Lemon Creek
Watershed Geomorphic Assessment and Sediment Management Alternatives Analysis

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Acknowledgements

Several state and federal agencies responded to the City's request for assistance in developing sediment management alternatives that reduce flooding potential while conserving fish and wildlife habitat. Subsequently, CBJ, Alaska Department of Natural Resources (ADNR), Alaska Department of Fish and Game (ADF&G), U.S. Fish and Wildlife Service (USFWS), and the U.S. Department of Agriculture – Natural Resources Conservation Service (NRCS), signed a Memorandum of Agreement in March, 2004 as a cooperative commitment to this project.

A number of local mine claims and landowners have contributed to this report. Their contributions were valuable in developing recommendations to meet the needs of the stakeholders.

A number of agencies have contributed to the development of this project and completion of this report. The USFWS and NRCS assisted with field investigations. The NRCS coordinated and facilitated meetings with project partners, stakeholders, and the public, researched and wrote Section 2, Introduction and Section 3 Study Purpose and Scope and contributed to Section 6 Fisheries. ADF&G conducted the aquatic habitat assessment; their data is included in Appendix D and referenced in the report. The USGS developed a provisional existing conditions HEC-RAS model of Lemon Creek including provisional estimates of peak discharges for various flow events. The USGS calibrated their provisional model to a 2004 high flow event. A report by the USGS documenting this model is in review and is to be published in the future. The USGS provisional HEC-RAS model and flows were provided, reviewed and used as the basis for modeling alternative conditions.

Inter-Fluve, Inc. conducted field investigations, analyses and developed recommendations for all remaining sections of this study. The Engineer of Record's stamp applies solely to these Inter-Fluve authored analyses and sections.

1. Executive Summary

Lemon Creek is located in the City and Borough of Juneau (CBJ), Alaska, five miles northwest of downtown Juneau. The creek flows approximately seven miles east to west, from its headwaters at Lemon Glacier to the outlet at Gastineau Channel. Several small, clear water tributaries are included in the Lemon Creek watershed, which encompasses approximately 25 square miles of alpine and forested uplands, wetlands, and urban areas (see Figure 1).

The Alaska Department of Environmental Conservation (ADEC) has identified Lemon Creek as an impaired water body, due to sediment, turbidity, and habitat modification. Designated, protected uses for Lemon Creek water include drinking source water, industrial and agricultural source water, contact and non-contact recreation uses, and growth and propagation of aquatic life and wildlife (Alaska's Water Quality Standard Regulations, 18 AAC 70). ADEC lists urban runoff and gravel mining as primary pollutant sources to Lemon Creek (ADEC, 1995).

In the fall of 2002, the CBJ expressed concern about potential flooding in the lower, urbanized portion of Lemon Creek. Past gravel mining operations have provided a much-needed source of gravel for local construction projects, with the added consequence of lowering the streambed and increasing flood conveyance. Since no in stream gravel mining has occurred during the past 20 years, the streambed has aggraded over time. The channel's capacity has been reduced, effectively increasing the likelihood of flooding of adjacent structures during major storm events.

Prior studies of the affects of gravel deposition on channel capacity were conducted. In 2002, the USGS surveyed 42 cross sections and developed a provisional HEC-RAS river hydraulic model along Lemon Creek from above Egan Drive to above the gorge. In 2003 and 2004, the USGS repeated the survey of a number of these cross sections. The USGS calibrated the provisional HEC-RAS model to a 2004 high flow event. In the fall of 2002, the CBJ hired Inter-Fluve, Inc. to conduct a reconnaissance level sediment transport study, documented in a report submitted to the CBJ in the spring of 2003. Findings indicated that gravel deposition would continue, possibly at problematic levels in response to individual flood events. A number of recommendations were made including further study of the Hidden Valley area to better understand the sediment supply reach and an analysis of sediment management alternatives.

Several state and federal agencies responded to the City's request for assistance in developing sediment management alternatives that reduce flooding potential while conserving fish and wildlife habitat. Subsequently, CBJ, Alaska Department of Natural Resources (ADNR) – Office of Habitat Management and Permitting, Alaska Department of Fish and Game (ADF&G) – Sport Fish Division, U.S. Fish and Wildlife Service (USFWS), and the U.S. Department of Agriculture – Natural Resources Conservation Service (NRCS), signed a Memorandum of Agreement in March, 2004 (Appendix A) as a cooperative commitment to this project. The purposes of this study are to:

- Assess the geomorphology and sediment transport regime of Lemon Creek,
- Identify potential sediment management alternatives,
- Identify fish and wildlife habitat protection and rehabilitation opportunities, and
- Educate property owners within the watershed about the findings of this study.

The scope of this study is limited to the stream corridor and associated processes that directly influence the stream's characteristics. It is intended as a guidance document, to be used by CBJ and participating regulatory agencies in making planning and permitting decisions about activities that would affect Lemon Creek.

Over bank flooding limits are not evaluated and are beyond the scope of this study, as is an assessment of potential costs of flooding of structures near the creek. In order to fully explore over bank flooding and potential flood damages, the Federal Emergency Management Agency flood boundaries and mapping would need to be updated to formally determine flood limits.

ADF&G conducted field surveys of Lemon Creek fish habitat in May 2004. The study area extended from the Egan Drive Bridge upstream approximately 4.5 miles to the first definite fish barrier. Field observers used habitat survey methodology developed by USFS and modified by ADF&G to measure parameters that influence salmonid presence and abundance. Data collected include Tongass National Forest channel types, channel pattern, average gradient, bank full width, dominant and subdominant substrate, riparian vegetation composition and density, pool frequency and characteristics and large woody debris frequency.

Inter-Fluve conducted field investigations with assistance from USFWS and NRCS to identify and document geomorphic conditions, collect bulk gravel substrate samples and collect survey data of channel profile, cross sections and face area of high eroding banks. Field observations were combined with an analysis of historic air photos to determine historic and present geomorphic conditions of the Hidden Valley area and along the urbanized reach. This analysis provided the basis for existing conditions sediment supply and development of concepts to limit excessive bank erosion and restore natural stream process. Sediment supply, transport and deposition reaches were identified.

From the geomorphic analysis, considerations to manage sediments were developed. Formulation of these alternatives took into account land use and land and mineral claim ownership and guidance on mining law. Five general categories of sediment management were considered:

1. Do nothing
2. Floodplain acquisition
3. Reduce excessive sediment supply from Hidden Valley sources
4. Remove backwater effect at private bridge below Glacier Highway
5. Mitigated mining to increase flood capacity.

Hydraulic and sediment transport analyses were conducted to evaluate short and long term performance of these sediment management alternatives. A provisional HEC-RAS model of Lemon Creek prepared by the USGS was used to model existing conditions and then copied and modified to represent each alternative condition. Results of the HEC-RAS models provided an evaluation of flood water surface elevations. Comparisons of water surface elevations were evaluated to determine the relative immediate benefit to reducing flood risk. Analyses of sediment transport conditions and estimated sediment budget provided a long term evaluation of rate of gravel deposition.

For the short term, removal of the RediMix Bridge will provide immediate and significant reductions in flood levels. HEC-RAS model results indicate that the 100-year water surface elevation will be below the Glacier Highway Bridge deck and will only exceed the top of bank at one cross section by less than 1 foot.

Consideration for reducing excessive erosion of high banks in the Hidden Valley area will provide benefits of reduced rates of excessive deposition, decrease turbidity, decrease the volume of fines deposited in the Gastineau Channel and result in fewer fines in spawning gravels. Reducing excessive erosion along the Hidden Valley supply reach will also increase the interval between in stream maintenance operations along lower Lemon Creek necessary to maintain flood conveyance capacity. Methods to increase flow roughness along gravel bars to store sediment and encourage establishment of vegetation are presented to accelerate recovery of natural stream-forested terrace processes.

Over the long term, deposition of gravels will continue for all Alternatives. In order to maintain flood conveyance capacity, maintenance mining will be required. From the hydraulic analysis, in stream mining will provide negligible reduction in flood water surface elevations while the backwater condition created by the RediMix Bridge exists. With the RediMix Bridge removed, in stream mining will provide additional reductions in flood water surface elevations. Methods to construct habitat elements following mining of in stream gravels are presented.

2. Introduction

2.1. Watershed Description

Lemon Creek is located in the City and Borough of Juneau (CBJ), Alaska, five miles northwest of downtown Juneau. The creek flows approximately seven miles east to west, from its headwaters at Lemon Glacier to the outlet at Gastineau Channel. Several small, clear water tributaries are included in the Lemon Creek watershed, which encompasses approximately 25 square miles of alpine and forested uplands, wetlands, and urban areas (See Figure 1).

Lemon Creek descends 1,300 feet over a course of 7.3 miles for an overall stream gradient of 0.03 ft/ft. There are several distinct gradient changes as it flows from its headwaters to tidewater. From the Lemon Glacier terminus at approximately 1,300 feet of elevation (U.S. Geological Survey 1974 topographic map), the creek flows through a steep canyon, and then enters a wider valley where the gradient decreases and the stream meanders. This area is known as Hidden Valley, and ends approximately 1.5 miles upstream of the Glacier Highway Bridge as Lemon Creek enters a steep, bedrock gorge. The Lemon Creek Correction Center (Correction Center) is located adjacent to the downstream end of the gorge. From there, the creek gradient is flatter to the outlet at Gastineau Channel. Tidal influence extends to approximately 0.24 miles upstream from the Glacier Highway Bridge.

Local climate and glaciers influence Lemon Creek's hydrology and turbidity. Juneau is located in Alaska's mildest climate zone, with temperatures ranging from 44° to 65° Fahrenheit in summer, and from 25° to 35° Fahrenheit in winter. Average annual precipitation ranges from 54 inches at the airport to 92 inches in downtown Juneau. Mean annual snowfall is approximately 101 inches (http://www.commerce.state.ak.us/dca/commdb/CF_BLOCK.cfm). Rainfall is greatest in late summer and fall, resulting in increased runoff. This is reflected in the Lemon Creek hydrograph, which shows discharge peaks in late summer and early fall for the period of record (http://nwis.waterdata.usgs.gov/). A corresponding increase in turbidity occurs as discharge carries glacial silt and sediment from eroding banks and upland soils. Low flows generally occur in late winter and early spring, due to lower precipitation levels and low temperatures resulting in lack of snowmelt. The water in Lemon Creek is nearly transparent during winter low flows and into late spring.

The Alaska Department of Environmental Conservation (ADEC) has identified Lemon Creek as an impaired water body due to sediment, turbidity, and habitat modification. Designated, protected uses for Lemon Creek water include drinking source water, industrial and agricultural source water, contact and non-contact recreation uses, and growth and propagation of aquatic life and wildlife (Alaska's Water Quality Standard Regulations, 18 AAC 70). ADEC lists urban runoff and gravel mining as primary pollutant sources to Lemon Creek (ADEC, 1995).

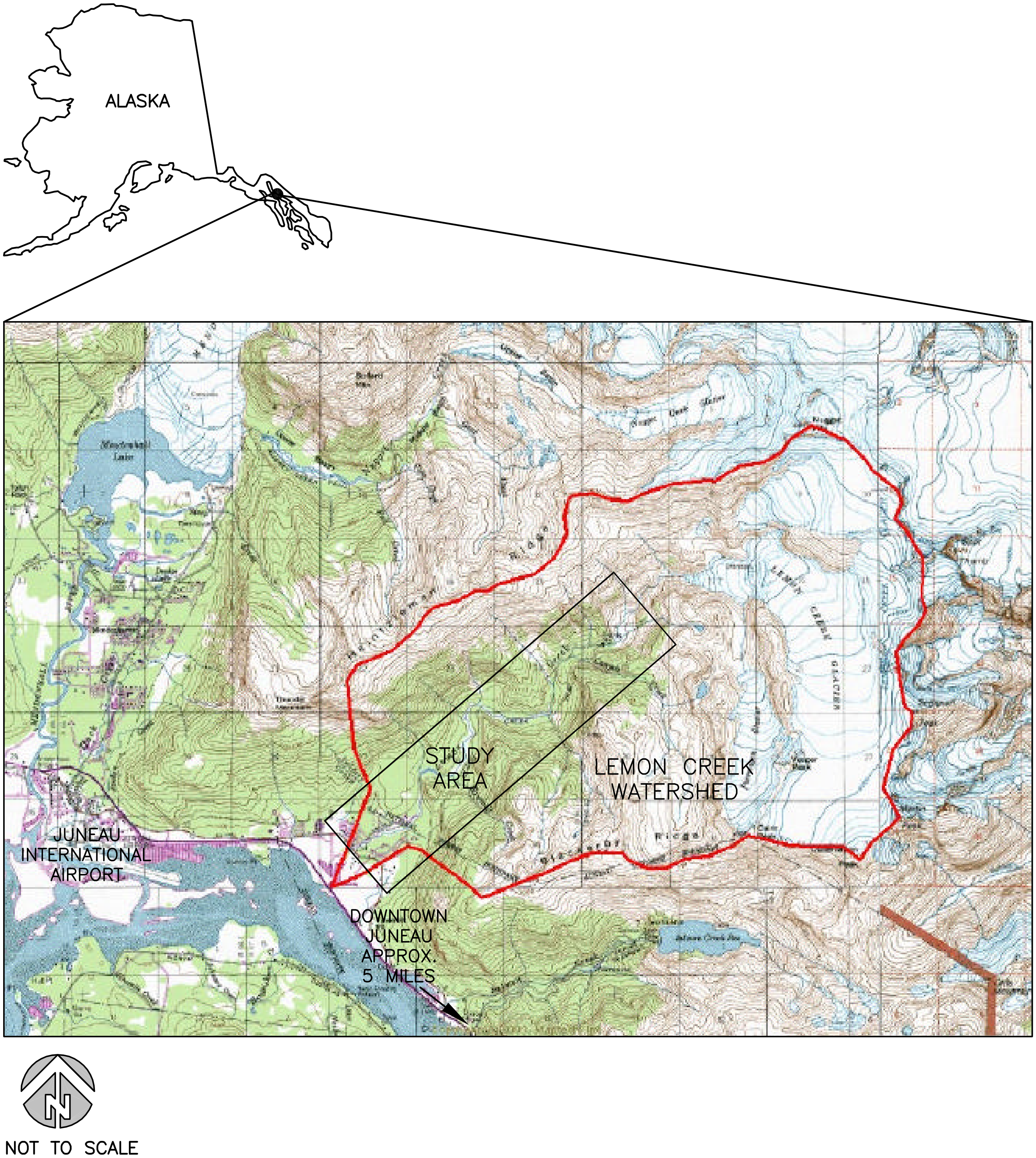

FIGURE 1

WATERSHED LOCATION
STUDY AREA

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Geologic formations in the Lemon Creek watershed consist primarily of metamorphosed siltstones and mudstones with granitic intrusions that are part of the Great Tonalite Sill, which extends the length of Southeast Alaska (Connor and O'Haire, 1988). Upland soils are generally well drained gravelly loamy till on glacial moraines, with areas of poorly drained deep peat soils on benches or in valleys. Within the creek corridor in the lower portion of the basin, soils consist of excessively drained, very gravelly, sandy soils. Soils information has been documented only for the lower three miles of Lemon Creek (Soil Conservation Service, 1974).

The watershed's vegetation includes high alpine, bog, riparian, freshwater wetland and intertidal wetland communities. However, the majority of the drainage consists of Sitka spruce-dominated forest. Where riparian vegetation is present, alders are the primary streamside species found throughout most of the stream corridor. A variety of birds and mammals live or pass through the Lemon Creek watershed, including bears, porcupine and bald eagles. Southeast Alaska is a major migration flyway, and the Lemon Creek wetlands provide both seasonal and year round habitat for a variety of shorebirds, waterfowl, and songbirds.

Lemon Creek is an anadromous fish stream (ADF&G number 111-40-10100). Coho, chum, and pink salmon have been documented in the main stem and/or its tributaries, as have Dolly Varden char (Bethers et al., 1995). A more thorough discussion of Lemon Creek fisheries is included in Section 6 of this report.

2.2. History

Lemon Creek is named for John Lemon, who discovered gold in the creek in 1879 and established a placer mine claim in 1897. Small-scale mining occurred until the Lemon Creek Company acquired the placer claim and began an advertising campaign in Eastern U.S. newspapers (Redman et al., 1988). Mining operations were established at One Mile Bar and at Bear Gulch on Sawmill Creek (Tom Horn, 2004). A road and flume were constructed on the south side of the valley in 1901, but fall floods destroyed most of the work. The company rebuilt the road and flume, but closed down due to lack of water at the site and released its 30 employees. Some minor work continued, but little gold was produced and the claims were eventually abandoned (Redman, 1988).

Logging and sawmill operations were also part of Lemon Creek's history. A small sawmill was initially located in the area currently occupied by Costco on the south side of the creek, and was later moved to the current Correction Center site in the mid-1940s. Logs were yarded down the frozen creek during winter months. The mill was later moved to Montana Creek (Tom Horn, 2004). According to William Tonsgard (2004), trees were last logged in the watershed in the early 1980s.

Gravel mining began in Lemon Creek during World War II. Prior to extracting gravel from the creek bed, the elevations of the stream banks were nearly even with the adjacent road level (Tom Horn, 2004). Since then, Lemon Creek has been mined several times. Although gravel and rock mining continue in Hidden Valley, in stream mining last occurred in the mid-1980s (Ralph Horecny, 2004).

The U.S. Forest Service owns most of the upper watershed. The lower portion of the creek corridor and associated floodplain has largely been developed for residential and industrial uses since about 1950. As the floodplain was developed, Lemon Creek has been straightened and confined. The stream banks have been riprapped throughout much of the urbanized section of the creek, and the current meander belt is significantly narrower than it was prior to development.

3. Study Purpose and Scope

In the fall of 2002, the CBJ expressed concern about potential flooding in the lower, urbanized portion of Lemon Creek. Past gravel mining operations have provided a much-needed source of gravel for local construction projects, with the added consequence of lowering the streambed and increasing flood conveyance. Since no in stream gravel mining has occurred during the past 20 years, the streambed has aggraded along this relatively mild sloped reach over time. The channel's capacity has been reduced, effectively increasing the likelihood of flooding of adjacent structures during major storm events.

Several state and federal agencies responded to the City's request for assistance in developing sediment management alternatives that reduce flooding potential while conserving fish and wildlife habitat. Subsequently, CBJ, Alaska Department of Natural Resources (ADNR) – Office of Habitat Management and Permitting, Alaska Department of Fish and Game (ADF&G) – Sport Fish Division, U.S. Fish and Wildlife Service (USFWS), and the U.S. Department of Agriculture – Natural Resources Conservation Service (NRCS), signed a Memorandum of Agreement in March, 2004 (Appendix A) as a cooperative commitment to this project.

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3.1. Public Outreach

Public input into the Lemon Creek hydrology and sediment transport regime study is critical to developing sediment management alternatives that are favorable to stakeholders. Several meetings have been held throughout the study's duration, the goal of which was to get feedback from landowners, mining claim owners, the City, and agencies that may influence or be affected by management decisions. Comments made by meeting attendees have been incorporated into the development of proposed sediment management alternatives presented in this report.

Separate meetings were held on July 15, 2004 for interested City, State, and Federal representatives, and land and mining claim owners in the Lemon Creek corridor. A public meeting was held on August 26, 2004. Subsequent stakeholder and public meetings are scheduled for November 22, 2004. Summaries for each have been prepared by NRCS and distributed to attendees and/or Lemon Creek land and mining claim owners, and are included in Appendix B.

4. Prior Research

4.1. USGS Channel Cross Section Survey and HEC-RAS Model

Through a 2002 funding agreement between the CBJ and the U.S. Geological Survey (USGS), the USGS surveyed 42 cross sections along Lemon Creek. Cross section locations are shown in Figure 2. The USGS survey is documented in a June 28, 2002 letter to the CBJ. Survey data were collected in April 2002 from below the RediMix Bridge to a few hundred feet above the gorge bridge. Cross section survey coverage extended to the tops of bank of Lemon Creek and did not extend into the adjacent floodplain areas. Twenty four of the cross sections were located as closely as possible to sections included in the Flood Insurance Study prepared by the U.S. Army Corps of Engineers (USGS 2002). The USGS also repeated survey data collection at a number of cross sections in January 2003 and April 2004 for comparison to the original April 2002 cross section condition.

The USGS developed a provisional HEC-RAS model from these cross sections. HEC-RAS is a one-dimensional model developed by the U.S. Army Corps of Engineers (USACE) and is the industry standard for modeling river hydraulic conditions. The USGS provisional model was used to estimate water surface elevations of the 2-, 10-, 25-, 50- and 100-year events. The model requires estimates of flood discharges and values for channel and over bank roughness coefficients. Flood discharges were estimated from USGS regression methods. Subsequent work by the USGS included calibration of the provisional hydraulic model based on a high flow event in 2004. The provisional model was calibrated by adjusting roughness coefficients to match calculated water surface elevations to observed high water marks.

4.2. Reconnaissance-level Sediment Transport Analysis

In the fall of 2002 CBJ hired Inter-Fluve, Inc. (Inter-Fluve) to conduct a reconnaissance-level sediment transport study of Lemon Creek. A letter report was submitted in the spring of 2003. Inter-Fluve used the provisional HEC-RAS model prepared by the USGS to characterize flood flow discharges and hydraulic conditions along Lemon Creek. CBJ collected five streambed substrate samples at locations requested by Inter-Fluve. These substrate samples were delivered to R&M Engineering in Juneau for sieve testing to characterize grain size distributions (GSD) of the sediments. The results of the HEC-RAS model and sediment grain size distributions were used as input to the USACE's SAM sediment transport model (Copeland, et. al. 1998). The SAM model was used to generate rating curves relating stream discharge to sediment transport potential. To estimate volumes of sediment transported along the study reaches, these rating curves were integrated over flood hydrographs extrapolated from the flood of record on August 23, 1983 at the USGS gauge 15052009. By comparing sediment transport capability of adjacent reaches, planning level estimates of the potential depths of gravel deposition were developed. Further details are documented in the Inter-Fluve report (2003)

The analysis confirmed the observations that gravel deposition is occurring at a rate that could significantly reduce flood conveyance following individual events. Deposition of sediment along the reach between Glacier Highway and the Correction Center will continue to be a chronic condition. A number of recommendations were suggested including further study of the sediment supply reach above the gorge and analysis of sediment management alternatives.

The recommendation to conduct further study of the Hidden Valley area was made in order to better understand the source of gravel that ultimately deposits near the Glacier Highway Bridge. By understanding the channel geomorphic and land use conditions and sediment budget on the watershed scale, the most appropriate approach to managing sediment deposition near Glacier Highway can be developed.

Figure 2. USGS provisional HEC-RAS cross section locations

5. 2004 Field Investigations and Data Collection

The current study focuses on Lemon Creek from tidewater extending upstream to approximately river mile 4.5, or 3.5 miles in a straight line between upstream and downstream limits. The watershed and study area are shown in Figure 1. This study contains three primary components:

1) ADF&G aquatic habitat survey: ADF&G conducted a habitat survey from the Egan Drive Bridge upstream to a fish passage barrier at approximately river mile 4.5. Additional details of the ADF&G study are included in Section 6 and Appendix D.

2) Watershed fluvial geomorphic assessment: A geomorphic analysis of Lemon Creek from tidewater through the Hidden Valley area was conducted to gain a watershed scale understanding of the channel condition and sediment budget. Included in the upper watershed study were survey data collection of channel profile and cross section, collection of streambed substrate samples and collection of visual and photographic data collection of upper watershed conditions. A discussion of the watershed conditions is included in Section 7.

3) Sediment management alternatives analysis: An alternatives analysis of sediment management options was conducted. This analysis included hydraulic and sediment transport analyses of a longer study area than conducted in the reconnaissance-level study. The alternatives focused on: 1) sediment supply, 2) sediment deposition, and 3) managing constrictions to flood flows. In addition, do nothing and floodplain acquisition alternatives are discussed.

Inter-Fluve conducted field investigations on May 16 and 17, 2004, with assistance from NRCS and USFWS. Activities included observations of Lemon Creek, collection of topographic survey data and collection of sediment substrate samples. Additional field observations were completed on July 14, 2004.

5.1. Field Observations

The field observations included viewing Lemon Creek conditions from the Glacier Highway Bridge upstream to approximately river mile 4.5. The upper limit of the fieldwork was the first barrier to fish passage and corresponded to the limits of the ADF&G habitat survey. Lemon Creek was viewed from the road between the Glacier Highway Bridge and the gorge bridge. Above the gorge bridge, observations were made and documented while walking the stream corridor to the upstream extent of the study area. A number of streambed substrates were photo documented with a tape measure placed on the sediment to reference size of materials. Locations of data and photos collected and observations were noted on 2002 aerial photographs.

5.2. Survey

The USGS cross section survey extends to approximately 350-ft above the gorge bridge. Additional survey data was collected by Inter-Fluve with assistance from NRCS on May 17,

2004. The Inter-Fluve survey data was collected with a Sokkia total station and included an additional 8,550-lineal feet of stream profile data and thirteen channel cross sections above the gorge bridge through the Hidden Valley area. In addition, the toe and tops of high eroding banks were surveyed to estimate the volume of material eroded per foot of lateral migration. The May 2004 survey was based on a relative horizontal datum and tied to the USGS vertical datum through surveyed elevations at points along the gorge bridge deck that were common with the USGS survey. Locations of profile and cross sections surveyed are shown in Figure 3.

5.3. Bulk Sediment Sample

The sediment transport analysis is based on stream hydraulics and the grain size distribution of the sediments. In order to characterize the grain size distributions, bulk sediment samples were collected at ten sample sites. At five of these sites, a separate sample of the coarser armor (surface) layer were collected, bagged and analyzed separately from the underlying sub armor (subsurface) layer. For the reconnaissance level study five samples had been collected using similar methods. Thus, each sample represents a grab sample from one location at one point in time. Each sample location was selected to collect gravels representative of those passing through the system.

5.3.1. Methodology

All streambed substrate samples were collected from exposed gravel bars near the water line. Where there was a distinct coarser armor layer at the surface where fine particles have been winnowed away and an underlying subarmor layer that still contains fine particles, samples were taken of both the subarmor and armor layers. For sample sites without a distinct armor layer, one composite sample was taken.

In sample areas with observed armoring, the coarser surface layer was sampled and bagged separately. The depth of the armor layer was determined by sight and by feel to estimate the depth at which fine sediments were contained in the voids of the subarmor layer.

Bed substrate sample sizes ranged from 48 to 80 pounds with an average weight of 60 pounds, approximately 2/3 of a five gallon bucket in size. Armor layer samples ranged from 38 to 68 pounds with an average weight of 56 pounds. One 22 pound sample was taken from an eroding bank in the Hidden Valley area. A three-pronged hand rake was used to loosen the substrate as necessary, and samples were collected by hand or a small pot and placed in a canvas ore sample bag. Each bag was labeled with sample name, location, stream name and date.

Sampling and testing methods used in this study were similar to those used in the reconnaissance level study. The reconnaissance level sediment locations sampled by the CBJ were not resampled as part of the current study.

Figure 3. Hidden Valley survey locations and estimated sediment source volumes

Five gravel samples were taken along Lemon Creek between tidewater and the gorge. Seven gravel samples were taken above the gorge in the Hidden Valley area. Sample locations are noted in Table 1. Samples were delivered to R&M Engineering (R&M) soils test lab for mechanical sieve testing.

Table 1. Streambed substrate sample locations

Sample ID	Location
Egan Drive	Above Egan Drive
103	Near Glacier Highway Bridge
Sample 1, Reach 1	Near Correction Center
Sample 1, Reach 2	Near Correction Center
Sample 2, Reach 2	Near Correction Center
Sample 1, Reach 3	Near Correction Center
1	Gravel bar above gorge bridge near XS 40
2	Point bar above gorge bridge near XS 41
5	Point bar near XS 45
4	Channel margin near XS 46
3	Gravel bar near XS 48
102	Gravel bar above XS 49
101	Gravel bar near XS 51
Bank	North eroding bank near XS 51

5.3.2. Lab Analyses

All bulk samples were delivered to R&M in Juneau for sieve testing following ASTM C-136. This method begins by drying and weighing the total sample. The sample is then placed in the top of a stack of sieves and shaken. Each sieve has a screen with progressively smaller openings down the stack. The various size particles are retained on the sieves with corresponding opening sizes, thus separating the various sizes of particles. The weight of material retained on each sieve is then measured. Test data results provide charts of grain size (Ds) versus percent of the sample finer by weight (Pf), also known as a grain size distribution (GSD). Numeric and graphical lab results are included in Appendix C. Charts with grain size distributions of samples are shown in Figures 4 through 6.

5.3.3. Results

The sample GSD obtained from the lab tests were used as input for the sediment transport analyses. The GSD provides information about the suitability of the gravel as spawning habitat as discussed in Section 6. Additional discussion of the GSD and sediment transport analysis is included in Section 8.4.

Figure 4. Summary of stream substrate sample grain size distributions - all samples

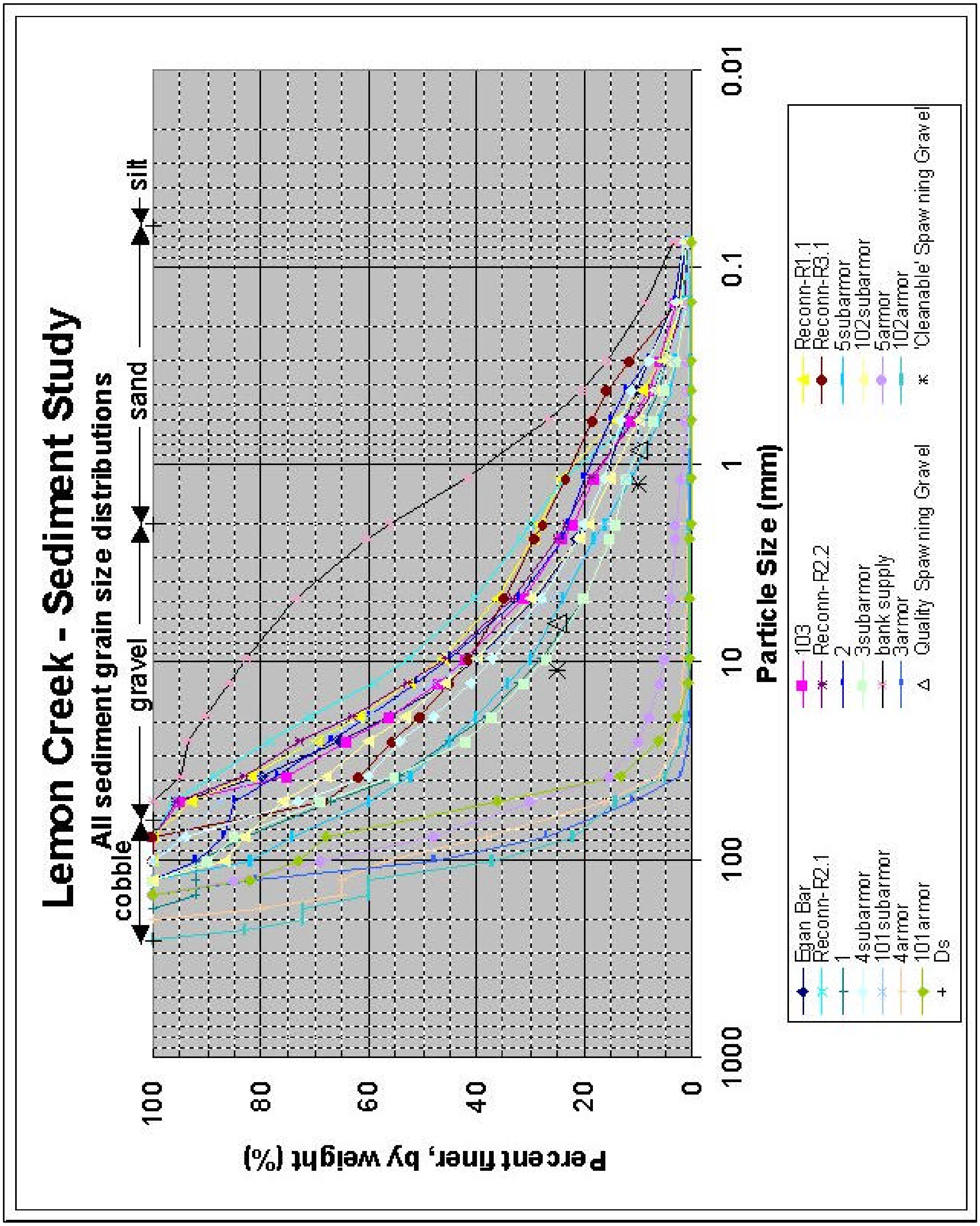


Figure 5. Summary of stream substrate sample grain size distributions - along Hidden Valley

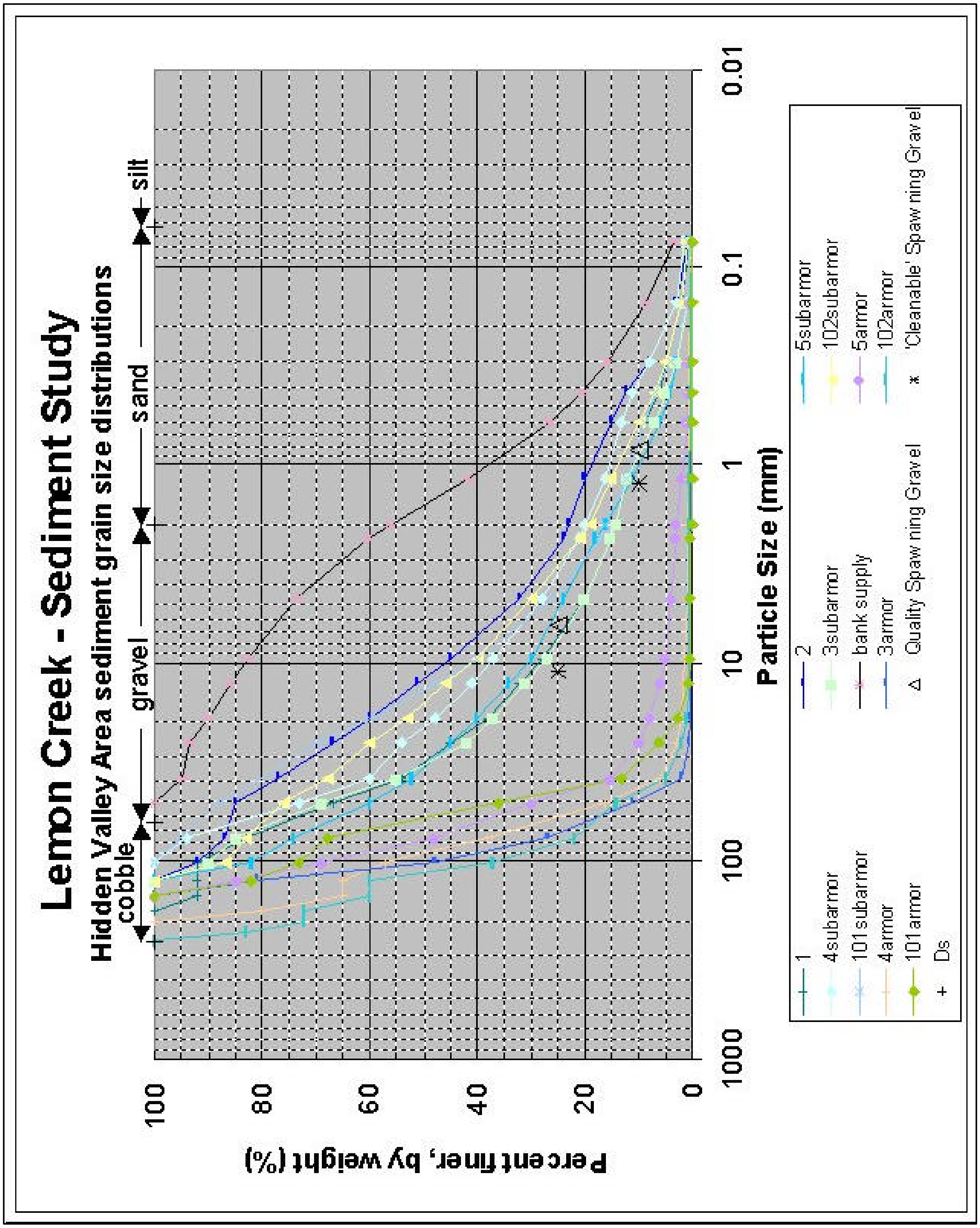
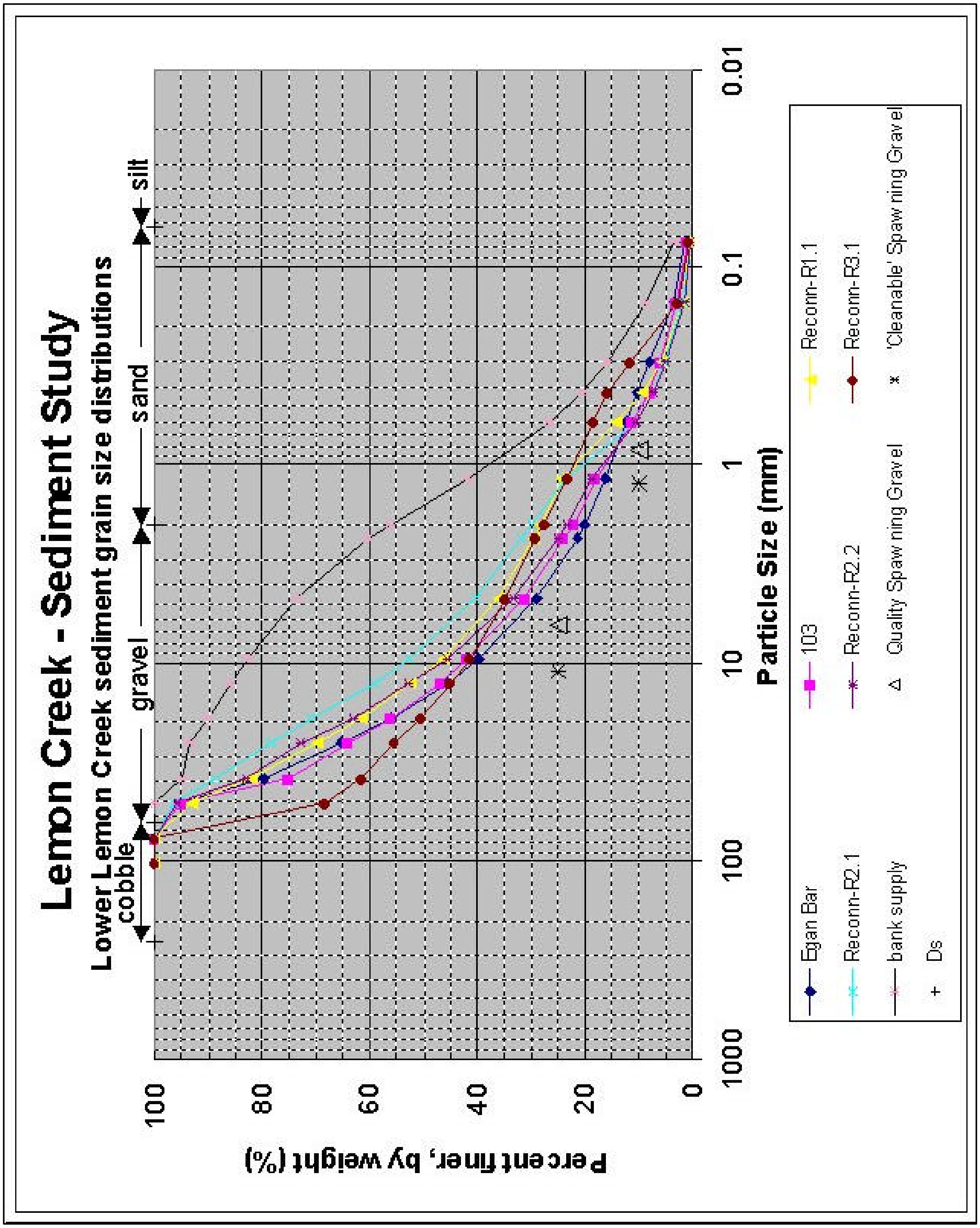


Figure 6. Summary of stream substrate sample grain size distributions - along lower Lemon Creek



6. Fisheries

The Alaska Department of Fish and Game has designated Lemon Creek as an anadromous fish stream that supports stocks of coho, chum, and pink salmon, and Dolly Varden char (ADF&G number 111-40-01-10100). Spawning chum and coho salmon have been observed in Lemon Creek during late summer and early fall. The main stem provides fair rearing habitat for Dolly Varden char and coho salmon, but Lemon Creek's clear water tributaries offer high value rearing habitat (Bethers et al., 1995). Lemon Creek's fishery resources have yet to be fully evaluated (Brian Glynn, 2004; Bethers et al., 1995).

Knowledge of fisheries resources in Lemon Creek is somewhat limited to date. Escapement data cited in Bethers et al. (1995) show few returning coho or pink adults. However, the collection dates for coho are primarily in mid- to late-October, past the adult coho return timing of August through September cited in the report. Although fish trapping during the 2004 ADFG Survey yielded few results, juvenile coho and Dolly Varden were observed in main stem side channels and in three of the tributaries during May, 2004 stream channel surveys conducted by Inter-Fluve, USFWS, and NRCS.

Little is known about potential use of the stream by non-game fish. K Koski, a researcher for the National Oceanic and Atmospheric Administration at the Auke Bay Laboratory in Juneau, has stated that the presence of large populations of shore and sea birds at the mouth of Lemon Creek in early spring suggests the presence of eulachon or capelin (personal communication, 2004). No data related to nongame fish in Lemon Creek has been found.

6.1. Existing Habitat Conditions

ADF&G conducted field surveys of Lemon Creek fish habitat in May 2004. The study area extended from tidewater upstream approximately 4.5 miles to the first definite fish barrier. Field observers used habitat survey methodology developed by USFS and modified by ADF&G to measure parameters that influence salmonid presence and abundance. Data collected include Tongass National Forest channel types, channel pattern, average gradient, bank full width, dominant and subdominant substrate, riparian vegetation composition and density, pool frequency and characteristics and large woody debris frequency. Recorded observations and photographs of the study reaches are included in Appendix D. Limited fish trapping was conducted during this study.

The May 2004 ADF&G habitat survey divided Lemon Creek into 8 individual channel segments having similar geomorphic and habitat characteristics. The first 3 channel segments comprise the lower portion of Lemon Creek below the canyon, the fourth segment the canyon itself and the remaining 4 segments contain the upper reaches of Lemon Creek through Hidden Valley.

<u>Lower Lemon Creek:</u>

Fish habitat in the lowermost reaches of Lemon Creek (below the canyon) was found to be heavily influenced by the effects of tidewater, the supply of fine sediments and channelization. Surveyors noted that spawning habitat, while plentiful for chum and pink salmon, was likely impacted by the steady supply of fine sediments from above. Rearing habitat for juvenile coho salmon and Dolly Varden char was found to be limited to a few locations where side channels or clear water in-flows were available. Rearing habitat for out-migrating chum and pink salmon juveniles appeared to be available but limited by the presence of bare eroding banks.

Canyon "gorge":
Fish habitat in the canyon reach was largely described as a migratory corridor. Though pool frequency and bank stability was found to be fairly high, the high velocities and limited availability of near bank vegetation limits the use of this reach as rearing habitat for all salmonids.

Hidden Valley and Upper Lemon Creek:
In the upper reaches of Lemon Creek Fish habitat was quite variable. The upper portions of this area were little impacted by human influences and had expected levels of spawning and rearing habitat. The middle portions of the reach in Hidden Valley by contrast were heavily impacted by human use and much of the channel was actively eroding. The lower reach was similarly impacted by human use with a short section of gorge that was characterized as another migration corridor with sufficient habitat to facilitate this use. The Hidden Valley section appears to have sufficient wood, channel slope, gravel and clear water in-flows to provide good habitat for both rearing and spawning Coho Salmon however, due to the mass wasting of lateral boundaries and lack of near bank vegetation habitat was severely limited. The same issues in the lowermost portion of this upper reach suffer from similar issues.

6.2. Fish Habitat Enhancement Opportunities

Opportunities for improvement of fish habitat within Lemon Creek are largely a function of reducing or eliminating the human imposed changes (both direct and indirect) to portions of the channel. In general, these direct and indirect human impositions include removal of riparian vegetation, accelerated erosion of lateral and vertical channel boundaries, and loss of attendant fluvial landforms on the flood prone surfaces adjacent to the active channel. To counter act these impositions, restoration of natural vegetation and construction of improvements in the erosional resistance of the banks and bed should be considered. These actions are suggested by channel segment below.

Lower Lemon Creek:
Fish habitat enhancement opportunities in the lowermost reaches of Lemon Creek (below the canyon) should focus on reduction of fine sediment contributions and reducing the influences of channelization. Eroding channel banks should be treated to restore erosion resistance by additions of large woody debris and natural vegetation. In the channelized reach, the creation of side channels along the channelized margins could benefit rearing juveniles. These created side channels should include aggregations of large woody debris for habitat and stabilization of the features.

Canyon "gorge":
Opportunities for improving fish habitat in the canyon reach are limited to stabilization of the left channel banks adjacent to the access road. These bank slopes are subject to rilling and surfical

erosion and contribute fine sediments to reaches downstream. Hydroseeding the streambank to increase the riparian margin and any additional grading of the road to insure inboard drainage to a settling basin are suggested.

Hidden Valley and Upper Lemon Creek:
In the upper reaches of Lemon Creek, opportunities include the stabilization of the actively eroding glacial outwash deposits and the stabilization of features on the existing flood plain. This is particularly true of the Hidden Valley area though limited opportunities exist in other areas. The glacial outwash deposits are located at the valley margins, near or at the limits of meander migration and will require aggressive stabilization measures at the toe of the slope and some re-vegetation efforts on the eroding slopes. This aggressive stabilization should include considerations for extensive toe scour and may require large volumes of riprap in addition to large wood and vegetative plantings. Stabilization of the existing floodplain may require re-location, vertical grade control or establishment of a gentler active channel profile to control incision. Re-vegetation of the largely bare flood prone surface should be a priority.

Habitat for rearing juveniles in the upper reaches could be improved through construction of side channel habitats. These habitats should be considered in areas of clear water inflows from either tributary or groundwater sources near the valley margins. Enhancement of existing inflows should consider improvements in pool riffle ratios and the addition of large woody debris to improve cover characteristics.

6.3. Suitability of sampled gravels as spawning gravels

Results of the sieve tests on the gravel bulk samples were used to compare sample GSD against findings in the literature of the effect of fines on quality of salmonid spawning gravels. Research by Kondolf (2000) indicates that for substrates with more than 12 percent by weight of particles 1 mm and smaller (sand, silt and clay), eggs have a reduced rate of survival to hatching. For substrates with more than 30 percent by weight of particles 3.35 to 6.35 mm (very fine to fine gravel and smaller), fry have a reduced rate of survival to emergence. These reference points of percent passing and size of particle are plotted against the summary lab results for each sample in Figures 4 through 6.

Other research by Kondolf (1993) indicates that salmon and trout are capable of reducing the volume of fines in substrates during construction of redds. Kondolf concluded that trout were capable of removing approximately 33 percent of 1 mm sized particles and 42 percent of 4 mm sized particles. These were the only quantitative data found in a non-exhaustive search of the literature regarding the cleaning of gravels during construction of redds. These reference points for substrates cleaned during redd construction are indicated in Figures 4 through 6.

In general, the volume (percent by weight) of fines in each Lemon Creek bulk sample was at or greater than the benchmarks discussed by Kondolf, indicating that they would provide poor to unsuitable spawning habitat. The reported ability of fish to remove some of the fine material during construction of redds will improve somewhat the quality of the substrate for spawning. The quantity of fines transported and deposited onto and into the redd following construction is not known.

It is important to note that bulk samples were collected from exposed gravel bars to characterize sediment transport conditions. The sample locations did not focus on salmonid selection of spawning gravels as affected by natural variability in gravel sizes within the stream, groundwater upwelling, interflow, water temperature or flow velocities.

7. Fluvial Geomorphic Assessment

7.1. Objectives

The objective of this fluvial geomorphic assessment is to understand recent geomorphic conditions and processes occurring within the lower portions of Lemon Creek. With this understanding, a measured approach to solving flood related problems along Lemon Creek could be completed. The assessment is based on field observations conducted on May 16-17, 2004 and July 14, 2004, an analysis of historic air photos and local accounts of past human activity within the project reach.

Emphasis has been placed on field and air photo observations to compare and understand changes in geomorphic process relative to flood frequency, channel stability, sediment sources and depositional areas observable within the air photo record

7.2. Study Site

The study reach extends from tidewater up to the first major waterfall above Hidden Valley at approximately river mile 4.5. This area encompasses a portion of the confined upper valley, the Hidden Valley area, the lower canyon area and the alluvial fan deposits located on the periphery of the Gastineau trench as shown on Figure 1.

The study reach has been broken into two primary segments. Upper Lemon Creek is the stream segment upstream of the canyon immediately above the Correction Center. This reach includes the confined upper valley, the Hidden Valley area and the lower canyon. Lower Lemon Creek is that portion of the stream below the lower canyon mouth (immediately upstream of the Correction Center site). The lower reach extends downstream through the deposited alluvial fan debris into the tidewaters of Gastineau Channel.

7.3. Methods

While collecting bulk sediment samples and elevational survey data, observations of existing conditions and evidence of historical channel alignments were investigated. Obvious sediment sources, transport reaches, depositional areas, historical channel elevations, large wood function and channel stability were observed and noted. Subsequent field visits focused on ground truthing and comparing the historical photo record with channel features existing today.

The air photo record reviewed for this study includes photos for the years 1948, 1962, 1974, 1977, 1984, 1988, 1997 and 2002. The historic air photos are included in Appendix E. Major floods occurred in 1927, 1943, 1961 and 1983 with smaller yet still significant events in the years 1952, 1957, 1966, 1967, 1972 (USACE, 1970, and USGS, http://nwis.waterdata.usgs.gov/ak/nwis/). Human disturbance in the Hidden Valley area occurred sometime between 1977 and 1988. Lower in the watershed, major gravel extraction efforts started sometime after 1977; however, roads and homes were in place prior to 1962.

Areas of channel were mapped that appeared to be either, 1) sediment supply, 2) sediment storage or 3) sediment transport reaches. Sediment supply reaches were identified as those areas that are actively eroding or supplying sediment to the system following flood episodes. In the air photo record these were identified by observing the location of channel segments relative to their boundary conditions noting areas where channel changes resulted in erosion of lateral boundaries. Sediment storage or depositional areas are those reaches that appear to be storing or collecting gravel as evidenced by deposition of lateral boundaries. Field evidence and ground truthing provided insight into whether a channel reach had been accumulating or losing materials in a vertical direction. Sediment transport reaches were identified as those reach locations that changed little in either their horizontal or vertical location throughout the photo record.

7.4. Observations of Response within Upper Lemon Creek

In the 1962 air photo through the Hidden Valley area, the near channel riparian areas are dominated by areas of bare gravel bars and remnant deciduous trees. The bare gravel bars are likely a response of the channel to the major flood of 1961 while the remnant deciduous trees are likely a re-colonization of floodplain areas stripped of vegetation following the large flood of 1943. The 1977 air photo shows some minor flood modifications of vegetation that re-colonized following the flood of 1961 but this is minor compared to the widespread bare gravel bars evident in the 1962 photo. Furthermore, it is evident that high bank sources of gravel are not wide spread and lateral areas along meander boundaries appear to be well bound by mature coniferous trees. A representative series of air photographs are shown in Figure 7.

Beginning in the 1977 air photo, mining of aggregate from floodplain sources, logging of riparian trees and attendant road building activities greatly increase in the Hidden Valley area. By 1988, the combined impacts of resource extraction (timber and aggregate) and the flood effects of 1983 have left widespread bare gravel bars and many areas of eroding high banks. This is particularly true of channel boundaries on river right (north) where most of the mature coniferous trees were removed.

In addition to the lateral boundary adjustments discussed above, field and aerial photograph evidence suggests that between 1988 and 2004, Lemon Creek incised (lowered) 3 to 6 feet within the Hidden Valley area. It is suspected that this recent incision has been caused by a combination of direct channel manipulation by excavation, loss of channel length from avulsion, road building within and adjacent to the channel and removal of valley bottom forest

The lowered base elevation of the stream caused by the incision process through the Hidden Valley area has caused Lemon Creek to destabilize and fall out of equilibrium with incoming sediment. Rapid lateral erosion, braided channel patterns, avulsions, abandoned side or main channels and floodplain terraces were observed in the air photo record and in the field.

Figure 7. Upper Lemon Creek air photo series of Hidden Valley conditions

7.5. Observations of Response In Lower Lemon Creek

Lower Lemon Creek, from the outlet of the gorge to tidewater, is unable to convey the volume and size of sediment supplied to it from Hidden Valley, elevating flood risk. There are two primary factors causing elevated flooding risk to occur. The first is human development that changed the way lower Lemon Creek functions and processes sediment naturally. The second is relatively recent (1977-2004) increases in sediment supply as observed in the aerial photo record and confirmed in the field evaluation.

The lower Lemon Creek channel network and floodplain has been heavily impacted by extraction of aggregate and development. A representative series of air photographs are shown in Figure 8. In the 1974 air photo, lower Lemon Creek occupies a braided channel meandering down alluvial fan deposits within the Gastineau Channel. By 1984, the meandering portion of lower Lemon Creek upstream of the RediMix Bridge has been excavated and straightened. The channel cross section has also been changed from wide and relatively shallow into a deep and narrow trapezoidal section in some places up to 20 feet below the pre-excavation surface. In addition to these changes in the cross sectional configuration, the longitudinal profile of the channel was affected. The braided channel in the 1974 air photo likely had a gradually decreasing slope starting at the mouth of the canyon downstream to the Gastineau Channel. Following the extraction of aggregate, the profile changed to a steep upper section followed by a very flat segment downstream to the bridge. This change in profile and section has changed the sediment transport characteristics of lower Lemon Creek. The flatter slope collects sediment more rapidly and collects sediment sizes much smaller than pre-channelization.

Before development and aggregate extraction, Lemon Creek processed sediment through a braided/multiple channel network that existed on a broad fan at the canyon outlet and slope break. As individual channels became filled by sediment or blocked by debris, water would have the space to run into old channels or create new channels over the alluvial fan floodplain complex. The dynamic nature of these natural alluvial fan processes would lead to conflicts with local human development. Following the extraction of aggregate and the deepening and straightening of the lower Lemon Creek channel, conflicts between adjacent land use and flooding was lessened due to the increased channel conveyance capacity of the modified channel. However, the sediment supply from upstream, change in gradient and hydrology that produced the pre-development channel still exists. As a result, the excavated channel has continued to fill and flood conveyance is being reduced over time as hydrology, sediment and gradient slowly re-create channel characteristics that existed before development.

The speed at which gravel deposition and loss of flood conveyance progresses is the second factor influencing sediment conveyance and flood risk within the Lemon Creek area. As previously stated, sediment production upstream of lower Lemon Creek in the Hidden Valley has substantially increased over the last 25 years. As upper Lemon Creek started to produce more sediment, the amount entering and depositing in lower Lemon Creek increased. The resulting loss in channel capacity has the natural tendency to increase flood risk to adjacent land area were the alluvial fan footprint has already been encroached by development. Even without elevated sediment yields from within Hidden Valley, the existing channel configuration would fill in over time. Elevated sediment load from past management activities has likely accelerated this process.

Figure 8. Lower Lemon Creek, air photo series of stream conditions

7.5.1. Sediment Supply Reaches

In its current state, lateral erosion of abandoned terraces and glacial deposits are the primary sources of sediment that appear to be contributing to Lemon Creek. Eroded terrace material is part of the former floodplain that has been abandoned during the incision process. Glacial outwash deposits are from high banks and most likely the largest source of sediment entering Lemon Creek. The air photo record suggests that the glacial deposits were likely much more stable prior to incision due to the presence of mature coniferous trees and collected large woody debris at the base of the slope. However, where the incised Lemon Creek meets the toe of these deposits, they have begun to erode. The height and volume of material make these deposits substantial current and future sediment sources. Estimates of volume of material per foot of lateral erosion were made from survey data and are noted on Figure 3. This is exacerbated by the high silt and sand content composing the glacial deposits and reduced riparian area roughness caused by mining, logging and road building activities. Sediment supply areas from erosion of terrace and glacial outwash deposits are shown in Figure 9.

7.5.2. Sediment Transport Reaches

Sediment transport reaches are identified in Figure 9. These stream reaches efficiently transport the sediment supplied and are armored and relatively stable. The bed and banks are composed of larger percentages of cobble, boulders and bedrock than upstream eroding terraces that contribute gravel, cobble and boulders and large volumes of silt and sand.

The relative stability, confinement and steeper slope of the transport reaches results in a tendency to transport sediment delivered from upstream eroding sources to downstream depositional storage reaches. Transport reaches are located along both upper and lower Lemon Creek.

7.5.3. Sediment Storage or Depositional Reaches

Depositional reaches are reaches that are showing evidence of aggradation and/or sediment storage. These reaches may be in equilibrium if the rate of transport equals the rate of supply, or may not be in equilibrium is the rate of transport is less than the supply. They are often transport limited and tend to store sediment as gravel bar deposits while adjacent banks laterally erode. Channel braiding, active lateral erosion and reduced flood conveyance are consequences of reaches that are depositing excess sediment relative to upstream supply. Depositional reaches are shown in Figure 9. Depositional reaches are located along both upper and lower Lemon Creek.

Figure 9. Lemon Creek - sediment supply, transport and deposition reaches

8. Hydrologic, Hydraulic and Sediment Transport Analyses

Hydraulic and sediment transport analyses were conducted to compare existing conditions with alternatives conditions as well as to evaluate short and long term impacts of each condition. The hydraulic evaluation provides a measure of the short-term flood risk associated with each condition. The sediment transport analysis provides a measure of the long-term flood risk by comparing rates of potential gravel deposition for each alternative.

The purpose of this approach was to use the estimated transport capability in conjunction with the geomorphic analysis (see Section 7) to identify ongoing trends and potential future conditions. The sediment transport analyses included: 1) incipient motion particle size analysis, and 2) estimates of sediment transport potential. From the sediment transport potential estimates, a planning-level sediment budget was prepared for each condition. A comparison of the sediment budgets provides an indication of changes to the rate of potential deposition of gravels near the Glacier Highway Bridge. In addition to sediment grain size distributions, the sediment transport analysis requires stream hydrology and hydraulics.

8.1. Hydrology

8.1.1. Event Peak Discharges

Existing stream flow records along Lemon Creek exist for only a few years. This limited amount of data is inadequate to statistically estimate peak flood discharges for a number of return period events. The 2004 provisional HEC-RAS model prepared by the USGS includes estimates of peak flood discharges from USGS regression equations. A USGS report summarizing methods is currently in internal review and will be released as an Open File Report in the future. A summary of these USGS provisional flows is included in Table 2.

Table 2. Return period event peak discharge estimates

Return period event	2-Year	5-Year[1]	10-Year	25-Year	50-Year	100-Year
Est'd. peak flow (cfs)	3930	5140	5990	6720	7140	7340

Note 1: The 5-year event discharge was not included in the provisional USGS model and was estimated by interpolation to be approximately 5,140-cfs.

Low flows were necessary for the sediment transport analysis. A series of low flows ranging from 50- to 3,000-cfs were added to the provisional HEC-RAS model.

8.1.2. Flood Hydrographs

The sediment transport analysis requires flood hydrographs for various events in order to estimate volumes of sediment transported per event. Recorded hydrographs for the 2- through 100-year events considered are not available. Therefore, hydrographs were estimated from the available gage record. The largest event recorded by the lower USGS gage (15052009) occurred on August 23, 1983 with a peak discharge of 4,510-cfs, nearly equal to the 5-year event included in the USGS 2004 provisional model. The duration of flows of this event that exceeded a typical base flow of approximately 500-cfs was approximately 5.2-days. Other events recorded at the upper USGS gage (15052000) in September 1952, September 1957, August 1961, September 1967 and September 1972 were of similar duration. Considering that most floods recorded by the USGS occurred during a similar season and had similar durations, this 1983 event was selected as the most appropriate example of a flood hydrograph. The 1983 event hydrograph was used to extrapolate hydrographs for other return period events by prorating discharges based on the ratio of flood peaks of the various return period events to the 1983 event peak flow. Durations were not prorated, as the durations of the larger floods became very large and did not make intuitive sense. It should be noted that the value of the hydrographs is to provide an equal basis for comparison of the sediment budgets of the various alternatives. By using the same event hydrographs for all alternatives, there is a common basis for comparison.

Project hydrographs are included in Appendix F.

8.2. Hydraulics

The provisional HEC-RAS model developed by the USGS in 2002 was calibrated by the USGS to a September 27, 2003 event with a peak discharge of 1,820-cfs. An updated 2004 provisional HEC-RAS model was prepared by the USGS that included this calibration. Details of the model and calibration are provisional and will be published by the USGS in the future. The provisional HEC-RAS model was provided by the USGS for this study. The model was reviewed by Inter-Fluve and appears to be a well developed model.

The USGS provisional HEC-RAS model was used to evaluate hydraulic and sediment characteristics for existing conditions along Lemon Creek. The existing conditions model was then copied and modified to represent each Alternative condition as described in Section 9.

In order to characterize the sediment supply reach above the USGS model coverage, additional hydraulic modeling was necessary within Hidden Valley. The Hidden Valley area modeling was prepared by Inter-Fluve using cross sections and profiles surveyed in May 2004 by Inter-Fluve with assistance from NRCS. The survey and hydraulic modeling represent a reach extending from the gorge bridge approximately 8,550-ft upstream to an area above a big bend. The survey coverage was described in Section 5.2. The cross section coverage was too dispersed to be included in the USGS model. However, sections and channel slopes were collected at sufficient resolution to provide representative hydraulic conditions of specific reaches.

Calibrated channel roughness values for Manning's n included in the USGS model were used as the basis for the upper watershed hydraulic modeling. Adjustments to the Manning's n coefficients were made based on engineering judgment to account for changes in channel conditions.

Representative output from the HEC-RAS models are included in Appendix F.

8.3. Incipient Motion Particle Size Analysis

Incipient motion particle size analysis is used to estimate the size of particle that is at the threshold of mobility for a given hydraulic flow condition. Smaller particles would be expected to mobilize, while larger particles would be expected to remain in place. The analysis is used to estimate the frequency of mobilization by size of bed substrates and provide insight into geomorphic and biologic function of the gravels. Incipient motion particle size analyses were conducted for a number of flows for each reach to provide an estimate of the size of particle at the threshold of mobility. The flow on the rising limb of the flood hydrograph required to mobilize material was estimated based on the incipient motion particle size.

Incipient motion particle size is estimated using the equation:

$$t^* = \frac{t_o}{(?_s - ?_w) D_s}$$

Where:

t^* = dimensionless Shield's parameter, typically = 0.030 for cobble bed rivers
t_o = channel bed shear, psf
$?_s$ = unit weight of sediment, assumed to be 165 pcf
$?_w$ = unit weight of water, 62.4 pcf
D_s = size of sediment at incipient motion, ft

Values of the dimensionless Shield's parameter depend on the size and shape of the substrate. For common substrate along gravel- and cobble-bedded streams this value is 0.030.

8.4. Sediment Transport

8.4.1. Sediment Transport Analysis

The sediment transport analysis was conducted to develop planning-level estimates of the potential rate of sediment deposition along lower Lemon Creek. This rate of deposition provides insight on the long-term gain in streambed elevation. Rates of deposition associated with each Alternative condition are compared to assess relative benefit.

It is common for sediment transport equations to give results that differ by orders of magnitude between equations and in comparison to actual river conditions. Therefore, the sediment transport estimates should not be viewed as a predictive tool. Rather, the value of the sediment transport analyses is to provide a tool to estimate trends between conditions.

Rating curves of stream discharge (Qw) to sediment discharge (Qs) were generated using the USACE's SAM sediment transport model (Copeland, et. al. 1998) along each of the study reaches. SAM is an at-a-section model that supports a number of sediment transport equations to estimate sediment transport potential based on given flow and hydraulic conditions and size of substrate. Reach-average hydraulic conditions from the HEC-RAS model for each reach were used as input for SAM. Hydraulic input requirements for each reach were generated by length-weighted averages of hydraulic parameters generated from cross sections within each reach. The parameters required to run SAM includes: water discharge, water velocity, channel width, average flow depth, energy slope, water temperature and substrate grain size distributions. Representative output from the sediment transport analysis is included in Appendix G.

No sediment bed load measurements along Lemon Creek are known to exist to aid in selecting or calibrating an equation appropriate to Lemon Creek. Using the SAM module, SAMAID, stream conditions were matched to a known database of rivers. Results of SAMAID indicated that the Yang, Laursen (Madden) and Schoklistch sediment transport equations would be the most applicable to Lemon Creek conditions. In addition, the Parker equation has been developed for gravel and cobble bedded streams. These four equations were used for the following analysis.

Comparing rating curves for adjacent reaches provided estimates of the relative trend toward deposition or erosion. If a reach has less transport capability than the upstream supply reach deposition would be expected, whereas greater transport capability would suggest erosion would occur.

8.4.2. Estimated Depths of Erosion/Deposition

The rating curves, combined with flood hydrographs provide an estimate of the volume of sediment transported during that flood hydrograph. Development of the flood hydrographs for the 2-, 5-, 25-, 50- and 100-year events is discussed in Section 8.1. The hydrographs were integrated with the Qw-Qs rating curves to estimate the volume of sediment transport potential along each reach during these flood events.

The volume of sediment transported along each reach during each event was compared to the sediment volume delivered from the respective upstream supply reach. The difference in sediment volume would be expected to either erode or deposit to match the subject reach's capability. This volume of erosion/deposition divided by the channel area was used to estimate the potential depth of erosion/deposition along each of the reaches for each of the study events.

As described in the next section, cross section 48 is the most representative of sediment supply from the Hidden Valley area. Reaches I, H, and F have a greater transport potential but are also better armored, lack evidence of sediment deposition and were considered to be transport reaches. Cross section 48 is located at a transition from a wide, depositional area into a single thread channel with little evidence of deposition. The transport capability of Reach G is similar in magnitude to Cross Section 48.

Using Cross section 48 to estimate the sediment supply from the Hidden Valley area, An estimate of depths of deposition or erosion was made for Reaches A through E for the 2-, 5-, 25-, 50- and 100-year events. These depth estimates use very approximate methods and should be viewed strictly as a planning level tool to identify trends and compare relative depths of potential deposition or erosion for the Alternatives.

8.4.3. Study Reaches

This study expanded on the coverage included in the reconnaissance level study. Two additional reaches were considered downstream of the Glacier Highway Bridge. Five additional reaches were considered along the 8,550-ft reach above the gorge bridge to determine a representative reach that supplies sediment to the urbanized reach. Reaches were based on multiple and single cross section hydraulics. All study Reaches A through K are described in Table 3 and shown in Figure 10.

Table 3. Study reach descriptions (downstream to upstream)

Reach (reconn. study)	HEC-RAS Sections (source)	Reach Description
A	1 to 3 (USGS)	Below RediMix Bridge
B	4 to 7.5 (USGS)	RediMix Bridge to Glacier Highway Bridge
C (1)	8.5 to 10 (USGS)	1,500-ft reach immediately above Glacier Highway Bridge. No gravel bars evident in 8/1/2001 air photo. (Reach 1 in 2003 Inter-Fluve reconnaissance level sediment transport study)
D (2)	10 to 13 (USGS)	1,700-ft reach midway between Glacier Highway Bridge and Correction Center. Gravel bars evident in 8/1/2001 air photo. (Reach 2 in 2003 Inter-Fluve reconnaissance level sediment transport study)
E (3)	13 to 15.5 (USGS)	1,900-ft reach immediately below Correction Center. Moderate gradient. Gravel bar deposition evident. (Reach 3 in 2003 Inter-Fluve reconnaissance level sediment transport study)
F (4)	15.8 to 23 (USGS)	1,800-ft reach through gorge. Transport reach: Steep gradient and confined cross section (Reach 4 in 2003 Inter-Fluve reconnaissance level sediment transport study)
G (5)	30 to 31 (USGS)	250-ft reach immediately above bridge above gorge. (Reach 5 in 2003 Inter-Fluve reconnaissance level sediment transport study)
H	40 to 43 (IFI)	Single thread channel above backwater influence of gorge bridge
I	44 to 48 (IFI)	Single thread channel
I-48	48 (IFI)	Cross Section 48 transition from wide valley to single thread channel. Active gravel deposition on bars, channel bottom armored. **Represents Sediment Supply Conditions.**
J	49 (IFI)	Short segment of single thread channel between wide valley bottom areas
K	50 to 52 (IFI)	Transport reach above the quarry near a big bend. Gravel bar deposition causing eroding bank on opposite bank

Figure 10. Lemon Creek sediment transport study reaches

Reach A. **Transport reach**. Reach A extends from the RediMix Bridge downstream approximately 370-ft to the limit of the USGS HEC-RAS model. The channel and floodplain are substantially wider along this reach as it transitions to estuarine wetlands and flats. This reach is tidally influenced. The USGS HEC-RAS model accounts for high tide water conditions by including a downstream water surface elevation equal to 20-ft as the boundary condition for all profiles.

Reach B. **Depositional reach**. Reach B is located between the Glacier Highway Bridge and the RediMix Bridge. This reach is tidally influenced and backwatered by the RediMix Bridge at high flows. This backwater causes this reach to have a deposition trend. The channel is narrower than adjacent reaches. Banks are vegetated, with riprap armoring the right bank immediately below the Glacier Highway Bridge along the outside of a bend. Aggregate stockpiles and minimal riparian margin are located along the top of the left bank midway along this reach.

Reach C (1). **Depositional reach**. Reach C (reconnaissance study reach 1) has a lower gradient than Reach D with a corresponding reduction in sediment transport capacity at all study flows. As expected, deposition would occur along Reach D at all study flows.

Reach D (2). **Depositional reach**. Reach D (reconnaissance study reach 2) has a lower gradient than Reach E with a corresponding reduction in sediment transport capacity at all study flows. As expected, deposition would occur along Reach E at all study flows.

Reach E (3). **Depositional reach**. Reach E (reconnaissance study reach 3) is a moderate gradient reach. Comparison of Qw-Qs rating curves between the supply reach (cross section 48) and Reach E indicates a depositional trend for low flows up to and including the 10-year event. For the 25-year through 100-year events, the sediment delivery is near or less than the transport capacity of this reach. This condition appears to be the result of flows along the supply reach accessing flood plain whereas Reach E is contained within an entrenched channel.

Reach F (4). **Transport reach**. Reach F (reconnaissance study reach 4) is the gorge and has a very high transport capacity. Little volume of gravel and cobble deposits along Reach F was observed in the field. Therefore, Reach F is a transport reach for gravel and cobble materials.

Reach G (5). **Depositional reach**. Reach G (reconnaissance study reach 5) is represented by two cross sections upstream of the bridge above the gorge. Gravel bar deposits were observed immediately above the bridge. Transport conditions along Reach G are similar to Cross section 48.

Reach H. **Transport reach.** Reach H is located above the backwater influence from the gorge bridge. This reach has gravel bars that have deposition features storing sediment. Much of the sediment delivered to this reach appears to be passing downstream.

Reach I. **Transport reach.** Reach I is comprised of five cross sections. Four sections are located along the single thread channel with over bank areas vegetated with alder. The upstream cross section (section 48) is located at a transition from a wide valley bottom into a single thread channel. Depositional gravel bars are located along this section.

Cross section 48. **Supply reach.** As noted for Reach I, cross section 48 is located at a transition from a wide valley bottom into a single thread channel. Depositional gravel bars are located along this section. The hydraulic conditions and gravel sample collected at cross section 48 were used to represent sediment supply reach from the Hidden Valley area. This sediment transport potential at this section was considered to most closely represent the actual sediment volume delivered from the Hidden Valley area to the gorge and ultimately lower Lemon Creek.

Reach J. **Short transport reach within depositional reach.** Reach J is represented by a single section along a reach that narrows between upstream and downstream wide valley bottoms near the upstream end of the quarry. This reach tends to transport sediments delivered from upstream.

Reach K. **Transport reach.** Reach K is located near the big bend above the quarry in the Hidden Valley area. This reach is generally a transport reach with some deposition and storage of gravels along a point bar. Deposition along this point bar is causing lateral erosion of the right bank. Three cross sections were surveyed along Reach K.

9. Sediment Management Alternatives

9.1. Geomorphic Considerations for Sediment Management

9.1.1. Upper Lemon Creek Sediment Supply

Because Hidden Valley acts as a sediment supply zone, efforts to reduce excessive bank erosion will reduce the amount of sediment mobilized in this reach and carried into the lower Lemon Creek reaches. Creation of a meander corridor along the valley walls and restoration of natural stream processes would allow sediment transport from the undisturbed upper watershed and sediment redistribution and transport within the valley bottom.

Encouraging sediment storage and preventing excessive erosion and mobilization of banks, terraces and glacial deposits could be completed by increasing surficial roughness of bar deposits or resistance near eroding banks, terraces and lateral glacial deposits. This can be done using riprap, large wood, encouraging the re-colonization of vegetation and/or a combination of these practices. To increase sediment deposition and storage on exposed gravel surfaces, large wood roughness could be placed to enhance sediment deposition and riparian tree re-colonization.

Large wood materials may be salvaged from a future upland gravel pit in the Hidden Valley area. The proximity and current low market value of this wood would provide a cost effective source of materials.

Meander corridor boundary options to limit excessive bank erosion:

- A project that includes constructed logjams similar to those what would develop naturally would require large volumes of trees and logs. The jams would be buried near the annual scour depth and built upward to an elevation at or above bank full. These jams would be buried and void spaces filled using existing alluvial material as ballast. At implementation, design of boulders and vertically oriented logs may be required to resist the anticipated hydraulic forces of flow velocities between 7- and 12-fps and hydraulic flow depths between 5- and 7-ft. Depending on channel scour, tree size, and bank full flood stage, these jams may or may not need additional ballast. Habitat benefits would be greatest using this approach.

- An alternative to log jams would be the use of riprap. Riprap would require large volumes of rock and would not work as well near the high eroding glacial deposits unless they were set back away from the eroding slope to form a bench. The bench would provide a margin for material sloughing from the bank to deposit and support establishment of vegetation. Riprap would not provide the same ecological benefits that log jams would. Woody debris can be incorporated into the riprap to provide some habitat benefit. Concurrent creation or enhancement of clear water side channels can be included to improve habitat conditions.

Increased flood plain roughness concepts:

- A third alternative is the use of trees and logs to establish logjams that are not buried deep but are placed on the existing flood prone surface (e.g. gravel bars and low terraces). These jams would need rock ballast and cable to remain in place but would simulate natural bar jams, require less wood material and still provide aquatic habitat similar to logjams buried in alluvial material. The goal of any wood related project would increase lateral roughness to retard erosion and enhance local sediment storage.

Other habitat enhancements:

- As noted in Section 6.2, Lemon Creek is limited in clear water side channel habitat. Habitat for rearing juveniles in the upper reaches could be improved through construction of side channel habitats. These habitats should be considered in areas of clear water inflows from either tributary or groundwater sources near the valley margins. Enhancement of existing inflows should consider improvements in pool riffle ratios and the addition of large woody debris to improve cover characteristics. Creation and enhancement of these clear water side channels is relatively simple.

These alternatives and general locations are shown in Figures 11 and 12.

9.1.2. Priorities

Priority areas for reductions in sediment supply are drawn in red in Figures 11 and 12. The top priority is the high eroding banks of glacial deposits. These glacial deposits are extensive and have the potential to supply the most volume of sediment in the shortest period of time. Stopping the excessive high bank erosion that occurs in these areas would provide the most cost effective reduction of excessive sediment supply.

A second priority would place roughness to limit lateral erosion of lower eroding banks of terraces along valley walls or the natural meander corridor limits. If reductions in erosion are attempted in these locations it should be completed with large wood jams that emulate natural process and do not preclude future plan form development and habitat developments. Slowing erosion with riprap in areas that are within historic meander corridor limits is not recommended in order to allow natural migration within the meander corridor.

The third priority would be placement of wood on gravel bars to encourage deposition and storage of sediments to pre-disturbance levels. Wood placements and deposition will also accelerate establishment of vegetation, an important component of natural stream process, stability and habitat function. Plan view locations and concept details are shown in Figures 11 and 12.

Concepts to reduce the excessive sediment supply from high eroding banks using large wood or riprap are shown in Figure 13 and 14.

9.1.3. Lower Lemon Creek

Currently, lower Lemon Creek cannot convey all the sediment it receives. Therefore, to reduce flooding and maintain channel flood conveyance capacity in lower Lemon Creek, all the sediment entering lower Lemon Creek must continue through the reach or surplus sediment removed. One way to increase transport capacity is to steepen the gradient and/or reduce the width/depth ratio. Channels with low width/depth ratios are narrow, deep and efficient at transporting sediment. Increasing stream gradient increases the energy available to keep sediment moving through the stream reach. Increasing stream gradient to allow sediment conveyance may not be feasible due to the height of historical alluvial fan surface adjacent structures have been built on. This planning level modeling effort suggests that deposition would continue due to the flat gradient through this reach.

Existing bridges that cause backwater conditions at high flows reduce energy gradients and encourage sediment deposition. Bridges that are found to create backwater conditions could be modified or removed to lower water surface elevations, increase hydraulic gradient and increase sediment transport capability.

Finally, gravel mining could be used as a management tool to maintain flood conveyance capacity within the lower Lemon Creek channel or the stream reach above the gorge bridge between two bedrock control segments. Mining would be followed by construction of habitat elements including pool-riffle-gravel bar sequences, backwatered side channels along the downstream end of the gravel bars, placement of woody debris on the apex of gravel bars and along backwatered side channels. The channel width has been narrowed from pre-human conditions by encroachment of infrastructure and hardening of stream banks with riprap. In order to protect these properties from ongoing bank erosion, additional hardening of the channel banks would be required. Concepts are shown on Figure 15.

Figure 11. Hidden Valley (lower) general sediment control prescriptions

Figure 12. Hidden Valley (upper) general sediment control prescriptions

Figure 13. Concepts to reduce excessive sediment supply - large wood treatment option

Figure 14. Concepts to reduce excessive sediment supply – rock and large wood option

Figure 15. Lower Lemon Creek mitigated in stream mining concepts

9.2. Sediment Management Alternatives

In order to reduce flood risk, a number of alternatives were developed for managing excessive supply and deposition of sediments. The alternatives also consider methods to preserve or enhance aquatic habitats. Five basic alternatives were considered:

1. Do nothing: baseline condition
2. Floodplain acquisition to allow Lemon Creek to laterally migrate
3. Reduce excessive sediment supply from Hidden Valley by defining migration corridor
4. Remove or replace the RediMix Bridge and associated flood backwater
5. Mitigated mining to remove sediment from streambed.

Each alternative was evaluated to determine the relative short and long term benefit or impact to flood risk and opportunities for habitat enhancement.

Short term, or immediate, benefits to flooding risk were evaluated using the HEC-RAS model results to compare water surface elevations between the existing conditions model and each Alternative. Comparing channel flow velocity and bed shear (a measure of erosive force along the bed of the stream) between the existing conditions model and each Alternative provided a measure of relative risk of erosion immediately following implementation of the Alternative condition.

Long term reductions in flood conveyance of each Alternative are evaluated by comparing planning-level estimates of potential depths of erosion or deposition developed from the sediment transport analysis.

9.2.1. Existing Conditions - Do nothing

The do nothing Alternative was examined based on existing conditions. These existing conditions provide the baseline condition for comparing Alternatives. As noted in Section 8, hydraulic conditions for Reaches A through G were generated from the USGS 2004 provisional HEC-RAS model. Hydraulic conditions for Reaches H through K were generated from project survey and additional hydraulic modeling.

Under existing conditions, bank erosion is occurring and is expected to continue to occur. CBJ's objective of protecting property includes responding to this existing bank erosion. Bank hardening concepts described in Section 9.1.3 and shown in Figure 15 can be applied to current bank erosion problems.

9.2.2. Floodplain Acquisition

The floodplain acquisition alternative involves no active in stream work to manage flooding risks or manage sediments. Floodwater surface elevations and rates of sediment deposition would be identical to existing conditions. Removing infrastructure from hazard areas would reduce flooding risk. The costs would be that necessary to acquire properties or flooding rights.

Flooding limits are not known and are beyond the scope of this study, as is an assessment of potential costs for this alternative. In order to fully explore this alternative, update the Federal Emergency Management Agency flood inundation limits and mapping and assessing the feasibility of property or easement acquisition is recommended.

To pursue this Alternative, CBJ should evaluate and prioritize areas of Lemon Creek for potential floodplain acquisition. Portions of the floodplain might be acquired through land trades, compensatory mitigation settlements, grants and other land protection mechanisms. Development proposals that encroach in the floodplain or further contain the active channel should be given due consideration of flooding risk.

9.2.3. Reduce Excessive Supply from the Hidden Valley Area.

Upper Lemon Creek through the Hidden Valley area is bounded by high eroding banks. These banks contribute large volumes of sediment as they are eroded, collapse and retreat. In order to reduce the avulsive nature and excessive supply, creating a stream plan form meander corridor is considered. The geomorphic basis for these concepts was described in Section 9.1.

The alternatives do not substantially change stream channel hydraulic conditions of the sediment supply in the Hidden Valley area. Therefore, the existing conditions hydraulic models in the upper watershed were not modified for alternative conditions. The alternatives do, however, change the grain size distribution, volume of source material and corresponding rate of sediment transport along the Hidden Valley area.

Analysis of reducing excessive erosion from the high banks involves considering the change in size and volume of sediment sourced and delivered through the Hidden Valley area. Existing conditions allow large volumes of fine material to enter the stream. The rate of sediment transport for existing conditions with excessive sediment supply from the high eroding banks was analyzed based on the size of sediments sampled from one of the banks.

Limiting excessive erosion from high banks in the Hidden Valley area is anticipated to reduce the volume of sediment delivered to lower Lemon Creek. In addition, the percent (volume) of fines in the streambed substrates would be expected to decrease, thereby improving the quality of the gravels as spawning habitat. The Hidden Valley area has the capability of transporting nearly an order of magnitude larger quantity (tons/day) of the finer bank material than the larger bed material for all flows. However, the small size of the material from the banks would permit Lemon Creek to pass a portion of this volume directly to tidewater. From the bar sample immediately above Egan Drive, the D10 (10-percent of the material is finer in size) is 0.6-mm or smaller. The D10 particle size is typically associated with wash load; smaller particles remain in suspension and pass through the system. From the bank sample collected in Hidden Valley, approximately 30-percent of the sample would be transported as wash load and would not deposit along lower Lemon Creek.

Implementation of a migration corridor and reduction of excessive erosion of the high banks reduces the volume of fine sediment entering the creek from high banks. Sediment delivered by stream flow may pass through this area with the channel meandering between the limits of this corridor. With hardening of the toe of the high eroding banks, the size and volume of sediment supplied and delivered through Hidden Valley is represented by bed substrate material.

Results are presented in Section 9.3.

9.2.4. Remove/Replace RediMix Bridge

The existing conditions HEC-RAS hydraulic model indicates that the RediMix Bridge creates a significant backwater that extends from the bridge upstream to about cross section 13.5. Removal of the bridge will immediately lower this water surface elevation and increase the hydraulic gradient or energy available to move sediment through the lower Lemon Creek reach.

Removal of the bridge will require an alternate access for the owner. This is being pursued by the CBJ. Replacement of the bridge will require a structure that does not encroach on the 100-year water surface elevation to gain the full benefit to flood level reductions.

Removal of the RediMix Bridge was accounted for by copying the existing conditions HEC-RAS model and deleting the bridge and cross sections immediately upstream and downstream constricted by the bridge embankment. The distance between remaining upstream and downstream cross sections were adjusted accordingly. The model was then run to generate hydraulic conditions without the bridge in place. The results of the HEC-RAS model were input to an Alternatives condition sediment budget to estimate changes in rates of deposition. Results are presented in Section 9.3.

9.2.5. Mitigated Mining

Continuing deposition of sediment is expected to occur for existing and alternative conditions. As gravel deposition occurs along the streambed, the flood capacity will be reduced creating greater risk of flood damage to current land uses. In an effort to accommodate human use and habitats along this reach, a combination of mining to remove gravels and creation of stream forms to provide habitats is considered. A goal of this approach is to work cooperatively with owners of existing mining claims along Lemon Creek, or make the solution revenue neutral to CBJ. The claims owners have indicated that selective removal of small volumes of sediment is cost prohibitive. Removing larger volumes of material provides an economically viable operation and will also increase the interval between in stream operations to maintain flood conveyance capacity.

Approximately eleven mining claims are located between the RediMix Bridge and the Correction Center. Considering that mining and lowering the streambed elevation will require agreement from the various owners, the analysis for this Alternative considered a number of scenarios:

1. Mining between the Glacier Highway Bridge and the Correction Center.
2. Mining between the RediMix Bridge and the Glacier Highway Bridge
3. Mining between the RediMix Bridge and the Correction Center.

These scenarios are considered for conditions with the RediMix Bridge in place and with the RediMix Bridge removed.

Habitat features of the finished mining activity would include construction of pool, riffle gravel bar bed forms, somewhat similar to what presently exists. The existing conditions HEC-RAS model was copied and modified to represent these scenarios with stream forms included. Mining above the Glacier Highway Bridge is accounted for in the HEC-RAS model by lowering the bed of the channel in the model cross sections. From cross section 8 to 13, the existing conditions channel cross section was copied and the ground points between the banks were all lowered by 5-ft.

Mining between the RediMix and Glacier Bridge is accounted for by lowering the bed of the channel in the model cross sections. Considering as-built channel elevations of the Glacier Highway Bridge (ADOT&PF, 1981) and downstream channel profile, it was assumed that mining would occur to a depth of approximately 3-ft but no deeper than elevation 13-ft to reduce risk of destabilizing the Glacier Highway Bridge. From cross section 4 through 8, the existing conditions channel cross section was copied and the ground points between the banks were all lowered by 3-ft, or to elevation 13-ft whichever was higher.

Mining between the RediMix Bridge and the Correction Center was modeled by combining both sets of model changes noted above. The cross section through the Glacier Highway Bridge was also lowered.

9.2.6. Combination of Alternatives

The most benefit would be obtained by looking at these alternatives in combination. Reducing the excessive supply from the source reach, removing backwater constrictions and considering mitigated mining will all contribute to lower the water surface elevations during flood and reduce the rate of gravel deposition to more natural levels.

9.3. Results

9.3.1. Existing Conditions – Do Nothing

Sediment deposition/erosion trends comparison:

Long term flood risk is evaluated by the rate of sediment deposition anticipated from various return period floods. These rates are provided in Table 4. The sediment supply condition is based on cross section 48 hydraulics combined with the larger bed material grain size distribution.

As shown in Table 4, Reach A indicates a strongly erosional trend. This is a function of the model boundary conditions creating higher energy flow conditions combined with the backwater condition through Reaches B through E trapping sediments, providing little sediment delivery into Reach A.

While Reach B is backwatered, Table 4 indicates a slight erosional trend. Reach B is narrower than Reach C, with higher flow velocities. The lower sediment transport capacity along Reach C causes sediments to deposit with relatively clear water delivered into Reach B.

As shown in Table 4, there is a strong depositional tendency along Reaches C and D, both immediately above the Glacier Highway Bridge.

Reach E has a depositional tendency for the 2- and 5-year events. For the 25- through 100-year events Reach E indicates an erosional tendency. This occurs due to the entrenchment of Reach E in comparison to the sediment supply from cross section 48. Cross section 48 has some connection to its floodplain, thereby reducing flow energy and sediment delivery for the higher events.

9.3.2. Floodplain Acquisition

Flooding conditions are the same as do-nothing alternative. Removal of structures from hazard areas will reduce flooding risks.

9.3.3. Reduce Excessive Supply from the Hidden Valley Area.

The depths of deposition/erosion with the finer bank material as the source material is listed in Table 4. The sediment supply condition is based on cross section 48 hydraulics combined with the finer bank material grain size distribution. With the fine bank material, greater deposition is anticipated along Reach E than is seen for existing conditions. One limitation of this method is that the differences in sediment supply and transport capability are accounted for in a single reach. This deposition would likely be spread more thinly over a greater number of reaches.

The hydraulic condition along lower Lemon Creek is the same as existing conditions. There is no immediate flood level reduction benefit.

9.3.4. Remove/Replace RediMix Bridge

Water surface elevation comparison:

Immediate flood risk benefits by removing the RediMix Bridge were evaluated by comparing water surface elevations to existing conditions. A comparative water surface profile is shown in Figure 16 and Table 5. There is an immediate lowering in the water surface elevation along Lemon Creek extending from the bridge to approximately cross section 13.5. The 100-year event water surface reduction at the RediMix Bridge is approximately 11-ft. The 100-year event water surface reduction is approximately 7.5-ft at the upstream face of the Glacier Highway Bridge. A reduction in water surface elevations extends upstream to cross section 13.5 near the Correction Center. Examining the HEC-RAS model cross sections, all sections except for section 8.5 are contained within the tops of bank. The model indicates that cross section 8.5, exceeds the right bank by 0.47-ft and the left bank by 0.81-ft.

Channel velocity and bed shear comparison:

A comparison of the channel velocity and bed shear for the existing conditions and with the RediMix Bridge removed is included in Tables 6 and 7, respectively. Removing the bridge and associated backwater increases the 100-year event channel flow velocity over existing conditions up to about cross section 13.5. Between the RediMix Bridge and the Glacier Highway Bridge, 100-year event channel velocities increase by an average of 3 to 5-fps. Locally higher increases in 100-year event velocity of 6.5-fps and 8.9-fps occur at the Glacier Highway and RediMix Bridges, respectively. Above the Glacier Highway Bridge 100-year event channel velocities increase between 1.5- and 3.8-fps. Values of the 100-year event bed shears exhibit similar trends.

The velocity and shear along the channel increase with the bridge backwater removed indicating a greater erosional tendency. It will be necessary to evaluate increased risk of destabilizing existing structures including the Glacier Highway Bridge and riprap revetment along the right bank below the Glacier Highway and other structures that might be present. Retrofits to existing structures may be necessary to maintain levels of erosion protection. If necessary, launchable riprap toes might be added to existing revetments to account for greater scour depths. Existing structures should be evaluated for risk of flanking and other failure mechanisms.

Sediment deposition/erosion trends comparison:
Sediment deposition is anticipated to continue upstream of the Glacier Highway Bridge as shown in Table 4. The sediment supply condition is based on cross section 48 hydraulics combined with the larger bed material grain size distribution.

As shown in Table 4, Reach A has less of an erosional trend than existing conditions. This is the result of the removal of the backwater created by the RediMix Bridge, combined with the ability of Reach B to deliver more sediment into Reach A.

Along Reach B, downstream of the Glacier Highway Bridge, Lemon Creek is narrower creating higher velocities and a steeper hydraulic gradient. As a result there is a trend towards erosion along this formerly backwatered reach.

The depositional tendency at Reach D will continue but will be reduced and distributed into Reach C. Reach C will have a greater depositional tendency. This redistribution of deposition is due to the increased hydraulic gradient from removing the backwater at the RediMix Bridge.

No changes in depositional trends along Reach E in comparison to existing conditions are projected.

9.3.5. Mitigated Mining with RediMix Bridge in Place

This alternative considers two conditions of mitigated mining along lower Lemon Creek:

1. Between the Glacier Highway Bridge and the Correction Center
2. Between the RediMix Bridge and Glacier Highway Bridge

These two conditions were examined with the RediMix Bridge in place.

Water surface elevation comparison:

The backwater created by the bridge during high flows allows only minimal reductions in water surface elevations from mining. During a 100-year event, the net benefit to lowering water surface elevations is a few tenths of a foot near the upper limits of the mined area. Water surface profiles are summarized in Figure 17 for both conditions. Changes in water surface elevations area summarized in Table 8 and 9 for mining above the Glacier Highway Bridge, and mining between the RediMix Bridge and the Glacier Highway Bridge, respectively.

Channel velocity and bed shear comparison:

Changes to flow velocity along the channel are small. Some reduction of flow velocities occurs locally at the RediMix with nearby dredging. Changes in channel velocities are summarized in Tables 10 and 11 for mining above and below, respectively of the Glacier Highway Bridge. Similar behavior is reflected in values of bed shear as shown in Tables 12 and 13, for mining above and below, respectively of the Glacier Highway Bridge.

Sediment deposition/erosion trends comparison:

Given the negligible reduction in flood water surface elevations by mining while the RediMix Bridge backwater condition exists, changes to the sediment deposition/erosion trends were not analyzed.

9.3.6. Mitigated Mining with RediMix Bridge Removed

This alternative considers three conditions of mitigated mining along lower Lemon Creek:

3. Between the Glacier Highway Bridge and the Correction Center
4. Between the RediMix Bridge and Glacier Highway Bridge
5. Between the RediMix Bridge and the Correction Center

These three conditions were examined with the RediMix Bridge removed. In order to estimate the contribution from mining, these conditions were compared against the scenario of the RediMix Bridge removed and existing channel conditions.

Water surface elevation comparison:

A plot of the water surface elevation profiles is shown in Figure 18. Changes in water surface elevations are summarized in Tables 14, 15 and 16, respectively, for mining above Glacier Highway, below Glacier Highway and from the RediMix Bridge to the Correction Center. In summary, there is greater reduction in 100-year event water surface elevations from mining with the RediMix Bridge removed. By removing the RediMix Bridge and mining from the bridge to the Corrections Center the 100-year water surface elevations are contained within the tops of banks of all cross sections including section 8.5 which is approximately 0.3 ft below the left bank.

Channel velocity and bed shear comparison:

Changes in flow velocity are summarized in Tables 17, 18 and 19, respectively, for mining above Glacier Highway, below Glacier Highway and from the RediMix Bridge to the Correction Center. Changes in bed shear are summarized in Tables 20, 21 and 22, respectively, for mining above Glacier Highway, below Glacier Highway and from the RediMix Bridge to the Correction Center.

Channel velocities and bed shears increase slightly over the scenario of simply removing the RediMix Bridge. As noted in Section 9.3.4, changes to hydraulic conditions as they may impact stability of the channel and existing structures should be evaluated if this alternative is to be implemented. Designs may be required to retrofit existing structures to maintain erosion protection.

<u>Sediment deposition/erosion trends comparison:</u>
Changes to the sediment deposition/erosion trends were analyzed for the condition of mining from the RediMix Bridge to the Correction Center only. Results are presented in Table 4. The sediment supply condition is based on cross section 48 hydraulics combined with the larger bed material grain size distribution.

As shown in Table 4, Reach A has a greater erosional tendency for this alternative than for the removal of the RediMix Bridge alone. The mining above the RediMix Bridge increases the rate of deposition above the bridge, thereby passing less sediment into Reach A. As a result of this reduced supply there is the greater erosional tendency along Reach A.

Through Reach B the erosional trend is reduced. This is due to the reduced sediment transport capacity by increasing the cross sectional area of the channel by mining thereby reducing flow energy.

As shown in Table 4, there is a very large tendency towards deposition along Reach C. The depths shown in the table indicate that Reach C will be very efficient at trapping sediments. As this mined reach fills with sediment, the rate of deposition will decrease to a rate similar to the scenario of existing channel with RediMix Bridge removed (i.e. as gravel deposits, the bed elevation will raise, increasing flow energy, transporting these sediments more easily through this reach).

Mining between the banks lowers the channel bed and increases the degree of entrenchment (depth to width ratio) at the flood plain elevation. For flows contained in this excavated channel that are not able to spill onto and access the flood plain, the sediment transport capability is increased above that of upstream supply stream reaches that readily access flood plain terraces. This is seen by the increased trend towards erosion along Reach D. The highly depositional trend seen for Reach C is expected to extend into Reach D.

The entrenchment described above for Reach D also exists for Reach E. This causes an erosional trend for the 5- through 100-year events. This can be understood by considering that the sediment supply is originating from cross section 48 in the Hidden Valley. Cross section 48 is connected with its flood plain allowing high flows to spill out of bank and expend some energy out of channel. Thus the sediment delivered downstream as supply into Reach E is less than the conveyance capacity of Reach E for these higher flows.

At the upstream end of the mined area, the elevation difference between the mine and the upstream unmined areas will create a sudden drop in elevation. This abrupt drop in the streambed profile will cause a local erosive condition that will initiate a headcut that will migrate upstream causing the streambed to downcut and possibly initiate bank erosion. The impact to channel stability must be evaluated and addressed if this alternative is implemented. Constructing a cross channel grade control with rock is one option to control the local erosion. Another approach is to include a transition zone between the mined and unmined areas. The stability of this transition zone can be evaluated using engineering methods during design. Larger cobble to boulder sized material may be required along the streambed to limit channel downcutting and bank erosion.

9.4. Summary

Short term impacts:

Short term reductions in flood risks were evaluated based on comparisons of the 100-year water surface elevation generated with the HEC-RAS hydraulic model. From these analyses a number of observations are made:

1. Reductions of excessive sediment source in the Hidden Valley area will have no impact in the immediate to short term on flood levels.
2. Removal of the RediMix Bridge will provide immediate and significant benefit to reducing flood risk.
3. Mining with the RediMix Bridge in place provides negligible reduction in water surface elevations.
4. Mining combined with removal of the RediMix Bridge provides a slight additional reduction in flood levels compared to removal of the bridge alone.

Long term impacts:

For all alternatives, deposition of gravels is expected to continue to occur, raising the streambed elevation. With time, flood capacity will be reduced and mitigated mining will be required at some time in the future to maintain current levels of flood conveyance.

9.5. Discussion and Conclusions

The study reach of Lemon Creek is located at a grade break where flows exit the more confined, higher gradient reaches from the mountains. As these flows enter the less confined, lower gradient reach between the Correction Center and the Glacier Highway, the energy and sediment transport potential are significantly reduced. This area would naturally be an alluvial fan where sediment is deposited, raising streambed elevations and continued lateral migration of the stream across the face of the fan. Continued deposition of gravel- and cobble-sized sediments would be expected along the lower gradient reaches of Lemon Creek. The results of this study indicate that deposition will continue to occur for all alternatives.

From the study the following priorities are recommended:

1. The highest priority is for CBJ to pursue removal of the RediMix Bridge. Removal of the bridge will provide immediate and significant reductions in flood water surface elevations. HEC-RAS model results indicate that the 100-year water surface elevation

will be below the Glacier Highway Bridge deck and will only exceed the top of bank in one location by less than 1 foot.

2. The second priority should be to reduce excessive erosion in the Hidden Valley area. This will provide benefits of reduced rates of deposition, decrease turbidity, decrease the volume of fines deposited in the Gastineau Channel and result in fewer fines in spawning gravels. Reducing excessive erosion along the Hidden Valley supply reach will increase the interval between in stream maintenance operations along the lower Lemon Creek. In addition, methods to increase flow roughness along gravel bars to store sediment and encourage establishment of vegetation have been presented to restore natural stream-forested terrace processes.

3. Over the long term, deposition of gravels will continue for all Alternatives in response to flood events. Therefore, in order to maintain flood conveyance capacity, maintenance mining will be required at some point in time. Methods to construct aquatic habitat following removal of in stream gravels have been presented.

Table 4. Sediment budget/estimates of deposition(+) or erosion (-) trends using Schoklitsch eqr

Notes: 1) Indice value equal 0 indicate sediment transport capability of reach is in equilibrium with upstream supply
2) Values shall only be used as an indicator of relative depostional or erosional trends

Event	Existing channel RediMix Bridge in place Upstream high banks eroding	Existing channel RediMix Bridge in place Upstream high banks protected	Existing Channel RediMix Bridge Removed Upstream high banks protected	Mining from XS 4 to 13, RediMix Bridge Removed Upstream high banks protected
	Reach A			
2-yr	-1.23	-1.23	1.45	-0.96
5-yr	-7.25	-7.25	0.71	-4.79
25-yr	-9.91	-9.91	0.52	-6.53
50-yr	-11.52	-11.52	-0.20	-8.16
100-yr	-12.33	-12.33	-0.57	-8.97
	Reach B			
2-yr	0.02	0.02	-1.10	-0.42
5-yr	-0.13	-0.13	-2.79	-1.27
25-yr	-0.16	-0.16	-3.55	-1.58
50-yr	-0.16	-0.16	-3.94	-1.76
100-yr	-0.17	-0.17	-4.12	-1.85
	Reach C			
2-yr	0.96	0.96	0.84	5.72
5-yr	1.40	1.40	1.38	13.19
25-yr	1.50	1.50	1.53	15.70
50-yr	1.51	1.51	1.63	15.74
100-yr	1.51	1.51	1.67	15.70
	Reach D			
2-yr	1.11	1.11	1.13	-0.63
5-yr	1.98	1.98	1.92	-3.47
25-yr	2.35	2.35	2.23	-4.37
50-yr	2.59	2.59	2.42	-4.17
100-yr	2.70	2.70	2.51	-4.04
	Reach E			
2-yr	5.91	1.51	1.51	0.59
5-yr	4.76	0.22	0.22	-0.82
25-yr	4.10	-0.37	-0.37	-1.41
50-yr	3.73	-0.71	-0.71	-1.75
100-yr	3.55	-0.87	-0.87	-1.90
	Reaches F - I			
2-yr	transp	transp	transp	transp
5-yr	transp	transp	transp	transp
25-yr	transp	transp	transp	transp
50-yr	transp	transp	transp	transp
100-yr	transp	transp	transp	transp
	XS 48 (Rch I)			
2-yr	Supply	supply	supply	supply
5-yr	Supply	supply	supply	supply
25-yr	Supply	supply	supply	supply
50-yr	Supply	supply	supply	supply
100-yr	Supply	supply	supply	supply

Figure 16 – Water surface Profiles: 1) Existing Conditions, 2) Existing Channel with RediMix Bridge removed.

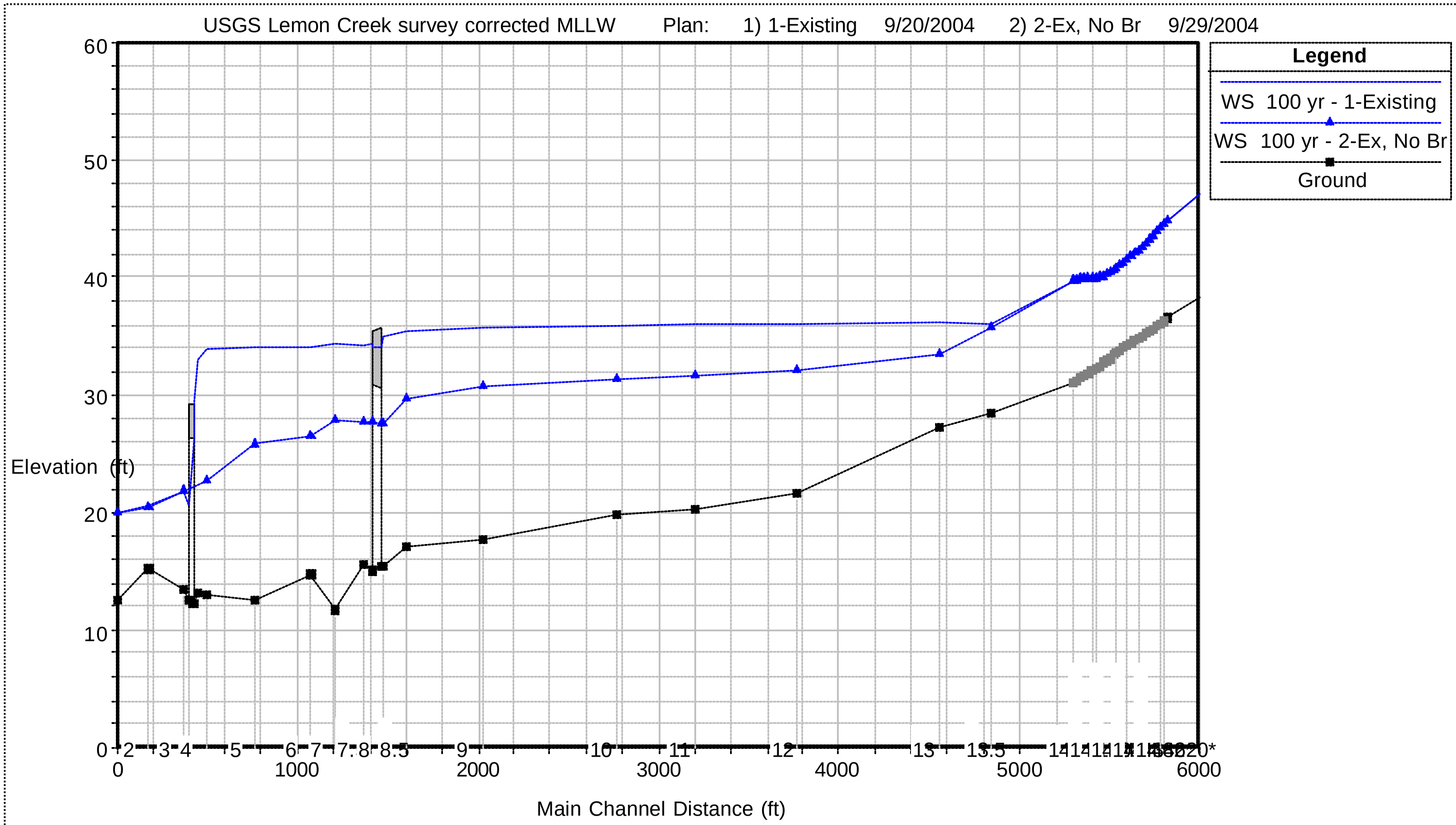


Table 5. Water Surface Elevations

Plans: 1-Existing **Existing conditions**
2-Ex, No Br **Existing channel with RediMix Bridge removed**

Station	2 yr			5 yr (est)			25 yr			50 yr			100 yr		
	1-Existing	2-Ex, No Br	Change	1-Existing	2-Ex, No Br	Change	1-Existing	2-Ex, No Br	Change	1-Existing	2-Ex, No Br	Change	1-Existing	2-Ex, No Br	Change
1	20	20	0.0	20	20	0.0	20	20	0.0	20	20	0.0	20	20	0.0
2	19.74	19.74	0.0	20.06	20.06	0.0	20.86	20.58	-0.3	20.63	20.49	-0.1	20.53	20.45	-0.1
3	20.59	20.59	0.0	19.55	21.12	1.6	21.18	21.5	0.3	21.62	21.76	0.1	21.81	21.89	0.1
3.2	18.27		--	19.29		--	20.2		--	20.5		--	20.62		--
3.3	22.24		--	23.95		--	28.25		--	26.3		--	29.5		--
3.5	25.64		--	28.14		--	31.6		--	31.91		--	32.88		--
4	26.52	21.01	-5.5	29.1	21.64	-7.5	32.58	22.36	-10.2	32.97	22.52	-10.5	33.88	22.61	-11.3
5	26.72	22.55	-4.2	29.31	23.71	-5.6	32.8	25.17	-7.6	33.22	25.56	-7.7	34.11	25.74	-8.4
6	26.82	23.58	-3.2	29.34	24.64	-4.7	32.78	25.92	-6.9	33.19	26.25	-6.9	34.08	26.4	-7.7
7	27.14	24.43	-2.7	29.68	25.72	-4.0	33.1	27.28	-5.8	33.53	27.68	-5.9	34.39	27.87	-6.5
7.5	27.11	24.52	-2.6	29.61	25.73	-3.9	32.99	27.17	-5.8	33.41	27.54	-5.9	34.27	27.71	-6.6
7.8	27.12	24.56	-2.6	29.61	25.76	-3.9	33	27.19	-5.8	33.42	27.56	-5.9	34.28	27.73	-6.6
8	27.08	24.5	-2.6	29.56	25.65	-3.9	33.49	27.04	-6.5	34.04	27.4	-6.6	35.04	27.56	-7.5
8.5	27.67	25.81	-1.9	30.13	27.29	-2.8	33.92	29.03	-4.9	34.48	29.47	-5.0	35.43	29.68	-5.8
9	28.13	26.65	-1.5	30.56	28.19	-2.4	34.28	29.99	-4.3	34.86	30.45	-4.4	35.78	30.66	-5.1
10	28.6	27.58	-1.0	30.88	28.96	-1.9	34.47	30.66	-3.8	35.04	31.09	-4.0	35.94	31.3	-4.6
11	28.97	28.2	-0.8	31.12	29.48	-1.6	34.61	31.09	-3.5	35.18	31.51	-3.7	36.06	31.71	-4.4
12	29.45	29.01	-0.4	31.35	30.06	-1.3	34.7	31.5	-3.2	35.27	31.89	-3.4	36.13	32.07	-4.1
13	31.85	32.1	0.3	32.34	32.46	0.1	34.99	33.09	-1.9	35.52	33.31	-2.2	36.32	33.42	-2.9
13.5	34.73	34.56	-0.2	35.22	35.13	-0.1	35.57	35.63	0.1	35.75	35.75	0.0	36.04	35.83	-0.2
14	37.59	37.62	0.0	38.41	38.43	0.0	39.45	39.43	0.0	39.69	39.68	0.0	39.74	39.8	0.1
14.5	43.23	43.23	0.0	43.83	43.83	0.0	44.5	44.5	0.0	44.67	44.67	0.0	44.74	44.74	0.0
15	45.77	45.77	0.0	46.52	46.52	0.0	47.36	47.36	0.0	47.56	47.56	0.0	47.66	47.66	0.0
15.5	48.96	48.96	0.0	49.9	49.9	0.0	51.02	51.02	0.0	51.27	51.27	0.0	51.39	51.39	0.0
15.8	55.76	55.76	0.0	56.73	56.73	0.0	57.72	57.72	0.0	58.08	58.08	0.0	58.23	58.23	0.0
16	60.04	60.04	0.0	61.07	61.07	0.0	62.4	62.4	0.0	62.58	62.58	0.0	62.7	62.7	0.0
17	64.87	64.87	0.0	66.08	66.08	0.0	67.48	67.48	0.0	67.82	67.82	0.0	67.98	67.98	0.0
17.5	67.42	67.42	0.0	68.64	68.64	0.0	70.01	70.01	0.0	70.34	70.34	0.0	70.49	70.49	0.0
18	72.39	72.39	0.0	73.46	73.46	0.0	74.75	74.75	0.0	75.06	75.06	0.0	75.22	75.22	0.0
19	78.73	78.73	0.0	80.07	80.07	0.0	81.56	81.56	0.0	81.93	81.93	0.0	82.09	82.09	0.0
20	80.79	80.79	0.0	82.1	82.1	0.0	83.59	83.59	0.0	83.96	83.96	0.0	84.13	84.13	0.0
21	84.72	84.72	0.0	85.91	85.91	0.0	87.33	87.33	0.0	87.67	87.67	0.0	87.81	87.81	0.0
22	89.26	89.26	0.0	90.59	90.59	0.0	92.11	92.11	0.0	92.49	92.49	0.0	92.67	92.67	0.0
23	91.4	91.4	0.0	92.77	92.77	0.0	94.32	94.32	0.0	94.7	94.7	0.0	94.88	94.88	0.0
24	95.52	95.52	0.0	97.11	97.11	0.0	98.94	98.94	0.0	99.4	99.4	0.0	99.61	99.61	0.0
25	96.9	96.9	0.0	98.66	98.66	0.0	100.74	100.74	0.0	101.26	101.26	0.0	101.5	101.5	0.0
26	96.77	96.77	0.0	98.53	98.53	0.0	100.61	100.61	0.0	101.14	101.14	0.0	101.38	101.38	0.0
27	96.41	96.41	0.0	97.94	97.94	0.0	99.85	99.85	0.0	100.33	100.33	0.0	100.56	100.56	0.0
28	96.59	96.59	0.0	98.11	98.11	0.0	100	100	0.0	100.47	100.47	0.0	100.7	100.7	0.0
29	98.55	98.55	0.0	100.24	100.24	0.0	102.42	102.42	0.0	102.96	102.96	0.0	103.21	103.21	0.0
30	98.19	98.19	0.0	99.67	99.67	0.0	101.54	101.54	0.0	102.05	102.05	0.0	102.29	102.29	0.0
31	101.55	101.55	0.0	102.85	102.85	0.0	104.12	104.12	0.0	104.39	104.39	0.0	104.53	104.53	0.0

Table 6. Channel Flow Velocity (fps)

Plans: 1-Existing **Existing**
2-Ex, No Br **Existing channel with RediMix Bridge removed**

Station	2 yr			5 yr (est)			25 yr			50 yr			100 yr		
	1-Existing	2-Ex, No Br	Change	1-Existing	2-Ex, No Br	Change	1-Existing	2-Ex, No Br	Change	1-Existing	2-Ex, No Br	Change	1-Existing	2-Ex, No Br	Change
1	4.57	4.57	0.0	5.97	5.97	0.0	7.81	7.81	0.0	8.3	8.3	0.0	8.53	8.53	0.0
2	8.95	8.94	0.0	10.66	10.66	0.0	11.12	12	0.9	12.57	13.06	0.5	13.28	13.58	0.3
3	9.68	9.68	0.0	15.79	11.5	-4.3	14.87	14.09	-0.8	14.69	14.37	-0.3	14.66	14.46	-0.2
3.2	20.65		--	22.68		--	25.97		--	26.5		--	26.83		--
3.3	16.46		--	18.04		--	16.75		--	20.49		--	16.88		--
3.5	8.81		--	9.3		--	9.61		--	10.02		--	9.74		--
4	5.14	9.95	4.8	5.46	11.78	6.3	5.68	13.87	8.2	5.9	14.43	8.5	5.76	14.66	8.9
5	4.8	8.45	3.7	4.93	9.14	4.2	4.97	9.8	4.8	5.14	9.94	4.8	5	10.01	5.0
6	5.97	8.64	2.7	6.26	9.87	3.6	6.34	11.18	4.8	6.56	11.48	4.9	6.38	11.62	5.2
7	4.68	6.52	1.8	4.81	7.2	2.4	4.85	7.89	3.0	5.01	8.05	3.0	4.88	8.12	3.2
7.5	5.91	7.85	1.9	6.2	8.92	2.7	6.36	10.04	3.7	6.58	10.3	3.7	6.42	10.42	4.0
7.8	6.38	8.51	2.1	6.65	9.64	3.0	6.73	10.83	4.1	6.95	11.1	4.2	6.76	11.22	4.5
8	7.93	10.77	2.8	8.18	12.17	4.0	7.77	13.62	5.9	7.94	13.95	6.0	7.63	14.1	6.5
8.5	5.35	6.65	1.3	5.51	7.28	1.8	5.42	7.97	2.6	5.56	8.12	2.6	5.39	8.19	2.8
9	3.99	4.94	1.0	3.94	5.18	1.2	3.7	5.47	1.8	3.76	5.54	1.8	3.62	5.57	2.0
10	3.95	4.72	0.8	3.76	4.88	1.1	3.44	5.06	1.6	3.48	5.1	1.6	3.34	5.12	1.8
11	3.64	4.22	0.6	3.42	4.36	0.9	3.04	4.48	1.4	3.07	4.51	1.4	2.93	4.53	1.6
12	5.03	5.64	0.6	4.49	5.73	1.2	3.74	5.72	2.0	3.75	5.72	2.0	3.54	5.72	2.2
13	8	7.3	-0.7	8.77	8.42	-0.4	6.07	9.16	3.1	5.88	9.2	3.3	5.36	9.2	3.8
13.5	8.66	9.08	0.4	9.97	10.2	0.2	12.01	11.86	-0.2	12.26	12.26	0.0	11.84	12.38	0.5
14	4.22	4.19	0.0	4.6	4.58	0.0	4.97	4.99	0.0	5.08	5.08	0.0	5.17	5.13	0.0
14.5	8.96	8.96	0.0	9.86	9.86	0.0	10.89	10.89	0.0	11.15	11.15	0.0	11.27	11.27	0.0
15	7.04	7.04	0.0	8.04	8.04	0.0	9.28	9.28	0.0	9.53	9.53	0.0	9.65	9.65	0.0
15.5	8.45	8.45	0.0	9.26	9.26	0.0	10.12	10.12	0.0	10.37	10.37	0.0	10.48	10.48	0.0
15.8	10.18	10.18	0.0	11.23	11.23	0.0	12.7	12.7	0.0	12.76	12.76	0.0	12.83	12.83	0.0
16	11.25	11.25	0.0	12.21	12.21	0.0	12.98	12.98	0.0	13.42	13.42	0.0	13.57	13.57	0.0
17	10.91	10.91	0.0	12.08	12.08	0.0	13.36	13.36	0.0	13.66	13.66	0.0	13.81	13.81	0.0
17.5	12.81	12.81	0.0	14.44	14.44	0.0	16.24	16.24	0.0	16.68	16.68	0.0	16.88	16.88	0.0
18	14.34	14.34	0.0	15.66	15.66	0.0	16.95	16.95	0.0	17.29	17.29	0.0	17.41	17.41	0.0
19	11.24	11.24	0.0	12.23	12.23	0.0	13.37	13.37	0.0	13.63	13.63	0.0	13.76	13.76	0.0
20	13.53	13.53	0.0	13.62	13.62	0.0	13.98	13.98	0.0	14.09	14.09	0.0	14.15	14.15	0.0
21	15.03	15.03	0.0	16.38	16.38	0.0	17.81	17.81	0.0	18.18	18.18	0.0	18.37	18.37	0.0
22	11.81	11.81	0.0	13.12	13.12	0.0	14.58	14.58	0.0	14.92	14.92	0.0	15.06	15.06	0.0
23	12.9	12.9	0.0	14.38	14.38	0.0	16.04	16.04	0.0	16.44	16.44	0.0	16.63	16.63	0.0
24	8.96	8.96	0.0	9.78	9.78	0.0	10.72	10.72	0.0	10.94	10.94	0.0	11.04	11.04	0.0
25	5.02	5.02	0.0	5.02	5.02	0.0	5.11	5.11	0.0	5.13	5.13	0.0	5.15	5.15	0.0
26	7.5	7.5	0.0	7.2	7.2	0.0	7.07	7.07	0.0	7.06	7.06	0.0	7.06	7.06	0.0
27	12.17	12.17	0.0	12.72	12.72	0.0	13.26	13.26	0.0	13.39	13.39	0.0	13.46	13.46	0.0
28	12.14	12.14	0.0	12.59	12.59	0.0	13.1	13.1	0.0	13.24	13.24	0.0	13.3	13.3	0.0
29	7.1	7.1	0.0	6.72	6.72	0.0	5.66	5.66	0.0	5.53	5.53	0.0	5.47	5.47	0.0
30	10.74	10.74	0.0	11.13	11.13	0.0	11.42	11.42	0.0	11.44	11.44	0.0	11.44	11.44	0.0
31	9.21	9.21	0.0	9.1	9.1	0.0	9.52	9.52	0.0	9.69	9.69	0.0	9.76	9.76	0.0

Table 7. Bed Shear (psf)

Plans: 1-Existing **Existing**
2-Ex, No Br **Existing channel with RediMix Bridge removed**

Station	2 yr			5 yr (est)			25 yr			50 yr			100 yr		
	1-Existing	2-Ex, No Br	Change	1-Existing	2-Ex, No Br	Change	1-Existing	2-Ex, No Br	Change	1-Existing	2-Ex, No Br	Change	1-Existing	2-Ex, No Br	Change
1	0.33	0.33	0.0	0.57	0.57	0.0	0.97	0.97	0.0	1.1	1.1	0.0	1.16	1.16	0.0
2	1.35	1.35	0.0	1.86	1.86	0.0	1.9	2.26	0.4	2.47	2.7	0.2	2.78	2.93	0.2
3	1.37	1.37	0.0	3.92	1.88	-2.0	3.12	2.76	-0.4	2.97	2.83	-0.1	2.94	2.84	-0.1
3.2	6.57		--	7.48		--	9.39		--	9.64		--	9.84		--
3.3	3.47		--	3.93		--	3.02		--	4.74		--	2.99		--
3.5	0.88		--	0.92		--	0.91		--	0.99		--	0.91		--
4	0.3	1.39	1.1	0.31	1.88	1.6	0.32	2.52	2.2	0.34	2.71	2.4	0.32	2.79	2.5
5	0.38	1.4	1.0	0.37	1.55	1.2	0.35	1.67	1.3	0.37	1.69	1.3	0.34	1.7	1.4
6	0.56	1.33	0.8	0.58	1.66	1.1	0.55	2.03	1.5	0.58	2.12	1.5	0.54	2.16	1.6
7	0.36	0.78	0.4	0.36	0.9	0.5	0.33	1.03	0.7	0.35	1.06	0.7	0.33	1.07	0.7
7.5	0.55	1.07	0.5	0.57	1.32	0.8	0.56	1.6	1.0	0.59	1.66	1.1	0.55	1.69	1.1
7.8	0.65	1.26	0.6	0.65	1.54	0.9	0.62	1.85	1.2	0.66	1.93	1.3	0.61	1.96	1.4
8	0.98	1.98	1.0	0.98	2.42	1.4	0.81	2.9	2.1	0.84	3.01	2.2	0.76	3.06	2.3
8.5	0.46	0.75	0.3	0.45	0.86	0.4	0.4	0.97	0.6	0.42	1	0.6	0.38	1.01	0.6
9	0.27	0.45	0.2	0.25	0.46	0.2	0.2	0.48	0.3	0.2	0.49	0.3	0.18	0.49	0.3
10	0.29	0.44	0.2	0.24	0.44	0.2	0.18	0.44	0.3	0.18	0.44	0.3	0.16	0.44	0.3
11	0.26	0.36	0.1	0.21	0.36	0.2	0.14	0.35	0.2	0.14	0.35	0.2	0.13	0.35	0.2
12	0.43	0.56	0.1	0.3	0.53	0.2	0.18	0.49	0.3	0.18	0.48	0.3	0.16	0.47	0.3
13	1.82	1.47	-0.4	2.06	1.87	-0.2	0.8	2.09	1.3	0.73	2.07	1.3	0.58	2.05	1.5
13.5	2.19	2.44	0.3	2.79	2.94	0.2	3.95	3.83	-0.1	4.06	4.06	0.0	3.71	4.12	0.4
14	0.63	0.62	0.0	0.71	0.7	0.0	0.78	0.78	0.0	0.8	0.8	0.0	0.83	0.81	0.0
14.5	2.99	2.99	0.0	3.45	3.45	0.0	4.02	4.02	0.0	4.17	4.17	0.0	4.24	4.24	0.0
15	2.37	2.37	0.0	2.98	2.98	0.0	3.83	3.83	0.0	4.01	4.01	0.0	4.09	4.09	0.0
15.5	3.61	3.61	0.0	4.12	4.12	0.0	4.67	4.67	0.0	4.85	4.85	0.0	4.94	4.94	0.0
15.8	6.06	6.06	0.0	7.03	7.03	0.0	8.61	8.61	0.0	8.56	8.56	0.0	8.62	8.62	0.0
16	8.8	8.8	0.0	9.99	9.99	0.0	10.82	10.82	0.0	11.51	11.51	0.0	11.72	11.72	0.0
17	8.51	8.51	0.0	9.93	9.93	0.0	11.54	11.54	0.0	11.94	11.94	0.0	12.13	12.13	0.0
17.5	13.54	13.54	0.0	16.58	16.58	0.0	20.18	20.18	0.0	21.1	21.1	0.0	21.53	21.53	0.0
18	18.96	18.96	0.0	21.58	21.58	0.0	24.07	24.07	0.0	24.8	24.8	0.0	25.01	25.01	0.0
19	10.47	10.47	0.0	11.92	11.92	0.0	13.72	13.72	0.0	14.12	14.12	0.0	14.35	14.35	0.0
20	16.88	16.88	0.0	16.2	16.2	0.0	16.19	16.19	0.0	16.24	16.24	0.0	16.29	16.29	0.0
21	20.57	20.57	0.0	23.26	23.26	0.0	26.1	26.1	0.0	26.9	26.9	0.0	27.35	27.35	0.0
22	11.86	11.86	0.0	13.97	13.97	0.0	16.5	16.5	0.0	17.09	17.09	0.0	17.34	17.34	0.0
23	13.62	13.62	0.0	16.24	16.24	0.0	19.38	19.38	0.0	20.18	20.18	0.0	20.56	20.56	0.0
24	4.2	4.2	0.0	4.73	4.73	0.0	5.37	5.37	0.0	5.52	5.52	0.0	5.59	5.59	0.0
25	0.63	0.63	0.0	0.59	0.59	0.0	0.56	0.56	0.0	0.56	0.56	0.0	0.56	0.56	0.0
26	1.43	1.43	0.0	1.21	1.21	0.0	1.07	1.07	0.0	1.05	1.05	0.0	1.04	1.04	0.0
27	3.65	3.65	0.0	3.71	3.71	0.0	3.75	3.75	0.0	3.76	3.76	0.0	3.77	3.77	0.0
28	3.68	3.68	0.0	3.68	3.68	0.0	3.69	3.69	0.0	3.71	3.71	0.0	3.72	3.72	0.0
29	1.17	1.17	0.0	0.69	0.69	0.0	0.46	0.46	0.0	0.42	0.42	0.0	0.4	0.4	0.0
30	2.9	2.9	0.0	2.89	2.89	0.0	2.82	2.82	0.0	2.78	2.78	0.0	2.76	2.76	0.0
31	1.92	1.92	0.0	1.79	1.79	0.0	1.87	1.87	0.0	1.93	1.93	0.0	1.95	1.95	0.0

Figure 17 – Water surface Profiles: 1) Existing Conditions, 2) RediMix Bridge in place, mining above Glacier Highway (xs 8-13), 3) mining below Glacier Highway (XS 4 – 8).

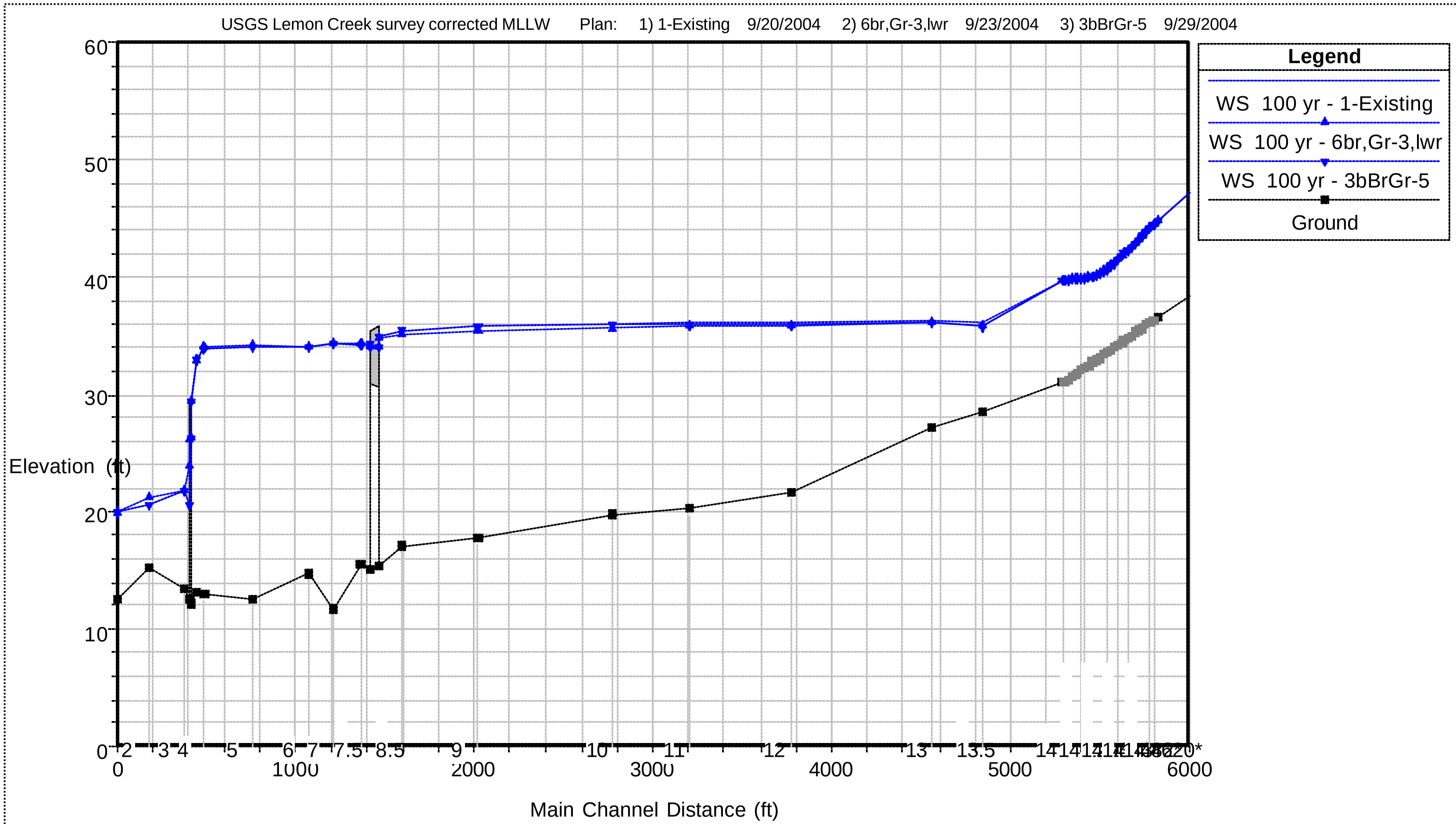


Table 8. Water Surface Elevations

Plans: 1-Existing **Existing conditions**
3bBrGr-5 **Mining above Glacier Highway with RediMix Bridge in place**

Station	2 yr			5 yr (est)			25 yr			50 yr			100 yr		
	1-Existing	3bBrGr-5	Change	1-Existing	3bBrGr-5	Change	1-Existing	3bBrGr-5	Change	1-Existing	3bBrGr-5	Change	1-Existing	3bBrGr-5	Change
1	20	20	0.0	20	20	0.0	20	20	0.0	20	20	0.0	20	20	0.0
2	19.74	19.74	0.0	20.06	20.06	0.0	20.86	20.86	0.0	20.63	20.63	0.0	20.53	20.53	0.0
3	20.59	20.59	0.0	19.55	19.55	0.0	21.18	21.18	0.0	21.62	21.62	0.0	21.81	21.81	0.0
3.2	18.27	18.27	0.0	19.29	19.29	0.0	20.2	20.2	0.0	20.5	20.5	0.0	20.62	20.62	0.0
3.3	22.24	22.24	0.0	23.95	23.95	0.0	28.25	28.25	0.0	26.3	26.3	0.0	29.5	29.5	0.0
3.5	25.64	25.64	0.0	28.14	28.14	0.0	31.6	31.6	0.0	31.91	31.91	0.0	32.88	32.88	0.0
4	26.52	26.52	0.0	29.1	29.1	0.0	32.58	32.58	0.0	32.97	32.97	0.0	33.88	33.88	0.0
5	26.72	26.72	0.0	29.31	29.31	0.0	32.8	32.8	0.0	33.22	33.22	0.0	34.11	34.11	0.0
6	26.82	26.82	0.0	29.34	29.34	0.0	32.78	32.78	0.0	33.19	33.19	0.0	34.08	34.08	0.0
7	27.14	27.14	0.0	29.68	29.68	0.0	33.1	33.1	0.0	33.53	33.53	0.0	34.39	34.39	0.0
7.5	27.11	27.11	0.0	29.61	29.61	0.0	32.99	32.99	0.0	33.41	33.41	0.0	34.27	34.27	0.0
7.8	27.12	27.12	0.0	29.61	29.61	0.0	33	33	0.0	33.42	33.42	0.0	34.28	34.28	0.0
8	27.08	27.08	0.0	29.56	29.56	0.0	33.49	33.49	0.0	34.04	34.04	0.0	35.04	35.04	0.0
8.5	27.67	27.82	0.1	30.13	30.28	0.2	33.92	34.04	0.1	34.48	34.6	0.1	35.43	35.54	0.1
9	28.13	28.02	-0.1	30.56	30.51	0.0	34.28	34.27	0.0	34.86	34.84	0.0	35.78	35.77	0.0
10	28.6	28.19	-0.4	30.88	30.66	-0.2	34.47	34.38	-0.1	35.04	34.96	-0.1	35.94	35.88	-0.1
11	28.97	28.28	-0.7	31.12	30.74	-0.4	34.61	34.45	-0.2	35.18	35.03	-0.1	36.06	35.94	-0.1
12	29.45	28.35	-1.1	31.35	30.79	-0.6	34.7	34.48	-0.2	35.27	35.06	-0.2	36.13	35.97	-0.2
13	31.85	28.57	-3.3	32.34	30.92	-1.4	34.99	34.55	-0.4	35.52	35.13	-0.4	36.32	36.02	-0.3
13.5	34.73	34.15	-0.6	35.22	34.8	-0.4	35.57	35.57	0.0	35.75	35.75	0.0	36.04	35.83	-0.2
14	37.59	37.73	0.1	38.41	38.52	0.1	39.45	39.45	0.0	39.69	39.69	0.0	39.74	39.8	0.1
14.5	43.23	43.23	0.0	43.83	43.83	0.0	44.5	44.5	0.0	44.67	44.67	0.0	44.74	44.74	0.0
15	45.77	45.77	0.0	46.52	46.52	0.0	47.36	47.36	0.0	47.56	47.56	0.0	47.66	47.66	0.0
15.5	48.96	48.96	0.0	49.9	49.9	0.0	51.02	51.02	0.0	51.27	51.27	0.0	51.39	51.39	0.0
15.8	55.76	55.76	0.0	56.73	56.73	0.0	57.72	57.72	0.0	58.08	58.08	0.0	58.23	58.23	0.0
16	60.04	60.04	0.0	61.07	61.07	0.0	62.4	62.4	0.0	62.58	62.58	0.0	62.7	62.7	0.0
17	64.87	64.87	0.0	66.08	66.08	0.0	67.48	67.48	0.0	67.82	67.82	0.0	67.98	67.98	0.0
17.5	67.42	67.42	0.0	68.64	68.64	0.0	70.01	70.01	0.0	70.34	70.34	0.0	70.49	70.49	0.0
18	72.39	72.39	0.0	73.46	73.46	0.0	74.75	74.75	0.0	75.06	75.06	0.0	75.22	75.22	0.0
19	78.73	78.73	0.0	80.07	80.07	0.0	81.56	81.56	0.0	81.93	81.93	0.0	82.09	82.09	0.0
20	80.79	80.79	0.0	82.1	82.1	0.0	83.59	83.59	0.0	83.96	83.96	0.0	84.13	84.13	0.0
21	84.72	84.72	0.0	85.91	85.91	0.0	87.33	87.33	0.0	87.67	87.67	0.0	87.81	87.81	0.0
22	89.26	89.26	0.0	90.59	90.59	0.0	92.11	92.11	0.0	92.49	92.49	0.0	92.67	92.67	0.0
23	91.4	91.4	0.0	92.77	92.77	0.0	94.32	94.32	0.0	94.7	94.7	0.0	94.88	94.88	0.0
24	95.52	95.52	0.0	97.11	97.11	0.0	98.94	98.94	0.0	99.4	99.4	0.0	99.61	99.61	0.0
25	96.9	96.9	0.0	98.66	98.66	0.0	100.74	100.74	0.0	101.26	101.26	0.0	101.5	101.5	0.0
26	96.77	96.77	0.0	98.53	98.53	0.0	100.61	100.61	0.0	101.14	101.14	0.0	101.38	101.38	0.0
27	96.41	96.41	0.0	97.94	97.94	0.0	99.85	99.85	0.0	100.33	100.33	0.0	100.56	100.56	0.0
28	96.59	96.59	0.0	98.11	98.11	0.0	100	100	0.0	100.47	100.47	0.0	100.7	100.7	0.0
29	98.55	98.55	0.0	100.24	100.24	0.0	102.42	102.42	0.0	102.96	102.96	0.0	103.21	103.21	0.0
30	98.19	98.19	0.0	99.67	99.67	0.0	101.54	101.54	0.0	102.05	102.05	0.0	102.29	102.29	0.0
31	101.55	101.55	0.0	102.85	102.85	0.0	104.12	104.12	0.0	104.39	104.39	0.0	104.53	104.53	0.0

Table 9. Water Surface Elevations

Plans: 1-Existing **Existing conditions**
6br,Gr-3,lwr **Mining below Glacier Highway with RediMix Bridge in place**

Station	2 yr			5 yr (est)			25 yr			50 yr			100 yr		
	1-Existing	6br,Gr-3,lwr	Change	1-Existing	6br,Gr-3,lwr	Change	1-Existing	6br,Gr-3,lwr	Change	1-Existing	6br,Gr-3,lwr	Change	1-Existing	6br,Gr-3,lwr	Change
1	20	20	0.0	20	20	0.0	20	20	0.0	20	20	0.0	20	20	0.0
2	19.74	19.74	0.0	20.06	20.06	0.0	20.86	20.92	0.1	20.63	21.08	0.4	20.53	21.16	0.6
3	20.59	20.59	0.0	19.55	21.12	1.6	21.18	21.5	0.3	21.62	21.76	0.1	21.81	21.89	0.1
3.2	18.27	20.38	2.1	19.29	21.57	2.3	20.2	23.24	3.0	20.5	23.68	3.2	20.62	23.89	3.3
3.3	22.24	22.24	0.0	23.95	23.95	0.0	28.25	28.25	0.0	26.3	26.3	0.0	29.5	29.5	0.0
3.5	25.64	25.64	0.0	28.14	28.14	0.0	31.6	31.6	0.0	31.91	31.91	0.0	32.88	32.88	0.0
4	26.52	26.62	0.1	29.1	29.19	0.1	32.58	32.66	0.1	32.97	33.06	0.1	33.88	33.96	0.1
5	26.72	26.76	0.0	29.31	29.36	0.1	32.8	32.84	0.0	33.22	33.26	0.0	34.11	34.15	0.0
6	26.82	26.79	0.0	29.34	29.35	0.0	32.78	32.81	0.0	33.19	33.22	0.0	34.08	34.11	0.0
7	27.14	27	-0.1	29.68	29.59	-0.1	33.1	33.05	-0.1	33.53	33.48	-0.1	34.39	34.35	0.0
7.5	27.11	27	-0.1	29.61	29.56	-0.1	32.99	32.99	0.0	33.41	33.41	0.0	34.27	34.28	0.0
7.8	27.12	26.98	-0.1	29.61	29.53	-0.1	33	32.96	0.0	33.42	33.39	0.0	34.28	34.26	0.0
8	27.08	26.95	-0.1	29.56	29.49	-0.1	33.49	33.31	-0.2	34.04	33.83	-0.2	35.04	34.81	-0.2
8.5	27.67	27.25	-0.4	30.13	29.83	-0.3	33.92	33.61	-0.3	34.48	34.14	-0.3	35.43	35.09	-0.3
9	28.13	27.77	-0.4	30.56	30.29	-0.3	34.28	34	-0.3	34.86	34.54	-0.3	35.78	35.46	-0.3
10	28.6	28.33	-0.3	30.88	30.64	-0.2	34.47	34.2	-0.3	35.04	34.74	-0.3	35.94	35.63	-0.3
11	28.97	28.74	-0.2	31.12	30.9	-0.2	34.61	34.35	-0.3	35.18	34.89	-0.3	36.06	35.76	-0.3
12	29.45	29.3	-0.1	31.35	31.16	-0.2	34.7	34.45	-0.3	35.27	34.98	-0.3	36.13	35.83	-0.3
13	31.85	31.93	0.1	32.34	32.3	0.0	34.99	34.77	-0.2	35.52	35.27	-0.3	36.32	36.05	-0.3
13.5	34.73	34.67	-0.1	35.22	35.25	0.0	35.57	35.57	0.0	35.75	35.75	0.0	36.04	35.83	-0.2
14	37.59	37.6	0.0	38.41	38.41	0.0	39.45	39.45	0.0	39.69	39.69	0.0	39.74	39.8	0.1
14.5	43.23	43.23	0.0	43.83	43.83	0.0	44.5	44.5	0.0	44.67	44.67	0.0	44.74	44.74	0.0
15	45.77	45.77	0.0	46.52	46.52	0.0	47.36	47.36	0.0	47.56	47.56	0.0	47.66	47.66	0.0
15.5	48.96	48.96	0.0	49.9	49.9	0.0	51.02	51.02	0.0	51.27	51.27	0.0	51.39	51.39	0.0
15.8	55.76	55.76	0.0	56.73	56.73	0.0	57.72	57.72	0.0	58.08	58.08	0.0	58.23	58.23	0.0
16	60.04	60.04	0.0	61.07	61.07	0.0	62.4	62.4	0.0	62.58	62.58	0.0	62.7	62.7	0.0
17	64.87	64.87	0.0	66.08	66.08	0.0	67.48	67.48	0.0	67.82	67.82	0.0	67.98	67.98	0.0
17.5	67.42	67.42	0.0	68.64	68.64	0.0	70.01	70.01	0.0	70.34	70.34	0.0	70.49	70.49	0.0
18	72.39	72.39	0.0	73.46	73.46	0.0	74.75	74.75	0.0	75.06	75.06	0.0	75.22	75.22	0.0
19	78.73	78.73	0.0	80.07	80.07	0.0	81.56	81.56	0.0	81.93	81.93	0.0	82.09	82.09	0.0
20	80.79	80.79	0.0	82.1	82.1	0.0	83.59	83.59	0.0	83.96	83.96	0.0	84.13	84.13	0.0
21	84.72	84.72	0.0	85.91	85.91	0.0	87.33	87.33	0.0	87.67	87.67	0.0	87.81	87.81	0.0
22	89.26	89.26	0.0	90.59	90.59	0.0	92.11	92.11	0.0	92.49	92.49	0.0	92.67	92.67	0.0
23	91.4	91.4	0.0	92.77	92.77	0.0	94.32	94.32	0.0	94.7	94.7	0.0	94.88	94.88	0.0
24	95.52	95.52	0.0	97.11	97.11	0.0	98.94	98.94	0.0	99.4	99.4	0.0	99.61	99.61	0.0
25	96.9	96.9	0.0	98.66	98.66	0.0	100.74	100.74	0.0	101.26	101.26	0.0	101.5	101.5	0.0
26	96.77	96.77	0.0	98.53	98.53	0.0	100.61	100.61	0.0	101.14	101.14	0.0	101.38	101.38	0.0
27	96.41	96.41	0.0	97.94	97.94	0.0	99.85	99.85	0.0	100.33	100.33	0.0	100.56	100.56	0.0
28	96.59	96.59	0.0	98.11	98.11	0.0	100	100	0.0	100.47	100.47	0.0	100.7	100.7	0.0
29	98.55	98.55	0.0	100.24	100.24	0.0	102.42	102.42	0.0	102.96	102.96	0.0	103.21	103.21	0.0
30	98.19	98.19	0.0	99.67	99.67	0.0	101.54	101.54	0.0	102.05	102.05	0.0	102.29	102.29	0.0
31	101.55	101.55	0.0	102.85	102.85	0.0	104.12	104.12	0.0	104.39	104.39	0.0	104.53	104.53	0.0

Table 10. Channel Flow Velocity (fps)

Plans: 1-Existing **Existing**
3bBrGr-5 **Mining above Glacier Highway with RediMix Bridge in place**

Station	2 yr			5 yr (est)			25 yr			50 yr			100 yr		
	1-Existing	3bBrGr-5	Change	1-Existing	3bBrGr-5	Change	1-Existing	3bBrGr-5	Change	1-Existing	3bBrGr-5	Change	1-Existing	3bBrGr-5	Change
1	4.57	4.57	0.0	5.97	5.97	0.0	7.81	7.81	0.0	8.3	8.3	0.0	8.53	8.53	0.0
2	8.95	8.95	0.0	10.66	10.66	0.0	11.12	11.12	0.0	12.57	12.57	0.0	13.28	13.28	0.0
3	9.68	9.68	0.0	15.79	15.79	0.0	14.87	14.87	0.0	14.69	14.69	0.0	14.66	14.66	0.0
3.2	20.65	20.65	0.0	22.68	22.68	0.0	25.97	25.97	0.0	26.5	26.5	0.0	26.83	26.83	0.0
3.3	16.46	16.46	0.0	18.04	18.04	0.0	16.75	16.75	0.0	20.49	20.49	0.0	16.88	16.88	0.0
3.5	8.81	8.81	0.0	9.3	9.3	0.0	9.61	9.61	0.0	10.02	10.02	0.0	9.74	9.74	0.0
4	5.14	5.14	0.0	5.46	5.46	0.0	5.68	5.68	0.0	5.9	5.9	0.0	5.76	5.76	0.0
5	4.8	4.8	0.0	4.93	4.93	0.0	4.97	4.97	0.0	5.14	5.14	0.0	5	5	0.0
6	5.97	5.97	0.0	6.26	6.26	0.0	6.34	6.34	0.0	6.56	6.56	0.0	6.38	6.38	0.0
7	4.68	4.68	0.0	4.81	4.81	0.0	4.85	4.85	0.0	5.01	5.01	0.0	4.88	4.88	0.0
7.5	5.91	5.91	0.0	6.2	6.2	0.0	6.36	6.36	0.0	6.58	6.58	0.0	6.42	6.42	0.0
7.8	6.38	6.38	0.0	6.65	6.65	0.0	6.73	6.73	0.0	6.95	6.95	0.0	6.76	6.76	0.0
8	7.93	7.93	0.0	8.18	8.18	0.0	7.77	7.77	0.0	7.94	7.94	0.0	7.63	7.63	0.0
8.5	5.35	3.88	-1.5	5.51	4.26	-1.3	5.42	4.45	-1.0	5.56	4.59	-1.0	5.39	4.5	-0.9
9	3.99	2.9	-1.1	3.94	3.06	-0.9	3.7	3.07	-0.6	3.76	3.15	-0.6	3.62	3.06	-0.6
10	3.95	2.5	-1.5	3.76	2.61	-1.2	3.44	2.61	-0.8	3.48	2.67	-0.8	3.34	2.6	-0.7
11	3.64	2.2	-1.4	3.42	2.27	-1.2	3.04	2.24	-0.8	3.07	2.29	-0.8	2.93	2.22	-0.7
12	5.03	2.69	-2.3	4.49	2.67	-1.8	3.74	2.55	-1.2	3.75	2.6	-1.2	3.54	2.51	-1.0
13	8	5.12	-2.9	8.77	4.22	-4.6	6.07	3.49	-2.6	5.88	3.5	-2.4	5.36	3.32	-2.0
13.5	8.66	10.29	1.6	9.97	11.1	1.1	12.01	12.01	0.0	12.26	12.26	0.0	11.84	12.38	0.5
14	4.22	4.08	-0.1	4.6	4.51	-0.1	4.97	4.97	0.0	5.08	5.08	0.0	5.17	5.13	0.0
14.5	8.96	8.96	0.0	9.86	9.86	0.0	10.89	10.89	0.0	11.15	11.15	0.0	11.27	11.27	0.0
15	7.04	7.04	0.0	8.04	8.04	0.0	9.28	9.28	0.0	9.53	9.53	0.0	9.65	9.65	0.0
15.5	8.45	8.45	0.0	9.26	9.26	0.0	10.12	10.12	0.0	10.37	10.37	0.0	10.48	10.48	0.0
15.8	10.18	10.18	0.0	11.23	11.23	0.0	12.7	12.7	0.0	12.76	12.76	0.0	12.83	12.83	0.0
16	11.25	11.25	0.0	12.21	12.21	0.0	12.98	12.98	0.0	13.42	13.42	0.0	13.57	13.57	0.0
17	10.91	10.91	0.0	12.08	12.08	0.0	13.36	13.36	0.0	13.66	13.66	0.0	13.81	13.81	0.0
17.5	12.81	12.81	0.0	14.44	14.44	0.0	16.24	16.24	0.0	16.68	16.68	0.0	16.88	16.88	0.0
18	14.34	14.34	0.0	15.66	15.66	0.0	16.95	16.95	0.0	17.29	17.29	0.0	17.41	17.41	0.0
19	11.24	11.24	0.0	12.23	12.23	0.0	13.37	13.37	0.0	13.63	13.63	0.0	13.76	13.76	0.0
20	13.53	13.53	0.0	13.62	13.62	0.0	13.98	13.98	0.0	14.09	14.09	0.0	14.15	14.15	0.0
21	15.03	15.03	0.0	16.38	16.38	0.0	17.81	17.81	0.0	18.18	18.18	0.0	18.37	18.37	0.0
22	11.81	11.81	0.0	13.12	13.12	0.0	14.58	14.58	0.0	14.92	14.92	0.0	15.06	15.06	0.0
23	12.9	12.9	0.0	14.38	14.38	0.0	16.04	16.04	0.0	16.44	16.44	0.0	16.63	16.63	0.0
24	8.96	8.96	0.0	9.78	9.78	0.0	10.72	10.72	0.0	10.94	10.94	0.0	11.04	11.04	0.0
25	5.02	5.02	0.0	5.02	5.02	0.0	5.11	5.11	0.0	5.13	5.13	0.0	5.15	5.15	0.0
26	7.5	7.5	0.0	7.2	7.2	0.0	7.07	7.07	0.0	7.06	7.06	0.0	7.06	7.06	0.0
27	12.17	12.17	0.0	12.72	12.72	0.0	13.26	13.26	0.0	13.39	13.39	0.0	13.46	13.46	0.0
28	12.14	12.14	0.0	12.59	12.59	0.0	13.1	13.1	0.0	13.24	13.24	0.0	13.3	13.3	0.0
29	7.1	7.1	0.0	6.72	6.72	0.0	5.66	5.66	0.0	5.53	5.53	0.0	5.47	5.47	0.0
30	10.74	10.74	0.0	11.13	11.13	0.0	11.42	11.42	0.0	11.44	11.44	0.0	11.44	11.44	0.0
31	9.21	9.21	0.0	9.1	9.1	0.0	9.52	9.52	0.0	9.69	9.69	0.0	9.76	9.76	0.0

Table 11. Channel Flow Velocity (fps)

Plans: 1-Existing **Existing**
6br,Gr-3,lwr **Mining below Glacier Highway with RediMix Bridge in place**

Station	2 yr			5 yr (est)			25 yr			50 yr			100 yr		
	1-Existing	6br,Gr-3,lwr	Change	1-Existing	6br,Gr-3,lwr	Change	1-Existing	6br,Gr-3,lwr	Change	1-Existing	6br,Gr-3,lwr	Change	1-Existing	6br,Gr-3,lwr	Change
1	4.57	4.57	0.0	5.97	5.97	0.0	7.81	7.81	0.0	8.3	8.3	0.0	8.53	8.53	0.0
2	8.95	8.95	0.0	10.66	10.66	0.0	11.12	10.95	-0.2	12.57	11.15	-1.4	13.28	11.25	-2.0
3	9.68	9.68	0.0	15.79	11.5	-4.3	14.87	14.09	-0.8	14.69	14.37	-0.3	14.66	14.46	-0.2
3.2	20.65	14.83	-5.8	22.68	16.72	-6.0	25.97	18.34	-7.6	26.5	18.69	-7.8	26.83	18.85	-8.0
3.3	16.46	16.46	0.0	18.04	18.04	0.0	16.75	16.75	0.0	20.49	20.49	0.0	16.88	16.88	0.0
3.5	8.81	8.81	0.0	9.3	9.3	0.0	9.61	9.61	0.0	10.02	10.02	0.0	9.74	9.74	0.0
4	5.14	4.46	-0.7	5.46	4.86	-0.6	5.68	5.18	-0.5	5.9	5.38	-0.5	5.76	5.29	-0.5
5	4.8	4.06	-0.7	4.93	4.31	-0.6	4.97	4.48	-0.5	5.14	4.65	-0.5	5	4.55	-0.5
6	5.97	5.17	-0.8	6.26	5.56	-0.7	6.34	5.78	-0.6	6.56	5.99	-0.6	6.38	5.85	-0.5
7	4.68	4.24	-0.4	4.81	4.43	-0.4	4.85	4.55	-0.3	5.01	4.71	-0.3	4.88	4.6	-0.3
7.5	5.91	4.92	-1.0	6.2	5.32	-0.9	6.36	5.62	-0.7	6.58	5.84	-0.7	6.42	5.72	-0.7
7.8	6.38	5.67	-0.7	6.65	6.02	-0.6	6.73	6.21	-0.5	6.95	6.43	-0.5	6.76	6.28	-0.5
8	7.93	6.76	-1.2	8.18	7.17	-1.0	7.77	7.11	-0.7	7.94	7.3	-0.6	7.63	7.07	-0.6
8.5	5.35	5.6	0.3	5.51	5.66	0.2	5.42	5.53	0.1	5.56	5.68	0.1	5.39	5.5	0.1
9	3.99	4.19	0.2	3.94	4.05	0.1	3.7	3.78	0.1	3.76	3.85	0.1	3.62	3.7	0.1
10	3.95	4.13	0.2	3.76	3.87	0.1	3.44	3.52	0.1	3.48	3.57	0.1	3.34	3.42	0.1
11	3.64	3.79	0.2	3.42	3.52	0.1	3.04	3.12	0.1	3.07	3.15	0.1	2.93	3	0.1
12	5.03	5.22	0.2	4.49	4.63	0.1	3.74	3.85	0.1	3.75	3.86	0.1	3.54	3.64	0.1
13	8	7.76	-0.2	8.77	8.89	0.1	6.07	6.32	0.3	5.88	6.14	0.3	5.36	5.58	0.2
13.5	8.66	8.8	0.1	9.97	9.9	-0.1	12.01	12.01	0.0	12.26	12.26	0.0	11.84	12.38	0.5
14	4.22	4.21	0.0	4.6	4.6	0.0	4.97	4.97	0.0	5.08	5.08	0.0	5.17	5.13	0.0
14.5	8.96	8.96	0.0	9.86	9.86	0.0	10.89	10.89	0.0	11.15	11.15	0.0	11.27	11.27	0.0
15	7.04	7.04	0.0	8.04	8.04	0.0	9.28	9.28	0.0	9.53	9.53	0.0	9.65	9.65	0.0
15.5	8.45	8.45	0.0	9.26	9.26	0.0	10.12	10.12	0.0	10.37	10.37	0.0	10.48	10.48	0.0
15.8	10.18	10.18	0.0	11.23	11.23	0.0	12.7	12.7	0.0	12.76	12.76	0.0	12.83	12.83	0.0
16	11.25	11.25	0.0	12.21	12.21	0.0	12.98	12.98	0.0	13.42	13.42	0.0	13.57	13.57	0.0
17	10.91	10.91	0.0	12.08	12.08	0.0	13.36	13.36	0.0	13.66	13.66	0.0	13.81	13.81	0.0
17.5	12.81	12.81	0.0	14.44	14.44	0.0	16.24	16.24	0.0	16.68	16.68	0.0	16.88	16.88	0.0
18	14.34	14.34	0.0	15.66	15.66	0.0	16.95	16.95	0.0	17.29	17.29	0.0	17.41	17.41	0.0
19	11.24	11.24	0.0	12.23	12.23	0.0	13.37	13.37	0.0	13.63	13.63	0.0	13.76	13.76	0.0
20	13.53	13.53	0.0	13.62	13.62	0.0	13.98	13.98	0.0	14.09	14.09	0.0	14.15	14.15	0.0
21	15.03	15.03	0.0	16.38	16.38	0.0	17.81	17.81	0.0	18.18	18.18	0.0	18.37	18.37	0.0
22	11.81	11.81	0.0	13.12	13.12	0.0	14.58	14.58	0.0	14.92	14.92	0.0	15.06	15.06	0.0
23	12.9	12.9	0.0	14.38	14.38	0.0	16.04	16.04	0.0	16.44	16.44	0.0	16.63	16.63	0.0
24	8.96	8.96	0.0	9.78	9.78	0.0	10.72	10.72	0.0	10.94	10.94	0.0	11.04	11.04	0.0
25	5.02	5.02	0.0	5.02	5.02	0.0	5.11	5.11	0.0	5.13	5.13	0.0	5.15	5.15	0.0
26	7.5	7.5	0.0	7.2	7.2	0.0	7.07	7.07	0.0	7.06	7.06	0.0	7.06	7.06	0.0
27	12.17	12.17	0.0	12.72	12.72	0.0	13.26	13.26	0.0	13.39	13.39	0.0	13.46	13.46	0.0
28	12.14	12.14	0.0	12.59	12.59	0.0	13.1	13.1	0.0	13.24	13.24	0.0	13.3	13.3	0.0
29	7.1	7.1	0.0	6.72	6.72	0.0	5.66	5.66	0.0	5.53	5.53	0.0	5.47	5.47	0.0
30	10.74	10.74	0.0	11.13	11.13	0.0	11.42	11.42	0.0	11.44	11.44	0.0	11.44	11.44	0.0
31	9.21	9.21	0.0	9.1	9.1	0.0	9.52	9.52	0.0	9.69	9.69	0.0	9.76	9.76	0.0

Table 12. Bed Shear (psf)

Plans: 1-Existing **Existing**
3bBrGr-5 **Mining above Glacier Highway with RediMix Bridge in place**

Station	2 yr			5 yr (est)			25 yr			50 yr			100 yr		
	1-Existing	3bBrGr-5	Change	1-Existing	3bBrGr-5	Change	1-Existing	3bBrGr-5	Change	1-Existing	3bBrGr-5	Change	1-Existing	3bBrGr-5	Change
1	0.33	0.33	0.0	0.57	0.57	0.0	0.97	0.97	0.0	1.1	1.1	0.0	1.16	1.16	0.0
2	1.35	1.35	0.0	1.86	1.86	0.0	1.9	1.9	0.0	2.47	2.47	0.0	2.78	2.78	0.0
3	1.37	1.37	0.0	3.92	3.92	0.0	3.12	3.12	0.0	2.97	2.97	0.0	2.94	2.94	0.0
3.2	6.57	6.57	0.0	7.48	7.48	0.0	9.39	9.39	0.0	9.64	9.64	0.0	9.84	9.84	0.0
3.3	3.47	3.47	0.0	3.93	3.93	0.0	3.02	3.02	0.0	4.74	4.74	0.0	2.99	2.99	0.0
3.5	0.88	0.88	0.0	0.92	0.92	0.0	0.91	0.91	0.0	0.99	0.99	0.0	0.91	0.91	0.0
4	0.3	0.3	0.0	0.31	0.31	0.0	0.32	0.32	0.0	0.34	0.34	0.0	0.32	0.32	0.0
5	0.38	0.38	0.0	0.37	0.37	0.0	0.35	0.35	0.0	0.37	0.37	0.0	0.34	0.34	0.0
6	0.56	0.56	0.0	0.58	0.58	0.0	0.55	0.55	0.0	0.58	0.58	0.0	0.54	0.54	0.0
7	0.36	0.36	0.0	0.36	0.36	0.0	0.33	0.33	0.0	0.35	0.35	0.0	0.33	0.33	0.0
7.5	0.55	0.55	0.0	0.57	0.57	0.0	0.56	0.56	0.0	0.59	0.59	0.0	0.55	0.55	0.0
7.8	0.65	0.65	0.0	0.65	0.65	0.0	0.62	0.62	0.0	0.66	0.66	0.0	0.61	0.61	0.0
8	0.98	0.98	0.0	0.98	0.98	0.0	0.81	0.81	0.0	0.84	0.84	0.0	0.76	0.76	0.0
8.5	0.46	0.22	-0.2	0.45	0.25	-0.2	0.4	0.26	-0.1	0.42	0.27	-0.2	0.38	0.26	-0.1
9	0.27	0.13	-0.1	0.25	0.14	-0.1	0.2	0.13	-0.1	0.2	0.13	-0.1	0.18	0.12	-0.1
10	0.29	0.1	-0.2	0.24	0.1	-0.1	0.18	0.09	-0.1	0.18	0.1	-0.1	0.16	0.09	-0.1
11	0.26	0.08	-0.2	0.21	0.08	-0.1	0.14	0.07	-0.1	0.14	0.07	-0.1	0.13	0.07	-0.1
12	0.43	0.1	-0.3	0.3	0.09	-0.2	0.18	0.07	-0.1	0.18	0.08	-0.1	0.16	0.07	-0.1
13	1.82	0.64	-1.2	2.06	0.38	-1.7	0.8	0.22	-0.6	0.73	0.22	-0.5	0.58	0.19	-0.4
13.5	2.19	3.26	1.1	2.79	3.58	0.8	3.95	3.95	0.0	4.06	4.06	0.0	3.71	4.12	0.4
14	0.63	0.59	0.0	0.71	0.68	0.0	0.78	0.78	0.0	0.8	0.8	0.0	0.83	0.81	0.0
14.5	2.99	2.99	0.0	3.45	3.45	0.0	4.02	4.02	0.0	4.17	4.17	0.0	4.24	4.24	0.0
15	2.37	2.37	0.0	2.98	2.98	0.0	3.83	3.83	0.0	4.01	4.01	0.0	4.09	4.09	0.0
15.5	3.61	3.61	0.0	4.12	4.12	0.0	4.67	4.67	0.0	4.85	4.85	0.0	4.94	4.94	0.0
15.8	6.06	6.06	0.0	7.03	7.03	0.0	8.61	8.61	0.0	8.56	8.56	0.0	8.62	8.62	0.0
16	8.8	8.8	0.0	9.99	9.99	0.0	10.82	10.82	0.0	11.51	11.51	0.0	11.72	11.72	0.0
17	8.51	8.51	0.0	9.93	9.93	0.0	11.54	11.54	0.0	11.94	11.94	0.0	12.13	12.13	0.0
17.5	13.54	13.54	0.0	16.58	16.58	0.0	20.18	20.18	0.0	21.1	21.1	0.0	21.53	21.53	0.0
18	18.96	18.96	0.0	21.58	21.58	0.0	24.07	24.07	0.0	24.8	24.8	0.0	25.01	25.01	0.0
19	10.47	10.47	0.0	11.92	11.92	0.0	13.72	13.72	0.0	14.12	14.12	0.0	14.35	14.35	0.0
20	16.88	16.88	0.0	16.2	16.2	0.0	16.19	16.19	0.0	16.24	16.24	0.0	16.29	16.29	0.0
21	20.57	20.57	0.0	23.26	23.26	0.0	26.1	26.1	0.0	26.9	26.9	0.0	27.35	27.35	0.0
22	11.86	11.86	0.0	13.97	13.97	0.0	16.5	16.5	0.0	17.09	17.09	0.0	17.34	17.34	0.0
23	13.62	13.62	0.0	16.24	16.24	0.0	19.38	19.38	0.0	20.18	20.18	0.0	20.56	20.56	0.0
24	4.2	4.2	0.0	4.73	4.73	0.0	5.37	5.37	0.0	5.52	5.52	0.0	5.59	5.59	0.0
25	0.63	0.63	0.0	0.59	0.59	0.0	0.56	0.56	0.0	0.56	0.56	0.0	0.56	0.56	0.0
26	1.43	1.43	0.0	1.21	1.21	0.0	1.07	1.07	0.0	1.05	1.05	0.0	1.04	1.04	0.0
27	3.65	3.65	0.0	3.71	3.71	0.0	3.75	3.75	0.0	3.76	3.76	0.0	3.77	3.77	0.0
28	3.68	3.68	0.0	3.68	3.68	0.0	3.69	3.69	0.0	3.71	3.71	0.0	3.72	3.72	0.0
29	1.17	1.17	0.0	0.69	0.69	0.0	0.46	0.46	0.0	0.42	0.42	0.0	0.4	0.4	0.0
30	2.9	2.9	0.0	2.89	2.89	0.0	2.82	2.82	0.0	2.78	2.78	0.0	2.76	2.76	0.0
31	1.92	1.92	0.0	1.79	1.79	0.0	1.87	1.87	0.0	1.93	1.93	0.0	1.95	1.95	0.0

Table 13. Bed Shear (psf)

Plans: 1-Existing — **Existing**
6br,Gr-3,lwr — **Mining below Glacier Highway with RediMix Bridge in place**

Station	2 yr			5 yr (est)			25 yr			50 yr			100 yr		
	1-Existing	6br,Gr-3,lwr	Change	1-Existing	6br,Gr-3,lwr	Change	1-Existing	6br,Gr-3,lwr	Change	1-Existing	6br,Gr-3,lwr	Change	1-Existing	6br,Gr-3,lwr	Change
1	0.33	0.33	0.0	0.57	0.57	0.0	0.97	0.97	0.0	1.1	1.1	0.0	1.16	1.16	0.0
2	1.35	1.35	0.0	1.86	1.86	0.0	1.9	1.84	-0.1	2.47	1.88	-0.6	2.78	1.91	-0.9
3	1.37	1.37	0.0	3.92	1.88	-2.0	3.12	2.76	-0.4	2.97	2.83	-0.1	2.94	2.84	-0.1
3.2	6.57	3.04	-3.5	7.48	3.68	-3.8	9.39	4.17	-5.2	9.64	4.27	-5.4	9.84	4.32	-5.5
3.3	3.47	3.47	0.0	3.93	3.93	0.0	3.02	3.02	0.0	4.74	4.74	0.0	2.99	2.99	0.0
3.5	0.88	0.88	0.0	0.92	0.92	0.0	0.91	0.91	0.0	0.99	0.99	0.0	0.91	0.91	0.0
4	0.3	0.22	-0.1	0.31	0.24	-0.1	0.32	0.26	-0.1	0.34	0.27	-0.1	0.32	0.26	-0.1
5	0.38	0.25	-0.1	0.37	0.27	-0.1	0.35	0.27	-0.1	0.37	0.29	-0.1	0.34	0.27	-0.1
6	0.56	0.4	-0.2	0.58	0.44	-0.1	0.55	0.44	-0.1	0.58	0.47	-0.1	0.54	0.45	-0.1
7	0.36	0.29	-0.1	0.36	0.29	-0.1	0.33	0.29	0.0	0.35	0.3	-0.1	0.33	0.29	0.0
7.5	0.55	0.37	-0.2	0.57	0.41	-0.2	0.56	0.42	-0.1	0.59	0.45	-0.1	0.55	0.43	-0.1
7.8	0.65	0.5	-0.2	0.65	0.53	-0.1	0.62	0.52	-0.1	0.66	0.56	-0.1	0.61	0.52	-0.1
8	0.98	0.69	-0.3	0.98	0.73	-0.3	0.81	0.67	-0.1	0.84	0.7	-0.1	0.76	0.64	-0.1
8.5	0.46	0.51	0.1	0.45	0.48	0.0	0.4	0.42	0.0	0.42	0.44	0.0	0.38	0.4	0.0
9	0.27	0.31	0.0	0.25	0.26	0.0	0.2	0.21	0.0	0.2	0.21	0.0	0.18	0.19	0.0
10	0.29	0.33	0.0	0.24	0.26	0.0	0.18	0.19	0.0	0.18	0.19	0.0	0.16	0.17	0.0
11	0.26	0.28	0.0	0.21	0.22	0.0	0.14	0.15	0.0	0.14	0.15	0.0	0.13	0.14	0.0
12	0.43	0.47	0.0	0.3	0.33	0.0	0.18	0.19	0.0	0.18	0.19	0.0	0.16	0.17	0.0
13	1.82	1.69	-0.1	2.06	2.13	0.1	0.8	0.88	0.1	0.73	0.81	0.1	0.58	0.64	0.1
13.5	2.19	2.27	0.1	2.79	2.75	0.0	3.95	3.95	0.0	4.06	4.06	0.0	3.71	4.12	0.4
14	0.63	0.63	0.0	0.71	0.71	0.0	0.78	0.78	0.0	0.8	0.8	0.0	0.83	0.81	0.0
14.5	2.99	2.99	0.0	3.45	3.45	0.0	4.02	4.02	0.0	4.17	4.17	0.0	4.24	4.24	0.0
15	2.37	2.37	0.0	2.98	2.98	0.0	3.83	3.83	0.0	4.01	4.01	0.0	4.09	4.09	0.0
15.5	3.61	3.61	0.0	4.12	4.12	0.0	4.67	4.67	0.0	4.85	4.85	0.0	4.94	4.94	0.0
15.8	6.06	6.06	0.0	7.03	7.03	0.0	8.61	8.61	0.0	8.56	8.56	0.0	8.62	8.62	0.0
16	8.8	8.8	0.0	9.99	9.99	0.0	10.82	10.82	0.0	11.51	11.51	0.0	11.72	11.72	0.0
17	8.51	8.51	0.0	9.93	9.93	0.0	11.54	11.54	0.0	11.94	11.94	0.0	12.13	12.13	0.0
17.5	13.54	13.54	0.0	16.58	16.58	0.0	20.18	20.18	0.0	21.1	21.1	0.0	21.53	21.53	0.0
18	18.96	18.96	0.0	21.58	21.58	0.0	24.07	24.07	0.0	24.8	24.8	0.0	25.01	25.01	0.0
19	10.47	10.47	0.0	11.92	11.92	0.0	13.72	13.72	0.0	14.12	14.12	0.0	14.35	14.35	0.0
20	16.88	16.88	0.0	16.2	16.2	0.0	16.19	16.19	0.0	16.24	16.24	0.0	16.29	16.29	0.0
21	20.57	20.57	0.0	23.26	23.26	0.0	26.1	26.1	0.0	26.9	26.9	0.0	27.35	27.35	0.0
22	11.86	11.86	0.0	13.97	13.97	0.0	16.5	16.5	0.0	17.09	17.09	0.0	17.34	17.34	0.0
23	13.62	13.62	0.0	16.24	16.24	0.0	19.38	19.38	0.0	20.18	20.18	0.0	20.56	20.56	0.0
24	4.2	4.2	0.0	4.73	4.73	0.0	5.37	5.37	0.0	5.52	5.52	0.0	5.59	5.59	0.0
25	0.63	0.63	0.0	0.59	0.59	0.0	0.56	0.56	0.0	0.56	0.56	0.0	0.56	0.56	0.0
26	1.43	1.43	0.0	1.21	1.21	0.0	1.07	1.07	0.0	1.05	1.05	0.0	1.04	1.04	0.0
27	3.65	3.65	0.0	3.71	3.71	0.0	3.75	3.75	0.0	3.76	3.76	0.0	3.77	3.77	0.0
28	3.68	3.68	0.0	3.68	3.68	0.0	3.69	3.69	0.0	3.71	3.71	0.0	3.72	3.72	0.0
29	1.17	1.17	0.0	0.69	0.69	0.0	0.46	0.46	0.0	0.42	0.42	0.0	0.4	0.4	0.0
30	2.9	2.9	0.0	2.89	2.89	0.0	2.82	2.82	0.0	2.78	2.78	0.0	2.76	2.76	0.0
31	1.92	1.92	0.0	1.79	1.79	0.0	1.87	1.87	0.0	1.93	1.93	0.0	1.95	1.95	0.0

Figure 18 – Water surface Profiles: 1) Existing Conditions, 2) RediMix Bridge Removed, existing channel, 3) RediMix Bridge removed, mining above Glacier Highway (xs 8-13), 4) mining below Glacier Highway (XS 4 – 8), 5) mining from RediMix Bridge to Corrections Center (XS 4-13)

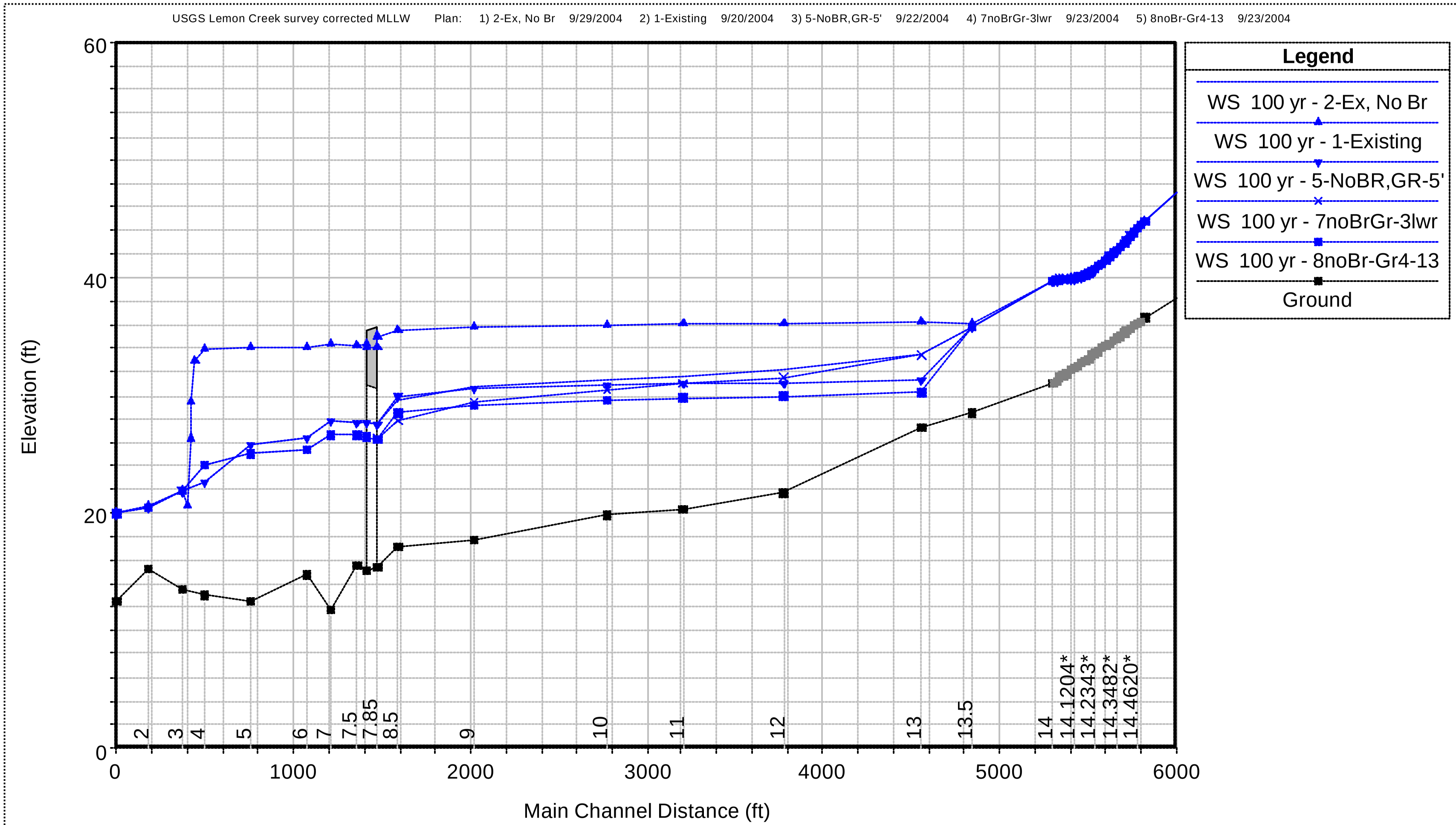


Table 14. Water Surface Elevations

Plans: 2-Ex, No Br — **Existing channel RediMix Bridge removed**
5-NoBR,GR-5' — **Mining above Glacier Highway RediMix Bridge Removed**

Station	2 yr			5 yr (est)			25 yr			50 yr			100 yr		
	2-Ex, No Br	5-NoBR,GR-5'	Change	2-Ex, No Br	5-NoBR,GR-5'	Change	2-Ex, No Br	5-NoBR,GR-5'	Change	2-Ex, No Br	5-NoBR,GR-5'	Change	2-Ex, No Br	5-NoBR,GR-5'	Change
1	20	20	0.0	20	20	0.0	20	20	0.0	20	20	0.0	20	20	0.0
2	19.74	19.74	0.0	20.06	20.06	0.0	20.58	20.58	0.0	20.49	20.49	0.0	20.45	20.45	0.0
3	20.59	20.59	0.0	21.12	21.12	0.0	21.5	21.5	0.0	21.76	21.76	0.0	21.89	21.89	0.0
4	21.01	21.01	0.0	21.64	21.64	0.0	22.36	22.36	0.0	22.52	22.52	0.0	22.61	22.61	0.0
5	22.55	22.55	0.0	23.71	23.71	0.0	25.17	25.17	0.0	25.56	25.56	0.0	25.74	25.74	0.0
6	23.58	23.58	0.0	24.64	24.64	0.0	25.92	25.92	0.0	26.25	26.25	0.0	26.4	26.4	0.0
7	24.43	24.43	0.0	25.72	25.72	0.0	27.28	27.28	0.0	27.68	27.68	0.0	27.87	27.87	0.0
7.5	24.52	24.52	0.0	25.73	25.73	0.0	27.17	27.17	0.0	27.54	27.54	0.0	27.71	27.71	0.0
7.8	24.56	24.56	0.0	25.76	25.76	0.0	27.19	27.19	0.0	27.56	27.56	0.0	27.73	27.73	0.0
8	24.5	24.5	0.0	25.65	25.65	0.0	27.04	27.04	0.0	27.4	27.4	0.0	27.56	27.56	0.0
8.5	25.81	26.04	0.2	27.29	27.56	0.3	29.03	29.34	0.3	29.47	29.79	0.3	29.68	30	0.3
9	26.65	26.33	-0.3	28.19	27.93	-0.3	29.99	29.8	-0.2	30.45	30.27	-0.2	30.66	30.49	-0.2
10	27.58	26.61	-1.0	28.96	28.22	-0.7	30.66	30.1	-0.6	31.09	30.58	-0.5	31.3	30.79	-0.5
11	28.2	26.76	-1.4	29.48	28.38	-1.1	31.09	30.27	-0.8	31.51	30.74	-0.8	31.71	30.96	-0.8
12	29.01	26.91	-2.1	30.06	28.5	-1.6	31.5	30.37	-1.1	31.89	30.84	-1.1	32.07	31.06	-1.0
13	32.1	26.15	-6.0	32.46	28.85	-3.6	33.09	30.64	-2.5	33.31	31.09	-2.2	33.42	31.3	-2.1
13.5	34.56	34.15	-0.4	35.13	34.8	-0.3	35.63	35.57	-0.1	35.75	35.75	0.0	35.83	35.83	0.0
14	37.62	37.73	0.1	38.43	38.52	0.1	39.43	39.45	0.0	39.68	39.69	0.0	39.8	39.8	0.0
14.5	43.23	43.23	0.0	43.83	43.83	0.0	44.5	44.5	0.0	44.67	44.67	0.0	44.74	44.74	0.0
15	45.77	45.77	0.0	46.52	46.52	0.0	47.36	47.36	0.0	47.56	47.56	0.0	47.66	47.66	0.0
15.5	48.96	48.96	0.0	49.9	49.9	0.0	51.02	51.02	0.0	51.27	51.27	0.0	51.39	51.39	0.0
15.8	55.76	55.76	0.0	56.73	56.73	0.0	57.72	57.72	0.0	58.08	58.08	0.0	58.23	58.23	0.0
16	60.04	60.04	0.0	61.07	61.07	0.0	62.4	62.4	0.0	62.58	62.58	0.0	62.7	62.7	0.0
17	64.87	64.87	0.0	66.08	66.08	0.0	67.48	67.48	0.0	67.82	67.82	0.0	67.98	67.98	0.0
17.5	67.42	67.42	0.0	68.64	68.64	0.0	70.01	70.01	0.0	70.34	70.34	0.0	70.49	70.49	0.0
18	72.39	72.39	0.0	73.46	73.46	0.0	74.75	74.75	0.0	75.06	75.06	0.0	75.22	75.22	0.0
19	78.73	78.73	0.0	80.07	80.07	0.0	81.56	81.56	0.0	81.93	81.93	0.0	82.09	82.09	0.0
20	80.79	80.79	0.0	82.1	82.1	0.0	83.59	83.59	0.0	83.96	83.96	0.0	84.13	84.13	0.0
21	84.72	84.72	0.0	85.91	85.91	0.0	87.33	87.33	0.0	87.67	87.67	0.0	87.81	87.81	0.0
22	89.26	89.26	0.0	90.59	90.59	0.0	92.11	92.11	0.0	92.49	92.49	0.0	92.67	92.67	0.0
23	91.4	91.4	0.0	92.77	92.77	0.0	94.32	94.32	0.0	94.7	94.7	0.0	94.88	94.88	0.0
24	95.52	95.52	0.0	97.11	97.11	0.0	98.94	98.94	0.0	99.4	99.4	0.0	99.61	99.61	0.0
25	96.9	96.9	0.0	98.66	98.66	0.0	100.74	100.74	0.0	101.26	101.26	0.0	101.5	101.5	0.0
26	96.77	96.77	0.0	98.53	98.53	0.0	100.61	100.61	0.0	101.14	101.14	0.0	101.38	101.38	0.0
27	96.41	96.41	0.0	97.94	97.94	0.0	99.85	99.85	0.0	100.33	100.33	0.0	100.56	100.56	0.0
28	96.59	96.59	0.0	98.11	98.11	0.0	100	100	0.0	100.47	100.47	0.0	100.7	100.7	0.0
29	98.55	98.55	0.0	100.24	100.24	0.0	102.42	102.42	0.0	102.96	102.96	0.0	103.21	103.21	0.0
30	98.19	98.19	0.0	99.67	99.67	0.0	101.54	101.54	0.0	102.05	102.05	0.0	102.29	102.29	0.0
31	101.55	101.55	0.0	102.85	102.85	0.0	104.12	104.12	0.0	104.39	104.39	0.0	104.53	104.53	0.0

Table 15. Water Surface Elevations

Plans: 2-Ex, No Br — **Existing channel RediMix Bridge removed**
7noBrGr-3lwr — **Mining below Glacier Highway RediMix Bridge Removed**

Station	2 yr			5 yr (est)			25 yr			50 yr			100 yr		
	2-Ex, No Br	7noBrGr-3lwr	Change	2-Ex, No Br	7noBrGr-3lwr	Change	2-Ex, No Br	7noBrGr-3lwr	Change	2-Ex, No Br	7noBrGr-3lwr	Change	2-Ex, No Br	7noBrGr-3lwr	Change
1	20	20	0.0	20	20	0.0	20	20	0.0	20	20	0.0	20	20	0.0
2	19.74	19.74	0.0	20.06	20.06	0.0	20.58	20.58	0.0	20.49	20.49	0.0	20.45	20.45	0.0
3	20.59	20.59	0.0	21.12	21.12	0.0	21.5	21.5	0.0	21.76	21.76	0.0	21.89	21.89	0.0
4	21.01	21.55	0.5	21.64	22.44	0.8	22.36	23.59	1.2	22.52	23.86	1.3	22.61	23.99	1.4
5	22.55	22.09	-0.5	23.71	23.17	-0.5	25.17	24.55	-0.6	25.56	24.89	-0.7	25.74	25.05	-0.7
6	23.58	22.56	-1.0	24.64	23.63	-1.0	25.92	24.92	-1.0	26.25	25.24	-1.0	26.4	25.39	-1.0
7	24.43	23.16	-1.3	25.72	24.42	-1.3	27.28	25.97	-1.3	27.68	26.36	-1.3	27.87	26.54	-1.3
7.5	24.52	23.37	-1.2	25.73	24.58	-1.2	27.17	26.05	-1.1	27.54	26.41	-1.1	27.71	26.58	-1.1
7.8	24.56	23.31	-1.3	25.76	24.5	-1.3	27.19	25.94	-1.3	27.56	26.3	-1.3	27.73	26.46	-1.3
8	24.5	23.29	-1.2	25.65	24.45	-1.2	27.04	25.84	-1.2	27.4	26.19	-1.2	27.56	26.34	-1.2
8.5	25.81	23.94	-1.9	27.29	25.46	-1.8	29.03	27.26	-1.8	29.47	27.71	-1.8	29.68	27.91	-1.8
9	26.65	25.68	-1.0	28.19	27.07	-1.1	29.99	28.81	-1.2	30.45	29.25	-1.2	30.66	29.45	-1.2
10	27.58	27.15	-0.4	28.96	28.31	-0.7	30.66	29.82	-0.8	31.09	30.22	-0.9	31.3	30.4	-0.9
11	28.2	27.95	-0.3	29.48	29.02	-0.5	31.09	30.43	-0.7	31.51	30.8	-0.7	31.71	30.98	-0.7
12	29.01	28.91	-0.1	30.06	29.78	-0.3	31.5	31	-0.5	31.89	31.33	-0.6	32.07	31.49	-0.6
13	32.1	32.15	0.0	32.46	32.58	0.1	33.09	33.13	0.0	33.31	33.29	0.0	33.42	33.37	-0.1
13.5	34.56	34.52	0.0	35.13	35.05	-0.1	35.63	35.6	0.0	35.75	35.75	0.0	35.83	35.83	0.0
14	37.62	37.63	0.0	38.43	38.45	0.0	39.43	39.44	0.0	39.68	39.68	0.0	39.8	39.8	0.0
14.5	43.23	43.23	0.0	43.83	43.83	0.0	44.5	44.5	0.0	44.67	44.67	0.0	44.74	44.74	0.0
15	45.77	45.77	0.0	46.52	46.52	0.0	47.36	47.36	0.0	47.56	47.56	0.0	47.66	47.66	0.0
15.5	48.96	48.96	0.0	49.9	49.9	0.0	51.02	51.02	0.0	51.27	51.27	0.0	51.39	51.39	0.0
15.8	55.76	55.76	0.0	56.73	56.73	0.0	57.72	57.72	0.0	58.08	58.08	0.0	58.23	58.23	0.0
16	60.04	60.04	0.0	61.07	61.07	0.0	62.4	62.4	0.0	62.58	62.58	0.0	62.7	62.7	0.0
17	64.87	64.87	0.0	66.08	66.08	0.0	67.48	67.48	0.0	67.82	67.82	0.0	67.98	67.98	0.0
17.5	67.42	67.42	0.0	68.64	68.64	0.0	70.01	70.01	0.0	70.34	70.34	0.0	70.49	70.49	0.0
18	72.39	72.39	0.0	73.46	73.46	0.0	74.75	74.75	0.0	75.06	75.06	0.0	75.22	75.22	0.0
19	78.73	78.73	0.0	80.07	80.07	0.0	81.56	81.56	0.0	81.93	81.93	0.0	82.09	82.09	0.0
20	80.79	80.79	0.0	82.1	82.1	0.0	83.59	83.59	0.0	83.96	83.96	0.0	84.13	84.13	0.0
21	84.72	84.72	0.0	85.91	85.91	0.0	87.33	87.33	0.0	87.67	87.67	0.0	87.81	87.81	0.0
22	89.26	89.26	0.0	90.59	90.59	0.0	92.11	92.11	0.0	92.49	92.49	0.0	92.67	92.67	0.0
23	91.4	91.4	0.0	92.77	92.77	0.0	94.32	94.32	0.0	94.7	94.7	0.0	94.88	94.88	0.0
24	95.52	95.52	0.0	97.11	97.11	0.0	98.94	98.94	0.0	99.4	99.4	0.0	99.61	99.61	0.0
25	96.9	96.9	0.0	98.66	98.66	0.0	100.74	100.74	0.0	101.26	101.26	0.0	101.5	101.5	0.0
26	96.77	96.77	0.0	98.53	98.53	0.0	100.61	100.61	0.0	101.14	101.14	0.0	101.38	101.38	0.0
27	96.41	96.41	0.0	97.94	97.94	0.0	99.85	99.85	0.0	100.33	100.33	0.0	100.56	100.56	0.0
28	96.59	96.59	0.0	98.11	98.11	0.0	100	100	0.0	100.47	100.47	0.0	100.7	100.7	0.0
29	98.55	98.55	0.0	100.24	100.24	0.0	102.42	102.42	0.0	102.96	102.96	0.0	103.21	103.21	0.0
30	98.19	98.19	0.0	99.67	99.67	0.0	101.54	101.54	0.0	102.05	102.05	0.0	102.29	102.29	0.0
31	101.55	101.55	0.0	102.85	102.85	0.0	104.12	104.12	0.0	104.39	104.39	0.0	104.53	104.53	0.0

Table 16. Water Surface Elevations

Plans: 2-Ex, No Br — **Existing channel RediMix Bridge removed**
8noBr-Gr4-13 — **Mining from RediMix Bridge to Correction Center RediMix Bridge Removed**

Station	2 yr			5 yr (est)			25 yr			50 yr			100 yr		
	2-Ex, No Br	8noBr-Gr4-13	Change	2-Ex, No Br	8noBr-Gr4-13	Change	2-Ex, No Br	8noBr-Gr4-13	Change	2-Ex, No Br	8noBr-Gr4-13	Change	2-Ex, No Br	8noBr-Gr4-13	Change
1	20	20	0.0	20	20	0.0	20	20	0.0	20	20	0.0	20	20	0.0
2	19.74	19.74	0.0	20.06	20.06	0.0	20.58	20.58	0.0	20.49	20.49	0.0	20.45	20.45	0.0
3	20.59	20.59	0.0	21.12	21.12	0.0	21.5	21.5	0.0	21.76	21.76	0.0	21.89	21.89	0.0
4	21.01	21.55	0.5	21.64	22.44	0.8	22.36	23.59	1.2	22.52	23.86	1.3	22.61	23.99	1.4
5	22.55	22.09	-0.5	23.71	23.17	-0.5	25.17	24.55	-0.6	25.56	24.89	-0.7	25.74	25.05	-0.7
6	23.58	22.56	-1.0	24.64	23.63	-1.0	25.92	24.92	-1.0	26.25	25.24	-1.0	26.4	25.39	-1.0
7	24.43	23.16	-1.3	25.72	24.42	-1.3	27.28	25.97	-1.3	27.68	26.36	-1.3	27.87	26.54	-1.3
7.5	24.52	23.37	-1.2	25.73	24.58	-1.2	27.17	26.05	-1.1	27.54	26.41	-1.1	27.71	26.58	-1.1
7.8	24.56	23.31	-1.3	25.76	24.5	-1.3	27.19	25.94	-1.3	27.56	26.3	-1.3	27.73	26.46	-1.3
8	24.5	23.29	-1.2	25.65	24.45	-1.2	27.04	25.84	-1.2	27.4	26.19	-1.2	27.56	26.34	-1.2
8.5	25.81	24.52	-1.3	27.29	26.03	-1.3	29.03	27.83	-1.2	29.47	28.27	-1.2	29.68	28.48	-1.2
9	26.65	24.94	-1.7	28.19	26.54	-1.7	29.99	28.43	-1.6	30.45	28.9	-1.6	30.66	29.12	-1.5
10	27.58	25.39	-2.2	28.96	26.98	-2.0	30.66	28.87	-1.8	31.09	29.33	-1.8	31.3	29.55	-1.8
11	28.2	25.62	-2.6	29.48	27.21	-2.3	31.09	29.09	-2.0	31.51	29.56	-2.0	31.71	29.77	-1.9
12	29.01	25.88	-3.1	30.06	27.41	-2.7	31.5	29.25	-2.3	31.89	29.71	-2.2	32.07	29.92	-2.2
13	32.1	26.15	-6.0	32.46	26.41	-6.1	33.09	29.69	-3.4	33.31	30.11	-3.2	33.42	30.31	-3.1
13.5	34.56	34.15	-0.4	35.13	34.8	-0.3	35.63	35.57	-0.1	35.75	35.75	0.0	35.83	35.83	0.0
14	37.62	37.73	0.1	38.43	38.52	0.1	39.43	39.45	0.0	39.68	39.69	0.0	39.8	39.8	0.0
14.5	43.23	43.23	0.0	43.83	43.83	0.0	44.5	44.5	0.0	44.67	44.67	0.0	44.74	44.74	0.0
15	45.77	45.77	0.0	46.52	46.52	0.0	47.36	47.36	0.0	47.56	47.56	0.0	47.66	47.66	0.0
15.5	48.96	48.96	0.0	49.9	49.9	0.0	51.02	51.02	0.0	51.27	51.27	0.0	51.39	51.39	0.0
15.8	55.76	55.76	0.0	56.73	56.73	0.0	57.72	57.72	0.0	58.08	58.08	0.0	58.23	58.23	0.0
16	60.04	60.04	0.0	61.07	61.07	0.0	62.4	62.4	0.0	62.58	62.58	0.0	62.7	62.7	0.0
17	64.87	64.87	0.0	66.08	66.08	0.0	67.48	67.48	0.0	67.82	67.82	0.0	67.98	67.98	0.0
17.5	67.42	67.42	0.0	68.64	68.64	0.0	70.01	70.01	0.0	70.34	70.34	0.0	70.49	70.49	0.0
18	72.39	72.39	0.0	73.46	73.46	0.0	74.75	74.75	0.0	75.06	75.06	0.0	75.22	75.22	0.0
19	78.73	78.73	0.0	80.07	80.07	0.0	81.56	81.56	0.0	81.93	81.93	0.0	82.09	82.09	0.0
20	80.79	80.79	0.0	82.1	82.1	0.0	83.59	83.59	0.0	83.96	83.96	0.0	84.13	84.13	0.0
21	84.72	84.72	0.0	85.91	85.91	0.0	87.33	87.33	0.0	87.67	87.67	0.0	87.81	87.81	0.0
22	89.26	89.26	0.0	90.59	90.59	0.0	92.11	92.11	0.0	92.49	92.49	0.0	92.67	92.67	0.0
23	91.4	91.4	0.0	92.77	92.77	0.0	94.32	94.32	0.0	94.7	94.7	0.0	94.88	94.88	0.0
24	95.52	95.52	0.0	97.11	97.11	0.0	98.94	98.94	0.0	99.4	99.4	0.0	99.61	99.61	0.0
25	96.9	96.9	0.0	98.66	98.66	0.0	100.74	100.74	0.0	101.26	101.26	0.0	101.5	101.5	0.0
26	96.77	96.77	0.0	98.53	98.53	0.0	100.61	100.61	0.0	101.14	101.14	0.0	101.38	101.38	0.0
27	96.41	96.41	0.0	97.94	97.94	0.0	99.85	99.85	0.0	100.33	100.33	0.0	100.56	100.56	0.0
28	96.59	96.59	0.0	98.11	98.11	0.0	100	100	0.0	100.47	100.47	0.0	100.7	100.7	0.0
29	98.55	98.55	0.0	100.24	100.24	0.0	102.42	102.42	0.0	102.96	102.96	0.0	103.21	103.21	0.0
30	98.19	98.19	0.0	99.67	99.67	0.0	101.54	101.54	0.0	102.05	102.05	0.0	102.29	102.29	0.0
31	101.55	101.55	0.0	102.85	102.85	0.0	104.12	104.12	0.0	104.39	104.39	0.0	104.53	104.53	0.0

Table 17. Channel Flow Velocity (fps)

Plans: 2-Ex, No Br — **Existing channel RediMix Bridge removed**

5-NoBR,GR-5' — **Mining above Glacier Highway RediMix Bridge Removed**

Station	2 yr			5 yr (est)			25 yr			50 yr			100 yr		
	2-Ex, No Br	5-NoBR,GR-5'	Change	2-Ex, No Br	5-NoBR,GR-5'	Change	2-Ex, No Br	5-NoBR,GR-5'	Change	2-Ex, No Br	5-NoBR,GR-5'	Change	2-Ex, No Br	5-NoBR,GR-5'	Change
1	4.57	4.57	0.0	5.97	5.97	0.0	7.81	7.81	0.0	8.3	8.3	0.0	8.53	8.53	0.0
2	8.94	8.94	0.0	10.66	10.66	0.0	12	12	0.0	13.06	13.06	0.0	13.58	13.58	0.0
3	9.68	9.68	0.0	11.5	11.5	0.0	14.09	14.09	0.0	14.37	14.37	0.0	14.46	14.46	0.0
4	9.95	9.95	0.0	11.78	11.78	0.0	13.87	13.87	0.0	14.43	14.43	0.0	14.66	14.66	0.0
5	8.45	8.45	0.0	9.14	9.14	0.0	9.8	9.8	0.0	9.94	9.94	0.0	10.01	10.01	0.0
6	8.64	8.64	0.0	9.87	9.87	0.0	11.18	11.18	0.0	11.48	11.48	0.0	11.62	11.62	0.0
7	6.52	6.52	0.0	7.2	7.2	0.0	7.89	7.89	0.0	8.05	8.05	0.0	8.12	8.12	0.0
7.5	7.85	7.85	0.0	8.92	8.92	0.0	10.04	10.04	0.0	10.3	10.3	0.0	10.42	10.42	0.0
7.8	8.51	8.51	0.0	9.64	9.64	0.0	10.83	10.83	0.0	11.1	11.1	0.0	11.22	11.22	0.0
8	10.77	10.77	0.0	12.17	12.17	0.0	13.62	13.62	0.0	13.95	13.95	0.0	14.1	14.1	0.0
8.5	6.65	4.48	-2.2	7.28	5.18	-2.1	7.97	5.93	-2.0	8.12	6.11	-2.0	8.19	6.19	-2.0
9	4.94	3.43	-1.5	5.18	3.82	-1.4	5.47	4.24	-1.2	5.54	4.34	-1.2	5.57	4.38	-1.2
10	4.72	2.97	-1.8	4.88	3.26	-1.6	5.06	3.58	-1.5	5.1	3.65	-1.5	5.12	3.69	-1.4
11	4.22	2.63	-1.6	4.36	2.85	-1.5	4.48	3.1	-1.4	4.51	3.16	-1.4	4.53	3.19	-1.3
12	5.64	3.31	-2.3	5.73	3.45	-2.3	5.72	3.64	-2.1	5.72	3.69	-2.0	5.72	3.71	-2.0
13	7.3	12.19	4.9	8.42	6.26	-2.2	9.16	5.77	-3.4	9.2	5.71	-3.5	9.2	5.68	-3.5
13.5	9.08	10.29	1.2	10.2	11.1	0.9	11.86	12.01	0.2	12.26	12.26	0.0	12.38	12.38	0.0
14	4.19	4.08	-0.1	4.58	4.5	-0.1	4.99	4.97	0.0	5.08	5.08	0.0	5.13	5.13	0.0
14.5	8.96	8.96	0.0	9.86	9.86	0.0	10.89	10.89	0.0	11.15	11.15	0.0	11.27	11.27	0.0
15	7.04	7.04	0.0	8.04	8.04	0.0	9.28	9.28	0.0	9.53	9.53	0.0	9.65	9.65	0.0
15.5	8.45	8.45	0.0	9.26	9.26	0.0	10.12	10.12	0.0	10.37	10.37	0.0	10.48	10.48	0.0
15.8	10.18	10.18	0.0	11.23	11.23	0.0	12.7	12.7	0.0	12.76	12.76	0.0	12.83	12.83	0.0
16	11.25	11.25	0.0	12.21	12.21	0.0	12.98	12.98	0.0	13.42	13.42	0.0	13.57	13.57	0.0
17	10.91	10.91	0.0	12.08	12.08	0.0	13.36	13.36	0.0	13.66	13.66	0.0	13.81	13.81	0.0
17.5	12.81	12.81	0.0	14.44	14.44	0.0	16.24	16.24	0.0	16.68	16.68	0.0	16.88	16.88	0.0
18	14.34	14.34	0.0	15.66	15.66	0.0	16.95	16.95	0.0	17.29	17.29	0.0	17.41	17.41	0.0
19	11.24	11.24	0.0	12.23	12.23	0.0	13.37	13.37	0.0	13.63	13.63	0.0	13.76	13.76	0.0
20	13.53	13.53	0.0	13.62	13.62	0.0	13.98	13.98	0.0	14.09	14.09	0.0	14.15	14.15	0.0
21	15.03	15.03	0.0	16.38	16.38	0.0	17.81	17.81	0.0	18.18	18.18	0.0	18.37	18.37	0.0
22	11.81	11.81	0.0	13.12	13.12	0.0	14.58	14.58	0.0	14.92	14.92	0.0	15.06	15.06	0.0
23	12.9	12.9	0.0	14.38	14.38	0.0	16.04	16.04	0.0	16.44	16.44	0.0	16.63	16.63	0.0
24	8.96	8.96	0.0	9.78	9.78	0.0	10.72	10.72	0.0	10.94	10.94	0.0	11.04	11.04	0.0
25	5.02	5.02	0.0	5.02	5.02	0.0	5.11	5.11	0.0	5.13	5.13	0.0	5.15	5.15	0.0
26	7.5	7.5	0.0	7.2	7.2	0.0	7.07	7.07	0.0	7.06	7.06	0.0	7.06	7.06	0.0
27	12.17	12.17	0.0	12.72	12.72	0.0	13.26	13.26	0.0	13.39	13.39	0.0	13.46	13.46	0.0
28	12.14	12.14	0.0	12.59	12.59	0.0	13.1	13.1	0.0	13.24	13.24	0.0	13.3	13.3	0.0
29	7.1	7.1	0.0	6.72	6.72	0.0	5.66	5.66	0.0	5.53	5.53	0.0	5.47	5.47	0.0
30	10.74	10.74	0.0	11.13	11.13	0.0	11.42	11.42	0.0	11.44	11.44	0.0	11.44	11.44	0.0
31	9.21	9.21	0.0	9.1	9.1	0.0	9.52	9.52	0.0	9.69	9.69	0.0	9.76	9.76	0.0

Table 18. Channel Flow Velocity (fps)

Plans: 2-Ex, No Br — **Existing channel RediMix Bridge removed**
7noBrGr-3lwr — **Mining below Glacier Highway RediMix Bridge Removed**

Station	2 yr			5 yr (est)			25 yr			50 yr			100 yr		
	2-Ex, No Br	7noBrGr-3lwr	Change	2-Ex, No Br	7noBrGr-3lwr	Change	2-Ex, No Br	7noBrGr-3lwr	Change	2-Ex, No Br	7noBrGr-3lwr	Change	2-Ex, No Br	7noBrGr-3lwr	Change
1	4.57	4.57	0.0	5.97	5.97	0.0	7.81	7.81	0.0	8.3	8.3	0.0	8.53	8.53	0.0
2	8.94	8.94	0.0	10.66	10.66	0.0	12	12	0.0	13.06	13.06	0.0	13.58	13.58	0.0
3	9.68	9.68	0.0	11.5	11.5	0.0	14.09	14.09	0.0	14.37	14.37	0.0	14.46	14.46	0.0
4	9.95	7.26	-2.7	11.78	8.56	-3.2	13.87	9.93	-3.9	14.43	10.27	-4.2	14.66	10.43	-4.2
5	8.45	6.81	-1.6	9.14	7.72	-1.4	9.8	8.6	-1.2	9.94	8.81	-1.1	10.01	8.92	-1.1
6	8.64	7.91	-0.7	9.87	9.15	-0.7	11.18	10.46	-0.7	11.48	10.78	-0.7	11.62	10.93	-0.7
7	6.52	6.59	0.1	7.2	7.31	0.1	7.89	8.03	0.1	8.05	8.2	0.1	8.12	8.28	0.2
7.5	7.85	6.89	-1.0	8.92	7.96	-1.0	10.04	9.11	-0.9	10.3	9.38	-0.9	10.42	9.51	-0.9
7.8	8.51	8.26	-0.3	9.64	9.43	-0.2	10.83	10.66	-0.2	11.1	10.95	-0.2	11.22	11.09	-0.1
8	10.77	9.79	-1.0	12.17	11.27	-0.9	13.62	12.81	-0.8	13.95	13.17	-0.8	14.1	13.35	-0.8
8.5	6.65	8.73	2.1	7.28	9.1	1.8	7.97	9.55	1.6	8.12	9.67	1.6	8.19	9.73	1.5
9	4.94	5.83	0.9	5.18	6.06	0.9	5.47	6.27	0.8	5.54	6.32	0.8	5.57	6.34	0.8
10	4.72	5.14	0.4	4.88	5.42	0.5	5.06	5.63	0.6	5.1	5.68	0.6	5.12	5.7	0.6
11	4.22	4.45	0.2	4.36	4.72	0.4	4.48	4.92	0.4	4.51	4.96	0.5	4.53	4.97	0.4
12	5.64	5.8	0.2	5.73	6.08	0.4	5.72	6.24	0.5	5.72	6.26	0.5	5.72	6.26	0.5
13	7.3	7.14	-0.2	8.42	8.12	-0.3	9.16	9.08	-0.1	9.2	9.24	0.0	9.2	9.31	0.1
13.5	9.08	9.19	0.1	10.2	10.41	0.2	11.86	11.93	0.1	12.26	12.26	0.0	12.38	12.38	0.0
14	4.19	4.18	0.0	4.58	4.57	0.0	4.99	4.98	0.0	5.08	5.08	0.0	5.13	5.13	0.0
14.5	8.96	8.96	0.0	9.86	9.86	0.0	10.89	10.89	0.0	11.15	11.15	0.0	11.27	11.27	0.0
15	7.04	7.04	0.0	8.04	8.04	0.0	9.28	9.28	0.0	9.53	9.53	0.0	9.65	9.65	0.0
15.5	8.45	8.45	0.0	9.26	9.26	0.0	10.12	10.12	0.0	10.37	10.37	0.0	10.48	10.48	0.0
15.8	10.18	10.18	0.0	11.23	11.23	0.0	12.7	12.7	0.0	12.76	12.76	0.0	12.83	12.83	0.0
16	11.25	11.25	0.0	12.21	12.21	0.0	12.98	12.98	0.0	13.42	13.42	0.0	13.57	13.57	0.0
17	10.91	10.91	0.0	12.08	12.08	0.0	13.36	13.36	0.0	13.66	13.66	0.0	13.81	13.81	0.0
17.5	12.81	12.81	0.0	14.44	14.44	0.0	16.24	16.24	0.0	16.68	16.68	0.0	16.88	16.88	0.0
18	14.34	14.34	0.0	15.66	15.66	0.0	16.95	16.95	0.0	17.29	17.29	0.0	17.41	17.41	0.0
19	11.24	11.24	0.0	12.23	12.23	0.0	13.37	13.37	0.0	13.63	13.63	0.0	13.76	13.76	0.0
20	13.53	13.53	0.0	13.62	13.62	0.0	13.98	13.98	0.0	14.09	14.09	0.0	14.15	14.15	0.0
21	15.03	15.03	0.0	16.38	16.38	0.0	17.81	17.81	0.0	18.18	18.18	0.0	18.37	18.37	0.0
22	11.81	11.81	0.0	13.12	13.12	0.0	14.58	14.58	0.0	14.92	14.92	0.0	15.06	15.06	0.0
23	12.9	12.9	0.0	14.38	14.38	0.0	16.04	16.04	0.0	16.44	16.44	0.0	16.63	16.63	0.0
24	8.96	8.96	0.0	9.78	9.78	0.0	10.72	10.72	0.0	10.94	10.94	0.0	11.04	11.04	0.0
25	5.02	5.02	0.0	5.02	5.02	0.0	5.11	5.11	0.0	5.13	5.13	0.0	5.15	5.15	0.0
26	7.5	7.5	0.0	7.2	7.2	0.0	7.07	7.07	0.0	7.06	7.06	0.0	7.06	7.06	0.0
27	12.17	12.17	0.0	12.72	12.72	0.0	13.26	13.26	0.0	13.39	13.39	0.0	13.46	13.46	0.0
28	12.14	12.14	0.0	12.59	12.59	0.0	13.1	13.1	0.0	13.24	13.24	0.0	13.3	13.3	0.0
29	7.1	7.1	0.0	6.72	6.72	0.0	5.66	5.66	0.0	5.53	5.53	0.0	5.47	5.47	0.0
30	10.74	10.74	0.0	11.13	11.13	0.0	11.42	11.42	0.0	11.44	11.44	0.0	11.44	11.44	0.0
31	9.21	9.21	0.0	9.1	9.1	0.0	9.52	9.52	0.0	9.69	9.69	0.0	9.76	9.76	0.0

Table 19. Channel Flow Velocity (fps)

Plans: 2-Ex, No Br — **Existing channel RediMix Bridge removed**

8noBr-Gr4-13 — **Mining from RediMix Bridge to Correction Center RediMix Bridge Removed**

Station	2 yr			5 yr (est)			25 yr			50 yr			100 yr		
	2-Ex, No Br	8noBr-Gr4-13	Change	2-Ex, No Br	8noBr-Gr4-13	Change	2-Ex, No Br	8noBr-Gr4-13	Change	2-Ex, No Br	8noBr-Gr4-13	Change	2-Ex, No Br	8noBr-Gr4-13	Change
1	4.57	4.57	0.0	5.97	5.97	0.0	7.81	7.81	0.0	8.3	8.3	0.0	8.53	8.53	0.0
2	8.94	8.94	0.0	10.66	10.66	0.0	12	12	0.0	13.06	13.06	0.0	13.58	13.58	0.0
3	9.68	9.68	0.0	11.5	11.5	0.0	14.09	14.09	0.0	14.37	14.37	0.0	14.46	14.46	0.0
4	9.95	7.26	-2.7	11.78	8.56	-3.2	13.87	9.93	-3.9	14.43	10.27	-4.2	14.66	10.43	-4.2
5	8.45	6.81	-1.6	9.14	7.72	-1.4	9.8	8.6	-1.2	9.94	8.81	-1.1	10.01	8.92	-1.1
6	8.64	7.91	-0.7	9.87	9.15	-0.7	11.18	10.46	-0.7	11.48	10.78	-0.7	11.62	10.93	-0.7
7	6.52	6.59	0.1	7.2	7.31	0.1	7.89	8.03	0.1	8.05	8.2	0.1	8.12	8.28	0.2
7.5	7.85	6.89	-1.0	8.92	7.96	-1.0	10.04	9.11	-0.9	10.3	9.38	-0.9	10.42	9.51	-0.9
7.8	8.51	8.26	-0.3	9.64	9.43	-0.2	10.83	10.66	-0.2	11.1	10.95	-0.2	11.22	11.09	-0.1
8	10.77	9.79	-1.0	12.17	11.27	-0.9	13.62	12.81	-0.8	13.95	13.17	-0.8	14.1	13.35	-0.8
8.5	6.65	5.15	-1.5	7.28	5.87	-1.4	7.97	6.63	-1.3	8.12	6.81	-1.3	8.19	6.9	-1.3
9	4.94	4.01	-0.9	5.18	4.39	-0.8	5.47	4.77	-0.7	5.54	4.86	-0.7	5.57	4.9	-0.7
10	4.72	3.44	-1.3	4.88	3.72	-1.2	5.06	4	-1.1	5.1	4.07	-1.0	5.12	4.1	-1.0
11	4.22	3.06	-1.2	4.36	3.26	-1.1	4.48	3.47	-1.0	4.51	3.52	-1.0	4.53	3.54	-1.0
12	5.64	3.95	-1.7	5.73	4.01	-1.7	5.72	4.12	-1.6	5.72	4.15	-1.6	5.72	4.17	-1.6
13	7.3	12.19	4.9	8.42	13.91	5.5	9.16	6.85	-2.3	9.2	6.72	-2.5	9.2	6.67	-2.5
13.5	9.08	10.29	1.2	10.2	11.1	0.9	11.86	12.01	0.2	12.26	12.26	0.0	12.38	12.38	0.0
14	4.19	4.08	-0.1	4.58	4.51	-0.1	4.99	4.97	0.0	5.08	5.08	0.0	5.13	5.13	0.0
14.5	8.96	8.96	0.0	9.86	9.86	0.0	10.89	10.89	0.0	11.15	11.15	0.0	11.27	11.27	0.0
15	7.04	7.04	0.0	8.04	8.04	0.0	9.28	9.28	0.0	9.53	9.53	0.0	9.65	9.65	0.0
15.5	8.45	8.45	0.0	9.26	9.26	0.0	10.12	10.12	0.0	10.37	10.37	0.0	10.48	10.48	0.0
15.8	10.18	10.18	0.0	11.23	11.23	0.0	12.7	12.7	0.0	12.76	12.76	0.0	12.83	12.83	0.0
16	11.25	11.25	0.0	12.21	12.21	0.0	12.98	12.98	0.0	13.42	13.42	0.0	13.57	13.57	0.0
17	10.91	10.91	0.0	12.08	12.08	0.0	13.36	13.36	0.0	13.66	13.66	0.0	13.81	13.81	0.0
17.5	12.81	12.81	0.0	14.44	14.44	0.0	16.24	16.24	0.0	16.68	16.68	0.0	16.88	16.88	0.0
18	14.34	14.34	0.0	15.66	15.66	0.0	16.95	16.95	0.0	17.29	17.29	0.0	17.41	17.41	0.0
19	11.24	11.24	0.0	12.23	12.23	0.0	13.37	13.37	0.0	13.63	13.63	0.0	13.76	13.76	0.0
20	13.53	13.53	0.0	13.62	13.62	0.0	13.98	13.98	0.0	14.09	14.09	0.0	14.15	14.15	0.0
21	15.03	15.03	0.0	16.38	16.38	0.0	17.81	17.81	0.0	18.18	18.18	0.0	18.37	18.37	0.0
22	11.81	11.81	0.0	13.12	13.12	0.0	14.58	14.58	0.0	14.92	14.92	0.0	15.06	15.06	0.0
23	12.9	12.9	0.0	14.38	14.38	0.0	16.04	16.04	0.0	16.44	16.44	0.0	16.63	16.63	0.0
24	8.96	8.96	0.0	9.78	9.78	0.0	10.72	10.72	0.0	10.94	10.94	0.0	11.04	11.04	0.0
25	5.02	5.02	0.0	5.02	5.02	0.0	5.11	5.11	0.0	5.13	5.13	0.0	5.15	5.15	0.0
26	7.5	7.5	0.0	7.2	7.2	0.0	7.07	7.07	0.0	7.06	7.06	0.0	7.06	7.06	0.0
27	12.17	12.17	0.0	12.72	12.72	0.0	13.26	13.26	0.0	13.39	13.39	0.0	13.46	13.46	0.0
28	12.14	12.14	0.0	12.59	12.59	0.0	13.1	13.1	0.0	13.24	13.24	0.0	13.3	13.3	0.0
29	7.1	7.1	0.0	6.72	6.72	0.0	5.66	5.66	0.0	5.53	5.53	0.0	5.47	5.47	0.0
30	10.74	10.74	0.0	11.13	11.13	0.0	11.42	11.42	0.0	11.44	11.44	0.0	11.44	11.44	0.0
31	9.21	9.21	0.0	9.1	9.1	0.0	9.52	9.52	0.0	9.69	9.69	0.0	9.76	9.76	0.0

Table 20. Bed Shear (psf)

Plans: 2-Ex, No Br — **Existing channel RediMix Bridge removed**
5-NoBR,GR-5' — **Mining above Glacier Highway RediMix Bridge Removed**

Station	2 yr			5 yr (est)			25 yr			50 yr			100 yr		
	2-Ex, No Br	5-NoBR,GR-5'	Change	2-Ex, No Br	5-NoBR,GR-5'	Change	2-Ex, No Br	5-NoBR,GR-5'	Change	2-Ex, No Br	5-NoBR,GR-5'	Change	2-Ex, No Br	5-NoBR,GR-5'	Change
1	0.33	0.33	0.0	0.57	0.57	0.0	0.97	0.97	0.0	1.1	1.1	0.0	1.16	1.16	0.0
2	1.35	1.35	0.0	1.86	1.86	0.0	2.26	2.26	0.0	2.7	2.7	0.0	2.93	2.93	0.0
3	1.37	1.37	0.0	1.88	1.88	0.0	2.76	2.76	0.0	2.83	2.83	0.0	2.84	2.84	0.0
4	1.39	1.39	0.0	1.88	1.88	0.0	2.52	2.52	0.0	2.71	2.71	0.0	2.79	2.79	0.0
5	1.4	1.4	0.0	1.55	1.55	0.0	1.67	1.67	0.0	1.69	1.69	0.0	1.7	1.7	0.0
6	1.33	1.33	0.0	1.66	1.66	0.0	2.03	2.03	0.0	2.12	2.12	0.0	2.16	2.16	0.0
7	0.78	0.78	0.0	0.9	0.9	0.0	1.03	1.03	0.0	1.06	1.06	0.0	1.07	1.07	0.0
7.5	1.07	1.07	0.0	1.32	1.32	0.0	1.6	1.6	0.0	1.66	1.66	0.0	1.69	1.69	0.0
7.8	1.26	1.26	0.0	1.54	1.54	0.0	1.85	1.85	0.0	1.93	1.93	0.0	1.96	1.96	0.0
8	1.98	1.98	0.0	2.42	2.42	0.0	2.9	2.9	0.0	3.01	3.01	0.0	3.06	3.06	0.0
8.5	0.75	0.31	-0.4	0.86	0.39	-0.5	0.97	0.5	-0.5	1	0.52	-0.5	1.01	0.53	-0.5
9	0.45	0.19	-0.3	0.46	0.23	-0.2	0.48	0.27	-0.2	0.49	0.28	-0.2	0.49	0.28	-0.2
10	0.44	0.15	-0.3	0.44	0.17	-0.3	0.44	0.2	-0.2	0.44	0.2	-0.2	0.44	0.21	-0.2
11	0.36	0.12	-0.2	0.36	0.14	-0.2	0.35	0.15	-0.2	0.35	0.15	-0.2	0.35	0.16	-0.2
12	0.56	0.16	-0.4	0.53	0.17	-0.4	0.49	0.17	-0.3	0.48	0.17	-0.3	0.47	0.17	-0.3
13	1.47	4.76	3.3	1.87	0.94	-0.9	2.09	0.71	-1.4	2.07	0.68	-1.4	2.05	0.67	-1.4
13.5	2.44	3.26	0.8	2.94	3.58	0.6	3.83	3.95	0.1	4.06	4.06	0.0	4.12	4.12	0.0
14	0.62	0.59	0.0	0.7	0.68	0.0	0.78	0.78	0.0	0.8	0.8	0.0	0.81	0.81	0.0
14.5	2.99	2.99	0.0	3.45	3.45	0.0	4.02	4.02	0.0	4.17	4.17	0.0	4.24	4.24	0.0
15	2.37	2.37	0.0	2.98	2.98	0.0	3.83	3.83	0.0	4.01	4.01	0.0	4.09	4.09	0.0
15.5	3.61	3.61	0.0	4.12	4.12	0.0	4.67	4.67	0.0	4.85	4.85	0.0	4.94	4.94	0.0
15.8	6.06	6.06	0.0	7.03	7.03	0.0	8.61	8.61	0.0	8.56	8.56	0.0	8.62	8.62	0.0
16	8.8	8.8	0.0	9.99	9.99	0.0	10.82	10.82	0.0	11.51	11.51	0.0	11.72	11.72	0.0
17	8.51	8.51	0.0	9.93	9.93	0.0	11.54	11.54	0.0	11.94	11.94	0.0	12.13	12.13	0.0
17.5	13.54	13.54	0.0	16.58	16.58	0.0	20.18	20.18	0.0	21.1	21.1	0.0	21.53	21.53	0.0
18	18.96	18.96	0.0	21.58	21.58	0.0	24.07	24.07	0.0	24.8	24.8	0.0	25.01	25.01	0.0
19	10.47	10.47	0.0	11.92	11.92	0.0	13.72	13.72	0.0	14.12	14.12	0.0	14.35	14.35	0.0
20	16.88	16.88	0.0	16.2	16.2	0.0	16.19	16.19	0.0	16.24	16.24	0.0	16.29	16.29	0.0
21	20.57	20.57	0.0	23.26	23.26	0.0	26.1	26.1	0.0	26.9	26.9	0.0	27.35	27.35	0.0
22	11.86	11.86	0.0	13.97	13.97	0.0	16.5	16.5	0.0	17.09	17.09	0.0	17.34	17.34	0.0
23	13.62	13.62	0.0	16.24	16.24	0.0	19.38	19.38	0.0	20.18	20.18	0.0	20.56	20.56	0.0
24	4.2	4.2	0.0	4.73	4.73	0.0	5.37	5.37	0.0	5.52	5.52	0.0	5.59	5.59	0.0
25	0.63	0.63	0.0	0.59	0.59	0.0	0.56	0.56	0.0	0.56	0.56	0.0	0.56	0.56	0.0
26	1.43	1.43	0.0	1.21	1.21	0.0	1.07	1.07	0.0	1.05	1.05	0.0	1.04	1.04	0.0
27	3.65	3.65	0.0	3.71	3.71	0.0	3.75	3.75	0.0	3.76	3.76	0.0	3.77	3.77	0.0
28	3.68	3.68	0.0	3.68	3.68	0.0	3.69	3.69	0.0	3.71	3.71	0.0	3.72	3.72	0.0
29	1.17	1.17	0.0	0.69	0.69	0.0	0.46	0.46	0.0	0.42	0.42	0.0	0.4	0.4	0.0
30	2.9	2.9	0.0	2.89	2.89	0.0	2.82	2.82	0.0	2.78	2.78	0.0	2.76	2.76	0.0
31	1.92	1.92	0.0	1.79	1.79	0.0	1.87	1.87	0.0	1.93	1.93	0.0	1.95	1.95	0.0

Table 21. Bed Shear (psf)

Plans: 2-Ex, No Br — **Existing channel RediMix Bridge removed**

7noBrGr-3lwr — **Mining below Glacier Highway RediMix Bridge Removed**

Station	2 yr			5 yr (est)			25 yr			50 yr			100 yr		
	2-Ex, No Br	7noBrGr-3lwr	Change	2-Ex, No Br	7noBrGr-3lwr	Change	2-Ex, No Br	7noBrGr-3lwr	Change	2-Ex, No Br	7noBrGr-3lwr	Change	2-Ex, No Br	7noBrGr-3lwr	Change
1	0.33	0.33	0.0	0.57	0.57	0.0	0.97	0.97	0.0	1.1	1.1	0.0	1.16	1.16	0.0
2	1.35	1.35	0.0	1.86	1.86	0.0	2.26	2.26	0.0	2.7	2.7	0.0	2.93	2.93	0.0
3	1.37	1.37	0.0	1.88	1.88	0.0	2.76	2.76	0.0	2.83	2.83	0.0	2.84	2.84	0.0
4	1.39	0.67	-0.7	1.88	0.9	-1.0	2.52	1.16	-1.4	2.71	1.23	-1.5	2.79	1.27	-1.5
5	1.4	0.84	-0.6	1.55	1.03	-0.5	1.67	1.22	-0.5	1.69	1.27	-0.4	1.7	1.29	-0.4
6	1.33	1.09	-0.2	1.66	1.4	-0.3	2.03	1.75	-0.3	2.12	1.84	-0.3	2.16	1.88	-0.3
7	0.78	0.8	0.0	0.9	0.93	0.0	1.03	1.06	0.0	1.06	1.1	0.0	1.07	1.11	0.0
7.5	1.07	0.8	-0.3	1.32	1.03	-0.3	1.6	1.29	-0.3	1.66	1.36	-0.3	1.69	1.39	-0.3
7.8	1.26	1.19	-0.1	1.54	1.48	-0.1	1.85	1.81	0.0	1.93	1.89	0.0	1.96	1.93	0.0
8	1.98	1.6	-0.4	2.42	2.04	-0.4	2.9	2.53	-0.4	3.01	2.65	-0.4	3.06	2.71	-0.4
8.5	0.75	1.41	0.7	0.86	1.43	0.6	0.97	1.48	0.5	1	1.49	0.5	1.01	1.5	0.5
9	0.45	0.66	0.2	0.46	0.66	0.2	0.48	0.66	0.2	0.49	0.66	0.2	0.49	0.66	0.2
10	0.44	0.54	0.1	0.44	0.56	0.1	0.44	0.57	0.1	0.44	0.56	0.1	0.44	0.56	0.1
11	0.36	0.41	0.1	0.36	0.43	0.1	0.35	0.44	0.1	0.35	0.44	0.1	0.35	0.44	0.1
12	0.56	0.6	0.0	0.53	0.62	0.1	0.49	0.6	0.1	0.48	0.59	0.1	0.47	0.59	0.1
13	1.47	1.4	-0.1	1.87	1.72	-0.2	2.09	2.04	0.0	2.07	2.09	0.0	2.05	2.1	0.1
13.5	2.44	2.51	0.1	2.94	3.08	0.1	3.83	3.88	0.0	4.06	4.06	0.0	4.12	4.12	0.0
14	0.62	0.62	0.0	0.7	0.7	0.0	0.78	0.78	0.0	0.8	0.8	0.0	0.81	0.81	0.0
14.5	2.99	2.99	0.0	3.45	3.45	0.0	4.02	4.02	0.0	4.17	4.17	0.0	4.24	4.24	0.0
15	2.37	2.37	0.0	2.98	2.98	0.0	3.83	3.83	0.0	4.01	4.01	0.0	4.09	4.09	0.0
15.5	3.61	3.61	0.0	4.12	4.12	0.0	4.67	4.67	0.0	4.85	4.85	0.0	4.94	4.94	0.0
15.8	6.06	6.06	0.0	7.03	7.03	0.0	8.61	8.61	0.0	8.56	8.56	0.0	8.62	8.62	0.0
16	8.8	8.8	0.0	9.99	9.99	0.0	10.82	10.82	0.0	11.51	11.51	0.0	11.72	11.72	0.0
17	8.51	8.51	0.0	9.93	9.93	0.0	11.54	11.54	0.0	11.94	11.94	0.0	12.13	12.13	0.0
17.5	13.54	13.54	0.0	16.58	16.58	0.0	20.18	20.18	0.0	21.1	21.1	0.0	21.53	21.53	0.0
18	18.96	18.96	0.0	21.58	21.58	0.0	24.07	24.07	0.0	24.8	24.8	0.0	25.01	25.01	0.0
19	10.47	10.47	0.0	11.92	11.92	0.0	13.72	13.72	0.0	14.12	14.12	0.0	14.35	14.35	0.0
20	16.88	16.88	0.0	16.2	16.2	0.0	16.19	16.19	0.0	16.24	16.24	0.0	16.29	16.29	0.0
21	20.57	20.57	0.0	23.26	23.26	0.0	26.1	26.1	0.0	26.9	26.9	0.0	27.35	27.35	0.0
22	11.86	11.86	0.0	13.97	13.97	0.0	16.5	16.5	0.0	17.09	17.09	0.0	17.34	17.34	0.0
23	13.62	13.62	0.0	16.24	16.24	0.0	19.38	19.38	0.0	20.18	20.18	0.0	20.56	20.56	0.0
24	4.2	4.2	0.0	4.73	4.73	0.0	5.37	5.37	0.0	5.52	5.52	0.0	5.59	5.59	0.0
25	0.63	0.63	0.0	0.59	0.59	0.0	0.56	0.56	0.0	0.56	0.56	0.0	0.56	0.56	0.0
26	1.43	1.43	0.0	1.21	1.21	0.0	1.07	1.07	0.0	1.05	1.05	0.0	1.04	1.04	0.0
27	3.65	3.65	0.0	3.71	3.71	0.0	3.75	3.75	0.0	3.76	3.76	0.0	3.77	3.77	0.0
28	3.68	3.68	0.0	3.68	3.68	0.0	3.69	3.69	0.0	3.71	3.71	0.0	3.72	3.72	0.0
29	1.17	1.17	0.0	0.69	0.69	0.0	0.46	0.46	0.0	0.42	0.42	0.0	0.4	0.4	0.0
30	2.9	2.9	0.0	2.89	2.89	0.0	2.82	2.82	0.0	2.78	2.78	0.0	2.76	2.76	0.0
31	1.92	1.92	0.0	1.79	1.79	0.0	1.87	1.87	0.0	1.93	1.93	0.0	1.95	1.95	0.0

Table 22. Bed Shear (psf)

Plans: 2-Ex, No Br — **Existing channel RediMix Bridge removed**

8noBr-Gr4-13 — **Mining from RediMix Bridge to Correction Center RediMix Bridge Removed**

Station	2 yr			5 yr (est)			25 yr			50 yr			100 yr		
	2-Ex, No Br	8noBr-Gr4-13	Change	2-Ex, No Br	8noBr-Gr4-13	Change	2-Ex, No Br	8noBr-Gr4-13	Change	2-Ex, No Br	8noBr-Gr4-13	Change	2-Ex, No Br	8noBr-Gr4-13	Change
1	0.33	0.33	0.0	0.57	0.57	0.0	0.97	0.97	0.0	1.1	1.1	0.0	1.16	1.16	0.0
2	1.35	1.35	0.0	1.86	1.86	0.0	2.26	2.26	0.0	2.7	2.7	0.0	2.93	2.93	0.0
3	1.37	1.37	0.0	1.88	1.88	0.0	2.76	2.76	0.0	2.83	2.83	0.0	2.84	2.84	0.0
4	1.39	0.67	-0.7	1.88	0.9	-1.0	2.52	1.16	-1.4	2.71	1.23	-1.5	2.79	1.27	-1.5
5	1.4	0.84	-0.6	1.55	1.03	-0.5	1.67	1.22	-0.5	1.69	1.27	-0.4	1.7	1.29	-0.4
6	1.33	1.09	-0.2	1.66	1.4	-0.3	2.03	1.75	-0.3	2.12	1.84	-0.3	2.16	1.88	-0.3
7	0.78	0.8	0.0	0.9	0.93	0.0	1.03	1.06	0.0	1.06	1.1	0.0	1.07	1.11	0.0
7.5	1.07	0.8	-0.3	1.32	1.03	-0.3	1.6	1.29	-0.3	1.66	1.36	-0.3	1.69	1.39	-0.3
7.8	1.26	1.19	-0.1	1.54	1.48	-0.1	1.85	1.81	0.0	1.93	1.89	0.0	1.96	1.93	0.0
8	1.98	1.6	-0.4	2.42	2.04	-0.4	2.9	2.53	-0.4	3.01	2.65	-0.4	3.06	2.71	-0.4
8.5	0.75	0.42	-0.3	0.86	0.52	-0.3	0.97	0.64	-0.3	1	0.67	-0.3	1.01	0.68	-0.3
9	0.45	0.28	-0.2	0.46	0.31	-0.2	0.48	0.35	-0.1	0.49	0.36	-0.1	0.49	0.36	-0.1
10	0.44	0.21	-0.2	0.44	0.23	-0.2	0.44	0.25	-0.2	0.44	0.26	-0.2	0.44	0.26	-0.2
11	0.36	0.18	-0.2	0.36	0.18	-0.2	0.35	0.2	-0.2	0.35	0.2	-0.2	0.35	0.2	-0.2
12	0.56	0.25	-0.3	0.53	0.23	-0.3	0.49	0.23	-0.3	0.48	0.23	-0.3	0.47	0.23	-0.2
13	1.47	4.76	3.3	1.87	5.97	4.1	2.09	1.06	-1.0	2.07	1	-1.1	2.05	0.97	-1.1
13.5	2.44	3.26	0.8	2.94	3.58	0.6	3.83	3.95	0.1	4.06	4.06	0.0	4.12	4.12	0.0
14	0.62	0.59	0.0	0.7	0.68	0.0	0.78	0.78	0.0	0.8	0.8	0.0	0.81	0.81	0.0
14.5	2.99	2.99	0.0	3.45	3.45	0.0	4.02	4.02	0.0	4.17	4.17	0.0	4.24	4.24	0.0
15	2.37	2.37	0.0	2.98	2.98	0.0	3.83	3.83	0.0	4.01	4.01	0.0	4.09	4.09	0.0
15.5	3.61	3.61	0.0	4.12	4.12	0.0	4.67	4.67	0.0	4.85	4.85	0.0	4.94	4.94	0.0
15.8	6.06	6.06	0.0	7.03	7.03	0.0	8.61	8.61	0.0	8.56	8.56	0.0	8.62	8.62	0.0
16	8.8	8.8	0.0	9.99	9.99	0.0	10.82	10.82	0.0	11.51	11.51	0.0	11.72	11.72	0.0
17	8.51	8.51	0.0	9.93	9.93	0.0	11.54	11.54	0.0	11.94	11.94	0.0	12.13	12.13	0.0
17.5	13.54	13.54	0.0	16.58	16.58	0.0	20.18	20.18	0.0	21.1	21.1	0.0	21.53	21.53	0.0
18	18.96	18.96	0.0	21.58	21.58	0.0	24.07	24.07	0.0	24.8	24.8	0.0	25.01	25.01	0.0
19	10.47	10.47	0.0	11.92	11.92	0.0	13.72	13.72	0.0	14.12	14.12	0.0	14.35	14.35	0.0
20	16.88	16.88	0.0	16.2	16.2	0.0	16.19	16.19	0.0	16.24	16.24	0.0	16.29	16.29	0.0
21	20.57	20.57	0.0	23.26	23.26	0.0	26.1	26.1	0.0	26.9	26.9	0.0	27.35	27.35	0.0
22	11.86	11.86	0.0	13.97	13.97	0.0	16.5	16.5	0.0	17.09	17.09	0.0	17.34	17.34	0.0
23	13.62	13.62	0.0	16.24	16.24	0.0	19.38	19.38	0.0	20.18	20.18	0.0	20.56	20.56	0.0
24	4.2	4.2	0.0	4.73	4.73	0.0	5.37	5.37	0.0	5.52	5.52	0.0	5.59	5.59	0.0
25	0.63	0.63	0.0	0.59	0.59	0.0	0.56	0.56	0.0	0.56	0.56	0.0	0.56	0.56	0.0
26	1.43	1.43	0.0	1.21	1.21	0.0	1.07	1.07	0.0	1.05	1.05	0.0	1.04	1.04	0.0
27	3.65	3.65	0.0	3.71	3.71	0.0	3.75	3.75	0.0	3.76	3.76	0.0	3.77	3.77	0.0
28	3.68	3.68	0.0	3.68	3.68	0.0	3.69	3.69	0.0	3.71	3.71	0.0	3.72	3.72	0.0
29	1.17	1.17	0.0	0.69	0.69	0.0	0.46	0.46	0.0	0.42	0.42	0.0	0.4	0.4	0.0
30	2.9	2.9	0.0	2.89	2.89	0.0	2.82	2.82	0.0	2.78	2.78	0.0	2.76	2.76	0.0
31	1.92	1.92	0.0	1.79	1.79	0.0	1.87	1.87	0.0	1.93	1.93	0.0	1.95	1.95	0.0

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Appendix A

Memorandum of Agreement

MEMORANDUM OF AGREEMENT

Between
The City and Borough of Juneau,
and
The Alaska Department of Natural Resources
Office of Habitat Management and Permitting,
and
The Alaska Department of Fish and Game Sport Fish Division,
and
The U.S. Fish and Wildlife Service,
and
The U.S. Department of Agriculture Natural Resources Conservation Service,

To Support a Watershed Assessment
& Sediment Management Alternatives Analysis
For Lemon Creek in Juneau

WHEREAS, Lemon Creek is disconnected from its flood plain in reaches 1, 2, and 3 by urban and commercial development (as shown in Exhibit A), and

WHEREAS, Lemon Creek is a dynamic glacial stream and the area stated above is a rapidly aggrading channel which is causing bank destabilization and has the potential for flooding which will cause significant public and private property damage, and

WHEREAS, The City and Borough of Juneau (CBJ) desires to control potential Lemon Creek flooding in the above stated areas, and

WHEREAS, property owners have expressed interest in extracting gravel from the streambed, and

WHEREAS, Lemon Creek is listed as an "impaired" waterbody by the U.S. Environmental Protection Agency and the Alaska Department of Environmental Conservation because of water quality (sediment and turbidity) and habitat degradation, and

WHEREAS, CBJ, the Alaska Department of Natural Resources Office of Habitat Management and Permitting, the Alaska Department of Fish and Game Sport Fish Division, the U.S. Fish and Wildlife Service, and the U.S. Department of Agriculture Natural Resources Conservation Service agree that a watershed assessment and sediment management alternatives analysis would provide necessary information on which to base watershed management, flood control, gravel extraction, and aquatic habitat management decisions, and

WHEREAS, the U.S. Army Corps of Engineers and the Alaska Department of Natural Resources Office of Habitat Management and Permitting have the expertise and permitting authority for potential in-stream projects, and

WHEREAS, the Alaska Department of Fish and Game Sport Fish Division and the U.S. Fish and Wildlife Service have agreed to partially fund a Watershed Assessment and Sediment Management Alternatives Analysis, and

WHEREAS, the CBJ will secure approximately $25,000 in funding for a Watershed Assessment and Sediment Management Alternatives Analysis, and

WHEREAS, the U.S. Department of Agriculture Natural Resources Conservation Service has agreed to dedicate Juneau Field Office staff time towards development of the Watershed Assessment and Sediment Management Alternatives Analysis, and State Office staff time towards development of engineering alternatives for erosion and sediment control, and

WHEREAS, the agencies listed above and the City and Borough of Juneau will consider the comments and input from landowners and residents in the Lemon Creek corridor and citizens of Juneau regarding resource management in the Lemon Creek watershed,

THEREFORE, the CBJ, the Alaska Department of Natural Resources Office of Habitat Management and Permitting, the Alaska Department of Fish and Game Sport Fish Division, the U.S. Fish and Wildlife Service, and the U.S. Department of Agriculture Natural Resources Conservation Service, mutually agree to cooperate on the project as follows:

The State and Federal Agencies listed in this Memorandum of Understanding will:

– Provide technical review and support for conducting a watershed assessment (for the geographic area defined in Exhibit A) and sediment management alternatives analysis. The assessment will include:

  - addressing flooding and flood control issues
  - addressing erosion control issues, including bank stabilization techniques and control of sediment input
  - fish and wildlife habitat assessment and management alternatives
  - consideration of gravel extraction as a sediment management alternative
  - landowner and public input and review of the assessment and alternatives

– Utilize the Watershed Assessment in making planning and permitting decisions for activities that would affect Lemon Creek, including:

  - gravel extraction from within the streambed
  - bank stabilization and erosion control projects
  - habitat improvement projects

The City and Borough of Juneau will:

– Hire a consultant to prepare a Watershed Assessment.

– Provide contract administration services.

– Use the Watershed Assessment for support information when planning and issuing permits in the Lemon Creek watershed.

Contacts:

1. The contact person for the City and Borough of Juneau shall be:

   Bob Millard
   155 S. Seward St.
   Juneau, Alaska 99801
   Phone: (907) 586-0883
   Fax: (907) 463-2606

2. The contact person for the Alaska Department of Natural Resources Office of Habitat Management and Permitting shall be:

   Carl Schrader
   400 Willoughby Ave., 4th Floor
   Juneau, Alaska 99801-1796
   Phone: (907) 465-4287
   Fax: (907) 465-4759

3. The contact person for the Alaska Department of Fish and Game Sport Fish Division shall be:

   Ben Kirkpatrick
   Box 330
   Haines, AK 99827
   Phone: (907) 766-3502
   Fax: (907) 766-2189

4. US Fish and Wildlife Service shall be:

   Neil Stichert
   3000 Vintage Park Blvd., Suite 201
   Juneau, Alaska 99801
   Phone: (907) 586-7482
   Fax: (907) 586-7154

5. The contact person for the USDA Natural Resources Conservation Service shall be:

   Samia Savell
   175 South Franklin Street, Suite 424
   Juneau, Alaska 99801
   Phone: (907) 586-7220
   Fax: (907) 586-7383

It is specifically agreed between the parties executing this Memorandum of Understanding that it is not intended by any of the provisions to create in the public, or any member thereof, a third party benefit hereunder, or to authorize anyone not a party to this contract to maintain a suit for personal injuries, or property damage pursuant to the terms, or provisions of this contract.

This agreement contains the entire agreement by the parties, and there are no written or oral promises or understandings between the parties that modify its terms. It may be amended only by written agreement of the parties, signed by their respective representatives. This agreement is effective upon execution by the parties.

CITY & BOROUGH OF JUNEAU

By:

______________________________ Date: 3/10/04
Rod Swope
City & Borough Manager

Approved as to Content:

______________________________ Date: Feb. 27, 2004
Roger Healy, P.E. Date
Director, CBJ Engineering Department

Approved as to Form:

______________________________ Date: 1/27/04
John A. Leque
City Attorney

ALASKA DEPARTMENT OF NATURAL RESOURCES OFFICE OF HABITAT MANAGEMENT AND PERMITTING

______________________________ Date: 2/9/04
Kerry Howard
Executive Director

ALASKA DEPARTMENT OF FISH AND GAME

______________________________ Date: 2/4/04
Kevin Duffy
Commissioner (Acting Commissioner)

U.S. FISH AND WILDLIFE SERVICE

______________________________ Date: 2/10/04
Bruce Halstead
Field Supervisor

U.S.D.A. NATURAL RESOURCES CONSERVATION SERVICE

______________________________ Date: 2/20/04
Shirley Gammon
Alaska State Conservationist

Appendix B

Meeting Summaries
Property Map

Lemon Creek Meetings Summary
July 15, 2004

Three meetings regarding the undergoing study of Lemon Creek's hydrologic and sediment transport regime were held on July 15, 2004 in the City and Borough of Juneau (CBJ) Assembly Chambers. Following is a summary of each meeting.

Core Group Meeting – 8 – 10:30 a.m.

Attendees:

Greg Koonce – Inter-Fluve
Ben Kirkpatrick – ADF&G
Bob Millard – CBJ
Dan Miller – Inter-Fluve
Rob Sampson – NRCS
Richard Enriquez – USFWS
Ben White – ADNR
Neil Stichert – USFWS
Samia Savell – NRCS

Purpose:
Provide Ben White and Richard Enriquez with project background, update core group members on work thus far, begin identifying possible sediment management alternatives.

Summary:
Samia Savell gave a brief introduction to the project's origin and the Memorandum of Agreement (MOA) signed by the attending government agencies and the CBJ.

Dan Miller introduced Inter-Fluve and provided background information about the project, including an overview of Inter-Fluve's Reconnaissance study, USGS hydraulic modeling, and observations made during May and July site visits. The longitudinal profile and cross sections were used to demonstrate channel characteristics at various flow levels and constriction removal scenarios.

Ben Kirkpatrick relayed his observations of fish use and habitat in Lemon Creek and its tributaries. A fish survey was conducted in May, but the data results have not been reported yet. Overall, fish habitat in the lower reaches of Lemon Creek is limited due to low pool frequency and lack of side channels. Group discussion regarding Lemon Creek's productivity and "relative value" in relation to other Juneau road system waterways followed. There was general agreement that although the system is not as productive as similar waterways such as the Eagle or Herbert Rivers, fish habitat in Lemon Creek could be improved.

Bob Millard reminded the group that CBJ wishes to manage Lemon Creek through the property owners. Sediment management alternatives will need to be "revenue neutral."

Discussion turned to sediment management alternatives. Rob Sampson pointed out that a combination of restoration bonds, watershed council oversight, and agency guidance is most effective in encouraging landowners to participate in resource management. Mining must be economically viable if it is to be used as a management tactic. Dan Miller noted that aggradation will be event-based, so management will be ongoing. Bob Millard expressed concern that SECON may be unwilling to participate in any type of local management plan because they are an international company.

The group considered historical photos, which indicate that Hidden Valley was active prior to mining. Instream mining in the lower reaches has significantly changed the channel's behavior over time. Bank stabilization and floodplain development have constricted the channel.

Dan Miller summarized the alternatives that had been raised during discussions:

- Do nothing
- Remove the Ready Mix bridge
- Mitigated mining upstream of the Glacier Highway bridge
- Upstream sediment control
- Mining downstream of the Ready Mix bridge
- Purchase floodplain easements

The group noted that these alternatives are neither mutually exclusive nor all-inclusive. Other alternatives may be identified, and some combination of management alternatives would likely be the best approach to managing the stream for both fish habitat and flood mitigation.

The group planned to present this information to the steering meeting attendees to get additional feedback/comments from other agencies and CBJ representatives. A public meeting will be held at a later date, which will be set once information from today's meetings has been incorporated into the draft report.

Steering Meeting – 10:30 a.m. – noon

Attendees:

Core Group meeting attendees
Fran Roche – ADEC
Ed Neal – USGS
Teri Camery – CBJ Planning
Rorie Watt – CBJ Engineering
Mark Miles – ADOT
Steve Gilbertson – CBJ Lands
K Koski – NMFS
Lisa Hofferkamp – UAS
Merrill Sanford – CBJ Assembly

Purpose: Provide information to agency and city representatives who are not signatories of the MOA but who might have some interest or concern about the project, get feedback from attendees, and determine the amount and type of support that can be expected from attendees.

Summary:
Samia Savell gave a brief introduction to the project's origin and the MOA.

Dan Miller introduced Inter-Fluve and provided background information about the project, including an overview of Inter-Fluve's December, 2002 Reconnaissance Level Sediment Transport Study, USGS hydraulic modeling, and observations made during May and July site visits. The longitudinal profile and cross sections were used to demonstrate channel characteristics and flood hazard at various flow levels.

Some discussion of the historical resource uses in the Lemon Creek corridor followed. Steve Gilbertson estimated Shorty Tonsgard logged upper Hidden Valley in 1984. Merrill Sanford stated that he remembered some hand logging in the area upstream of the jail when he was a kid.

Gravel mining and channel alterations have occurred for many years (the group referred to historical photos). Rob Sampson stated that the pre- and post-gravel mining bank height near the jail is different, according to the FEMA reports. He estimated ~150,000 cubic yards of material had been removed from the jail reach. Ben Kirkpatrick commented on channel changes over time, and noted that there no longer is riprap on the dike below the Ready Mix bridge. Mark Miles added that the sediment load seems to have increased in the last six years or so.

Ben Kirkpatrick gave a brief overview of fisheries resources in Lemon Creek and its tributaries. Greg Koonce and Neil Stichert had added comments regarding side channel and tributary habitat value in the watershed. K Koski commented that the high density of birds at the mouth of Lemon Creek in early spring indicates presence of eulachon or capelin.

A discussion about sediment management alternatives followed. Mark Miles expressed some concern that sediment reduction in the lower reaches might destabilize the Glacier Highway bridge abutments. There was less concerned about Egan Drive, and he anticipated that using wood in the channel design would not cause problems for ADOT. He also pointed out that CBJ may need to negotiate flood insurance rates with FEMA if maintenance dredging is used for sediment control.

Steve Gilbertson pointed out that a new bridge crossing upstream of the jail will be necessary to access the future CBJ gravel site.

K Koski stated that creation of off-channel habitat in the lower reaches should be included in sediment management alternatives.

When asked if there were anticipated TMDL issues with this project or with future sediment management alternatives, Fran Roche stated that she would have to check with the Anchorage ADEC office.

Samia Savell concluded the meeting by thanking the attendees, and stated that the core group would continue to inform attendees as the project progressed. She also said that the core group would request the following support:
USGS – continued assistance with modeling and data interpretation

ADOT – comments and concerns regarding the effects of sediment management alternatives on roads and associated structures
ADEC – coordination of sediment management and fish habitat enhancement with TMDL efforts
NMFS – continued input on fisheries and wildlife concerns
CBJ – continued support from various departments as the project develops

Stakeholder Meeting – 2 – 4 p.m.

Attendees:

- Core Group meeting attendees
- Scott LaFavour – Lacono
- Ian Black – SECON
- Ron Hildre
- Tom Horn
- Jan Van Dort – Attorney representing Horecny
- Ralph Horecny – RSH Company
- Peter Freer - CBJ

Purpose: Provide information to and get feedback from landowners and mining claim owners.

Summary:
Samia Savell gave a brief introduction to the project's origin.

Dan Miller introduced Inter-Fluve and provided background information about the project and MOA, including some of the alternatives discussed in the previous two meetings. Discussion followed, focusing on gravel mining in the lower reaches and sediment loss in Hidden Valley.

Ralph Horecny has been working the creek for many years, but has not mined his Lemon Creek claim since 1984. He said that the glacier is farther back than it used to be, and noted that the water has been brown lately—an unusual color for a glacial stream, especially since there has been little precipitation this summer. He riprapped the banks on his property in the late 1980s.

Tom Horn wanted to know his rights as a property owner. He was unhappy that people have been doing surveys in the creek without informing him or asking permission to cross his property. He said that he is not interested in going back into the mining business.

Jan Van Dort noted that any gravel mining alternatives would need to be economically feasible. He gave an example of unitizing agreements that are used to coordinate diamond mining claims, and suggested that he and Ralph submit a mining plan to which the project participants could respond. He later stated that the City may have to impose a plan on the landowners if the creek is to be controlled. Ralph said that any mining plan would have to be flexible, since the creek changes with every storm. He also stated that material removed from the stream could be stockpiled for later use, and screened/sorted to meet market demands at any given time—in which case a long term stockpile location is the limiting factor.

Ron Hildre noted that Lemon Creek has been problematic for more than 50 years, and that landowners need to be able to protect their property. He wanted to know how the management alternatives would affect his ability to riprap his banks. Scott LaFavour agreed, and said that his banks are more expensive to fix now than they were several years ago. He wanted to know who would cover that cost.

Ian Black said that he could not get a permit to protect SECON property streambanks. DGC denied the permit through the ACMP process. He stated that SECON has been fighting to protect their property for years. There is not much valuable instream material in Hidden Valley—it is mostly clay underneath a thin layer of gravel and sand. He noted that stopping the erosion upstream is necessary for controlling aggradation downstream, but said that SECON needs to recoup some losses in order to appeal to their corporate interests. He also suggested that contracting gravel removal, with royalties paid to the property owner, might be one way to conduct ongoing maintenance mining in the lower reaches.

Samia Savell concluded the meeting by thanking everyone for attending, and said that a subsequent meeting would be held once the draft report had been written. In addition, a public meeting would be advertised. Jan Van Dort said that he and Ralph would submit a mining plan in about a week.

Lemon Creek Sediment Transport and Hydrologic Study
Public Meeting
August 26, 2004
Dzantiki Heeni Middle School Library

Introduction to meeting and project partners – Rorie Watt, City and Borough of Juneau

Project purpose and goals, Lemon Creek development over time – Samia Savell, USDA Natural Resources Conservation Service

Lemon Creek study overview – Dan Miller, Interfluve, Inc.

Studies and information to date
Review of reconnaissance level sediment transport study
Current study of sediment transport and habitat
Historical air photographs
Photographs of Lemon Creek from Egan Drive upstream to study endpoint at fish barrier
Alternatives being considered thus far
Next steps…

Questions and comments from attendees

Note: Some questions/comments came up during the presentation—not all of them are reflected here, but the main points are included. The meeting was recorded once the presentation concluded, so questions and comments were transcribed directly from the tape recorder and paraphrased only where points could be simplified while keeping the points clear. Where possible, the person speaking was listed.

Tide influences sediment transport through the wetlands in the lower portion of the creek.

Lemon Creek is the worst local stream in terms of sediment deposition in the Mendenhall State Game Refuge.

Uplift is occurring at a rate of about 1 foot every 10 years. Streambed aggradation is occurring at a much faster rate.

Floodgates at various locations along Egan may help transport flood waters. – Dennis Harris

Flooding a few years ago put the jail road at risk.

Pits near Ready Mix provided most of Juneau's gravel in the 1960s.

Problems came up when they made us quit mining.

The instream mining…Am I correct in saying that there are certain times of the year when it's okay to do so, and other times of the year when the fish are spawning or moving upstream when it's not okay? – Dennis Harris

Any instream mining would have to be permitted through DNR Habitat…There are a lot of issues, but certainly the fish timing would be part of that. –Ben Kirkpatrick

In the spring, Bob Millard also discussed possibly digging a pit in the stream that could be dredged periodically. How does that fit into this? – Dan Collison

Having a pit in the middle of the river will intercept anything that comes into it, so material will not leave the pit—meaning clear water will flow downstream, and will tend to scour and erode further downstream. We should be getting some legal guidance this week regarding mining claims. – Dan Miller

You're saying that if the gravel comes downstream and is deposited on their claim, they may not own it? –Dennis Harris

No, they own it, but if you don't allow it to go downstream…There may be a problem. –Dan Miller

You got it right there. They made us quit mining, they had problems. I think it was Ben who came to me one year and said, "Tom, can you not bail until after June 6." I made a mistake, I said I would do that. But then they said…I've got the deed right here that says I own the gravel and the water, so they're trespassing on my property with their stinking fish already. Anyway, but you saw the picture where it was perfectly straight—that was because we mined it. That's as simple as it can get. – Tom Horn

What opportunity will there be for the public to comment on this? – Dan Collison

There's a form for comments at the back of the room, and I will send a meeting summary to everyone who signed up on the sign-up sheet. That summary will have my contact information, and you can direct all questions to me. We can also post the information on the CBJ website. – Samia Savell

So, if I'm understanding this correctly, our concerns are reaches 1, 2, and 3 of the populated areas, to reduce the level of the streambed and allow it to flow enough in a natural manner so that we don't suffer from a 100-year flood. And also to not interrupt or disturb the fish habitat?

Yes, that's basically it. We knew that there were mineral right owners that wanted to mine gravel but were having trouble getting permits, and that there were unsuspecting residential and commercial property owners that are at increasing risk of floods. So we were looking to get involved and broker some kind of deal…I don't have a favorite alternative, but if there's a way to do some mining and at the same time some habitat improvements, and the mining operators can do it economically, great. If there's a way to remove that one bridge and provide alternative access, then perhaps we can pursue some kind of cooperative deal to get that done...—Rorie Watt

It's likely that some combination of alternatives would be used...—Dan Miller

It makes sense to have some gravel mining in the lower reaches, but what would be the effect on salmon? Are there salmon laying eggs there?

Lemon Creek wasn't a fishery until fish were planted in the stream. – Tom Horn

I didn't know that we were planting eggs in the stream. I don't see the problem if it wasn't a naturally occurring salmon creek—we can go in and clean up the mess and then put fish in there.

There is a natural run of coho and reports of steelhead. – Ben Kirkpatrick

Well then let's go with that then. Can't we capture that brood and preserve them in a hatchery atmosphere for a period of time to sustain them and then reintroduce them at a later time? Salmon are an amazingly adaptive and persevering species. The thing is, we're trying to come up with a way where we can deal with the flooding and incorporate some fish habitat at the same time. I think there are ways to do both. These aren't mutually exclusive ideas. If we only wanted to control flooding, we could have another Gold Creek. That's what we're trying to avoid, and I think there are ways to extract gravel to protect people and still have fish. – Ben Kirkpatrick

The salmon aren't spawning in the lower reaches. It's my understanding that you have to time the mining to avoid upstream spawning and downstream migration activities, is that correct?

Not completely. That is a large part of it. There are a lot of things to take into consideration. You can go in and mine gravel, and get out of the creek quickly. You don't want to be in the creek during high water anyway. – Ben Kirkpatrick

I think it's important to recall the series of photographs of the lower valley, where we had a pattern or form of the creek that had braids. That serves multiple advantages to fish that includes spawning on downstream bars, serves as a migration corridor for adults moving upstream seeking more favorable spawning and rearing habitats, and provides a lot more dimension and complexity such as riparian habitats where you have vegetation on the tips of the bars and on adjacent stream edges. When you get to a situation where the stream is lined bank to bank, you lose all of that dimension. If you recall the series of photos, we looked at a series of braided channels, and when you get to the 1984 photo, it's basically a bathtub. Now we have about 20 years of recovery within that system, providing some degree of habitat value. – Neil Stichert

I think some of these ideas are exciting, but I have to say that there's a certain level of skepticism that I bring to this because of CBJ's history of studying issues on Lemon Creek and basically doing nothing about the study recommendations. We know that ten years ago there was a recovery plan that identified Lemon Creek as an impaired waterbody. CBJ and state and federal agencies put together a recovery plan for Lemon Creek and from what I can see, that recovery plan has never been implemented. There were several recommendations, one of which was that CBJ would protect the 50-foot buffer zone. We've seen, especially on the south side of the creek, that variances have been granted on the 50-foot setback. The City also said that they would either purchase or trade for property along the creek to protect that buffer zone, and the

City has done nothing…In fact the only land the City purchased was so they could access their gravel further back in the gorge. So I think this is a great opportunity, but given CBJ's record in the past of abiding by agreements, I would hope that the City comes to this with a greater commitment to implement the recommendations of this report. One of the things we see right now is that the City continues to grant variances to the 50-foot setback. Right now there's a zoning request at the end of Davis Avenue that in fact grants a developer right of way access, and a part of that right of way access is in the 50-foot buffer zone. And again what we're doing is narrowing the channel of Lemon Creek and we're making it more difficult for that channel to meander, and we're putting more property on the edge of the stream that we have to protect with rock riprap. And that's a real concern for the Neighborhood Association and for me. The Lemon Creek Neighborhood Association would like to see permits followed, and perhaps there should be a gravel tax to pay for problems resulting from instream activity. There are a lot of resources coming out of Lemon Creek and we see nothing from all of that activity. – Dan Collison

Remember that CBJ is a "multi-headed monster" representing many different interests. Different departments and committees deal with different aspects of the same issues. I'm not familiar with the recovery plan, so I can't comment on that. What I do know is that there's a gravel pit behind Costco that the City owns, and the City charges a management fee to contractors using that pit. That money goes into a gravel reserve fund that is used to help pay for access up the river and to get conditional use permits for new gravel areas. Over time that fee has increased, so it may be appropriate to increase it further to pay for other uses as well. In fact, the Borough's portion of this study is being paid for out of that fund, which I think is appropriate. Gravel mining clearly has its up and down sides, the up side is that it allows a lot of the local construction projects to happen…The fact of the matter is that we've had an increasing regulatory standard over time. I'm not opposed to those standards, it's just the way it's happened. It's a changing field. Where it'll all end up, I don't know. But I know that we'll continue to need gravel and as we learn more about the creek and salmon, we're going to be doing more and more things to protect it. As for variances, the City's Planning Commission, which is appointed by the Assembly, and the City's Planning Department, deals with those issues and I can't really speak to that. That's another head of the monster. I think the best thing to do is articulate your comments in a written form as part of the study is intended to incorporate that. – Rorie Watt

When will written comments be due? And would it be within the scope of this project to identify what kind of financial resources would be needed over a ten-fifteen year period, with the idea of maybe increasing the gravel reserve fund to accommodate those needs? –Dan Collison

Comments will be due to Samia Labor Day week. I'll have to check on the scope of the project, but I think we can give planning level estimates of what removing a bridge would cost, or…The idea is for the instream mining to be economically feasible, including some kind of instream habitat component, so we're looking to have that be revenue neutral. As far as the upstream issues, we can provide some estimates of control structures...—Dan Miller

Those areas along the stream, if you go by them during the winter when there are no leaves on the trees, those areas are just trashed. Concrete blocks, cables, debris falling into the banks. What type of private and public resources would be needed to clean that up? If there is a possibility…you referred to some kind of meander corridor? What can be done to stabilize the buffer zone of that stream? – Dan Collison

The meander corridor I referred to is upstream in Hidden Valley. We've done a fair amount of work in biostabilization. There are some rivers where vegetation by itself will not do the trick...—Dan Miller

One thing you have to remember, the stream for the most part is private property, just like your yard is private property. Buffers are just a regulation. But they've never funded it—it's private property. You can't take someone's private property and not compensate them. – Hugh Grant

Hugh, that's been litigated many times and the Supreme Court said three years ago that cities have the right to regulate development. – Dennis Harris

Okay, back to bioengineering. There are many ways to protect the bank and provide habitat. – Dan Miller

I would like to know what would be the best management practices for the streambank in that residential neighborhood and what would be the financial costs to do that? And, is it possible that we can tap into the gravel reserve fund so that we can start taking care of some of those issues? – Dan Collison

Try to keep in mind what we're talking about. It's kind of a three pronged issue—we're trying to improve flood conveyance while preserving habitat and allowing gravel mining. I think the comments should focus on that. You can do a lot to preserve a buffer zone on either side but you may not be improving flood conveyance. – Mark Miles

But who does he go to, because there's really no point in pursuing alternative concepts if they're not realistic, if they can't be funded…

Mendenhall Watershed Partnership is kind of that entity. Mendenhall is where we started, but I think we are able to bring parts of the "many-headed dragon" of various agencies and people who live here together. The Lands Department, the Public Works Department, the Engineering Department, the Planning Department are all going different directions…It's helpful to have a quasi-public entity that can help identify the best solutions. So, if it's working with neighborhood associations set up your own Lemon Creek Watershed Partnership or working with Samia to set up a watershed council, I think that's a much easier way for both the state and local governments to have an effective local group to look at not just regulations, but how to get solutions on the ground…– Mark Jaqua

The other thing to remember here is that we make in this study will have to be compatible with City ordinances and with the TMDL—those are the laws we're working with, and we've already made that commitment to work with DEC to make sure that whatever management practices are used are going to work within the constraints of that TMDL. Of course, we're doing this study for the City, so those issues related to ordinances and regulating how development occurs within the City and Borough of Juneau are going to have to be part of the study. – Samia Savell

Will your study give an estimate of what it would take to remove that lower bridge? If the bridge is responsible for most of the backwatering, it should be removed first and then followed up with some mining if necessary. And then maybe consider structures or log jams higher up. The problem with instream flood control structures is that at some point they fail. – Dennis Harris

You have to address the contributing factors, not just downstream issues. The erosion upstream has to be controlled.

Yes, you need to discourage further development upstream that will cause more disturbance, more erosion. – Dennis Harris

What kinds of things can be used to address that erosion? I've seen along the highways where there's a lot of development in urban areas where they spray this green foliage stuff on the ground that actually acts kind of like a glue…

Chances are that wouldn't be much help in this case. – Dan Miller

Can you prioritize the management alternatives according to the level of effectiveness? – Dan Collison

A lot of sediment is coming from the glacier—that can't be controlled. – Mark Miles

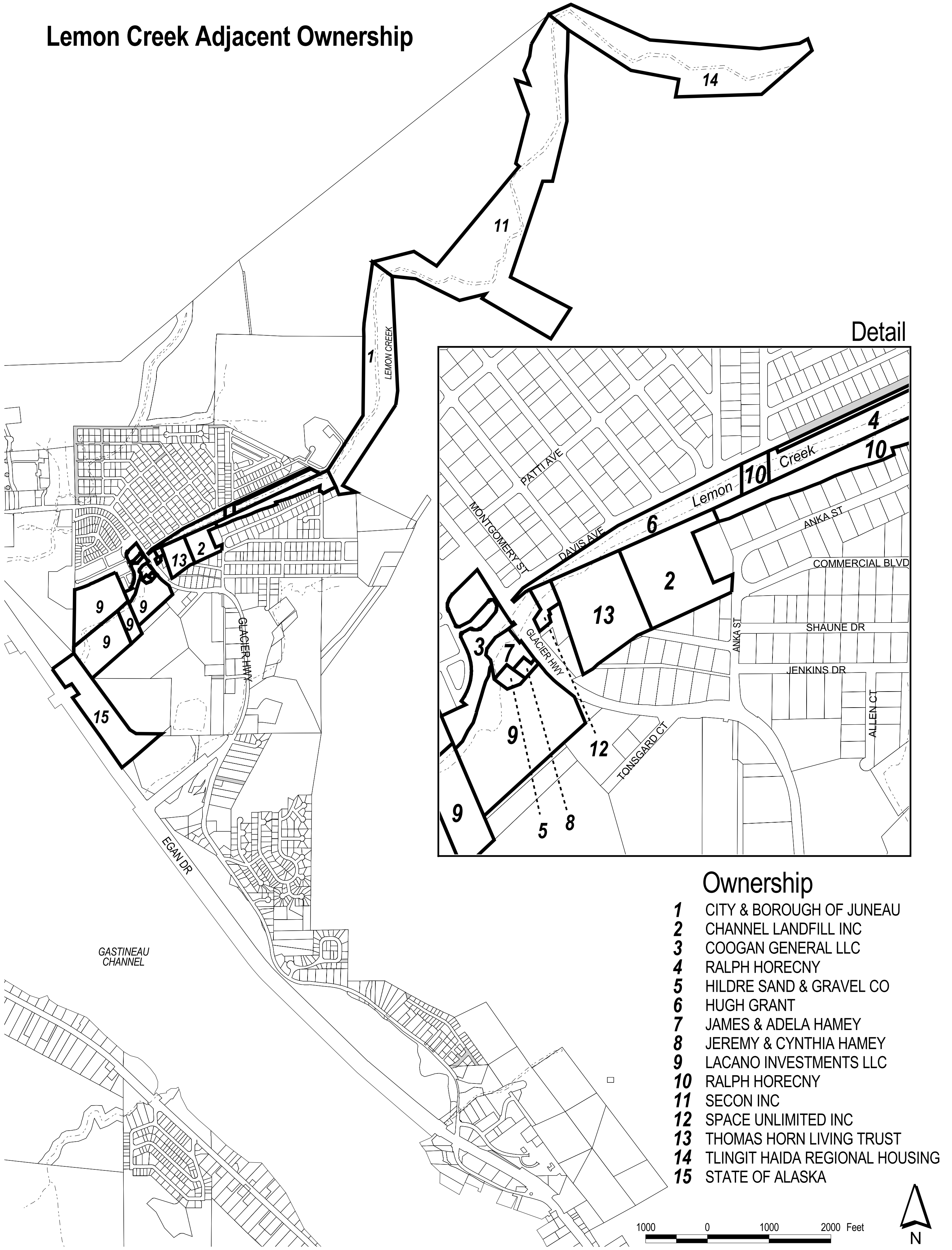
But is seemed like the natural meandering of the stream over time was handling that, and the sediment was making its way out into Gastineau Channel.

The tendency in systems like this is to build up an alluvial fan, where the stream moves from one location to another as sediment is deposited. Obviously, the stream has been constrained, so some type of management is needed, or floodplain acquisition needs to occur. Ben, do you want to talk about the habitat survey? – Dan Miller

Fish and Game did a habitat survey, looking at pools and instream structure such as logs and log jams…What we're looking to do is have some kind of positive impact on the available habitat with any type of management. We're at the bottom right now, so there are a lot of options for improving habitat. What we did is not quite as quantitative as the sediment work, but it does give us an idea of what's available now in terms of fish habitat. There are basically no pools below Glacier Highway, and very few above, and almost no wood in the stream…Looking at the photos, it's been better in the past. –Ben Kirkpatrick

Meeting wrap-up. Comments are due to Samia by September 8, 2004.

Lemon Creek Adjacent Ownership



Ownership

- *1* CITY & BOROUGH OF JUNEAU
- *2* CHANNEL LANDFILL INC
- *3* COOGAN GENERAL LLC
- *4* RALPH HORECNY
- *5* HILDRE SAND & GRAVEL CO
- *6* HUGH GRANT
- *7* JAMES & ADELA HAMEY
- *8* JEREMY & CYNTHIA HAMEY
- *9* LACANO INVESTMENTS LLC
- *10* RALPH HORECNY
- *11* SECON INC
- *12* SPACE UNLIMITED INC
- *13* THOMAS HORN LIVING TRUST
- *14* TLINGIT HAIDA REGIONAL HOUSING
- *15* STATE OF ALASKA

FILE REFERENCE: F:\GIS_Work\Jeanette\PROJECTS\DEPTS\LANDS\master plans\lemon creek study.apr
LAYOUT: ADJACENT CREEK OWNERS DATE: May 21, 2004

Appendix C

Streambed Gravel Sample Sieve Tests

R&M PROJECT NUMBER: 041136

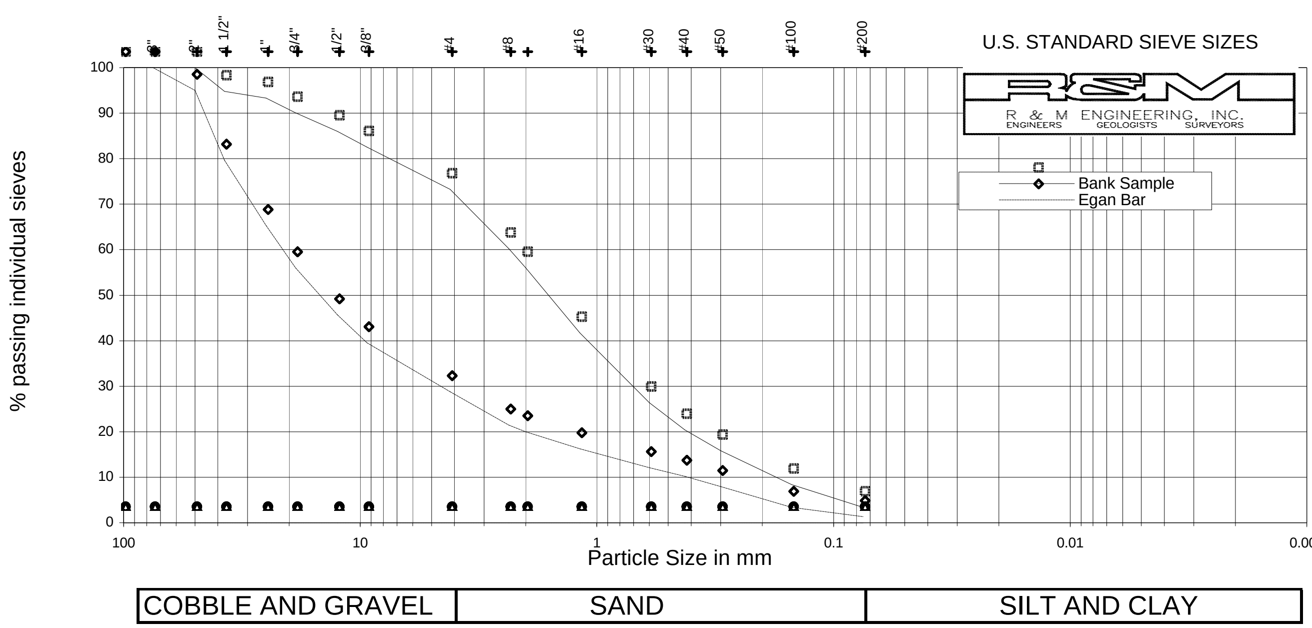
R & M ENGINEERING, INC.
ENGINEERS GEOLOGISTS SURVEYORS
6205 Glacier Highway, P.O.Box 34278, Juneau, Alaska 99801

PROJECT : Lemon Creek Reconnaissance Sediment Transport Studies
CLIENT: Inter-Fluve **MATERIAL TYPE:** Native Sand/Gravel
DATE RECEIVED: 7/16/2004 **SAMPLE SOURCE:** Lemon Creek
DATE REPORTED: 7/21/2004 **SAMPLE SUBMITTED BY:** Bob Millard, CBJ Engineering

Moisture	N.A.		N.A.					
SIEVE SIZE	Percent passing of **Bank Sample**	Required specs	Percent passing of **Egan Bar**	Required specs	Percent passing of	Required specs	Percent passing of	Required specs
4 "								
3 "			100					
2 "	100		95					
1 1/2 "	95		80					
1 "	93		65					
3/4 "	90		56					
1/2 "	86		46					
3/8 "	83		40					
No 4	73		29					
No 8	60		21					
No 10	56		20					
No 16	42		16					
No 30	26		12					
No 40	20		10					
No 50	16		8					
No 100	8		3					
No 200	3.3		1.3					

Grain size distribution for soils of the

Lemon Creek Reconnaissance Sediment Transport Studies



Sieve analysis following ASTM C-136
Moisture content determination following ASTM C-566

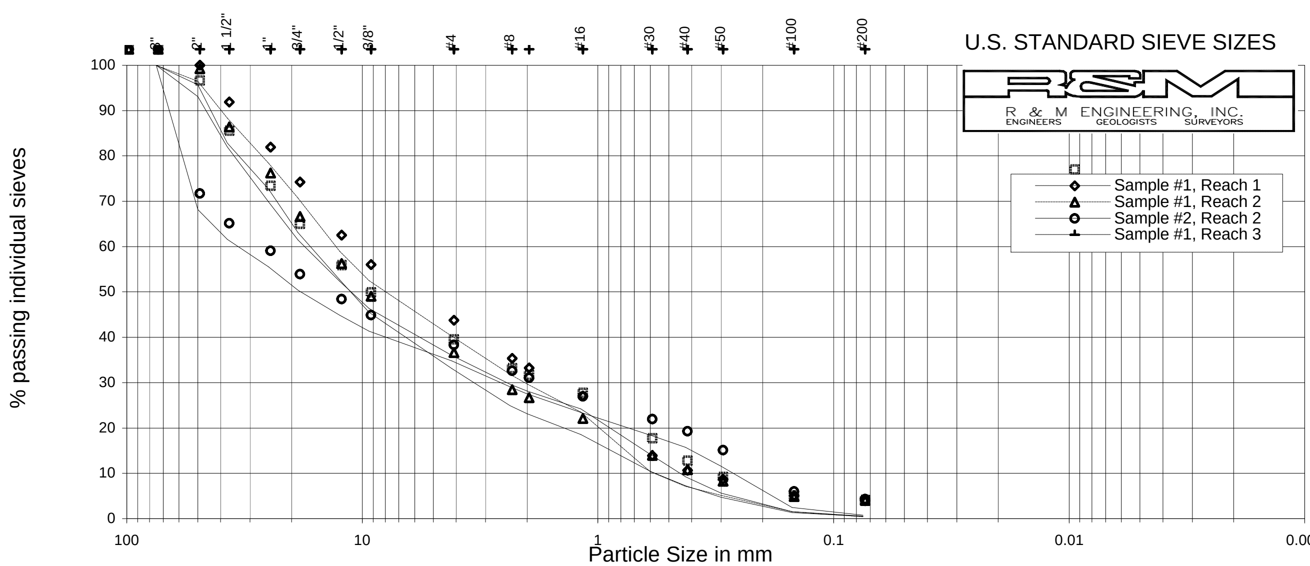
R&M ENGINEERING, INC.
ENGINEERS GEOLOGISTS SURVEYORS
6205 Glacier Highway, P.O.Box 34278, Juneau, Alaska 99801

R&M PROJECT NUMBER: 021177

PROJECT : Lemon Creek Stream Bed Gradation
CLIENT: City and Borough of Juneau **MATERIAL TYPE:** Gravel and Sand
DATE RECEIVED: 11/8/2002 **SAMPLE SOURCE:** Lemon Creek Stream
DATE REPORTED: 11/13/2002 **SAMPLE SUBMITTED BY:** Bob Millard

Moisture								
SIEVE SIZE	Percent passing of **Sample #1, Reach 1**	Required specs	Percent passing of **Sample #1, Reach 2**	Required specs	Percent passing of **Sample #2, Reach 2**	Required specs	Percent passing of **Sample #1, Reach 3**	Required specs
4 "	100		100		100		100	
3 "	100		100		100		100	
2 "	93		96		96		68	
1 1/2 "	82		88		83		62	
1 "	70		78		73		56	
3/4 "	61		71		63		50	
1/2 "	52		59		53		45	
3/8 "	46		53		46		41	
No 4	36		40		33		35	
No 8	30		32		25		29	
No 10	28		30		23		28	
No 16	24		24		19		23	
No 30	14		10		10		18	
No 40	9		7		7		16	
No 50	6		5		5		12	
No 100	2		2		1		3	
No 200	0.6		0.5		0.5		0.8	

Grain size distribution for soils of the
Lemon Creek Stream Bed Gradation



COBBLE AND GRAVEL	SAND	SILT AND CLAY

Sieve analysis following ASTM C-136
Moisture content determination following ASTM C-566

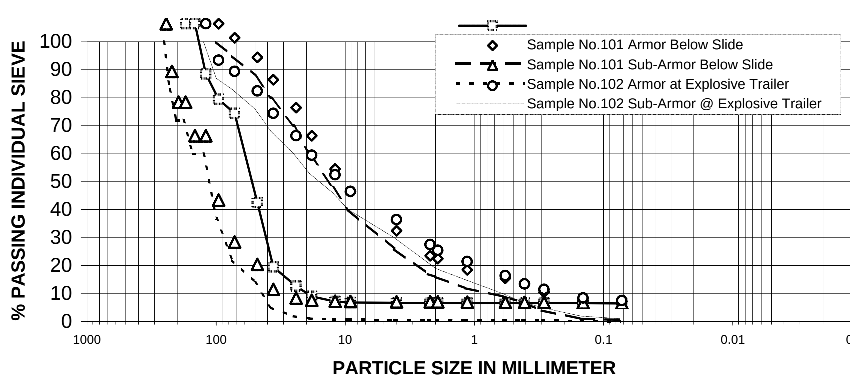
R&M PROJECT NUMBER: 041136

R & M ENGINEERING, INC.
ENGINEERS GEOLOGISTS SURVEYORS
6205 Glacier Highway, P.O.Box 34278, Juneau, Alaska 99801

PROJECT : Materials Testing for Lemon Creek Reconnaissance Sediment Transport Studies
CLIENT: Inter-Fluve **MATERIAL TYPE: Native Sand/Gravel**
DATE RECEIVED: 5/19/2004 **SAMPLE SOURCE: On Site Material**
DATE REPORTED: 6/10/2004 **SAMPLE SUBMITTED BY: Inter-Fluve**

Moisture	N.A.		N.A.		N.A.		N.A.	
SIEVE SIZE	Percent passing of **Sample No.101 Armor Below Slide**	Required specs	Percent passing of **Sample No.101 Sub-Armor Below Slide**	Required specs	Percent passing of **Sample No.102 Armor at Explosive Trailer**	Required specs	Percent passing of **Sample No.102 Sub-Armor @ Explosive Trailer**	Required specs
12 "								
11 "								
10 "					100			
9 "					83			
8 "					72			
7 "					72			
6 "	100				60			
5 "	82				60		100	
4 "	73		100		37		87	
3 "	68		95		22		83	
2 "	36		88		14		76	
1 1/2 "	13		80		5		68	
1 "	6		70		2		60	
3/4 "	3		60		1		53	
1/2 "	0.6		48		0.80		46	
3/8 "	0.3		40		0.70		40	
No 4	0.2		26		0.60		30	
No 8	0.17		17		0.60		21	
No 10	0.16		16		0.60		19	
No 16	0.15		12		0.50		15	
No 30	0.13		9		0.40		10	
No 40	0.12		7		0.30		7	
No 50	0.10		4		0.30		5	
No 100	0.06		1		0.20		2	
No 200	0.03		0.70		0.10		1	

GRAIN SIZE DISTRIBUTION CURVE



R&M PROJECT NUMBER: 041136

R & M ENGINEERING, INC.
ENGINEERS GEOLOGISTS SURVEYORS
6205 Glacier Highway, P.O.Box 34278, Juneau, Alaska 99801

PROJECT : Materials Testing for Lemon Creek Reconnaissance Sediment Transport Studies

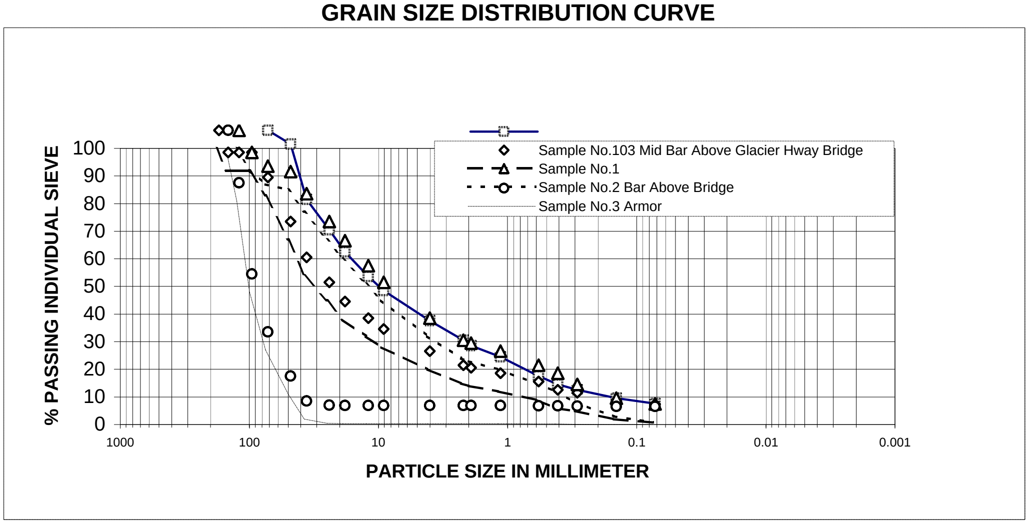
CLIENT: Inter-Fluve **MATERIAL TYPE: Native Sand/Gravel**

DATE RECEIVED: 5/19/2004 **SAMPLE SOURCE: On Site Material**

DATE REPORTED: 6/10/2004 **SAMPLE SUBMITTED BY: Inter-Fluve**

Moisture	N.A.		N.A.		N.A.		N.A.	
SIEVE SIZE	**Sample No.103 Mid Bar Above Glacier Hway Bridge**		**Sample No.1**		**Sample No.2 Bar Above Bridge**		**Sample No.3 Armor**	Required specs
12 "								
11 "								
10 "								
9 "								
8 "								
7 "			100					
6 "			92				100	
5 "			92		100		81	
4 "			92		92		48	
3 "	100		83		87		27	
2 "	95		67		85		11	
1 1/2 "	75		54		77		2	
1 "	64		45		67		1	
3/4 "	56		38		60		0.40	
1/2 "	47		32		51		0.40	
3/8 "	42		28		45		0.40	
No 4	31		20		32		0.30	
No 8	24		15		24		0.30	
No 10	22		14		23		0.30	
No 16	18		12		20		0.30	
No 30	11		9		15		0.20	
No 40	8		6		12		0.20	
No 50	6		5		8		0.10	
No 100	3		2		3		0.03	
No 200	1.1		0.80		0.90		0.00	

GRAIN SIZE DISTRIBUTION CURVE



R&M PROJECT NUMBER: 041136

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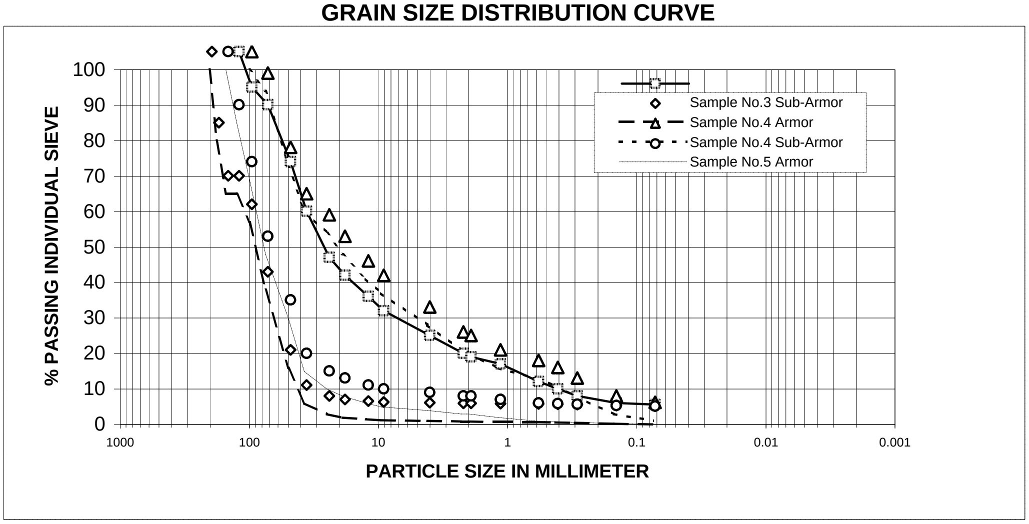
ENGINEERS GEOLOGISTS SURVEYORS
6205 Glacier Highway, P.O.Box 34278, Juneau, Alaska 99801

PROJECT : Materials Testing for Lemon Creek Reconnaissance Sediment Transport Studies
CLIENT: Inter-Fluve **MATERIAL TYPE: Native Sand/Gravel**
DATE RECEIVED: 5/19/2004 **SAMPLE SOURCE: On Site Material**
DATE REPORTED: 6/10/2004 **SAMPLE SUBMITTED BY: Inter-Fluve**

Moisture	N.A.		N.A.		N.A.		N.A.	
SIEVE SIZE	Percent passing of **Sample No.3 Sub-Armor**	Required specs	Percent passing of **Sample No.4 Armor**	Required specs	Percent passing of **Sample No.4 Sub-Armor**	Required specs	Percent passing of **Sample No.5 Armor**	Required specs
12 "								
11 "								
10 "								
9 "								
8 "			100					
7 "			80					
6 "			65				100	
5 "	100		65				85	
4 "	90		57		100		69	
3 "	85		38		94		48	
2 "	69		16		73		30	
1 1/2 "	55		6		60		15	
1 "	42		3		54		10	
3/4 "	37		2		48		8	
1/2 "	31		1.50		41		6	
3/8 "	27		1.30		37		5	
No 4	20		1.10		28		4	
No 8	15		0.90		21		3	
No 10	14		0.90		20		3	
No 16	12		0.80		16		2	
No 30	7		0.70		13		1	
No 40	5		0.60		11		0.80	
No 50	3		0.50		8		0.60	
No 100	1		0.30		3		0.30	
No 200	0.50		0.10		1.20		0.10	

GRAIN SIZE DISTRIBUTION CURVE



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PROJECT : Materials Testing for Lemon Creek Reconnaissance Sediment Transport Studies

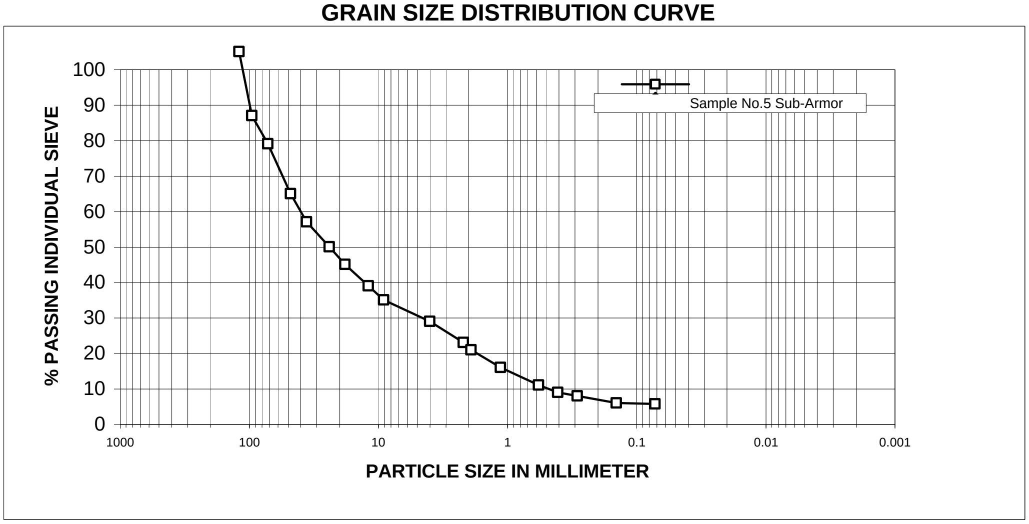
CLIENT: Inter-Fluve **MATERIAL TYPE:** Native Sand/Gravel

DATE RECEIVED: 5/19/2004 **SAMPLE SOURCE:** On Site Material

DATE REPORTED: 6/10/2004 **SAMPLE SUBMITTED BY:** Inter-Fluve

Moisture	N.A.		N.A.		N.A.		N.A.	
SIEVE SIZE	Percent passing of **Sample No.5 Sub-Armor**	Required specs	Percent passing of	Required specs	Percent passing of	Required specs	Percent passing of	Required specs
12 "								
11 "								
10 "								
9 "								
8 "								
7 "								
6 "								
5 "	100							
4 "	82							
3 "	74							
2 "	60							
1 1/2 "	52							
1 "	45							
3/4 "	40							
1/2 "	34							
3/8 "	30							
No 4	24							
No 8	18							
No 10	16							
No 16	11							
No 30	6							
No 40	4							
No 50	3							
No 100	1							
No 200	0.70							

GRAIN SIZE DISTRIBUTION CURVE



Appendix D

ADF&G Habitat Survey

Appendix E

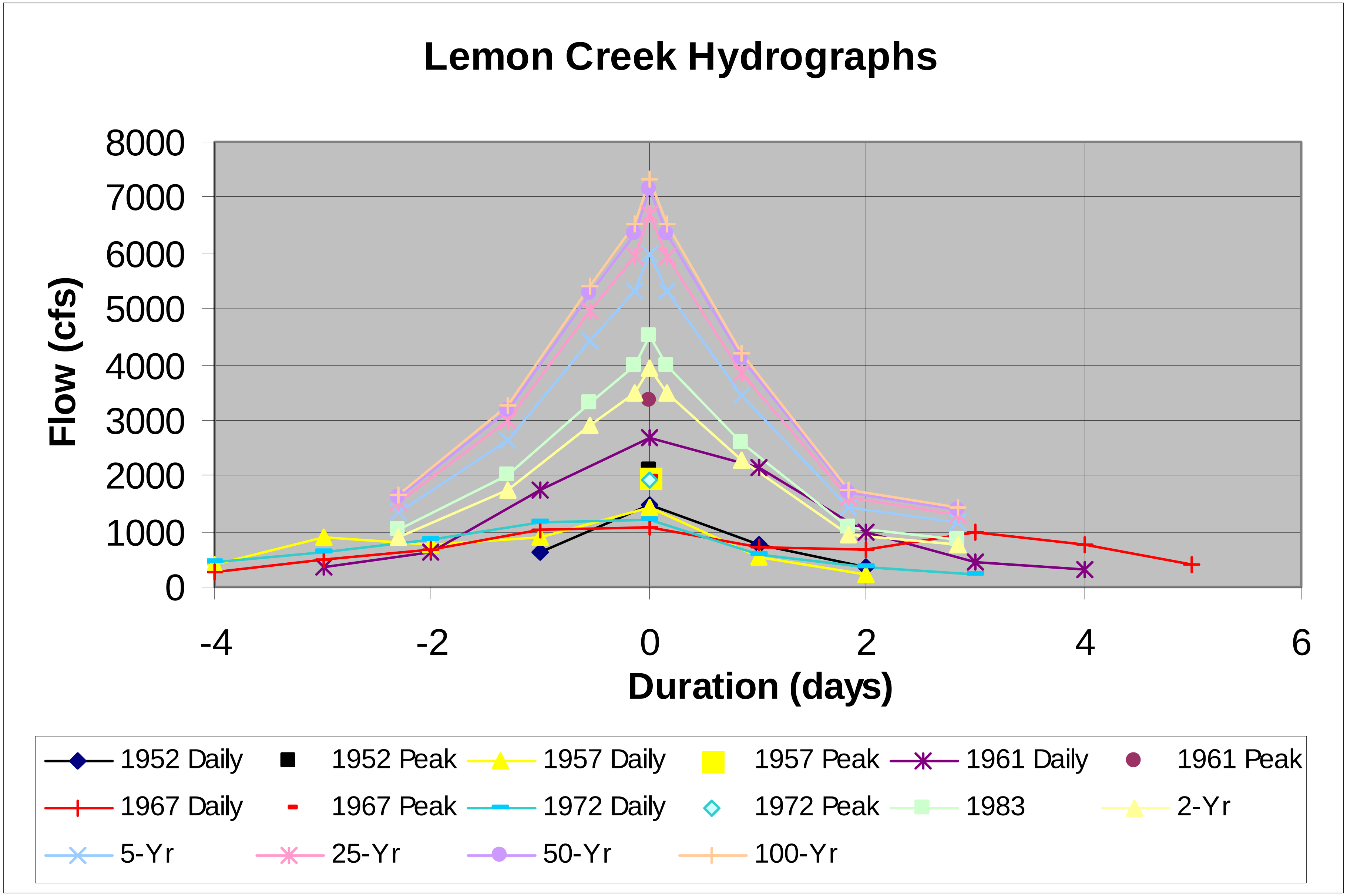
Historical Aerial Photographs

Appendix F

Hydrology and Hydraulics

Appendix F(a)

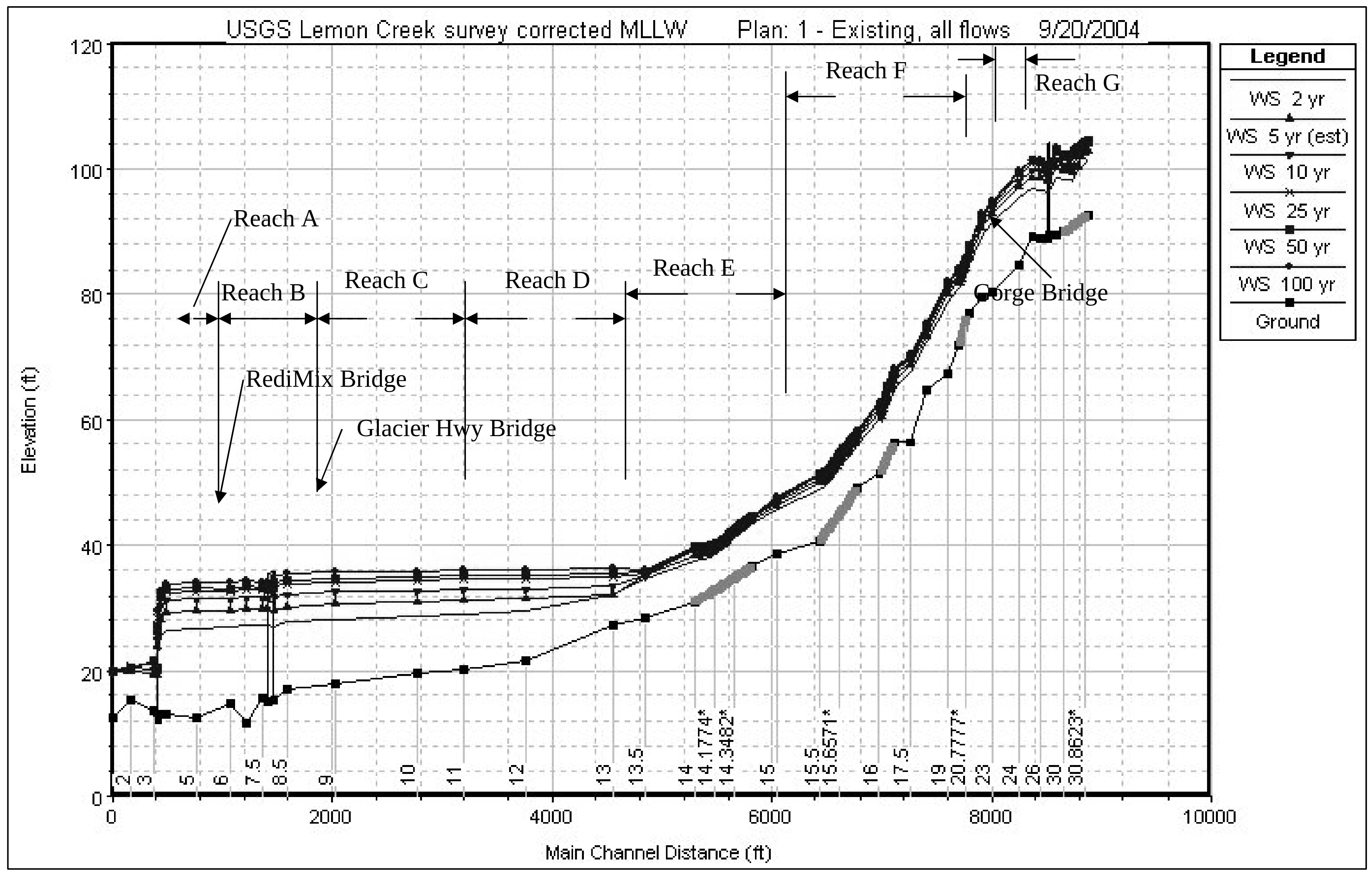
Hydrology


Lemon Creek Hydrographs
Flow (cfs)
8000
7000
6000
5000
4000
3000
2000
1000
0
-4
-2
0
2
4
6
Duration (days)
1952 Daily
1952 Peak
1957 Daily
1957 Peak
1961 Daily
1961 Peak
1967 Daily
1967 Peak
1972 Daily
1972 Peak
1983
2-Yr
5-Yr
25-Yr
50-Yr
100-Yr

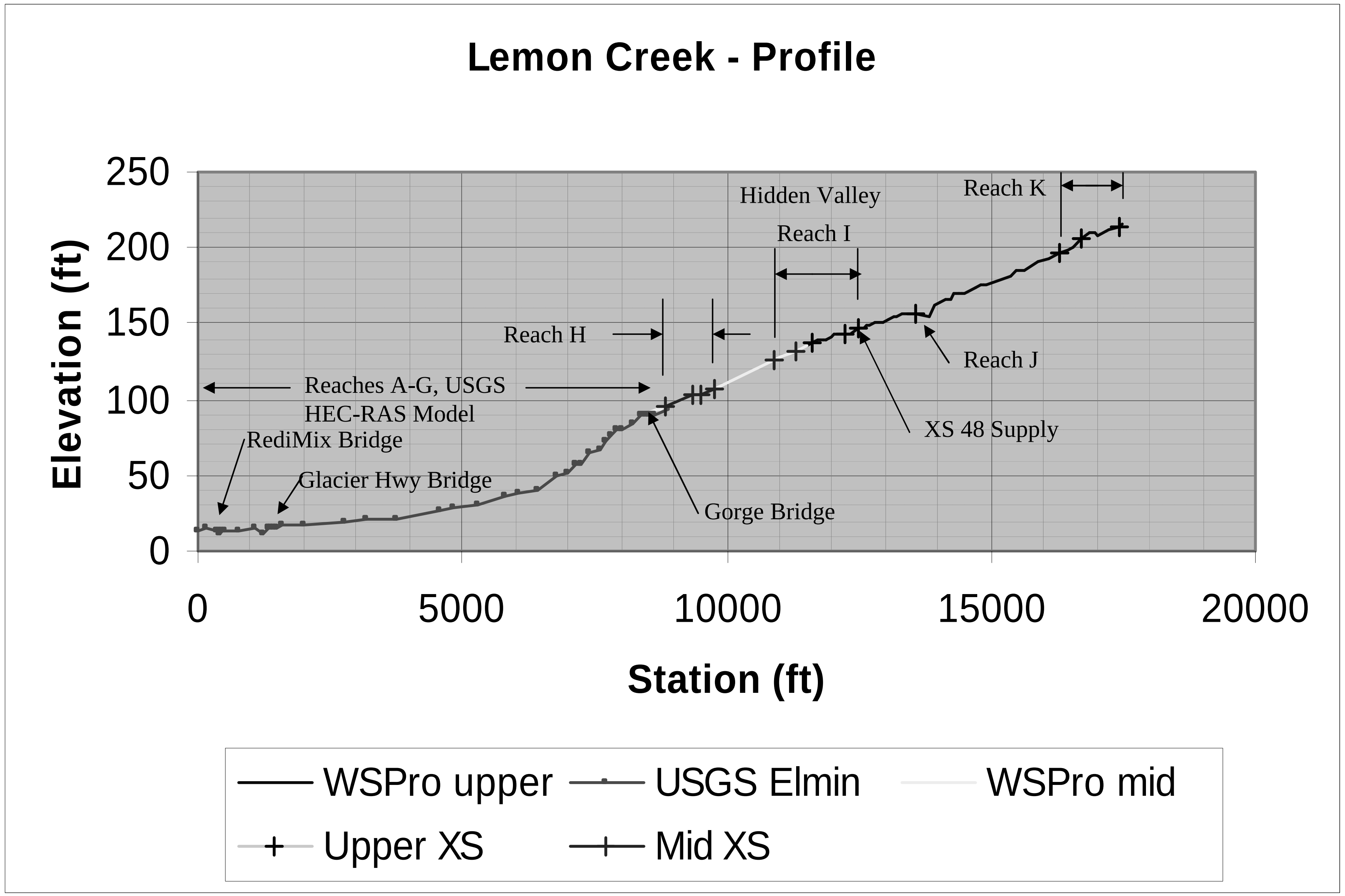
Appendix F(b)

Hydraulics

Reach Locations - existing conditions water surface profile



Reach Locations - existing conditions channel invert profile



Appendix F(b)

Hydraulics

Tide Water to Top of Gorge
Existing Channel (No in Stream Mining)
RediMix Bridge in Place

Lemon Creek from tidewater to 350-ft above gorge bridge

Plan 1 Existing channel with RediMix Bridge in place

HEC-RAS Plan: 1-Existing River: lemon creek Reach: 1

Reach	River Sta	Profile	Cum Ch Len (ft)	Q Total (cfs)	Q Channel (cfs)	Vel Chnl (ft/s)	Hydr Depth C (ft)	Top W Act Chan (ft)	E.G. Slope (ft/ft)	Shear Chan (lb/sq ft)
1	1	2 yr		3930	2552.53	4.57	4.2	133.03	0.001304	0.33
1	1	5 yr (est)		5140	3338.42	5.97	4.2	133.03	0.00223	0.57
1	1	10 yr		5990	3890.5	6.96	4.2	133.03	0.003028	0.77
1	1	25 yr		6720	4364.63	7.81	4.2	133.03	0.003811	0.97
1	1	50 yr		7140	4637.42	8.3	4.2	133.03	0.004303	1.1
1	1	100 yr		7340	4767.32	8.53	4.2	133.03	0.004547	1.16
1	2	2 yr	174	3930	3909.9	8.95	3.48	125.48	0.006237	1.35
1	2	5 yr (est)	174	5140	5092.9	10.66	3.78	126.34	0.007936	1.86
1	2	10 yr	174	5990	5801.93	10.62	4.3	126.91	0.006641	1.77
1	2	25 yr	174	6720	6437.91	11.12	4.56	126.91	0.006741	1.9
1	2	50 yr	174	7140	6907.78	12.57	4.33	126.91	0.009217	2.47
1	2	100 yr	174	7340	7130.93	13.28	4.23	126.91	0.010607	2.78
1	3	2 yr	372	3930	3907.28	9.68	5.34	75.6	0.004166	1.37
1	3	5 yr (est)	372	5140	5128.59	15.79	4.3	75.6	0.014812	3.92
1	3	10 yr	372	5990	5961.51	15.55	5.07	75.6	0.011514	3.6
1	3	25 yr	372	6720	6665.65	14.87	5.93	75.6	0.008557	3.12
1	3	50 yr	372	7140	7069.8	14.69	6.37	75.6	0.007581	2.97
1	3	100 yr	372	7340	7262.46	14.66	6.55	75.6	0.007273	2.94
1	3.2	2 yr	404	3930	3929.96	20.65	5.38	35.4	0.023438	6.57
1	3.2	5 yr (est)	404	5140	5139.91	22.68	6.4	35.4	0.022407	7.48
1	3.2	10 yr	404	5990	5989.87	25.03	6.76	35.4	0.025391	8.95
1	3.2	25 yr	404	6720	6719.81	25.97	7.31	35.4	0.024629	9.39
1	3.2	50 yr	404	7140	7139.77	26.5	7.61	35.4	0.024291	9.64
1	3.2	100 yr	404	7340	7339.76	26.83	7.73	35.4	0.024402	9.84
1	3.3	2 yr	419	3930	3929.96	16.46	8.84	27	0.007095	3.47
1	3.3	5 yr (est)	419	5140	5139.93	18.04	10.55	27	0.006731	3.93
1	3.3	10 yr	419	5990	5989.87	16.12	13.76	27	0.003773	2.87
1	3.3	25 yr	419	6720	6719.84	16.75	14.86	27	0.003679	3.02
1	3.3	50 yr	419	7140	7139.86	20.49	12.9	27	0.006642	4.74
1	3.3	100 yr	419	7340	7339.8	16.88	16.11	27	0.003351	2.99
1	3.5	2 yr	446	3930	3841.3	8.81	11.66	37.42	0.001238	0.88
1	3.5	5 yr (est)	446	5140	4931.52	9.3	14.16	37.42	0.001066	0.92
1	3.5	10 yr	446	5990	5680.56	9.35	16.24	37.42	0.000896	0.89
1	3.5	25 yr	446	6720	6334.76	9.61	17.62	37.42	0.00085	0.91
1	3.5	50 yr	446	7140	6722.7	10.02	17.93	37.42	0.000903	0.99
1	3.5	100 yr	446	7340	6887.46	9.74	18.9	37.42	0.000794	0.91
1	4	2 yr	493	3930	3848.41	5.14	11.55	64.74	0.000419	0.3
1	4	5 yr (est)	493	5140	4993.07	5.46	14.13	64.74	0.000361	0.31
1	4	10 yr	493	5990	5787.55	5.52	16.19	64.74	0.000308	0.31
1	4	25 yr	493	6720	6474.74	5.68	17.61	64.74	0.000291	0.32
1	4	50 yr	493	7140	6874.78	5.9	18.01	64.74	0.000305	0.34
1	4	100 yr	493	7340	7057.67	5.76	18.91	64.74	0.000273	0.32
1	5	2 yr	764	3930	3764.22	4.8	10	78.34	0.000643	0.38
1	5	5 yr (est)	764	5140	4864.4	4.93	12.59	78.34	0.000499	0.37
1	5	10 yr	764	5990	5612.94	4.89	14.65	78.34	0.000401	0.35
1	5	25 yr	764	6720	6261.81	4.97	16.08	78.34	0.000366	0.35
1	5	50 yr	764	7140	6644.1	5.14	16.49	78.34	0.000378	0.37
1	5	100 yr	764	7340	6812.55	5	17.39	78.34	0.000334	0.34

Lemon Creek from tidewater to 350-ft above gorge bridge

Plan 1 Existing channel with RediMix Bridge in place

HEC-RAS Plan: 1-Existing River: lemon creek Reach: 1

Reach	River Sta	Profile	Cum Ch Len (ft)	Q Total (cfs)	Q Channel (cfs)	Vel Chnl (ft/s)	Hydr Depth C (ft)	Top W Act Chan (ft)	E.G. Slope (ft/ft)	Shear Chan (lb/sq ft)
1	6	2 yr	1078	3930	3806.38	5.97	10.85	58.77	0.000852	0.56
1	6	5 yr (est)	1078	5140	4915.7	6.26	13.37	58.77	0.000709	0.58
1	6	10 yr	1078	5990	5637.94	6.23	15.4	58.77	0.000582	0.55
1	6	25 yr	1078	6720	6262.62	6.34	16.81	58.77	0.000536	0.55
1	6	50 yr	1078	7140	6637	6.56	17.22	58.77	0.000555	0.58
1	6	100 yr	1078	7340	6788.18	6.38	18.1	58.77	0.000491	0.54
1	7	2 yr	1213	3930	3837.51	4.68	10.05	81.56	0.00064	0.36
1	7	5 yr (est)	1213	5140	4934.74	4.81	12.59	81.56	0.0005	0.36
1	7	10 yr	1213	5990	5684.44	4.78	14.59	81.56	0.000405	0.33
1	7	25 yr	1213	6720	6337.79	4.85	16.01	81.56	0.00037	0.33
1	7	50 yr	1213	7140	6723.05	5.01	16.44	81.56	0.000381	0.35
1	7	100 yr	1213	7340	6891.39	4.88	17.3	81.56	0.000338	0.33
1	7.5	2 yr	1361	3930	3857.65	5.91	10.84	60.22	0.000851	0.55
1	7.5	5 yr (est)	1361	5140	4979.16	6.2	13.34	60.22	0.000712	0.57
1	7.5	10 yr	1361	5990	5751.86	6.23	15.32	60.22	0.000598	0.55
1	7.5	25 yr	1361	6720	6408.03	6.36	16.72	60.22	0.000555	0.56
1	7.5	50 yr	1361	7140	6795.39	6.58	17.14	60.22	0.000574	0.59
1	7.5	100 yr	1361	7340	6960.48	6.42	18.01	60.22	0.000512	0.55
1	7.8	2 yr	1413	3930	3798.49	6.38	10.81	55.07	0.00099	0.65
1	7.8	5 yr (est)	1413	5140	4869.6	6.65	13.3	55.07	0.000816	0.65
1	7.8	10 yr	1413	5990	5574.23	6.62	15.28	55.07	0.000672	0.62
1	7.8	25 yr	1413	6720	6183.09	6.73	16.68	55.07	0.000618	0.62
1	7.8	50 yr	1413	7140	6549.37	6.95	17.1	55.07	0.000638	0.66
1	7.8	100 yr	1413	7340	6693.25	6.76	17.97	55.07	0.000565	0.61
1	8	2 yr	1472	3930	3295.88	7.93	11.01	37.72	0.00144	0.98
1	8	5 yr (est)	1472	5140	4163.99	8.18	13.49	37.72	0.001168	0.98
1	8	10 yr	1472	5990	4672.59	7.87	15.74	37.72	0.000881	0.86
1	8	25 yr	1472	6720	5105.92	7.77	17.42	37.72	0.00075	0.81
1	8	50 yr	1472	7140	5383.79	7.94	17.97	37.72	0.000751	0.84
1	8	100 yr	1472	7340	5463.1	7.63	18.97	37.72	0.000646	0.76
1	8.5	2 yr	1597	3930	3692.75	5.35	10.25	67.41	0.000716	0.46
1	8.5	5 yr (est)	1597	5140	4721.16	5.51	12.71	67.41	0.00057	0.45
1	8.5	10 yr	1597	5990	5417.8	5.41	14.86	67.41	0.000446	0.41
1	8.5	25 yr	1597	6720	6027.32	5.42	16.5	67.41	0.00039	0.4
1	8.5	50 yr	1597	7140	6388.99	5.56	17.06	67.41	0.000392	0.42
1	8.5	100 yr	1597	7340	6545.07	5.39	18.01	67.41	0.000343	0.38
1	9	2 yr	2020	3930	3707.12	3.99	8.45	109.93	0.000541	0.27
1	9	5 yr (est)	2020	5140	4711.27	3.94	10.88	109.93	0.000376	0.25
1	9	10 yr	2020	5990	5369.18	3.76	12.98	109.93	0.000271	0.21
1	9	25 yr	2020	6720	5931.83	3.7	14.6	109.93	0.000224	0.2
1	9	50 yr	2020	7140	6274.01	3.76	15.17	109.93	0.00022	0.2
1	9	100 yr	2020	7340	6408.15	3.62	16.1	109.93	0.000189	0.18
1	10	2 yr	2770	3930	3842.82	3.95	6.4	152.17	0.000752	0.29
1	10	5 yr (est)	2770	5140	4979.88	3.76	8.61	153.63	0.000462	0.24
1	10	10 yr	2770	5990	5767.28	3.53	10.62	153.63	0.000308	0.2
1	10	25 yr	2770	6720	6441.23	3.44	12.2	153.63	0.000242	0.18
1	10	50 yr	2770	7140	6833.28	3.48	12.78	153.63	0.000234	0.18
1	10	100 yr	2770	7340	7008.17	3.34	13.67	153.63	0.000196	0.16

Lemon Creek from tidewater to 350-ft above gorge bridge

Plan 1 Existing channel with RediMix Bridge in place

HEC-RAS Plan: 1-Existing River: lemon creek Reach: 1

Reach	River Sta	Profile	Cum Ch Len (ft)	Q Total (cfs)	Q Channel (cfs)	Vel Chnl (ft/s)	Hydr Depth C (ft)	Top W Act Chan (ft)	E.G. Slope (ft/ft)	Shear Chan (lb/sq ft)
1	11	2 yr	3204	3930	3878.84	3.64	5.71	186.55	0.000748	0.26
1	11	5 yr (est)	3204	5140	5017.52	3.42	7.86	186.55	0.000432	0.21
1	11	10 yr	3204	5990	5789.61	3.17	9.8	186.55	0.000276	0.16
1	11	25 yr	3204	6720	6444.75	3.04	11.36	186.55	0.000209	0.14
1	11	50 yr	3204	7140	6829.62	3.07	11.93	186.55	0.000199	0.14
1	11	100 yr	3204	7340	6994.12	2.93	12.81	186.55	0.000165	0.13
1	12	2 yr	3771	3930	3923.47	5.03	4.11	189.83	0.001716	0.43
1	12	5 yr (est)	3771	5140	5119.97	4.49	6.01	189.83	0.000822	0.3
1	12	10 yr	3771	5990	5948.35	3.99	7.85	189.83	0.000456	0.22
1	12	25 yr	3771	6720	6654.34	3.74	9.36	189.83	0.000317	0.18
1	12	50 yr	3771	7140	7062.13	3.75	9.92	189.83	0.000294	0.18
1	12	100 yr	3771	7340	7246.7	3.54	10.78	189.83	0.000235	0.16
1	13	2 yr	4559	3930	3888.43	8	2.54	191.55	0.011518	1.82
1	13	5 yr (est)	4559	5140	5079.65	8.77	3.02	191.55	0.010938	2.06
1	13	10 yr	4559	5990	5900.4	7.12	4.33	191.55	0.004468	1.2
1	13	25 yr	4559	6720	6596.77	6.07	5.67	191.55	0.002264	0.8
1	13	50 yr	4559	7140	6999.45	5.88	6.21	191.55	0.001889	0.73
1	13	100 yr	4559	7340	7188.97	5.36	7.01	191.55	0.001332	0.58
1	13.5	2 yr	4845	3930	3762.56	8.66	3.84	113.03	0.009447	2.19
1	13.5	5 yr (est)	4845	5140	4888.31	9.97	4.34	113.04	0.010666	2.79
1	13.5	10 yr	4845	5990	5696.1	11.6	4.34	113.04	0.014398	3.77
1	13.5	25 yr	4845	6720	6358.68	12.01	4.68	113.04	0.013958	3.95
1	13.5	50 yr	4845	7140	6738.08	12.26	4.86	113.04	0.013837	4.06
1	13.5	100 yr	4845	7340	6896.95	11.84	5.15	113.04	0.011928	3.71
1	14	2 yr	5293	3930	3840.83	4.22	4.18	217.92	0.002448	0.63
1	14	5 yr (est)	5293	5140	5013.06	4.6	5	217.92	0.002293	0.71
1	14	10 yr	5293	5990	5833.9	4.77	5.62	217.92	0.002109	0.73
1	14	25 yr	5293	6720	6538.9	4.97	6.04	217.92	0.002081	0.78
1	14	50 yr	5293	7140	6944.11	5.08	6.28	217.92	0.002065	0.8
1	14	100 yr	5293	7340	7137.81	5.17	6.33	217.92	0.002119	0.83
1	14.5	2 yr	5820	3930	3824.51	8.96	3.78	112.73	0.013079	2.99
1	14.5	5 yr (est)	5820	5140	4877.48	9.86	4.37	113.24	0.013114	3.45
1	14.5	10 yr	5820	5990	5601.7	10.43	4.73	113.55	0.013236	3.76
1	14.5	25 yr	5820	6720	6216.56	10.89	5.01	113.8	0.013364	4.02
1	14.5	50 yr	5820	7140	6567.91	11.15	5.17	113.94	0.013443	4.17
1	14.5	100 yr	5820	7340	6734.64	11.27	5.24	114	0.013481	4.24
1	15	2 yr	6042	3930	3785.15	7.04	5.84	92.08	0.006656	2.37
1	15	5 yr (est)	6042	5140	4880.35	8.04	6.53	92.94	0.007482	2.98
1	15	10 yr	6042	5990	5699.47	8.76	6.96	93.46	0.008192	3.47
1	15	25 yr	6042	6720	6357.35	9.28	7.3	93.89	0.008633	3.83
1	15	50 yr	6042	7140	6716.43	9.53	7.49	94.12	0.008817	4.01
1	15	100 yr	6042	7340	6886.44	9.65	7.58	94.23	0.008901	4.09
1	15.5	2 yr	6436	3930	3929.64	8.45	4.93	94.42	0.01203	3.61
1	15.5	5 yr (est)	6436	5140	5137.21	9.26	5.79	95.89	0.011705	4.12
1	15.5	10 yr	6436	5990	5983.7	9.71	6.36	96.89	0.011383	4.39
1	15.5	25 yr	6436	6720	6709.74	10.12	6.79	97.64	0.011357	4.67
1	15.5	50 yr	6436	7140	7127.11	10.37	7.01	98.04	0.011419	4.85
1	15.5	100 yr	6436	7340	7325.76	10.48	7.11	98.23	0.011451	4.94

Lemon Creek from tidewater to 350-ft above gorge bridge

Plan 1 Existing channel with RediMix Bridge in place

HEC-RAS Plan: 1-Existing River: lemon creek Reach: 1

Reach	River Sta	Profile	Cum Ch Len (ft)	Q Total (cfs)	Q Channel (cfs)	Vel Chnl (ft/s)	Hydr Depth C (ft)	Top W Act Chan (ft)	E.G. Slope (ft/ft)	Shear Chan (lb/sq ft)
1	15.8	2 yr	6772	3930	3774.87	10.18	5.46	67.9	0.018385	6.06
1	15.8	5 yr (est)	6772	5140	4904.8	11.23	6.35	68.81	0.018448	7.03
1	15.8	10 yr	6772	5990	5791.88	12.39	6.75	69.23	0.020718	8.38
1	15.8	25 yr	6772	6720	6422.51	12.7	7.25	69.75	0.019902	8.61
1	15.8	50 yr	6772	7140	6773.2	12.76	7.58	70.1	0.018971	8.56
1	15.8	100 yr	6772	7340	6942.98	12.83	7.7	70.23	0.018794	8.62
1	16	2 yr	6985	3930	3292.49	11.25	6.47	45.25	0.023246	8.8
1	16	5 yr (est)	6985	5140	4154.34	12.21	7.29	46.66	0.023535	9.99
1	16	10 yr	6985	5990	4719.02	12.34	7.98	47.87	0.021414	9.92
1	16	25 yr	6985	6720	5235.33	12.98	8.32	48.47	0.022457	10.82
1	16	50 yr	6985	7140	5536.46	13.42	8.47	48.71	0.023502	11.51
1	16	100 yr	6985	7340	5675.68	13.57	8.57	48.82	0.023682	11.72
1	17	2 yr	7123	3930	3353.14	10.91	7.35	41.81	0.018787	8.51
1	17	5 yr (est)	7123	5140	4322.53	12.08	8.56	41.81	0.018816	9.93
1	17	10 yr	7123	5990	4991.46	12.8	9.33	41.81	0.018829	10.83
1	17	25 yr	7123	6720	5559.37	13.36	9.95	41.81	0.018814	11.54
1	17	50 yr	7123	7140	5882.1	13.66	10.3	41.81	0.018807	11.94
1	17	100 yr	7123	7340	6035.12	13.81	10.45	41.81	0.018821	12.13
1	17.5	2 yr	7263	3930	2955.51	12.81	10.08	22.89	0.022179	13.54
1	17.5	5 yr (est)	7263	5140	3734.99	14.44	11.3	22.89	0.024229	16.58
1	17.5	10 yr	7263	5990	4264.06	15.45	12.06	22.89	0.025418	18.56
1	17.5	25 yr	7263	6720	4708.87	16.24	12.66	22.89	0.026317	20.18
1	17.5	50 yr	7263	7140	4961.42	16.68	12.99	22.89	0.026809	21.1
1	17.5	100 yr	7263	7340	5080.86	16.88	13.15	22.89	0.027037	21.53
1	18	2 yr	7408	3930	2763.67	14.34	7.12	27.07	0.043368	18.96
1	18	5 yr (est)	7408	5140	3468.9	15.66	8.18	27.07	0.042951	21.58
1	18	10 yr	7408	5990	3946.39	16.38	8.9	27.07	0.042031	22.97
1	18	25 yr	7408	6720	4348.9	16.95	9.48	27.07	0.041354	24.07
1	18	50 yr	7408	7140	4579.8	17.29	9.79	27.07	0.041274	24.8
1	18	100 yr	7408	7340	4686.84	17.41	9.94	27.07	0.040964	25.01
1	19	2 yr	7600	3930	2027.67	11.24	10.96	16.45	0.017324	10.47
1	19	5 yr (est)	7600	5140	2474.33	12.23	12.3	16.45	0.017588	11.92
1	19	10 yr	7600	5990	2778.05	12.87	13.12	16.45	0.017859	12.92
1	19	25 yr	7600	6720	3032.04	13.37	13.79	16.45	0.018053	13.72
1	19	50 yr	7600	7140	3174.36	13.63	14.16	16.45	0.018092	14.12
1	19	100 yr	7600	7340	3243.12	13.76	14.32	16.45	0.018182	14.35
1	20	2 yr	7704	3930	2413.59	13.53	7.29	24.49	0.038675	16.88
1	20	5 yr (est)	7704	5140	2867.75	13.62	8.6	24.49	0.031459	16.2
1	20	10 yr	7704	5990	3184.03	13.8	9.42	24.49	0.028557	16.12
1	20	25 yr	7704	6720	3454.41	13.98	10.09	24.49	0.026779	16.19
1	20	50 yr	7704	7140	3608.66	14.09	10.46	24.49	0.025912	16.24
1	20	100 yr	7704	7340	3682.65	14.15	10.63	24.49	0.025587	16.29
1	21	2 yr	7794	3930	2677.21	15.03	7.37	24.16	0.045303	20.57
1	21	5 yr (est)	7794	5140	3389.12	16.38	8.56	24.16	0.044125	23.26
1	21	10 yr	7794	5990	3877.86	17.16	9.35	24.16	0.043034	24.78
1	21	25 yr	7794	6720	4293.6	17.81	9.98	24.16	0.042473	26.1
1	21	50 yr	7794	7140	4531.65	18.18	10.32	24.16	0.04233	26.9
1	21	100 yr	7794	7340	4645.48	18.37	10.47	24.16	0.042428	27.35

Lemon Creek from tidewater to 350-ft above gorge bridge

Plan 1 Existing channel with RediMix Bridge in place

HEC-RAS Plan: 1-Existing River: lemon creek Reach: 1

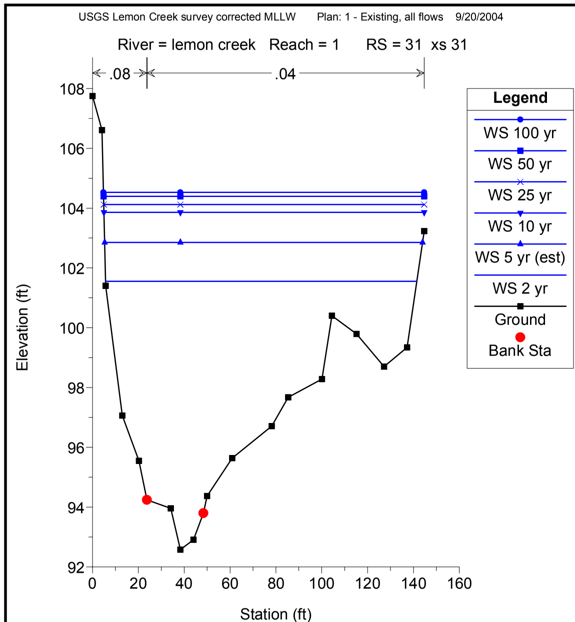
Reach	River Sta	Profile	Cum Ch Len (ft)	Q Total (cfs)	Q Channel (cfs)	Vel Chnl (ft/s)	Hydr Depth C (ft)	Top W Act Chan (ft)	E.G. Slope (ft/ft)	Shear Chan (lb/sq ft)
1	22	2 yr	7906	3930	3050.35	11.81	9.11	28.33	0.021176	11.86
1	22	5 yr (est)	7906	5140	3882.2	13.12	10.44	28.33	0.021776	13.97
1	22	10 yr	7906	5990	4455.18	13.95	11.28	28.33	0.022212	15.39
1	22	25 yr	7906	6720	4939.37	14.58	11.96	28.33	0.022462	16.5
1	22	50 yr	7906	7140	5214.63	14.92	12.34	28.33	0.022545	17.09
1	22	100 yr	7906	7340	5344.39	15.06	12.52	28.33	0.022532	17.34
1	23	2 yr	8014	3930	2857.73	12.9	10.28	21.55	0.021818	13.62
1	23	5 yr (est)	8014	5140	3611.53	14.38	11.66	21.55	0.022941	16.24
1	23	10 yr	8014	5990	4126.6	15.3	12.52	21.55	0.023611	17.95
1	23	25 yr	8014	6720	4564.02	16.04	13.21	21.55	0.024155	19.38
1	23	50 yr	8014	7140	4814.23	16.44	13.59	21.55	0.024458	20.18
1	23	100 yr	8014	7340	4932.92	16.63	13.76	21.55	0.024591	20.56
1	24	2 yr	8247	3930	3926.51	8.96	8.18	53.6	0.009178	4.2
1	24	5 yr (est)	8247	5140	5127.11	9.78	9.71	54	0.008723	4.73
1	24	10 yr	8247	5990	5964.67	10.3	10.72	54	0.008491	5.08
1	24	25 yr	8247	6720	6679.37	10.72	11.54	54	0.008325	5.37
1	24	50 yr	8247	7140	7088.55	10.94	12	54	0.008237	5.52
1	24	100 yr	8247	7340	7282.88	11.04	12.21	54	0.008197	5.59
1	25	2 yr	8378	3930	3896.07	5.02	5.9	131.61	0.001761	0.63
1	25	5 yr (est)	8378	5140	5067.19	5.02	7.57	133.48	0.001274	0.59
1	25	10 yr	8378	5990	5883.52	5.06	8.63	134.69	0.00109	0.57
1	25	25 yr	8378	6720	6581.45	5.11	9.5	135.69	0.00098	0.56
1	25	50 yr	8378	7140	6981.76	5.13	9.98	136.24	0.000929	0.56
1	25	100 yr	8378	7340	7172.07	5.15	10.21	136.5	0.000908	0.56
1	26	2 yr	8453	3930	3872.42	7.5	5.65	91.43	0.004104	1.43
1	26	5 yr (est)	8453	5140	4880.85	7.2	7.41	91.43	0.002636	1.21
1	26	10 yr	8453	5990	5563.99	7.11	8.56	91.43	0.002121	1.12
1	26	25 yr	8453	6720	6142.09	7.07	9.5	91.43	0.001828	1.07
1	26	50 yr	8453	7140	6471.51	7.06	10.02	91.43	0.001697	1.05
1	26	100 yr	8453	7340	6627.7	7.06	10.26	91.43	0.001642	1.04
1	27	2 yr	8505	3930	3727.88	12.17	6.35	48.2	0.009442	3.65
1	27	5 yr (est)	8505	5140	4833.54	12.72	7.88	48.2	0.007729	3.71
1	27	10 yr	8505	5990	5602.39	13.02	8.93	48.2	0.006865	3.73
1	27	25 yr	8505	6720	6257.58	13.26	9.79	48.2	0.006288	3.75
1	27	50 yr	8505	7140	6633.69	13.39	10.28	48.2	0.006012	3.76
1	27	100 yr	8505	7340	6814.34	13.46	10.51	48.2	0.005898	3.77
1	28	2 yr	8524	3930	3776.36	12.14	6.03	51.58	0.009954	3.68
1	28	5 yr (est)	8524	5140	4906.05	12.59	7.55	51.58	0.007932	3.68
1	28	10 yr	8524	5990	5698.21	12.87	8.58	51.58	0.006983	3.68
1	28	25 yr	8524	6720	6376.27	13.1	9.44	51.58	0.006372	3.69
1	28	50 yr	8524	7140	6768.26	13.24	9.91	51.58	0.006104	3.71
1	28	100 yr	8524	7340	6955.14	13.3	10.14	51.58	0.005979	3.72
1	29	2 yr	8593	3930	3917.56	7.1	5.46	100.98	0.003474	1.17
1	29	5 yr (est)	8593	5140	5116.78	6.72	4.37	173.97	0.00253	0.69
1	29	10 yr	8593	5990	5960.45	6	5.15	192.8	0.001669	0.53
1	29	25 yr	8593	6720	6677.5	5.66	6.12	192.8	0.001201	0.46
1	29	50 yr	8593	7140	7088.38	5.53	6.65	192.8	0.001014	0.42
1	29	100 yr	8593	7340	7283.63	5.47	6.91	192.8	0.00094	0.4

<u>Lemon Creek from tidewater to 350-ft above gorge bridge</u>

Plan 1 Existing channel with RediMix Bridge in place

HEC-RAS Plan: 1-Existing River: lemon creek Reach: 1

Reach	River Sta	Profile	Cum Ch Len (ft)	Q Total (cfs)	Q Channel (cfs)	Vel Chnl (ft/s)	Hydr Depth C (ft)	Top W Act Chan (ft)	E.G. Slope (ft/ft)	Shear Chan (lb/sq ft)
1	30	2 yr	8659	3930	3859.99	10.74	5.89	61.06	0.008	2.9
1	30	5 yr (est)	8659	5140	4998.07	11.13	7.36	61.06	0.006374	2.89
1	30	10 yr	8659	5990	5784.33	11.32	8.37	61.06	0.005553	2.87
1	30	25 yr	8659	6720	6437.47	11.42	9.24	61.06	0.004956	2.82
1	30	50 yr	8659	7140	6802.44	11.44	9.74	61.06	0.004638	2.78
1	30	100 yr	8659	7340	6971.14	11.44	9.98	61.06	0.004486	2.76
1	31	2 yr	8877	3930	1821.26	9.21	8.04	24.6	0.003881	1.92
1	31	5 yr (est)	8877	5140	2091.81	9.1	9.34	24.6	0.003106	1.79
1	31	10 yr	8877	5990	2254.64	8.86	10.35	24.6	0.002567	1.64
1	31	25 yr	8877	6720	2484.75	9.52	10.61	24.6	0.002868	1.87
1	31	50 yr	8877	7140	2594.32	9.69	10.88	24.6	0.002873	1.93
1	31	100 yr	8877	7340	2645.17	9.76	11.02	24.6	0.002866	1.95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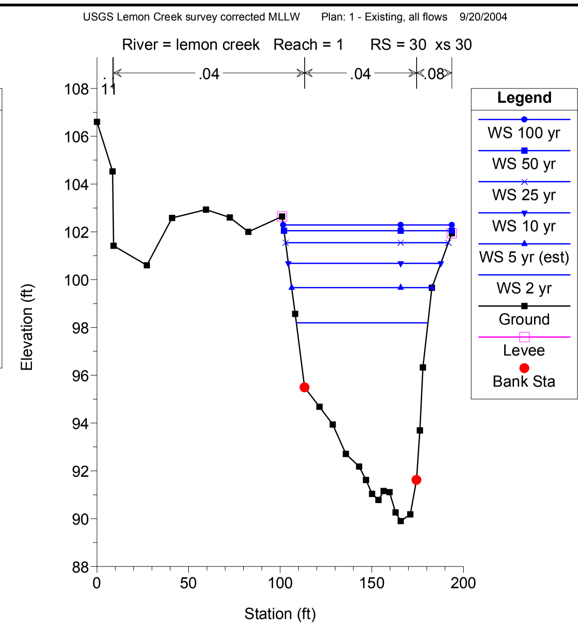
River = lemon creek Reach = 1 RS = 31 xs 31
.08
.04
Elevation (ft)
Station (ft)
Legend
WS 100 yr
WS 50 yr
WS 25 yr
WS 10 yr
WS 5 yr (est)
WS 2 yr
Ground
Bank Sta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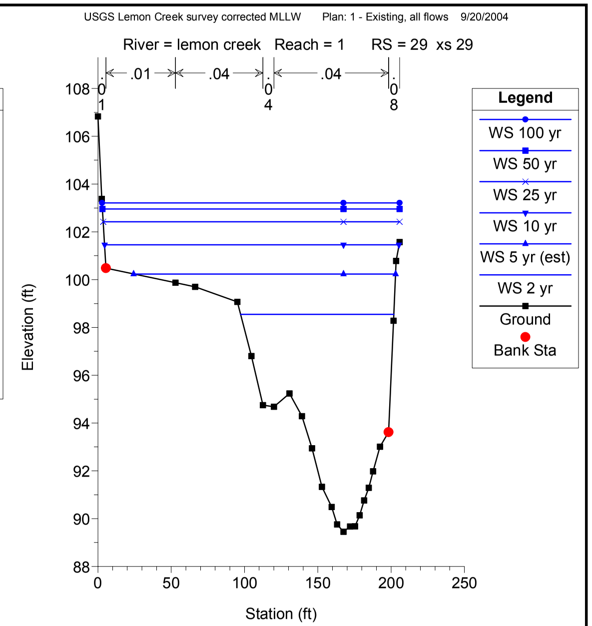
.04
.04
.08
Elevation (ft)
Station (ft)
Legend
WS 100 yr
WS 50 yr
WS 25 yr
WS 10 yr
WS 5 yr (est)
WS 2 yr
Ground
Levee
Bank Sta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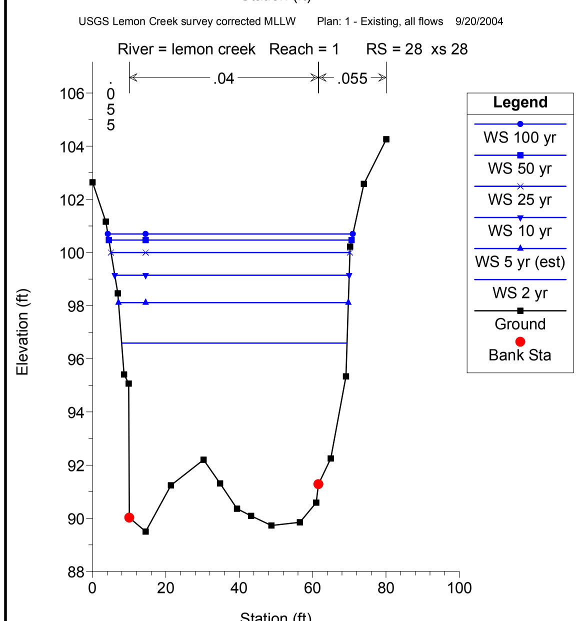
River = lemon creek Reach = 1 RS = 29 xs 29
.01
.04
.04
Elevation (ft)
Station (ft)
Legend
WS 100 yr
WS 50 yr
WS 25 yr
WS 10 yr
WS 5 yr (est)
WS 2 yr
Ground
Bank Sta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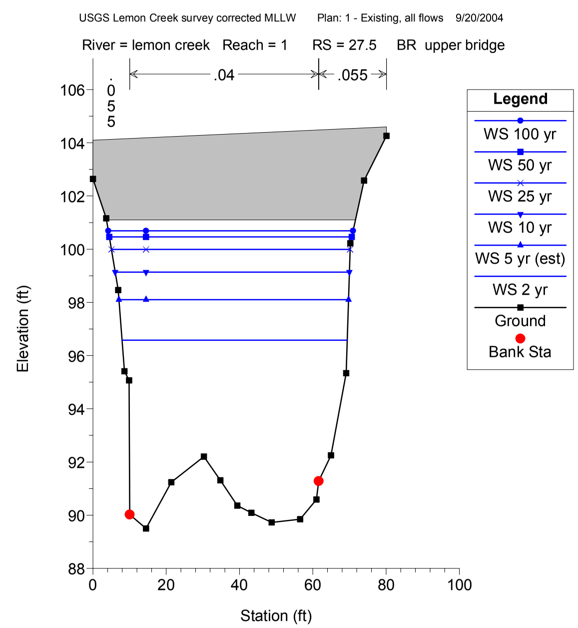
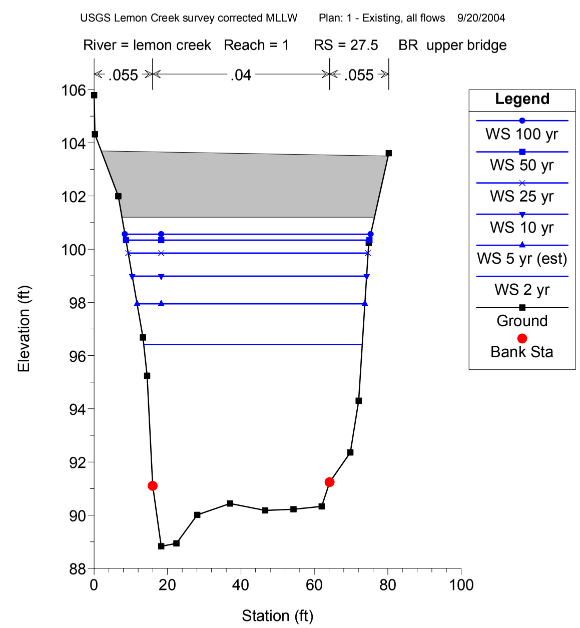
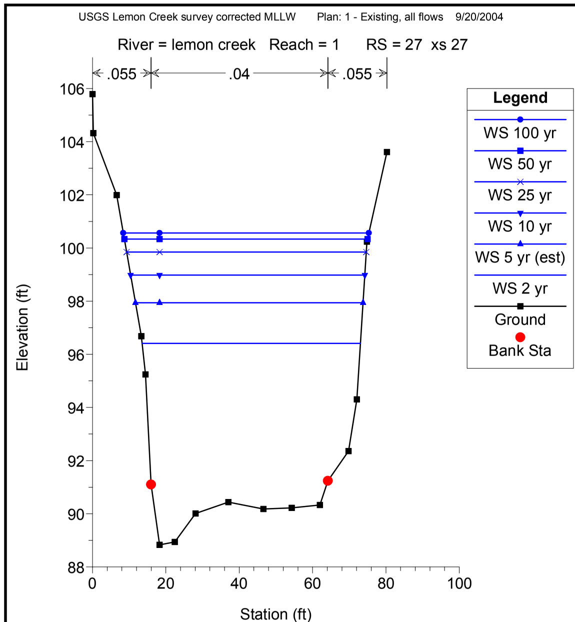
River = lemon creek Reach = 1 RS = 28 xs 28
.04
.055
Elevation (ft)
Station (ft)
Legend
WS 100 yr
WS 50 yr
WS 25 yr
WS 10 yr
WS 5 yr (est)
WS 2 yr
Ground
Bank Sta


USGS Lemon Creek survey corrected MLLW Plan: 1 - Existing, all flows 9/20/2004
River = lemon creek Reach = 1 RS = 27.5 BR upper bridge
.04
.055
Elevation (ft)
Station (ft)
Legend
WS 100 yr
WS 50 yr
WS 25 yr
WS 10 yr
WS 5 yr (est)
WS 2 yr
Ground
Bank Sta


USGS Lemon Creek survey corrected MLLW Plan: 1 - Existing, all flows 9/20/2004
River = lemon creek Reach = 1 RS = 27.5 BR upper bridge
.055
.04
.055
Elevation (ft)
Station (ft)
Legend
WS 100 yr
WS 50 yr
WS 25 yr
WS 10 yr
WS 5 yr (est)
WS 2 yr
Ground
Bank Sta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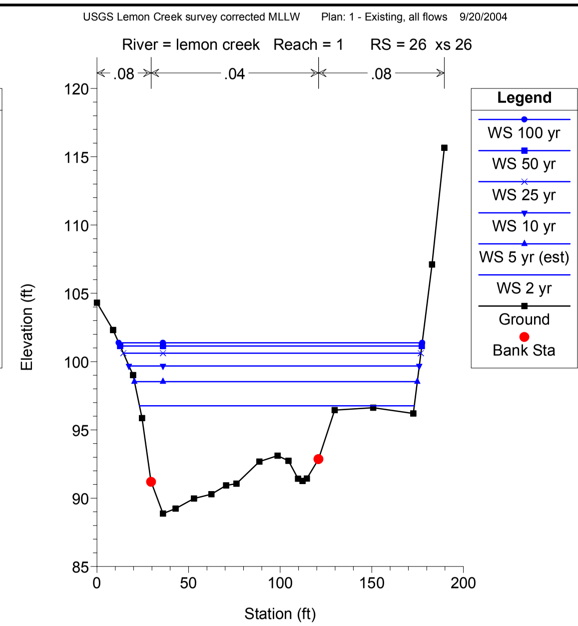
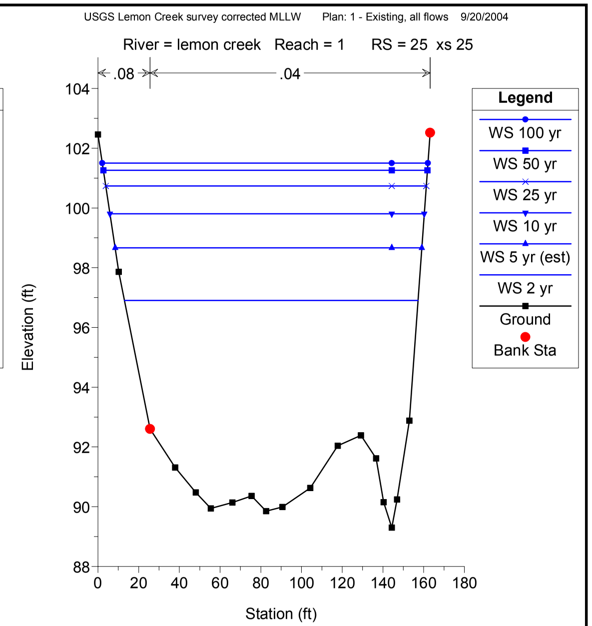
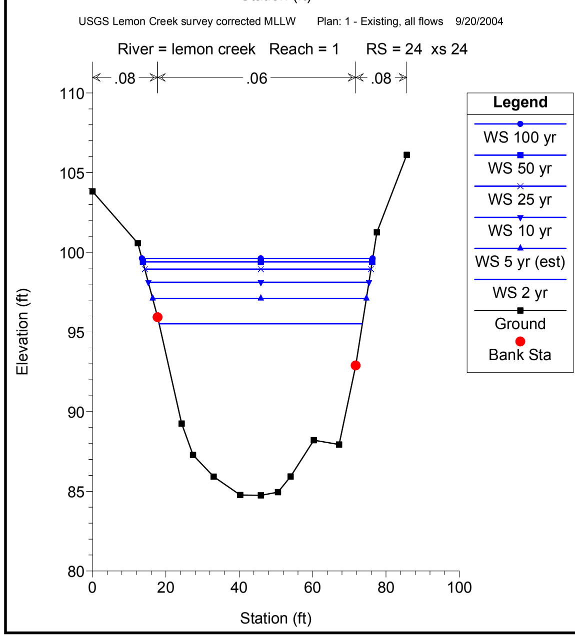
River = lemon creek Reach = 1 RS = 27 xs 27
.055
.04
.055
Elevation (ft)
Station (ft)
Legend
WS 100 yr
WS 50 yr
WS 25 yr
WS 10 yr
WS 5 yr (est)
WS 2 yr
Ground
Bank Sta


USGS Lemon Creek survey corrected MLLW Plan: 1 - Existing, all flows 9/20/2004
River = lemon creek Reach = 1 RS = 26 xs 26
.08
.04
.08
Elevation (ft)
Station (ft)
Legend
WS 100 yr
WS 50 yr
WS 25 yr
WS 10 yr
WS 5 yr (est)
WS 2 yr
Ground
Bank Sta


USGS Lemon Creek survey corrected MLLW Plan: 1 - Existing, all flows 9/20/2004
River = lemon creek Reach = 1 RS = 25 xs 25
.08
.04
Elevation (ft)
Station (ft)
Legend
WS 100 yr
WS 50 yr
WS 25 yr
WS 10 yr
WS 5 yr (est)
WS 2 yr
Ground
Bank Sta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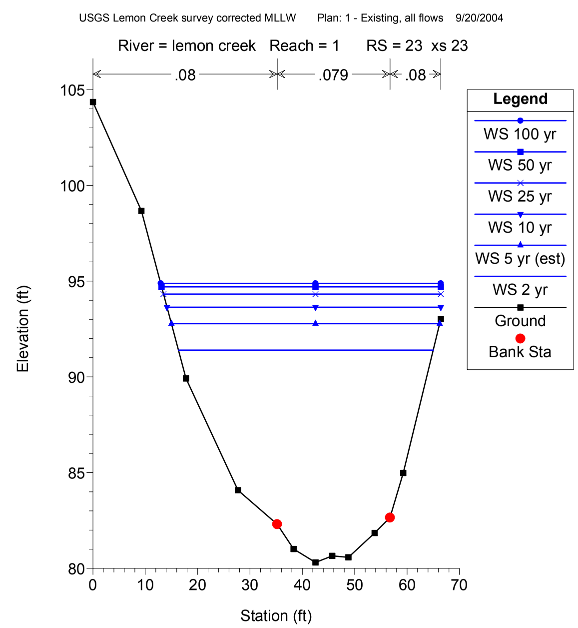
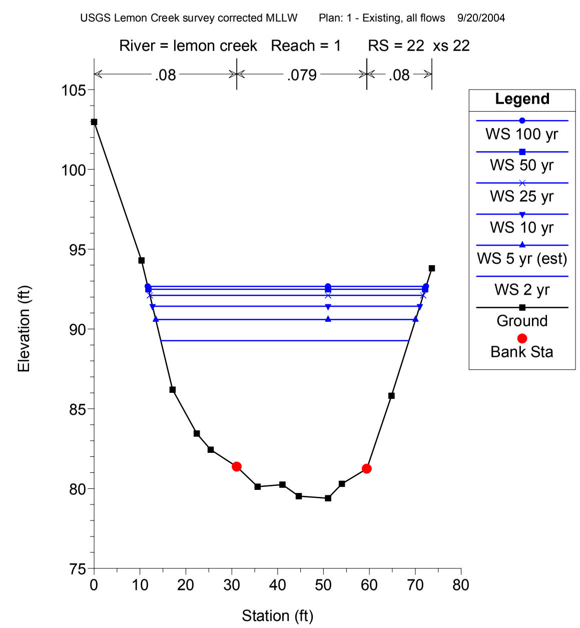
River = lemon creek Reach = 1 RS = 24 xs 24
.08
.06
.08
Elevation (ft)
Station (ft)
Legend
WS 100 yr
WS 50 yr
WS 25 yr
WS 10 yr
WS 5 yr (est)
WS 2 yr
Ground
Bank Sta


USGS Lemon Creek survey corrected MLLW Plan: 1 - Existing, all flows 9/20/2004
River = lemon creek Reach = 1 RS = 23 xs 23
.08
.079
.08
Elevation (ft)
Station (ft)
Legend
WS 100 yr
WS 50 yr
WS 25 yr
WS 10 yr
WS 5 yr (est)
WS 2 yr
Ground
Bank Sta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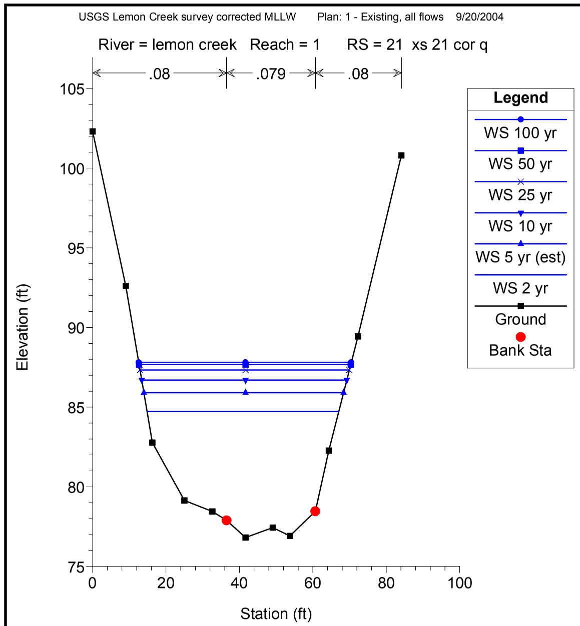
River = lemon creek Reach = 1 RS = 22 xs 22
.08
.079
.08
Elevation (ft)
Station (ft)
Legend
WS 100 yr
WS 50 yr
WS 25 yr
WS 10 yr
WS 5 yr (est)
WS 2 yr
Ground
Bank Sta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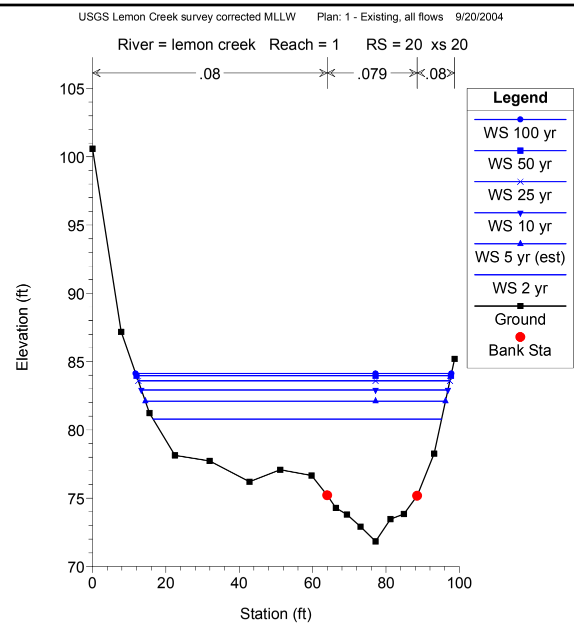
River = lemon creek Reach = 1 RS = 21 xs 21 cor q
.08 .079 .08
Elevation (ft)
Station (ft)
Legend
WS 100 yr
WS 50 yr
WS 25 yr
WS 10 yr
WS 5 yr (est)
WS 2 yr
Ground
Bank Sta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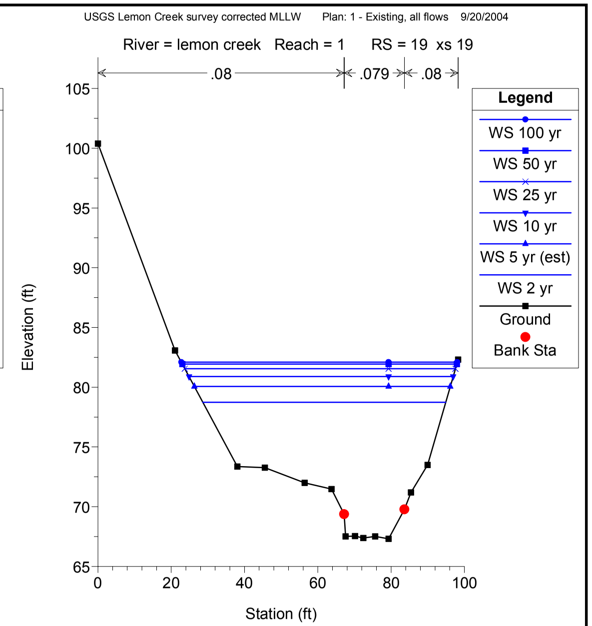
River = lemon creek Reach = 1 RS = 20 xs 20
.08 .079 .08
Elevation (ft)
Station (ft)
Legend
WS 100 yr
WS 50 yr
WS 25 yr
WS 10 yr
WS 5 yr (est)
WS 2 yr
Ground
Bank Sta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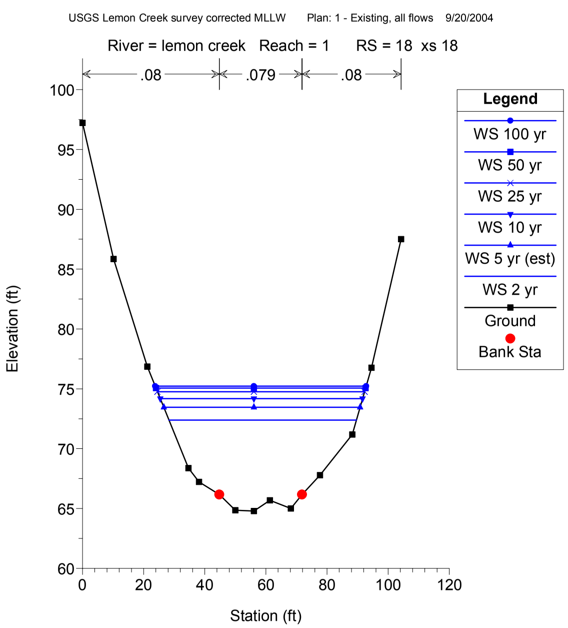
River = lemon creek Reach = 1 RS = 19 xs 19
.08 .079 .08
Elevation (ft)
Station (ft)
Legend
WS 100 yr
WS 50 yr
WS 25 yr
WS 10 yr
WS 5 yr (est)
WS 2 yr
Ground
Bank Sta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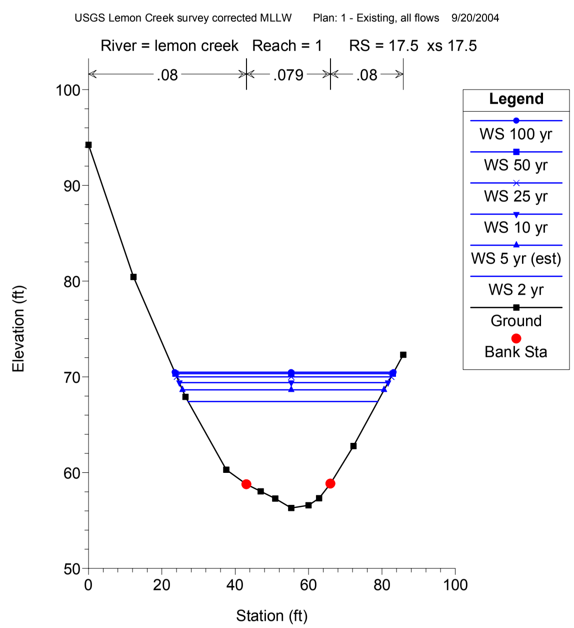
River = lemon creek Reach = 1 RS = 18 xs 18
.08 .079 .08
Elevation (ft)
Station (ft)
Legend
WS 100 yr
WS 50 yr
WS 25 yr
WS 10 yr
WS 5 yr (est)
WS 2 yr
Ground
Bank Sta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.08 .079 .08
Elevation (ft)
Station (ft)
Legend
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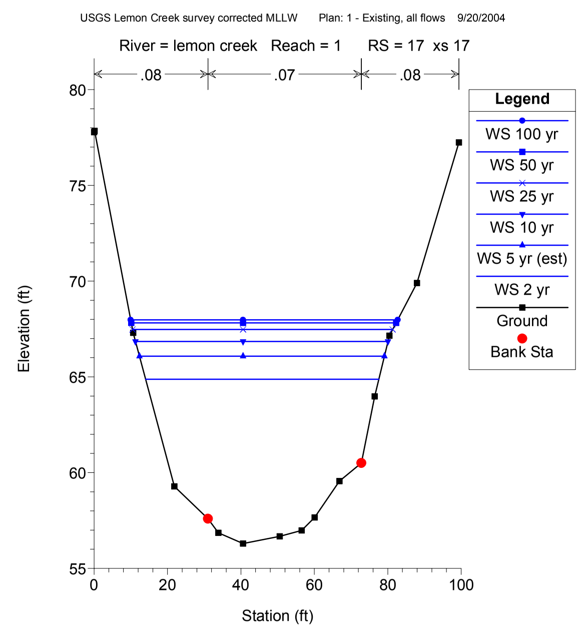
WS 50 yr
WS 25 yr
WS 10 yr
WS 5 yr (est)
WS 2 yr
Ground
Bank Sta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Elevation (ft)
Station (ft)
Legend
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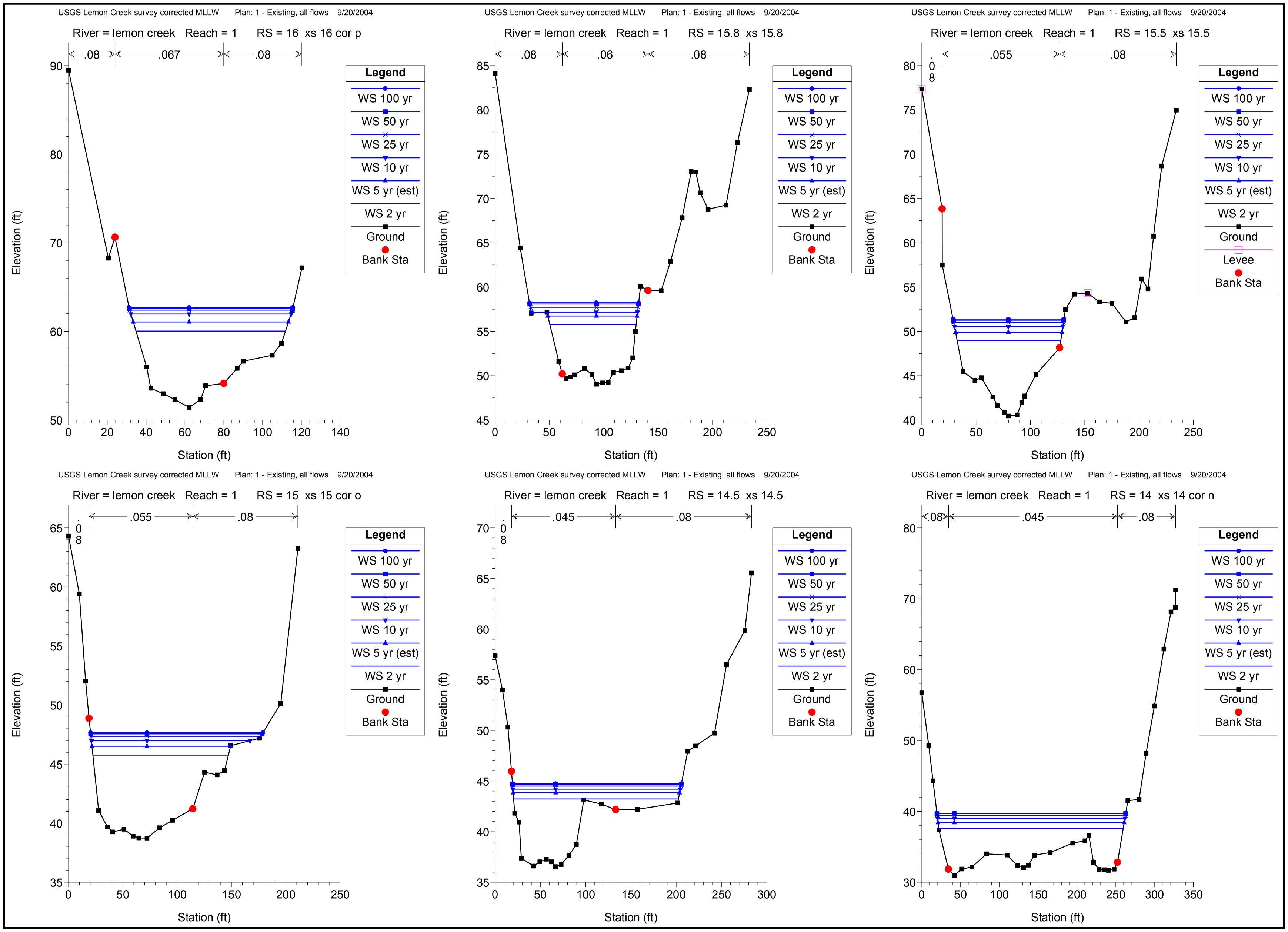
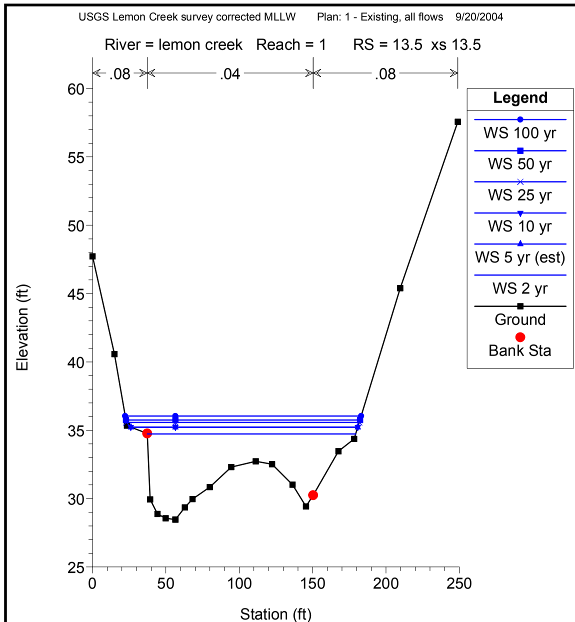
WS 50 yr
WS 25 yr
WS 10 yr
WS 5 yr (est)
WS 2 yr
Ground
Bank Sta



USGS Lemon Creek survey corrected MLLW Plan: 1 - Existing, all flows 9/20/2004
River = lemon creek Reach = 1 RS = 16 xs 16 cor p
River = lemon creek Reach = 1 RS = 15.8 xs 15.8
River = lemon creek Reach = 1 RS = 15.5 xs 15.5
River = lemon creek Reach = 1 RS = 15 xs 15 cor o
River = lemon creek Reach = 1 RS = 14.5 xs 14.5
River = lemon creek Reach = 1 RS = 14 xs 14 cor n
Legend
WS 100 yr
WS 50 yr
WS 25 yr
WS 10 yr
WS 5 yr (est)
WS 2 yr
Ground
Levee
Bank Sta
Elevation (ft)
Station (ft)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Legend
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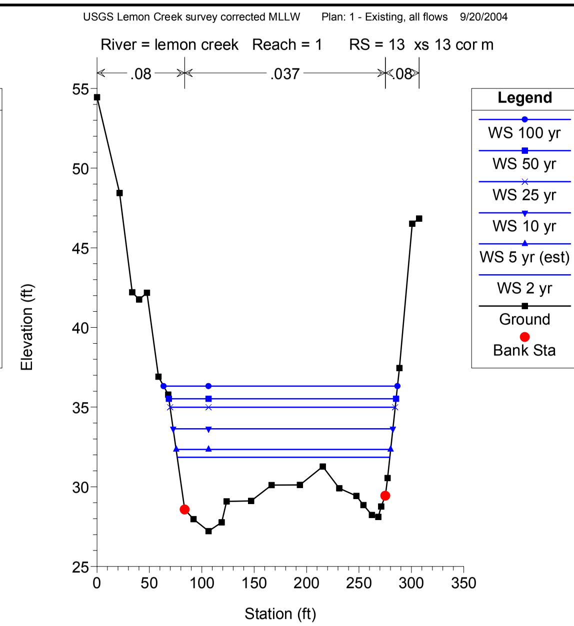
WS 50 yr
WS 25 yr
WS 10 yr
WS 5 yr (est)
WS 2 yr
Ground
Bank Sta
Elevation (ft)
Station (ft)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.08 .037 .08
Legend
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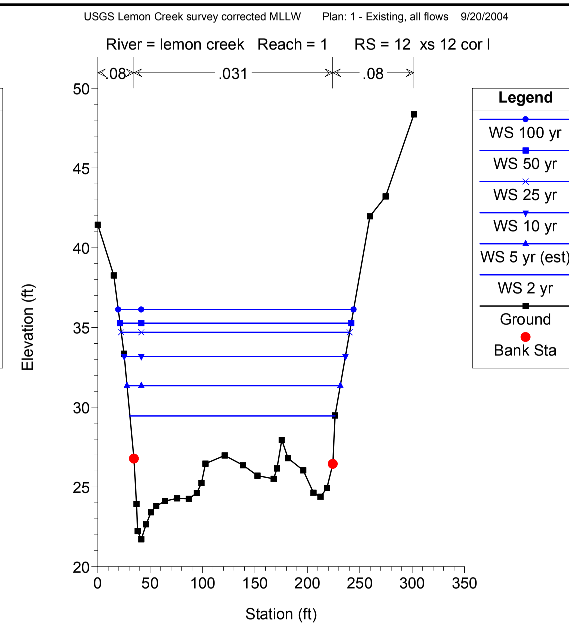
WS 50 yr
WS 25 yr
WS 10 yr
WS 5 yr (est)
WS 2 yr
Ground
Bank Sta
Elevation (ft)
Station (ft)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River = lemon creek Reach = 1 RS = 12 xs 12 cor l
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Legend
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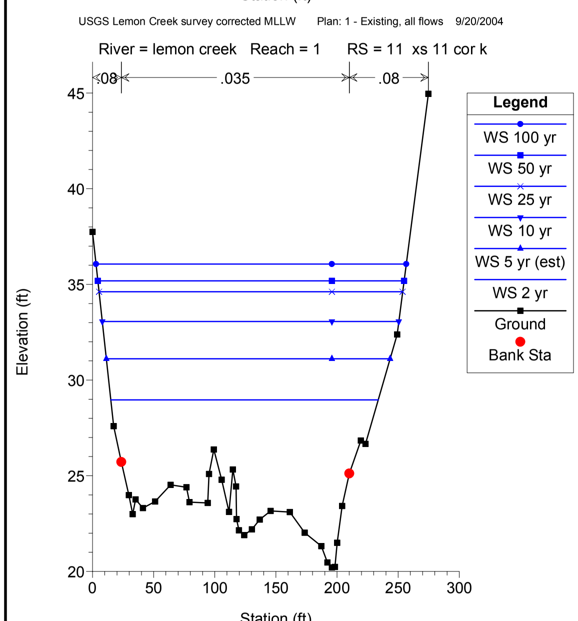
WS 50 yr
WS 25 yr
WS 10 yr
WS 5 yr (est)
WS 2 yr
Ground
Bank Sta
Elevation (ft)
Station (ft)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River = lemon creek Reach = 1 RS = 11 xs 11 cor k
.08 .035 .08
Legend
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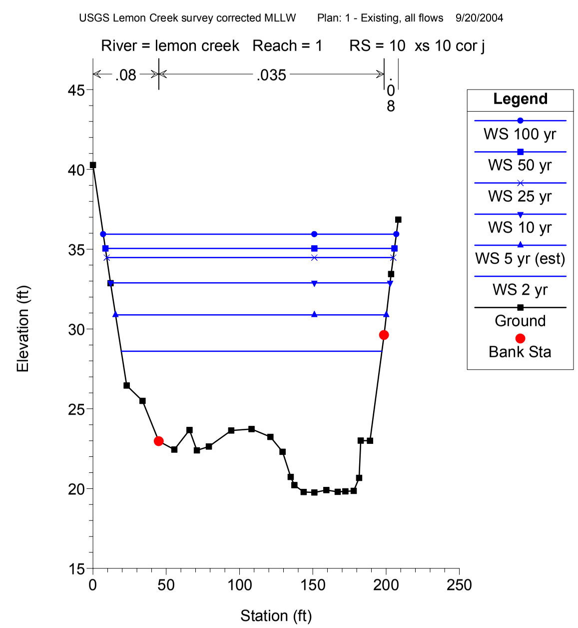
WS 50 yr
WS 25 yr
WS 10 yr
WS 5 yr (est)
WS 2 yr
Ground
Bank Sta
Elevation (ft)
Station (ft)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.08 .035 .0 8
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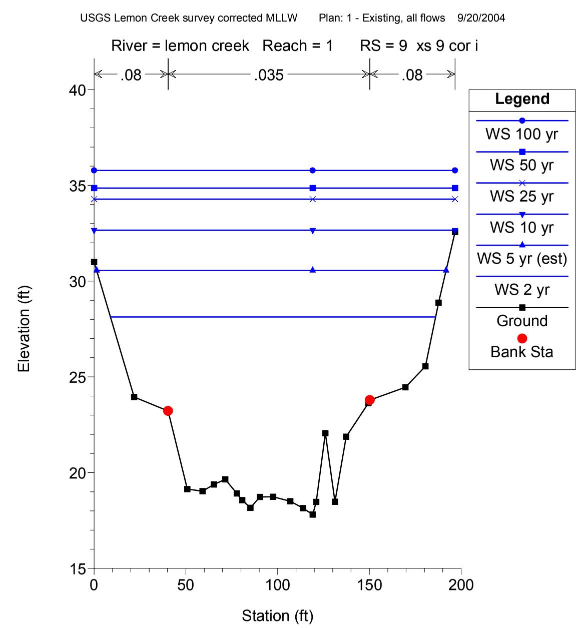
WS 25 yr
WS 10 yr
WS 5 yr (est)
WS 2 yr
Ground
Bank Sta
Elevation (ft)
Station (ft)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River = lemon creek Reach = 1 RS = 9 xs 9 cor i
.08 .035 .08
Legend
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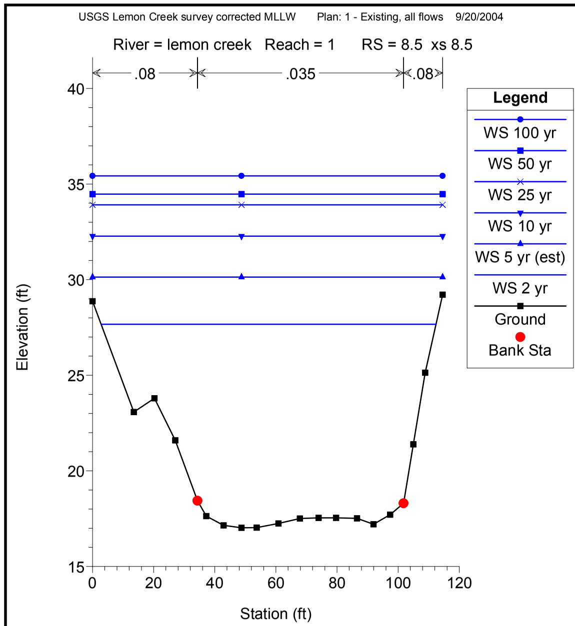
WS 50 yr
WS 25 yr
WS 10 yr
WS 5 yr (est)
WS 2 yr
Ground
Bank Sta
Elevation (ft)
Station (ft)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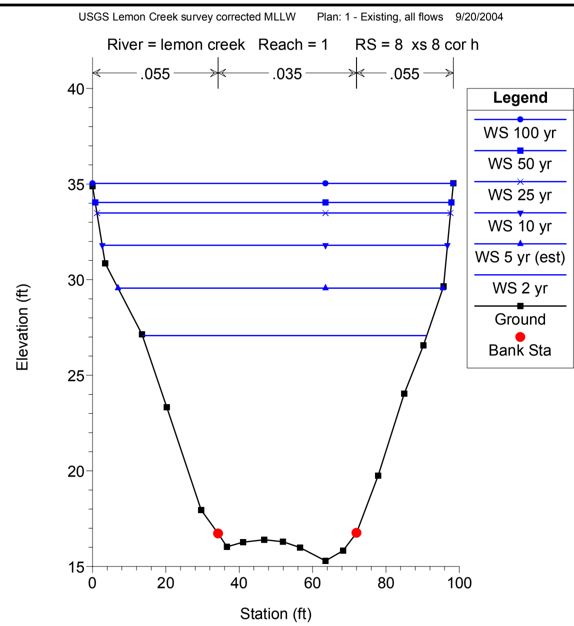
.08
.035
.08
Elevation (ft)
Station (ft)
Legend
WS 100 yr
WS 50 yr
WS 25 yr
WS 10 yr
WS 5 yr (est)
WS 2 yr
Ground
Bank Sta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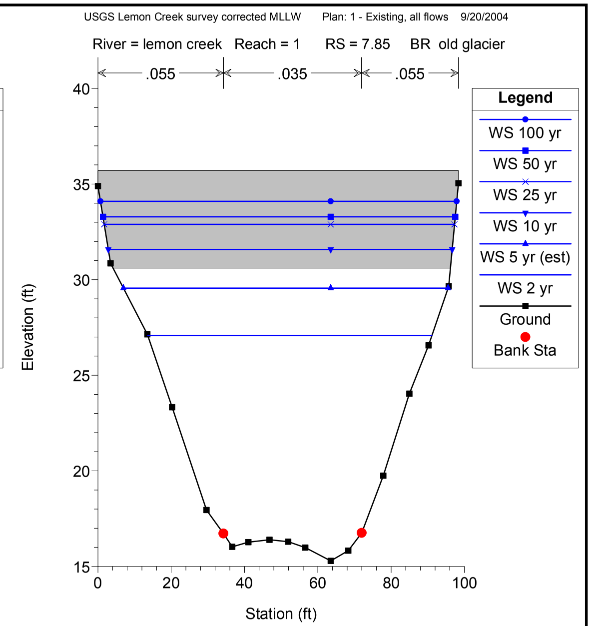
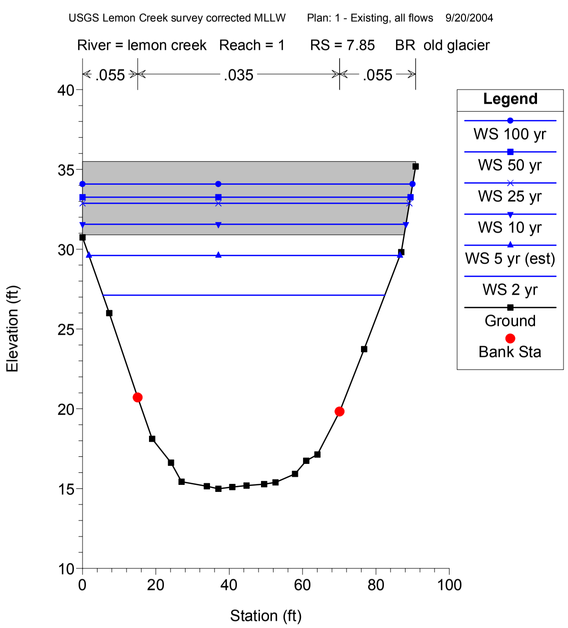
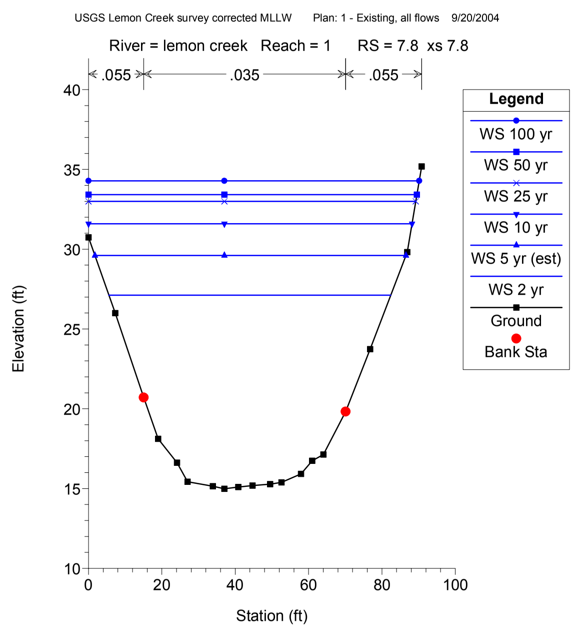
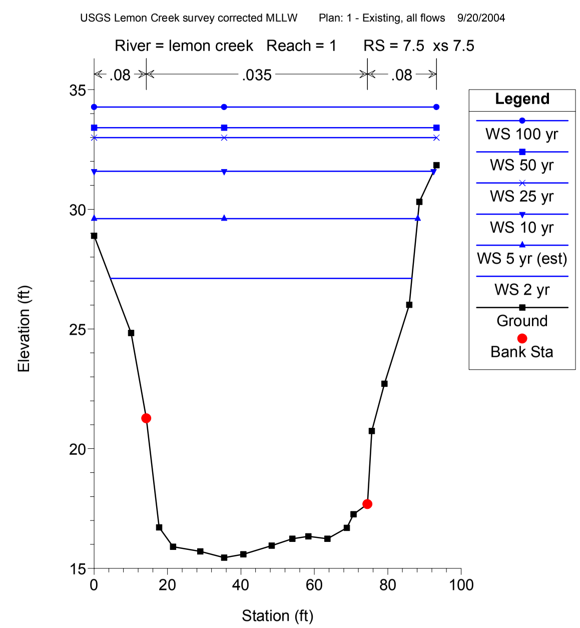
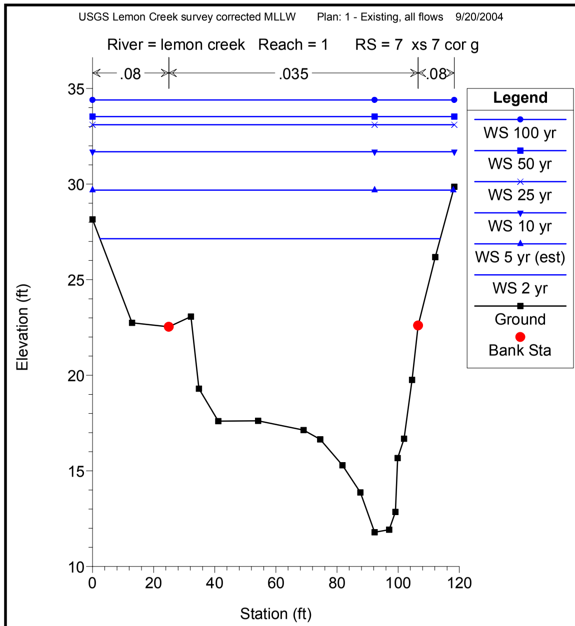
River = lemon creek Reach = 1 RS = 8 xs 8 cor h
.055
.035
.055
Elevation (ft)
Station (ft)
Legend
WS 100 yr
WS 50 yr
WS 25 yr
WS 10 yr
WS 5 yr (est)
WS 2 yr
Ground
Bank Sta

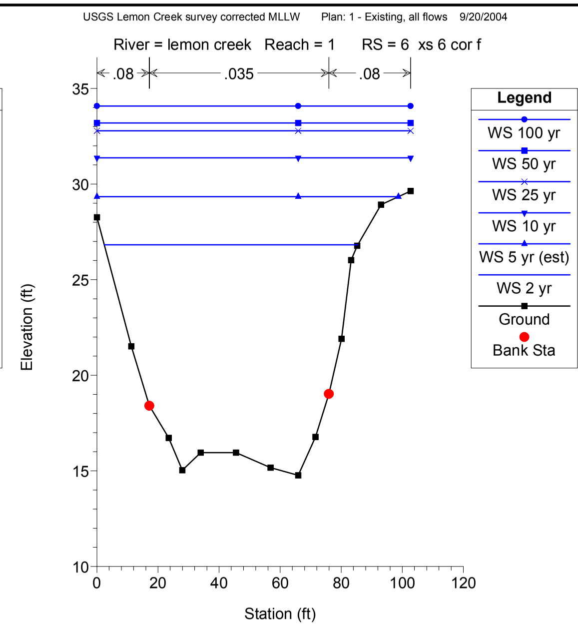

USGS Lemon Creek survey corrected MLLW Plan: 1 - Existing, all flows 9/20/2004
River = lemon creek Reach = 1 RS = 7.85 BR old glacier
.055
.035
.055
Elevation (ft)
Station (ft)
Legend
WS 100 yr
WS 50 yr
WS 25 yr
WS 10 yr
WS 5 yr (est)
WS 2 yr
Ground
Bank Sta

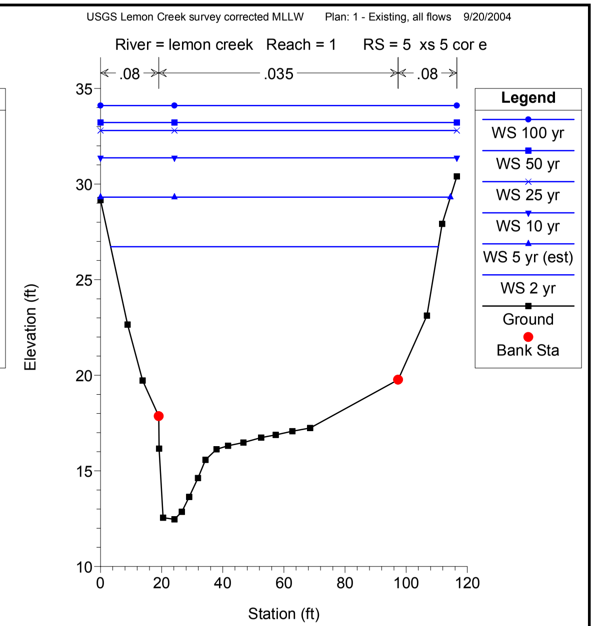

USGS Lemon Creek survey corrected MLLW Plan: 1 - Existing, all flows 9/20/2004
River = lemon creek Reach = 1 RS = 7.85 BR old glacier
.055
.035
.055
Elevation (ft)
Station (ft)
Legend
WS 100 yr
WS 50 yr
WS 25 yr
WS 10 yr
WS 5 yr (est)
WS 2 yr
Ground
Bank Sta

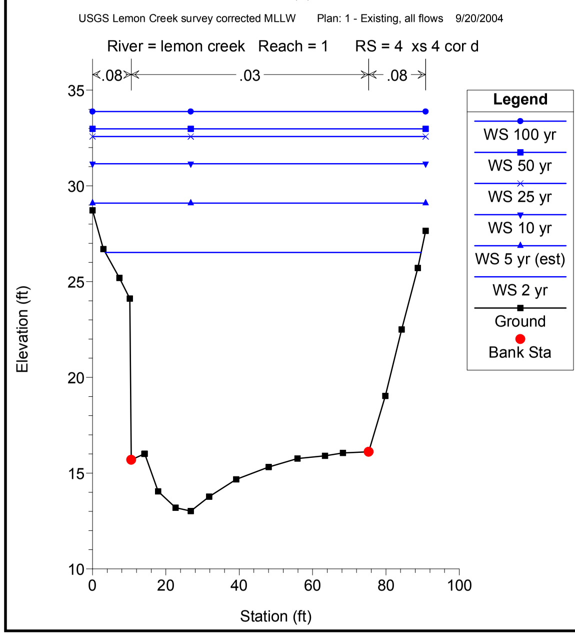

USGS Lemon Creek survey corrected MLLW Plan: 1 - Existing, all flows 9/20/2004
River = lemon creek Reach = 1 RS = 7.8 xs 7.8
.055
.035
.055
Elevation (ft)
Station (ft)
Legend
WS 100 yr
WS 50 yr
WS 25 yr
WS 10 yr
WS 5 yr (est)
WS 2 yr
Ground
Bank Sta

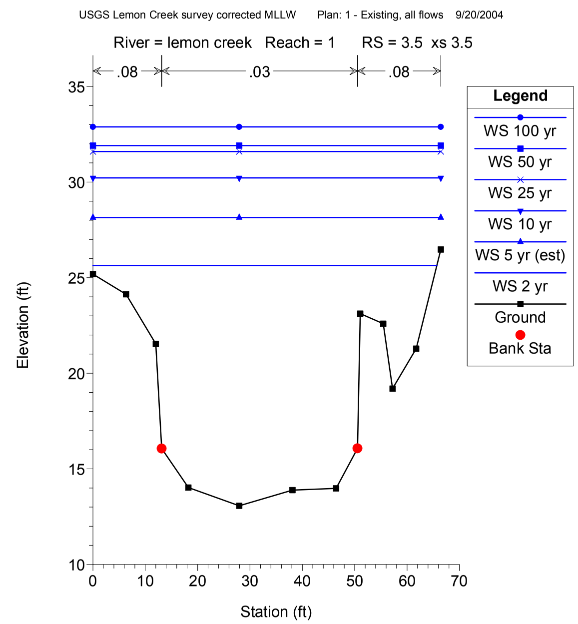

USGS Lemon Creek survey corrected MLLW Plan: 1 - Existing, all flows 9/20/2004
River = lemon creek Reach = 1 RS = 7.5 xs 7.5
.08
.035
.08
Elevation (ft)
Station (ft)
Legend
WS 100 yr
WS 50 yr
WS 25 yr
WS 10 yr
WS 5 yr (est)
WS 2 yr
Ground
Bank Sta

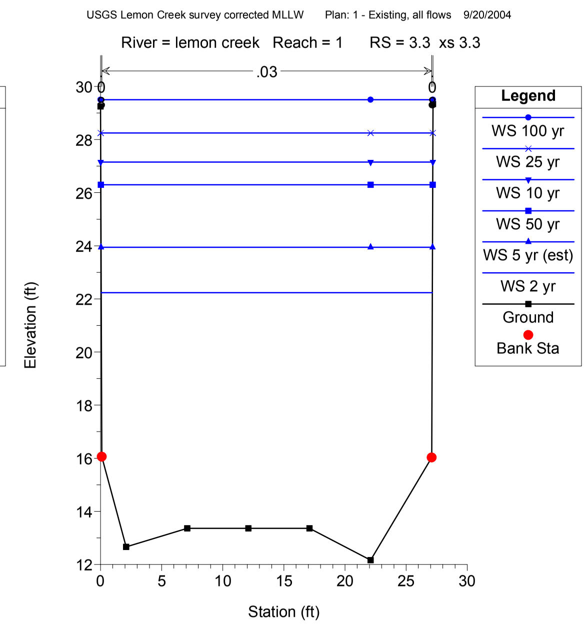

USGS Lemon Creek survey corrected MLLW Plan: 1 - Existing, all flows 9/20/2004
River = lemon creek Reach = 1 RS = 7 xs 7 cor g
.08
.035
.08
Legend
WS 100 yr
WS 50 yr
WS 25 yr
WS 10 yr
WS 5 yr (est)
WS 2 yr
Ground
Bank Sta
Elevation (ft)
Station (ft)


USGS Lemon Creek survey corrected MLLW Plan: 1 - Existing, all flows 9/20/2004
River = lemon creek Reach = 1 RS = 6 xs 6 cor f
.08
.035
.08
Legend
WS 100 yr
WS 50 yr
WS 25 yr
WS 10 yr
WS 5 yr (est)
WS 2 yr
Ground
Bank Sta
Elevation (ft)
Station (ft)


USGS Lemon Creek survey corrected MLLW Plan: 1 - Existing, all flows 9/20/2004
River = lemon creek Reach = 1 RS = 5 xs 5 cor e
.08
.035
.08
Legend
WS 100 yr
WS 50 yr
WS 25 yr
WS 10 yr
WS 5 yr (est)
WS 2 yr
Ground
Bank Sta
Elevation (ft)
Station (ft)


USGS Lemon Creek survey corrected MLLW Plan: 1 - Existing, all flows 9/20/2004
River = lemon creek Reach = 1 RS = 4 xs 4 cor d
.08
.03
.08
Legend
WS 100 yr
WS 50 yr
WS 25 yr
WS 10 yr
WS 5 yr (est)
WS 2 yr
Ground
Bank Sta
Elevation (ft)
Station (ft)


USGS Lemon Creek survey corrected MLLW Plan: 1 - Existing, all flows 9/20/2004
River = lemon creek Reach = 1 RS = 3.5 xs 3.5
.08
.03
.08
Legend
WS 100 yr
WS 50 yr
WS 25 yr
WS 10 yr
WS 5 yr (est)
WS 2 yr
Ground
Bank Sta
Elevation (ft)
Station (ft)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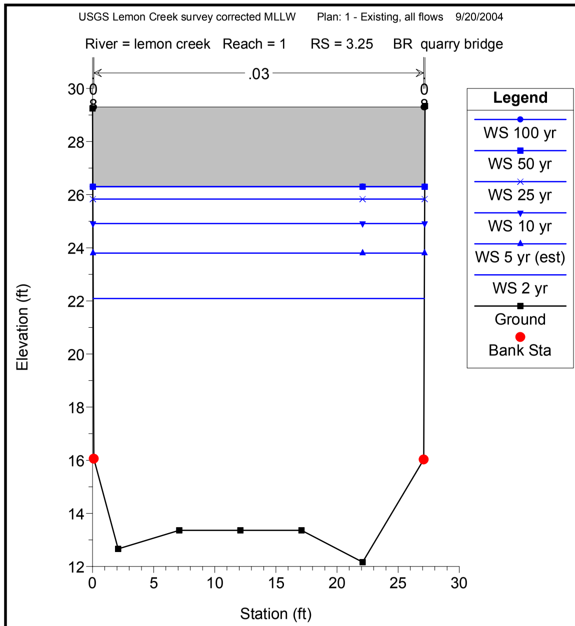
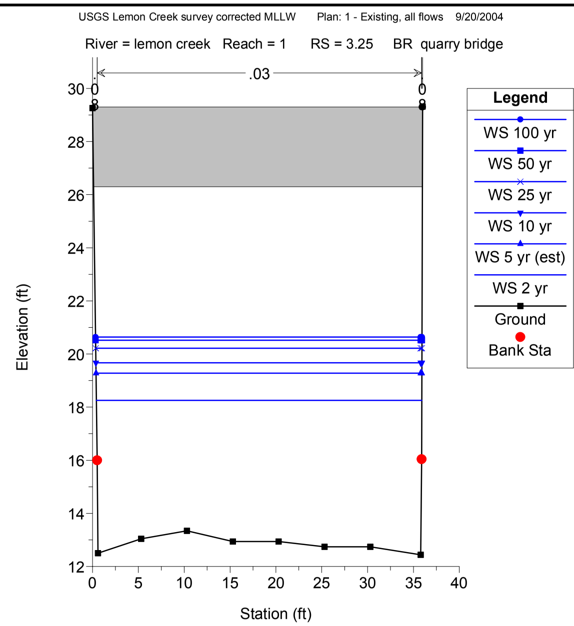
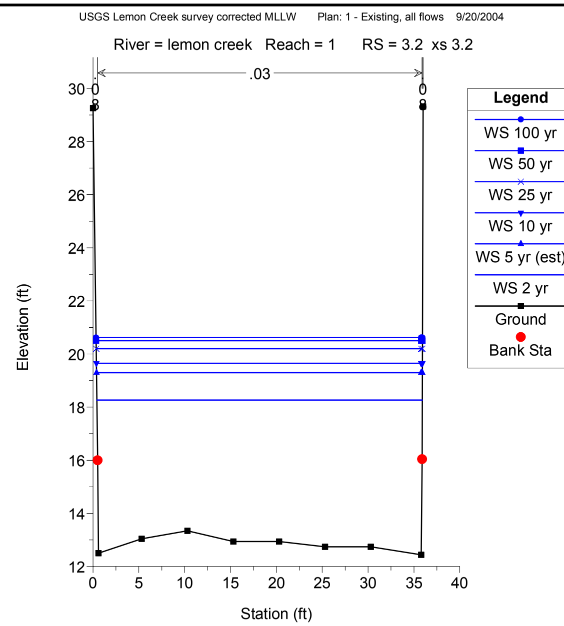
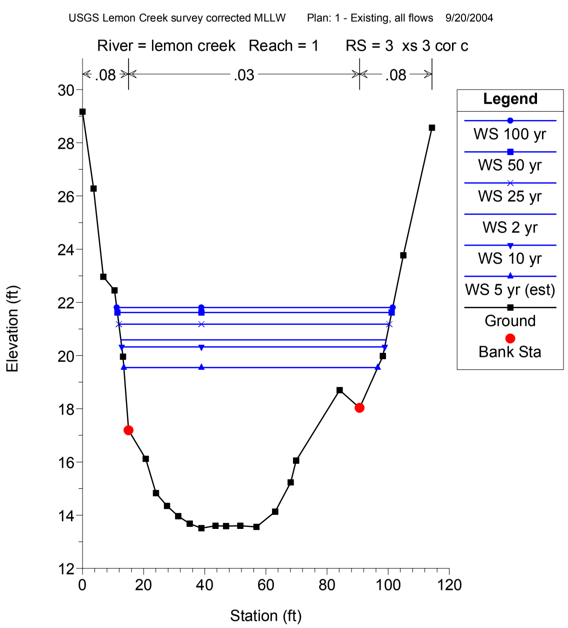
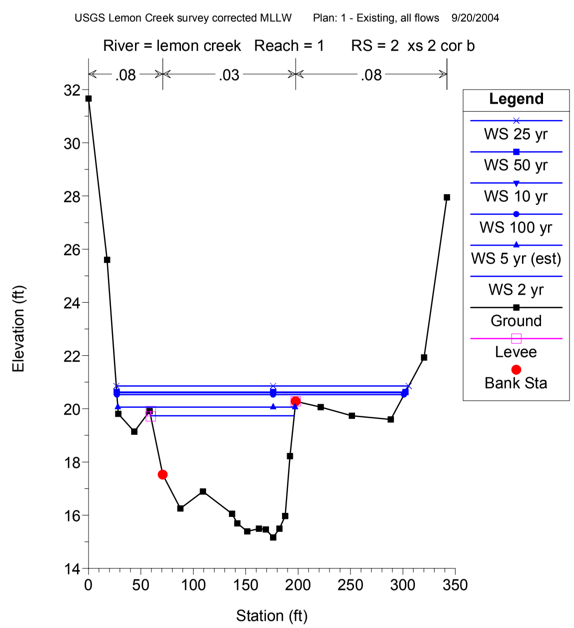
River = lemon creek Reach = 1 RS = 3.3 xs 3.3
0
.03
0
Legend
WS 100 yr
WS 25 yr
WS 10 yr
WS 50 yr
WS 5 yr (est)
WS 2 yr
Ground
Bank Sta
Elevation (ft)
Station (ft)

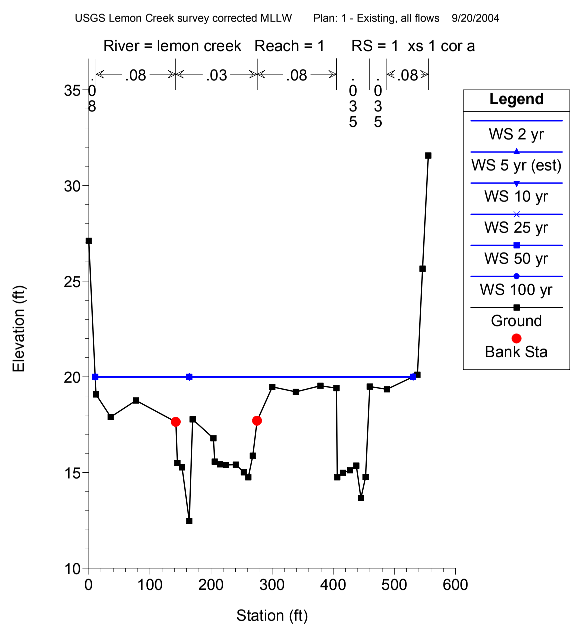

USGS Lemon Creek survey corrected MLLW Plan: 1 - Existing, all flows 9/20/2004
River = lemon creek Reach = 1 RS = 3.25 BR quarry bridge
Legend
WS 100 yr
WS 50 yr
WS 25 yr
WS 10 yr
WS 5 yr (est)
WS 2 yr
Ground
Bank Sta
Elevation (ft)
Station (ft)


USGS Lemon Creek survey corrected MLLW Plan: 1 - Existing, all flows 9/20/2004
River = lemon creek Reach = 1 RS = 3.25 BR quarry bridge
Legend
WS 100 yr
WS 50 yr
WS 25 yr
WS 10 yr
WS 5 yr (est)
WS 2 yr
Ground
Bank Sta
Elevation (ft)
Station (ft)


USGS Lemon Creek survey corrected MLLW Plan: 1 - Existing, all flows 9/20/2004
River = lemon creek Reach = 1 RS = 3.2 xs 3.2
Legend
WS 100 yr
WS 50 yr
WS 25 yr
WS 10 yr
WS 5 yr (est)
WS 2 yr
Ground
Bank Sta
Elevation (ft)
Station (ft)


USGS Lemon Creek survey corrected MLLW Plan: 1 - Existing, all flows 9/20/2004
River = lemon creek Reach = 1 RS = 3 xs 3 cor c
Legend
WS 100 yr
WS 50 yr
WS 25 yr
WS 2 yr
WS 10 yr
WS 5 yr (est)
Ground
Bank Sta
Elevation (ft)
Station (ft)


USGS Lemon Creek survey corrected MLLW Plan: 1 - Existing, all flows 9/20/2004
River = lemon creek Reach = 1 RS = 2 xs 2 cor b
Legend
WS 25 yr
WS 50 yr
WS 10 yr
WS 100 yr
WS 5 yr (est)
WS 2 yr
Ground
Levee
Bank Sta
Elevation (ft)
Station (ft)


USGS Lemon Creek survey corrected MLLW Plan: 1 - Existing, all flows 9/20/2004
River = lemon creek Reach = 1 RS = 1 xs 1 cor a
Legend
WS 2 yr
WS 5 yr (est)
WS 10 yr
WS 25 yr
WS 50 yr
WS 100 yr
Ground
Bank Sta
Elevation (ft)
Station (ft)

Appendix F(b)

Hydraulics

Tide Water to Top of Gorge
Existing Channel (No in Stream Mining)
RediMix Bridge Removed

Lemon Creek from tidewater to 350-ft above gorge bridge
Plan 2 Existing channel with RediMix Bridge removed

HEC-RAS Plan: 2-Ex, No Br River: lemon creek Reach: 1

Reach	River Sta	Profile	Cum Ch Len (ft)	Q Total (cfs)	Q Channel (cfs)	Vel Chnl (ft/s)	Hydr Depth C (ft)	Top W Act Chan (ft)	E.G. Slope (ft/ft)	Shear Chan (lb/sq ft)
1	1	2 yr		3930	2552.53	4.57	4.2	133.03	0.001304	0.33
1	1	5 yr (est)		5140	3338.42	5.97	4.2	133.03	0.00223	0.57
1	1	10 yr		5990	3890.5	6.96	4.2	133.03	0.003028	0.77
1	1	25 yr		6720	4364.63	7.81	4.2	133.03	0.003811	0.97
1	1	50 yr		7140	4637.42	8.3	4.2	133.03	0.004303	1.1
1	1	100 yr		7340	4767.32	8.53	4.2	133.03	0.004547	1.16
1	2	2 yr	174	3930	3909.9	8.94	3.48	125.48	0.006237	1.35
1	2	5 yr (est)	174	5140	5092.9	10.66	3.78	126.34	0.007936	1.86
1	2	10 yr	174	5990	5801.93	10.62	4.3	126.91	0.006641	1.77
1	2	25 yr	174	6720	6515.87	12	4.28	126.91	0.00854	2.26
1	2	50 yr	174	7140	6947.95	13.06	4.19	126.91	0.010387	2.7
1	2	100 yr	174	7340	7154.84	13.58	4.15	126.91	0.011388	2.93
1	3	2 yr	372	3930	3907.28	9.68	5.34	75.6	0.004166	1.37
1	3	5 yr (est)	372	5140	5099.71	11.5	5.86	75.6	0.005191	1.88
1	3	10 yr	372	5990	5940.02	13.11	5.99	75.6	0.006553	2.42
1	3	25 yr	372	6720	6657.1	14.09	6.25	75.6	0.007158	2.76
1	3	50 yr	372	7140	7065.91	14.37	6.51	75.6	0.007053	2.83
1	3	100 yr	372	7340	7259.87	14.46	6.64	75.6	0.00695	2.84
1	4	2 yr	493	3930	3896.17	9.95	6.05	64.74	0.003722	1.39
1	4	5 yr (est)	493	5140	5088.92	11.78	6.67	64.74	0.004569	1.88
1	4	10 yr	493	5990	5925.75	12.99	7.05	64.74	0.005162	2.25
1	4	25 yr	493	6720	6643.04	13.87	7.4	64.74	0.005525	2.52
1	4	50 yr	493	7140	7055.93	14.43	7.55	64.74	0.005817	2.71
1	4	100 yr	493	7340	7252.22	14.66	7.64	64.74	0.005905	2.79
1	5	2 yr	764	3930	3858.18	8.45	5.83	78.34	0.004089	1.4
1	5	5 yr (est)	764	5140	5008.7	9.14	6.99	78.34	0.003757	1.55
1	5	10 yr	764	5990	5808.11	9.52	7.79	78.34	0.003529	1.62
1	5	25 yr	764	6720	6490.53	9.8	8.45	78.34	0.003352	1.67
1	5	50 yr	764	7140	6881.28	9.94	8.84	78.34	0.003248	1.69
1	5	100 yr	764	7340	7067.07	10.01	9.02	78.34	0.003204	1.7
1	6	2 yr	1078	3930	3864.66	8.64	7.61	58.77	0.002867	1.33
1	6	5 yr (est)	1078	5140	5028.57	9.87	8.67	58.77	0.003143	1.66
1	6	10 yr	1078	5990	5840.35	10.61	9.36	58.77	0.003275	1.87
1	6	25 yr	1078	6720	6533.85	11.18	9.94	58.77	0.003357	2.03
1	6	50 yr	1078	7140	6932.56	11.48	10.27	58.77	0.00339	2.12
1	6	100 yr	1078	7340	7122.2	11.62	10.43	58.77	0.003406	2.16
1	7	2 yr	1213	3930	3901.54	6.52	7.33	81.56	0.001892	0.78
1	7	5 yr (est)	1213	5140	5063.88	7.2	8.63	81.56	0.001855	0.9
1	7	10 yr	1213	5990	5870.06	7.59	9.48	81.56	0.001819	0.98
1	7	25 yr	1213	6720	6556.27	7.89	10.18	81.56	0.001787	1.03
1	7	50 yr	1213	7140	6948.37	8.05	10.58	81.56	0.001765	1.06
1	7	100 yr	1213	7340	7134.48	8.12	10.77	81.56	0.001755	1.07
1	7.5	2 yr	1361	3930	3900.01	7.85	8.25	60.22	0.002163	1.07
1	7.5	5 yr (est)	1361	5140	5078.77	8.92	9.46	60.22	0.002328	1.32
1	7.5	10 yr	1361	5990	5897.09	9.55	10.25	60.22	0.0024	1.47
1	7.5	25 yr	1361	6720	6594.38	10.04	10.9	60.22	0.002444	1.6
1	7.5	50 yr	1361	7140	6993.43	10.3	11.27	60.22	0.00246	1.66
1	7.5	100 yr	1361	7340	7182.97	10.42	11.45	60.22	0.002466	1.69

Lemon Creek from tidewater to 350-ft above gorge bridge
Plan 2 Existing channel with RediMix Bridge removed

HEC-RAS Plan: 2-Ex, No Br River: lemon creek Reach: 1

Reach	River Sta	Profile	Cum Ch Len (ft)	Q Total (cfs)	Q Channel (cfs)	Vel Chnl (ft/s)	Hydr Depth C (ft)	Top W Act Chan (ft)	E.G. Slope (ft/ft)	Shear Chan (lb/sq ft)
1	7.8	2 yr	1413	3930	3868.03	8.51	8.25	55.07	0.002526	1.26
1	7.8	5 yr (est)	1413	5140	5018.18	9.64	9.45	55.07	0.002705	1.54
1	7.8	10 yr	1413	5990	5814.71	10.31	10.24	55.07	0.002782	1.72
1	7.8	25 yr	1413	6720	6491.46	10.83	10.88	55.07	0.002828	1.85
1	7.8	50 yr	1413	7140	6877.53	11.1	11.25	55.07	0.002842	1.93
1	7.8	100 yr	1413	7340	7060.63	11.22	11.42	55.07	0.002847	1.96
1	8	2 yr	1472	3930	3425.04	10.77	8.43	37.72	0.003786	1.98
1	8	5 yr (est)	1472	5140	4403.77	12.17	9.59	37.72	0.004078	2.42
1	8	10 yr	1472	5990	5074.49	13	10.35	37.72	0.0042	2.69
1	8	25 yr	1472	6720	5638.8	13.62	10.98	37.72	0.004263	2.9
1	8	50 yr	1472	7140	5962.11	13.95	11.33	37.72	0.004286	3.01
1	8	100 yr	1472	7340	6115.54	14.1	11.5	37.72	0.004295	3.06
1	8.5	2 yr	1597	3930	3759.26	6.65	8.39	67.41	0.001443	0.75
1	8.5	5 yr (est)	1597	5140	4846.32	7.28	9.87	67.41	0.001394	0.86
1	8.5	10 yr	1597	5990	5598.66	7.67	10.83	67.41	0.001366	0.92
1	8.5	25 yr	1597	6720	6236.95	7.97	11.61	67.41	0.001345	0.97
1	8.5	50 yr	1597	7140	6597.96	8.12	12.05	67.41	0.001329	1
1	8.5	100 yr	1597	7340	6769.48	8.19	12.26	67.41	0.001323	1.01
1	9	2 yr	2020	3930	3786.25	4.94	6.97	109.93	0.001071	0.45
1	9	5 yr (est)	2020	5140	4844.94	5.18	8.5	109.93	0.000905	0.46
1	9	10 yr	2020	5990	5575.87	5.34	9.5	109.93	0.000828	0.47
1	9	25 yr	2020	6720	6197.4	5.47	10.31	109.93	0.000778	0.48
1	9	50 yr	2020	7140	6552.15	5.54	10.77	109.93	0.000753	0.49
1	9	100 yr	2020	7340	6720.45	5.57	10.98	109.93	0.000742	0.49
1	10	2 yr	2770	3930	3864.39	4.72	5.43	150.69	0.001337	0.44
1	10	5 yr (est)	2770	5140	5017.39	4.88	6.73	152.68	0.001076	0.44
1	10	10 yr	2770	5990	5824.03	4.97	7.62	153.63	0.000949	0.44
1	10	25 yr	2770	6720	6515.64	5.06	8.39	153.63	0.000863	0.44
1	10	50 yr	2770	7140	6912.72	5.1	8.82	153.63	0.000821	0.44
1	10	100 yr	2770	7340	7101.6	5.12	9.03	153.63	0.000803	0.44
1	11	2 yr	3204	3930	3894.72	4.22	4.95	186.55	0.001216	0.36
1	11	5 yr (est)	3204	5140	5059.44	4.36	6.23	186.55	0.000956	0.36
1	11	10 yr	3204	5990	5869.5	4.43	7.11	186.55	0.000828	0.36
1	11	25 yr	3204	6720	6560.56	4.48	7.84	186.55	0.000745	0.35
1	11	50 yr	3204	7140	6956.19	4.51	8.26	186.55	0.000704	0.35
1	11	100 yr	3204	7340	7144.12	4.53	8.46	186.55	0.000687	0.35
1	12	2 yr	3771	3930	3925.01	5.64	3.67	189.83	0.002506	0.56
1	12	5 yr (est)	3771	5140	5128.57	5.73	4.72	189.83	0.001847	0.53
1	12	10 yr	3771	5990	5971.06	5.73	5.49	189.83	0.001511	0.51
1	12	25 yr	3771	6720	6692.31	5.72	6.16	189.83	0.001295	0.49
1	12	50 yr	3771	7140	7106.27	5.72	6.55	189.83	0.001192	0.48
1	12	100 yr	3771	7340	7303.15	5.72	6.73	189.83	0.001148	0.47
1	13	2 yr	4559	3930	3886.16	7.3	2.78	191.55	0.008471	1.47
1	13	5 yr (est)	4559	5140	5078.1	8.42	3.15	191.55	0.009557	1.87
1	13	10 yr	4559	5990	5913.43	8.94	3.45	191.55	0.009545	2.05
1	13	25 yr	4559	6720	6628.71	9.16	3.78	191.55	0.008884	2.09
1	13	50 yr	4559	7140	7039.14	9.2	3.99	191.55	0.008311	2.07
1	13	100 yr	4559	7340	7234.28	9.2	4.11	191.55	0.00801	2.05

Lemon Creek from tidewater to 350-ft above gorge bridge

Plan 2 Existing channel with RediMix Bridge removed

HEC-RAS Plan: 2-Ex, No Br River: lemon creek Reach: 1

Reach	River Sta	Profile	Cum Ch Len (ft)	Q Total (cfs)	Q Channel (cfs)	Vel Chnl (ft/s)	Hydr Depth C (ft)	Top W Act Chan (ft)	E.G. Slope (ft/ft)	Shear Chan (lb/sq ft)
1	13.5	2 yr	4845	3930	3771.76	9.08	3.68	112.96	0.011005	2.44
1	13.5	5 yr (est)	4845	5140	4894.37	10.2	4.24	113.04	0.011473	2.94
1	13.5	10 yr	4845	5990	5678.52	11.02	4.56	113.04	0.012181	3.35
1	13.5	25 yr	4845	6720	6353.26	11.86	4.74	113.04	0.013385	3.83
1	13.5	50 yr	4845	7140	6738.08	12.26	4.86	113.04	0.013837	4.06
1	13.5	100 yr	4845	7340	6918.54	12.38	4.94	113.04	0.013811	4.12
1	14	2 yr	5293	3930	3840.54	4.19	4.21	217.92	0.002394	0.62
1	14	5 yr (est)	5293	5140	5012.86	4.58	5.02	217.92	0.002267	0.7
1	14	10 yr	5293	5990	5834.65	4.82	5.56	217.92	0.002185	0.75
1	14	25 yr	5293	6720	6539.2	4.99	6.02	217.92	0.002106	0.78
1	14	50 yr	5293	7140	6944.16	5.08	6.27	217.92	0.002068	0.8
1	14	100 yr	5293	7340	7137	5.13	6.39	217.92	0.002059	0.81
1	14.5	2 yr	5820	3930	3824.51	8.96	3.78	112.73	0.013079	2.99
1	14.5	5 yr (est)	5820	5140	4877.48	9.86	4.37	113.24	0.013114	3.45
1	14.5	10 yr	5820	5990	5601.7	10.43	4.73	113.55	0.013236	3.76
1	14.5	25 yr	5820	6720	6216.56	10.89	5.01	113.8	0.013364	4.02
1	14.5	50 yr	5820	7140	6567.91	11.15	5.17	113.94	0.013443	4.17
1	14.5	100 yr	5820	7340	6734.64	11.27	5.24	114	0.013481	4.24
1	15	2 yr	6042	3930	3785.15	7.04	5.84	92.08	0.006656	2.37
1	15	5 yr (est)	6042	5140	4880.35	8.04	6.53	92.94	0.007482	2.98
1	15	10 yr	6042	5990	5699.47	8.76	6.96	93.46	0.008192	3.47
1	15	25 yr	6042	6720	6357.35	9.28	7.3	93.89	0.008633	3.83
1	15	50 yr	6042	7140	6716.43	9.53	7.49	94.12	0.008817	4.01
1	15	100 yr	6042	7340	6886.44	9.65	7.58	94.23	0.008901	4.09
1	15.5	2 yr	6436	3930	3929.64	8.45	4.93	94.42	0.01203	3.61
1	15.5	5 yr (est)	6436	5140	5137.21	9.26	5.79	95.89	0.011705	4.12
1	15.5	10 yr	6436	5990	5983.7	9.71	6.36	96.89	0.011383	4.39
1	15.5	25 yr	6436	6720	6709.74	10.12	6.79	97.64	0.011357	4.67
1	15.5	50 yr	6436	7140	7127.11	10.37	7.01	98.04	0.011419	4.85
1	15.5	100 yr	6436	7340	7325.76	10.48	7.11	98.23	0.011451	4.94
1	15.8	2 yr	6772	3930	3774.87	10.18	5.46	67.9	0.018385	6.06
1	15.8	5 yr (est)	6772	5140	4904.8	11.23	6.35	68.81	0.018448	7.03
1	15.8	10 yr	6772	5990	5791.88	12.39	6.75	69.23	0.020718	8.38
1	15.8	25 yr	6772	6720	6422.51	12.7	7.25	69.75	0.019902	8.61
1	15.8	50 yr	6772	7140	6773.2	12.76	7.58	70.1	0.018971	8.56
1	15.8	100 yr	6772	7340	6942.98	12.83	7.7	70.23	0.018794	8.62
1	16	2 yr	6985	3930	3292.49	11.25	6.47	45.25	0.023246	8.8
1	16	5 yr (est)	6985	5140	4154.34	12.21	7.29	46.66	0.023535	9.99
1	16	10 yr	6985	5990	4719.02	12.34	7.98	47.87	0.021414	9.92
1	16	25 yr	6985	6720	5235.33	12.98	8.32	48.47	0.022457	10.82
1	16	50 yr	6985	7140	5536.46	13.42	8.47	48.71	0.023502	11.51
1	16	100 yr	6985	7340	5675.68	13.57	8.57	48.82	0.023682	11.72
1	17	2 yr	7123	3930	3353.14	10.91	7.35	41.81	0.018787	8.51
1	17	5 yr (est)	7123	5140	4322.53	12.08	8.56	41.81	0.018816	9.93
1	17	10 yr	7123	5990	4991.46	12.8	9.33	41.81	0.018829	10.83
1	17	25 yr	7123	6720	5559.37	13.36	9.95	41.81	0.018814	11.54
1	17	50 yr	7123	7140	5882.1	13.66	10.3	41.81	0.018807	11.94
1	17	100 yr	7123	7340	6035.12	13.81	10.45	41.81	0.018821	12.13

Lemon Creek from tidewater to 350-ft above gorge bridge

Plan 2 Existing channel with RediMix Bridge removed

HEC-RAS Plan: 2-Ex, No Br River: lemon creek Reach: 1

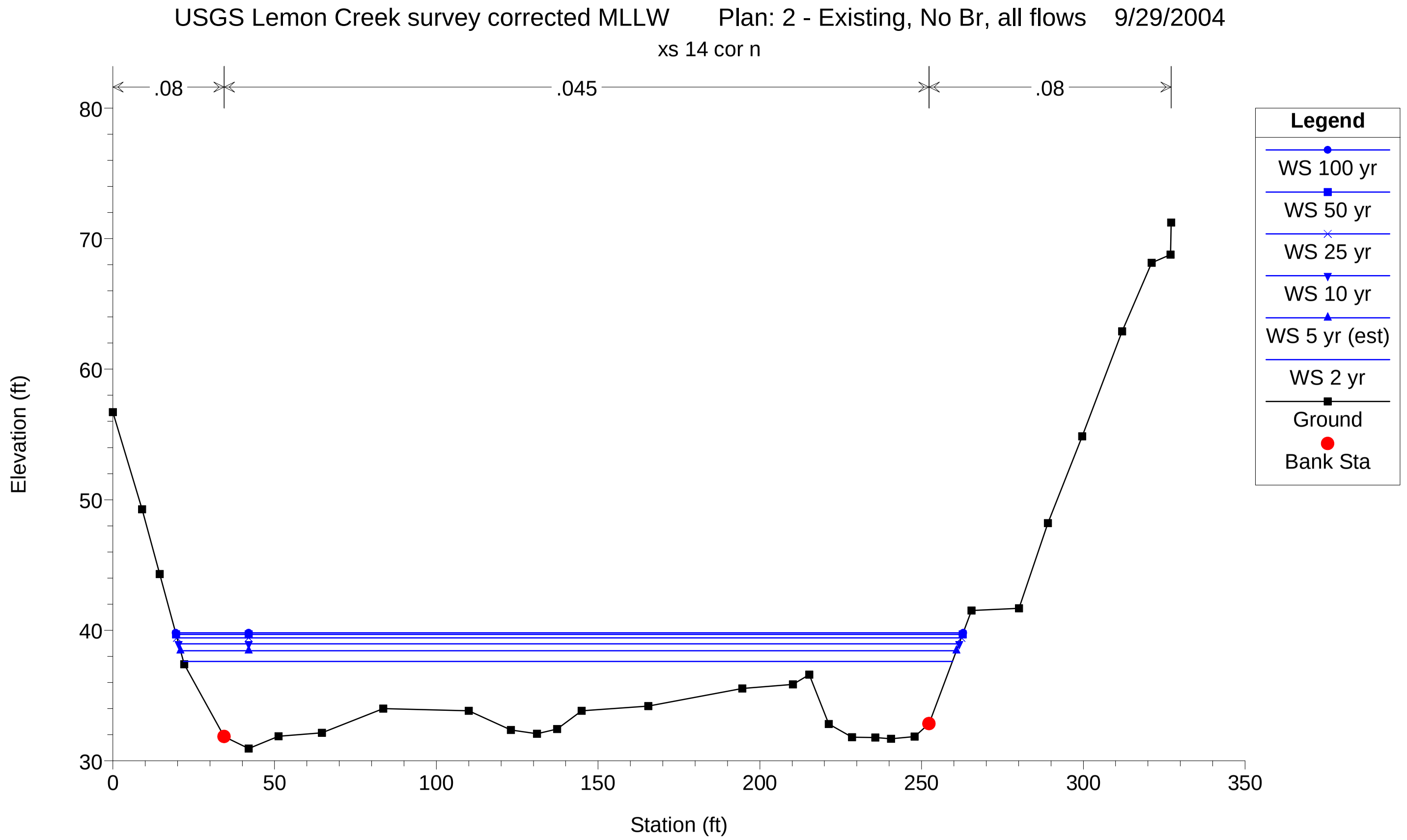
Reach	River Sta	Profile	Cum Ch Len (ft)	Q Total (cfs)	Q Channel (cfs)	Vel Chnl (ft/s)	Hydr Depth C (ft)	Top W Act Chan (ft)	E.G. Slope (ft/ft)	Shear Chan (lb/sq ft)
1	17.5	2 yr	7263	3930	2955.51	12.81	10.08	22.89	0.022179	13.54
1	17.5	5 yr (est)	7263	5140	3734.99	14.44	11.3	22.89	0.024229	16.58
1	17.5	10 yr	7263	5990	4264.06	15.45	12.06	22.89	0.025418	18.56
1	17.5	25 yr	7263	6720	4708.87	16.24	12.66	22.89	0.026317	20.18
1	17.5	50 yr	7263	7140	4961.42	16.68	12.99	22.89	0.026809	21.1
1	17.5	100 yr	7263	7340	5080.86	16.88	13.15	22.89	0.027037	21.53
1	18	2 yr	7408	3930	2763.67	14.34	7.12	27.07	0.043368	18.96
1	18	5 yr (est)	7408	5140	3468.9	15.66	8.18	27.07	0.042951	21.58
1	18	10 yr	7408	5990	3946.39	16.38	8.9	27.07	0.042031	22.97
1	18	25 yr	7408	6720	4348.9	16.95	9.48	27.07	0.041354	24.07
1	18	50 yr	7408	7140	4579.8	17.29	9.79	27.07	0.041274	24.8
1	18	100 yr	7408	7340	4686.84	17.41	9.94	27.07	0.040964	25.01
1	19	2 yr	7600	3930	2027.67	11.24	10.96	16.45	0.017324	10.47
1	19	5 yr (est)	7600	5140	2474.33	12.23	12.3	16.45	0.017588	11.92
1	19	10 yr	7600	5990	2778.05	12.87	13.12	16.45	0.017859	12.92
1	19	25 yr	7600	6720	3032.04	13.37	13.79	16.45	0.018053	13.72
1	19	50 yr	7600	7140	3174.36	13.63	14.16	16.45	0.018092	14.12
1	19	100 yr	7600	7340	3243.12	13.76	14.32	16.45	0.018182	14.35
1	20	2 yr	7704	3930	2413.59	13.53	7.29	24.49	0.038675	16.88
1	20	5 yr (est)	7704	5140	2867.75	13.62	8.6	24.49	0.031459	16.2
1	20	10 yr	7704	5990	3184.03	13.8	9.42	24.49	0.028557	16.12
1	20	25 yr	7704	6720	3454.41	13.98	10.09	24.49	0.026779	16.19
1	20	50 yr	7704	7140	3608.66	14.09	10.46	24.49	0.025912	16.24
1	20	100 yr	7704	7340	3682.65	14.15	10.63	24.49	0.025587	16.29
1	21	2 yr	7794	3930	2677.21	15.03	7.37	24.16	0.045303	20.57
1	21	5 yr (est)	7794	5140	3389.12	16.38	8.56	24.16	0.044125	23.26
1	21	10 yr	7794	5990	3877.86	17.16	9.35	24.16	0.043034	24.78
1	21	25 yr	7794	6720	4293.6	17.81	9.98	24.16	0.042473	26.1
1	21	50 yr	7794	7140	4531.65	18.18	10.32	24.16	0.04233	26.9
1	21	100 yr	7794	7340	4645.48	18.37	10.47	24.16	0.042428	27.35
1	22	2 yr	7906	3930	3050.35	11.81	9.11	28.33	0.021176	11.86
1	22	5 yr (est)	7906	5140	3882.2	13.12	10.44	28.33	0.021776	13.97
1	22	10 yr	7906	5990	4455.18	13.95	11.28	28.33	0.022212	15.39
1	22	25 yr	7906	6720	4939.37	14.58	11.96	28.33	0.022462	16.5
1	22	50 yr	7906	7140	5214.63	14.92	12.34	28.33	0.022545	17.09
1	22	100 yr	7906	7340	5344.39	15.06	12.52	28.33	0.022532	17.34
1	23	2 yr	8014	3930	2857.73	12.9	10.28	21.55	0.021818	13.62
1	23	5 yr (est)	8014	5140	3611.53	14.38	11.66	21.55	0.022941	16.24
1	23	10 yr	8014	5990	4126.6	15.3	12.52	21.55	0.023611	17.95
1	23	25 yr	8014	6720	4564.02	16.04	13.21	21.55	0.024155	19.38
1	23	50 yr	8014	7140	4814.23	16.44	13.59	21.55	0.024458	20.18
1	23	100 yr	8014	7340	4932.92	16.63	13.76	21.55	0.024591	20.56
1	24	2 yr	8247	3930	3926.51	8.96	8.18	53.6	0.009178	4.2
1	24	5 yr (est)	8247	5140	5127.11	9.78	9.71	54	0.008723	4.73
1	24	10 yr	8247	5990	5964.67	10.3	10.72	54	0.008491	5.08
1	24	25 yr	8247	6720	6679.37	10.72	11.54	54	0.008325	5.37
1	24	50 yr	8247	7140	7088.55	10.94	12	54	0.008237	5.52
1	24	100 yr	8247	7340	7282.88	11.04	12.21	54	0.008197	5.59

Lemon Creek from tidewater to 350-ft above gorge bridge

Plan 2 Existing channel with RediMix Bridge removed

HEC-RAS Plan: 2-Ex, No Br River: lemon creek Reach: 1

Reach	River Sta	Profile	Cum Ch Len (ft)	Q Total (cfs)	Q Channel (cfs)	Vel Chnl (ft/s)	Hydr Depth C (ft)	Top W Act Chan (ft)	E.G. Slope (ft/ft)	Shear Chan (lb/sq ft)
1	25	2 yr	8378	3930	3896.07	5.02	5.9	131.61	0.001761	0.63
1	25	5 yr (est)	8378	5140	5067.19	5.02	7.57	133.48	0.001274	0.59
1	25	10 yr	8378	5990	5883.52	5.06	8.63	134.69	0.00109	0.57
1	25	25 yr	8378	6720	6581.45	5.11	9.5	135.69	0.00098	0.56
1	25	50 yr	8378	7140	6981.76	5.13	9.98	136.24	0.000929	0.56
1	25	100 yr	8378	7340	7172.07	5.15	10.21	136.5	0.000908	0.56
1	26	2 yr	8453	3930	3872.42	7.5	5.65	91.43	0.004104	1.43
1	26	5 yr (est)	8453	5140	4880.85	7.2	7.41	91.43	0.002636	1.21
1	26	10 yr	8453	5990	5563.99	7.11	8.56	91.43	0.002121	1.12
1	26	25 yr	8453	6720	6142.09	7.07	9.5	91.43	0.001828	1.07
1	26	50 yr	8453	7140	6471.51	7.06	10.02	91.43	0.001697	1.05
1	26	100 yr	8453	7340	6627.7	7.06	10.26	91.43	0.001642	1.04
1	27	2 yr	8505	3930	3727.88	12.17	6.35	48.2	0.009442	3.65
1	27	5 yr (est)	8505	5140	4833.54	12.72	7.88	48.2	0.007729	3.71
1	27	10 yr	8505	5990	5602.39	13.02	8.93	48.2	0.006865	3.73
1	27	25 yr	8505	6720	6257.58	13.26	9.79	48.2	0.006288	3.75
1	27	50 yr	8505	7140	6633.69	13.39	10.28	48.2	0.006012	3.76
1	27	100 yr	8505	7340	6814.34	13.46	10.51	48.2	0.005898	3.77
1	28	2 yr	8524	3930	3776.36	12.14	6.03	51.58	0.009954	3.68
1	28	5 yr (est)	8524	5140	4906.05	12.59	7.55	51.58	0.007932	3.68
1	28	10 yr	8524	5990	5698.21	12.87	8.58	51.58	0.006983	3.68
1	28	25 yr	8524	6720	6376.27	13.1	9.44	51.58	0.006372	3.69
1	28	50 yr	8524	7140	6768.26	13.24	9.91	51.58	0.006104	3.71
1	28	100 yr	8524	7340	6955.14	13.3	10.14	51.58	0.005979	3.72
1	29	2 yr	8593	3930	3917.56	7.1	5.46	100.98	0.003474	1.17
1	29	5 yr (est)	8593	5140	5116.78	6.72	4.37	173.97	0.00253	0.69
1	29	10 yr	8593	5990	5960.45	6	5.15	192.8	0.001669	0.53
1	29	25 yr	8593	6720	6677.5	5.66	6.12	192.8	0.001201	0.46
1	29	50 yr	8593	7140	7088.38	5.53	6.65	192.8	0.001014	0.42
1	29	100 yr	8593	7340	7283.63	5.47	6.91	192.8	0.00094	0.4
1	30	2 yr	8659	3930	3859.99	10.74	5.89	61.06	0.008	2.9
1	30	5 yr (est)	8659	5140	4998.07	11.13	7.36	61.06	0.006374	2.89
1	30	10 yr	8659	5990	5784.33	11.32	8.37	61.06	0.005553	2.87
1	30	25 yr	8659	6720	6437.47	11.42	9.24	61.06	0.004956	2.82
1	30	50 yr	8659	7140	6802.44	11.44	9.74	61.06	0.004638	2.78
1	30	100 yr	8659	7340	6971.14	11.44	9.98	61.06	0.004486	2.76
1	31	2 yr	8877	3930	1821.26	9.21	8.04	24.6	0.003881	1.92
1	31	5 yr (est)	8877	5140	2091.81	9.1	9.34	24.6	0.003106	1.79
1	31	10 yr	8877	5990	2254.64	8.86	10.35	24.6	0.002567	1.64
1	31	25 yr	8877	6720	2484.75	9.52	10.61	24.6	0.002868	1.87
1	31	50 yr	8877	7140	2594.32	9.69	10.88	24.6	0.002873	1.93
1	31	100 yr	8877	7340	2645.17	9.76	11.02	24.6	0.002866	1.95



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Elevation (ft)
Station (ft)
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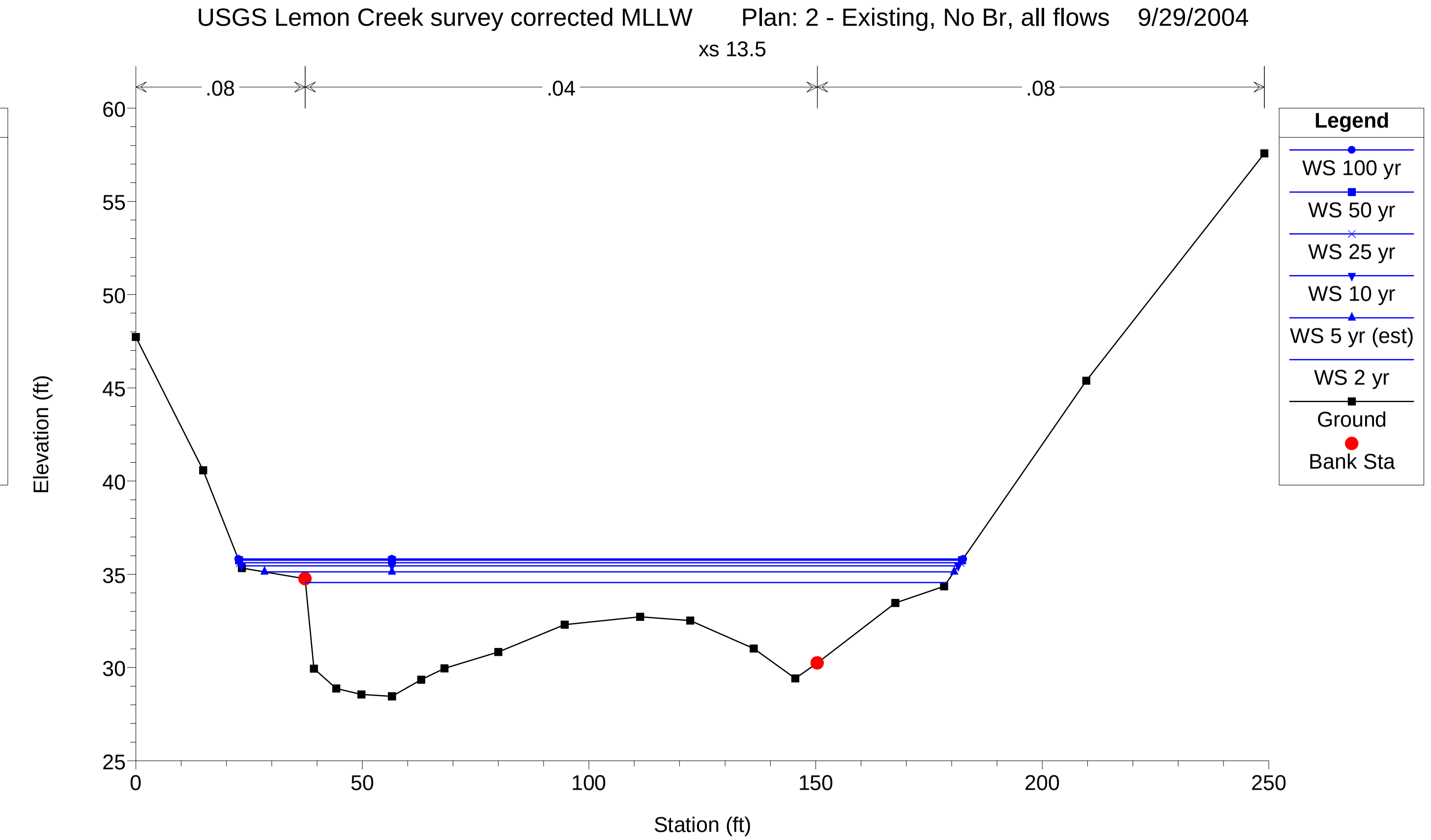
WS 100 yr
WS 50 yr
WS 25 yr
WS 10 yr
WS 5 yr (est)
WS 2 yr
Ground
Bank Sta



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Elevation (ft)
Station (ft)
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WS 5 yr (est)
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Ground
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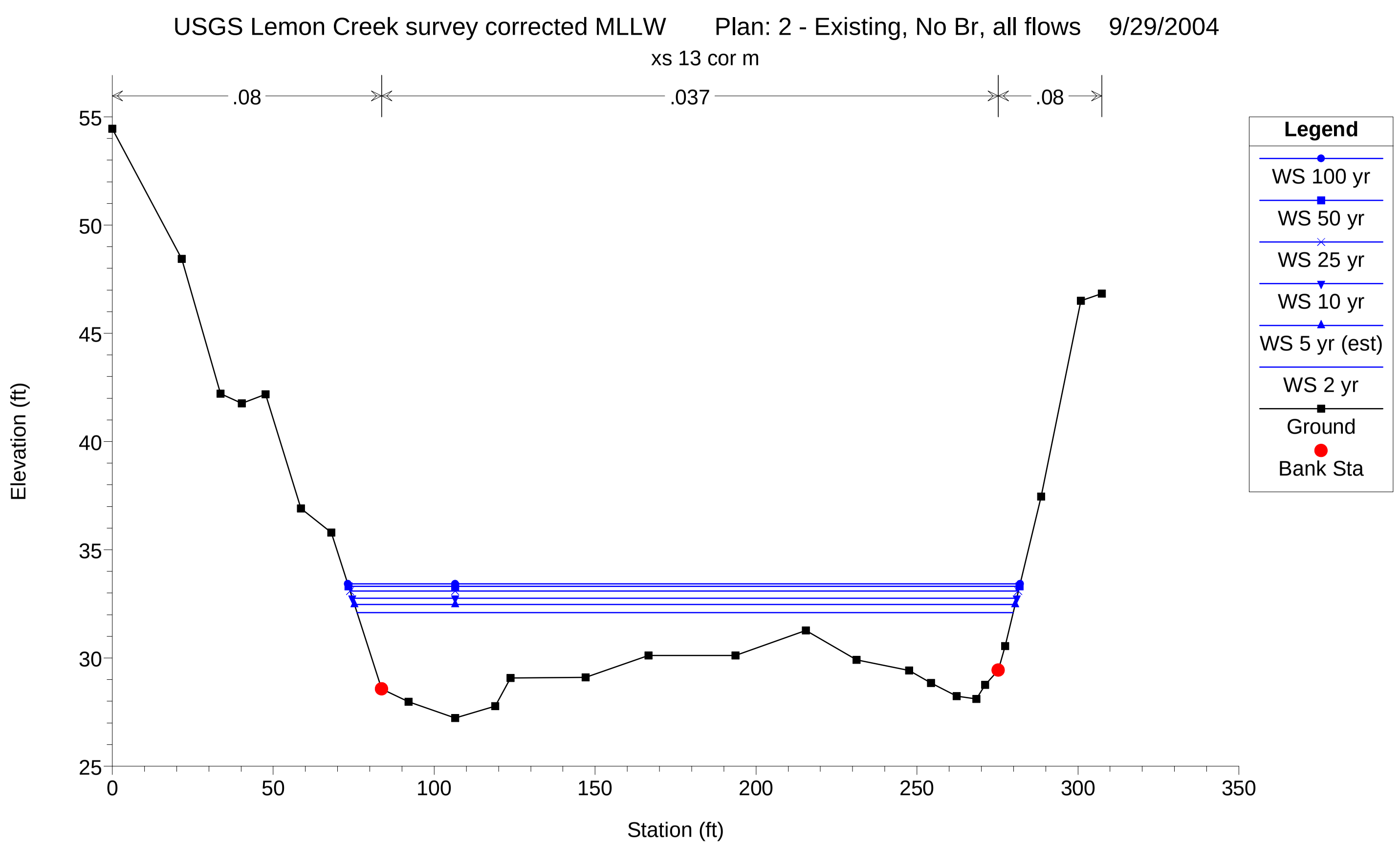

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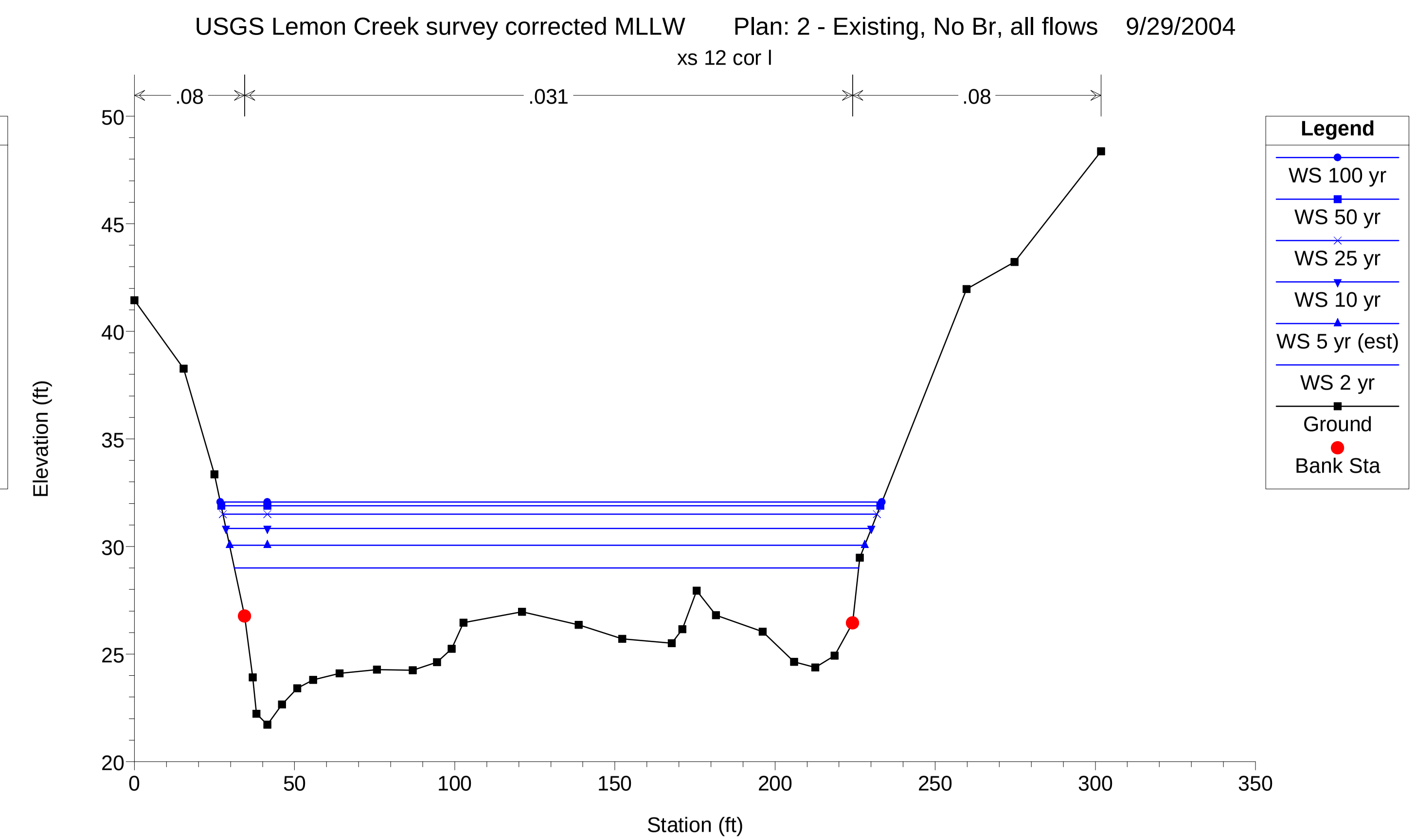

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Station (ft)
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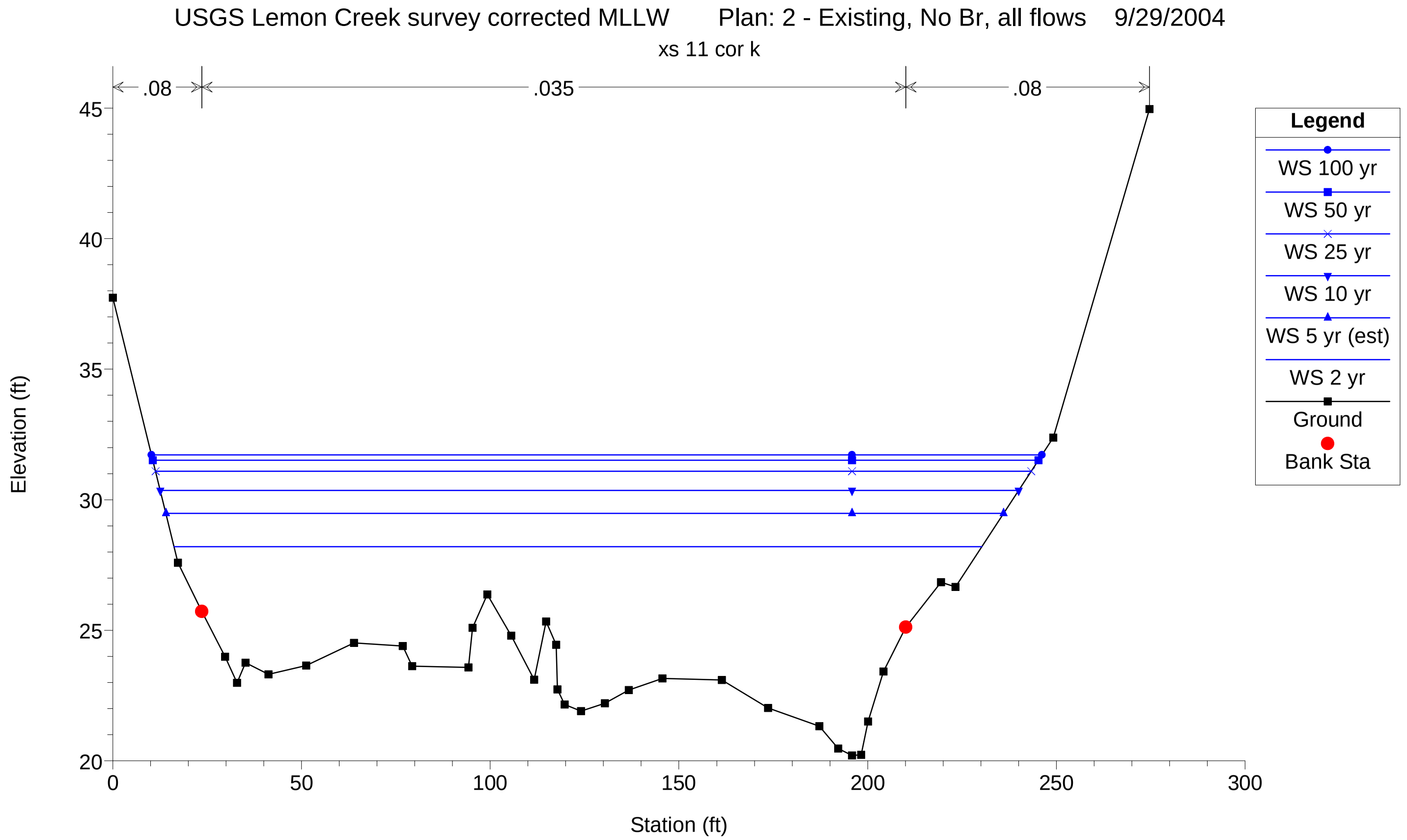
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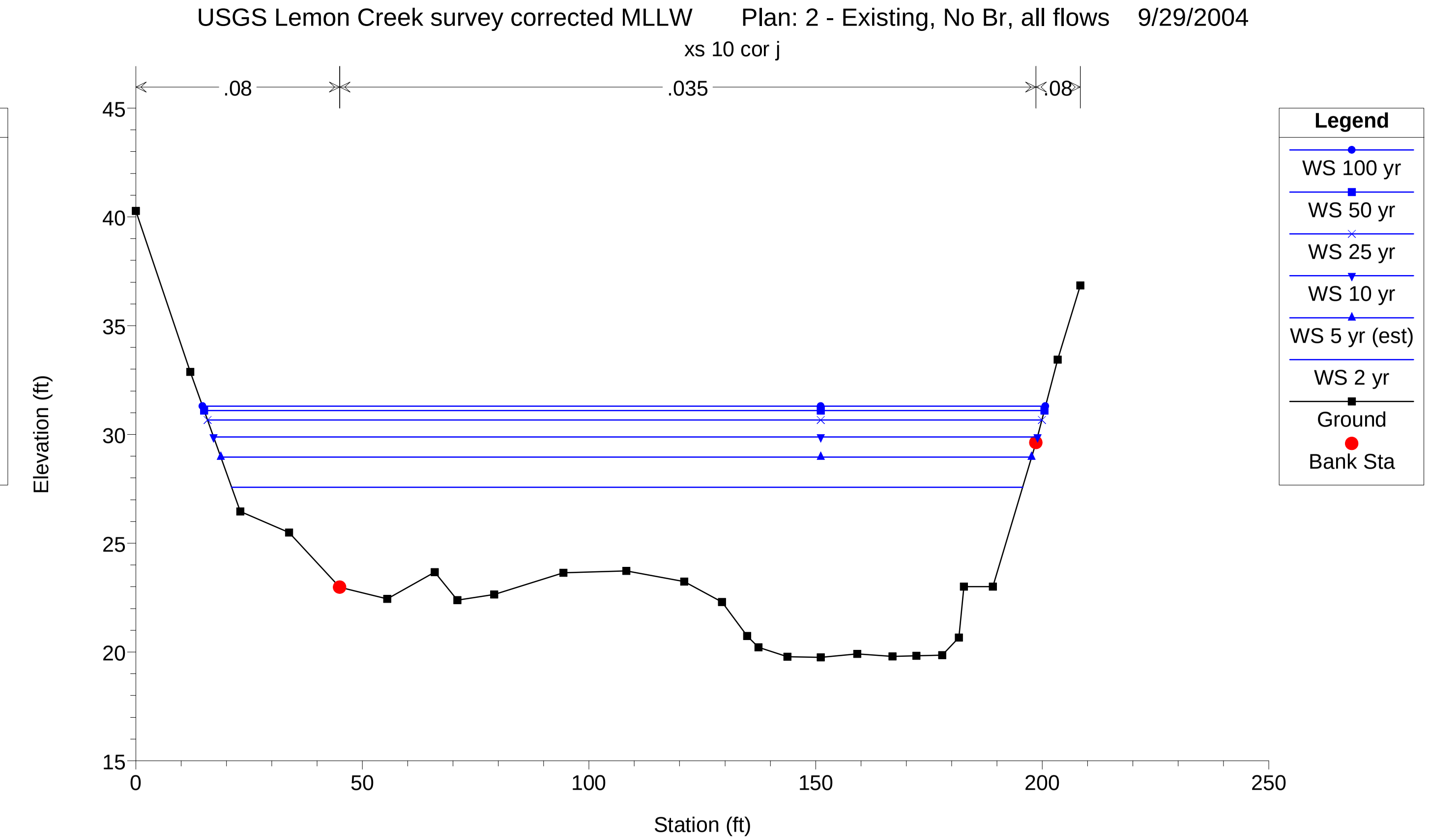
Elevation (ft)
Station (ft)
Legend
WS 100 yr
WS 50 yr
WS 25 yr
WS 10 yr
WS 5 yr (est)
WS 2 yr
Ground
Bank Sta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Elevation (ft)
Station (ft)
Legend
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WS 50 yr
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WS 5 yr (est)
WS 2 yr
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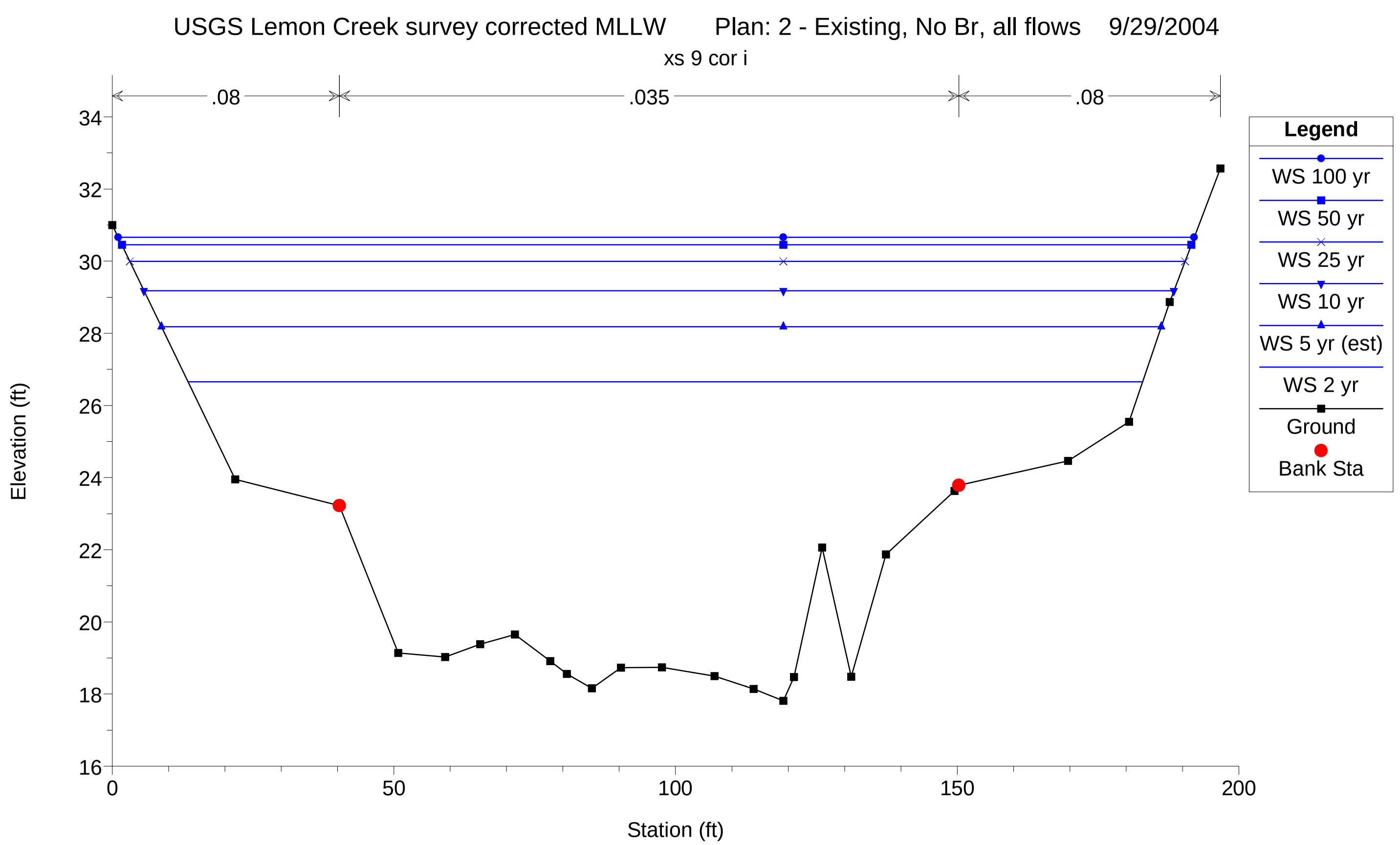
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Elevation (ft)
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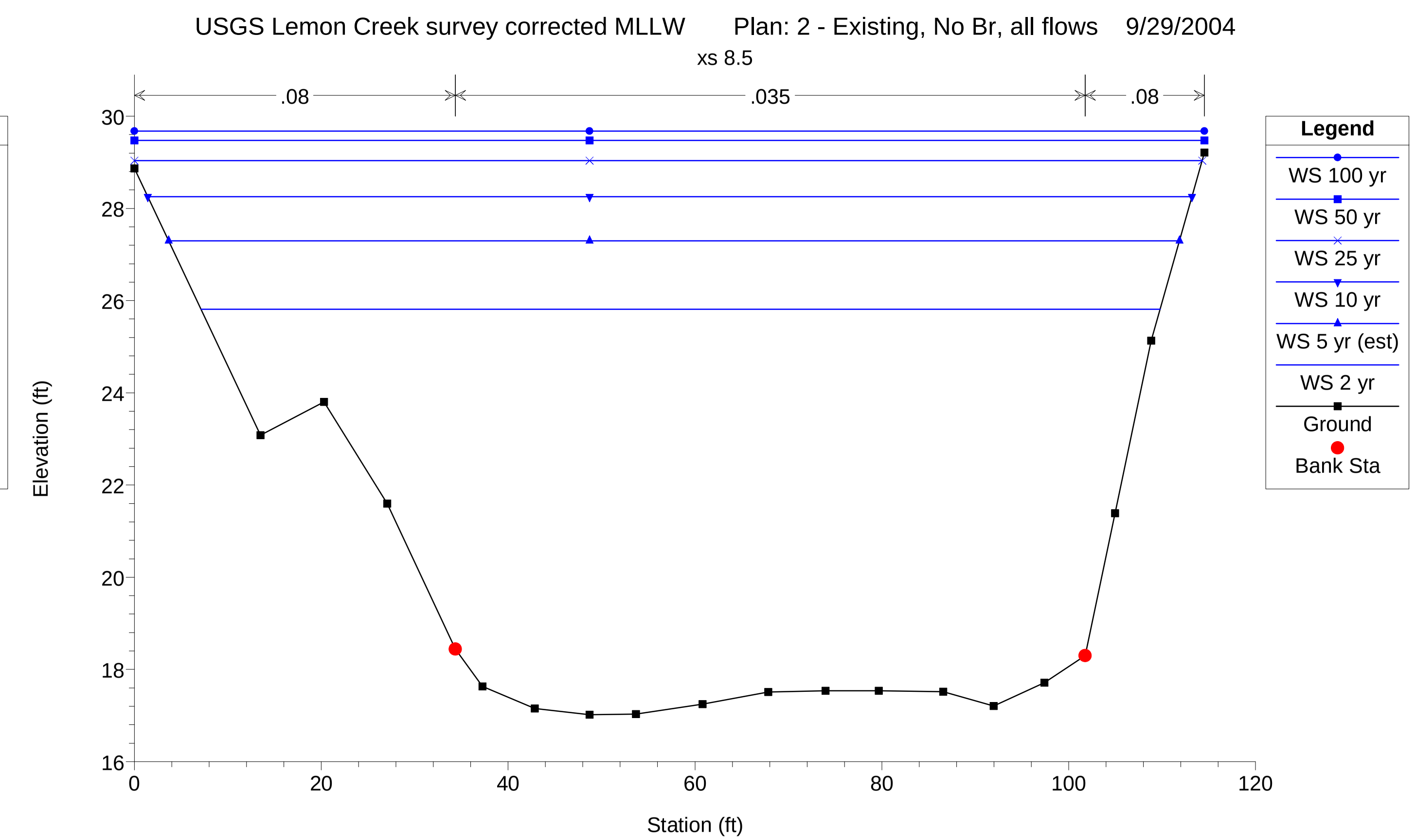
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Elevation (ft)
Station (ft)
Legend
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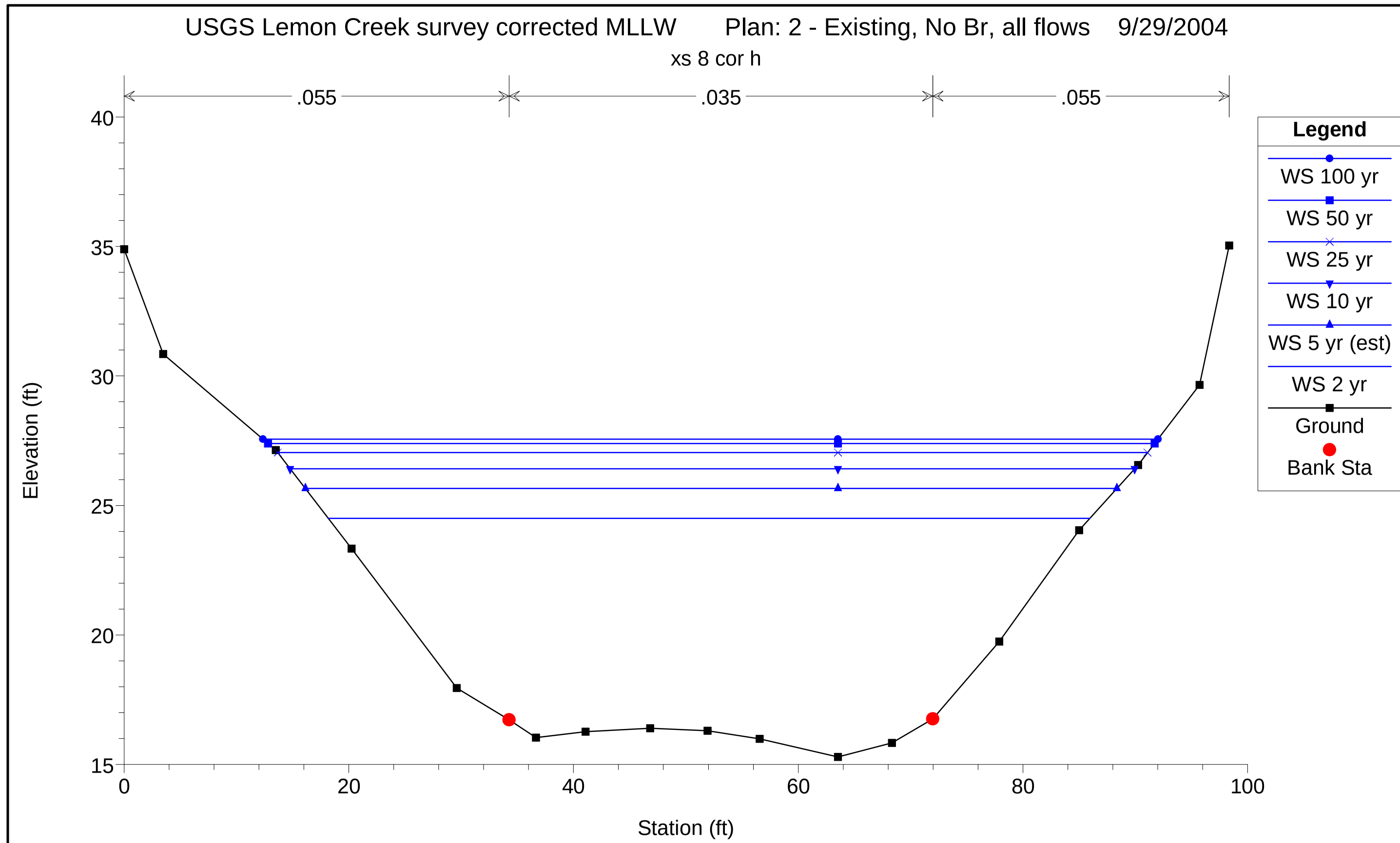
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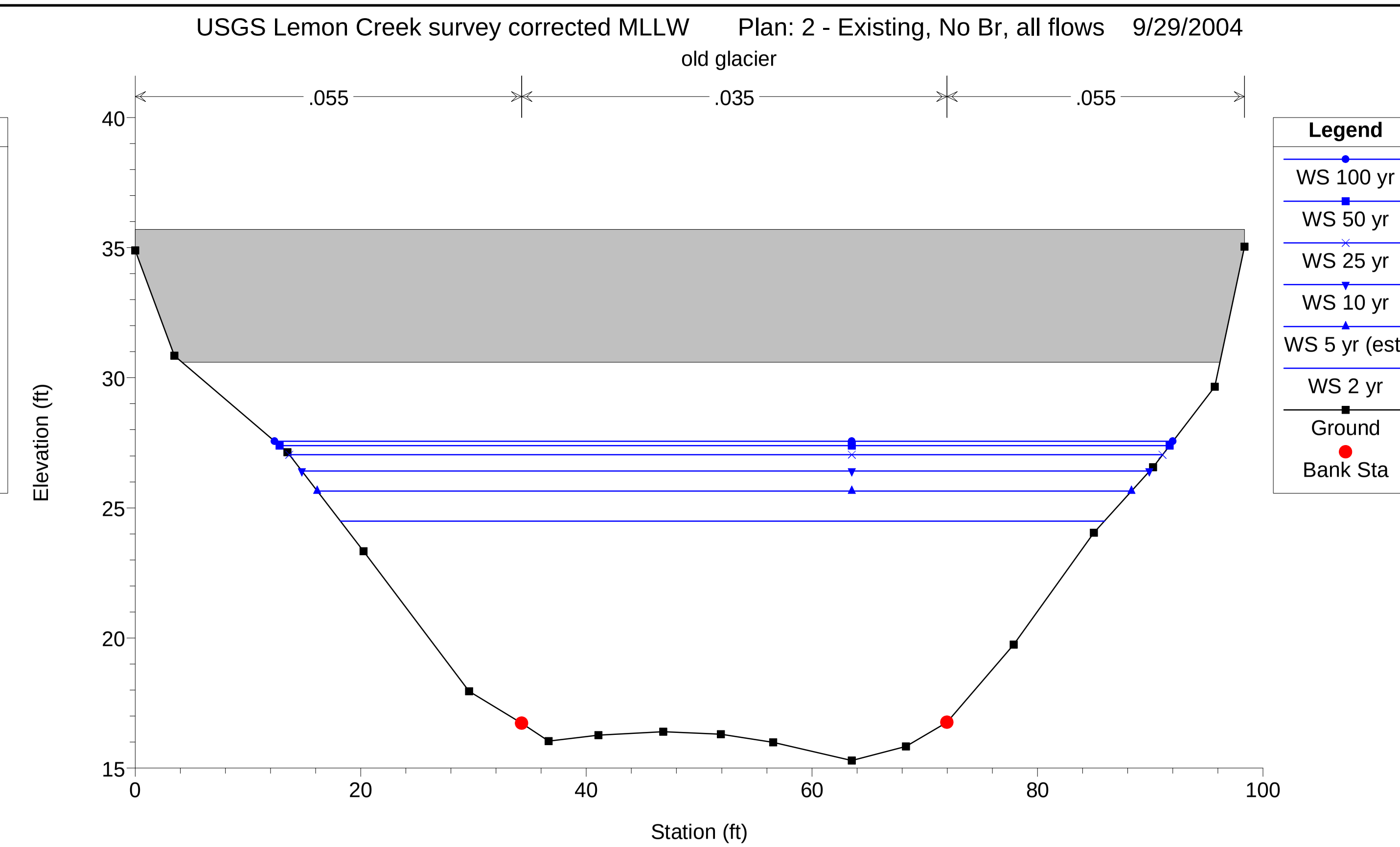
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WS 50 yr
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WS 5 yr (est)
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Station (ft)
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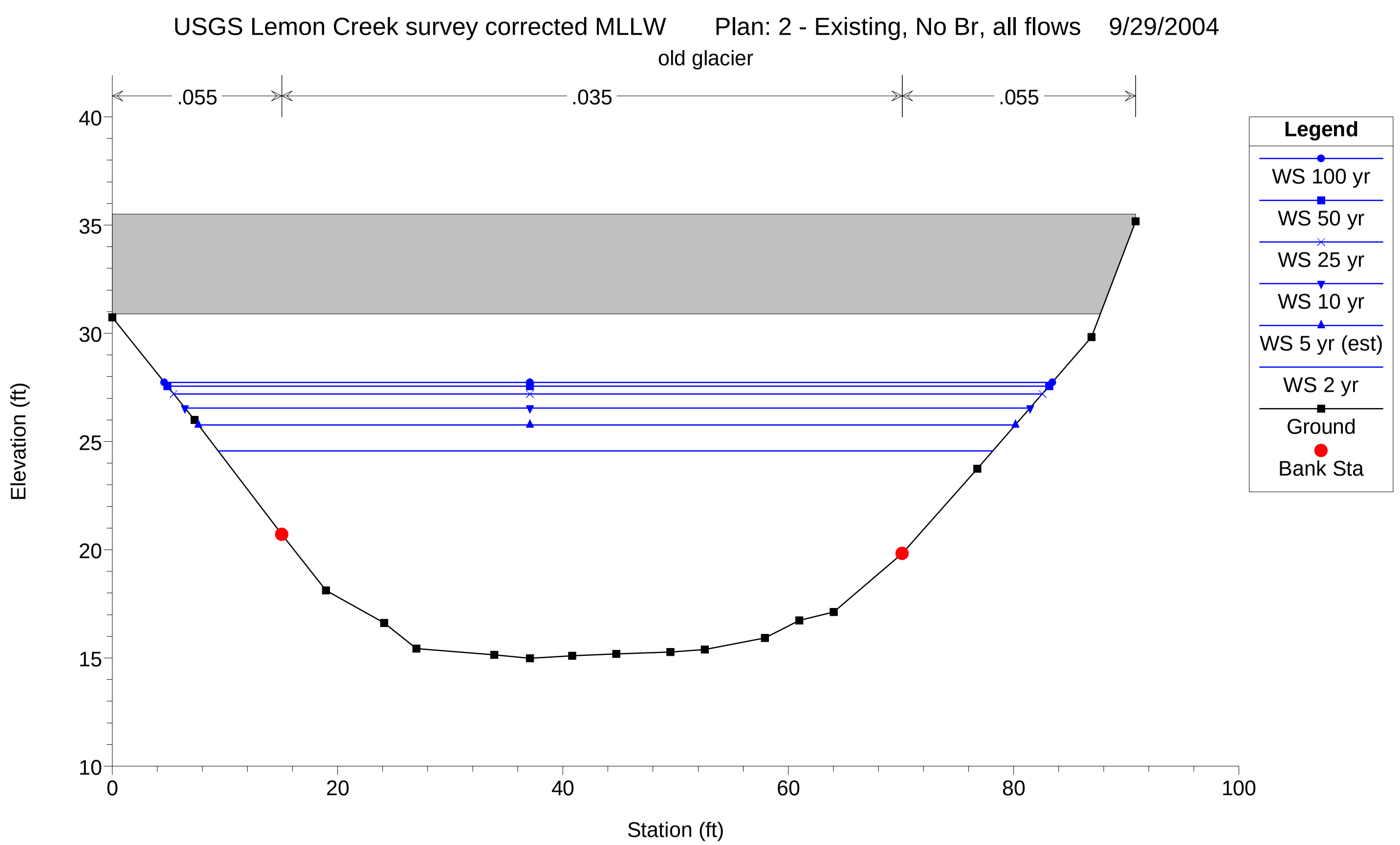
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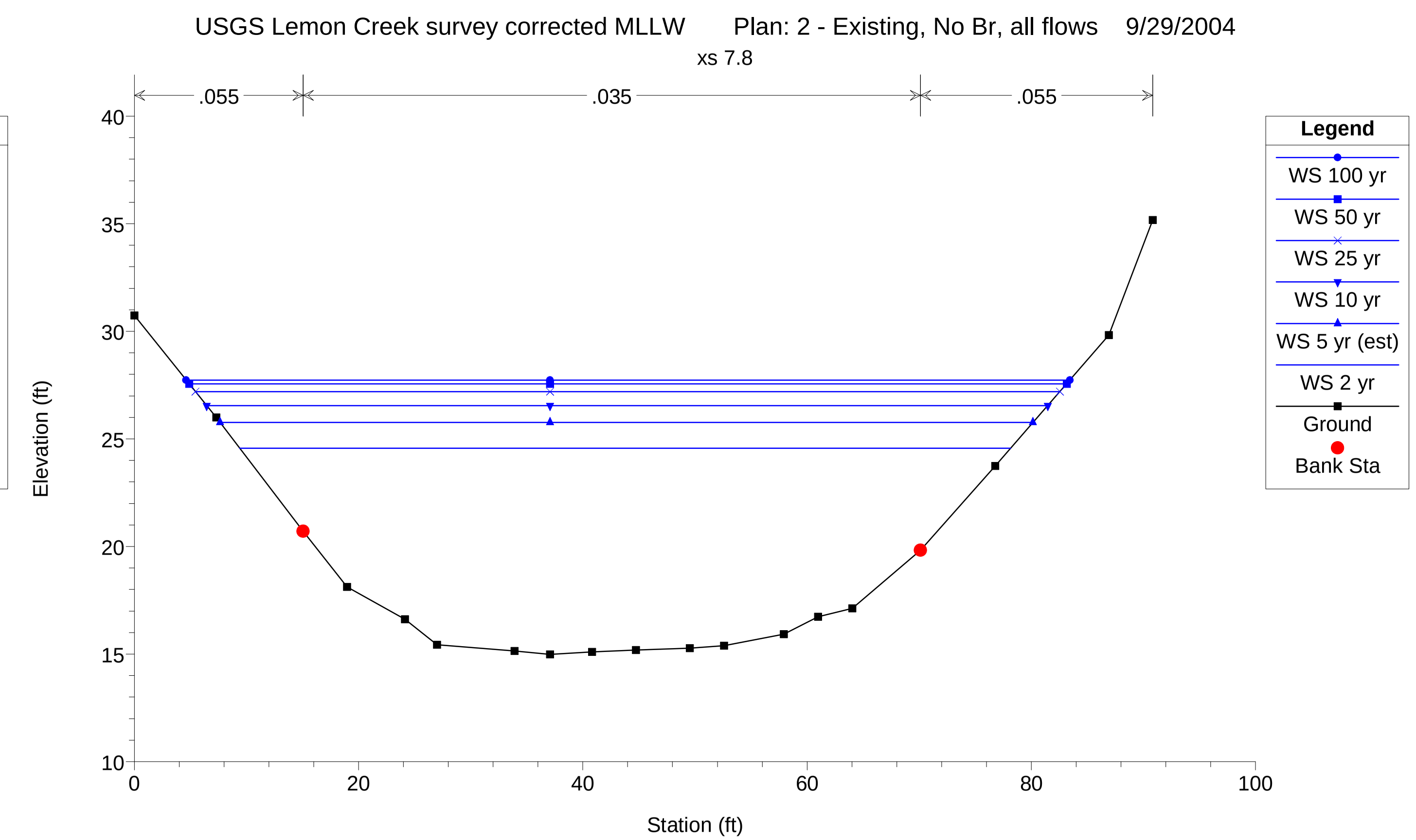
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WS 5 yr (est)
WS 2 yr
Ground
Bank Sta
Elevation (ft)
Station (ft)
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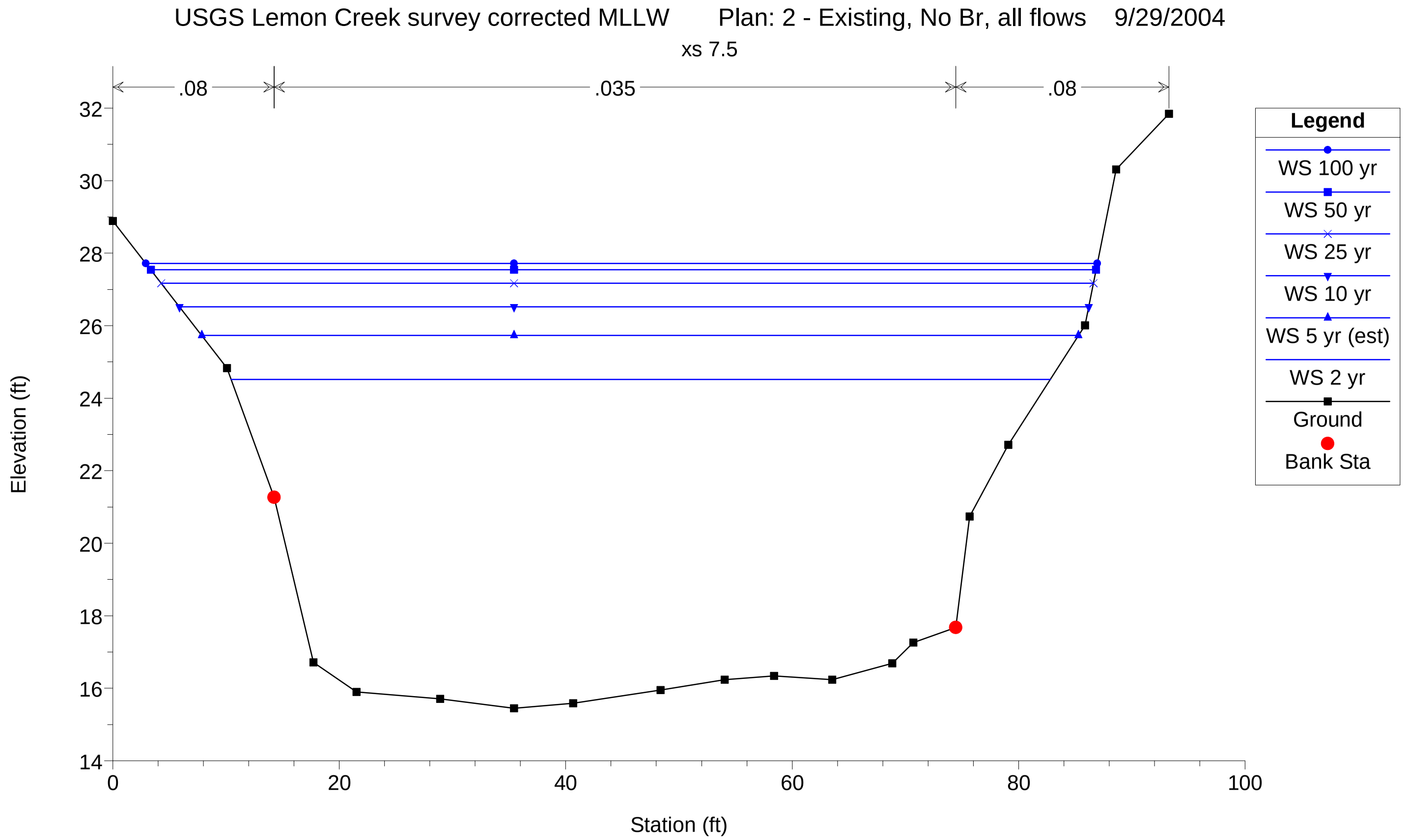
15
20
25
30
35
40
0
20
40
60
80
100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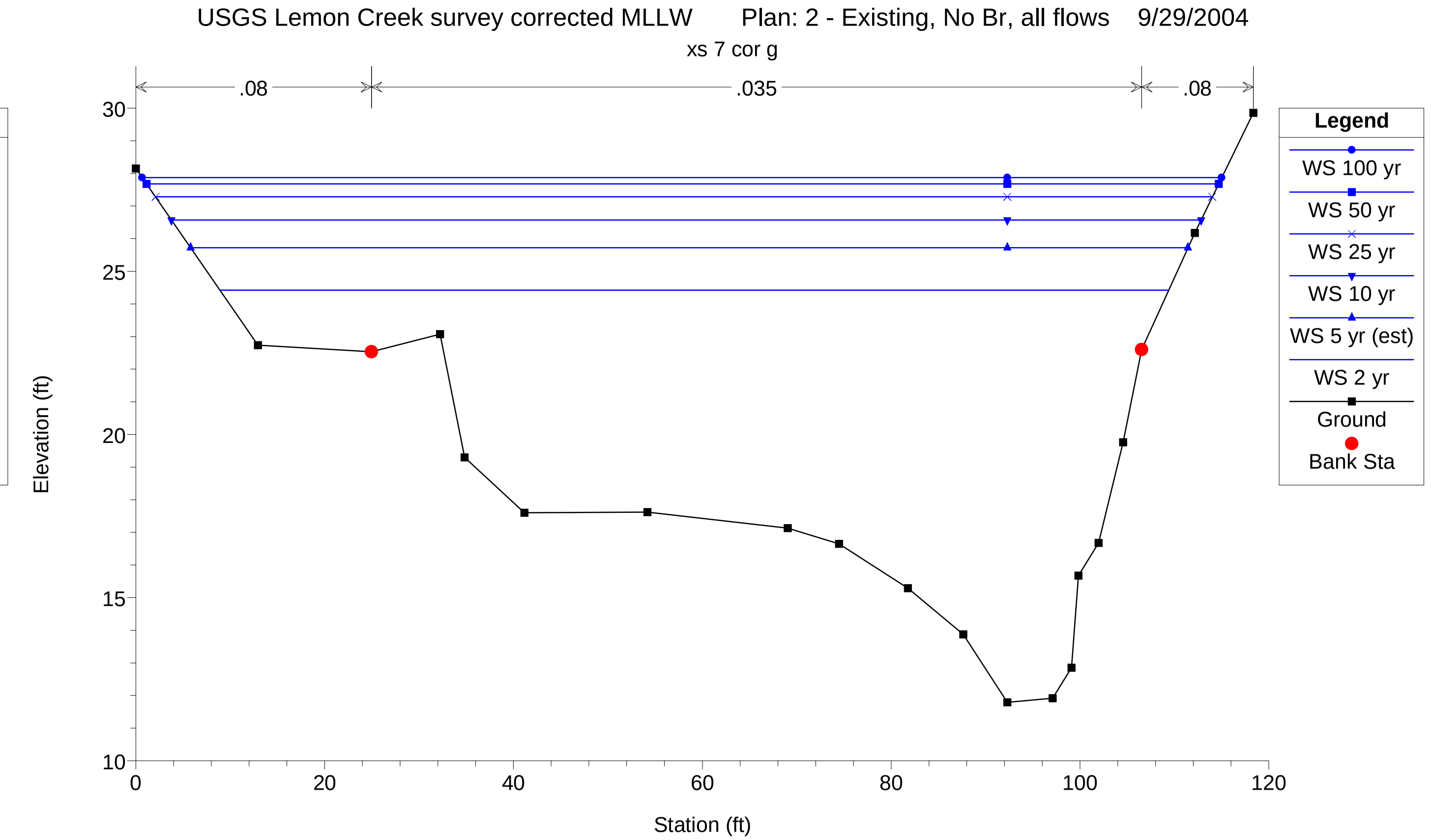
xs 7.5
.08
.035
.08
Elevation (ft)
Station (ft)
Legend
WS 100 yr
WS 50 yr
WS 25 yr
WS 10 yr
WS 5 yr (est)
WS 2 yr
Ground
Bank Sta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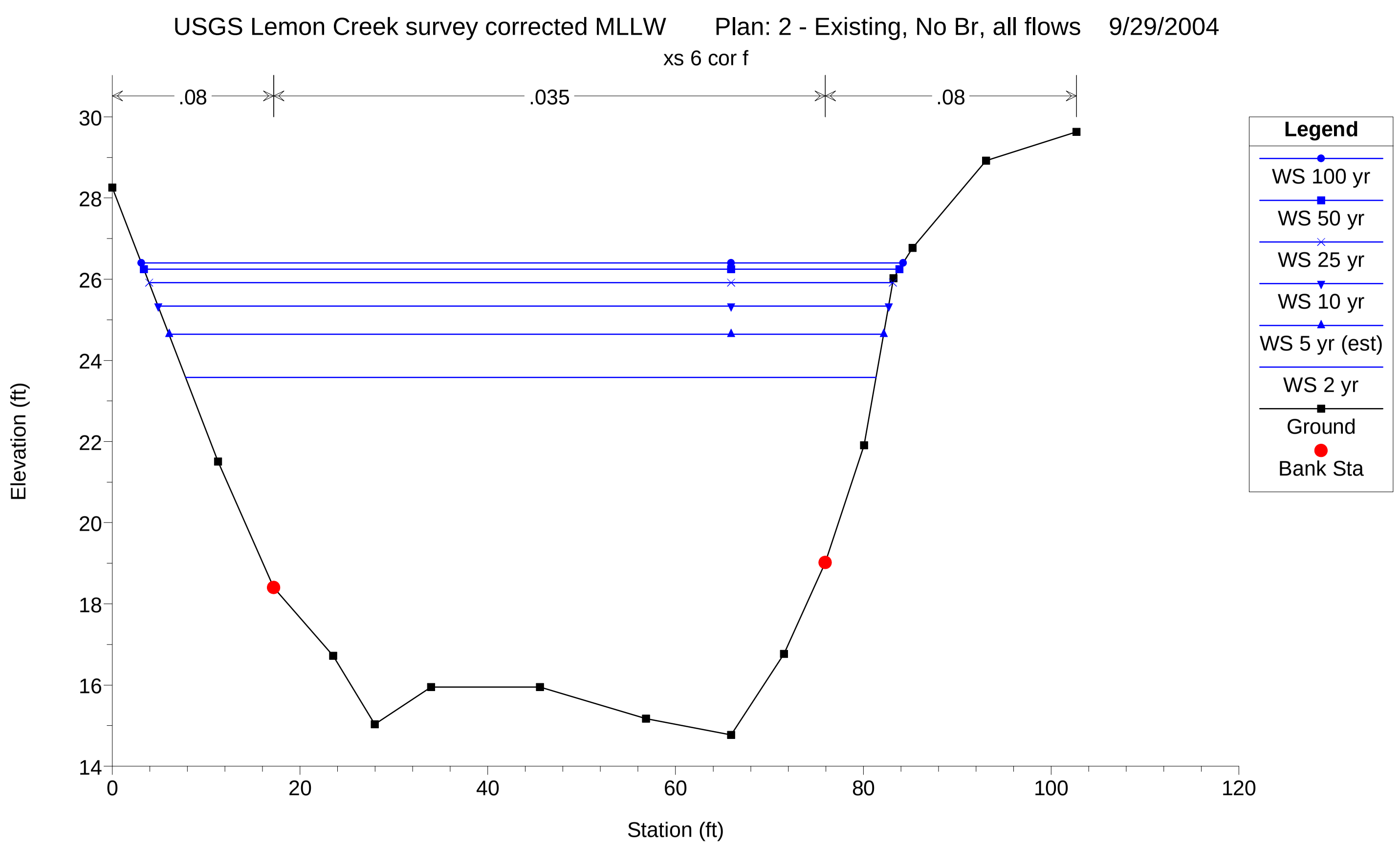
xs 7 cor g
.08
.035
.08
Elevation (ft)
Station (ft)
Legend
WS 100 yr
WS 50 yr
WS 25 yr
WS 10 yr
WS 5 yr (est)
WS 2 yr
Ground
Bank Sta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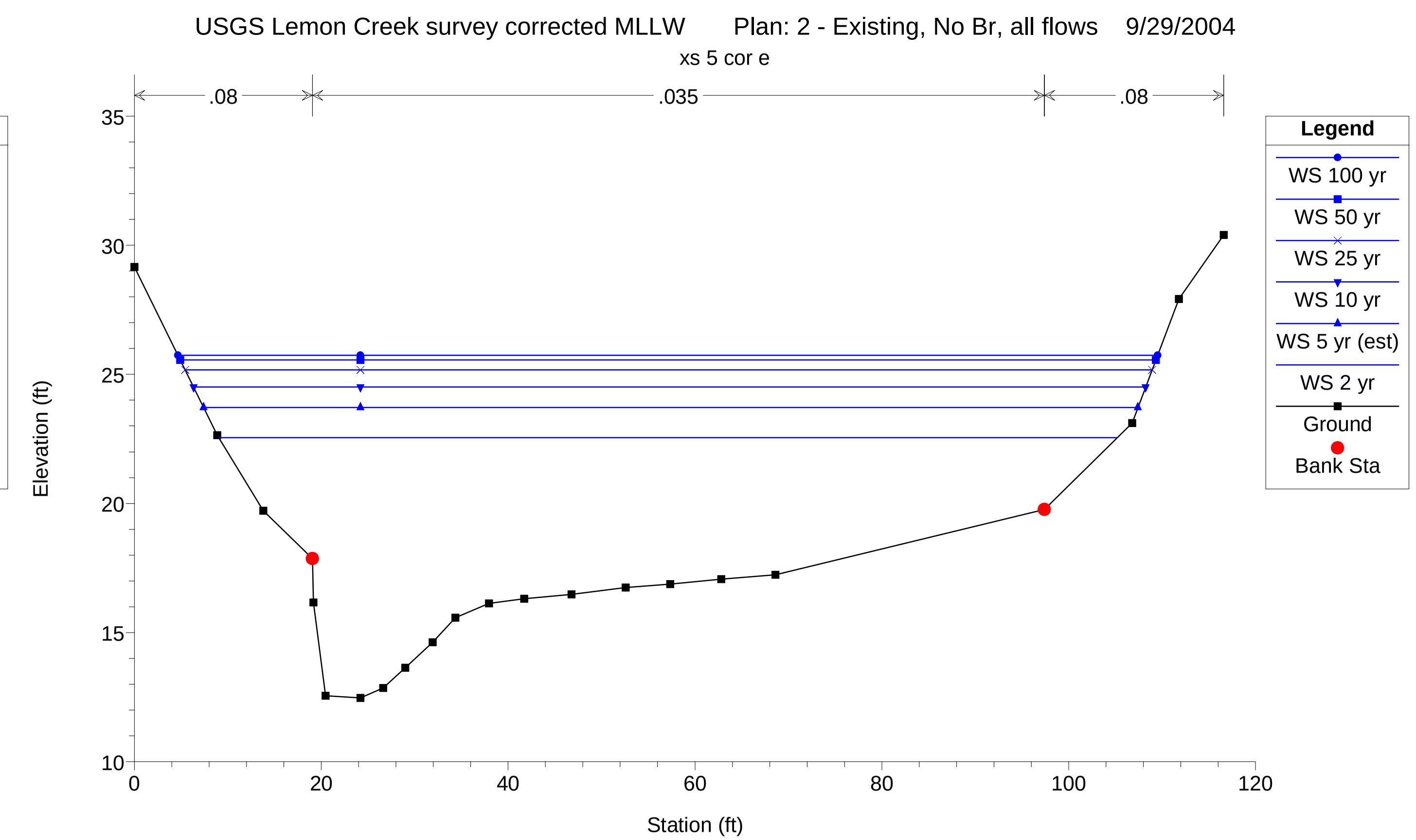
xs 6 cor f
.08
.035
.08
Elevation (ft)
Station (ft)
Legend
WS 100 yr
WS 50 yr
WS 25 yr
WS 10 yr
WS 5 yr (est)
WS 2 yr
Ground
Bank Sta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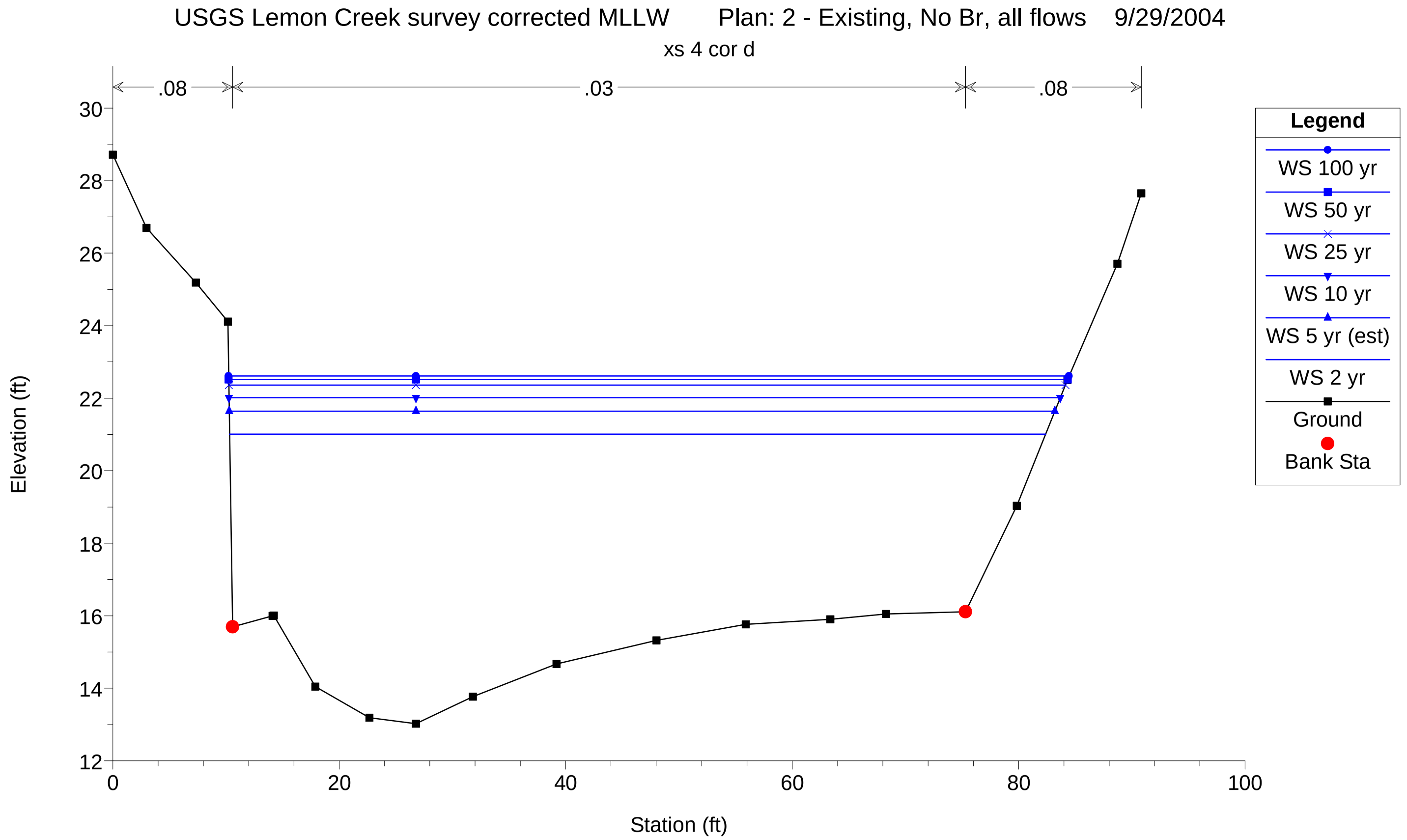
xs 5 cor e
.08
.035
.08
Elevation (ft)
Station (ft)
Legend
WS 100 yr
WS 50 yr
WS 25 yr
WS 10 yr
WS 5 yr (est)
WS 2 yr
Ground
Bank Sta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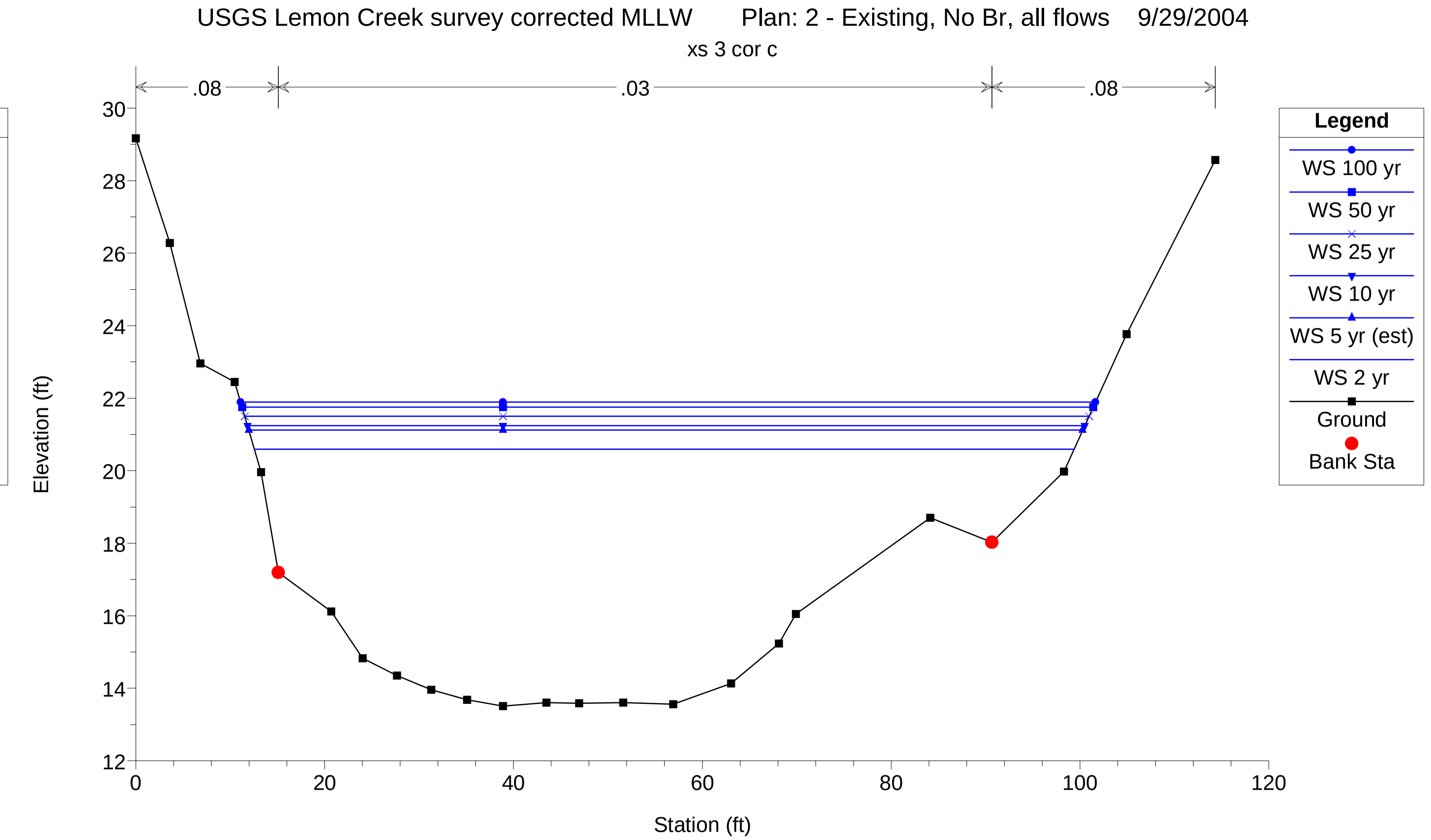
.08
.03
.08
Elevation (ft)
Station (ft)
Legend
WS 100 yr
WS 50 yr
WS 25 yr
WS 10 yr
WS 5 yr (est)
WS 2 yr
Ground
Bank Sta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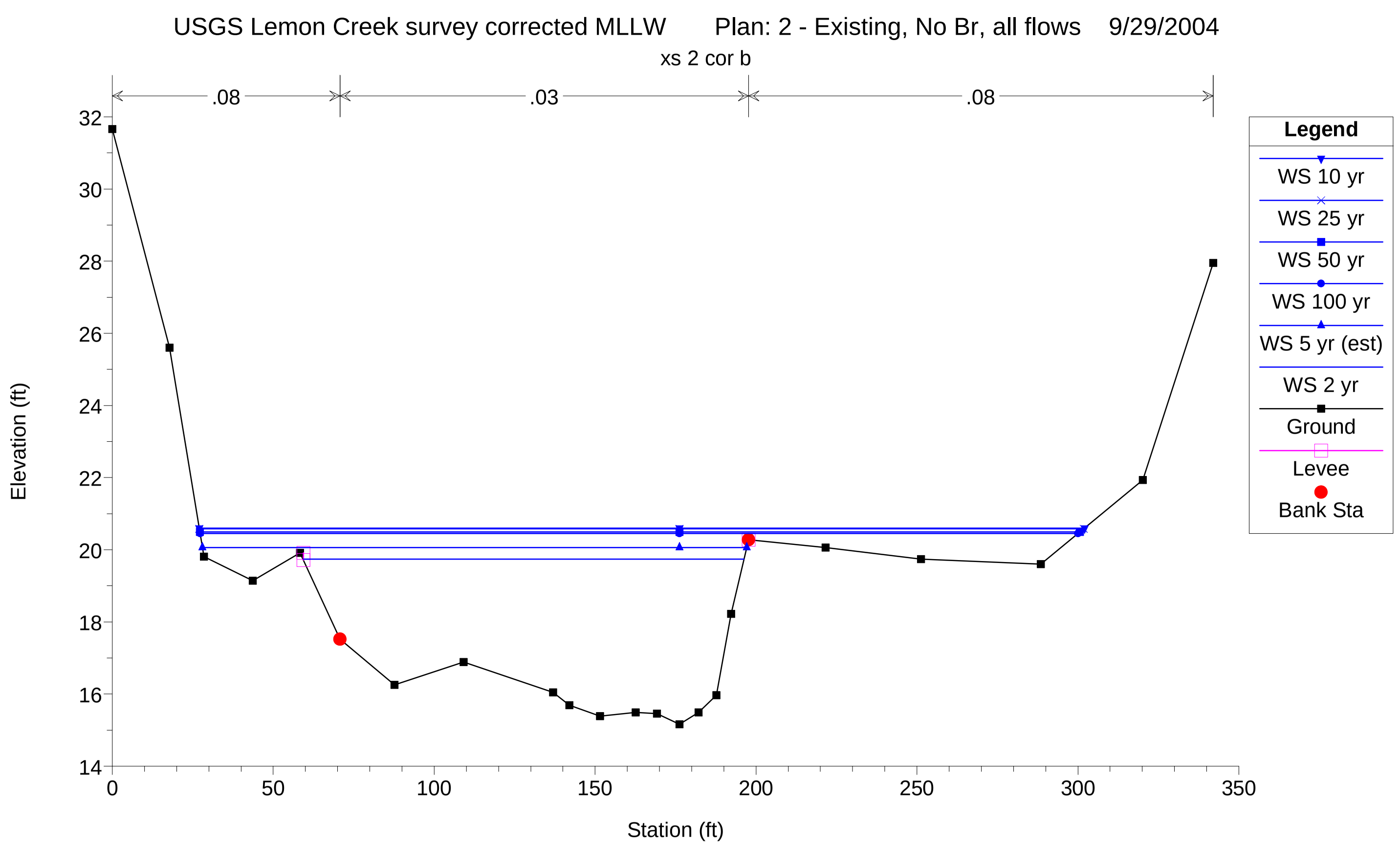
xs 3 cor c
.08
.03
.08
Elevation (ft)
Station (ft)
Legend
WS 100 yr
WS 50 yr
WS 25 yr
WS 10 yr
WS 5 yr (est)
WS 2 yr
Ground
Bank Sta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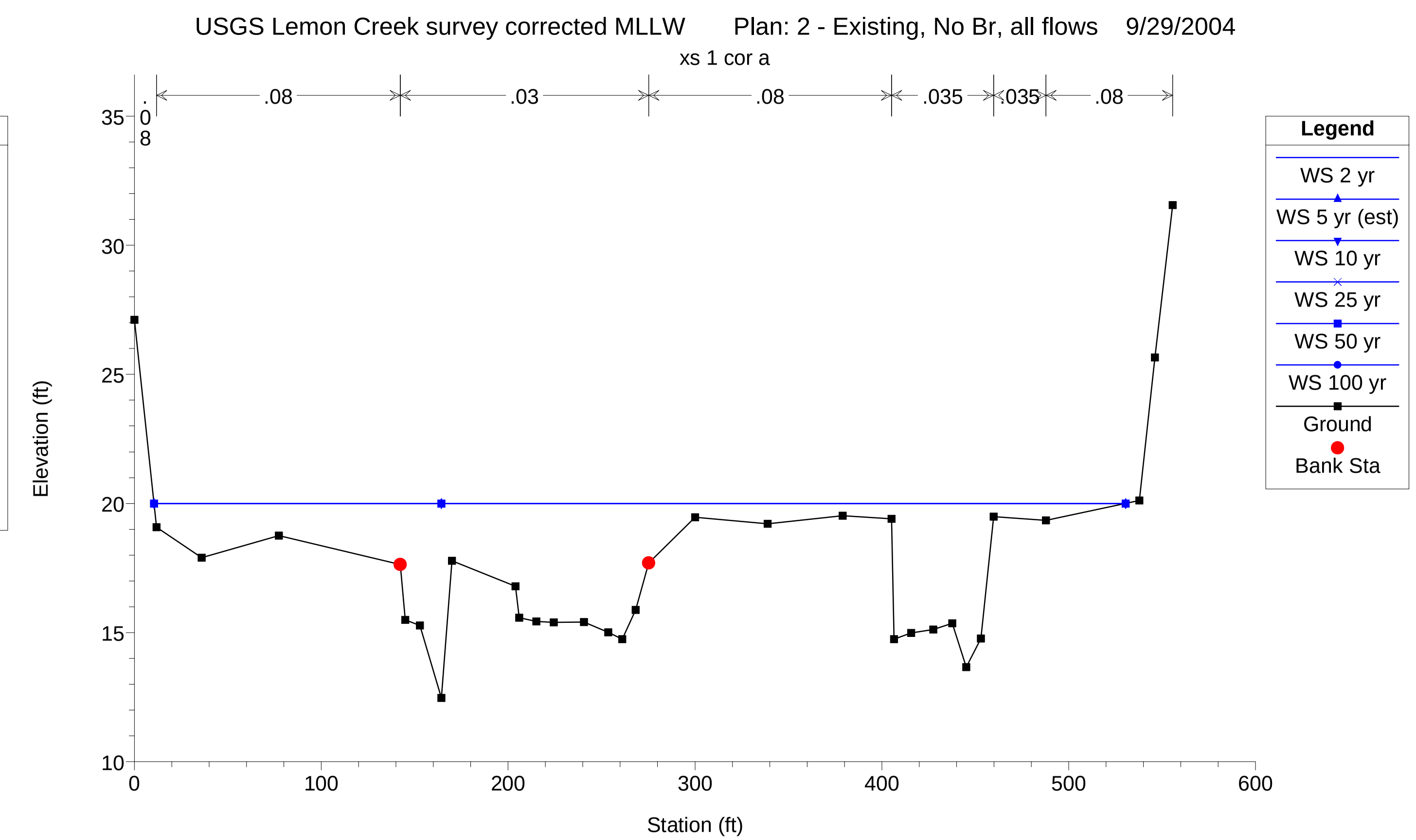
xs 2 cor b
.08
.03
.08
Elevation (ft)
Station (ft)
Legend
WS 10 yr
WS 25 yr
WS 50 yr
WS 100 yr
WS 5 yr (est)
WS 2 yr
Ground
Levee
Bank Sta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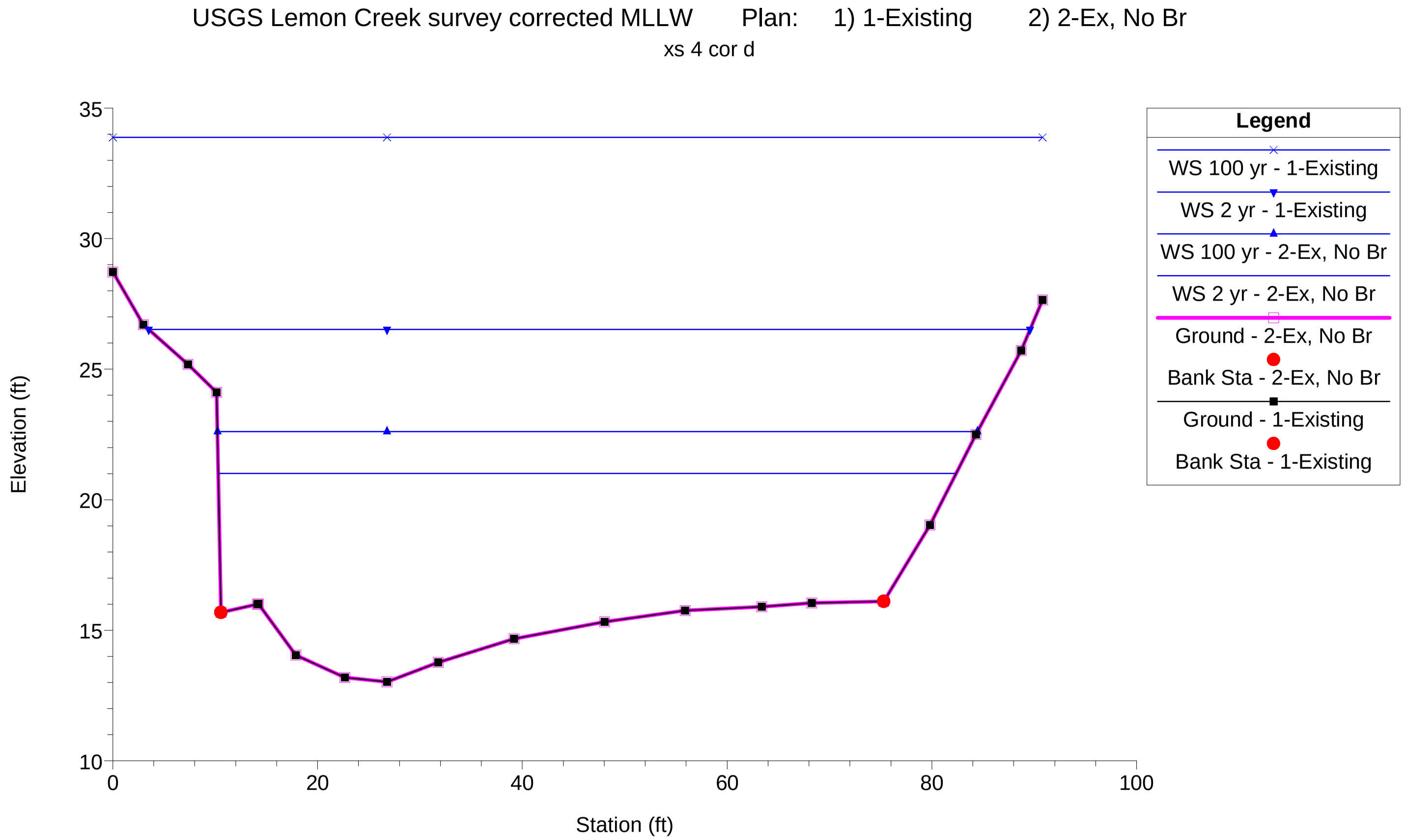
xs 1 cor a
.08
.03
.08
.035
.035
.08
Elevation (ft)
Station (ft)
Legend
WS 2 yr
WS 5 yr (est)
WS 10 yr
WS 25 yr
WS 50 yr
WS 100 yr
Ground
Bank Sta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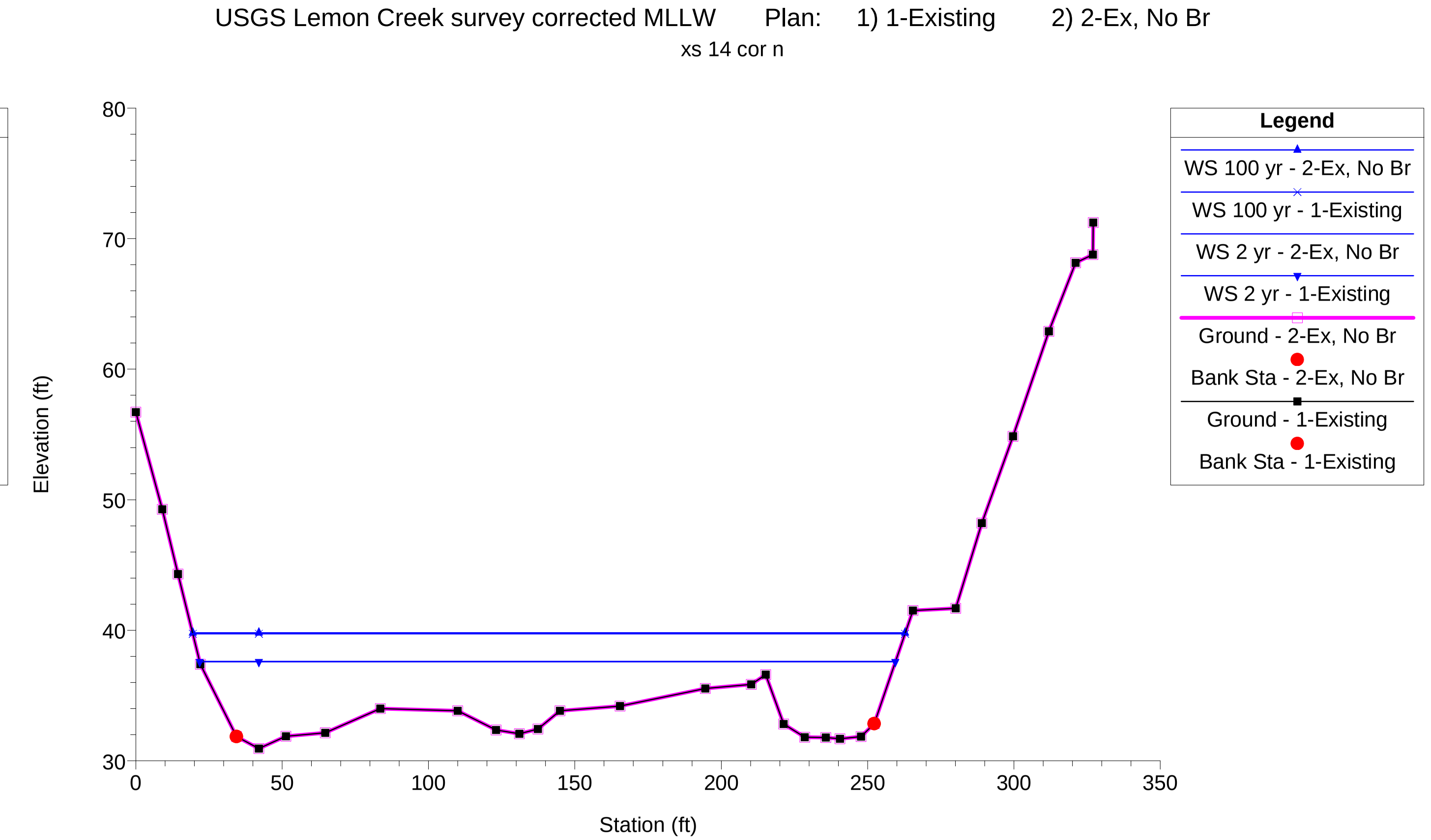
xs 4 cor d
Elevation (ft)
Station (ft)
Legend
WS 100 yr - 1-Existing
WS 2 yr - 1-Existing
WS 100 yr - 2-Ex, No Br
WS 2 yr - 2-Ex, No Br
Ground - 2-Ex, No Br
Bank Sta - 2-Ex, No Br
Ground - 1-Existing
Bank Sta - 1-Existing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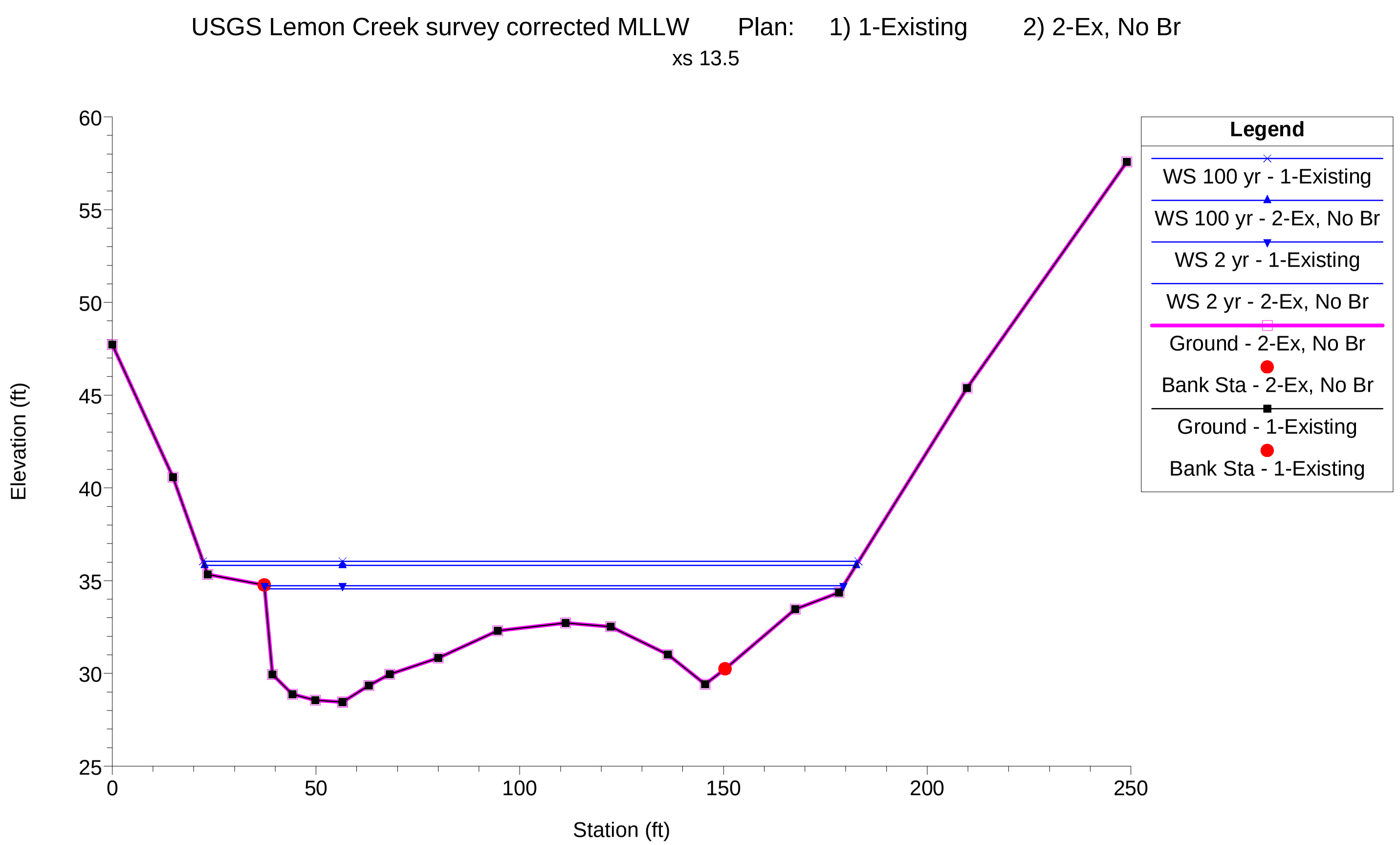
xs 14 cor n
Elevation (ft)
Station (ft)
Legend
WS 100 yr - 2-Ex, No Br
WS 100 yr - 1-Existing
WS 2 yr - 2-Ex, No Br
WS 2 yr - 1-Existing
Ground - 2-Ex, No Br
Bank Sta - 2-Ex, No Br
Ground - 1-Existing
Bank Sta - 1-Existing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xs 13.5
Elevation (ft)
Station (ft)
Legend
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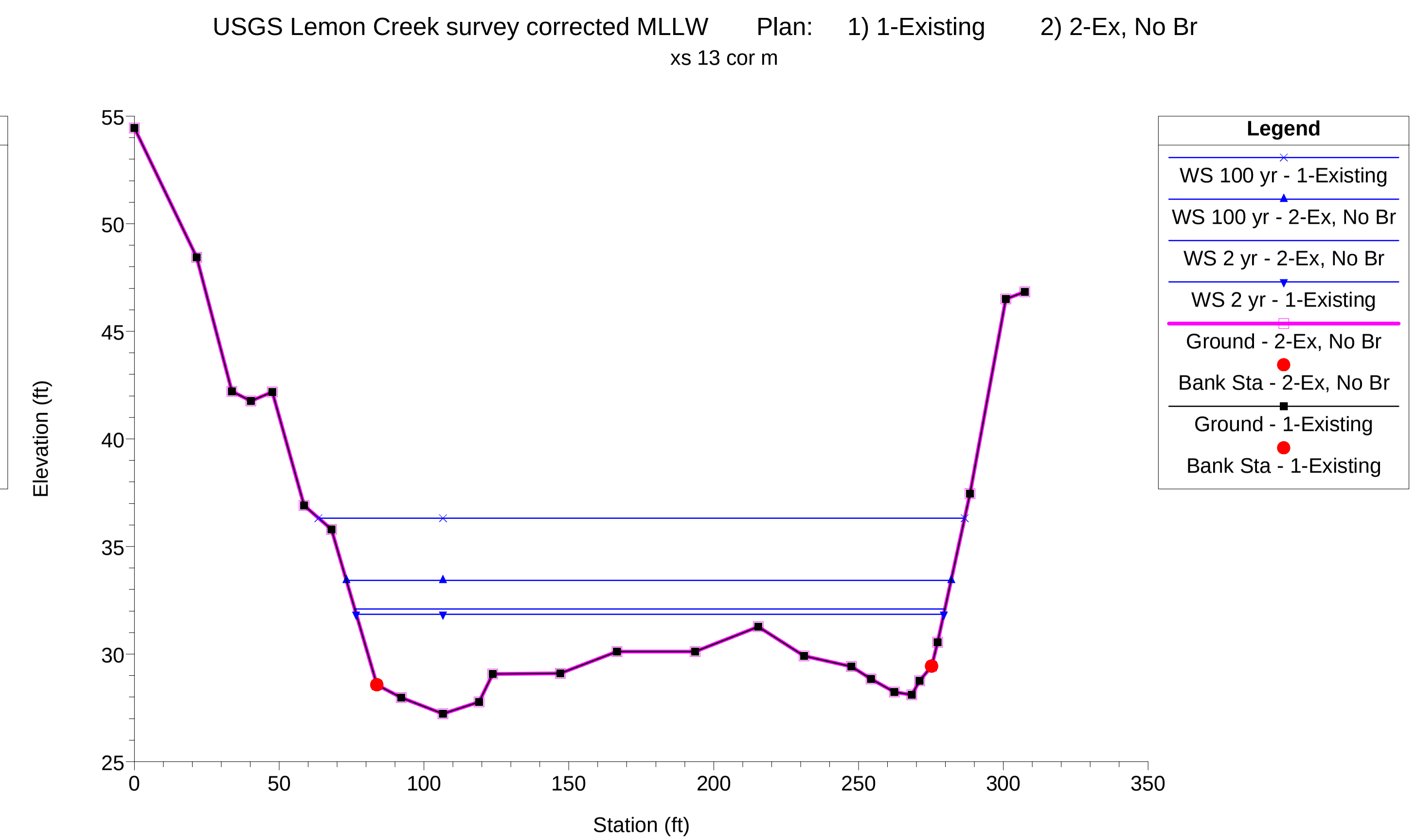
WS 100 yr - 2-Ex, No Br
WS 2 yr - 1-Existing
WS 2 yr - 2-Ex, No Br
Ground - 2-Ex, No Br
Bank Sta - 2-Ex, No Br
Ground - 1-Existing
Bank Sta - 1-Existing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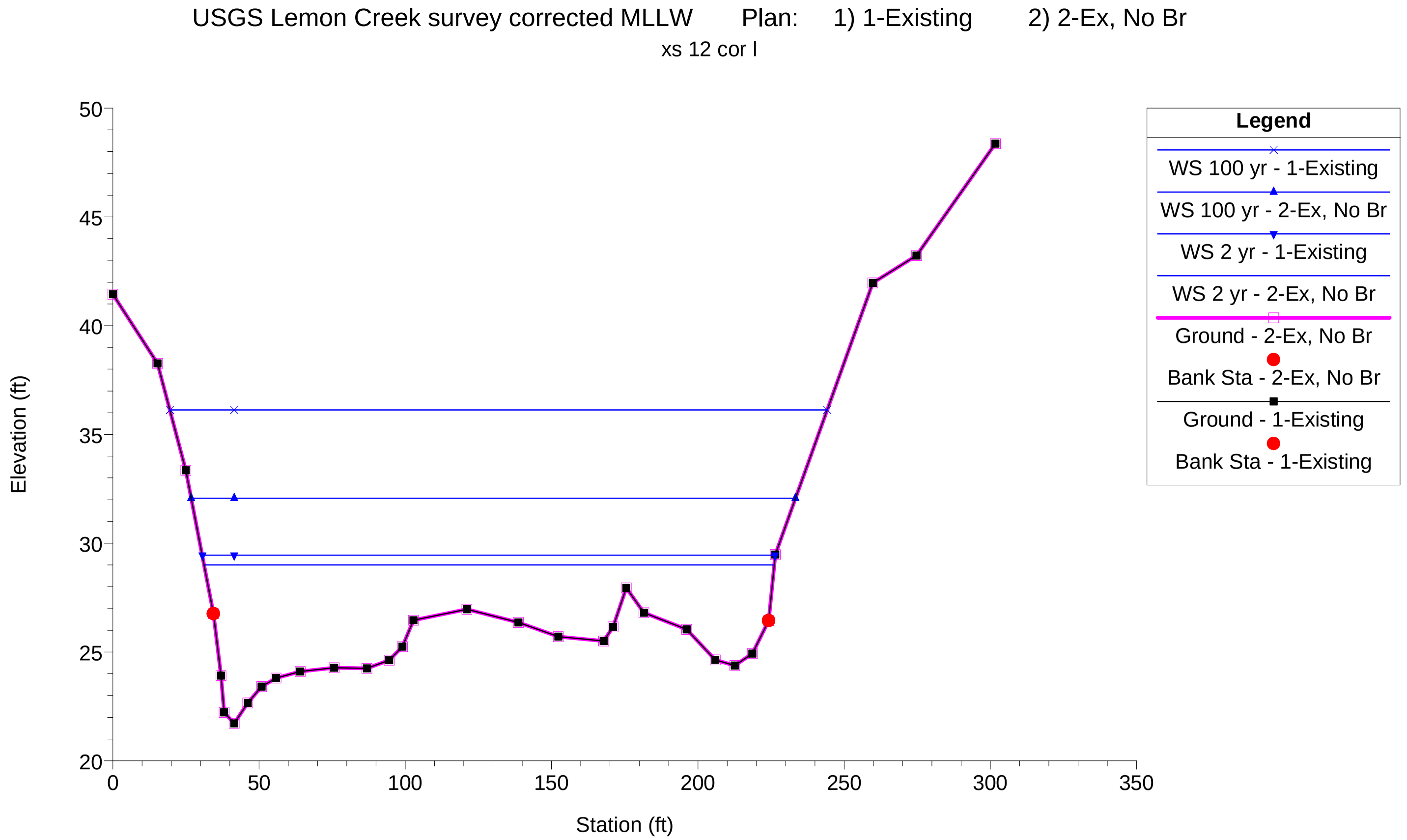
xs 13 cor m
Elevation (ft)
Station (ft)
Legend
WS 100 yr - 1-Existing
WS 100 yr - 2-Ex, No Br
WS 2 yr - 2-Ex, No Br
WS 2 yr - 1-Existing
Ground - 2-Ex, No Br
Bank Sta - 2-Ex, No Br
Ground - 1-Existing
Bank Sta - 1-Existing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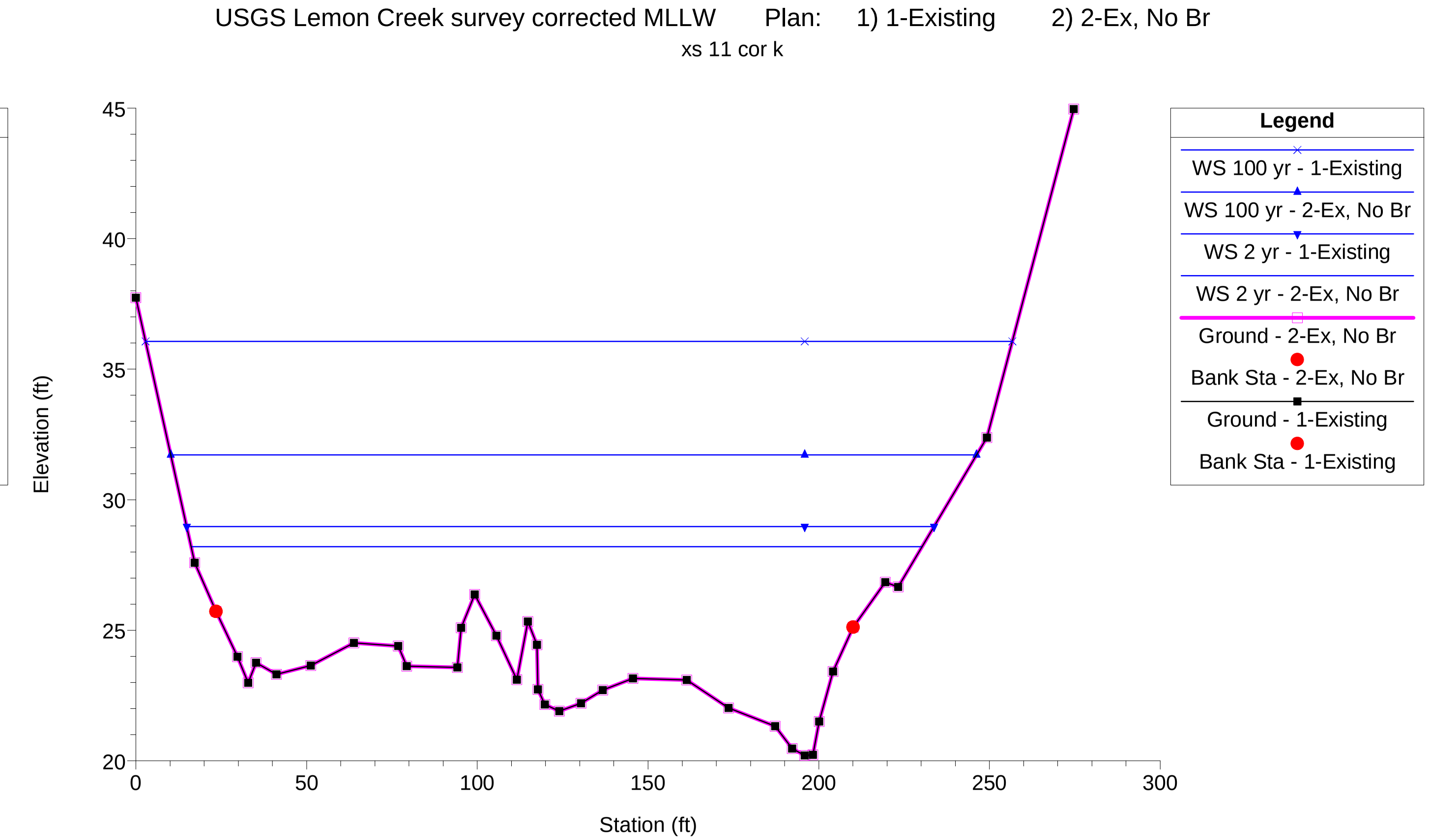
xs 12 cor l
Elevation (ft)
Station (ft)
Legend
WS 100 yr - 1-Existing
WS 100 yr - 2-Ex, No Br
WS 2 yr - 1-Existing
WS 2 yr - 2-Ex, No Br
Ground - 2-Ex, No Br
Bank Sta - 2-Ex, No Br
Ground - 1-Existing
Bank Sta - 1-Existing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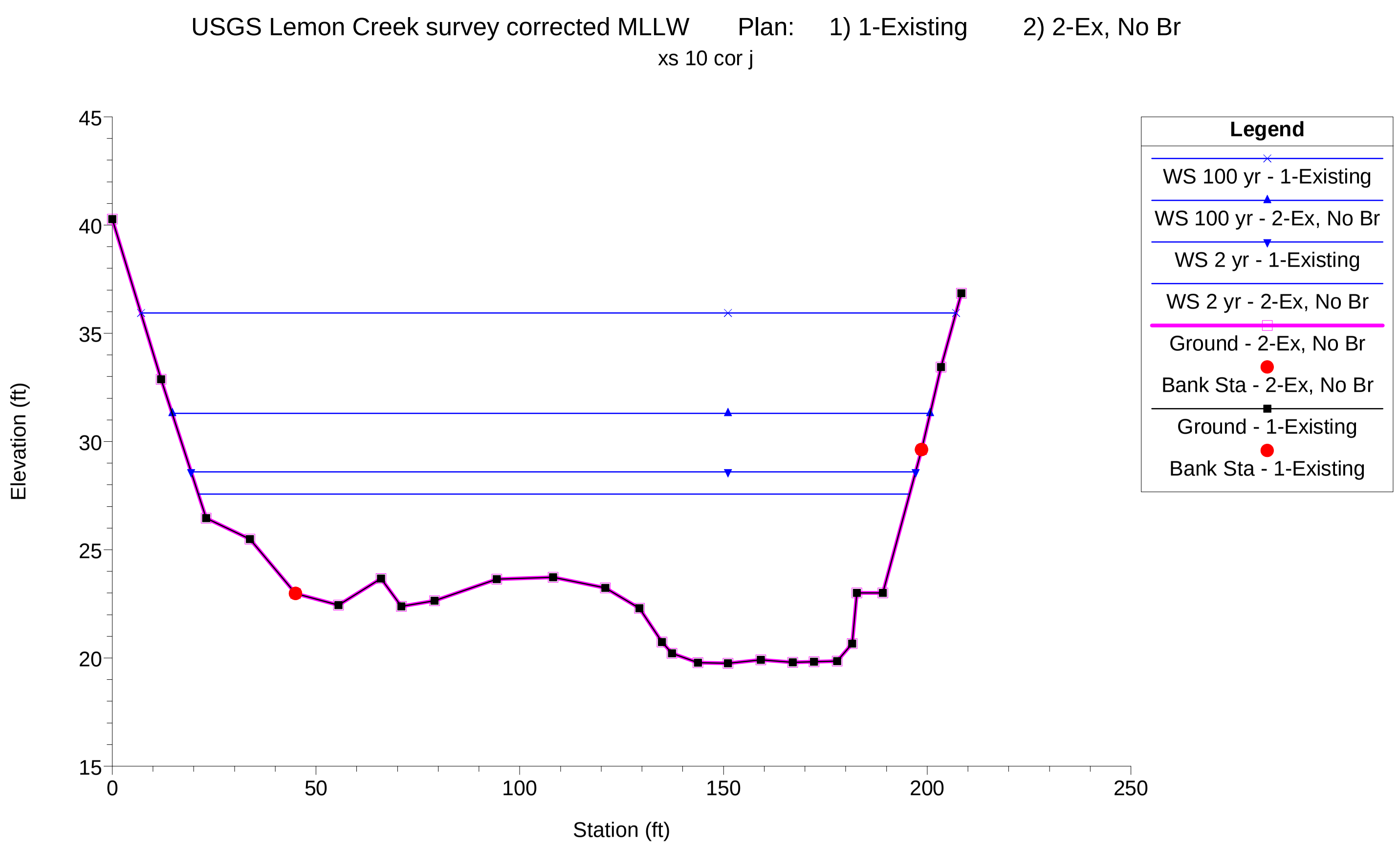
xs 11 cor k
Elevation (ft)
Station (ft)
Legend
WS 100 yr - 1-Existing
WS 100 yr - 2-Ex, No Br
WS 2 yr - 1-Existing
WS 2 yr - 2-Ex, No Br
Ground - 2-Ex, No Br
Bank Sta - 2-Ex, No Br
Ground - 1-Existing
Bank Sta - 1-Existing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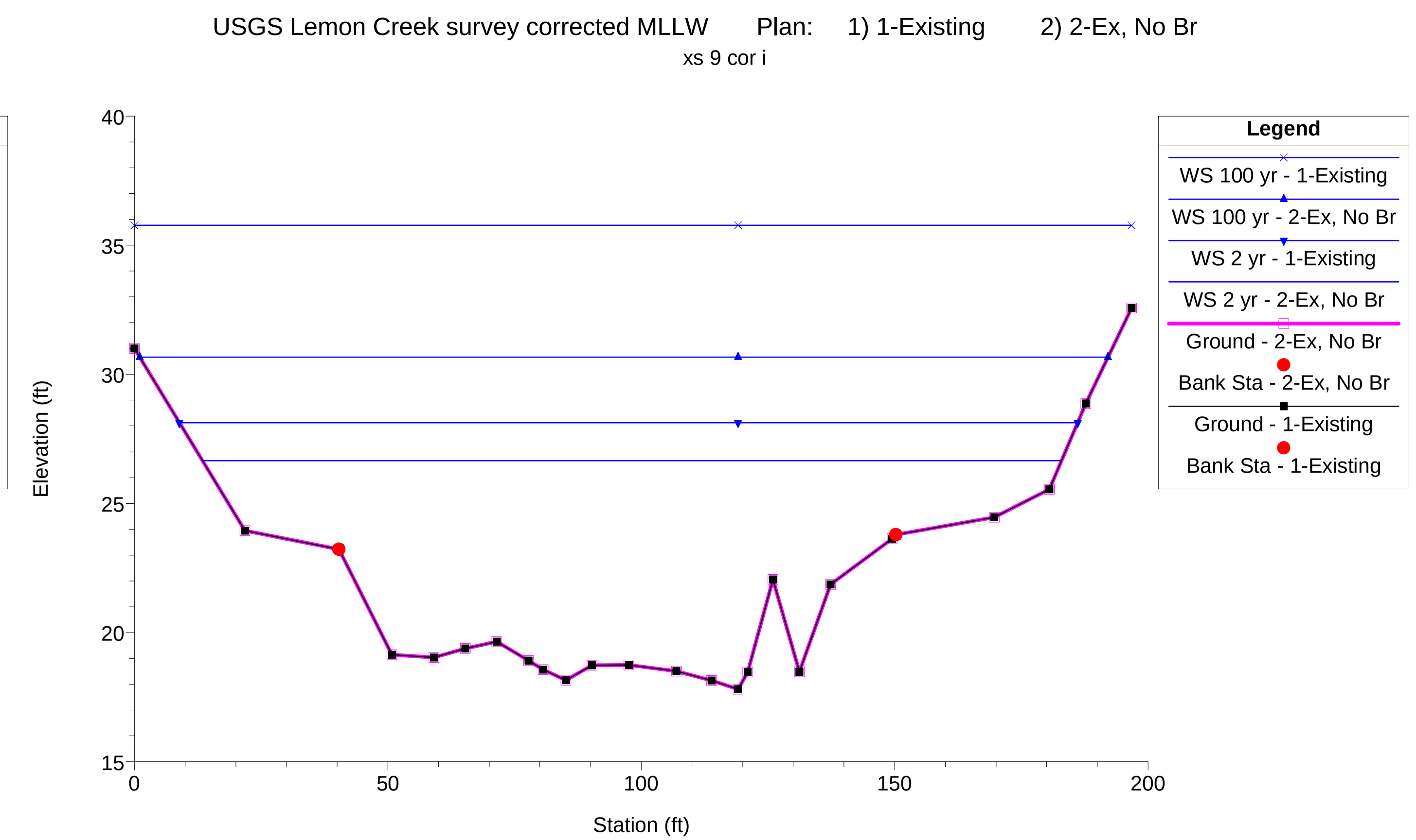
xs 10 cor j
Elevation (ft)
Station (ft)
Legend
WS 100 yr - 1-Existing
WS 100 yr - 2-Ex, No Br
WS 2 yr - 1-Existing
WS 2 yr - 2-Ex, No Br
Ground - 2-Ex, No Br
Bank Sta - 2-Ex, No Br
Ground - 1-Existing
Bank Sta - 1-Existing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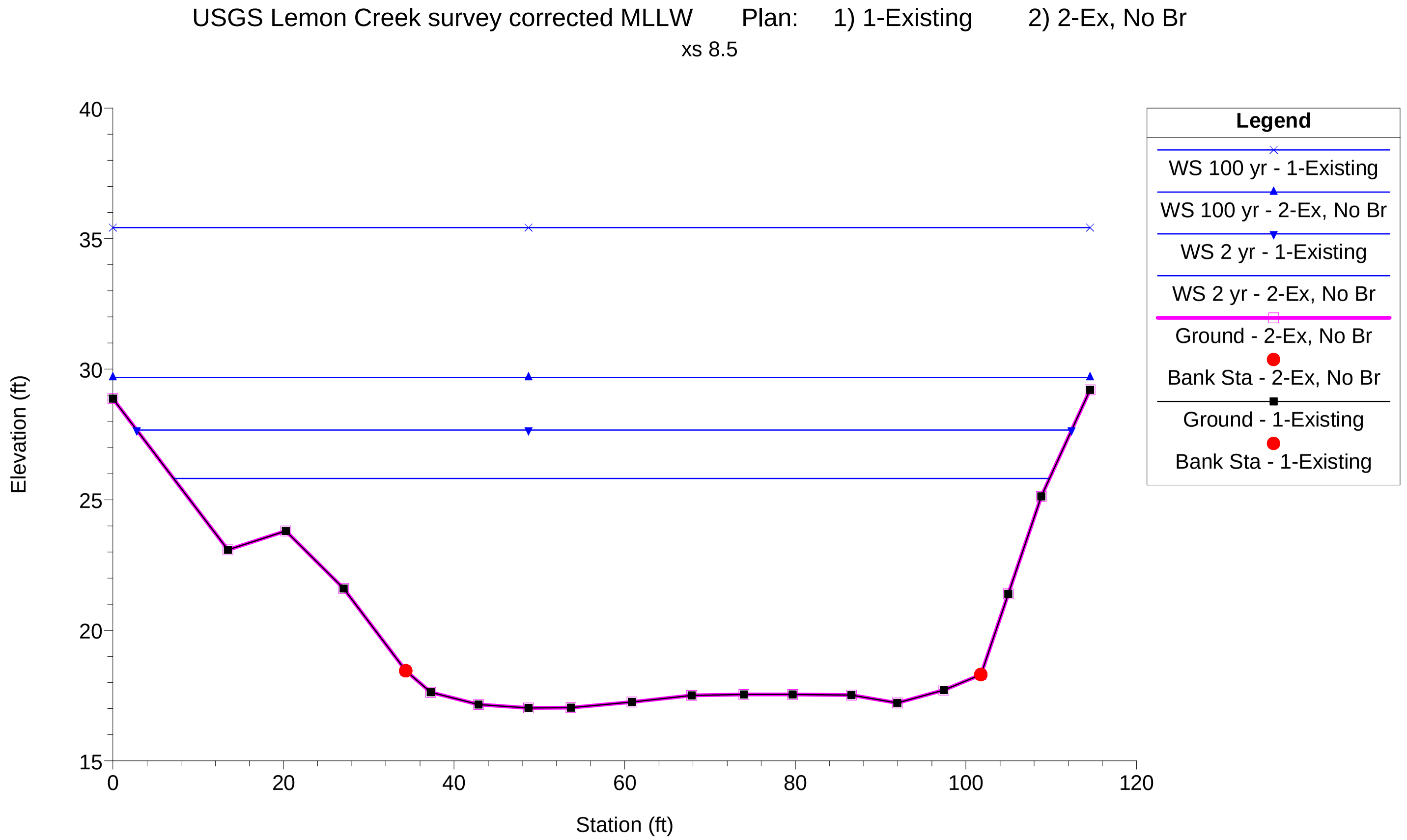
xs 9 cor i
Elevation (ft)
Station (ft)
Legend
WS 100 yr - 1-Existing
WS 100 yr - 2-Ex, No Br
WS 2 yr - 1-Existing
WS 2 yr - 2-Ex, No Br
Ground - 2-Ex, No Br
Bank Sta - 2-Ex, No Br
Ground - 1-Existing
Bank Sta - 1-Existing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xs 8.5
Elevation (ft)
Station (ft)
Legend
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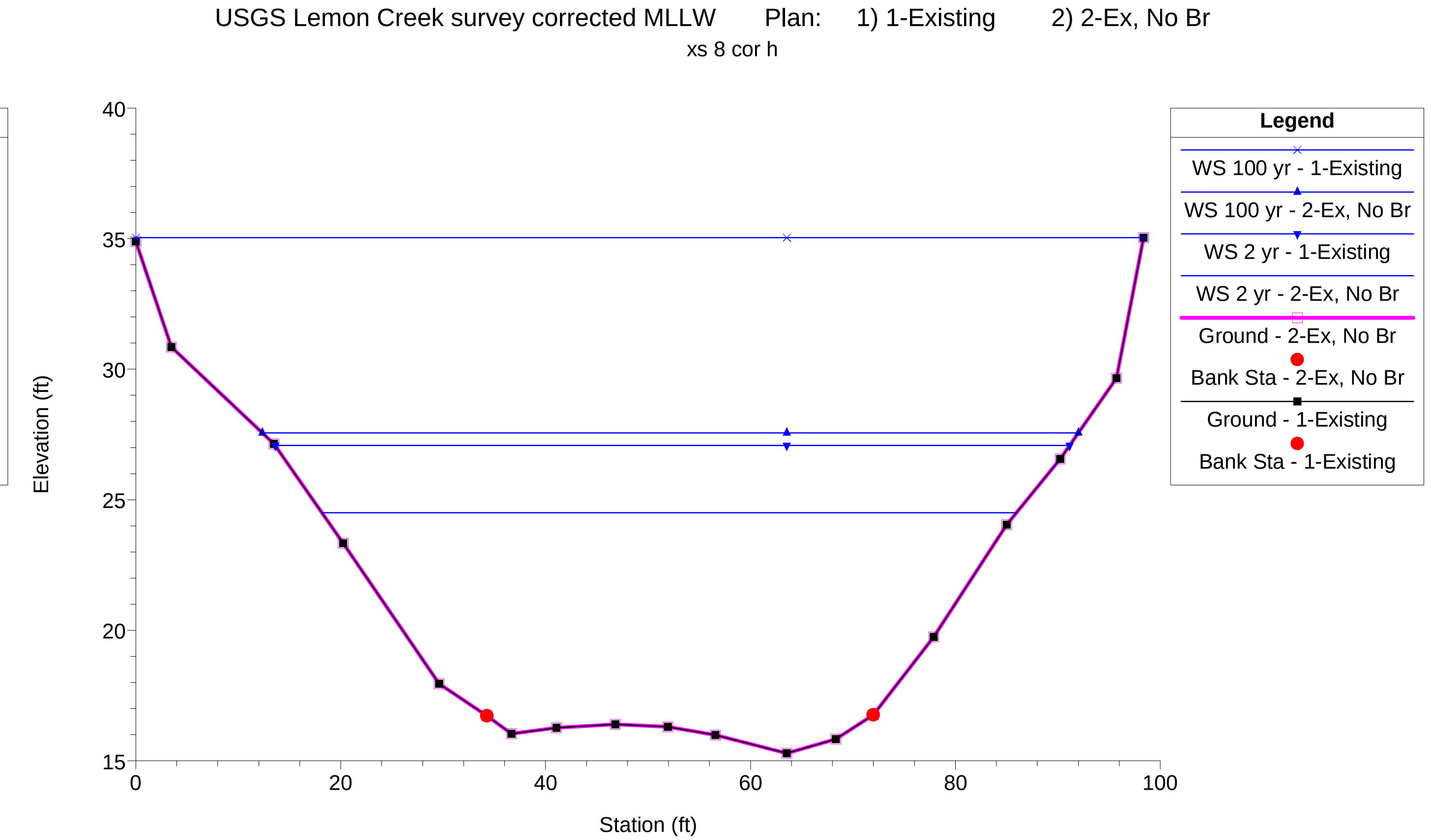
WS 100 yr - 2-Ex, No Br
WS 2 yr - 1-Existing
WS 2 yr - 2-Ex, No Br
Ground - 2-Ex, No Br
Bank Sta - 2-Ex, No Br
Ground - 1-Existing
Bank Sta - 1-Existing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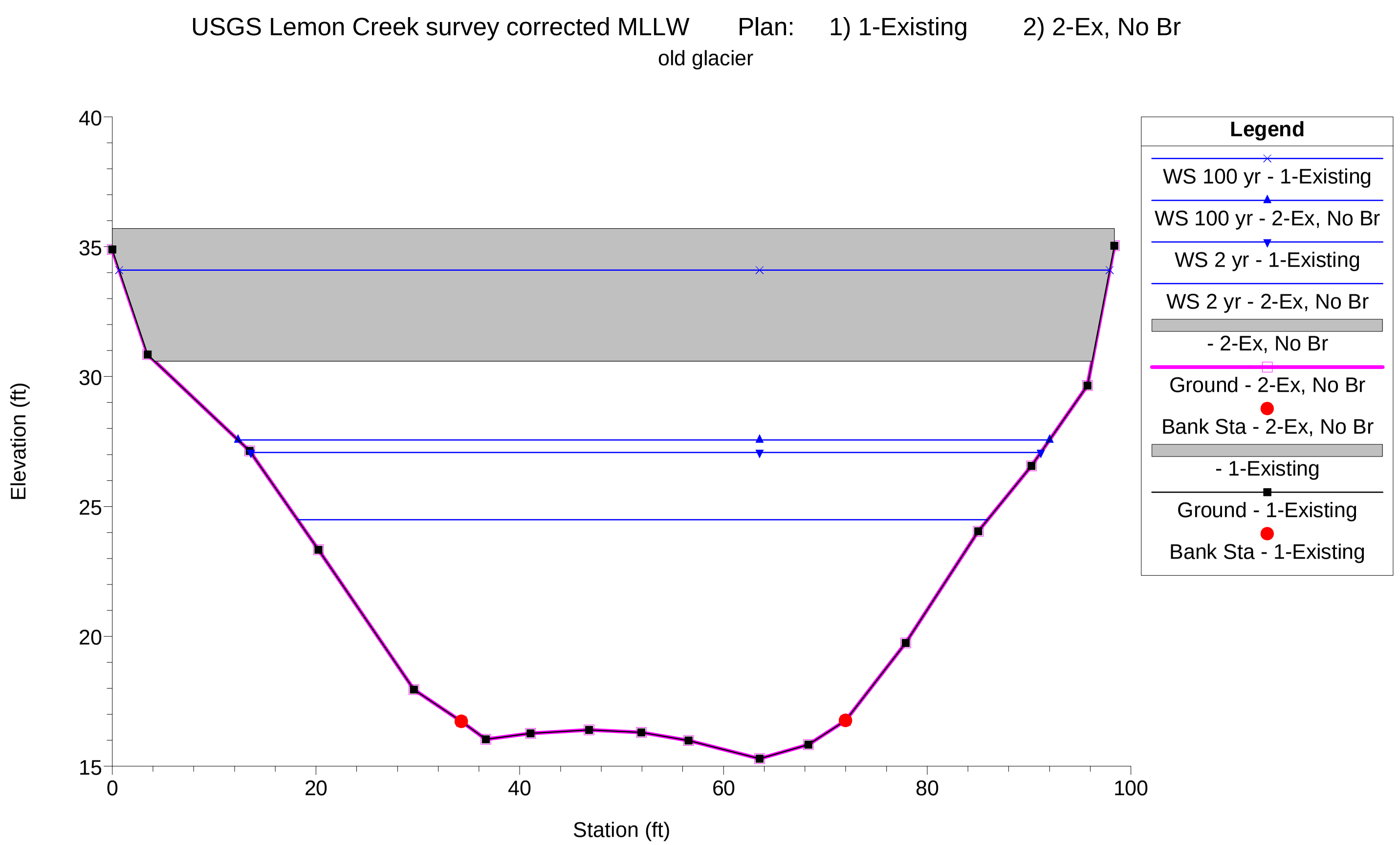
xs 8 cor h
Elevation (ft)
Station (ft)
Legend
WS 100 yr - 1-Existing
WS 100 yr - 2-Ex, No Br
WS 2 yr - 1-Existing
WS 2 yr - 2-Ex, No Br
Ground - 2-Ex, No Br
Bank Sta - 2-Ex, No Br
Ground - 1-Existing
Bank Sta - 1-Existing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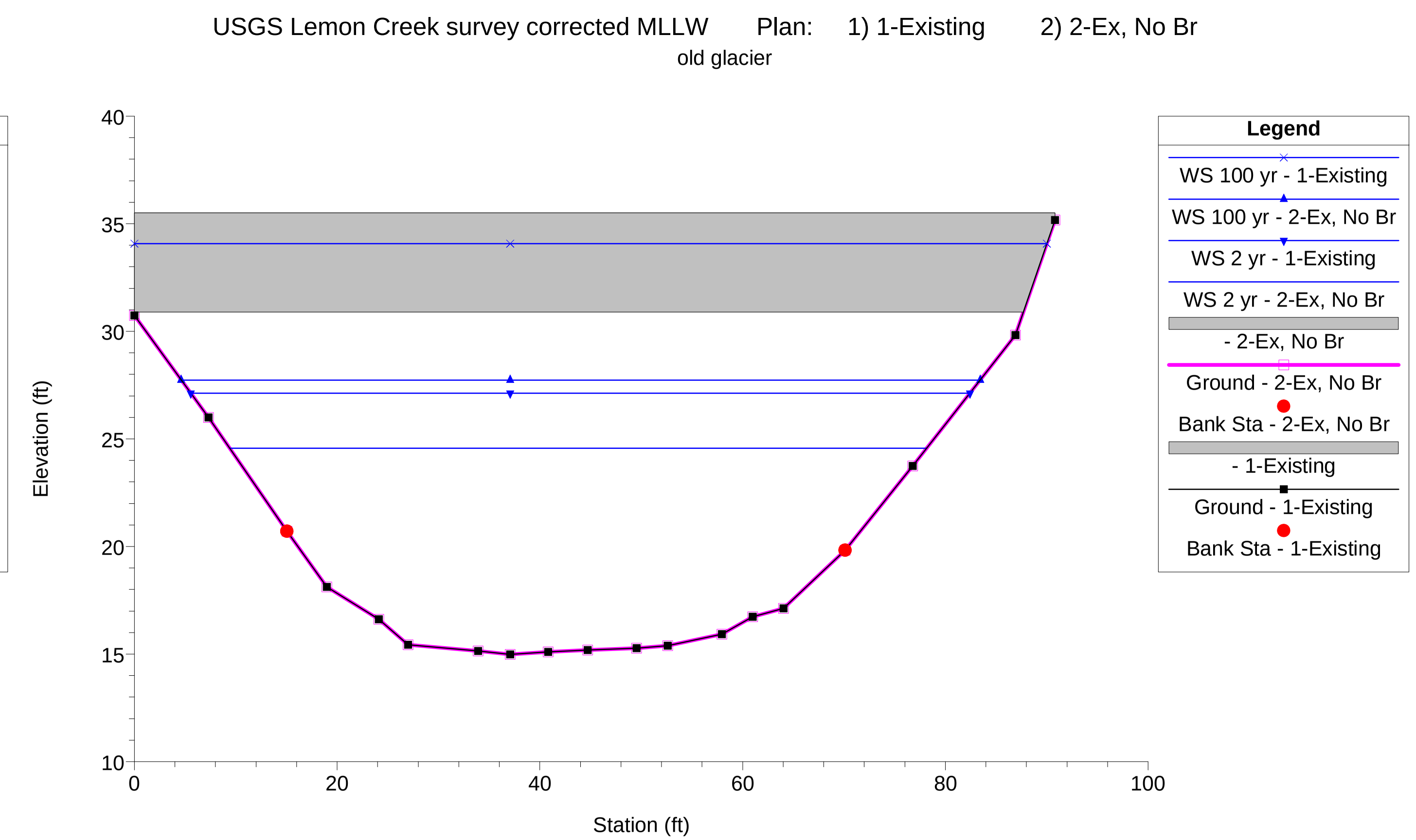
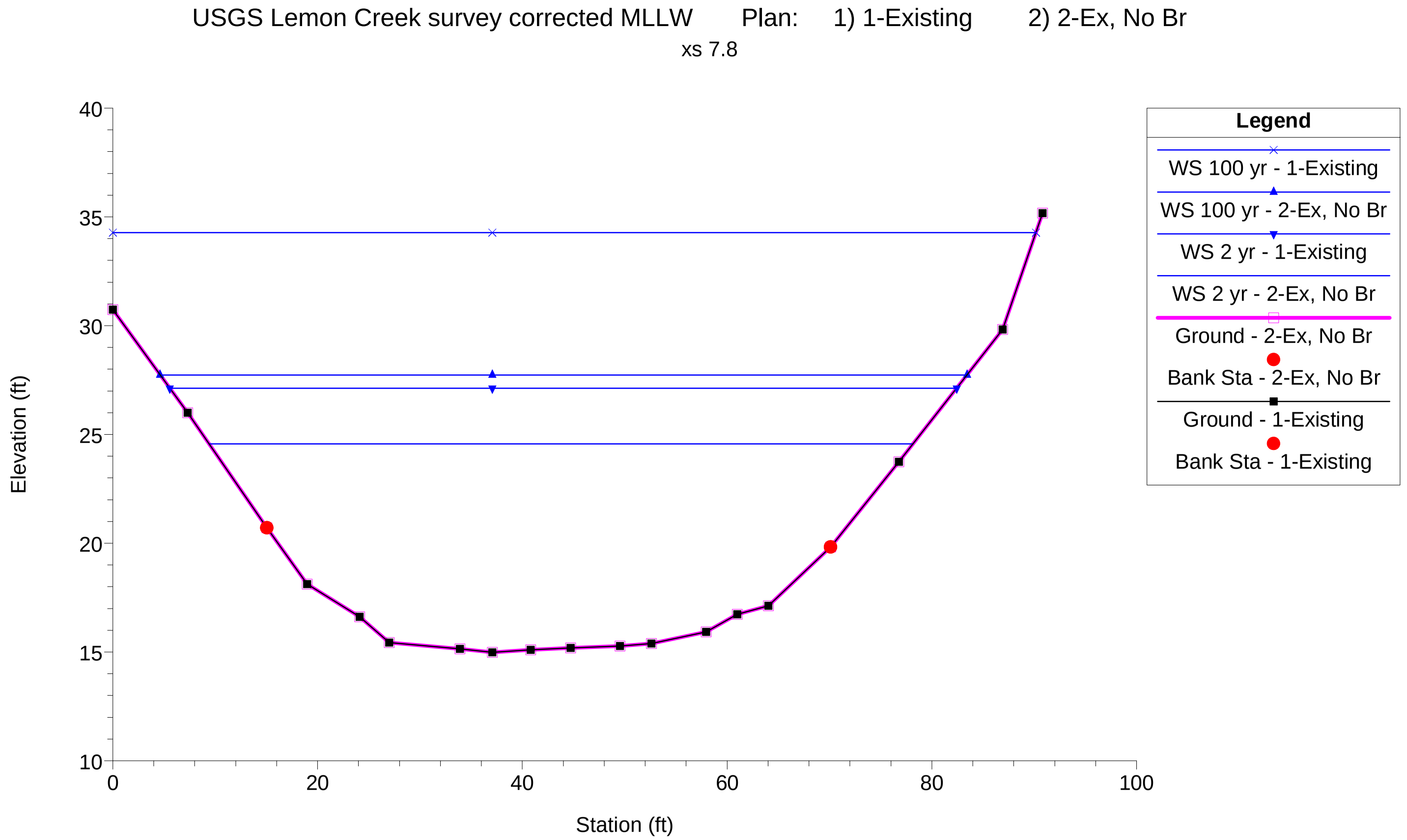
old glacier
Elevation (ft)
Station (ft)
Legend
WS 100 yr - 1-Existing
WS 100 yr - 2-Ex, No Br
WS 2 yr - 1-Existing
WS 2 yr - 2-Ex, No Br
- 2-Ex, No Br
Ground - 2-Ex, No Br
Bank Sta - 2-Ex, No Br
- 1-Existing
Ground - 1-Existing
Bank Sta - 1-Existing


USGS Lemon Creek survey corrected MLLW Plan: 1) 1-Existing 2) 2-Ex, No Br
old glacier
Elevation (ft)
Station (ft)
Legend
WS 100 yr - 1-Existing
WS 100 yr - 2-Ex, No Br
WS 2 yr - 1-Existing
WS 2 yr - 2-Ex, No Br
- 2-Ex, No Br
Ground - 2-Ex, No Br
Bank Sta - 2-Ex, No Br
- 1-Existing
Ground - 1-Existing
Bank Sta - 1-Existing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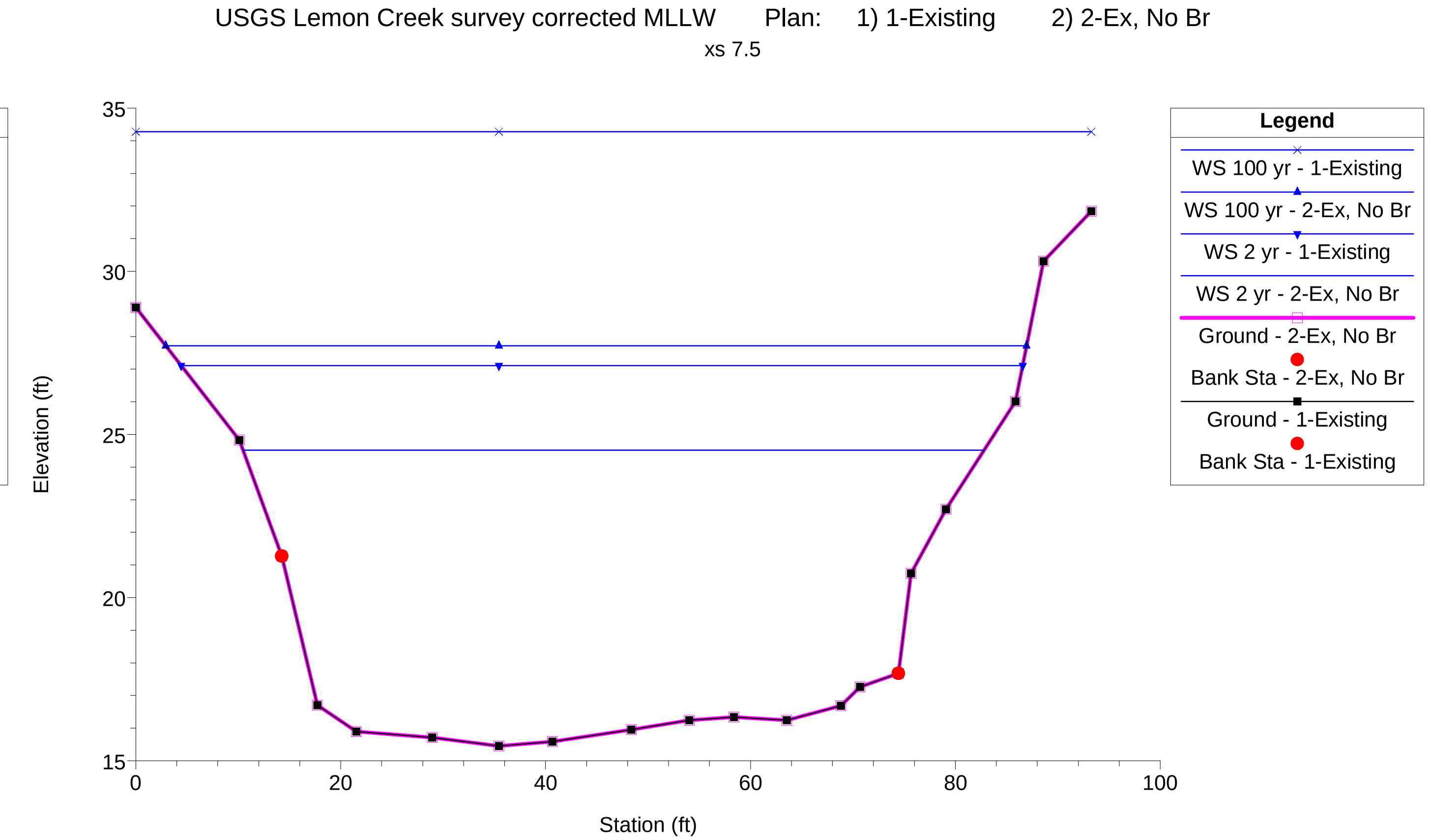
xs 7.8
Elevation (ft)
Station (ft)
Legend
WS 100 yr - 1-Existing
WS 100 yr - 2-Ex, No Br
WS 2 yr - 1-Existing
WS 2 yr - 2-Ex, No Br
Ground - 2-Ex, No Br
Bank Sta - 2-Ex, No Br
Ground - 1-Existing
Bank Sta - 1-Existing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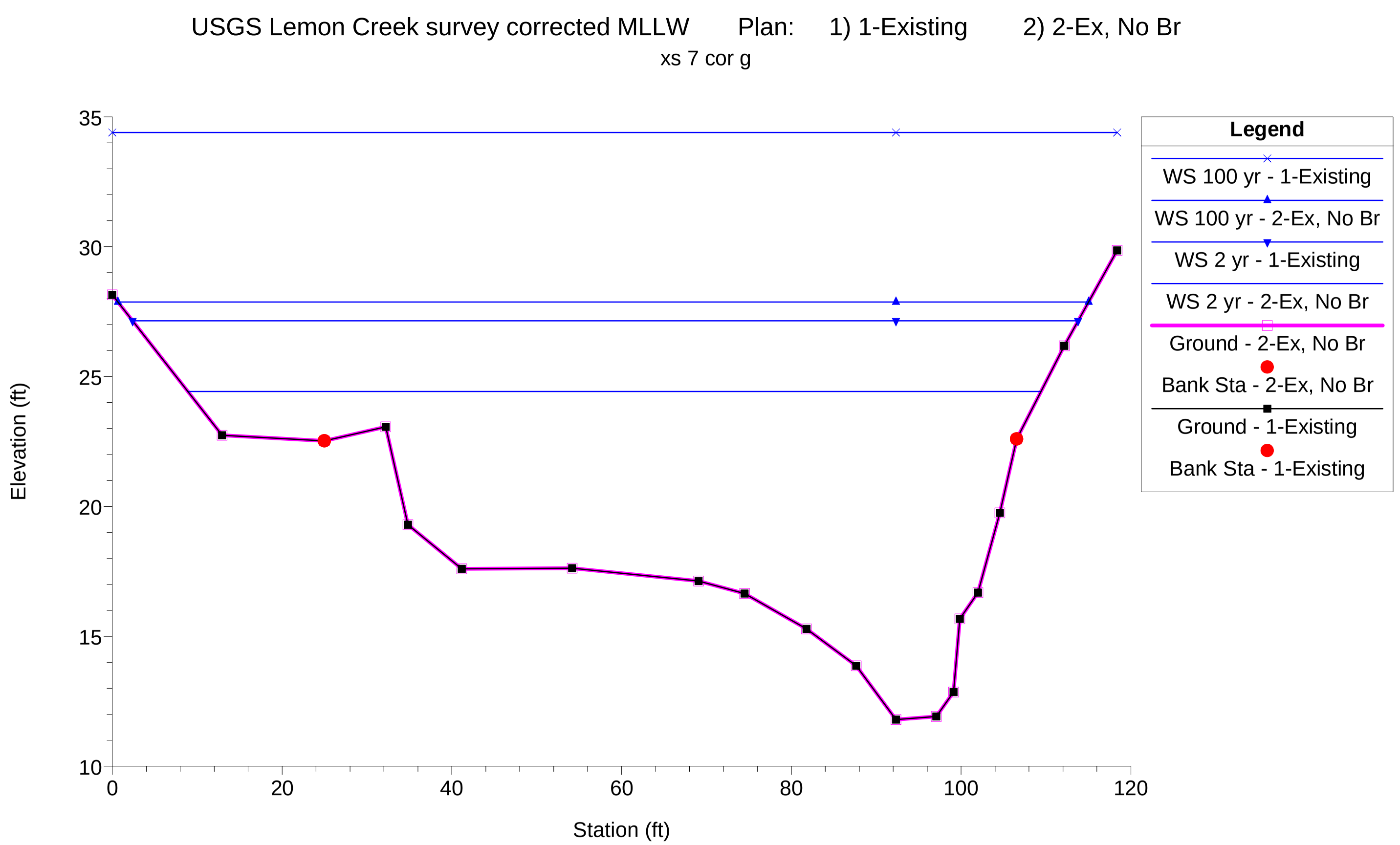
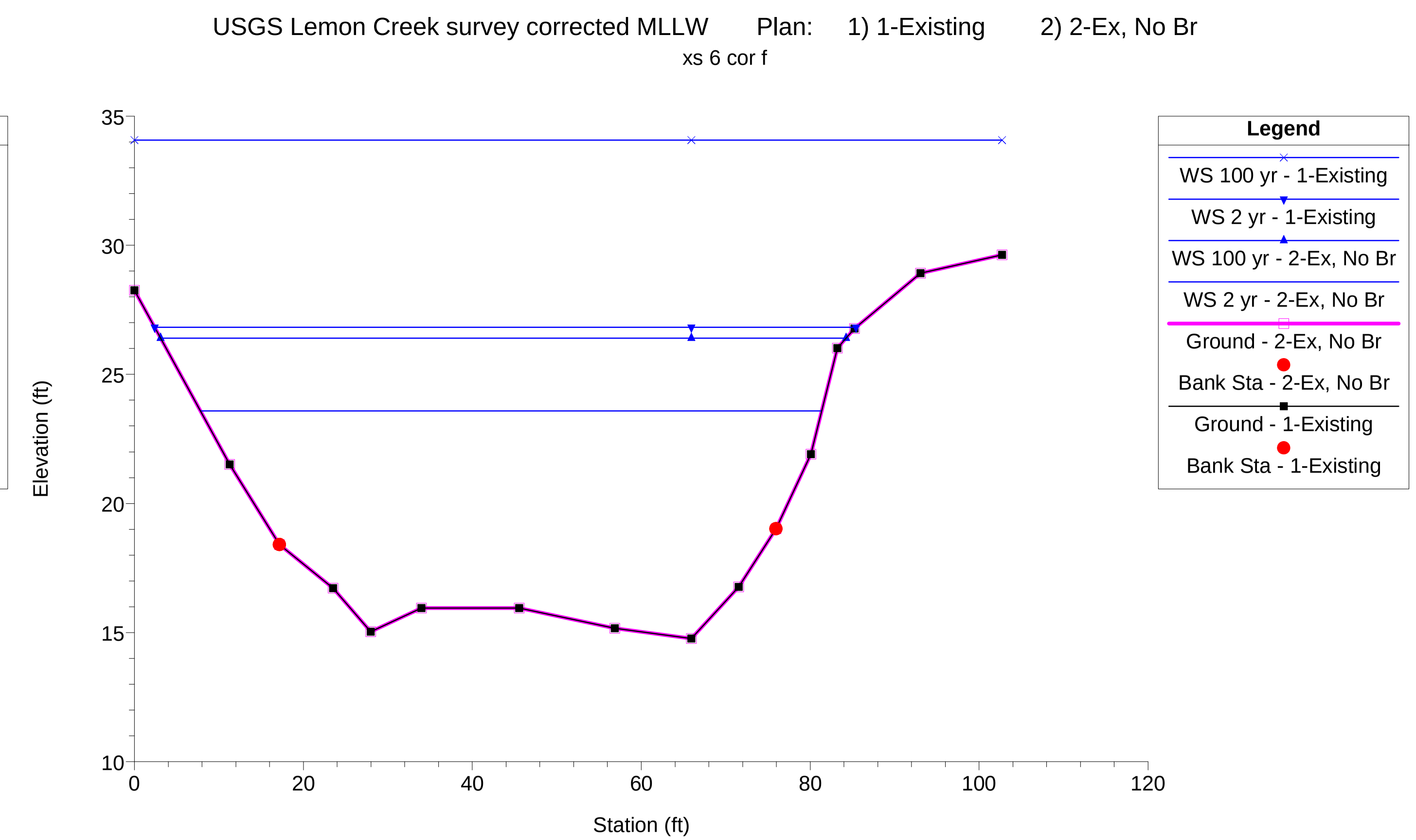
xs 7.5
Elevation (ft)
Station (ft)
Legend
WS 100 yr - 1-Existing
WS 100 yr - 2-Ex, No Br
WS 2 yr - 1-Existing
WS 2 yr - 2-Ex, No Br
Ground - 2-Ex, No Br
Bank Sta - 2-Ex, No Br
Ground - 1-Existing
Bank Sta - 1-Existing


USGS Lemon Creek survey corrected MLLW Plan: 1) 1-Existing 2) 2-Ex, No Br
xs 7 cor g
Elevation (ft)
Station (ft)
Legend
WS 100 yr - 1-Existing
WS 100 yr - 2-Ex, No Br
WS 2 yr - 1-Existing
WS 2 yr - 2-Ex, No Br
Ground - 2-Ex, No Br
Bank Sta - 2-Ex, No Br
Ground - 1-Existing
Bank Sta - 1-Existing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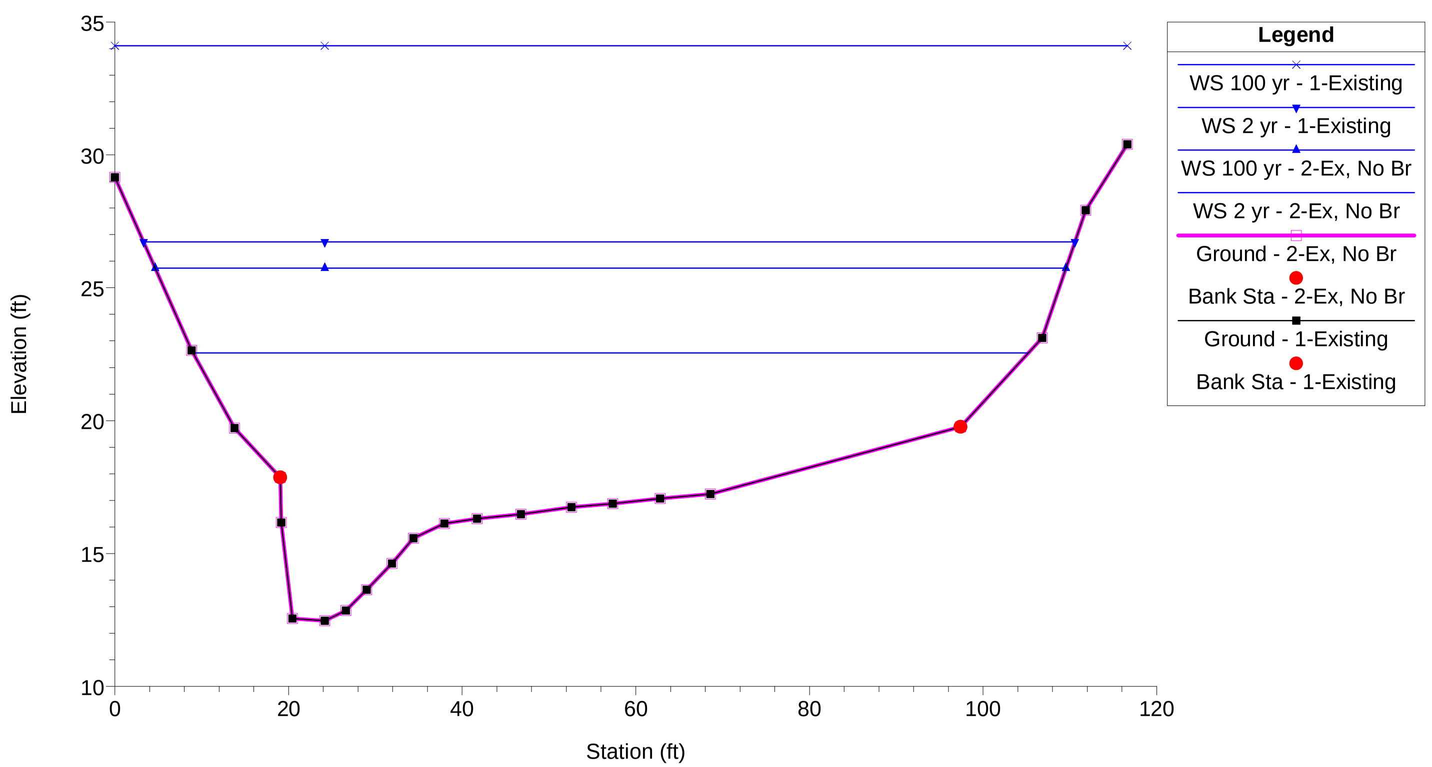
xs 6 cor f
Elevation (ft)
Station (ft)
Legend
WS 100 yr - 1-Existing
WS 2 yr - 1-Existing
WS 100 yr - 2-Ex, No Br
WS 2 yr - 2-Ex, No Br
Ground - 2-Ex, No Br
Bank Sta - 2-Ex, No Br
Ground - 1-Existing
Bank Sta - 1-Existing

USGS Lemon Creek survey corrected MLLW   Plan: 1) 1-Existing   2) 2-Ex, No Br

xs 5 cor e



Appendix F(b)

Hydraulics

Tide Water to Top of Gorge
In Stream Mining above Glacier Highway
RediMix Bridge in Place

Lemon Creek from tidewater to 350-ft above gorge bridge

Plan 3 Mining above Glacier Highway with RediMix Bridge in place

HEC-RAS Plan: 3bBrGr-5 River: lemon creek Reach: 1

Reach	River Sta	Profile	Cum Ch Len (ft)	Q Total (cfs)	Q Channel (cfs)	Vel Chnl (ft/s)	Hydr Depth C (ft)	Top W Act Chan (ft)	E.G. Slope (ft/ft)	Shear Chan (lb/sq ft)
1	1	2 yr		3930	2552.53	4.57	4.2	133.03	0.001304	0.33
1	1	5 yr (est)		5140	3338.42	5.97	4.2	133.03	0.00223	0.57
1	1	10 yr		5990	3890.5	6.96	4.2	133.03	0.003028	0.77
1	1	25 yr		6720	4364.63	7.81	4.2	133.03	0.003811	0.97
1	1	50 yr		7140	4637.42	8.3	4.2	133.03	0.004303	1.1
1	1	100 yr		7340	4767.32	8.53	4.2	133.03	0.004547	1.16
1	2	2 yr	174	3930	3909.9	8.95	3.48	125.48	0.006237	1.35
1	2	5 yr (est)	174	5140	5092.9	10.66	3.78	126.34	0.007936	1.86
1	2	10 yr	174	5990	5801.93	10.62	4.3	126.91	0.006641	1.77
1	2	25 yr	174	6720	6437.91	11.12	4.56	126.91	0.006741	1.9
1	2	50 yr	174	7140	6907.78	12.57	4.33	126.91	0.009217	2.47
1	2	100 yr	174	7340	7130.93	13.28	4.23	126.91	0.010607	2.78
1	3	2 yr	372	3930	3907.28	9.68	5.34	75.6	0.004166	1.37
1	3	5 yr (est)	372	5140	5128.59	15.79	4.3	75.6	0.014812	3.92
1	3	10 yr	372	5990	5961.51	15.55	5.07	75.6	0.011514	3.6
1	3	25 yr	372	6720	6665.65	14.87	5.93	75.6	0.008557	3.12
1	3	50 yr	372	7140	7069.8	14.69	6.37	75.6	0.007581	2.97
1	3	100 yr	372	7340	7262.46	14.66	6.55	75.6	0.007273	2.94
1	3.2	2 yr	404	3930	3929.96	20.65	5.38	35.4	0.023438	6.57
1	3.2	5 yr (est)	404	5140	5139.91	22.68	6.4	35.4	0.022407	7.48
1	3.2	10 yr	404	5990	5989.87	25.03	6.76	35.4	0.025391	8.95
1	3.2	25 yr	404	6720	6719.81	25.97	7.31	35.4	0.024629	9.39
1	3.2	50 yr	404	7140	7139.77	26.5	7.61	35.4	0.024291	9.64
1	3.2	100 yr	404	7340	7339.76	26.83	7.73	35.4	0.024402	9.84
1	3.3	2 yr	419	3930	3929.96	16.46	8.84	27	0.007095	3.47
1	3.3	5 yr (est)	419	5140	5139.93	18.04	10.55	27	0.006731	3.93
1	3.3	10 yr	419	5990	5989.87	16.12	13.76	27	0.003773	2.87
1	3.3	25 yr	419	6720	6719.84	16.75	14.86	27	0.003679	3.02
1	3.3	50 yr	419	7140	7139.86	20.49	12.9	27	0.006642	4.74
1	3.3	100 yr	419	7340	7339.8	16.88	16.11	27	0.003351	2.99
1	3.5	2 yr	446	3930	3841.3	8.81	11.66	37.42	0.001238	0.88
1	3.5	5 yr (est)	446	5140	4931.52	9.3	14.16	37.42	0.001066	0.92
1	3.5	10 yr	446	5990	5680.56	9.35	16.24	37.42	0.000896	0.89
1	3.5	25 yr	446	6720	6334.76	9.61	17.62	37.42	0.00085	0.91
1	3.5	50 yr	446	7140	6722.7	10.02	17.93	37.42	0.000903	0.99
1	3.5	100 yr	446	7340	6887.46	9.74	18.9	37.42	0.000794	0.91
1	4	2 yr	493	3930	3848.41	5.14	11.55	64.74	0.000419	0.3
1	4	5 yr (est)	493	5140	4993.07	5.46	14.13	64.74	0.000361	0.31
1	4	10 yr	493	5990	5787.55	5.52	16.19	64.74	0.000308	0.31
1	4	25 yr	493	6720	6474.74	5.68	17.61	64.74	0.000291	0.32
1	4	50 yr	493	7140	6874.78	5.9	18.01	64.74	0.000305	0.34
1	4	100 yr	493	7340	7057.67	5.76	18.91	64.74	0.000273	0.32
1	5	2 yr	764	3930	3764.22	4.8	10	78.34	0.000643	0.38
1	5	5 yr (est)	764	5140	4864.4	4.93	12.59	78.34	0.000499	0.37
1	5	10 yr	764	5990	5612.94	4.89	14.65	78.34	0.000401	0.35
1	5	25 yr	764	6720	6261.81	4.97	16.08	78.34	0.000366	0.35
1	5	50 yr	764	7140	6644.1	5.14	16.49	78.34	0.000378	0.37
1	5	100 yr	764	7340	6812.55	5	17.39	78.34	0.000334	0.34

Lemon Creek from tidewater to 350-ft above gorge bridge

Plan 3 Mining above Glacier Highway with RediMix Bridge in place

HEC-RAS Plan: 3bBrGr-5 River: lemon creek Reach: 1

Reach	River Sta	Profile	Cum Ch Len (ft)	Q Total (cfs)	Q Channel (cfs)	Vel Chnl (ft/s)	Hydr Depth C (ft)	Top W Act Chan (ft)	E.G. Slope (ft/ft)	Shear Chan (lb/sq ft)
1	6	2 yr	1078	3930	3806.38	5.97	10.85	58.77	0.000852	0.56
1	6	5 yr (est)	1078	5140	4915.7	6.26	13.37	58.77	0.000709	0.58
1	6	10 yr	1078	5990	5637.94	6.23	15.4	58.77	0.000582	0.55
1	6	25 yr	1078	6720	6262.62	6.34	16.81	58.77	0.000536	0.55
1	6	50 yr	1078	7140	6637	6.56	17.22	58.77	0.000555	0.58
1	6	100 yr	1078	7340	6788.18	6.38	18.1	58.77	0.000491	0.54
1	7	2 yr	1213	3930	3837.51	4.68	10.05	81.56	0.00064	0.36
1	7	5 yr (est)	1213	5140	4934.74	4.81	12.59	81.56	0.0005	0.36
1	7	10 yr	1213	5990	5684.44	4.78	14.59	81.56	0.000405	0.33
1	7	25 yr	1213	6720	6337.79	4.85	16.01	81.56	0.00037	0.33
1	7	50 yr	1213	7140	6723.05	5.01	16.44	81.56	0.000381	0.35
1	7	100 yr	1213	7340	6891.39	4.88	17.3	81.56	0.000338	0.33
1	7.5	2 yr	1361	3930	3857.65	5.91	10.84	60.22	0.000851	0.55
1	7.5	5 yr (est)	1361	5140	4979.16	6.2	13.34	60.22	0.000712	0.57
1	7.5	10 yr	1361	5990	5751.86	6.23	15.32	60.22	0.000598	0.55
1	7.5	25 yr	1361	6720	6408.03	6.36	16.72	60.22	0.000555	0.56
1	7.5	50 yr	1361	7140	6795.39	6.58	17.14	60.22	0.000574	0.59
1	7.5	100 yr	1361	7340	6960.48	6.42	18.01	60.22	0.000512	0.55
1	7.8	2 yr	1413	3930	3798.49	6.38	10.81	55.07	0.00099	0.65
1	7.8	5 yr (est)	1413	5140	4869.6	6.65	13.3	55.07	0.000816	0.65
1	7.8	10 yr	1413	5990	5574.23	6.62	15.28	55.07	0.000672	0.62
1	7.8	25 yr	1413	6720	6183.09	6.73	16.68	55.07	0.000618	0.62
1	7.8	50 yr	1413	7140	6549.37	6.95	17.1	55.07	0.000638	0.66
1	7.8	100 yr	1413	7340	6693.25	6.76	17.97	55.07	0.000565	0.61
1	8	2 yr	1472	3930	3295.88	7.93	11.01	37.72	0.00144	0.98
1	8	5 yr (est)	1472	5140	4163.99	8.18	13.49	37.72	0.001168	0.98
1	8	10 yr	1472	5990	4672.59	7.87	15.74	37.72	0.000881	0.86
1	8	25 yr	1472	6720	5105.92	7.77	17.42	37.72	0.00075	0.81
1	8	50 yr	1472	7140	5383.79	7.94	17.97	37.72	0.000751	0.84
1	8	100 yr	1472	7340	5463.1	7.63	18.97	37.72	0.000646	0.76
1	8.5	2 yr	1597	3930	3780.12	3.88	14.45	67.41	0.00026	0.22
1	8.5	5 yr (est)	1597	5140	4851.08	4.26	16.91	67.41	0.000253	0.25
1	8.5	10 yr	1597	5990	5574.4	4.34	19.04	67.41	0.000225	0.25
1	8.5	25 yr	1597	6720	6200.4	4.45	20.67	67.41	0.000212	0.26
1	8.5	50 yr	1597	7140	6570.94	4.59	21.23	67.41	0.000218	0.27
1	8.5	100 yr	1597	7340	6728.59	4.5	22.17	67.41	0.000198	0.26
1	9	2 yr	2020	3930	3804.24	2.9	11.95	109.93	0.00019	0.13
1	9	5 yr (est)	2020	5140	4860.59	3.06	14.43	109.93	0.000165	0.14
1	9	10 yr	2020	5990	5553.16	3.05	16.56	109.93	0.000136	0.13
1	9	25 yr	2020	6720	6140.53	3.07	18.19	109.93	0.000122	0.13
1	9	50 yr	2020	7140	6495.02	3.15	18.77	109.93	0.000123	0.13
1	9	100 yr	2020	7340	6632.79	3.06	19.7	109.93	0.000109	0.12
1	10	2 yr	2770	3930	3896.76	2.5	10.28	151.56	0.000167	0.1
1	10	5 yr (est)	2770	5140	5058.05	2.61	12.6	153.63	0.000139	0.1
1	10	10 yr	2770	5990	5860.04	2.59	14.71	153.63	0.000112	0.1
1	10	25 yr	2770	6720	6545.58	2.61	16.33	153.63	0.000098	0.09
1	10	50 yr	2770	7140	6944.12	2.67	16.91	153.63	0.000098	0.1
1	10	100 yr	2770	7340	7121.71	2.6	17.82	153.63	0.000087	0.09

Lemon Creek from tidewater to 350-ft above gorge bridge

Plan 3 Mining above Glacier Highway with RediMix Bridge in place

HEC-RAS Plan: 3bBrGr-5 River: lemon creek Reach: 1

Reach	River Sta	Profile	Cum Ch Len (ft)	Q Total (cfs)	Q Channel (cfs)	Vel Chnl (ft/s)	Hydr Depth C (ft)	Top W Act Chan (ft)	E.G. Slope (ft/ft)	Shear Chan (lb/sq ft)
1	11	2 yr	3204	3930	3916.9	2.2	9.53	186.55	0.000146	0.08
1	11	5 yr (est)	3204	5140	5086.43	2.27	11.99	186.55	0.000115	0.08
1	11	10 yr	3204	5990	5883.94	2.24	14.08	186.55	0.00009	0.07
1	11	25 yr	3204	6720	6559.22	2.24	15.7	186.55	0.000078	0.07
1	11	50 yr	3204	7140	6953.74	2.29	16.28	186.55	0.000077	0.07
1	11	100 yr	3204	7340	7124.24	2.22	17.19	186.55	0.000068	0.07
1	12	2 yr	3771	3930	3929.38	2.69	7.7	189.83	0.000222	0.1
1	12	5 yr (est)	3771	5140	5134.18	2.67	10.14	189.83	0.000152	0.09
1	12	10 yr	3771	5990	5972.48	2.57	12.22	189.83	0.00011	0.08
1	12	25 yr	3771	6720	6687.64	2.55	13.83	189.83	0.000091	0.07
1	12	50 yr	3771	7140	7100.02	2.6	14.41	189.83	0.00009	0.08
1	12	100 yr	3771	7340	7289.19	2.51	15.31	189.83	0.000077	0.07
1	13	2 yr	4559	3930	3930	5.12	4.1	187.35	0.002572	0.64
1	13	5 yr (est)	4559	5140	5135.45	4.22	6.35	191.55	0.000976	0.38
1	13	10 yr	4559	5990	5969.71	3.72	8.39	191.55	0.000522	0.27
1	13	25 yr	4559	6720	6679.36	3.49	9.98	191.55	0.000366	0.22
1	13	50 yr	4559	7140	7089.23	3.5	10.56	191.55	0.000342	0.22
1	13	100 yr	4559	7340	7277.01	3.32	11.45	191.55	0.000275	0.19
1	13.5	2 yr	4845	3930	3789.43	10.29	3.27	112.79	0.016479	3.26
1	13.5	5 yr (est)	4845	5140	4915.97	11.1	3.92	113.04	0.015131	3.58
1	13.5	10 yr	4845	5990	5696.1	11.6	4.34	113.04	0.014398	3.77
1	13.5	25 yr	4845	6720	6358.68	12.01	4.68	113.04	0.013958	3.95
1	13.5	50 yr	4845	7140	6738.08	12.26	4.86	113.04	0.013837	4.06
1	13.5	100 yr	4845	7340	6918.54	12.38	4.94	113.04	0.013811	4.12
1	14	2 yr	5293	3930	3839.44	4.08	4.32	217.92	0.002198	0.59
1	14	5 yr (est)	5293	5140	5011.86	4.51	5.1	217.92	0.002142	0.68
1	14	10 yr	5293	5990	5833.86	4.76	5.62	217.92	0.002105	0.73
1	14	25 yr	5293	6720	6538.9	4.97	6.04	217.92	0.002081	0.78
1	14	50 yr	5293	7140	6944.11	5.08	6.28	217.92	0.002065	0.8
1	14	100 yr	5293	7340	7136.96	5.13	6.39	217.92	0.002056	0.81
1	14.5	2 yr	5820	3930	3824.51	8.96	3.78	112.73	0.013079	2.99
1	14.5	5 yr (est)	5820	5140	4877.48	9.86	4.37	113.24	0.013114	3.45
1	14.5	10 yr	5820	5990	5601.7	10.43	4.73	113.55	0.013236	3.76
1	14.5	25 yr	5820	6720	6216.56	10.89	5.01	113.8	0.013364	4.02
1	14.5	50 yr	5820	7140	6567.91	11.15	5.17	113.94	0.013443	4.17
1	14.5	100 yr	5820	7340	6734.64	11.27	5.24	114	0.013481	4.24
1	15	2 yr	6042	3930	3785.15	7.04	5.84	92.08	0.006656	2.37
1	15	5 yr (est)	6042	5140	4880.35	8.04	6.53	92.94	0.007482	2.98
1	15	10 yr	6042	5990	5699.47	8.76	6.96	93.46	0.008192	3.47
1	15	25 yr	6042	6720	6357.35	9.28	7.3	93.89	0.008633	3.83
1	15	50 yr	6042	7140	6716.43	9.53	7.49	94.12	0.008817	4.01
1	15	100 yr	6042	7340	6886.44	9.65	7.58	94.23	0.008901	4.09
1	15.5	2 yr	6436	3930	3929.64	8.45	4.93	94.42	0.01203	3.61
1	15.5	5 yr (est)	6436	5140	5137.21	9.26	5.79	95.89	0.011705	4.12
1	15.5	10 yr	6436	5990	5983.7	9.71	6.36	96.89	0.011383	4.39
1	15.5	25 yr	6436	6720	6709.74	10.12	6.79	97.64	0.011357	4.67
1	15.5	50 yr	6436	7140	7127.11	10.37	7.01	98.04	0.011419	4.85
1	15.5	100 yr	6436	7340	7325.76	10.48	7.11	98.23	0.011451	4.94

Lemon Creek from tidewater to 350-ft above gorge bridge

Plan 3 Mining above Glacier Highway with RediMix Bridge in place

HEC-RAS Plan: 3bBrGr-5 River: lemon creek Reach: 1

Reach	River Sta	Profile	Cum Ch Len (ft)	Q Total (cfs)	Q Channel (cfs)	Vel Chnl (ft/s)	Hydr Depth C (ft)	Top W Act Chan (ft)	E.G. Slope (ft/ft)	Shear Chan (lb/sq ft)
1	15.8	2 yr	6772	3930	3774.87	10.18	5.46	67.9	0.018385	6.06
1	15.8	5 yr (est)	6772	5140	4904.8	11.23	6.35	68.81	0.018448	7.03
1	15.8	10 yr	6772	5990	5791.88	12.39	6.75	69.23	0.020718	8.38
1	15.8	25 yr	6772	6720	6422.51	12.7	7.25	69.75	0.019902	8.61
1	15.8	50 yr	6772	7140	6773.2	12.76	7.58	70.1	0.018971	8.56
1	15.8	100 yr	6772	7340	6942.98	12.83	7.7	70.23	0.018794	8.62
1	16	2 yr	6985	3930	3292.49	11.25	6.47	45.25	0.023246	8.8
1	16	5 yr (est)	6985	5140	4154.34	12.21	7.29	46.66	0.023535	9.99
1	16	10 yr	6985	5990	4719.02	12.34	7.98	47.87	0.021414	9.92
1	16	25 yr	6985	6720	5235.33	12.98	8.32	48.47	0.022457	10.82
1	16	50 yr	6985	7140	5536.46	13.42	8.47	48.71	0.023502	11.51
1	16	100 yr	6985	7340	5675.68	13.57	8.57	48.82	0.023682	11.72
1	17	2 yr	7123	3930	3353.14	10.91	7.35	41.81	0.018787	8.51
1	17	5 yr (est)	7123	5140	4322.53	12.08	8.56	41.81	0.018816	9.93
1	17	10 yr	7123	5990	4991.46	12.8	9.33	41.81	0.018829	10.83
1	17	25 yr	7123	6720	5559.37	13.36	9.95	41.81	0.018814	11.54
1	17	50 yr	7123	7140	5882.1	13.66	10.3	41.81	0.018807	11.94
1	17	100 yr	7123	7340	6035.12	13.81	10.45	41.81	0.018821	12.13
1	17.5	2 yr	7263	3930	2955.51	12.81	10.08	22.89	0.022179	13.54
1	17.5	5 yr (est)	7263	5140	3734.99	14.44	11.3	22.89	0.024229	16.58
1	17.5	10 yr	7263	5990	4264.06	15.45	12.06	22.89	0.025418	18.56
1	17.5	25 yr	7263	6720	4708.87	16.24	12.66	22.89	0.026317	20.18
1	17.5	50 yr	7263	7140	4961.42	16.68	12.99	22.89	0.026809	21.1
1	17.5	100 yr	7263	7340	5080.86	16.88	13.15	22.89	0.027037	21.53
1	18	2 yr	7408	3930	2763.67	14.34	7.12	27.07	0.043368	18.96
1	18	5 yr (est)	7408	5140	3468.9	15.66	8.18	27.07	0.042951	21.58
1	18	10 yr	7408	5990	3946.39	16.38	8.9	27.07	0.042031	22.97
1	18	25 yr	7408	6720	4348.9	16.95	9.48	27.07	0.041354	24.07
1	18	50 yr	7408	7140	4579.8	17.29	9.79	27.07	0.041274	24.8
1	18	100 yr	7408	7340	4686.84	17.41	9.94	27.07	0.040964	25.01
1	19	2 yr	7600	3930	2027.67	11.24	10.96	16.45	0.017324	10.47
1	19	5 yr (est)	7600	5140	2474.33	12.23	12.3	16.45	0.017588	11.92
1	19	10 yr	7600	5990	2778.05	12.87	13.12	16.45	0.017859	12.92
1	19	25 yr	7600	6720	3032.04	13.37	13.79	16.45	0.018053	13.72
1	19	50 yr	7600	7140	3174.36	13.63	14.16	16.45	0.018092	14.12
1	19	100 yr	7600	7340	3243.12	13.76	14.32	16.45	0.018182	14.35
1	20	2 yr	7704	3930	2413.59	13.53	7.29	24.49	0.038675	16.88
1	20	5 yr (est)	7704	5140	2867.75	13.62	8.6	24.49	0.031459	16.2
1	20	10 yr	7704	5990	3184.03	13.8	9.42	24.49	0.028557	16.12
1	20	25 yr	7704	6720	3454.41	13.98	10.09	24.49	0.026779	16.19
1	20	50 yr	7704	7140	3608.66	14.09	10.46	24.49	0.025912	16.24
1	20	100 yr	7704	7340	3682.65	14.15	10.63	24.49	0.025587	16.29
1	21	2 yr	7794	3930	2677.21	15.03	7.37	24.16	0.045303	20.57
1	21	5 yr (est)	7794	5140	3389.12	16.38	8.56	24.16	0.044125	23.26
1	21	10 yr	7794	5990	3877.86	17.16	9.35	24.16	0.043034	24.78
1	21	25 yr	7794	6720	4293.6	17.81	9.98	24.16	0.042473	26.1
1	21	50 yr	7794	7140	4531.65	18.18	10.32	24.16	0.04233	26.9
1	21	100 yr	7794	7340	4645.48	18.37	10.47	24.16	0.042428	27.35

Lemon Creek from tidewater to 350-ft above gorge bridge

Plan 3   Mining above Glacier Highway with RediMix Bridge in place

HEC-RAS Plan: 3bBrGr-5   River: lemon creek   Reach: 1

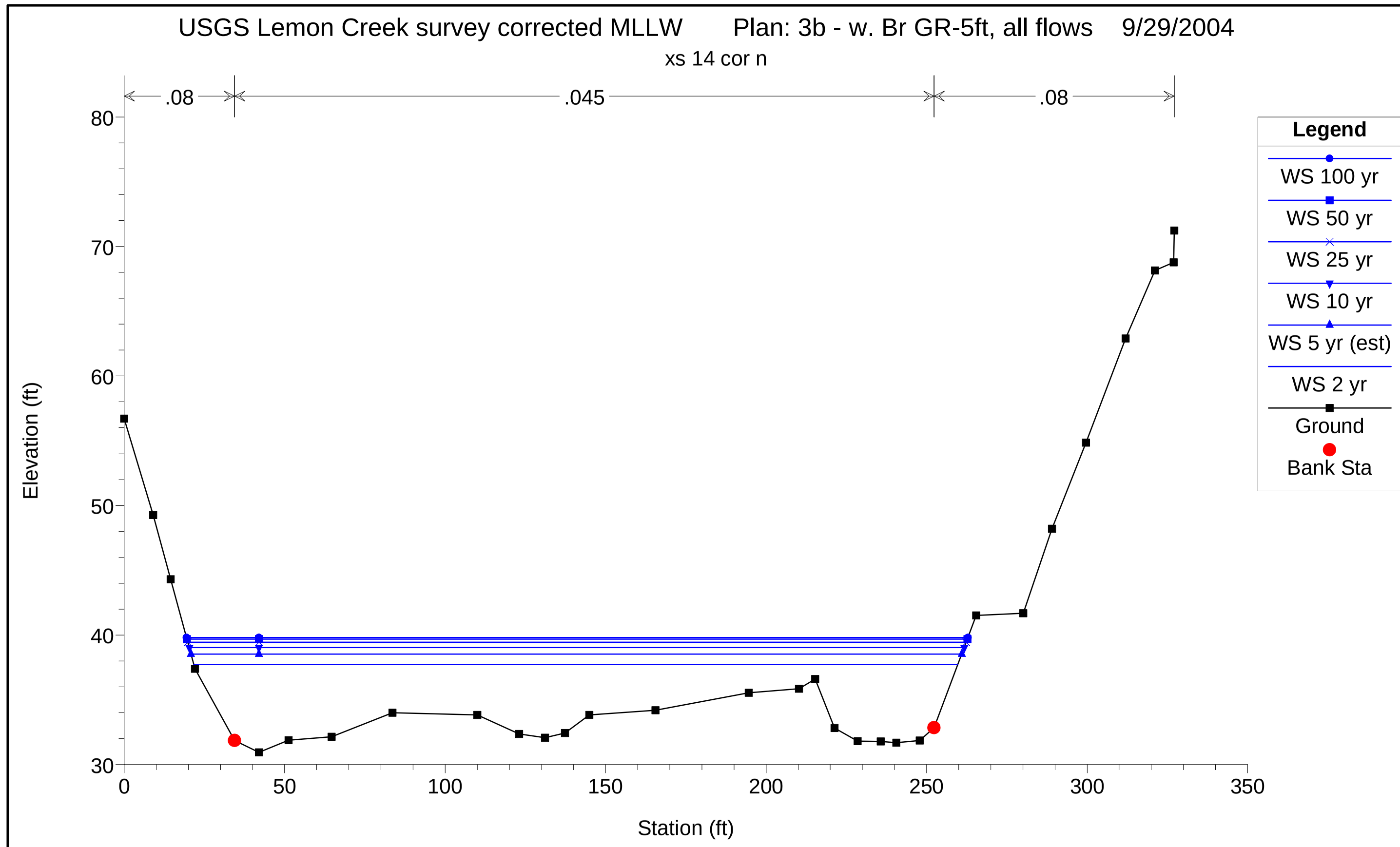
Reach	River Sta	Profile	Cum Ch Len (ft)	Q Total (cfs)	Q Channel (cfs)	Vel Chnl (ft/s)	Hydr Depth C (ft)	Top W Act Chan (ft)	E.G. Slope (ft/ft)	Shear Chan (lb/sq ft)
1	22	2 yr	7906	3930	3050.35	11.81	9.11	28.33	0.021176	11.86
1	22	5 yr (est)	7906	5140	3882.2	13.12	10.44	28.33	0.021776	13.97
1	22	10 yr	7906	5990	4455.18	13.95	11.28	28.33	0.022212	15.39
1	22	25 yr	7906	6720	4939.37	14.58	11.96	28.33	0.022462	16.5
1	22	50 yr	7906	7140	5214.63	14.92	12.34	28.33	0.022545	17.09
1	22	100 yr	7906	7340	5344.39	15.06	12.52	28.33	0.022532	17.34
1	23	2 yr	8014	3930	2857.73	12.9	10.28	21.55	0.021818	13.62
1	23	5 yr (est)	8014	5140	3611.53	14.38	11.66	21.55	0.022941	16.24
1	23	10 yr	8014	5990	4126.6	15.3	12.52	21.55	0.023611	17.95
1	23	25 yr	8014	6720	4564.02	16.04	13.21	21.55	0.024155	19.38
1	23	50 yr	8014	7140	4814.23	16.44	13.59	21.55	0.024458	20.18
1	23	100 yr	8014	7340	4932.92	16.63	13.76	21.55	0.024591	20.56
1	24	2 yr	8247	3930	3926.51	8.96	8.18	53.6	0.009178	4.2
1	24	5 yr (est)	8247	5140	5127.11	9.78	9.71	54	0.008723	4.73
1	24	10 yr	8247	5990	5964.67	10.3	10.72	54	0.008491	5.08
1	24	25 yr	8247	6720	6679.37	10.72	11.54	54	0.008325	5.37
1	24	50 yr	8247	7140	7088.55	10.94	12	54	0.008237	5.52
1	24	100 yr	8247	7340	7282.88	11.04	12.21	54	0.008197	5.59
1	25	2 yr	8378	3930	3896.07	5.02	5.9	131.61	0.001761	0.63
1	25	5 yr (est)	8378	5140	5067.19	5.02	7.57	133.48	0.001274	0.59
1	25	10 yr	8378	5990	5883.52	5.06	8.63	134.69	0.00109	0.57
1	25	25 yr	8378	6720	6581.45	5.11	9.5	135.69	0.00098	0.56
1	25	50 yr	8378	7140	6981.76	5.13	9.98	136.24	0.000929	0.56
1	25	100 yr	8378	7340	7172.07	5.15	10.21	136.5	0.000908	0.56
1	26	2 yr	8453	3930	3872.42	7.5	5.65	91.43	0.004104	1.43
1	26	5 yr (est)	8453	5140	4880.85	7.2	7.41	91.43	0.002636	1.21
1	26	10 yr	8453	5990	5563.99	7.11	8.56	91.43	0.002121	1.12
1	26	25 yr	8453	6720	6142.09	7.07	9.5	91.43	0.001828	1.07
1	26	50 yr	8453	7140	6471.51	7.06	10.02	91.43	0.001697	1.05
1	26	100 yr	8453	7340	6627.7	7.06	10.26	91.43	0.001642	1.04
1	27	2 yr	8505	3930	3727.88	12.17	6.35	48.2	0.009442	3.65
1	27	5 yr (est)	8505	5140	4833.54	12.72	7.88	48.2	0.007729	3.71
1	27	10 yr	8505	5990	5602.39	13.02	8.93	48.2	0.006865	3.73
1	27	25 yr	8505	6720	6257.58	13.26	9.79	48.2	0.006288	3.75
1	27	50 yr	8505	7140	6633.69	13.39	10.28	48.2	0.006012	3.76
1	27	100 yr	8505	7340	6814.34	13.46	10.51	48.2	0.005898	3.77
1	28	2 yr	8524	3930	3776.36	12.14	6.03	51.58	0.009954	3.68
1	28	5 yr (est)	8524	5140	4906.05	12.59	7.55	51.58	0.007932	3.68
1	28	10 yr	8524	5990	5698.21	12.87	8.58	51.58	0.006983	3.68
1	28	25 yr	8524	6720	6376.27	13.1	9.44	51.58	0.006372	3.69
1	28	50 yr	8524	7140	6768.26	13.24	9.91	51.58	0.006104	3.71
1	28	100 yr	8524	7340	6955.14	13.3	10.14	51.58	0.005979	3.72
1	29	2 yr	8593	3930	3917.56	7.1	5.46	100.98	0.003474	1.17
1	29	5 yr (est)	8593	5140	5116.78	6.72	4.37	173.97	0.00253	0.69
1	29	10 yr	8593	5990	5960.45	6	5.15	192.8	0.001669	0.53
1	29	25 yr	8593	6720	6677.5	5.66	6.12	192.8	0.001201	0.46
1	29	50 yr	8593	7140	7088.38	5.53	6.65	192.8	0.001014	0.42
1	29	100 yr	8593	7340	7283.63	5.47	6.91	192.8	0.00094	0.4

Lemon Creek from tidewater to 350-ft above gorge bridge

Plan 3 Mining above Glacier Highway with RediMix Bridge in place

HEC-RAS Plan: 3bBrGr-5 River: lemon creek Reach: 1

Reach	River Sta	Profile	Cum Ch Len (ft)	Q Total (cfs)	Q Channel (cfs)	Vel Chnl (ft/s)	Hydr Depth C (ft)	Top W Act Chan (ft)	E.G. Slope (ft/ft)	Shear Chan (lb/sq ft)
1	30	2 yr	8659	3930	3859.99	10.74	5.89	61.06	0.008	2.9
1	30	5 yr (est)	8659	5140	4998.07	11.13	7.36	61.06	0.006374	2.89
1	30	10 yr	8659	5990	5784.33	11.32	8.37	61.06	0.005553	2.87
1	30	25 yr	8659	6720	6437.47	11.42	9.24	61.06	0.004956	2.82
1	30	50 yr	8659	7140	6802.44	11.44	9.74	61.06	0.004638	2.78
1	30	100 yr	8659	7340	6971.14	11.44	9.98	61.06	0.004486	2.76
1	31	2 yr	8877	3930	1821.26	9.21	8.04	24.6	0.003881	1.92
1	31	5 yr (est)	8877	5140	2091.81	9.1	9.34	24.6	0.003106	1.79
1	31	10 yr	8877	5990	2254.64	8.86	10.35	24.6	0.002567	1.64
1	31	25 yr	8877	6720	2484.75	9.52	10.61	24.6	0.002868	1.87
1	31	50 yr	8877	7140	2594.32	9.69	10.88	24.6	0.002873	1.93
1	31	100 yr	8877	7340	2645.17	9.76	11.02	24.6	0.002866	1.95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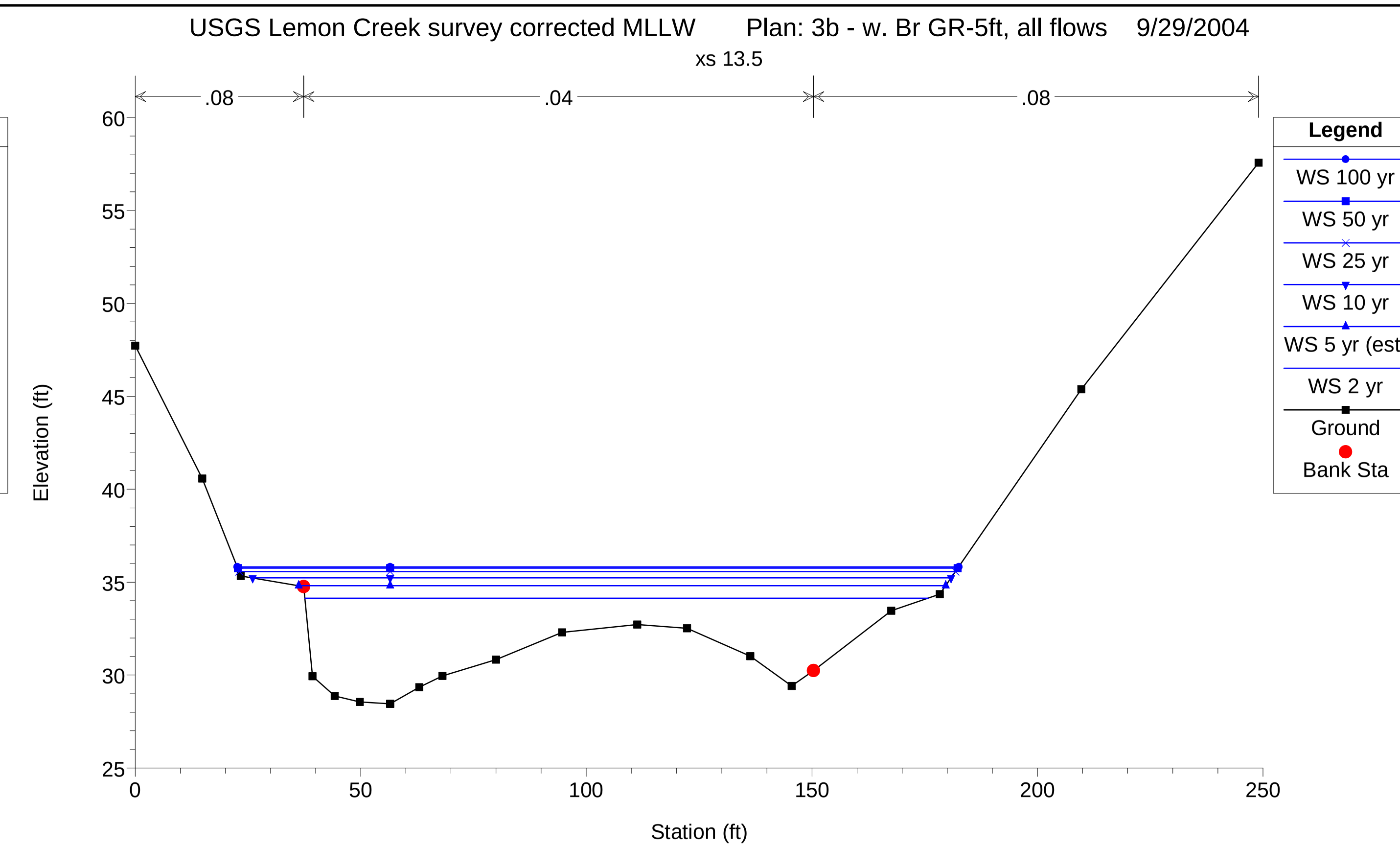
xs 14 cor n
.08
.045
.08
Elevation (ft)
Station (ft)
Legend
WS 100 yr
WS 50 yr
WS 25 yr
WS 10 yr
WS 5 yr (est)
WS 2 yr
Ground
Bank Sta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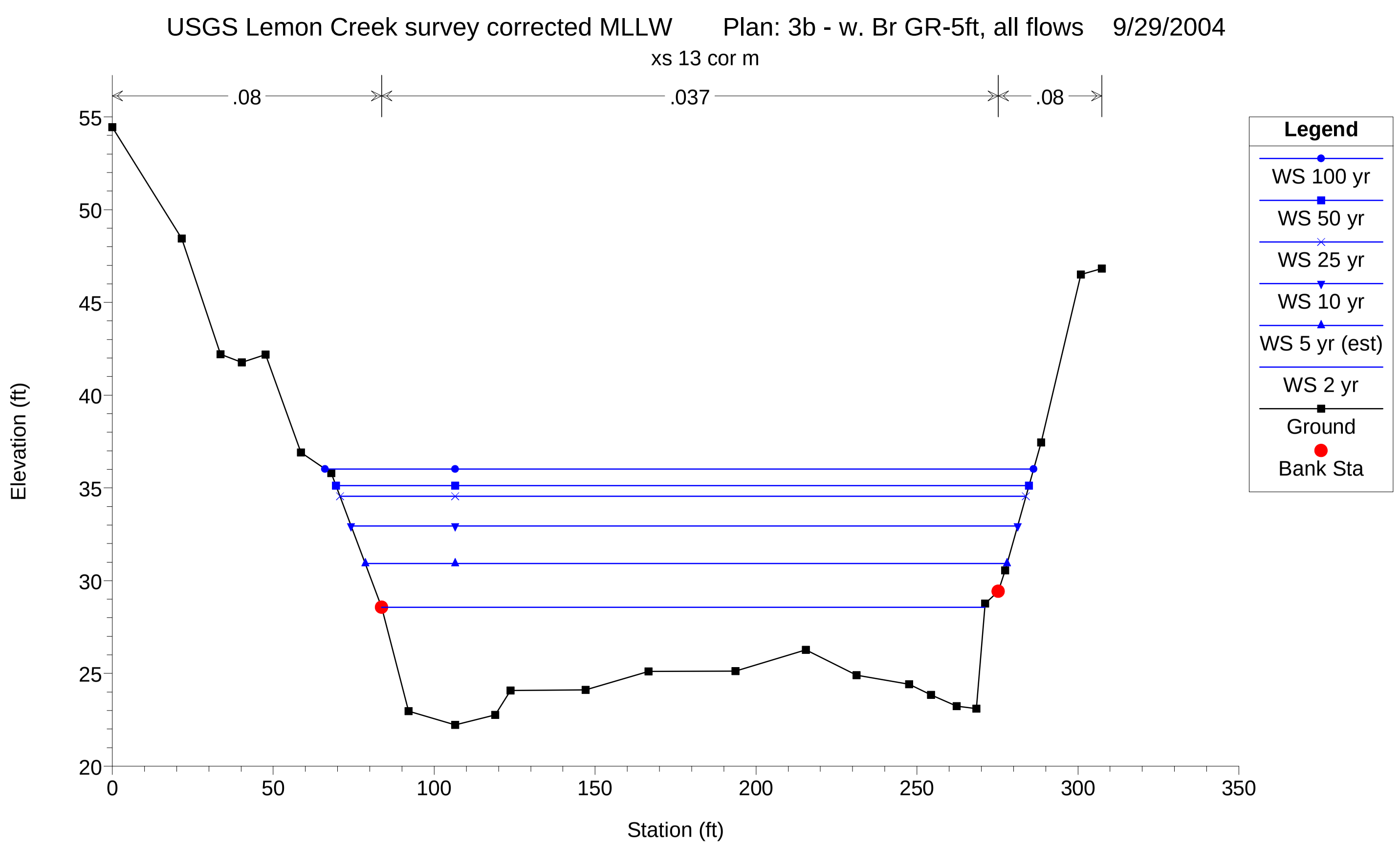
xs 13.5
.08
.04
.08
Elevation (ft)
Station (ft)
Legend
WS 100 yr
WS 50 yr
WS 25 yr
WS 10 yr
WS 5 yr (est)
WS 2 yr
Ground
Bank Sta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xs 13 cor m
.08
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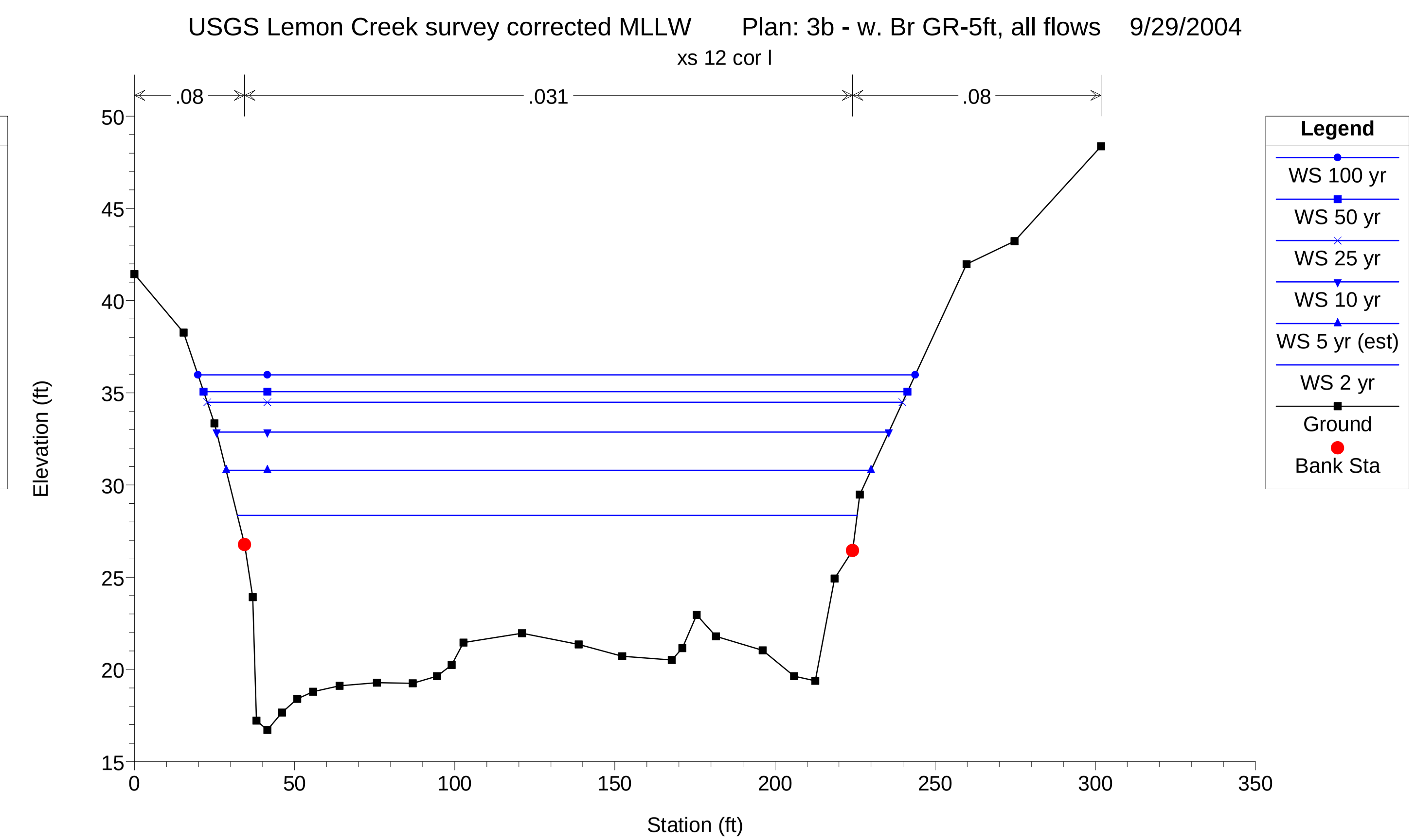
Elevation (ft)
Station (ft)
Legend
WS 100 yr
WS 50 yr
WS 25 yr
WS 10 yr
WS 5 yr (est)
WS 2 yr
Ground
Bank Sta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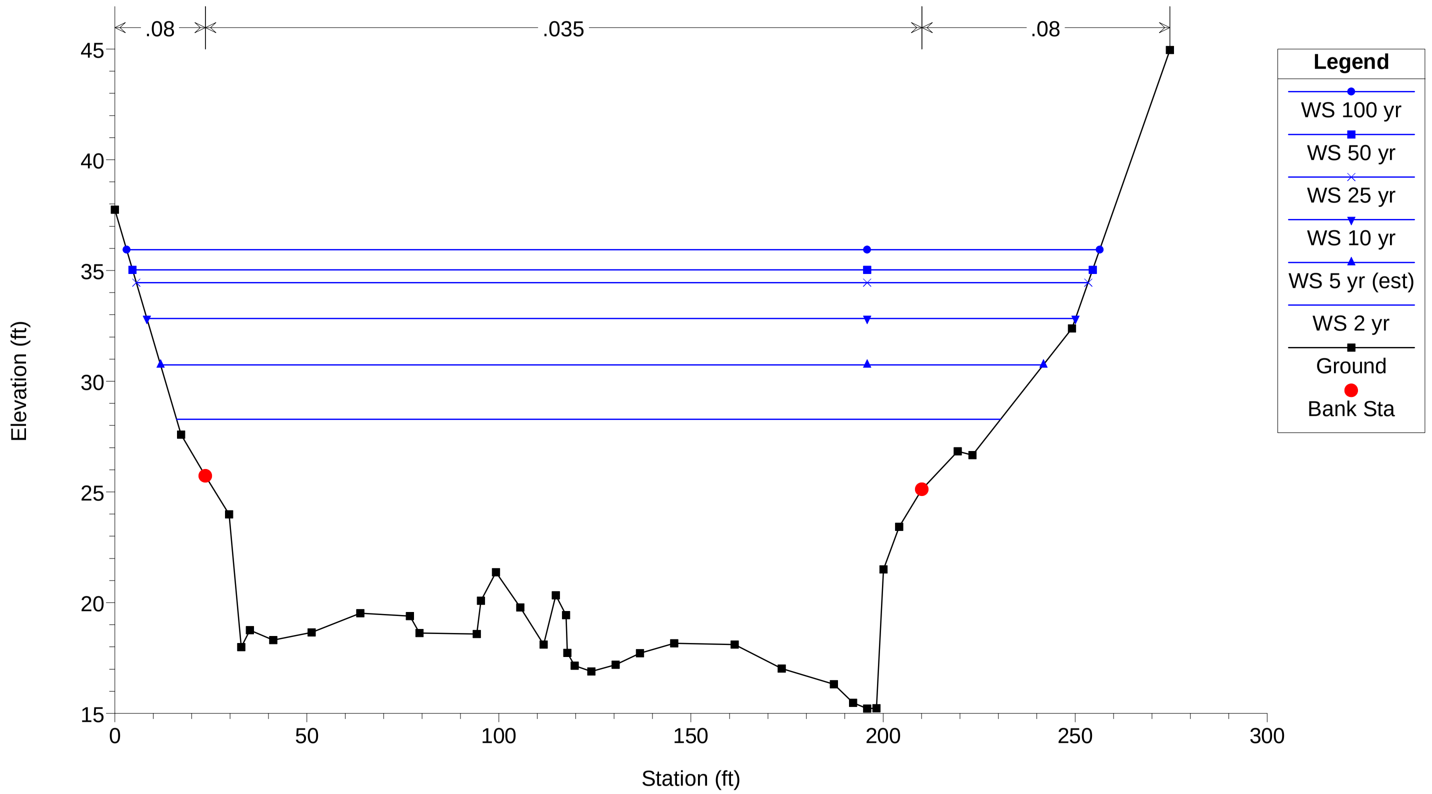
xs 12 cor l
.08
.031
.08
Elevation (ft)
Station (ft)
Legend
WS 100 yr
WS 50 yr
WS 25 yr
WS 10 yr
WS 5 yr (est)
WS 2 yr
Ground
Bank Sta

USGS Lemon Creek survey corrected MLLW   Plan: 3b - w. Br GR-5ft, all flows   9/29/2004

xs 11 cor k



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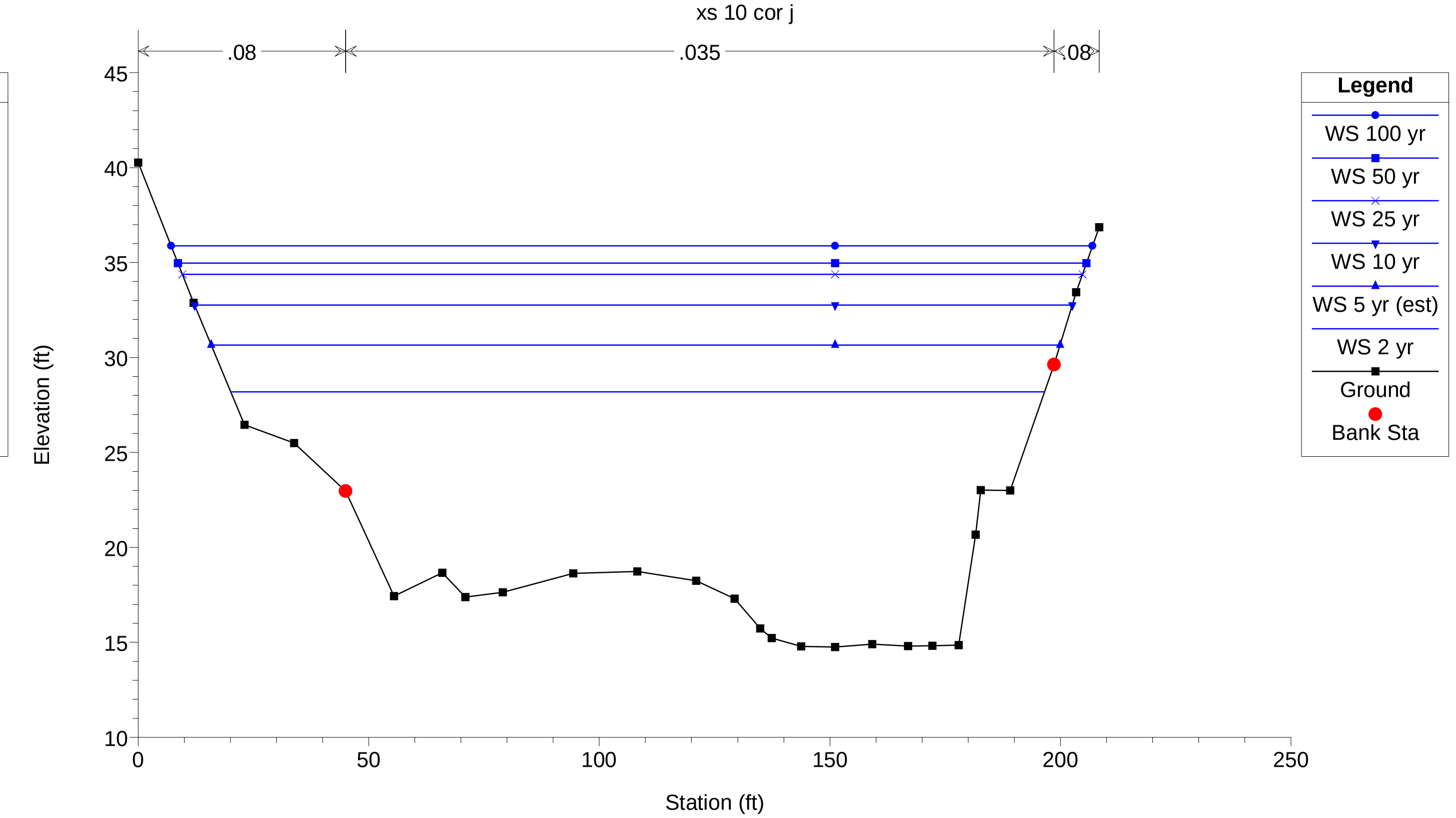
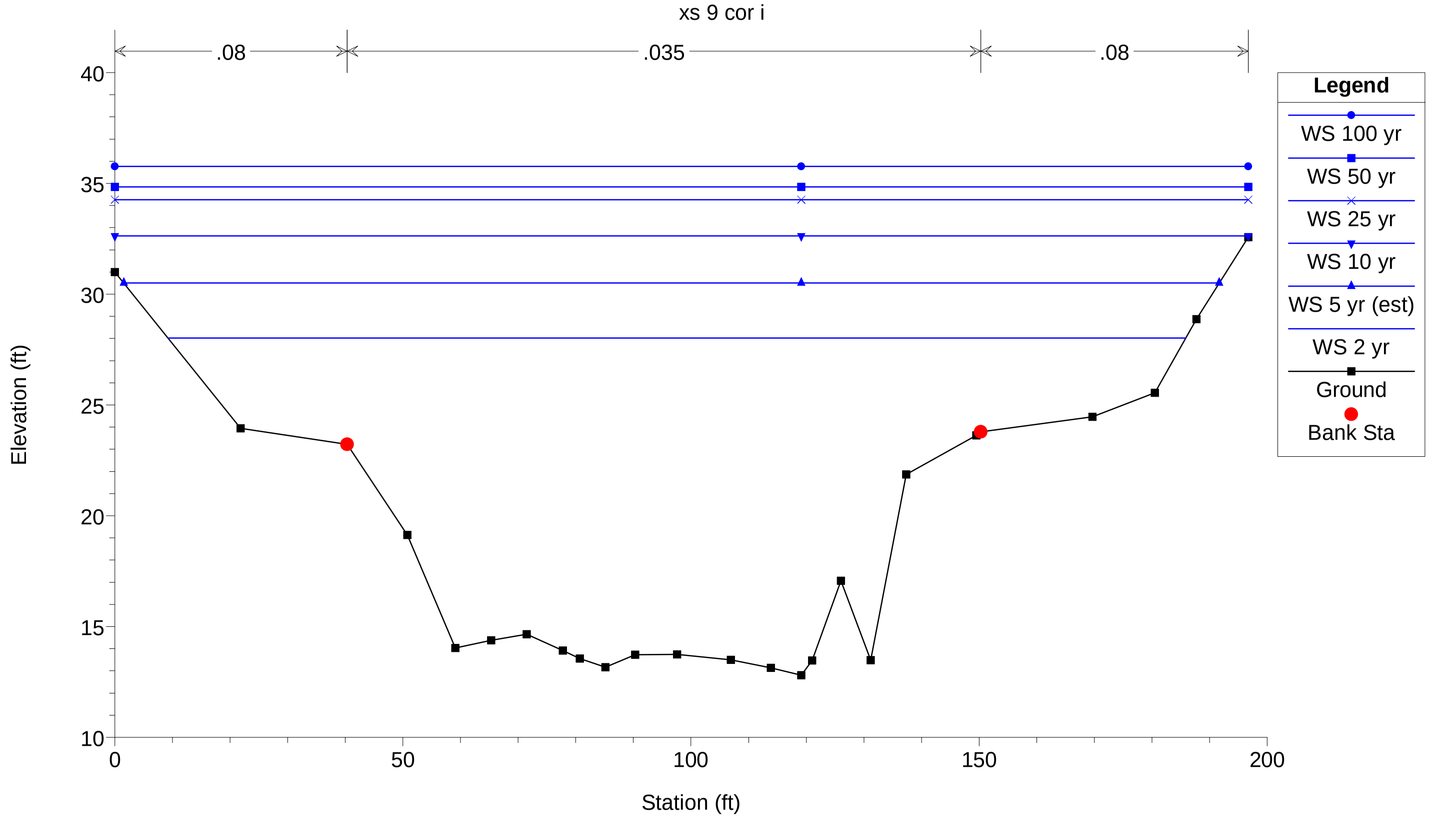
xs 10 cor j



USGS Lemon Creek survey corrected MLLW   Plan: 3b - w. Br GR-5ft, all flows   9/29/2004

xs 9 cor i



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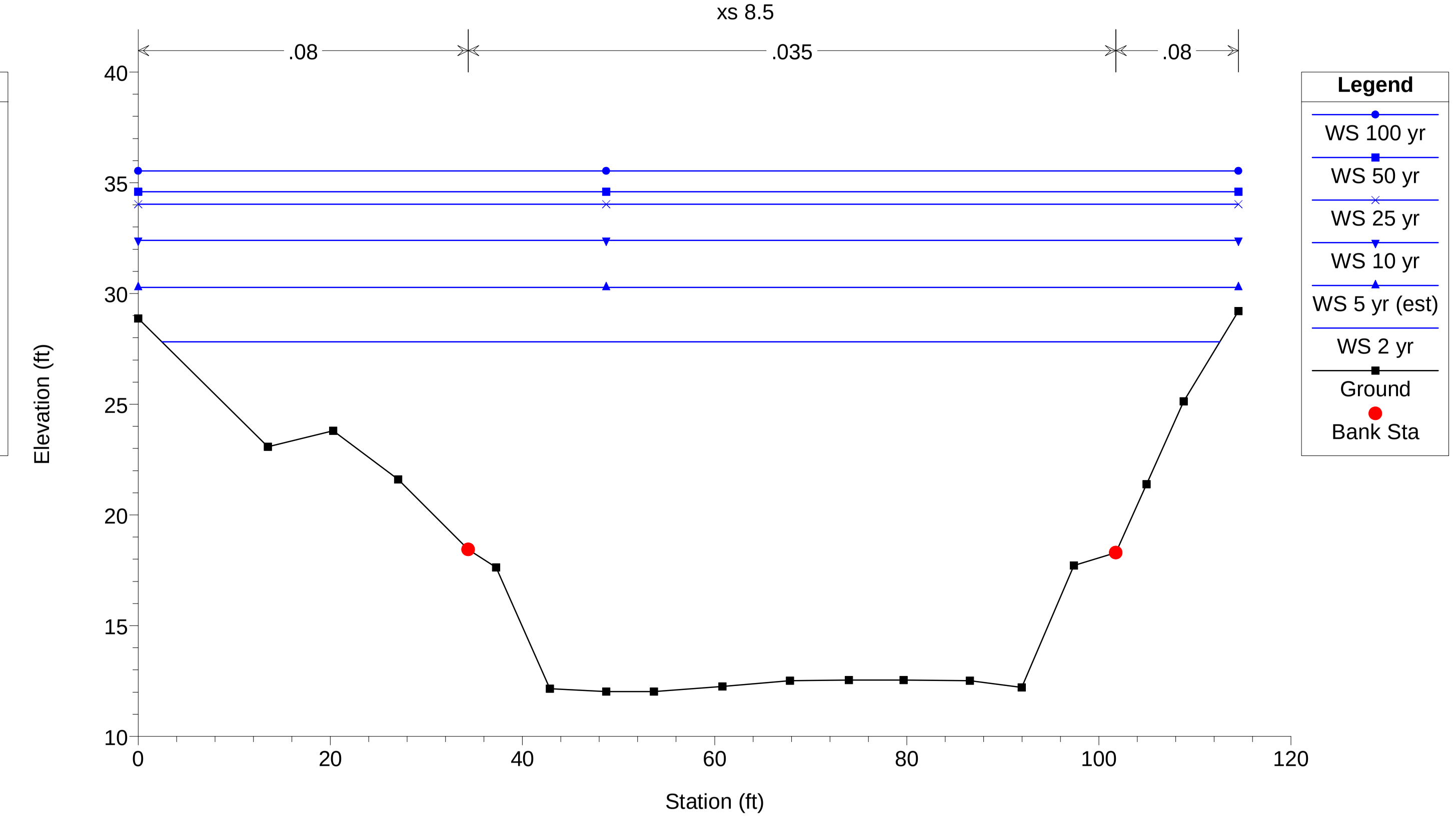
xs 8.5



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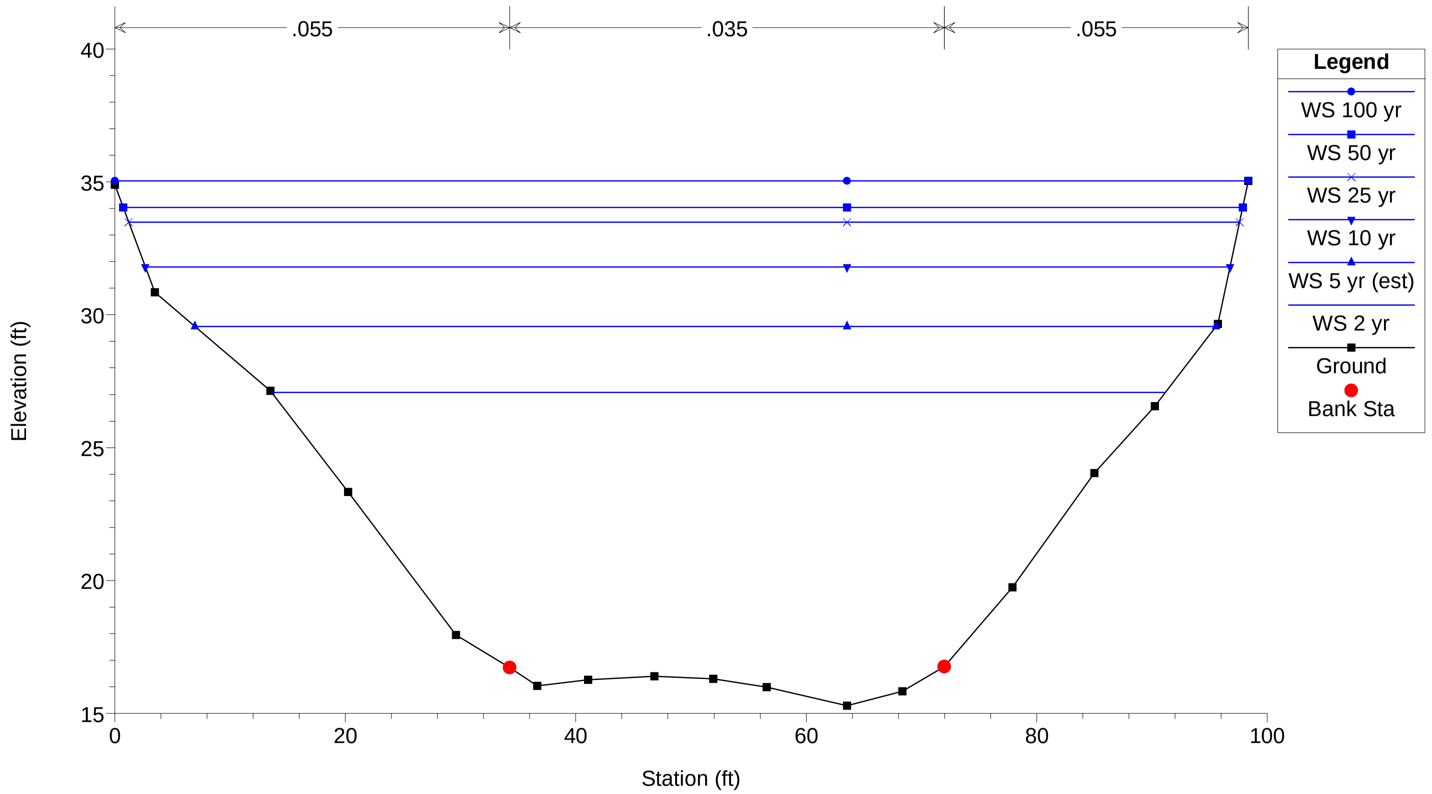
xs 8 cor h



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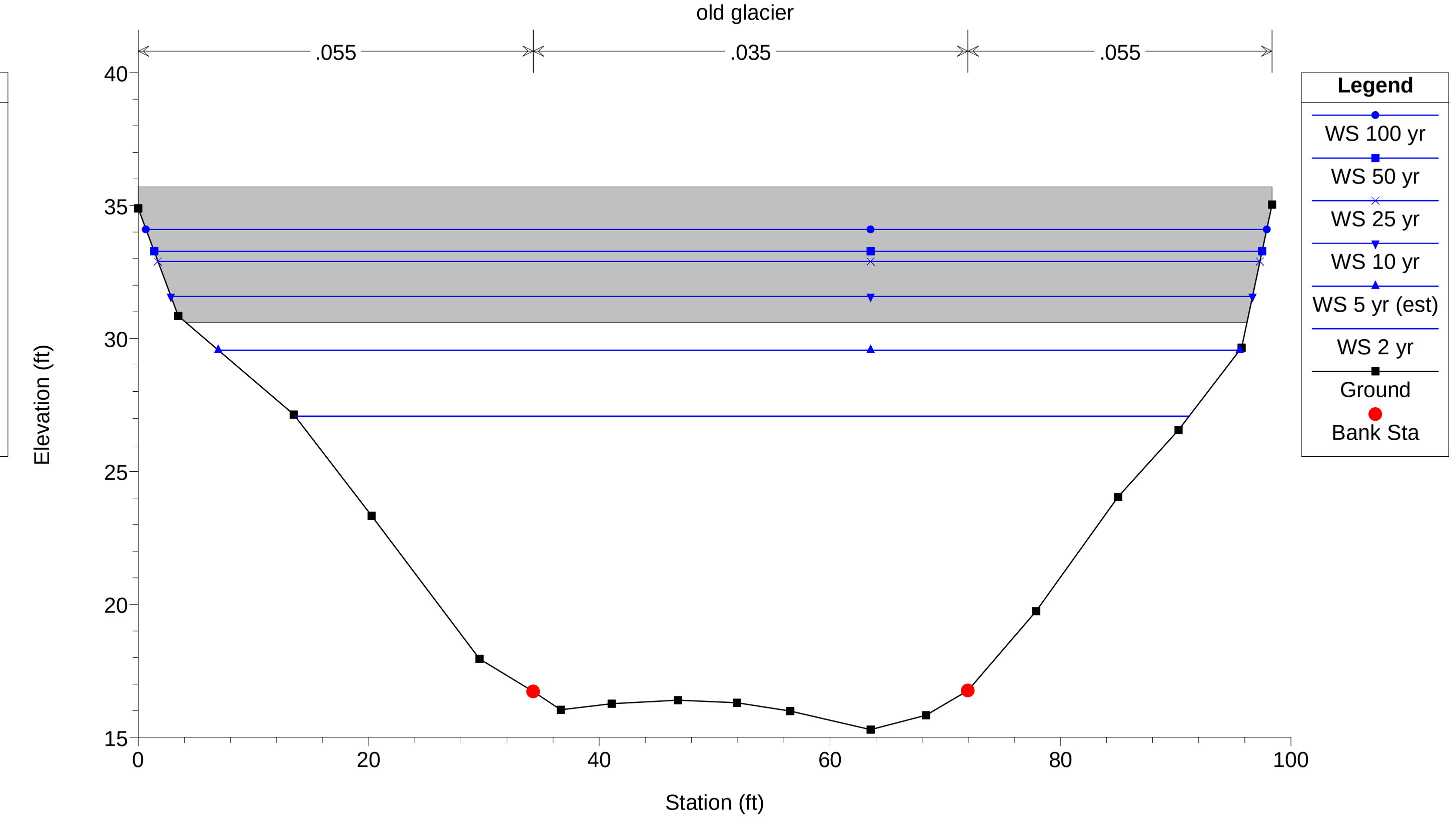
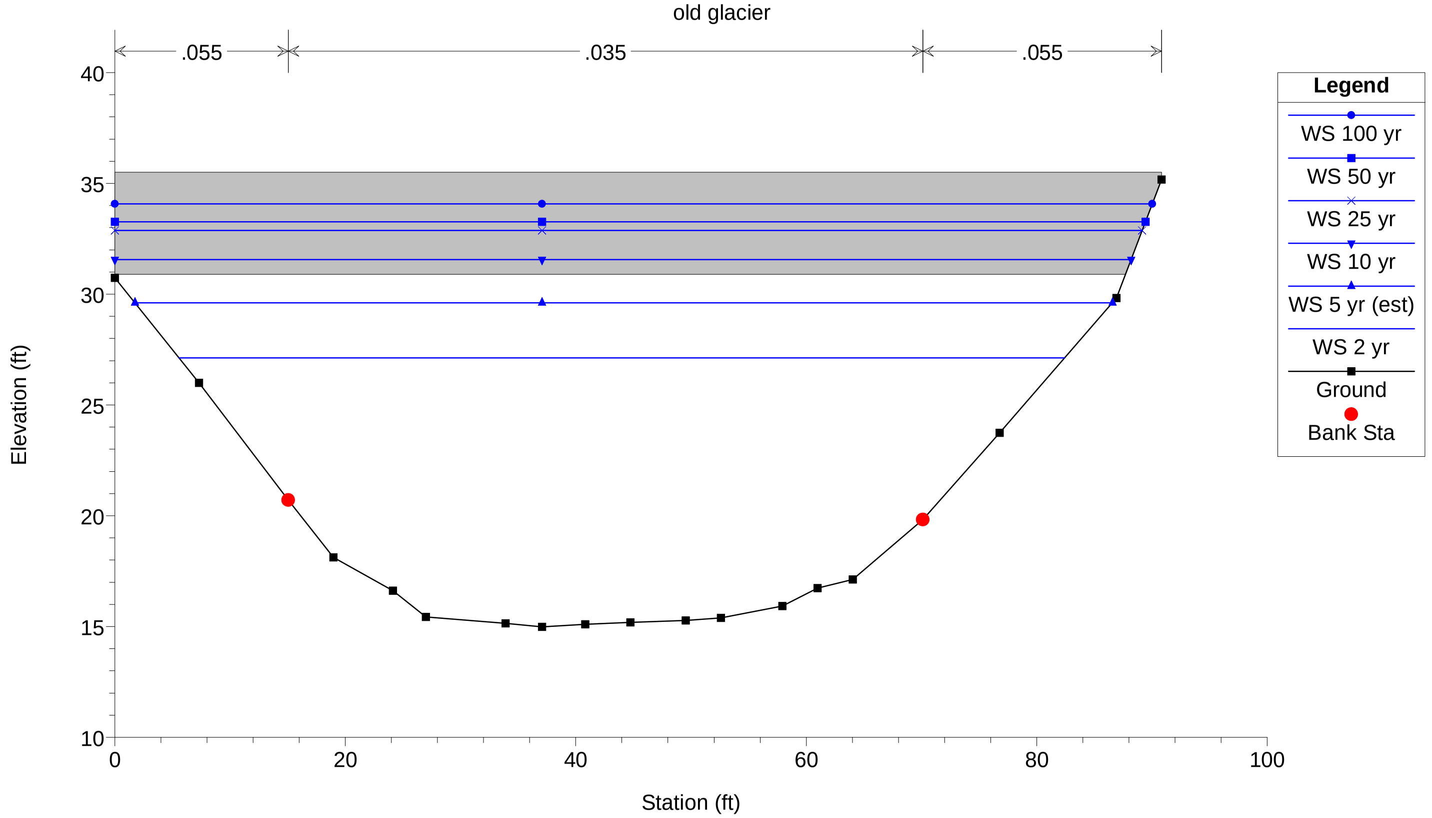
old glacier



USGS Lemon Creek survey corrected MLLW Plan: 3b - w. Br GR-5ft, all flows 9/29/2004
old glacier



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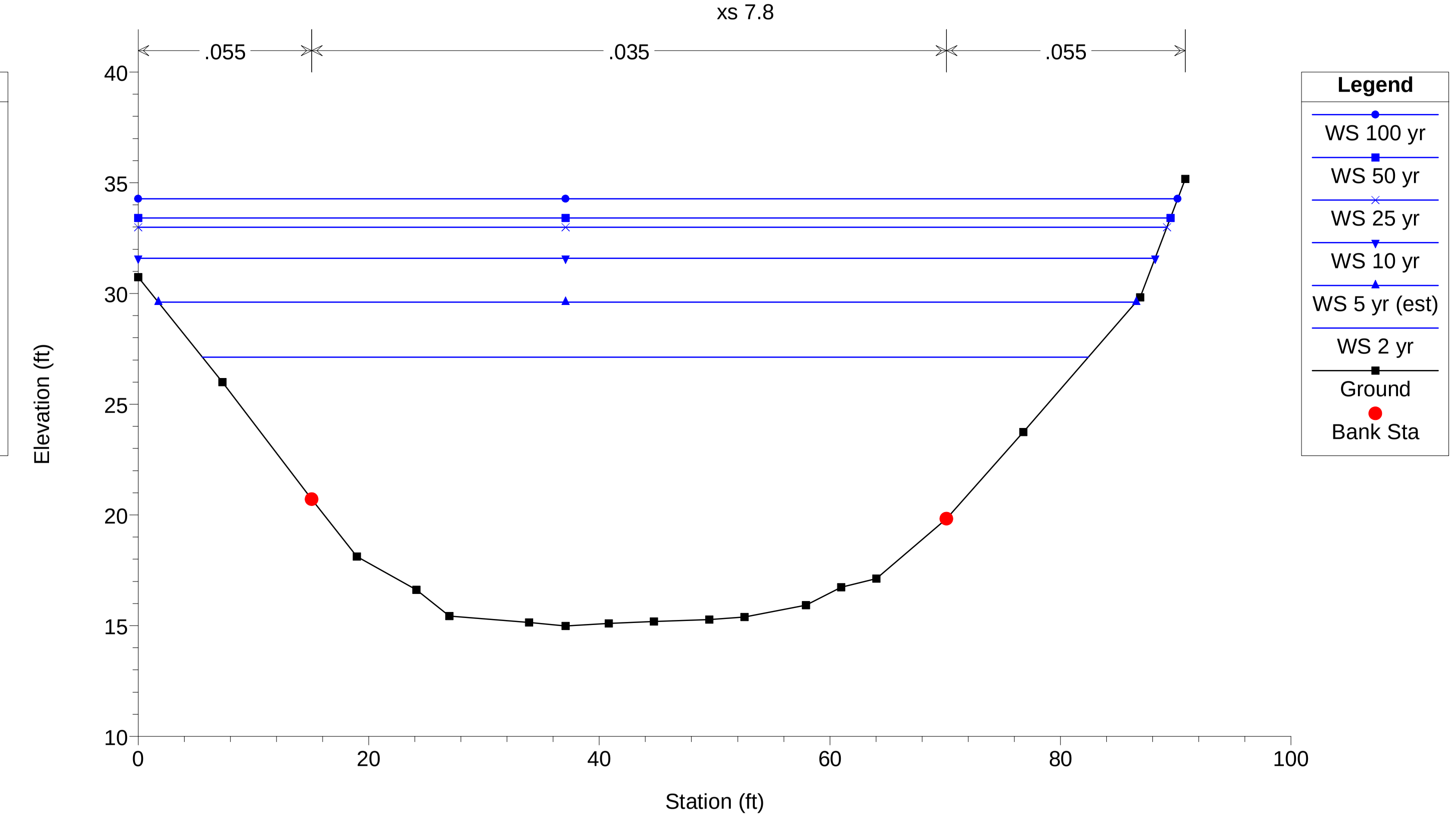
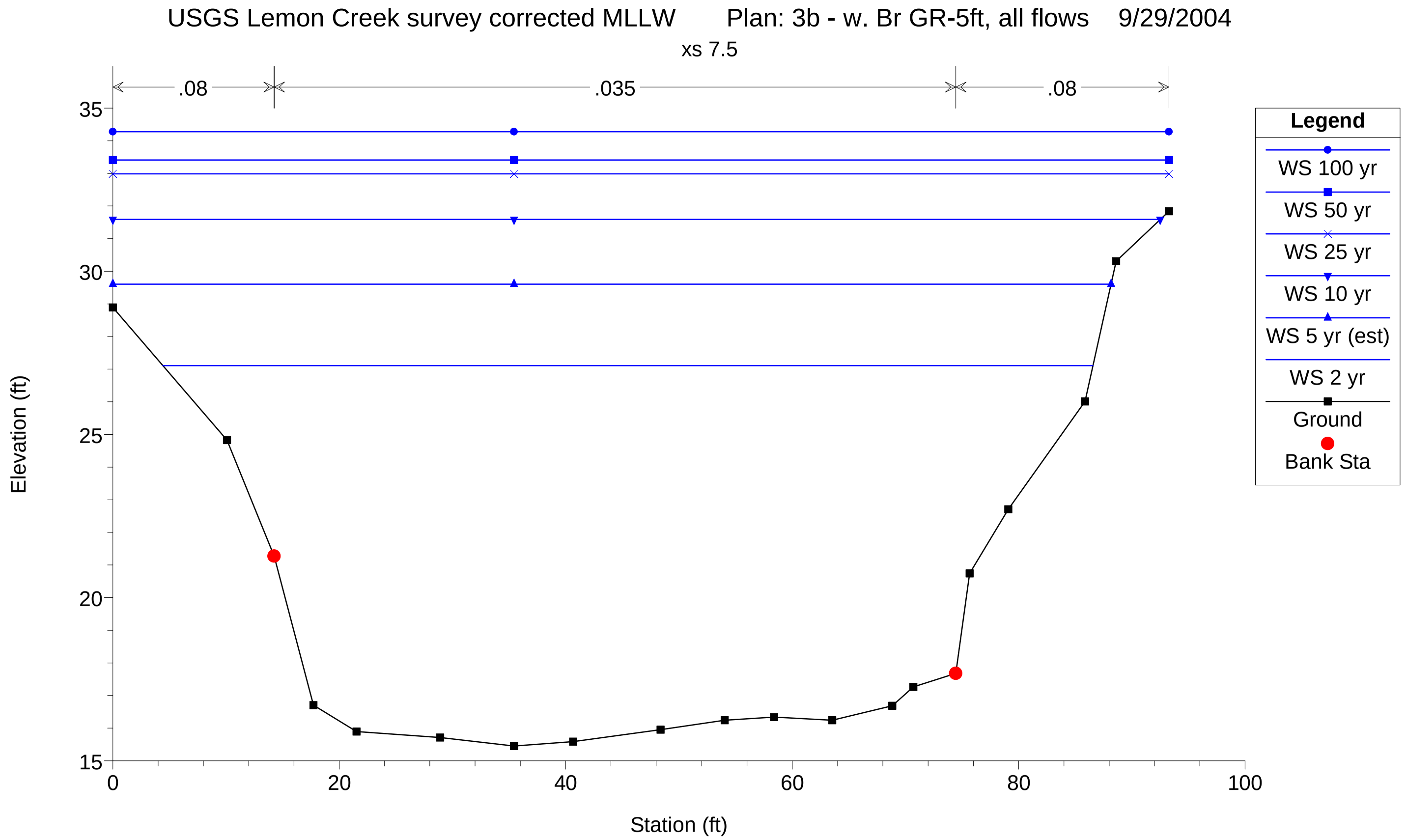
xs 7.8

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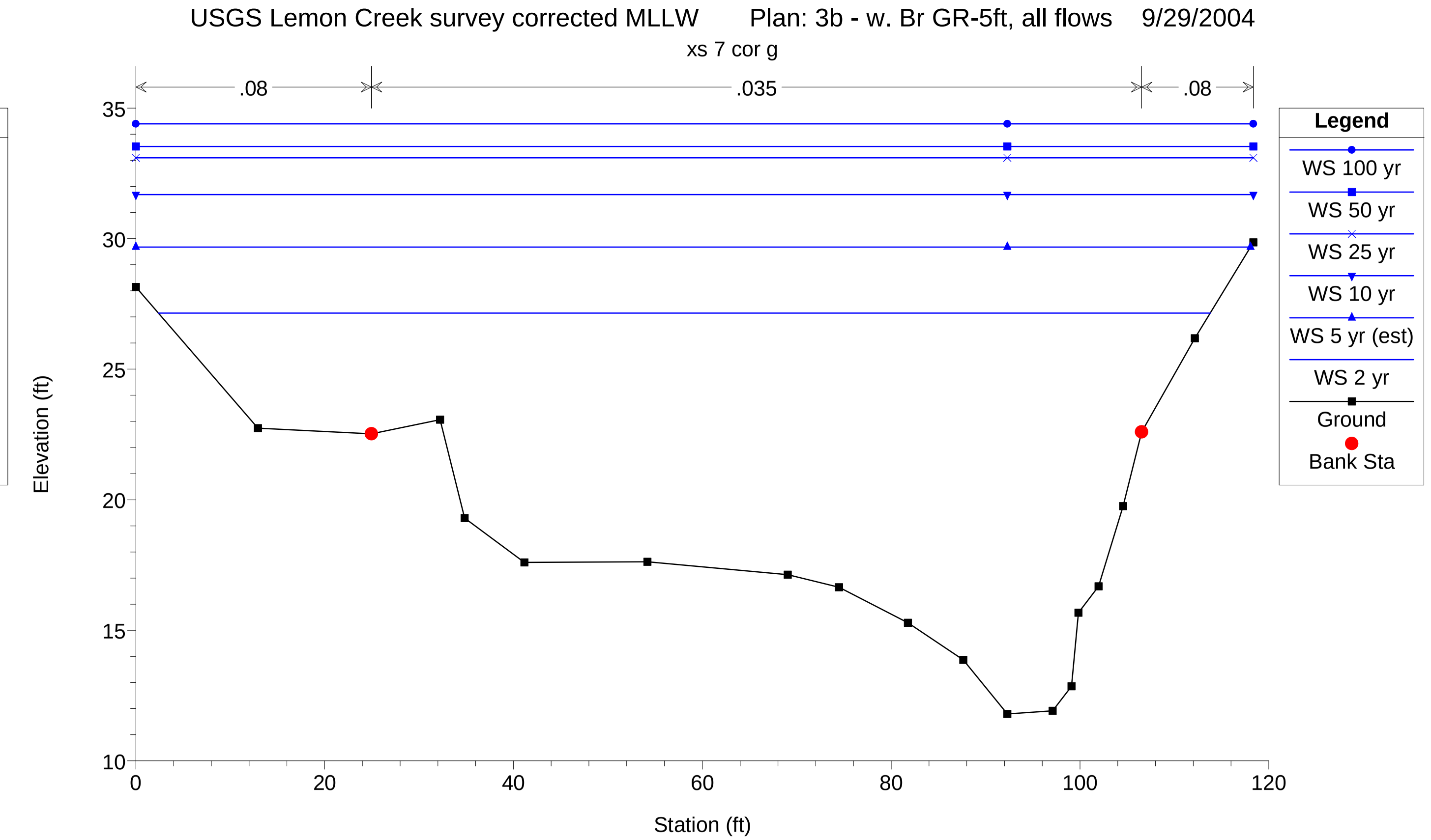
xs 7.5
.08
.035
.08
Legend
WS 100 yr
WS 50 yr
WS 25 yr
WS 10 yr
WS 5 yr (est)
WS 2 yr
Ground
Bank Sta
Elevation (ft)
Station (ft)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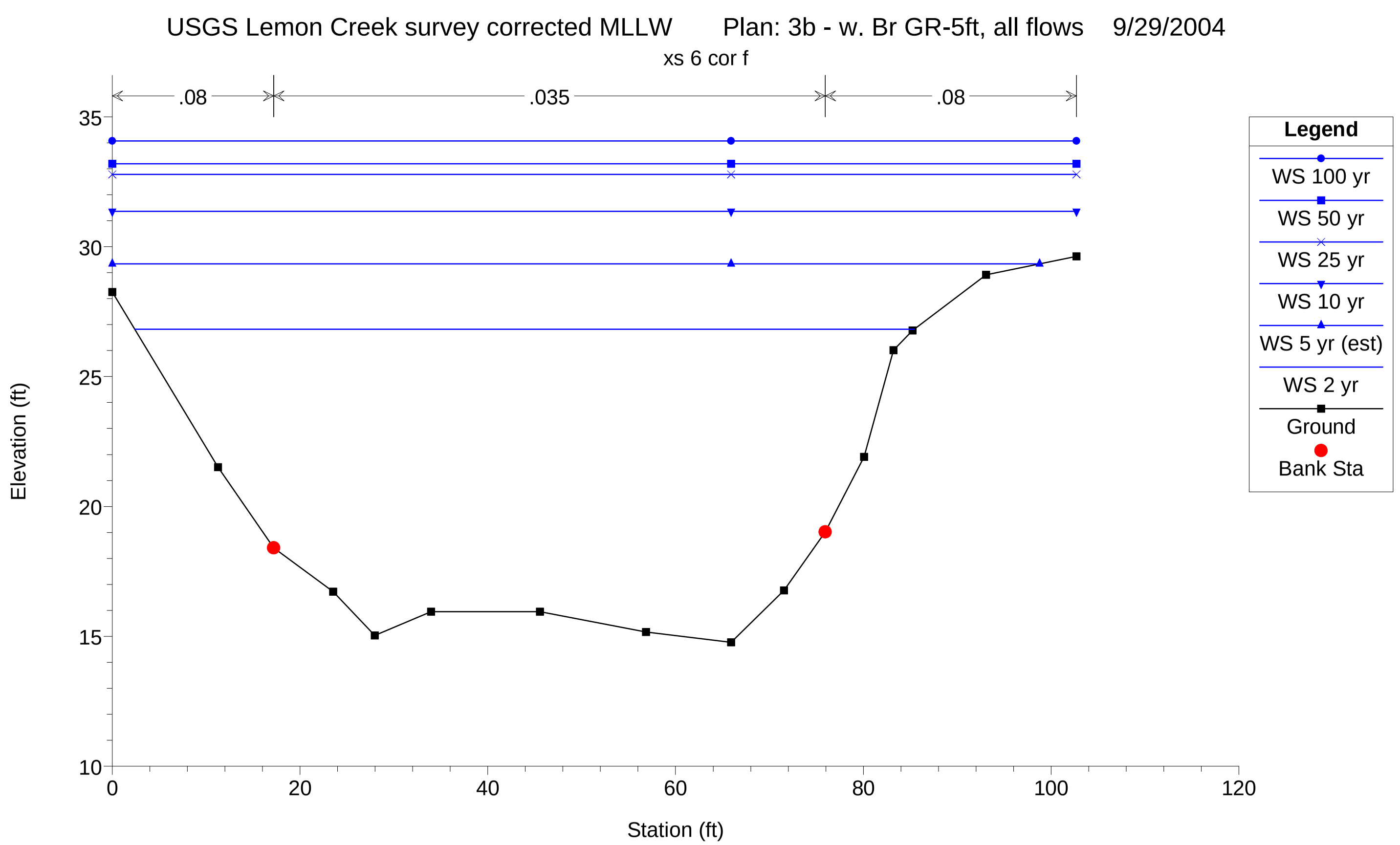
xs 7 cor g
.08
.035
.08
Legend
WS 100 yr
WS 50 yr
WS 25 yr
WS 10 yr
WS 5 yr (est)
WS 2 yr
Ground
Bank Sta
Elevation (ft)
Station (ft)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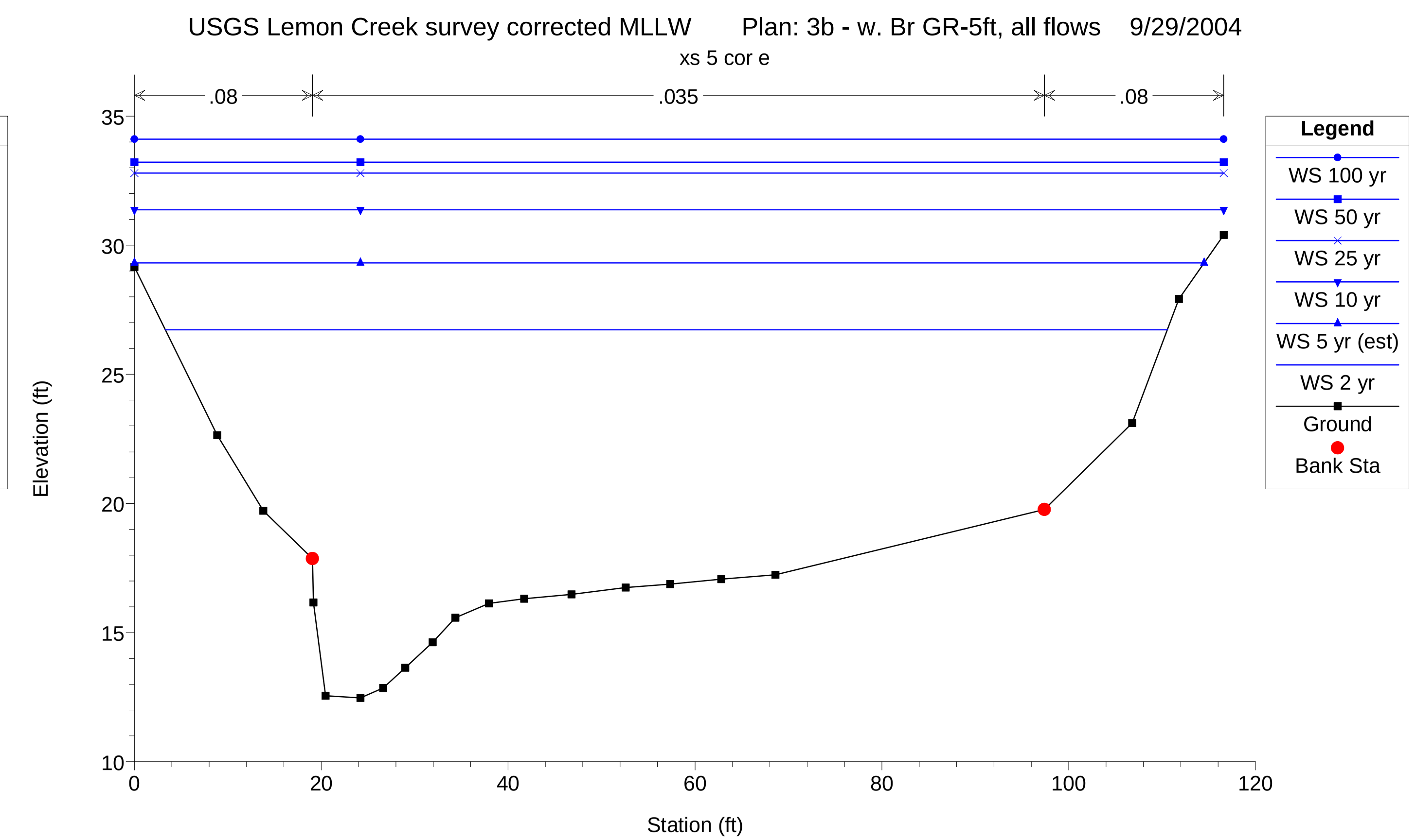
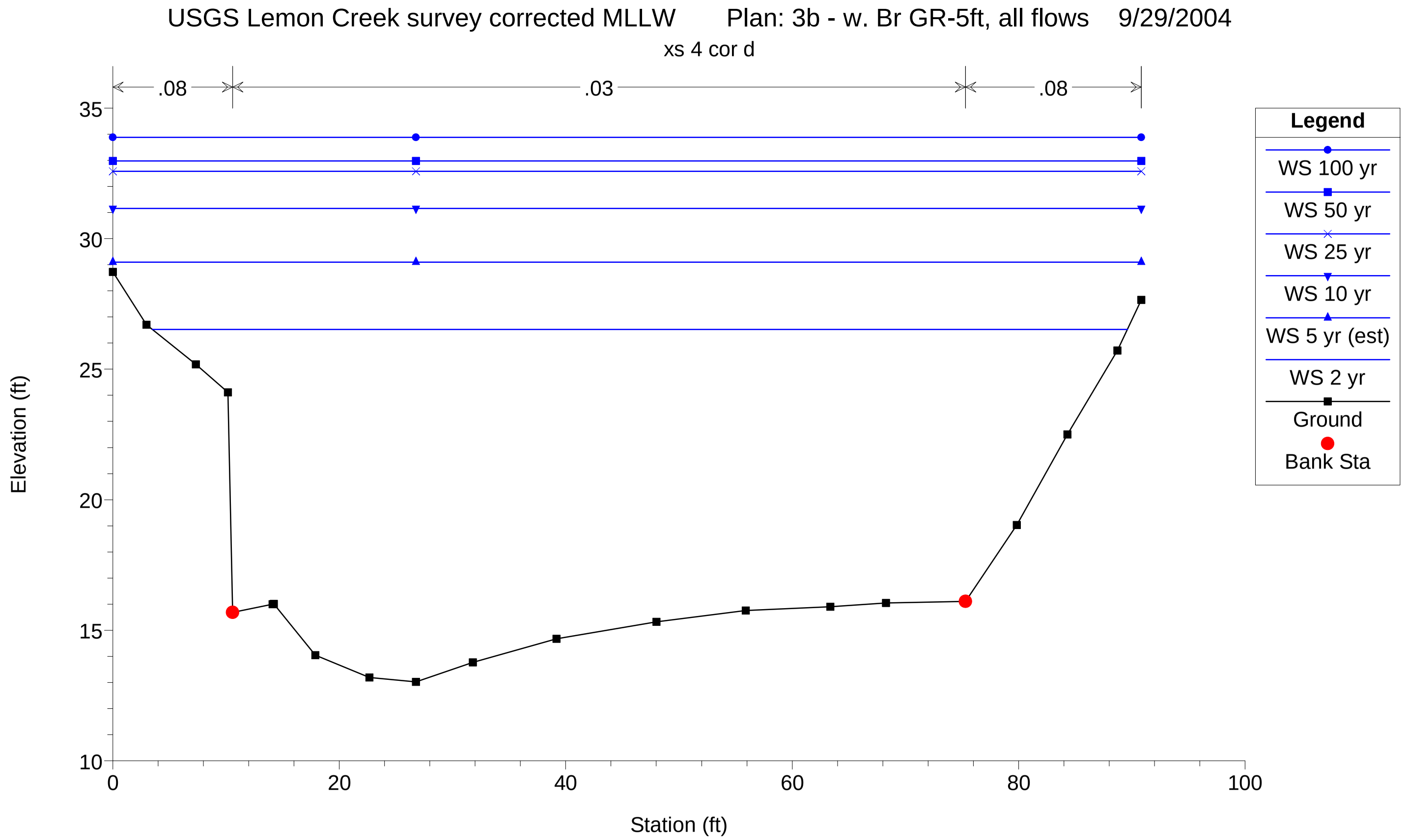
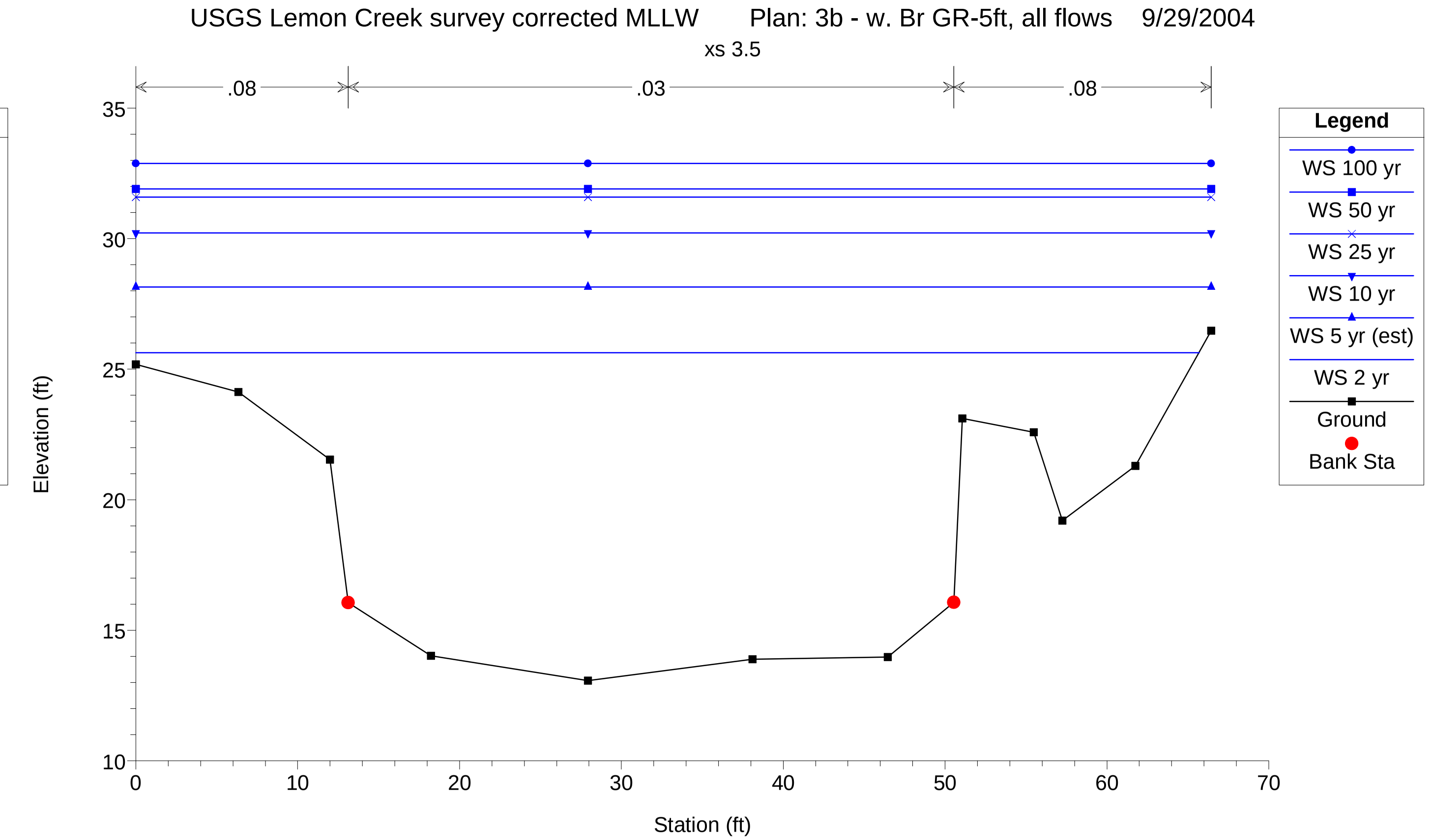
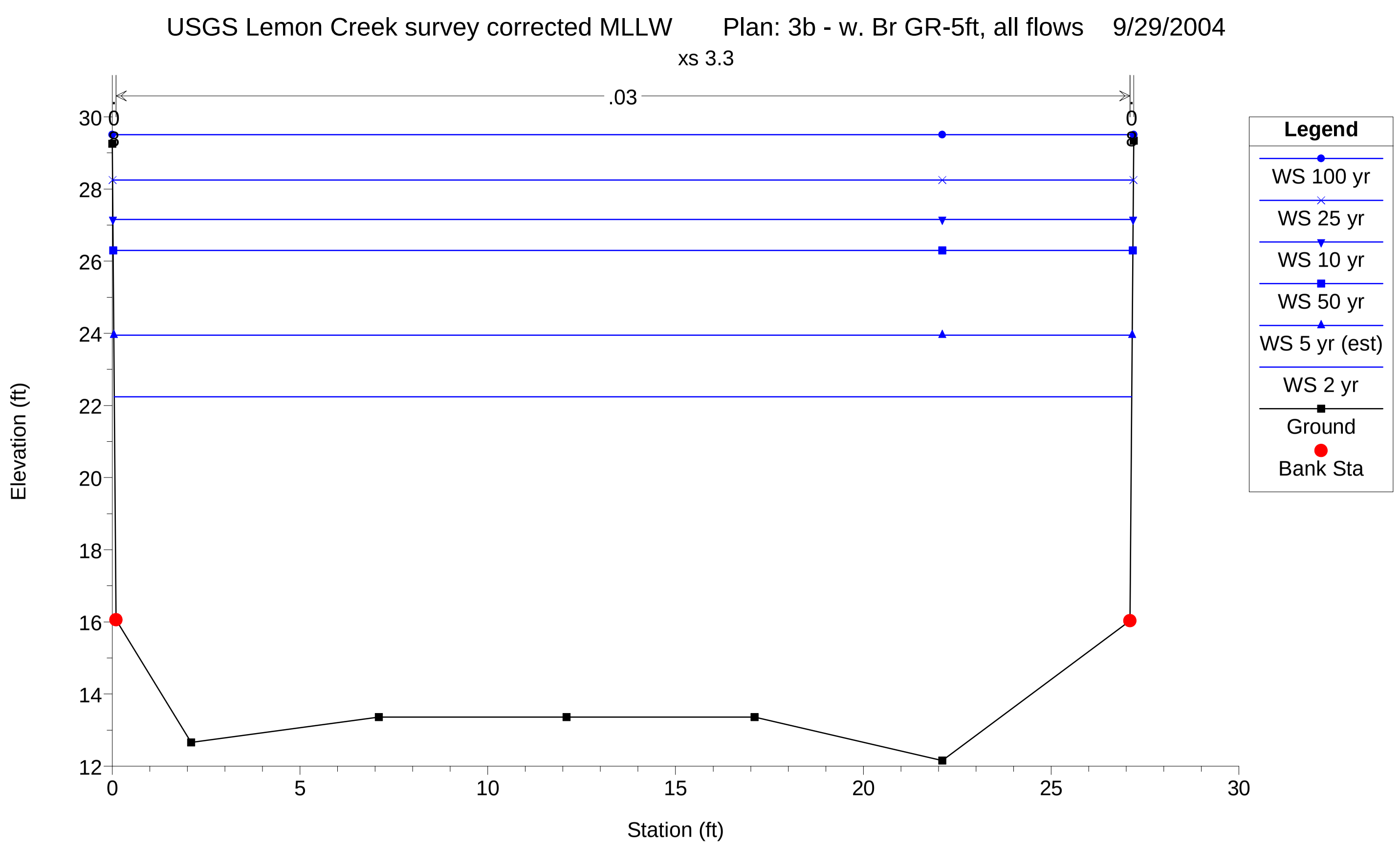
xs 6 cor f
.08
.035
.08
Legend
WS 100 yr
WS 50 yr
WS 25 yr
WS 10 yr
WS 5 yr (est)
WS 2 yr
Ground
Bank Sta
Elevation (ft)
Station (ft)


USGS Lemon Creek survey corrected MLLW Plan: 3b - w. Br GR-5ft, all flows 9/29/2004
xs 5 cor e
.08
.035
.08
Legend
WS 100 yr
WS 50 yr
WS 25 yr
WS 10 yr
WS 5 yr (est)
WS 2 yr
Ground
Bank Sta
Elevation (ft)
Station (ft)


USGS Lemon Creek survey corrected MLLW Plan: 3b - w. Br GR-5ft, all flows 9/29/2004
xs 4 cor d
.08
.03
.08
Elevation (ft)
Station (ft)
Legend
WS 100 yr
WS 50 yr
WS 25 yr
WS 10 yr
WS 5 yr (est)
WS 2 yr
Ground
Bank Sta


USGS Lemon Creek survey corrected MLLW Plan: 3b - w. Br GR-5ft, all flows 9/29/2004
xs 3.5
.08
.03
.08
Elevation (ft)
Station (ft)
Legend
WS 100 yr
WS 50 yr
WS 25 yr
WS 10 yr
WS 5 yr (est)
WS 2 yr
Ground
Bank Sta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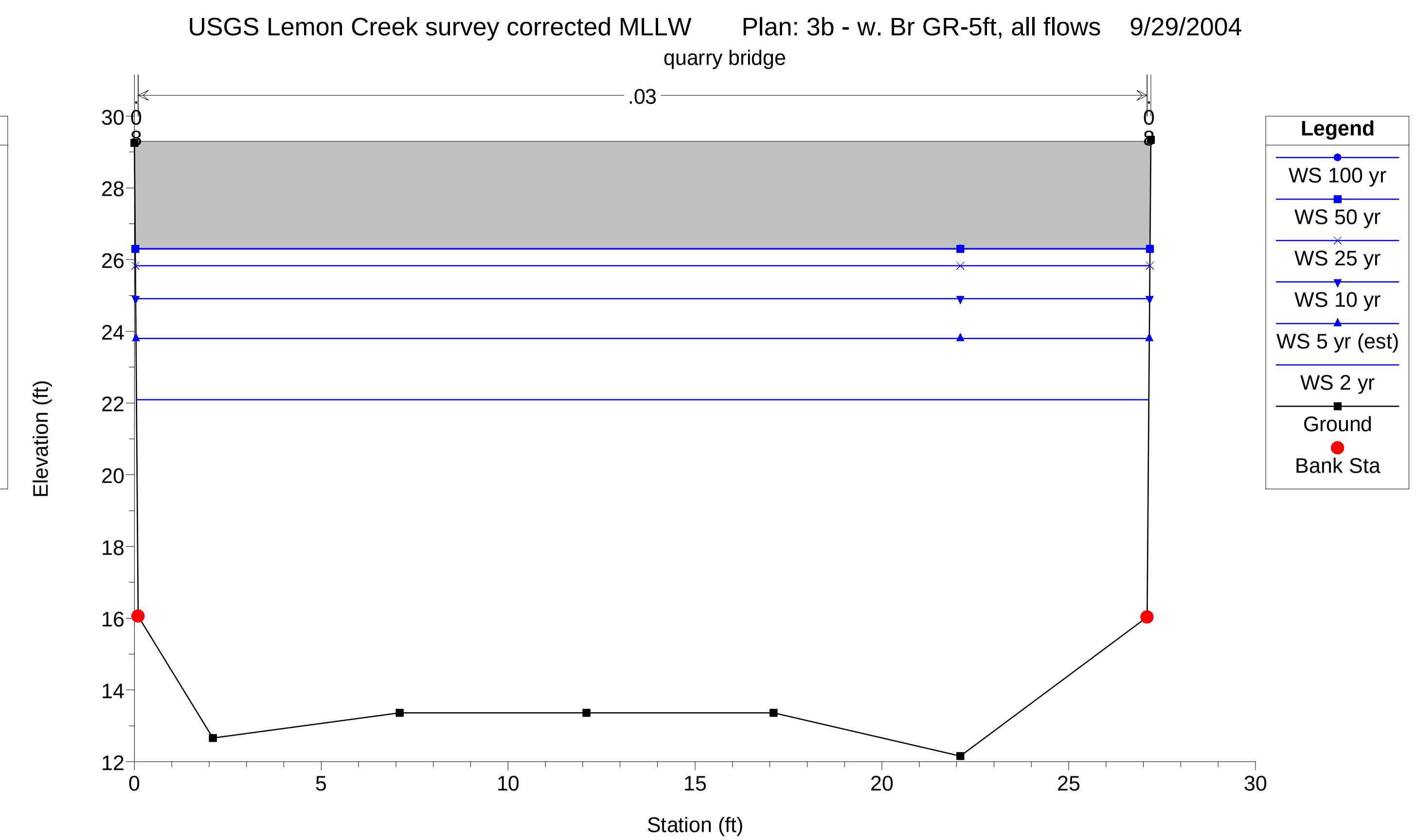
xs 3.3
.03
Elevation (ft)
Station (ft)
Legend
WS 100 yr
WS 25 yr
WS 10 yr
WS 50 yr
WS 5 yr (est)
WS 2 yr
Ground
Bank Sta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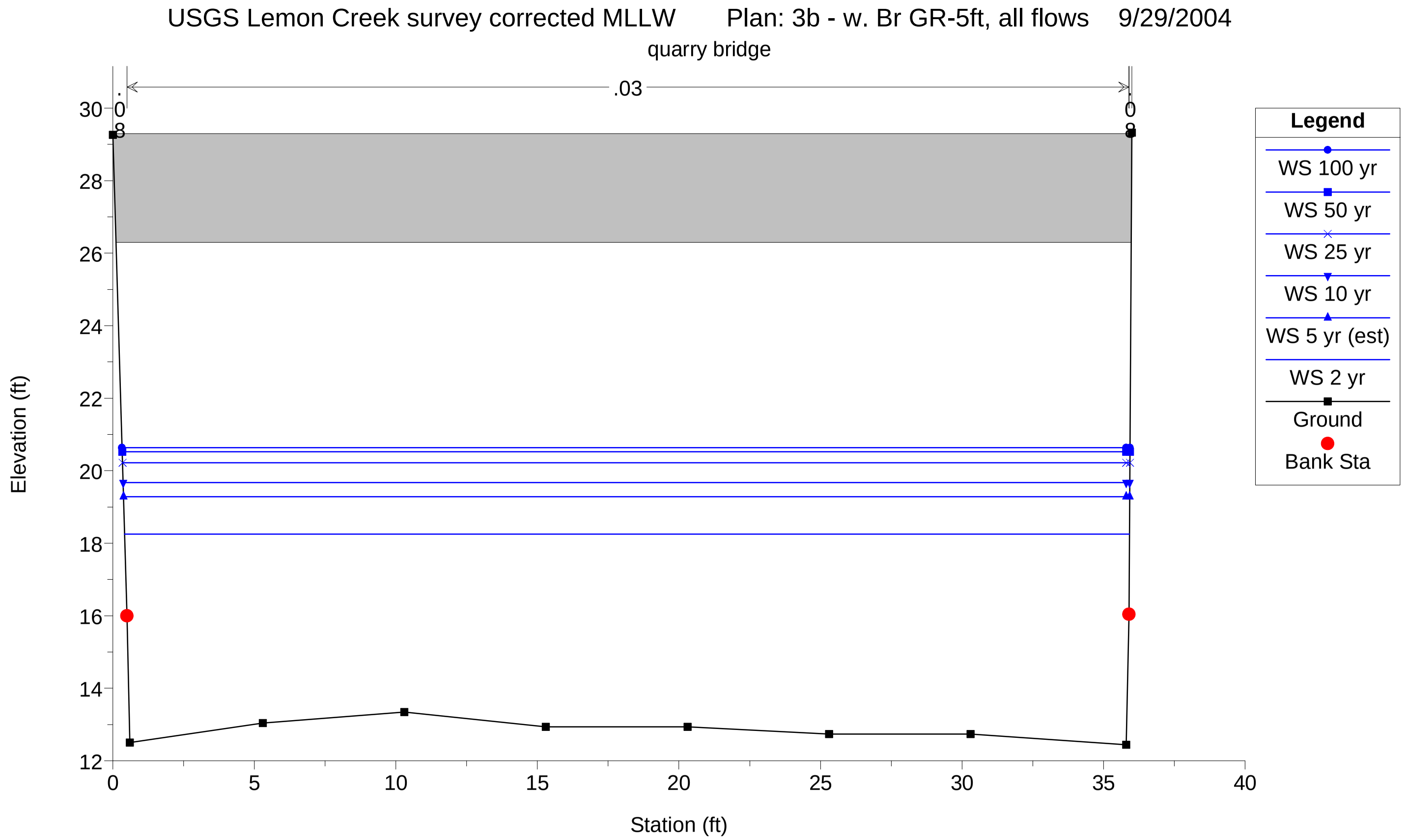
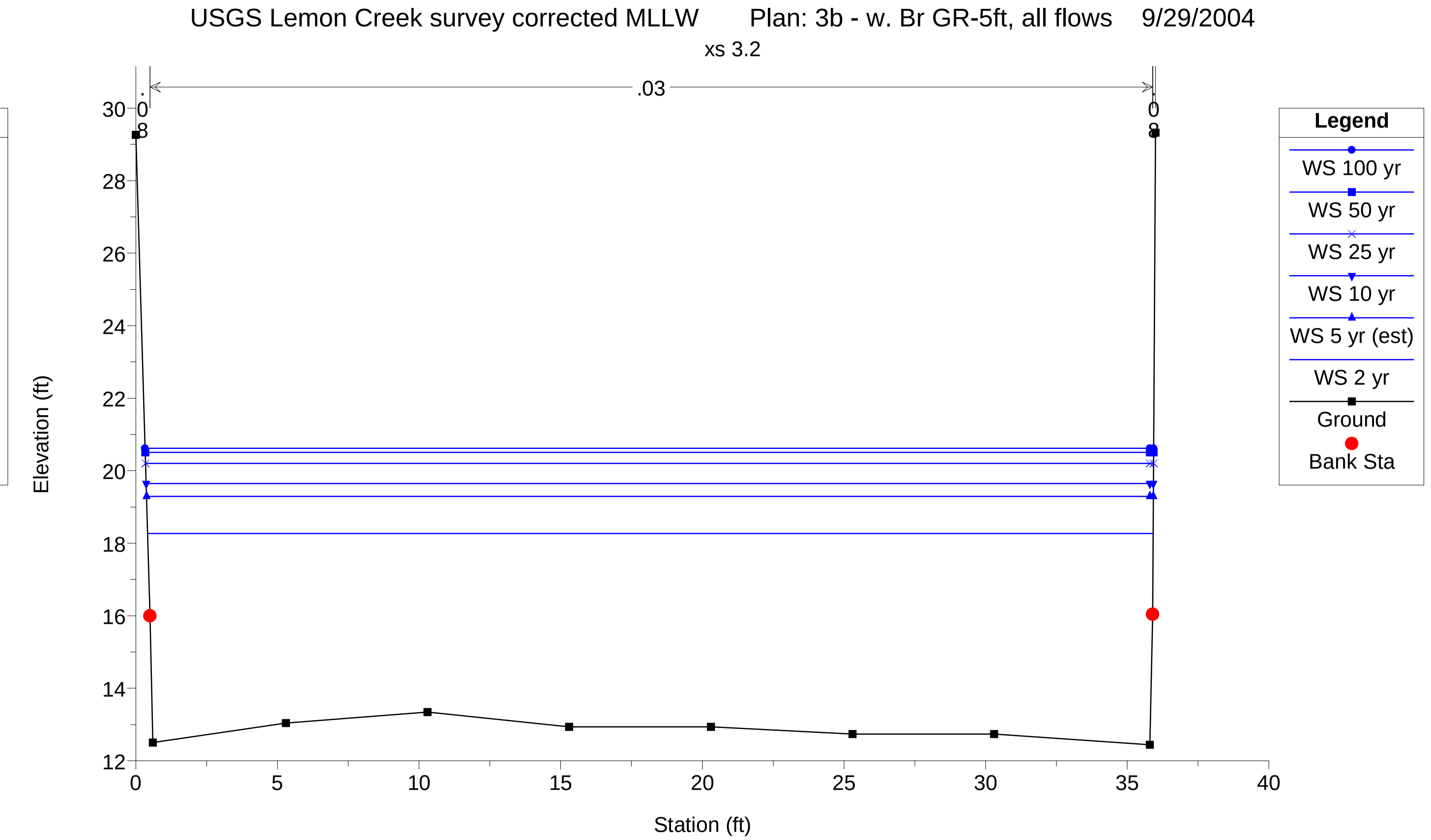
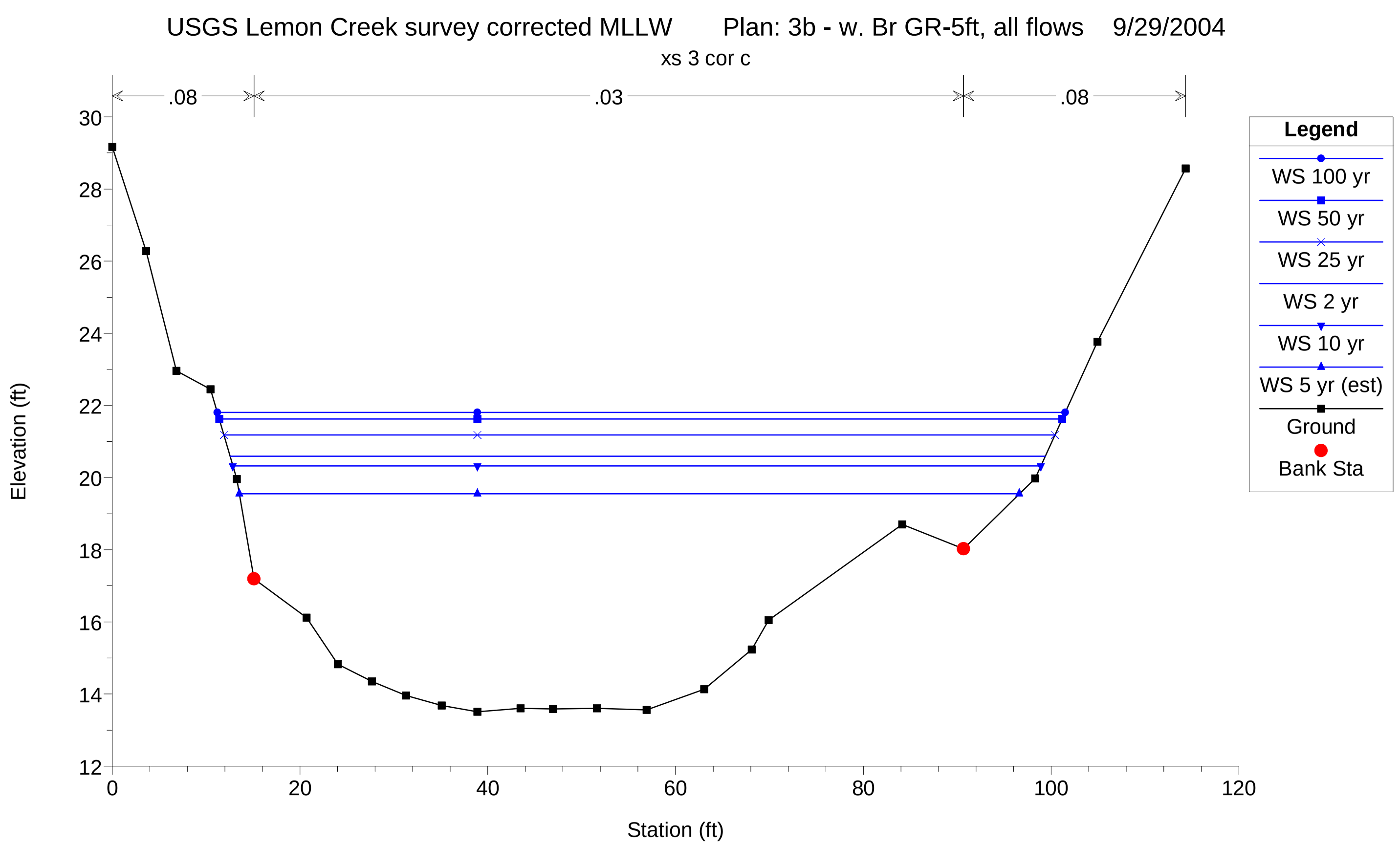
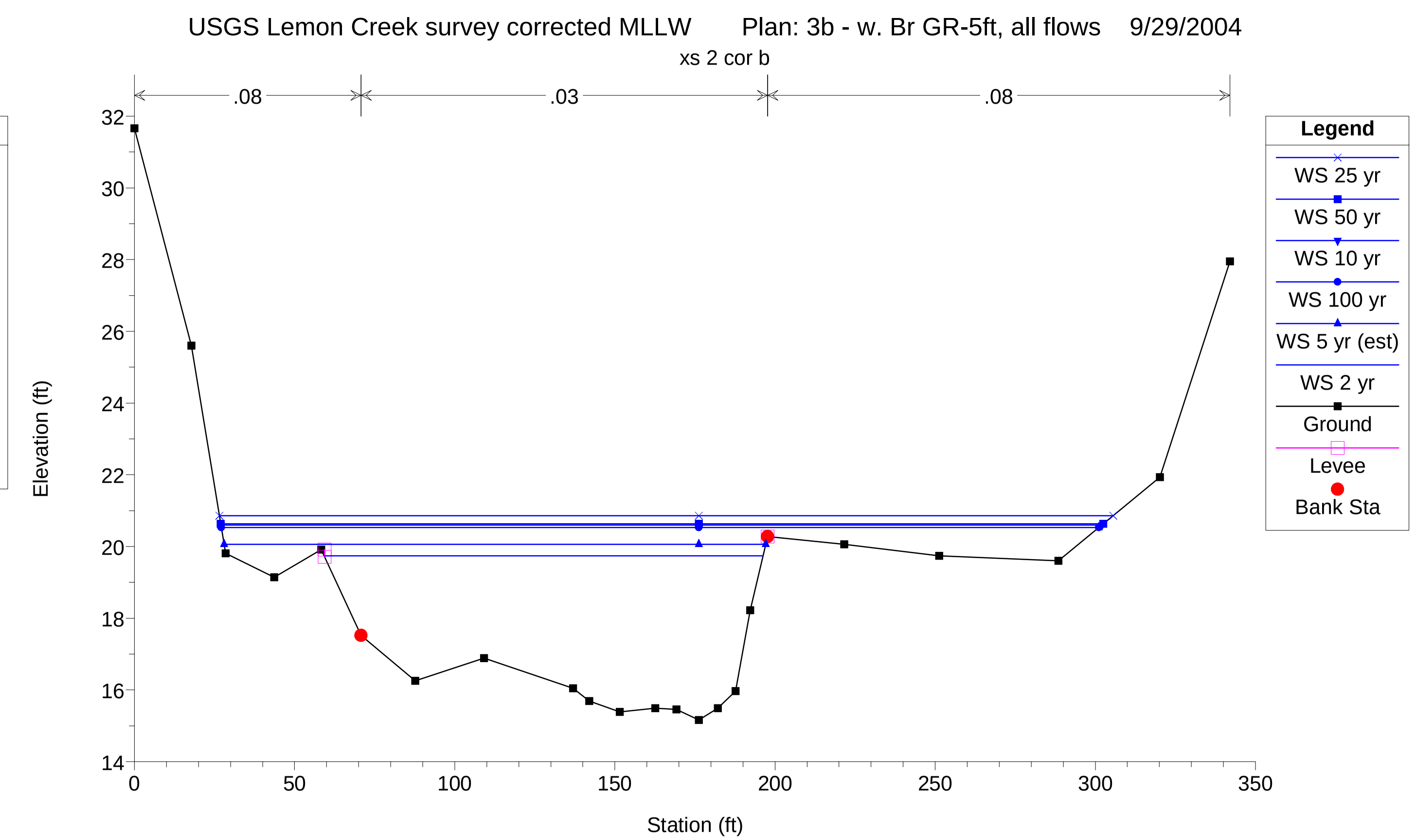
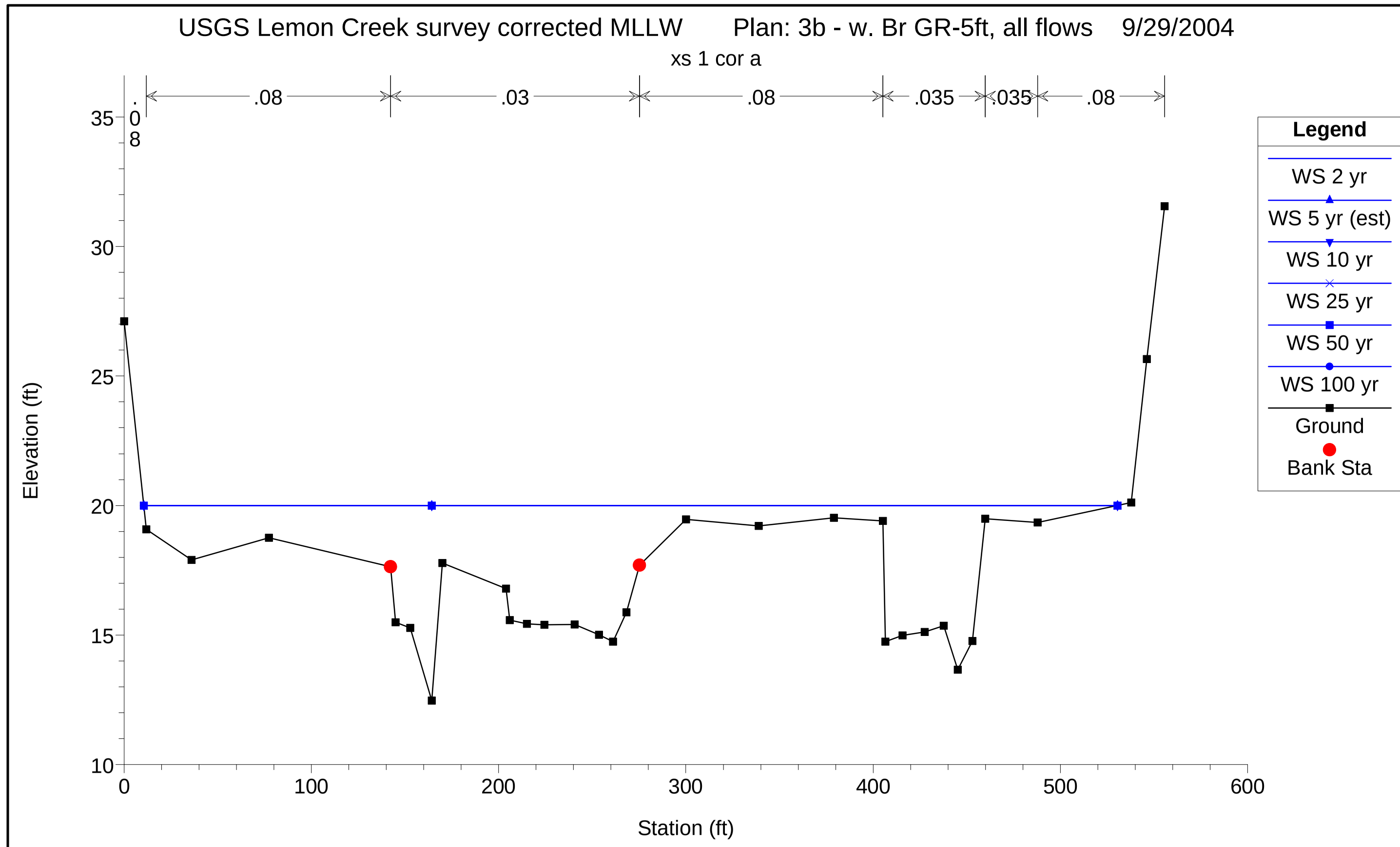
quarry bridge
.03
Elevation (ft)
Station (ft)
Legend
WS 100 yr
WS 50 yr
WS 25 yr
WS 10 yr
WS 5 yr (est)
WS 2 yr
Ground
Bank Sta


USGS Lemon Creek survey corrected MLLW Plan: 3b - w. Br GR-5ft, all flows 9/29/2004
quarry bridge
.03
Elevation (ft)
Station (ft)
Legend
WS 100 yr
WS 50 yr
WS 25 yr
WS 10 yr
WS 5 yr (est)
WS 2 yr
Ground
Bank Sta


USGS Lemon Creek survey corrected MLLW Plan: 3b - w. Br GR-5ft, all flows 9/29/2004
xs 3.2
.03
Elevation (ft)
Station (ft)
Legend
WS 100 yr
WS 50 yr
WS 25 yr
WS 10 yr
WS 5 yr (est)
WS 2 yr
Ground
Bank Sta


USGS Lemon Creek survey corrected MLLW Plan: 3b - w. Br GR-5ft, all flows 9/29/2004
xs 3 cor c
.08
.03
.08
Elevation (ft)
Station (ft)
Legend
WS 100 yr
WS 50 yr
WS 25 yr
WS 2 yr
WS 10 yr
WS 5 yr (est)
Ground
Bank Sta


USGS Lemon Creek survey corrected MLLW Plan: 3b - w. Br GR-5ft, all flows 9/29/2004
xs 2 cor b
.08
.03
.08
Elevation (ft)
Station (ft)
Legend
WS 25 yr
WS 50 yr
WS 10 yr
WS 100 yr
WS 5 yr (est)
WS 2 yr
Ground
Levee
Bank Sta


USGS Lemon Creek survey corrected MLLW   Plan: 3b - w. Br GR-5ft, all flows   9/29/2004
xs 1 cor a
.08
.03
.08
.035
.035
.08
Legend
WS 2 yr
WS 5 yr (est)
WS 10 yr
WS 25 yr
WS 50 yr
WS 100 yr
Ground
Bank Sta
Elevation (ft)
Station (ft)
10
15
20
25
30
35
0
100
200
300
400
500
600

Appendix F(b)

Hydraulics

Tide Water to Top of Gorge
In Stream Mining above Glacier Highway
RediMix Bridge Removed

Lemon Creek from tidewater to 350-ft above gorge bridge

Plan 5 Mining above Glacier Highway with RediMix Bridge removed

(Note: Plan 4 was superceeded and is not included in the final analyses)

HEC-RAS Plan: 5-NoBR,GR-5' River: lemon creek Reach: 1

Reach	River Sta	Profile	Cum Ch Len (ft)	Q Total (cfs)	Q Channel (cfs)	Vel Chnl (ft/s)	Hydr Depth C (ft)	Top W Act Chan (ft)	E.G. Slope (ft/ft)	Shear Chan (lb/sq ft)
1	1	2 yr		3930	2552.53	4.57	4.2	133.03	0.001304	0.33
1	1	5 yr (est)		5140	3338.42	5.97	4.2	133.03	0.00223	0.57
1	1	10 yr		5990	3890.5	6.96	4.2	133.03	0.003028	0.77
1	1	25 yr		6720	4364.63	7.81	4.2	133.03	0.003811	0.97
1	1	50 yr		7140	4637.42	8.3	4.2	133.03	0.004303	1.1
1	1	100 yr		7340	4767.32	8.53	4.2	133.03	0.004547	1.16
1	2	2 yr	174	3930	3909.89	8.94	3.48	125.48	0.006236	1.35
1	2	5 yr (est)	174	5140	5092.9	10.66	3.78	126.34	0.007936	1.86
1	2	10 yr	174	5990	5801.93	10.62	4.3	126.91	0.006641	1.77
1	2	25 yr	174	6720	6515.87	12	4.28	126.91	0.00854	2.26
1	2	50 yr	174	7140	6947.95	13.06	4.19	126.91	0.010387	2.7
1	2	100 yr	174	7340	7154.84	13.58	4.15	126.91	0.011388	2.93
1	3	2 yr	372	3930	3907.28	9.68	5.34	75.6	0.004166	1.37
1	3	5 yr (est)	372	5140	5099.71	11.5	5.86	75.6	0.005191	1.88
1	3	10 yr	372	5990	5940.02	13.11	5.99	75.6	0.006553	2.42
1	3	25 yr	372	6720	6657.1	14.09	6.25	75.6	0.007158	2.76
1	3	50 yr	372	7140	7065.91	14.37	6.51	75.6	0.007053	2.83
1	3	100 yr	372	7340	7259.87	14.46	6.64	75.6	0.00695	2.84
1	4	2 yr	493	3930	3896.17	9.95	6.05	64.74	0.003722	1.39
1	4	5 yr (est)	493	5140	5088.92	11.78	6.67	64.74	0.004569	1.88
1	4	10 yr	493	5990	5925.75	12.99	7.05	64.74	0.005162	2.25
1	4	25 yr	493	6720	6643.04	13.87	7.4	64.74	0.005525	2.52
1	4	50 yr	493	7140	7055.93	14.43	7.55	64.74	0.005817	2.71
1	4	100 yr	493	7340	7252.22	14.66	7.64	64.74	0.005905	2.79
1	5	2 yr	764	3930	3858.18	8.45	5.83	78.34	0.004089	1.4
1	5	5 yr (est)	764	5140	5008.7	9.14	6.99	78.34	0.003757	1.55
1	5	10 yr	764	5990	5808.11	9.52	7.79	78.34	0.003529	1.62
1	5	25 yr	764	6720	6490.53	9.8	8.45	78.34	0.003352	1.67
1	5	50 yr	764	7140	6881.28	9.94	8.84	78.34	0.003248	1.69
1	5	100 yr	764	7340	7067.07	10.01	9.02	78.34	0.003204	1.7
1	6	2 yr	1078	3930	3864.66	8.64	7.61	58.77	0.002867	1.33
1	6	5 yr (est)	1078	5140	5028.57	9.87	8.67	58.77	0.003143	1.66
1	6	10 yr	1078	5990	5840.35	10.61	9.36	58.77	0.003275	1.87
1	6	25 yr	1078	6720	6533.85	11.18	9.94	58.77	0.003357	2.03
1	6	50 yr	1078	7140	6932.56	11.48	10.27	58.77	0.00339	2.12
1	6	100 yr	1078	7340	7122.2	11.62	10.43	58.77	0.003406	2.16
1	7	2 yr	1213	3930	3901.54	6.52	7.33	81.56	0.001892	0.78
1	7	5 yr (est)	1213	5140	5063.88	7.2	8.63	81.56	0.001855	0.9
1	7	10 yr	1213	5990	5870.06	7.59	9.48	81.56	0.001819	0.98
1	7	25 yr	1213	6720	6556.27	7.89	10.18	81.56	0.001787	1.03
1	7	50 yr	1213	7140	6948.37	8.05	10.58	81.56	0.001765	1.06
1	7	100 yr	1213	7340	7134.48	8.12	10.77	81.56	0.001755	1.07
1	7.5	2 yr	1361	3930	3900.01	7.85	8.25	60.22	0.002163	1.07
1	7.5	5 yr (est)	1361	5140	5078.77	8.92	9.46	60.22	0.002328	1.32
1	7.5	10 yr	1361	5990	5897.09	9.55	10.25	60.22	0.0024	1.47
1	7.5	25 yr	1361	6720	6594.38	10.04	10.9	60.22	0.002444	1.6
1	7.5	50 yr	1361	7140	6993.43	10.3	11.27	60.22	0.00246	1.66
1	7.5	100 yr	1361	7340	7182.97	10.42	11.45	60.22	0.002466	1.69

Lemon Creek from tidewater to 350-ft above gorge bridge

Plan 5 Mining above Glacier Highway with RediMix Bridge removed

(Note: Plan 4 was superceeded and is not included in the final analyses)

HEC-RAS Plan: 5-NoBR,GR-5' River: lemon creek Reach: 1

Reach	River Sta	Profile	Cum Ch Len (ft)	Q Total (cfs)	Q Channel (cfs)	Vel Chnl (ft/s)	Hydr Depth C (ft)	Top W Act Chan (ft)	E.G. Slope (ft/ft)	Shear Chan (lb/sq ft)
1	7.8	2 yr	1413	3930	3868.03	8.51	8.25	55.07	0.002526	1.26
1	7.8	5 yr (est)	1413	5140	5018.18	9.64	9.45	55.07	0.002705	1.54
1	7.8	10 yr	1413	5990	5814.71	10.31	10.24	55.07	0.002782	1.72
1	7.8	25 yr	1413	6720	6491.46	10.83	10.88	55.07	0.002828	1.85
1	7.8	50 yr	1413	7140	6877.53	11.1	11.25	55.07	0.002842	1.93
1	7.8	100 yr	1413	7340	7060.63	11.22	11.42	55.07	0.002847	1.96
1	8	2 yr	1472	3930	3425.04	10.77	8.43	37.72	0.003786	1.98
1	8	5 yr (est)	1472	5140	4403.77	12.17	9.59	37.72	0.004078	2.42
1	8	10 yr	1472	5990	5074.49	13	10.35	37.72	0.0042	2.69
1	8	25 yr	1472	6720	5638.8	13.62	10.98	37.72	0.004263	2.9
1	8	50 yr	1472	7140	5962.11	13.95	11.33	37.72	0.004286	3.01
1	8	100 yr	1472	7340	6115.54	14.1	11.5	37.72	0.004295	3.06
1	8.5	2 yr	1597	3930	3829.39	4.48	12.67	67.41	0.000413	0.31
1	8.5	5 yr (est)	1597	5140	4953.24	5.18	14.19	67.41	0.000473	0.39
1	8.5	10 yr	1597	5990	5731.01	5.6	15.18	67.41	0.000507	0.45
1	8.5	25 yr	1597	6720	6389.31	5.93	15.97	67.41	0.000531	0.5
1	8.5	50 yr	1597	7140	6764.16	6.11	16.42	67.41	0.000543	0.52
1	8.5	100 yr	1597	7340	6942.34	6.19	16.63	67.41	0.000549	0.53
1	9	2 yr	2020	3930	3866.75	3.43	10.26	109.93	0.000326	0.19
1	9	5 yr (est)	2020	5140	4979.94	3.82	11.85	109.93	0.000333	0.23
1	9	10 yr	2020	5990	5746.05	4.06	12.89	109.93	0.000336	0.25
1	9	25 yr	2020	6720	6396.03	4.24	13.72	109.93	0.000338	0.27
1	9	50 yr	2020	7140	6766.54	4.34	14.19	109.93	0.000338	0.28
1	9	100 yr	2020	7340	6942.24	4.38	14.41	109.93	0.000338	0.28
1	10	2 yr	2770	3930	3916.34	2.97	8.85	149.29	0.000285	0.15
1	10	5 yr (est)	2770	5140	5095.97	3.26	10.31	151.61	0.000282	0.17
1	10	10 yr	2770	5990	5919.03	3.44	11.25	153.11	0.00028	0.19
1	10	25 yr	2770	6720	6623.46	3.58	12.05	153.63	0.000277	0.2
1	10	50 yr	2770	7140	7027.79	3.65	12.52	153.63	0.000274	0.2
1	10	100 yr	2770	7340	7220.09	3.69	12.74	153.63	0.000273	0.21
1	11	2 yr	3204	3930	3927.75	2.63	8.01	186.55	0.000263	0.12
1	11	5 yr (est)	3204	5140	5121.63	2.85	9.62	186.55	0.000242	0.14
1	11	10 yr	3204	5990	5951.73	2.99	10.67	186.55	0.000232	0.14
1	11	25 yr	3204	6720	6660.01	3.1	11.51	186.55	0.000225	0.15
1	11	50 yr	3204	7140	7065.58	3.16	11.99	186.55	0.000222	0.15
1	11	100 yr	3204	7340	7258.26	3.19	12.21	186.55	0.00022	0.16
1	12	2 yr	3771	3930	3929.99	3.31	6.25	189.83	0.000445	0.16
1	12	5 yr (est)	3771	5140	5139.02	3.45	7.85	189.83	0.000357	0.17
1	12	10 yr	3771	5990	5986.96	3.55	8.88	189.83	0.00032	0.17
1	12	25 yr	3771	6720	6714.08	3.64	9.72	189.83	0.000298	0.17
1	12	50 yr	3771	7140	7131.69	3.69	10.19	189.83	0.000288	0.17
1	12	100 yr	3771	7340	7330.36	3.71	10.41	189.83	0.000283	0.17
1	13	2 yr	4559	3930	3930	12.19	1.8	179.05	0.043107	4.76
1	13	5 yr (est)	4559	5140	5139.98	6.26	4.37	188.01	0.003532	0.94
1	13	10 yr	4559	5990	5988.85	5.94	5.27	191.55	0.00248	0.79
1	13	25 yr	4559	6720	6715.62	5.77	6.07	191.55	0.001941	0.71
1	13	50 yr	4559	7140	7132.56	5.71	6.52	191.55	0.001723	0.68
1	13	100 yr	4559	7340	7330.8	5.68	6.74	191.55	0.001636	0.67

Lemon Creek from tidewater to 350-ft above gorge bridge

Plan 5 Mining above Glacier Highway with RediMix Bridge removed

(Note: Plan 4 was superceeded and is not included in the final analyses)

HEC-RAS Plan: 5-NoBR,GR-5' River: lemon creek Reach: 1

Reach	River Sta	Profile	Cum Ch Len (ft)	Q Total (cfs)	Q Channel (cfs)	Vel Chnl (ft/s)	Hydr Depth C (ft)	Top W Act Chan (ft)	E.G. Slope (ft/ft)	Shear Chan (lb/sq ft)
1	13.5	2 yr	4845	3930	3789.43	10.29	3.27	112.79	0.016479	3.26
1	13.5	5 yr (est)	4845	5140	4915.97	11.1	3.92	113.04	0.015131	3.58
1	13.5	10 yr	4845	5990	5696.1	11.6	4.34	113.04	0.014398	3.77
1	13.5	25 yr	4845	6720	6358.68	12.01	4.68	113.04	0.013958	3.95
1	13.5	50 yr	4845	7140	6738.08	12.26	4.86	113.04	0.013837	4.06
1	13.5	100 yr	4845	7340	6918.54	12.38	4.94	113.04	0.013811	4.12
1	14	2 yr	5293	3930	3839.46	4.08	4.31	217.92	0.002201	0.59
1	14	5 yr (est)	5293	5140	5011.84	4.5	5.11	217.92	0.002139	0.68
1	14	10 yr	5293	5990	5833.86	4.76	5.62	217.92	0.002105	0.73
1	14	25 yr	5293	6720	6538.9	4.97	6.04	217.92	0.002081	0.78
1	14	50 yr	5293	7140	6944.11	5.08	6.28	217.92	0.002065	0.8
1	14	100 yr	5293	7340	7136.96	5.13	6.39	217.92	0.002056	0.81
1	14.5	2 yr	5820	3930	3824.51	8.96	3.78	112.73	0.013079	2.99
1	14.5	5 yr (est)	5820	5140	4877.48	9.86	4.37	113.24	0.013114	3.45
1	14.5	10 yr	5820	5990	5601.7	10.43	4.73	113.55	0.013236	3.76
1	14.5	25 yr	5820	6720	6216.56	10.89	5.01	113.8	0.013364	4.02
1	14.5	50 yr	5820	7140	6567.91	11.15	5.17	113.94	0.013443	4.17
1	14.5	100 yr	5820	7340	6734.64	11.27	5.24	114	0.013481	4.24
1	15	2 yr	6042	3930	3785.15	7.04	5.84	92.08	0.006656	2.37
1	15	5 yr (est)	6042	5140	4880.35	8.04	6.53	92.94	0.007482	2.98
1	15	10 yr	6042	5990	5699.47	8.76	6.96	93.46	0.008192	3.47
1	15	25 yr	6042	6720	6357.35	9.28	7.3	93.89	0.008633	3.83
1	15	50 yr	6042	7140	6716.43	9.53	7.49	94.12	0.008817	4.01
1	15	100 yr	6042	7340	6886.44	9.65	7.58	94.23	0.008901	4.09
1	15.5	2 yr	6436	3930	3929.64	8.45	4.93	94.42	0.01203	3.61
1	15.5	5 yr (est)	6436	5140	5137.21	9.26	5.79	95.89	0.011705	4.12
1	15.5	10 yr	6436	5990	5983.7	9.71	6.36	96.89	0.011383	4.39
1	15.5	25 yr	6436	6720	6709.74	10.12	6.79	97.64	0.011357	4.67
1	15.5	50 yr	6436	7140	7127.11	10.37	7.01	98.04	0.011419	4.85
1	15.5	100 yr	6436	7340	7325.76	10.48	7.11	98.23	0.011451	4.94
1	15.8	2 yr	6772	3930	3774.87	10.18	5.46	67.9	0.018385	6.06
1	15.8	5 yr (est)	6772	5140	4904.8	11.23	6.35	68.81	0.018448	7.03
1	15.8	10 yr	6772	5990	5791.88	12.39	6.75	69.23	0.020718	8.38
1	15.8	25 yr	6772	6720	6422.51	12.7	7.25	69.75	0.019902	8.61
1	15.8	50 yr	6772	7140	6773.2	12.76	7.58	70.1	0.018971	8.56
1	15.8	100 yr	6772	7340	6942.98	12.83	7.7	70.23	0.018794	8.62
1	16	2 yr	6985	3930	3292.49	11.25	6.47	45.25	0.023246	8.8
1	16	5 yr (est)	6985	5140	4154.34	12.21	7.29	46.66	0.023535	9.99
1	16	10 yr	6985	5990	4719.02	12.34	7.98	47.87	0.021414	9.92
1	16	25 yr	6985	6720	5235.33	12.98	8.32	48.47	0.022457	10.82
1	16	50 yr	6985	7140	5536.46	13.42	8.47	48.71	0.023502	11.51
1	16	100 yr	6985	7340	5675.68	13.57	8.57	48.82	0.023682	11.72
1	17	2 yr	7123	3930	3353.14	10.91	7.35	41.81	0.018787	8.51
1	17	5 yr (est)	7123	5140	4322.53	12.08	8.56	41.81	0.018816	9.93
1	17	10 yr	7123	5990	4991.46	12.8	9.33	41.81	0.018829	10.83
1	17	25 yr	7123	6720	5559.37	13.36	9.95	41.81	0.018814	11.54
1	17	50 yr	7123	7140	5882.1	13.66	10.3	41.81	0.018807	11.94
1	17	100 yr	7123	7340	6035.12	13.81	10.45	41.81	0.018821	12.13

Lemon Creek from tidewater to 350-ft above gorge bridge

Plan 5 Mining above Glacier Highway with RediMix Bridge removed

(Note: Plan 4 was superceeded and is not included in the final analyses)

HEC-RAS Plan: 5-NoBR,GR-5' River: lemon creek Reach: 1

Reach	River Sta	Profile	Cum Ch Len (ft)	Q Total (cfs)	Q Channel (cfs)	Vel Chnl (ft/s)	Hydr Depth C (ft)	Top W Act Chan (ft)	E.G. Slope (ft/ft)	Shear Chan (lb/sq ft)
1	17.5	2 yr	7263	3930	2955.51	12.81	10.08	22.89	0.022179	13.54
1	17.5	5 yr (est)	7263	5140	3734.99	14.44	11.3	22.89	0.024229	16.58
1	17.5	10 yr	7263	5990	4264.06	15.45	12.06	22.89	0.025418	18.56
1	17.5	25 yr	7263	6720	4708.87	16.24	12.66	22.89	0.026317	20.18
1	17.5	50 yr	7263	7140	4961.42	16.68	12.99	22.89	0.026809	21.1
1	17.5	100 yr	7263	7340	5080.86	16.88	13.15	22.89	0.027037	21.53
1	18	2 yr	7408	3930	2763.67	14.34	7.12	27.07	0.043368	18.96
1	18	5 yr (est)	7408	5140	3468.9	15.66	8.18	27.07	0.042951	21.58
1	18	10 yr	7408	5990	3946.39	16.38	8.9	27.07	0.042031	22.97
1	18	25 yr	7408	6720	4348.9	16.95	9.48	27.07	0.041354	24.07
1	18	50 yr	7408	7140	4579.8	17.29	9.79	27.07	0.041274	24.8
1	18	100 yr	7408	7340	4686.84	17.41	9.94	27.07	0.040964	25.01
1	19	2 yr	7600	3930	2027.67	11.24	10.96	16.45	0.017324	10.47
1	19	5 yr (est)	7600	5140	2474.33	12.23	12.3	16.45	0.017588	11.92
1	19	10 yr	7600	5990	2778.05	12.87	13.12	16.45	0.017859	12.92
1	19	25 yr	7600	6720	3032.04	13.37	13.79	16.45	0.018053	13.72
1	19	50 yr	7600	7140	3174.36	13.63	14.16	16.45	0.018092	14.12
1	19	100 yr	7600	7340	3243.12	13.76	14.32	16.45	0.018182	14.35
1	20	2 yr	7704	3930	2413.59	13.53	7.29	24.49	0.038675	16.88
1	20	5 yr (est)	7704	5140	2867.75	13.62	8.6	24.49	0.031459	16.2
1	20	10 yr	7704	5990	3184.03	13.8	9.42	24.49	0.028557	16.12
1	20	25 yr	7704	6720	3454.41	13.98	10.09	24.49	0.026779	16.19
1	20	50 yr	7704	7140	3608.66	14.09	10.46	24.49	0.025912	16.24
1	20	100 yr	7704	7340	3682.65	14.15	10.63	24.49	0.025587	16.29
1	21	2 yr	7794	3930	2677.21	15.03	7.37	24.16	0.045303	20.57
1	21	5 yr (est)	7794	5140	3389.12	16.38	8.56	24.16	0.044125	23.26
1	21	10 yr	7794	5990	3877.86	17.16	9.35	24.16	0.043034	24.78
1	21	25 yr	7794	6720	4293.6	17.81	9.98	24.16	0.042473	26.1
1	21	50 yr	7794	7140	4531.65	18.18	10.32	24.16	0.04233	26.9
1	21	100 yr	7794	7340	4645.48	18.37	10.47	24.16	0.042428	27.35
1	22	2 yr	7906	3930	3050.35	11.81	9.11	28.33	0.021176	11.86
1	22	5 yr (est)	7906	5140	3882.2	13.12	10.44	28.33	0.021776	13.97
1	22	10 yr	7906	5990	4455.18	13.95	11.28	28.33	0.022212	15.39
1	22	25 yr	7906	6720	4939.37	14.58	11.96	28.33	0.022462	16.5
1	22	50 yr	7906	7140	5214.63	14.92	12.34	28.33	0.022545	17.09
1	22	100 yr	7906	7340	5344.39	15.06	12.52	28.33	0.022532	17.34
1	23	2 yr	8014	3930	2857.73	12.9	10.28	21.55	0.021818	13.62
1	23	5 yr (est)	8014	5140	3611.53	14.38	11.66	21.55	0.022941	16.24
1	23	10 yr	8014	5990	4126.6	15.3	12.52	21.55	0.023611	17.95
1	23	25 yr	8014	6720	4564.02	16.04	13.21	21.55	0.024155	19.38
1	23	50 yr	8014	7140	4814.23	16.44	13.59	21.55	0.024458	20.18
1	23	100 yr	8014	7340	4932.92	16.63	13.76	21.55	0.024591	20.56
1	24	2 yr	8247	3930	3926.51	8.96	8.18	53.6	0.009178	4.2
1	24	5 yr (est)	8247	5140	5127.11	9.78	9.71	54	0.008723	4.73
1	24	10 yr	8247	5990	5964.67	10.3	10.72	54	0.008491	5.08
1	24	25 yr	8247	6720	6679.37	10.72	11.54	54	0.008325	5.37
1	24	50 yr	8247	7140	7088.55	10.94	12	54	0.008237	5.52
1	24	100 yr	8247	7340	7282.88	11.04	12.21	54	0.008197	5.59

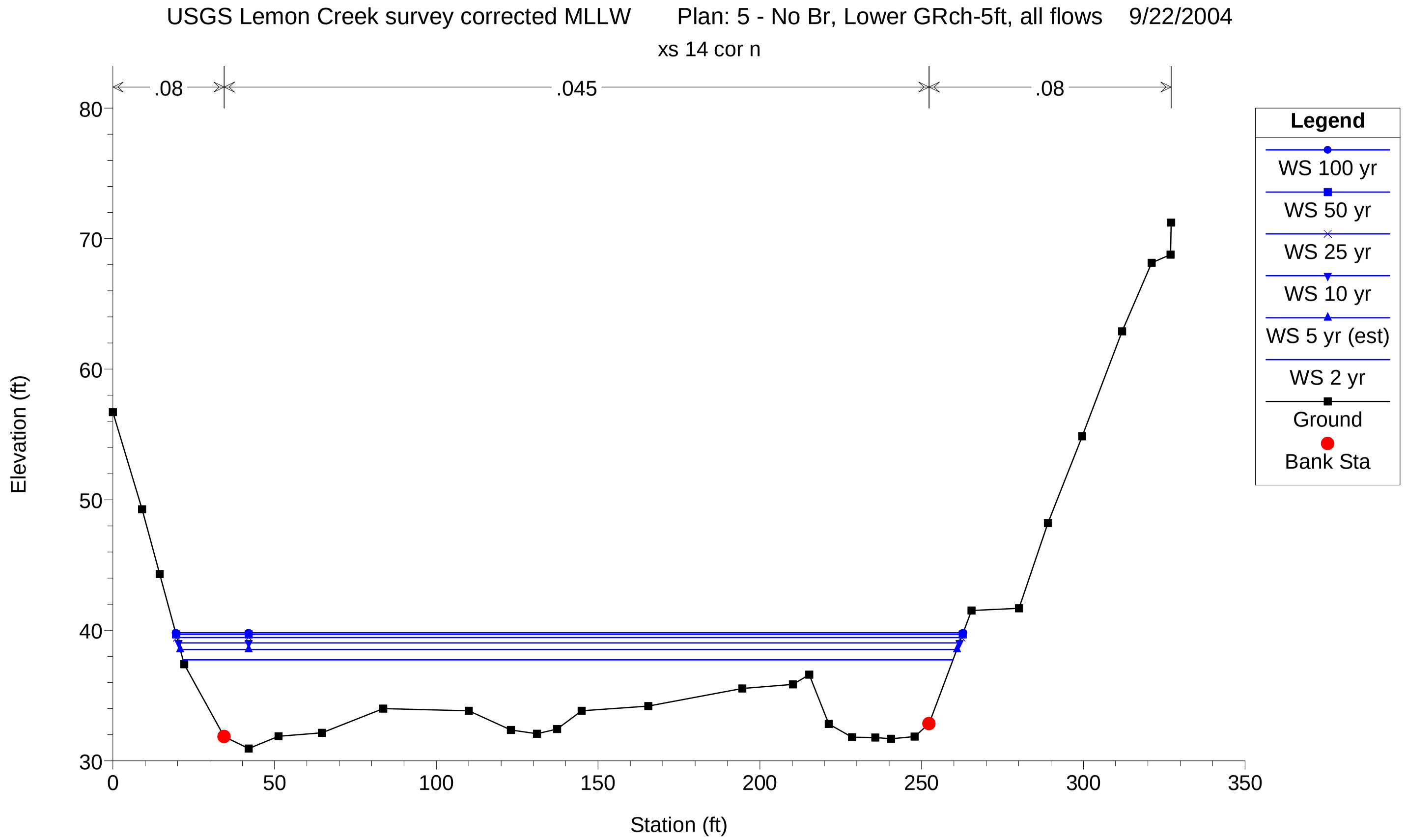
Lemon Creek from tidewater to 350-ft above gorge bridge

Plan 5 Mining above Glacier Highway with RediMix Bridge removed

(Note: Plan 4 was superceeded and is not included in the final analyses)

HEC-RAS Plan: 5-NoBR,GR-5' River: lemon creek Reach: 1

Reach	River Sta	Profile	Cum Ch Len (ft)	Q Total (cfs)	Q Channel (cfs)	Vel Chnl (ft/s)	Hydr Depth C (ft)	Top W Act Chan (ft)	E.G. Slope (ft/ft)	Shear Chan (lb/sq ft)
1	25	2 yr	8378	3930	3896.07	5.02	5.9	131.61	0.001761	0.63
1	25	5 yr (est)	8378	5140	5067.19	5.02	7.57	133.48	0.001274	0.59
1	25	10 yr	8378	5990	5883.52	5.06	8.63	134.69	0.00109	0.57
1	25	25 yr	8378	6720	6581.45	5.11	9.5	135.69	0.00098	0.56
1	25	50 yr	8378	7140	6981.76	5.13	9.98	136.24	0.000929	0.56
1	25	100 yr	8378	7340	7172.07	5.15	10.21	136.5	0.000908	0.56
1	26	2 yr	8453	3930	3872.42	7.5	5.65	91.43	0.004104	1.43
1	26	5 yr (est)	8453	5140	4880.85	7.2	7.41	91.43	0.002636	1.21
1	26	10 yr	8453	5990	5563.99	7.11	8.56	91.43	0.002121	1.12
1	26	25 yr	8453	6720	6142.09	7.07	9.5	91.43	0.001828	1.07
1	26	50 yr	8453	7140	6471.51	7.06	10.02	91.43	0.001697	1.05
1	26	100 yr	8453	7340	6627.7	7.06	10.26	91.43	0.001642	1.04
1	27	2 yr	8505	3930	3727.88	12.17	6.35	48.2	0.009442	3.65
1	27	5 yr (est)	8505	5140	4833.54	12.72	7.88	48.2	0.007729	3.71
1	27	10 yr	8505	5990	5602.39	13.02	8.93	48.2	0.006865	3.73
1	27	25 yr	8505	6720	6257.58	13.26	9.79	48.2	0.006288	3.75
1	27	50 yr	8505	7140	6633.69	13.39	10.28	48.2	0.006012	3.76
1	27	100 yr	8505	7340	6814.34	13.46	10.51	48.2	0.005898	3.77
1	28	2 yr	8524	3930	3776.36	12.14	6.03	51.58	0.009954	3.68
1	28	5 yr (est)	8524	5140	4906.05	12.59	7.55	51.58	0.007932	3.68
1	28	10 yr	8524	5990	5698.21	12.87	8.58	51.58	0.006983	3.68
1	28	25 yr	8524	6720	6376.27	13.1	9.44	51.58	0.006372	3.69
1	28	50 yr	8524	7140	6768.26	13.24	9.91	51.58	0.006104	3.71
1	28	100 yr	8524	7340	6955.14	13.3	10.14	51.58	0.005979	3.72
1	29	2 yr	8593	3930	3917.56	7.1	5.46	100.98	0.003474	1.17
1	29	5 yr (est)	8593	5140	5116.78	6.72	4.37	173.97	0.00253	0.69
1	29	10 yr	8593	5990	5960.45	6	5.15	192.8	0.001669	0.53
1	29	25 yr	8593	6720	6677.5	5.66	6.12	192.8	0.001201	0.46
1	29	50 yr	8593	7140	7088.38	5.53	6.65	192.8	0.001014	0.42
1	29	100 yr	8593	7340	7283.63	5.47	6.91	192.8	0.00094	0.4
1	30	2 yr	8659	3930	3859.99	10.74	5.89	61.06	0.008	2.9
1	30	5 yr (est)	8659	5140	4998.07	11.13	7.36	61.06	0.006374	2.89
1	30	10 yr	8659	5990	5784.33	11.32	8.37	61.06	0.005553	2.87
1	30	25 yr	8659	6720	6437.47	11.42	9.24	61.06	0.004956	2.82
1	30	50 yr	8659	7140	6802.44	11.44	9.74	61.06	0.004638	2.78
1	30	100 yr	8659	7340	6971.14	11.44	9.98	61.06	0.004486	2.76
1	31	2 yr	8877	3930	1821.26	9.21	8.04	24.6	0.003881	1.92
1	31	5 yr (est)	8877	5140	2091.81	9.1	9.34	24.6	0.003106	1.79
1	31	10 yr	8877	5990	2254.64	8.86	10.35	24.6	0.002567	1.64
1	31	25 yr	8877	6720	2484.75	9.52	10.61	24.6	0.002868	1.87
1	31	50 yr	8877	7140	2594.32	9.69	10.88	24.6	0.002873	1.93
1	31	100 yr	8877	7340	2645.17	9.76	11.02	24.6	0.002866	1.95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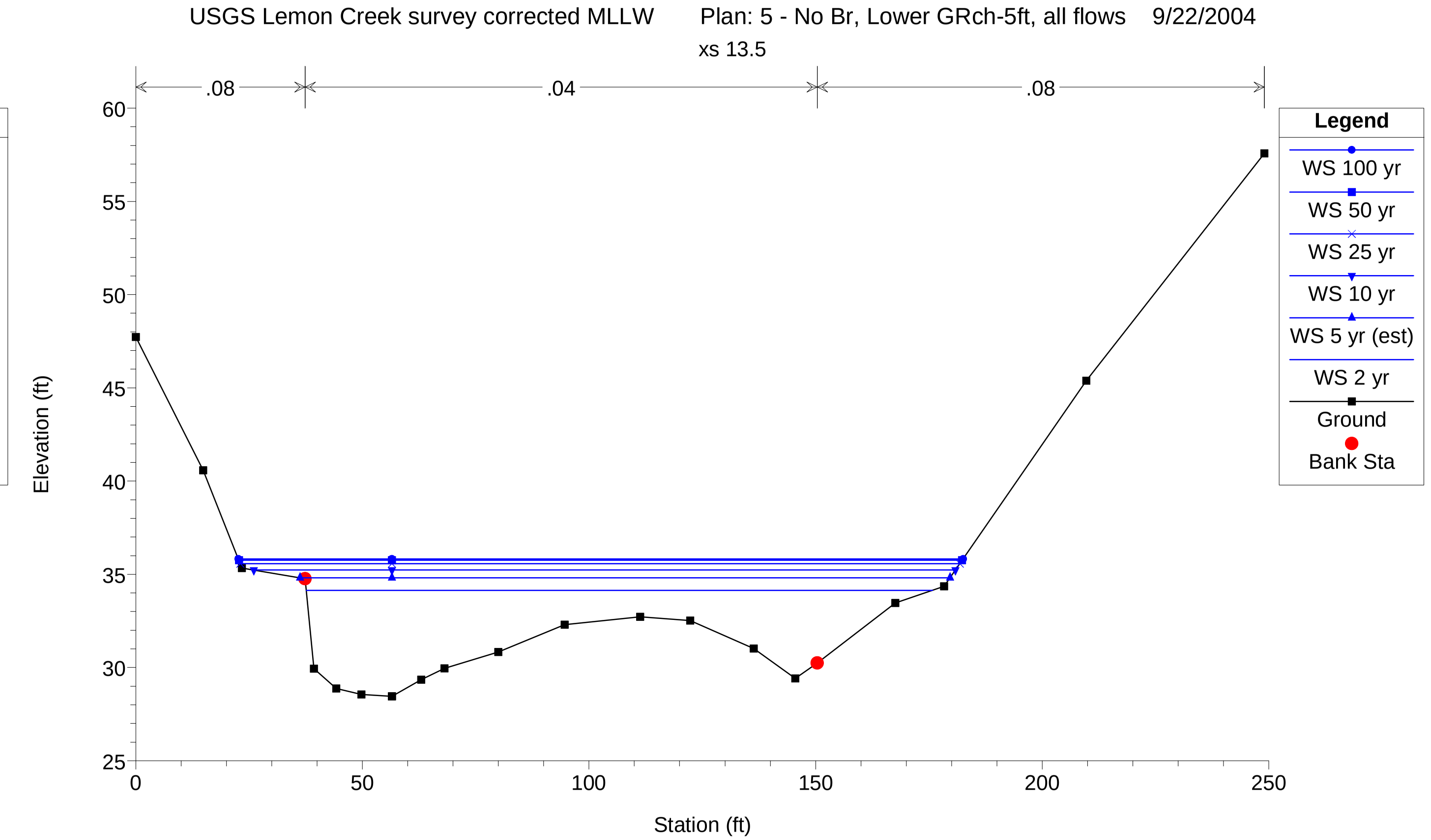
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WS 100 yr
WS 50 yr
WS 25 yr
WS 10 yr
WS 5 yr (est)
WS 2 yr
Ground
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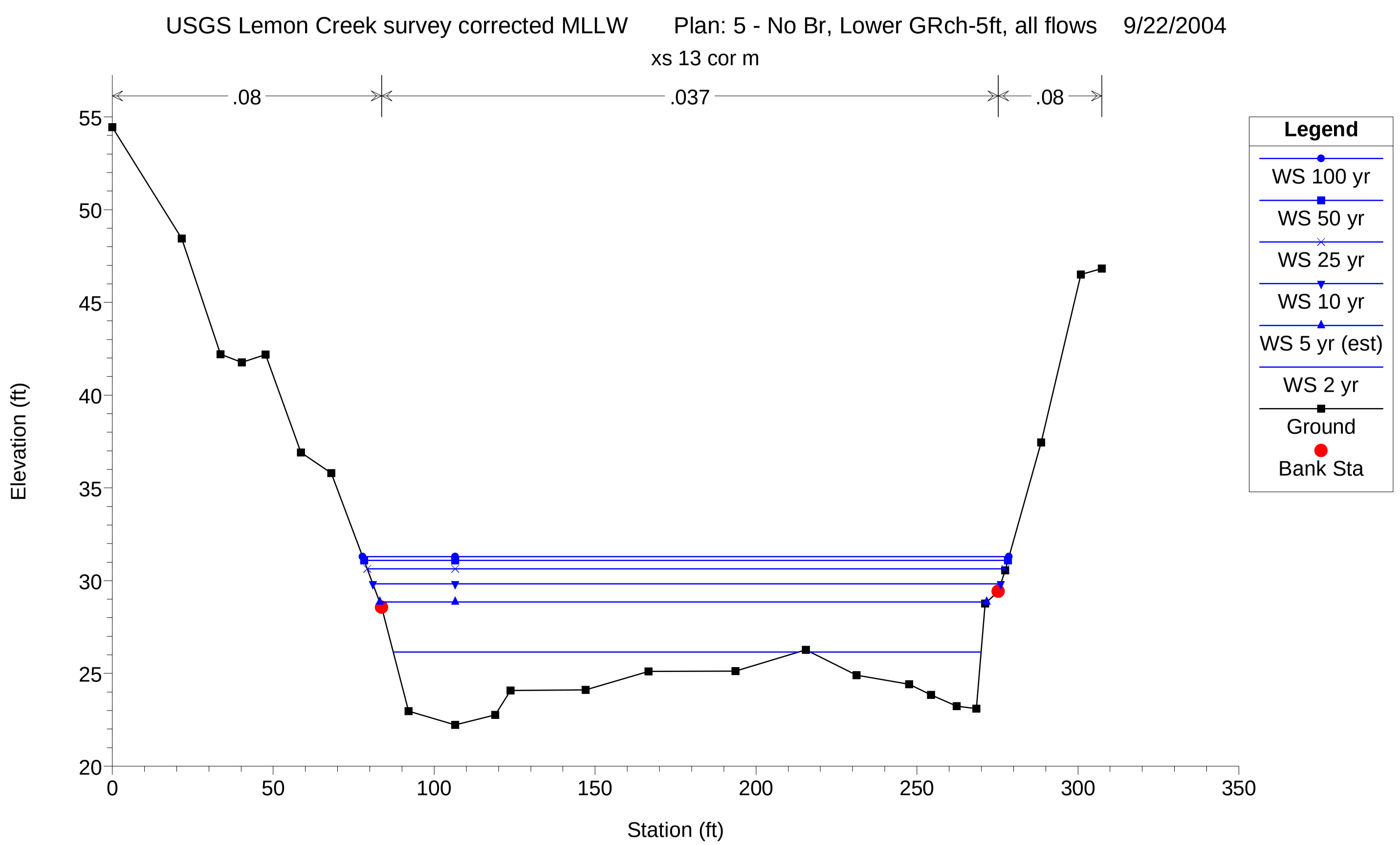
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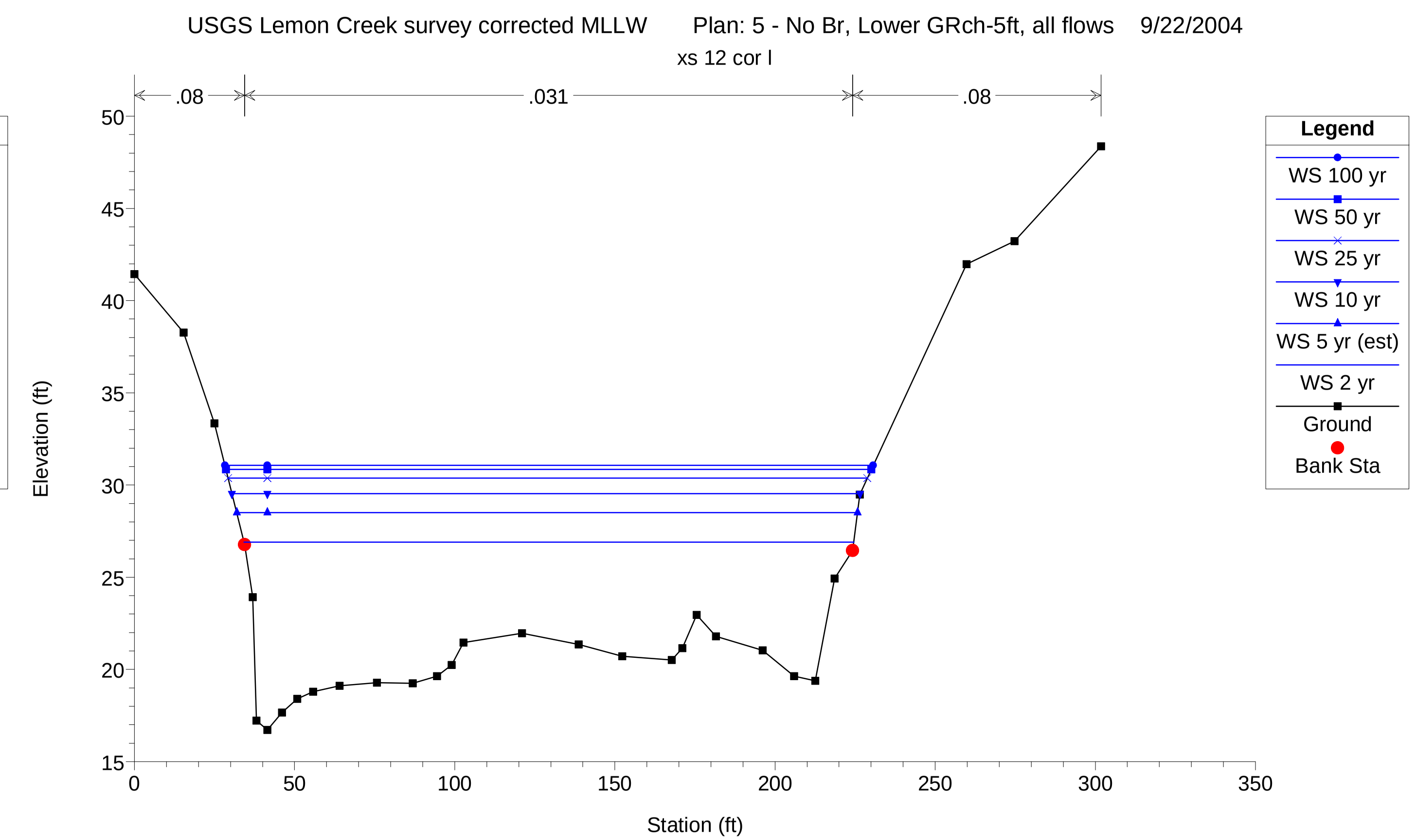
Bank Sta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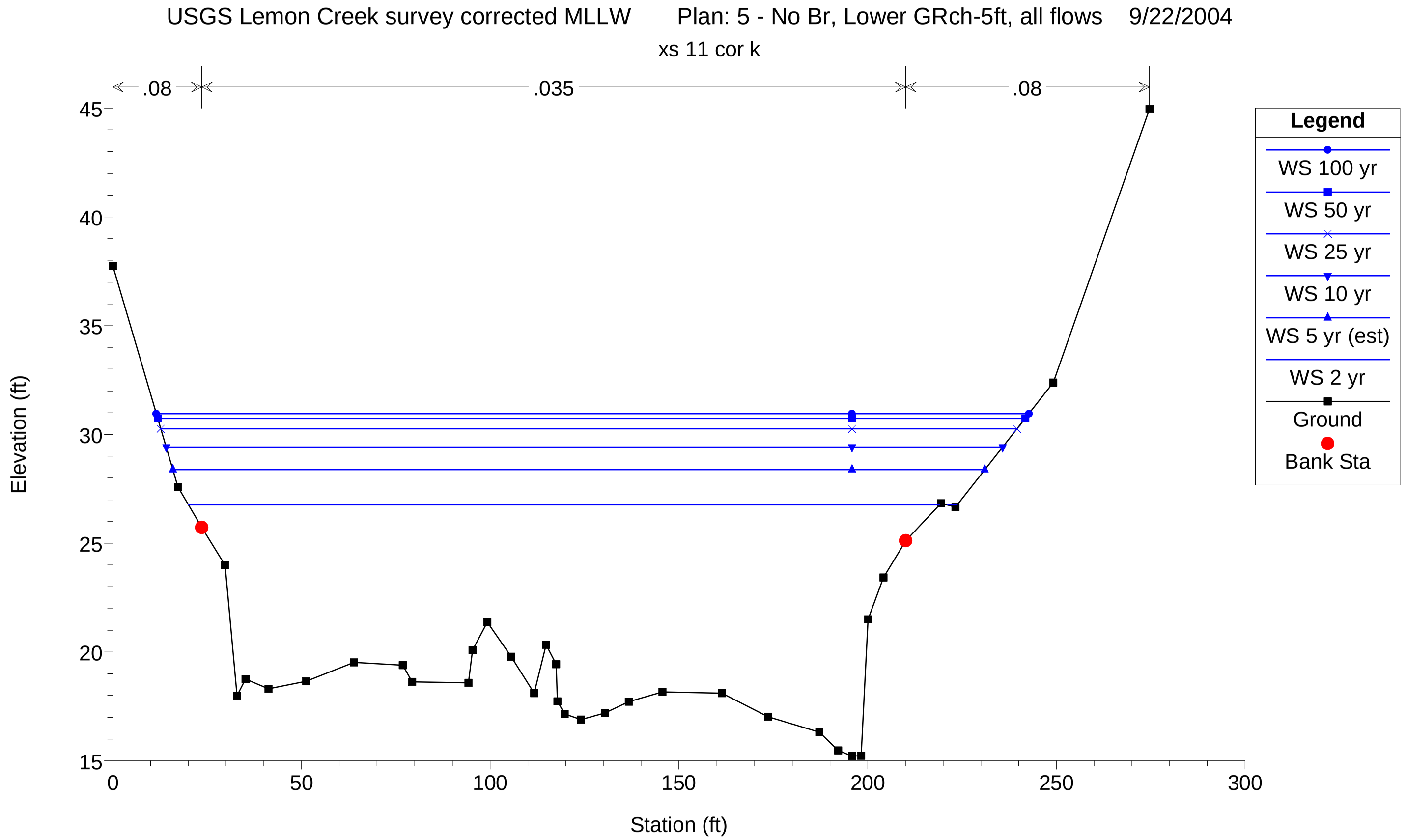
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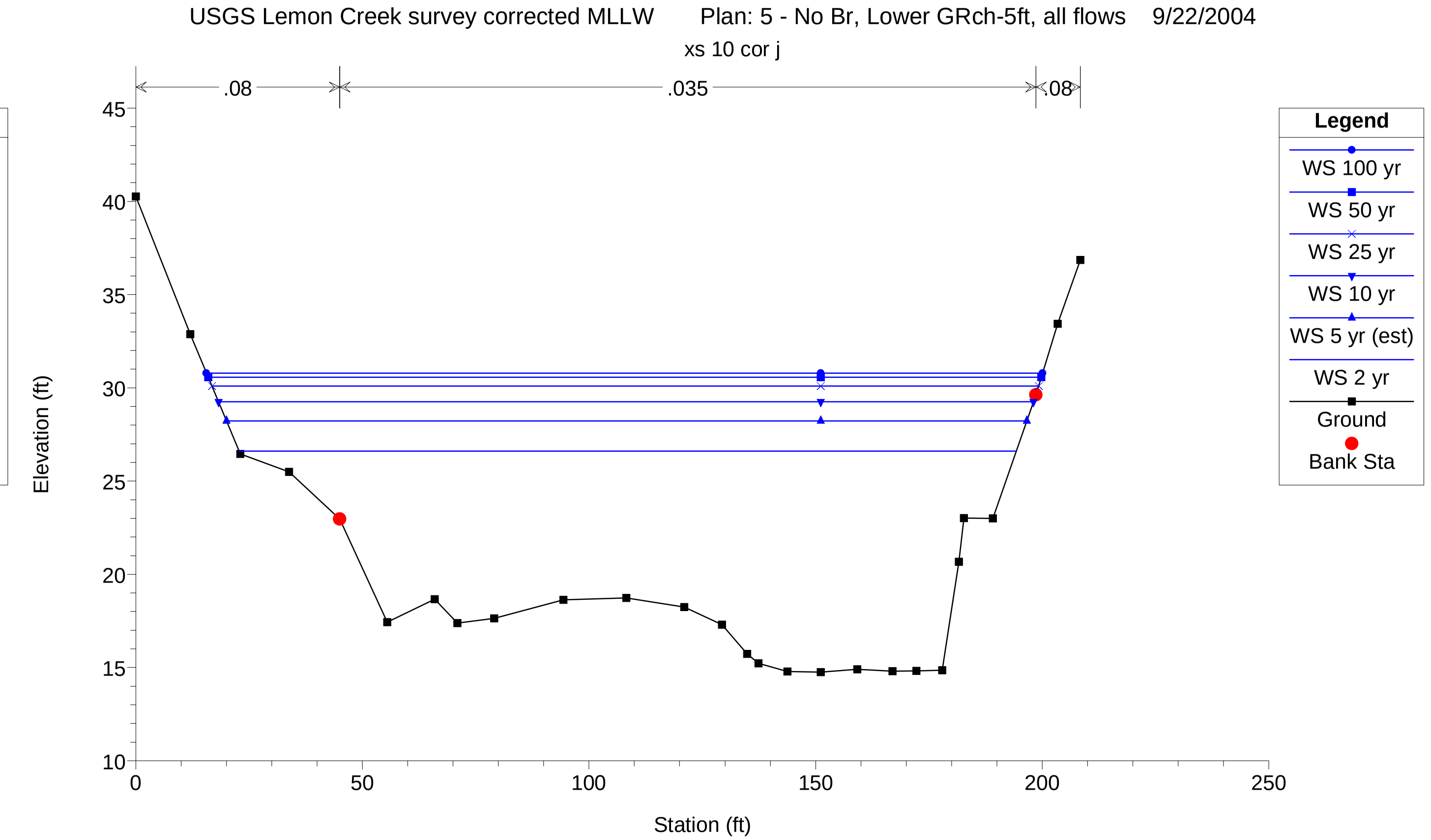
Elevation (ft)
Station (ft)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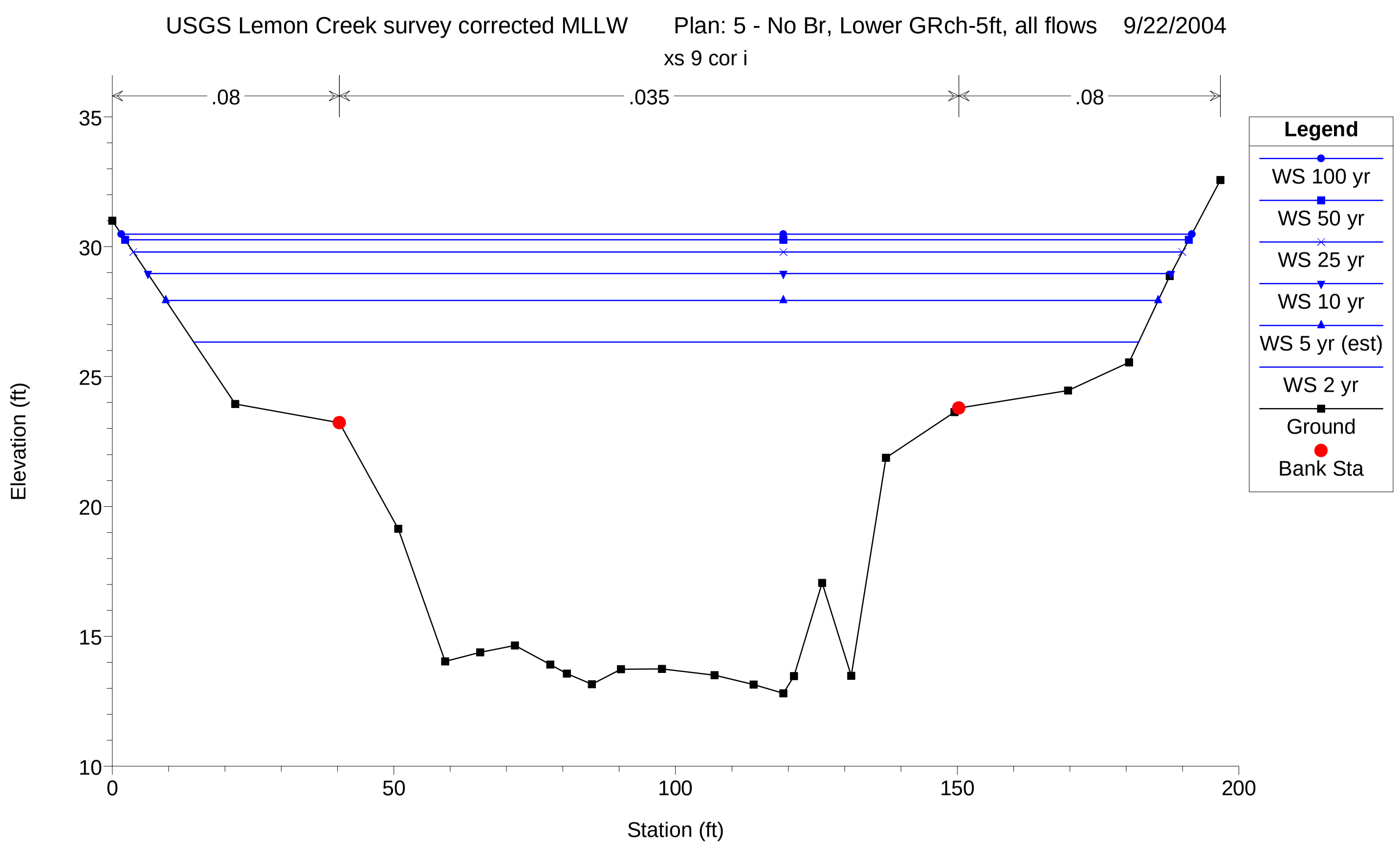
Bank Sta
Elevation (ft)
Station (ft)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9/22/2004
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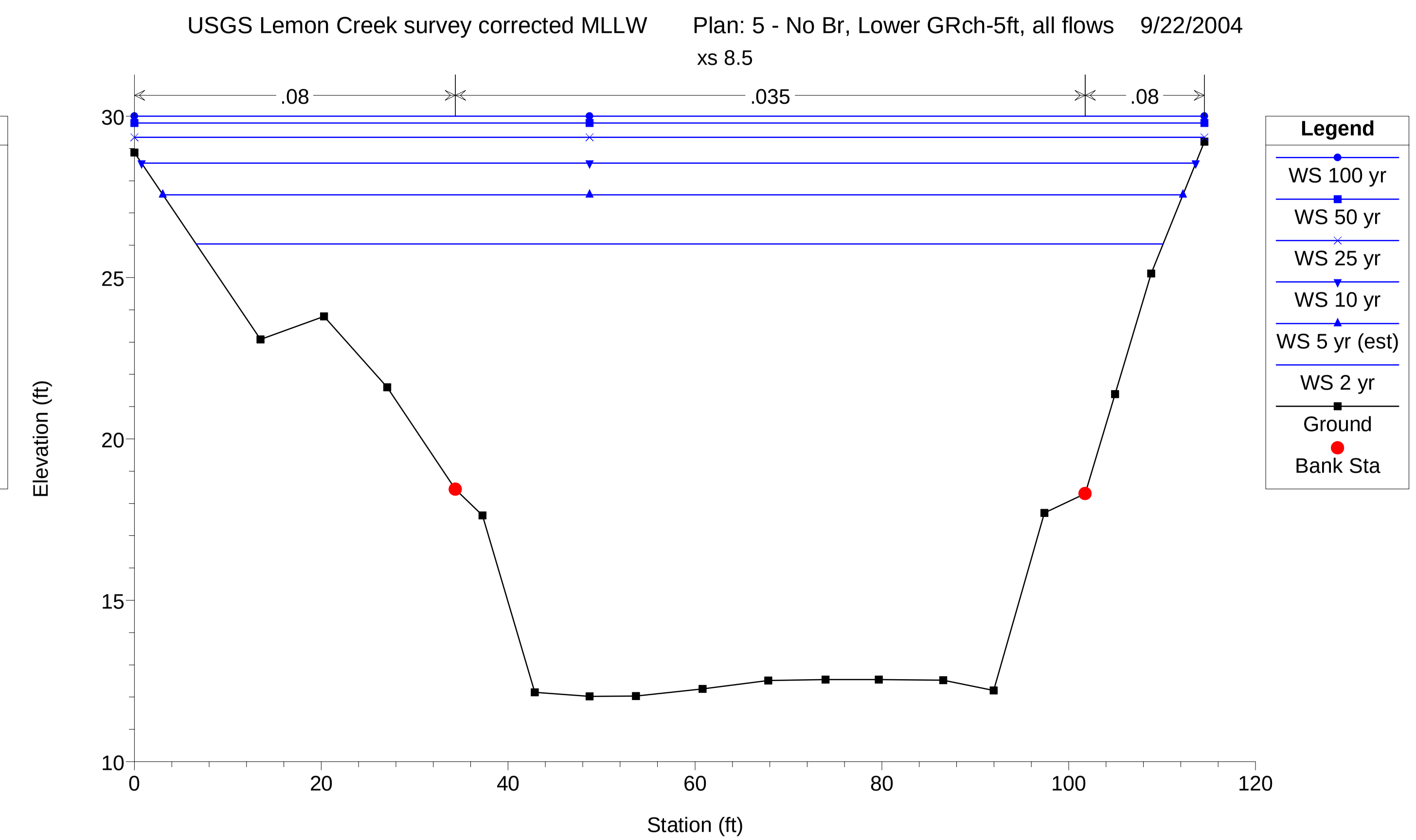
Elevation (ft)
Station (ft)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9/22/2004
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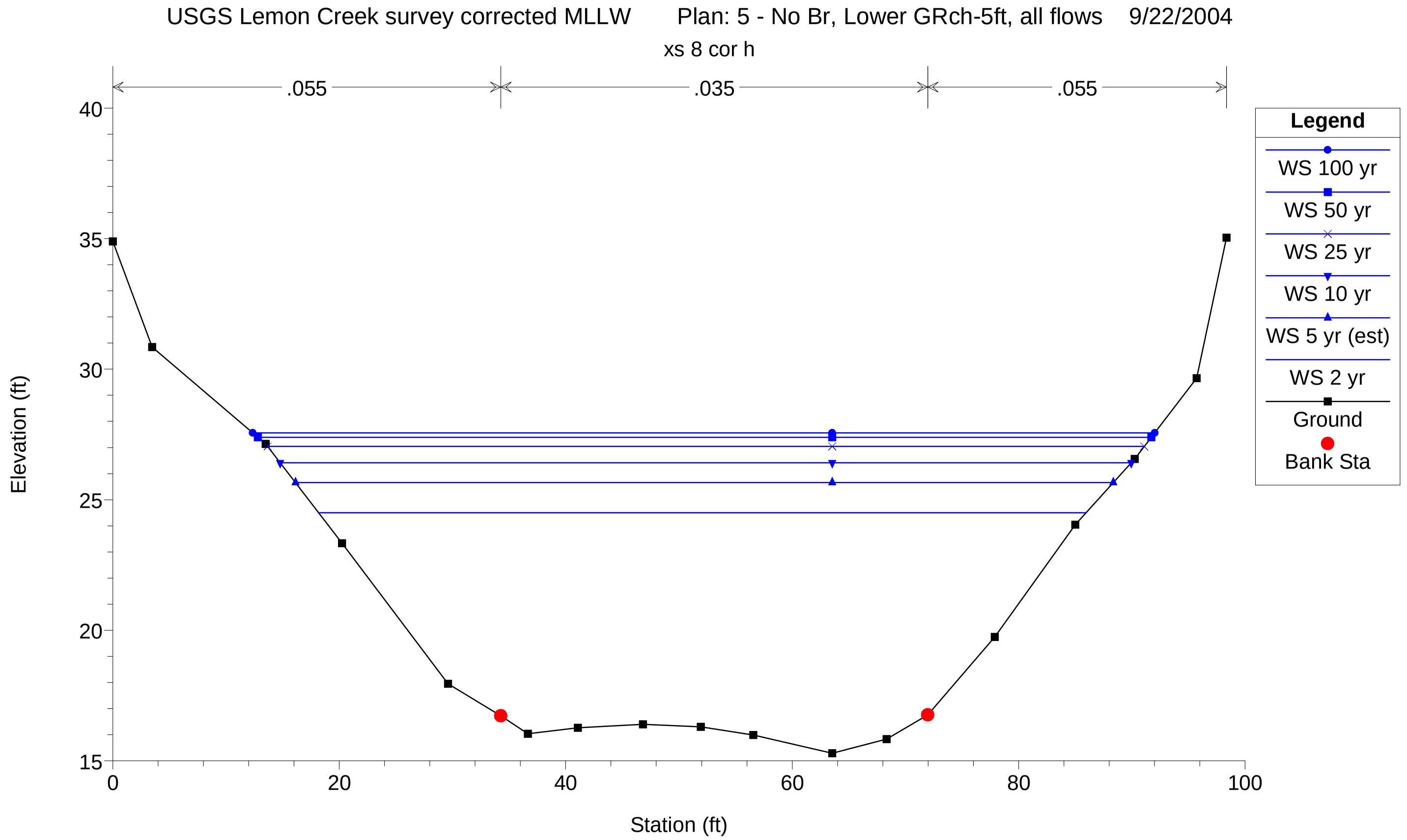
WS 5 yr (est)
WS 2 yr
Ground
Bank Sta
Elevation (ft)
Station (ft)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WS 25 yr
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WS 5 yr (est)
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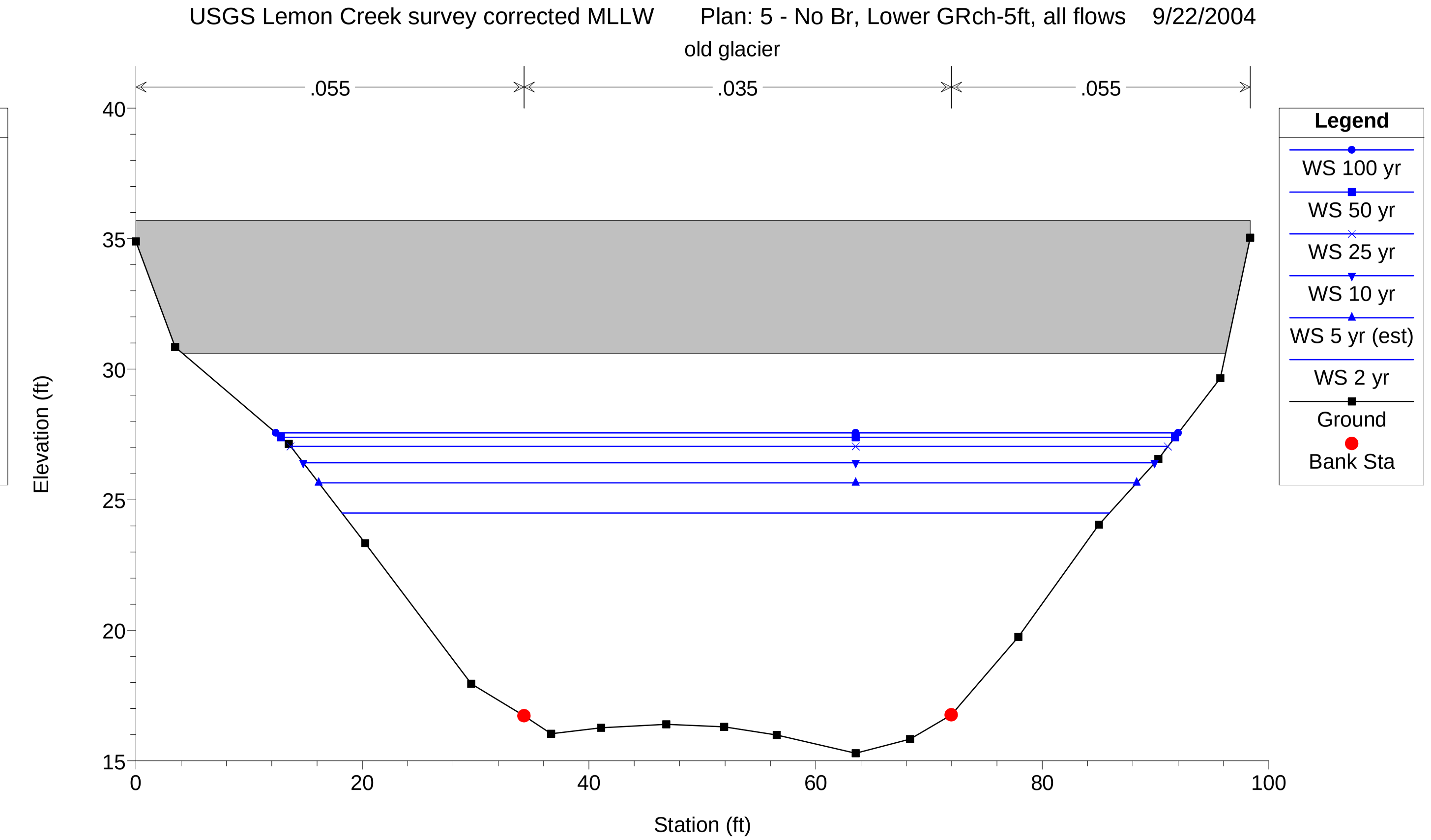
Ground
Bank Sta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Elevation (ft)
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WS 100 yr
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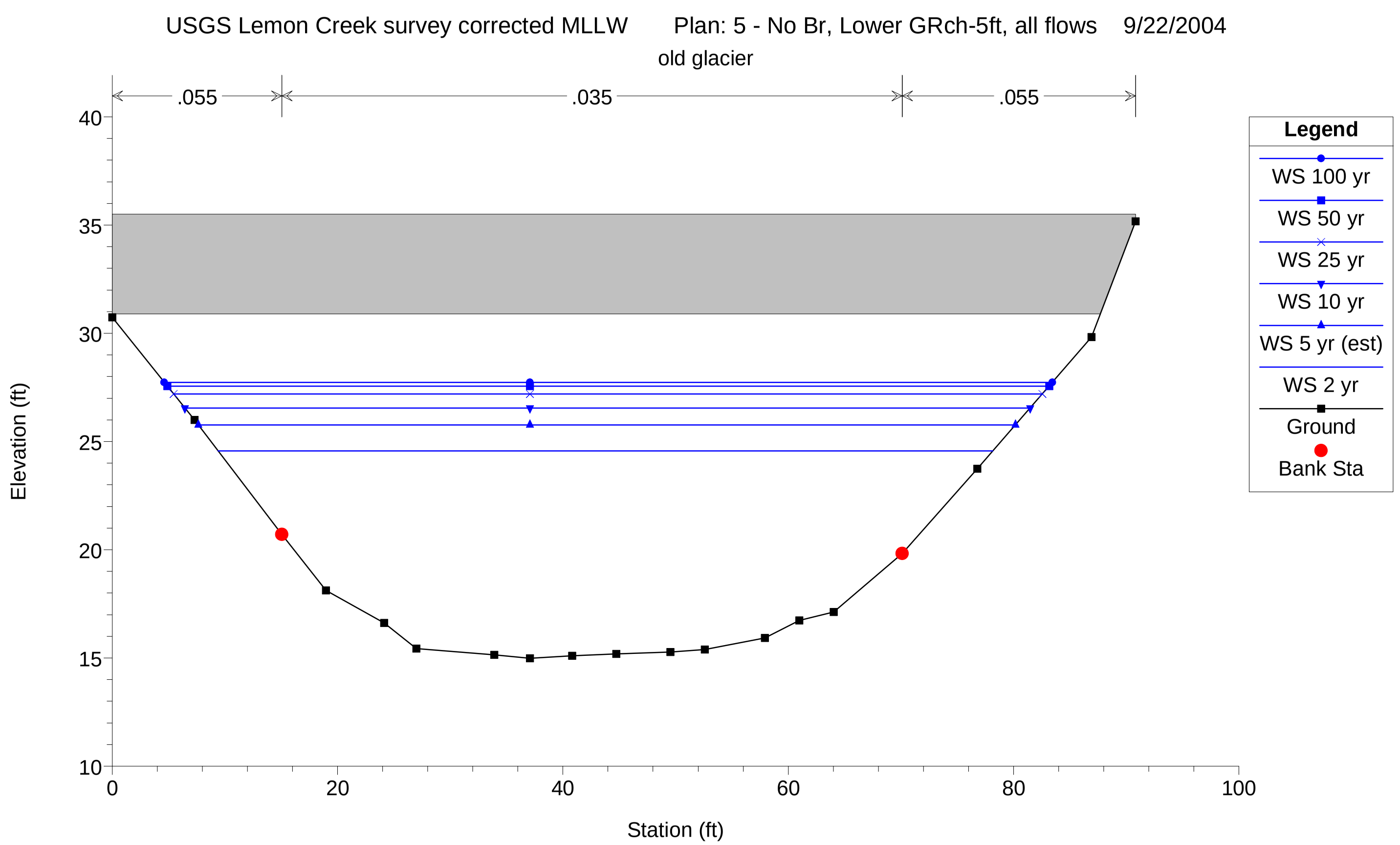
WS 5 yr (est)
WS 2 yr
Ground
Bank Sta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old glacier
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Station (ft)
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WS 100 yr
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WS 5 yr (est)
WS 2 yr
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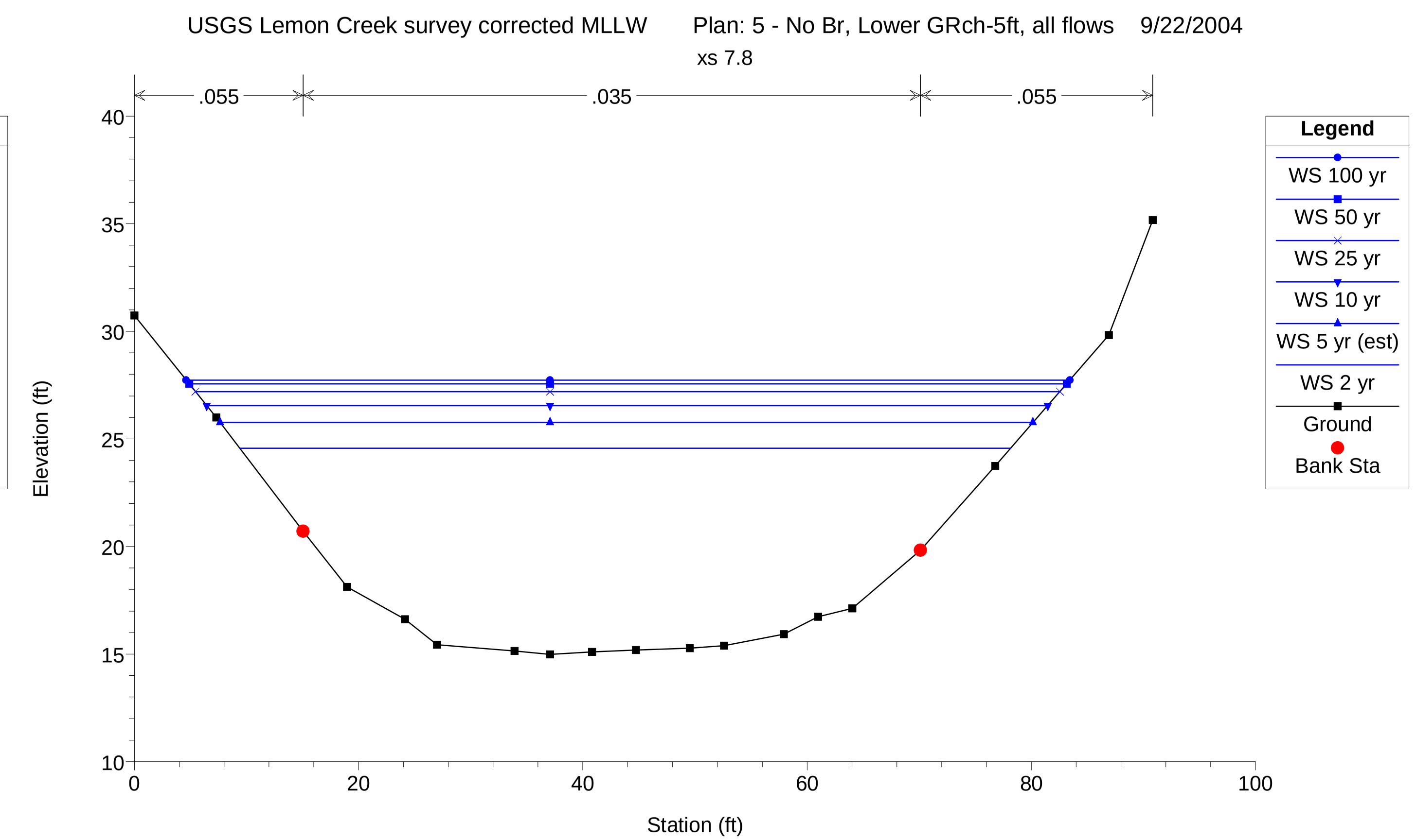
Bank Sta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Elevation (ft)
Station (ft)
Legend
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WS 5 yr (est)
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Ground
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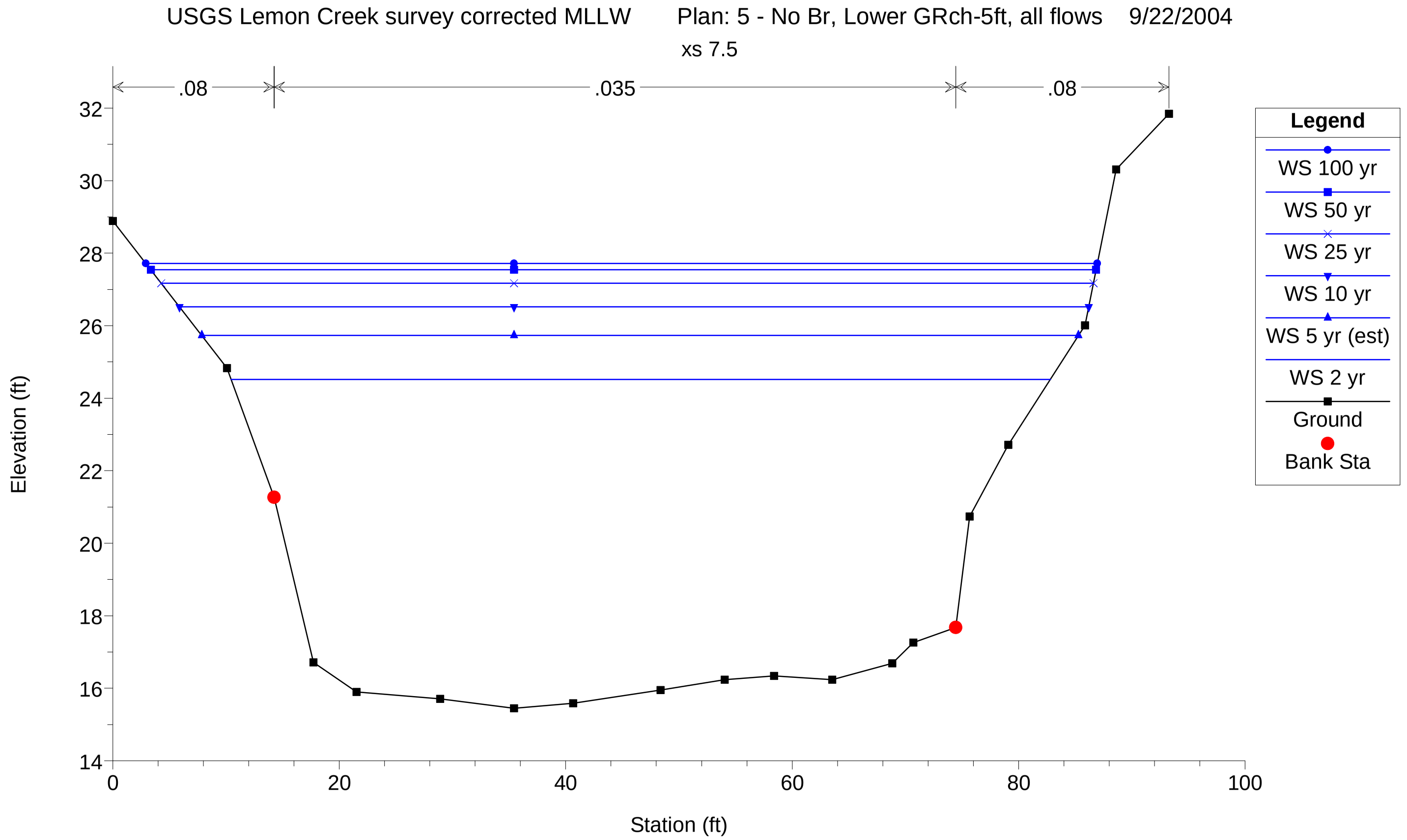

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9/22/2004
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Elevation (ft)
Station (ft)
Legend
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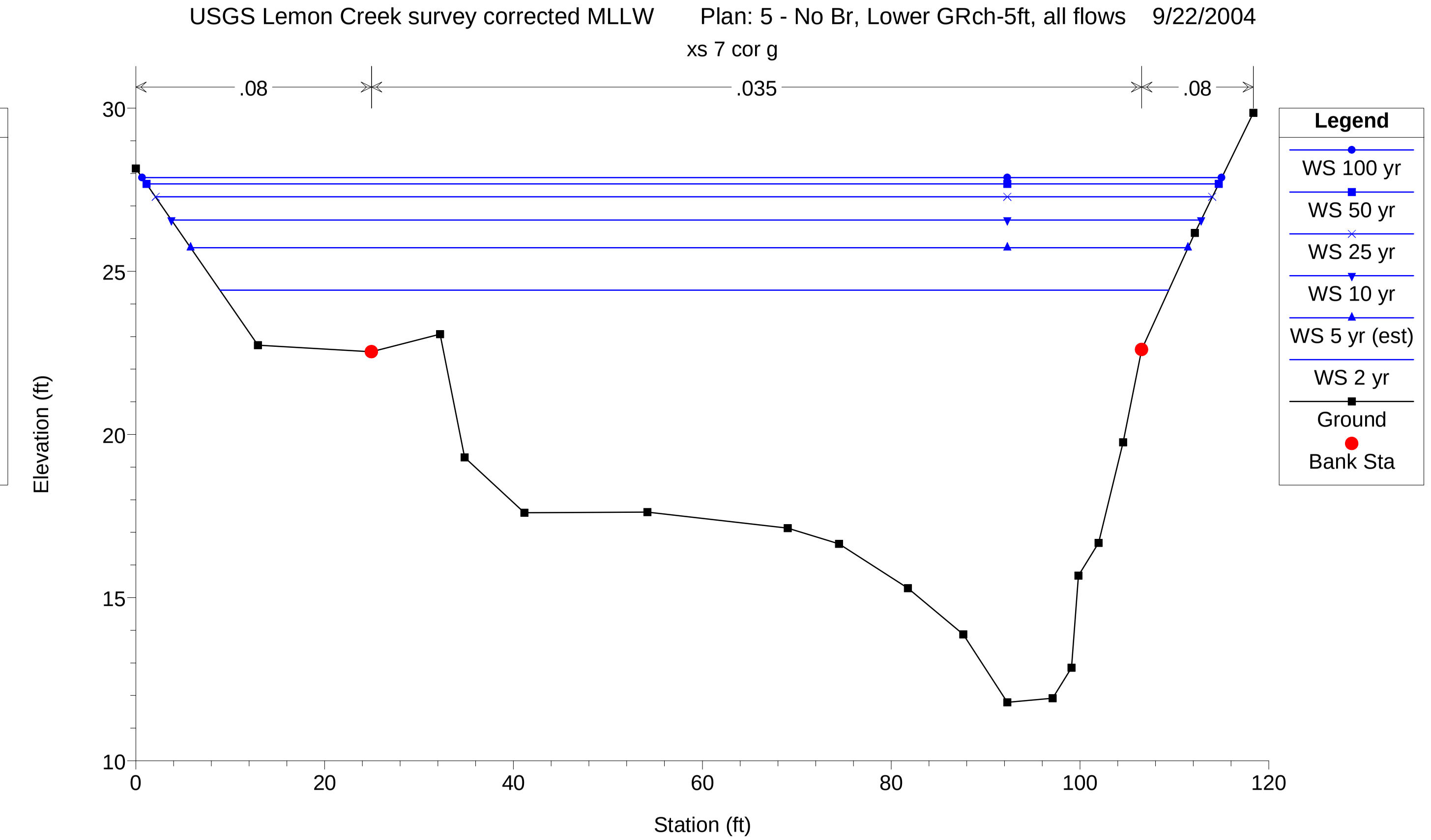
WS 25 yr
WS 10 yr
WS 5 yr (est)
WS 2 yr
Ground
Bank Sta



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9/22/2004
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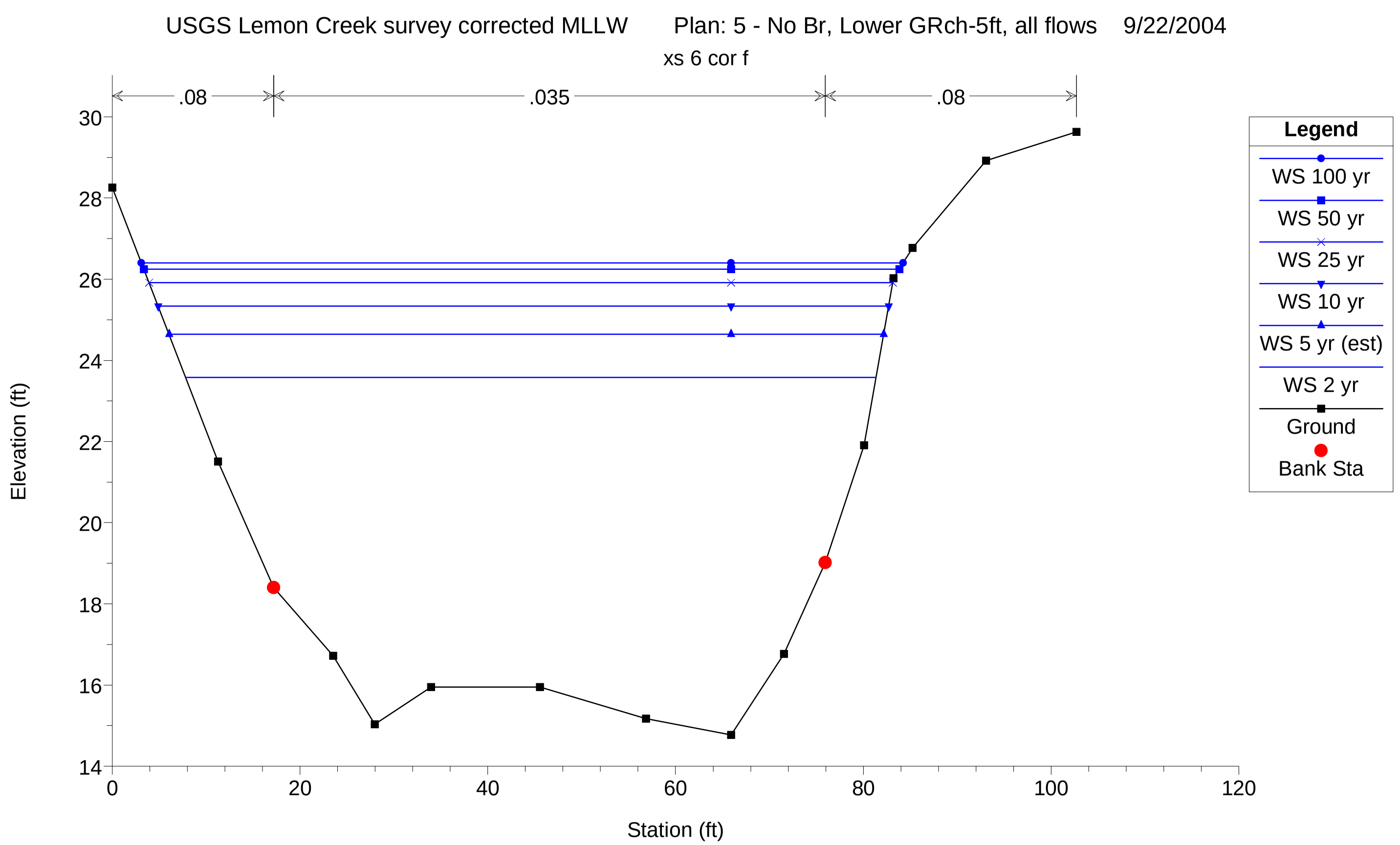
Elevation (ft)
Station (ft)
Legend
WS 100 yr
WS 50 yr
WS 25 yr
WS 10 yr
WS 5 yr (est)
WS 2 yr
Ground
Bank Sta



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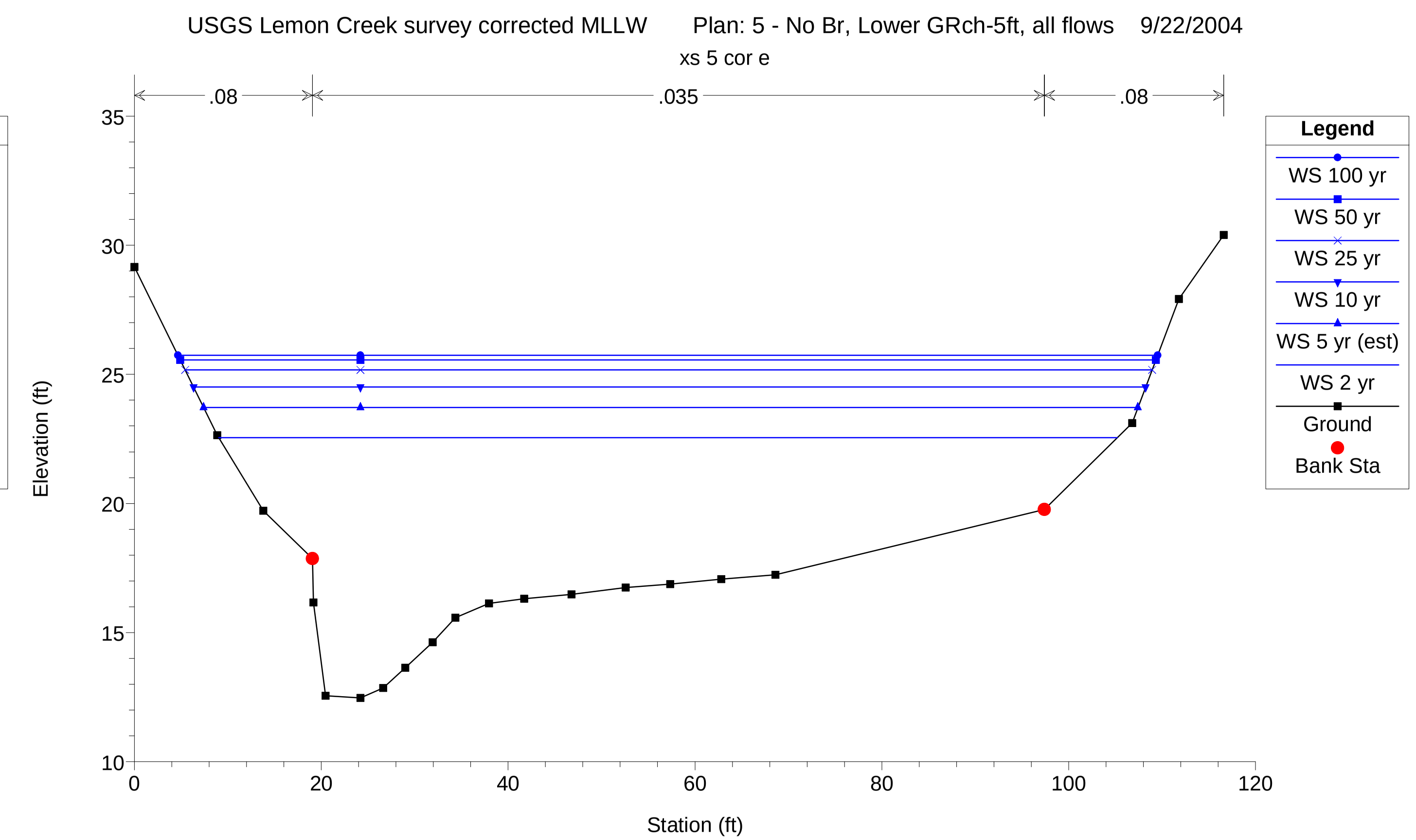
Elevation (ft)
Station (ft)
Legend
WS 100 yr
WS 50 yr
WS 25 yr
WS 10 yr
WS 5 yr (est)
WS 2 yr
Ground
Bank Sta



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9/22/2004
xs 5 cor e
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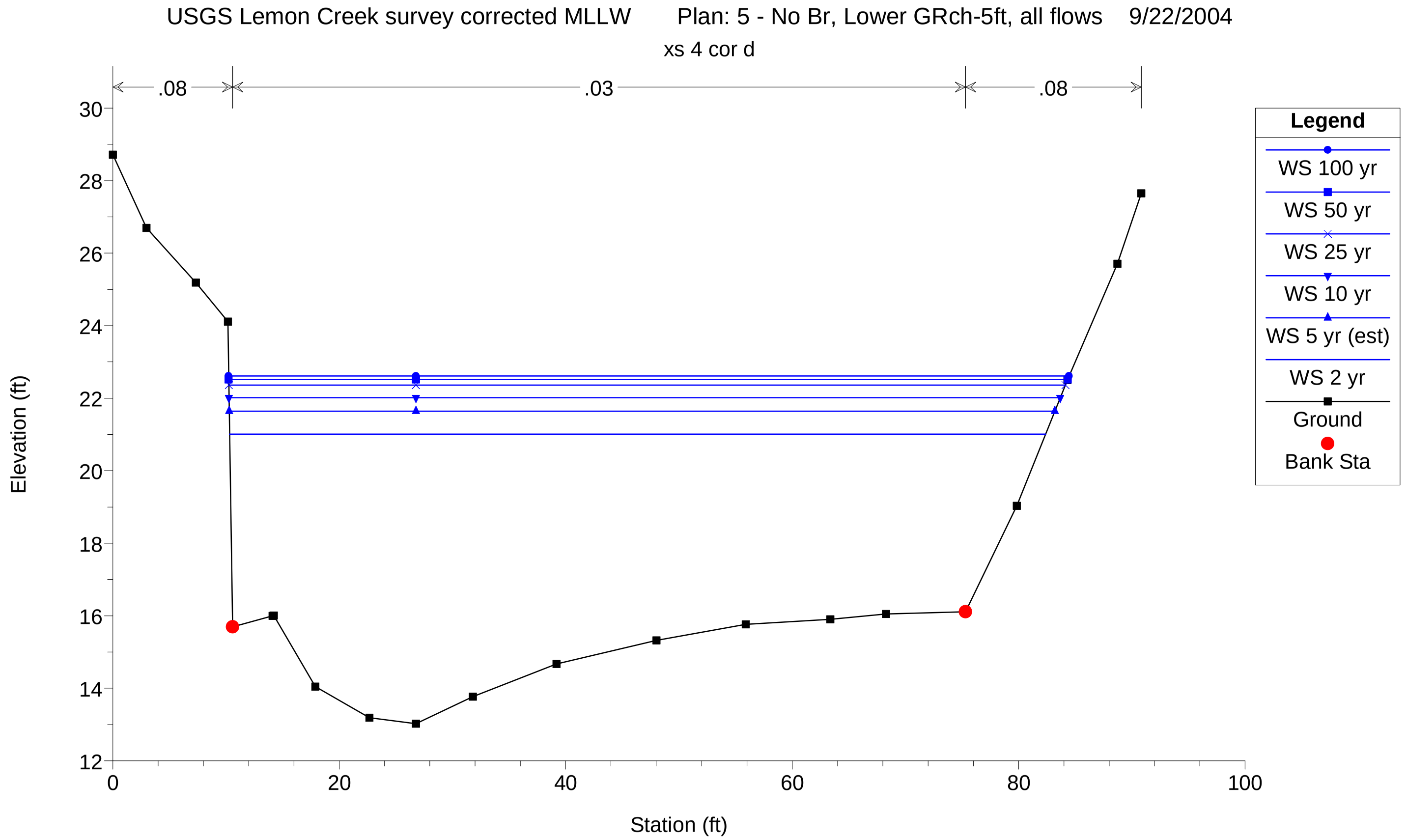
Elevation (ft)
Station (ft)
Legend
WS 100 yr
WS 50 yr
WS 25 yr
WS 10 yr
WS 5 yr (est)
WS 2 yr
Ground
Bank Sta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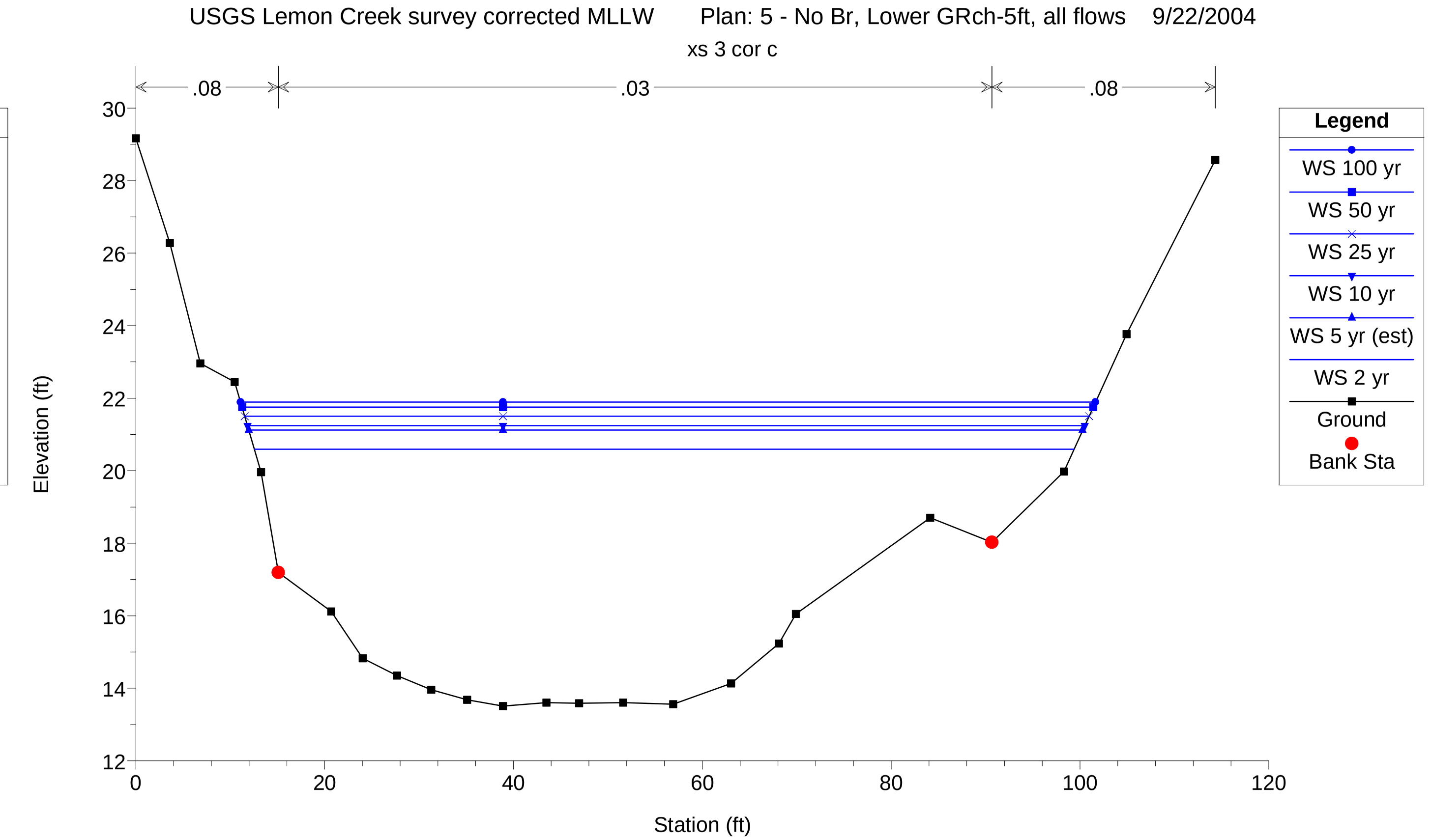
Elevation (ft)
Station (ft)
Legend
WS 100 yr
WS 50 yr
WS 25 yr
WS 10 yr
WS 5 yr (est)
WS 2 yr
Ground
Bank Sta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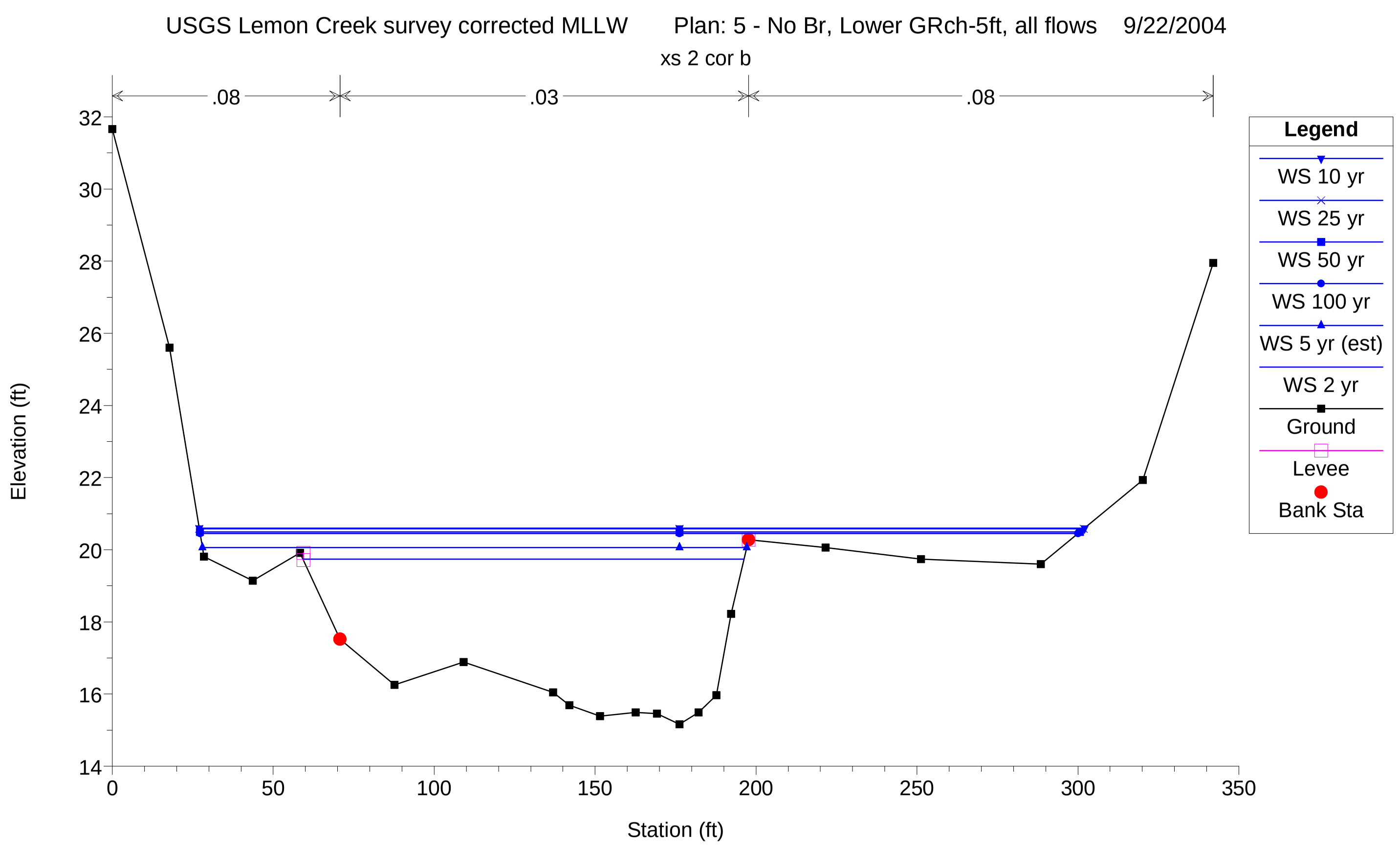
Elevation (ft)
Station (ft)
Legend
WS 100 yr
WS 50 yr
WS 25 yr
WS 10 yr
WS 5 yr (est)
WS 2 yr
Ground
Bank Sta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xs 2 cor b
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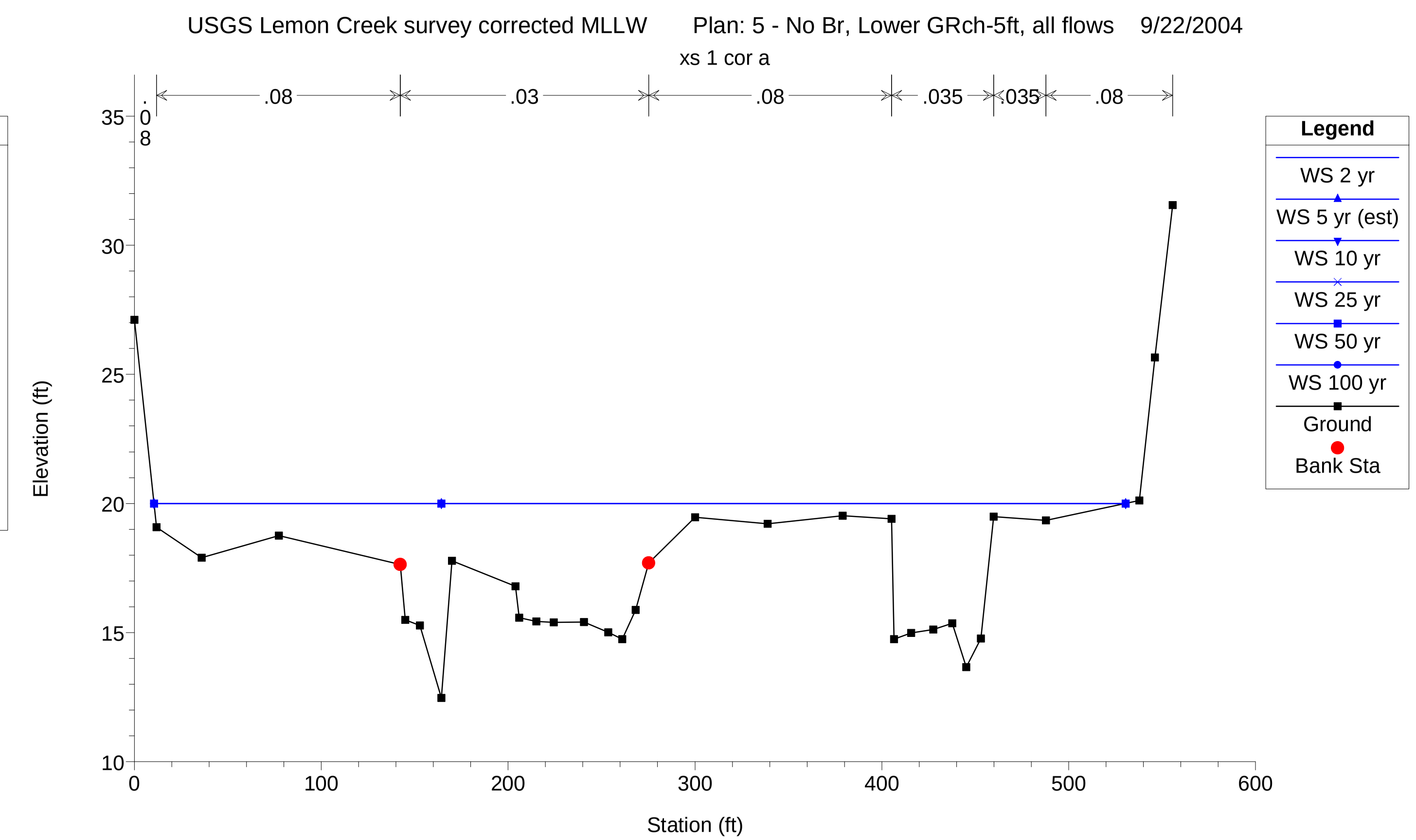
Elevation (ft)
Station (ft)
Legend
WS 10 yr
WS 25 yr
WS 50 yr
WS 100 yr
WS 5 yr (est)
WS 2 yr
Ground
Levee
Bank Sta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Elevation (ft)
Station (ft)
Legend
WS 2 yr
WS 5 yr (est)
WS 10 yr
WS 25 yr
WS 50 yr
WS 100 yr
Ground
Bank Sta

Appendix F(b)

Hydraulics

Tide Water to Top of Gorge
In Stream Mining RediMix to Glacier Highway
RediMix Bridge in Place

Lemon Creek from tidewater to 350-ft above gorge bridge

Plan 6 Mining below Glacier Highway with RediMix Bridge in place

HEC-RAS Plan: 6br,Gr-3,lwr River: lemon creek Reach: 1

Reach	River Sta	Profile	Cum Ch Len (ft)	Q Total (cfs)	Q Channel (cfs)	Vel Chnl (ft/s)	Hydr Depth C (ft)	Top W Act Chan (ft)	E.G. Slope (ft/ft)	Shear Chan (lb/sq ft)
1	1	2 yr		3930	2552.53	4.57	4.2	133.03	0.001304	0.33
1	1	5 yr (est)		5140	3338.42	5.97	4.2	133.03	0.00223	0.57
1	1	10 yr		5990	3890.5	6.96	4.2	133.03	0.003028	0.77
1	1	25 yr		6720	4364.63	7.81	4.2	133.03	0.003811	0.97
1	1	50 yr		7140	4637.42	8.3	4.2	133.03	0.004303	1.1
1	1	100 yr		7340	4767.32	8.53	4.2	133.03	0.004547	1.16
1	2	2 yr	174	3930	3909.9	8.95	3.48	125.48	0.006237	1.35
1	2	5 yr (est)	174	5140	5092.9	10.66	3.78	126.34	0.007936	1.86
1	2	10 yr	174	5990	5801.93	10.62	4.3	126.91	0.006641	1.77
1	2	25 yr	174	6720	6421.08	10.95	4.62	126.91	0.006416	1.84
1	2	50 yr	174	7140	6774.47	11.15	4.79	126.91	0.006357	1.88
1	2	100 yr	174	7340	6941.57	11.25	4.86	126.91	0.00633	1.91
1	3	2 yr	372	3930	3907.28	9.68	5.34	75.6	0.004166	1.37
1	3	5 yr (est)	372	5140	5099.71	11.5	5.86	75.6	0.005191	1.88
1	3	10 yr	372	5990	5940.02	13.11	5.99	75.6	0.006553	2.42
1	3	25 yr	372	6720	6657.1	14.09	6.25	75.6	0.007158	2.76
1	3	50 yr	372	7140	7065.91	14.37	6.51	75.6	0.007053	2.83
1	3	100 yr	372	7340	7259.87	14.46	6.64	75.6	0.00695	2.84
1	3.2	2 yr	404	3930	3929.88	14.83	7.48	35.4	0.007784	3.04
1	3.2	5 yr (est)	404	5140	5139.77	16.72	8.68	35.4	0.008117	3.68
1	3.2	10 yr	404	5990	5989.66	17.62	9.6	35.4	0.007883	3.95
1	3.2	25 yr	404	6720	6719.54	18.34	10.35	35.4	0.007727	4.17
1	3.2	50 yr	404	7140	7139.47	18.69	10.79	35.4	0.007585	4.27
1	3.2	100 yr	404	7340	7339.43	18.85	11	35.4	0.00753	4.32
1	3.3	2 yr	419	3930	3929.96	16.46	8.84	27	0.007095	3.47
1	3.3	5 yr (est)	419	5140	5139.93	18.04	10.55	27	0.006731	3.93
1	3.3	10 yr	419	5990	5989.87	16.12	13.76	27	0.003773	2.87
1	3.3	25 yr	419	6720	6719.84	16.75	14.86	27	0.003679	3.02
1	3.3	50 yr	419	7140	7139.86	20.49	12.9	27	0.006642	4.74
1	3.3	100 yr	419	7340	7339.8	16.88	16.11	27	0.003351	2.99
1	3.5	2 yr	446	3930	3841.3	8.81	11.66	37.42	0.001238	0.88
1	3.5	5 yr (est)	446	5140	4931.52	9.3	14.16	37.42	0.001066	0.92
1	3.5	10 yr	446	5990	5680.56	9.35	16.24	37.42	0.000896	0.89
1	3.5	25 yr	446	6720	6334.76	9.61	17.62	37.42	0.00085	0.91
1	3.5	50 yr	446	7140	6722.7	10.02	17.93	37.42	0.000903	0.99
1	3.5	100 yr	446	7340	6887.46	9.74	18.9	37.42	0.000794	0.91
1	4	2 yr	493	3930	3863.46	4.46	13.38	64.74	0.000264	0.22
1	4	5 yr (est)	493	5140	5015.75	4.86	15.95	64.74	0.000247	0.24
1	4	10 yr	493	5990	5815.57	4.99	18	64.74	0.000222	0.24
1	4	25 yr	493	6720	6506.28	5.18	19.42	64.74	0.000216	0.26
1	4	50 yr	493	7140	6908.16	5.38	19.82	64.74	0.000227	0.27
1	4	100 yr	493	7340	7091.75	5.29	20.72	64.74	0.000207	0.26
1	5	2 yr	764	3930	3804.91	4.06	11.97	78.34	0.000358	0.25
1	5	5 yr (est)	764	5140	4920.13	4.31	14.57	78.34	0.000311	0.27
1	5	10 yr	764	5990	5679.84	4.36	16.62	78.34	0.000267	0.26
1	5	25 yr	764	6720	6336.87	4.48	18.05	78.34	0.000252	0.27
1	5	50 yr	764	7140	6723.51	4.65	18.47	78.34	0.000263	0.29
1	5	100 yr	764	7340	6893.31	4.55	19.36	78.34	0.000237	0.27

Lemon Creek from tidewater to 350-ft above gorge bridge

Plan 6 Mining below Glacier Highway with RediMix Bridge in place

HEC-RAS Plan: 6br,Gr-3,lwr River: lemon creek Reach: 1

Reach	River Sta	Profile	Cum Ch Len (ft)	Q Total (cfs)	Q Channel (cfs)	Vel Chnl (ft/s)	Hydr Depth C (ft)	Top W Act Chan (ft)	E.G. Slope (ft/ft)	Shear Chan (lb/sq ft)
1	6	2 yr	1078	3930	3832.15	5.17	12.61	58.77	0.000543	0.4
1	6	5 yr (est)	1078	5140	4953.14	5.56	15.17	58.77	0.00049	0.44
1	6	10 yr	1078	5990	5687.98	5.62	17.21	58.77	0.000425	0.43
1	6	25 yr	1078	6720	6321.66	5.78	18.63	58.77	0.000403	0.44
1	6	50 yr	1078	7140	6700.17	5.99	19.04	58.77	0.000421	0.47
1	6	100 yr	1078	7340	6853.85	5.85	19.93	58.77	0.000378	0.45
1	7	2 yr	1213	3930	3856.97	4.24	11.15	81.56	0.000452	0.29
1	7	5 yr (est)	1213	5140	4967.17	4.43	13.74	81.56	0.000374	0.29
1	7	10 yr	1213	5990	5724.69	4.45	15.78	81.56	0.000313	0.28
1	7	25 yr	1213	6720	6383.3	4.55	17.2	81.56	0.000292	0.29
1	7	50 yr	1213	7140	6771.41	4.71	17.63	81.56	0.000303	0.3
1	7	100 yr	1213	7340	6940.65	4.6	18.5	81.56	0.000271	0.29
1	7.5	2 yr	1361	3930	3877.42	4.92	13.09	60.22	0.000494	0.37
1	7.5	5 yr (est)	1361	5140	5013.17	5.32	15.64	60.22	0.000456	0.41
1	7.5	10 yr	1361	5990	5794.39	5.45	17.66	60.22	0.000407	0.41
1	7.5	25 yr	1361	6720	6458.39	5.62	19.07	60.22	0.000391	0.42
1	7.5	50 yr	1361	7140	6849.44	5.84	19.49	60.22	0.000409	0.45
1	7.5	100 yr	1361	7340	7016.66	5.72	20.36	60.22	0.000371	0.43
1	7.8	2 yr	1413	3930	3824.95	5.67	12.26	55.07	0.000706	0.5
1	7.8	5 yr (est)	1413	5140	4909.67	6.02	14.81	55.07	0.00062	0.53
1	7.8	10 yr	1413	5990	5624.44	6.07	16.83	55.07	0.000531	0.51
1	7.8	25 yr	1413	6720	6240.09	6.21	18.24	55.07	0.000499	0.52
1	7.8	50 yr	1413	7140	6609.98	6.43	18.67	55.07	0.000519	0.56
1	7.8	100 yr	1413	7340	6754.99	6.28	19.54	55.07	0.000466	0.52
1	8	2 yr	1472	3930	3446.87	6.76	13.51	37.72	0.00089	0.69
1	8	5 yr (est)	1472	5140	4344.6	7.17	16.06	37.72	0.000796	0.73
1	8	10 yr	1472	5990	4877.48	7.08	18.25	37.72	0.000654	0.68
1	8	25 yr	1472	6720	5328.52	7.11	19.88	37.72	0.000588	0.67
1	8	50 yr	1472	7140	5618.08	7.3	20.39	37.72	0.0006	0.7
1	8	100 yr	1472	7340	5696.37	7.07	21.37	37.72	0.000527	0.64
1	8.5	2 yr	1597	3930	3707.02	5.6	9.83	67.41	0.000829	0.51
1	8.5	5 yr (est)	1597	5140	4733.67	5.66	12.41	67.41	0.00062	0.48
1	8.5	10 yr	1597	5990	5426.82	5.52	14.58	67.41	0.000477	0.43
1	8.5	25 yr	1597	6720	6035.72	5.53	16.19	67.41	0.000416	0.42
1	8.5	50 yr	1597	7140	6397.92	5.68	16.72	67.41	0.00042	0.44
1	8.5	100 yr	1597	7340	6552.8	5.5	17.67	67.41	0.000367	0.4
1	9	2 yr	2020	3930	3725.05	4.19	8.09	109.93	0.000631	0.31
1	9	5 yr (est)	2020	5140	4724.83	4.05	10.61	109.93	0.000411	0.26
1	9	10 yr	2020	5990	5383.13	3.85	12.72	109.93	0.000292	0.22
1	9	25 yr	2020	6720	5946.38	3.78	14.31	109.93	0.00024	0.21
1	9	50 yr	2020	7140	6289.56	3.85	14.86	109.93	0.000237	0.21
1	9	100 yr	2020	7340	6422.01	3.7	15.77	109.93	0.000203	0.19
1	10	2 yr	2770	3930	3848.26	4.13	6.14	151.76	0.000871	0.33
1	10	5 yr (est)	2770	5140	4983.93	3.87	8.38	153.63	0.000508	0.26
1	10	10 yr	2770	5990	5771.3	3.62	10.38	153.63	0.000333	0.21
1	10	25 yr	2770	6720	6446.09	3.52	11.93	153.63	0.000261	0.19
1	10	50 yr	2770	7140	6838.86	3.57	12.47	153.63	0.000254	0.19
1	10	100 yr	2770	7340	7013.85	3.42	13.36	153.63	0.000212	0.17

Lemon Creek from tidewater to 350-ft above gorge bridge
Plan 6 Mining below Glacier Highway with RediMix Bridge in place

HEC-RAS Plan: 6br,Gr-3,lwr River: lemon creek Reach: 1

Reach	River Sta	Profile	Cum Ch Len (ft)	Q Total (cfs)	Q Channel (cfs)	Vel Chnl (ft/s)	Hydr Depth C (ft)	Top W Act Chan (ft)	E.G. Slope (ft/ft)	Shear Chan (lb/sq ft)
1	11	2 yr	3204	3930	3883.45	3.79	5.49	186.55	0.000857	0.28
1	11	5 yr (est)	3204	5140	5022.92	3.52	7.65	186.55	0.000475	0.22
1	11	10 yr	3204	5990	5796.72	3.24	9.58	186.55	0.000299	0.17
1	11	25 yr	3204	6720	6452.87	3.12	11.1	186.55	0.000227	0.15
1	11	50 yr	3204	7140	6838.78	3.15	11.64	186.55	0.000217	0.15
1	11	100 yr	3204	7340	7003.18	3	12.51	186.55	0.000179	0.14
1	12	2 yr	3771	3930	3924	5.22	3.96	189.83	0.001937	0.47
1	12	5 yr (est)	3771	5140	5121.38	4.63	5.82	189.83	0.000915	0.33
1	12	10 yr	3771	5990	5950.65	4.11	7.63	189.83	0.000501	0.23
1	12	25 yr	3771	6720	6657.71	3.85	9.11	189.83	0.000348	0.19
1	12	50 yr	3771	7140	7066.28	3.86	9.64	189.83	0.000324	0.19
1	12	100 yr	3771	7340	7251.33	3.64	10.49	189.83	0.000258	0.17
1	13	2 yr	4559	3930	3887.71	7.76	2.62	191.55	0.0104	1.69
1	13	5 yr (est)	4559	5140	5080.16	8.89	2.98	191.55	0.011445	2.13
1	13	10 yr	4559	5990	5902.77	7.39	4.17	191.55	0.005064	1.31
1	13	25 yr	4559	6720	6600.53	6.32	5.45	191.55	0.002591	0.88
1	13	50 yr	4559	7140	7004.01	6.14	5.96	191.55	0.002173	0.81
1	13	100 yr	4559	7340	7190.64	5.58	6.73	191.55	0.001521	0.64
1	13.5	2 yr	4845	3930	3765.53	8.8	3.79	113.01	0.009926	2.27
1	13.5	5 yr (est)	4845	5140	4886.32	9.9	4.37	113.04	0.010418	2.75
1	13.5	10 yr	4845	5990	5696.1	11.6	4.34	113.04	0.014398	3.77
1	13.5	25 yr	4845	6720	6358.68	12.01	4.68	113.04	0.013958	3.95
1	13.5	50 yr	4845	7140	6738.08	12.26	4.86	113.04	0.013837	4.06
1	13.5	100 yr	4845	7340	6918.54	12.38	4.94	113.04	0.013811	4.12
1	14	2 yr	5293	3930	3840.74	4.21	4.19	217.92	0.002432	0.63
1	14	5 yr (est)	5293	5140	5013.12	4.6	5	217.92	0.0023	0.71
1	14	10 yr	5293	5990	5833.91	4.77	5.62	217.92	0.002111	0.73
1	14	25 yr	5293	6720	6538.9	4.97	6.04	217.92	0.002081	0.78
1	14	50 yr	5293	7140	6944.11	5.08	6.28	217.92	0.002065	0.8
1	14	100 yr	5293	7340	7136.96	5.13	6.39	217.92	0.002056	0.81
1	14.5	2 yr	5820	3930	3824.51	8.96	3.78	112.73	0.013079	2.99
1	14.5	5 yr (est)	5820	5140	4877.48	9.86	4.37	113.24	0.013114	3.45
1	14.5	10 yr	5820	5990	5601.7	10.43	4.73	113.55	0.013236	3.76
1	14.5	25 yr	5820	6720	6216.56	10.89	5.01	113.8	0.013364	4.02
1	14.5	50 yr	5820	7140	6567.91	11.15	5.17	113.94	0.013443	4.17
1	14.5	100 yr	5820	7340	6734.64	11.27	5.24	114	0.013481	4.24
1	15	2 yr	6042	3930	3785.15	7.04	5.84	92.08	0.006656	2.37
1	15	5 yr (est)	6042	5140	4880.35	8.04	6.53	92.94	0.007482	2.98
1	15	10 yr	6042	5990	5699.47	8.76	6.96	93.46	0.008192	3.47
1	15	25 yr	6042	6720	6357.35	9.28	7.3	93.89	0.008633	3.83
1	15	50 yr	6042	7140	6716.43	9.53	7.49	94.12	0.008817	4.01
1	15	100 yr	6042	7340	6886.44	9.65	7.58	94.23	0.008901	4.09
1	15.5	2 yr	6436	3930	3929.64	8.45	4.93	94.42	0.01203	3.61
1	15.5	5 yr (est)	6436	5140	5137.21	9.26	5.79	95.89	0.011705	4.12
1	15.5	10 yr	6436	5990	5983.7	9.71	6.36	96.89	0.011383	4.39
1	15.5	25 yr	6436	6720	6709.74	10.12	6.79	97.64	0.011357	4.67
1	15.5	50 yr	6436	7140	7127.11	10.37	7.01	98.04	0.011419	4.85
1	15.5	100 yr	6436	7340	7325.76	10.48	7.11	98.23	0.011451	4.94

Lemon Creek from tidewater to 350-ft above gorge bridge

Plan 6 Mining below Glacier Highway with RediMix Bridge in place

HEC-RAS Plan: 6br,Gr-3,lwr River: lemon creek Reach: 1

Reach	River Sta	Profile	Cum Ch Len (ft)	Q Total (cfs)	Q Channel (cfs)	Vel Chnl (ft/s)	Hydr Depth C (ft)	Top W Act Chan (ft)	E.G. Slope (ft/ft)	Shear Chan (lb/sq ft)
1	15.8	2 yr	6772	3930	3774.87	10.18	5.46	67.9	0.018385	6.06
1	15.8	5 yr (est)	6772	5140	4904.8	11.23	6.35	68.81	0.018448	7.03
1	15.8	10 yr	6772	5990	5791.88	12.39	6.75	69.23	0.020718	8.38
1	15.8	25 yr	6772	6720	6422.51	12.7	7.25	69.75	0.019902	8.61
1	15.8	50 yr	6772	7140	6773.2	12.76	7.58	70.1	0.018971	8.56
1	15.8	100 yr	6772	7340	6942.98	12.83	7.7	70.23	0.018794	8.62
1	16	2 yr	6985	3930	3292.49	11.25	6.47	45.25	0.023246	8.8
1	16	5 yr (est)	6985	5140	4154.34	12.21	7.29	46.66	0.023535	9.99
1	16	10 yr	6985	5990	4719.02	12.34	7.98	47.87	0.021414	9.92
1	16	25 yr	6985	6720	5235.33	12.98	8.32	48.47	0.022457	10.82
1	16	50 yr	6985	7140	5536.46	13.42	8.47	48.71	0.023502	11.51
1	16	100 yr	6985	7340	5675.68	13.57	8.57	48.82	0.023682	11.72
1	17	2 yr	7123	3930	3353.14	10.91	7.35	41.81	0.018787	8.51
1	17	5 yr (est)	7123	5140	4322.53	12.08	8.56	41.81	0.018816	9.93
1	17	10 yr	7123	5990	4991.46	12.8	9.33	41.81	0.018829	10.83
1	17	25 yr	7123	6720	5559.37	13.36	9.95	41.81	0.018814	11.54
1	17	50 yr	7123	7140	5882.1	13.66	10.3	41.81	0.018807	11.94
1	17	100 yr	7123	7340	6035.12	13.81	10.45	41.81	0.018821	12.13
1	17.5	2 yr	7263	3930	2955.51	12.81	10.08	22.89	0.022179	13.54
1	17.5	5 yr (est)	7263	5140	3734.99	14.44	11.3	22.89	0.024229	16.58
1	17.5	10 yr	7263	5990	4264.06	15.45	12.06	22.89	0.025418	18.56
1	17.5	25 yr	7263	6720	4708.87	16.24	12.66	22.89	0.026317	20.18
1	17.5	50 yr	7263	7140	4961.42	16.68	12.99	22.89	0.026809	21.1
1	17.5	100 yr	7263	7340	5080.86	16.88	13.15	22.89	0.027037	21.53
1	18	2 yr	7408	3930	2763.67	14.34	7.12	27.07	0.043368	18.96
1	18	5 yr (est)	7408	5140	3468.9	15.66	8.18	27.07	0.042951	21.58
1	18	10 yr	7408	5990	3946.39	16.38	8.9	27.07	0.042031	22.97
1	18	25 yr	7408	6720	4348.9	16.95	9.48	27.07	0.041354	24.07
1	18	50 yr	7408	7140	4579.8	17.29	9.79	27.07	0.041274	24.8
1	18	100 yr	7408	7340	4686.84	17.41	9.94	27.07	0.040964	25.01
1	19	2 yr	7600	3930	2027.67	11.24	10.96	16.45	0.017324	10.47
1	19	5 yr (est)	7600	5140	2474.33	12.23	12.3	16.45	0.017588	11.92
1	19	10 yr	7600	5990	2778.05	12.87	13.12	16.45	0.017859	12.92
1	19	25 yr	7600	6720	3032.04	13.37	13.79	16.45	0.018053	13.72
1	19	50 yr	7600	7140	3174.36	13.63	14.16	16.45	0.018092	14.12
1	19	100 yr	7600	7340	3243.12	13.76	14.32	16.45	0.018182	14.35
1	20	2 yr	7704	3930	2413.59	13.53	7.29	24.49	0.038675	16.88
1	20	5 yr (est)	7704	5140	2867.75	13.62	8.6	24.49	0.031459	16.2
1	20	10 yr	7704	5990	3184.03	13.8	9.42	24.49	0.028557	16.12
1	20	25 yr	7704	6720	3454.41	13.98	10.09	24.49	0.026779	16.19
1	20	50 yr	7704	7140	3608.66	14.09	10.46	24.49	0.025912	16.24
1	20	100 yr	7704	7340	3682.65	14.15	10.63	24.49	0.025587	16.29
1	21	2 yr	7794	3930	2677.21	15.03	7.37	24.16	0.045303	20.57
1	21	5 yr (est)	7794	5140	3389.12	16.38	8.56	24.16	0.044125	23.26
1	21	10 yr	7794	5990	3877.86	17.16	9.35	24.16	0.043034	24.78
1	21	25 yr	7794	6720	4293.6	17.81	9.98	24.16	0.042473	26.1
1	21	50 yr	7794	7140	4531.65	18.18	10.32	24.16	0.04233	26.9
1	21	100 yr	7794	7340	4645.48	18.37	10.47	24.16	0.042428	27.35

Lemon Creek from tidewater to 350-ft above gorge bridge
Plan 6   Mining below Glacier Highway with RediMix Bridge in place

HEC-RAS Plan: 6br,Gr-3,lwr   River: lemon creek   Reach: 1

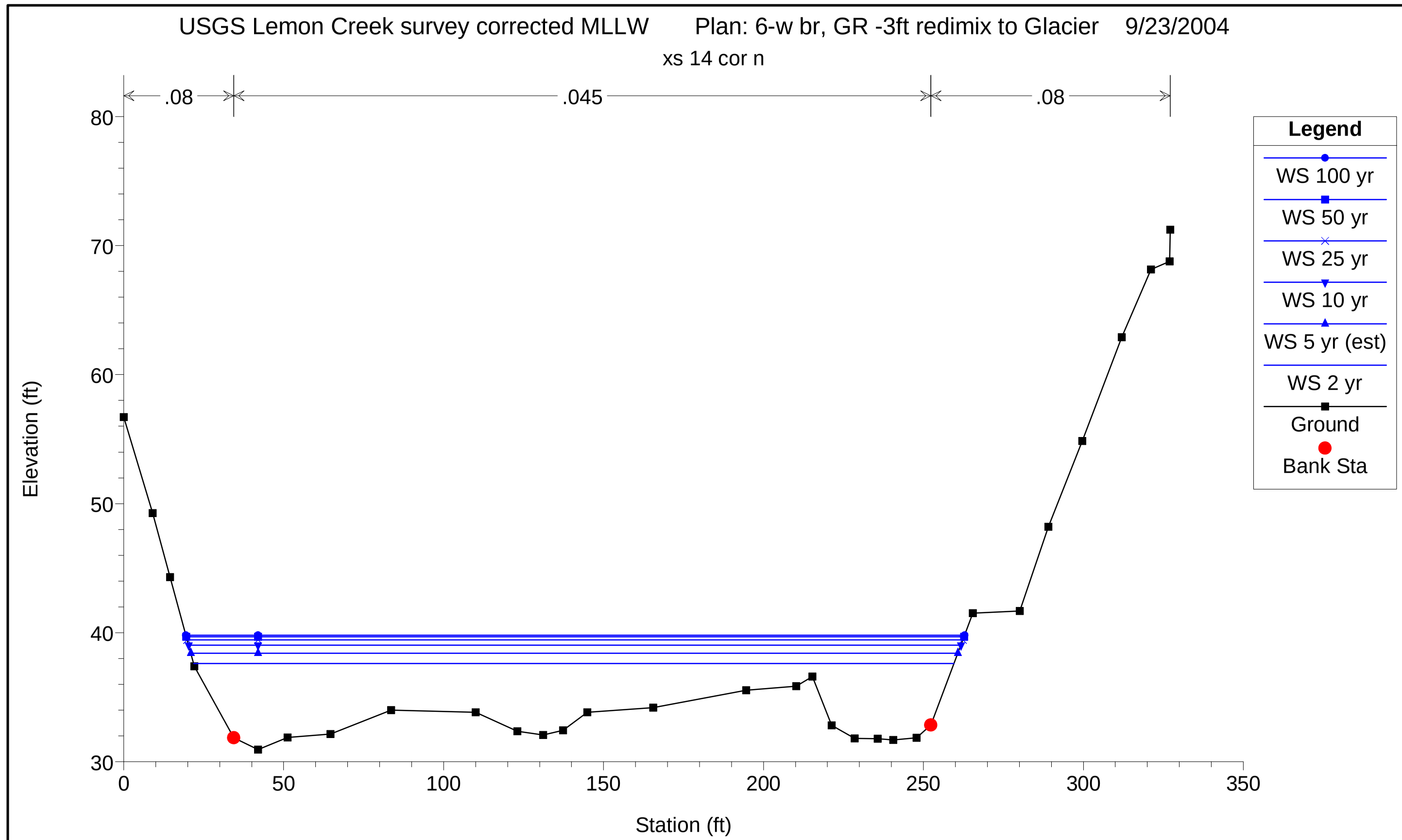
Reach	River Sta	Profile	Cum Ch Len (ft)	Q Total (cfs)	Q Channel (cfs)	Vel Chnl (ft/s)	Hydr Depth C (ft)	Top W Act Chan (ft)	E.G. Slope (ft/ft)	Shear Chan (lb/sq ft)
1	22	2 yr	7906	3930	3050.35	11.81	9.11	28.33	0.021176	11.86
1	22	5 yr (est)	7906	5140	3882.2	13.12	10.44	28.33	0.021776	13.97
1	22	10 yr	7906	5990	4455.18	13.95	11.28	28.33	0.022212	15.39
1	22	25 yr	7906	6720	4939.37	14.58	11.96	28.33	0.022462	16.5
1	22	50 yr	7906	7140	5214.63	14.92	12.34	28.33	0.022545	17.09
1	22	100 yr	7906	7340	5344.39	15.06	12.52	28.33	0.022532	17.34
1	23	2 yr	8014	3930	2857.73	12.9	10.28	21.55	0.021818	13.62
1	23	5 yr (est)	8014	5140	3611.53	14.38	11.66	21.55	0.022941	16.24
1	23	10 yr	8014	5990	4126.6	15.3	12.52	21.55	0.023611	17.95
1	23	25 yr	8014	6720	4564.02	16.04	13.21	21.55	0.024155	19.38
1	23	50 yr	8014	7140	4814.23	16.44	13.59	21.55	0.024458	20.18
1	23	100 yr	8014	7340	4932.92	16.63	13.76	21.55	0.024591	20.56
1	24	2 yr	8247	3930	3926.51	8.96	8.18	53.6	0.009178	4.2
1	24	5 yr (est)	8247	5140	5127.11	9.78	9.71	54	0.008723	4.73
1	24	10 yr	8247	5990	5964.67	10.3	10.72	54	0.008491	5.08
1	24	25 yr	8247	6720	6679.37	10.72	11.54	54	0.008325	5.37
1	24	50 yr	8247	7140	7088.55	10.94	12	54	0.008237	5.52
1	24	100 yr	8247	7340	7282.88	11.04	12.21	54	0.008197	5.59
1	25	2 yr	8378	3930	3896.07	5.02	5.9	131.61	0.001761	0.63
1	25	5 yr (est)	8378	5140	5067.19	5.02	7.57	133.48	0.001274	0.59
1	25	10 yr	8378	5990	5883.52	5.06	8.63	134.69	0.00109	0.57
1	25	25 yr	8378	6720	6581.45	5.11	9.5	135.69	0.00098	0.56
1	25	50 yr	8378	7140	6981.76	5.13	9.98	136.24	0.000929	0.56
1	25	100 yr	8378	7340	7172.07	5.15	10.21	136.5	0.000908	0.56
1	26	2 yr	8453	3930	3872.42	7.5	5.65	91.43	0.004104	1.43
1	26	5 yr (est)	8453	5140	4880.85	7.2	7.41	91.43	0.002636	1.21
1	26	10 yr	8453	5990	5563.99	7.11	8.56	91.43	0.002121	1.12
1	26	25 yr	8453	6720	6142.09	7.07	9.5	91.43	0.001828	1.07
1	26	50 yr	8453	7140	6471.51	7.06	10.02	91.43	0.001697	1.05
1	26	100 yr	8453	7340	6627.7	7.06	10.26	91.43	0.001642	1.04
1	27	2 yr	8505	3930	3727.88	12.17	6.35	48.2	0.009442	3.65
1	27	5 yr (est)	8505	5140	4833.54	12.72	7.88	48.2	0.007729	3.71
1	27	10 yr	8505	5990	5602.39	13.02	8.93	48.2	0.006865	3.73
1	27	25 yr	8505	6720	6257.58	13.26	9.79	48.2	0.006288	3.75
1	27	50 yr	8505	7140	6633.69	13.39	10.28	48.2	0.006012	3.76
1	27	100 yr	8505	7340	6814.34	13.46	10.51	48.2	0.005898	3.77
1	28	2 yr	8524	3930	3776.36	12.14	6.03	51.58	0.009954	3.68
1	28	5 yr (est)	8524	5140	4906.05	12.59	7.55	51.58	0.007932	3.68
1	28	10 yr	8524	5990	5698.21	12.87	8.58	51.58	0.006983	3.68
1	28	25 yr	8524	6720	6376.27	13.1	9.44	51.58	0.006372	3.69
1	28	50 yr	8524	7140	6768.26	13.24	9.91	51.58	0.006104	3.71
1	28	100 yr	8524	7340	6955.14	13.3	10.14	51.58	0.005979	3.72
1	29	2 yr	8593	3930	3917.56	7.1	5.46	100.98	0.003474	1.17
1	29	5 yr (est)	8593	5140	5116.78	6.72	4.37	173.97	0.00253	0.69
1	29	10 yr	8593	5990	5960.45	6	5.15	192.8	0.001669	0.53
1	29	25 yr	8593	6720	6677.5	5.66	6.12	192.8	0.001201	0.46
1	29	50 yr	8593	7140	7088.38	5.53	6.65	192.8	0.001014	0.42
1	29	100 yr	8593	7340	7283.63	5.47	6.91	192.8	0.00094	0.4

Lemon Creek from tidewater to 350-ft above gorge bridge

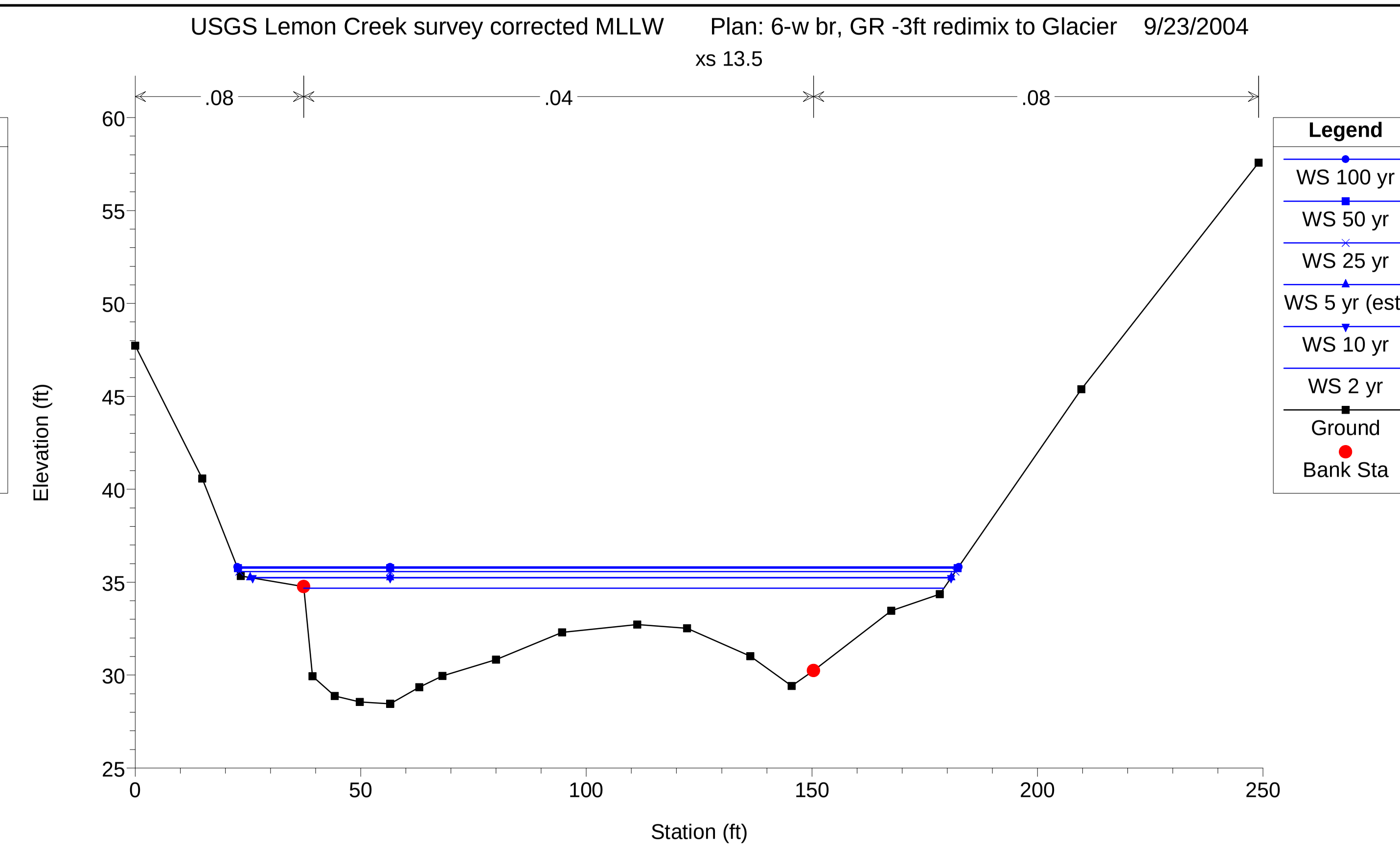
Plan 6 Mining below Glacier Highway with RediMix Bridge in place

HEC-RAS Plan: 6br,Gr-3,lwr River: lemon creek Reach: 1

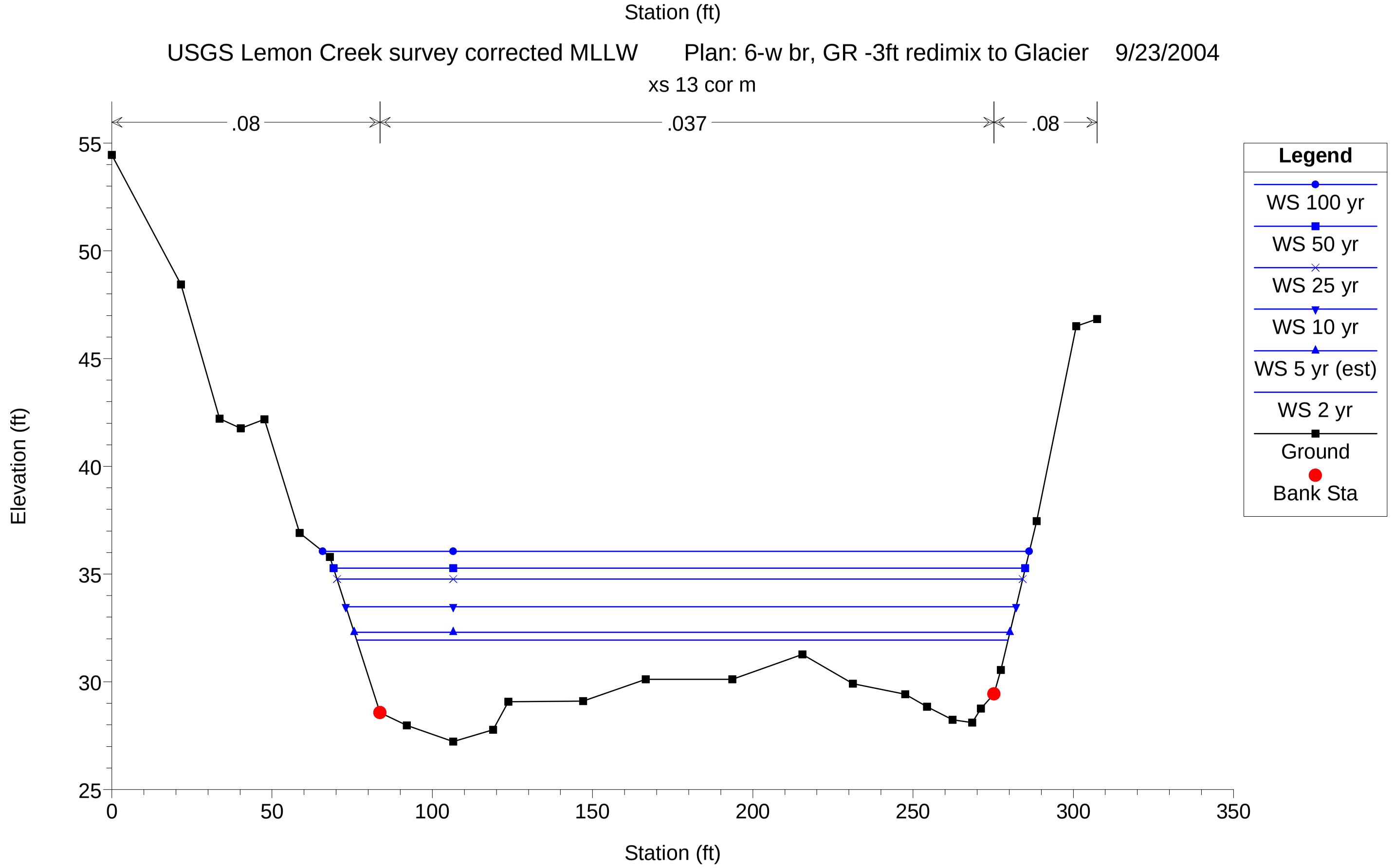
Reach	River Sta	Profile	Cum Ch Len (ft)	Q Total (cfs)	Q Channel (cfs)	Vel Chnl (ft/s)	Hydr Depth C (ft)	Top W Act Chan (ft)	E.G. Slope (ft/ft)	Shear Chan (lb/sq ft)
1	30	2 yr	8659	3930	3859.99	10.74	5.89	61.06	0.008	2.9
1	30	5 yr (est)	8659	5140	4998.07	11.13	7.36	61.06	0.006374	2.89
1	30	10 yr	8659	5990	5784.33	11.32	8.37	61.06	0.005553	2.87
1	30	25 yr	8659	6720	6437.47	11.42	9.24	61.06	0.004956	2.82
1	30	50 yr	8659	7140	6802.44	11.44	9.74	61.06	0.004638	2.78
1	30	100 yr	8659	7340	6971.14	11.44	9.98	61.06	0.004486	2.76
1	31	2 yr	8877	3930	1821.26	9.21	8.04	24.6	0.003881	1.92
1	31	5 yr (est)	8877	5140	2091.81	9.1	9.34	24.6	0.003106	1.79
1	31	10 yr	8877	5990	2254.64	8.86	10.35	24.6	0.002567	1.64
1	31	25 yr	8877	6720	2484.75	9.52	10.61	24.6	0.002868	1.87
1	31	50 yr	8877	7140	2594.32	9.69	10.88	24.6	0.002873	1.93
1	31	100 yr	8877	7340	2645.17	9.76	11.02	24.6	0.002866	1.95



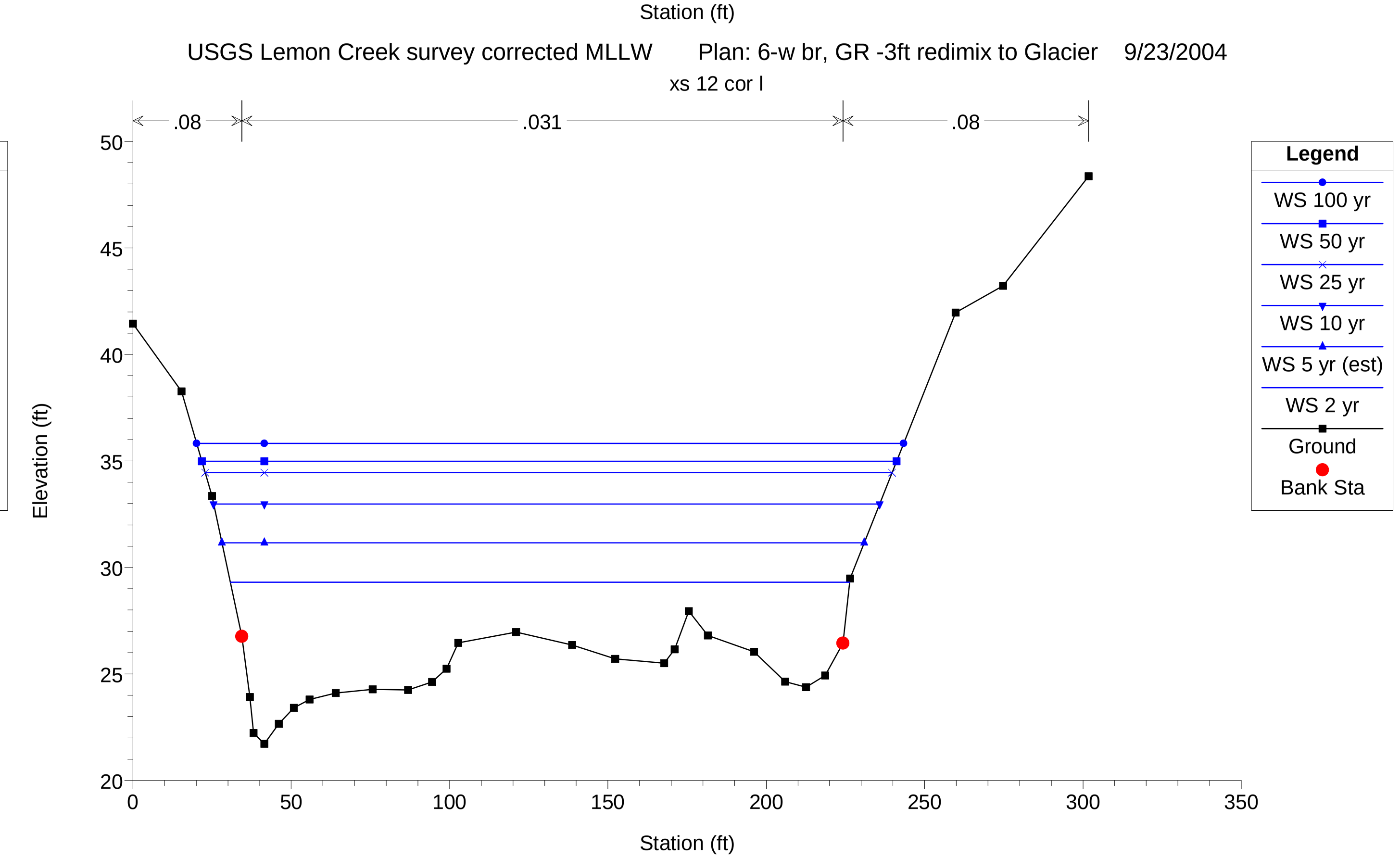
USGS Lemon Creek survey corrected MLLW Plan: 6-w br, GR -3ft redimix to Glacier 9/23/2004
xs 14 cor n
.08
.045
.08
Elevation (ft)
Station (ft)
Legend
WS 100 yr
WS 50 yr
WS 25 yr
WS 10 yr
WS 5 yr (est)
WS 2 yr
Ground
Bank Sta



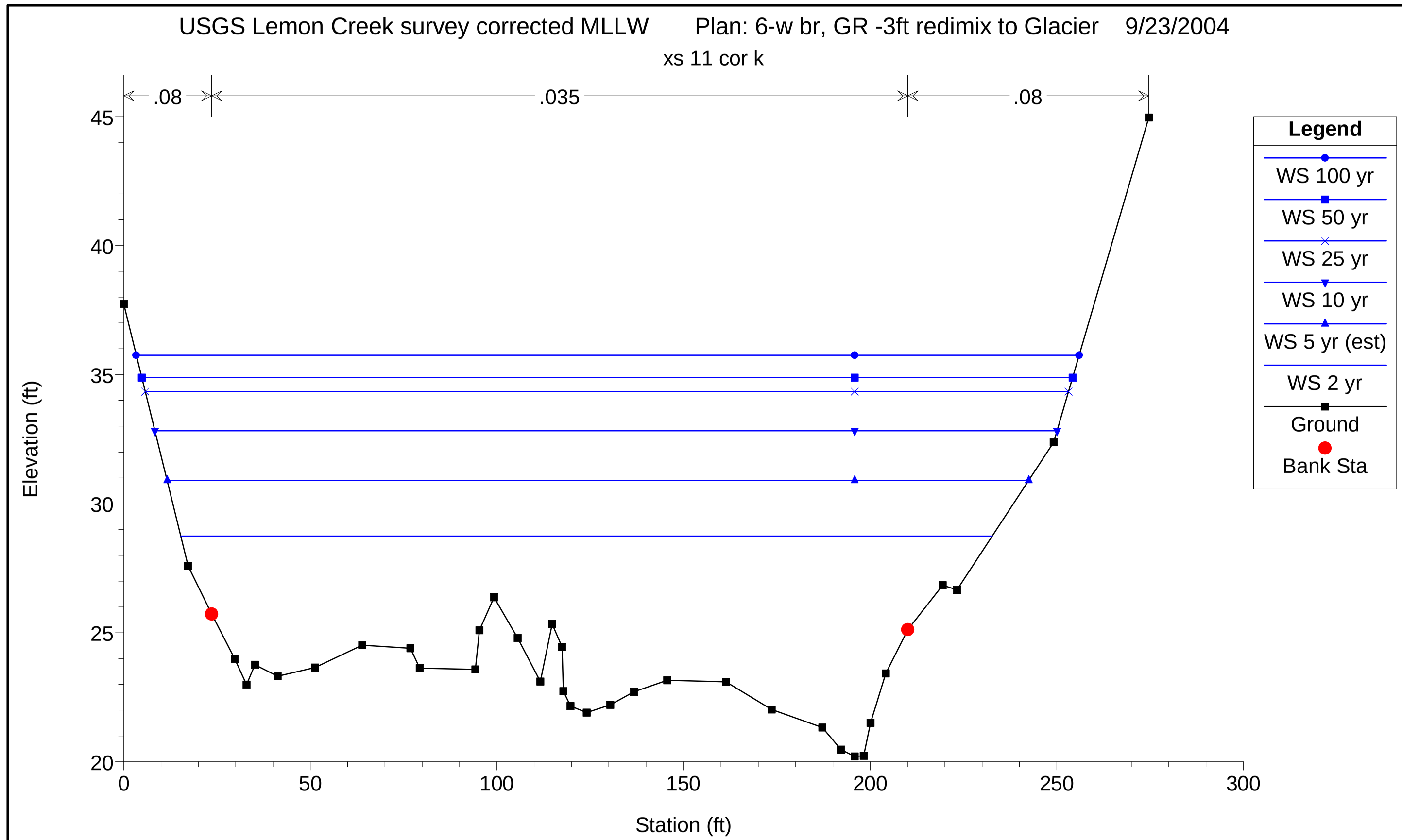
USGS Lemon Creek survey corrected MLLW Plan: 6-w br, GR -3ft redimix to Glacier 9/23/2004
xs 13.5
.08
.04
.08
Elevation (ft)
Station (ft)
Legend
WS 100 yr
WS 50 yr
WS 25 yr
WS 5 yr (est)
WS 10 yr
WS 2 yr
Ground
Bank Sta

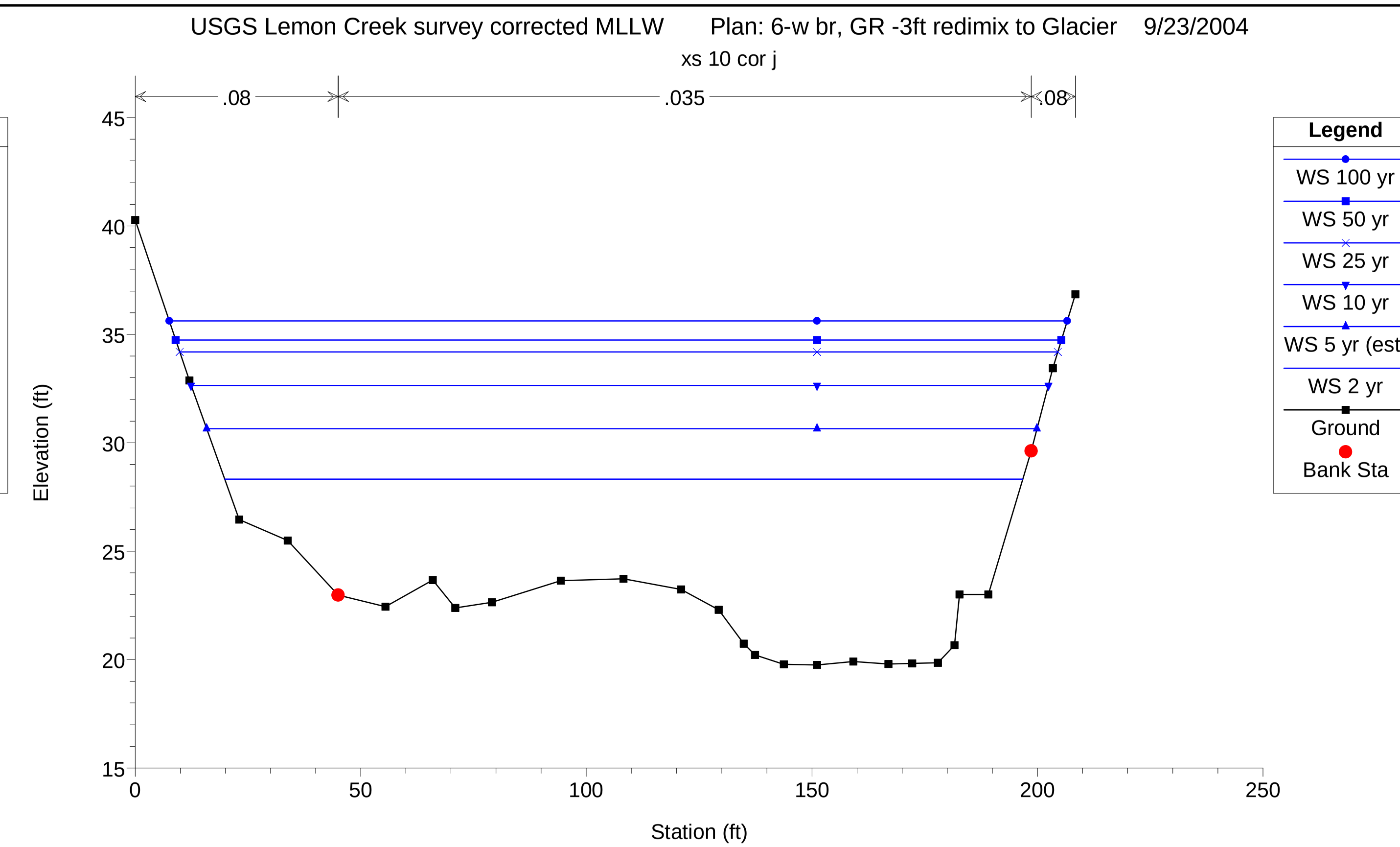


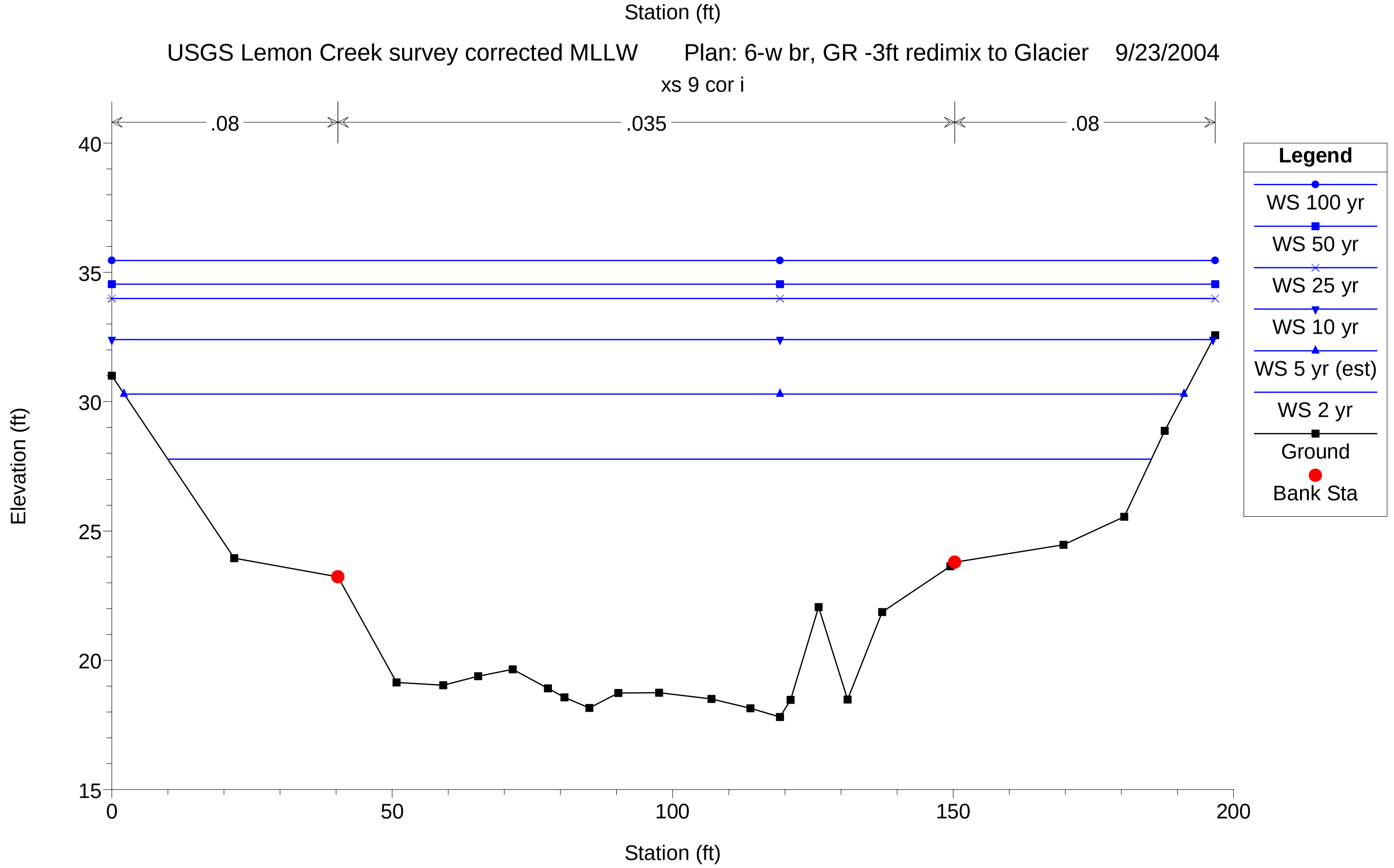
USGS Lemon Creek survey corrected MLLW Plan: 6-w br, GR -3ft redimix to Glacier 9/23/2004
xs 13 cor m
.08
.037
.08
Elevation (ft)
Station (ft)
Legend
WS 100 yr
WS 50 yr
WS 25 yr
WS 10 yr
WS 5 yr (est)
WS 2 yr
Ground
Bank Sta



USGS Lemon Creek survey corrected MLLW Plan: 6-w br, GR -3ft redimix to Glacier 9/23/2004
xs 12 cor l
.08
.031
.08
Elevation (ft)
Station (ft)
Legend
WS 100 yr
WS 50 yr
WS 25 yr
WS 10 yr
WS 5 yr (est)
WS 2 yr
Ground
Bank Sta


USGS Lemon Creek survey corrected MLLW Plan: 6-w br, GR -3ft redimix to Glacier 9/23/2004
xs 11 cor k
.08
.035
.08
Legend
WS 100 yr
WS 50 yr
WS 25 yr
WS 10 yr
WS 5 yr (est)
WS 2 yr
Ground
Bank Sta
Elevation (ft)
Station (ft)


USGS Lemon Creek survey corrected MLLW Plan: 6-w br, GR -3ft redimix to Glacier 9/23/2004
xs 10 cor j
.08
.035
.08
Legend
WS 100 yr
WS 50 yr
WS 25 yr
WS 10 yr
WS 5 yr (est)
WS 2 yr
Ground
Bank Sta
Elevation (ft)
Station (ft)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Legend
WS 100 yr
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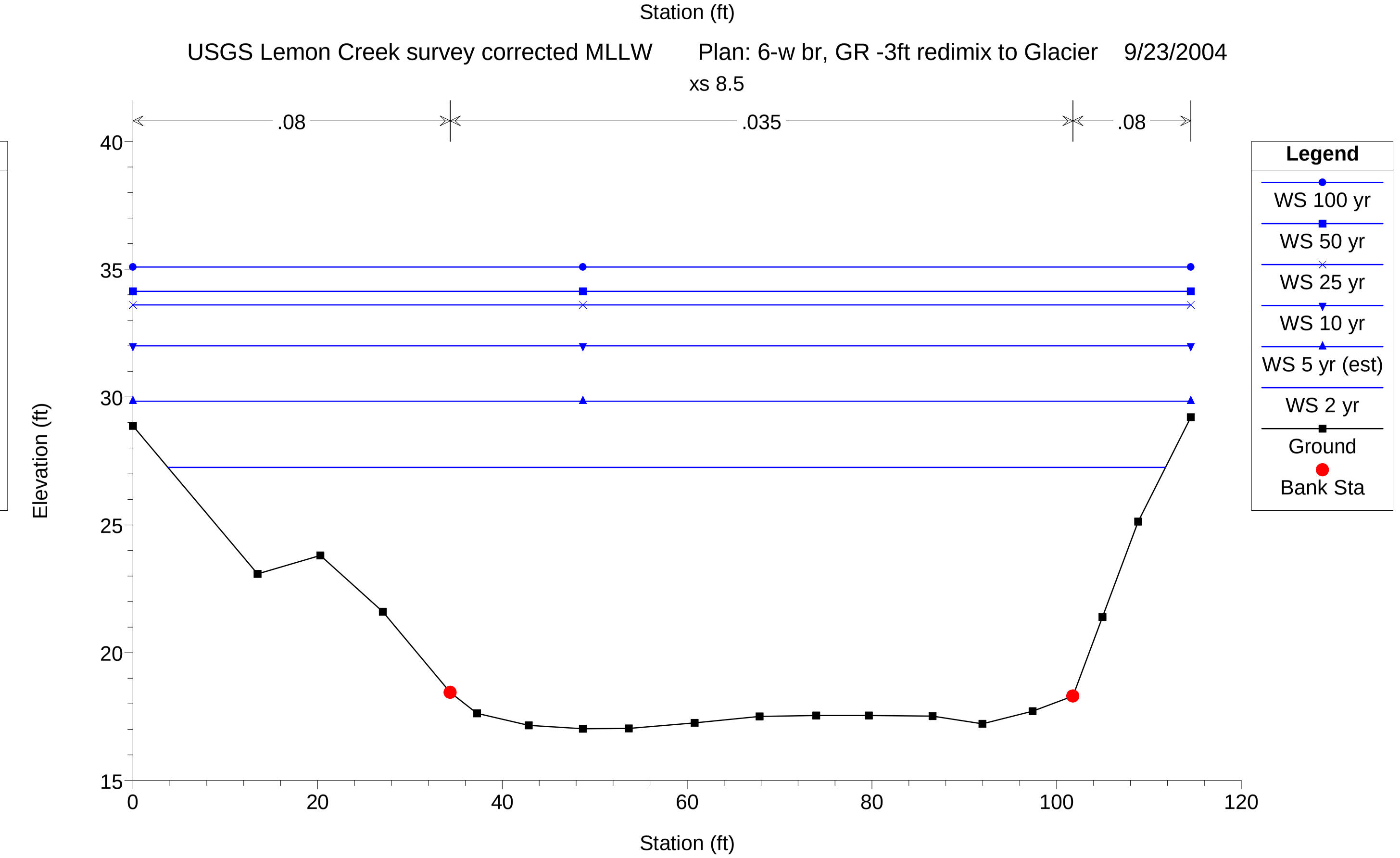
WS 5 yr (est)
WS 2 yr
Ground
Bank Sta
Elevation (ft)
Station (ft)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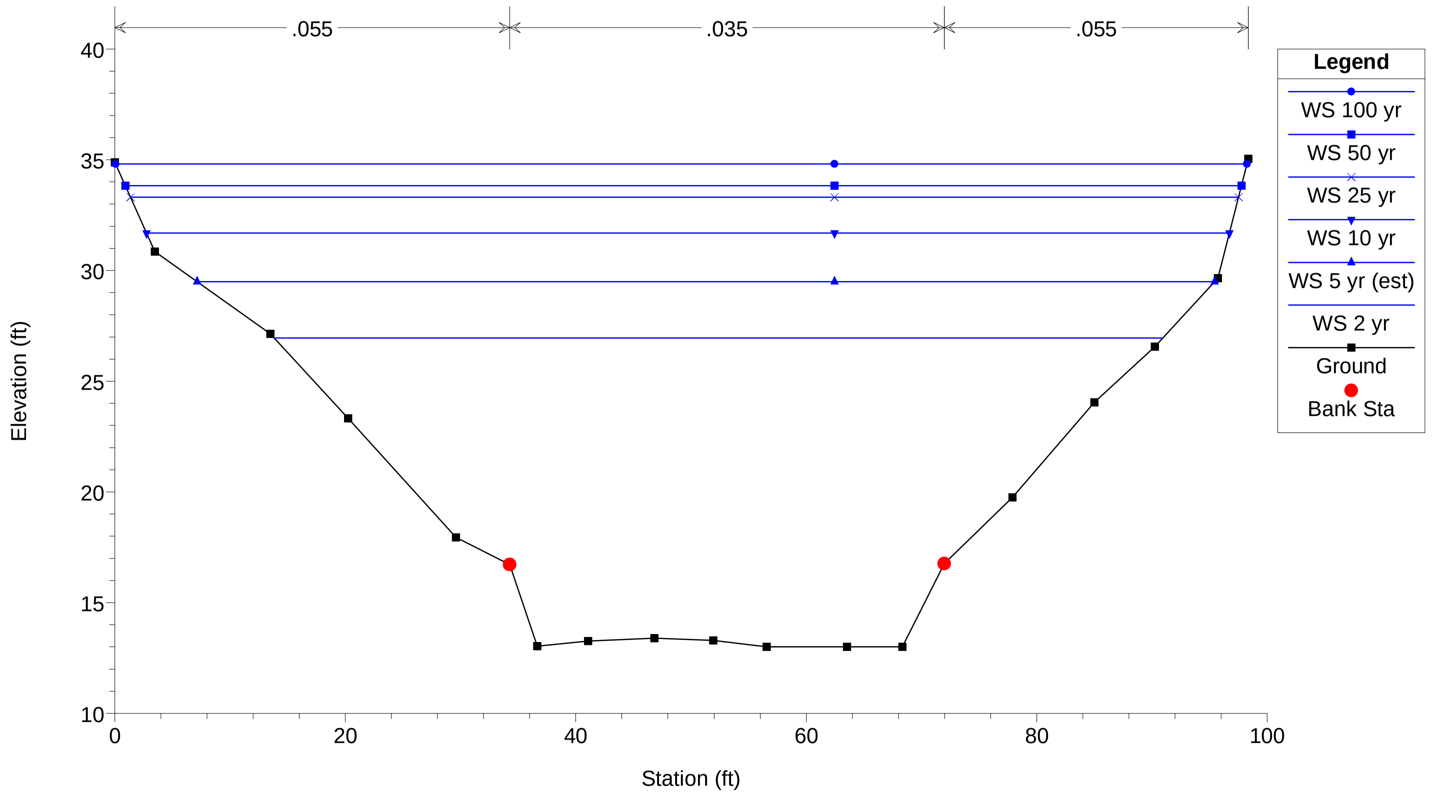
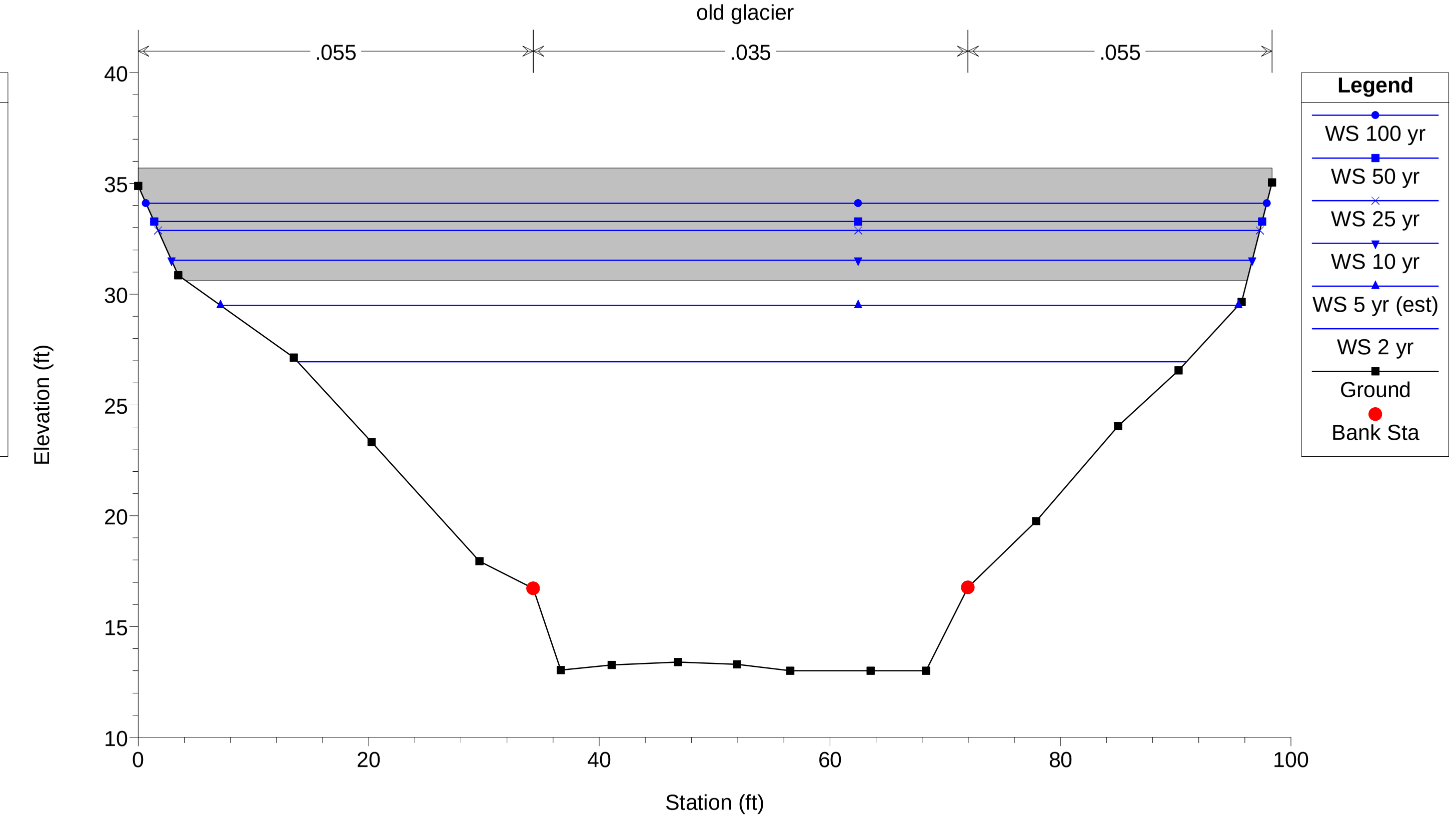
Legend
WS 100 yr
WS 50 yr
WS 25 yr
WS 10 yr
WS 5 yr (est)
WS 2 yr
Ground
Bank Sta
Elevation (ft)
Station (ft)

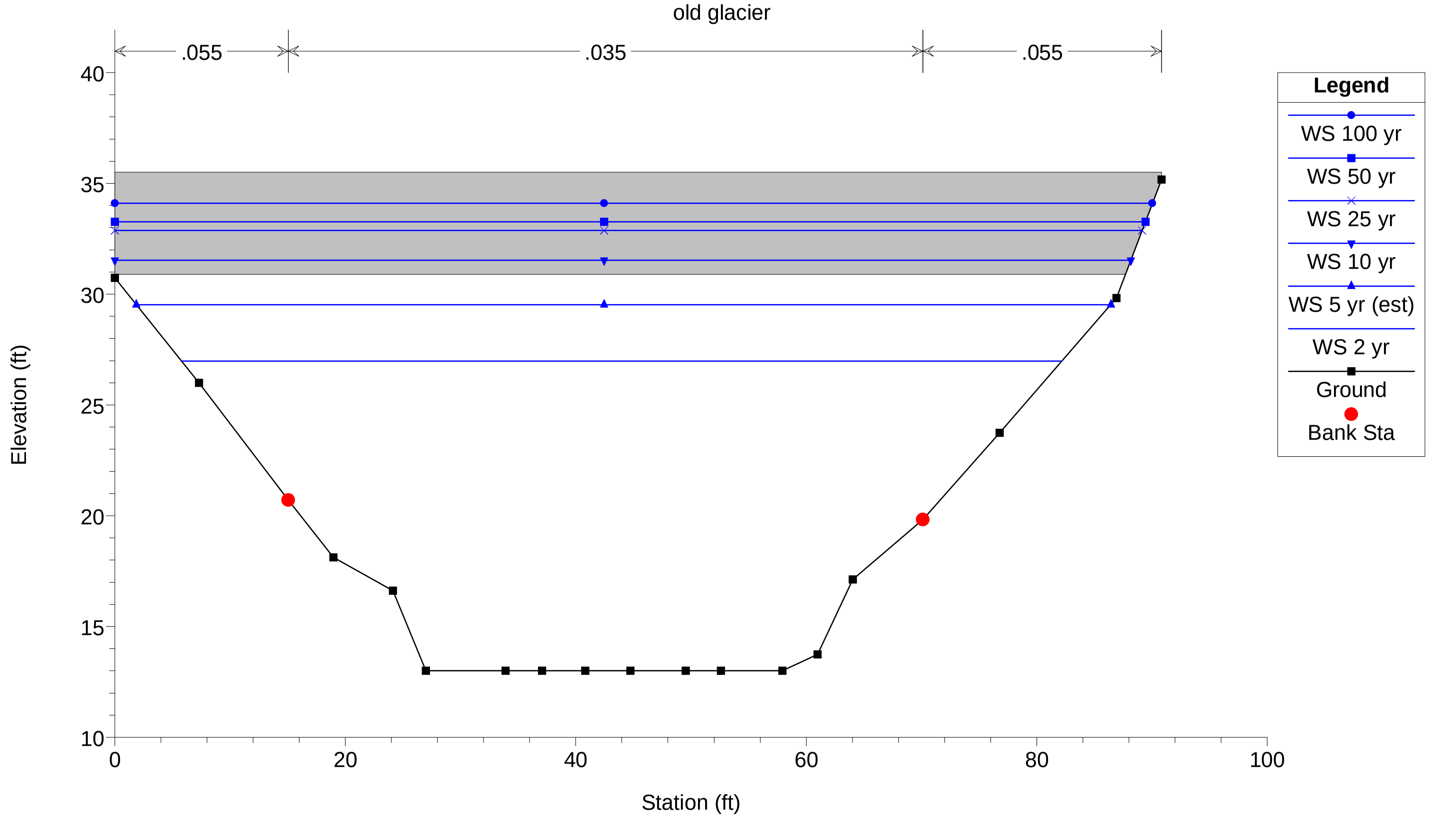
USGS Lemon Creek survey corrected MLLW   Plan: 6-w br, GR -3ft redimix to Glacier   9/23/2004
xs 8 cor h



USGS Lemon Creek survey corrected MLLW   Plan: 6-w br, GR -3ft redimix to Glacier   9/23/2004
old glacier



USGS Lemon Creek survey corrected MLLW   Plan: 6-w br, GR -3ft redimix to Glacier   9/23/2004
old glacier



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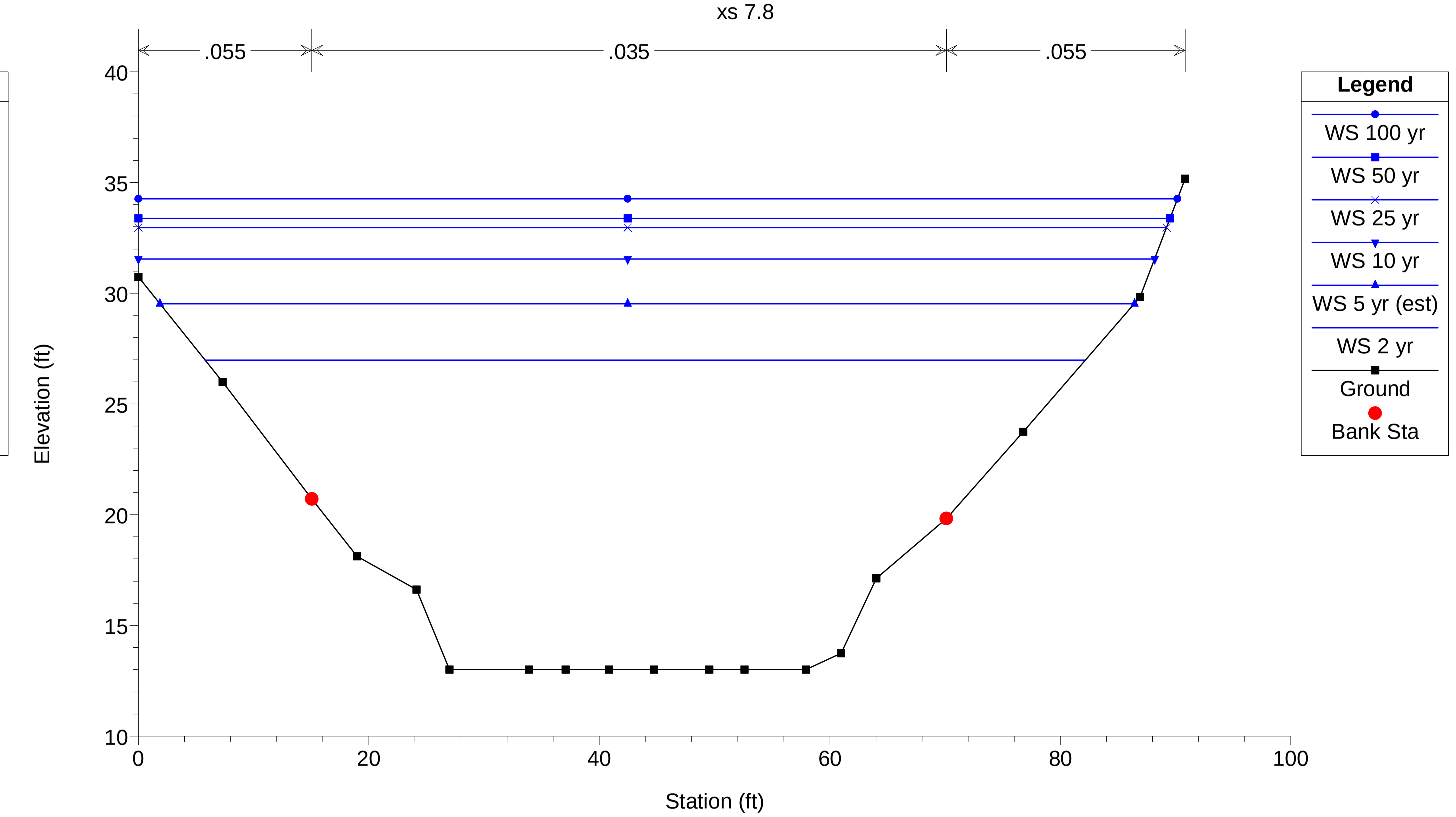
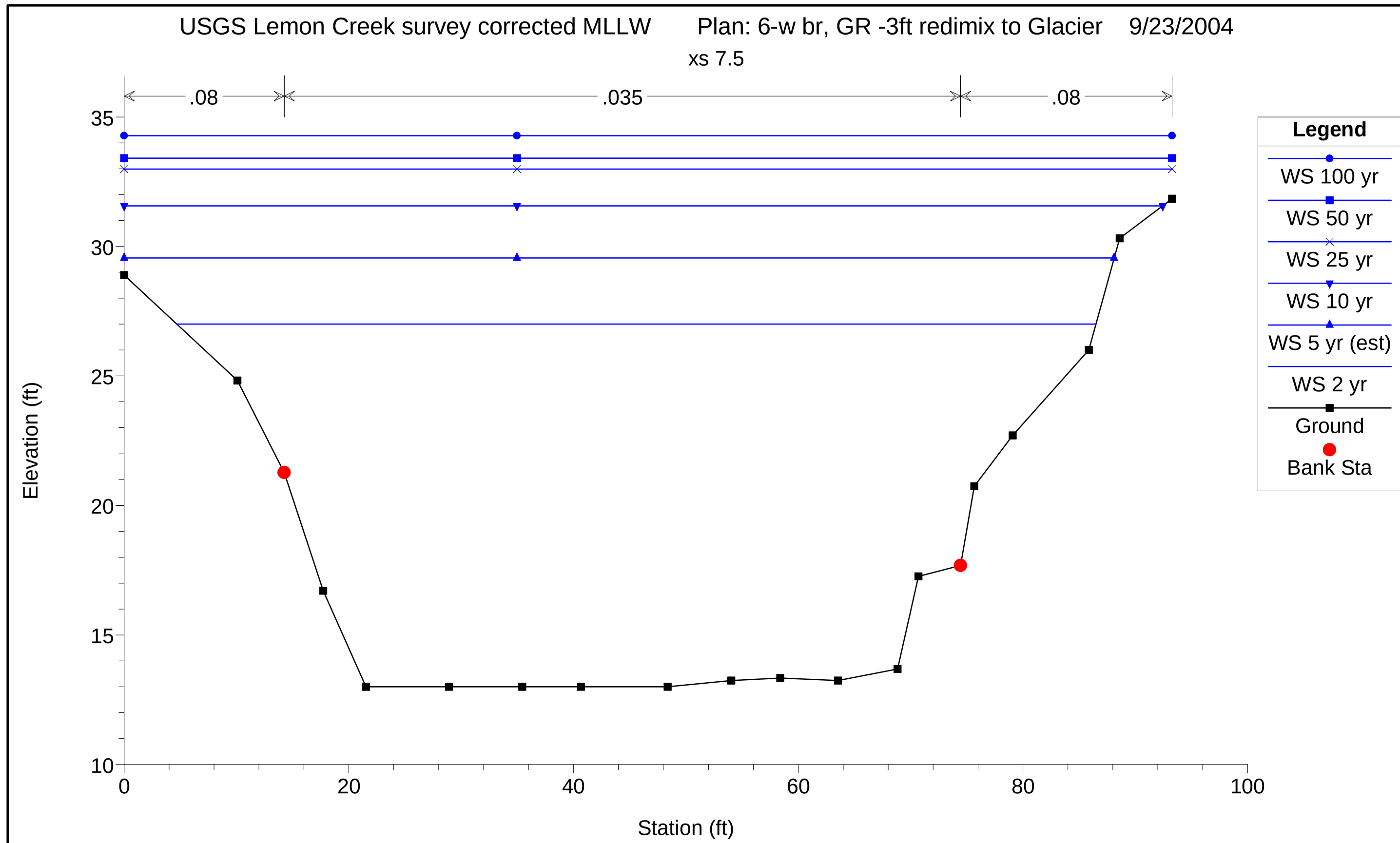
xs 7.8




USGS Lemon Creek survey corrected MLLW Plan: 6-w br, GR -3ft redimix to Glacier 9/23/2004
xs 7.5
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Legend
WS 100 yr
WS 50 yr
WS 25 yr
WS 10 yr
WS 5 yr (est)
WS 2 yr
Ground
Bank Sta
Elevation (ft)
Station (ft)
10
15
20
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30
35
0
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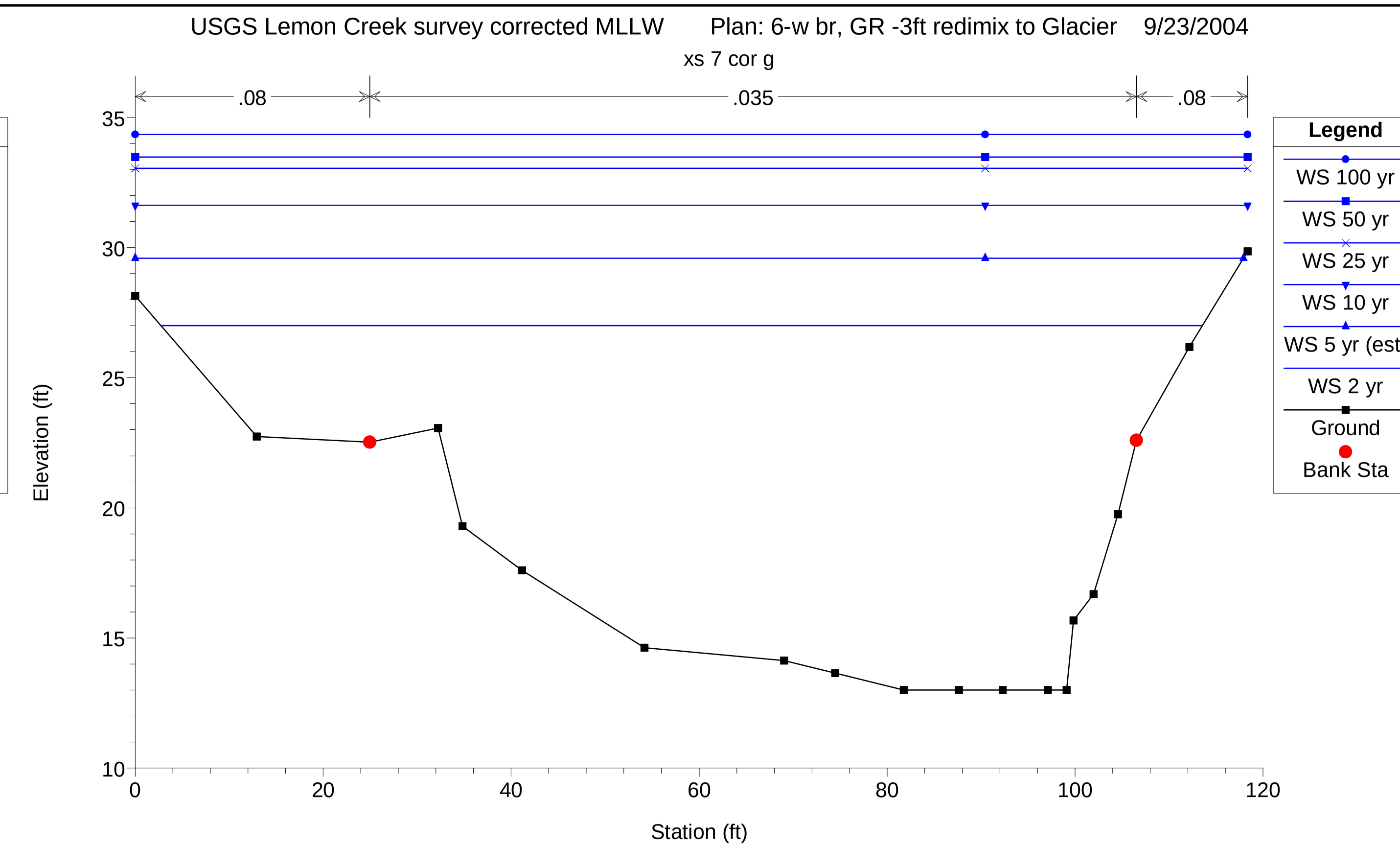
40
60
80
100


USGS Lemon Creek survey corrected MLLW Plan: 6-w br, GR -3ft redimix to Glacier 9/23/2004
xs 7 cor g
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Legend
WS 100 yr
WS 50 yr
WS 25 yr
WS 10 yr
WS 5 yr (est)
WS 2 yr
Ground
Bank Sta
Elevation (ft)
Station (ft)
10
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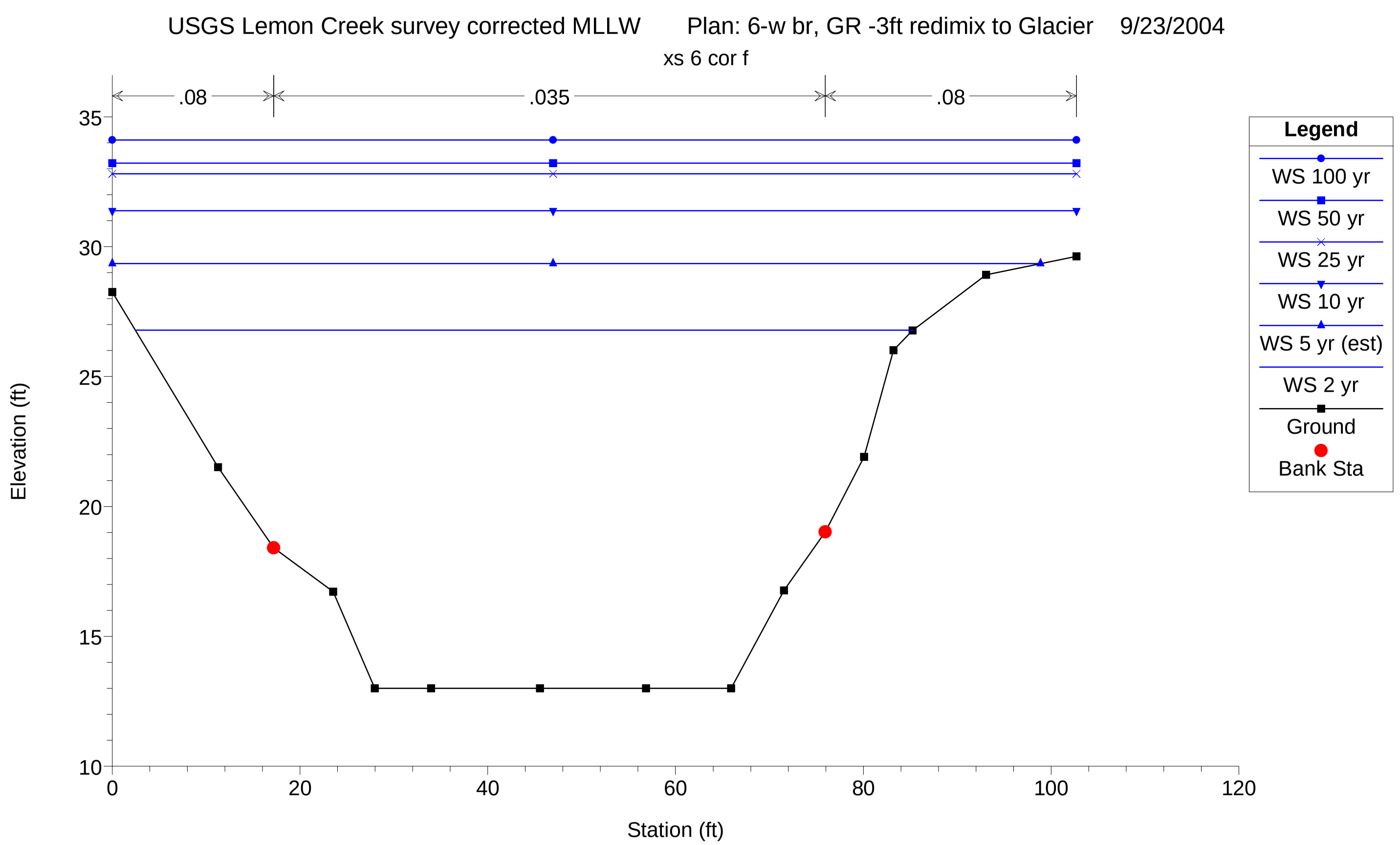
40
60
80
100
120


USGS Lemon Creek survey corrected MLLW Plan: 6-w br, GR -3ft redimix to Glacier 9/23/2004
xs 6 cor f
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Legend
WS 100 yr
WS 50 yr
WS 25 yr
WS 10 yr
WS 5 yr (est)
WS 2 yr
Ground
Bank Sta
Elevation (ft)
Station (ft)
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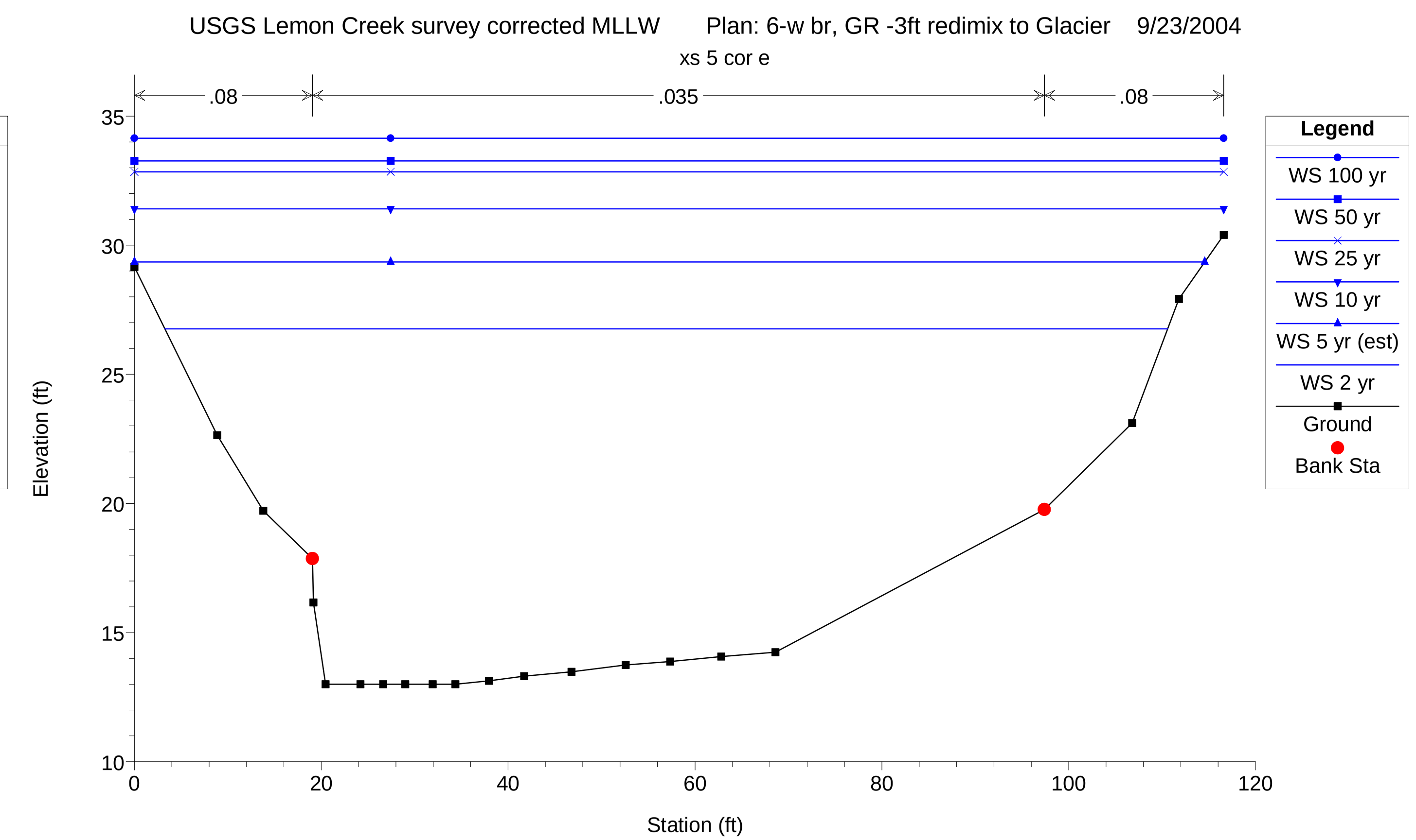
80
100
120


USGS Lemon Creek survey corrected MLLW Plan: 6-w br, GR -3ft redimix to Glacier 9/23/2004
xs 5 cor e
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Legend
WS 100 yr
WS 50 yr
WS 25 yr
WS 10 yr
WS 5 yr (est)
WS 2 yr
Ground
Bank Sta
Elevation (ft)
Station (ft)
10
15
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0
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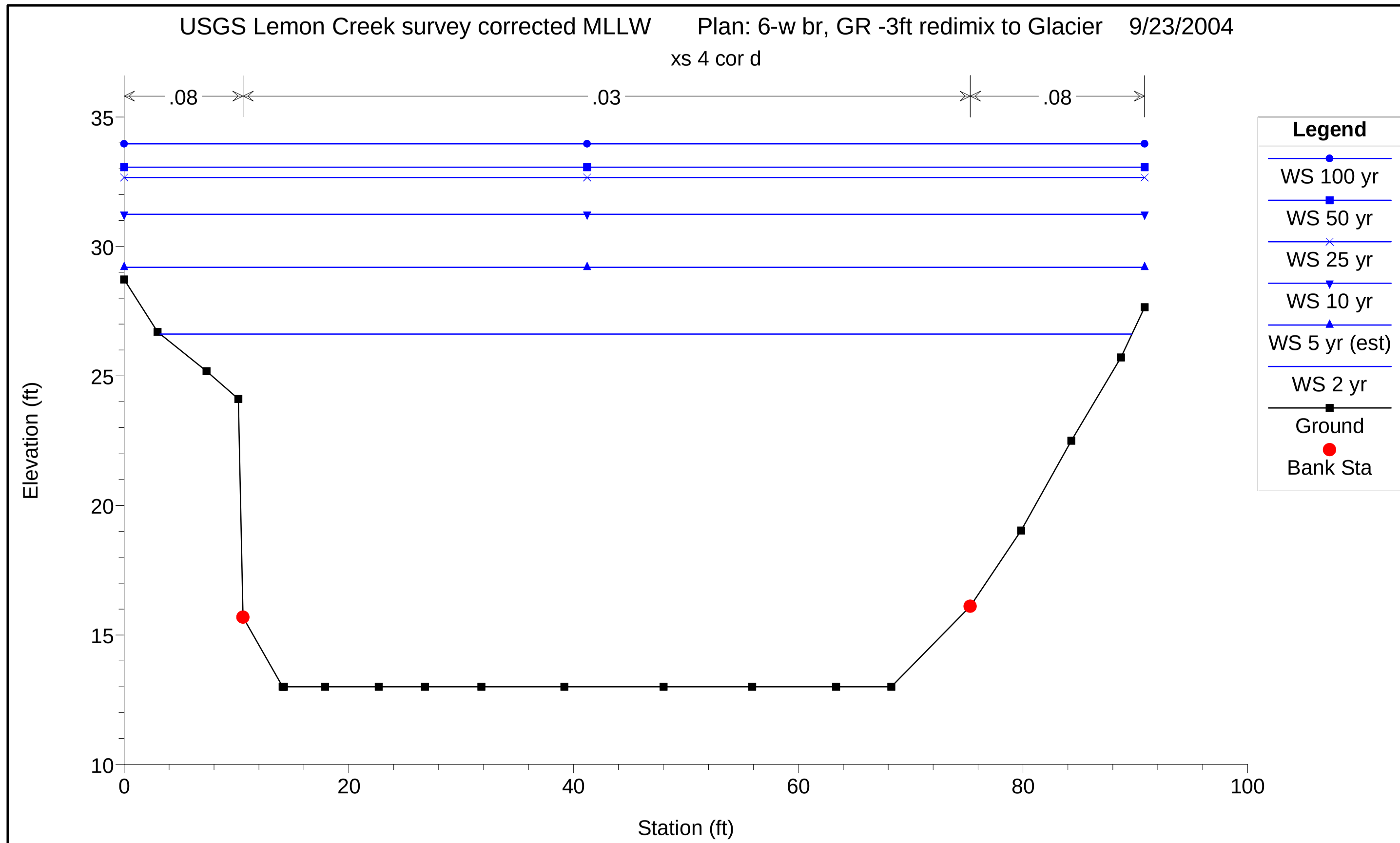
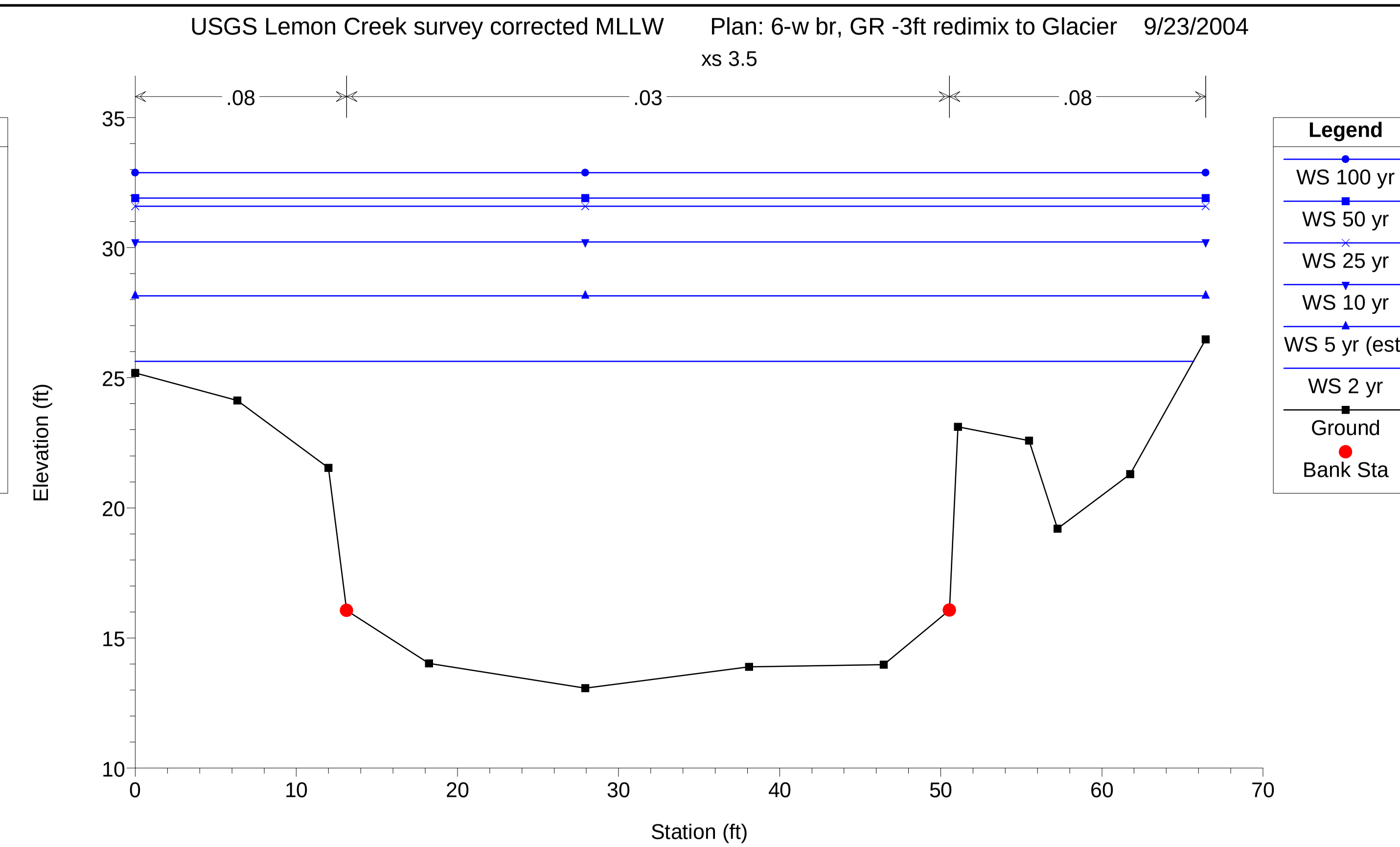
80
100
120


USGS Lemon Creek survey corrected MLLW
Plan: 6-w br, GR -3ft redimix to Glacier
9/23/2004
xs 4 cor d
.08
.03
.08
Elevation (ft)
Station (ft)
Legend
WS 100 yr
WS 50 yr
WS 25 yr
WS 10 yr
WS 5 yr (est)
WS 2 yr
Ground
Bank Sta


USGS Lemon Creek survey corrected MLLW
Plan: 6-w br, GR -3ft redimix to Glacier
9/23/2004
xs 3.5
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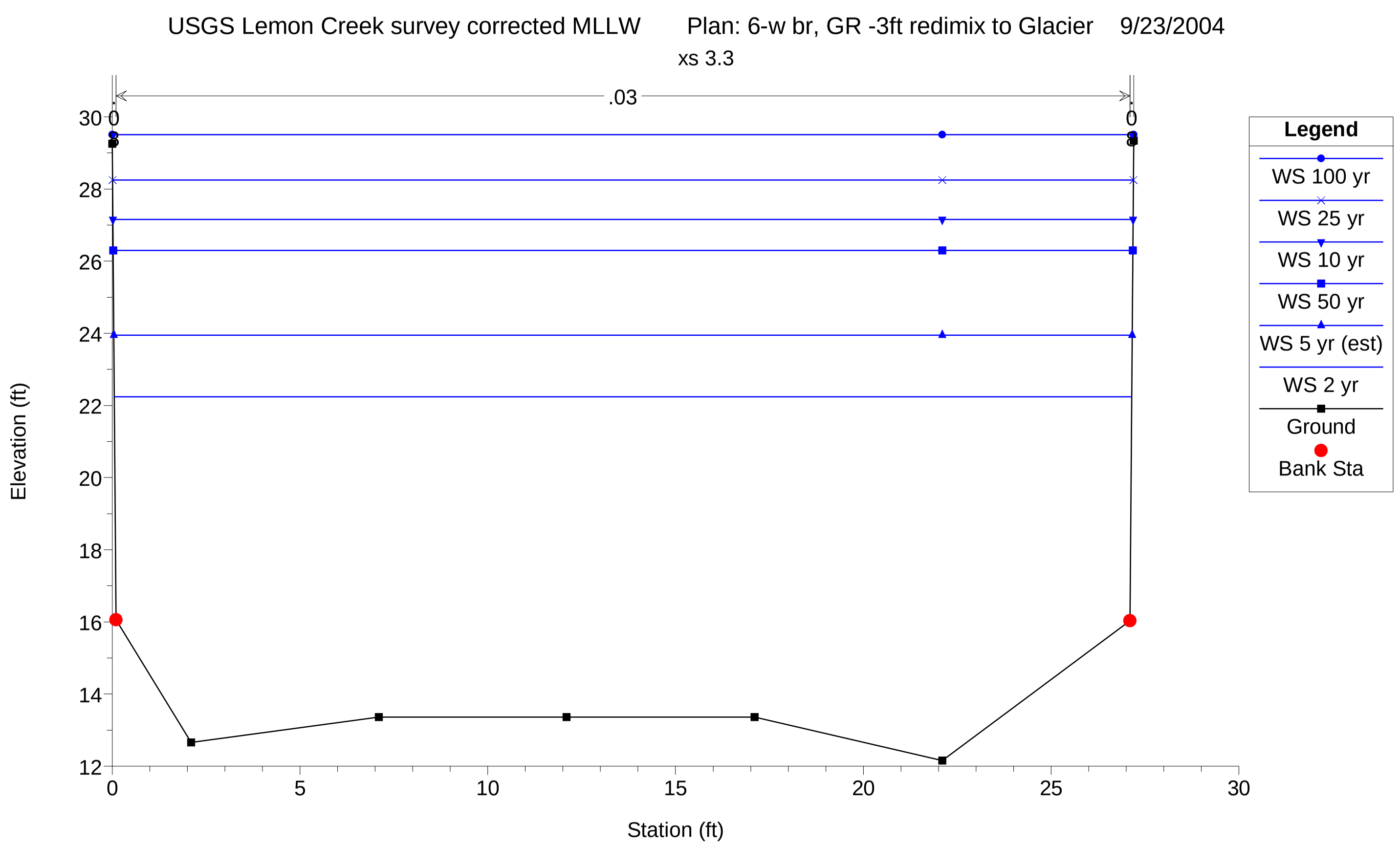
Elevation (ft)
Station (ft)
Legend
WS 100 yr
WS 50 yr
WS 25 yr
WS 10 yr
WS 5 yr (est)
WS 2 yr
Ground
Bank Sta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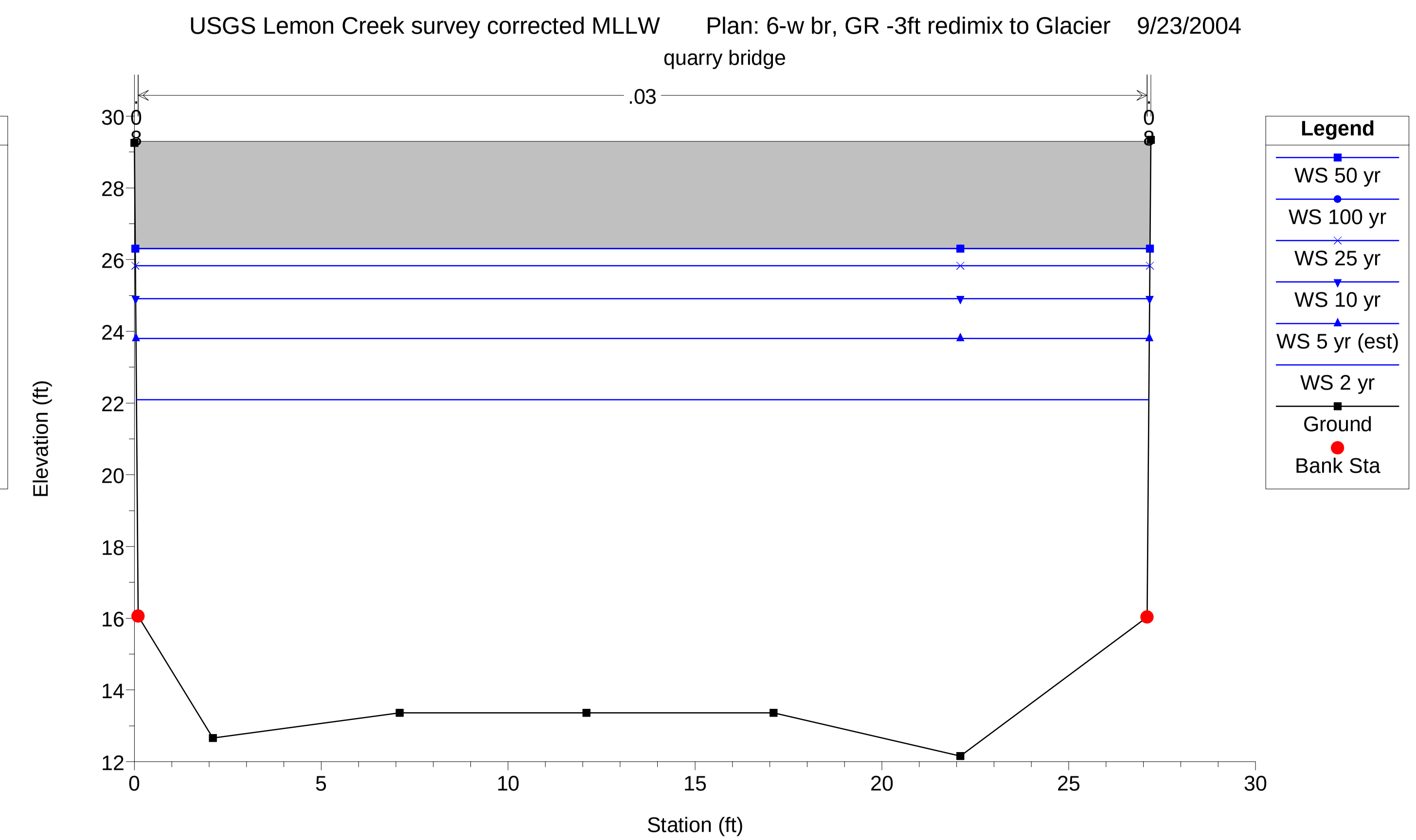
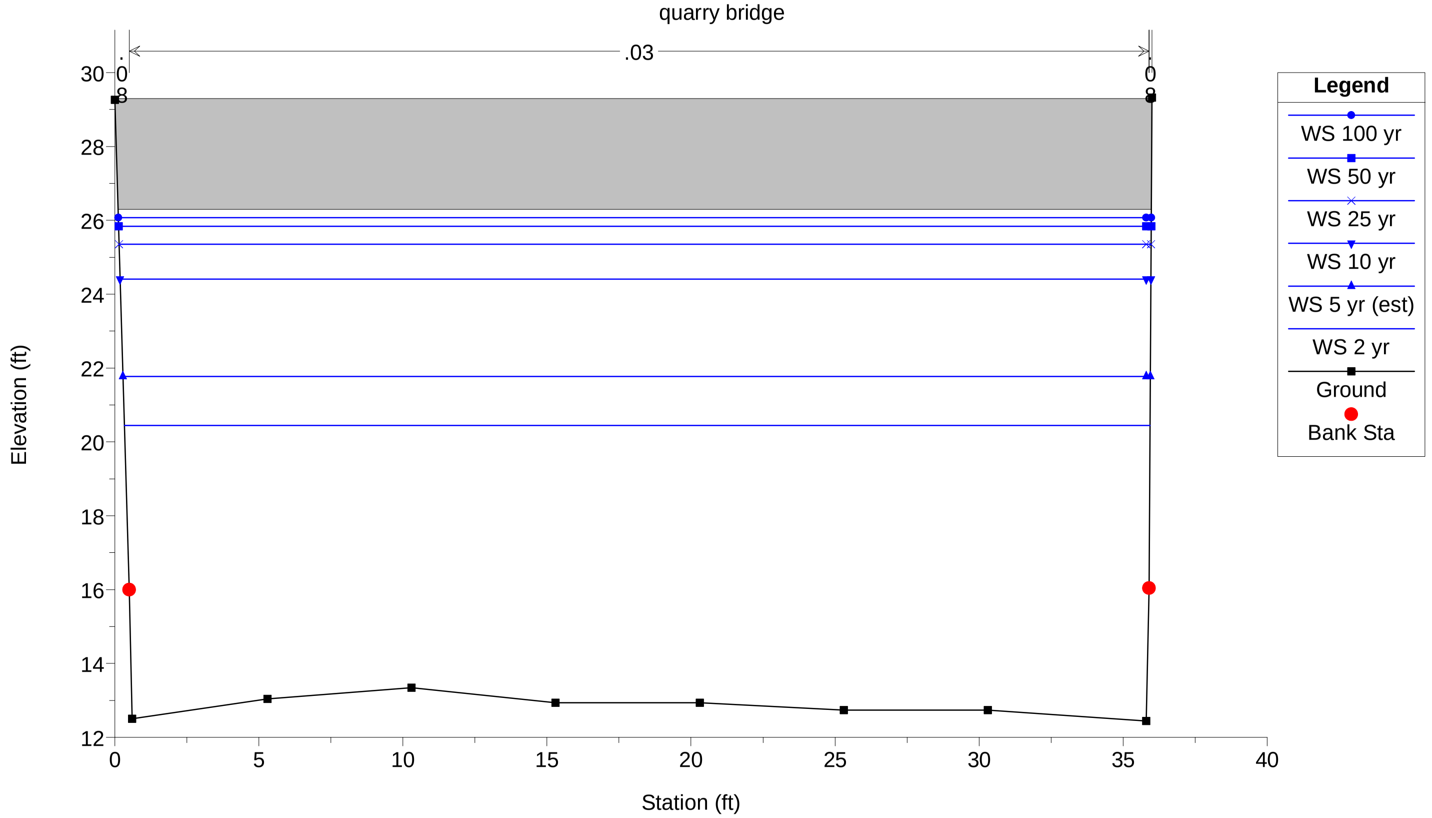
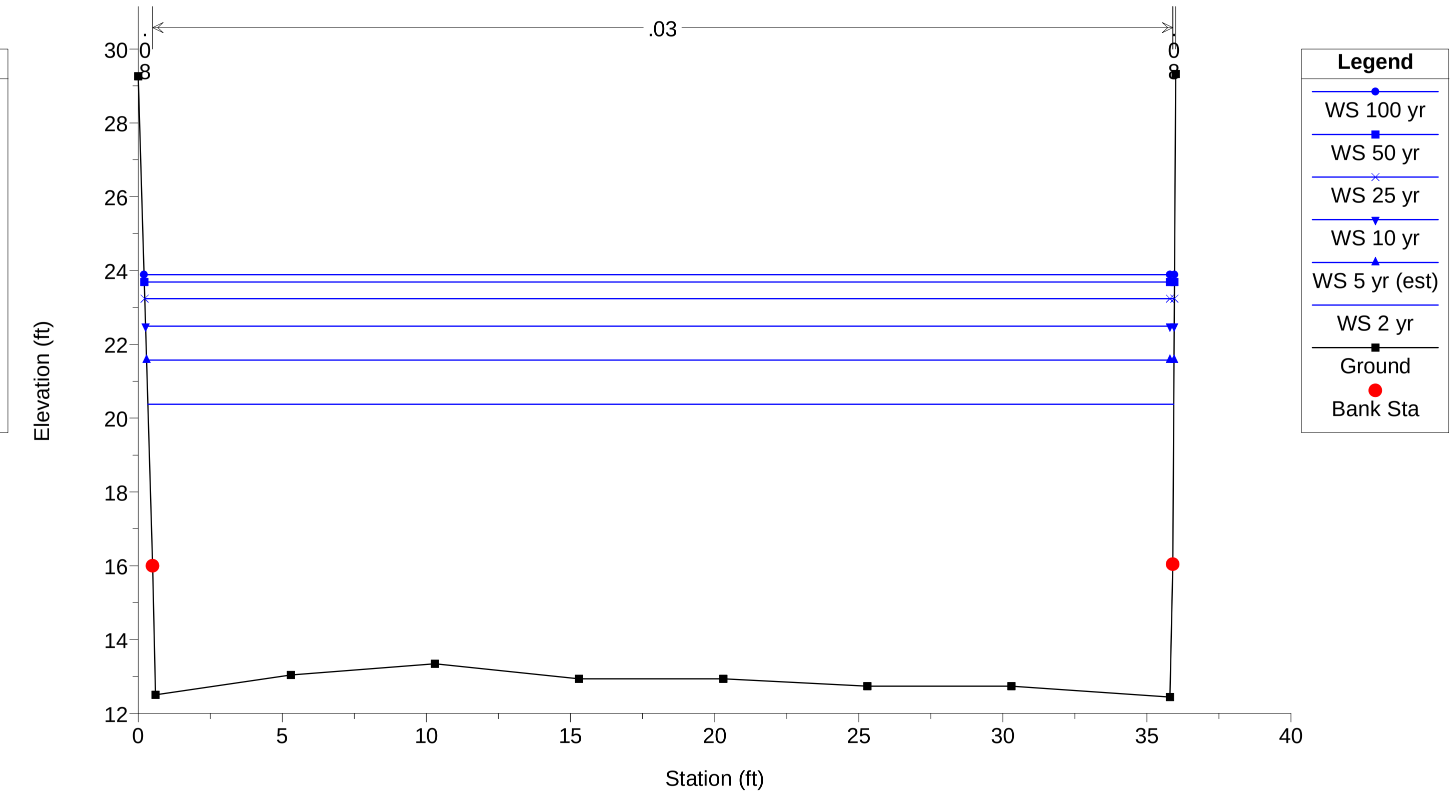
Plan: 6-w br, GR -3ft redimix to Glacier
9/23/2004
xs 3.3
.03
Elevation (ft)
Station (ft)
Legend
WS 100 yr
WS 25 yr
WS 10 yr
WS 50 yr
WS 5 yr (est)
WS 2 yr
Ground
Bank Sta


USGS Lemon Creek survey corrected MLLW
Plan: 6-w br, GR -3ft redimix to Glacier
9/23/2004
quarry bridge
.03
Elevation (ft)
Station (ft)
Legend
WS 50 yr
WS 100 yr
WS 25 yr
WS 10 yr
WS 5 yr (est)
WS 2 yr
Ground
Bank Sta

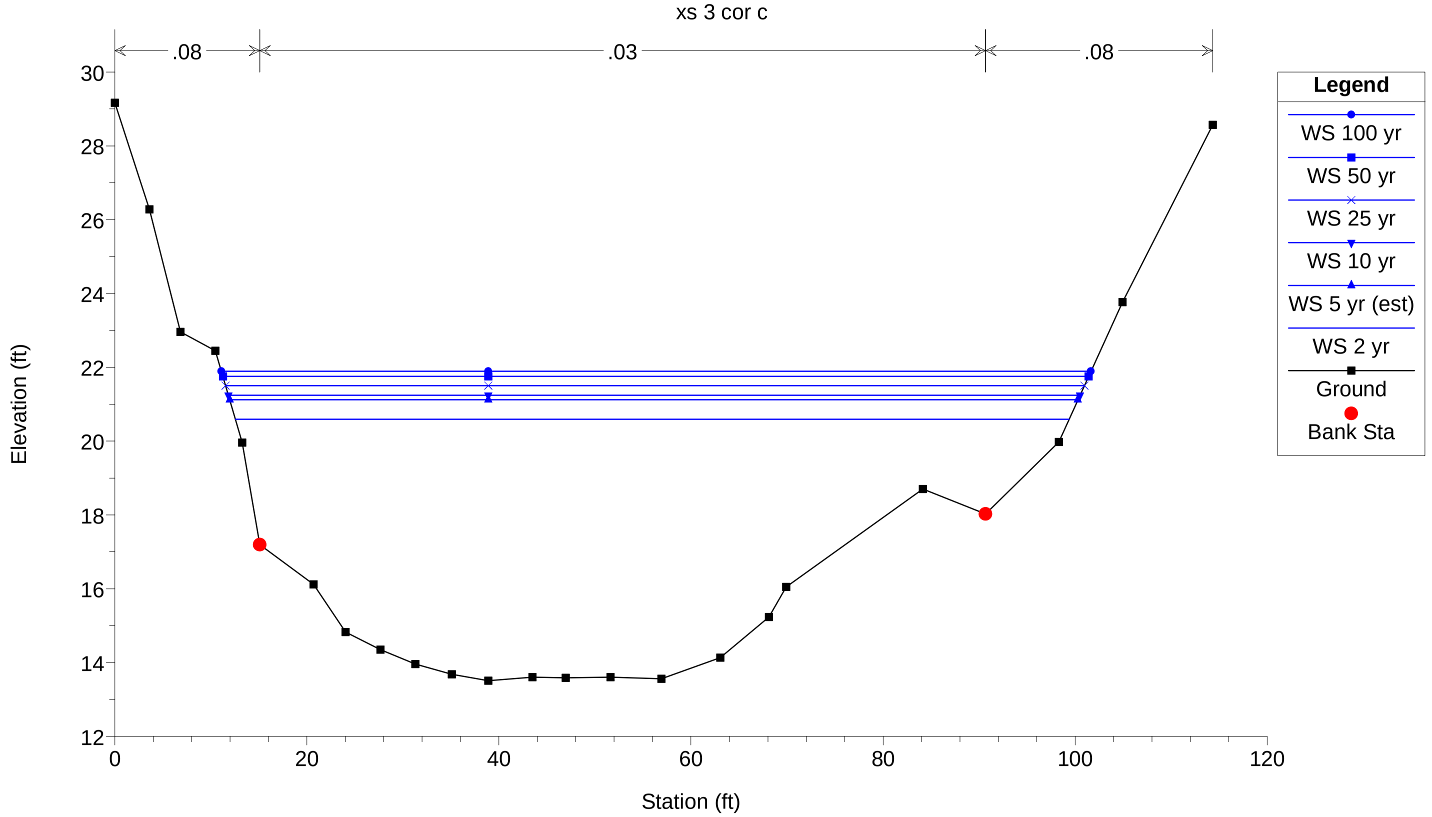
USGS Lemon Creek survey corrected MLLW Plan: 6-w br, GR -3ft redimix to Glacier 9/23/2004
quarry bridge



USGS Lemon Creek survey corrected MLLW Plan: 6-w br, GR -3ft redimix to Glacier 9/23/2004
xs 3.2



USGS Lemon Creek survey corrected MLLW Plan: 6-w br, GR -3ft redimix to Glacier 9/23/2004
xs 3 cor c



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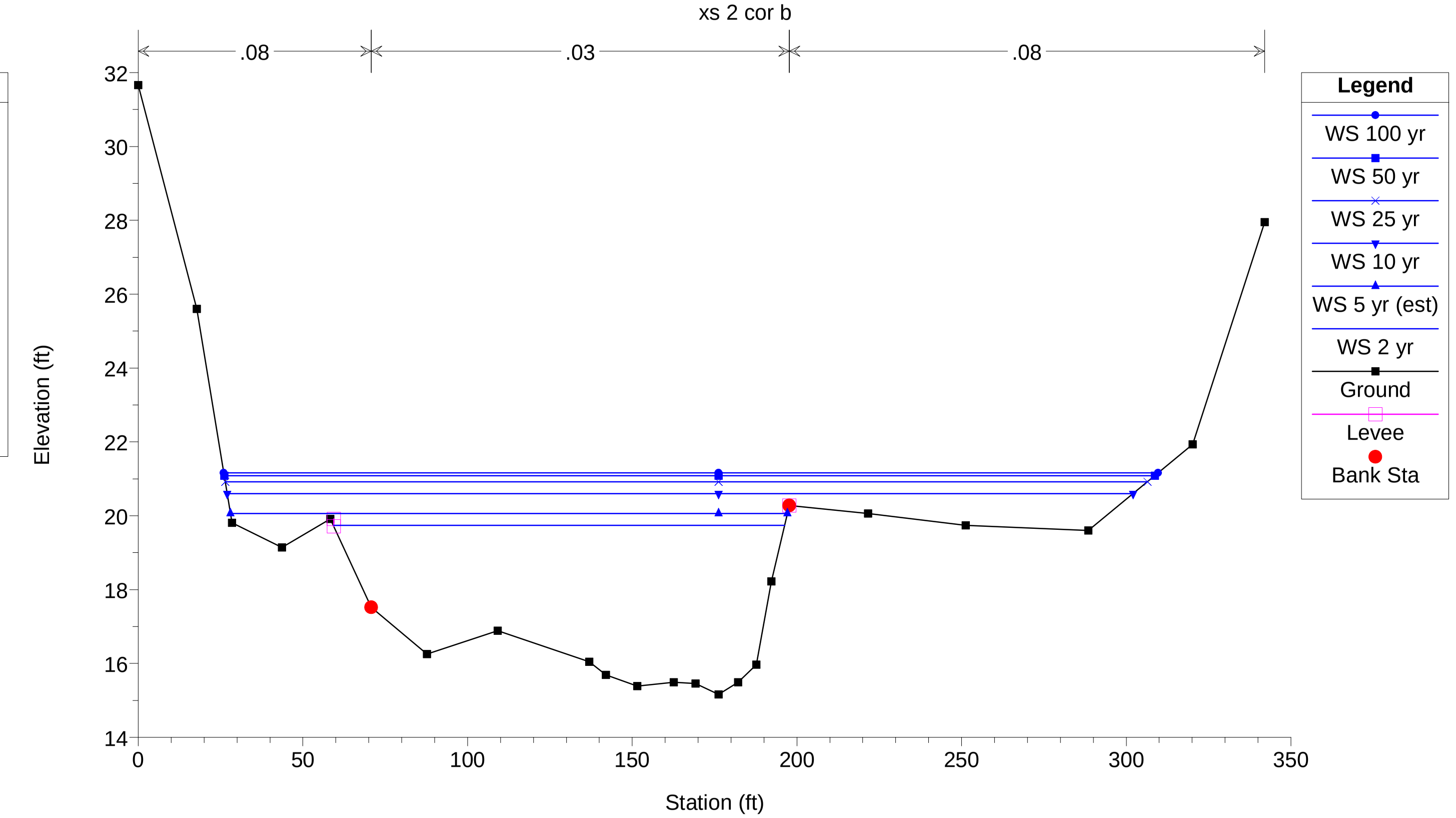
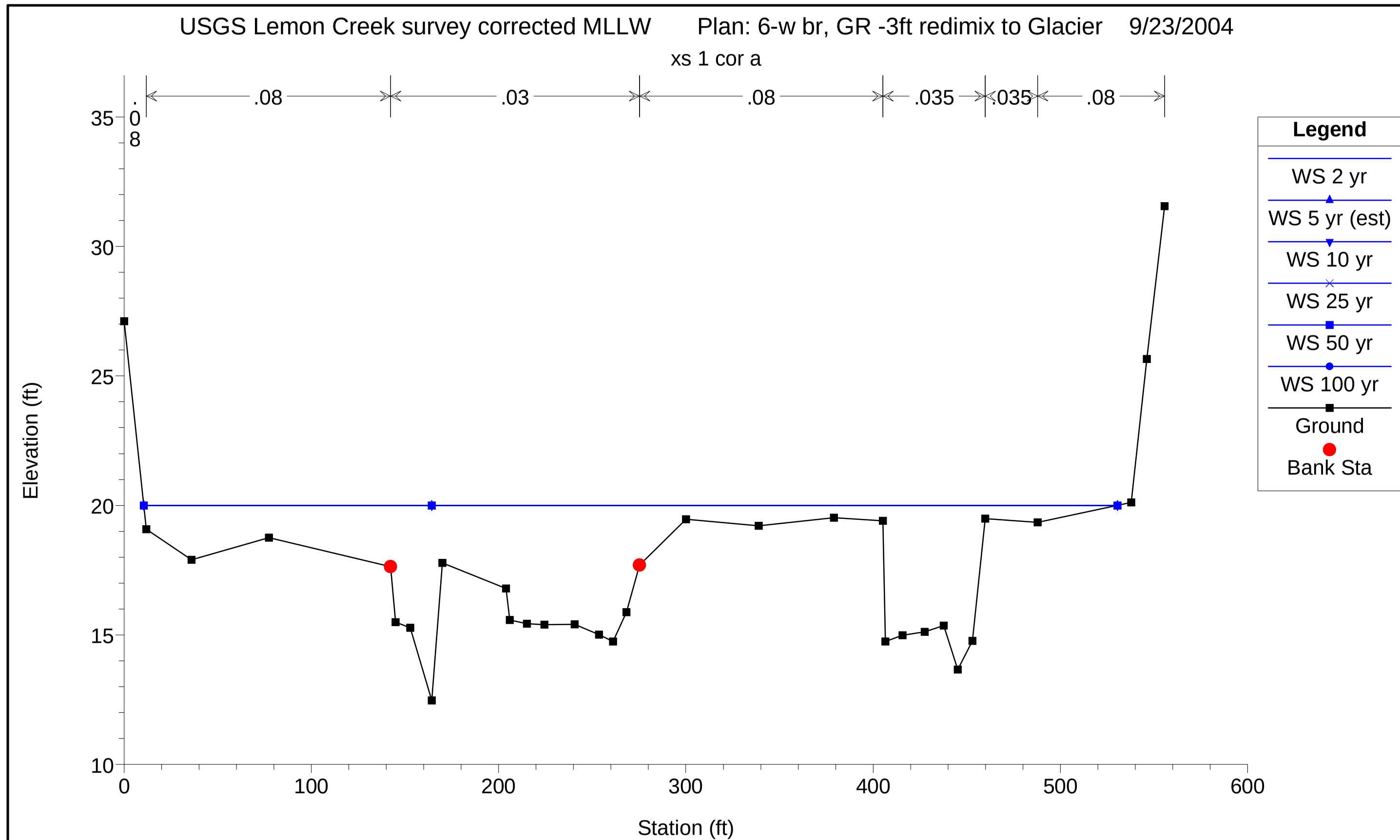
xs 2 cor b




USGS Lemon Creek survey corrected MLLW
Plan: 6-w br, GR -3ft redimix to Glacier
9/23/2004
xs 1 cor a
.08
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Elevation (ft)
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30
25
20
15
10
0
100
200
300
400
500
600
Station (ft)
Legend
WS 2 yr
WS 5 yr (est)
WS 10 yr
WS 25 yr
WS 50 yr
WS 100 yr
Ground
Bank Sta

Appendix F(b)

Hydraulics

Tide Water to Top of Gorge
In Stream Mining RediMix to Glacier Highway
RediMix Bridge Removed

Lemon Creek from tidewater to 350-ft above gorge bridge

Plan 7 Mining below Glacier Highway with RediMix Bridge removed

HEC-RAS Plan: 7noBrGr-3lwr River: lemon creek Reach: 1

Reach	River Sta	Profile	Cum Ch Len (ft)	Q Total (cfs)	Q Channel (cfs)	Vel Chnl (ft/s)	Hydr Depth C (ft)	Top W Act Chan (ft)	E.G. Slope (ft/ft)	Shear Chan (lb/sq ft)
1	1	2 yr		3930	2552.53	4.57	4.2	133.03	0.001304	0.33
1	1	5 yr (est)		5140	3338.42	5.97	4.2	133.03	0.00223	0.57
1	1	10 yr		5990	3890.5	6.96	4.2	133.03	0.003028	0.77
1	1	25 yr		6720	4364.63	7.81	4.2	133.03	0.003811	0.97
1	1	50 yr		7140	4637.42	8.3	4.2	133.03	0.004303	1.1
1	1	100 yr		7340	4767.32	8.53	4.2	133.03	0.004547	1.16
1	2	2 yr	174	3930	3909.9	8.94	3.48	125.48	0.006237	1.35
1	2	5 yr (est)	174	5140	5092.9	10.66	3.78	126.34	0.007936	1.86
1	2	10 yr	174	5990	5801.93	10.62	4.3	126.91	0.006641	1.77
1	2	25 yr	174	6720	6515.87	12	4.28	126.91	0.00854	2.26
1	2	50 yr	174	7140	6947.95	13.06	4.19	126.91	0.010387	2.7
1	2	100 yr	174	7340	7154.84	13.58	4.15	126.91	0.011388	2.93
1	3	2 yr	372	3930	3907.28	9.68	5.34	75.6	0.004166	1.37
1	3	5 yr (est)	372	5140	5099.71	11.5	5.86	75.6	0.005191	1.88
1	3	10 yr	372	5990	5940.02	13.11	5.99	75.6	0.006553	2.42
1	3	25 yr	372	6720	6657.1	14.09	6.25	75.6	0.007158	2.76
1	3	50 yr	372	7140	7065.91	14.37	6.51	75.6	0.007053	2.83
1	3	100 yr	372	7340	7259.87	14.46	6.64	75.6	0.00695	2.84
1	4	2 yr	493	3930	3903.69	7.26	8.31	64.74	0.001317	0.67
1	4	5 yr (est)	493	5140	5097.26	8.56	9.2	64.74	0.0016	0.9
1	4	10 yr	493	5990	5933.54	9.35	9.8	64.74	0.001752	1.05
1	4	25 yr	493	6720	6649.93	9.93	10.34	64.74	0.00184	1.16
1	4	50 yr	493	7140	7061.84	10.27	10.62	64.74	0.001901	1.23
1	4	100 yr	493	7340	7257.93	10.43	10.75	64.74	0.001931	1.27
1	5	2 yr	764	3930	3893.04	6.81	7.3	78.34	0.001948	0.84
1	5	5 yr (est)	764	5140	5066.53	7.72	8.38	78.34	0.002084	1.03
1	5	10 yr	764	5990	5881.64	8.23	9.12	78.34	0.002119	1.14
1	5	25 yr	764	6720	6576.78	8.6	9.76	78.34	0.002112	1.22
1	5	50 yr	764	7140	6975.77	8.81	10.1	78.34	0.002119	1.27
1	5	100 yr	764	7340	7165.53	8.92	10.26	78.34	0.002123	1.29
1	6	2 yr	1078	3930	3898.37	7.91	8.38	58.77	0.002191	1.09
1	6	5 yr (est)	1078	5140	5077.62	9.15	9.45	58.77	0.002498	1.4
1	6	10 yr	1078	5990	5900.38	9.89	10.15	58.77	0.002656	1.59
1	6	25 yr	1078	6720	6603.05	10.46	10.74	58.77	0.00275	1.75
1	6	50 yr	1078	7140	7006.32	10.78	11.06	58.77	0.002809	1.84
1	6	100 yr	1078	7340	7198.11	10.93	11.21	58.77	0.002838	1.88
1	7	2 yr	1213	3930	3926.58	6.59	7.31	81.56	0.001915	0.8
1	7	5 yr (est)	1213	5140	5111.49	7.31	8.57	81.56	0.001908	0.93
1	7	10 yr	1213	5990	5932.97	7.73	9.42	81.56	0.001881	1.01
1	7	25 yr	1213	6720	6631.81	8.03	10.12	81.56	0.001845	1.06
1	7	50 yr	1213	7140	7031.82	8.2	10.51	81.56	0.00183	1.1
1	7	100 yr	1213	7340	7221.88	8.28	10.69	81.56	0.001826	1.11
1	7.5	2 yr	1361	3930	3919.07	6.89	9.45	60.22	0.001494	0.8
1	7.5	5 yr (est)	1361	5140	5112.37	7.96	10.67	60.22	0.001699	1.03
1	7.5	10 yr	1361	5990	5945.07	8.61	11.47	60.22	0.001805	1.18
1	7.5	25 yr	1361	6720	6655.25	9.11	12.13	60.22	0.001874	1.29
1	7.5	50 yr	1361	7140	7061.28	9.38	12.5	60.22	0.001912	1.36
1	7.5	100 yr	1361	7340	7254.3	9.51	12.66	60.22	0.001931	1.39

Lemon Creek from tidewater to 350-ft above gorge bridge

Plan 7 Mining below Glacier Highway with RediMix Bridge removed

HEC-RAS Plan: 7noBrGr-3lwr River: lemon creek Reach: 1

Reach	River Sta	Profile	Cum Ch Len (ft)	Q Total (cfs)	Q Channel (cfs)	Vel Chnl (ft/s)	Hydr Depth C (ft)	Top W Act Chan (ft)	E.G. Slope (ft/ft)	Shear Chan (lb/sq ft)
1	7.8	2 yr	1413	3930	3905.17	8.26	8.59	55.07	0.002413	1.19
1	7.8	5 yr (est)	1413	5140	5079.03	9.43	9.78	55.07	0.002646	1.48
1	7.8	10 yr	1413	5990	5893.14	10.13	10.56	55.07	0.002753	1.67
1	7.8	25 yr	1413	6720	6584.99	10.66	11.22	55.07	0.002811	1.81
1	7.8	50 yr	1413	7140	6980.65	10.95	11.58	55.07	0.002846	1.89
1	7.8	100 yr	1413	7340	7168.54	11.09	11.74	55.07	0.002864	1.93
1	8	2 yr	1472	3930	3639.52	9.79	9.86	37.72	0.002843	1.6
1	8	5 yr (est)	1472	5140	4679.67	11.27	11.01	37.72	0.003248	2.04
1	8	10 yr	1472	5990	5393.32	12.15	11.77	37.72	0.003455	2.32
1	8	25 yr	1472	6720	5993.82	12.81	12.4	37.72	0.003581	2.53
1	8	50 yr	1472	7140	6335.62	13.17	12.75	37.72	0.003651	2.65
1	8	100 yr	1472	7340	6497.68	13.35	12.91	37.72	0.003686	2.71
1	8.5	2 yr	1597	3930	3836.17	8.73	6.52	67.41	0.00348	1.41
1	8.5	5 yr (est)	1597	5140	4934.16	9.1	8.05	67.41	0.002861	1.43
1	8.5	10 yr	1597	5990	5693.25	9.35	9.03	67.41	0.002589	1.46
1	8.5	25 yr	1597	6720	6337.74	9.55	9.84	67.41	0.002408	1.48
1	8.5	50 yr	1597	7140	6706.29	9.67	10.29	67.41	0.002327	1.49
1	8.5	100 yr	1597	7340	6881.3	9.73	10.49	67.41	0.002294	1.5
1	9	2 yr	2020	3930	3844.85	5.83	6	109.93	0.001823	0.66
1	9	5 yr (est)	2020	5140	4920.88	6.06	7.39	109.93	0.001489	0.66
1	9	10 yr	2020	5990	5658.76	6.18	8.33	109.93	0.001319	0.66
1	9	25 yr	2020	6720	6283.89	6.27	9.12	109.93	0.001203	0.66
1	9	50 yr	2020	7140	6641.27	6.32	9.56	109.93	0.001148	0.66
1	9	100 yr	2020	7340	6810.9	6.34	9.77	109.93	0.001125	0.66
1	10	2 yr	2770	3930	3874.79	5.14	5.02	150.07	0.001757	0.54
1	10	5 yr (est)	2770	5140	5033.6	5.42	6.12	151.74	0.001506	0.56
1	10	10 yr	2770	5990	5842.76	5.55	6.89	152.91	0.00135	0.57
1	10	25 yr	2770	6720	6535.52	5.63	7.55	153.63	0.001232	0.57
1	10	50 yr	2770	7140	6933.71	5.68	7.95	153.63	0.00117	0.56
1	10	100 yr	2770	7340	7123.14	5.7	8.13	153.63	0.001143	0.56
1	11	2 yr	3204	3930	3900.07	4.45	4.7	186.55	0.001453	0.41
1	11	5 yr (est)	3204	5140	5071.77	4.72	5.76	186.55	0.001243	0.43
1	11	10 yr	3204	5990	5887.11	4.84	6.52	186.55	0.00111	0.44
1	11	25 yr	3204	6720	6582.5	4.92	7.18	186.55	0.001009	0.44
1	11	50 yr	3204	7140	6980.78	4.96	7.55	186.55	0.000958	0.44
1	11	100 yr	3204	7340	7169.98	4.97	7.73	186.55	0.000935	0.44
1	12	2 yr	3771	3930	3925.36	5.8	3.56	189.83	0.002759	0.6
1	12	5 yr (est)	3771	5140	5130	6.08	4.44	189.83	0.002262	0.62
1	12	10 yr	3771	5990	5974.17	6.19	5.09	189.83	0.001953	0.61
1	12	25 yr	3771	6720	6697.22	6.24	5.66	189.83	0.001721	0.6
1	12	50 yr	3771	7140	7112.39	6.26	5.99	189.83	0.001605	0.59
1	12	100 yr	3771	7340	7309.87	6.26	6.15	189.83	0.001553	0.59
1	13	2 yr	4559	3930	3885.61	7.14	2.84	191.55	0.007898	1.4
1	13	5 yr (est)	4559	5140	5076.68	8.12	3.26	191.55	0.008489	1.72
1	13	10 yr	4559	5990	5911.99	8.7	3.55	191.55	0.008693	1.92
1	13	25 yr	4559	6720	6628.12	9.08	3.81	191.55	0.008612	2.04
1	13	50 yr	4559	7140	7039.45	9.24	3.98	191.55	0.008433	2.09
1	13	100 yr	4559	7340	7235.14	9.31	4.06	191.55	0.008324	2.1

Lemon Creek from tidewater to 350-ft above gorge bridge

Plan 7 Mining below Glacier Highway with RediMix Bridge removed

HEC-RAS Plan: 7noBrGr-3lwr River: lemon creek Reach: 1

Reach	River Sta	Profile	Cum Ch Len (ft)	Q Total (cfs)	Q Channel (cfs)	Vel Chnl (ft/s)	Hydr Depth C (ft)	Top W Act Chan (ft)	E.G. Slope (ft/ft)	Shear Chan (lb/sq ft)
1	13.5	2 yr	4845	3930	3774.14	9.19	3.63	112.94	0.011443	2.51
1	13.5	5 yr (est)	4845	5140	4899.65	10.41	4.17	113.04	0.012248	3.08
1	13.5	10 yr	4845	5990	5684.83	11.22	4.48	113.04	0.012899	3.49
1	13.5	25 yr	4845	6720	6355.75	11.93	4.71	113.04	0.013645	3.88
1	13.5	50 yr	4845	7140	6738.08	12.26	4.86	113.04	0.013837	4.06
1	13.5	100 yr	4845	7340	6918.54	12.38	4.94	113.04	0.013811	4.12
1	14	2 yr	5293	3930	3840.45	4.18	4.22	217.92	0.002378	0.62
1	14	5 yr (est)	5293	5140	5012.66	4.57	5.04	217.92	0.002241	0.7
1	14	10 yr	5293	5990	5834.42	4.8	5.58	217.92	0.002161	0.75
1	14	25 yr	5293	6720	6539.09	4.98	6.03	217.92	0.002097	0.78
1	14	50 yr	5293	7140	6944.16	5.08	6.27	217.92	0.002068	0.8
1	14	100 yr	5293	7340	7137	5.13	6.39	217.92	0.002059	0.81
1	14.5	2 yr	5820	3930	3824.51	8.96	3.78	112.73	0.013079	2.99
1	14.5	5 yr (est)	5820	5140	4877.48	9.86	4.37	113.24	0.013114	3.45
1	14.5	10 yr	5820	5990	5601.7	10.43	4.73	113.55	0.013236	3.76
1	14.5	25 yr	5820	6720	6216.56	10.89	5.01	113.8	0.013364	4.02
1	14.5	50 yr	5820	7140	6567.91	11.15	5.17	113.94	0.013443	4.17
1	14.5	100 yr	5820	7340	6734.64	11.27	5.24	114	0.013481	4.24
1	15	2 yr	6042	3930	3785.15	7.04	5.84	92.08	0.006656	2.37
1	15	5 yr (est)	6042	5140	4880.35	8.04	6.53	92.94	0.007482	2.98
1	15	10 yr	6042	5990	5699.47	8.76	6.96	93.46	0.008192	3.47
1	15	25 yr	6042	6720	6357.35	9.28	7.3	93.89	0.008633	3.83
1	15	50 yr	6042	7140	6716.43	9.53	7.49	94.12	0.008817	4.01
1	15	100 yr	6042	7340	6886.44	9.65	7.58	94.23	0.008901	4.09
1	15.5	2 yr	6436	3930	3929.64	8.45	4.93	94.42	0.01203	3.61
1	15.5	5 yr (est)	6436	5140	5137.21	9.26	5.79	95.89	0.011705	4.12
1	15.5	10 yr	6436	5990	5983.7	9.71	6.36	96.89	0.011383	4.39
1	15.5	25 yr	6436	6720	6709.74	10.12	6.79	97.64	0.011357	4.67
1	15.5	50 yr	6436	7140	7127.11	10.37	7.01	98.04	0.011419	4.85
1	15.5	100 yr	6436	7340	7325.76	10.48	7.11	98.23	0.011451	4.94
1	15.8	2 yr	6772	3930	3774.87	10.18	5.46	67.9	0.018385	6.06
1	15.8	5 yr (est)	6772	5140	4904.8	11.23	6.35	68.81	0.018448	7.03
1	15.8	10 yr	6772	5990	5791.88	12.39	6.75	69.23	0.020718	8.38
1	15.8	25 yr	6772	6720	6422.51	12.7	7.25	69.75	0.019902	8.61
1	15.8	50 yr	6772	7140	6773.2	12.76	7.58	70.1	0.018971	8.56
1	15.8	100 yr	6772	7340	6942.98	12.83	7.7	70.23	0.018794	8.62
1	16	2 yr	6985	3930	3292.49	11.25	6.47	45.25	0.023246	8.8
1	16	5 yr (est)	6985	5140	4154.34	12.21	7.29	46.66	0.023535	9.99
1	16	10 yr	6985	5990	4719.02	12.34	7.98	47.87	0.021414	9.92
1	16	25 yr	6985	6720	5235.33	12.98	8.32	48.47	0.022457	10.82
1	16	50 yr	6985	7140	5536.46	13.42	8.47	48.71	0.023502	11.51
1	16	100 yr	6985	7340	5675.68	13.57	8.57	48.82	0.023682	11.72
1	17	2 yr	7123	3930	3353.14	10.91	7.35	41.81	0.018787	8.51
1	17	5 yr (est)	7123	5140	4322.53	12.08	8.56	41.81	0.018816	9.93
1	17	10 yr	7123	5990	4991.46	12.8	9.33	41.81	0.018829	10.83
1	17	25 yr	7123	6720	5559.37	13.36	9.95	41.81	0.018814	11.54
1	17	50 yr	7123	7140	5882.1	13.66	10.3	41.81	0.018807	11.94
1	17	100 yr	7123	7340	6035.12	13.81	10.45	41.81	0.018821	12.13

Lemon Creek from tidewater to 350-ft above gorge bridge

Plan 7 Mining below Glacier Highway with RediMix Bridge removed

HEC-RAS Plan: 7noBrGr-3lwr River: lemon creek Reach: 1

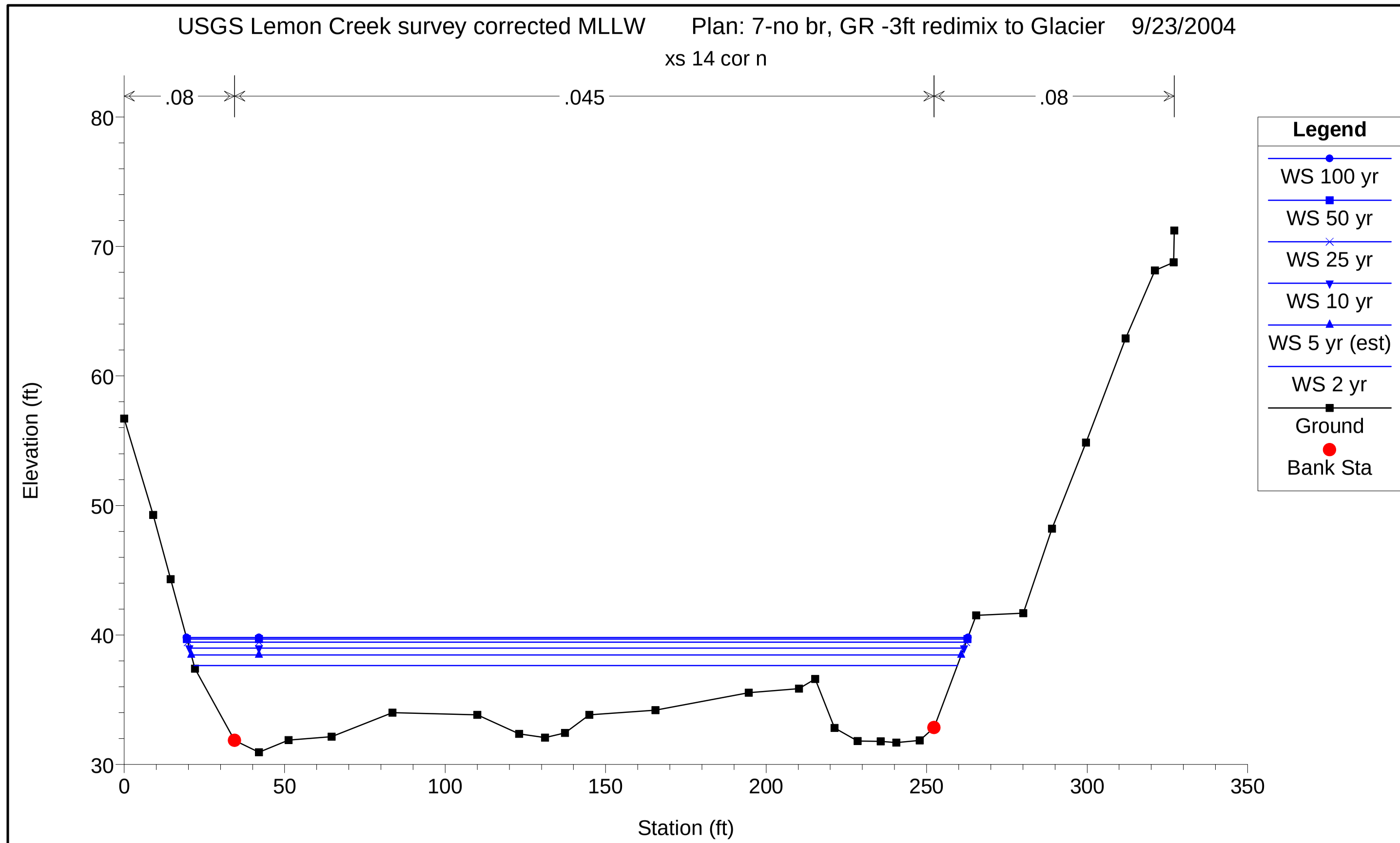
Reach	River Sta	Profile	Cum Ch Len (ft)	Q Total (cfs)	Q Channel (cfs)	Vel Chnl (ft/s)	Hydr Depth C (ft)	Top W Act Chan (ft)	E.G. Slope (ft/ft)	Shear Chan (lb/sq ft)
1	17.5	2 yr	7263	3930	2955.51	12.81	10.08	22.89	0.022179	13.54
1	17.5	5 yr (est)	7263	5140	3734.99	14.44	11.3	22.89	0.024229	16.58
1	17.5	10 yr	7263	5990	4264.06	15.45	12.06	22.89	0.025418	18.56
1	17.5	25 yr	7263	6720	4708.87	16.24	12.66	22.89	0.026317	20.18
1	17.5	50 yr	7263	7140	4961.42	16.68	12.99	22.89	0.026809	21.1
1	17.5	100 yr	7263	7340	5080.86	16.88	13.15	22.89	0.027037	21.53
1	18	2 yr	7408	3930	2763.67	14.34	7.12	27.07	0.043368	18.96
1	18	5 yr (est)	7408	5140	3468.9	15.66	8.18	27.07	0.042951	21.58
1	18	10 yr	7408	5990	3946.39	16.38	8.9	27.07	0.042031	22.97
1	18	25 yr	7408	6720	4348.9	16.95	9.48	27.07	0.041354	24.07
1	18	50 yr	7408	7140	4579.8	17.29	9.79	27.07	0.041274	24.8
1	18	100 yr	7408	7340	4686.84	17.41	9.94	27.07	0.040964	25.01
1	19	2 yr	7600	3930	2027.67	11.24	10.96	16.45	0.017324	10.47
1	19	5 yr (est)	7600	5140	2474.33	12.23	12.3	16.45	0.017588	11.92
1	19	10 yr	7600	5990	2778.05	12.87	13.12	16.45	0.017859	12.92
1	19	25 yr	7600	6720	3032.04	13.37	13.79	16.45	0.018053	13.72
1	19	50 yr	7600	7140	3174.36	13.63	14.16	16.45	0.018092	14.12
1	19	100 yr	7600	7340	3243.12	13.76	14.32	16.45	0.018182	14.35
1	20	2 yr	7704	3930	2413.59	13.53	7.29	24.49	0.038675	16.88
1	20	5 yr (est)	7704	5140	2867.75	13.62	8.6	24.49	0.031459	16.2
1	20	10 yr	7704	5990	3184.03	13.8	9.42	24.49	0.028557	16.12
1	20	25 yr	7704	6720	3454.41	13.98	10.09	24.49	0.026779	16.19
1	20	50 yr	7704	7140	3608.66	14.09	10.46	24.49	0.025912	16.24
1	20	100 yr	7704	7340	3682.65	14.15	10.63	24.49	0.025587	16.29
1	21	2 yr	7794	3930	2677.21	15.03	7.37	24.16	0.045303	20.57
1	21	5 yr (est)	7794	5140	3389.12	16.38	8.56	24.16	0.044125	23.26
1	21	10 yr	7794	5990	3877.86	17.16	9.35	24.16	0.043034	24.78
1	21	25 yr	7794	6720	4293.6	17.81	9.98	24.16	0.042473	26.1
1	21	50 yr	7794	7140	4531.65	18.18	10.32	24.16	0.04233	26.9
1	21	100 yr	7794	7340	4645.48	18.37	10.47	24.16	0.042428	27.35
1	22	2 yr	7906	3930	3050.35	11.81	9.11	28.33	0.021176	11.86
1	22	5 yr (est)	7906	5140	3882.2	13.12	10.44	28.33	0.021776	13.97
1	22	10 yr	7906	5990	4455.18	13.95	11.28	28.33	0.022212	15.39
1	22	25 yr	7906	6720	4939.37	14.58	11.96	28.33	0.022462	16.5
1	22	50 yr	7906	7140	5214.63	14.92	12.34	28.33	0.022545	17.09
1	22	100 yr	7906	7340	5344.39	15.06	12.52	28.33	0.022532	17.34
1	23	2 yr	8014	3930	2857.73	12.9	10.28	21.55	0.021818	13.62
1	23	5 yr (est)	8014	5140	3611.53	14.38	11.66	21.55	0.022941	16.24
1	23	10 yr	8014	5990	4126.6	15.3	12.52	21.55	0.023611	17.95
1	23	25 yr	8014	6720	4564.02	16.04	13.21	21.55	0.024155	19.38
1	23	50 yr	8014	7140	4814.23	16.44	13.59	21.55	0.024458	20.18
1	23	100 yr	8014	7340	4932.92	16.63	13.76	21.55	0.024591	20.56
1	24	2 yr	8247	3930	3926.51	8.96	8.18	53.6	0.009178	4.2
1	24	5 yr (est)	8247	5140	5127.11	9.78	9.71	54	0.008723	4.73
1	24	10 yr	8247	5990	5964.67	10.3	10.72	54	0.008491	5.08
1	24	25 yr	8247	6720	6679.37	10.72	11.54	54	0.008325	5.37
1	24	50 yr	8247	7140	7088.55	10.94	12	54	0.008237	5.52
1	24	100 yr	8247	7340	7282.88	11.04	12.21	54	0.008197	5.59

<u>Lemon Creek from tidewater to 350-ft above gorge bridge</u>

Plan 7 Mining below Glacier Highway with RediMix Bridge removed

HEC-RAS Plan: 7noBrGr-3lwr River: lemon creek Reach: 1

Reach	River Sta	Profile	Cum Ch Len (ft)	Q Total (cfs)	Q Channel (cfs)	Vel Chnl (ft/s)	Hydr Depth C (ft)	Top W Act Chan (ft)	E.G. Slope (ft/ft)	Shear Chan (lb/sq ft)
1	25	2 yr	8378	3930	3896.07	5.02	5.9	131.61	0.001761	0.63
1	25	5 yr (est)	8378	5140	5067.19	5.02	7.57	133.48	0.001274	0.59
1	25	10 yr	8378	5990	5883.52	5.06	8.63	134.69	0.00109	0.57
1	25	25 yr	8378	6720	6581.45	5.11	9.5	135.69	0.00098	0.56
1	25	50 yr	8378	7140	6981.76	5.13	9.98	136.24	0.000929	0.56
1	25	100 yr	8378	7340	7172.07	5.15	10.21	136.5	0.000908	0.56
1	26	2 yr	8453	3930	3872.42	7.5	5.65	91.43	0.004104	1.43
1	26	5 yr (est)	8453	5140	4880.85	7.2	7.41	91.43	0.002636	1.21
1	26	10 yr	8453	5990	5563.99	7.11	8.56	91.43	0.002121	1.12
1	26	25 yr	8453	6720	6142.09	7.07	9.5	91.43	0.001828	1.07
1	26	50 yr	8453	7140	6471.51	7.06	10.02	91.43	0.001697	1.05
1	26	100 yr	8453	7340	6627.7	7.06	10.26	91.43	0.001642	1.04
1	27	2 yr	8505	3930	3727.88	12.17	6.35	48.2	0.009442	3.65
1	27	5 yr (est)	8505	5140	4833.54	12.72	7.88	48.2	0.007729	3.71
1	27	10 yr	8505	5990	5602.39	13.02	8.93	48.2	0.006865	3.73
1	27	25 yr	8505	6720	6257.58	13.26	9.79	48.2	0.006288	3.75
1	27	50 yr	8505	7140	6633.69	13.39	10.28	48.2	0.006012	3.76
1	27	100 yr	8505	7340	6814.34	13.46	10.51	48.2	0.005898	3.77
1	28	2 yr	8524	3930	3776.36	12.14	6.03	51.58	0.009954	3.68
1	28	5 yr (est)	8524	5140	4906.05	12.59	7.55	51.58	0.007932	3.68
1	28	10 yr	8524	5990	5698.21	12.87	8.58	51.58	0.006983	3.68
1	28	25 yr	8524	6720	6376.27	13.1	9.44	51.58	0.006372	3.69
1	28	50 yr	8524	7140	6768.26	13.24	9.91	51.58	0.006104	3.71
1	28	100 yr	8524	7340	6955.14	13.3	10.14	51.58	0.005979	3.72
1	29	2 yr	8593	3930	3917.56	7.1	5.46	100.98	0.003474	1.17
1	29	5 yr (est)	8593	5140	5116.78	6.72	4.37	173.97	0.00253	0.69
1	29	10 yr	8593	5990	5960.45	6	5.15	192.8	0.001669	0.53
1	29	25 yr	8593	6720	6677.5	5.66	6.12	192.8	0.001201	0.46
1	29	50 yr	8593	7140	7088.38	5.53	6.65	192.8	0.001014	0.42
1	29	100 yr	8593	7340	7283.63	5.47	6.91	192.8	0.00094	0.4
1	30	2 yr	8659	3930	3859.99	10.74	5.89	61.06	0.008	2.9
1	30	5 yr (est)	8659	5140	4998.07	11.13	7.36	61.06	0.006374	2.89
1	30	10 yr	8659	5990	5784.33	11.32	8.37	61.06	0.005553	2.87
1	30	25 yr	8659	6720	6437.47	11.42	9.24	61.06	0.004956	2.82
1	30	50 yr	8659	7140	6802.44	11.44	9.74	61.06	0.004638	2.78
1	30	100 yr	8659	7340	6971.14	11.44	9.98	61.06	0.004486	2.76
1	31	2 yr	8877	3930	1821.26	9.21	8.04	24.6	0.003881	1.92
1	31	5 yr (est)	8877	5140	2091.81	9.1	9.34	24.6	0.003106	1.79
1	31	10 yr	8877	5990	2254.64	8.86	10.35	24.6	0.002567	1.64
1	31	25 yr	8877	6720	2484.75	9.52	10.61	24.6	0.002868	1.87
1	31	50 yr	8877	7140	2594.32	9.69	10.88	24.6	0.002873	1.93
1	31	100 yr	8877	7340	2645.17	9.76	11.02	24.6	0.002866	1.95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Station (ft)
Legend
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WS 25 yr
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WS 5 yr (est)
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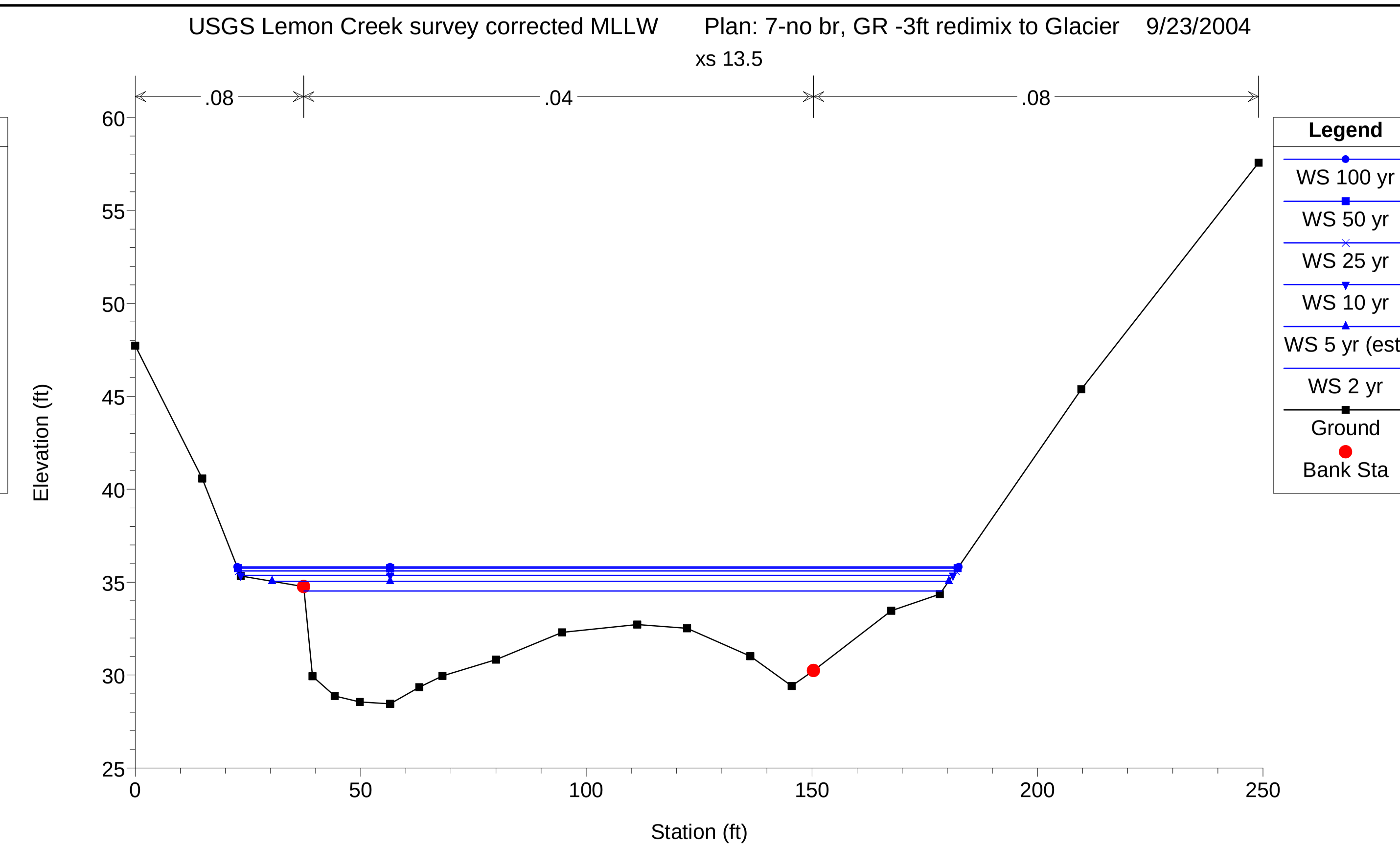
Ground
Bank Sta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WS 2 yr
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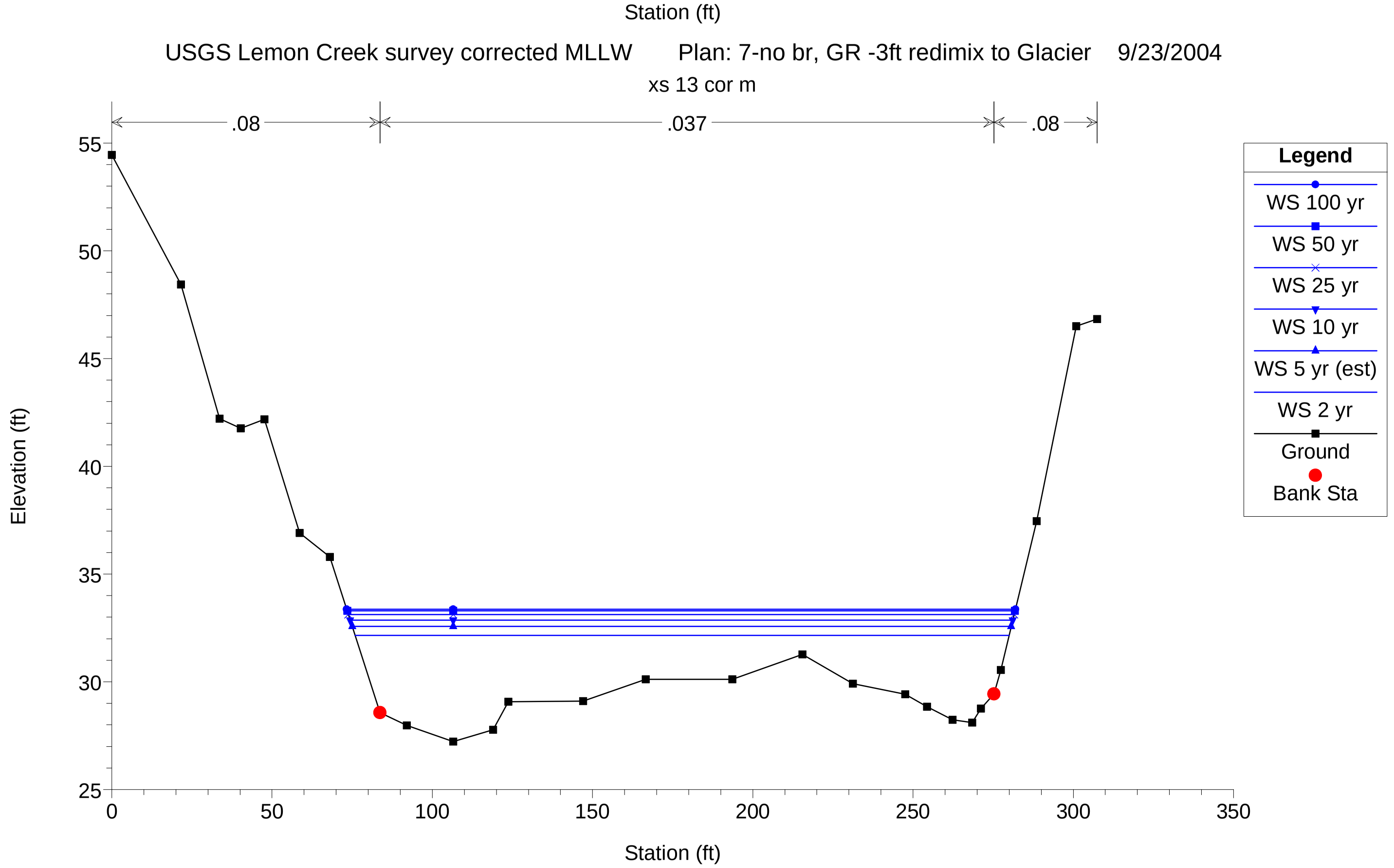
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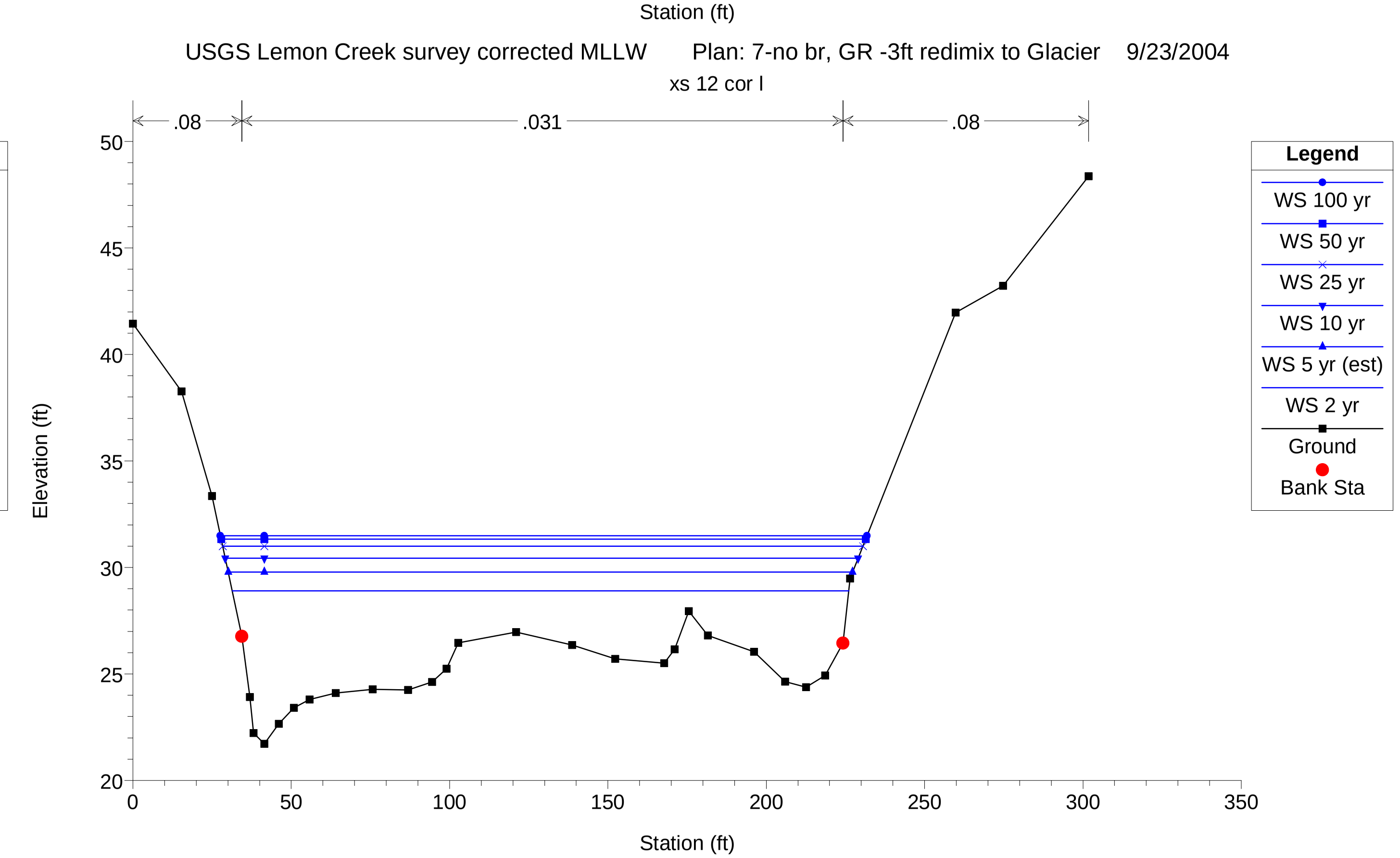
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Station (ft)
Legend
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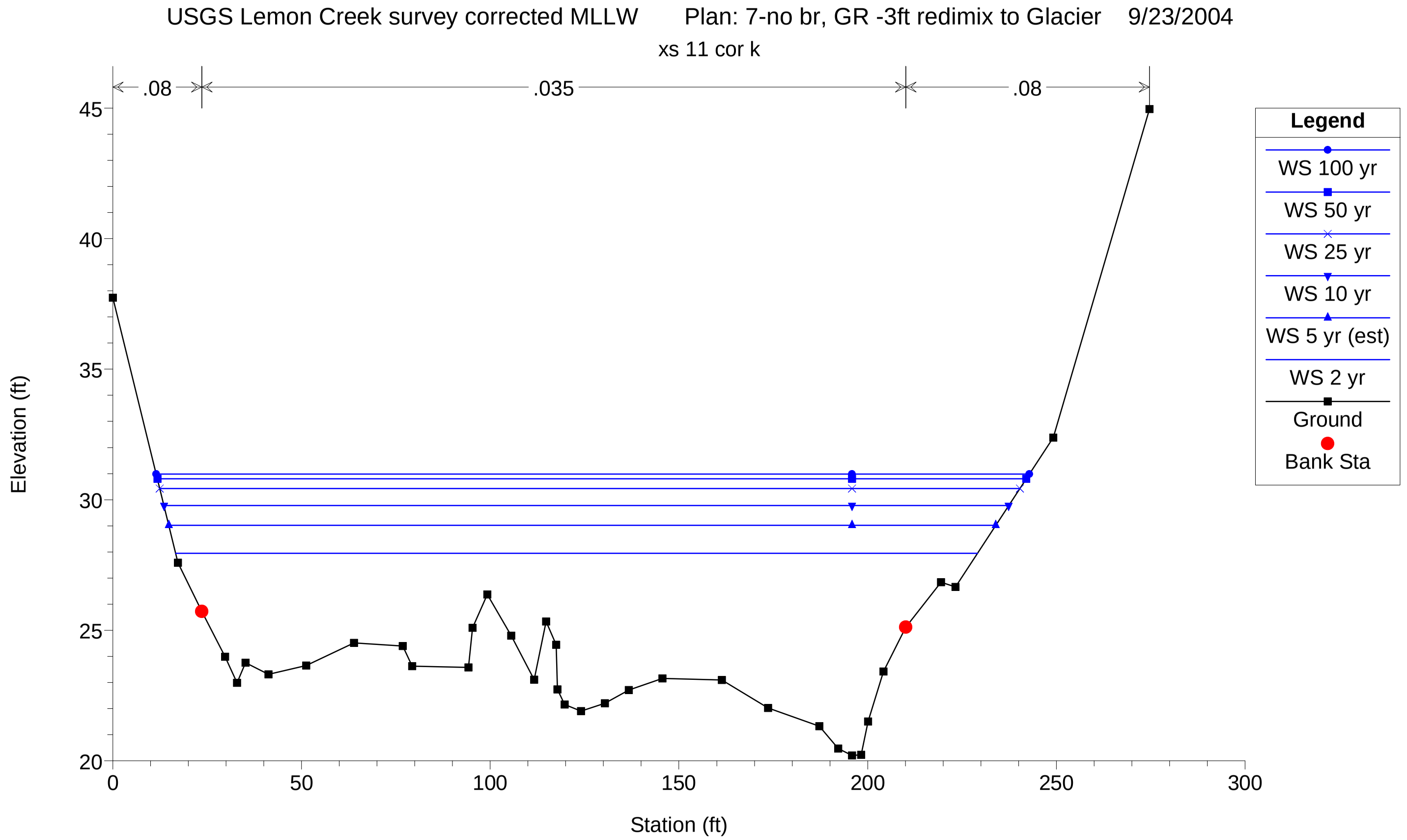
WS 50 yr
WS 25 yr
WS 10 yr
WS 5 yr (est)
WS 2 yr
Ground
Bank Sta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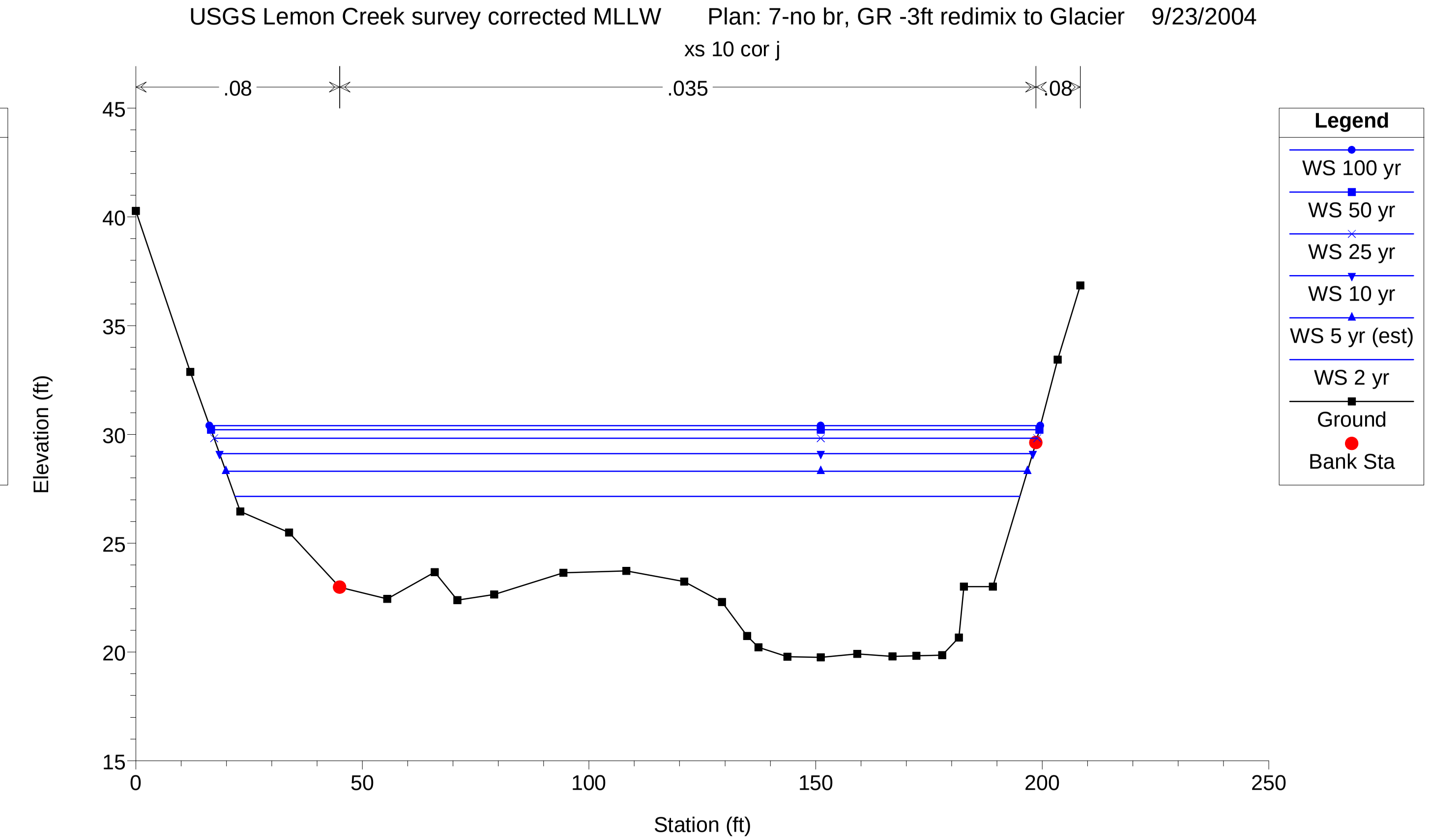
Elevation (ft)
Station (ft)
Legend
WS 100 yr
WS 50 yr
WS 25 yr
WS 10 yr
WS 5 yr (est)
WS 2 yr
Ground
Bank Sta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Elevation (ft)
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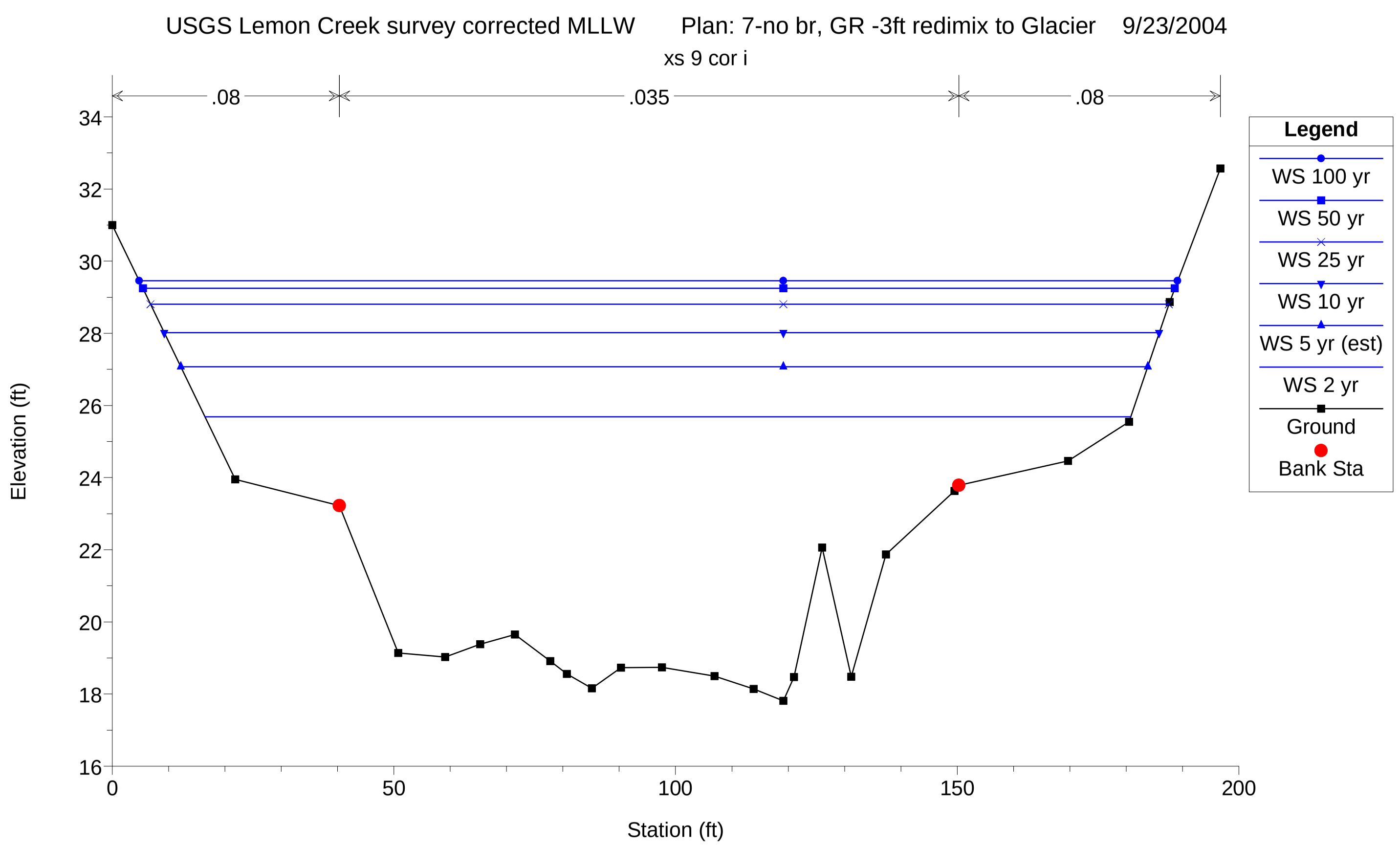
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Elevation (ft)
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WS 50 yr
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WS 5 yr (est)
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Ground
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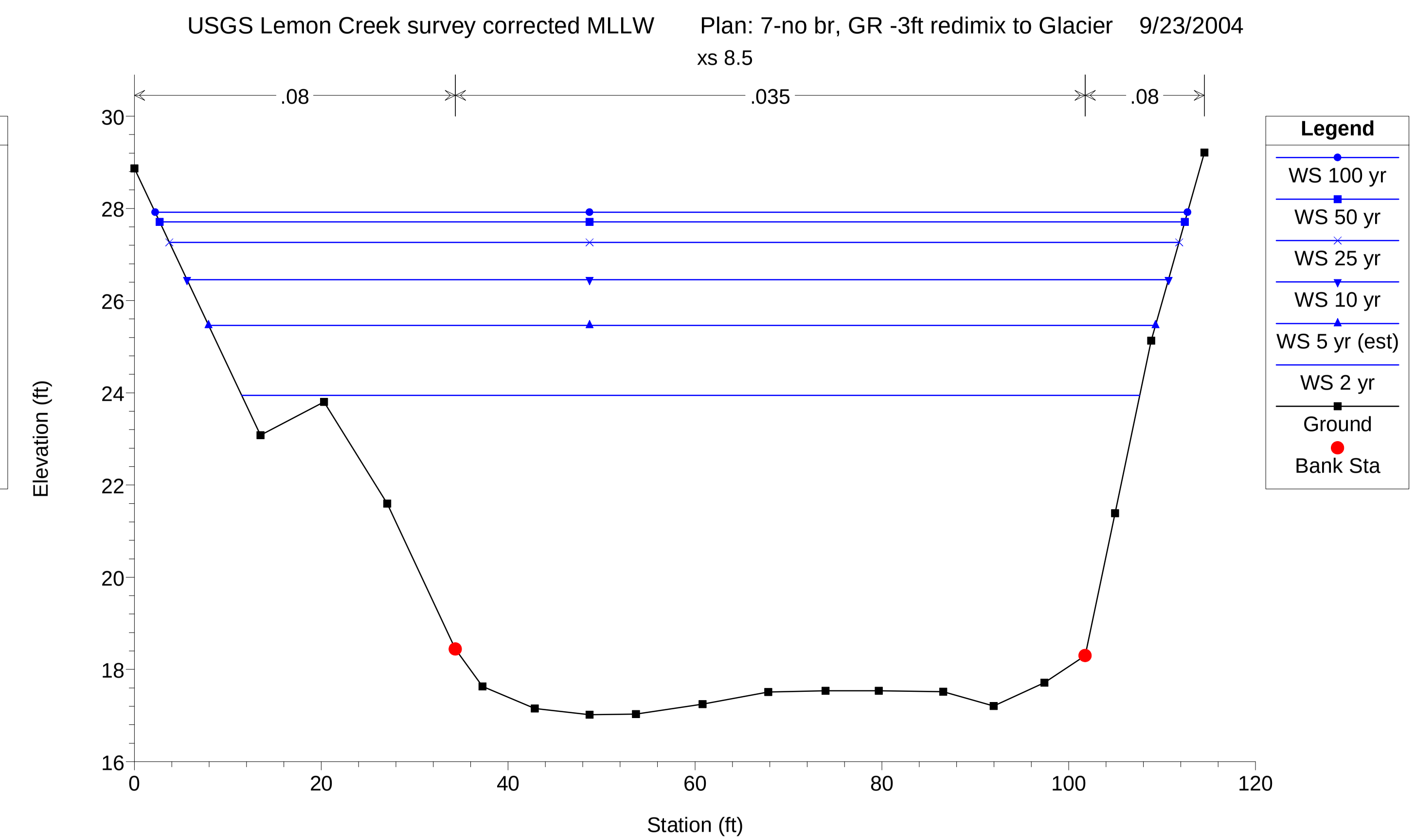
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Elevation (ft)
Station (ft)
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WS 100 yr
WS 50 yr
WS 25 yr
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USGS Lemon Creek survey corrected MLLW Plan: 7-no br, GR -3ft redimix to Glacier 9/23/2004
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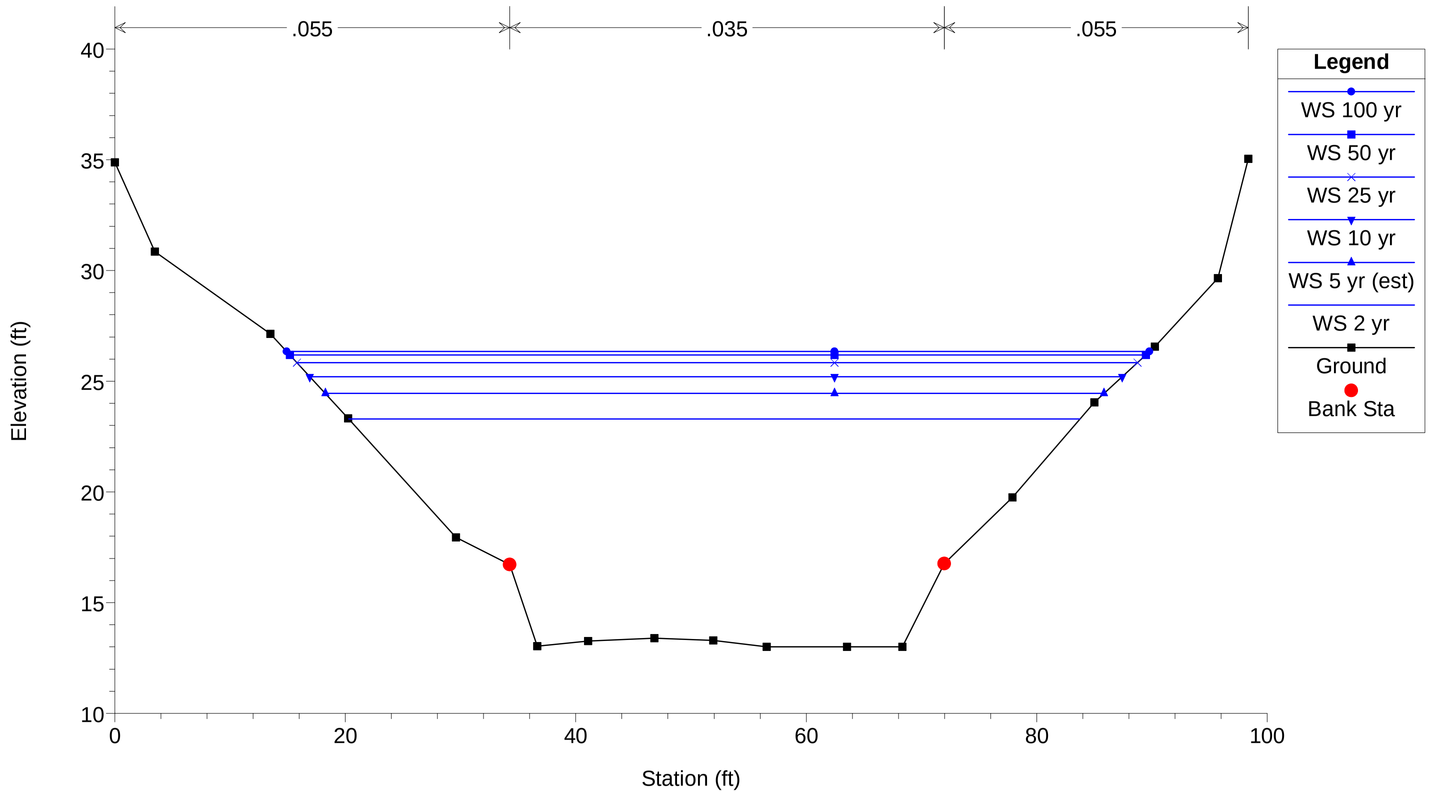

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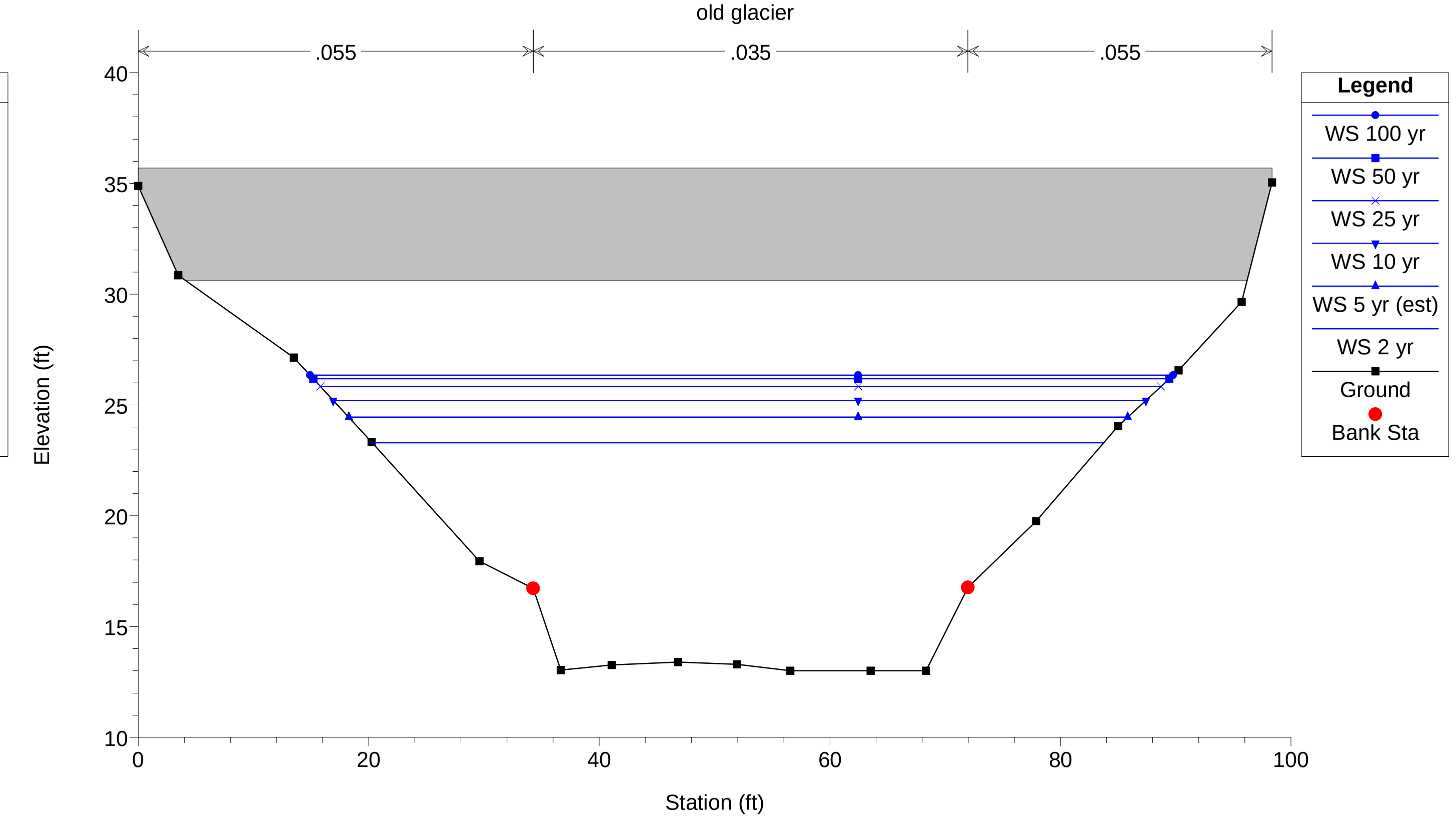
old glacier



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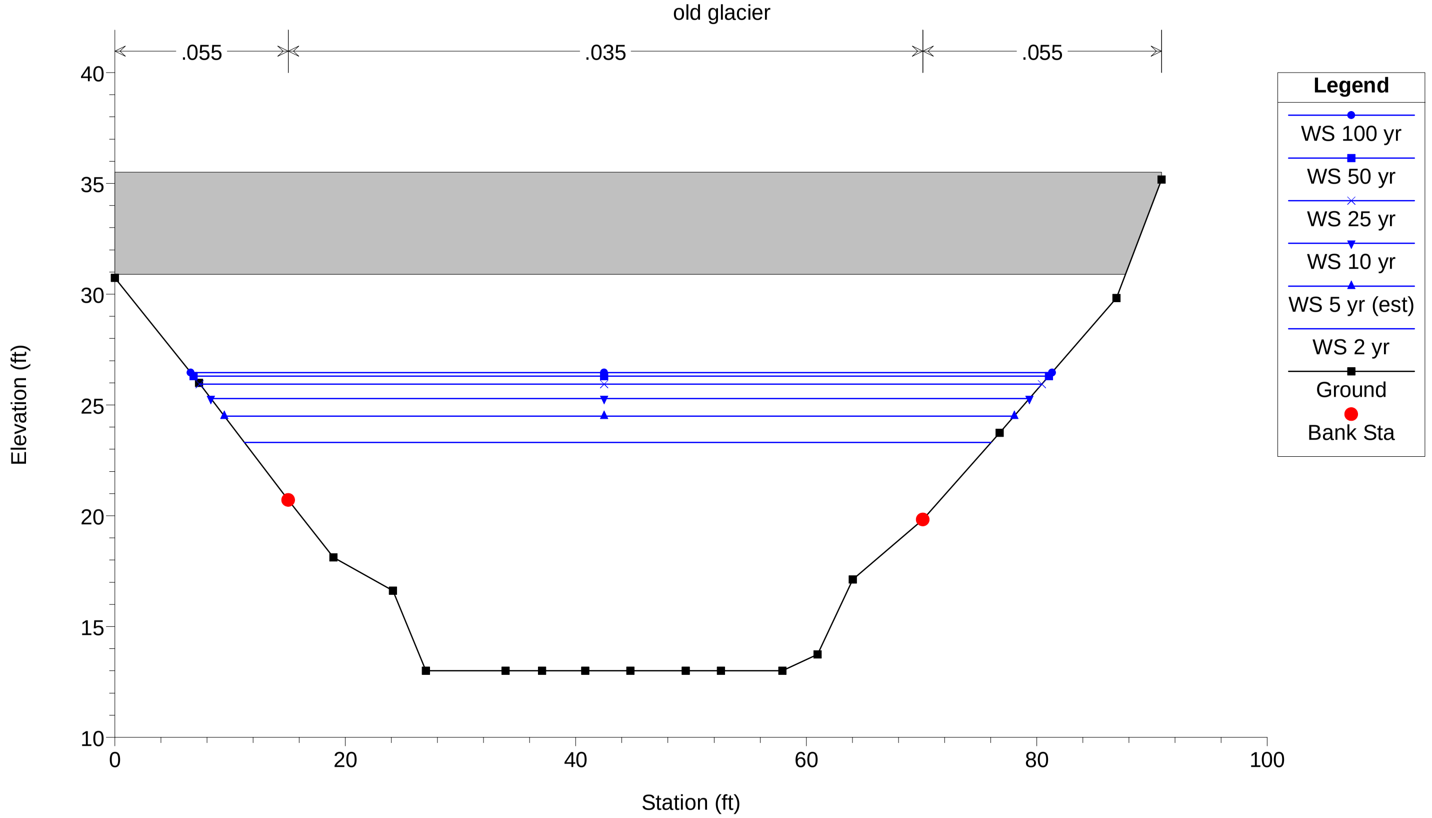
old glacier



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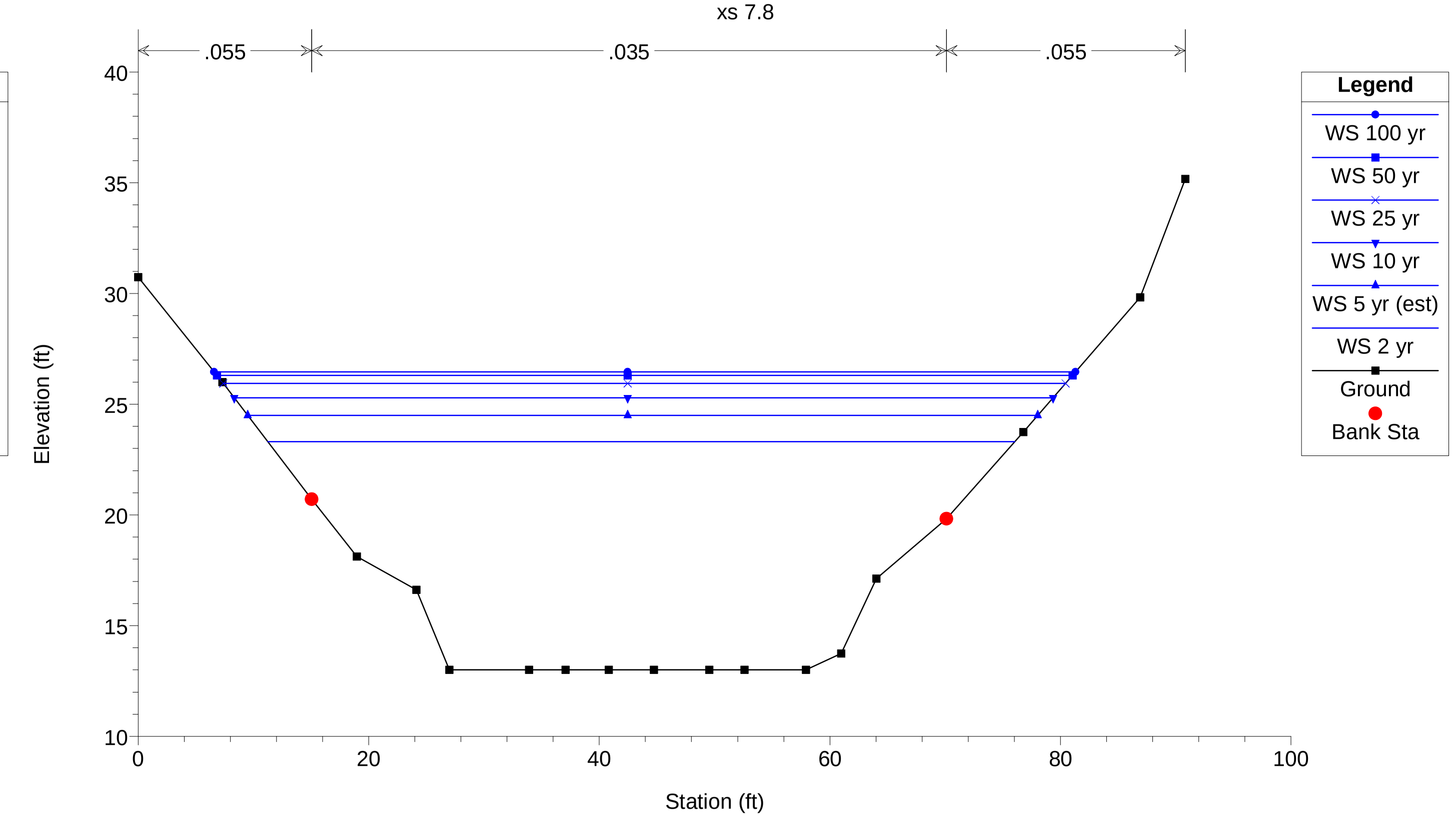
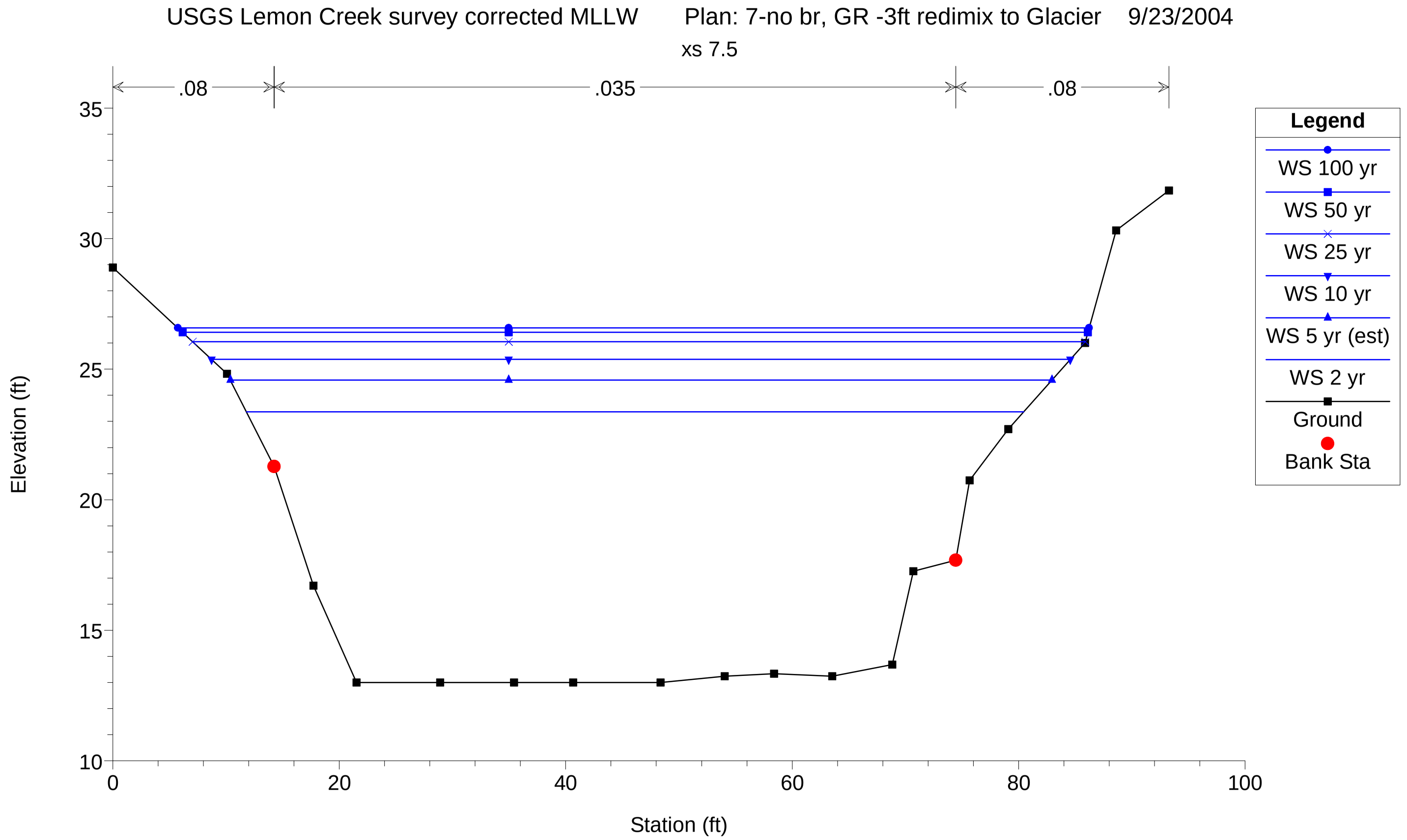
xs 7.8

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.08
.035
.08
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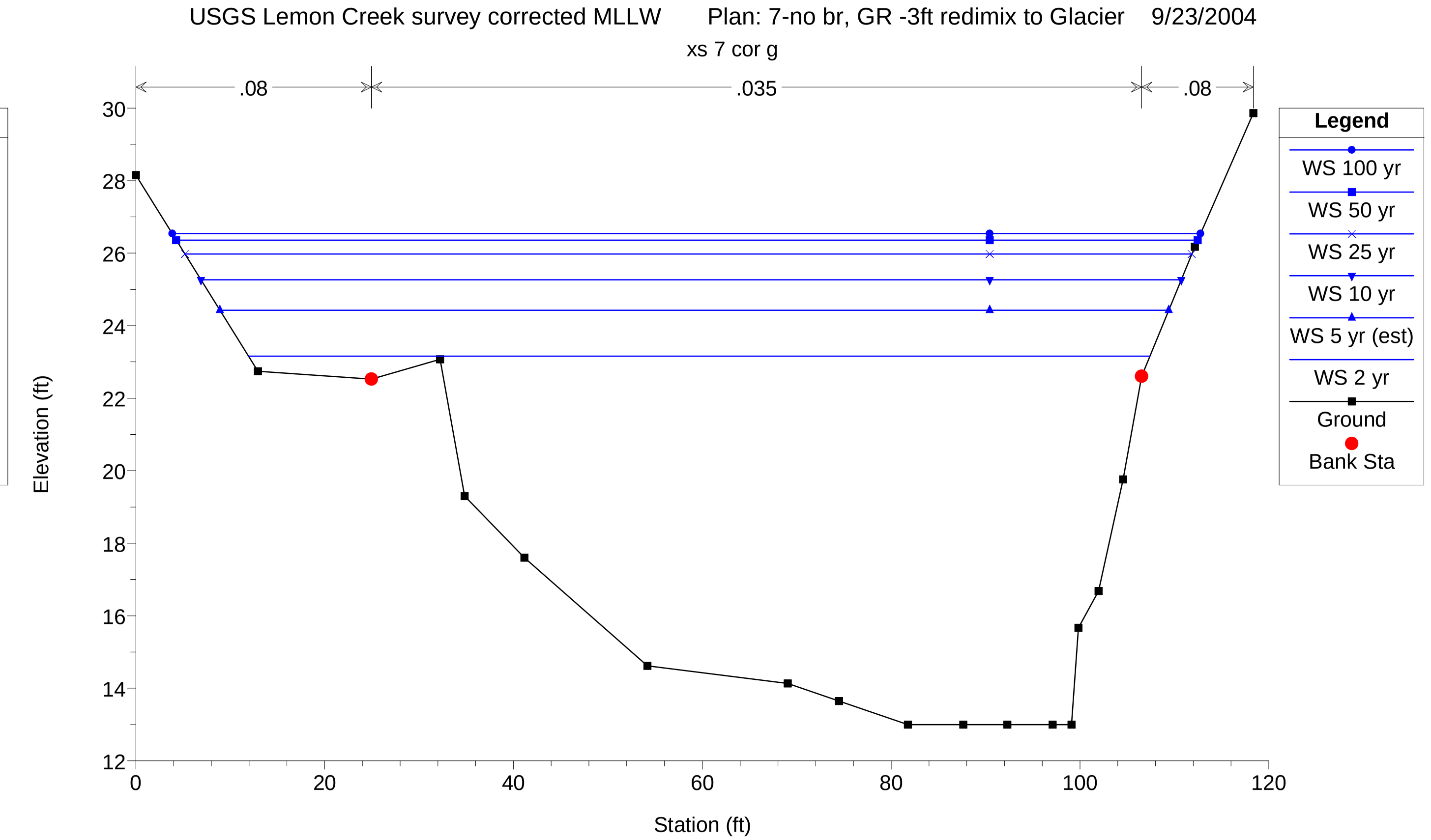
Station (ft)
Legend
WS 100 yr
WS 50 yr
WS 25 yr
WS 10 yr
WS 5 yr (est)
WS 2 yr
Ground
Bank Sta


USGS Lemon Creek survey corrected MLLW Plan: 7-no br, GR -3ft redimix to Glacier 9/23/2004
xs 7 cor g
.08
.035
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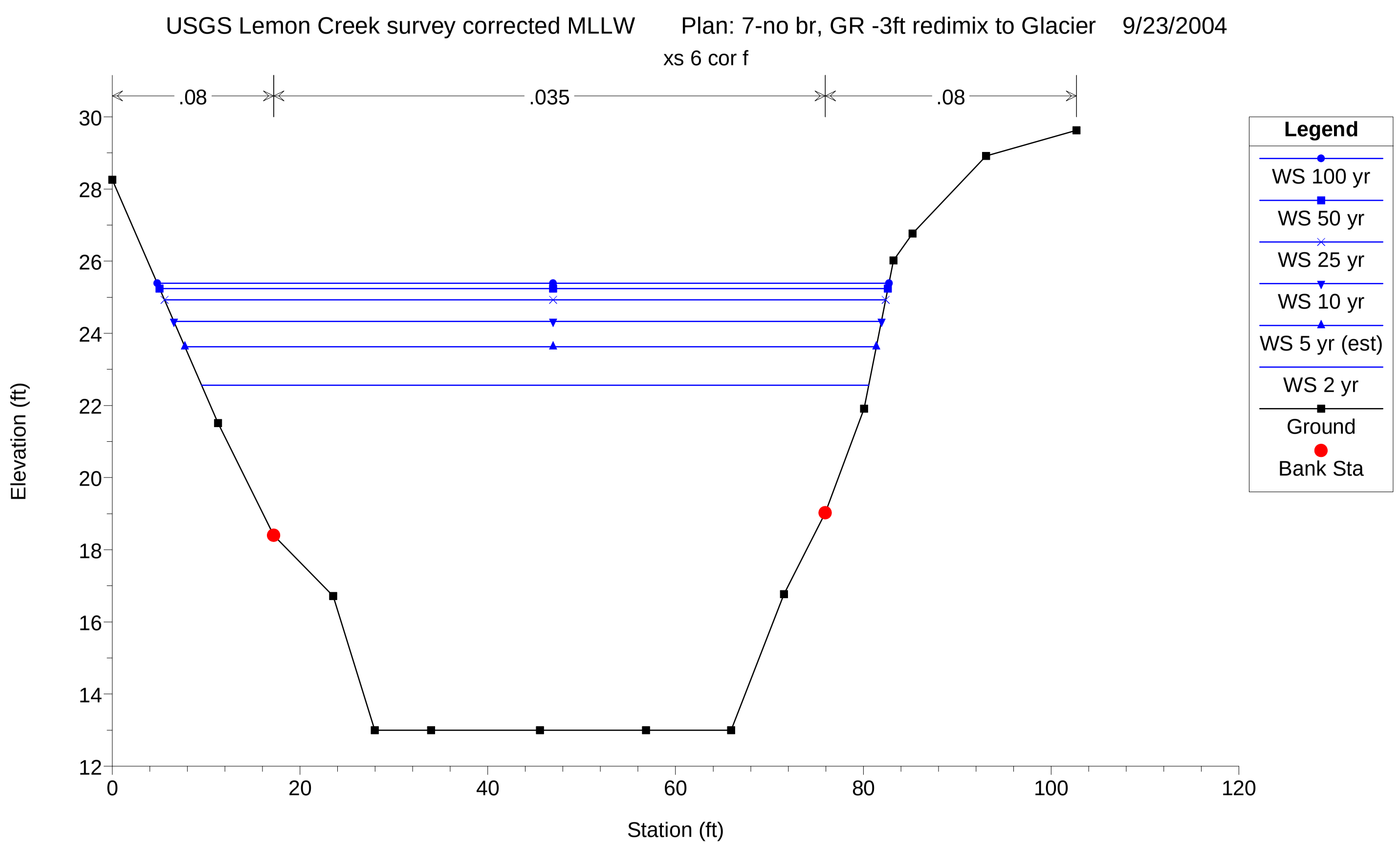
Elevation (ft)
Station (ft)
Legend
WS 100 yr
WS 50 yr
WS 25 yr
WS 10 yr
WS 5 yr (est)
WS 2 yr
Ground
Bank Sta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xs 6 cor f
.08
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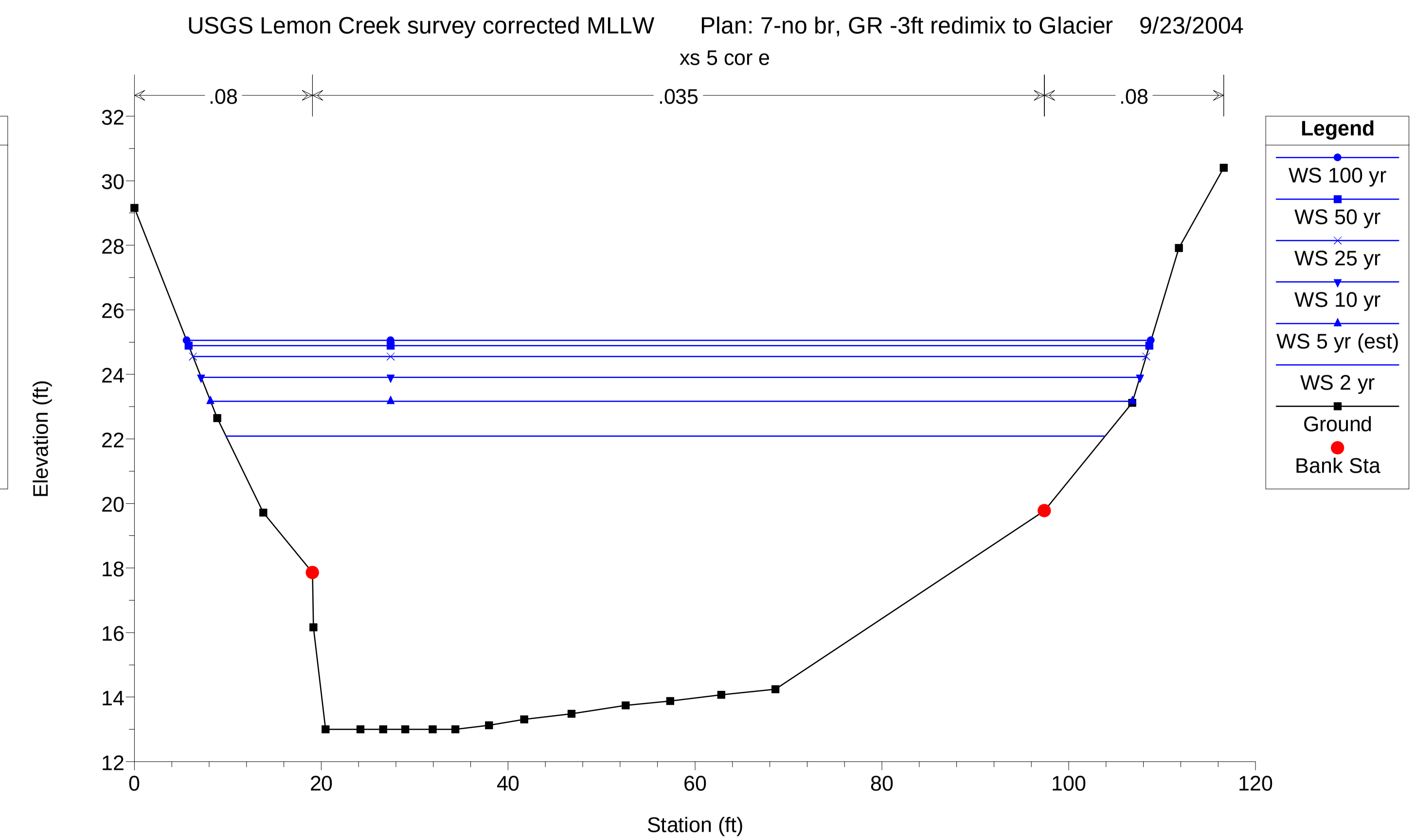
Elevation (ft)
Station (ft)
Legend
WS 100 yr
WS 50 yr
WS 25 yr
WS 10 yr
WS 5 yr (est)
WS 2 yr
Ground
Bank Sta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.08
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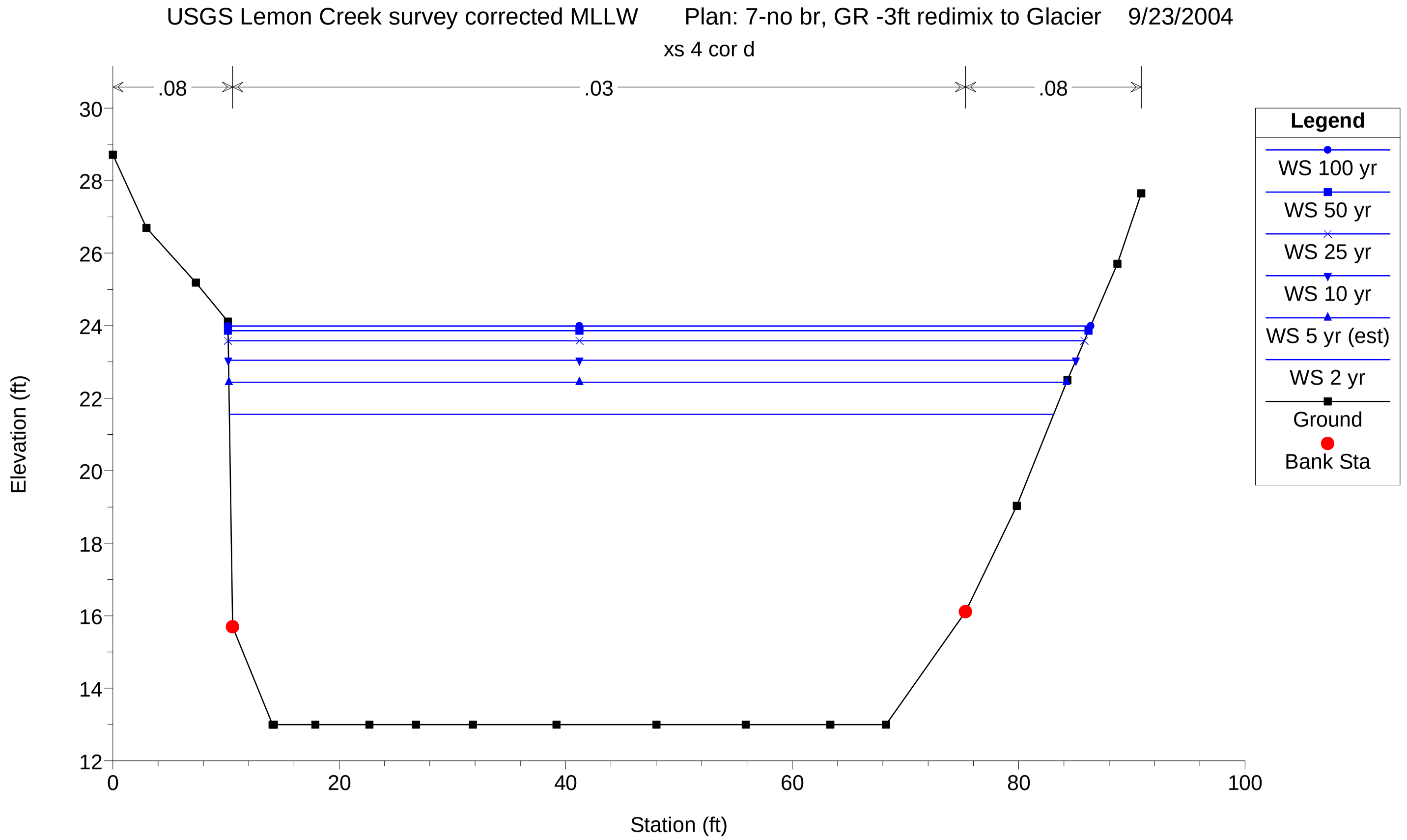
Elevation (ft)
Station (ft)
Legend
WS 100 yr
WS 50 yr
WS 25 yr
WS 10 yr
WS 5 yr (est)
WS 2 yr
Ground
Bank Sta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xs 4 cor d
.08
.03
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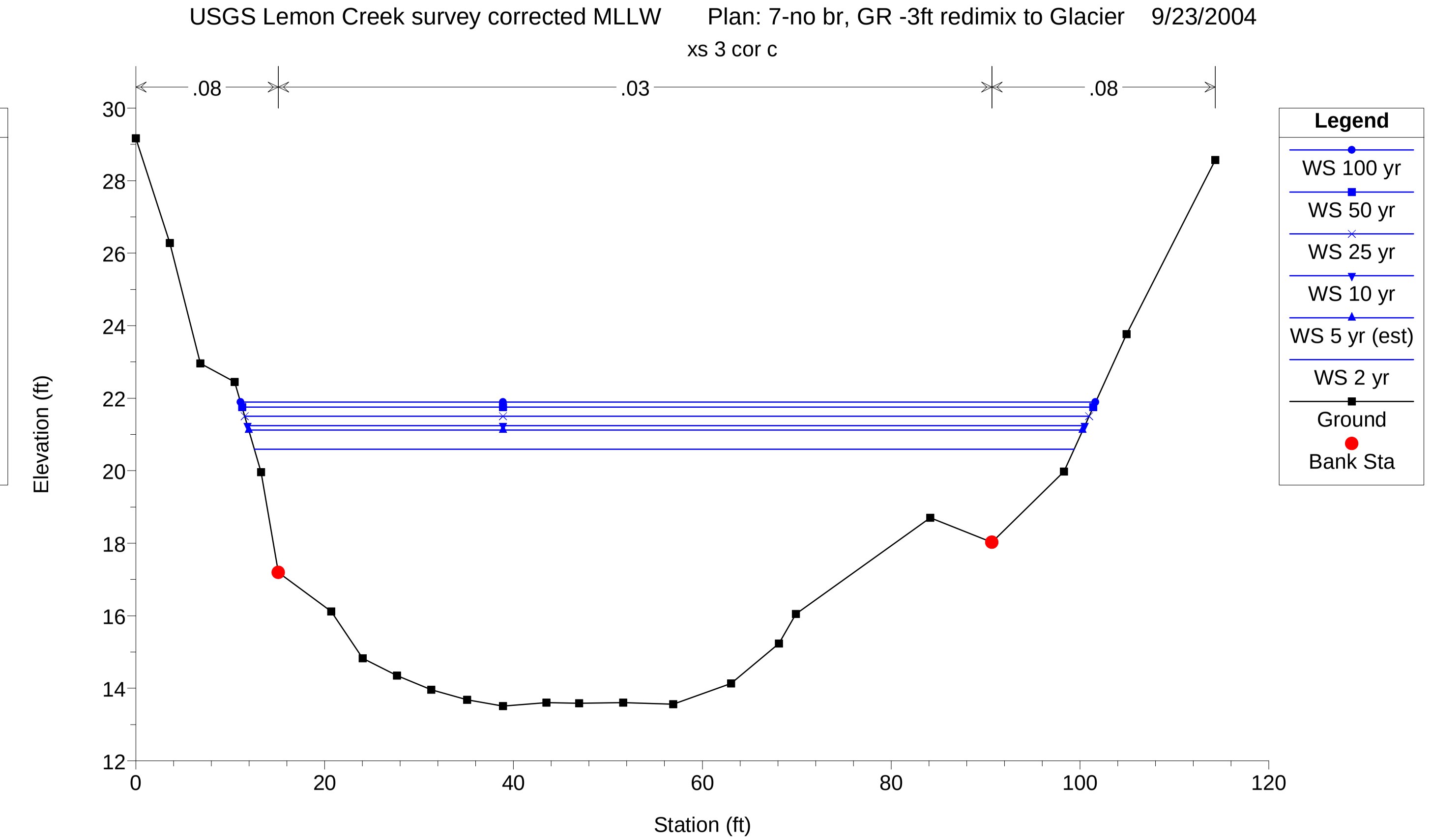
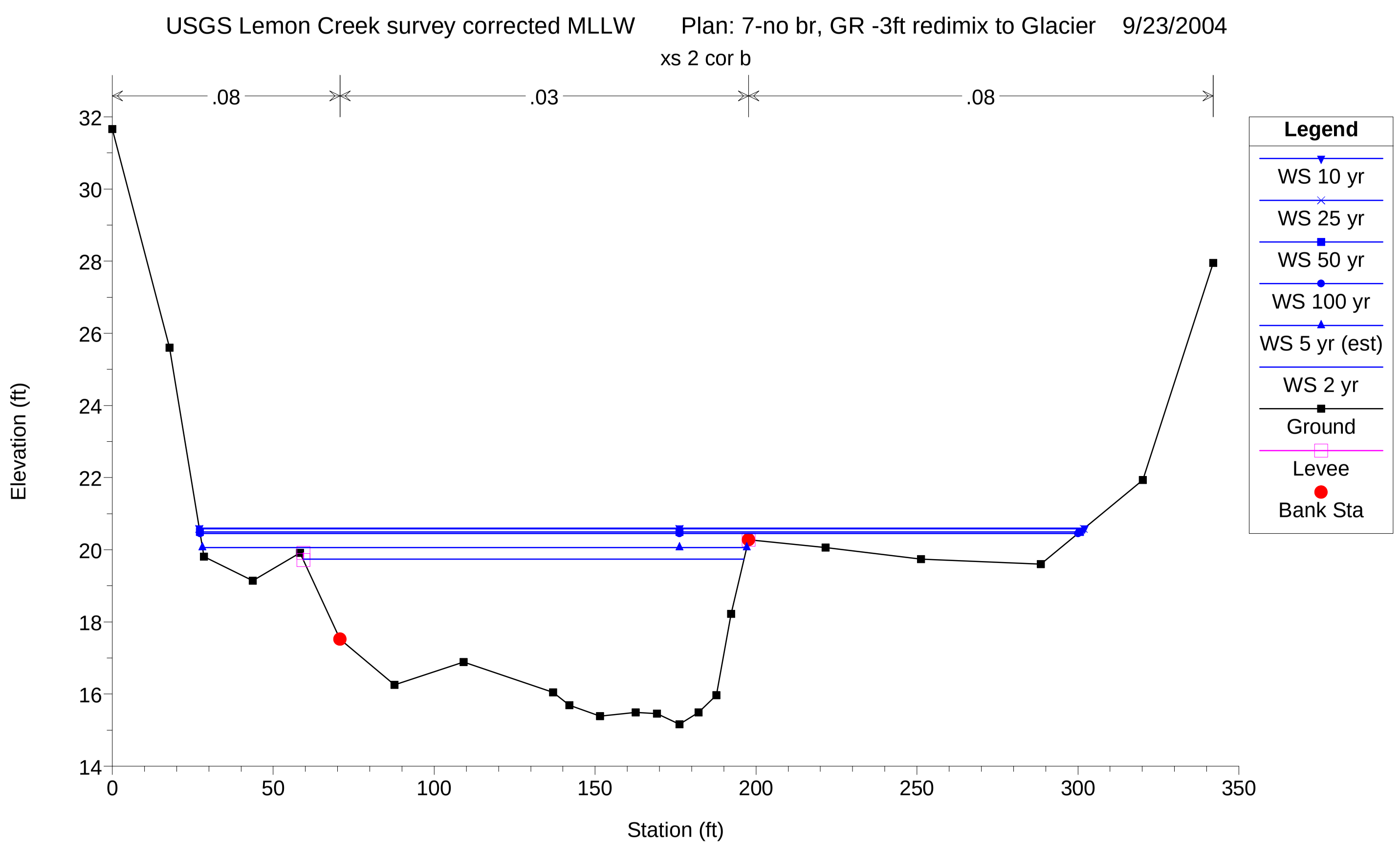
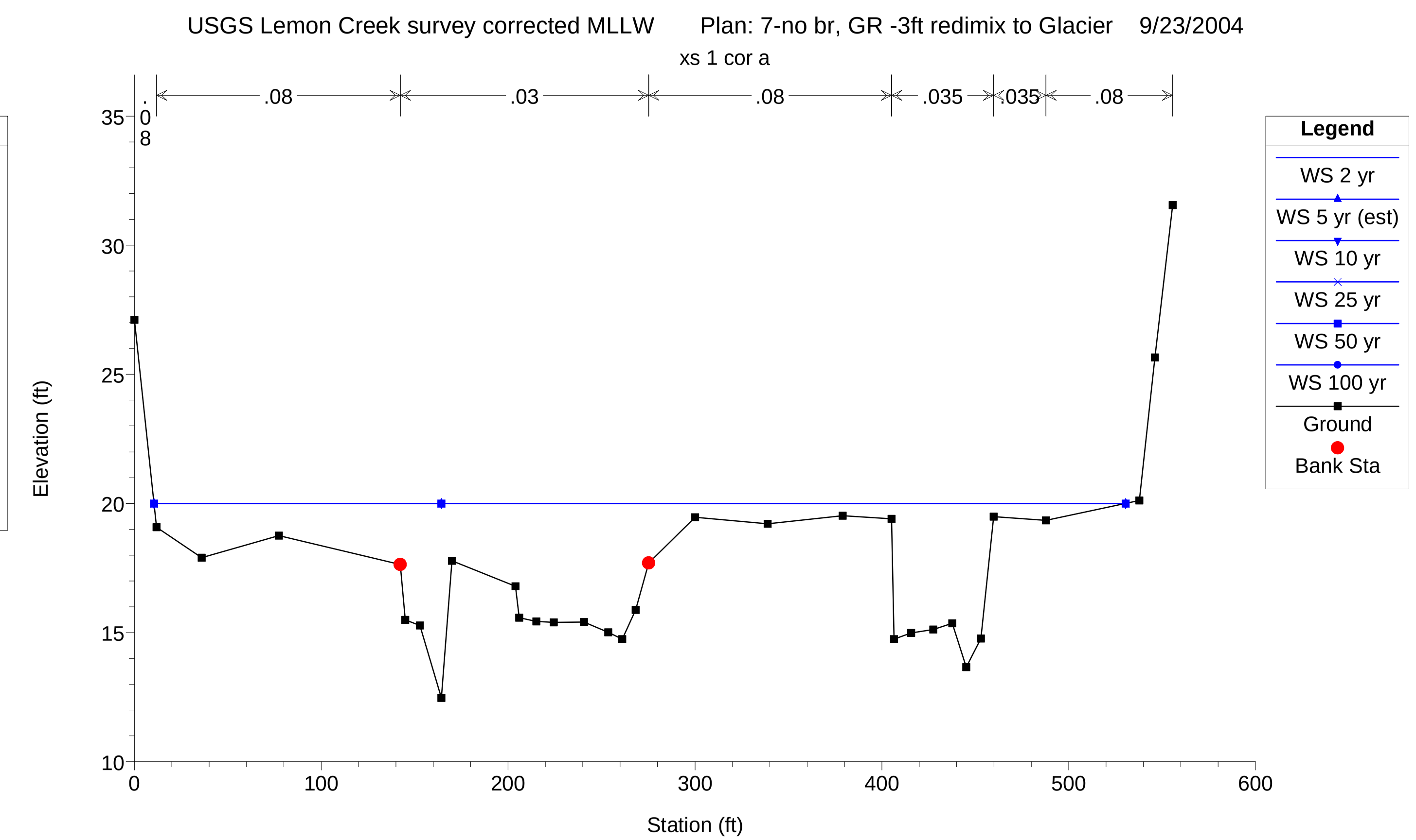
Elevation (ft)
Station (ft)
Legend
WS 100 yr
WS 50 yr
WS 25 yr
WS 10 yr
WS 5 yr (est)
WS 2 yr
Ground
Bank Sta


USGS Lemon Creek survey corrected MLLW Plan: 7-no br, GR -3ft redimix to Glacier 9/23/2004
xs 3 cor c
.08
.03
.08
Elevation (ft)
Station (ft)
Legend
WS 100 yr
WS 50 yr
WS 25 yr
WS 10 yr
WS 5 yr (est)
WS 2 yr
Ground
Bank Sta


USGS Lemon Creek survey corrected MLLW Plan: 7-no br, GR -3ft redimix to Glacier 9/23/2004
xs 2 cor b
.08
.03
.08
Elevation (ft)
Station (ft)
Legend
WS 10 yr
WS 25 yr
WS 50 yr
WS 100 yr
WS 5 yr (est)
WS 2 yr
Ground
Levee
Bank Sta


USGS Lemon Creek survey corrected MLLW Plan: 7-no br, GR -3ft redimix to Glacier 9/23/2004
xs 1 cor a
.08
.03
.08
.035
.035
.08
Elevation (ft)
Station (ft)
Legend
WS 2 yr
WS 5 yr (est)
WS 10 yr
WS 25 yr
WS 50 yr
WS 100 yr
Ground
Bank Sta

Appendix F(b)

Hydraulics

Tide Water to Top of Gorge
RediMix Bridge Removed
In Stream Mining RediMix to Prison

Lemon Creek from tidewater to 350-ft above gorge bridge

Plan 8 Mining from RediMix to Corrections Ctr with RediMix Bridge removed

HEC-RAS Plan: 8noBr-Gr4-13 River: lemon creek Reach: 1

Reach	River Sta	Profile	Cum Ch Len (ft)	Q Total (cfs)	Q Channel (cfs)	Vel Chnl (ft/s)	Hydr Depth C (ft)	Top W Act Chan (ft)	E.G. Slope (ft/ft)	Shear Chan (lb/sq ft)
1	1	2 yr		3930	2552.53	4.57	4.2	133.03	0.001304	0.33
1	1	5 yr (est)		5140	3338.42	5.97	4.2	133.03	0.00223	0.57
1	1	10 yr		5990	3890.5	6.96	4.2	133.03	0.003028	0.77
1	1	25 yr		6720	4364.63	7.81	4.2	133.03	0.003811	0.97
1	1	50 yr		7140	4637.42	8.3	4.2	133.03	0.004303	1.1
1	1	100 yr		7340	4767.32	8.53	4.2	133.03	0.004547	1.16
1	2	2 yr	174	3930	3909.89	8.94	3.48	125.48	0.006236	1.35
1	2	5 yr (est)	174	5140	5092.9	10.66	3.78	126.34	0.007936	1.86
1	2	10 yr	174	5990	5801.93	10.62	4.3	126.91	0.006641	1.77
1	2	25 yr	174	6720	6515.87	12	4.28	126.91	0.00854	2.26
1	2	50 yr	174	7140	6947.95	13.06	4.19	126.91	0.010387	2.7
1	2	100 yr	174	7340	7154.84	13.58	4.15	126.91	0.011388	2.93
1	3	2 yr	372	3930	3907.28	9.68	5.34	75.6	0.004166	1.37
1	3	5 yr (est)	372	5140	5099.71	11.5	5.86	75.6	0.005191	1.88
1	3	10 yr	372	5990	5940.02	13.11	5.99	75.6	0.006553	2.42
1	3	25 yr	372	6720	6657.1	14.09	6.25	75.6	0.007158	2.76
1	3	50 yr	372	7140	7065.91	14.37	6.51	75.6	0.007053	2.83
1	3	100 yr	372	7340	7259.87	14.46	6.64	75.6	0.00695	2.84
1	4	2 yr	493	3930	3903.69	7.26	8.31	64.74	0.001317	0.67
1	4	5 yr (est)	493	5140	5097.26	8.56	9.2	64.74	0.0016	0.9
1	4	10 yr	493	5990	5933.54	9.35	9.8	64.74	0.001752	1.05
1	4	25 yr	493	6720	6649.93	9.93	10.34	64.74	0.00184	1.16
1	4	50 yr	493	7140	7061.84	10.27	10.62	64.74	0.001901	1.23
1	4	100 yr	493	7340	7257.93	10.43	10.75	64.74	0.001931	1.27
1	5	2 yr	764	3930	3893.04	6.81	7.3	78.34	0.001948	0.84
1	5	5 yr (est)	764	5140	5066.53	7.72	8.38	78.34	0.002084	1.03
1	5	10 yr	764	5990	5881.64	8.23	9.12	78.34	0.002119	1.14
1	5	25 yr	764	6720	6576.78	8.6	9.76	78.34	0.002112	1.22
1	5	50 yr	764	7140	6975.77	8.81	10.1	78.34	0.002119	1.27
1	5	100 yr	764	7340	7165.53	8.92	10.26	78.34	0.002123	1.29
1	6	2 yr	1078	3930	3898.37	7.91	8.38	58.77	0.002191	1.09
1	6	5 yr (est)	1078	5140	5077.62	9.15	9.45	58.77	0.002498	1.4
1	6	10 yr	1078	5990	5900.38	9.89	10.15	58.77	0.002656	1.59
1	6	25 yr	1078	6720	6603.05	10.46	10.74	58.77	0.00275	1.75
1	6	50 yr	1078	7140	7006.32	10.78	11.06	58.77	0.002809	1.84
1	6	100 yr	1078	7340	7198.11	10.93	11.21	58.77	0.002838	1.88
1	7	2 yr	1213	3930	3926.58	6.59	7.31	81.56	0.001915	0.8
1	7	5 yr (est)	1213	5140	5111.49	7.31	8.57	81.56	0.001908	0.93
1	7	10 yr	1213	5990	5932.97	7.73	9.42	81.56	0.001881	1.01
1	7	25 yr	1213	6720	6631.81	8.03	10.12	81.56	0.001845	1.06
1	7	50 yr	1213	7140	7031.82	8.2	10.51	81.56	0.00183	1.1
1	7	100 yr	1213	7340	7221.88	8.28	10.69	81.56	0.001826	1.11
1	7.5	2 yr	1361	3930	3919.07	6.89	9.45	60.22	0.001494	0.8
1	7.5	5 yr (est)	1361	5140	5112.37	7.96	10.67	60.22	0.001699	1.03
1	7.5	10 yr	1361	5990	5945.07	8.61	11.47	60.22	0.001805	1.18
1	7.5	25 yr	1361	6720	6655.25	9.11	12.13	60.22	0.001874	1.29
1	7.5	50 yr	1361	7140	7061.28	9.38	12.5	60.22	0.001912	1.36
1	7.5	100 yr	1361	7340	7254.3	9.51	12.66	60.22	0.001931	1.39

Lemon Creek from tidewater to 350-ft above gorge bridge

Plan 8 Mining from RediMix to Corrections Ctr with RediMix Bridge removed

HEC-RAS Plan: 8noBr-Gr4-13 River: lemon creek Reach: 1

Reach	River Sta	Profile	Cum Ch Len (ft)	Q Total (cfs)	Q Channel (cfs)	Vel Chnl (ft/s)	Hydr Depth C (ft)	Top W Act Chan (ft)	E.G. Slope (ft/ft)	Shear Chan (lb/sq ft)
1	7.8	2 yr	1413	3930	3905.17	8.26	8.59	55.07	0.002413	1.19
1	7.8	5 yr (est)	1413	5140	5079.03	9.43	9.78	55.07	0.002646	1.48
1	7.8	10 yr	1413	5990	5893.14	10.13	10.56	55.07	0.002753	1.67
1	7.8	25 yr	1413	6720	6584.99	10.66	11.22	55.07	0.002811	1.81
1	7.8	50 yr	1413	7140	6980.65	10.95	11.58	55.07	0.002846	1.89
1	7.8	100 yr	1413	7340	7168.54	11.09	11.74	55.07	0.002864	1.93
1	8	2 yr	1472	3930	3639.52	9.79	9.86	37.72	0.002843	1.6
1	8	5 yr (est)	1472	5140	4679.67	11.27	11.01	37.72	0.003248	2.04
1	8	10 yr	1472	5990	5393.32	12.15	11.77	37.72	0.003455	2.32
1	8	25 yr	1472	6720	5993.82	12.81	12.4	37.72	0.003581	2.53
1	8	50 yr	1472	7140	6335.62	13.17	12.75	37.72	0.003651	2.65
1	8	100 yr	1472	7340	6497.68	13.35	12.91	37.72	0.003686	2.71
1	8.5	2 yr	1597	3930	3870.57	5.15	11.15	67.41	0.000645	0.42
1	8.5	5 yr (est)	1597	5140	5008.66	5.87	12.67	67.41	0.000707	0.52
1	8.5	10 yr	1597	5990	5795.32	6.3	13.65	67.41	0.000738	0.59
1	8.5	25 yr	1597	6720	6463.25	6.63	14.46	67.41	0.000757	0.64
1	8.5	50 yr	1597	7140	6844.89	6.81	14.91	67.41	0.000768	0.67
1	8.5	100 yr	1597	7340	7026.04	6.9	15.11	67.41	0.000773	0.68
1	9	2 yr	2020	3930	3910.95	4.01	8.87	109.93	0.000541	0.28
1	9	5 yr (est)	2020	5140	5047.43	4.39	10.46	109.93	0.000519	0.31
1	9	10 yr	2020	5990	5823.28	4.6	11.5	109.93	0.000504	0.33
1	9	25 yr	2020	6720	6479.11	4.77	12.36	109.93	0.000491	0.35
1	9	50 yr	2020	7140	6853.11	4.86	12.83	109.93	0.000486	0.36
1	9	100 yr	2020	7340	7030.6	4.9	13.04	109.93	0.000483	0.36
1	10	2 yr	2770	3930	3924.21	3.44	7.73	147.53	0.00046	0.21
1	10	5 yr (est)	2770	5140	5116.3	3.72	9.19	149.82	0.000427	0.23
1	10	10 yr	2770	5990	5942.61	3.88	10.13	151.32	0.000409	0.25
1	10	25 yr	2770	6720	6648.68	4	10.89	152.54	0.000395	0.25
1	10	50 yr	2770	7140	7053.79	4.07	11.31	153.22	0.000389	0.26
1	10	100 yr	2770	7340	7246.46	4.1	11.51	153.53	0.000387	0.26
1	11	2 yr	3204	3930	3929.89	3.06	6.89	186.21	0.000437	0.18
1	11	5 yr (est)	3204	5140	5134.37	3.26	8.45	186.55	0.000375	0.18
1	11	10 yr	3204	5990	5970.58	3.37	9.49	186.55	0.000345	0.19
1	11	25 yr	3204	6720	6683.37	3.47	10.34	186.55	0.000325	0.2
1	11	50 yr	3204	7140	7091.55	3.52	10.8	186.55	0.000316	0.2
1	11	100 yr	3204	7340	7285.47	3.54	11.02	186.55	0.000312	0.2
1	12	2 yr	3771	3930	3930	3.95	5.32	186.95	0.000786	0.25
1	12	5 yr (est)	3771	5140	5139.88	4.01	6.76	189.83	0.000587	0.23
1	12	10 yr	3771	5990	5988.97	4.06	7.77	189.83	0.000502	0.23
1	12	25 yr	3771	6720	6717.26	4.12	8.6	189.83	0.00045	0.23
1	12	50 yr	3771	7140	7135.93	4.15	9.06	189.83	0.000426	0.23
1	12	100 yr	3771	7340	7335.16	4.17	9.27	189.83	0.000417	0.23
1	13	2 yr	4559	3930	3930	12.19	1.8	179.05	0.043107	4.76
1	13	5 yr (est)	4559	5140	5140	13.91	2.02	183.1	0.048275	5.97
1	13	10 yr	4559	5990	5990	14.99	2.18	183.42	0.050659	6.75
1	13	25 yr	4559	6720	6719.05	6.85	5.12	191.55	0.003429	1.06
1	13	50 yr	4559	7140	7137.74	6.72	5.55	191.55	0.002965	1
1	13	100 yr	4559	7340	7336.86	6.67	5.75	191.55	0.002784	0.97

Lemon Creek from tidewater to 350-ft above gorge bridge

Plan 8 Mining from RediMix to Corrections Ctr with RediMix Bridge removed

HEC-RAS Plan: 8noBr-Gr4-13 River: lemon creek Reach: 1

Reach	River Sta	Profile	Cum Ch Len (ft)	Q Total (cfs)	Q Channel (cfs)	Vel Chnl (ft/s)	Hydr Depth C (ft)	Top W Act Chan (ft)	E.G. Slope (ft/ft)	Shear Chan (lb/sq ft)
1	13.5	2 yr	4845	3930	3789.43	10.29	3.27	112.79	0.016479	3.26
1	13.5	5 yr (est)	4845	5140	4915.97	11.1	3.92	113.04	0.015131	3.58
1	13.5	10 yr	4845	5990	5696.1	11.6	4.34	113.04	0.014398	3.77
1	13.5	25 yr	4845	6720	6358.68	12.01	4.68	113.04	0.013958	3.95
1	13.5	50 yr	4845	7140	6738.08	12.26	4.86	113.04	0.013837	4.06
1	13.5	100 yr	4845	7340	6918.54	12.38	4.94	113.04	0.013811	4.12
1	14	2 yr	5293	3930	3839.43	4.08	4.32	217.92	0.002196	0.59
1	14	5 yr (est)	5293	5140	5011.86	4.51	5.1	217.92	0.002142	0.68
1	14	10 yr	5293	5990	5833.9	4.77	5.62	217.92	0.002109	0.73
1	14	25 yr	5293	6720	6538.91	4.97	6.04	217.92	0.002082	0.78
1	14	50 yr	5293	7140	6944.11	5.08	6.28	217.92	0.002065	0.8
1	14	100 yr	5293	7340	7136.96	5.13	6.39	217.92	0.002056	0.81
1	14.5	2 yr	5820	3930	3824.51	8.96	3.78	112.73	0.013079	2.99
1	14.5	5 yr (est)	5820	5140	4877.48	9.86	4.37	113.24	0.013114	3.45
1	14.5	10 yr	5820	5990	5601.7	10.43	4.73	113.55	0.013236	3.76
1	14.5	25 yr	5820	6720	6216.56	10.89	5.01	113.8	0.013364	4.02
1	14.5	50 yr	5820	7140	6567.91	11.15	5.17	113.94	0.013443	4.17
1	14.5	100 yr	5820	7340	6734.64	11.27	5.24	114	0.013481	4.24
1	15	2 yr	6042	3930	3785.15	7.04	5.84	92.08	0.006656	2.37
1	15	5 yr (est)	6042	5140	4880.35	8.04	6.53	92.94	0.007482	2.98
1	15	10 yr	6042	5990	5699.47	8.76	6.96	93.46	0.008192	3.47
1	15	25 yr	6042	6720	6357.35	9.28	7.3	93.89	0.008633	3.83
1	15	50 yr	6042	7140	6716.43	9.53	7.49	94.12	0.008817	4.01
1	15	100 yr	6042	7340	6886.44	9.65	7.58	94.23	0.008901	4.09
1	15.5	2 yr	6436	3930	3929.64	8.45	4.93	94.42	0.01203	3.61
1	15.5	5 yr (est)	6436	5140	5137.21	9.26	5.79	95.89	0.011705	4.12
1	15.5	10 yr	6436	5990	5983.7	9.71	6.36	96.89	0.011383	4.39
1	15.5	25 yr	6436	6720	6709.74	10.12	6.79	97.64	0.011357	4.67
1	15.5	50 yr	6436	7140	7127.11	10.37	7.01	98.04	0.011419	4.85
1	15.5	100 yr	6436	7340	7325.76	10.48	7.11	98.23	0.011451	4.94
1	15.8	2 yr	6772	3930	3774.87	10.18	5.46	67.9	0.018385	6.06
1	15.8	5 yr (est)	6772	5140	4904.8	11.23	6.35	68.81	0.018448	7.03
1	15.8	10 yr	6772	5990	5791.88	12.39	6.75	69.23	0.020718	8.38
1	15.8	25 yr	6772	6720	6422.51	12.7	7.25	69.75	0.019902	8.61
1	15.8	50 yr	6772	7140	6773.2	12.76	7.58	70.1	0.018971	8.56
1	15.8	100 yr	6772	7340	6942.98	12.83	7.7	70.23	0.018794	8.62
1	16	2 yr	6985	3930	3292.49	11.25	6.47	45.25	0.023246	8.8
1	16	5 yr (est)	6985	5140	4154.34	12.21	7.29	46.66	0.023535	9.99
1	16	10 yr	6985	5990	4719.02	12.34	7.98	47.87	0.021414	9.92
1	16	25 yr	6985	6720	5235.33	12.98	8.32	48.47	0.022457	10.82
1	16	50 yr	6985	7140	5536.46	13.42	8.47	48.71	0.023502	11.51
1	16	100 yr	6985	7340	5675.68	13.57	8.57	48.82	0.023682	11.72
1	17	2 yr	7123	3930	3353.14	10.91	7.35	41.81	0.018787	8.51
1	17	5 yr (est)	7123	5140	4322.53	12.08	8.56	41.81	0.018816	9.93
1	17	10 yr	7123	5990	4991.46	12.8	9.33	41.81	0.018829	10.83
1	17	25 yr	7123	6720	5559.37	13.36	9.95	41.81	0.018814	11.54
1	17	50 yr	7123	7140	5882.1	13.66	10.3	41.81	0.018807	11.94
1	17	100 yr	7123	7340	6035.12	13.81	10.45	41.81	0.018821	12.13

Lemon Creek from tidewater to 350-ft above gorge bridge

Plan 8 Mining from RediMix to Corrections Ctr with RediMix Bridge removed

HEC-RAS Plan: 8noBr-Gr4-13 River: lemon creek Reach: 1

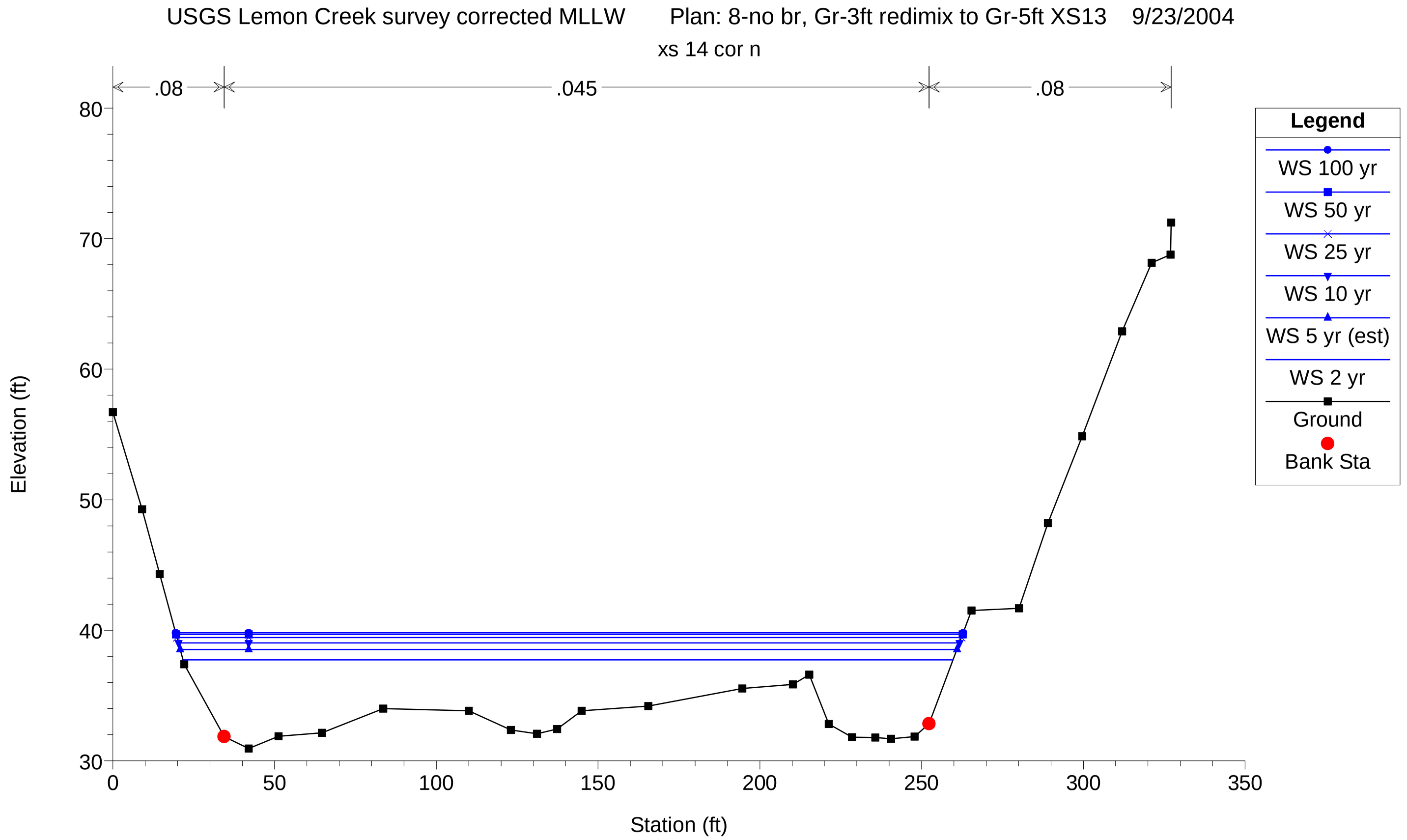
Reach	River Sta	Profile	Cum Ch Len (ft)	Q Total (cfs)	Q Channel (cfs)	Vel Chnl (ft/s)	Hydr Depth C (ft)	Top W Act Chan (ft)	E.G. Slope (ft/ft)	Shear Chan (lb/sq ft)
1	17.5	2 yr	7263	3930	2955.51	12.81	10.08	22.89	0.022179	13.54
1	17.5	5 yr (est)	7263	5140	3734.99	14.44	11.3	22.89	0.024229	16.58
1	17.5	10 yr	7263	5990	4264.06	15.45	12.06	22.89	0.025418	18.56
1	17.5	25 yr	7263	6720	4708.87	16.24	12.66	22.89	0.026317	20.18
1	17.5	50 yr	7263	7140	4961.42	16.68	12.99	22.89	0.026809	21.1
1	17.5	100 yr	7263	7340	5080.86	16.88	13.15	22.89	0.027037	21.53
1	18	2 yr	7408	3930	2763.67	14.34	7.12	27.07	0.043368	18.96
1	18	5 yr (est)	7408	5140	3468.9	15.66	8.18	27.07	0.042951	21.58
1	18	10 yr	7408	5990	3946.39	16.38	8.9	27.07	0.042031	22.97
1	18	25 yr	7408	6720	4348.9	16.95	9.48	27.07	0.041354	24.07
1	18	50 yr	7408	7140	4579.8	17.29	9.79	27.07	0.041274	24.8
1	18	100 yr	7408	7340	4686.84	17.41	9.94	27.07	0.040964	25.01
1	19	2 yr	7600	3930	2027.67	11.24	10.96	16.45	0.017324	10.47
1	19	5 yr (est)	7600	5140	2474.33	12.23	12.3	16.45	0.017588	11.92
1	19	10 yr	7600	5990	2778.05	12.87	13.12	16.45	0.017859	12.92
1	19	25 yr	7600	6720	3032.04	13.37	13.79	16.45	0.018053	13.72
1	19	50 yr	7600	7140	3174.36	13.63	14.16	16.45	0.018092	14.12
1	19	100 yr	7600	7340	3243.12	13.76	14.32	16.45	0.018182	14.35
1	20	2 yr	7704	3930	2413.59	13.53	7.29	24.49	0.038675	16.88
1	20	5 yr (est)	7704	5140	2867.75	13.62	8.6	24.49	0.031459	16.2
1	20	10 yr	7704	5990	3184.03	13.8	9.42	24.49	0.028557	16.12
1	20	25 yr	7704	6720	3454.41	13.98	10.09	24.49	0.026779	16.19
1	20	50 yr	7704	7140	3608.66	14.09	10.46	24.49	0.025912	16.24
1	20	100 yr	7704	7340	3682.65	14.15	10.63	24.49	0.025587	16.29
1	21	2 yr	7794	3930	2677.21	15.03	7.37	24.16	0.045303	20.57
1	21	5 yr (est)	7794	5140	3389.12	16.38	8.56	24.16	0.044125	23.26
1	21	10 yr	7794	5990	3877.86	17.16	9.35	24.16	0.043034	24.78
1	21	25 yr	7794	6720	4293.6	17.81	9.98	24.16	0.042473	26.1
1	21	50 yr	7794	7140	4531.65	18.18	10.32	24.16	0.04233	26.9
1	21	100 yr	7794	7340	4645.48	18.37	10.47	24.16	0.042428	27.35
1	22	2 yr	7906	3930	3050.35	11.81	9.11	28.33	0.021176	11.86
1	22	5 yr (est)	7906	5140	3882.2	13.12	10.44	28.33	0.021776	13.97
1	22	10 yr	7906	5990	4455.18	13.95	11.28	28.33	0.022212	15.39
1	22	25 yr	7906	6720	4939.37	14.58	11.96	28.33	0.022462	16.5
1	22	50 yr	7906	7140	5214.63	14.92	12.34	28.33	0.022545	17.09
1	22	100 yr	7906	7340	5344.39	15.06	12.52	28.33	0.022532	17.34
1	23	2 yr	8014	3930	2857.73	12.9	10.28	21.55	0.021818	13.62
1	23	5 yr (est)	8014	5140	3611.53	14.38	11.66	21.55	0.022941	16.24
1	23	10 yr	8014	5990	4126.6	15.3	12.52	21.55	0.023611	17.95
1	23	25 yr	8014	6720	4564.02	16.04	13.21	21.55	0.024155	19.38
1	23	50 yr	8014	7140	4814.23	16.44	13.59	21.55	0.024458	20.18
1	23	100 yr	8014	7340	4932.92	16.63	13.76	21.55	0.024591	20.56
1	24	2 yr	8247	3930	3926.51	8.96	8.18	53.6	0.009178	4.2
1	24	5 yr (est)	8247	5140	5127.11	9.78	9.71	54	0.008723	4.73
1	24	10 yr	8247	5990	5964.67	10.3	10.72	54	0.008491	5.08
1	24	25 yr	8247	6720	6679.37	10.72	11.54	54	0.008325	5.37
1	24	50 yr	8247	7140	7088.55	10.94	12	54	0.008237	5.52
1	24	100 yr	8247	7340	7282.88	11.04	12.21	54	0.008197	5.59

Lemon Creek from tidewater to 350-ft above gorge bridge

Plan 8 Mining from RediMix to Corrections Ctr with RediMix Bridge removed

HEC-RAS Plan: 8noBr-Gr4-13 River: lemon creek Reach: 1

Reach	River Sta	Profile	Cum Ch Len (ft)	Q Total (cfs)	Q Channel (cfs)	Vel Chnl (ft/s)	Hydr Depth C (ft)	Top W Act Chan (ft)	E.G. Slope (ft/ft)	Shear Chan (lb/sq ft)
1	25	2 yr	8378	3930	3896.07	5.02	5.9	131.61	0.001761	0.63
1	25	5 yr (est)	8378	5140	5067.19	5.02	7.57	133.48	0.001274	0.59
1	25	10 yr	8378	5990	5883.52	5.06	8.63	134.69	0.00109	0.57
1	25	25 yr	8378	6720	6581.45	5.11	9.5	135.69	0.00098	0.56
1	25	50 yr	8378	7140	6981.76	5.13	9.98	136.24	0.000929	0.56
1	25	100 yr	8378	7340	7172.07	5.15	10.21	136.5	0.000908	0.56
1	26	2 yr	8453	3930	3872.42	7.5	5.65	91.43	0.004104	1.43
1	26	5 yr (est)	8453	5140	4880.85	7.2	7.41	91.43	0.002636	1.21
1	26	10 yr	8453	5990	5563.99	7.11	8.56	91.43	0.002121	1.12
1	26	25 yr	8453	6720	6142.09	7.07	9.5	91.43	0.001828	1.07
1	26	50 yr	8453	7140	6471.51	7.06	10.02	91.43	0.001697	1.05
1	26	100 yr	8453	7340	6627.7	7.06	10.26	91.43	0.001642	1.04
1	27	2 yr	8505	3930	3727.88	12.17	6.35	48.2	0.009442	3.65
1	27	5 yr (est)	8505	5140	4833.54	12.72	7.88	48.2	0.007729	3.71
1	27	10 yr	8505	5990	5602.39	13.02	8.93	48.2	0.006865	3.73
1	27	25 yr	8505	6720	6257.58	13.26	9.79	48.2	0.006288	3.75
1	27	50 yr	8505	7140	6633.69	13.39	10.28	48.2	0.006012	3.76
1	27	100 yr	8505	7340	6814.34	13.46	10.51	48.2	0.005898	3.77
1	28	2 yr	8524	3930	3776.36	12.14	6.03	51.58	0.009954	3.68
1	28	5 yr (est)	8524	5140	4906.05	12.59	7.55	51.58	0.007932	3.68
1	28	10 yr	8524	5990	5698.21	12.87	8.58	51.58	0.006983	3.68
1	28	25 yr	8524	6720	6376.27	13.1	9.44	51.58	0.006372	3.69
1	28	50 yr	8524	7140	6768.26	13.24	9.91	51.58	0.006104	3.71
1	28	100 yr	8524	7340	6955.14	13.3	10.14	51.58	0.005979	3.72
1	29	2 yr	8593	3930	3917.56	7.1	5.46	100.98	0.003474	1.17
1	29	5 yr (est)	8593	5140	5116.78	6.72	4.37	173.97	0.00253	0.69
1	29	10 yr	8593	5990	5960.45	6	5.15	192.8	0.001669	0.53
1	29	25 yr	8593	6720	6677.5	5.66	6.12	192.8	0.001201	0.46
1	29	50 yr	8593	7140	7088.38	5.53	6.65	192.8	0.001014	0.42
1	29	100 yr	8593	7340	7283.63	5.47	6.91	192.8	0.00094	0.4
1	30	2 yr	8659	3930	3859.99	10.74	5.89	61.06	0.008	2.9
1	30	5 yr (est)	8659	5140	4998.07	11.13	7.36	61.06	0.006374	2.89
1	30	10 yr	8659	5990	5784.33	11.32	8.37	61.06	0.005553	2.87
1	30	25 yr	8659	6720	6437.47	11.42	9.24	61.06	0.004956	2.82
1	30	50 yr	8659	7140	6802.44	11.44	9.74	61.06	0.004638	2.78
1	30	100 yr	8659	7340	6971.14	11.44	9.98	61.06	0.004486	2.76
1	31	2 yr	8877	3930	1821.26	9.21	8.04	24.6	0.003881	1.92
1	31	5 yr (est)	8877	5140	2091.81	9.1	9.34	24.6	0.003106	1.79
1	31	10 yr	8877	5990	2254.64	8.86	10.35	24.6	0.002567	1.64
1	31	25 yr	8877	6720	2484.75	9.52	10.61	24.6	0.002868	1.87
1	31	50 yr	8877	7140	2594.32	9.69	10.88	24.6	0.002873	1.93
1	31	100 yr	8877	7340	2645.17	9.76	11.02	24.6	0.002866	1.95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xs 14 cor n
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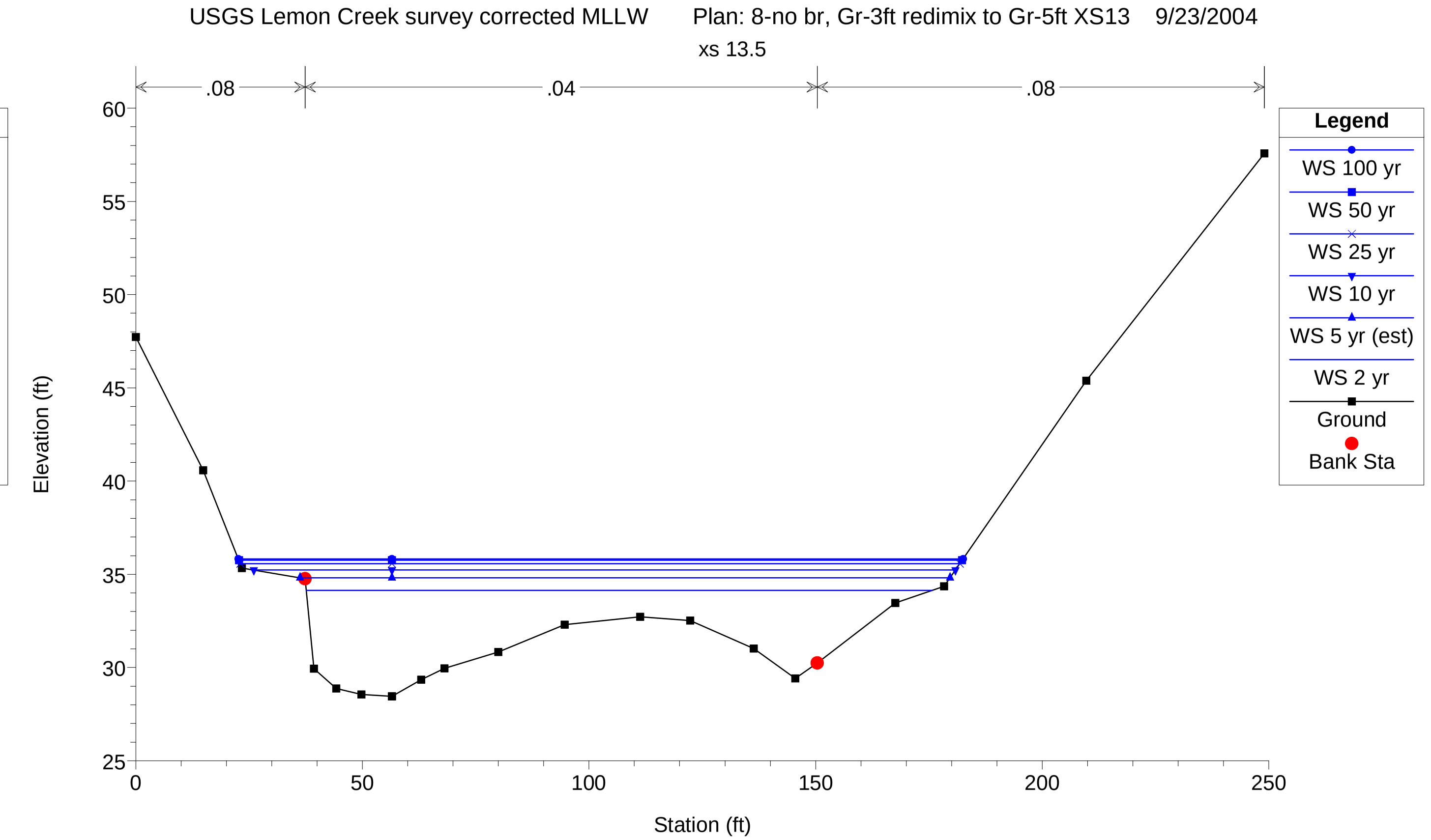
Elevation (ft)
Station (ft)
Legend
WS 100 yr
WS 50 yr
WS 25 yr
WS 10 yr
WS 5 yr (est)
WS 2 yr
Ground
Bank Sta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xs 13.5
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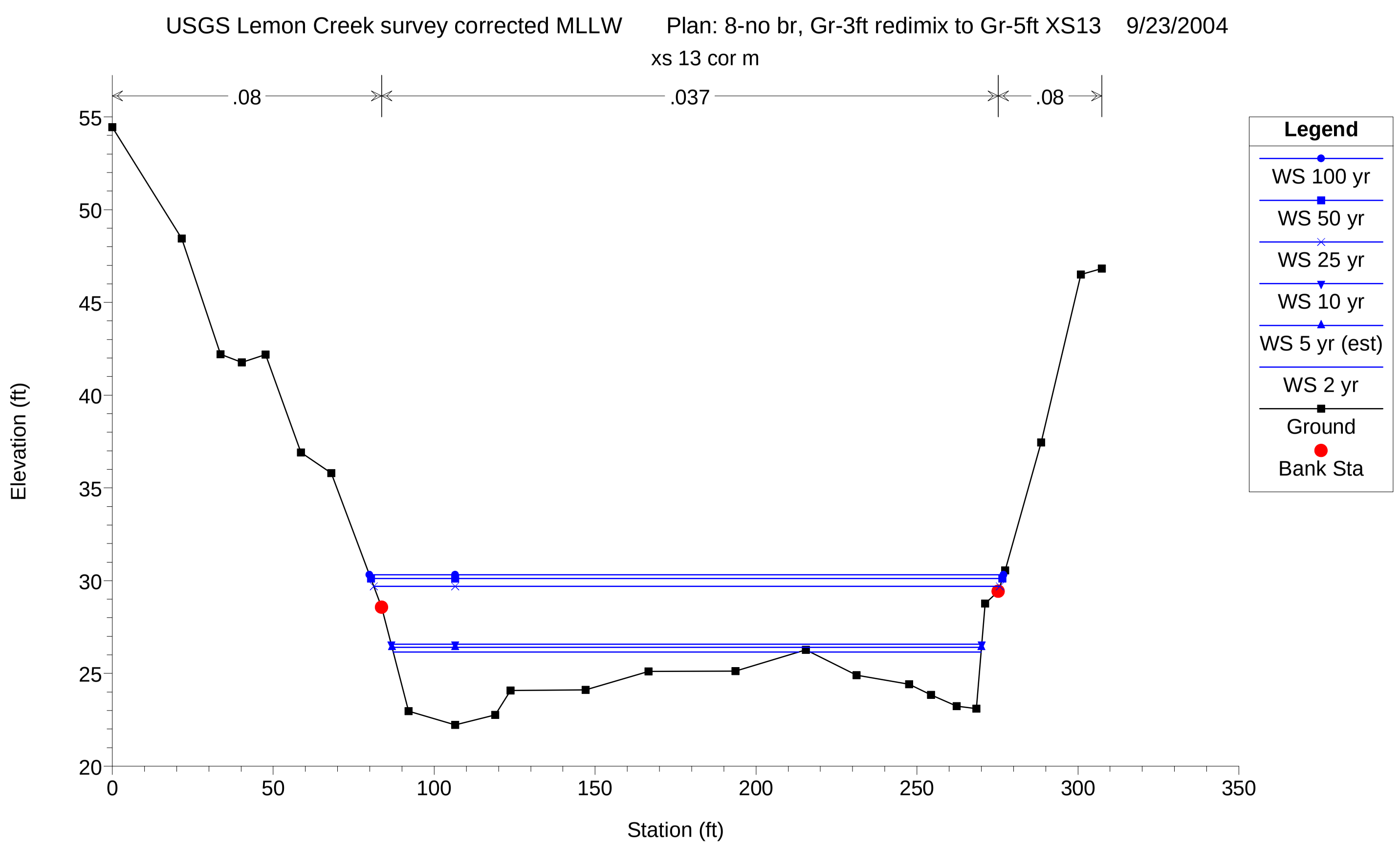
Elevation (ft)
Station (ft)
Legend
WS 100 yr
WS 50 yr
WS 25 yr
WS 10 yr
WS 5 yr (est)
WS 2 yr
Ground
Bank Sta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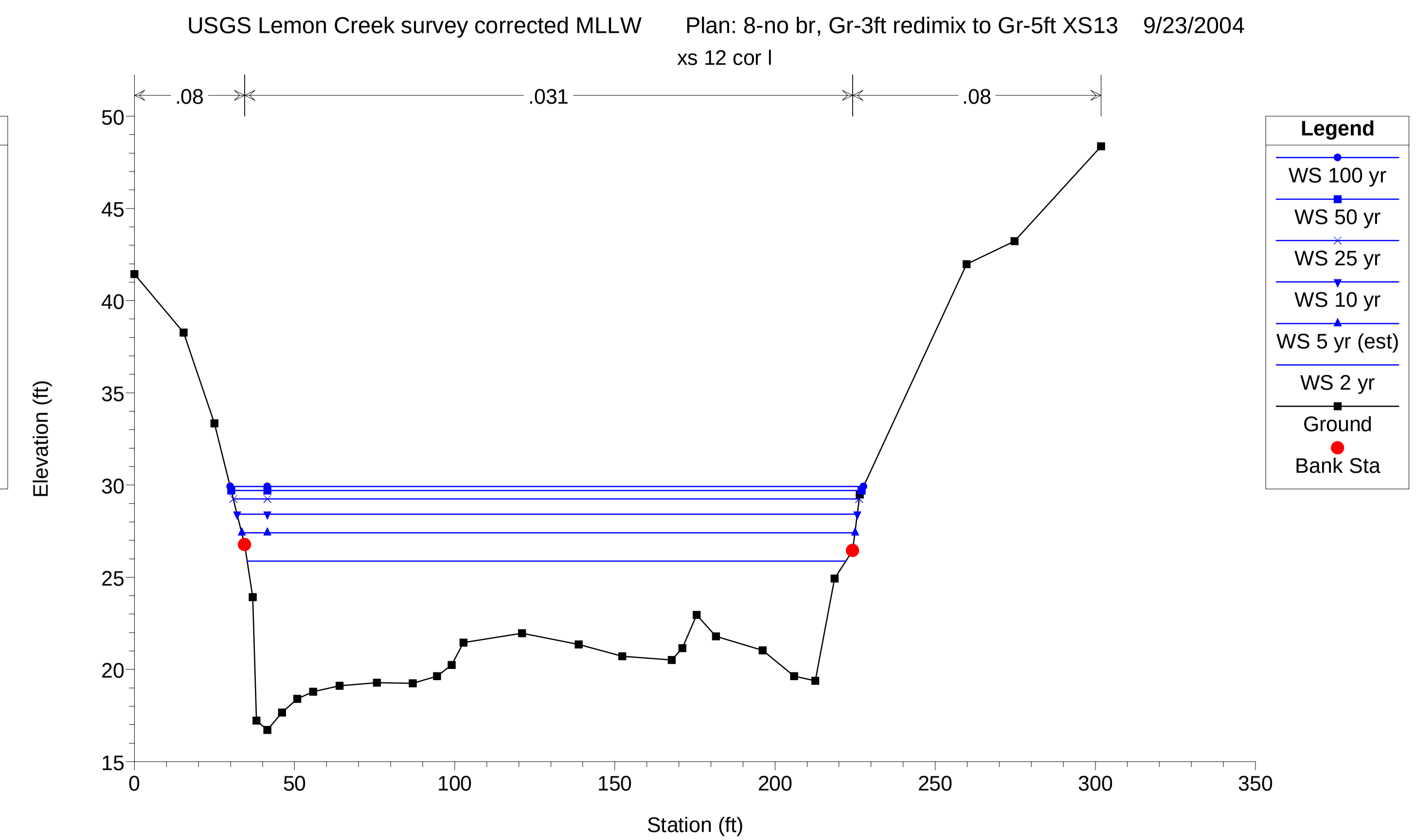
Elevation (ft)
Station (ft)
Legend
WS 100 yr
WS 50 yr
WS 25 yr
WS 10 yr
WS 5 yr (est)
WS 2 yr
Ground
Bank Sta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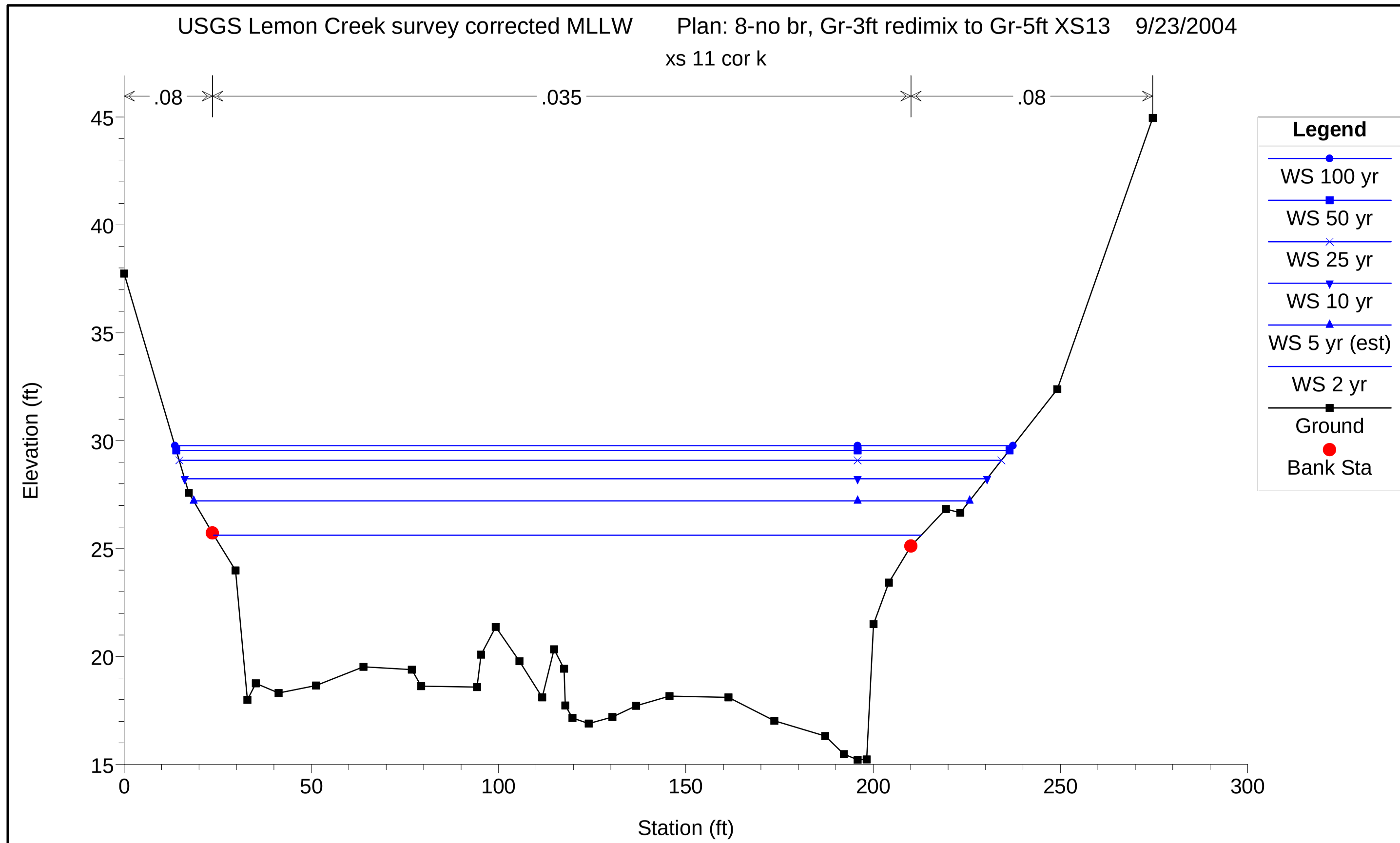
Elevation (ft)
Station (ft)
Legend
WS 100 yr
WS 50 yr
WS 25 yr
WS 10 yr
WS 5 yr (est)
WS 2 yr
Ground
Bank Sta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xs 11 cor k
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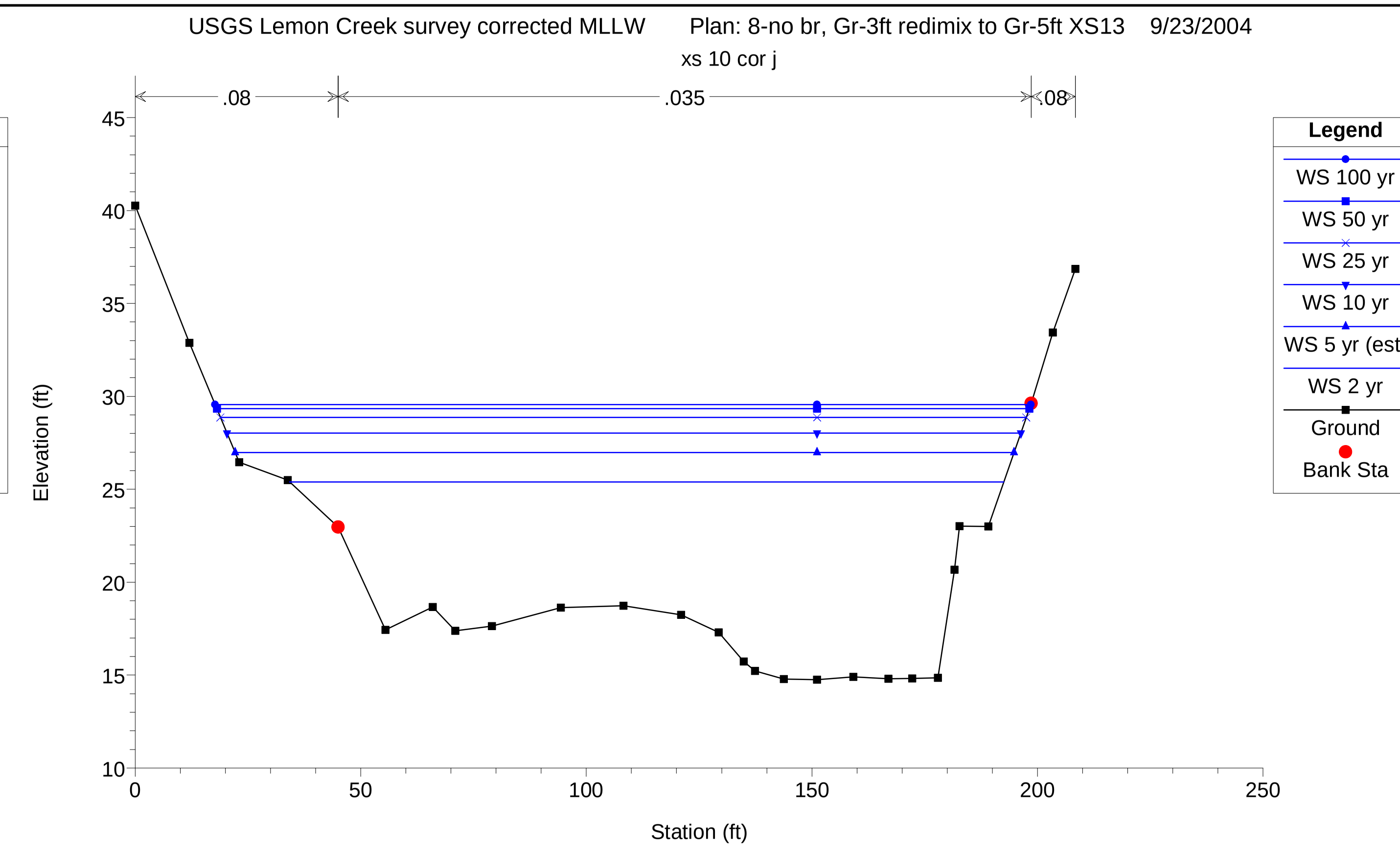
.035
.08
Elevation (ft)
Station (ft)
Legend
WS 100 yr
WS 50 yr
WS 25 yr
WS 10 yr
WS 5 yr (est)
WS 2 yr
Ground
Bank Sta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Elevation (ft)
Station (ft)
Legend
WS 100 yr
WS 50 yr
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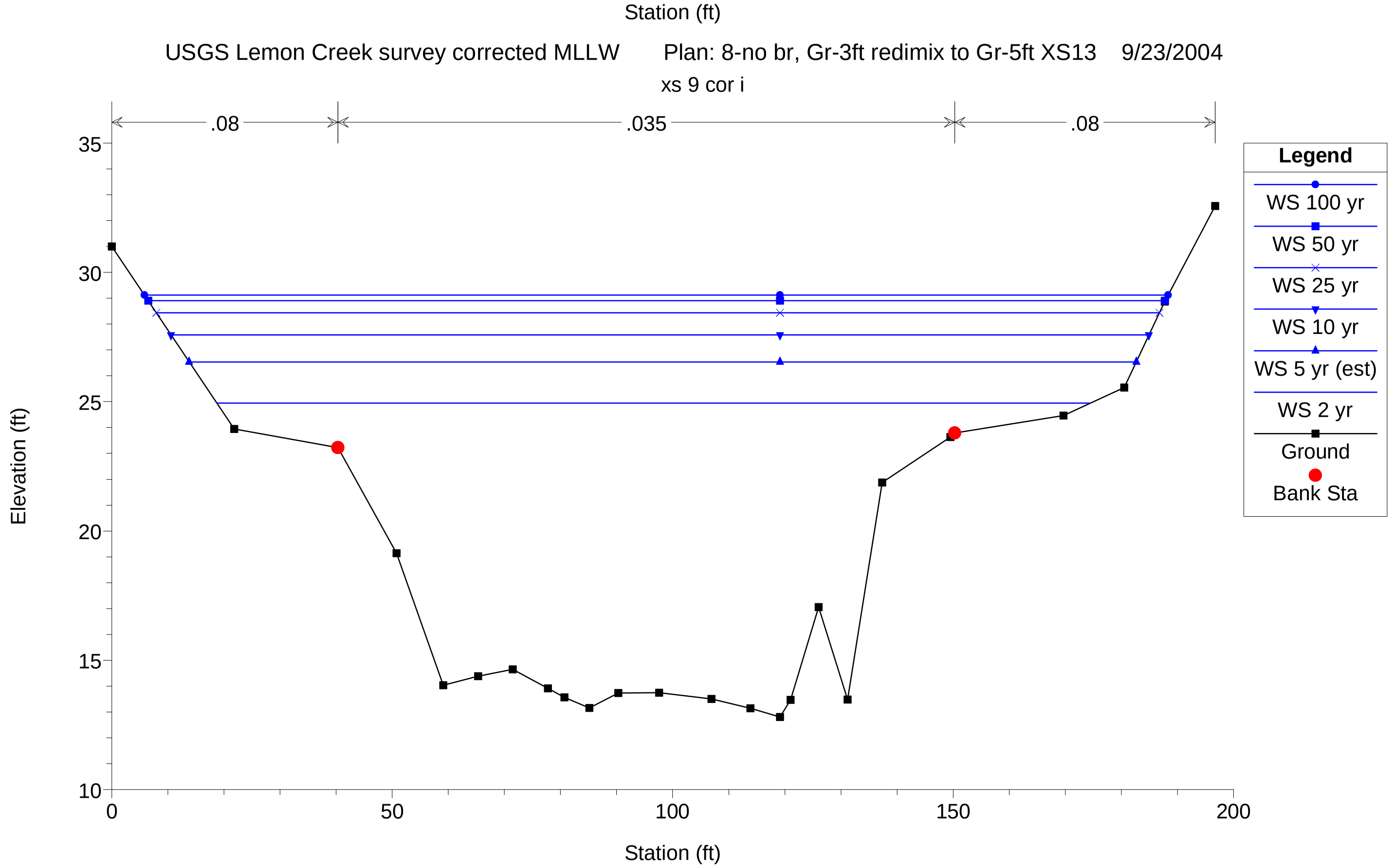
WS 10 yr
WS 5 yr (est)
WS 2 yr
Ground
Bank Sta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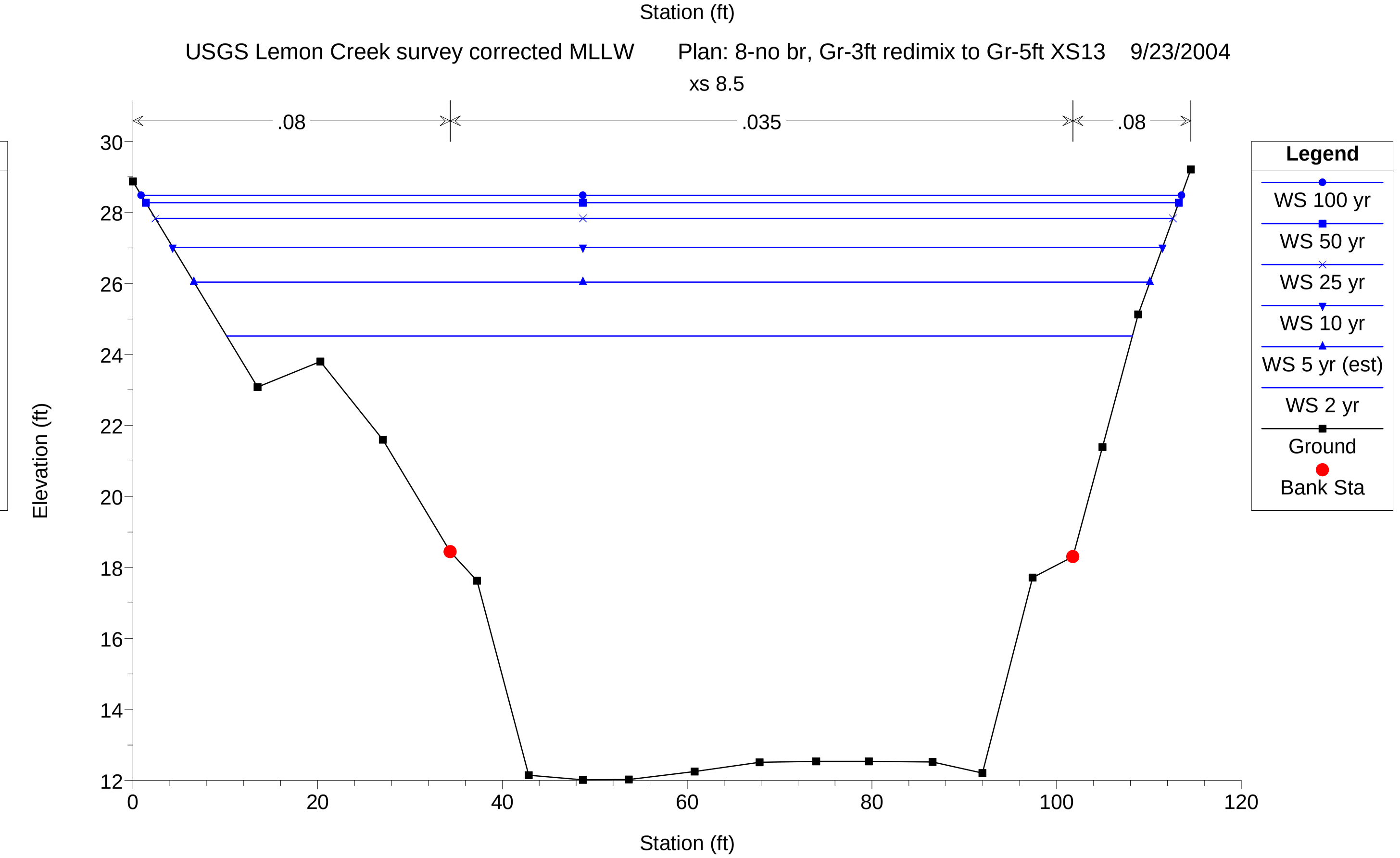
Elevation (ft)
Station (ft)
Legend
WS 100 yr
WS 50 yr
WS 25 yr
WS 10 yr
WS 5 yr (est)
WS 2 yr
Ground
Bank Sta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xs 8.5
.08
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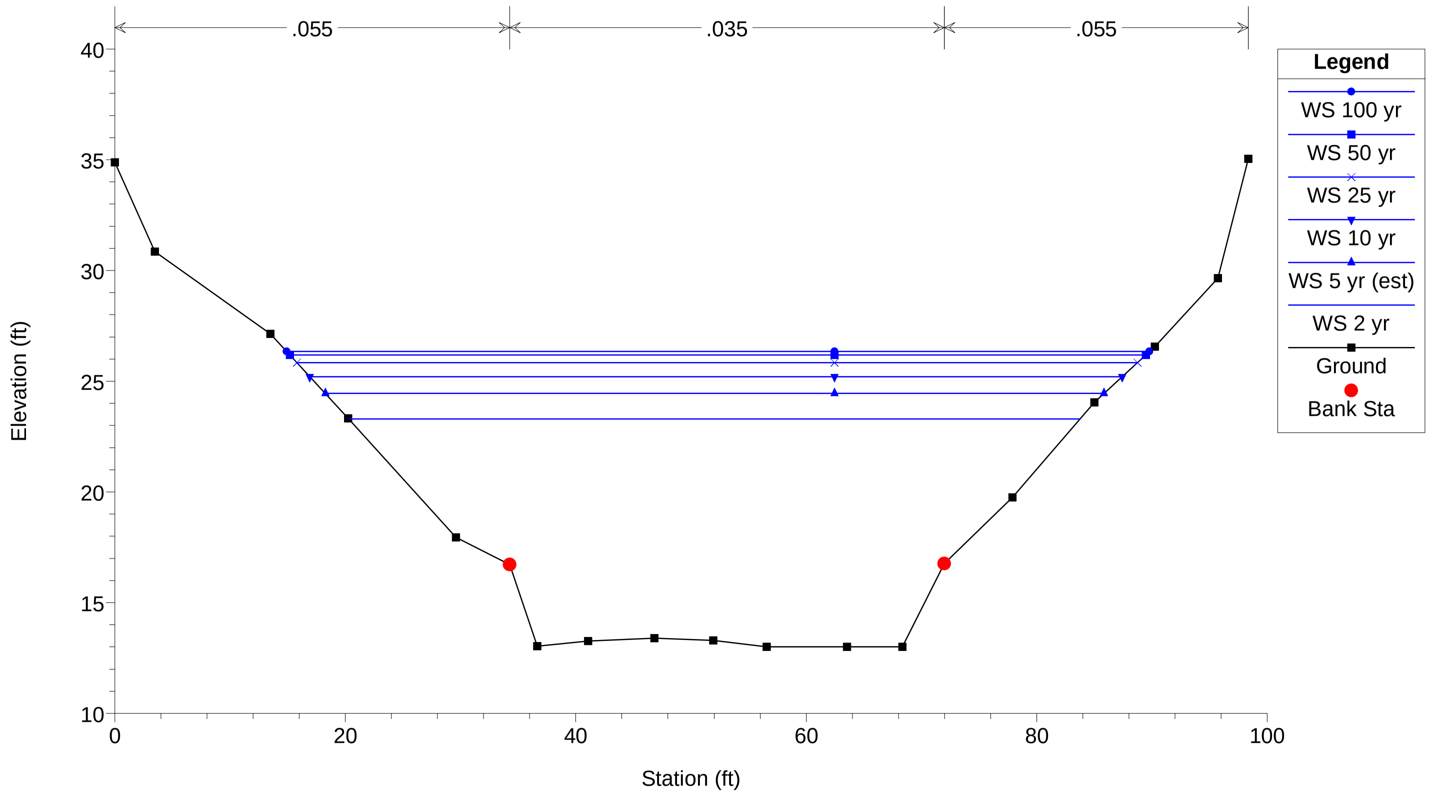
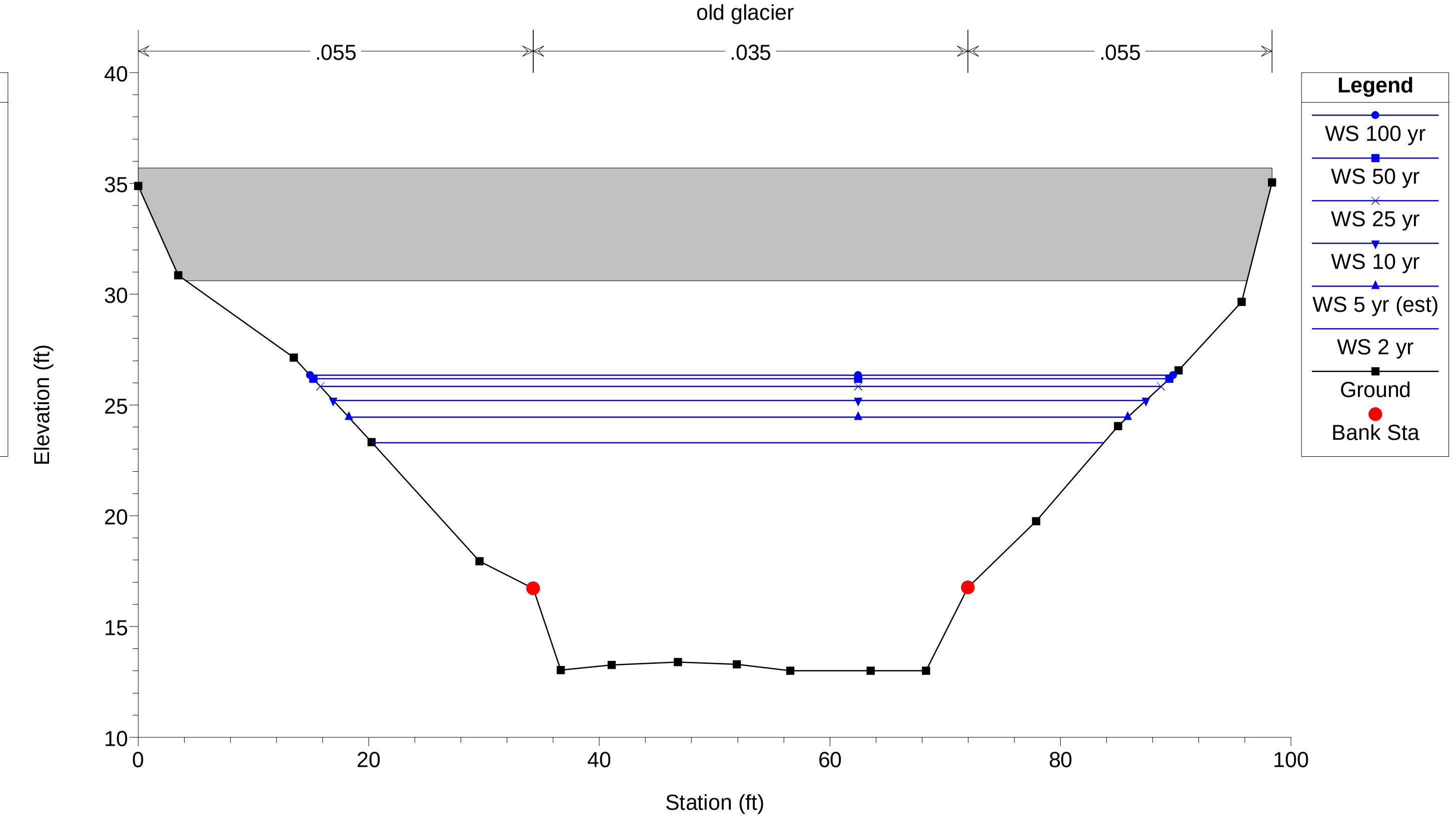
Elevation (ft)
Station (ft)
Legend
WS 100 yr
WS 50 yr
WS 25 yr
WS 10 yr
WS 5 yr (est)
WS 2 yr
Ground
Bank Sta

USGS Lemon Creek survey corrected MLLW   Plan: 8-no br, Gr-3ft redimix to Gr-5ft XS13   9/23/2004
xs 8 cor h



USGS Lemon Creek survey corrected MLLW   Plan: 8-no br, Gr-3ft redimix to Gr-5ft XS13   9/23/2004
old glacier



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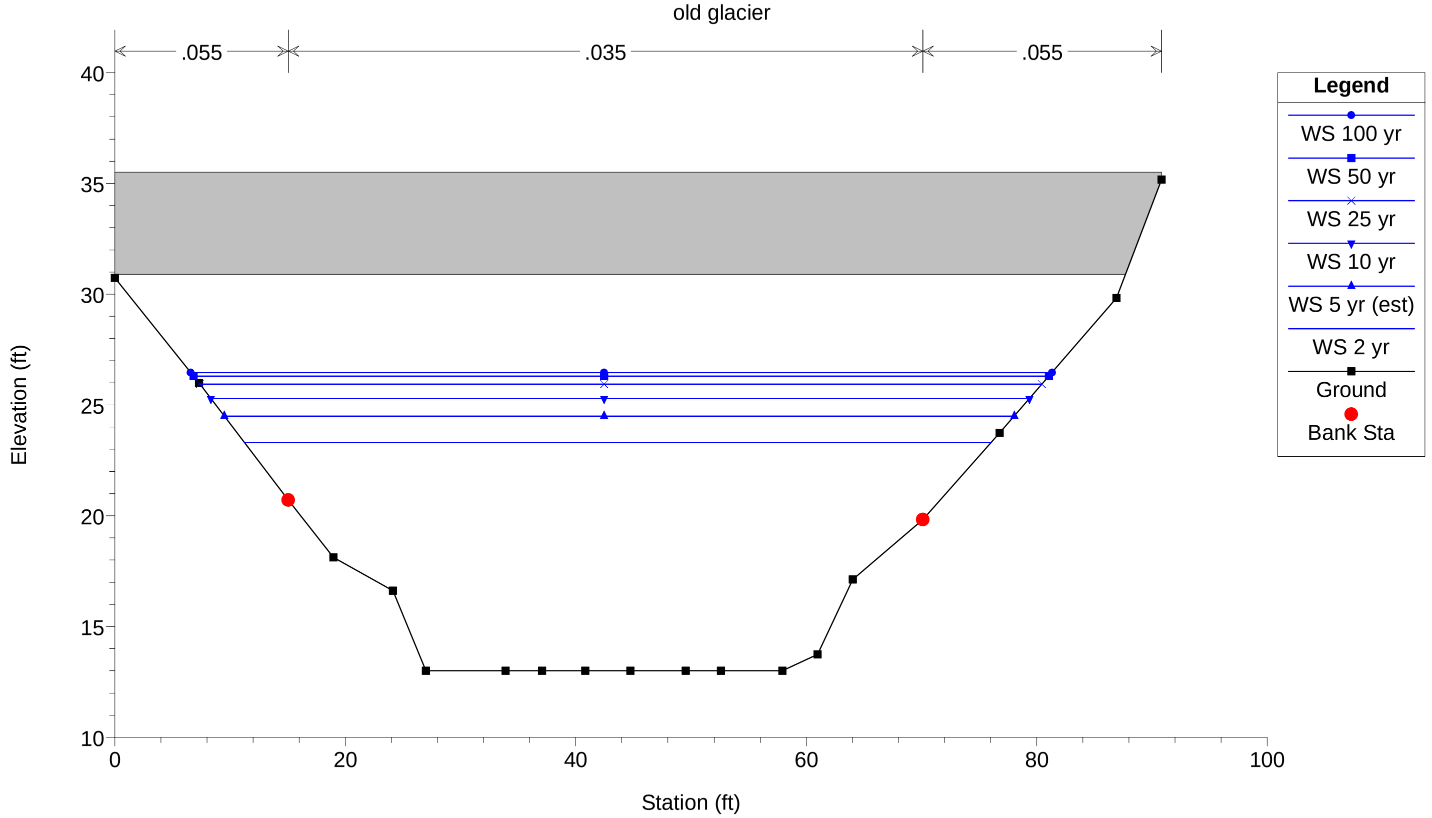
old glacier



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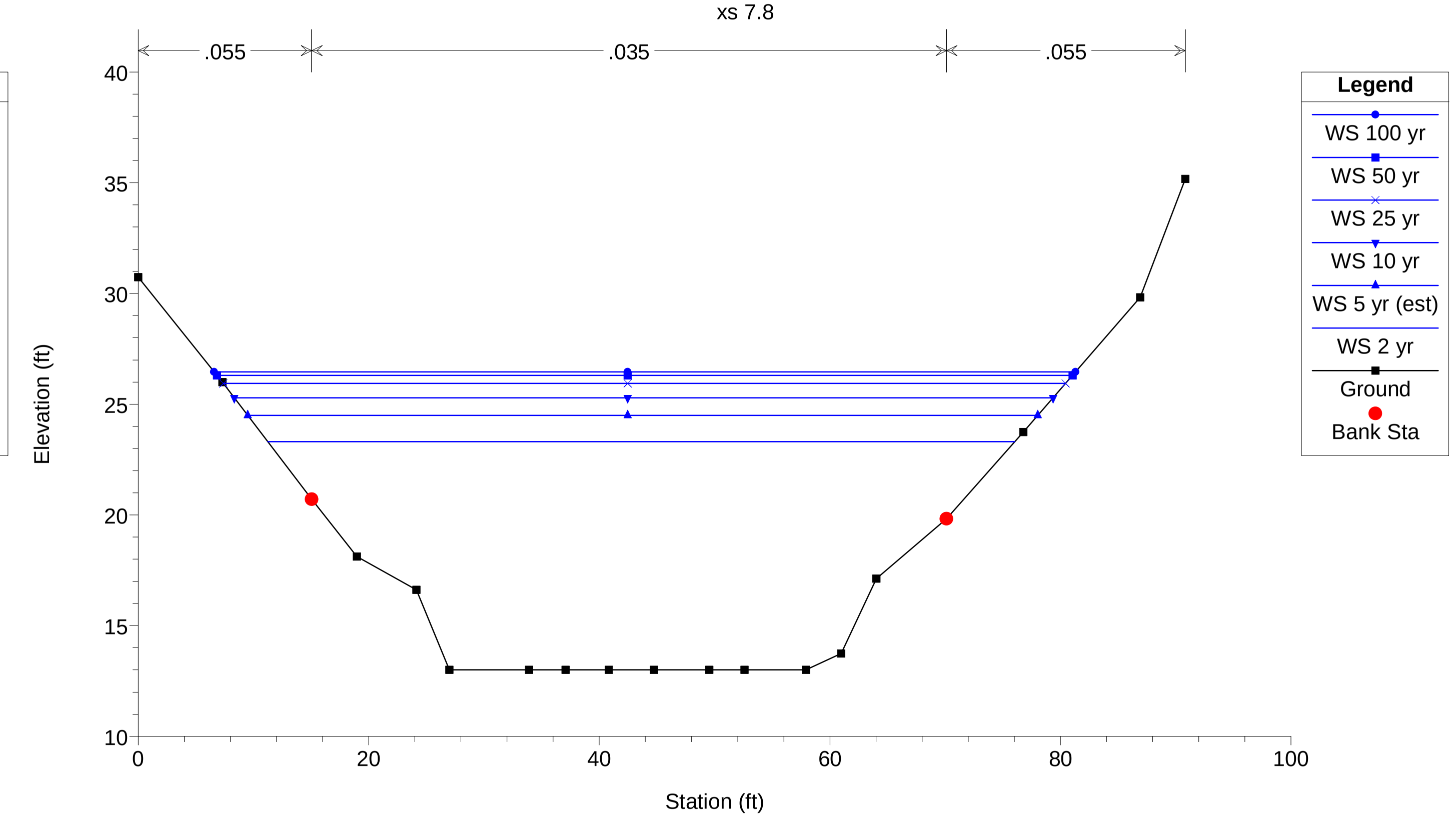

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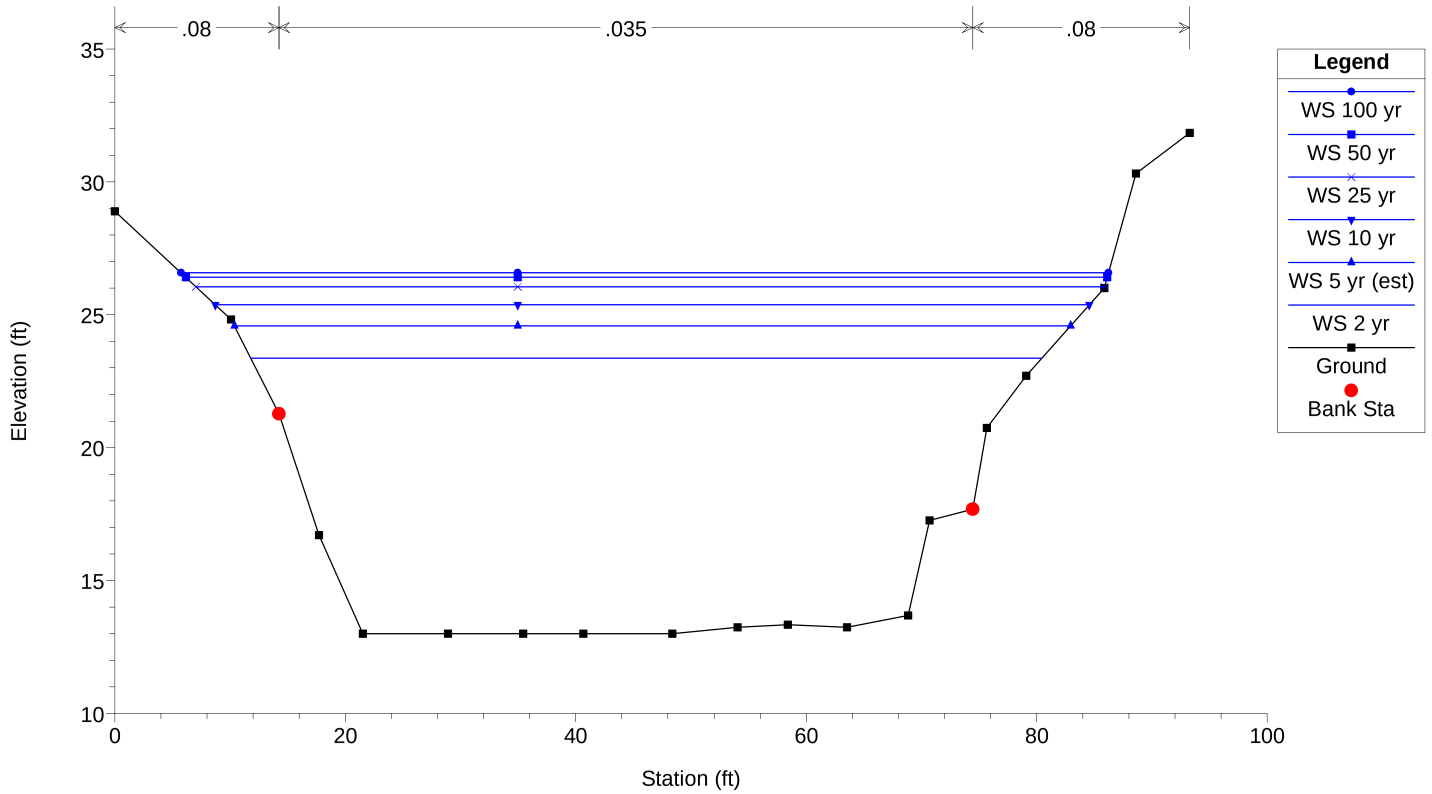
xs 7.5



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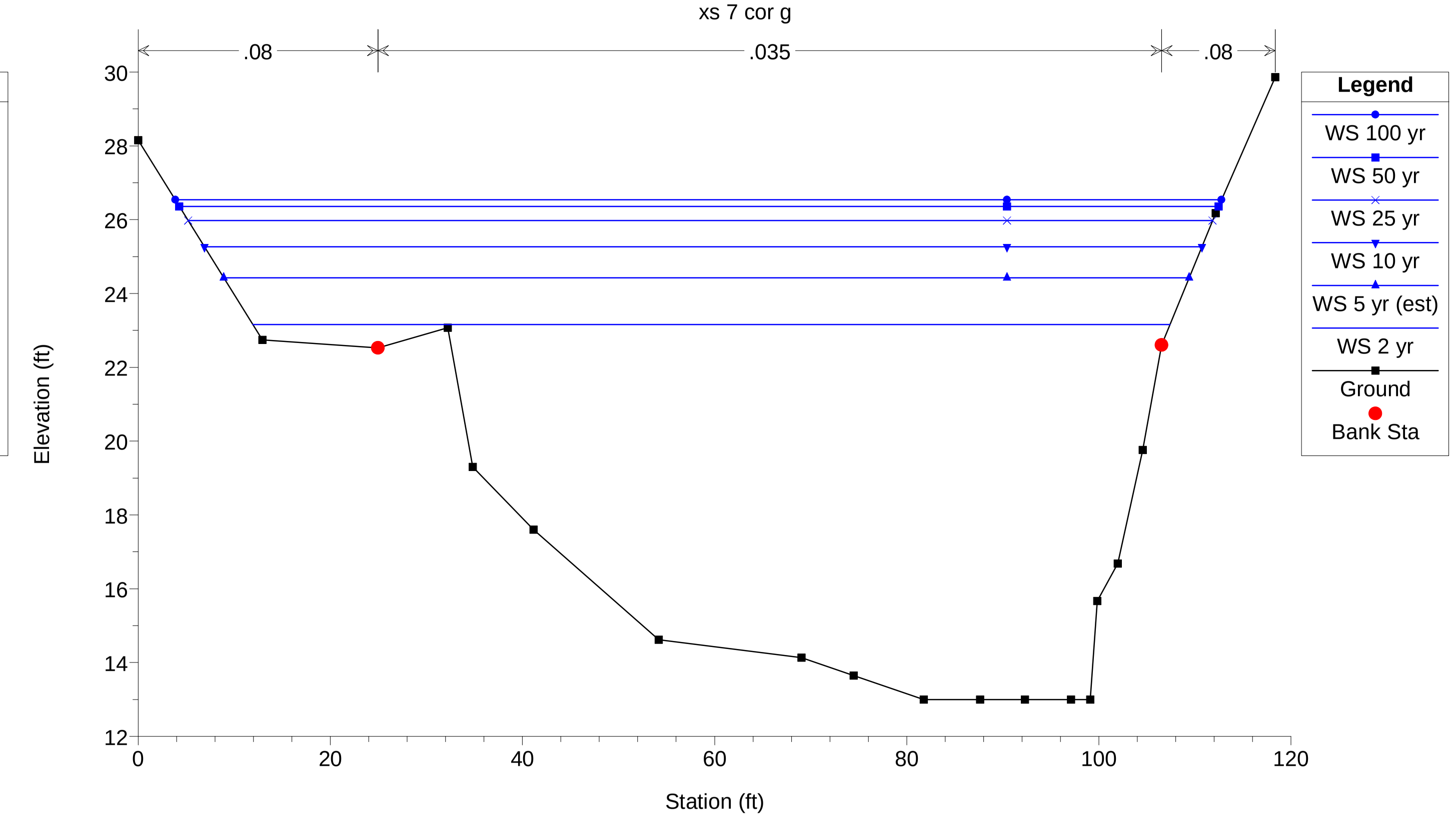
xs 7 cor g



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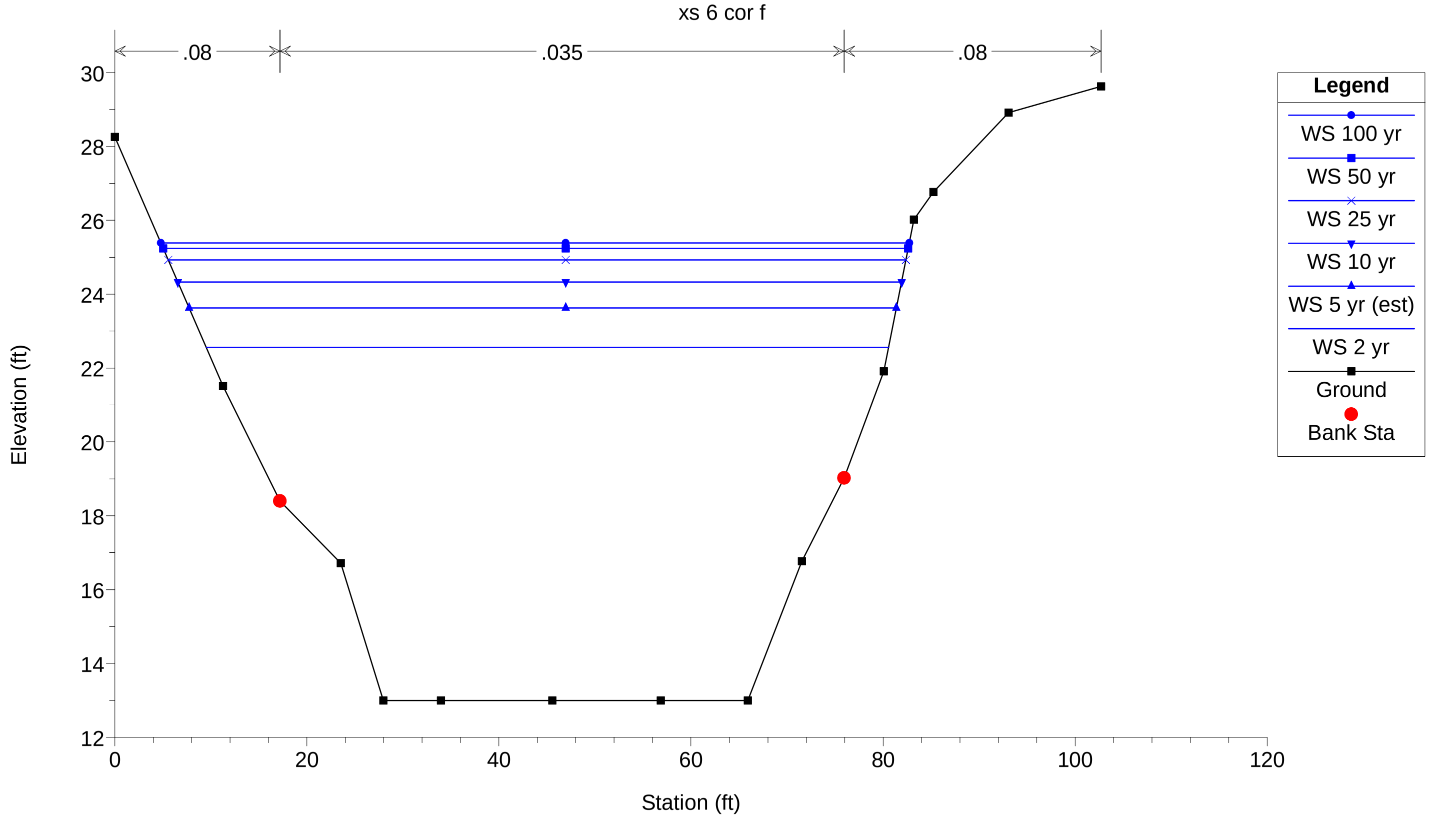
xs 6 cor f



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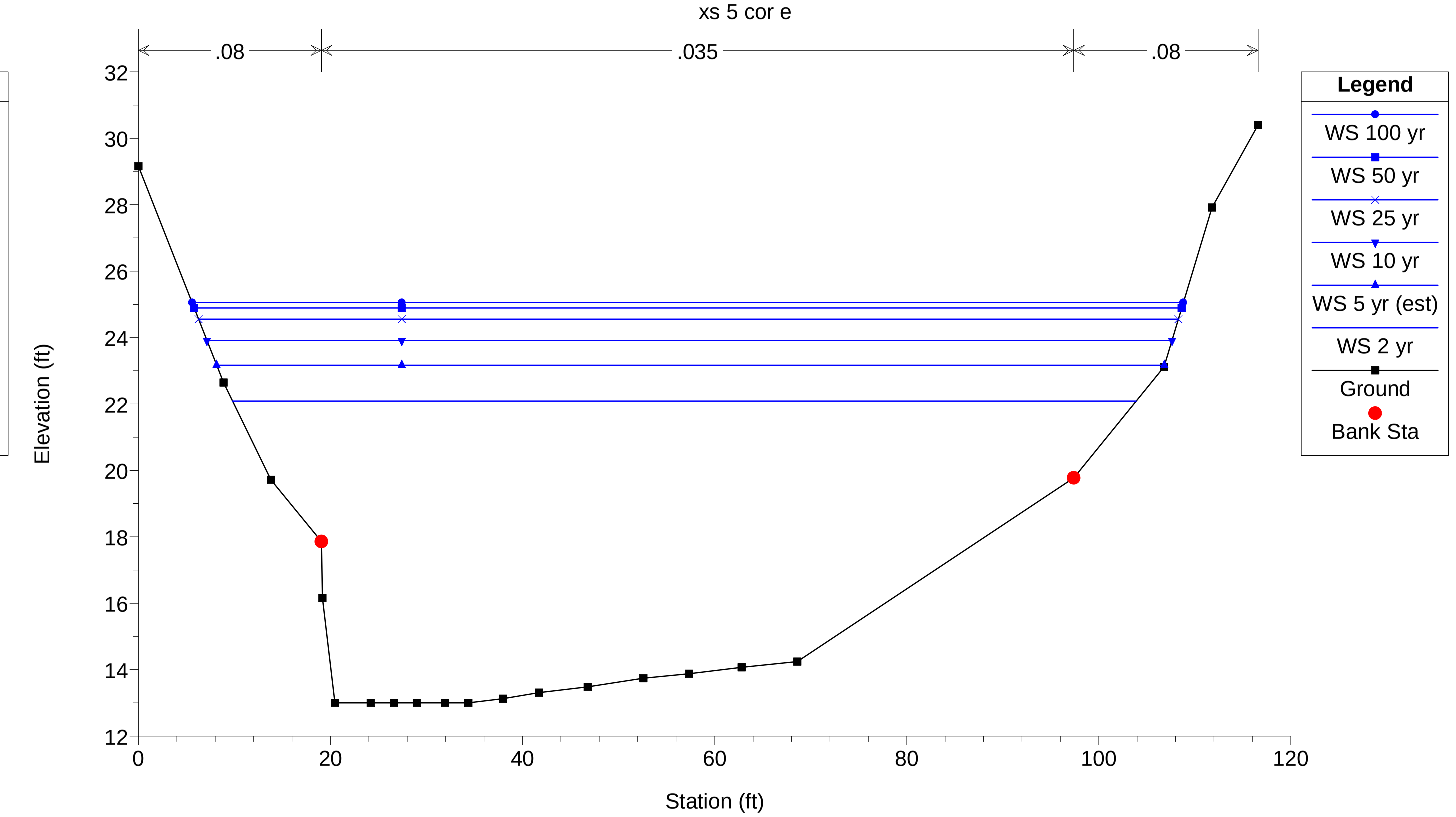
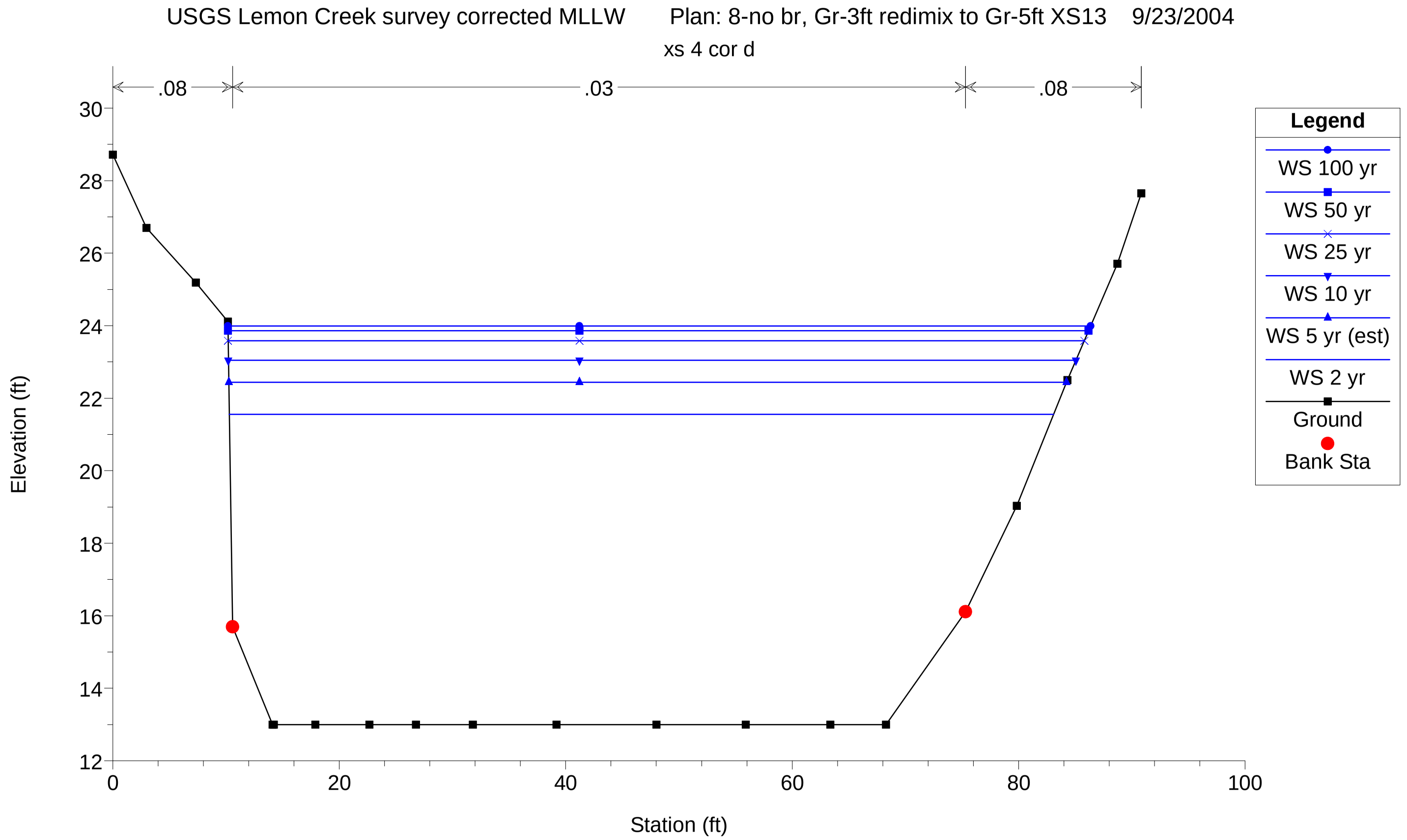
xs 5 cor e

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xs 4 cor d
.08
.03
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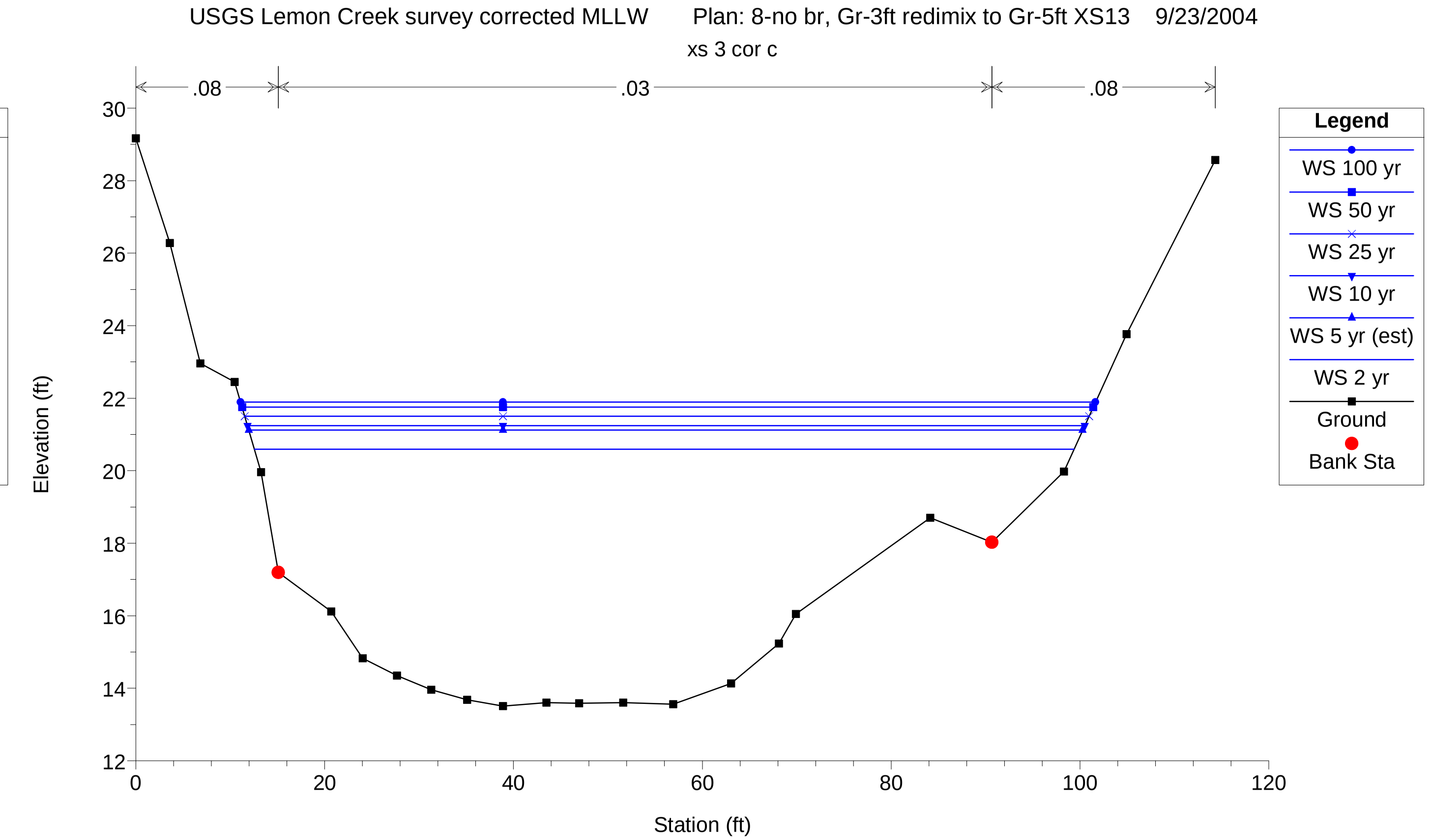
Elevation (ft)
Station (ft)
Legend
WS 100 yr
WS 50 yr
WS 25 yr
WS 10 yr
WS 5 yr (est)
WS 2 yr
Ground
Bank Sta


USGS Lemon Creek survey corrected MLLW Plan: 8-no br, Gr-3ft redimix to Gr-5ft XS13 9/23/2004
xs 3 cor c
.08
.03
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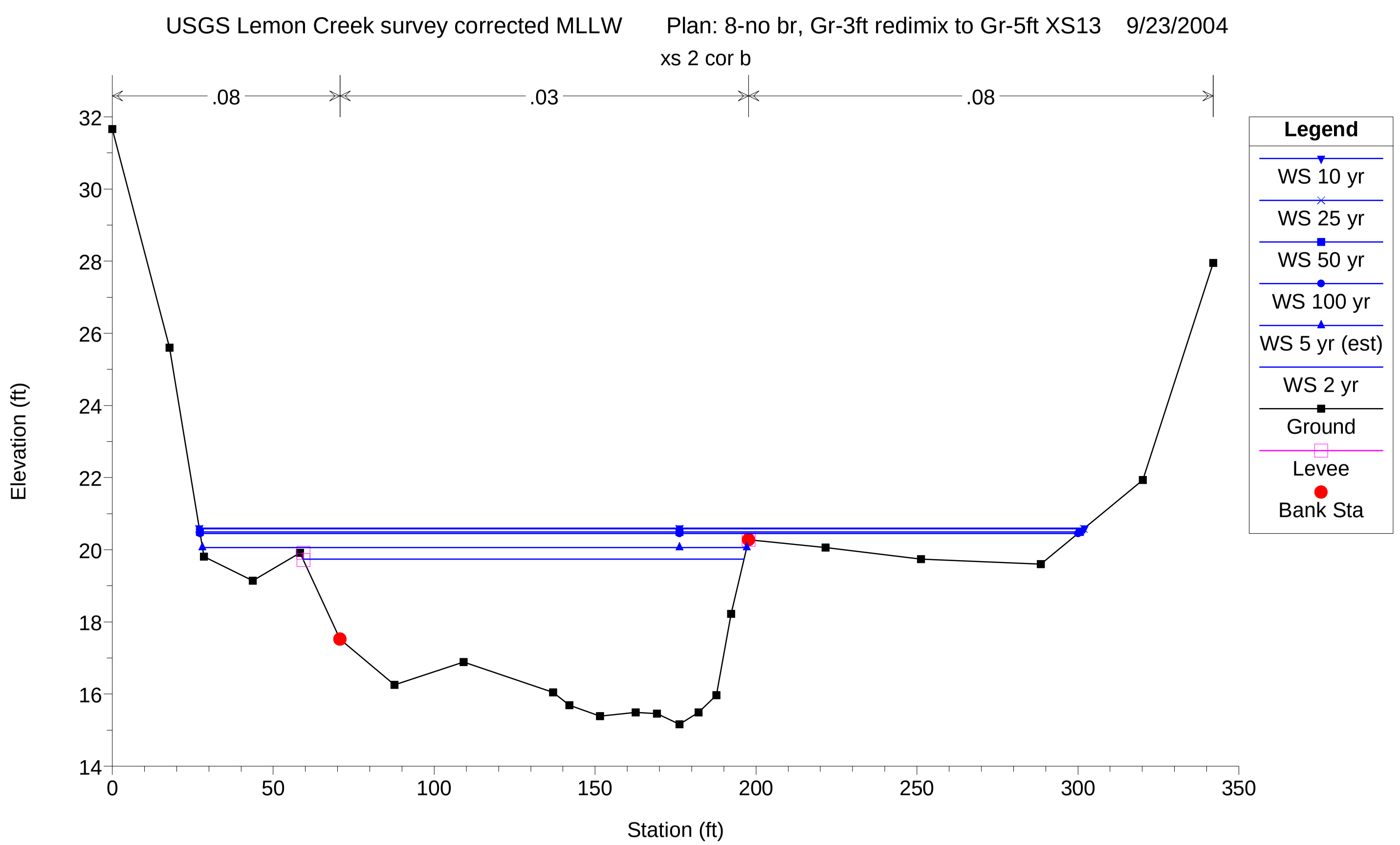
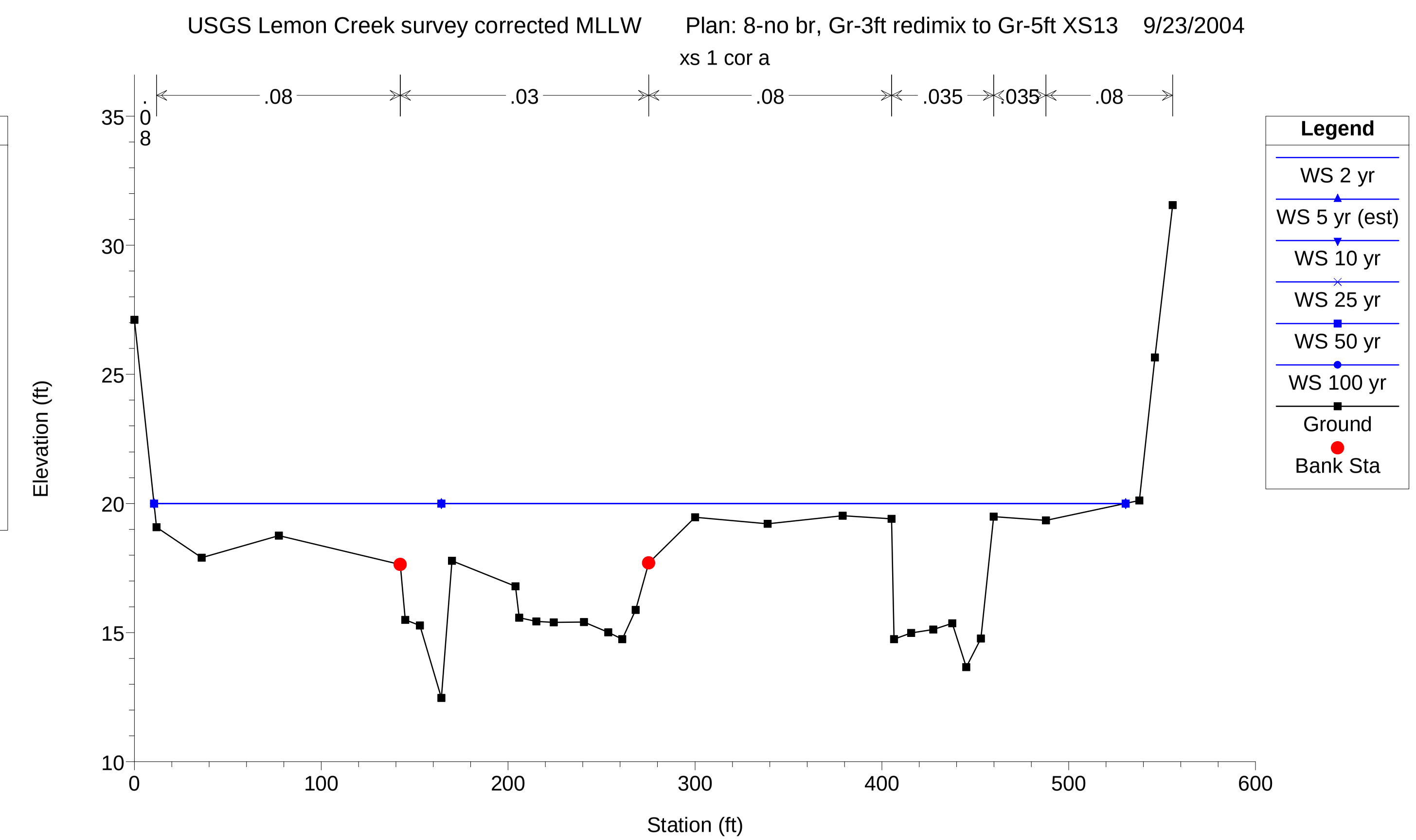
Elevation (ft)
Station (ft)
Legend
WS 100 yr
WS 50 yr
WS 25 yr
WS 10 yr
WS 5 yr (est)
WS 2 yr
Ground
Bank Sta


USGS Lemon Creek survey corrected MLLW Plan: 8-no br, Gr-3ft redimix to Gr-5ft XS13 9/23/2004
xs 2 cor b
.08
.03
.08
Elevation (ft)
Station (ft)
Legend
WS 10 yr
WS 25 yr
WS 50 yr
WS 100 yr
WS 5 yr (est)
WS 2 yr
Ground
Levee
Bank Sta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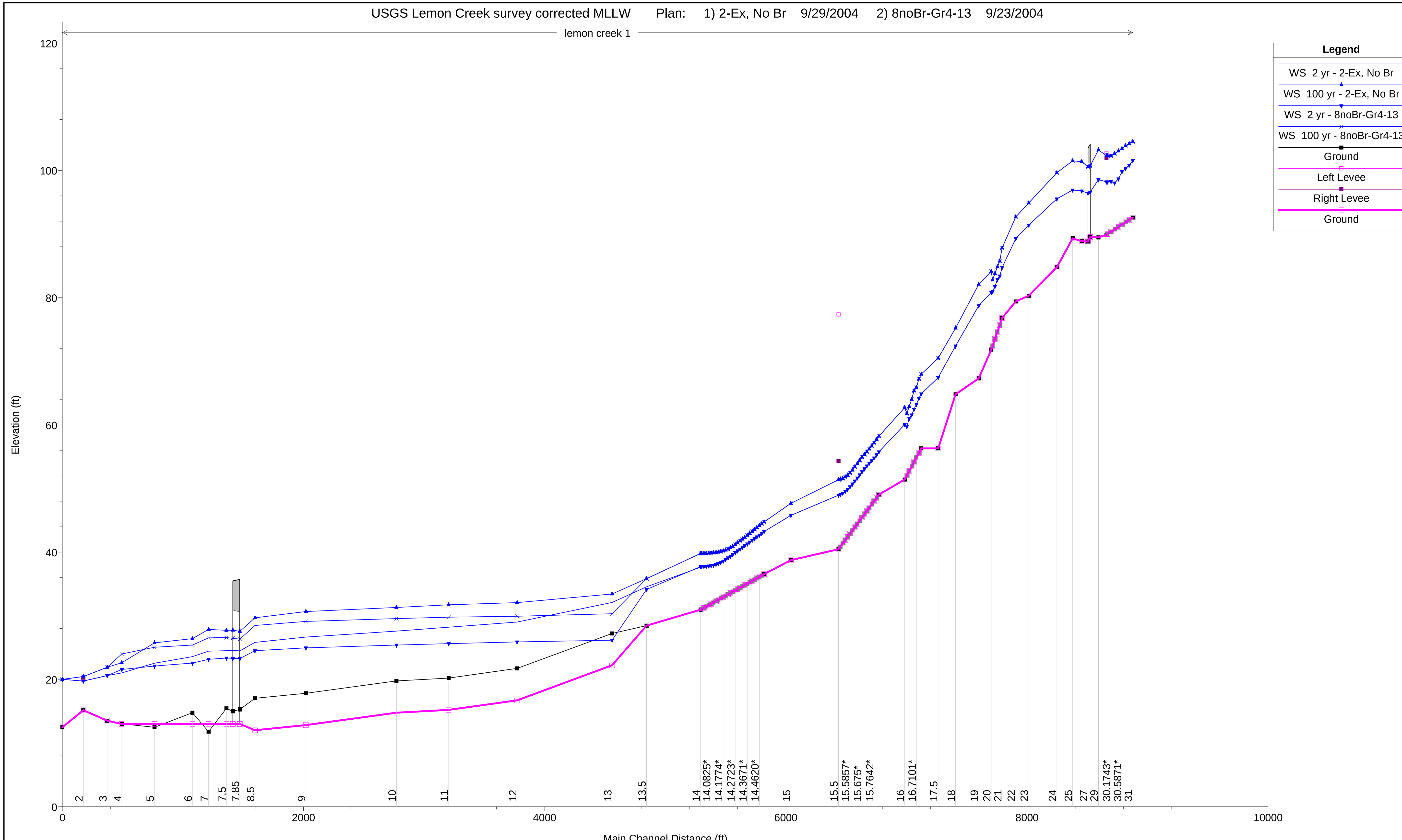
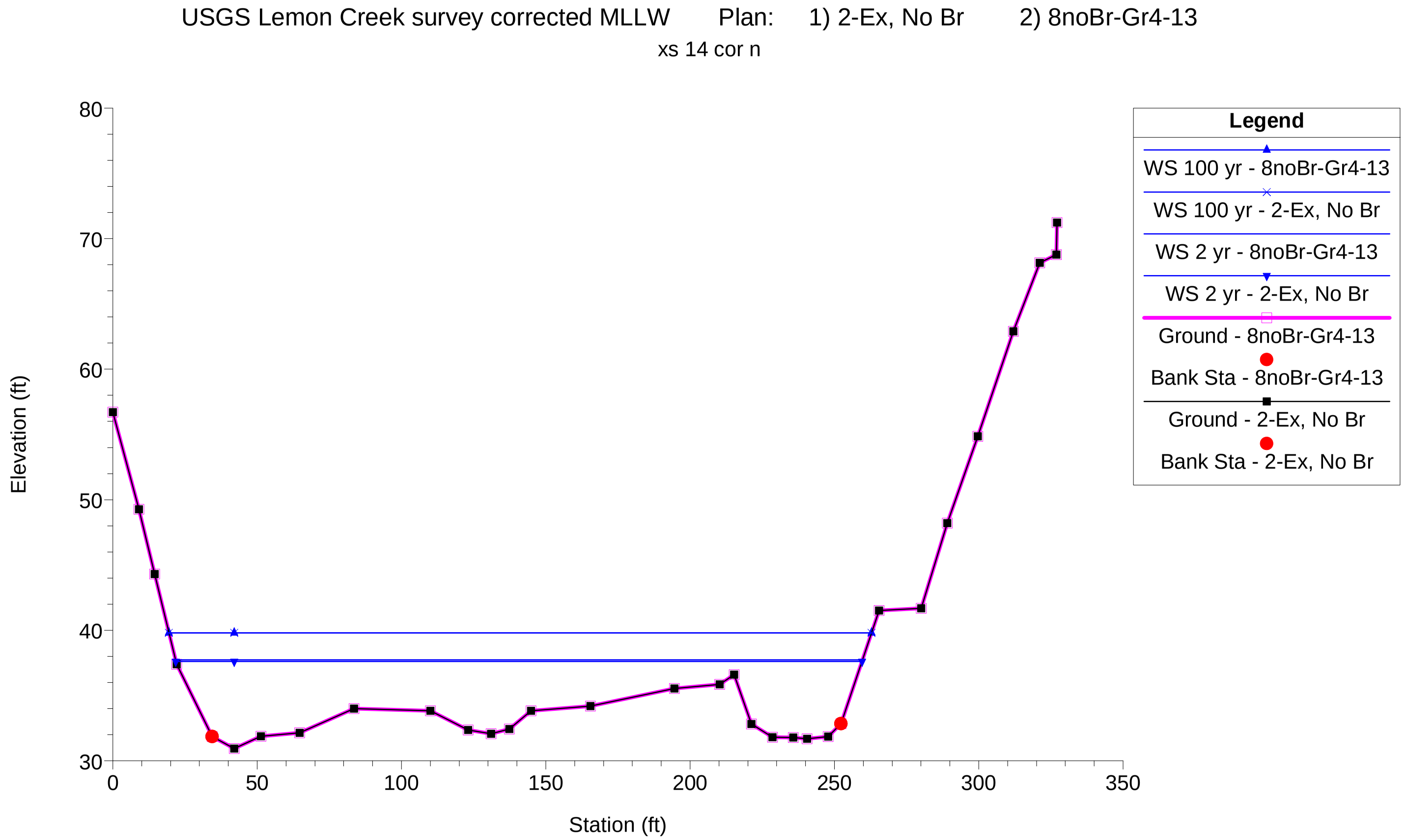
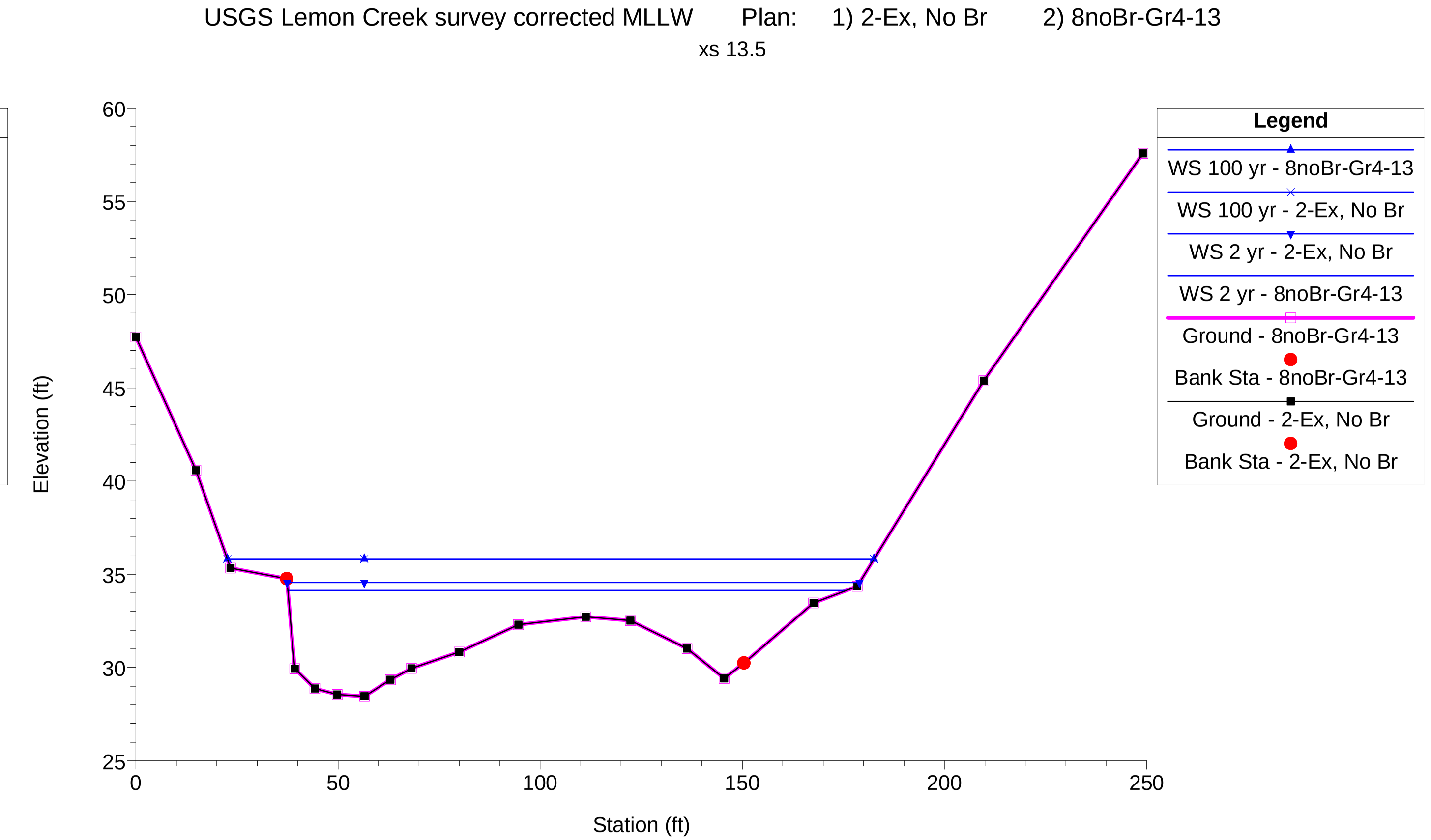
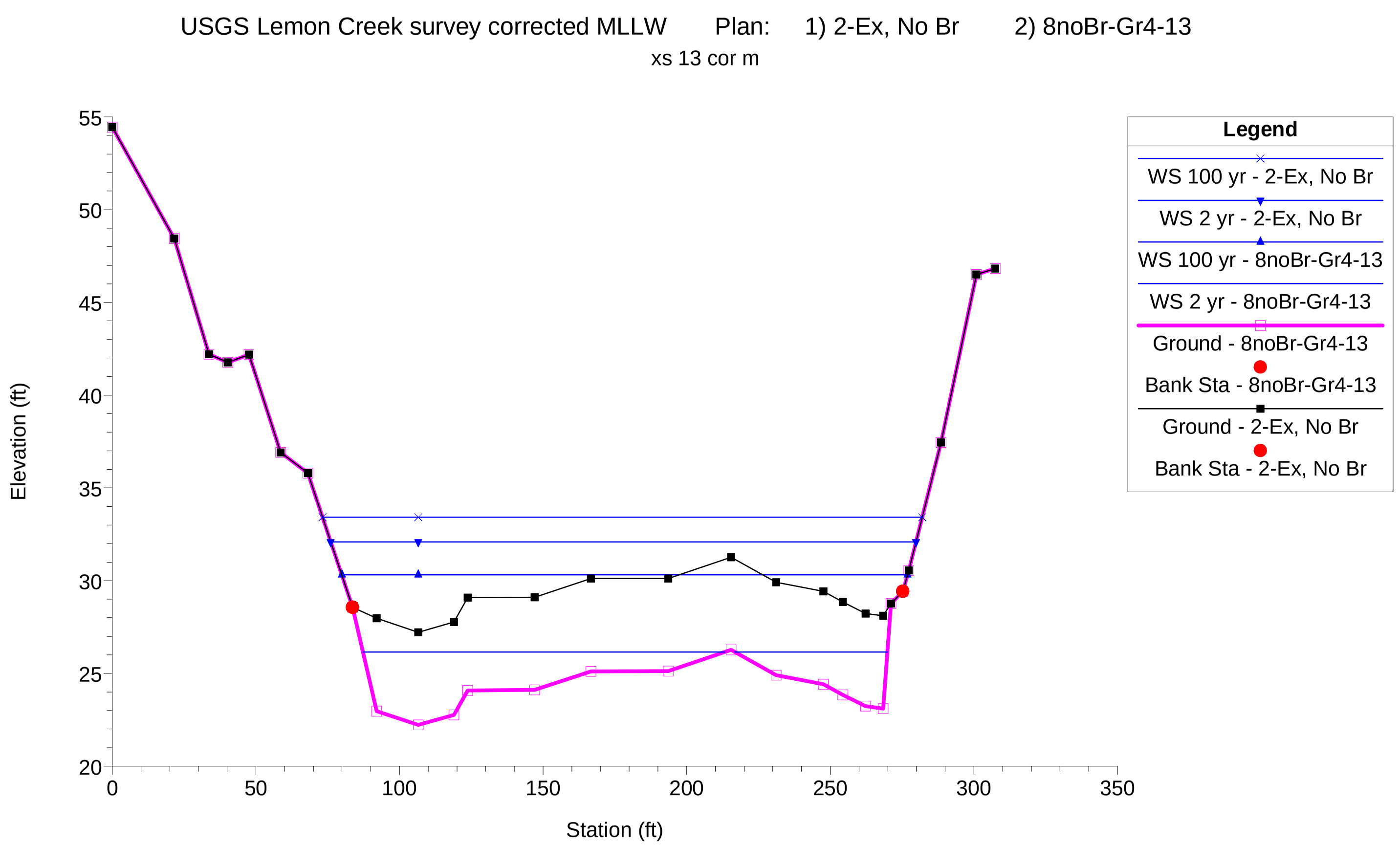
xs 1 cor a
.08
.08
.03
.08
.035
.035
.08
Elevation (ft)
Station (ft)
Legend
WS 2 yr
WS 5 yr (est)
WS 10 yr
WS 25 yr
WS 50 yr
WS 100 yr
Ground
Bank Sta



USGS Lemon Creek survey corrected MLLW Plan: 1) 2-Ex, No Br 9/29/2004 2) 8noBr-Gr4-13 9/23/2004
lemon creek 1
Legend
WS 2 yr - 2-Ex, No Br
WS 100 yr - 2-Ex, No Br
WS 2 yr - 8noBr-Gr4-13
WS 100 yr - 8noBr-Gr4-13
Ground
Left Levee
Right Levee
Ground
Elevation (ft)
Main Channel Distance (ft)
0
20
40
60
80
100
120
0
2000
4000
6000
8000
10000
2 3 4 5 6 7 7.5 7.85 8.5 9 10 11 12 13 13.5 14 14.0825* 14.1774* 14.2723* 14.3671* 14.4620* 15 15.5 15.5857* 15.675* 15.7642* 16 16.7101* 17.5 18 19 20 21 22 23 24 25 27 29 30.1743* 30.5871* 31


USGS Lemon Creek survey corrected MLLW Plan: 1) 2-Ex, No Br 2) 8noBr-Gr4-13
xs 14 cor n
Elevation (ft)
Station (ft)
Legend
WS 100 yr - 8noBr-Gr4-13
WS 100 yr - 2-Ex, No Br
WS 2 yr - 8noBr-Gr4-13
WS 2 yr - 2-Ex, No Br
Ground - 8noBr-Gr4-13
Bank Sta - 8noBr-Gr4-13
Ground - 2-Ex, No Br
Bank Sta - 2-Ex, No Br


USGS Lemon Creek survey corrected MLLW Plan: 1) 2-Ex, No Br 2) 8noBr-Gr4-13
xs 13.5
Elevation (ft)
Station (ft)
Legend
WS 100 yr - 8noBr-Gr4-13
WS 100 yr - 2-Ex, No Br
WS 2 yr - 2-Ex, No Br
WS 2 yr - 8noBr-Gr4-13
Ground - 8noBr-Gr4-13
Bank Sta - 8noBr-Gr4-13
Ground - 2-Ex, No Br
Bank Sta - 2-Ex, No Br


USGS Lemon Creek survey corrected MLLW Plan: 1) 2-Ex, No Br 2) 8noBr-Gr4-13
xs 13 cor m
Elevation (ft)
Station (ft)
Legend
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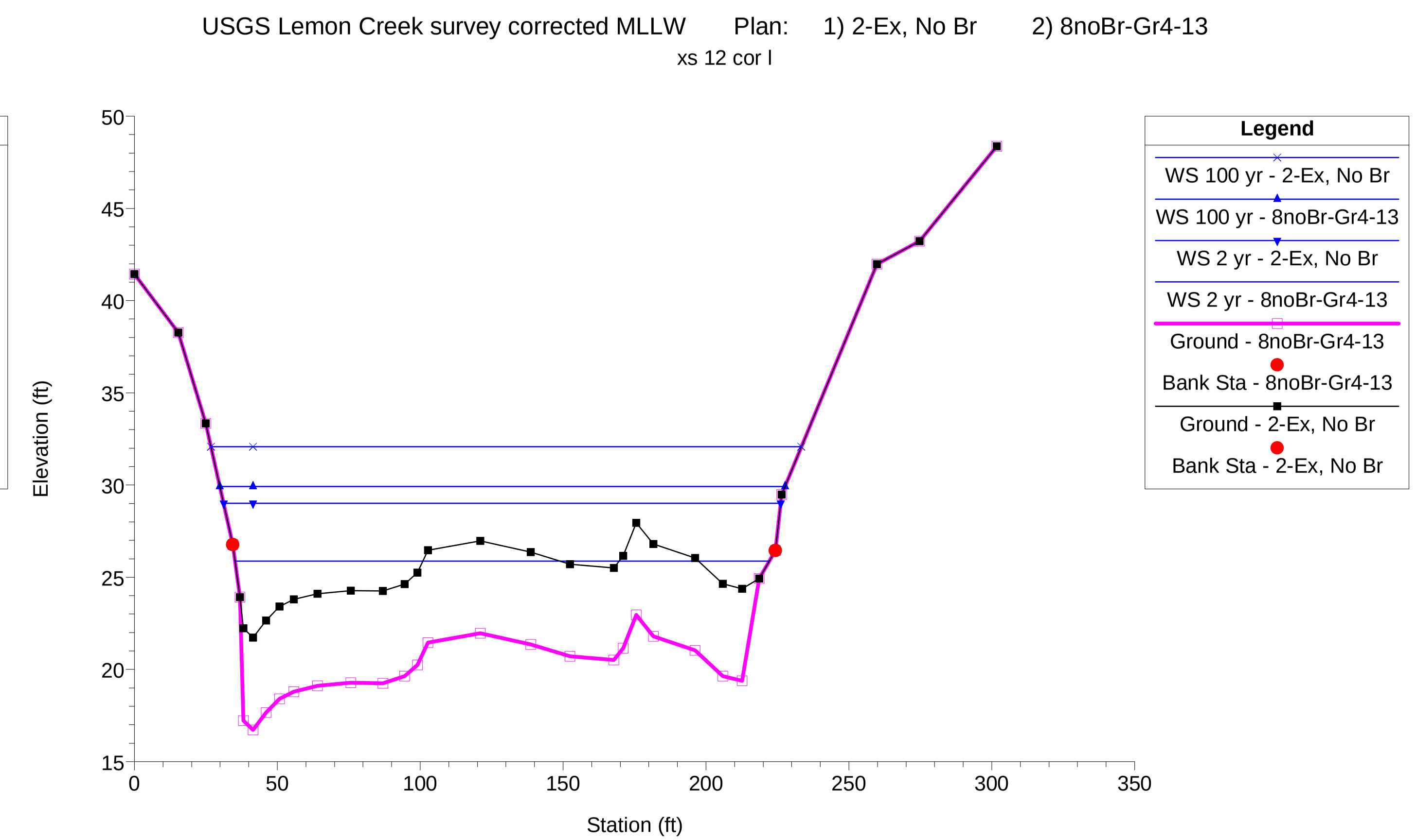
WS 2 yr - 2-Ex, No Br
WS 100 yr - 8noBr-Gr4-13
WS 2 yr - 8noBr-Gr4-13
Ground - 8noBr-Gr4-13
Bank Sta - 8noBr-Gr4-13
Ground - 2-Ex, No Br
Bank Sta - 2-Ex, No Br


USGS Lemon Creek survey corrected MLLW Plan: 1) 2-Ex, No Br 2) 8noBr-Gr4-13
xs 12 cor l
Elevation (ft)
Station (ft)
Legend
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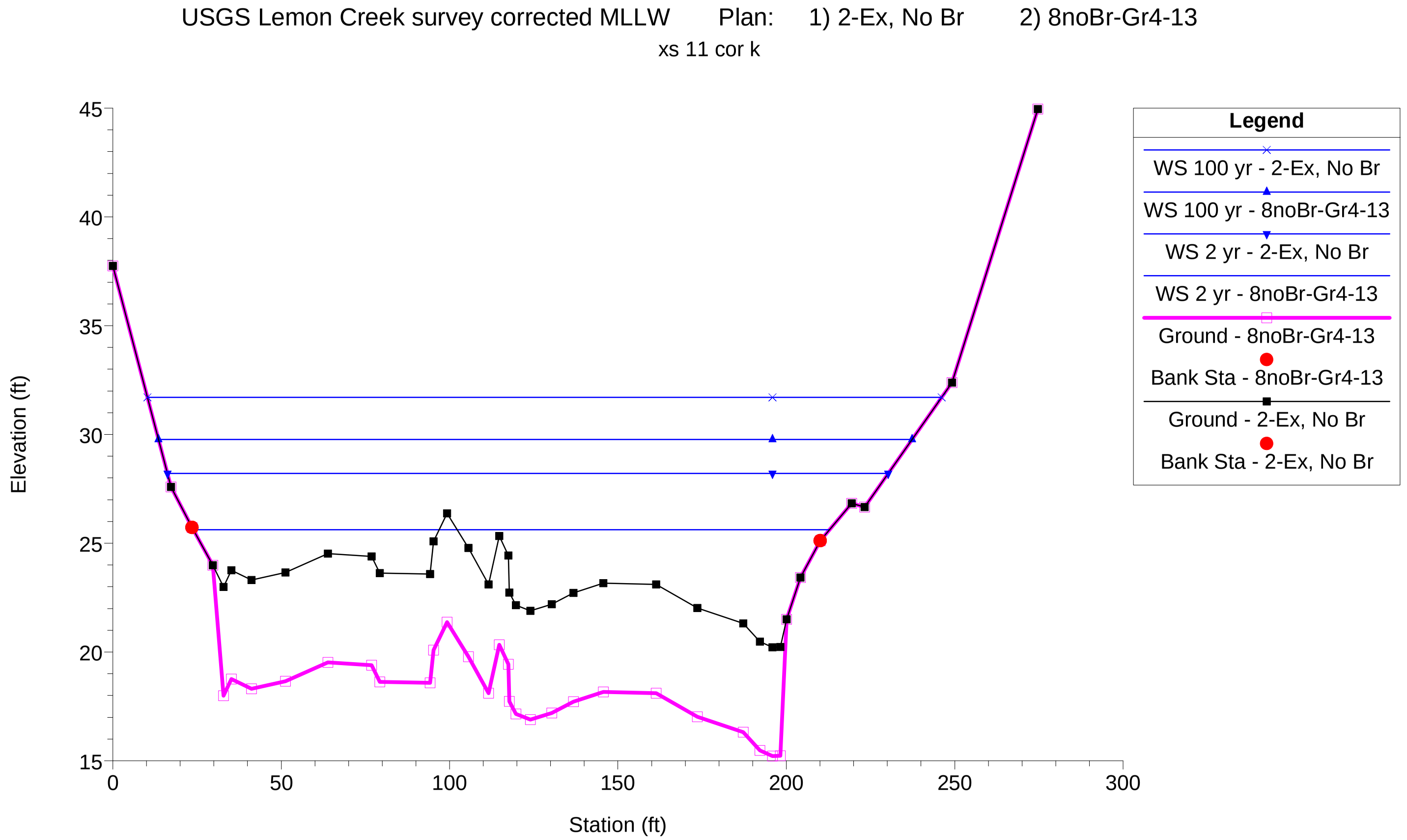
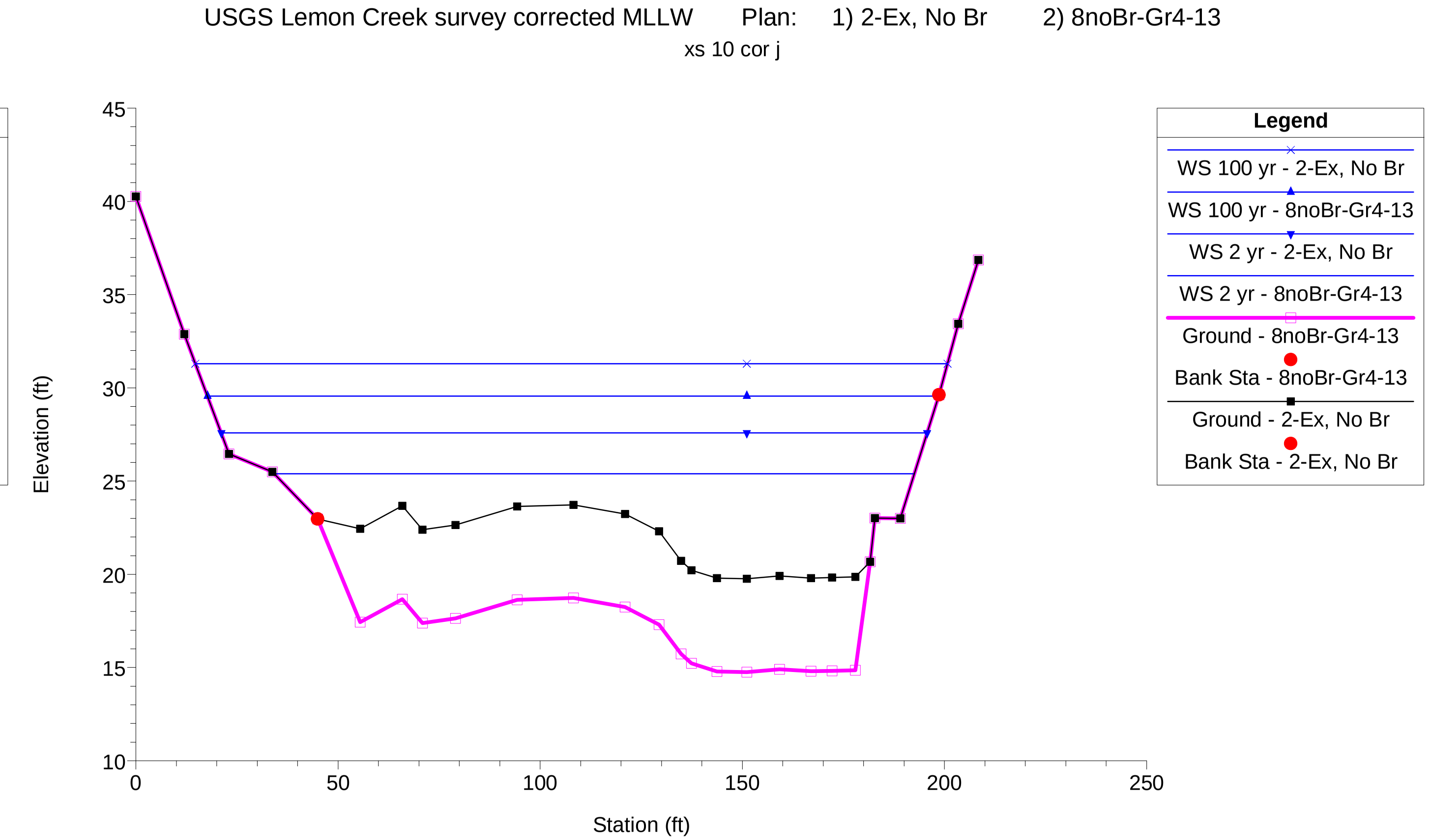
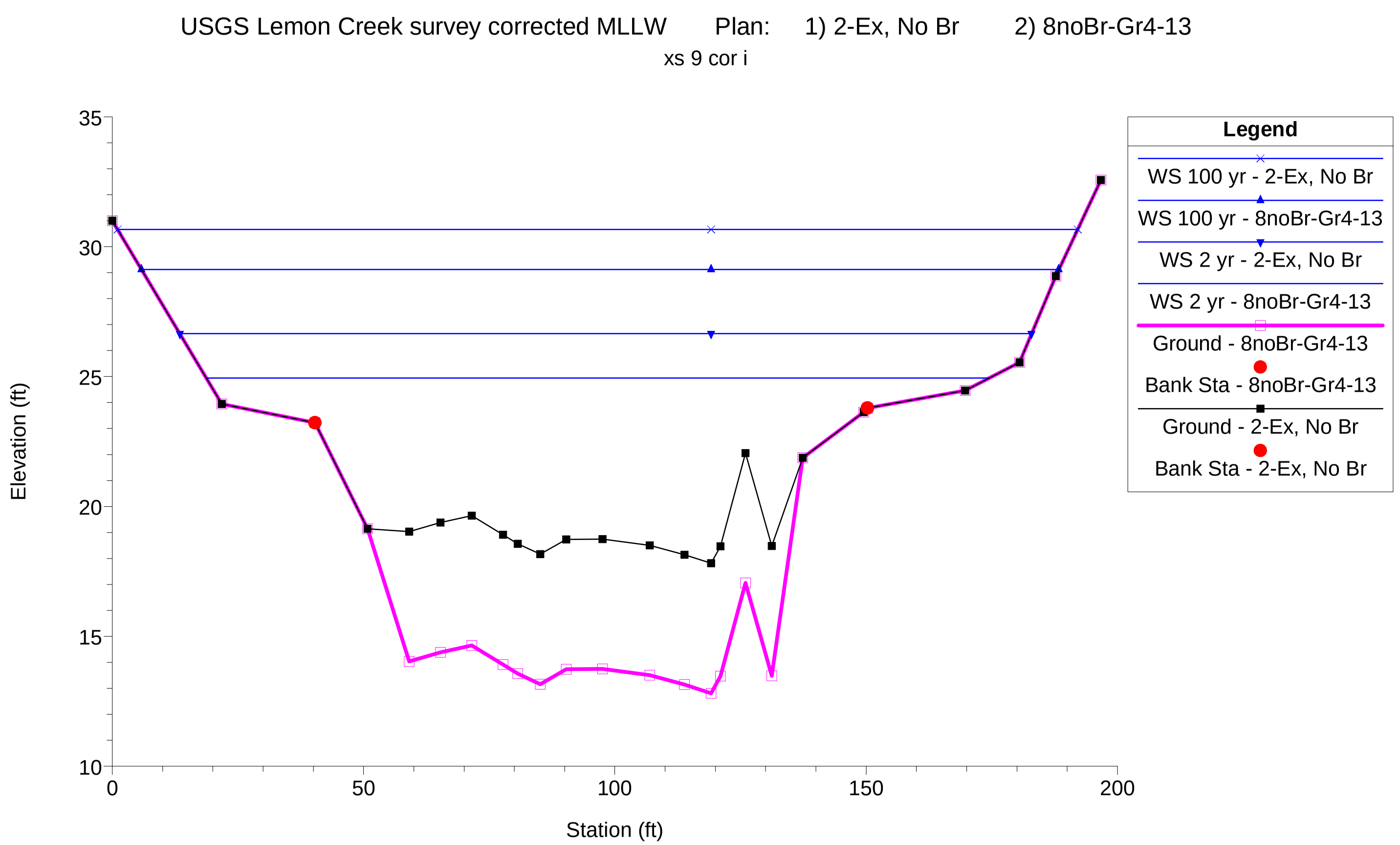
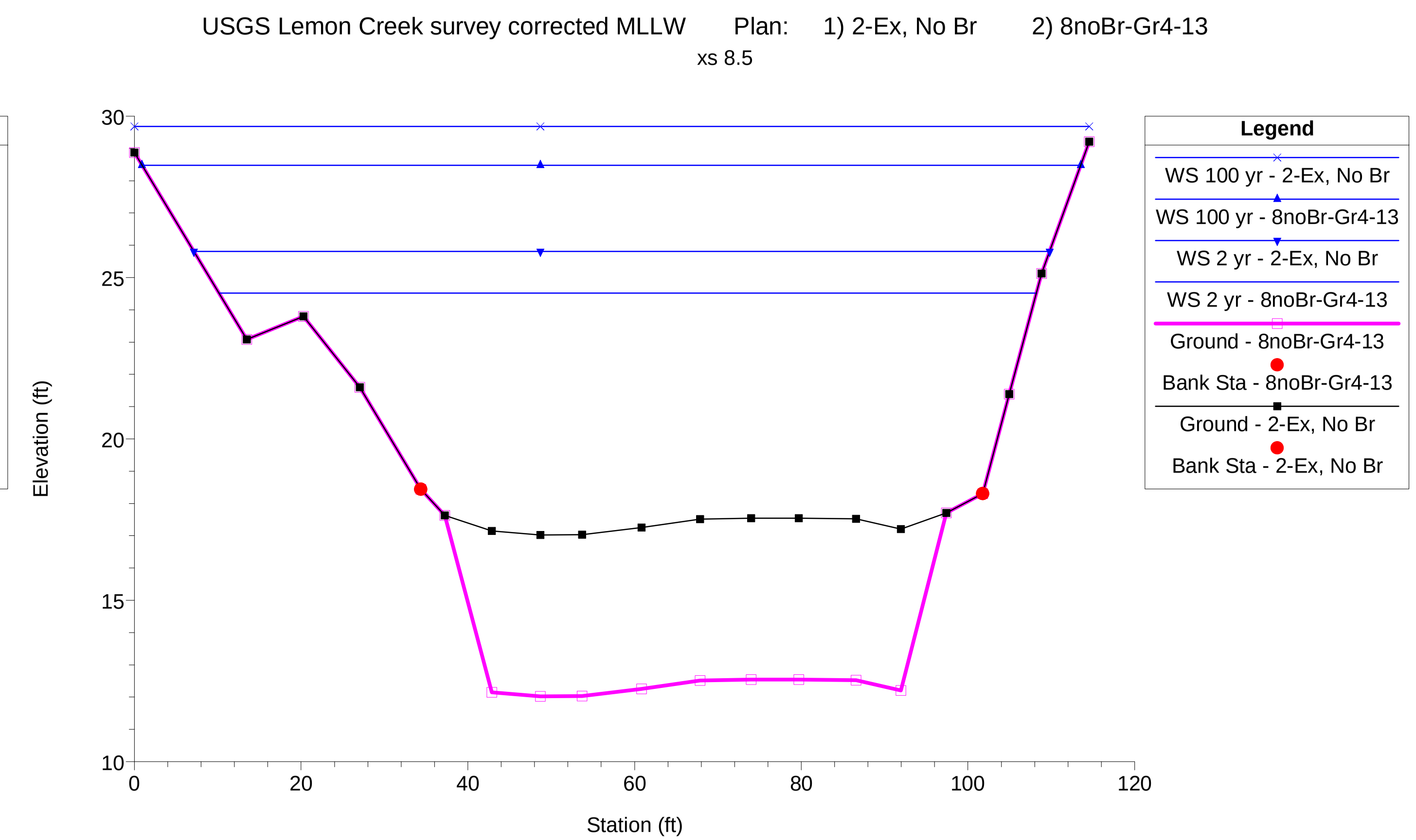
WS 100 yr - 8noBr-Gr4-13
WS 2 yr - 2-Ex, No Br
WS 2 yr - 8noBr-Gr4-13
Ground - 8noBr-Gr4-13
Bank Sta - 8noBr-Gr4-13
Ground - 2-Ex, No Br
Bank Sta - 2-Ex, No Br

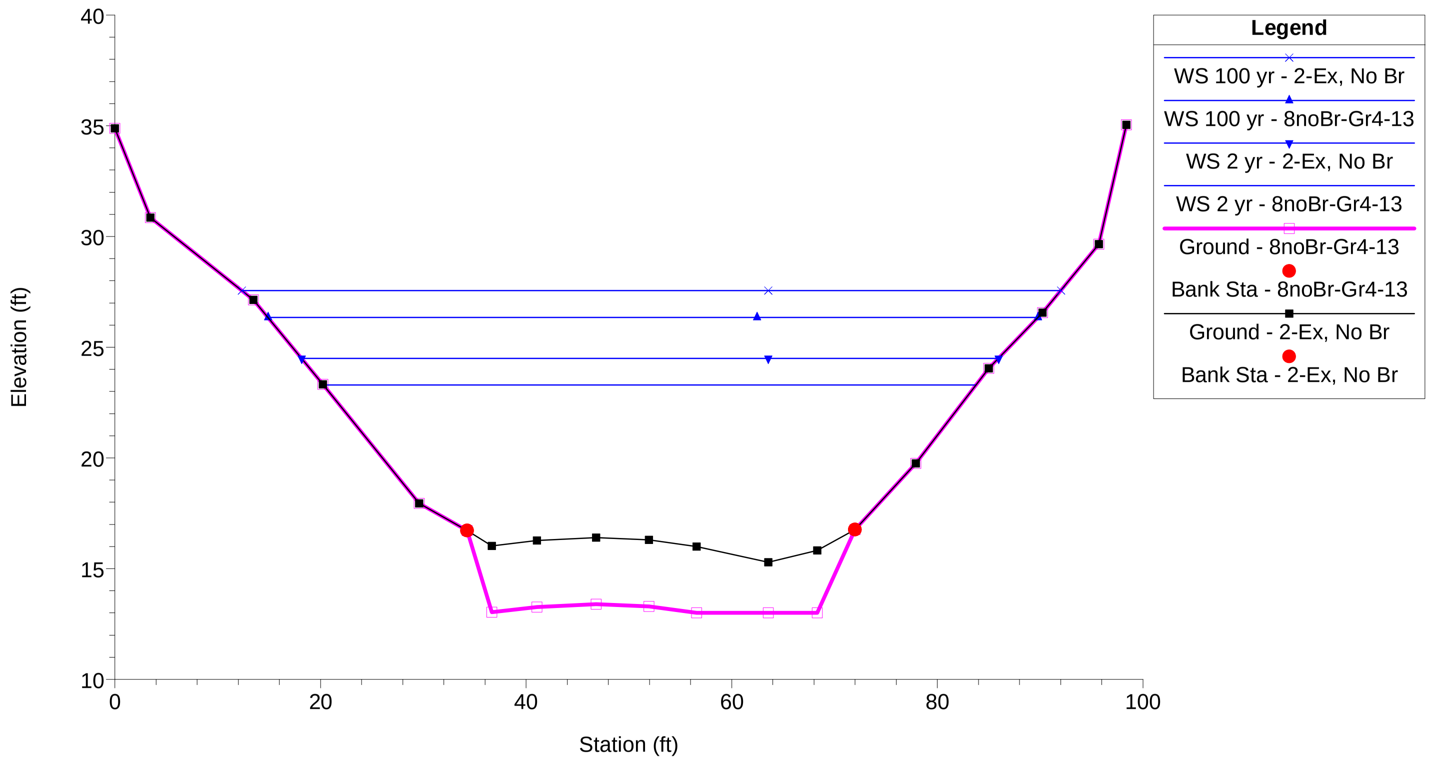

USGS Lemon Creek survey corrected MLLW Plan: 1) 2-Ex, No Br 2) 8noBr-Gr4-13
xs 11 cor k
Elevation (ft)
Station (ft)
Legend
WS 100 yr - 2-Ex, No Br
WS 100 yr - 8noBr-Gr4-13
WS 2 yr - 2-Ex, No Br
WS 2 yr - 8noBr-Gr4-13
Ground - 8noBr-Gr4-13
Bank Sta - 8noBr-Gr4-13
Ground - 2-Ex, No Br
Bank Sta - 2-Ex, No Br


USGS Lemon Creek survey corrected MLLW Plan: 1) 2-Ex, No Br 2) 8noBr-Gr4-13
xs 10 cor j
Elevation (ft)
Station (ft)
Legend
WS 100 yr - 2-Ex, No Br
WS 100 yr - 8noBr-Gr4-13
WS 2 yr - 2-Ex, No Br
WS 2 yr - 8noBr-Gr4-13
Ground - 8noBr-Gr4-13
Bank Sta - 8noBr-Gr4-13
Ground - 2-Ex, No Br
Bank Sta - 2-Ex, No Br

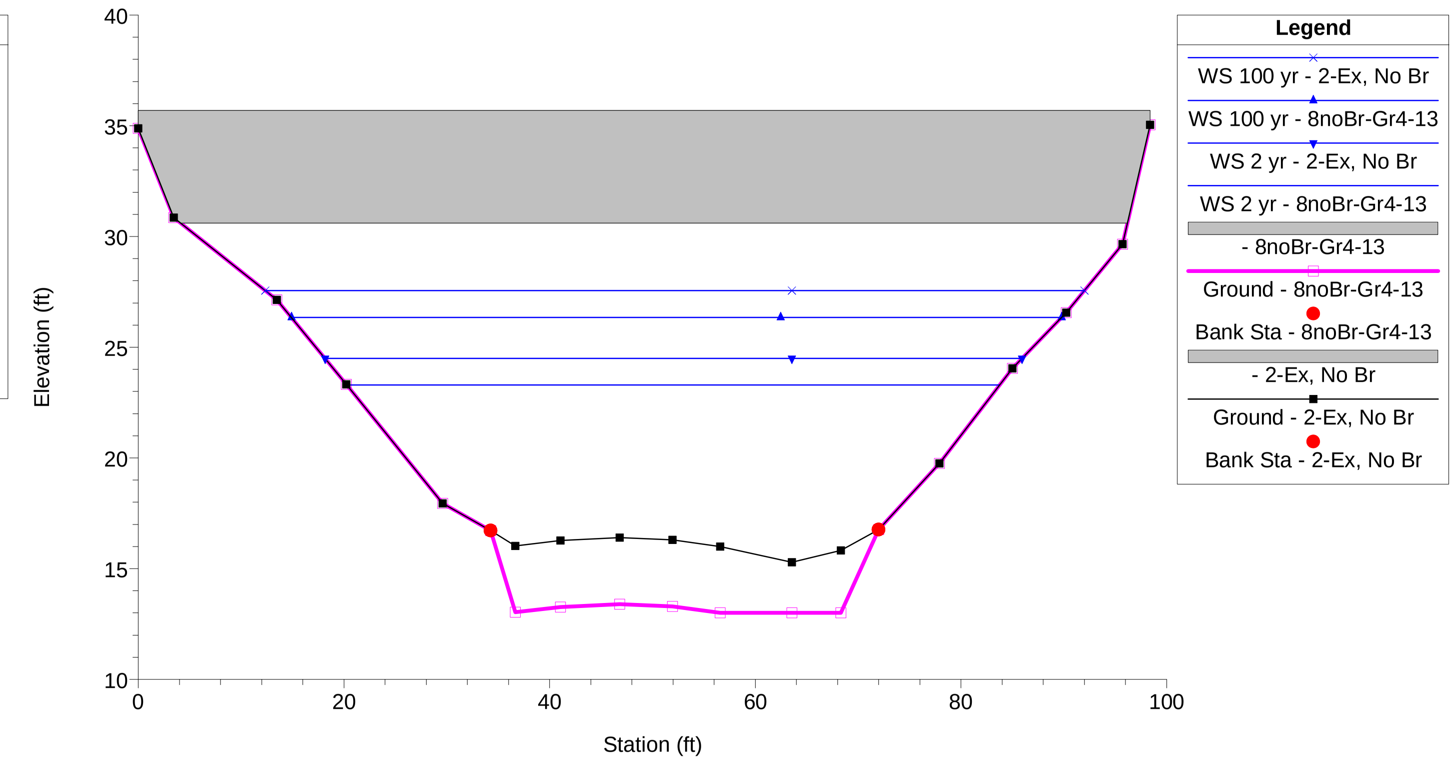

USGS Lemon Creek survey corrected MLLW Plan: 1) 2-Ex, No Br 2) 8noBr-Gr4-13
xs 9 cor i
Elevation (ft)
Station (ft)
Legend
WS 100 yr - 2-Ex, No Br
WS 100 yr - 8noBr-Gr4-13
WS 2 yr - 2-Ex, No Br
WS 2 yr - 8noBr-Gr4-13
Ground - 8noBr-Gr4-13
Bank Sta - 8noBr-Gr4-13
Ground - 2-Ex, No Br
Bank Sta - 2-Ex, No Br


USGS Lemon Creek survey corrected MLLW Plan: 1) 2-Ex, No Br 2) 8noBr-Gr4-13
xs 8.5
Elevation (ft)
Station (ft)
Legend
WS 100 yr - 2-Ex, No Br
WS 100 yr - 8noBr-Gr4-13
WS 2 yr - 2-Ex, No Br
WS 2 yr - 8noBr-Gr4-13
Ground - 8noBr-Gr4-13
Bank Sta - 8noBr-Gr4-13
Ground - 2-Ex, No Br
Bank Sta - 2-Ex, No Br

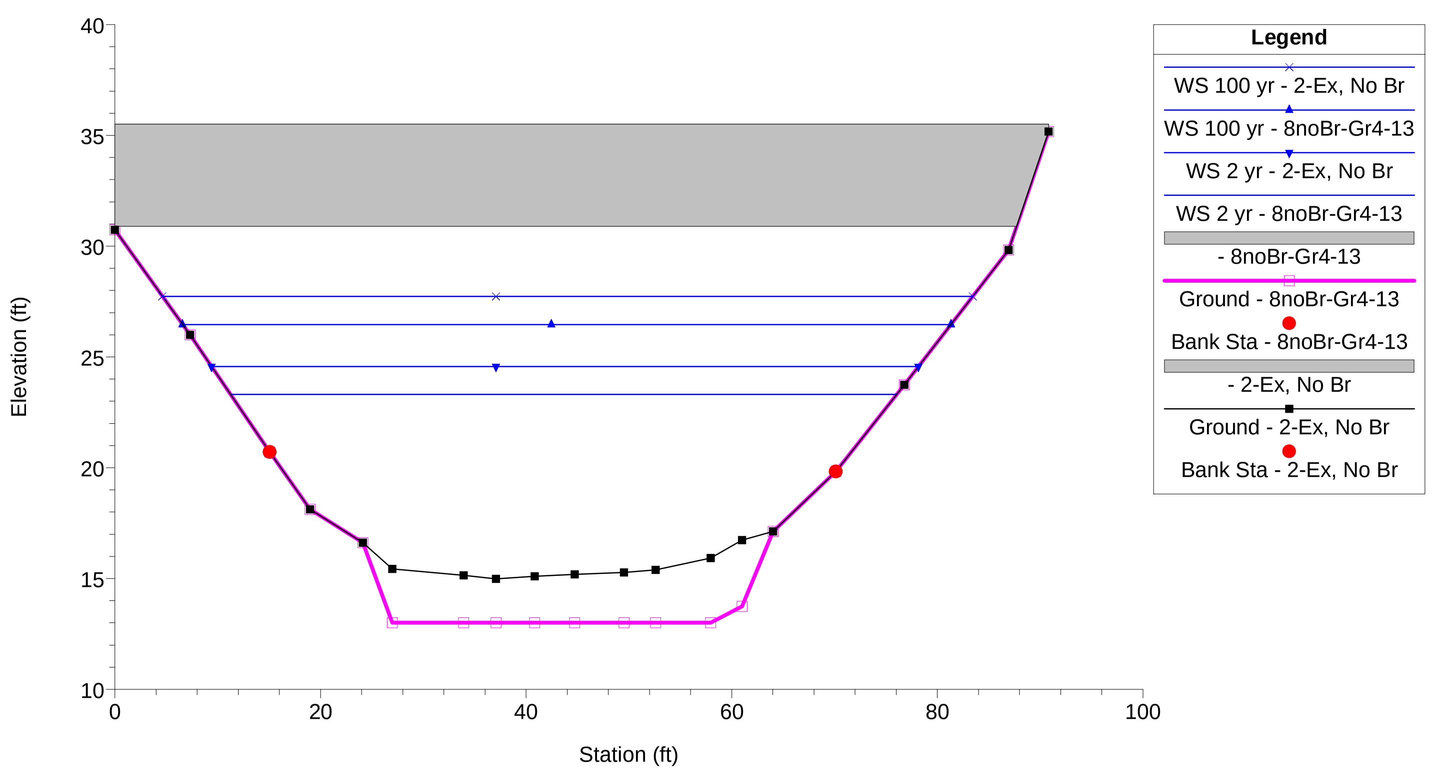
USGS Lemon Creek survey corrected MLLW Plan: 1) 2-Ex, No Br 2) 8noBr-Gr4-13
xs 8 cor h



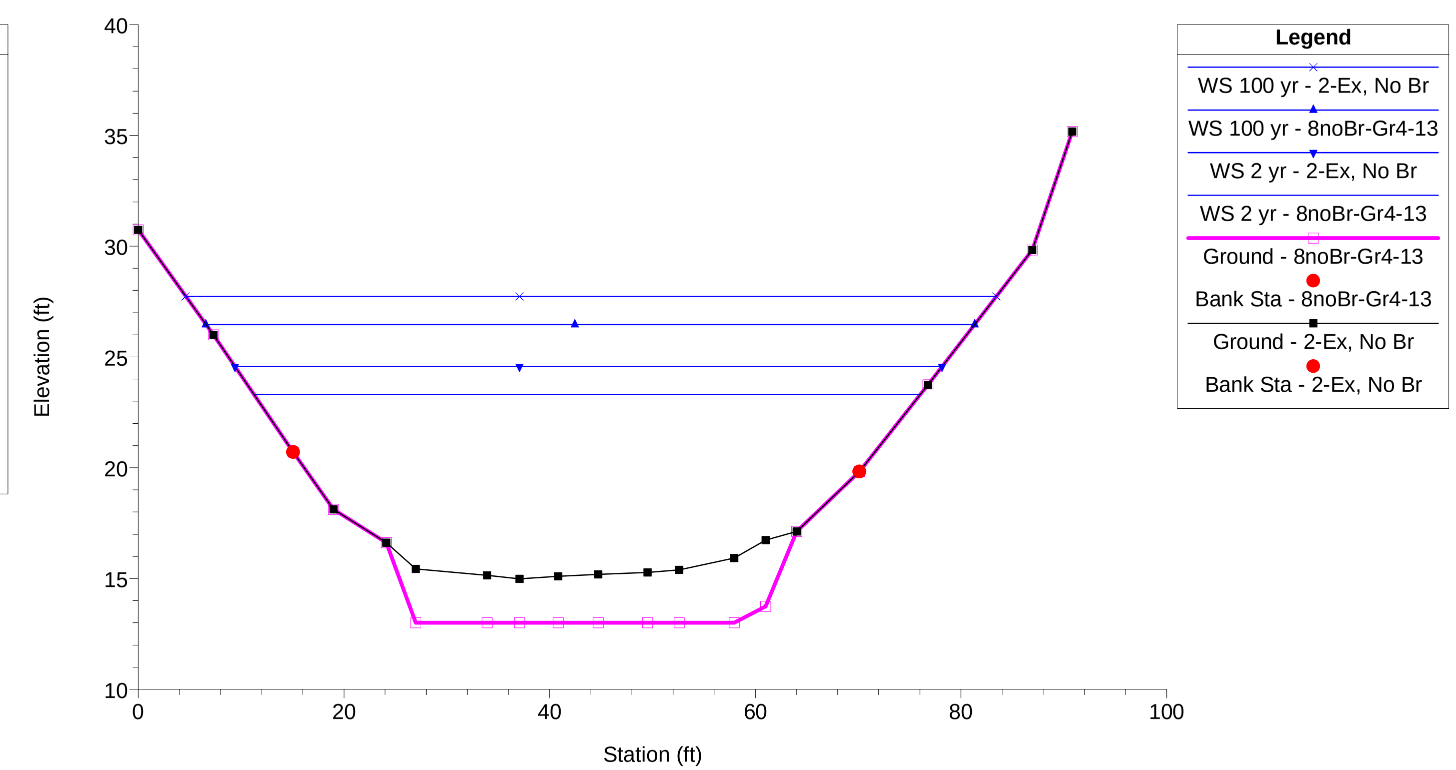
USGS Lemon Creek survey corrected MLLW Plan: 1) 2-Ex, No Br 2) 8noBr-Gr4-13
old glacier

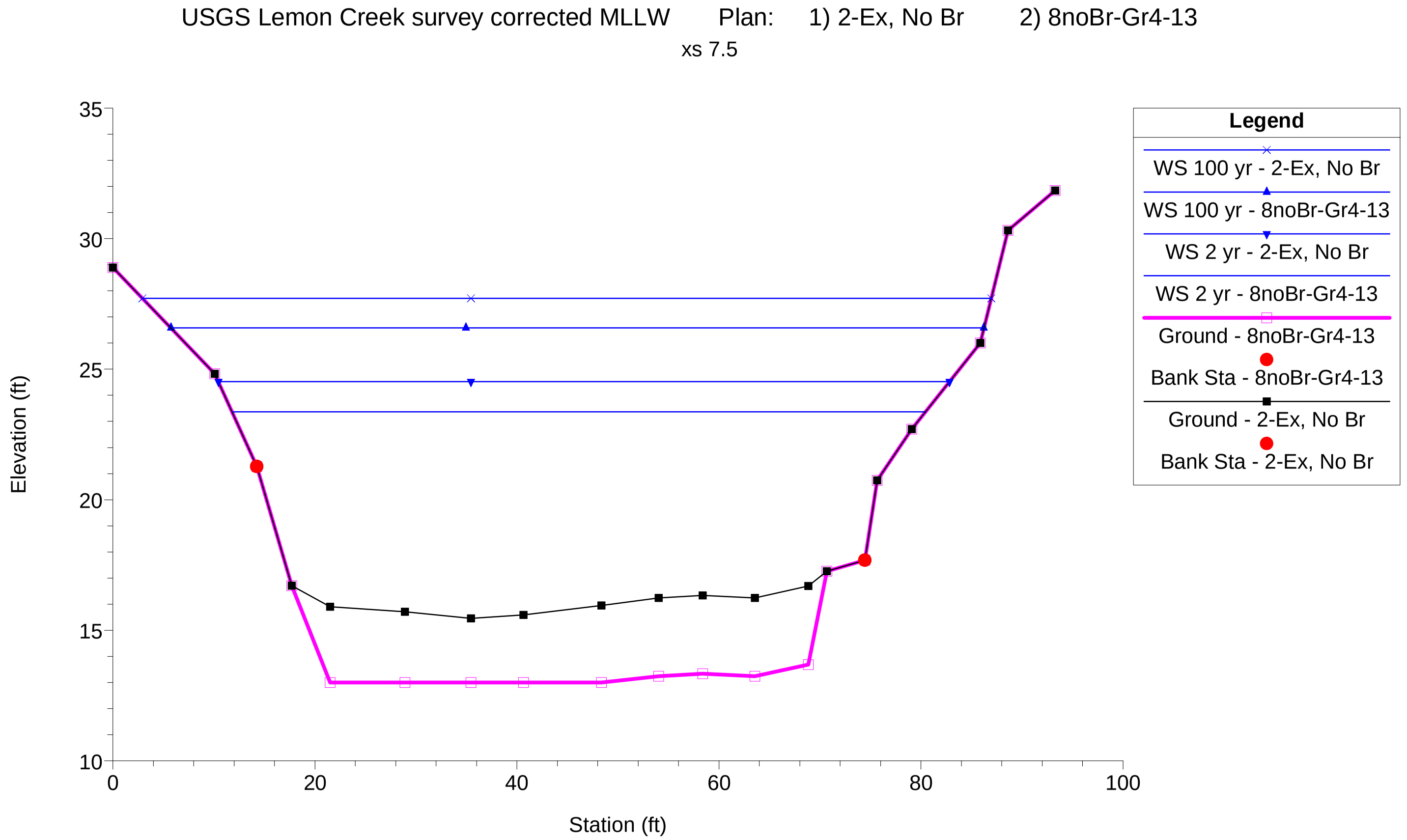


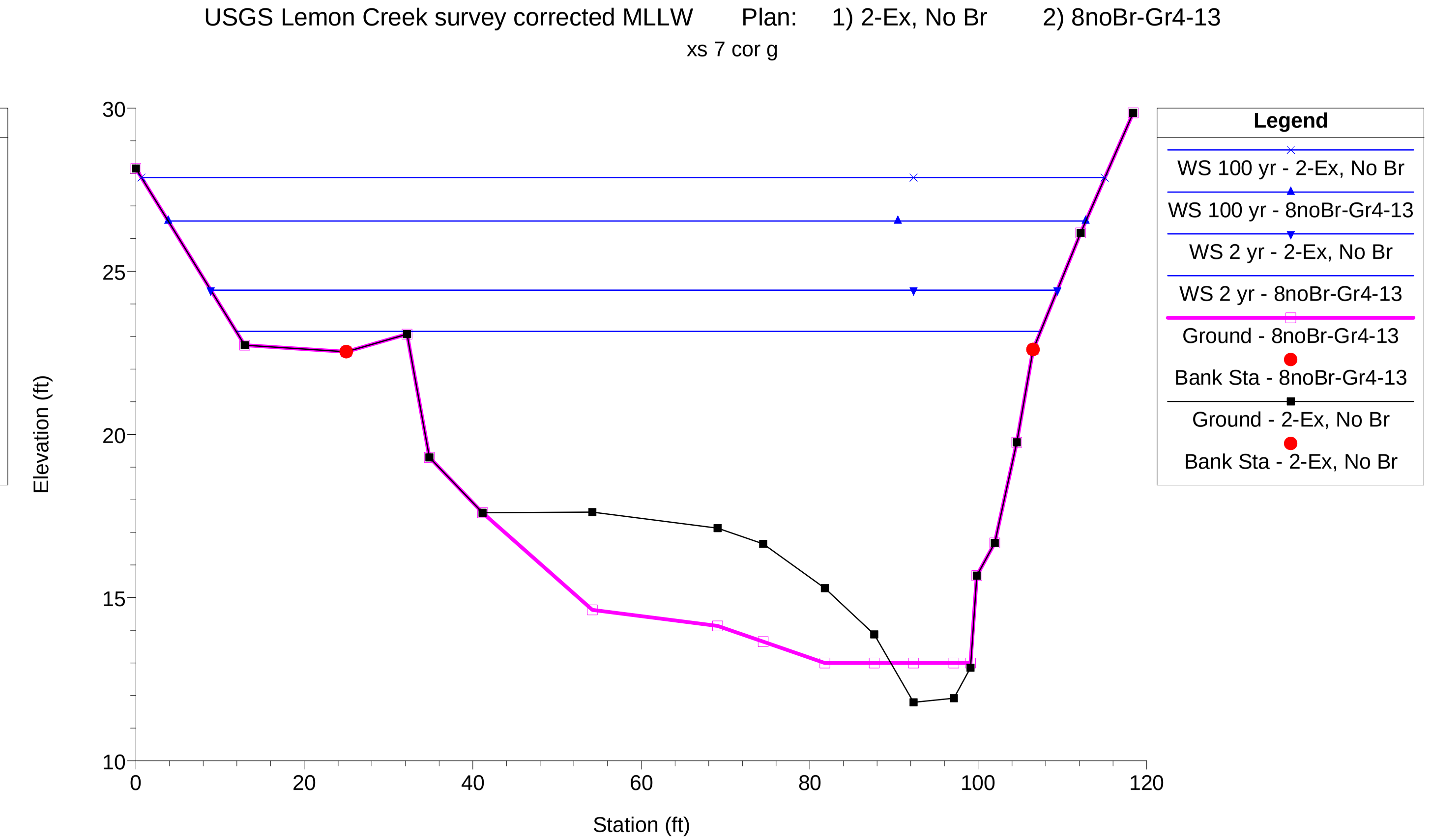
USGS Lemon Creek survey corrected MLLW Plan: 1) 2-Ex, No Br 2) 8noBr-Gr4-13
old glacier

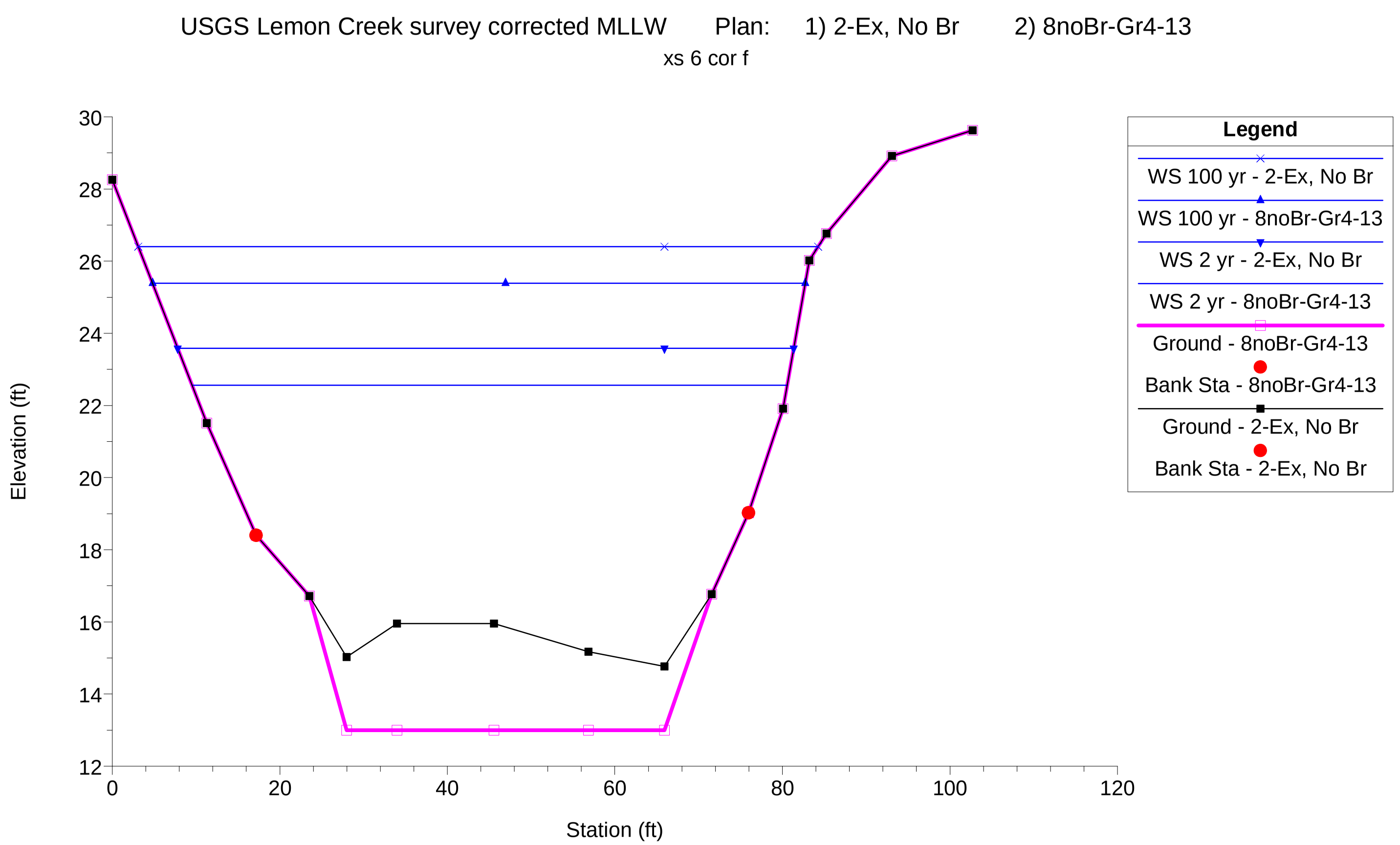


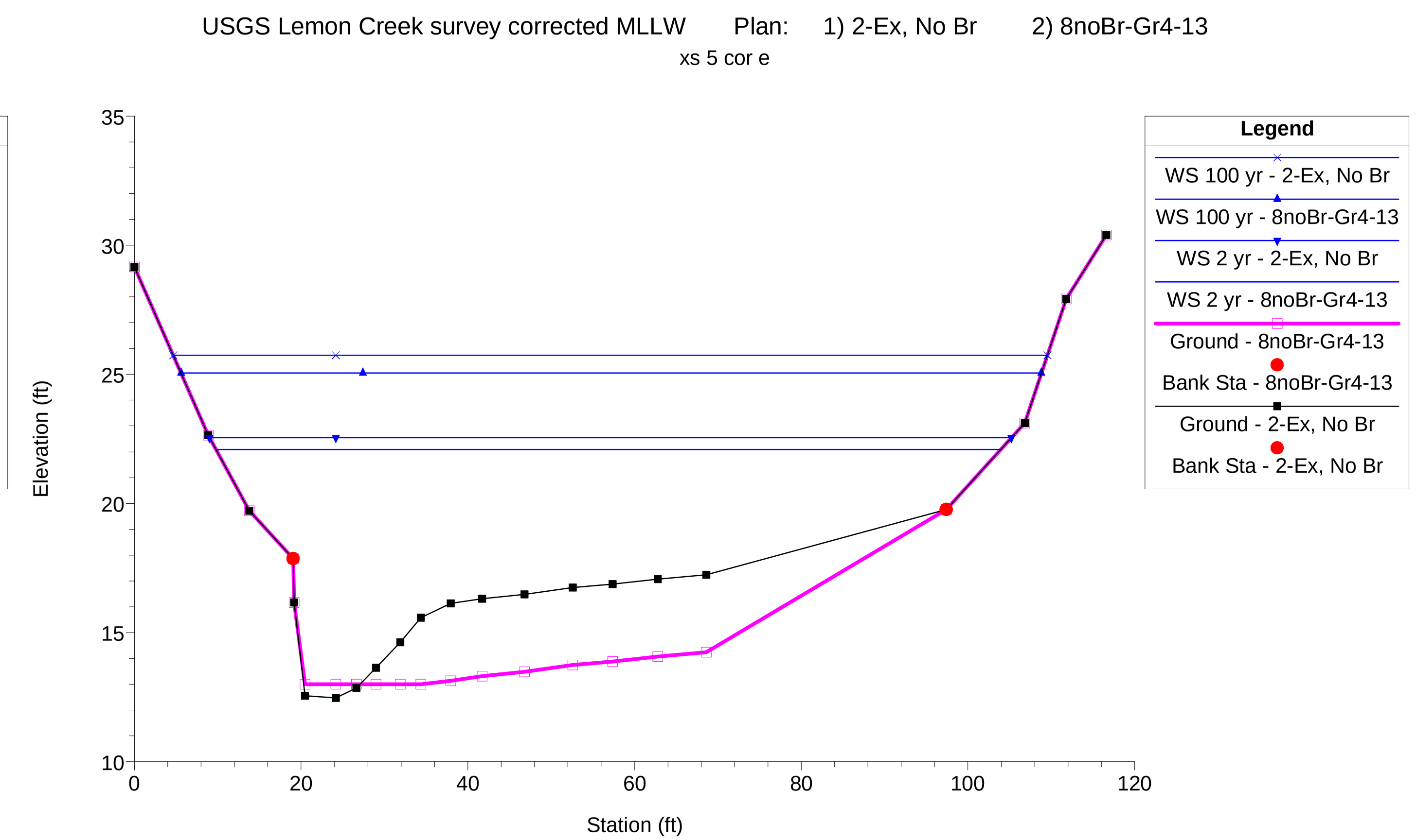
USGS Lemon Creek survey corrected MLLW Plan: 1) 2-Ex, No Br 2) 8noBr-Gr4-13
xs 7.8

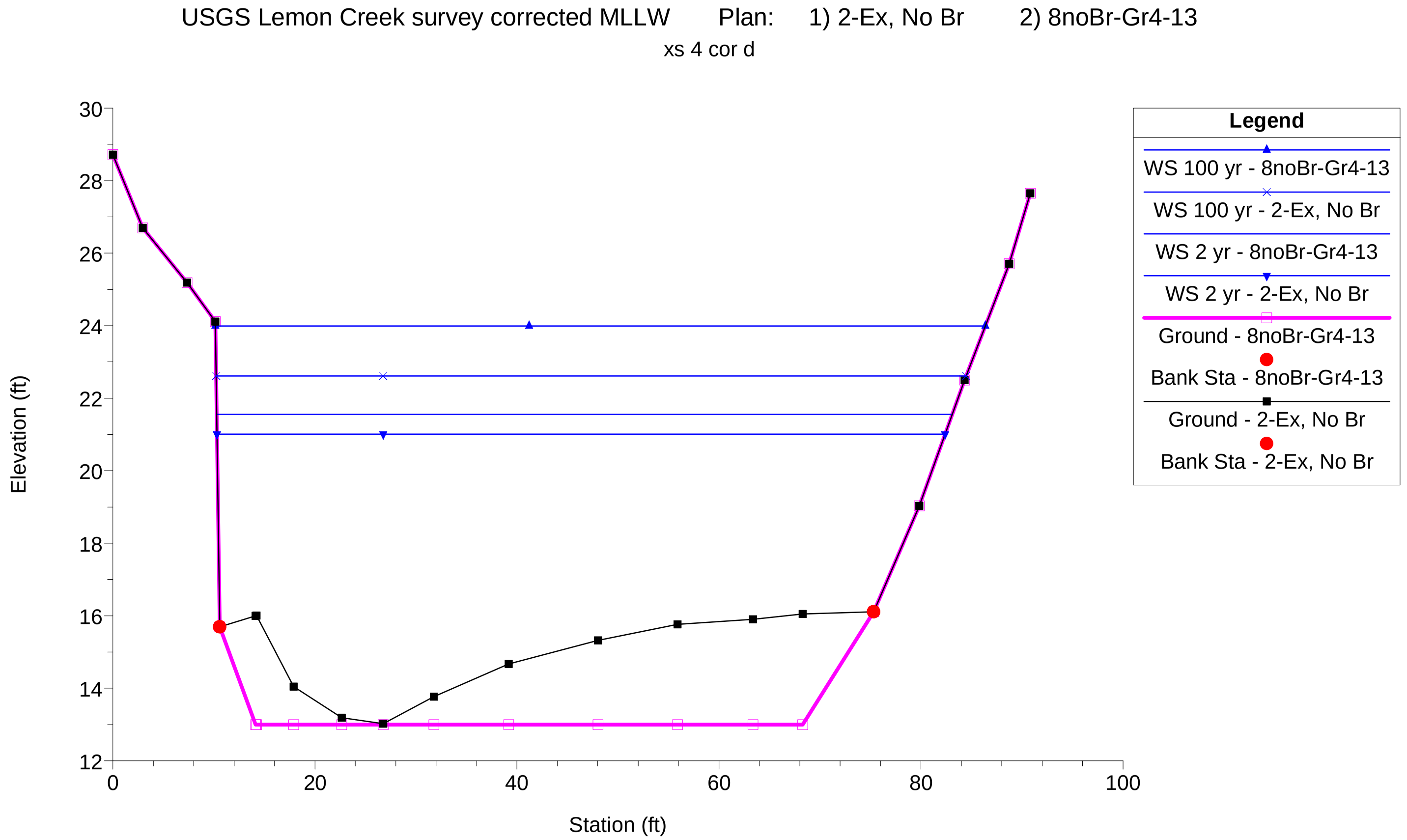



USGS Lemon Creek survey corrected MLLW Plan: 1) 2-Ex, No Br 2) 8noBr-Gr4-13
xs 7.5
Elevation (ft)
Station (ft)
Legend
WS 100 yr - 2-Ex, No Br
WS 100 yr - 8noBr-Gr4-13
WS 2 yr - 2-Ex, No Br
WS 2 yr - 8noBr-Gr4-13
Ground - 8noBr-Gr4-13
Bank Sta - 8noBr-Gr4-13
Ground - 2-Ex, No Br
Bank Sta - 2-Ex, No Br

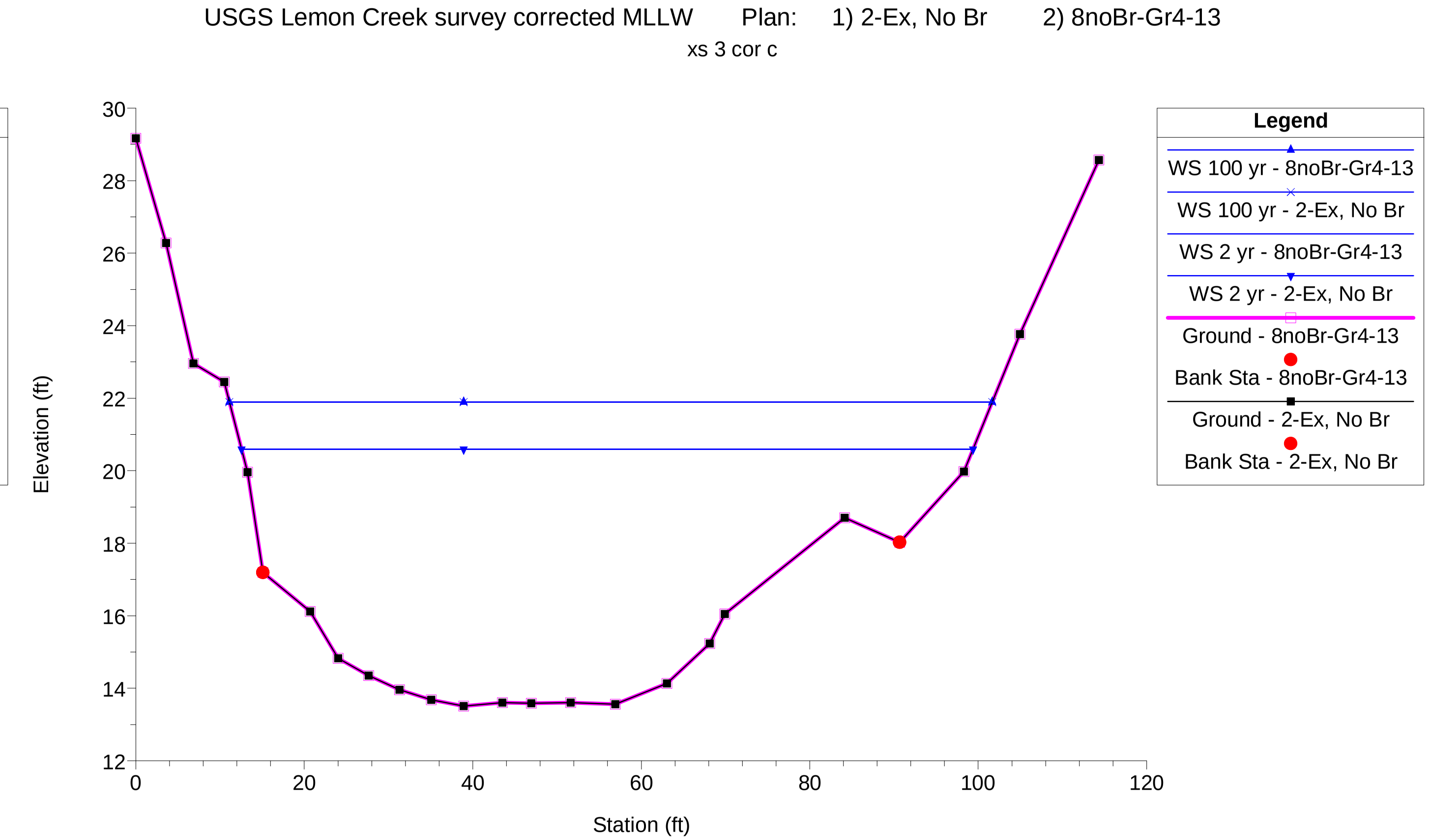

USGS Lemon Creek survey corrected MLLW Plan: 1) 2-Ex, No Br 2) 8noBr-Gr4-13
xs 7 cor g
Elevation (ft)
Station (ft)
Legend
WS 100 yr - 2-Ex, No Br
WS 100 yr - 8noBr-Gr4-13
WS 2 yr - 2-Ex, No Br
WS 2 yr - 8noBr-Gr4-13
Ground - 8noBr-Gr4-13
Bank Sta - 8noBr-Gr4-13
Ground - 2-Ex, No Br
Bank Sta - 2-Ex, No Br


USGS Lemon Creek survey corrected MLLW Plan: 1) 2-Ex, No Br 2) 8noBr-Gr4-13
xs 6 cor f
Elevation (ft)
Station (ft)
Legend
WS 100 yr - 2-Ex, No Br
WS 100 yr - 8noBr-Gr4-13
WS 2 yr - 2-Ex, No Br
WS 2 yr - 8noBr-Gr4-13
Ground - 8noBr-Gr4-13
Bank Sta - 8noBr-Gr4-13
Ground - 2-Ex, No Br
Bank Sta - 2-Ex, No Br


USGS Lemon Creek survey corrected MLLW Plan: 1) 2-Ex, No Br 2) 8noBr-Gr4-13
xs 5 cor e
Elevation (ft)
Station (ft)
Legend
WS 100 yr - 2-Ex, No Br
WS 100 yr - 8noBr-Gr4-13
WS 2 yr - 2-Ex, No Br
WS 2 yr - 8noBr-Gr4-13
Ground - 8noBr-Gr4-13
Bank Sta - 8noBr-Gr4-13
Ground - 2-Ex, No Br
Bank Sta - 2-Ex, No Br



USGS Lemon Creek survey corrected MLLW Plan: 1) 2-Ex, No Br 2) 8noBr-Gr4-13
xs 4 cor d
Elevation (ft)
Station (ft)
Legend
WS 100 yr - 8noBr-Gr4-13
WS 100 yr - 2-Ex, No Br
WS 2 yr - 8noBr-Gr4-13
WS 2 yr - 2-Ex, No Br
Ground - 8noBr-Gr4-13
Bank Sta - 8noBr-Gr4-13
Ground - 2-Ex, No Br
Bank Sta - 2-Ex, No Br



USGS Lemon Creek survey corrected MLLW Plan: 1) 2-Ex, No Br 2) 8noBr-Gr4-13
xs 3 cor c
Elevation (ft)
Station (ft)
Legend
WS 100 yr - 8noBr-Gr4-13
WS 100 yr - 2-Ex, No Br
WS 2 yr - 8noBr-Gr4-13
WS 2 yr - 2-Ex, No Br
Ground - 8noBr-Gr4-13
Bank Sta - 8noBr-Gr4-13
Ground - 2-Ex, No Br
Bank Sta - 2-Ex, No Br

Appendix F(b)

Hydraulics

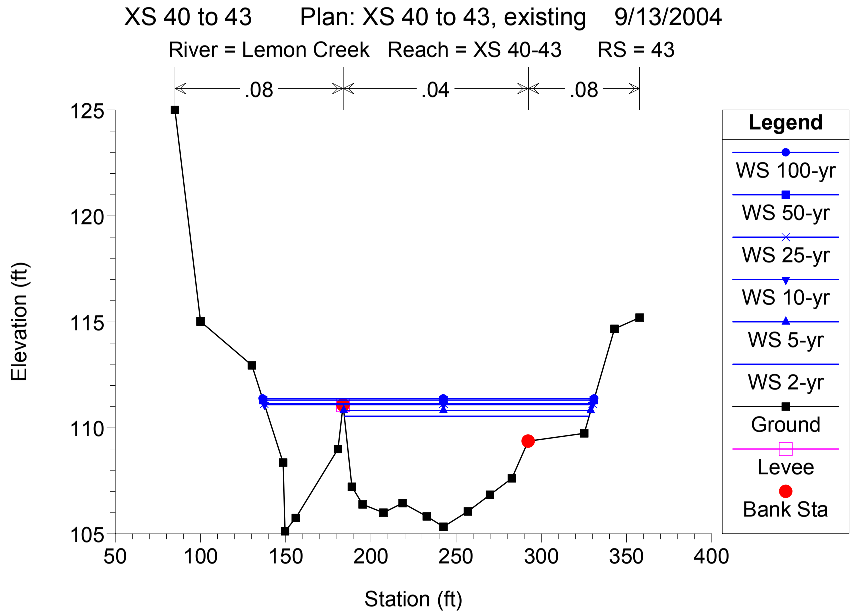
Hidden Valley
Existing Conditions

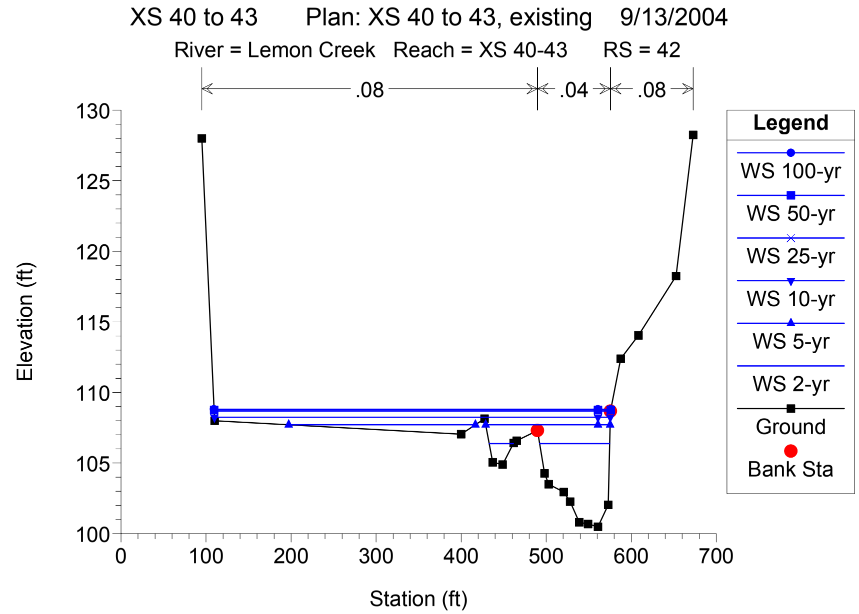
Lemon Creek through Hidden Valley Area

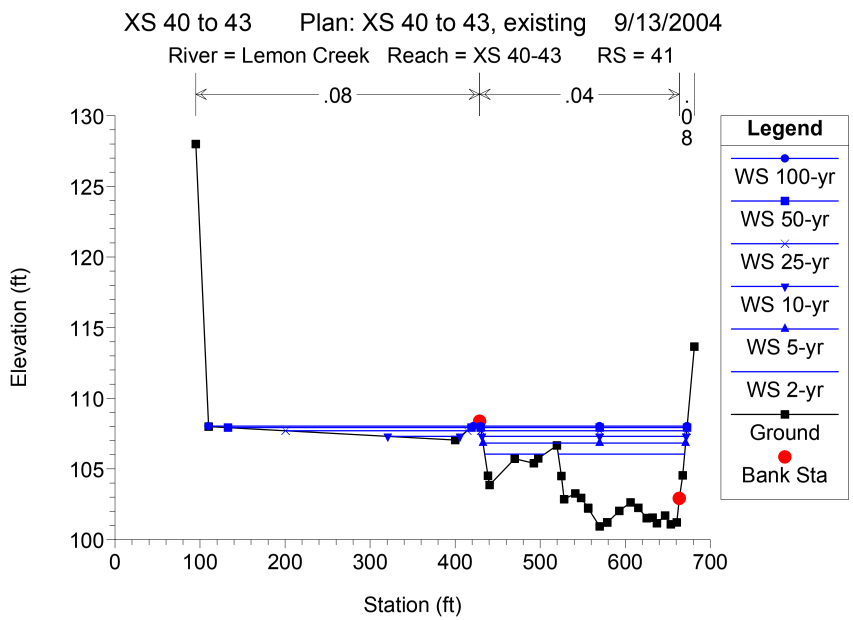
Reach H XS 40 - 43

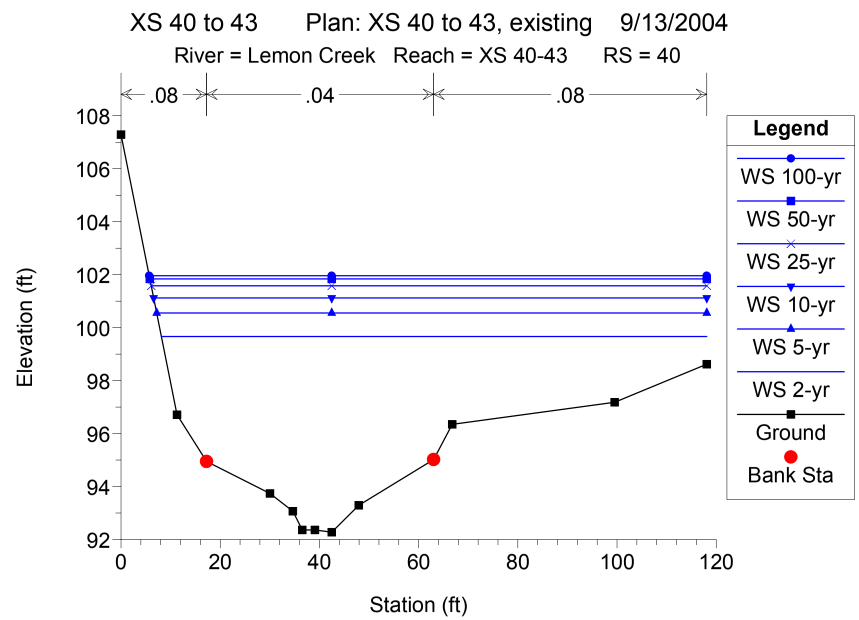
HEC-RAS Plan: 40-43,ex River: Lemon Creek Reach: XS 40-43

Reach	River Sta	Profile	Cum Ch Len (ft)	Q Total (cfs)	Q Channel (cfs)	Vel Chnl (ft/s)	Hydr Depth C (ft)	Top W Act Chan (ft)	E.G. Slope (ft/ft)	Shear Chan (lb/sq ft)
XS 40-43	40	2-yr		3930	3340.89	12.18	5.99	45.77	0.010002	3.71
XS 40-43	40	5-yr		5140	4204.35	13.36	6.88	45.77	0.010006	4.26
XS 40-43	40	10-yr		5990	4800.04	14.08	7.45	45.77	0.010005	4.61
XS 40-43	40	25-yr		6720	5306.63	14.66	7.91	45.77	0.010003	4.89
XS 40-43	40	50-yr		7140	5596.41	14.97	8.17	45.77	0.010003	5.05
XS 40-43	40	100-yr		7340	5734.01	15.12	8.29	45.77	0.010003	5.13
XS 40-43	41	2-yr	600	3930	3908.26	6.25	2.94	212.77	0.006806	1.24
XS 40-43	41	5-yr	600	5140	5105.76	6.39	3.46	230.89	0.005729	1.23
XS 40-43	41	10-yr	600	5990	5943.55	6.54	3.92	232.11	0.005075	1.23
XS 40-43	41	25-yr	600	6720	6627.44	6.61	4.3	233.13	0.004596	1.22
XS 40-43	41	50-yr	600	7140	6995.71	6.63	4.51	233.7	0.004337	1.21
XS 40-43	41	100-yr	600	7340	7161.69	6.64	4.61	233.96	0.004214	1.2
XS 40-43	42	2-yr	717	3930	3867.34	11.2	4.19	82.42	0.014269	3.57
XS 40-43	42	5-yr	717	5140	4856.52	10.6	5.36	85.51	0.009317	2.96
XS 40-43	42	10-yr	717	5990	5409.81	10.73	5.88	85.72	0.008481	2.94
XS 40-43	42	25-yr	717	6720	5686.05	10.49	6.31	85.89	0.007402	2.75
XS 40-43	42	50-yr	717	7140	5975.95	10.89	6.39	85.89	0.007859	2.95
XS 40-43	42	100-yr	717	7340	6108.03	11.06	6.43	85.89	0.008041	3.04
XS 40-43	43	2-yr	1017	3930	3870.68	9.01	3.98	107.85	0.009498	2.33
XS 40-43	43	5-yr	1017	5140	5036.48	10.99	4.23	108.2	0.013023	3.39
XS 40-43	43	10-yr	1017	5990	5228.02	10.72	4.49	108.55	0.011471	3.17
XS 40-43	43	25-yr	1017	6720	5858.26	11.89	4.54	108.55	0.013916	3.88
XS 40-43	43	50-yr	1017	7140	6197.71	12.12	4.71	108.55	0.013741	3.98
XS 40-43	43	100-yr	1017	7340	6359.84	12.24	4.79	108.55	0.013732	4.04


XS 40 to 43 Plan: XS 40 to 43, existing 9/13/2004
River = Lemon Creek Reach = XS 40-43 RS = 43
.08
.04
.08
Elevation (ft)
Station (ft)
Legend
WS 100-yr
WS 50-yr
WS 25-yr
WS 10-yr
WS 5-yr
WS 2-yr
Ground
Levee
Bank Sta


XS 40 to 43 Plan: XS 40 to 43, existing 9/13/2004
River = Lemon Creek Reach = XS 40-43 RS = 42
.08
.04
.08
Elevation (ft)
Station (ft)
Legend
WS 100-yr
WS 50-yr
WS 25-yr
WS 10-yr
WS 5-yr
WS 2-yr
Ground
Bank Sta


XS 40 to 43 Plan: XS 40 to 43, existing 9/13/2004
River = Lemon Creek Reach = XS 40-43 RS = 41
.08
.04
.08
Elevation (ft)
Station (ft)
Legend
WS 100-yr
WS 50-yr
WS 25-yr
WS 10-yr
WS 5-yr
WS 2-yr
Ground
Bank Sta

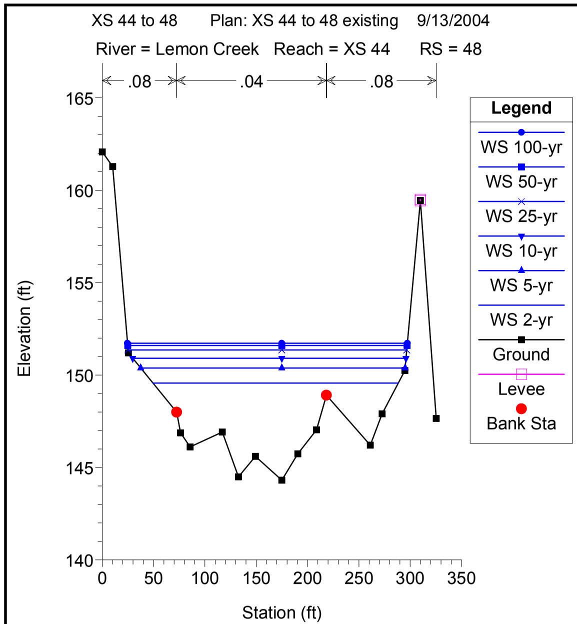

XS 40 to 43 Plan: XS 40 to 43, existing 9/13/2004
River = Lemon Creek Reach = XS 40-43 RS = 40
.08
.04
.08
Elevation (ft)
Station (ft)
Legend
WS 100-yr
WS 50-yr
WS 25-yr
WS 10-yr
WS 5-yr
WS 2-yr
Ground
Bank Sta

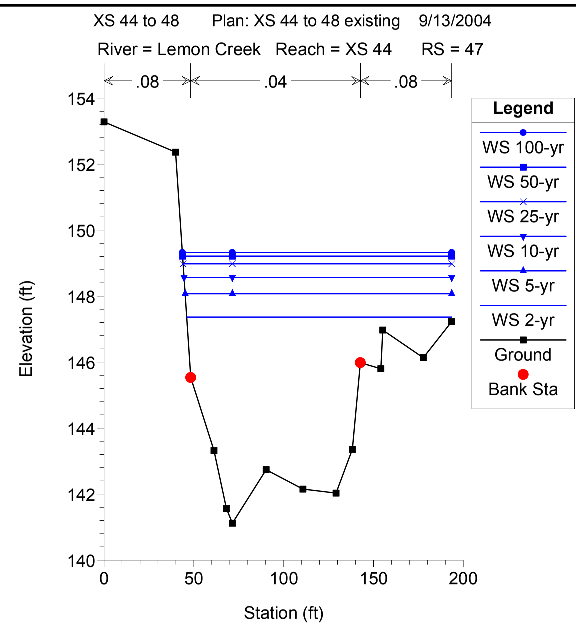
Lemon Creek through Hidden Valley Area

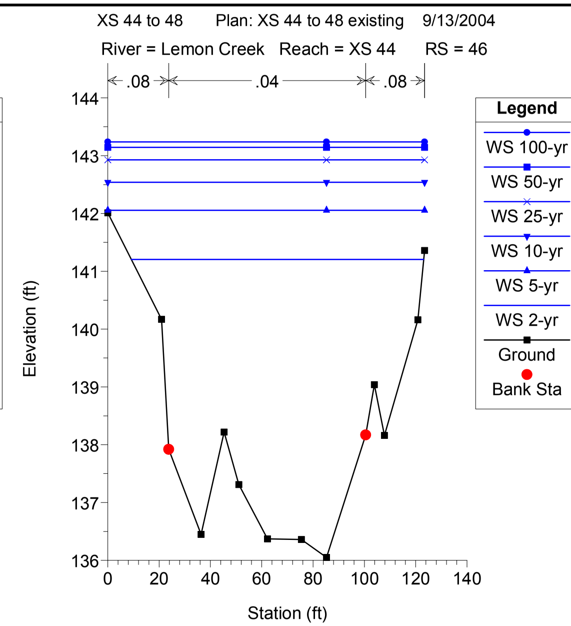
Reach I XS 44 - 48

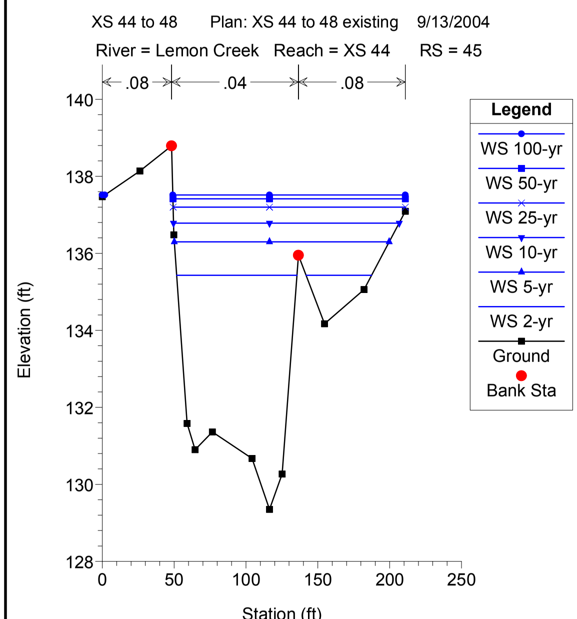
HEC-RAS Plan: 44-48,ex River: Lemon Creek Reach: XS 44

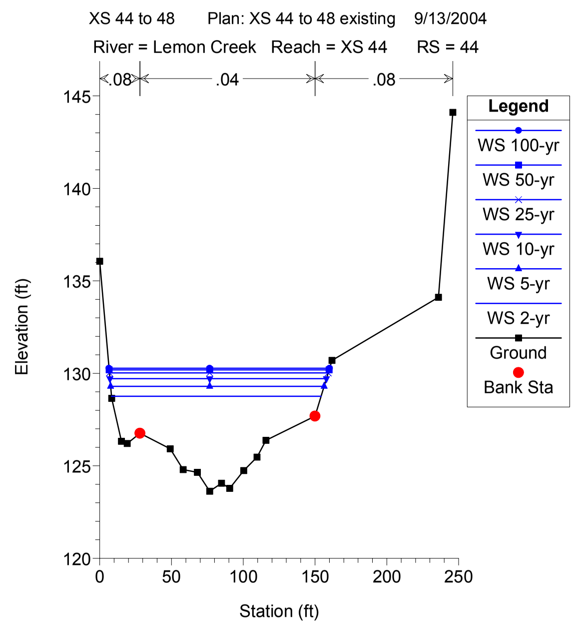
Reach	River Sta	Profile	Cum Ch Len (ft)	Q Total (cfs)	Q Channel (cfs)	Vel Chnl (ft/s)	Hydr Depth C (ft)	Top W Act Chan (ft)	E.G. Slope (ft/ft)	Shear Chan (lb/sq ft)
XS 44	44	2-yr		3930	3788.05	9.88	3.14	121.96	0.015402	3.02
XS 44	44	5-yr		5140	4926.52	10.95	3.69	121.96	0.015306	3.52
XS 44	44	10-yr		5990	5719.63	11.44	4.1	121.96	0.014517	3.7
XS 44	44	25-yr		6720	6399.45	11.89	4.41	121.96	0.014197	3.9
XS 44	44	50-yr		7140	6790.48	12.17	4.57	121.96	0.014188	4.04
XS 44	44	100-yr		7340	6975.83	12.27	4.66	121.96	0.014064	4.08
XS 44	45	2-yr	360	3930	3877.42	10.99	4.21	83.77	0.013339	3.41
XS 44	45	5-yr	360	5140	4951.28	11.6	4.94	86.45	0.012078	3.61
XS 44	45	10-yr	360	5990	5682.51	12.11	5.39	87	0.011733	3.82
XS 44	45	25-yr	360	6720	6288.42	12.44	5.79	87.27	0.011295	3.94
XS 44	45	50-yr	360	7140	6628.37	12.64	6	87.41	0.011146	4.03
XS 44	45	100-yr	360	7340	6790.42	12.74	6.09	87.48	0.011108	4.07
XS 44	46	2-yr	675	3930	3746.01	11.38	4.29	76.77	0.013581	3.61
XS 44	46	5-yr	675	5140	4809.02	12.19	5.14	76.77	0.012248	3.9
XS 44	46	10-yr	675	5990	5540.98	12.83	5.63	76.77	0.012027	4.2
XS 44	46	25-yr	675	6720	6166.35	13.36	6.01	76.77	0.011937	4.45
XS 44	46	50-yr	675	7140	6524.41	13.64	6.23	76.77	0.011868	4.59
XS 44	46	100-yr	675	7340	6695.56	13.79	6.32	76.77	0.011888	4.66
XS 44	47	2-yr	1235	3930	3859.17	8.65	4.73	94.38	0.006961	2.03
XS 44	47	5-yr	1235	5140	4955.65	9.66	5.44	94.38	0.007203	2.41
XS 44	47	10-yr	1235	5990	5705.71	10.19	5.93	94.38	0.007135	2.61
XS 44	47	25-yr	1235	6720	6342.05	10.59	6.34	94.38	0.007053	2.75
XS 44	47	50-yr	1235	7140	6705.53	10.81	6.57	94.38	0.007	2.83
XS 44	47	100-yr	1235	7340	6877.34	10.9	6.69	94.38	0.006956	2.86
XS 44	48	2-yr	1495	3930	3630.06	6.84	3.64	145.83	0.006113	1.38
XS 44	48	5-yr	1495	5140	4626.69	7.13	4.45	145.83	0.005074	1.4
XS 44	48	10-yr	1495	5990	5299.42	7.3	4.98	145.83	0.004567	1.41
XS 44	48	25-yr	1495	6720	5865.11	7.42	5.42	145.83	0.004212	1.42
XS 44	48	50-yr	1495	7140	6184.36	7.48	5.67	145.83	0.00403	1.42
XS 44	48	100-yr	1495	7340	6335.82	7.5	5.79	145.83	0.00395	1.42


XS 44 to 48 Plan: XS 44 to 48 existing 9/13/2004
River = Lemon Creek Reach = XS 44 RS = 48
.08
.04
.08
Elevation (ft)
Station (ft)
Legend
WS 100-yr
WS 50-yr
WS 25-yr
WS 10-yr
WS 5-yr
WS 2-yr
Ground
Levee
Bank Sta


XS 44 to 48 Plan: XS 44 to 48 existing 9/13/2004
River = Lemon Creek Reach = XS 44 RS = 47
.08
.04
.08
Elevation (ft)
Station (ft)
Legend
WS 100-yr
WS 50-yr
WS 25-yr
WS 10-yr
WS 5-yr
WS 2-yr
Ground
Bank Sta


XS 44 to 48 Plan: XS 44 to 48 existing 9/13/2004
River = Lemon Creek Reach = XS 44 RS = 46
.08
.04
.08
Elevation (ft)
Station (ft)
Legend
WS 100-yr
WS 50-yr
WS 25-yr
WS 10-yr
WS 5-yr
WS 2-yr
Ground
Bank Sta


XS 44 to 48 Plan: XS 44 to 48 existing 9/13/2004
River = Lemon Creek Reach = XS 44 RS = 45
.08
.04
.08
Elevation (ft)
Station (ft)
Legend
WS 100-yr
WS 50-yr
WS 25-yr
WS 10-yr
WS 5-yr
WS 2-yr
Ground
Bank Sta

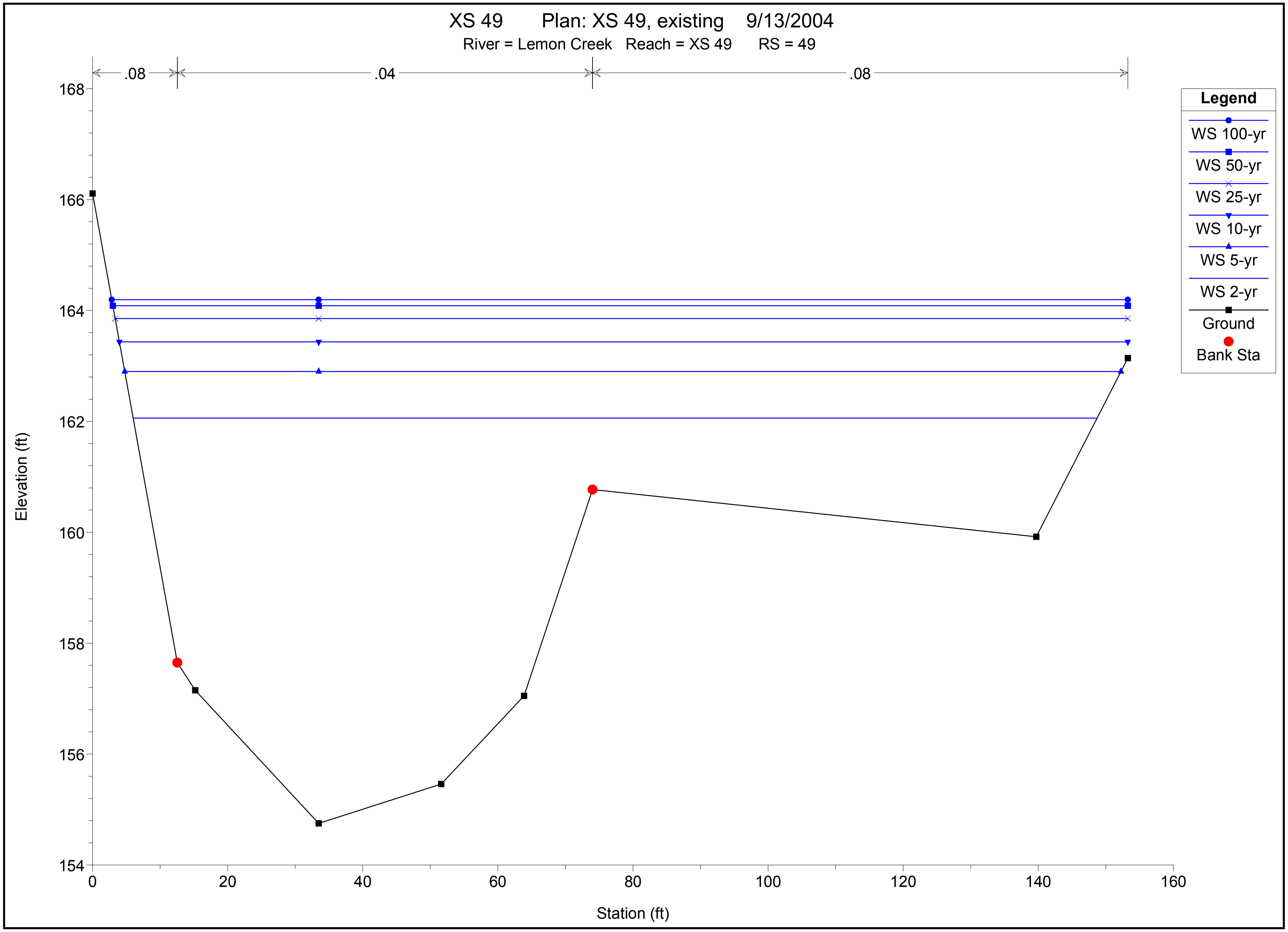

XS 44 to 48 Plan: XS 44 to 48 existing 9/13/2004
River = Lemon Creek Reach = XS 44 RS = 44
.08
.04
.08
Elevation (ft)
Station (ft)
Legend
WS 100-yr
WS 50-yr
WS 25-yr
WS 10-yr
WS 5-yr
WS 2-yr
Ground
Bank Sta

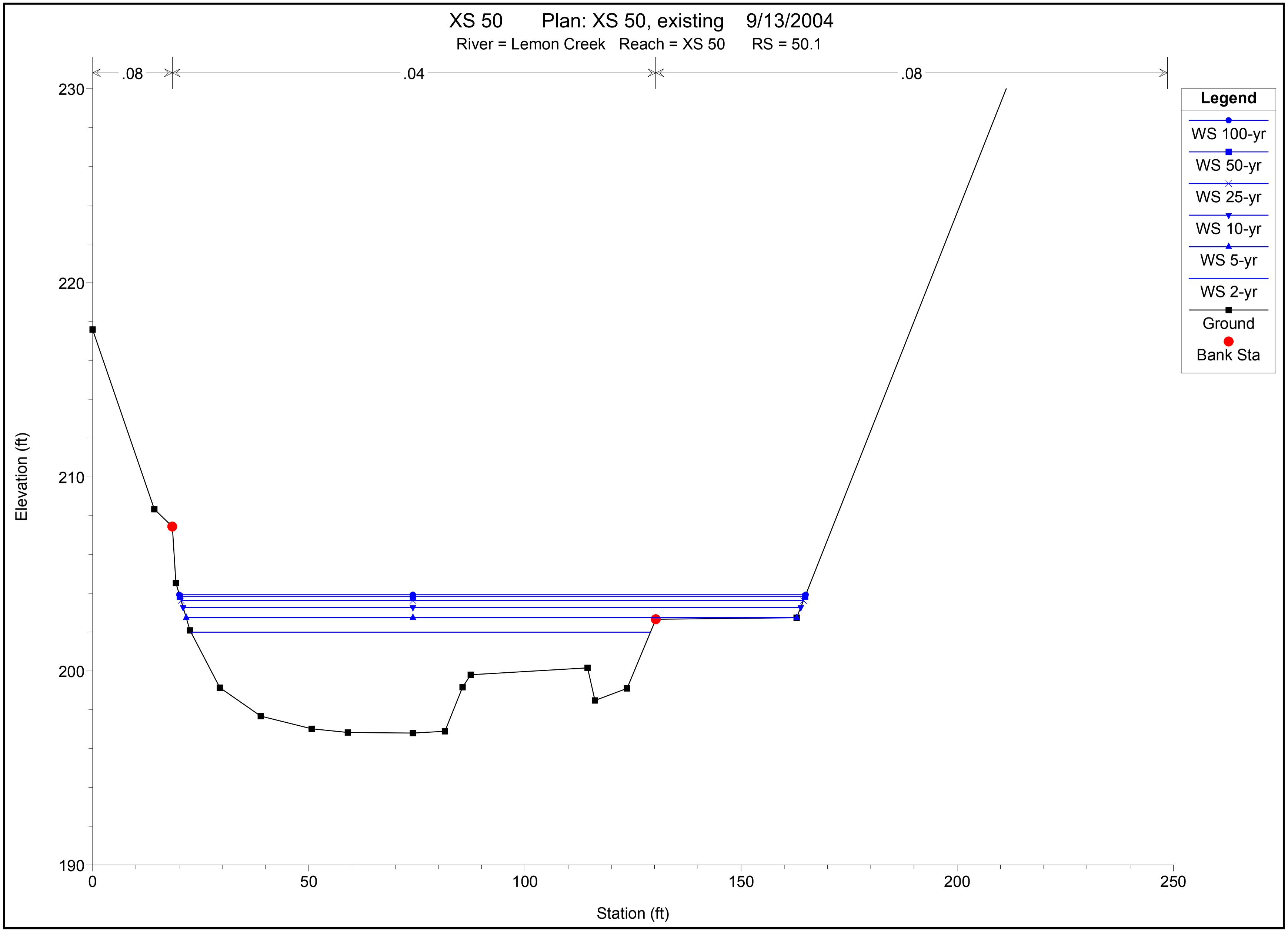
Lemon Creek through Hidden Valley Area

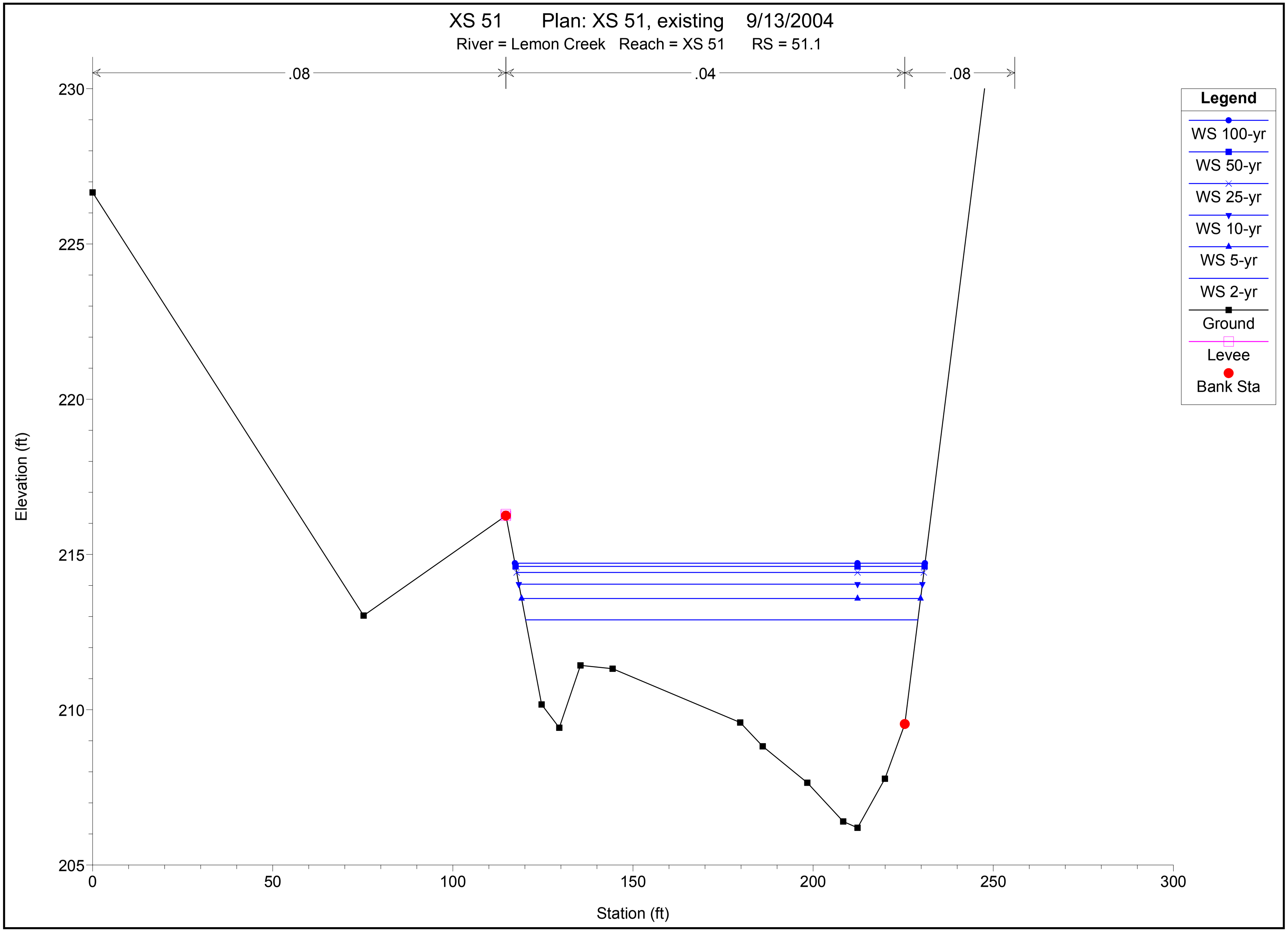
Reach J & K XS 49 - 52

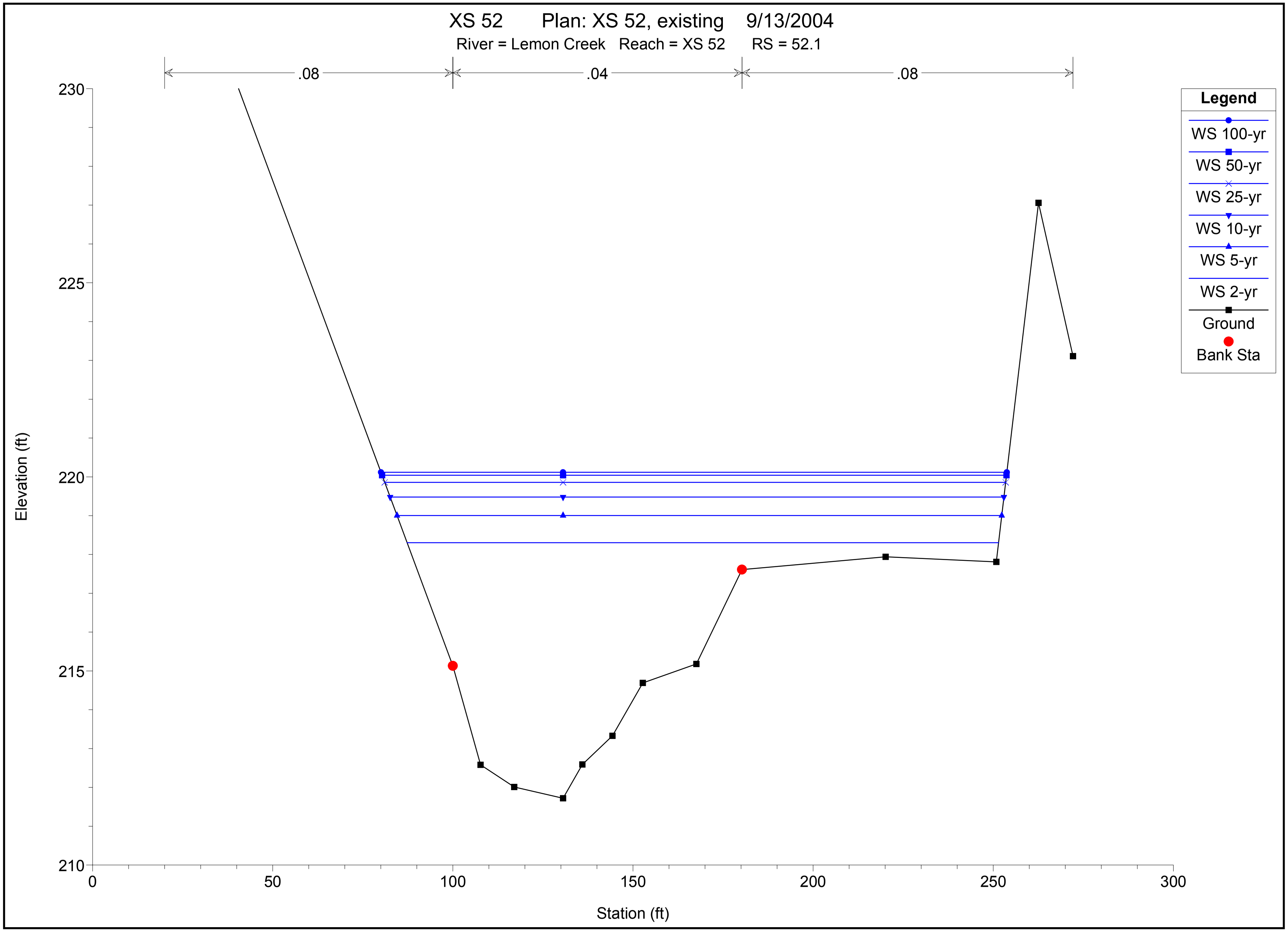
Note: Sections are spaced widely and are not linked into one model. Sections were analyzed individually by normal depth methods but summarized collectively here

Reach	River Sta	Profile	Cum Ch Len (ft)	Q Total (cfs)	Q Channel (cfs)	Vel Chnl (ft/s)	Hydr Depth C (ft)	Top W Act Chan (ft)	E.G. Slope (ft/ft)	Shear Chan (lb/sq ft)
HEC-RAS	Plan: 49,ex	River: Lemon Creek	Reach: XS 49							
XS 49	49	2-yr	0	3930	3621.69	10.25	5.75	61.46	0.007559	2.67
XS 49	49	5-yr	0	5140	4548.46	11.23	6.59	61.46	0.007564	3.06
XS 49	49	10-yr	0	5990	5174.34	11.82	7.12	61.46	0.00755	3.3
XS 49	49	25-yr	0	6720	5701.97	12.3	7.54	61.46	0.007572	3.51
XS 49	49	50-yr	0	7140	6002.46	12.56	7.77	61.46	0.007583	3.62
XS 49	49	100-yr	0	7340	6144.87	12.68	7.88	61.46	0.007588	3.68
HEC-RAS	Plan: 50, ex	River: Lemon Creek	Reach: XS 50							
XS 50	50.1	2-yr	0	3930	3930	10.66	3.47	106.29	0.016248	3.43
XS 50	50.1	5-yr	0	5140	5139.58	11.44	4.13	108.62	0.014877	3.73
XS 50	50.1	10-yr	0	5990	5962.31	11.77	4.63	109.33	0.01356	3.8
XS 50	50.1	25-yr	0	6720	6658.43	12.21	4.97	109.81	0.013303	4
XS 50	50.1	50-yr	0	7140	7054.84	12.43	5.16	110.08	0.013116	4.09
XS 50	50.1	100-yr	0	7340	7242.72	12.53	5.25	110.21	0.013024	4.13
HEC-RAS	Plan: 51, ex	River: Lemon Creek	Reach: XS 51							
XS 51	51.1	2-yr	0	3930	3913.75	10.59	3.51	105.25	0.015597	3.36
XS 51	51.1	5-yr	0	5140	5113.91	11.56	4.16	106.37	0.014857	3.78
XS 51	51.1	10-yr	0	5990	5955.83	12.12	4.59	107.12	0.014345	4.03
XS 51	51.1	25-yr	0	6720	6678.2	12.55	4.94	107.74	0.013955	4.21
XS 51	51.1	50-yr	0	7140	7093.7	12.83	5.12	108.06	0.013906	4.35
XS 51	51.1	100-yr	0	7340	7291.36	12.92	5.21	108.23	0.013769	4.39
HEC-RAS	Plan: 52, ex	River: Lemon Creek	Reach: XS 52							
XS 52	52.1	2-yr	0	3930	3837.71	10.5	4.56	80.27	0.010726	3.02
XS 52	52.1	5-yr	0	5140	4872	11.55	5.25	80.27	0.010738	3.48
XS 52	52.1	10-yr	0	5990	5559.21	12.08	5.73	80.27	0.010466	3.7
XS 52	52.1	25-yr	0	6720	6137.14	12.52	6.11	80.27	0.010314	3.89
XS 52	52.1	50-yr	0	7140	6471.19	12.81	6.29	80.27	0.010382	4.03
XS 52	52.1	100-yr	0	7340	6632.14	12.97	6.37	80.27	0.01048	4.12


XS 49 Plan: XS 49, existing 9/13/2004
River = Lemon Creek Reach = XS 49 RS = 49
.08
.04
.08
Elevation (ft)
168
166
164
162
160
158
156
154
0
20
40
60
80
100
120
140
160
Station (ft)
Legend
WS 100-yr
WS 50-yr
WS 25-yr
WS 10-yr
WS 5-yr
WS 2-yr
Ground
Bank Sta


XS 50 Plan: XS 50, existing 9/13/2004
River = Lemon Creek Reach = XS 50 RS = 50.1
.08
.04
.08
Legend
WS 100-yr
WS 50-yr
WS 25-yr
WS 10-yr
WS 5-yr
WS 2-yr
Ground
Bank Sta
Elevation (ft)
230
220
210
200
190
0
50
100
150
200
250
Station (ft)


XS 51 Plan: XS 51, existing 9/13/2004
River = Lemon Creek Reach = XS 51 RS = 51.1
.08
.04
.08
Elevation (ft)
Station (ft)
230
225
220
215
210
205
0
50
100
150
200
250
300
Legend
WS 100-yr
WS 50-yr
WS 25-yr
WS 10-yr
WS 5-yr
WS 2-yr
Ground
Levee
Bank Sta


XS 52 Plan: XS 52, existing 9/13/2004
River = Lemon Creek Reach = XS 52 RS = 52.1
.08
.04
.08
Legend
WS 100-yr
WS 50-yr
WS 25-yr
WS 10-yr
WS 5-yr
WS 2-yr
Ground
Bank Sta
Elevation (ft)
230
225
220
215
210
0
50
100
150
200
250
300
Station (ft)

Appendix G

Sediment Transport

Appendix G

Sediment Transport

Existing Channel (No in Stream Mining)
RediMix Bridge in Place

Below Hidden Valley **Existing conditions**

SAM Input

Transpose Reach average parameters

		50-cfs	250-cfs	1000-cfs	2000-cfs	3000-cfs	2 yr	10 yr	25 yr	50 yr	100 yr
reach	parameter	**1**	**2**	**4**	**6**	**7**	**8**	**10**	**11**	**12**	**13**
A	ra L	388	388	388	388	388	388	388	388	388	388
	ra Qch	46	229	916	1833	2752	3605	5421	6041	6447	6640
	ra Vch	0.11	0.52	2.09	4.18	6.26	8.18	11.26	11.49	12.24	12.62
	ra Yh	4.13	4.13	4.13	4.15	4.16	4.19	4.51	4.89	4.91	4.91
	ra TW	112.72	112.71	112.71	112.66	112.56	112.39	113.07	113.07	113.07	113.07
	ra Se	0.000001	0.000018	0.000289	0.001152	0.002585	0.004517	0.007275	0.006622	0.00763	0.00826
	ra Shear	0	0	0.07	0.29	0.66	1.13	2.09	2.05	2.31	2.46
B	ra L	954.5	954.5	954.5	954.5	954.5	954.5	954.5	954.5	954.5	954.5
	ra Qch	50	249	995	1981	2940	3812	5676	6327	6711	6878
	ra Vch	0.19	0.96	3.31	4.9	5.19	5.39	5.61	5.72	5.92	5.77
	ra Yh	3.98	4.03	4.61	6.12	8.5	10.62	15.21	16.62	17.03	17.92
	ra TW	66.71	66.73	66.99	67.69	68.46	68.46	68.46	68.46	68.46	68.46
	ra Se	0.000004	0.000088	0.000849	0.001226	0.000873	0.000699	0.000468	0.000433	0.000449	0.000398
	ra Shear	0	0.02	0.23	0.44	0.44	0.44	0.43	0.43	0.46	0.43
C	ra L	1452.5	1452.5	1452.5	1452.5	1452.5	1452.5	1452.5	1452.5	1452.5	1452.5
	ra Qch	50	250	997	1985	2925	3760	5541	6157	6524	6679
	ra Vch	1.54	2.29	3.66	4.28	4.31	4.23	3.98	3.92	3.99	3.84
	ra Yh	1.12	1.79	2.67	4.22	6.13	7.95	12.37	13.98	14.55	15.47
	ra TW	62.15	66.44	110.4	117.19	118.12	119.12	119.72	119.72	119.72	119.72
	ra Se	0.008119	0.001656	0.002328	0.001623	0.000986	0.00066	0.000319	0.000263	0.000258	0.000221
	ra Shear	0.2	0.16	0.34	0.4	0.35	0.31	0.24	0.23	0.23	0.21
D	ra L	1715	1715	1715	1715	1715	1715	1715	1715	1715	1715
	ra Qch	50	250	998	1993	2985	3899	5887	6575	6975	7155
	ra Vch	2.35	3.3	3.8	4.61	5.2	5.55	4.73	4.27	4.22	3.93
	ra Yh	0.78	1.05	1.67	2.36	3.17	4.09	7.32	8.79	9.34	10.19
	ra TW	31.77	75.7	160.8	187.67	189.41	189.41	189.41	189.41	189.41	189.41
	ra Se	0.004875	0.006623	0.004218	0.004075	0.003982	0.004503	0.00166	0.000895	0.000766	0.000558
	ra Shear	0.21	0.4	0.41	0.55	0.68	0.82	0.51	0.36	0.34	0.28
E	ra L	1902	1902	1902	1902	1902	1902	1902	1902	1902	1902
	ra Qch	50	249	991	1974	2954	3831	5769	6444	6829	7007
	ra Vch	1.87	3.03	4.66	5.93	6.83	7.28	8.8	9.18	9.4	9.4
	ra Yh	0.66	1.35	2.3	3.22	3.99	4.45	5.56	5.92	6.12	6.24
	ra TW	45.49	66.64	104.93	120.7	125.15	132.89	133.75	134.01	134.16	134.22
	ra Se	0.007257	0.006855	0.007635	0.00812	0.008282	0.008412	0.009436	0.009435	0.009465	0.009138
	ra Shear	0.26	0.55	1.12	1.64	2.04	2.25	3.06	3.27	3.39	3.37
F	ra L	1811.5	1811.5	1811.5	1811.5	1811.5	1811.5	1811.5	1811.5	1811.5	1811.5
	ra Qch	50	246	907	1711	2470	3152	4627	5129	5415	5550
	ra Vch	2.79	4.54	7.21	9.11	10.44	11.41	13.15	13.66	13.93	14.05
	ra Yh	0.87	1.91	3.88	5.52	6.81	7.85	9.82	10.44	10.79	10.94
	ra TW	24.83	34.79	39.57	41.75	42.35	42.82	43.49	43.68	43.79	43.84
	ra Se	0.033763	0.027272	0.022881	0.022808	0.022788	0.022632	0.022442	0.022358	0.02232	0.022303
	ra Shear	1.39	2.7	5.13	7.5	9.27	10.62	13.13	13.91	14.34	14.54
G	ra L	251	251	251	251	251	251	251	251	251	251
	ra Qch	50	244	888	1638	2382	2975	4252	4721	4975	5093
	ra Vch	3.39	5.03	7.56	8.65	9.81	10.08	10.25	10.59	10.68	10.71
	ra Yh	0.72	1.58	3.17	4.56	5.75	6.82	9.23	9.83	10.24	10.43
	ra TW	21.08	31.54	39.67	45.23	45.23	45.23	45.23	45.23	45.23	45.23
	ra Se	0.013027	0.010205	0.009223	0.007821	0.007292	0.006211	0.004256	0.004049	0.003872	0.003782
	ra Shear	0.58	1	1.77	2.07	2.47	2.47	2.34	2.41	2.41	2.41

Hidden Valley Area

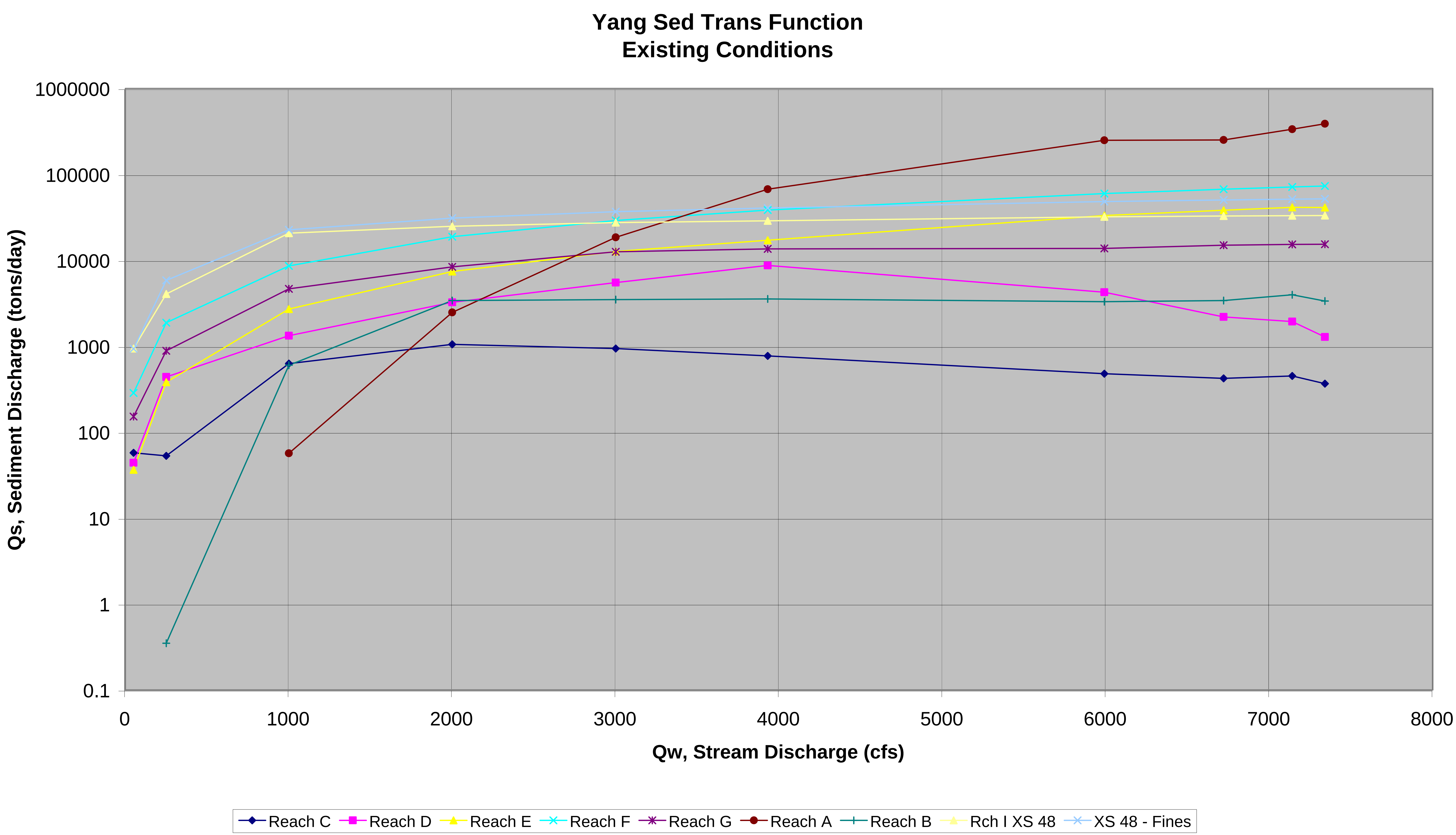
Existing conditions

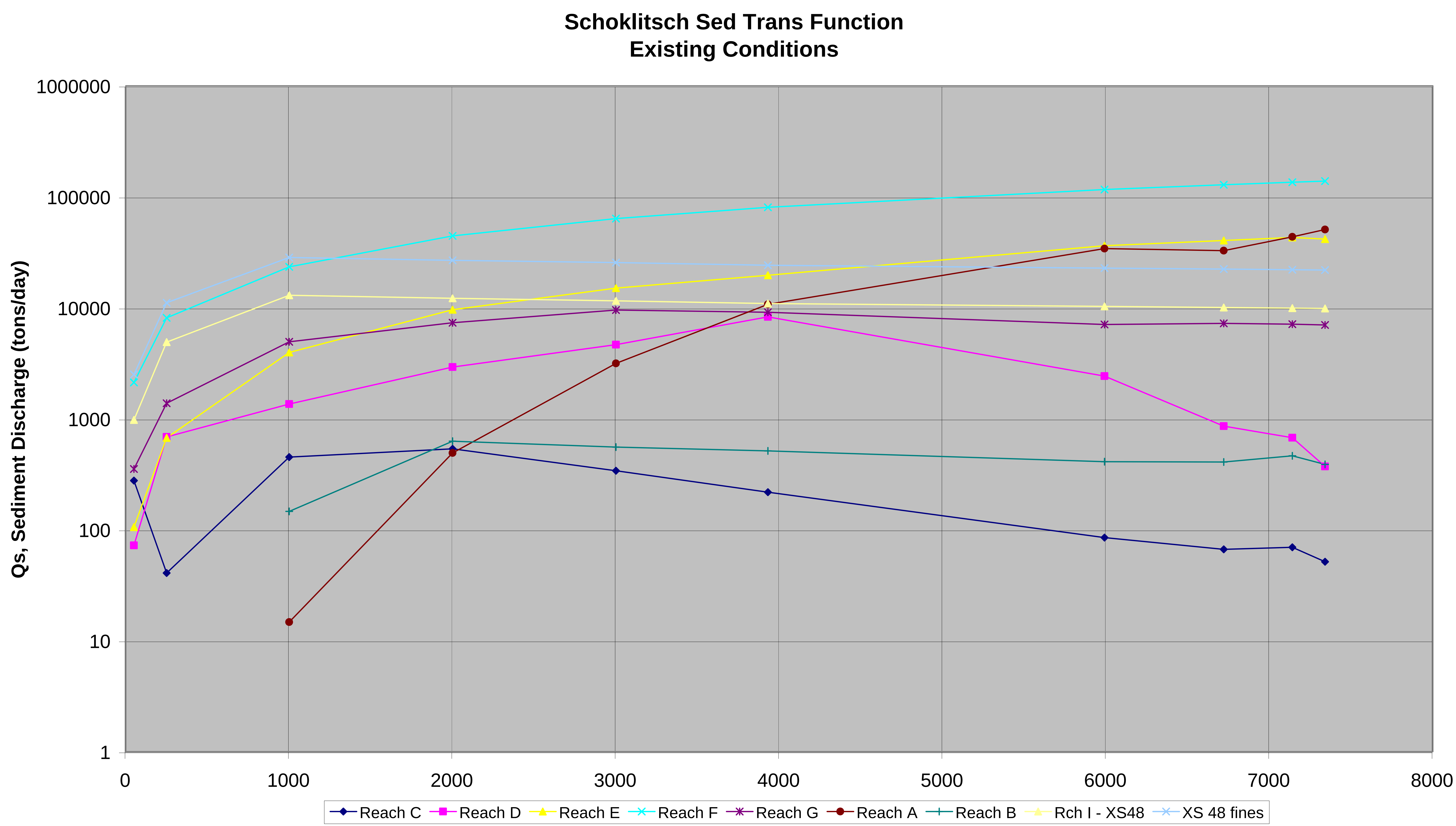
SAM Input: Hidden Valley Area

Transpose Reach average parameters

		50-cfs	250-cfs	1000-cfs	2000-cfs	3000-cfs	2 yr	10 yr	25 yr	50 yr	100 yr
reach	parameter	**1**	**2**	**4**	**6**	**7**	**8**	**10**	**11**	**12**	**13**
H	ra L	1017	1017	1017	1017	1017	1017	1017	1017	1017	1017
	ra Qch	50	250	997	1960	2890	3727	5391	5931	6256	6406
	ra Vch	2.5	3.85	6.11	7.78	8.86	9.42	10.24	10.56	10.77	10.87
	ra Yh	0.61	1.08	2.09	3.05	3.77	4.25	5.45	5.81	6	6.1
	ra TW	43.06	67.59	91.37	96.97	104.13	121.31	128.91	129.3	129.5	129.59
	ra Se	0.014522	0.0127	0.011265	0.010326	0.01003	0.009676	0.008171	0.008141	0.008117	0.00811
	ra Shear	0.39	0.7	1.37	1.94	2.36	2.61	2.86	3.01	3.11	3.16
I	ra L	1495	1495	1495	1495	1495	1495	1495	1495	1495	1495
	ra Qch	50	250	998	1978	2939	3802	5619	6244	6600	6769
	ra Vch	2.86	4.16	6.48	8.1	9.21	9.97	11.3	11.7	11.93	12.03
	ra Yh	0.51	0.93	1.86	2.76	3.55	4.2	5.42	5.81	6.02	6.12
	ra TW	39.15	66.96	86.52	92.63	93.88	94.63	95.36	95.42	95.45	95.46
	ra Se	0.015852	0.015325	0.014712	0.013205	0.012085	0.011281	0.01027	0.010053	0.009968	0.009931
	ra Shear	0.49	0.84	1.61	2.2	2.59	2.87	3.38	3.54	3.64	3.68
J	ra L	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000
	ra Qch	50	250	999.17	1990.07	2884.3	3637.27	5198.8	5726.82	6027.51	6169.99
	ra Vch	2.51	4	6.49	8.3	9.52	10.45	12.06	12.53	12.79	12.91
	ra Yh	0.66	1.33	2.76	4	4.93	5.66	7.02	7.44	7.67	7.78
	ra TW	30.13	47.06	55.89	59.93	61.46	61.46	61.46	61.46	61.46	61.46
	ra Se	0.008013	0.008002	0.008011	0.008003	0.008002	0.008008	0.008009	0.008005	0.008004	0.008003
	ra Shear	0.33	0.66	1.36	1.97	2.42	2.79	3.45	3.66	3.77	3.82
K	ra L	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000
	ra Qch	50	250	1000	1998	2995	3922	5959	6668	7074	7267
	ra Vch	3.48	5.545	7.69	8.555	9.755	10.63	11.95	12.38	12.62	12.72
	ra Yh	0.565	1.14	1.895	2.29	2.95	3.49	4.605	4.955	5.14	5.235
	ra TW	28.02	40.58	68.61	101.955	104.055	105.765	108.225	108.775	109.07	109.22
	ra Se	0.019006	0.019007	0.01869	0.018008	0.016743	0.01595	0.013971	0.013625	0.013488	0.01339
	ra Shear	0.67	1.345	2.175	2.525	3.02	3.4	3.915	4.1	4.215	4.255

	ra L										
48	ra Qch	50	250	989	1934	2837	3630	5299	5865	6184	6336
	ra Vch	3.1	4.68	5.66	6.24	6.59	6.84	7.3	7.42	7.48	7.5
	ra Yh	0.4	0.79	1.31	2.19	2.96	3.64	4.98	5.42	5.67	5.79
	ra TW	40.78	67.61	133.11	141.32	145.69	145.83	145.83	145.83	145.83	145.83
	ra Se	0.024051	0.021765	0.016219	0.009974	0.007466	0.006113	0.004567	0.004212	0.00403	0.00395
	ra Shear	0.59	1.07	1.33	1.36	1.37	1.38	1.41	1.42	1.42	1.42


Yang Sed Trans Function
Existing Conditions
Qs, Sediment Discharge (tons/day)
1000000
100000
10000
1000
100
10
1
0.1
0
1000
2000
3000
4000
5000
6000
7000
8000
Qw, Stream Discharge (cfs)
Reach C
Reach D
Reach E
Reach F
Reach G
Reach A
Reach B
Rch I XS 48
XS 48 - Fines


Schoklitsch Sed Trans Function
Existing Conditions
Qs, Sediment Discharge (tons/day)
1000000
100000
10000
1000
100
10
1
0
1000
2000
3000
4000
5000
6000
7000
8000
Reach C
Reach D
Reach E
Reach F
Reach G
Reach A
Reach B
Rch I - XS48
XS 48 fines

Lemon Creek - Reach A **Existing Conditions**

Threshold Flow to Mobilize, D 84
Di = 41.67 mm
Q(threshold) = 2161 cfs

SAM generated rating curve of stream discharge (Qw) to sediment transport potential (Qs)

TABLE 5.0 SUMMARY TABLE: BED-MATERIAL SEDIMENT DISCHARGE, TONS/DAY

Q NO	WATER DISCHARGE total	channel	TRANSPORT FUNCTIONS YANG. (HEC-6)	LAURSEN (MADDEN), 85	PARKER	SCHOKLITSCH
1	50	46	0	0	0	0
2	250	229	0	1.13	0	0
3	1000	916	56.84	1364.4	0	14.72
4	2000	1833	2476.76	20274.84	24.43	491.81
5	3000	2752	18513.36	82828.01	1810.73	3155.21
6	3930	3605	67253.16	208554.56	14747.32	10742.12
7	5990	5421	249220.8	567237.13	66314.88	34097.22
8	6720	6041	251598.4	584910.25	64251.04	32743.77
9	7140	6447	335773.2	724820.38	90432.67	43541.86
10	7340	6640	389054.4	807648.94	108080.1	50680.72

Conversion: tons - cubic yards

Lemon Creek gravel = 130 lb/cy
conversion = (cf/130lb) * (cy/27cf) * (2000lb/ton)
0.569801 cy/ton
1.755 ton/cy

Assume: no bulkage or shrinkage

1	46	0	0	0	0
2	229	0	1.13	0	0
3	916	56.84	1364.4	0	14.72
4	1833	2476.76	20274.84	24.43	491.81
5	2752	18513.36	82828.01	1810.73	3155.21
6	3605	67253.16	208554.6	14747.32	10742.12
7	5421	249220.8	567237.1	66314.88	34097.22
8	6041	251598.4	584910.3	64251.04	32743.77
9	6447	335773.2	724820.4	90432.67	43541.86
10	6640	389054.4	807648.9	108080.06	50680.72

Lemon Creek - Reach A **Existing Conditions**

Event	Reach A - Summary Qsed (cy/event)			
	YANG. (HEC-6)	LAURSEN (MADDEN), 85	PARKER	SCHOKLITSCH
2-yr	15467.8	62821.8	2344.5	2582.6
5-yr	85778.2	245902.7	19700.9	12754.6
25-yr	117613.3	320868.3	28006.7	17143
50-yr	137963	366229.3	33430.6	19787.7
100-yr	148377.4	388659.6	36263.9	21127.2

2-yr hydrograph		Qsed (tons/hr)			
Duration (hrs)	Ave Qw (cfs)	YANG. (HEC-6)	LAURSEN (MADDEN), 85	PARKER	SCHOKLITSCH
24	880	0	0	0	0
18	1743	0	0	0	0
10	2897	702.57	3182.71	67.78	120.04
3	3486	1832.66	6188.76	357.13	296.67
1	3930	2802.22	8689.77	614.47	447.59
4	3486	1832.66	6188.76	357.13	296.67
16	2257	274.92	1514.63	20.15	49.01
24	941	2.18	52.38	0	0.57
24	757	1.6	38.45	0	0.41
	tons/event	27146	110252.2	4114.6	4532.4
	cy/event	15467.8	62821.8	2344.5	2582.6

5-yr hydrograph		Qsed (tons/hr)			
Duration (hrs)	Ave Qw (cfs)	YANG. (HEC-6)	LAURSEN (MADDEN), 85	PARKER	SCHOKLITSCH
24	1341	0	0	0	0
18	2656	541.53	2554.57	49.84	93.29
10	4416	4590.97	12215.66	1121.39	677.17
3	5313	7892.45	18723.31	2056.99	1100.91
1	5990	10384.2	23634.88	2763.12	1420.72
4	5313	7892.45	18723.31	2056.99	1100.91
16	3440	1732.21	5929.65	330.47	281.03
24	1434	46.13	398.81	0.44	9.24
24	1154	17.9	178.19	0.16	3.67
	tons/event	150540.7	431559.3	34575	22384.3
	cy/event	85778.2	245902.7	19700.9	12754.6

Lemon Creek - Reach A **Existing Conditions**

25-yr hydrograph		Qsed (tons/hr)			
Duration (hrs)	Ave Qw (cfs)	YANG. (HEC-6)	LAURSEN (MADDEN), 85	PARKER	SCHOKLITSCH
24	1505	0	0	0	0
18	2980	758.03	3399.04	73.96	129.25
10	4954	6571.12	16118.8	1682.54	931.32
3	5960	10273.78	23417.23	2731.83	1406.55
1	6720	10483.27	24371.26	2677.13	1364.32
4	5960	10273.78	23417.23	2731.83	1406.55
16	3859	2647.17	8289.84	573.32	423.45
24	1609	63.77	536.7	0.62	12.72
24	1295	32.11	289.29	0.3	6.48
	tons/event	206411.3	563123.8	49151.8	30085.9
	cy/event	117613.3	320868.3	28006.7	17143

50-yr hydrograph		Qsed (tons/hr)			
Duration (hrs)	Ave Qw (cfs)	YANG. (HEC-6)	LAURSEN (MADDEN), 85	PARKER	SCHOKLITSCH
24	1599	0	0	0	0
18	3166	1133.88	4386.23	171.66	187.89
10	5264	7712.1	18367.82	2005.88	1077.76
3	6333	10430.75	23980.88	2722.71	1394.22
1	7140	13990.55	30200.85	3768.03	1814.24
4	6333	10430.75	23980.88	2722.71	1394.22
16	4100	3427.91	9923.11	791.79	527.9
24	1710	73.96	616.28	0.72	14.73
24	1376	40.28	353.11	0.38	8.09
	tons/event	242125	642732.5	58670.7	34727.5
	cy/event	137963	366229.3	33430.6	19787.7

100-yr hydrograph		Qsed (tons/hr)			
Duration (hrs)	Ave Qw (cfs)	YANG. (HEC-6)	LAURSEN (MADDEN), 85	PARKER	SCHOKLITSCH
24	1644	0	0	0	0
18	3255	1328.23	4887.56	223.24	218.15
10	5411	8253.15	19434.29	2159.2	1147.2
3	6510	10454.77	24159.43	2701.86	1380.55
1	7340	16210.6	33652.04	4503.34	2111.7
4	6510	10454.77	24159.43	2701.86	1380.55
16	4215	3851.18	10757.42	911.74	582.22
24	1758	78.8	654.1	0.77	15.68
24	1414	44.11	383.06	0.42	8.84
	tons/event	260402.4	682097.6	63643.1	37078.3
	cy/event	148377.4	388659.6	36263.9	21127.2

Lemon Creek - Reach B **Existing Conditions**

Threshold Flow to Mobilize, D 84
Di = 41.67 mm
Q(threshold) = 1872 cfs

SAM generated rating curve of stream discharge (Qw) to sediment transport potential (Qs)
TABLE 5.0 SUMMARY TABLE: BED-MATERIAL SEDIMENT DISCHARGE, TONS/DAY

Q NO	WATER DISCHARGE total	channel	TRANSPORT FUNCTIONS YANG. (HEC-6)	LAURSEN (MADDEN), 85	PARKER	SCHOKLITSCH
1	50	50	0	0	0	0
2	250	249	0.35	34.35	0	0
3	1000	995	600.23	6273.17	2.76	146.16
4	2000	1981	3398.63	23122.38	204.8	627.2
5	3000	2940	3485.74	25800.4	195.93	555.39
6	3930	3812	3549.09	27638.42	196.31	513.52
7	5990	5676	3296.46	28840.29	158.53	409.94
8	6720	6327	3406.74	30094.08	167.69	406.79
9	7140	6711	3971.68	33485.21	227.58	463.87
10	7340	6878	3358.48	30384.55	160.13	387.87

Conversion: tons - cubic yards
Lemon Creek gravel = 130 lb/cy
conversion = (cf/130lb) * (cy/27cf) * (2000lb/ton)
0.5698 cy/ton
1.755 ton/cy
Assume: no bulkage or shrinkage

1	50	0	0	0	0
2	249	0.35	34.35	0	0
3	995	600.23	6273.17	2.76	146.16
4	1981	3398.63	23122.4	204.8	627.2
5	2940	3485.74	25800.4	195.93	555.39
6	3812	3549.09	27638.4	196.31	513.52
7	5676	3296.46	28840.3	158.53	409.94
8	6327	3406.74	30094.1	167.69	406.79
9	6711	3971.68	33485.2	227.58	463.87
10	6878	3358.48	30384.6	160.13	387.87

Lemon Creek - Reach B **Existing Conditions**

Event	Reach B - Summary Qsed (cy/event)			
	YANG. (HEC-6)	LAURSEN (MADDEN), 85	PARKER	SCHOKLITSCH
2-yr	3340.4	25925.9	163.5	598.7
5-yr	5902.3	45598.5	307	978.8
25-yr	6403	49484.7	338.2	1036.3
50-yr	6705	51710.4	358.6	1075.2
100-yr	6824.8	52634.1	365.9	1091.1

2-yr hydrograph		Qsed (tons/hr)			
Duration (hrs)	Ave Qw (cfs)	YANG. (HEC-6)	LAURSEN (MADDEN), 85	PARKER	SCHOKLITSCH
24	880	0	0	0	0
18	1743	0	0	0	0
10	2897	144.87	1063.52	8.2	23.45
3	3486	146.62	1115.04	8.17	22.23
1	3930	147.88	1151.6	8.18	21.4
4	3486	146.62	1115.04	8.17	22.23
16	2257	142.54	992.11	8.44	25.36
24	941	23.04	240.93	0.11	5.61
24	757	16.91	177.16	0.08	4.12
	tons/event	5862.4	45500	287	1050.8
	cy/event	3340.4	25925.9	163.5	598.7

5-yr hydrograph		Qsed (tons/hr)			
Duration (hrs)	Ave Qw (cfs)	YANG. (HEC-6)	LAURSEN (MADDEN), 85	PARKER	SCHOKLITSCH
24	1341	0	0	0	0
18	2656	143.99	1036.63	8.29	24.17
10	4416	145.4	1163.42	7.81	20.38
3	5313	140.81	1185.22	7.12	18.5
1	5990	137.35	1201.68	6.61	17.08
4	5313	140.81	1185.22	7.12	18.5
16	3440	146.49	1111.25	8.17	22.32
24	1434	75.61	566.07	3.77	14.79
24	1154	42.97	369.5	1.41	9.18
	tons/event	10358.6	80025.4	538.8	1717.8
	cy/event	5902.3	45598.5	307	978.8

Lemon Creek - Reach B **Existing Conditions**

25-yr hydrograph		Qsed (tons/hr)			
Duration (hrs)	Ave Qw (cfs)	YANG. (HEC-6)	LAURSEN (MADDEN), 85	PARKER	SCHOKLITSCH
24	1505	0	0	0	0
18	2980	145.17	1072.78	8.17	23.2
10	4954	142.65	1176.49	7.4	19.25
3	5960	137.51	1200.95	6.63	17.14
1	6720	141.95	1253.92	6.99	16.95
4	5960	137.51	1200.95	6.63	17.14
16	3859	147.68	1145.75	8.18	21.53
24	1609	96.02	688.93	5.24	18.3
24	1295	59.41	468.49	2.6	12
	tons/event	11237.3	86845.6	593.5	1818.7
	cy/event	6403	49484.7	338.2	1036.3

50-yr hydrograph		Qsed (tons/hr)			
Duration (hrs)	Ave Qw (cfs)	YANG. (HEC-6)	LAURSEN (MADDEN), 85	PARKER	SCHOKLITSCH
24	1599	0	0	0	0
18	3166	145.71	1088.69	8.17	22.83
10	5264	141.06	1184.03	7.16	18.6
3	6333	139.51	1226.22	6.78	17.02
1	7140	165.49	1395.22	9.48	19.33
4	6333	139.51	1226.22	6.78	17.02
16	4100	147.01	1155.73	8.05	21.04
24	1710	107.8	759.84	6.09	20.32
24	1376	68.85	525.35	3.28	13.63
	tons/event	11767.2	90751.7	629.3	1886.9
	cy/event	6705	51710.4	358.6	1075.2

100-yr hydrograph		Qsed (tons/hr)			
Duration (hrs)	Ave Qw (cfs)	YANG. (HEC-6)	LAURSEN (MADDEN), 85	PARKER	SCHOKLITSCH
24	1644	0	0	0	0
18	3255	145.96	1096.02	8.17	22.66
10	5411	140.31	1187.6	7.05	18.29
3	6510	140.63	1238.89	6.88	16.99
1	7340	139.94	1266.02	6.67	16.16
4	6510	140.63	1238.89	6.88	16.99
16	4215	146.42	1158.53	7.96	20.8
24	1758	113.39	793.54	6.5	21.28
24	1414	73.28	552.03	3.6	14.39
	tons/event	11977.5	92372.8	642.2	1914.8
	cy/event	6824.8	52634.1	365.9	1091.1

Lemon Creek - Reach C **Existing Conditions**

Threshold Flow to Mobilize, D 84
Di = 40.39 mm
Q(threshold) = 5139 cfs

SAM generated rating curve of stream discharge (Qw) to sediment transport potential (Qs)
TABLE 5.0 SUMMARY TABLE: BED-MATERIAL SEDIMENT DISCHARGE, TONS/DAY

Q NO	WATER DISCHARGE total	channel	TRANSPORT FUNCTIONS YANG. (HEC-6)	LAURSEN (MADDEN), 85	PARKER	SCHOKLITSCH
1	50	50	57.46	14.7	401.86	276.68
2	250	250	52.99	16.6	0.08	40.71
3	1000	997	627.22	187.61	115.76	450.76
4	2000	1985	1052.32	313.24	207.41	535.79
5	3000	2925	938.67	267.54	105.95	340.27
6	3930	3760	772.26	215.07	46.32	218.22
7	5990	5541	479.04	130.29	5.51	84.86
8	6720	6157	422.79	115.73	2.68	66.55
9	7140	6524	451.18	122.38	3.36	69.47
10	7340	6679	367.13	102.41	1.09	51.49

Conversion: tons - cubic yards
Lemon Creek gravel = 130 lb/cy
conversion = (cf/130lb) * (cy/27cf) * (2000lb/ton)
0.5698 cy/ton
1.755 ton/cy
Assume: no bulkage or shrinkage

Lemon Creek - Reach C **Existing Conditions**

Event	Reach C - Summary Qsed (cy/event)			
	YANG. (HEC-6)	LAURSEN (MADDEN), 85	PARKER	SCHOKLITSCH
2-yr	1070.8	317	182.5	635.6
5-yr	1290.8	377.4	195.4	672.9
25-yr	1322.3	386.3	199.5	660
50-yr	1486.2	432	210.4	690.6
100-yr	1491.6	433.7	213.2	688.6

2-yr hydrograph		Qsed (tons/hr)			
Duration (hrs)	Ave Qw (cfs)	YANG. (HEC-6)	LAURSEN (MADDEN), 85	PARKER	SCHOKLITSCH
24	880	0	0	0	0
18	1743	0	0	0	0
10	2897	0	0	0	0
3	3486	0	0	0	0
1	3930	32.18	8.96	1.93	9.09
4	3486	35.49	10.01	3.12	11.52
16	2257	42.63	12.56	7.56	20.23
24	941	24.25	7.26	4.44	17.44
24	757	18.38	5.51	3.26	13.25
	tons/event	1879.3	556.4	320.2	1115.4
	cy/event	1070.8	317	182.5	635.6

5-yr hydrograph		Qsed (tons/hr)			
Duration (hrs)	Ave Qw (cfs)	YANG. (HEC-6)	LAURSEN (MADDEN), 85	PARKER	SCHOKLITSCH
24	1341	0	0	0	0
18	2656	0	0	0	0
10	4416	0	0	0	0
3	5313	23.98	6.59	0.79	5.36
1	5990	19.96	5.43	0.23	3.54
4	5313	23.98	6.59	0.79	5.36
16	3440	35.83	10.11	3.24	11.77
24	1434	33.82	10.09	6.48	20.32
24	1154	28.86	8.62	5.41	19.33
	tons/event	2265.4	662.4	343	1181
	cy/event	1290.8	377.4	195.4	672.9

Lemon Creek - Reach C **Existing Conditions**

25-yr hydrograph		Qsed (tons/hr)			
Duration (hrs)	Ave Qw (cfs)	YANG. (HEC-6)	LAURSEN (MADDEN), 85	PARKER	SCHOKLITSCH
24	1505	0	0	0	0
18	2980	0	0	0	0
10	4954	0	0	0	0
3	5960	20.14	5.48	0.25	3.62
1	6720	17.62	4.82	0.11	2.77
4	5960	20.14	5.48	0.25	3.62
16	3859	32.71	9.13	2.12	9.48
24	1609	36.92	11	7.15	20.94
24	1295	31.36	9.36	5.95	19.83
	tons/event	2320.7	677.9	350.2	1158.3
	cy/event	1322.3	386.3	199.5	660

50-yr hydrograph		Qsed (tons/hr)			
Duration (hrs)	Ave Qw (cfs)	YANG. (HEC-6)	LAURSEN (MADDEN), 85	PARKER	SCHOKLITSCH
24	1599	0	0	0	0
18	3166	0	0	0	0
10	5264	24.27	6.67	0.83	5.49
3	6333	18.86	5.14	0.17	3.18
1	7140	18.8	5.1	0.14	2.89
4	6333	18.86	5.14	0.17	3.18
16	4100	31.17	8.67	1.79	8.63
24	1710	38.71	11.53	7.53	21.3
24	1376	32.79	9.79	6.26	20.11
	tons/event	2608.2	758.2	369.2	1212
	cy/event	1486.2	432	210.4	690.6

100-yr hydrograph		Qsed (tons/hr)			
Duration (hrs)	Ave Qw (cfs)	YANG. (HEC-6)	LAURSEN (MADDEN), 85	PARKER	SCHOKLITSCH
24	1644	0	0	0	0
18	3255	0	0	0	0
10	5411	23.39	6.42	0.71	5.1
3	6510	18.29	5	0.15	2.99
1	7340	15.3	4.27	0.05	2.15
4	6510	18.29	5	0.15	2.99
16	4215	30.49	8.47	1.69	8.32
24	1758	39.56	11.78	7.72	21.47
24	1414	33.47	9.98	6.4	20.25
	tons/event	2617.8	761.2	374.1	1208.5
	cy/event	1491.6	433.7	213.2	688.6

Lemon Creek - Reach D **Existing Conditions**

Threshold Flow to Mobilize, D 84
Di = 36.06 mm
Q(threshold) = 214 cfs

SAM generated rating curve of stream discharge (Qw) to sediment transport potential (Qs)

TABLE 5.0 SUMMARY TABLE: BED-MATERIAL SEDIMENT DISCHARGE, TONS/DAY

Q NO	WATER DISCHARGE total	channel	TRANSPORT FUNCTIONS YANG. (HEC-6)	LAURSEN (MADDEN), 85	PARKER	SCHOKLITSCH
1	50	50	44.03	13.21	4.36	72.19
2	250	250	438.72	135.46	271.14	685.35
3	1000	998	1325.19	396.45	610.95	1356.13
4	2000	1993	3247.52	1114.97	2900.77	2927.04
5	3000	2985	5510.71	2333.79	8369.74	4644.27
6	3930	3899	8725.81	4320.08	27859.86	8289.51
7	5990	5887	4261.4	1581.83	7302.89	2423.66
8	6720	6575	2195.27	564.12	1195.69	857.38
9	7140	6975	1935.72	485.64	772.81	675.36
10	7340	7155	1282	297.22	252.63	372.07

Conversion: tons - cubic yards

Lemon Creek gravel = 130 lb/cy
conversion = (cf/130lb) * (cy/27cf) * (2000lb/ton)
0.5698 cy/ton
1.755 ton/cy
Assume: no bulkage or shrinkage

NO	DISCHARGE	YANG. (HEC-6)	LAURSEN (MADDEN), 85	PARKER	SCHOKLITSCH
1	50	44.03	13.21	4.36	72.19
2	250	438.72	135.46	271.14	685.35
3	998	1325.19	396.45	610.95	1356.13
4	1993	3247.52	1114.97	2900.77	2927.04
5	2985	5510.71	2333.79	8369.74	4644.27
6	3899	8725.81	4320.08	27859.86	8289.51
7	5887	4261.4	1581.83	7302.89	2423.66
8	6575	2195.27	564.12	1195.69	857.38
9	6975	1935.72	485.64	772.81	675.36
10	7155	1282	297.22	252.63	372.07

Lemon Creek - Reach D **Existing Conditions**

Event	Reach D - Summary Qsed (cy/event)			
	YANG. (HEC-6)	LAURSEN (MADDEN), 85	PARKER	SCHOKLITSCH
2-yr	7267.6	2721.3	9157.9	6806.8
5-yr	10851.1	4442.1	19684.2	9721.7
25-yr	11681.7	4810.4	21910.8	10305.8
50-yr	11863.9	4871.2	22454.1	10417
100-yr	11869.9	4856.1	22379.5	10389.2

2-yr hydrograph		Qsed (tons/hr)			
Duration (hrs)	Ave Qw (cfs)	YANG. (HEC-6)	LAURSEN (MADDEN), 85	PARKER	SCHOKLITSCH
24	880	49.31	14.78	23.19	52.03
18	1743	114.73	38.76	96.35	105.14
10	2897	219.9	92.01	325.27	186.14
3	3486	299.62	140.49	773.12	272.88
1	3930	363.58	180	1160.83	345.4
4	3486	299.62	140.49	773.12	272.88
16	2257	159.55	59.51	179.43	140.35
24	941	52.31	15.66	24.34	54.31
24	757	43.25	13	20.87	47.45
	tons/event	12754.7	4775.9	16072.2	11946
	cy/event	7267.6	2721.3	9157.9	6806.8

5-yr hydrograph		Qsed (tons/hr)			
Duration (hrs)	Ave Qw (cfs)	YANG. (HEC-6)	LAURSEN (MADDEN), 85	PARKER	SCHOKLITSCH
24	1341	82.53	26.73	57.99	78.83
18	2656	197.17	79.77	270.35	168.9
10	4416	319.69	153.09	958.75	287.73
3	5313	238.69	103.41	585.78	181.31
1	5990	177.56	65.91	304.29	100.99
4	5313	238.69	103.41	585.78	181.31
16	3440	292.99	136.4	732.95	265.37
24	1434	89.98	29.51	66.86	84.91
24	1154	67.55	21.13	40.15	66.59
	tons/event	19043.6	7795.8	34545.8	17061.5
	cy/event	10851.1	4442.1	19684.2	9721.7

Lemon Creek - Reach D **Existing Conditions**

25-yr hydrograph		Qsed (tons/hr)			
Duration (hrs)	Ave Qw (cfs)	YANG. (HEC-6)	LAURSEN (MADDEN), 85	PARKER	SCHOKLITSCH
24	1505	95.67	31.64	73.64	89.56
18	2980	227.73	96.23	344.18	192.08
10	4954	271.11	123.29	735.05	223.9
3	5960	180.27	67.57	316.76	104.55
1	6720	91.47	23.51	49.82	35.72
4	5960	180.27	67.57	316.76	104.55
16	3859	353.35	173.68	1098.83	333.8
24	1609	104	34.75	83.56	96.37
24	1295	78.84	25.35	53.6	75.81
	tons/event	20501.4	8442.2	38453.4	18086.6
	cy/event	11681.7	4810.4	21910.8	10305.8

50-yr hydrograph		Qsed (tons/hr)			
Duration (hrs)	Ave Qw (cfs)	YANG. (HEC-6)	LAURSEN (MADDEN), 85	PARKER	SCHOKLITSCH
24	1599	103.19	34.45	82.61	95.71
18	3166	253.52	112.01	493.69	220.62
10	5264	243.12	106.12	606.16	187.12
3	6333	137.11	45.99	184.72	70.32
1	7140	80.66	20.24	32.2	28.14
4	6333	137.11	45.99	184.72	70.32
16	4100	348.22	170.59	1090.14	325.23
24	1710	112.09	37.77	93.2	102.98
24	1376	85.33	27.78	61.33	81.12
	tons/event	20821.2	8549	39406.9	18281.9
	cy/event	11863.9	4871.2	22454.1	10417

100-yr hydrograph		Qsed (tons/hr)			
Duration (hrs)	Ave Qw (cfs)	YANG. (HEC-6)	LAURSEN (MADDEN), 85	PARKER	SCHOKLITSCH
24	1644	106.8	35.8	86.9	98.66
18	3255	266.34	119.93	571.41	235.16
10	5411	229.84	97.98	545.03	169.68
3	6510	116.23	35.7	123.02	54.5
1	7340	53.42	12.38	10.53	15.5
4	6510	116.23	35.7	123.02	54.5
16	4215	337.84	164.22	1042.33	311.58
24	1758	115.93	39.21	97.78	106.12
24	1414	88.38	28.91	64.96	83.6
	tons/event	20831.6	8522.4	39276	18233.1
	cy/event	11869.9	4856.1	22379.5	10389.2

Lemon Creek - Reach E **Existing Conditions**

Threshold Flow to Mobilize, D 84
Di = 58.06 mm
Q(threshold) = 292 cfs

SAM generated rating curve of stream discharge (Qw) to sediment transport potential (Qs)
TABLE 5.0 SUMMARY TABLE: BED-MATERIAL SEDIMENT DISCHARGE, TONS/DAY

Q NO	WATER DISCHARGE total	channel	TRANSPORT FUNCTIONS YANG. (HEC-6)	LAURSEN (MADDEN), 85	PARKER	SCHOKLITSCH
1	50	50	36.47	9.8	2.92	105.6
2	250	249	380.61	90.45	166.31	672.04
3	1000	991	2710.52	1295.48	4736.99	3963.1
4	2000	1974	7390.58	3930.09	21853.91	9616.86
5	3000	2954	12698.5	7377.66	45013.29	15054.12
6	3930	3831	17137.3	10725.18	66811.73	19644.98
7	5990	5769	33263.9	26657.93	153250	36182.36
8	6720	6444	38250.1	31567.76	176923.4	40363.12
9	7140	6829	41370.3	34719.56	192068.5	43037.39
10	7340	7007	41083.2	34034.24	185560.7	41620.52

Conversion: tons - cubic yards
Lemon Creek gravel = 130 lb/cy
conversion = (cf/130lb) * (cy/27cf) * (2000lb/ton)
0.5698 cy/ton
1.755 ton/cy
Assume: no bulkage or shrinkage

NO (HEC-6)	DISCHARC (MADDEN)	YANG. 85	LAURSEI	PARKER	SCHOKLITSCH
1	50	36.47	9.8	2.92	105.6
2	249	380.61	90.45	166.31	672.04
3	991	2710.52	1295.48	4736.99	3963.1
4	1974	7390.58	3930.09	21853.91	9616.86
5	2954	12698.48	7377.66	45013.29	15054.12
6	3831	17137.34	10725.2	66811.73	19644.98
7	5769	33263.86	26657.9	153249.97	36182.36
8	6444	38250.12	31567.8	176923.39	40363.12
9	6829	41370.3	34719.6	192068.53	43037.39
10	7007	41083.15	34034.2	185560.67	41620.52

Lemon Creek - Reach E **Existing Conditions**

Event	Reach E - Summary Qsed (cy/event)			
	YANG. (HEC-6)	LAURSEN (MADDEN), 85	PARKER	SCHOKLITSCH
2-yr	15644.2	8486.5	45734.7	20200.3
5-yr	27787.7	17290.9	99096.9	33504.4
25-yr	32522.3	20997.9	121149.2	38576.9
50-yr	35355.3	23359.7	134549.2	41535.3
100-yr	36695.6	24482.8	140815.3	42910.7

2-yr hydrograph		Qsed (tons/hr)			
Duration (hrs)	Ave Qw (cfs)	YANG. (HEC-6)	LAURSEN (MADDEN), 85	PARKER	SCHOKLITSCH
24	880	97.41	45.94	166.9	143.19
18	1743	257.83	135.54	727.29	340.16
10	2897	506.32	292.61	1776.16	603.92
3	3486	625.76	380.29	2350.2	727.22
1	3930	714.06	446.88	2783.82	818.54
4	3486	625.76	380.29	2350.2	727.22
16	2257	364.78	200.67	1158.58	458.93
24	941	105.3	50.03	182.39	154.34
24	757	81.48	37.71	135.67	120.7
	tons/event	27455.6	14893.8	80264.4	35451.6
	cy/event	15644.2	8486.5	45734.7	20200.3

5-yr hydrograph		Qsed (tons/hr)			
Duration (hrs)	Ave Qw (cfs)	YANG. (HEC-6)	LAURSEN (MADDEN), 85	PARKER	SCHOKLITSCH
24	1341	179.43	91.41	440.58	245.46
18	2656	453.02	257.99	1543.6	549.32
10	4416	872.58	603.5	3633.52	981.1
3	5313	1165.17	892.57	5201.78	1281.15
1	5990	1385.99	1110.75	6385.42	1507.6
4	5313	1165.17	892.57	5201.78	1281.15
16	3440	616.61	373.39	2305.27	717.76
24	1434	197.57	101.62	506.91	267.37
24	1154	142.97	70.88	307.21	201.41
	tons/event	48767.4	30345.6	173915	58800.3
	cy/event	27787.7	17290.9	99096.9	33504.4

Lemon Creek - Reach E **Existing Conditions**

25-yr hydrograph		Qsed (tons/hr)			
Duration (hrs)	Ave Qw (cfs)	YANG. (HEC-6)	LAURSEN (MADDEN), 85	PARKER	SCHOKLITSCH
24	1505	211.41	109.41	557.54	284.09
18	2980	524.68	304.53	1856.25	622.72
10	4954	1048.07	776.88	4574.13	1161.06
3	5960	1376.21	1101.08	6332.97	1497.56
1	6720	1593.76	1315.32	7371.81	1681.8
4	5960	1376.21	1101.08	6332.97	1497.56
16	3859	699.94	436.23	2714.48	803.94
24	1609	231.69	120.83	631.72	308.59
24	1295	170.46	86.36	407.77	234.62
	tons/event	57076.7	36851.3	212616.8	67702.5
	cy/event	32522.3	20997.9	121149.2	38576.9

50-yr hydrograph		Qsed (tons/hr)			
Duration (hrs)	Ave Qw (cfs)	YANG. (HEC-6)	LAURSEN (MADDEN), 85	PARKER	SCHOKLITSCH
24	1599	229.74	119.73	624.58	306.24
18	3166	562.12	332.3	2037.67	661.4
10	5264	1149.18	876.78	5116.12	1264.76
3	6333	1483.61	1206.87	6848.88	1589.45
1	7140	1723.76	1446.65	8002.86	1793.22
4	6333	1483.61	1206.87	6848.88	1589.45
16	4100	769.51	501.67	3081.04	875.4
24	1710	251.39	131.92	703.75	332.39
24	1376	186.26	95.25	465.54	253.7
	tons/event	62048.5	40996.3	236133.8	72894.5
	cy/event	35355.3	23359.7	134549.2	41535.3

100-yr hydrograph		Qsed (tons/hr)			
Duration (hrs)	Ave Qw (cfs)	YANG. (HEC-6)	LAURSEN (MADDEN), 85	PARKER	SCHOKLITSCH
24	1644	238.52	124.67	656.68	316.84
18	3255	579.82	345.65	2124.6	679.7
10	5411	1197.13	924.16	5373.12	1313.93
3	6510	1533.99	1256.47	7088.05	1631.68
1	7340	1711.8	1418.09	7731.69	1734.19
4	6510	1533.99	1256.47	7088.05	1631.68
16	4215	807.02	538.73	3282.1	913.87
24	1758	260.75	137.19	737.98	343.69
24	1414	193.67	99.43	492.64	262.66
	tons/event	64400.7	42967.3	247130.8	75308.3
	cy/event	36695.6	24482.8	140815.3	42910.7

Lemon Creek - Reach I: XS 48 **Existing Conditions**

GSD from Sample: 3sub
Threshold Flow to Mobilize, D 84
Di = 74.61 mm
Q(threshold) = 119 cfs

SAM generated rating curve of stream discharge (Qw) to sediment transport potential (Qs)

TABLE 5.0 SUMMARY TABLE: BED-MATERIAL SEDIMENT DISCHARGE, TONS/DAY

Q NO	WATER DISCHARGE total	channel	TRANSPORT FUNCTIONS YANG. (HEC-6)	LAURSEN (MADDEN), 85	PARKER	SCHOKLITSCH
1	50	50	939.18	3100.86	57.54	974.75
2	250	250	4054.85	12974.64	1617.28	4901.16
3	1000	989.13	20730.44	63375.7	8158.54	12953.26
4	2000	1933.85	24865.59	82190.48	9701.78	12172.71
5	3000	2837.15	27450.04	94435.79	10484.44	11560.01
6	3930	3630.06	28802.06	101695.91	10787.42	10912.67
7	5990	5299.42	32023.32	116669.21	11769.7	10276.58
8	6720	5865.11	32790.11	120564.21	11945.23	10060.4
9	7140	6184.36	33121.59	122433.76	11988.77	9922.29
10	7340	6335.82	33204.54	123073.6	12031.03	9854.53

Conversion: tons - cubic yards

Lemon Creek gravel = 130 lb/cy
conversion = (cf/130lb) * (cy/27cf) * (2000lb/ton)
0.569801 cy/ton
1.755 ton/cy
Assume: no bulkage or shrinkage

1	50	939.18	3100.86	57.54	974.75
2	250	4054.85	12974.64	1617.28	4901.16
3	989.13	20730.44	63375.7	8158.54	12953.26
4	1933.85	24865.59	82190.48	9701.78	12172.71
5	2837.15	27450.04	94435.79	10484.44	11560.01
6	3630.06	28802.06	101695.9	10787.42	10912.67
7	5299.42	32023.32	116669.2	11769.7	10276.58
8	5865.11	32790.11	120564.2	11945.23	10060.4
9	6184.36	33121.59	122433.8	11988.77	9922.29
10	6335.82	33204.54	123073.6	12031.03	9854.53

Lemon Creek - Reach I: XS 48 **Existing Conditions**

Event	Reach I - Summary Qsed (cy/event)			
	YANG. (HEC-6)	LAURSEN (MADDEN), 85	PARKER	SCHOKLITSCH
2-yr	61777.6	198510.9	24082.3	34296.4
5-yr	72571.7	240353.6	27963.7	35576.1
25-yr	74678.1	250240	28662.3	35089.2
50-yr	75784.2	255457	29026.7	34828.8
100-yr	76304	257901.7	29199.7	34709.3

2-yr hydrograph		Qsed (tons/hr)			
Duration (hrs)	Ave Qw (cfs)	YANG. (HEC-6)	LAURSEN (MADDEN), 85	PARKER	SCHOKLITSCH
24	880	752.6	2304.65	296.33	486.04
18	1743	991.79	3223.13	387.72	515.55
10	2897	1132.66	3882.27	433.49	484.3
3	3486	1173.19	4092.91	443.45	467.57
1	3930	1200.09	4237.33	449.48	454.69
4	3486	1173.19	4092.91	443.45	467.57
16	2257	1063.74	3555.73	412.62	500.64
24	941	809.11	2475.45	318.5	513.33
24	757	638.65	1960.24	251.63	431.02
	tons/event	108419.7	348386.6	42264.5	60190.2
	cy/event	61777.6	198510.9	24082.3	34296.4

5-yr hydrograph		Qsed (tons/hr)			
Duration (hrs)	Ave Qw (cfs)	YANG. (HEC-6)	LAURSEN (MADDEN), 85	PARKER	SCHOKLITSCH
24	1341	922.52	2907.98	361.87	528.63
18	2656	1106.71	3759.31	425.63	490.45
10	4416	1231.75	4384.52	459.13	448.44
3	5313	1290.2	4656.18	476.95	436.9
1	5990	1334.31	4861.22	490.4	428.19
4	5313	1290.2	4656.18	476.95	436.9
16	3440	1170.4	4077.95	442.82	468.91
24	1434	938.55	2980.89	367.85	525.6
24	1154	890.3	2761.38	349.84	534.71
	tons/event	127363.3	421820.5	49076.3	62436.1
	cy/event	72571.7	240353.6	27963.7	35576.1

Lemon Creek - Reach I: XS 48 **Existing Conditions**

25-yr hydrograph		Qsed (tons/hr)			
Duration (hrs)	Ave Qw (cfs)	YANG. (HEC-6)	LAURSEN (MADDEN), 85	PARKER	SCHOKLITSCH
24	1505	950.78	3036.55	372.41	523.3
18	2980	1141.6	3924.62	436.2	482.18
10	4954	1266.8	4547.46	469.82	441.52
3	5960	1332.35	4852.13	489.81	428.58
1	6720	1366.25	5023.51	497.72	419.18
4	5960	1332.35	4852.13	489.81	428.58
16	3859	1195.79	4214.24	448.51	456.75
24	1609	968.7	3118.08	379.1	519.91
24	1295	914.6	2871.92	358.91	530.12
	tons/event	131060.1	439171.2	50302.4	61581.6
	cy/event	74678.1	250240	28662.3	35089.2

50-yr hydrograph		Qsed (tons/hr)			
Duration (hrs)	Ave Qw (cfs)	YANG. (HEC-6)	LAURSEN (MADDEN), 85	PARKER	SCHOKLITSCH
24	1599	966.97	3110.24	378.46	520.24
18	3166	1153.81	3988.82	439.11	476.85
10	5264	1287	4641.34	475.98	437.53
3	6333	1349.32	4937.47	493.84	423.96
1	7140	1380.07	5101.41	499.53	413.43
4	6333	1349.32	4937.47	493.84	423.96
16	4100	1211.16	4288.82	452.85	452.51
24	1710	986.1	3197.26	385.59	516.63
24	1376	928.55	2935.42	364.12	527.49
	tons/event	133001.3	448327.1	50941.9	61124.6
	cy/event	75784.2	255457	29026.7	34828.8

100-yr hydrograph		Qsed (tons/hr)			
Duration (hrs)	Ave Qw (cfs)	YANG. (HEC-6)	LAURSEN (MADDEN), 85	PARKER	SCHOKLITSCH
24	1644	974.73	3145.52	381.35	518.77
18	3255	1159.2	4017.77	440.31	474.27
10	5411	1296.58	4685.86	478.9	435.64
3	6510	1357.06	4976.82	495.61	421.77
1	7340	1383.52	5128.07	501.29	410.61
4	6510	1357.06	4976.82	495.61	421.77
16	4215	1218.65	4323.64	455.14	451.03
24	1758	994.37	3234.89	388.68	515.07
24	1414	935.1	2965.21	366.56	526.25
	tons/event	133913.5	452617.4	51245.5	60914.9
	cy/event	76304	257901.7	29199.7	34709.3

Lemon Creek - Reach I: XS 48 **Existing Conditions Bank mat'l supply**

GSD sample: Bank Sample
Threshold Flow to Mobilize, D 84
Di = 74.61 mm
Q(threshold) = 119 cfs

SAM generated rating curve of stream discharge (Qw) to sediment transport potential (Qs)
TABLE 5.0 SUMMARY TABLE: BED-MATERIAL SEDIMENT DISCHARGE, TONS/DAY

Q NO	WATER DISCHARGE total	channel	YANG. (HEC-6)	LAURSEN (MADDEN), 85	PARKER	SCHOKLITSCH
1	50	50	936.07	184.14	1175.8	2501.18
2	250	250	5835.28	1558.35	8943.15	11115.57
3	1000	989.13	22619.7	7508.67	28289.69	28417.86
4	2000	1933.85	30990.6	9857.72	31868.1	26797.43
5	3000	2837.15	36827.7	11382.48	33679.55	25523.49
6	3930	3630.06	40599.6	12293.1	34205.91	24148.59
7	5990	5299.42	48324.5	14242.71	35825.44	22764.67
8	6720	5865.11	50433.7	14743.11	36109.22	22301.65
9	7140	6184.36	51482.1	14977.95	36179.36	22008.58
10	7340	6335.82	51882.5	15059.62	36247.35	21865.38

Conversion: tons - cubic yards
Lemon Creek gravel = 130 lb/cy
conversion = (cf/130lb) * (cy/27cf) * (2000lb/ton)
0.5698 cy/ton
1.755 ton/cy
Assume: no bulkage or shrinkage

1	50	936.07	184.14	1175.8	2501.18
2	250	5835.28	1558.35	8943.15	11115.57
3	989.13	22619.66	7508.67	28289.69	28417.86
4	1933.85	30990.62	9857.72	31868.1	26797.43
5	2837.15	36827.73	11382.5	33679.55	25523.49
6	3630.06	40599.64	12293.1	34205.91	24148.59
7	5299.42	48324.5	14242.7	35825.44	22764.67
8	5865.11	50433.65	14743.1	36109.22	22301.65
9	6184.36	51482.11	14978	36179.36	22008.58
10	6335.82	51882.53	15059.6	36247.35	21865.38

Lemon Creek - Reach I: XS 48 **Existing Conditions Bank mat'l supply**

Event	Reach I - Summary Qsed (cy/event)			
	YANG. (HEC-6)	LAURSEN (MADDEN), 85	PARKER	SCHOKLITSCH
2-yr	73964.3	23703.5	82071.1	75501.8
5-yr	91473.2	28832.9	92195.5	78317.9
25-yr	96148.7	30076.9	93706.7	77294.1
50-yr	98638.6	30735.3	94476.9	76744.3
100-yr	99806.9	31044.2	94840.3	76492.5

2-yr hydrograph		Qsed (tons/hr)			
Duration (hrs)	Ave Qw (cfs)	YANG. (HEC-6)	LAURSEN (MADDEN), 85	PARKER	SCHOKLITSCH
24	880	830.59	273.19	1049.76	1068.73
18	1743	1201.64	385.58	1289.52	1133.91
10	2897	1509.44	467.73	1395.54	1068.95
3	3486	1616.62	494.1	1414.78	1033.54
1	3930	1691.65	512.21	1425.25	1006.19
4	3486	1616.62	494.1	1414.78	1033.54
16	2257	1353.78	427.07	1347.24	1102.92
24	941	887.47	293.36	1115.32	1127.36
24	757	715.9	232.53	917.56	950.5
	tons/event	129807.4	41599.7	144034.7	132505.7
	cy/event	73964.3	23703.5	82071.1	75501.8

5-yr hydrograph		Qsed (tons/hr)			
Duration (hrs)	Ave Qw (cfs)	YANG. (HEC-6)	LAURSEN (MADDEN), 85	PARKER	SCHOKLITSCH
24	1341	1061.42	346.24	1229.58	1161.05
18	2656	1450.82	452.42	1377.35	1081.74
10	4416	1767.59	531.38	1441.17	992.59
3	5313	1907.74	566.75	1470.55	967.48
1	5990	2013.52	593.45	1492.73	948.53
4	5313	1907.74	566.75	1470.55	967.48
16	3440	1608.85	492.22	1413.69	1036.37
24	1434	1093.86	355.34	1243.45	1154.77
24	1154	996.2	327.93	1201.7	1173.68
	tons/event	160535.5	50601.8	161803.1	137448
	cy/event	91473.2	28832.9	92195.5	78317.9

Lemon Creek - Reach I: XS 48 **Existing Conditions Bank mat'l supply**

25-yr hydrograph		Qsed (tons/hr)			
Duration (hrs)	Ave Qw (cfs)	YANG. (HEC-6)	LAURSEN (MADDEN), 85	PARKER	SCHOKLITSCH
24	1505	1118.62	362.29	1254.03	1149.98
18	2980	1529.62	473	1401.81	1064.54
10	4954	1851.65	552.59	1458.79	977.53
3	5960	2008.83	592.26	1491.74	949.37
1	6720	2101.4	614.3	1504.55	929.24
4	5960	2008.83	592.26	1491.74	949.37
16	3859	1679.65	509.32	1423.57	1010.56
24	1609	1154.9	372.47	1269.54	1142.96
24	1295	1045.38	341.73	1222.72	1164.16
	tons/event	168740.9	52784.9	164455.3	135651.2
	cy/event	96148.7	30076.9	93706.7	77294.1

50-yr hydrograph		Qsed (tons/hr)			
Duration (hrs)	Ave Qw (cfs)	YANG. (HEC-6)	LAURSEN (MADDEN), 85	PARKER	SCHOKLITSCH
24	1599	1151.41	371.49	1268.05	1143.63
18	3166	1562.54	481.04	1407.23	1053.25
10	5264	1900.09	564.82	1468.94	968.85
3	6333	2054.81	603.24	1498.28	939.46
1	7140	2145.09	624.08	1507.47	917.02
4	6333	2054.81	603.24	1498.28	939.46
16	4100	1718.21	518.92	1430.82	1001.43
24	1710	1190.13	382.35	1284.6	1136.14
24	1376	1073.63	349.66	1234.8	1158.69
	tons/event	173110.8	53940.4	165806.9	134686.2
	cy/event	98638.6	30735.3	94476.9	76744.3

100-yr hydrograph		Qsed (tons/hr)			
Duration (hrs)	Ave Qw (cfs)	YANG. (HEC-6)	LAURSEN (MADDEN), 85	PARKER	SCHOKLITSCH
24	1644	1167.11	375.89	1274.76	1140.6
18	3255	1577.58	484.67	1409.33	1047.77
10	5411	1923.05	570.61	1473.76	964.74
3	6510	2076.12	608.3	1501.15	934.79
1	7340	2161.77	627.48	1510.31	911.06
4	6510	2076.12	608.3	1501.15	934.79
16	4215	1736.18	523.45	1434.58	998.21
24	1758	1206.87	387.05	1291.76	1132.9
24	1414	1086.88	353.38	1240.46	1156.13
	tons/event	175161.1	54482.6	166444.7	134244.3
	cy/event	99806.9	31044.2	94840.3	76492.5

Existing Conditions

Summary Sediment Transport Estimate / Transport rate supply - reach / Estimated depth of deposition/erosion

Reach A

Reach A	Reach Average L	W	Event	Reach A - Summary Qsed (cy/event)				Change B to A (cy/event) - (+)Deposition/(-)Erosion				Reach A - Depostion (+)/Erosion (-)			
Below Redimix				YANG. (HEC-6)	LAURSEN (MADDEN), 85	PARKER	SCHOKLITSCH	YANG. (HEC-6)	LAURSEN (MADDEN), 85	PARKER	SCHOKLITSCH	YANG. (HEC-6)	LAURSEN (MADDEN), 85	PARKER	SCHOKLITSCH
	388	112.39	2-yr	15468	62822	2345	2583	-12127	-36896	-2181	-1984	-7.51	-22.84	-1.35	-1.23
	388	113.07	5-yr	85778	245903	19701	12755	-79876	-200304	-19394	-11776	-49.16	-123.27	-11.94	-7.25
	388	113.07	25-yr	117613	320868	28007	17143	-111210	-271384	-27669	-16107	-68.44	-167.02	-17.03	-9.91
	388	113.07	50-yr	137963	366229	33431	19788	-131258	-314519	-33072	-18713	-80.78	-193.57	-20.35	-11.52
	388	113.07	100-yr	148377	388660	36264	21127	-141553	-336026	-35898	-20036	-87.12	-206.80	-22.09	-12.33

Reach B

Reach B	L	W	Event	Reach B - Summary Qsed (cy/event)				Change C to B (cy/event) - (+)Deposition/(-)Erosion				Reach B - Depostion (+)/Erosion (-)			
Redimix to Glacier Hwy				YANG. (HEC-6)	LAURSEN (MADDEN), 85	PARKER	SCHOKLITSCH	YANG. (HEC-6)	LAURSEN (MADDEN), 85	PARKER	SCHOKLITSCH	YANG. (HEC-6)	LAURSEN (MADDEN), 85	PARKER	SCHOKLITSCH
	954.5	68.46	2-yr	3340	25926	164	599	-2270	-25609	19	37	-0.94	-10.58	0.01	0.02
	954.5	68.46	5-yr	5902	45599	307	979	-4612	-45221	-112	-306	-1.91	-18.68	-0.05	-0.13
	954.5	68.46	25-yr	6403	49485	338	1036	-5081	-49098	-139	-376	-2.10	-20.29	-0.06	-0.16
	954.5	68.46	50-yr	6705	51710	359	1075	-5219	-51278	-148	-385	-2.16	-21.19	-0.06	-0.16
	954.5	68.46	100-yr	6825	52634	366	1091	-5333	-52200	-153	-403	-2.20	-21.57	-0.06	-0.17

Reach C (1)

Reach C (1)	L	W	Event	Reach C - Summary Qsed (cy/event)				Change D to C (cy/event) - (+)Deposition/(-)Erosion				Reach C - Depostion (+)/Erosion (-)			
Immed. Above Glacier Hwy				YANG. (HEC-6)	LAURSEN (MADDEN), 85	PARKER	SCHOKLITSCH	YANG. (HEC-6)	LAURSEN (MADDEN), 85	PARKER	SCHOKLITSCH	YANG. (HEC-6)	LAURSEN (MADDEN), 85	PARKER	SCHOKLITSCH
	1452.5	119.12	2-yr	1071	317	183	636	6197	2404	8975	6171	0.97	0.38	1.40	0.96
	1452.5	119.72	5-yr	1291	377	195	673	9560	4065	19489	9049	1.48	0.63	3.03	1.40
	1452.5	119.72	25-yr	1322	386	200	660	10359	4424	21711	9646	1.61	0.69	3.37	1.50
	1452.5	119.72	50-yr	1486	432	210	691	10378	4439	22244	9726	1.61	0.69	3.45	1.51
	1452.5	119.72	100-yr	1492	434	213	689	10378	4422	22166	9701	1.61	0.69	3.44	1.51

Reach D(2)

Reach D(2)	L	W	Event	Reach D - Summary Qsed (cy/event)				Change E to D (cy/event) - (+)Deposition/(-)Erosion				Reach D - Depostion (+)/Erosion (-)			
between Glacier Hwy & Prison				YANG. (HEC-6)	LAURSEN (MADDEN), 85	PARKER	SCHOKLITSCH	YANG. (HEC-6)	LAURSEN (MADDEN), 85	PARKER	SCHOKLITSCH	YANG. (HEC-6)	LAURSEN (MADDEN), 85	PARKER	SCHOKLITSCH
	1715	189.41	2-yr	7268	2721	9158	6807	8377	5765	36577	13394	0.70	0.48	3.04	1.11
	1715	189.41	5-yr	10851	4442	19684	9722	16937	12849	79413	23783	1.41	1.07	6.60	1.98
	1715	189.41	25-yr	11682	4810	21911	10306	20841	16188	99238	28271	1.73	1.35	8.25	2.35
	1715	189.41	50-yr	11864	4871	22454	10417	23491	18489	112095	31118	1.95	1.54	9.32	2.59
	1715	189.41	100-yr	11870	4856	22380	10389	24826	19627	118436	32522	2.06	1.63	9.84	2.70

Reach E(3)

Reach E(3)	L	W	Event	Reach E - Summary Qsed (cy/event)				Change xs48 to E (cy/event) - (+)Deposition/(-)Erosion				Reach E - Depostion (+)/Erosion (-)			
Prison - Costco				YANG. (HEC-6)	LAURSEN (MADDEN), 85	PARKER	SCHOKLITSCH	YANG. (HEC-6)	LAURSEN (MADDEN), 85	PARKER	SCHOKLITSCH	YANG. (HEC-6)	LAURSEN (MADDEN), 85	PARKER	SCHOKLITSCH
	1902	132.89	2-yr	15644	8487	45735	20200	46133	190024	-21652	14096	4.93	20.30	-2.31	1.51
	1902	133.75	5-yr	27788	17291	99097	33504	44784	223063	-71133	2072	4.75	23.67	-7.55	0.22
	1902	134.01	25-yr	32522	20998	121149	38577	42156	229242	-92487	-3488	4.47	24.28	-9.80	-0.37
	1902	134.16	50-yr	35355	23360	134549	41535	40429	232097	-105523	-6707	4.28	24.56	-11.17	-0.71
	1902	134.22	100-yr	36696	24483	140815	42911	39608	233419	-111616	-8201	4.19	24.69	-11.80	-0.87

Existing Conditions

Summary Sediment Transport Estimate | Transport rate supply - reach | Estimated depth of deposition/erosion

Reach F(4)
Gorge

			Event	Reach F - Summary Qsed (cy/event)				Change G to F (cy/event) - (+)Deposition/(-)Erosion				Reach F - Depostion (+)/Erosion (-)			
				YANG. (HEC-6)	LAURSEN (MADDEN), 85	PARKER	SCHOKLITSCH	YANG. (HEC-6)	LAURSEN (MADDEN), 85	PARKER	SCHOKLITSCH	YANG. (HEC-6)	LAURSEN (MADDEN), 85	PARKER	SCHOKLITSCH
	1811.5	42.82	2-yr	40802	56354	612043	99116	transp	transp	transp	transp	transp	transp	transp	transp
	1811.5	43.49	5-yr	64236	99215	916573	143980	transp	transp	transp	transp	transp	transp	transp	transp
	1811.5	43.68	25-yr	72665	115367	1023606	159664	transp	transp	transp	transp	transp	transp	transp	transp
	1811.5	43.79	50-yr	77513	124964	1083878	168500	transp	transp	transp	transp	transp	transp	transp	transp
	1811.5	43.84	100-yr	79818	129554	1112389	172684	transp	transp	transp	transp	transp	transp	transp	transp

Reach G(5)
USGS above
Gorge
Bridge

			Event	Reach G - Summary Qsed (cy/event)				Change xs48 to G (cy/event) - (+)Deposition/(-)Erosion				Reach G - Depostion (+)/Erosion (-)			
				YANG. (HEC-6)	LAURSEN (MADDEN), 85	PARKER	SCHOKLITSCH	YANG. (HEC-6)	LAURSEN (MADDEN), 85	PARKER	SCHOKLITSCH	YANG. (HEC-6)	LAURSEN (MADDEN), 85	PARKER	SCHOKLITSCH
		45.23											depths compounded by short reach length		
0	1000	100	2-yr	18887	11284	43189	17139	42891	187227	-19107	17157	11.6	50.6	-5.2	4.6
0	1000	100	5-yr	25481	15627	57892	20507	47091	224727	-29928	15069	12.7	60.7	-8.1	4.1
0	1000	100	25-yr	27305	16761	61585	21167	47373	233479	-32923	13922	12.8	63.0	-8.9	3.8
0	1000	100	50-yr	28150	17220	63008	21387	47634	238237	-33981	13442	12.9	64.3	-9.2	3.6
0	1000	100	100-yr	28528	17415	63603	21475	47776	240487	-34403	13235	12.9	64.9	-9.3	3.6

Reach H
above
Gorge
Bridge &
USGS

			Event	Reach H - Summary Qsed (cy/event)				Change I to H (cy/event) - (+)Deposition/(-)Erosion				Reach H - Depostion (+)/Erosion (-)			
				YANG. (HEC-6)	LAURSEN (MADDEN), 85	PARKER	SCHOKLITSCH	YANG. (HEC-6)	LAURSEN (MADDEN), 85	PARKER	SCHOKLITSCH	YANG. (HEC-6)	LAURSEN (MADDEN), 85	PARKER	SCHOKLITSCH
	1017	121.31	2-yr	26636	30825	83366	32482	12838	50359	3943	9236	transp	transp	transp	transp
	1017	128.38	5-yr	43071	52035	137662	46438	18305	79231	3508	10193	transp	transp	transp	transp
	1017	129.3	25-yr	48712	59379	156014	50787	20343	89804	4212	10580	transp	transp	transp	transp
	1017	129.5	50-yr	51866	63583	166323	53128	21526	95903	4634	10835	transp	transp	transp	transp
	1017	129.59	100-yr	53325	65532	171064	54185	22121	98858	4979	11000	transp	transp	transp	transp

Reach I
Single thread
channel

			Event	Reach I - Summary Qsed (cy/event)				Change 48 to I (cy/event) - (+)Deposition/(-)Erosion				Reach I - Depostion (+)/Erosion (-)			
				YANG. (HEC-6)	LAURSEN (MADDEN), 85	PARKER	SCHOKLITSCH	YANG. (HEC-6)	LAURSEN (MADDEN), 85	PARKER	SCHOKLITSCH	YANG. (HEC-6)	LAURSEN (MADDEN), 85	PARKER	SCHOKLITSCH
	1495	94.63	2-yr	39473	81184	87308	41718	22304	117327	-63226	-7422	transp	transp	transp	transp
	1495	95.23	5-yr	61376	131267	141169	56630	11195	109087	-113206	-21054	transp	transp	transp	transp
	1495	95.42	25-yr	69055	149184	160225	61367	5623	101057	-131563	-26278	transp	transp	transp	transp
	1495	95.45	50-yr	73392	159486	170957	63963	2392	95971	-141931	-29134	transp	transp	transp	transp
	1495	95.46	100-yr	75446	164390	176043	65185	858	93512	-146843	-30476	transp	transp	transp	transp

Existing Conditions

Summary Sediment Transport Estimate | Transport rate supply - reach | Estimated depth of deposition/erosion

XS 43
wider section above single thread channel

		Event	XS 48 (Rch I) - Summary Qsed (cy/event)				Change J to 48 (cy/event) - (+)Deposition/(-)Erosion				XS 48 (Rch I) - Depostion (+)/Erosion (-)			
			YANG. (HEC-6)	LAURSEN (MADDEN), 85	PARKER	SCHOKLITSCH	YANG. (HEC-6)	LAURSEN (MADDEN), 85	PARKER	SCHOKLITSCH	YANG. (HEC-6)	LAURSEN (MADDEN), 85	PARKER	SCHOKLITSCH
1000	145.83	2-yr	61778	198511	24082	34296	-42188	-174536	15598	-15830	supply	supply	supply	supply
1000	145.83	5-yr	72572	240354	27964	35576	-39913	-197446	46440	-7773	supply	supply	supply	supply
1000	145.83	25-yr	74678	250240	28662	35089	-37262	-200212	58829	-4048	supply	supply	supply	supply
1000	145.83	50-yr	75784	255457	29027	34829	-35639	-201206	66025	-1978	supply	supply	supply	supply
1000	145.83	100-yr	76304	257902	29200	34709	-34861	-201626	69455	-1002	supply	supply	supply	supply

Reach J
Section between wide valley area near Quarry

		Event	Reach J - Summary Qsed (cy/event)				Change K to J (cy/event) - (+)Deposition/(-)Erosion				Reach J - Depostion (+)/Erosion (-)			
			YANG. (HEC-6)	LAURSEN (MADDEN), 85	PARKER	SCHOKLITSCH	YANG. (HEC-6)	LAURSEN (MADDEN), 85	PARKER	SCHOKLITSCH	YANG. (HEC-6)	LAURSEN (MADDEN), 85	PARKER	SCHOKLITSCH
1000	61.46	2-yr	19589	23975	39680	18467	37126	81551	186826	53981	16.3	35.8	82.1	23.7
1000	61.46	5-yr	32659	42908	74404	27804	54621	128472	269278	73548	24.0	56.4	118.3	32.3
1000	61.46	25-yr	37416	50028	87491	31041	60390	144545	295808	79705	26.5	63.5	130.0	35.0
1000	61.46	50-yr	40145	54251	95051	32851	63595	153652	310148	83016	27.9	67.5	136.3	36.5
1000	61.46	100-yr	41443	56276	98655	33707	65084	157900	316759	84534	28.6	69.4	139.2	37.1

Reach K
above quarry

		Event	Reach K - Summary Qsed (cy/event)				Reach K				Reach K - Depostion (+)/Erosion (-)			
			YANG. (HEC-6)	LAURSEN (MADDEN), 85	PARKER	SCHOKLITSCH	YANG. (HEC-6)	LAURSEN (MADDEN), 85	PARKER	SCHOKLITSCH	YANG. (HEC-6)	LAURSEN (MADDEN), 85	PARKER	SCHOKLITSCH
1000	105.765	2-yr	56715	105526	226506	72447	supply	supply	supply	supply	supply	supply	supply	supply
1000	107.505	5-yr	87280	171380	343682	101352	supply	supply	supply	supply	supply	supply	supply	supply
1000	108.775	25-yr	97806	194573	383299	110746	supply	supply	supply	supply	supply	supply	supply	supply
1000	109.07	50-yr	103740	207903	405199	115867	supply	supply	supply	supply	supply	supply	supply	supply
1000	109.22	100-yr	106527	214176	415413	118241	supply	supply	supply	supply	supply	supply	supply	supply

Existing Conditions

Summary Sediment Transport Estimate | Transport rate supply - reach | Estimated depth of deposition/erosion

Reach A
Below Redimix

Reach Average L	W	Event	Reach A - Summary Qsed (cy/event)				Change B to A (cy/event) - (+)Deposition/(-)Erosion				Reach A - Depostion (+)/Erosion (-)			
			YANG. (HEC-6)	LAURSEN (MADDEN), 85	PARKER	SCHOKLITSCH	YANG. (HEC-6)	LAURSEN (MADDEN), 85	PARKER	SCHOKLITSCH	YANG. (HEC-6)	LAURSEN (MADDEN), 85	PARKER	SCHOKLITSCH
388	112.39	2-yr	15468	62822	2345	2583	-12127	-36896	-2181	-1984	-7.51	-22.84	-1.35	-1.23
388	113.07	5-yr	85778	245903	19701	12755	-79876	-200304	-19394	-11776	-49.16	-123.27	-11.94	-7.25
388	113.07	25-yr	117613	320868	28007	17143	-111210	-271384	-27669	-16107	-68.44	-167.02	-17.03	-9.91
388	113.07	50-yr	137963	366229	33431	19788	-131258	-314519	-33072	-18713	-80.78	-193.57	-20.35	-11.52
388	113.07	100-yr	148377	388660	36264	21127	-141553	-336026	-35898	-20036	-87.12	-206.80	-22.09	-12.33

Reach B
Redimix to Glacier Hwy

L	W	Event	Reach B - Summary Qsed (cy/event)				Change C to B (cy/event) - (+)Deposition/(-)Erosion				Reach B - Depostion (+)/Erosion (-)			
			YANG. (HEC-6)	LAURSEN (MADDEN), 85	PARKER	SCHOKLITSCH	YANG. (HEC-6)	LAURSEN (MADDEN), 85	PARKER	SCHOKLITSCH	YANG. (HEC-6)	LAURSEN (MADDEN), 85	PARKER	SCHOKLITSCH
954.5	68.46	2-yr	3340	25926	164	599	-2270	-25609	19	37	-0.94	-10.58	0.01	0.02
954.5	68.46	5-yr	5902	45599	307	979	-4612	-45221	-112	-306	-1.91	-18.68	-0.05	-0.13
954.5	68.46	25-yr	6403	49485	338	1036	-5081	-49098	-139	-376	-2.10	-20.29	-0.06	-0.16
954.5	68.46	50-yr	6705	51710	359	1075	-5219	-51278	-148	-385	-2.16	-21.19	-0.06	-0.16
954.5	68.46	100-yr	6825	52634	366	1091	-5333	-52200	-153	-403	-2.20	-21.57	-0.06	-0.17

Reach C (1)
Immed. Above Glacier Hwy

L	W	Event	Reach C - Summary Qsed (cy/event)				Change D to C (cy/event) - (+)Deposition/(-)Erosion				Reach C - Depostion (+)/Erosion (-)			
			YANG. (HEC-6)	LAURSEN (MADDEN), 85	PARKER	SCHOKLITSCH	YANG. (HEC-6)	LAURSEN (MADDEN), 85	PARKER	SCHOKLITSCH	YANG. (HEC-6)	LAURSEN (MADDEN), 85	PARKER	SCHOKLITSCH
1452.5	119.12	2-yr	1071	317	183	636	6197	2404	8975	6171	0.97	0.38	1.40	0.96
1452.5	119.72	5-yr	1291	377	195	673	9560	4065	19489	9049	1.48	0.63	3.03	1.40
1452.5	119.72	25-yr	1322	386	200	660	10359	4424	21711	9646	1.61	0.69	3.37	1.50
1452.5	119.72	50-yr	1486	432	210	691	10378	4439	22244	9726	1.61	0.69	3.45	1.51
1452.5	119.72	100-yr	1492	434	213	689	10378	4422	22166	9701	1.61	0.69	3.44	1.51

Reach D(2)
between Glacier Hwy & Prison

L	W	Event	Reach D - Summary Qsed (cy/event)				Change E to D (cy/event) - (+)Deposition/(-)Erosion				Reach D - Depostion (+)/Erosion (-)			
			YANG. (HEC-6)	LAURSEN (MADDEN), 85	PARKER	SCHOKLITSCH	YANG. (HEC-6)	LAURSEN (MADDEN), 85	PARKER	SCHOKLITSCH	YANG. (HEC-6)	LAURSEN (MADDEN), 85	PARKER	SCHOKLITSCH
1715	189.41	2-yr	7268	2721	9158	6807	8377	5765	36577	13394	0.70	0.48	3.04	1.11
1715	189.41	5-yr	10851	4442	19684	9722	16937	12849	79413	23783	1.41	1.07	6.60	1.98
1715	189.41	25-yr	11682	4810	21911	10306	20841	16188	99238	28271	1.73	1.35	8.25	2.35
1715	189.41	50-yr	11864	4871	22454	10417	23491	18489	112095	31118	1.95	1.54	9.32	2.59
1715	189.41	100-yr	11870	4856	22380	10389	24826	19627	118436	32522	2.06	1.63	9.84	2.70

Reach E(3)
Prison - Costco

L	W	Event	Reach E - Summary Qsed (cy/event)				Change xs48 to E (cy/event) - (+)Deposition/(-)Erosion				Reach E - Depostion (+)/Erosion (-)			
			YANG. (HEC-6)	LAURSEN (MADDEN), 85	PARKER	SCHOKLITSCH	YANG. (HEC-6)	LAURSEN (MADDEN), 85	PARKER	SCHOKLITSCH	YANG. (HEC-6)	LAURSEN (MADDEN), 85	PARKER	SCHOKLITSCH
1902	132.89	2-yr	15644	8487	45735	20200	58320	15217	36336	55302	6.23	1.63	3.88	5.91
1902	133.75	5-yr	27788	17291	99097	33504	63686	11542	-6901	44814	6.76	1.23	-0.73	4.76
1902	134.01	25-yr	32522	20998	121149	38577	63626	9079	-27443	38717	6.74	0.96	-2.91	4.10
1902	134.16	50-yr	35355	23360	134549	41535	63283	7376	-40072	35209	6.70	0.78	-4.24	3.73
1902	134.22	100-yr	36696	24483	140815	42911	63111	6561	-45975	33582	6.67	0.69	-4.86	3.55

Existing Conditions

Summary Sediment Transport Estimate | Transport rate supply - reach | Estimated depth of deposition/erosion

Reach F(4)
Gorge

		Event	Reach F - Summary Qsed (cy/event) YANG. (HEC-6)	LAURSEN (MADDEN), 85	PARKER	SCHOKLITSCH	Change G to F (cy/event) - (+)Deposition/(-)Erosion YANG. (HEC-6)	LAURSEN (MADDEN), 85	PARKER	SCHOKLITSCH	Reach F - Depostion (+)/Erosion (-) YANG. (HEC-6)	LAURSEN (MADDEN), 85	PARKER	SCHOKLITSCH
1811.5	42.82	2-yr	40802	56354	612043	99116	transp	transp	transp	transp	transp	transp	transp	transp
1811.5	43.49	5-yr	64236	99215	916573	143980	transp	transp	transp	transp	transp	transp	transp	transp
1811.5	43.68	25-yr	72665	115367	1023606	159664	transp	transp	transp	transp	transp	transp	transp	transp
1811.5	43.79	50-yr	77513	124964	1083878	168500	transp	transp	transp	transp	transp	transp	transp	transp
1811.5	43.84	100-yr	79818	129554	1112389	172684	transp	transp	transp	transp	transp	transp	transp	transp

Reach G(5)
USGS above
Gorge
Bridge

			Event	Reach G - Summary Qsed (cy/event) YANG. (HEC-6)	LAURSEN (MADDEN), 85	PARKER	SCHOKLITSCH	Change xs48 to G (cy/event) - (+)Deposition/(-)Erosion YANG. (HEC-6)	LAURSEN (MADDEN), 85	PARKER	SCHOKLITSCH	Reach G - Depostion (+)/Erosion (-) YANG. (HEC-6)	LAURSEN (MADDEN), 85	PARKER	SCHOKLITSCH
		45.23											depths compounded by short reach length		
0	1000	100	2-yr	18887	11284	43189	17139	55077	12420	38882	58363	14.9	3.4	10.5	15.8
0	1000	100	5-yr	25481	15627	57892	20507	65992	13206	34304	57811	17.8	3.6	9.3	15.6
0	1000	100	25-yr	27305	16761	61585	21167	68844	13316	32121	56127	18.6	3.6	8.7	15.2
0	1000	100	50-yr	28150	17220	63008	21387	70488	13516	31469	55358	19.0	3.6	8.5	14.9
0	1000	100	100-yr	28528	17415	63603	21475	71279	13629	31237	55018	19.2	3.7	8.4	14.9

Reach H
above
Gorge
Bridge &
USGS

		Event	Reach H - Summary Qsed (cy/event) YANG. (HEC-6)	LAURSEN (MADDEN), 85	PARKER	SCHOKLITSCH	Change I to H (cy/event) - (+)Deposition/(-)Erosion YANG. (HEC-6)	LAURSEN (MADDEN), 85	PARKER	SCHOKLITSCH	Reach H - Depostion (+)/Erosion (-) YANG. (HEC-6)	LAURSEN (MADDEN), 85	PARKER	SCHOKLITSCH
1017	121.31	2-yr	26636	30825	83366	32482	12838	50359	3943	9236	transp	transp	transp	transp
1017	128.38	5-yr	43071	52035	137662	46438	18305	79231	3508	10193	transp	transp	transp	transp
1017	129.3	25-yr	48712	59379	156014	50787	20343	89804	4212	10580	transp	transp	transp	transp
1017	129.5	50-yr	51866	63583	166323	53128	21526	95903	4634	10835	transp	transp	transp	transp
1017	129.59	100-yr	53325	65532	171064	54185	22121	98858	4979	11000	transp	transp	transp	transp

Reach I
Single thread
channel

		Event	Reach I - Summary Qsed (cy/event) YANG. (HEC-6)	LAURSEN (MADDEN), 85	PARKER	SCHOKLITSCH	Change 48 to I (cy/event) - (+)Deposition/(-)Erosion YANG. (HEC-6)	LAURSEN (MADDEN), 85	PARKER	SCHOKLITSCH	Reach I - Depostion (+)/Erosion (-) YANG. (HEC-6)	LAURSEN (MADDEN), 85	PARKER	SCHOKLITSCH
1495	94.63	2-yr	39473	81184	87308	41718	34491	-57481	-5237	33784	transp	transp	transp	transp
1495	95.23	5-yr	61376	131267	141169	56630	30097	-102434	-48974	21688	transp	transp	transp	transp
1495	95.42	25-yr	69055	149184	160225	61367	27094	-119107	-66519	15927	transp	transp	transp	transp
1495	95.45	50-yr	73392	159486	170957	63963	25246	-128751	-76481	12781	transp	transp	transp	transp
1495	95.46	100-yr	75446	164390	176043	65185	24361	-133346	-81203	11307	transp	transp	transp	transp

Existing Conditions

XS 43 - Bank Fines as GSD
wider section above single thread channel

		Summary Sediment Transport Estimate					Transport rate supply - reach				Estimated depth of deposition/erosion			
			XS 48 ***FINES*** (Rch I) - Summary Qsed (cy/event)				Change J to 48 ***FINES*** (cy/event) - (+)Deposition/(-)Erosion				XS 48 ***FINES*** (Rch I) - Depostion (+)/Erosion (-)			
		Event	YANG. (HEC-6)	LAURSEN (MADDEN), 85	PARKER	SCHOKLITSCH	YANG. (HEC-6)	LAURSEN (MADDEN), 85	PARKER	SCHOKLITSCH	YANG. (HEC-6)	LAURSEN (MADDEN), 85	PARKER	SCHOKLITSCH
1000	145.83	2-yr	73964	23704	82071	75502	-54375	271	-42391	-57035	Supply	Supply	Supply	Supply
1000	145.83	5-yr	91473	28833	92196	78318	-58815	14075	-17792	-50514	Supply	Supply	Supply	Supply
1000	145.83	25-yr	96149	30077	93707	77294	-58733	19951	-6216	-46253	Supply	Supply	Supply	Supply
1000	145.83	50-yr	98639	30735	94477	76744	-58493	23516	574	-43893	Supply	Supply	Supply	Supply
1000	145.83	100-yr	99807	31044	94840	76493	-58364	25232	3814	-42785	Supply	Supply	Supply	Supply

Reach J
Section between wide valley area near Quarry

			Reach J - Summary Qsed (cy/event)				Change K to J (cy/event) - (+)Deposition/(-)Erosion				Reach J - Depostion (+)/Erosion (-)			
		Event	YANG. (HEC-6)	LAURSEN (MADDEN), 85	PARKER	SCHOKLITSCH	YANG. (HEC-6)	LAURSEN (MADDEN), 85	PARKER	SCHOKLITSCH	YANG. (HEC-6)	LAURSEN (MADDEN), 85	PARKER	SCHOKLITSCH
1000	61.46	2-yr	19589	23975	39680	18467	37126	81551	186826	53981	16.3	35.8	82.1	23.7
1000	61.46	5-yr	32659	42908	74404	27804	54621	128472	269278	73548	24.0	56.4	118.3	32.3
1000	61.46	25-yr	37416	50028	87491	31041	60390	144545	295808	79705	26.5	63.5	130.0	35.0
1000	61.46	50-yr	40145	54251	95051	32851	63595	153652	310148	83016	27.9	67.5	136.3	36.5
1000	61.46	100-yr	41443	56276	98655	33707	65084	157900	316759	84534	28.6	69.4	139.2	37.1

Reach K
above quarry

			Reach K - Summary Qsed (cy/event)				Reach K				Reach K - Depostion (+)/Erosion (-)			
		Event	YANG. (HEC-6)	LAURSEN (MADDEN), 85	PARKER	SCHOKLITSCH	YANG. (HEC-6)	LAURSEN (MADDEN), 85	PARKER	SCHOKLITSCH	YANG. (HEC-6)	LAURSEN (MADDEN), 85	PARKER	SCHOKLITSCH
1000	105.765	2-yr	56715	105526	226506	72447	supply	supply	supply	supply	supply	supply	supply	supply
1000	107.505	5-yr	87280	171380	343682	101352	supply	supply	supply	supply	supply	supply	supply	supply
1000	108.775	25-yr	97806	194573	383299	110746	supply	supply	supply	supply	supply	supply	supply	supply
1000	109.07	50-yr	103740	207903	405199	115867	supply	supply	supply	supply	supply	supply	supply	supply
1000	109.22	100-yr	106527	214176	415413	118241	supply	supply	supply	supply	supply	supply	supply	supply

Appendix G

Sediment Transport

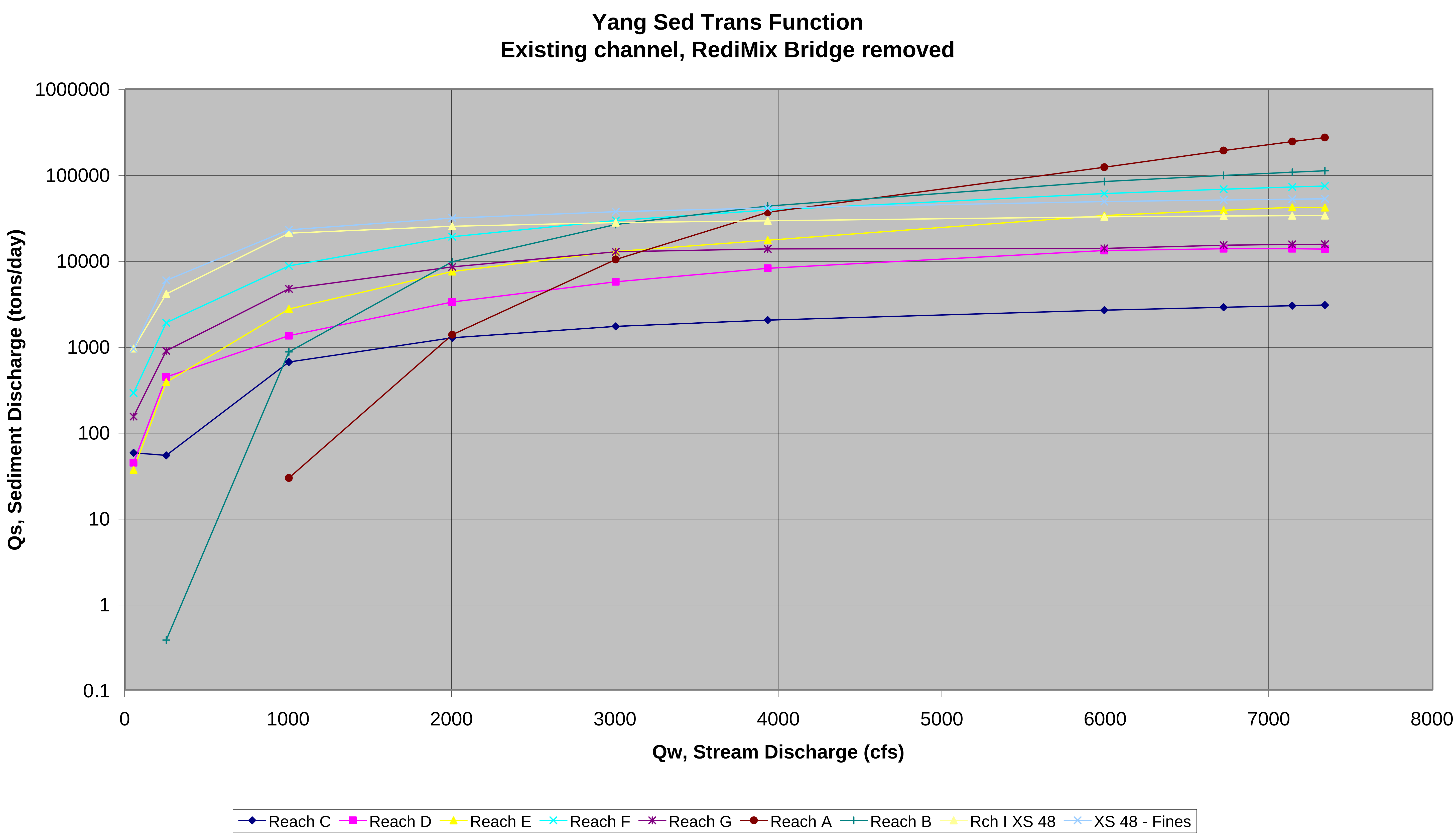
Existing Channel (No in Stream Mining)
RediMix Bridge Removed

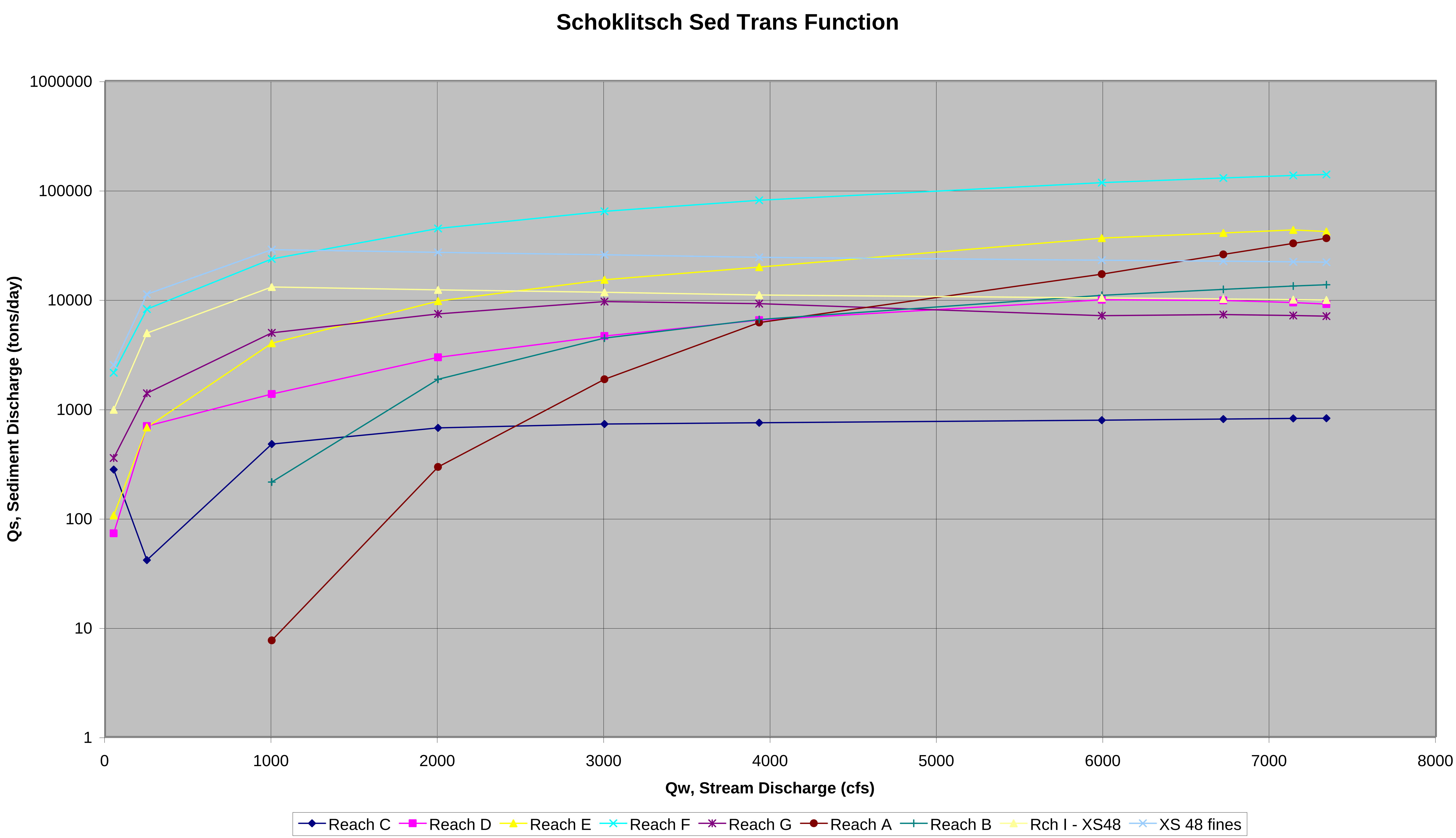
Below Hidden Valley **Existing Channel - No Redimix Bridge**

SAM Input

Transpose Reach average parameters

		50-cfs	250-cfs	1000-cfs	2000-cfs	3000-cfs	2 yr	10 yr	25 yr	50 yr	100 yr
reach	parameter	**1**	**2**	**4**	**6**	**7**	**8**	**10**	**11**	**12**	**13**
A	ra L	372	372	372	372	372	372	372	372	372	372
	ra Qch	42	208	833	1666	2500	3274	4945	5547	5899	6066
	ra Vch	0.09	0.46	1.84	3.67	5.47	7.09	9.57	10.6	11.18	11.45
	ra Yh	4.22	4.22	4.22	4.24	4.26	4.31	4.7	4.77	4.81	4.84
	ra TW	115.92	115.92	115.91	115.89	115.83	115.74	116.12	116.12	116.12	116.12
	ra Se	0.000001	0.000014	0.00023	0.000906	0.001997	0.003378	0.004928	0.00596	0.006654	0.007007
	ra Shear	0	0	0.06	0.24	0.53	0.88	1.48	1.79	1.99	2.08
B	ra L	894	894	894	894	894	894	894	894	894	894
	ra Qch	50	249	996	1988	2972	3877	5854	6547	6944	7133
	ra Vch	0.19	0.96	3.47	5.79	7.33	8.35	10.02	10.49	10.75	10.87
	ra Yh	3.87	3.9	4.3	5.13	5.95	6.82	8.61	9.21	9.55	9.71
	ra TW	67.97	67.99	68.21	68.54	69.85	69.85	69.85	69.85	69.85	69.85
	ra Se	0.000004	0.000093	0.001051	0.002311	0.002963	0.003163	0.003316	0.003333	0.00335	0.003352
	ra Shear	0	0.02	0.25	0.67	1.01	1.25	1.66	1.78	1.85	1.88
C	ra L	1452.5	1452.5	1452.5	1452.5	1452.5	1452.5	1452.5	1452.5	1452.5	1452.5
	ra Qch	50	250	997	1987	2950	3813	5681	6335	6708	6885
	ra Vch	1.54	2.3	3.71	4.46	4.9	5.17	5.63	5.77	5.85	5.88
	ra Yh	1.12	1.78	2.64	4.04	5.42	6.61	8.98	9.77	10.22	10.43
	ra TW	62.14	66.41	110.09	117.16	117.87	118.52	119.72	119.72	119.72	119.72
	ra Se	0.008132	0.001665	0.002389	0.00183	0.001467	0.00125	0.000979	0.00092	0.000889	0.000876
	ra Shear	0.2	0.17	0.35	0.44	0.48	0.5	0.54	0.56	0.57	0.57
D	ra L	1715	1715	1715	1715	1715	1715	1715	1715	1715	1715
	ra Qch	50	250	998	1993	2986	3904	5923	6634	7041	7235
	ra Vch	2.35	3.3	3.8	4.62	5.28	5.75	6.36	6.44	6.46	6.46
	ra Yh	0.78	1.05	1.67	2.36	3.09	3.76	5.32	5.91	6.25	6.41
	ra TW	31.78	75.69	160.8	187.64	189.41	189.41	189.41	189.41	189.41	189.41
	ra Se	0.004874	0.006649	0.004219	0.004081	0.003992	0.003997	0.003827	0.003511	0.003279	0.003162
	ra Shear	0.21	0.4	0.41	0.55	0.68	0.79	0.95	0.95	0.94	0.93
E	ra L	1902	1902	1902	1902	1902	1902	1902	1902	1902	1902
	ra Qch	50	249	991	1974	2954	3832	5765	6443	6829	7011
	ra Vch	1.87	3.03	4.66	5.93	6.85	7.35	8.7	9.16	9.4	9.5
	ra Yh	0.66	1.35	2.3	3.22	3.99	4.43	5.58	5.93	6.12	6.21
	ra TW	45.49	66.65	104.93	120.7	125.15	132.88	133.75	134.01	134.16	134.22
	ra Se	0.007256	0.006854	0.007635	0.00812	0.008354	0.008699	0.009028	0.009331	0.009466	0.009486
	ra Shear	0.26	0.55	1.12	1.64	2.05	2.3	2.98	3.25	3.39	3.45
F	ra L	1811.5	1811.5	1811.5	1811.5	1811.5	1811.5	1811.5	1811.5	1811.5	1811.5
	ra Qch	50	246	907	1711	2470	3152	4627	5129	5415	5550
	ra Vch	2.79	4.54	7.21	9.11	10.44	11.41	13.15	13.66	13.93	14.05
	ra Yh	0.87	1.91	3.88	5.52	6.81	7.85	9.82	10.44	10.79	10.94
	ra TW	24.83	34.79	39.57	41.75	42.35	42.82	43.49	43.68	43.79	43.84
	ra Se	0.033763	0.027272	0.022881	0.022808	0.022788	0.022632	0.022442	0.022358	0.02232	0.022303
	ra Shear	1.39	2.7	5.13	7.5	9.27	10.62	13.13	13.91	14.34	14.54
G	ra L	251	251	251	251	251	251	251	251	251	251
	ra Qch	50	244	888	1638	2382	2975	4252	4721	4975	5093
	ra Vch	3.39	5.03	7.56	8.65	9.81	10.08	10.25	10.59	10.68	10.71
	ra Yh	0.72	1.58	3.17	4.56	5.75	6.82	9.23	9.83	10.24	10.43
	ra TW	21.08	31.54	39.67	45.23	45.23	45.23	45.23	45.23	45.23	45.23
	ra Se	0.013027	0.010205	0.009223	0.007821	0.007292	0.006211	0.004256	0.004049	0.003872	0.003782
	ra Shear	0.58	1	1.77	2.07	2.47	2.47	2.34	2.41	2.41	2.41


Yang Sed Trans Function
Existing channel, RediMix Bridge removed
Qs, Sediment Discharge (tons/day)
1000000
100000
10000
1000
100
10
1
0.1
0
1000
2000
3000
4000
5000
6000
7000
8000
Qw, Stream Discharge (cfs)
Reach C
Reach D
Reach E
Reach F
Reach G
Reach A
Reach B
Rch I XS 48
XS 48 - Fines


Schoklitsch Sed Trans Function
Qs, Sediment Discharge (tons/day)
1000000
100000
10000
1000
100
10
1
0
1000
2000
3000
4000
5000
6000
7000
8000
Qw, Stream Discharge (cfs)
Reach C
Reach D
Reach E
Reach F
Reach G
Reach A
Reach B
Rch I - XS48
XS 48 fines

Lemon Creek - Reach A **Existing Channel - No Redimix Bridge**

Threshold Flow to Mobilize, D 84

Di =	41.67	mm
Q(threshold) =	2190	cfs

SAM generated rating curve of stream discharge (Qw) to sediment transport potential (Qs)

TABLE 5.0 SUMMARY TABLE: BED-MATERIAL SEDIMENT DISCHARGE, TONS/DAY

Q	WATER		TRANSPORT FUNCTIONS			
NO	DISCHARGE		YANG.	LAURSEN	PARKER	SCHOKLITSCH
	total	channel	(HEC-6)	(MADDEN), 85		
1	50	42	0	0	0	0
2	250	208	0	0.43	0	0
3	1000	833	29.33	862.34	0	7.59
4	2000	1666	1361.77	13411.45	3.95	292.09
5	3000	2500	10225.94	54955.98	641.03	1852.24
6	3930	3274	36210.09	134196.72	6282.9	6114.34
7	5990	4945	120974.6	336367.09	27681.89	16944.75
8	6720	5547	189115.8	469467.56	47813.03	25673.74
9	7140	5899	240556.1	563542.06	64149.29	32389.75
10	7340	6066	268750.2	612497.63	73689.98	36150.81

Conversion: tons - cubic yards

Lemon Creek gravel =	130	lb/cy
conversion =	(cf/130lb) * (cy/27cf) * (2000lb/ton)	
	0.569801	cy/ton
	1.755	ton/cy

Assume: no bulkage or shrinkage

1	42	0	0	0	0
2	208	0	0.43	0	0
3	833	29.33	862.34	0	7.59
4	1666	1361.77	13411.45	3.95	292.09
5	2500	10225.94	54955.98	641.03	1852.24
6	3274	36210.09	134196.7	6282.9	6114.34
7	4945	120974.6	336367.1	27681.89	16944.75
8	5547	189115.8	469467.6	47813.03	25673.74
9	5899	240556.1	563542.1	64149.29	32389.75
10	6066	268750.2	612497.6	73689.98	36150.81

Lemon Creek - Reach A **Existing Channel - No Redimix Bridge**

Event	Reach A - Summary Qsed (cy/event)			
	YANG. (HEC-6)	LAURSEN (MADDEN), 85	PARKER	SCHOKLITSCH
2-yr	8436.4	41168.3	946.1	1494.9
5-yr	43793.5	153712.4	8218.4	6820.9
25-yr	61005.8	201534.1	12194.6	9261.8
50-yr	76388.5	238210.4	16241.4	11346.9
100-yr	84165.2	256303.9	18326.3	12389.3

2-yr hydrograph		Qsed (tons/hr)			
Duration (hrs)	Ave Qw (cfs)	YANG. (HEC-6)	LAURSEN (MADDEN), 85	PARKER	SCHOKLITSCH
24	880	0	0	0	0
18	1743	0	0	0	0
10	2897	388.04	2111.54	23.98	70.48
3	3486	991.86	4015.24	149.56	169.98
1	3930	1508.75	5591.53	261.79	254.76
4	3486	991.86	4015.24	149.56	169.98
16	2257	151.66	1003.68	6.99	28.88
24	941	1.13	33.11	0	0.29
24	757	0.83	24.3	0	0.21
	tons/event	14805.8	72250.3	1660.4	2623.5
	cy/event	8436.4	41168.3	946.1	1494.9

5-yr hydrograph		Qsed (tons/hr)			
Duration (hrs)	Ave Qw (cfs)	YANG. (HEC-6)	LAURSEN (MADDEN), 85	PARKER	SCHOKLITSCH
24	1341	0	0	0	0
18	2656	299.03	1694.36	17.58	54.81
10	4416	2342	7578.88	472.14	361.23
3	5313	3879.9	11246.9	860.39	557.73
1	5990	5040.61	14015.3	1153.41	706.03
4	5313	3879.9	11246.9	860.39	557.73
16	3440	938.31	3851.93	137.93	161.2
24	1434	25.32	262.86	0.07	5.46
24	1154	9.77	116.45	0.03	2.14
	tons/event	76857.6	269765.2	14423.3	11970.6
	cy/event	43793.5	153712.4	8218.4	6820.9

Lemon Creek - Reach A **Existing Channel - No Redimix Bridge**

25-yr hydrograph		Qsed (tons/hr)			
Duration (hrs)	Ave Qw (cfs)	YANG. (HEC-6)	LAURSEN (MADDEN), 85	PARKER	SCHOKLITSCH
24	1505	0	0	0	0
18	2980	418.69	2255.21	26.18	75.88
10	4954	3264.39	9778.88	705	479.08
3	5960	4989.17	13892.62	1140.43	699.46
1	6720	7879.83	19561.15	1992.21	1069.74
4	5960	4989.17	13892.62	1140.43	699.46
16	3859	1426.1	5339.46	243.84	241.21
24	1609	35.03	354.36	0.1	7.54
24	1295	17.6	190.18	0.05	3.81
	tons/event	107065.1	353692.4	21401.5	16254.4
	cy/event	61005.8	201534.1	12194.6	9261.8

50-yr hydrograph		Qsed (tons/hr)			
Duration (hrs)	Ave Qw (cfs)	YANG. (HEC-6)	LAURSEN (MADDEN), 85	PARKER	SCHOKLITSCH
24	1599	0	0	0	0
18	3166	619.33	2879.17	68.67	108.88
10	5264	3795.89	11046.53	839.18	546.99
3	6333	6374.65	16621.09	1547.53	876.92
1	7140	10023.17	23480.92	2672.89	1349.57
4	6333	6374.65	16621.09	1547.53	876.92
16	4100	1800.22	6286.7	335.37	292
24	1710	40.64	407.18	0.12	8.73
24	1376	22.1	232.53	0.06	4.77
	tons/event	134061.8	418059.2	28503.7	19913.8
	cy/event	76388.5	238210.4	16241.4	11346.9

100-yr hydrograph		Qsed (tons/hr)			
Duration (hrs)	Ave Qw (cfs)	YANG. (HEC-6)	LAURSEN (MADDEN), 85	PARKER	SCHOKLITSCH
24	1644	0	0	0	0
18	3255	722.94	3195.14	91.17	125.87
10	5411	4047.92	11647.64	902.8	579.19
3	6510	7063.07	17965.77	1750.91	965.11
1	7340	11197.93	25520.73	3070.42	1506.28
4	6510	7063.07	17965.77	1750.91	965.11
16	4215	1997.38	6756.95	385.14	317.2
24	1758	43.3	432.27	0.12	9.3
24	1414	24.21	252.4	0.07	5.22
	tons/event	147709.9	449813.3	32162.7	21743.3
	cy/event	84165.2	256303.9	18326.3	12389.3

Lemon Creek - Reach B **Existing Channel - No Redimix Bridge**

Threshold Flow to Mobilize, D 84
Di = 41.67 mm
Q(threshold) = 1404 cfs

SAM generated rating curve of stream discharge (Qw) to sediment transport potential (Qs)
TABLE 5.0 SUMMARY TABLE: BED-MATERIAL SEDIMENT DISCHARGE, TONS/DAY

Q NO	WATER DISCHARGE total	channel	TRANSPORT FUNCTIONS YANG. (HEC-6)	LAURSEN (MADDEN), 85	PARKER	SCHOKLITSCH
1	50	50	0	0	0	0
2	250	249	0.38	36.2	0	0
3	1000	996	857.56	7878.44	9.8	213.1
4	2000	1988	9607.97	45014.86	1674.31	1848.82
5	3000	2972	26132.58	96465.99	7313.82	4402.59
6	3930	3877	42724.32	142863.59	13591.66	6513.46
7	5990	5854	82518.5	243986.19	29074.95	10845.28
8	6720	6547	97100.3	279688.91	34848.44	12291.39
9	7140	6944	106159.8	301411.06	38549.27	13189.96
10	7340	7133	110356	311507.19	40184.35	13584.75

Conversion: tons - cubic yards
Lemon Creek gravel = 130 lb/cy
conversion = (cf/130lb) * (cy/27cf) * (2000lb/ton)
0.569801 cy/ton
1.755 ton/cy
Assume: no bulkage or shrinkage

1	50	0	0	0	0
2	249	0.38	36.2	0	0
3	996	857.56	7878.44	9.8	213.1
4	1988	9607.97	45014.86	1674.31	1848.82
5	2972	26132.58	96465.99	7313.82	4402.59
6	3877	42724.32	142863.6	13591.66	6513.46
7	5854	82518.5	243986.2	29074.95	10845.28
8	6547	97100.3	279688.9	34848.44	12291.39
9	6944	106159.8	301411.1	38549.27	13189.96
10	7133	110356	311507.2	40184.35	13584.75

Lemon Creek - Reach B **Existing Channel - No Redimix Bridge**

Event	Reach B - Summary Qsed (cy/event)			
	YANG. (HEC-6)	LAURSEN (MADDEN), 85	PARKER	SCHOKLITSCH
2-yr	21787	89557.8	5410.3	3808.4
5-yr	51428.3	180464.8	15542.7	7961.1
25-yr	66028.8	229787.5	20087.6	10091.5
50-yr	73412.3	251283.5	22673.2	11028.2
100-yr	76949.3	261489.1	23916.3	11469.6

2-yr hydrograph		Qsed (tons/hr)			
Duration (hrs)	Ave Qw (cfs)	YANG. (HEC-6)	LAURSEN (MADDEN), 85	PARKER	SCHOKLITSCH
24	880	0	0	0	0
18	1743	306.63	1477.95	51.94	59.52
10	2897	1017.94	3798.61	280.54	172.48
3	3486	1450.13	5029.69	441.44	229.4
1	3930	1780.18	5952.65	566.32	271.39
4	3486	1450.13	5029.69	441.44	229.4
16	2257	577.28	2426.58	130.15	104.38
24	941	32.92	302.56	0.38	8.18
24	757	24.16	222.4	0.28	6
	tons/event	38236.2	157174	9495	6683.8
	cy/event	21787	89557.8	5410.3	3808.4

5-yr hydrograph		Qsed (tons/hr)			
Duration (hrs)	Ave Qw (cfs)	YANG. (HEC-6)	LAURSEN (MADDEN), 85	PARKER	SCHOKLITSCH
24	1341	0	0	0	0
18	2656	852	3281.95	223.91	146.84
10	4416	2171.36	6946.69	718.52	313.98
3	5313	2893.35	8781.38	999.44	392.57
1	5990	3438.27	10166.09	1211.46	451.89
4	5313	2893.35	8781.38	999.44	392.57
16	3440	1415.93	4934.06	428.5	225.05
24	1434	193.97	999.82	30.51	38.46
24	1154	91.88	566.56	11.09	19.38
	tons/event	90256.6	316715.8	27277.5	13971.8
	cy/event	51428.3	180464.8	15542.7	7961.1

Lemon Creek - Reach B **Existing Channel - No Redimix Bridge**

25-yr hydrograph		Qsed (tons/hr)			
Duration (hrs)	Ave Qw (cfs)	YANG. (HEC-6)	LAURSEN (MADDEN), 85	PARKER	SCHOKLITSCH
24	1505	219.85	1109.68	35.43	43.3
18	2980	1075.09	3976.54	300.04	181.31
10	4954	2604.4	8047.1	887.01	361.11
3	5960	3414.12	10104.73	1202.06	449.26
1	6720	4045.85	11653.7	1452.02	512.14
4	5960	3414.12	10104.73	1202.06	449.26
16	3859	1727.4	5805.06	546.35	264.68
24	1609	257.77	1270.6	42.65	50.39
24	1295	143.29	784.74	20.87	28.98
	tons/event	115881	403277	35253.7	17710.6
	cy/event	66028.8	229787.5	20087.6	10091.5

50-yr hydrograph		Qsed (tons/hr)			
Duration (hrs)	Ave Qw (cfs)	YANG. (HEC-6)	LAURSEN (MADDEN), 85	PARKER	SCHOKLITSCH
24	1599	254.13	1255.13	41.95	49.7
18	3166	1212.25	4364.49	351.43	199.14
10	5264	2853.91	8681.16	984.09	388.28
3	6333	3723.75	10865.07	1324.49	480.2
1	7140	4423.33	12558.79	1606.22	549.58
4	6333	3723.75	10865.07	1324.49	480.2
16	4100	1917.01	6300.36	619.56	286.29
24	1710	294.6	1426.89	49.65	57.27
24	1376	172.82	910.07	26.49	34.51
	tons/event	128839	441002.6	39791.4	19354.5
	cy/event	73412.3	251283.5	22673.2	11028.2

100-yr hydrograph		Qsed (tons/hr)			
Duration (hrs)	Ave Qw (cfs)	YANG. (HEC-6)	LAURSEN (MADDEN), 85	PARKER	SCHOKLITSCH
24	1644	270.53	1324.76	45.07	52.77
18	3255	1278.41	4549.5	376.47	207.56
10	5411	2972.23	8981.83	1030.13	401.16
3	6510	3871.06	11225.76	1382.82	494.81
1	7340	4598.17	12979.47	1674.35	566.03
4	6510	3871.06	11225.76	1382.82	494.81
16	4215	2009.58	6535.58	655.57	296.37
24	1758	312.1	1501.16	52.98	60.54
24	1414	186.68	968.87	29.12	37.1
	tons/event	135046	458913.3	41973.1	20129.1
	cy/event	76949.3	261489.1	23916.3	11469.6

Lemon Creek - Reach C **Existing Channel - No Redimix Bridge**

Threshold Flow to Mobilize, D 84
Di = 40.39 mm
Q(threshold) = 1488 cfs

SAM generated rating curve of stream discharge (Qw) to sediment transport potential (Qs)
TABLE 5.0 SUMMARY TABLE: BED-MATERIAL SEDIMENT DISCHARGE, TONS/DAY

Q NO	WATER DISCHARGE total	channel	TRANSPORT FUNCTIONS YANG. (HEC-6)	LAURSEN (MADDEN), 85	PARKER	SCHOKLITSCH
1	50	50	57.45	14.69	401.8	276.64
2	250	250	53.59	16.85	0.08	41.11
3	1000	997	656.52	197.44	125.08	473.86
4	2000	1987	1256.47	378.87	305.92	665.46
5	3000	2950	1699.84	505.31	438.52	722.48
6	3930	3813	2012.48	597.56	528.05	740.87
7	5990	5681	2628.66	781.38	709.95	782.15
8	6720	6335	2839.98	855.04	785.34	801.78
9	7140	6708	2961	902.85	825.27	811.36
10	7340	6885	3011.28	923.89	846.91	815.69

Conversion: tons - cubic yards
Lemon Creek gravel = 130 lb/cy
conversion = (cf/130lb) * (cy/27cf) * (2000lb/ton)
0.5698 cy/ton
1.755 ton/cy
Assume: no bulkage or shrinkage

1	50	57.45	14.69	401.8	276.64
2	250	53.59	16.85	0.08	41.11
3	997	656.52	197.44	125.08	473.86
4	1987	1256.47	378.87	305.92	665.46
5	2950	1699.84	505.31	438.52	722.48
6	3813	2012.48	597.56	528.05	740.87
7	5681	2628.66	781.38	709.95	782.15
8	6335	2839.98	855.04	785.34	801.78
9	6708	2961	902.85	825.27	811.36
10	6885	3011.28	923.89	846.91	815.69

Lemon Creek - Reach C **Existing Channel - No Redimix Bridge**

Event	Reach C - Summary Qsed (cy/event)			
	YANG. (HEC-6)	LAURSEN (MADDEN), 85	PARKER	SCHOKLITSCH
2-yr	2351.7	704.8	547.9	1271.9
5-yr	3290.1	982.2	814.1	1506.9
25-yr	4135.4	1235.6	1026.3	1882.8
50-yr	4328.4	1294.5	1084.8	1919.9
100-yr	4419.2	1322.6	1112.3	1937.5

2-yr hydrograph		Qsed (tons/hr)			
Duration (hrs)	Ave Qw (cfs)	YANG. (HEC-6)	LAURSEN (MADDEN), 85	PARKER	SCHOKLITSCH
24	880	0	0	0	0
18	1743	45.93	13.84	10.81	25.68
10	2897	68.92	20.51	17.7	29.86
3	3486	77.63	23.06	20.22	30.5
1	3930	83.85	24.9	22	30.87
4	3486	77.63	23.06	20.22	30.5
16	2257	57.1	17.14	14.17	28.34
24	941	25.38	7.63	4.8	18.33
24	757	19.22	5.79	3.52	13.9
	tons/event	4127.2	1236.9	961.5	2232.2
	cy/event	2351.7	704.8	547.9	1271.9

5-yr hydrograph		Qsed (tons/hr)			
Duration (hrs)	Ave Qw (cfs)	YANG. (HEC-6)	LAURSEN (MADDEN), 85	PARKER	SCHOKLITSCH
24	1341	0	0	0	0
18	2656	64.47	19.24	16.37	29.29
10	4416	89.91	26.71	23.79	31.28
3	5313	101.09	30.04	27.09	32.02
1	5990	109.53	32.56	29.58	32.59
4	5313	101.09	30.04	27.09	32.02
16	3440	76.99	22.87	20.04	30.47
24	1434	38.2	11.51	8.48	23.21
24	1154	31.2	9.39	6.37	20.97
	tons/event	5774.2	1723.8	1428.8	2644.6
	cy/event	3290.1	982.2	814.1	1506.9

Lemon Creek - Reach C **Existing Channel - No Redimix Bridge**

25-yr hydrograph		Qsed (tons/hr)			
Duration (hrs)	Ave Qw (cfs)	YANG. (HEC-6)	LAURSEN (MADDEN), 85	PARKER	SCHOKLITSCH
24	1505	39.98	12.04	9.02	23.78
18	2980	70.46	20.95	18.16	30.06
10	4954	96.62	28.71	25.77	31.72
3	5960	109.15	32.45	29.47	32.56
1	6720	118.33	35.63	32.72	33.41
4	5960	109.15	32.45	29.47	32.56
16	3859	82.86	24.6	21.72	30.81
24	1609	42.58	12.83	9.8	24.61
24	1295	34.73	10.46	7.43	22.1
	tons/event	7257.6	2168.5	1801.1	3304.3
	cy/event	4135.4	1235.6	1026.3	1882.8

50-yr hydrograph		Qsed (tons/hr)			
Duration (hrs)	Ave Qw (cfs)	YANG. (HEC-6)	LAURSEN (MADDEN), 85	PARKER	SCHOKLITSCH
24	1599	42.33	12.75	9.73	24.53
18	3166	73.15	21.74	18.94	30.24
10	5264	100.48	29.86	26.91	31.98
3	6333	113.66	34	31.06	32.97
1	7140	123.38	37.62	34.39	33.81
4	6333	113.66	34	31.06	32.97
16	4100	85.97	25.53	22.63	31.01
24	1710	45.1	13.59	10.56	25.41
24	1376	36.75	11.07	8.04	22.75
	tons/event	7596.3	2271.9	1903.8	3369.4
	cy/event	4328.4	1294.5	1084.8	1919.9

100-yr hydrograph		Qsed (tons/hr)			
Duration (hrs)	Ave Qw (cfs)	YANG. (HEC-6)	LAURSEN (MADDEN), 85	PARKER	SCHOKLITSCH
24	1644	43.45	13.1	10.06	24.89
18	3255	74.4	22.11	19.29	30.31
10	5411	102.31	30.4	27.45	32.11
3	6510	115.8	34.74	31.82	33.17
1	7340	125.47	38.5	35.29	33.99
4	6510	115.8	34.74	31.82	33.17
16	4215	87.41	25.96	23.05	31.11
24	1758	46.3	13.96	10.92	25.8
24	1414	37.7	11.36	8.33	23.05
	tons/event	7755.7	2321.1	1952	3400.4
	cy/event	4419.2	1322.6	1112.3	1937.5

Lemon Creek - Reach D **Existing Channel - No Redimix Bridge**

Threshold Flow to Mobilize, D 84
Di = 36.06 mm
Q(threshold) = 214 cfs

SAM generated rating curve of stream discharge (Qw) to sediment transport potential (Qs)
TABLE 5.0 SUMMARY TABLE: BED-MATERIAL SEDIMENT DISCHARGE, TONS/DAY

Q NO	WATER DISCHARGE total	channel	TRANSPORT FUNCTIONS YANG. (HEC-6)	LAURSEN (MADDEN), 85	PARKER	SCHOKLITSCH
1	50	50	44.05	13.22	4.37	72.21
2	250	250	440.19	135.98	276.03	690.06
3	1000	998	1325.46	396.54	611.61	1356.71
4	2000	1993	3269.49	1124.57	2918.32	2941.94
5	3000	2986	5625.78	2349.04	7709.77	4607.51
6	3930	3904	8064.76	3715.9	15049.65	6425.8
7	5990	5923	12999.7	6497.56	36859.72	9871.14
8	6720	6634	13625.1	6766.51	38807.67	9760
9	7140	7041	13611.4	6692.54	37523.77	9314.28
10	7340	7235	13501.8	6598.22	36411.16	9024.28

Conversion: tons - cubic yards
Lemon Creek gravel = 130 lb/cy
conversion = (cf/130lb) * (cy/27cf) * (2000lb/ton)
0.5698 cy/ton
1.755 ton/cy
Assume: no bulkage or shrinkage

1	50	44.05	13.22	4.37	72.21
2	250	440.19	135.98	276.03	690.06
3	998	1325.46	396.54	611.61	1356.71
4	1993	3269.49	1124.57	2918.32	2941.94
5	2986	5625.78	2349.04	7709.77	4607.51
6	3904	8064.76	3715.9	15049.65	6425.8
7	5923	12999.68	6497.56	36859.72	9871.14
8	6634	13625.09	6766.51	38807.67	9760
9	7041	13611.42	6692.54	37523.77	9314.28
10	7235	13501.77	6598.22	36411.16	9024.28

Lemon Creek - Reach D **Existing Channel - No Redimix Bridge**

Event	Reach D - Summary Qsed (cy/event)			
	YANG. (HEC-6)	LAURSEN (MADDEN), 85	PARKER	SCHOKLITSCH
2-yr	7254.1	2666.8	7497.4	6598.2
5-yr	12318.6	5145.3	19709.2	10364.7
25-yr	14172.3	6071.9	24796.8	11730.9
50-yr	15146.6	6553.2	27610.4	12406
100-yr	15602.3	6778.3	28966.8	12718.9

2-yr hydrograph		Qsed (tons/hr)			
Duration (hrs)	Ave Qw (cfs)	YANG. (HEC-6)	LAURSEN (MADDEN), 85	PARKER	SCHOKLITSCH
24	880	49.33	14.79	23.25	52.09
18	1743	115.41	39.06	96.9	105.61
10	2897	224.3	92.62	300.68	184.83
3	3486	287.51	127.64	481.06	231.57
1	3930	336.03	154.83	627.07	267.74
4	3486	287.51	127.64	481.06	231.57
16	2257	161.46	59.97	172.91	140.42
24	941	52.33	15.67	24.38	54.34
24	757	43.28	13	20.95	47.53
	tons/event	12730.9	4680.2	13158	11579.8
	cy/event	7254.1	2666.8	7497.4	6598.2

5-yr hydrograph		Qsed (tons/hr)			
Duration (hrs)	Ave Qw (cfs)	YANG. (HEC-6)	LAURSEN (MADDEN), 85	PARKER	SCHOKLITSCH
24	1341	82.85	26.87	58.26	79.05
18	2656	200.63	80.33	252.56	168.11
10	4416	384.54	182.17	841.46	301.61
3	5313	474.08	232.64	1237.17	364.12
1	5990	541.65	270.73	1535.82	411.3
4	5313	474.08	232.64	1237.17	364.12
16	3440	282.49	124.82	465.93	227.82
24	1434	90.38	29.69	67.2	85.2
24	1154	67.7	21.19	40.29	66.7
	tons/event	21619.1	9030	34589.6	18190.1
	cy/event	12318.6	5145.3	19709.2	10364.7

Lemon Creek - Reach D **Existing Channel - No Redimix Bridge**

25-yr hydrograph		Qsed (tons/hr)			
Duration (hrs)	Ave Qw (cfs)	YANG. (HEC-6)	LAURSEN (MADDEN), 85	PARKER	SCHOKLITSCH
24	1505	96.13	31.84	74.02	89.89
18	2980	232.44	96.86	317.25	190.59
10	4954	438.24	212.44	1078.8	339.1
3	5960	538.66	269.04	1522.59	409.21
1	6720	567.71	281.94	1616.99	406.67
4	5960	538.66	269.04	1522.59	409.21
16	3859	328.27	150.48	603.72	261.96
24	1609	104.56	35	84.02	96.75
24	1295	79.12	25.47	53.84	76.01
	tons/event	24872.4	10656.2	43518.3	20587.7
	cy/event	14172.3	6071.9	24796.8	11730.9

50-yr hydrograph		Qsed (tons/hr)			
Duration (hrs)	Ave Qw (cfs)	YANG. (HEC-6)	LAURSEN (MADDEN), 85	PARKER	SCHOKLITSCH
24	1599	103.75	34.69	83.06	96.09
18	3166	252.55	108.04	375.83	205.5
10	5264	469.19	229.88	1215.55	360.7
3	6333	553.9	276	1573.96	409.12
1	7140	567.14	278.86	1563.49	388.1
4	6333	553.9	276	1573.96	409.12
16	4100	353	164.39	702.06	279.59
24	1710	112.74	38.06	93.72	103.43
24	1376	85.68	27.93	61.62	81.36
	tons/event	26582.3	11500.9	48456.2	21772.5
	cy/event	15146.6	6553.2	27610.4	12406

100-yr hydrograph		Qsed (tons/hr)			
Duration (hrs)	Ave Qw (cfs)	YANG. (HEC-6)	LAURSEN (MADDEN), 85	PARKER	SCHOKLITSCH
24	1644	107.39	36.06	87.38	99.07
18	3255	262.27	113.49	405.1	212.75
10	5411	483.86	238.16	1280.4	370.95
3	6510	560.22	278.71	1593.64	408
1	7340	562.57	274.93	1517.13	376.01
4	6510	560.22	278.71	1593.64	408
16	4215	364.48	170.86	752.79	287.6
24	1758	116.63	39.52	98.34	106.6
24	1414	88.76	29.08	65.27	83.87
	tons/event	27382	11895.9	50836.8	22321.6
	cy/event	15602.3	6778.3	28966.8	12718.9

Lemon Creek - Reach E **Existing Channel - No Redimix Bridge**

Threshold Flow to Mobilize, D 84
Di = 58.06 mm
Q(threshold) = 292 cfs

SAM generated rating curve of stream discharge (Qw) to sediment transport potential (Qs)
TABLE 5.0 SUMMARY TABLE: BED-MATERIAL SEDIMENT DISCHARGE, TONS/DAY

Q NO	WATER DISCHARGE total	channel	TRANSPORT FUNCTIONS YANG. (HEC-6)	LAURSEN (MADDEN), 85	PARKER	SCHOKLITSCH
1	50	50	36.47	9.8	2.92	105.6
2	250	249	380.61	90.45	166.31	672.04
3	1000	991	2710.52	1295.48	4736.99	3963.1
4	2000	1974	7390.58	3930.09	21853.91	9616.86
5	3000	2954	12698.5	7377.66	45013.29	15054.12
6	3930	3831	17137.3	10725.18	66811.73	19644.98
7	5990	5769	33263.9	26657.93	153250	36182.36
8	6720	6444	38250.1	31567.76	176923.4	40363.12
9	7140	6829	41370.3	34719.56	192068.5	43037.39
10	7340	7007	41083.2	34034.24	185560.7	41620.52

Conversion: tons - cubic yards
Lemon Creek gravel = 130 lb/cy
conversion = (cf/130lb) * (cy/27cf) * (2000lb/ton)
0.5698 cy/ton
1.755 ton/cy
Assume: no bulkage or shrinkage

NO (HEC-6)	DISCHARC (MADDEN)	YANG. 85	LAURSEI	PARKER	SCHOKLITSCH
1	50	36.47	9.8	2.92	105.6
2	249	380.61	90.45	166.31	672.04
3	991	2710.52	1295.48	4736.99	3963.1
4	1974	7390.58	3930.09	21853.91	9616.86
5	2954	12698.48	7377.66	45013.29	15054.12
6	3831	17137.34	10725.2	66811.73	19644.98
7	5769	33263.86	26657.9	153249.97	36182.36
8	6444	38250.12	31567.8	176923.39	40363.12
9	6829	41370.3	34719.6	192068.53	43037.39
10	7007	41083.15	34034.2	185560.67	41620.52

Lemon Creek - Reach E **Existing Channel - No Redimix Bridge**

Event	Reach E - Summary Qsed (cy/event)			
	YANG. (HEC-6)	LAURSEN (MADDEN), 85	PARKER	SCHOKLITSCH
2-yr	15644.2	8486.5	45734.7	20200.3
5-yr	27787.7	17290.9	99096.9	33504.4
25-yr	32522.3	20997.9	121149.2	38576.9
50-yr	35355.3	23359.7	134549.2	41535.3
100-yr	36695.6	24482.8	140815.3	42910.7

2-yr hydrograph		Qsed (tons/hr)			
Duration (hrs)	Ave Qw (cfs)	YANG. (HEC-6)	LAURSEN (MADDEN), 85	PARKER	SCHOKLITSCH
24	880	97.41	45.94	166.9	143.19
18	1743	257.83	135.54	727.29	340.16
10	2897	506.32	292.61	1776.16	603.92
3	3486	625.76	380.29	2350.2	727.22
1	3930	714.06	446.88	2783.82	818.54
4	3486	625.76	380.29	2350.2	727.22
16	2257	364.78	200.67	1158.58	458.93
24	941	105.3	50.03	182.39	154.34
24	757	81.48	37.71	135.67	120.7
	tons/event	27455.6	14893.8	80264.4	35451.6
	cy/event	15644.2	8486.5	45734.7	20200.3

5-yr hydrograph		Qsed (tons/hr)			
Duration (hrs)	Ave Qw (cfs)	YANG. (HEC-6)	LAURSEN (MADDEN), 85	PARKER	SCHOKLITSCH
24	1341	179.43	91.41	440.58	245.46
18	2656	453.02	257.99	1543.6	549.32
10	4416	872.58	603.5	3633.52	981.1
3	5313	1165.17	892.57	5201.78	1281.15
1	5990	1385.99	1110.75	6385.42	1507.6
4	5313	1165.17	892.57	5201.78	1281.15
16	3440	616.61	373.39	2305.27	717.76
24	1434	197.57	101.62	506.91	267.37
24	1154	142.97	70.88	307.21	201.41
	tons/event	48767.4	30345.6	173915	58800.3
	cy/event	27787.7	17290.9	99096.9	33504.4

Lemon Creek - Reach E **Existing Channel - No Redimix Bridge**

25-yr hydrograph		Qsed (tons/hr)			
Duration (hrs)	Ave Qw (cfs)	YANG. (HEC-6)	LAURSEN (MADDEN), 85	PARKER	SCHOKLITSCH
24	1505	211.41	109.41	557.54	284.09
18	2980	524.68	304.53	1856.25	622.72
10	4954	1048.07	776.88	4574.13	1161.06
3	5960	1376.21	1101.08	6332.97	1497.56
1	6720	1593.76	1315.32	7371.81	1681.8
4	5960	1376.21	1101.08	6332.97	1497.56
16	3859	699.94	436.23	2714.48	803.94
24	1609	231.69	120.83	631.72	308.59
24	1295	170.46	86.36	407.77	234.62
	tons/event	57076.7	36851.3	212616.8	67702.5
	cy/event	32522.3	20997.9	121149.2	38576.9

50-yr hydrograph		Qsed (tons/hr)			
Duration (hrs)	Ave Qw (cfs)	YANG. (HEC-6)	LAURSEN (MADDEN), 85	PARKER	SCHOKLITSCH
24	1599	229.74	119.73	624.58	306.24
18	3166	562.12	332.3	2037.67	661.4
10	5264	1149.18	876.78	5116.12	1264.76
3	6333	1483.61	1206.87	6848.88	1589.45
1	7140	1723.76	1446.65	8002.86	1793.22
4	6333	1483.61	1206.87	6848.88	1589.45
16	4100	769.51	501.67	3081.04	875.4
24	1710	251.39	131.92	703.75	332.39
24	1376	186.26	95.25	465.54	253.7
	tons/event	62048.5	40996.3	236133.8	72894.5
	cy/event	35355.3	23359.7	134549.2	41535.3

100-yr hydrograph		Qsed (tons/hr)			
Duration (hrs)	Ave Qw (cfs)	YANG. (HEC-6)	LAURSEN (MADDEN), 85	PARKER	SCHOKLITSCH
24	1644	238.52	124.67	656.68	316.84
18	3255	579.82	345.65	2124.6	679.7
10	5411	1197.13	924.16	5373.12	1313.93
3	6510	1533.99	1256.47	7088.05	1631.68
1	7340	1711.8	1418.09	7731.69	1734.19
4	6510	1533.99	1256.47	7088.05	1631.68
16	4215	807.02	538.73	3282.1	913.87
24	1758	260.75	137.19	737.98	343.69
24	1414	193.67	99.43	492.64	262.66
	tons/event	64400.7	42967.3	247130.8	75308.3
	cy/event	36695.6	24482.8	140815.3	42910.7

Lemon Creek - Reach I: XS 48 **Existing Conditions**

GSD from Sample: 3sub
Threshold Flow to Mobilize, D 84
Di = 74.61 mm
Q(threshold) = 119 cfs

SAM generated rating curve of stream discharge (Qw) to sediment transport potential (Qs)

TABLE 5.0 SUMMARY TABLE: BED-MATERIAL SEDIMENT DISCHARGE, TONS/DAY

Q NO	WATER DISCHARGE total	channel	TRANSPORT FUNCTIONS YANG. (HEC-6)	LAURSEN (MADDEN), 85	PARKER	SCHOKLITSCH
1	50	50	939.18	3100.86	57.54	974.75
2	250	250	4054.85	12974.64	1617.28	4901.16
3	1000	989.13	20730.44	63375.7	8158.54	12953.26
4	2000	1933.85	24865.59	82190.48	9701.78	12172.71
5	3000	2837.15	27450.04	94435.79	10484.44	11560.01
6	3930	3630.06	28802.06	101695.91	10787.42	10912.67
7	5990	5299.42	32023.32	116669.21	11769.7	10276.58
8	6720	5865.11	32790.11	120564.21	11945.23	10060.4
9	7140	6184.36	33121.59	122433.76	11988.77	9922.29
10	7340	6335.82	33204.54	123073.6	12031.03	9854.53

Conversion: tons - cubic yards

Lemon Creek gravel = 130 lb/cy
conversion = (cf/130lb) * (cy/27cf) * (2000lb/ton)
0.569801 cy/ton
1.755 ton/cy
Assume: no bulkage or shrinkage

1	50	939.18	3100.86	57.54	974.75
2	250	4054.85	12974.64	1617.28	4901.16
3	989.13	20730.44	63375.7	8158.54	12953.26
4	1933.85	24865.59	82190.48	9701.78	12172.71
5	2837.15	27450.04	94435.79	10484.44	11560.01
6	3630.06	28802.06	101695.9	10787.42	10912.67
7	5299.42	32023.32	116669.2	11769.7	10276.58
8	5865.11	32790.11	120564.2	11945.23	10060.4
9	6184.36	33121.59	122433.8	11988.77	9922.29
10	6335.82	33204.54	123073.6	12031.03	9854.53

Lemon Creek - Reach I: XS 48 **Existing Conditions**

Event	Reach I - Summary Qsed (cy/event)			
	YANG. (HEC-6)	LAURSEN (MADDEN), 85	PARKER	SCHOKLITSCH
2-yr	61777.6	198510.9	24082.3	34296.4
5-yr	72571.7	240353.6	27963.7	35576.1
25-yr	74678.1	250240	28662.3	35089.2
50-yr	75784.2	255457	29026.7	34828.8
100-yr	76304	257901.7	29199.7	34709.3

2-yr hydrograph		Qsed (tons/hr)			
Duration (hrs)	Ave Qw (cfs)	YANG. (HEC-6)	LAURSEN (MADDEN), 85	PARKER	SCHOKLITSCH
24	880	752.6	2304.65	296.33	486.04
18	1743	991.79	3223.13	387.72	515.55
10	2897	1132.66	3882.27	433.49	484.3
3	3486	1173.19	4092.91	443.45	467.57
1	3930	1200.09	4237.33	449.48	454.69
4	3486	1173.19	4092.91	443.45	467.57
16	2257	1063.74	3555.73	412.62	500.64
24	941	809.11	2475.45	318.5	513.33
24	757	638.65	1960.24	251.63	431.02
	tons/event	108419.7	348386.6	42264.5	60190.2
	cy/event	61777.6	198510.9	24082.3	34296.4

5-yr hydrograph		Qsed (tons/hr)			
Duration (hrs)	Ave Qw (cfs)	YANG. (HEC-6)	LAURSEN (MADDEN), 85	PARKER	SCHOKLITSCH
24	1341	922.52	2907.98	361.87	528.63
18	2656	1106.71	3759.31	425.63	490.45
10	4416	1231.75	4384.52	459.13	448.44
3	5313	1290.2	4656.18	476.95	436.9
1	5990	1334.31	4861.22	490.4	428.19
4	5313	1290.2	4656.18	476.95	436.9
16	3440	1170.4	4077.95	442.82	468.91
24	1434	938.55	2980.89	367.85	525.6
24	1154	890.3	2761.38	349.84	534.71
	tons/event	127363.3	421820.5	49076.3	62436.1
	cy/event	72571.7	240353.6	27963.7	35576.1

Lemon Creek - Reach I: XS 48 **Existing Conditions**

25-yr hydrograph		Qsed (tons/hr)			
Duration (hrs)	Ave Qw (cfs)	YANG. (HEC-6)	LAURSEN (MADDEN), 85	PARKER	SCHOKLITSCH
24	1505	950.78	3036.55	372.41	523.3
18	2980	1141.6	3924.62	436.2	482.18
10	4954	1266.8	4547.46	469.82	441.52
3	5960	1332.35	4852.13	489.81	428.58
1	6720	1366.25	5023.51	497.72	419.18
4	5960	1332.35	4852.13	489.81	428.58
16	3859	1195.79	4214.24	448.51	456.75
24	1609	968.7	3118.08	379.1	519.91
24	1295	914.6	2871.92	358.91	530.12
	tons/event	131060.1	439171.2	50302.4	61581.6
	cy/event	74678.1	250240	28662.3	35089.2

50-yr hydrograph		Qsed (tons/hr)			
Duration (hrs)	Ave Qw (cfs)	YANG. (HEC-6)	LAURSEN (MADDEN), 85	PARKER	SCHOKLITSCH
24	1599	966.97	3110.24	378.46	520.24
18	3166	1153.81	3988.82	439.11	476.85
10	5264	1287	4641.34	475.98	437.53
3	6333	1349.32	4937.47	493.84	423.96
1	7140	1380.07	5101.41	499.53	413.43
4	6333	1349.32	4937.47	493.84	423.96
16	4100	1211.16	4288.82	452.85	452.51
24	1710	986.1	3197.26	385.59	516.63
24	1376	928.55	2935.42	364.12	527.49
	tons/event	133001.3	448327.1	50941.9	61124.6
	cy/event	75784.2	255457	29026.7	34828.8

100-yr hydrograph		Qsed (tons/hr)			
Duration (hrs)	Ave Qw (cfs)	YANG. (HEC-6)	LAURSEN (MADDEN), 85	PARKER	SCHOKLITSCH
24	1644	974.73	3145.52	381.35	518.77
18	3255	1159.2	4017.77	440.31	474.27
10	5411	1296.58	4685.86	478.9	435.64
3	6510	1357.06	4976.82	495.61	421.77
1	7340	1383.52	5128.07	501.29	410.61
4	6510	1357.06	4976.82	495.61	421.77
16	4215	1218.65	4323.64	455.14	451.03
24	1758	994.37	3234.89	388.68	515.07
24	1414	935.1	2965.21	366.56	526.25
	tons/event	133913.5	452617.4	51245.5	60914.9
	cy/event	76304	257901.7	29199.7	34709.3

Lemon Creek - Reach I: XS 48 **Existing Conditions**

GSD sample: Bank Sample
Threshold Flow to Mobilize, D 84
Di = 74.61 mm
Q(threshold) = 119 cfs

SAM generated rating curve of stream discharge (Qw) to sediment transport potential (Qs)
TABLE 5.0 SUMMARY TABLE: BED-MATERIAL SEDIMENT DISCHARGE, TONS/DAY

Q NO	WATER DISCHARGE total	channel	TRANSPORT FUNCTIONS YANG. (HEC-6)	LAURSEN (MADDEN), 85	PARKER	SCHOKLITSCH
1	50	50	936.07	184.14	1175.8	2501.18
2	250	250	5835.28	1558.35	8943.15	11115.57
3	1000	989.13	22619.7	7508.67	28289.69	28417.86
4	2000	1933.85	30990.6	9857.72	31868.1	26797.43
5	3000	2837.15	36827.7	11382.48	33679.55	25523.49
6	3930	3630.06	40599.6	12293.1	34205.91	24148.59
7	5990	5299.42	48324.5	14242.71	35825.44	22764.67
8	6720	5865.11	50433.7	14743.11	36109.22	22301.65
9	7140	6184.36	51482.1	14977.95	36179.36	22008.58
10	7340	6335.82	51882.5	15059.62	36247.35	21865.38

Conversion: tons - cubic yards
Lemon Creek gravel = 130 lb/cy
conversion = (cf/130lb) * (cy/27cf) * (2000lb/ton)
0.5698 cy/ton
1.755 ton/cy
Assume: no bulkage or shrinkage

1	50	936.07	184.14	1175.8	2501.18
2	250	5835.28	1558.35	8943.15	11115.57
3	989.13	22619.66	7508.67	28289.69	28417.86
4	1933.85	30990.62	9857.72	31868.1	26797.43
5	2837.15	36827.73	11382.5	33679.55	25523.49
6	3630.06	40599.64	12293.1	34205.91	24148.59
7	5299.42	48324.5	14242.7	35825.44	22764.67
8	5865.11	50433.65	14743.1	36109.22	22301.65
9	6184.36	51482.11	14978	36179.36	22008.58
10	6335.82	51882.53	15059.6	36247.35	21865.38

Lemon Creek - Reach I: XS 48 **Existing Conditions**

Event	Reach I - Summary Qsed (cy/event)			
	YANG. (HEC-6)	LAURSEN (MADDEN), 85	PARKER	SCHOKLITSCH
2-yr	73964.3	23703.5	82071.1	75501.8
5-yr	91473.2	28832.9	92195.5	78317.9
25-yr	96148.7	30076.9	93706.7	77294.1
50-yr	98638.6	30735.3	94476.9	76744.3
100-yr	99806.9	31044.2	94840.3	76492.5

2-yr hydrograph		Qsed (tons/hr)			
Duration (hrs)	Ave Qw (cfs)	YANG. (HEC-6)	LAURSEN (MADDEN), 85	PARKER	SCHOKLITSCH
24	880	830.59	273.19	1049.76	1068.73
18	1743	1201.64	385.58	1289.52	1133.91
10	2897	1509.44	467.73	1395.54	1068.95
3	3486	1616.62	494.1	1414.78	1033.54
1	3930	1691.65	512.21	1425.25	1006.19
4	3486	1616.62	494.1	1414.78	1033.54
16	2257	1353.78	427.07	1347.24	1102.92
24	941	887.47	293.36	1115.32	1127.36
24	757	715.9	232.53	917.56	950.5
	tons/event	129807.4	41599.7	144034.7	132505.7
	cy/event	73964.3	23703.5	82071.1	75501.8

5-yr hydrograph		Qsed (tons/hr)			
Duration (hrs)	Ave Qw (cfs)	YANG. (HEC-6)	LAURSEN (MADDEN), 85	PARKER	SCHOKLITSCH
24	1341	1061.42	346.24	1229.58	1161.05
18	2656	1450.82	452.42	1377.35	1081.74
10	4416	1767.59	531.38	1441.17	992.59
3	5313	1907.74	566.75	1470.55	967.48
1	5990	2013.52	593.45	1492.73	948.53
4	5313	1907.74	566.75	1470.55	967.48
16	3440	1608.85	492.22	1413.69	1036.37
24	1434	1093.86	355.34	1243.45	1154.77
24	1154	996.2	327.93	1201.7	1173.68
	tons/event	160535.5	50601.8	161803.1	137448
	cy/event	91473.2	28832.9	92195.5	78317.9

Lemon Creek - Reach I: XS 48 **Existing Conditions**

25-yr hydrograph		Qsed (tons/hr)			
Duration (hrs)	Ave Qw (cfs)	YANG. (HEC-6)	LAURSEN (MADDEN), 85	PARKER	SCHOKLITSCH
24	1505	1118.62	362.29	1254.03	1149.98
18	2980	1529.62	473	1401.81	1064.54
10	4954	1851.65	552.59	1458.79	977.53
3	5960	2008.83	592.26	1491.74	949.37
1	6720	2101.4	614.3	1504.55	929.24
4	5960	2008.83	592.26	1491.74	949.37
16	3859	1679.65	509.32	1423.57	1010.56
24	1609	1154.9	372.47	1269.54	1142.96
24	1295	1045.38	341.73	1222.72	1164.16
	tons/event	168740.9	52784.9	164455.3	135651.2
	cy/event	96148.7	30076.9	93706.7	77294.1

50-yr hydrograph		Qsed (tons/hr)			
Duration (hrs)	Ave Qw (cfs)	YANG. (HEC-6)	LAURSEN (MADDEN), 85	PARKER	SCHOKLITSCH
24	1599	1151.41	371.49	1268.05	1143.63
18	3166	1562.54	481.04	1407.23	1053.25
10	5264	1900.09	564.82	1468.94	968.85
3	6333	2054.81	603.24	1498.28	939.46
1	7140	2145.09	624.08	1507.47	917.02
4	6333	2054.81	603.24	1498.28	939.46
16	4100	1718.21	518.92	1430.82	1001.43
24	1710	1190.13	382.35	1284.6	1136.14
24	1376	1073.63	349.66	1234.8	1158.69
	tons/event	173110.8	53940.4	165806.9	134686.2
	cy/event	98638.6	30735.3	94476.9	76744.3

100-yr hydrograph		Qsed (tons/hr)			
Duration (hrs)	Ave Qw (cfs)	YANG. (HEC-6)	LAURSEN (MADDEN), 85	PARKER	SCHOKLITSCH
24	1644	1167.11	375.89	1274.76	1140.6
18	3255	1577.58	484.67	1409.33	1047.77
10	5411	1923.05	570.61	1473.76	964.74
3	6510	2076.12	608.3	1501.15	934.79
1	7340	2161.77	627.48	1510.31	911.06
4	6510	2076.12	608.3	1501.15	934.79
16	4215	1736.18	523.45	1434.58	998.21
24	1758	1206.87	387.05	1291.76	1132.9
24	1414	1086.88	353.38	1240.46	1156.13
	tons/event	175161.1	54482.6	166444.7	134244.3
	cy/event	99806.9	31044.2	94840.3	76492.5

Existing Channel - No Redimix Bridge

Summary Sediment Transport Estimate | Transport rate supply - reach | Estimated depth of deposition/erosion

Reach A	L	W	Event	Reach A - Summary Qsed (cy/event)				Change B to A (cy/event) - (+)Deposition/(-)Erosion				Reach A - Depostion (+)/Erosion (-)			
Below Redimix	Reach Average L	W		YANG. (HEC-6)	LAURSEN (MADDEN), 85	PARKER	SCHOKLITSCH	YANG. (HEC-6)	LAURSEN (MADDEN), 85	PARKER	SCHOKLITSCH	YANG. (HEC-6)	LAURSEN (MADDEN), 85	PARKER	SCHOKLITSCH
	372	115.74	2-yr	8436	41168	946	1495	13351	48390	4464	2314	8.37	30.35	2.80	1.45
	372	116.12	5-yr	43794	153712	8218	6821	7635	26752	7324	1140	4.77	16.72	4.58	0.71
	372	116.12	25-yr	61006	201534	12195	9262	5023	28253	7893	830	3.14	17.66	4.93	0.52
	372	116.12	50-yr	76389	238210	16241	11347	-2976	13073	6432	-319	-1.86	8.17	4.02	-0.20
	372	116.12	100-yr	84165	256304	18326	12389	-7216	5185	5590	-920	-4.51	3.24	3.49	-0.57

Reach B	L	W	Event	Reach B - Summary Qsed (cy/event)				Change C to B (cy/event) - (+)Deposition/(-)Erosion				Reach B - Depostion (+)/Erosion (-)			
Redimix to Glacier Hwy				YANG. (HEC-6)	LAURSEN (MADDEN), 85	PARKER	SCHOKLITSCH	YANG. (HEC-6)	LAURSEN (MADDEN), 85	PARKER	SCHOKLITSCH	YANG. (HEC-6)	LAURSEN (MADDEN), 85	PARKER	SCHOKLITSCH
	894	69.85	2-yr	21787	89558	5410	3808	-19435	-88853	-4862	-2537	-8.40	-38.42	-2.10	-1.10
	894	69.85	5-yr	51428	180465	15543	7961	-48138	-179483	-14729	-6454	-20.81	-77.60	-6.37	-2.79
	894	69.85	25-yr	66029	229788	20088	10092	-61893	-228552	-19061	-8209	-26.76	-98.82	-8.24	-3.55
	894	69.85	50-yr	73412	251284	22673	11028	-69084	-249989	-21588	-9108	-29.87	-108.09	-9.33	-3.94
	894	69.85	100-yr	76949	261489	23916	11470	-72530	-260167	-22804	-9532	-31.36	-112.49	-9.86	-4.12

Reach C (1)	L	W	Event	Reach C - Summary Qsed (cy/event)				Change D to C (cy/event) - (+)Deposition/(-)Erosion				Reach C - Depostion (+)/Erosion (-)			
Immed. Above Glacier Hwy				YANG. (HEC-6)	LAURSEN (MADDEN), 85	PARKER	SCHOKLITSCH	YANG. (HEC-6)	LAURSEN (MADDEN), 85	PARKER	SCHOKLITSCH	YANG. (HEC-6)	LAURSEN (MADDEN), 85	PARKER	SCHOKLITSCH
	1452.5	118.52	2-yr	2352	705	548	1272	4902	1962	6950	5326	0.77	0.31	1.09	0.84
	1452.5	119.72	5-yr	3290	982	814	1507	9029	4163	18895	8858	1.40	0.65	2.93	1.38
	1452.5	119.72	25-yr	4135	1236	1026	1883	10037	4836	23771	9848	1.56	0.75	3.69	1.53
	1452.5	119.72	50-yr	4328	1295	1085	1920	10818	5259	26526	10486	1.68	0.82	4.12	1.63
	1452.5	119.72	100-yr	4419	1323	1112	1938	11183	5456	27855	10781	1.74	0.85	4.32	1.67

Reach D(2)	L	W	Event	Reach D - Summary Qsed (cy/event)				Change E to D (cy/event) - (+)Deposition/(-)Erosion				Reach D - Depostion (+)/Erosion (-)			
between Glacier Hwy & Prison				YANG. (HEC-6)	LAURSEN (MADDEN), 85	PARKER	SCHOKLITSCH	YANG. (HEC-6)	LAURSEN (MADDEN), 85	PARKER	SCHOKLITSCH	YANG. (HEC-6)	LAURSEN (MADDEN), 85	PARKER	SCHOKLITSCH
	1715	189.41	2-yr	7254	2667	7497	6598	8390	5820	38237	13602	0.70	0.48	3.18	1.13
	1715	189.41	5-yr	12319	5145	19709	10365	15469	12146	79388	23140	1.29	1.01	6.60	1.92
	1715	189.41	25-yr	14172	6072	24797	11731	18350	14926	96352	26846	1.53	1.24	8.01	2.23
	1715	189.41	50-yr	15147	6553	27610	12406	20209	16807	106939	29129	1.68	1.40	8.89	2.42
	1715	189.41	100-yr	15602	6778	28967	12719	21093	17705	111849	30192	1.75	1.47	9.30	2.51

Reach E(3)	L	W	Event	Reach E - Summary Qsed (cy/event)				Change xs48 to E (cy/event) - (+)Deposition/(-)Erosion				Reach E - Depostion (+)/Erosion (-)			
Prison - Costco				YANG. (HEC-6)	LAURSEN (MADDEN), 85	PARKER	SCHOKLITSCH	YANG. (HEC-6)	LAURSEN (MADDEN), 85	PARKER	SCHOKLITSCH	YANG. (HEC-6)	LAURSEN (MADDEN), 85	PARKER	SCHOKLITSCH
	1902	132.88	2-yr	15644	8487	45735	20200	46133	190024	-21652	14096	4.93	20.30	-2.31	1.51
	1902	133.75	5-yr	27788	17291	99097	33504	44784	223063	-71133	2072	4.75	23.67	-7.55	0.22
	1902	134.01	25-yr	32522	20998	121149	38577	42156	229242	-92487	-3488	4.47	24.28	-9.80	-0.37
	1902	134.16	50-yr	35355	23360	134549	41535	40429	232097	-105523	-6707	4.28	24.56	-11.17	-0.71
	1902	134.22	100-yr	36696	24483	140815	42911	39608	233419	-111616	-8201	4.19	24.69	-11.80	-0.87

Existing Channel - No Redimix Bridge

Summary Sediment Transport Estimate | Transport rate supply - reach | Estimated depth of deposition/erosion

Reach F(4)
Gorge

				Reach F - Summary Qsed (cy/event)				Change G to F (cy/event) - (+)Deposition/(-)Erosion				Reach F - Depostion (+)/Erosion (-)			
			Event	YANG. (HEC-6)	LAURSEN (MADDEN), 85	PARKER	SCHOKLITSCH	YANG. (HEC-6)	LAURSEN (MADDEN), 85	PARKER	SCHOKLITSCH	YANG. (HEC-6)	LAURSEN (MADDEN), 85	PARKER	SCHOKLITSCH
	1811.5	42.82	2-yr	40802	56354	612043	99116	transp	transp	transp	transp	transp	transp	transp	transp
	1811.5	43.49	5-yr	64236	99215	916573	143980	transp	transp	transp	transp	transp	transp	transp	transp
	1811.5	43.68	25-yr	72665	115367	1023606	159664	transp	transp	transp	transp	transp	transp	transp	transp
	1811.5	43.79	50-yr	77513	124964	1083878	168500	transp	transp	transp	transp	transp	transp	transp	transp
	1811.5	43.84	100-yr	79818	129554	1112389	172684	transp	transp	transp	transp	transp	transp	transp	transp

Reach G(5)
USGS above
Gorge
Bridge

				Reach G - Summary Qsed (cy/event)				Change xs48 to G (cy/event) - (+)Deposition/(-)Erosion				Reach G - Depostion (+)/Erosion (-)			
			Event	YANG. (HEC-6)	LAURSEN (MADDEN), 85	PARKER	SCHOKLITSCH	YANG. (HEC-6)	LAURSEN (MADDEN), 85	PARKER	SCHOKLITSCH	YANG. (HEC-6)	LAURSEN (MADDEN), 85	PARKER	SCHOKLITSCH
		45.23											depths compounded by short reach length		
0	1000	100	2-yr	18887	11284	43189	17139	42891	187227	-19107	17157	11.6	50.6	-5.2	4.6
0	1000	100	5-yr	25481	15627	57892	20507	47091	224727	-29928	15069	12.7	60.7	-8.1	4.1
0	1000	100	25-yr	27305	16761	61585	21167	47373	233479	-32923	13922	12.8	63.0	-8.9	3.8
0	1000	100	50-yr	28150	17220	63008	21387	47634	238237	-33981	13442	12.9	64.3	-9.2	3.6
0	1000	100	100-yr	28528	17415	63603	21475	47776	240487	-34403	13235	12.9	64.9	-9.3	3.6

Reach H
above
Gorge
Bridge &
USGS

				Reach H - Summary Qsed (cy/event)				Change I to H (cy/event) - (+)Deposition/(-)Erosion				Reach H - Depostion (+)/Erosion (-)			
			Event	YANG. (HEC-6)	LAURSEN (MADDEN), 85	PARKER	SCHOKLITSCH	YANG. (HEC-6)	LAURSEN (MADDEN), 85	PARKER	SCHOKLITSCH	YANG. (HEC-6)	LAURSEN (MADDEN), 85	PARKER	SCHOKLITSCH
	1017	121.31	2-yr	26636	30825	83366	32482	12838	50359	3943	9236	transp	transp	transp	transp
	1017	128.38	5-yr	43071	52035	137662	46438	18305	79231	3508	10193	transp	transp	transp	transp
	1017	129.3	25-yr	48712	59379	156014	50787	20343	89804	4212	10580	transp	transp	transp	transp
	1017	129.5	50-yr	51866	63583	166323	53128	21526	95903	4634	10835	transp	transp	transp	transp
	1017	129.59	100-yr	53325	65532	171064	54185	22121	98858	4979	11000	transp	transp	transp	transp

Reach I
Single thread
channel

				Reach I - Summary Qsed (cy/event)				Change 48 to I (cy/event) - (+)Deposition/(-)Erosion				Reach I - Depostion (+)/Erosion (-)			
			Event	YANG. (HEC-6)	LAURSEN (MADDEN), 85	PARKER	SCHOKLITSCH	YANG. (HEC-6)	LAURSEN (MADDEN), 85	PARKER	SCHOKLITSCH	YANG. (HEC-6)	LAURSEN (MADDEN), 85	PARKER	SCHOKLITSCH
	1495	94.63	2-yr	39473	81184	87308	41718	22304	117327	-63226	-7422	transp	transp	transp	transp
	1495	95.23	5-yr	61376	131267	141169	56630	11195	109087	-113206	-21054	transp	transp	transp	transp
	1495	95.42	25-yr	69055	149184	160225	61367	5623	101057	-131563	-26278	transp	transp	transp	transp
	1495	95.45	50-yr	73392	159486	170957	63963	2392	95971	-141931	-29134	transp	transp	transp	transp
	1495	95.46	100-yr	75446	164390	176043	65185	858	93512	-146843	-30476	transp	transp	transp	transp

Existing Channel - No Redimix Bridge

Summary Sediment Transport Estimate | Transport rate supply - reach | Estimated depth of deposition/erosion

XS 43
wider section above single thread channel

		Event	XS 48 (Rch I) - Summary Qsed (cy/event) YANG. (HEC-6)	LAURSEN (MADDEN), 85	PARKER	SCHOKLITSCH	Change J to 48 (cy/event) - (+)Deposition/(-)Erosion YANG. (HEC-6)	LAURSEN (MADDEN), 85	PARKER	SCHOKLITSCH	XS 48 (Rch I) - Depostion (+)/Erosion (-) YANG. (HEC-6)	LAURSEN (MADDEN), 85	PARKER	SCHOKLITSCH
1000	145.83	2-yr	61778	198511	24082	34296	-42188	-174536	15598	-15830	supply	supply	supply	supply
1000	145.83	5-yr	72572	240354	27964	35576	-39913	-197446	46440	-7773	supply	supply	supply	supply
1000	145.83	25-yr	74678	250240	28662	35089	-37262	-200212	58829	-4048	supply	supply	supply	supply
1000	145.83	50-yr	75784	255457	29027	34829	-35639	-201206	66025	-1978	supply	supply	supply	supply
1000	145.83	100-yr	76304	257902	29200	34709	-34861	-201626	69455	-1002	supply	supply	supply	supply

Reach J
Section between wide valley area near Quarry

		Event	Reach J - Summary Qsed (cy/event) YANG. (HEC-6)	LAURSEN (MADDEN), 85	PARKER	SCHOKLITSCH	Change K to J (cy/event) - (+)Deposition/(-)Erosion YANG. (HEC-6)	LAURSEN (MADDEN), 85	PARKER	SCHOKLITSCH	Reach J - Depostion (+)/Erosion (-) YANG. (HEC-6)	LAURSEN (MADDEN), 85	PARKER	SCHOKLITSCH
1000	61.46	2-yr	19589	23975	39680	18467	37126	81551	186826	53981	16.3	35.8	82.1	23.7
1000	61.46	5-yr	32659	42908	74404	27804	54621	128472	269278	73548	24.0	56.4	118.3	32.3
1000	61.46	25-yr	37416	50028	87491	31041	60390	144545	295808	79705	26.5	63.5	130.0	35.0
1000	61.46	50-yr	40145	54251	95051	32851	63595	153652	310148	83016	27.9	67.5	136.3	36.5
1000	61.46	100-yr	41443	56276	98655	33707	65084	157900	316759	84534	28.6	69.4	139.2	37.1

Reach K
above quarry

		Event	Reach K - Summary Qsed (cy/event) YANG. (HEC-6)	LAURSEN (MADDEN), 85	PARKER	SCHOKLITSCH	Reach K YANG. (HEC-6)	LAURSEN (MADDEN), 85	PARKER	SCHOKLITSCH	Reach K - Depostion (+)/Erosion (-) YANG. (HEC-6)	LAURSEN (MADDEN), 85	PARKER	SCHOKLITSCH
1000	105.765	2-yr	56715	105526	226506	72447	supply	supply	supply	supply	supply	supply	supply	supply
1000	107.505	5-yr	87280	171380	343682	101352	supply	supply	supply	supply	supply	supply	supply	supply
1000	108.775	25-yr	97806	194573	383299	110746	supply	supply	supply	supply	supply	supply	supply	supply
1000	109.07	50-yr	103740	207903	405199	115867	supply	supply	supply	supply	supply	supply	supply	supply
1000	109.22	100-yr	106527	214176	415413	118241	supply	supply	supply	supply	supply	supply	supply	supply

Appendix G

Sediment Transport

In Stream Mining from RediMix to Prison
RediMix Bridge Removed

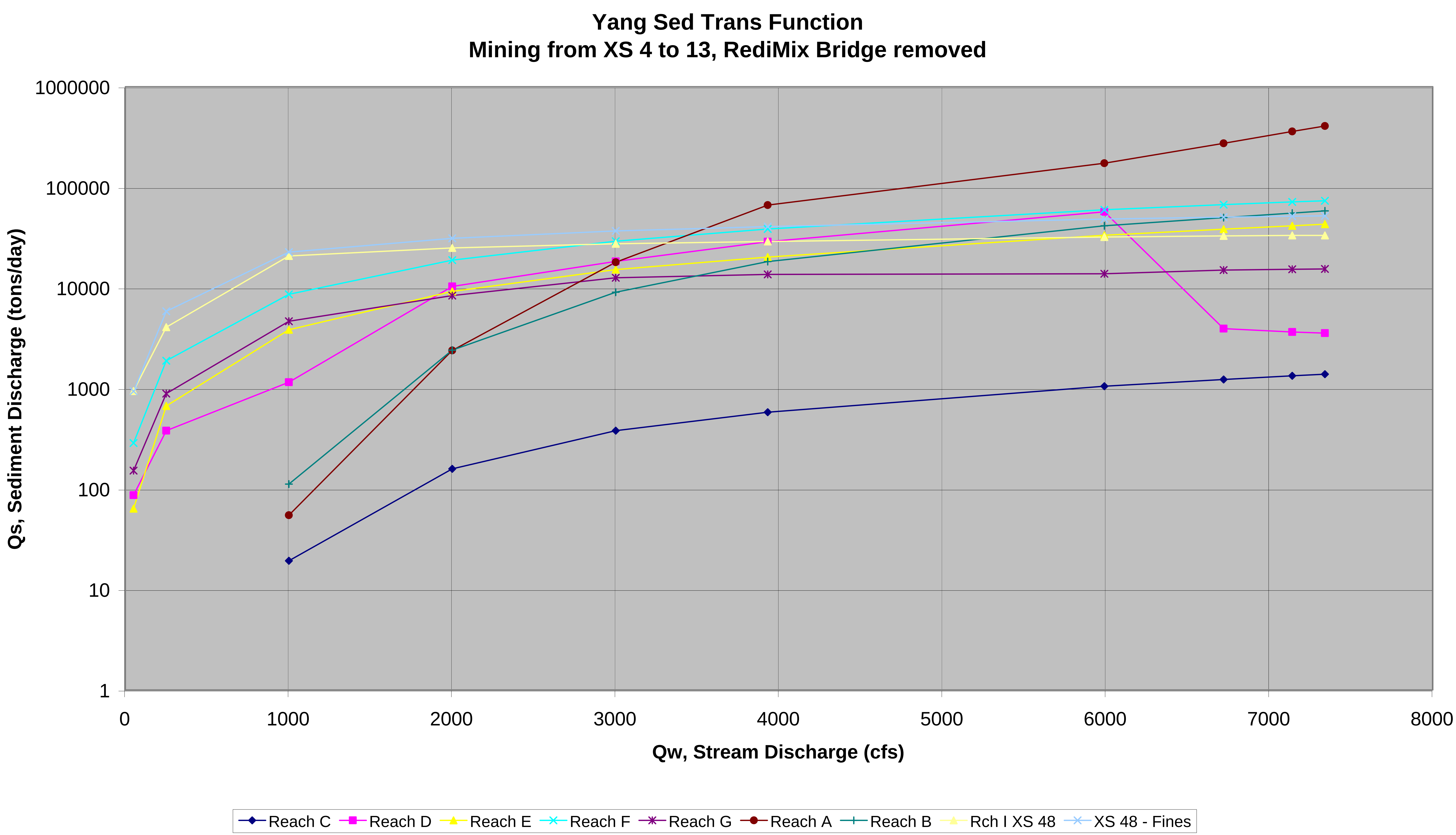
Below Hidden Valley

Mining - No Redimix Bridge

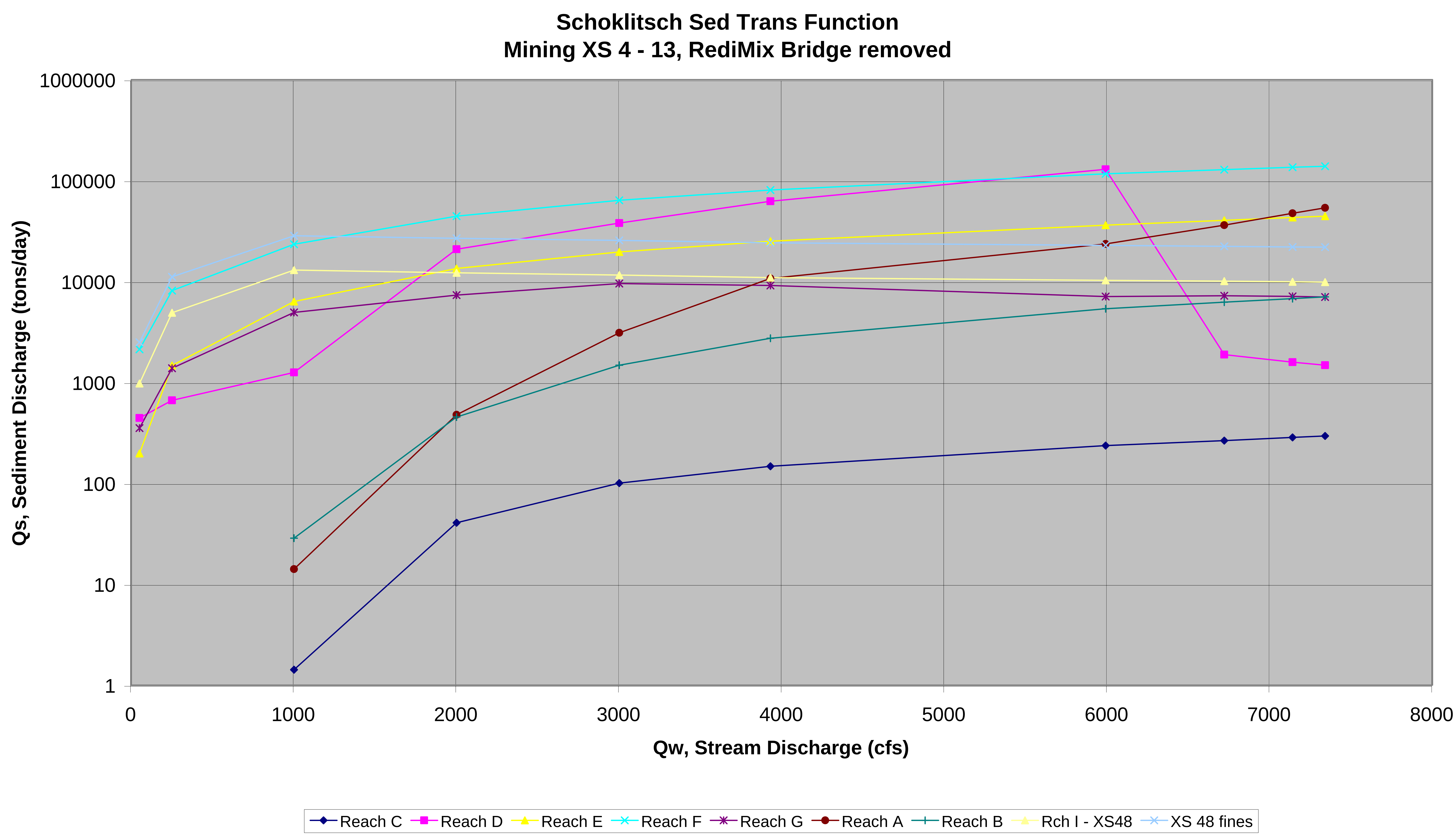
SAM Input

Transpose Reach average parameters

		50-cfs	250-cfs	1000-cfs	2000-cfs	3000-cfs	2 yr	10 yr	25 yr	50 yr	100 yr
reach	parameter	**1**	**2**	**4**	**6**	**7**	**8**	**10**	**11**	**12**	**13**
A	ra L	372	372	372	372	372	372	372	372	372	372
	ra Qch	46	228	913	1826	2742	3592	5392	6050	6439	6624
	ra Vch	0.11	0.52	2.07	4.13	6.19	8.11	10.43	11.58	12.3	12.63
	ra Yh	4.11	4.11	4.11	4.12	4.13	4.14	4.73	4.79	4.81	4.82
	ra TW	114.32	114.31	114.3	114.25	114.15	113.97	114.69	114.69	114.69	114.69
	ra Se	0.000001	0.000018	0.000285	0.001138	0.002565	0.004532	0.005773	0.007066	0.008077	0.008607
	ra Shear	0	0	0.07	0.29	0.65	1.12	1.71	2.09	2.36	2.49
B	ra L	894	894	894	894	894	894	894	894	894	894
	ra Qch	50	250	998	1994	2987	3904	5909	6612	7015	7207
	ra Vch	0.13	0.65	2.51	4.57	6.09	7.13	8.78	9.24	9.49	9.62
	ra Yh	5.7	5.72	5.92	6.47	7.24	7.97	9.79	10.42	10.75	10.91
	ra TW	67.97	67.98	68.08	68.33	68.55	69.85	69.85	69.85	69.85	69.85
	ra Se	0.000001	0.000025	0.000351	0.001019	0.001549	0.001857	0.002125	0.002162	0.00219	0.002205
	ra Shear	0	0.01	0.12	0.39	0.66	0.87	1.22	1.33	1.39	1.42
C	ra L	1452.5	1452.5	1452.5	1452.5	1452.5	1452.5	1452.5	1452.5	1452.5	1452.5
	ra Qch	50	250	1000	1998	2994	3909	5867	6545	6933	7118
	ra Vch	0.11	0.57	1.94	3	3.6	3.99	4.63	4.81	4.91	4.95
	ra Yh	4.69	4.74	5.35	6.58	7.57	8.84	11.35	12.16	12.6	12.81
	ra TW	101.24	101.37	103.03	106.94	116.04	117.23	118.78	119.28	119.55	119.68
	ra Se	0.000001	0.000031	0.000269	0.000452	0.00053	0.000528	0.000509	0.000502	0.0005	0.000499
	ra Shear	0	0.01	0.08	0.17	0.24	0.28	0.35	0.36	0.38	0.38
D	ra L	1715	1715	1715	1715	1715	1715	1715	1715	1715	1715
	ra Qch	50	250	1000	2000	3000	3930	5984	6708	7124	7321
	ra Vch	1.53	2.81	3.55	5.2	5.76	6.27	7.28	4.79	4.77	4.77
	ra Yh	1.15	1.42	1.96	2.81	3.85	4.68	6.52	8.02	8.47	8.68
	ra TW	82.01	90.35	157.51	171.18	177.54	184.26	186.87	189.41	189.41	189.41
	ra Se	0.008464	0.005358	0.003836	0.011454	0.012432	0.013936	0.016161	0.001346	0.001189	0.001128
	ra Shear	0.25	0.36	0.37	1.07	1.35	1.64	2.26	0.48	0.46	0.45
E	ra L	1902	1902	1902	1902	1902	1902	1902	1902	1902	1902
	ra Qch	50	249	993	1975	2955	3835	5769	6444	6829	7011
	ra Vch	2.08	3.43	5.06	6.18	7.08	7.56	8.8	9.18	9.4	9.5
	ra Yh	0.66	1.32	2.29	3.17	3.93	4.37	5.56	5.92	6.12	6.21
	ra TW	45.95	65.56	102.01	120.97	125.11	132.85	133.75	134.01	134.16	134.22
	ra Se	0.008844	0.010153	0.009744	0.009829	0.00968	0.009704	0.009436	0.009436	0.009465	0.009485
	ra Shear	0.34	0.74	1.33	1.81	2.22	2.45	3.06	3.27	3.39	3.45
F	ra L	1811.5	1811.5	1811.5	1811.5	1811.5	1811.5	1811.5	1811.5	1811.5	1811.5
	ra Qch	50	246	907	1711	2470	3152	4627	5129	5415	5550
	ra Vch	2.79	4.54	7.21	9.11	10.44	11.41	13.15	13.66	13.93	14.05
	ra Yh	0.87	1.91	3.88	5.52	6.81	7.85	9.82	10.44	10.79	10.94
	ra TW	24.83	34.79	39.57	41.75	42.35	42.82	43.49	43.68	43.79	43.84
	ra Se	0.033763	0.027272	0.022881	0.022808	0.022788	0.022632	0.022442	0.022358	0.02232	0.022303
	ra Shear	1.39	2.7	5.13	7.5	9.27	10.62	13.13	13.91	14.34	14.54
G	ra L	251	251	251	251	251	251	251	251	251	251
	ra Qch	50	244	888	1638	2382	2975	4252	4721	4975	5093
	ra Vch	3.39	5.03	7.56	8.65	9.81	10.08	10.25	10.59	10.68	10.71
	ra Yh	0.72	1.58	3.17	4.56	5.75	6.82	9.23	9.83	10.24	10.43
	ra TW	21.08	31.54	39.67	45.23	45.23	45.23	45.23	45.23	45.23	45.23
	ra Se	0.013027	0.010205	0.009223	0.007821	0.007292	0.006211	0.004256	0.004049	0.003872	0.003782
	ra Shear	0.58	1	1.77	2.07	2.47	2.47	2.34	2.41	2.41	2.41



Yang Sed Trans Function
Mining from XS 4 to 13, RediMix Bridge removed
Qs, Sediment Discharge (tons/day)
1000000
100000
10000
1000
100
10
1
0
1000
2000
3000
4000
5000
6000
7000
8000
Qw, Stream Discharge (cfs)
Reach C
Reach D
Reach E
Reach F
Reach G
Reach A
Reach B
Rch I XS 48
XS 48 - Fines


Schoklitsch Sed Trans Function
Mining XS 4 - 13, RediMix Bridge removed
1000000
100000
10000
1000
100
10
1
Qs, Sediment Discharge (tons/day)
0
1000
2000
3000
4000
5000
6000
7000
8000
Qw, Stream Discharge (cfs)
Reach C
Reach D
Reach E
Reach F
Reach G
Reach A
Reach B
Rch I - XS48
XS 48 fines

Lemon Creek - Reach A **Mining RediMix to Corrections - No Redimix Bridge**

Threshold Flow to Mobilize, D 84
Di = 41.67 mm
Q(threshold) = 2163 cfs

SAM generated rating curve of stream discharge (Qw) to sediment transport potential (Qs)
TABLE 5.0 SUMMARY TABLE: BED-MATERIAL SEDIMENT DISCHARGE, TONS/DAY

Q NO	WATER DISCHARGE total	channel	TRANSPORT FUNCTIONS YANG. (HEC-6)	LAURSEN (MADDEN), 85	PARKER	SCHOKLITSCH
1	50	46	0	0	0	0
2	250	228	0	1.15	0	0
3	1000	913	54.64	1330.77	0	14.11
4	2000	1826	2382.63	19743.75	21.56	477.83
5	3000	2742	17979.33	81269.42	1717.6	3095.17
6	3930	3592	66432.93	206655.36	14554.07	10712.85
7	5990	5392	173156.3	438005.28	42580.89	23538.19
8	6720	6050	273103.2	619162.44	72438.58	36199.63
9	7140	6439	358936.8	758801.81	99596.79	47403.24
10	7340	6624	406206.8	831605.75	115251.7	53750.35

Conversion: tons - cubic yards
Lemon Creek gravel = 130 lb/cy
conversion = (cf/130lb) * (cy/27cf) * (2000lb/ton)
0.569801 cy/ton
1.755 ton/cy
Assume: no bulkage or shrinkage

1	46	0	0	0	0
2	228	0	1.15	0	0
3	913	54.64	1330.77	0	14.11
4	1826	2382.63	19743.75	21.56	477.83
5	2742	17979.33	81269.42	1717.6	3095.17
6	3592	66432.93	206655.4	14554.07	10712.85
7	5392	173156.3	438005.3	42580.89	23538.19
8	6050	273103.2	619162.4	72438.58	36199.63
9	6439	358936.8	758801.8	99596.79	47403.24
10	6624	406206.8	831605.8	115251.7	53750.35

Lemon Creek - Reach A **Mining - No Redimix Bridge**

Event	Reach A - Summary Qsed (cy/event)			
	YANG. (HEC-6)	LAURSEN (MADDEN), 85	PARKER	SCHOKLITSCH
2-yr	15138.1	61810.4	2285.9	2551.1
5-yr	70580.1	219355.6	15033.5	10686
25-yr	96012.4	283370.6	21378.7	14201.1
50-yr	118747.7	332546.2	27670.9	17219.5
100-yr	130064.2	356430.1	30840.7	18704

2-yr hydrograph		Qsed (tons/hr)			
Duration (hrs)	Ave Qw (cfs)	YANG. (HEC-6)	LAURSEN (MADDEN), 85	PARKER	SCHOKLITSCH
24	880	0	0	0	0
18	1743	0	0	0	0
10	2897	682.2	3122.18	64.29	117.73
3	3486	1804.18	6116.4	351.07	294.83
1	3930	2768.04	8610.64	606.42	446.37
4	3486	1804.18	6116.4	351.07	294.83
16	2257	266.29	1481.49	19.06	47.94
24	941	2.1	51.09	0	0.54
24	757	1.54	37.5	0	0.4
	tons/event	26567.3	108477.2	4011.8	4477.1
	cy/event	15138.1	61810.4	2285.9	2551.1

5-yr hydrograph		Qsed (tons/hr)			
Duration (hrs)	Ave Qw (cfs)	YANG. (HEC-6)	LAURSEN (MADDEN), 85	PARKER	SCHOKLITSCH
24	1341	0	0	0	0
18	2656	525.59	2504.36	47.26	91.45
10	4416	3817.14	10884.83	881.93	572.44
3	5313	5753.44	15082.26	1390.42	805.14
1	5990	7214.85	18250.22	1774.2	980.76
4	5313	5753.44	15082.26	1390.42	805.14
16	3440	1704.32	5857.99	324.62	279.13
24	1434	44.37	388.42	0.39	8.97
24	1154	17.21	173.6	0.14	3.56
	tons/event	123868	384969.1	26383.8	18754
	cy/event	70580.1	219355.6	15033.5	10686

Lemon Creek - Reach A **Mining - No Redimix Bridge**

25-yr hydrograph		Qsed (tons/hr)			
Duration (hrs)	Ave Qw (cfs)	YANG. (HEC-6)	LAURSEN (MADDEN), 85	PARKER	SCHOKLITSCH
24	1505	0	0	0	0
18	2980	736.14	3334.95	70.15	126.78
10	4954	4978.49	13402.35	1186.91	712.01
3	5960	7150.09	18109.84	1757.2	972.98
1	6720	11379.3	25798.44	3018.27	1508.32
4	5960	7150.09	18109.84	1757.2	972.98
16	3859	2613.91	8211.79	565.59	422.14
24	1609	61.35	522.68	0.55	12.35
24	1295	30.89	281.77	0.27	6.29
	tons/event	168501.7	497315.4	37519.6	24922.9
	cy/event	96012.4	283370.6	21378.7	14201.1

50-yr hydrograph		Qsed (tons/hr)			
Duration (hrs)	Ave Qw (cfs)	YANG. (HEC-6)	LAURSEN (MADDEN), 85	PARKER	SCHOKLITSCH
24	1599	0	0	0	0
18	3166	1109.5	4318.76	167.04	185.62
10	5264	5647.67	14852.97	1362.64	792.42
3	6333	9171.57	21796.85	2358.75	1228.64
1	7140	14955.7	31616.74	4149.87	1975.14
4	6333	9171.57	21796.85	2358.75	1228.64
16	4100	3135.01	9406.14	702.79	490.47
24	1710	71.15	600.17	0.64	14.31
24	1376	38.75	343.92	0.34	7.85
	tons/event	208402.2	583618.5	48562.4	30220.3
	cy/event	118747.7	332546.2	27670.9	17219.5

100-yr hydrograph		Qsed (tons/hr)			
Duration (hrs)	Ave Qw (cfs)	YANG. (HEC-6)	LAURSEN (MADDEN), 85	PARKER	SCHOKLITSCH
24	1644	0	0	0	0
18	3255	1302.71	4818.73	218.22	216
10	5411	5964.99	15540.84	1445.98	830.56
3	6510	10181.31	23627.03	2660.39	1356.55
1	7340	16925.28	34650.24	4802.15	2239.6
4	6510	10181.31	23627.03	2660.39	1356.55
16	4215	3383.25	9944.27	767.98	520.3
24	1758	75.8	636.99	0.68	15.23
24	1414	42.43	373.07	0.37	8.59
	tons/event	228262.7	625534.8	54125.5	32825.5
	cy/event	130064.2	356430.1	30840.7	18704

Lemon Creek - Reach B **Mining RediMix to Corrections - No Redimix Bridge**

Threshold Flow to Mobilize, D 84
Di = 41.67 mm
Q(threshold) = 2113 cfs

SAM generated rating curve of stream discharge (Qw) to sediment transport potential (Qs)
TABLE 5.0 SUMMARY TABLE: BED-MATERIAL SEDIMENT DISCHARGE, TONS/DAY

Q NO	WATER DISCHARGE total	channel	TRANSPORT FUNCTIONS YANG. (HEC-6)	LAURSEN (MADDEN), 85	PARKER	SCHOKLITSCH
1	50	50	0	0	0	0
2	250	250	0	3.21	0	0
3	1000	998	111.57	2057.86	0	28.64
4	2000	1994	2399.51	18468.67	105.27	453.67
5	3000	2987	9046.07	47515.88	1324.5	1482.09
6	3930	3904	18222.87	80223.54	4023.95	2739.28
7	5990	5909	41341.93	152698	12218.69	5371.02
8	6720	6612	49956.93	177605.08	15399.67	6230.14
9	7140	7015	55292.63	192466.53	17426.04	6760
10	7340	7207	58186.9	200417.69	18497	7040.9

Conversion: tons - cubic yards
Lemon Creek gravel = 130 lb/cy
conversion = (cf/130lb) * (cy/27cf) * (2000lb/ton)
0.569801 cy/ton
1.755 ton/cy
Assume: no bulkage or shrinkage

1	50	0	0	0	0
2	250	0	3.21	0	0
3	998	111.57	2057.86	0	28.64
4	1994	2399.51	18468.67	105.27	453.67
5	2987	9046.07	47515.88	1324.5	1482.09
6	3904	18222.87	80223.54	4023.95	2739.28
7	5909	41341.93	152698	12218.69	5371.02
8	6612	49956.93	177605.1	15399.67	6230.14
9	7015	55292.63	192466.5	17426.04	6760
10	7207	58186.9	200417.7	18497	7040.9

Lemon Creek - Reach B **Mining - No Redimix Bridge**

Event	Reach B - Summary Qsed (cy/event)			
	YANG. (HEC-6)	LAURSEN (MADDEN), 85	PARKER	SCHOKLITSCH
2-yr	6380	34938	993.7	1046.2
5-yr	21078.8	95957.2	4697.8	3120.3
25-yr	26826.5	117399.8	6358.9	3875.5
50-yr	30492.7	130127.9	7530.5	4323.2
100-yr	32278.1	136226.8	8112.3	4537.2

2-yr hydrograph		Qsed (tons/hr)			
Duration (hrs)	Ave Qw (cfs)	YANG. (HEC-6)	LAURSEN (MADDEN), 85	PARKER	SCHOKLITSCH
24	880	0	0	0	0
18	1743	0	0	0	0
10	2897	348.39	1855.17	49.95	57.34
3	3486	576.74	2692.01	113.97	89.13
1	3930	759.29	3342.65	167.66	114.14
4	3486	576.74	2692.01	113.97	89.13
16	2257	171.15	1080.58	17.44	29.92
24	941	4.28	79.01	0	1.1
24	757	3.14	58.01	0	0.81
	tons/event	11196.9	61316.2	1744	1836
	cy/event	6380	34938	993.7	1046.2

5-yr hydrograph		Qsed (tons/hr)			
Duration (hrs)	Ave Qw (cfs)	YANG. (HEC-6)	LAURSEN (MADDEN), 85	PARKER	SCHOKLITSCH
24	1341	0	0	0	0
18	2656	281.65	1563.48	37.71	47.01
10	4416	986.55	4055.08	248.22	140.01
3	5313	1406	5370	396.9	187.76
1	5990	1722.58	6362.42	509.11	223.79
4	5313	1406	5370	396.9	187.76
16	3440	557.82	2624.6	108.4	86.54
24	1434	46.02	382.51	1.9	8.88
24	1154	19.33	191.05	0.68	3.92
	tons/event	36993.3	168404.9	8244.7	5476.2
	cy/event	21078.8	95957.2	4697.8	3120.3

Lemon Creek - Reach B **Mining - No Redimix Bridge**

25-yr hydrograph		Qsed (tons/hr)			
Duration (hrs)	Ave Qw (cfs)	YANG. (HEC-6)	LAURSEN (MADDEN), 85	PARKER	SCHOKLITSCH
24	1505	0	0	0	0
18	2980	371.38	1955.62	54.17	60.9
10	4954	1238.13	4843.74	337.39	168.65
3	5960	1708.55	6318.44	504.14	222.2
1	6720	2081.54	7400.21	641.65	259.59
4	5960	1708.55	6318.44	504.14	222.2
16	3859	730.09	3238.6	159.08	110.14
24	1609	62.71	502.17	2.67	11.98
24	1295	32.77	287.46	1.29	6.42
	tons/event	47080.5	206036.6	11159.9	6801.5
	cy/event	26826.5	117399.8	6358.9	3875.5

50-yr hydrograph		Qsed (tons/hr)			
Duration (hrs)	Ave Qw (cfs)	YANG. (HEC-6)	LAURSEN (MADDEN), 85	PARKER	SCHOKLITSCH
24	1599	0	0	0	0
18	3166	445.17	2223.08	75.26	71.1
10	5264	1383.09	5298.17	388.78	185.15
3	6333	1891.24	6850.04	571.39	240.61
1	7140	2303.86	8019.44	726.09	281.67
4	6333	1891.24	6850.04	571.39	240.61
16	4100	838.78	3591.85	195.84	123.19
24	1710	72.33	571.23	3.11	13.77
24	1376	40.49	342.85	1.65	7.85
	tons/event	53514.7	228374.4	13216	7587.2
	cy/event	30492.7	130127.9	7530.5	4323.2

100-yr hydrograph		Qsed (tons/hr)			
Duration (hrs)	Ave Qw (cfs)	YANG. (HEC-6)	LAURSEN (MADDEN), 85	PARKER	SCHOKLITSCH
24	1644	0	0	0	0
18	3255	481.76	2353.5	86.03	76.12
10	5411	1451.83	5513.66	413.14	192.97
3	6510	1978.28	7101.67	603.52	249.29
1	7340	2424.45	8350.74	770.71	293.37
4	6510	1978.28	7101.67	603.52	249.29
16	4215	892.56	3760.43	214.9	129.31
24	1758	76.91	604.05	3.32	14.62
24	1414	44.12	368.83	1.82	8.53
	tons/event	56648.1	239078	14237.1	7962.8
	cy/event	32278.1	136226.8	8112.3	4537.2

Lemon Creek - Reach C **Mining RediMix to Corrections - No Redimix Bridge**

Threshold Flow to Mobilize, D 84
Di = 40.39 mm
Q(threshold) = 50 cfs override Qthreshold on rising limb

SAM generated rating curve of stream discharge (Qw) to sediment transport potential (Qs)

TABLE 5.0 SUMMARY TABLE: BED-MATERIAL SEDIMENT DISCHARGE, TONS/DAY

Q NO	WATER DISCHARGE total	channel	TRANSPORT FUNCTIONS YANG. (HEC-6)	LAURSEN (MADDEN), 85	PARKER	SCHOKLITSCH
1	50	50	0	0	0	0
2	250	250	0	0	0	0
3	1000	1000	19.27	6.39	0	1.42
4	2000	1998	158.24	46.98	0.13	40.69
5	3000	2994	379.73	104.33	6.23	100.41
6	3930	3909	579.35	158.6	21	147.67
7	5990	5867	1050.12	283.19	82.31	236.77
8	6720	6545	1224.95	331.76	113.1	264.91
9	7140	6933	1333.27	361.53	135.01	284.65
10	7340	7118	1381.62	374.63	146.35	293.94

Conversion: tons - cubic yards

Lemon Creek gravel = 130 lb/cy
conversion = (cf/130lb) * (cy/27cf) * (2000lb/ton)
0.5698 cy/ton
1.755 ton/cy
Assume: no bulkage or shrinkage

1	50	0	0	0	0
2	250	0	0	0	0
3	1000	19.27	6.39	0	1.42
4	1998	158.24	46.98	0.13	40.69
5	2994	379.73	104.33	6.23	100.41
6	3909	579.35	158.6	21	147.67
7	5867	1050.12	283.19	82.31	236.77
8	6545	1224.95	331.76	113.1	264.91
9	6933	1333.27	361.53	135.01	284.65
10	7118	1381.62	374.63	146.35	293.94

Lemon Creek - Reach C **Mining - No Redimix Bridge**

Event	Reach C - Summary Qsed (cy/event)			
	YANG. (HEC-6)	LAURSEN (MADDEN), 85	PARKER	SCHOKLITSCH
2-yr	339.8	97.1	4.8	82.8
5-yr	754.1	209.6	27.5	184.3
25-yr	914.8	253.4	38.5	222.1
50-yr	1008.4	279.1	47.4	242.6
100-yr	1053	291.5	51.9	252.2

2-yr hydrograph		Qsed (tons/hr)			
Duration (hrs)	Ave Qw (cfs)	YANG. (HEC-6)	LAURSEN (MADDEN), 85	PARKER	SCHOKLITSCH
24	880	0.67	0.22	0	0.05
18	1743	5.11	1.52	0	1.27
10	2897	14.87	4.1	0.23	3.93
3	3486	20.17	5.53	0.58	5.21
1	3930	24.14	6.61	0.88	6.15
4	3486	20.17	5.53	0.58	5.21
16	2257	8.97	2.57	0.07	2.33
24	941	0.74	0.25	0	0.05
24	757	0.54	0.18	0	0.04
	tons/event	596.3	170.4	8.4	145.4
	cy/event	339.8	97.1	4.8	82.8

5-yr hydrograph		Qsed (tons/hr)			
Duration (hrs)	Ave Qw (cfs)	YANG. (HEC-6)	LAURSEN (MADDEN), 85	PARKER	SCHOKLITSCH
24	1341	2.78	0.84	0	0.62
18	2656	12.65	3.53	0.17	3.33
10	4416	28.77	7.83	1.48	7.03
3	5313	37.31	10.09	2.59	8.65
1	5990	43.76	11.8	3.43	9.87
4	5313	37.31	10.09	2.59	8.65
16	3440	19.76	5.42	0.55	5.12
24	1434	3.32	1	0	0.77
24	1154	1.69	0.53	0	0.31
	tons/event	1323.5	367.9	48.2	323.4
	cy/event	754.1	209.6	27.5	184.3

Lemon Creek - Reach C **Mining - No Redimix Bridge**

25-yr hydrograph		Qsed (tons/hr)			
Duration (hrs)	Ave Qw (cfs)	YANG. (HEC-6)	LAURSEN (MADDEN), 85	PARKER	SCHOKLITSCH
24	1505	3.73	1.12	0	0.89
18	2980	15.64	4.3	0.25	4.13
10	4954	33.89	9.19	2.14	8
3	5960	43.47	11.72	3.39	9.81
1	6720	51.04	13.82	4.71	11.04
4	5960	43.47	11.72	3.39	9.81
16	3859	23.5	6.44	0.83	6
24	1609	4.33	1.3	0	1.06
24	1295	2.51	0.77	0	0.54
	tons/event	1605.4	444.8	67.6	389.8
	cy/event	914.8	253.4	38.5	222.1

50-yr hydrograph		Qsed (tons/hr)			
Duration (hrs)	Ave Qw (cfs)	YANG. (HEC-6)	LAURSEN (MADDEN), 85	PARKER	SCHOKLITSCH
24	1599	4.27	1.28	0	1.04
18	3166	17.31	4.75	0.37	4.54
10	5264	36.84	9.97	2.53	8.56
3	6333	47.18	12.75	4.03	10.42
1	7140	55.55	15.06	5.63	11.86
4	6333	47.18	12.75	4.03	10.42
16	4100	25.76	7.04	1.09	6.46
24	1710	4.91	1.47	0	1.22
24	1376	2.98	0.9	0	0.67
	tons/event	1769.8	489.8	83.2	425.8
	cy/event	1008.4	279.1	47.4	242.6

100-yr hydrograph		Qsed (tons/hr)			
Duration (hrs)	Ave Qw (cfs)	YANG. (HEC-6)	LAURSEN (MADDEN), 85	PARKER	SCHOKLITSCH
24	1644	4.53	1.36	0	1.11
18	3255	18.1	4.97	0.43	4.72
10	5411	38.24	10.34	2.71	8.82
3	6510	48.94	13.24	4.34	10.7
1	7340	57.57	15.61	6.1	12.25
4	6510	48.94	13.24	4.34	10.7
16	4215	26.85	7.33	1.23	6.67
24	1758	5.19	1.55	0	1.3
24	1414	3.2	0.97	0	0.74
	tons/event	1848	511.6	91	442.6
	cy/event	1053	291.5	51.9	252.2

Lemon Creek - Reach D **Mining RediMix to Corrections - No Redimix Bridge**

Threshold Flow to Mobilize, D 84
Di = 36.06 mm
Q(threshold) = 962 cfs

SAM generated rating curve of stream discharge (Qw) to sediment transport potential (Qs)
TABLE 5.0 SUMMARY TABLE: BED-MATERIAL SEDIMENT DISCHARGE, TONS/DAY

Q NO	WATER DISCHARGE total	channel	TRANSPORT FUNCTIONS YANG. (HEC-6)	LAURSEN (MADDEN), 85	PARKER	SCHOKLITSCH
1	50	50	86.45	20.33	1049.35	443.7
2	250	250	378.53	107.13	488.77	663.14
3	1000	1000	1149.83	340.14	806.44	1253.74
4	2000	2000	10307.3	6399.41	103259.91	20865.81
5	3000	3000	18295.8	14642.66	248150.22	37913.52
6	3930	3930	28776.1	26693.22	467417.34	62434.95
7	5990	5984	56927.9	65928.3	1116354.1	129101.45
8	6720	6708	3924.74	1325.37	4679.82	1880.78
9	7140	7124	3636.2	1144.59	3545.39	1587.66
10	7340	7321	3538.11	1079.51	3155.96	1481.16

Conversion: tons - cubic yards
Lemon Creek gravel = 130 lb/cy
conversion = (cf/130lb) * (cy/27cf) * (2000lb/ton)
0.5698 cy/ton
1.755 ton/cy
Assume: no bulkage or shrinkage

1	50	86.45	20.33	1049.35	443.7
2	250	378.53	107.13	488.77	663.14
3	1000	1149.83	340.14	806.44	1253.74
4	2000	10307.31	6399.41	103259.91	20865.81
5	3000	18295.83	14642.7	248150.22	37913.52
6	3930	28776.05	26693.2	467417.34	62434.95
7	5984	56927.85	65928.3	1116354.13	129101.45
8	6708	3924.74	1325.37	4679.82	1880.78
9	7124	3636.2	1144.59	3545.39	1587.66
10	7321	3538.11	1079.51	3155.96	1481.16

Lemon Creek - Reach D **Mining - No Redimix Bridge**

Event	Reach D - Summary Qsed (cy/event)			
	YANG. (HEC-6)	LAURSEN (MADDEN), 85	PARKER	SCHOKLITSCH
2-yr	18010.1	13027.8	213844.7	36144.2
5-yr	39974.5	35476.6	597940.6	84466.7
25-yr	47335.4	43284.6	731267.2	100980.9
50-yr	47758.1	43254.5	729966.6	101484.3
100-yr	47806	43091.4	726531.9	101365.4

2-yr hydrograph		Qsed (tons/hr)			
Duration (hrs)	Ave Qw (cfs)	YANG. (HEC-6)	LAURSEN (MADDEN), 85	PARKER	SCHOKLITSCH
24	880	0	0	0	0
18	1743	331.41	201.76	3205.39	659.4
10	2897	728.04	574.73	9717.77	1506.57
3	3486	990.52	872.5	15113.96	2113.66
1	3930	1199	1112.22	19475.72	2601.46
4	3486	990.52	872.5	15113.96	2113.66
16	2257	515.01	354.91	5854.03	1051.96
24	941	45.38	13.41	32.56	50.3
24	757	37.5	11.03	29.31	44.27
	tons/event	31607.7	22863.8	375297.5	63433
	cy/event	18010.1	13027.8	213844.7	36144.2

5-yr hydrograph		Qsed (tons/hr)			
Duration (hrs)	Ave Qw (cfs)	YANG. (HEC-6)	LAURSEN (MADDEN), 85	PARKER	SCHOKLITSCH
24	1341	178.02	100.26	1489.29	330.89
18	2656	647.82	491.96	8262.83	1335.38
10	4416	1475.74	1497.9	25854.83	3256.79
3	5313	1986.5	2209.75	37628.63	4466.34
1	5990	2371.99	2747.01	46514.76	5379.23
4	5313	1986.5	2209.75	37628.63	4466.34
16	3440	968.93	847.67	14662.06	2063.13
24	1434	213.51	123.74	1886.3	406.89
24	1154	106.67	53.05	691.01	178.08
	tons/event	70155.3	62261.5	1049385.8	148239.1
	cy/event	39974.5	35476.6	597940.6	84466.7

Lemon Creek - Reach D **Mining - No Redimix Bridge**

25-yr hydrograph		Qsed (tons/hr)			
Duration (hrs)	Ave Qw (cfs)	YANG. (HEC-6)	LAURSEN (MADDEN), 85	PARKER	SCHOKLITSCH
24	1505	240.6	141.67	2189.39	464.91
18	2980	755.67	603.24	10218.85	1565.52
10	4954	1782.08	1924.85	32916.48	3982.25
3	5960	2354.91	2723.2	46120.98	5338.77
1	6720	163.53	55.22	194.99	78.37
4	5960	2354.91	2723.2	46120.98	5338.77
16	3859	1165.66	1073.88	18778.23	2523.45
24	1609	280.28	167.93	2633.36	549.9
24	1295	160.47	88.65	1292.93	293.3
	tons/event	83073.7	75964.5	1283374	177221.5
	cy/event	47335.4	43284.6	731267.2	100980.9

50-yr hydrograph		Qsed (tons/hr)			
Duration (hrs)	Ave Qw (cfs)	YANG. (HEC-6)	LAURSEN (MADDEN), 85	PARKER	SCHOKLITSCH
24	1599	276.47	165.4	2590.67	541.72
18	3166	840.27	699.73	11970.34	1762.1
10	5264	1958.6	2170.87	36985.47	4400.27
3	6333	1334.32	1482.24	24750.81	2888.55
1	7140	151.51	47.69	147.72	66.15
4	6333	1334.32	1482.24	24750.81	2888.55
16	4100	1295.8	1247.13	21707.1	2830.69
24	1710	318.82	193.43	3064.52	632.43
24	1376	191.38	109.1	1638.71	359.49
	tons/event	83815.5	75911.6	1281091.4	178104.9
	cy/event	47758.1	43254.5	729966.6	101484.3

100-yr hydrograph		Qsed (tons/hr)			
Duration (hrs)	Ave Qw (cfs)	YANG. (HEC-6)	LAURSEN (MADDEN), 85	PARKER	SCHOKLITSCH
24	1644	293.64	176.76	2782.77	578.5
18	3255	882.06	747.79	12844.66	1859.88
10	5411	2042.3	2287.52	38914.95	4598.48
3	6510	798.84	829.57	13519.86	1603.27
1	7340	147.42	44.98	131.5	61.72
4	6510	798.84	829.57	13519.86	1603.27
16	4215	1361.28	1338.39	23216.56	2985.76
24	1758	337.13	205.54	3269.42	671.65
24	1414	205.88	118.69	1800.92	390.55
	tons/event	83899.5	75625.4	1275063.5	177896.2
	cy/event	47806	43091.4	726531.9	101365.4

Lemon Creek - Reach E **Mining RediMix to Corrections - No Redimix Bridge**

Threshold Flow to Mobilize, D 84
Di = 58.06 mm
Q(threshold) = 174 cfs

SAM generated rating curve of stream discharge (Qw) to sediment transport potential (Qs)
TABLE 5.0 SUMMARY TABLE: BED-MATERIAL SEDIMENT DISCHARGE, TONS/DAY

Q	WATER		TRANSPORT FUNCTIONS			
NO	DISCHARGE		YANG.	LAURSEN	PARKER	SCHOKLITSCH
	total	channel	(HEC-6)	(MADDEN), 85		
1	50	50	63.57	17.74	15.04	197.31
2	250	249	667.84	219.91	937.51	1467.59
3	1000	993	3824.08	2004.13	11015.09	6322.81
4	2000	1975	9206.05	5373.01	36889.09	13442.72
5	3000	2955	15153	9837.66	65600.76	19639.85
6	3930	3835	20219.7	14300.03	91780.62	25031.09
7	5990	5769	33263.9	26657.93	153250	36182.36
8	6720	6444	38252.6	31571.85	176965.4	40369.67
9	7140	6829	41370.3	34719.56	192068.5	43037.39
10	7340	7011	42848.3	36238.2	199372	44321.08

Conversion: tons - cubic yards
Lemon Creek gravel = 130 lb/cy
conversion = (cf/130lb) * (cy/27cf) * (2000lb/ton)
0.5698 cy/ton
1.755 ton/cy
Assume: no bulkage or shrinkage

NO	DISCHARG	YANG.	LAURSEN	PARKER	SCHOKLITSCH
(HEC-6)	(MADDEN)	85			
1	50	63.57	17.74	15.04	197.31
2	249	667.84	219.91	937.51	1467.59
3	993	3824.08	2004.13	11015.09	6322.81
4	1975	9206.05	5373.01	36889.09	13442.72
5	2955	15153	9837.66	65600.76	19639.85
6	3835	20219.66	14300	91780.62	25031.09
7	5769	33263.86	26657.9	153249.97	36182.36
8	6444	38252.61	31571.9	176965.38	40369.67
9	6829	41370.3	34719.6	192068.53	43037.39
10	7011	42848.27	36238.2	199371.97	44321.08

Lemon Creek - Reach E **Mining - No Redimix Bridge**

Event	Reach E - Summary Qsed (cy/event)			
	YANG. (HEC-6)	LAURSEN (MADDEN), 85	PARKER	SCHOKLITSCH
2-yr	19836.4	11845.4	75564.7	28763.5
5-yr	32790.7	21771.5	136947.2	43319.3
25-yr	37561.1	25602.6	160062.6	48420.3
50-yr	40361.8	27957.8	173615.7	51325.8
100-yr	41704.6	29097.2	180091.9	52702.2

2-yr hydrograph		Qsed (tons/hr)			
Duration (hrs)	Ave Qw (cfs)	YANG. (HEC-6)	LAURSEN (MADDEN), 85	PARKER	SCHOKLITSCH
24	880	138.3	71.61	391.78	231.08
18	1743	325.95	187.8	1259.98	483.87
10	2897	605.85	390.74	2610.14	791.73
3	3486	741.7	507.07	3303.41	935.72
1	3930	842.49	595.83	3824.19	1042.96
4	3486	741.7	507.07	3303.41	935.72
16	2257	447.27	271.68	1844.5	626.47
24	941	148.99	77.66	425.93	247.54
24	757	116.73	59.42	322.91	197.9
	tons/event	34812.8	20788.6	132616	50480
	cy/event	19836.4	11845.4	75564.7	28763.5

5-yr hydrograph		Qsed (tons/hr)			
Duration (hrs)	Ave Qw (cfs)	YANG. (HEC-6)	LAURSEN (MADDEN), 85	PARKER	SCHOKLITSCH
24	1341	235.81	131.37	826.59	364.61
18	2656	546.14	345.91	2321.83	729.5
10	4416	970.71	717.31	4428.44	1152.58
3	5313	1207.38	941.53	5543.69	1354.9
1	5990	1385.99	1110.75	6385.42	1507.6
4	5313	1207.38	941.53	5543.69	1354.9
16	3440	731.26	497.87	3249.46	924.61
24	1434	256.66	144.43	926.85	392.2
24	1154	193.87	105.12	624.99	309.14
	tons/event	57547.6	38208.9	240342.3	76025.3
	cy/event	32790.7	21771.5	136947.2	43319.3

Lemon Creek - Reach E **Mining - No Redimix Bridge**

25-yr hydrograph		Qsed (tons/hr)			
Duration (hrs)	Ave Qw (cfs)	YANG. (HEC-6)	LAURSEN (MADDEN), 85	PARKER	SCHOKLITSCH
24	1505	272.58	154.39	1003.39	413.27
18	2980	626.42	406.18	2709.44	813.16
10	4954	1112.66	851.79	5097.34	1273.93
3	5960	1378.08	1103.25	6348.12	1500.83
1	6720	1593.86	1315.49	7373.56	1682.07
4	5960	1378.08	1103.25	6348.12	1500.83
16	3859	826.37	581.64	3740.91	1025.81
24	1609	295.9	168.99	1115.51	444.12
24	1295	225.49	124.91	777	350.97
	tons/event	65919.8	44932.6	280909.9	84977.7
	cy/event	37561.1	25602.6	160062.6	48420.3

50-yr hydrograph		Qsed (tons/hr)			
Duration (hrs)	Ave Qw (cfs)	YANG. (HEC-6)	LAURSEN (MADDEN), 85	PARKER	SCHOKLITSCH
24	1599	293.66	167.59	1104.73	441.15
18	3166	669.06	443.09	2928.07	858.42
10	5264	1194.45	929.28	5482.77	1343.85
3	6333	1483.66	1206.95	6849.71	1589.58
1	7140	1723.76	1446.65	8002.86	1793.22
4	6333	1483.66	1206.95	6849.71	1589.58
16	4100	887.34	638.33	4035.56	1081.31
24	1710	318.55	183.17	1224.4	474.08
24	1376	243.65	136.28	864.32	375
	tons/event	70835	49066	304695.6	90076.8
	cy/event	40361.8	27957.8	173615.7	51325.8

100-yr hydrograph		Qsed (tons/hr)			
Duration (hrs)	Ave Qw (cfs)	YANG. (HEC-6)	LAURSEN (MADDEN), 85	PARKER	SCHOKLITSCH
24	1644	303.75	173.9	1153.25	454.5
18	3255	689.26	460.88	3032.46	879.92
10	5411	1233.23	966.02	5665.54	1377
3	6510	1534.06	1256.59	7089.3	1631.88
1	7340	1785.34	1509.93	8307.17	1846.71
4	6510	1534.06	1256.59	7089.3	1631.88
16	4215	917.68	667.07	4178.54	1107.24
24	1758	329.32	189.91	1276.15	488.32
24	1414	252.18	141.62	905.29	386.27
	tons/event	73191.6	51065.5	316061.2	92492.4
	cy/event	41704.6	29097.2	180091.9	52702.2

Mining RediMix to Corrections - No Redimix Bridge

Summary Sediment Transport Estimate | Transport rate supply - reach | Estimated depth of deposition/erosion

Reach A

Below Redimix	Reach Average L	W	Event	Reach A - Summary Qsed (cy/event)				Change B to A (cy/event) - (+)Deposition/(-)Erosion				Reach A - Depostion (+)/Erosion (-)			
				YANG. (HEC-6)	LAURSEN (MADDEN), 85	PARKER	SCHOKLITSCH	YANG. (HEC-6)	LAURSEN (MADDEN), 85	PARKER	SCHOKLITSCH	YANG. (HEC-6)	LAURSEN (MADDEN), 85	PARKER	SCHOKLITSCH
	372	113.97	2-yr	15138	61810	2286	2551	-8758	-26872	-1292	-1505	-5.58	-17.11	-0.82	-0.96
	372	114.69	5-yr	70580	219356	15034	10686	-49501	-123398	-10336	-7566	-31.33	-78.09	-6.54	-4.79
	372	114.69	25-yr	96012	283371	21379	14201	-69186	-165971	-15020	-10326	-43.78	-105.03	-9.51	-6.53
	372	114.69	50-yr	118748	332546	27671	17220	-88255	-202418	-20140	-12896	-55.85	-128.10	-12.75	-8.16
	372	114.69	100-yr	130064	356430	30841	18704	-97786	-220203	-22728	-14167	-61.88	-139.35	-14.38	-8.97

Reach B

Redimix to Glacier Hwy	L	W	Event	Reach B - Summary Qsed (cy/event)				Change C to B (cy/event) - (+)Deposition/(-)Erosion				Reach B - Depostion (+)/Erosion (-)			
				YANG. (HEC-6)	LAURSEN (MADDEN), 85	PARKER	SCHOKLITSCH	YANG. (HEC-6)	LAURSEN (MADDEN), 85	PARKER	SCHOKLITSCH	YANG. (HEC-6)	LAURSEN (MADDEN), 85	PARKER	SCHOKLITSCH
	894	68.55	2-yr	6380	34938	994	1046	-6040	-34841	-989	-963	-2.66	-15.35	-0.44	-0.42
	894	69.85	5-yr	21079	95957	4698	3120	-20325	-95748	-4670	-2936	-8.79	-41.40	-2.02	-1.27
	894	69.85	25-yr	26827	117400	6359	3876	-25912	-117146	-6320	-3653	-11.20	-50.65	-2.73	-1.58
	894	69.85	50-yr	30493	130128	7531	4323	-29484	-129849	-7483	-4081	-12.75	-56.14	-3.24	-1.76
	894	69.85	100-yr	32278	136227	8112	4537	-31225	-135935	-8060	-4285	-13.50	-58.77	-3.49	-1.85

Reach C (1)

Immed. Above Glacier Hwy	L	W	Event	Reach C - Summary Qsed (cy/event)				Change D to C (cy/event) - (+)Deposition/(-)Erosion				Reach C - Depostion (+)/Erosion (-)			
				YANG. (HEC-6)	LAURSEN (MADDEN), 85	PARKER	SCHOKLITSCH	YANG. (HEC-6)	LAURSEN (MADDEN), 85	PARKER	SCHOKLITSCH	YANG. (HEC-6)	LAURSEN (MADDEN), 85	PARKER	SCHOKLITSCH
	1452.5	117.23	2-yr	340	97	5	83	17670	12931	213840	36061	2.80	2.05	33.91	5.72
	1452.5	118.78	5-yr	754	210	28	184	39220	35267	597913	84282	6.14	5.52	93.57	13.19
	1452.5	119.28	25-yr	915	253	39	222	46421	43031	731229	100759	7.23	6.71	113.95	15.70
	1452.5	119.55	50-yr	1008	279	47	243	46750	42975	729919	101242	7.27	6.68	113.49	15.74
	1452.5	119.68	100-yr	1053	292	52	252	46753	42800	726480	101113	7.26	6.65	112.84	15.70

Reach D(2)

between Glacier Hwy & Prison	L	W	Event	Reach D - Summary Qsed (cy/event)				Change E to D (cy/event) - (+)Deposition/(-)Erosion				Reach D - Depostion (+)/Erosion (-)			
				YANG. (HEC-6)	LAURSEN (MADDEN), 85	PARKER	SCHOKLITSCH	YANG. (HEC-6)	LAURSEN (MADDEN), 85	PARKER	SCHOKLITSCH	YANG. (HEC-6)	LAURSEN (MADDEN), 85	PARKER	SCHOKLITSCH
	1715	184.26	2-yr	18010	13028	213845	36144	1826	-1182	-138280	-7381	0.16	-0.10	-11.81	-0.63
	1715	186.87	5-yr	39975	35477	597941	84467	-7184	-13705	-460993	-41147	-0.61	-1.15	-38.84	-3.47
	1715	189.41	25-yr	47335	43285	731267	100981	-9774	-17682	-571205	-52561	-0.81	-1.47	-47.48	-4.37
	1715	189.41	50-yr	47758	43255	729967	101484	-7396	-15297	-556351	-50159	-0.61	-1.27	-46.24	-4.17
	1715	189.41	100-yr	47806	43091	726532	101365	-6101	-13994	-546440	-48663	-0.51	-1.16	-45.42	-4.04

Reach E(3)

Prison - Costco	L	W	Event	Reach E - Summary Qsed (cy/event)				Change xs48 to E (cy/event) - (+)Deposition/(-)Erosion				Reach E - Depostion (+)/Erosion (-)			
				YANG. (HEC-6)	LAURSEN (MADDEN), 85	PARKER	SCHOKLITSCH	YANG. (HEC-6)	LAURSEN (MADDEN), 85	PARKER	SCHOKLITSCH	YANG. (HEC-6)	LAURSEN (MADDEN), 85	PARKER	SCHOKLITSCH
	1902	132.85	2-yr	19836	11845	75565	28764	41941	186666	-51482	5533	4.48	19.95	-5.50	0.59
	1902	133.75	5-yr	32791	21772	136947	43319	39781	218582	-108984	-7743	4.22	23.20	-11.57	-0.82
	1902	134.01	25-yr	37561	25603	160063	48420	37117	224637	-131400	-13331	3.93	23.80	-13.92	-1.41
	1902	134.16	50-yr	40362	27958	173616	51326	35422	227499	-144589	-16497	3.75	24.07	-15.30	-1.75
	1902	134.22	100-yr	41705	29097	180092	52702	34599	228805	-150892	-17993	3.66	24.20	-15.96	-1.90

Mining RediMix to Corrections - No Redimix Bridge

Summary Sediment Transport Estimate | Transport rate supply - reach | Estimated depth of deposition/erosion

Reach F(4)
Gorge

			Event	Reach F - Summary Qsed (cy/event)				Change G to F (cy/event) - (+)Deposition/(-)Erosion				Reach F - Depostion (+)/Erosion (-)			
				YANG. (HEC-6)	LAURSEN (MADDEN), 85	PARKER	SCHOKLITSCH	YANG. (HEC-6)	LAURSEN (MADDEN), 85	PARKER	SCHOKLITSCH	YANG. (HEC-6)	LAURSEN (MADDEN), 85	PARKER	SCHOKLITSCH
	1811.5	42.82	2-yr	40802	56354	612043	99116	transp	transp	transp	transp	transp	transp	transp	transp
	1811.5	43.49	5-yr	64236	99215	916573	143980	transp	transp	transp	transp	transp	transp	transp	transp
	1811.5	43.68	25-yr	72665	115367	1023606	159664	transp	transp	transp	transp	transp	transp	transp	transp
	1811.5	43.79	50-yr	77513	124964	1083878	168500	transp	transp	transp	transp	transp	transp	transp	transp
	1811.5	43.84	100-yr	79818	129554	1112389	172684	transp	transp	transp	transp	transp	transp	transp	transp

Reach G(5)
USGS above
Gorge
Bridge

			Event	Reach G - Summary Qsed (cy/event)				Change xs48 to G (cy/event) - (+)Deposition/(-)Erosion				Reach G - Depostion (+)/Erosion (-)			
				YANG. (HEC-6)	LAURSEN (MADDEN), 85	PARKER	SCHOKLITSCH	YANG. (HEC-6)	LAURSEN (MADDEN), 85	PARKER	SCHOKLITSCH	YANG. (HEC-6)	LAURSEN (MADDEN), 85	PARKER	SCHOKLITSCH
		45.23											depths compounded by short reach length		
0	1000	100	2-yr	18887	11284	43189	17139	42891	187227	-19107	17157	11.6	50.6	-5.2	4.6
0	1000	100	5-yr	25481	15627	57892	20507	47091	224727	-29928	15069	12.7	60.7	-8.1	4.1
0	1000	100	25-yr	27305	16761	61585	21167	47373	233479	-32923	13922	12.8	63.0	-8.9	3.8
0	1000	100	50-yr	28150	17220	63008	21387	47634	238237	-33981	13442	12.9	64.3	-9.2	3.6
0	1000	100	100-yr	28528	17415	63603	21475	47776	240487	-34403	13235	12.9	64.9	-9.3	3.6

Reach H
above
Gorge
Bridge &
USGS

			Event	Reach H - Summary Qsed (cy/event)				Change I to H (cy/event) - (+)Deposition/(-)Erosion				Reach H - Depostion (+)/Erosion (-)			
				YANG. (HEC-6)	LAURSEN (MADDEN), 85	PARKER	SCHOKLITSCH	YANG. (HEC-6)	LAURSEN (MADDEN), 85	PARKER	SCHOKLITSCH	YANG. (HEC-6)	LAURSEN (MADDEN), 85	PARKER	SCHOKLITSCH
	1017	121.31	2-yr	26636	30825	83366	32482	12838	50359	3943	9236	transp	transp	transp	transp
	1017	128.38	5-yr	43071	52035	137662	46438	18305	79231	3508	10193	transp	transp	transp	transp
	1017	129.3	25-yr	48712	59379	156014	50787	20343	89804	4212	10580	transp	transp	transp	transp
	1017	129.5	50-yr	51866	63583	166323	53128	21526	95903	4634	10835	transp	transp	transp	transp
	1017	129.59	100-yr	53325	65532	171064	54185	22121	98858	4979	11000	transp	transp	transp	transp

Reach I
Single thread
channel

			Event	Reach I - Summary Qsed (cy/event)				Change 48 to I (cy/event) - (+)Deposition/(-)Erosion				Reach I - Depostion (+)/Erosion (-)			
				YANG. (HEC-6)	LAURSEN (MADDEN), 85	PARKER	SCHOKLITSCH	YANG. (HEC-6)	LAURSEN (MADDEN), 85	PARKER	SCHOKLITSCH	YANG. (HEC-6)	LAURSEN (MADDEN), 85	PARKER	SCHOKLITSCH
	1495	94.63	2-yr	39473	81184	87308	41718	22304	117327	-63226	-7422	transp	transp	transp	transp
	1495	95.23	5-yr	61376	131267	141169	56630	11195	109087	-113206	-21054	transp	transp	transp	transp
	1495	95.42	25-yr	69055	149184	160225	61367	5623	101057	-131563	-26278	transp	transp	transp	transp
	1495	95.45	50-yr	73392	159486	170957	63963	2392	95971	-141931	-29134	transp	transp	transp	transp
	1495	95.46	100-yr	75446	164390	176043	65185	858	93512	-146843	-30476	transp	transp	transp	transp

Mining RediMix to Corrections - No Redimix Bridge

Summary Sediment Transport Estimate

XS 43
wider section above single thread channel

		Event	XS 48 (Rch I) - Summary Qsed (cy/event)			
			YANG. (HEC-6)	LAURSEN (MADDEN), 85	PARKER	SCHOKLITSCH
1000	145.83	2-yr	61778	198511	24082	34296
1000	145.83	5-yr	72572	240354	27964	35576
1000	145.83	25-yr	74678	250240	28662	35089
1000	145.83	50-yr	75784	255457	29027	34829
1000	145.83	100-yr	76304	257902	29200	34709

Reach J
Section between wide valley area near Quarry

		Event	Reach J - Summary Qsed (cy/event)			
			YANG. (HEC-6)	LAURSEN (MADDEN), 85	PARKER	SCHOKLITSCH
1000	61.46	2-yr	19589	23975	39680	18467
1000	61.46	5-yr	32659	42908	74404	27804
1000	61.46	25-yr	37416	50028	87491	31041
1000	61.46	50-yr	40145	54251	95051	32851
1000	61.46	100-yr	41443	56276	98655	33707

Reach K
above quarry

		Event	Reach K - Summary Qsed (cy/event)			
			YANG. (HEC-6)	LAURSEN (MADDEN), 85	PARKER	SCHOKLITSCH
1000	105.765	2-yr	56715	105526	226506	72447
1000	107.505	5-yr	87280	171380	343682	101352
1000	108.775	25-yr	97806	194573	383299	110746
1000	109.07	50-yr	103740	207903	405199	115867
1000	109.22	100-yr	106527	214176	415413	118241

Transport rate supply - reach

Change J to 48 (cy/event) - (+)Deposition/(-)Erosion			
YANG. (HEC-6)	LAURSEN (MADDEN), 85	PARKER	SCHOKLITSCH
-42188	-174536	15598	-15830
-39913	-197446	46440	-7773
-37262	-200212	58829	-4048
-35639	-201206	66025	-1978
-34861	-201626	69455	-1002

Change K to J (cy/event) - (+)Deposition/(-)Erosion			
YANG. (HEC-6)	LAURSEN (MADDEN), 85	PARKER	SCHOKLITSCH
37126	81551	186826	53981
54621	128472	269278	73548
60390	144545	295808	79705
63595	153652	310148	83016
65084	157900	316759	84534

Reach K			
YANG. (HEC-6)	LAURSEN (MADDEN), 85	PARKER	SCHOKLITSCH
supply	supply	supply	supply
supply	supply	supply	supply
supply	supply	supply	supply
supply	supply	supply	supply
supply	supply	supply	supply

Estimated depth of deposition/erosion

XS 48 (Rch I) - Depostion (+)/Erosion (-)			
YANG. (HEC-6)	LAURSEN (MADDEN), 85	PARKER	SCHOKLITSCH
supply	supply	supply	supply
supply	supply	supply	supply
supply	supply	supply	supply
supply	supply	supply	supply
supply	supply	supply	supply

Reach J - Depostion (+)/Erosion (-)			
YANG. (HEC-6)	LAURSEN (MADDEN), 85	PARKER	SCHOKLITSCH
16.3	35.8	82.1	23.7
24.0	56.4	118.3	32.3
26.5	63.5	130.0	35.0
27.9	67.5	136.3	36.5
28.6	69.4	139.2	37.1

Reach K - Depostion (+)/Erosion (-)			
YANG. (HEC-6)	LAURSEN (MADDEN), 85	PARKER	SCHOKLITSCH
supply	supply	supply	supply
supply	supply	supply	supply
supply	supply	supply	supply
supply	supply	supply	supply
supply	supply	supply	supply