Preliminary Basis of Design

Silver Creek Kilpatrick Pond Enhancement
Blaine County, Idaho

for
The Nature Conservancy

August 23, 2012

GeoEngineers
Earth Science + Technology

Preliminary Basis of Design

Silver Creek Kilpatrick Pond Enhancement
Blaine County, Idaho

for
The Nature Conservancy

August 23, 2012

GeoEngineers

1525 South David Lane
Boise, Idaho 83705
208.433.8098

Preliminary Basis of Design

Silver Creek
Kilpatrick Pond Enhancement
Blaine County, Idaho

File No. 11130-011-01

August 23, 2012

Prepared for:

The Nature Conservancy
116 1st Avenue North
Hailey, Idaho 83333

Attention: Dayna Gross

Prepared by:

GeoEngineers, Inc.
1525 South David Lane
Boise, Idaho 83705
208.433.8098

Jeffrey J. Fealko, PE
Senior Water Resources Engineer

Michael K. Homza, PE
Associate Water Resources Engineer

PROFESSIONAL ENGINEER
REGISTERED
12495
8/23/12
STATE OF IDAHO
JEFFREY J. FEALKO

JJF:MKH:mlh

GEOENGINEERS

LIST OF FIGURES

APPENDICES

INTRODUCTION

Project Overview / Background

Silver Creek is a spring-fed system located in the unique high-desert setting of the lower Wood River Valley in Blaine County, Idaho and is home to rainbow and brown trout and a variety of wildlife species. The Silver Creek system is recognized by many as a valuable fishery with diverse recreational opportunities that contribute to the local economy (Perrigo 2006).

Kilpatrick Pond (project site) is located approximately three miles west of Picabo, Idaho, as shown in Figure 1 and is located on two properties of separate ownership. The Nature Conservancy (TNC) owns the property upstream of Kilpatrick Bridge and Double R Ranch owns the property downstream of Kilpatrick Bridge. The Double R Ranch property owners created Kilpatrick Pond with the construction an irrigation diversion dam in the early 20th century. Over the years, the operation of the diversion dam has increased the surface area of Kilpatrick Pond, reduced velocities and increased the deposition of legacy sediments. Previous studies, conducted by others, have identified natural sediment transport and increasing summer water temperatures as impacts on the ecological potential of Silver Creek (Gillilan 2007) (Perrigo 2006) (TNC 2012).Sediment accumulation within Kilpatrick Pond is believed to have been a product of livestock grazing throughout the drainage basin over the past century (Gillilan 2007) (Perrigo 2006). Recent land management practices have removed much of the grazing activities, which reduce sediment loading and provide an opportunity for enhancement (Perrigo 2006).

TNC has contracted with GeoEngineers to assist with the development of a channel restoration design within a portion of the Kilpatrick Pond reach of Silver Creek. The overall goals and objectives of the design are to create a healthier in stream habitat by reducing channel width and increasing channel depth and velocities through the reach. The design will improve the riparian corridor, increase bank stability and reduce summer water temperatures and sediment loading. In addition to the in channel and bank improvements, additional habitat enhancements will be conducted through the development of an adjacent wetland complex.

TNC and Double R Ranch have come together to develop a self-sustaining design that improves instream habitat and fits well with the ongoing operations of each property. This is a teaming opportunity that will provide habitat sustainability and improved fish passage.

Report Overview

GeoEngineers has prepared this preliminary design report in collaboration with TNC, along with input from the University of Idaho, the adjacent landowner, Nick Purdy and Brockway Engineering. This report provides a summary of our findings pertaining to the existing conditions of the project site and an explanation of our preliminary design.

This Basis of Design Report is intended to describe and support the design of the Kilpatrick Pond enhancements. The body of the report contains a description of existing conditions and supporting analysis, an alternative analysis, proposed conditions and supporting analysis, conclusions and references.

Following the body of the report is Figure 1, containing a vicinity map and seven appendices:

- Appendix A, Geotechnical Field Exploration and Laboratory Testing,
- Appendix B, Site Photograph Log
- Appendix C, Hydrologic Analysis,
- Appendix D, Hydraulic, Sediment Transport, and Temperature Analysis,
- Appendix E, Construction Quantities and Cost Estimate,
- Appendix F, Kilpatrick Pond Restoration Drawings (Drawings); and
- Appendix G, Report Limitations and Guidelines for Use.

The Drawings, which are also referred to as “Sheets”, graphically support the discussions in this report and are referenced throughout the report as necessary.

Contractual Authorization

GeoEngineers developed these designs and prepared this report for The Nature Conservancy as described in our proposal dated March 14, 2012 and signed by both parties March 14, 2012 and subsequently edited on June 27, 2012 and signed by both parties on June 28, 2012. The services performed under this Agreement are described in more detail in the Scope of Services section below.

SCOPE OF SERVICES

The purpose of GeoEngineers services is to prepare a preliminary design package for environmental permitting and a final design package for construction. GeoEngineers performed the following services in general accordance with our original agreement with TNC as noted above. These services, briefly described below, have been completed and constitute the first of several necessary phases of this project.

Task 1 Conceptual Design

GeoEngineers completed a conceptual design of the enhancement efforts on the TNC potion of Kilpatrick Pond, identified as the Project Reach. This conceptual design included the following:

- GeoEngineers reviewed the existing available data on Silver Creek and communicated a need for additional topographic, hydraulic and geotechnical data to TNC.
- GeoEngineers attended initial kickoff meetings where we discussed the project goals and objectives with TNC, the Purdy Family, the University of Idaho and Brockway Engineering. We evaluated preliminary hydraulic, soil and construction site access conditions during initial site visitations.
- GeoEngineers reviewed the physical and computer hydraulic models and results provided by the University of Idaho’s Sedimentation Engineering class. The preferred geometric alternatives, including channel width and depth, were parameters identified in the class sedimentation modeling. We also met with the class and discussed the construction process associated with the project.

- GeoEngineers developed multiple alternatives for bank treatments that included configurations and materials. We have presented alternatives for geometry and bank treatments to TNC for review. In addition, we considered with TNC a number of construction techniques and scenarios that dictated, in part, which bank treatments could be implemented.
- GeoEngineers has provided assistance regarding the fish passage design provided by the Purdy's design team. GeoEngineers has and will continue to coordinate design efforts with Brockway Engineering for their design being developed for the Double R Ranch.

Task 2 Preliminary Design

GeoEngineers took the approved conceptual design and refined it to support environmental permitting and fundraising. These revisions were based on input from TNC, the Purdy design team, permitting agencies and other stakeholders. This preliminary design effort included the following:

- GeoEngineers developed a set of Preliminary Design Plans to support environmental permitting and fundraising. These plans are included in this submittal package as Appendix F and include plans, profiles, and cross-sections of the existing conditions, proposed improvements and temporary construction measures.
- GeoEngineers developed construction quantities and cost estimates for the Preliminary Design.
- GeoEngineers composed this Preliminary Basis of Design Report that explains and supports the Preliminary Design Package.

Task 4 Environmental Permitting

GeoEngineers organized and conducted an onsite jurisdictional agency meeting with representatives from the United States Army Corps of Engineers (USACE), Idaho Department of Water Resources (IDWR), Idaho Department of Environmental Quality (IDEQ), Idaho Department of Fish and Game (IDFG) and Blaine County Planning and Development (County). It was determined that a Nationwide Permit would be requested under Section 404 Joint Permit Application which will be submitted jointly to the USACE, IDWR, IDEQ and County. The joint permit application also covers the request for a Stream Alteration Permit from IDWR. In addition to the Joint Permit application process, Blaine County requires a separate Building Services Stream Alteration Permit Application, which will also be submitted with the proper supporting documentation and a copy of the Joint Permit Application. This report will be provided with all appropriate applications as supporting documentation for the project.

Task 6 Topographic Survey

GeoEngineers deemed it necessary to have accurate topographic survey data to perform a hydraulic model, design, quantify and cost the proposed instream improvements. We authorized Bruce Smith of Alpine Enterprises Inc. to provide a topographic survey, and this survey work was performed in two separate phases. The first phase included the gathering of previous survey data conducted by Alpine along with the actual physical survey of newly identified areas of interest and the corresponding data processing. The second phase of the survey work included updating existing data and generating contours of both the existing topography above water and the silt and gravel layers in the creek.

Task 7 Hydraulic Modeling

GeoEngineers developed a hydraulic computer model of Silver Creek to better understand both the existing and proposed creek conditions and to develop detailed engineering designs. We utilized the Hydraulic Engineering Center's River Analysis System (HEC-RAS) one dimensional model to complete this analysis (HEC-RAS, 2010). This model was based off of survey data and is assumed to be more accurate then the model performed by the University of Idaho. We utilized the temperature and sediment modules within the HEC-RAS model to model changes in water temperature and sediment transport between the existing and proposed conditions.

Task 8 Geotechnical Exploration and Evaluation

GeoEngineers provided geotechnical engineering services to support the stream and wetland designs. The geotechnical engineering services included the following:

- Exploration of soil and groundwater conditions underlying the site by completing four (4) test pits on the site to depths of approximately 5.5 feet to 6.5 feet below existing grade.
- Laboratory testing to assess pertinent physical and engineering properties of the soil encountered.
- Geotechnical engineering recommendations to support design and construction of the new stream channel and wetlands.

PROJECT GOALS AND OBJECTIVES

Project Goals

The goal of this project as established by TNC is to reduce thermal and sediment loads by encapsulating legacy sediments while enhancing fish and wildlife habitat through stream enhancement and newly constructed emergent wetlands, ultimately creating a more natural functioning and sustainable ecosystem.

Project Objectives

To achieve the overarching project goal, stated above, specific objectives were identified. The project objectives are briefly described below. While the benefits below are specific, it is understood that all of these objectives support each other and are mutually beneficial to the larger environment, habitat and neighboring landowners.

Objective 1: Reduce Thermal Loading

Historical scientific studies and Forward Looking Infra Red (FLIR) temperature data have concluded that Silver Creek's water temperature increases through Kilpatrick Pond at a higher rate than the remaining portions of the system. While not lethal on the project site, this increase creates potentially lethal temperatures downstream during low flow conditions with high air temperatures, and could and has resulted in some fish kills downstream. The ability to reduce temperatures through the pond creates a benefit that will be delivered downstream throughout the remainder of the system to ensure a more viable and productive fishery.

Objective 2: Protect Legacy Sediment

Some form of a concrete irrigation dam with check boards has been in place to form Kilpatrick Pond for over 100 years. During that time multiple land uses and land use practices have created historic sediment accumulations in the Pond which create the mudflats and silt beds that are there today. It is important to maintain those sediments on site and not transport them downstream to downstream landowners.

Objective 3: Promote Sediment Transport

Once the legacy sediments have been stabilized it is imperative to promote the transport of incoming sediment through the pond in a more natural manner. This would ultimately result in a balance of sediment transport through the Pond and project reach and would minimize deposition within the pond as well as reduce the potential for the movement of legacy sediments. Sediment transport will be increased by increasing flow velocities and localized shear stresses through the project reach.

Objective 4: Enhance and Create Wetlands

To help protect legacy sediments, promote sediment transport and to help reduce thermal loading the existing channel is going to be narrowed to a more natural channel width. The open water area will be enhanced from open water to a large wetland area. This wetland will create a mosaic of emergent, scrub/shrub and forested wetlands to increase the habitat diversity of the system. North of the existing pond wetlands will be created to balance cut and fill quantities on site and will extend and connect wetland bodies together. This again will create a more diverse system and provide connectivity between wetlands.

RELATED STUDIES

Several scientific studies have been published that address the hydrology, land use, sediment characteristics and ecological impacts to Silver Creek. Perrigo, in 2006 studied the sediment budget for Silver Creek at Kilpatrick Pond in an academic dissertation titled “Historical Sedimentation and Sediment Transport Characteristics of Silver Creek, Idaho, USA.” This study identified historic land uses for the contributing drainage basins, hydrology, sediment inputs and the likelihood of sediment deposition for various sediment size classifications.

Following the acquisition of the Preserve in 1976, TNC commissioned several studies to evaluate existing Kilpatrick Pond conditions and to provide feasibility of ecological enhancement. This report makes reference to two specific studies that address land use, hydrology, sediment loading, thermal loading and the feasibility of specific restoration considerations of Silver Creek and Kilpatrick Pond. These studies are identified and described in the following two paragraphs.

Gillilan Associates, Inc. were contracted by TNC and prepared a studied titled “Kilpatrick Pond and Dam Restoration Feasibility Study” in June 2007. This report detailed an investigation of historic conditions and man-made alterations that impacted channel configuration and sediment accumulation. A conclusion that the current operation of the existing dam located at the downstream end of Kilpatrick Pond impairs the overall ecology of Kilpatrick Pond. The report addressed the feasibility of several alternatives. The alternatives range from complete restoration of the system to modest enhancement activities to no action. This report did not investigate complete removal of the dam. The alternative with the best cost: benefit ratio was to alter the dam configuration for a bottom release.

Ecosystem Sciences Foundation (ESF) prepared a comprehensive enhancement plan titled "Silver Creek Watershed, An Ecological Enhancement Strategy for Silver Creek, Idaho" in 2010. This plan prioritizes areas of Silver Creek and its tributaries and identifies restoration methods producing the most conservation benefit. The plan describes the contributing basin geology, climate, hydrology, land uses, wildlife and fisheries. Elements that are impairing the ecology of Silver Creek including thermal loading, sediment accumulation, herbicide / pesticide accumulation and exotic species invasion are identified in the plan. Restoration concepts and specific locations are described in the plan with a three tiered approach. Restoration of Kilpatrick Pond, specifically the construction of an island and dam reconstruction, is identified in these tiered approaches.

The University of Idaho's Center for Ecohydraulics Research (CER) teamed with TNC and the Purdy Family to evaluate rehabilitation alternatives associated with Kilpatrick Pond in 2012. The CER team included graduate level students from the University of Idaho and Washington State University enrolled in a Sedimentation Engineering class in the spring of 2012. The class project included an analysis of existing site conditions including hydrology, cross sectional velocity and flow rate measurements, topographic survey information and sediment and gravel grain size distributions. The class provided a physical model of the proposed conditions with a varying channel width and alternative island size and location. They also provided a numerical two-dimensional (2D) model of the proposed conditions. They evaluated sediment incipient motion and sediment transport rates in a relative comparison analysis of varying geometric conditions. Results from their studies were included in a report titled "Study of Sedimentation Processes in Silver Creek" completed in the spring of 2012.

EXISTING CONDITIONS

Site Location

The Project Reach is located within Section25, Township 1 South, Range 19 East and Section 30, Township 1 South, Range 20 East, within Blaine County, Idaho. Kilpatrick Pond represents an approximate 3,700-foot-long reach of Silver Creek beginning approximately 1,600 feet downstream of the Silver Creek confluence with Loving Creek and ending at the existing diversion dam on the Picabo Livestock Property. The diversion dam is located approximately 2.2 miles upstream of the point that Silver Creek crosses under US Highway 20 west of the town of Picabo, Idaho. Dividing the Kilpatrick Pond in east and west halves is Kilpatrick Bridge Road .The bridge and road are also the property boundary between TNC's Preserve and Picabo Livestock. Kilpatrick Pond is bound on the south by the Picabo Hills and is otherwise encompassed by agricultural land and The Nature Conservancy's Silver Creek Preserve. See Sheet 1.1 in Appendix E for a vicinity map of Kilpatrick Pond and the project site.

Soils

Soil and groundwater conditions at the site were observed on July 5, 2012 by performing four (4) test pits (TP-1 through TP-4) at the approximate locations shown on Sheet 2.1, Existing Conditions.

The test pits were excavated to depths ranging from about 5.5 feet to 6.5 feet below existing site grade. In addition to the test pits, a sample (H-1) from the existing Silver Creek stream bed near the project area was obtained during a previous site visit. Detailed descriptions of our site exploration and laboratory testing programs along with exploration logs and test results are presented in Appendix A.

Subsurface Conditions

Soil Conditions

We observed generally consistent subsurface conditions at the site to a depth of about 2.5 feet to 3.0 feet below the ground surface. At all four test pit locations, we observed that the upper 2.5 to 3.0 feet of soil consisted of silty sand and/or sandy silt. Below the silt and sand, we observed hardpan (caliche) that varied in thickness from less than 1 inch (TP-1 and TP-2) to 6 inches (TP-4) to about 1.5 feet (TP-3). In test pits TP-2 and TP-4, we observed poorly graded gravel with sand to a depth of about 5.5 feet below the current site grade. In test pits TP-1 and TP-3, we observed poorly graded sand and silty sand to a depth of about 6 feet to 6.5 feet below the current site grade. The H-1 sample obtained within Silver Creek that represents the sediment in the pond is similar to that of TP-3 and consists primarily of sandy silt.

We characterized the sand and silt layer as having low to moderate strength, low permeability, and moderate to high susceptibility to changes in moisture content. Additional information is included on the test pit logs in Appendix A.

Groundwater Conditions

Groundwater was observed in all test pits during our field exploration ranging from depths of approximately 3 feet (TP-4) to 4 feet (TP-2). Piezometers were installed in each of the test pits to allow for additional groundwater level readings. On-going groundwater level observations and recordings were outside the scope of our authorized services.

Depth to groundwater will likely vary seasonally and from year to year depending on factors such as precipitation, irrigation, creek flows or other means of groundwater recharge and loss.

Watershed Physiography/Geomorphology

Silver Creek lies in the southeast corner of the Big Wood River Valley. This region is surrounded by the Pioneer Mountains to the northeast, the Smoky Mountains to the northwest and the Picabo Hills to the south (Perrigo 2006). The Big Wood River Valley is composed of alluvial material deposited by a series of historic lake formations (Gillilan 2007). The alluvium is made up of coarse sediments flushed from an area of active glaciers by the Big Wood River and trend from coarser near the northern portion of the valley to finer near the southern end (Gillilan 2007). Below the alluvial material are units of Tertiary-age sedimentary rocks deposited by ancestral Big Wood River (Gillilan 2007). The drainage is divided in the valley and discharge to the west of the divide is drained by the Big Wood River. Discharge that is east of the divide drains to the east as groundwater until it encounters fine sediment pockets and surfaces in spring fed creeks that are tributaries to Silver Creek. Silver Creek ultimately drains this eastern region of the valley to the Snake River Plane (Gillilan 2007) (Perrigo 2006).

Silver Creek near the project site is characterized as a single thread channel that is bound by fine-grained banks (Gillilan 2007). Immediately upstream of Kilpatrick Pond is a reach known as the S-turn section of Silver Creek. The S-turns exhibit a sinuosity of approximately 1.41 (Gillilan 2007) and an approximate bankfull width of 75 feet. The channel within the S-turns is comprised mostly of gravels and includes patches of sand and finer grained materials (Gillilan 2007). Upstream of the S-turn reach is the confluence with Loving Creek. Channel slopes for Silver Creek from the S-turns up to the Stalker Creek Bridge are approximately 0.0007 ft/ft (Gillilan 2007).

Vegetation

The majority of the vegetation within the project site consists of emergent type species such as rushes (*Juncus sp.*) and sedges (*Carex sp.*) with pockets of birch (*Betula sp.)* black cottonwoods (Populus balsamifera and willows (*Salix sp.*). A significant amount of reed canarygrass (*Phalaris arundinacea*) has also taken hold within the project site. The surrounding upland areas would be considered sage steppe with sage brush (*Artemisia tridentata*) and rabbitbrush (*Chrysothamnus nauseosus*) as the most prominent species.

Land Use

Agriculture has been the predominant land use in the Silver Creek watershed since European settlers arrived in the latter part of the 19th century (ESF 2011). Irrigated agriculture and livestock grazing were introduced to the area in the 1880's resulting in the devastation of native vegetative communities and destabilization of stream banks (ESF 2011). Additionally, riparian areas were cleared to increase available land for agricultural use (Gillilan 2007). The effects of this agricultural based land use included an increase in sedimentation and a reduction in bank stability. Further manipulation of the watershed occurred around the 1950s. Those changes included construction of the Patton Drain, channelization in the upper Stalker Creek drainage, Patterson Drain and Daly Ditch, which augmented flows in Loving Creek. Results of these channel altering projects included increased sediment loading in Silver Creek and its tributaries (Manuel, 1979).

Beginning in the mid 1970s management activities within the drainage included native vegetation restoration, riparian fencing, and bioengineered bank stabilization. These efforts, along with a replacement of flood irrigation with sprinkler irrigation, have significantly reduced the Creek's sediment loading (Gillilan 2007). TNC developed the Preserve, including an area of 882 acres with an additional 9,000 acres of conservation easement to protect it from development (Perrigo 2006). There have been numerous rehabilitation efforts focusing on habitat restoration, protection of stream banks and improvements in water quality (Perrigo 2006). The area continues to support significant recreational opportunities that include hiking, fishing, canoeing and bird watching (Perrigo 2006).

ESF prepared a land use map in their 2011 report comparing 2009 land use to 1946 land use by acre within the Silver Creek drainage. The map indicates that the total irrigated agriculture area increased from 4,351 acres in 1946 to approximately 7,205 acres. The increase in irrigated agricultural land resulted in a decrease in emergent wetlands, grasslands and shrub/scrub areas (ESF 2011). Other changes within the watershed include an additional 49 miles of roads and an increase in woody wetland areas (ESC 2011).

Silver Creek Hydrology

Silver Creek is a spring driven system with flow rates heavily influenced by the Wood River Valley Aquifer System (TNC 2011). Groundwater feeds Silver Creek through many tributaries upstream of Kilpatrick Pond. The hydrograph of Silver Creek experiences rising flow rates in the early spring as a result of groundwater recharge due to snowmelt and gradually decline through late spring to late summer. The hydrograph experiences a rise through late summer and fall culminating in a second peak in late fall (TNC 2011). Peak flood flows through the Creek are associated primarily with early season rain on snow events where the ground is frozen and limits the amount of infiltration, ultimately creating large volumes of surface water ponding and flowing toward and through Silver Creek.

Sediment Yield

Sediment transported and deposited by river systems can vary in size between boulders to small clay particles. Stream characteristics that influence morphology of alluvial rivers, such as Silver Creek, include erosion, transport and deposition of sediments (Perrigo 2006). Drainage basin environmental factors that have had a significant impact on the sediment yield through Silver Creek include topography, geology, hydrology, landuse, climate and vegetation (Perrigo 2006).

Sediment deposition within Kilpatrick Pond was most severe during the time of intensive grazing during the 20th century (ESF, 2011). The volume of sediments that entered the system over that time period overwhelmed the carrying capacity of Silver Creek and its tributaries (ESF 2011). Stream channels were altered from their natural forms with sediment deposition. A study conducted by Manuel el al., in 1979 measured the depth of sediments within Silver Creek. These depths varied between 1 inch and 7.5 inches (Perrigo 2006). These values demonstrated an increasing trend moving downstream toward Kilpatrick Pond. A more recent study of sediment depth was conducted by Watershed Sciences in 2006 and sediment depths from this investigation approached 3.2 feet (Perrigo 2006).

Alpine Engineering, Inc. conducted a sediment depth survey across numerous sections through Kilpatrick Pond in 2011. This survey covered a reach starting at the S-turns to the existing diversion dam at the downstream end of Kilpatrick Pond. Results from this topographic survey indicated increasing sediment accumulation in a downstream direction. Sediment deposits were up to approximately 3.7 feet above Kilpatrick Bridge and up to approximately 7 feet in the lower portion of Kilpatrick Pond below Kilpatrick Bridge.

Annual volume inflows of sediment to Kilpatrick Pond are unknown, but are assumed to be greatly reduced in recent years due to the efforts of TNC through conservation easements and restoration actions.

EXISTING CONDITIONS ANALYSIS

Hydrology

A hydrologic analysis was completed for the Silver Creek watershed to establish and identify various flood frequency discharge estimates and fish passage design flows to model the existing and proposed hydraulic conditions.

GeoEngineers completed a hydrologic evaluation of Kilpatrick Pond by reviewing United States Geological Survey (USGS) gage data at a sportsman access near Picabo, Idaho. The hydrologic evaluation included peak flow calculations, monthly, daily and average daily discharge statistics. The hydrologic evaluation also included information regarding irrigation water rights removed from Silver Creek near the downstream end of the project reach (above the Purdy dam).

USGS stream gage number 13150430 is approximately 2.3 miles downstream of the project site and is the closest applicable stream gage with an acceptable dataset of 38 years (1974—2012).

Annual Peak Discharges

GeoEngineers statistically analyzed historic instantaneous peak flow gage data of Silver Creek using a Log Pearson Type III Statistical Distribution (LP3 Distribution) completed with the USGS's PKFQWin program to estimate peak flows at the site. The PKFQWin program utilizes the methodologies discussed within USGS Bulletin 17B (USGS 1982). The complete 38 years of flow data were utilized for the peak flow analysis.

Peak flow rates were estimated to support the hydraulic analysis of the channel improvements. The channel forming flow is often referred to as the bankfull discharge and typically occurs at approximately the 1.5 year flood return interval. The 1.5 year discharge is estimated at 266 cubic feet per second (cfs). The 100-year and 500-year discharges are 649 and 765 cfs, respectively. Table 1, Peak Flood Discharges shows the estimated peak flood frequency discharges estimated from the LP3 Distribution. A detailed hydrologic output can be found in Appendix C.

TABLE 1. PEAK FLOOD DISCHARGES

Occurrence Interval	Discharge (cfs)
1.25-Year	231
1.5-Year	266
2-Year	308
5-Year	407
10-Year	469
25-Year	543
50-Year	597
100-Year	649
200-Year	699
500-Year	765

Average Monthly Discharge

The average monthly discharges were estimated from the statistical data available at the USGS gage. This data, however, does not account for water lost through irrigation diversions between the gage site and the Project Reach upstream. The existing dam located at the downstream end of Kilpatrick Pond is used to divert irrigation runoff by elevating the water surface to access gravity fed irrigation ditches. The diversion provides irrigation water to a ranch located downstream of Kilpatrick Pond owned and operated by the Picabo Livestock Company. Based on conversations with Charles G. Brockway of Brockway Engineering Inc, the surface water right serving the ranch is approximately 73 cfs. Multiple surface water rights have accumulated over time and based on the priority of the water rights, Charles Brockway approximated an irrigation flow of 35 cfs during typical summer days. Therefore we added the 35 cfs to the flow rates obtained from the gage data for months falling within the irrigation season. Since the irrigation season typically falls within the middle of April through the middle of October we only added 35 cfs for half of the month so the average increase for these two months was only 17.5 cfs. Table 2, Average Monthly Discharges below shows the estimated average monthly discharges through the Project Reach.

TABLE 2. AVERAGE MONTHLY DISCHARGES

Month	Monthly Discharge USGS Gage (cfs)	Monthly Discharge Project Reach (cfs)
January	146	146
February	152	152
March	184	184
April	168	185
May	128	163
June	126	161
July	118	153
August	137	172
September	138	173
October	155	173
November	160	160
December	152	152

Hydraulic Model Calibration Flows

The hydraulic model was calibrated using the average daily discharge observed on July 9, 2012. The daily average flow rate at USGS gage number 13150430 was 114 cfs on that day. Because this measurement was made during irrigation season, we added 35 cfs to the gage reading to create a summer flow rate of 149 cfs through the Project Reach.

Existing Conditions Hydraulic Analysis

Hydraulic Model

GeoEngineers used Version 4.1.0 of the USACE HEC-RAS (USACE 2010) hydraulic computer model was used to model the Kilpatrick Pond reach of Silver Creek. HEC-RAS is a one-dimensional, hydraulic model computing water surface elevations, velocities, shear stress, temperature dispersion and sediment transport using a step-wise methodology. We analyzed the project's hydraulic and temperature characteristics using a steady state subcritical flow regime. We approximated the project's sediment transport properties using an unsteady state, subcritical flow regime.

Existing Conditions Model Development

GeoEngineers used topographic information from field survey points provided by Alpine Engineering Inc. on April 26 2012 to prepare HEC-RAS existing condition cross sections. The channel of Kilpatrick Pond includes a layer of silt that has accumulated since the construction of the original diversion dam over 100 years ago. The survey points included elevations representing the top of silt and elevations at the gravel surface located below the silt. The survey included the floodplain located on the northern (left) side of Kilpatrick Pond, the channel bathymetry and the top of bank on the southern (right) side of Kilpatrick Pond at several cross sections. Within the channel the survey points and topographic information were very limited in frequency both across the channel and parallel to the channel. The survey included cross sectional data from upstream of the confluence of Silver Creek and Loving Creek to the downstream side of the existing diversion dam. The survey data also included bridge deck elevations at Kilpatrick Bridge and elevation differences between the bridge deck to top of silt elevations and top of gravel elevations within the channel.

GeoEngineers developed 26 existing condition cross sections using the topographic information for silt, gravel and overbank topography. The HEC-RAS model started at river station 62+23.00, upstream of the Silver Creek and Loving Creek confluence and ended at river station 10+66.51 located immediately upstream of the existing diversion dam. We approximated the right top of bank location using an aerial photo at cross sections that did not include topographic points. We modeled the existing Kilpatrick Bridge based on the bridge deck survey points and the field measured vertical differences to the silt and to the gravel provided by Alpine Engineering, Inc.

GeoEngineers approximated roughness coefficients for the model to represent the physical features of the river and corresponding floodplain. GeoEngineers ultimately used a Manning's n value of 0.025 to model channel roughness and a Manning's n value of 0.028 to model the floodplain roughness. These values were calibrated in the existing condition model using information provided by TNC that included a measurement of 2.83 vertical feet from the deck of the Kilpatrick Bridge to the water surface elevation on July 9, 2012.

Ineffective flow areas were placed in accordance with field observations, and professional judgment to accurately model the expansion and contraction of flow through the Project Reach. The downstream boundary control was set to a known water surface elevation based on surveyed information adjacent to the Purdy Dam.

Existing Conditions Hydraulic Results

Steady state model results were obtained for the wide range of annual peak flood discharges described above ranging from the 1.25-year to the 500-year discharge. These results contain certain hydraulic characteristics that describe what is occurring at each cross section location. These parameters include flow depth, velocity, shear, and stream power. Parameters obtained during the more frequently occurring flood intervals (1.25- and 1.5-year), which tend to be the channel forming flows, were used in the subsequent channel design (Castro 2001).

Table 3, Summary of Existing Peak Flow Hydraulic Results, provides a brief summary of existing hydraulic characteristics for Silver Creek for the 1.5-, 2-, 5-, and 10-year design discharges. This table shows the range of velocities, top widths and shear stresses throughout the S-Turns and Project Reach.

TABLE 3. SUMMARY OF EXISTING PEAK FLOW HYDRAULIC RESULTS

Reach	Dam Scenario	Flood Recurrence Interval	Velocity (ft/s)			Top Width (ft)			Shear Stress (lb/ft²)		
			Min.	Ave.	Max.	Min.	Ave.	Max.	Min.	Ave.	Max.
S-Turns	Dam Up	1.5-Year	1.0	1.2	1.3	117	168	203	0.01	0.02	0.03
		2-Year	1.0	1.3	1.4	131	180	211	0.02	0.02	0.03
		5-Year	1.2	1.4	1.6	140	191	222	0.02	0.03	0.03
		10-Year	1.2	1.5	1.7	143	194	227	0.02	0.03	0.04
	Dam Down	1.5-Year	1.1	1.4	1.8	96	131	162	0.02	0.03	0.05
		2-Year	1.2	1.5	1.8	108	151	198	0.02	0.03	0.05
		5-Year	1.2	1.6	1.8	136	184	218	0.02	0.04	0.05
		10-Year	1.3	1.5	1.7	143	194	227	0.02	0.03	0.04
Project Reach	Dam Up	1.5-Year	0.4	0.5	0.9	233	325	593	0.00	0.00	0.01
		2-Year	0.4	0.6	1.0	237	328	595	0.00	0.00	0.01
		5-Year	0.5	0.7	1.2	242	339	601	0.00	0.01	0.02
		10-Year	0.5	0.7	1.3	243	344	604	0.00	0.01	0.02
	Dam Down	1.5-Year	0.5	0.6	1.0	203	302	584	0.00	0.01	0.01
		2-Year	0.5	0.7	1.1	213	311	587	0.00	0.01	0.02
		5-Year	0.6	0.8	1.3	236	328	595	0.00	0.01	0.02
		10-Year	0.6	0.8	1.4	242	340	602	0.00	0.01	0.02

ALTERNATIVE ANALYSIS

GeoEngineers conducted the alternative analysis in collaboration with TNC, developing alternatives consistent with the vision of TNC and their goal, and objectives. The goal of all alternatives is to provide a channel alignment, floodplain geometry, and planting structure that would enhance conditions in the Project Reach by reducing thermal loading of the system through the pond, protecting and maintaining legacy sediment in place while promoting the transport of new material through the system all the while maintaining dynamic geomorphic processes.

The goal of the project was fairly well defined which limited the amount of variation between each specific alternative. Each alternative filled approximately 2/3rds of the pond upstream of Kilpatrick Bridge and maintained the southern bank. Creek channel alignments varied from a single threaded channel, to two channels, to a semi-anastomosed channel with multi-threads through the Project Reach.

The major factor on what alternative was selected as preferred was based more on how it would have to be constructed than what it looked like. Originally we discussed multiple construction methods to remove existing sediment in the pond and fill in the open water as desired. These methods ranged from a full channel diversion, to a sediment barrier following the proposed bank line in the middle of the channel, to constructed fill cells. Ultimately a full channel diversion that would have dewatered the full channel was unacceptable. This eliminated the ability to complete complex multiple channel configurations. A long single barrier did not provide a method to remove the existing legacy sediment on the bottom of the channel in remaining channel area and would have likely mobilized sediment downstream during and after construction. The construction of fill cells again would have left existing legacy sediment in the proposed channel and would have risked mobilization.

Selected Alternative

Based on input from TNC, the enhancement alternative that provides the greatest flexibility in construction means and achieving the overall project goal is considered the preferred alternative. This alternative goes about construction through dredging the proposed channel area to remove the existing legacy sediment and then constructing a bank that is capable of retaining the legacy sediments and provides a single thread channel to promote sediment movement through the system while still maintaining some small open areas at the upstream end of the pond and immediately upstream of the bridge, wetland side channels, and backwater areas to provide a diverse habitat for aquatic and avian species.

PROPOSED ENHANCEMENTS

The proposed design is based largely on the selected alternative from the alternatives analysis. The proposed design is graphically presented on Sheet 3.1 in Appendix F. This design consists of five major tasks to accomplish the desired results including: channel modifications, development of a channel bank that contains legacy sediment, the enhancement of the existing open water area, the creation of new wetlands, and a robust revegetation plan. The combination of these five things significantly narrows the channel to reduce thermal loading, promote sediment transport of incoming materials while maintaining the existing legacy sediment on site, and creates a more diverse and complex wetland habitat.

Channel Modifications

GeoEngineers has proposed channel modifications for Kilpatrick Pond upstream and downstream of Kilpatrick Bridge to support design concepts including sediment mobility, wetland creation and temperature reduction. The proposed channel modification involves dredging the existing sediments from the right (south) side of the channel. The dredging will effectively remove the legacy sediments from the proposed main channel to reduce the likelihood that it is mobilized downstream during typical irrigation dam operations and construction.

Upstream of the Kilpatrick Bridge the top width of the dredged channel will be approximately 65 to 75 feet wide. Downstream of Kilpatrick Bridge the dredged channel width will be approximately 60 feet wide. The proposed channel widths after dredging will resemble a more natural and functioning geometry that is capable of transporting incoming sediment through Kilpatrick Pond. The proposed width of the channel between the left top of bank and the right top of bank is consistent with the results presented by the University of Idaho Sedimentation Engineering Class report, “Study of Sedimentation Processes in Silver Creek” (CER 2012). The University of Idaho study evaluated channel widths of 65 and 80 feet. Conclusions presented in this study indicate the 80-foot-wide channel produced the largest total volume of sediment transported. The proposed condition channel widths associated with our design varies between approximately 65 feet and 90 feet. The dredged material will be relocated to the northern two thirds of Kilpatrick Pond upstream of Kilpatrick Bridge to create the enhanced wetland area and will also be spread across the upland area to the north of the Pond. The south bank of the channel will remain untouched to provide a source for macroinvertebrates to recolonize the northern bank after construction.

Bank Treatments

GeoEngineers developed a bank treatment option through the conceptual and preliminary design phases that reflect the project’s intent to provide a near vertical bank and stabilize legacy sediments and provide initial bank stability until vegetation can be established and the root zone can ultimately provide the bank stability needed. The design consists of a biodegradable bank retention fence composed of wood and fabric along the proposed northern channel bank. The retention fence is made of 6-8 inch diameter wooden piles evenly spaced at 8 feet on center that will be vibrated to a minimum depth of 8 feet below the top of the gravel layer. Prefabricated fence panels will be installed between the piles to support the soil. A biodegradable filter fabric will be used on the landward side of the fence panels to ultimately retain the proposed wetland backfill. This bank treatment was designed to provide bank stability, habitat enhancement and function within the limitations of the proposed stream geometric characteristics, sediment characteristics and stream hydraulics. Ultimately the wood will rot away as will the fabric to result in a natural native bank held together by a dense root zone. The robust population of aquatic vegetation, or macrophytes, will visually shield the fence while it decomposes to make it aesthetically more pleasing. The location of the proposed bank treatment is shown in on Sheet 3.2 and is laid out in more detail on sheet 6.1 in Appendix F.

Wetland Enhancements

The proposed design includes the enhancement of existing wetlands. These include converting open pond water in the northern portion of Kilpatrick Pond to an emergent and scrub/shrub wetland and providing backwater channels to convey water in high runoff events. These wetland enhancements are shown on Sheets 3.1 through 3.4 in Appendix E. We developed the elevations for the wetlands on the northern (left) side of the channel by modeling anticipated seasonal flow rates and providing inundation of the wetlands through strategic times of the year. Specific flow rates and dam operational conditions are discussed below in the Proposed Enhancement Analysis section of this report.

Wetland Creation

The pond dredging effort will not provide enough material to fill the northern portion of the pond to construct the desired channel and wetland configuration. The additional fill necessary to strike this balance will be excavated from the upland area north of the pond. Wetlands will be created in the area to be excavated. The depth of excavation will vary such that the resulting surface elevations range from above to below the local groundwater in order to maximize the wetland and open water habitat. This area will likely vary in size to meet the need for fill material. The preliminary design estimates that this area will be approximately 1.9 acres in size and will vary from open water, emergent, scrub/shrub and forested wetlands. This wetland creation area will provide areas of juvenile fish refuge and provide various habitats for nesting birds.

Revegetation Plan

The establishment of healthy, self-sustaining native vegetative community throughout the project site is vital to the success of a Stream Enhancement project. Revegetation immediately after grading provides key initial site stabilization and energy dissipation even as the plants begin to provide food web support. Such communities promote short-term and long-term bank stabilization; shade for cooler water; protective cover for fish; habitat for terrestrial wildlife (birds, mammals, amphibians and macroinvertebrates); and woody debris recruitment in the future. A robust riparian plant community also provides greater protective cover, food sources, habitat complexity and diversity, and migration continuity for the larger ecosystem.

The species of plants proposed in this plan vary in relation to the stream’s bankfull elevation, with the more hydrophytic plants closer to the stream and the more drought-tolerant species at higher elevations. The proposed vegetation consists of plant species native to the area that are typically found at similar sites within the region. Where possible and appropriate based on plant condition, clumps of existing shrubs (particularly willow) may be salvaged during construction. Willows that cannot be salvaged as whole plants can provide whips to be used as live stakes.

Revegetation activities will occur immediately following earth moving activities. Once the final grade has been attained, all disturbed areas will be replanted as appropriate. Although a complete species pallet has not been finalized, it is understood that a planting plan will be developed across the emergent, scrub/shrub and forested wetland types in addition to replanting of upland buffers. General species will include a variety naturally occurring sedges, rushes, willows and poplar(s) along with a general mix of existing upland species.

PROPOSED ENHANCEMENT ANALYSIS

Hydraulics

Proposed Conditions Model Development

The existing conditions HEC-RAS hydraulic model was modified to represent the proposed conditions through the Project Reach. Cross sections through the modified section were altered to represent the proposed grades and configurations. Channel improvements are proposed from the upstream end of Kilpatrick Pond through Kilpatrick Bridge and downstream approximately 1,200 feet downstream of the bridge. The proposed channel improvements involve dredging the existing sediments from the proposed channel (south side of the existing channel). The existing top of gravel elevation was used as the thalweg of the proposed condition channel. The proposed bank, wetland and upland areas were also included in the cross sections in the hydraulic model to represent the proposed conditions.

Steady state model results were obtained for the range of peak discharges ranging from the 1.25-year to the 100-year recurrence events. These results contain certain hydraulic characteristics used to describe what is occurring at each individual cross section. These parameters include flow depth, velocity, shear stress, and stream power. Parameters obtained during the more frequently occurring events (1.25- and 1.5-year), which tend to be the channel forming flows, were evaluated to ensure proper channel shape and function compared to the naturally occurring reach immediately upstream. Table 4, Summary of Proposed Peak Flow Hydraulic Results, show a summary of average hydraulic characteristics through the Project Reach and compare them to the average characteristics observed upstream in the S-turns section.

TABLE 4. SUMMARY OF PROPOSED PEAK FLOW HYDRAULIC RESULTS

Reach	Dam Scenario	Flood Recurrence Interval	Velocity (ft/s)			Top Width (ft)			Shear Stress (lb/ft^2)		
			Min.	Ave.	Max.	Min.	Ave.	Max.	Min.	Ave.	Max.
S-Turns	Dam Up	1.5-Year	1.1	1.3	1.5	99	143	181	0.02	0.03	0.04
		2-Year	1.2	1.4	1.7	117	160	204	0.02	0.03	0.05
		5-Year	1.3	1.7	2.0	134	181	216	0.02	0.04	0.06
		10-Year	1.4	1.8	2.1	138	186	221	0.03	0.05	0.07
	Dam Down	1.5-Year	1.2	1.6	2.2	94	116	135	0.02	0.04	0.08
		2-Year	1.2	1.7	2.2	98	134	176	0.02	0.05	0.09
		5-Year	1.4	1.8	2.4	132	164	213	0.03	0.05	0.09
		10-Year	1.5	2.0	2.7	135	167	218	0.03	0.07	0.12
Project Reach	Dam Up	1.5-Year	0.6	0.8	1.1	158	328	583	0.00	0.01	0.01
		2-Year	0.6	1.0	1.2	175	337	584	0.00	0.01	0.02
		5-Year	0.8	1.2	1.6	226	354	586	0.01	0.02	0.03
		10-Year	0.9	1.4	1.8	234	358	588	0.01	0.02	0.04
	Dam Down	1.5-Year	1.3	2.2	3.7	48	66	181	0.03	0.08	0.22
		2-Year	1.3	2.2	3.5	58	69	183	0.03	0.08	0.19
		5-Year	1.4	2.3	3.3	64	74	188	0.03	0.07	0.15
		10-Year	1.4	2.3	3.1	67	98	240	0.03	0.07	0.13

Sediment Transport

GeoEngineers routed the monthly average discharges, representing an annual hydrograph, for a time interval of 3 years through the hydraulic model to analyze potential sediment transport and transport capacity. The Meyer-Peter Müller bedload transport equation was selected to best approximate the system's transport functions in the sediment transport element of the HEC-RAS model. We ran two sediment transport models to compare the estimated aggradation and degradation of sediment within Kilpatrick Pond in the proposed conditions. The first model included a downstream boundary condition that represented an in-place dam scenario for summer months while removing the dam during winter months. The second scenario included a downstream boundary condition that represented an in-place dam scenario for the entire year.

Due to the fact that the sediment flow rate upstream of Kilpatrick Pond is unknown, we modeled the upstream boundary condition as in an equilibrium state where any sediment entering the upstream cross section exited the upstream section. This setting requires the sediment transport model to balance the incoming sediment and the conveyance capacity at the upstream cross section.

We evaluated two general sediment types, the first being a sandy-silt representing the legacy sediment and assumed sediment entering the system. The second type of sediment evaluated was the existing gravels located underneath the legacy sediments. We used the sediment transport model output in the HEC-RAS model to estimate the ability of the hydrograph to change the elevations of the inverts of each cross section and the channel elevation profile through aggradation and degradation processes.

The results for the sediment transport model indicate that very little sediment is transported in the dam in scenario. Sediment transport increases with the seasonal fluctuation of the dam. In the fluctuation scenario, the channel invert experiences relatively minor degradation upstream of the backwater effects of Kilpatrick Pond. The channel inverts through the pond experience both minor aggradation and degradation within the modeled cross sections upstream of the dam as the channel tries to achieve a more uniform slope through the pond. The degradation and aggradation processes in these sections experience their greatest change in channel elevation over the first winter with the dam out. Those changes in channel invert are followed by smaller changes with the following two dam out scenarios in the 3-year model. The dam out scenario will likely be modified during final design to better represent the actual dam operations plan that will be developed by the Purdy Design Team. Longitudinal plots of the modeled change in invert elevation are included in Appendix C titled “Hydraulic, Sediment Transport and Temperature Analysis.

PROJECT CONSTRUCTION

Construction will occur in a sensitive manner that avoids the disturbance of the existing instream habitat and live vegetation as much as possible. Where disturbance is necessary, it will be minimized and the disturbed areas will be replanted and/or mitigated with an overall net benefit to the stream and surrounding environment. A general construction sequencing plan is outlined on Sheet 8.1 in Appendix F. Key elements of the construction plan include:

- A sensitive design that addresses the overall long-term equilibrium of the stream, sediment and wetland areas.
- A sensitive design that minimizes the extent of disturbance to the stream and riparian habitat as much as possible.
- A construction sequencing plan that minimizes the area over which the disturbance occurs.
- Timing construction to enable the proposed stream and wetland enhancements to be constructed during low flow conditions typically observed in fall.
- On-site landscape sculpting and soil dispersal minimizing haul distances and the import or export of material.

The proposed creek improvements will be constructed sequentially, from site preparations, excavation of temporary dredge settling ponds, dredging the main channel upstream of Kilpatrick Bridge, installation of the northern bank retention fence, dredging downstream of Kilpatrick Bridge, enhancing wetland areas within the existing pond area, creating wetland areas in the existing uplands, and finally planting the affected areas to promote a healthy riparian corridor.

Surface waters will be routed away from the active construction zones using floating booms to facilitate construction, minimize potential on-site habitat degradation and to eliminate off-site downstream sedimentation. Streambank and riparian vegetation will be planted during construction to provide initial stream and floodplain stability and to minimize the potential for project-related erosion and downstream sedimentation. As designed, the proposed stream construction should not increase offsite sedimentation nor should it negatively impact off-site habitat during construction. Once vegetation is established and the stream has stabilized, the proposed enhancements will reestablish the natural sediment transport through the system and greatly enhance the aquatic and riparian habitat.

We anticipate that difficult earthwork conditions may occur due to the silt soil observed on site in conjunction with anticipated high soil moisture conditions along Silver Creek. In addition, the hardpan (caliche) layer may be difficult for small earthwork equipment to excavate. Specific recommendations for the proposed design and construction are presented in the following sections.

Construction Timeframe

The project's construction should be timed to minimize the potential for construction related erosion and sedimentation. Construction should occur during the autumn months, when rainfall is less likely and fisherman access has slowed down. The most productive time for construction would be from September through November.

Fill placement will be difficult to accomplish if earthwork is performed during extended periods of wet weather which could occur in winter and spring. Earthwork performed in sub-freezing weather may improve equipment mobility and fill placement in the existing Kilpatrick Pond area. It should be noted, however, that earthwork operations should not take place in areas of frozen water or on snow. In addition, snow is not acceptable to be used as fill material. As a result, we recommend that earthwork be scheduled for the normally warmer months, where possible, unless delays in the construction schedule can be tolerated.

Unprotected site soil can deteriorate under construction traffic if exposed to inclement weather. Accordingly, to the degree possible, we recommend that construction equipment and personnel be prohibited from traversing prepared subgrade areas during wet weather conditions.

Construction Quantities and Cost Estimates

Approximate construction quantities and associated costs have been generated for the proposed project based on the preliminary design. These costs were developed using a single list of standard unit costs based upon our recent project design/construction experience, R.S. Means Heavy Construction Cost Data, and other appropriate sources. In addition to unit costs for specific construction quantities, our unit cost basis includes costs and variables to account for inflation, local location adjustment factors, mobilization, incidentals and contingencies. Additional costs from construction administration, inspection and testing, surveying, and construction observation have not been included in the construction cost estimates, but can be provided to you at your request to estimate the entire process through construction observation and construction. The estimated construction cost of the proposed preliminary design is $470,000. This includes a 10 percent increase for incidentals along with a 15 percent price contingency.

CONCLUSIONS

GeoEngineers worked closely with TNC in developing a design that captured the overarching vision for the enhancement of Silver Creek at the Kilpatrick Pond site. Detailed objectives and treatments which specifically targeted the project's goal were subsequently identified and refined into a host of distinct conceptual-level enhancement alternatives. These alternatives were compared against one another that resulted in identifying the enhancement alternative that best achieved the project's goal. This preferred alternative was further refined to a preliminary-level of design, of which this report is an integral part. This report summarizes this process.

The proposed habitat enhancement will improve the existing degraded condition by reconfiguring the stream into a narrower single channel alignment and newly enhanced wetland to reduce the amount of surface area available to solar heating, increase the channel velocities and shear stresses to promote the transport of incoming sediment through the pond, and to contain the existing legacy sediment within the project area. The enhancement of natural physical processes is expected to result in ecological responses such as increased biological production and biodiversity for both aquatic and terrestrial organisms.

The enhancements proposed to achieve these results include:

- Dredging the southern third of Kilpatrick Pond to remove legacy sediments from the active flow path.
- Creating a near vertical northern channel bank to confine the channel to a narrower cross section to increase channel shear stress and velocity while protecting and preventing the migration of legacy sediment downstream.
- Sculpting emergent, scrub/shrub and forested wetlands around open water to create a more complex wetland system.
- Using native vegetation for long-term stream bank stability and habitat diversification.

The proposed improvements will result in enhancing, expanding and diversifying the function and values of the aquatic and riparian habitat along the stream corridor itself while enhancing the continuity to the larger mosaic of upland habitats. Such enhancements include:

FUTURE PHASES OF ENHANCEMENT

With the completion of this report, the next step in the enhancement process includes acquiring construction permits and funding for the final design (which is adequate for construction bidding and construction) and the construction of the project. To facilitate acquisition of environmental permits this preliminary design report and attached preliminary plans will be used as supplemental information. It should be noted that the plans and cost estimates from this report are preliminary and should not be used for construction. During the acquisition of permits and funding for the construction phase of the project, GeoEngineers will continue working with TNC and the Purdy Design Team to acquire permits, complete the final design, help throughout the contractor bidding and selection process for construction, and provide on-site construction observation.

LIMITATIONS

We have prepared this report for The Nature Conservancy and their authorized agents and regulatory agencies for the Kilpatrick Pond Restoration.

Within the limitations of scope, schedule and budget, our services have been executed in accordance with generally accepted practices in the fields of river bank stabilization design engineering and environmental engineering in this area at the time this report was prepared. The conclusions, recommendations, and opinions presented in this report are based on our professional knowledge, judgment and experience. No warranty or other conditions, expressed or implied, should be understood.

Any electronic form, facsimile or hard copy of the original document (email, text, table and/or figure), if provided, and any attachments should be considered a copy of the original document. The original document is stored by GeoEngineers, Inc. and will serve as the official document of record.

Please refer to the Appendix F titled "General Limitations and Guidelines for Use" for additional information pertaining to the use of this report.

REFERENCES

Castro, J.M. and P.L. Jackson. 2001. Bankfull discharge recurrence intervals and regional hydraulic geometry relationships: patterns in the Pacific Northwest, USA, Journal of the American Water Resources Association. Volume 37, Issue 5, pp. 1249–1262.

Ecosystem Sciences Foundation. 2011. "Silver Creek Watershed – An Ecological Enhancement strategy for Silver Creek, Idaho."

Gillilan Associates, Inc. 2007. "Kilpatrick Pond and Dam Restoration Feasibility Study – Final Report."

Hydraulic Engineering Center – River Analysis system (HEC-RAS), Version 4.1.0, January 2010.

Manuel, C. Y., J.S. Griffith, and G.W. Minshall. n.d. "The Sources and Causes of Sedimentation in Silver Creek, Blaine Co., Idaho," Idaho State University.

Perrigo, Ross. 2006. "Historical Sedimentation and Sediment Transport characteristics of Silver Creek, Idaho, USA," University of Western Australia, Dissertation for Degree of Bachelor of Engineering.

United States Department of the Interior Geologic Survey. 1982. “Guidelines for Determining Flood Flow Frequency – Bulletin #17B.”

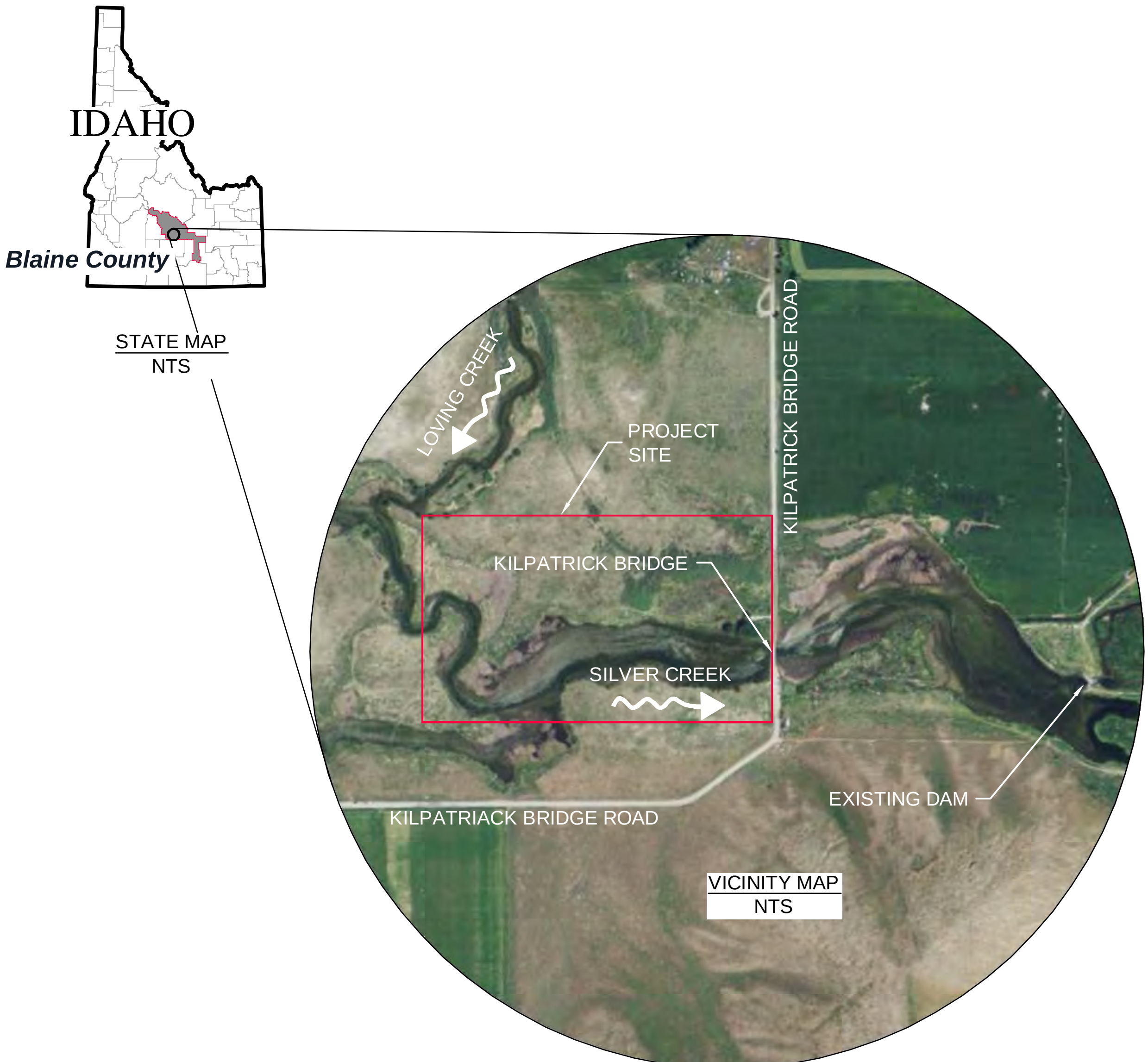
University of Idaho Center for Ecohydraulics Research. 2012. “Study of Sedimentation Processes in Silver Creek.”

FIGURES

GeoEngineers

SILVER CREEK

KILPATRICK POND RESTORATION



CONTACT INFORMATION

GEOENGINEERS INC.
JEFF FEALKO, PE
1525 SOUTH DAVID LANE
BOISE, IDAHO 83705
PH: 208.258.8321
FAX: 208.433.8092

THE NATURE CONSERVANCY
DAYNA GROSS OR ART TALSMA
116 1ST AVE NORTH
HAILEY, IDAHO 83333
PH: 208-350-2204

The Nature Conservancy
Protecting nature. Preserving life.

Reference: Base drawing provided by ???, dated Month date, Year.

Revision No:	Date:	Description:	Initials:	
				Designed: JJF
				Drawn: MGF
				Checked: MKH
				Date: 07/25/2012
				Project No: 11130-011-01

GEOENGINEERS
1525 South David Lane
Boise, Idaho 83705

Site Location Map

Kilpatrick Pond Enhancement

Figure 1

MKH : MGF

\\BOI\Projects\11\1113001101\CAD\DWG\1113001101-Site Location Map.dwg\TAB:Figure 1 modified on Jul 23, 2012 - 9:26am

APPENDICES

GeoEngineers

APPENDIX A

Geotechnical Exploration, Testing and Recommendations

APPENDIX A
CONSTRUCTION RECOMMENDATIONS

Site Preparation and Earthwork

Initial Preparation

Initial site preparation and earthwork activities should include clearing and grubbing surficial vegetation at the site and stripping topsoil. We recommend that proposed areas for dredge settling pond(s) and or wetlands, and areas to receive fill, excluding the existing channel and Kilpatrick pond, be cleared of surface vegetation and topsoil. Based on our observations, we estimate that stripping depths to remove topsoil will be about 3 inches in the upland areas. Materials which are stripped should be stockpiled for use as topsoil on site.

Silver Creek Channel Dredging & Site Dewatering

We propose to use a hydraulic dredge to remove much of the material from Kilpatrick Pond to create a deeper and narrower channel. The dredge spoils will be used to partially fill the northern portion of the existing "mud flats" in Kilpatrick Pond, with the excess water pumped to long-term settling ponds to allow the finer grained soils to settle out before the dredge water is returned to the creek. The results of the dredging will be to deepen and narrow the creek channel to enhance instream habitat in Silver Creek. Soil excavated from the settling pond excavations will be placed on top of the dredged material placed in the pond area.

We recommend that the earthwork operations for final filling and grading of the pond area not begin until after completion of the dredging operations, and after the dredge spoils placed as fill in the pond area have been allowed to drain. We anticipate that the dredge spoils may take several weeks to drain sufficiently to allow fill placement. After dredging is complete, we recommend that the water level in Silver Creek be reduced to its lowest possible level during earthwork operations and final placement of the fill in the pond area.

Excavations, Subgrade Preparation, and Grading,

During excavation of the settling pond(s), the on-site silt and sand, observed in about the upper 2.5 feet to 3.0 feet in our test pits, should be separated from the caliche and granular soil observed at greater depths and stockpiled accordingly.

The moisture content of the native silty soil will likely be difficult to control and as a result may lead to difficult earthwork operations. This will be more likely during periods of inclement weather. In general, soil that is too wet will tend to pump or yield under equipment load. This condition is unacceptable for support of heavy earthwork equipment and proper fill placement.

Earthwork during wet weather should be avoided, if possible. During warmer and/or drier periods excess soil moisture can be reduced using mechanical means such as disking or windrowing. Earthwork operations during inclement weather will likely be difficult with respect to equipment mobility and control of soil moisture content during fill placement. Earthwork activities during inclement weather may cause subgrade disturbance or failure such as rutting or pumping.

Continued earthwork operations during inclement weather may result in greater subgrade disturbance if the moisture content of the site soil exceeds the optimum moisture content.

Current site grades near the proposed enhancement area are relatively flat. We anticipate excavation depths for the proposed settlement pond(s) to be fairly consistent and on the order of five feet or less. In order to provide fairly uniform fill placement conditions, we recommend the following site preparation activities be completed:

In areas to receive fill, excluding the existing stream channel and Kilpatrick Pond area, the ground surface should be stripped as described above.

Following stripping, the exposed subgrade soil should be assessed before placing fill to establish final grade.

Assessing the subgrade soil will consist of performing field tests, observing soil moisture conditions, and probing the subsurface to determine the relative density. Any soft, loose, or wet soil encountered during the subgrade assessment is likely to result in more difficult earthwork conditions. Ideally, the subgrade soil should be in a relatively firm condition prior to placement of fill.

In our opinion, site soil in the upland areas can be excavated using conventional excavation equipment such as backhoes, excavators or dozers. However, earthwork in the area of Kilpatrick Pond will require low ground pressure equipment. The silty sand and sandy silt soils observed at the site are highly moisture sensitive, as described above. For this reason, we recommend using equipment with a ground pressure of 4 pounds per square inch (psi) or less (or equivalent) to complete the earthwork operations in the pond area. This is the typical ground pressure for a Cat® 247B Series 3 Multi Terrain Loader or a Cat® D3K2-LGP Dozer with 30 inch shoes (www.cat.com/products).

Temporary Slopes

Temporary cut slopes might be necessary during grading and pond excavation operations. Temporary slopes must conform to the provisions of current Occupational Safety and Health Act (OSHA) requirements. The contractor is responsible for monitoring slope stability and providing worker safety in accordance with local and state regulations.

Fill

General

Soil used as fill in Kilpatrick Pond and to create the proposed wetlands is classified as fill for the purposes of this report. The soil at the site can be generally identified as two types; 1) silt and sand soil and 2) granular soil. Fill material requirements vary depending on use as described below.

Use of On-Site Soil

The on-site silt and sand observed in our test pits is highly moisture sensitive and will be difficult to work or place if moisture conditions are not near optimum. The optimum moisture content is to be determined in accordance with ASTM International (ASTM) D1557 laboratory test procedure. Placement of the silt and sand as fill will be more efficient if the moisture content is within 5 percentage points of optimum moisture content during placement. In general, the greater the soil moisture content of the silt and sand in relation to the optimum moisture content, the greater the difficulty in placing the material as fill. The on-site granular soils (including the caliche layer) may also be reused as fill. The on-site soils can be used to fill in unacceptable areas observed during the subgrade assessment.

Fill Placement

Fill placement in the Kilpatrick Pond area should be accomplished with low ground pressure, tracked earthwork equipment as described in the *Excavations, Subgrade Preparation and Grading* section of this report. This will reduce the potential for subgrade disturbance during placement and improve equipment mobility if the fill materials are wetter than optimum, as is anticipated.

Fill should be place in loose lifts, working from the perimeter of the existing pond area toward the new stream bank limits. Fill should be placed in a loose lift ranging from 1 foot to 1 ½ feet thick. A minimum of 1 foot of fill material should be maintained beneath the earthwork equipment as the fill material is placed. This minimum fill thickness will help “bridge” any soft subgrade areas and help maintain a more stable working surface for the equipment. The fill material is to be track-compacted in place by several passes of the equipment. The contractor should exercise caution and not over compact the fill to reduce the potential for subgrade failure during placement.

We recommend that a representative of GeoEngineers be on site during earthwork operations to observe site preparation and fill placement. Conditions of the fill should be evaluated visually and by probing as these materials are prepared to determine compliance with the recommendations in this report.

Topsoil Considerations

Based on the laboratory test results, it appears the soil at the Silver Creek site is considered to have high levels of Boron. Four samples tested indicated that the Boron levels range from 3.0 to 4.5 parts per million (ppm). Additional topsoil tests were conducted and the results are presented in Appendix A.

Appendix B
Site Photograph Log

Photo 1 - General view of Kilpatrick Pond from the north shore facing west-southwest.

Photo 2 - General view of Kilpatrick Pond from the north shore facing east-southeast.

Site Photographs

Kilpatrick Pond Enhancement
Blaine County, Idaho

GeoEngineers

Figure B-1

Photo 3 - General view of Kilpatrick Pond from the north shore facing east-southeast.

Photo 4 - General view of Kilpatrick Pond from the west.

Site Photographs

Kilpatrick Pond Enhancement
Blaine County, Idaho

GeoEngineers

Figure B-2

Photo 5 - View of the north and eastern portions of Kilpatrick Pond.

Photo 6 - General view of Kilpatrick Pond from the south shore facing northwest.

Site Photographs	
Kilpatrick Pond Enhancement Blaine County, Idaho	
GeoEngineers	Figure B-3

Photo 7 - General view of the north shore of Kilpatrick Pond from a boat in the central portion of the pond/channel.

Photo 8 - General view of the eastern portion of Kilpatrick Pond from a boat in the central portion of the pond/channel West of Kilpatrick Bridge.

Site Photographs

Kilpatrick Pond Enhancement
Blaine County, Idaho

GeoEngineers

Figure B-4

Photo 9 - General view of the south shore of Kilpatrick Pond from a boat in the central portion of the pond/channel west of Kilpatrick Bridge.

Photo 10 – General view of Kilpartick Pond from Kilpartick Bridge facing west.

Site Photographs

Kilpatrick Pond Enhancement
Blaine County, Idaho

GeoEngineers

Figure B-5

Photo 11 – General view of Kilpatrick Pond downstream of Kilpatrick Bridge facing east.

Photo 12 – Second general view of Kilpatrick Pond downstream of Kilpatrick Bridge facing east.

Site Photographs

Kilpatrick Pond Enhancement
Blaine County, Idaho

GeoEngineers | **Figure B-6**

APPENDIX C
Hydrologic Analysis

USGS Stream Gage Analysis

Project:	TNC - Kilpatrick Pond	**Site:**	Kilpatrick Pond
Project Number:	11130-011-01	**Analyst:**	Jeff Fealko
Watercourse:	Silver Creek	**Latest Revision:**	3/8/2012

Workbook Description

- This workbook is:
- proprietary to GeoEngineers, Inc.,
- contains spreadsheets that facilitate the analysis and/or design of this project,
- lists the general project and workbook information that is consistent throughout the workbook,
- lists the titles of the spreadsheets contained in this workbook, and
- is intended for use with ENGLISH UNITS.

Filename: *C:\Documents and Settings\rcarnie\My Documents\SharePoint Drafts\[USGS Gage Analysis-Silver Creek.xlsx]Monthly*

Sheet Titles:

USGS Stream Gage Analysis
Gage and Site Information
Daily Historic Record
Daily Statistics
Monthly Statistics
Peak Flows
Log-Pearson Type III Distribution

Gage and Site Information

Project:	TNC - Kilpatrick Pond	**Site:**	Kilpatrick Pond
Project Number:	11130-011-01	**Analyst:**	Jeff Fealko
Watercourse:	Silver Creek	**Latest Revision:**	3/8/2012

Spreadsheet Description

- This spreadsheet contains basic information about the USGS stream gage and the downstream limits of the project site.

Gage Information

Gage Number:	13150430
Latitude:	43°19'20"N
Longitude:	114°06'24"W
Location:	Silver Creek at Sportsman Access Near Picabo, Idaho
Hydrologic Unit:	17040221
Drainage Area (mi^2):	70 (USGS), 41.7 (StreamStats)
Period of Record:	10/01/1974 to 03/07/2012

Project Site Information

Latitude:	43°18'52"N
Longitude:	114°07'47"W
Location:	Nick Purdy's Outlet Structure of Kilpatrick Pond
Hydrologic Unit:	17040221
Drainage Area (mi^2):	65.3 (USGS Estimation), 37.0 (StreamStats)

Daily Historic Record

Project: TNC - Kilpatrick Pond
Project Number: 11130-011-01
Watercourse: Silver Creek

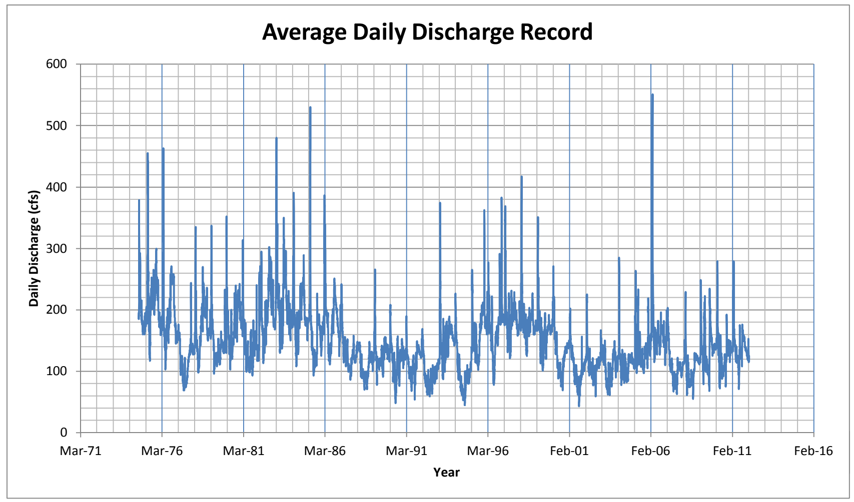
Site: Kilpatrick Pond
Analyst: Jeff Fealko
Latest Revision: 3/8/2012

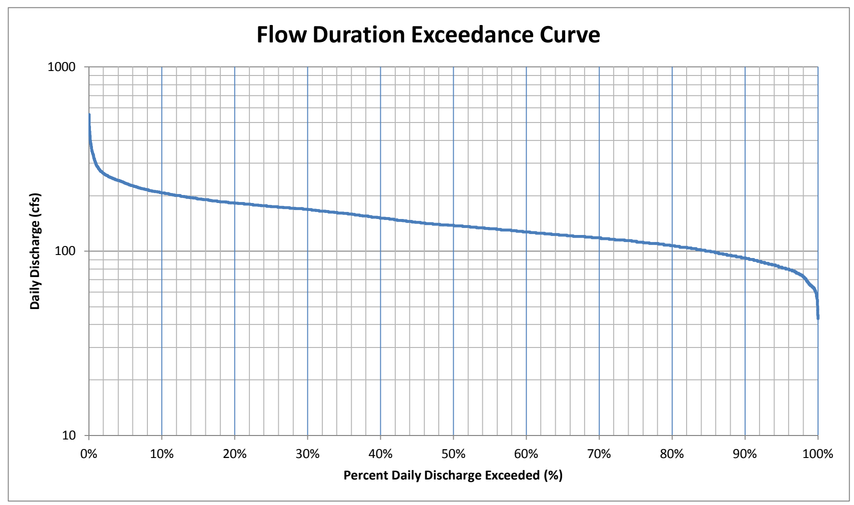
Spreadsheet Description

- This spreadsheet contains the average daily discharge for the historic period of record.
- This spreadsheet ranks the discharges and estimates the percent exceeded for each flow to develop a flow duration exceedance curve.
- This spreadsheet contains a graph of the average daily discharge record and a graph of the flow duration

Period of Record 13673 days

Date	Discharge (cfs)	Rank	Date	Discharge (cfs)	Percent Exceeded
10/1/1974	195	1	4/6/2006	551	0.01%
10/2/1974	192	2	4/10/1985	530	0.01%
10/3/1974	185	3	4/9/1985	526	0.02%
10/4/1974	192	4	3/14/1983	480	0.03%
10/5/1974	197	5	4/5/2006	473	0.04%
10/6/1974	218	6	4/8/1985	463	0.04%
10/7/1974	224	7	4/6/1976	460	0.05%
10/8/1974	221	8	4/7/1985	459	0.06%
10/9/1974	229	9	4/21/1975	455	0.07%
10/10/1974	375	10	4/7/2006	450	0.07%
10/11/1974	335	11	4/26/1975	442	0.08%
10/12/1974	304	12	4/11/1985	440	0.09%
10/13/1974	288	13	4/27/1975	438	0.10%
10/14/1974	278	14	4/5/1976	431	0.10%
10/15/1974	268	15	4/20/1975	425	0.11%
10/16/1974	265	16	3/15/1983	423	0.12%
10/17/1974	262	17	4/6/1985	423	0.12%
10/18/1974	259	18	3/25/1998	417	0.13%
10/19/1974	256	19	3/4/1983	416	0.14%
10/20/1974	259	20	4/22/1975	400	0.15%
10/21/1974	256	21	4/25/1975	400	0.15%
10/22/1974	253	22	4/28/1975	400	0.16%
10/23/1974	256	23	3/12/1983	394	0.17%
10/24/1974	265	24	4/23/1975	390	0.18%
10/25/1974	259	25	3/5/1983	390	0.18%
10/26/1974	250	26	4/6/1984	390	0.19%
10/27/1974	244	27	3/11/1983	387	0.20%
10/28/1974	244	28	3/13/1983	387	0.20%
10/29/1974	268	29	4/24/1975	385	0.21%
10/30/1974	265	30	2/19/1986	385	0.22%
10/31/1974	262	31	4/8/2006	384	0.23%
11/1/1974	281	32	1/3/1997	383	0.23%
11/2/1974	291	33	4/19/1975	381	0.24%
11/3/1974	253	34	3/26/1998	381	0.25%
11/4/1974	241	35	10/10/1974	375	0.26%
11/5/1974	229	36	3/27/1993	373	0.26%
11/6/1974	226	37	2/25/1986	371	0.27%
11/7/1974	224	38	4/7/1984	370	0.28%
11/8/1974	221	39	2/20/1986	369	0.29%
11/9/1974	218	40	3/24/1997	369	0.29%
11/10/1974	215	41	3/16/1983	367	0.30%
11/11/1974	205	42	3/27/1997	367	0.31%
11/12/1974	207	43	3/6/1983	363	0.31%
11/13/1974	207	44	4/4/2006	363	0.32%
11/14/1974	207	45	3/28/1993	362	0.33%
11/15/1974	205	46	12/13/1995	360	0.34%
11/16/1974	205	47	3/24/1998	357	0.34%
11/17/1974	202	48	3/25/1997	355	0.35%





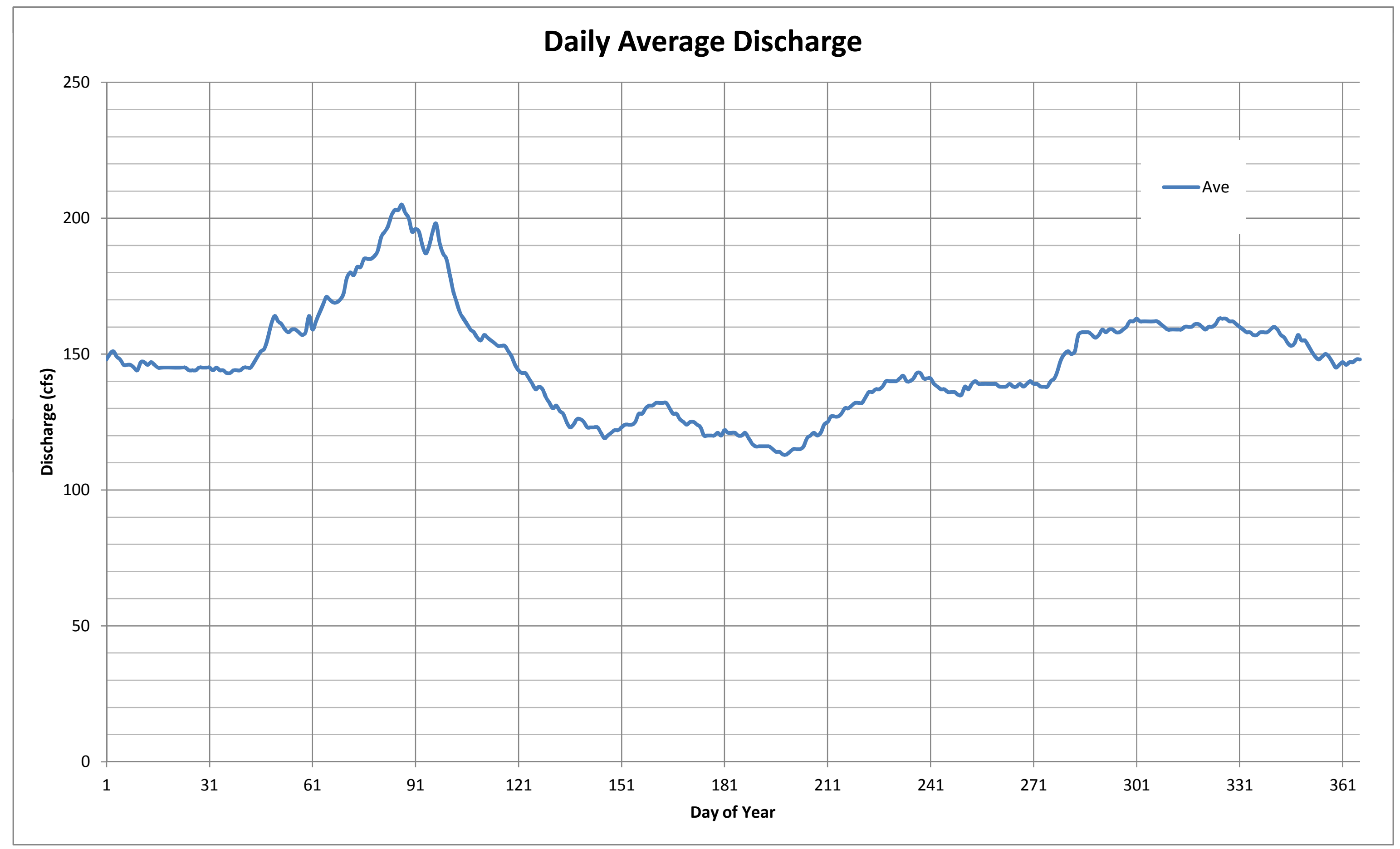
Daily Statistics

Project: TNC - Kilpatrick Pond **Site:** Kilpatrick Pond
Project Number: 11130-011-01 **Analyst:** Jeff Fealko
Watercourse: Silver Creek **Latest Revision:** 3/8/2012

Spreadsheet Description

- This spreadsheet contains the average daily discharge for the historic period of record.
- This spreadsheet contains a graph of the average daily discharge record along with the maximum and minimum daily average discharges.

Day of Year	Month	Day	Start Year	End Year	Years of Record	Max Year	Max Discharge (cfs)	Min Year	Min Discharge (cfs)	Mean Discharge (cfs)
1	1	1	1975	2011	36	1997	257	1995	85	148
2	1	2	1975	2011	36	1997	346	1995	80	150
3	1	3	1975	2011	36	1997	383	1995	80	151
4	1	4	1975	2011	36	1997	347	1995	85	149
5	1	5	1975	2011	36	1997	300	1995	90	148
6	1	6	1975	2011	36	1997	270	1993	90	146
7	1	7	1975	2011	36	1997	248	1995	85	146
8	1	8	1975	2011	36	1997	229	1995	85	146
9	1	9	1975	2011	36	1997	217	2008	93	145
10	1	10	1975	2011	36	1997	212	2008	93	144
11	1	11	1975	2011	36	1997	207	2008	94	147
12	1	12	1975	2011	36	1980	233	1993	88	147
13	1	13	1975	2011	36	1976	196	2008	92	146
14	1	14	1975	2011	36	1980	207	2008	92	147
15	1	15	1975	2011	36	1997	190	2008	92	146
16	1	16	1975	2011	36	1997	191	2008	91	145
17	1	17	1975	2011	36	1997	189	2008	90	145
18	1	18	1975	2011	36	1997	187	2008	92	145
19	1	19	1975	2011	36	1996	183	2008	95	145
20	1	20	1975	2011	36	1997	184	1995	100	145
21	1	21	1975	2011	36	1997	188	1995	90	145
22	1	22	1975	2011	36	1997	188	1995	90	145
23	1	23	1975	2011	36	1985	186	2008	93	145
24	1	24	1975	2011	36	1997	190	1995	95	145
25	1	25	1975	2011	36	1997	190	1995	99	144
26	1	26	1975	2011	36	1984	190	1995	101	144
27	1	27	1975	2011	36	1984	190	2002	100	144
28	1	28	1975	2011	36	1984	200	2002	100	145
29	1	29	1975	2011	36	1997	192	2002	100	145
30	1	30	1975	2011	36	1997	192	2002	100	145
31	1	31	1975	2011	36	1997	192	1995	103	145
32	2	1	1975	2011	36	1997	193	2004	100	144
33	2	2	1975	2011	36	1997	193	1993	105	145



Monthly Statistics

Project: TNC - Kilpatrick Pond
Project Number: 11130-011-01
Watercourse: Silver Creek

Site: Kilpatrick Pond
Analyst: Jeff Fealko
Latest Revision: 3/8/2012

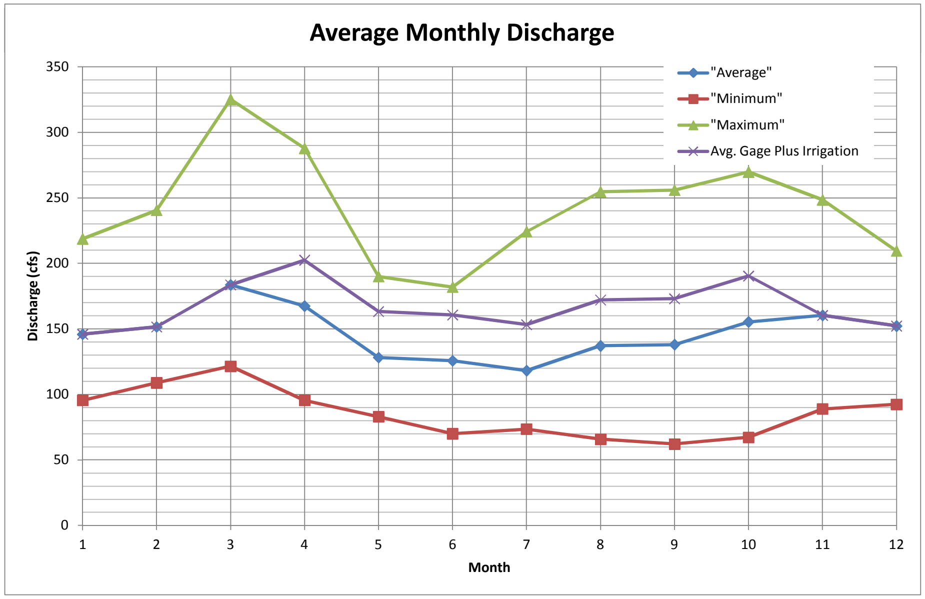
Spreadsheet Description

- This spreadsheet contains the average monthly discharge for the historic period of record.
- This spreadsheet contains a graph of the average monthly discharge record along with the maximum and minimum monthly average discharges.

Year	Month	Monthly Mean Discharge (cfs)
1974	10	252.4
1974	11	213.1
1974	12	180.8
1975	1	169.6
1975	2	173.6
1975	3	186.1
1975	4	287.8
1975	5	189.1
1975	6	163.1
1975	7	224.2
1975	8	222
1975	9	216.4
1975	10	254.1
1975	11	238.7
1975	12	207.2
1976	1	176.2
1976	2	167
1976	3	177.5
1976	4	228.9
1976	5	129.8
1976	6	163.8
1976	7	166.8
1976	8	192.9
1976	9	228
1976	10	252.8
1976	11	248.5
1976	12	188
1977	1	162.1
1977	2	153.1
1977	3	160.1
1977	4	128.7
1977	5	109.2
1977	6	91
1977	7	78.5
1977	8	78.9
1977	9	87.1
1977	10	115
1977	11	130.1
1977	12	150.1
1978	1	134.6
1978	2	133.6

Month	Discharge (cfs)
1	169.6
1	176.2
1	162.1
1	134.6
1	160.1
1	151.4
1	179.2
1	134.5
1	178.9
1	183.9
1	179.2
1	170
1	152.4
1	120.4
1	125.7
1	129.2
1	128.5
1	126.3
1	102.2
1	152.3
1	95.5
1	176.1
1	218.7
1	167.7
1	166.4
1	167.4
1	139.1
1	108.2
1	119
1	113
1	117.5
1	159.6
1	97.2
1	119.5
1	137.7
1	134.6
2	173.6
2	167
2	153.1
2	133.6
2	166.4

Month	Mean of Monthly Discharge (cfs)	Min Monthly Discharge (cfs)	Max Monthly Discharge (cfs)	Kilpatrick Pond - with 35 cfs added during irrigation	Stage Elev from steady state analysis
1	146	96	219	146	4854.9
2	152	109	241	152	4854.9
3	184	122	325	184	4855.1
4	168	96	288	203	4859.73
5	128	83	190	163	4859.73
6	126	70	182	161	4859.73
7	118	74	224	153	4859.73
8	137	66	255	172	4859.73
9	138	62	256	173	4859.73
10	155	67	270	190	4859.73
11	160	89	249	160	4855
12	152	93	210	152	4854.9



Peak Flows

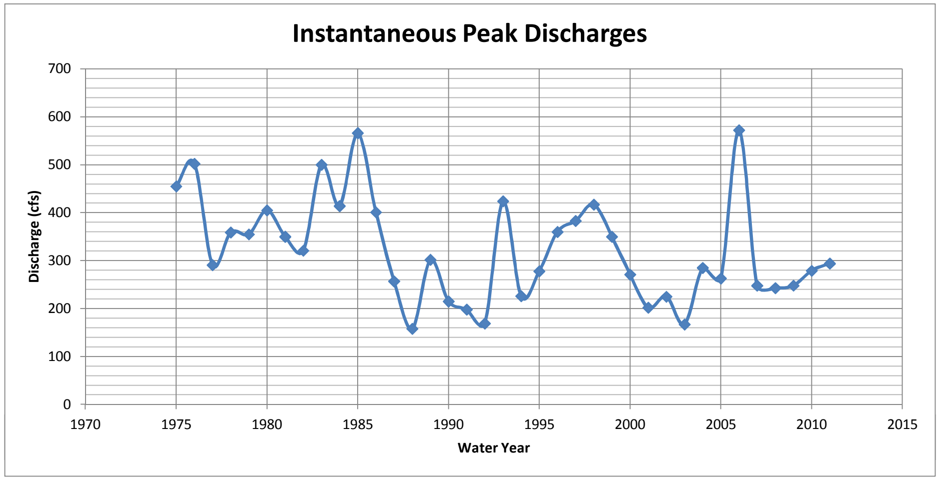
Project: TNC - Kilpatrick Pond
Project Number: 11130-011-01
Watercourse: Silver Creek

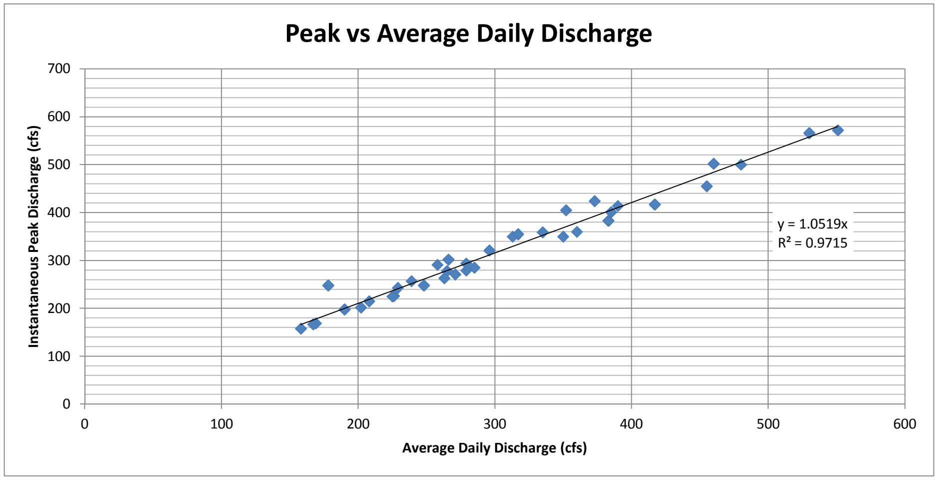
Site: Kilpatrick Pond
Analyst: Jeff Fealko
Latest Revision: 3/8/2012

Spreadsheet Description

- This spreadsheet contains the annual instantaneous peak discharges for the historic period of record.
- This spreadsheet contains a graph of the peak annual discharges along with a graph showing instantaneous peak compared to the daily average discharge.

Water Year	Date	Peak Discharge (cfs)	Average Day Discharge (cfs)
1975	4/21/1975	455	455
1976	4/6/1976	502	460
1977	10/20/1976	291	258
1978	3/29/1978	359	335
1979	3/17/1979	355	317
1980	2/19/1980	405	352
1981	2/18/1981	350	313
1982	9/26/1982	321	296
1983	3/14/1983	500	480
1984	4/6/1984	414	390
1985	4/10/1985	566	530
1986	2/19/1986	401	385
1987	3/8/1987	257	239
1988	12/3/1987	158	158
1989	3/29/1989	302	266
1990	3/6/1990	215	208
1991	3/5/1991	198	190
1992	2/21/1992	169	169
1993	3/27/1993	424	373
1994	3/5/1994	226	226
1995	3/12/1995	278	265
1996	12/13/1995	360	360
1997	1/3/1997	383	383
1998	3/25/1998	417	417
1999	3/27/1999	350	350
2000	3/7/2000	271	271
2001	3/20/2001	202	202
2002	3/30/2002	225	225
2003	2/1/2003	167	167
2004	3/20/2004	285	285
2005	3/24/2005	263	263
2006	4/6/2006	572	551
2007	2/22/2007	248	178
2008	4/14/2008	243	229
2009	3/22/2009	248	248
2010	3/31/2010	279	279
2011	4/1/2011	294	279





Log-Pearson Type III Distribution

Project: TNC - Kilpatrick Pond
Project Number: 11130-011-01
Watercourse: Silver Creek

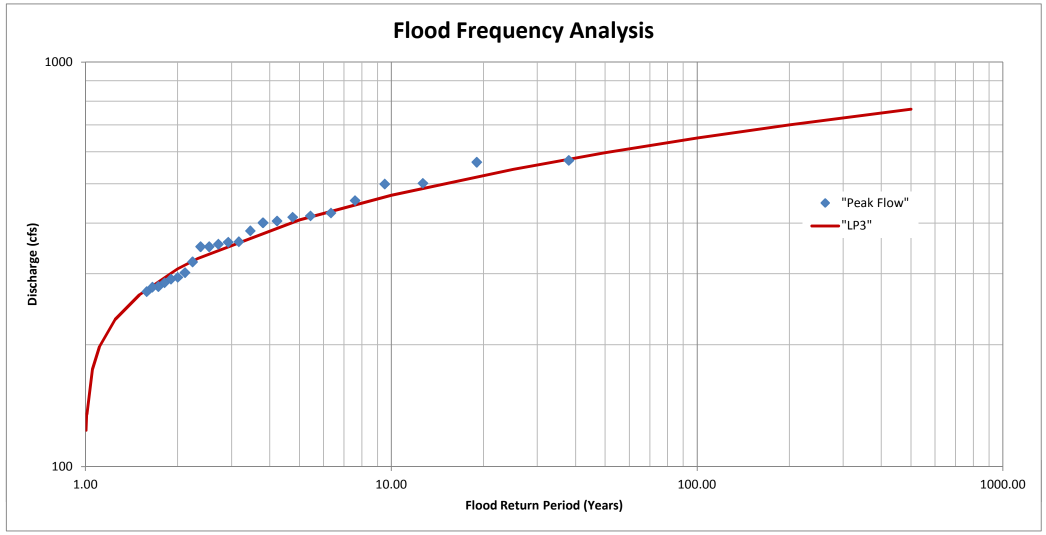
Site: Kilpatrick Pond
Analyst: Jeff Fealko
Latest Revision: 3/8/2012

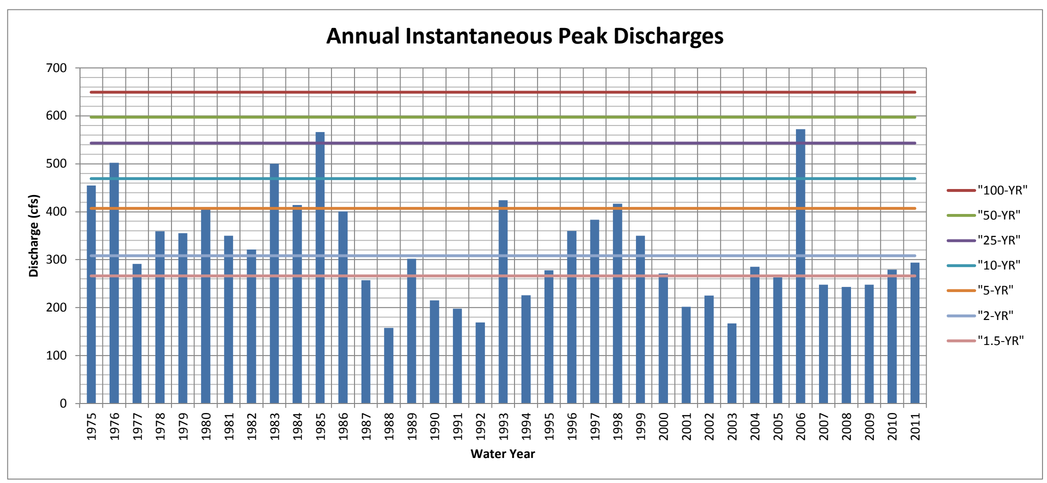
Spreadsheet Description

- This spreadsheet contains the results from a LP3 analysis conducted on the gage using the USGS WinPKFQ Program, which follows the USGS Bulleting 17B guidelines.
- This spreadsheet contains a graph of the flood frequency analysis as well as a graph showing the instantaneous peak discharges and how they relate to selected recurrence intervals.

Return Frequency (Years)	Exceedance Probability	Discharge (cfs)
1.005	0.995	123
1.010	0.99	135
1.05	0.95	174
1.11	0.9	198
1.25	0.8	231
1.5	0.66666667	266
2	0.5	308
2.33	0.4292	327
5	0.2	407
10	0.1	469
25	0.04	543
50	0.02	597
100	0.01	649
200	0.005	699
500	0.002	765

Rank	Discharge (cfs)	Weibul Position	Return Period (years)
1	572	0.026	38.00
2	566	0.053	19.00
3	502	0.079	12.67
4	500	0.105	9.50
5	455	0.132	7.60
6	424	0.158	6.33
7	417	0.184	5.43
8	414	0.211	4.75
9	405	0.237	4.22
10	401	0.263	3.80
11	383	0.289	3.45
12	360	0.316	3.17
13	359	0.342	2.92
14	355	0.368	2.71
15	350	0.395	2.53
16	350	0.421	2.38
17	321	0.447	2.24
18	302	0.474	2.11
19	294	0.500	2.00
20	291	0.526	1.90
21	285	0.553	1.81
22	279	0.579	1.73
23	278	0.605	1.65
24	271	0.632	1.58
25	263	0.658	1.52
26	257	0.684	1.46
27	248	0.711	1.41
28	248	0.737	1.36
29	243	0.763	1.31
30	226	0.789	1.27
31	225	0.816	1.23
32	215	0.842	1.19
33	202	0.868	1.15
34	198	0.895	1.12
35	169	0.921	1.09
36	167	0.947	1.06
37	158	0.974	1.03

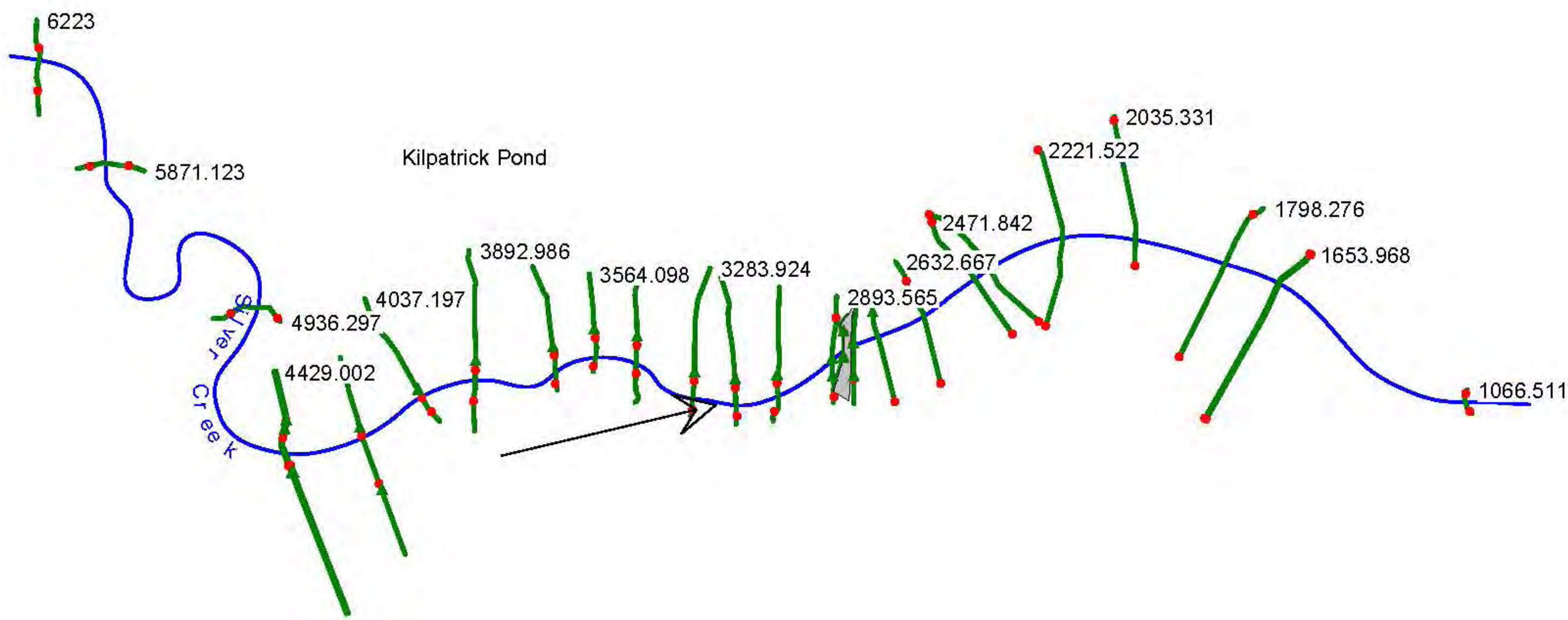




For Plotting Only

100	1	649
	37	649
50	1	597
	37	597
25	1	543
	37	543
10	1	469
	37	469
5	1	407
	37	407
2	1	308
	37	308
1.5	1	266
	37	266

APPENDIX D
Hydraulic Analysis



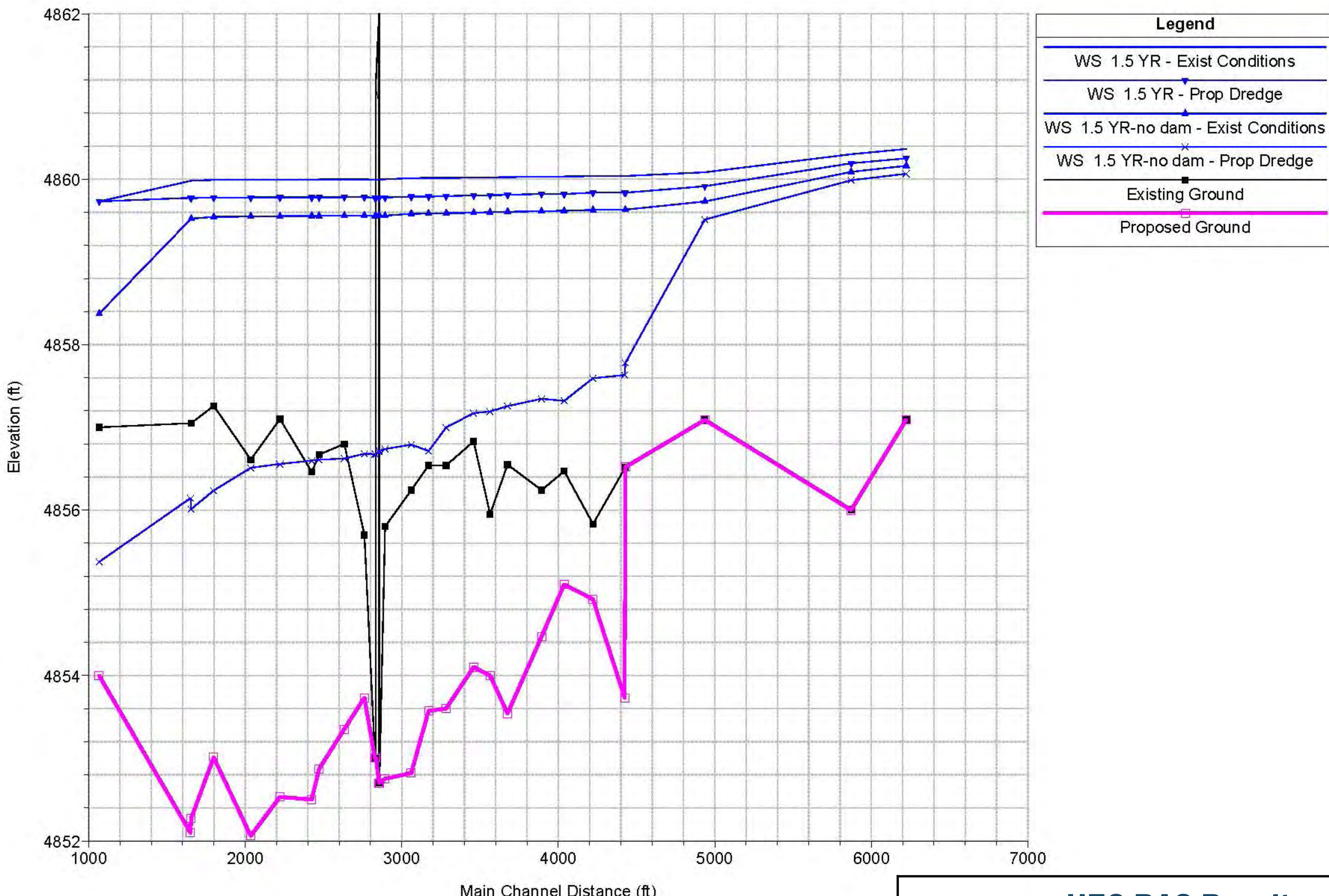
HEC-RAS Results
Plan View

Silver Creek Kilpatrick Pond Design
Blaine County, Idaho

GeoEngineers | **Figure D-1**

Reference: Model output obtained from HEC-RAS v41.0

https://projects.geoengineers.com/sites/1113001101/Final/Forms/AllItems.aspx



HEC-RAS Results
Profile View

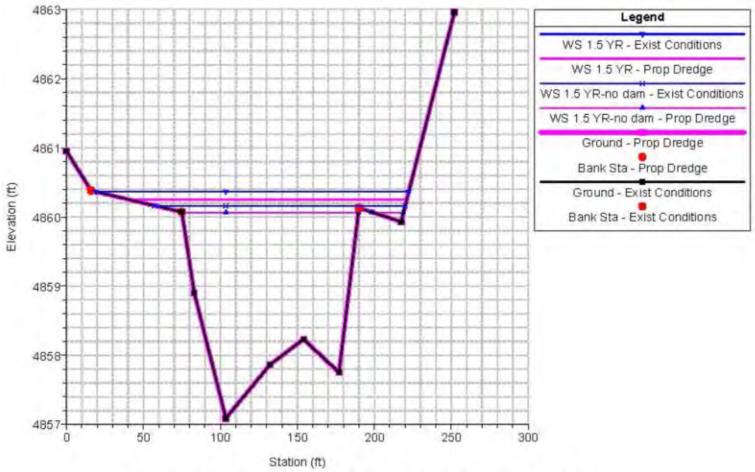
Silver Creek Kilpatrick Pond Design
Blaine County, Idaho

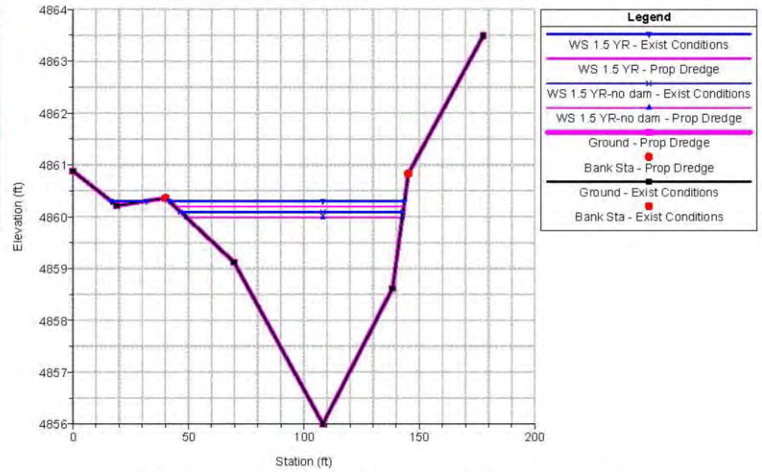
GeoEngineers

Figure D-2

Reference: Model output obtained from HEC-RAS v41.0

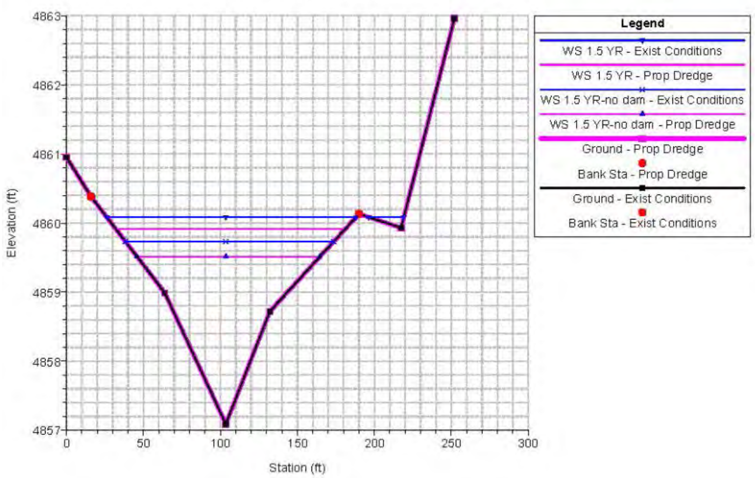
https://projects.geoengineers.com/sites/1113001101/Final/Forms/AllItems.aspx

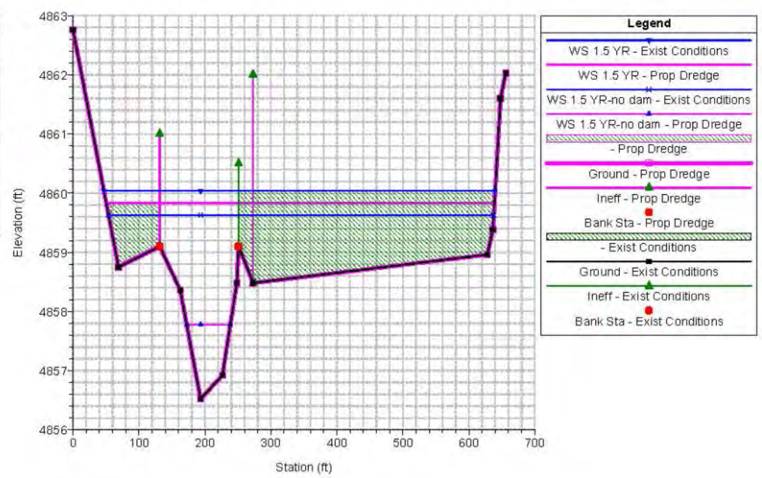




Silver Creek K Pond Plan: 1) Exist Conditions 2) Prop Dredge
Geom: Existing Conditions
RS = 4936.297 Section B-B from Alpine Engineering

Silver Creek K Pond Plan: 1) Exist Conditions 2) Prop Dredge
Geom: Existing Conditions
RS = 4429.002 Section A-A from Alpine Engineering. Stations 628 - 656 approxi





Reference: Model output obtained from HEC-RAS v41.0

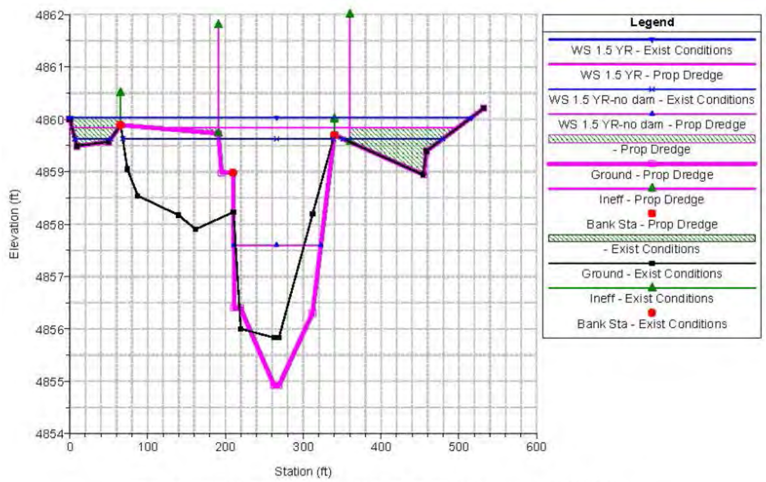
HEC-RAS Results Cross Sections

Silver Creek Kilpatrick Pond Design
Blaine County, Idaho

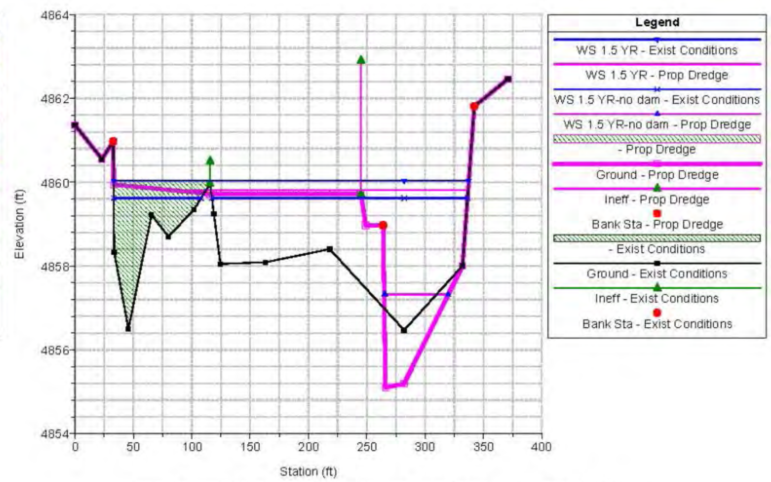
GeoEngineers

Figure D-3

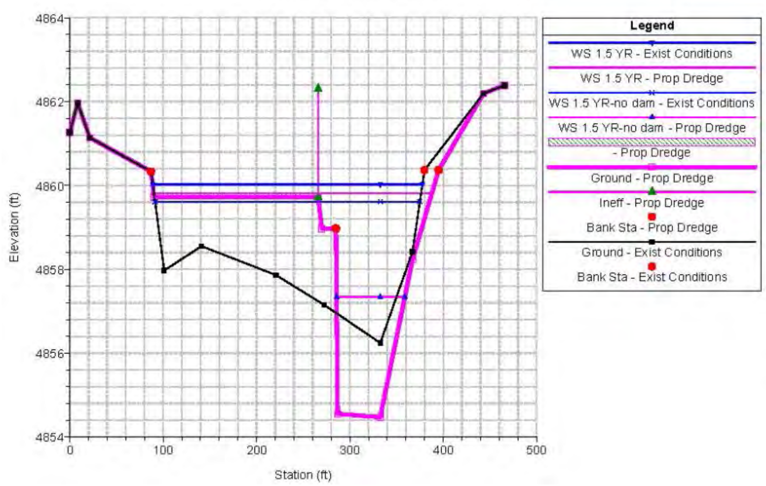
https://projects.geoengineers.com/sites/1113001101/Final/Forms/AllItems.aspx

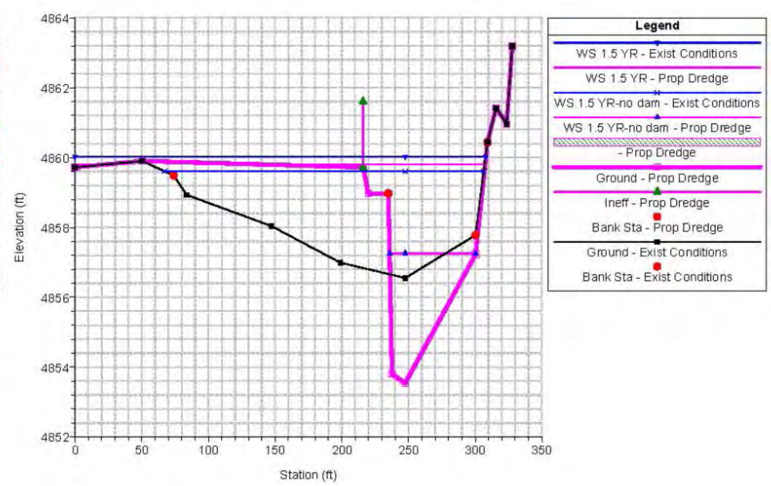


Silver Creek K Pond Plan: 1) Exist Conditions 2) Prop Dredge
Geom: Existing Conditions
RS = 3892.986 Section D from Alpine Engineering



Silver Creek K Pond Plan: 1) Exist Conditions 2) Prop Dredge
Geom: Existing Conditions
RS = 3675.366 Section E from Alpine Engineering





Reference: Model output obtained from HEC-RAS v41.0

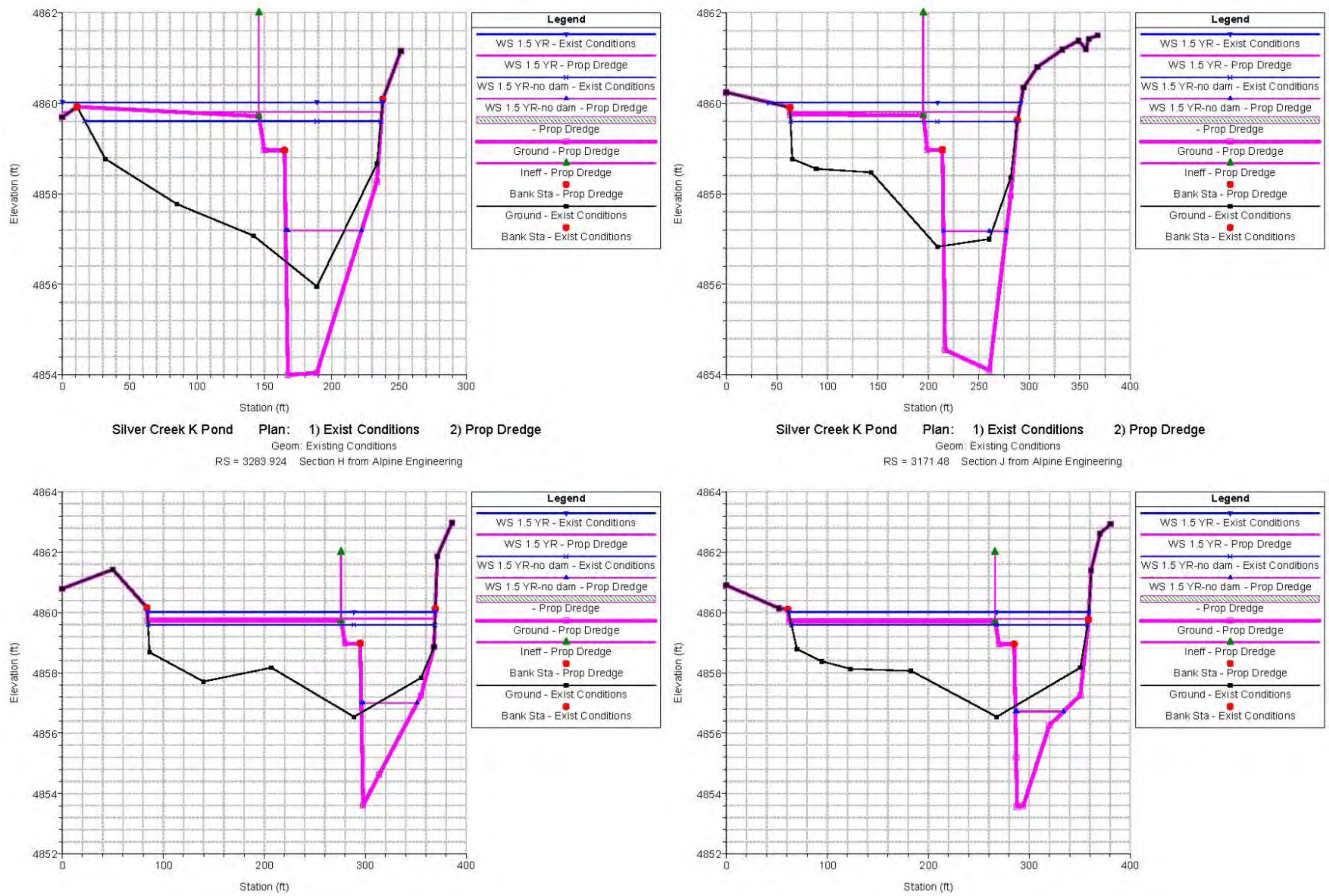
HEC-RAS Results
Cross Sections

Silver Creek Kilpatrick Pond Design
Blaine County, Idaho

GeoEngineers

Figure D-4

https://projects.geoengineers.com/sites/1113001101/Final/Forms/AllItems.aspx



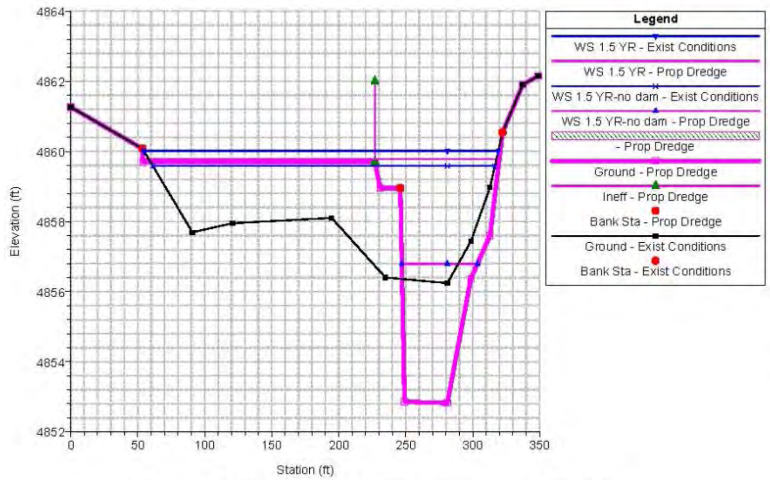
Reference: Model output obtained from HEC-RAS v41.0

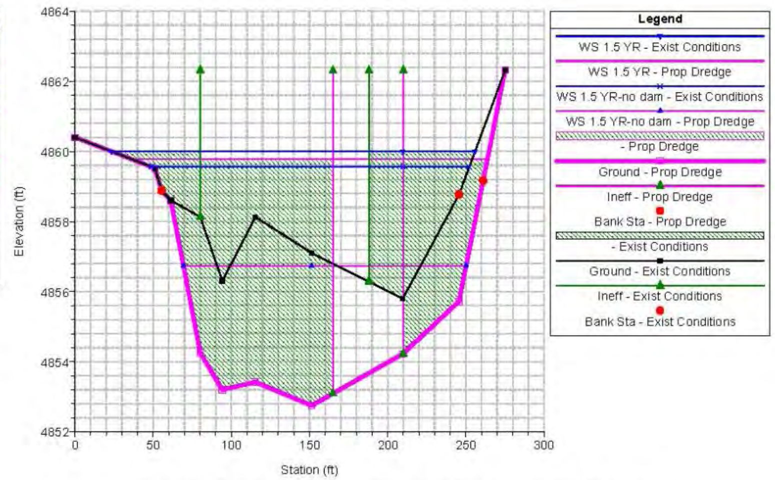
HEC-RAS Results
Cross Sections

Silver Creek Kilpatrick Pond Design
Blaine County, Idaho

GeoEngineers

Figure D-5





Silver Creek K Pond Plan: 1) Exist Conditions 2) Prop Dredge

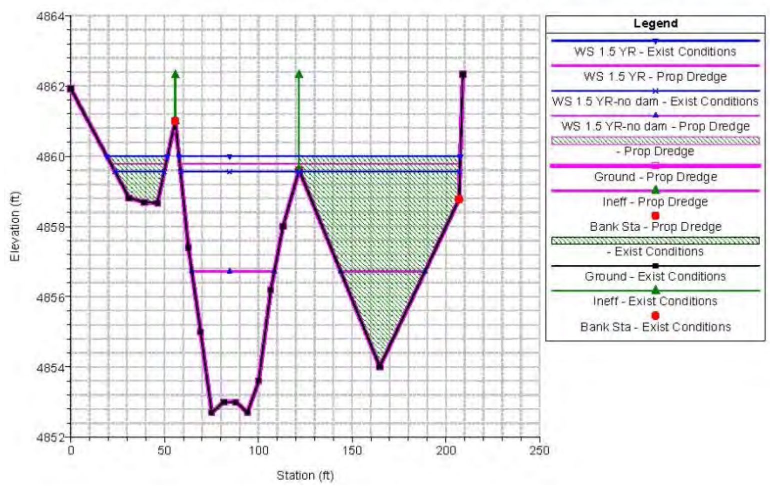
Geom: Existing Conditions

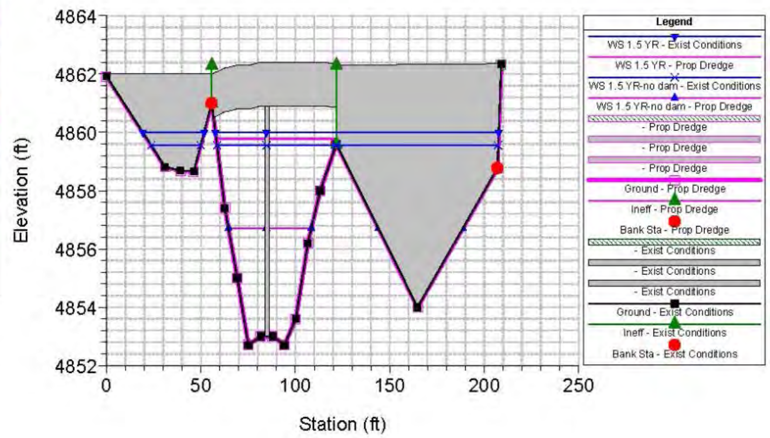
RS = 2856.361 Based on field measurements from bridge deck by Alpine Engineeri

Silver Creek K Pond Plan: 1) Exist Conditions 2) Prop Dredge

Geom: Existing Conditions

RS = 2845 BR Existing Kilpatrick Pond Bridge. Deck based on Alpine Engineeri





HEC-RAS Results
Cross Sections

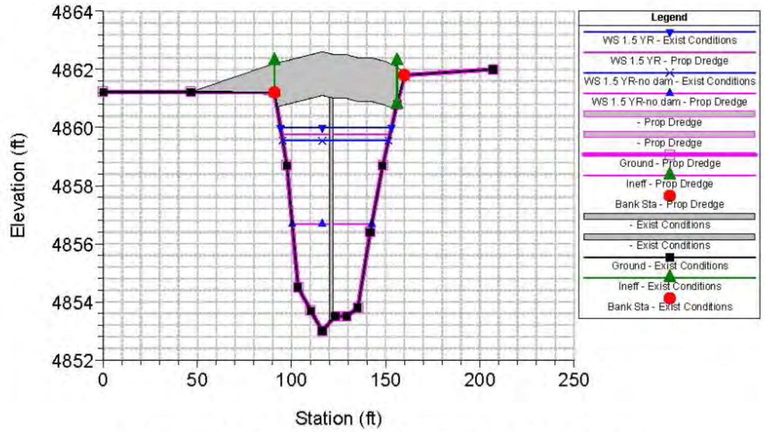
Silver Creek Kilpatrick Pond Design
Blaine County, Idaho

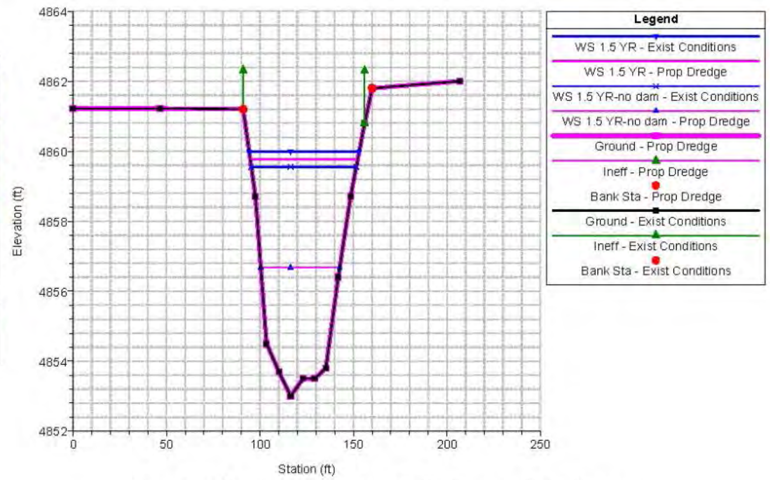
GEOENGINEERS

Figure D-6

Reference: Model output obtained from HEC-RAS v41.0

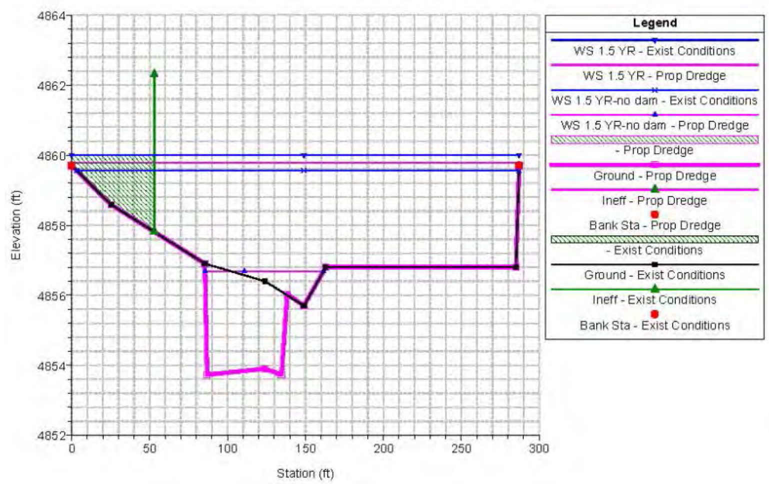
https://projects.geoengineers.com/sites/1113001101/Final/Forms/AllItems.aspx

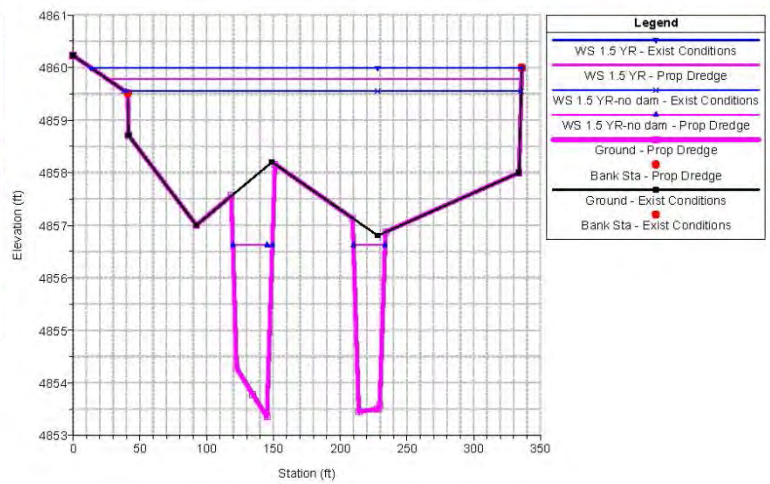




Silver Creek K Pond Plan: 1) Exist Conditions 2) Prop Dredge
Geom: Existing Conditions
RS = 2761.115 Section M from Alpine Engineering

Silver Creek K Pond Plan: 1) Exist Conditions 2) Prop Dredge
Geom: Existing Conditions
RS = 2632.667 Section O from Alpine Engineering. Right bank built from aerial

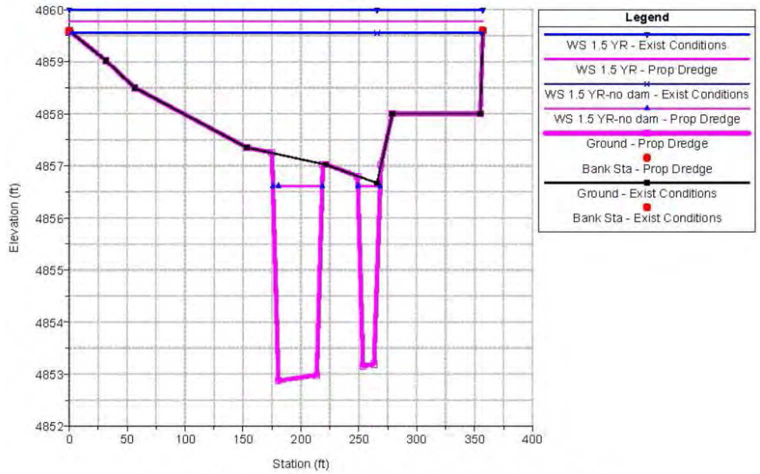


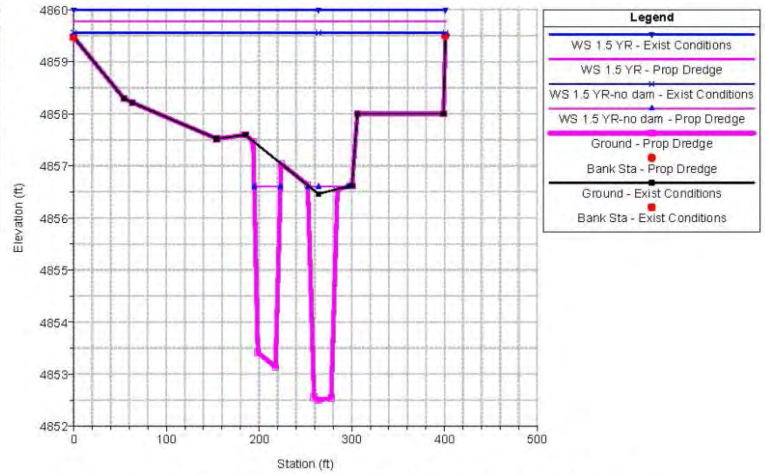


Reference: Model output obtained from HEC-RAS v41.0

HEC-RAS Results **Cross Sections**	
Silver Creek Kilpatrick Pond Design Blaine County, Idaho	
GeoEngineers	**Figure D-7**

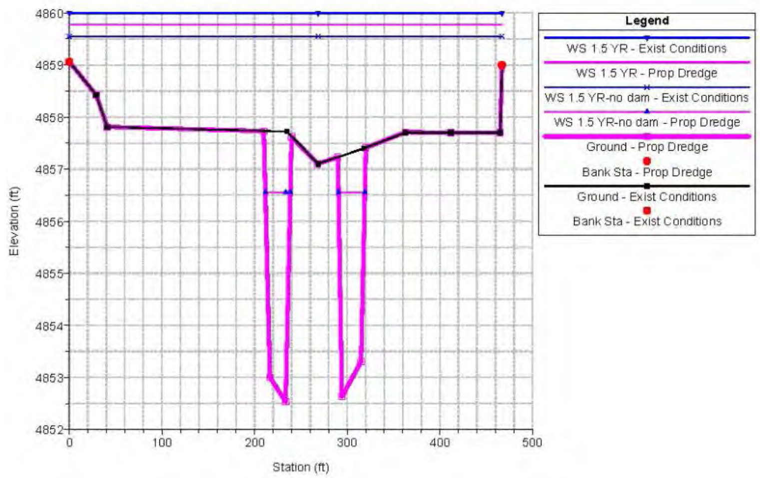
https://projects.geoengineers.com/sites/1113001101/Final/Forms/AllItems.aspx

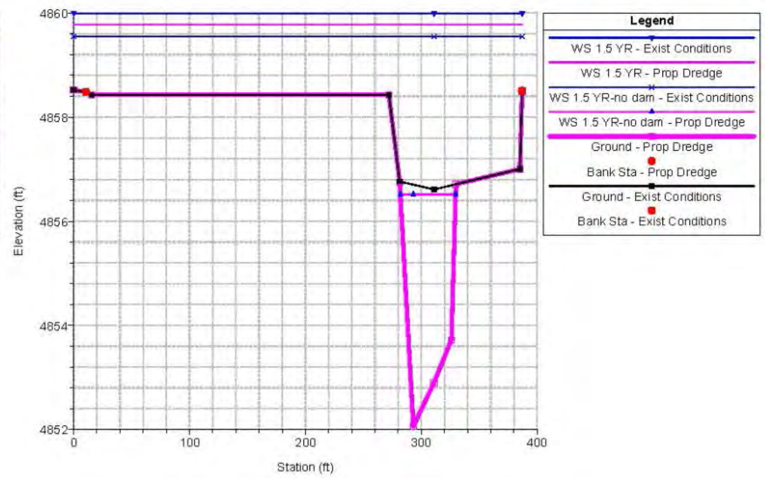




Silver Creek K Pond Plan: 1) Exist Conditions 2) Prop Dredge
Geom: Existing Conditions
RS = 2221.522 Section R from Alpine Engineering. Right bank built from aerial

Silver Creek K Pond Plan: 1) Exist Conditions 2) Prop Dredge
Geom: Existing Conditions
RS = 2035.331 Section S from Alpine Engineering. Banks built from aerial phot





HEC-RAS Results
Cross Sections

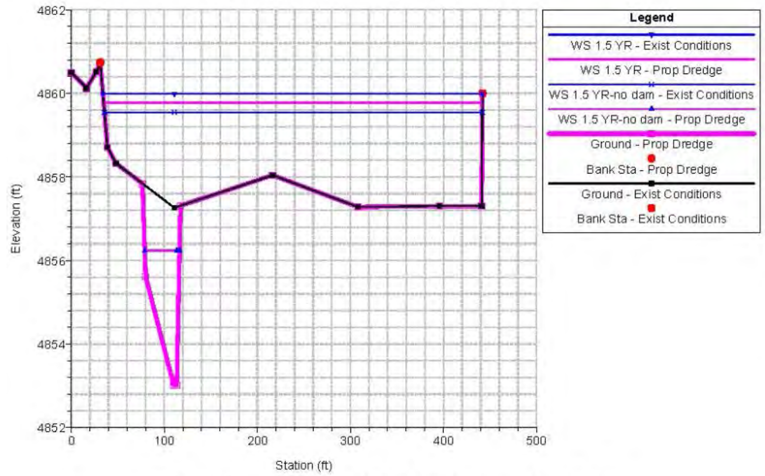
Silver Creek Kilpatrick Pond Design
Blaine County, Idaho

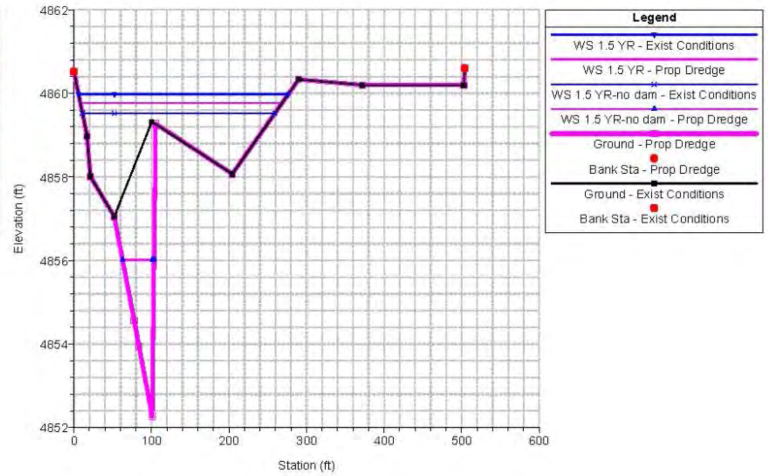
GeoEngineers

Figure D-8

Reference: Model output obtained from HEC-RAS v41.0

https://projects.geoengineers.com/sites/1113001101/Final/Forms/AllItems.aspx

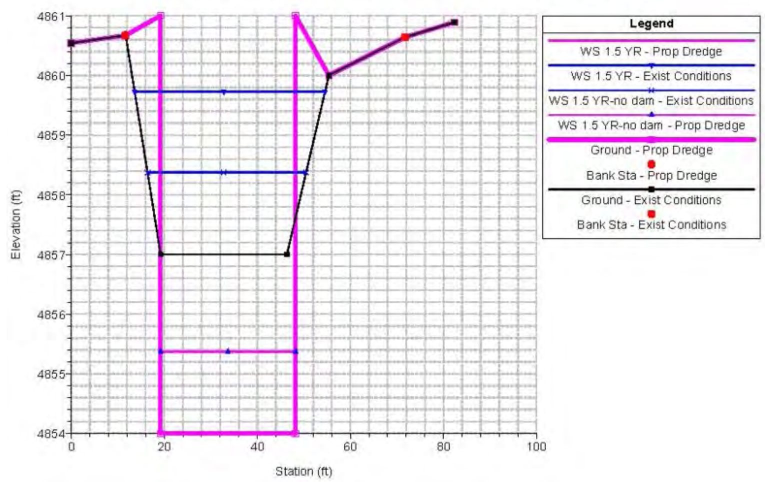




Silver Creek K Pond Plan: 1) Exist Conditions 2) Prop Dredge

Geom: Existing Conditions

RS = 1066.511 Cross section upstream of the existing diversion dam. Approximat



HEC-RAS Results
Cross Sections

Silver Creek Kilpatrick Pond Design
Blaine County, Idaho

GEOENGINEERS

Figure D-9

Reference: Model output obtained from HEC-RAS v41.0

Reach	River Sta	Profile	Q Total	Min Ch El	W.S. Elev	Crit W.S.	E.G. Elev	E.G. Slope	Vel Chnl	Flow Area	Top Width	Froude # Chl
			(cfs)	(ft)	(ft)	(ft)	(ft)	(ft/ft)	(ft/s)	(sq ft)	(ft)	
Kilpatrick Pond	6223	95 % Exc	117.00	4857.09	4859.89		4859.89	0.000040	0.56	207.55	112.39	0.07
Kilpatrick Pond	6223	5 % Exc	268.00	4857.09	4860.35		4860.36	0.000150	0.99	277.10	199.90	0.14
Kilpatrick Pond	6223	1.5 YR	266.00	4857.09	4860.36		4860.38	0.000146	0.97	280.54	203.35	0.14
Kilpatrick Pond	6223	95 % Exc-no dam	117.00	4857.09	4859.31		4859.32	0.000121	0.81	145.04	105.34	0.12
Kilpatrick Pond	6223	5 % Exc-no dam	268.00	4857.09	4860.14		4860.16	0.000160	1.13	240.42	158.63	0.15
Kilpatrick Pond	6223	1.5 YR-no dam	266.00	4857.09	4860.16		4860.18	0.000158	1.11	243.48	162.47	0.15
Kilpatrick Pond	5871.123	95 % Exc	117.00	4856.00	4859.87		4859.88	0.000053	0.67	175.25	90.39	0.08
Kilpatrick Pond	5871.123	5 % Exc	268.00	4856.00	4860.28		4860.31	0.000163	1.25	215.34	113.65	0.15
Kilpatrick Pond	5871.123	1.5 YR	266.00	4856.00	4860.30		4860.33	0.000157	1.23	217.48	117.49	0.15
Kilpatrick Pond	5871.123	95 % Exc-no dam	117.00	4856.00	4859.27		4859.28	0.000122	0.93	125.67	74.17	0.13
Kilpatrick Pond	5871.123	5 % Exc-no dam	268.00	4856.00	4860.07		4860.10	0.000214	1.38	193.56	95.69	0.17
Kilpatrick Pond	5871.123	1.5 YR-no dam	266.00	4856.00	4860.09		4860.12	0.000205	1.36	195.62	96.27	0.17
Kilpatrick Pond	4936.297	95 % Exc	117.00	4857.09	4859.79		4859.80	0.000131	0.74	158.47	140.05	0.12
Kilpatrick Pond	4936.297	5 % Exc	268.00	4857.09	4860.05		4860.08	0.000395	1.36	198.02	177.43	0.22
Kilpatrick Pond	4936.297	1.5 YR	266.00	4857.09	4860.08		4860.11	0.000364	1.31	203.85	184.65	0.21
Kilpatrick Pond	4936.297	95 % Exc-no dam	117.00	4857.09	4858.99		4859.03	0.000936	1.67	69.93	79.13	0.31
Kilpatrick Pond	4936.297	5 % Exc-no dam	268.00	4857.09	4859.68		4859.73	0.000894	1.88	142.70	131.28	0.32
Kilpatrick Pond	4936.297	1.5 YR-no dam	266.00	4857.09	4859.73		4859.78	0.000782	1.76	149.67	135.22	0.30
Kilpatrick Pond	4429.002	95 % Exc	117.00	4856.52	4859.78	4857.36	4859.78	0.000018	0.41	316.50	587.25	0.05
Kilpatrick Pond	4429.002	5 % Exc	268.00	4856.52	4860.00	4857.73	4860.01	0.000064	0.84	361.30	592.28	0.10
Kilpatrick Pond	4429.002	1.5 YR	266.00	4856.52	4860.04	4857.73	4860.05	0.000059	0.81	368.57	593.03	0.09
Kilpatrick Pond	4429.002	95 % Exc-no dam	117.00	4856.52	4858.88	4857.36	4858.89	0.000120	0.79	149.00	443.21	0.12
Kilpatrick Pond	4429.002	5 % Exc-no dam	268.00	4856.52	4859.56	4857.73	4859.58	0.000142	1.09	273.42	582.37	0.14
Kilpatrick Pond	4429.002	1.5 YR-no dam	266.00	4856.52	4859.63	4857.73	4859.65	0.000122	1.03	286.86	583.90	0.13
Kilpatrick Pond	4221.636	95 % Exc	117.00	4855.83	4859.78	4856.43	4859.78	0.000004	0.21	570.67	482.98	0.03
Kilpatrick Pond	4221.636	5 % Exc	268.00	4855.83	4860.00	4856.79	4860.00	0.000015	0.40	729.52	513.23	0.05
Kilpatrick Pond	4221.636	1.5 YR	266.00	4855.83	4860.04	4856.79	4860.04	0.000014	0.39	745.54	516.44	0.05
Kilpatrick Pond	4221.636	95 % Exc-no dam	117.00	4855.83	4858.88	4856.43	4858.88	0.000023	0.35	333.83	246.10	0.05
Kilpatrick Pond	4221.636	5 % Exc-no dam	268.00	4855.83	4859.56	4856.79	4859.56	0.000033	0.53	510.47	416.81	0.07
Kilpatrick Pond	4221.636	1.5 YR-no dam	266.00	4855.83	4859.63	4856.79	4859.63	0.000029	0.50	529.17	445.46	0.06
Kilpatrick Pond	4037.197	95 % Exc	117.00	4856.47	4859.78	4857.42	4859.78	0.000008	0.27	438.03	298.68	0.03
Kilpatrick Pond	4037.197	5 % Exc	268.00	4856.47	4860.00	4857.81	4860.00	0.000030	0.55	485.90	304.24	0.07
Kilpatrick Pond	4037.197	1.5 YR	266.00	4856.47	4860.03	4857.79	4860.04	0.000028	0.54	493.90	304.34	0.06
Kilpatrick Pond	4037.197	95 % Exc-no dam	117.00	4856.47	4858.87	4857.42	4858.87	0.000057	0.49	240.28	253.36	0.08
Kilpatrick Pond	4037.197	5 % Exc-no dam	268.00	4856.47	4859.55	4857.81	4859.55	0.000063	0.69	387.18	291.71	0.09
Kilpatrick Pond	4037.197	1.5 YR-no dam	266.00	4856.47	4859.62	4857.79	4859.62	0.000055	0.66	402.66	293.63	0.09
Kilpatrick Pond	3892.986	95 % Exc	117.00	4856.24	4859.78		4859.78	0.000004	0.20	588.83	285.59	0.02
Kilpatrick Pond	3892.986	5 % Exc	268.00	4856.24	4859.99		4860.00	0.000016	0.41	650.76	288.29	0.05
Kilpatrick Pond	3892.986	1.5 YR	266.00	4856.24	4860.03		4860.03	0.000015	0.40	661.18	288.74	0.05
Kilpatrick Pond	3892.986	95 % Exc-no dam	117.00	4856.24	4858.86		4858.86	0.000027	0.35	332.62	274.11	0.06
Kilpatrick Pond	3892.986	5 % Exc-no dam	268.00	4856.24	4859.54		4859.55	0.000033	0.51	521.96	282.64	0.07
Kilpatrick Pond	3892.986	1.5 YR-no dam	266.00	4856.24	4859.61		4859.62	0.000029	0.49	542.14	283.53	0.06
Kilpatrick Pond	3675.366	95 % Exc	117.00	4856.55	4859.78		4859.78	0.000006	0.24	498.15	265.32	0.03
Kilpatrick Pond	3675.366	5 % Exc	268.00	4856.55	4859.99		4859.99	0.000022	0.49	560.55	307.68	0.06
Kilpatrick Pond	3675.366	1.5 YR	266.00	4856.55	4860.03		4860.03	0.000020	0.48	571.97	307.80	0.05
Kilpatrick Pond	3675.366	95 % Exc-no dam	117.00	4856.55	4858.86		4858.86	0.000032	0.41	285.75	214.97	0.06
Kilpatrick Pond	3675.366	5 % Exc-no dam	268.00	4856.55	4859.53		4859.54	0.000045	0.61	438.56	234.93	0.08
Kilpatrick Pond	3675.366	1.5 YR-no dam	266.00	4856.55	4859.61		4859.61	0.000039	0.59	455.81	239.30	0.07
Kilpatrick Pond	3564.098	95 % Exc	117.00	4855.95	4859.78		4859.78	0.000006	0.24	489.19	227.62	0.03
Kilpatrick Pond	3564.098	5 % Exc	268.00	4855.95	4859.99		4859.99	0.000022	0.50	538.24	237.79	0.06
Kilpatrick Pond	3564.098	1.5 YR	266.00	4855.95	4860.02		4860.03	0.000021	0.49	546.96	237.91	0.06
Kilpatrick Pond	3564.098	95 % Exc-no dam	117.00	4855.95	4858.85		4858.85	0.000028	0.40	291.63	203.80	0.06
Kilpatrick Pond	3564.098	5 % Exc-no dam	268.00	4855.95	4859.53		4859.53	0.000043	0.62	434.12	218.21	0.08
Kilpatrick Pond	3564.098	1.5 YR-no dam	266.00	4855.95	4859.60		4859.61	0.000038	0.59	450.16	219.77	0.07
Kilpatrick Pond	3458.971	95 % Exc	117.00	4856.83	4859.78		4859.78	0.000009	0.27	432.31	226.25	0.03
Kilpatrick Pond	3458.971	5 % Exc	268.00	4856.83	4859.98		4859.99	0.000033	0.56	479.87	243.32	0.07
Kilpatrick Pond	3458.971	1.5 YR	266.00	4856.83	4860.02		4860.02	0.000030	0.55	489.03	250.50	0.07
Kilpatrick Pond	3458.971	95 % Exc-no dam	117.00	4856.83	4858.85		4858.85	0.000073	0.52	225.49	219.03	0.09
Kilpatrick Pond	3458.971	5 % Exc-no dam	268.00	4856.83	4859.52		4859.53	0.000073	0.71	374.85	223.95	0.10
Kilpatrick Pond	3458.971	1.5 YR-no dam	266.00	4856.83	4859.59		4859.60	0.000062	0.68	391.38	224.49	0.09
Kilpatrick Pond	3283.924	95 % Exc	117.00	4856.54	4859.77		4859.78	0.000004	0.20	597.07	284.35	0.02
Kilpatrick Pond	3283.924	5 % Exc	268.00	4856.54	4859.98		4859.98	0.000016	0.41	655.43	284.89	0.05
Kilpatrick Pond	3283.924	1.5 YR	266.00	4856.54	4860.02		4860.02	0.000015	0.40	665.87	284.99	0.05
Kilpatrick Pond	3283.924	95 % Exc-no dam	117.00	4856.54	4858.84		4858.84	0.000028	0.35	332.34	281.75	0.06
Kilpatrick Pond	3283.924	5 % Exc-no dam	268.00	4856.54	4859.51		4859.52	0.000033	0.51	523.15	283.66	0.07
Kilpatrick Pond	3283.924	1.5 YR-no dam	266.00	4856.54	4859.59		4859.59	0.000028	0.49	544.21	283.85	0.06
Kilpatrick Pond	3171.48	95 % Exc	117.00	4856.54	4859.77		4859.77	0.000004	0.20	592.70	295.39	0.02
Kilpatrick Pond	3171.48	5 % Exc	268.00	4856.54	4859.98		4859.98	0.000017	0.41	653.02	297.10	0.05
Kilpatrick Pond	3171.48	1.5 YR	266.00	4856.54	4860.02		4860.02	0.000016	0.40	664.05	297.41	0.05
Kilpatrick Pond	3171.48	95 % Exc-no dam	117.00	4856.54	4858.84		4858.84	0.000032	0.36	320.87	284.17	0.06
Kilpatrick Pond	3171.48	5 % Exc-no dam	268.00	4856.54	4859.51		4859.51	0.000036	0.52	515.08	292.26	0.07
Kilpatrick Pond	3171.48	1.5 YR-no dam	266.00	4856.54	4859.59		4859.59	0.000031	0.50	537.09	293.17	0.06
Kilpatrick Pond	3060.256	95 % Exc	117.00	4856.24	4859.77		4859.77	0.000004	0.21	558.51	259.43	0.03

Reference: Model output obtained from HEC-RAS v4.1.0

HEC-RAS Results
Existing Conditions Output Table

Silver Creek Kilpatrick Pond Design
Blaine County, Idaho

GeoEngineers

Figure D-10

Reach	River Sta	Profile	Q Total	Min Ch El	W.S. Elev	Crit W.S.	E.G. Elev	E.G. Slope	Vel Chnl	Flow Area	Top Width	Froude # Chl
			(cfs)	(ft)	(ft)	(ft)	(ft)	(ft/ft)	(ft/s)	(sq ft)	(ft)	
Kilpatrick Pond	3060.256	5 % Exc	268.00	4856.24	4859.98		4859.98	0.000018	0.44	611.27	263.78	0.05
Kilpatrick Pond	3060.256	1.5 YR	266.00	4856.24	4860.01		4860.02	0.000017	0.43	621.07	264.58	0.05
Kilpatrick Pond	3060.256	95 % Exc-no dam	117.00	4856.24	4858.83		4858.84	0.000025	0.36	324.12	238.66	0.05
Kilpatrick Pond	3060.256	5 % Exc-no dam	268.00	4856.24	4859.51		4859.51	0.000035	0.55	489.75	253.65	0.07
Kilpatrick Pond	3060.256	1.5 YR-no dam	266.00	4856.24	4859.58		4859.59	0.000031	0.52	509.00	255.28	0.07
Kilpatrick Pond	2893.565	95 % Exc	117.00	4855.80	4859.77	4857.25	4859.77	0.000014	0.42	280.29	217.38	0.05
Kilpatrick Pond	2893.565	5 % Exc	268.00	4855.80	4859.96	4857.64	4859.97	0.000057	0.89	300.83	230.00	0.09
Kilpatrick Pond	2893.565	1.5 YR	266.00	4855.80	4860.00	4857.63	4860.01	0.000054	0.87	304.93	232.53	0.09
Kilpatrick Pond	2893.565	95 % Exc-no dam	117.00	4855.80	4858.82	4857.25	4858.83	0.000063	0.66	178.03	189.41	0.09
Kilpatrick Pond	2893.565	5 % Exc-no dam	268.00	4855.80	4859.48	4857.64	4859.50	0.000107	1.08	249.22	200.27	0.12
Kilpatrick Pond	2893.565	1.5 YR-no dam	266.00	4855.80	4859.56	4857.63	4859.58	0.000095	1.03	257.59	203.44	0.12
Kilpatrick Pond	2856.361	95 % Exc	117.00	4852.70	4859.77	4853.82	4859.77	0.000012	0.40	291.49	178.74	0.03
Kilpatrick Pond	2856.361	5 % Exc	268.00	4852.70	4859.96	4854.43	4859.97	0.000054	0.88	303.53	181.85	0.07
Kilpatrick Pond	2856.361	1.5 YR	266.00	4852.70	4860.00	4854.42	4860.01	0.000052	0.87	305.97	182.48	0.07
Kilpatrick Pond	2856.361	95 % Exc-no dam	117.00	4852.70	4858.82	4853.82	4858.83	0.000017	0.50	233.68	152.92	0.04
Kilpatrick Pond	2856.361	5 % Exc-no dam	268.00	4852.70	4859.48	4854.43	4859.50	0.000071	0.98	273.21	172.40	0.08
Kilpatrick Pond	2856.361	1.5 YR-no dam	266.00	4852.70	4859.56	4854.42	4859.57	0.000068	0.96	278.08	174.69	0.08
Kilpatrick Pond	2845		Bridge									
Kilpatrick Pond	2828.3	95 % Exc	117.00	4853.00	4859.77	4854.30	4859.77	0.000011	0.44	264.62	57.54	0.04
Kilpatrick Pond	2828.3	5 % Exc	268.00	4853.00	4859.95	4854.86	4859.97	0.000055	0.97	275.35	58.69	0.08
Kilpatrick Pond	2828.3	1.5 YR	266.00	4853.00	4859.99	4854.85	4860.01	0.000053	0.96	277.59	58.93	0.08
Kilpatrick Pond	2828.3	95 % Exc-no dam	117.00	4853.00	4858.82	4854.30	4858.83	0.000014	0.55	212.85	51.65	0.05
Kilpatrick Pond	2828.3	5 % Exc-no dam	268.00	4853.00	4859.48	4854.86	4859.49	0.000064	1.08	248.00	55.72	0.09
Kilpatrick Pond	2828.3	1.5 YR-no dam	266.00	4853.00	4859.55	4854.85	4859.57	0.000061	1.05	252.35	56.20	0.09
Kilpatrick Pond	2761.115	95 % Exc	117.00	4855.70	4859.77	4856.86	4859.77	0.000002	0.17	706.37	287.00	0.02
Kilpatrick Pond	2761.115	5 % Exc	268.00	4855.70	4859.96	4857.01	4859.96	0.000008	0.36	751.04	287.00	0.04
Kilpatrick Pond	2761.115	1.5 YR	266.00	4855.70	4860.00	4857.01	4860.00	0.000007	0.35	759.84	287.00	0.03
Kilpatrick Pond	2761.115	95 % Exc-no dam	117.00	4855.70	4858.82	4856.86	4858.82	0.000006	0.24	484.86	266.43	0.03
Kilpatrick Pond	2761.115	5 % Exc-no dam	268.00	4855.70	4859.48	4857.01	4859.49	0.000013	0.42	639.43	281.93	0.04
Kilpatrick Pond	2761.115	1.5 YR-no dam	266.00	4855.70	4859.56	4857.01	4859.56	0.000012	0.40	657.59	283.75	0.04
Kilpatrick Pond	2632.667	95 % Exc	117.00	4856.80	4859.77		4859.77	0.000003	0.18	654.60	309.56	0.02
Kilpatrick Pond	2632.667	5 % Exc	268.00	4856.80	4859.96		4859.96	0.000013	0.38	714.28	320.53	0.04
Kilpatrick Pond	2632.667	1.5 YR	266.00	4856.80	4860.00		4860.00	0.000012	0.37	726.69	322.77	0.04
Kilpatrick Pond	2632.667	95 % Exc-no dam	117.00	4856.80	4858.82		4858.82	0.000020	0.31	373.46	293.43	0.05
Kilpatrick Pond	2632.667	5 % Exc-no dam	268.00	4856.80	4859.48		4859.48	0.000026	0.47	567.66	294.46	0.06
Kilpatrick Pond	2632.667	1.5 YR-no dam	266.00	4856.80	4859.56		4859.56	0.000023	0.45	590.74	297.37	0.06
Kilpatrick Pond	2471.842	95 % Exc	117.00	4856.67	4859.77		4859.77	0.000003	0.17	692.43	357.00	0.02
Kilpatrick Pond	2471.842	5 % Exc	268.00	4856.67	4859.96		4859.96	0.000013	0.35	759.71	357.00	0.04
Kilpatrick Pond	2471.842	1.5 YR	266.00	4856.67	4860.00		4860.00	0.000012	0.34	773.31	357.00	0.04
Kilpatrick Pond	2471.842	95 % Exc-no dam	117.00	4856.67	4858.82		4858.82	0.000023	0.32	369.31	314.68	0.05
Kilpatrick Pond	3471.842	5 % Exc-no dam	268.00	4856.67	4859.48		4859.48	0.000030	0.46	588.38	350.56	0.06
Kilpatrick Pond	2471.842	1.5 YR-no dam	266.00	4856.67	4859.56		4859.56	0.000025	0.43	616.11	355.02	0.06
Kilpatrick Pond	2424.489	95 % Exc	117.00	4856.46	4859.77		4859.77	0.000002	0.14	817.39	401.00	0.02
Kilpatrick Pond	2424.489	5 % Exc	268.00	4856.46	4859.96		4859.96	0.000009	0.30	892.97	401.00	0.04
Kilpatrick Pond	2424.489	1.5 YR	266.00	4856.46	4860.00		4860.00	0.000008	0.29	908.24	401.00	0.03
Kilpatrick Pond	2424.489	95 % Exc-no dam	117.00	4856.46	4858.82		4858.82	0.000015	0.26	445.54	369.98	0.04
Kilpatrick Pond	2424.489	5 % Exc-no dam	268.00	4856.46	4859.48		4859.48	0.000020	0.38	699.91	400.97	0.05
Kilpatrick Pond	2424.489	1.5 YR-no dam	266.00	4856.46	4859.56		4859.56	0.000017	0.36	731.63	401.00	0.05
Kilpatrick Pond	2221.522	95 % Exc	117.00	4857.10	4859.77		4859.77	0.000002	0.12	956.00	467.00	0.02
Kilpatrick Pond	2221.522	5 % Exc	268.00	4857.10	4859.96		4859.96	0.000006	0.26	1043.56	467.00	0.03
Kilpatrick Pond	2221.522	1.5 YR	266.00	4857.10	4860.00		4860.00	0.000006	0.25	1061.35	467.00	0.03
Kilpatrick Pond	2221.522	95 % Exc-no dam	117.00	4857.10	4858.81		4858.81	0.000013	0.23	511.15	455.54	0.04
Kilpatrick Pond	2221.522	5 % Exc-no dam	268.00	4857.10	4859.47		4859.48	0.000014	0.33	818.04	467.00	0.04
Kilpatrick Pond	2221.522	1.5 YR-no dam	266.00	4857.10	4859.55		4859.55	0.000012	0.31	854.98	467.00	0.04
Kilpatrick Pond	2035.331	95 % Exc	117.00	4856.61	4859.77		4859.77	0.000004	0.17	698.26	387.00	0.02
Kilpatrick Pond	2035.331	5 % Exc	268.00	4856.61	4859.95		4859.96	0.000014	0.35	770.07	387.00	0.04
Kilpatrick Pond	2035.331	1.5 YR	266.00	4856.61	4859.99		4859.99	0.000013	0.34	785.00	387.00	0.04
Kilpatrick Pond	2035.331	95 % Exc-no dam	117.00	4856.61	4858.81		4858.81	0.000045	0.36	326.76	387.00	0.07
Kilpatrick Pond	2035.331	5 % Exc-no dam	268.00	4856.61	4859.47		4859.47	0.000035	0.46	581.86	387.00	0.07
Kilpatrick Pond	2035.331	1.5 YR-no dam	266.00	4856.61	4859.55		4859.55	0.000029	0.44	613.04	387.00	0.06
Kilpatrick Pond	1798.276	95 % Exc	117.00	4857.26	4859.77		4859.77	0.000002	0.13	884.68	407.08	0.02
Kilpatrick Pond	1798.276	5 % Exc	268.00	4857.26	4859.95		4859.95	0.000007	0.28	959.88	407.85	0.03
Kilpatrick Pond	1798.276	1.5 YR	266.00	4857.26	4859.99		4859.99	0.000007	0.27	975.62	408.01	0.03
Kilpatrick Pond	1798.276	95 % Exc-no dam	117.00	4857.26	4858.80		4858.81	0.000012	0.24	494.22	403.10	0.04
Kilpatrick Pond	1798.276	5 % Exc-no dam	268.00	4857.26	4859.46		4859.47	0.000015	0.35	760.84	405.82	0.05
Kilpatrick Pond	1798.276	1.5 YR-no dam	266.00	4857.26	4859.54		4859.55	0.000013	0.34	793.74	406.16	0.04
Kilpatrick Pond	1653.968	95 % Exc	117.00	4857.05	4859.77		4859.77	0.000029	0.37	319.71	260.06	0.06
Kilpatrick Pond	1653.968	5 % Exc	268.00	4857.05	4859.94		4859.95	0.000100	0.73	366.31	268.67	0.11
Kilpatrick Pond	1653.968	1.5 YR	266.00	4857.05	4859.98		4859.99	0.000091	0.71	376.98	270.60	0.11
Kilpatrick Pond	1653.968	95 % Exc-no dam	117.00	4857.05	4858.78	4858.09	4858.80	0.000664	1.15	101.81	156.48	0.25
Kilpatrick Pond	1653.968	5 % Exc-no dam	268.00	4857.05	4859.44	4858.49	4859.46	0.000377	1.13	237.01	244.02	0.20
Kilpatrick Pond	1653.968	1.5 YR-no dam	266.00	4857.05	4859.52	4858.48	4859.54	0.000286	1.03	258.04	248.20	0.16

Reference: Model output obtained from HEC-RAS v4.1.0

HEC-RAS Results
Existing Conditions Output Table

Silver Creek Kilpatrick Pond Design
Blaine County, Idaho

GEOENGINEERS

Figure D-11

Reach	River Sta	Profile	Q Total	Min Ch El	W.S. Elev	Crit W.S.	E.G. Elev	E.G. Slope	Vel Chnl	Flow Area	Top Width	Froude # Chl
			(cfs)	(ft)	(ft)	(ft)	(ft)	(ft/ft)	(ft/s)	(sq ft)	(ft)	
Kilpatrick Pond	1066.511	95 % Exc	82.00	4857.00	4859.73	4857.64	4859.74	0.000076	0.88	92.91	40.92	0.10
Kilpatrick Pond	1066.511	5 % Exc	233.00	4857.00	4859.73	4858.26	4859.83	0.000617	2.51	92.91	40.92	0.29
Kilpatrick Pond	1066.511	1.5 YR	266.00	4857.00	4859.73	4858.38	4859.86	0.000805	2.86	92.91	40.92	0.33
Kilpatrick Pond	1066.511	95 % Exc-no dam	82.00	4857.00	4857.65	4857.65	4857.95	0.010731	4.41	18.59	30.41	0.99
Kilpatrick Pond	1066.511	5 % Exc-no dam	233.00	4857.00	4858.26	4858.26	4858.84	0.008989	6.09	38.24	33.51	1.01
Kilpatrick Pond	1066.511	1.5 YR-no dam	266.00	4857.00	4858.37	4858.37	4859.00	0.008741	6.33	42.06	34.08	1.00

Reference: Model output obtained from HEC-RAS v4.1.0

HEC-RAS Results
Existing Conditions Output Table

Silver Creek Kilpatrick Pond Design
Blaine County, Idaho

GeoEngineers

Figure D-12

Reach	River Sta	Profile	Q Total	Min Ch El	W.S. Elev	Crit W.S.	E.G. Elev	E.G. Slope	Vel Chnl	Flow Area	Top Width	Froude # Chl
			(cfs)	(ft)	(ft)	(ft)	(ft)	(ft/ft)	(ft/s)	(sq ft)	(ft)	
Kilpatrick Pond	6223	95 % Exc	117.00	4857.09	4859.86	4858.15	4859.87	0.000041	0.57	204.92	112.10	0.07
Kilpatrick Pond	6223	5 % Exc	268.00	4857.09	4860.25	4858.44	4860.27	0.000116	1.07	259.07	180.79	0.13
Kilpatrick Pond	6223	1.5 YR	266.00	4857.09	4860.25	4858.44	4860.27	0.000114	1.06	258.89	180.60	0.13
Kilpatrick Pond	6223	95 % Exc-no dam	117.00	4857.09	4859.28	4858.15	4859.29	0.000130	0.83	141.45	104.92	0.13
Kilpatrick Pond	6223	5 % Exc-no dam	268.00	4857.09	4860.08	4858.44	4860.10	0.000155	1.17	230.34	137.07	0.15
Kilpatrick Pond	6223	1.5 YR-no dam	266.00	4857.09	4860.07	4858.44	4860.09	0.000155	1.17	229.01	134.60	0.15
Kilpatrick Pond	5871.123	95 % Exc	117.00	4856.00	4859.85	4857.42	4859.85	0.000054	0.68	173.01	89.72	0.09
Kilpatrick Pond	5871.123	5 % Exc	268.00	4856.00	4860.19	4857.98	4860.22	0.000182	1.30	205.83	99.08	0.16
Kilpatrick Pond	5871.123	1.5 YR	266.00	4856.00	4860.19	4857.97	4860.22	0.000180	1.29	205.83	99.08	0.16
Kilpatrick Pond	5871.123	95 % Exc-no dam	117.00	4856.00	4859.23	4857.42	4859.24	0.000129	0.95	122.90	73.15	0.13
Kilpatrick Pond	5871.123	5 % Exc-no dam	268.00	4856.00	4860.00	4857.98	4860.03	0.000233	1.43	186.99	93.82	0.18
Kilpatrick Pond	5871.123	1.5 YR-no dam	266.00	4856.00	4859.99	4857.97	4860.02	0.000233	1.43	186.07	93.56	0.18
Kilpatrick Pond	4936.297	95 % Exc	117.00	4857.09	4859.77	4858.27	4859.78	0.000140	0.76	154.53	137.91	0.13
Kilpatrick Pond	4936.297	5 % Exc	268.00	4857.09	4859.91	4858.74	4859.95	0.000533	1.53	175.18	148.78	0.25
Kilpatrick Pond	4936.297	1.5 YR	266.00	4857.09	4859.92	4858.73	4859.95	0.000520	1.51	175.91	149.15	0.25
Kilpatrick Pond	4936.297	95 % Exc-no dam	117.00	4857.09	4858.92	4858.27	4858.97	0.001123	1.81	64.81	75.02	0.34
Kilpatrick Pond	4936.297	5 % Exc-no dam	268.00	4857.09	4859.52	4858.73	4859.60	0.001292	2.18	123.05	119.46	0.38
Kilpatrick Pond	4936.297	1.5 YR-no dam	266.00	4857.09	4859.51	4858.73	4859.59	0.001303	2.18	121.69	118.72	0.38
Kilpatrick Pond	4429.002	95 % Exc	117.00	4856.52	4859.75	4857.36	4859.75	0.000021	0.45	271.34	586.54	0.05
Kilpatrick Pond	4429.002	5 % Exc	268.00	4856.52	4859.83	4857.78	4859.84	0.000098	0.98	282.75	588.34	0.12
Kilpatrick Pond	4429.002	1.5 YR	266.00	4856.52	4859.84	4857.78	4859.85	0.000095	0.97	283.72	588.50	0.12
Kilpatrick Pond	4429.002	95 % Exc-no dam	117.00	4856.52	4857.36	4857.36	4857.62	0.011408	4.16	28.16	53.12	1.01
Kilpatrick Pond	4429.002	5 % Exc-no dam	268.00	4856.52	4857.78	4857.78	4858.17	0.009529	5.03	53.33	66.09	0.99
Kilpatrick Pond	4429.002	1.5 YR-no dam	266.00	4856.52	4857.78	4857.78	4858.16	0.009275	4.97	53.56	66.20	0.97
Kilpatrick Pond	4424	95 % Exc	117.00	4853.73	4859.75	4854.81	4859.75	0.000005	0.35	359.27	481.14	0.03
Kilpatrick Pond	4424	5 % Exc	268.00	4853.73	4859.83	4855.43	4859.84	0.000025	0.78	368.95	582.61	0.07
Kilpatrick Pond	4424	1.5 YR	266.00	4853.73	4859.84	4855.42	4859.85	0.000025	0.77	369.75	582.77	0.06
Kilpatrick Pond	4424	95 % Exc-no dam	117.00	4853.73	4856.75	4854.81	4856.76	0.000157	1.08	108.84	61.00	0.14
Kilpatrick Pond	4424	5 % Exc-no dam	268.00	4853.73	4857.63	4855.43	4857.67	0.000238	1.58	169.14	72.05	0.18
Kilpatrick Pond	4424	1.5 YR-no dam	266.00	4853.73	4857.63	4855.42	4857.67	0.000233	1.57	169.60	72.06	0.18
Kilpatrick Pond	4221.636	95 % Exc	117.00	4854.92	4859.75	4855.82	4859.75	0.000003	0.25	479.31	368.12	0.02
Kilpatrick Pond	4221.636	5 % Exc	268.00	4854.92	4859.83	4856.19	4859.84	0.000016	0.56	493.25	445.72	0.05
Kilpatrick Pond	4221.636	1.5 YR	266.00	4854.92	4859.84	4856.20	4859.84	0.000016	0.55	494.33	451.68	0.05
Kilpatrick Pond	4221.636	95 % Exc-no dam	117.00	4854.92	4856.70	4855.82	4856.72	0.000336	1.10	106.10	103.96	0.19
Kilpatrick Pond	4221.636	5 % Exc-no dam	268.00	4854.92	4857.59	4856.19	4857.61	0.000229	1.33	201.80	111.78	0.17
Kilpatrick Pond	4221.636	1.5 YR-no dam	266.00	4854.92	4857.59	4856.20	4857.62	0.000223	1.31	202.57	111.84	0.17
Kilpatrick Pond	4037.197	95 % Exc	117.00	4855.10	4859.75	4856.15	4859.75	0.000014	0.48	253.54	230.33	0.05
Kilpatrick Pond	4037.197	5 % Exc	268.00	4855.10	4859.81	4856.71	4859.83	0.000068	1.07	259.67	255.50	0.10
Kilpatrick Pond	4037.197	1.5 YR	266.00	4855.10	4859.82	4856.68	4859.84	0.000066	1.06	260.34	258.26	0.10
Kilpatrick Pond	4037.197	95 % Exc-no dam	117.00	4855.10	4856.15	4856.15	4856.50	0.010062	4.77	24.52	33.58	0.98
Kilpatrick Pond	4037.197	5 % Exc-no dam	268.00	4855.10	4857.30	4856.71	4857.50	0.002415	3.56	75.35	54.67	0.53
Kilpatrick Pond	4037.197	1.5 YR-no dam	266.00	4855.10	4857.32	4856.68	4857.51	0.002300	3.49	76.29	54.99	0.52
Kilpatrick Pond	3892.986	95 % Exc	117.00	4854.47	4859.75	4855.08	4859.75	0.000005	0.31	389.66	296.82	0.03
Kilpatrick Pond	3892.986	5 % Exc	268.00	4854.47	4859.81	4855.49	4859.82	0.000024	0.69	397.95	298.06	0.06
Kilpatrick Pond	3892.986	1.5 YR	266.00	4854.47	4859.82	4855.50	4859.83	0.000024	0.68	398.84	298.19	0.06
Kilpatrick Pond	3892.986	95 % Exc-no dam	117.00	4854.47	4856.27	4855.08	4856.29	0.000250	1.23	95.47	62.80	0.18
Kilpatrick Pond	3892.986	5 % Exc-no dam	268.00	4854.47	4857.33	4855.49	4857.37	0.000247	1.60	167.74	73.00	0.19
Kilpatrick Pond	3892.986	1.5 YR-no dam	266.00	4854.47	4857.35	4855.50	4857.38	0.000239	1.58	168.85	73.15	0.18
Kilpatrick Pond	3675.366	95 % Exc	117.00	4853.54	4859.74	4854.81	4859.75	0.000006	0.38	320.76	118.26	0.03
Kilpatrick Pond	3675.366	5 % Exc	268.00	4853.54	4859.80	4855.45	4859.81	0.000031	0.85	326.25	190.62	0.07
Kilpatrick Pond	3675.366	1.5 YR	266.00	4853.54	4859.81	4855.44	4859.82	0.000030	0.84	326.96	200.03	0.07
Kilpatrick Pond	3675.366	95 % Exc-no dam	117.00	4853.54	4856.18	4854.81	4856.22	0.000383	1.53	76.33	48.90	0.22
Kilpatrick Pond	3675.366	5 % Exc-no dam	268.00	4853.54	4857.24	4855.45	4857.30	0.000424	1.97	136.10	64.40	0.24
Kilpatrick Pond	3675.366	1.5 YR-no dam	266.00	4853.54	4857.26	4855.44	4857.32	0.000406	1.94	137.32	64.46	0.23
Kilpatrick Pond	3564.098	95 % Exc	117.00	4854.00	4859.74	4854.93	4859.74	0.000007	0.39	307.11	113.80	0.03
Kilpatrick Pond	3564.098	5 % Exc	268.00	4854.00	4859.80	4855.52	4859.81	0.000036	0.89	312.28	153.07	0.08
Kilpatrick Pond	3564.098	1.5 YR	266.00	4854.00	4859.81	4855.51	4859.82	0.000035	0.88	313.00	158.49	0.08
Kilpatrick Pond	3564.098	95 % Exc-no dam	117.00	4854.00	4856.13	4854.93	4856.17	0.000465	1.69	69.41	44.58	0.24
Kilpatrick Pond	3564.098	5 % Exc-no dam	268.00	4854.00	4857.17	4855.52	4857.25	0.000512	2.20	121.82	56.10	0.26
Kilpatrick Pond	3564.098	1.5 YR-no dam	266.00	4854.00	4857.19	4855.51	4857.26	0.000490	2.16	123.05	56.34	0.26
Kilpatrick Pond	3458.971	95 % Exc	117.00	4854.10	4859.74	4854.91	4859.74	0.000005	0.35	343.37	164.97	0.03
Kilpatrick Pond	3458.971	5 % Exc	268.00	4854.10	4859.80	4855.34	4859.81	0.000025	0.79	348.62	226.61	0.07
Kilpatrick Pond	3458.971	1.5 YR	266.00	4854.10	4859.80	4855.33	4859.81	0.000025	0.78	349.36	226.68	0.07
Kilpatrick Pond	3458.971	95 % Exc-no dam	117.00	4854.10	4856.11	4854.91	4856.13	0.000260	1.30	89.95	55.81	0.18
Kilpatrick Pond	3458.971	5 % Exc-no dam	268.00	4854.10	4857.15	4855.34	4857.20	0.000280	1.77	151.53	62.11	0.20
Kilpatrick Pond	3458.971	1.5 YR-no dam	266.00	4854.10	4857.17	4855.33	4857.22	0.000268	1.74	152.96	62.25	0.20
Kilpatrick Pond	3283.924	95 % Exc	117.00	4853.60	4859.74	4855.29	4859.74	0.000009	0.41	291.88	284.42	0.04
Kilpatrick Pond	3283.924	5 % Exc	268.00	4853.60	4859.79	4855.94	4859.80	0.000044	0.94	296.28	284.52	0.08
Kilpatrick Pond	3283.924	1.5 YR	266.00	4853.60	4859.79	4855.93	4859.81	0.000043	0.93	297.01	284.54	0.08
Kilpatrick Pond	3283.924	95 % Exc-no dam	117.00	4853.60	4855.91	4855.29	4856.03	0.001837	2.72	42.98	37.41	0.45
Kilpatrick Pond	3283.924	5 % Exc-no dam	268.00	4853.60	4856.97	4855.94	4857.10	0.001284	2.93	91.57	54.67	0.40
Kilpatrick Pond	3283.924	1.5 YR-no dam	266.00	4853.60	4857.00	4855.93	4857.13	0.001201	2.85	93.37	55.21	0.39
Kilpatrick Pond	3171.48	95 % Exc	117.00	4853.57	4859.74	4855.10	4859.74	0.000009	0.42	286.97	296.35	0.04

HEC-RAS Results
Proposed Conditions Output Table

Silver Creek Kilpatrick Pond Design
Blaine County, Idaho

GeoEngineers

Figure D-13

Reference: Model output obtained from HEC-RAS v4.1.0

Reach	River Sta	Profile	Q Total	Min Ch El	W.S. Elev	Crit W.S.	E.G. Elev	E.G. Slope	Vel Chnl	Flow Area	Top Width	Froude # Chl
			(cfs)	(ft)	(ft)	(ft)	(ft)	(ft/ft)	(ft/s)	(sq ft)	(ft)	
Kilpatrick Pond	3171.48	5 % Exc	268.00	4853.57	4859.78	4855.87	4859.79	0.000047	0.95	290.94	296.59	0.09
Kilpatrick Pond	3171.48	1.5 YR	266.00	4853.57	4859.79	4855.86	4859.80	0.000046	0.94	291.71	296.63	0.09
Kilpatrick Pond	3171.48	95 % Exc-no dam	117.00	4853.57	4855.52	4855.10	4855.74	0.003341	3.76	31.14	25.92	0.60
Kilpatrick Pond	3171.48	5 % Exc-no dam	268.00	4853.57	4856.65	4855.87	4856.89	0.002696	3.93	68.27	45.58	0.57
Kilpatrick Pond	3171.48	1.5 YR-no dam	266.00	4853.57	4856.71	4855.86	4856.93	0.002425	3.72	71.41	47.69	0.54
Kilpatrick Pond	3060.256	95 % Exc	117.00	4852.82	4859.74	4853.57	4859.74	0.000004	0.31	383.00	265.86	0.02
Kilpatrick Pond	3060.256	5 % Exc	268.00	4852.82	4859.78	4854.09	4859.79	0.000018	0.71	387.03	266.03	0.06
Kilpatrick Pond	3060.256	1.5 YR	266.00	4852.82	4859.79	4854.09	4859.80	0.000018	0.71	387.81	266.06	0.06
Kilpatrick Pond	3060.256	95 % Exc-no dam	117.00	4852.82	4855.63	4853.57	4855.65	0.000107	1.06	110.73	47.30	0.12
Kilpatrick Pond	3060.256	5 % Exc-no dam	268.00	4852.82	4856.74	4854.09	4856.78	0.000181	1.61	166.82	55.77	0.16
Kilpatrick Pond	3060.256	1.5 YR-no dam	266.00	4852.82	4856.79	4854.09	4856.83	0.000170	1.57	169.94	56.44	0.16
Kilpatrick Pond	2893.565	95 % Exc	117.00	4852.75	4859.74	4854.23	4859.74	0.000005	0.43	273.34	225.06	0.03
Kilpatrick Pond	2893.565	5 % Exc	268.00	4852.75	4859.77	4854.71	4859.79	0.000024	0.97	274.90	227.22	0.07
Kilpatrick Pond	2893.565	1.5 YR	266.00	4852.75	4859.78	4854.70	4859.79	0.000024	0.97	275.29	227.77	0.07
Kilpatrick Pond	2893.565	95 % Exc-no dam	117.00	4852.75	4855.59	4854.23	4855.62	0.000213	1.35	86.90	168.22	0.17
Kilpatrick Pond	2893.565	5 % Exc-no dam	268.00	4852.75	4856.68	4854.71	4856.74	0.000254	1.97	135.70	180.24	0.20
Kilpatrick Pond	2893.565	1.5 YR-no dam	266.00	4852.75	4856.74	4854.70	4856.79	0.000234	1.92	138.40	180.76	0.19
Kilpatrick Pond	2856.361	95 % Exc	117.00	4852.70	4859.74	4853.82	4859.74	0.000012	0.40	289.35	178.18	0.03
Kilpatrick Pond	2856.361	5 % Exc	268.00	4852.70	4859.77	4854.43	4859.78	0.000061	0.92	291.52	178.74	0.08
Kilpatrick Pond	2856.361	1.5 YR	266.00	4852.70	4859.78	4854.42	4859.79	0.000059	0.91	292.11	178.90	0.07
Kilpatrick Pond	2856.361	95 % Exc-no dam	117.00	4852.70	4855.58	4853.82	4855.61	0.000217	1.44	81.20	63.61	0.17
Kilpatrick Pond	2856.361	5 % Exc-no dam	268.00	4852.70	4856.65	4854.43	4856.73	0.000337	2.15	124.53	87.46	0.22
Kilpatrick Pond	2856.361	1.5 YR-no dam	266.00	4852.70	4856.72	4854.42	4856.78	0.000313	2.09	127.22	88.86	0.22
Kilpatrick Pond	2845		Bridge									
Kilpatrick Pond	2828.3	95 % Exc	117.00	4853.00	4859.74	4854.30	4859.74	0.000011	0.45	262.69	57.34	0.04
Kilpatrick Pond	2828.3	5 % Exc	268.00	4853.00	4859.77	4854.86	4859.78	0.000058	1.01	264.40	57.52	0.08
Kilpatrick Pond	2828.3	1.5 YR	266.00	4853.00	4859.77	4854.85	4859.79	0.000057	1.00	264.93	57.58	0.08
Kilpatrick Pond	2828.3	95 % Exc-no dam	117.00	4853.00	4855.55	4854.30	4855.60	0.000401	1.73	67.52	37.68	0.23
Kilpatrick Pond	2828.3	5 % Exc-no dam	268.00	4853.00	4856.61	4854.86	4856.70	0.000489	2.44	109.64	41.94	0.27
Kilpatrick Pond	2828.3	1.5 YR-no dam	266.00	4853.00	4856.68	4854.85	4856.76	0.000448	2.37	112.41	42.22	0.26
Kilpatrick Pond	2761.115	95 % Exc	117.00	4853.73	4859.74	4854.38	4859.74	0.000001	0.14	835.60	287.00	0.01
Kilpatrick Pond	2761.115	5 % Exc	268.00	4853.73	4859.77	4854.79	4859.78	0.000005	0.32	844.40	287.00	0.03
Kilpatrick Pond	2761.115	1.5 YR	266.00	4853.73	4859.78	4854.80	4859.79	0.000005	0.31	846.57	287.00	0.03
Kilpatrick Pond	2761.115	95 % Exc-no dam	117.00	4853.73	4855.54	4854.38	4855.57	0.000278	1.36	85.76	51.46	0.19
Kilpatrick Pond	2761.115	5 % Exc-no dam	268.00	4853.73	4856.62	4854.79	4856.66	0.000335	1.73	155.26	75.09	0.21
Kilpatrick Pond	2761.115	1.5 YR-no dam	266.00	4853.73	4856.68	4854.80	4856.72	0.000301	1.66	160.28	75.97	0.20
Kilpatrick Pond	2632.667	95 % Exc	117.00	4853.35	4859.74	4854.32	4859.74	0.000001	0.14	827.35	307.63	0.01
Kilpatrick Pond	2632.667	5 % Exc	268.00	4853.35	4859.77	4854.78	4859.77	0.000007	0.32	838.65	309.76	0.03
Kilpatrick Pond	2632.667	1.5 YR	266.00	4853.35	4859.78	4854.78	4859.78	0.000007	0.32	841.53	310.29	0.03
Kilpatrick Pond	2632.667	95 % Exc-no dam	117.00	4853.35	4855.50	4854.32	4855.53	0.000342	1.48	78.88	47.78	0.20
Kilpatrick Pond	2632.667	5 % Exc-no dam	268.00	4853.35	4856.55	4854.78	4856.61	0.000382	2.03	132.01	53.07	0.23
Kilpatrick Pond	2632.667	1.5 YR-no dam	266.00	4853.35	4856.62	4854.78	4856.68	0.000345	1.96	135.86	53.43	0.22
Kilpatrick Pond	2471.842	95 % Exc	117.00	4852.87	4859.74	4853.58	4859.74	0.000001	0.13	895.23	357.00	0.01
Kilpatrick Pond	2471.842	5 % Exc	268.00	4852.87	4859.77	4854.03	4859.77	0.000007	0.30	907.95	357.00	0.03
Kilpatrick Pond	2471.842	1.5 YR	266.00	4852.87	4859.78	4854.02	4859.78	0.000007	0.29	911.26	357.00	0.03
Kilpatrick Pond	2471.842	95 % Exc-no dam	117.00	4852.87	4855.48	4853.58	4855.50	0.000097	0.95	122.78	55.82	0.11
Kilpatrick Pond	2471.842	5 % Exc-no dam	268.00	4852.87	4856.53	4854.03	4856.57	0.000152	1.45	184.46	61.53	0.15
Kilpatrick Pond	2471.842	1.5 YR-no dam	266.00	4852.87	4856.61	4854.02	4856.64	0.000140	1.41	189.01	61.93	0.14
Kilpatrick Pond	2424.489	95 % Exc	117.00	4852.50	4859.74	4853.54	4859.74	0.000001	0.12	1001.83	401.00	0.01
Kilpatrick Pond	2424.489	5 % Exc	268.00	4852.50	4859.77	4854.01	4859.77	0.000006	0.26	1015.92	401.00	0.03
Kilpatrick Pond	2424.489	1.5 YR	266.00	4852.50	4859.78	4854.01	4859.78	0.000006	0.26	1019.64	401.00	0.03
Kilpatrick Pond	2424.489	95 % Exc-no dam	117.00	4852.50	4855.48	4853.54	4855.49	0.000106	1.00	117.42	53.36	0.12
Kilpatrick Pond	2424.489	5 % Exc-no dam	268.00	4852.50	4856.52	4854.01	4856.56	0.000169	1.52	176.63	59.76	0.16
Kilpatrick Pond	2424.489	1.5 YR-no dam	266.00	4852.50	4856.60	4854.01	4856.63	0.000188	1.47	181.34	70.86	0.16
Kilpatrick Pond	2221.522	95 % Exc	117.00	4852.53	4859.74	4853.53	4859.74	0.000001	0.10	1167.71	467.00	0.01
Kilpatrick Pond	2221.522	5 % Exc	268.00	4852.53	4859.77	4854.00	4859.77	0.000004	0.23	1183.67	467.00	0.03
Kilpatrick Pond	2221.522	1.5 YR	266.00	4852.53	4859.78	4854.00	4859.78	0.000004	0.22	1188.00	467.00	0.02
Kilpatrick Pond	2221.522	95 % Exc-no dam	117.00	4852.53	4855.45	4853.53	4855.47	0.000112	1.03	113.35	50.11	0.12
Kilpatrick Pond	2221.522	5 % Exc-no dam	268.00	4852.53	4856.48	4854.00	4856.52	0.000186	1.60	167.52	55.09	0.16
Kilpatrick Pond	2221.522	1.5 YR-no dam	266.00	4852.53	4856.56	4854.00	4856.60	0.000171	1.55	171.62	55.45	0.16
Kilpatrick Pond	2035.331	95 % Exc	117.00	4852.06	4859.74	4853.48	4859.74	0.000002	0.14	843.54	387.00	0.02
Kilpatrick Pond	2035.331	5 % Exc	268.00	4852.06	4859.77	4854.03	4859.77	0.000010	0.32	856.39	387.00	0.04
Kilpatrick Pond	2035.331	1.5 YR	266.00	4852.06	4859.78	4854.03	4859.78	0.000009	0.31	860.17	387.00	0.04
Kilpatrick Pond	2035.331	95 % Exc-no dam	117.00	4852.06	4855.43	4853.48	4855.45	0.000130	1.16	100.63	43.58	0.13
Kilpatrick Pond	2035.331	5 % Exc-no dam	268.00	4852.06	4856.43	4854.03	4856.48	0.000222	1.83	146.38	47.43	0.18
Kilpatrick Pond	2035.331	1.5 YR-no dam	266.00	4852.06	4856.51	4854.03	4856.56	0.000203	1.77	150.12	47.73	0.18
Kilpatrick Pond	1798.276	95 % Exc	117.00	4853.01	4859.74	4854.62	4859.74	0.000001	0.12	994.56	406.95	0.01
Kilpatrick Pond	1798.276	5 % Exc	268.00	4853.01	4859.77	4855.34	4859.77	0.000006	0.27	1007.48	407.08	0.03
Kilpatrick Pond	1798.276	1.5 YR	266.00	4853.01	4859.78	4855.33	4859.78	0.000006	0.26	1011.45	407.12	0.03
Kilpatrick Pond	1798.276	95 % Exc-no dam	117.00	4853.01	4855.20	4854.62	4855.35	0.002293	3.16	37.01	30.60	0.51
Kilpatrick Pond	1798.276	5 % Exc-no dam	268.00	4853.01	4856.11	4855.34	4856.35	0.001967	3.88	69.02	37.04	0.50
Kilpatrick Pond	1798.276	1.5 YR-no dam	266.00	4853.01	4856.24	4855.33	4856.44	0.001588	3.62	73.58	37.35	0.45

Reference: Model output obtained from HEC-RAS v4.1.0

HEC-RAS Results
Proposed Conditions Output Table

Silver Creek Kilpatrick Pond Design
Blaine County, Idaho

GEOENGINEERS

Figure D-14

Reach	River Sta	Profile	Q Total	Min Ch El	W.S. Elev	Crit W.S.	E.G. Elev	E.G. Slope	Vel Chnl	Flow Area	Top Width	Froude # Chl
			(cfs)	(ft)	(ft)	(ft)	(ft)	(ft/ft)	(ft/s)	(sq ft)	(ft)	
Kilpatrick Pond	1653.968	95 % Exc	117.00	4852.27	4859.73	4854.22	4859.74	0.000007	0.23	499.78	258.53	0.03
Kilpatrick Pond	1653.968	5 % Exc	268.00	4852.27	4859.76	4855.00	4859.77	0.000033	0.53	506.99	259.89	0.07
Kilpatrick Pond	1653.968	1.5 YR	266.00	4852.27	4859.77	4854.98	4859.78	0.000032	0.52	509.53	260.37	0.07
Kilpatrick Pond	1653.968	95 % Exc-no dam	117.00	4852.27	4854.87	4854.22	4855.03	0.002196	3.20	36.54	28.08	0.49
Kilpatrick Pond	1653.968	5 % Exc-no dam	268.00	4852.27	4855.79	4855.00	4856.04	0.002283	3.99	67.20	38.28	0.53
Kilpatrick Pond	1653.968	1.5 YR-no dam	266.00	4852.27	4856.01	4854.98	4856.20	0.001633	3.51	75.80	40.68	0.45
Kilpatrick Pond	1650	95 % Exc	117.00	4852.10	4859.73	4852.51	4859.73	0.000000	0.05	2531.26	484.13	0.00
Kilpatrick Pond	1650	5 % Exc	268.00	4852.10	4859.77	4852.73	4859.77	0.000000	0.11	2545.93	485.13	0.01
Kilpatrick Pond	1650	1.5 YR	266.00	4852.10	4859.77	4852.73	4859.77	0.000000	0.10	2550.67	485.45	0.01
Kilpatrick Pond	1650	95 % Exc-no dam	117.00	4852.10	4854.98	4852.51	4854.98	0.000004	0.19	627.77	315.87	0.02
Kilpatrick Pond	1650	5 % Exc-no dam	268.00	4852.10	4855.97	4852.73	4855.97	0.000006	0.28	954.40	347.44	0.03
Kilpatrick Pond	1650	1.5 YR-no dam	266.00	4852.10	4856.15	4852.73	4856.15	0.000005	0.26	1017.35	353.20	0.03
Kilpatrick Pond	1066.511	95 % Exc	82.00	4854.00	4859.73	4854.63	4859.73	0.000010	0.49	166.17	29.00	0.04
Kilpatrick Pond	1066.511	5 % Exc	233.00	4854.00	4859.73	4855.26	4859.76	0.000085	1.40	166.17	29.00	0.10
Kilpatrick Pond	1066.511	1.5 YR	266.00	4854.00	4859.73	4855.37	4859.77	0.000110	1.60	166.17	29.00	0.12
Kilpatrick Pond	1066.511	95 % Exc-no dam	82.00	4854.00	4854.63	4854.63	4854.94	0.011096	4.48	18.31	29.00	0.99
Kilpatrick Pond	1066.511	5 % Exc-no dam	233.00	4854.00	4855.26	4855.26	4855.89	0.009469	6.38	36.52	29.00	1.00
Kilpatrick Pond	1066.511	1.5 YR-no dam	266.00	4854.00	4855.37	4855.37	4856.07	0.009350	6.68	39.80	29.00	1.01

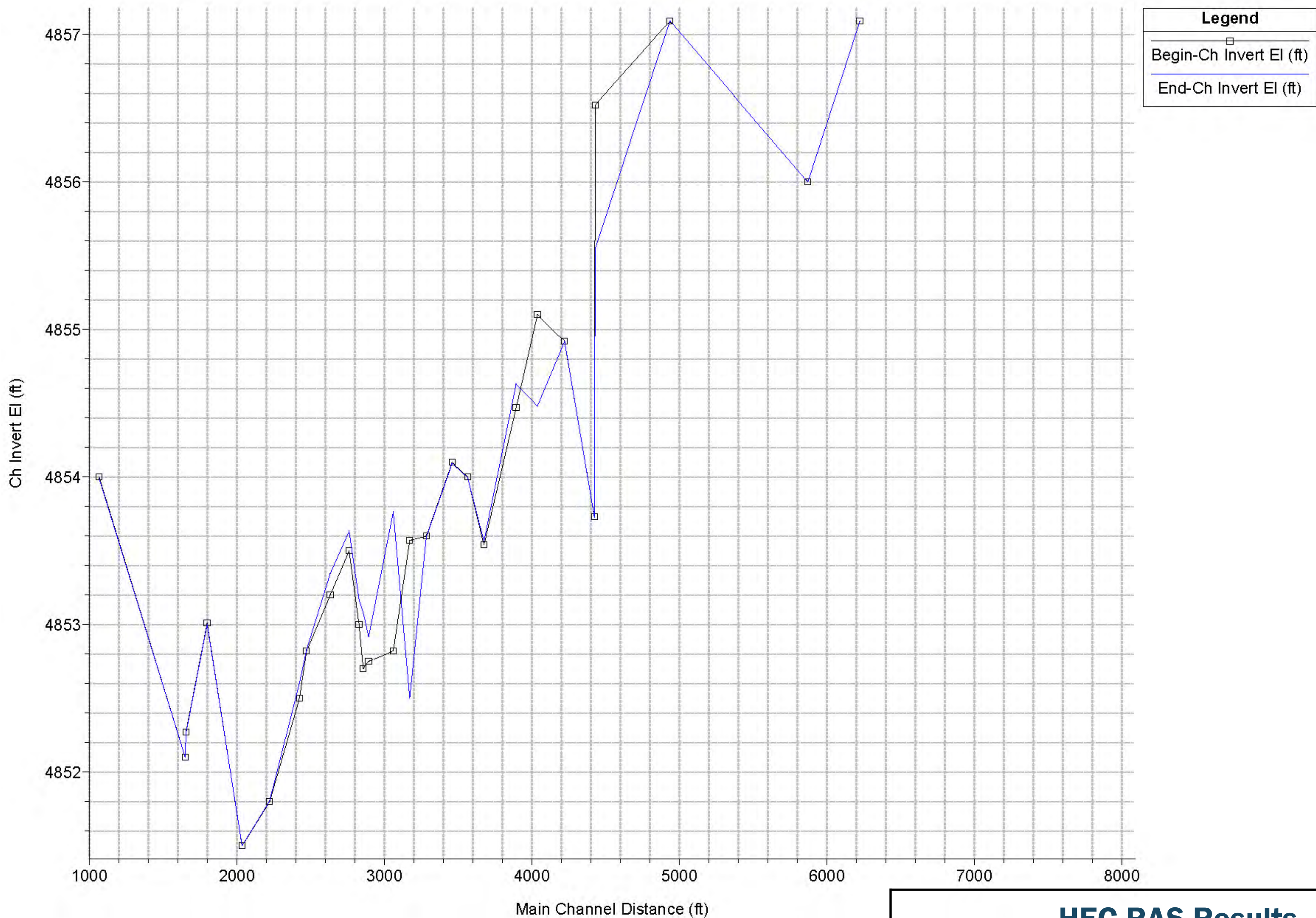
Reference: Model output obtained from HEC-RAS v4.1.0

HEC-RAS Results
Proposed Conditions Output Table

Silver Creek Kilpatrick Pond Design
Blaine County, Idaho

GeoEngineers

Figure D-15



Reference: Model output obtained from HEC-RAS v41.0

HEC-RAS Results Sediment Transport Channel Profile	
Silver Creek Kilpatrick Pond Design Blaine County, Idaho	
GEOENGINEERS	Figure D-16

Appendix E
Construction Quantities and Cost Estimate

Cost Estimate: Conceptual Design

Project: Kilpatrick Pond - Silver Creek
Project Number: 11130-011-01

Analyst: R. Carnie
Latest Revision: 8/6/2012

Workbook Description

- This wookbook contains spreadsheets that facilitate the analysis and/or design of this project.
- This spreadsheet lists the general project and workbook information that is consistent throughout the workbook.
- It also lists the titles of the spreadsheets contained in this workbook.
- This workbook is intended for use with ENGLISH UNITS.

Filename: *C:\Documents and Settings\jfealko\My Documents\SharePoint Drafts\[Kilpatrick Pond Cost Estimate.xlsx]Intro*

Sheet Titles:

Cost Estimate: Conceptual Design
Unit Costs
Preliminary Construction Cost Estimate

Unit Costs

Project: Kilpatrick Pond - Silver Creek
Analyst: R. Carnie
Project Number: 11130-011-01
Latest Revision: 8/6/2012

- This spreadsheet calculates the costs associated with site preparation. Unit costs include materials, labor, equipment, overhead and contractor profit.
- Reference used for "unit costs" include:
  (1) R.S. Means Heavy Construction Cost Data Manual, 2004 (Means)
  (2) Engineering Experience & Recent Similar Projects
  (3) Contractor or Supplier
- Inflation adjustment is a rough estimate using an annual average of 3 percent.
- Additional adjustments are based on engineering judgement, experience and site-specific degree of difficulty.
- Blank rows are provided at the bottom for additional items. Add new items & unit costs on this sheet, if necessary. These will be used to calculate costs on subsequent sheets.
- General mark-up percentages are also provided at the bottom.

26 = Adjustment for inflation from to 2004 to 2012 (Construction) (%)
-8 = Location Factor (Boise) (%)

Item #	Item Description	Ref. ID	Ref. #	Page #	Units	Unit Cost ($)	Inflation & Location Adjustments (%)	Additional Adjustments (%)	Adjusted Unit Price ($)
1	Mobilization	2			LS	15000	0	0	15000.00
2	Mobilization (Dredging)	1	0235-250-0020		LS	12000	18	0	14160.00
3	Construction Staking	3			Day	1000	0	0	1000.00
4	Erosion and Sediment Control with ESCP	2			LS	5000	0	0	5000.00
5	Clear and Grub Bank & Floodplain Area	2			Acre	885	0	0	885.00
6	Dredge Upper Pond (Includes Settling Boom)	1	02325-250-1000	56	CY	8	18	0	9.26
7	Excavate Secondary & Tertiary Settling Pond for Upper Reach	2			CY	3	0	0	2.50
8	Pump Materials to Ponds for Upper Reach	1	01590-400-4200	23	Day	51	18	0	60.42
9	Dredge Lower Pond (Includes Settling Boom)	1	02325-250-1000	56	CY	8	18	0	9.26
10	Pump Materials to Ponds for Lower Reach	1	01590-400-4200	23	Day	51	18	0	60.42
11	Bank Retention Fence	2			FT	23	0	0	23.00
12	Inland Wetland Final Grading	2			SY	1	0	0	0.60
13	Shorthaul and Stockpile Wetland Fill Material	1	02315-490-0020	53	CY	3	18	0	3.54
14	Emergent Wetland Final Grading	2			SY	2	0	0	1.50
15	Wetland Plantings and Seeding (Acquire and install)	2			Acre	6000	0	0	6000.00
15	Upland Planting and Seedings (Acquire and plant)	2			Acre	2500	0	0	2500.00
16	Site Cleanup	2			LS	3000	0	0	3000.00
18							0	0	0.00
19							0	0	0.00
20							0	0	0.00
101	Taxes (as % of Construction Sub-Total)							0	
102	Incidentals not included in items above (as % of Construction Sub-Total)							10	
103	Contingency (as % of Construction Sub-Total)							15	
104	Permitting & Design (as % of Construction Sub-Total)							0	
105	Other (as % of Construction Sub-Total)							0	

Preliminary Construction Cost Estimate

Project: Kilpatrick Pond - Silver Creek — **Analyst:** R. Carnie

Project No: 11130-011-01 — **Latest Revision:** 8/6/2012

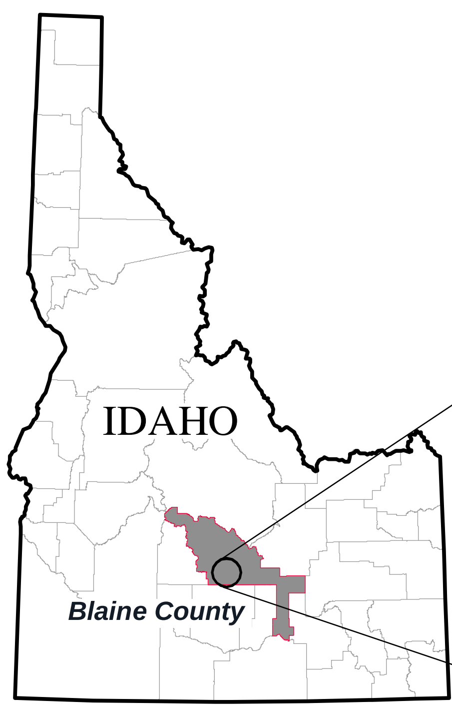
- This spreadsheet calculates the costs for the items noted.
- The unit costs are based upon those listed & calculated on the Unit Cost sheet.

Item #	Item Description	Units	Adjusted Unit Cost ($)	No. of Units	Cost per Item ($)
1	Mobilization	LS	15,000.00	1.0	15000
2	Mobilization (Dredging)	LS	14,160.00	1.0	14160
3	Construction Staking	Day	1,000.00	3.0	3000
4	Erosion and Sediment Control with ESCP	LS	5,000.00	1.0	5000
5	Clear and Grub Bank & Floodplain Area	Acre	885.00	5.5	4868
6	Dredge Upper Pond (Includes Settling Boom)	CY	9.26	7600.0	70399
7	Excavate Secondary & Tertiary Settling Pond for Upper Reach	CY	2.50	12700.0	31750
8	Pump Materials to Ponds for Upper Reach	Day	60.42	20.0	1208
9	Dredge Lower Pond (Includes Settling Boom)	CY	9.26	7500.0	69473
10	Pump Materials to Ponds for Lower Reach	Day	60.42	20.0	1208
11	Bank Retention Fence	FT	23.00	1600.0	36800
12	Inland Wetland Final Grading	SY	0.60	9200.0	5520
13	Shorthaul and Stockpile Wetland Fill Material	CY	3.54	11465.0	40586
14	Emergent Wetland Final Grading	SY	1.50	13000.0	19500
15	Wetland Plantings and Seeding (Acquire and install)	Acre	6,000.00	5.5	33000
15	Upland Planting and Seedings (Acquire and plant)	Acre	2,500.00	8.6	21500
16	Site Cleanup	LS	3,000.00	1.0	3000
18					
19					
	Constrution Sub-Total				**$375,972**
101	Taxes (as % of Construction Sub-Total)			**0.0%**	$0
102	Incidentals not included in items above (as % of Construction Sub-Total)			**10.0%**	$37,597
103	Contingency (as % of Construction Sub-Total)			**15.0%**	$56,396
104	Permitting & Design (as % of Construction Sub-Total)			**0.0%**	$0
105	Other (as % of Construction Sub-Total)			**0.0%**	$0
	Final Construction Cost				**$469,964**

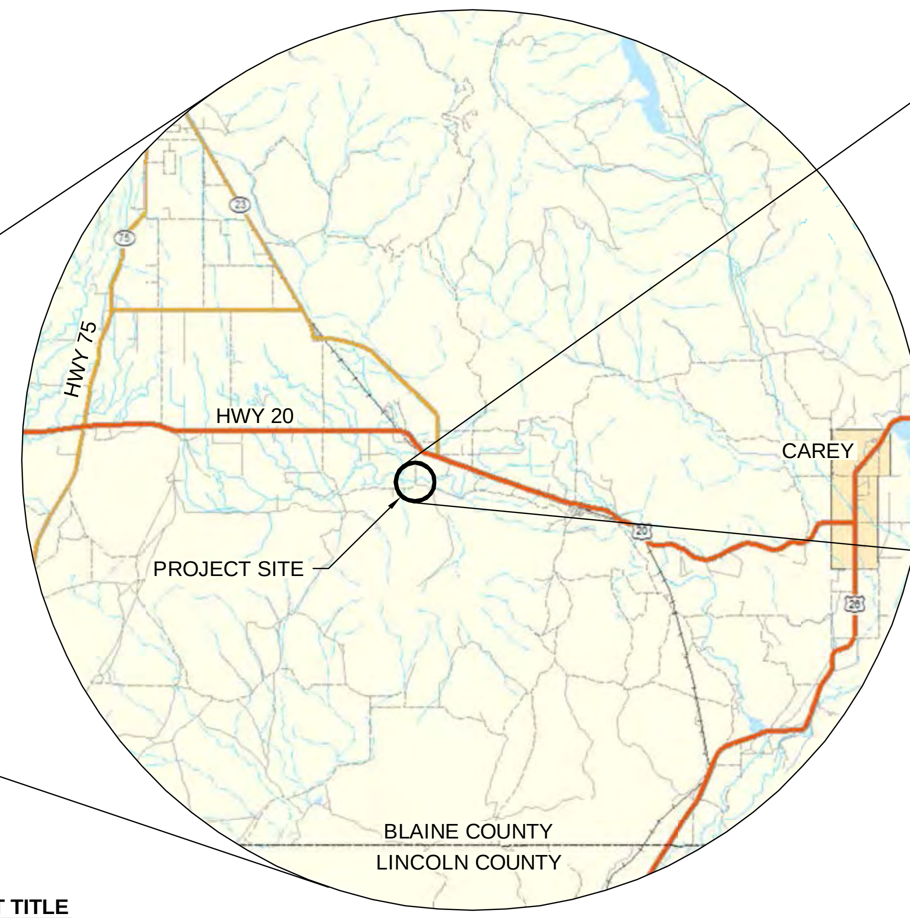
Appendix F
Kilpatrick Pond Enhancement Preliminary Design Drawings

SILVER CREEK

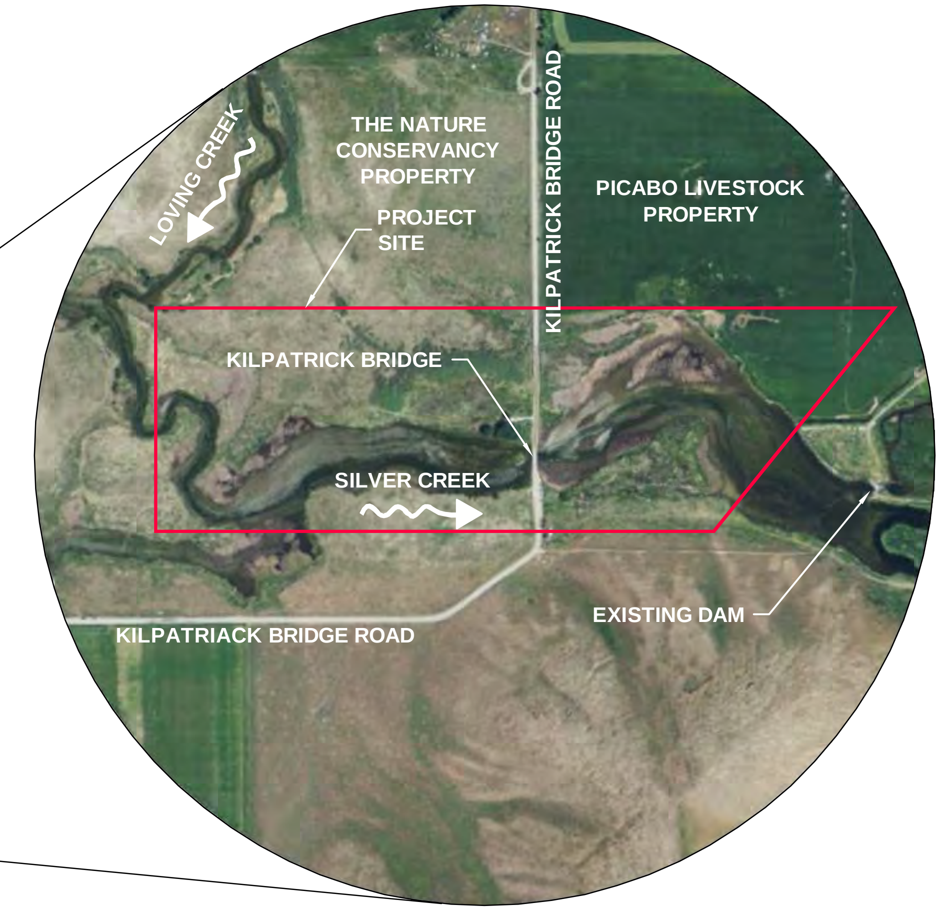
KILPATRICK POND ENHANCEMENT
PRELIMINARY DESIGN DRAWINGS



STATE MAP
NTS



REGION MAP
NTS



VICINITY MAP
NTS

NOTE: THE ROAD AND/OR BRIDGE IS THE PROPERTY BOUNDARY.

SHEET INDEX

Reference: Map data provided by ESRI Maps and Data. Aerial imagery provided by USDA.

CONTACT INFORMATION

GEOENGINEERS INC.
JEFF FEALKO, PE
1525 SOUTH DAVID LANE
BOISE, IDAHO 83705
PH: 208.258.8321
FAX: 208.433.8092

THE NATURE CONSERVANCY
DAYNA GROSS OR ART TALSMA
116 1ST AVE NORTH
HAILEY, IDAHO 83333
PH: 208-350-2204

PROJECT LOCATION:
FROM THE INTERSECTION OF U.S 20 AND IDAHO 75, HEAD EAST ON U.S. 20 TOWARD SILVER CREEK ROAD FOR 7.4 MILES. TURN RIGHT ONTO KILPATRICK BRIDGE ROAD AND TRAVEL 0.8 MILES TO KILPATRICK ROAD BRIDGE. PROJECT SITE IS WEST OF BRIDGE. PROJECT COORDINATES ARE 43°18'53"N, 114°08'08"W.

Revision No:	Date:	Description:	Initials:	
PRELIMINARY				Designed: JJF
NOT FOR CONSTRUCTION				Drawn: MGF
				Checked: MKH
				Date: 08/10/2012
				Project No: 11130-011-01

Silver Creek Blaine County, Idaho The Nature Conservancy	The Nature Conservancy Protecting nature. Preserving life.	GEOENGINEERS 1525 South David Lane Boise, Idaho 83705	Cover Sheet Kilpatrick Pond Enhancement Preliminary Design Drawings	Sheet 1.1

MKH : MGF

\\BOI\Projects\1\11130011\01\CAD\DWG\1113001101-S1.1.dwg\TAB:S1.1 modified on Aug 10, 2012 - 1:39pm

GENERAL NOTES:

1. These designs and drawings have been prepared for the exclusive use of The Nature Conservancy (TNC) and their authorized agents. No other party may rely on the product of our services unless GeoEngineers Inc. (GeoEngineers) agrees in writing in advance of such use.
2. The drawings contained within should not be applied for any purpose or project except the Silver Creek Restoration Project Creek as shown in the Project Area located on Sheet 1.
3. These designs and drawings are copyrighted by GeoEngineers, Inc. Any use, alteration, deletion, or editing of this document without explicit written permission from GeoEngineers, Inc. is strictly prohibited. Any other unauthorized use of this document is prohibited.
4. TNC is advised to contact and to obtain the necessary permits and approvals from all appropriate regulatory agencies (local, state, and federal) prior to construction.
5. Geomorphic conditions can change and these designs are based on conditions that existed at the time the design was performed. The results of these designs may be affected by the passage of time, by manmade events such as construction on or adjacent to the site, or by natural events such as floods, earthquakes, slope instability or groundwater fluctuations. Always contact GeoEngineers before applying these designs to determine if they remain applicable.
6. All rivers, streams, rocks and woody habitat structures are potentially dangerous. These proposed creek improvements are intended to address a wide variety of constraints which target more naturally functioning stream systems and habitat; they are inherently dangerous to people in or around the pond and stream. TNC and the property owner should address safety concerns appropriately.
7. Potential regulatory changes to flood elevations and flood extents resulting from the proposed enhancements have not been addressed by GeoEngineers as part of this project.
8. In general, the proposed enhancements are intended to result in more stable streambeds, banks and floodplains. However, channel erosion, channel migration and/or avulsions can be expected to occur over time. These channel processes are natural and appropriate for these stream systems.
9. Design specifics for bank typical structures shall be confirmed and/or verified by a qualified engineer prior to or during construction at each proposed structure location.
10. These figures were originally produced in color.
11. Horizontal datum based on Idaho State Plane Coordinate System, NAD83(1992), Central Zone in US Survey Feet. Vertical datum based on an assumed elevation of 4861.00 at an Aluminum Cap that has been used since 1997 at the site. Location of Aluminum Cap is shown on Sheet 2.1.

GENERAL CONSTRUCTION NOTES:

1. All contractors working within the project boundaries are responsible for compliance with all applicable safety laws. The contractor shall be responsible for all barricades, safety devices and control of traffic within and around the construction area.
2. All material and workmanship furnished on or for the project must meet the minimum requirements of project permits, approving agencies, specifications as set forth herein, or whichever is more restrictive.
3. Contractor shall not work within any wetland area until the owner has obtained a 404 permit from the United States Army Corps of Engineers. All work within or adjacent to any wetland area shall comply with the conditions of the 404 permit.
4. Contractor shall obtain a short-term activity exemption from the Idaho Department of Environmental Quality prior to any dewatering activities.
5. The contractor shall install and maintain appropriate sediment control devices throughout the whole project site, including those associated with construction access, staging and stockpile areas throughout the project's construction period. Temporary construction and permanent erosion control measures shall be designed, constructed and maintained in accordance with all applicable local, state and federal regulations.
6. Construction activity shall be limited to the construction areas and access routes to minimize disturbance of the existing vegetation and landscape. All public and private property either inside or outside the construction limits impacted by construction shall be restored to a condition equal to or better than that which existed prior to the construction. No construction-related materials, debris, garbage, equipment, fuel, provisions of any kind shall remain on site after construction. No stockpiles or excavations are to remain after construction unless authorized by the landowner. The site will be graded to appear natural and conform to the natural topography.
7. Construction shall minimize disturbance to, and maximize reuse of, existing riparian vegetation to remain and salvage.
8. Only appropriate approved native riparian vegetation shall be used for cuttings and transplanting. Vegetation cutting, transplanting, planting and irrigation shall be managed by an appropriate professional.
9. Cuttings and transplants shall be installed immediately or stockpiled appropriately to ensure viability. All acceptable existing vegetation to be disturbed shall be transplanted as described on Sheet 7.3.
10. Construction records and as-built information shall be accurately recorded by the contractor and supplied to the owner and GeoEngineers for future use, reference and monitoring. Submittal of record information is a condition of final acceptance.
11. This design has been performed and these plans have been prepared with the express understanding that GeoEngineers will provide guidance to the contractor during construction.
12. The long-term success of this project relies upon the success of the proposed vegetation. The vegetation and disturbed project site must be monitored and maintained to promote vigorous revegetation.

LEGEND:

TP-2 TEST PIT BY GEOENGINEERS

PROJECT BENCHMARK

4860 EXISTING MAJOR CONTOUR

EXISTING MINOR CONTOUR

EXISTING SILVER CREEK CENTERLINE

1.5-YEAR WSEL WITH DAM

1.5-YEAR WSEL WITHOUT DAM

EXISTING SILT DEPOSITS (PROFILE VIEW)

EXISTING GRAVEL BOTTOM (PROFILE VIEW)

PROPOSED GRADE (PROFILE VIEW)

PROPOSED DREDGE AREA (PROFILE VIEW)

PROPOSED CUT AREA (PROFILE VIEW)

PROPOSED FILL AREA (PROFILE VIEW)

PROPOSED WETLAND AREA

EXISTING TOP OF BANK

PROPOSED BANK RETENTION FENCE

PROPOSED COIR LOG BANK TREATMENT

PROPOSED NEW WETLANDS

PROPOSED WETLAND ENHANCEMENT AREA

EXISTING WETLANDS TO REMAIN

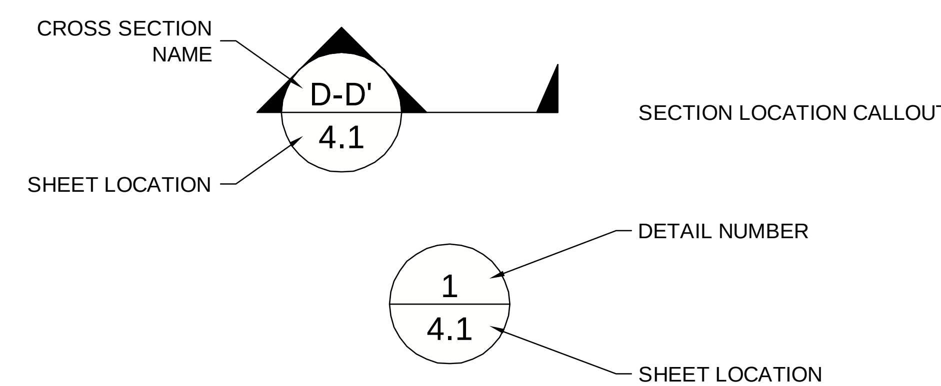
EMERGENT WETLAND (1.9 AC)

SCRUB/SHRUB WETLAND (2.5 AC)

FORESTED WETLAND (1.2 AC)

UPLAND (10.4 AC)

WSEL	WATER SURFACE ELEVATION
TYP	TYPICAL
FT	FEET
ELEV	ELEVATION
Horiz.	HORIZONTAL
Vert.	VERTICAL
ML	INORGANIC SILTS, ROCK FLOUR, CLAYEY SILTS
SM	SILTY SANDS, SAND-SILT MIX
GP	POORLY GRADED GRAVELS, GRAVEL-SAND MIX
GM	SILTY GRAVELS, GRAVEL-SAND-SILT MIX
SP	POORLY GRADED SANDS, GRAVELLY SAND
SM	SILTY SANDS, SAND-SILT MIX
MIN	MINIMUM
MAX	MAXIMUM
NTS	NOT TO SCALE
AC	ACRES
℄	CHANNEL THALWEG (SECTION VIEW)



Revision No:	Date:	Description:	Initials:	
PRELIMINARY				Designed: JJF
NOT FOR CONSTRUCTION				Drawn: MGF
				Checked: MKH
				Date: 08/10/2012
				Project No: 11130-011-01

Silver Creek
Blaine County, Idaho

The Nature Conservancy

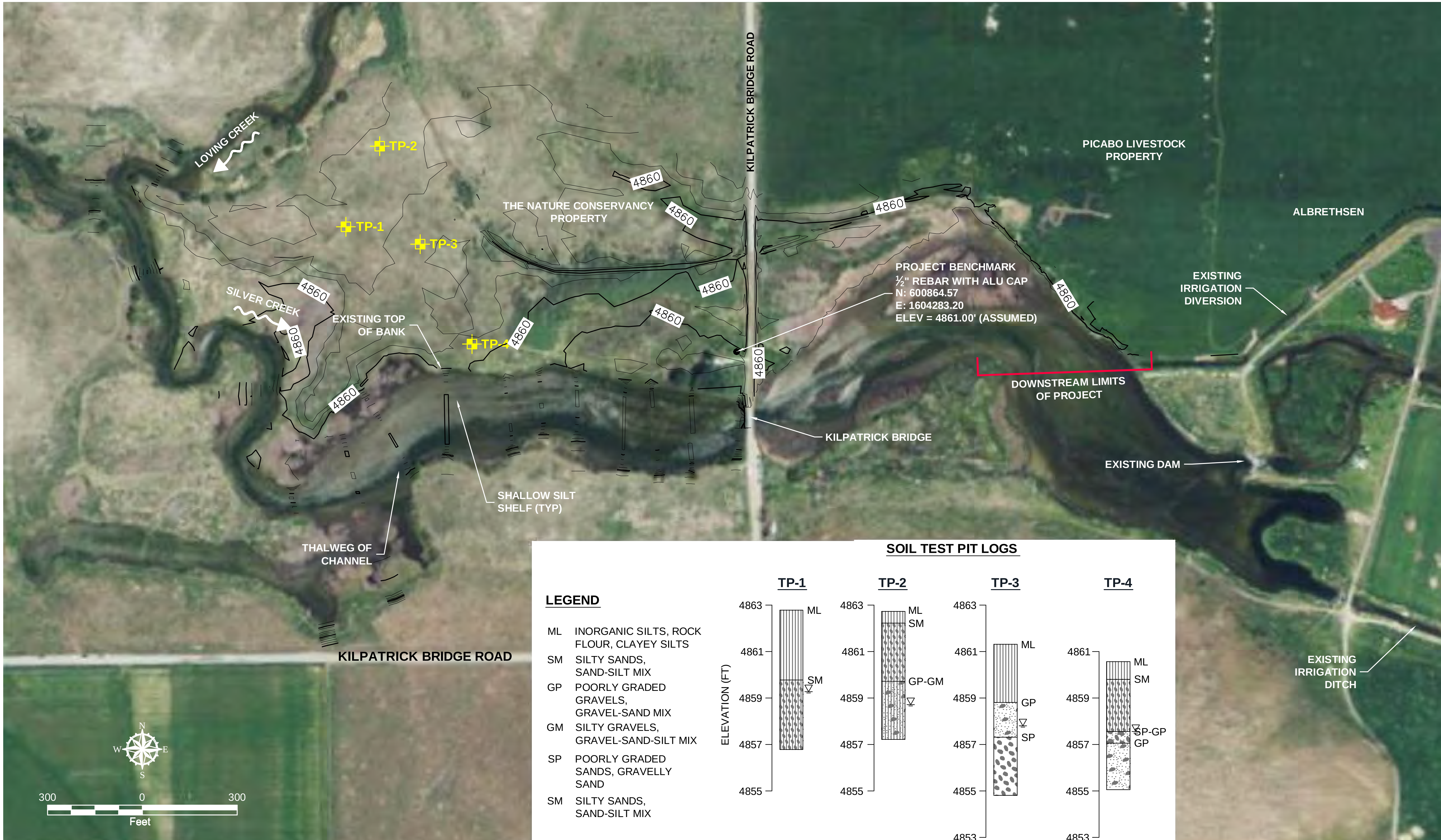
The Nature Conservancy
Protecting nature. Preserving life.

GEOENGINEERS
1525 South David Lane
Boise, Idaho 83705

General Notes and Legend

Kilpatrick Pond Enhancement
Preliminary Design Drawings

Sheet **1.2**



Reference: Base map data, dated 04/26/2012, provided by Alpine Enterprises Inc., 2011 aerial imagery provided by USDA. Contour data in creek are approximate and incomplete.

Revision No:	Date:	Description:	Initials:	
PRELIMINARY				Designed: JJF
NOT FOR CONSTRUCTION				Drawn: MGF
				Checked: MKH
				Date: 08/10/2012
				Project No: 11130-011-01

Silver Creek
Blaine County, Idaho

The Nature Conservancy

The Nature Conservancy
Protecting nature. Preserving life.

GEOENGINEERS
1525 South David Lane
Boise, Idaho 83705

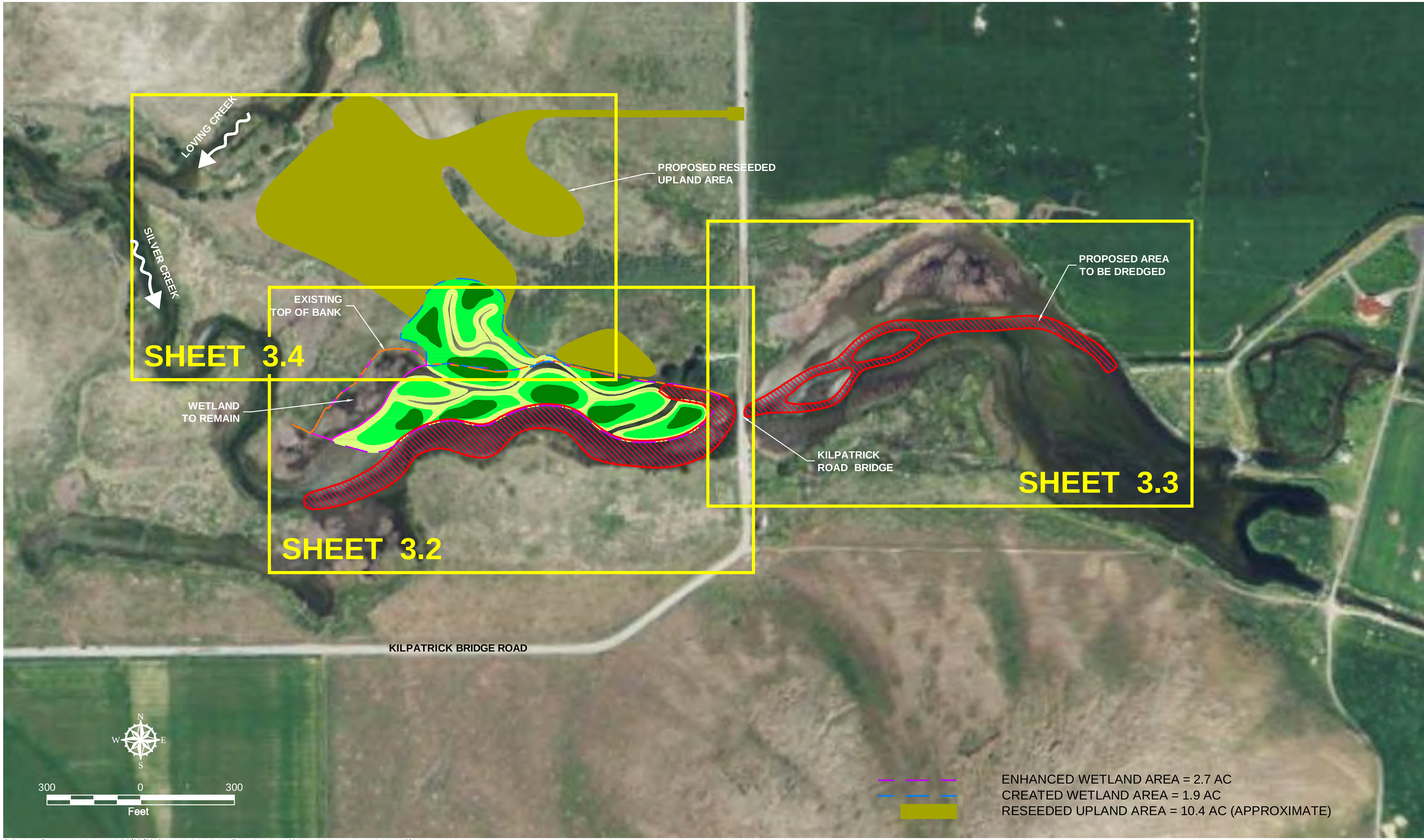
Existing Conditions

Kilpatrick Pond Enhancement
Preliminary Design Drawings

Sheet
2.1

MKH : MGF

\\BOI\Projects\11\11130011\01\CAD\DWG\1113001101-S2.1.dwg\TAB:S2.1 modified on Aug 10, 2012 - 1:43pm



Reference: Base map data, dated 04/26/2012, provided by Alpine Enterprises Inc.. 2011 aerial imagery provided by USDA.

Revision No:	Date:	Description:	Initials:	Designed: JJF
PRELIMINARY				Drawn: MGF
NOT FOR CONSTRUCTION				Checked: MKH
				Date: 08/10/2012
				Project No: 11130-011-01

Silver Creek
Blaine County, Idaho

The Nature Conservancy

The Nature Conservancy
Protecting nature. Preserving life.

GeoEngineers
1525 South David Lane
Boise, Idaho 83705

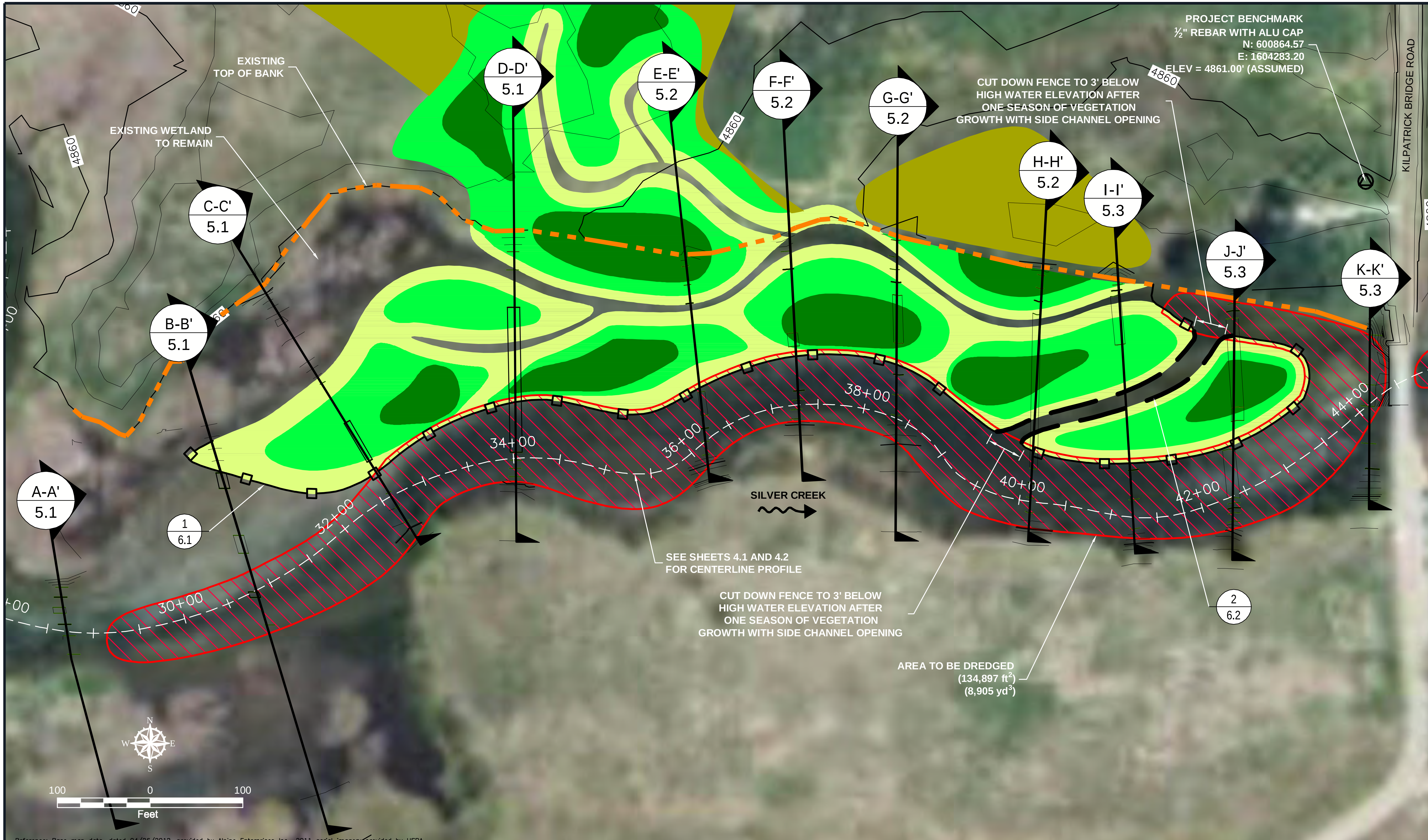
Proposed Conditions Overview & Sheet Index

Kilpatrick Pond Enhancement
Preliminary Design Drawings

Sheet
3.1

MKH : MGF

\\BOI\Projects\11\1113001101\CAD\DWG\1113001101-S3.1.dwg\TAB:S3.1 modified on Aug 10, 2012 - 12:53pm



Reference: Base map data, dated 04/26/2012, provided by Alpine Enterprises Inc., 2011 aerial imagery provided by USDA.

MKH : MGF

\BOI\Projects\11\1113001101\CAD\DWG\1113001101-S3.X.dwg\TAB:S3.2 modified on Aug 10, 2012 - 1:45pm

Revision No:	Date:	Description:	Initials:	
PRELIMINARY				Designed: JJF
NOT FOR CONSTRUCTION				Drawn: MGF
				Checked: MKH
				Date: 08/10/2012
				Project No: 11130-011-01

Silver Creek
Blaine County, Idaho

The Nature Conservancy

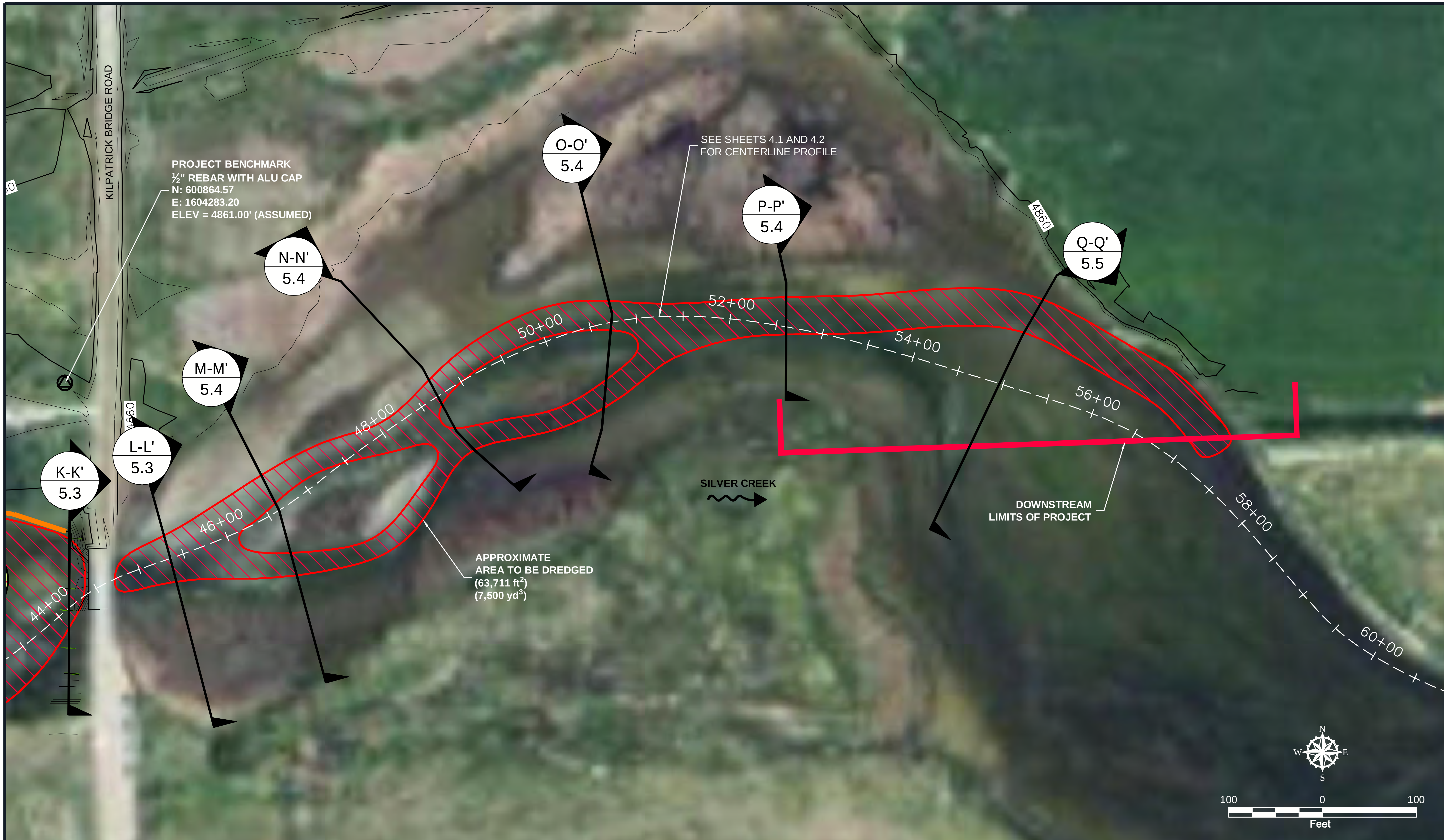
The Nature Conservancy
Protecting nature. Preserving life.

GEOENGINEERS
1525 South David Lane
Boise, Idaho 83705

Proposed Conditions

Kilpatrick Pond Enhancement
Preliminary Design Drawings

Sheet
3.2



Reference: Base map data, dated 04/26/2012, provided by Alpine Enterprises Inc.. 2011 aerial imagery provided by USDA.

MKH : MGF

\BOI\Projects\1\11130011\01\CAD\DWG\1113001101-S3.X.dwg\TAB:S3.3 modified on Aug 10, 2012 - 1:45pm

Revision No:	Date:	Description:	Initials:	
PRELIMINARY				Designed: JJF
NOT FOR CONSTRUCTION				Drawn: MGF
				Checked: MKH
				Date: 08/10/2012
				Project No: 11130-011-01

Silver Creek
Blaine County, Idaho

The Nature Conservancy

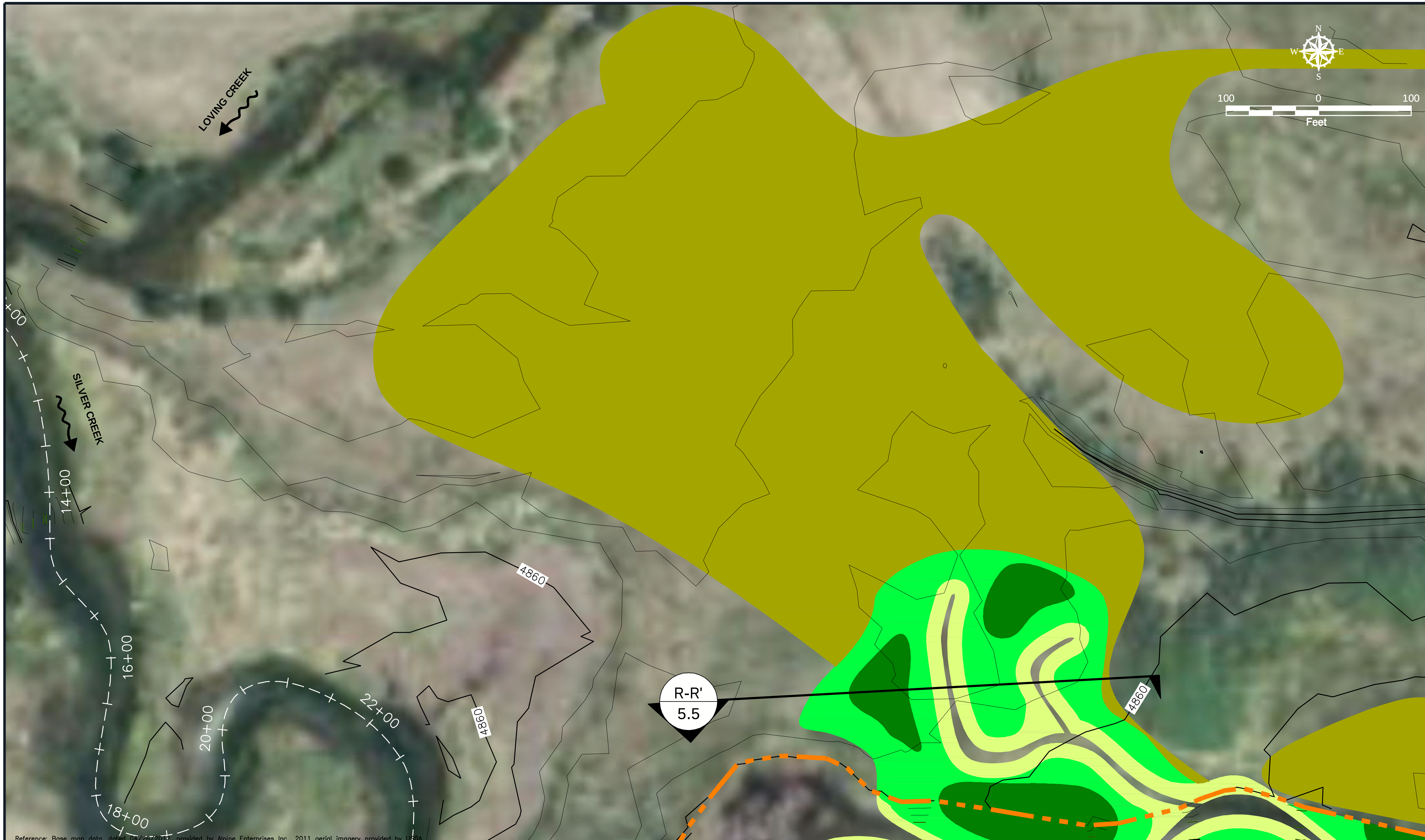
The Nature Conservancy
Protecting nature. Preserving life.

GEOENGINEERS
1525 South David Lane
Boise, Idaho 83705

Proposed Conditions

Kilpatrick Pond Enhancement
Preliminary Design Drawings

Sheet
3.3



Revision No:	Date:	Description:	Initials:	Designed: JJF
PRELIMINARY				Drawn: MGF
NOT FOR CONSTRUCTION				Checked: MKH
				Date: 08/10/2012
				Project No: 11130-011-01

Silver Creek
Blaine County, Idaho

The Nature Conservancy

The Nature Conservancy
Protecting nature. Preserving life.

GEOENGINEERS
1525 South David Lane
Boise, Idaho 83705

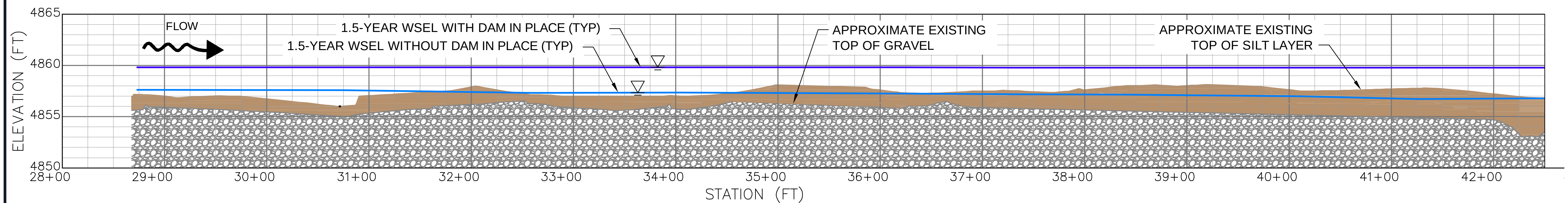
Proposed Conditions

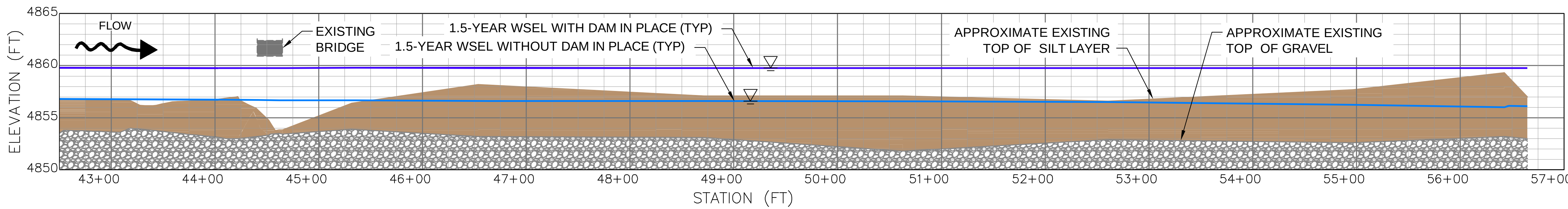
Kilpatrick Pond Enhancement
Preliminary Design Drawings

Sheet
3.4

MKH : MGF

\\BOI\Projects\11\11130011\01\CAD\DWG\11130011\01-S3.X.dwg\TAB:S3.4 modified on Aug 10, 2012 - 1:45pm





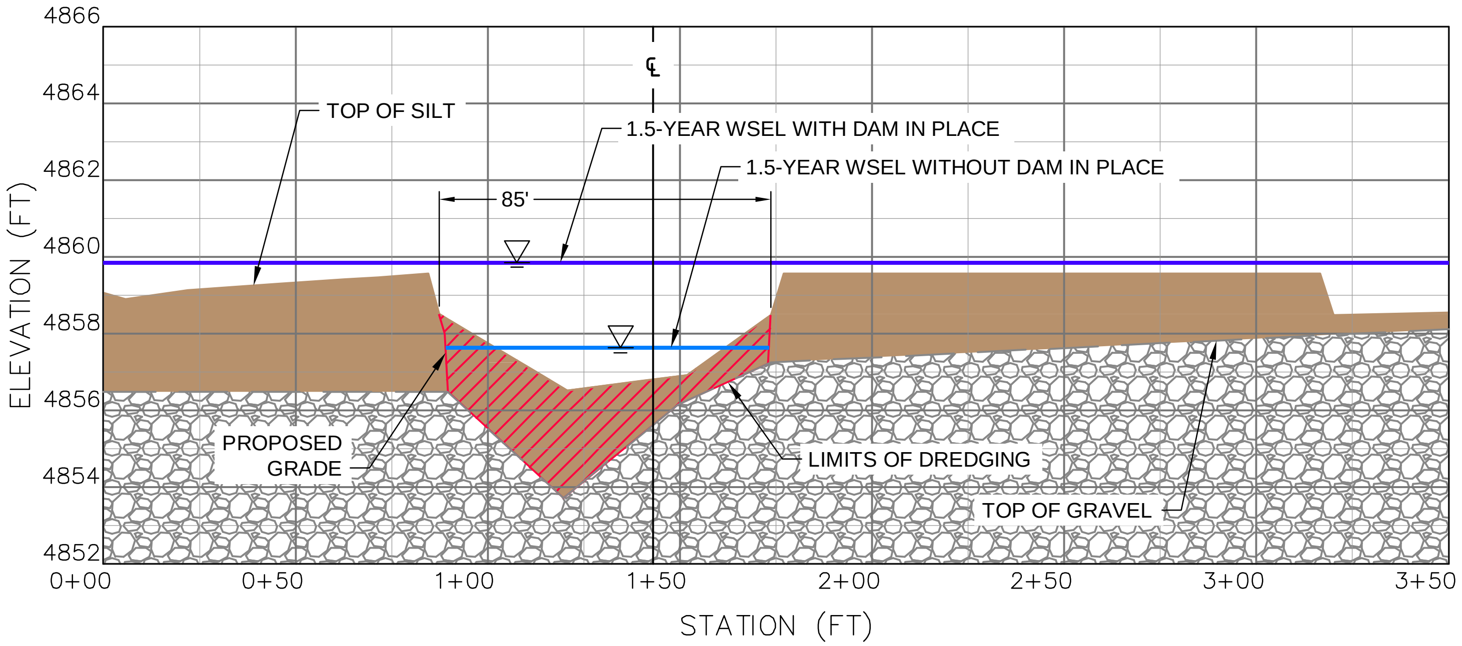
1 CHANNEL PROFILE

Horiz. Scale: 1:100, Vert. Scale: 1:10

MKH : MGF

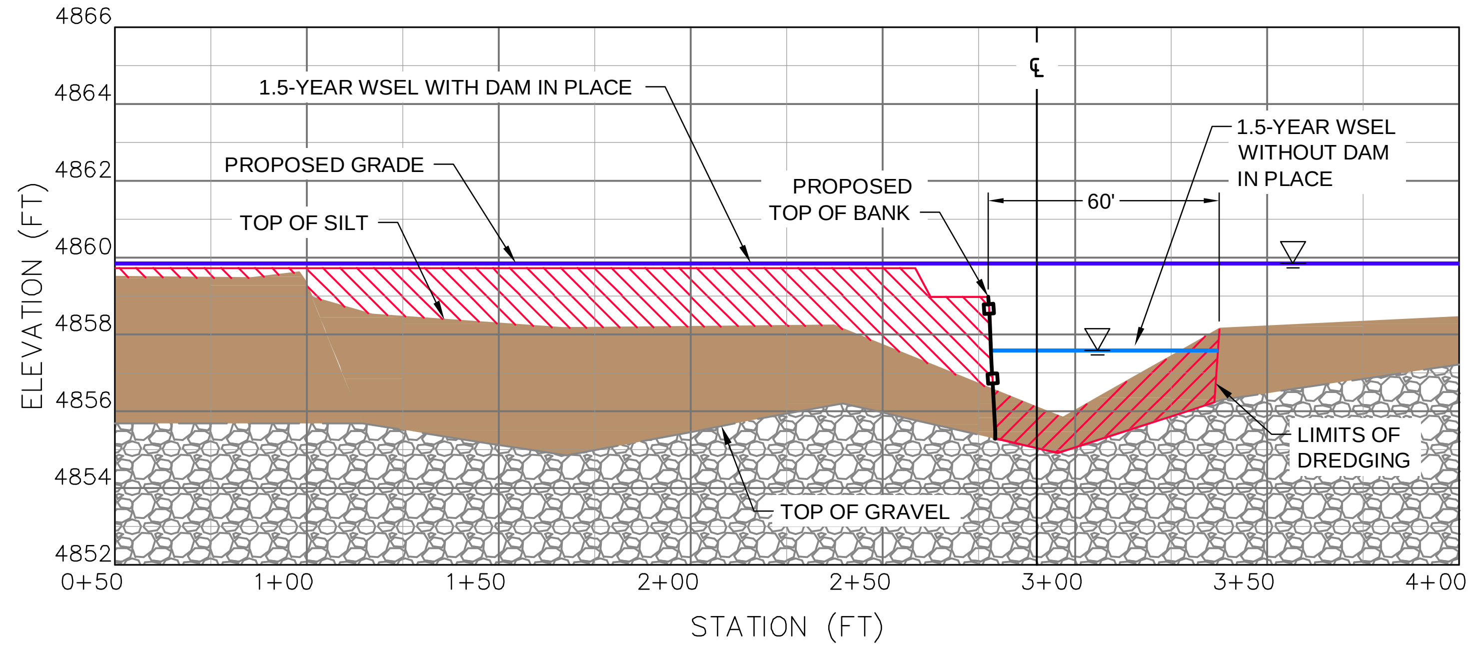
\BOI\Projects\11\11130011101\CAD\DWG\11130011101-S4.X.dwg\TAB:S4.1 modified on Aug 08, 2012 - 4:16pm

Revision No:	Date:	Description:	Initials:						
PRELIMINARY NOT FOR CONSTRUCTION				Designed: JJF Drawn: MGF Checked: MKH Date: 08/10/2012 Project No: 11130-011-01	Silver Creek Blaine County, Idaho The Nature Conservancy	The Nature Conservancy Protecting nature. Preserving life.	GEOENGINEERS 1525 South David Lane Boise, Idaho 83705	Channel Profile Kilpatrick Pond Enhancement Preliminary Design Drawings	Sheet 4.1



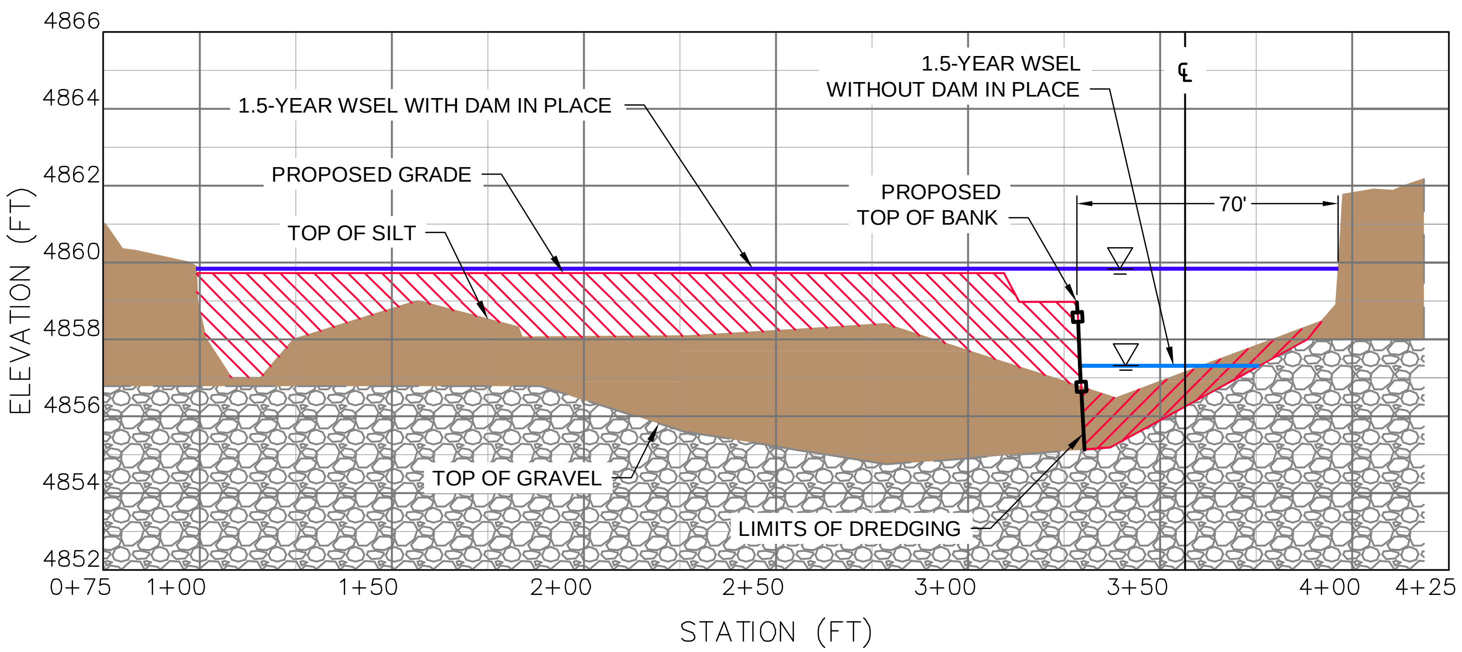
A CROSS SECTION A-A'

Horiz. Scale: 1:50, Vert. Scale: 1:5



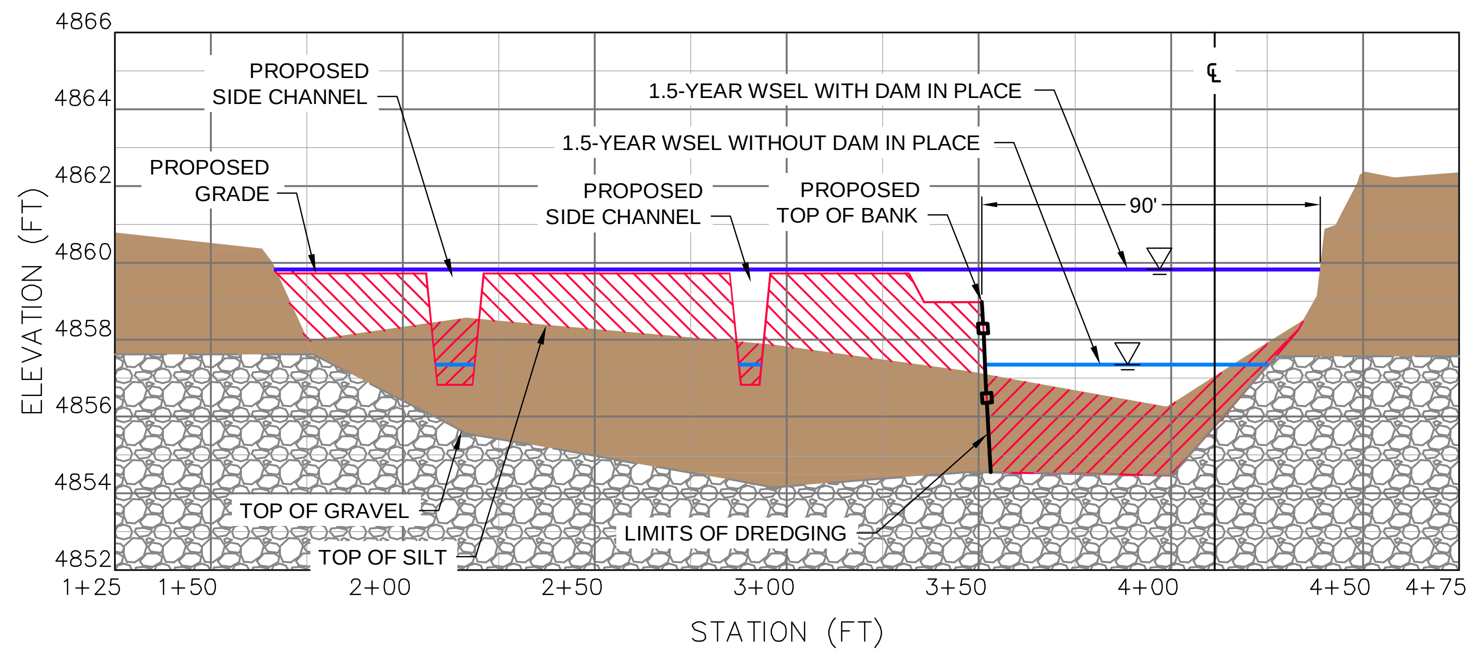
B CROSS SECTION B-B'

Horiz. Scale: 1:50, Vert. Scale: 1:5



C CROSS SECTION C-C'

Horiz. Scale: 1:50, Vert. Scale: 1:5



D CROSS SECTION D-D'

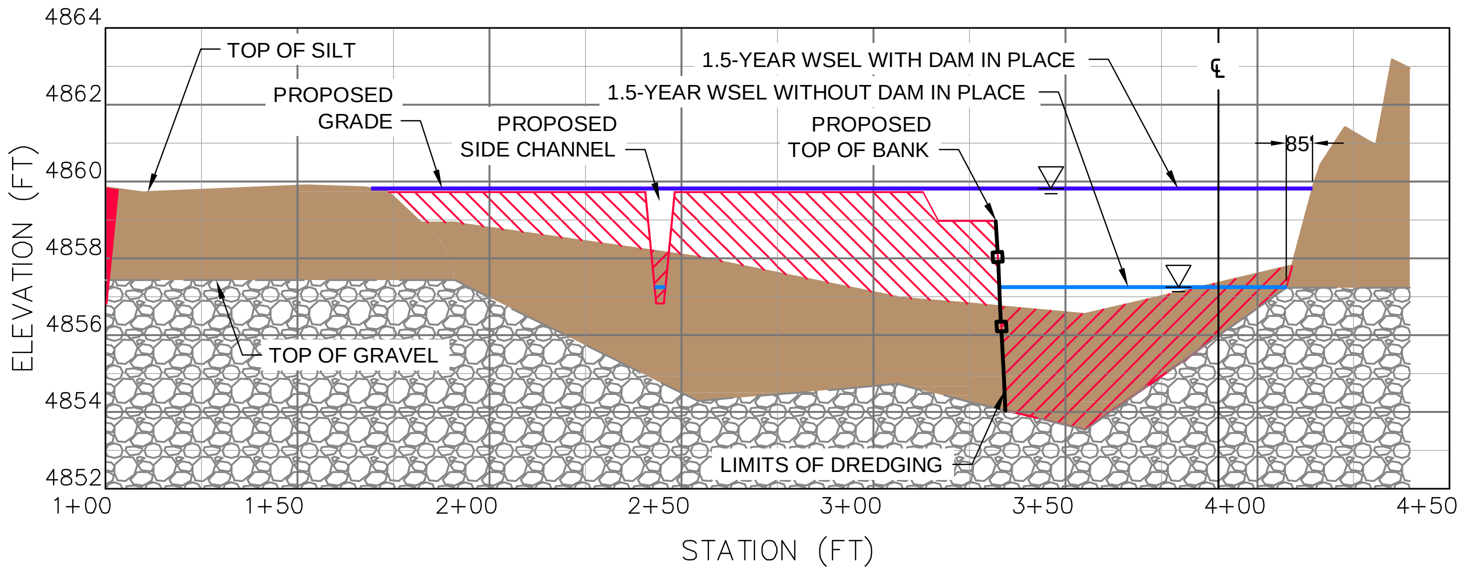
Horiz. Scale: 1:50, Vert. Scale: 1:5

NOTE: CHANNEL DIMENSIONS ARE APPROXIMATE AND HAVE BEEN ROUNDED TO THE NEAREST 5-FOOT MARK.

Revision No:	Date:	Description:	Initials:					
PRELIMINARY NOT FOR CONSTRUCTION				Designed: JJF Drawn: MGF Checked: MKH Date: 08/10/2012 Project No: 11130-011-01	Silver Creek Blaine County, Idaho The Nature Conservancy	The Nature Conservancy Protecting nature. Preserving life.	GeoEngineers 1525 South David Lane Boise, Idaho 83705	**Cross Sections** Kilpatrick Pond Enhancement Preliminary Design Drawings	**Sheet** **5.1**

MKH : MGF

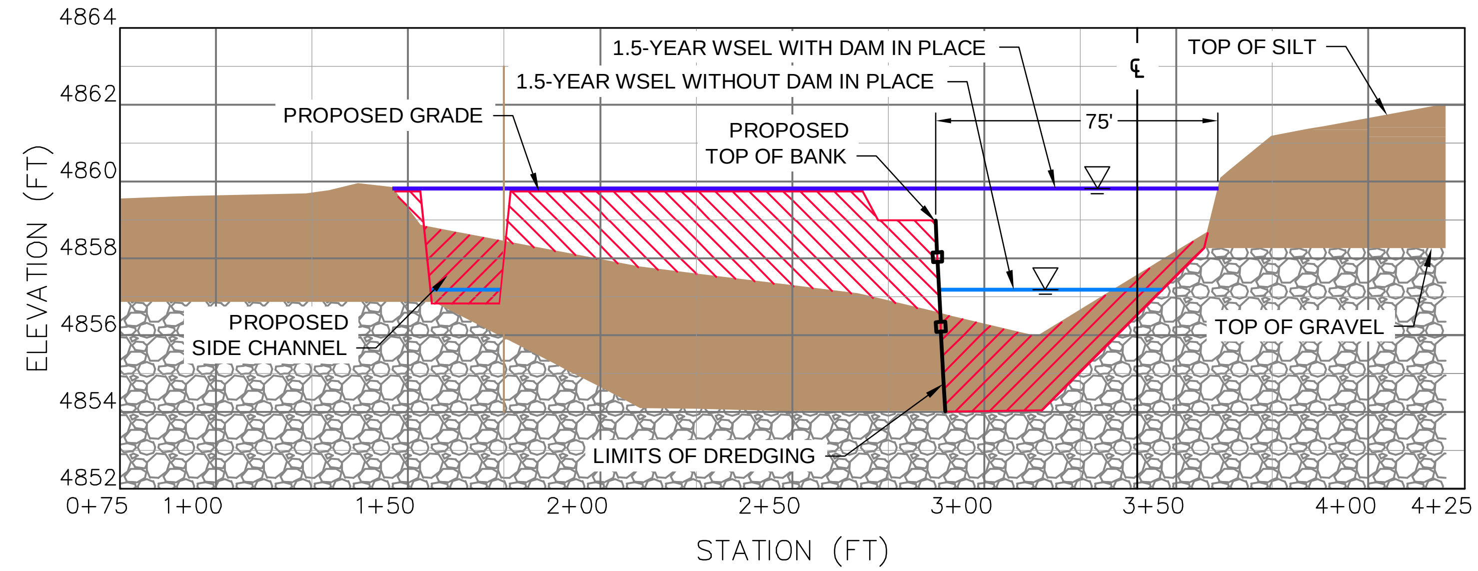
\BOI\Projects\11\11130011101\CAD\DWG\11130011101-S5.X.dwg\TAB:S5.1 modified on Aug 10, 2012 - 11:27am



E

CROSS SECTION E-E'

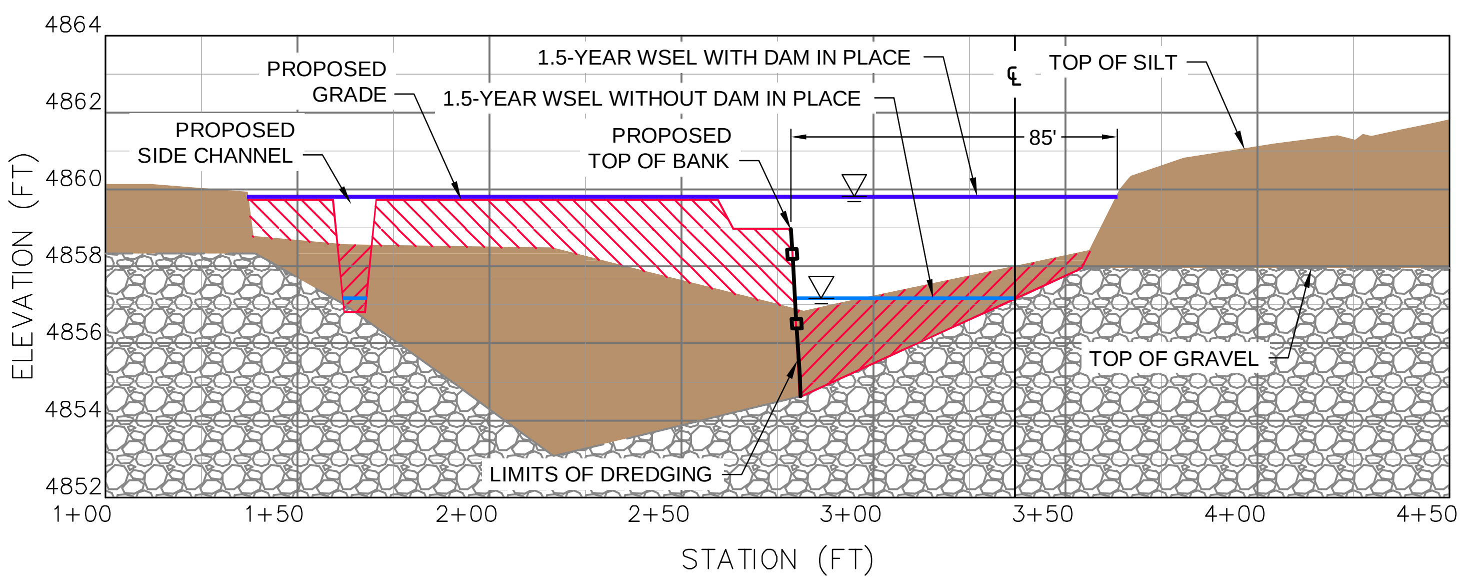
Horiz. Scale: 1:50, Vert. Scale: 1:5



F

CROSS SECTION F-F'

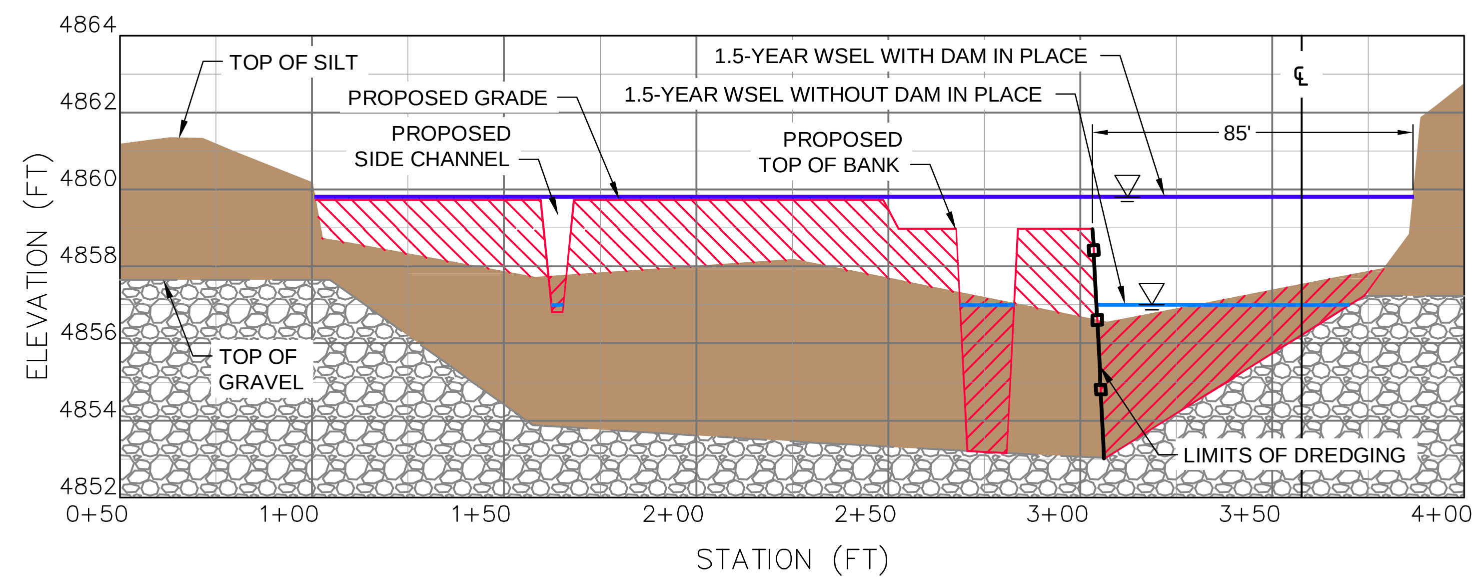
Horiz. Scale: 1:50, Vert. Scale: 1:5



G

CROSS SECTION G-G'

Horiz. Scale: 1:50, Vert. Scale: 1:5



H

CROSS SECTION H-H'

Horiz. Scale: 1:50, Vert. Scale: 1:5

NOTE: CHANNEL DIMENSIONS ARE APPROXIMATE AND HAVE BEEN ROUNDED TO THE NEAREST 5-FOOT MARK.

Revision No:	Date:	Description:	Initials:	
PRELIMINARY				Designed: JJF
				Drawn: MGF
NOT FOR CONSTRUCTION				Checked: MKH
				Date: 08/10/2012
				Project No: 11130-011-01

Silver Creek
Blaine County, Idaho

The Nature Conservancy

The Nature Conservancy
Protecting nature. Preserving life.

GeoEngineers
1525 South David Lane
Boise, Idaho 83705

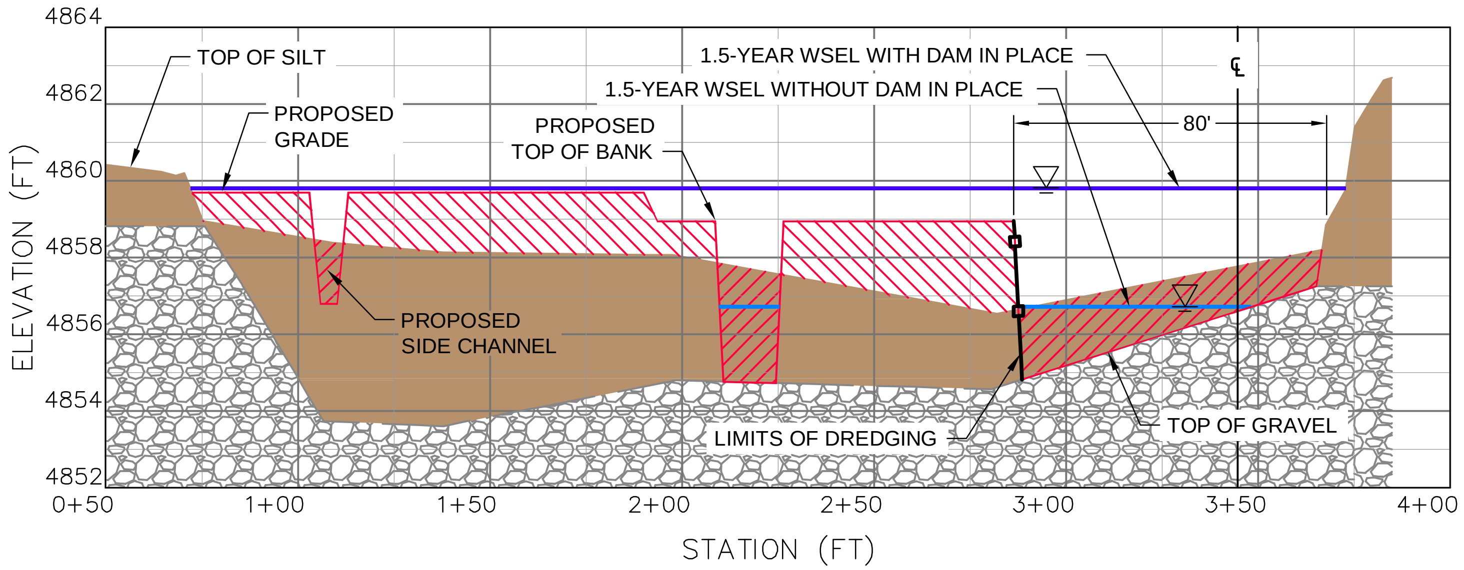
Cross Sections

Kilpatrick Pond Enhancement
Preliminary Design Drawings

Sheet
5.2

MKH : MGF

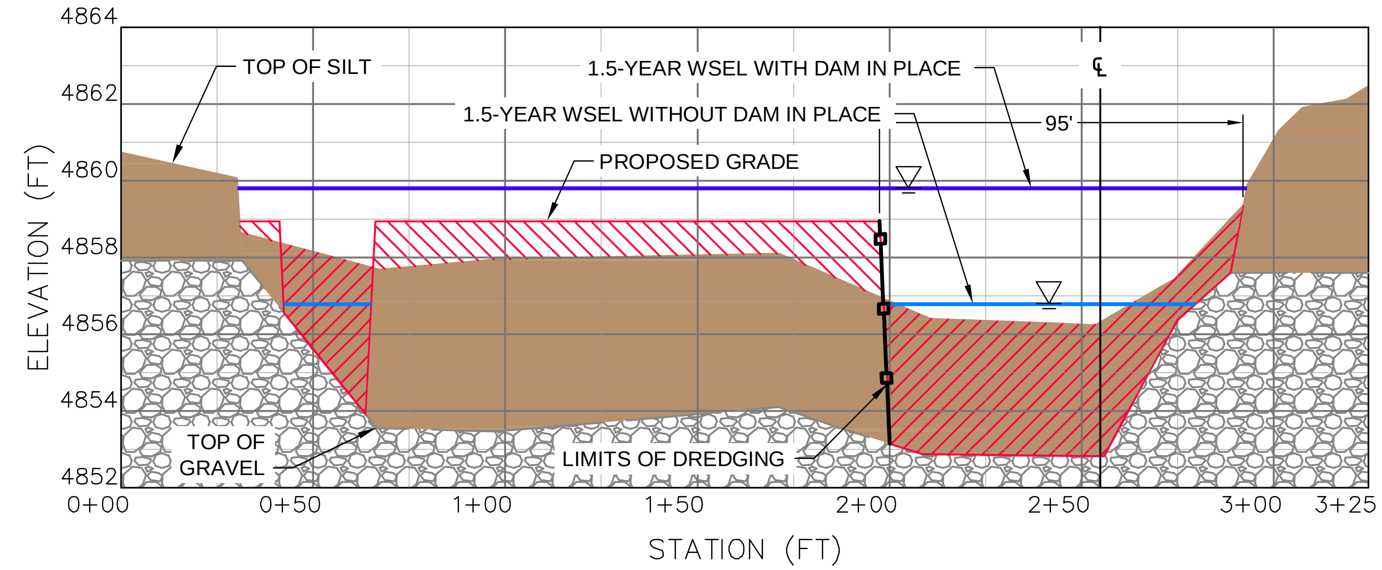
\\BOI\Projects\11\1113001101\01\CAD\DWG\1113001101-S5.X.dwg\TAB:S5.2 modified on Aug 10, 2012 - 11:28am



I

CROSS SECTION I-I'

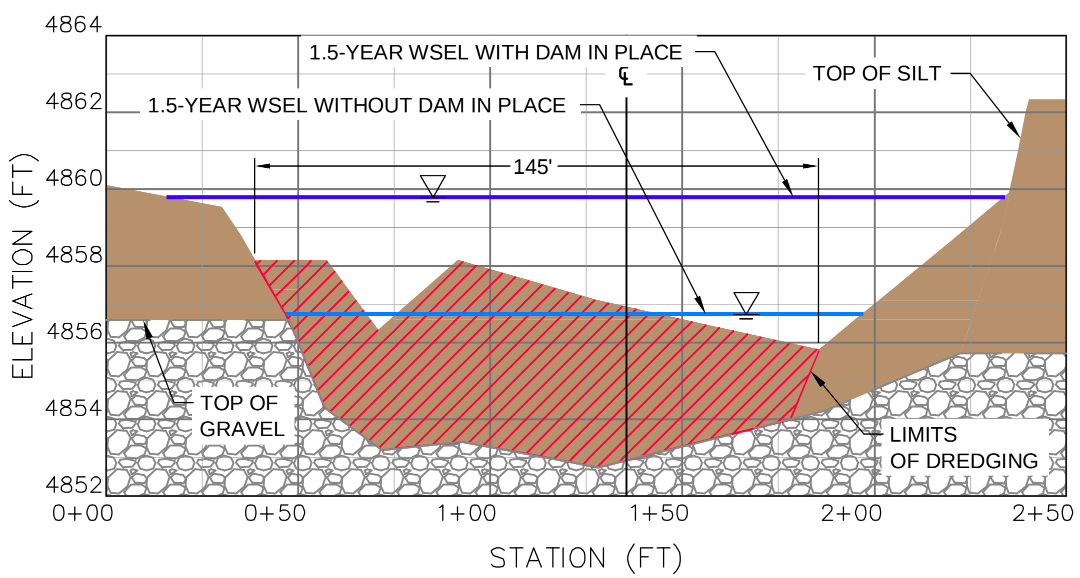
Horiz. Scale: 1:50, Vert. Scale: 1:5



J

CROSS SECTION J-J'

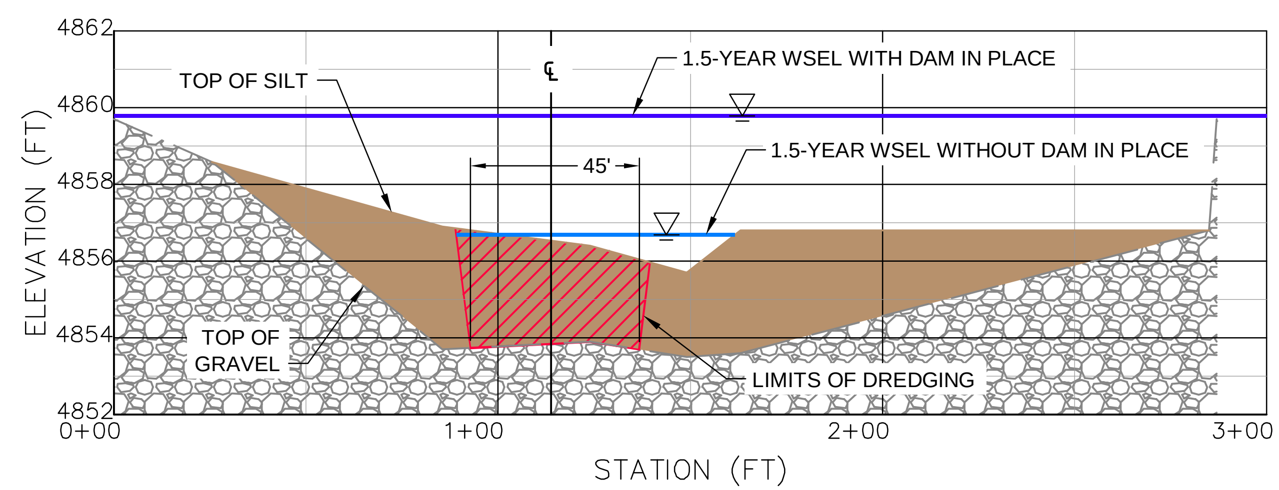
Horiz. Scale: 1:50, Vert. Scale: 1:5



K

CROSS SECTION K-K'

Horiz. Scale: 1:50, Vert. Scale: 1:5



L

CROSS SECTION L-L'

Horiz. Scale: 1:50, Vert. Scale: 1:5

NOTE: CHANNEL DIMENSIONS ARE APPROXIMATE AND HAVE BEEN ROUNDED TO THE NEAREST 5-FOOT MARK.

Revision No:	Date:	Description:	Initials:	
PRELIMINARY				Designed: JJF
NOT FOR CONSTRUCTION				Drawn: MGF
				Checked: MKH
				Date: 08/10/2012
				Project No: 11130-011-01

Silver Creek
Blaine County, Idaho

The Nature Conservancy

The Nature Conservancy
Protecting nature. Preserving life.

GEOENGINEERS
1525 South David Lane
Boise, Idaho 83705

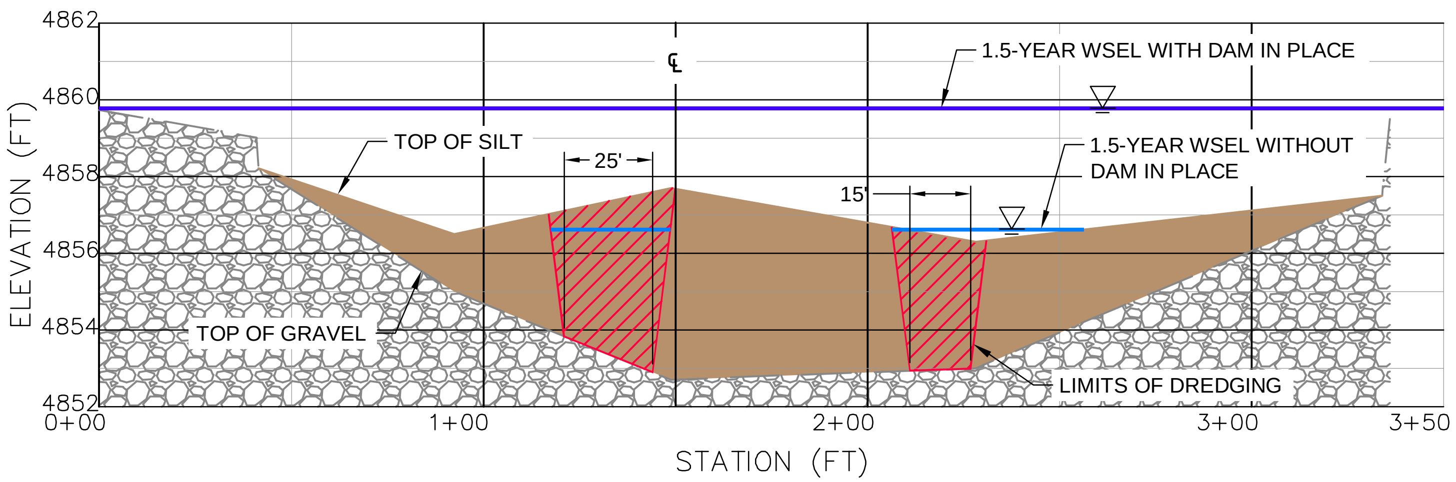
Cross Sections

Kilpatrick Pond Enhancement
Preliminary Design Drawings

Sheet
5.3

MKH : MGF

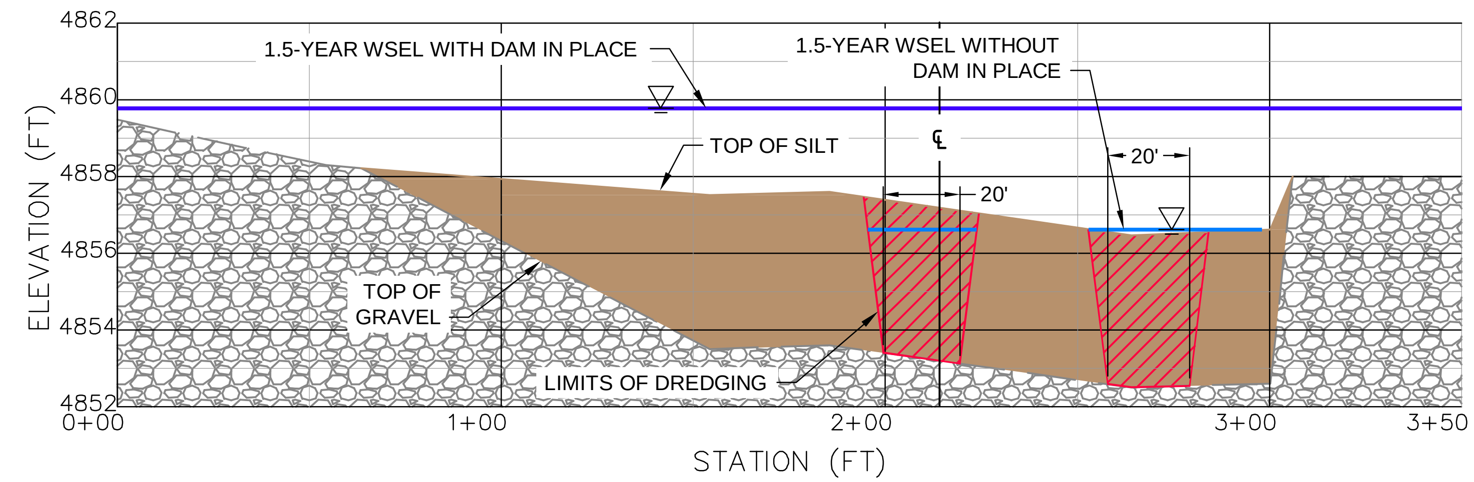
\\BOI\Projects\1\11130011\01\CAD\DWG\11130011101-S5.X.dwg\TAB:S5.3 modified on Aug 10, 2012 - 11:28am



M

CROSS SECTION M-M'

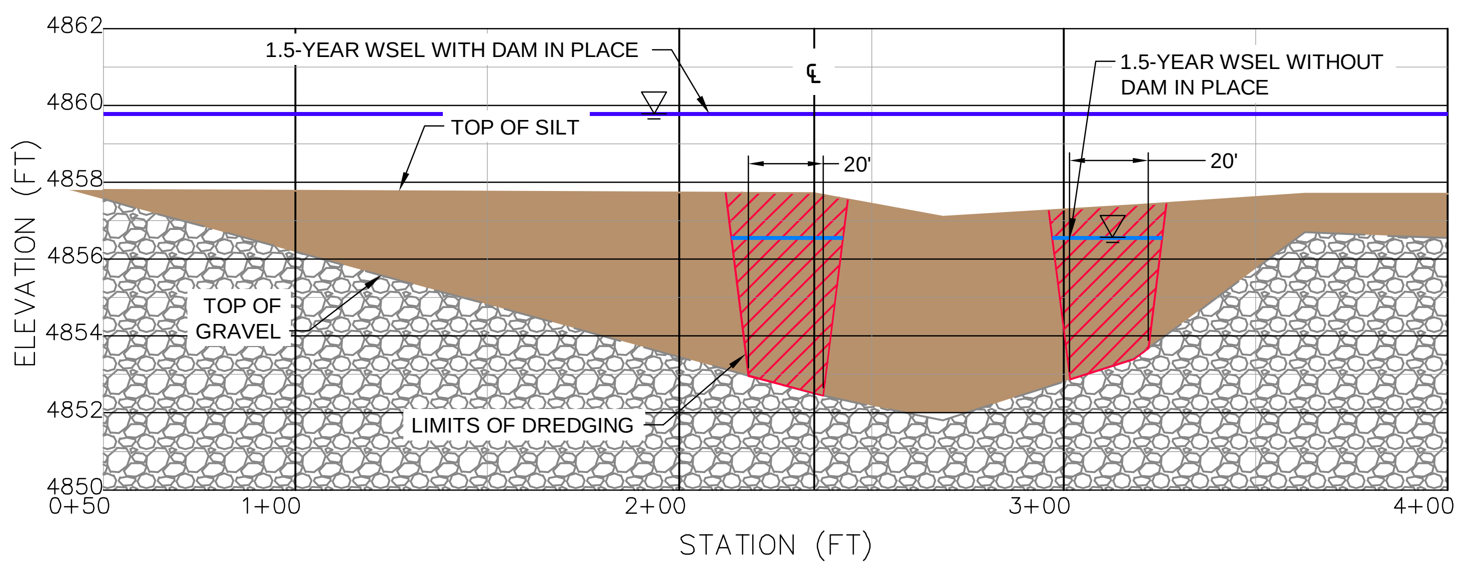
Horiz. Scale: 1:50, Vert. Scale: 1:5



N

CROSS SECTION N-N'

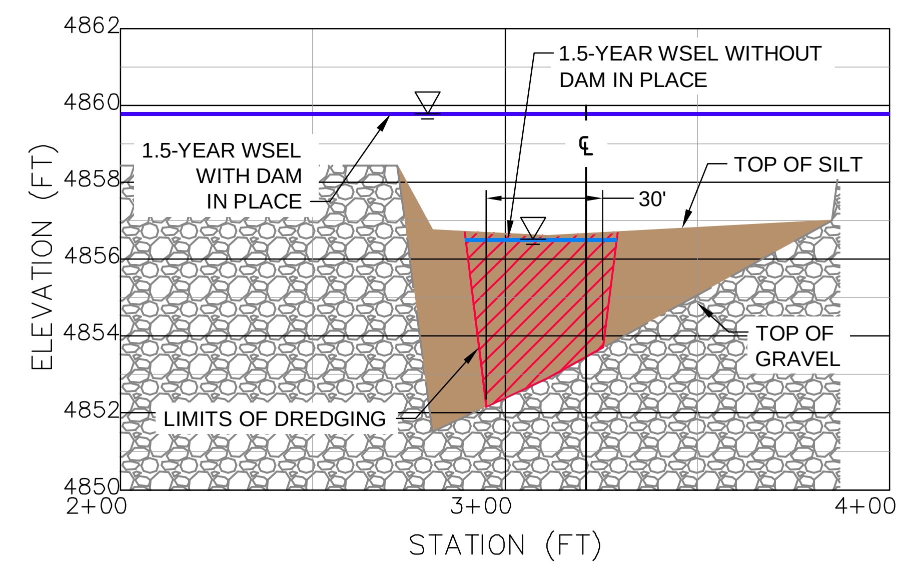
Horiz. Scale: 1:50, Vert. Scale: 1:5



O

CROSS SECTION O-O'

Horiz. Scale: 1:50, Vert. Scale: 1:5



P

CROSS SECTION P-P'

Horiz. Scale: 1:50, Vert. Scale: 1:5

NOTE: CHANNEL DIMENSIONS ARE APPROXIMATE AND HAVE BEEN ROUNDED TO THE NEAREST 5-FOOT MARK.

MKH : MGF

\\BOI\Projects\1\11130011\01\CAD\DWG\1113001101-S5.X.dwg\TAB:S5.4 modified on Aug 09, 2012 - 1:40pm

Revision No:	Date:	Description:	Initials:	
PRELIMINARY				Designed: JJF
				Drawn: MGF
NOT FOR CONSTRUCTION				Checked: MKH
				Date: 08/10/2012
				Project No: 11130-011-01

Silver Creek
Blaine County, Idaho

The Nature Conservancy

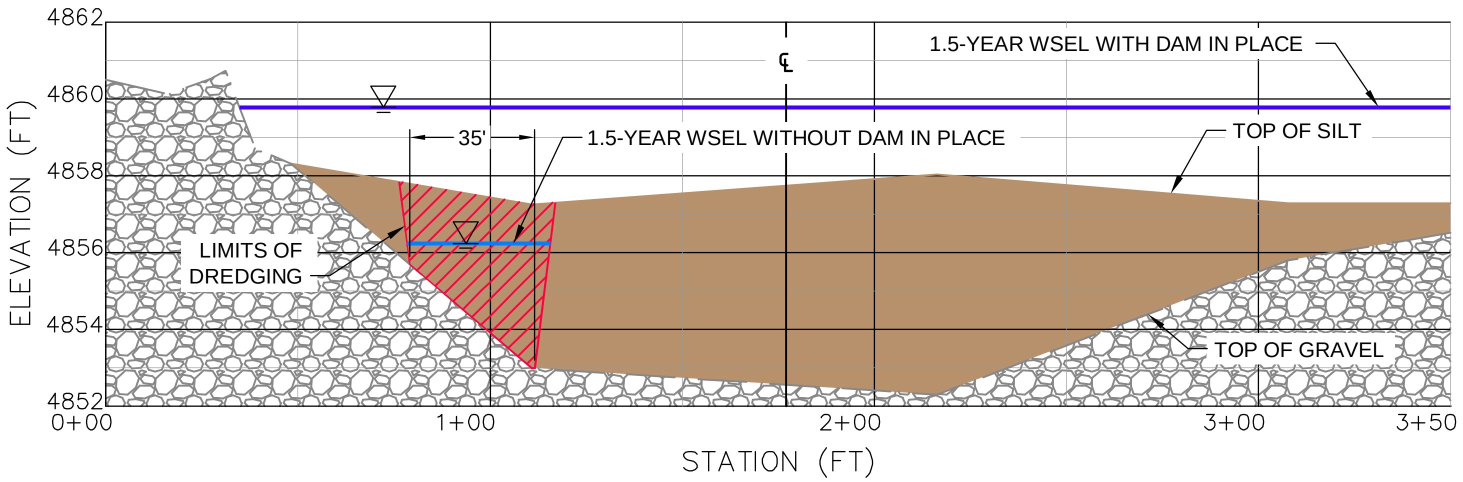
The Nature Conservancy
Protecting nature. Preserving life.

GEOENGINEERS
1525 South David Lane
Boise, Idaho 83705

Cross Sections

Kilpatrick Pond Enhancement
Preliminary Design Drawings

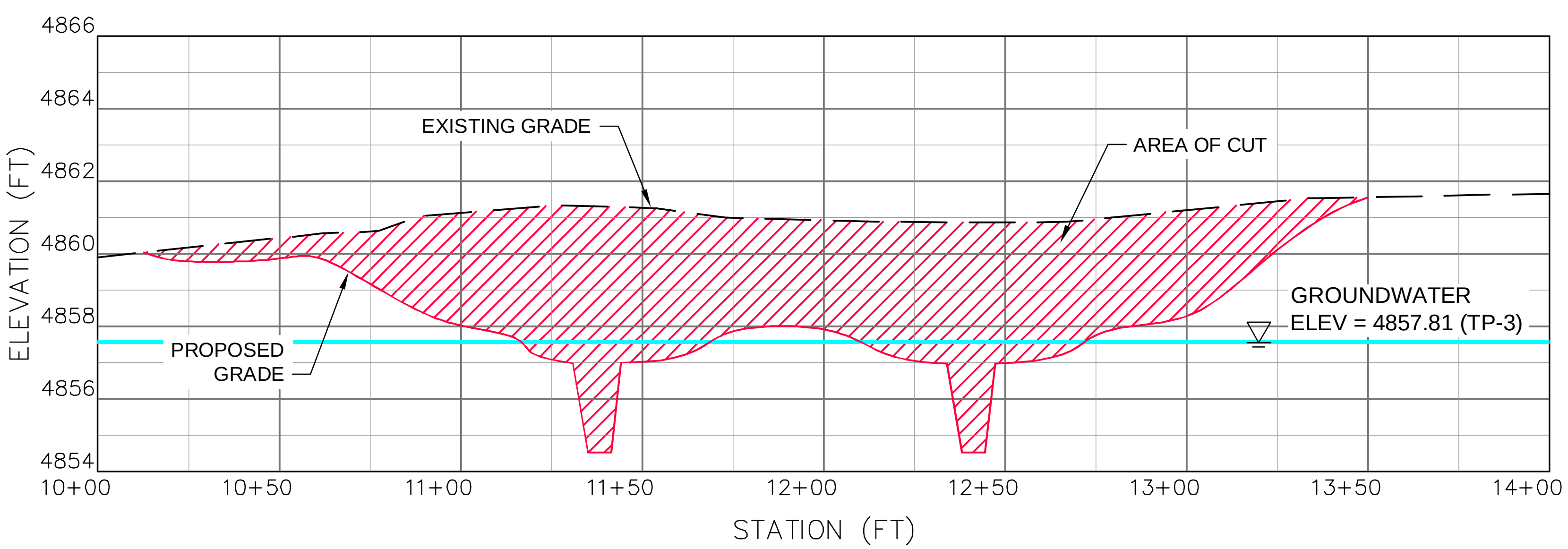
Sheet
5.4



Q

CROSS SECTION Q-Q'

Horiz. Scale: 1:50, Vert. Scale: 1:5



R

CROSS SECTION R-R'

Horiz. Scale: 1:50, Vert. Scale: 1:5

NOTE: CHANNEL DIMENSIONS ARE APPROXIMATE AND HAVE BEEN ROUNDED TO THE NEAREST 5-FOOT MARK.

Revision No:	Date:	Description:	Initials:	
PRELIMINARY				Designed: JJF
NOT FOR CONSTRUCTION				Drawn: MGF
				Checked: MKH
				Date: 08/10/2012
				Project No: 11130-011-01

Silver Creek
Blaine County, Idaho

The Nature Conservancy

The Nature Conservancy
Protecting nature. Preserving life.™

GEOENGINEERS
1525 South David Lane
Boise, Idaho 83705

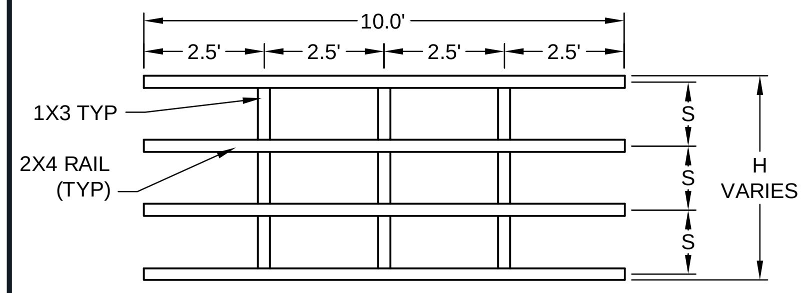
Cross Sections

Kilpatrick Pond Enhancement
Preliminary Design Drawings

Sheet
5.5

MKH : MGF

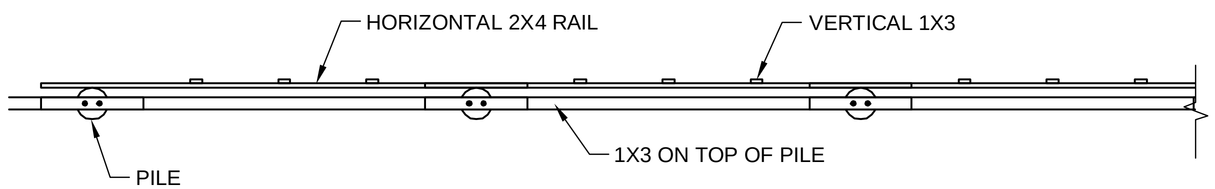
\\BOI\Projects\11\1113001101\CAD\DWG\1113001101-S5.X.dwg\TAB:S5.5 modified on Aug 09, 2012 - 1:59pm



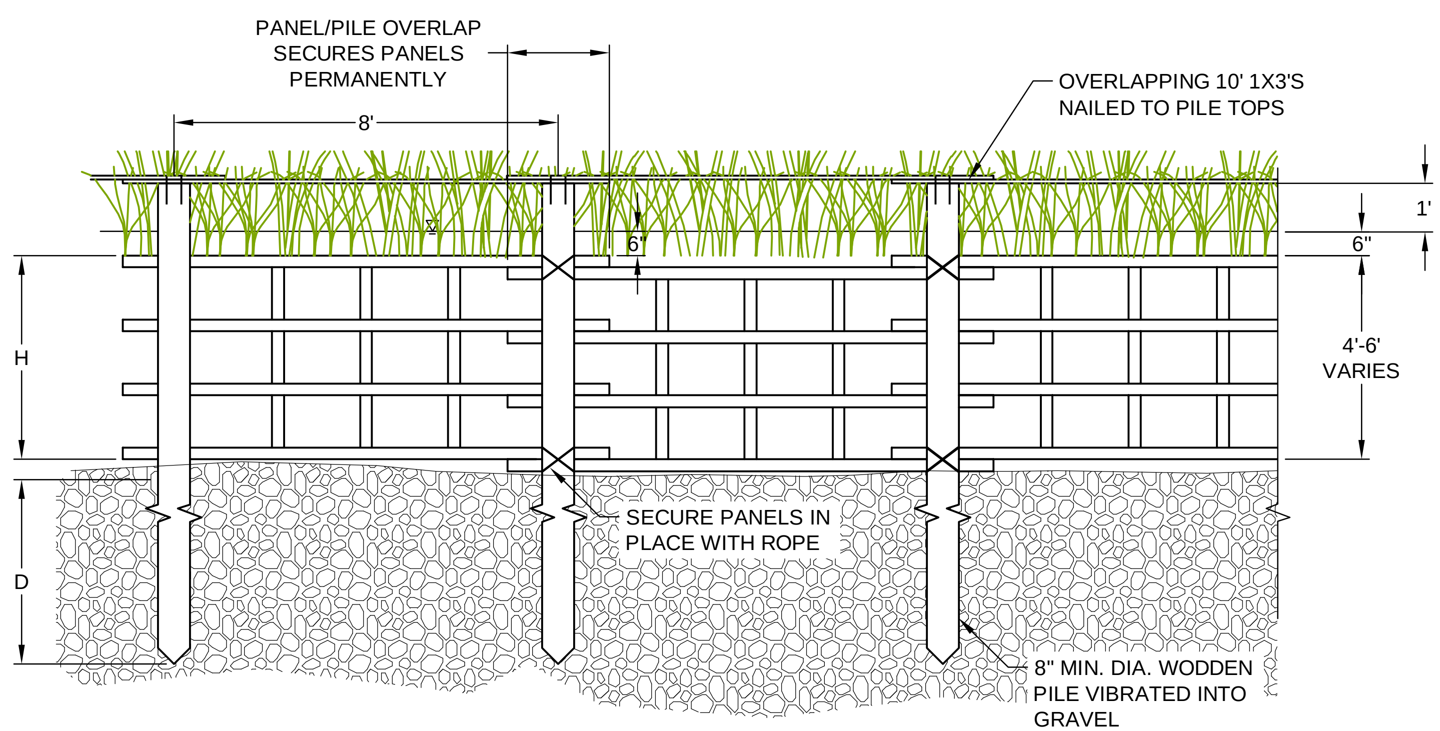
TYPICAL PREFABRICATED FENCE PANEL

PANEL HEIGHT SPACING & DEPTH TABLE

H	S	# RAILS	D
4'	12"	4	TBD
5'	20"	4	TBD
6'	18"	4	TBD



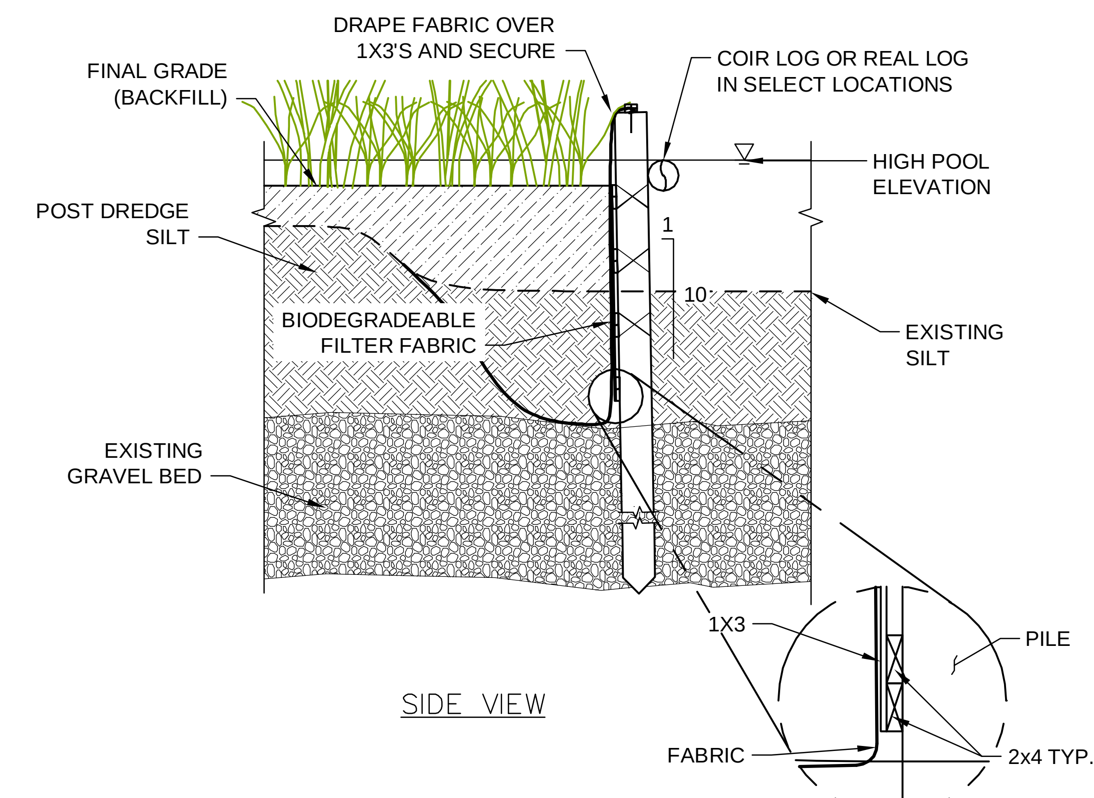
PLAN VIEW



ELEVATION VIEW

BANK FENCE NOTES

1. IT IS PROPOSED TO CONSTRUCT THIS BANK RETENTION FENCE ALONG THE AREA TO BE FILLED ALONG THE NORTH BANK OF KILPATRICK POND. THIS FENCE WILL PROTECT THE AREA OF THE PROPOSED WETLANDS. THE FENCE WILL BE CONSTRUCTED FROM THE DREDGE BARGE UNDER HIGH POND WATER CONDITIONS.
2. THE FENCE WILL BE PERMANENT IN THAT IT WILL NOT BE REMOVED AFTER CONSTRUCTION. IT WILL HOWEVER BE CONSTRUCTED WITH WOOD AND FABRIC SO IT WILL DEGRADE OVERTIME. THE ULTIMATE STABILITY OF THE BANK WILL BE SUSTAINED BY THE ROOT MASS OF THE PROPOSED WETLAND AND RIPARIAN VEGETATION.
3. THE PROPOSED WETLANDS WILL BE CONSTRUCTED FROM FILL OBTAINED FROM THREE (3) DIFFERENT PHASES AND LOCATIONS. FILL FOR THE FIRST PHASE WILL COME FROM THE POND DREDGING UPSTREAM OF THE BRIDGE. FILL FOR THE SECOND PHASE WILL COME FROM THE POND DREDGING DOWNSTREAM OF THE BRIDGE. FILL FOR THE THIRD PHASE WILL COME FROM UPLAND EXCAVATIONS ON THE NORTH BANK OF THE POND. BECAUSE THE FENCE FOOTPRINT MUST BE DREDGED BEFORE THE FENCE IS INSTALLED, IT WILL BE CONSTRUCTED BETWEEN THE FIRST AND SECOND DREDGING PHASES. SEE THE DREDGING SCHEMATIC FOR MORE DETAILS ON SEQUENCING.
4. THE FENCE PILES WILL BE DRIVEN AND/OR VIBRATED INTO THE GRAVEL BED FROM THE DREDGING BARGE. THE TOPS OF THE PILES WILL BE CUT OFF SO THEY UNIFORMLY EXTEND ABOVE THE WATER SURFACE 1 FOOT.
5. PREFABRICATED FENCE PANELS CONSTRUCTED OUT OF UNTREATED, ROUGH-SAWN TIMBER WILL THEN BE INSTALLED ALONG THE LANDWARD SIDE OF THE PILES AND SECURED TO THE PILES WITH ROPE. THE BOTTOM OF THE PANELS WILL BE PLACED ON OR NEAR THE GRAVEL BED. THE OVERLAPPING OF THE PANELS AGAINST THE PILES WILL PROVIDE THE ULTIMATE STRUCTURAL INTEGRITY TO HOLD THE PANELS IN PLACE.
6. 1 INCH BY 3 INCH BOARDS (1 X 3S) WILL BE NAILED TO THE TOPS OF THE PILES. THE 1 X 3S WILL OVERLAP THE PILES FOR ADDED STRUCTURAL INTEGRITY.
7. AFTER ALL THE PILES AND PANELS ARE INSTALLED, A DOUBLE LAYER OF BIODEGRADABLE FILTER FABRIC WILL BE INSTALLED ALONG THE LANDWARD SIDE TO RETAIN THE BANK. THE BOTTOM OF THE FABRIC WILL BE WEIGHTED AND TUCKED-IN ON THE CHANNEL BOTTOM AND THE TOP OF THE FABRIC WILL BE DRAPED AND SECURED AROUND THE 1 X 3S ON THE TOP OF THE PILES. AFTER THE FENCE IS COMPLETE, THE DREDGED SLURRY FROM THE SECOND DREDGING PHASE WILL BE PUMPED IN BEHIND THE FENCE.
8. AFTER THE FIRST WINTER/SPRING HIGH FLOWS AND AFTER WETLAND VEGETATION IS ADEQUATELY SECURE, THE 1 X 3S, TOPS OF THE PILES, AND TOPS OF FABRIC WILL BE CUT TO JUST BELOW THE WATER SURFACE ELEVATION.
9. IT IS ANTICIPATED THAT THE NATURALLY OCCURRING AQUATIC VEGETATION WILL GROW ON THE BANK FENCE MAKING IT ESSENTIALLY IMPERCEPTIBLE. VEGETATED COIR LOGS WILL ALSO BE SECURED TO THE PILES IN SELECT LOCATIONS TO PROVIDE OVERHANGING BANKS FOR FISH COVER.
10. PANELS INITIALLY SECURED TO PILES WITH ROPE THEN ULTIMATELY HELD IN PLACE BY WEIGHT OF BACKFILL.
11. CUT PILE TOPS AND FABRIC OFF AFTER BANKS AND VEGETATION ARE SECURE. PILES AND PANELS TO REMAIN IN PLACE.



SIDE VIEW

1 BANK RETENTION FENCE

Scale: NTS

Revision No:	Date:	Description:	Initials:	Designed: JJF
PRELIMINARY				Drawn: MGF
NOT FOR CONSTRUCTION				Checked: MKH
				Date: 08/10/2012
				Project No: 11130-011-01

Silver Creek
Blaine County, Idaho

The Nature Conservancy

The Nature Conservancy
Protecting nature. Preserving life.

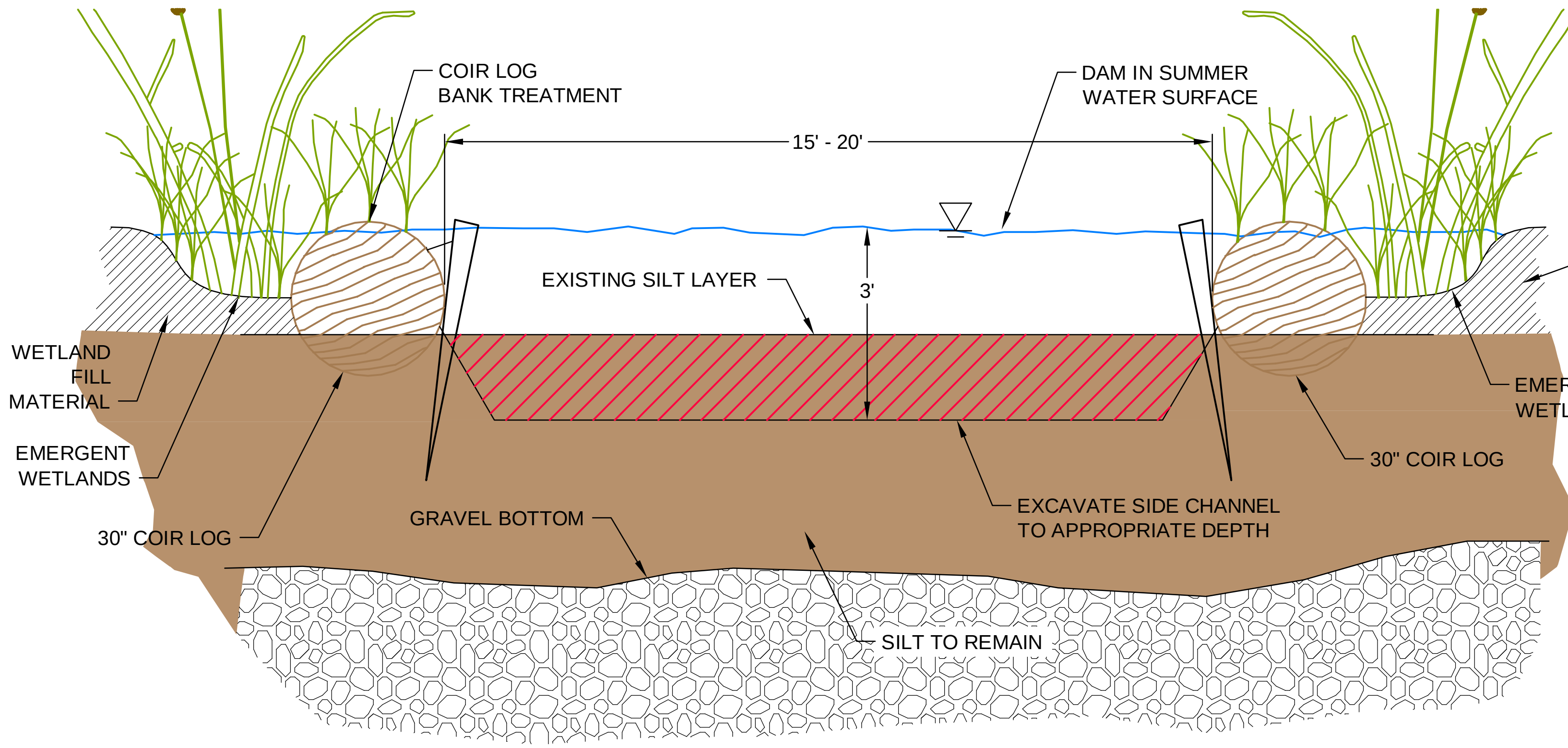
GEOENGINEERS
1525 South David Lane
Boise, Idaho 83705

Bank Retention Fence Detail

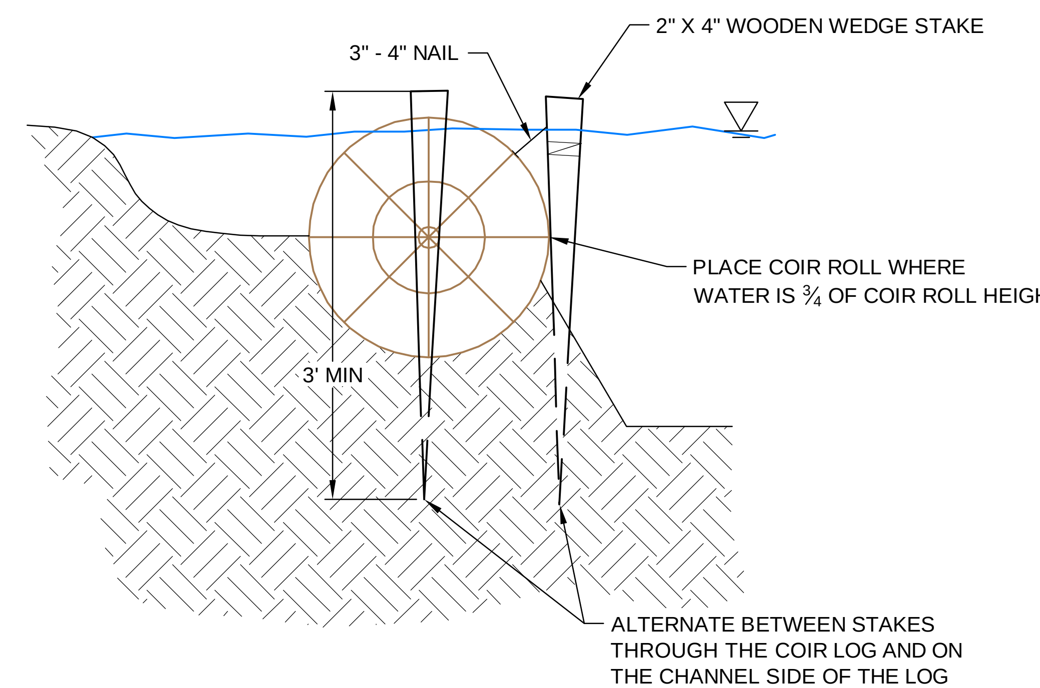
Kilpatrick Pond Enhancement
Preliminary Design Drawings

Sheet 6.1

OFFICE: BOI \\boi\projects\11\11130011\01\cad\dwg\1113001101-e8.x.dwg 5/24/2012 9:20 AM By mformolo



SECTION VIEW



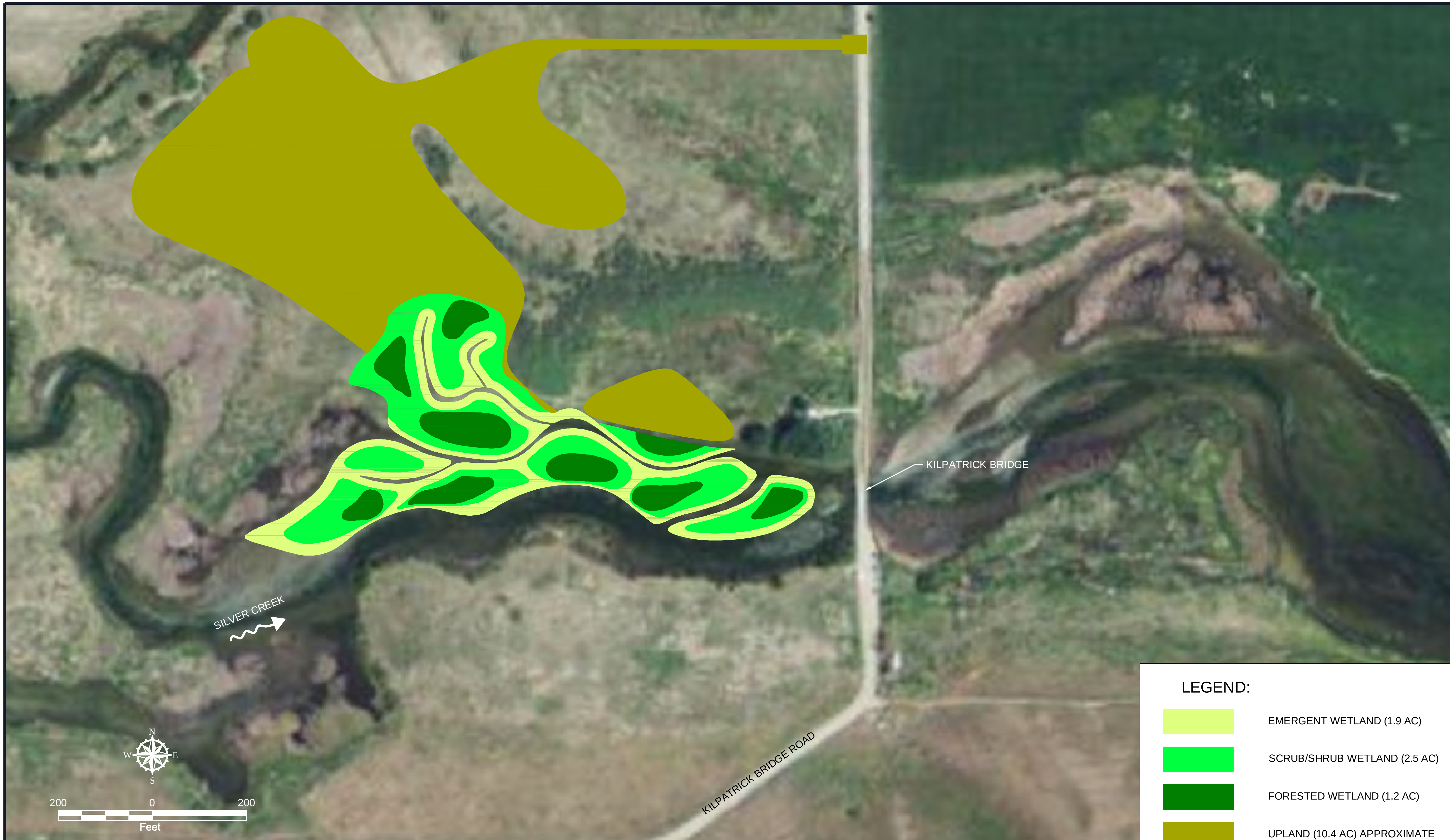
COIR LOG INSTALLATION DETAIL

2 TYPICAL SIDE CHANNEL DETAIL

Scale: NTS

Revision No:	Date:	Description:	Initials:	Designed: JJF	Silver Creek Blaine County, Idaho The Nature Conservancy	The Nature Conservancy Protecting nature. Preserving life.	GEOENGINEERS 1525 South David Lane Boise, Idaho 83705	Typical Bank Details Kilpatrick Pond Enhancement Preliminary Design Drawings	Sheet 6.2
PRELIMINARY				Drawn: MGF					
NOT FOR CONSTRUCTION				Checked: MKH					
				Date: 08/10/2012					
				Project No: 11130-011-01					

OFFICE: BOI \\boi\projects\11\11130011\01\cad\dwg\1113001101-e8.x.dwg 5/24/2012 9:20 AM By mformolo



Reference: Base map data, dated 04/26/2012, provided by Alpine Enterprises Inc.. Aerial imagery provided by USDA.

Revision No:	Date:	Description:	Initials:	
PRELIMINARY				Designed: JJF
				Drawn: MGF
NOT FOR CONSTRUCTION				Checked: MKH
				Date: 08/10/2012
				Project No: 11130-011-01

Silver Creek
Blaine County, Idaho

The Nature Conservancy

The Nature Conservancy
Protecting nature. Preserving life.

GeoEngineers
1525 South David Lane
Boise, Idaho 83705

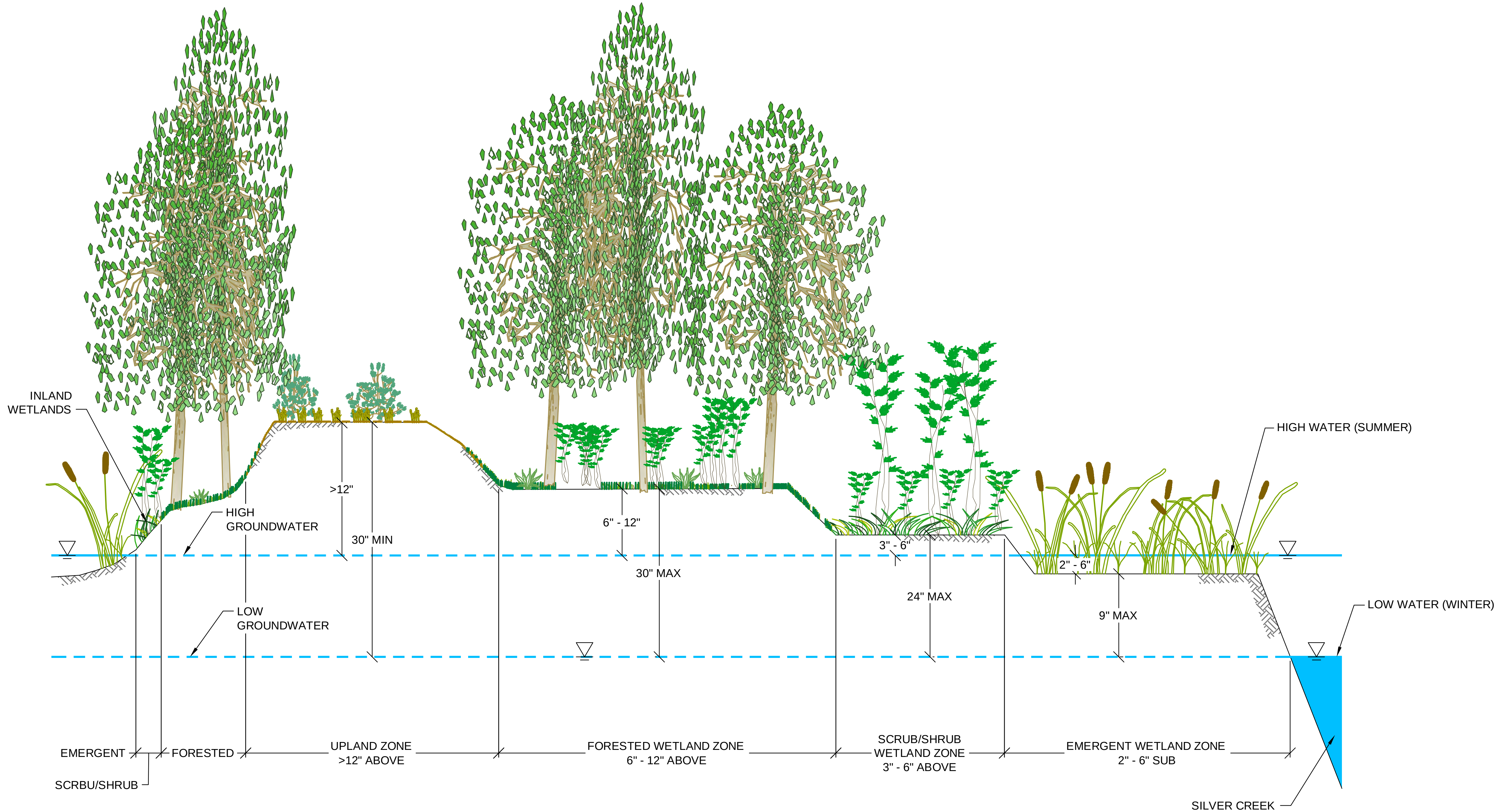
Planting Plan

Kilpatrick Pond Enhancement
Preliminary Design Drawings

Sheet 7.1

\BOI\Projects\1\1113001101\CAD\DWG\1113001101-S7.X.dwg\TAB:S7.1 modified on Aug 09, 2012 - 2:03pm

MKH : MGF



1 PLANT/HABITAT SECTION

Scale: NTS

NOTE:

1. WATER VARIATIONS ARE BASED ON SEDIMENT PLUG DOWNSTREAM OF BRIDGE REMAINING IN PLACE.
2. HIGH WATER OCCURS WHEN THE BOARDS IN THE DAM ARE IN PLACE AND THE POND IS AT FULL LEVEL, USUALLY DURING THE IRRIGATION SEASON.

Revision No:	Date:	Description:	Initials:	
PRELIMINARY				Designed: JJF
NOT FOR CONSTRUCTION				Drawn: MGF
				Checked: MKH
				Date: 08/10/2012
				Project No: 11130-011-01

Silver Creek
Blaine County, Idaho

The Nature Conservancy

The Nature Conservancy
Protecting nature. Preserving life.

GEOENGINEERS
1525 South David Lane
Boise, Idaho 83705

Planting Details

Kilpatrick Pond Enhancement
Preliminary Design Drawings

Sheet
7.2

MKH : MGF

\\BOI\Projects\1\1113001101\CAD\DWG\1113001101-S7.X.dwg\TAB:S7.2 modified on Aug 08, 2012 - 3:22pm

ZONE	SPECIES	COMMON NAME
Emergent Wetlands	Schoenoplectus acutus	Bulrush
	Carex nebrascensis	Nebraska Sedge
	Typha latifolia	Cattail
	Juncus arcticus	Rushes
	Salix drummondiana	Drummond Willow
Scrub/Shrub Wetlands	Salix boothii	Booth Willow
	Salix geyeriana	Geyers Willow
	Cornus sericea	Red Osier Dogwood
	Rosa woodsii	Wood's Rose
	Mimulus guttata	Monkey Flower
	Iliamna rivularis	Wild Hollyhock
	Elymus lanceolatus ssp psammphilus	Streambank Wheatgrass
	Hordeum jubatum	Foxtail Barley
Forested Wetlands	Elymus trachycaulus	Slender Wheatgrass
	Deschampsia cespitosa	Tufted Hairgrass
	Geranium viscosissimum	Sticky Purple Geranium
	Populus balsamifera ssp. Trichocarpa	Black Cottonwood
	Prunus virginiana	Chokecherry
	Betula occidentalis	Water Birch
	Ribes aureum	Golden Currant
	Symphoricarpos albus	Snowberry
Upland	Leymus cinereus	Great Basin Wildrye
	Chrysothamnus viscidiflorus	Yellow Rabbitbrush
	Ericameria nauseosa	Gray Rabbitbrush
	Artemisia tridentata	Sage
	Rhus trilobata	Sumac
	Sambucus nigra ssp. coerulea	Elderberry
	Pseudoroegneria spicata	Blue Bunch Grass
	Elymus elymoides	Bottlebrush Squirreltail

MKH : MGF

\BOI\Projects\1\1113001101\CAD\DWG\1113001101-S7.X.dwg\TAB:S7.3 modified on Aug 23, 2012 - 10:31am

Revision No:	Date:	Description:	Initials:	
PRELIMINARY				Designed: JJF
NOT FOR CONSTRUCTION				Drawn: MGF
				Checked: MKH
				Date: 08/10/2012
				Project No: 11130-011-01

Silver Creek
Blaine County, Idaho

The Nature Conservancy

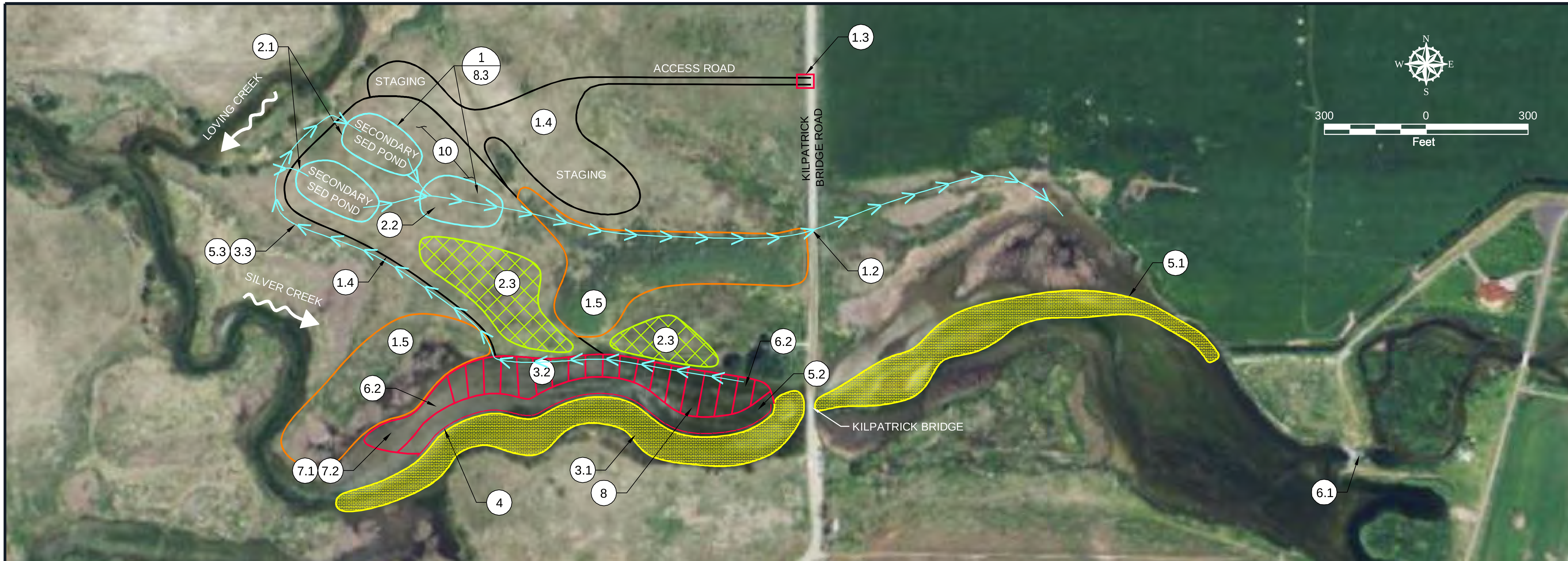
The Nature Conservancy
Protecting nature. Preserving life.

GeoEngineers
1525 South David Lane
Boise, Idaho 83705

Planting Specifications

Kilpatrick Pond Enhancement
Preliminary Design Drawings

Sheet
7.3



CONSTRUCTION SEQUENCING

1. GENERAL SITE PREPARATION
   - 1.1. PROTECT SITE PERIMETER
   - 1.2. CLEAN OUT EXISTING CULVERT
   - 1.3. ESTABLISH ACCESS ROAD ENTRANCE PROTECTION
   - 1.4. ESTABLISH ACCESS ROADS AND STAGING AREAS
   - 1.5. PROTECT SENSITIVE AREAS
2. SETTLING POND EXCAVATION
   - 2.1. EXCAVATE SECONDARY SETTLING PONDS (BERM AROUND PONDS)
   - 2.2. EXCAVATE TERTIARY SETTLING POND (BERM AROUND POND)
   - 2.3. STOCKPILE SOIL FOR SOUTHERN WETLAND FILL
3. DREDGE UPPER POND AREA (POND AT HIGH WATER ELEVATION) (SEE DREDGE SEQUENCING SCHEMATIC)
   - 3.1. DREDGE UPSTREAM POND (ADVANCE UPSTREAM FROM BRIDGE)
   - 3.2. USE MUDFLATS AS PRIMARY SETTLING POND (ADVANCE UPSTREAM FROM BRIDGE IN SERIES OF SETTLING CELLS)
   - 3.3. PUMP FROM PRIMARY INTO SECONDARY THEN TERTIARY PONDS
4. CONSTRUCT BANK FENCE
5. DREDGE DOWNSTREAM POND (SEE DREDGE SEQUENCING SCHEMATIC)
   - 5.1. DREDGE DOWNSTREAM POND
   - 5.2. USE MUDFLATS BETWEEN CELLS (3.2) AND BANK FENCE (4.0) AS PRIMARY SETTLING POND
   - 5.3. PUMP FROM PRIMARY INTO SECONDARY THEN TERTIARY PONDS (SAME AS 3.3)
6. LOWER POND
   - 6.1. LOWER POND SURFACE ELEVATION AT DAM
   - 6.2. ALLOW MUDFLATS/PRIMARY POND TO DRY
7. FILL MUDFLATS TO CREATE SOUTHERN WETLAND
   - 7.1. PUSH STOCKPILED MATERIAL (FROM 2.3) INTO PRIMARY POND AREA
   - 7.2. GRADE SOUTHERN WETLAND AREA. EXCAVATE SMALL SIDE CHANNELS.
8. PLANT SOUTHERN WETLAND
   - 8.1. PLANT SOUTHERN WETLAND
   - 8.2. ELEVATE POND SURFACE TO NORMAL ELEVATION
   - 8.3. SECONDARY AND TERTIARY PONDS (2.1 & 2.2) DRY UNTIL FOLLOWING SPRING/SUMMER
9. DEMOBILIZE DREDGING OPERATION
   - 9.1. DEMOBILIZE DREDGING OPERATION
   - 9.2. CLEANUP DISTURBANCE RELATED TOP DREDGING
   - 9.3. PROTECT DISTURBED SITE WITH TEMPORARY EROSION CONTROLS
   - 9.4. SITE OVERWINTERS
10. CONSTRUCT NORTHERN WETLANDS (FOLLOWING SPRING/SUMMER)
    - 10.1. GRADE POND BERMS INTO/OVER ACCUMULATED DREDGE SPOILS
    - 10.2. FINE GRADE WETLANDS. CONSTRUCT DENDRITIC SIDE CHANNELS.
    - 10.3. SEED & PLANT NORTHERN WETLANDS
11. GENERAL SITE CLEANUP
12. MONITOR AND MAINTAIN

Reference: Base map data, dated 04/26/2012, provided by Alpine Enterprises Inc.. Aerial imagery provided by USDA.

Revision No:	Date:	Description:	Initials:	
PRELIMINARY				Designed: JJF
NOT FOR CONSTRUCTION				Drawn: MGF
				Checked: MKH
				Date: 08/10/2012
				Project No: 11130-011-01

Silver Creek
Blaine County, Idaho

The Nature Conservancy

The Nature Conservancy
Protecting nature. Preserving life.

GEOENGINEERS
1525 South David Lane
Boise, Idaho 83705

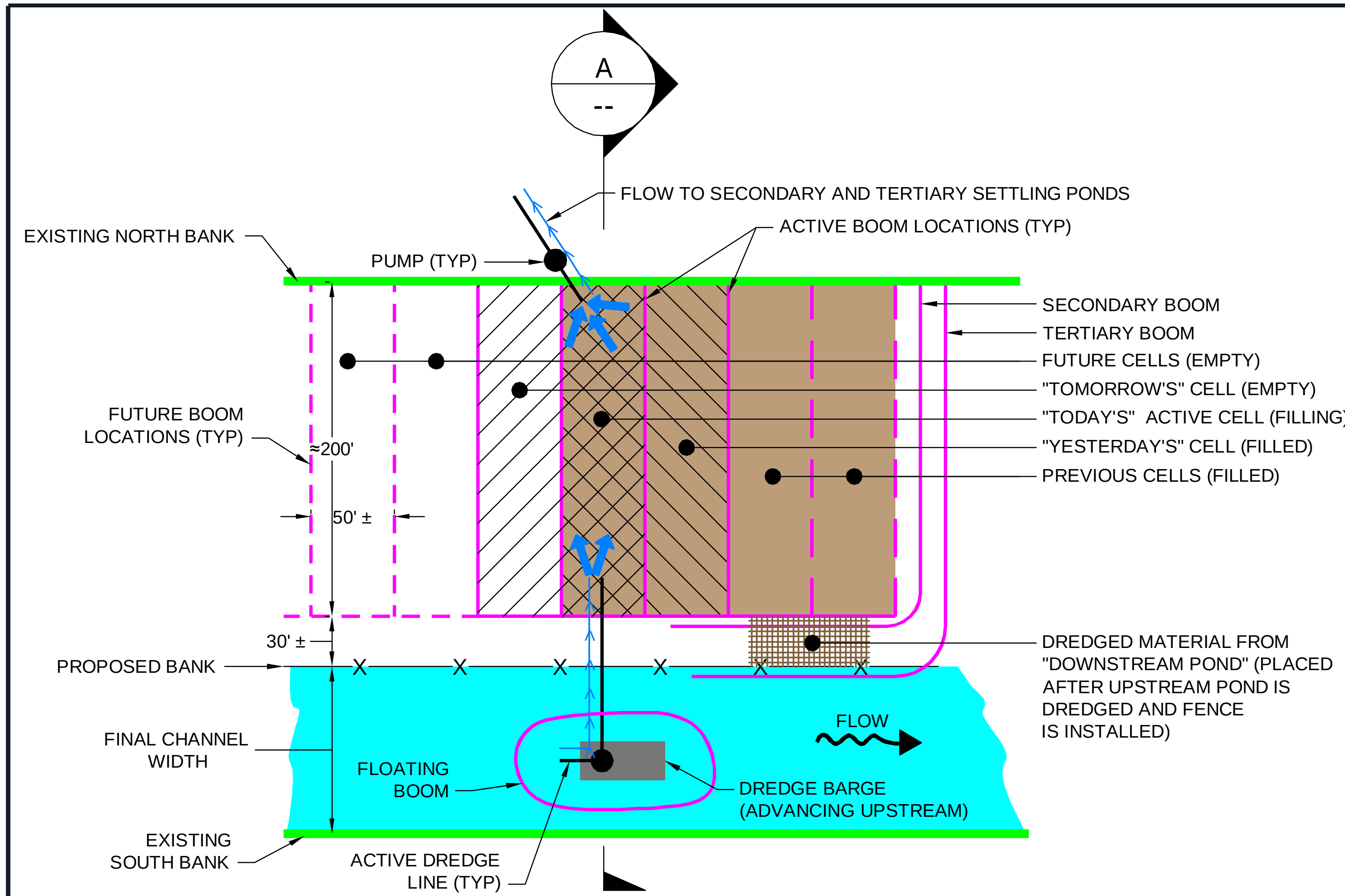
Construction Sequencing Plan

Kilpatrick Pond Enhancement
Preliminary Design Drawings

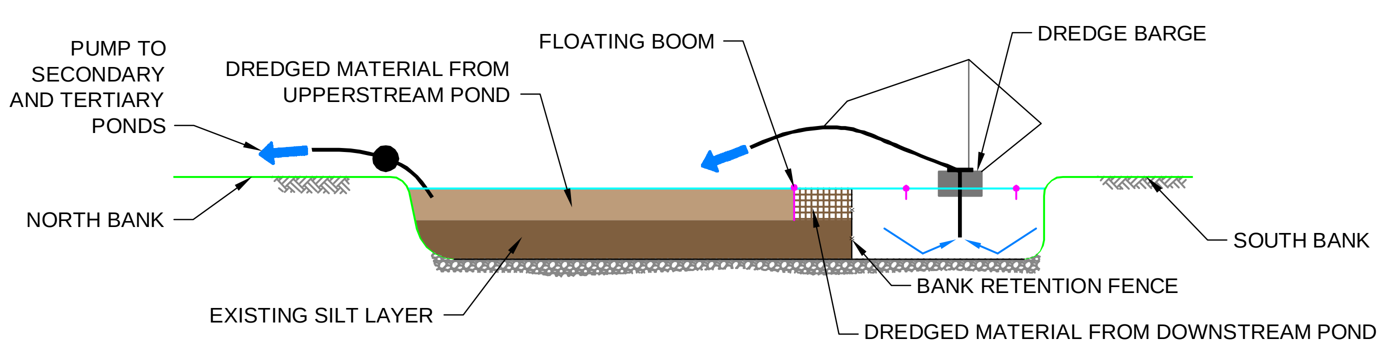
Sheet
8.1

MKH : MGF

\BOI\Projects\11\1113001101\CAD\DWG\1113001101-S8.X.dwg\TAB:S8.1 modified on Aug 10, 2012 - 1:48pm



PLAN VIEW



A SECTION A–A'

1 DREDGE SEQUENCING SCHEMATIC

Scale: NTS

DREDGE SEQUENCING SCHEMATIC NOTES

1. THIS SCHEMATIC DEPICTS THE DREDGING SEQUENCE FOR CONSTRUCTION SEQUENCING STEPS 3, 4 AND 5 AS NOTED ON THE PREVIOUS CONSTRUCTION SEQUENCING SHEET, SHEET ???
2. DURING THE FIRST PHASE OF DREDGING THE POND UPSTREAM OF THE BRIDGE WILL BE DREDGED. (STEP #3) THE DREDGED SLURRY WILL BE PUMPED ON TOP OF THE EXISTING "MUD FLATS" IN SETTLING "CELLS". THE CELLS WILL FUNCTION AS THE PRIMARY SETTLING PONDS WHERE THE LARGER GRAIN SIZED MATERIAL WILL SETTLE OUT OF THE SLURRY RELATIVELY QUICKLY.
3. THE CELLS WILL BE SET BACK FROM THE PROPOSED BANK FENCE BY 30 FEET AND WILL BE CONTAINED BY FLOATING BOOMS. THE BANK FENCE WILL NOT BE IN PLACE DURING THIS FIRST DREDGING PHASE BECAUSE THE SILT IN THE LOCATION OF THE PROPOSED FENCE NEEDS TO BE DREDGED FIRST TO ACCOMMODATE THE FENCE.
4. THE DREDGE BARGE WILL ADVANCE IN AN UPSTREAM DIRECTION. IT IS ESTIMATED THAT THE DREDGE BARGE WILL ADVANCE UPSTREAM ABOUT 50 TO 60 FEET EVERY DAY. CELL WIDTHS WILL EQUAL THE DISTANCE THE BARGE CAN ADVANCE EACH DAY.
5. AT ANY POINT IN TIME THERE WILL BE THREE (3) CELLS IN PLACE. THE MIDDLE CELL WILL BE ACTIVELY RECEIVING THE DREDGED MATERIAL. SINCE IT IS ACTIVE, IT IS REFERENCED AS "TODAY'S CELL". THE CELL DOWNSTREAM OF THE MIDDLE CELL WILL HAVE RECEIVED THE DREDGED SLURRY THE PREVIOUS DAY, HENCE IT IS REFERRED TO AS "YESTERDAY'S CELL". AFTER THE SLURRY IN YESTERDAY'S CELL HAS HAD A CHANCE TO SETTLE OVERNIGHT, ITS BOOMS WILL BE MOVED UPSTREAM TO "TOMORROW'S CELL", WHICH WILL BE INSTALLED AND IN PLACE TO RECEIVE THE NEXT DAY'S SLURRY.
6. A SECONDARY FLOATING BOOM WILL PROTECT THE DOWNSTREAM SIDE OF THE MOST DOWNSTREAM CELL AND WILL BE CONTINUALLY EXTENDED UPSTREAM TO PROTECT THE ACTIVE AND COMPLETED CELLS. SIMILARLY, A FLOATING BOOM WILL ENCIRCLE THE DREDGE AS IT ADVANCES UPSTREAM.
7. THE SLURRY ENTERING EACH CELL WILL BE PUMPED INTO THE SECONDARY SETTLING PONDS FROM A PUMP ON THE NORTH BANK. THE PUMP WILL ADVANCE UPSTREAM DAILY WITH THE DREDGE.
8. THE BANK FENCE WILL BE INSTALLED FROM THE BARGE AFTER THE UPSTREAM POND/CHANNEL HAS BEEN DREDGED. THE FENCE WILL REMAIN IN PLACE AND WILL SERVE AS A PERMANENT BANK FOR THE FINISHED CHANNEL. THE FENCE WILL BE MADE OF WOOD AND FABRIC SO IT WILL DEGRADE OVER TIME.
9. THE PORTION OF THE POND DOWNSTREAM OF THE BRIDGE WILL BE DREDGED AFTER THE BANK FENCE IS INSTALLED. THE SLURRY FROM THIS SECOND PHASE OF DREDGING WILL BE PLACED BETWEEN THE PREVIOUSLY PLACED SEDIMENT AND THE BANK FENCE. THIS TOO WILL FUNCTION AS A PRIMARY SETTLING BASIN AND THE EXCESS SLURRY FROM THIS AREA WILL BE PUMPED INTO THE SECONDARY SETTLING PONDS. THE SECONDARY FLOATING BOOM WILL BE REMOVED AND RELOCATED INTO POSITION AS THE TERTIARY BOOM TO PROTECT THE CREEK FROM SEDIMENTATION DURING THIS SECOND PHASE OF DREDGING.
10. AFTER THE DOWNSTREAM POND/CHANNEL IS DREDGED, THE DREDGE BARGE WILL BE REMOVED FROM THE POND AND THE WATER SURFACE IN THE POND WILL BE LOWERED AT THE DAM TO DRAIN AND DRY THE DREDGED MATERIAL BEHIND THE FENCE.
11. AFTER THE DREDGED MATERIAL IS SUFFICIENTLY DRY, THE MATERIAL STOCKPILED FROM THE EXCAVATION OF SECONDARY AND TERTIARY SETTLING PONDS WILL BE PLACED ON TOP OF THE DREDGED MATERIAL TO CONSTRUCT THE PROPOSED WETLANDS.

Revision No:	Date:	Description:	Initials:	
PRELIMINARY				Designed: JJF
				Drawn: MGF
NOT FOR CONSTRUCTION				Checked: MKH
				Date: 08/10/2012
				Project No: 11130-011-01

Silver Creek
Blaine County, Idaho

The Nature Conservancy

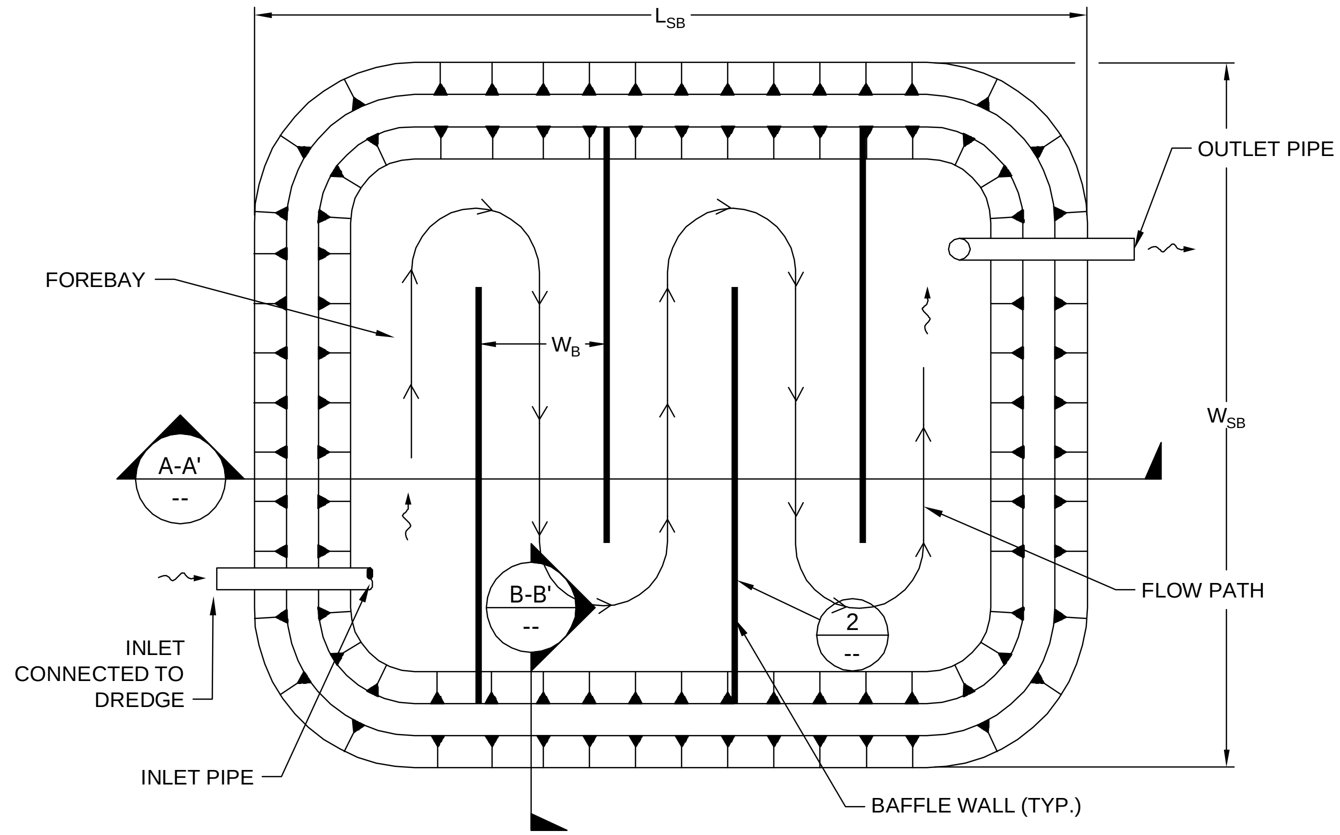
The Nature Conservancy
Protecting nature. Preserving life.™

GEOENGINEERS
1525 South David Lane
Boise, Idaho 83705

Dredge Sequencing Schematic

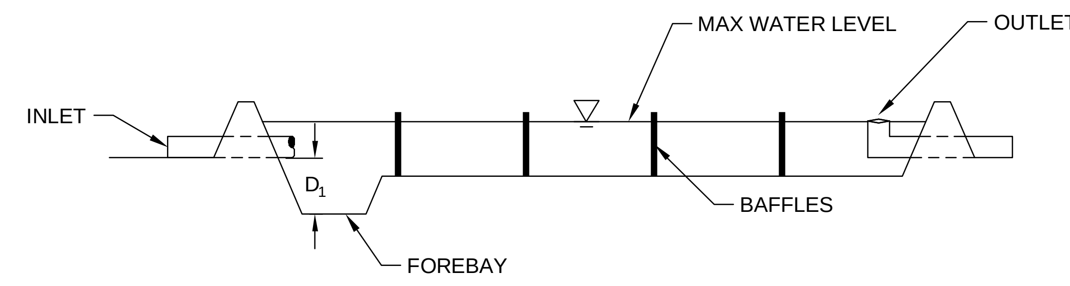
Kilpatrick Pond Enhancement
Preliminary Design Drawings

Sheet **8.2**



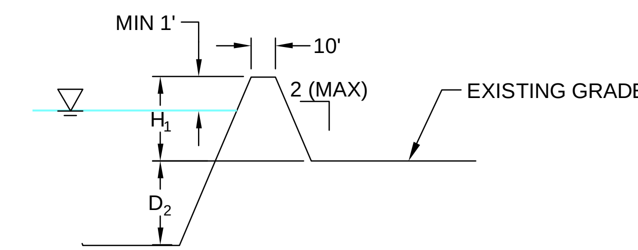
1 TYPICAL SETTLING BASIN PLAN

Scale: NTS



A SECTION A-A'

Scale: NTS



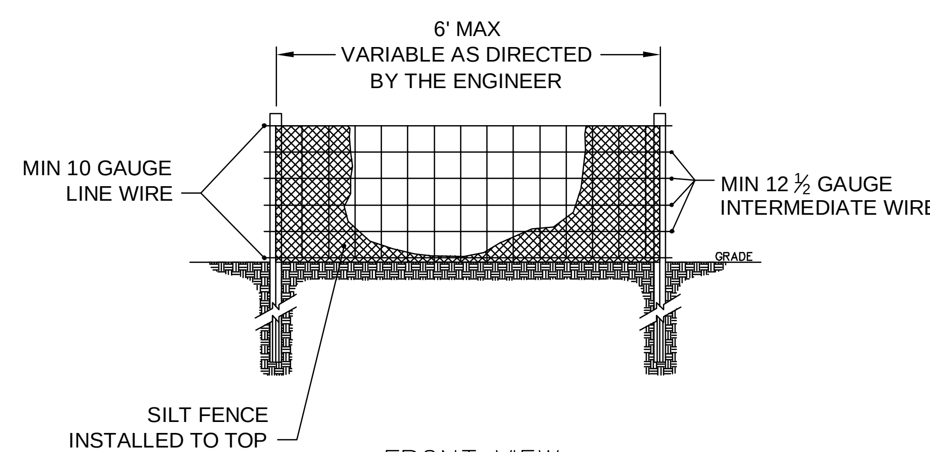
B SECTION B-B'

Scale: NTS

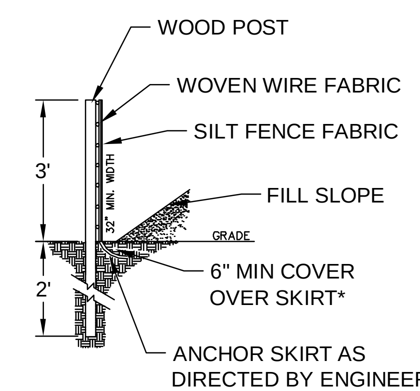
SETTLIN G POND	L_{SB}	W_{SB}	W_B	D_1	D_2	H_1
1	274	91	25	0	4.5	1.5
2	274	91	25	0	4.5	1.5
3	274	91	25	0	4.5	1.5

NOTE: ALL DIMENSIONS ARE IN FEET.

SETTLING BASIN DIMENSION TABLE



FRONT VIEW



SIDE VIEW

2 BAFFLE WALL DETAIL

Scale: NTS

MKH : MGF

\BOI\Projects\1\11130011\01\CAD\DWG\11130011\01-S8.X.dwg\TAB:S8.3 modified on Aug 10, 2012 - 1:38pm

Revision No:	Date:	Description:	Initials:	
PRELIMINARY				Designed: JJF
NOT FOR CONSTRUCTION				Drawn: MGF
				Checked: MKH
				Date: 08/10/2012
				Project No: 11130-011-01

Silver Creek
Blaine County, Idaho

The Nature Conservancy

The Nature Conservancy
Protecting nature. Preserving life.

GEOENGINEERS
1525 South David Lane
Boise, Idaho 83705

Dredge Settling Pond Details

Kilpatrick Pond Enhancement
Preliminary Design Drawings

Sheet
8.3

APPENDIX G
Report Limitations and Guidelines for Use

APPENDIX G
REPORT LIMITATIONS AND GUIDELINES FOR USE[1]

This appendix provides information to help you manage your risks with respect to the use of this report.

Stream and River Design Engineering Services Are Performed for Specific Purposes, Persons and Projects

This report has been prepared for The Nature Conservancy and their authorized agents. The information contained herein is not applicable to other sites.

GeoEngineers structures our services to meet the specific needs of our clients. No party other than The Nature Conservancy and their authorized agents may rely on the product of our services unless we agree to such reliance in advance and in writing. This is to provide our firm with reasonable protection against open-ended liability claims by third parties with whom there would otherwise be no contractual limits to their actions. Within the limitations of scope, schedule and budget, our services have been executed in accordance with our Agreement with The Nature Conservancy executed on March 14, 2012 and generally accepted practices in this area at the time this report was prepared. Use of this report is not recommended for any purpose or project except the one originally contemplated.

A Stream or River Design Engineering Report is based on a Unique Set of Project-Specific Factors

This report has been prepared for The Nature Conservancy and their authorized agents, specifically for the Silver Creek Kilpatrick Pond Enhancement Project. GeoEngineers considered a number of unique, project-specific factors when establishing the scope of services for this project and report. Unless GeoEngineers specifically indicates otherwise, it is important not to rely on this report if it was:

- not prepared for you,
- not prepared for your project,
- not prepared for the specific site, or
- completed before important project changes were made. For example, changes that can affect the applicability of this report include those that affect:
    - the function of the proposed design;
    - neighboring projects;
    - composition of the design team; or
    - project ownership.

[1] Developed based on material provided by ASFE, Professional Firms Practicing in the Geosciences; www.asfe.org.

If important changes are made after the date of this report, we recommend that GeoEngineers be given the opportunity to review our interpretations and recommendations. Based on that review, we can provide written modifications or confirmation, as appropriate.

Conditions Can Change

This report is based on conditions that existed at the time the study/design was performed. The findings and conclusions of this report may be affected by the passage of time, by man-made events such as construction on or adjacent to the site, or by natural events such as floods, earthquakes, slope instability, stream flow fluctuations or stream channel fluctuations. If more than a few months have passed since issuance of our report or work product, or if any of the described events may have occurred, please contact GeoEngineers before applying this report for its intended purpose so that we may evaluate whether changed conditions affect the continued reliability or applicability of our conclusions and recommendations.

Report Recommendations and Designs Are Not Final

Do not over-rely on the recommendations included in this report. These recommendations are not final, because they were developed principally from GeoEngineers' professional judgment and opinion. GeoEngineers' recommendations can be finalized during subsequent design phases of the project.

We recommend that you allow sufficient monitoring and consultation by GeoEngineers during subsequent design and construction phases of this project to provide recommendations for changes if the conditions revealed during the work differ from those anticipated and to evaluate whether construction activities are completed in accordance with our recommendations. GeoEngineers is unable to assume responsibility for the recommendations in this report without performing further studies, designs and/or construction observation as required by the specific concept under consideration.

The concepts depicted herein are approximate and are intended to express the overall intent of the project. These are planning-level concepts and will need to undergo detailed final designs in order to meet the specific-site conditions and intended function.

Report Could Be Subject to Misinterpretation

Misinterpretation of this report by stakeholders, members of the design team or by contractors can result in costly problems. GeoEngineers can help reduce the risks of misinterpretation by conferring with appropriate members of the design team after submitting the report, reviewing pertinent elements of the design team's plans and specifications, participating in pre-bid and preconstruction conferences, and providing construction observation.

To help prevent costly problems, we recommend giving contractors the complete report, but preface it with a clearly written letter of transmittal. In that letter, advise contractors that the report's accuracy is limited. In addition, encourage them to confer with GeoEngineers and/or to conduct additional study to obtain the specific types of information they need or prefer.

Instream Habitat Structures

Instream habitat, stabilization, enhancement and/or restoration structures and artificial (Structures) involve the placement of large logs, logs with root wads, large rocks and other natural and artificial materials and/or features in and adjacent to creeks, streams and rivers (streams). They are designed for various purposes including but not limited to: improvement of aquatic and riparian habitat; stabilization of eroding stream banks and channels; restoration of stream channels; creation or improvement of recreational uses; irrigation; and flood management.

Hazards of Instream Habitat Structures

Instream habitat structures create potential hazards, including, but not limited to: humans falling from the Structures and associated injury or death; collisions of recreational users' watercraft with the Structures and associated risk of injury or death, with partial or total damage of the watercraft; mobilization of a portion or all of the structures during high water flow conditions and related damage to downstream properties, utilities, roads, bridges and other infrastructure, and injury or death to humans; flooding; erosion; and channel avulsion. In some cases, instream habitat structures are only intended to be temporary, providing temporary stabilization while riparian vegetation becomes established or stream/river processes stabilize. This gradual deterioration with age and vulnerability to major flood events make temporary Structures inherently dangerous with increasing age.

It is strongly recommended that the Client address the necessary safety concerns appropriately. This would include warning construction workers of hazards associated with working in or near deep and fast moving water and on steep, slippery and unstable slopes. In addition, signs should be placed along the enhanced stream reaches in prominent locations to warn recreational users of the potential hazards noted above and pamphlets should be distributed to nearby residents warning of the potential hazards to children and adults posed by these Structures.

Increased Flood Elevations and Wetland Expansion Are Possible

The proposed stream enhancements may result in increased flood elevations and expansion of wetlands. The analysis of these impacts, which are generally considered advantageous for aquatic and riparian habitat in the project locations of these stream systems, may need to be considered and quantified if they were beyond the context of GeoEngineers' scope of services.

Channel Erosion and Migration Are Possible

In general, river and stream enhancements are intended to result in more stable streambeds, banks and floodplains. In some cases, stream enhancement and channel stability means reestablishing the natural balance of sediment erosion, distribution and deposition, which induces channel meandering and migration. Therefore, channel erosion, channel migration and/or avulsions can be expected to occur over time.

Importance of Monitoring and Maintenance

Piles, anchors, chains, cables, reinforcing bars, bolts and similar fasteners may have purposely been excluded from woody habitat structures with the intent of mimicking naturally-occurring instream wood structures. Conversely, such fasteners may have purposely been included in woody habitat Structures if considered appropriate. While the Structures are designed to be relatively stable during flood events, movement of these Structures should be expected. As noted in the text of this report, we recommend that the Client implement appropriate monitoring and maintenance procedures to minimize potential adverse impacts at or near areas of concern, such as at downstream road, bridge and/or culvert crossings. This would include replacing, adjusting and removing damaged, malfunctioning or deteriorated components of Structures, particularly following a major storm event.

Contractors Are Responsible for Site Safety on Their Own Construction Projects

Our recommendations are not intended to direct the contractor's procedures, methods, schedule or management of the work site. The contractor is solely responsible for job site safety and for managing construction operations to minimize risks to on-site personnel and adjacent properties.

Have we delivered World Class Client Service?

Please let us know by visiting **www. geoengineers.com/feedback**.

GEOENGINEERS