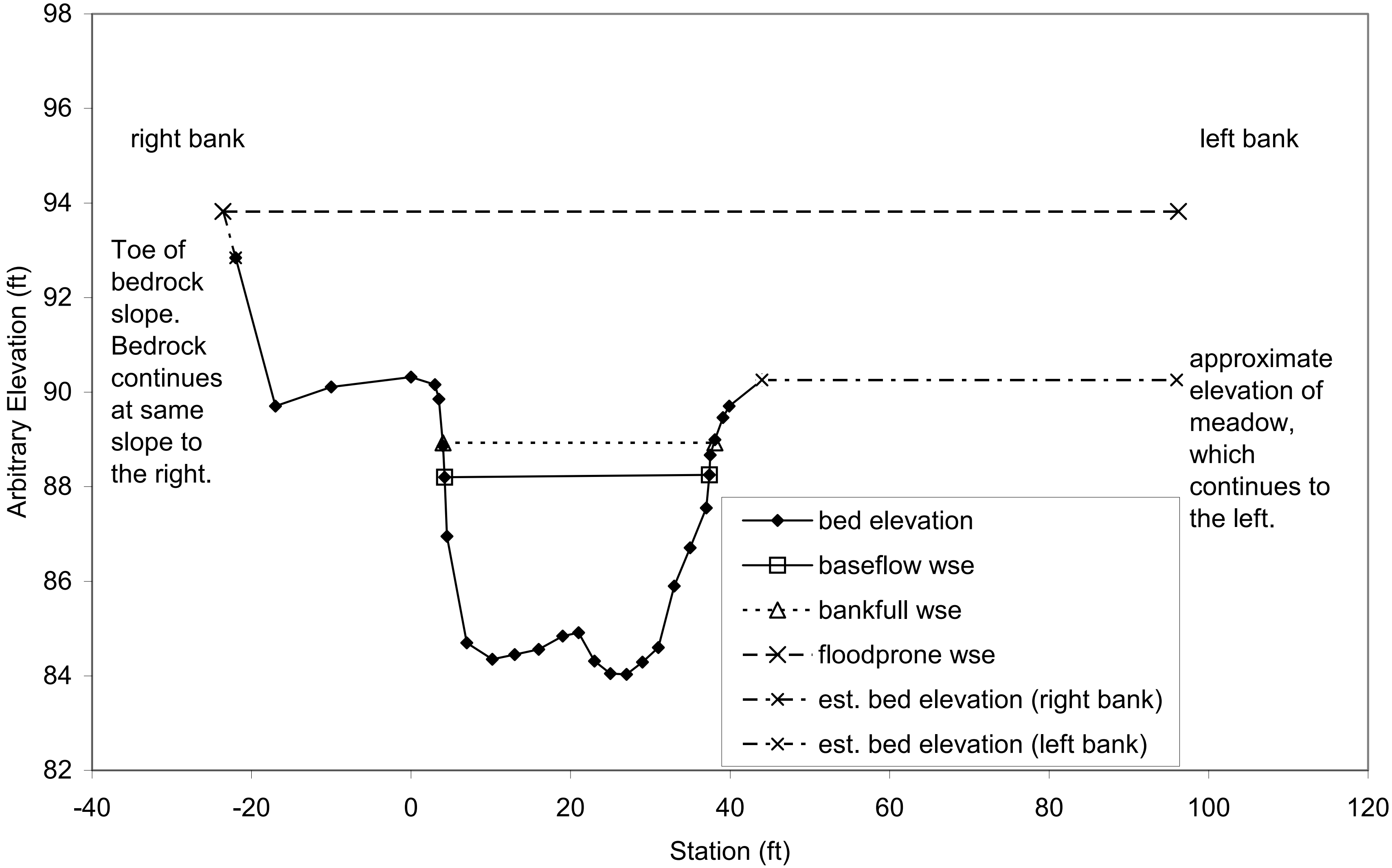
Loon Lake Dam Reach Upper Site (LL-G1) long profile



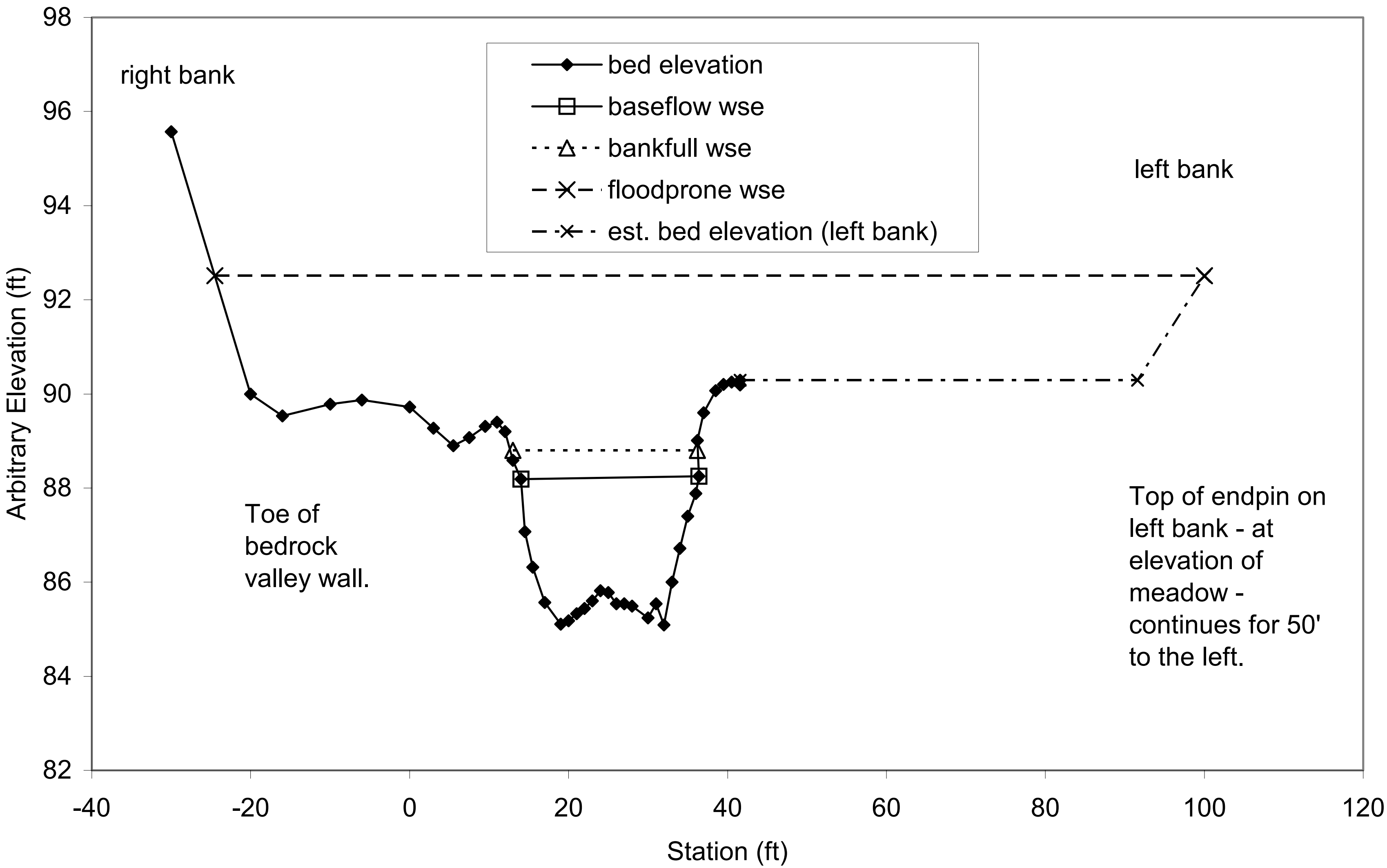
Loon Lake Dam Reach Upper Site (LL-G1) upper cross-section



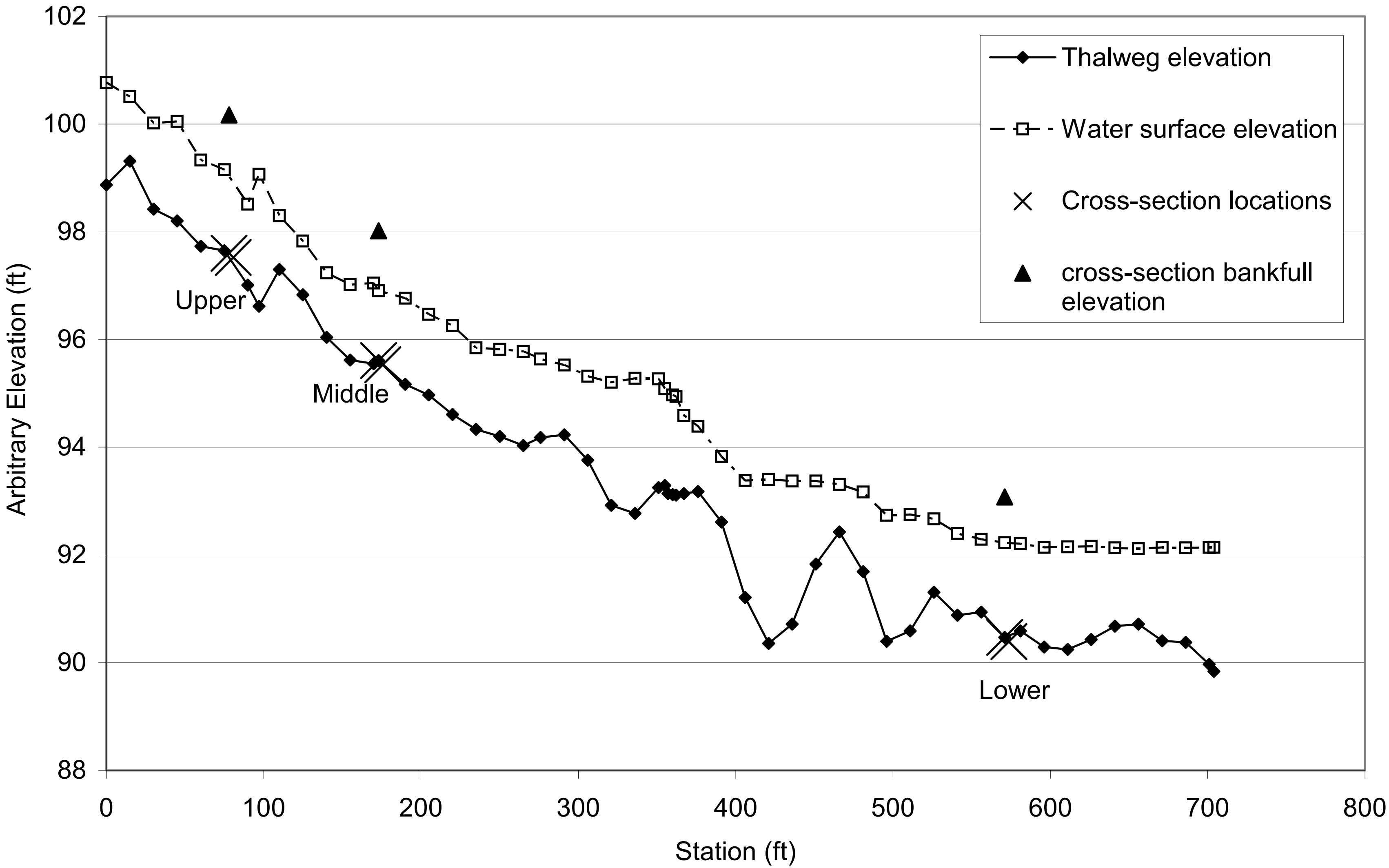
Loon Lake Dam Reach Upper Site (LL-G1) middle cross-section



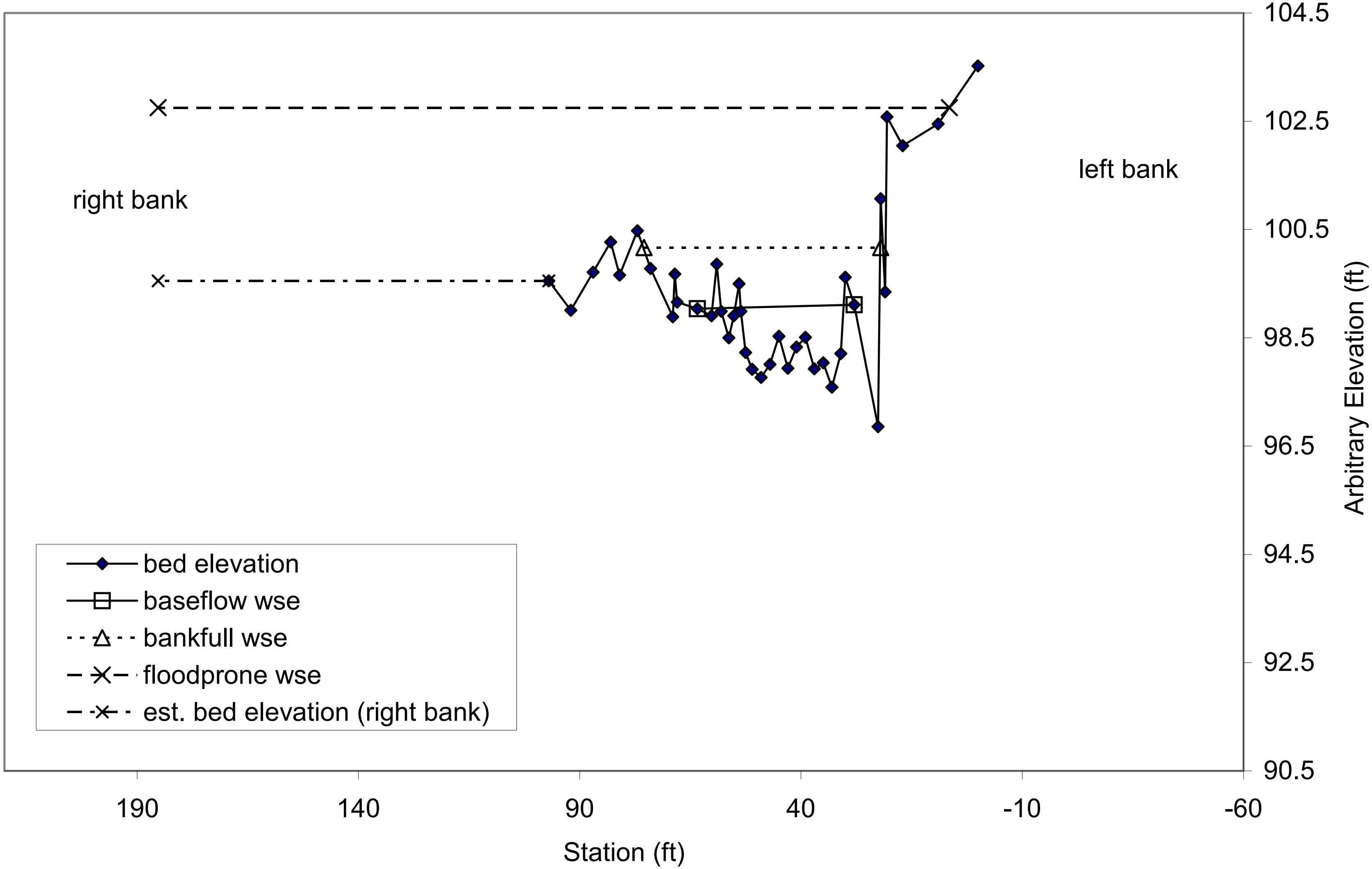
Loon Lake Dam Reach Upper Site (LL-G1) lower cross-section



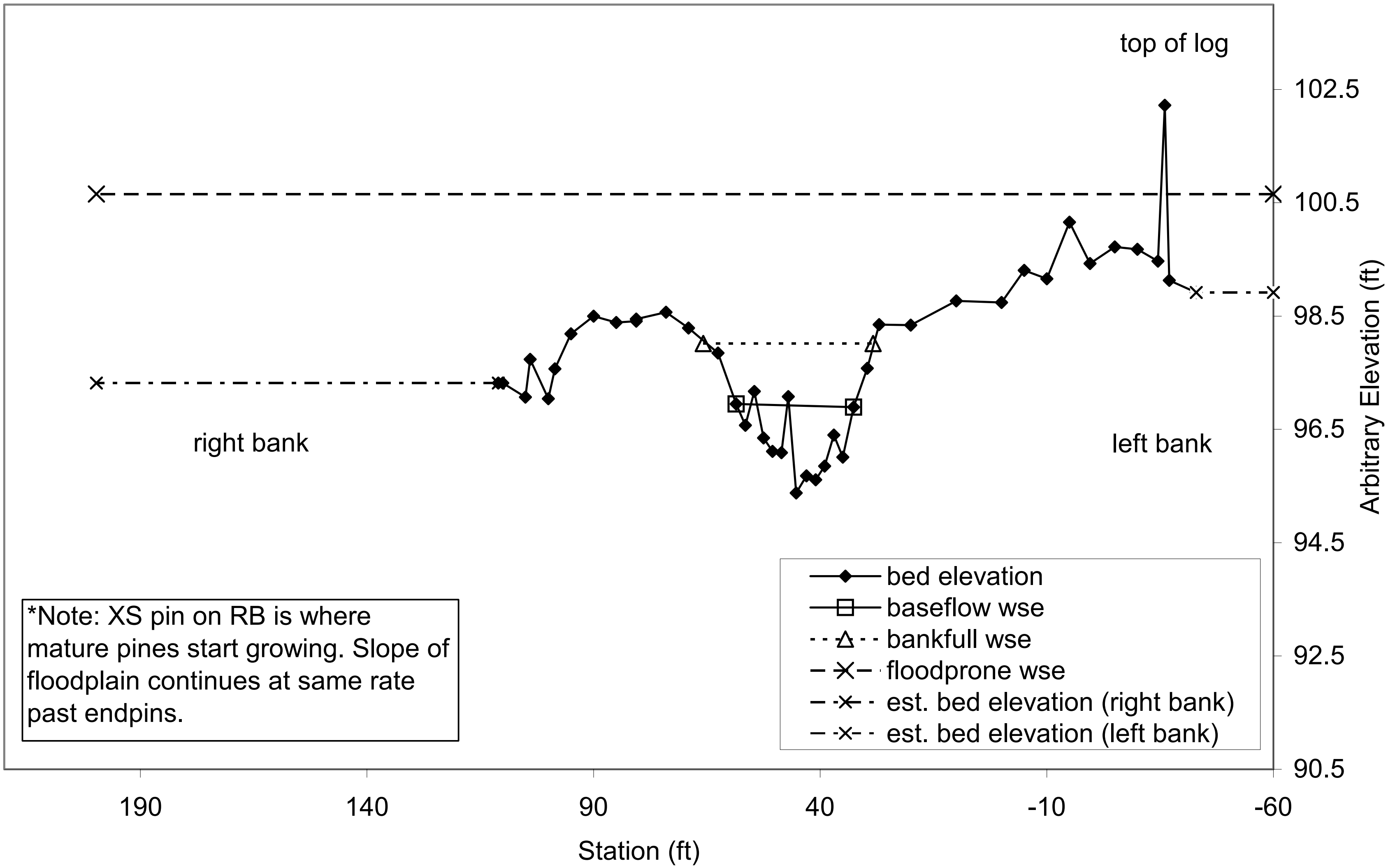
Loon Lake Dam Reach Middle Site (LL-G2) long profile



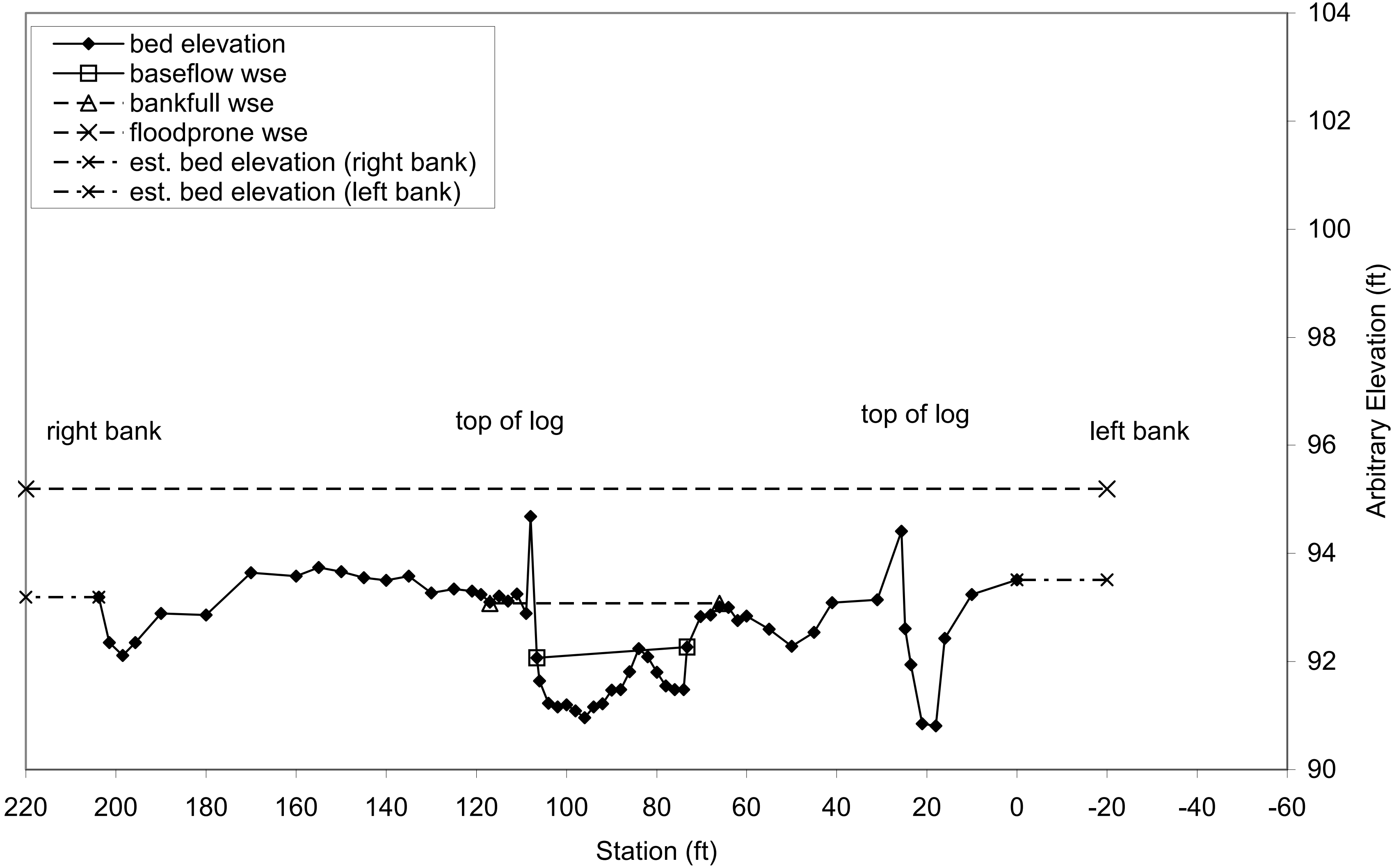
Loon Lake Dam Reach Middle Site (LL-G2) upper cross-section



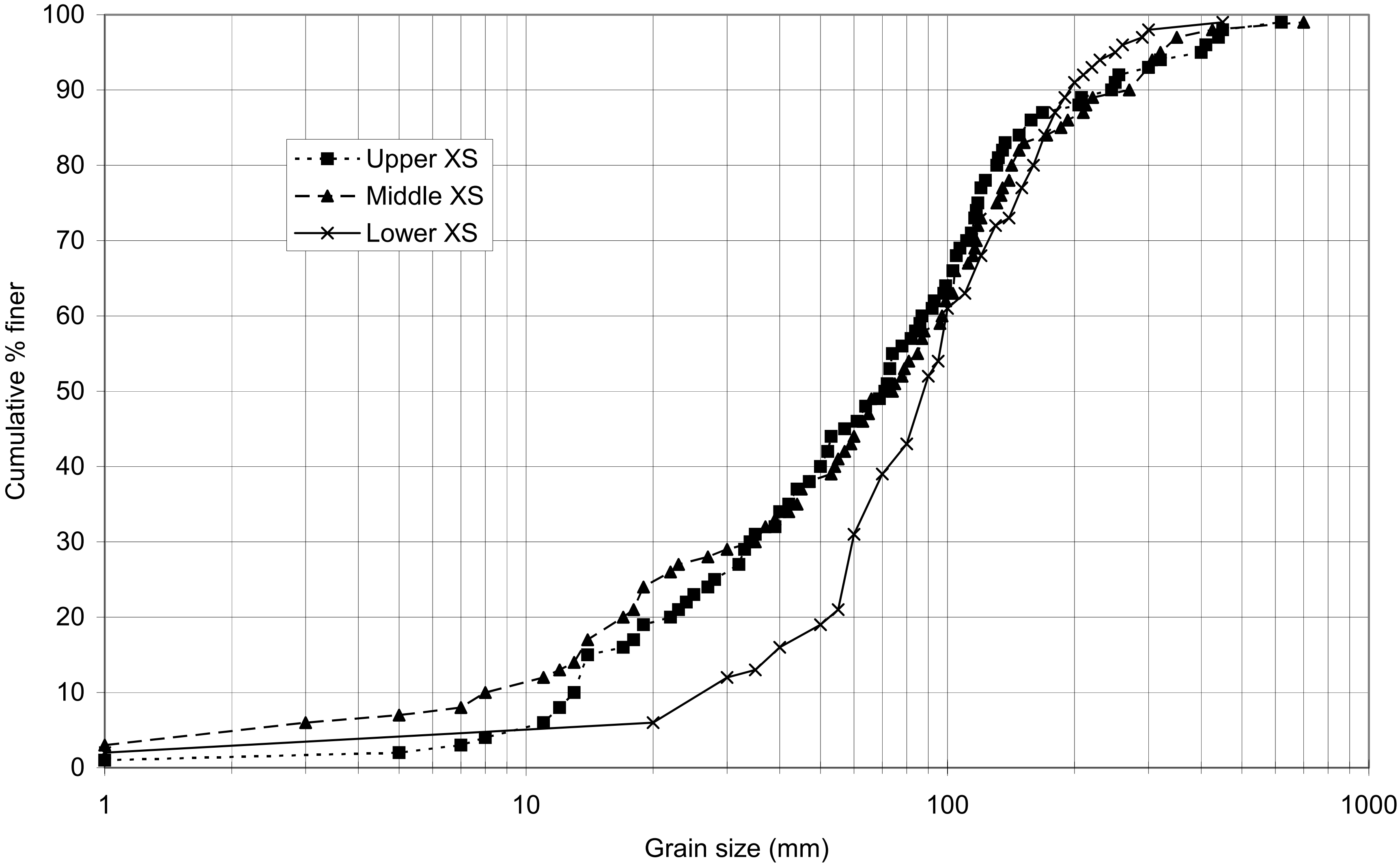
Loon Lake Dam Reach Middle Site (LL-G2) middle cross-section



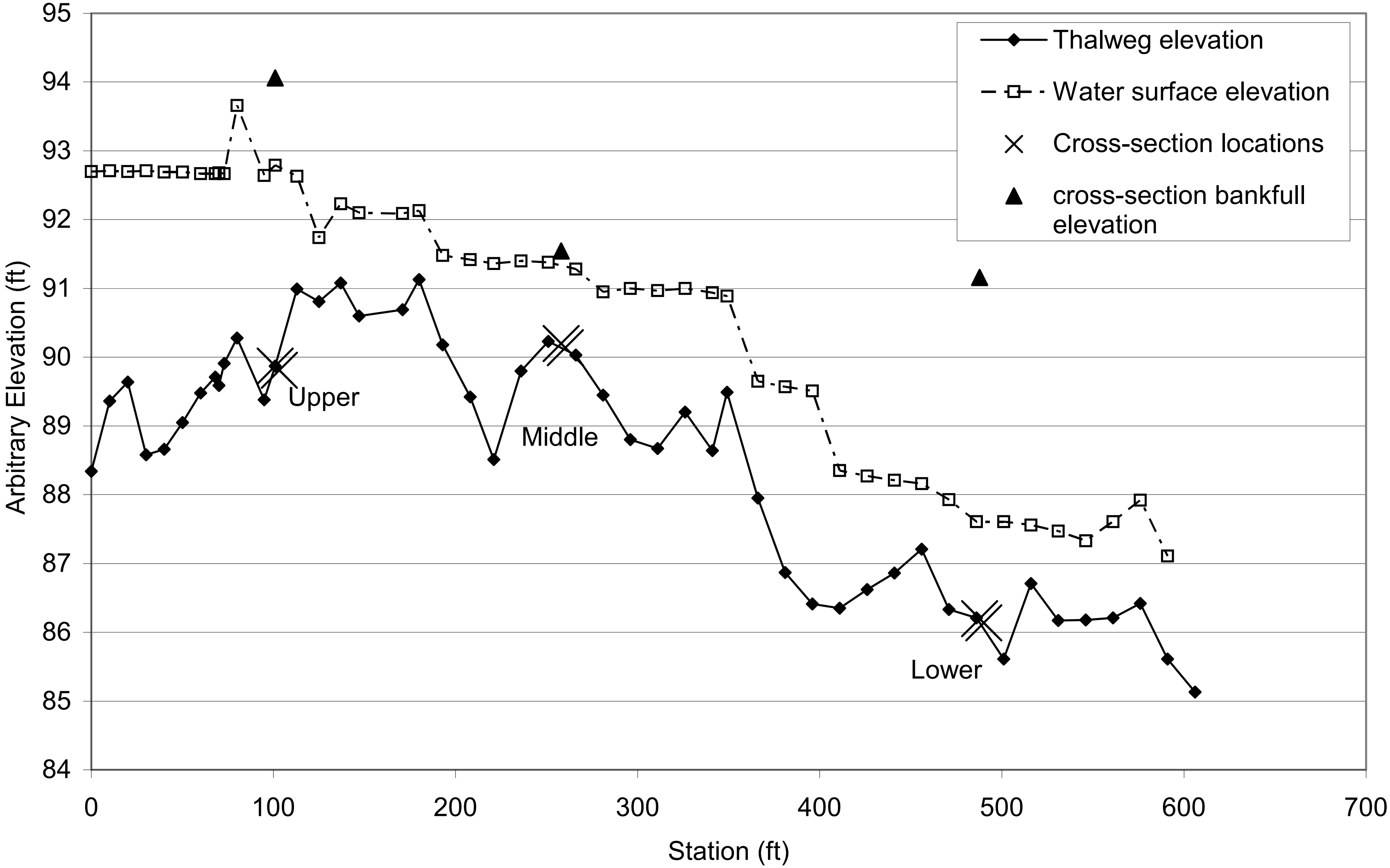
Loon Lake Dam Reach Middle Site (LL-G2) lower cross-section



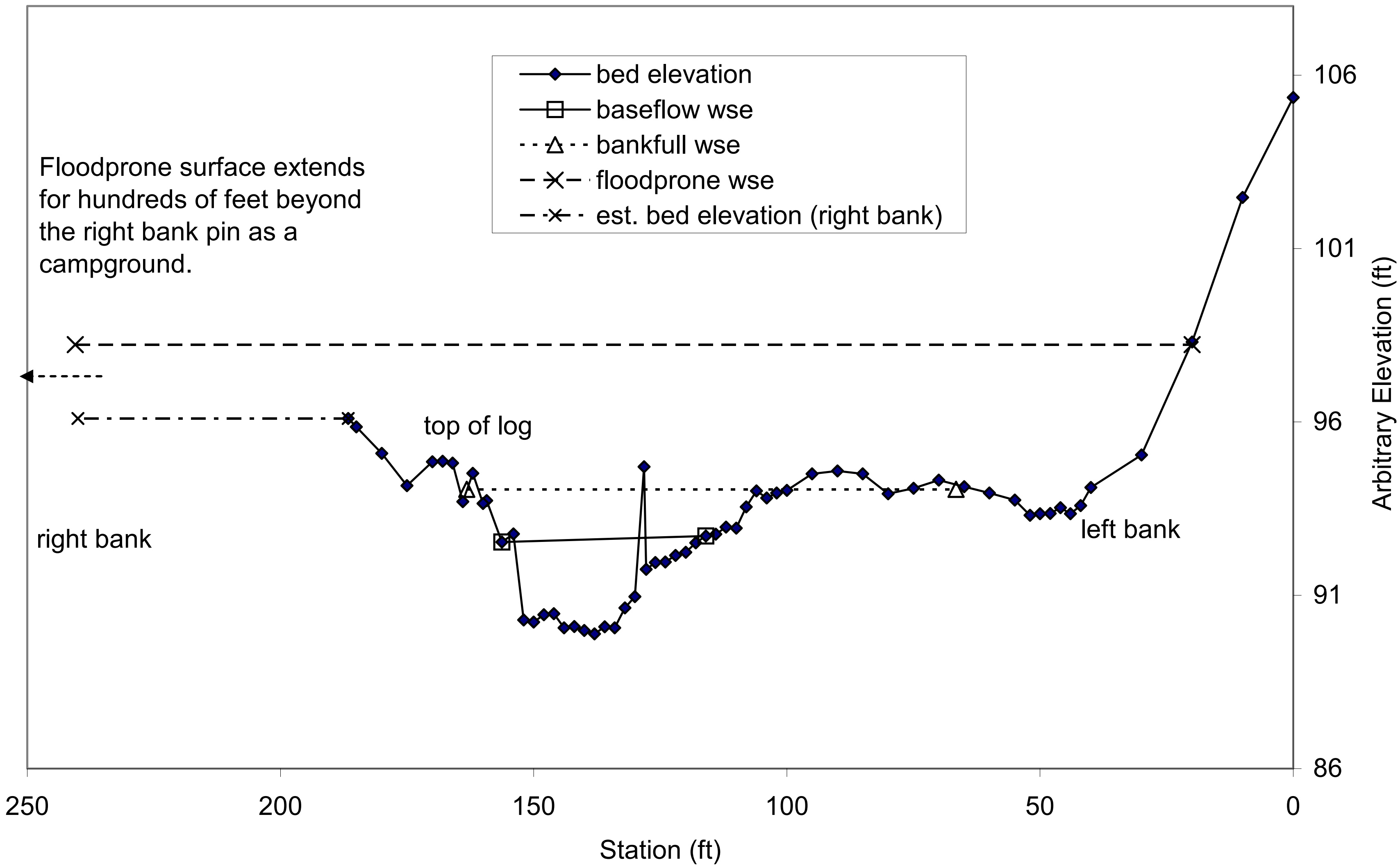
Loon Lake Dam Reach Middle Site (LL-G2) pebble count



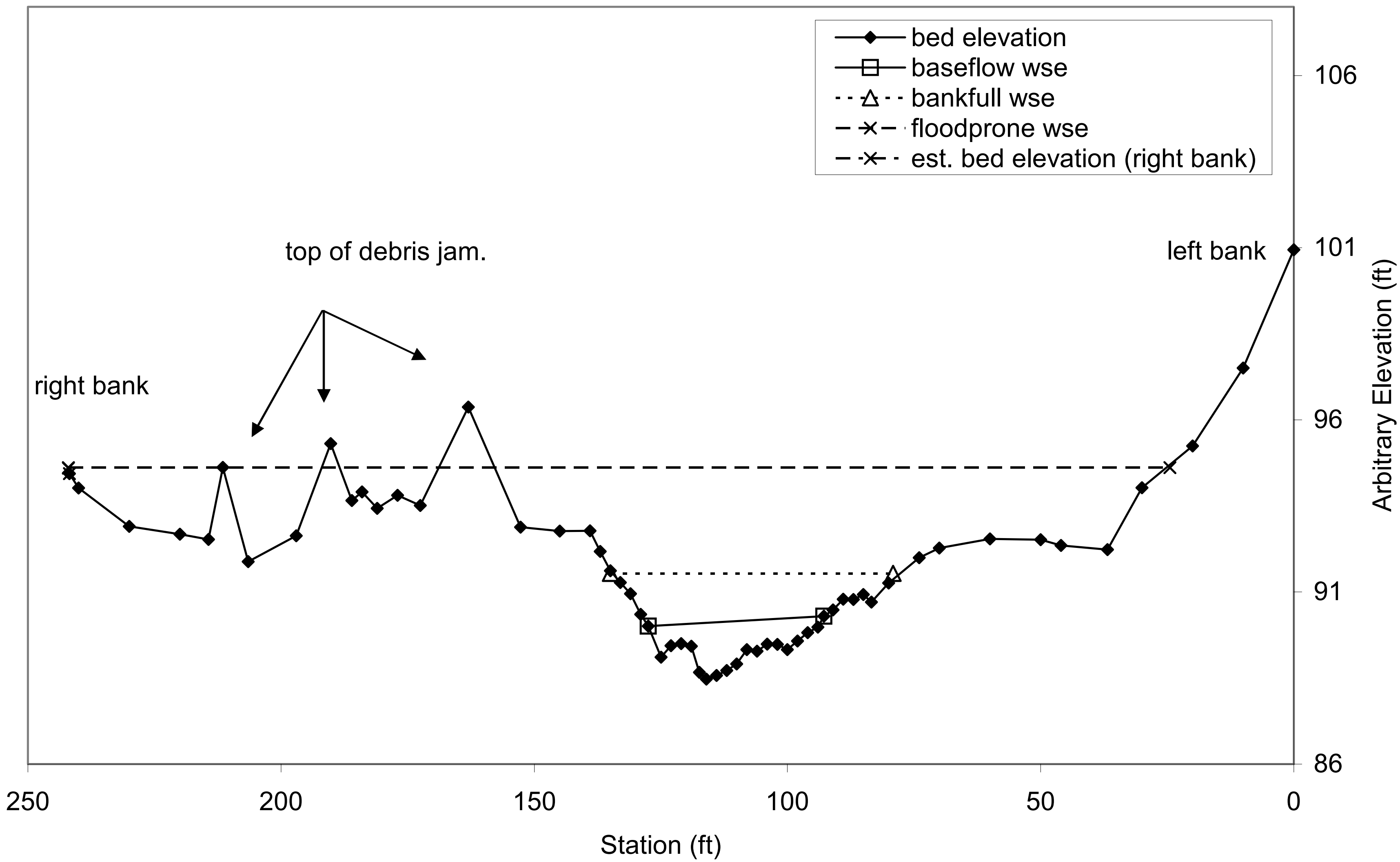
Loon Lake Dam Reach Lower Site (LL-G3) long profile



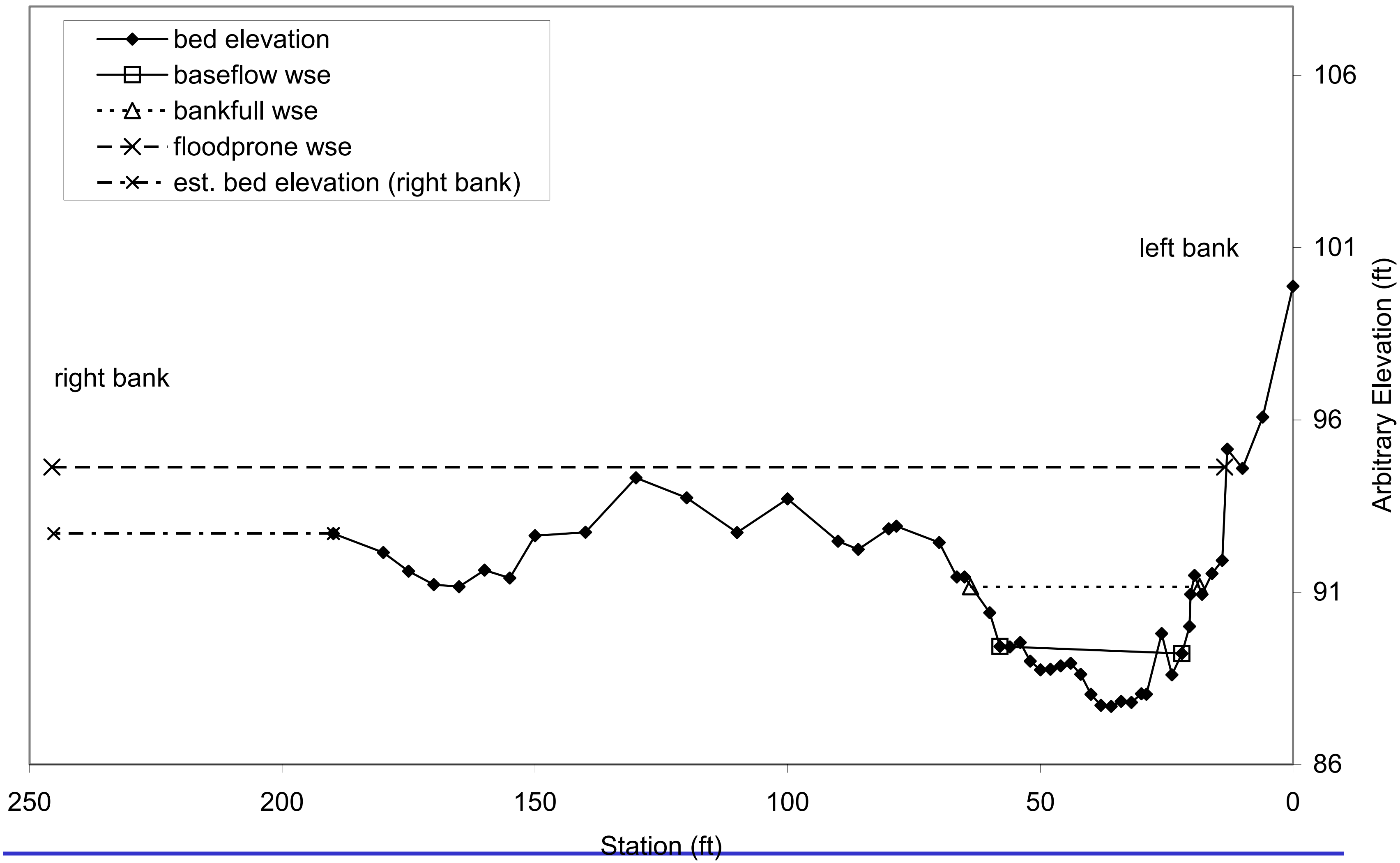
Loon Lake Dam Reach Lower Site (LL-G3) upper cross-section



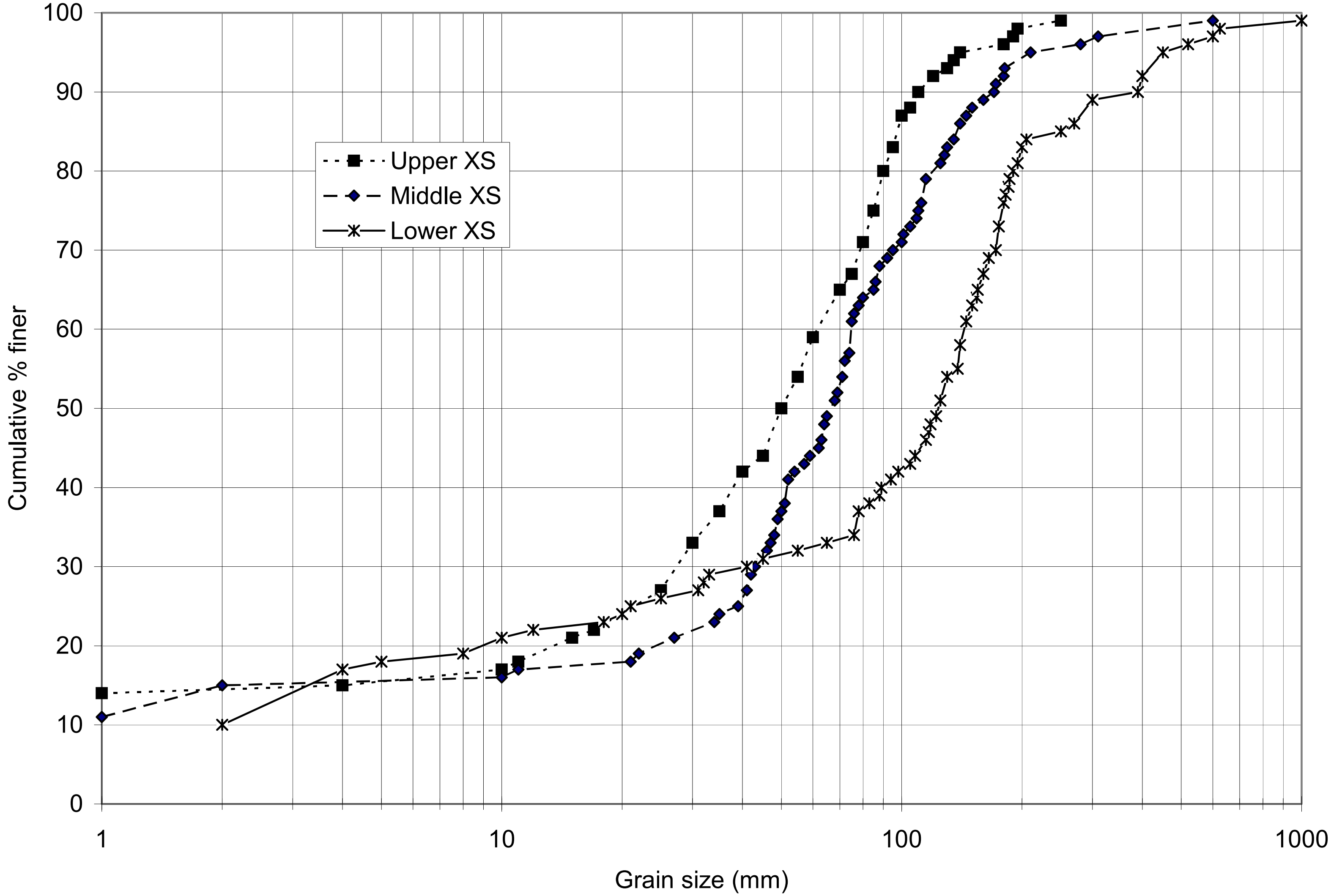
Loon Lake Dam Reach Lower Site (LL-G3) middle cross-section



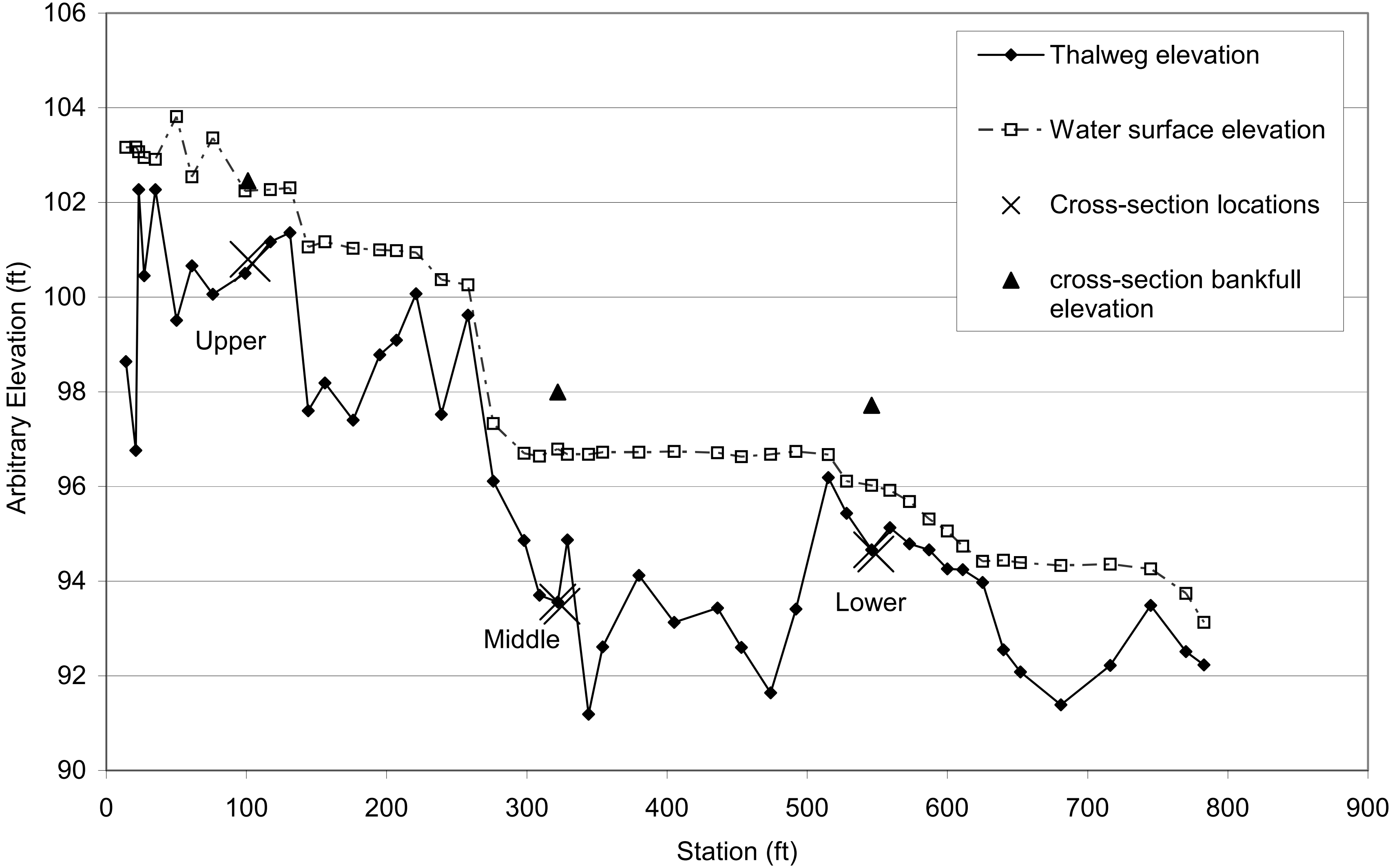
Loon Lake Dam Reach Lower Site (LL-G3) lower cross-section



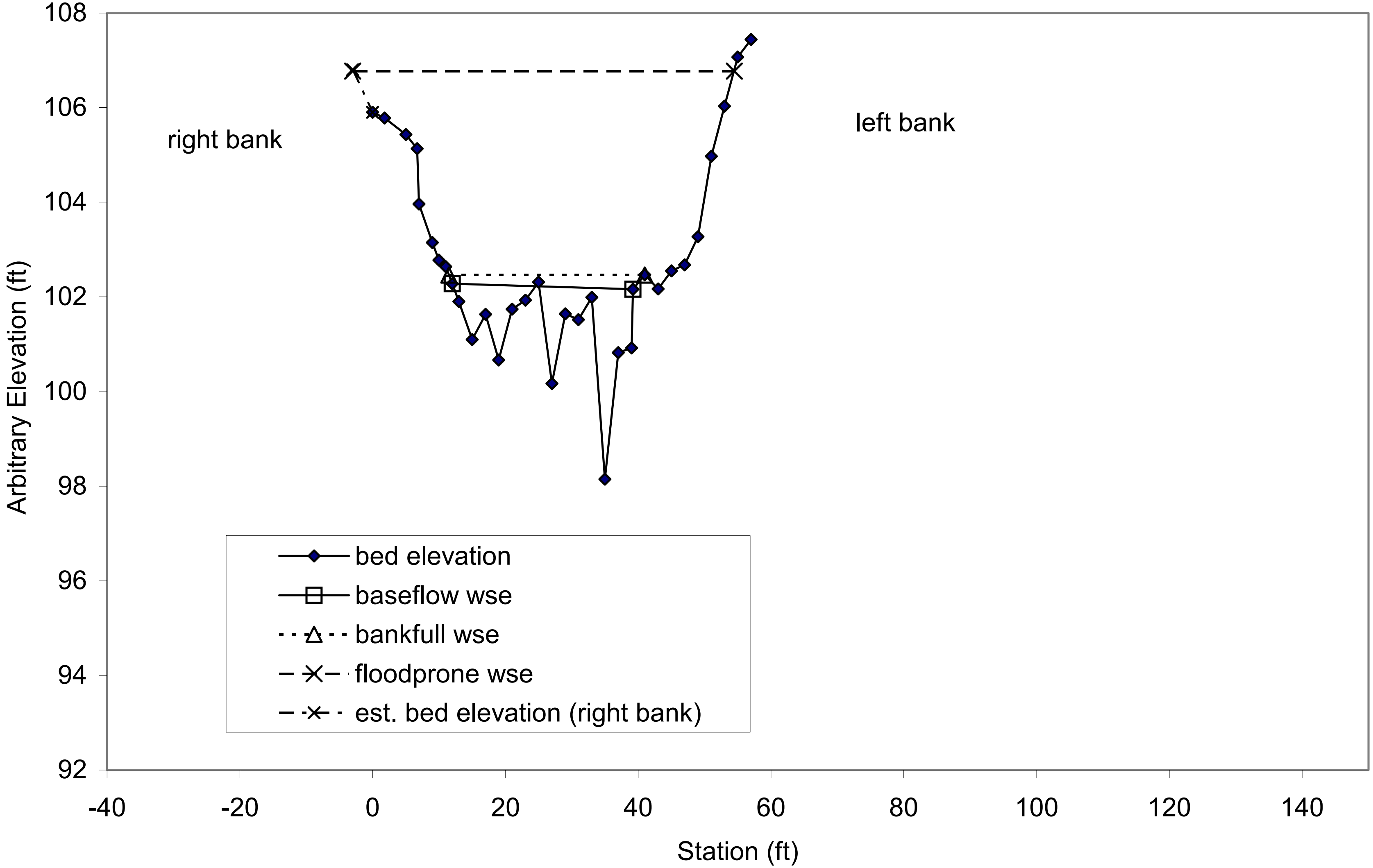
Loon Lake Dam Reach Lower Site (LL-G3) pebble count



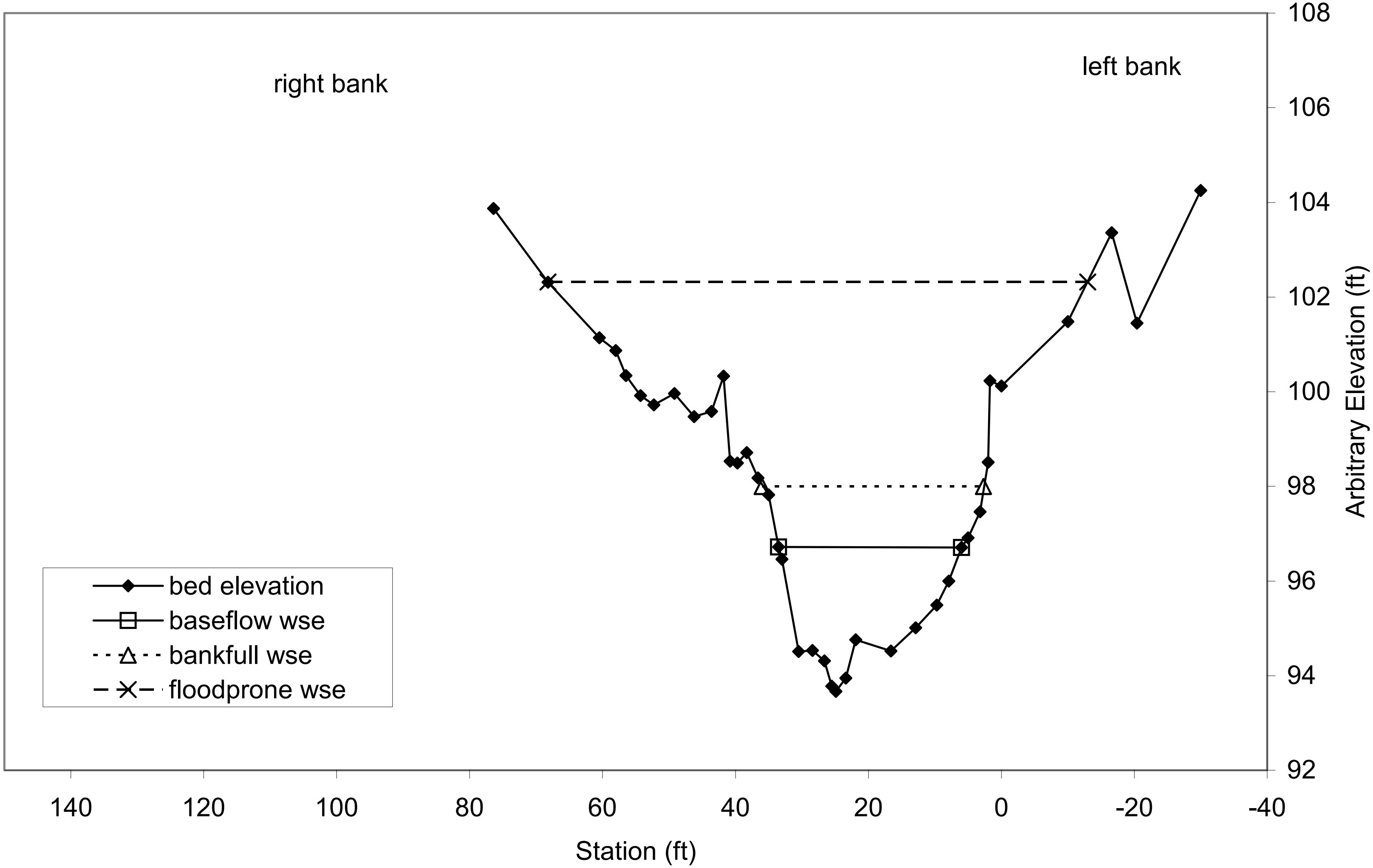
Gerle Creek Dam Reach Site (GC-G1) long profile



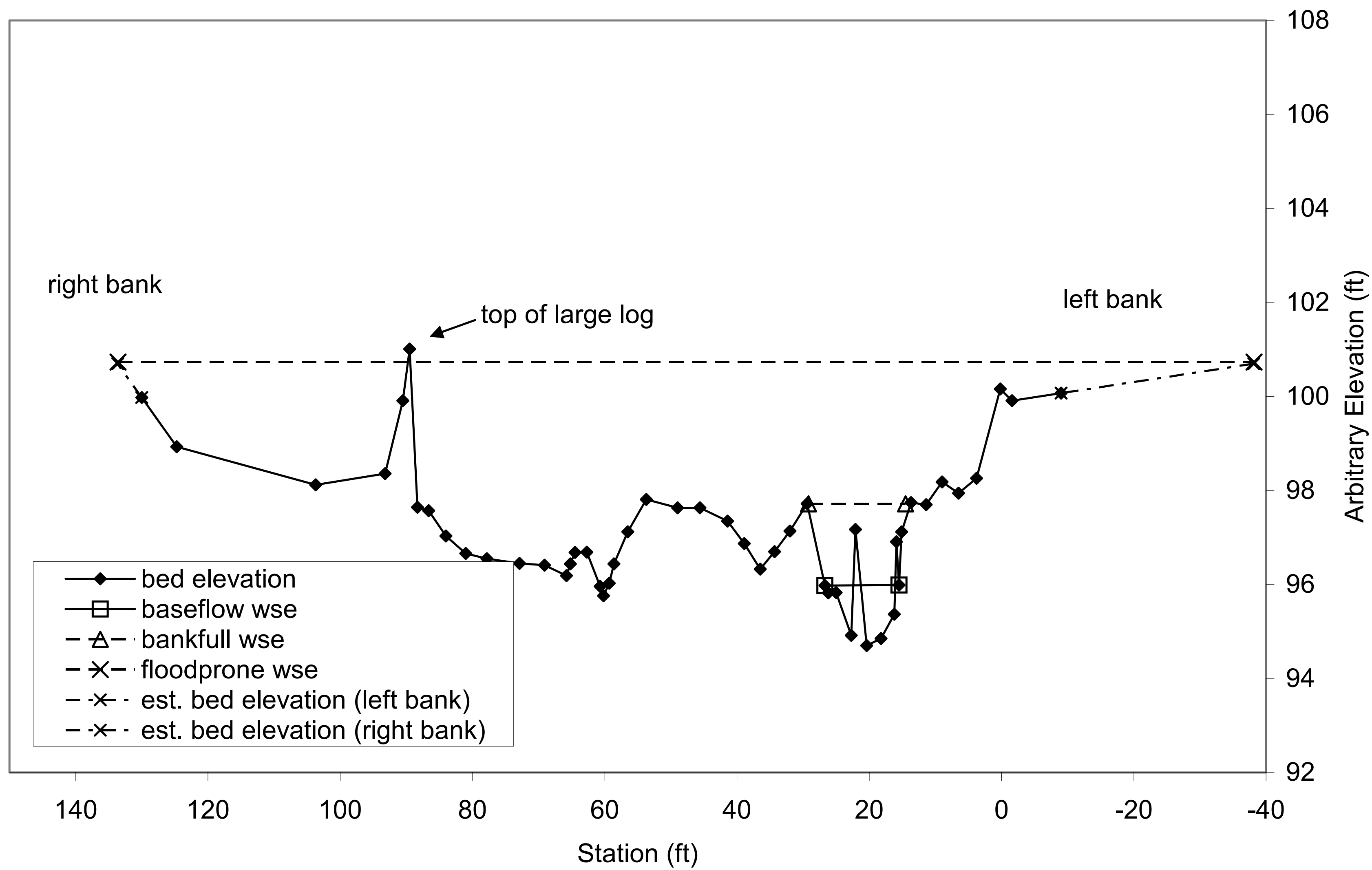
Gerle Creek Dam Reach Site (GC-G1) upper cross-section



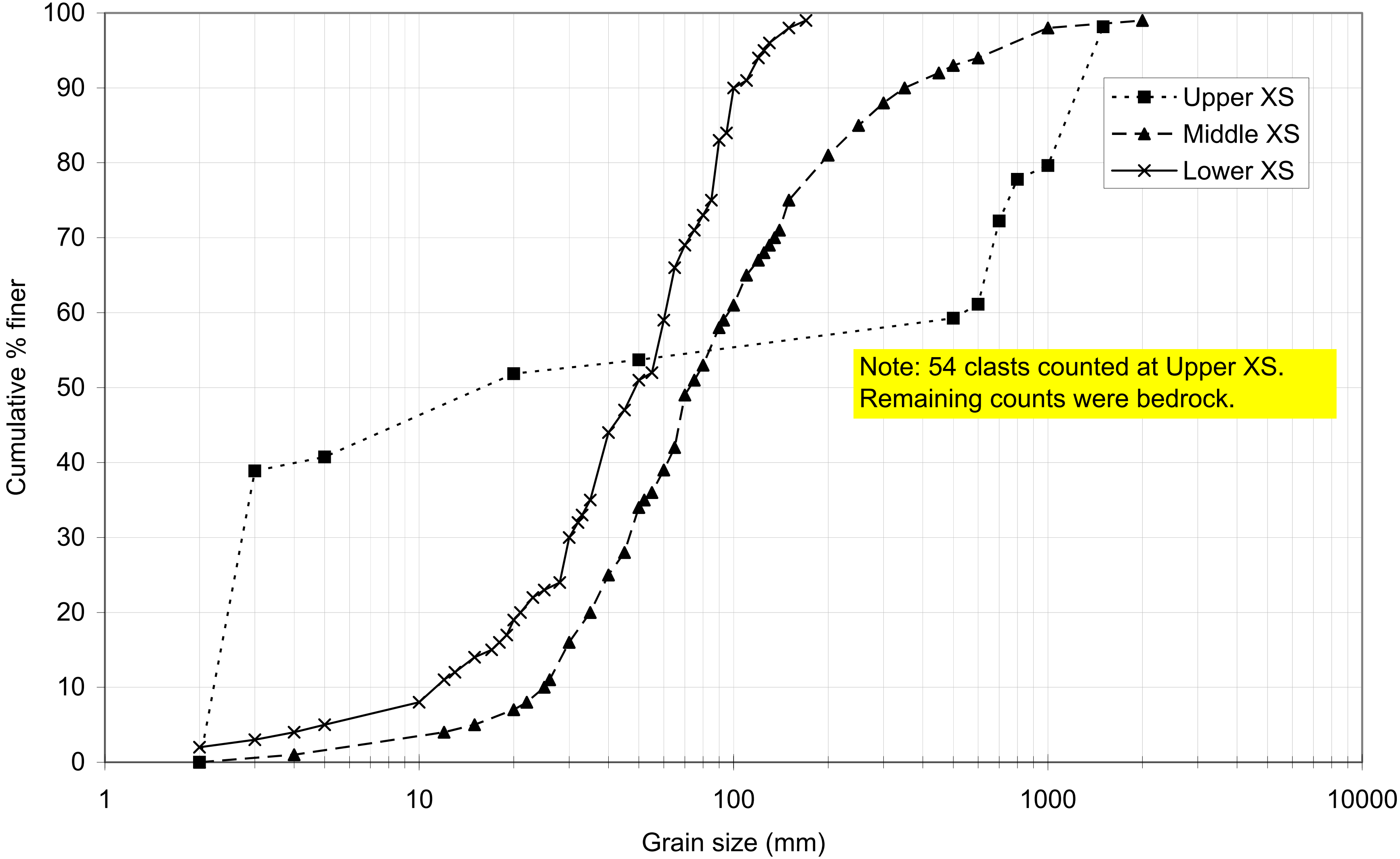
Gerle Creek Dam Reach Site (GC-G1) middle cross-section



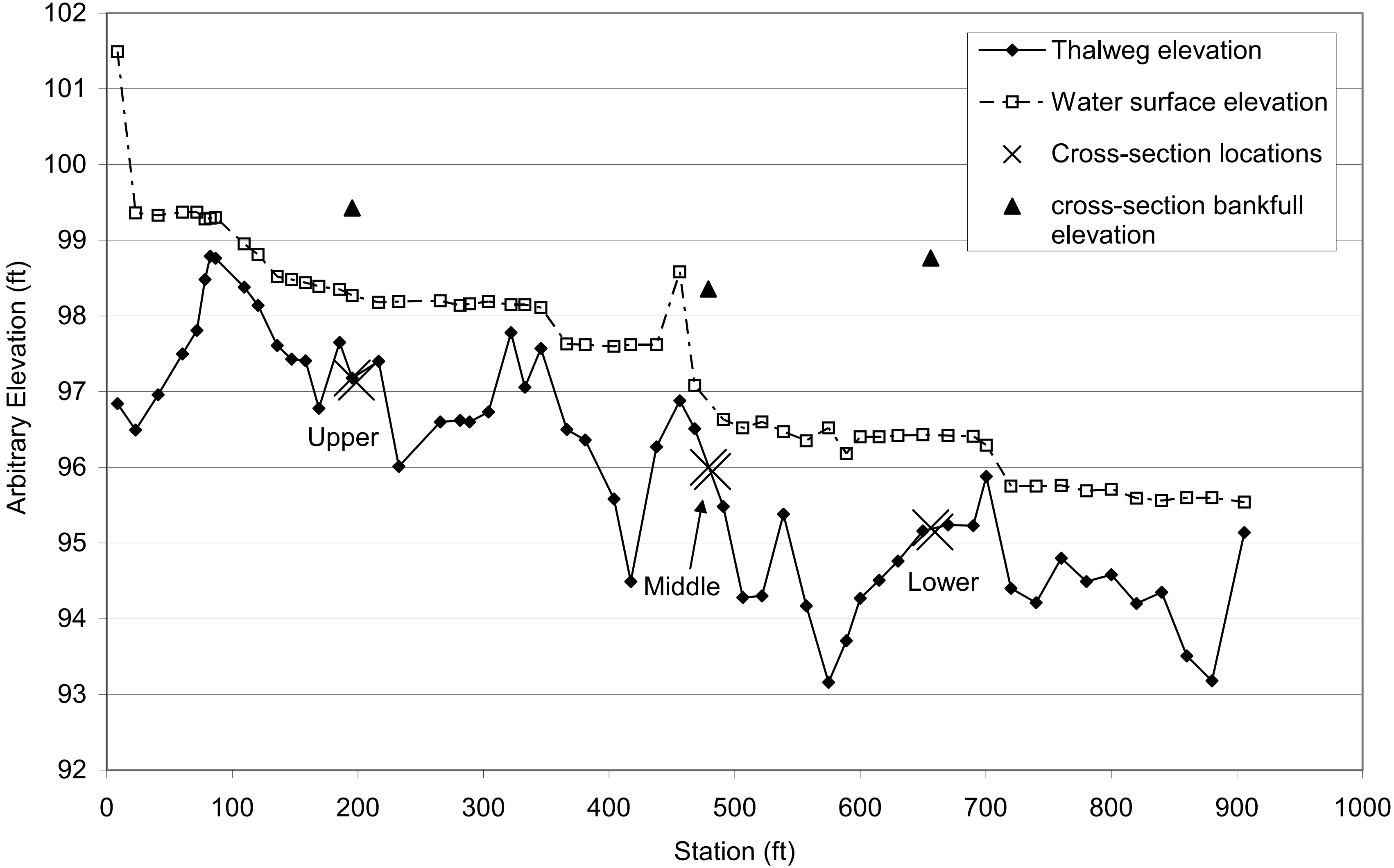
Gerle Creek Dam Reach Site (GC-G1) lower cross-section



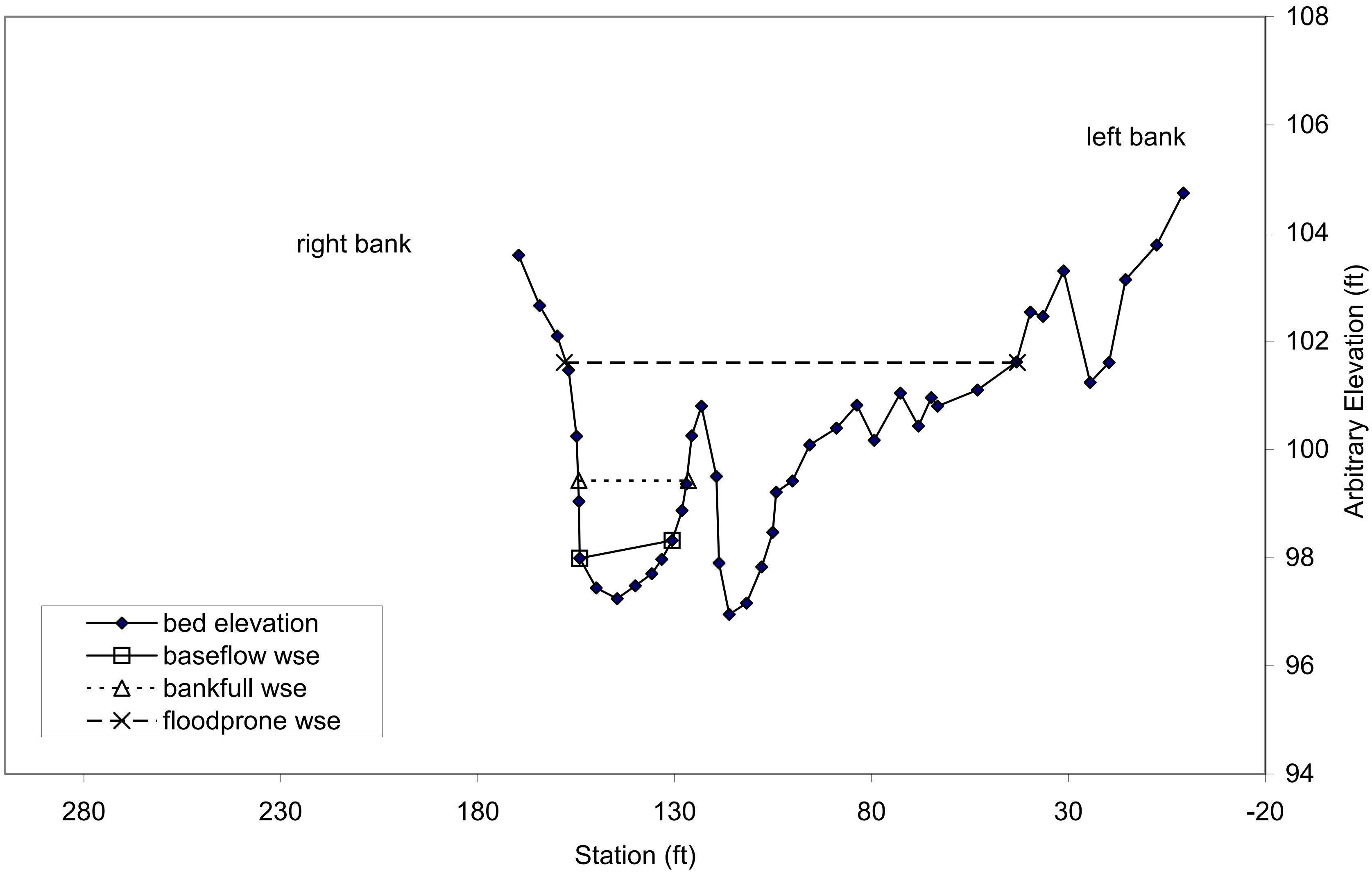
Gerle Creek Dam Reach Site (GC-G1) pebble count



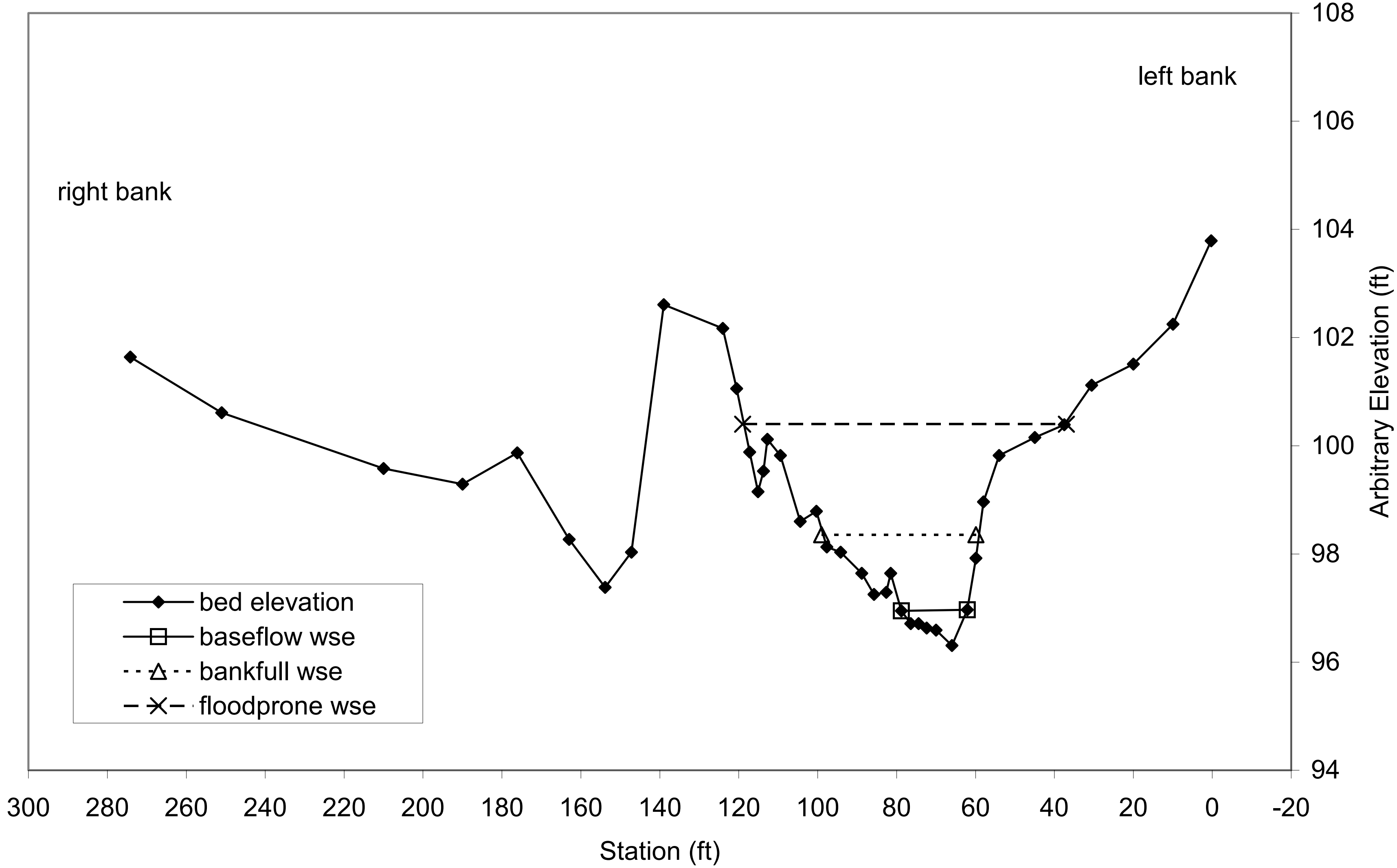
Robbs Peak Dam Reach Site (RPD-G1) long profile



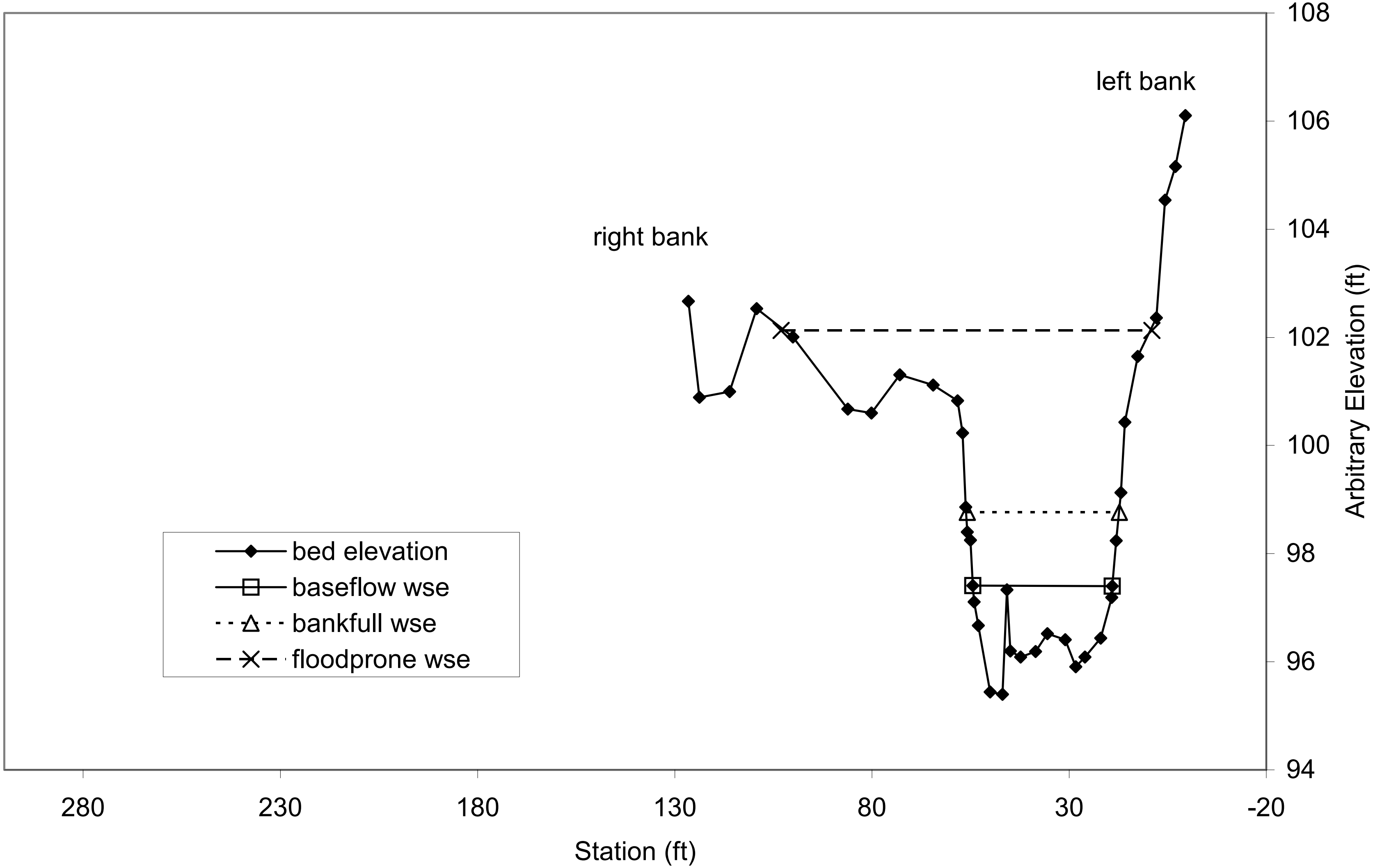
Robbs Peak Dam Reach Site (RPD-G1) upper cross-section



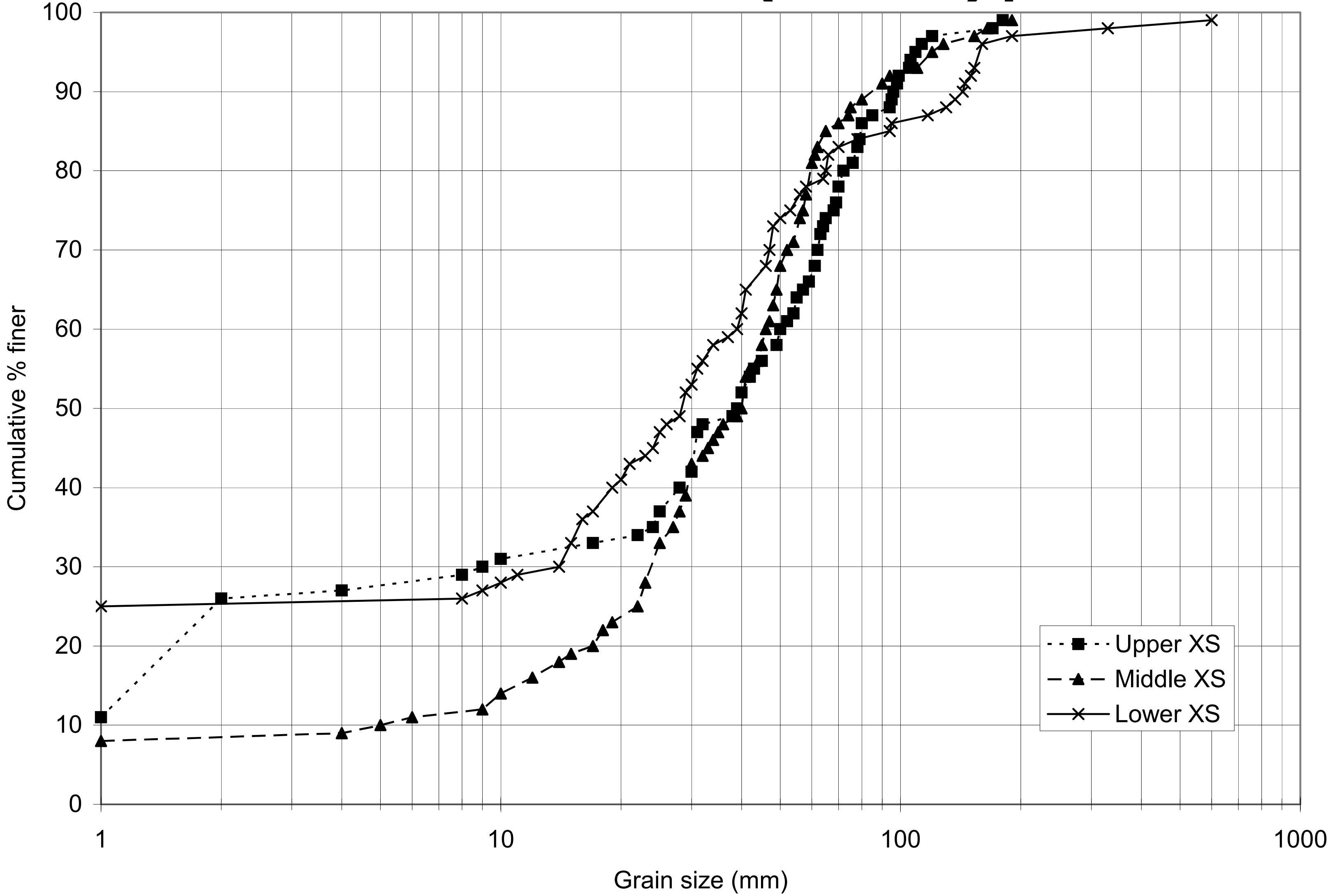
Robbs Peak Dam Reach Site (RPD-G1) middle cross-section



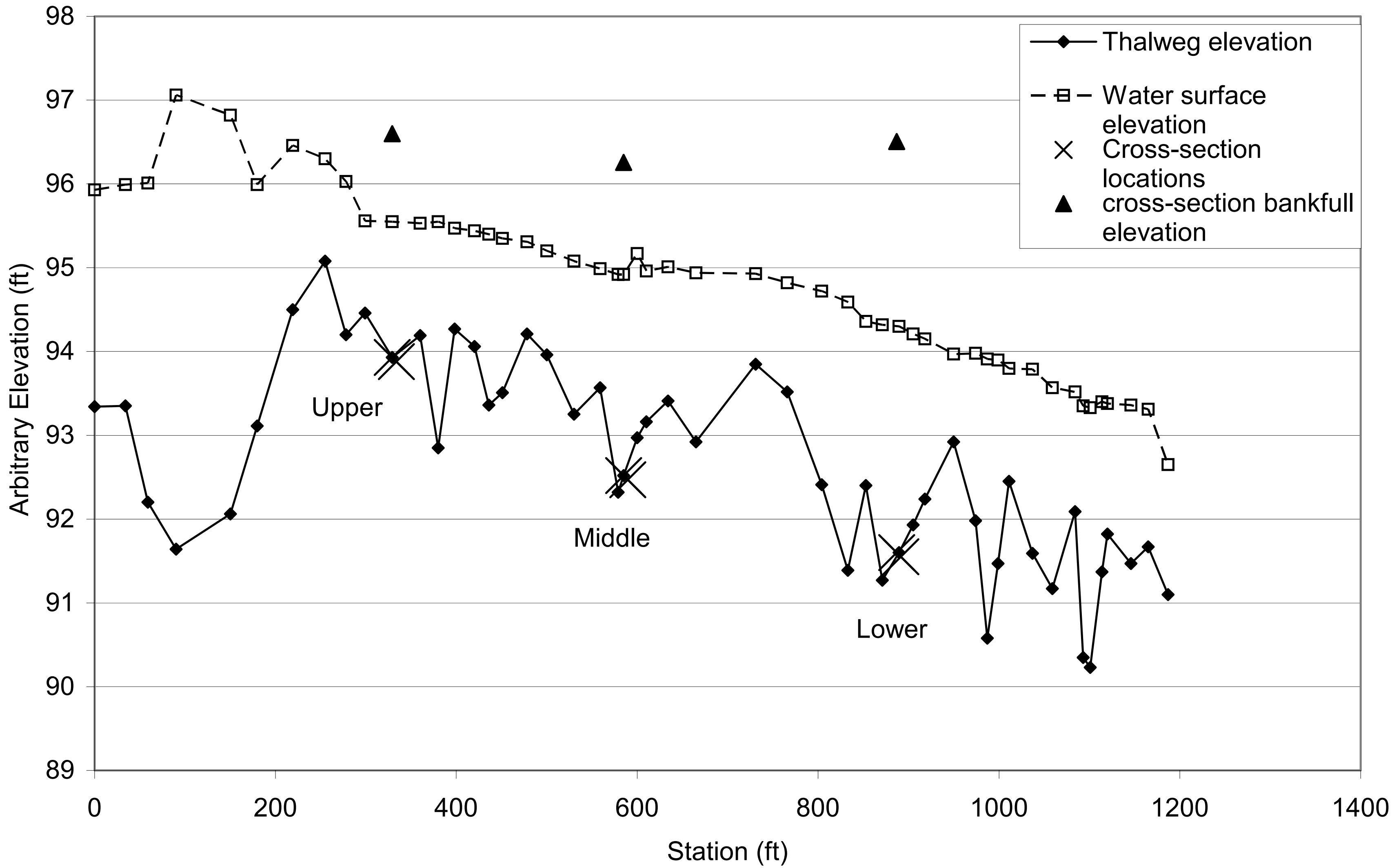
Robbs Peak Dam Reach Site (RPD-G1) lower cross-section



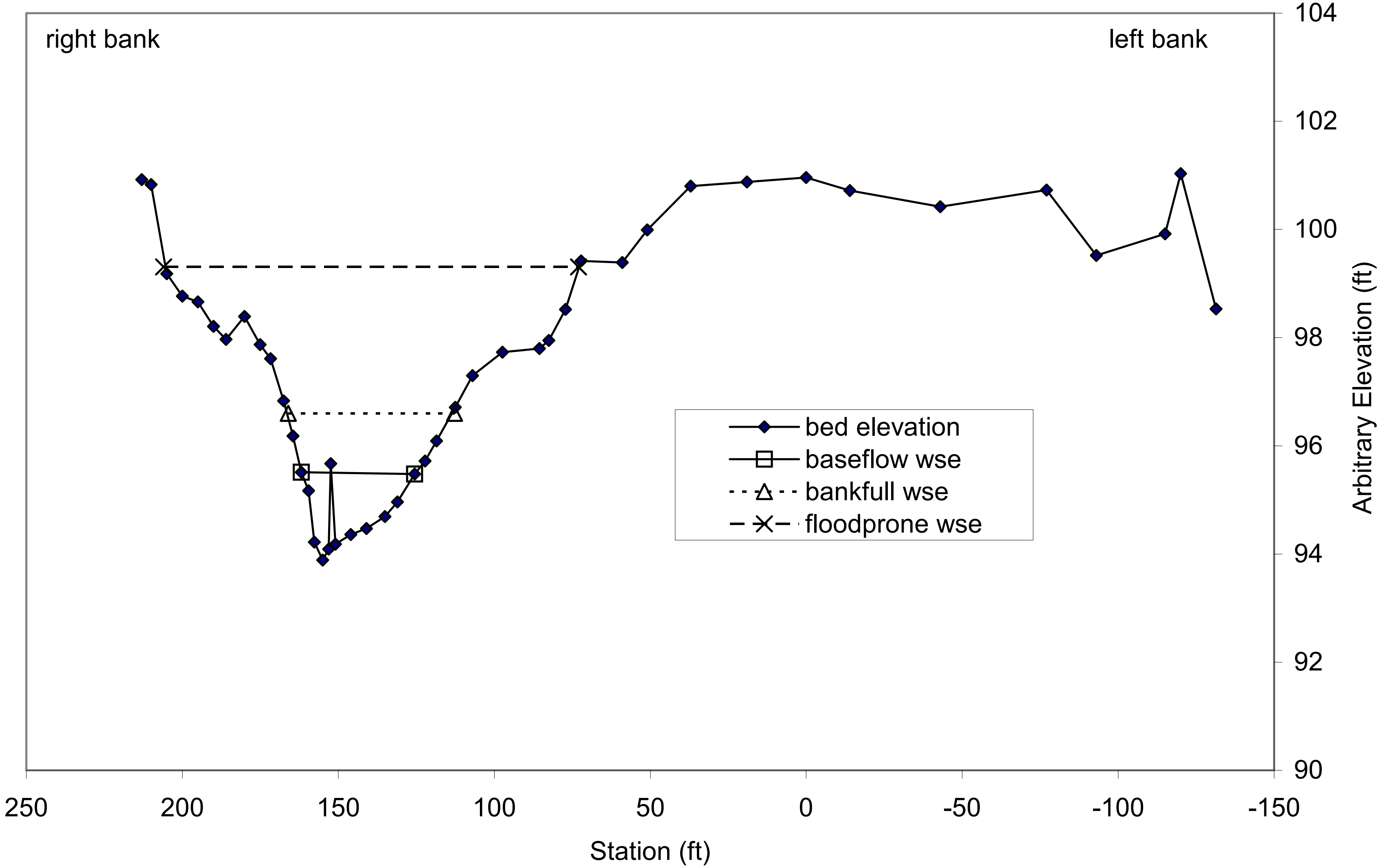
Robbs Peak Dam Reach Site (RPD-G1) pebble count



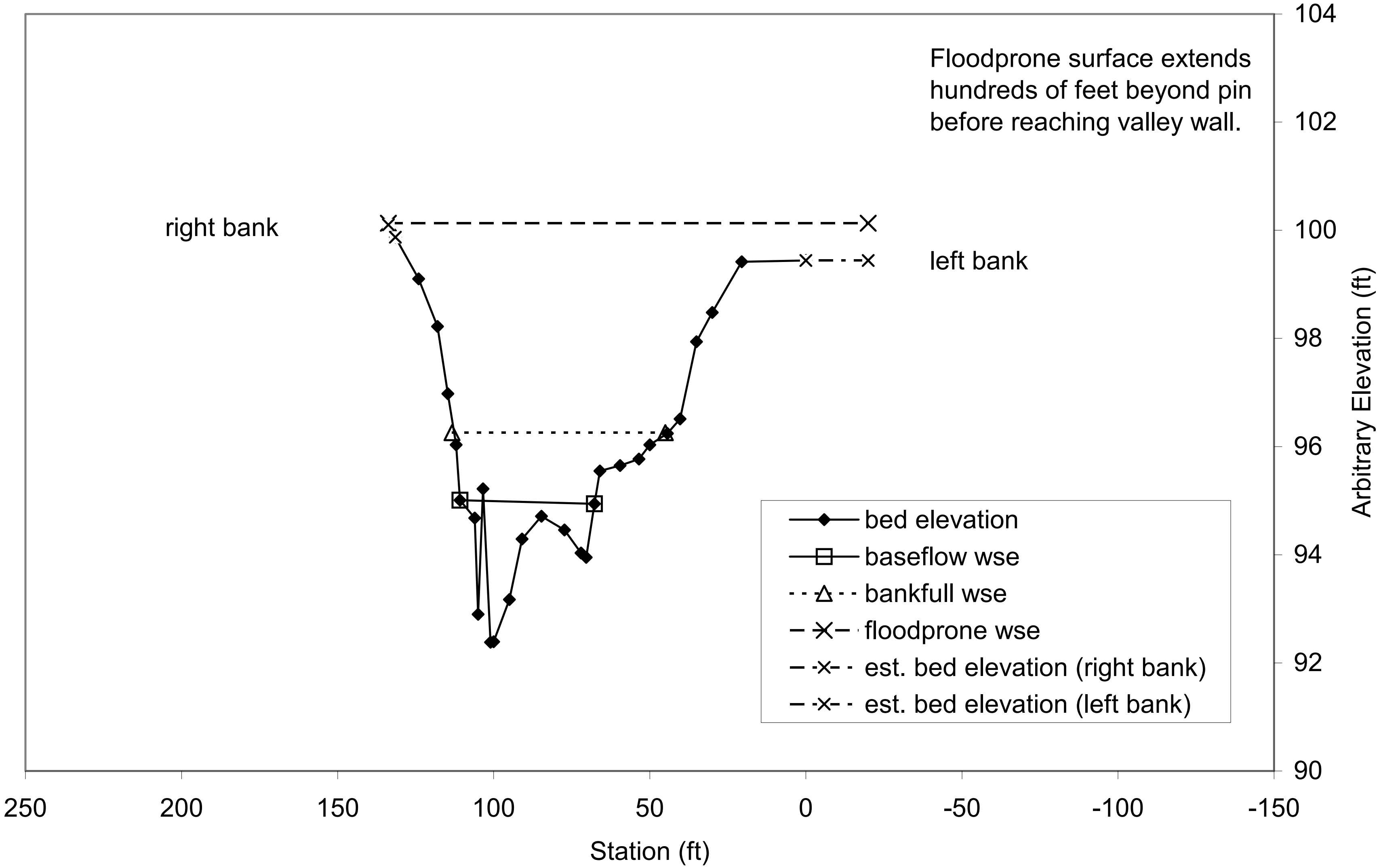
Ice House Dam Reach Upper Site (IH-G1) long profile



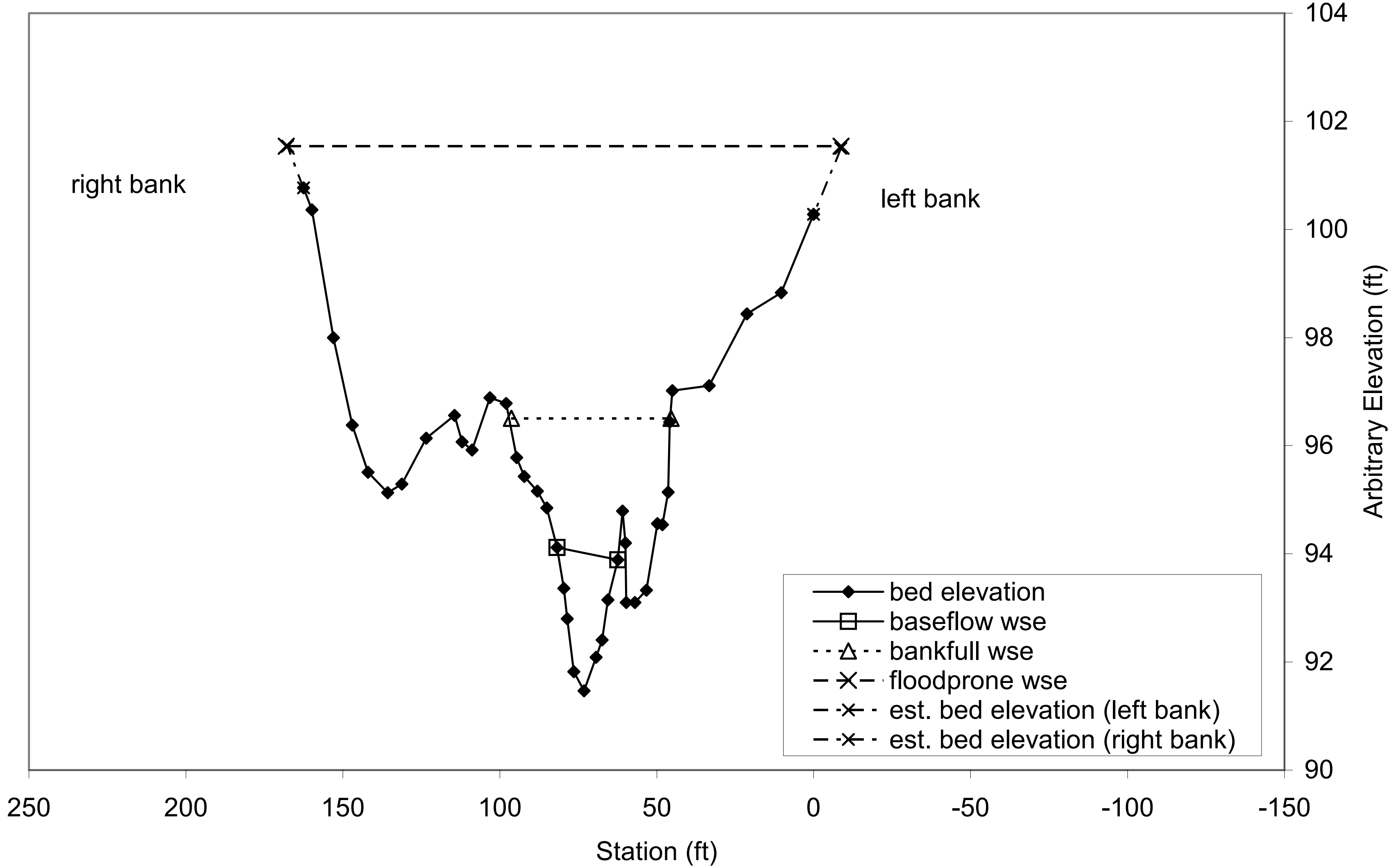
Ice House Dam Reach Upper Site (IH-G1) upper cross-section



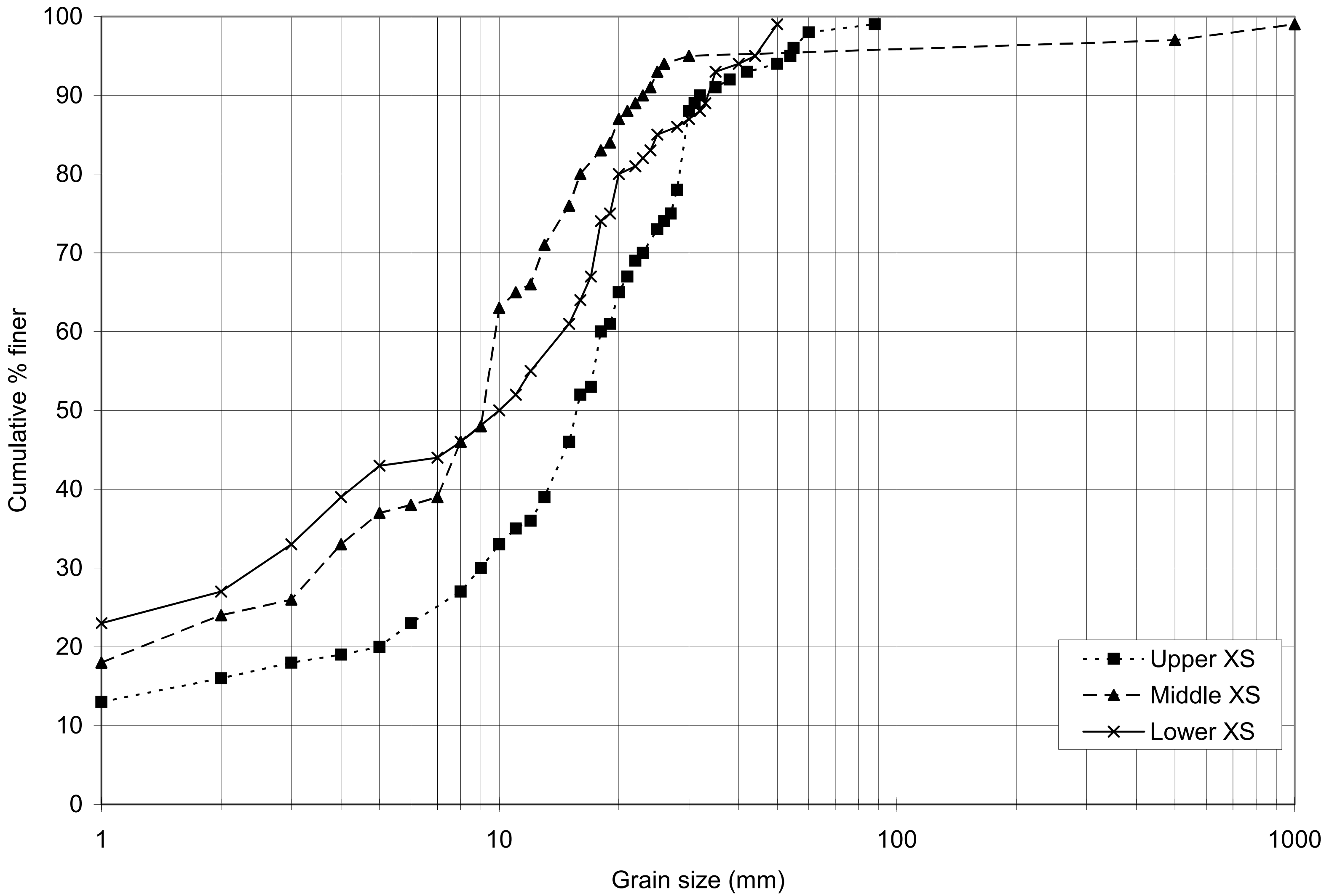
Ice House Dam Reach Upper Site (IH-G1) middle cross-section



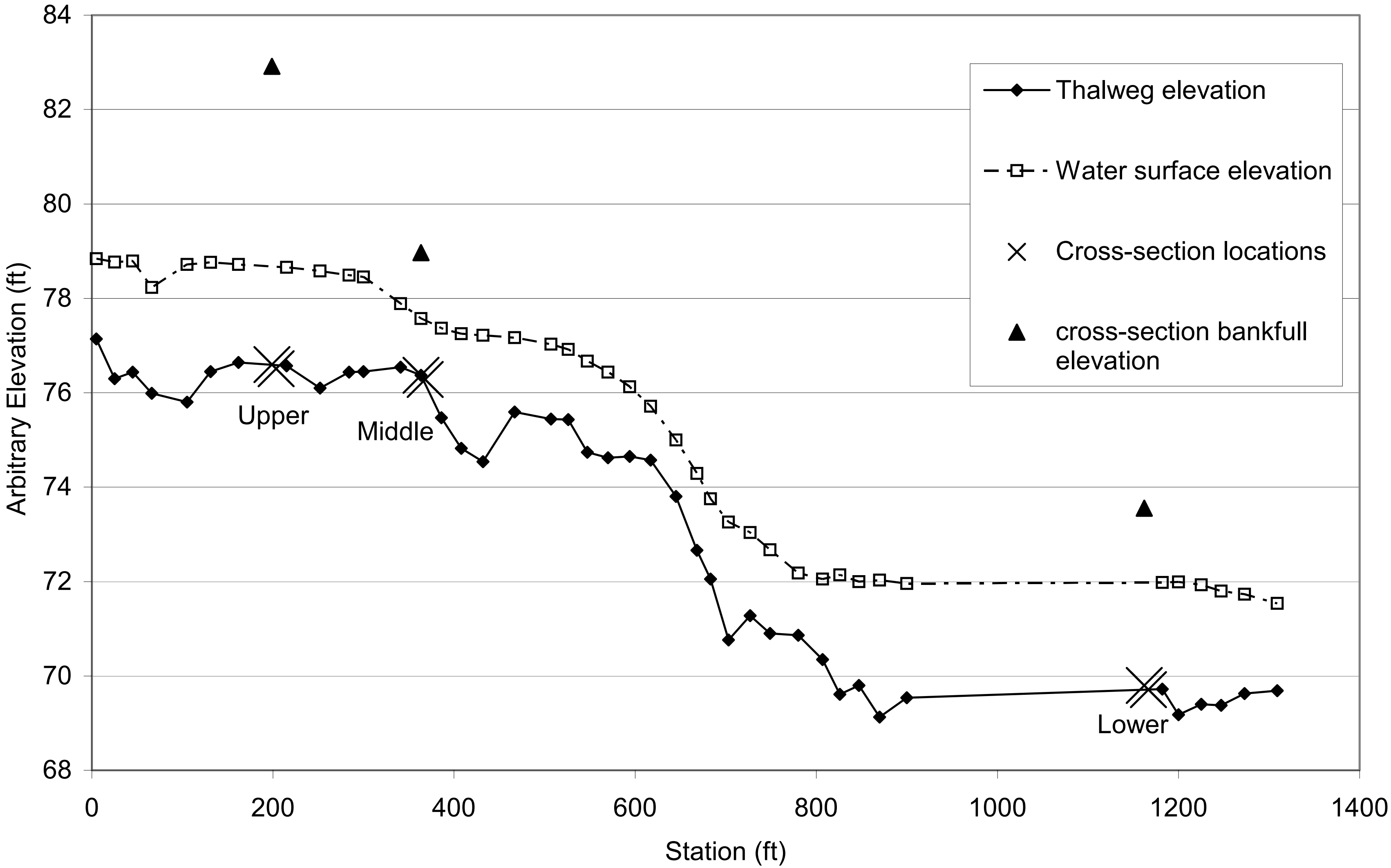
Ice House Dam Reach Upper Site (IH-G1) lower cross-section



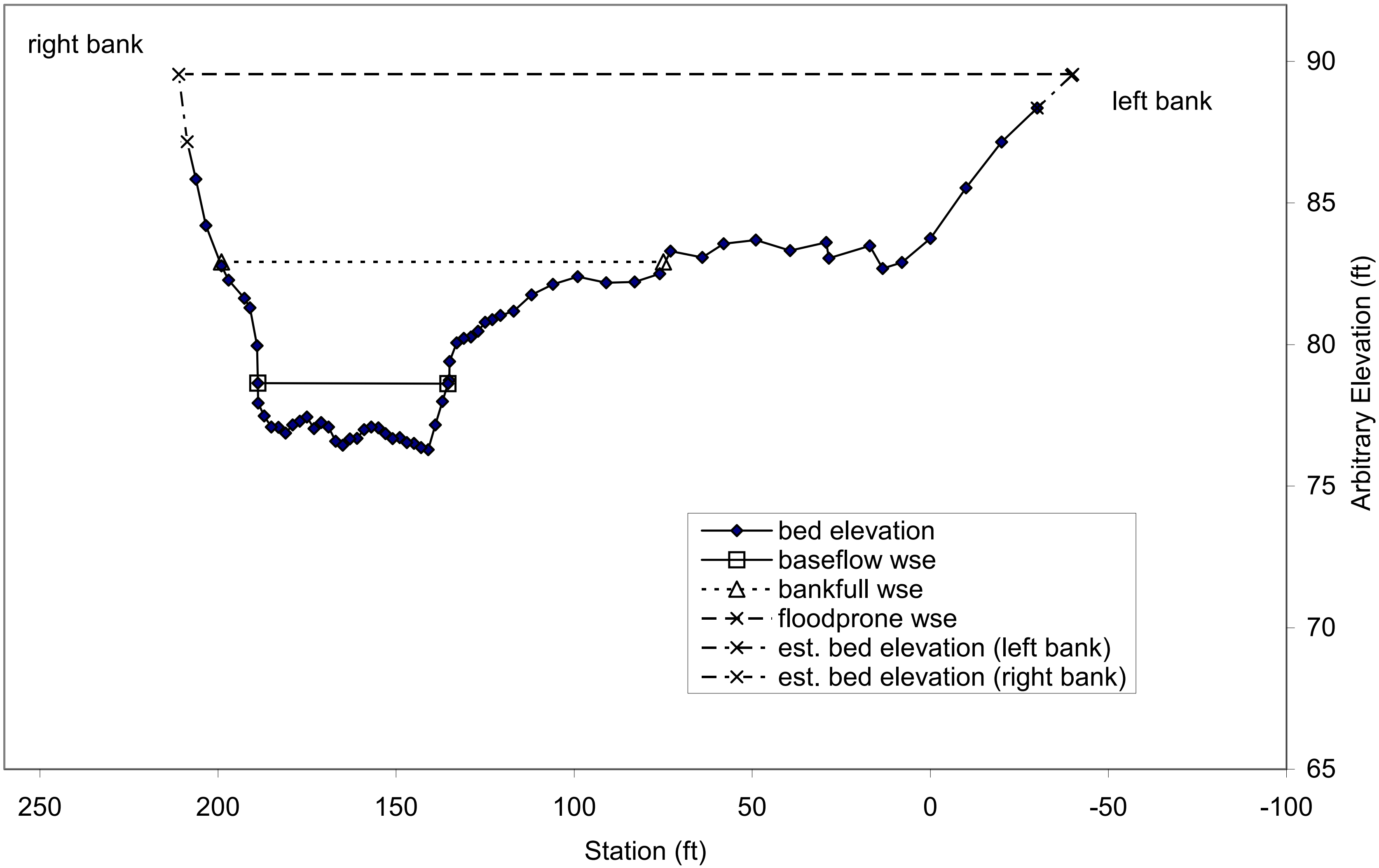
Ice House Dam Reach Upper Site (IH-G1) pebble count



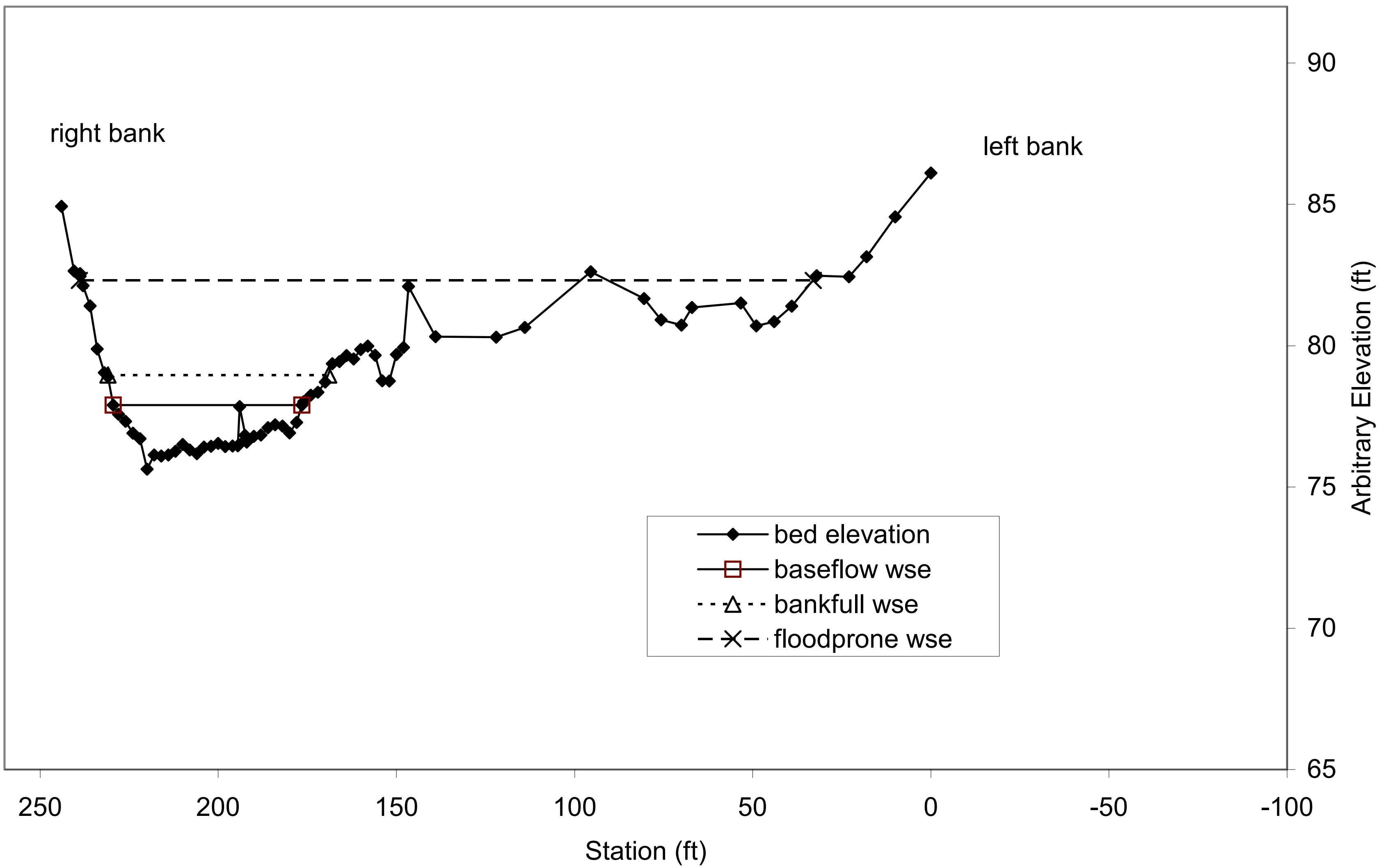
Ice House Dam Reach Lower Site (IH-G2) long profile



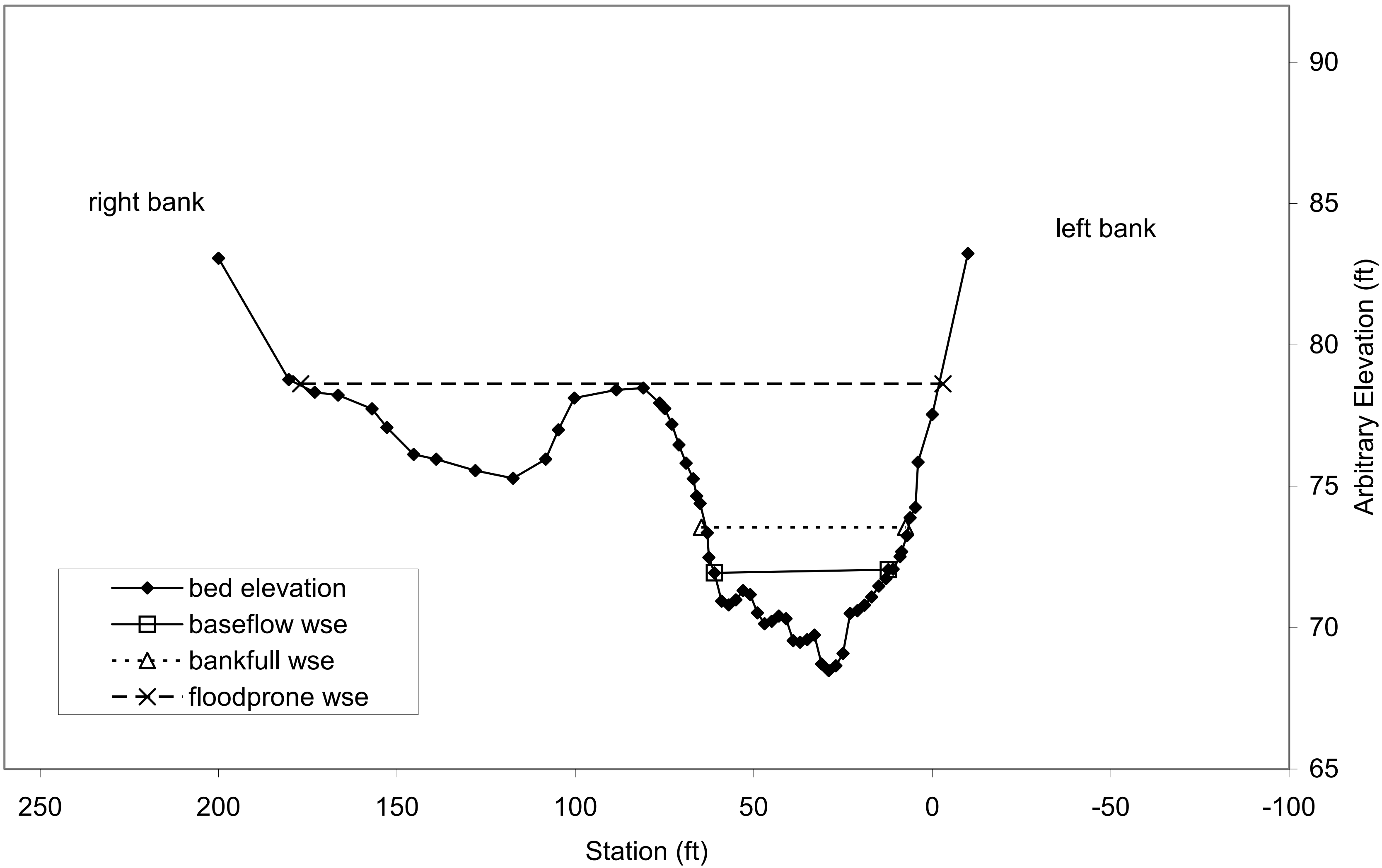
Ice House Dam Reach Lower Site (IH-G2) upper cross-section



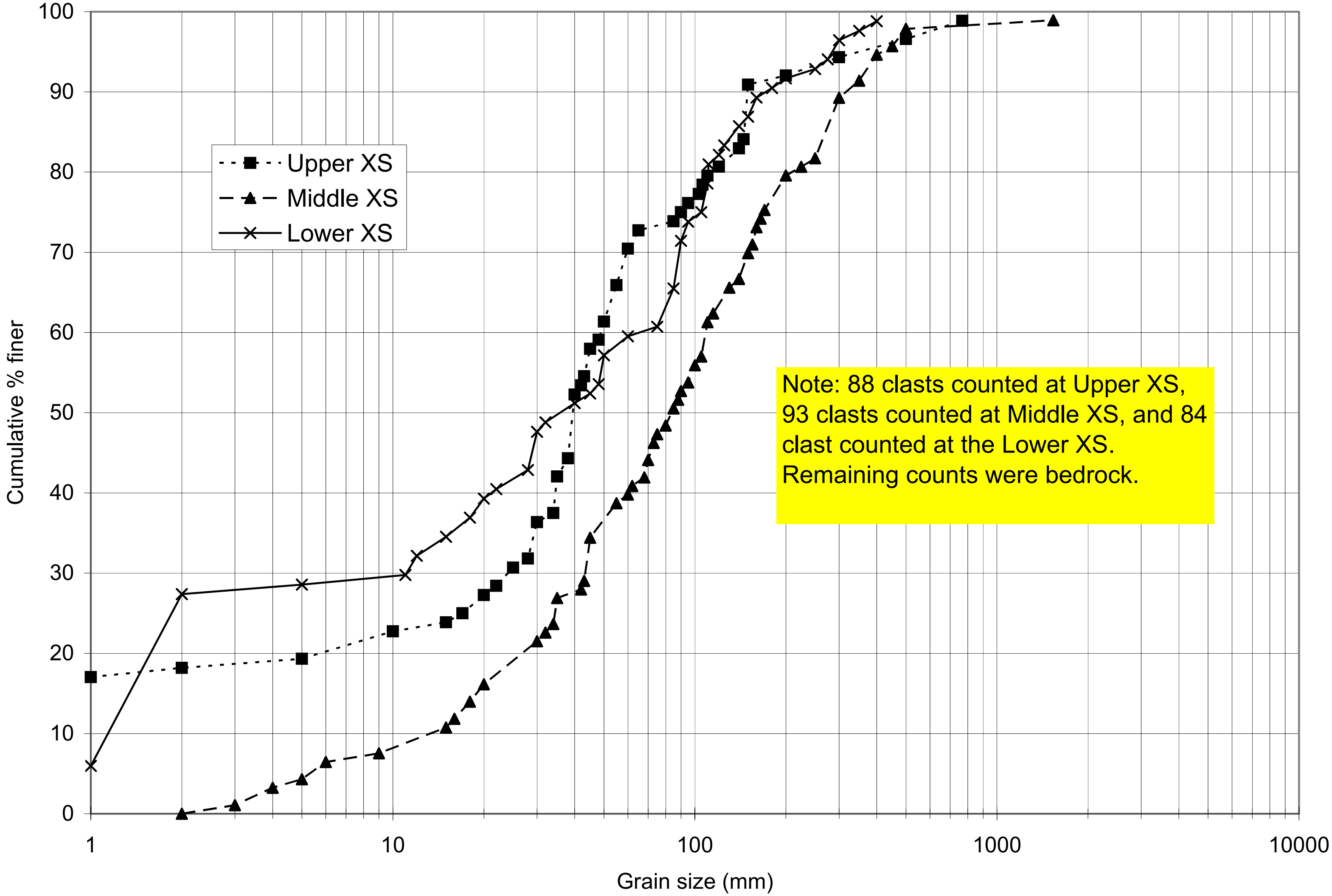
Ice House Dam Reach Lower Site (IH-G2) middle cross-section



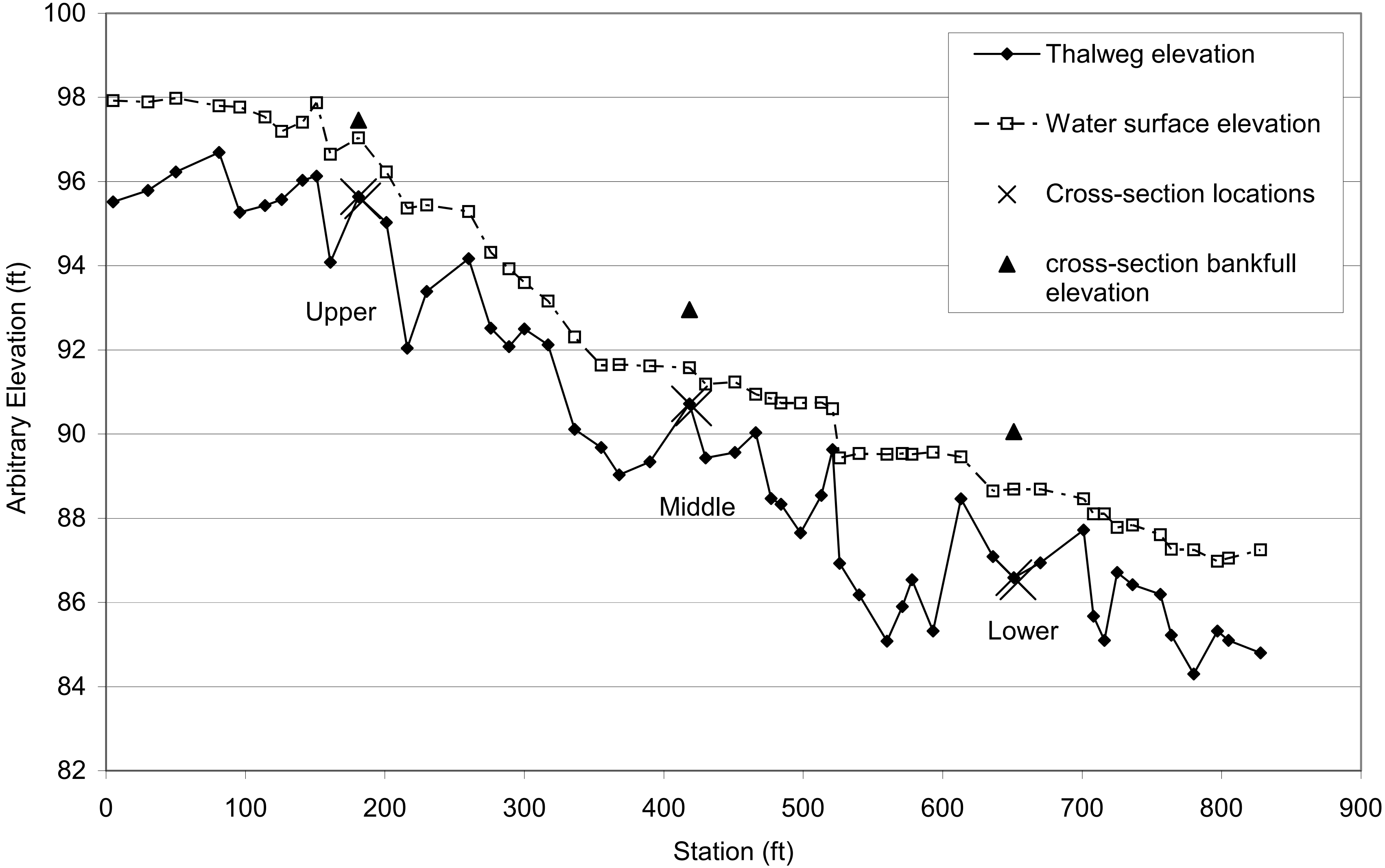
Ice House Dam Reach Lower Site (IH-G2) lower cross-section



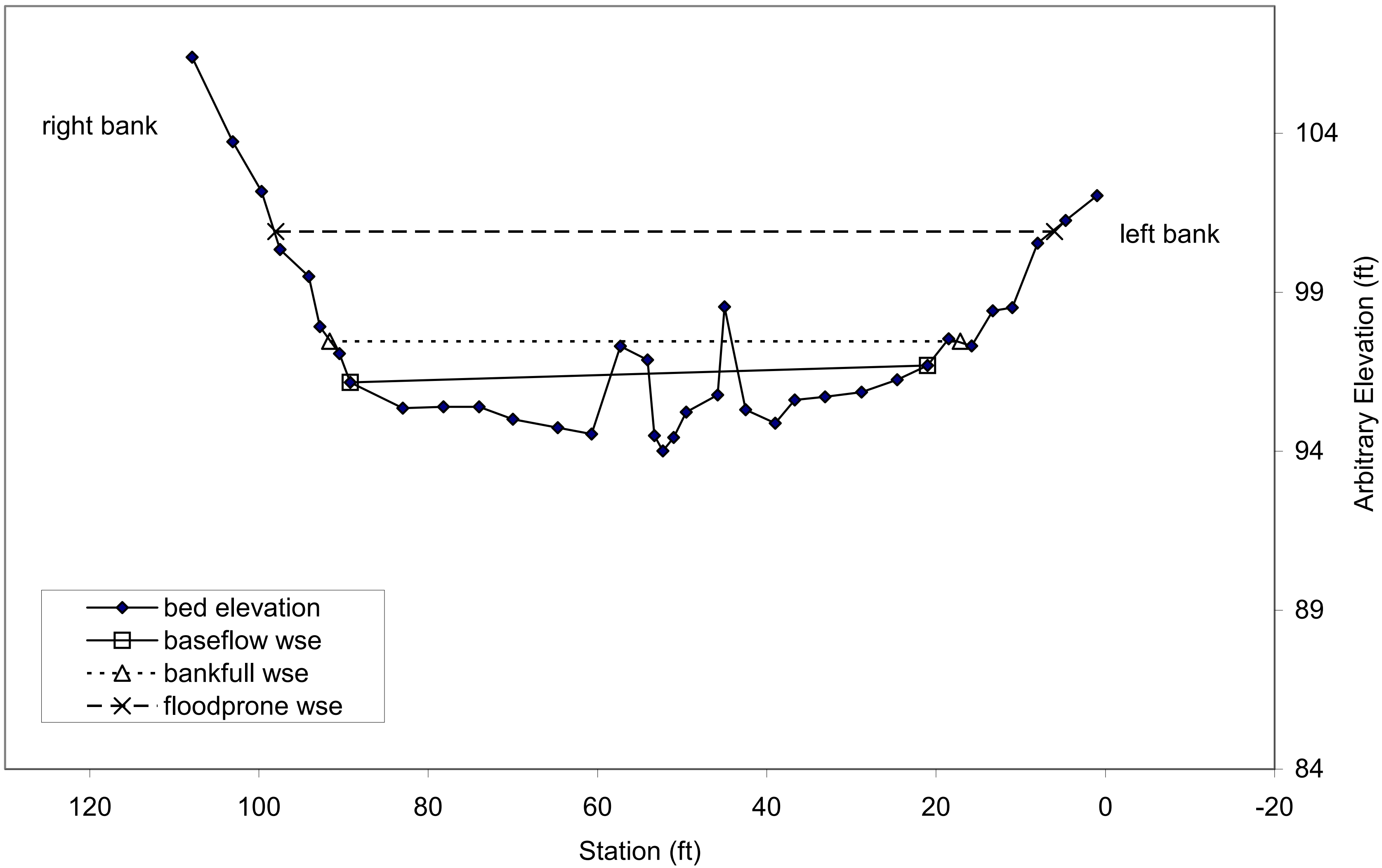
Ice House Dam Reach Lower Site (IH-G2) pebble count



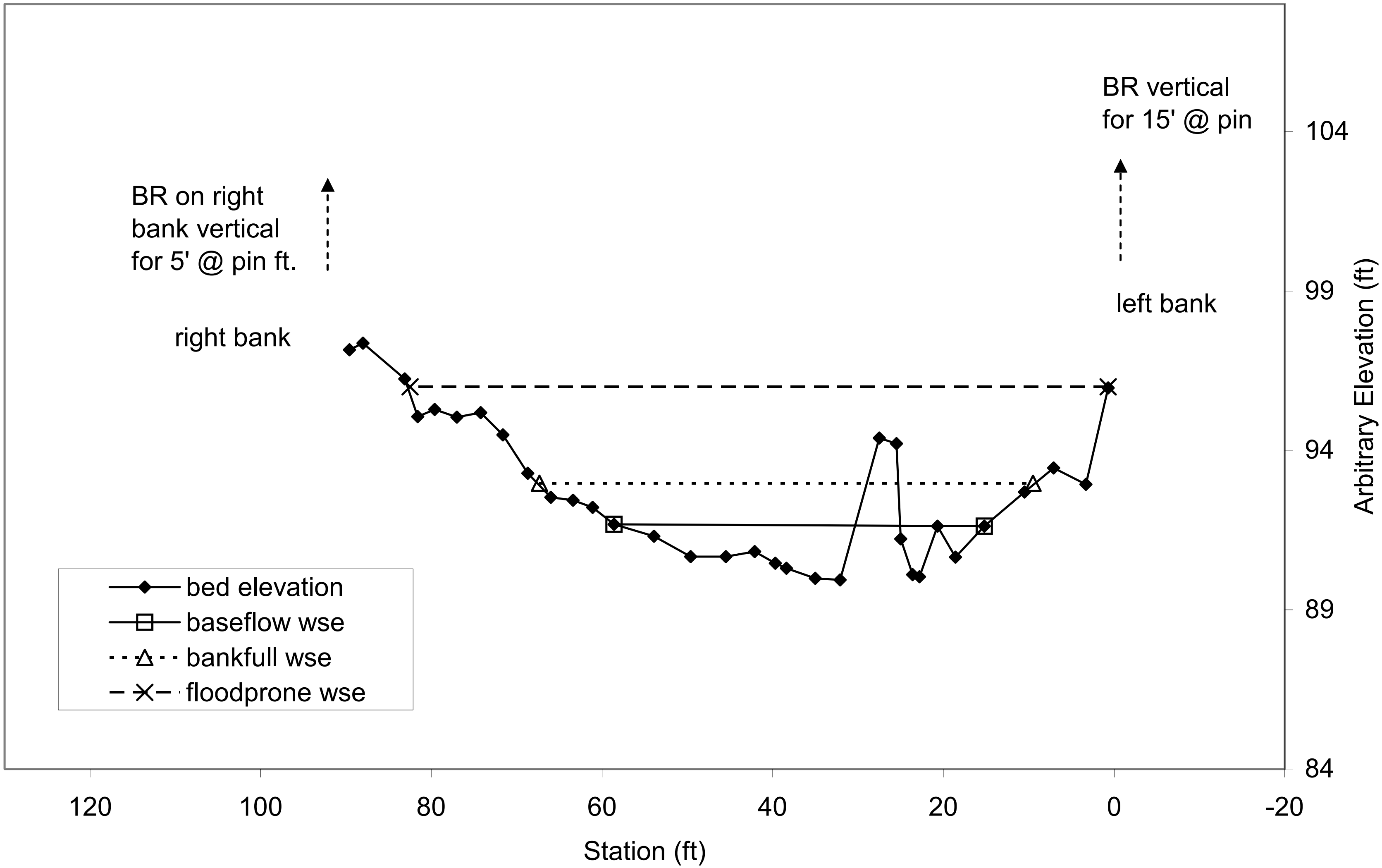
Junction Dam Reach Site (JD-G1) long profile



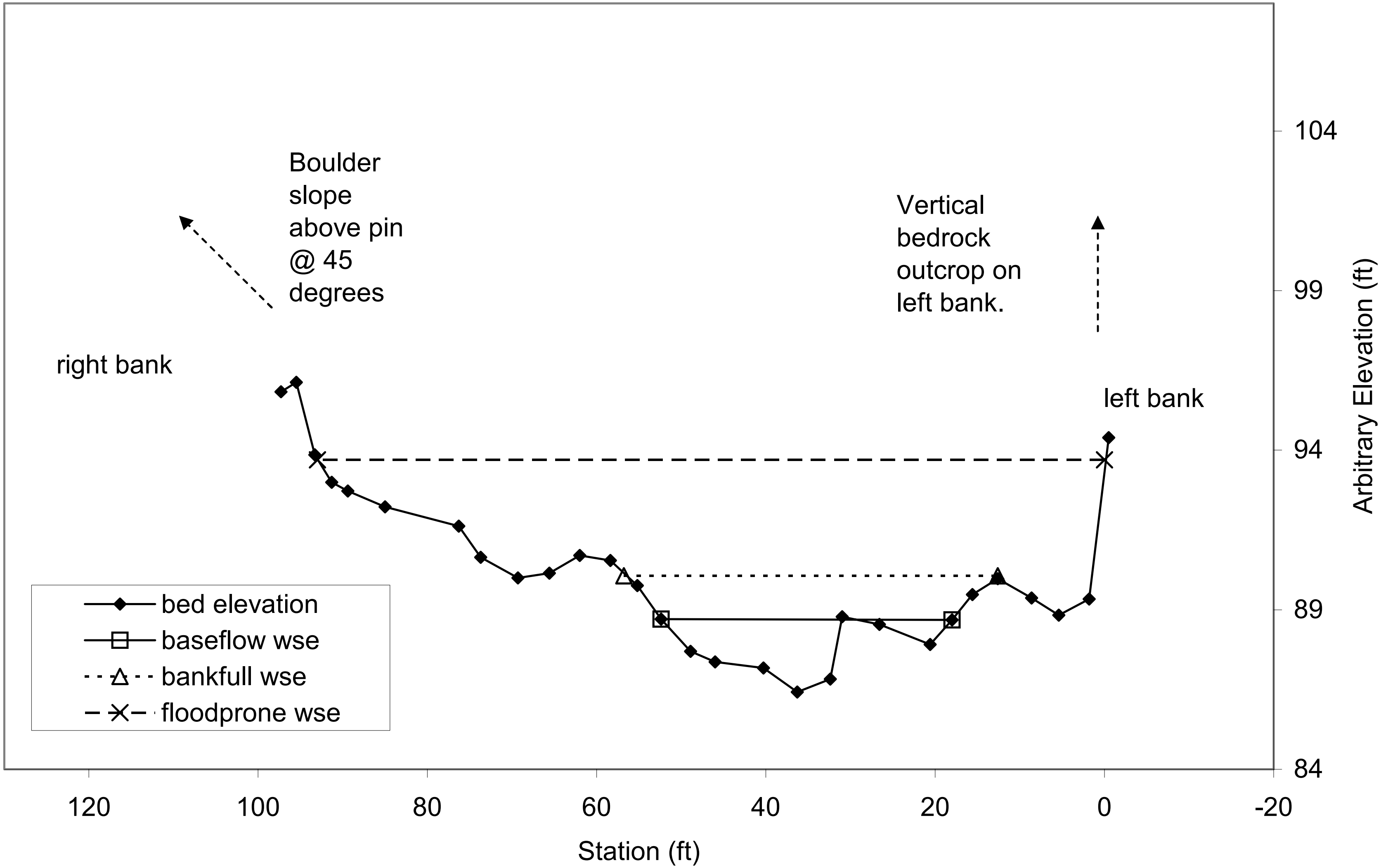
Junction Dam Reach Site (JD-G1) upper cross-section



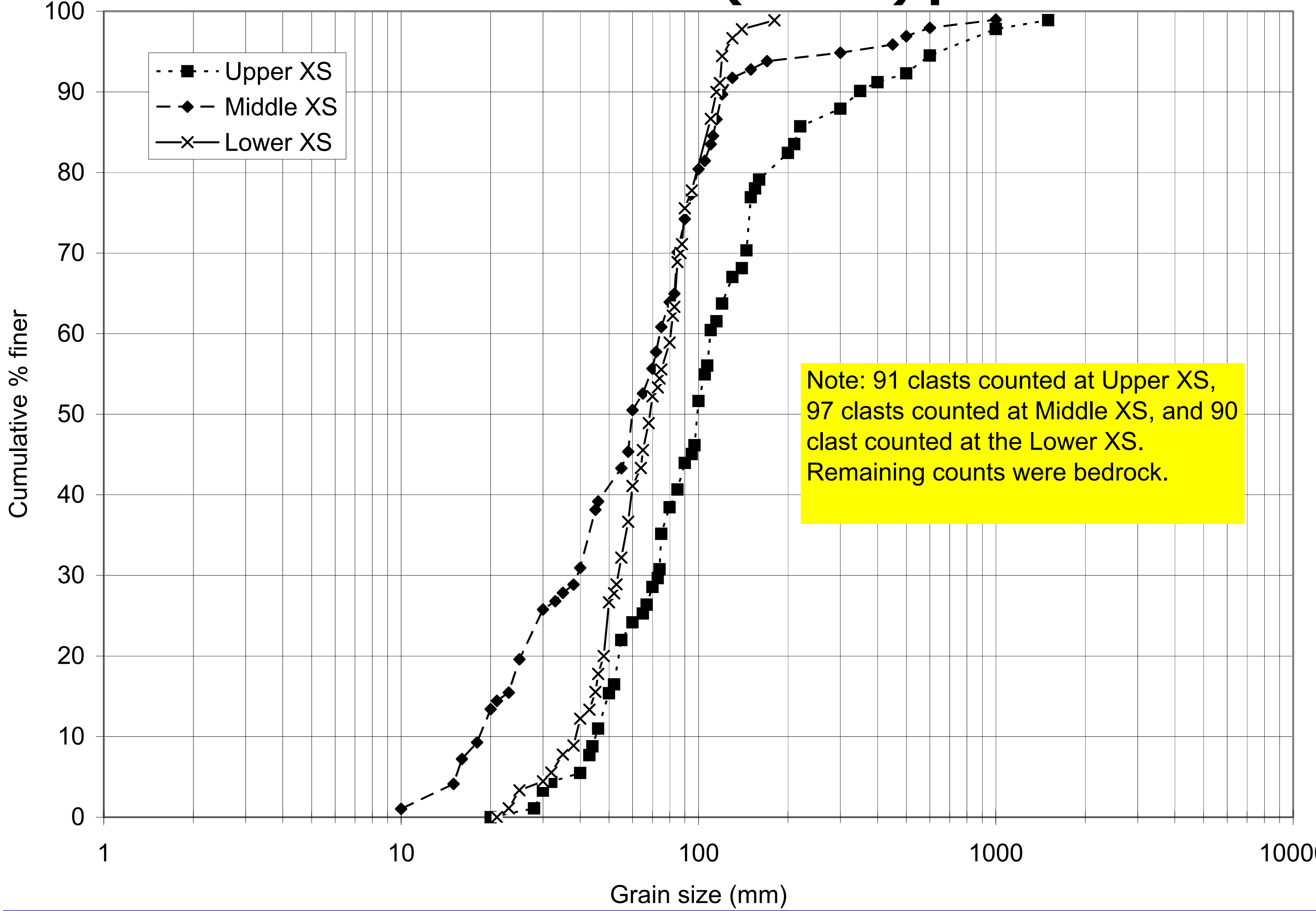
Junction Dam Reach Site (JD-G1) middle cross-section



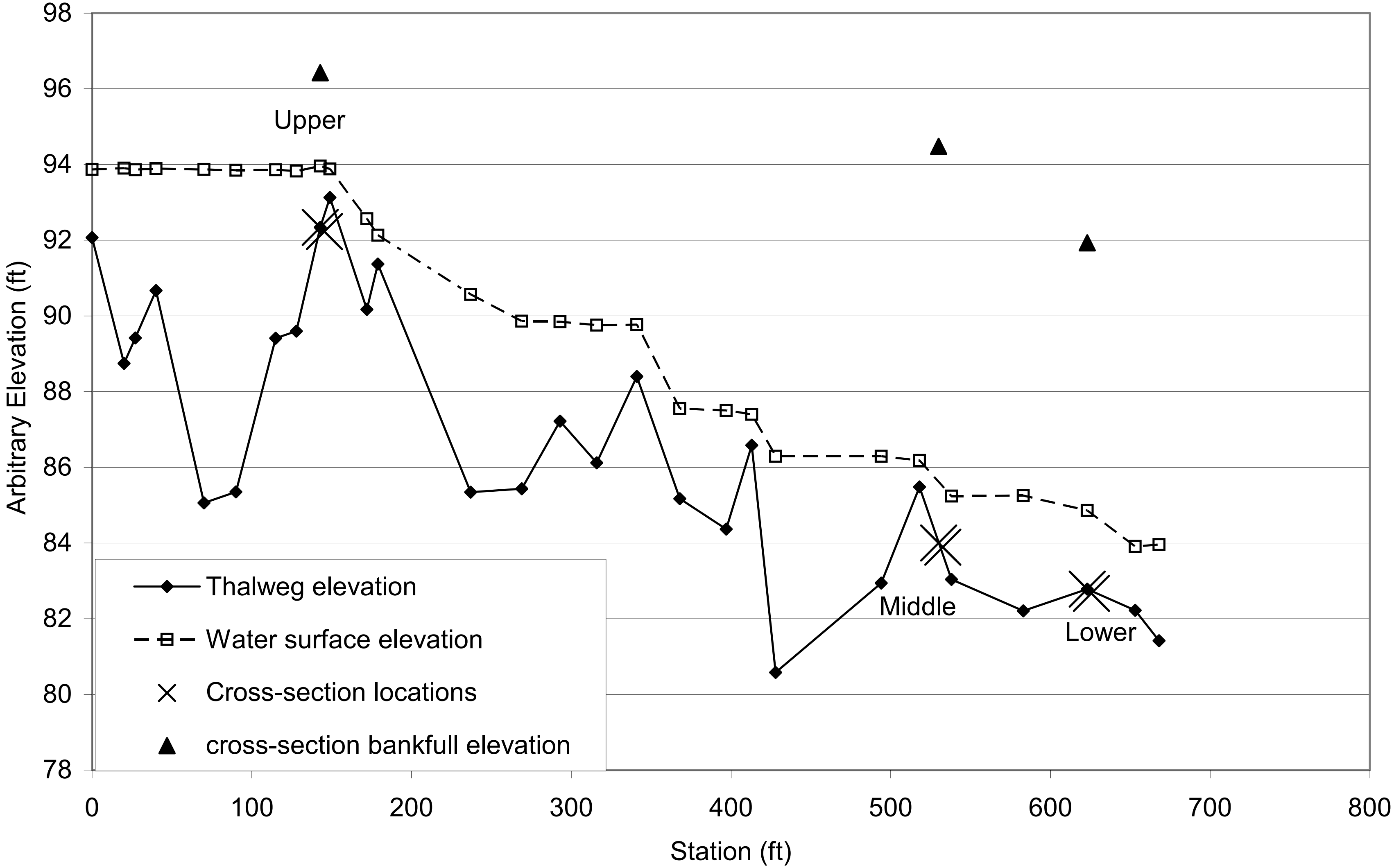
Junction Dam Reach Site (JD-G1) lower cross-section



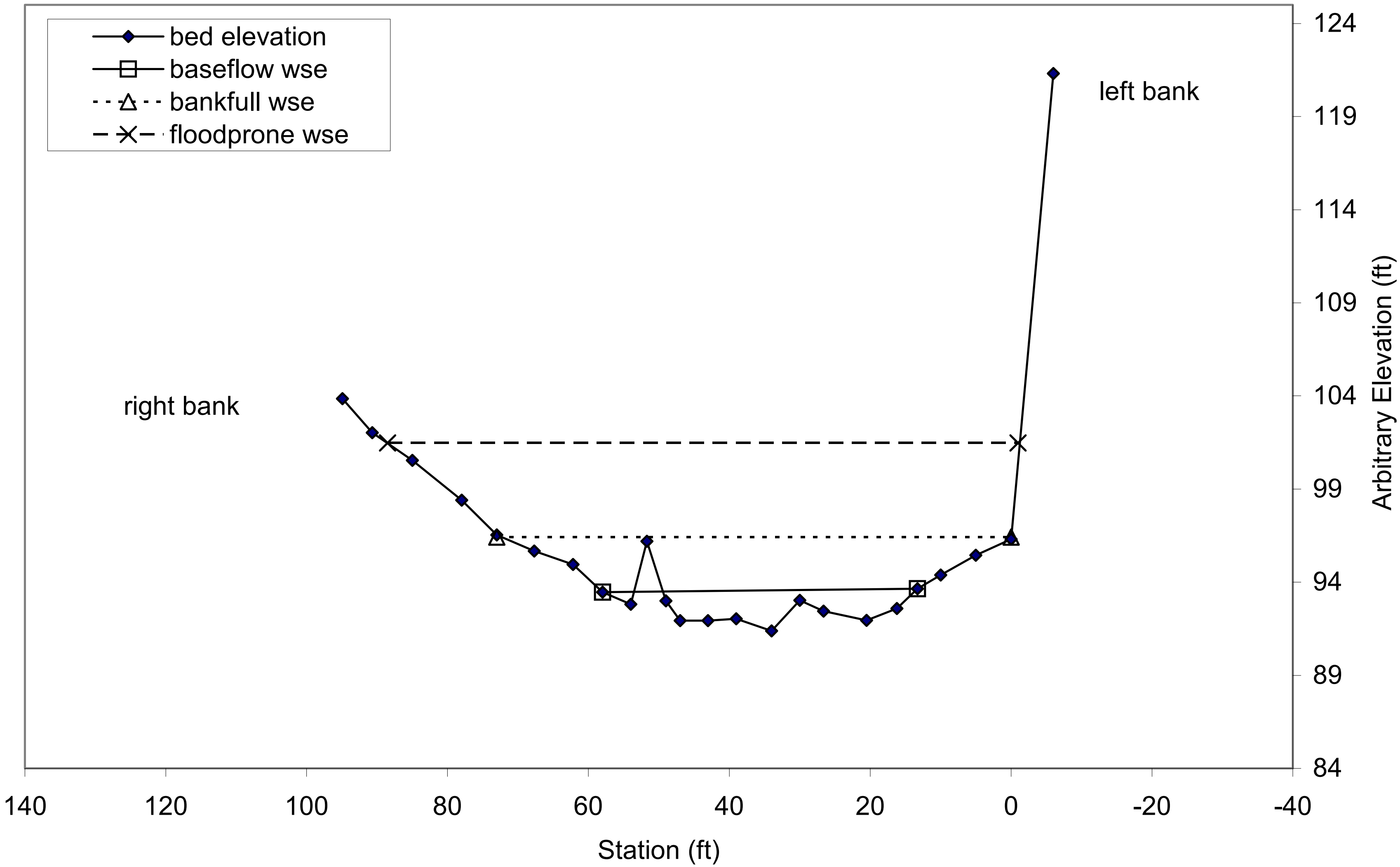
Junction Dam Reach Site (JD-G1) pebble count



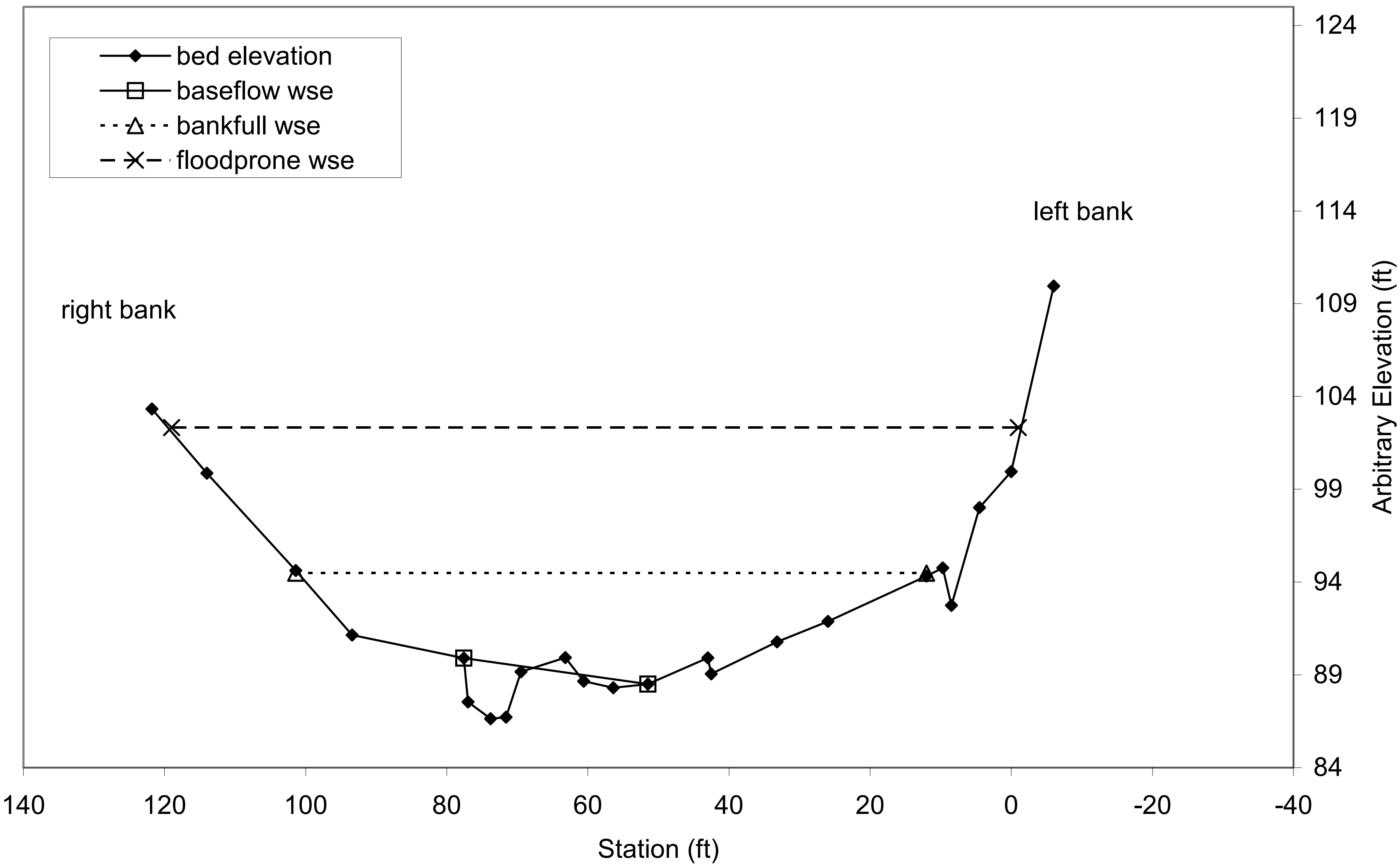
Camino Dam Reach Site (CD-G1) long profile



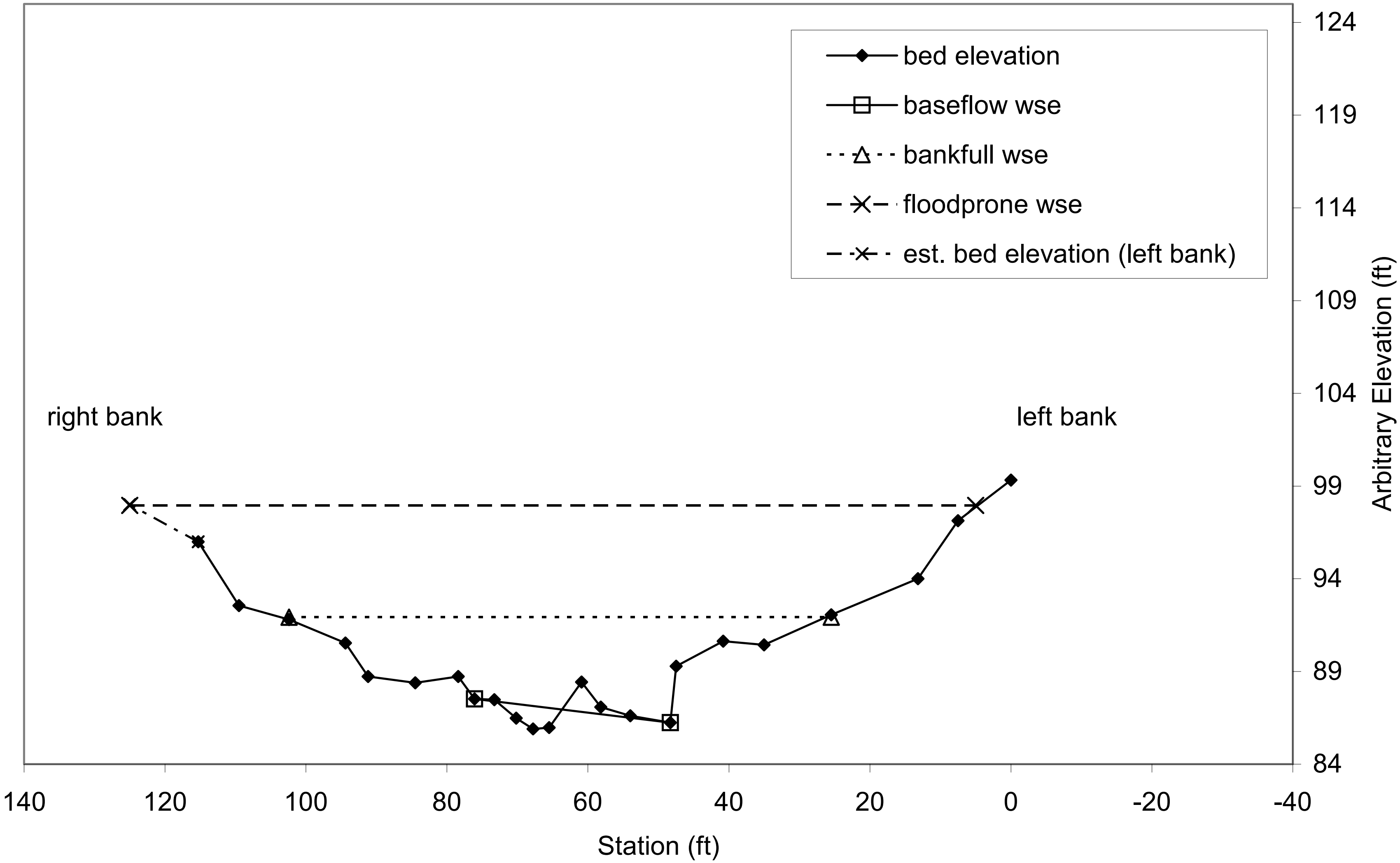
Camino Dam Reach Site (CD-G1) upper cross-section



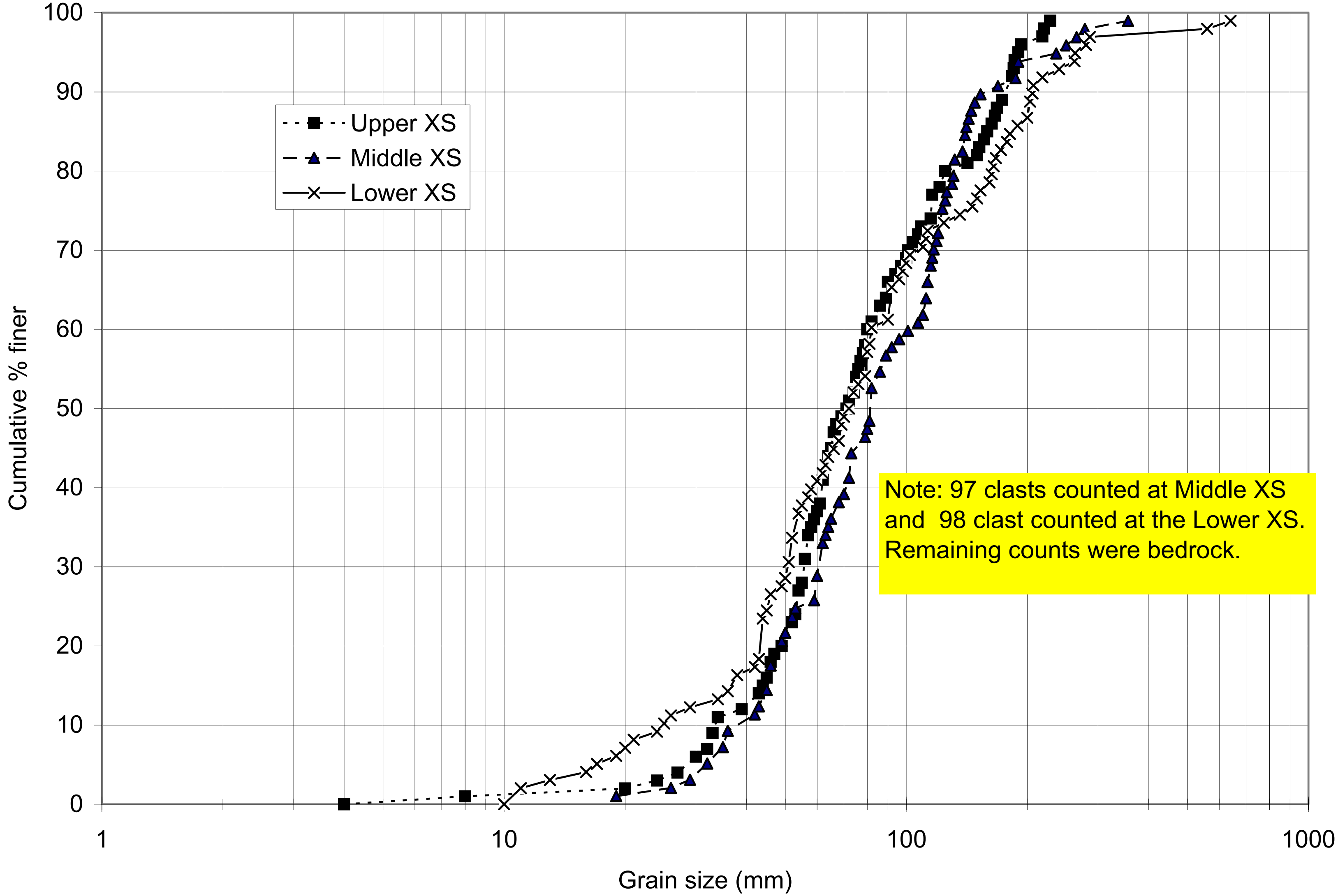
Camino Dam Reach Site (CD-G1) middle cross-section



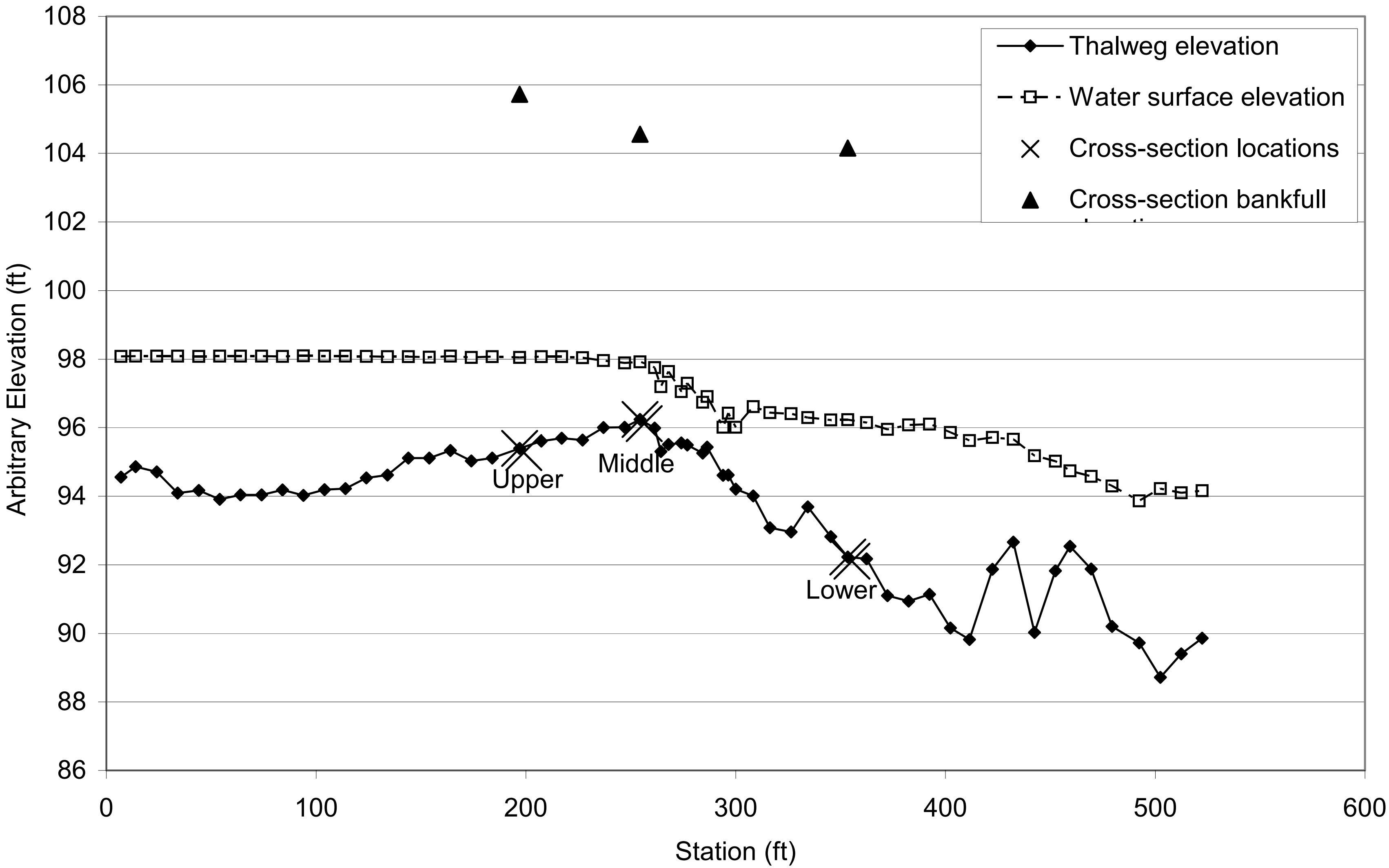
Camino Dam Reach Site (CD-G1) lower cross-section



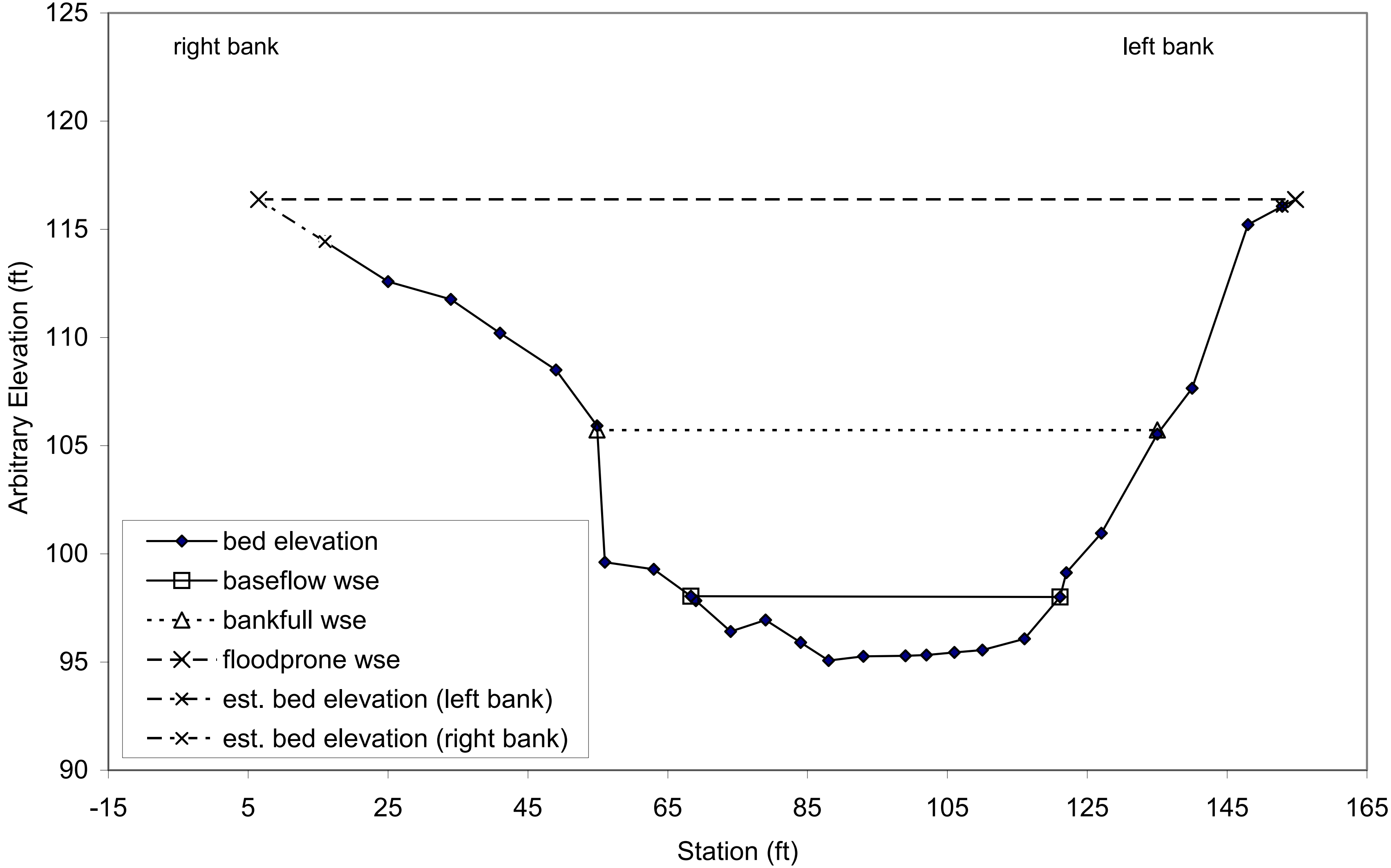
Camino Dam Reach Site (CD-G1) pebble count



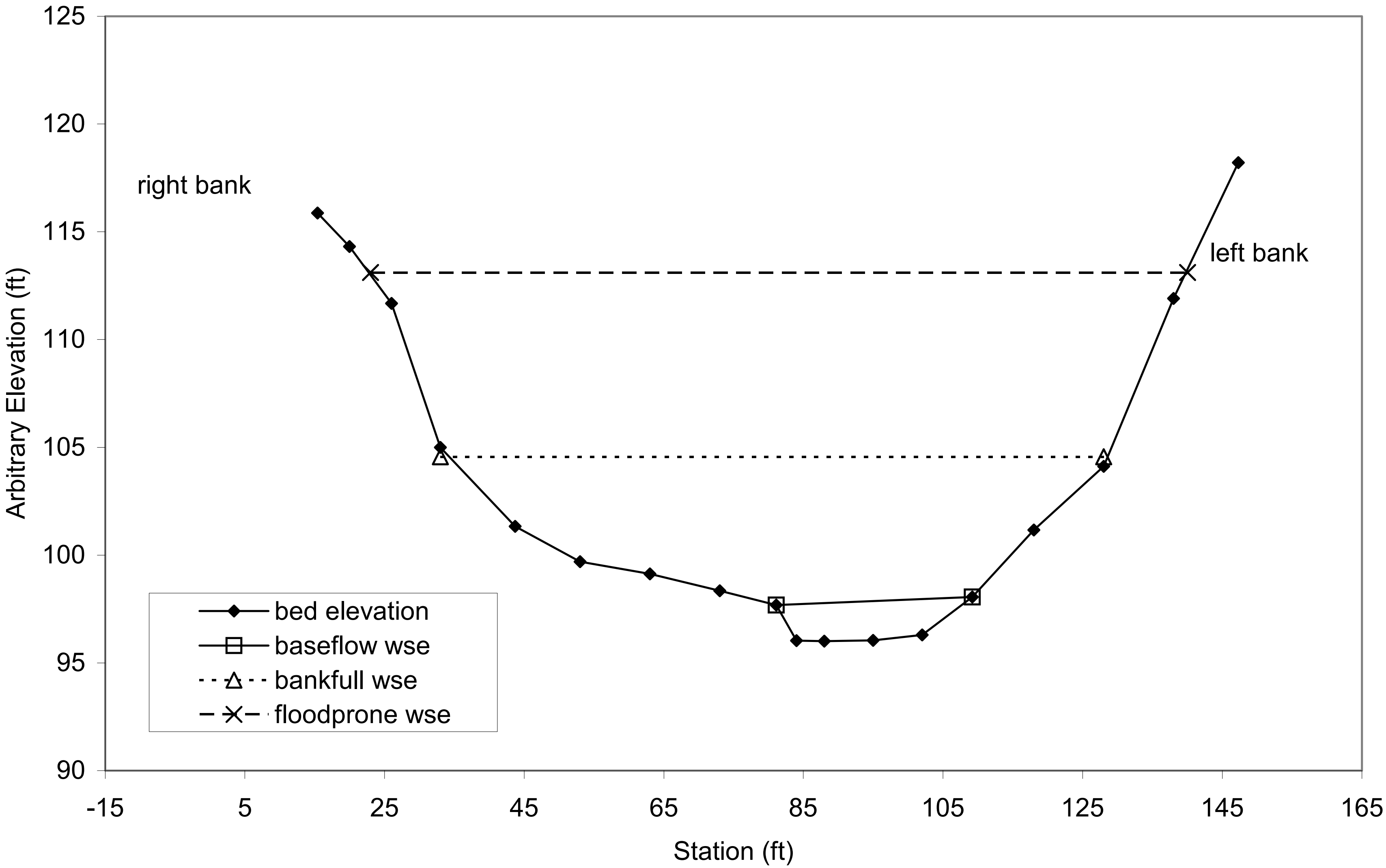
S. F. American Reach Site (SFAR-G1) long profile



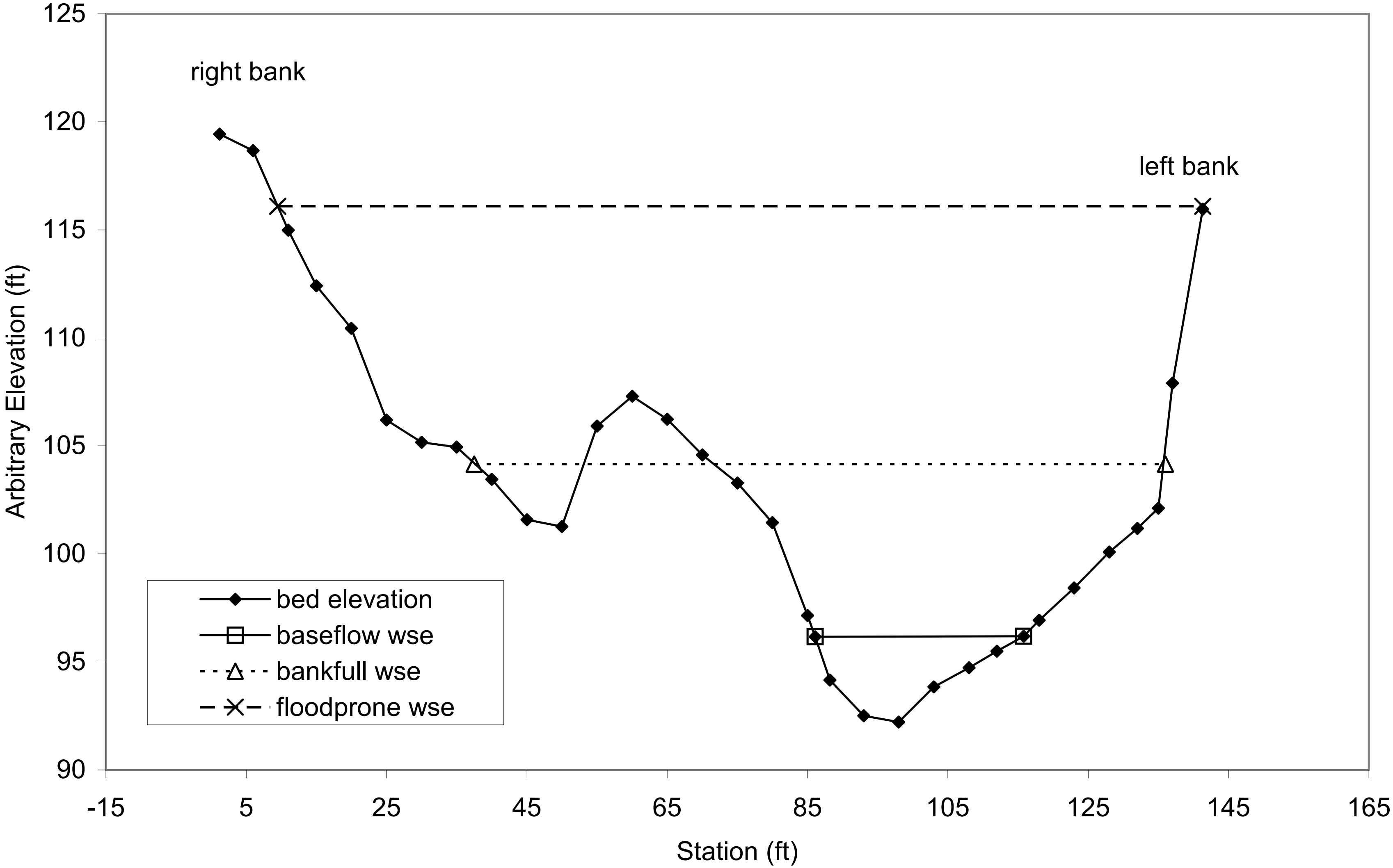
S. F. American Reach Site (SFAR-G1) upper cross-section



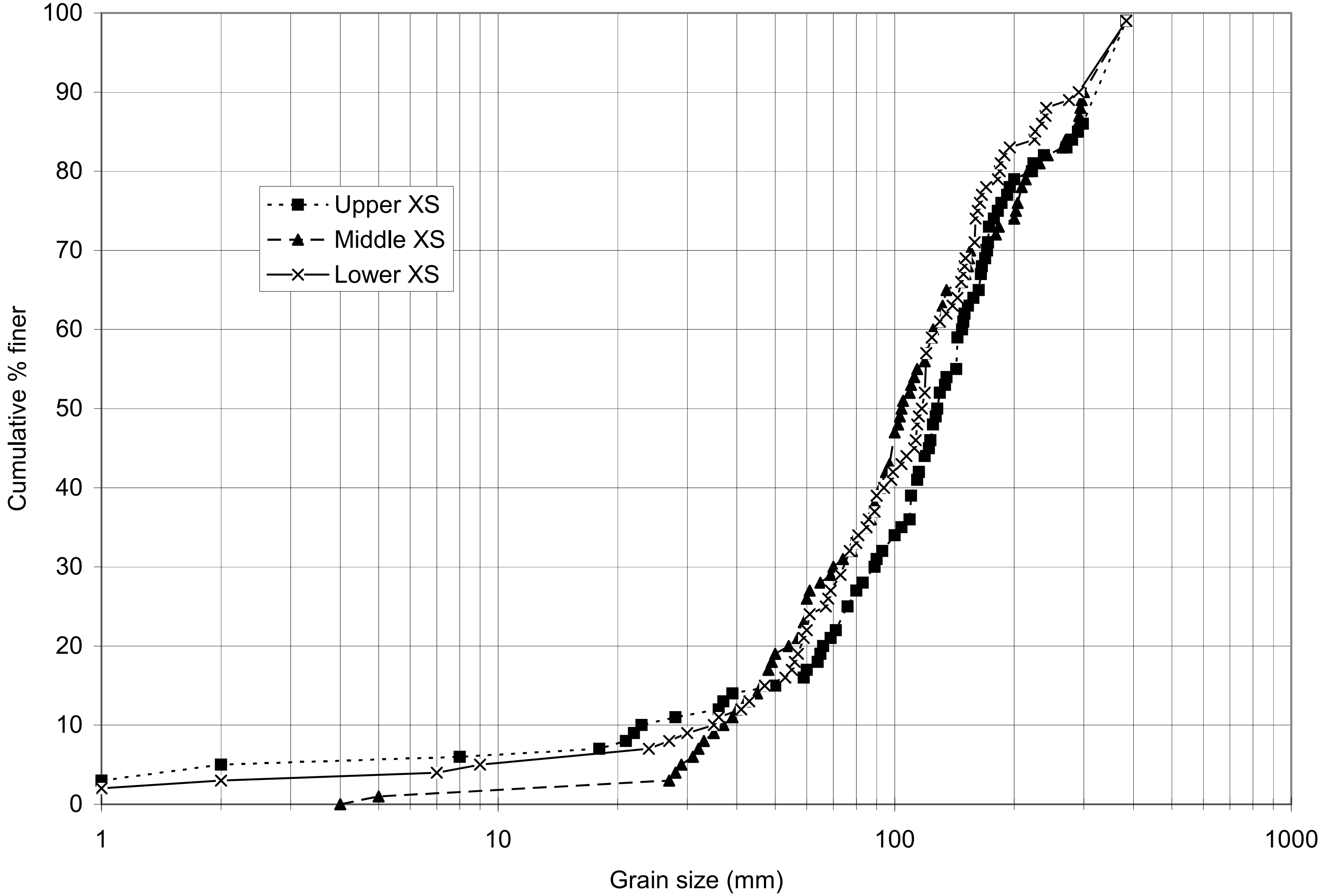
S. F. American Reach Site (SFAR-G1) middle cross-section



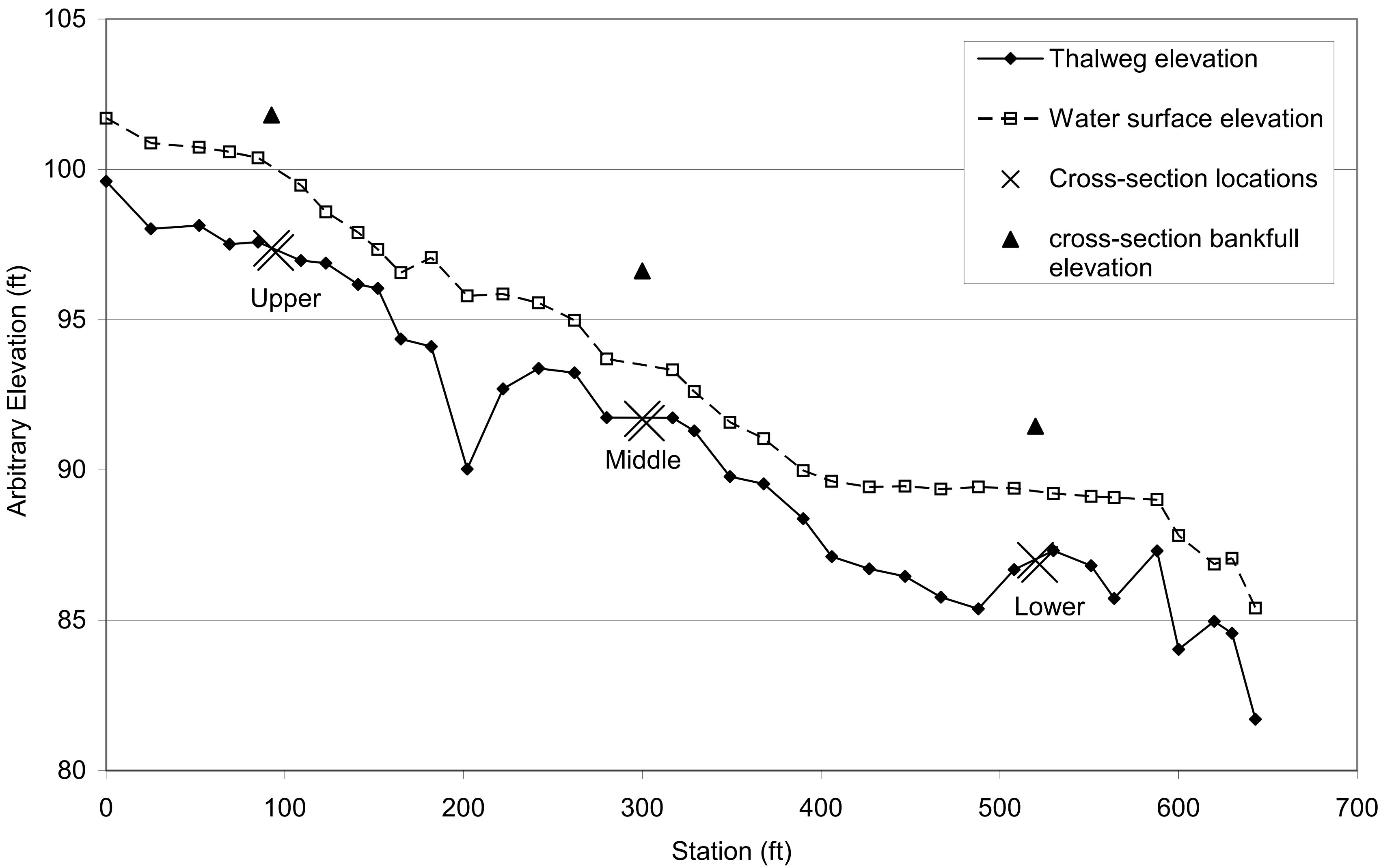
S. F. American Reach Site (SFAR-G1) lower cross-section



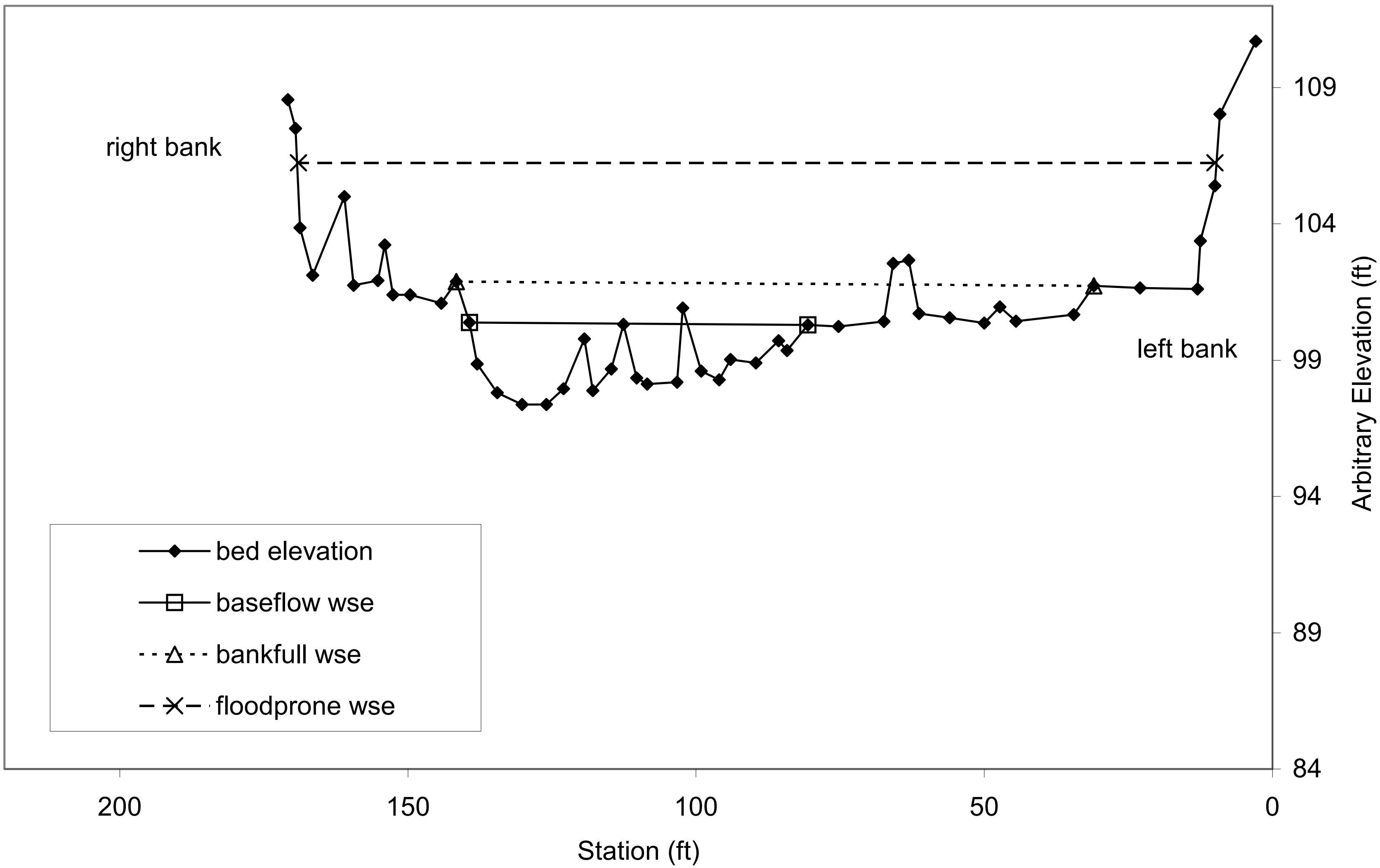
S. F. American Reach Site (SFAR-G1) pebble count



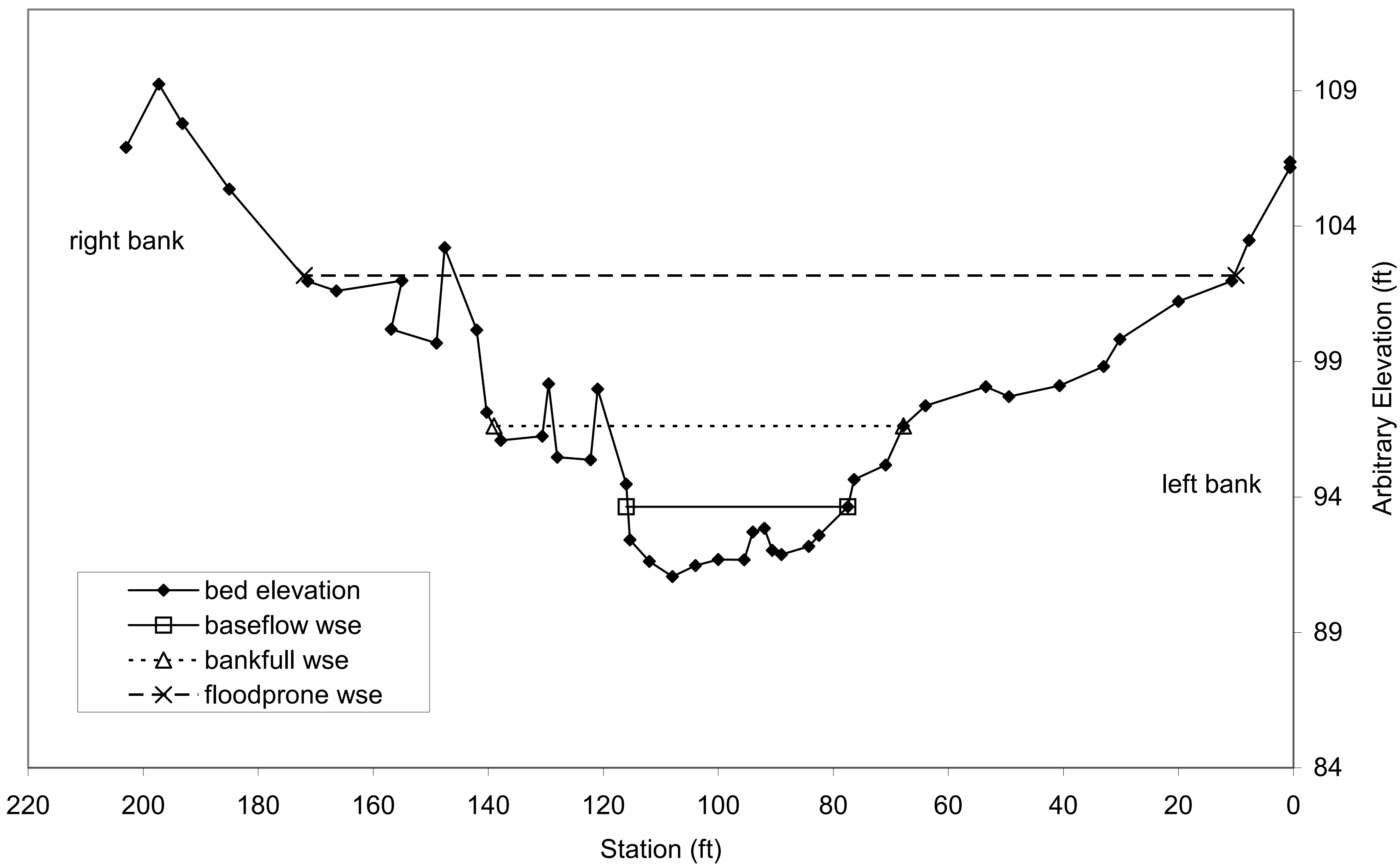
Slab Creek Dam Reach Site (SC-G1) long profile



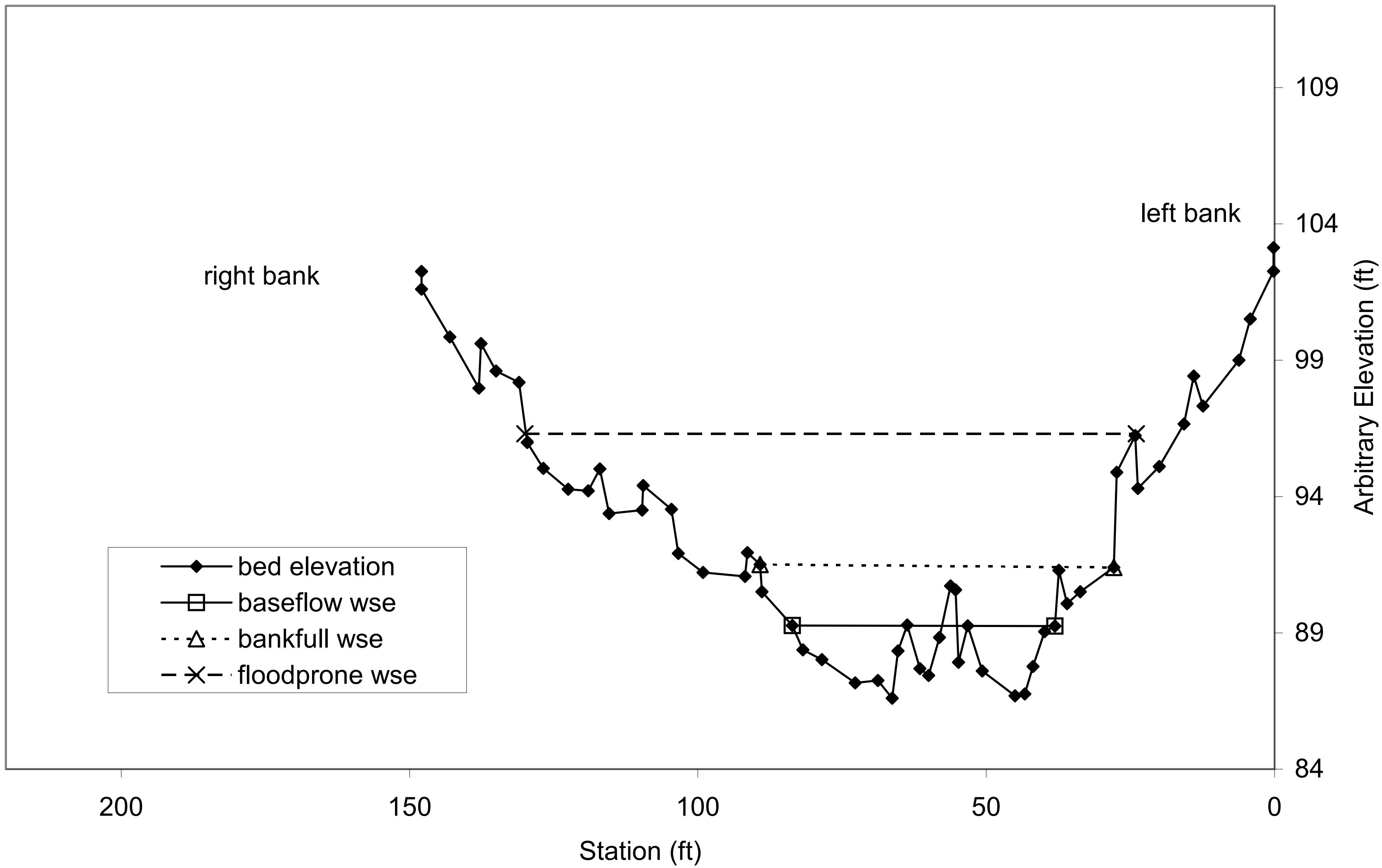
Slab Creek Dam Reach Site (SC-G1) upper cross-section



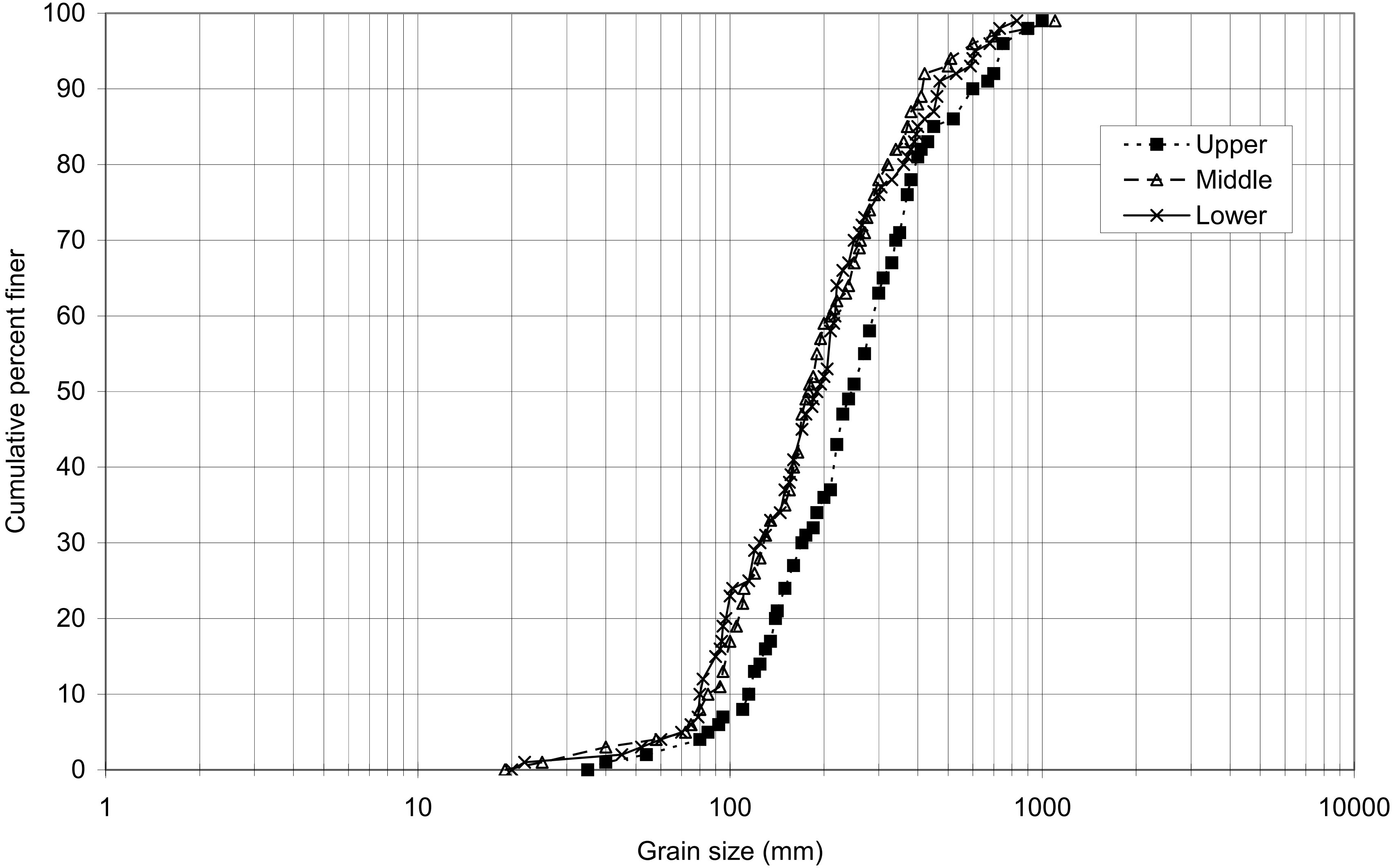
Slab Creek Dam Reach Site (SC-G1) middle cross-section



Slab Creek Dam Reach Site (SC-G1) lower cross-section



Slab Creek Dam Reach Site (SC-G1) pebble count chart



APPENDIX I

LEVEL III DATA FOR THE UARP

Rubicon Dam Reach Site (RD-G1) LWD Frequency

LWD Frequency Data Sheet

Study Reach Name: Rubicon Dam Reach **Crew Initials: TNC, SRD**

Date: 8/26/03 **Start time: 1315** **End time:**

Diameter Class	**Length Class** 3-10 ft (0.9-3.0 m)	10-25 ft (3.1-7.6 m)	25-50 ft (7.7-15.2 m)	50-75 ft (15.3-22.9 m)	>75 ft (>23 m)
6-12 in (10-30 cm)					
12-24 in (31-60 cm)		Fallen log, REW at head of second riffle (near middle cross-section)			
24-36 in (61-90 cm)					
>36 in (>90 cm)					

"Tally as R if rootwad is attached."

Comments: No key pieces

Rubicon Dam Reach Site (RD-G1) V Star

No Vstar measurements taken.

Rubicon Dam Reach Site (RD-G1) Rosgen Level III

Rosgen Level III Data Sheet
Study Reach Name: Rubicon Dam Reach
Date: 8/26/03
Crew Initials: TNC, SRD
Start time: **End time:**

Depositional Features (indicate one)

	B-1	point bars
	B-2	pt. bars w/ few mid channel bars
	B-3	many mid channel bars
x	B-4	side bars
	B-5	diagonal bars
	B-6	main branching w/ many mid channel bars and islands
	B-7	mixed side bar and mid channel bars exceeding 2-3X width
	B-8	delta bars

Description: straight reach with stable, vegetated gravel/cobble bars

Meander Pattern (indicate one)

	M-1	regular meander
	M-2	tortuous meander
x	M-3	irregular meander
	M-4	truncated meander
	M-5	unconfined me. scrolls
	M-6	confine me. scrolls
	M-7	distorted me. loops
	M-8	irregular with oxbows

Description: high mountain, bedrock controlled channel

STREAM CHANNEL DEBRIS/BLOCKAGES (indicate one)

Materials, which upon placement into the active channel or floodprone area may cause and adjustment in channel dimensions or conditions, due to influences on the existing flow regime

	Description/Extent	
x	D-1 (None)	Minor amounts of small, floatable material
	D-2 (Infrequent)	Debris consists of small, easily moved, floatable material; i.e. leaves, needles, small limbs, twigs, etc..
	D-3 (Moderate)	Increasing frequency of small to medium sized material, i.e. large limbs, branches, small logs that when accumulated effect 10% or less of the active channel cross-sectional area.
	D-4 (Numerous)	Significant buildup of medium to large sized materials, i.e. large limbs, branches, small logs, or portions of trees that may occupy 10 to 30% of the active cross-sectional area.
	D-5 (Extensive)	Debris "dams" of predominantly larger materials, i.e. branches, logs, trees, etc., occupying 30 to 50% of the active channel cross-section, often extending across the width of the active channel.
	D-6 (Dominating)	Large, somewhat continuous debris "dams," extensive in nature and occupying over 50% of the active channel cross-section. Such accumulations may divert water into floodprone areas and form fish migration barriers, even when flows are at less than bankfull
	D-7 (Beaver Dams - Few)	An infrequent number of dams spaced such that normal streamflow and expected channel conditions exist in the reaches between dams.
	D-8 (Beaver Dams - Frequent)	Frequency of dams is such that backwater conditions exist for channel reaches between structures; where streamflow velocities are reduced and channel dimensions or conditions are influenced.
	D-9 (Beaver Dams - Abandoned)	Numerous abandoned dams, many of which have filled with sediment and/or breached, initiating a series of channel adjustments such as bank erosion, lateral migration, evulsion, aggradations and degradation.
	D-10 (Human Influences)	Structures, facilities, or materials related to land uses or development located within the floodprone area, such as diversions or low-head dams, controlled by-pass channels, velocity control structures, and various transportation encroachments that have

Notes: Fairly clean channel, with with monir amounts LWD on banks/bars

Rubicon Dam Reach Site (RD-G1) Pfankuch

Channel Stability (Pfankuch)

Study Reach Name: Rubicon Dam Reach
Crew Initials: TNC, SRD
Date: 8/26/2003
Start Time:
Stop Time:

		Category	(choose one for each of the four options for each category)		Place X in this column:
Upper Banks	1	Landform slope	Bank slope gradient <30%	2	
			Bank slope gradient 30-40%	4	X
			Bank slope gradient 40-60%	6	
			Bank slope gradient 60+%	8	
	2	Mass wasting	No evidence of past or future mass wasting	3	
			Infrequent. Most likely healed over. Low future potential	6	X
			Frequent or large, causing sediment nearly year long	9	
			Frequent or large causing sediment nearly year long or imminent danger of same	12	
	3	Debris jam potential	Essentially absent from immediate channel area	2	
			Present, but mostly small twigs and limbs	4	
			Moderate to heavy amounts, mostly larger sizes	6	X
			Moderate to heavy amounts, predominately lager sizes	8	
	4	Vegetative bank protection	90%+ plant density. Vigor and variety suggest a deep, dense soil binding root mass	3	
			70-90% density. Fewer species or less vigor suggest less dense or deep root mass	6	X
			<50-70% density. Lower vigor and fewer species from a shallow, discontinuous root mass	9	
			<50% density, fewer species and less vigor indicate poor, discontinuous and shallow root mass	12	
Lower Banks	5	Channel capacity	Ample for present plus some increases. Peak flows contained. W/D ration <7	1	
			Adequate. Bank overflows rare. W/D ratio 8-15	2	
			Barely contains present peaks. Occasional overbank floods. W/D ratio 15 to 25	3	X
			Inadequate. Overbank flows common. W/D ratio >25	4	
	6	Bank rock content	65%+ with large angular boulders. 12”+ common.	2	
			40-65%. Mostly small boulders to cobbles 6-12”	4	
			20-40%. With most in the 3-6” diameter class	6	
			20% rock fragments of gravel sizes, 1-3” or less	8	X
	7	Obstructions to flow	Rocks and logs firmly embedded. Flow pattern w/out cutting or deposition. Stable bed	2	X
			Some present causing erosive cross currents and minor pool filling. Obstructions newer and less	4	
			Moderately frequent, unstable obstructions move with high flows causing bank cutting and pool	6	
			Sediment traps full, channel migration occurring	8	
	8	Cutting	Little or none. Infrequent raw banks less than 6”	4	
			Some, intermittently at outcurves and constrictions. Raw banks may be up to 12”	6	X
			Significant. Cuts 12-24” high. Root mat overhangs and sloughing evident	12	
			Almost continuous cuts, some over 24” high. Failure of overhangs frequent	16	
	9	Deposition	Little or no enlargement of channel or point bars	4	X
			Some new bar increase, mostly from coarse gravel	8	
			Moderate deposition of new gravel and course sand on old and some new bars	12	
			Extensive deposits of predominately fine particles. Accelerated bar development	16	
Bottom	10	Rock angularity	Sharp edges and corners. Plane surfaces rough.	1	
			Rounded corners and edges, surfaces smooth, flat	2	
			Corners and edges well rounded in two dimensions	3	X
			Well rounded in all dimensions, surfaces smooth	4	
	11	Brightness	Surfaces dull, dark, or stained. Generally not bright	1	
			Mostly dull, but may have <35% bright surfaces	2	
			Mixture dull and bright, ie 35-65% mixture range	3	X
			Predominately bright, 65% exposed or scoured surfaces	4	
	12	Consolidation of particles	Assorted sizes tightly packed or overlapping	2	
			Moderately packed with some overlapping	4	
			Mostly loose assortment with no apparent overlap	6	X
			No packing evident. Loose assortment easily moved	8	
	13	Bottom size distribution	No size change evident. Stable mater. 80-100%	4	
			Distribution shift light. Stable material 50-80%	8	X
			Moderate changes in sizes. Stable materials 20-50%	12	
			Marked distribution change. Stable materials 0-20%	16	
	14	Scouring and deposition	<5% of bottom affected by scour or deposition	6	X
			5-30% affected. Scour at constrictions and where grades steepen. Some deposition in pools	12	
			30-50% affected. Deposits and scour at obstructions, constrictions, and bends. Some filling of pools	18	
			More than 50% of the bottom in a state of flux or change nearly year long	24	
	15	Aquatic vegetation	Abundant growth moss-like, dark green perennial. In swift water too.	1	
			Common. Algae forms in low velocity and pool areas. Moss here too	2	X
			Present but spotty, mostly in backwater. Seasonal algae growth makes rocks slick	3	
			Perennial types scare or absent. Yellow-green, short term bloom may be present	4	

Rubicon Dam Reach Site (RD-G1)
Bank Erosion and Vegetation

Bank Erosion and Vegetation

Study Reach Name: Rubicon Dam Reach **Crew Initials**: TNC, SRD
Date: 8/26/03 **Start Time**: 1500 **Stop Time**:

BANK EROSION POTENTIAL				
(if banks are bedrock or composed of boulders, do not fill out this table)				
	Bank a	**Bank b**	**Bank c**	**Bank d**
Bank height (ft)	6	8	8	
Bankfull height (ft)	3	3	3	
Root depth (ft)	4	4	4	
Root density (%)	40%	40%	40%	
Bank Angle (degrees)	30-40	30-40	30-40	
Surface Protection (%)	80%	80%	80%	
% of total study reach				

Notes

Bank material: Sand
Stratification of unstable layers in banks (below bankfull): Middle of bank

Sediment supply: Moderate
Vertical streambed stability: Stable
Bank and channel bed conditions notes:
Banks are well vegetated. Well vegetated gravel bars present in channel

RIPARIAN VEGETATION				
	DENSITY (indicate all that apply)			
VEGETATION TYPE	**LOW**	**MOD.**	**HIGH**	**NOTES**
Bare				
Forbs only				
Annual Grass w/ forbes				
Perennial grass				
Rhizomatous grasses (bluegrass, Grass like plants, sedges, rushes)		5b		
Low brush				
High brush				
Combination grass/brush		8b		
Deciduous overstory				
Deciduous w/brush/grass understory		10b		
Perennial overstory				
Wetland vegetation community				

Loon Lake Dam Reach Upper Site (LL-G1) LWD Frequency

LWD Frequency Data Sheet

Study Reach Name: Upper Loon Lake **Crew Initials:** JDS, MCM
Date: 6/2/2003 **Start time:** 13:12 **End time:** 13:48

Diameter Class	Length Class 3-10 ft (0.9-3.0 m)	10-25 ft (3.1-7.6 m)	25-50 ft (7.7-15.2 m)	50-75 ft (15.3-22.9 m)	>75 ft (>23 m)
6-12 in (10-30 cm)	15 + R	7	6	2	
12-24 in (31-60 cm)	4	3+R	2+R		
24-36 in (61-90 cm)	4	2	3	12	
>36 in (>90 cm)					

"Tally as R if rootwad is attached."

Comments:

Loon Lake Dam Reach Upper Site (LL-G1) V Star

V* Measurements

Study Reach Name: Loon Lake Upper **Crew Initials:** JDS, MCM
Date: 6/2/2003 **Start time:** **End time:**

Comments:
No V* measurements taken.
No pool-riffle morphology, so no true riffle control points.
The bed is comprised of silt and fine to coarse sand.
Silt patches overlay the unconsolidated sand, so Silvey road wouldn't stop after going through silt.
There are a lot of silt deposits, but this method doesn't seem applicable.

Loon Lake Dam Reach Upper Site (LL-G1) LWD Key Pieces

LWD Key Pieces Information

Study Reach Name: Upper Loon Lake **Crew Initials:** JDS, MCM
Date: 6/2/2003 **Start time:** **End time:**

Perform for 100 m of stream or reach length, whichever is greater. **Criteria for Determining Key Pieces to be Measured** (circle which used): (1) all pieces with length > 1.2 times bankfull channel width OR (2) pieces meeting criteria 1 and having diameters

KEY PIECE ATTRIBUTE	KEY PIECE NUMBER											
	1	2	3	4	5	6	7	8	9	10	11	12
Location on longitudinal profile												
Diameter (in)	25	32	30									
Length (ft)	75	75	40									
rootwad attached	no	no	no									
LOCATION IN BANKFULL CHANNEL AREA												
< 25% of piece length in bankfull channel												
25-50% of piece length in bankfull channel												
50-75% of piece length in bankfull channel												
75-100% of piece length in bankfull channel	x	x	x									
ORIENTATION												
Perpendicular	x	x										
angled downstream			x									
angled upstream												
parallel or near parallel to channel												
FUNCTION IN CHANNEL												
located in bankfull channel, but not influencing channel morphology and not associated with pool habitat												
associated with, but not creating pool habitat												
acting as complex instream cover												
(has attached rootwad or intact branches)												
acting as velocity refuge			x									
associated with LWD jam (3 or more key pieces)												
piece is acting as sediment storage site												
piece appears to be stable in stream channel*	x	x										
POOL FORMATION												
forming dammed pool												
forming plunge pool												
forming lateral scour pool	x	x	x									
forming backwater pool												
pool surface area (m^2) associated with piece(s) (L x W)												
ADDITIONAL INFORMATION (OPTIONAL)												
decay class (1 = sound, limbs present; 2 = bark loose or absent, limbs absent, surface slightly rotted; 3 = surface extensively rotted, center solid or rotted)	2	2	2									
tree species (C = conifer, D = deciduous, U = unknown)	u	u	u									
input mechanism (W=windthrow, B=bank undercutting,	u	u	u									
D=debris flow, L=landslide, M=tree mortality, U=unkn)												

*Rootwad present, piece stabilized at more than one point by banks or channel obstructions, end anchored by streambed or bank burial, pegged by standing trees, spanning

Loon Lake Dam Reach Upper Site (LL-G1)
Rosgen Level III

Rosgen Level III Data Sheet

Study Reach Name: Upper Loon Lake
Date: 6/2/2003
Crew Initials: JDS, MCM
Start time: **End time:**

Depositional Features (indicate one)

x	B-1	point bars
	B-2	pt. bars w/ few mid channel bars
	B-3	many mid channel bars
	B-4	side bars
	B-5	diagonal bars
	B-6	main branching w/ many mid channel bars and islands
	B-7	mixed side bar and mid channel bars exceeding 2-3X width
	B-8	delta bars
Description:	vegetated (herbaceous) point bars; lateral bars (silt and fine sand common)	

Meander Pattern (indicate one)

x	M-1	regular meander
	M-2	tortuous meander
	M-3	irregular meander
	M-4	truncated meander
	M-5	unconfined me. scrolls
	M-6	confine me. scrolls
	M-7	distorted me. loops
	M-8	irregular with oxbows
Description:	freely-formed meanders, subtle pool-riffle morphology	

STREAM CHANNEL DEBRIS/BLOCKAGES (indicate one)

Materials, which upon placement into the active channel or floodprone area may cause and adjustment in channel dimensions or conditions, due to influences on the existing flow regime

	Description/Extent	
	D-1 (None)	Minor amounts of small, floatable material
	D-2 (Infrequent)	Debris consists of small, easily moved, floatable material; i.e. leaves, needles, small limbs, twigs, etc..
	D-3 (Moderate)	Increasing frequency of small to medium sized material, i.e. large limbs, branches, small logs that when accumulated effect 10% or less of the active channel cross-sectional area.
x	D-4 (Numerous)	Significant buildup of medium to large sized materials, i.e. large limbs, branches, small logs, or portions of trees that may occupy 10 to 30% of the active cross-sectional area.
	D-5 (Extensive)	Debris "dams" of predominantly larger materials, i.e. branches, logs, trees, etc., occupying 30 to 50% of the active channel cross-section, often extending across the width of the active channel.
	D-6 (Dominating)	Large, somewhat continuous debris "dams," extensive in nature and occupying over 50% of the active channel cross-section. Such accumulations may divert water into floodprone areas and form fish migration barriers, even when flows are at less than bankfull
	D-7 (Beaver Dams - Few)	An infrequent number of dams spaced such that normal streamflow and expected channel conditions exist in the reaches between dams.
	D-8 (Beaver Dams - Frequent)	Frequency of dams is such that backwater conditions exist for channel reaches between structures; where streamflow velocities are reduced and channel dimensions or conditions are influenced.
	D-9 (Beaver Dams - Abandoned)	Numerous abandoned dams, many of which have filled with sediment and/or breached, initiating a series of channel adjustments such as bank erosion, lateral migration, evulsion, aggradations and degradation.
	D-10 (Human Influences)	Structures, facilities, or materials related to land uses or development located within the floodprone area, such as diversions or low-head dams, controlled by-pass channels, velocity control structures, and various transportation encroachments that have

Notes:
Many downed trees cross channel - some spanning above WSEL; some submerged. Many moderate to small logs and branches buried in silt and fine sand deposits.

Loon Lake Dam Reach Upper Site (LL-G1) Pfankuch

Channel Stability (Pfankuch)

Study Reach Name: Upper Loon Lake
Crew Initials: JDS, MCM
Date: 6/2/2003
Start Time:
Stop Time:

		Category	(choose one for each of the four options for each category)		Place X in this column:
Upper Banks	1	Landform slope	Bank slope gradient <30%	2	
			Bank slope gradient 30-40%	4	
			Bank slope gradient 40-60%	6	
			Bank slope gradient 60+%	8	x
	2	Mass wasting	No evidence of past or future mass wasting	3	x
			Infrequent. Most likely healed over. Low future potential	6	
			Frequent or large, causing sediment nearly year long	9	
			Frequent or large causing sediment nearly year long or imminent danger of same	12	
	3	Debris jam potential	Essentially absent from immediate channel area	2	
			Present, but mostly small twigs and limbs	4	
			Moderate to heavy amounts, mostly larger sizes	6	x
			Moderate to heavy amounts, predominately lager sizes	8	
	4	Vegetative bank protection	90%+ plant density. Vigor and variety suggest a deep, dense soil binding root mass	3	x
			70-90% density. Fewer species or less vigor suggest less dense or deep root mass	6	
			<50-70% density. Lower vigor and fewer species from a shallow, discontinuous root mass	9	
			<50% density, fewer species and less vigor indicate poor, discontinuous and shallow root mass	12	
Lower Banks	5	Channel capacity	Ample for present plus some increases. Peak flows contained. W/D ration <7	1	
			Adequate. Bank overflows rare. W/D ratio 8-15	2	
			Barely contains present peaks. Occasional overbank floods. W/D ratio 15 to 25	3	
			Inadequate. Overbank flows common. W/D ratio >25	4	x
	6	Bank rock content	65%+ with large angular boulders. 12"+ common.	2	
			40-65%. Mostly small boulders to cobbles 6-12"	4	
			20-40%. With most in the 3-6" diameter class	6	
			20% rock fragments of gravel sizes, 1-3" or less	8	x
	7	Obstructions to flow	Rocks and logs firmly embedded. Flow pattern w/out cutting or deposition. Stable bed	2	
			Some present causing erosive cross currents and minor pool filling. Obstructions newer and less	4	x
			Moderately frequent, unstable obstructions move with high flows causing bank cutting and pool	6	
			Sediment traps full, channel migration occurring	8	
	8	Cutting	Little or none. Infrequent raw banks less than 6"	4	
			Some, intermittently at outcurves and constrictions. Raw banks may be up to 12"	6	x
			Significant. Cuts 12-24" high. Root mat overhangs and sloughing evident	12	
			Almost continuous cuts, some over 24" high. Failure of overhangs frequent	16	
	9	Deposition	Little or no enlargement of channel or point bars	4	
			Some new bar increase, mostly from coarse gravel	8	
			Moderate deposition of new gravel and course sand on old and some new bars	12	
			Extensive deposits of predominately fine particles. Accelerated bar development	16	x
Bottom	10	Rock angularity	Sharp edges and corners. Plane surfaces rough.	1	
			Rounded corners and edges, surfaces smooth, flat	2	
			Corners and edges well rounded in two dimensions	3	
			Well rounded in all dimensions, surfaces smooth	4	x
	11	Brightness	Surfaces dull, dark, or stained. Generally not bright	1	
			Mostly dull, but may have <35% bright surfaces	2	
			Mixture dull and bright, ie 35-65% mixture range	3	x
			Predominately bright, 65% exposed or scoured surfaces	4	
	12	Consolidation of particles	Assorted sizes tightly packed or overlapping	2	
			Moderately packed with some overlapping	4	
			Mostly loose assortment with no apparent overlap	6	x
			No packing evident. Loose assortment easily moved	8	
	13	Bottom size distribution	No size change evident. Stable mater. 80-100%	4	
			Distribution shift light. Stable material 50-80%	8	
			Moderate changes in sizes. Stable materials 20-50%	12	
			Marked distribution change. Stable materials 0-20%	16	x
	14	Scouring and deposition	<5% of bottom affected by scour or deposition	6	
			5-30% affected. Scour at constrictions and where grades steepen. Some deposition in pools	12	
			30-50% affected. Deposits and scour at obstructions, constrictions, and bends. Some filling of pools	18	x
			More than 50% of the bottom in a state of flux or change nearly year long	24	
	15	Aquatic vegetation	Abundant growth moss-like, dark green perennial. In swift water too.	1	
			Common. Algae forms in low velocity and pool areas. Moss here too	2	x
			Present but spotty, mostly in backwater. Seasonal algae growth makes rocks slick	3	
			Perennial types scare or absent. Yellow-green, short term bloom may be present	4	

Loon Lake Dam Reach Upper Site (LL-G1)
Bank Erosion and Vegetation

Bank Erosion and Vegetation

Study Reach Name: Upper Loon Lake **Crew Initials**: JDS, MCM
Date: 6/2/03 **Start Time**: **Stop Time**:

Bank material: sand, silt/clay

BANK EROSION POTENTIAL				
(if banks are bedrock or composed of boulders, do not fill out this table)				
	Bank a	**Bank b**	**Bank c**	**Bank d**
Bank height	12-18"	12-18"		
Bankfull height	10"	10"		
Root depth	12-18"	12-18"		
Root density (%)	80-100%	80-100%		
Bank Angle (degrees)	60-90	10--20		
Surface Protection (%)	80-100%	80-100%		
% of total study reach	80%	20%		

Notes

Stratification of unstable layers in banks (below bankfull):

Sediment supply: High
Vertical streambed stability: Aggrading
Bank and channel bed conditions notes:
Spalling of bedrock and prevasive overland flow during snowmelt leads to high rate of sand production to channel. Regulation of flow likely has led to lower transport and channel aggradation.

RIPARIAN VEGETATION				
	DENSITY (indicate all that apply)			
VEGETATION TYPE	**LOW**	**MOD.**	**HIGH**	**NOTES**
Bare				
Forbs only				
Annual Grass w/ forbes				
Perennial grass				
Rhizomatous grasses (bluegrass, Grass like plants, sedges, rushes)				
Low brush				
High brush				
Combination grass/brush			8c	
Deciduous overstory				
Deciduous w/brush/grass understory				
Perennial overstory			11c	
Wetland vegetation community				

VEGETATION NOTES (composition, vigor, density, and potential):

Loon Lake Dam Reach Middle Site (LL-G2)
LWD Frequency

LWD Frequency Data Sheet

Study Reach Name: Middle Loon Lake **Crew Initials: ZED, JLA, MCM**

Date:7/13/03 **Start time: 11:00** **End time: 1145**

Diameter Class	**Length Class** 3-10 ft (0.9-3.0 m)	10-25 ft (3.1-7.6 m)	25-50 ft (7.7-15.2 m)	50-75 ft (15.3-22.9 m)	>75 ft (>23 m)
6-12 in (10-30 cm)	5	7	5		
12-24 in (31-60 cm)	3	5	10		
24-36 in (61-90 cm)					
>36 in (>90 cm)					

"Tally as R if rootwad is attached."

Comments: There are many downed trees in the reach and large volume of LWD compared with other sites.
Because of low banks, LWD and jams tend to push flows around, creating forced overflow channels.
There are no pools in this reach caused by LWD with the exception of one area that is more like an aerction channel with stagnant water.
Many of the forced overflow channels are well vegetated with grasses and herbaceous plants.
So many dead pine and cedar trees because they get inundated so often?

Loon Lake Dam Reach Middle Site (LL-G2) V Star

No Vstar measurements taken.

Loon Lake Dam Reach Middle Site (LL-G2)
LWD Key Pieces

LWD Key Pieces Information

Study Reach Name: **Crew Initials:**

Date: **Start time:** **End time:**

Perform for 100 m of stream or reach length, whichever is greater. **Criteria for Determining Key Pieces to be Measured** (circle which used): (1) all pieces with length > 1.2 times bankfull channel width OR (2) pieces meeting criteria 1 and having diameters

KEY PIECE ATTRIBUTE	KEY PIECE NUMBER											
	1	2	3	4	5	6	7	8	9	10	11	12
Location on longitudinal profile												
Diameter (ft)	0.6	0.7	0.7	1.4	1	0.5	1.3	0.9	1	1.5	1.3	0.6
Length (ft)	27	30	25	20	30	27	35	40	50	30	35	25
rootwad attached	N	N	N	N	N	Y	N	N	N	Y	Y	N
LOCATION IN BANKFULL CHANNEL AREA												
< 25% of piece length in bankfull channel												
25-50% of piece length in bankfull channel							X			X	X	
50-75% of piece length in bankfull channel	X	X		X								X
75-100% of piece length in bankfull channel			X		X	X		X	X			
ORIENTATION												
Perpendicular	X	X								X	X	X
angled downstream									X			
angled upstream				X								
parallel or near parallel to channel			X		X	X	X	X				
FUNCTION IN CHANNEL												
located in bankfull channel, but not influencing channel morphology and not associated with pool habitat	X	X	X	X	X	X						X
associated with, but not creating pool habitat									X			
acting as complex instream cover										X	X	
(has attached rootwad or intact branches)												
acting as velocity refuge								X				
associated with LWD jam (3 or more key pieces)								X	X	X	X	
piece is acting as sediment storage site								X				
piece appears to be stable in stream channel*	X	X		X			X	X	X	X	X	X
POOL FORMATION												
forming dammed pool								X				
forming plunge pool												
forming lateral scour pool												
forming backwater pool								X	X			
pool surface area (m^2) associated with piece(s) (L x W)								2x3	2x3			
ADDITIONAL INFORMATION (OPTIONAL)												
decay class (1 = sound, limbs present; 2 = bark loose or absent, limbs absent, surface slightly rotted; 3 = surface extensively rotted, center solid or rotted)	3	3	3	3	3	3	3	3	3	1	1	3
tree species (C = conifer, D = deciduous, U = unknown)	U	U	U	U	U	U	U	U	U	C	C	U
input mechanism (W=windthrow, B=bank undercutting,	U	U	U	U	U	U	m?	U	U	W/M	W/M	U
D=debris flow, L=landslide, M=tree mortality, U=unkn)												

*Rootwad present, piece stabilized at more than one point by banks or channel obstructions, end anchored by streambed or bank burial, pegged by standing trees, spanning

Loon Lake Dam Reach Middle Site (LL-G2)
Rosgen Level III

Rosgen Level III Data Sheet

Study Reach Name: Middle Loon Lake
Date:7/13/03
Crew Initials: JLA, MCM, ZED
Start time: 1245 **End time: 1250**

Depositional Features (indicate one)

	B-1	point bars
	B-2	pt. bars w/ few mid channel bars
	B-3	many mid channel bars
x	B-4	side bars
	B-5	diagonal bars
	B-6	main branching w/ many mid channel bars and islands
	B-7	mixed side bar and mid channel bars exceeding 2-3X width
	B-8	delta bars

Description: very meager- one small mid-channel and one small point.

Meander Pattern (indicate one)

x	M-1	regular meander
	M-2	tortuous meander
	M-3	irregular meander
	M-4	truncated meander
	M-5	unconfined me. scrolls
	M-6	confine me. scrolls
	M-7	distorted me. loops
	M-8	irregular with oxbows

Description: almost no meander- flows go over bank and do not scour

STREAM CHANNEL DEBRIS/BLOCKAGES (indicate one)

Materials, which upon placement into the active channel or floodprone area may cause and adjustment in channel dimensions or conditions, due to influences on the existing flow regime

	Description/Extent	
	D-1 (None)	Minor amounts of small, floatable material
	D-2 (Infrequent)	Debris consists of small, easily moved, floatable material; i.e. leaves, needles, small limbs, twigs, etc..
	D-3 (Moderate)	Increasing frequency of small to medium sized material, i.e. large limbs, branches, small logs that when accumulated effect 10% or less of the active channel cross-sectional area.
x	D-4 (Numerous)	Significant buildup of medium to large sized materials, i.e. large limbs, branches, small logs, or portions of trees that may occupy 10 to 30% of the active cross-sectional area.
	D-5 (Extensive)	Debris "dams" of predominantly larger materials, i.e. branches, logs, trees, etc., occupying 30 to 50% of the active channel cross-section, often extending across the width of the active channel.
	D-6 (Dominating)	Large, somewhat continuous debris "dams," extensive in nature and occupying over 50% of the active channel cross-section. Such accumulations may divert water into floodprone areas and form fish migration barriers, even when flows are at less than bankfull
	D-7 (Beaver Dams - Few)	An infrequent number of dams spaced such that normal streamflow and expected channel conditions exist in the reaches between dams.
	D-8 (Beaver Dams - Frequent)	Frequency of dams is such that backwater conditions exist for channel reaches between structures; where streamflow velocities are reduced and channel dimensions or conditions are influenced.
	D-9 (Beaver Dams - Abandoned)	Numerous abandoned dams, many of which have filled with sediment and/or breached, initiating a series of channel adjustments such as bank erosion, lateral migration, evulsion, aggradations and degradation.
	D-10 (Human Influences)	Structures, facilities, or materials related to land uses or development located within the floodprone area, such as diversions or low-head dams, controlled by-pass channels, velocity control structures, and various transportation encroachments that have

Notes: LWD plentiful in reach withseveral debris jams

Loon Lake Dam Reach Middle Site (LL-G2) Pfankuch

Channel Stability (Pfankuch)
Study Reach Name: Loon Lake Middle
Crew Initials: MCM, JLA, ZED
Date: 7/13/03
Start Time: 1230
Stop Time: 1245

		Category	(choose one for each of the four options for each category)		Place X in this column:
Upper Banks	1	Landform slope	Bank slope gradient <30%	2	X
			Bank slope gradient 30-40%	4	
			Bank slope gradient 40-60%	6	
			Bank slope gradient 60+%	8	
	2	Mass wasting	No evidence of past or future mass wasting	3	X
			Infrequent. Most likely healed over. Low future potential	6	
			Frequent or large, causing sediment nearly year long	9	
			Frequent or large causing sediment nearly year long or imminent danger of same	12	
	3	Debris jam potential	Essentially absent from immediate channel area	2	X
			Present, but mostly small twigs and limbs	4	
			Moderate to heavy amounts, mostly larger sizes	6	
			Moderate to heavy amounts, predominately lager sizes	8	
	4	Vegetative bank protection	90%+ plant density. Vigor and variety suggest a deep, dense soil binding root mass	3	X
			70-90% density. Fewer species or less vigor suggest less dense or deep root mass	6	
			<50-70% density. Lower vigor and fewer species from a shallow, discontinuous root mass	9	
			<50% density, fewer species and less vigor indicate poor, discontinuous and shallow root mass	12	
Lower Banks	5	Channel capacity	Ample for present plus some increases. Peak flows contained. W/D ration <7	1	
			Adequate. Bank overflows rare. W/D ratio 8-15	2	
			Barely contains present peaks. Occasional overbank floods. W/D ratio 15 to 25	3	X
			Inadequate. Overbank flows common. W/D ratio >25	4	
	6	Bank rock content	65%+ with large angular boulders. 12"+ common.	2	
			40-65%. Mostly small boulders to cobbles 6-12"	4	X
			20-40%. With most in the 3-6" diameter class	6	
			20% rock fragments of gravel sizes, 1-3" or less	8	
	7	Obstructions to flow	Rocks and logs firmly embedded. Flow pattern w/out cutting or deposition. Stable bed	2	X
			Some present causing erosive cross currents and minor pool filling. Obstructions newer and less	4	
			Moderately frequent, unstable obstructions move with high flows causing bank cutting and pool	6	
			Sediment traps full, channel migration occurring	8	
	8	Cutting	Little or none. Infrequent raw banks less than 6"	4	X
			Some, intermittently at outcurves and constrictions. Raw banks may be up to 12"	6	
			Significant. Cuts 12-24" high. Root mat overhangs and sloughing evident	12	
			Almost continuous cuts, some over 24" high. Failure of overhangs frequent	16	
	9	Deposition	Little or no enlargement of channel or point bars	4	X
			Some new bar increase, mostly from coarse gravel	8	
			Moderate deposition of new gravel and course sand on old and some new bars	12	
			Extensive deposits of predominately fine particles. Accelerated bar development	16	
Bottom	10	Rock angularity	Sharp edges and corners. Plane surfaces rough.	1	
			Rounded corners and edges, surfaces smooth, flat	2	X
			Corners and edges well rounded in two dimensions	3	
			Well rounded in all dimensions, surfaces smooth	4	
	11	Brightness	Surfaces dull, dark, or stained. Generally not bright	1	X
			Mostly dull, but may have <35% bright surfaces	2	
			Mixture dull and bright, ie 35-65% mixture range	3	
			Predominately bright, 65% exposed or scoured surfaces	4	X
	12	Consolidation of particles	Assorted sizes tightly packed or overlapping	2	
			Moderately packed with some overlapping	4	
			Mostly loose assortment with no apparent overlap	6	
			No packing evident. Loose assortment easily moved	8	
	13	Bottom size distribution	No size change evident. Stable mater. 80-100%	4	X
			Distribution shift light. Stable material 50-80%	8	
			Moderate changes in sizes. Stable materials 20-50%	12	
			Marked distribution change. Stable materials 0-20%	16	
	14	Scouring and deposition	<5% of bottom affected by scour or deposition	6	
			5-30% affected. Scour at constrictions and where grades steepen. Some deposition in pools	12	X
			30-50% affected. Deposits and scour at obstructions, constrictions, and bends. Some filling of pools	18	
			More than 50% of the bottom in a state of flux or change nearly year long	24	
	15	Aquatic vegetation	Abundant growth moss-like, dark green perennial. In swift water too.	1	
			Common. Algae forms in low velocity and pool areas. Moss here too	2	
			Present but spotty, mostly in backwater. Seasonal algae growth makes rocks slick	3	X
			Perennial types scare or absent. Yellow-green, short term bloom may be present	4	

Notes:

Loon Lake Dam Reach Middle Site (LL-G2)
Bank Erosion and Vegetation

Bank Erosion and Vegetation

Study Reach Name: Loon Lake - Middle **Crew Initials**: ZED, MCM, JLA
Date: 7/13/03 **Start Time**: 121! **Stop Time**: 1230

BANK EROSION POTENTIAL				
(if banks are bedrock or composed of boulders, do not fill out this table)				
	Bank a	**Bank b**	**Bank c**	**Bank d**
Bank height (ft)	2	0		
Bankfull height (ft)	3	3		
Root depth (ft)	2	<1		
Root density (%)	30%	50		
Bank Angle (degrees)	80	20		
Surface Protection (%)	95%	95		
% of total study reach	75%	25		

Notes

Bank material: Cobble
Stratification of unstable layers in banks (below bankfull): N/A - banks stable and almost totally vegetated with uniform layers

Sediment supply: Low
Vertical streambed stability: Stable
Bank and channel bed conditions notes:
Channel and bank condition are extremely uniform throughout reach. Channel is wide and unconfined; banks are poorly defined - sometimes not at all.

RIPARIAN VEGETATION				
	DENSITY (indicate all that apply)			
VEGETATION TYPE	**LOW**	**MOD.**	**HIGH**	**NOTES**
Bare				
Forbs only				
Annual Grass w/ forbes				
Perennial grass				
Rhizomatous grasses (bluegrass, Grass like plants, sedges, rushes)				
Low brush				
High brush				
Combination grass/brush		8b		
Deciduous overstory	9a			some aspen
Deciduous w/brush/grass understory		10b		alders with grass & wildflower
Perennial overstory		11b		pines, cedars, firs - yong only (40-50 yrs)
Wetland vegetation community			Marsh	valley floor in almost all marsh/swampy

VEGETATION NOTES (composition, vigor, density, and potential):
Site is entirely vegetated. Was likely marsh/swamp through entire valley floor.
Conifers have stared establishing in last 40-50 years - likely from lower stream levels.

Loon Lake Dam Reach Lower Site (LL-G3)
LWD Frequency

LWD Frequency Data Sheet
Study Reach Name: Loon Lake - Lower **Crew Initials: MCM, ZED, JLA**
Date: 7/14/03 **Start time: 0924** **End time: 1200**

Diameter Class	Length Class 3-10 ft (0.9-3.0 m)	10-25 ft (3.1-7.6 m)	25-50 ft (7.7-15.2 m)	50-75 ft (15.3-22.9 m)	>75 ft (>23 m)
6-12 in (10-30 cm)	4		R	1	
12-24 in (31-60 cm)	1		R		
24-36 in (61-90 cm)	1				
>36 in (>90 cm)					

"Tally as R if rootwad is attached."

Comments:

Loon Lake Dam Reach Lower Site (LL-G3) V Star

V* Measurements
Study Reach Name: Lower Loon Lake **Crew Initials: ZED, MCM, JLA**
Date: 7/14/03 **Start time:** 1430 **End time:** 1435

Comments:
1. No Vstar measurments taken
2. Sand behind obstructions; deposited on banks by high flows
3. No sand filling pools; pools generally scarce and not filled with sand

Loon Lake Dam Reach Lower Site (LL-G3)
LWD Key Pieces

LWD Key Pieces Information

Study Reach Name: Loon Lake - Lower | **Crew Initials: MCM, ZED, JLA**
Date: 7/14/03 | **Start time: 0924** | **End time: 1200**

Perform for 100 m of stream or reach length, whichever is greater. **Criteria for Determining Key Pieces to be Measured** (circle which used): **(1) all pieces with length > 1.2 times bankfull channel width** OR (2) pieces meeting criteria 1 and having diameters

KEY PIECE ATTRIBUTE	KEY PIECE NUMBER											
	1	2	3	4	5	6	7	8	9	10	11	12
Location on longitudinal profile	/											
Diameter (in)	12											
Length (ft)	70											
rootwad attached	No											
LOCATION IN BANKFULL CHANNEL AREA												
< 25% of piece length in bankfull channel												
25-50% of piece length in bankfull channel												
50-75% of piece length in bankfull channel												
75-100% of piece length in bankfull channel	X											
ORIENTATION												
Perpendicular												
angled downstream	X											
angled upstream												
parallel or near parallel to channel												
FUNCTION IN CHANNEL												
located in bankfull channel, but not influencing channel morphology and not associated with pool habitat												
associated with, but not creating pool habitat												
acting as complex instream cover												
(has attached rootwad or intact branches)												
acting as velocity refuge	X											
associated with LWD jam (3 or more key pieces)												
piece is acting as sediment storage site												
piece appears to be stable in stream channel*												
POOL FORMATION												
forming dammed pool												
forming plunge pool	X											
forming lateral scour pool												
forming backwater pool												
pool surface area (ft^2) associated with piece(s) (L x W)	50											
ADDITIONAL INFORMATION (OPTIONAL)												
decay class (1 = sound, limbs present; 2 = bark loose or absent, limbs absent, surface slightly rotted; 3 = surface extensively rotted, center solid or rotted)	3											
tree species (C = conifer, D = deciduous, U = unknown)	C											
input mechanism (W=windthrow, B=bank undercutting,												
D=debris flow, L=landslide, M=tree mortality, U=unkn)	U											

*Rootwad present, piece stabilized at more than one point by banks or channel obstructions, end anchored by streambed or bank burial, pegged by standing trees, spanning

Loon Lake Dam Reach Lower Site (LL-G3)
Rosgen Level III

Rosgen Level III Data Sheet

Study Reach Name: Lower Loon Lake
Date: 7/14/03
Crew Initials: ZED, MCM, JLA
Start time: 1415 **End time: 1420**

Depositional Features (indicate one)

x	B-1	point bars
	B-2	pt. bars w/ few mid channel bars
	B-3	many mid channel bars
	B-4	side bars
	B-5	diagonal bars
	B-6	main branching w/ many mid channel bars and islands
	B-7	mixed side bar and mid channel bars exceeding 2-3X width
	B-8	delta bars

Description:

Meander Pattern (indicate one)

x	M-1	regular meander
	M-2	tortuous meander
	M-3	irregular meander
	M-4	truncated meander
	M-5	unconfined me. scrolls
	M-6	confine me. scrolls
	M-7	distorted me. loops
	M-8	irregular with oxbows

Description:

STREAM CHANNEL DEBRIS/BLOCKAGES (indicate one)

Materials, which upon placement into the active channel or floodprone area may cause and adjustment in channel dimensions or conditions, due to influences on the existing flow regime

	Description/Extent	
	D-1 (None)	Minor amounts of small, floatable material
x	D-2 (Infrequent)	Debris consists of small, easily moved, floatable material; i.e. leaves, needles, small limbs, twigs, etc..
	D-3 (Moderate)	Increasing frequency of small to medium sized material, i.e. large limbs, branches, small logs that when accumulated effect 10% or less of the active channel cross-sectional area.
	D-4 (Numerous)	Significant buildup of medium to large sized materials, i.e. large limbs, branches, small logs, or portions of trees that may occupy 10 to 30% of the active cross-sectional area.
	D-5 (Extensive)	Debris "dams" of predominantly larger materials, i.e. branches, logs, trees, etc., occupying 30 to 50% of the active channel cross-section, often extending across the width of the active channel.
	D-6 (Dominating)	Large, somewhat continuous debris "dams," extensive in nature and occupying over 50% of the active channel cross-section. Such accumulations may divert water into floodprone areas and form fish migration barriers, even when flows are at less than bankfull
	D-7 (Beaver Dams - Few)	An infrequent number of dams spaced such that normal streamflow and expected channel conditions exist in the reaches between dams.
	D-8 (Beaver Dams - Frequent)	Frequency of dams is such that backwater conditions exist for channel reaches between structures; where streamflow velocities are reduced and channel dimensions or conditions are influenced.
	D-9 (Beaver Dams - Abandoned)	Numerous abandoned dams, many of which have filled with sediment and/or breached, initiating a series of channel adjustments such as bank erosion, lateral migration, evulsion, aggradations and degradation.
	D-10 (Human Influences)	Structures, facilities, or materials related to land uses or development located within the floodprone area, such as diversions or low-head dams, controlled by-pass channels, velocity control structures, and various transportation encroachments that have

Notes: 3-4 LWD near XS 1

Loon Lake Dam Reach Lower Site (LL-G3) Pfankuch

Channel Stability (Pfankuch)
Study Reach Name: Loon Lake - Lower
Crew Initials: ZED, MCM, JLA
Date: 7/14/03
Start Time: 1420
Stop Time: 1430

		Category	(choose one for each of the four options for each category)		Place X in this column:
Upper Banks	1	Landform slope	Bank slope gradient <30%	2	
			Bank slope gradient 30-40%	4	X
			Bank slope gradient 40-60%	6	
			Bank slope gradient 60+%	8	
	2	Mass wasting	No evidence of past or future mass wasting	3	X
			Infrequent. Most likely healed over. Low future potential	6	
			Frequent or large, causing sediment nearly year long	9	
			Frequent or large causing sediment nearly year long or imminent danger of same	12	
	3	Debris jam potential	Essentially absent from immediate channel area	2	
			Present, but mostly small twigs and limbs	4	
			Moderate to heavy amounts, mostly larger sizes	6	X
			Moderate to heavy amounts, predominately lager sizes	8	
	4	Vegetative bank protection	90%+ plant density. Vigor and variety suggest a deep, dense soil binding root mass	3	
			70-90% density. Fewer species or less vigor suggest less dense or deep root mass	6	
			<50-70% density. Lower vigor and fewer species from a shallow, discontinuous root mass	9	X
			<50% density, fewer species and less vigor indicate poor, discontinuous and shallow root mass	12	
Lower Banks	5	Channel capacity	Ample for present plus some increases. Peak flows contained. W/D ration <7	1	X
			Adequate. Bank overflows rare. W/D ratio 8-15	2	
			Barely contains present peaks. Occasional overbank floods. W/D ratio 15 to 25	3	
			Inadequate. Overbank flows common. W/D ratio >25	4	
	6	Bank rock content	65%+ with large angular boulders. 12"+ common.	2	
			40-65%. Mostly small boulders to cobbles 6-12"	4	X
			20-40%. With most in the 3-6" diameter class	6	
			20% rock fragments of gravel sizes, 1-3" or less	8	
	7	Obstructions to flow	Rocks and logs firmly embedded. Flow pattern w/out cutting or deposition. Stable bed	2	
			Some present causing erosive cross currents and minor pool filling. Obstructions newer and less	4	X
			Moderately frequent, unstable obstructions move with high flows causing bank cutting and pool	6	
			Sediment traps full, channel migration occurring	8	
	8	Cutting	Little or none. Infrequent raw banks less than 6"	4	
			Some, intermittently at outcurves and constrictions. Raw banks may be up to 12"	6	X
			Significant. Cuts 12-24" high. Root mat overhangs and sloughing evident	12	
			Almost continuous cuts, some over 24" high. Failure of overhangs frequent	16	
	9	Deposition	Little or no enlargement of channel or point bars	4	
			Some new bar increase, mostly from coarse gravel	8	X
			Moderate deposition of new gravel and course sand on old and some new bars	12	
			Extensive deposits of predominately fine particles. Accelerated bar development	16	
Bottom	10	Rock angularity	Sharp edges and corners. Plane surfaces rough.	1	
			Rounded corners and edges, surfaces smooth, flat	2	
			Corners and edges well rounded in two dimensions	3	X
			Well rounded in all dimensions, surfaces smooth	4	
	11	Brightness	Surfaces dull, dark, or stained. Generally not bright	1	
			Mostly dull, but may have <35% bright surfaces	2	
			Mixture dull and bright, ie 35-65% mixture range	3	X
			Predominately bright, 65% exposed or scoured surfaces	4	
	12	Consolidation of particles	Assorted sizes tightly packed or overlapping	2	
			Moderately packed with some overlapping	4	X
			Mostly loose assortment with no apparent overlap	6	
			No packing evident. Loose assortment easily moved	8	
	13	Bottom size distribution	No size change evident. Stable mater. 80-100%	4	
			Distribution shift light. Stable material 50-80%	8	
			Moderate changes in sizes. Stable materials 20-50%	12	X
			Marked distribution change. Stable materials 0-20%	16	
	14	Scouring and deposition	<5% of bottom affected by scour or deposition	6	
			5-30% affected. Scour at constrictions and where grades steepen. Some deposition in pools	12	
			30-50% affected. Deposits and scour at obstructions, constrictions, and bends. Some filling of pools	18	X
			More than 50% of the bottom in a state of flux or change nearly year long	24	
	15	Aquatic vegetation	Abundant growth moss-like, dark green perennial. In swift water too.	1	
			Common. Algae forms in low velocity and pool areas. Moss here too	2	
			Present but spotty, mostly in backwater. Seasonal algae growth makes rocks slick	3	
			Perennial types scare or absent. Yellow-green, short term bloom may be present	4	X

Notes:

Loon Lake Dam Reach Lower Site (LL-G3)
Bank Erosion and Vegetation

Bank Erosion and Vegetation

Study Reach Name: Loon Lake - Lower **Crew Initials**: ZED, MCM, JLA
Date: 7/14/03 **Start Time**: 1400 **Stop Time**: 1415

BANK EROSION POTENTIAL				
(if banks are bedrock or composed of boulders, do not fill out this table)				
	Bank a	**Bank b**	**Bank c**	**Bank d**
Bank height (ft)	4	2		
Bankfull height (ft)	3	3.5		
Root depth (ft)	2	1		
Root density (%)	30%	30%		
Bank Angle (degrees)	35	20		
Surface Protection (%)	50%	70%		
% of total study reach	25%	75%		

Notes

Bank material: Cobble
Stratification of unstable layers in banks (below bankfull): Bottom of bank

Sediment supply: Moderate
Vertical streambed stability: Stable
Bank and channel bed conditions notes:
About 50% of reach river-left bank is cobble bar; river-right bank is low elevation pine forest with some high flow channels; evidence of high flow (debris jams present along river-right bank)

RIPARIAN VEGETATION				
	DENSITY (indicate all that apply)			
VEGETATION TYPE	**LOW**	**MOD.**	**HIGH**	**NOTES**
Bare	1			cobble bar on river-left bank
Forbs only				
Annual Grass w/ forbes				
Perennial grass				
Rhizomatous grasses (bluegrass, Grass like plants, sedges, rushes)				
Low brush	6a			whitethorn/willow
High brush		7b		alder/willow
Combination grass/brush				
Deciduous overstory				
Deciduous w/brush/grass understory				
Perennial overstory		11b		pines/cedars/firs
Wetland vegetation community				

VEGETATION NOTES (composition, vigor, density, and potential):

Gerle Creek Dam Reach Site (GC-G1)
LWD Frequency

LWD Frequency Data Sheet
Study Reach Name: Gerle Creek **Crew Initials: JDS, TNC**
Date: 5/21/03 **Start time: 1250; End time: ---**

Diameter Class	Length Class 3-10 ft (0.9-3.0 m)	10-25 ft (3.1-7.6 m)	25-50 ft (7.7-15.2 m)	50-75 ft (15.3-22.9 m)	>75 ft (>23 m)
6-12 in (10-30 cm)	4	R1	0	0	0
12-24 in (31-60 cm)	3	3	0	0	0
24-36 in (61-90 cm)	0	0	0	0	0
>36 in (>90 cm)	0	0	0	0	0

"Tally as R if rootwad is attached."

Comments: No key pieces (no datasheet filled out for key pieces).

Gerle Creek Dam Reach Site (GC-G1) V Star

No Vstar measurements taken.

Gerle Creek Dam Reach Site (GC-G1) Rosgen Level III

Rosgen Level III Data Sheet
Study Reach Name: Gerle Creek
Date: 5/20/03
Crew Initials: JDS, TNC
Start time: 1338; End time: 1340

Depositional Features (indicate one)

[none circled]	B-1	point bars
	B-2	pt. bars w/ few mid channel bars
	B-3	many mid channel bars
	B-4	side bars
	B-5	diagonal bars
	B-6	main branching w/ many mid channel bars and islands
	B-7	mixed side bar and mid channel bars exceeding 2-3X width
	B-8	delta bars

Description: Boulder bedrock, no bars; little to no mobile sediment

Meander Pattern (indicate one)

[none circled]	M-1	regular meander
	M-2	tortuous meander
	M-3	irregular meander
	M-4	truncated meander
	M-5	unconfined me. scrolls
	M-6	confine me. scrolls
	M-7	distorted me. loops
	M-8	irregular with oxbows

Description: Boulder bedrock channel. No meander pattern - straight.

STREAM CHANNEL DEBRIS/BLOCKAGES (indicate one)

Materials, which upon placement into the active channel or floodprone area may cause and adjustment in channel dimensions or conditions, due to influences on the existing flow regime

	Description/Extent	
X	D-1 (None)	Minor amounts of small, floatable material
	D-2 (Infrequent)	Debris consists of small, easily moved, floatable material; i.e. leaves, needles, small limbs, twigs, etc..
	D-3 (Moderate)	Increasing frequency of small to medium sized material, i.e. large limbs, branches, small logs that when accumulated effect 10% or less of the active channel cross-sectional area.
	D-4 (Numerous)	Significant buildup of medium to large sized materials, i.e. large limbs, branches, small logs, or portions of trees that may occupy 10 to 30% of the active cross-sectional area.
	D-5 (Extensive)	Debris "dams" of predominantly larger materials, i.e. branches, logs, trees, etc., occupying 30 to 50% of the active channel cross-section, often extending across the width of the active channel.
	D-6 (Dominating)	Large, somewhat continuous debris "dams," extensive in nature and occupying over 50% of the active channel cross-section. Such accumulations may divert water into floodprone areas and form fish migration barriers, even when flows are at less than bankfull.
	D-7 (Beaver Dams - Few)	An infrequent number of dams spaced such that normal streamflow and expected channel conditions exist in the reaches between dams.
	D-8 (Beaver Dams - Frequent)	Frequency of dams is such that backwater conditions exist for channel reaches between structures; where streamflow velocities are reduced and channel dimensions or conditions are influenced.
	D-9 (Beaver Dams - Abandoned)	Numerous abandoned dams, many of which have filled with sediment and/or breached, initiating a series of channel adjustments such as bank erosion, lateral migration, evulsion, aggradations and degradation.
	D-10 (Human Influences)	Structures, facilities, or materials related to land uses or development located within the floodprone area, such as diversions or low-head dams, controlled by-pass channels, velocity control structures, and various transportation encroachments that have influence on the existing flow regime, such that significant channel adjustments occur.

Notes:

Pool tailout/riffle crest from station 515 to 625 on long profile. Comprised of cobble/gravel. Occupied by riparian scrub.

This section is the only pushable alluvial deposit in the study reach (remaining portions of reach are all boulder/ bedrock).

Thalweg through pool tailout/riffle crest impinges on LB. High flow channel/oxbow with ponded water on RB at the pool tailout/riffle crest.

From station 640 on (along long profile) channel is confined by a bedrock wall (RB) and narrows. Bed of channel from 640 on is all exposed bedrock.

LB from 640 on (long profile) is low gradient hillslope of soil material over boulders - stable, no signs of bank erosion.

Gerle Creek Dam Reach Site (GC-G1) Pfankuch

Channel Stability (Pfankuch)

Study Reach Name: Gerle Creek
Crew Initials: **JDS, TNC**
Date: 5/20/2003
Start Time:
Stop Time:

		Category	(choose one for each of the four options for each category)		Place X in this column:
Upper Banks	1	Landform slope	Bank slope gradient <30%	2	x
			Bank slope gradient 30-40%	4	
			Bank slope gradient 40-60%	6	
			Bank slope gradient 60+%	8	
	2	Mass wasting	No evidence of past or future mass wasting	3	x
			Infrequent. Most likely healed over. Low future potential	6	
			Frequent or large, causing sediment nearly year long	9	
			Frequent or large causing sediment nearly year long or imminent danger of same	12	
	3	Debris jam potential	Essentially absent from immediate channel area	2	x
			Present, but mostly small twigs and limbs	4	
			Moderate to heavy amounts, mostly larger sizes	6	
			Moderate to heavy amounts, predominately lager sizes	8	
	4	Vegetative bank protection	90%+ plant density. Vigor and variety suggest a deep, dense soil binding root mass	3	x
			70-90% density. Fewer species or less vigor suggest less dense or deep root mass	6	
			<50-70% density. Lower vigor and fewer species from a shallow, discontinuous root mass	9	
			<50% density, fewer species and less vigor indicate poor, discontinuous and shallow root mass	12	
Lower Banks	5	Channel capacity	Ample for present plus some increases. Peak flows contained. W/D ration <7	1	x
			Adequate. Bank overflows rare. W/D ratio 8-15	2	
			Barely contains present peaks. Occasional overbank floods. W/D ratio 15 to 25	3	
			Inadequate. Overbank flows common. W/D ratio >25	4	
	6	Bank rock content	65%+ with large angular boulders. 12”+ common.	2	
			40-65%. Mostly small boulders to cobbles 6-12”	4	x
			20-40%. With most in the 3-6” diameter class	6	
			20% rock fragments of gravel sizes, 1-3” or less	8	
	7	Obstructions to flow	Rocks and logs firmly embedded. Flow pattern w/out cutting or deposition. Stable bed	2	x
			Some present causing erosive cross currents and minor pool filling. Obstructions newer and less	4	
			Moderately frequent, unstable obstructions move with high flows causing bank cutting and pool	6	
			Sediment traps full, channel migration occurring	8	
	8	Cutting	Little or none. Infrequent raw banks less than 6”	4	x
			Some, intermittently at outcurves and constrictions. Raw banks may be up to 12”	6	
			Significant. Cuts 12-24” high. Root mat overhangs and sloughing evident	12	
			Almost continuous cuts, some over 24” high. Failure of overhangs frequent	16	
	9	Deposition	Little or no enlargement of channel or point bars	4	x
			Some new bar increase, mostly from coarse gravel	8	
			Moderate deposition of new gravel and course sand on old and some new bars	12	
			Extensive deposits of predominately fine particles. Accelerated bar development	16	
Bottom	10	Rock angularity	Sharp edges and corners. Plane surfaces rough.	1	x
			Rounded corners and edges, surfaces smooth, flat	2	
			Corners and edges well rounded in two dimensions	3	
			Well rounded in all dimensions, surfaces smooth	4	
	11	Brightness	Surfaces dull, dark, or stained. Generally not bright	1	x
			Mostly dull, but may have <35% bright surfaces	2	
			Mixture dull and bright, ie 35-65% mixture range	3	
			Predominately bright, 65% exposed or scoured surfaces	4	
	12	Consolidation of particles	Assorted sizes tightly packed or overlapping	2	x
			Moderately packed with some overlapping	4	
			Mostly loose assortment with no apparent overlap	6	
			No packing evident. Loose assortment easily moved	8	
	13	Bottom size distribution	No size change evident. Stable mater. 80-100%	4	x
			Distribution shift light. Stable material 50-80%	8	
			Moderate changes in sizes. Stable materials 20-50%	12	
			Marked distribution change. Stable materials 0-20%	16	
	14	Scouring and deposition	<5% of bottom affected by scour or deposition	6	
			5-30% affected. Scour at constrictions and where grades steepen. Some deposition in pools	12	x
			30-50% affected. Deposits and scour at obstructions, constrictions, and bends. Some filling of pools	18	
			More than 50% of the bottom in a state of flux or change nearly year long	24	
	15	Aquatic vegetation	Abundant growth moss-like, dark green perennial. In swift water too.	1	x
			Common. Algae forms in low velocity and pool areas. Moss here too	2	
			Present but spotty, mostly in backwater. Seasonal algae growth makes rocks slick	3	
			Perennial types scare or absent. Yellow-green, short term bloom may be present	4	

Notes: Applies only to pool margins. Remaining portion of reach are boulder or bedrock (sheet does not apply to rest of reach)

Gerle Creek Dam Reach Site (GC-G1)
Bank Erosion and Vegetation

Bank Erosion and Vegetation

Study Reach Name: Gerle Creek **Crew Initials**: JDS, TNC
Date: 5/20/03 **Start Time**: 1748 **Stop Time**: ---

BANK EROSION POTENTIAL				
(if banks are bedrock or composed of boulders, do not fill out this table)				
	Bank a	**Bank b**	**Bank c**	**Bank d**
Bank height	3 ft			
Bankfull height	1.5 ft			
Root depth	2.0+ ft			
Root density (%)	30%			
Bank Angle (degrees)	20-40 %			
Surface Protection (%)	100%			
% of total study reach	35%			

Notes This only applies to margin of big pool.

Bank material: Bedrock - boulders
Stratification of unstable layers in banks (below bankfull): Banks un-stratified

Sediment supply: low
Vertical streambed stability: stable
Bank and channel bed conditions notes:
See back of Rosgen Level III datasheet for notes. Little or no fine sediment stored in reach, except in deposit parts of the big pool.

RIPARIAN VEGETATION				
	DENSITY (indicate all that apply)			
VEGETATION TYPE	**LOW**	**MOD.**	**HIGH**	**NOTES**
Bare				
Forbs only				
Annual Grass w/ forbes		3b		
Perennial grass				
Rhizomatous grasses (bluegrass, Grass like plants, sedges, rushes)				
Low brush	6a			??? Below chest.
High brush			7c	
Combination grass/brush		8b		
Deciduous overstory				none
Deciduous w/brush/grass understory		10b		
Perennial overstory		11b		
Wetland vegetation community				doesn't apply.

VEGETATION NOTES (composition, vigor, density, and potential):
This only applies to margin and tailout of pool. Little to no veg. In other parts of reach.

Robbs Peak Dam Reach Site (RPD-G1)
LWD Frequency

LWD Frequency Data Sheet

Study Reach Name: Robbs Peak **Crew Initials:** CAB, TNC, MCM
Date: 5/19/2003 **Start time:** 18:46 **End time:**

Diameter Class	Length Class 3-10 ft (0.9-3.0 m)	10-25 ft (3.1-7.6 m)	25-50 ft (7.7-15.2 m)	50-75 ft (15.3-22.9 m)	>75 ft (>23 m)
6-12 in (10-30 cm)					
12-24 in (31-60 cm)		1			
24-36 in (61-90 cm)					
>36 in (>90 cm)	1				

"Tally as R if rootwad is attached."

Comments:
Almost no LWD in BF channel. There is lots of wood rafted during extreme events (>5-1R Good [?]) that provide little or no habitat. Approximately 5 LWD jams were observed in the low water channel between the dam and the upstream end of the site, most key pieces were locally derived, w/ some smaller logs floated in. No key pieces.
QA Check: CAB

Robbs Peak Dam Reach Site (RPD-G1) V Star

V star Measurements

Study Reach Name: Robbs Peak **Crew Initials: CAB, TNC, MCM**
Date: 5/19/03 **Start time: ----; End time: ----**

Comments:
No V* measurements taken.
No well defined residual pools, no discrete sand deposits.

Robbs Peak Dam Reach Site (RPD-G1)
Rosgen Level III

Rosgen Level III Data Sheet

Study Reach Name: Robbs Peak
Date: 5/19/2003
Crew Initials: CAB, TNC, MCM
Start time: 18:46 **End time:** 18:48

Depositional Features (indicate one)

	B-1	point bars
	B-2	pt. bars w/ few mid channel bars
x	B-3	many mid channel bars
	B-4	side bars
	B-5	diagonal bars
	B-6	main branching w/ many mid channel bars and islands
	B-7	mixed side bar and mid channel bars exceeding 2-3X width
	B-8	delta bars
Description:	mid-channel bars with willow	

Meander Pattern (indicate one)

	M-1	regular meander
	M-2	tortuous meander
x	M-3	irregular meander
	M-4	truncated meander
	M-5	unconfined me. scrolls
	M-6	confine me. scrolls
	M-7	distorted me. loops
	M-8	irregular with oxbows
Description:	it's a big mess of mid channel bars and abondoned side channels	

STREAM CHANNEL DEBRIS/BLOCKAGES (indicate one)

Materials, which upon placement into the active channel or floodprone area may cause and adjustment in channel dimensions or conditions, due to influences on the existing flow regime

	Description/Extent		
x	D-1 (None)	Minor amounts of small, floatable material	in low-water/bankful channel
	D-2 (Infrequent)	Debris consists of small, easily moved, floatable material; i.e. leaves, needles, small limbs, twigs, etc..	
	D-3 (Moderate)	Increasing frequency of small to medium sized material, i.e. large limbs, branches, small logs that when accumulated effect 10% or less of the active channel cross-sectional area.	
x	D-4 (Numerous)	Significant buildup of medium to large sized materials, i.e. large limbs, branches, small logs, or portions of trees that may occupy 10 to 30% of the active cross-sectional area.	in active channel
	D-5 (Extensive)	Debris "dams" of predominantly larger materials, i.e. branches, logs, trees, etc., occupying 30 to 50% of the active channel cross-section, often extending across the width of the active channel.	
	D-6 (Dominating)	Large, somewhat continuous debris "dams," extensive in nature and occupying over 50% of the active channel cross-section. Such accumulations may divert water into floodprone areas and form fish migration barriers, even when flows are at less than bankfull	
	D-7 (Beaver Dams - Few)	An infrequent number of dams spaced such that normal streamflow and expected channel conditions exist in the reaches between dams.	
	D-8 (Beaver Dams - Frequent)	Frequency of dams is such that backwater conditions exist for channel reaches between structures; where streamflow velocities are reduced and channel dimensions or conditions are influenced.	
	D-9 (Beaver Dams - Abandoned)	Numerous abandoned dams, many of which have filled with sediment and/or breached, initiating a series of channel adjustments such as bank erosion, lateral migration, evulsion, aggradations and degradation.	
	D-10 (Human Influences)	Structures, facilities, or materials related to land uses or development located within the floodprone area, such as diversions or low-head dams, controlled by-pass channels, velocity control structures, and various transportation encroachments that have	

Robbs Peak Dam Reach Site (RPD-G1) Pfankuch

Channel Stability (Pfankuch)

Study Reach Name: Robbs Peak
Crew Initials: CAB
Date: 5/19/2003
Start Time: 17:15
Stop Time:

		Category	(choose one for each of the four options for each category)		Place X in this column:
Upper Banks	1	Landform slope	Bank slope gradient <30%	2	x
			Bank slope gradient 30-40%	4	
			Bank slope gradient 40-60%	6	
			Bank slope gradient 60+%	8	
	2	Mass wasting	No evidence of past or future mass wasting	3	
			Infrequent. Most likely healed over. Low future potential	6	x
			Frequent or large, causing sediment nearly year long	9	
			Frequent or large causing sediment nearly year long or imminent danger of same	12	
	3	Debris jam potential	Essentially absent from immediate channel area	2	x
			Present, but mostly small twigs and limbs	4	
			Moderate to heavy amounts, mostly larger sizes	6	
			Moderate to heavy amounts, predominately lager sizes	8	
	4	Vegetative bank protection	90%+ plant density. Vigor and variety suggest a deep, dense soil binding root mass	3	
			70-90% density. Fewer species or less vigor suggest less dense or deep root mass	6	x
			<50-70% density. Lower vigor and fewer species from a shallow, discontinuous root mass	9	
			<50% density, fewer species and less vigor indicate poor, discontinuous and shallow root mass	12	
Lower Banks	5	Channel capacity	Ample for present plus some increases. Peak flows contained. W/D ration <7	1	
			Adequate. Bank overflows rare. W/D ratio 8-15	2	x
			Barely contains present peaks. Occasional overbank floods. W/D ratio 15 to 25	3	
			Inadequate. Overbank flows common. W/D ratio >25	4	
	6	Bank rock content	65%+ with large angular boulders. 12"+ common.	2	
			40-65%. Mostly small boulders to cobbles 6-12"	4	
			20-40%. With most in the 3-6" diameter class	6	x
			20% rock fragments of gravel sizes, 1-3" or less	8	
	7	Obstructions to flow	Rocks and logs firmly embedded. Flow pattern w/out cutting or deposition. Stable bed	2	
			Some present causing erosive cross currents and minor pool filling. Obstructions newer and less	4	x
			Moderately frequent, unstable obstructions move with high flows causing bank cutting and pool	6	
			Sediment traps full, channel migration occurring	8	
	8	Cutting	Little or none. Infrequent raw banks less than 6"	4	
			Some, intermittently at outcurves and constrictions. Raw banks may be up to 12"	6	
			Significant. Cuts 12-24" high. Root mat overhangs and sloughing evident	12	x
			Almost continuous cuts, some over 24" high. Failure of overhangs frequent	16	
	9	Deposition	Little or no enlargement of channel or point bars	4	x
			Some new bar increase, mostly from coarse gravel	8	
			Moderate deposition of new gravel and course sand on old and some new bars	12	
			Extensive deposits of predominately fine particles. Accelerated bar development	16	
Bottom	10	Rock angularity	Sharp edges and corners. Plane surfaces rough.	1	
			Rounded corners and edges, surfaces smooth, flat	2	x
			Corners and edges well rounded in two dimensions	3	
			Well rounded in all dimensions, surfaces smooth	4	
	11	Brightness	Surfaces dull, dark, or stained. Generally not bright	1	
			Mostly dull, but may have <35% bright surfaces	2	x
			Mixture dull and bright, ie 35-65% mixture range	3	
			Predominately bright, 65% exposed or scoured surfaces	4	
	12	Consolidation of particles	Assorted sizes tightly packed or overlapping	2	
			Moderately packed with some overlapping	4	
			Mostly loose assortment with no apparent overlap	6	x
			No packing evident. Loose assortment easily moved	8	
	13	Bottom size distribution	No size change evident. Stable mater. 80-100%	4	
			Distribution shift light. Stable material 50-80%	8	x
			Moderate changes in sizes. Stable materials 20-50%	12	
			Marked distribution change. Stable materials 0-20%	16	
	14	Scouring and deposition	<5% of bottom affected by scour or deposition	6	x
			5-30% affected. Scour at constrictions and where grades steepen. Some deposition in pools	12	
			30-50% affected. Deposits and scour at obstructions, constrictions, and bends. Some filling of pools	18	
			More than 50% of the bottom in a state of flux or change nearly year long	24	
	15	Aquatic vegetation	Abundant growth moss-like, dark green perennial. In swift water too.	1	x
			Common. Algae forms in low velocity and pool areas. Moss here too	2	
			Present but spotty, mostly in backwater. Seasonal algae growth makes rocks slick	3	
			Perennial types scare or absent. Yellow-green, short term bloom may be present	4	

Notes: The brightness is B.S. (bright where we walked). Rocks are bright but totally covered in algae. The size distribution doesn't work either. Bed poorly sorted. These categories do not apply here.

Robbs Peak Dam Reach Site (RPD-G1)
Bank Erosion and Vegetation

Bank Erosion and Vegetation

Study Reach Name: Robbs Peak **Crew Initials**: CAB, TNC, MCM
Date: 5/19/2003 **Start Time**: 18:57 **Stop Time**: 19:07

Bank material: Gravel with high sand

BANK EROSION POTENTIAL				
(if banks are bedrock or composed of boulders, do not fill out this table)				
	Bank a	**Bank b**	**Bank c**	**Bank d**
Bank height	2'	3'	BO	1'
Bankfull height	1.5'	1.5'	BO	1'
Root depth	2'	3'	BO	1'
Root density (%)	70%	75	BO	75
Bank Angle (degrees)	vertical	vertical	BO	20
Surface Protection (%)	none	none	BO	20
% of total study reach	20%	30	20	30

Notes

Stratification of unstable layers in banks (below bankfull): top of bank; there is no stratification

Sediment supply: moderate
Vertical streambed stability: stable
Bank and channel bed conditions notes:
sediment supply is moderate, but high flows capable of tranporting gravel. Banks eroding because of veg encroachment. The river avulses between side channels during high flow.

RIPARIAN VEGETATION				
	DENSITY (indicate all that apply)			
VEGETATION TYPE	**LOW**	**MOD.**	**HIGH**	**NOTES**
Bare		1		high unvegetated bar
Forbs only				
Annual Grass w/ forbes				
Perennial grass				
Rhizomatous grasses (bluegrass, Grass like plants, sedges, rushes)				
Low brush				
High brush				
Combination grass/brush			8c	willows
Deciduous overstory				
Deciduous w/brush/grass understory				
Perennial overstory		11b		lots of small pines
Wetland vegetation community				

VEGETATION NOTES (composition, vigor, density, and potential):
Very dense willows

Ice House Dam Reach Upper Site (IH-G1)
LWD Frequency

LWD Frequency Data Sheet

Study Reach Name: Upper Ice House **Crew Initials:** JDS, RAP
Date: 5/15/2003 **Start time:** **End time:**

Diameter Class	Length Class 3-10 ft (0.9-3.0 m)	10-25 ft (3.1-7.6 m)	25-50 ft (7.7-15.2 m)	50-75 ft (15.3-22.9 m)	>75 ft (>23 m)
6-12 in (10-30 cm)	2	1	1		
12-24 in (31-60 cm)	3	4		2	
24-36 in (61-90 cm)					
>36 in (>90 cm)					

"Tally as R if rootwad is attached."

Comments:
All of the wood is stored in the channel downstream of XS2 where channel is steeper and narrower.

Ice House Dam Reach Upper Site (IH-G1) V Star

V* Measurements

Study Reach Name: Upper Ice House **Crew Initials:** JDS, RAP
Date: 5/15/2003 **Start time:** **End time:**

Comments:
No V* measurements taken.
1. Reach is predominantly gravel/sand facies.
2. Little or no evidence of material finer than sand except on floodplain/low bench surfaces.
3. Only one "pool" at upstream end of reach, and it's too deep and doesn't have evidence of fine sediment deposits.
4. No other well-defined pools.

Ice House Dam Reach Upper Site (IH-G1)
LWD Key Pieces

LWD Key Pieces Information

Study Reach Name: Upper Ice House **Crew Initials:** JDS, RAP
Date: 5/15/2003 **Start time:** **End time:**

Perform for 100 m of stream or reach length, whichever is greater. **Criteria for Determining Key Pieces to be Measured** (circle which used): (1) all pieces with length > 1.2 times bankfull channel width OR (2) pieces meeting criteria 1 and having diameters

KEY PIECE ATTRIBUTE	KEY PIECE NUMBER											
	1	2	3	4	5	6	7	8	9	10	11	12
Location on longitudinal profile												
Diameter (inches)	12--24	12--24	12--24									
Length (ft)	75	75	>25									
rootwad attached	Y	y	n									
LOCATION IN BANKFULL CHANNEL AREA												
< 25% of piece length in bankfull channel												
25-50% of piece length in bankfull channel												
50-75% of piece length in bankfull channel			Y									
75-100% of piece length in bankfull channel	Y	Y										
ORIENTATION												
Perpendicular	Y	Y										
angled downstream												
angled upstream			Y									
parallel or near parallel to channel												
FUNCTION IN CHANNEL												
located in bankfull channel, but not influencing channel morphology and not associated with pool habitat	Y	Y	Y									
associated with, but not creating pool habitat												
acting as complex instream cover	Y	Y										
(has attached rootwad or intact branches)												
acting as velocity refuge	Y	Y										
associated with LWD jam (3 or more key pieces)												
piece is acting as sediment storage site			Y									
piece appears to be stable in stream channel*	Y	Y	Y									
POOL FORMATION												
forming dammed pool												
forming plunge pool												
forming lateral scour pool												
forming backwater pool	Y	Y										
pool surface area (m^2) associated with piece(s) (L x W)	15	15										
ADDITIONAL INFORMATION (OPTIONAL)												
decay class (1 = sound, limbs present; 2 = bark loose or absent, limbs absent, surface slightly rotted; 3 = surface extensively rotted, center solid or rotted)	1	1	2									
tree species (C = conifer, D = deciduous, U = unknown)	C	C	U									
input mechanism (W=windthrow, B=bank undercutting,	U	U	U									
D=debris flow, L=landslide, M=tree mortality, U=unkn)												

*Rootwad present, piece stabilized at more than one point by banks or channel obstructions, end anchored by streambed or bank burial, pegged by standing trees, spanning

Ice House Dam Reach Upper Site (IH-G1)
Rosgen Level III

Rosgen Level III Data Sheet

Study Reach Name: Upper Ice House
Date: 5/15/2003
Crew Initials: JDS/RAP
Start time: **End time:**

Depositional Features (indicate one)

x	B-1	point bars	
	B-2	pt. bars w/ few mid channel bars	
	B-3	many mid channel bars	
x	B-4	side bars	lateral
	B-5	diagonal bars	
	B-6	main branching w/ many mid channel bars and islands	
	B-7	mixed side bar and mid channel bars exceeding 2-3X width	
	B-8	delta bars	

Description: Sand/gravel bars common. Reach comprised of two point bar sequences.

Meander Pattern (indicate one)

x	M-1	regular meander
	M-2	tortuous meander
	M-3	irregular meander
	M-4	truncated meander
	M-5	unconfined me. scrolls
	M-6	confine me. scrolls
	M-7	distorted me. loops
	M-8	irregular with oxbows

Description: Frequent terrace surfaces approx. 3-5m above bankfull (see upper XS). Terraces retain oxbox characteristics.

STREAM CHANNEL DEBRIS/BLOCKAGES (indicate one)

Materials, which upon placement into the active channel or floodprone area may cause and adjustment in

	Description/Extent	
	D-1 (None)	Minor amounts of small, floatable material
	D-2 (Infrequent)	Debris consists of small, easily moved, floatable material; i.e. leaves, needles, small limbs, twigs, etc..
x	D-3 (Moderate)	Increasing frequency of small to medium sized material, i.e. large limbs, branches, small logs that when accumulated effect 10% or less of the active channel cross-sectional area.
	D-4 (Numerous)	Significant buildup of medium to large sized materials, i.e. large limbs, branches, small logs, or portions of trees that may occupy 10 to 30% of the active cross-sectional area.
	D-5 (Extensive)	Debris "dams" of predominantly larger materials, i.e. branches, logs, trees, etc., occupying 30 to 50% of the active channel cross-section, often extending across the width of the active channel.
	D-6 (Dominating)	Large, somewhat continuous debris "dams," extensive in nature and occupying over 50% of the active channel cross-section. Such accumulations may divert water into floodprone areas and form fish migration barriers, even when flows are at less than bankfull
	D-7 (Beaver Dams - Few)	An infrequent number of dams spaced such that normal streamflow and expected channel conditions exist in the reaches between dams.
	D-8 (Beaver Dams - Frequent)	Frequency of dams is such that backwater conditions exist for channel reaches between structures; where streamflow velocities are reduced and channel dimensions or conditions are influenced.
	D-9 (Beaver Dams - Abandoned)	Numerous abandoned dams, many of which have filled with sediment and/or breached, initiating a series of channel adjustments such as bank erosion, lateral migration, evulsion, aggradations and degradation.
	D-10 (Human Influences)	Structures, facilities, or materials related to land uses or development located within the floodprone area, such as diversions or low-head dams, controlled by-pass channels, velocity control structures, and various transportation encroachments that have

Notes:
Only a few logs w/ little influence on channel.

Ice House Dam Reach Upper Site (IH-G1) Pfankuch

Channel Stability (Pfankuch)

Study Reach Name: Upper Ice House
Crew Initials: JDS, RAP
Date: 5/15/2003
Start Time: **Stop Time:**

		Category	(choose one for each of the four options for each category)		
Upper Banks	1	Landform slope	Bank slope gradient <30%	2	x
			Bank slope gradient 30-40%	4	
			Bank slope gradient 40-60%	6	
			Bank slope gradient 60+%	8	
	2	Mass wasting	No evidence of past or future mass wasting	3	x
			Infrequent. Most likely healed over. Low future potential	6	
			Frequent or large, causing sediment nearly year long	9	
			Frequent or large causing sediment nearly year long or imminent danger of same	12	
	3	Debris jam potential	Essentially absent from immediate channel area	2	x
			Present, but mostly small twigs and limbs	4	
			Moderate to heavy amounts, mostly larger sizes	6	
			Moderate to heavy amounts, predominately lager sizes	8	
	4	Vegetative bank protection	90%+ plant density. Vigor and variety suggest a deep, dense soil binding root mass	3	x
			70-90% density. Fewer species or less vigor suggest less dense or deep root mass	6	
			<50-70% density. Lower vigor and fewer species from a shallow, discontinuous root mass	9	
			<50% density, fewer species and less vigor indicate poor, discontinuous and shallow root mass	12	
Lower Banks	5	Channel capacity	Ample for present plus some increases. Peak flows contained. W/D ration <7	1	
			Adequate. Bank overflows rare. W/D ratio 8-15	2	x
			Barely contains present peaks. Occasional overbank floods. W/D ratio 15 to 25	3	
			Inadequate. Overbank flows common. W/D ratio >25	4	
	6	Bank rock content	65%+ with large angular boulders. 12”+ common.	2	
			40-65%. Mostly small boulders to cobbles 6-12”	4	
			20-40%. With most in the 3-6” diameter class	6	x
			20% rock fragments of gravel sizes, 1-3” or less	8	
	7	Obstructions to flow	Rocks and logs firmly embedded. Flow pattern w/out cutting or deposition. Stable bed	2	
			Some present causing erosive cross currents and minor pool filling. Obstructions newer and less firm	4	x
			Moderately frequent, unstable obstructions move with high flows causing bank cutting and pool filling	6	
			Sediment traps full, channel migration occurring	8	
	8	Cutting	Little or none. Infrequent raw banks less than 6”	4	
			Some, intermittently at outcurves and constrictions. Raw banks may be up to 12”	6	x
			Significant. Cuts 12-24” high. Root mat overhangs and sloughing evident	12	
			Almost continuous cuts, some over 24” high. Failure of overhangs frequent	16	
	9	Deposition	Little or no enlargement of channel or point bars	4	
			Some new bar increase, mostly from coarse gravel	8	x
			Moderate deposition of new gravel and course sand on old and some new bars	12	
			Extensive deposits of predominately fine particles. Accelerated bar development	16	
Bottom	10	Rock angularity	Sharp edges and corners. Plane surfaces rough.	1	
			Rounded corners and edges, surfaces smooth, flat	2	x
			Corners and edges well rounded in two dimensions	3	
			Well rounded in all dimensions, surfaces smooth	4	
	11	Brightness	Surfaces dull, dark, or stained. Generally not bright	1	
			Mostly dull, but may have <35% bright surfaces	2	x
			Mixture dull and bright, ie 35-65% mixture range	3	
			Predominately bright, 65% exposed or scoured surfaces	4	
	12	Consolidation of particles	Assorted sizes tightly packed or overlapping	2	
			Moderately packed with some overlapping	4	x
			Mostly loose assortment with no apparent overlap	6	
			No packing evident. Loose assortment easily moved	8	
	13	Bottom size distribution	No size change evident. Stable mater. 80-100%	4	
			Distribution shift light. Stable material 50-80%	8	x
			Moderate changes in sizes. Stable materials 20-50%	12	
			Marked distribution change. Stable materials 0-20%	16	
	14	Scouring and deposition	<5% of bottom affected by scour or deposition	6	
			5-30% affected. Scour at constrictions and where grades steepen. Some deposition in pools	12	x
			30-50% affected. Deposits and scour at obstructions, constrictions, and bends. Some filling of pools	18	
			More than 50% of the bottom in a state of flux or change nearly year long	24	
	15	Aquatic vegetation	Abundant growth moss-like, dark green perennial. In swift water too.	1	
			Common. Algae forms in low velocity and pool areas. Moss here too	2	x
			Present but spotty, mostly in backwater. Seasonal algae growth makes rocks slick	3	
			Perennial types scare or absent. Yellow-green, short term bloom may be present	4	

Notes: Banks all appear to be vegetated and stable. Bankfull margin typically comprised of medium gravel and sand deposits (alternating bars and point bars). Little or no signs of bank erosion.

Ice House Dam Reach Upper Site (IH-G1)
Bank Erosion and Vegetation

Bank Erosion and Vegetation

Study Reach Name: Upper Ice House **Crew Initials**: JDS, RAP
Date: 5/15/2003 **Start Time**: **Stop Time**:
Bank material: gravel with high sand

BANK EROSION POTENTIAL				
(if banks are bedrock or composed of boulders, do not fill out this table)				
	Bank a	**Bank b**	**Bank c**	**Bank d**
Bank height	3'	3'	2.5'	
Bankfull height	3'	2.5'	2.5'	
Root depth	2'	3'	2.5'	
Root density (%)	<10	40	50	
Bank Angle (degrees)	30	80	30	
Surface Protection (%)	10%	25	50	
% of total study reach	20%	10	70	

Notes

Stratification of unstable layers in banks (below bankfull): little stratification in bank profile

Sediment supply: moderate

Vertical streambed stability: aggrading — loose bed material and sand/fine gravel in pools suggest a lot of bed mobilization

Bank and channel bed conditions notes:
Moderately high supply of sand and gravel (from where?). Could be 1) passed through/over dam; 2) derived from banks (unlikely-no signs of bank erosion); 3) scoured from bed in upper part of reach

RIPARIAN VEGETATION				
	DENSITY (indicate all that apply)			
VEGETATION TYPE	**LOW**	**MOD.**	**HIGH**	**NOTES**
Bare	1			
Forbs only				
Annual Grass w/ forbes		3b		
Perennial grass		4b		
Rhizomatous grasses (bluegrass, Grass like plants, sedges, rushes)	5a			
Low brush		6b		
High brush			7c	
Combination grass/brush			8c	
Deciduous overstory	9a			
Deciduous w/brush/grass understory	10a			
Perennial overstory		11b		conifer
Wetland vegetation community				

VEGETATION NOTES (composition, vigor, density, and potential):

Ice House Dam Reach Lower Site (IH-G2)
LWD Frequency

LWD Frequency Data Sheet

Study Reach Name: Ice House Dam - Lower **Crew Initials: MCM, JDS**

Date: 5/18/03 **Start time: 0930** **End time: 1140**

Diameter Class	Length Class 3-10 ft (0.9-3.0 m)	10-25 ft (3.1-7.6 m)	25-50 ft (7.7-15.2 m)	50-75 ft (15.3-22.9 m)	>75 ft (>23 m)
6-12 in (10-30 cm)	14, RRR	5, RRR	2, RRR	1	
12-24 in (31-60 cm)	13	3, R	1, R		
24-36 in (61-90 cm)	3	1	1		
>36 in (>90 cm)	1	2			

"Tally as R if rootwad is attached."

Comments:

Photo number 65 (digital card 64MB) looking upstream at Jay near cross-section 2. Note LWD on left bank. In reach, there were two medium-sized log jams (see photo), but wood appears to only cause local scour, and is not affecting the channel much. Some local scour (1-1.5 feet) and sand deposits around wood. Most of the wood is only touching the wetted channel and is perched up on boulders or channel banks. Photo number 67, looking upstream. Note that LWD is not in water - perched up on bedrock. NO KEY PIECES IN REACH.

Ice House Dam Reach Lower Site (IH-G2)
V Star

V* Measurements

Study Reach Name: Lower Ice House **Crew Initials:** MCM/JDS

Date: 5/18/2003 **Start time:** **End time:**

Comments:

Pool morphology not present in this reach (it's all plane bed runs and riffles)

All fine sediment is draped in thin sheets over bed, except in only localized areas (e.g., behind a log or boulder).

No deep sand deposits in reach.

Ice House Dam Reach Lower Site (IH-G2)
Rosgen Level III

Rosgen Level III Data Sheet

Study Reach Name: Lower Ice House Dam
Date: 5/18/2003
Crew Initials: MCM/JDS
Start time: 9:30 **End time:** 9:50

Depositional Features (indicate one)

	B-1	point bars
	B-2	pt. bars w/ few mid channel bars
	B-3	many mid channel bars
X	B-4	side bars
	B-5	diagonal bars
	B-6	main branching w/ many mid channel bars and islands
	B-7	mixed side bar and mid channel bars exceeding 2-3X width
	B-8	delta bars

Description: Not really bars. Active terrace-plane bed channel with local deposits behind boulder obstructions.

Meander Pattern (indicate one)

X	M-1	regular meander
	M-2	tortuous meander
	M-3	irregular meander
	M-4	truncated meander
	M-5	unconfined me. scrolls
	M-6	confine me. scrolls
	M-7	distorted me. loops
	M-8	irregular with oxbows

Description: Not much meandering; mostly 2 straight channel segments with active terraces separated by riffle at bend.

STREAM CHANNEL DEBRIS/BLOCKAGES (indicate one)

Materials, which upon placement into the active channel or floodprone area may cause and adjustment in channel dimensions or conditions, due to influences on the existing flow regime

	Description/Extent	
X	D-1 (None)	Minor amounts of small, floatable material
	D-2 (Infrequent)	Debris consists of small, easily moved, floatable material; i.e. leaves, needles, small limbs, twigs, etc..
	D-3 (Moderate)	Increasing frequency of small to medium sized material, i.e. large limbs, branches, small logs that when accumulated effect 10% or less of the active channel cross-sectional area.
	D-4 (Numerous)	Significant buildup of medium to large sized materials, i.e. large limbs, branches, small logs, or portions of trees that may occupy 10 to 30% of the active cross-sectional area.
	D-5 (Extensive)	Debris "dams" of predominantly larger materials, i.e. branches, logs, trees, etc., occupying 30 to 50% of the active channel cross-section, often extending across the width of the active channel.
	D-6 (Dominating)	Large, somewhat continuous debris "dams," extensive in nature and occupying over 50% of the active channel cross-section. Such accumulations may divert water into floodprone areas and form fish migration barriers, even when flows are at less than bankfull
	D-7 (Beaver Dams - Few)	An infrequent number of dams spaced such that normal streamflow and expected channel conditions exist in the reaches between dams.
	D-8 (Beaver Dams - Frequent)	Frequency of dams is such that backwater conditions exist for channel reaches between structures; where streamflow velocities are reduced and channel dimensions or conditions are influenced.
	D-9 (Beaver Dams - Abandoned)	Numerous abandoned dams, many of which have filled with sediment and/or breached, initiating a series of channel adjustments such as bank erosion, lateral migration, evulsion, aggradations and degradation.
	D-10 (Human Influences)	Structures, facilities, or materials related to land uses or development located within the floodprone area, such as diversions or low-head dams, controlled by-pass channels, velocity control structures, and various transportation encroachments that have

Notes: Refer to LWD data sheet. Infrequent medium-sized wood occurs in channel but doesn't influence channel morphology. Abundant LWD stored on terraces above bankfull elevations.

Ice House Dam Reach Lower Site (IH-G2) Pfankuch

Channel Stability (Pfankuch)
Study Reach Name: Ice House - Lower
Crew Initials: MCM, JDS
Date: 5/18/03
Start Time: 930
Stop Time: 1140

		Category	(choose one for each of the four options for each category)		Place X in this column:
Upper Banks	1	Landform slope	Bank slope gradient <30%	2	
			Bank slope gradient 30-40%	4	X
			Bank slope gradient 40-60%	6	
			Bank slope gradient 60+%	8	
	2	Mass wasting	No evidence of past or future mass wasting	3	X
			Infrequent. Most likely healed over. Low future potential	6	
			Frequent or large, causing sediment nearly year long	9	
			Frequent or large causing sediment nearly year long or imminent danger of same	12	
	3	Debris jam potential	Essentially absent from immediate channel area	2	X
			Present, but mostly small twigs and limbs	4	
			Moderate to heavy amounts, mostly larger sizes	6	
			Moderate to heavy amounts, predominately lager sizes	8	
	4	Vegetative bank protection	90%+ plant density. Vigor and variety suggest a deep, dense soil binding root mass	3	
			70-90% density. Fewer species or less vigor suggest less dense or deep root mass	6	X
			<50-70% density. Lower vigor and fewer species from a shallow, discontinuous root mass	9	
			<50% density, fewer species and less vigor indicate poor, discontinuous and shallow root mass	12	
Lower Banks	5	Channel capacity	Ample for present plus some increases. Peak flows contained. W/D ration <7	1	
			Adequate. Bank overflows rare. W/D ratio 8-15	2	X
			Barely contains present peaks. Occasional overbank floods. W/D ratio 15 to 25	3	
			Inadequate. Overbank flows common. W/D ratio >25	4	
	6	Bank rock content	65%+ with large angular boulders. 12"+ common.	2	
			40-65%. Mostly small boulders to cobbles 6-12"	4	X
			20-40%. With most in the 3-6" diameter class	6	
			20% rock fragments of gravel sizes, 1-3" or less	8	
	7	Obstructions to flow	Rocks and logs firmly embedded. Flow pattern w/out cutting or deposition. Stable bed	2	X
			Some present causing erosive cross currents and minor pool filling. Obstructions newer and less firm	4	
			Moderately frequent, unstable obstructions move with high flows causing bank cutting and pool filling	6	
			Sediment traps full, channel migration occurring	8	
	8	Cutting	Little or none. Infrequent raw banks less than 6"	4	
			Some, intermittently at outcurves and constrictions. Raw banks may be up to 12"	6	X
			Significant. Cuts 12-24" high. Root mat overhangs and sloughing evident	12	
			Almost continuous cuts, some over 24" high. Failure of overhangs frequent	16	
	9	Deposition	Little or no enlargement of channel or point bars	4	
			Some new bar increase, mostly from coarse gravel	8	
			Moderate deposition of new gravel and course sand on old and some new bars	12	X
			Extensive deposits of predominately fine particles. Accelerated bar development	16	
Bottom	10	Rock angularity	Sharp edges and corners. Plane surfaces rough.	1	
			Rounded corners and edges, surfaces smooth, flat	2	X
			Corners and edges well rounded in two dimensions	3	
			Well rounded in all dimensions, surfaces smooth	4	
	11	Brightness	Surfaces dull, dark, or stained. Generally not bright	1	X
			Mostly dull, but may have <35% bright surfaces	2	
			Mixture dull and bright, ie 35-65% mixture range	3	
			Predominately bright, 65% exposed or scoured surfaces	4	
	12	Consolidation of particles	Assorted sizes tightly packed or overlapping	2	
			Moderately packed with some overlapping	4	X
			Mostly loose assortment with no apparent overlap	6	
			No packing evident. Loose assortment easily moved	8	
	13	Bottom size distribution	No size change evident. Stable mater. 80-100%	4	
			Distribution shift light. Stable material 50-80%	8	
			Moderate changes in sizes. Stable materials 20-50%	12	X
			Marked distribution change. Stable materials 0-20%	16	
	14	Scouring and deposition	<5% of bottom affected by scour or deposition	6	
			5-30% affected. Scour at constrictions and where grades steepen. Some deposition in pools	12	X
			30-50% affected. Deposits and scour at obstructions, constrictions, and bends. Some filling of pools	18	
			More than 50% of the bottom in a state of flux or change nearly year long	24	
	15	Aquatic vegetation	Abundant growth moss-like, dark green perennial. In swift water too.	1	
			Common. Algae forms in low velocity and pool areas. Moss here too	2	X
			Present but spotty, mostly in backwater. Seasonal algae growth makes rocks slick	3	
			Perennial types scare or absent. Yellow-green, short term bloom may be present	4	

Ice House Dam Reach Lower Site (IH-G2)
Bank Erosion and Vegetation

Bank Erosion and Vegetation

Study Reach Name: Ice House Dam - Lower **Crew Initials**: MCM, JDS
Date: 5/18/03 **Start Time**: 0930 **Stop Time**:

BANK EROSION POTENTIAL				
(if banks are bedrock or composed of boulders, do not fill out this table)				
	Bank a	**Bank b**	**Bank c**	**Bank d**
Bank height (ft)	2	3.5	2	
Bankfull height (ft)	2	2	2	
Root depth (ft)	2	?	-	
Root density (%)	80%	?	-	
Bank Angle (degrees)	20-30	45	<10	
Surface Protection (%)	100%	20	80-100	
% of total study reach	45%	10	30	

Notes 15 % of banks are bedrock.

Bank material: Gravel w/high sand & Sand
Stratification of unstable layers in banks (below bankfull): Little or no stratification of bank material

Sediment supply: High
Vertical streambed stability: Stable to Aggrading
Bank and channel bed conditions notes:
Banks very stable - low gradient - vegetated. Channel highly embedded and draped with sand in the lower gradient portions of the reach. Abundant recent sand deposits on floodplains and terraces. Plane-bed channel with sand drape suggests aggradation following fire/salvage operation.

RIPARIAN VEGETATION				
	DENSITY (indicate all that apply)			
VEGETATION TYPE	**LOW**	**MOD.**	**HIGH**	**NOTES**
Bare				
Forbs only				
Annual Grass w/ forbes		3b		
Perennial grass		4b		
Rhizomatous grasses (bluegrass, Grass like plants, sedges, rushes)	5a			
Low brush		6b		manzanita and whitethorn
High brush			7c	head high willow and alder riparian
Combination grass/brush				
Deciduous overstory				none-fire
Deciduous w/brush/grass understory				none-no tree overstory
Perennial overstory				none-fire
Wetland vegetation community				

Junction Dam Reach Site (JD-G1) LWD Frequency

LWD Frequency Data Sheet

Study Reach Name: Junction **Crew Initials:** ZED/JDS
Date: 5/19/2003 **Start time:** 1335 **End time:** 1340

Diameter Class	Length Class 3-10 ft (0.9-3.0 m)	10-25 ft (3.1-7.6 m)	25-50 ft (7.7-15.2 m)	50-75 ft (15.3-22.9 m)	>75 ft (>23 m)
6-12 in (10-30 cm)					
12-24 in (31-60 cm)					
24-36 in (61-90 cm)					
>36 in (>90 cm)					

"Tally as R if rootwad is attached."

Comments: No LWD within bankfull channel. Very few pieces perched on floodplain/terrace surfaces. No key pieces.

QA Check: JDS

Junction Dam Reach Site (JD-G1) V Star

V* Measurements

Study Reach Name: Junction Dam **Crew Initials:** ZED/JDS
Date: 5/19/2003 **Start time:** 1600 **End time:** 1605

Comments:
No V* measurements taken.
No pools at site with any substrate finer than medium gravel, therefore no V* taken.
Where fine sediments occur, only occur as thin veneer.

Junction Dam Reach Site (JD-G1) Rosgen Level III

Rosgen Level III Data Sheet

Study Reach Name: Junction
Date: 5/19/2003
Crew Initials: ZED, JDS
Start time: 13:20 **End time:** 13:30

Depositional Features (indicate one)

x	B-1	point bars
	B-2	pt. bars w/ few mid channel bars
	B-3	many mid channel bars
	B-4	side bars
	B-5	diagonal bars
	B-6	main branching w/ many mid channel bars and islands
	B-7	mixed side bar and mid channel bars exceeding 2-3X width
	B-8	delta bars
Description:	Large point bar deposition RB; Cobble-gravel deposits common behind large obstructions along margins and in midchannel positions. These categories apply to alluvial rivers - not high-gradient bedrock channels!	

Meander Pattern (indicate one)

x ?	M-1	regular meander
	M-2	tortuous meander
	M-3	irregular meander
	M-4	truncated meander
	M-5	unconfined me. scrolls
	M-6	confine me. scrolls
	M-7	distorted me. loops
	M-8	irregular with oxbows
Description:	Meander pattern controlled by bedrock. These categories don't really apply.	

STREAM CHANNEL DEBRIS/BLOCKAGES (indicate one)

Materials, which upon placement into the active channel or floodprone area may cause and adjustment in channel dimensions or conditions, due to influences on the existing flow regime

	Description/Extent	
x	D-1 (None)	Minor amounts of small, floatable material
	D-2 (Infrequent)	Debris consists of small, easily moved, floatable material; i.e. leaves, needles, small limbs, twigs, etc..
	D-3 (Moderate)	Increasing frequency of small to medium sized material, i.e. large limbs, branches, small logs that when accumulated effect 10% or less of the active channel cross-sectional area.
	D-4 (Numerous)	Significant buildup of medium to large sized materials, i.e. large limbs, branches, small logs, or portions of trees that may occupy 10 to 30% of the active cross-sectional area.
	D-5 (Extensive)	Debris "dams" of predominantly larger materials, i.e. branches, logs, trees, etc., occupying 30 to 50% of the active channel cross-section, often extending across the width of the active channel.
	D-6 (Dominating)	Large, somewhat continuous debris "dams," extensive in nature and occupying over 50% of the active channel cross-section. Such accumulations may divert water into floodprone areas and form fish migration barriers, even when flows are at less than bankfull
	D-7 (Beaver Dams - Few)	An infrequent number of dams spaced such that normal streamflow and expected channel conditions exist in the reaches between dams.
	D-8 (Beaver Dams - Frequent)	Frequency of dams is such that backwater conditions exist for channel reaches between structures; where streamflow velocities are reduced and channel dimensions or conditions are influenced.
	D-9 (Beaver Dams - Abandoned)	Numerous abandoned dams, many of which have filled with sediment and/or breached, initiating a series of channel adjustments such as bank erosion, lateral migration, evulsion, aggradations and degradation.
	D-10 (Human Influences)	Structures, facilities, or materials related to land uses or development located within the floodprone area, such as diversions or low-head dams, controlled by-pass channels, velocity control structures, and various transportation encroachments that have

Notes:
High transport capacity and conveyance - only coarse, large debris flows or large locally derived joint blocks have the potential to block channel.

Junction Dam Reach Site (JD-G1) Pfankuch

Channel Stability (Pfankuch)

Study Reach Name: Junction
Crew Initials: ZED, JDS
Date: 5/19/2003
Start Time: 13:30
Stop Time: 13:35

		Category	(choose one for each of the four options for each category)		Place X in this column:
Upper Banks	1	Landform slope	Bank slope gradient <30%	2	
			Bank slope gradient 30-40%	4	
			Bank slope gradient 40-60%	6	
			Bank slope gradient 60+%	8	x
	2	Mass wasting	No evidence of past or future mass wasting	3	x
			Infrequent. Most likely healed over. Low future potential	6	
			Frequent or large, causing sediment nearly year long	9	
			Frequent or large causing sediment nearly year long or imminent danger of same	12	
	3	Debris jam potential	Essentially absent from immediate channel area	2	x
			Present, but mostly small twigs and limbs	4	
			Moderate to heavy amounts, mostly larger sizes	6	
			Moderate to heavy amounts, predominately lager sizes	8	
	4	Vegetative bank protection	90%+ plant density. Vigor and variety suggest a deep, dense soil binding root mass	3	
			70-90% density. Fewer species or less vigor suggest less dense or deep root mass	6	
			<50-70% density. Lower vigor and fewer species from a shallow, discontinuous root mass	9	
			<50% density, fewer species and less vigor indicate poor, discontinuous and shallow root mass	12	x
Lower Banks	5	Channel capacity	Ample for present plus some increases. Peak flows contained. W/D ration <7	1	x
			Adequate. Bank overflows rare. W/D ratio 8-15	2	
			Barely contains present peaks. Occasional overbank floods. W/D ratio 15 to 25	3	
			Inadequate. Overbank flows common. W/D ratio >25	4	
	6	Bank rock content	65%+ with large angular boulders. 12”+ common.	2	x
			40-65%. Mostly small boulders to cobbles 6-12”	4	
			20-40%. With most in the 3-6” diameter class	6	
			20% rock fragments of gravel sizes, 1-3” or less	8	
	7	Obstructions to flow	Rocks and logs firmly embedded. Flow pattern w/out cutting or deposition. Stable bed	2	x
			Some present causing erosive cross currents and minor pool filling. Obstructions newer and less	4	
			Moderately frequent, unstable obstructions move with high flows causing bank cutting and pool	6	
			Sediment traps full, channel migration occurring	8	
	8	Cutting	Little or none. Infrequent raw banks less than 6”	4	x
			Some, intermittently at outcurves and constrictions. Raw banks may be up to 12”	6	
			Significant. Cuts 12-24” high. Root mat overhangs and sloughing evident	12	
			Almost continuous cuts, some over 24” high. Failure of overhangs frequent	16	
	9	Deposition	Little or no enlargement of channel or point bars	4	x
			Some new bar increase, mostly from coarse gravel	8	
			Moderate deposition of new gravel and course sand on old and some new bars	12	
			Extensive deposits of predominately fine particles. Accelerated bar development	16	
Bottom	10	Rock angularity	Sharp edges and corners. Plane surfaces rough.	1	
			Rounded corners and edges, surfaces smooth, flat	2	x
			Corners and edges well rounded in two dimensions	3	
			Well rounded in all dimensions, surfaces smooth	4	
	11	Brightness	Surfaces dull, dark, or stained. Generally not bright	1	x
			Mostly dull, but may have <35% bright surfaces	2	
			Mixture dull and bright, ie 35-65% mixture range	3	
			Predominately bright, 65% exposed or scoured surfaces	4	
	12	Consolidation of particles	Assorted sizes tightly packed or overlapping	2	x
			Moderately packed with some overlapping	4	
			Mostly loose assortment with no apparent overlap	6	
			No packing evident. Loose assortment easily moved	8	
	13	Bottom size distribution	No size change evident. Stable mater. 80-100%	4	x
			Distribution shift light. Stable material 50-80%	8	
			Moderate changes in sizes. Stable materials 20-50%	12	
			Marked distribution change. Stable materials 0-20%	16	
	14	Scouring and deposition	<5% of bottom affected by scour or deposition	6	
			5-30% affected. Scour at constrictions and where grades steepen. Some deposition in pools	12	x
			30-50% affected. Deposits and scour at obstructions, constrictions, and bends. Some filling of pools	18	
			More than 50% of the bottom in a state of flux or change nearly year long	24	
	15	Aquatic vegetation	Abundant growth moss-like, dark green perennial. In swift water too.	1	x
			Common. Algae forms in low velocity and pool areas. Moss here too	2	
			Present but spotty, mostly in backwater. Seasonal algae growth makes rocks slick	3	
			Perennial types scare or absent. Yellow-green, short term bloom may be present	4	

Junction Dam Reach Site (JD-G1)
Bank Erosion and Vegetation

Bank Erosion and Vegetation

Study Reach Name: Junction **Crew Initials**: ZED/JDS
Date: 5/19/2003 **Start Time**: 1340 **Stop Time**: 1345

Bank material: bedrock/boulder

BANK EROSION POTENTIAL				
(if banks are bedrock or composed of boulders, do not fill out this table)				
	Bank a	**Bank b**	**Bank c**	**Bank d**
Bank height				
Bankfull height				
Root depth				
Root density (%)				
Bank Angle (degrees)				
Surface Protection (%)				
% of total study reach				

Notes

Stratification of unstable layers in banks (below bankfull): unstratified banks

Sediment supply: Low
Vertical streambed stability: Stable
Bank and channel bed conditions notes:
Moderately to highly embedded cobble-gravel deposits behind inchannel obstructions. Little or no fine sediment (<2mm) present. Fine gravel fills interstices of cobble-gravel.

RIPARIAN VEGETATION				
	DENSITY (indicate all that apply)			
VEGETATION TYPE	**LOW**	**MOD.**	**HIGH**	**NOTES**
Bare			1	
Forbs only	2a			
Annual Grass w/ forbes	3a			
Perennial grass	4a			
Rhizomatous grasses (bluegrass, Grass like plants, sedges, rushes)	5a			
Low brush	6a			
High brush	7a			
Combination grass/brush	8a			
Deciduous overstory	9a			
Deciduous w/brush/grass understory	10a			
Perennial overstory	11a			
Wetland vegetation community				none

VEGETATION NOTES (composition, vigor, density, and potential):
few alder saplings along low water shoreline. BLDR/BDRX substrate does not support veg.

Camino Dam Reach Site (CD-G1) LWD Frequency

LWD Frequency Data Sheet

Study Reach Name: Camino **Crew Initials:** ACF, SRD
Date: 8/13/2003 **Start time:** **End time:**

Diameter Class	Length Class 3-10 ft (0.9-3.0 m)	10-25 ft (3.1-7.6 m)	25-50 ft (7.7-15.2 m)	50-75 ft (15.3-22.9 m)	>75 ft (>23 m)
6-12 in (10-30 cm)					
12-24 in (31-60 cm)	1				
24-36 in (61-90 cm)					
>36 in (>90 cm)					

"Tally as R if rootwad is attached."

Comments:
Very little LWD in channel or surrounding area. No key pieces.

Camino Dam Reach Site (CD-G1) V Star

V* Measurements

Study Reach Name: Camino **Crew Initials:** ACF/SRD
Date: 8/13/2003 **Start time:** **End time:**

Comments:
No V* measurements taken (N/A).
Pools were too deep to measure and there didn't appear to be any fine sediment except for in the eddy of large boulders (and even that was rare).

Camino Dam Reach Site (CD-G1) Rosgen Level III

Rosgen Level III Data Sheet

Study Reach Name: Camino
Date: 8/13/2003
Crew Initials: ACF, SRD
Start time: 9:30 End time:

Depositional Features (indicate one)

	B-1	point bars
	B-2	pt. bars w/ few mid channel bars
	B-3	many mid channel bars
	B-4	side bars
	B-5	diagonal bars
	B-6	main branching w/ many mid channel bars and islands
	B-7	mixed side bar and mid channel bars exceeding 2-3X width
	B-8	delta bars
Description:	bedrock channel. gravel/cobble in channel; gravel on bank ledges	

Meander Pattern (indicate one)

	M-1	regular meander
	M-2	tortuous meander
	M-3	irregular meander
	M-4	truncated meander
	M-5	unconfined me. scrolls
	M-6	confine me. scrolls
	M-7	distorted me. loops
	M-8	irregular with oxbows
Description:	bedrock channel. cascade/step-pool sequencing; low frequency meandering	

STREAM CHANNEL DEBRIS/BLOCKAGES (indicate one)

Materials, which upon placement into the active channel or floodprone area may cause and adjustment in channel dimensions or conditions, due to influences on the existing flow regime

	Description/Extent	
	D-1 (None)	Minor amounts of small, floatable material
	D-2 (Infrequent)	Debris consists of small, easily moved, floatable material; i.e. leaves, needles, small limbs, twigs, etc..
	D-3 (Moderate)	Increasing frequency of small to medium sized material, i.e. large limbs, branches, small logs that when accumulated effect 10% or less of the active channel cross-sectional area.
	D-4 (Numerous)	Significant buildup of medium to large sized materials, i.e. large limbs, branches, small logs, or portions of trees that may occupy 10 to 30% of the active cross-sectional area.
	D-5 (Extensive)	Debris "dams" of predominantly larger materials, i.e. branches, logs, trees, etc., occupying 30 to 50% of the active channel cross-section, often extending across the width of the active channel.
	D-6 (Dominating)	Large, somewhat continuous debris "dams," extensive in nature and occupying over 50% of the active channel cross-section. Such accumulations may divert water into floodprone areas and form fish migration barriers, even when flows are at less than bankfull
	D-7 (Beaver Dams - Few)	An infrequent number of dams spaced such that normal streamflow and expected channel conditions exist in the reaches between dams.
	D-8 (Beaver Dams - Frequent)	Frequency of dams is such that backwater conditions exist for channel reaches between structures; where streamflow velocities are reduced and channel dimensions or conditions are influenced.
	D-9 (Beaver Dams - Abandoned)	Numerous abandoned dams, many of which have filled with sediment and/or breached, initiating a series of channel adjustments such as bank erosion, lateral migration, evulsion, aggradations and degradation.
x	D-10 (Human Influences)	Structures, facilities, or materials related to land uses or development located within the floodprone area, such as diversions or low-head dams, controlled by-pass channels, velocity control structures, and various transportation encroachments that have

Notes:
Sediment supply/flow affected by upstream dam

Camino Dam Reach Site (CD-G1) Pfankuch

Channel Stability (Pfankuch)

Study Reach Name: Camino
Crew Initials: ACF, SRD
Date: 8/13/2003
Start Time: 9:30
Stop Time:

		Category	(choose one for each of the four options for each category)		Place X in this column:
Upper Banks	1	Landform slope	Bank slope gradient <30%	2	
			Bank slope gradient 30-40%	4	
			Bank slope gradient 40-60%	6	x
			Bank slope gradient 60+%	8	
	2	Mass wasting	No evidence of past or future mass wasting	3	
			Infrequent. Most likely healed over. Low future potential	6	x
			Frequent or large, causing sediment nearly year long	9	
			Frequent or large causing sediment nearly year long or imminent danger of same	12	
	3	Debris jam potential	Essentially absent from immediate channel area	2	x
			Present, but mostly small twigs and limbs	4	
			Moderate to heavy amounts, mostly larger sizes	6	
			Moderate to heavy amounts, predominately lager sizes	8	
	4	Vegetative bank protection	90%+ plant density. Vigor and variety suggest a deep, dense soil binding root mass	3	
			70-90% density. Fewer species or less vigor suggest less dense or deep root mass	6	
			<50-70% density. Lower vigor and fewer species from a shallow, discontinuous root mass	9	x
			<50% density, fewer species and less vigor indicate poor, discontinuous and shallow root mass	12	
Lower Banks	5	Channel capacity	Ample for present plus some increases. Peak flows contained. W/D ration <7	1	x
			Adequate. Bank overflows rare. W/D ratio 8-15	2	
			Barely contains present peaks. Occasional overbank floods. W/D ratio 15 to 25	3	
			Inadequate. Overbank flows common. W/D ratio >25	4	
	6	Bank rock content	65%+ with large angular boulders. 12"+ common.	2	x
			40-65%. Mostly small boulders to cobbles 6-12"	4	
			20-40%. With most in the 3-6" diameter class	6	
			20% rock fragments of gravel sizes, 1-3" or less	8	
	7	Obstructions to flow	Rocks and logs firmly embedded. Flow pattern w/out cutting or deposition. Stable bed	2	x
			Some present causing erosive cross currents and minor pool filling. Obstructions newer and less	4	
			Moderately frequent, unstable obstructions move with high flows causing bank cutting and pool	6	
			Sediment traps full, channel migration occurring	8	
	8	Cutting	Little or none. Infrequent raw banks less than 6"	4	x
			Some, intermittently at outcurves and constrictions. Raw banks may be up to 12"	6	
			Significant. Cuts 12-24" high. Root mat overhangs and sloughing evident	12	
			Almost continuous cuts, some over 24" high. Failure of overhangs frequent	16	
	9	Deposition	Little or no enlargement of channel or point bars	4	x
			Some new bar increase, mostly from coarse gravel	8	
			Moderate deposition of new gravel and course sand on old and some new bars	12	
			Extensive deposits of predominately fine particles. Accelerated bar development	16	
Bottom	10	Rock angularity	Sharp edges and corners. Plane surfaces rough.	1	
			Rounded corners and edges, surfaces smooth, flat	2	x
			Corners and edges well rounded in two dimensions	3	
			Well rounded in all dimensions, surfaces smooth	4	
	11	Brightness	Surfaces dull, dark, or stained. Generally not bright	1	
			Mostly dull, but may have <35% bright surfaces	2	x
			Mixture dull and bright, ie 35-65% mixture range	3	
			Predominately bright, 65% exposed or scoured surfaces	4	
	12	Consolidation of particles	Assorted sizes tightly packed or overlapping	2	
			Moderately packed with some overlapping	4	
			Mostly loose assortment with no apparent overlap	6	x
			No packing evident. Loose assortment easily moved	8	
	13	Bottom size distribution	No size change evident. Stable mater. 80-100%	4	
			Distribution shift light. Stable material 50-80%	8	x
			Moderate changes in sizes. Stable materials 20-50%	12	
			Marked distribution change. Stable materials 0-20%	16	
	14	Scouring and deposition	<5% of bottom affected by scour or deposition	6	
			5-30% affected. Scour at constrictions and where grades steepen. Some deposition in pools	12	
			30-50% affected. Deposits and scour at obstructions, constrictions, and bends. Some filling of pools	18	
			More than 50% of the bottom in a state of flux or change nearly year long	24	x
	15	Aquatic vegetation	Abundant growth moss-like, dark green perennial. In swift water too.	1	
			Common. Algae forms in low velocity and pool areas. Moss here too	2	x
			Present but spotty, mostly in backwater. Seasonal algae growth makes rocks slick	3	
			Perennial types scare or absent. Yellow-green, short term bloom may be present	4	

Camino Dam Reach Site (CD-G1)
Bank Erosion and Vegetation

Bank Erosion and Vegetation

Study Reach Name: Camino **Crew Initials**: ACF, SRD
Date: 8/13/03 **Start Time**: 9:30 **Stop Time**: 12:00

Bank material: Bedrock

BANK EROSION POTENTIAL				
(if banks are bedrock or composed of boulders, do not fill out this table)				
	Bank a	**Bank b**	**Bank c**	**Bank d**
Bank height				
Bankfull height				
Root depth				
Root density (%)				
Bank Angle (degrees)				
Surface Protection (%)				
% of total study reach				

Notes

Stratification of unstable layers in banks (below bankfull):

Sediment supply: Low
Vertical streambed stability: Stable?
Bank and channel bed conditions notes:
Coarse gravel/cobble in channel. Coarse gravel/gravel on bedrock channel ledges. Supply-limited reach due to upstream dam affects.

RIPARIAN VEGETATION				
	DENSITY (indicate all that apply)			
VEGETATION TYPE	**LOW**	**MOD.**	**HIGH**	**NOTES**
Bare			1	
Forbs only				
Annual Grass w/ forbes	3a			along water edge
Perennial grass	4a			along water edge
Rhizomatous grasses (bluegrass, Grass like plants, sedges, rushes)				
Low brush				
High brush				
Combination grass/brush	8a			
Deciduous overstory	9a			oaks and bays on slopes; alders along water edge
Deciduous w/brush/grass understory				
Perennial overstory				
Wetland vegetation community				

VEGETATION NOTES (composition, vigor, density, and potential):

S. F. American Reach Site (SFAR-G1) LWD Frequency

LWD Frequency Data Sheet NO LWD IN THIS REACH

Study Reach Name: **Crew Initials:**

Date: **Start time:** **End time: ---**

Diameter Class	**Length Class** 3-10 ft (0.9-3.0 m)	10-25 ft (3.1-7.6 m)	25-50 ft (7.7-15.2 m)	50-75 ft (15.3-22.9 m)	>75 ft (>23 m)
6-12 in (10-30 cm)					
12-24 in (31-60 cm)					
24-36 in (61-90 cm)					
>36 in (>90 cm)					

"Tally as R if rootwad is attached."

Comments:

S. F. American Reach Site (SFAR-G1) V Star

No Vstar measurements taken.

S. F. American Reach Site (SFAR-G1) Rosgen Level III

Rosgen Level III Data Sheet

Study Reach Name: SFAR
Date: 10/23/2003
Crew Initials: SRD/CDJ
Start time: ; End time:

Depositional Features (indicate one)

	B-1	point bars
	B-2	pt. bars w/ few mid channel bars
	B-3	many mid channel bars
x	B-4	side bars
	B-5	diagonal bars
	B-6	main branching w/ many mid channel bars and islands
	B-7	mixed side bar and mid channel bars exceeding 2-3X width
	B-8	delta bars

Description:

Meander Pattern (indicate one)

	M-1	regular meander
	M-2	tortuous meander
x	M-3	irregular meander
	M-4	truncated meander
	M-5	unconfined me. scrolls
	M-6	confine me. scrolls
	M-7	distorted me. loops
	M-8	irregular with oxbows

Description:

STREAM CHANNEL DEBRIS/BLOCKAGES (indicate one)

Materials, which upon placement into the active channel or floodprone area may cause and adjustment in channel dimensions or conditions, due to influences on the existing flow regime

	Description/Extent	
x	D-1 (None)	Minor amounts of small, floatable material
	D-2 (Infrequent)	Debris consists of small, easily moved, floatable material; i.e. leaves, needles, small limbs, twigs, etc..
	D-3 (Moderate)	Increasing frequency of small to medium sized material, i.e. large limbs, branches, small logs that when accumulated effect 10% or less of the active channel cross-sectional area.
	D-4 (Numerous)	Significant buildup of medium to large sized materials, i.e. large limbs, branches, small logs, or portions of trees that may occupy 10 to 30% of the active cross-sectional area.
	D-5 (Extensive)	Debris "dams" of predominantly larger materials, i.e. branches, logs, trees, etc., occupying 30 to 50% of the active channel cross-section, often extending across the width of the active channel.
	D-6 (Dominating)	Large, somewhat continuous debris "dams," extensive in nature and occupying over 50% of the active channel cross-section. Such accumulations may divert water into floodprone areas and form fish migration barriers, even when flows are at less than bankfull
	D-7 (Beaver Dams - Few)	An infrequent number of dams spaced such that normal streamflow and expected channel conditions exist in the reaches between dams.
	D-8 (Beaver Dams - Frequent)	Frequency of dams is such that backwater conditions exist for channel reaches between structures; where streamflow velocities are reduced and channel dimensions or conditions are influenced.
	D-9 (Beaver Dams - Abandoned)	Numerous abandoned dams, many of which have filled with sediment and/or breached, initiating a series of channel adjustments such as bank erosion, lateral migration, evulsion, aggradations and degradation.
	D-10 (Human Influences)	Structures, facilities, or materials related to land uses or development located within the floodprone area, such as diversions or low-head dams, controlled by-pass channels, velocity control structures, and various transportation encroachments that have

Notes: Very little LWD in channel or on banks

S. F. American Reach Site (SFAR-G1) Pfankuch

Channel Stability (Pfankuch)

Study Reach Name: SFAR
Crew Initials: SRD/CDJ
Date: 10/23/2003
Start Time:
Stop Time:

		Category	(choose one for each of the four options for each category)		Place X in this column:
Upper Banks	1	Landform slope	Bank slope gradient <30%	2	
			Bank slope gradient 30-40%	4	
			Bank slope gradient 40-60%	6	x
			Bank slope gradient 60+%	8	
	2	Mass wasting	No evidence of past or future mass wasting	3	
			Infrequent. Most likely healed over. Low future potential	6	
			Frequent or large, causing sediment nearly year long	9	x
			Frequent or large causing sediment nearly year long or imminent danger of same	12	
	3	Debris jam potential	Essentially absent from immediate channel area	2	x
			Present, but mostly small twigs and limbs	4	
			Moderate to heavy amounts, mostly larger sizes	6	
			Moderate to heavy amounts, predominately lager sizes	8	
	4	Vegetative bank protection	90%+ plant density. Vigor and variety suggest a deep, dense soil binding root mass	3	
			70-90% density. Fewer species or less vigor suggest less dense or deep root mass	6	
			<50-70% density. Lower vigor and fewer species from a shallow, discontinuous root mass	9	x
			<50% density, fewer species and less vigor indicate poor, discontinuous and shallow root mass	12	
Lower Banks	5	Channel capacity	Ample for present plus some increases. Peak flows contained. W/D ration <7	1	x
			Adequate. Bank overflows rare. W/D ratio 8-15	2	
			Barely contains present peaks. Occasional overbank floods. W/D ratio 15 to 25	3	
			Inadequate. Overbank flows common. W/D ratio >25	4	
	6	Bank rock content	65%+ with large angular boulders. 12"+ common.	2	x
			40-65%. Mostly small boulders to cobbles 6-12"	4	
			20-40%. With most in the 3-6" diameter class	6	
			20% rock fragments of gravel sizes, 1-3" or less	8	
	7	Obstructions to flow	Rocks and logs firmly embedded. Flow pattern w/out cutting or deposition. Stable bed	2	
			Some present causing erosive cross currents and minor pool filling. Obstructions newer and less	4	x
			Moderately frequent, unstable obstructions move with high flows causing bank cutting and pool	6	
			Sediment traps full, channel migration occurring	8	
	8	Cutting	Little or none. Infrequent raw banks less than 6"	4	x
			Some, intermittently at outcurves and constrictions. Raw banks may be up to 12"	6	
			Significant. Cuts 12-24" high. Root mat overhangs and sloughing evident	12	
			Almost continuous cuts, some over 24" high. Failure of overhangs frequent	16	
	9	Deposition	Little or no enlargement of channel or point bars	4	
			Some new bar increase, mostly from coarse gravel	8	
			Moderate deposition of new gravel and course sand on old and some new bars	12	x
			Extensive deposits of predominately fine particles. Accelerated bar development	16	
Bottom	10	Rock angularity	Sharp edges and corners. Plane surfaces rough.	1	
			Rounded corners and edges, surfaces smooth, flat	2	x
			Corners and edges well rounded in two dimensions	3	
			Well rounded in all dimensions, surfaces smooth	4	
	11	Brightness	Surfaces dull, dark, or stained. Generally not bright	1	x
			Mostly dull, but may have <35% bright surfaces	2	
			Mixture dull and bright, ie 35-65% mixture range	3	
			Predominately bright, 65% exposed or scoured surfaces	4	
	12	Consolidation of particles	Assorted sizes tightly packed or overlapping	2	
			Moderately packed with some overlapping	4	x
			Mostly loose assortment with no apparent overlap	6	
			No packing evident. Loose assortment easily moved	8	
	13	Bottom size distribution	No size change evident. Stable mater. 80-100%	4	
			Distribution shift light. Stable material 50-80%	8	
			Moderate changes in sizes. Stable materials 20-50%	12	x
			Marked distribution change. Stable materials 0-20%	16	
	14	Scouring and deposition	<5% of bottom affected by scour or deposition	6	
			5-30% affected. Scour at constrictions and where grades steepen. Some deposition in pools	12	x
			30-50% affected. Deposits and scour at obstructions, constrictions, and bends. Some filling of	18	
			More than 50% of the bottom in a state of flux or change nearly year long	24	
	15	Aquatic vegetation	Abundant growth moss-like, dark green perennial. In swift water too.	1	
			Common. Algae forms in low velocity and pool areas. Moss here too	2	x
			Present but spotty, mostly in backwater. Seasonal algae growth makes rocks slick	3	
			Perennial types scare or absent. Yellow-green, short term bloom may be present	4	

Notes: Channel is characterized by steep valley walls with coniferous overstory on shallow soils. Large clasts make up majority of bed material, with some cobble/gravel/sand deposition on banks. LWD essentially absent from reach.

S. F. American Reach Site (SFAR-G1)
Bank Erosion and Vegetation

Bank Erosion and Vegetation

Study Reach Name: SFAR **Crew Initials**: SRD, CDJ
Date: 10/23/03 **Start Time**: 15:00 **Stop Time**: ---

Bank material: Bedrock

BANK EROSION POTENTIAL				
(if banks are bedrock or composed of boulders, do not fill out this table)				
	Bank a	**Bank b**	**Bank c**	**Bank d**
Bank height				
Bankfull height				
Root depth				
Root density (%)				
Bank Angle (degrees)				
Surface Protection (%)				
% of total study reach				

Notes

Stratification of unstable layers in banks (below bankfull):

Sediment supply: Moderate/Low
Vertical streambed stability: Stable
Bank and channel bed conditions notes:
Banks are bedrock and reach is supply limited. Depositional features on banks include large boulders. Small boulder deposition and sand deposition approx. bankful elevation

RIPARIAN VEGETATION				
	DENSITY (indicate all that apply)			
VEGETATION TYPE	**LOW**	**MOD.**	**HIGH**	**NOTES**
Bare			1	
Forbs only	2a			
Annual Grass w/ forbes		3b		
Perennial grass		4b		
Rhizomatous grasses (bluegrass, Grass like plants, sedges, rushes)		5b		
Low brush		6b		
High brush				
Combination grass/brush				
Deciduous overstory			9c	higher on banks/valley walls
Deciduous w/brush/grass understory			10c	
Perennial overstory				
Wetland vegetation community				

VEGETATION NOTES (composition, vigor, density, and potential):

Slab Creek Dam Reach Site (SC-G1) LWD Frequency

LWD Frequency Data Sheet

Study Reach Name: Slab Creek Dam **Crew Initials:** CAB, ZED
Date: 5/23/2003 **Start time:** 15:10 **End time:** 15:15

Diameter Class	Length Class 3-10 ft (0.9-3.0 m)	10-25 ft (3.1-7.6 m)	25-50 ft (7.7-15.2 m)	50-75 ft (15.3-22.9 m)	>75 ft (>23 m)
6-12 in (10-30 cm)					
12-24 in (31-60 cm)					
24-36 in (61-90 cm)					
>36 in (>90 cm)					

"Tally as R if rootwad is attached."

Comments:
No LWD in or out of channel. Some very floatable small pieces outside bankfull. No key pieces.

Slab Creek Dam Reach Site (SC-G1) V Star

V star Measurements

Study Reach Name: Slab Creek Dam **Crew Initials: CAB/ZED**
Date: 5/23/03 **Start time: 1520 End time:1525**

Comments:
No V* measurements taken.
No evidence of fine sediment in reach.
Pools absent, generally glides.
Pool/glide below end of reach too turbid and deep to measure V*.

Slab Creek Dam Reach Site (SC-G1) Rosgen Level III

Rosgen Level III Data Sheet

Study Reach Name: Slab Creek Dam
Date: 5/23/2003
Crew Initials: CAB, ZED
Start time: 15:05 **End time:** 15:10

Depositional Features (indicate one)

x	B-1	point bars
	B-2	pt. bars w/ few mid channel bars
	B-3	many mid channel bars
	B-4	side bars
	B-5	diagonal bars
	B-6	main branching w/ many mid channel bars and islands
	B-7	mixed side bar and mid channel bars exceeding 2-3X width
	B-8	delta bars
Description:	coarse CO/BO point bars	

Meander Pattern (indicate one)

	M-1	regular meander
	M-2	tortuous meander
	M-3	irregular meander
	M-4	truncated meander
	M-5	unconfined me. scrolls
	M-6	confine me. scrolls
	M-7	distorted me. loops
	M-8	irregular with oxbows
Description:	Meander pattern (nearly straight) determined by BR	

STREAM CHANNEL DEBRIS/BLOCKAGES (indicate one)

Materials, which upon placement into the active channel or floodprone area may cause and adjustment in channel dimensions or conditions, due to influences on the existing flow regime

	Description/Extent	
x	D-1 (None)	Minor amounts of small, floatable material
	D-2 (Infrequent)	Debris consists of small, easily moved, floatable material; i.e. leaves, needles, small limbs, twigs, etc..
	D-3 (Moderate)	Increasing frequency of small to medium sized material, i.e. large limbs, branches, small logs that when accumulated effect 10% or less of the active channel cross-sectional area.
	D-4 (Numerous)	Significant buildup of medium to large sized materials, i.e. large limbs, branches, small logs, or portions of trees that may occupy 10 to 30% of the active cross-sectional area.
	D-5 (Extensive)	Debris "dams" of predominantly larger materials, i.e. branches, logs, trees, etc., occupying 30 to 50% of the active channel cross-section, often extending across the width of the active channel.
	D-6 (Dominating)	Large, somewhat continuous debris "dams," extensive in nature and occupying over 50% of the active channel cross-section. Such accumulations may divert water into floodprone areas and form fish migration barriers, even when flows are at less than bankfull
	D-7 (Beaver Dams - Few)	An infrequent number of dams spaced such that normal streamflow and expected channel conditions exist in the reaches between dams.
	D-8 (Beaver Dams - Frequent)	Frequency of dams is such that backwater conditions exist for channel reaches between structures; where streamflow velocities are reduced and channel dimensions or conditions are influenced.
	D-9 (Beaver Dams - Abandoned)	Numerous abandoned dams, many of which have filled with sediment and/or breached, initiating a series of channel adjustments such as bank erosion, lateral migration, evulsion, aggradations and degradation.
	D-10 (Human Influences)	Structures, facilities, or materials related to land uses or development located within the floodprone area, such as diversions or low-head dams, controlled by-pass channels, velocity control structures, and various transportation encroachments that have

Notes:
QA Check: ZED

Slab Creek Dam Reach Site (SC-G1) Pfankuch

Channel Stability (Pfankuch)

Study Reach Name: Slab Creek Dam
Crew Initials: CAB, ZED
Date: 5/23/2003
Start Time: 15:10
Stop Time: 15:20

		Category	(choose one for each of the four options for each category)		Place X in this column:
Upper Banks	1	Landform slope	Bank slope gradient <30%	2	
			Bank slope gradient 30-40%	4	
			Bank slope gradient 40-60%	6	
			Bank slope gradient 60+%	8	x
	2	Mass wasting	No evidence of past or future mass wasting	3	
			Infrequent. Most likely healed over. Low future potential	6	x
			Frequent or large, causing sediment nearly year long	9	
			Frequent or large causing sediment nearly year long or imminent danger of same	12	
	3	Debris jam potential	Essentially absent from immediate channel area	2	x
			Present, but mostly small twigs and limbs	4	
			Moderate to heavy amounts, mostly larger sizes	6	
			Moderate to heavy amounts, predominately lager sizes	8	
	4	Vegetative bank protection	90%+ plant density. Vigor and variety suggest a deep, dense soil binding root mass	3	
			70-90% density. Fewer species or less vigor suggest less dense or deep root mass	6	
			<50-70% density. Lower vigor and fewer species from a shallow, discontinuous root mass	9	x
			<50% density, fewer species and less vigor indicate poor, discontinuous and shallow root mass	12	
Lower Banks	5	Channel capacity	Ample for present plus some increases. Peak flows contained. W/D ration <7	1	
			Adequate. Bank overflows rare. W/D ratio 8-15	2	x
			Barely contains present peaks. Occasional overbank floods. W/D ratio 15 to 25	3	
			Inadequate. Overbank flows common. W/D ratio >25	4	
	6	Bank rock content	65%+ with large angular boulders. 12"+ common.	2	x
			40-65%. Mostly small boulders to cobbles 6-12"	4	
			20-40%. With most in the 3-6" diameter class	6	
			20% rock fragments of gravel sizes, 1-3" or less	8	
	7	Obstructions to flow	Rocks and logs firmly embedded. Flow pattern w/out cutting or deposition. Stable bed	2	x
			Some present causing erosive cross currents and minor pool filling. Obstructions newer and less	4	
			Moderately frequent, unstable obstructions move with high flows causing bank cutting and pool	6	
			Sediment traps full, channel migration occurring	8	
	8	Cutting	Little or none. Infrequent raw banks less than 6"	4	x
			Some, intermittently at outcurves and constrictions. Raw banks may be up to 12"	6	
			Significant. Cuts 12-24" high. Root mat overhangs and sloughing evident	12	
			Almost continuous cuts, some over 24" high. Failure of overhangs frequent	16	
	9	Deposition	Little or no enlargement of channel or point bars	4	x
			Some new bar increase, mostly from coarse gravel	8	
			Moderate deposition of new gravel and course sand on old and some new bars	12	
			Extensive deposits of predominately fine particles. Accelerated bar development	16	
Bottom	10	Rock angularity	Sharp edges and corners. Plane surfaces rough.	1	
			Rounded corners and edges, surfaces smooth, flat	2	
			Corners and edges well rounded in two dimensions	3	x
			Well rounded in all dimensions, surfaces smooth	4	
	11	Brightness	Surfaces dull, dark, or stained. Generally not bright	1	
			Mostly dull, but may have <35% bright surfaces	2	
			Mixture dull and bright, ie 35-65% mixture range	3	x
			Predominately bright, 65% exposed or scoured surfaces	4	
	12	Consolidation of particles	Assorted sizes tightly packed or overlapping	2	x
			Moderately packed with some overlapping	4	
			Mostly loose assortment with no apparent overlap	6	
			No packing evident. Loose assortment easily moved	8	
	13	Bottom size distribution	No size change evident. Stable mater. 80-100%	4	
			Distribution shift light. Stable material 50-80%	8	x
			Moderate changes in sizes. Stable materials 20-50%	12	
			Marked distribution change. Stable materials 0-20%	16	
	14	Scouring and deposition	<5% of bottom affected by scour or deposition	6	x
			5-30% affected. Scour at constrictions and where grades steepen. Some deposition in pools	12	
			30-50% affected. Deposits and scour at obstructions, constrictions, and bends. Some filling of pools	18	
			More than 50% of the bottom in a state of flux or change nearly year long	24	
	15	Aquatic vegetation	Abundant growth moss-like, dark green perennial. In swift water too.	1	
			Common. Algae forms in low velocity and pool areas. Moss here too	2	
			Present but spotty, mostly in backwater. Seasonal algae growth makes rocks slick	3	
			Perennial types scare or absent. Yellow-green, short term bloom may be present	4	x

Slab Creek Dam Reach Site (SC-G1)
Bank Erosion and Vegetation

Bank Erosion and Vegetation

Study Reach Name: Slab Creek Dam **Crew Initials**: CAB, ZED
Date: 05/23/03 **Start Time**: 15:05 **Stop Time**: 15:10

Bank material: bedrock, boulders

BANK EROSION POTENTIAL				
(if banks are bedrock or composed of boulders, do not fill out this table)				
	Bank a	**Bank b**	**Bank c**	**Bank d**
Bank height				
Bankfull height				
Root depth				
Root density (%)				
Bank Angle (degrees)				
Surface Protection (%)				
% of total study reach				

Notes

Stratification of unstable layers in banks (below bankfull): N/A

Sediment supply: presume low
Vertical streambed stability: stable
Bank and channel bed conditions notes:
BO/BR banks. Some overbank deposition of small CO and GR in small patches. Presume sediment supply is low; but reach is not very depositional, so hard to say.

RIPARIAN VEGETATION				
	DENSITY (indicate all that apply)			
VEGETATION TYPE	**LOW**	**MOD.**	**HIGH**	**NOTES**
Bare			1	BO/BR banks preclude veg establishment
Forbs only	2a			
Annual Grass w/ forbes	3a			
Perennial grass	4a			
Rhizomatous grasses (bluegrass, Grass like plants, sedges, rushes)	5a			
Low brush	6a			
High brush	7a			
Combination grass/brush	8a			
Deciduous overstory	9a			
Deciduous w/brush/grass understory	10a			
Perennial overstory	11a			
Wetland vegetation community				none

VEGETATION NOTES (composition, vigor, density, and potential):

UARP:
Rubicon Dam Reach Site (RD-G1)
Loon Lake Dam Reach Upper Site (LL-G1)
Loon Lake Dam Reach Middle Site (LL-G2)
Loon Lake Dam Reach Lower Site (LL-G3)
Gerle Creek Dam Reach Site (GC-G1)
Robbs Peak Dam Reach Site (RPD-G1)
Ice House Dam Reach Upper Site (IH-G1)
Ice House Dam Reach Lower Site (IH-G2)
Junction Dam Reach Site (JD-G1)
Camino Dam Reach Site (CD-G1)
S. F. American Reach Site (SFAR-G1)
Slab Creek Dam Reach Site (SC-G1)

APPENDIX J

DATA SETS: LONGITUDINAL PROFILE DATA, CROSS-SECTION DATA, AND PEBBLE COUNT TABLES FOR THE REACH DOWNSTREAM OF CHILI BAR

The Reach Downstream of Chili Bar:
Upper Canyon Site (CB-G1)
Upper Coloma Site (CB-G2)
Lower Coloma Site (CB-G3)
Gorge Site (CB-G4)

The Reach Downstream of Chili Bar: Upper Canyon Site (CB-G1)
long profile (p. 1 of 2)

HI	BS	FS	STA	NEW STA	WSE	ELEV	Water depth (ft)	Notes
90.23		10.18				80.05		FS to US benchmark (BM 2) from OS 1 (as recorded on pg 4 of cross section data sheet) *Note original BM name from field notes was changed to prevent confusion 18JAN2004 CDJ
	3.45							BS to BM 2 from OS 2 *Note original BM name from field notes was changed to prevent confusion 18JAN2004 CDJ
		6.82	10.00	10.00	78.88	76.68	2.20	
		4.95	30.00	30.00	80.85	78.55	2.30	
		5.22	50.00	50.00	80.68	78.28	2.40	
		5.66	70.00	70.00	80.52	77.84	2.68	
		7.76	90.00	90.00	78.54	75.74	2.80	
		7.74	110.00	110.00	78.36	75.76	2.60	
		8.55	127.70	127.70	78.07	74.95	3.12	XS 1 (upper XS)
		8.66	147.00	147.00	78.00	74.84	3.16	
		8.96	165.00	165.00	77.56	74.54	3.02	
		10.35	185.00	185.00	77.55	73.15	4.40	
		9.25	205.00	205.00	77.21	74.25	2.96	
		9.15	225.00	225.00	77.20	74.35	2.85	
		8.70	245.00	245.00	77.04	74.80	2.24	riffle - rapids with bedrock bottom that is strewn with boulders and cobbles
		9.11	265.00	265.00	76.99	74.39	2.60	
		9.23	285.00	285.00	76.82	74.27	2.55	
		9.70	295.00	295.00	76.75	73.80	2.95	296 on the first tape is equal to 16 ft on the second tape
		9.45	315.00	315.00	75.75	74.05	1.70	rapids!
		11.20	335.00	335.00	75.20	72.30	2.90	
		11.96	75.00	355.00	74.94	71.54	3.40	Station = 296 + 75 - 16 = 355
		11.50	95.00	375.00	74.60	72.00	2.60	
		11.46	115.00	395.00	74.74	72.04	2.70	
		10.84	135.00	415.00	74.64	72.66	1.98	
		11.59	160.00	440.00	74.51	71.91	2.60	XS 2 (middle XS)
		10.91	180.00	460.00	74.35	72.59	1.76	beginning of pool
		11.35	200.00	480.00	74.63	72.15	2.48	
		12.89	220.00	500.00	74.27	70.61	3.66	
		12.90	240.00	520.00	74.74	70.60	4.14	
		12.91	260.00	540.00	74.19	70.59	3.60	mid-pool (this reading was taken just after I nudged the tripod by accident. All previous readings are not affected by nudge.
83.50		3.44						FS back to BM 2 from OS 2 *Note original BM name from field notes was changed to prevent confusion 18JAN2004 CDJ
	12.88					80.05		BS to BM 2 from OS 3 *Note original BM name from field notes was changed to prevent confusion 18JAN2004 CDJ
92.93		0.61				92.32		*FS to middle XS LB pin from OS 3 (this is the only tie-in to the other cross-sections, so back calculating elevations from here CDJ)*
Day 2 Long Profile								
92.70	0.38					92.32		top LB middle XS
		14.72				77.98		BM 3 *Note original BM name from field notes was changed to prevent confusion 18JAN2004 CDJ

Did not use this value in the analysis because of the "nudge."

The Reach Downstream of Chili Bar: Upper Canyon Site (CB-G1) long profile (p. 2 of 2)

HI	BS	FS	STA	NEW STA	WSE	ELEV	Water depth (ft)	Notes
83.24	5.26					77.98		BM 3 *Note original BM name from field notes was changed to prevent confusion 18JAN2004 CDJ
		13.13	96.00	540.00	74.15	70.11	4.04	starting where we left off on sheet 1 (STA 96 = 260)
		13.53	116.00	560.00	74.16	69.71	4.45	
		13.41	136.00	580.00	74.23	69.83	4.40	
		13.16	156.00	600.00	74.13	70.08	4.05	
		14.35	176.00	620.00	73.99	68.89	5.10	tail of pool
		13.94	196.00	640.00	74.10	69.30	4.80	tail of pool
		13.65	216.00	660.00	74.01	69.59	4.42	tail of pool
		12.00	236.00	680.00	73.99	71.24	2.75	head of riffle
		12.45	256.00	700.00	73.95	70.79	3.16	middle of riffle
		12.31	276.00	720.00	73.03	70.93	2.10	middle of riffle
		13.01	296.00	740.00	72.38	70.23	2.15	=6 ft on new tape
		14.10	26.00	760.00	72.24	69.14	3.10	
		13.78	46.00	780.00	72.01	69.46	2.55	top edge of small pool
		14.33	66.00	800.00	71.91	68.91	3.00	
		14.95	86.00	820.00	71.94	68.29	3.65	
		14.71	106.00	840.00	71.83	68.53	3.30	tail end of small pool
		14.63	126.00	860.00	71.76	68.61	3.15	
		14.17	146.00	880.00	71.47	69.07	2.40	
		14.48	153.00	887.00	71.46	68.76	2.70	XS 3 (lower XS)
		14.39	170.00	904.00	71.35	68.85	2.50	
		14.83	190.00	924.00	71.21	68.41	2.80	
		14.96	210.00	944.00	71.18	68.28	2.90	
		14.44	230.00	964.00	70.90	68.80	2.10	
		15.70	250.00	984.00	70.64	67.54	3.10	beginning of pool (end riffle)
		16.17	270.00	1004.00	70.67	67.07	3.60	
		16.60	290.00	1024.00	70.64	66.64	4.00	middle pool
		5.27				77.97		BM 3 *Note original BM name from field notes was changed to prevent confusion 18JAN2004 CDJ

The Reach Downstream of Chili Bar: Upper Canyon Site (CB-G1)
upper cross-section (p. 1 of 2)

Hillslope beyond both LB and RB pins has a slope of 60-70 degrees; too steep for pin/level placement

HI	BS	FS	STA	ELEV	Notes
100.35	0.35		LB pin		top of pin = assumed to be 100.0
		0.79	15.50	99.56	base of LB pin
		4.88	20.00	95.47	
		7.53	25.00	92.82	
		9.21	30.00	91.14	
		11.18	36.00	89.17	
		12.14	40.00	88.21	
		13.66	45.00	86.69	upper bankfull est.
		14.80	50.00	85.55	
		15.99	55.00	84.36	
		16.92	60.00	83.43	
		19.63	65.00	80.72	
		20.00	67.00	80.35	lower bankfull est.
		20.97	73.00	79.38	
		21.28	80.00	79.07	
		22.03	80.40	78.32	LEW
		22.95	85.00	77.40	
		23.06	90.00	77.29	
		23.33	95.00	77.02	
		22.70	100.00	77.65	
		23.09	105.00	77.26	
		22.45	110.00	77.90	
		22.12	115.00	78.23	
		23.11	120.00	77.24	
		24.10	125.00	76.25	
		23.39	130.00	76.96	
		23.42	135.00	76.93	
		23.36	140.00	76.99	
		21.22	145.00	79.13	
		23.60	150.00	76.75	
		24.48	155.00	75.87	
		24.66	160.00	75.69	
		25.40	165.00	74.95	estimated reading--thalweg (rod was too short)
		24.05	170.00	76.30	
		23.52	175.00	76.83	
		23.46	180.00	76.89	
		21.77	190.00	78.58	
		23.73	195.00	76.62	

The Reach Downstream of Chili Bar: Upper Canyon Site (CB-G1)
upper cross-section (p. 2 of 2)

HI	BS	FS	STA	ELEV	Notes
100.35		22.82	200.00	77.53	
		22.68	205.00	77.67	
		23.46	210.00	76.89	
		21.96	215.00	78.39	
		22.25	220.00	78.10	
		22.87	225.00	77.48	
		22.67	230.00	77.68	
		22.34	235.00	78.01	
		22.09	240.00	78.26	
		20.96	245.00	79.39	
		19.84	250.00	80.51	
		20.32	257.00	80.03	
		21.40	243.50	78.95	REW
		20.39	264.00	79.96	
		19.51	270.00	80.84	
		20.21	277.00	80.14	
		19.79	283.00	80.56	
		19.22	290.00	81.13	lower bankfull
		16.91	297.00	83.44	
		13.90	304.00	86.45	
		13.41	310.00	86.94	
		14.95	317.00	85.40	
		16.62	325.00	83.73	
		17.30	332.00	83.05	
		15.85	339.00	84.50	
		15.11	346.00	85.24	
		14.00	353.00	86.35	
		13.10	356.30	87.25	upper bankfull
		10.66	360.00	89.69	
		4.48	365.80	95.87	base of pin
		3.66	RB pin		top of pin
		0.35	LB pin		top of pin OK

The Reach Downstream of Chili Bar: Upper Canyon Site (CB-G1) middle cross-section (p. 1 of 2)

HI	BS	FS	STA	ELEV	Bed material	Notes
						In order to tie cross sections
						together, reshooting top of LB pin on
						upper cross section (XS 1) and
						turning on BM 1 to tie into top of LB
100.30	0.30		top of LB pin XS 1	100.00		pin XS 2, middle cross section
		14.36	BM 1	85.94		Discharge ~ 200 cfs
92.96	7.02		BM 1 (OS 1)			
						Estimate 21 feet up and 15 feet back
		0.64	top of LB pin XS 2	92.32		to edge of terrace [from pin]
		1.20	1.40	91.76		base of pin XS 2
		2.44	6.00	90.52	bedrock	
		5.29	11.00	87.67	bedrock	
		6.60	17.00	86.36	bedrock	
		8.58	24.00	84.38	bedrock	
		10.70	31.00	82.26	bedrock	
		11.26	38.00	81.70	bedrock	upper bankfull estimate
		13.56	45.00	79.40	bedrock	
		14.90	49.00	78.06	bedrock	lower bankfull estimate
		15.38	56.00	77.58	bedrock	
		17.03	65.00	75.93	bedrock	
		17.77	67.00	75.19	bedrock	LEW
		19.92	69.00	73.04	bedrock	
						thalweg estimated. Tape broke!!
		22.88	76.00	70.08	bedrock	Knot in tape, 0.1 feet lost
		21.56	80.00	71.40	bedrock	
		20.78	85.00	72.18	bedrock/gravel	
		20.05	90.00	72.91		
		19.54	95.00	73.42		
		20.05	100.00	72.91	boulder	
		20.48	105.00	72.48		
		20.75	110.00	72.21		
		20.30	115.00	72.66		
		20.83	120.00	72.13		
		20.40	125.00	72.56		
		20.64	130.00	72.32		
		21.29	135.00	71.67		
		21.26	140.00	71.70		
		21.26	145.00	71.70		
		21.04	150.00	71.92		
		20.42	155.00	72.54		
		20.13	160.00	72.83		
		20.27	165.00	72.69		

The Reach Downstream of Chili Bar: Upper Canyon Site (CB-G1)
middle cross-section (p. 2 of 2)

HI	BS	FS	STA	ELEV	Bed material	Notes
92.96		19.50	170.00	73.46		
		19.63	175.00	73.33		
		19.31	180.00	73.65		
		18.68	185.00	74.28	boulder/large cobble	REW
		17.72	190.00	75.24	boulder/large cobble	
		17.70	197.00	75.26	large cobble/small boulder	
		17.29	207.00	75.67	large cobble/small boulder	
		16.05	214.00	76.91	large cobble/small boulder	
		15.18	221.00	77.78	large cobble/small boulder	
		14.72	227.00	78.24	large cobble/small boulder	lower bankfull estimate
		12.24	238.00	80.72	riparian veg	
		11.88	245.00	81.08	riparian veg	
		12.04	252.00	80.92		on top of cobble bar, dividing main channel and high flow channel
		11.58	259.00	81.38		
		10.60	267.00	82.36		
		9.00	279.00	83.96		top of cobble bar, upper BF estimate
		9.81	287.00	83.15		left edge of bank high flow channel
		10.88	295.00	82.08		
		11.29	300.00	81.67		
		10.46	307.00	82.50		
		9.70	314.00	83.26		
		9.21	321.00	83.75		
		8.76	330.00	84.20		
		4.75	336.00	88.21	bedrock	on steep slope
		2.10	340.00	90.86		
		1.14	348.00	91.82		
		1.49	TP 1	91.47		
103.56	12.09		TP 1			OS 2
		5.26	352.40	98.30		base of pin RB
		5.09	352.40	98.47		top of pin RB
		11.25	top LB pin	92.31		reshoot OK

The Reach Downstream of Chili Bar: Upper Canyon Site (CB-G1) lower cross-section (p. 1 of 2)

HI	BS	FS	STA	ELEV	WD	Bed material	Notes
90.23							5 feet back from left bank pin, 15 feet up from hillslope is the location of first measurement
	1.44		1.20				Top of pin (LB)
		1.78	1.20	88.45	68.99		base of pin (LB)
		2.90	3.00	87.33			alluvial terrace, boulder-cobble w/veg on it
		3.88	5.00	86.35			
		4.59	7.00	85.64			
		5.16	9.00	85.07			
		5.74	11.00	84.49			
		6.16	13.00	84.07			
		6.39	15.00	83.84			
		6.48	17.00	83.75			
		6.65	19.00	83.58			
		6.56	21.00	83.67			
		8.40	23.00	81.83			
		7.30	25.00	82.93			on top of boulder
		9.57	27.00	80.66			
		10.23	29.00	80.00			
		9.65	31.00	80.58			estimated bankfull (LB)
		10.92	33.00	79.31			
		11.04	35.00	79.19			
		11.36	37.00	78.87			
		11.10	39.00	79.13			
		11.10	41.00	79.13			
		10.99	43.00	79.24			
		11.01	45.00	79.22			
		11.15	47.00	79.08			
		10.83	49.00	79.40			
		10.95	51.00	79.28			
		11.24	53.00	78.99			
		11.10	55.00	79.13			
		12.31	57.00	77.92			
		12.27	59.00	77.96			
		12.05	61.00	78.18			
		11.20	63.00	79.03			measurement taken on top of boulder
		11.65	65.00	78.58			
		12.57	67.40	77.66			
		14.29	70.40	75.94			
		15.02	72.50	75.21			
		15.69	75.00	74.54			
		16.05	77.00	74.18			on a small cobb gravel bar
		16.28	79.00	73.95			
		16.56	81.00	73.67			
		17.00	83.00	73.23			
		17.75	85.00	72.48			
		18.00	87.00	72.23			
		18.40	89.00	71.83			LEW
		19.50	95.00	70.73			small cobble gravel
		20.14	100.00	70.09			
		20.00	105.00	70.23		bedrock and small boulder	
		20.28	111.00	69.95			
		19.74	117.00	70.49			
		21.04	122.00	69.19			
		21.16	127.50	69.07			
		20.66	134.00	69.57			
		19.37	141.30	70.86			
		20.68	148.00	69.55			
		21.07	154.30	69.16	2.30		2.3 feet water depth ~ thalweg, time: 11:30am
		20.82	161.00	69.41			
		21.24	166.00	68.99			
		21.22	172.00	69.01			
		20.26	177.00	69.97			

The Reach Downstream of Chili Bar: Upper Canyon Site (CB-G1) lower cross-section (p. 2 of 2)

HI	BS	FS	STA	ELEV	WD	Bed material	Notes
90.23		20.68	182.00	69.55			
		20.05	189.00	70.18			
		19.16	195.00	71.07			
		19.46	200.00	70.77			
		19.60	205.00	70.63			
		19.52	210.00	70.71			
		19.65	215.00	70.58		gravel sand boulder	
		19.44	220.00	70.79			
		19.02	224.10	71.21			REW at 11:45 am
		18.33	227.00	71.90		cobble boulder sand (new facies)	
		18.04	229.00	72.19			
		17.77	231.00	72.46			
		17.61	233.00	72.62			
		17.06	235.00	73.17			
		16.65	237.00	73.58			
		16.36	239.00	73.87			
		16.13	241.00	74.10			
		15.84	243.00	74.39			
		15.65	245.00	74.58		more cobble gravel boulder facies	
		15.29	247.00	74.94			
		14.84	249.00	75.39			
		13.87	251.00	76.36			
		13.42	253.00	76.81			
		12.80	255.00	77.43		riparian veg begins	
		12.14	257.00	78.09			
		11.56	259.00	78.67			
		11.20	261.00	79.03			
		10.53	263.00	79.70			
		10.08	265.00	80.15			
		9.68	267.00	80.55			
		9.59	269.00	80.64			estimated bankfull (RB)
		9.26	271.00	80.97			
		9.02	273.00	81.21			
		8.86	275.00	81.37			
		9.32	277.00	80.91			
		9.58	279.00	80.65			
		9.89	281.00	80.34			
		10.28	283.00	79.95			
		10.57	285.00	79.66			
		10.92	287.00	79.31			
		11.46	289.00	78.77			
		11.90	291.00	78.33			
		12.13	293.00	78.10			
		12.44	295.00	77.79			
		12.54	297.00	77.69			
		12.33	299.00	77.90			
		12.22	301.00	78.01			
		11.76	303.00	78.47			
		11.53	305.00	78.70			
		11.32	307.00	78.91		gravel sand	
		11.11	309.00	79.12			
		10.83	311.00	79.40			
		9.20	313.00	81.03		bedrock	
		8.61	315.00	81.62			
		8.07	317.00	82.16		scree slope w/bedrock	
		7.72	319.00	82.51			
		6.15	321.00	84.08			
		4.27	323.00	85.96			
		4.05	325.00	86.18			
		3.82	327.00	86.41			
		3.29	328.50	86.94			base of pin, RB
		2.75	328.50				top of pin, RB (12:33 pm)
		1.44	LB T.O.P.				LB top of pin, reshoot close-out
90.23		10.18	BM 2	80.05			FS from OS 1 to u/s benchmark (BM 2) *Note original BM name from field notes was changed to prevent confusion 18JAN2004 CDJ
	3.45		BM 2				BS from OS 2 to BM 2 *Note original BM name from field notes was changed to prevent confusion 18JAN2004 CDJ

The Reach Downstream of Chili Bar: Upper Canyon Site (CB-G1) pebble count summary

Modified Wolman Pebble Count (mm), Upper Canyon Chili Bar

Particle Description	Upper Class Boundary (mm)	Rosgen Particle Size	XS #1	XS #2	XS #3	Total	Item %	Cum %
Very coarse sand (unmeasured)	<2	6	0	0	0	0	0%	0%
Very coarse sand (measured)	2	5	0	0	0	0	0%	0%
Very Fine Gravel	4	4	0	1	0	1	0%	0%
Fine Gravel	8		1	3	1	5	2%	2%
Medium Gravel	16		5	1	1	7	2%	4%
Coarse Gravel	32		9	9	9	27	9%	13%
Very Coarse Gravel	64		24	20	24	68	23%	36%
Small Cobble	128	3	25	28	29	82	27%	63%
Large Cobble	256		24	24	19	67	22%	86%
Small Boulder	512	2	12	14	17	43	14%	100%
Medium Boulder	1024		0	0	0	0	0%	100%
Large Boulder	2048		0	0	0	0	0%	100%
Very Large Boulder	4096		0	0	0	0	0%	100%
Bedrock	>4096	1	0	0	0	0	0%	100%
		Total	100	100	100	300	100%	

The Reach Downstream of Chili Bar: Upper Coloma Site (CB-G2) long profile

HI	BS	FS	STA	WSE	ELEV	Water depth (ft)	Notes
	2.87		**BM2**				A non-descript rock on RB near XS1
		12.01	0.00	89.32	84.67	4.65	
		11.26	15.00	89.32	85.42	3.90	
		10.89	30.00	89.29	85.79	3.50	
		9.82	45.00	89.26	86.86	2.40	head of riffle
		9.35	60.00	89.03	87.33	1.70	
			68.00				Upper XS crosses long profile
		9.89	75.00	88.99	86.79	2.20	
		10.39	90.00	88.24	86.29	1.95	
		11.73	105.00	86.95	84.95	2.00	
		12.30	120.00	86.91	84.38	2.53	
		12.37	135.00	86.51	84.31	2.20	
		12.25	151.90	85.83	84.43	1.40	
		12.54	165.00	86.02	84.14	1.88	end of island
		12.93	180.00	86.15	83.75	2.40	
		13.53	195.00	85.60	83.15	2.45	
		14.47	210.00	85.61	82.21	3.40	
		14.64	225.00	85.44	82.04	3.40	
			231.50				Long profile crosses Middle XS
		14.48	240.00	85.30	82.20	3.10	
		13.89	255.00	85.04	82.79	2.25	
		13.86	270.00	84.97	82.82	2.15	
		14.00	285.00	84.88	82.68	2.20	
		14.23	300.00	84.75	82.45	2.30	
		14.57	315.00	84.81	82.11	2.70	
		14.73	330.00	84.65	81.95	2.70	
		14.94	345.00	84.54	81.74	2.80	
		14.43	360.00	84.50	82.25	2.25	End of riffle/top of pool
		14.89	375.00	84.49	81.79	2.70	
		14.98	390.00	84.45	81.70	2.75	
		14.90	405.00	84.38	81.78	2.60	
		15.43	420.00	84.43	81.25	3.18	
		15.62	435.00	84.41	81.06	3.35	
		15.95	450.00	84.43	80.73	3.70	
			459.80				Long profile crosses Lower XS
		15.88	465.00	84.40	80.80	3.60	
		16.16	480.00	84.37	80.52	3.85	
		15.93	495.00	84.35	80.75	3.60	
		15.80	510.00	84.36	80.88	3.48	
		16.39	525.00	84.39	80.29	4.10	
		16.03	540.00	84.40	80.65	3.75	
		15.65	555.00	84.33	81.03	3.30	
		16.05	570.00	84.33	80.63	3.70	
		15.85	585.00	84.37	80.83	3.54	
		16.25	600.00	84.33	80.43	3.90	
96.68		2.88	BM2	93.80	93.80		A non-descript rock on RB near XS1 -- Loop Closed Station OK (0.01 error)
93.81	12.55						A non-descript rock on RB near XS1 BM2, backshot from different OS
106.36		6.36			100.00		T.O.P. R.B. Upper XS (really on 6.355 but closer to 6.36) [Used this value for the analysis]
		8.51			97.84		T.O.P. R.B. Middle XS

The Reach Downstream of Chili Bar: Upper Coloma Site (CB-G2)
upper cross-section

HI	BS	FS	STA	ELEV	WD	Bed material	Notes
							assumed elevation T.O.P. R.B. = 100 ft
100.99	0.99		16.20	100.00			T.O.P. RB Upper XS
		1.21	16.20	99.78		sediment: sand gravel cobble boulder	base of pin RB Upper XS terrace bar, slightly vegetated from the RB pin road surface made of sand/gravel/cobble extending ~15 feet horizontally away from the pin.
		0.30	-4.00	100.69			
		3.69	22.00	97.30			
		5.24	26.00	95.75			
		6.46	33.00	94.53			
		7.27	40.00	93.72			
		8.03	45.00	92.96			estimated bankfull elevation
		10.32	52.00	90.67			
		11.44	57.00	89.55		cobble, gravel, sand	active channel
		11.60	58.00	89.39	0.00		WSE RB (09:58)
		12.70	63.00	88.29		boulders present	
		13.10	68.00	87.89			
		13.31	73.00	87.68			
		13.44	78.00	87.55			
		13.65	83.00	87.34			
		13.48	88.00	87.51			
		14.34	93.00	86.65			
		14.32	98.00	86.67		sand in small patches between boulder and cobble	
		14.81	103.00	86.18			
		14.66	108.00	86.33			
		14.57	113.00	86.42			
		14.29	118.00	86.70			
		14.42	123.00	86.57			
		14.39	128.00	86.60			
		15.07	133.00	85.92			
		15.33	138.00	85.66			
		15.39	143.00	85.60			estimate thalweg
		14.69	148.00	86.30			
		13.45	153.00	87.54			
		12.22	158.00	88.77			
		11.70	161.60	89.29	0.00		WSE start of mid-channel island LB of right channel (Time = 10:14)
		11.06	165.00	89.93			
		9.89	170.00	91.10			
		8.29	175.00	92.70			
		8.33	180.00	92.66			
		8.44	184.00	92.55			
		10.71	190.00	90.28			
		12.10	193.70	88.89	0.00		WSE (time= 10:23) end of mid-channel island, RB of left channel
		12.42	195.00	88.57			
		13.97	200.00	87.02			
		14.09	205.00	86.90		substrate: cobble/gravel/boulder continues	
		13.59	210.00	87.40			
		13.27	215.00	87.72			
		13.12	220.00	87.87			
		12.95	225.00	88.04			
		12.47	230.00	88.52			
		12.58	235.00	88.41			
		12.53	240.00	88.46			
		12.32	245.00	88.67			
		12.38	250.00	88.61			
		12.11	255.00	88.88			
		12.26	260.00	88.73			
		12.24	265.00	88.75			
		11.63	270.00	89.36	0.00		WSE, LB (Time = 10:37)
		11.35	275.00	89.64			
		11.23	280.00	89.76			
		10.57	286.00	90.42			
		11.13	290.00	89.86			
		10.17	295.00	90.82			entering riparian veg. zone
		9.39	300.00	91.60			
		8.38	305.00	92.61		substrate: sand/gravel/boulder	
		7.18	310.00	93.81			
		7.06	313.30	93.93			estimated bankfull elevation
		5.45	320.00	95.54			
		5.11	325.00	95.88			
		4.13	332.00	96.86			
		6.06	BM1 11/16/2003	94.93			from OS1

The Reach Downstream of Chili Bar: Upper Coloma Site (CB-G2) upper cross-section (p. 2 of 2)

HI	BS	FS	STA	ELEV	WD	Bed material	Notes
106.05	11.12		BM1 11/16/2003				from OS2
		8.55	337.00	97.50			
		7.82	342.00	98.23			
		6.81	347.00	99.24			
		5.64	352.00	100.41			
		3.58	359.00	102.47			
		2.18	366.00	103.87			Bottom of pin LB, upper XS
		1.72	366.00	104.33			Top of pin LB, upper XS
		11.13		94.92			BM1 11/16/2003
		6.05		100.00			Top of pin RB, Closed out loop, OK

The Reach Downstream of Chili Bar: Upper Coloma Site (CB-G2) middle cross-section (p. 1 of 2)

HI	BS	FS	STA	ELEV	WD	Bed material	Notes
105.29	5.29			100.00			T.O.P. RB Upper XS
		7.45		97.84			T.O.P. RB Middle XS
		0.43	-67.00	104.86			From RB pin @ middle XS
		2.21	-52.00	103.08		silt/sand -- in middle of dirt driveway of property owner	
		4.16	-37.00	101.13			
		5.01	-22.00	100.28			
		6.63	-7.00	98.66			
		7.45	4.00	97.84			T.O.P. RB middle XS station is stable
		7.75	4.00	97.54			Base of pin RB Middle XS
		9.05	10.00	96.24			
		9.07	15.00	96.22		silt/cobble/boulder	
		9.83	20.00	95.46			
		9.96	25.00	95.33			
		9.97	30.00	95.32			
		10.01	35.00	95.28		cobble/boulder/sand	
		10.35	40.00	94.94			"Historical Floodplain = obviously once a surface that saw frequent floods, but now high above current active channel surface"
		11.35	45.00	93.94			
		11.72	50.00	93.57			
		12.61	55.00	92.68			
		12.83	60.00	92.46			estimated bankfull elevation
		13.43	65.00	91.86			
		14.03	70.00	91.26		cobble/boulder/gravel	
		13.96	75.00	91.33			
		14.04	80.00	91.25			
		14.18	85.00	91.11			
		14.24	90.00	91.05			
		15.11	95.00	90.18			
		14.89	100.00	90.40			
		14.51	105.00	90.78			
		14.97	110.00	90.32			
		15.44	115.00	89.85			
		15.82	120.00	89.47			
		16.01	125.00	89.28			
		16.13	130.00	89.16			
		16.12	135.00	89.17			
		15.20	140.00	90.09			
		15.81	145.00	89.48			
		15.70	150.00	89.59			
		15.53	155.00	89.76			
		16.12	160.00	89.17			
		16.43	165.00	88.86			
		17.30	170.00	87.99			
		18.99	175.00	86.30			
		19.82	177.80	85.47			W.S.E. RB (14:57 = Time)
		20.01	180.00	85.28			

The Reach Downstream of Chili Bar: Upper Coloma Site (CB-G2) middle cross-section (p. 2 of 2)

HI	BS	FS	STA	ELEV	WD	Bed material	Notes
105.29		20.62	185.00	84.67			
		21.31	190.00	83.98		cobble/small boulder	
		22.46	195.00	82.83			
		22.85	200.00	82.44			
		22.74	205.00	82.55			
		22.85	210.00	82.44			
		21.66	215.00	83.63			
		21.20	220.00	84.09			
		20.19	223.20	85.10			W.S.E. LB (Time = 15:13)
		19.57	225.00	85.72			
		17.73	230.00	87.56			
		15.90	235.00	89.39			
		15.90	240.00	89.39		cobble/gravel/boulder	
		15.90	245.00	89.39			
		15.60	250.00	89.69			
		15.01	255.00	90.28			
		14.44	260.00	90.85			
		13.82	265.00	91.47			estimated bankfull elevation - start riparian veg.
		13.46	270.00	91.83			
		13.67	275.00	91.62			
		13.62	280.00	91.67			
		13.29	285.00	92.00			
		12.91	290.00	92.38			
		12.95	295.00	92.34			
		12.69	300.00	92.60			
		13.18	305.00	92.11			Historical Floodplain
		13.66	310.00	91.63			
		12.59	315.00	92.70			
		12.41	320.00	92.88			
		11.73	325.00	93.56			
		9.91	330.00	95.38			
		8.17	335.00	97.12			
		5.85	341.30	99.44			base LB pin Middle XS (pin is at the base of a large pine tree)
		5.43	341.30	99.86			T.O.P. LB
		7.46		97.83			T.O.P. RB Middle XS
		5.29		100.00			T.O.P. RB Upper XS Loop closed OK
		5.06		100.23			T.O.P. RB Lower XS

The Reach Downstream of Chili Bar: Upper Coloma Site (CB-G2) lower cross-section (p. 1 of 2)

HI	BS	FS	STA	ELEV	WD	Bed material	Notes
102.98	2.75		1.20	100.23			T.O.P. RB Lower XS
		3.31	1.20	99.67			B.O.P. RB Lower XS
		4.17	5.00	98.81		silt/sand/angular boulders (at end of earth driveway along flow axis)	
		4.28	10.00	98.70			
		4.85	15.00	98.13			
		5.40	20.00	97.58			
		5.67	25.00	97.31			
		6.10	30.00	96.88			
		6.11	35.00	96.87		cobble/boulder/silt and sand	entered historic floodplain
		6.40	40.00	96.58			
		6.54	45.00	96.44			
		6.83	50.00	96.15			
		6.38	55.00	96.60			
		6.96	60.00	96.02			
		6.42	65.00	96.56			
		6.28	70.00	96.70			
		6.83	75.00	96.15			
		6.75	80.00	96.23			
		7.40	85.00	95.58			
		6.38	90.00	96.60			
		7.16	95.00	95.82			
		8.06	100.00	94.92			
		8.33	105.00	94.65			
		8.86	110.00	94.12			
		8.67	115.00	94.31			
		9.36	120.00	93.62			
		9.53	125.00	93.45		rounded boulder/cobble	
		9.37	130.00	93.61			
		9.76	135.00	93.22			
		10.18	140.00	92.80			
		10.86	145.00	92.12			
		11.56	150.00	91.42			
		12.43	155.00	90.55			
		12.55	160.00	90.43			
		12.85	165.00	90.13			
		13.92	170.00	89.06			estimated bankfull elevation
		13.94	175.00	89.04			
		14.42	180.00	88.56			
		15.06	185.00	87.92			
		14.75	190.00	88.23			
		14.14	195.00	88.84			
		13.85	200.00	89.13			
		14.11	205.00	88.87			
		14.69	210.00	88.29		cobble/boulder/gravel	
		15.52	215.00	87.46			
		15.85	220.00	87.13			
		17.00	225.00	85.98			
		18.64	228.70	84.34			WSE RB (Time=10:51)
		18.70	230.00	84.28			
		20.29	235.00	82.69			
		21.88	240.00	81.10			
		22.31	245.00	80.67			
		22.31	250.00	80.67			estimated thalweg
		22.06	255.00	80.92			
		22.30	260.00	80.68			
		21.77	265.00	81.21			
		21.34	270.00	81.64			
		19.96	275.00	83.02		bedrock	
		18.75	279.00	84.23		bedrock	WSE LB (Time=10:59)
		16.88	284.00	86.10		bedrock	
		14.36	290.00	88.62		cobble/boulder/gravel	
		13.65	295.00	89.33			dense riparian veg.
		12.88	300.00	90.10			
		13.95	305.00	89.03		sand/silt matrix	
		12.58	310.00	90.40			
		11.92	315.00	91.06			estimated bankfull elevation
		11.41	320.00	91.57			
		10.39	325.00	92.59			
		9.09	330.00	93.89			
		8.78	335.00	94.20			
		8.60	340.00	94.38			
		8.65	345.00	94.33			
		11.56	BM1	91.42			From OS1

The Reach Downstream of Chili Bar: Upper Coloma Site (CB-G2) lower cross-section (p. 2 of 2)

HI	BS	FS	STA	ELEV	WD	Bed material	Notes
108.68	17.26		BM1				From OS2
		14.75	351.60	93.93			
		15.01	355.00	93.67			
		15.76	360.00	92.92			boulders more angular with moss on historic floodplain
		15.41	365.00	93.27			
		14.59	370.00	94.09			
		14.50	375.00	94.18			
		13.68	380.00	95.00			
		13.20	385.00	95.48			
		13.28	390.00	95.40			
		13.05	395.00	95.63			
		12.55	400.00	96.13			
		12.78	405.00	95.90			end of historic floodplain (Terrace 1) entering a slope and then bench (terrace 2)
		11.59	410.00	97.09		silt/sand	
		10.38	415.00	98.30			
		9.41	420.00	99.27			
		8.53	425.00	100.15			
		8.27	430.00	100.41			
		7.70	435.00	100.98			
		6.99	440.00	101.69			
		6.61	445.00	102.07			
		6.53	450.00	102.15			
		5.80	455.00	102.88			
		4.33	461.40	104.35			Base LB pin
		3.96	461.40	104.72			T.O.P. LB
		17.26		91.42			BM1 11/17/2003
		8.43		100.25			T.O.P. RB Lower XS Loop Closed OK (0.02 error)
		8.68		100.00			T.O.P. RB Upper XS

The Reach Downstream of Chili Bar: Upper Coloma Site (CB-G2)
Pebble count summary

Modified Wolman Pebble Count (mm), Upper Coloma

Particle Description	Upper Class Boundary (mm)	Rosgen Particle Size	XS #1	XS #2	XS #3	Total	Item %	Cum %
Very coarse sand (unmeasured)	<2	6	3	0	0	3	1%	1%
Very coarse sand (measured)	2	5	0	0	0	0	0%	1%
Very Fine Gravel	4	4	1	0	1	2	1%	2%
Fine Gravel	8		1	0	1	2	1%	2%
Medium Gravel	16		0	0	0	0	0%	2%
Coarse Gravel	32		3	2	4	9	3%	5%
Very Coarse Gravel	64		17	10	3	30	10%	15%
Small Cobble	128	3	36	41	27	104	35%	50%
Large Cobble	256		26	34	42	102	34%	84%
Small Boulder	512	2	13	13	22	48	16%	100%
Medium Boulder	1024		0	0	0	0	0%	100%
Large Boulder	2048		0	0	0	0	0%	100%
Very Large Boulder	4096		0	0	0	0	0%	100%
Bedrock	>4096	1	0	0	0	0	0%	100%
		Total	100	100	100	300	100%	

The Reach Downstream of Chili Bar: Lower Coloma Site (CB-G3) long profile

HI	BS	FS	STA	WSE	ELEV	Water depth (ft)	Notes
							set up level near XS2 on LB
93.45	3.59		TP2		89.86		low flow fluctuation pin on XS2, LB
		5.62	XS3pin		87.83		flow fluctuation pin on RB, U/S of XS3
		1.23	TP1		92.22		flow fluctuation pin on RB, XS2
		12.62	65.00	86.27	80.83	5.44	
		10.92	75.00	87.32	82.53	4.79	
		9.32	85.00	86.33	84.13	2.20	
		8.70	95.00	86.32	84.75	1.57	
		8.15	105.00	86.30	85.30	1.00	
		8.36	115.00	86.28	85.09	1.19	
		8.30	125.00	86.32	85.15	1.17	
		8.35	135.00	86.25	85.10	1.15	
		8.42	145.00	86.13	85.03	1.10	
		8.33	155.00	86.04	85.12	0.92	
		8.35	161.30	85.77	85.10	0.67	XS1 (upper XS)
		8.41	165.00	85.91	85.04	0.87	
		8.69	175.00	85.76	84.76	1.00	
		8.98	185.00	85.49	84.47	1.02	
		9.89	195.00	85.30	83.56	1.74	
		10.88	205.00	85.09	82.57	2.52	
		10.21	215.00	85.14	83.24	1.90	
		10.97	225.00	84.68	82.48	2.20	
		10.96	235.00	84.59	82.49	2.10	
		11.24	245.00	84.08	82.21	1.87	
		12.40	255.00	83.65	81.05	2.60	
		16.75	265.00	82.80	76.70	6.10	
		16.09	275.00	83.18	77.36	5.82	
		15.54	285.00	83.16	77.91	5.25	
		15.82	295.00	82.87	77.63	5.24	
		16.62	305.00	83.00	76.83	6.17	(not quite in thalweg)
		15.60	315.00	83.10	77.85	5.25	(not quite in thalweg)
		14.27	325.00	83.28	79.18	4.10	
		12.77	335.00	83.26	80.68	2.58	
		12.65	345.00	83.25	80.80	2.45	
		12.50	350.20	83.23	80.95	2.28	XS2 (middle XS)
		12.34	355.00	83.11	81.11	2.00	
		12.53	365.00	83.11	80.92	2.19	
		3.59	TP2		89.86		flow fluctuation pin on LB at XS2
		12.64	375.00	83.08	80.81	2.27	
		12.33	385.00	82.87	81.12	1.75	
		12.47	395.00	82.78	80.98	1.80	
		12.99	405.00	82.66	80.46	2.20	
		13.77	415.00	82.18	79.68	2.50	
		13.91	425.00	82.22	79.54	2.68	
		13.45	435.00	82.27	80.00	2.27	
		13.22	445.00	82.18	80.23	1.95	
		13.65	455.00	81.98	79.80	2.18	
		13.91	465.00	81.79	79.54	2.25	
		14.25	475.00	81.60	79.20	2.40	
		14.39	485.00	81.61	79.06	2.55	
		14.09	495.00	81.96	79.36	2.60	
		14.76	505.00	81.29	78.69	2.60	
		15.44	515.00	80.66	78.01	2.65	
		15.17	525.00	80.55	78.28	2.27	
		15.88	535.00	80.57	77.57	3.00	
		15.97	545.00	80.54	77.48	3.06	
		15.59	555.00	80.50	77.86	2.64	
		15.72	565.00	80.37	77.73	2.64	
		15.54	575.00	80.31	77.91	2.40	
		5.62	~RB XS3pin		87.83		XS3 - flow fluctuation pin on RB
		3.59	TP2		89.86		flow pin on LB at XS2
		15.48	585.00	80.16	77.97	2.19	at XS3 (lower XS) 295 on tape 2 = 25 on tape 3
		15.56	594.70	80.11	77.89	2.22	
		15.98	605.00	79.97	77.47	2.50	
		16.20	615.00	79.85	77.25	2.60	
		16.53	625.00	79.57	76.92	2.65	
		16.85	635.00	79.70	76.60	3.10	
		17.04	645.00	79.76	76.41	3.35	
		16.96	655.00	79.74	76.49	3.25	
		17.98	665.00	79.69	75.47	4.22	
		17.80	675.00	79.70	75.65	4.05	
		18.20	685.00	79.65	75.25	4.40	
		3.59	TP2		89.86		

The Reach Downstream of Chili Bar: Lower Coloma Site (CB-G3) upper cross section

HI	BS	FS	STA	ELEV	WD	Bed material	Notes
106.87	6.87		BM1	100.00			pipe in ground near RB pin (top of pipe) [arbitrary elevation = 100 ft]
		3.13	RB pin	103.74			RB top of pin
		4.02	17.00	102.85			RB base of pin
		3.88	22.00	102.99			on boulder
		6.72	27.00	100.15			
		7.58	32.00	99.29			
		7.69	37.00	99.18			
		7.69	42.00	99.18			
		8.15	47.00	98.72			
		9.42	52.00	97.45			
		10.63	57.00	96.24			brambles
		11.30	62.00	95.57			
		11.11	67.00	95.76			
		10.66	72.00	96.21			
		11.63	75.00	95.24			edge of tall brambles
		17.39	89.00	89.48			waters edge of small backwater
		17.87	93.00	89.00		co/gravel/boulder	small channel:
		18.20	98.00	88.67			
		18.00	103.00	88.87			
		17.84	105.00	89.03			waters edge of backwater (sand) LOTS OF BRAMBLES BETWEEN 105-115
		15.71	115.00	91.16			
		15.39	120.00	91.48			
		14.21	125.00	92.66			
		13.22	130.00	93.65		cobbles/sand	upper bankfull estimate
		13.27	135.00	93.60		cobbles/sand	
		13.96	140.00	92.91		cobbles/sand	
		14.20	145.00	92.67		cobbles/sand	
		13.95	150.00	92.92		cobbles/sand	
		15.21	157.00	91.66		cobbles/sand	
		15.79	162.00	91.08		cobbles/sand	
		16.15	167.00	90.72		cobbles/sand	
		17.65	174.80	89.22		cobble/gravel/small boulder	Lower bankfull estimate
		18.42	180.00	88.45		cobble/gravel/small boulder	
		19.25	185.00	87.62		cobble/gravel/small boulder	
		19.57	190.00	87.30		cobble/gravel/small boulder	
		20.27	195.00	86.60		cobble/gravel/small boulder	
		20.87	196.60	86.00		cobble/gravel/small boulder	RB WSEL (at 12:57)
		21.14	200.00	85.73			
		21.26	205.00	85.61			
		21.45	210.00	85.42			
		21.10	215.00	85.77			
		21.15	220.00	85.72			
		21.52	225.00	85.35			
		21.89	230.00	84.98			
		22.33	235.00	84.54			
		22.43	240.00	84.44			
		22.36	245.00	84.51			
		22.31	249.00	84.56			tail end of pool (225.00–275.00)
		22.26	251.00	84.61			
		22.25	255.00	84.62			
		22.55	259.00	84.32			
		22.38	265.00	84.49			
		22.28	270.00	84.59			
		22.00	275.00	84.87			
		21.90	280.00	84.97			edge of riffle cross-over
		21.46	285.00	85.41			
		21.26	290.00	85.61			
		21.37	295.00	85.50			
		21.42	299.00	85.45			tapes knotted together
		21.60	303.00	85.27			
		21.72	308.00	85.15			
		21.80	313.00	85.07			
		21.78	318.00	85.09			
		21.90	323.00	84.97			
		21.86	328.00	85.01			
		20.80	330.40	86.07			LB WSEL (13:16)
		19.62	333.00	87.25			
		19.73	338.00	87.14			
		19.74	343.00	87.13		CO/SI/GR (small bar)	
		19.18	348.30	87.69			very lower bankfull estimate (top of edge of bar)
		19.90	353.00	86.97			

The Reach Downstream of Chili Bar: Lower Coloma Site (CB-G3) middle cross section (p. 1 of 2)

	HI	BS	FS	STA	ELEV	WD	Bed material	Notes
	107.67	7.67		BM1	100.00			metal pipe in ground near XS1
			4.84	RB pin	102.83			top of RB pin
			5.28	16.40	102.39			base of RB pin
			5.90	22.00	101.77		silts/soil	
			6.69	30.00	100.98		asphalt driveway	
			7.55	37.00	100.12			
			8.06	44.00	99.61			
			8.49	50.00	99.18			
			8.78	56.00	98.89			
			9.08	61.00	98.59			
			9.45	68.00	98.22		end of asphalt driveway	
			9.84	73.00	97.83		silts/soil	
			10.53	80.00	97.14			
			11.05	85.00	96.62			
			11.46	90.00	96.21			
			12.40	95.00	95.27			
			13.76	100.00	93.91			
			14.13	105.00	93.54			
			14.70	110.00	92.97			
			15.62	115.00	92.05			
			16.65	117.50	91.02			top of bank of overflow channel
			18.72	120.10	88.95			bottom of bank of overflow channel -- WSEL (10:20)
			19.12	122.70	88.55			thalweg of overflow channel
			18.20	128.00	89.47			
			17.44	133.00	90.23			
			17.43	138.00	90.24			
			17.52	143.00	90.15			
Phase 1			16.93	148.00	90.74			passed rod through the blackberry brambles!
			15.84	157.00	91.83			
			16.01	162.00	91.66			
			16.15	167.00	91.52			
			16.39	172.00	91.28			upper bankfull
			16.58	177.00	91.09			edge of brambles
			17.82	182.00	89.85			
			18.74	187.00	88.93			
			19.50	192.00	88.17			
			20.17	197.00	87.50			
			21.08	202.40	86.59			lower bankfull? --WSEL for side channel
			21.21	207.00	86.46			
			21.45	212.00	86.22			
			21.25	217.40	86.42			WSEL on LB of small channel
			21.20	222.00	86.47			
	107.67		21.35	227.00	86.32			
			21.53	232.00	86.14			
			21.88	237.00	85.79			
			22.30	242.00	85.37			
			22.46	247.00	85.21			
			22.40	252.00	85.27			
			22.48	257.00	85.19			
			22.86	262.00	84.81			
			23.17	267.00	84.50			
			23.83	272.00	83.84			
			24.70	276.50	82.97			WSEL RB
			15.46	TP1	92.21			TP1 (sta 180.7) -- turning point. Top of rebar (RB) from Matt Sloat. Surveyed upper stations of LB before turning to get shots in the channel.
			17.81	TP2	89.86			top of pin (low flow fluctuation pin LB)

The Reach Downstream of Chili Bar: Lower Coloma Site (CB-G3) middle cross section (p. 2 of 2)

	HI	BS	FS	STA	ELEV	WD	Bed material	Notes
	92.16	2.30		TP2	89.86			flow fluctuation pin on LB
								turned level down to cobble bar to get shots in channel
			9.87	280.00	82.29			
			10.39	285.00	81.77			
			10.42	290.00	81.74			
			10.75	295.00	81.41			an old tape (298 on old tape = 8 feet on new tape)
			10.68	300.00	81.48			tape broke -- had to retie it
			11.09	305.00	81.07			
			11.30	310.00	80.86			
Phase 3			10.82	315.00	81.34			
			10.21	320.00	81.95			
			10.42	325.00	81.74			
			10.72	330.00	81.44			
			10.60	335.00	81.56			
			10.99	340.00	81.17			station 50 on new tape
			2.30	TP2	89.86			flow fluctuation pin on LB
	107.24	17.38		TP2				turned back to RB
			7.22	BM1	100.02			close out OK (0.02 error)
	107.76							high continued from above, Operation Station #1 (OS1)
			6.88	TopofLBpin	100.88			top of LB pin (station 172.2 on new tape)
			24.46	343.00	83.30			WSEL - LB (11:25)
			24.33	345.00	83.43		rounded co/bo/gr	
			24.20	348.20	83.56		bedrock	base of bank
			22.08	350.00	85.68			lower bankfull estimate
			19.97	355.00	87.79		bedrock	
			17.81	TP2	89.95			top of pin (low flow fluctuation pin LB)
			19.81	357.60	87.95			at base of low flow pin (Matt Sloat)
			19.49	360.00	88.27			
			18.80	365.00	88.96			
			18.32	380.50	89.44			
			18.31	370.00	89.45			
			18.25	375.00	89.51			
			18.01	385.00	89.75		rounded cobble/gravel	
			17.71	390.00	90.05			
Phase 2			17.50	395.00	90.26			
			17.22	400.00	90.54		cobble/sand	
			16.83	404.80	90.93			upper bankfull estimate
			16.32	407.00	91.44			
			14.93	412.00	92.83			
			14.09	417.00	93.67			
			13.71	422.00	94.05			
			12.94	427.00	94.82			
			12.12	432.00	95.64			
			11.00	437.00	96.76			
			10.40	442.00	97.36			
			9.93	447.00	97.83			silts/sands (on yard)
			9.48	452.00	98.28			
			8.60	457.00	99.16			
			7.76	462.20	100.00			base of LB pin
			6.88	TopofLBpin	100.88			top of LB pin (station 172.2 on new tape)

The Reach Downstream of Chili Bar: Lower Coloma Site (CB-G3) lower cross section (p. 1 of 2)

HI	BS	FS	STA	ELEV	WD	Bed material	Notes
96.74	0.13		16.3	96.61			RB TOP XS3
		0.80	16.3	95.94			RB Base of pin XS3
		2.60	21.0	94.14			
		4.68	27.0	92.06			top of pond RB --silt sand
		7.68	29.4	89.06			WSE of pond, bottom of bank
		10.54	34.0	86.20		substrate: silty muck	
		11.36	39.0	85.38			
		11.45	44.0	85.29			
		11.13	49.0	85.61			
		10.76	54.0	85.98			
		9.57	59.0	87.17			
		7.71	62.4	89.03			WSE of LB pond
		5.79	66.0	90.95			
		4.95	71.0	91.79			
		4.99	76.0	91.75			upper bankfull estimate substrate: sand/cobble/small boulder
		5.51	81.0	91.23			
		5.03	86.0	91.71			
		5.20	91.0	91.54			
		4.68	96.1	92.06			
		5.44	105.0	91.30		substrate: cobble/gravel/boulder	
		6.06	110.0	90.68			
		6.74	115.0	90.00			
		7.56	120.0	89.18			
		7.91	125.0	88.83			
		9.42	130.0	87.32			
		10.65	135.0	86.09			
		11.11	140.0	85.63			
		11.61	145.0	85.13			
		11.29	150.0	85.45			
		10.73	155.0	86.01			
		9.83	160.0	86.91			
		9.77	165.0	86.97			
		9.38	170.0	87.36			
		9.29	175.0	87.45			
		9.69	180.0	87.05			
		9.98	185.0	86.76			
		9.73	190.0	87.01			
		10.09	195.0	86.65			
		11.54	200.0	85.20			
		11.81	203.5	84.93		substrate: boulder top of bank on right side of channel	lower bankfull estimate
		16.28	207.0	80.46			
		16.75	207.9	79.99			RB WSE (time=15:30)

The Reach Downstream of Chili Bar: Lower Coloma Site (CB-G3) lower cross section (p. 2 of 2)

HI	BS	FS	STA	ELEV	WD	Bed material	Notes
96.74		8.91		87.83			top of RB flow fluctuation pin just upstream of XS3
		17.92	210.0	78.82			
		18.97	215.0	77.77			
		18.75	220.0	77.99			
		18.62	225.0	78.12			
		18.60	230.0	78.14			
		18.24	235.0	78.50			
		17.83	240.0	78.91			
		17.61	245.0	79.13			
		17.54	250.0	79.20			
		17.58	255.0	79.16			
		17.46	260.0	79.28			
		17.55	265.0	79.19			
		17.17	270.0	79.57			
		17.02	275.0	79.72			
		17.22	280.0	79.52			
		16.77	284.2	79.97			LB XS3 WSE (Time = 15:50)
		16.68	285.0	80.06			
		16.48	290.0	80.26			
		16.56	295.0	80.18			
		15.35	300.0	81.39			298 ft old tape = 8 ft new tape
		13.75	305.0	82.99			
		13.86	307.5	82.88			base of a large boulder
		11.26	307.3	85.48			top of boulder
		10.09	310.6	86.65			other edge of boulder
		11.65	311.0	85.09			lower bankfull estimate
		11.82	312.7	84.92			
		7.31	317.5	89.43			top of bedrock outcrop
		8.56	322.7	88.18			upper bankfull estimate
		8.00	328.0	88.74			
		7.19	331.7	89.55			
		4.75	334.5	91.99			
		3.40	338.7	93.34			LB base of pin XS3
		2.61	338.7	94.13			TOP LB XS3
		-7.39	353.7	104.13			(15 ft. past LB pin and 10 ft elevation to road surface)
		2.61		94.13			LB pin XS3 T.O.P.
		8.90		87.84			Top of RB flow fluctuation pin just upstream of XS3
		0.13		96.61			RB TOP XS3 Loop closed OK

The Reach Downstream of Chili Bar: Lower Coloma Site (CB-G3) pebble count summary

Modified Wolman Pebble Count (mm), Lower Coloma

Particle Description	Upper Class Boundary (mm)	Rosgen Particle Size	XS #1	XS #2	XS #3	Total	Item %	Cum %
Very coarse sand (unmeasured)	<2	6	12	3	2	17	6%	6%
Very coarse sand (measured)	2	5	0	0	0	0	0%	6%
Very Fine Gravel	4	4	1	0	0	1	0%	6%
Fine Gravel	8		4	2	1	7	2%	8%
Medium Gravel	16		1	1	1	3	1%	9%
Coarse Gravel	32		9	8	1	18	6%	15%
Very Coarse Gravel	64		13	13	19	45	15%	30%
Small Cobble	128	3	32	32	28	92	30%	61%
Large Cobble	256		25	30	39	94	31%	92%
Small Boulder	512	2	3	11	9	23	8%	99%
Medium Boulder	1024		0	0	0	0	0%	99%
Large Boulder	2048		0	0	0	0	0%	99%
Very Large Boulder	4096		0	0	0	0	0%	99%
Bedrock	>4096	1	0	2	0	2	1%	100%
		Total	100	102	100	302	100%	

The Reach Downstream of Chili Bar: Gorge Site (CB-G4)
long profile

HI	BS	FS	STA	WSE	ELEV	Water depth (ft)	Notes
							Elev = 80.27+4.73=85.00 (mid-channel BR)
85.00	4.73		TP 5		80.27		(use TP2, error = 0.01)
84.99	1.62		TP 2		83.37		Elev = 83.37+1.62=84.99 (on island)
		9.44	20.00	79.55	75.55	4.00	
		8.38	30.00	79.51	76.61	2.90	
		8.19	40.00	79.52	76.80	2.72	
		9.60	50.00	79.55	75.39	4.16	
		9.59	63.00	79.59	75.40	4.19	
		8.57	75.00	79.49	76.42	3.07	
		8.88	90.00	79.27	76.11	3.16	
		8.95	106.00	79.28	76.04	3.24	
		9.13	125.00	79.06	75.86	3.20	
		11.34	140.00	79.15	73.65	5.50	not quite thalweg
		11.38	154.00	80.31	73.61	6.70	
		11.84	160.00	79.07	73.15	5.92	upper XS - XS 1
		9.85	180.00	79.10	75.14	3.96	
		9.95	203.00	79.04	75.04	4.00	
		9.88	224.00	79.11	75.11	4.00	
		10.20	244.00	78.99	74.79	4.20	
		10.27	265.00	78.92	74.72	4.20	
		9.71	285.00	78.68	75.28	3.40	
		9.03	300.00	78.71	75.96	2.75	
		9.27	320.00	78.72	75.72	3.00	
		8.89	340.00	78.70	76.10	2.60	
		8.36	360.00	78.69	76.63	2.06	
		8.61	380.00	78.78	76.38	2.40	
		8.62	400.00	78.71	76.37	2.34	
		8.70	420.00	78.77	76.29	2.48	middle XS - XS 2
		8.95	440.00	78.44	76.04	2.40	
		8.70	460.00	78.19	76.29	1.90	
		9.06	480.00	77.73	75.93	1.80	
		9.44	500.00	76.95	75.55	1.40	
		10.19	520.00	76.50	74.80	1.70	
		5.83	TP 6		79.16		near XS 2, LB. Elev TP 6 = 85.00-5.83=79.17
81.44	2.28		TP 6				turned to end of island
81.44	4.65		TP 4				OK. HI using TP 4 = 76.79+4.65=81.44 OK
		7.17	540.00		74.27	--	
		7.79	560.00	75.31	73.65	1.66	
		7.91	573.00	74.83	73.53	1.30	lower XS
		9.10	600.00	74.74	72.34	2.40	
		4.65	TP 4		76.79		OK, closed

The Reach Downstream of Chili Bar: Gorge Site (CB-G4) upper cross-section (p. 1 of 2)

HI	BS	FS	STA	ELEV	WD	Bed material	Notes
102.18	2.18		LB pin				top of LB pin = assumed to be 100.0
		2.48	1.20	99.70			base of LB pin
		3.29	8.00	98.89			
		3.57	13.00	98.61			
		3.99	22.00	98.19			
		4.56	29.00	97.62			
		5.19	36.00	96.99			
		6.06	42.50	96.12			
		8.09	46.00	94.09			
		8.74	51.00	93.44			
		10.82	58.00	91.36			
		13.58	64.00	88.60			
		15.30	69.00	86.88		sand	entering small drainage
		17.03	73.20	85.15		CO/SA	bottom of draw
		17.02	80.00	85.16			
		15.77	87.00	86.41			
		15.56	93.00	86.62		sand	
		15.33	100.00	86.85			
		15.66	107.00	86.52			
		17.41	115.00	84.77			upper BF indicator (veg)
		19.24	122.00	82.94			
		20.18	126.10	82.00			lower BF indicator (break in slope)
		22.56	132.30	79.62			LB edge of water
		23.57	137.00	78.61		GR/CO	
		19.32	TP 1	82.86			Elev = 102.18-19.32=82.86
93.49	10.63		TP 1				moved level
		17.19	143.20	76.30			
		17.24	149.00	76.25			
		18.31	153.50	75.18			
		20.45	156.00	73.04			tape broke-had to retie
		18.63	173.00	74.86			
		16.82	178.00	76.67			
		15.30	185.00	78.19			
		14.78	191.00	78.71			
		14.57	198.20	78.92			
		14.14	205.00	79.35			
		14.13	212.00	79.36			
		14.03	219.00	79.46			
		14.06	225.00	79.43			
		14.01	230.00	79.48			
		14.00	237.00	79.49			
		13.70	243.00	79.79			
		13.62	245.40	79.87			RB edge of water-island
		12.85	252.00	80.64			
		12.61	258.20	80.88			
		12.58	265.00	80.91			
		12.40	271.00	81.09			BF depth ~ 9.0 ft therefore pins are high enough
		12.39	276.00	81.10			
		12.24	282.00	81.25			

The Reach Downstream of Chili Bar: Gorge Site (CB-G4)
upper cross-section (p. 2 of 2)

HI	BS	FS	STA	ELEV	WD	Bed material	Notes
93.49		12.06	288.00	81.43			
		12.04	293.00	81.45			
		12.16	299.00	81.33			
		12.23	305.00	81.26			
		12.60	311.00	80.89			
		13.18	320.00	80.31			
		13.81	326.00	79.68			
		13.82	331.00	79.67			
		14.46	337.00	79.03			LB edge of water - island
		14.57	342.00	78.92			
		15.68	349.00	77.81			
		16.53	354.00	76.96			
		16.08	360.00	77.41			
		15.84	365.00	77.65			
		15.59	370.00	77.90			
		14.95	375.00	78.54		bedrock	
		15.19	381.00	78.30			
		14.84	388.00	78.65			
		14.47	393.50	79.02			RB edge of water
		14.33	400.00	79.16			
		13.98	404.50	79.51			
		11.95	407.00	81.54			lower bankfull indicator (break in slope)
		11.38	413.00	82.11			
		11.00	420.00	82.49			
		10.09	423.10	83.40			upper bankfull indicator (veg break)
		9.82	430.00	83.67			
		8.05	435.00	85.44			
		6.34	440.00	87.15			
		5.18	447.00	88.31			
		4.02	453.00	89.47			
		3.25	456.80	90.24			base of RB pin
		2.98	RB pin	90.51			top of RB pin
		10.63	TP 1	82.86			
102.23	19.37		TP 1				turned
		2.25	LB pin	99.98			top of LB pin, OK (0.02 error)

The Reach Downstream of Chili Bar: Gorge Site (CB-G4) middle cross-section (p. 1 of 2)

HI	BS	FS	STA	ELEV	Bed material	Notes
102.25		18.88	TP 2	83.37		TP on island, Elev = 102.25
	9.54		TP 2			turn
92.91		0.82	LB pin			Top of LB tailpin
		0.82	LB pin			top of pin
		1.96	1.30	90.95		base of pin
		2.30	6.00	90.61		
		4.17	11.60	88.74		
		5.06	21.20	87.85		
		6.46	26.00	86.45		
		6.79	31.00	86.12		
		7.47	36.00	85.44		
		8.69	42.00	84.22		
		9.10	47.00	83.81		
		9.66	51.10	83.25		upper BF indicator
		10.25	58.00	82.66		
		10.55	65.00	82.36		
		10.50	70.00	82.41		
		10.77	77.00	82.14		lower BF indicator
		11.93	82.00	80.98		
		13.21	89.00	79.70		
		14.03	95.00	78.88		
		14.27	98.00	78.64		LB edge of water
		14.73	105.00	78.18		
		15.39	110.00	77.52		
		15.97	116.00	76.94		
		16.48	122.00	76.43		
		16.71	128.00	76.20		
		16.58	132.50	76.33		
		16.48	138.00	76.43		
		16.24	143.00	76.67		
		16.15	149.00	76.76		
		16.04	155.00	76.87		
		16.01	162.00	76.90		
		15.41	168.00	77.50		
		14.20	172.50	78.71		RB edge of water (island)
		12.58	178.00	80.33		
		11.63	185.00	81.28		
		11.35	191.00	81.56		
		10.91	197.00	82.00		
		10.64	202.00	82.27		
		10.52	209.00	82.39		

The Reach Downstream of Chili Bar: Gorge Site (CB-G4)
middle cross-section (p. 2 of 2)

HI	BS	FS	STA	ELEV	Bed material	Notes
92.91		10.10	215.00	82.81		
		9.86	222.00	83.05		
		9.85	230.00	83.06		
		9.54	237.00	83.37		
		9.86	243.00	83.05		
		9.90	250.00	83.01		
		10.50	258.00	82.41		
		10.92	264.00	81.99		
		12.14	270.00	80.77		
		13.06	275.10	79.85		
		14.25	281.00	78.66		
		15.87	287.50	77.04		LB edge of water (island)
		15.95	292.00	76.96		
		16.47	297.00	76.44		
		16.95	303.00	75.96		
		17.04	309.00	75.87		
		16.60	314.00	76.31		
		16.84	320.00	76.07		
		16.49	326.00	76.42	bedrock	
		16.32	332.00	76.59		
		15.98	337.00	76.93		
		15.54	343.10	77.37		RB edge of water
		15.15	349.00	77.76		
		14.70	353.20	78.21		lower bankfull estimate
		12.75	360.00	80.16		
		11.37	366.00	81.54		
		10.62	372.00	82.29		
		9.79	377.00	83.12		
		9.42	383.00	83.49		
		8.02	387.00	84.89		
		7.26	390.00	85.65		upper bankfull estimate
		6.05	396.00	86.86		
		4.63	402.00	88.28		
		2.95	408.00	89.96		
		2.05	411.90	90.86		base of RB pin
		1.87	RB pin	91.04		top of RB pin
		0.82	LB pin	92.09		top of LB pin
		9.55	TP 2	83.36		turning point on island (0.01 error)
102.37	19.01		TP 2			turning point on island
		2.39	BM 1	99.98		top of XS 1 LB pin = BM 1 (0.02 error)

The Reach Downstream of Chili Bar: Gorge Site (CB-G4) lower cross-section (p. 1 of 2)

HI	BS	FS	STA	ELEV	Notes
93.05	9.68		TP 2	83.37	turning point on island (HI = 83.37+9.68=93.05)
		0.26	LB pin	92.79	top of pin
		0.80	1.30	92.25	
		2.03	7.00	91.02	
		4.16	14.00	88.89	
		5.57	20.00	87.48	
		6.75	25.00	86.30	
		7.63	30.00	85.42	
		8.09	35.00	84.96	
		8.69	40.00	84.36	
		9.53	45.00	83.52	toe of slope - start of cobble bar (upper bankfull estimate)
		9.91	50.00	83.14	
		10.22	55.00	82.83	
		10.30	60.00	82.75	
		10.52	65.00	82.53	
		10.73	70.00	82.32	
		10.71	75.00	82.34	
		10.72	80.00	82.33	
		10.85	85.00	82.20	
		10.98	90.00	82.07	
		11.45	95.00	81.60	
		11.88	100.00	81.17	
		12.11	105.00	80.94	
		12.18	110.00	80.87	
		12.34	115.00	80.71	
		12.58	120.00	80.47	
		12.69	125.00	80.36	
		12.43	130.00	80.62	
		12.74	135.00	80.31	
		12.97	140.00	80.08	
		13.19	145.00	79.86	
		13.19	150.00	79.86	lower bankfull estimate
		13.71	155.00	79.34	
		14.49	160.00	78.56	
		16.08	165.00	76.97	
		16.56	170.00	76.49	
		17.07	175.00	75.98	
		17.93	179.00	75.12	LEW
		18.40	184.00	74.65	tape broke
		16.70	TP 3	76.35	in channel

The Reach Downstream of Chili Bar: Gorge Site (CB-G4) lower cross-section (p. 2 of 2)

HI	BS	FS	STA	ELEV	Notes
81.67	5.32		TP 3		turned level (to edge of island)
		7.23	185.00	74.44	
		7.68	190.00	73.99	
		9.04	198.00	72.63	thalweg is very swift--can't get
		8.89	202.00	72.78	
		8.74	206.50	72.93	
		8.71	212.00	72.96	
		7.18	218.00	74.49	
		7.57	225.00	74.10	
		7.17	230.00	74.50	
		7.81	235.00	73.86	
		8.10	240.00	73.57	
		8.54	245.00	73.13	
		7.71	250.00	73.96	at crossover riffle
		6.44	255.00	75.23	
		6.28	260.00	75.39	
		6.24	265.00	75.43	
		6.03	270.00	75.64	
		6.14	275.00	75.53	
		5.96	280.00	75.71	
		6.23	285.00	75.44	
		6.50	290.00	75.17	
		6.17	295.00	75.50	
		5.96	300.00	75.71	
		5.63	305.00	76.04	
		5.68	310.00	75.99	
		5.18	316.10	76.49	bedrock, REW
		3.73	320.00	77.94	
		2.85	326.00	78.82	
		4.88	TP 4	76.79	on XS 3 RB, Elev TP 4 = 81.67-4.88=76.79
98.44	21.65		TP 4		turned up to bank
		19.07	330.00	79.37	
		18.34	335.00	80.10	
					* 3.4 ft knot in rope b/w Sta 95 and 100 (on second tape-need to correct for it) CDJ, MCM, and SRD decided that knot was
		17.69	340.00	80.75	actually on unmeasured side of endpin.
		16.34	345.00	82.10	
		15.13	350.00	83.31	
		13.28	355.00	85.16	
		10.73	360.00	87.71	
		8.52	365.00	89.92	
		5.62	370.70	92.82	base of RB pin
		5.28	RB pin	93.16	top of pin
		18.17	TP 5	80.27	on bedrock outcrop, mid channel u/s of XS 3
		5.63	LB pin	92.81	top of LB pin (error = 0.02)

The Reach Downstream of Chili Bar: Gorge Site (CB-G4) pebble count summary

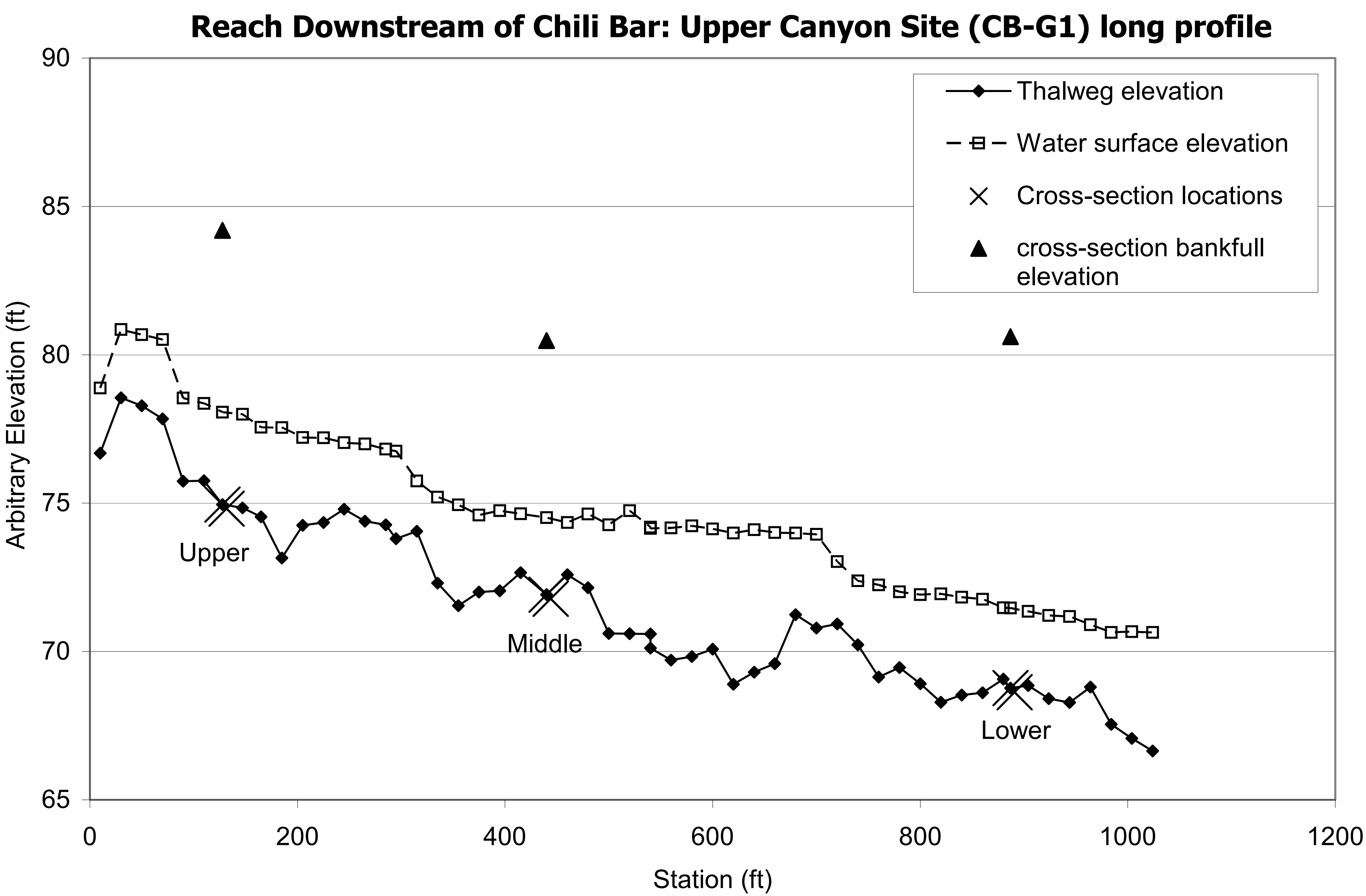
Modified Wolman Pebble Count (mm), Chili Bar Gorge Reach

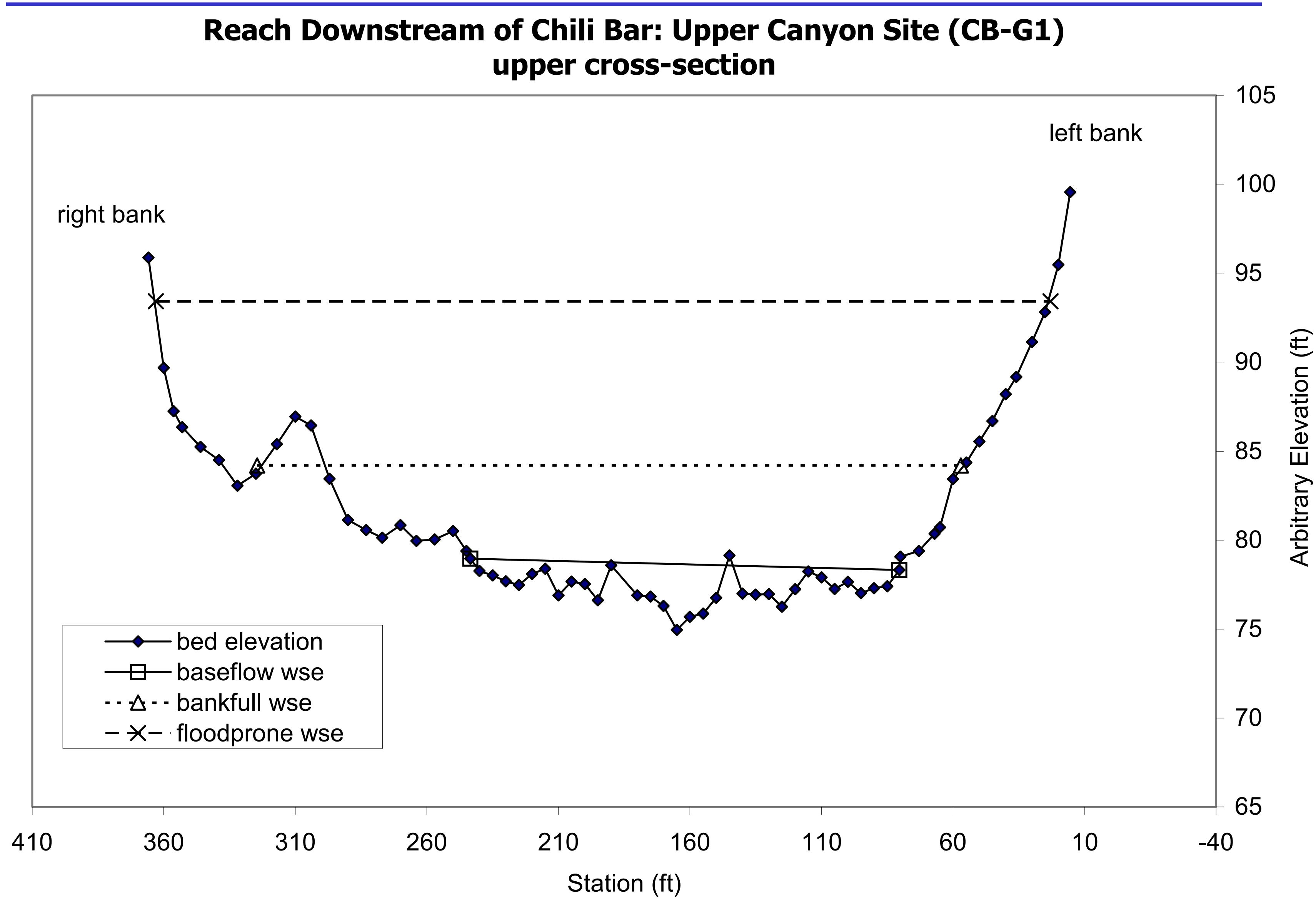
Particle Description	Upper Class Boundary (mm)	Rosgen Particle Size	XS #1	XS #2	XS #3	Total	Item %	Cum %
Very coarse sand (unmeasured)	<2	6	0	0	0	0	0%	0%
Very coarse sand (measured)	2	5	0	0	0	0	0%	0%
Very Fine Gravel	4	4	0	0	0	0	0%	0%
Fine Gravel	8		2	0	0	2	1%	1%
Medium Gravel	16		4	0	0	4	1%	2%
Coarse Gravel	32		10	5	4	19	6%	8%
Very Coarse Gravel	64		32	28	21	81	27%	35%
Small Cobble	128	3	36	44	47	127	42%	78%
Large Cobble	256		15	20	18	53	18%	95%
Small Boulder	512	2	1	3	10	14	5%	100%
Medium Boulder	1024		0	0	0	0	0%	100%
Large Boulder	2048		0	0	0	0	0%	100%
Very Large Boulder	4096		0	0	0	0	0%	100%
Bedrock	>4096	1	0	0	0	0	0%	100%
		Total	100	100	100	300	100%	

APPENDIX K

GRAPHS: LONGITUDINAL PROFILES, CROSS-SECTIONS, AND PEBBLE COUNT PLOTS FOR THE REACH DOWNSTREAM OF CHILI BAR

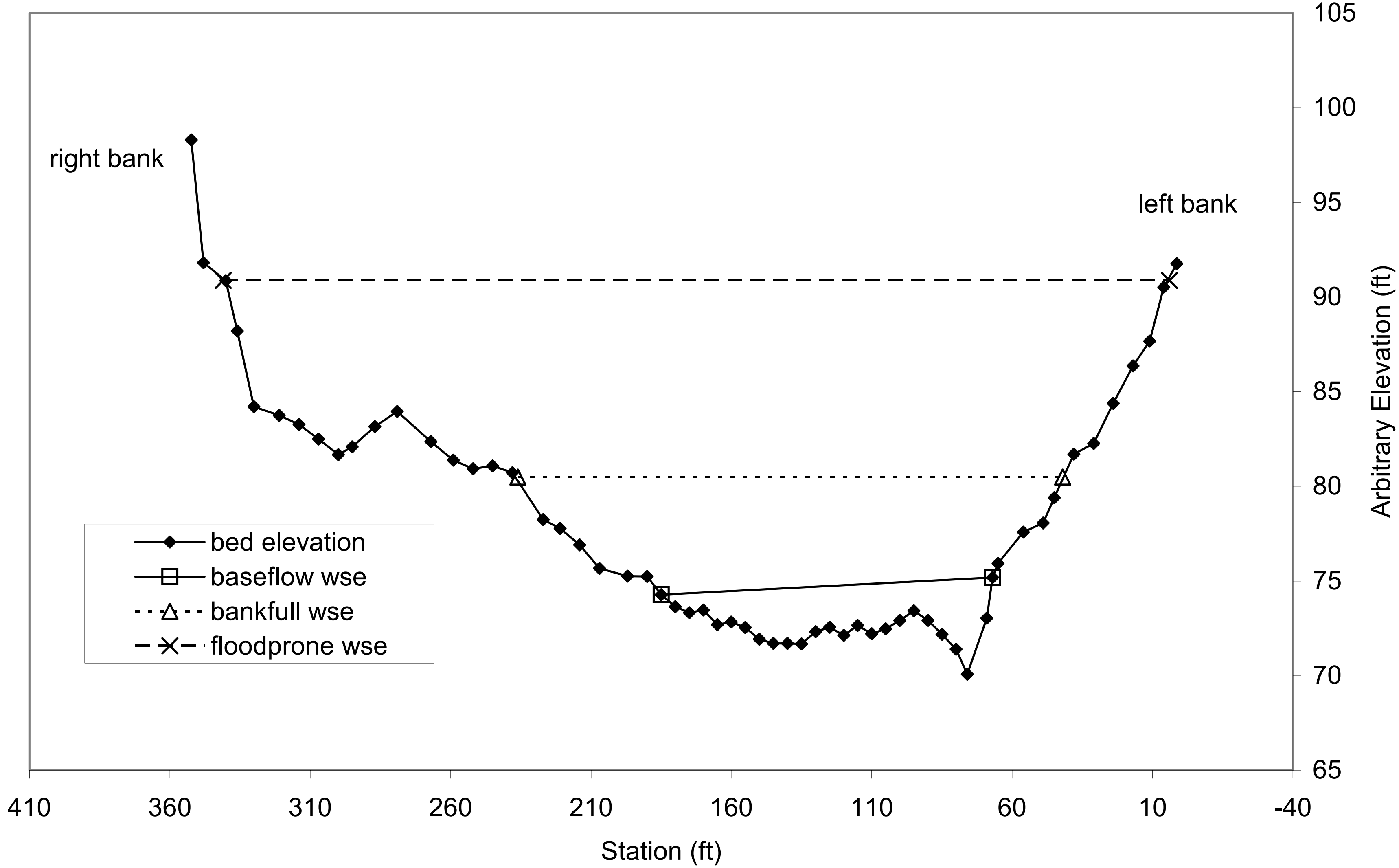
Reach Downstream of Chili Bar:
Upper Canyon Site (CB-G1)
Upper Coloma Site (CB-G2)
Lower Coloma Site (CB-G3)
Gorge Site (CB-G4)

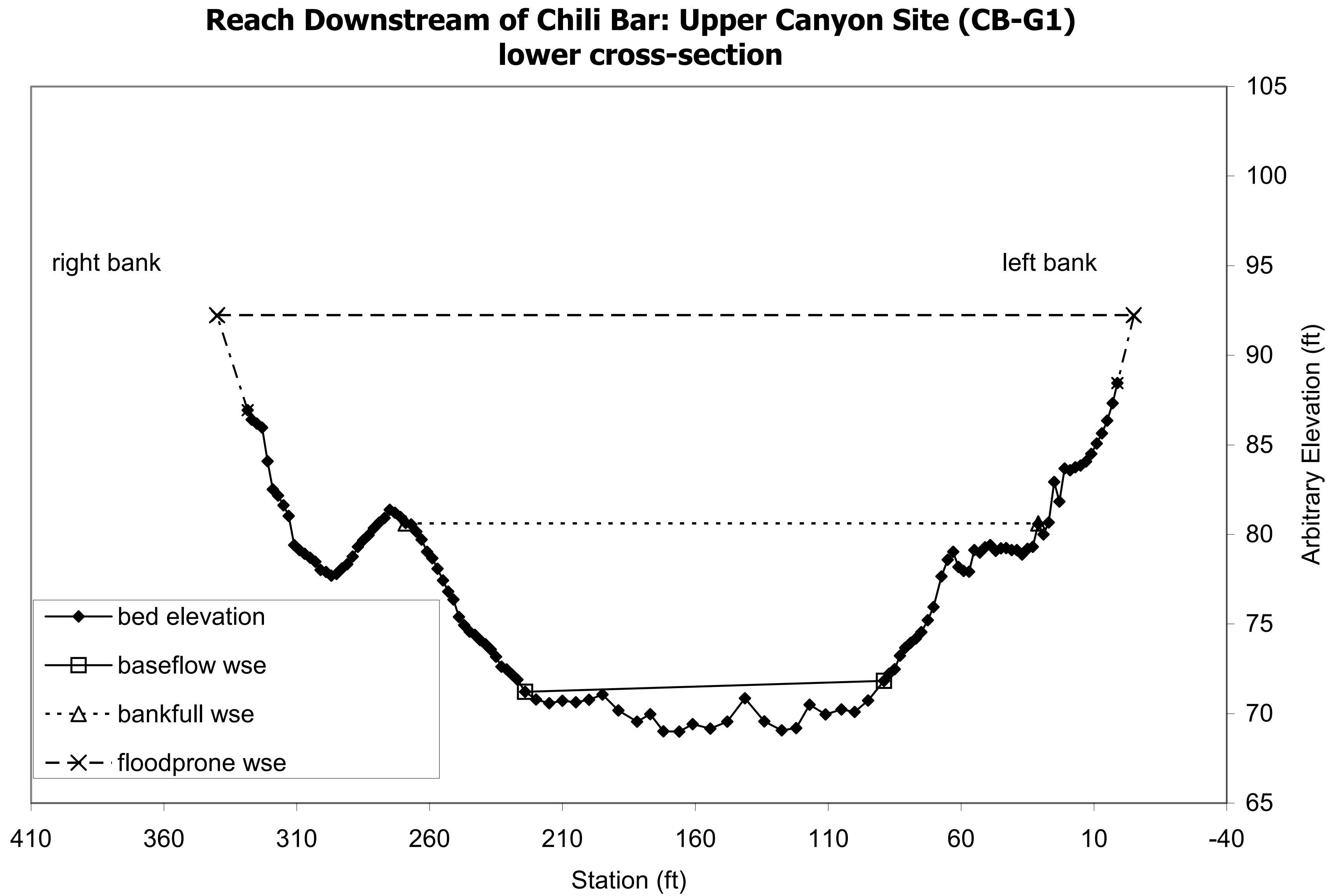

Reach Downstream of Chili Bar: Upper Canyon Site (CB-G1) long profile
90
85
80
75
70
65
Arbitrary Elevation (ft)
0
200
400
600
800
1000
1200
Station (ft)
Thalweg elevation
Water surface elevation
Cross-section locations
cross-section bankfull elevation
Upper
Middle
Lower

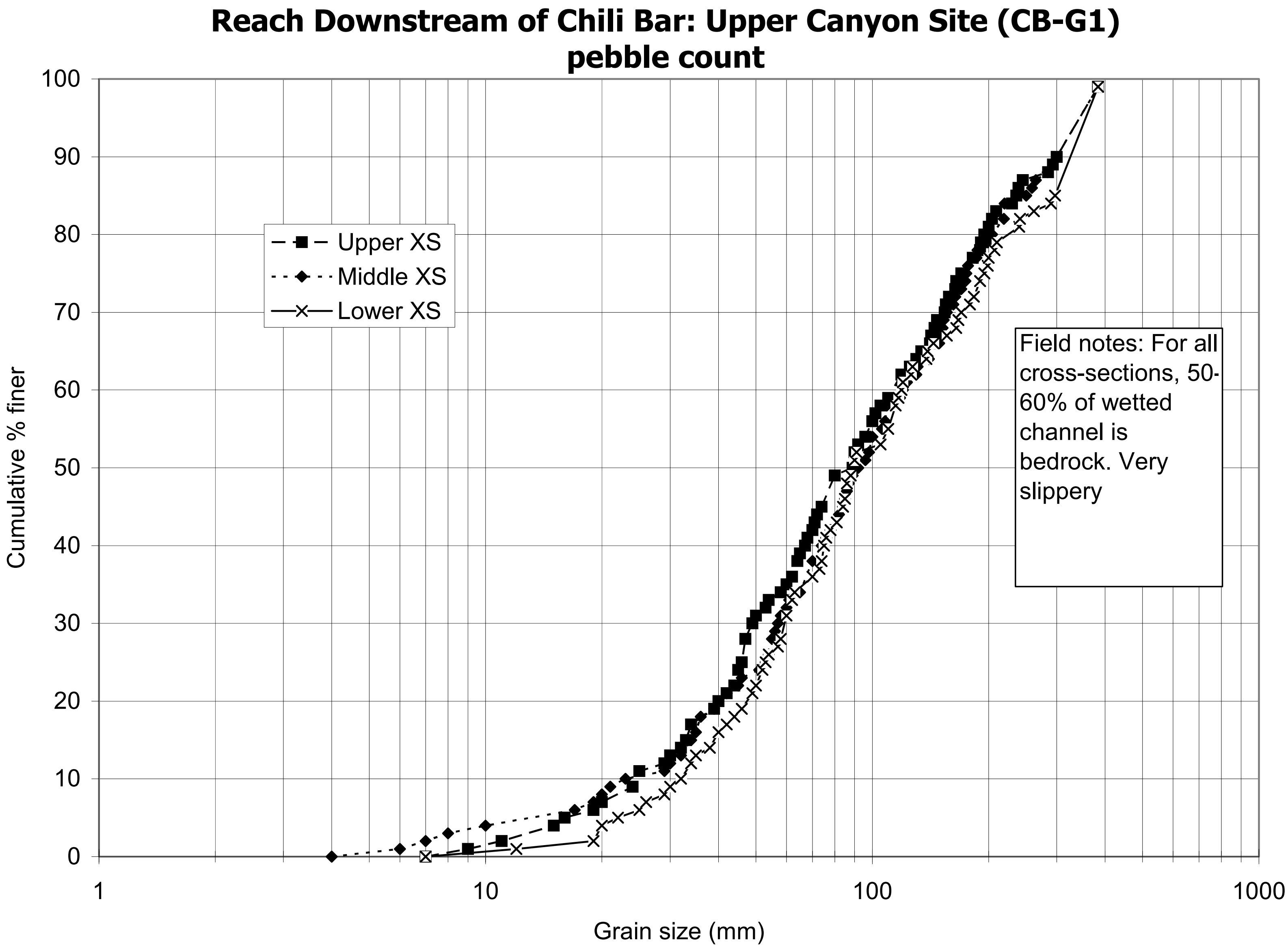


Reach Downstream of Chili Bar: Upper Canyon Site (CB-G1)
upper cross-section
right bank
left bank
bed elevation
baseflow wse
bankfull wse
floodprone wse
Arbitrary Elevation (ft)
105
100
95
90
85
80
75
70
65
Station (ft)
410
360
310
260
210
160
110
60
10
-40

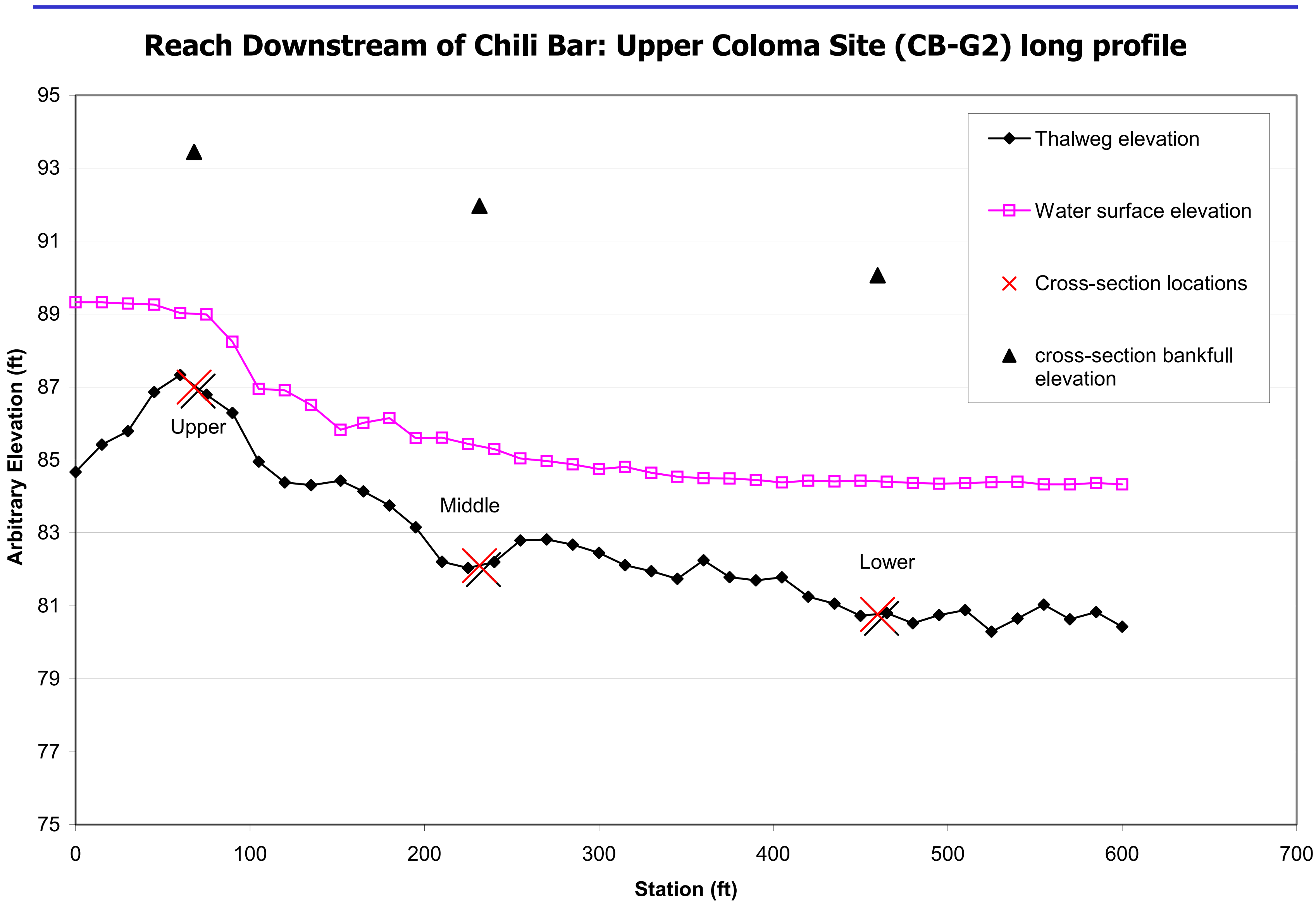
Reach Downstream of Chili Bar: Upper Canyon Site (CB-G1) middle cross-section

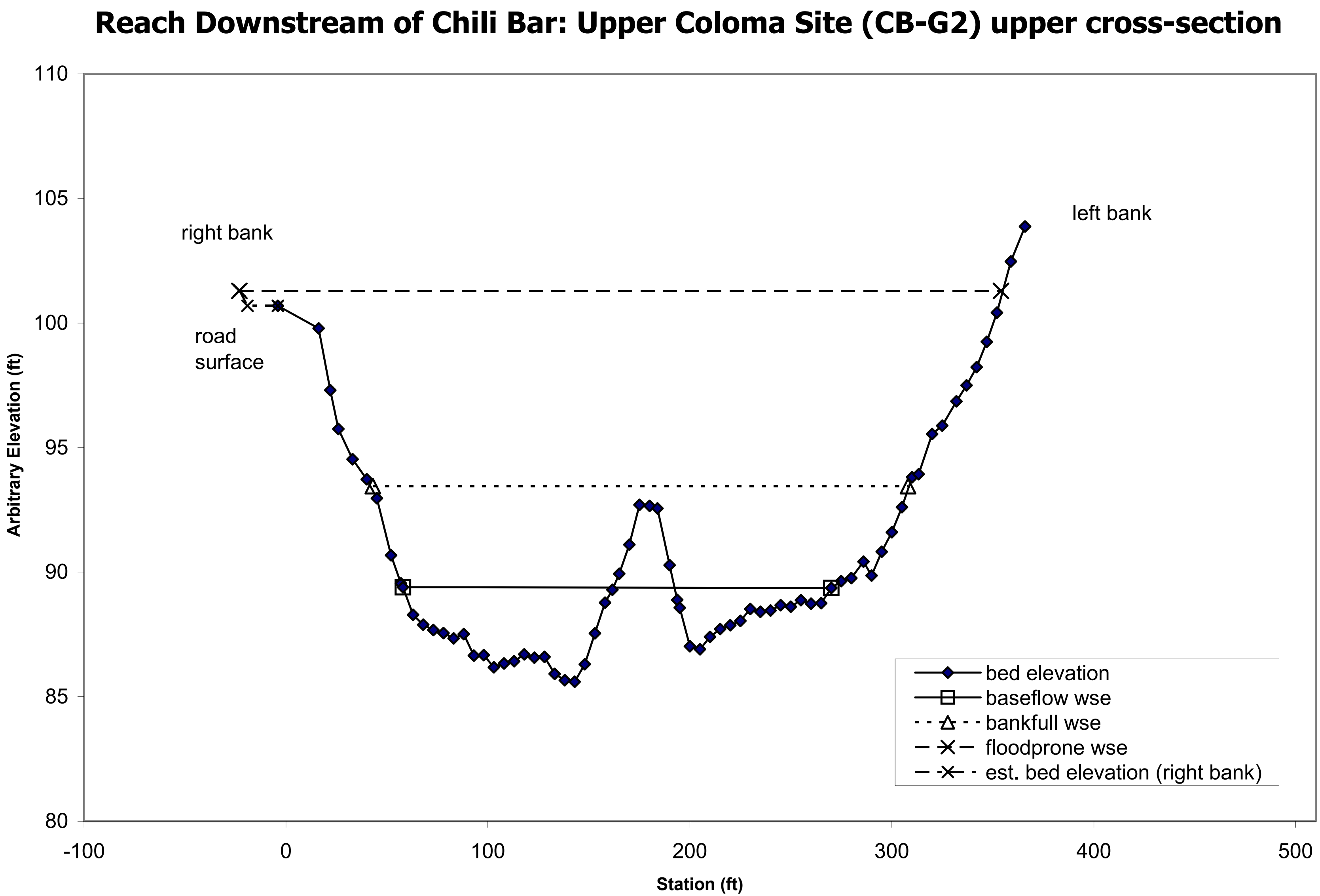



Reach Downstream of Chili Bar: Upper Canyon Site (CB-G1)
lower cross-section
right bank
left bank
bed elevation
baseflow wse
bankfull wse
floodprone wse
105
100
95
90
85
80
75
70
65
Arbitrary Elevation (ft)
410
360
310
260
210
160
110
60
10
-40
Station (ft)

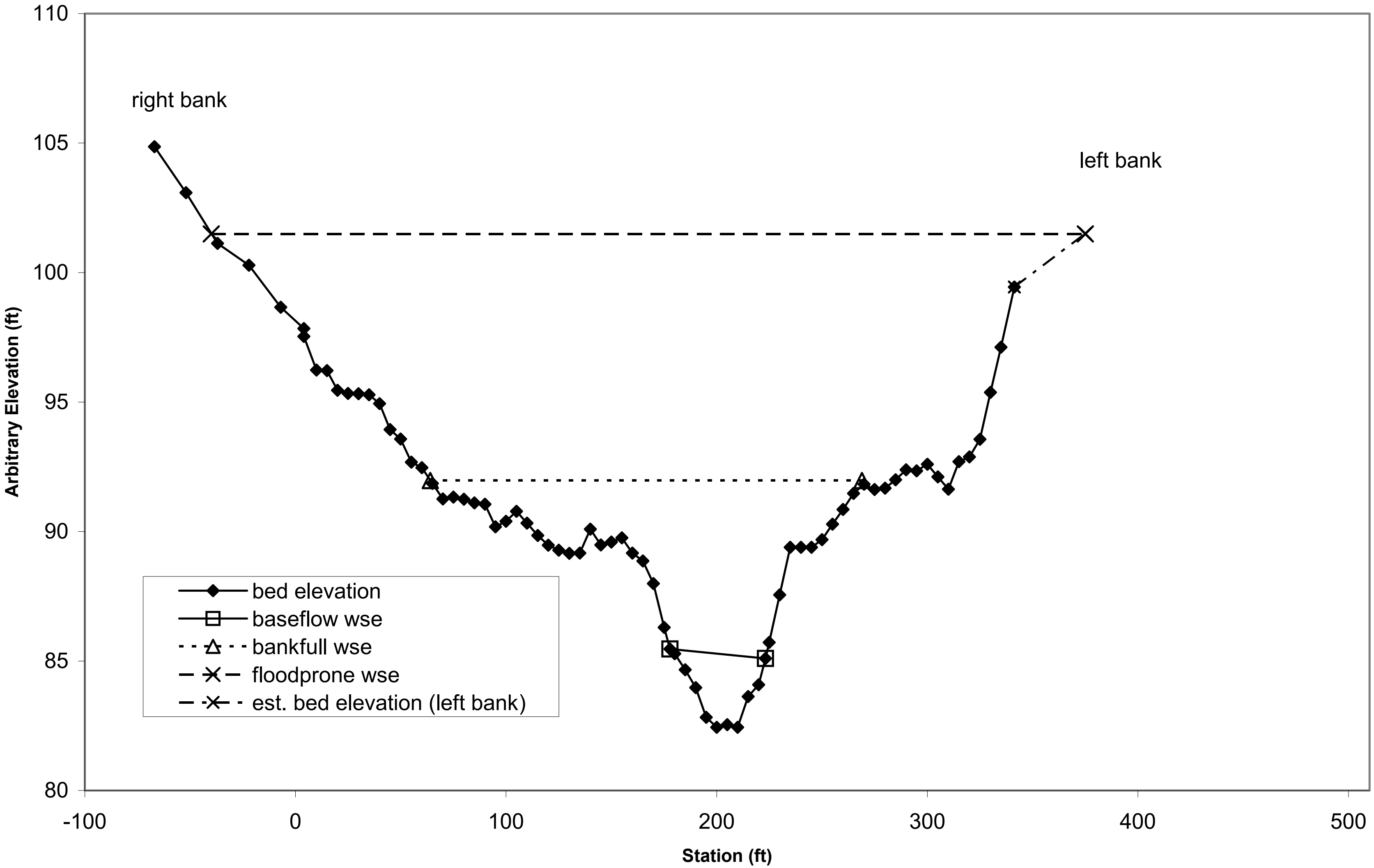


Reach Downstream of Chili Bar: Upper Canyon Site (CB-G1)
pebble count
Upper XS
Middle XS
Lower XS
Field notes: For all cross-sections, 50-60% of wetted channel is bedrock. Very slippery
Cumulative % finer
Grain size (mm)
0
10
20
30
40
50
60
70
80
90
100
1
10
100
1000

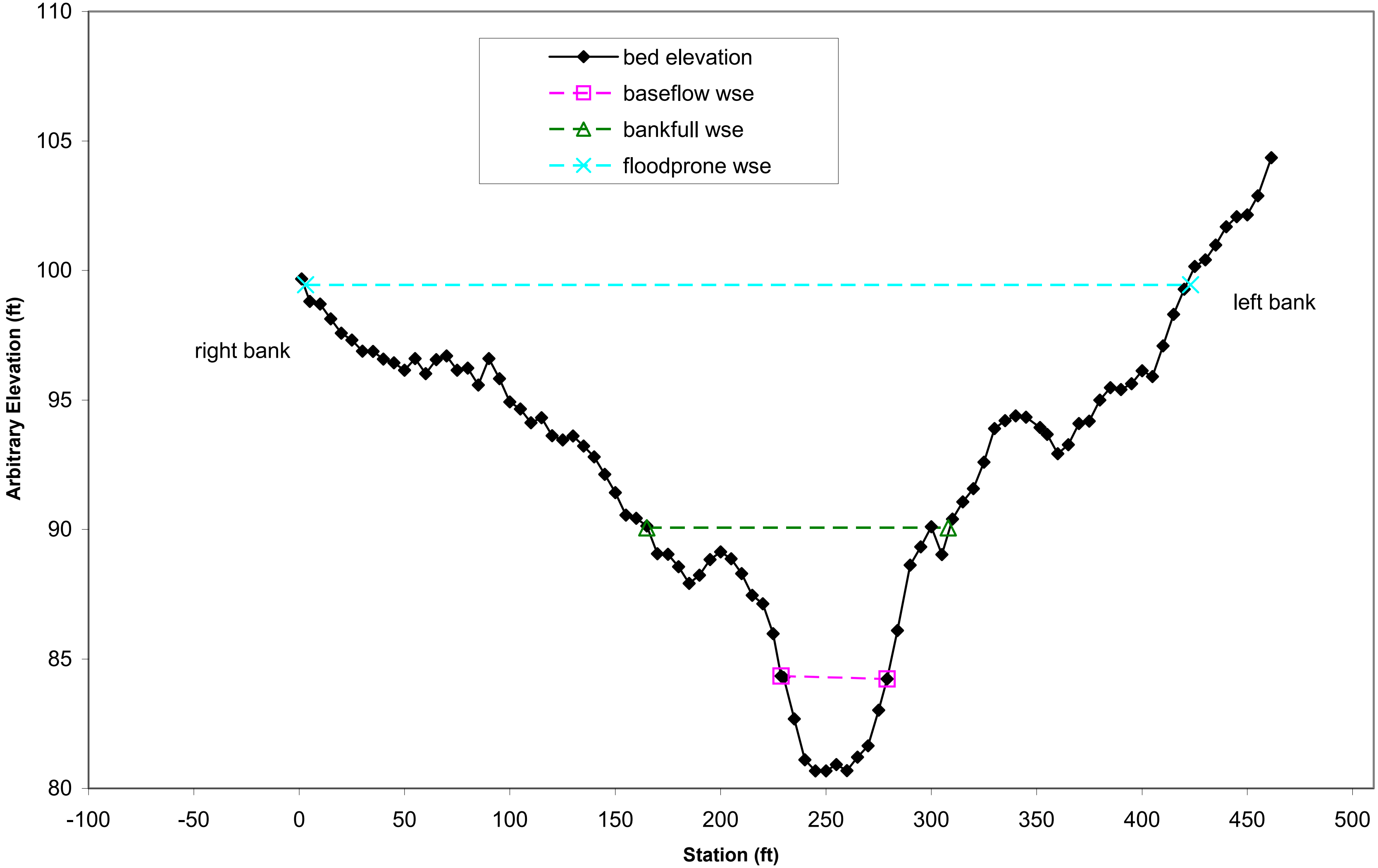

Reach Downstream of Chili Bar: Upper Coloma Site (CB-G2) long profile
Arbitrary Elevation (ft)
Station (ft)
95
93
91
89
87
85
83
81
79
77
75
0
100
200
300
400
500
600
700
Thalweg elevation
Water surface elevation
Cross-section locations
cross-section bankfull elevation
Upper
Middle
Lower


Reach Downstream of Chili Bar: Upper Coloma Site (CB-G2) upper cross-section
110
105
100
95
90
85
80
Arbitrary Elevation (ft)
-100
0
100
200
300
400
500
Station (ft)
right bank
road
surface
left bank
bed elevation
baseflow wse
bankfull wse
floodprone wse
est. bed elevation (right bank)

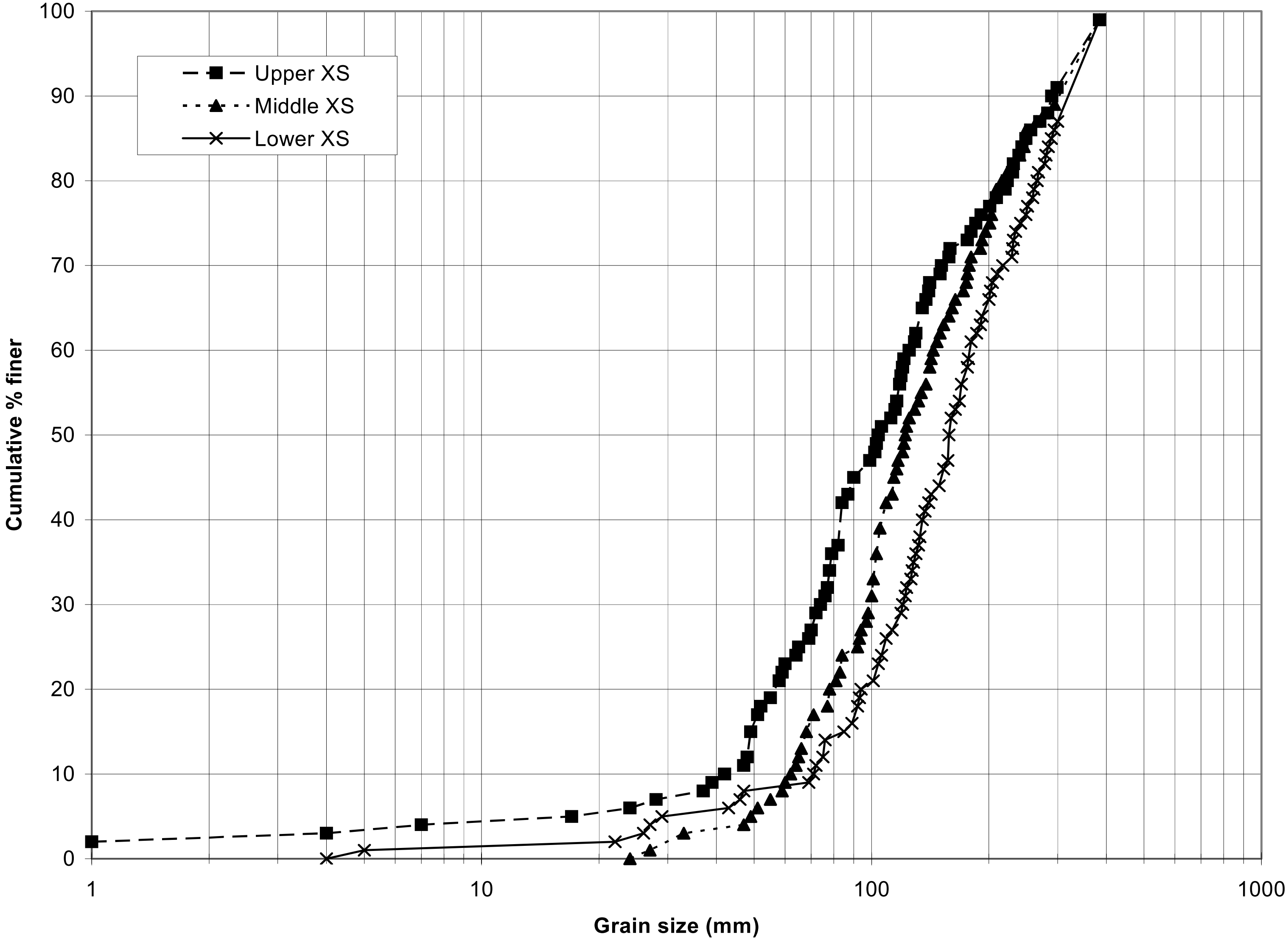
Reach Downstream of Chili Bar: Upper Coloma Site (CB-G2) middle cross-section

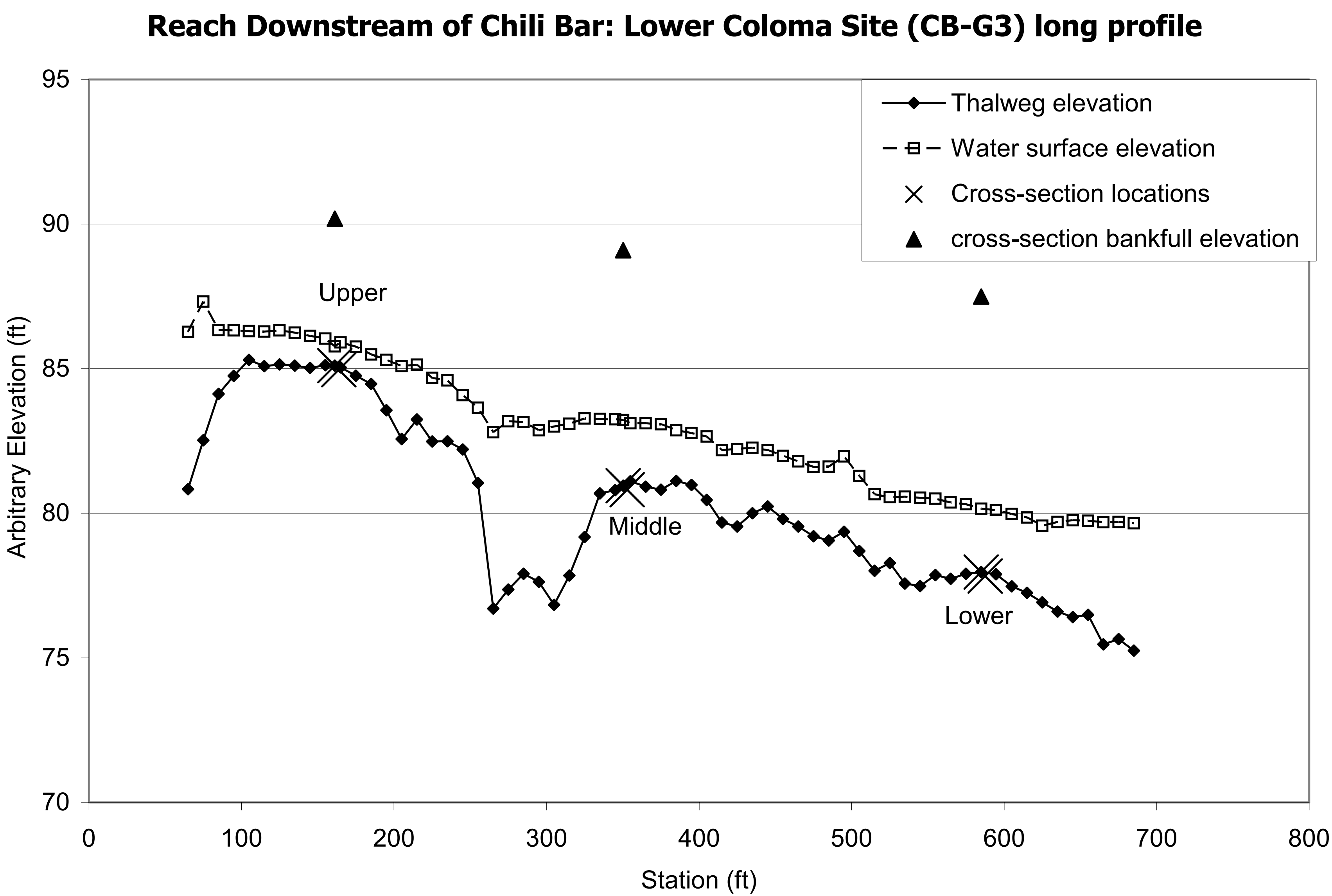


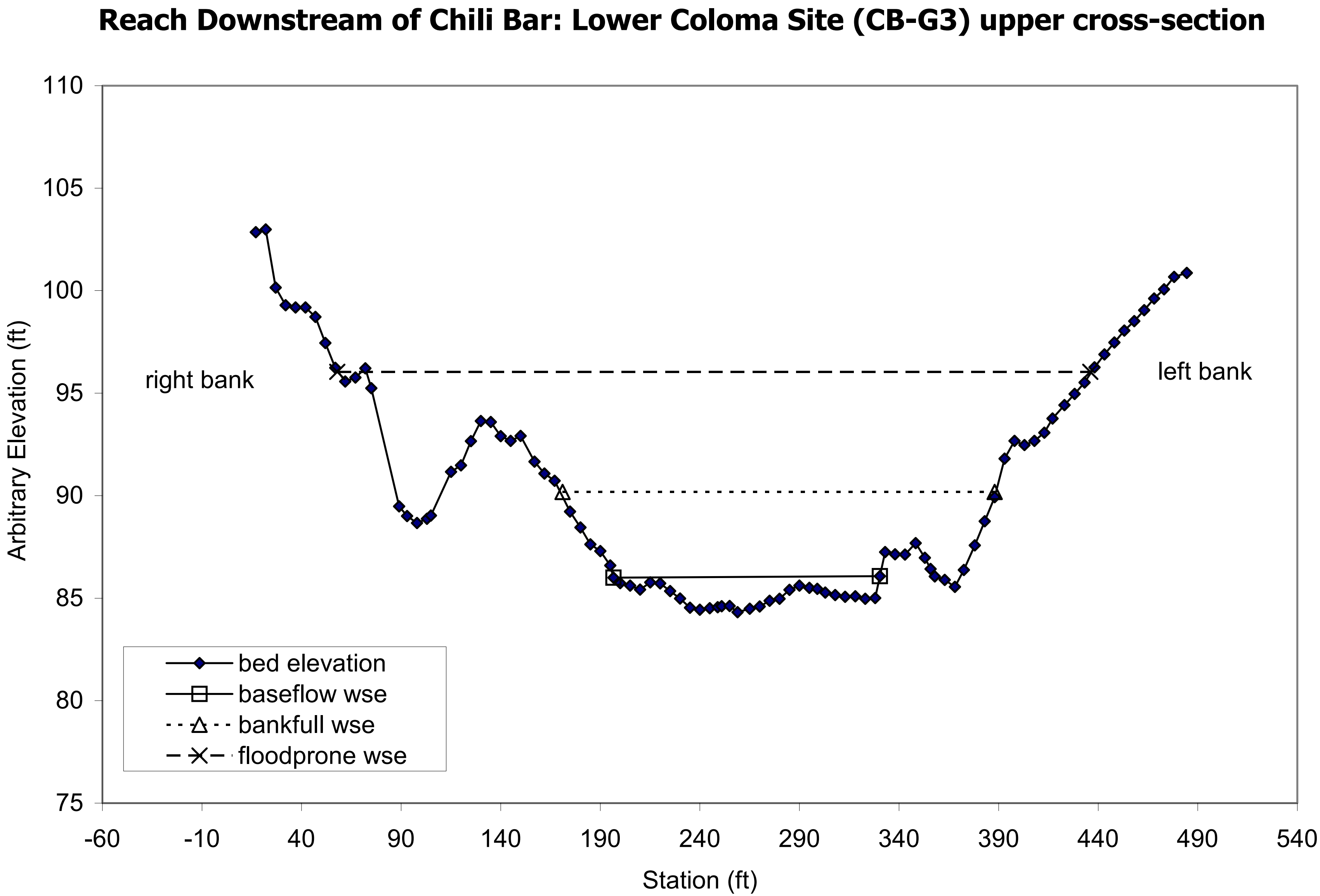
Reach Downstream of Chili Bar: Upper Coloma Site (CB-G2) lower cross-section



Reach Downstream of Chili Bar: Upper Coloma Site (CB-G2) pebble count

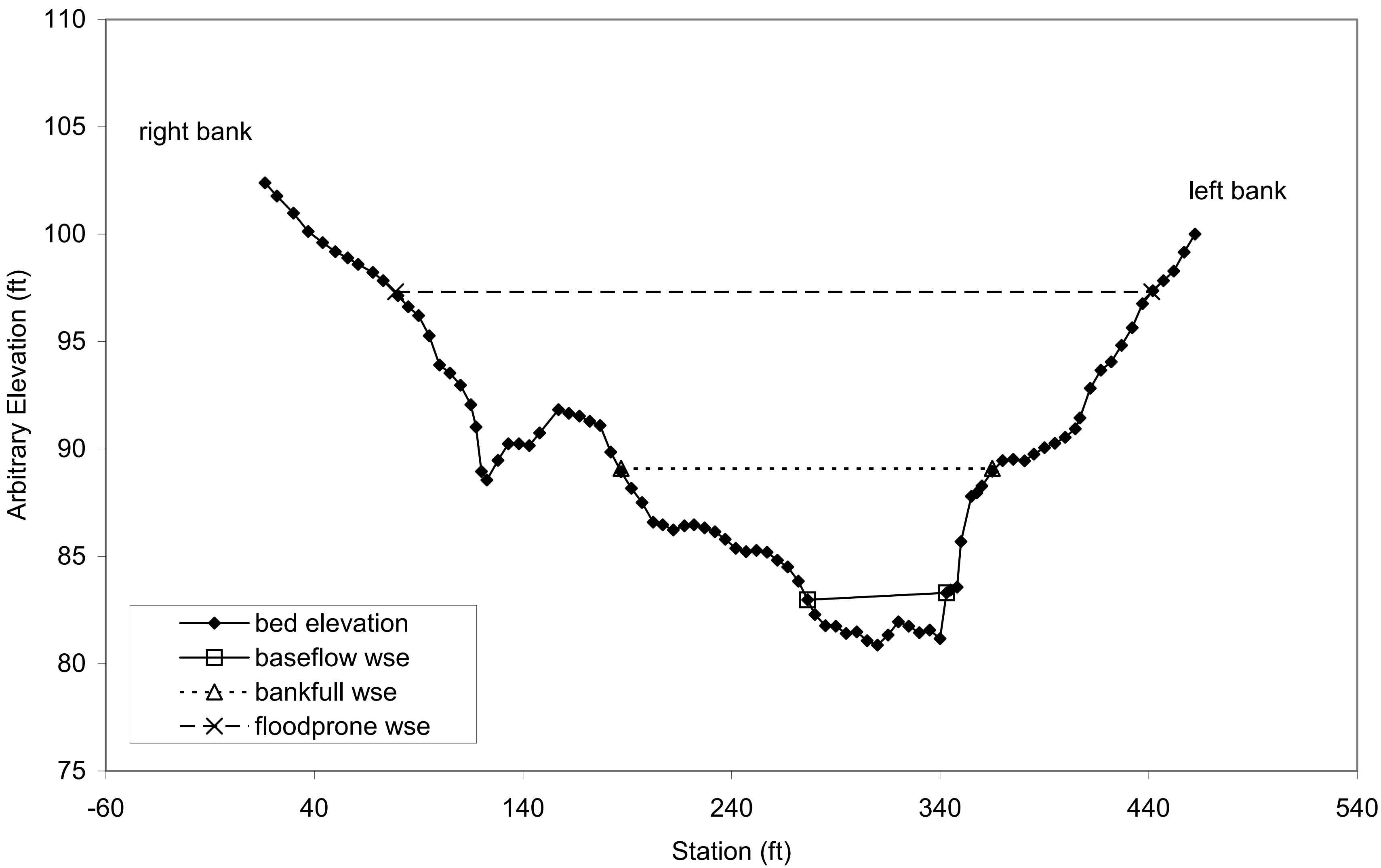


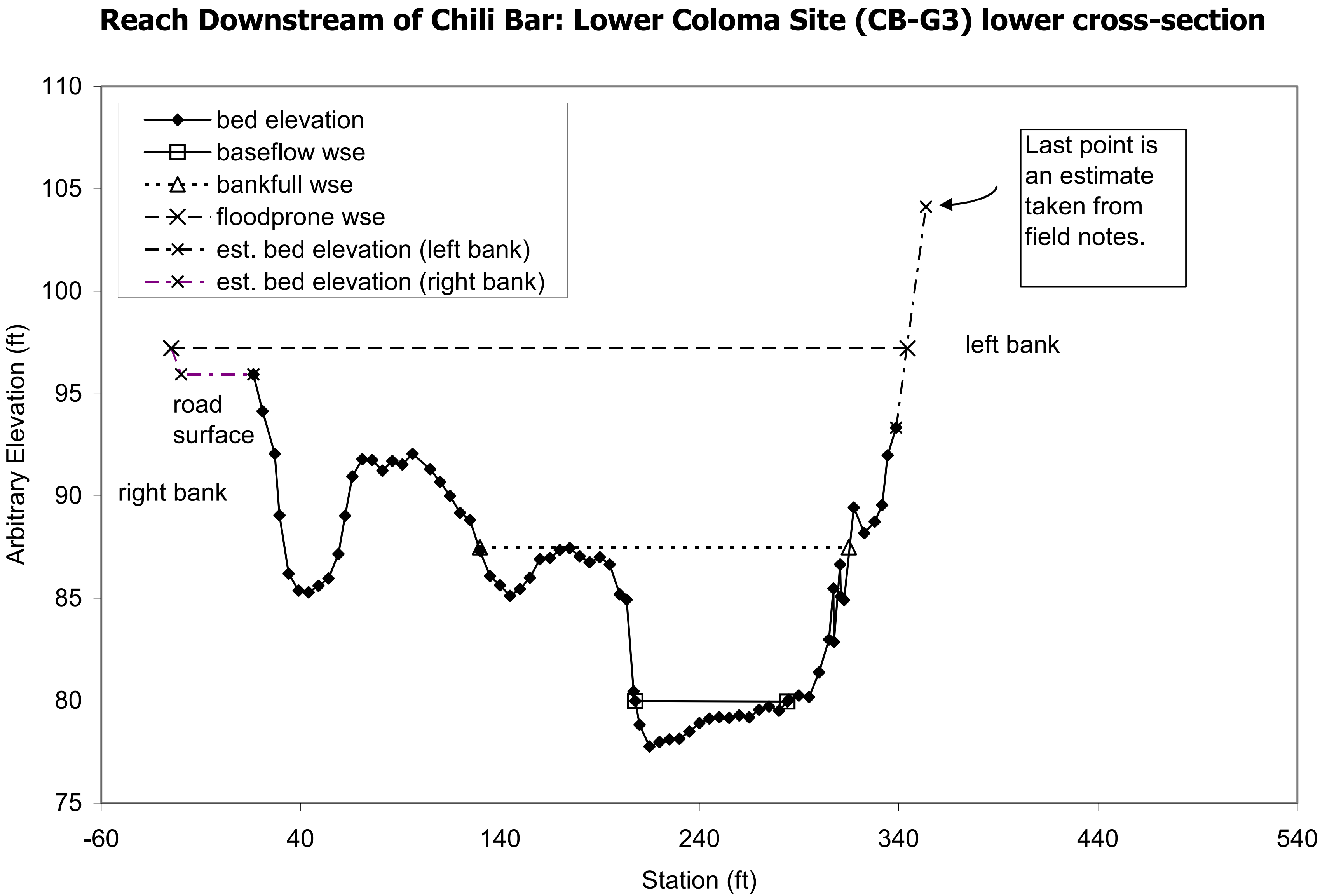

Reach Downstream of Chili Bar: Lower Coloma Site (CB-G3) long profile
Thalweg elevation
Water surface elevation
Cross-section locations
cross-section bankfull elevation
Upper
Middle
Lower
Arbitrary Elevation (ft)
Station (ft)
95
90
85
80
75
70
0
100
200
300
400
500
600
700
800

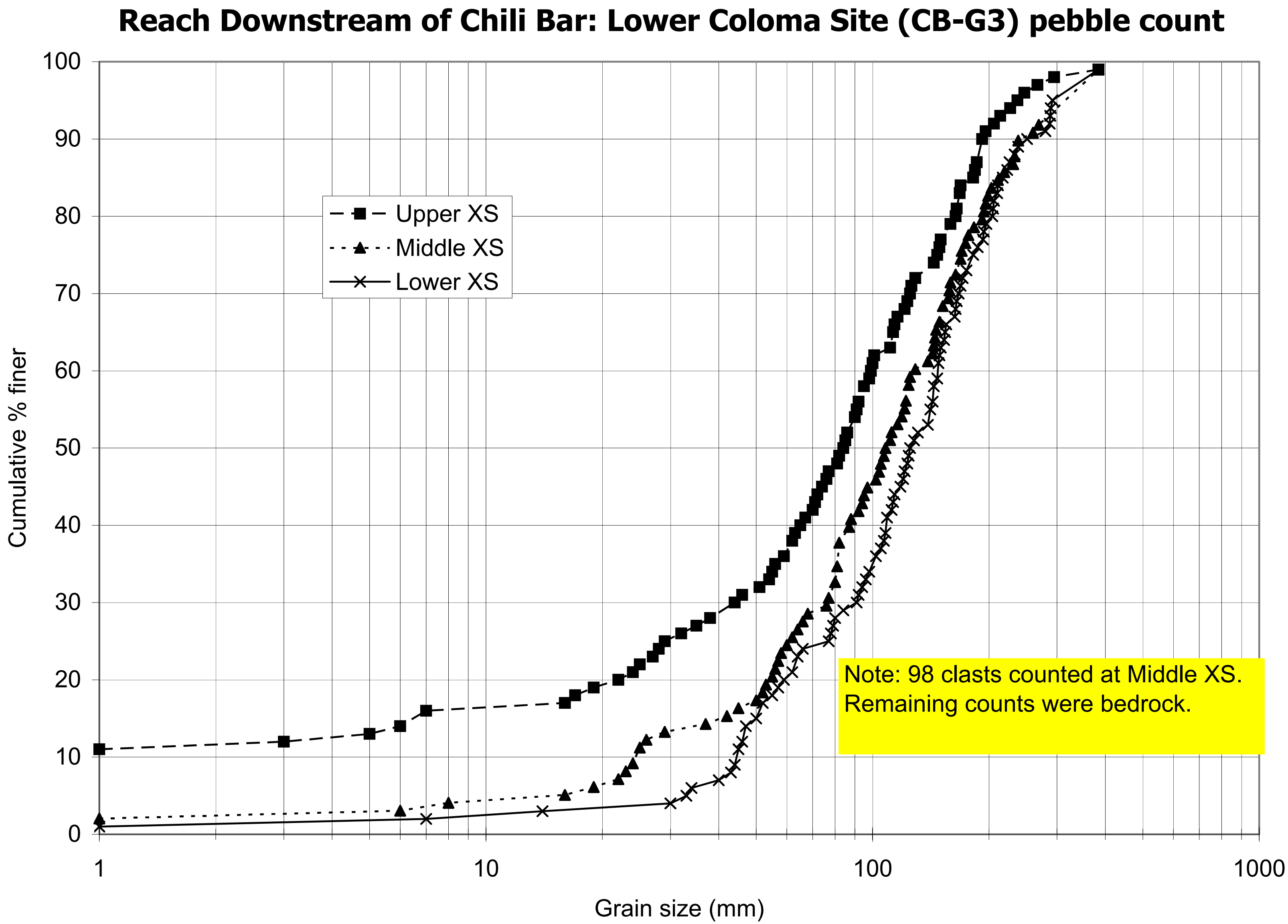


Reach Downstream of Chili Bar: Lower Coloma Site (CB-G3) upper cross-section
Arbitrary Elevation (ft)
110
105
100
95
90
85
80
75
-60
-10
40
90
140
190
240
290
340
390
440
490
540
Station (ft)
right bank
left bank
bed elevation
baseflow wse
bankfull wse
floodprone wse

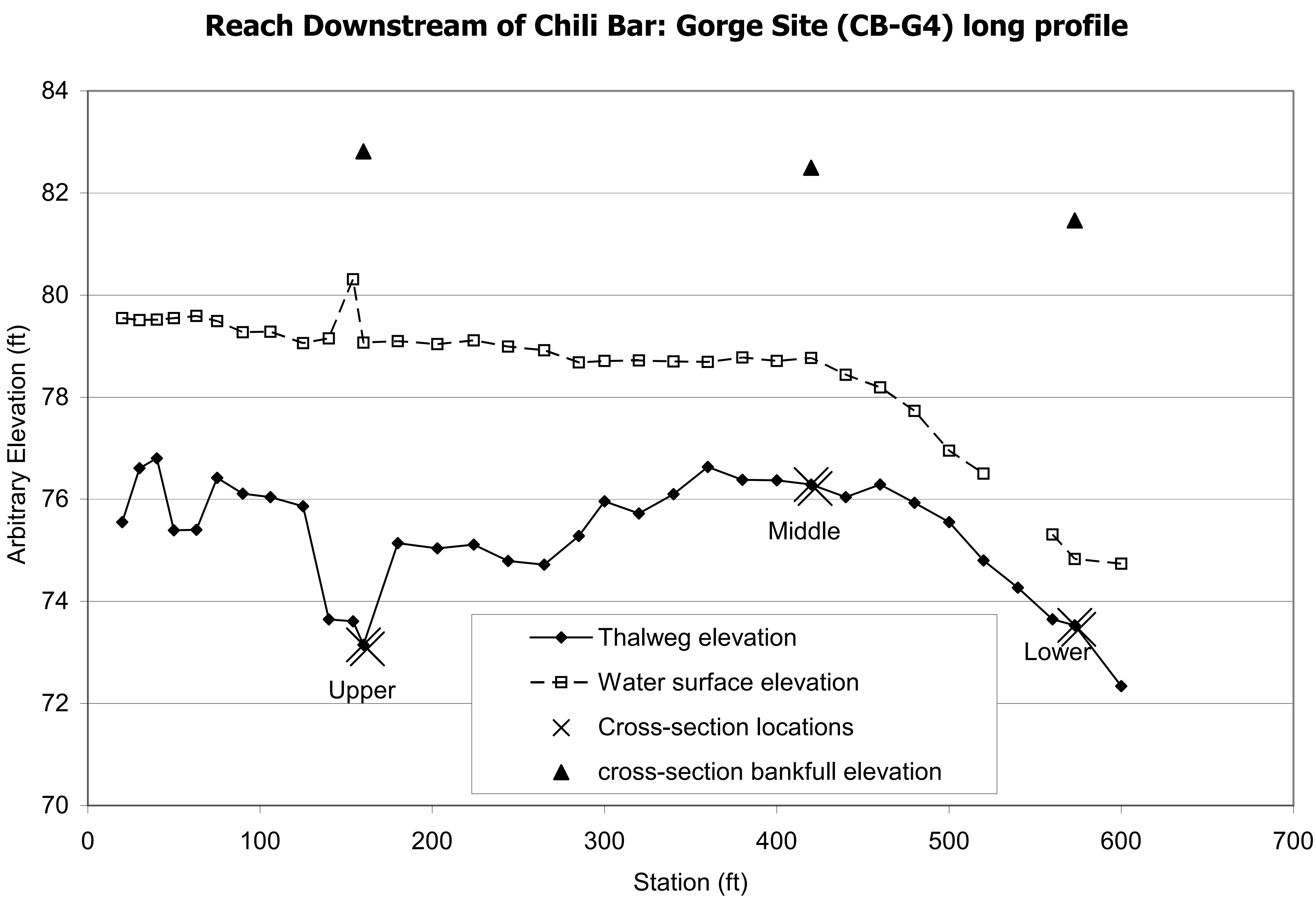
Reach Downstream of Chili Bar: Lower Coloma Site (CB-G3) middle cross-section



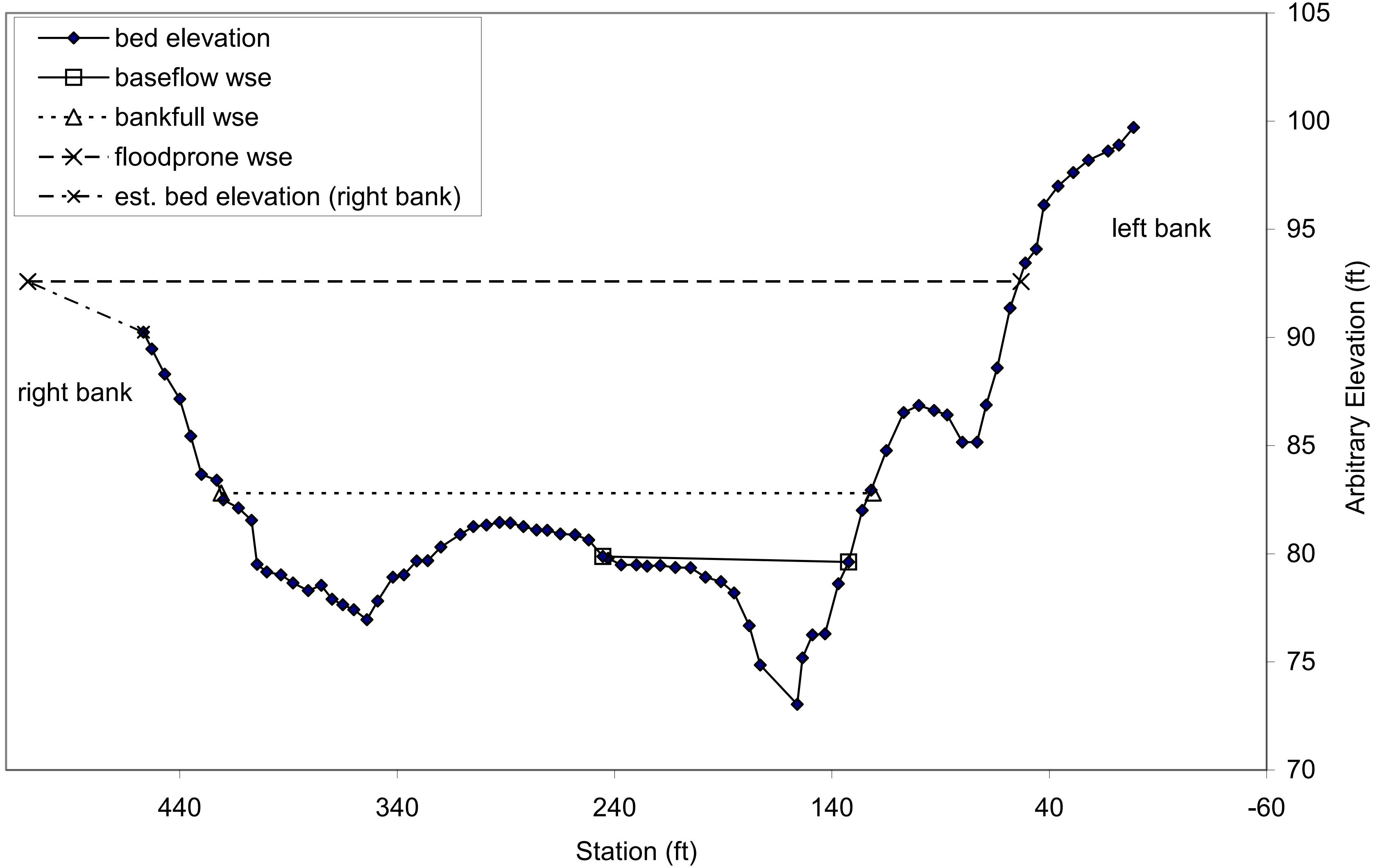

Reach Downstream of Chili Bar: Lower Coloma Site (CB-G3) lower cross-section
bed elevation
baseflow wse
bankfull wse
floodprone wse
est. bed elevation (left bank)
est. bed elevation (right bank)
Last point is an estimate taken from field notes.
left bank
road surface
right bank
Arbitrary Elevation (ft)
Station (ft)
110
105
100
95
90
85
80
75
-60
40
140
240
340
440
540



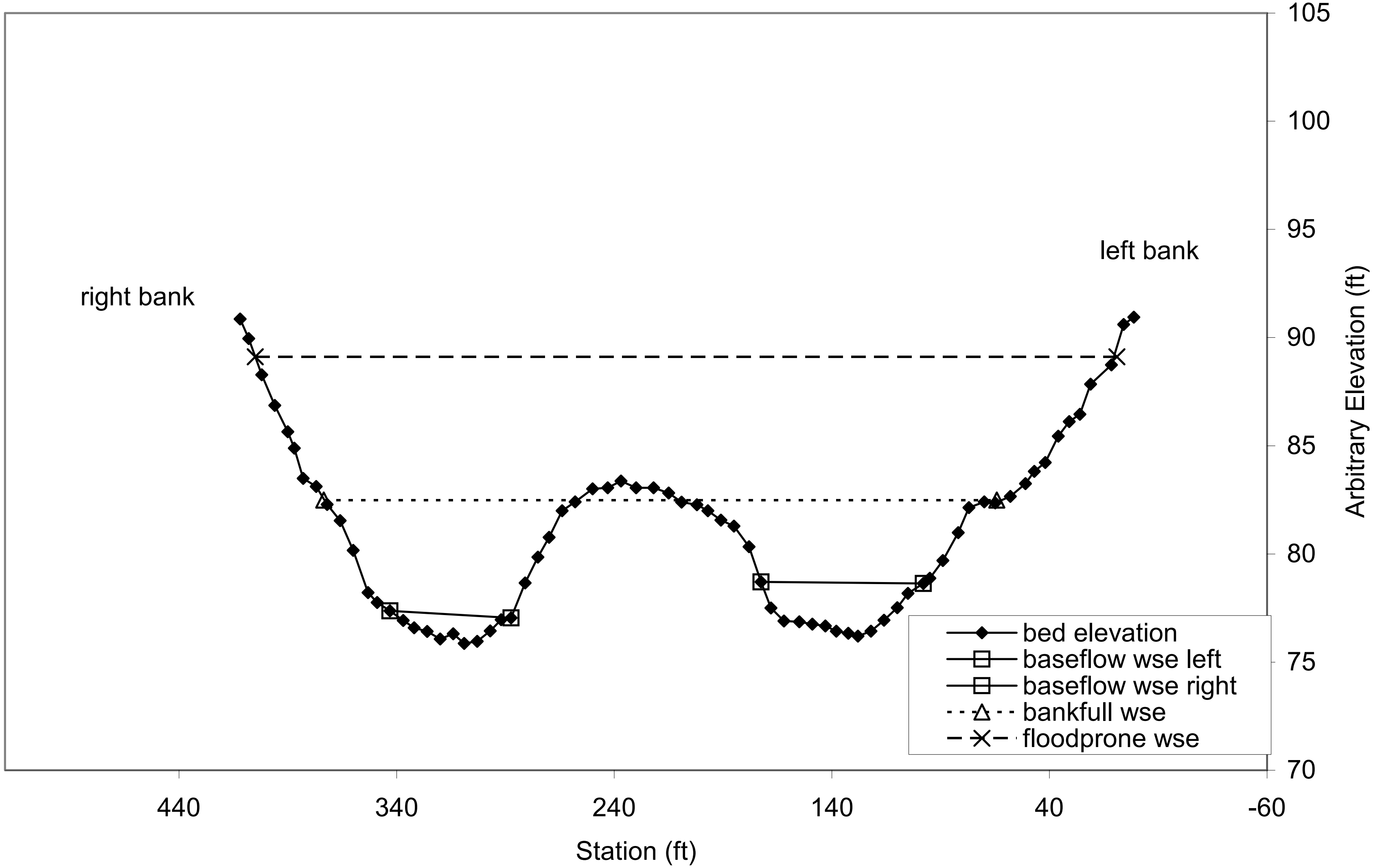
Reach Downstream of Chili Bar: Lower Coloma Site (CB-G3) pebble count
Cumulative % finer
100
90
80
70
60
50
40
30
20
10
0
1
10
100
1000
Grain size (mm)
Upper XS
Middle XS
Lower XS
Note: 98 clasts counted at Middle XS.
Remaining counts were bedrock.


Reach Downstream of Chili Bar: Gorge Site (CB-G4) long profile
84
82
80
78
76
74
72
70
Arbitrary Elevation (ft)
0
100
200
300
400
500
600
700
Station (ft)
Upper
Middle
Lower
Thalweg elevation
Water surface elevation
Cross-section locations
cross-section bankfull elevation

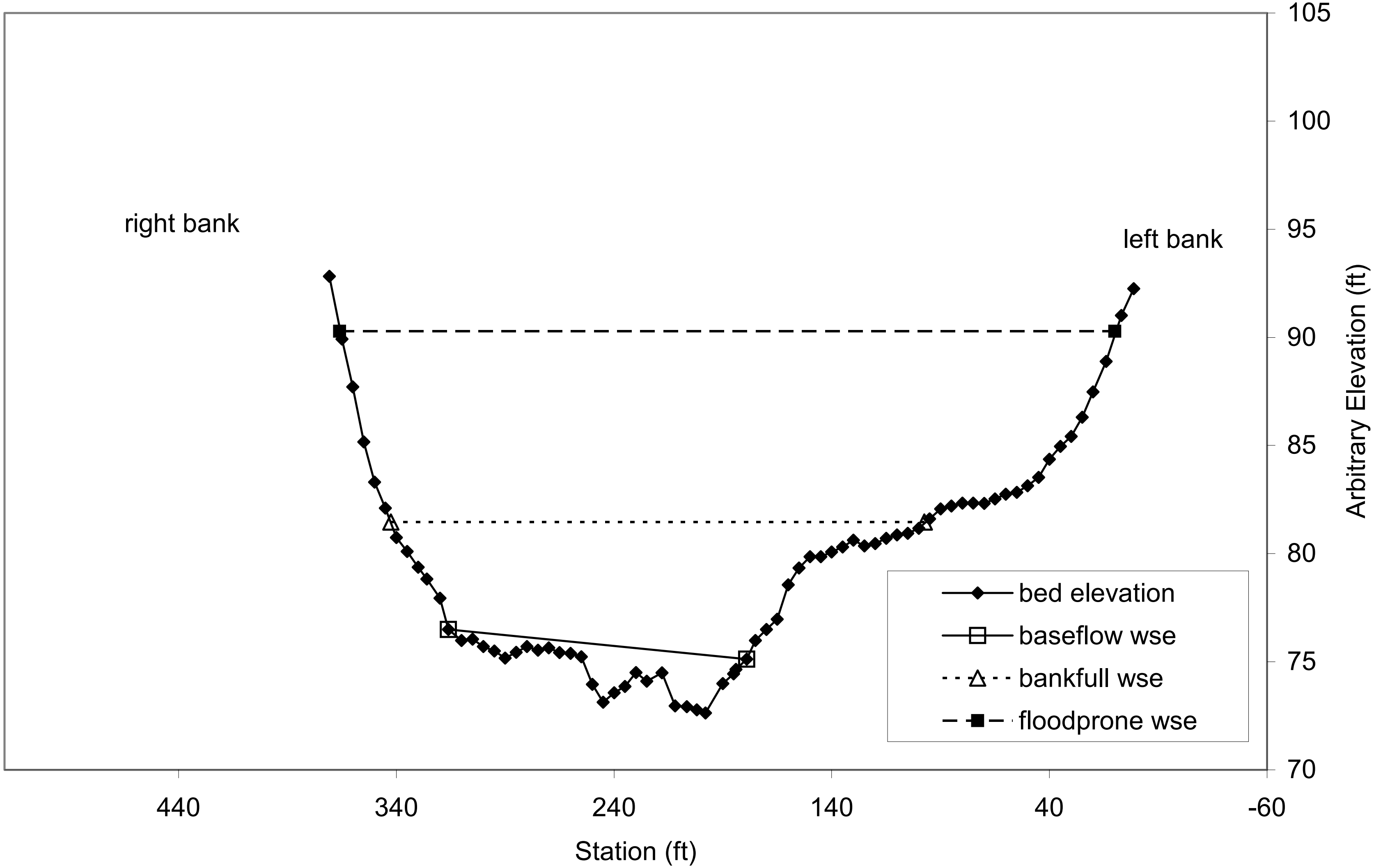
Reach Downstream of Chili Bar: Gorge Site (CB-G4) upper cross-section

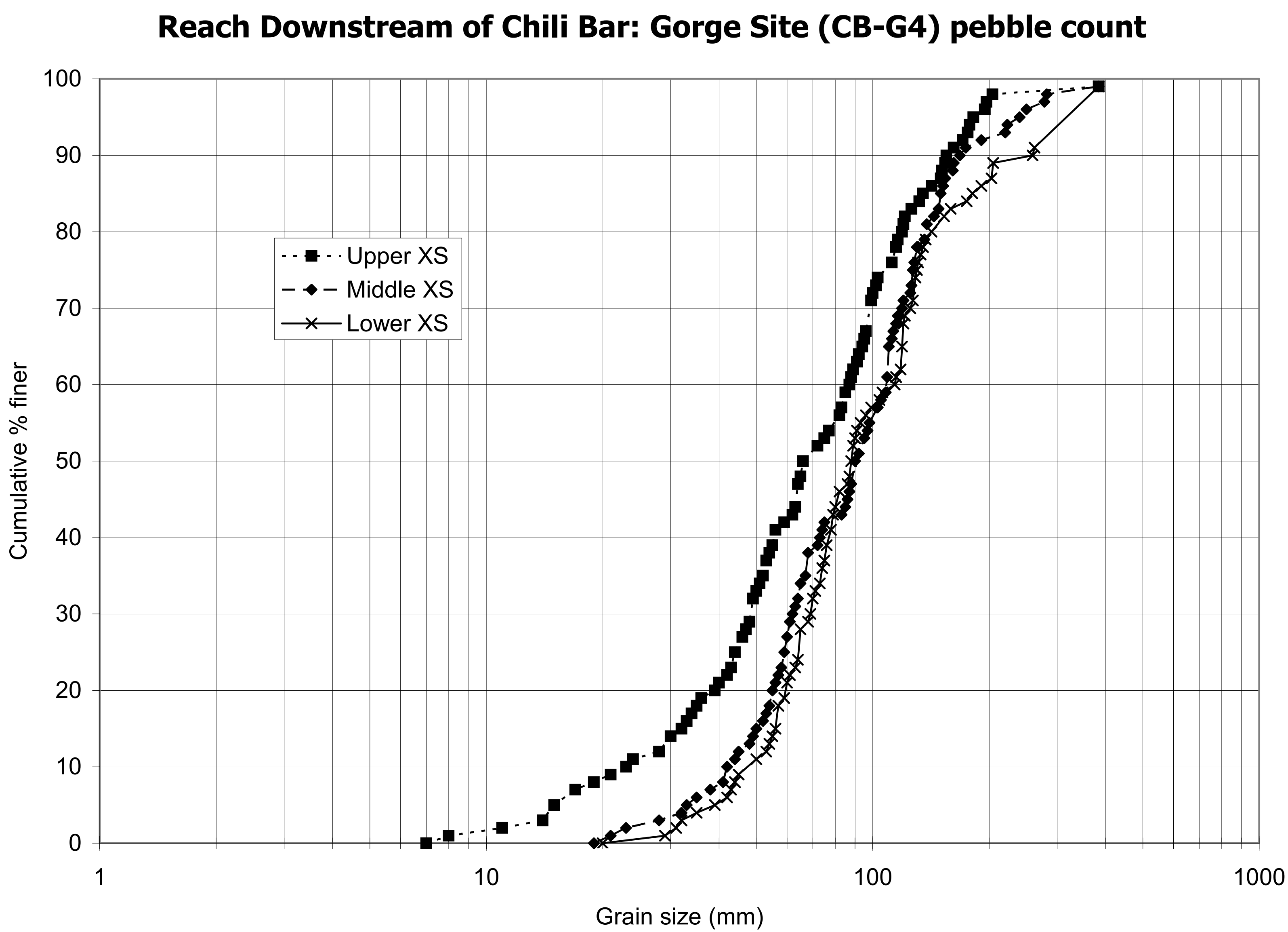


Reach Downstream of Chili Bar: Gorge Site (CB-G4) middle cross-section



Reach Downstream of Chili Bar: Gorge Site (CB-G4) lower cross-section





Reach Downstream of Chili Bar: Gorge Site (CB-G4) pebble count
Upper XS
Middle XS
Lower XS
Cumulative % finer
Grain size (mm)
0
10
20
30
40
50
60
70
80
90
100
1
10
100
1000

APPENDIX L

LEVEL III DATA FOR THE REACH DOWNSTREAM OF CHILI BAR

The Reach Downstream of Chili Bar: Upper Coloma Site (CB-G2) Lower Coloma Site (CB-G3)

Upper Coloma Site (CB-G2) LWD Frequency

LWD Frequency Data Sheet
Study Reach Name: Chili Bar - Upper Coloma **Crew Initials: CDJ, SKW**
Date: 11/18/03 **Start time:** **End time:**

Diameter Class	**Length Class** 3-10 ft (0.9-3.0 m)	10-25 ft (3.1-7.6 m)	25-50 ft (7.7-15.2 m)	50-75 ft (15.3-22.9 m)	>75 ft (>23 m)
6-12 in (10-30 cm)					
12-24 in (31-60 cm)					
24-36 in (61-90 cm)					
>36 in (>90 cm)					

"Tally as R if rootwad is attached."

Comments: No Key Pieces. No LWD in channel or along bank. Some present above bankfull elevation on left bank upper slope

Upper Coloma Site (CB-G2) V Star

V* Measurements
Study Reach Name: Chili Bar - Upper Coloma **Crew Initials: CDJ, SDW**
Date: 11/18/03 **Start time:** **End time:**

Comments: No V* taken - small patches of fine sediment present in residual pools, but wetted not applicable due to lack of fine sediment

Upper Coloma Site (CB-G2) Rosgen Level III

Rosgen Level III Data Sheet

Study Reach Name: Chili Bar - Upper Coloma
Date: 11/18/2003
Crew Initials: CDJ, SDW
Start time: End time:

Depositional Features (indicate one)

	B-1	point bars
X	B-2	pt. bars w/ few mid channel bars
	B-3	many mid channel bars
	B-4	side bars
	B-5	diagonal bars
	B-6	main branching w/ many mid channel bars and islands
	B-7	mixed side bar and mid channel bars exceeding 2-3X width
	B-8	delta bars
Description:		C/B/G Bars

Meander Pattern (indicate one)

	M-1	regular meander
	M-2	tortuous meander
X	M-3	irregular meander
	M-4	truncated meander
	M-5	unconfined me. scrolls
	M-6	confine me. scrolls
	M-7	distorted me. loops
	M-8	irregular with oxbows
Description:		Channel marked by occasional meanders and long runs with pool riffle sequences

STREAM CHANNEL DEBRIS/BLOCKAGES (indicate one)

Materials, which upon placement into the active channel or floodprone area may cause an adjustment in channel dimensions or conditions, due to influences on the existing flow regime

	Description/Extent	
X	D-1 (None)	Minor amounts of small, floatable material
	D-2 (Infrequent)	Debris consists of small, easily moved, floatable material; i.e. leaves, needles, small limbs, twigs, etc..
	D-3 (Moderate)	Increasing frequency of small to medium sized material, i.e. large limbs, branches, small logs that when accumulated effect 10% or less of the active channel cross-sectional area.
	D-4 (Numerous)	Significant buildup of medium to large sized materials, i.e. large limbs, branches, small logs, or portions of trees that may occupy 10 to 30% of the active cross-sectional area.
	D-5 (Extensive)	Debris "dams" of predominantly larger materials, i.e. branches, logs, trees, etc., occupying 30 to 50% of the active channel cross-section, often extending across the width of the active channel.
	D-6 (Dominating)	Large, somewhat continuous debris "dams," extensive in nature and occupying over 50% of the active channel cross-section. Such accumulations may divert water into floodprone areas and form fish migration barriers, even when flows are at less than bankfull
	D-7 (Beaver Dams - Few)	An infrequent number of dams spaced such that normal streamflow and expected channel conditions exist in the reaches between dams.
	D-8 (Beaver Dams - Frequent)	Frequency of dams is such that backwater conditions exist for channel reaches between structures; where streamflow velocities are reduced and channel dimensions or conditions are influenced.
	D-9 (Beaver Dams - Abandoned)	Numerous abandoned dams, many of which have filled with sediment and/or breached, initiating a series of channel adjustments such as bank erosion, lateral migration, evulsion, aggradations and degradation.
	D-10 (Human Influences)	Structures, facilities, or materials related to land uses or development located within the floodprone area, such as diversions or low-head dams, controlled by-pass channels, velocity control structures, and various transportation encroachments that have influence on the existing flow regime, such that significant channel adjustments occur.

Upper Coloma Site (CB-G2) Pfankuch

Channel Stability (Pfankuch)
Study Reach Name: **Chili Bar - Upper Coloma**
Crew Initials: CDJ, SDW
Date: 11/18/2003
Start Time:
Stop Time:

		Category	(choose one for each of the four options for each category)		Place X in this column:
Upper Banks	1	Landform slope	Bank slope gradient <30%	2	
			Bank slope gradient 30-40%	4	
			Bank slope gradient 40-60%	6	**X**
			Bank slope gradient 60+%	8	
	2	Mass wasting	No evidence of past or future mass wasting	3	
			Infrequent. Most likely healed over. Low future potential	6	**X**
			Frequent or large, causing sediment nearly year long	9	
			Frequent or large causing sediment nearly year long or imminent danger of same	12	
	3	Debris jam potential	Essentially absent from immediate channel area	2	**X**
			Present, but mostly small twigs and limbs	4	
			Moderate to heavy amounts, mostly larger sizes	6	
			Moderate to heavy amounts, predominately lager sizes	8	
	4	Vegetative bank protection	90%+ plant density. Vigor and variety suggest a deep, dense soil binding root mass	3	
			70-90% density. Fewer species or less vigor suggest less dense or deep root mass	6	
			<50-70% density. Lower vigor and fewer species from a shallow, discontinuous root mass	9	**X**
			<50% density, fewer species and less vigor indicate poor, discontinuous and shallow root mass	12	
Lower Banks	5	Channel capacity	Ample for present plus some increases. Peak flows contained. W/D ration <7	1	
			Adequate. Bank overflows rare. W/D ratio 8-15	2	**X**
			Barely contains present peaks. Occasional overbank floods. W/D ratio 15 to 25	3	
			Inadequate. Overbank flows common. W/D ratio >25	4	
	6	Bank rock content	65%+ with large angular boulders. 12”+ common.	2	
			40-65%. Mostly small boulders to cobbles 6-12”	4	**X**
			20-40%. With most in the 3-6” diameter class	6	
			20% rock fragments of gravel sizes, 1-3” or less	8	
	7	Obstructions to flow	Rocks and logs firmly embedded. Flow pattern w/out cutting or deposition. Stable bed	2	
			Some present causing erosive cross currents and minor pool filling. Obstructions newer and less firm	4	**X**
			Moderately frequent, unstable obstructions move with high flows causing bank cutting and pool filling	6	
			Sediment traps full, channel migration occurring	8	
	8	Cutting	Little or none. Infrequent raw banks less than 6”	4	**X**
			Some, intermittently at outcurves and constrictions. Raw banks may be up to 12”	6	
			Significant. Cuts 12-24” high. Root mat overhangs and sloughing evident	12	
			Almost continuous cuts, some over 24” high. Failure of overhangs frequent	16	
	9	Deposition	Little or no enlargement of channel or point bars	4	**X**
			Some new bar increase, mostly from coarse gravel	8	
			Moderate deposition of new gravel and course sand on old and some new bars	12	
			Extensive deposits of predominately fine particles. Accelerated bar development	16	
Bottom	10	Rock angularity	Sharp edges and corners. Plane surfaces rough.	1	
			Rounded corners and edges, surfaces smooth, flat	2	
			Corners and edges well rounded in two dimensions	3	**X**
			Well rounded in all dimensions, surfaces smooth	4	
	11	Brightness	Surfaces dull, dark, or stained. Generally not bright	1	**X**
			Mostly dull, but may have <35% bright surfaces	2	
			Mixture dull and bright, ie 35-65% mixture range	3	
			Predominately bright, 65% exposed or scoured surfaces	4	
	12	Consolidation of particles	Assorted sizes tightly packed or overlapping	2	
			Moderately packed with some overlapping	4	
			Mostly loose assortment with no apparent overlap	6	**X**
			No packing evident. Loose assortment easily moved	8	
	13	Bottom size distribution	No size change evident. Stable mater. 80-100%	4	
			Distribution shift light. Stable material 50-80%	8	
			Moderate changes in sizes. Stable materials 20-50%	12	**X**
			Marked distribution change. Stable materials 0-20%	16	
	14	Scouring and deposition	<5% of bottom affected by scour or deposition	6	
			5-30% affected. Scour at constrictions and where grades steepen. Some deposition in pools	12	**X**
			30-50% affected. Deposits and scour at obstructions, constrictions, and bends. Some filling of pools	18	
			More than 50% of the bottom in a state of flux or change nearly year long	24	
	15	Aquatic vegetation	Abundant growth moss-like, dark green perennial. In swift water too.	1	
			Common. Algae forms in low velocity and pool areas. Moss here too	2	**X**
			Present but spotty, mostly in backwater. Seasonal algae growth makes rocks slick	3	
			Perennial types scare or absent. Yellow-green, short term bloom may be present	4	

Upper Coloma Site (CB-G2)
Bank Erosion and Vegetation

Bank Erosion and Vegetation

Study Reach Name: Chili Bar - Upper Coloma **Crew Initials**: CDJ, SKW
Date: 11/18/03 **Start Time**: **Stop Time**:

Bank material: Boulders, cobble

BANK EROSION POTENTIAL				
(if banks are bedrock or composed of boulders, do not fill out this table)				
	Bank a	**Bank b**	**Bank c**	**Bank d**
Bank height (ft)	8.03-11.60	14.69-18.64		
Bankfull height (ft)	8.03	13.92		
Root depth (ft)	0.5-1.5	not visible		
Root density (%)	5-20%	not visible		
Bank Angle (degrees)	60-80	30-50		
Surface Protection (%)	75%	<5%		
% of total study reach	20-30%	60-80%		

Notes

Stratification of unstable layers in banks (below bankfull): N/A No stratification present

Sediment supply: Moderat
Vertical streambed stability: Degrading

Bank and channel bed conditions notes: Modern river is incising alluvial fill deposited during a prior period of aggradation. Thus, modern river banks are comprised of well rounded large cobble and small boulder. Modern river lies 5 - 15 feet below historical flow surface. Occasional high flows cover this historical surface (middle and lower cross-section).

RIPARIAN VEGETATION				
	DENSITY (indicate all that apply)			
VEGETATION TYPE	**LOW**	**MOD.**	**HIGH**	**NOTES**
Bare		1		
Forbs only	2a			
Annual Grass w/ forbes	3a			
Perennial grass	4a			
Rhizomatous grasses (bluegrass, Grass like plants, sedges, rushes)				
Low brush			6c	
High brush				
Combination grass/brush	8a			
Deciduous overstory		9b		
Deciduous w/brush/grass understory		10b		
Perennial overstory				
Wetland vegetation community				

VEGETATION NOTES (composition, vigor, density, and potential):
Left bank has higher veg. denisity due to north facing aspect

Lower Coloma Site (CB-G1) LWD Frequency

LWD Frequency Data Sheet
Study Reach Name: Chili Bar - Lower Coloma **Crew Initials: MCM, SKW, CDJ**
Date: 11/22/03 **Start time:** **End time:**

Diameter Class	Length Class				
	3-10 ft (0.9-3.0 m)	10-25 ft (3.1-7.6 m)	25-50 ft (7.7-15.2 m)	50-75 ft (15.3-22.9 m)	>75 ft (>23 m)
6-12 in (10-30 cm)	3				
12-24 in (31-60 cm)					
24-36 in (61-90 cm)					
>36 in (>90 cm)					

"Tally as R if rootwad is attached."

Comments: No Key Pieces. A few pieces upstream of cross-section 3 on right bank, along with smaller twigs - but thest might be just above bankfull (?). Otherwise no wood in bankfull channel.

Lower Coloma Site (CB-G1) V Star

V* Measurements
Study Reach Name: Chili Bar - Lower Coloma **Crew Initials: CDJ, SKW, MCM**
Date: 11/23/03 **Start time:** **End time:**

Comments: Fine sediment is present in backwaters. No significant accumulation of fine sediment within the pools of their reach. No V* measurements done. Small patches with disucts pockets, but none measureable

Lower Coloma Site (CB-G1) Rosgen Level III

Rosgen Level III Data Sheet

Study Reach Name: Chili Bar - Lower Coloma
Date: 11/22/03
Crew Initials: MCM, SKU, CDJ
Start time: End time:

Depositional Features (indicate one)

X	B-1	point bars
	B-2	pt. bars w/ few mid channel bars
	B-3	many mid channel bars
	B-4	side bars
	B-5	diagonal bars
	B-6	main branching w/ many mid channel bars and islands
	B-7	mixed side bar and mid channel bars exceeding 2-3X width
	B-8	delta bars
Description:		Pod at upstream end, followed by riffle, then a long run

Meander Pattern (indicate one)

X	M-1	regular meander
	M-2	tortuous meander
	M-3	irregular meander
	M-4	truncated meander
	M-5	unconfined me. scrolls
	M-6	confine me. scrolls
	M-7	distorted me. loops
	M-8	irregular with oxbows
Description:		

STREAM CHANNEL DEBRIS/BLOCKAGES (indicate one)

Materials, which upon placement into the active channel or floodprone area may cause an adjustment in channel dimensions or conditions, due to influences on the existing flow regime

	Description/Extent	
X	D-1 (None)	Minor amounts of small, floatable material
	D-2 (Infrequent)	Debris consists of small, easily moved, floatable material; i.e. leaves, needles, small limbs, twigs, etc..
	D-3 (Moderate)	Increasing frequency of small to medium sized material, i.e. large limbs, branches, small logs that when accumulated effect 10% or less of the active channel cross-sectional area.
	D-4 (Numerous)	Significant buildup of medium to large sized materials, i.e. large limbs, branches, small logs, or portions of trees that may occupy 10 to 30% of the active cross-sectional area.
	D-5 (Extensive)	Debris "dams" of predominantly larger materials, i.e. branches, logs, trees, etc., occupying 30 to 50% of the active channel cross-section, often extending across the width of the active channel.
	D-6 (Dominating)	Large, somewhat continuous debris "dams," extensive in nature and occupying over 50% of the active channel cross-section. Such accumulations may divert water into floodprone areas and form fish migration barriers, even when flows are at less than bankfull
	D-7 (Beaver Dams - Few)	An infrequent number of dams spaced such that normal streamflow and expected channel conditions exist in the reaches between dams.
	D-8 (Beaver Dams - Frequent)	Frequency of dams is such that backwater conditions exist for channel reaches between structures; where streamflow velocities are reduced and channel dimensions or conditions are influenced.
	D-9 (Beaver Dams - Abandoned)	Numerous abandoned dams, many of which have filled with sediment and/or breached, initiating a series of channel adjustments such as bank erosion, lateral migration, evulsion, aggradations and degradation.
	D-10 (Human Influences)	Structures, facilities, or materials related to land uses or development located within the floodprone area, such as diversions or low-head dams, controlled by-pass channels, velocity control structures, and various transportation encroachments that have influence on the existing flow regime, such that significant channel adjustments occur.

Lower Coloma Site (CB-G1) Pfankuch

Channel Stability (Pfankuch)

Study Reach Name: Chili Bar - Lower Coloma
Crew Initials: SKW/MCM/CDJ
Date: 11/22/2003
Start Time:
Stop Time:

		Category	(choose one for each of the four options for each category)		Place X in this column:
Upper Banks	1	Landform slope	Bank slope gradient <30%	2	
			Bank slope gradient 30-40%	4	X
			Bank slope gradient 40-60%	6	
			Bank slope gradient 60+%	8	
	2	Mass wasting	No evidence of past or future mass wasting	3	X
			Infrequent. Most likely healed over. Low future potential	6	
			Frequent or large, causing sediment nearly year long	9	
			Frequent or large causing sediment nearly year long or imminent danger of same	12	
	3	Debris jam potential	Essentially absent from immediate channel area	2	X
			Present, but mostly small twigs and limbs	4	
			Moderate to heavy amounts, mostly larger sizes	6	
			Moderate to heavy amounts, predominately lager sizes	8	
	4	Vegetative bank protection	90%+ plant density. Vigor and variety suggest a deep, dense soil binding root mass	3	
			70-90% density. Fewer species or less vigor suggest less dense or deep root mass	6	
			<50-70% density. Lower vigor and fewer species from a shallow, discontinuous root mass	9	X
			<50% density, fewer species and less vigor indicate poor, discontinuous and shallow root mass	12	
Lower Banks	5	Channel capacity	Ample for present plus some increases. Peak flows contained. W/D ration <7	1	
			Adequate. Bank overflows rare. W/D ratio 8-15	2	X
			Barely contains present peaks. Occasional overbank floods. W/D ratio 15 to 25	3	
			Inadequate. Overbank flows common. W/D ratio >25	4	
	6	Bank rock content	65%+ with large angular boulders. 12”+ common.	2	X
			40-65%. Mostly small boulders to cobbles 6-12”	4	
			20-40%. With most in the 3-6” diameter class	6	
			20% rock fragments of gravel sizes, 1-3” or less	8	
	7	Obstructions to flow	Rocks and logs firmly embedded. Flow pattern w/out cutting or deposition. Stable bed	2	
			Some present causing erosive cross currents and minor pool filling. Obstructions newer and less firm	4	X
			Moderately frequent, unstable obstructions move with high flows causing bank cutting and pool filling	6	
			Sediment traps full, channel migration occurring	8	
	8	Cutting	Little or none. Infrequent raw banks less than 6”	4	X
			Some, intermittently at outcurves and constrictions. Raw banks may be up to 12”	6	
			Significant. Cuts 12-24” high. Root mat overhangs and sloughing evident	12	
			Almost continuous cuts, some over 24” high. Failure of overhangs frequent	16	
	9	Deposition	Little or no enlargement of channel or point bars	4	X
			Some new bar increase, mostly from coarse gravel	8	
			Moderate deposition of new gravel and course sand on old and some new bars	12	
			Extensive deposits of predominately fine particles. Accelerated bar development	16	
Bottom	10	Rock angularity	Sharp edges and corners. Plane surfaces rough.	1	
			Rounded corners and edges, surfaces smooth, flat	2	
			Corners and edges well rounded in two dimensions	3	
			Well rounded in all dimensions, surfaces smooth	4	X
	11	Brightness	Surfaces dull, dark, or stained. Generally not bright	1	X
			Mostly dull, but may have <35% bright surfaces	2	
			Mixture dull and bright, ie 35-65% mixture range	3	
			Predominately bright, 65% exposed or scoured surfaces	4	
	12	Consolidation of particles	Assorted sizes tightly packed or overlapping	2	
			Moderately packed with some overlapping	4	X
			Mostly loose assortment with no apparent overlap	6	
			No packing evident. Loose assortment easily moved	8	
	13	Bottom size distribution	No size change evident. Stable mater. 80-100%	4	
			Distribution shift light. Stable material 50-80%	8	X
			Moderate changes in sizes. Stable materials 20-50%	12	
			Marked distribution change. Stable materials 0-20%	16	
	14	Scouring and deposition	<5% of bottom affected by scour or deposition	6	X
			5-30% affected. Scour at constrictions and where grades steepen. Some deposition in pools	12	
			30-50% affected. Deposits and scour at obstructions, constrictions, and bends. Some filling of pools	18	
			More than 50% of the bottom in a state of flux or change nearly year long	24	
	15	Aquatic vegetation	Abundant growth moss-like, dark green perennial. In swift water too.	1	
			Common. Algae forms in low velocity and pool areas. Moss here too	2	
			Present but spotty, mostly in backwater. Seasonal algae growth makes rocks slick	3	X
			Perennial types scare or absent. Yellow-green, short term bloom may be present	4	

Lower Coloma Site (CB-G1)
Bank Erosion and Vegetation

Bank Erosion and Vegetation

Study Reach Name: Chili Bar - Lower Coloma **Crew Initials**: MCM, CDJ, SKU
Date: 11/22/03 **Start Time**: **Stop Time**:

Bank material: Cobble

BANK EROSION POTENTIAL				
(if banks are bedrock or composed of boulders, do not fill out this table)				
	Bank a	**Bank b**	**Bank c**	**Bank d**
Bank height	3	1		
Bankfull height	5	5		
Root depth	1	0		
Root density (%)	20%	0%		
Bank Angle (degrees)	40	20		
Surface Protection (%)	20%	5%		
% of total study reach	30%	40%		

Notes: 30% of banks are bedrock or boulder

Stratification of unstable layers in banks (below bankfull): Middle of bank

Sediment supply: High
Vertical streambed stability: Stable
Bank and channel bed conditions notes:

RIPARIAN VEGETATION				
	DENSITY (indicate all that apply)			
VEGETATION TYPE	**LOW**	**MOD.**	**HIGH**	**NOTES**
Bare			1	
Forbs only				
Annual Grass w/ forbes				
Perennial grass	4a			looks like bunch grass
Rhizomatous grasses (bluegrass, Grass like plants, sedges, rushes)				
Low brush	6a			
High brush	7a			
Combination grass/brush				
Deciduous overstory				
Deciduous w/brush/grass understory	10a			
Perennial overstory				
Wetland vegetation community				

VEGETATION NOTES (composition, vigor, density, and potential):
Willows, alders, and blackberry pervasive along both banks, but cobble bars are generally exposed

APPENDIX M

ENHANCED ACRONYM SERIES (1 & 2) WITH INTERFACE (EASI): MODEL DOCUMENTATION

ENHANCED ACRONYM SERIES (1 & 2) WITH INTERFACE (EASI): MODEL DOCUMENTATION

1 INTRODUCTION

Sediment transport has been realized to be one of the most important processes in a fluvial ecosystem. Many recent channel rehabilitation projects and proposals have been focused on the remobilization or augmentation of gravel in heavily altered rivers in order to improve the quality of fish habitats. Suggestions on modifying channel cross sections (e.g., narrowing the main channel, lowering floodplain elevation, and lay back levees) are also proposed in certain rivers in order to increase the frequency of gravel transport and decrease the amount of gravel transported during extremely high flows. For example, gravel has been added below the Whiskeytown Reservoir in Clear Creek, California in hope of improving the existing salmonid spawning habitats. Similar practices are also documented at the Keswick Dam on the upper Sacramento River, California (Kondolf 1995). Larger scale gravel augmentations and flow alterations are also being considered in other rivers of California's Central Valley. A user-friendly tool for evaluation of such projects and proposals is, however, still unavailable to watershed managers, planners and practitioners. To fill in this void, Stillwater Sciences developed the *EASI* (Enhanced Acronym Series with Interface) program based on the surface based bedload equation and the *Acronym1* and *Acronym2* programs of Parker (Parker 1990a, b). In the *EASI* program, the *Acronym* programs are enhanced to allow for calculation of: (1) gravel transport rate and bedload grain size distribution with given surface gravel grain size distribution, channel geometry and water discharge; and (2) bedload transport rate and surface layer grain size distribution with given bedload grain size distribution, channel geometry and water discharge. The *EASI* program also allows for a river cross section and a duration curve as input parameters. In the case of a river cross section, the *EASI* program allows for the separation of floodplain and the main channel so that the hydraulics of the river can be evaluated more accurately. Table M-1 shows the similarities and differences between the *EASI* program and the *Acronym* Series (1 & 2) of Parker (1990b).

The most significant difference between *EASI* and the *Acronym* series is in the case of calculating surface layer grain size distribution. In this specific case, the *EASI* program uses bedload grain size distribution, water discharge or duration curve and channel width or channel cross section as input parameters, whereas *Acronym2* uses bedload transport rate and grain size distribution as part of the input parameters. The advantage of using bedload grain size distribution but not bedload transport rate as an input parameter can easily be seen in the case of gravel augmentation, in which the bedload grain size is readily available and bedload transport rate needs to be evaluated.

This report discusses how the surface based bedload equation of Parker (1990a) is implemented.

As is for any sediment modeling tools, the *EASI* program predicts certain parameters only as guidelines for management and engineering practice and thus, its results must be

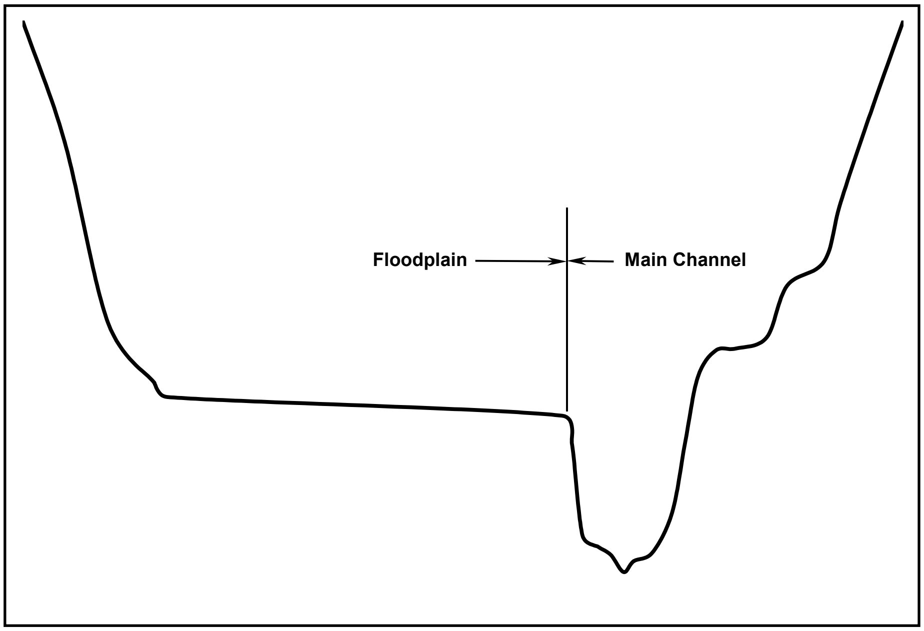


Figure M-2. A typical cross section of a river.

Floodplain hydraulics and flow continuity are brought in to close the equations,

$$Q_{wf} = \frac{1}{n} A_f R_{hf}^{\ 2/3} S^{1/2} \tag{17}$$

$$Q_{wf} + Q_{wc} = Q_w \tag{18}$$

$$R_{hf} = \frac{A_f}{P_f} \tag{19}$$

$$u_c = \frac{Q_{wc}}{A_c} \tag{20}$$

where n denotes Manning's n for floodplain; A_f denotes flow area in floodplain; P_f denotes the wet perimeter of the floodplain; R_{hf} denotes hydraulic radius of the floodplain; Q_{wf} and Q_{wc} denotes the discharge on floodplain and main channel respectively.

3 CALCULATION OF BEDLOAD TRANSPORT RATE AND BEDLOAD GRAIN SIZE DISTRIBUTION

This part of the *EASI* program is designed for the following two cases:

interpreted by qualified hydraulic engineers or fluvial geomorphologists with field experience in the river to be modeled.

Table M-1. Comparison of input and output parameters of EASI and Acronym series

	Input Parameters	Output Parameters
Acronym1	1. Surface layer grain size distribution 2. Shear velocity	1. Bedload transport rate 2. Bedload grain size distribution
Acronym2	1. Bedload transport rate 2. Bedload grain size distribution	1. Surface layer grain size distribution 2. Shear velocity
EASI	1. Surface layer grain size distribution 2. Water discharge or duration curve 3. Channel width or channel cross section 4. Average channel/water surface slope 5. Floodplain Manning's n	1. Bedload transport rate 2. Bedload grain size distribution
	1. Bedload grain size distribution 2. Water discharge or duration curve 3. Channel width or channel cross section 4. Average channel/water surface slope 5. Floodplain Manning's n	1. Bedload transport rate 2. Surface layer grain size distribution

2 THE SURFACE BASED BEDLOAD EQUATION OF PARKER AND ITS MODIFICATION

The surface based bedload equation of Parker (1990a) is expressed for wide rectangular channel for which channel geometry can be expressed as a channel width. The equation is modified for the *EASI* program so that it can also handle a given cross section. Details of the surface based bedload equation of Parker can be found in the original references (Parker 1990a, b). Here only the most essential part of the Parker equation is presented so that we can discuss how the equation is modified and implemented in the *EASI* program.

The surface based bedload equation of Parker (1990a) for a wide rectangular channel is as follows,

$$\frac{RgQ_G p_i}{Bu_*^{\,3}} = \alpha F_i G\left[\omega\phi_{sgo}\left(\frac{\overline{D_i}}{D_{sg}}\right)^{-\beta}\right] \tag{1}$$

where R denotes the submerged specific gravity of gravel; g denotes the acceleration of gravity; Q_G denotes volumetric bedload transport rate; B denotes channel width; u_* denotes shear velocity; $\overline{D_i}$ denotes the mean grain size of the i-th subrange; p_i denotes the volumetric fraction of the i-th subrange in bedload; F_i denotes the volumetric fraction of the i-th subrange in the surface layer; D_{sg} denotes geometric mean grain size of the surface layer; ϕ_{sgo} is normalized Shields stress; ω is a function of the normalized Shields stress ϕ_{sgo} and the arithmetic standard deviation of the surface layer. Coefficients α and β are given as

$$\alpha = 0.00218\,; \quad \beta = 0.0951 \tag{2a, b}$$

Grain size is described both in diameter and in Ψ-scale, which is the negative of the more commonly used ϕ-scale in geophysics community (Parker 1990b).

$$\psi_i = -\phi_i = \ell og_2(D_i) \tag{3}$$

The grain size is divided into N subgroups bounded by N+1 grain sizes Ψ_1 (D_1) to Ψ_{N+1} (D_{N+1}). The mean grain size of the i-th subrange is then given as

$$\overline{\psi_i} = \frac{\psi_i + \psi_{i+1}}{2}\,, \quad \overline{D_i} = \sqrt{D_i D_{i+1}} \tag{4a, b}$$

The surface layer mean grain size $\overline{\psi_s}$ and standard deviation $\sigma_{s\psi}$ are as follows,

$$\overline{\psi_s} = \sum_{i=1}^{N}\overline{\psi_i}F_i\,, \quad \sigma_{s\psi}^{\;2} = \sum\left(\overline{\psi_i} - \overline{\psi_s}\right)^2 F_i \tag{5a, b}$$

and the geometric mean grain size is given as

$$D_{sg} = 2^{\overline{\psi_s}} \tag{5c}$$

Note that the surface based bedload equation of Parker applies only to particles too coarse to be transported in suspension, and Parker further suggested that the finest grain size (D_1) be set as 2 mm as a common rule in field cases (Parker 1990a, b).

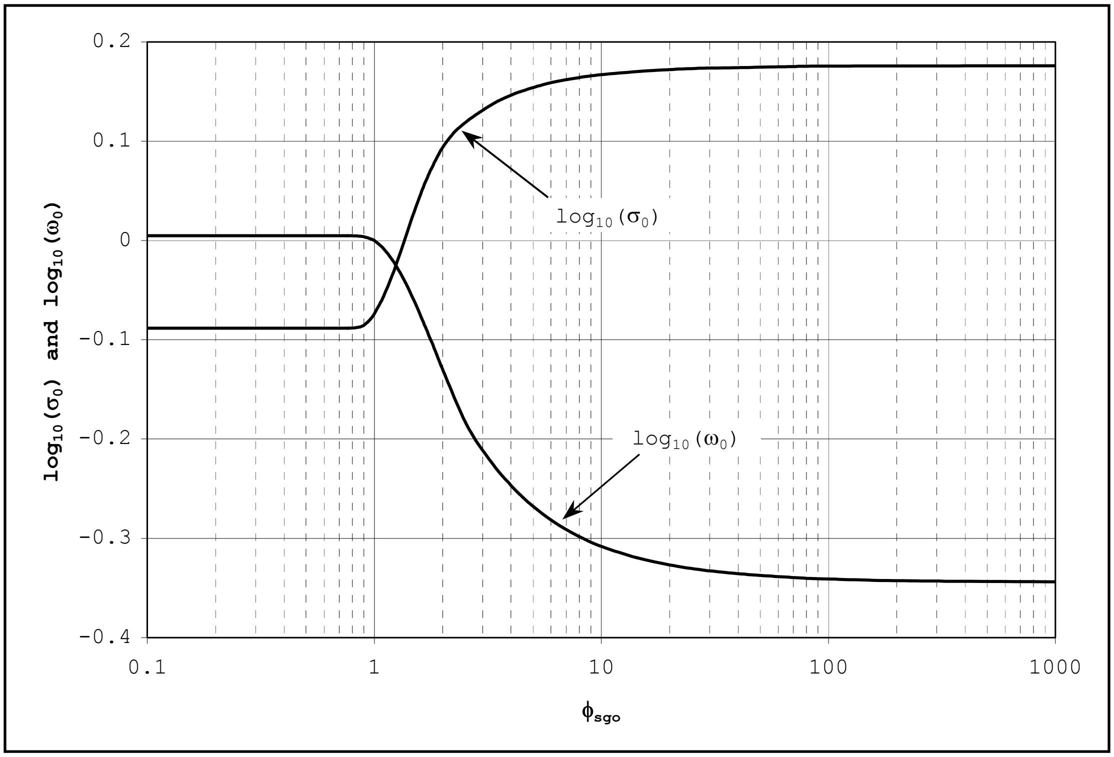


Figure M-1. Parameters σ_0 and ω_0 as functions of ϕ_{sgo} in Parker equation

Parameter ω is a function of the normalized Shields stress ϕ_{sgo},

$$\omega = 1 + \frac{\sigma_0}{\sigma_{s\psi}}(\omega_0 - 1) \tag{6}$$

where σ_0 and ω_0 are functions of ϕ_{sgo} given in Figure M-1 (Parker 1990a). The relations can also be found in tabulated form in Parker (1990b).

The normalized Shields stress ϕ_{sgo} is acquired by dividing the surface based Shields stress τ^*_{sg} by a reference stress τ^*_{rsgo},

$$\phi_{sgo} = \frac{\tau^*_{sg}}{\tau^*_{rsgo}} \tag{7}$$

where the reference Shields stress τ^*_{rsgo} is given by Parker (1990a) as 0.0386. The surface based Shields stress τ^*_{sg} is defined as

$$\tau^*_{sg} = \frac{{u_*}^2}{RgD_{sg}} \tag{8}$$

Shear velocity u_* is assumed to obey the Keulegan resistance relation,

$$\frac{u}{u_*} = 2.5\ell n\left(11\frac{h}{k_s}\right) \tag{9}$$

in which u denotes flow velocity; h denotes water depth and k_s denotes roughness height. Roughness height is defined slightly differently from the original work of Parker (1990a, b) for simplicity,

$$k_s = 2D_{sg}{\sigma_{sg}}^{1.28} \tag{10}$$

where σ_{sg} denotes surface layer geometric standard deviation,

$$\sigma_{sg} = 2^{\sigma_{s\psi}} \tag{11}$$

Note that the roughness height given by Equation (10) is an approximation of the original value given by Parker (1990a, b), in which the roughness height was defined as twice of surface layer D_{90}.

In case of a normal flow, shear velocity u_* can be expressed as

$$u_* = \sqrt{ghS} \tag{12}$$

in which S is channel bed slope.

Function G is given by Parker (1990a, b) as

$$G(\phi) = \begin{cases} 5474\left(1 - \dfrac{0.853}{\phi}\right)^{4.5} & \phi > 1.59 \\ \exp\left[14.2(\phi - 1) - 9.28(\phi - 1)^2\right] & 1 \le \phi \le 1.59 \\ \phi^{14.2} & \phi < 1 \end{cases} \tag{13}$$

In case of an arbitrary cross section, the cross section is divided into the main channel and a floodplain as shown in Figure M-2. In this case the sediment transport over floodplain is assumed to be insignificant.

The surface based bedload equation of Parker (Equation 1) and the Keulegan resistance relation (Equation 9) are modified as follows,

$$\frac{RQ_G p_i}{A_c S u_*} = \alpha F_i G\left(\omega \phi_{sgo} \left(\overline{D_i} / D_{sg}\right)^{-\beta}\right) \tag{14}$$

$$\frac{u_c}{u_*} = 2.5\ell n\left(11 \frac{R_{hc}}{k_s}\right) \tag{15}$$

where A_c denotes flow area in the main channel; R_{hc} denotes hydraulic radius of the flow in the main channel,

$$R_{hc} = \frac{A_c}{P_c} \tag{16}$$

and P_c denotes the wet perimeter of the main channel. Shear velocity, roughness height and grain size parameters in equations (14) and (15) all refer to those in the main channel.

1. To estimate current or historical gravel transport rate and bedload grain size distribution based on the existing or historical surface layer grain size distribution and the knowledge of channel geometry and water discharge information;
2. To estimate gravel transport rate and grain size distribution based on targeted surface layer grain size distribution, channel geometry and water discharge in case of gravel augmentation.

With the two cases, channel restoration practitioners and management can evaluate different restoration options or whether certain restoration practices are economically achievable. The procedure also allows for evaluation of channel cross section optimization such as channel narrowing, floodplain restoration and modification, etc.

4 CALCULATION OF BEDLOAD TRANSPORT RATE AND SURFACE LAYER GRAIN SIZE DISTRIBUTION

This part of the *EASI* program is designed for the purpose of estimating gravel transport rate and surface layer grain size distribution if a gravel augmentation with certain grain size distribution is given. Such an application allows restoration practitioners and management to evaluate whether the existing gravel for augmentation should be modified and if the practice is economically achievable. The procedure also allows for the evaluation of aforementioned channel cross section optimization.

5 APPLICATION EXAMPLE

The example is presented here to demonstrate what can be achieved from program *EASI*. The cross sections and grain size distributions used here are from an actual river. The scenarios to be simulated, however, are constructed only for demonstration purposes.

The scenario is as follows. A certain reach of a gravel bed river with salmon run is deprived of gravel because of a dam built not too far upstream. As a result, there are fewer areas available as salmonid spawning habitat and the quality of the available spawning habitat is degrading. The management is considering gravel augmentation as a way of improving the salmon habitat. The reach is fairly uniform with a typical cross section as shown in Figure M-3. The reach average channel slope is 0.003 based on water surface survey at a medium discharge. Post-dam flow duration curves are given in Figure M-4. The current reach average surface layer grain size distribution is given in Figure M-5.

Applying *EASI* program, it is found that the current post-dam gravel transport rate is only about 10 metric tons per annum (t/a) with bedload grain size distribution given in Figure M-5. Because the dam is capturing all the gravel and there are no tributaries between the dam and the reach, the 10 t/a gravel transport rate calculated by *EASI* program is probably not too far from reality. In some cases, however, the *EASI* program might over estimate the sediment transport rate because of the following conditions: (a) the reach could still be under going the post dam erosion process; and (b) there are bedrock controls that prevent further erosion of the current channel bed, banks or terraces. Under either of the two conditions, the actual gravel transport rate could be lower than the value calculated with *EASI* program.

In order to increase gravel transport and improve salmonid spawning habitat, fish and wild life management is planning to have a gravel augmentation project implemented upstream of the reach in question. One of the concepts developed by McBain and Trush is to do a "gravel transfusion" before the augmentation. That is, to introduce massive amount of gravel into the reach before the augmentation so that the channel can be recovered quickly. The gravel transfusion will also prevent the possibility that gravel from augmentation will simply pass through the reach during high flows without leaving enough deposit.

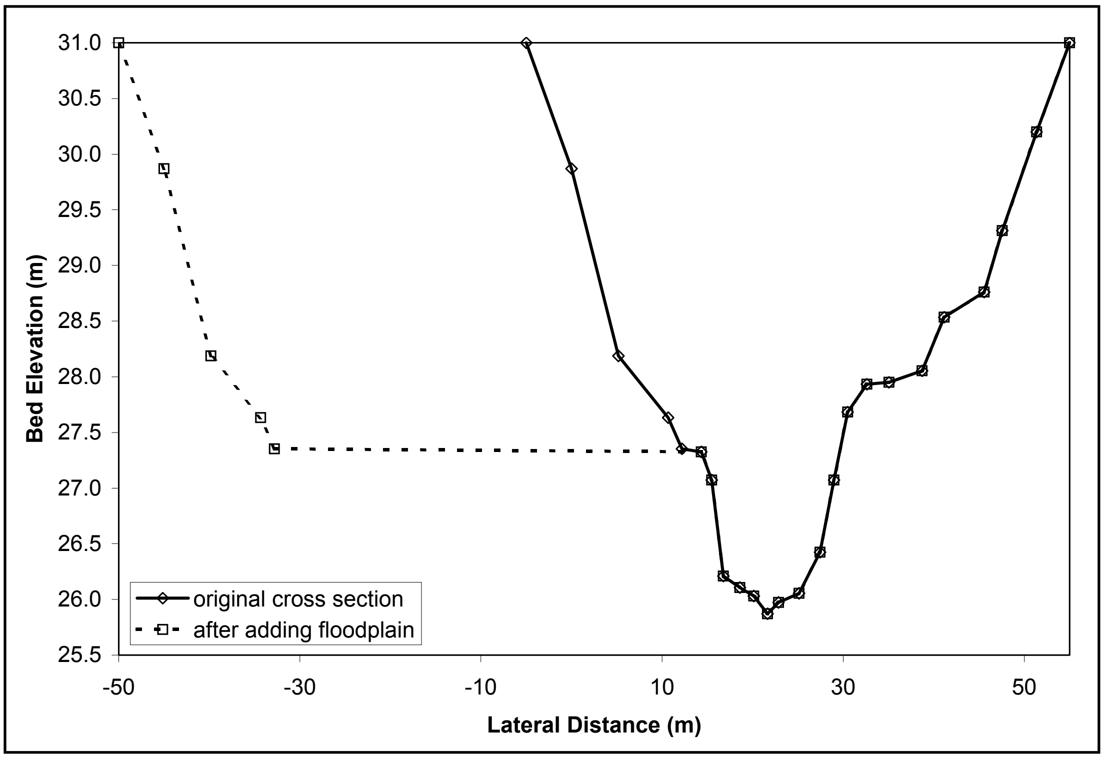


Figure M-3. Channel cross sections to be used in the example

In this example, it is assumed that a gravel transfusion will be implemented with the grain size distribution given in Figure M-5. Applying *EASI* program, it is found that the long time average gravel transport rate will be increased to about 3660 t/a, or an annual gravel augmentation of about 3660 t/a.

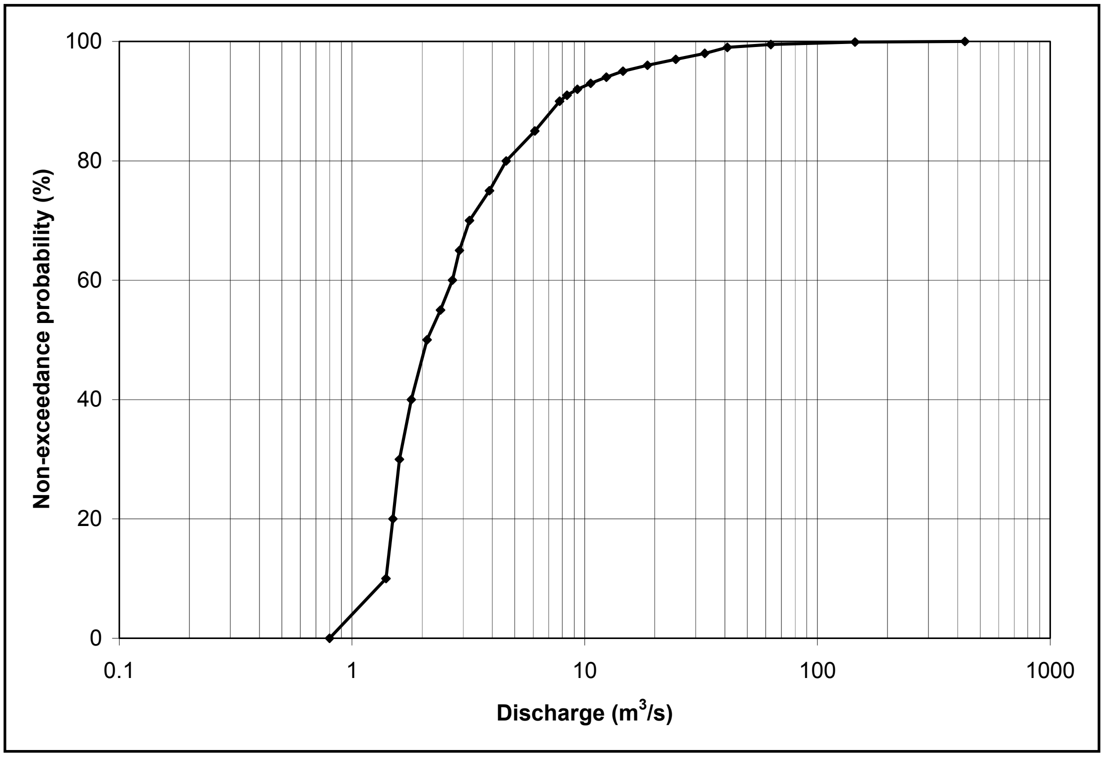


Figure M-4. Pre- and post-dam duration curves to be used in the example.

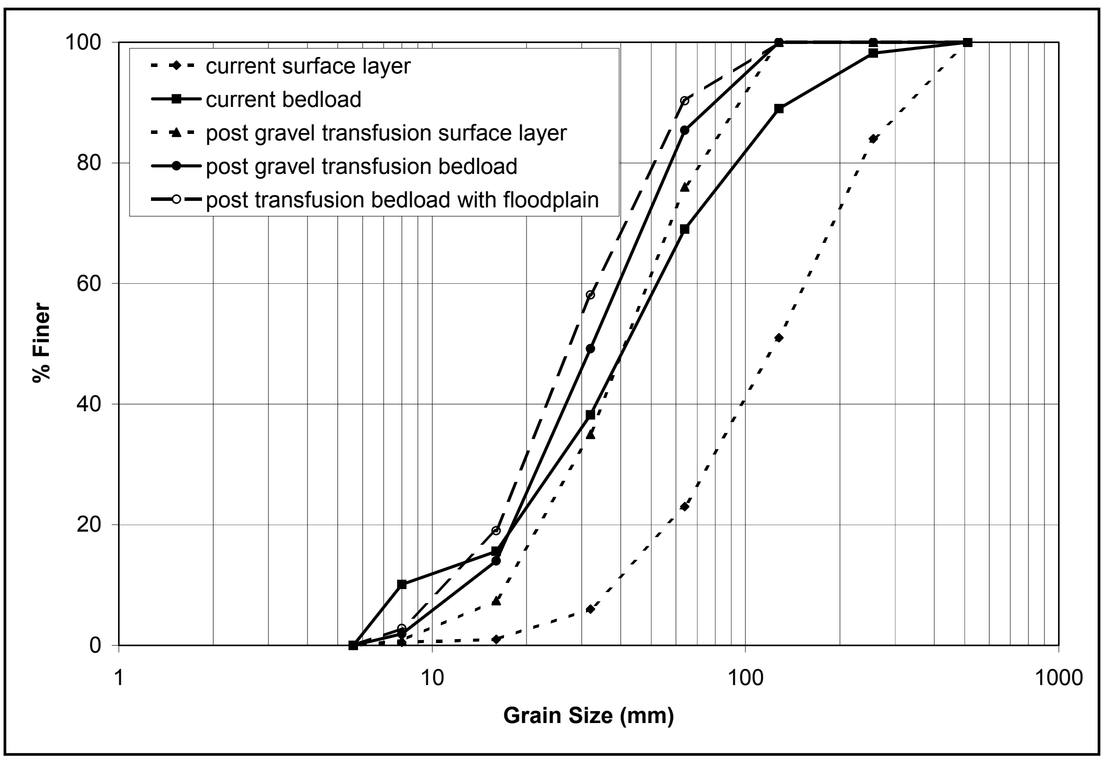


Figure M-5. Grain size distributions presented in the example.

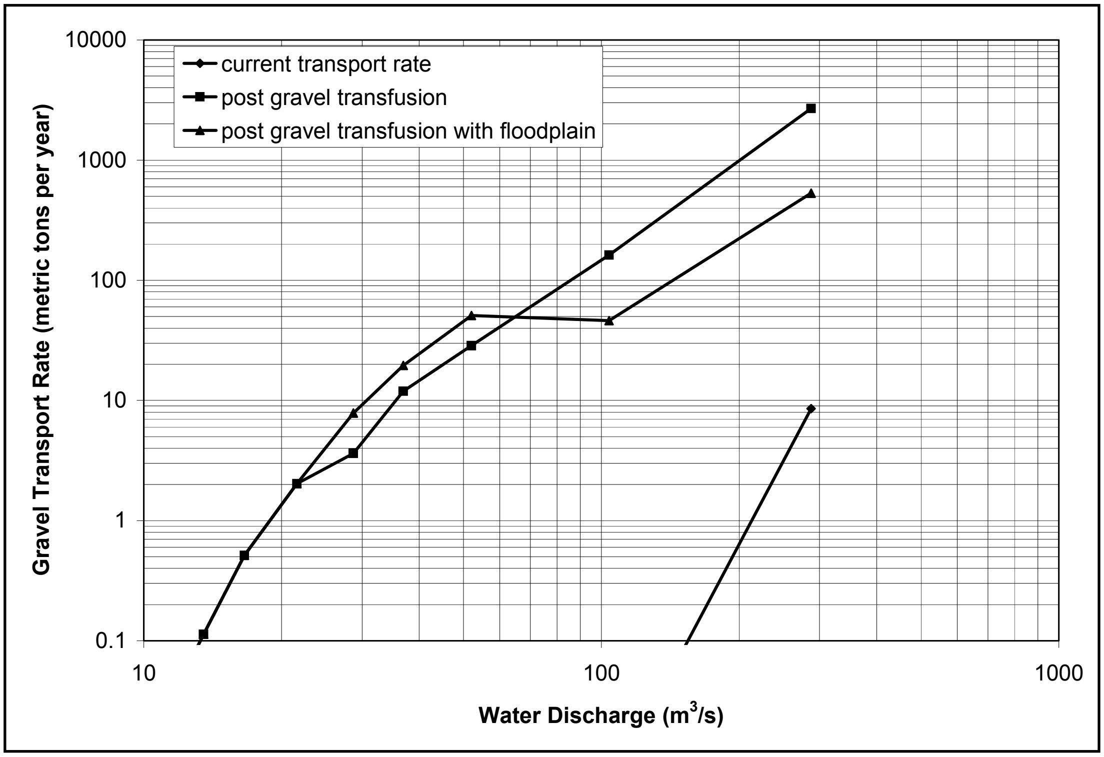


Figure M-6. Predicted gravel transport rate presented in the example.

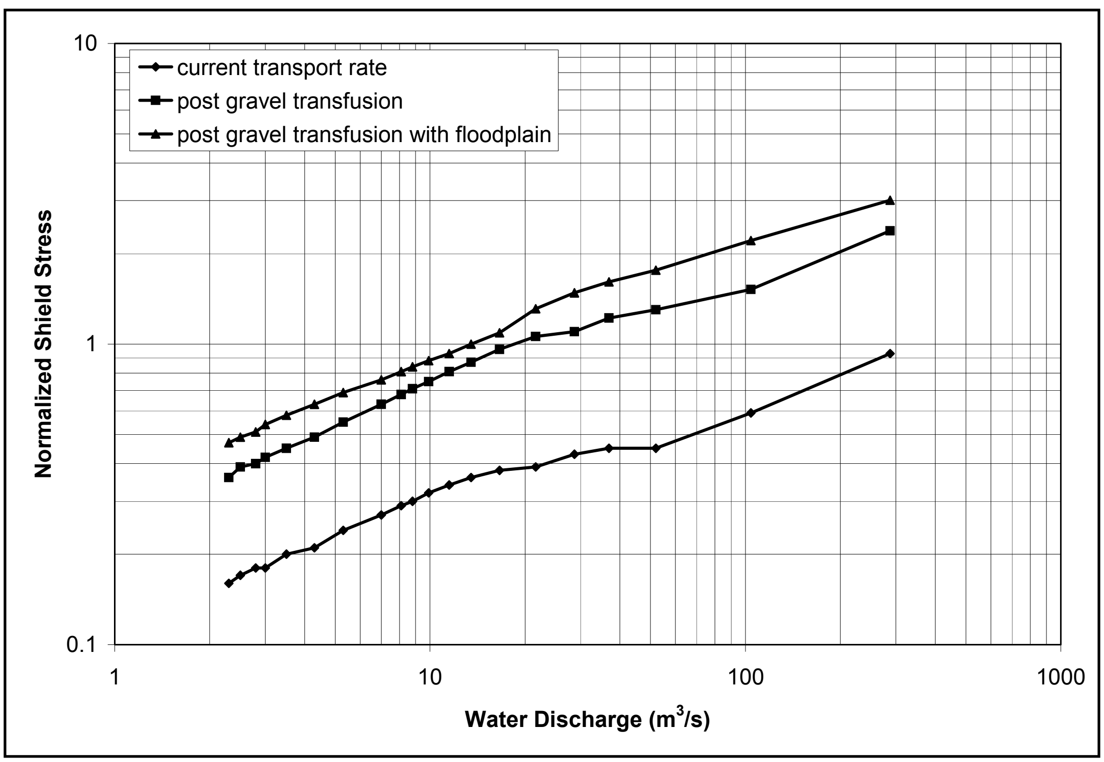


Figure M-7. Predicted normalized Shields stress as presented in the example.

3,660 t/a of gravel transport is probably a very reasonable amount for augmentation. For demonstration purposes, however, let's assume that the management decided that the 3660 t/a gravel is too much to add and there is easy way to modify the channel so that a floodplain can be added as shown in Figure M-3. Applying *EASI* program it is found that the gravel transport rate dropped to about 1,270 t/a by adding the floodplain, which is about 35% of the amount without a floodplain. In this calculation the Manning's n for floodplain is assumed to be 0.035.

The grain size distributions, bedload rating curves and normalized Shields stresses in this example are given in Figures M-5, M-6, and M-7 respectively. One of the potentially most useful diagram is the normalized Shields stress given in Figure M-7. It is important to point out that normalized Shields stress equals to unity represents the incipient motion of bed material. Combine the rating curve given in Figure M-4 with the normalized Shields stress curves in Figure M-7, one can easily estimate at what percentage of time there is significant gravel transport in the river reach. For example, in the case of post gravel transfusion, the water discharge identified to correspond to normalized Shields stress equal to unit is about 19 m^3/s, which corresponds to a non-exceedance probability of about 95%. In other word, there is only about 5% of the time during which the river is actively transporting gravel even with the gravel transfusion.

Possible measures to increase gravel transport duration include modification on the operation of the upstream reservoir, narrowing the main channel, further decrease the grain size of the transfusion gravel within the limitation for fish habitat, or a combination of those measures. All those measures could be evaluated with the *EASI* program. In the post transfusion case, for example, modifying the operation of the upstream reservoir so that there is more than 37 days every year to have discharge over 19 m^3/s will increase the gravel transport period to 10%.

6 DISCUSSIONS

Program *EASI* stands for "Enhanced *Acronym* Series (1 & 2) with Interface", which is adopted from the *Acronym* series (Parker 1990b) and is simply a solution of the modified surface based bedload equation of Parker (1990a, b). It provides a tool for hydraulic engineers, fluvial geomorphologists, river restoration practitioners and management for a quantitative evaluation of gravel transport in a river reach. The program, however, cannot be blindly used to answer management questions. The practitioners must use their field experience in the river reach in question and in sediment transport in general in order to interpret the results. We strongly discourage any application of the program prior to a good understanding of the hydrology of the river and thorough field investigations of the river reach to be modeled. To reiterate, we would like to cite a sentence from Parker (1990b) while presenting his *Acronym* series: This program is "*nothing more than tools for implementing calculation procedures published in the literature. The calculation of bedload transport in gravel rivers yields at best crude approximations of the actual observed numbers in field streams. Where engineering decisions are to be made, the results should be interpreted only by a competent hydraulic engineer or river geomorphologist with prior experience in the field of gravel rivers."*

7 REFERENCES

Kondolf, G. M. (1995) Managing bedload sediment in regulated rivers: Examples from California, U.S.A. in *Natural and Anthropogenic Influences in Fluvial Geomorphology*, Geophysical Monograph 89, Costa, J.E., Miller, A.J., Potter, K.W., Wilcock, P.R. editors.

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APPENDIX N

BEDLOAD TRANSPORT AND SHEAR STRESS PLOTS

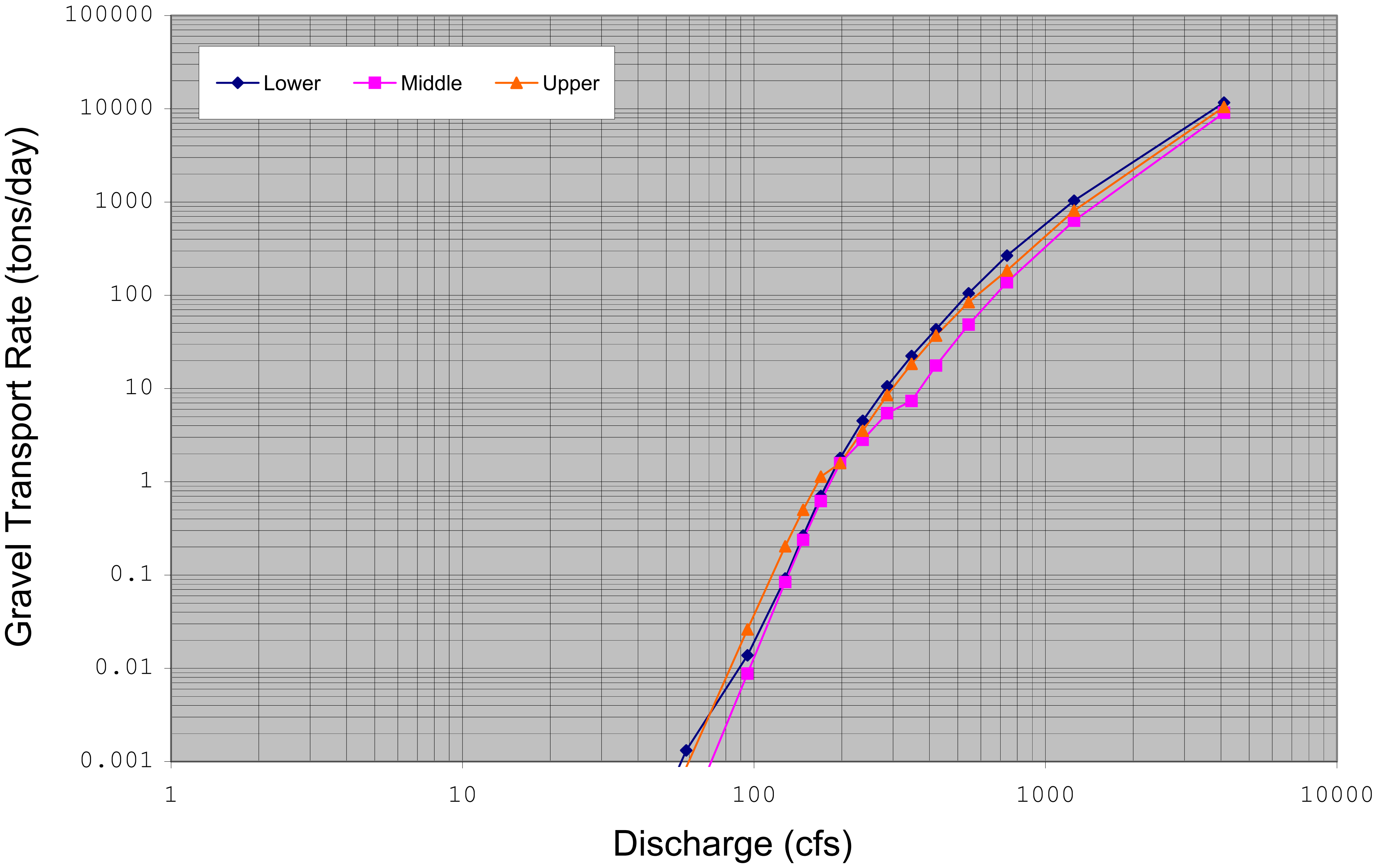


Figure N-1: Estimated bedload transport rating curve for the Rubicon Dam Reach Site.

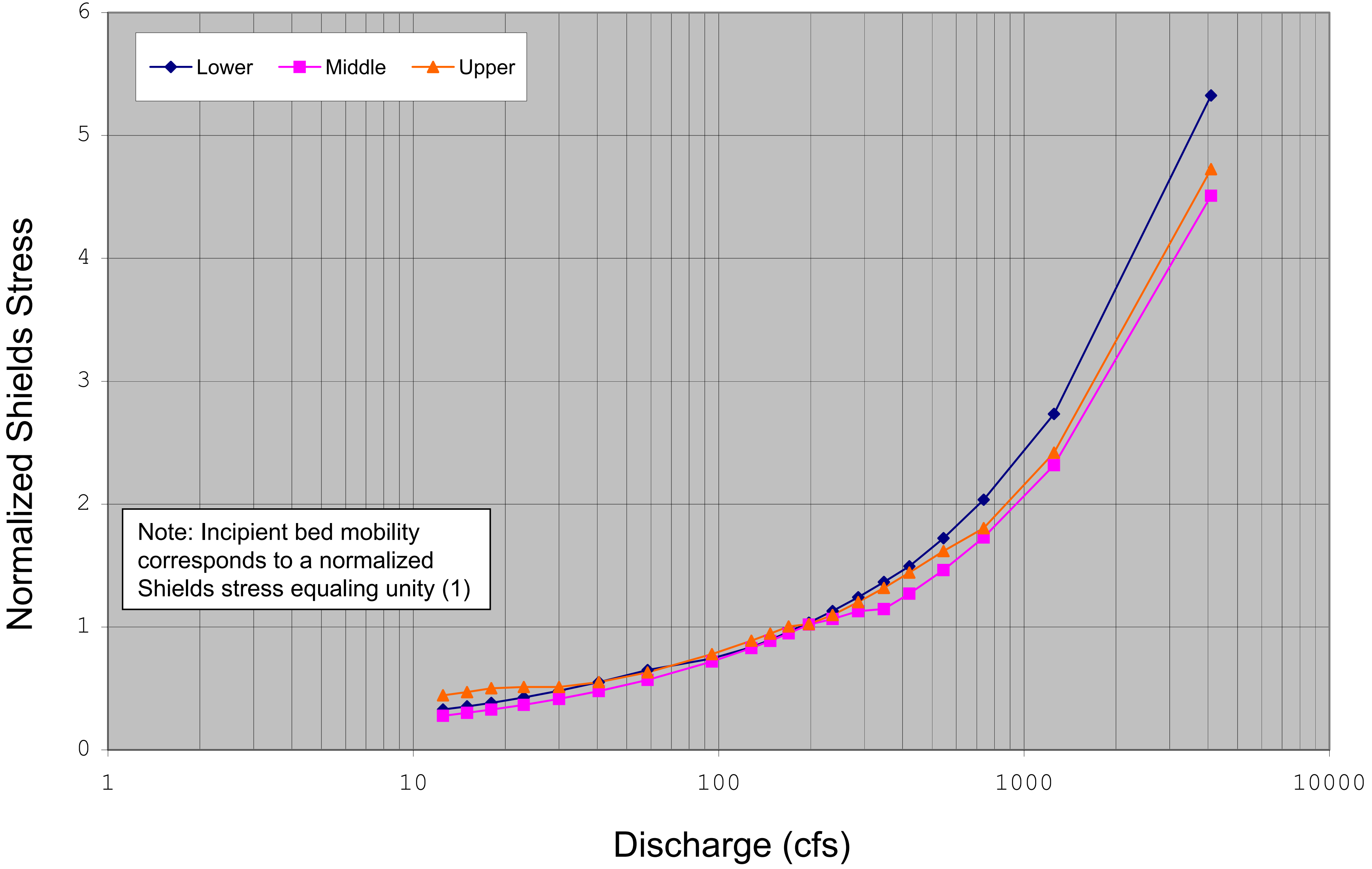


Figure N-2: Estimated Shields stress rating curve for the Rubicon Dam Reach Site.

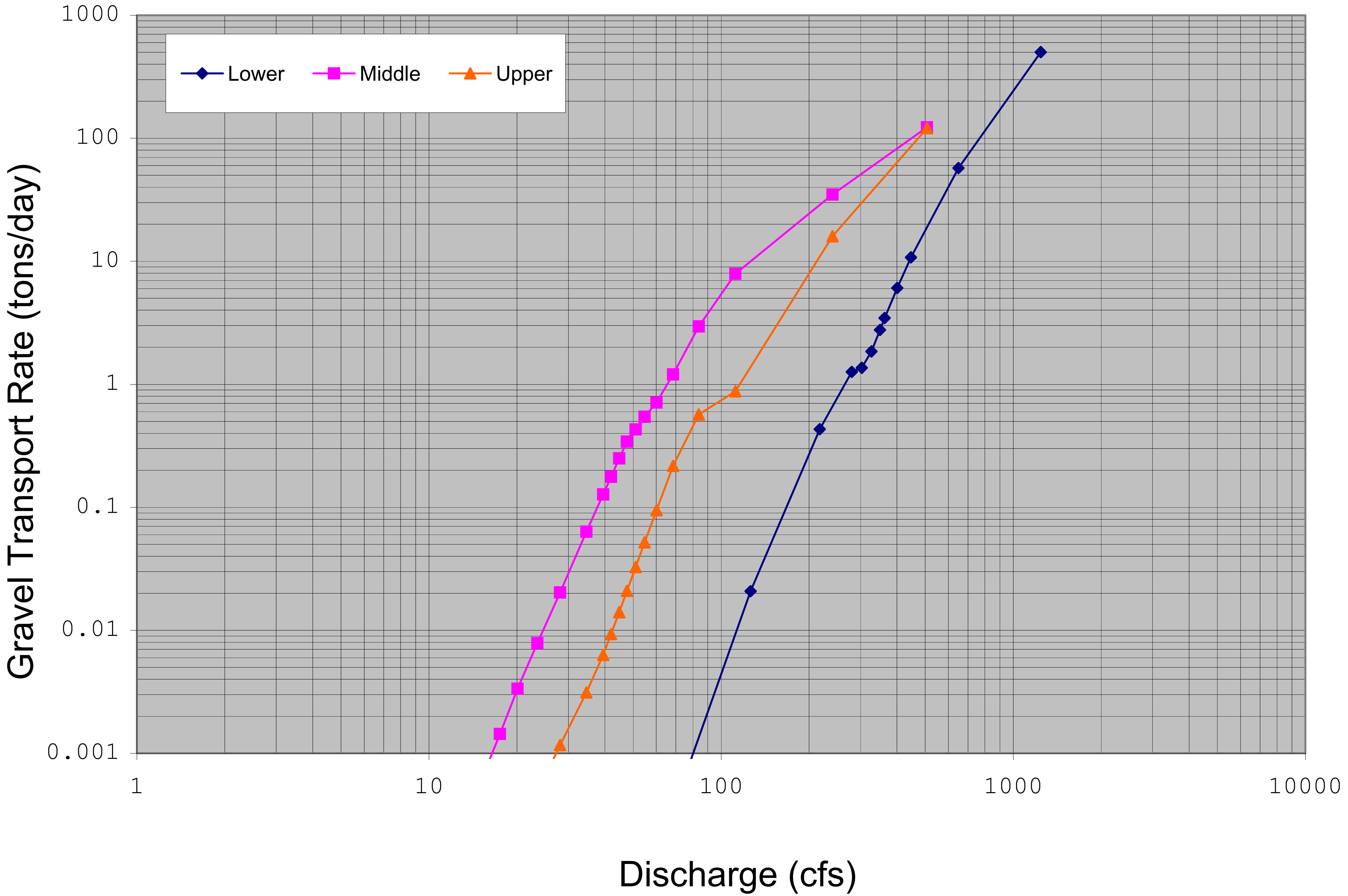


Figure N-3: Estimated bedload transport rating curve for the Loon Lake Dam Reach Middle Site.

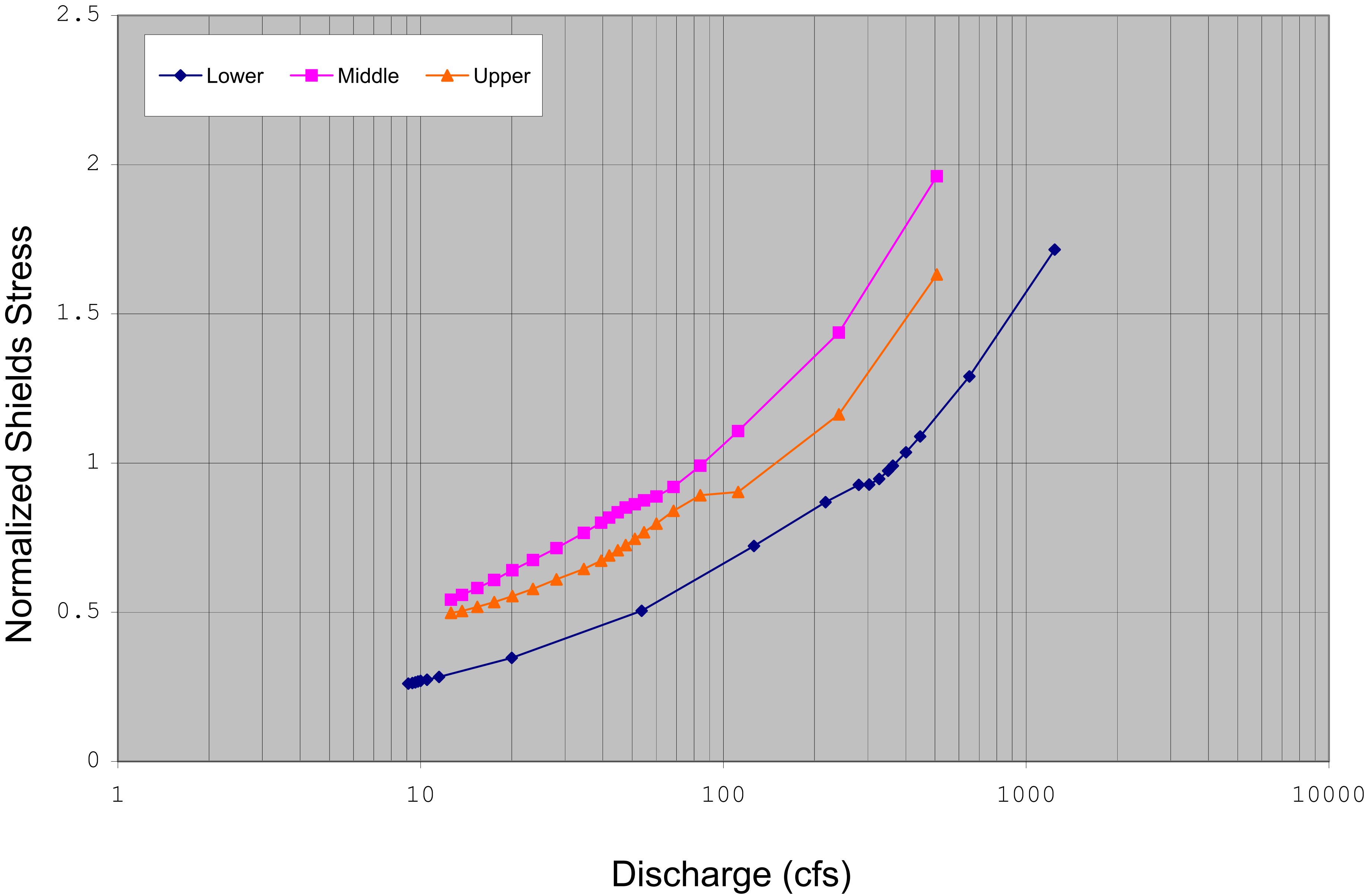


Figure N-4: Estimated Shields stress rating curve for the Loon Lake Dam Reach Middle Site.

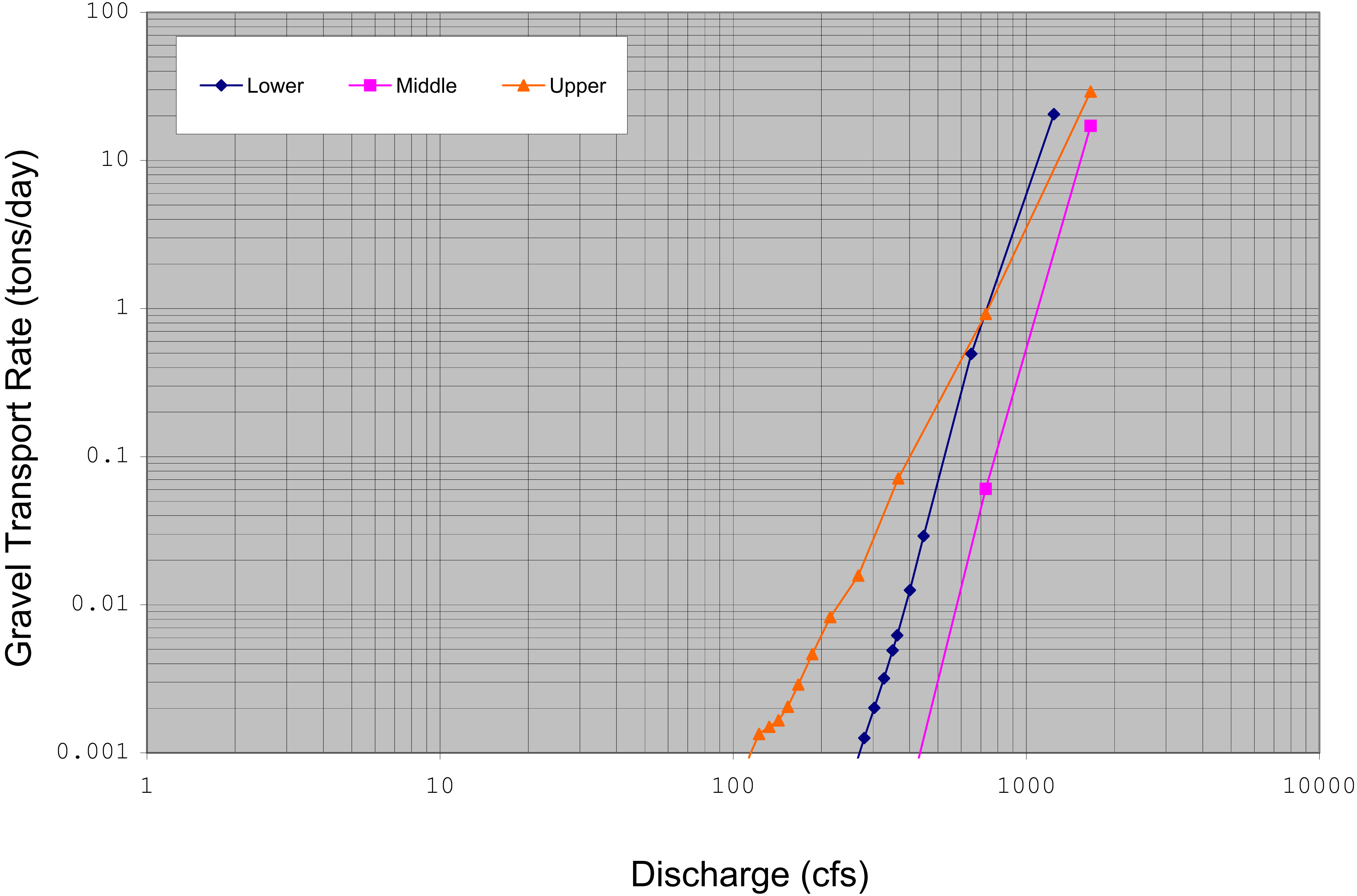


Figure N-5: Estimated bedload transport rating curve for the Loon Lake Dam Reach Lower Site.

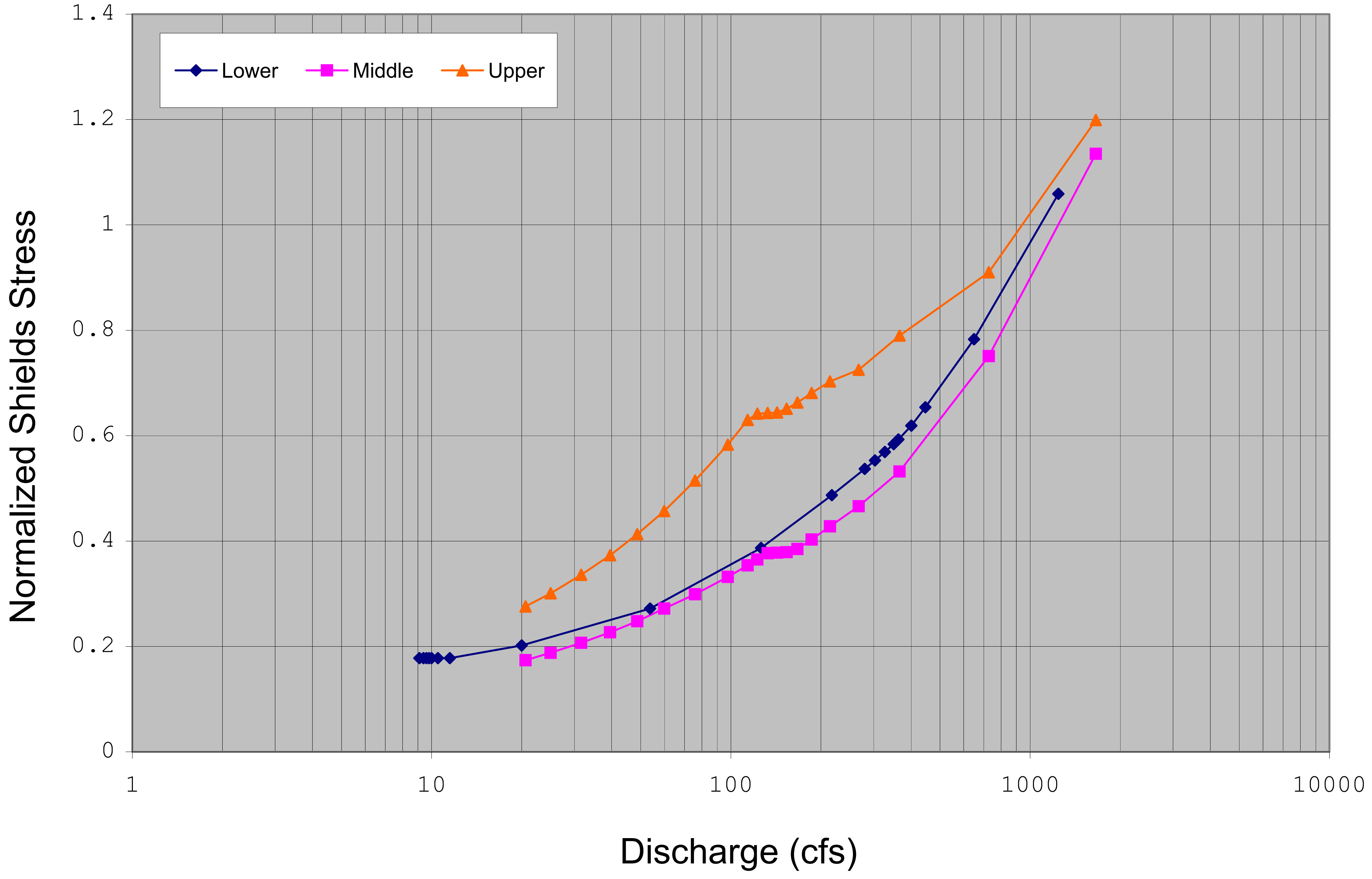


Figure N-6: Estimated Shields stress rating curve for the Loon Lake Dam Reach Lower Site.

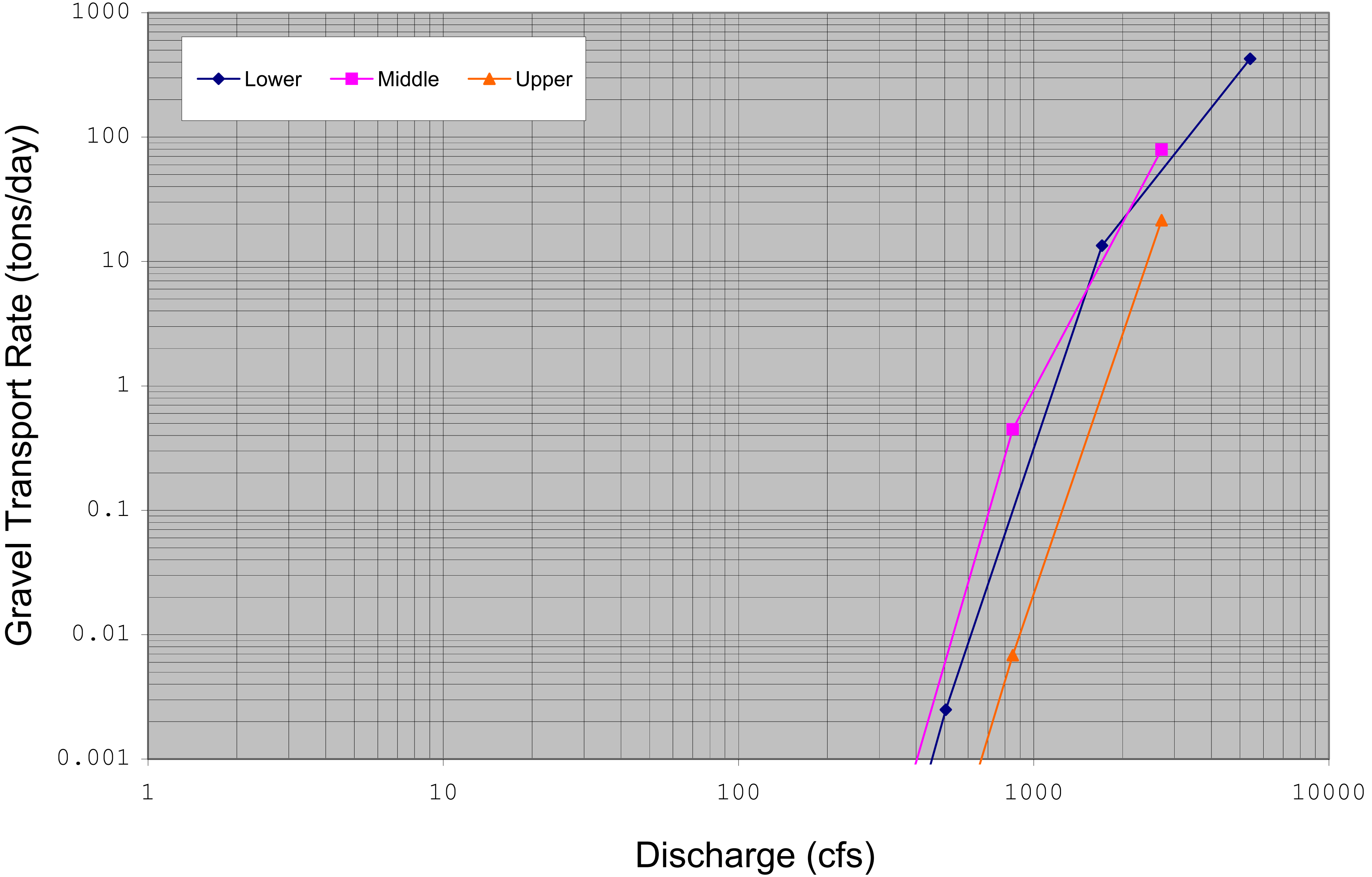


Figure N-7: Estimated bedload transport rating curve for the Robbs Peak Dam Reach Site.

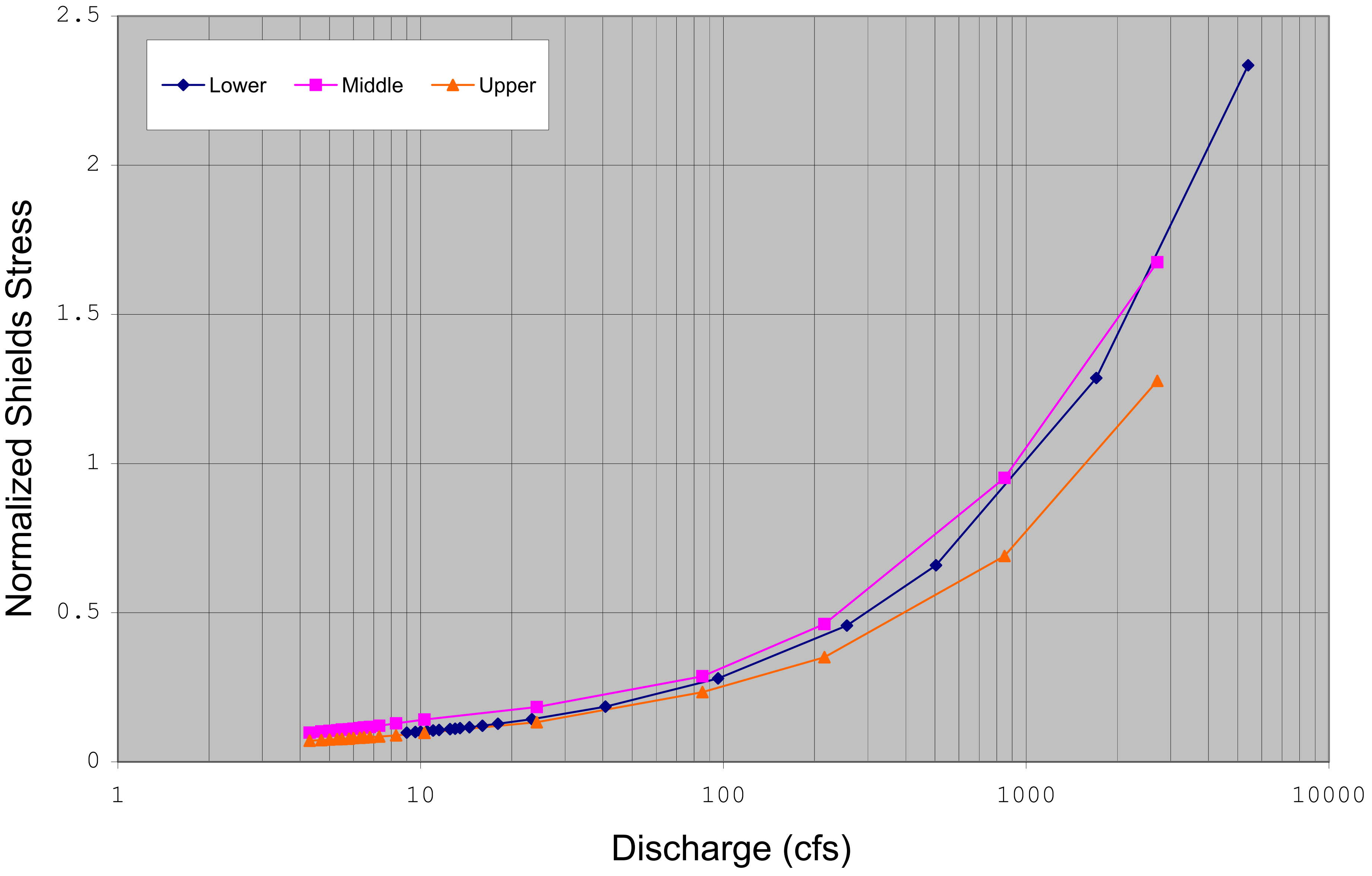


Figure N-8: Estimated Shields stress rating curve for the Robbs Peak Dam Reach Site.

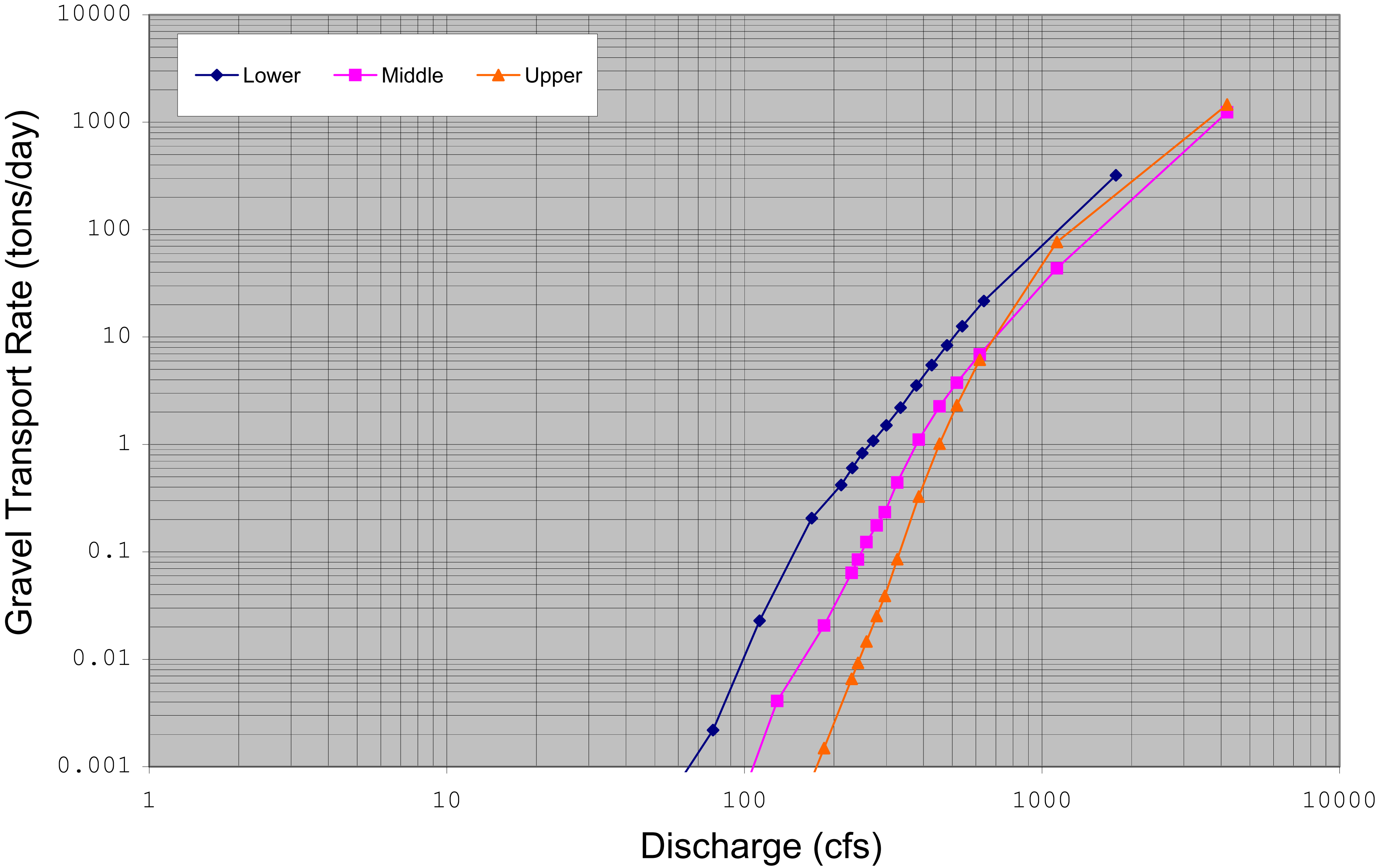


Figure N-9: Estimated bedload transport rating curve for the Ice House Dam Reach Upper Site.

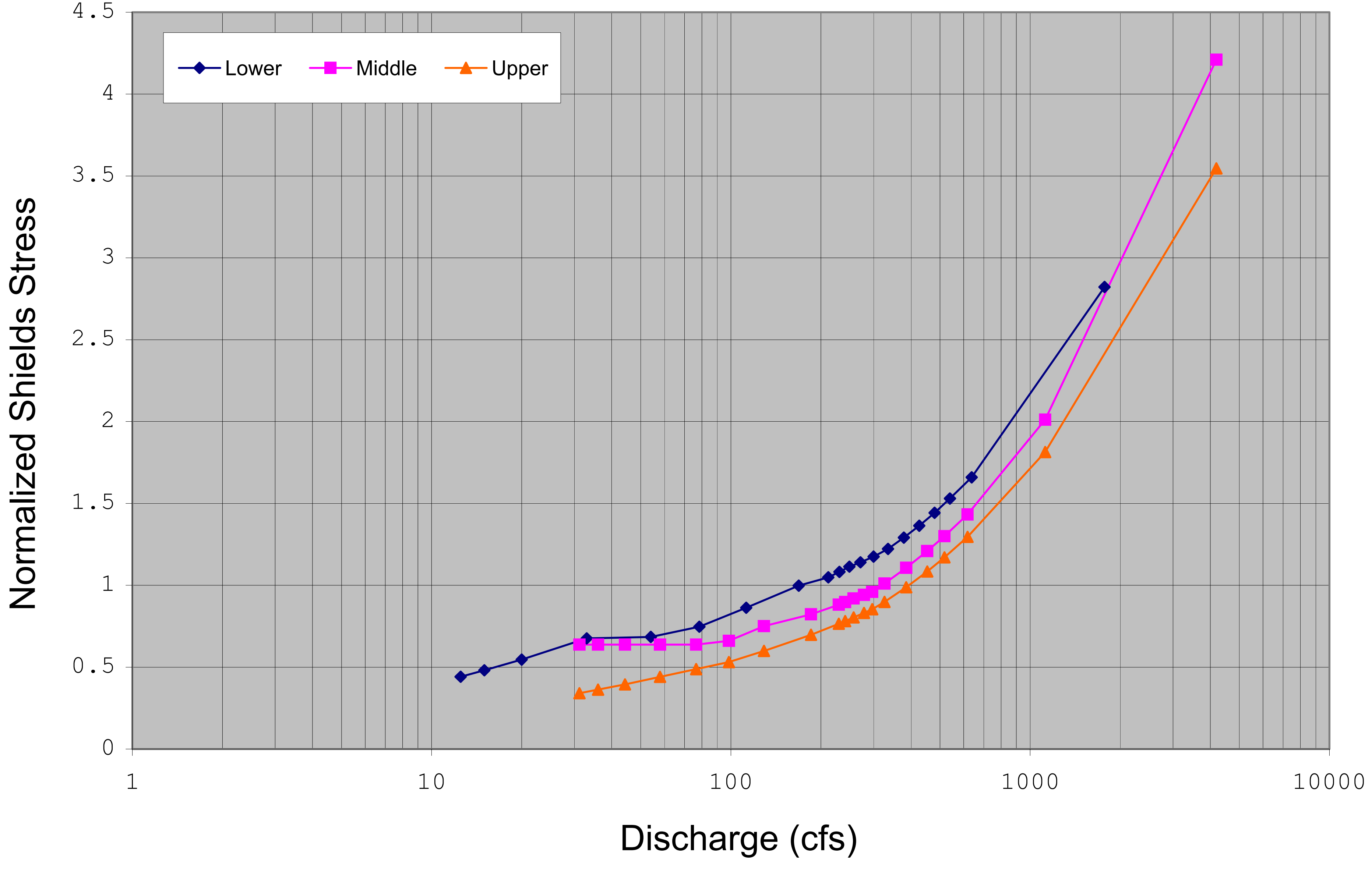


Figure N-10: Estimated Shields stress rating curve for the Ice House Dam Reach Upper Site.

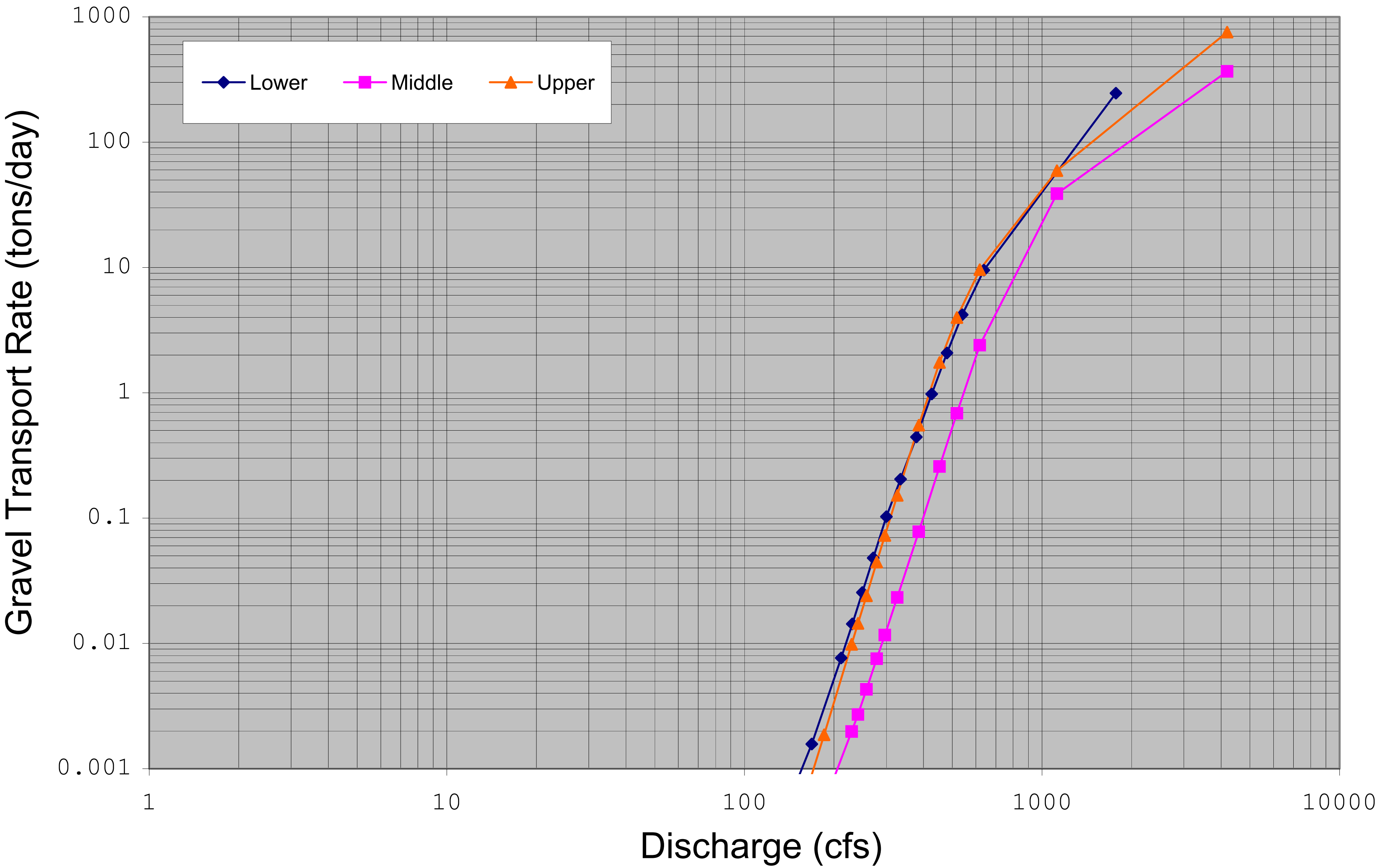


Figure N-11: Estimated bedload transport rating curve for the Ice House Dam Reach Lower Site.

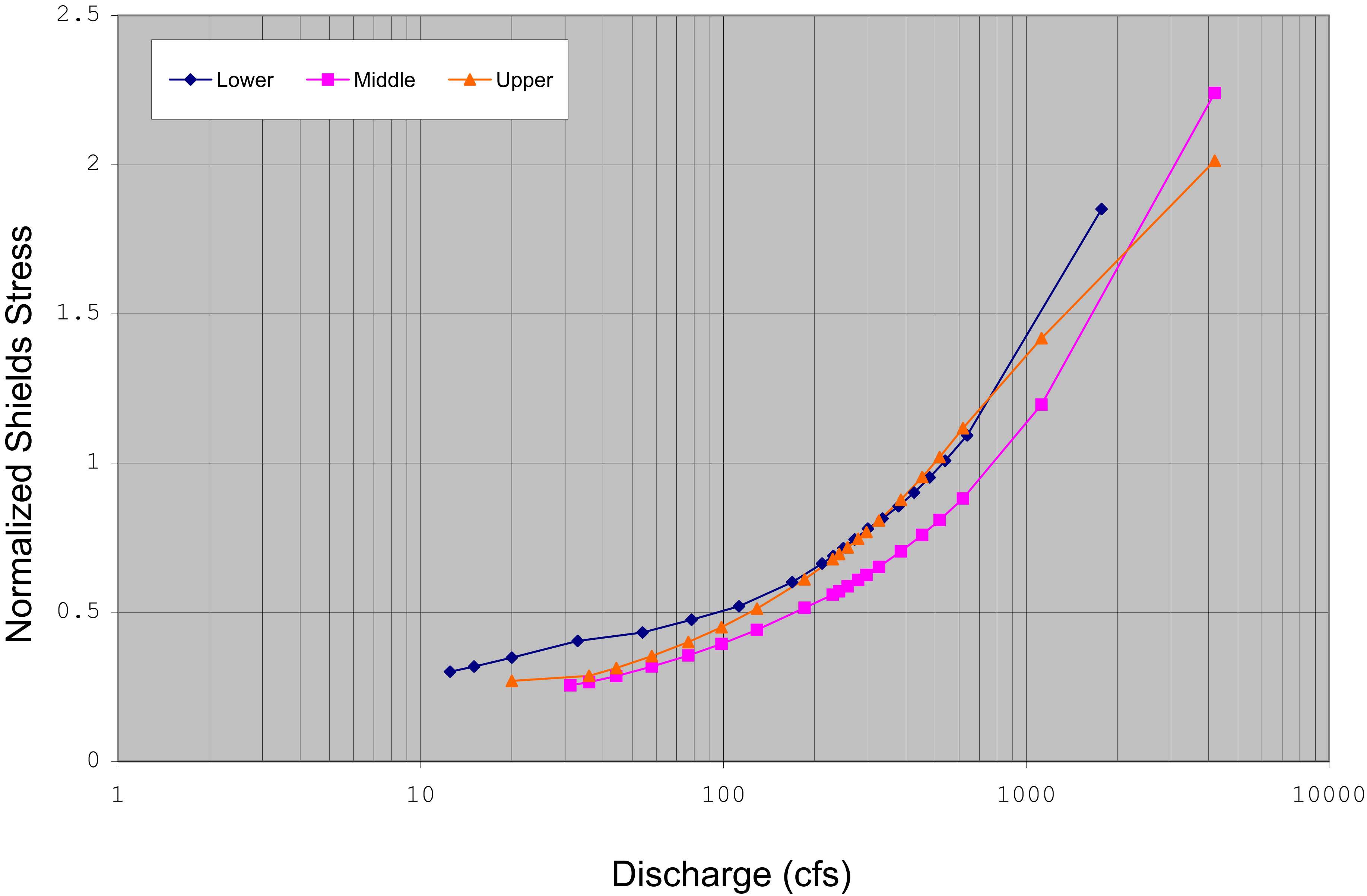


Figure N-12: Estimated Shields stress rating curve for the Ice House Dam Reach Lower Site.

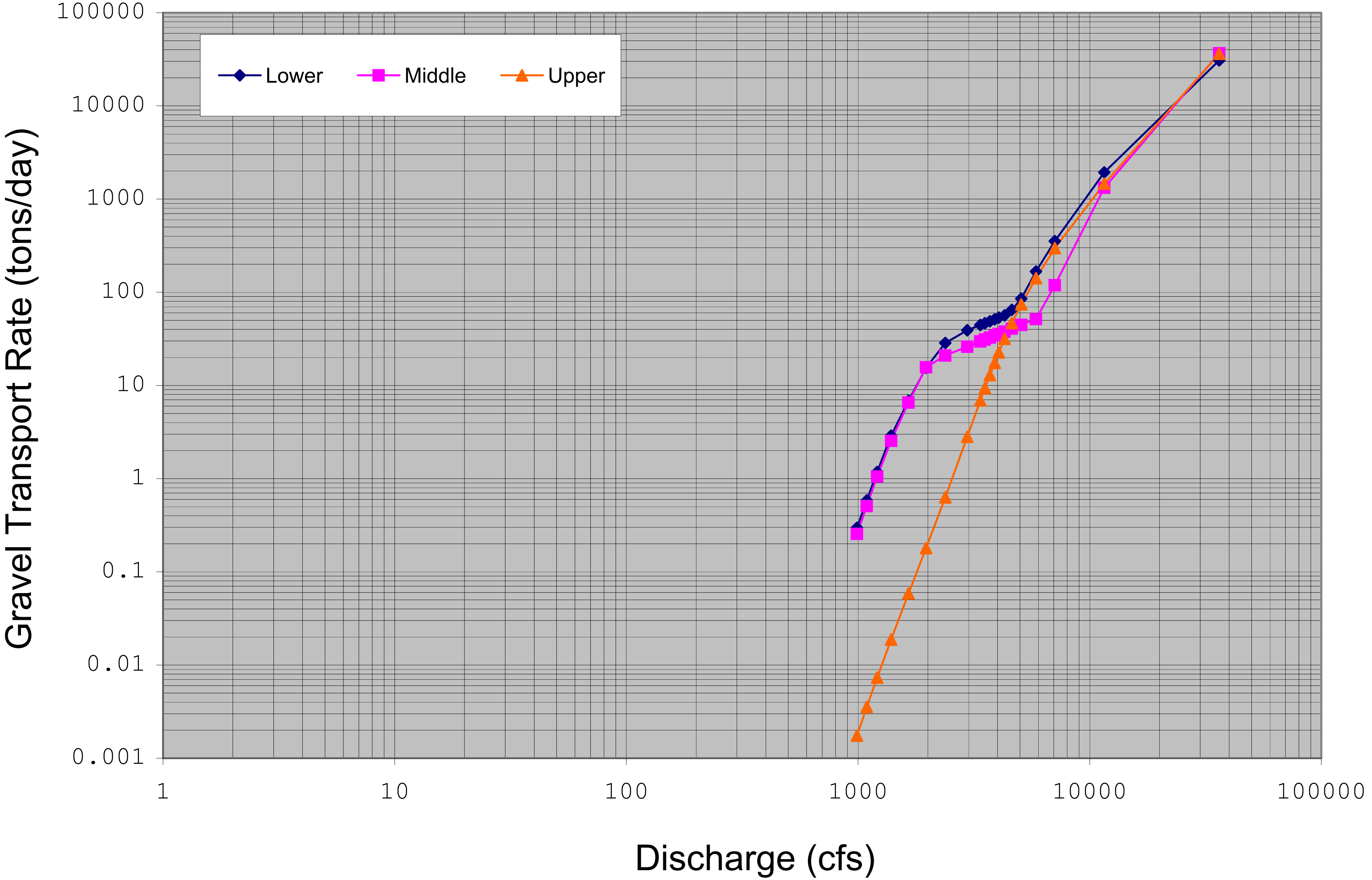


Figure N-13: Estimated bedload transport rating curve for the Reach Downstream of Chili Bar, Upper Coloma Study Site.

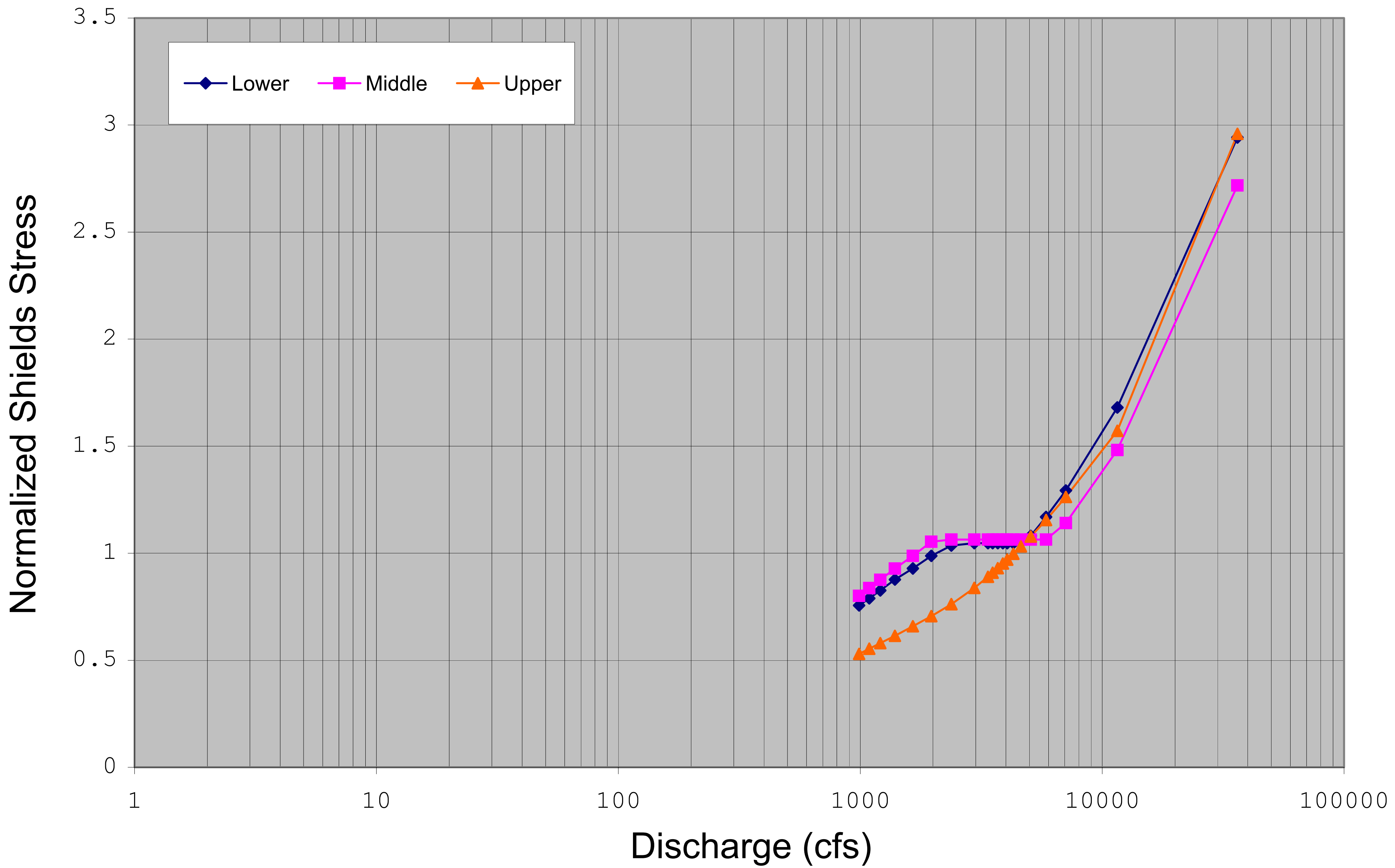


Figure N-14: Estimated Shields stress rating curve for the Reach Downstream of Chili Bar, Upper Coloma Study Site.

APPENDIX O

FACIES MAPS FOR THE UARP PROJECT AREA SITES

APPENDIX P

FACIES MAPS FOR THE REACH DOWNSTREAM OF CHILI BAR

Reach Downstream of Chili Bar:
Upper Canyon Site (CB-G1)
Upper Coloma Site (CB-G2)
Lower Coloma Site (CB-G3)
Gorge Site (CB-G4)

Upper Canyon Site (CB-G1)

The channel at the Upper Canyon Site is straight with a gravel bar on the right bank. Boulder and bedrock facies dominate the banks and channel (50-60 % of the wetted channel). Cobble and small amounts of coarse gravel are deposited along the margins of the channel and behind large flow obstructions in the channel. Sparsely vegetated, steep hillslopes constrict the active channel, leaving little room for lateral movement or floodplain development. Despite this, well-established riparian plant communities were observed in some places along the waters edge, particularly on river-right. A thick layer of algae covers much of the substrate within the wetted channel.

Facies Map Data Sheet

PROJECT CODE: 166.01 TASK CODE ______
Page 1 of ______

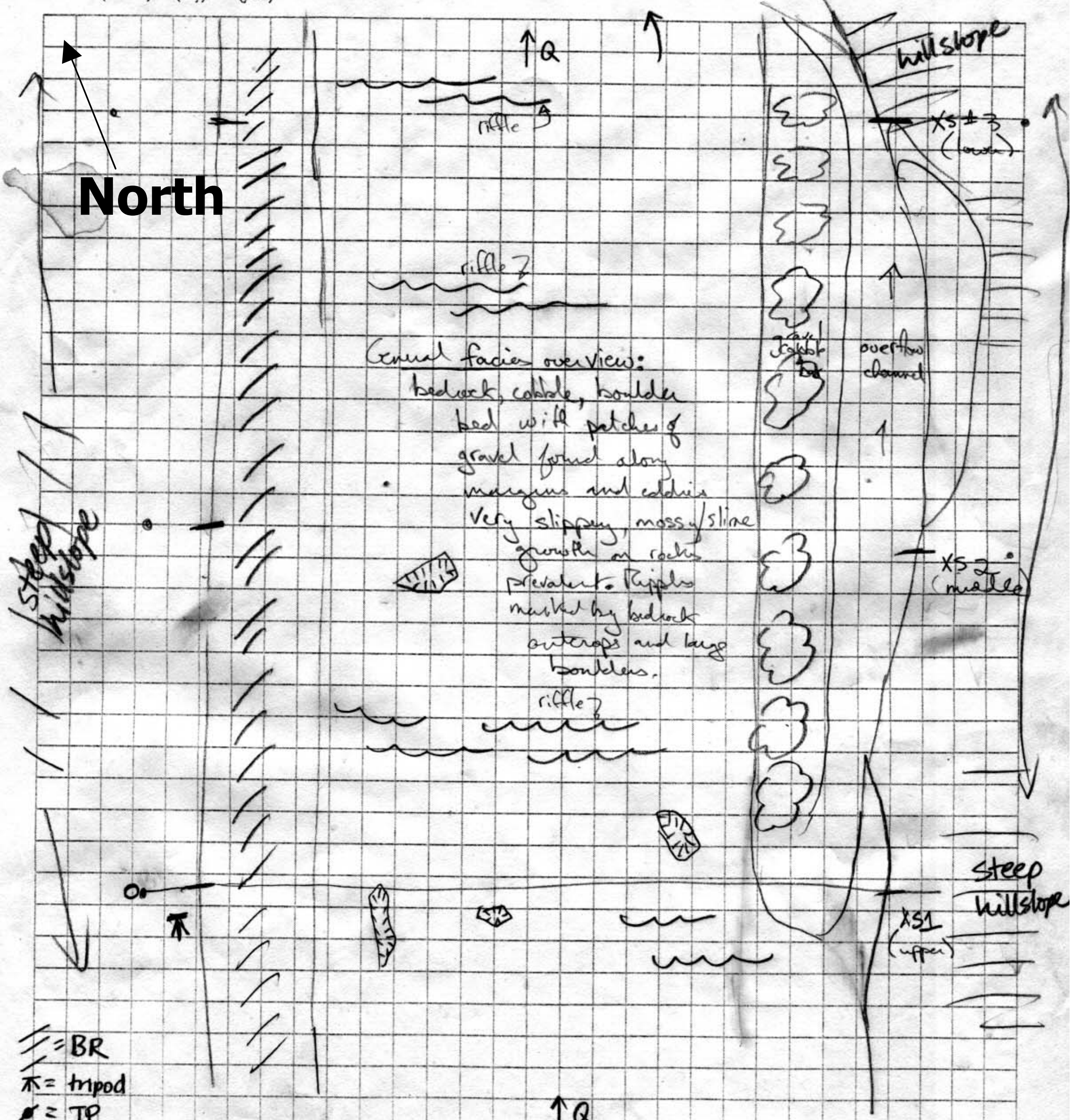
Study reach Name: Chili Bar- Upper Canyon Subreach

Crew Initials: mcm, SRD, CDJ

Date: 10 / 16 / 03 (month) (day) (year)

Start time: 9:15

End time: ______



33 rows x 30 columns Each cell equals ______ X ______

QA Check CDT

O = BM

Approximate scale (1:530)

Upper Coloma Site (CB-G2)

The channel at the Upper Coloma Site is dominated by cobble, boulder, and gravel, with a small amount of fines in the tail end of the upstream pool. A densely vegetated, cobble and gravel mid-channel island exists near the upper cross-section, creating a riffle that ends upstream of the lower cross-section. Cobble, boulder, and gravel dominate the facies on both banks and a large lateral bar on river-right. Large trees are set back from the wetted channel on both banks, with smaller trees and shrubs growing close to the waters edge.

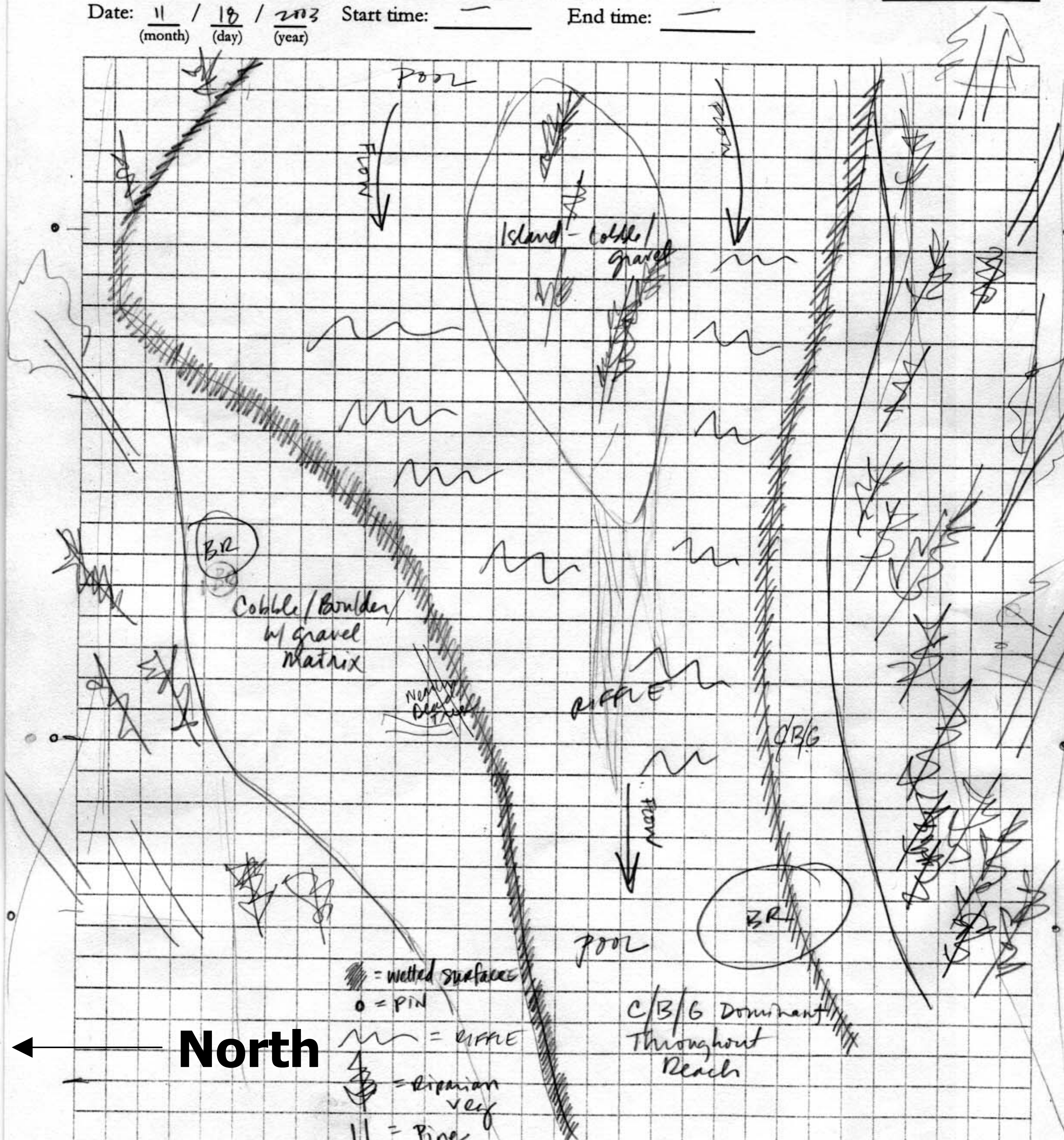
Facies Map Data Sheet

PROJECT CODE: 166.01 TASK CODE 4630

Page 1 of 1

Study reach Name: UPPER COLOMA SUBREACH Crew Initials: CDJ SKW

Date: 11 (month) / 18 (day) / 2003 (year) Start time: — End time: —



33 rows x 30 columns Each cell equals 10ft X 10ft QA Check

= Deciduous tree

Approximate scale provided

Lower Coloma Site (CB-G3)

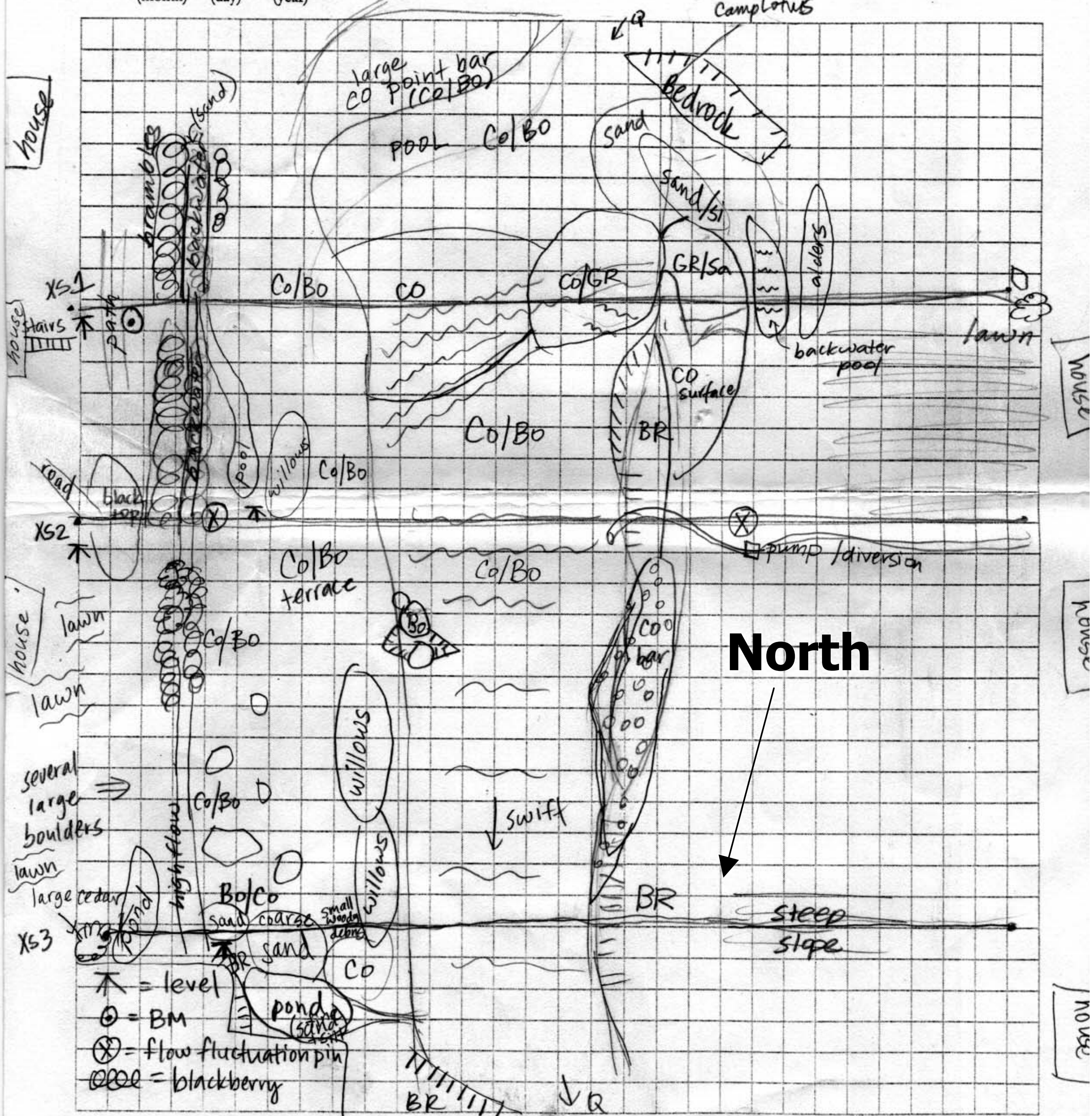
The channel at the Lower Coloma Site is dominated by cobble and boulder. Sand, gravel, and silt are deposited in a bar on the left bank below a large bedrock outcrop that obstructs the primary channel flow on the left bank above the upper cross-section. Both banks consist of cobble and boulder, with bedrock dominating near the end of the reach. Large trees are set back on a cobble and boulder terrace on both banks, with smaller trees and shrubs growing close to the waters edge.

Facies Map Data Sheet

PROJECT CODE: ______ TASK CODE ______
Page ______ of ______

Study reach Name: Chili Bar Lower Coloma   Crew Initials: MCM, SKW, CDJ

Date: 11 / 22 / 03 (month) (day) (year)   Start time: ______   End time: ______



33 rows x 30 columns Each cell equals ______ X ______   QA Check ______

Approximate scale (1:500)

Gorge Site (CB-G4)

The flow splits around a lightly vegetated mid-channel bar, which extends from the upper cross-section to just upstream of the lower cross-section at the Gorge Site. A riffle exists at the tail end of this bar. A cobble and boulder lateral bar extends from upstream of the middle cross-section through the end of the reach on river left. The wetted channel is dominated by gravel and cobble for most of the site, coarsening in the downstream direction as the main flow runs through a riffle. Bedrock outcrops occur in several locations along the left bank. Sand beaches exist on both banks upstream of the upper cross-section.

Facies Map Data Sheet

PROJECT CODE: 166.01 TASK CODE: ______
Page 1 of ______

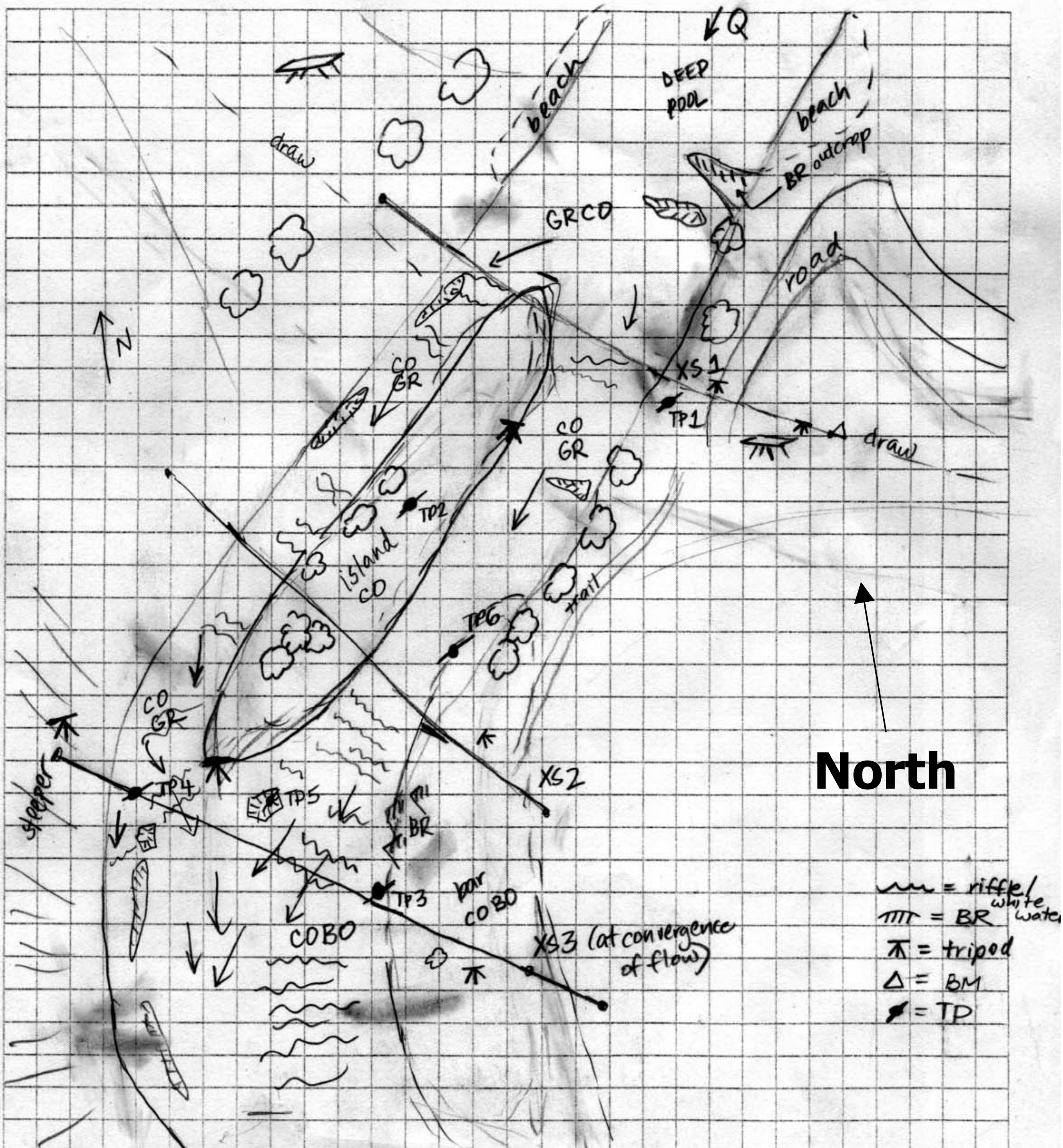
Study reach Name: Chili Bar (most d/s, near Weber Ck)

Crew Initials: MCM, SRD, CDJ

Date: 10 (month) / 14 (day) / 03 (year)

Start time: 8:45 AM

End time: ______



33 rows x 30 columns Each cell equals ______ X ______

QA Check ______

Approximate scale (1:840)

APPENDIX Q

BANKFULL ELEVATION AND DISCHARGE COMPARISONS

Appendix Q. Q Calculations
Eight response reaches, three calculations each:

References:
Cowan, W.L. 1956. Estimating hydraulic roughness coefficients. Agricultural Engineering 37, 473-475.
Hannaford, M. 2004. Pers. comm. with Chris Jaquette, Stillwater Sciences, September 2004.
Wohl, E. 2000. Mountain Rivers. American Geophysical Union, Washington D.C.

Field Q_{bf}. Solve for Q with known input parameters from field data. Use Manning's, because V needs to be calculated.
assumptions: A, S, and R are determined using XS data, n is determined using Cowan's method. w and d are from field data.
equation: Q = 1.486/n * A * R^2/3 * S^1/2

Regulated Q_{recc} (1.5-year return interval, hydro). Use known impaired or regulated Q1.5 to back out d, depth and compare to what we saw in the field.
In Manning's, velocity is dependent on roughness (n) and slope (S).
assumptions: assuming d approximates R (R may be more equivalent to d as width/depth ratio is greater than 20), all assumptions related to estimating n using Cowan's (1956) method, w and S from field data, Q determined with data directly from the USGS and the technical report on hydrology. Methods for estimating Q were either taken from hydrology report or from recommendations from Margaret Hannaford, primary author of the hydrology technical report for SMUD.
equation: Q = 1.486/n * w * d^5/3 * S^1/2

Unregulated Q_{recc} (1.5-year return interval, hydro). Use known unimpaired or unregulated Q1.5 to back out d, depth and compare to what we saw in the field.
assumptions: assuming d approximates R (R may be more equivalent to d as width/depth ratio is greater than 20), all assumptions related to estimating n using Cowan's (1956) method, w and S from field data, Q determined with data directly from the USGS and the technical report on hydrology. Methods for estimating Q were either taken from hydrology report or from recommendations from Margaret Hannaford, primary author of the hydrology technical report for SMUD.
equation: Q = 1.486/n * w * d^5/3 * S^1/2

NOTE: Caution should be taken with calculations. They are "order-of-magnitude" estimates, and an adjustment for the appropriate number of significant figures has not been made.

Appendix Q. Q Calculations
Eight response reaches, three calculations each:
Rubicon Dam

Calculation	XS	Q (cfs)	n	A (sqft)	R (ft)	S (ft/ft)	w (ft)	dmean (ft)	velocity check using continuity (V = Q/A, ft/s)
Field Q_{bf}	1	630	0.037	129.14	1.75	0.007	73	1.8	4.9
	2	317	0.036	77.86	1.28	0.007	60	1.3	4.1
	3	124	0.035	41.65	0.77	0.007	75	0.6	3.0
Regulated Q_{recc}	1	665	0.037	NA	NA	0.007	73	1.82	
	2	665	0.036	NA	NA	0.007	60	2.01	
	3	665	0.035	NA	NA	0.007	75	1.73	
Unregulated data is a range, 1660-2460 cfs									
UnRegulated Q_{recc}	1	1386	0.037	NA	NA	0.007	73	2.83	
	2	1386	0.036	NA	NA	0.007	60	3.13	
	3	1386	0.035	NA	NA	0.007	75	2.69	

Appendix Q. Q Calculations

Eight response reaches, three calculations each:

Loon Lake Dam Upper

Calculation	XS	Q (cfs)	n	A (sqft)	R (ft)	S (ft/ft)	w (ft)	dmean (ft)	velocity check using continuity (V = Q/A, ft/s)
Field Q_{bf}	1	219	0.044	48.19	2.04	0.007	22	2.2	4.5
	2	620	0.063	131.06	3.71	0.007	34	3.9	4.7
	3	228	0.066	66.68	2.44	0.007	33	2.9	3.4
Regulated Q_{recc}	1	40	0.044	NA	NA	0.007	22	0.77	
	2	40	0.063	NA	NA	0.007	34	0.73	
	3	40	0.066	NA	NA	0.007	23	0.95	
UnRegulated Q_{recc}	1	208	0.044	NA	NA	0.007	22	2.07	
	2	208	0.063	NA	NA	0.007	34	1.97	
	3	208	0.066	NA	NA	0.007	23	2.57	

Loon Lake Dam Middle

Calculation	XS	Q (cfs)	n	A (sqft)	R (ft)	S (ft/ft)	w (ft)	dmean (ft)	velocity check using continuity (V = Q/A, ft/s)
Field Q_{bf}	1	399	0.047	84.41	1.5	0.013	54	1.6	4.7
	2	206	0.051	50.67	1.35	0.013	38	1.3	4.1
	3	259	0.043	56	1.27	0.013	51	1.1	4.6
Regulated Q_{recc}	1	174	0.047	NA	NA	0.013	54	0.94	
	2	174	0.051	NA	NA	0.013	38	1.21	
	3	174	0.043	NA	NA	0.013	51	0.92	
UnRegulated Q_{recc}	1	343	0.047	NA	NA	0.013	54	1.40	
	2	343	0.051	NA	NA	0.013	38	1.82	
	3	343	0.043	NA	NA	0.013	51	1.38	

Appendix Q. Q Calculations
Eight response reaches, three calculations each:
<u>Loon Lake Dam Lower</u>

Calculation	XS	Q (cfs)	n	A (sqft)	R (ft)	S (ft/ft)	w (ft)	dmean (ft)	velocity check using continuity (V = Q/A, ft/s)
Field Q_{bf}	1	329	0.068	133.26	2.02	0.005	97	1.4	2.5
	2	326	0.04	90.68	1.6	0.005	56	1.6	3.6
	3	409	0.042	99.65	2.1	0.005	45	2.2	4.1
Regulated Q_{recc}	1	510	0.068	NA	NA	0.005	97	2.09	
	2	510	0.04	NA	NA	0.005	56	2.11	
	3	510	0.042	NA	NA	0.005	45	2.48	
UnRegulated Q_{recc}	1	678	0.068	NA	NA	0.005	97	2.47	
	2	678	0.04	NA	NA	0.005	56	2.50	
	3	678	0.042	NA	NA	0.005	45	2.94	

Appendix Q. Q Calculations
Eight response reaches, three calculations each:
Robbs Peak Dam

Calculation	XS	Q (cfs)	n	A (sqft)	R (ft)	S (ft/ft)	w (ft)	dmean (ft)	velocity check using continuity (V = Q/A, ft/s)
Field Q_{bf}	1	98	0.041	44.63	1.58	0.002	28	1.6	2.2
	2	89	0.039	46.66	1.18	0.002	39	1.2	1.9
	3	342	0.03	92.39	2.16	0.002	39	2.4	3.7

Range of data due to hydrologic analysis in technical report on hydrology. Please see notes regarding the calculations for regulated Q2 at the Robbs Peak Site.

Calculation	XS	Q (cfs)	n	A (sqft)	R (ft)	S (ft/ft)	w (ft)	dmean (ft)
Regulated Q_{recc}	1	116	0.041	NA	NA	0.002	28	1.75
	2	116	0.039	NA	NA	0.002	39	1.39
	3	116	0.03	NA	NA	0.002	39	1.19
UnRegulated Q_{recc}	1	395	0.041	NA	NA	0.002	28	3.66
	2	395	0.039	NA	NA	0.002	39	2.91
	3	395	0.03	NA	NA	0.002	39	2.49

Appendix Q. Q Calculations
Eight response reaches, three calculations each:
Ice House Dam Upper

Calculation	XS	Q (cfs)	n	A (sqft)	R (ft)	S (ft/ft)	w (ft)	dmean (ft)	velocity check using continuity (V = Q/A, ft/s)
Field Q_{bf}	1	250	0.028	80.63	1.49	0.002	53	1.5	3.1
	2	334	0.028	107.78	1.49	0.002	64	1.7	3.1
	3	566	0.03	137.95	2.52	0.002	51	2.7	4.1

Regulated data comes in ranges for two phases of regulation, when SMUD UARP built dam (1959) and then when Jones Fork Powerplant went in (1984)

Calculation	XS	Q (cfs)	n	A (sqft)	R (ft)	S (ft/ft)	w (ft)	dmean (ft)
Regulated Q_{recc}	SMUD UARP							
	1	559	0.028	NA	NA	0.002	53	2.45
	2	559	0.028	NA	NA	0.002	64	2.19
	3	559	0.03	NA	NA	0.002	51	2.61
	JFPH							
	1	176	0.028	NA	NA	0.002	53	1.22
	2	176	0.028	NA	NA	0.002	64	1.09
	3	176	0.03	NA	NA	0.002	51	1.30
UnRegulated Q_{recc}	1	674	0.028	NA	NA	0.002	53	2.74
	2	674	0.028	NA	NA	0.002	64	2.44
	3	674	0.03	NA	NA	0.002	51	2.92

Appendix Q. Q Calculations

Eight response reaches, three calculations each:

<u>Ice House Dam Lower</u>

Calculation		XS	Q (cfs)	n	A (sqft)	R (ft)	S (ft/ft)	w (ft)	dmean (ft)	velocity check using continuity (V = Q/A, ft/s)
Field Q_{bf}		1	2783	0.035	406.85	3	0.006	124	3.3	6.8
		2	564	0.041	131.02	1.9	0.006	62	2.1	4.3
		3	1125	0.034	166.86	2.81	0.006	57	2.9	6.7
	Regulated data comes in ranges for two phases of regulation, when SMUD UARP built dam (1959) and then when Jones Fork Powerplant went in (1984)									
Regulated Q_{recc}	SMUD UARP									
		1	871	0.035	NA	NA	0.006	124	1.58	
		2	871	0.041	NA	NA	0.006	62	2.63	
		3	871	0.034	NA	NA	0.006	57	2.47	
	JFPH									
		1	488	0.035	NA	NA	0.006	124	1.11	
		2	488	0.041	NA	NA	0.006	62	1.86	
		3	488	0.034	NA	NA	0.006	57	1.74	
UnRegulated Q_{recc}		1	986	0.035	NA	NA	0.006	124	1.70	
		2	986	0.041	NA	NA	0.006	62	2.83	
		3	986	0.034	NA	NA	0.006	57	2.66	

Appendix Q. Q Calculations
Eight response reaches, three calculations each:
Chili Bar - Upper Coloma Site

Calculation	XS	Q (cfs)	n	A (sqft)	R (ft)	S (ft/ft)	w (ft)	dmean (ft)	velocity check using continuity (V = Q/A, ft/s)
Field Q_{bf}	1	12434	0.036	1277.68	4.73	0.007	265	4.8	9.7
	2	5495	0.037	742.34	3.27	0.007	205	3.6	7.4
	3	5069	0.037	590.86	4.08	0.007	143	4.1	8.6
Regulated Q_{recc}	1	5667	0.036	NA	NA	0.007	265	2.99	
	2	5667	0.037	NA	NA	0.007	205	3.54	
	3	5667	0.037	NA	NA	0.007	143	4.40	
UnRegulated Q_{recc}	1	5813	0.036	NA	NA	0.007	265	3.03	
	2	5813	0.037	NA	NA	0.007	205	3.60	
	3	5813	0.037	NA	NA	0.007	143	4.46	

Appendix Q. Roughness "n" Comparisons.

	Site	XS	Mean Local Slope	D_{84} (mm)	D_{50} (mm)	R (ft)	R/D84	n: Limerinos (1970)	n: Bray (1979)	n: Griffiths (1981)	n: Bathurst (1985)	n: Jarrett (1987)	n: Cowan	n: average (except Cowan)	Average (Cowan vs. average of empirical relations)
UARP	Rubicon Dam Reach	Upper		60	30	1.75	8.9	0.033	0.032	0.029	0.031	0.044	0.041	0.034	0.037
	(RD-G1)	Middle		93	34	1.28	4.2	0.040	0.039	0.029	0.036	0.047	0.034	0.038	0.036
		Lower	0.007	67	31	0.77	3.5	0.039	0.039	0.029	0.036	0.051	0.032	0.039	0.035
	Upper Loon Lake Dam Reach	Upper		3.5	3.5	2.04	177.7	0.018	0.017	0.021	0.018	0.043	0.044	0.024	0.034
	(LL-G1)	Middle		0.3	0.3	3.71	3769.4	0.014	0.013	0.017	0.014	0.039	0.063	0.019	0.041
		Lower	0.007	3	3	2.44	247.9	0.018	0.017	0.021	0.017	0.042	0.066	0.023	0.045
	Middle Loon Lake Dam Reach	Upper		148	40	1.5	3.1	0.046	0.046	0.030	0.041	0.058	0.049	0.044	0.047
	(LL-G2)	Middle		172	74	1.35	2.4	0.051	0.051	0.034	0.045	0.059	0.054	0.048	0.051
		Lower	0.013	170	90	1.27	2.3	0.051	0.051	0.035	0.045	0.059	0.037	0.049	0.043
	Lower Loon Lake Dam Reach	Upper		95	50	2.02	6.5	0.037	0.036	0.031	0.034	0.038	0.068	0.035	0.052
	(LL-G3)	Middle		135	68	1.6	3.6	0.044	0.043	0.033	0.040	0.040	0.040	0.040	0.040
		Lower	0.005	205	125	2.1	3.1	0.049	0.048	0.037	0.044	0.038	0.041	0.043	0.042
	Robbs Peak Dam Reach	Upper		79	39	1.58	6.1	0.037	0.036	0.030	0.034	0.028	0.041	0.033	0.037
	(RPD-G1)	Middle		63	40	1.18	5.7	0.036	0.035	0.030	0.033	0.029	0.039	0.032	0.036
		Lower	0.002	78	28	2.16	8.4	0.035	0.034	0.028	0.032	0.027	0.030	0.031	0.031
	Upper Ice House Dam Reach	Upper		29	16	1.49	15.7	0.028	0.027	0.026	0.026	0.028	0.029	0.027	0.028
	(IH-G1)	Middle		19	9	1.49	23.9	0.025	0.024	0.024	0.024	0.028	0.030	0.025	0.028
		Lower	0.002	25	10	2.52	30.7	0.026	0.025	0.025	0.025	0.026	0.035	0.025	0.030
	Lower Ice House Dam Reach	Upper		145	40	3	6.3	0.040	0.039	0.030	0.037	0.038	0.034	0.037	0.035
	(IH-G2)	Middle		265	85	1.9	2.2	0.056	0.056	0.034	0.049	0.041	0.035	0.047	0.041
		Lower	0.006	130	40	2.81	6.6	0.039	0.038	0.030	0.036	0.039	0.031	0.036	0.034
CHILI BAR	Upper Coloma	Upper		243	104	4.73	5.9	0.044	0.043	0.035	0.041	0.038	0.032	0.040	0.036
	(CB-G2)	Middle		246	122	3.27	4.1	0.048	0.047	0.036	0.043	0.040	0.031	0.043	0.037
		Lower	0.007	284	158	4.08	4.4	0.048	0.047	0.038	0.044	0.039	0.031	0.043	0.037

Appendix Q. Roughness "n" Comparisons.

<u>Empirical methods based on grain size and hydraulic radius presented in Wohl 2000.</u>

Limerinos	low end	top end	
slope range	0.00068	0.024	lower gradient
D84 size range (mm)	20	750	small gravel to medium sized boulders
discharge range (m^3/second)	5.62	427	
R/D84 range	0.9	47.2	

Bray	low end	top end	
slope range	0.00022	0.015	
D84 size range (mm)			gravel bed rivers
discharge range (m^3/second)	5.5	8140	
R/D84 range	11	85	

Griffiths	low end	top end
slope range	0.000085	0.011
D50 size range (mm)	13	301
discharge range (m^3/second)	0.05	1540
R/D84 range	3	53

Bathurst	low end	top end	
slope range	0.004	0.04	
D84 size range (mm)	113	740	
discharge range (m^3/second)	0.14	195	
R/D84 range			<10

Jarrett	low end	top end
slope range	0.002	0.052
D84 size range (mm)	100	800
discharge range (m^3/second)	0.34	127
R/D84 range	0.19	22
Range of R (m)	0.15	2.2
Range of R (ft)	0.49	7.22

Appendix Q. Roughness "n" values based on Cowan (1956)

Rubicon Dam

XS1	n = (nb + n1 + n2 + n3 + n4)m		0.041	**XS2**	n = (nb + n1 + n2 + n3 + n4)m		0.034	**XS3**	n = (nb + n1 + n2 + n3 + n4)m		0.032
	nb	0.03			nb	0.03			nb	0.03	
	n1	0.002			n1	0			n1	0	
	n2	0.003			n2	0			n2	0	
	n3	0.001			n3	0.002			n3	0.001	
	n4	0.005			n4	0.002			n4	0.001	
	m	1			m	1			m	1	

Loon Lake Dam Upper

XS1	n = (nb + n1 + n2 + n3 + n4)m		0.0437	**XS2**	n = (nb + n1 + n2 + n3 + n4)m		0.06325	**XS3**	n = (nb + n1 + n2 + n3 + n4)m		0.06555
	nb	0.027			nb	0.027			nb	0.027	
	n1	0.002			n1	0.002			n1	0.002	
	n2	0			n2	0			n2	0	
	n3	0.001			n3	0.018			n3	0.02	
	n4	0.008			n4	0.008			n4	0.008	
	m	1.15			m	1.15			m	1.15	

Loon Lake Dam Middle

XS1	n = (nb + n1 + n2 + n3 + n4)m		0.049	**XS2**	n = (nb + n1 + n2 + n3 + n4)m		0.054	**XS3**	n = (nb + n1 + n2 + n3 + n4)m		0.037
	nb	0.032			nb	0.032			nb	0.032	
	n1	0.003			n1	0			n1	0	
	n2	0.001			n2	0.001			n2	0	
	n3	0.003			n3	0.001			n3	0	
	n4	0.01			n4	0.02			n4	0.005	
	m	1			m	1			m	1	

Loon Lake Dam Lower

XS1	n = (nb + n1 + n2 + n3 + n4)m		0.068	**XS2**	n = (nb + n1 + n2 + n3 + n4)m		0.04	**XS3**	n = (nb + n1 + n2 + n3 + n4)m		0.041
	nb	0.034			nb	0.034			nb	0.034	
	n1	0.001			n1	0.001			n1	0.001	
	n2	0			n2	0			n2	0	
	n3	0.023			n3	0.002			n3	0.004	
	n4	0.01			n4	0.003			n4	0.002	
	m	1			m	1			m	1	

Appendix Q. Roughness "n" values based on Cowan (1956)

<u>Robbs Peak Dam</u>

XS1	n = (nb + n1 + n2 + n3 + n4)m		0.041	**XS2**	n = (nb + n1 + n2 + n3 + n4)m		0.039	**XS3**	n = (nb + n1 + n2 + n3 + n4)m		0.03
	nb	0.028			nb	0.028			nb	0.028	
	n1	0.004			n1	0.004			n1	0	
	n2	0.001			n2	0.001			n2	0	
	n3	0.003			n3	0.002			n3	0.001	
	n4	0.005			n4	0.004			n4	0.001	
	m	1			m	1			m	1	

<u>Ice House Dam Upper</u>

XS1	n = (nb + n1 + n2 + n3 + n4)m		0.029	**XS2**	n = (nb + n1 + n2 + n3 + n4)m		0.03	**XS3**	n = (nb + n1 + n2 + n3 + n4)m		0.035
	nb	0.027			nb	0.027			nb	0.027	
	n1	0			n1	0			n1	0.001	
	n2	0			n2	0			n2	0.001	
	n3	0			n3	0.001			n3	0.001	
	n4	0.002			n4	0.002			n4	0.005	
	m	1			m	1			m	1	

<u>Ice House Dam Lower</u>

XS1	n = (nb + n1 + n2 + n3 + n4)m		0.034	**XS2**	n = (nb + n1 + n2 + n3 + n4)m		0.035	**XS3**	n = (nb + n1 + n2 + n3 + n4)m		0.031
	nb	0.03			nb	0.03			nb	0.03	
	n1	0			n1	0.002			n1	0	
	n2	0			n2	0			n2	0	
	n3	0.002			n3	0.002			n3	0	
	n4	0.002			n4	0.001			n4	0.001	
	m	1			m	1			m	1	

<u>Chili Bar - Upper Coloma Site</u>

XS1	n = (nb + n1 + n2 + n3 + n4)m		0.032	**XS2**	n = (nb + n1 + n2 + n3 + n4)m		0.031	**XS3**	n = (nb + n1 + n2 + n3 + n4)m		0.031
	nb	0.03			nb	0.03			nb	0.03	
	n1	0			n1	0			n1	0	
	n2	0			n2	0			n2	0	
	n3	0.001			n3	0			n3	0	
	n4	0.001			n4	0.001			n4	0.001	
	m	1			m	1			m	1	

Appendix Q. 1.5 Regulated

Rubicon Dam

Gauge # 11428000		
Record	1964 to 1986	
Drainage Area	31.4	square miles
Q1.5 (events with 1.5-year return period)	665	cfs
cfs/square mile	21.2	cfs/square mile
elevation	6140	ft

Loon Lake Dam Upper

Gauge # 11429500		
Record	1964 to 2001	
Drainage Area	8.01	square miles
Q1.5 (events with 1.5-year return period)	40	cfs
cfs/square mile	5.0	cfs/square mile
elevation	6150	ft

Loon Lake Dam Middle

No gauge			
Node Identification from Hydro Report	Loon		4
Drainage Area	13.18	square miles	
Use USGS Gauge # 11429500 and adjust for drainage area and climate Adjustment is from pers. comm. with Margaret Hannaford, hydrologist for SMUD who recommended using nearby unregulated watersheds to adjust for unregulated flow below Loon Lake Dam			
Q1.5 for gauge is 40 cfs. 40 + (26*(13.18-8.01))			
Q1.5 (events with 1.5-year return period)	174	cfs	
cfs/square mile	13.2	cfs/square mile	
elevation	5900	ft	

Loon Lake Dam Lower

No gauge			
Node Identification from Hydro Report	Loon		7
Drainage Area	26.09	square miles	
Use USGS Gauge # 11429500 and adjust for drainage area and climate Adjustment is from pers. comm. with Margaret Hannaford, hydrologist for SMUD who recommended using nearby unregulated watersheds to adjust for unregulated flow below Loon Lake Dam			
Q1.5 for gauge is 40 cfs. 40 + (26*(26.09-8.01))			
Q1.5 (events with 1.5-year return period)	510	cfs	
cfs/square mile	19.6	cfs/square mile	
elevation	5340	ft	

Robbs Peak Dam

No gauge		
Node Identification from Hydro Report	none	none
Drainage Area	15.2	square miles
Problematic because USGS Gauge # 11430000, South Fork Rubicon River below Gerle Creek near Georgetown, CA, is nearest gauge and is located below the confluence of Gerle Creek, a regulated drainage. Flow/drainage area was used for the gauge during the regulated period, which represents the spill of Robbs Peak Diversion Dam and Gerle Reservoir, and multiplied by the drainage area above Robbs Peak Diversion Dam.		
Record	1964 to 2001	
Solution: Flow/Drainage Area for Gerle and South Fork Rubicon River drainages will be used to calculate Q1.5 for this location		
Flow/Area for Gerle/South Fork Rubicon drainages is 7.6 cfs/sqmi, thus multiply 7.6*15.2 for solution		
Q1.5 (events with 1.5-year return period)	116	cfs
cfs/square mile	7.6	cfs/square mile
elevation	5130	ft

Appendix Q. 1.5 Regulated

Ice House Dam Upper

No gauge

Node Identification from Hydro Report	Ice House		4
Drainage Area	30.69	square miles	

Use USGS gauge #11441500 and adjust for drainage area and climate
Adjustment is from pers. comm. with Margaret Hannaford, hydrologist for SMUD who recommended using nearby unregulated watersheds to adjust for unregulated flow below Ice House Dam

Record	UARP), 1985 to 2001 (JFPH)	
Q1.5 for gauge is a range 476 (and 93) cfs. 476 as example. 476 + (26*(30.69-27.5))		
Q1.5 (events with 1.5-year return period, subsequent to SMUD UARP)	559	cfs
Q1.5 (events with 1.5-year return period, subsequent to JFPH)	176	cfs
cfs/square mile	18.2	cfs/square mile
cfs/square mile	5.7	cfs/square mile
elevation	5190	ft

Ice House Dam Lower

No gauge

Node Identification from Hydro Report	Ice House		6
Drainage Area	42.69	square miles	

Use USGS gauge #11441500 and adjust for drainage area and climate
Adjustment is from pers. comm. with Margaret Hannaford, hydrologist for SMUD who recommended using nearby unregulated watersheds to adjust for unregulated flow below Ice House Dam
Q1.5 for gauge is a range 476 (and 93) cfs. 476 as example. 476 + (26*(42.69-27.5))

Q1.5 (events with 1.5-year return period, subsequent to SMUD UARP)	871	cfs
Q1.5 (events with 1.5-year return period, subsequent to JFPH)	488	cfs
cfs/square mile	20.4	cfs/square mile
cfs/square mile	11.4	cfs/square mile
elevation	4665	ft

Chili Bar Upper Coloma Site

Gauge # 11444500, South Fork of the American near Placerville.

Node Identification from Hydro Report	none	none
Record	1965 to 2001	

Adjustment is made to values given location of site, estimated drainage area of 27 square miles greater than that at gauge (598 square miles), thus drainage area estimated at 625 square miles.
To adjust for unregulated flow below Chili Bar Dam, use unregulated flow records from Placerville, Lotus, and Coloma gages
Q1.5 for gauge is 5416 cfs. 5416+(9.3*(625-598))

Drainage Area	625	square miles
Q1.5 (events with 1.5-year return period)	5667	cfs
cfs/square mile	9.1	cfs/square mile
elevation	764	ft

Appendix Q. 1.5 Unregulated

Rubicon Dam Reach

Gauge # 11428000		
Record	1956 to 1963	
Drainage Area		31.4 square miles
Q1.5 (events with 1.5-year return period)		1386 cfs
cfs/square mile		44.1 cfs/square mile
elevation		6140 ft

Loon Lake Dam Upper

no unregulated data available, therefore used gauge records "from nearby watershed with similar characteristics (e.g., watershed elevation and basin geology)"
Technical Report on Hydrology

Adjustment is from pers. comm. with Margaret Hannaford, hydrologist for SMUD
Calculation: 8.01 sqmi*26 cfs/sqmi

Drainage Area		8.01 square miles
Q1.5 (events with 1.5-year return period)		208 cfs
cfs/square mile		26.0 cfs/square mile
elevation		6150 ft

Loon Lake Dam Middle

no unregulated data available, therefore used gauge records "from nearby watershed with similar characteristics (e.g., watershed elevation and basin geology)"
Technical Report on Hydrology

Adjustment is from pers. comm. with Margaret Hannaford, hydrologist for SMUD
Calculation: 11.2 sqmi*26 cfs/sqmi

Node Identification from Hydro Report	Loon	4
Drainage Area		13.18 square miles
Q1.5 (events with 1.5-year return period)		343 cfs
cfs/square mile		26.0 cfs/square mile
elevation		5900 ft

Loon Lake Dam Lower

no unregulated data available, therefore used gauge records "from nearby watershed with similar characteristics (e.g., watershed elevation and basin geology)"
Technical Report on Hydrology

Node Identification from Hydro Report	Loon	7
Drainage Area		26.09 square miles
Q1.5 (events with 1.5-year return period)		678 cfs
cfs/square mile		26.0 cfs/square mile
elevation		5340 ft

Robbs Peak Dam

no unregulated data available, therefore used gauge records "from nearby watershed with similar characteristics (e.g., watershed elevation and basin geology)"
Technical Report on Hydrology
No gauge

Node Identification from Hydro Report	none	none
Drainage Area		15.2 square miles
Q1.5 (events with 1.5-year return period)		395 cfs
cfs/square mile		26.0 cfs/square mile
elevation		5130 ft

Appendix Q. 1.5 Unregulated

Ice House Dam Upper

Node Identification from Hydro Report	Ice House	4
Use USGS gauge #11441500 and adjust for drainage area		
Record	1925 to 1959	
Q1.5 is 591. Adjustment = 591+(26*(30.69-27.5))		
Drainage Area		30.69 square miles
Q1.5 (events with 1.5-year return period)		674 cfs
cfs/square mile		22.0 cfs/square mile
elevation		5190 ft

Ice House Dam Lower

Node Identification from Hydro Report	Ice House	6
Use USGS gauge #11441500 and adjust for drainage area		
Q1.5 is 591. Adjustment = 591+(26*(42.69-27.5))		
Drainage Area		42.69 square miles
Q1.5 (events with 1.5-year return period)		986 cfs
cfs/square mile		23.1 cfs/square mile
elevation		4665 ft

Chili Bar Upper Coloma Site

3 gauges on SFAR in this section have unregulated data, SFAR nr Placerville, SFAR @ Coloma, SFAR @ Lotus

Record	From available data (No flow adjustment) SFAR nr Placerville (1912 to 1920) SFAR @ Coloma (1930-1941) and SFAR @ Lotus (1951-1962)	
Average of discharge/area calculations for all 3 gauges = 9.3 cfs/sqmi		
Drainage Area		625 square miles
Calculation: 625 sqmi * 9.3 cfs/sqmi		
Q1.5 (events with 1.5-year return period)		5813 cfs
cfs/square mile		9.3 cfs/square mile
elevation		764 ft

Appendix Q. 1.5 Unregulated Gages Outside.

Unregulated	Cole Creek	Duncan Creek	Blackwood Creek	Ward creek	Pilot Creek	Rock Creek
Drainage Area (sqmi)	21	9.9	11.2	9.7	11.7	73
Q1.5 (cfs)	798	369	274	190	201	1433
flow/area (cfs/sqmi)	38	37	24	20	17	20
elevation (ft)	5920	5270	6240	6230	4280	1305
period of record (years)	1928-2001 excluding 1976	1961-2001	1964-2001	1972-2001	1961-2001	1993-2001

Adjustments:
For calculations of unregulated flows and accretions where records are not available in UARP.

Average Drainage Area (sqmi)	23
Average Q1.5 (cfs)	544
Average flow/area (cfs/sqmi)	26
Average elevation (ft)	4874

Appendix Q. 1.5 Gages Inside

Pre-regulation	Rubicon R @ Rubicon Springs	Gerle Creek @ Loon Lake Dam	South Fork Rubicon below Gerle Creek
Drainage Area (sqmi)	31.4	NA	NA
Q1.5 (cfs)	1386	NA	NA
flow/area (cfs/sqmi)	44	NA	NA
elevation (ft)	6053	NA	NA
period of record (years)	1956-1963	NA	NA

Regulation	Rubicon R @ Rubicon Springs	Gerle Creek @ Loon Lake Dam	South Fork Rubicon below Gerle Creek
Drainage Area (sqmi)	31.4	8.01	47.6
Q1.5 (cfs)	665	40	361
flow/area (cfs/sqmi)	21	5.0	7.6
elevation (ft)	6053	6250	4970
period of record (years)	1964-1986	1964-2001	1964-2001

Adjustments:
For accretion adjustments in the SFAR
drainage in the Reach Downstream of Chili Bar

Average flow/area (cfs/sqmi)	9.3
Average drainage area (sqmi)	634

Appendix Q. 1.5 Gages Inside

Pre-regulation	South Fork Silver Creek near Ice Hous	South Fork American nr Placerville	South Fork American nr Colom	South Fork American nr Lotus
Drainage Area (sqmi)	27.5	598	631	673
Q1.5 (cfs)	591	6083	5141	6492
flow/area (cfs/sqmi)	21	10	8.1	9.6
elevation (ft)	5290	931	731	635
period of record (years)	1925-1959	1912-1920	1930-1941	1951-1962

Regulation	South Fork Silver Creek near Ice Hous	South Fork American nr Placerville	South Fork American nr Colom	South Fork American nr Lotus
Drainage Area (sqmi)	27.5	598	NA	NA
Q1.5 (cfs)	476	5416	NA	NA
flow/area (cfs/sqmi)	17	9.1	NA	NA
elevation (ft)	5290	931	NA	NA
period of record (years)	1961-2001	1965-2001	NA	NA
	South Fork Silver Creek near Ice House subsequent to JFPH			
	27.5			
	93			
	3.4			
	5290			
	1961-2001			

Adjustments:
For accretion adjustments in the SFAR
drainage in the Reach Downstream of Chili Bar

Average flow/area (cfs/sqmi)	9.3
Average drainage area (sqmi)	634