OFFICIAL USE ONLY
File Number:
Date Received:
By:
Fee Paid:
Approved Date:
Denied Date:
By:

Floodplain Development Permit Application

Submit completed application and documentation to planningandzoning@ketchumidaho.org Or hand deliver to Ketchum City Hall, 191 5th St. W. Ketchum, ID If you have questions, please contact the Planning and Building Department at (208) 726-7801. To view the Development Standards, visit the City website at: www.ketchumidaho.org and click on Municipal Code. You will be contacted and invoiced once your application package is complete.

When is a Floodplain Development Permit Application required?

The Floodplain Management Overlay Zoning District boundaries are represented on the official zoning map of the City.

All land within the external boundary of the special flood hazard area (SFHA) and all parcels with any portion thereof affected by said SFHA shall be considered to be within the Floodplain Management Overlay Zoning district.

All land areas within the external boundary of the SFHA shall be considered to be within the floodplain subdistrict of the Floodplain Management Overlay Zoning District. The City may make necessary interpretations of the boundary based upon the recommendation of the City Engineer or other expert.

All land areas within the external boundary of the regulatory floodway shall be considered to be within the floodway subdistrict of the Floodplain Management Overlay Zoning District. The City may make necessary interpretations of the boundary based upon the recommendation of the City Engineer or other expert.

NOTE: This permit is required for all properties containing 100 year floodplain area and Riparian Setbacks

PROPERTY OWNER INFORMATION
Property Owner Name(s): Idaho Transportation Department
Property Owner's Mailing Address: 216 South Date Street, Shoshone, ID 83352
Phone: 208-886-7809
Email: Scott.Malone@itd.idaho.gov
PROJECT INFORMATION
Project Name: SH-75 Bridge over Trail Creek
Project Representative's Name (main point of contact for project): Mike Schubert, HDR Engineering
Project Representative's Phone: 208-387-7070
Project Representative's Mailing Address: 412 E Parkcenter Blvd, Boise, ID 83706
Project Representative's Email: Michael.Schubert@hdrinc.com
Architect's name, phone number, e-mail:
Landscape Architect's name, phone number, e-mail:
Environmental consultant's name, phone number, e-mail:
Engineer's name, phone number, e-mail: Mike Schubert, Michael.Schubert@hdrinc.com
Project Address:
Legal Description of parcel:
Lot Size:
Zoning District:
Overlay Zones – indicate all that apply: ☐ Floodplain ☑ Floodway ☑ Riparian Zone ☐ Avalanche ☐ Mountain
Brief description of project scope: ITD is replacing the SH-75 bridge that goes over Trail Creek, along with stabilizing a portion of the bank upstream of the bridge where SH-75 will be widened
Value of Project: $ 25,000,000
TYPE OF PROJECT – indicate all that apply:

☐ New Building in Floodplain	☐ Building Addition in Floodplain	☐ Emergency Streambank Stabilization / Stream Alteration	☑ Other. Please describe: Replace bridge
☑ Floodplain Development	☑ Streambank Stabilization / Stream Alteration		
PROPOSED SETBACKS – if project is a new building or an addition to an existing building			
Front:	Side:	Side:	Rear:
ADDITIONAL INFORMATION			
Will fill or excavation be required in floodplain, floodway or riparian zone? Yes ◉ No ○			
If Yes, Amount in Cubic Yards: Fill: 192 CY Excavation: 192 CY			
Will Existing Trees or Vegetation be Removed? Yes ◉ No ○			
Will new trees or vegetation be planted? Yes ◉ No ○			

Applicant agrees in the event of a dispute concerning the interpretation or enforcement of the Floodplain Management Overlay Application, in which the City of Ketchum is the prevailing party, to pay reasonable attorney fees, including attorney fees on appeal, and expenses of the City of Ketchum. I, the undersigned, certify that all information submitted with and upon this application form is true and accurate to the best of my knowledge and belief.

Scott E. Malone, P.E. D4 Engineering Manager Digitally signed by Scott E. Malone, P.E. D4 Engineering Manager Date: 2024.07.22 16:44:37 -06'00'

Signature of Owner/Representative Date

FLOODPLAIN MANAGEMENT OVERLAY EVALUATION STANDARDS

Please provide a narrative to address each of the criteria below.

Criteria for Evaluation of Applications: The criteria of floodplain development permit applications shall be as follows:

1. The proposal preserves or restores the inherent natural characteristics of the river, floodplain, and Riparian Zone, including riparian vegetation and wildlife habitat. Development does not alter river channel unless all stream alteration criteria for evaluation are also met.
2. No temporary construction activities, encroachment, or other disturbance into the twenty-five foot (25') Riparian Zone, including encroachment of below grade structures, shall be permitted, except for approved stream stabilization work and restoration work associated with a riparian zone that is degraded.
3. No permanent development shall occur within the twenty-five foot (25') Riparian Zone, except for approved stream stabilization work and restoration work associated with permit issued under this title, or exceptions as described below:
    a. Access to a property where no other primary access is available.
    b. Emergency access required by the Fire Department.
    c. A single defined pathways or staircases for the purpose of providing access to the river channel and in order to mitigate multiple undefined social paths.
    d. Development by the City of Ketchum
4. New or replacement planting and vegetation in the Riparian Zone shall include plantings that are low growing and have dense root systems for the purpose of stabilizing stream banks and repairing damage previously done to riparian vegetation. Examples of such plantings most commonly include red osier dogwood, common chokecherry, serviceberry, elderberry, river birch, skunk bush sumac, Beb’s willow, Drummond's willow, little wild rose, gooseberry, and honeysuckle. However, in rare instances the distance from the top-of-bank to the mean high-water mark is significant and the native vegetation appropriate for the Riparian Zone are low growing, drought resistant grasses and shrubs. Replacement planting and vegetation shall be appropriate for the specific site conditions. Proposal does not include vegetation within the twenty-five foot (25') Riparian Zone that is degraded, not natural, or which does not promote bank stability.
5. Landscaping and driveway plans to accommodate the function of the floodplain allow for sheet flooding. Surface drainage is controlled and shall not adversely impact adjacent properties including driveways drained away from paved roadways. Culvert(s) under driveways may be required. Landscaping berms shall be designed to not dam or otherwise obstruct floodwaters or divert same onto roads or other public pathways.
6. Floodwater carrying capacity is not diminished by the proposal.
7. Impacts of the development on aquatic life, recreation, or water quality upstream, downstream or across the stream are not negative.
8. Building setback in excess of the minimum required along waterways is encouraged. An additional ten-foot (10') building setback beyond the required twenty-five foot (25’) Riparian Zone is encouraged to provide for yards, decks and patios outside the twenty five foot (25') Riparian Zone.
9. The top of the lowest floor of a building located in, or partially within, the SFHA shall be at or above the Flood Protection Elevation (FPE). A building is considered to be partially within the SFHA if any portion of the building or appendage of the building, such as footings, attached decks, posts for upper story decks, are located within the SFHA. See section 17.88.060, figures 1 and 2 of this chapter to reference construction details. See Chapter 17.08 of this title for definition of “lowest floor.”
    a. In the SFHA where Base Flood Elevations (BFEs) have been determined, the FPE shall be twenty-four inches (24”) above the BFE for the subject property; twenty-four inches (24”) or two (2) feet is the required freeboard in Ketchum city limits.
    b. In the SFHA where no BFE has been established, the FPE shall be at least two (2) feet above the highest adjacent grade.
10. The backfill used around the foundation in the SFHA floodplain shall provide a reasonable transition to existing grade but shall not be used to fill the parcel to any greater extent.
    a. Compensatory storage shall be required for any fill placed within the floodplain.
    b. A CLOMR-F shall be obtained prior to placement of any additional fill in the floodplain.
11. All new buildings located partially or wholly within the SFHA shall be constructed on foundations that are designed by a licensed professional engineer.

12. Driveways shall comply with City of Ketchum street standards; access for emergency vehicles has been adequately provided for by limiting flood depths in all roadways to one foot (1-ft) or less during the 1% annual chance event.
13. Landscaping or revegetation shall conceal cuts and fills required for driveways and other elements of the development.
14. (Stream alteration.) The proposal is shown to be a permanent solution and creates a stable situation.
15. (Stream alteration.) No increase to the one percent (1%) annual chance flood elevation at any location in the community, based on hydrologic and hydraulic analysis performed in accordance with standard engineering practice and has been certified and submitted with supporting calculations and a No Rise Certificate, by a registered Idaho engineer.
16. (Stream alteration.) The project has demonstrated No Adverse Impact or has demonstrated all impacts will be mitigated.
17. (Stream alteration.) The recreational use of the stream including access along any and all public pedestrian/fisher's easements and the aesthetic beauty shall not be obstructed or interfered with by the proposed work.
18. (Stream alteration.) Fish habitat shall be maintained or improved as a result of the work proposed.
19. (Stream alteration.) The proposed work shall not be in conflict with the local public interest, including, but not limited to, property values, fish and wildlife habitat, aquatic life, recreation and access to public lands and waters, aesthetic beauty of the stream and water quality.
20. (Stream alteration.) The work proposed is for the protection of the public health, safety and/or welfare such as public schools, sewage treatment plant, water and sewer distribution lines and bridges providing particularly limited or sole access to areas of habitation.
21. (Wetlands) Where development is proposed that impacts any wetland the first priority shall be to move development from the wetland area. Mitigation strategies shall be proposed at time of application that replace the impacted wetland area with an equal amount and quality of new wetland area or riparian habitat improvement.

APPLICATION CHECKLIST

Please utilize and submit the checklist on the following pages to ensure a complete application.

Floodplain management overlay application certification of completeness is based on submittal of all applicable items on this checklist.

Project name: SH-75 Bridge over Trail Creek____

Reviewed by:____

DOCUMENTS

- ☑ One (1) digital copy of all application materials
- ☑ Application form
- ☑ Evaluation criteria narrative
- ☑ Description of proposed development
- ☑ Specifications for building construction and materials, flood proofing, filling, grading, dredging, channel improvement/changes and utilities
- ☑ Elevation and/or flood proofing certification prepared by a professional engineer for existing and proposed residential and nonresidential structures located partially or wholly in the regulatory floodplain. Said floodproofing methods shall meet the criteria in subsection 17.88.060.B of the Ketchum Municipal Code.
- ☐ Copy of letter of map amendment based on fill (LOMA-F) application for any proposed fill in the floodplain. LOMA-F approval shall be obtained from FEMA prior to issuance of a floodplain development permit.
- ☑ Signed, notarized, original copy of the Acknowledgement of Floodplain Management Overlay District and Waterways Design Review District Affidavit.

SITE SURVEY OF EXISTING CONDITIONS (prepared and stamped by a licensed engineer or surveyor) – REQUIRED FOR NEW BUILDINGS OR ADDITIONS TO BUILDINGS IN THE FLOODPLAIN AND ANY WORK WITHIN THE FLOODWAY

- ☐ Exterior boundary lines of the property together with dimensions
- ☐ Topographic survey of the real property at a minimum of one (1) foot contour intervals, significant hillsides may be a minimum of ten (10) foot contour intervals
- ☐ Location of any existing dwelling units, other structures, fill, storage of materials, drainage facilities and all improved areas (pavement) with dimensions thereof showing the setback of each structure from the nearest property line
- ☐ Location of existing channels and ditches and other significant natural features, boundaries of floodway and floodplain, including Base Flood Elevation (BFE) and other site specific information from the studies referred to in Ketchum Municipal Code, subsection 17.88.040.A.3
- ☐ Location and elevations of adjacent streets, water supply and sewer lines, including private wells and/or septic systems
- ☐ Elevation of the lowest floor (including basement) of all structures existing and proposed partially or wholly located in the one percent (1%) annual chance floodplain, including elevation to which any structure has been or will be floodproofed
- ☐ Identification of the riparian zone and the "mean high water mark," as defined in Ketchum Municipal Code
- ☐ Location of previous stream alterations upstream, downstream and along both banks from subject lot
- ☐ Location of drainage ways, intermittent and year-round, including potential overflow channels or channel movement
- ☐ Location and dimensions of easements, private and public, within and adjacent to the proposed project together with the purpose thereof
- ☐ Location of all existing trees to be preserved and significant trees to be removed
- ☐ Indication of any zoning district overlay which affects the property (floodplain, mountain overlay or avalanche)
- ☐ Location of existing structures on adjacent properties

SITE PLAN – REQUIRED FOR ALL PROJECTS.

- [x] Vicinity map
- [x] Proposed excavation or land fill including resulting slope grades for the building pad(s), driveways and any other element of the proposed development where excavation or fill will take place
- [ ] Drainage plan including offsite improvements such as borrow ditches and culverts and including a plan for on- and off-site improvements to provide for unobstructed conveyance of floodwaters
- [ ] Location of on-site parking spaces and access thereto, including the dimensions of the spaces and the width and length of access and curb cuts
- [ ] Location and dimensions of snow storage areas
- [ ] Location of dumpster and/or garbage and recycling can storage areas, including the dimensions and proposed fencing or other screening
- [ ] Location and type of any electrical power transformers, switches and/or sectors
- [ ] Location and type of all heating, ventilation, air conditioning and other mechanical units
- [ ] Drip line of all buildings
- [ ] Percentage of the lot coverage by proposed building and parking areas together with the total square footage of the parcel of property
- [x] Location of all proposed structures (buildings) and all improved areas (pavement, sidewalk) with dimensions thereof showing the setback of each structure from the nearest property line
- [x] Designation of the zoning district in which the project is located
- [x] Location of any zoning district boundary line within the proposed project or the immediate vicinity thereof
- [ ] For any building in the floodplain with an area below the lowest floor that is below the base flood elevation and has a ceiling height of five feet (5') or greater, the building owner shall sign a non-conversion agreement, that shall run with the property, promising not to improve, finish or otherwise convert the area below the lowest floor to living area and granting the city the right to inspect the enclosed area at its discretion. Such agreement shall be recorded at Blaine County's recorder's office

ARCHITECTURAL PLANS – REQUIRED FOR NEW BUILDINGS OR ADDITIONS TO EXISTING BUILDINGS

- [ ] Floor plans of all floors at not less than one-eighth (1/8) scale
- [ ] All exterior elevations
- [ ] Roof plan including direction of snow sliding and snow clips if applicable. Location and type of all mechanical equipment and rooftop appurtenances
- [ ] Cross-section(s) of the property and proposed building adequately establishing the natural grade, finished grade, slope of land, slope of proposed accesses and grades to all public rights-of-way
- [ ] Location and type (cut sheets) of all exterior lighting
- [ ] Model or computer simulation renderings, if required at pre-application design review meeting

LANDSCAPE PLAN – REQUIRED FOR ANY PROJECT PROPOSING TO ALTER VEGETATION IN THE RIPARIAN ZONE OR SPECIAL FLOOD HAZARD AREA

- [x] All existing vegetation over 2 inches in caliper, including size and species
- [x] Proposed landscaping of the project including types, quantities and sizes of trees, shrubs, ground cover and other vegetation
- [ ] Proposed landscaping or other improvements within any public rights-of-way
- [ ] Location, type (materials and colors) and height of walls or fences
- [ ] Location of parking areas
- [x] Location of vehicular and pedestrian circulation patterns, easements and proposed improvements with regard thereto
- [x] Irrigation system for landscaping
- [ ] Drainage plan including off-site improvements

STREAM ALTERATIONS / STREAMBANK STABILIZATION

- [x] Copies of the Joint Application for Permits submitted to the U.S. army corps of engineers (USACE) and Idaho department of water resources (IDWR). Please note, USACE and IDWR approvals shall be obtained prior to issuance of a stream alteration permit.
- [ ] Copy of the USACE permit approval.
- [x] Copy of the IDWR permit approval.
- [ ] Cross section of proposed work

- ☑ Length of stream to be worked, type of work to be done, type of equipment to be used and starting and completion dates of work
- ☑ A valley cross section showing stream channel, floodway limits, elevations of adjacent land areas, Special Flood Hazard Area boundary, floodway boundary, existing Mean High Water mark, proposed Mean High Water mark, Riparian Zone regulated by the City of Ketchum, proposed excavation, proposed fill. A profile showing the slope of the bottom of the channel or flow line of the stream may be required upon review of all other material submitted.
- ☑ For any work proposed to occur in the regulatory floodway: A no net rise certificate, including supporting calculations, prepared and stamped by an Idaho registered professional hydraulic engineer
- ☑ For any work proposed to occur in the floodway: HEC-RAS model

NO ADVERSE IMPACT STATEMENT – WHERE APPLICABLE

- ☐ No Adverse Impact Statement
    - See definition of “No Adverse Impact” in section 17.08.020 of Ketchum Municipal Code.

Acknowledgement of Floodplain Affidavit

Pursuant to Ketchum Municipal Code §17.88.040 D1, prior to the issuance of any floodplain development permit for development within the Floodplain Management Overlay District and the Waterways Review District as defined under to Ketchum Municipal Code §17.08, the property owner shall submit to the Planning and Building Department a written affidavit on a form provided by the City, signed by the property owner under seal of a notary public, of the property owner's actual knowledge that the property is located within the Floodplain Management Overlay District or the Waterways Review District. The property owner will also acknowledge that he or she is aware of the flood hazard potential for the property and is aware of the regulations the Floodplain Management Overlay Zoning District and Waterways Review District no work shall occur in these areas without city permits and approvals

Instructions

1. Property owner shall complete the attached affidavit.

2. Property Owner shall sign before a notary public and have the affidavit notarized.

3. Property Owner shall return original notarized affidavit to the City of Ketchum Planning & Building Department.

4. The Planning & Building Department shall have the notarized affidavit recorded in the records of Blaine County for the property.

5. A copy of the recorded document will be delivered to the Property Owner and filed in the City records with the building permit documents.

RECORDING REQUESTED BY AND WHEN RECORDED RETURN TO: City Clerk, City of Ketchum PO Box 2315 Ketchum Idaho, 83340	

(Space Above Line For Recorder's Use)

Acknowledgement of Floodplain Management Overlay District and Waterways Design Review District Affidavit

Property Owner: Idaho Transportation Department	
Building Permit Number:	
Property Address: SH-75 Trail Creek Bridge	
Legal Description:	
Parcel Number: RPK	
Scope of Work: Reconstruct bridge, slope stabalization	

Please initial and fill below:

_________ I acknowledge that this development and the parcel of land, or portion thereof, on which the development will be situated are within the Floodplain Management Overlay District.

__________I acknowledge this property is within the Waterways Review District.

__________I have thoroughly read and fully understand Ketchum Municipal Code Title 17, Chapter 17.88 "Floodplain Management Overlay District", to include regulations for the Waterways Design Review District including regulations on activities within 100 feet of the mean high-water mark.

__________I fully understand and agree to comply with Ketchum Municipal Code Title 17, Chapter 17.88.040 C.

__________I fully understand and agree to comply with all conditions of approval associated with floodplain development permit #P________

__________I, on behalf of myself, my personal representatives and my heirs, successors, and assignees, acknowledge by this written *affidavit* that said property is located within the one percent annual chance floodplain (SFHA) as defined herein, and/or said property is within the Waterways Design Review District and that a violation of the terms of Ketchum Municipal Code 17.88 shall cause the City to seek legal remedies.

__________I, on behalf of myself, my personal representatives and my heirs, successors, and assignees, acknowledge by this written *affidavit* that said property is located within the one percent annual chance floodplain (SFHA) as defined herein, that such floodplain and floodway boundaries and restrictions and requirement for development on the property may change and I will comply with all requirements that may be in effect at the time of development.

__________ I acknowledge that the City of Ketchum Planning & Building Department shall have the notarized affidavit recorded in the records of Blaine County for the property.

____ _________________________________

Property Owner Signature Date

STATE OF __________, County of _____________

On this _________ day of _____________________, __________, before me, the undersigned, a Notary Public in and for said State, personally appeared _________________________________, known or identified to me to be the person whose name is subscribed to the within instrument.

WITNESS my hand and seal the day and year in this certificate first above written.

____ Residing at: ________________________________

Notary Public for _________________ Commission Expires: ________________________

(State)

City of Ketchum accepts this Affidavit from (insert owner's name).

____

ATTEST, CITY CLEK

JOINT APPLICATION FOR PERMITS

U.S. ARMY CORPS OF ENGINEERS - IDAHO DEPARTMENT OF WATER RESOURCES - IDAHO DEPARTMENT OF LANDS

Authorities: The Department of Army Corps of Engineers (Corps), Idaho Department of Water Resources (IDWR), and Idaho Department of Lands (IDL) established a joint process for activities impacting jurisdictional waterways that require review and/or approval of both the Corps and State of Idaho. Department of Army permits are required by Section 10 of the Rivers & Harbors Act of 1899 for any structure(s) or work in or affecting navigable waters of the United States and by Section 404 of the Clean Water Act for the discharge of dredged or fill materials into waters of the United States, including adjacent wetlands. State permits are required under the State of Idaho, Stream Protection Act (Title 42, Chapter 38, Idaho Code and Lake Protection Act (Section 58, Chapter 13 et seq., Idaho Code). In addition the information will be used to determine compliance with Section 401 of the Clean Water Act by the appropriate State, Tribal or Federal entity.

Joint Application: Information provided on this application will be used in evaluating the proposed activities. Disclosure of requested information is voluntary. Failure to supply the requested information may delay processing and issuance of the appropriate permit or authorization. **Applicant will need to send a completed application, along with one (1) set of legible, black and white (8½"x11"), reproducible drawings that illustrate the location and character of the proposed project / activities to both the Corps and the State of Idaho.**

See Instruction Guide for assistance with Application. Accurate submission of requested information can prevent delays in reviewing and permitting your application. Drawings including vicinity maps, plan-view and section-view drawings must be submitted on 8-1/2 x 11 papers.

Do not start work until you have received all required permits from both the Corps and the State of Idaho

FOR AGENCY USE ONLY			
USACE NWW-	Date Received:	☐ Incomplete Application Returned	Date Returned:
Idaho Department of Water Resources No.	Date Received:	☐ Fee Received DATE:	Receipt No.:
Idaho Department of Lands No.	Date Received:	☐ Fee Received DATE:	Receipt No.:

INCOMPLETE APPLICANTS MAY NOT BE PROCESSED

1. **CONTACT INFORMATION - APPLICANT** Required:	2. **CONTACT INFORMATION - AGENT:**
Name: Jesse Barrus (District Engineer) or Scott Malone (Engineer Manager)	Name: Nathan Jerke
Company: Idaho Transportation Department (ITD) District 4	Company: Idaho Transportation Department (ITD) District 4
Mailing Address: 216 South Date Street	Mailing Address: 216 South Date Street
City: Shoshone; State: ID; Zip Code: 83352-1521	City: Shoshone; State: ID; Zip Code: 83352-1521
Phone Number *(include area code)*: 208-886-7800; E-mail: scott.malone@itd.idaho.gov	Phone Number *(include area code)*: 208-886-7809; E-mail: nathan.jerke@itd.idaho.gov

3. PROJECT NAME or TITLE: SH-75, Elkhorn Rd to River St

4. PROJECT STREET ADDRESS: SH-75 MP 126.4 to MP 128.2

5. PROJECT COUNTY:	6. PROJECT CITY:	7. PROJECT ZIP CODE:	8. NEAREST WATERWAY/WATERBODY:
Blaine	Ketchum	83340	Trail Creek

9. TAX PARCEL ID#:	10. LATITUDE / LONGITUDE	11a. 1/4:	11b. 1/4:	11c. SECTION:	11d. TOWNSHIP:	11e. RANGE:
	LATITUDE: 43.667041 (approx. center) LONGITUDE: -114.355657			18, 19, 30	4N	18E

12a. ESTIMATED START DATE:	12b. ESTIMATED END DATE:	13a. IS PROJECT LOCATED WITHIN ESTABLISHED TRIBAL RESERVATION BOUNDARIES?
Jan 1, 2025	Oct 31, 2027	☒ NO ☐ YES Tribe:

13b. IS PROJECT LOCATED IN LISTED ESA AREA? ☐ NO ☒ YES

13c. IS PROJECT LOCATED ON/NEAR HISTORICAL SITE? ☒ NO ☐ YES

14. DIRECTIONS TO PROJECT SITE: Include vicinity map with legible crossroads, street numbers, names, landmarks.

The Project begins on SH-75 at approximately mile post (MP) 126.4 and ends near MP 128.2 at the intersection of River Street. The Project may be accessed from I-84 by taking US-93 (which transitions to SH-75) north to Ketchum, Idaho. From the City of Ketchum, take Main St south which transitions to SH-75.

15. PURPOSE and NEED: ☐ Commercial ☐ Industrial ☒ Public ☐ Private ☐ Other

Describe the reason or purpose of your project; include a brief description of the overall project. Continue to Block 16 to detail each work activity and overall project.

This Project aims to improve safety and capacity on SH-75 between the Big Wood River Bridge near Elkhorn Road and River Street in the City of Ketchum in Blaine County, mileposts (MP) 126.4 to 128.2. Project development will include roadway widening with curb, gutter, sidewalk, intersection improvement, retaining walls, drainage, public involvement, and replacing a box culvert and constructing a reinforced slope along Trail Creek.

16. DETAILED DESCRIPTION OF EACH ACTIVITY WITHIN OVERALL PROJECT. Specifically indicate portions that take place within waters of the United States, including wetlands: Include dimensions; equipment, construction, methods; erosion, sediment and turbidity controls; hydrological changes: general stream/surface water flows, estimated winter/summer flows; borrow sources, disposal locations etc.:

The wetland and stream impacts are a result of road widening, bridge replacement (construction of a reinforced slope to stabilize the stream bank on Trail Creek and construction of wildlife bench), and the installation of a stormwater facility. Work within wetlands consists of fill placement for roadway widening, scour protection, and stream bank grading to increase hydraulic flow. Additionally, culvert work will be required. This will include installation of a concrete box and headwalls, modification of stormwater pond, and replacement of three irrigation culverts and irrigation crossing. Construction equipment will include rollers, backhoes, excavators, cranes, and other construction equipment typical for a roadway and bridge construction project. All materials sources will be determined by the contractor and approved by the project engineer. Waste materials will be disposed of in an approved upland location.
All bridge improvements will be located outside of the existing and proposed stream channels. The project is designed to restore a more natural channel gradient, bed, and width, and improved bank stability through the structure. New bridge footings will be constructed outside OHWM. (See Attachment C, page 6 and 7). Equipment will include an excavator operating from the bank/existing roadway. The construction area within the OHWM of the open waters will be dewatered using sandbags or another similar temporary dewatering method. A qualified Biologist will capture and remove fish from the dewatered work area if needed. A pump with a fish screen will be used to transfer water. The in-water work window will be observed for construction from July 15 to March 15, which was confirmed by Idaho Department of Water Resources (IDWR) and Idaho Department of Fish and Game (IDFG).
An ITD approved Storm Water Pollution Prevention Plan (SWPPP) will be prepared for this project to comply with the Construction General permit. The SWPPP will include measures to address sediment and erosion control with both temporary and permanent measures. Critical areas including wetlands will be marked to retain and protect on Design Plans and SWPPP Plans except as allowed in 404 and other permits. The perimeter of the wetlands that are not permitted to be impacted will be clearly marked with high visibility silt fence.

17. DESCRIBE ALTERNATIVES CONSIDERED to AVOID or MEASURES TAKEN to MINIMIZE and/ or COMPENSATE for IMPACTS to WATERS of the UNITED STATES, INCLUDING WETLANDS: See Instruction Guide for specific details.

The do nothing alternative is not practicable because it does not meet the purpose and need of the project. Improvements that will not result in wetland impacts are not prudent or practicable since the highway must be widened in order to build the alternative and improve safety and capacity on SH-75 as described in the SH-75 Timmerman to Ketchum Environmental Impact Statement (FEIS) and Record of Decision (ROD) which was approved in August 2008.The FEIS-ROD was reevaluated in 2023 and approved by FHWA.
Tree removal along the riparian corridor will be minimized by using retaining walls and a reinforced slope along Trail Creek. The disturbed riparian area and reinforced slope will be planted with native plant species.
The existing box culvert at Trail Creek will be replaced with a clear span bridge which will improve hydrological flow and increase the amount of available aquatic habitat.

18. PROPOSED MITIGATION STATEMENT or PLAN: If you believe a mitigation plan is not needed, provide a statement and your reasoning why a mitigation plan is NOT required. Or, attach a copy of your proposed mitigation plan.

The total wetland impacts are 1,956 square ft (0.0449 acre) and the total open water impacts are 1,555 square feet (0.0358 acre). Wetland impact acreage is less than 0.1 acre; therefore, mitigation is not required through the US Army Corps of Engineers (USACE) but still required under FHWA Executive Order (EO) 11990. While the total acres of impact to open water exceeds the 0.03 acre threshold for mitigation through USACE the project impacts to Trail Creek due to the bridge replacement will increase aquatic habitat under the Trail Creek Bridge by 175 sqft and stabilization will be through a vegetated wall along the stream bank (716 sqft) which are improvements and self-mitigating; therefore, mitigation is not required through the USACE.

The mitigation plan for FHWA is available upon request.

19. TYPE and QUANTITY of MATERIAL(S) to be discharged below the ordinary high water mark and/or wetlands:

Dirt or Topsoil:	________	cubic yards
Dredged Material:	________	cubic yards
Clean Sand:	________	cubic yards
Clay:	________	cubic yards
Gravel, Rock, or Stone:	________	cubic yards
Concrete:	________	cubic yards
Other (describe): See Attachments :	________	cubic yards
Other (describe: ________ :	________	cubic yards

TOTAL:________ cubic yards

20. TYPE and QUANTITY of impacts to waters of the United States, including wetlands:

Filling:	________	acres	________	sq ft.	________	cubic yards
Backfill & Bedding:	________	acres	________	sq ft.	________	cubic yards
Land Clearing:	________	acres	________	sq ft.	________	cubic yards
Dredging:	________	acres	________	sq ft.	________	cubic yards
Flooding:	________	acres	________	sq ft.	________	cubic yards
Excavation:	________	acres	________	sq ft.	________	cubic yards
Draining:	________	acres	________	sq ft.	________	cubic yards
Other: See Attachments :	________	acres	________	sq ft.	________	cubic yards

TOTALS: ________ acres ________ sq ft.________ cubic yards

21. HAVE ANY WORK ACTIVITIES STARTED ON THIS PROJECT? ☒ NO ☐ YES If yes, describe ALL work that has occurred including dates.

22. LIST ALL PREVIOUSLY ISSUED PERMIT AUTHORIZATIONS:

Floodplain Management Permit (3/30/2020 application, pending). A final floodplain permit application would be approved by the City of Ketchum Floodplain Administrator within 180 days prior to construction under authority of FEMA's National Flood Insurance Program (NFIP) and the City of Ketchum's floodplain management ordinance (Ordinance 1120 §17.88.070 C.1).

USACE identifies this job as --SH-75, Elkhorn Rd. to River St. (KN 20033), NWW-2020-0050 from the PJD issued January 2024.

23. ☐ YES, Alteration(s) are located on Public Trust Lands, Administered by Idaho Department of Lands

24. SIZE AND FLOW CAPACITY OF BRIDGE/CULVERT and DRAINAGE AREA SERVED: 69 Square Miles

25. IS PROJECT LOCATED IN A MAPPED FLOODWAY? ☐ NO ☒ YES If yes, contact the floodplain administrator in the local government jsrisdiction in which the project is located. A Floodplain Development permit and a No-rise Certification may be required.

26a WATER QUALITY CERTIFICATION: Pursuant to the Clean Water Act, anyone who wishes to discharge dredge or fill material into the waters of the United States, either on private or public property, must obtain a Section 401 Water Quality Certification (WQC) from the appropriate water quality certifying government entity.
See Instruction Guide for further clarification and all contact information.

The following information is requested by IDEQ and/or EPA concerning the proposed impacts to water quality and anti-degradation:
☒ NO ☐ YES Is applicant willing to assume that the affected waterbody is high quality?
☒ NO ☐ YES Does applicant have water quality data relevant to determining whether the affected waterbody is high quality or not?
☒ NO ☐ YES Is the applicant willing to collect the data needed to determine whether the affected waterbody is high quality or not?

26b. BEST MANAGEMENT PRACTICTES (BMP's): List the Best Management Practices and describe these practices that you will use to minimize impacts on water quality and anti-degradation of water quality. All feasible alternatives should be considered - treatment or otherwise. Select an alternative which will minimize degrading water quality

1.Measures will be taken to minimize the potential for debris (e.g., dirt, concrete, etc.) to enter the area of wetlands not being impacted while removing and constructing structures.
2. A spill plan will be prepared by the construction contractor and approved by ITD D4 prior to project implementation.
3. An ITD approved SWPPP will be prepared for this project. The SWPPP will include measures to address sediment and erosion control with both temporary and permanent measures. All requirements of the Water Quality Certification issued by IDEQ will be followed.
4. All disturbed soils will be reseeded following construction.
5. On-site mitigation will consist of native plantings, and retention walls at Trail Creek restoration area.
6. Dewatering may be accomplished by draining, pumping, bailing, or cribbing. If needed, temporary sump holes may be installed within the footings and abutment areas to be dewatered to create a more suitable pumping area. The water removed during footing and abutment construction will be pumped to a temporary storage location where the water will be cleaned to standards specified by Idaho Department of Environmental Quality (IDEQ) to meet the current State of Idaho requirements. If appropriate, water from the dewatering activities may be pumped to a temporary storage/treatment site, or into upland areas and allowed to flow/filter through vegetation prior to reentering the stream channel. The water behind the barrier may be pumped directly back into the stream providing the pumped water meets applicable in stream turbidity criteria.
7. Turbidity monitoring will be conducted while working on or adjacent to Trail Creek

Through the 401 Certification process, water quality certification will stipulate minimum management practices needed to prevent degradation.

27. LIST EACH IMPACT to stream, river, lake, reservoir, including shoreline: Attach site map with each impact location.

Activity	Name of Water Body	Intermittent Perennial	Description of Impact and Dimensions	Impact Length Linear Feet
See attached narrative				
			TOTAL STREAM IMPACTS (Linear Feet):	

28. LIST EACH WETLAND IMPACT include mechanized clearing, filL excavation, flood, drainage, etc. Attach site map with each impact location.

Activity	Wetland Type: Emergent, Forested, Scrub/Shrub	Distance to Water Body (linear ft)	Description of Impact Purpose: road crossing, compound, culvert, etc.	Impact Length (acres, square ft linear ft
See attached narrative				
			TOTAL WETLAND IMPACTS (Square Feet):	

29. ADJACENT PROPERTY OWNERS NOTIFICATION REQUIREM: Provide contact information of ALL adjacent property owners below.

Name: See Attached Narrative Mailing Address: City: State: Zip Code: Phone Number *(include area code)*: E-mail:	Name: Mailing Address: City: State: Zip Code: Phone Number *(include area code)*: E-mail:
Name: Mailing Address: City: State: Zip Code: Phone Number *(include area code)*: E-mail:	Name: Mailing Address: City: State: Zip Code: Phone Number *(include area code)*: E-mail:
Name: Mailing Address: City: State: Zip Code: Phone Number *(include area code)*: E-mail:	Name: Mailing Address: City: State: Zip Code: Phone Number *(include area code)*: E-mail:
Name: Mailing Address: City: State: Zip Code: Phone Number *(include area code)*: E-mail:	Name: Mailing Address: City: State: Zip Code: Phone Number *(include area code)*: E-mail:

30. SIGNATURES: STATEMENT OF AUTHORIAZATION / CERTIFICATION OF AGENT / ACCESS

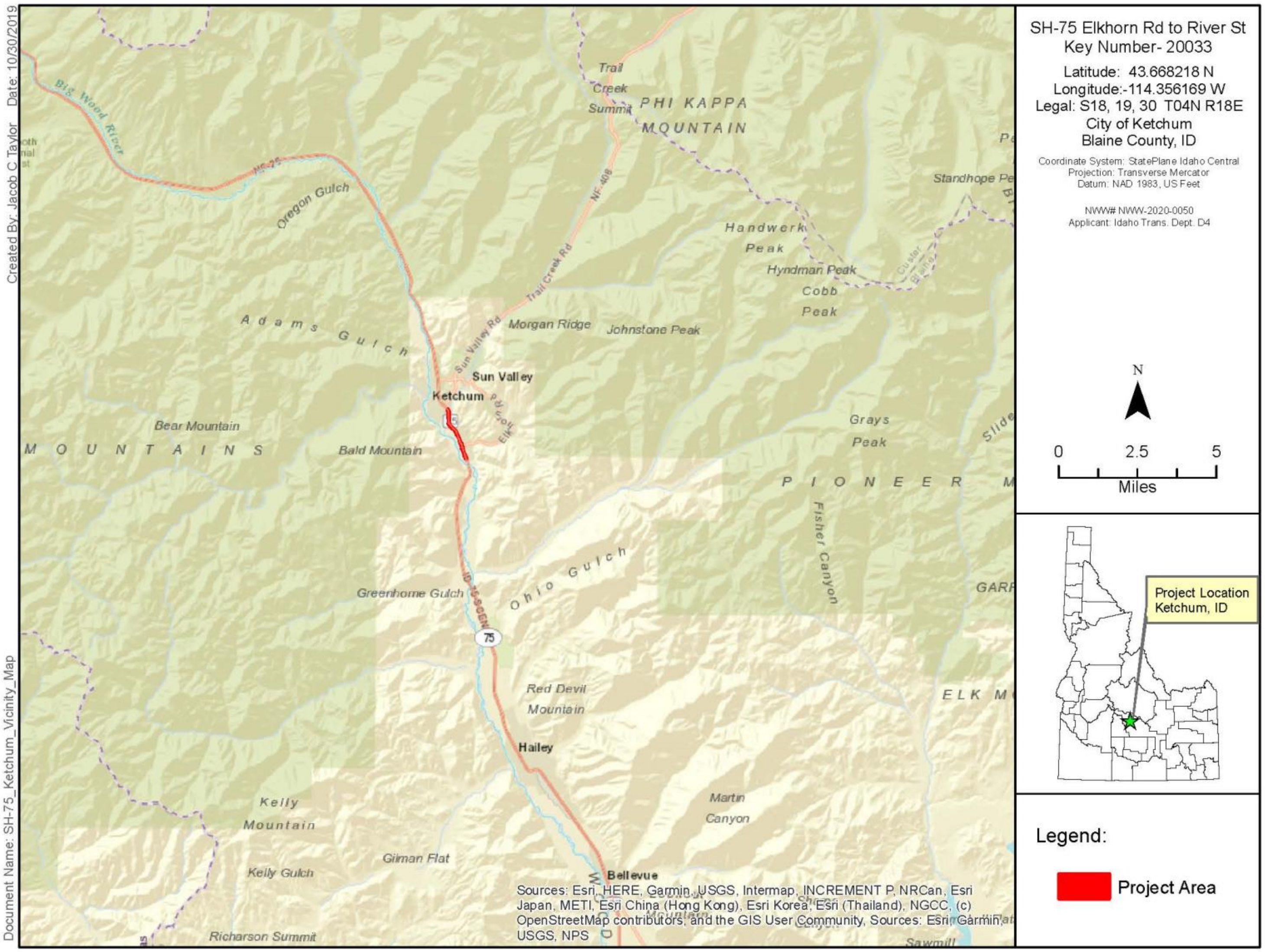
Application is hereby made for permit, or permits, to authorize the work described in this application and all supporting documentation. I certify that the information in this application is complete and accurate. I further certify that I possess the authority to undertake the work described herein; or am acting as the duly authorized agent of the applicant (Block 2). I hereby grant the agencies to which this application is made, the right to access/come upon the above-described location(s) to inspect the proposed and completed work/activities.

Signature of Applicant: ______________________________ *Date:* ______________

Signature of Agent: ______________________________ *Date:* ______________

This application must be signed by the person who desires to undertake the proposed activity AND signed by a duly authorized agent (see Block 1, 2, 30). Further, 18 USC Section 1001 provides that: "*Whoever, in any manner within the jurisdiction of any department of the United States knowingly and willfully falsifies, conceals, or covers up any trick, scheme, or disguises a material fact or makes any false, fictitious, or fraudulent statements or representations or makes or uses any false writing or document knowing same to contain any false, fictitious or fraudulent statements or entry, shall be fined not more than $10,000 or imprisoned not more than five years or both*".

Attachment A. Vicinity Map



KN20033, NWW-2020-0050

Attachment B.

- 19. TYPE and QUANTITY of MATERIAL(S) to be discharged below the ordinary high water mark and/or wetlands:
- 20. TYPE and QUANTITY of impacts to waters of the United States, including wetlands:
- 27. LIST EACH IMPACT to stream, river, lake, reservoir, including shoreline: Attach site map with each impact location.
- 28. LIST EACH WETLAND IMPACT include mechanized clearing, fill excavation, flood, drainage, etc. Attach site map with each impact location.
- 29. ADJACENT PROPERTY OWNERS NOTIFICATION REQUIREM: Provide contact information of ALL adjacent property owners below.

BLOCK 19

TYPE and QUANTITY of MATERIALS to be discharged
below ordinary high water mark and/or wetlands

	Length (ft)	X-Section Area Below OHW (SF)	Plan Area (SF)	Depth (ft)	Volume (CY)	Figure	Comments
Dirt or Topsoil							
Wetland G							
-Sand and Topsoil for Pond			1100	0.5	26.2	2	1' Sand/6" Topsoil on Bottom; 6" Topsoil on Sides
-Backfill Wetland G	-	-	350.0	2	25.9	2	Backfill Remaining Area of Wetland G
				Fill Sub-Total	*52.1*		
Gravel, Rock, or Stone							
Wetland G							
-Gravel Access Road			220	0.5	4.1	2	6" of 3/4" Aggregate for Access Road
-Riprap/Erosion Control	-	-	102	1.5	5.7	2	Stone Riprap for Outfall to Pond
				Fill Sub-Total	*9.7*		
Concrete, Metal, & Plastic							
Wetland G							
-New 24" Pipe	70	1.5	-	-	3.9	2	
-New Outlet	-	-	5.0	4	0.7	2	
-New 12" Pipe	30	0.5	-	-	0.6	2	
				Fill Sub-Total	*5.2*		
Dirt or Topsoil							
Ditch 3							
-Backfill Ditch 3	55	2	-	-	4.1	2	Backfill Ditch 3 Inlcuding Access Road
				Fill Sub-Total	*4.1*		
Concrete, Metal, & Plastic							
Ditch 3							
-New Concrete Manhole (TY D)	-	-	8.6	4.5	1.4	2	
-New Sediment and Oil Trap	-	-	45	6.0	10.0	2	
				Fill Sub-Total	*11.4*		
Dirt or Topsoil							
Wetland F							
-Backfill Wetland F	-	-	180	1.5	10.0	3	Backfill Wetland F During Roadway Slope Construction
				Fill Sub-Total	*10.0*		
Concrete, Metal, & Plastic							
Ditch 2							
-New Concrete 18" Pipe with Steel Aprons	15	0.9	-	-	1.5	4	Install New Concrete 18" Pipe with Aprons
-New Concrete 18" Pipe with Steel Aprons	21	0.9	-	-	1.7	4	Install New Concrete 18" Pipe with Aprons
-New Concrete 18" Pipe with Steel Aprons	22	0.9	-	-	1.7	4	Install New Concrete 18" Pipe with Aprons
-New Concrete Structure	-	-	25	5.5	5.1	4	New 5'x5' Concrete Irrigation Box
				Fill Sub-Total	*10.0*		
Concrete, Metal, & Plastic							
Ditch 1							Crossing Under SH-75
-New Concrete 24" Pipe	94	1.5	-	-	5.2	5	Install New Concrete 24" Pipe
-New Concrete Headwall	-	-	-	-	1.3	5	Install New Concrete 24" Headwall Rt.
-New Concrete Headwall	-	-	-	-	1.3	5	Install New Concrete 24" Headwall Lt.
				Fill Sub-Total	*7.8*		

BLOCK 19

TYPE and QUANTITY of MATERIALS to be discharged
below ordinary high water mark and/or wetlands

	Length (ft)	X-Section Area Below OHW (SF)	Plan Area (SF)	Depth (ft)	Volume (CY)	Figure	Comments
Dirt or Topsoil							
Trail Creek Bridge Replacement							
Fill Soil Above Rip Rap	-	-	574.4	3	63.8	6	Soil above rip w/i OHW at Trail Creek Bridge
Fill Bench	80	3.2	-	-	9.5	6	Fill for south bench
Fill Sub-Total					*73.3*		
Gravel, Rock, or Stone							
Trail Creek Bridge Replacement							
Install Riprap	-	-	574.4	3	71.4	6	Rip rap installation w/I OHW at Trail Creek Bridge
Install Geotextile Fabric under Riprap	-	-	574.4	0	0.0	6	Geotextile fabric installation w/i OHW at Trail Creek Bridge
Fill Sub-Total					*71.4*		
Dirt or Topsoil							
Wetland A							
Wetland A Disturbed for Planting, Fill			51.2	0.5	0.9	6	Native plantings for riparian area restoration in wetland A, fill
Wetland A Temp Disturbed for Planting, Fill			22	0.5	0.4	6	Fill below OHW for Planting plan in wetland A
Fill Sub-Total					*0.9*		
Gravel, Rock, or Stone							
Wetland A							
Riprap installation in wetland			0.5	3	0.1	6	Rip rap installation w/I OHW at Trail Creek Bridge
Geotextile Fabric under Riprap in wetland			0.5	0	0.0	6	Geotextile fabric installation within Wetland, permanent
Fill Sub-Total					*0.1*		
Dirt or Topsoil							
Trail Creek Slope Stabilization							
Water Diversion (Sandbags), Temporary	125	9.0	-	-	41.7	7	Temporary water diversion
Earth Fill Above RipRap			716	0.5	13.3	7	Earth Fill Above RipRap
Fill Sub-Total					*13.3*		
Gravel, Rock, or Stone							
Trail Creek Slope Stabilization							
Installation for RipRap			716	4	106.1	7	Riprap installation in front of reinforced slope
Install Geotextile Fabric under Riprap			716	0	0.0	7	Geotextile fabric installation w/i OHW at Trail Creek Slope
Fill Sub-Total					*106.1*		
Total Project Fill					*375.4*		
Total Project Net Materials Discharged Below OHW/Wetlands					**375.4**		

BLOCK 20

TYPE and QUANTITY of impacts to
waters of the United States, including wetlands

	Length (ft)	X-Section Area Below OHW (SF)	Plan Area (SF)	Depth (ft)	Volume (CY)	Figure	Comments
Dirt or Topsoil							
Wetland G							
-Excavate for New Riprap,Perm	-	-	102.0	1.5	-5.7	2	
-Excavate for New 24" Pipe, Temp	70	3.2	-	-	-8.3	2	Temporary excavation for pipe installation
-Excavate for New 24" Pipe.Perm	70	1.5	-	-	-3.9	2	Permanent excavation for pipe installation
-Excavate for New Outlet, Temp	-	-	45	4	-6.7	2	Temporary excavation for outlet installation
-Excavate for New Outlet, Perm			5	4	-0.7	2	Permanent excavation for outlet installation
-Excavate for New 12" Pipe, Temp	30	0.8	-	-	-0.9	2	Temporary excavation for pipe installation
-Excavate for New 12" Pipe, Perm	30	0.5	-	-	-0.6	2	Permanent excavation for pipe installation
-Excavate for Pond Expansion, Perm	-	-	1100	7	-285.2	2	
-Excavate for Access Road, Perm			300	2	-22.2	2	Permanent excavation for access road
Permanent Excavation Sub-Total					*-318.3*		
Ditch 3							
-Excavate for New Manhole, Temp	-	-	20	5	-3.7	2	Temporary excavation for manhole installation
-Excavate for New Manhole, Perm	-	-	8.6	4.5	-1.4	2	Permanent excavation for manhole installation
-Excavate for New Sed and Oil Trap, Temp	-	-	81	7	-21.0	2	Temporary excavation for sed trap installation
-Excavate for New Sed and Oil Trap, Perm	-	-	45	6	-10.0	2	Permanent excavation for sed trap installation
Permanent Excavation Sub-Total					*-11.4*		
Dirt or Topsoil							
Wetland F							
-Excavate Wetland F			180	1.5	-10.0	3	Excavate Wetland F During Roadway Slope Construction
Permanent Excavation Sub-Total					*-10.0*		
Dirt or Topsoil							
Ditch 2							
-Excavate for new Concrete Structure, Temp	-	-	77	6	-17.1	4	Temporary Excavationfor New 5'x5' Irrigation Box
-Excavate for new Concrete Structure, Perm	-	-	25	5.5	-5.1	4	Permanent excavation for New 5'x5' Irrigation Box
Permanent Excavation Sub-Total					*-5.1*		
Concrete, Metal, & Plastic							
Ditch 2							
-Remove Ex. CMP 18" Pipe	10	0.9	-	-	-0.3	4	Remove Existing CMP 18" Pipe
-Remove Ex. CMP 18" Pipe	21	0.9	-	-	-0.7	4	Remove Existing CMP 18" Pipe
-Remove Ex. CMP 18" Pipe	20	0.9	-	-	-0.7	4	Remove Existing CMP 18" Pipe
Permanent Excavation Sub-Total					*-1.7*		
Dirt or Topsoil							
Ditch 1							
-Excavate for Concrete Headwall, Temp	-	-	40.0	3.5	-5.2	5	Temporary excavtion for 24" Concrete Headwall Rt.
-Excavate for Concrete Headwall, Perm	-	-	-	-	-1.3	5	Permanent excavation for 24" Concrete Headwall Rt.
-Excavate for Concrete Headwall, Temp	-	-	40.0	3.5	-5.2	5	Temporary excavtion for 24" Concrete Headwall Lt.
-Excavate for Concrete Headwall, Perm	-	-	-	-	-1.3	5	Permanent excavation for 24" Concrete Headwall Lt.
-Regrade Ditch 1	-	-	15	2	-1.1	5	Temporay Excavation - Regrade Ditch 1 after Headwall Installation
Permanent Excavation Sub-Total					*-2.6*		
Concrete, Metal, & Plastic							
Ditch 1							Crossing Under SH-75
-Remove 24" CMP	94	1.5	-	-	-5.2	5	Remove Existing 24"" Pipe
Permanent Excavation Sub-Total					*-5.2*		
Dirt or Topsoil							
Wetland D							
-Regrade Ditch 1	-	-	20	2	-1.5	5	Temporary Excavation - Regrade Ditch 1 after Headwall Install
Permanent Excavation Sub-Total					*0.0*		
Dirt or Topsoil							
Trail Creek Bridge Replacement							
Excavate to Remove Bridge & Install Riprap			574.4	6	-127.6	6	Excavation for bridge removal and riprap installation w/i OHW
Excavate Channel to Install Riprap, Temporary			1428.0	5.1	-269.7	6	Temporary excavation for rip rap installation w/i OHW, fill back
Permanent Excavation Sub-Total					*-127.6*		
Wetland A							
Wetland A Disturbed for Planting, Excavation			51.2	0.5	-0.9	6	Native plantings for riparian area restoration in wetland A, excavation
Permanent Excavation Sub-Total					*-0.9*		
Dirt or Topsoil							
Trail Creek Slope Stabilization							
Excavation for RipRap installation			716	4.5	-119.4	7	Riprap excavation in front of reinforced slope
Excavation for RipRap, Temporary			883	2	-65.4	7	Temporary excavation for rip rap installation
Permanent Excavation Sub-Total					*-119.4*		
Total Project Excavation					*-602.3*		
Total Quantity of Excavaton in WOTUS					***-602.3***		

Block 20

TYPE and QUANTITY of impacts to
waters of the United States, including wetlands

Fig. #	Backfill and Bedding	Area (AC)	Impact Area (SF)	Volume (CY)	
2	*Wetland G*	*0.0391*	*1,705*	*67.0*	Pond Expansion, Access Road and Storm Drain
2	*Ditch 3*	*0.0037*	*160*	*15.5*	Pond Expansion, Access Road and Storm Drain
3	*Wetland F*	*0.0041*	*180*	*10.0*	Roadway and Slope Construction
4	*Ditch 2*	*0.0014*	*60*	*10.0*	Install new concrete box and Replace 3 Irrigation culverts
5	*Ditch 1*	*0.0010*	*45*	*7.8*	Replace Irrigation Crossing and Add Headwalls
6	*Trail Creek Bridge Replacement*	*0.0132*	*574*	*144.7*	Install Riprap & Bench for Bridge Abutments
6	*Bridge - Geotextile*	*0.0132*	*574*	*0.0*	Install Geotextile under Riprap at Bridge Abutments
6	*Wetland A*	*0.0005*	*23*	*1.0*	Install Riprap For Bridge Abutments/Native Plantings Area
6	*Wetland A - Geotextile*	*0.0000*	*1*	*0.0*	Install Geotextile under Riprap at Bridge Abutments
7	*Trail Creek Slope Stabilization*	*0.0164*	*716*	*119.3*	Riprap installation in front of Reinforced Slope
7	*Trail Creek Slope - Geotextile*	*0.0164*	*716*	*0.0*	Riprap installation in front of Reinforced Slope
Bedding and Backfill Sub-Total				*375.4*	

Fig. #	Excavation	Area (AC)	Impact Area (SF)	Volume (CY)	Pond Expansion, Access Road and Storm Drain
2	*Wetland G*	*0.0391*	*1,705*	*-318.3*	Pond Expansion, Access Road and Storm Drain
2	*Ditch 3*	*0.0037*	*160*	*-11.4*	Pond Expansion, Access Road and Storm Drain
3	*Wetland F*	*0.0041*	*180*	*-10.0*	Roadway and Slope Construction
4	*Ditch 2*	*0.0014*	*60*	*-6.8*	Install new concrete box and Replace 3 Irrigation culverts
5	*Ditch 1*	*0.0010*	*45*	*-7.8*	Replace Irrigation Crossing and Add Headwalls
5	*Wetland D*	*0.0005*	*20*	*0.0*	Replace Irrigation Crossing and Add Headwalls-Temporary impact only
6	*Trail Creek Bridge Replacement*	*0.0132*	*574*	*-127.6*	Excavate for Bridge Removal and Riprap Installation
6	*Wetland A*	*0.0012*	*51*	*-0.9*	Native plantings for riparian area restoration in wetland A
7	*Trail Creek Slope Stabilization*	*0.0164*	*716*	*-119.4*	Excavate for riprap in front of Reinforced Slope
Excavation Sub-Total				*-602.3*	
Project Net Materials Total				*-226.9*	

27. LIST EACH IMPACT to stream, river, lake, reservoir, including shoreline: Attach site map with each impact location

Table 1: Waterbody Impacts

Resource	Figure	Activity	Cowardin	Intermittent/ Perennial	Description of Impact	Permanent Impacts (SF)	Permanent Impacts (Acres)	Impact Length (LF)
Ditch 1	5	Pipe/headwalls installation	R4EM	Intermittent	Replace Irrigation Crossing and Add Headwalls	45	0.0010	22
Ditch 2	4	Pipe/Box installation	R4EM	Intermittent	Install new concrete box and Replace 3 Irrigation culverts	60	0.0014	30
Ditch 3	2	Pond Expansion & Storm Drain	R4EM	Intermittent	Pond Expansion, Access Road and Storm Drain	160	0.0037	80
Trail Creek*	6	Riprap installation	R2UB	Perennial	Bench for bridge abutments	574	0.0132	82
Trail Creek	7	Slope Stabilization (vegetated wall)	R2UB	Perennial	Riprap installation for Reinforced Slope	716	0.0164	98
					Total	1,555	0.0358	312
*175 SF increase in hydraulic opening (full opening of old culvert to full opening of new bridge)								

28. LIST EACH WETLAND IMPACT include mechanized clearing, filL excavation, flood, drainage, etc. Attach site map with each impact location.

Table 2: Wetland Impacts

Resource	Figure	Activity	Cowardin	Distance to waterbody (lin. feet)	Description of Impact	Total Impact (Sq Ft)	Total Impact (Acres)
Wetland A	6	Riprap installation	PFO	0	Install Riprap for bridge abutments, native riparian planting area	51	0.0012
Wetland D	5	Pipe/headwalls installation	PEM	0	Replace Irrigation Crossing and add headwalls	20	0.0005
Wetland F	3	Roadway Construction	PEM	120	Roadway and Slope Construction	180	0.0041
Wetland G	2	Pond Expansion & Storm Drain	PSS	0	Pond Expansion, Access Road and Storm Drain	1,705	0.0391
					Total	**1,956**	**0.0449**

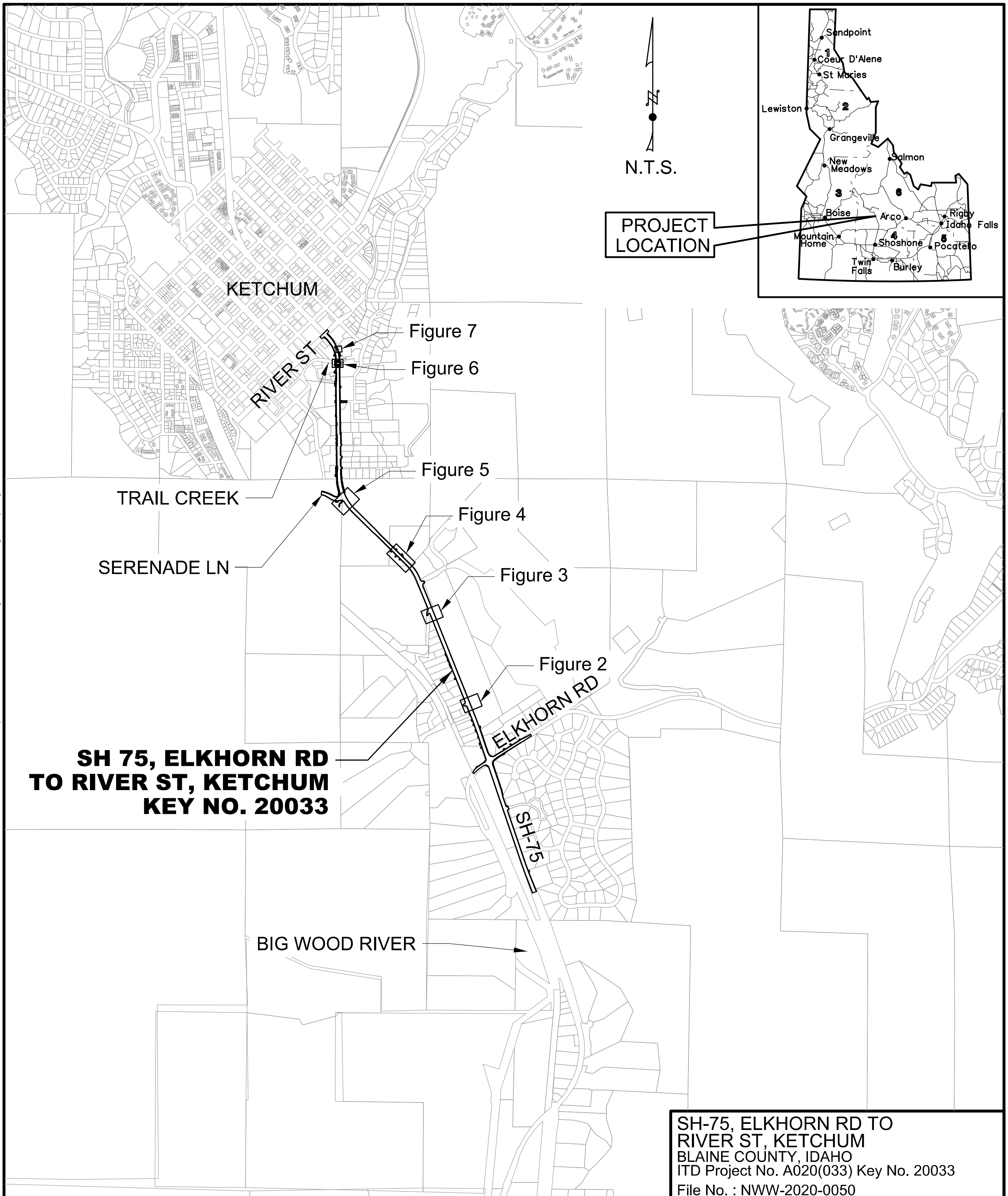
29. ADJACENT PROPERTY OWNERS NOTIFICATION: Provide contact information of ALL adjacent property owners

Table 3. Adjacent Property Owners

Assessor's Parcel No.	Adjacent Impacted Resources	Contact Name	Phone	Email	Mailing Address
RPK05030000010	Wetland F	Joseph Reali	Not Provided	Joe.reali@gmail.com	100 Neils Way, PO Box 88, Hauley, ID 83333
RPS05200050000	Wetland G Ditch 3	Weyyakin Ranch Property Owner Association	208-726-3858	scm@suncountrysv.com	PO Box 728 Ketchum, ID 83340
RPK4N180190790 **RPK4N180190780**	Ditch 2	Idaho Park Foundation Inc Kendra Kenyon	208-860-0311	office@idaholands.org	5657 WARM SPRINGS AVE BOISE, ID 83716
RPK4N180190820	Ditch 2 Ditch 1 Wetland D	Douglas Bradshaw Trustee	775-782-1959	DJBradshaw1@live.com	PO Box 7180 Gardnerville, NV 89460
RPK4N17024662M	Ditch 1 Wetland D	Sun Valley Resorts Tim Silva	208-622-2042	tsilva@sunvalley.com	PO BOX 10 SUN VALLEY, ID 83353
RPK07070030000	Trail Creek	Andora Villa Condos Will Schuckert	602-524-1797	will@edgescottsdale.com	15100 N 78th Way #207 Scottsdale, AZ 85250
RPK0000082003A	Trail Creek Wetland A	PEG Ketchum Hotel LLC	801-655-1998	Not Provided	145 W 200 N Ste 100 Provo, UT 84601
RPK0000082022A	Trail Creek	Jeffrey Barber	206-795-9321	Jeffbarber7@gmail.com	PO Box 2174 Sun Valley, ID 83353
RPK07770000000	Trail Creek	Habitat 2000 Condo Owners Tamara Code	208-726-8584	mgr.habitatontrailcreek@gmail.com	219 S 1st Ave St 101 Hailey, ID 83333
RPK09590000000	Trail Creek	Trail Creek LLC John Sahlberg	Not Provided	johntsahlberg@gmail.com	PO Box 2251 Ketchum, ID 83340

Assessor's Parcel No.	Adjacent Impacted Resources	Contact Name	Phone	Email	Mailing Address
RPK00000830020	Trail Creek	Harriman Ketchum Hotel LLC Jack Bariteau	Not Provided	jack@waypointsunvalley.com	PO Box 84 Sun Valley, ID 83353

Attachment C. Plan Sheets with Impacts



SH-75, ELKHORN RD TO
RIVER ST, KETCHUM
BLAINE COUNTY, IDAHO
ITD Project No. A020(033) Key No. 20033
File No. : NWW-2020-0050

VICINITY MAP	FIGURE 1	MAY 13 2024	Sheet 1 of 7

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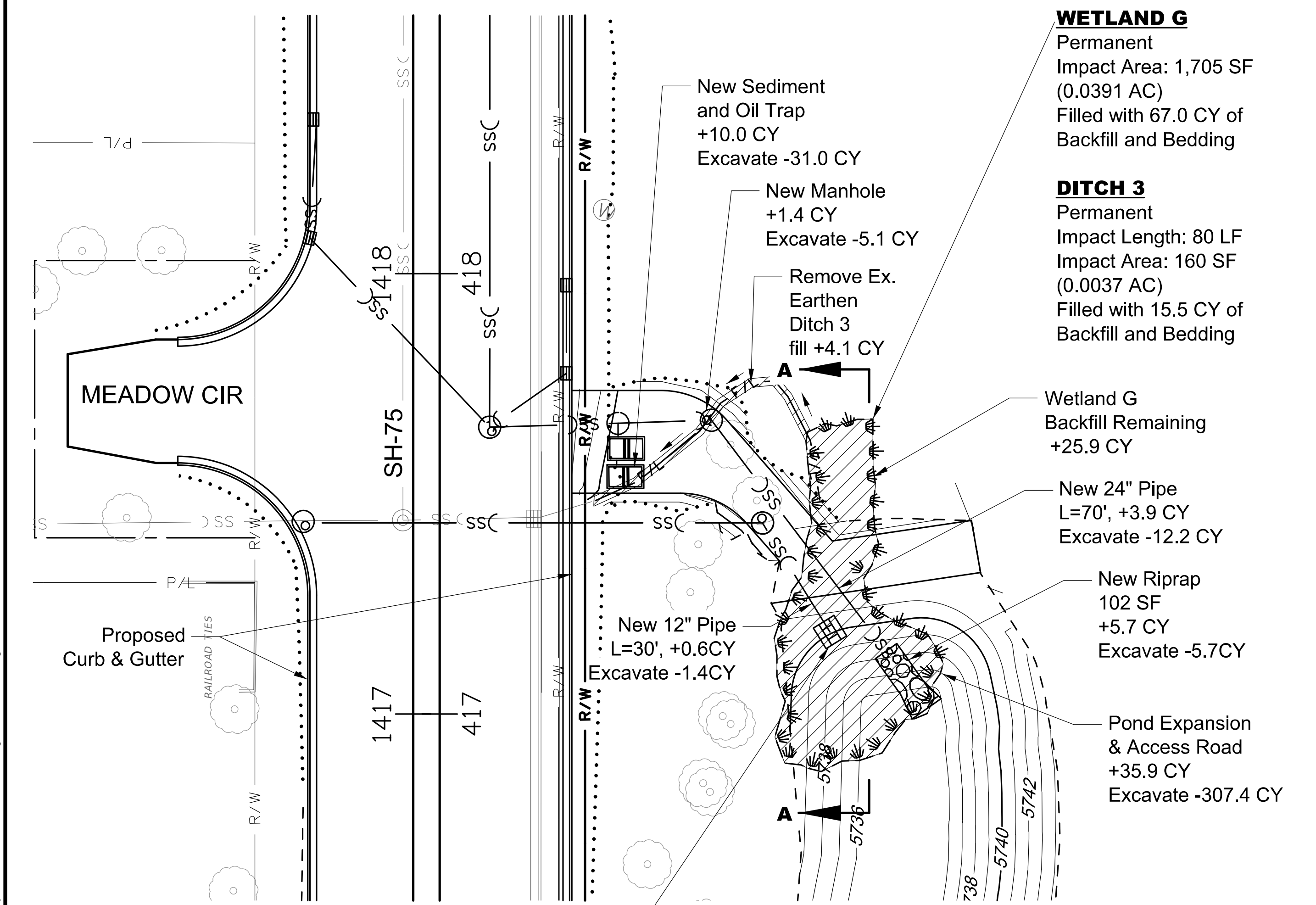

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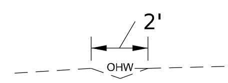
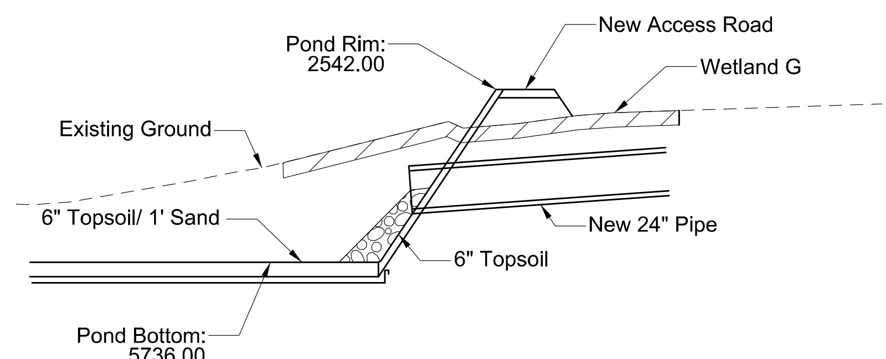


DITCH 3



SECTION A-A

LEGEND

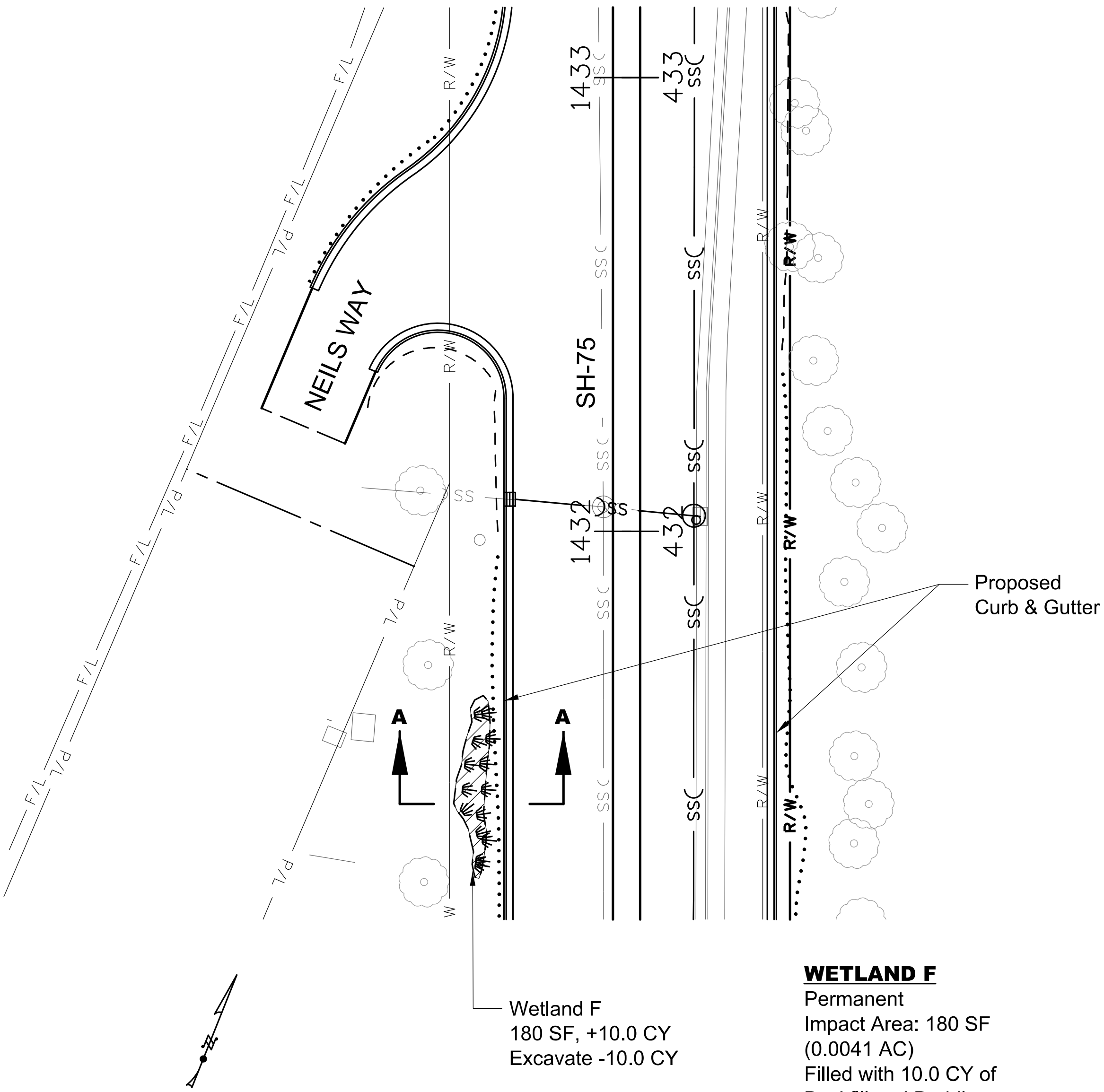
- Existing Pipe
- Existing Ditch
- Existing Storm Sewer
- Proposed Storm Sewer
- Proposed Irrigation Pipe
- Wetland Boundary
- Existing Right-of-Way
- Property Line
- Acquired ITD Right-of-Way

SH-75, ELKHORN RD TO
RIVER ST, KETCHUM
BLAINE COUNTY, IDAHO
ITD Project No. A020(033) Key No. 20033

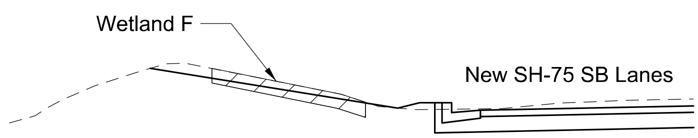
File No. : NWW-2020-0050
Waterway: DITCH 3 & WETLAND G
Proposed Activity:Pond Expansion & Storm Drain
Lat.: 43.667° N Long.: 114.356° W

Sheet 2 of 7

DITCH 3 & WETLAND G	FIGURE 2	MAY 13 2024



WETLAND F
Permanent
Impact Area: 180 SF
(0.0041 AC)
Filled with 10.0 CY of
Backfill and Bedding



SECTION A-A

LEGEND

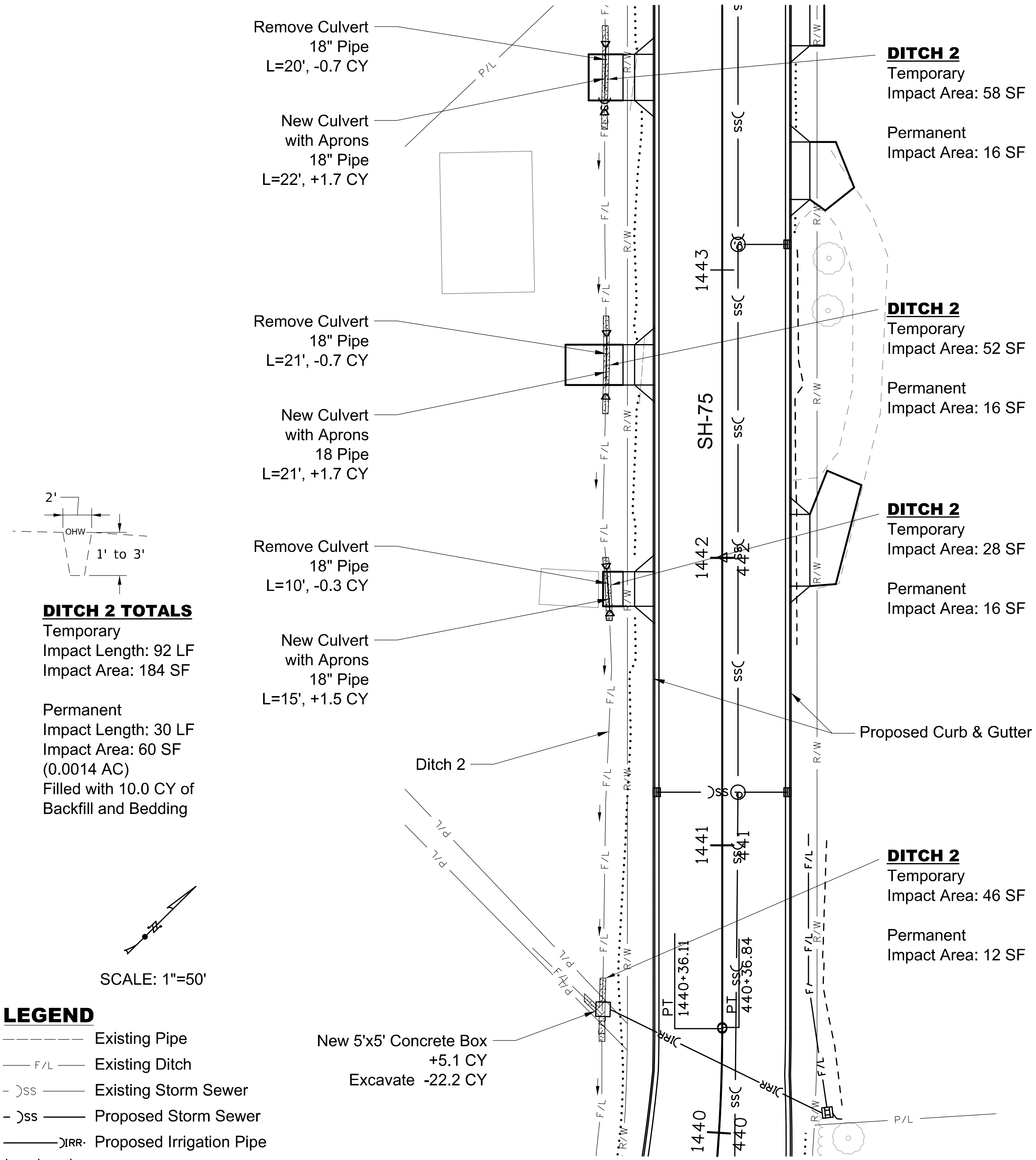
- Existing Pipe
- F/L — Existing Ditch
-)SS — Existing Storm Sewer
-)SS — Proposed Storm Sewer
-)IRR — Prposed Irrigation Pipe
- Wetland Boundary
- R/W — Existing Right-of-Way
- P/L — Property Line
- R/W — Acquired ITD Right-of-Way

SH-75, ELKHORN RD TO
RIVER ST, KETCHUM
BLAINE COUNTY, IDAHO
ITD Project No. A020(033) Key No. 20033

File No. : NWW-2020-0050
Waterway: WETLAND F
Proposed Activity:Roadway Construction
Lat.: 43.667° N Long.: 114.356° W

Sheet 3 of 7

WETLAND F	FIGURE 3	MAY 13 2024



DITCH 2 TOTALS
Temporary
Impact Length: 92 LF
Impact Area: 184 SF

Permanent
Impact Length: 30 LF
Impact Area: 60 SF
(0.0014 AC)
Filled with 10.0 CY of
Backfill and Bedding

SCALE: 1"=50'

LEGEND
- Existing Pipe
- Existing Ditch
- Existing Storm Sewer
- Proposed Storm Sewer
- Proposed Irrigation Pipe
- Wetland Boundary
- Existing Right-of-Way
- Property Line
- Acquired ITD Right-of-Way

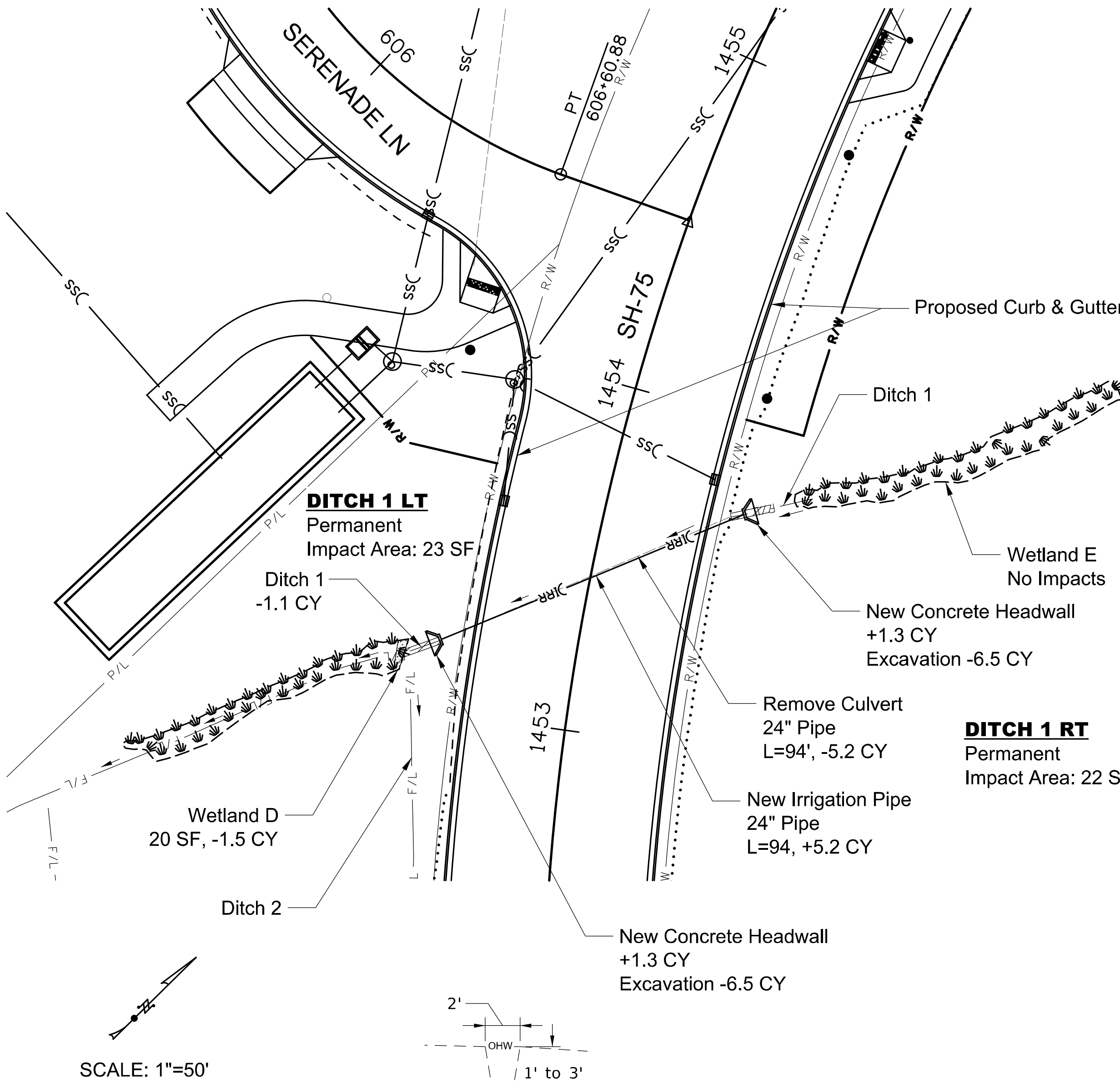
SH-75, ELKHORN RD TO
RIVER ST, KETCHUM
BLAINE COUNTY, IDAHO
ITD Project No. A020(033) Key No. 20033
File No. : NWW-2020-0050
Waterway: DITCH 2
Proposed Activity:Pipe/Box Installation
Lat.: 43.667° N Long.: 114.356° W

Sheet 4 of 7

DITCH 2	FIGURE 4	MAY 13 2024

U:\Bois\Projects\Clients\4006-ITD\314-4006-071SH-75 Elkhorn to River\99Svcs\CADD\DGN\404 permit\20033_404_Fig 04_DT 2.dgn 5/14/2024 6:04:11 PM

6:04:18 PM 5/14/2024 U:\Bois\Projects\Clients\4006-ITD\314-4006-07\SH-75 Elkhorn to River\99Svcs\CADD\DGN\404 permit\20033_404_Fig 05_WL D.dgn



LEGEND

- Existing Pipe
- F/L — Existing Ditch
-)SS — Existing Storm Sewer
-)SS — Proposed Storm Sewer
-)IRR — Proposed Irrigation Pipe
- Wetland Boundary
- R/W — Existing Right-of-Way
- P/L — Property Line
- R/W — Acquired ITD Right-of-Way

DITCH 1 TOTALS

Permanent
Impact Length: 22 LF
Impact Area: 45 SF
(0.0010 AC)
Filled with 7.8 CY of
Backfill and Bedding

WETLAND D TOTALS

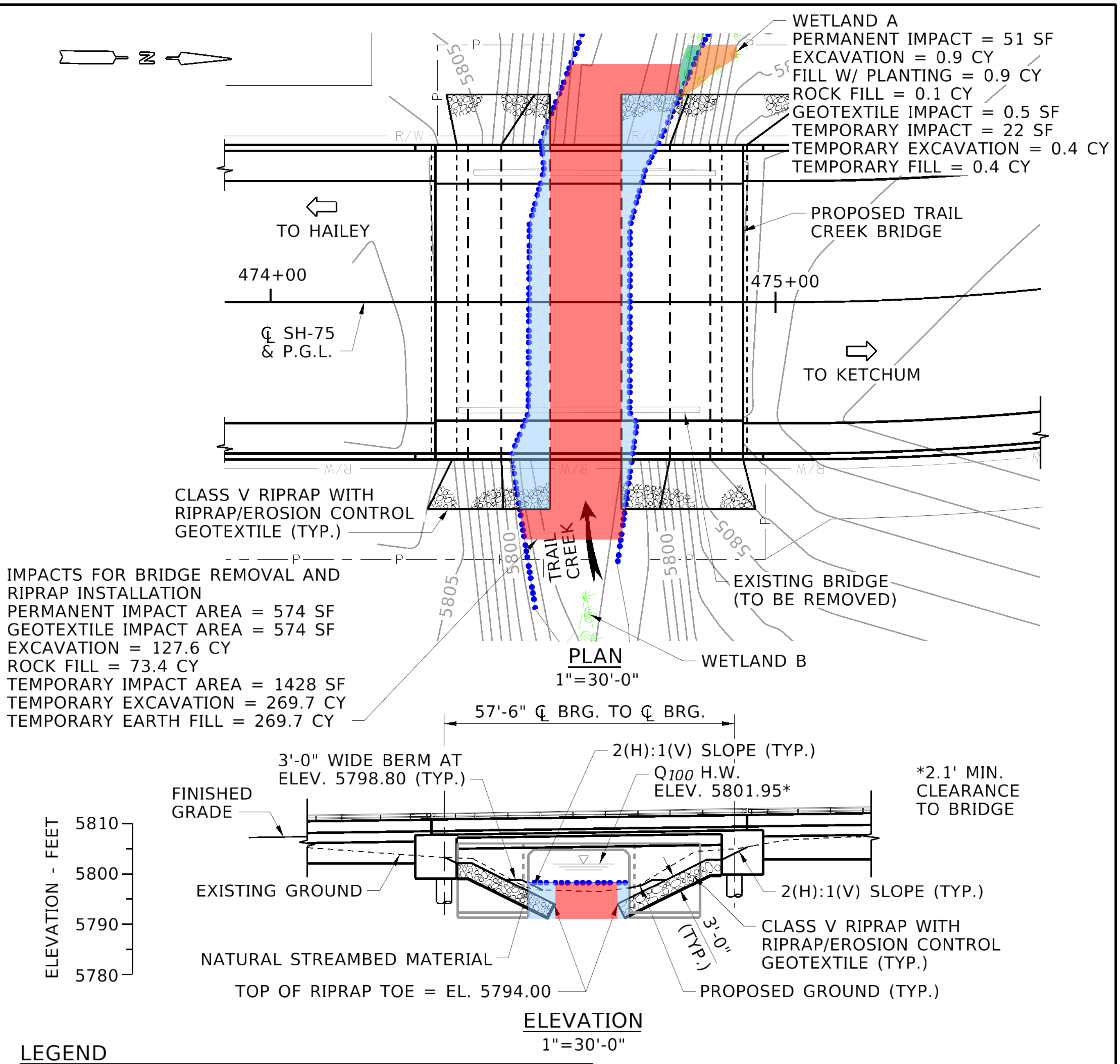
Temporary
Impact Area: 20 SF
(0.0005 AC)

SH-75, ELKHORN RD TO
RIVER ST, KETCHUM
BLAINE COUNTY, IDAHO
ITD Project No. A020(033) Key No. 20033

File No. : NWW-2020-0050
Waterway: DITCH 1 & WETLAND D
Proposed Activity:Pipe/Headwalls Installation
Lat.: 43.667° N Long.: 114.356° W

Sheet 5 of 7

DITCH 1 & WETLAND D	FIGURE 5	MAY 13 2024



LEGEND

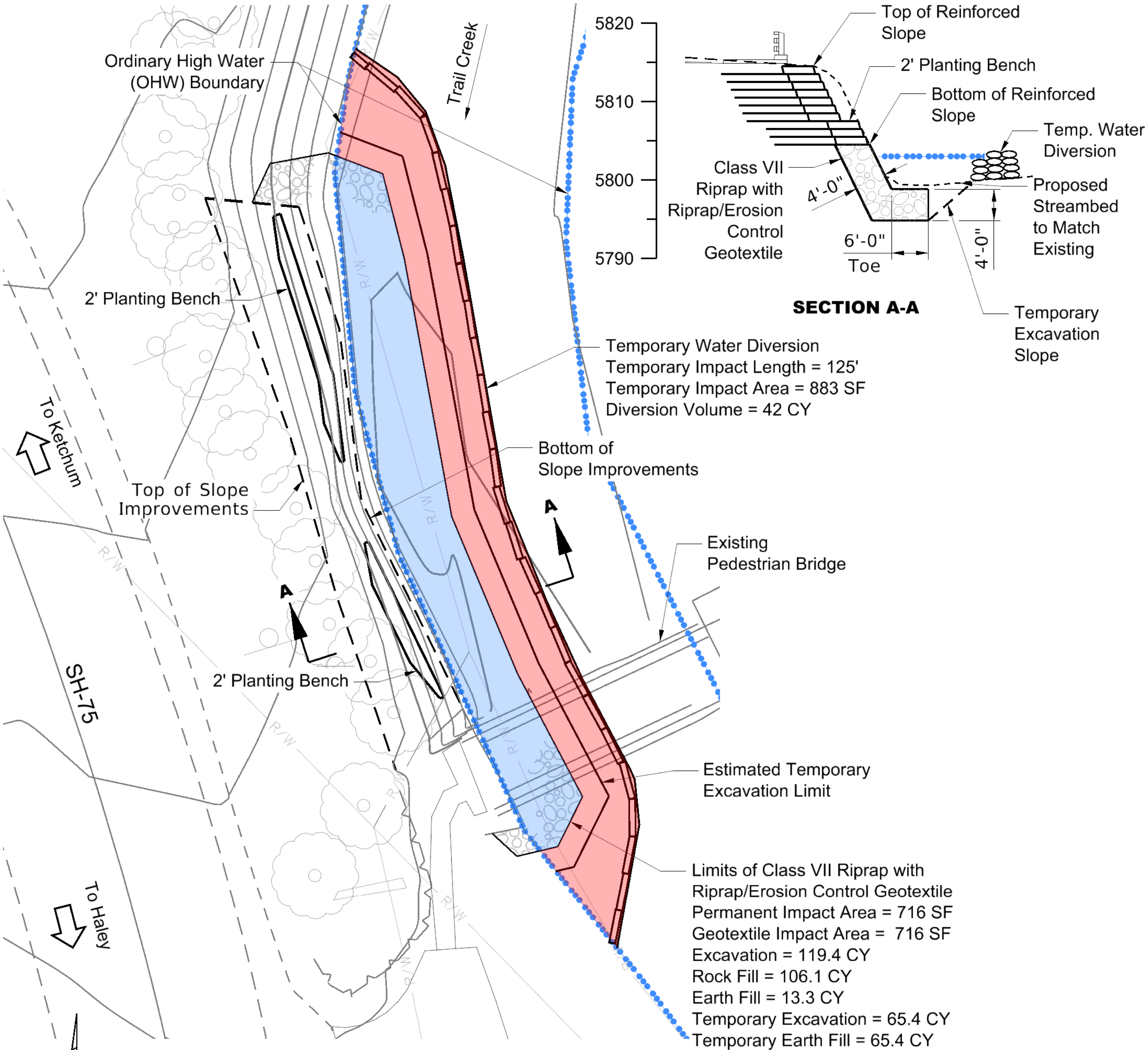
- ORDINARY HIGH WATER (OHW) BOUNDARY
- DELINEATED WETLAND BOUNDARY
- R/W — EXISTING RIGHT-OF-WAY
- P — — P — ACQUIRED RIGHT-OF-WAY
- PERMANENT IMPACTS BELOW OHW (574 S.F., 0.013 ACRE)
- TEMPORARY IMPACTS BELOW OHW (1428 S.F., 0.033 ACRE)
- PERMANENT IMPACTS TO WETLANDS (51 S.F., 0.001 ACRE)
- TEMPORARY IMPACTS TO WETLANDS (22 S.F., 0.001 ACRE)

EXISTING
HYDRAULIC OPENING = 158 S.F., 0.003 ACRE

PROPOSED
HYDRAULIC OPENING = 333 S.F., 0.008 ACRE

HYDRAULIC
OPENING CHANGE = INCREASE 175 S.F., 0.004 ACRE

TRAIL CREEK BRIDGE	FIGURE 6	MAY 13 2024	SH-75, ELKHORN RD TO RIVER ST, KETCHUM BLAINE COUNTY, IDAHO ITD Project No. A020(003) Key No. 20033 File No. : NWW-2020-0050 Waterway: Trail Creek Proposed Activity: Bridge Replacement Lat.: 43.667° N Long.: 114.356° W Sheet 6 of 7



PLAN - PROPOSED SLOPE IMPROVEMENTS

SCALE: 1"=20'

LEGEND

- Existing Right-of-Way
- Ordinary High Water (OHW) Boundary
- Permanent Impacts Below OHW (716 S.F., 0.016 Acre)
- Temporary Impacts Below OHW (883 S.F., 0.02 Acre)
- Riprap

SH-75, ELKHORN RD TO RIVER ST, KETCHUM
BLAINE COUNTY, IDAHO
ITD Project No. A020(003) Key No. 20033

File No. : NWW-2020-0050
Waterway: Trail Creek
Proposed Activity: Reinforced Slope
Lat.: 43.667° Long.: 114.356°

Sheet 7 of 7

SLOPE STABILIZATION	FIGURE 7	MAY 13 2024

pw://pwhdruswes01:HDR_US_West_01/Documents/Parametrix_Inc.-_Boise_ID/Parametrix_SH75_Elkhorn_River/6.0_CAD_BIM/6.2_WIP/6.2.2_Bridge/404 Permit exhibits for Retaining Wall

Memo

Date:	Friday, March 29, 2024
Project:	ITD SH-75 Bridge & Stabilization Slope on Trail Creek
To:	Adam Crutcher – City of Ketchum Floodplain Administrator
From:	Idaho Transportation Department District 4 Mike Schubert, PE – HDR Spencer Savage, PE – HDR Kyler Ashby, EIT - HDR
Subject:	**Floodplain Development Permit / No-Rise Analysis**

1 Background

In 2020, HDR submitted a floodplain development permit application and hydraulic report regarding the SH-75 Trail Creek bridge. This application was reviewed by the City of Ketchum. The City provided a formal statement of concurrence on February 8, 2021, but indicated that the package would need to be resubmitted prior to the start of the project. Construction is scheduled to take place from 2025 – 2026. This package is ITD's formal request for the floodplain development permit.

During final design, the roadway design team recognized that the roadway realignment requires bank stabilization upstream of the bridge where SH-75 would be widened. This bank stabilization has been discussed and reviewed by the City. This document also serves as an addendum to the previously submitted floodplain development permit, including the bank stabilization.

2 Project Description

State Highway 75 (SH-75) is the primary north-south highway in the Wood River Valley serving the cities of Bellevue, Hailey, Ketchum, and Sun Valley in Blaine County. The proposed SH-75 Elkhorn to River Street project is the third and northernmost roadway construction project to be developed from the *Timmerman to Ketchum Environmental Impact Statement Record of Decision* issued in August of 2008 (ITD 2008). The purpose of the project is to improve safety and capacity on SH-75 between Elkhorn Road, north of the Big Wood River Bridge, and River Street in the city of Ketchum. The approximate project milepost limits are from 126.5 to 128.2 on SH-75.

The proposed project includes replacing the existing SH-75 bridge over Trail Creek and stabilizing a portion of the right bank upstream of the bridge to accommodate widening of SH-75. These locations are shown in Figure 1 for reference.

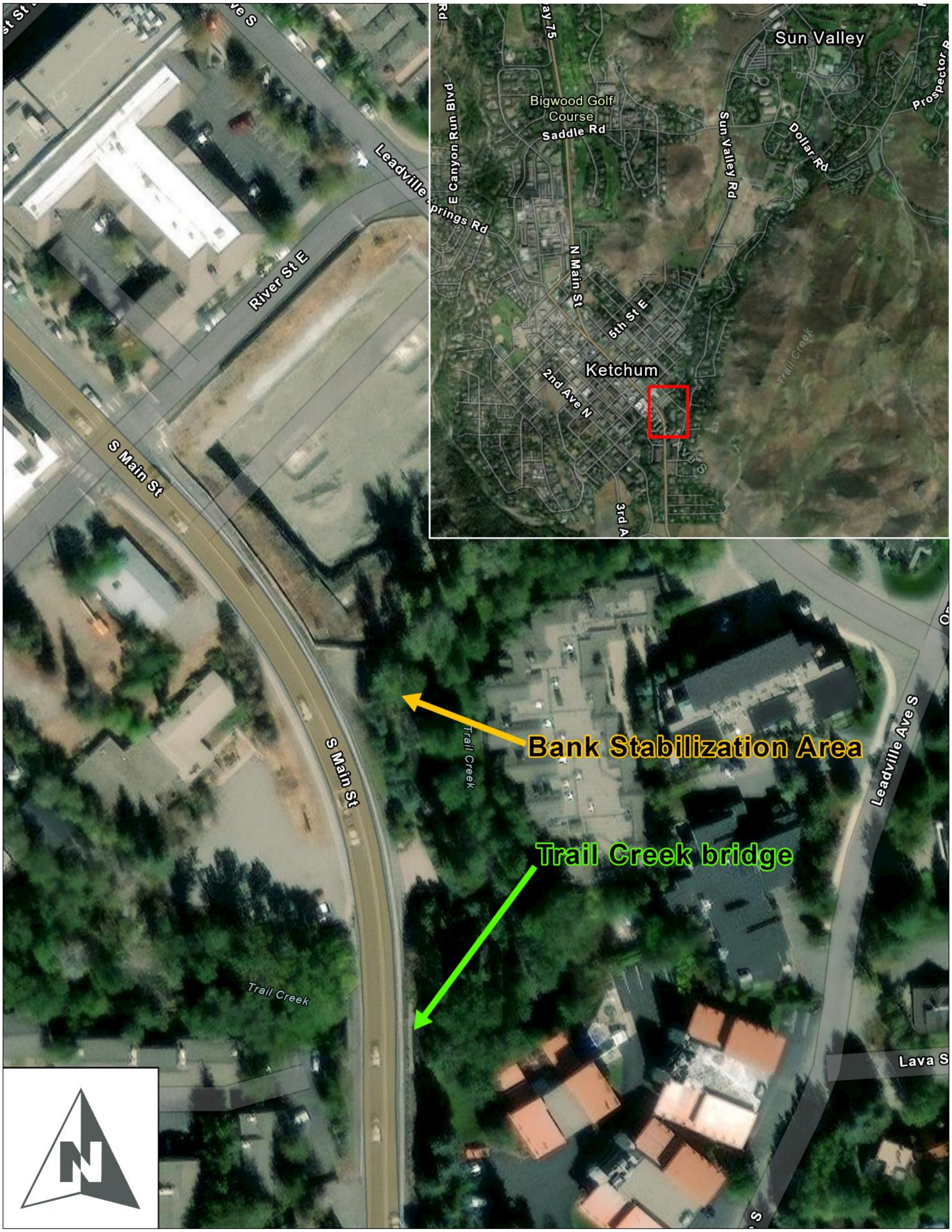


Figure 1: Project area for Trail Creek bridge and bank stabilization

Since the project is located in Zone AE Special Flood Hazard Area (SFHA), a floodplain development permit is required along with a no-rise analysis. The following sections describe the no-rise analysis, summarizes floodplain requirements, and provides discussion on how the project will address the floodplain requirements.

3 Hydraulic/No-Rise Analysis

The existing structure is a 20-foot clear span stiffleg box culvert. The proposed bridge replaces this structure with a 54-foot clear-span bridge. As is expected when making a significant increase in the span at a stream crossing, there is a significant hydraulic improvement upstream of the structure. This improvement is summarized in Table 1.

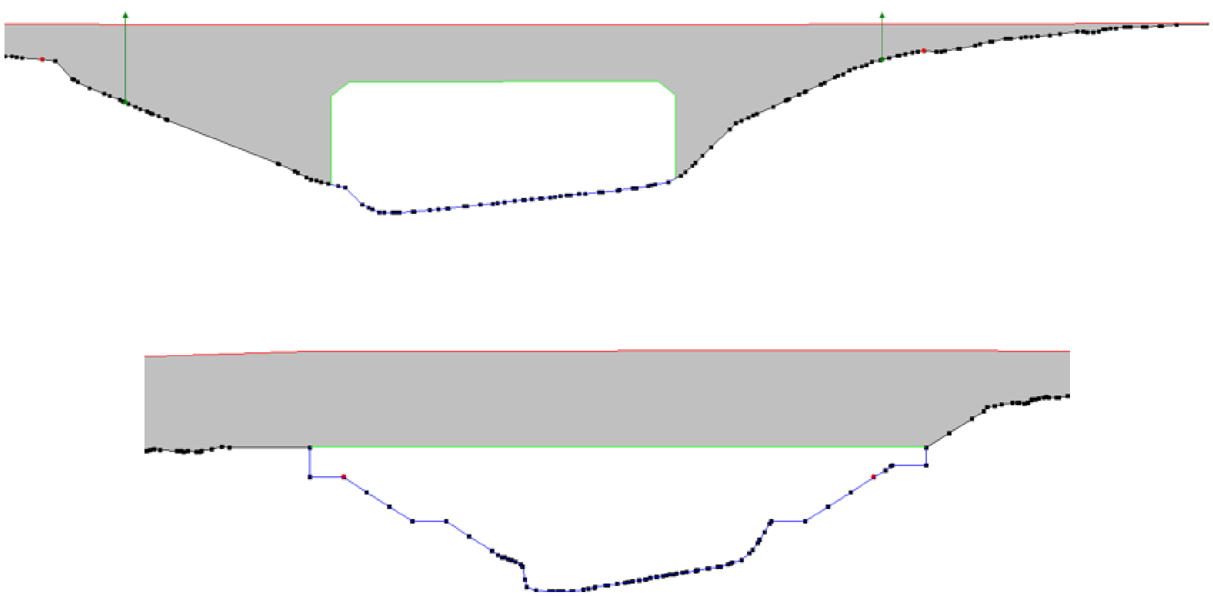


Figure 2: Existing box culvert bridge design compared to proposed clear-span bridge

Table 1: Summary of hydraulic improvement

Structure	Dimensions (Clear Span) (ft)	Channel Invert at Inlet (ft)	Low Chord Elevation (ft)	Headwater Elevation at Q50 of 900 cfs (ft)	Clearance at Q50 of 900 cfs (ft)	Headwater Elevation at Q100 of 1,020 cfs (ft)	Clearance at Q100 of 1,020 cfs (ft)
Existing	20	5795.03	5804.31	5802.14	2.17	5802.64	1.67
Proposed	54	5795.03	5804.91	5801.63	3.28	5801.95	2.96

During the development of this project, a concern was raised about the stabilization of the existing Trail Creek bank near the east side of SH-75, between the Trail Creek bridge and River Street. There is concern that removing the mature trees and vegetation to widen SH-75 could cause the bank to be unstable. To mitigate this concern, the bank will be stabilized. This includes designing scour protection and the use of a wrapped face geosynthetic slope.

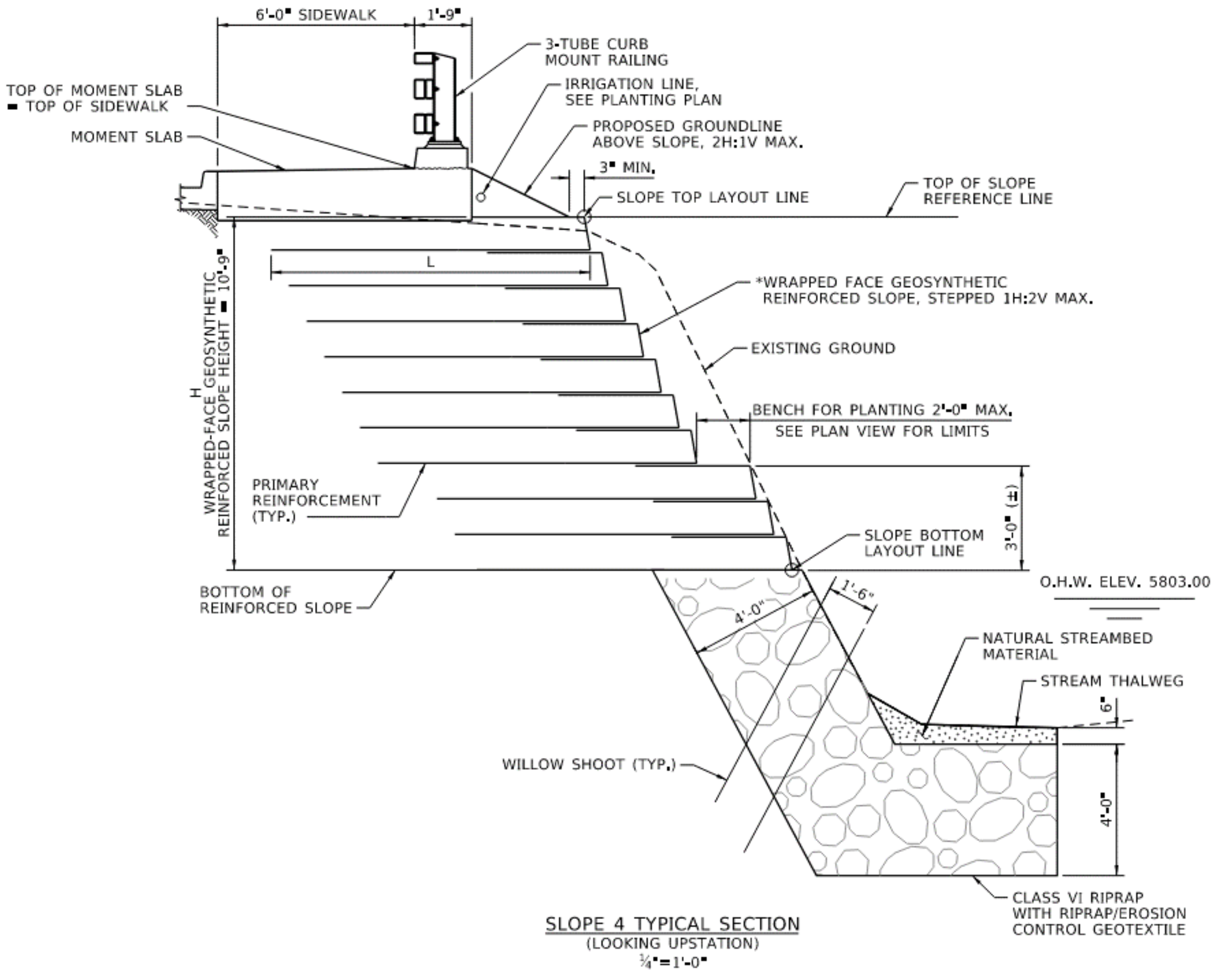


Figure 3: Standard detail for wrapped face geosynthetic slope

The existing and proposed bank conditions were simulated using a hydraulic model. The results conclude that the proposed design of the bridge and bank will result in a no-rise. The hydraulic results are summarized in Table 2.

Table 2: Comparison of existing and proposed water surface elevations

River Station	Existing 100-yr WSE (ft)	Proposed 100-yr WSE (ft)	Existing 100-yr Floodway WSE (ft)	Proposed 100-yr Floodway WSE (ft)	Notes
2075	5800.47	5800.40	5800.50	5800.48	Downstream Trail Creek bridge
2147	5802.64	5801.95	5802.64	5801.90	Upstream Trail Creek bridge
2205	5802.91	5802.14	5802.91	5802.13	
2247	5803.39	5802.99	5803.30	5802.89	
2300	5803.51	5803.19	5803.50	5803.16	
2389	5803.73	5803.54	5803.71	5803.51	
2415	5804.26	5804.15	5804.25	5804.14	Proposed bank edits
2432	5804.25	5804.10	5804.25	5804.09	Proposed bank edits
2439	5804.45	5804.38	5804.44	5804.37	Proposed bank edits
2462	5805.53	5805.49	5805.53	5805.49	Proposed bank edits
2490	5805.59	5805.56	5805.59	5805.55	Proposed bank edits
2531	5805.77	5805.75	5805.78	5805.75	

Figure 4: Location of cross sections along Trail Creek

4 Floodplain Permit Requirements

The SH-75 Trail Creek Project is in a mapped flood hazard area (Panel 16013C0461E, November 26, 2010) and crosses the floodway. Since the project is within a floodplain and a floodway, a floodplain development permit is required from the floodplain administrator for consistency with the community's floodplain ordinance requirements. Issuance of the permit will require a no-rise certificate. The City of Ketchum's floodplain administrator must confirm the project meets floodplain ordinance requirements:

Prohibit encroachments, including fill, new construction, substantial improvements, and other development unless certification with supporting calculation, by a registered professional hydraulic engineer is provided demonstrating that encroachments shall not result in any increase in flood level during the occurrence of the base flood discharge. Uses in the floodway shall be restricted to that which are required by public necessity (for example, bridges, water pumps), recreational use (for example, paths), wildlife habitat improvements (for example, vegetation, nesting structures, pool/riffle improvements), and gravel extractions; provided that the use/encroachment meets the approval of the Federal Emergency Management and Nation Flood Insurance Program and does not jeopardize the city's participation in the National Flood Insurance Program. (Ordinance 1120 §17.88.070 C.1).

HDR requested the effective regulatory model from FEMA, but FEMA was unable to produce model input files. Therefore, based on coordination with the City of Ketchum, HDR completed floodplain and floodway analyses using an alternative model which considers the floodway as delineated in the communities' FIRM, and the existing channel geometry, as surveyed for this project. The hydraulic analysis completed for this project is described in detail in the attached hydraulic report.

4.1 Floodplain Management Overlay Evaluation Standards

The City of Ketchum lists several criteria as requirements for issuing a Floodplain Development Permit. This section of the memo attempts to address each of the applicable standards.

1. **The proposal preserves or restores the inherent natural characteristics of the river, floodplain, and Riparian Zone, including riparian vegetation and wildlife habitat. Development does not alter river channel unless all stream alteration criteria for evaluation are also met.**

   The project removes the most substantial man-made constriction in Trail Creek. Project will remove existing vegetation within the bank stabilization area. However, the proposed design consists of restoring the vegetation and mitigating future stream channel migration by installing a wrapped face geosynthetic slope and inserting willow plantings and installing toe scour countermeasures. A planting plan was also prepared near the bridge to show how the area will be revegetated and to serve as mitigation for loss of wetlands. An additional planting plan will be prepared along the new wall.

2. **No temporary construction activities, encroachment, or other disturbance into the twenty-five foot (25') Riparian Zone, including encroachment of below grade structures, shall be permitted, except for approved stream stabilization work and restoration work associated with a riparian zone that is degraded.**

   Removing the culvert, which constricts the channel and disconnects the upstream and downstream riparian areas, as well as adjusting the bank slope and armoring the bank toe may disturb adjacent riparian areas. Measures will be taken to reduce the amount of disturbance to these areas. Disturbed areas will be restored in accordance with ITD specifications and the City of Ketchum's requirements.

   While there will be work done within the Riparian Zone, the proposed work should improve the conditions within the riparian area and prevent further degradation.

3. **No permanent development shall occur within the twenty-five foot (25') Riparian Zone, except for approved stream stabilization work and restoration work associated with permit issued under this title, or exceptions as described below:**
   a. **Access to a property where no other primary access is available.**
   b. **Emergency access required by the Fire Department.**
   c. **A single defined pathways or staircases for the purpose of providing access to the river channel and in order to mitigate multiple undefined social paths.**
   d. **Development by the City of Ketchum**

   This restriction should not apply to the SH-75 Trail Creek project, as the roadway for the bridge is critical for emergency access.

4. **New or replacement planting and vegetation in the Riparian Zone shall include plantings that are low growing and have dense root systems for the purpose of stabilizing stream banks and repairing damage previously done to riparian vegetation. Examples of such plantings most commonly include red osier dogwood, common chokecherry, serviceberry, elderberry, river birch, skunk bush sumac, Beb's willow, Drummond's willow, little wild rose, gooseberry, and honeysuckle. However, in rare instances the distance from the top-of-bank to the mean high-water mark is significant and the native vegetation appropriate for the Riparian Zone are low growing, drought resistant grasses and shrubs. Replacement planting and vegetation shall be appropriate for the specific site conditions. Proposal does not include vegetation within the twenty-five foot (25') Riparian Zone that is degraded, not natural, or which does not promote bank stability.**

   The seeding for the bank stabilization phase of the project is being developed in accordance with ITD specifications and the City of Ketchum's requirements. The seed mix has been coordinated with Idaho Fish and Game. The planting plan near the bridge has black cottonwood, coyote willow, quaking aspen, serviceberry and woods rose. Willow plantings will be included in the toe stabilization.

5. **Landscaping and driveway plans to accommodate the function of the floodplain allow for sheet flooding. Surface drainage is controlled and shall not adversely impact adjacent properties including driveways drained away from paved roadways. Culvert(s) under driveways may be required. Landscaping berms shall be designed to not dam or otherwise obstruct floodwaters or divert same onto roads or other public pathways.**

   Roadway drainage design will control surface drainage, in accordance with ITD specifications and the City of Ketchum's requirements.

6. **Floodwater carrying capacity is not diminished by the proposal.**

   The proposed project will improve flood flow conveyance.

7. **Impacts of the development on aquatic life, recreation, or water quality upstream, downstream or across the stream are not negative.**

   This project provides a clear span and wildlife access reconnection. This project will result in a net benefit to aquatic life and recreation and will not adversely affect water quality. Best management practices during construction will be implemented to mitigate water quality impacts.

8. **Building setback in excess of the minimum required along waterways is encouraged. An additional ten-foot (10') building setback beyond the required twenty-five foot (25') Riparian Zone is encouraged to provide for yards, decks and patios outside the twenty five foot (25') Riparian Zone.**

   This requirement does not apply to this project.

9. **The top of the lowest floor of a building located in, or partially within, the SFHA shall be at or above the Flood Protection Elevation (FPE). A building is considered to be partially within the SFHA if any portion of the building or appendage of the building, such as footings, attached decks, posts for upper story decks, are located within the SFHA. See section 17.88.060, figures 1 and 2 of this chapter to reference construction details. See Chapter 17.08 of this title for definition of "lowest floor."**
   a. **In the SFHA where Base Flood Elevations (BFEs) have been determined, the FPE shall be twenty-four inches (24") above the BFE for the subject property; twenty-four inches (24") or two (2) feet is the required freeboard in Ketchum city limits.**
   b. **In the SFHA where no BFE has been established, the FPE shall be at least two (2) feet above the highest adjacent grade.**

   This requirement does not apply to this project.

10. **The backfill used around the foundation in the SFHA floodplain shall provide a reasonable transition to existing grade but shall not be used to fill the parcel to any greater extent.**
    a. **Compensatory storage shall be required for any fill placed within the floodplain.**
    b. **A CLOMR-F shall be obtained prior to placement of any additional fill in the floodplain.**

    While fill material is being placed into the floodplain, the proposed design will ensure a no-rise scenario is met and restores the bank to its pre-project condition.

11. **All new buildings located partially or wholly within the SFHA shall be constructed on foundations that are designed by a licensed professional engineer.**

    This requirement does not apply to this project.

12. **Driveways shall comply with City of Ketchum street standards; access for emergency vehicles has been adequately provided for by limiting flood depths in all roadways to one foot (1-ft) or less during the 1% annual chance event.**

    This requirement does not apply to this project.

13. **Landscaping or revegetation shall conceal cuts and fills required for driveways and other elements of the development.**

    This requirement does not apply to this project.

14. **(Stream alteration.) The proposal is shown to be a permanent solution and creates a stable situation.**

    The project will stabilize the banks and maintain flood carrying capacity for the river.

15. **(Stream alteration.) No increase to the one percent (1%) annual chance flood elevation at any location in the community, based on hydrologic and hydraulic analysis performed in accordance with standard engineering practice and has been certified and submitted with supporting calculations and a No Rise Certificate, by a registered Idaho engineer.**

    A no-rise certificate is attached.

16. **(Stream alteration.) The project has demonstrated No Adverse Impact or has demonstrated all impacts will be mitigated.**

    This project will maintain flow conditions and improve bank stabilization. It is anticipated that there will be no adverse impacts as a result of this project.

17. **(Stream alteration.) The recreational use of the stream including access along any and all public pedestrian/fisher's easements and the aesthetic beauty shall not be obstructed or interfered with by the proposed work.**

There are no recreational amenities around the proposed project site. The project will reconnect riparian areas upstream and downstream of the structure. The aesthetic beauty will be maintained by constructing a slope with vegetation.

18. **(Stream alteration.) Fish habitat shall be maintained or improved as a result of the work proposed.**

    Fish habitat will not be impacted as a result of the construction done for the project.

19. **(Stream alteration.) The proposed work shall not be in conflict with the local public interest, including, but not limited to, property values, fish and wildlife habitat, aquatic life, recreation and access to public lands and waters, aesthetic beauty of the stream and water quality.**

    There are no known conflicts with this project and the public interest.

20. **(Stream alteration.) The work proposed is for the protection of the public health, safety and/or welfare such as public schools, sewage treatment plant, water and sewer distribution lines and bridges providing particularly limited or sole access to areas of habitation.**

    The Trail Creek bridge is critical for emergency access for the community and bank stabilization is necessary to mitigate future channel migration and scour.

21. **(Wetlands) Where development is proposed that impacts any wetland the first priority shall be to move development from the wetland area. Mitigation strategies shall be proposed at time of application that replace the impacted wetland area with an equal amount and quality of new wetland area or riparian habitat improvement.**

    Wetland A on the east side of the bridge is partially within the permanent easement and is assumed to be permanently impacted (0.002 acres). The permanent wetland loss will be mitigated under the FHWA Executive Order (EO) 11990 as described in the wetland mitigation plan included with the attached 404 permit.

5 Scour Analysis

HDR performed a bend scour analysis to determine the scour depth that would occur at the project location. Using equations from the U.S. Army Corps of Engineers (USACE) HEC-RAS User manual, HDR concluded the estimated scour depth to be approximately 3 feet.

$$\Delta y := D_{US} \cdot \left(-1.62 \log\left(\frac{R_c}{W}\right) + 3.375 \right) - D_{Max} = 2.94\ ft$$

Where:
D_{US} = average cross section depth at upstream, reference cross section, 3.89 ft
R_c = radius of curvature, 137 ft
W = flow width (within the banks), 30.87 ft
D_{Max} = maximum cross section depth before scour at evaluation cross section, 6.11 ft

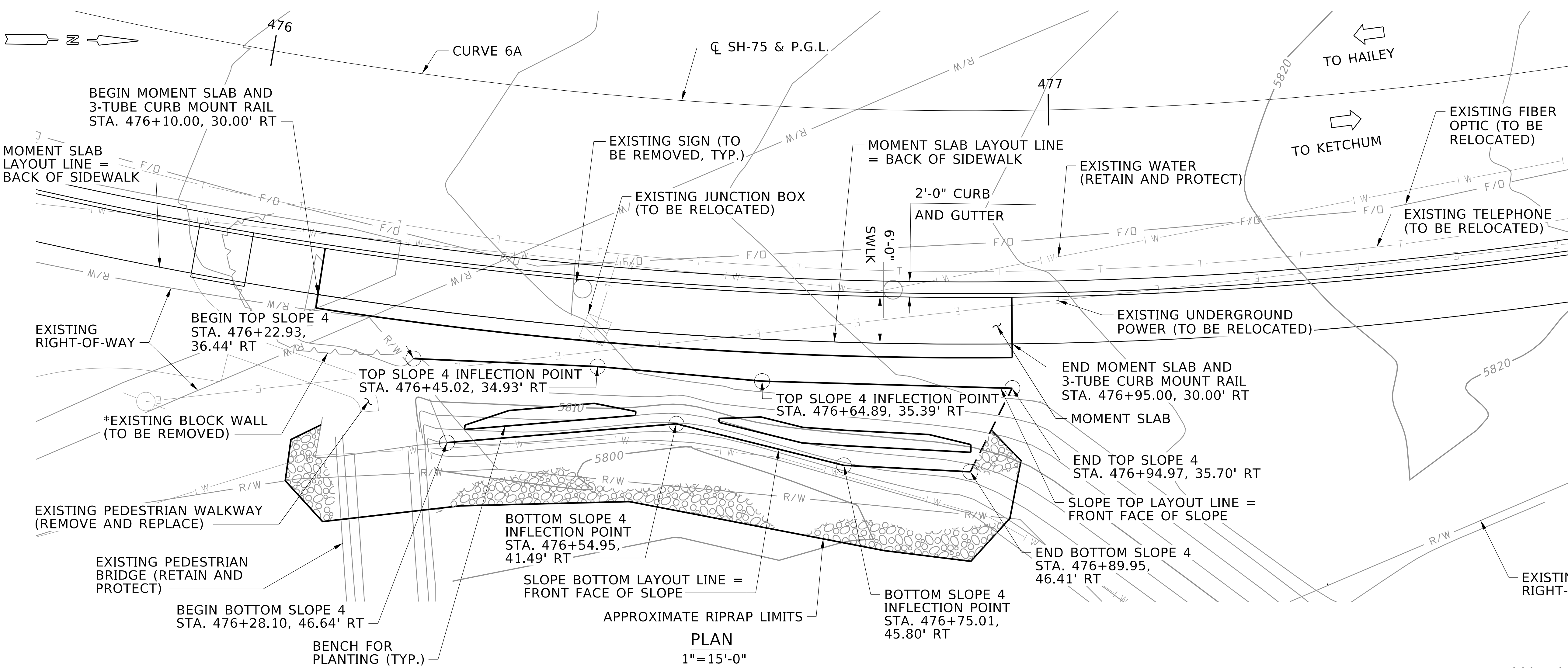
6 Conclusions

The project involves replacing the SH-75 bridge over Trail Creek and stabilizing the bank of Trail Creek upstream where SH-75 will be widened. HDR's analysis concludes that the proposed design to ensure bank stability will result in a no-rise. The hydraulic analysis also includes that bend scour of approximately 3 feet can be anticipated at the bank stabilization area. An appropriate scour design will be implemented to prevent erosion and destabilization of the bank.

NOTES

1. SEE DESIGN AND GENERAL NOTES SHEET FOR RETAINING WALL GENERAL NOTES.
2. SEE SLOPE 4 SECTION DETAIL SHEET FOR TYPICAL SECTION AND EMBEDMENT REQUIREMENTS.
3. SLOPE 4 IS A WRAPPED-FACE GEOSYNTHETIC REINFORCED SLOPE.

* 4. DEPTH OF EXISTING RETAINING WALL AND EXISTING PEDESTRIAN BRIDGE ABUTMENT IS UNKNOWN. PRIOR TO EXCAVATING, VERIFY EXISTING CONDITIONS AND PROVIDE TEMPORARY SHORING AS REQUIRED.

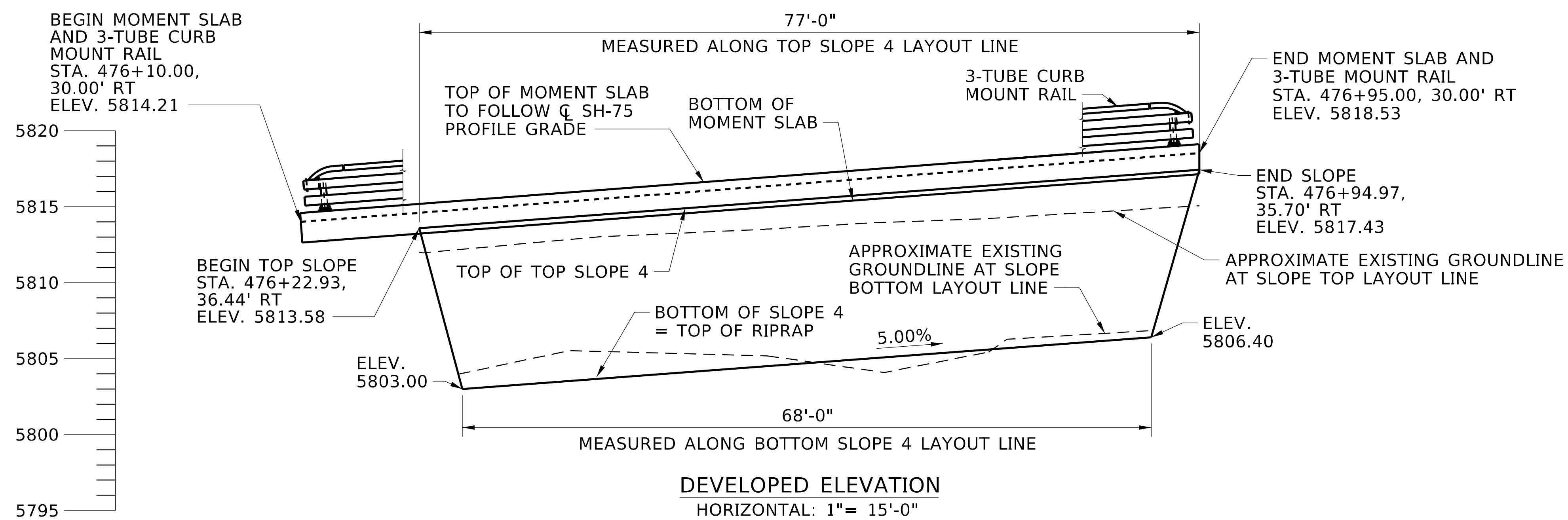


PLAN
1"=15'-0"

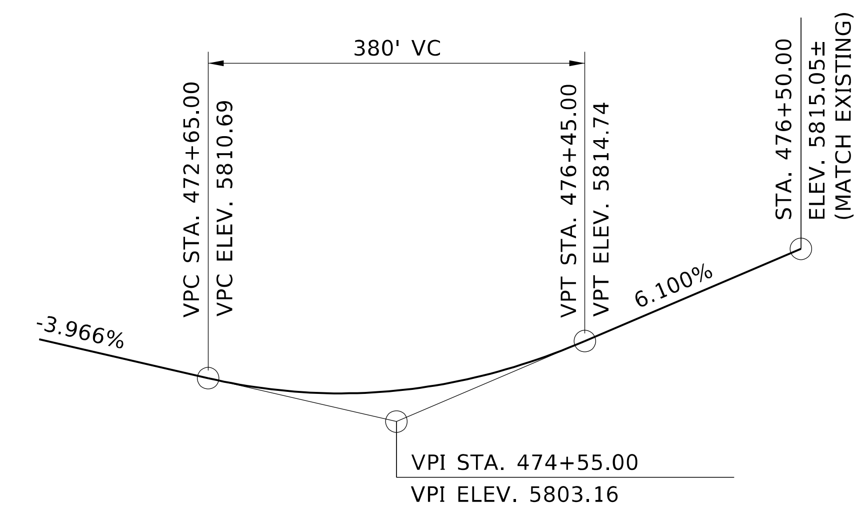
HORIZONTAL ALIGNMENT CURVE DATA ℄ SH-75

CURVE 6A

PI=477+11.2721
Δ=43°41'58" LT.
T=208.85'
L=397.26'
R=520.86'
S=2%



DEVELOPED ELEVATION
HORIZONTAL: 1"= 15'-0"
VERTICAL: 1" = 10'-0"



PROFILE DATA - ℄ SH-75
NTS

REVISIONS			
NO.	DATE	BY	DESCRIPTION

DESIGNED K. VASQUEZ
DESIGN CHECKED P. ESCHBACHER
DETAILED J. CULIAN
DRAWING CHECKED P. ESCHBACHER

SCALES SHOWN ARE FOR 11" X 17" PRINTS ONLY
CADD FILE NAME 20033brRW_001-3C.dgn
DRAWING DATE: MAY 2024

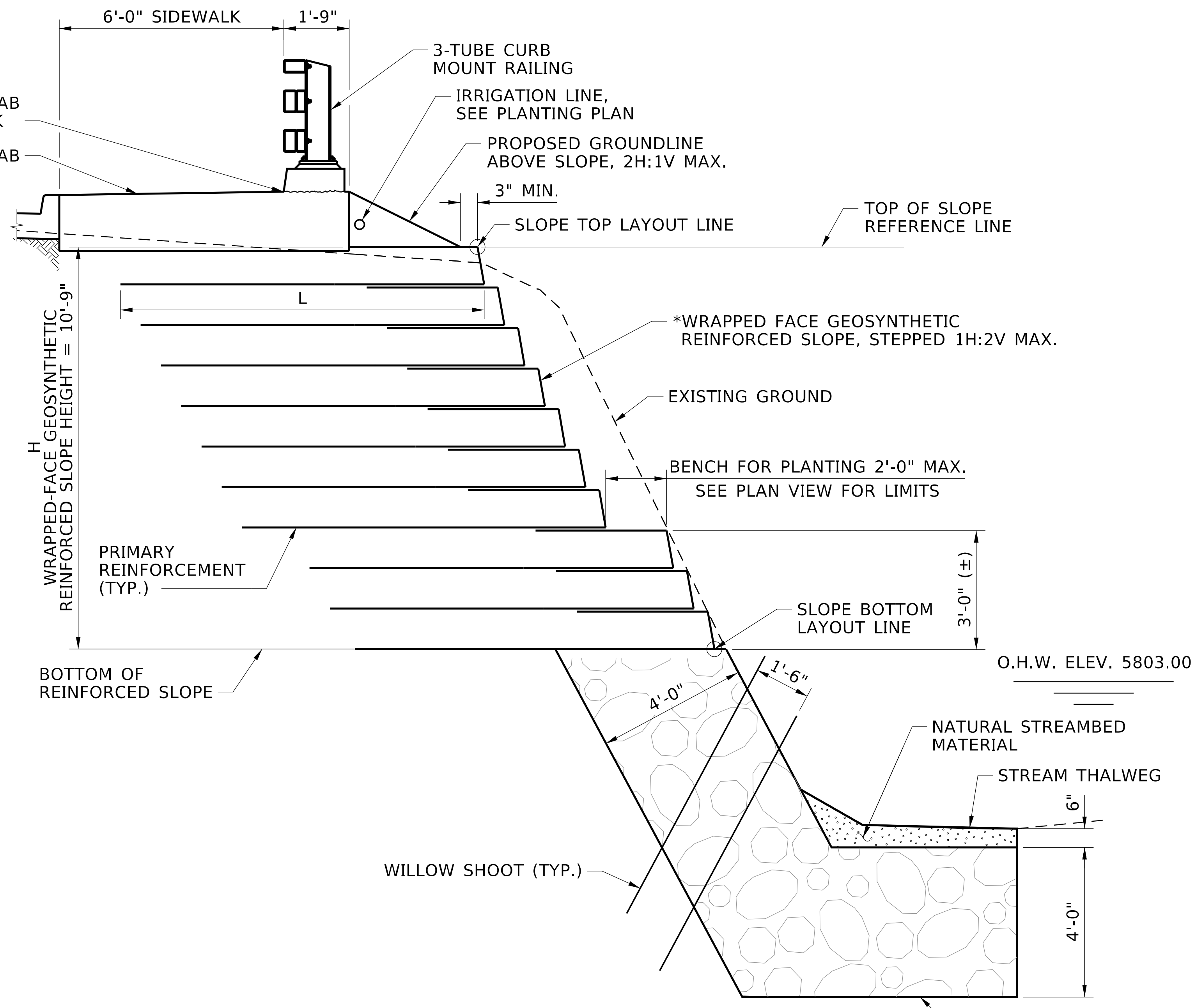
IDAHO TRANSPORTATION DEPARTMENT
YOUR Safety→YOUR Mobility→YOUR Economic Opportunity
HDR

PROJECT NO. A020(033)

SITUATION AND LAYOUT - SLOPE 4
SH-75, ELKHORN RD TO RIVER ST, KETCHUM

ENGLISH
COUNTY BLAINE
KEY NUMBER 20033
SHEET 204 OF 364

NOT APPROVED FOR CONSTRUCTION
PRELIMINARY
DATE ORIGINAL SIGNED: ORIGINAL SIGNED BY:



SLOPE 4 TYPICAL SECTION
(LOOKING UPSTATION)
¼"=1'-0"

NOTES

*1. ITEM TO BE DESIGNED BY THE REINFORCED SLOPE MANUFACTURER.

2. PROVIDE WRAPPED-FACE GEOSYNTHETIC REINFORCED SLOPE IN ACCORDANCE WITH S501-35A.

3. BOTTOM OF SLOPE LAYOUT AND ELEVATIONS ARE SHOWN FOR ESTIMATING PURPOSES AND MAY BE ADJUSTED AS REQUIRED BY THE REINFORCED SLOPE MANUFACTURER AND APPROVED BY THE ENGINEER AT NO ADDITIONAL COST TO THE STATE.

4. PRIMARY REINFORCEMENT LENGTH, L, MUST BE A MINIMUM 70 PERCENT OF THE HEIGHT, H, MEASURED FROM THE BOTTOM OF REINFORCED SLOPE TO TOP OF SLOPE REFERENCE LINE AND NOT LESS THAN 10'-0". ACTUAL PRIMARY REINFORCEMENT LENGTH MUST BE DETERMINED BY THE REINFORCED SLOPE MANUFACTURER.

5. GRANULAR SUBBASE (301-010A), COMPACTING BACKFILL (210-015A), AND EXCAVATION ARE INCIDENTAL TO BID ITEM S501-35A.

6. FOR 3-TUBE CURB MOUNT RAIL DETAILS, SEE 3-TUBE CURB MOUNT RAIL DETAILS SHEETS.

7. FOR MOMENT SLAB, SEE WALL 2 MOMENT SLAB DETAILS SHEET.

REVISIONS			
NO.	DATE	BY	DESCRIPTION

DESIGNED K. VASQUEZ
DESIGN CHECKED P. ESCHBACHER
DETAILED J. CULIAN
DRAWING CHECKED P. ESCHBACHER

SCALES SHOWN ARE FOR 11" X 17" PRINTS ONLY
CADD FILE NAME 20033brRW_002-3C.DGN.dgn
DRAWING DATE: MAY 2024

IDAHO TRANSPORTATION DEPARTMENT
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HDR

PROJECT NO. A020(033)

SLOPE 4 SECTION DETAIL
SH-75, ELKHORN RD TO RIVER ST, KETCHUM

ENGLISH
COUNTY BLAINE
KEY NUMBER 20033
SHEET 205 OF 364

NOT APPROVED FOR CONSTRUCTION
PRELIMINARY
DATE ORIGINAL SIGNED:
ORIGINAL SIGNED BY:

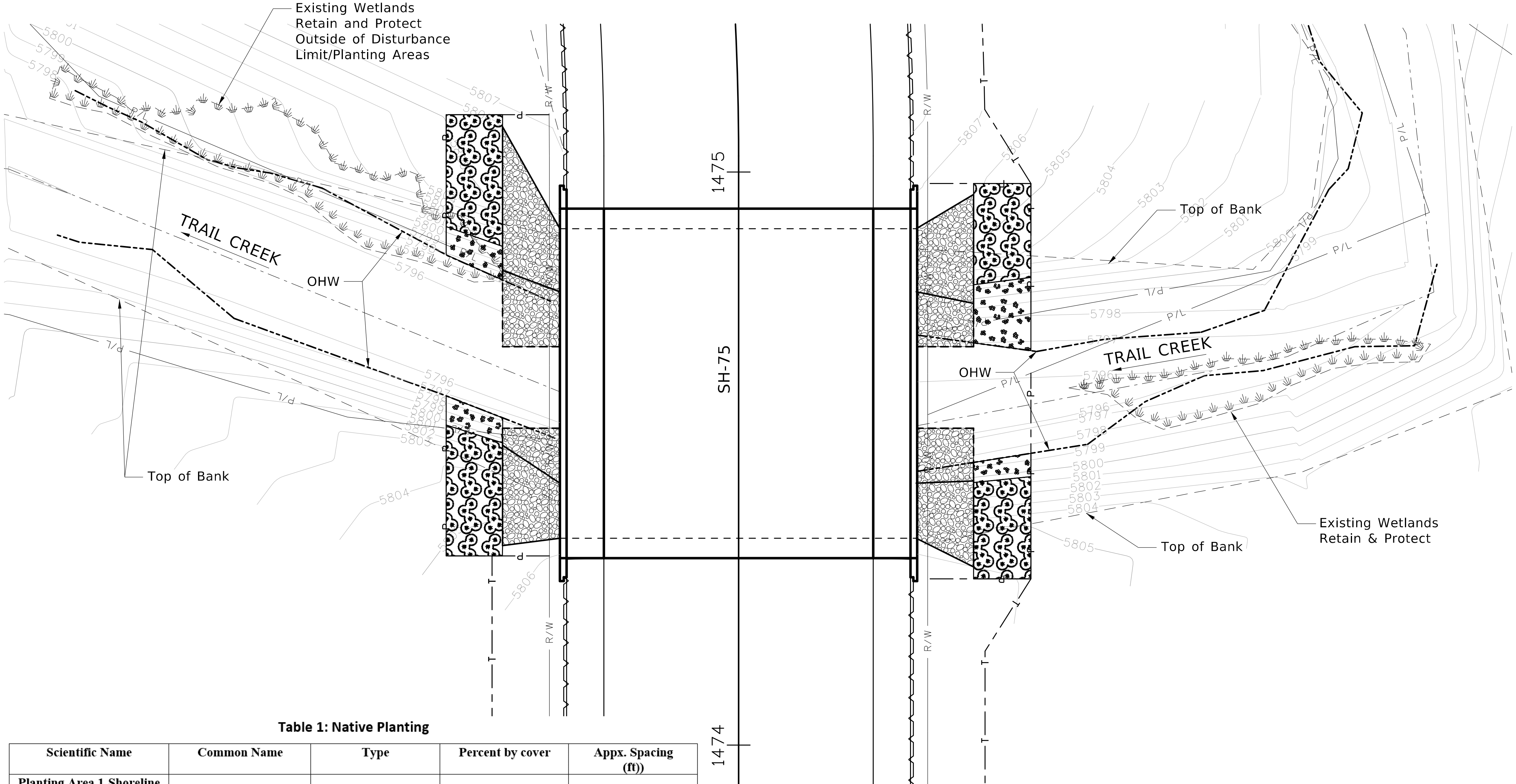

Table 1: Native Planting

Scientific Name	Common Name	Type	Percent by cover	Appx. Spacing (ft))
Planting Area 1-Shoreline				
Populus trichocarpa	Black Cottonwood	live stakes/poles	50	10
Salix exigua	Coyote Willow	live stakes/poles	50	5
Total Zone 1-Shoreline			**100**	
Planting Area 2-Riparian-Upland				
Populus tremuloides	Quaking Aspen	1-2-gallon or bareroot	50	8
Rosa Woodsii	Woods Rose	1-2-gallon or bareroot	50	8
Total Zone 2-Riparian			**100**	

****Planting Area 1**- Within 5-10 ft of the stream (Roots should reach below the water table), **Planting Area 2**- Upslope from Planting Area 1*

Construction Notes:

- Live stakes/pole plantings to appx. 24-36" and buried so that the bottom of the stakes/poles are below the OHWM of Trail Creek. Should be buried with shoots upward and at least ¾ of the pole should be buried.
- Plants should be placed at a recommended spacing of and clustered with like species as possible

LEGEND

- Zone 1 Planting Area (Shoreline) With Riparian Seeding
- Zone 2 Planting Area (Riparian) With Riparian Seeding
- Riprap areas

N

Scale (Feet)
10 0 10 20

NOT APPROVED
PRELIMINARY
FOR CONSTRUCTION

REVISIONS			
NO	DATE	BY	DESCRIPTION

DESIGNED JLJ
DESIGN CHECKED TMJ
DETAILED TM
DRAWING CHECKED JLJ

SCALES SHOWN ARE FOR 11" X 17" PRINTS ONLY
CADD FILE NAME 20033_land_001.dgn
DRAWING DATE: February 2022

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Parametrix

PROJECT NO.
A020(033)

TRAIL CREEK PLANTING PLAN
SH-75, ELKHORN RD
TO RIVER ST, KETCHUM

ENGLISH
COUNTY Blaine
KEY NUMBER 20033
SHEET 200 OF 249

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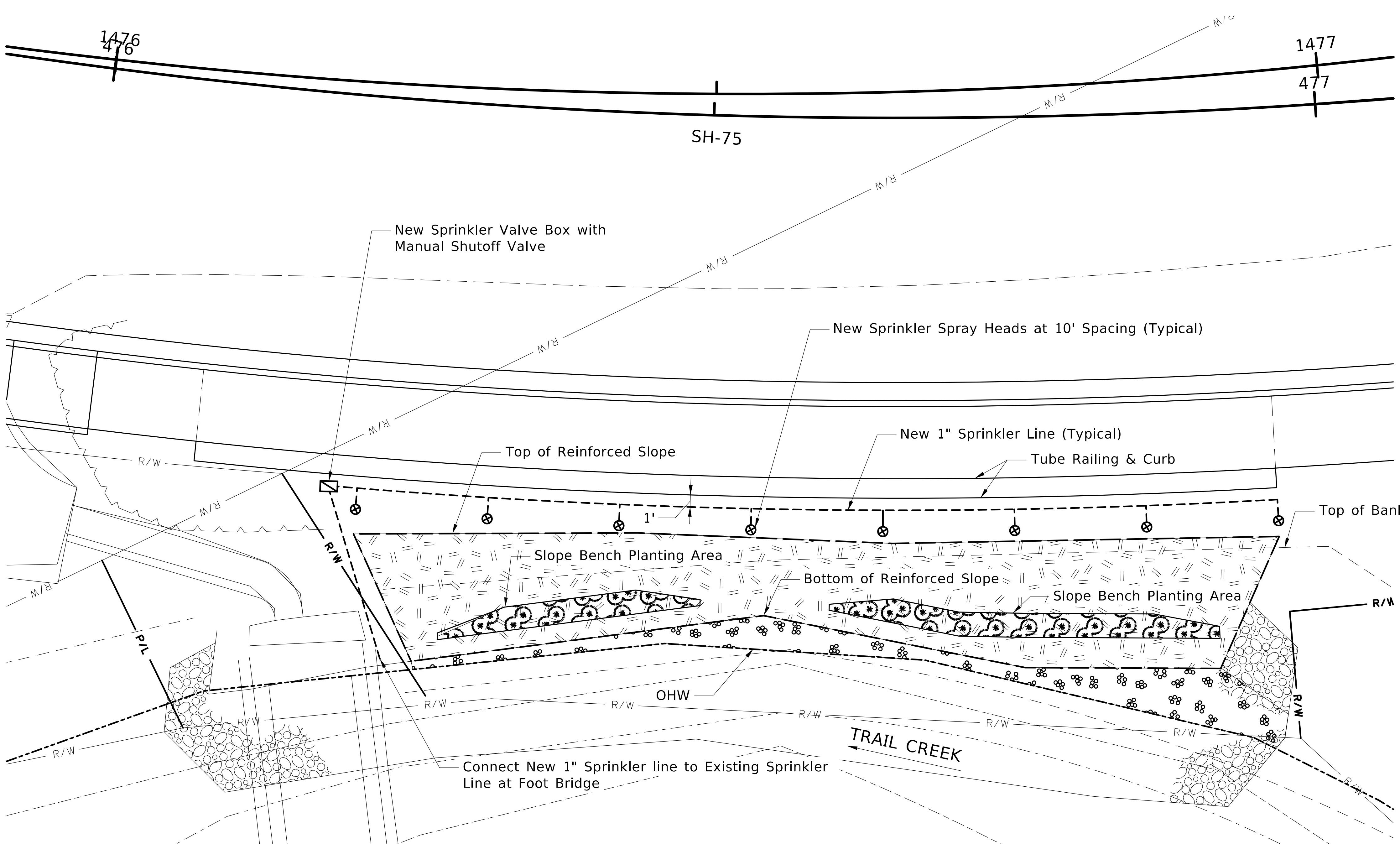

620-020A **PLANTING TREE (SEEDLING OR CONTAINER)**

25 EACH 476+28.00 (47.00 R) - 476+95.00 (52.00 R)

620-025A **PLANTING SHRUB (BARE ROOT OR CONTAINER)**

14 EACH 476+30.00 (45.00 R) - 476+90.00 (44.00 R)

NOTE:

SEE SWPP PLAN SHEETS FOR RIPARIAN SEED QUANTIITIES

Table 1: Native Planting

Scientific Name	Common Name	Type	Percent by cover	Appx. Spacing (ft))
Planting Area 1-Shoreline				
Salix exigua	Coyote Willow	live stakes/poles	100	5
Total Zone 1-Shoreline			**100**	
Planting Area 2-Riparian-Upland				
Amelanchier	Serviceberry	1-2-gallon	50	8
Rosa Woodsii	Woods Rose	1-2-gallon	50	8
Total Zone 2-Riparian			**100**	

****Planting Area 1*** *- Within 5-10 ft of the stream (Roots should reach below the water table),* ***Planting Area 2*** *- Upslope from Planting Area 1*

Construction Notes:

- Live stakes/pole plantings to appx. 24-36" and buried so that the bottom of the stakes/poles are below the OHWM of Trail Creek. Should be buried with shoots upward and at least ¾ of the pole should be buried.
- Plants should be placed at a recommended spacing of and clustered with like species as possible

LEGEND

- Zone 1 Planting Area (Shoreline)
- Zone 2 Planting Area (Riparian)
- Riparian Seeding
- Riprap Areas

Scale (Feet)
5 0 5 10

NOT APPROVED
FINAL DESIGN
FOR CONSTRUCTION

REVISIONS			
NO	DATE	BY	DESCRIPTION

DESIGNED JLJ
DESIGN CHECKED TMJ
DETAILED JRA
DRAWING CHECKED PSA

SCALES SHOWN ARE FOR 11" X 17" PRINTS ONLY

CADD FILE NAME 20033_land_003.dgn

DRAWING DATE: April 2024

IDAHO TRANSPORTATION DEPARTMENT
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Parametrix

PROJECT NO. A020(033)

TRAIL CREEK SLOPE PLANTING PLAN
SH-75, ELKHORN RD TO RIVER ST, KETCHUM

ENGLISH

COUNTY Blaine

KEY NUMBER 20033

SHEET 257 OF 367

This guide specification has been prepared by Propex Operating Company, LLC (Propex) to assist design professionals in the preparation of a specification section covering the use of Engineered Wrap-Face Vegetated Solutions for constructing reinforced-soil walls and steepened slopes. It may be used as the basis for developing either a project specification or an office master specification. Since it has been prepared according to the principles established in the Manual of Practice published by The Construction Specifications Institute (CSI) including the use of section numbers and titles from the 2011 Edition of MasterFormat, this guide specification may be used in conjunction with most commercially available master specifications sections with minor editing.

The following should be noted in using this guide specification:

•Optional text requiring a selection by the user is enclosed within brackets, e.g.: "Section [01 33 00] [_____]."

•Items requiring user input are enclosed within brackets, e.g.: "Section [_____ - _______]."

•Optional paragraphs are separated by an "OR" statement, e.g.:

***** OR *****

This guide specification is available in both hard copy and a variety of electronic formats to suit most popular word processing programs and operating platforms. Please contact Propex at (800) 621-1273 for additional copies or for information on available electronic formats.

1 GENERAL

1.1 SUMMARY

A. The work for this section shall consist of furnishing all materials, equipment, and labor necessary for the installation of an Engineered Wrap-Face Vegetated Solution for constructing reinforced-earth walls and steepened slopes.

1.2 RELATED SECTIONS

Edit the following paragraphs to coordinate with other sections of the Project Manual.

A. SECTION [01 33 00 SUBMITTAL PROCEDURES] [_____ - _______]

B. SECTION [31 00 00 EARTHWORK] [_____ - _______]

C. SECTION [31 05 19 GEOTEXTILE] [_____ - _______]

D. SECTION [31 25 00 EROSION AND SEDIMENTATION CONTROLS] [_____ - _______]

E. SECTION [32 92 19 SEEDING AND SODDING] [_____ - _______]

1.3 UNIT PRICES

Include the following article only for unit price contracts or lump sum contract with unit price adjustments. Delete for lump sum contracts.

A. Method of Measurement: By the square meter (or square foot - as indicated in contract documents) of wall face including seams, overlaps, and wastage.

B. Basis of Payment: By the square meter (or square foot - as indicated in contract documents) of wall face installed.

1.4 REFERENCES

The following article assumes that the date of each reference standard will be the latest edition as of the date of the project specification. This provision must be defined in Division 1; coordinate with Division 1 statements.

A. American Society for Testing and Materials (ASTM):

1. D 1557 - Standard Test Methods for Laboratory Compaction Characteristics of Soil Using Modified Effort

2. D 4354 - Standard Practice for Sampling of Geosynthetics and Rolled Erosion Control Products(RECPs) for Testing.

3. D 4355 - Standard Test Method for Deterioration of Geotextiles by Exposure to Light, Moisture and Heat in a Xenon Arc Type Apparatus.

4. D 4439 - Standard Terminology for Geosynthetics.

5. D 4759 - Standard Practice for Determining the Specification Conformance of Geosynthetics.

6. D 4873 - Standard Guide for Identification, Storage, and Handling of Geosynthetic Rolls and Samples.

7. D 6818 - Standard Test Method for Ultimate Tensile Properties of Rolled Erosion Control Products.

8. D 6524 - Standard Test Method for Measuring the Resiliency of Turf Reinforcement Mats (TRMs).

9. D 6525 - Standard Test Method for Measuring Nominal Thickness of Rolled Erosion Control Products.

10. D 6567 - Standard Test Method for Measuring the Light Penetration of a Rolled Erosion Control Product (RECP).

11. D 6575 – Standard Test Method for Determining Stiffness of Geosynthetics Used as Turf Reinforcement Mats (TRMs).

B. Geosynthetic Accreditation Institute - Laboratory Accreditation Program (GAI-LAP).

C. Greenhouse Gas (GHG) Protocol

D. International Standards Organization (ISO):

1. 9001:2015 - Quality System Certification.
2. 14001:2015 – Environmental Management System Certification
3. 14064-3:2006 – Environmental Management – Life Cycle Assessment
4. 17025:2005 – Laboratory Testing and Calibration

E. Publically Available Specification (PAS) 2050:2011 – Specification for the assessment of the life cycle greenhouse gas emissions

1.5 DEFINITIONS

A. *Certificate of Compliance (COC):* An official document certified by an authorized representative within the manufacturer's company that the manufactured synthetic turf reinforcement mat product(s) meet designated property values as manufactured in a facility having achieved ISO 9001:2015 certification, and tested in accordance with GAI-LAP procedures.

B. *Internal Bracing:* Bracing members designed to interlace through the HPTRM and provide internal support during construction and through the project design life.

C. *High Performance Turf Reinforcement Mat (HPTRM):* A long-term, non-degradable RECP composed of UV-stabilized, non-degradable, synthetic fibers, nettings and/or filaments processed into three-dimensional reinforcement matrices designed for permanent and critical hydraulic applications where design discharges exert velocities and shear stresses that exceed the limits of mature natural vegetation. HPTRMs provide sufficient thickness, strength and void space to permit soil filling and/or retention and the development of vegetation within the matrix. The HPTRM MARV tensile strength per ASTM D-6818 is 3000 lbs/ft in the weakest principle direction.

D. *Manufacturer:* Entity that produces synthetic turf reinforcement mats through a process directly utilizing obtained raw materials, in a facility owned and operated by said entity, using equipment and assemblies owned and operated by said entity, subject to a certified Manufacturing Quality Control (MQC) Program. Upon completion of production, the manufacturer may sell the turf reinforcement mat product(s) directly to the customer, or through a vendor entity.

E. *Manufacturing Quality Control (MQC) Program*: A certified and documented program initiated and operated by the manufacturer that outlines the operational techniques and activities which sustain a quality of the synthetic turf reinforcement mat product(s) that will satisfy given needs.

F. *Minimum Average Roll Value (MARV):* Property value calculated as typical minus two standard deviations. Statistically, it yields a 97.7 percent degree of confidence that any sample taken during quality assurance testing will exceed value reported.

G. *Engineered Wrap-Face Vegetated Solution:* A reinforced-earth wall and/or steepened slope system that provides permanent erosion protection and is comprised of consecutive layers of soil-filled wraps using an HPTRM and fiber-composite internal bracing.

H. *Rolled Erosion Control Product (RECP):* A temporary degradable or long-term non-degradable material manufactured or fabricated into rolls designed to reduce soil erosion and assist in the growth, establishment and protection of vegetation.

I. *Securing Pin:* A device designed to temporarily hold the HPTRM in place while either vegetation establishes, or the installation of the HPTRM occurs. The securing pin offers no long term value to permanent tie-down of the HPTRM in an armoring solution.

J. *Trilobal Monofilament Yarn:* A multi-dimensional polymer fiber consisting of a minimum of three points, providing increased surface area and grooves/channels along the fiber to capture additional moisture and sediment to enhance vegetative growth.

K. *Typical Roll Value:* Property value calculated from average or mean obtained from test data.

L. *Vendor:* An entity that provides synthetic turf reinforcement mat product(s) to a customer, on behalf of an independent manufacturer. A vendor does not manufacture the actual synthetic turf reinforcement mat product(s), and therefore is not subject to provisions of a certified MQC Program.

1.6 SUBMITTALS

Edit the following to coordinate with Division 1.

A. Submit under provisions of Section [01 33 00] [_____]:

1. Qualifications:

The following documentation shall be submitted to the engineer of record and/or project owner for review and approval prior to installation.

a) A Certificate of Compliance (COC) stating the name of the manufacturer, product name, style, chemical compositions of filaments or yarns and other pertinent information to fully describe the Engineered Wrap-Face Vegetated Solution. The COC shall state that the furnished material meets the requirements of the specification and shall be attested to by a person having legal authority to bind the Manufacturer.

b) The Manufacturer's Manufacturing Quality Control (MQC) Program to assure compliance with the requirements of the specification.

c) A project list demonstrating a documented history of installations of the HPTRM component totaling more than 2,000,000 square yards, with over 500,000 square yards having been installed in the marketplace for more than five (5) years. Past project documentation submitted for evaluation shall include project name, date of installation, and size of the project.

d) A certification demonstrating that the HPTRM component is manufactured in a facility that has been ISO 14001 certified for measuring environmental impact and continuously looking for ways to improve it for a minimum of ten (10) years.

e) A certification demonstrating that the HPTRM component is manufactured in a facility that has been ISO 9001:2015 certified and tested in a laboratory that has been both GAI-LAP and ISO 17025:2005 certified.

f) Third party / Independent Testing values demonstrating UV resistance testing on the HPTRM component for two consecutive years including most recent year. Testing and reporting of the results shall follow ASTM D-4355, showing the percent tensile strength retained in both machine and cross-machine direction.

g) Documentation of functional longevity for the HPTRM component demonstrating the material's durability in the field. The documentation shall demonstrate a minimum retained tensile strength of 70% per ASTM D-6818 after a minimum of ten (10) years of exposure in an area having a minimum solar radiation of 21.70 MJ/m^2-day. The documentation shall include photos and date of the initial installation and field sampling, and the test results of the field sampling.

h) A certification demonstrating that the HPTRM component has been evaluated and certified by an independent third party to have a maximum cradle-to-grave carbon footprint of 2.7 kg CO2e/m2 when tested per GHG Protocol, ISO 14064-3:2006, and PAS 2050:2011.

1.7 DELIVERY, STORAGE, AND HANDLING

A. HPTRM labeling, shipment and storage shall follow ASTM D-4873.

B. Product labels shall clearly show the manufacturer or supplier name, style name, and roll number.

C. Each shipping document shall include a notation certifying that the material is in accordance with the manufacturer's certificate.

D. Each HPTRM roll shall be wrapped with a material that will protect the geotextile from damage due to shipment, water, sunlight, and contaminants. Individual roll wrapping will not be required for HPTRMs exceeding the UV Resistance requirements per ASTM D-4355 in Section 2.2.A.6. The protective wrapping shall be maintained during periods of shipment and storage.

E. During storage, HPTRM rolls shall be elevated off the ground and adequately covered to protect them from the following: Site construction damage, extended exposure to ultraviolet (UV) radiation, precipitation, chemicals that are strong acids or strong bases, flames, sparks, temperatures in excess of 71 deg C (160 deg F)m and any other environmental condition that might damage the HPTRM.

1.8 QUALITY ASSURANCE SAMPLING, TESTING, AND ACCEPTANCE

A. HPTRM component shall be subject to sampling and testing to verify conformance with this specification. Sampling for testing shall be in accordance with ASTM D-4354.

B. Acceptance shall be in accordance with ASTM D-4759 based on testing of either conformance samples obtained using Procedure A of ASTM D-4354, or based on manufacturer's certifications and testing of quality control samples obtained using Procedure B of ASTM D-4354.

C. Quality Assurance Sampling and Testing will be waived for ISO 9001:2015 Certified Manufacturing Facilities. Documentation of ISO 9001:2015 Certification shall be provided per the requirements of Section 1.6.A.

2 PRODUCTS

2.1 MANUFACTURERS

A. All components of the armoring solution shall be furnished by a single manufacturer as a complete system.

B. Approved Engineered Wrap-Face Vegetated Solution Manufacturers:

1. Propex Operating Company, LLC

   4019 Industry Drive

   Chattanooga, TN 37416

   (800) 621-1273

C. Approved Engineered Wrap-Face Vegetation Solution:

1. PYRAWALL Engineered Vegetated Wall System

D. Alternate Engineered Wrap-Face Vegetation Solution Manufacturers:

1. Alternate manufacturers seeking pre-approval shall be submitted to the engineer of record and/or owner a minimum of ten (10) work days prior to the bid date and must meet the requirements outlined within this document.
2. For consideration, alternate systems meeting the material specification within Section 2 seeking pre-approval shall submit the following for evaluation.
   a) Documentation demonstrating a history of installations designed for erosion control meeting the requirements of Section 1.6.A.1.c.
   b) Documentation demonstrating local representation within the state in which the project is being constructed.
   c) Documentation demonstrating the alternative engineering design for engineered wrap-face vegetated solution. The following shall be submitted:
      1) Overall alternative engineered wrap-face vegetated solution design methodology
      2) Input parameters
      3) Calculations / Model output
      4) Factor of Safety for Sliding, Overturning, and Bearing Capacity to support the wrap-face vegetated solution design; with the conditions analyzed and documented for the proposed project
      5) Alternative engineered wrap-face vegetated solution product sample including all components.
3. Manufacturers seeking pre-approval must also have a manufacturer's representative present at the pre-bid meeting.
4. Alternate manufacturers that do not provide documentation meeting or exceeding the requirements of Section 1.6.A will not be approved.

2.2 MATERIALS

A. HPTRM:

1. Three-dimensional, high tensile strength, long term non-degradable lofty woven polypropylene HPTRM specially designed for erosion control applications that exhibits very high interlock and reinforcement capacity with both soil and vegetative root systems.

2. A homogeneous woven matrix composed of Trilobal monofilament yarns woven into uniform configuration of resilient pyramid-like projections to improve interlock and minimize yarn displacement around internal bracing and pins, which also results in greater flexibility for improved conformance to uneven surfaces.

3. A material not comprised of layers, composites, or discontinuous materials, or otherwise loosely held together by stitched or glued netting.

4. The HPTRM component should meet the following values:

Property	Test Method	Test Parameters	Units	Property Requirement
Thickness [1]	ASTM D-6525	Minimum	mm (in)	10.2 (0.40)

Light Penetration [1] (% Passing)	ASTM D-6567	Maximum	percent	10
Tensile Strength [1]	ASTM D-6818	Minimum	kN/m (lb/ft)	58.4 x 43.8 (4,000 x 3,000)
Tensile Elongation [1]	ASTM D-6818	Maximum	percent	40 x 35
Resiliency [1]	ASTM D-6524	Minimum	percent	80
Flexibility [2, 3]	ASTM D-6575	Maximum	mg-cm (in-lb)	615,000 (0.534)
UV Resistance [2]	ASTM D-4355	Minimum	percent	90 at 3,000 hrs [4] 90 at 6,000 hrs
Carbon Footprint [2]	ISO 14064-3 GHG Protocol PAS 2050:2011	Maximum	Kg CO2e	2.7 per 1 m^2

Note:

1. Minimum Average Roll Value (MARV).
2. Typical Value.
3. A smaller value for flexibility denotes a more flexible material.
4. Third party / Independent Testing values must be provided showing UV resistance testing for two consecutive years including most recent year.

5. Hydraulic Performance Properties:

a) Flume Testing: The HPTRM component must meet the following at a minimum when subjected to at least 0.5 hrs of continuous flow producing the following conditions.

1) Unvegetated HPTRM

Permissible velocity: 9 ft/sec (2.7 m/sec)

Permissible shear stress: 2.8 psf (130 Pa)

2) Partially Vegetated HPTRM

Permissible velocity: 15 ft/sec (4.6 m/sec)

Permissible shear stress: 8 psf (383 Pa)

3) Fully Vegetated HPTRM

Permissible velocity: 25 ft/sec (7.6 m/sec)

Permissible shear stress: 16 psf (766 Pa)

6. Functional Longevity: In addition to the UV resistance per ASTM D-4355 stated above, the HPTRM component must have a documented installation showing a minimum retained tensile strength of 70% per ASTM D-6818 after a minimum of 10 years of exposure to a minimum solar radiation of 21.70 MJ/m2-day.

7. Environmental Impact: The HPTRM component shall be evaluated and certified by an independent third party to have a maximum cradle-to-grave carbon footprint of 2.7 kg CO_2e/m^2 when tested per GHG Protocol, ISO 14064-3:2006, and PAS 2050:2011.

8. Manufacturing Impact: The HPTRM component shall be manufactured in a facility that is ISO 14001 certified for measuring environmental impact and continuously looking for ways to improve it for a minimum of ten (10) years.

9. Manufacturing Quality Control: Testing shall be performed at a laboratory accredited by GAI-LAP for tests required for the HPTRM, at frequency exceeding ASTM D-4354, with following minimum acceptable testing frequency:

Property	**Test Frequency m^2 (yd^2)**
Thickness	1/12,291 (1/14,700)
Light Penetration (% Passing)	1/12,291 (1/14,700)
Tensile Strength	1/12,291 (1/14,700)
Tensile Elongation	1/12,291 (1/14,700)
Resiliency	1/12,291 (1/14,700)
Flexibility	1/12,291 (1/14,700)
UV Resistance	Annually

B. Internal Bracing and Securing:

1. The internal brace assembly comprises 3 nonmetallic polymer bars specially designed, whereby 2 of the bars are threaded through the pyramidal projections of the HPTRM to form a semi-rigid base and upright member, which both are then connected using the third bar as a transverse member. These braces shall be installed for each lift at a horizontal spacing along the wall not to exceed 68 mm (27 inches). For curved wall applications, this spacing typically ranges from 53 to 61 mm (21 to 24 in).

2. Wood or plastic stakes, or steel pins are used to pin-down the geotextile near the back of the reinforcement zone to hold the geotextile taut while aligning the wall face and placing soil backfill. These are installed as needed along the HPTRM, but at a frequency no less than 1 per 2-3 lineal meters (6.5-10 lineal feet). The stakes or pins shall be 225 to 305 mm long (9 to 12 in) and shall be approved by the Engineer before installation.

3 EXECUTION

3.1 SUBGRADE PREPARATION

A. Excavate a shallow, level trench at least 1.3 m (4.3 ft.) wide and 15 to 23 cm (6 to 9 in) deep below finished grade using an excavator with smooth bucket to reduce disturbance at the defined subgrade elevation.

B. The cut-slope excavation width shall not exceed the lines and grades shown on the Plans, and care shall be taken to avoid encroachment near bordering properties. As necessary, to account for grade variations along the wall base line, the trench shall have level sections separated by 30 cm (12 in) steps to allow for grade alignment with the 30 cm (12 in) wrapped lifts.

C. Deleterious material (overly wet soil, uncontrolled loose fill, construction debris, organics, etc.) encountered during this excavation shall be over-excavated, removed, and replaced with compacted granular fill or approved backfill soil. Compact the subgrade as specified by the Engineer.

D. If specified by the engineer, a perforated drainage pipe shall be installed at the back of the trench and connected to a prescribed outlet for draining groundwater.

E. Granular soil is defined as:

1. Classified as GM, GW, SM, SW, GW-GM, SW-SM referencing the USCS (Unified Soil Classification System).
2. Contains maximum particle size of 3.8 cm (1-1/2 in) and less than 12 percent fines passing 0.074 mm (No. 200 sieve).
3. Inert earth material with less than 3 percent organics or other deleterious substances (wood, metal, plastic, waste, etc).

<u>OR</u>

4. Meets the untreated base grading requirements for 3.8 cm (1-1/2 in) maximum nominal size crushed aggregate per typical state construction standards.

A. For clay subgrade soils, line the trench with GEOTEX® 801 nonwoven geotextile. Place a 10 cm (4 in) thick loose lift of granular soil on top of the filter fabric and compact it to at least 90 percent of the specified modified Procter dry density per ASTM D 1557. Smooth the surface of the compacted soil to provide a level pad needed for the first layer of HPTRM.

3.2 INSTALLATION

A. Install the armoring solution at elevation and alignment indicated.

B. Starting with the lowest portion of the wall alignment, roll out the first layer of the HPTRM along the trench line, with the inboard 1.2 m (4 ft.) of the 2.6 m (8.5 ft.) wide roll laid along the trench footprint. At each terminus of this lowest section of the wall alignment, curve the wall face slightly into the slope so the ends of this run can be buried, leaving no HPTRM edges exposed at the ground surface. Concave curves in the wall are formed by cutting and overlapping the fabric in the 1.2 m (4 ft.) backfill zone; convex curves are formed by spreading the fabric.

C. Weave the bottom and upright internal bracing components (bars) through the interior pyramidal projections of the HPTRM toward the 1.2 m (4 ft.) fold line, being sure to catch 4-8 yarns with the bracing bar at each pyramid. Fold the fabric and stand-up the face, then connect the bars using a T-slot at the 4-ft fold line. While holding the face near vertical, connect those 2 bars with the third bar, aligned transverse to the other two using 2 T-slots. Do not allow the vertical face segment to lay down prior to installing this transverse bar, because the vertical bar likely will be damaged and require replacement. Install these braces at a maximum uniform spacing of 68 mm (27 inches) along the wall face; a lesser spacing of 60 mm (24 inches) may be desirable for tighter face liners. Loose fabric at the outboard side is laid out away from the backfill area.

D. Pull the fabric fairly taut in both directions, then drive stakes or pins 225 to 305 mm long (9 to 12 in) through the HPTRM near the front and rear of the 1.2 m (4 ft.) backfill zone to hold the fabric in place for subsequent soil backfilling at a frequency no less than 1 per 2-3 lineal meters (6.5-10 lineal feet). Exercise extreme caution when driving or operating equipment across this HPTRM, as sudden turns or braking may deform or damage the HPTRM, or pull the wall face out of proper alignment.

E. Place a 17 to 20 cm (7 to 8 in) thick loose lift of backfill soil approved by the Engineer along the 1.2 m (4 ft.) backfill zone using hand shovels to place soil around the braces first, and then filling the space in-between braces along the face. Compact the soil lift to the specified modified Proctor dry density per the Engineer's recommendation, but never less than 85% of the maximum dry density per ASTM 1557.

1. The internal-braced design of the geosynthetic wrap allows mechanical compaction of the backfill zone immediately adjacent to the face without the use of temporary bracing and without the use of external support at the wall face.
2. Vibratory plate compactors should not be used within 7 cm (3 in) of the face; ramming compactors (“jumping jack” style) should not be used within 30 cm (12 in) of the face.

F. Place a second lift of backfill soil along the backfill zone and compact it to bring the total height up to 30 cm (12 in) at the face. Cohesive soils may tend to deform laterally more than granular soils and may require additional loose-lift height to achieve the final compacted height. The compacted lift thickness away from the face should be approximately 28 cm (11 in) to allow for a thin soil layer to be placed between the consecutive HPTRM wraps.

G. Fold the 1.1 m (3.5 ft.) outboard portion of the HPTRM wrap layer back over the backfill zone, stretch it taut to remove wrinkles, and pin it down. Spread approximately 2 cm (1 in) of fine backfill soil with no coarse gravel or larger particles evenly across the fabric in preparation for the next wrapped lift.

H. To splice onto the end of a HPTRM roll (previous roll), install a brace at 0.45 m (1.5 ft) from the end of the roll. For the new roll to be added, insert a brace close to the roll end, then slide the new roll end into the previous roll end until the new roll end abuts against the final brace of the previous roll. After placing and compacting backfill, fold the top wrap back over the fill and stretch taut to provide an end-to-end overlap of 0.45 m (1.5 ft).

I. Repeat Steps A. through H. for each subsequent backfill lift. Incorporate a setback with each lift to provide the desired overall slope angle.

J. To form a curve in the wall alignment, cut the fabric laydown flaps perpendicular to the wall face. Cuts should extend from the back of the flap to not closer than 10 cm (4 in) from the wall face. Spread the fabric at the cuts to form a concave face curve or overlap the fabric at the cuts to form a convex face curve. Add an additional braces within the curve if needed.

K. For taller walls, the geosynthetic-reinforced zone behind the wrap-face will need to be widened by using supplemental geosynthetic layers sandwiched in-between the upper fabric layer of a given lift and the lower fabric layer of the subsequent lift. Apply a thin layer of soil at fabric interfaces to eliminate complete fabric-to-fabric contact. Alternatively, the supplemental geosynthetic layers can be placed at mid-lift height after the first 15 cm (6 in) lift is compacted.

L. Where each wrap-face lift ends at the lateral project limits, the wall face should be curved slightly into the slope and buried, leaving no HPTRM loose ends exposed at the ground surface. Overall wall layout and foundation steps are specified in the Construction Plans, but foundation grade elevations may need to be modified to match actual field conditions during construction. Damage to the Engineered Wrap-Face Vegetated Solution resulting from Contractor vehicles, equipment, or operations shall be repaired.

END OF SECTION

FLOODWAY "NO-RISE / NO-IMPACT" CERTIFICATION

This document is to certify that I am duly qualified engineer licensed to practice in the State of

Idaho
(State)
. It is to further certify that the attached technical data supports

the fact that proposed SH-75 Trail Creek *(Name of Development)* will not impact the base flood

elevations, floodway elevations, and floodway widths on Trail Creek *(Name of Stream)* at published

cross sections in the Flood Insurance Study for, City of Ketchum *(Name of community)*, dated November 26, 2010 *(Date)*

and will not impact the base flood elevations, floodway elevations, and floodway widths at the

unpublished cross-sections in the area of the proposed development.

PROFESSIONAL ENGINEER
LICENSED
20374
3/8/2024
STATE OF IDAHO
SPENCER J. SAVAGE

SEAL, SIGNATURE AND DATE

Spencer J. Savage
Name

Water Resource Engineer
Title

412 E. Parkcenter Blvd., Suite 100
Boise, ID 83706-6659
Address

FOR COMMUNITY USE ONLY:

Community Approval

☐ Approved ☐ Disapproved

Community Official's Name | Community Official's Signature | Title

SH-75 Trail Creek Bridge

Project No. A020(033)
Key No. 20033

Blaine County, Idaho
April 28, 2021

Prepared for
The Idaho Transportation Department

Prepared by
HDR
412 E Parkcenter Blvd, Ste 100
Boise, ID 83706

Table of Contents

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Tables

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Acronyms

ACE	annual chance exceedance
cfs	cubic feet per second
CSU	Colorado State University
DEM	duplicate effective model
FEMA	Federal Emergency Management Agency
FIS	flood insurance study
FIRM	Flood Insurance Rate Map
fps	feet per second
HEC-RAS	Hydrologic Engineering Center River Analysis System program
ITD	Idaho Transportation Department
NAVD 88	North American Vertical Datum of 1988
SH-75	State Highway 75
USACE	U.S. Army Corps of Engineers
USGS	U.S. Geological Survey
WSE	water surface elevation

1 Introduction

State Highway 75 (SH-75) is the primary north-south highway in the Wood River Valley serving the cities of Bellevue, Hailey, Ketchum, and Sun Valley in Blaine County. The proposed SH-75 Elkhorn to River Street project is the third and northernmost roadway construction project to be developed from the *Timmerman to Ketchum Environmental Impact Statement Record of Decision* issued in August of 2008 (ITD 2008a). The purpose of the project is to improve safety and capacity on SH-75 between Elkhorn Road, north of the Big Wood River Bridge, and River Street in the city of Ketchum. The approximate project milepost limits are from 126.5 to 128.2 on SH-75. The Idaho Transportation Department (ITD) is replacing the SH-75 Bridge at Trail Creek to meet the purpose of this project.

2 Existing Conditions

2.1 Vicinity Sketch

Figure 1 is a map of the project vicinity. SH-75 runs approximately south to north. Trail Creek flows from approximately northeast to south/southwest. There are five structures in the project vicinity (three upstream of SH-75 and one downstream of SH-75). A site map with contours is shown in Appendix A.

2.2 Problems and Adverse Conditions including Scour

The bridge inspection report from 2016 notes the following (ITD 2016a):

- EMBANKMENT: Earth fill in good condition. Minor erosion under outside porta-rail, abutment 2 left side.
- CHANNEL: Rock channel is in good condition. Inlet and outlet has rock riprap protection.

Based on field reconnaissance completed in the summer and fall of 2019 and the survey data, indications of scour were not observed at the abutments or in the channel. The survey data suggest some aggradation of materials in the channel.

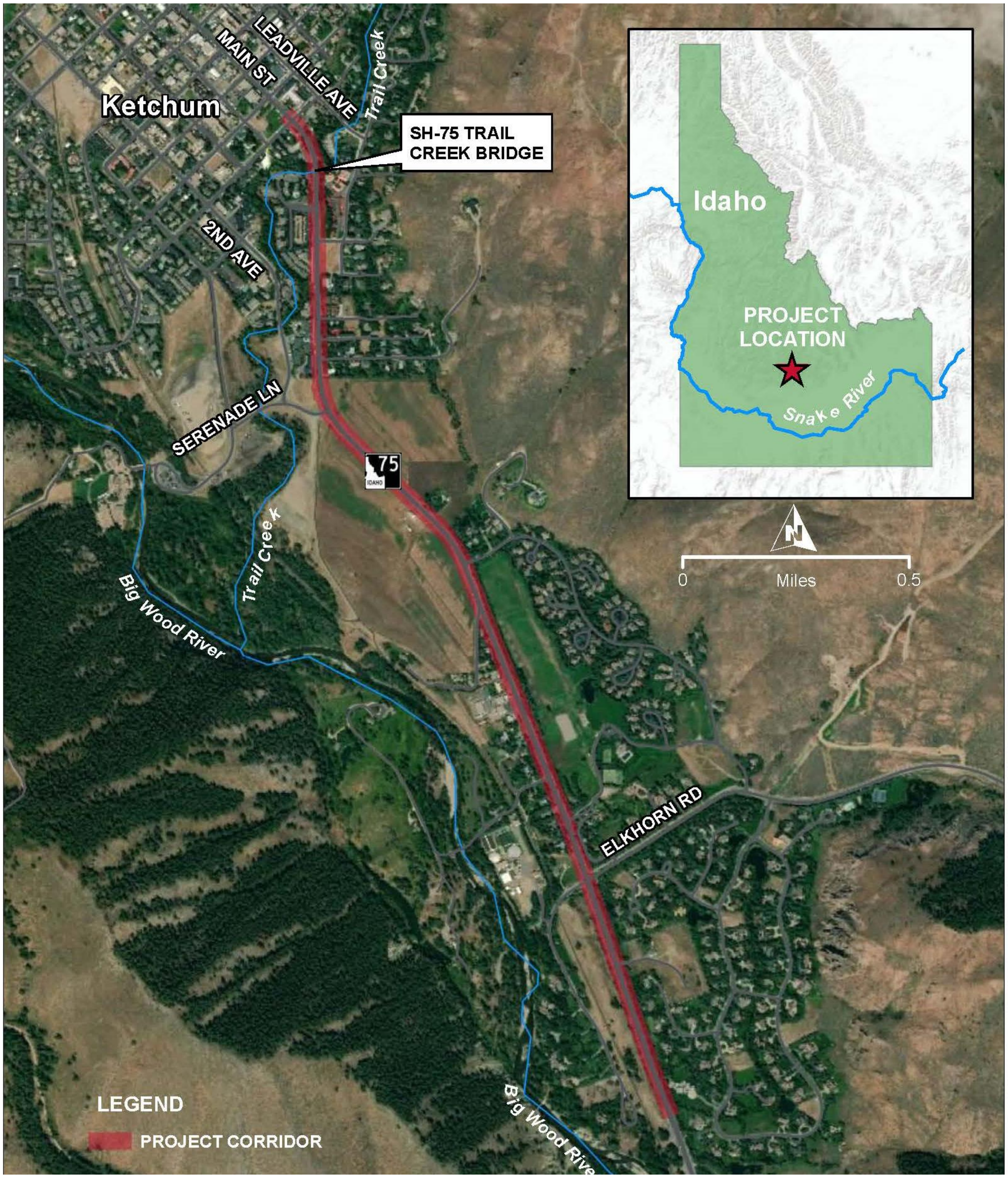

Figure 1. Vicinity Sketch with Aerial, SH-75 Trail Creek Bridge

2.3 Stream Stability

The stream in the study area appears to be stable. The reach has banks that have been stabilized with riprap, retaining walls, and a well-established vegetation riparian zone. The stream may be sediment starved due to the upstream Sun Valley Lake. Some down cutting could be possible due to the steep gradient of this mountain stream. The 2010 Federal

Emergency Management Agency (FEMA) *Flood Insurance Study* (FIS) prepared for this reach of Trail Creek states the following (FEMA 2010):

> *The Trail Creek floodplain is extensively developed, with residential dwellings lining the stream from one end of the city to the other. As in many other areas, stream-front property is considered prime residential land in Sun Valley.*
>
> *The Trail Creek Valley runs northeast to southwest, sloping toward the southwest. The creek has an average overall slope of 200 feet per mile (fpm) and, within Sun Valley, a slope of 80 fpm. The channel is narrow and well incised.*

2.4 Aerial and Ground Photographs

An aerial is included in Figure 1. Photographs of Trail Creek and SH-75 Bridge are shown in Photo 1 through Photo 5.

Photo 1. Looking upstream at Trail Creek from SH-75 Bridge on July 28, 2019.

Photo 2. Looking upstream face of SH-75 Bridge over Trail Creek from left bank on July 28, 2019.

Photo 3. Looking downstream face of SH-75 Bridge over Trail Creek from right bank on October 8, 2019.

Photo 4. Looking upstream under SH-75 Bridge over Trail Creek on October 8, 2019.

Photo 5. Looking downstream at Trail Creek from SH-75 Bridge on July 28, 2019.

3 Hydrology

There are U.S. Geological Survey (USGS) gaging stations located upstream (13137300 Trail Creek near Sun Valley, Idaho) and downstream (13137500 Trail Creek at Ketchum, Idaho) of the SH-75 Bridge. Both gages have stream records of less than 5 years. A FEMA FIS (16013CV001A, Blaine County, Idaho and Incorporated Areas, November 26, 2010) has been prepared for this reach of Trail Creek (FEMA 2010).

Flows on Trail Creek may be influenced by Sun Valley Lake, which is located upstream of the SH-75 Bridge. However, no mention of the hydrologic effects of the Lake are included in the stated record from the FIS (FEMA 2010):

> *Past floods in Ketchum from Trail Creek, Warm Springs Creek, and the Big Wood River have all been due to spring snowmelt conditions, generally during years marked by heavy snowpack with rapid melting during warm-weather periods. These conditions have sometimes been accompanied in the past by warm spring rains, which hasten the snowmelt, leading to more rapid runoff and higher stream stages. Future floods are likely to occur from similar conditions, although there is a possibility of winter floods caused by heavy, unseasonably warm rainfall on top of a deep snowpack.*
>
> *No records exist concerning flooding on Trail Creek. Because the stream channel is relatively steep and well-incised, past flooding would have been limited in extent and severity, attracting little attention. No damage reports were found for flooding on Trail Creek for any year, and no dollar estimates of past flood damage were found for any of the three study streams.*

The likelihood of hydraulic modifications to the Dam at Sun Valley Lake is unknown. No additional investigation or analysis was performed to evaluate the impacts of the Lake or removal of the Dam.

3.1 Floods and Peak Flow

The selected design flow and flood insurance consistency flow is the 100-year from Table 1. The scour design flow is the 500-year from Table 1.

3.2 Methods

The USGS gage has annual peak stream flow records from 2012 to 2018. Recorded annual peak flows during this period vary between 255 cubic feet per second (cfs) and 750 cfs. The USGS stream gage data consist of fewer than 20 years of records. Therefore, these data were not used to develop design flows. The Blaine County FIS includes 10-, 2-, 1- and 0.2-percent annual chance exceedance (ACE) (10-, 50-, 100-, and 500- year) flows for Trail Creek. Therefore, these flows were used as design flows. The FIS does not include a 50-percent ACE (2-year) flow. StreamStats was used to estimate the 50-percent flow based on regional regression equations (USGS 2009). Flows from the FIS, StreamStats, and the existing plans were similar for all return periods and were used to estimate the 2-year flow. Design flows are summarized in Table 1. A comparison of these flows to range of recorded peak flows at the USGS gage indicate that these are reasonable design flows and that adjustments to the FIS flows are not warranted.

Table 1. Summary of Design Discharges for SH-75 Bridge over Trail Creek

Flooding Source and Location	Drainage Area (square miles)[1]	50-percent annual chance (2-year)[2]	10-percent annual-chance (10-year)	2-percent-annual-chance (50-year)	1-percent-annual-chance (100-year)	0.2-percent-annual-chance (500-year)
Trail Creek At Mouth	69	360	600	900	1,020	1,300

[1]Using StreamStats drainage area at SH-75 Bridge is approximately 64 square miles
[2]Estimated using FIS flow, StreamStats, and Existing Plans

3.3 Floodplain

The SH-75 Bridge is in a mapped flood hazard area (Panel 16013C0461E, November 26, 2010) (FEMA 2010) and crosses the floodway. A portion of the Flood Insurance Rate Map (FIRM) for the vicinity is shown in Figure 2 and for the area near the SH-75 Bridge in Figure 3. Since the project is within a floodplain and a floodway, a floodplain development permit is required from the floodplain administrator for consistency with the community's floodplain ordinance requirements. Issuance of the permit will require a no-rise certificate. The City of Ketchum floodplain administrator must confirm flood ordinance requirements (Ketchum 2014):

> *Prohibit encroachments, including fill, new construction, substantial improvements, and other development unless certification with supporting calculation, by a registered professional hydraulic engineer is provided demonstrating that encroachments shall not result in any increase in flood level during the occurrence of the base flood discharge. Uses in the floodway shall be restricted to that which are required by public necessity (for example, bridges, water pumps), recreational use (for example, paths), wildlife habitat improvements (for example, vegetation, nesting structures, pool/riffle improvements), and gravel extractions; provided that the use/encroachment meets the approval of the Federal Emergency Management and Nation Flood Insurance Program and does not jeopardize the city's participation in the National Flood Insurance Program. (Ordinance 1120 §17.88.070 C.1).*

HDR requested the effective regulatory model from FEMA, but FEMA was unable to produce model input files. Therefore, based on coordination with the City of Ketchum, HDR completed floodplain and floodway analyses using an alternative model that considers the floodway as delineated in the communities' FIRM, and the existing channel geometry, as surveyed for this project.

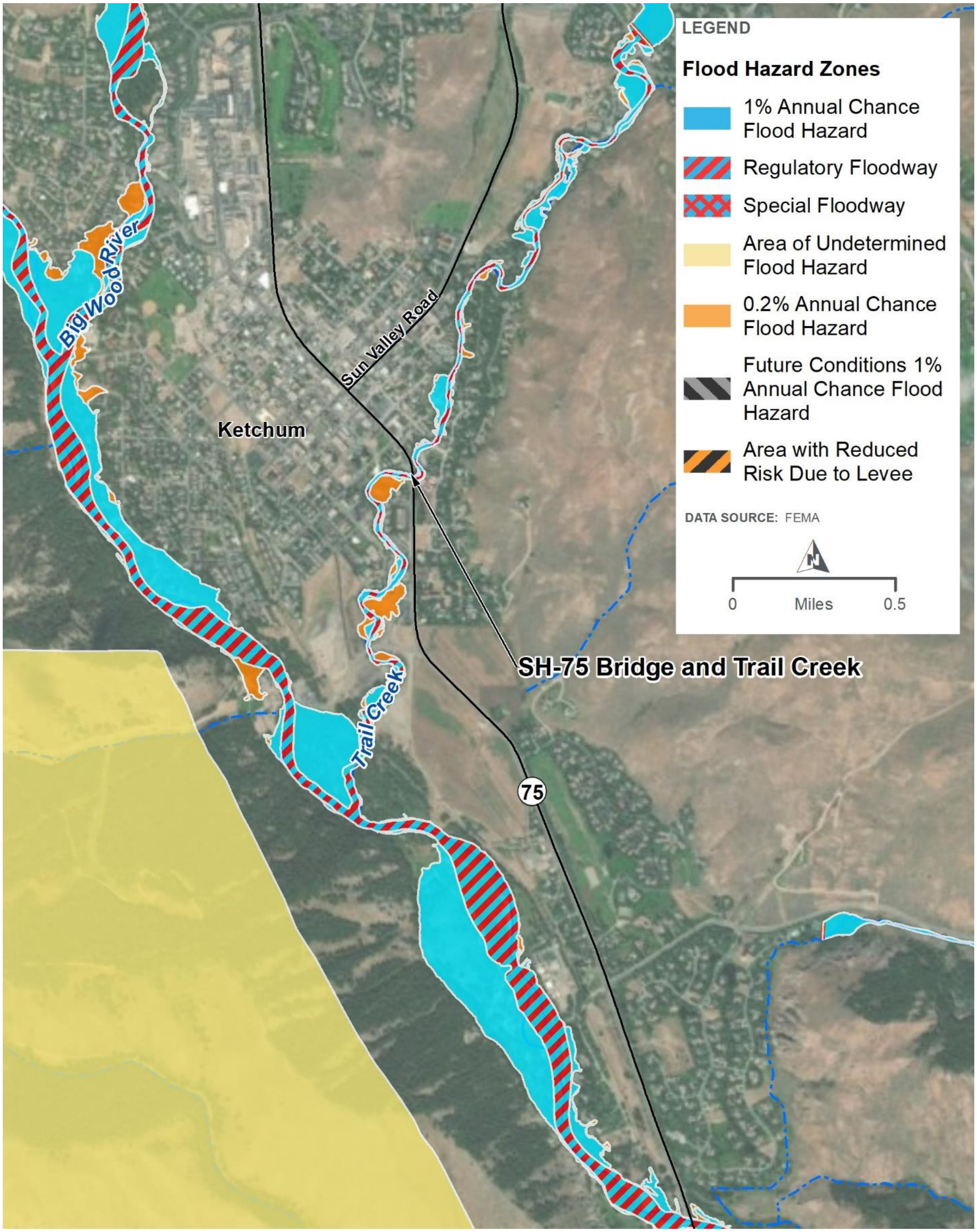

Figure 2. FEMA Flood Insurance Rate Map for Vicinity of SH-75 Bridge

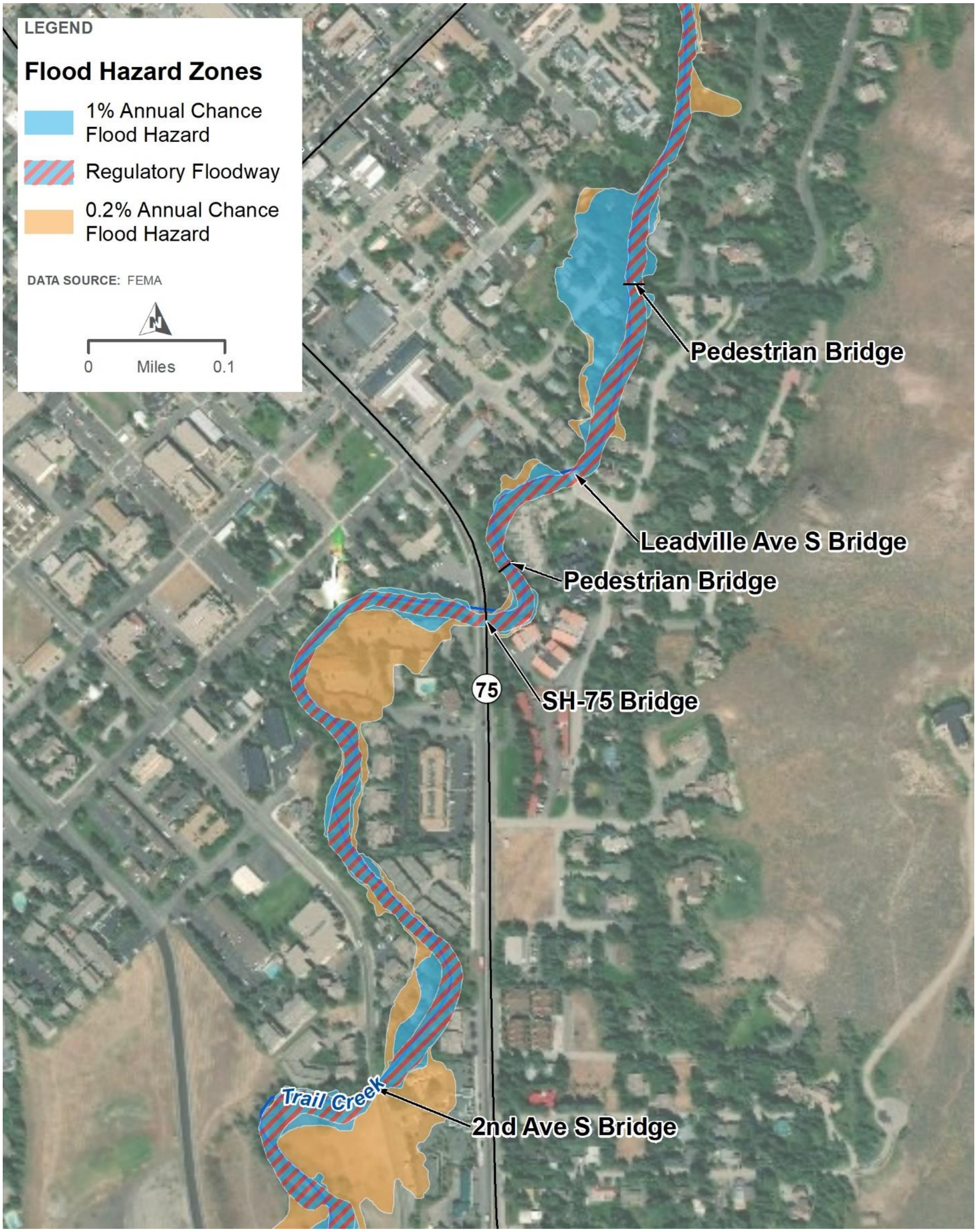

Figure 3. FEMA Flood Insurance Rate Map for Project Location: SH-75 Bridge

4 Hydraulics

4.1 Design Constraints and Freeboard Requirements

ITD sets waterway clearances for bridges and culverts (ITD, 2008b, ITD 2016b). For this location, the appropriate requirement is for bridges/culverts over waterways other than canals is as follows:

- All bridges/culverts with a clear span of 20 feet or greater shall have a minimum of 2-foot clearance above the Q_{50} flow (50-year flow in Table 1), and;
- In addition, the Q_{100} flow (100-year flow in Table 1) must pass beneath the lowest chord of the structure.

Additional constraints at this location are as follows:

- Provide 3-foot or wider paths on both sides of the channel at an elevation of 2-year flow (ordinary high water) water surface elevation or higher.
- Provide 5-foot or higher of clearance between the paths and the low chord of the bridge.
- Highway geometrics may impose a limit on the height the low chord may be raised.
- Result in no rise the flood elevation (no-rise certificate)

4.2 Hydraulic Analysis

4.2.1 Hydraulic Structure Survey

Parametrix surveyed Trail Creek in the fall of 2019. Parametrix surveyed cross-sections of Trail Creek from approximately 1,500 feet upstream to 2,000 feet downstream of the existing SH-75 Bridge. The survey included two pedestrian bridges upstream and the upstream bridge at Leadville Avenue along with one downstream bridge at 2nd Avenue S. Channel shape is generally V- or U-shaped. The channel bottom and sides are earthen with abundant native vegetation. The channel has side slopes generally ranging from 1V:2H to 1V:3H.

4.2.2 Hydraulic Analysis Methodology

The hydraulic analysis methodology followed FEMA's procedures for "No-Rise" certification (FEMA 2013). The hydraulic analysis involved using the Hydrologic Engineering Center River Analysis System (HEC-RAS) to create models of the existing condition and the proposed condition (the pre- and post-project condition). The HEC-RAS geometry is shown in Appendix B.

4.2.2.1 FLOODPLAIN ANALYSIS

The U.S. Army Corps of Engineers (USACE) used a HEC-2 computer program for Trail Creek for the FIS (FEMA 2010). This is the current effective model. In response to a request for this model, FEMA indicated that they were unable to recover model files or inputs for the effective regulatory model (Greene 2020). The City of Ketchum and HDR agreed that since the effective model was unavailable, that floodplain and floodway analyses should be completed using an alternative hydraulic model that considers the floodway as delineated in the communities' FIRM, and the existing channel geometry, as surveyed for this project (Zung 2020). Floodway stations were adjusted to match the floodways widths shown in the floodway data tables and to reduce or eliminate negative surcharges as much as possible. The HEC-RAS Version 5.0.7 was applied to Trail Creek to model the hydraulics (USACE 2018).

The alternative hydraulic model was developed using the surveyed cross-section data and modeled with the same Manning's roughness coefficients as used in the FIS (0.065 in channel, 0.20 in overbank areas) to try to reproduce the FIS profiles. Bank stations were simulated at or inside the published floodway in attempted to develop a duplicate effective model (DEM). Data regarding floodplain modifications since the model was published in 1974 were not available. Floodway profile elevations between the alternative DEM model and the published floodway elevations from the FIS floodway data are shown in Table 2.

Floodway water surface elevations in the DEM generally compared to within 0.5 feet of the published elevations. At two cross-sections, the difference was larger than 0.5 feet. The City of Ketchum has indicated that it has had difficulties comparing water surface elevations from FIS to existing topography, and has indicted that the effective model is not appropriate for use in this analysis. The City agrees that discrepancies are beyond the area of hydraulic influence for this bridge and that the bridge construction does not warrant a conditional letter of map revision submittal. However, these discrepancies do indicate that a revised study of Trail Creek may be warranted to accurately represent flood hazards and the existing condition of Trail Creek. Figure 4 shows that the surveyed channel bottom upstream of the Leadville Ave Bridge is roughly 2 feet lower than the channel bottom surveyed in 1974, which further supports the fact the effective model does not represent the current geometry in this reach. Based on guidance from the City of Ketchum, no further changes were made in attempt to recreate the results in the FIS. The DEM was considered to be the new model and calibrated to reproduce the FIS profiles within 0.5 feet or as close as possible and with the available known information.

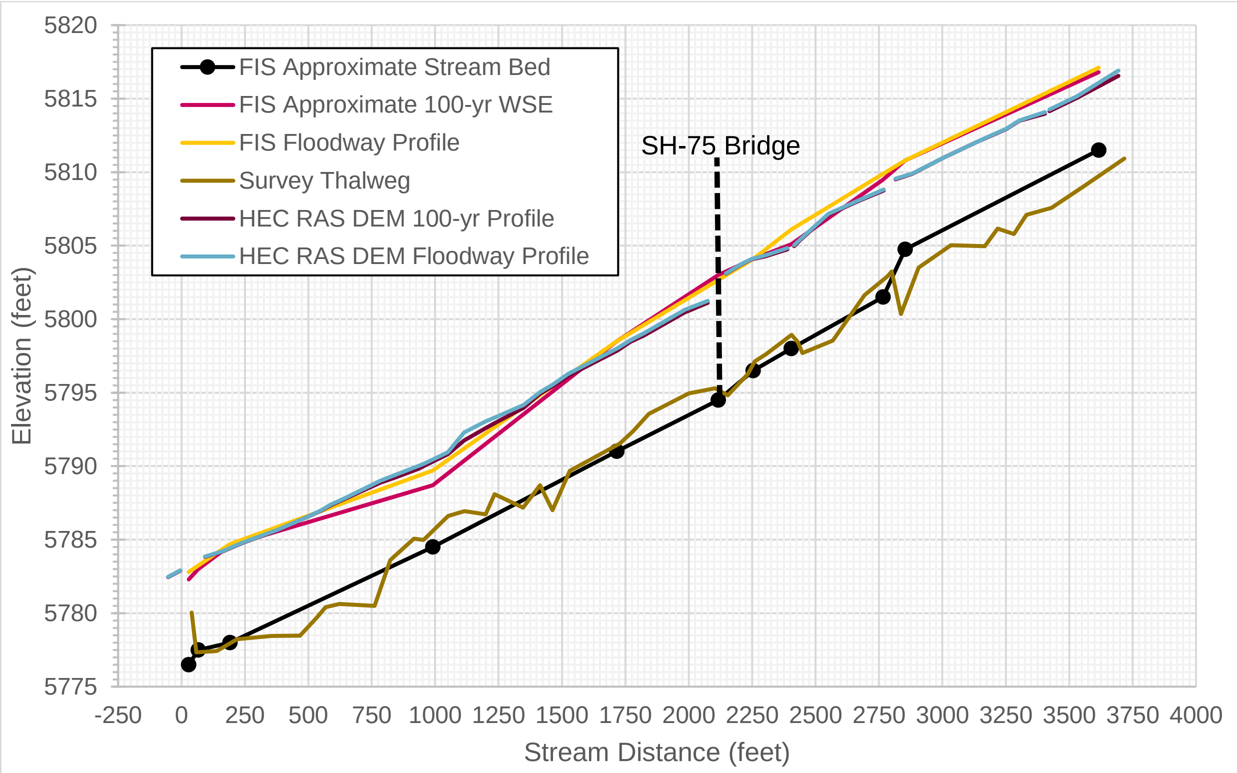

Figure 4. FIS and HEC-RAS DEM Thalweg and Water Surface Elevation Comparison

Table 2. Comparison of FIS WSE and Floodway Elevations Cross-Sections to HEC-RAS Model Results, without and with Floodway Encroachments

Lettered Cross-Sections from FIRM/FIS	FIS WSE without Floodway (ft, NAVD)	FIS WSE with Floodway (ft, NAVD)	DEM HEC-RAS model XS at the approximate location	DEM HEC-RAS WSE without Floodway (ft, NAVD)	DEM HEC-RAS WSE with Floodway (ft, NAVD)	Difference in 100— WSE (ft)	Difference in Floodway WSE (ft)
D	5782.3	5782.8	-53	5782.5	5782.5	0.1	-0.3
E	5784.6	5784.7	162	5784.2	5784.2	-0.4	-0.5
F	5788.7	5789.7	958	5790.0	5790.2	1.3	0.5
G	5798.5	5798.5	1719	5797.9	5798.0	-0.6	-0.5
H	5804.1	5804.1	2247	5804.1	5804.1	0.0	-0.1
I	5805.1	5806.1	2415	5805.2	5805.3	0.1	-0.8
J	5810.8	5810.8	2881	5809.9	5809.9	-0.9	-0.9
K	5816.8	5817.1	3694	5816.6	5816.6	-0.3	-0.5

FIRM = Flood Insurance Rate Map; FIS = Flood Insurance Study; ft = feet; NAVD = North American Vertical Datum of 1988; WSE = water surface elevation; DEM = duplicate effective model; HEC-RAS = Hydrologic Engineering Center River Analysis System

4.2.2.2 EXISTING CONDITIONS (PRE-PROJECT) MODEL

The DEM model was revised to reflect modifications that have occurred within the floodplain since the date of the effective model. Changes from the DEM include Manning's roughness coefficients and bank stations that better represent the observed stream conditions based on field observations and field survey data. The existing condition model serves as the baseline condition for determining the hydraulic effects of the proposed condition design.

4.2.2.3 PROPOSED CONDITION (POST-PROJECT) MODEL

A proposed conditions model was created based on existing conditions model and the proposed SH-75 Bridge. The results of the proposed conditions model are compared to the existing conditions model to determine the impact of the project.

The model downstream boundary condition for the existing and proposed models is normal depth. Manning's n values for both the main channel and culvert/bridge locations are based on the guidance in Chapters 3 and 6 of the HEC-RAS manual (USACE 2016). Selected hydraulic model conditions are summarized in Table 3.

Table 3. Summary of Selected Hydraulic Model Input Parameters

Hydraulic Model Parameter	Value Used in Model
Number of cross-sections	48
Channel roughness values (Manning's n)	0.070 (left overbank) 0.045 (channel) 0.070 (right overbank)
Contraction coefficient	0.1, except at bridges 0.3, 0.6 for SH-75 existing
Expansion coefficient	0.3, except at bridges 0.5, 0.8 for SH-75 existing
Boundary condition	Normal depth Slope = 0.01
Flow profiles	See Table 1

4.2.2.4 HYDRAULIC ANALYSIS DOWNSTREAM BOUNDARY CONDITION SENSITVITY

The sensitivity of the results to the downstream boundary condition was assessed. The selected hydraulic model input parameters are shown in Table 3. The boundary condition was changed and simulated for two conditions, a multiplier of a 10 (slope = 0.1) and a divisor of 10 (slope = 0.001). These changes in the boundary condition resulted in changes to the predicted water surface at distance upstream form the downstream boundary condition of up to 1,167 feet. The SH-75 Bridge is located at 2,188 feet from the downstream boundary condition. This sensitivity analysis demonstrates the SH-75 is upstream of the influence of the downstream boundary condition.

4.2.2.5 HYDRAULIC ANALYSIS MANNING'S N SENSITIVITY

The sensitivity of the results to Manning's n was assessed. The selected hydraulic model input parameters are shown in Table 3. The Manning's n was changed and simulated for two conditions, an addition of 0.02 (Manning's n channel = 0.065) and a subtraction of 0.02 (Manning's n channel = 0.025). These changes were made to bound the range of reasonable roughness coefficients for the studied stream reach. Results show that modifying the Manning's n coefficient changed the predicted water surface of approximately 0.75 feet. This demonstrates the model sensitivity to the selection of Manning's n is less than 1.0 feet.

5 Existing Structure

The existing structure is a reinforced concrete stiffleg bridge built in 1929 and extended in 1980 to 48.2 feet wide in the direction of the channel with a clear span of 20 feet (ITD 1979). There are two travel lanes on the structure. The bridge is currently near the end of its design life. The HEC-RAS output for existing conditions is shown in Appendix C.

There are additional structures over Trail Creek near the SH-75 Bridge. The structures are a pedestrian bridge, S Leadville Avenue, and a second pedestrian bridge located upstream of the SH-75 Bridge and the crossing at 2nd Avenue S located downstream of the SH-75 Bridge (Appendix B). Parametrix surveyed these structures as part of the fall 2019 channel survey. The survey information was used to define these structures in the HEC-RAS model as shown in Table 4. The HEC-RAS model simulation predicted Q_{50} and Q_{100} water surface elevations of 5,802.14 feet and 5,802.64 feet. The existing SH-75 Bridge meets the 2-foot of clearance for the Q_{50} flow.

Table 4. Summary of Structures in SH-75 Bridge HEC-RAS Model

Structure	Dimensions (Span x Rise x Length) (ft)	Channel Invert at Inlet (ft)	Low Chord Elevation (ft)
Pedestrian Bridge	49.5 x 7.5 x 9.5	5807.8	5815.33
S Leadville Ave Bridge	29.5 x 10.3 x 36	5800.9	5811.14
Pedestrian Bridge	30 x 7.0 x 8.7	5798.5	5805.49
SH-75 Bridge	20 x 9.3 x 48.5	5795.0	5804.31
2nd Ave S Bridge	44 x 6.8 x 44	5777.4	5784.20

ft = feet

The FIS notes a potential for debris accumulation during high flows (FEMA 2010):

> *Flooding on Trail Creek would be aggravated by debris collecting behind the many small bridges crossing the channel. This debris would include cottonwood trees, sediment, and material washed away from the many homes located along the streambanks. Historically, all major floods in the Big Wood River basin have been aggravated by such debris accumulation at channel obstructions, resulting in significantly higher water-surface elevations just upstream.*

The potential for debris to aggravate flooding on Trail Creek could justify additional clearance at the existing structure.

6 Proposed Structure

6.1 Structure Summary

The proposed structure is a prestressed, concrete-voided, slab bridge that is 62 feet wide measured normal to the roadway centerline with a span of 57.5 feet for a clear opening of 54 feet. A structure summary is provided in Table 5. The cross-section provides a 3-foot horizontal bench under the bridge abutment, with a 2 to 1 slope to a 3-foot horizontal wildlife bench at an elevation above ordinary high water and 2 to 1 slope that intersects with the existing channel bed cross-section. There is 5.4 feet of clearance from ordinary high water to the low chord that provides the wildlife crossing requirement of 5 feet of clearance.

6.2 Hydraulic Performance

Table 6 summarizes the changes in water surface elevations and velocities for the design flow. Table 7 summarizes these changes considering published floodway encroachments. The HEC-RAS output for proposed conditions is shown in Appendix D. A comparison of the existing and proposed condition results is shown in Appendix E.

Table 5. Summary of Existing and Proposed Structures and Water Surface Elevations Modeled

Structure	Dimensions (Clear Span) (ft)	Channel Invert at Inlet (ft)	Low Chord Elevation (ft)	Headwater Elevation at Q50 of 900 cfs (ft)	Clearance at Q50 of 900 cfs (ft)	Headwater Elevation at Q100 of 1,020 cfs (ft)	Clearance at Q100 of 1,020 cfs (ft)
Existing	20	5795.03	5804.31	5802.14	2.17	5802.64	1.67
Proposed	54	5795.03	5804.91	5801.63	3.28	5801.95	2.96

ft = feet; Q50 = 50-year flow; Q100 = 100-year flow; cfs = cubic feet per second
Ordinary High Water (OHW) Elevation is approximately 5799.6 ft

Table 6. Summary of Reach Water Surface Elevations and Velocities with Existing and Proposed Structures

River Station	Flow	WSEs (ft)			Average Velocities (fps)		
		Existing	Proposed	Change	Existing	Proposed	Change
3694	1,020	5815.72	5815.72	0.00	7.27	7.27	0.00
3532	1,020	5814.54	5814.54	0.00	5.42	5.42	0.00
3422	1,020	5813.36	5813.36	0.00	6.89	6.89	0.00
3418	1,020	***Existing Structure Pedestrian Bridge***					
3404	1,020	5813.15	5813.15	0.00	6.95	6.95	0.00
3304	1,020	5812.87	5812.87	0.00	4.30	4.30	0.00
3252	1,020	5812.07	5812.07	0.00	7.01	7.01	0.00
3189	1,020	5811.66	5811.66	0.00	6.12	6.12	0.00
3140	1,020	5811.23	5811.23	0.00	6.28	6.28	0.00
3008	1,020	5810.05	5810.05	0.00	6.42	6.42	0.00
2881	1,020	5808.95	5808.94	-0.01	6.71	6.72	0.01
2815	1,020	5808.78	5808.77	-0.01	5.56	5.57	0.01
2810	1,020	***Existing Structure Leadville Ave Bridge***					
2769	1,020	5807.89	5807.86	-0.03	7.22	7.27	0.05
2680	1,020	5807.37	5807.32	-0.05	6.20	6.27	0.07
2550	1,020	5806.48	5806.43	-0.05	6.04	6.19	0.15
2439	1,020	5804.06	5803.97	-0.09	10.07	10.3	0.23
2415	1,020	5804.26	5804.18	-0.08	7.35	7.51	0.16
2407	1,020	***Existing Structure Pedestrian Bridge***					
2389	1,020	5803.73	5803.54	-0.19	8.06	8.52	0.46
2300	1,020	5803.51	5803.19	-0.32	5.30	5.79	0.49
2247	1,020	5803.39	5802.99	-0.40	4.48	5.02	0.54
2205	1,020	5802.91	5802.14	-0.77	6.07	7.59	1.52
2147	1,020	5802.64	5801.95	-0.69	5.67	5.88	0.21
2135	1,020	***Existing/Proposed Structure SH-75 over Trail Creek***					
2075	1,020	5800.47	5800.40	-0.07	8.74	9.37	0.63
1984	1,020	5799.71	5799.71	0.00	6.38	6.38	0.00
1824	1,020	5798.03	5798.03	0.00	6.92	6.92	0.00
1769	1,020	5797.63	5797.63	0.00	6.39	6.39	0.00
1719	1,020	5796.96	5796.96	0.00	7.38	7.38	0.00
1524	1,020	5795.31	5795.31	0.00	6.71	6.71	0.00
1463	1,020	5794.53	5794.53	0.00	7.73	7.73	0.00
1414	1,020	5794.07	5794.07	0.00	7.69	7.69	0.00
1349	1,020	5792.89	5792.89	0.00	9.13	9.13	0.00
1239	1,020	5792.24	5792.24	0.00	6.43	6.43	0.00
1200	1,020	5791.73	5791.73	0.00	7.19	7.19	0.00
1114	1,020	5790.81	5790.81	0.00	6.39	6.39	0.00
1050	1,020	5790.02	5790.02	0.00	6.08	6.08	0.00

Table 6. Summary of Reach Water Surface Elevations and Velocities with Existing and Proposed Structures

River Station	Flow	WSEs (ft)			Average Velocities (fps)		
		Existing	Proposed	Change	Existing	Proposed	Change
958	1,020	5789.28	5789.28	0.00	5.07	5.07	0.00
936	1,020	5788.92	5788.92	0.00	5.99	5.99	0.00
842	1,020	5788.30	5788.30	0.00	5.63	5.63	0.00
784	1,020	5788.03	5788.03	0.00	5.40	5.40	0.00
643	1,020	5786.82	5786.82	0.00	7.35	7.35	0.00
587	1,020	5786.45	5786.45	0.00	6.87	6.87	0.00
549	1,020	5785.94	5785.94	0.00	7.48	7.48	0.00
482	1,020	5785.46	5785.46	0.00	6.76	6.76	0.00
376	1,020	5784.65	5784.65	0.00	6.81	6.81	0.00
241	1,020	5783.87	5783.87	0.00	5.87	5.87	0.00
162	1,020	5783.33	5783.33	0.00	6.03	6.03	0.00
93	1,020	5783.08	5783.08	0.00	5.07	5.07	0.00
66	1,020	***Existing Structure Second Ave Bridge***					
-5	1,020	5781.97	5781.97	0.00	7.06	7.06	0.00
-53	1,020	5781.51	5781.51	0.00	6.79	6.79	0.00

WSE = water surface elevation; ft = feet; fps = feet per second

Table 7. Summary of Reach Water Surface Elevations and Velocities with Existing and Proposed Structures Considering Floodway Encroachments

River Station	Flow	WSEs (ft)			Average Velocities (fps)		
		Existing	Proposed	Change	Existing	Proposed	Change
3694	1,020	5815.64	5815.64	0.00	7.59	7.59	0.00
3532	1,020	5814.48	5814.48	0.00	5.58	5.58	0.00
3422	1,020	5813.34	5813.34	0.00	6.92	6.92	0.00
3418	1,020	***Existing Structure Pedestrian Bridge***					
3404	1,020	5813.13	5813.13	0.00	6.98	6.98	0.00
3304	1,020	5812.86	5812.86	0.00	4.38	4.38	0.00
3252	1,020	5812.07	5812.07	0.00	7.01	7.01	0.00
3189	1,020	5811.65	5811.65	0.00	6.18	6.18	0.00
3140	1,020	5811.23	5811.23	0.00	6.28	6.28	0.00
3008	1,020	5810.06	5810.05	-0.01	6.41	6.42	0.01
2881	1,020	5808.96	5808.95	-0.01	6.70	6.71	0.01
2815	1,020	5808.78	5808.78	0.00	5.55	5.56	0.01
2810	1,020	***Existing Structure Leadville Ave Bridge***					
2769	1,020	5807.90	5807.88	-0.02	7.24	7.28	0.04
2680	1,020	5807.36	5807.32	-0.04	6.21	6.28	0.07
2550	1,020	5806.47	5806.42	-0.05	6.09	6.24	0.15
2439	1,020	5804.04	5803.96	-0.08	10.10	10.33	0.23
2415	1,020	5804.25	5804.17	-0.08	7.37	7.52	0.15
2407	1,020	***Existing Structure Pedestrian Bridge***					
2389	1,020	5803.71	5803.51	-0.20	8.10	8.57	0.47
2300	1,020	5803.50	5803.16	-0.34	5.38	5.87	0.49
2247	1,020	5803.30	5802.89	-0.41	5.14	5.67	0.53
2205	1,020	5802.91	5802.13	-0.78	6.07	7.63	1.56
2147	1,020	5802.64	5801.90	-0.74	5.67	6.04	0.37
2135	1,020	***Existing/Proposed Structure SH-75 over Trail Creek***					
2075	1,020	5800.50	5800.48	-0.02	8.68	9.14	0.46
1984	1,020	5799.74	5799.74	0.00	6.67	6.67	0.00
1824	1,020	5798.03	5798.03	0.00	7.35	7.35	0.00
1769	1,020	5797.60	5797.60	0.00	6.80	6.80	0.00
1719	1,020	5796.99	5796.99	0.00	7.41	7.41	0.00
1524	1,020	5795.29	5795.29	0.00	6.94	6.94	0.00
1463	1,020	5794.53	5794.53	0.00	7.80	7.80	0.00
1414	1,020	5794.08	5794.08	0.00	7.67	7.67	0.00
1349	1,020	5793.06	5793.06	0.00	8.73	8.73	0.00
1239	1,020	5792.64	5792.64	0.00	5.83	5.83	0.00
1200	1,020	5792.37	5792.37	0.00	6.01	6.01	0.00
1114	1,020	5791.84	5791.84	0.00	5.83	5.83	0.00
1050	1,020	5790.32	5790.32	0.00	8.93	8.93	0.00

Table 7. Summary of Reach Water Surface Elevations and Velocities with Existing and Proposed Structures Considering Floodway Encroachments

River Station	Flow	WSEs (ft)			Average Velocities (fps)		
		Existing	Proposed	Change	Existing	Proposed	Change
958	1,020	5789.26	5789.26	0.00	5.66	5.66	0.00
936	1,020	5789.08	5789.08	0.00	5.68	5.68	0.00
842	1,020	5788.35	5788.35	0.00	6.00	6.00	0.00
784	1,020	5788.04	5788.04	0.00	5.85	5.85	0.00
643	1,020	5786.82	5786.82	0.00	7.34	7.34	0.00
587	1,020	5786.45	5786.45	0.00	6.86	6.86	0.00
549	1,020	5785.93	5785.93	0.00	7.54	7.54	0.00
482	1,020	5785.46	5785.46	0.00	6.77	6.77	0.00
376	1,020	5784.65	5784.65	0.00	6.82	6.82	0.00
241	1,020	5783.86	5783.86	0.00	5.88	5.88	0.00
162	1,020	5783.32	5783.32	0.00	6.05	6.05	0.00
93	1,020	5783.07	5783.07	0.00	5.11	5.11	0.00
66	1,020	***Existing Structure Second Ave Bridge***					
-5	1,020	5781.96	5781.96	0.00	7.08	7.08	0.00
-53	1,020	5781.51	5781.51	0.00	6.79	6.79	0.00

WSE = water surface elevation; ft = feet; fps = feet per second

The proposed structure increases the available conveyance area for Trail Creek under SH-75 dramatically. The proposed structure reduces the base flood elevation immediately upstream of SH-75 by almost 0.8 feet with and without floodway encroachments considered. Model results demonstrate that there is not an increase in upstream and downstream flood elevations for the base flood as a result of this project, and that the project meets no-rise criteria.

6.3 Channel Stability Considerations

The existing channel profile was compared to the channel profile documented in the FIS, as shown in Figure 4. There are reaches, notably between model station 2800 and the upstream end of the study reach, where cross-section data from the effective FIS study, dated 1974, indicate the channel thalweg may be up to 2.0 feet lower now than it was in 1974. There is also a reach downstream of the bridge, from model cross-sections 958 and 1114, where the low-flow channel bifurcates and is wider than the floodway. This indicates an area where sedimentation may have occurred since 1974. However, surveyed cross-section inverts at and within 500 feet of the bridge are within 1 foot of the cross-section data from the 1974 hydraulic study. This suggests that the channel is not actively degrading at the existing structure. For this reason, long-term degradation will not be considered in the scour evaluation for the bridge.

The proposed channel modification is only under the bridge and transitions upstream and downstream at elevations to accommodate higher flows. The proposed bridge is designed to accommodate these modifications. This short reach of modifications increases the conveyance capacity of Trail Creek at the bridge, which results in some increases to channel-average velocity upstream of the bridge. The City of Ketchum requested ITD evaluate the implications on increasing velocity in this reach on channel stability.

The 2-year or ordinary high water event is used to approximate channel-forming event. The existing and proposed velocity for the 2-year event upstream and downstream of the bridge are shown in Table 8.

Table 8. Summary of 2-year Velocity and Top Width Upstream and Downstream of the SH-75 Crossing for Existing and Proposed Conditions

Cross-Section	Existing		Proposed	
	Velocity (fps)	Top Width (ft)	Velocity (fps)	Top Width (ft)
2389	5.97	28.20	5.97	28.20
2300	4.44	37.45	4.45	37.40
2247	4.60	40.91	4.64	40.63
2205	6.10	27.68	6.58	26.66
2147	4.35	27.45	4.32	27.70
SH-75 Bridge				
2075	5.07	31.48	5.94	24.46
1984	4.74	42.61	4.74	42.61
1824	5.56	36.50	5.56	36.50

fps = feet per second; ft = feet

Model results indicate increased channel average velocities of greater than 0.5 feet per second (fps) at one cross-section, 2075. Cross-section 2075 is located 7 feet downstream of the bridge. Bridge construction will include riprap stabilization at this cross-section, placed above OHW. Model results indicate that the section of the river immediately upstream of the bridge may experience increases in velocity up to about 0.5 fps. The section has a cobble bed with banks that have been stabilized by both large rock placed on the banks and by large tree roots (see Photo 6 through Photo 8). There are also areas that appear to have been cleared manually, as is evident by the lack of gravel, tree materials, and plants near the channel.

The rock on the bank in this reach appears to have a D50 between 0.5 feet and 1.0 feet. The Stream Restoration Design National Engineering Handbook Threshold Channel Design (NRCS 2007) estimates sediment sizes between a D50 of 0.5 feet and 1.0 feet would have an allowable velocity (for stability) of 10 to 12 fps, and cobbles to have a permissible velocity (for stability) of 6.5 fps.

To evaluate the safety factor for channel materials, the Colorado State University (CSU) method for evaluating safety factor for various riprap sizes (Simons and Sentunk 1992) was completed for all flows between the 2-year and 500-year. This method evaluates a safety factor for bed and bank materials based on channel geometry as a function of channel geometry, stream slope, and riprap sizing. These evaluations are summarized in Appendix F. This evaluation method indicates that for the 2-year flow, a stream bed with a D50 of about 0.2 feet has a safety factor just under 1.0, and 0.3 feet has a safety factor of 1.4. These grain sizes are consistent with the D50 collected for the project (see Appendix F). A safety factor of 1.0 suggests that bed material may start to mobilize just above the 2-year flow, which is consistent with expectations for a stable channel. The evaluation also shows that for the 100- and 500-year flows, side slopes protected with rock with a D50 of 0.5 feet has a safety factor of 1.2-1.3, indicating that this material is not likely to mobilize during high flows.

Throughout the entire modeled study reach, 2-year channel average velocities range from 3.75 fps to 6.75 fps and the follow a typical pool-riffle pattern. The channel top width ranges from 23 to 70 feet, with most cross-sections having top widths between 25 and 40 feet.

Based on an evaluation of the site conditions, the CSU stability evaluation, and model results, the channel bed material is not likely to mobilize and degrade during the 2-year event. If bed material were to mobilize and degrade the channel (which is unlikely), the riprap and other large material on the banks would drop into the scour hole, thus maintaining lateral channel stability. Therefore, the lateral stability of the channel is considered high, and the channel is not likely to move laterally as a result of this project.

As stated above, a comparison of channel bottom data from 1974 to 2019 survey data indicates that the channel has not changed more than a foot over the last 50 years. This suggests that the existing channel is stable. The hydraulic model results show a small increase in velocity upstream and downstream of the bridge, but do not indicate the project will significantly alter the hydraulics for the 2-year event in the vicinity of the crossing. Proposed conditions velocities do increase slightly, but are under or roughly equal to the published permissible velocities that minimize sediment movement for the size of materials present in Trail Creek. Historical data and hydraulic results indicate that the vertical channel stability will not be altered by this project.

Photo 6. Reach of Trail Creek Upstream of SH-75 Crossing

Photo 7. Stable natural stream bed and bank rock along the right (north) bank of Trail Creek upstream of the SH-75 Crossing

Photo 8. Bank Protection and Tree Roots along the left (south) bank of Trail Creek Upstream of SH-75 Bridge

6.4 Review of additional conditions

No design constraints, issues, problems, or adverse conditions were identified relating to the need and provisions for fish passage, navigation requirements, need for stream controls to protect highway, effects on stream ecology, and need for emergency supply and evacuation routes.

7 Outlet Protection and Riprap Recommendations

The proposed condition was evaluated to design the necessary scour protection measures. The proposed condition model was used to estimate potential contraction scour depth for the bridge design. Scour calculations were based on the design flow rate of 1,300 cfs as shown in Appendix F. A total contraction scour depth of 0.37 feet was calculated. This depth should be subtracted from the channel thalweg to estimate the design scour elevation of 5794.7 feet. The bridge substructure should be designed to sustain scour to this elevation. As described in Section 6.3, long term degradation is not observed and is not included in the scour analysis. Abutment scour was not considered, both because the abutments will be armored with multi-layer riprap and because the bridge abutments are above the 500-year water surface elevation.

7.1 Riprap Calculations

The abutment wing walls will be aligned with SH-75 due to the limited right-of-way. Riprap shall be applied to the abutment embankment for approximately 10 feet upstream and downstream of the SH-75 Bridge, which may require a permanent easement. Riprap shall have a gradation with the diameter of 50-percent of the particles (D_{50}) of 1.5 feet (18 inches) underlain with filter fabric (HEC-23 2009). Riprap shall extend down to 5794.0 feet, which is below the calculated contraction scour depth. The CSU riprap stability evaluation indicates that this riprap has a safety factor of about 2.0. Refer to Appendix A and Appendix F for the typical section for the riprap channel section. Any channel restoration in areas currently within the footprint of the reinforced concrete stiffleg shall use native material of a gradation similar to existing to reduce the potential for degradation.

The City of Ketchum requested the design team evaluate the feasibility of green or biotechnical alternatives to riprap. Biotechincal solutions are generally used in bank stabilization applications. The Federal Highway Administration’s (FHWA) HEC-23 manual discusses biotechnical scour countermeasures:

> *Biotechnical engineering can be a useful and cost-effective tool in controlling bank or channel erosion, while increasing the aesthetics and habitat diversity of the site. However, where failure of the countermeasure could lead to failure of a bridge or highway structure, the only acceptable solution in the immediate vicinity of a structure is a traditional, "hard" engineering approach.*

For this reason, biotechnical alternatives to riprap are not recommended at the bridge abutment. Biological aesthetic treatments, such as willow-plantings or vegetated riprap can be considered.

8 ITD Forms

ITD 210 Form for the hydraulic report is shown in Appendix G. The ITD Bridge Inspection Report is shown in Appendix H.

9 Consistency to Flood Insurance Requirements

The City of Ketchum floodplain administrator has reviewed this hydraulic report and provided a statement of concurrence that the structure, as shown, meets current hydraulic criteria. The City's statement of concurrence and supporting documents are shown in Appendix I. A final permit application should be submitted within 180 days prior to construction. The permit package has been provided to ITD as a separate deliverable.

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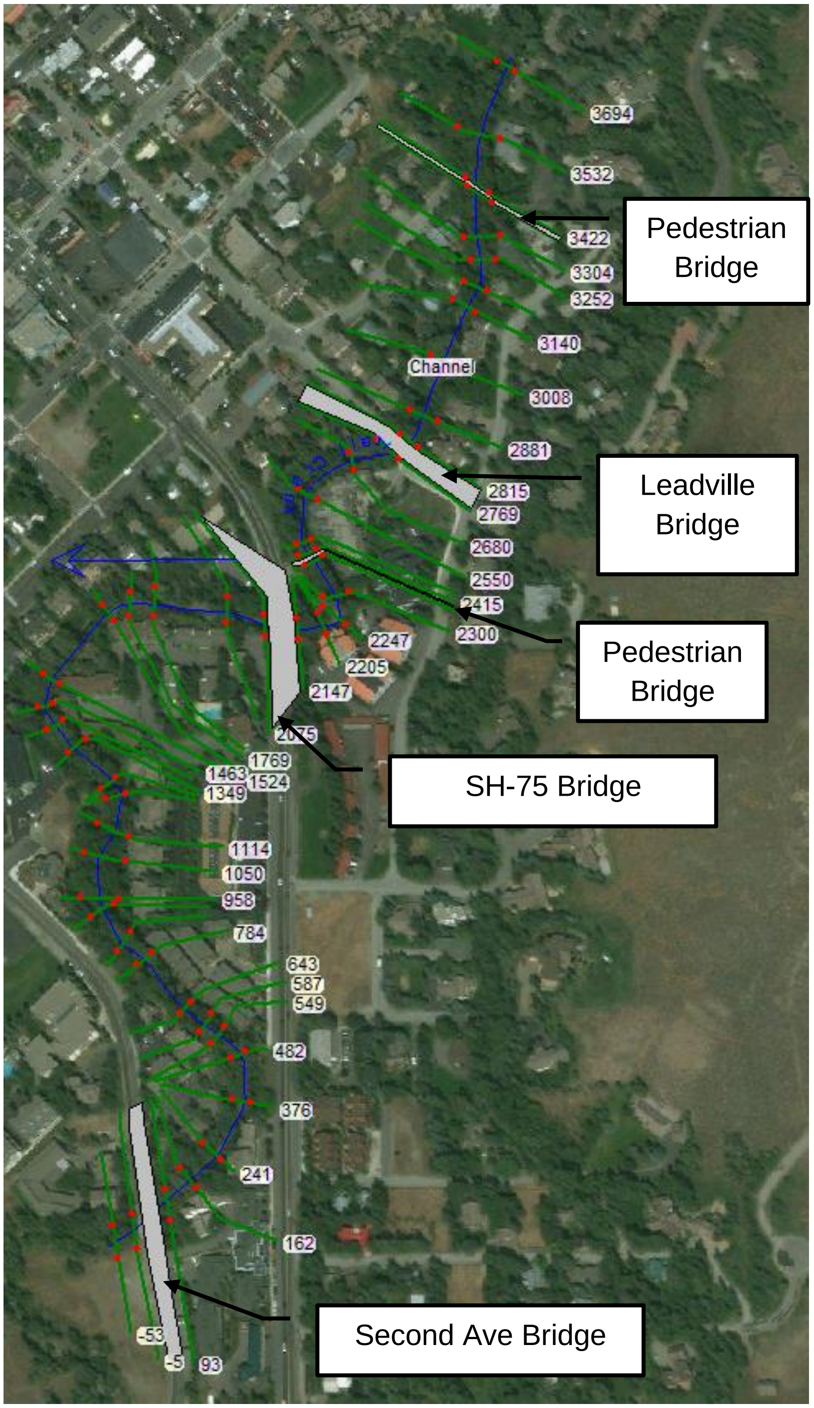
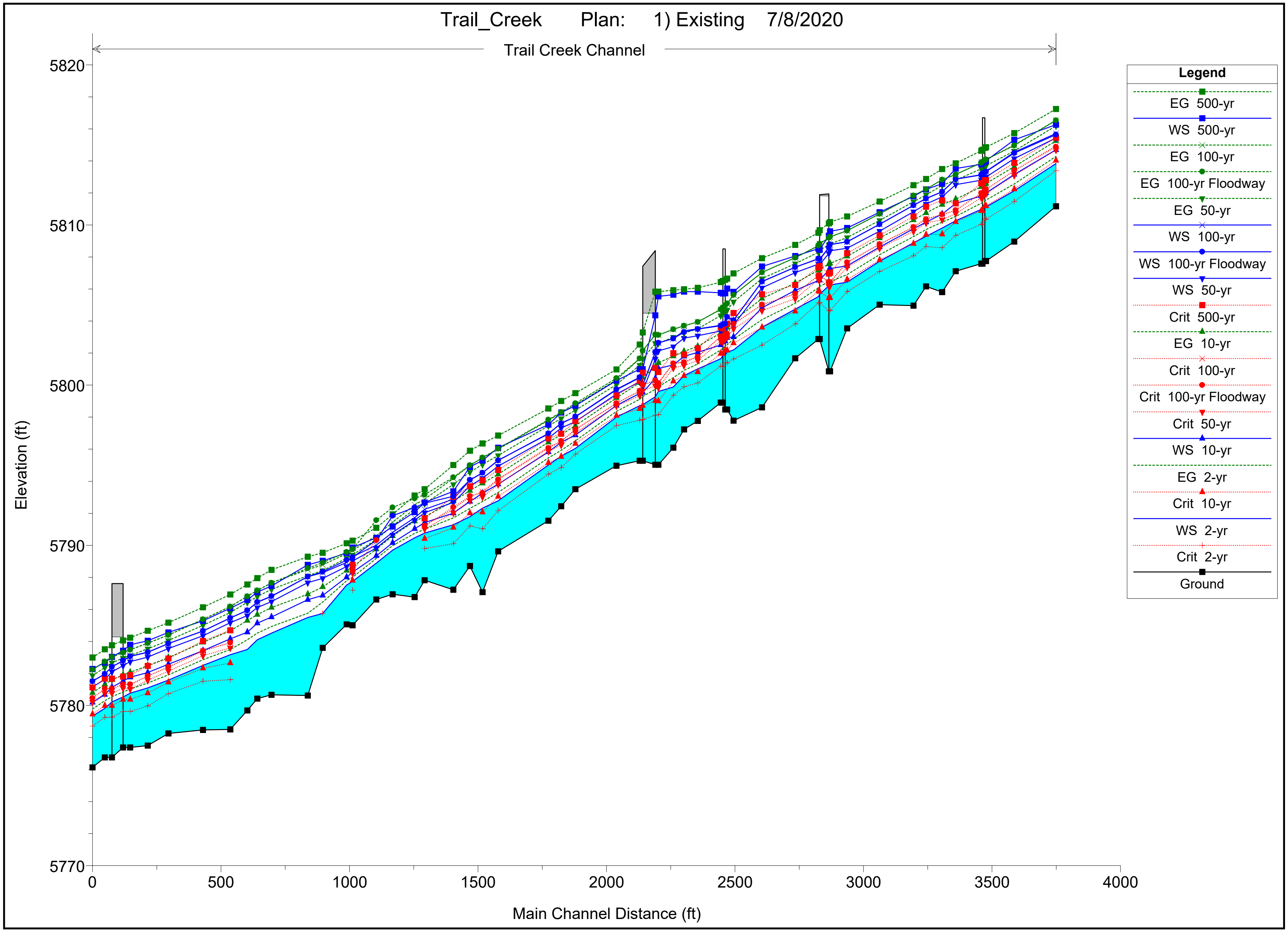
Appendix A Site Map with Contours, Type Size and Location

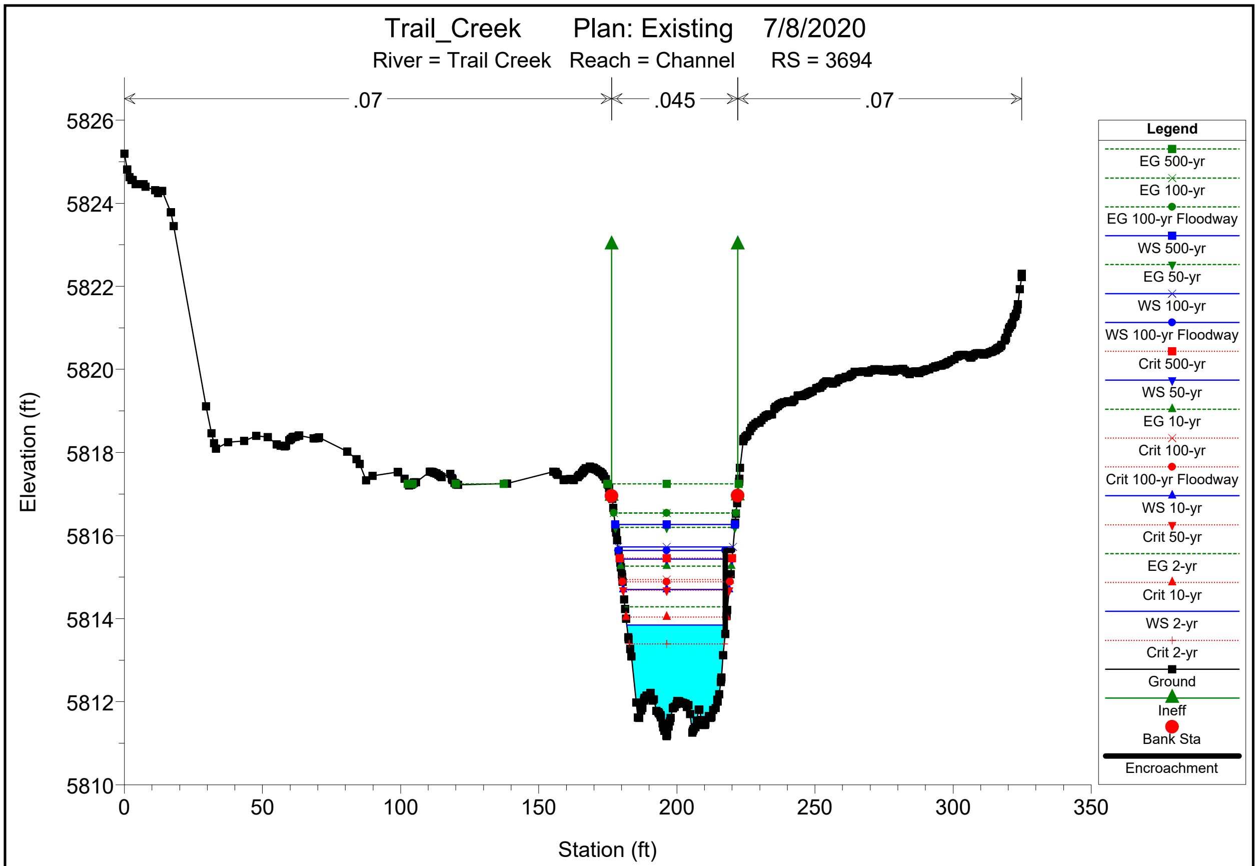
Appendix B. HEC-RAS Model Inputs including Cross-Sections



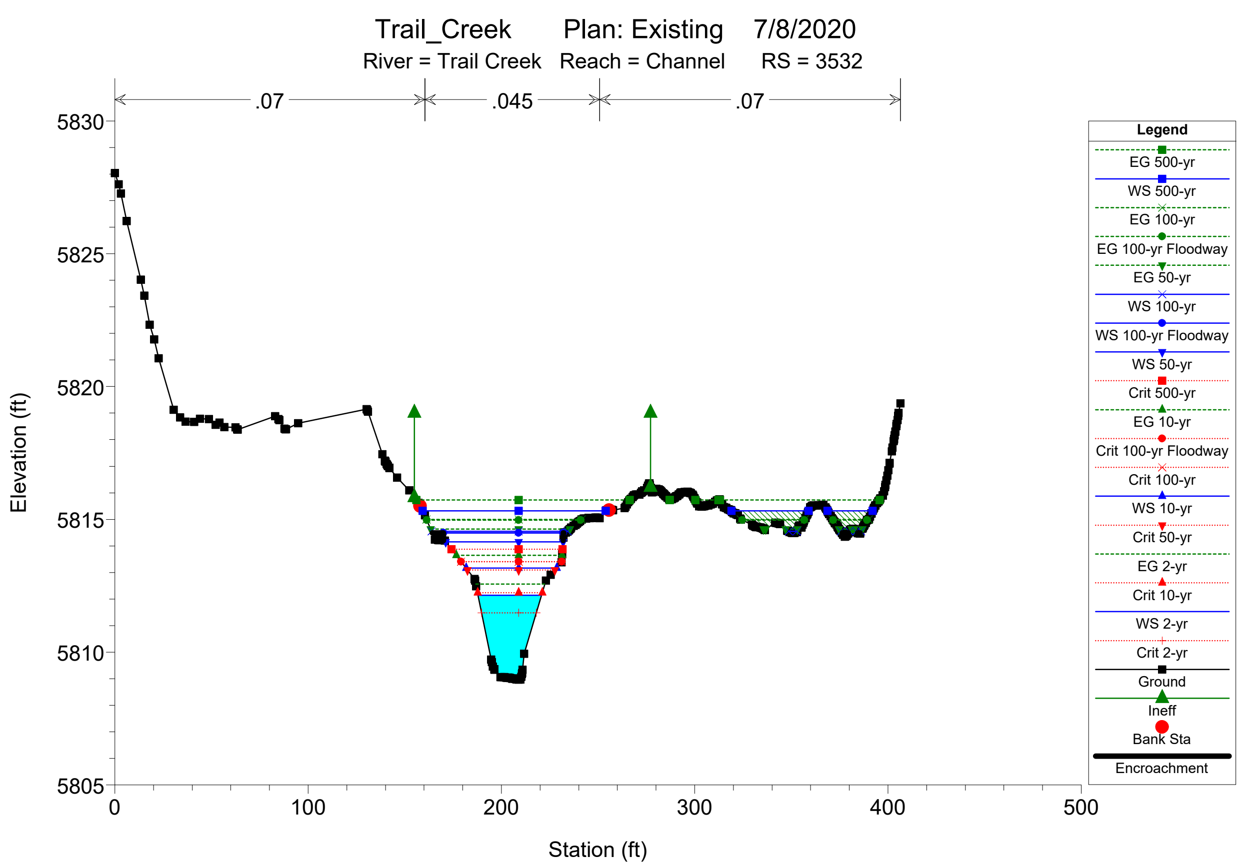
HEC-RAS plan view of geometric data. Cross-sections shown in existing and proposed appendices. Stream is blue line flowing approximately from north to south. Cross-section locations shown as green lines. Left and right bank shown as red dots. Structures shown as grey rectangles.

Appendix C. HEC-RAS Output: Existing Conditions

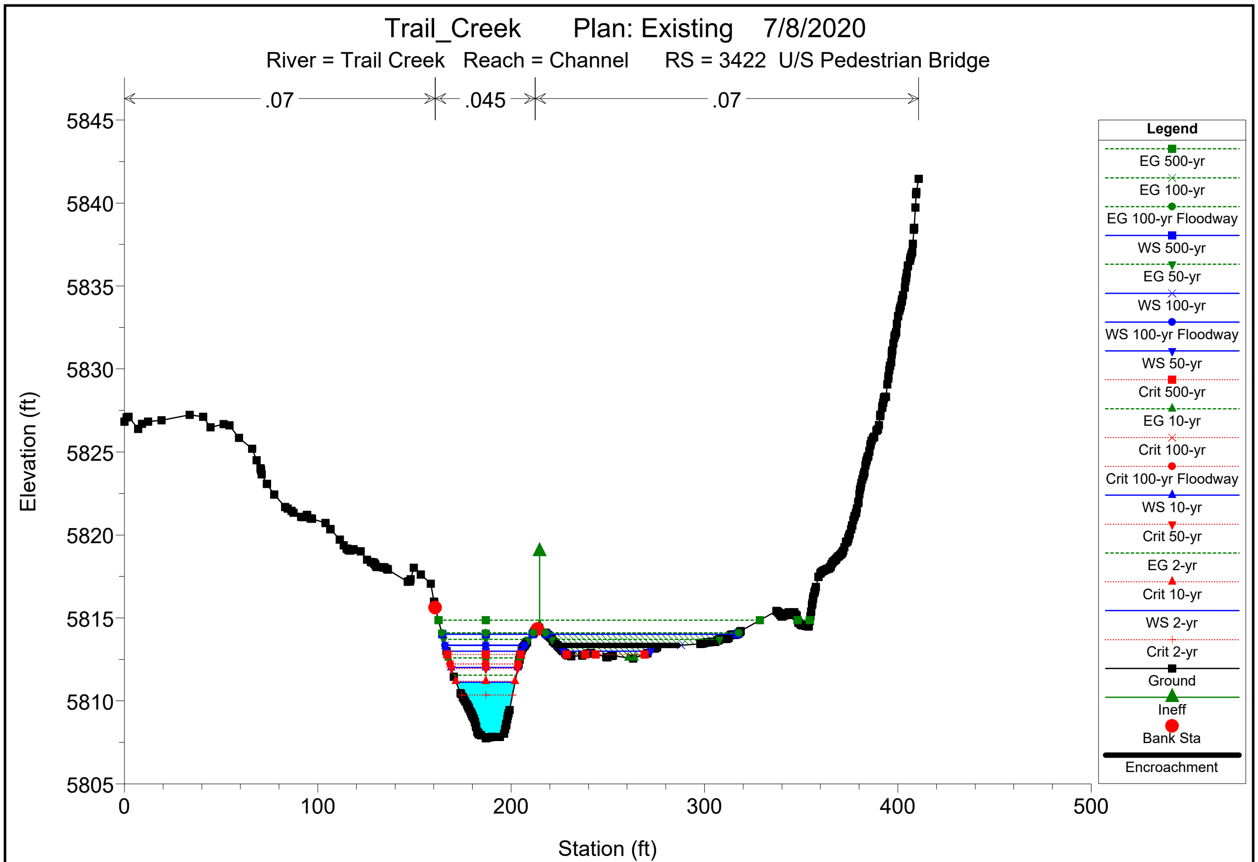

Trail_Creek Plan: 1) Existing 7/8/2020
Trail Creek Channel
Elevation (ft)
5820
5810
5800
5790
5780
5770
0
500
1000
1500
2000
2500
3000
3500
4000
Main Channel Distance (ft)
Legend
EG 500-yr
WS 500-yr
EG 100-yr
EG 100-yr Floodway
EG 50-yr
WS 100-yr
WS 100-yr Floodway
WS 50-yr
Crit 500-yr
EG 10-yr
Crit 100-yr
Crit 100-yr Floodway
Crit 50-yr
WS 10-yr
EG 2-yr
Crit 10-yr
WS 2-yr
Crit 2-yr
Ground

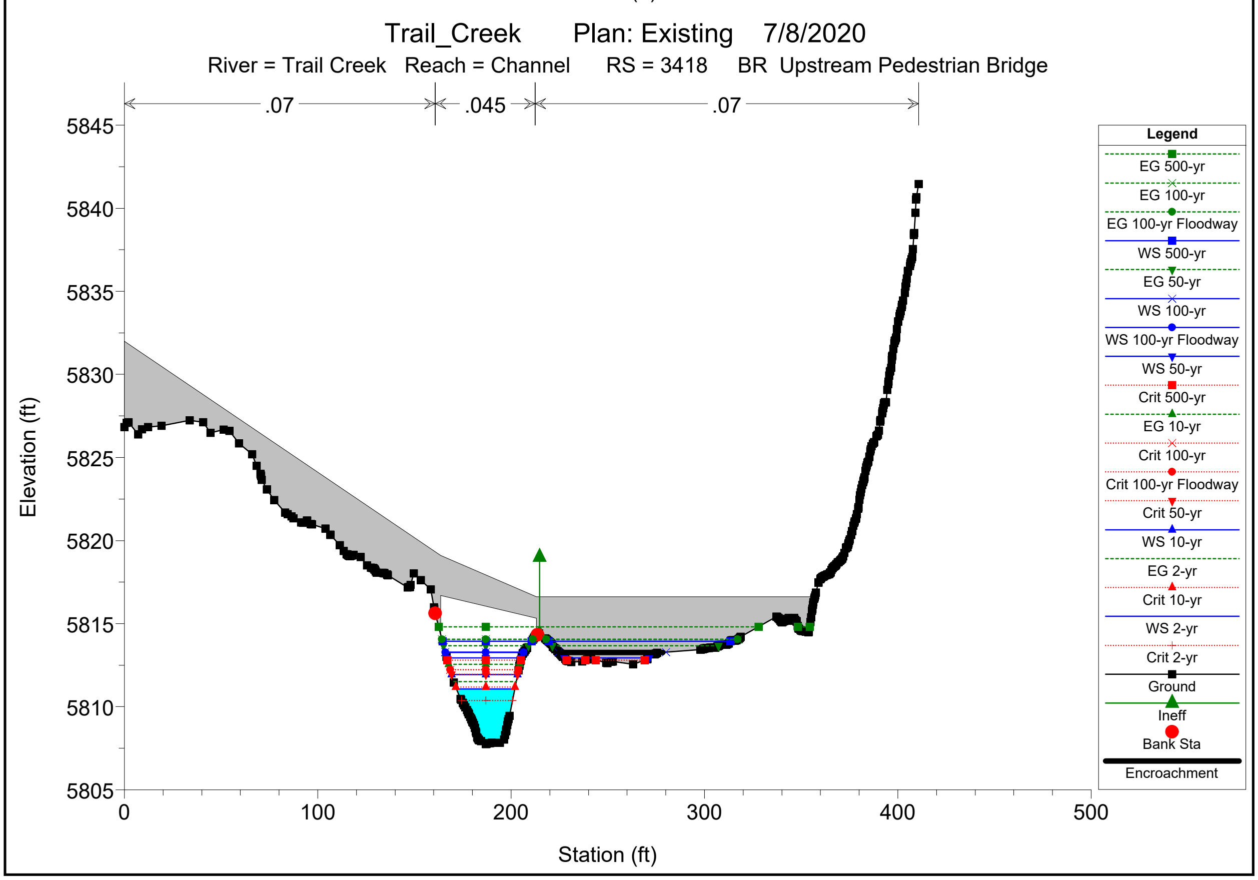


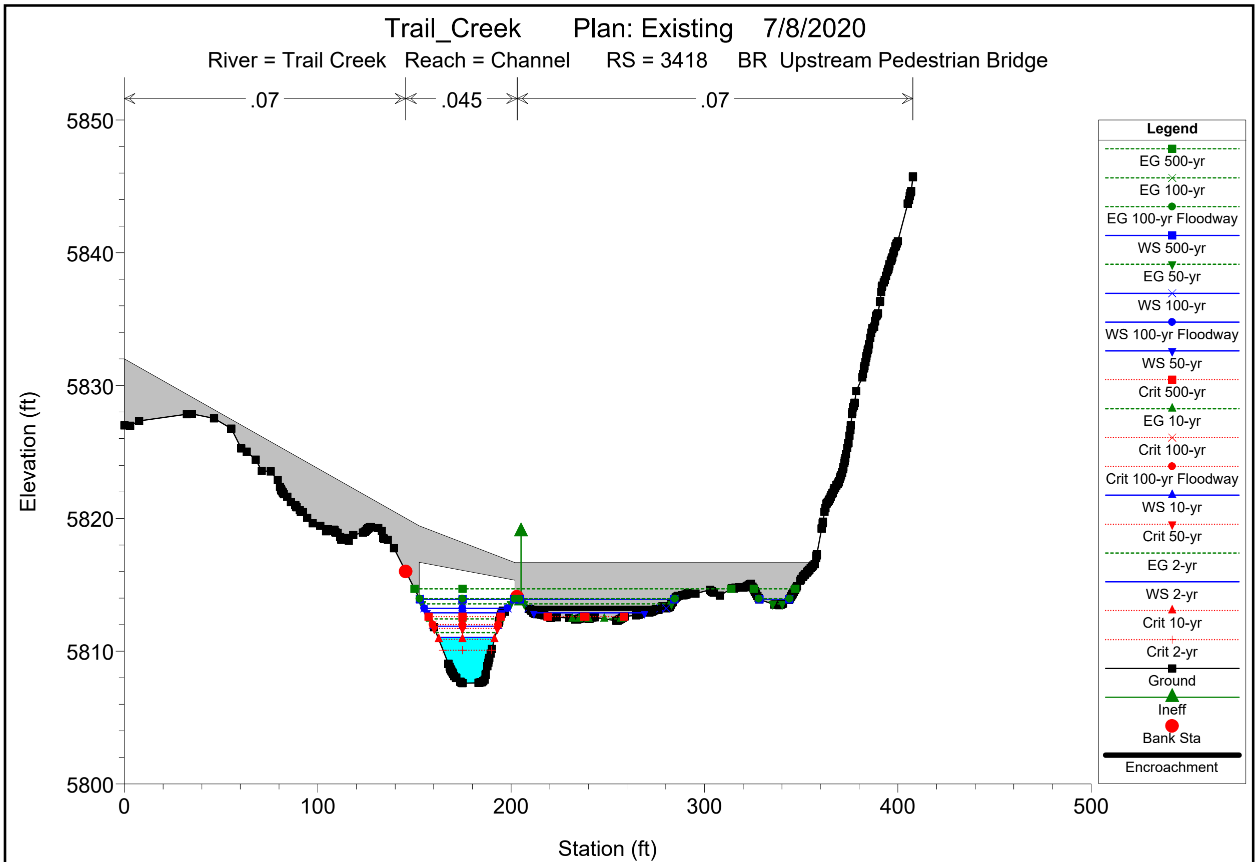
Trail_Creek Plan: Existing 7/8/2020
River = Trail Creek Reach = Channel RS = 3694
.07
.045
.07
Elevation (ft)
Station (ft)
Legend
EG 500-yr
EG 100-yr
EG 100-yr Floodway
WS 500-yr
EG 50-yr
WS 100-yr
WS 100-yr Floodway
Crit 500-yr
WS 50-yr
EG 10-yr
Crit 100-yr
Crit 100-yr Floodway
WS 10-yr
Crit 50-yr
EG 2-yr
Crit 10-yr
WS 2-yr
Crit 2-yr
Ground
Ineff
Bank Sta
Encroachment



Trail_Creek Plan: Existing 7/8/2020
River = Trail Creek Reach = Channel RS = 3532
.07
.045
.07
Elevation (ft)
Station (ft)
Legend
EG 500-yr
WS 500-yr
EG 100-yr
EG 100-yr Floodway
EG 50-yr
WS 100-yr
WS 100-yr Floodway
WS 50-yr
Crit 500-yr
EG 10-yr
Crit 100-yr Floodway
Crit 100-yr
WS 10-yr
Crit 50-yr
EG 2-yr
Crit 10-yr
WS 2-yr
Crit 2-yr
Ground
Ineff
Bank Sta
Encroachment


Trail_Creek Plan: Existing 7/8/2020
River = Trail Creek Reach = Channel RS = 3422 U/S Pedestrian Bridge
.07
.045
.07
Elevation (ft)
Station (ft)
Legend
EG 500-yr
EG 100-yr
EG 100-yr Floodway
WS 500-yr
EG 50-yr
WS 100-yr
WS 100-yr Floodway
WS 50-yr
Crit 500-yr
EG 10-yr
Crit 100-yr
Crit 100-yr Floodway
WS 10-yr
Crit 50-yr
EG 2-yr
Crit 10-yr
WS 2-yr
Crit 2-yr
Ground
Ineff
Bank Sta
Encroachment


Trail_Creek Plan: Existing 7/8/2020
River = Trail Creek Reach = Channel RS = 3418 BR Upstream Pedestrian Bridge
.07
.045
.07
Elevation (ft)
Station (ft)
Legend
EG 500-yr
EG 100-yr
EG 100-yr Floodway
WS 500-yr
EG 50-yr
WS 100-yr
WS 100-yr Floodway
WS 50-yr
Crit 500-yr
EG 10-yr
Crit 100-yr
Crit 100-yr Floodway
Crit 50-yr
WS 10-yr
EG 2-yr
Crit 10-yr
WS 2-yr
Crit 2-yr
Ground
Ineff
Bank Sta
Encroachment


Trail_Creek Plan: Existing 7/8/2020
River = Trail Creek Reach = Channel RS = 3418 BR Upstream Pedestrian Bridge
.07
.045
.07
Elevation (ft)
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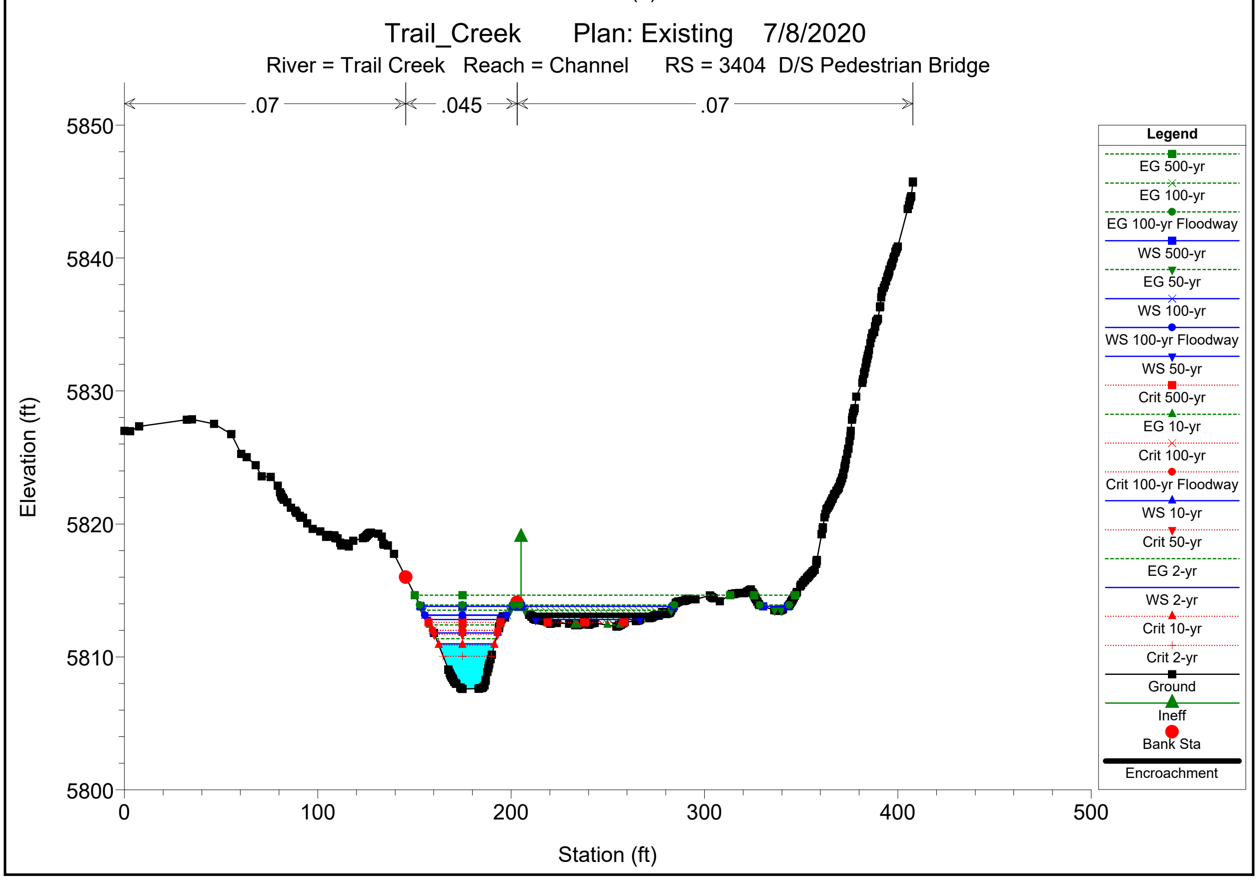
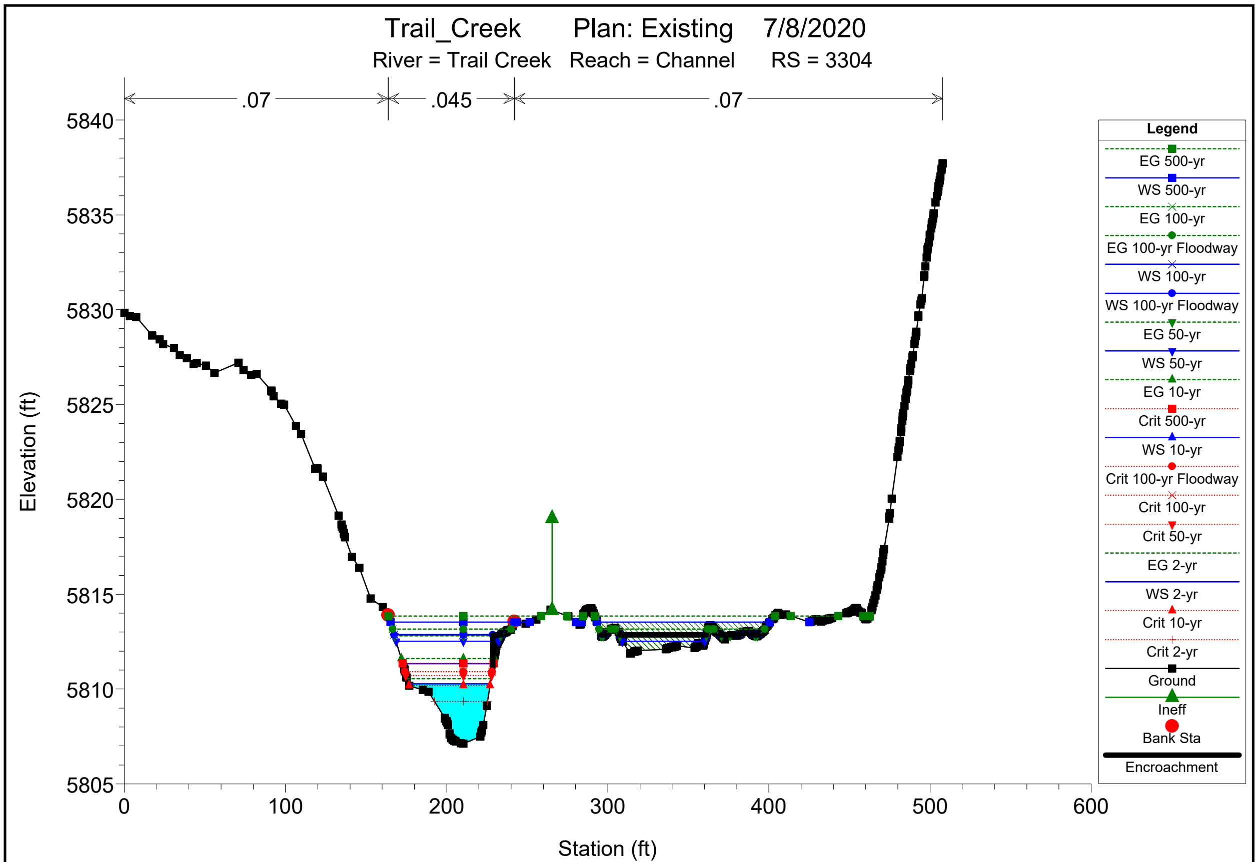
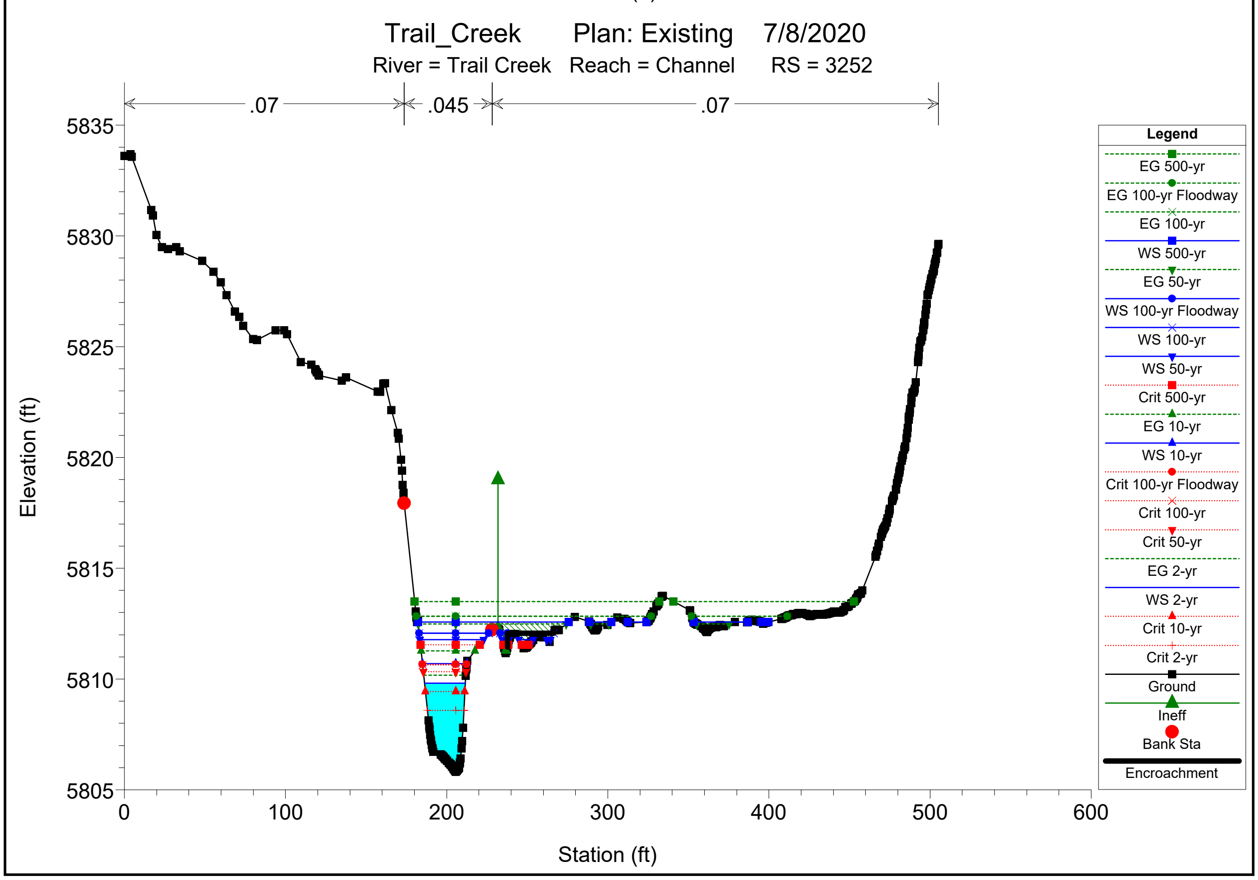
5840
5830
5820
5810
5800
0
100
200
300
400
500
Station (ft)
Legend
EG 500-yr
EG 100-yr
EG 100-yr Floodway
WS 500-yr
EG 50-yr
WS 100-yr
WS 100-yr Floodway
WS 50-yr
Crit 500-yr
EG 10-yr
Crit 100-yr
Crit 100-yr Floodway
WS 10-yr
Crit 50-yr
EG 2-yr
WS 2-yr
Crit 10-yr
Crit 2-yr
Ground
Ineff
Bank Sta
Encroachment

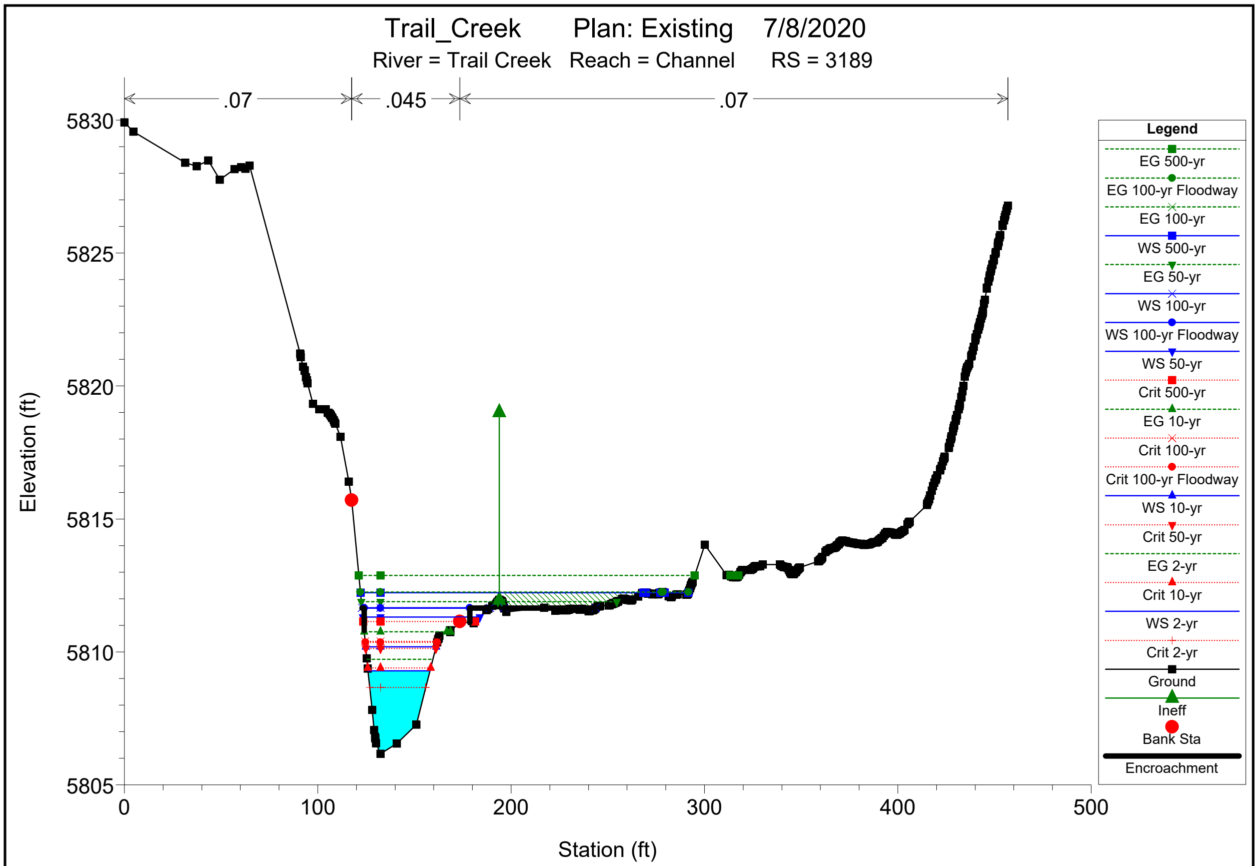

Trail_Creek Plan: Existing 7/8/2020
River = Trail Creek Reach = Channel RS = 3404 D/S Pedestrian Bridge
.07
.045
.07
Elevation (ft)
5850
5840
5830
5820
5810
5800
0
100
200
300
400
500
Station (ft)
Legend
EG 500-yr
EG 100-yr
EG 100-yr Floodway
WS 500-yr
EG 50-yr
WS 100-yr
WS 100-yr Floodway
WS 50-yr
Crit 500-yr
EG 10-yr
Crit 100-yr
Crit 100-yr Floodway
WS 10-yr
Crit 50-yr
EG 2-yr
WS 2-yr
Crit 10-yr
Crit 2-yr
Ground
Ineff
Bank Sta
Encroachment

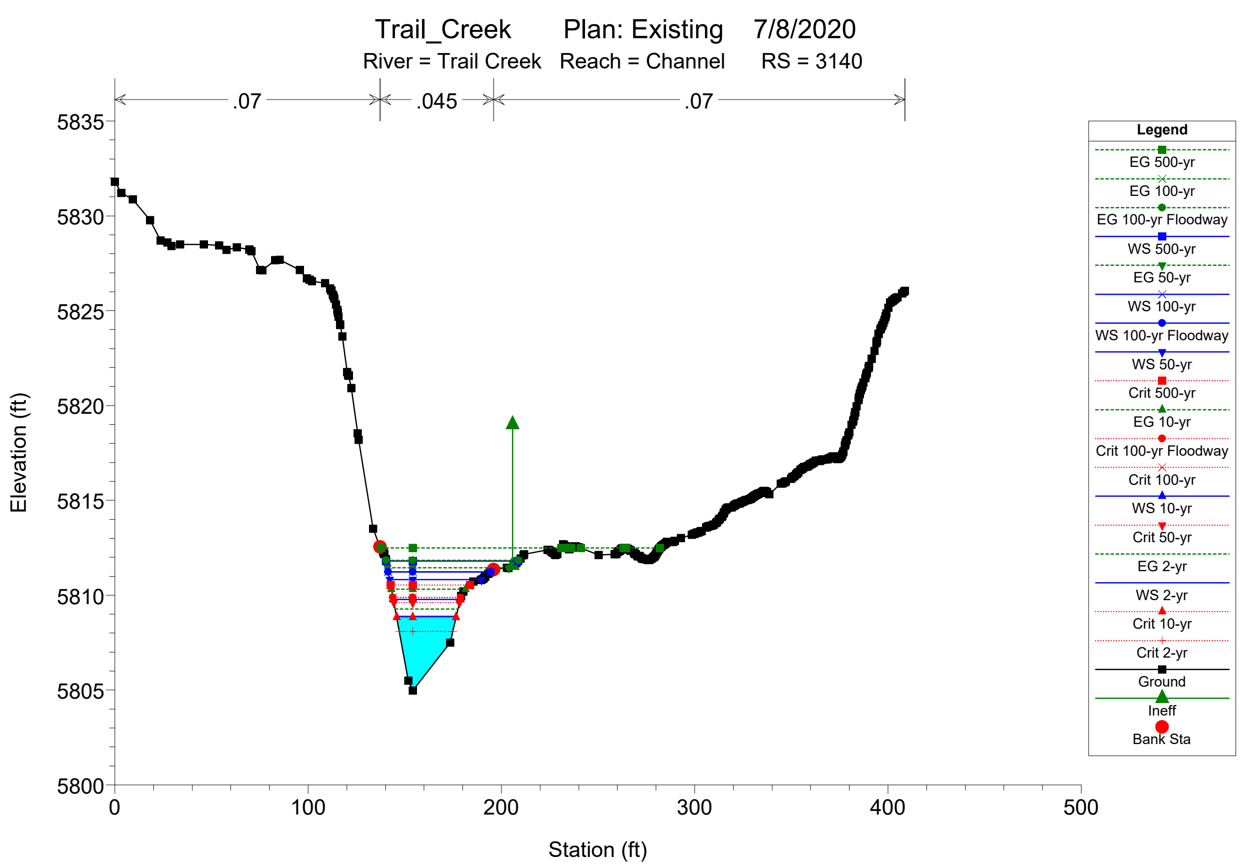


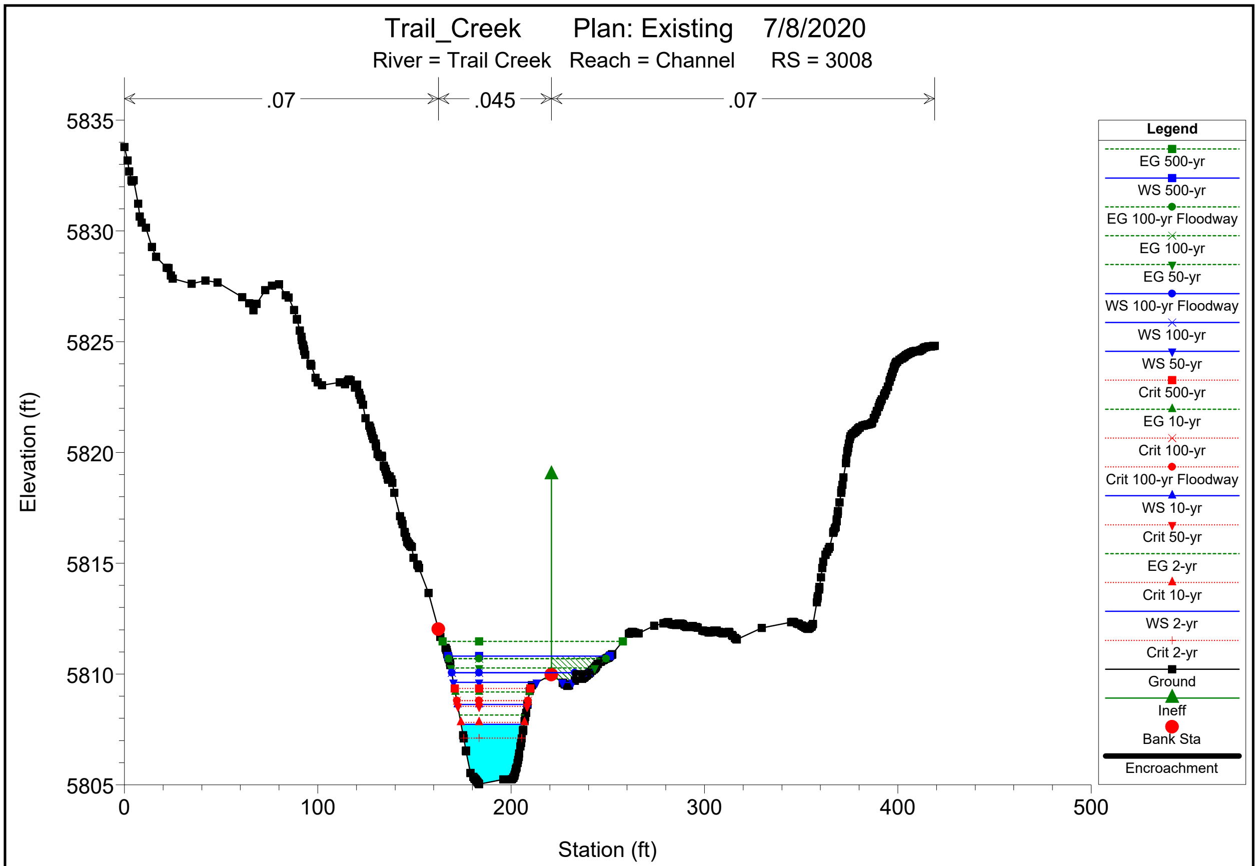
Trail_Creek Plan: Existing 7/8/2020
River = Trail Creek Reach = Channel RS = 3304
.07
.045
.07
Elevation (ft)
Station (ft)
Legend
EG 500-yr
WS 500-yr
EG 100-yr
EG 100-yr Floodway
WS 100-yr
WS 100-yr Floodway
EG 50-yr
WS 50-yr
EG 10-yr
Crit 500-yr
WS 10-yr
Crit 100-yr Floodway
Crit 100-yr
Crit 50-yr
EG 2-yr
WS 2-yr
Crit 10-yr
Crit 2-yr
Ground
Ineff
Bank Sta
Encroachment

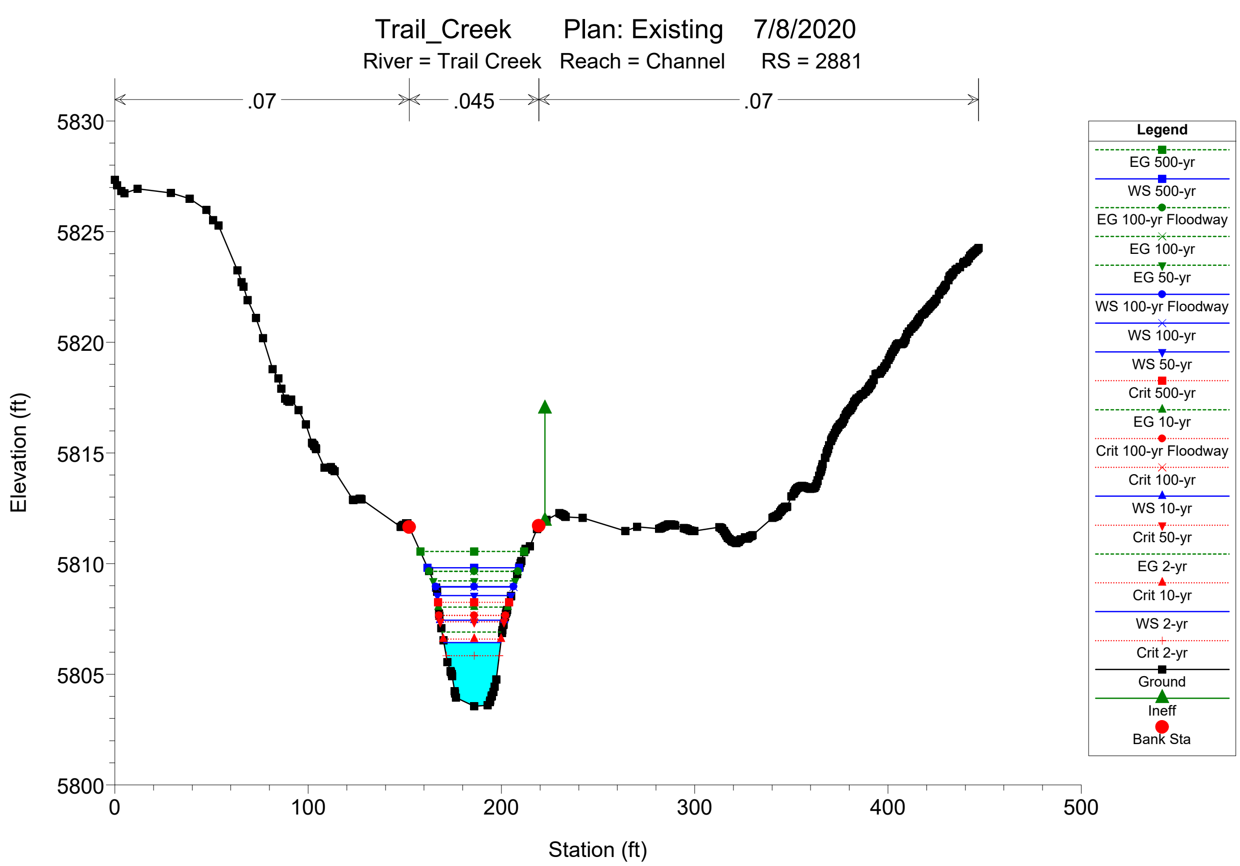


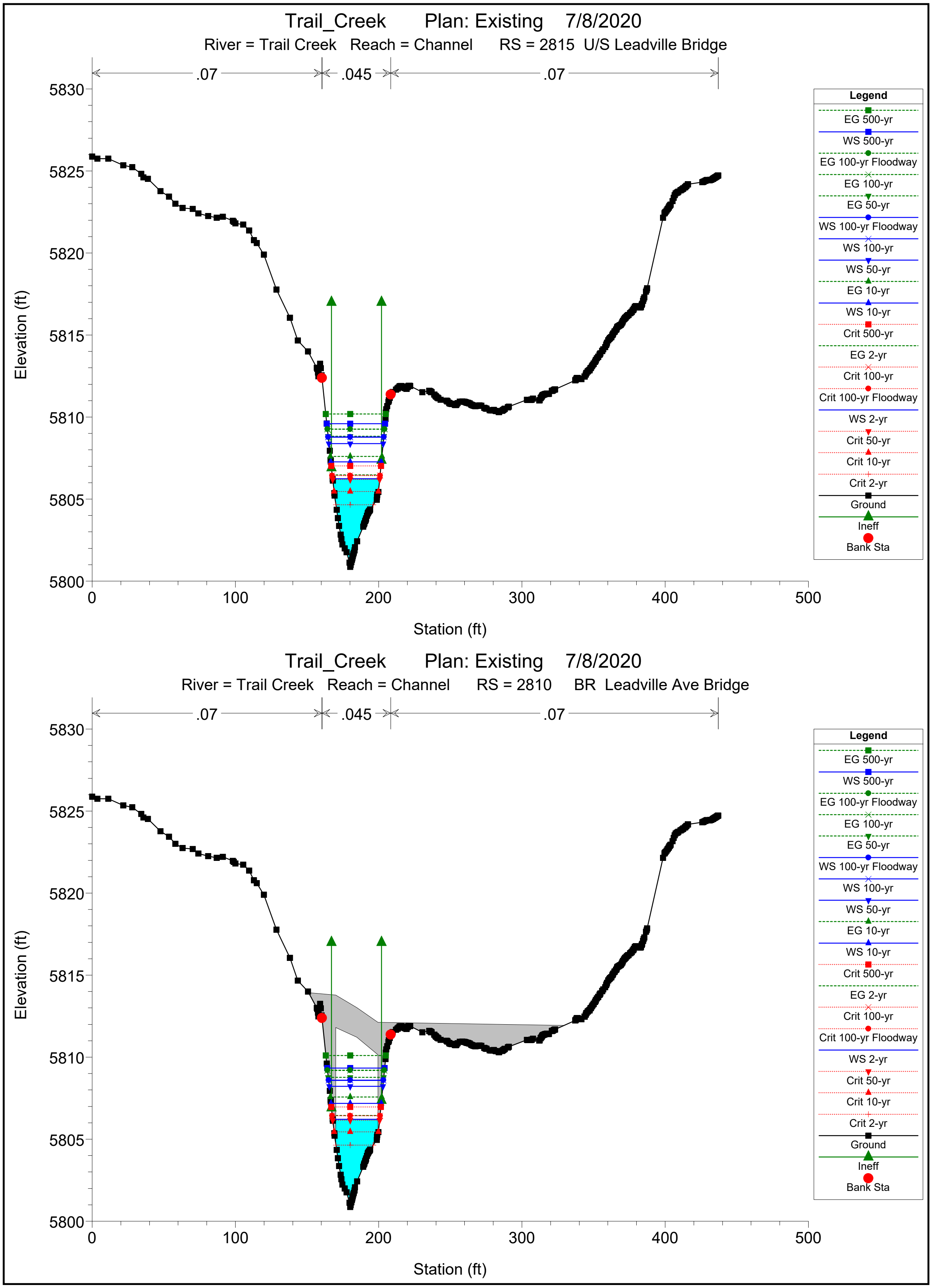
Trail_Creek Plan: Existing 7/8/2020
River = Trail Creek Reach = Channel RS = 3252
.07
.045
.07
Elevation (ft)
Station (ft)
Legend
EG 500-yr
EG 100-yr Floodway
EG 100-yr
WS 500-yr
EG 50-yr
WS 100-yr Floodway
WS 100-yr
WS 50-yr
Crit 500-yr
EG 10-yr
WS 10-yr
Crit 100-yr Floodway
Crit 100-yr
Crit 50-yr
EG 2-yr
WS 2-yr
Crit 10-yr
Crit 2-yr
Ground
Ineff
Bank Sta
Encroachment

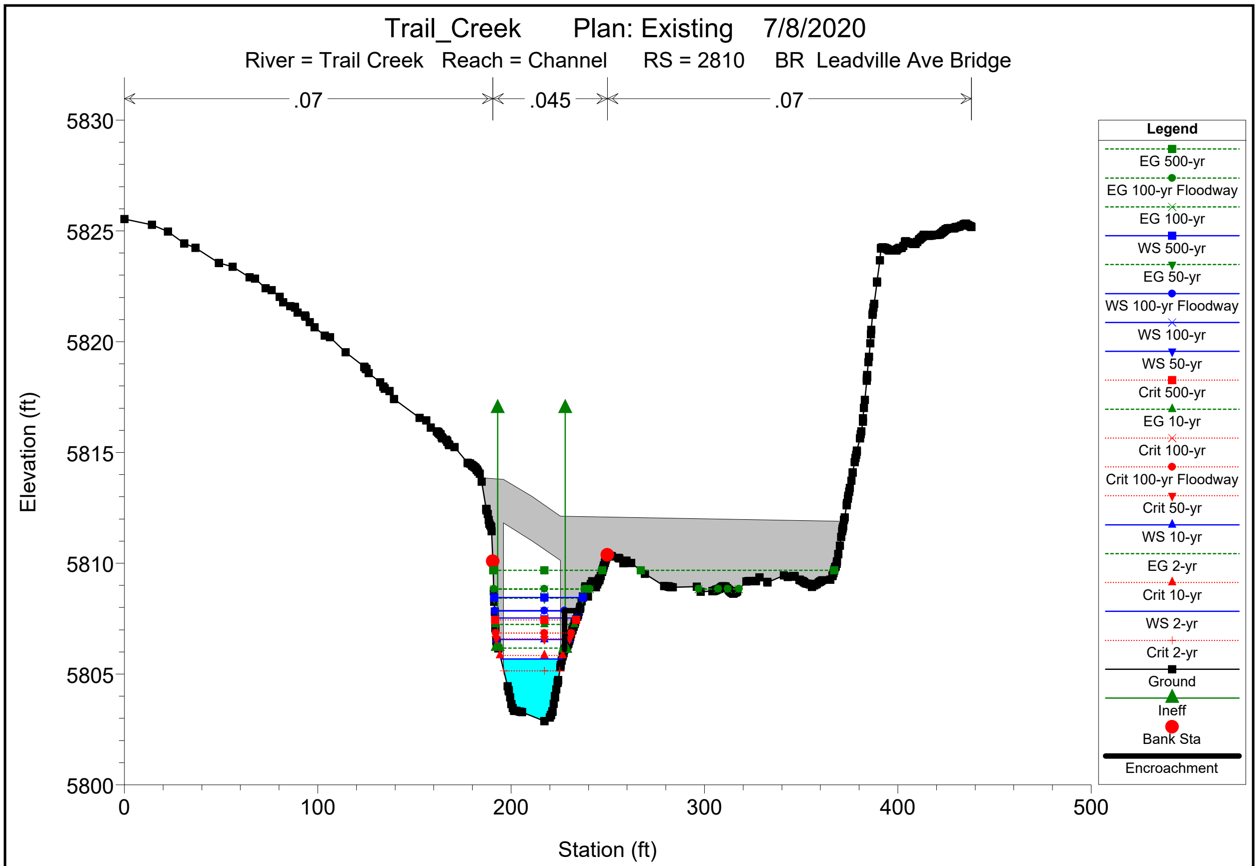

Trail_Creek Plan: Existing 7/8/2020
River = Trail Creek Reach = Channel RS = 3189
.07
.045
.07
Elevation (ft)
Station (ft)
Legend
EG 500-yr
EG 100-yr Floodway
EG 100-yr
WS 500-yr
EG 50-yr
WS 100-yr
WS 100-yr Floodway
WS 50-yr
Crit 500-yr
EG 10-yr
Crit 100-yr
Crit 100-yr Floodway
WS 10-yr
Crit 50-yr
EG 2-yr
Crit 10-yr
WS 2-yr
Crit 2-yr
Ground
Ineff
Bank Sta
Encroachment


Trail_Creek Plan: Existing 7/8/2020
River = Trail Creek Reach = Channel RS = 3140
.07
.045
.07
Elevation (ft)
Station (ft)
Legend
EG 500-yr
EG 100-yr
EG 100-yr Floodway
WS 500-yr
EG 50-yr
WS 100-yr
WS 100-yr Floodway
WS 50-yr
Crit 500-yr
EG 10-yr
Crit 100-yr Floodway
Crit 100-yr
WS 10-yr
Crit 50-yr
EG 2-yr
WS 2-yr
Crit 10-yr
Crit 2-yr
Ground
Ineff
Bank Sta

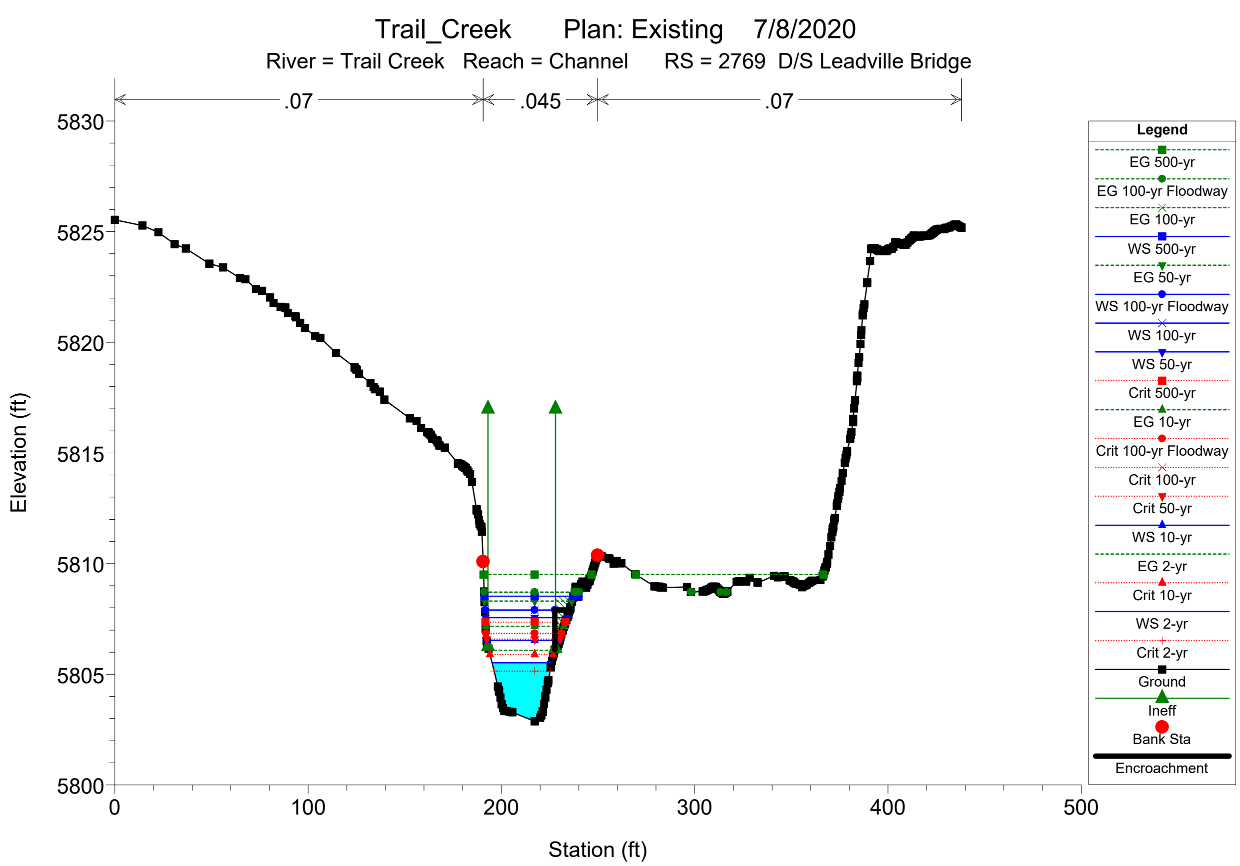

Trail_Creek Plan: Existing 7/8/2020
River = Trail Creek Reach = Channel RS = 3008
.07
.045
.07
Elevation (ft)
Station (ft)
Legend
EG 500-yr
WS 500-yr
EG 100-yr Floodway
EG 100-yr
EG 50-yr
WS 100-yr Floodway
WS 100-yr
WS 50-yr
Crit 500-yr
EG 10-yr
Crit 100-yr
Crit 100-yr Floodway
WS 10-yr
Crit 50-yr
EG 2-yr
Crit 10-yr
WS 2-yr
Crit 2-yr
Ground
Ineff
Bank Sta
Encroachment


Trail_Creek Plan: Existing 7/8/2020
River = Trail Creek Reach = Channel RS = 2881
.07
.045
.07
Elevation (ft)
Station (ft)
Legend
EG 500-yr
WS 500-yr
EG 100-yr Floodway
EG 100-yr
EG 50-yr
WS 100-yr Floodway
WS 100-yr
WS 50-yr
Crit 500-yr
EG 10-yr
Crit 100-yr Floodway
Crit 100-yr
WS 10-yr
Crit 50-yr
EG 2-yr
Crit 10-yr
WS 2-yr
Crit 2-yr
Ground
Ineff
Bank Sta

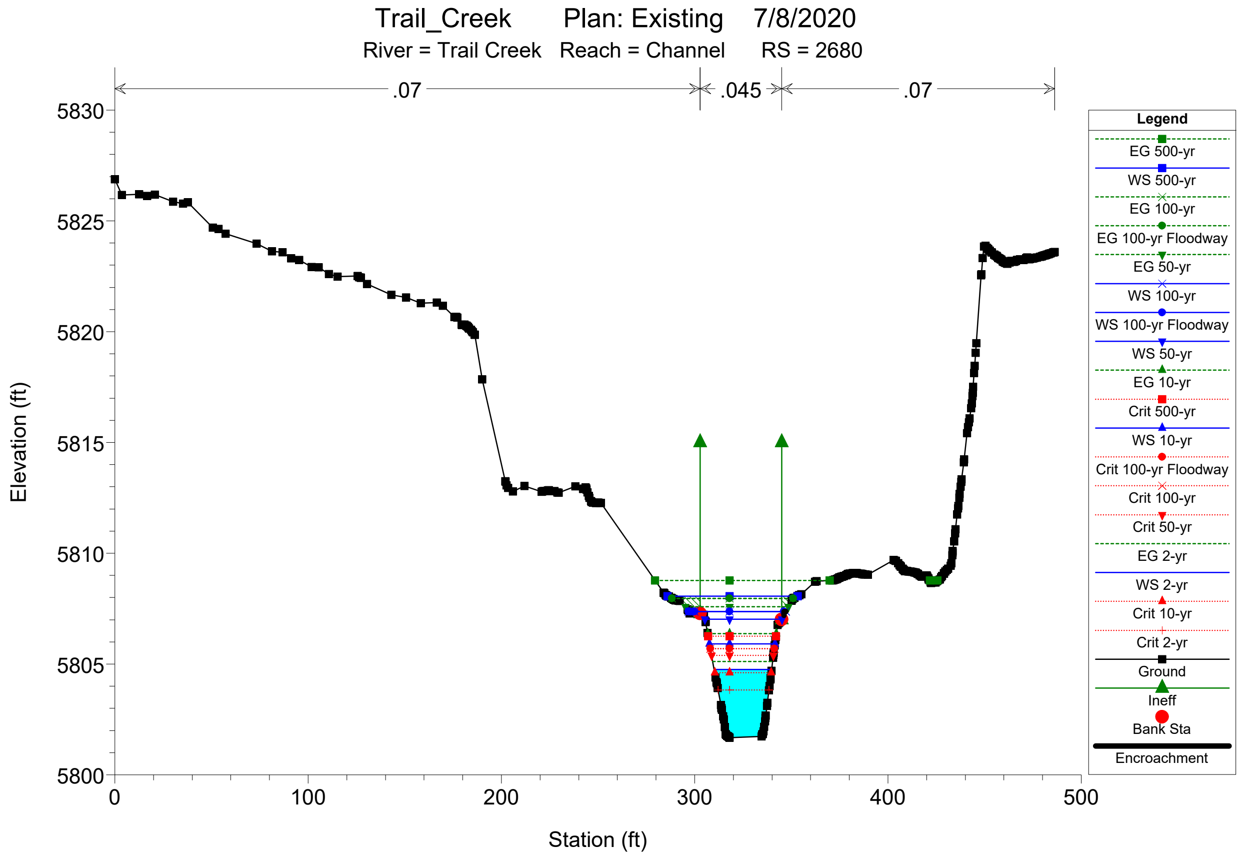

Trail_Creek Plan: Existing 7/8/2020
River = Trail Creek Reach = Channel RS = 2815 U/S Leadville Bridge
.07
.045
.07
Elevation (ft)
Station (ft)
Legend
EG 500-yr
WS 500-yr
EG 100-yr Floodway
EG 100-yr
EG 50-yr
WS 100-yr Floodway
WS 100-yr
WS 50-yr
EG 10-yr
WS 10-yr
Crit 500-yr
EG 2-yr
Crit 100-yr
Crit 100-yr Floodway
WS 2-yr
Crit 50-yr
Crit 10-yr
Crit 2-yr
Ground
Ineff
Bank Sta
Trail_Creek Plan: Existing 7/8/2020
River = Trail Creek Reach = Channel RS = 2810 BR Leadville Ave Bridge
.07
.045
.07
Elevation (ft)
Station (ft)
Legend
EG 500-yr
WS 500-yr
EG 100-yr Floodway
EG 100-yr
EG 50-yr
WS 100-yr Floodway
WS 100-yr
WS 50-yr
EG 10-yr
WS 10-yr
Crit 500-yr
EG 2-yr
Crit 100-yr
Crit 100-yr Floodway
WS 2-yr
Crit 50-yr
Crit 10-yr
Crit 2-yr
Ground
Ineff
Bank Sta

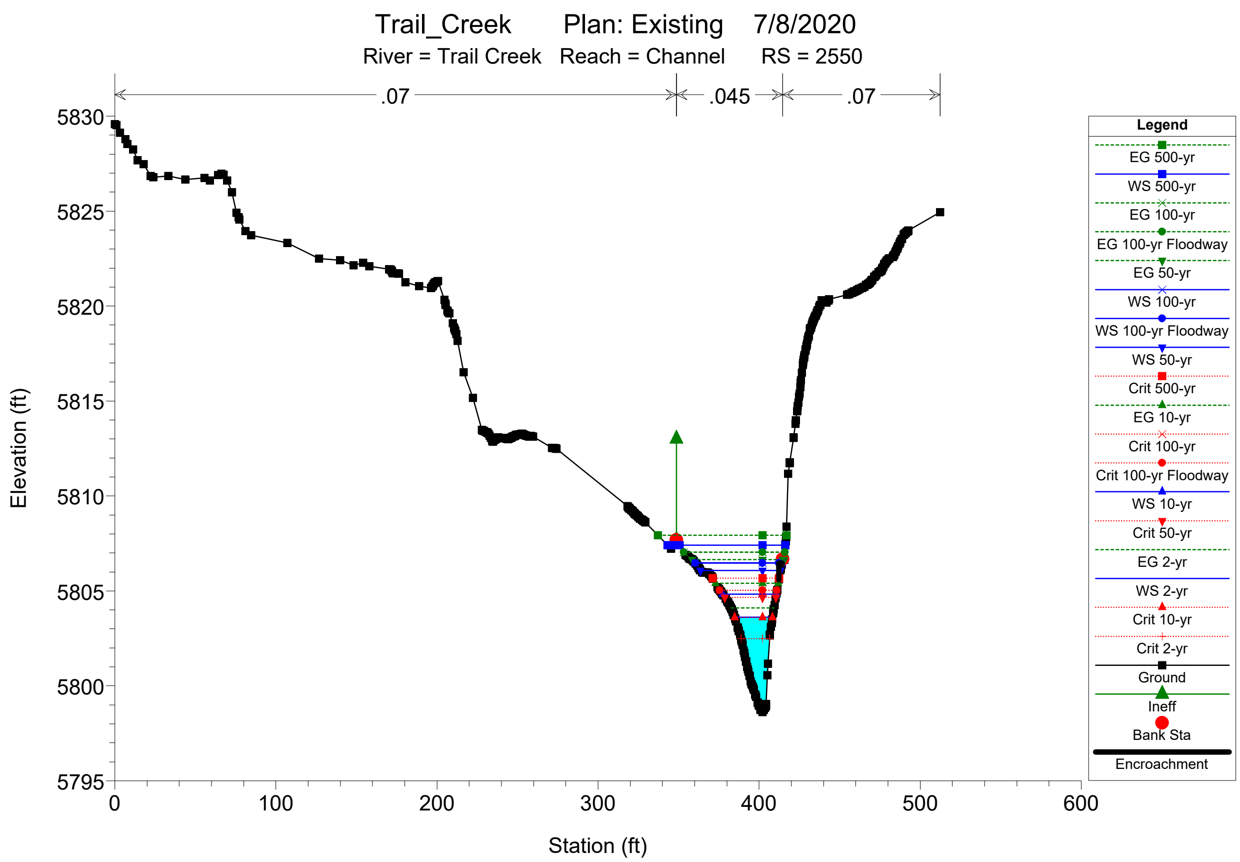


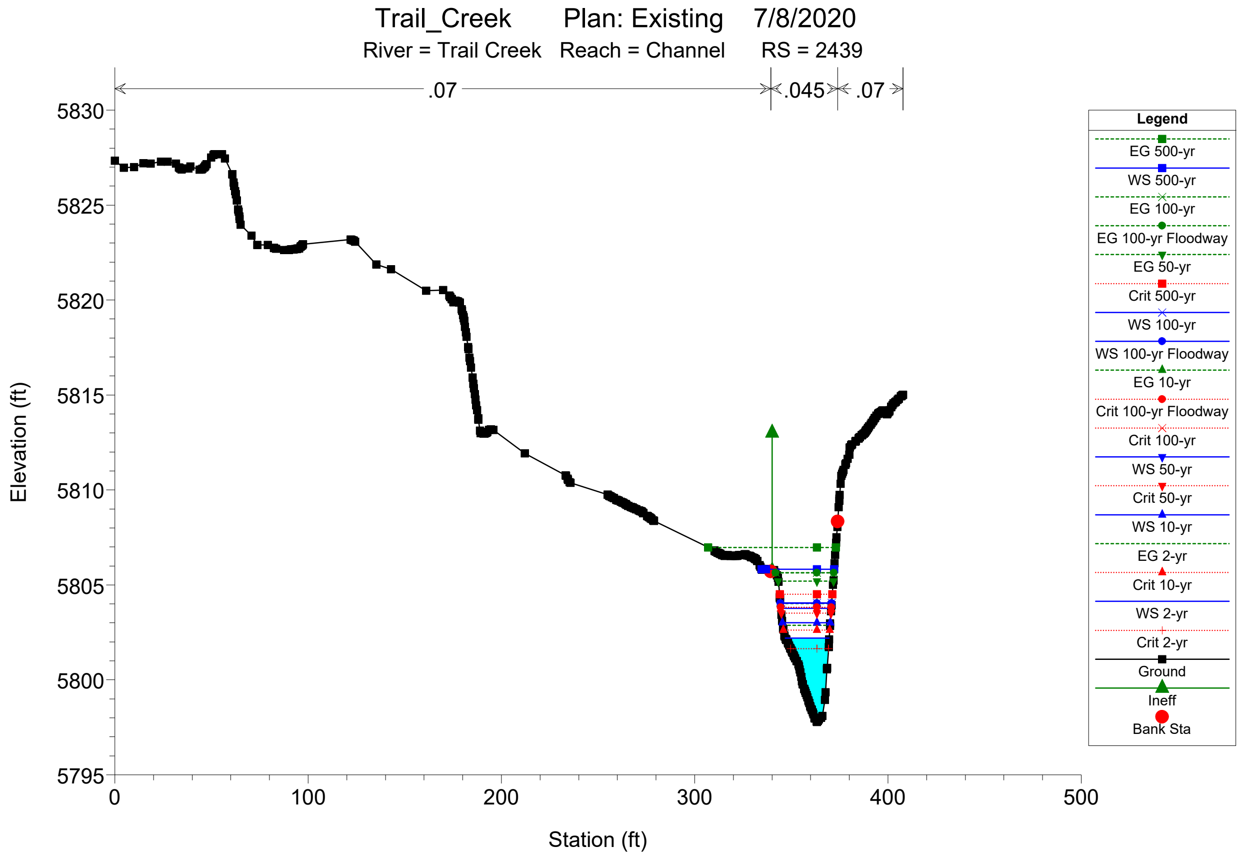
Trail_Creek Plan: Existing 7/8/2020
River = Trail Creek Reach = Channel RS = 2810 BR Leadville Ave Bridge
.07
.045
.07
Elevation (ft)
Station (ft)
Legend
EG 500-yr
EG 100-yr Floodway
EG 100-yr
WS 500-yr
EG 50-yr
WS 100-yr Floodway
WS 100-yr
WS 50-yr
Crit 500-yr
EG 10-yr
Crit 100-yr
Crit 100-yr Floodway
Crit 50-yr
WS 10-yr
EG 2-yr
Crit 10-yr
WS 2-yr
Crit 2-yr
Ground
Ineff
Bank Sta
Encroachment

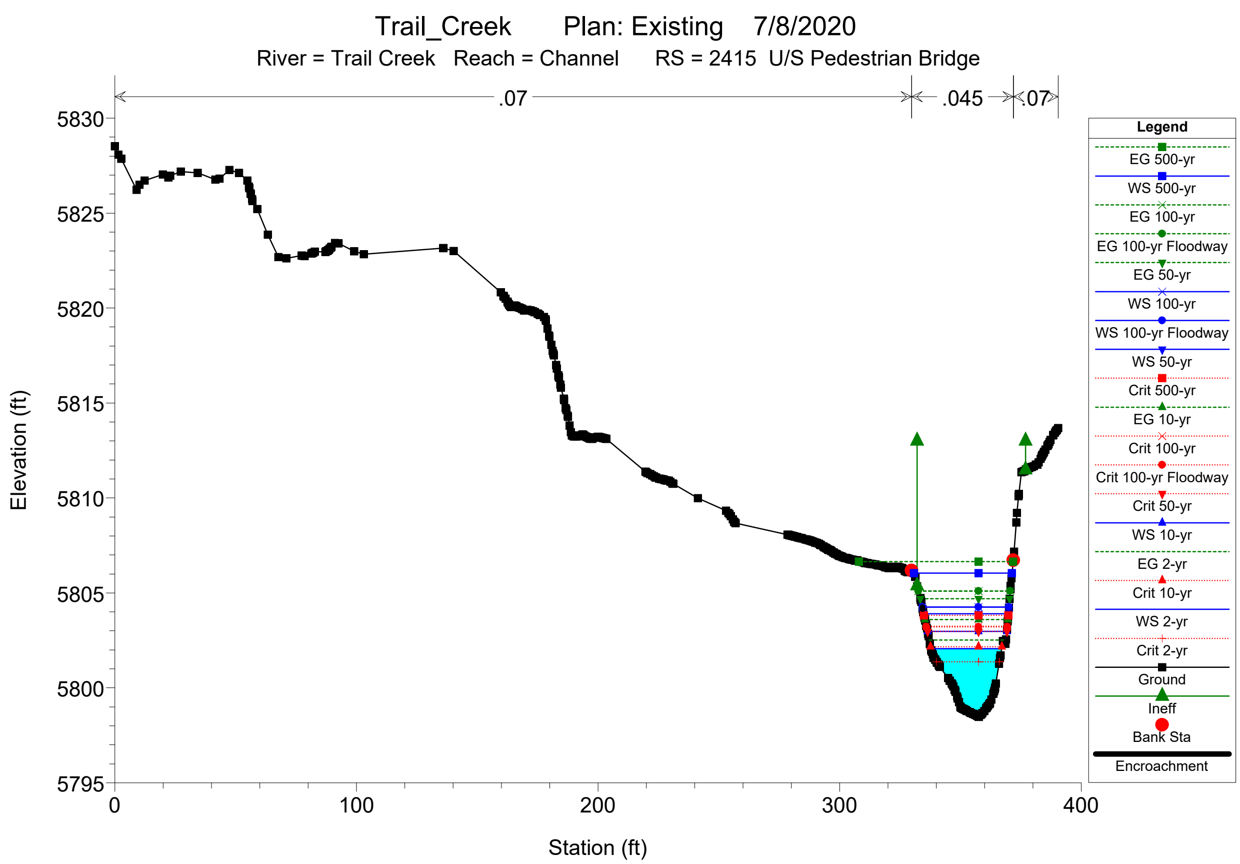


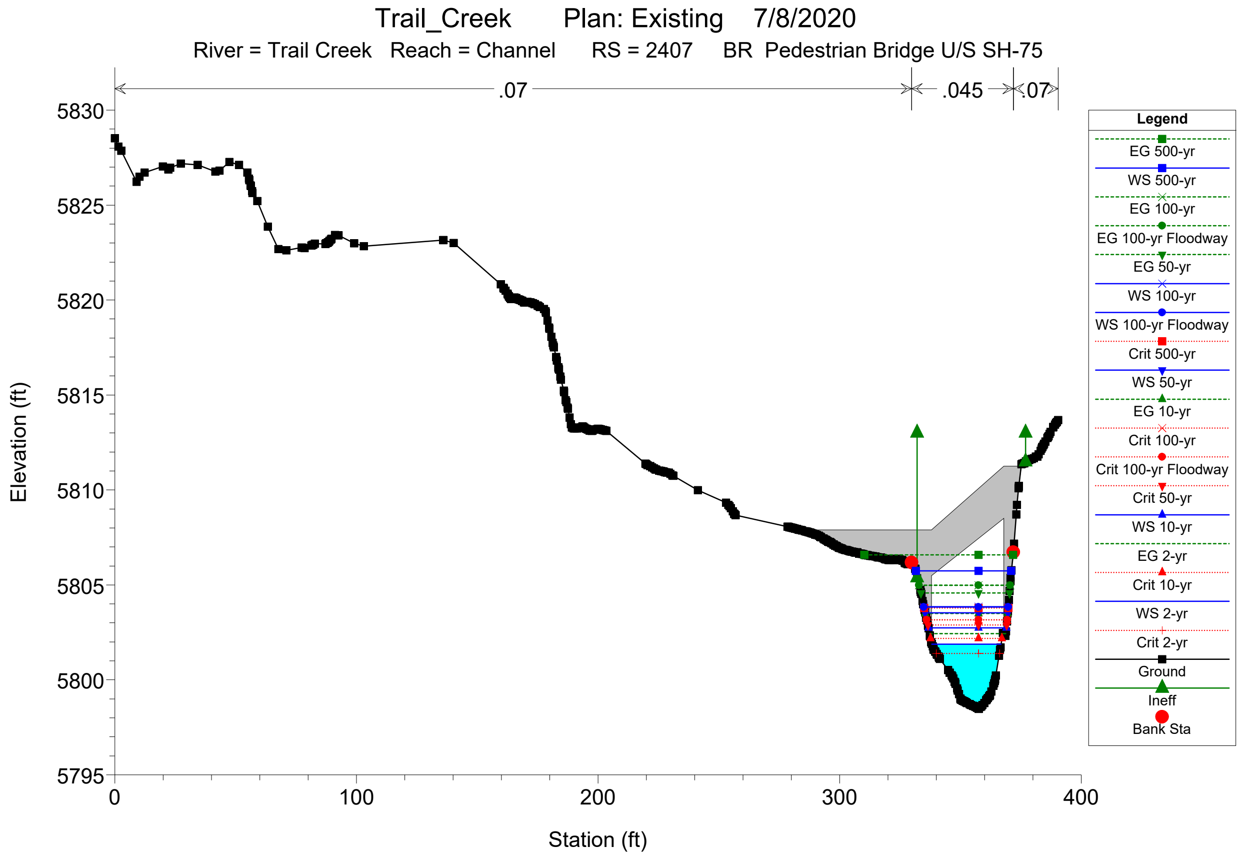
Trail_Creek Plan: Existing 7/8/2020
River = Trail Creek Reach = Channel RS = 2769 D/S Leadville Bridge
.07
.045
.07
Elevation (ft)
Station (ft)
Legend
EG 500-yr
EG 100-yr Floodway
EG 100-yr
WS 500-yr
EG 50-yr
WS 100-yr Floodway
WS 100-yr
WS 50-yr
Crit 500-yr
EG 10-yr
Crit 100-yr Floodway
Crit 100-yr
Crit 50-yr
WS 10-yr
EG 2-yr
Crit 10-yr
WS 2-yr
Crit 2-yr
Ground
Ineff
Bank Sta
Encroachment

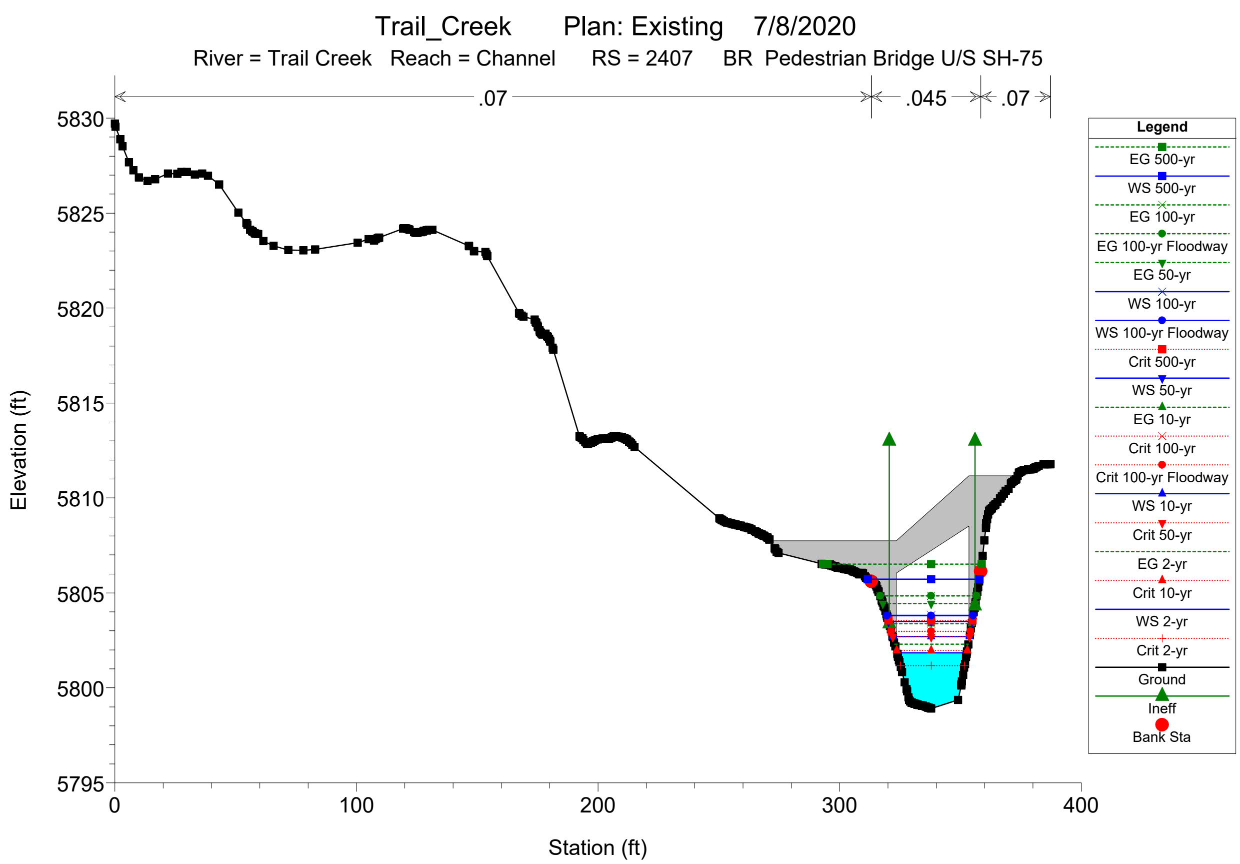

Trail_Creek Plan: Existing 7/8/2020
River = Trail Creek Reach = Channel RS = 2680
.07
.045
.07
Elevation (ft)
Station (ft)
Legend
EG 500-yr
WS 500-yr
EG 100-yr
EG 100-yr Floodway
EG 50-yr
WS 100-yr
WS 100-yr Floodway
WS 50-yr
EG 10-yr
Crit 500-yr
WS 10-yr
Crit 100-yr Floodway
Crit 100-yr
Crit 50-yr
EG 2-yr
WS 2-yr
Crit 10-yr
Crit 2-yr
Ground
Ineff
Bank Sta
Encroachment

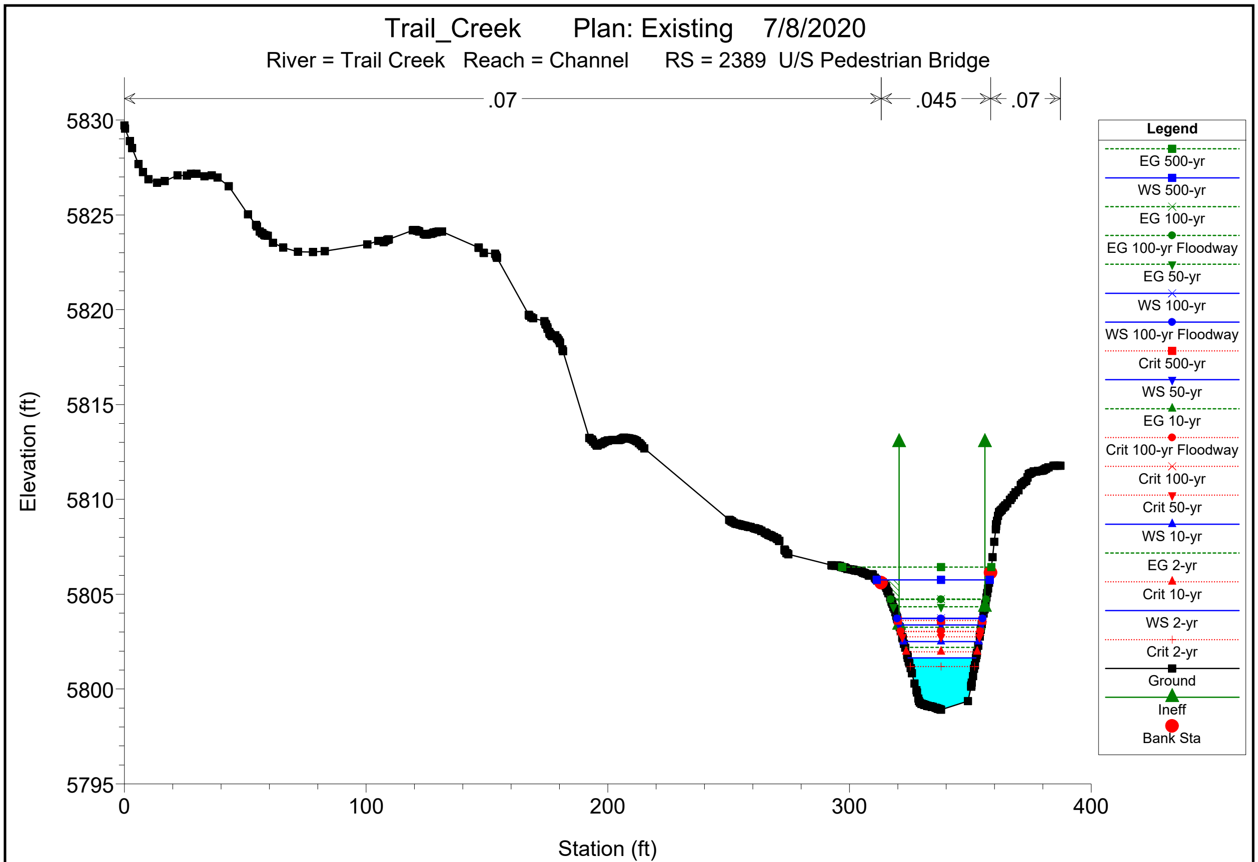

Trail_Creek Plan: Existing 7/8/2020
River = Trail Creek Reach = Channel RS = 2550
.07
.045
.07
Elevation (ft)
Station (ft)
Legend
EG 500-yr
WS 500-yr
EG 100-yr
EG 100-yr Floodway
EG 50-yr
WS 100-yr
WS 100-yr Floodway
WS 50-yr
Crit 500-yr
EG 10-yr
Crit 100-yr
Crit 100-yr Floodway
WS 10-yr
Crit 50-yr
EG 2-yr
WS 2-yr
Crit 10-yr
Crit 2-yr
Ground
Ineff
Bank Sta
Encroachment


Trail_Creek Plan: Existing 7/8/2020
River = Trail Creek Reach = Channel RS = 2439
.07
.045
.07
Elevation (ft)
Station (ft)
Legend
EG 500-yr
WS 500-yr
EG 100-yr
EG 100-yr Floodway
EG 50-yr
Crit 500-yr
WS 100-yr
WS 100-yr Floodway
EG 10-yr
Crit 100-yr Floodway
Crit 100-yr
WS 50-yr
Crit 50-yr
WS 10-yr
EG 2-yr
Crit 10-yr
WS 2-yr
Crit 2-yr
Ground
Ineff
Bank Sta

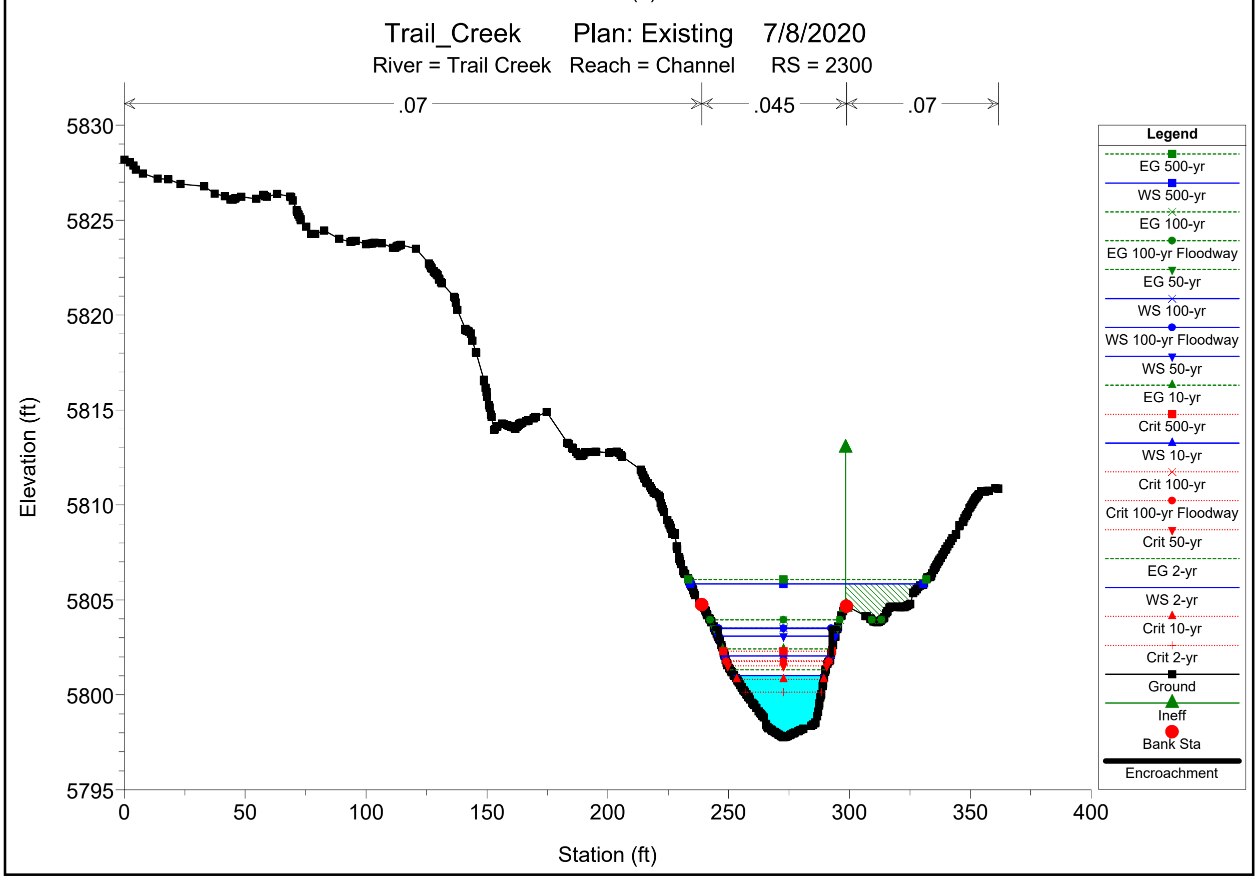

Trail_Creek Plan: Existing 7/8/2020
River = Trail Creek Reach = Channel RS = 2415 U/S Pedestrian Bridge
.07
.045
.07
Elevation (ft)
Station (ft)
Legend
EG 500-yr
WS 500-yr
EG 100-yr
EG 100-yr Floodway
EG 50-yr
WS 100-yr
WS 100-yr Floodway
WS 50-yr
Crit 500-yr
EG 10-yr
Crit 100-yr
Crit 100-yr Floodway
Crit 50-yr
WS 10-yr
EG 2-yr
Crit 10-yr
WS 2-yr
Crit 2-yr
Ground
Ineff
Bank Sta
Encroachment


Trail_Creek Plan: Existing 7/8/2020
River = Trail Creek Reach = Channel RS = 2407 BR Pedestrian Bridge U/S SH-75
.07
.045
.07
Elevation (ft)
Station (ft)
Legend
EG 500-yr
WS 500-yr
EG 100-yr
EG 100-yr Floodway
EG 50-yr
WS 100-yr
WS 100-yr Floodway
Crit 500-yr
WS 50-yr
EG 10-yr
Crit 100-yr
Crit 100-yr Floodway
Crit 50-yr
WS 10-yr
EG 2-yr
Crit 10-yr
WS 2-yr
Crit 2-yr
Ground
Ineff
Bank Sta

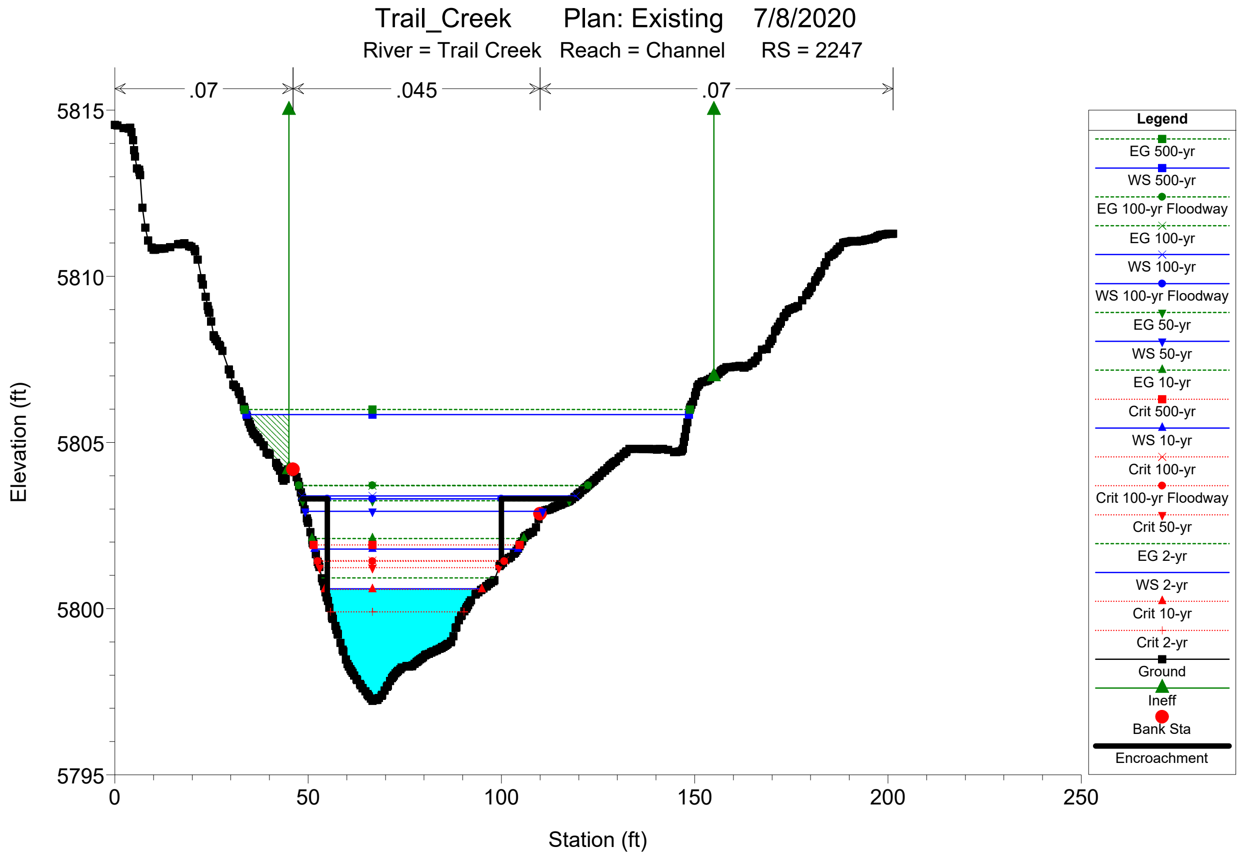

Trail_Creek Plan: Existing 7/8/2020
River = Trail Creek Reach = Channel RS = 2407 BR Pedestrian Bridge U/S SH-75
.07
.045
.07
Elevation (ft)
Station (ft)
Legend
EG 500-yr
WS 500-yr
EG 100-yr
EG 100-yr Floodway
EG 50-yr
WS 100-yr
WS 100-yr Floodway
Crit 500-yr
WS 50-yr
EG 10-yr
Crit 100-yr
Crit 100-yr Floodway
Crit 50-yr
WS 10-yr
EG 2-yr
Crit 10-yr
WS 2-yr
Crit 2-yr
Ground
Ineff
Bank Sta



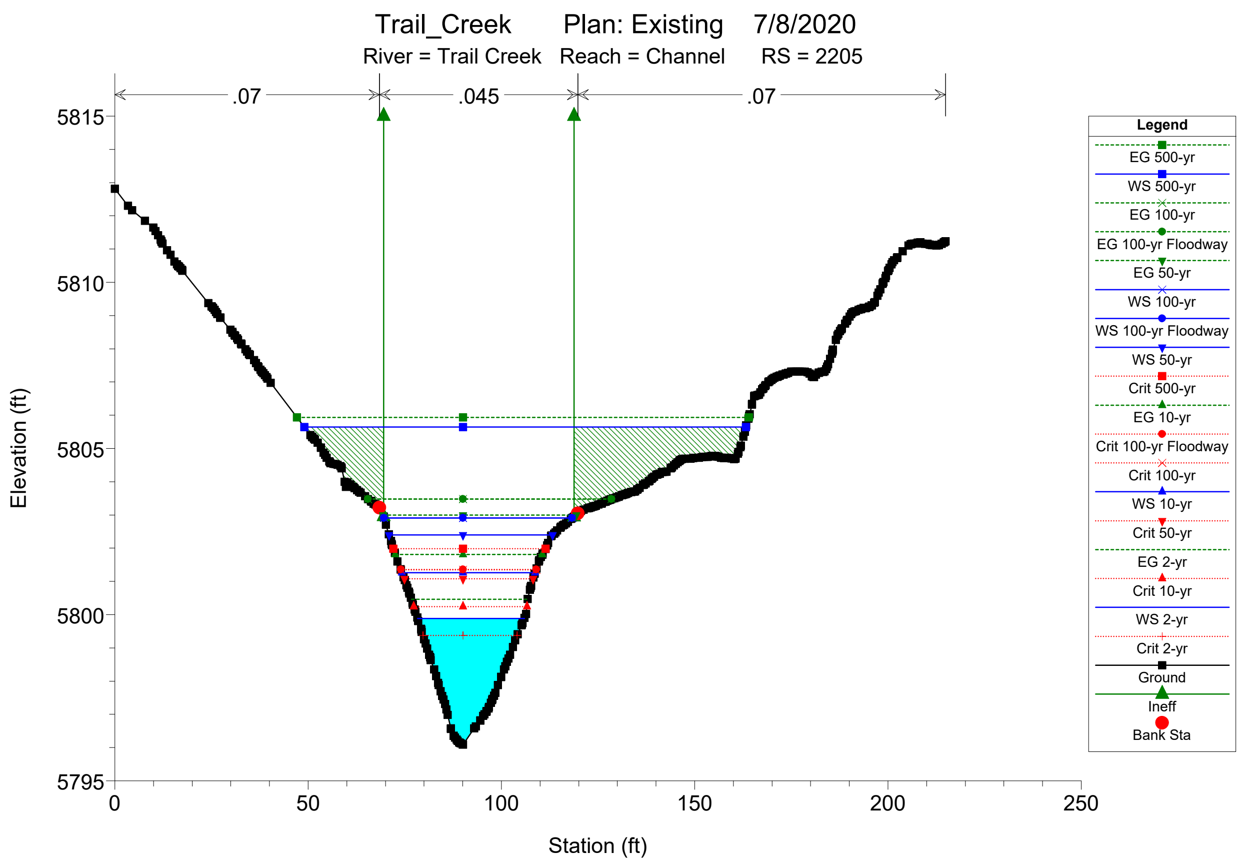
Trail_Creek Plan: Existing 7/8/2020
River = Trail Creek Reach = Channel RS = 2389 U/S Pedestrian Bridge
.07
.045
.07
Elevation (ft)
Station (ft)
5830
5825
5820
5815
5810
5805
5800
5795
0
100
200
300
400
Legend
EG 500-yr
WS 500-yr
EG 100-yr
EG 100-yr Floodway
EG 50-yr
WS 100-yr
WS 100-yr Floodway
Crit 500-yr
WS 50-yr
EG 10-yr
Crit 100-yr Floodway
Crit 100-yr
Crit 50-yr
WS 10-yr
EG 2-yr
Crit 10-yr
WS 2-yr
Crit 2-yr
Ground
Ineff
Bank Sta



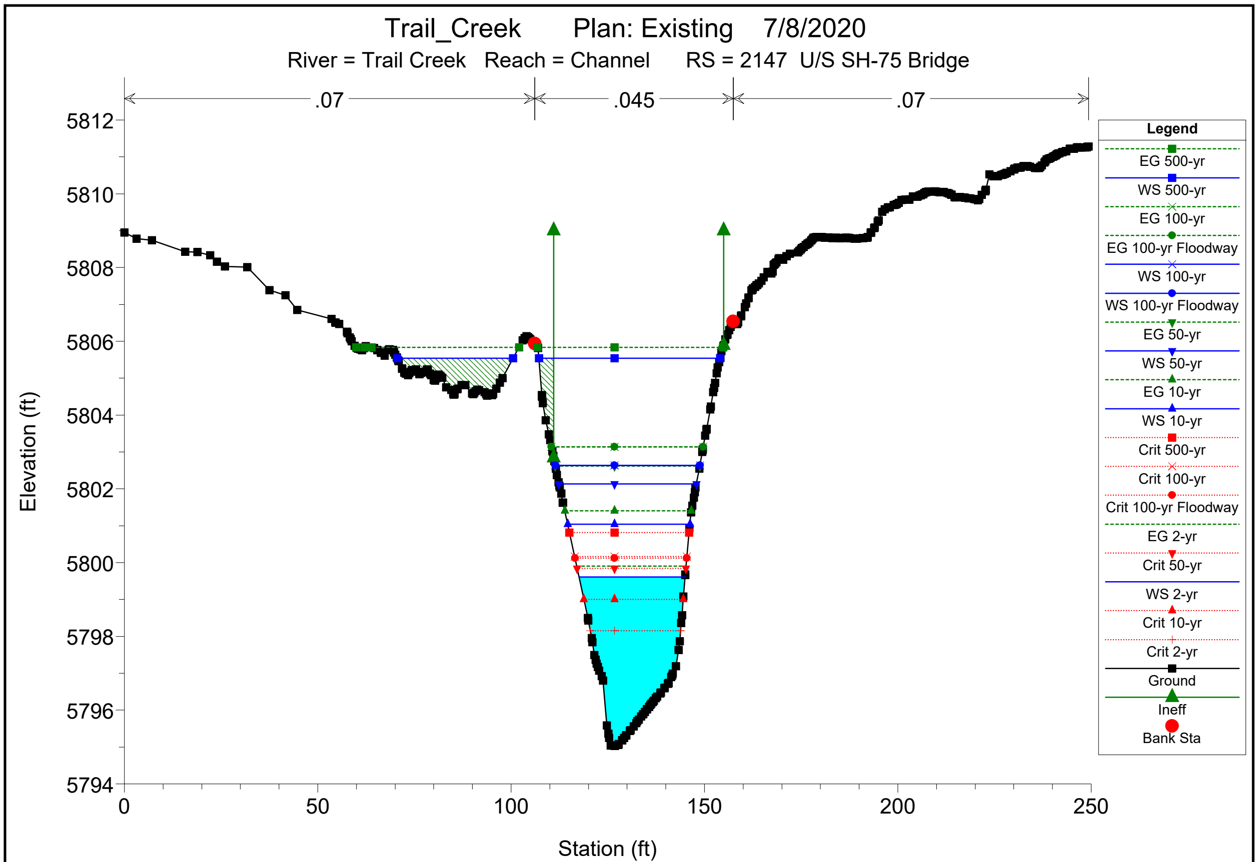
Trail_Creek Plan: Existing 7/8/2020
River = Trail Creek Reach = Channel RS = 2300
.07
.045
.07
Elevation (ft)
Station (ft)
5830
5825
5820
5815
5810
5805
5800
5795
0
50
100
150
200
250
300
350
400
Legend
EG 500-yr
WS 500-yr
EG 100-yr
EG 100-yr Floodway
EG 50-yr
WS 100-yr
WS 100-yr Floodway
WS 50-yr
EG 10-yr
Crit 500-yr
WS 10-yr
Crit 100-yr
Crit 100-yr Floodway
Crit 50-yr
EG 2-yr
WS 2-yr
Crit 10-yr
Crit 2-yr
Ground
Ineff
Bank Sta
Encroachment

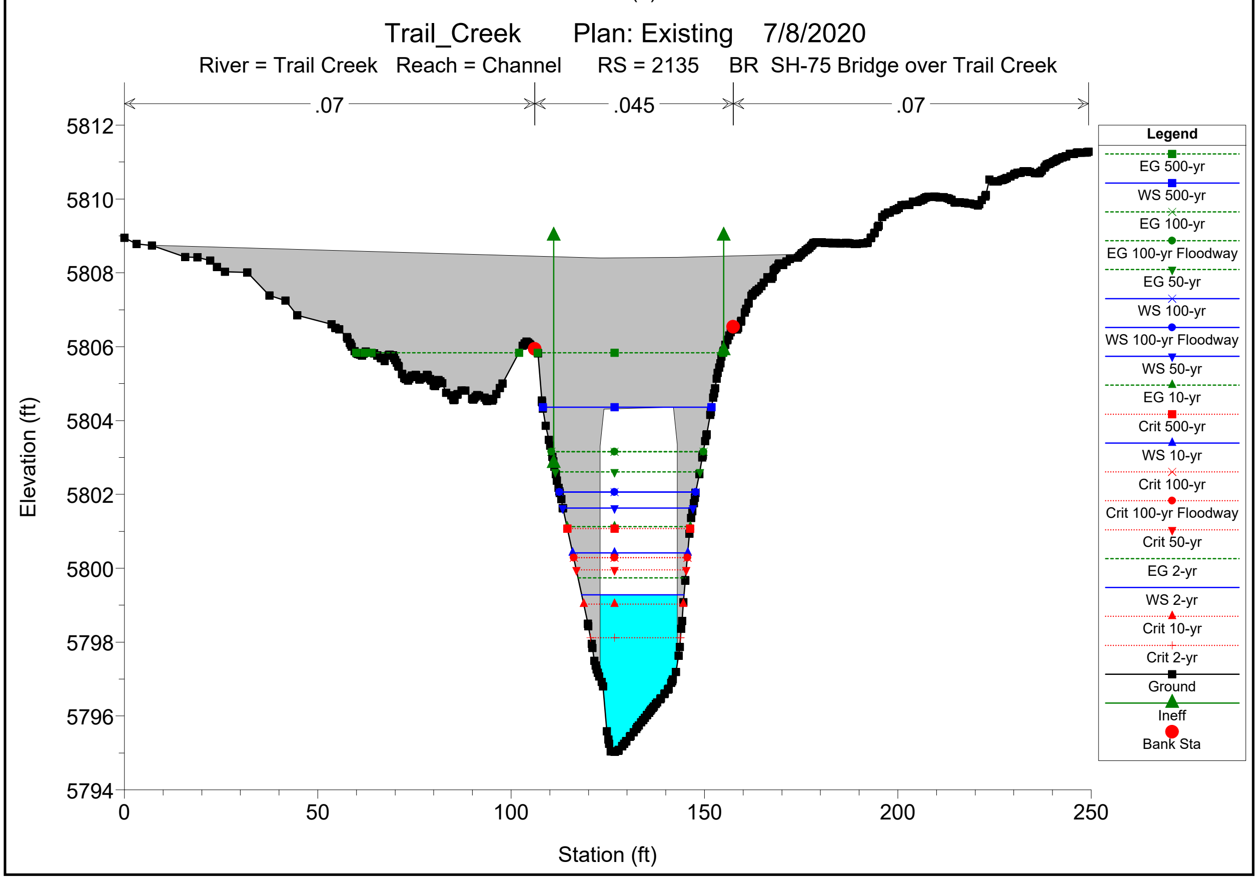


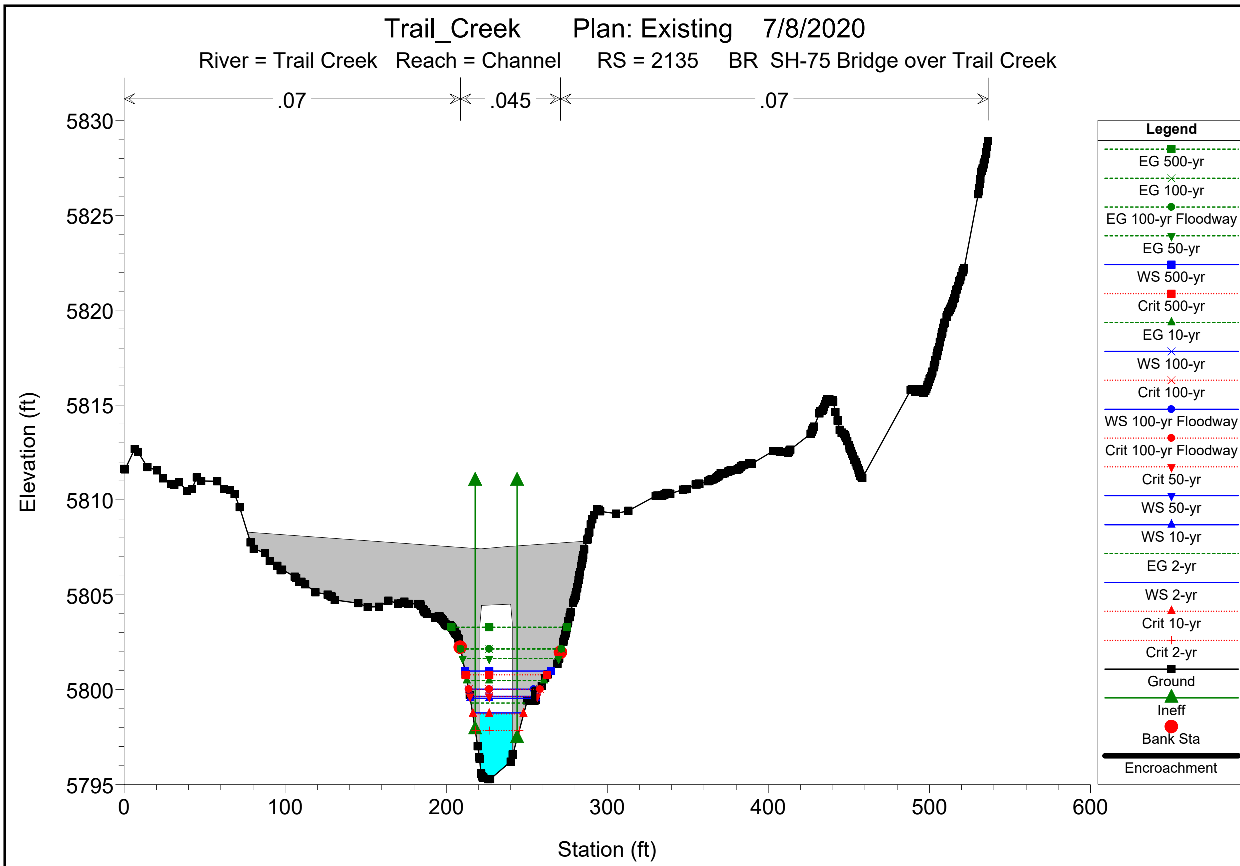
Trail_Creek Plan: Existing 7/8/2020
River = Trail Creek Reach = Channel RS = 2247
.07
.045
.07
Elevation (ft)
Station (ft)
Legend
EG 500-yr
WS 500-yr
EG 100-yr Floodway
EG 100-yr
WS 100-yr
WS 100-yr Floodway
EG 50-yr
WS 50-yr
EG 10-yr
Crit 500-yr
WS 10-yr
Crit 100-yr
Crit 100-yr Floodway
Crit 50-yr
EG 2-yr
WS 2-yr
Crit 10-yr
Crit 2-yr
Ground
Ineff
Bank Sta
Encroachment

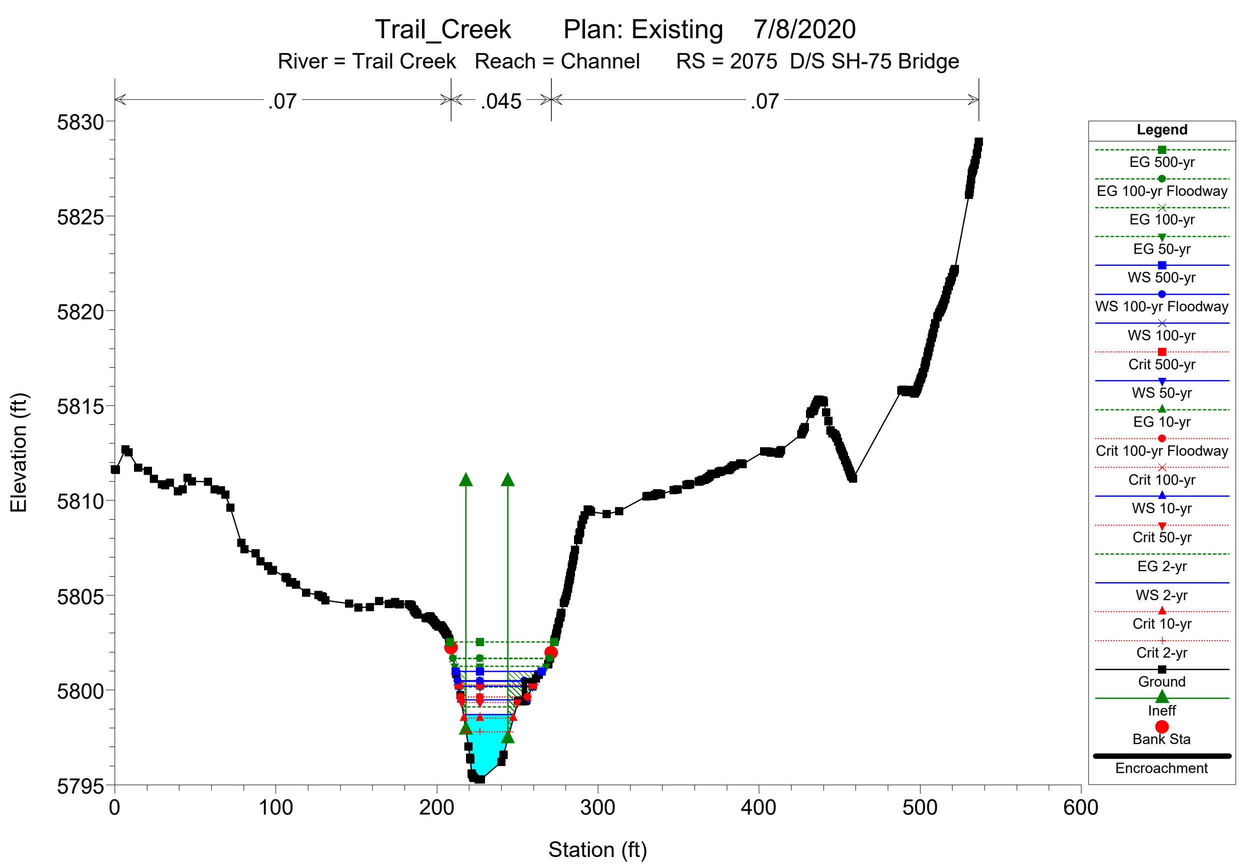


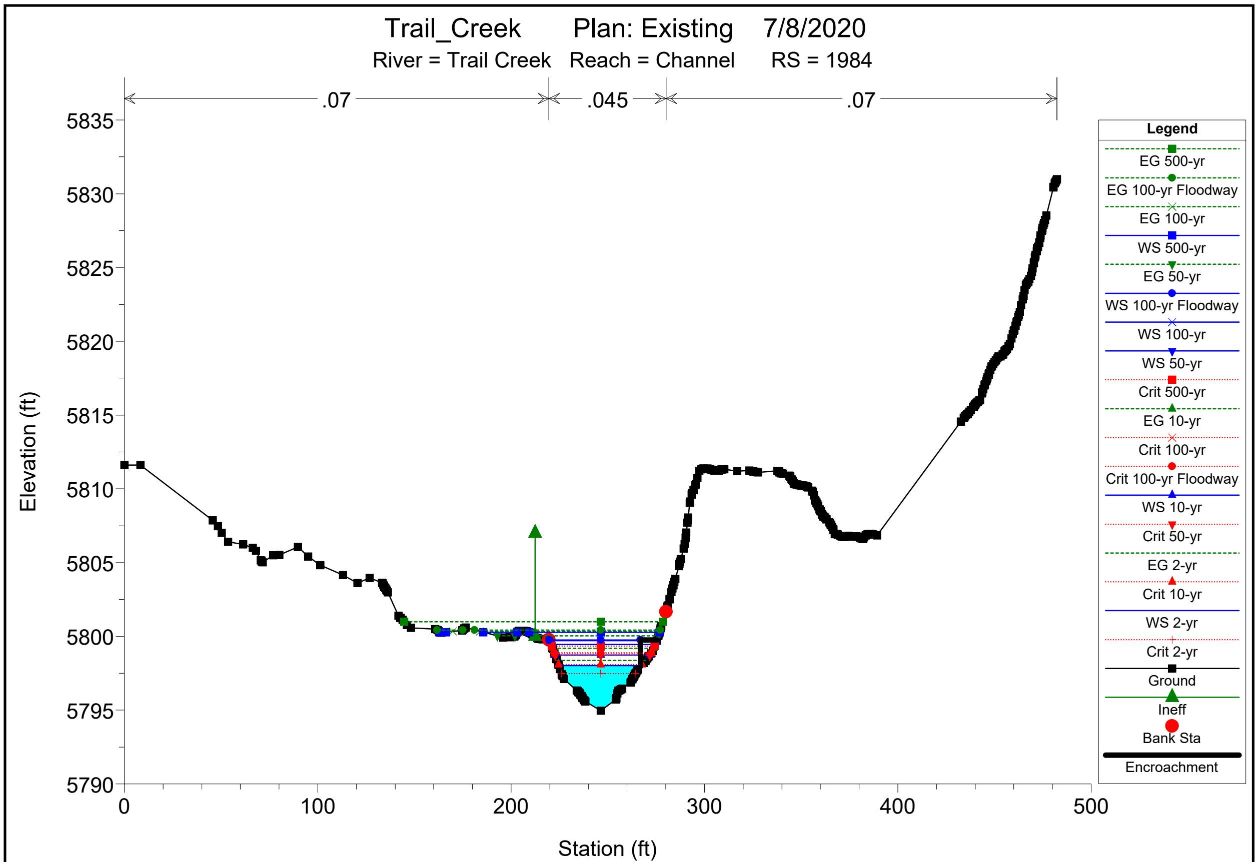
Trail_Creek Plan: Existing 7/8/2020
River = Trail Creek Reach = Channel RS = 2205
.07
.045
.07
Elevation (ft)
Station (ft)
Legend
EG 500-yr
WS 500-yr
EG 100-yr
EG 100-yr Floodway
EG 50-yr
WS 100-yr
WS 100-yr Floodway
WS 50-yr
Crit 500-yr
EG 10-yr
Crit 100-yr Floodway
Crit 100-yr
WS 10-yr
Crit 50-yr
EG 2-yr
Crit 10-yr
WS 2-yr
Crit 2-yr
Ground
Ineff
Bank Sta

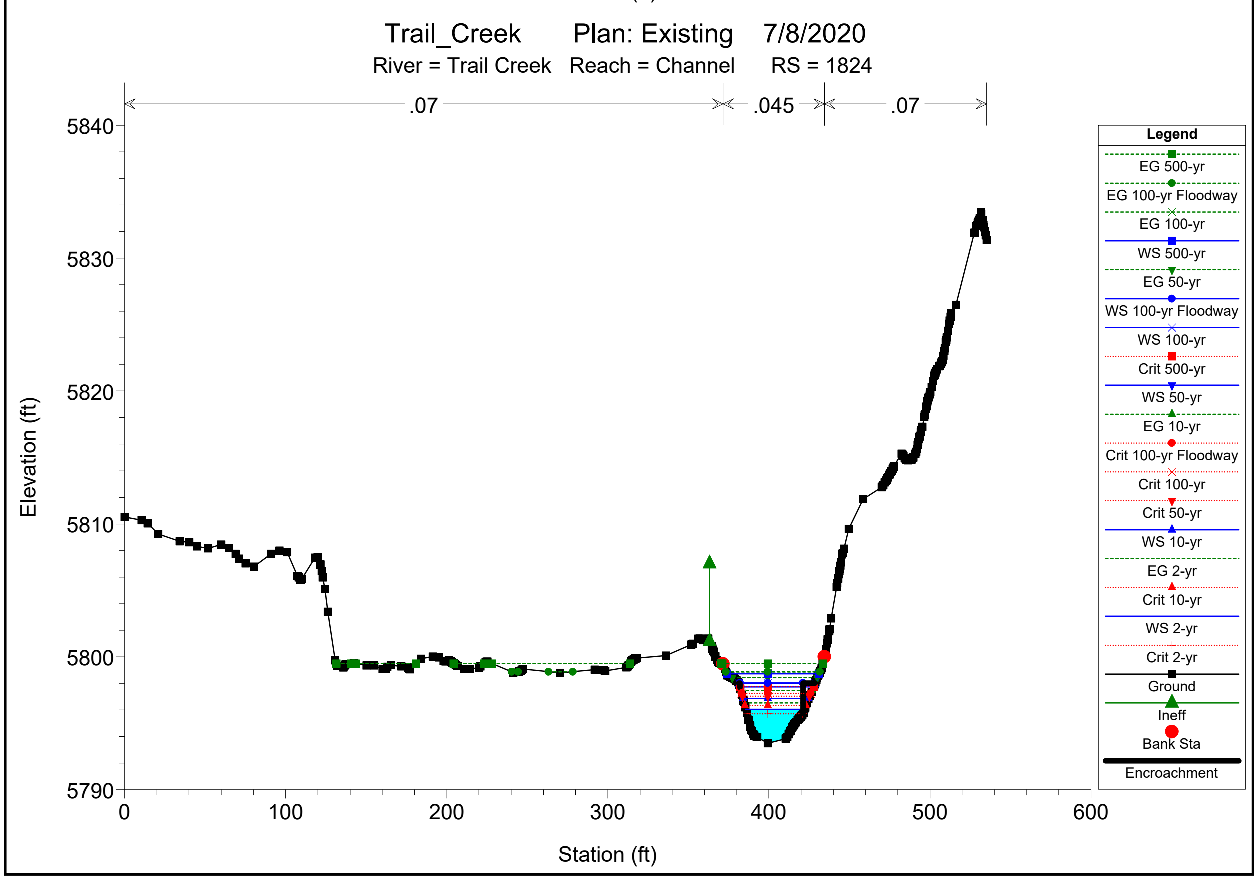

Trail_Creek Plan: Existing 7/8/2020
River = Trail Creek Reach = Channel RS = 2147 U/S SH-75 Bridge
.07
.045
.07
Elevation (ft)
Station (ft)
Legend
EG 500-yr
WS 500-yr
EG 100-yr
EG 100-yr Floodway
WS 100-yr
WS 100-yr Floodway
EG 50-yr
WS 50-yr
EG 10-yr
WS 10-yr
Crit 500-yr
Crit 100-yr
Crit 100-yr Floodway
EG 2-yr
Crit 50-yr
WS 2-yr
Crit 10-yr
Crit 2-yr
Ground
Ineff
Bank Sta

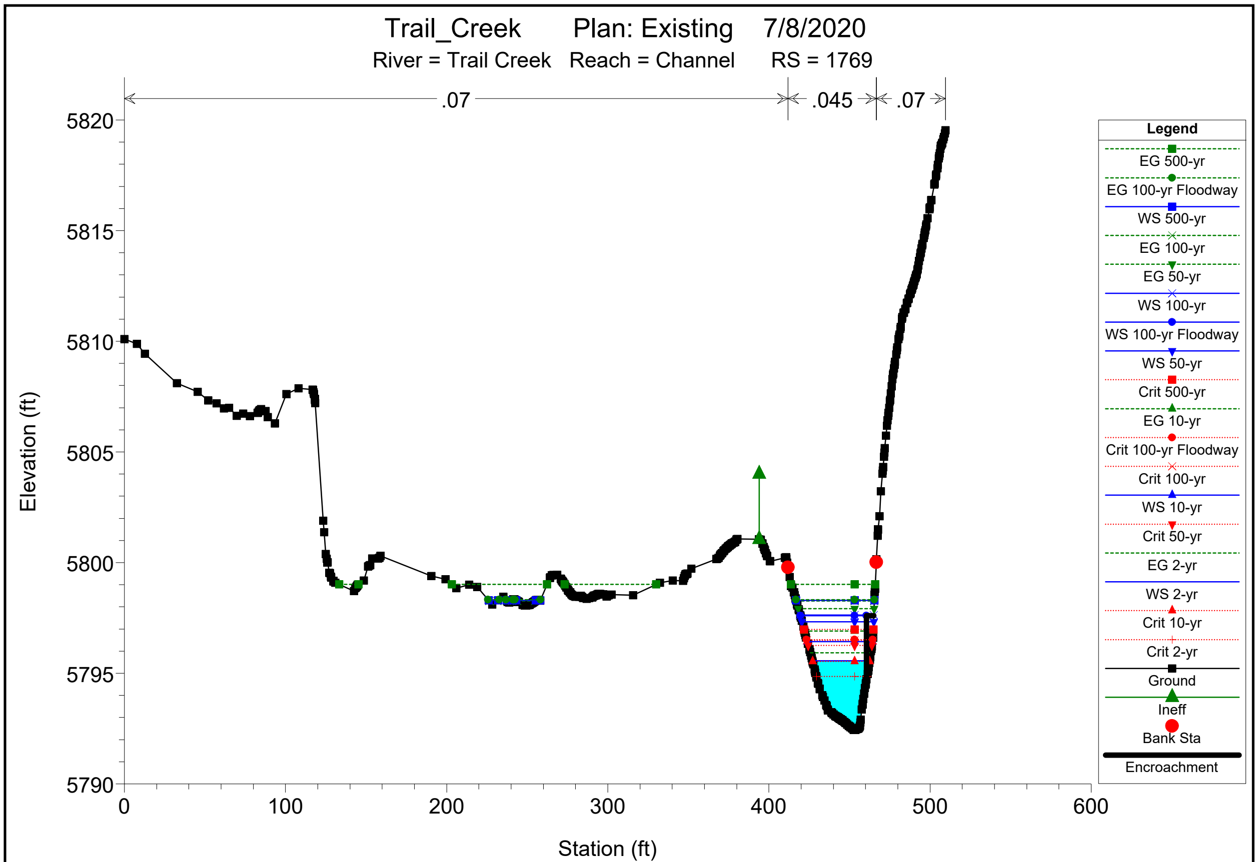

Trail_Creek Plan: Existing 7/8/2020
River = Trail Creek Reach = Channel RS = 2135 BR SH-75 Bridge over Trail Creek
.07
.045
.07
Elevation (ft)
Station (ft)
Legend
EG 500-yr
WS 500-yr
EG 100-yr
EG 100-yr Floodway
EG 50-yr
WS 100-yr
WS 100-yr Floodway
WS 50-yr
EG 10-yr
Crit 500-yr
WS 10-yr
Crit 100-yr
Crit 100-yr Floodway
Crit 50-yr
EG 2-yr
WS 2-yr
Crit 10-yr
Crit 2-yr
Ground
Ineff
Bank Sta

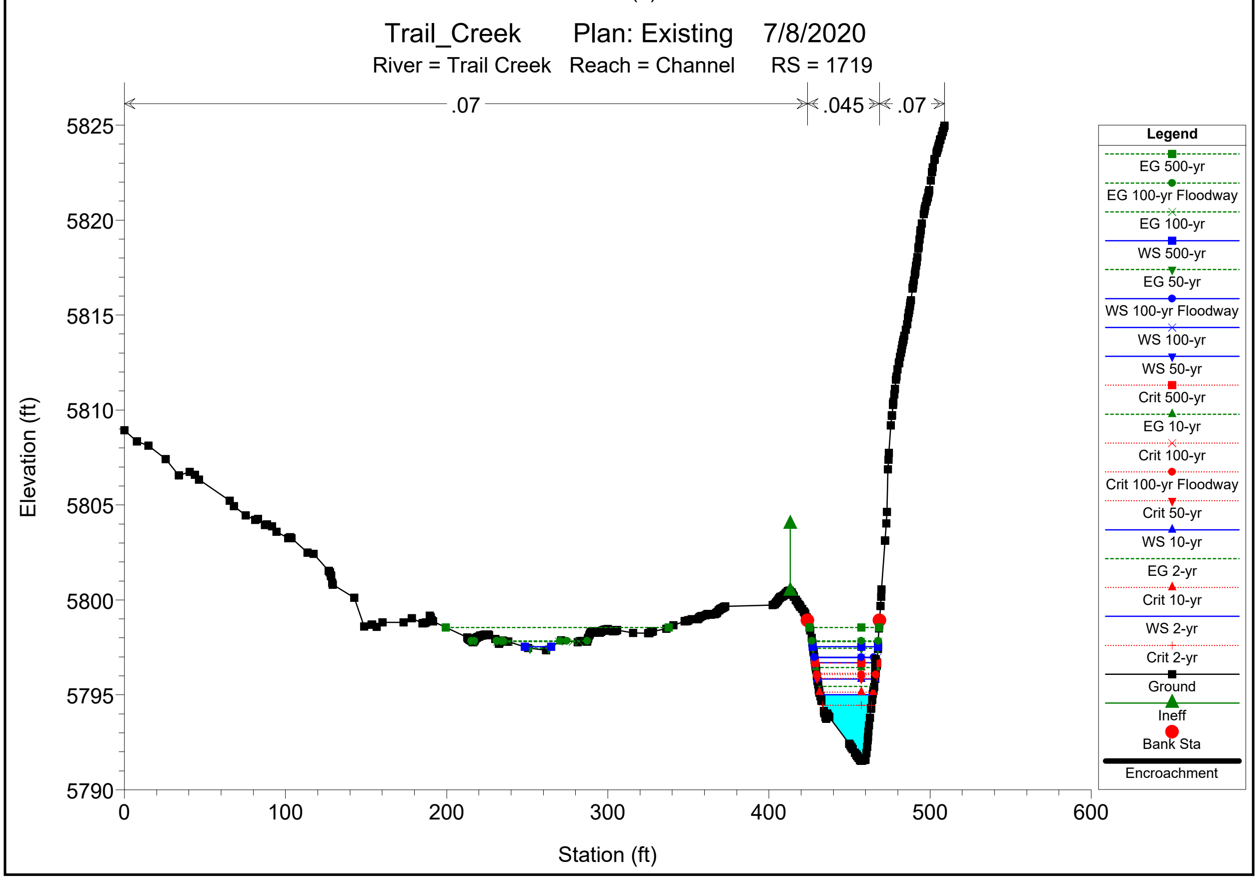

Trail_Creek Plan: Existing 7/8/2020
River = Trail Creek Reach = Channel RS = 2135 BR SH-75 Bridge over Trail Creek
.07
.045
.07
Elevation (ft)
Station (ft)
Legend
EG 500-yr
EG 100-yr
EG 100-yr Floodway
EG 50-yr
WS 500-yr
Crit 500-yr
EG 10-yr
WS 100-yr
Crit 100-yr
WS 100-yr Floodway
Crit 100-yr Floodway
Crit 50-yr
WS 50-yr
WS 10-yr
EG 2-yr
WS 2-yr
Crit 10-yr
Crit 2-yr
Ground
Ineff
Bank Sta
Encroachment

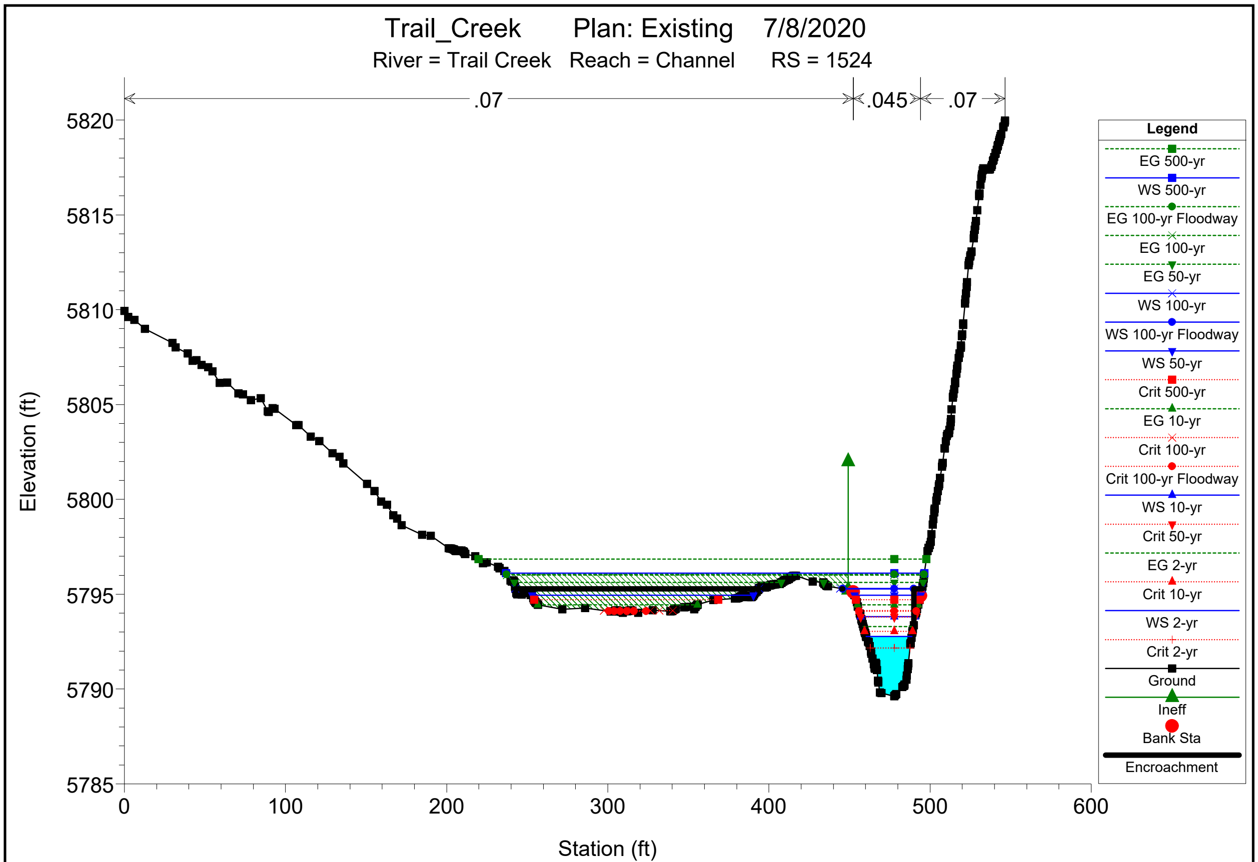

Trail_Creek Plan: Existing 7/8/2020
River = Trail Creek Reach = Channel RS = 2075 D/S SH-75 Bridge
.07
.045
.07
Elevation (ft)
Station (ft)
Legend
EG 500-yr
EG 100-yr Floodway
EG 100-yr
EG 50-yr
WS 500-yr
WS 100-yr Floodway
WS 100-yr
Crit 500-yr
WS 50-yr
EG 10-yr
Crit 100-yr Floodway
Crit 100-yr
WS 10-yr
Crit 50-yr
EG 2-yr
WS 2-yr
Crit 10-yr
Crit 2-yr
Ground
Ineff
Bank Sta
Encroachment


Trail_Creek Plan: Existing 7/8/2020
River = Trail Creek Reach = Channel RS = 1984
.07
.045
.07
Elevation (ft)
Station (ft)
5835
5830
5825
5820
5815
5810
5805
5800
5795
5790
0
100
200
300
400
500
Legend
EG 500-yr
EG 100-yr Floodway
EG 100-yr
WS 500-yr
EG 50-yr
WS 100-yr Floodway
WS 100-yr
WS 50-yr
Crit 500-yr
EG 10-yr
Crit 100-yr
Crit 100-yr Floodway
WS 10-yr
Crit 50-yr
EG 2-yr
Crit 10-yr
WS 2-yr
Crit 2-yr
Ground
Ineff
Bank Sta
Encroachment

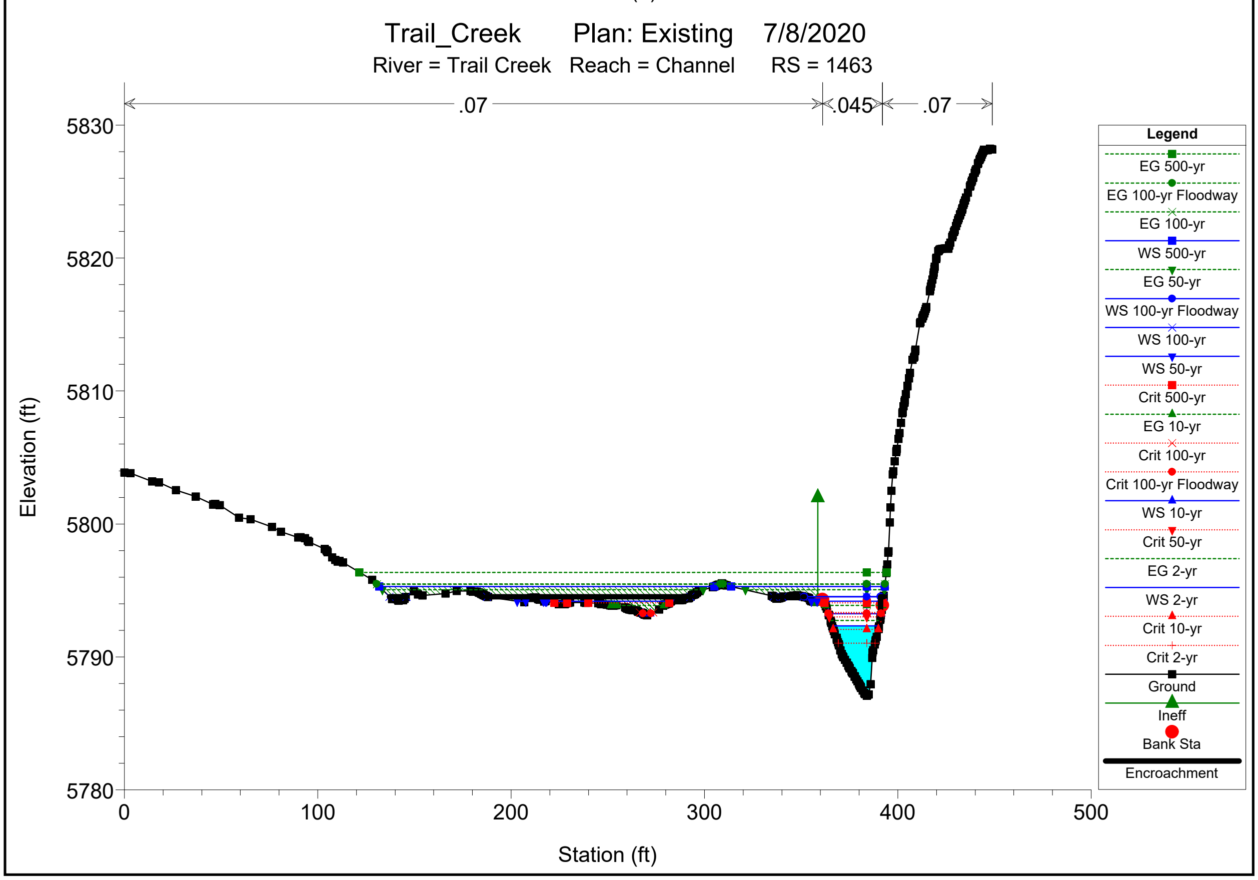

Trail_Creek Plan: Existing 7/8/2020
River = Trail Creek Reach = Channel RS = 1824
.07
.045
.07
Elevation (ft)
Station (ft)
5840
5830
5820
5810
5800
5790
0
100
200
300
400
500
600
Legend
EG 500-yr
EG 100-yr Floodway
EG 100-yr
WS 500-yr
EG 50-yr
WS 100-yr Floodway
WS 100-yr
Crit 500-yr
WS 50-yr
EG 10-yr
Crit 100-yr Floodway
Crit 100-yr
Crit 50-yr
WS 10-yr
EG 2-yr
Crit 10-yr
WS 2-yr
Crit 2-yr
Ground
Ineff
Bank Sta
Encroachment


Trail_Creek Plan: Existing 7/8/2020
River = Trail Creek Reach = Channel RS = 1769
.07
.045
.07
Elevation (ft)
Station (ft)
Legend
EG 500-yr
EG 100-yr Floodway
WS 500-yr
EG 100-yr
EG 50-yr
WS 100-yr
WS 100-yr Floodway
WS 50-yr
Crit 500-yr
EG 10-yr
Crit 100-yr Floodway
Crit 100-yr
WS 10-yr
Crit 50-yr
EG 2-yr
WS 2-yr
Crit 10-yr
Crit 2-yr
Ground
Ineff
Bank Sta
Encroachment

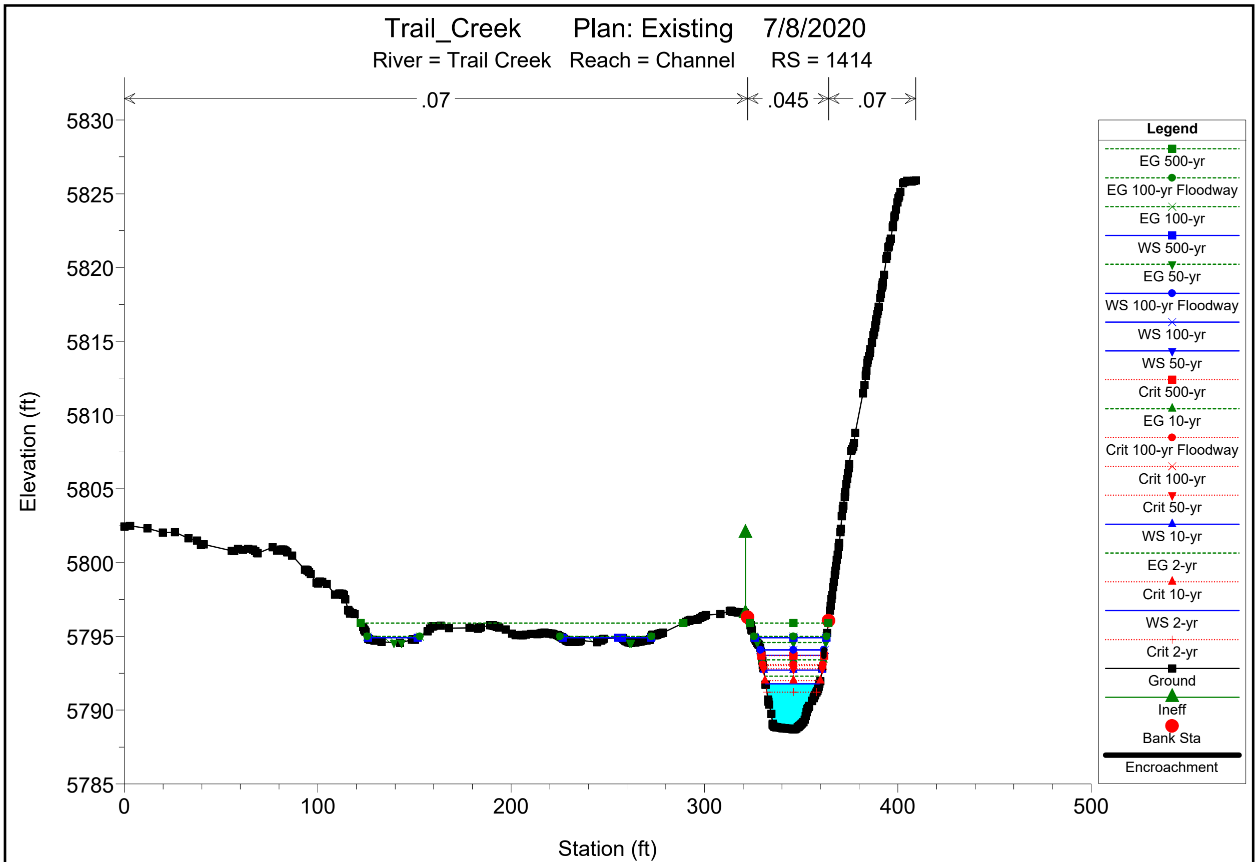

Trail_Creek Plan: Existing 7/8/2020
River = Trail Creek Reach = Channel RS = 1719
.07
.045
.07
Elevation (ft)
Station (ft)
Legend
EG 500-yr
EG 100-yr Floodway
EG 100-yr
WS 500-yr
EG 50-yr
WS 100-yr Floodway
WS 100-yr
WS 50-yr
Crit 500-yr
EG 10-yr
Crit 100-yr
Crit 100-yr Floodway
Crit 50-yr
WS 10-yr
EG 2-yr
Crit 10-yr
WS 2-yr
Crit 2-yr
Ground
Ineff
Bank Sta
Encroachment

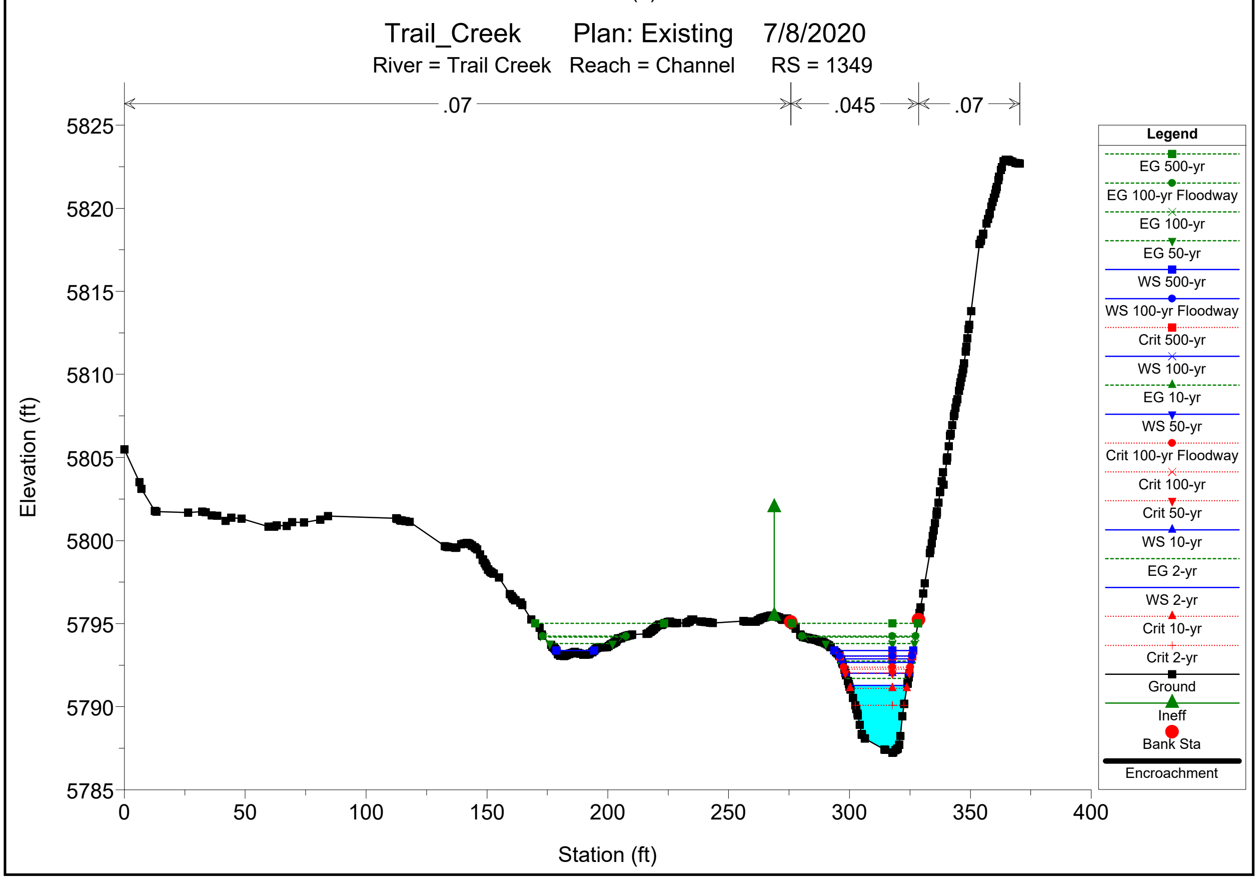


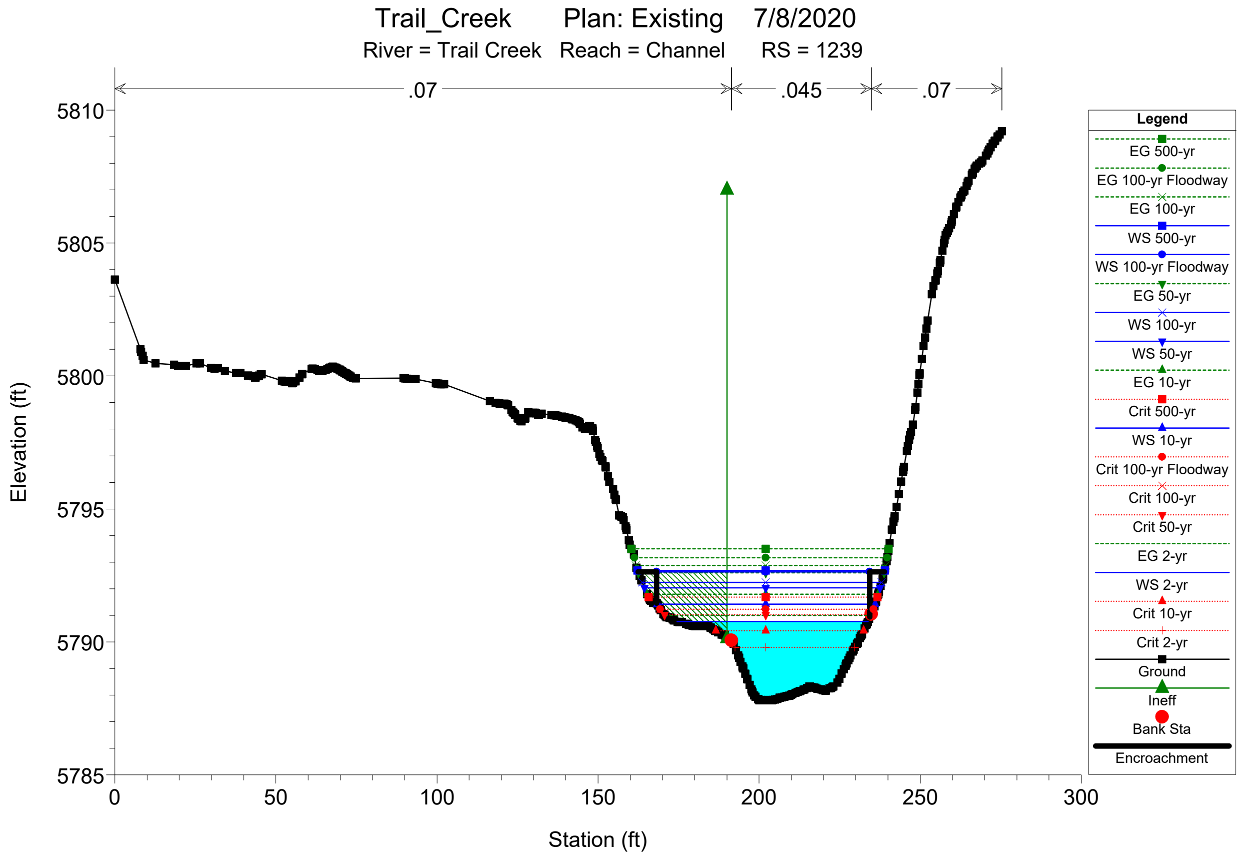
Trail_Creek Plan: Existing 7/8/2020
River = Trail Creek Reach = Channel RS = 1524
.07
.045
.07
Elevation (ft)
Station (ft)
Legend
EG 500-yr
WS 500-yr
EG 100-yr Floodway
EG 100-yr
EG 50-yr
WS 100-yr
WS 100-yr Floodway
WS 50-yr
Crit 500-yr
EG 10-yr
Crit 100-yr
Crit 100-yr Floodway
WS 10-yr
Crit 50-yr
EG 2-yr
Crit 10-yr
WS 2-yr
Crit 2-yr
Ground
Ineff
Bank Sta
Encroachment

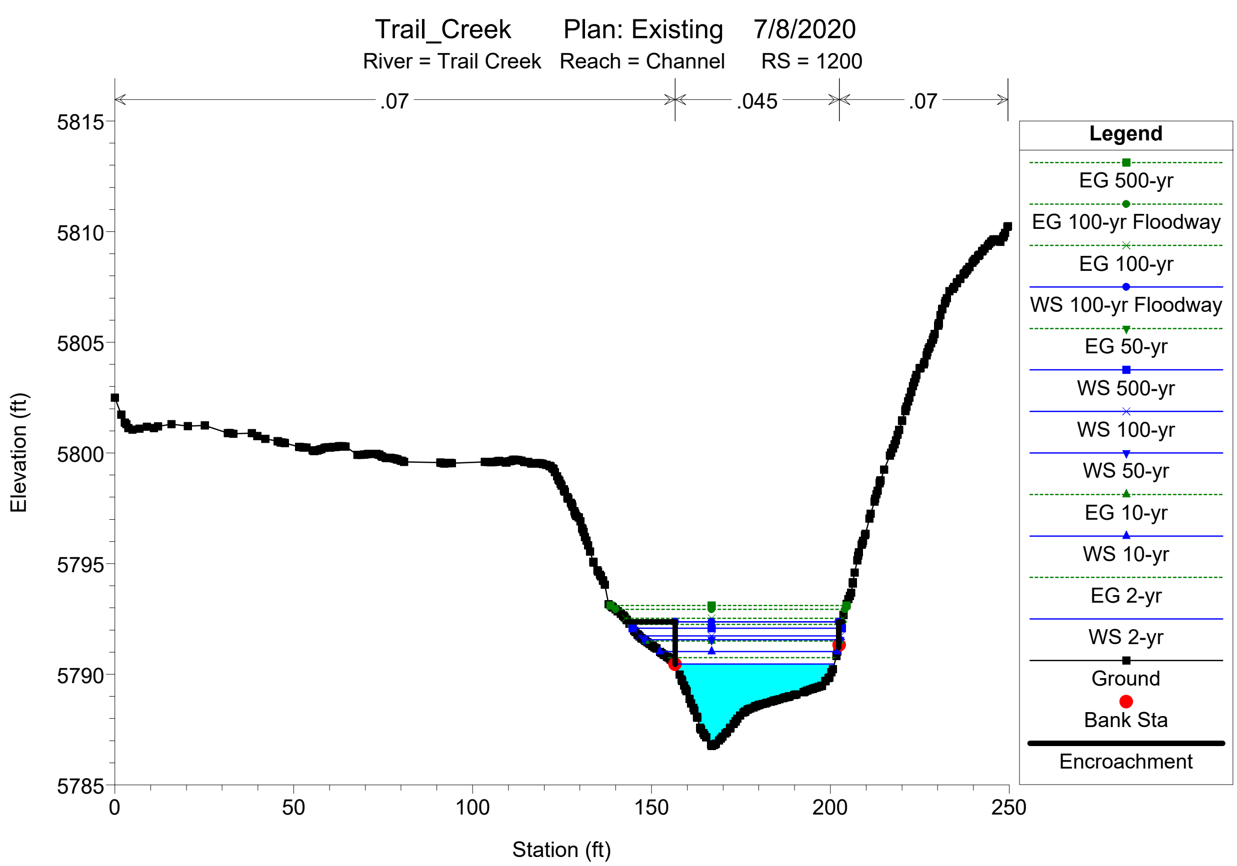


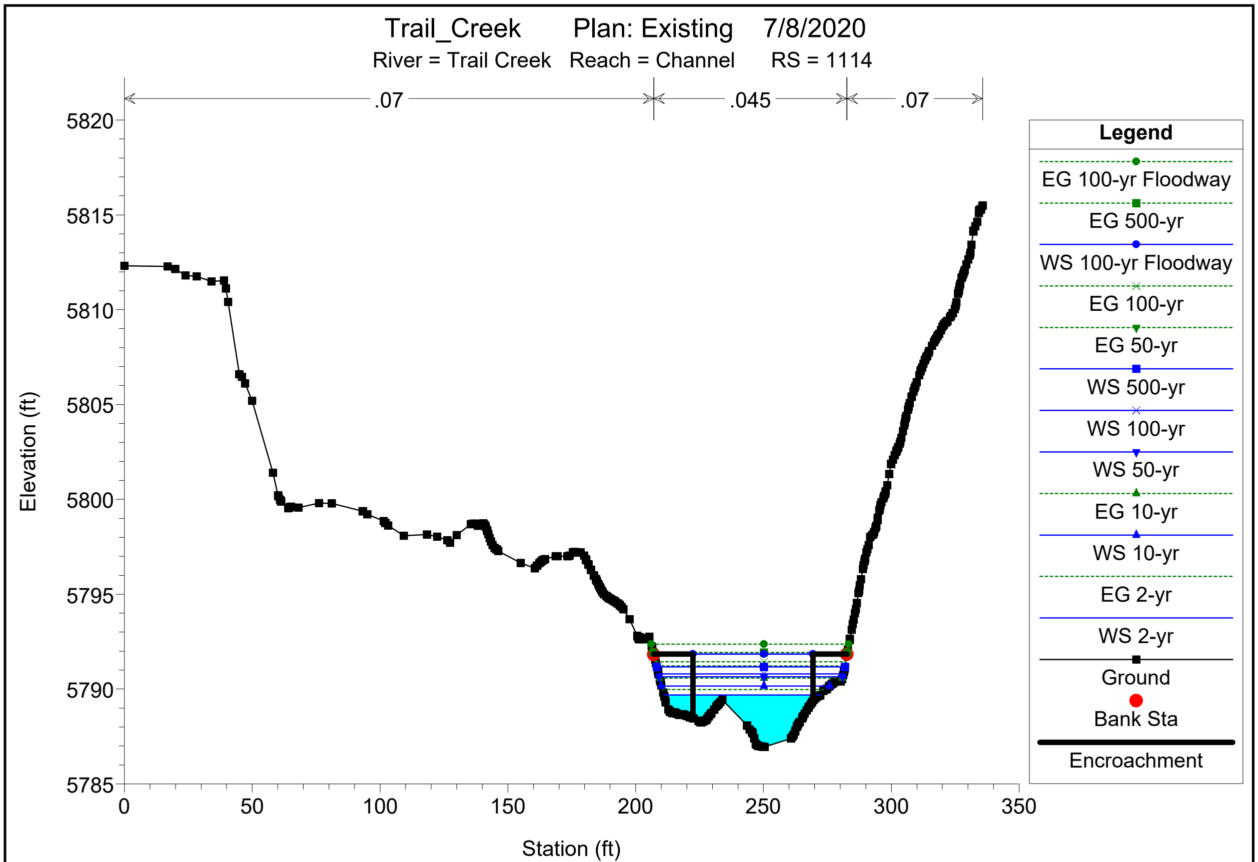
Trail_Creek Plan: Existing 7/8/2020
River = Trail Creek Reach = Channel RS = 1463
.07
.045
.07
Elevation (ft)
Station (ft)
Legend
EG 500-yr
EG 100-yr Floodway
EG 100-yr
WS 500-yr
EG 50-yr
WS 100-yr Floodway
WS 100-yr
WS 50-yr
Crit 500-yr
EG 10-yr
Crit 100-yr
Crit 100-yr Floodway
WS 10-yr
Crit 50-yr
EG 2-yr
WS 2-yr
Crit 10-yr
Crit 2-yr
Ground
Ineff
Bank Sta
Encroachment

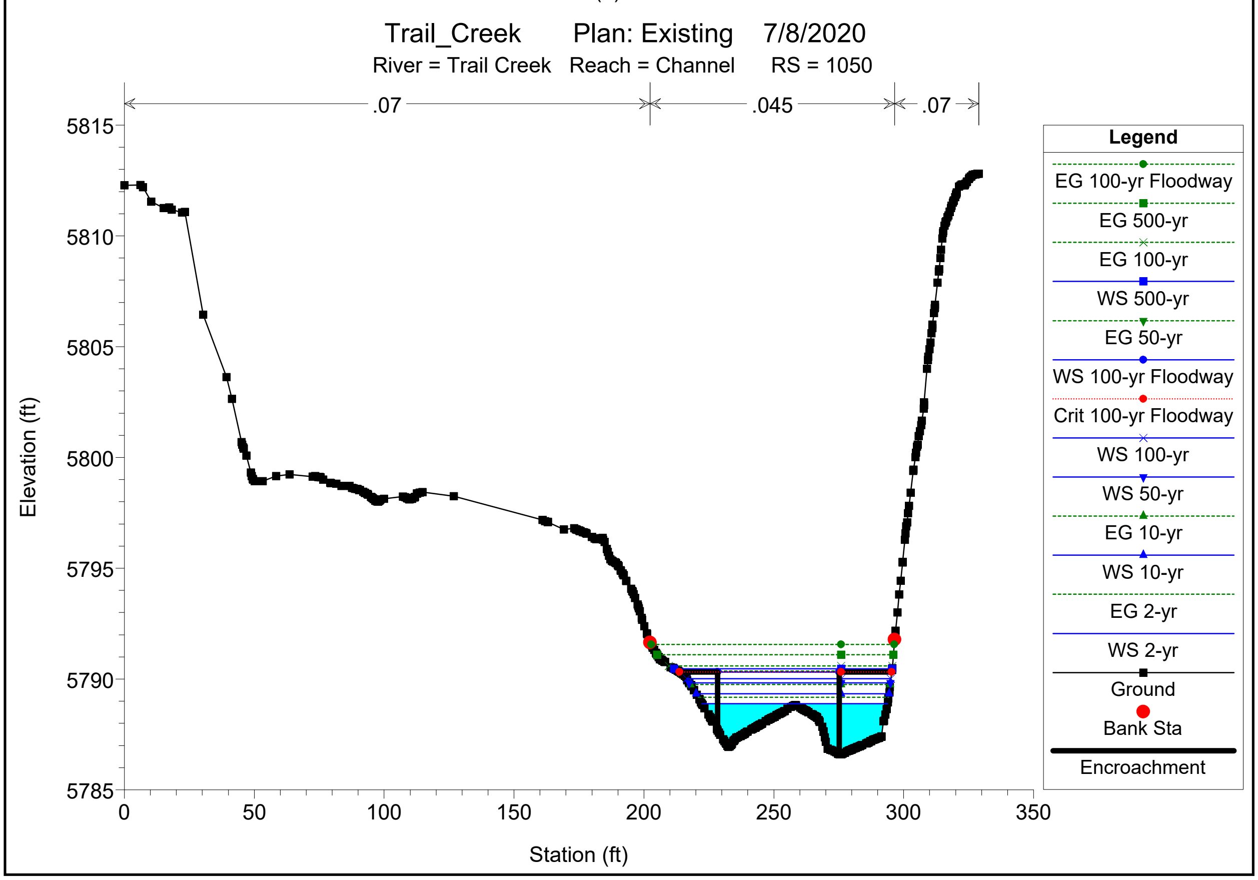

Trail_Creek Plan: Existing 7/8/2020
River = Trail Creek Reach = Channel RS = 1414
.07
.045
.07
Elevation (ft)
Station (ft)
5830
5825
5820
5815
5810
5805
5800
5795
5790
5785
0
100
200
300
400
500
Legend
EG 500-yr
EG 100-yr Floodway
EG 100-yr
WS 500-yr
EG 50-yr
WS 100-yr Floodway
WS 100-yr
WS 50-yr
Crit 500-yr
EG 10-yr
Crit 100-yr Floodway
Crit 100-yr
Crit 50-yr
WS 10-yr
EG 2-yr
Crit 10-yr
WS 2-yr
Crit 2-yr
Ground
Ineff
Bank Sta
Encroachment

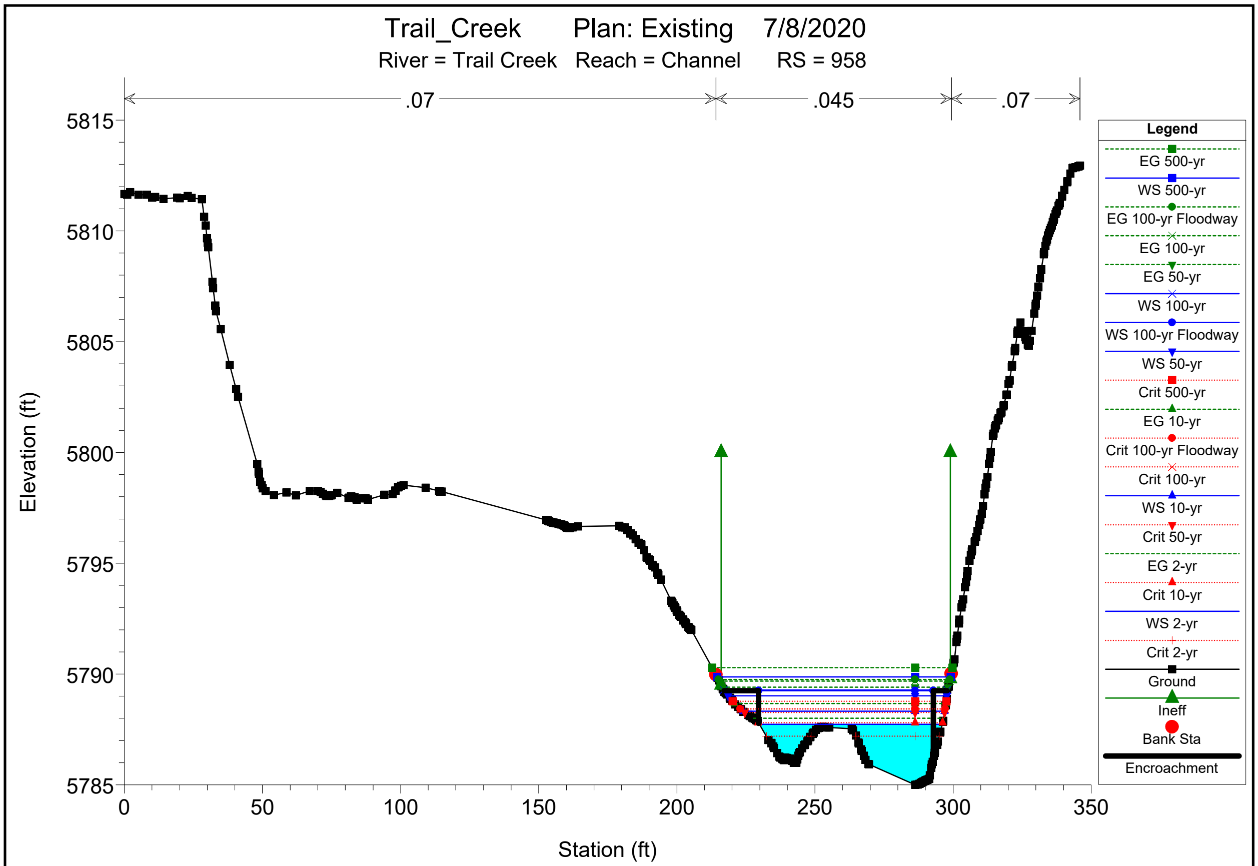

Trail_Creek Plan: Existing 7/8/2020
River = Trail Creek Reach = Channel RS = 1349
.07
.045
.07
Elevation (ft)
Station (ft)
5825
5820
5815
5810
5805
5800
5795
5790
5785
0
50
100
150
200
250
300
350
400
Legend
EG 500-yr
EG 100-yr Floodway
EG 100-yr
EG 50-yr
WS 500-yr
WS 100-yr Floodway
Crit 500-yr
WS 100-yr
EG 10-yr
WS 50-yr
Crit 100-yr Floodway
Crit 100-yr
Crit 50-yr
WS 10-yr
EG 2-yr
WS 2-yr
Crit 10-yr
Crit 2-yr
Ground
Ineff
Bank Sta
Encroachment

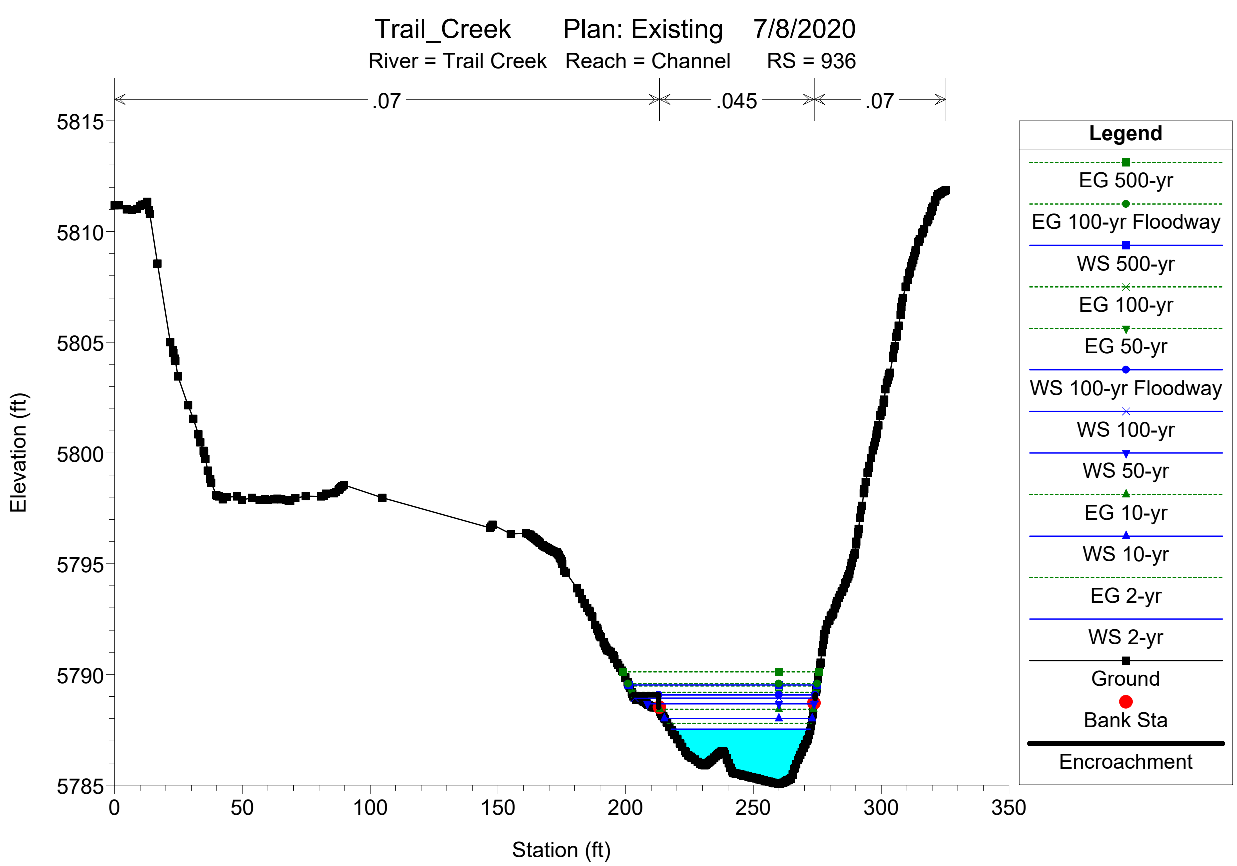

Trail_Creek Plan: Existing 7/8/2020
River = Trail Creek Reach = Channel RS = 1239
.07
.045
.07
Elevation (ft)
5810
5805
5800
5795
5790
5785
0
50
100
150
200
250
300
Station (ft)
Legend
EG 500-yr
EG 100-yr Floodway
EG 100-yr
WS 500-yr
WS 100-yr Floodway
EG 50-yr
WS 100-yr
WS 50-yr
EG 10-yr
Crit 500-yr
WS 10-yr
Crit 100-yr Floodway
Crit 100-yr
Crit 50-yr
EG 2-yr
WS 2-yr
Crit 10-yr
Crit 2-yr
Ground
Ineff
Bank Sta
Encroachment

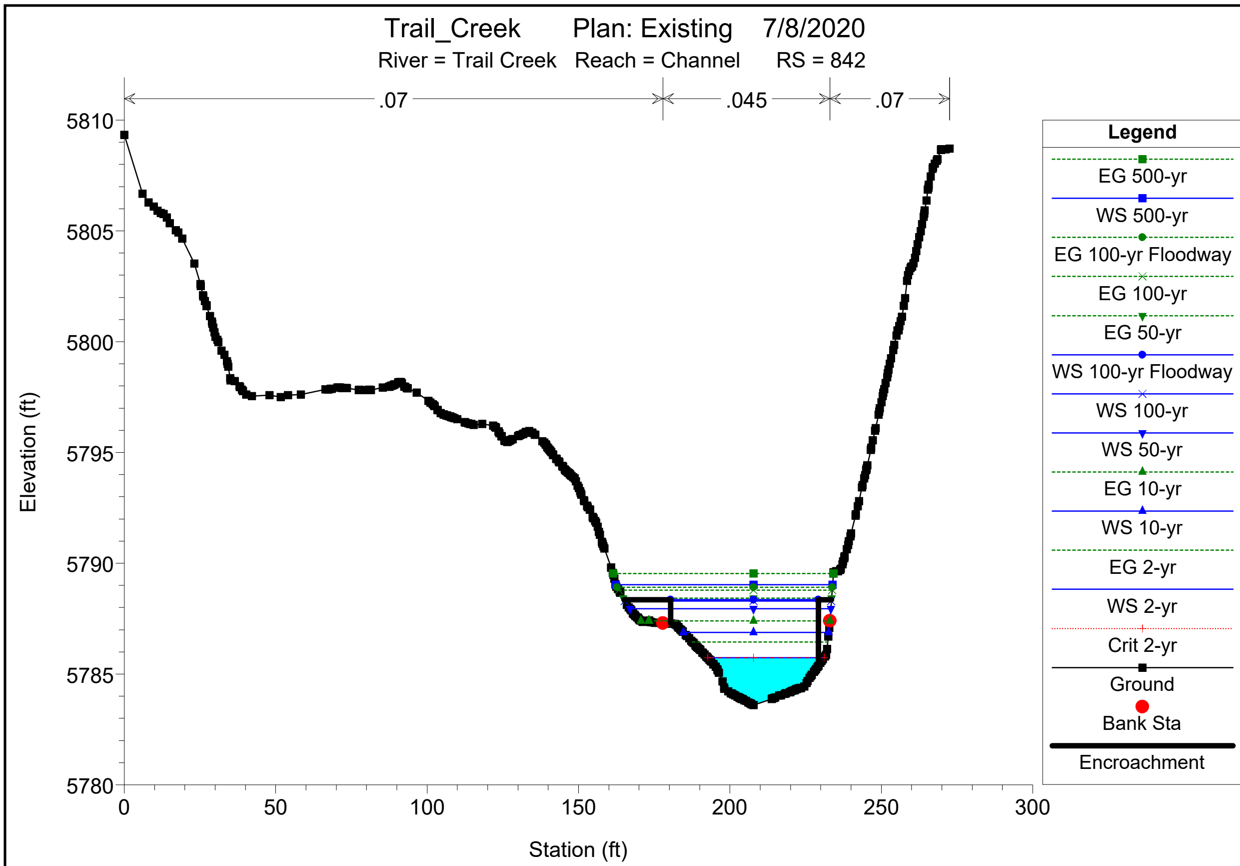

Trail_Creek Plan: Existing 7/8/2020
River = Trail Creek Reach = Channel RS = 1200
.07
.045
.07
Elevation (ft)
5815
5810
5805
5800
5795
5790
5785
0
50
100
150
200
250
Station (ft)
Legend
EG 500-yr
EG 100-yr Floodway
EG 100-yr
WS 100-yr Floodway
EG 50-yr
WS 500-yr
WS 100-yr
WS 50-yr
EG 10-yr
WS 10-yr
EG 2-yr
WS 2-yr
Ground
Bank Sta
Encroachment

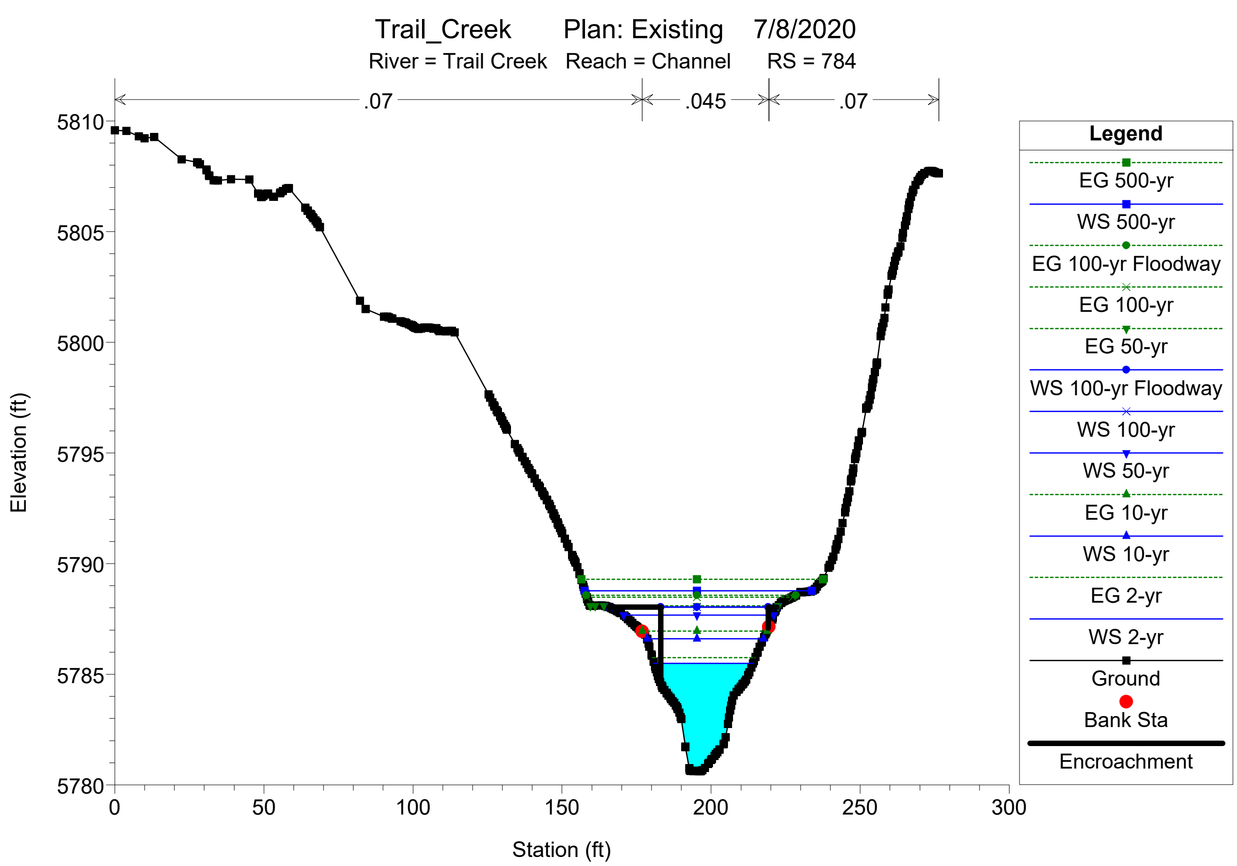

Trail_Creek Plan: Existing 7/8/2020
River = Trail Creek Reach = Channel RS = 1114
.07
.045
.07
Legend
EG 100-yr Floodway
EG 500-yr
WS 100-yr Floodway
EG 100-yr
EG 50-yr
WS 500-yr
WS 100-yr
WS 50-yr
EG 10-yr
WS 10-yr
EG 2-yr
WS 2-yr
Ground
Bank Sta
Encroachment
Elevation (ft)
5820
5815
5810
5805
5800
5795
5790
5785
0
50
100
150
200
250
300
350
Station (ft)

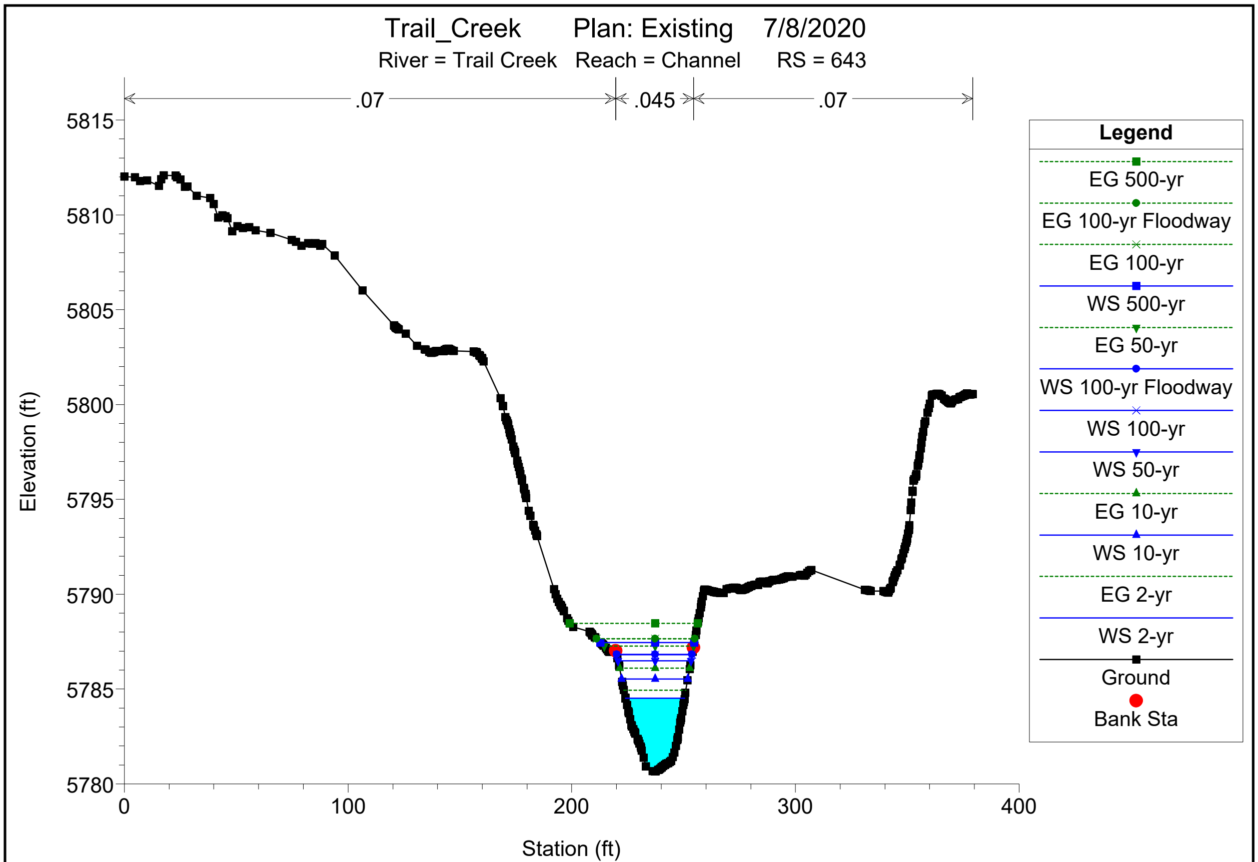

Trail_Creek Plan: Existing 7/8/2020
River = Trail Creek Reach = Channel RS = 1050
.07
.045
.07
Legend
EG 100-yr Floodway
EG 500-yr
EG 100-yr
WS 500-yr
EG 50-yr
WS 100-yr Floodway
Crit 100-yr Floodway
WS 100-yr
WS 50-yr
EG 10-yr
WS 10-yr
EG 2-yr
WS 2-yr
Ground
Bank Sta
Encroachment
Elevation (ft)
5815
5810
5805
5800
5795
5790
5785
0
50
100
150
200
250
300
350
Station (ft)


Trail_Creek Plan: Existing 7/8/2020
River = Trail Creek Reach = Channel RS = 958
.07
.045
.07
Legend
EG 500-yr
WS 500-yr
EG 100-yr Floodway
EG 100-yr
EG 50-yr
WS 100-yr
WS 100-yr Floodway
WS 50-yr
Crit 500-yr
EG 10-yr
Crit 100-yr Floodway
Crit 100-yr
WS 10-yr
Crit 50-yr
EG 2-yr
Crit 10-yr
WS 2-yr
Crit 2-yr
Ground
Ineff
Bank Sta
Encroachment
Elevation (ft)
Station (ft)

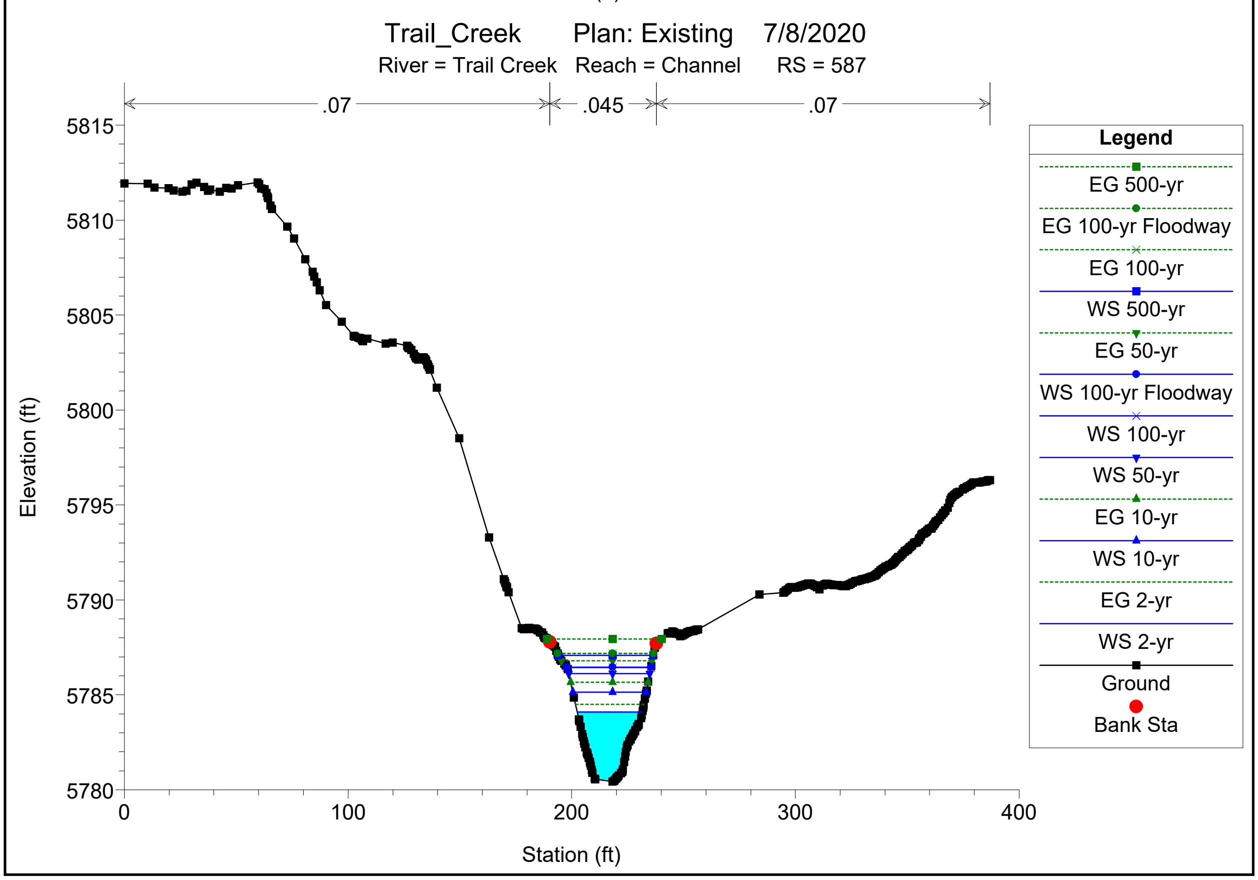

Trail_Creek Plan: Existing 7/8/2020
River = Trail Creek Reach = Channel RS = 936
.07
.045
.07
Legend
EG 500-yr
EG 100-yr Floodway
WS 500-yr
EG 100-yr
EG 50-yr
WS 100-yr Floodway
WS 100-yr
WS 50-yr
EG 10-yr
WS 10-yr
EG 2-yr
WS 2-yr
Ground
Bank Sta
Encroachment
Elevation (ft)
Station (ft)


Trail_Creek Plan: Existing 7/8/2020
River = Trail Creek Reach = Channel RS = 842
.07
.045
.07
5810
5805
5800
5795
5790
5785
5780
Elevation (ft)
0
50
100
150
200
250
300
Station (ft)
Legend
EG 500-yr
WS 500-yr
EG 100-yr Floodway
EG 100-yr
EG 50-yr
WS 100-yr Floodway
WS 100-yr
WS 50-yr
EG 10-yr
WS 10-yr
EG 2-yr
WS 2-yr
Crit 2-yr
Ground
Bank Sta
Encroachment

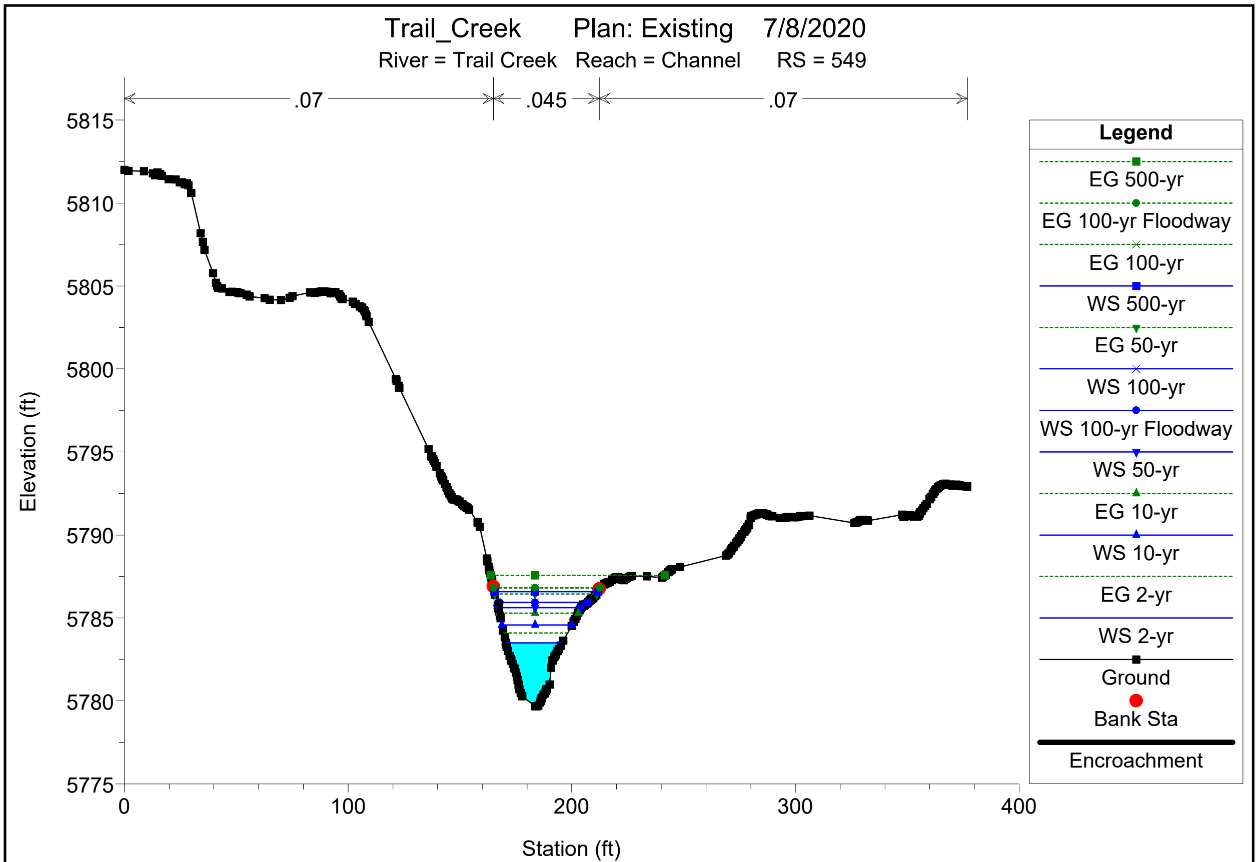

Trail_Creek Plan: Existing 7/8/2020
River = Trail Creek Reach = Channel RS = 784
.07
.045
.07
5810
5805
5800
5795
5790
5785
5780
Elevation (ft)
0
50
100
150
200
250
300
Station (ft)
Legend
EG 500-yr
WS 500-yr
EG 100-yr Floodway
EG 100-yr
EG 50-yr
WS 100-yr Floodway
WS 100-yr
WS 50-yr
EG 10-yr
WS 10-yr
EG 2-yr
WS 2-yr
Ground
Bank Sta
Encroachment

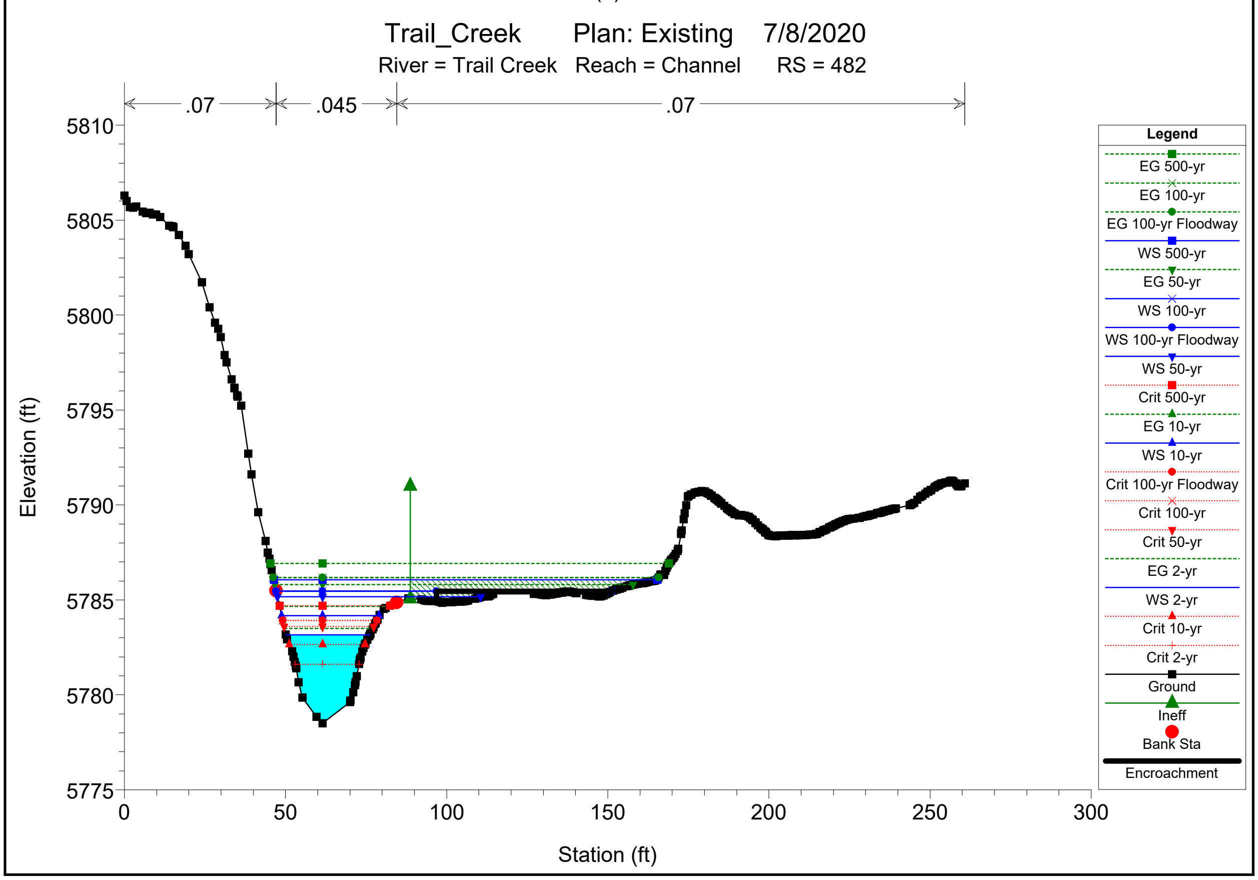


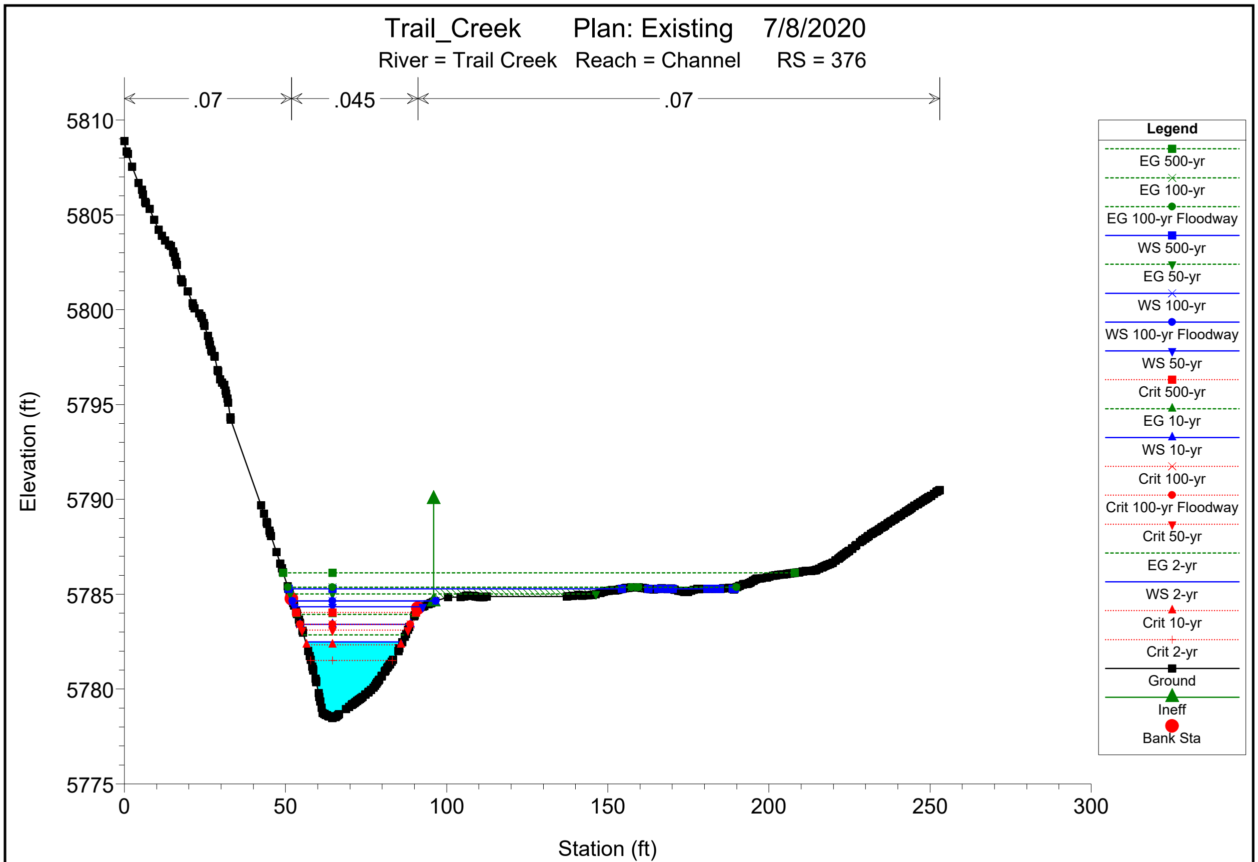
Trail_Creek Plan: Existing 7/8/2020
River = Trail Creek Reach = Channel RS = 643
.07
.045
.07
Elevation (ft)
Station (ft)
Legend
EG 500-yr
EG 100-yr Floodway
EG 100-yr
WS 500-yr
EG 50-yr
WS 100-yr Floodway
WS 100-yr
WS 50-yr
EG 10-yr
WS 10-yr
EG 2-yr
WS 2-yr
Ground
Bank Sta



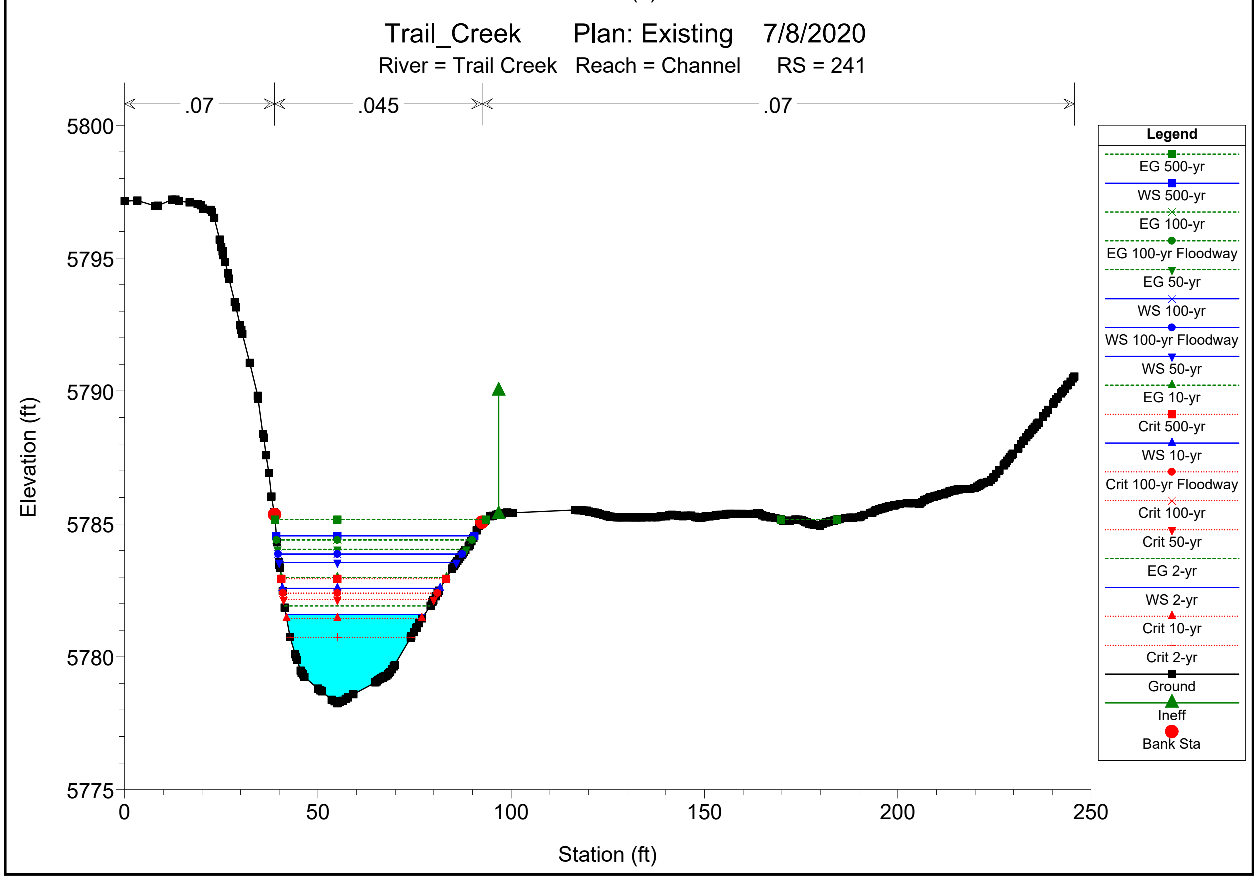
Trail_Creek Plan: Existing 7/8/2020
River = Trail Creek Reach = Channel RS = 587
.07
.045
.07
Elevation (ft)
Station (ft)
Legend
EG 500-yr
EG 100-yr Floodway
EG 100-yr
WS 500-yr
EG 50-yr
WS 100-yr Floodway
WS 100-yr
WS 50-yr
EG 10-yr
WS 10-yr
EG 2-yr
WS 2-yr
Ground
Bank Sta


Trail_Creek Plan: Existing 7/8/2020
River = Trail Creek Reach = Channel RS = 549
.07
.045
.07
Elevation (ft)
5815
5810
5805
5800
5795
5790
5785
5780
5775
0
100
200
300
400
Station (ft)
Legend
EG 500-yr
EG 100-yr Floodway
EG 100-yr
WS 500-yr
EG 50-yr
WS 100-yr
WS 100-yr Floodway
WS 50-yr
EG 10-yr
WS 10-yr
EG 2-yr
WS 2-yr
Ground
Bank Sta
Encroachment

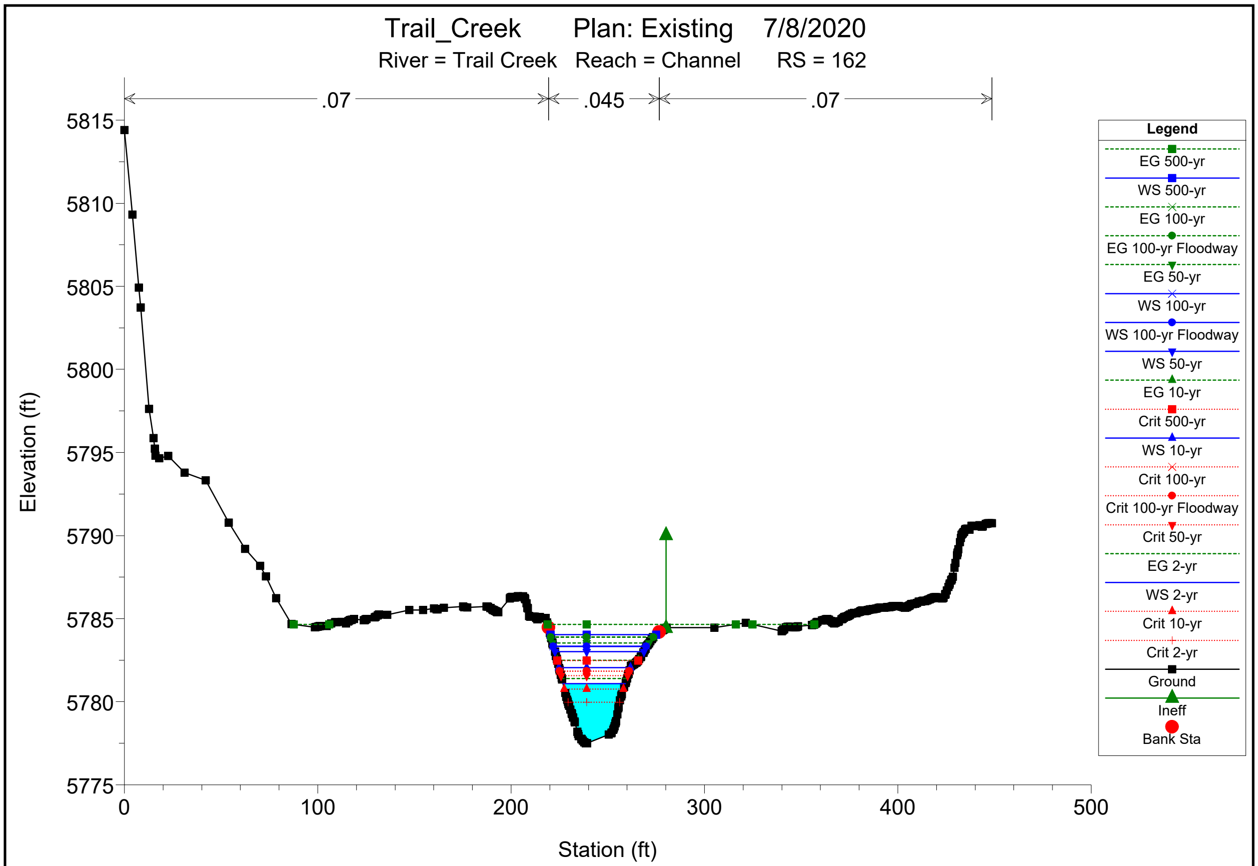

Trail_Creek Plan: Existing 7/8/2020
River = Trail Creek Reach = Channel RS = 482
.07
.045
.07
Elevation (ft)
5810
5805
5800
5795
5790
5785
5780
5775
0
50
100
150
200
250
300
Station (ft)
Legend
EG 500-yr
EG 100-yr
EG 100-yr Floodway
WS 500-yr
EG 50-yr
WS 100-yr
WS 100-yr Floodway
WS 50-yr
Crit 500-yr
EG 10-yr
WS 10-yr
Crit 100-yr Floodway
Crit 100-yr
Crit 50-yr
EG 2-yr
WS 2-yr
Crit 10-yr
Crit 2-yr
Ground
Ineff
Bank Sta
Encroachment



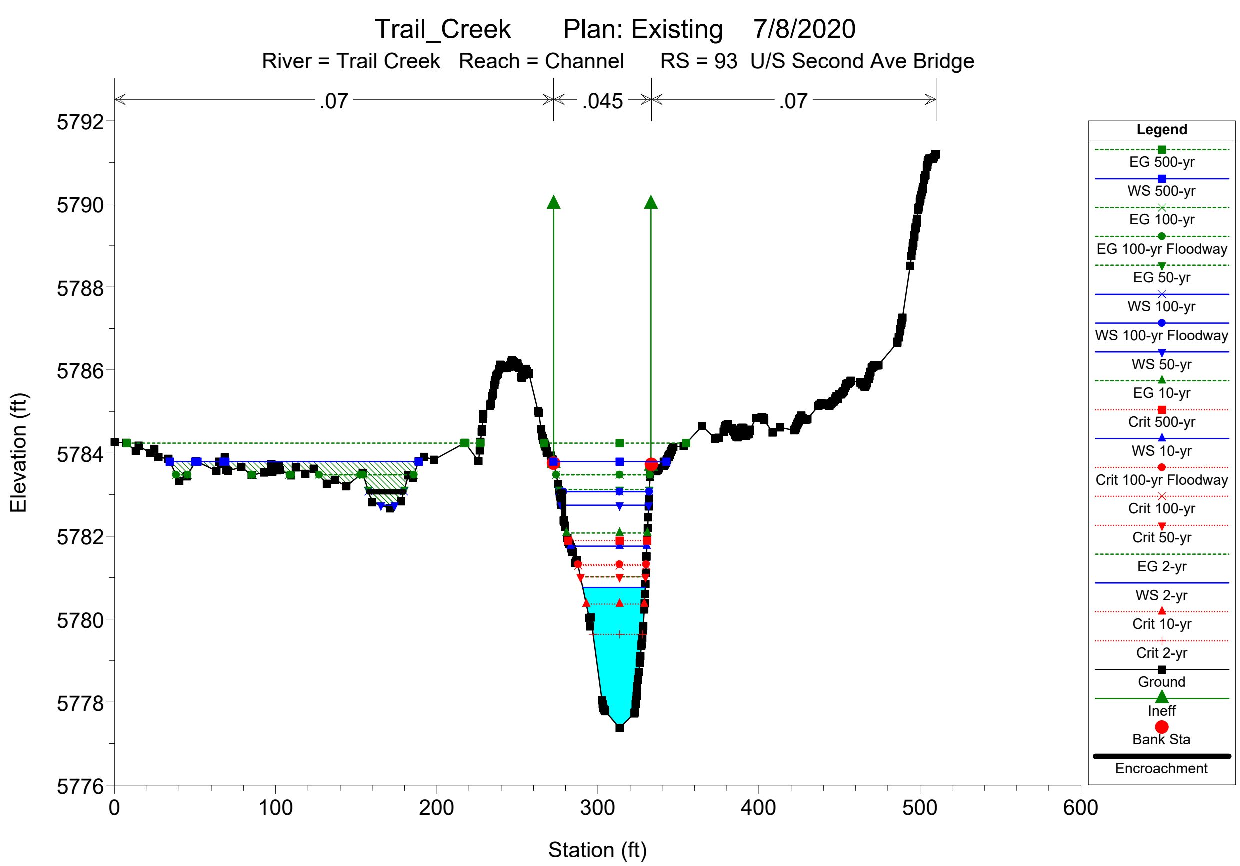
Trail_Creek Plan: Existing 7/8/2020
River = Trail Creek Reach = Channel RS = 376
.07
.045
.07
Elevation (ft)
Station (ft)
5810
5805
5800
5795
5790
5785
5780
5775
0
50
100
150
200
250
300
Legend
EG 500-yr
EG 100-yr
EG 100-yr Floodway
WS 500-yr
EG 50-yr
WS 100-yr
WS 100-yr Floodway
WS 50-yr
Crit 500-yr
EG 10-yr
WS 10-yr
Crit 100-yr
Crit 100-yr Floodway
Crit 50-yr
EG 2-yr
WS 2-yr
Crit 10-yr
Crit 2-yr
Ground
Ineff
Bank Sta



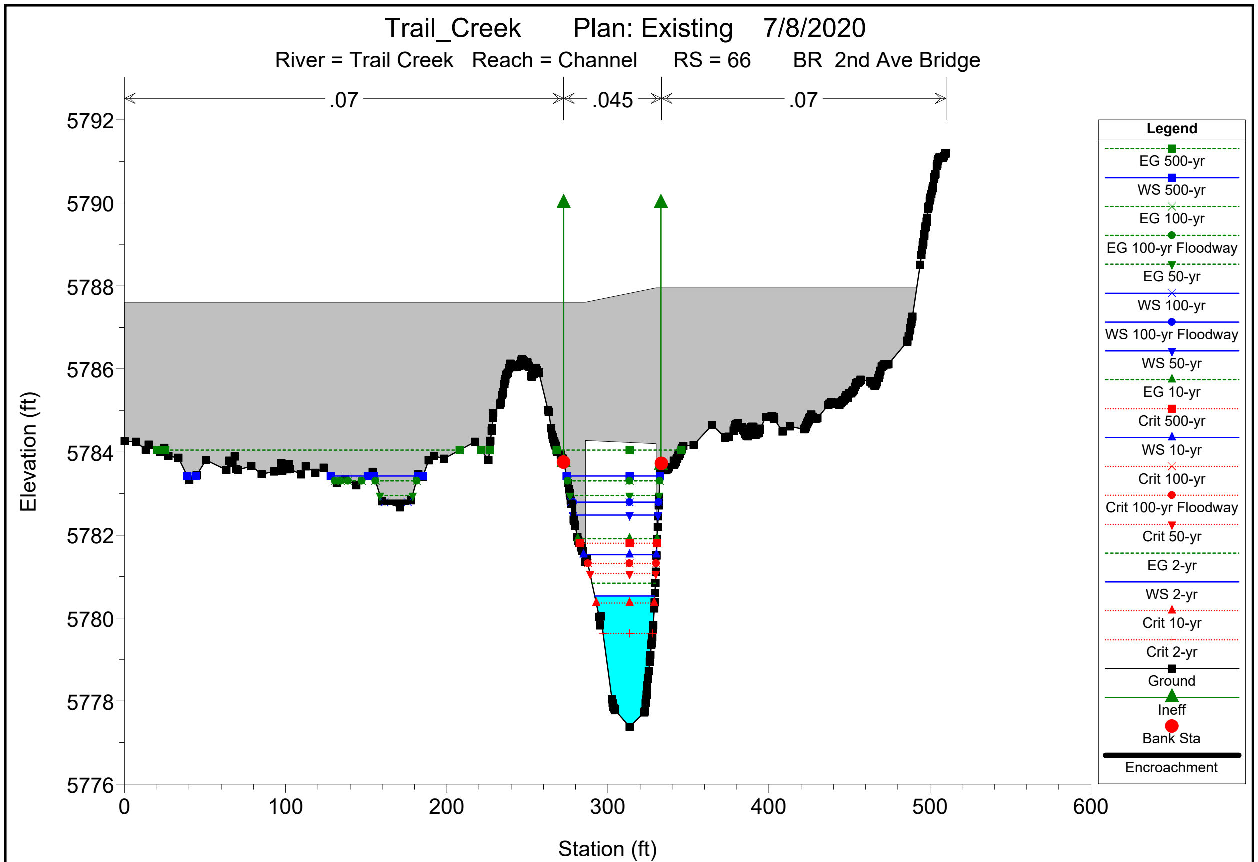
Trail_Creek Plan: Existing 7/8/2020
River = Trail Creek Reach = Channel RS = 241
.07
.045
.07
Elevation (ft)
Station (ft)
5800
5795
5790
5785
5780
5775
0
50
100
150
200
250
Legend
EG 500-yr
WS 500-yr
EG 100-yr
EG 100-yr Floodway
EG 50-yr
WS 100-yr
WS 100-yr Floodway
WS 50-yr
EG 10-yr
Crit 500-yr
WS 10-yr
Crit 100-yr Floodway
Crit 100-yr
Crit 50-yr
EG 2-yr
WS 2-yr
Crit 10-yr
Crit 2-yr
Ground
Ineff
Bank Sta

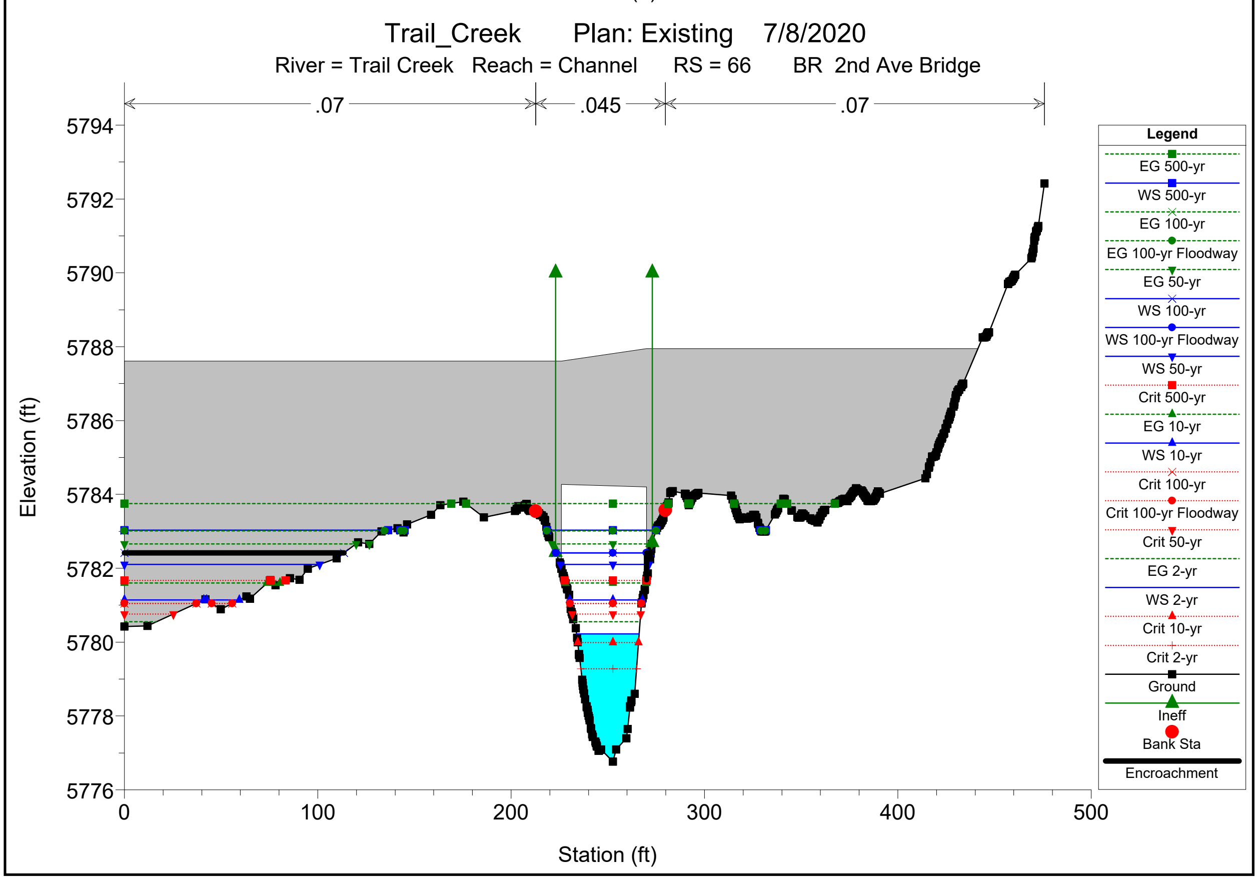


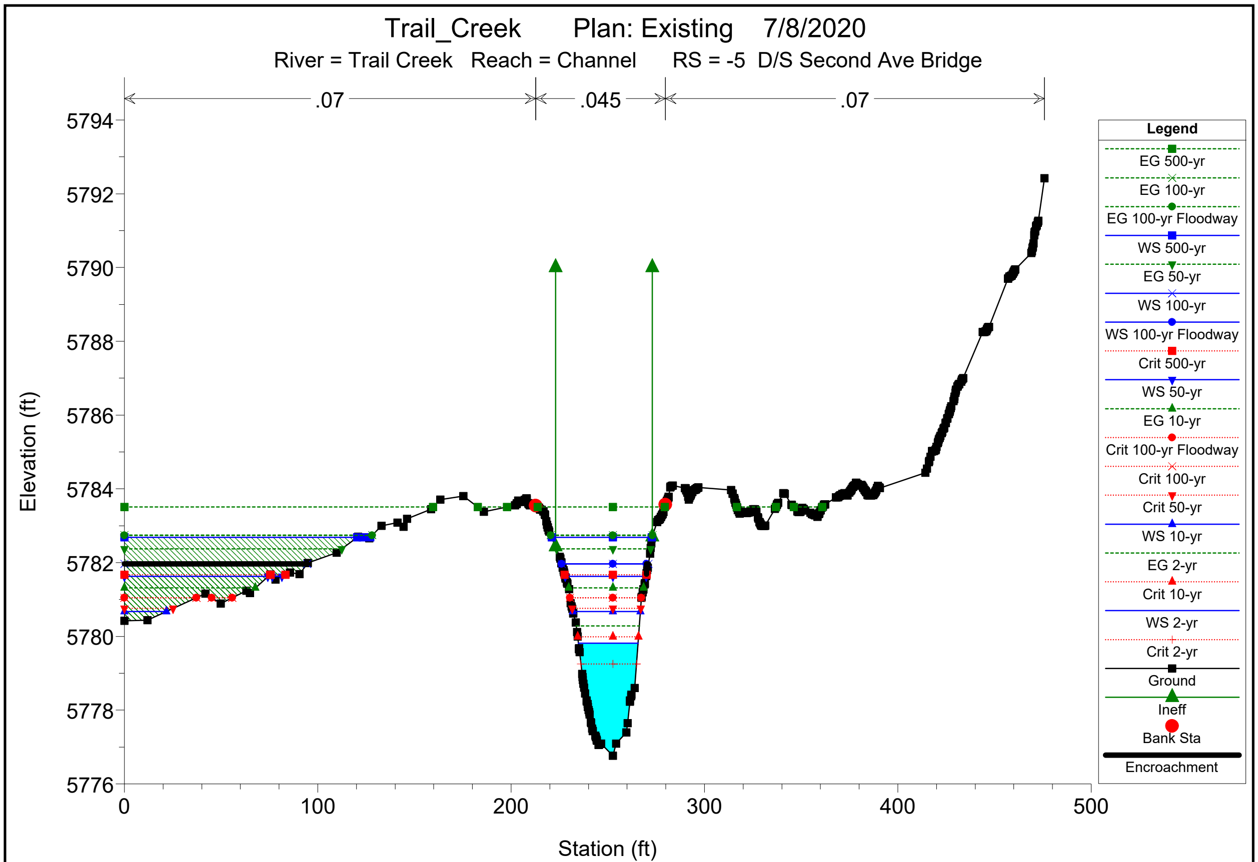
Trail_Creek Plan: Existing 7/8/2020
River = Trail Creek Reach = Channel RS = 162
.07
.045
.07
Elevation (ft)
Station (ft)
Legend
EG 500-yr
WS 500-yr
EG 100-yr
EG 100-yr Floodway
EG 50-yr
WS 100-yr
WS 100-yr Floodway
WS 50-yr
EG 10-yr
Crit 500-yr
WS 10-yr
Crit 100-yr
Crit 100-yr Floodway
Crit 50-yr
EG 2-yr
WS 2-yr
Crit 10-yr
Crit 2-yr
Ground
Ineff
Bank Sta



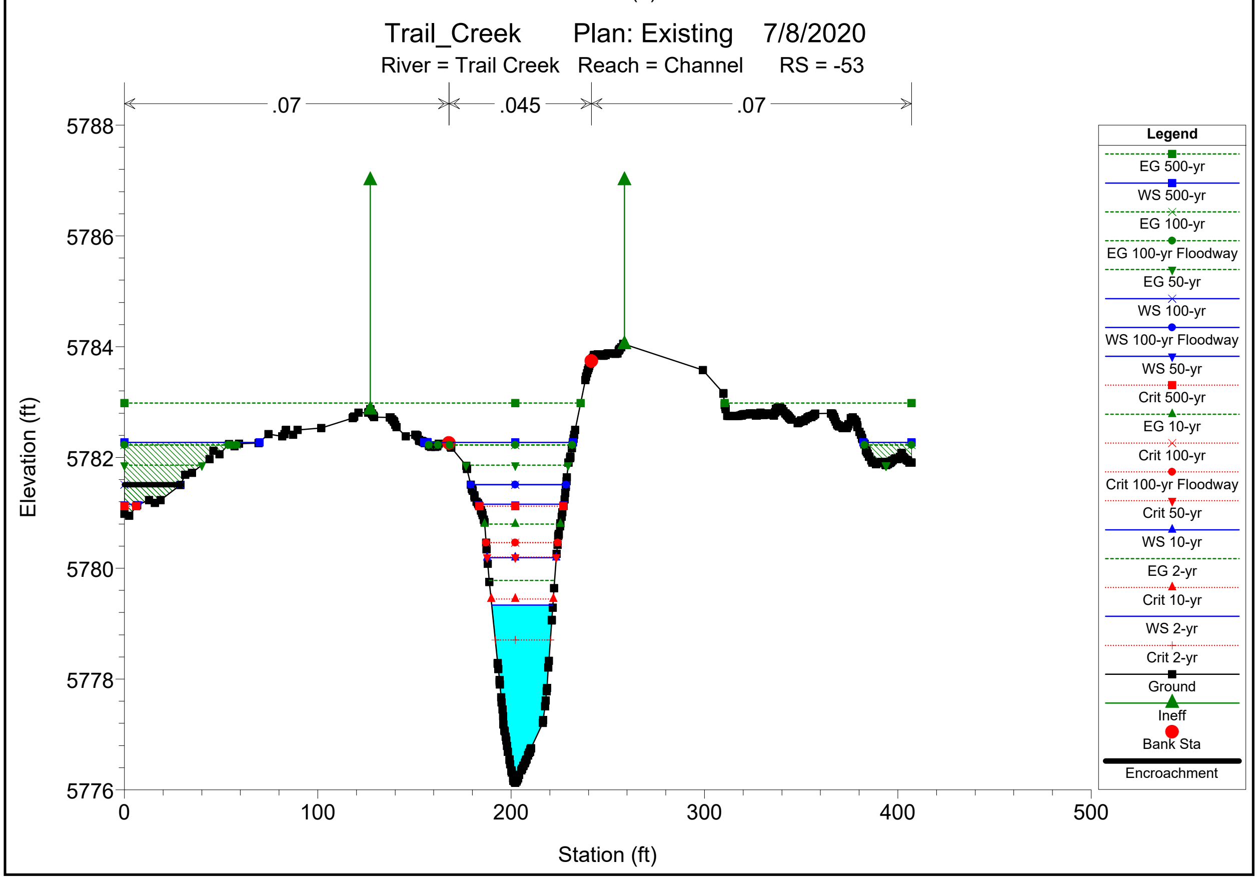
Trail_Creek Plan: Existing 7/8/2020
River = Trail Creek Reach = Channel RS = 93 U/S Second Ave Bridge
.07
.045
.07
Elevation (ft)
Station (ft)
Legend
EG 500-yr
WS 500-yr
EG 100-yr
EG 100-yr Floodway
EG 50-yr
WS 100-yr
WS 100-yr Floodway
WS 50-yr
EG 10-yr
Crit 500-yr
WS 10-yr
Crit 100-yr Floodway
Crit 100-yr
Crit 50-yr
EG 2-yr
WS 2-yr
Crit 10-yr
Crit 2-yr
Ground
Ineff
Bank Sta
Encroachment


Trail_Creek Plan: Existing 7/8/2020
River = Trail Creek Reach = Channel RS = 66 BR 2nd Ave Bridge
.07
.045
.07
Elevation (ft)
Station (ft)
Legend
EG 500-yr
WS 500-yr
EG 100-yr
EG 100-yr Floodway
EG 50-yr
WS 100-yr
WS 100-yr Floodway
WS 50-yr
EG 10-yr
Crit 500-yr
WS 10-yr
Crit 100-yr
Crit 100-yr Floodway
Crit 50-yr
EG 2-yr
WS 2-yr
Crit 10-yr
Crit 2-yr
Ground
Ineff
Bank Sta
Encroachment


Trail_Creek Plan: Existing 7/8/2020
River = Trail Creek Reach = Channel RS = 66 BR 2nd Ave Bridge
.07
.045
.07
Elevation (ft)
Station (ft)
Legend
EG 500-yr
WS 500-yr
EG 100-yr
EG 100-yr Floodway
EG 50-yr
WS 100-yr
WS 100-yr Floodway
WS 50-yr
Crit 500-yr
EG 10-yr
WS 10-yr
Crit 100-yr
Crit 100-yr Floodway
Crit 50-yr
EG 2-yr
WS 2-yr
Crit 10-yr
Crit 2-yr
Ground
Ineff
Bank Sta
Encroachment



Trail_Creek Plan: Existing 7/8/2020
River = Trail Creek Reach = Channel RS = -5 D/S Second Ave Bridge
.07
.045
.07
Elevation (ft)
Station (ft)
Legend
EG 500-yr
EG 100-yr
EG 100-yr Floodway
WS 500-yr
EG 50-yr
WS 100-yr
WS 100-yr Floodway
Crit 500-yr
WS 50-yr
EG 10-yr
Crit 100-yr Floodway
Crit 100-yr
Crit 50-yr
WS 10-yr
EG 2-yr
Crit 10-yr
WS 2-yr
Crit 2-yr
Ground
Ineff
Bank Sta
Encroachment



Trail_Creek Plan: Existing 7/8/2020
River = Trail Creek Reach = Channel RS = -53
.07
.045
.07
Elevation (ft)
Station (ft)
Legend
EG 500-yr
WS 500-yr
EG 100-yr
EG 100-yr Floodway
EG 50-yr
WS 100-yr
WS 100-yr Floodway
WS 50-yr
Crit 500-yr
EG 10-yr
Crit 100-yr
Crit 100-yr Floodway
Crit 50-yr
WS 10-yr
EG 2-yr
Crit 10-yr
WS 2-yr
Crit 2-yr
Ground
Ineff
Bank Sta
Encroachment

HEC-RAS Plan: Existing   River: Trail Creek   Reach: Channel

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)	
Channel	3694	2-yr	360.00	5811.17	5813.84	5813.39	5814.28	0.011864	5.31	67.76	35.87	0.68
Channel	3694	10-yr	600.00	5811.17	5814.70	5814.04	5815.27	0.010095	6.02	99.69	38.39	0.66
Channel	3694	50-yr	900.00	5811.17	5815.44	5814.69	5816.20	0.010613	7.00	128.52	40.66	0.69
Channel	3694	100-yr	1020.00	5811.17	5815.72	5814.94	5816.54	0.010514	7.27	140.38	41.63	0.70
Channel	3694	500-yr	1300.00	5811.17	5816.27	5815.46	5817.25	0.010930	7.95	163.42	43.38	0.72
Channel	3694	100-yr Floodway	1020.00	5811.17	5815.64	5814.88	5816.54	0.011556	7.59	134.36	38.62	0.72
Channel	3532	2-yr	360.00	5808.96	5812.14	5811.47	5812.56	0.009484	5.19	69.32	32.78	0.63
Channel	3532	10-yr	600.00	5808.96	5813.16	5812.24	5813.64	0.009621	5.56	107.99	46.86	0.65
Channel	3532	50-yr	900.00	5808.96	5814.15	5813.09	5814.63	0.007908	5.55	162.06	60.72	0.60
Channel	3532	100-yr	1020.00	5808.96	5814.54	5813.40	5815.00	0.007511	5.42	188.26	81.39	0.58
Channel	3532	500-yr	1300.00	5808.96	5815.32	5813.88	5815.73	0.006501	5.18	251.10	158.14	0.56
Channel	3532	100-yr Floodway	1020.00	5808.96	5814.48	5813.40	5814.97	0.007090	5.58	182.65	62.00	0.57
Channel	3422	2-yr	360.00	5807.75	5811.13	5810.36	5811.55	0.008821	5.22	69.03	30.37	0.61
Channel	3422	10-yr	600.00	5807.75	5812.01	5811.18	5812.60	0.009203	6.15	97.57	34.40	0.64
Channel	3422	50-yr	900.00	5807.75	5813.00	5811.95	5813.70	0.008545	6.72	133.86	84.14	0.64
Channel	3422	100-yr	1020.00	5807.75	5813.36	5812.23	5814.09	0.008515	6.89	147.95	105.24	0.64
Channel	3422	500-yr	1300.00	5807.75	5814.02	5812.81	5814.86	0.008947	7.33	177.23	145.27	0.66
Channel	3422	100-yr Floodway	1020.00	5807.75	5813.34	5812.23	5814.09	0.008589	6.92	147.43	41.15	0.64
Channel	3418		Bridge									
Channel	3404	2-yr	360.00	5807.59	5810.97	5810.04	5811.37	0.007440	5.02	71.67	29.17	0.57
Channel	3404	10-yr	600.00	5807.59	5811.81	5810.89	5812.40	0.008750	6.15	97.57	32.95	0.63
Channel	3404	50-yr	900.00	5807.59	5812.81	5811.71	5813.52	0.008576	6.76	133.20	92.16	0.64
Channel	3404	100-yr	1020.00	5807.59	5813.15	5811.98	5813.90	0.009071	6.95	146.75	108.78	0.66
Channel	3404	500-yr	1300.00	5807.59	5813.80	5812.61	5814.65	0.009373	7.37	176.41	139.64	0.68
Channel	3404	100-yr Floodway	1020.00	5807.59	5813.13	5811.98	5813.89	0.009175	6.98	146.06	42.24	0.66
Channel	3304	2-yr	360.00	5807.12	5810.27	5809.36	5810.54	0.007867	4.14	86.87	50.67	0.56
Channel	3304	10-yr	600.00	5807.12	5811.35	5810.20	5811.62	0.004659	4.15	144.41	56.34	0.46
Channel	3304	50-yr	900.00	5807.12	5812.53	5810.71	5812.80	0.003299	4.19	214.68	114.70	0.40
Channel	3304	100-yr	1020.00	5807.12	5812.87	5810.92	5813.16	0.003229	4.30	237.19	139.53	0.40
Channel	3304	500-yr	1300.00	5807.12	5813.53	5811.35	5813.86	0.003417	4.56	285.71	195.58	0.42
Channel	3304	100-yr Floodway	1020.00	5807.12	5812.86	5810.92	5813.16	0.003176	4.38	232.79	61.19	0.40
Channel	3252	2-yr	360.00	5805.81	5809.82	5808.59	5810.18	0.005756	4.83	74.59	25.23	0.49
Channel	3252	10-yr	600.00	5805.81	5810.69	5809.43	5811.28	0.007457	6.15	97.56	27.51	0.58
Channel	3252	50-yr	900.00	5805.81	5811.77	5810.33	5812.48	0.009328	6.76	133.13	55.16	0.65
Channel	3252	100-yr	1020.00	5805.81	5812.07	5810.64	5812.83	0.009965	7.01	145.50	76.21	0.67
Channel	3252	500-yr	1300.00	5805.81	5812.57	5811.55	5813.50	0.010813	7.72	169.42	157.10	0.71
Channel	3252	100-yr Floodway	1020.00	5805.81	5812.07	5810.66	5812.83	0.009959	7.01	145.54	47.64	0.67
Channel	3189	2-yr	360.00	5806.17	5809.29	5808.66	5809.72	0.009592	5.25	68.64	32.04	0.63
Channel	3189	10-yr	600.00	5806.17	5810.19	5809.39	5810.75	0.009251	6.03	99.46	36.38	0.64
Channel	3189	50-yr	900.00	5806.17	5811.31	5810.13	5811.89	0.008443	6.07	149.81	60.42	0.62
Channel	3189	100-yr	1020.00	5806.17	5811.66	5810.40	5812.24	0.007483	6.12	171.93	113.67	0.60
Channel	3189	500-yr	1300.00	5806.17	5812.23	5811.14	5812.88	0.007102	6.55	211.35	165.84	0.59
Channel	3189	100-yr Floodway	1020.00	5806.17	5811.65	5810.36	5812.24	0.007585	6.18	167.31	54.61	0.60
Channel	3140	2-yr	360.00	5804.97	5808.89	5808.08	5809.28	0.007786	4.98	72.32	31.00	0.57
Channel	3140	10-yr	600.00	5804.97	5809.77	5808.83	5810.32	0.008256	5.93	101.20	34.64	0.61
Channel	3140	50-yr	900.00	5804.97	5810.83	5809.60	5811.45	0.009057	6.33	142.16	47.56	0.65
Channel	3140	100-yr	1020.00	5804.97	5811.23	5809.87	5811.84	0.008582	6.28	162.52	53.02	0.63
Channel	3140	500-yr	1300.00	5804.97	5811.80	5810.54	5812.49	0.008224	6.69	197.52	68.22	0.63
Channel	3140	100-yr Floodway	1020.00	5804.97	5811.23	5809.88	5811.84	0.008582	6.28	162.52	53.02	0.63
Channel	3008	2-yr	360.00	5805.03	5807.73	5807.10	5808.15	0.009400	5.19	69.41	32.58	0.63
Channel	3008	10-yr	600.00	5805.03	5808.63	5807.82	5809.19	0.008966	6.00	100.01	36.13	0.64
Channel	3008	50-yr	900.00	5805.03	5809.62	5808.55	5810.28	0.008718	6.52	138.08	48.25	0.64
Channel	3008	100-yr	1020.00	5805.03	5810.05	5808.80	5810.69	0.008858	6.42	158.97	71.26	0.64
Channel	3008	500-yr	1300.00	5805.03	5810.80	5809.35	5811.47	0.007247	6.56	198.26	83.50	0.60
Channel	3008	100-yr Floodway	1020.00	5805.03	5810.06	5808.80	5810.69	0.008840	6.41	159.07	63.61	0.64
Channel	2881	2-yr	360.00	5803.55	5806.43	5805.84	5806.90	0.010200	5.52	65.25	29.45	0.65
Channel	2881	10-yr	600.00	5803.55	5807.45	5806.59	5808.04	0.008987	6.18	97.15	33.33	0.64
Channel	2881	50-yr	900.00	5803.55	5808.55	5807.37	5809.23	0.007851	6.59	136.54	38.05	0.61
Channel	2881	100-yr	1020.00	5803.55	5808.95	5807.66	5809.65	0.007586	6.71	152.02	40.16	0.61
Channel	2881	500-yr	1300.00	5803.55	5809.81	5808.25	5810.54	0.007264	6.84	189.94	47.36	0.60
Channel	2881	100-yr Floodway	1020.00	5803.55	5808.96	5807.66	5809.65	0.007549	6.70	152.34	40.22	0.61
Channel	2815	2-yr	360.00	5800.87	5806.25	5804.65	5806.47	0.003379	3.75	96.01	32.93	0.39
Channel	2815	10-yr	600.00	5800.87	5807.28	5805.46	5807.60	0.003666	4.58	130.97	35.35	0.42
Channel	2815	50-yr	900.00	5800.87	5808.39	5806.20	5808.82	0.003486	5.30	169.84	37.83	0.42
Channel	2815	100-yr	1020.00	5800.87	5808.78	5806.45	5809.26	0.003460	5.56	183.50	38.76	0.43
Channel	2815	500-yr	1300.00	5800.87	5809.60	5807.03	5810.18	0.003460	6.13	212.24	40.72	0.44
Channel	2815	100-yr Floodway	1020.00	5800.87	5808.78	5806.43	5809.26	0.003444	5.55	183.75	38.78	0.43
Channel	2810		Bridge									

HEC-RAS Plan: Existing River: Trail Creek Reach: Channel (Continued)

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)	
Channel	2769	2-yr	360.00	5802.88	5805.53	5805.15	5806.08	0.014032	5.99	60.11	30.79	0.76
Channel	2769	10-yr	600.00	5802.88	5806.53	5805.89	5807.17	0.010538	6.40	93.78	37.69	0.69
Channel	2769	50-yr	900.00	5802.88	5807.56	5806.59	5808.31	0.008062	6.94	129.62	42.40	0.64
Channel	2769	100-yr	1020.00	5802.88	5807.89	5806.84	5808.70	0.007781	7.22	141.22	43.88	0.63
Channel	2769	500-yr	1300.00	5802.88	5808.53	5807.35	5809.51	0.007728	7.94	163.68	46.23	0.65
Channel	2769	100-yr Floodway	1020.00	5802.88	5807.90	5806.85	5808.71	0.008241	7.24	140.91	36.10	0.63
Channel	2680	2-yr	360.00	5801.68	5804.75	5803.83	5805.12	0.007042	4.90	73.51	29.71	0.55
Channel	2680	10-yr	600.00	5801.68	5805.92	5804.61	5806.37	0.006045	5.42	110.62	33.81	0.53
Channel	2680	50-yr	900.00	5801.68	5807.03	5805.39	5807.58	0.006047	5.97	150.69	39.92	0.54
Channel	2680	100-yr	1020.00	5801.68	5807.37	5805.69	5807.97	0.006248	6.20	164.57	47.86	0.55
Channel	2680	500-yr	1300.00	5801.68	5808.07	5806.25	5808.77	0.005857	6.70	194.08	67.40	0.55
Channel	2680	100-yr Floodway	1020.00	5801.68	5807.36	5805.69	5807.96	0.006280	6.21	164.32	46.65	0.55
Channel	2550	2-yr	360.00	5798.62	5803.62	5802.49	5804.10	0.008794	5.58	64.53	23.48	0.59
Channel	2550	10-yr	600.00	5798.62	5804.83	5803.60	5805.41	0.009282	6.09	98.47	33.54	0.63
Channel	2550	50-yr	900.00	5798.62	5806.08	5804.66	5806.65	0.008674	6.07	148.37	49.56	0.62
Channel	2550	100-yr	1020.00	5798.62	5806.48	5805.03	5807.05	0.008035	6.04	168.96	53.91	0.60
Channel	2550	500-yr	1300.00	5798.62	5807.41	5805.67	5807.93	0.006249	5.78	225.82	68.84	0.54
Channel	2550	100-yr Floodway	1020.00	5798.62	5806.47	5805.02	5807.04	0.007994	6.09	167.57	51.83	0.60
Channel	2439	2-yr	360.00	5797.78	5802.20	5801.64	5802.87	0.013964	6.54	55.05	22.66	0.74
Channel	2439	10-yr	600.00	5797.78	5803.01	5802.62	5804.02	0.016429	8.08	74.26	24.80	0.82
Channel	2439	50-yr	900.00	5797.78	5803.76	5803.51	5805.20	0.018794	9.63	93.47	26.06	0.90
Channel	2439	100-yr	1020.00	5797.78	5804.06	5803.82	5805.63	0.019105	10.07	101.24	26.51	0.91
Channel	2439	500-yr	1300.00	5797.78	5805.83	5804.50	5806.98	0.010722	8.58	151.49	37.17	0.70
Channel	2439	100-yr Floodway	1020.00	5797.78	5804.04	5803.82	5805.63	0.019269	10.10	100.95	26.50	0.91
Channel	2415	2-yr	360.00	5798.48	5802.06	5801.38	5802.52	0.009819	5.46	65.95	29.23	0.64
Channel	2415	10-yr	600.00	5798.48	5802.97	5802.17	5803.60	0.009849	6.36	94.35	32.80	0.66
Channel	2415	50-yr	900.00	5798.48	5803.90	5802.98	5804.69	0.009485	7.15	125.83	35.11	0.67
Channel	2415	100-yr	1020.00	5798.48	5804.26	5803.25	5805.10	0.009145	7.35	138.80	35.97	0.66
Channel	2415	500-yr	1300.00	5798.48	5806.04	5803.82	5806.65	0.004605	6.31	206.15	40.54	0.49
Channel	2415	100-yr Floodway	1020.00	5798.48	5804.25	5803.21	5805.10	0.009184	7.37	138.43	35.77	0.66
Channel	2407		Bridge									
Channel	2389	2-yr	360.00	5798.91	5801.64	5801.19	5802.20	0.012621	5.97	60.28	28.20	0.72
Channel	2389	10-yr	600.00	5798.91	5802.51	5801.97	5803.26	0.012498	6.98	85.90	31.22	0.74
Channel	2389	50-yr	900.00	5798.91	5803.38	5802.76	5804.34	0.012320	7.86	114.54	34.20	0.76
Channel	2389	100-yr	1020.00	5798.91	5803.73	5803.03	5804.74	0.011597	8.06	126.56	35.49	0.74
Channel	2389	500-yr	1300.00	5798.91	5805.76	5803.62	5806.43	0.004356	6.55	198.49	46.70	0.49
Channel	2389	100-yr Floodway	1020.00	5798.91	5803.71	5803.04	5804.73	0.011777	8.10	125.94	35.43	0.75
Channel	2300	2-yr	360.00	5797.77	5801.02	5800.14	5801.33	0.006695	4.44	81.14	37.45	0.53
Channel	2300	10-yr	600.00	5797.77	5802.05	5800.82	5802.42	0.005739	4.86	123.46	44.08	0.51
Channel	2300	50-yr	900.00	5797.77	5803.09	5801.53	5803.52	0.004989	5.25	171.34	48.69	0.49
Channel	2300	100-yr	1020.00	5797.77	5803.51	5801.80	5803.95	0.004644	5.30	192.36	51.02	0.48
Channel	2300	500-yr	1300.00	5797.77	5805.84	5802.30	5806.08	0.001604	3.99	328.18	96.39	0.30
Channel	2300	100-yr Floodway	1020.00	5797.77	5803.50	5801.77	5803.95	0.004514	5.38	189.42	46.47	0.47
Channel	2247	2-yr	360.00	5797.23	5800.60	5799.90	5800.92	0.008403	4.60	78.26	40.91	0.59
Channel	2247	10-yr	600.00	5797.23	5801.80	5800.58	5802.11	0.005405	4.47	134.36	52.62	0.49
Channel	2247	50-yr	900.00	5797.23	5802.93	5801.23	5803.25	0.003975	4.51	199.36	61.49	0.44
Channel	2247	100-yr	1020.00	5797.23	5803.39	5801.45	5803.70	0.003352	4.48	230.09	71.00	0.41
Channel	2247	500-yr	1300.00	5797.23	5805.84	5801.92	5805.99	0.000920	3.24	449.27	114.45	0.23
Channel	2247	100-yr Floodway	1020.00	5797.23	5803.30	5801.43	5803.71	0.003937	5.14	198.56	45.00	0.43
Channel	2205	2-yr	360.00	5796.09	5799.89	5799.37	5800.46	0.013168	6.10	59.00	27.68	0.74
Channel	2205	10-yr	600.00	5796.09	5801.27	5800.24	5801.81	0.008114	5.91	101.55	34.44	0.61
Channel	2205	50-yr	900.00	5796.09	5802.40	5801.07	5803.00	0.007310	6.21	145.00	42.29	0.59
Channel	2205	100-yr	1020.00	5796.09	5802.91	5801.35	5803.48	0.006872	6.07	168.14	48.65	0.58
Channel	2205	500-yr	1300.00	5796.09	5805.65	5801.98	5805.93	0.001595	4.29	303.00	114.24	0.31
Channel	2205	100-yr Floodway	1020.00	5796.09	5802.91	5801.36	5803.48	0.006872	6.07	168.14	48.65	0.58
Channel	2147	2-yr	360.00	5795.03	5799.61	5798.15	5799.91	0.004495	4.35	82.74	27.45	0.44
Channel	2147	10-yr	600.00	5795.03	5801.04	5799.01	5801.40	0.003902	4.80	124.95	31.61	0.43
Channel	2147	50-yr	900.00	5795.03	5802.14	5799.85	5802.62	0.004385	5.57	161.55	35.55	0.46
Channel	2147	100-yr	1020.00	5795.03	5802.64	5800.17	5803.14	0.004219	5.67	179.91	37.44	0.46
Channel	2147	500-yr	1300.00	5795.03	5805.54	5800.81	5805.84	0.001563	4.38	296.88	76.89	0.29
Channel	2147	100-yr Floodway	1020.00	5795.03	5802.64	5800.13	5803.14	0.004219	5.67	179.91	37.44	0.46
Channel	2135		Bridge									
Channel	2075	2-yr	360.00	5795.28	5798.71	5797.81	5799.11	0.006460	5.07	71.06	31.48	0.54
Channel	2075	10-yr	600.00	5795.28	5799.48	5798.53	5800.16	0.007856	6.59	91.04	40.44	0.62
Channel	2075	50-yr	900.00	5795.28	5800.21	5799.34	5801.25	0.009417	8.18	109.97	45.85	0.70
Channel	2075	100-yr	1020.00	5795.28	5800.47	5799.64	5801.66	0.009938	8.74	116.64	47.80	0.73
Channel	2075	500-yr	1300.00	5795.28	5800.99	5800.27	5802.54	0.011163	9.98	130.29	53.40	0.79
Channel	2075	100-yr Floodway	1020.00	5795.28	5800.50	5799.64	5801.67	0.009696	8.68	117.51	41.53	0.72

HEC-RAS Plan: Existing River: Trail Creek Reach: Channel (Continued)

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)	
Channel	1984	2-yr	360.00	5794.97	5798.01	5797.48	5798.36	0.009728	4.74	75.92	42.61	0.63
Channel	1984	10-yr	600.00	5794.97	5798.73	5798.09	5799.20	0.009920	5.53	108.57	49.03	0.65
Channel	1984	50-yr	900.00	5794.97	5799.45	5798.71	5800.04	0.009491	6.18	145.70	53.71	0.66
Channel	1984	100-yr	1020.00	5794.97	5799.71	5798.88	5800.34	0.009351	6.38	159.98	55.58	0.66
Channel	1984	500-yr	1300.00	5794.97	5800.29	5799.35	5800.99	0.008476	6.73	195.94	88.60	0.65
Channel	1984	100-yr Floodway	1020.00	5794.97	5799.74	5798.87	5800.44	0.009154	6.67	153.01	47.23	0.65
Channel	1824	2-yr	360.00	5793.50	5796.05	5795.70	5796.53	0.013546	5.56	64.71	36.50	0.74
Channel	1824	10-yr	600.00	5793.50	5796.88	5796.35	5797.48	0.011576	6.22	96.48	40.69	0.71
Channel	1824	50-yr	900.00	5793.50	5797.73	5797.02	5798.44	0.010400	6.75	133.38	45.75	0.70
Channel	1824	100-yr	1020.00	5793.50	5798.03	5797.22	5798.77	0.010091	6.92	147.31	47.46	0.69
Channel	1824	500-yr	1300.00	5793.50	5798.72	5797.76	5799.50	0.010098	7.09	183.44	57.23	0.70
Channel	1824	100-yr Floodway	1020.00	5793.50	5798.03	5797.24	5798.87	0.010253	7.35	138.83	39.02	0.69
Channel	1769	2-yr	360.00	5792.44	5795.57	5794.85	5795.93	0.008224	4.82	74.76	35.62	0.59
Channel	1769	10-yr	600.00	5792.44	5796.43	5795.54	5796.92	0.008118	5.57	107.65	40.60	0.60
Channel	1769	50-yr	900.00	5792.44	5797.32	5796.26	5797.92	0.007630	6.17	145.81	44.56	0.60
Channel	1769	100-yr	1020.00	5792.44	5797.63	5796.49	5798.26	0.007557	6.39	159.57	45.75	0.60
Channel	1769	500-yr	1300.00	5792.44	5798.29	5796.97	5799.01	0.007395	6.82	190.75	70.89	0.61
Channel	1769	100-yr Floodway	1020.00	5792.44	5797.60	5796.52	5798.32	0.008565	6.80	149.91	41.07	0.63
Channel	1719	2-yr	360.00	5791.53	5795.02	5794.45	5795.45	0.010488	5.31	67.82	32.89	0.65
Channel	1719	10-yr	600.00	5791.53	5795.83	5795.15	5796.44	0.010353	6.24	96.09	35.90	0.67
Channel	1719	50-yr	900.00	5791.53	5796.69	5795.87	5797.46	0.010004	7.04	127.83	38.53	0.68
Channel	1719	100-yr	1020.00	5791.53	5796.96	5796.13	5797.80	0.010154	7.38	138.26	39.12	0.69
Channel	1719	500-yr	1300.00	5791.53	5797.53	5796.68	5798.54	0.010486	8.07	161.04	56.75	0.71
Channel	1719	100-yr Floodway	1020.00	5791.53	5796.99	5796.06	5797.84	0.009994	7.41	137.57	37.05	0.68
Channel	1524	2-yr	360.00	5789.62	5792.78	5792.16	5793.30	0.011546	5.78	62.33	28.35	0.69
Channel	1524	10-yr	600.00	5789.62	5793.82	5793.04	5794.44	0.010103	6.33	94.75	33.90	0.67
Channel	1524	50-yr	900.00	5789.62	5794.94	5793.81	5795.61	0.008634	6.58	136.72	178.40	0.64
Channel	1524	100-yr	1020.00	5789.62	5795.31	5794.14	5796.01	0.007980	6.71	152.54	202.29	0.62
Channel	1524	500-yr	1300.00	5789.62	5796.10	5794.71	5796.86	0.006630	6.98	189.67	259.64	0.59
Channel	1524	100-yr Floodway	1020.00	5789.62	5795.29	5794.10	5796.04	0.008238	6.94	147.30	44.30	0.62
Channel	1463	2-yr	360.00	5787.08	5792.32	5791.04	5792.73	0.006894	5.13	70.22	24.26	0.53
Channel	1463	10-yr	600.00	5787.08	5793.25	5792.07	5793.88	0.008508	6.38	94.11	31.16	0.61
Channel	1463	50-yr	900.00	5787.08	5794.19	5793.02	5795.05	0.009475	7.41	121.48	103.48	0.65
Channel	1463	100-yr	1020.00	5787.08	5794.53	5793.35	5795.46	0.009434	7.73	132.71	160.20	0.66
Channel	1463	500-yr	1300.00	5787.08	5795.29	5794.06	5796.36	0.008762	8.32	158.94	253.01	0.65
Channel	1463	100-yr Floodway	1020.00	5787.08	5794.53	5793.27	5795.48	0.009793	7.80	131.39	39.47	0.66
Channel	1414	2-yr	360.00	5788.70	5791.79	5791.22	5792.30	0.011112	5.75	62.56	27.95	0.68
Channel	1414	10-yr	600.00	5788.70	5792.73	5792.01	5793.42	0.010441	6.66	90.03	30.26	0.68
Channel	1414	50-yr	900.00	5788.70	5793.72	5792.80	5794.58	0.009811	7.43	121.07	32.37	0.68
Channel	1414	100-yr	1020.00	5788.70	5794.07	5793.03	5794.99	0.009662	7.69	132.72	33.20	0.68
Channel	1414	500-yr	1300.00	5788.70	5794.90	5793.68	5795.90	0.009491	8.05	161.45	106.32	0.68
Channel	1414	100-yr Floodway	1020.00	5788.70	5794.08	5793.08	5795.00	0.009554	7.67	132.95	32.78	0.67
Channel	1349	2-yr	360.00	5787.23	5791.29	5790.10	5791.71	0.007022	5.23	68.90	24.05	0.54
Channel	1349	10-yr	600.00	5787.23	5792.01	5791.11	5792.75	0.010189	6.88	87.20	26.46	0.67
Channel	1349	50-yr	900.00	5787.23	5792.67	5792.03	5793.80	0.013690	8.54	105.35	28.71	0.79
Channel	1349	100-yr	1020.00	5787.23	5792.89	5792.26	5794.18	0.014981	9.13	111.70	29.43	0.83
Channel	1349	500-yr	1300.00	5787.23	5793.38	5793.03	5795.01	0.018229	10.26	126.76	48.34	0.92
Channel	1349	100-yr Floodway	1020.00	5787.23	5793.06	5792.38	5794.24	0.013315	8.73	116.82	30.12	0.78
Channel	1239	2-yr	360.00	5787.81	5790.77	5789.80	5791.00	0.004915	3.87	93.80	59.26	0.46
Channel	1239	10-yr	600.00	5787.81	5791.42	5790.42	5791.79	0.005829	4.94	122.88	67.63	0.52
Channel	1239	50-yr	900.00	5787.81	5792.04	5791.02	5792.60	0.006654	6.03	151.93	73.15	0.58
Channel	1239	100-yr	1020.00	5787.81	5792.24	5791.23	5792.88	0.006993	6.43	161.87	74.32	0.60
Channel	1239	500-yr	1300.00	5787.81	5792.68	5791.68	5793.50	0.007703	7.29	183.15	76.74	0.64
Channel	1239	100-yr Floodway	1020.00	5787.81	5792.64	5791.23	5793.16	0.005226	5.83	176.72	66.24	0.51
Channel	1200	2-yr	360.00	5786.77	5790.46		5790.76	0.007767	4.34	82.95	44.52	0.56
Channel	1200	10-yr	600.00	5786.77	5791.02		5791.50	0.009151	5.54	109.29	49.70	0.63
Channel	1200	50-yr	900.00	5786.77	5791.56		5792.26	0.010493	6.74	137.21	54.88	0.70
Channel	1200	100-yr	1020.00	5786.77	5791.73		5792.53	0.011081	7.19	146.67	56.35	0.72
Channel	1200	500-yr	1300.00	5786.77	5792.08		5793.10	0.012359	8.17	166.88	58.47	0.78
Channel	1200	100-yr Floodway	1020.00	5786.77	5792.37		5792.93	0.006507	6.01	169.68	45.71	0.55
Channel	1114	2-yr	360.00	5786.95	5789.69		5789.97	0.010840	4.23	85.01	61.31	0.63
Channel	1114	10-yr	600.00	5786.95	5790.16		5790.59	0.012193	5.23	114.73	65.76	0.70
Channel	1114	50-yr	900.00	5786.95	5790.64		5791.22	0.013222	6.08	148.01	71.80	0.75
Channel	1114	100-yr	1020.00	5786.95	5790.81		5791.44	0.013348	6.39	159.69	72.40	0.76
Channel	1114	500-yr	1300.00	5786.95	5791.18		5791.93	0.013236	6.97	186.61	73.58	0.77
Channel	1114	100-yr Floodway	1020.00	5786.95	5791.84		5792.37	0.006416	5.83	174.97	47.00	0.53
Channel	1050	2-yr	360.00	5786.60	5788.88		5789.18	0.014416	4.34	83.02	71.48	0.71
Channel	1050	10-yr	600.00	5786.60	5789.34		5789.76	0.013725	5.16	116.35	74.30	0.73
Channel	1050	50-yr	900.00	5786.60	5789.83		5790.36	0.013086	5.87	153.24	77.49	0.74
Channel	1050	100-yr	1020.00	5786.60	5790.02		5790.59	0.012652	6.08	167.90	78.60	0.73

HEC-RAS Plan: Existing River: Trail Creek Reach: Channel (Continued)

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)	
Channel	1050	500-yr	1300.00	5786.60	5790.46		5791.09	0.011731	6.37	204.03	83.91	0.72
Channel	1050	100-yr Floodway	1020.00	5786.62	5790.32	5790.32	5791.56	0.026717	8.93	114.21	46.82	1.01
Channel	958	2-yr	360.00	5785.00	5787.74	5787.20	5788.01	0.011265	4.14	86.85	66.27	0.64
Channel	958	10-yr	600.00	5785.00	5788.32	5787.80	5788.67	0.009996	4.72	127.22	73.03	0.63
Channel	958	50-yr	900.00	5785.00	5789.02	5788.26	5789.40	0.007850	4.99	180.33	79.11	0.58
Channel	958	100-yr	1020.00	5785.00	5789.28	5788.42	5789.68	0.007242	5.07	201.09	80.86	0.57
Channel	958	500-yr	1300.00	5785.00	5789.87	5788.77	5790.29	0.005919	5.20	249.81	84.46	0.53
Channel	958	100-yr Floodway	1020.00	5785.00	5789.26	5788.43	5789.75	0.008120	5.66	180.19	63.21	0.59
Channel	936	2-yr	360.00	5785.06	5787.52		5787.78	0.008223	4.09	88.09	54.58	0.57
Channel	936	10-yr	600.00	5785.06	5788.01		5788.43	0.010089	5.20	115.30	57.80	0.65
Channel	936	50-yr	900.00	5785.06	5788.67		5789.20	0.009079	5.81	155.46	65.29	0.64
Channel	936	100-yr	1020.00	5785.06	5788.92		5789.48	0.008505	5.99	172.49	70.56	0.63
Channel	936	500-yr	1300.00	5785.06	5789.52		5790.12	0.007146	6.24	215.64	73.72	0.60
Channel	936	100-yr Floodway	1020.00	5785.06	5789.08		5789.58	0.007136	5.68	179.78	61.21	0.58
Channel	842	2-yr	360.00	5783.60	5785.74	5785.74	5786.45	0.027415	6.75	53.34	38.47	1.01
Channel	842	10-yr	600.00	5783.60	5786.88		5787.41	0.011679	5.84	102.66	47.99	0.70
Channel	842	50-yr	900.00	5783.60	5787.94		5788.43	0.007246	5.61	164.72	66.28	0.58
Channel	842	100-yr	1020.00	5783.60	5788.30		5788.78	0.006244	5.63	188.64	68.25	0.55
Channel	842	500-yr	1300.00	5783.60	5789.04		5789.54	0.004960	5.76	240.50	71.66	0.51
Channel	842	100-yr Floodway	1020.00	5783.60	5788.35		5788.91	0.007034	6.00	170.07	48.82	0.57
Channel	784	2-yr	360.00	5780.62	5785.49		5785.75	0.004572	4.10	87.87	33.14	0.44
Channel	784	10-yr	600.00	5780.62	5786.61		5786.95	0.004504	4.68	128.10	39.04	0.46
Channel	784	50-yr	900.00	5780.62	5787.68		5788.09	0.004165	5.20	175.46	50.35	0.45
Channel	784	100-yr	1020.00	5780.62	5788.03		5788.49	0.004007	5.40	194.54	56.33	0.45
Channel	784	500-yr	1300.00	5780.62	5788.78		5789.29	0.003754	5.79	244.50	76.20	0.45
Channel	784	100-yr Floodway	1020.00	5780.62	5788.04		5788.57	0.004829	5.85	174.26	36.08	0.47
Channel	643	2-yr	360.00	5780.66	5784.52		5784.93	0.007304	5.16	69.71	26.50	0.56
Channel	643	10-yr	600.00	5780.66	5785.53		5786.11	0.007706	6.12	97.97	29.62	0.59
Channel	643	50-yr	900.00	5780.66	5786.49		5787.26	0.008195	7.03	128.04	32.66	0.63
Channel	643	100-yr	1020.00	5780.66	5786.82		5787.66	0.008407	7.35	138.85	33.70	0.64
Channel	643	500-yr	1300.00	5780.66	5787.46		5788.47	0.008656	8.06	163.38	41.90	0.66
Channel	643	100-yr Floodway	1020.00	5780.66	5786.82		5787.66	0.008377	7.34	139.03	33.72	0.64
Channel	587	2-yr	360.00	5780.43	5784.10		5784.51	0.007882	5.11	70.49	29.14	0.58
Channel	587	10-yr	600.00	5780.43	5785.14		5785.67	0.007435	5.84	102.67	32.86	0.58
Channel	587	50-yr	900.00	5780.43	5786.12		5786.80	0.007443	6.59	136.58	36.23	0.60
Channel	587	100-yr	1020.00	5780.43	5786.45		5787.18	0.007595	6.87	148.56	37.55	0.61
Channel	587	500-yr	1300.00	5780.43	5787.08		5787.95	0.008549	7.48	173.91	42.39	0.65
Channel	587	100-yr Floodway	1020.00	5780.43	5786.45		5787.18	0.007564	6.86	148.80	37.59	0.61
Channel	549	2-yr	360.00	5779.68	5783.49		5784.10	0.013092	6.27	57.40	25.10	0.73
Channel	549	10-yr	600.00	5779.68	5784.57		5785.29	0.011845	6.83	87.82	31.31	0.72
Channel	549	50-yr	900.00	5779.68	5785.62		5786.44	0.010708	7.28	123.65	37.14	0.70
Channel	549	100-yr	1020.00	5779.68	5785.94		5786.81	0.011229	7.48	136.35	40.87	0.72
Channel	549	500-yr	1300.00	5779.68	5786.59		5787.56	0.011411	7.90	164.64	46.15	0.74
Channel	549	100-yr Floodway	1020.00	5779.68	5785.93		5786.82	0.011196	7.54	135.31	39.33	0.72
Channel	482	2-yr	360.00	5778.50	5783.16	5781.61	5783.50	0.005248	4.66	77.18	26.04	0.48
Channel	482	10-yr	600.00	5778.50	5784.17	5782.65	5784.67	0.006331	5.69	105.46	30.28	0.54
Channel	482	50-yr	900.00	5778.50	5785.16	5783.60	5785.81	0.007297	6.46	140.01	63.06	0.59
Channel	482	100-yr	1020.00	5778.50	5785.46	5783.92	5786.17	0.007339	6.76	152.46	104.12	0.59
Channel	482	500-yr	1300.00	5778.50	5786.07	5784.69	5786.93	0.007410	7.46	177.89	119.01	0.61
Channel	482	100-yr Floodway	1020.00	5778.50	5785.46	5783.93	5786.17	0.007342	6.77	152.44	49.76	0.59
Channel	376	2-yr	360.00	5778.47	5782.49	5781.51	5782.86	0.006906	4.84	74.43	30.08	0.54
Channel	376	10-yr	600.00	5778.47	5783.42	5782.33	5783.94	0.007466	5.76	104.22	34.23	0.58
Channel	376	50-yr	900.00	5778.47	5784.35	5783.11	5785.01	0.007730	6.53	137.94	39.88	0.61
Channel	376	100-yr	1020.00	5778.47	5784.65	5783.41	5785.37	0.007704	6.81	150.75	44.52	0.61
Channel	376	500-yr	1300.00	5778.47	5785.28	5784.03	5786.13	0.007511	7.41	178.79	119.76	0.62
Channel	376	100-yr Floodway	1020.00	5778.47	5784.65	5783.41	5785.37	0.007716	6.82	150.66	44.48	0.61
Channel	241	2-yr	360.00	5778.25	5781.58	5780.73	5781.91	0.007004	4.58	78.56	35.80	0.55
Channel	241	10-yr	600.00	5778.25	5782.57	5781.45	5782.98	0.006315	5.15	116.48	40.80	0.54
Channel	241	50-yr	900.00	5778.25	5783.55	5782.15	5784.05	0.005967	5.67	158.81	45.83	0.54
Channel	241	100-yr	1020.00	5778.25	5783.87	5782.39	5784.40	0.006008	5.87	173.63	47.63	0.54
Channel	241	500-yr	1300.00	5778.25	5784.55	5782.93	5785.16	0.005952	6.26	207.70	51.18	0.55
Channel	241	100-yr Floodway	1020.00	5778.25	5783.86	5782.40	5784.40	0.006037	5.88	173.33	47.59	0.54
Channel	162	2-yr	360.00	5777.50	5781.09	5779.97	5781.40	0.005703	4.47	80.49	32.20	0.50
Channel	162	10-yr	600.00	5777.50	5782.06	5780.76	5782.49	0.006009	5.26	114.01	36.98	0.53
Channel	162	50-yr	900.00	5777.50	5783.01	5781.56	5783.54	0.006638	5.84	154.05	46.14	0.56
Channel	162	100-yr	1020.00	5777.50	5783.33	5781.83	5783.90	0.006591	6.03	169.17	48.04	0.57
Channel	162	500-yr	1300.00	5777.50	5784.03	5782.48	5784.66	0.006682	6.34	205.04	54.63	0.58
Channel	162	100-yr Floodway	1020.00	5777.50	5783.32	5781.83	5783.89	0.006657	6.05	168.58	47.98	0.57
Channel	93	2-yr	360.00	5777.38	5780.77	5779.63	5781.02	0.005024	4.01	89.71	38.74	0.46

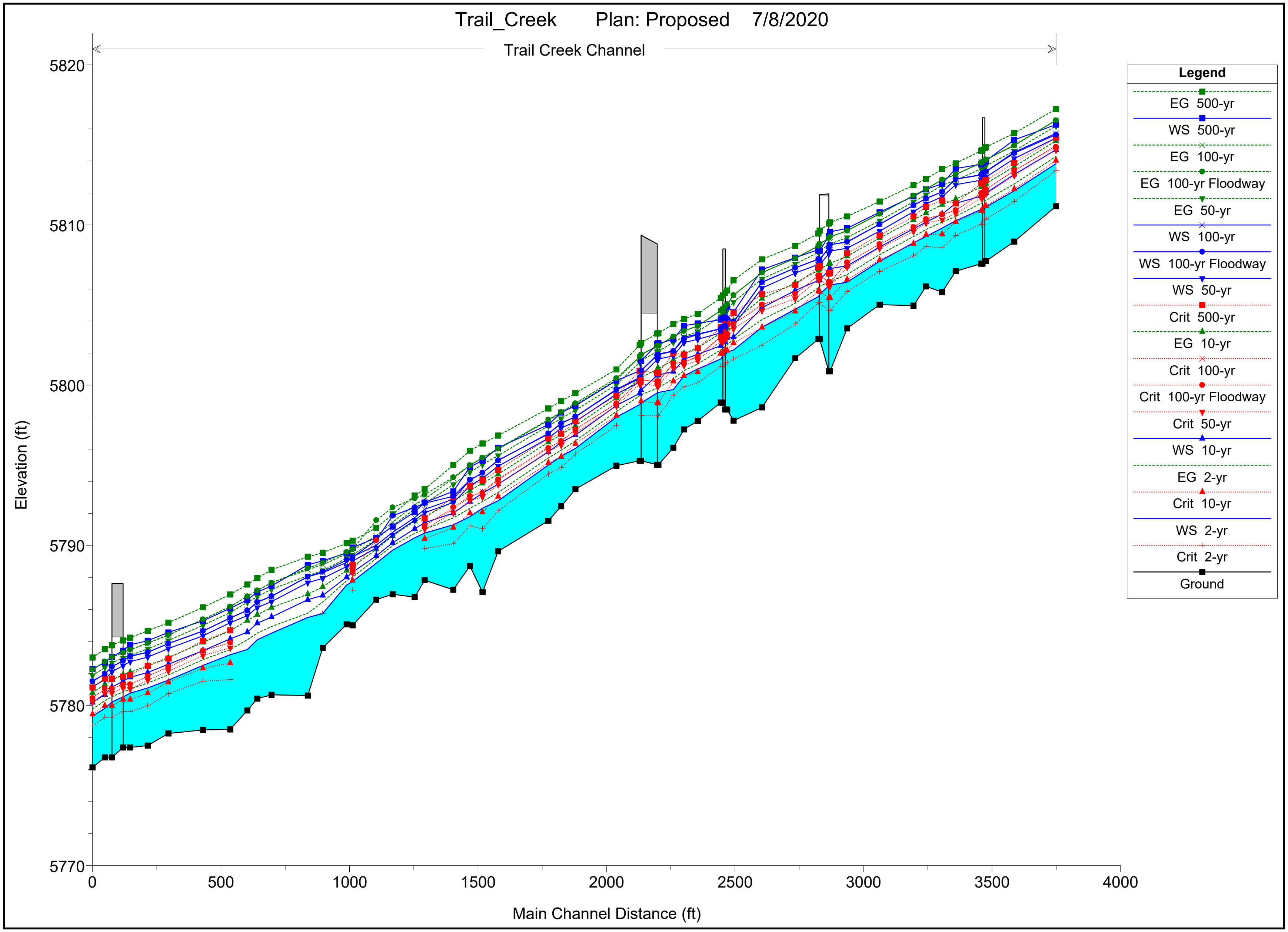
HEC-RAS Plan: Existing River: Trail Creek Reach: Channel (Continued)

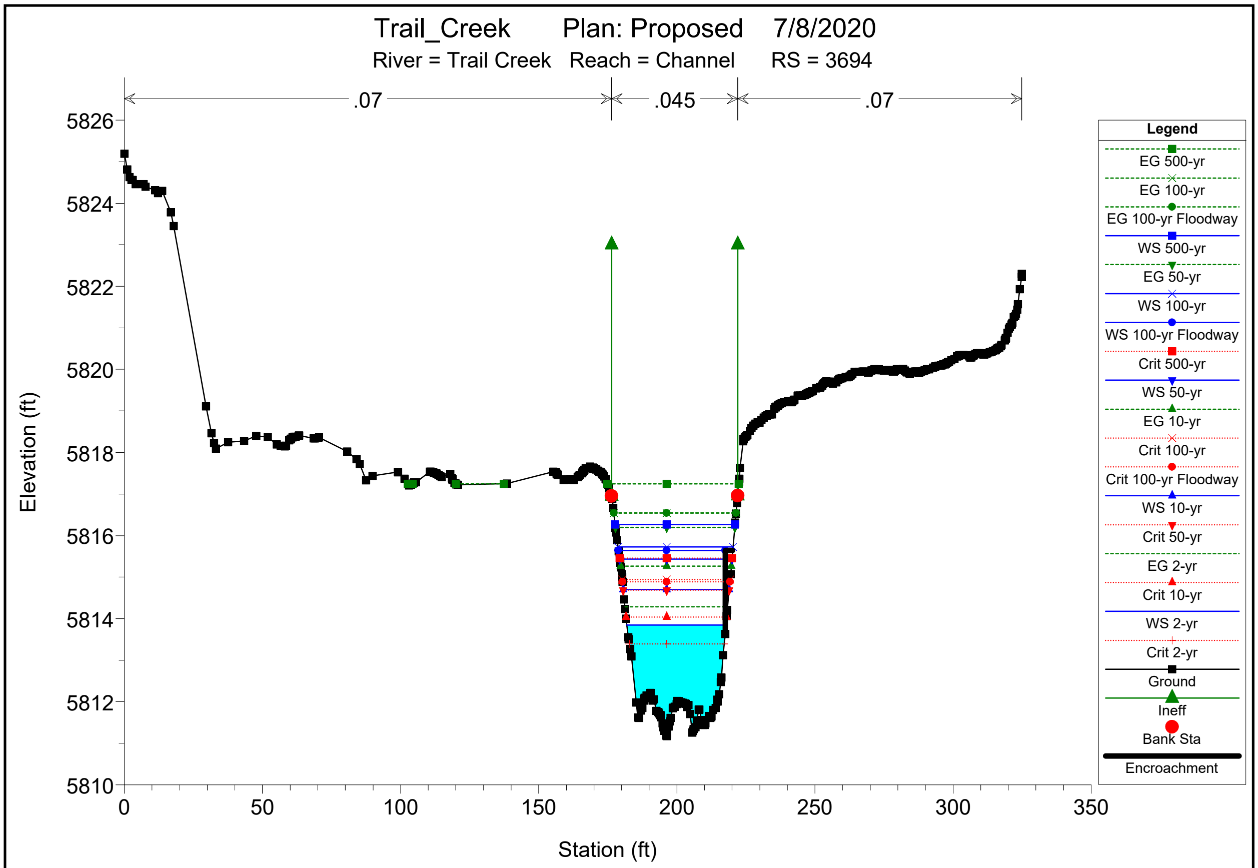
Reach	River Sta	Profile	Q Total	Min Ch El	W.S. Elev	Crit W.S.	E.G. Elev	E.G. Slope	Vel Chnl	Flow Area	Top Width	Froude # Chl
			(cfs)	(ft)	(ft)	(ft)	(ft)	(ft/ft)	(ft/s)	(sq ft)	(ft)	
Channel	93	10-yr	600.00	5777.38	5781.76	5780.36	5782.08	0.005084	4.55	131.95	47.46	0.48
Channel	93	50-yr	900.00	5777.38	5782.74	5781.02	5783.12	0.004658	4.93	182.54	62.74	0.47
Channel	93	100-yr	1020.00	5777.38	5783.08	5781.29	5783.48	0.004532	5.07	201.04	78.00	0.47
Channel	93	500-yr	1300.00	5777.38	5783.79	5781.89	5784.24	0.004365	5.36	242.57	222.15	0.47
Channel	93	100-yr Floodway	1020.00	5777.38	5783.07	5781.32	5783.47	0.004417	5.11	199.59	53.21	0.47
Channel	66		Bridge									
Channel	-5	2-yr	360.00	5776.76	5779.82	5779.26	5780.29	0.010643	5.49	65.52	30.86	0.66
Channel	-5	10-yr	600.00	5776.76	5780.68	5779.98	5781.31	0.010770	6.42	93.53	56.63	0.69
Channel	-5	50-yr	900.00	5776.76	5781.62	5780.76	5782.37	0.010397	6.94	129.59	121.01	0.70
Channel	-5	100-yr	1020.00	5776.76	5781.97	5781.05	5782.74	0.010161	7.06	144.50	139.41	0.69
Channel	-5	500-yr	1300.00	5776.76	5782.68	5781.67	5783.51	0.009351	7.27	178.74	176.16	0.68
Channel	-5	100-yr Floodway	1020.00	5776.76	5781.96	5781.05	5782.74	0.010034	7.08	144.11	43.83	0.69
Channel	-53	2-yr	360.00	5776.13	5779.33	5778.70	5779.78	0.010002	5.36	67.22	31.56	0.65
Channel	-53	10-yr	600.00	5776.13	5780.19	5779.45	5780.80	0.010015	6.24	96.15	35.72	0.67
Channel	-53	50-yr	900.00	5776.13	5781.15	5780.20	5781.86	0.010010	6.74	133.45	51.64	0.68
Channel	-53	100-yr	1020.00	5776.13	5781.51	5780.46	5782.23	0.010001	6.79	150.20	78.26	0.69
Channel	-53	500-yr	1300.00	5776.13	5782.27	5781.12	5782.98	0.010002	6.75	192.97	171.21	0.69
Channel	-53	100-yr Floodway	1020.00	5776.13	5781.51	5780.46	5782.23	0.010001	6.79	150.20	49.22	0.69

HEC-RAS Plan: Existing River: Trail Creek Reach: Channel

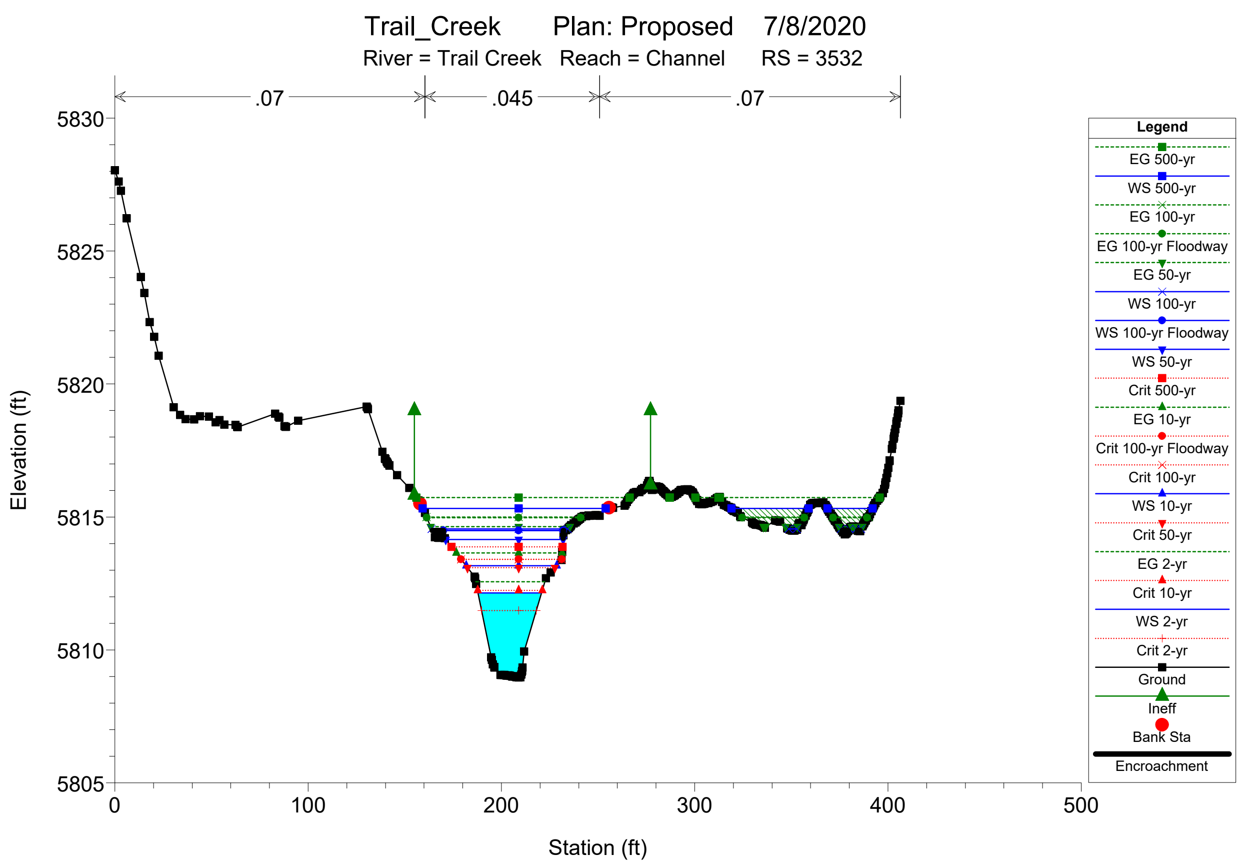
Reach	River Sta	Profile	E.G. US.	Min El Prs	BR Open Area	Prs O WS	Q Total	Min El Weir Flow	Q Weir	Delta EG	BR Sluice Coef
			(ft)	(ft)	(sq ft)	(ft)	(cfs)	(ft)	(cfs)	(ft)	
Channel	3418	2-yr	5811.55	5816.70	275.60		360.00	5816.67		0.19	
Channel	3418	10-yr	5812.60	5816.70	275.60		600.00	5816.67		0.20	
Channel	3418	50-yr	5813.70	5816.70	275.60		900.00	5816.67		0.19	
Channel	3418	100-yr	5814.09	5816.70	275.60		1020.00	5816.67		0.20	
Channel	3418	500-yr	5814.86	5816.70	275.60		1300.00	5816.67		0.21	
Channel	3418	100-yr Floodway	5814.09	5816.70	267.28		1020.00	5816.90		0.20	
Channel	2810	2-yr	5806.47	5811.81	221.26		360.00	5812.13		0.38	
Channel	2810	10-yr	5807.60	5811.81	221.26		600.00	5812.13		0.43	
Channel	2810	50-yr	5808.82	5811.81	221.26		900.00	5812.13		0.52	
Channel	2810	100-yr	5809.26	5811.81	221.26		1020.00	5812.13		0.56	
Channel	2810	500-yr	5810.18	5811.81	221.26		1300.00	5812.13		0.67	
Channel	2810	100-yr Floodway	5809.26	5811.81	221.26		1020.00	5812.13		0.55	
Channel	2407	2-yr	5802.52	5808.51	213.90		360.00	5807.91		0.33	
Channel	2407	10-yr	5803.60	5808.51	213.90		600.00	5807.91		0.33	
Channel	2407	50-yr	5804.69	5808.51	213.90		900.00	5807.91		0.35	
Channel	2407	100-yr	5805.10	5808.51	213.90		1020.00	5807.91		0.36	
Channel	2407	500-yr	5806.65	5808.51	213.90		1300.00	5807.91		0.22	
Channel	2407	100-yr Floodway	5805.10	5808.51	213.90		1020.00	5807.91		0.36	
Channel	2135	2-yr	5799.91	5804.50	166.28		360.00	5808.42		0.79	
Channel	2135	10-yr	5801.40	5804.50	166.28		600.00	5808.42		1.24	
Channel	2135	50-yr	5802.62	5804.50	166.28		900.00	5808.42		1.37	
Channel	2135	100-yr	5803.14	5804.50	166.28		1020.00	5808.42		1.48	
Channel	2135	500-yr	5805.84	5804.50	166.28	5805.54	1300.00	5808.42		3.30	0.41
Channel	2135	100-yr Floodway	5803.14	5804.50	166.28		1020.00	5808.42		1.47	
Channel	66	2-yr	5781.02	5784.28	240.55		360.00	5787.62		0.73	
Channel	66	10-yr	5782.08	5784.28	240.55		600.00	5787.62		0.76	
Channel	66	50-yr	5783.12	5784.28	240.55		900.00	5787.62		0.74	
Channel	66	100-yr	5783.48	5784.28	240.55		1020.00	5787.62		0.73	
Channel	66	500-yr	5784.24	5784.28	240.55		1300.00	5787.62		0.73	
Channel	66	100-yr Floodway	5783.47	5784.28	240.55		1020.00	5787.62		0.73	

Appendix D. HEC-RAS Output: Proposed Conditions


Trail_Creek Plan: Proposed 7/8/2020
Trail Creek Channel
Legend
EG 500-yr
WS 500-yr
EG 100-yr
EG 100-yr Floodway
EG 50-yr
WS 100-yr
WS 100-yr Floodway
WS 50-yr
Crit 500-yr
EG 10-yr
Crit 100-yr
Crit 100-yr Floodway
Crit 50-yr
WS 10-yr
EG 2-yr
Crit 10-yr
WS 2-yr
Crit 2-yr
Ground
Elevation (ft)
Main Channel Distance (ft)
5820
5810
5800
5790
5780
5770
0
500
1000
1500
2000
2500
3000
3500
4000

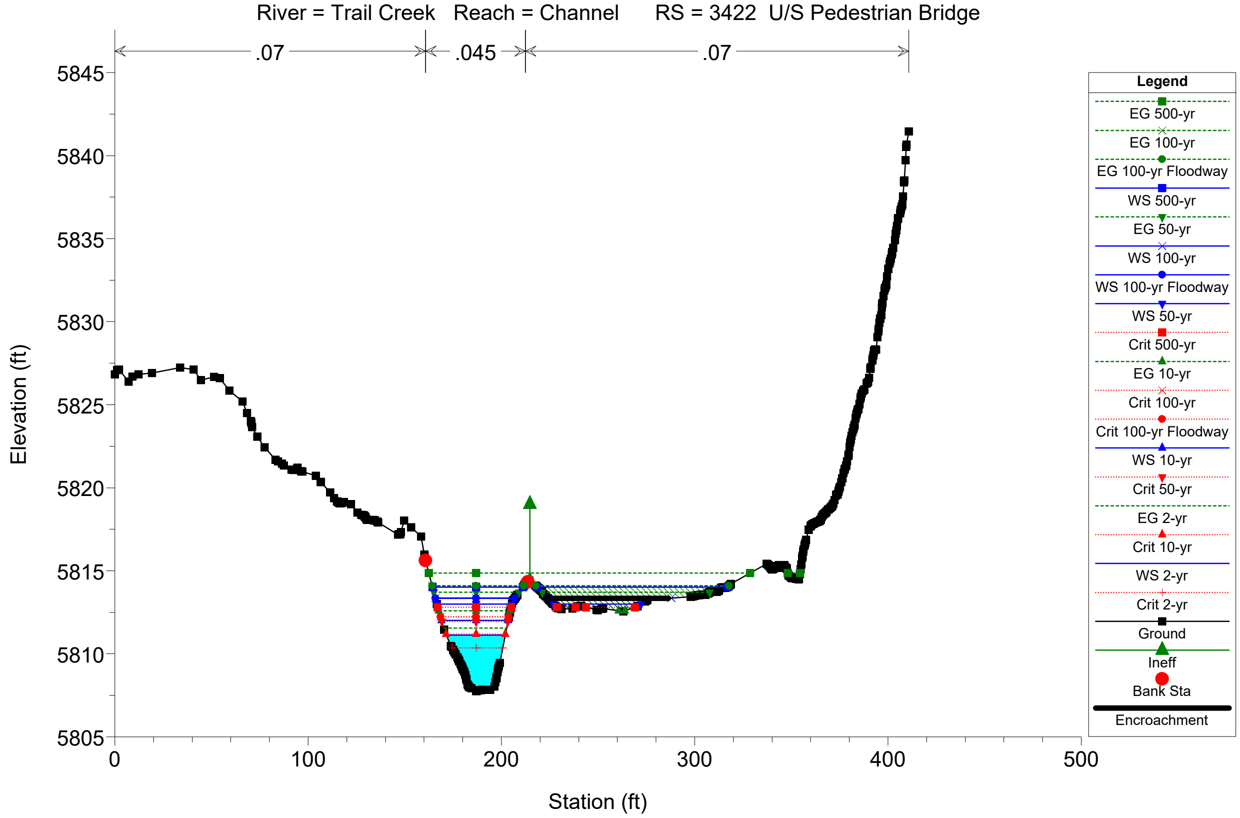


Trail_Creek Plan: Proposed 7/8/2020
River = Trail Creek Reach = Channel RS = 3694
.07
.045
.07
Elevation (ft)
Station (ft)
Legend
EG 500-yr
EG 100-yr
EG 100-yr Floodway
WS 500-yr
EG 50-yr
WS 100-yr
WS 100-yr Floodway
Crit 500-yr
WS 50-yr
EG 10-yr
Crit 100-yr
Crit 100-yr Floodway
WS 10-yr
Crit 50-yr
EG 2-yr
Crit 10-yr
WS 2-yr
Crit 2-yr
Ground
Ineff
Bank Sta
Encroachment

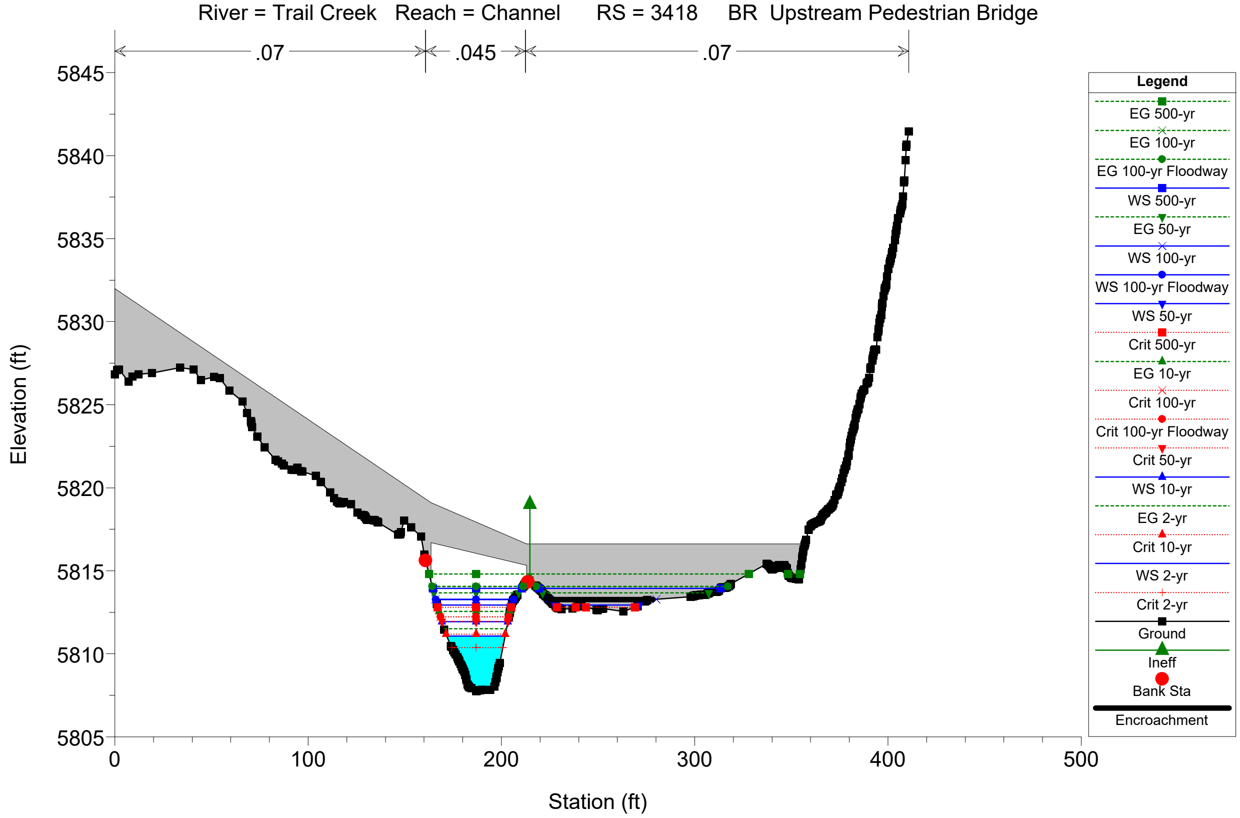


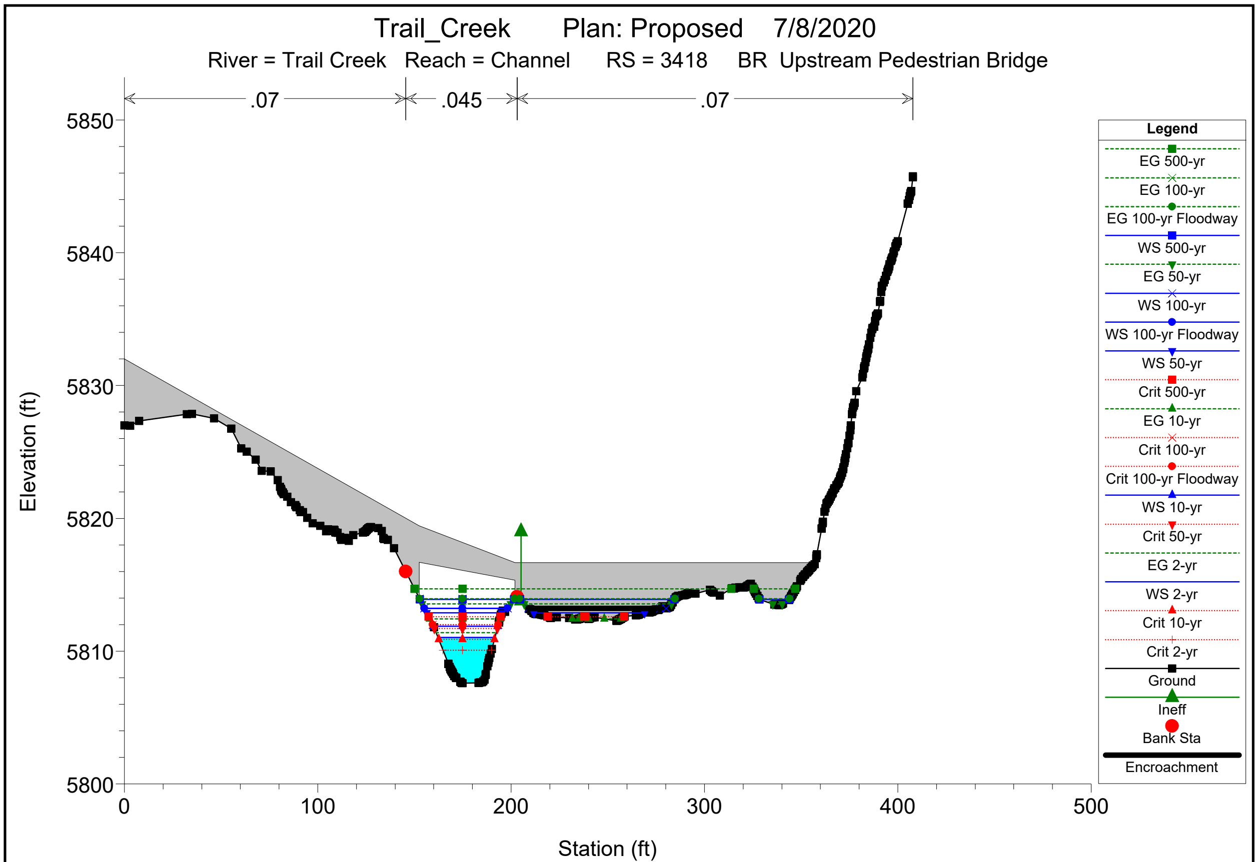
Trail_Creek Plan: Proposed 7/8/2020
River = Trail Creek Reach = Channel RS = 3532
.07
.045
.07
Elevation (ft)
Station (ft)
Legend
EG 500-yr
WS 500-yr
EG 100-yr
EG 100-yr Floodway
EG 50-yr
WS 100-yr
WS 100-yr Floodway
WS 50-yr
Crit 500-yr
EG 10-yr
Crit 100-yr Floodway
Crit 100-yr
WS 10-yr
Crit 50-yr
EG 2-yr
Crit 10-yr
WS 2-yr
Crit 2-yr
Ground
Ineff
Bank Sta
Encroachment

Trail_Creek Plan: Proposed 7/8/2020
River = Trail Creek Reach = Channel RS = 3422 U/S Pedestrian Bridge

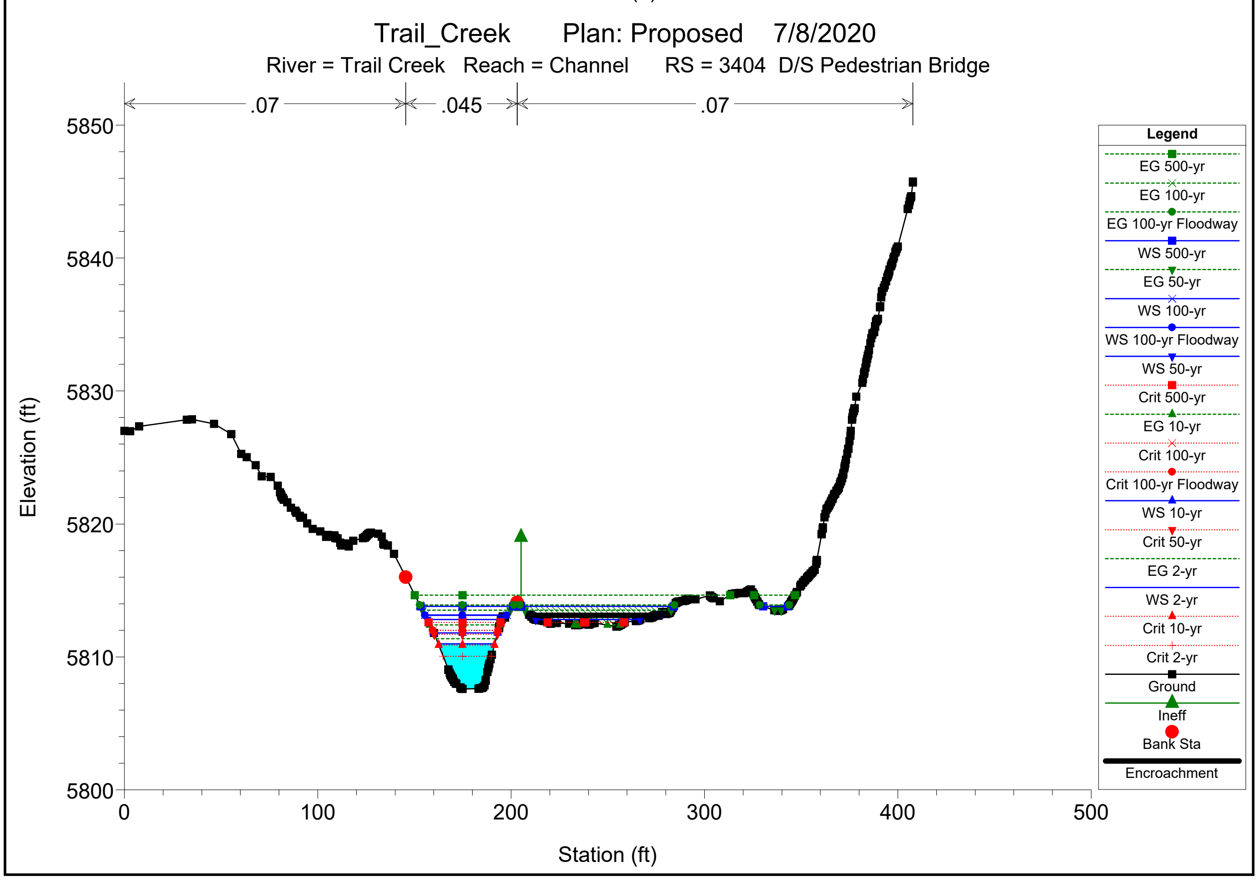


Trail_Creek Plan: Proposed 7/8/2020
River = Trail Creek Reach = Channel RS = 3418 BR Upstream Pedestrian Bridge

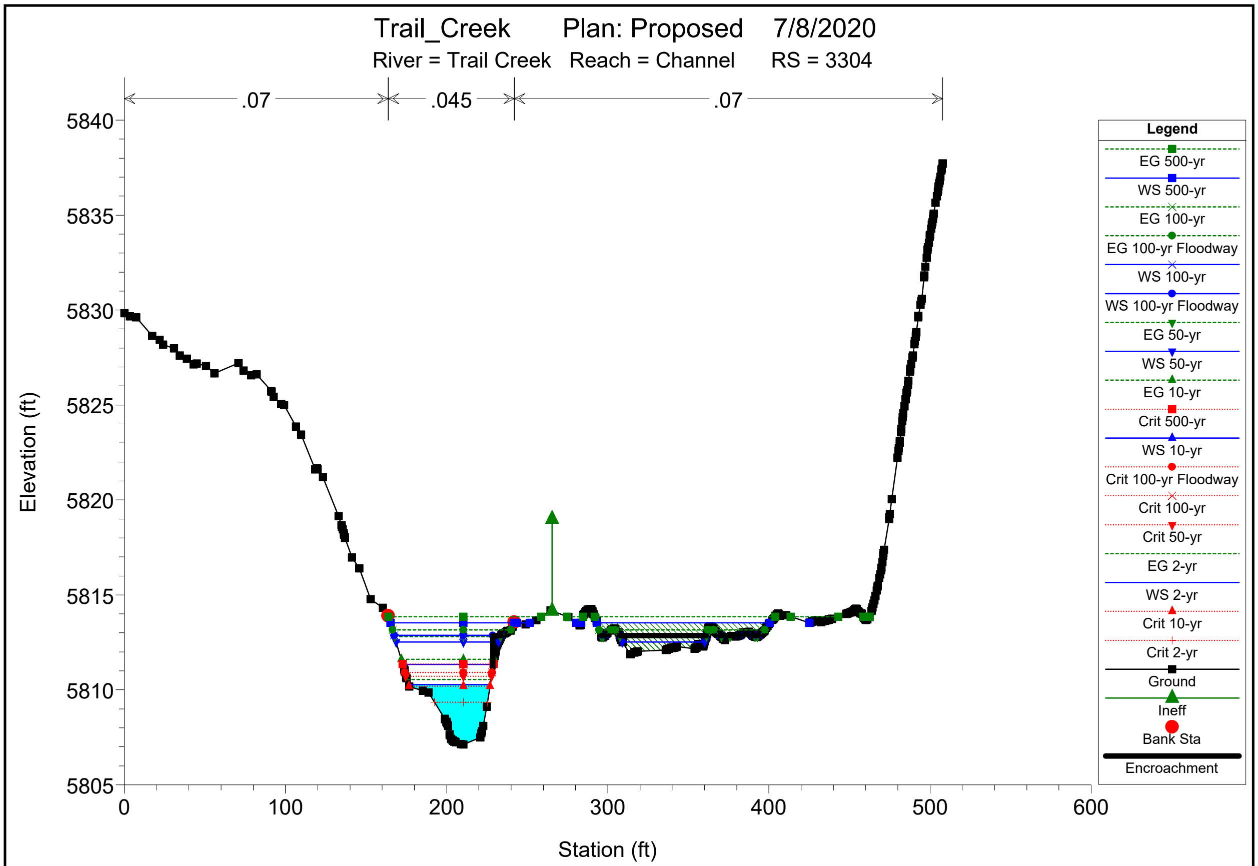


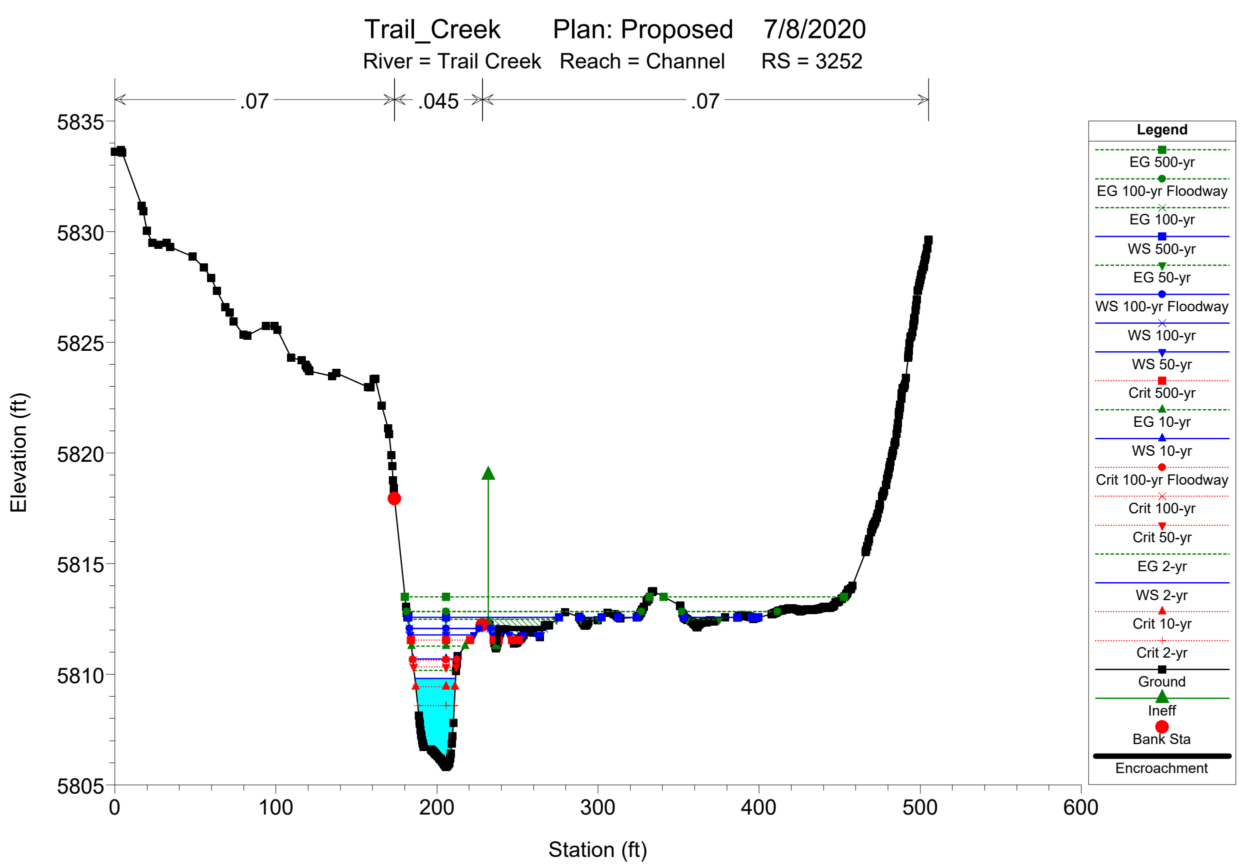


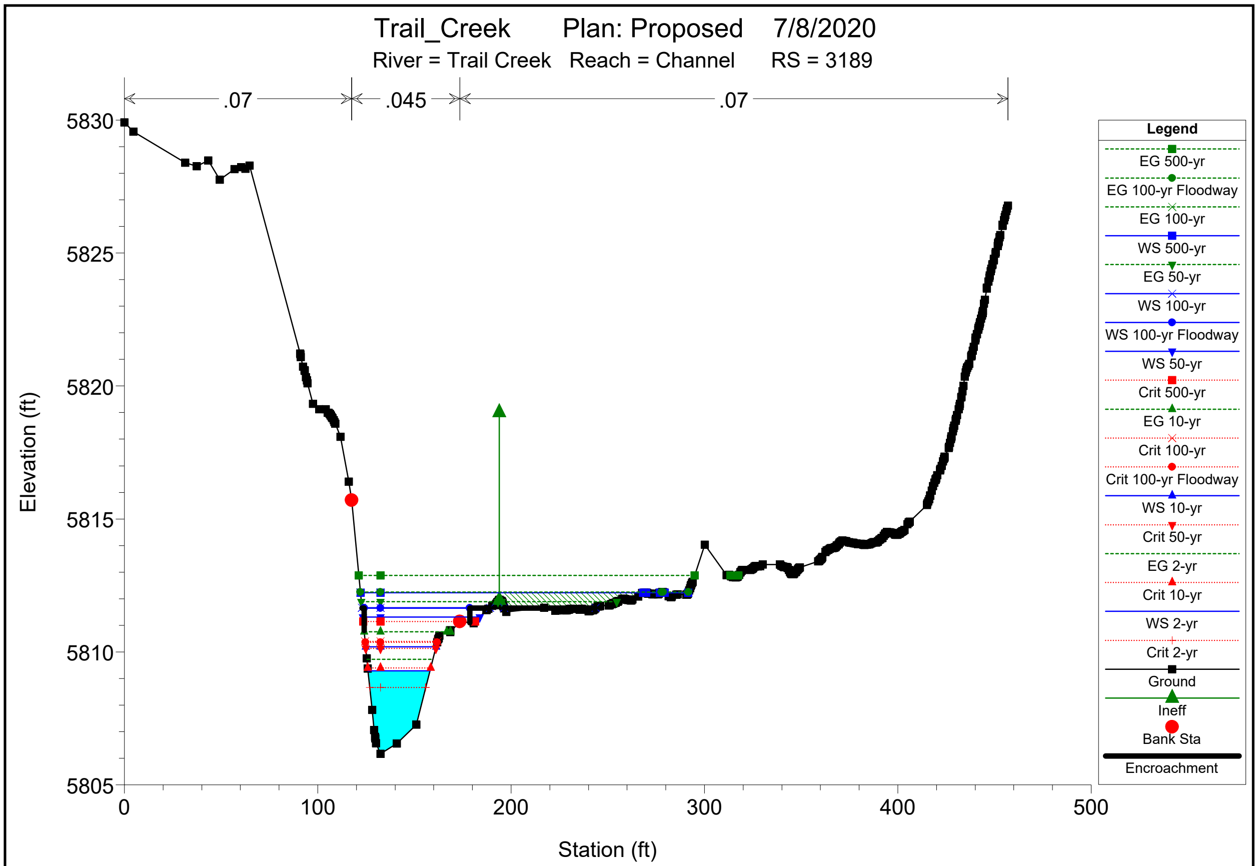
Trail_Creek Plan: Proposed 7/8/2020
River = Trail Creek Reach = Channel RS = 3418 BR Upstream Pedestrian Bridge
.07
.045
.07
Elevation (ft)
Station (ft)
5800
5810
5820
5830
5840
5850
0
100
200
300
400
500
Legend
EG 500-yr
EG 100-yr
EG 100-yr Floodway
WS 500-yr
EG 50-yr
WS 100-yr
WS 100-yr Floodway
WS 50-yr
Crit 500-yr
EG 10-yr
Crit 100-yr
Crit 100-yr Floodway
WS 10-yr
Crit 50-yr
EG 2-yr
WS 2-yr
Crit 10-yr
Crit 2-yr
Ground
Ineff
Bank Sta
Encroachment



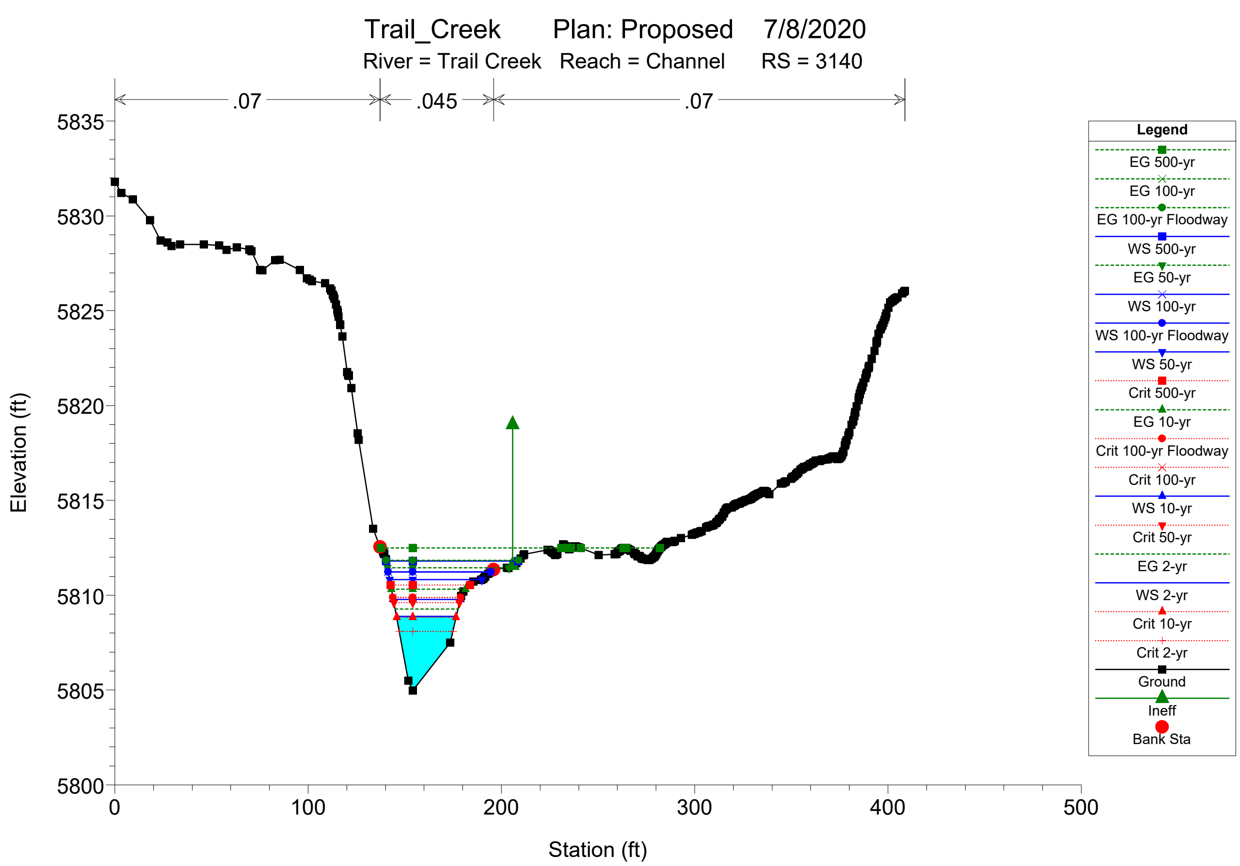
Trail_Creek Plan: Proposed 7/8/2020
River = Trail Creek Reach = Channel RS = 3404 D/S Pedestrian Bridge
.07
.045
.07
Elevation (ft)
Station (ft)
5800
5810
5820
5830
5840
5850
0
100
200
300
400
500
Legend
EG 500-yr
EG 100-yr
EG 100-yr Floodway
WS 500-yr
EG 50-yr
WS 100-yr
WS 100-yr Floodway
WS 50-yr
Crit 500-yr
EG 10-yr
Crit 100-yr
Crit 100-yr Floodway
WS 10-yr
Crit 50-yr
EG 2-yr
WS 2-yr
Crit 10-yr
Crit 2-yr
Ground
Ineff
Bank Sta
Encroachment


Trail_Creek Plan: Proposed 7/8/2020
River = Trail Creek Reach = Channel RS = 3304
.07
.045
.07
Elevation (ft)
Station (ft)
Legend
EG 500-yr
WS 500-yr
EG 100-yr
EG 100-yr Floodway
WS 100-yr
WS 100-yr Floodway
EG 50-yr
WS 50-yr
EG 10-yr
Crit 500-yr
WS 10-yr
Crit 100-yr Floodway
Crit 100-yr
Crit 50-yr
EG 2-yr
WS 2-yr
Crit 10-yr
Crit 2-yr
Ground
Ineff
Bank Sta
Encroachment

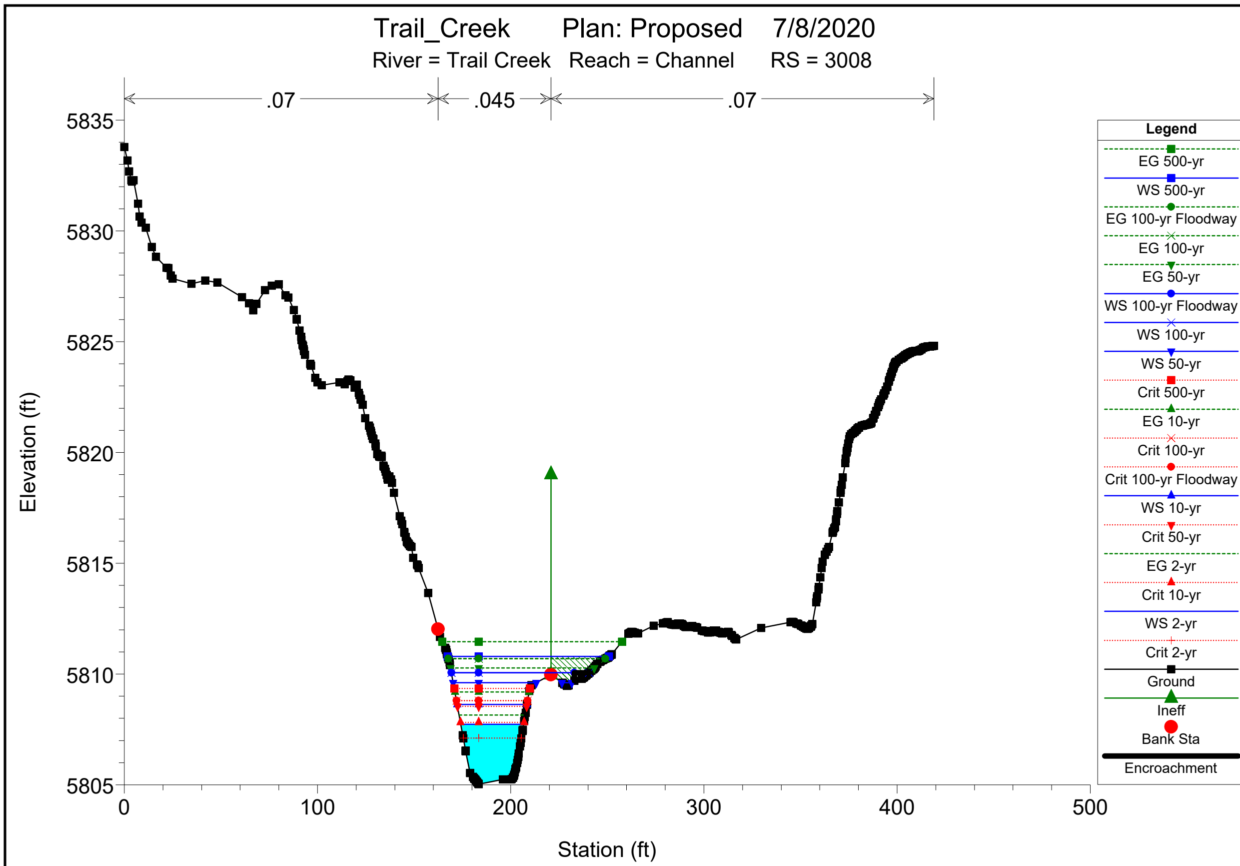

Trail_Creek Plan: Proposed 7/8/2020
River = Trail Creek Reach = Channel RS = 3252
.07
.045
.07
Elevation (ft)
Station (ft)
Legend
EG 500-yr
EG 100-yr Floodway
EG 100-yr
WS 500-yr
EG 50-yr
WS 100-yr Floodway
WS 100-yr
WS 50-yr
Crit 500-yr
EG 10-yr
WS 10-yr
Crit 100-yr Floodway
Crit 100-yr
Crit 50-yr
EG 2-yr
WS 2-yr
Crit 10-yr
Crit 2-yr
Ground
Ineff
Bank Sta
Encroachment

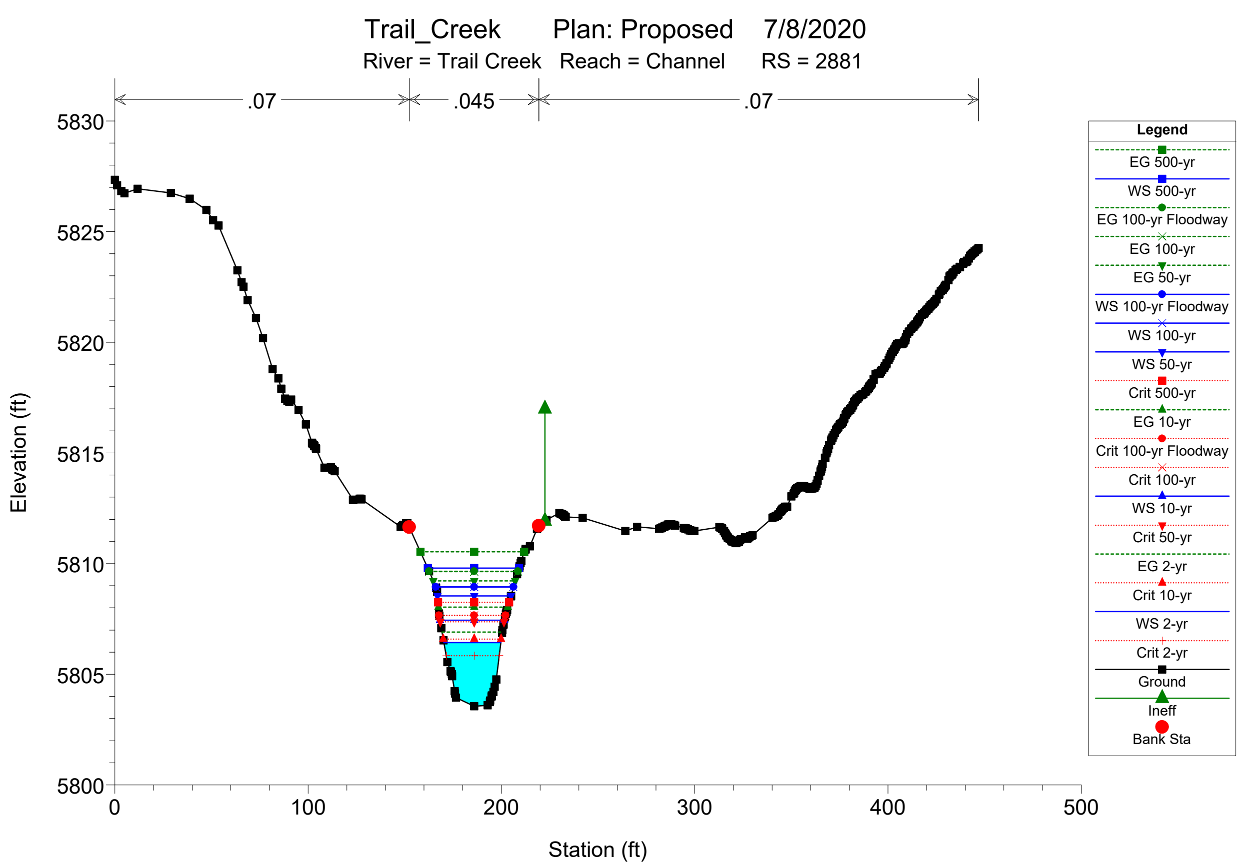


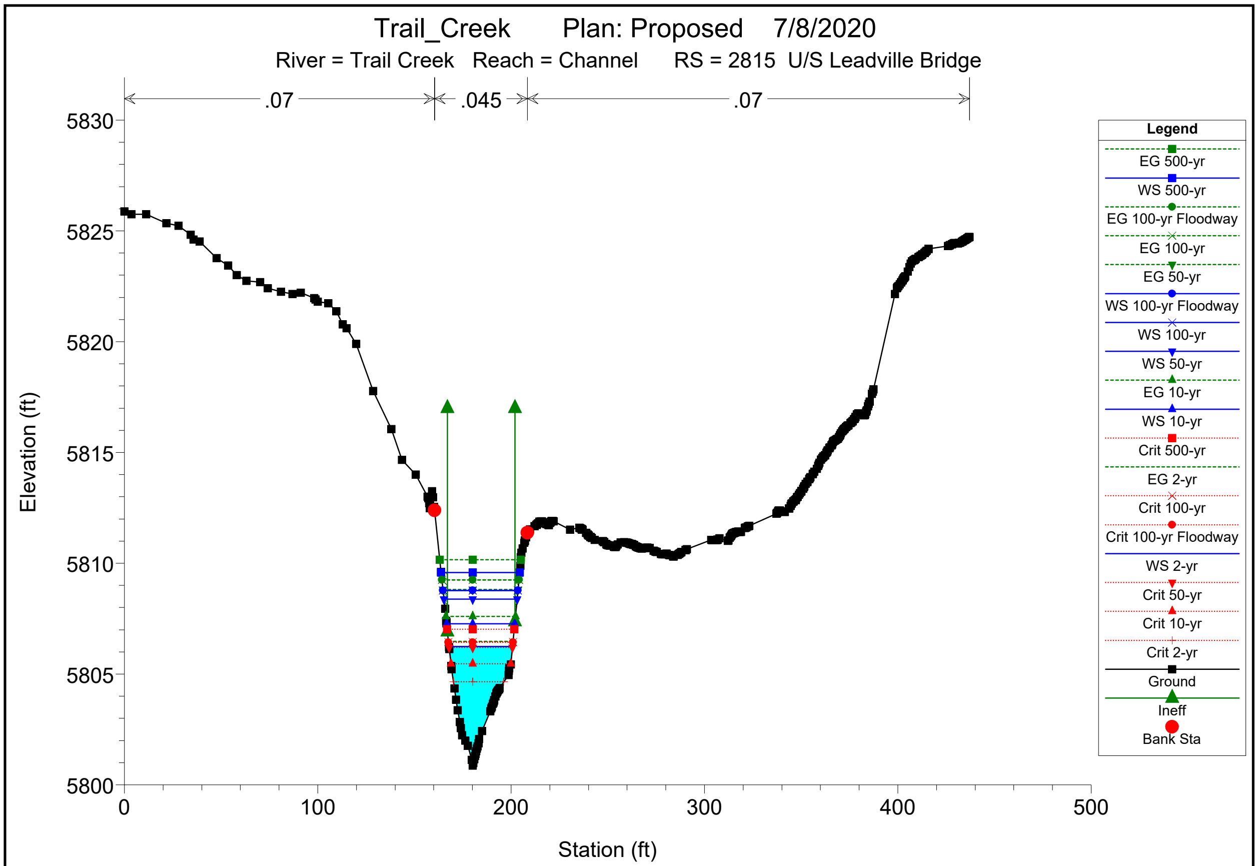
Trail_Creek Plan: Proposed 7/8/2020
River = Trail Creek Reach = Channel RS = 3189
.07
.045
.07
Elevation (ft)
Station (ft)
Legend
EG 500-yr
EG 100-yr Floodway
EG 100-yr
WS 500-yr
EG 50-yr
WS 100-yr
WS 100-yr Floodway
WS 50-yr
Crit 500-yr
EG 10-yr
Crit 100-yr
Crit 100-yr Floodway
WS 10-yr
Crit 50-yr
EG 2-yr
Crit 10-yr
WS 2-yr
Crit 2-yr
Ground
Ineff
Bank Sta
Encroachment



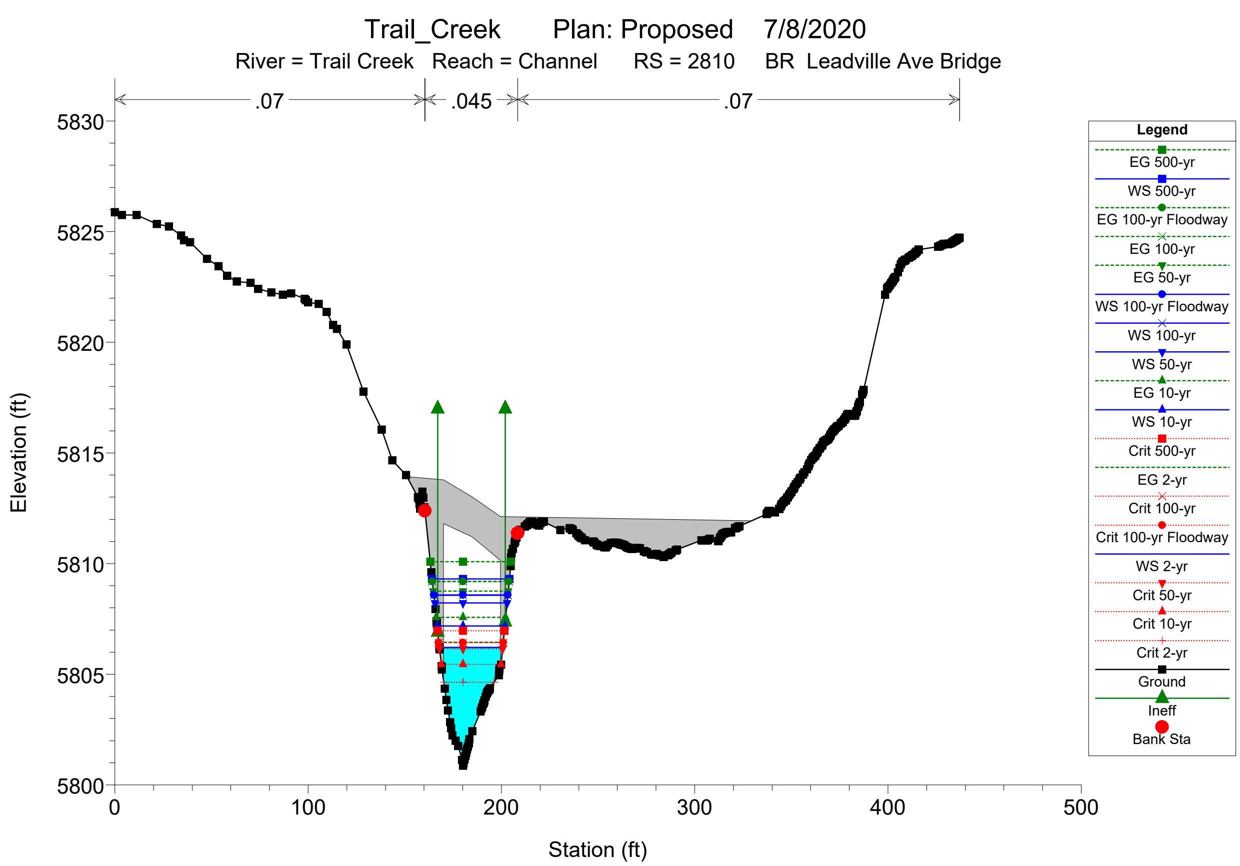
Trail_Creek Plan: Proposed 7/8/2020
River = Trail Creek Reach = Channel RS = 3140
.07
.045
.07
Elevation (ft)
Station (ft)
Legend
EG 500-yr
EG 100-yr
EG 100-yr Floodway
WS 500-yr
EG 50-yr
WS 100-yr
WS 100-yr Floodway
WS 50-yr
Crit 500-yr
EG 10-yr
Crit 100-yr Floodway
Crit 100-yr
WS 10-yr
Crit 50-yr
EG 2-yr
WS 2-yr
Crit 10-yr
Crit 2-yr
Ground
Ineff
Bank Sta


Trail_Creek Plan: Proposed 7/8/2020
River = Trail Creek Reach = Channel RS = 3008
.07
.045
.07
Elevation (ft)
Station (ft)
Legend
EG 500-yr
WS 500-yr
EG 100-yr Floodway
EG 100-yr
EG 50-yr
WS 100-yr Floodway
WS 100-yr
WS 50-yr
Crit 500-yr
EG 10-yr
Crit 100-yr
Crit 100-yr Floodway
WS 10-yr
Crit 50-yr
EG 2-yr
Crit 10-yr
WS 2-yr
Crit 2-yr
Ground
Ineff
Bank Sta
Encroachment

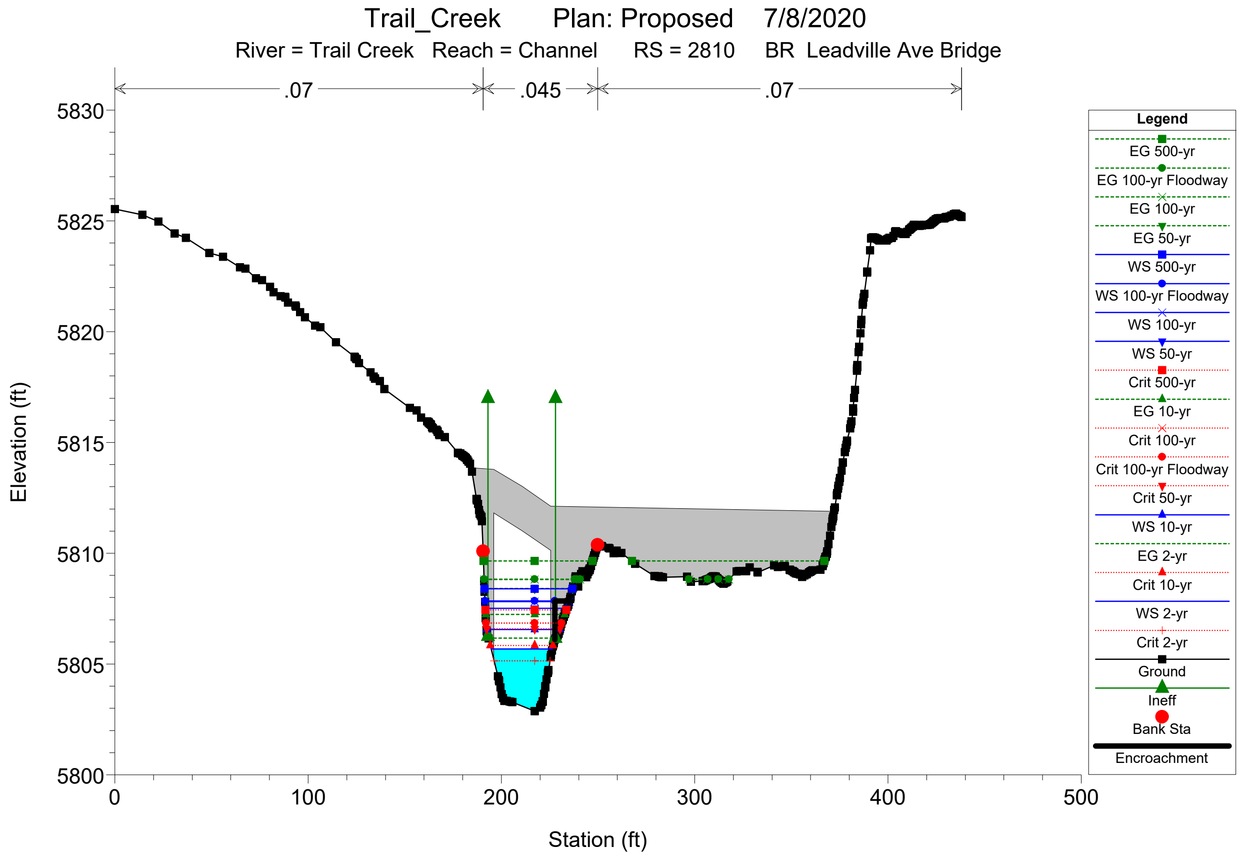

Trail_Creek Plan: Proposed 7/8/2020
River = Trail Creek Reach = Channel RS = 2881
.07
.045
.07
Elevation (ft)
Station (ft)
Legend
EG 500-yr
WS 500-yr
EG 100-yr Floodway
EG 100-yr
EG 50-yr
WS 100-yr Floodway
WS 100-yr
WS 50-yr
Crit 500-yr
EG 10-yr
Crit 100-yr Floodway
Crit 100-yr
WS 10-yr
Crit 50-yr
EG 2-yr
Crit 10-yr
WS 2-yr
Crit 2-yr
Ground
Ineff
Bank Sta

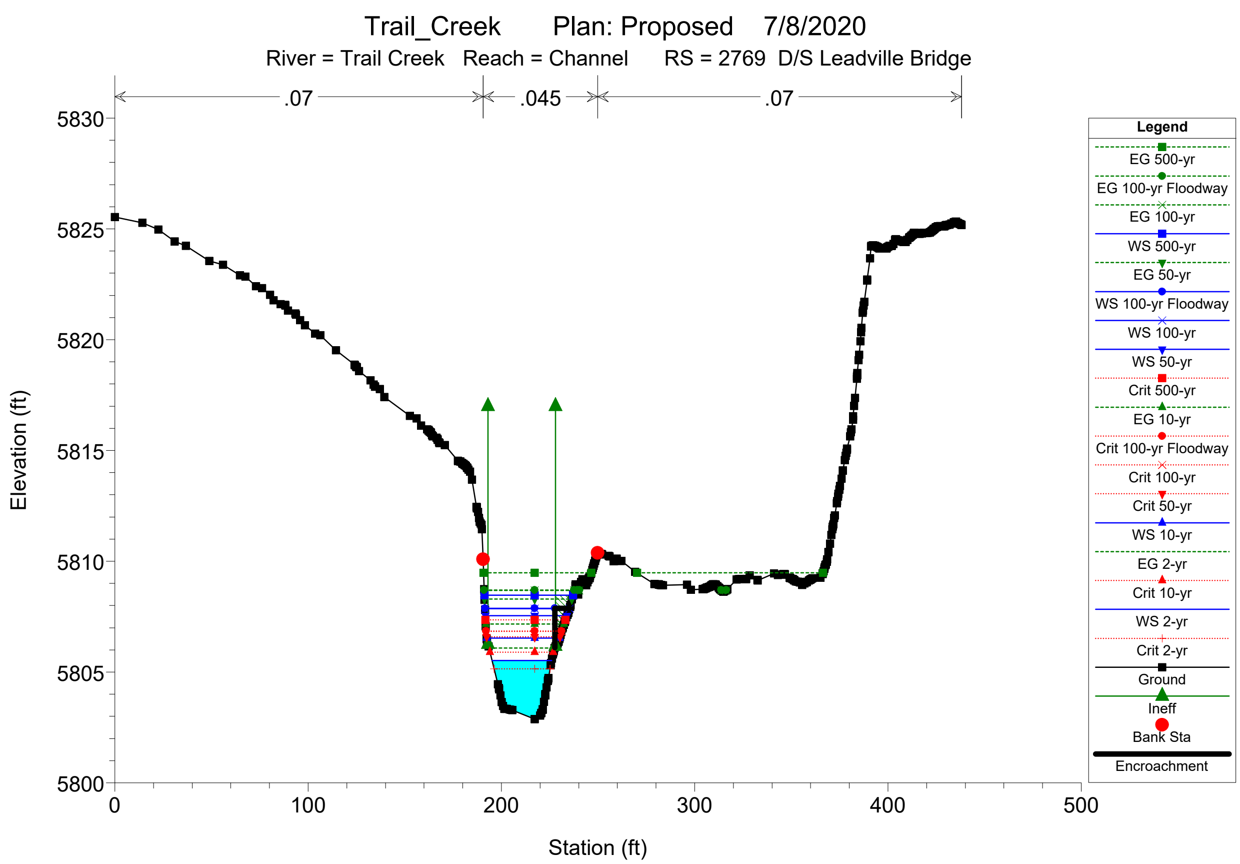


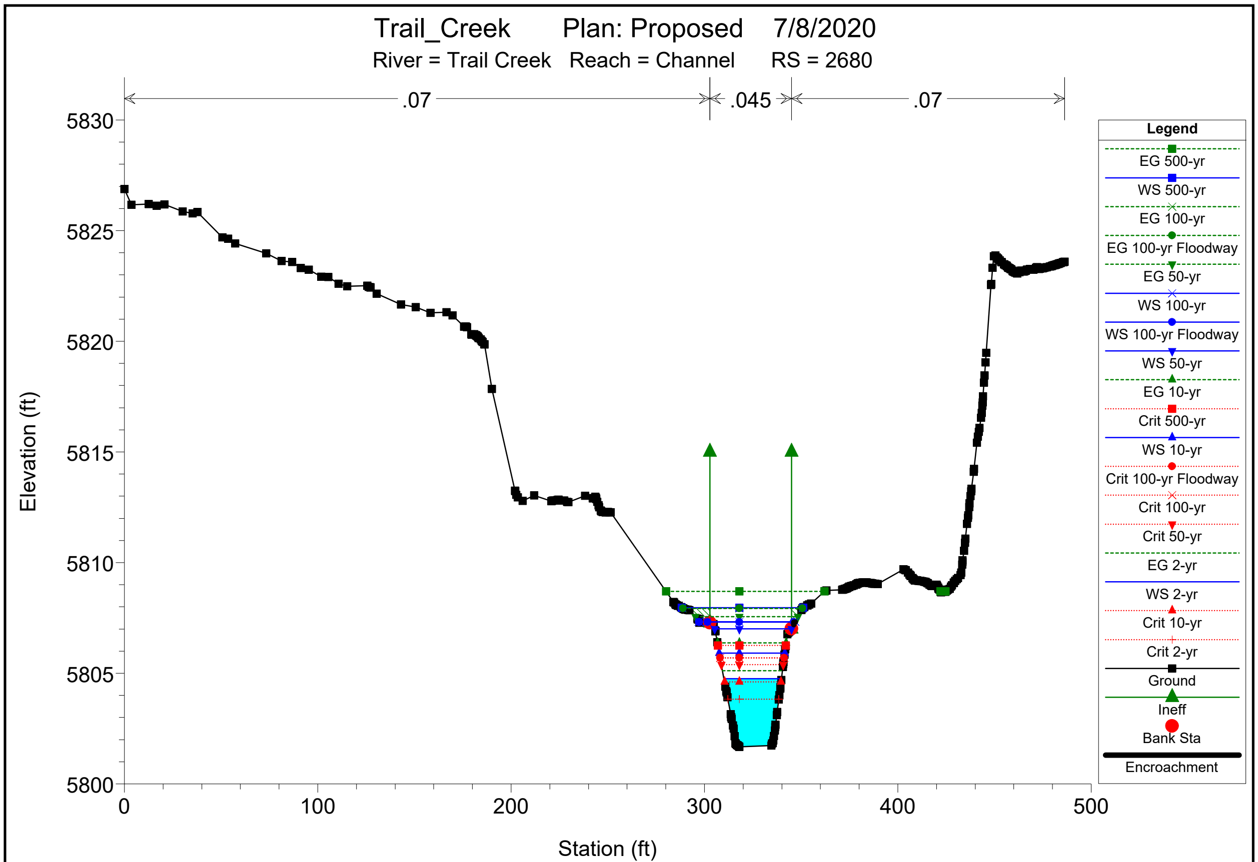
Trail_Creek Plan: Proposed 7/8/2020
River = Trail Creek Reach = Channel RS = 2815 U/S Leadville Bridge
.07
.045
.07
Elevation (ft)
Station (ft)
Legend
EG 500-yr
WS 500-yr
EG 100-yr Floodway
EG 100-yr
EG 50-yr
WS 100-yr Floodway
WS 100-yr
WS 50-yr
EG 10-yr
WS 10-yr
Crit 500-yr
EG 2-yr
Crit 100-yr
Crit 100-yr Floodway
WS 2-yr
Crit 50-yr
Crit 10-yr
Crit 2-yr
Ground
Ineff
Bank Sta

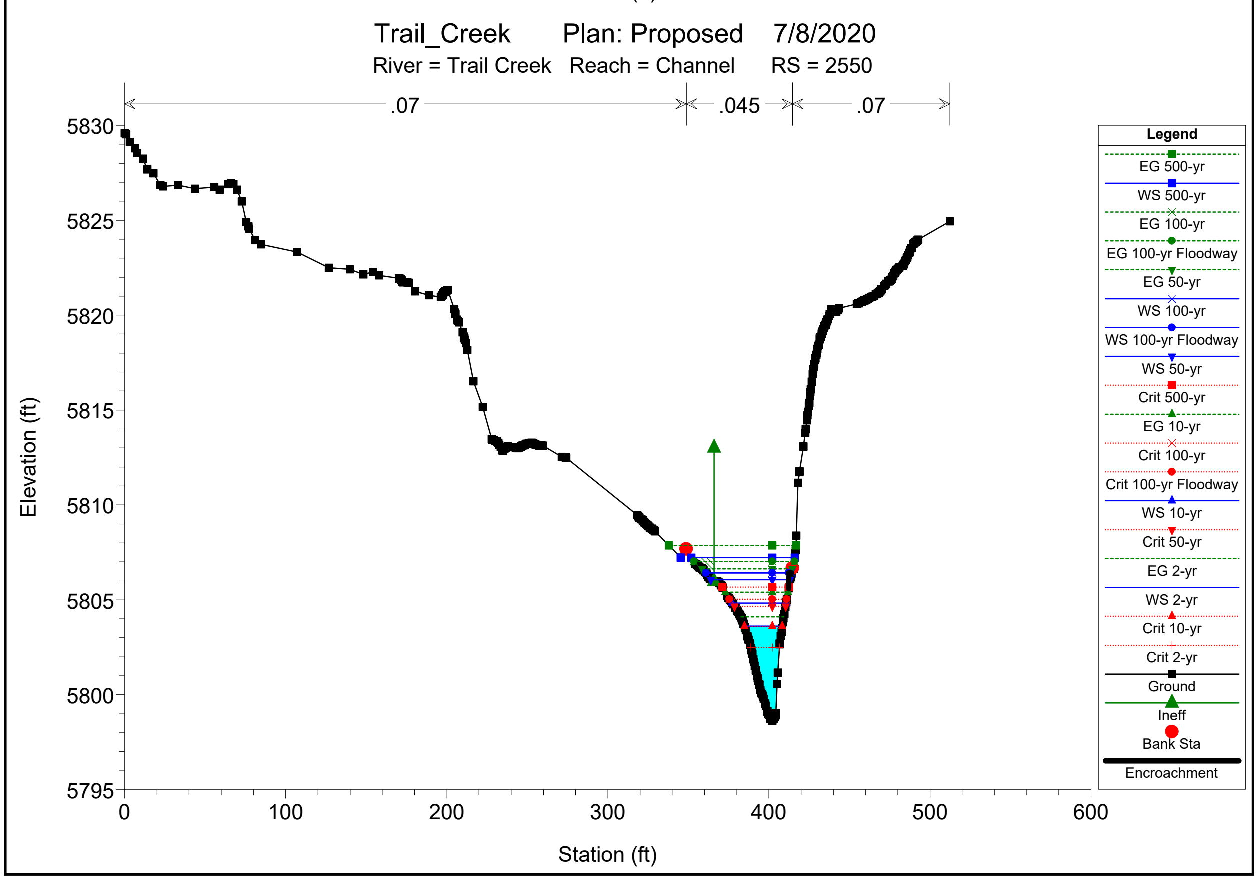


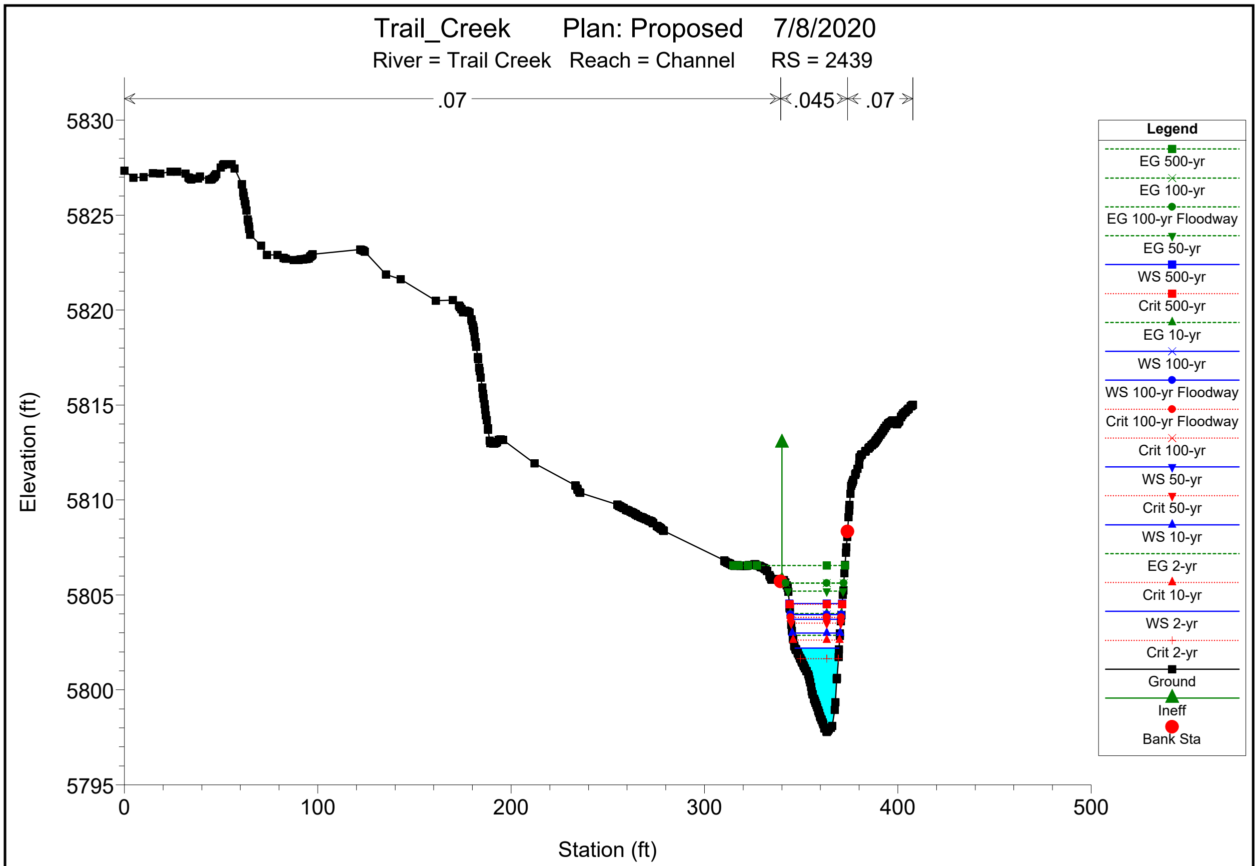
Trail_Creek Plan: Proposed 7/8/2020
River = Trail Creek Reach = Channel RS = 2810 BR Leadville Ave Bridge
.07
.045
.07
Elevation (ft)
Station (ft)
Legend
EG 500-yr
WS 500-yr
EG 100-yr Floodway
EG 100-yr
EG 50-yr
WS 100-yr Floodway
WS 100-yr
WS 50-yr
EG 10-yr
WS 10-yr
Crit 500-yr
EG 2-yr
Crit 100-yr
Crit 100-yr Floodway
WS 2-yr
Crit 50-yr
Crit 10-yr
Crit 2-yr
Ground
Ineff
Bank Sta

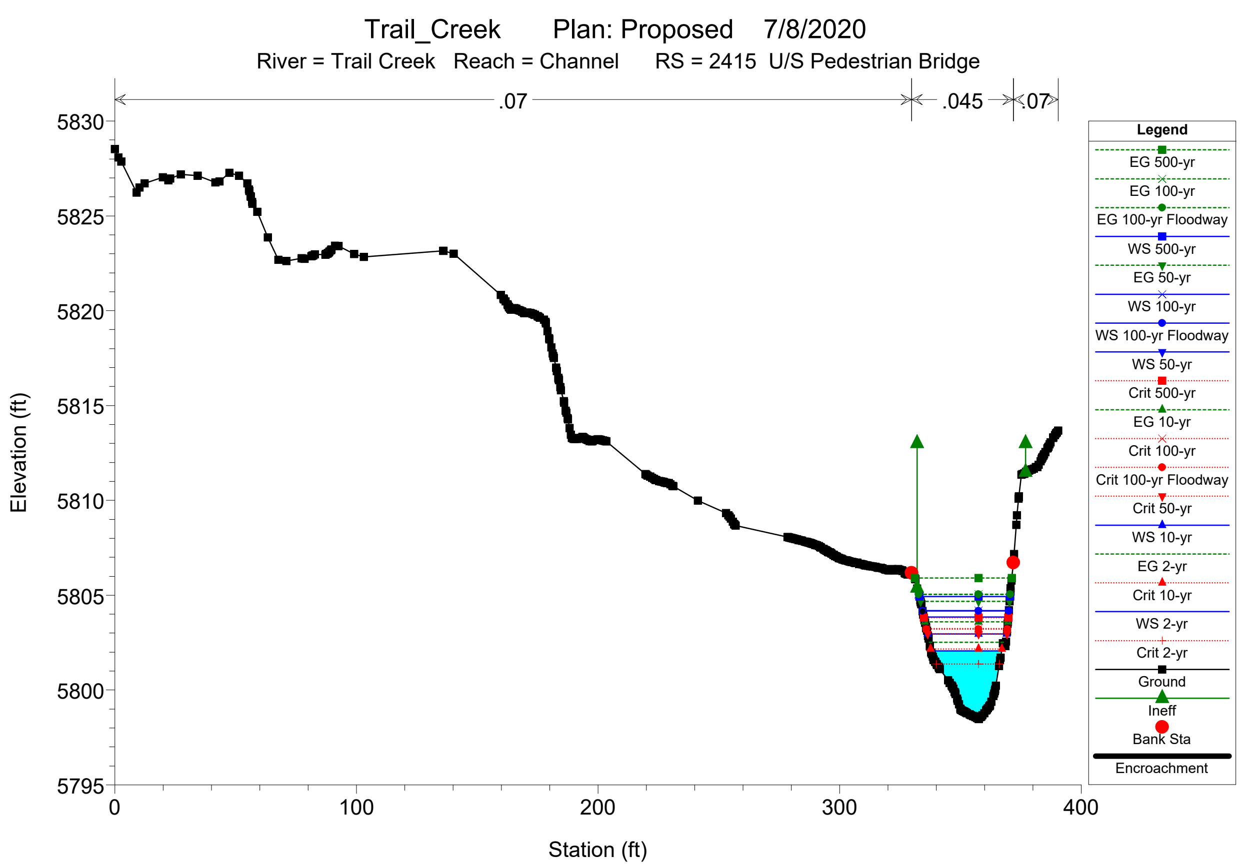

Trail_Creek Plan: Proposed 7/8/2020
River = Trail Creek Reach = Channel RS = 2810 BR Leadville Ave Bridge
.07
.045
.07
Elevation (ft)
Station (ft)
Legend
EG 500-yr
EG 100-yr Floodway
EG 100-yr
EG 50-yr
WS 500-yr
WS 100-yr Floodway
WS 100-yr
WS 50-yr
Crit 500-yr
EG 10-yr
Crit 100-yr
Crit 100-yr Floodway
Crit 50-yr
WS 10-yr
EG 2-yr
Crit 10-yr
WS 2-yr
Crit 2-yr
Ground
Ineff
Bank Sta
Encroachment

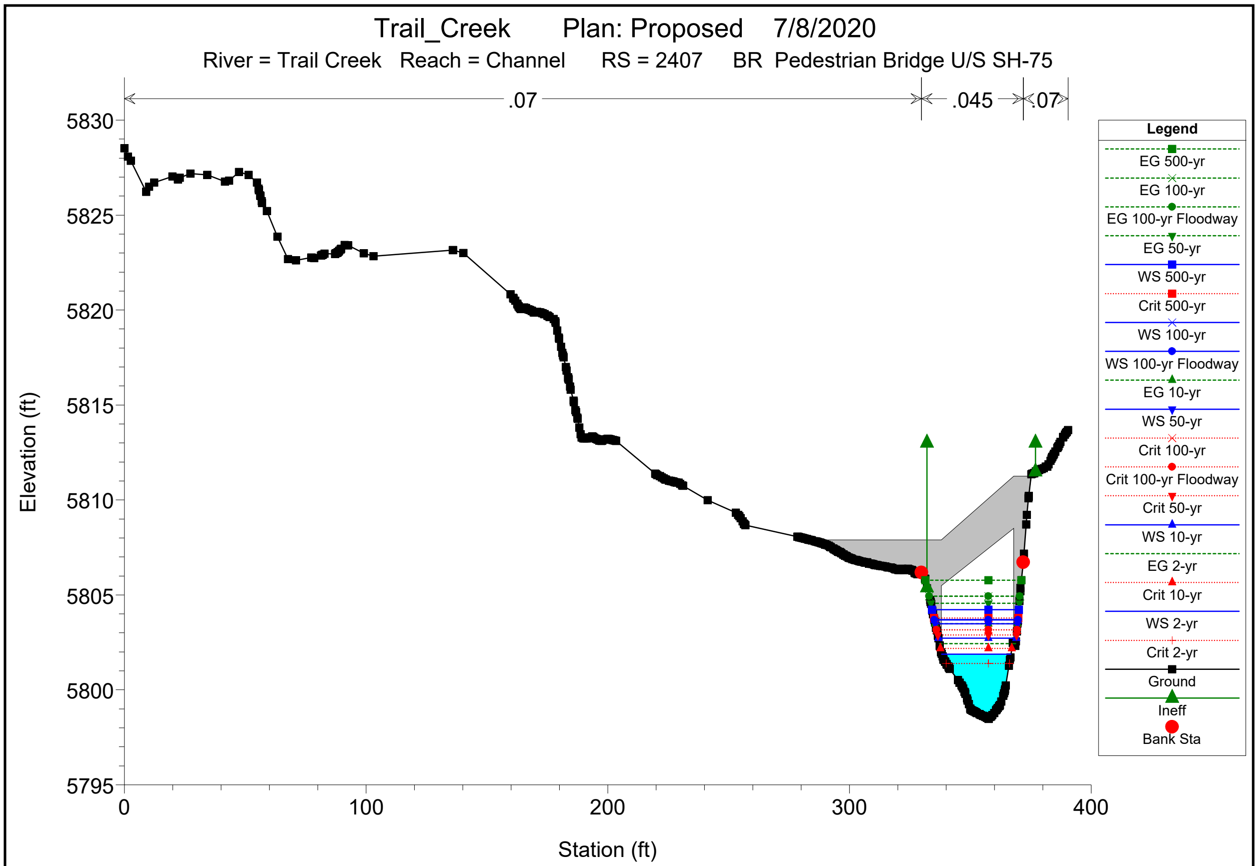

Trail_Creek Plan: Proposed 7/8/2020
River = Trail Creek Reach = Channel RS = 2769 D/S Leadville Bridge
.07
.045
.07
Elevation (ft)
Station (ft)
Legend
EG 500-yr
EG 100-yr Floodway
EG 100-yr
WS 500-yr
EG 50-yr
WS 100-yr Floodway
WS 100-yr
WS 50-yr
Crit 500-yr
EG 10-yr
Crit 100-yr Floodway
Crit 100-yr
Crit 50-yr
WS 10-yr
EG 2-yr
Crit 10-yr
WS 2-yr
Crit 2-yr
Ground
Ineff
Bank Sta
Encroachment


Trail_Creek Plan: Proposed 7/8/2020
River = Trail Creek Reach = Channel RS = 2680
.07
.045
.07
Elevation (ft)
Station (ft)
Legend
EG 500-yr
WS 500-yr
EG 100-yr
EG 100-yr Floodway
EG 50-yr
WS 100-yr
WS 100-yr Floodway
WS 50-yr
EG 10-yr
Crit 500-yr
WS 10-yr
Crit 100-yr Floodway
Crit 100-yr
Crit 50-yr
EG 2-yr
WS 2-yr
Crit 10-yr
Crit 2-yr
Ground
Ineff
Bank Sta
Encroachment

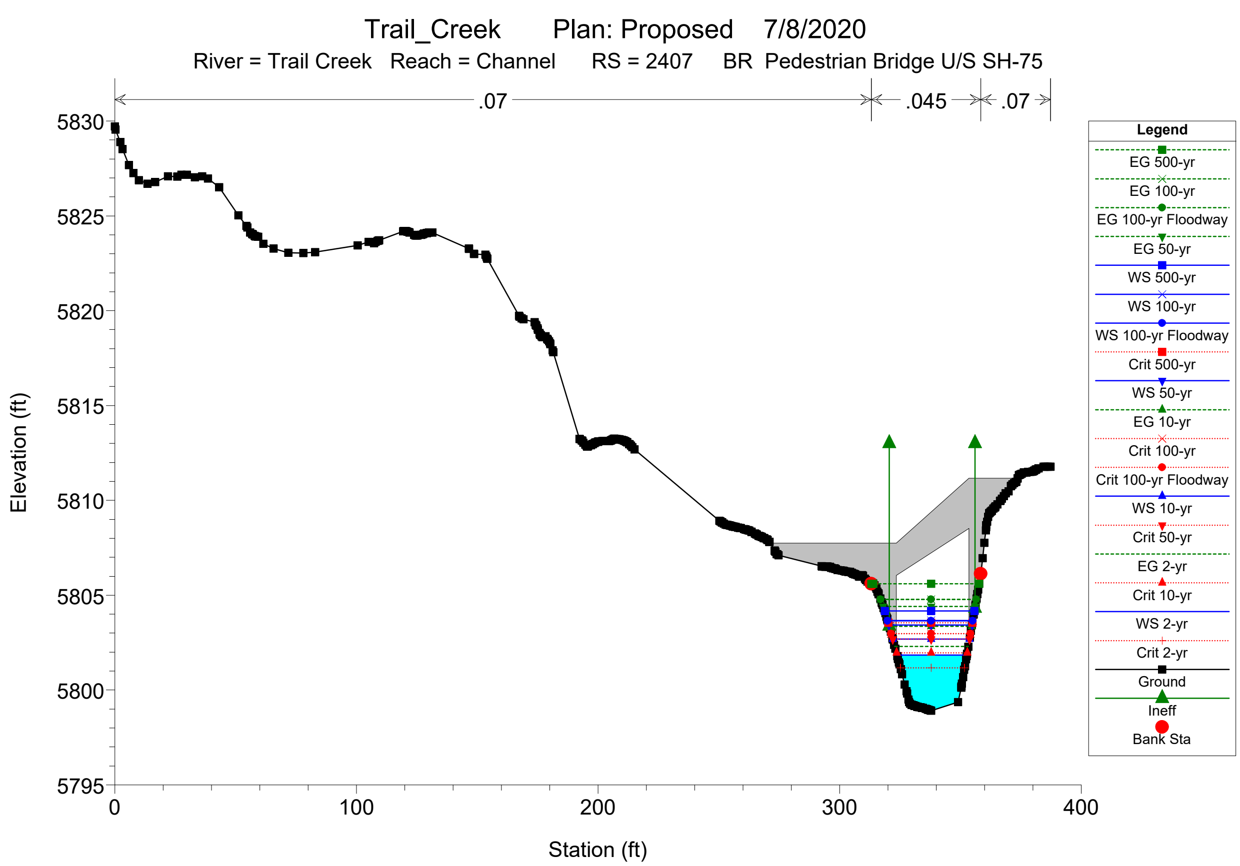

Trail_Creek Plan: Proposed 7/8/2020
River = Trail Creek Reach = Channel RS = 2550
.07
.045
.07
Elevation (ft)
Station (ft)
Legend
EG 500-yr
WS 500-yr
EG 100-yr
EG 100-yr Floodway
EG 50-yr
WS 100-yr
WS 100-yr Floodway
WS 50-yr
Crit 500-yr
EG 10-yr
Crit 100-yr
Crit 100-yr Floodway
WS 10-yr
Crit 50-yr
EG 2-yr
WS 2-yr
Crit 10-yr
Crit 2-yr
Ground
Ineff
Bank Sta
Encroachment


Trail_Creek Plan: Proposed 7/8/2020
River = Trail Creek Reach = Channel RS = 2439
.07
.045
.07
Elevation (ft)
Station (ft)
Legend
EG 500-yr
EG 100-yr
EG 100-yr Floodway
EG 50-yr
WS 500-yr
Crit 500-yr
EG 10-yr
WS 100-yr
WS 100-yr Floodway
Crit 100-yr Floodway
Crit 100-yr
WS 50-yr
Crit 50-yr
WS 10-yr
EG 2-yr
Crit 10-yr
WS 2-yr
Crit 2-yr
Ground
Ineff
Bank Sta

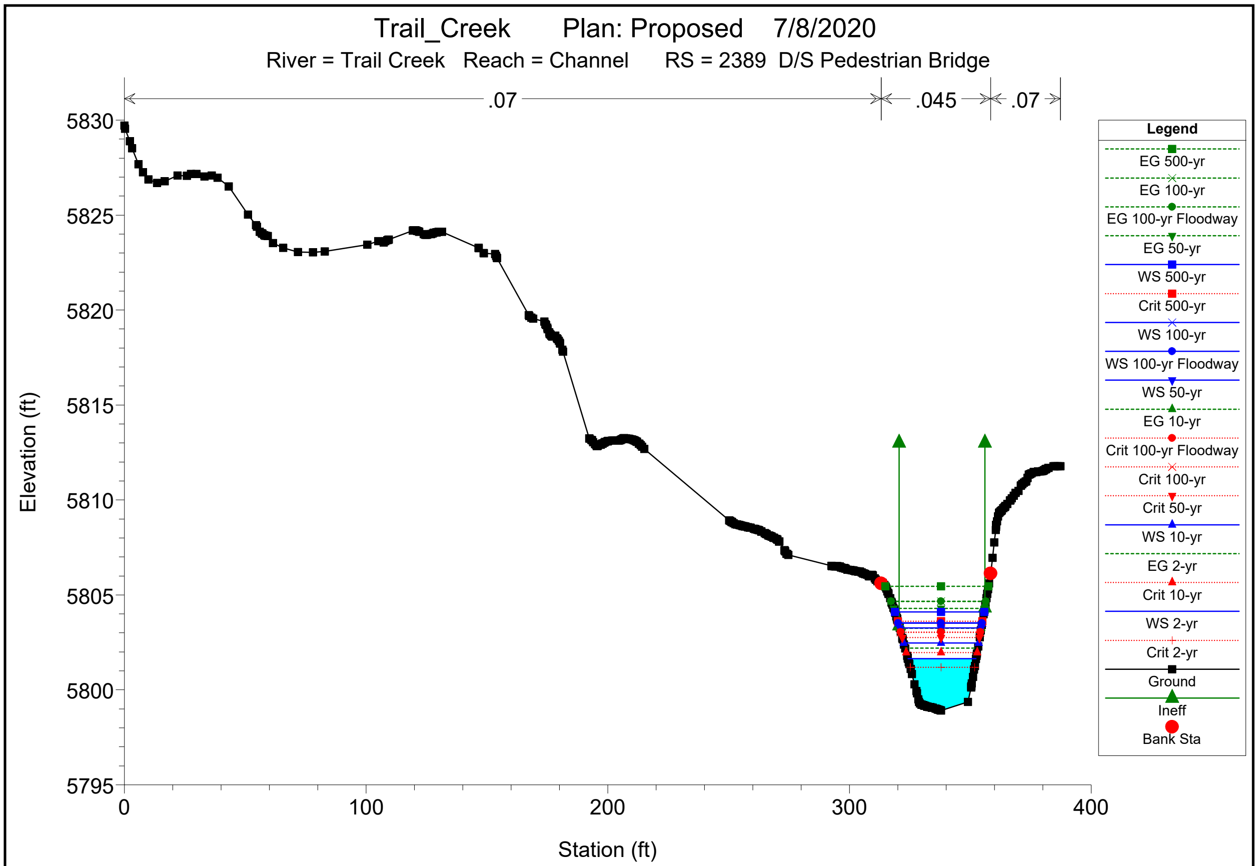

Trail_Creek Plan: Proposed 7/8/2020
River = Trail Creek Reach = Channel RS = 2415 U/S Pedestrian Bridge
.07
.045
.07
Elevation (ft)
Station (ft)
Legend
EG 500-yr
EG 100-yr
EG 100-yr Floodway
WS 500-yr
EG 50-yr
WS 100-yr
WS 100-yr Floodway
WS 50-yr
Crit 500-yr
EG 10-yr
Crit 100-yr
Crit 100-yr Floodway
Crit 50-yr
WS 10-yr
EG 2-yr
Crit 10-yr
WS 2-yr
Crit 2-yr
Ground
Ineff
Bank Sta
Encroachment

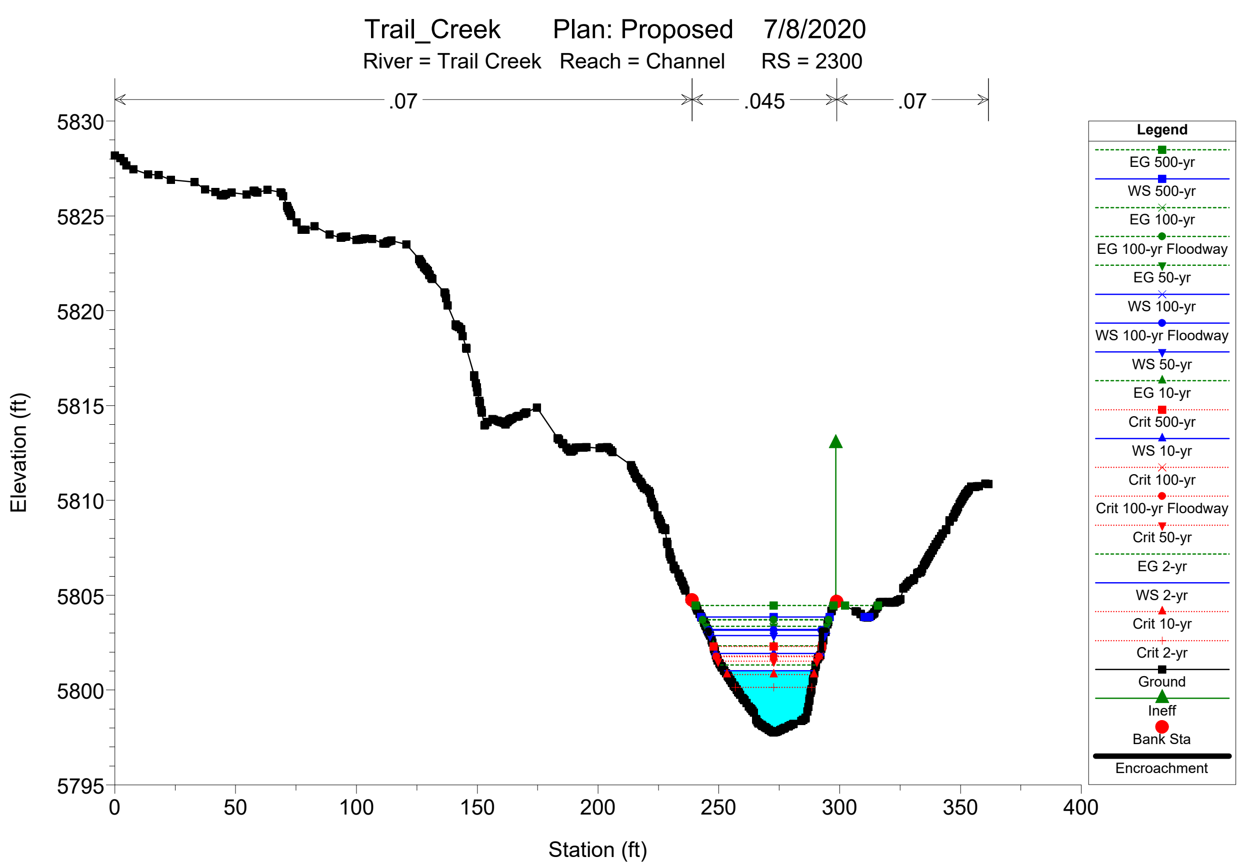


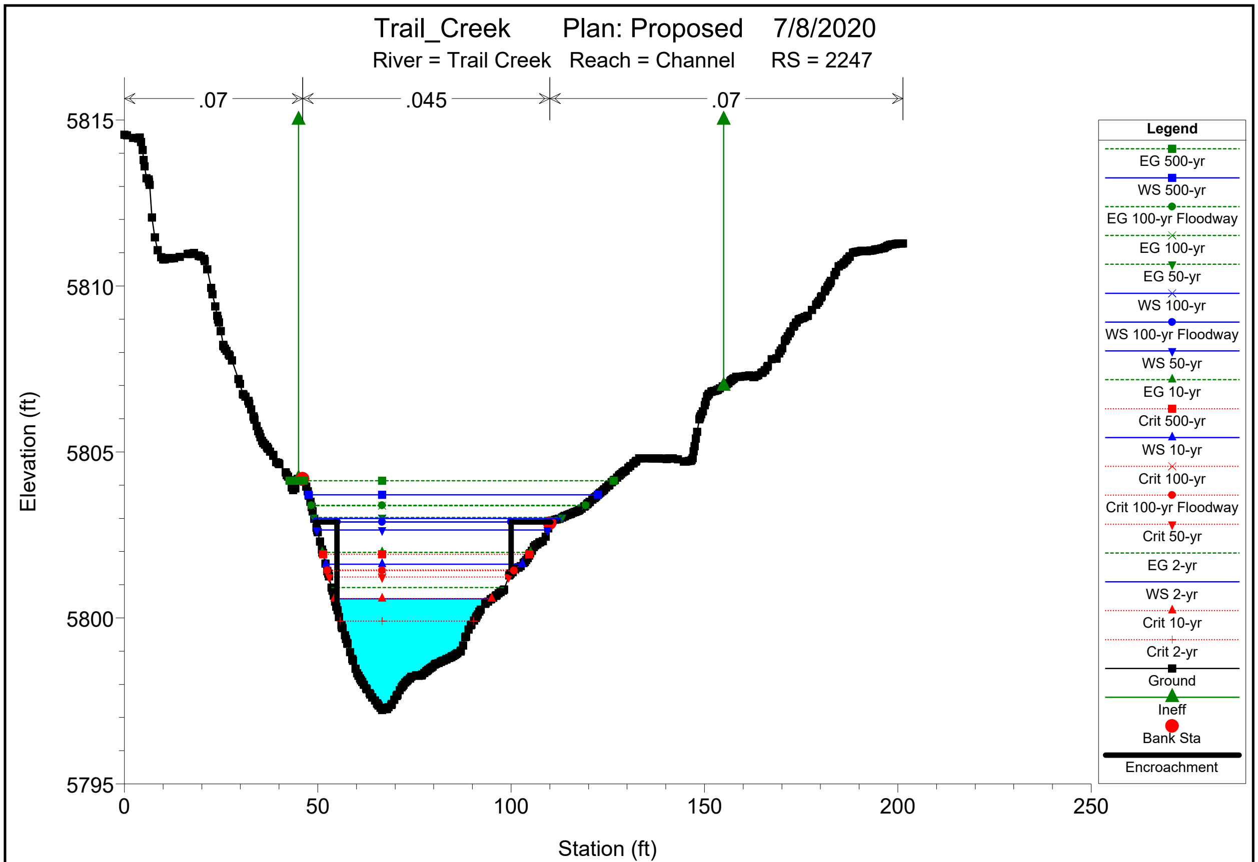
Trail_Creek Plan: Proposed 7/8/2020
River = Trail Creek Reach = Channel RS = 2407 BR Pedestrian Bridge U/S SH-75
.07
.045
.07
Elevation (ft)
5830
5825
5820
5815
5810
5805
5800
5795
0
100
200
300
400
Station (ft)
Legend
EG 500-yr
EG 100-yr
EG 100-yr Floodway
EG 50-yr
WS 500-yr
Crit 500-yr
WS 100-yr
WS 100-yr Floodway
EG 10-yr
WS 50-yr
Crit 100-yr
Crit 100-yr Floodway
Crit 50-yr
WS 10-yr
EG 2-yr
Crit 10-yr
WS 2-yr
Crit 2-yr
Ground
Ineff
Bank Sta

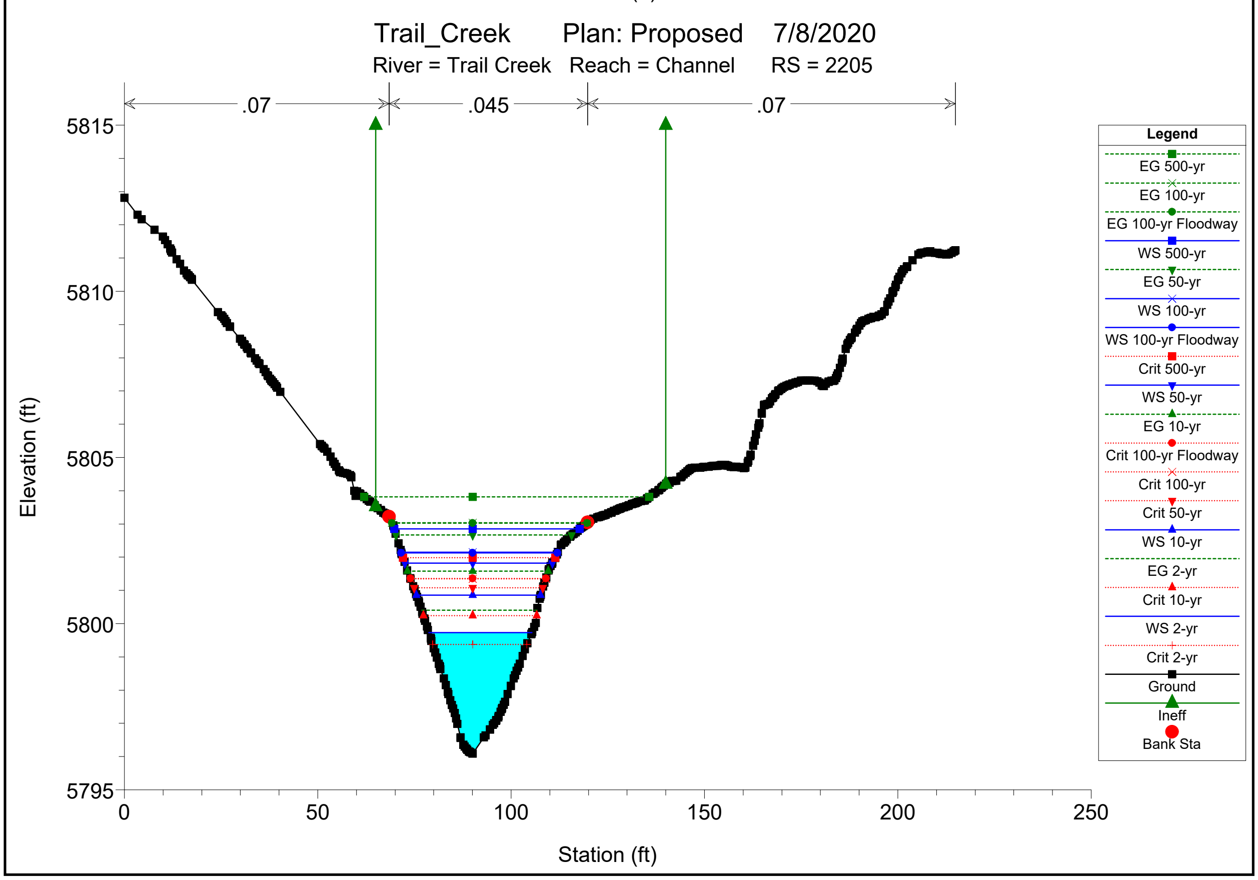


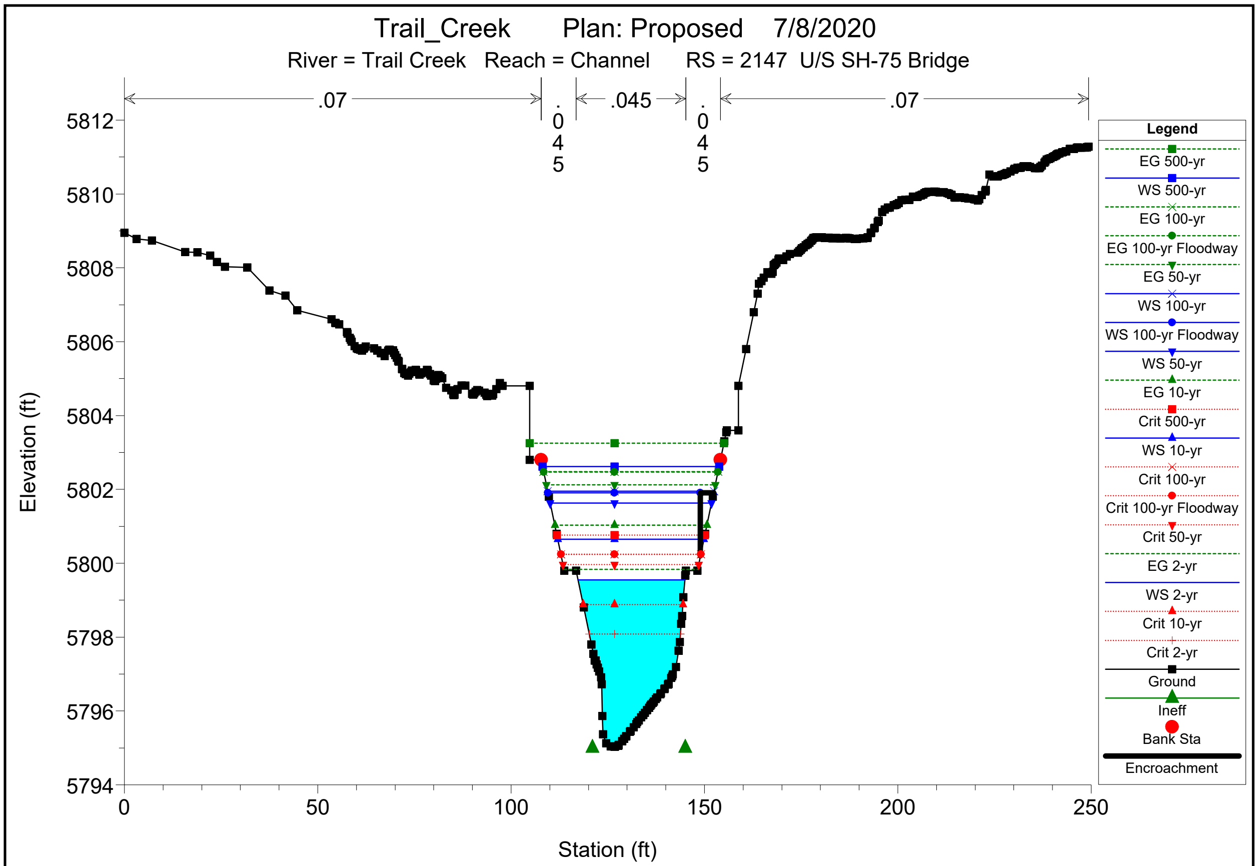
Trail_Creek Plan: Proposed 7/8/2020
River = Trail Creek Reach = Channel RS = 2407 BR Pedestrian Bridge U/S SH-75
.07
.045
.07
Elevation (ft)
5830
5825
5820
5815
5810
5805
5800
5795
0
100
200
300
400
Station (ft)
Legend
EG 500-yr
EG 100-yr
EG 100-yr Floodway
EG 50-yr
WS 500-yr
WS 100-yr
WS 100-yr Floodway
Crit 500-yr
WS 50-yr
EG 10-yr
Crit 100-yr
Crit 100-yr Floodway
WS 10-yr
Crit 50-yr
EG 2-yr
Crit 10-yr
WS 2-yr
Crit 2-yr
Ground
Ineff
Bank Sta


Trail_Creek Plan: Proposed 7/8/2020
River = Trail Creek Reach = Channel RS = 2389 D/S Pedestrian Bridge
.07
.045
.07
Legend
EG 500-yr
EG 100-yr
EG 100-yr Floodway
EG 50-yr
WS 500-yr
Crit 500-yr
WS 100-yr
WS 100-yr Floodway
WS 50-yr
EG 10-yr
Crit 100-yr Floodway
Crit 100-yr
Crit 50-yr
WS 10-yr
EG 2-yr
Crit 10-yr
WS 2-yr
Crit 2-yr
Ground
Ineff
Bank Sta
Elevation (ft)
Station (ft)

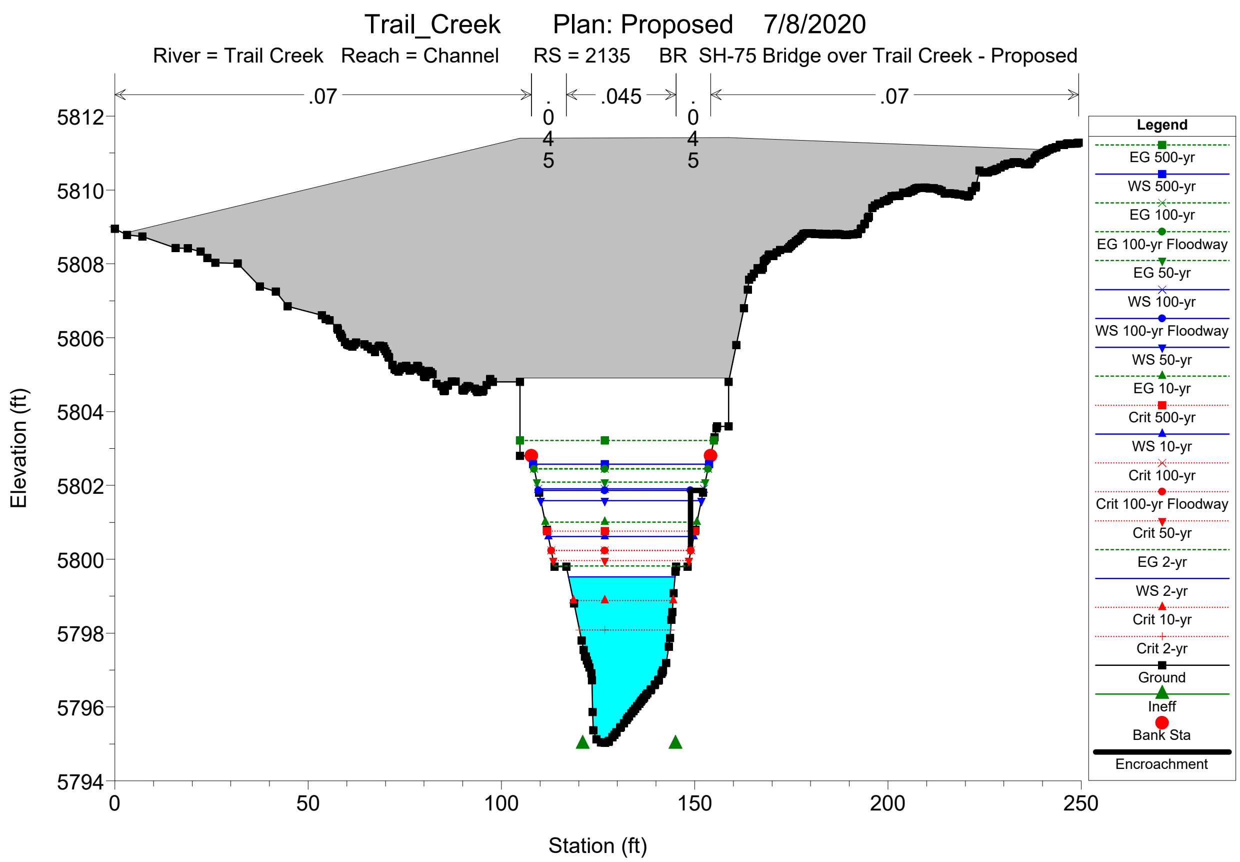

Trail_Creek Plan: Proposed 7/8/2020
River = Trail Creek Reach = Channel RS = 2300
.07
.045
.07
Legend
EG 500-yr
WS 500-yr
EG 100-yr
EG 100-yr Floodway
EG 50-yr
WS 100-yr
WS 100-yr Floodway
WS 50-yr
EG 10-yr
Crit 500-yr
WS 10-yr
Crit 100-yr
Crit 100-yr Floodway
Crit 50-yr
EG 2-yr
WS 2-yr
Crit 10-yr
Crit 2-yr
Ground
Ineff
Bank Sta
Encroachment
Elevation (ft)
Station (ft)


Trail_Creek Plan: Proposed 7/8/2020
River = Trail Creek Reach = Channel RS = 2247
.07
.045
.07
Elevation (ft)
Station (ft)
Legend
EG 500-yr
WS 500-yr
EG 100-yr Floodway
EG 100-yr
EG 50-yr
WS 100-yr
WS 100-yr Floodway
WS 50-yr
EG 10-yr
Crit 500-yr
WS 10-yr
Crit 100-yr
Crit 100-yr Floodway
Crit 50-yr
EG 2-yr
WS 2-yr
Crit 10-yr
Crit 2-yr
Ground
Ineff
Bank Sta
Encroachment

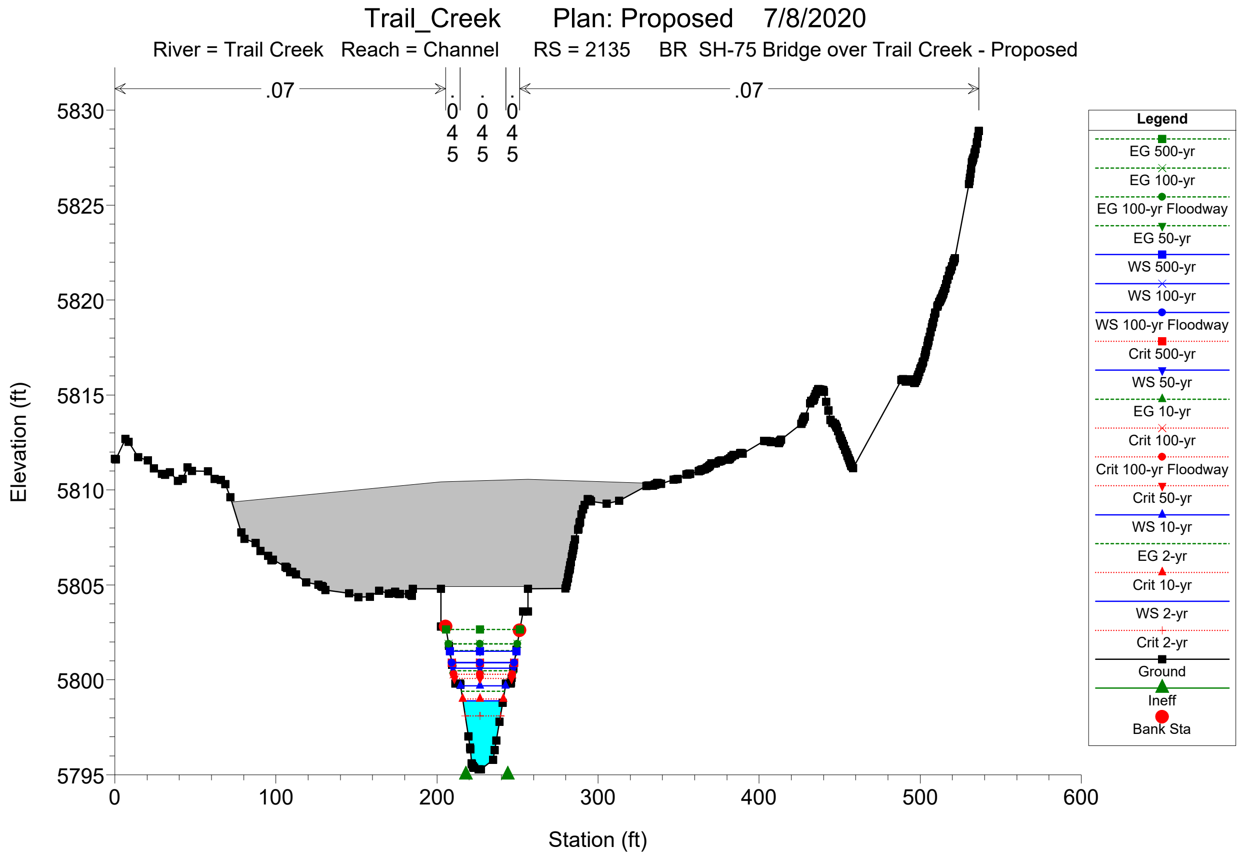

Trail_Creek Plan: Proposed 7/8/2020
River = Trail Creek Reach = Channel RS = 2205
.07
.045
.07
Elevation (ft)
Station (ft)
Legend
EG 500-yr
EG 100-yr
EG 100-yr Floodway
WS 500-yr
EG 50-yr
WS 100-yr
WS 100-yr Floodway
Crit 500-yr
WS 50-yr
EG 10-yr
Crit 100-yr Floodway
Crit 100-yr
Crit 50-yr
WS 10-yr
EG 2-yr
Crit 10-yr
WS 2-yr
Crit 2-yr
Ground
Ineff
Bank Sta



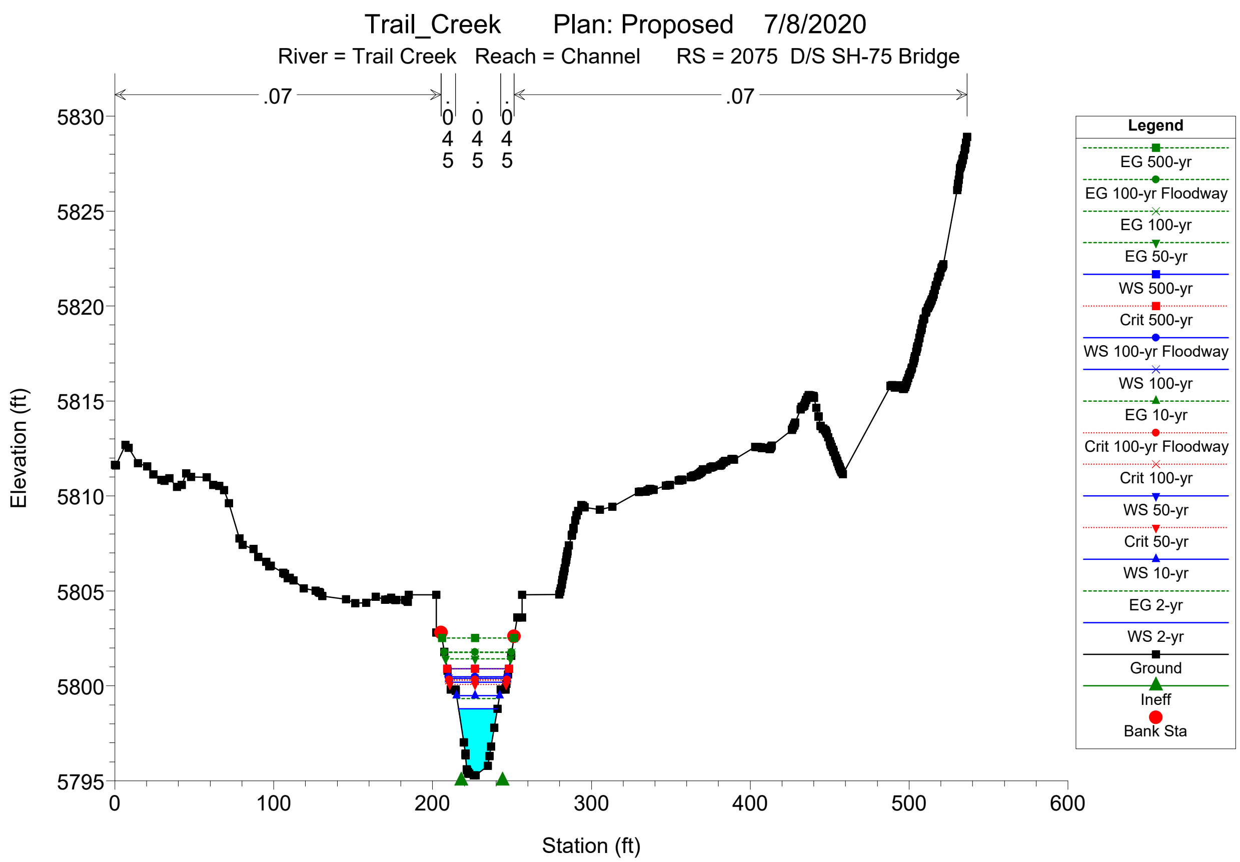
Trail_Creek Plan: Proposed 7/8/2020
River = Trail Creek Reach = Channel RS = 2147 U/S SH-75 Bridge
.07
.045
.07
.045
.045
Elevation (ft)
Station (ft)
5812
5810
5808
5806
5804
5802
5800
5798
5796
5794
0
50
100
150
200
250
Legend
EG 500-yr
WS 500-yr
EG 100-yr
EG 100-yr Floodway
EG 50-yr
WS 100-yr
WS 100-yr Floodway
WS 50-yr
EG 10-yr
Crit 500-yr
WS 10-yr
Crit 100-yr
Crit 100-yr Floodway
Crit 50-yr
EG 2-yr
WS 2-yr
Crit 10-yr
Crit 2-yr
Ground
Ineff
Bank Sta
Encroachment



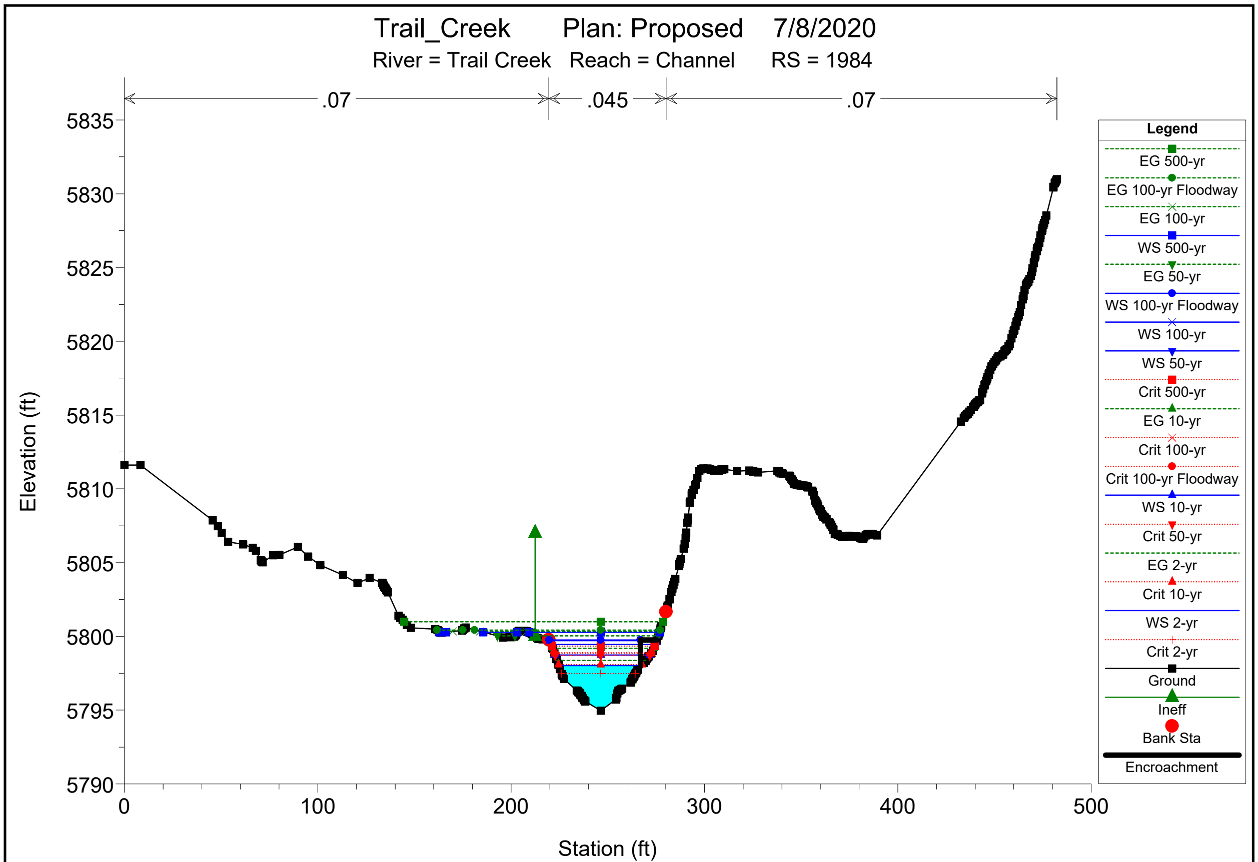
Trail_Creek Plan: Proposed 7/8/2020
River = Trail Creek Reach = Channel RS = 2135 BR SH-75 Bridge over Trail Creek - Proposed
.07
.045
.07
.045
.045
Elevation (ft)
Station (ft)
5812
5810
5808
5806
5804
5802
5800
5798
5796
5794
0
50
100
150
200
250
Legend
EG 500-yr
WS 500-yr
EG 100-yr
EG 100-yr Floodway
EG 50-yr
WS 100-yr
WS 100-yr Floodway
WS 50-yr
EG 10-yr
Crit 500-yr
WS 10-yr
Crit 100-yr
Crit 100-yr Floodway
Crit 50-yr
EG 2-yr
WS 2-yr
Crit 10-yr
Crit 2-yr
Ground
Ineff
Bank Sta
Encroachment



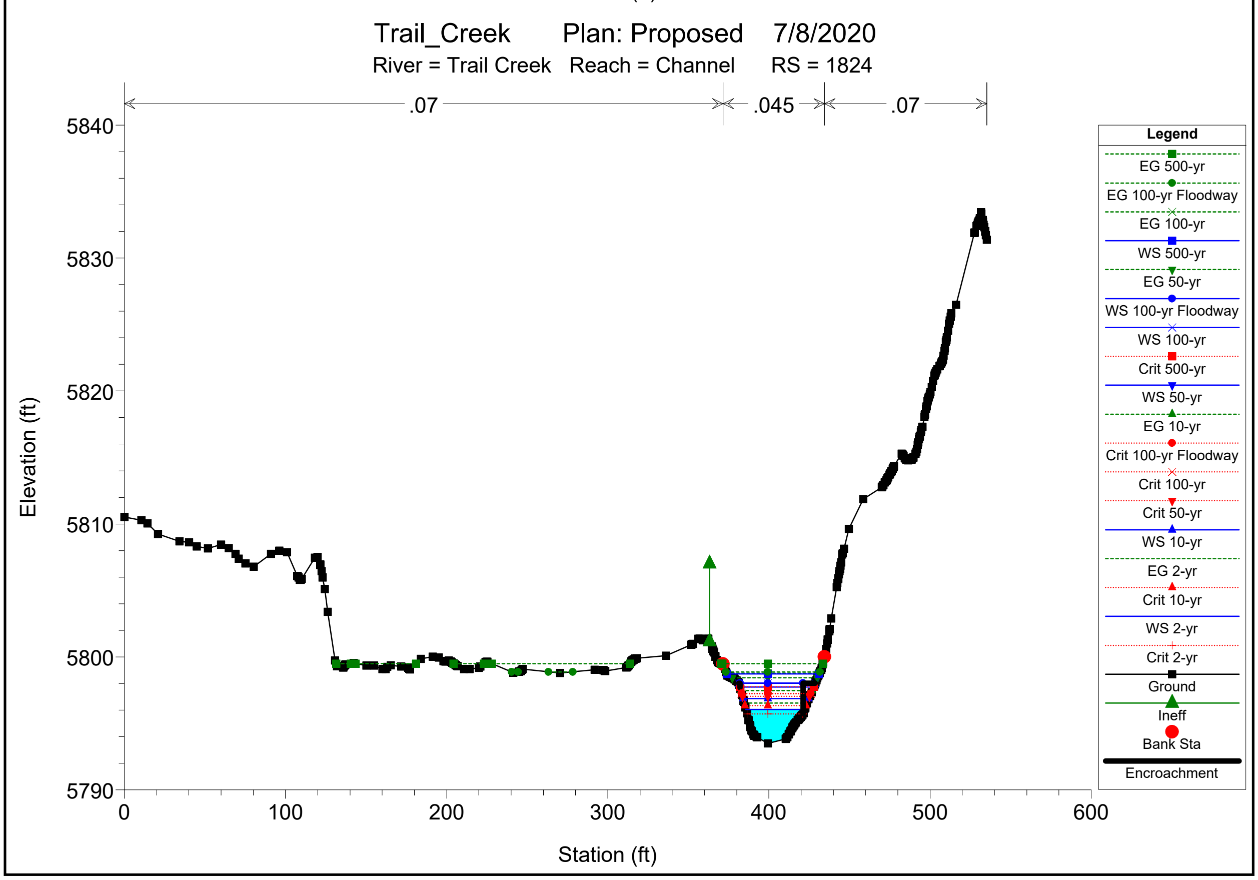
Trail_Creek Plan: Proposed 7/8/2020
River = Trail Creek Reach = Channel RS = 2135 BR SH-75 Bridge over Trail Creek - Proposed
.07
.045
.045
.045
.07
Elevation (ft)
5830
5825
5820
5815
5810
5805
5800
5795
0
100
200
300
400
500
600
Station (ft)
Legend
EG 500-yr
EG 100-yr
EG 100-yr Floodway
EG 50-yr
WS 500-yr
WS 100-yr
WS 100-yr Floodway
Crit 500-yr
WS 50-yr
EG 10-yr
Crit 100-yr
Crit 100-yr Floodway
Crit 50-yr
WS 10-yr
EG 2-yr
Crit 10-yr
WS 2-yr
Crit 2-yr
Ground
Ineff
Bank Sta



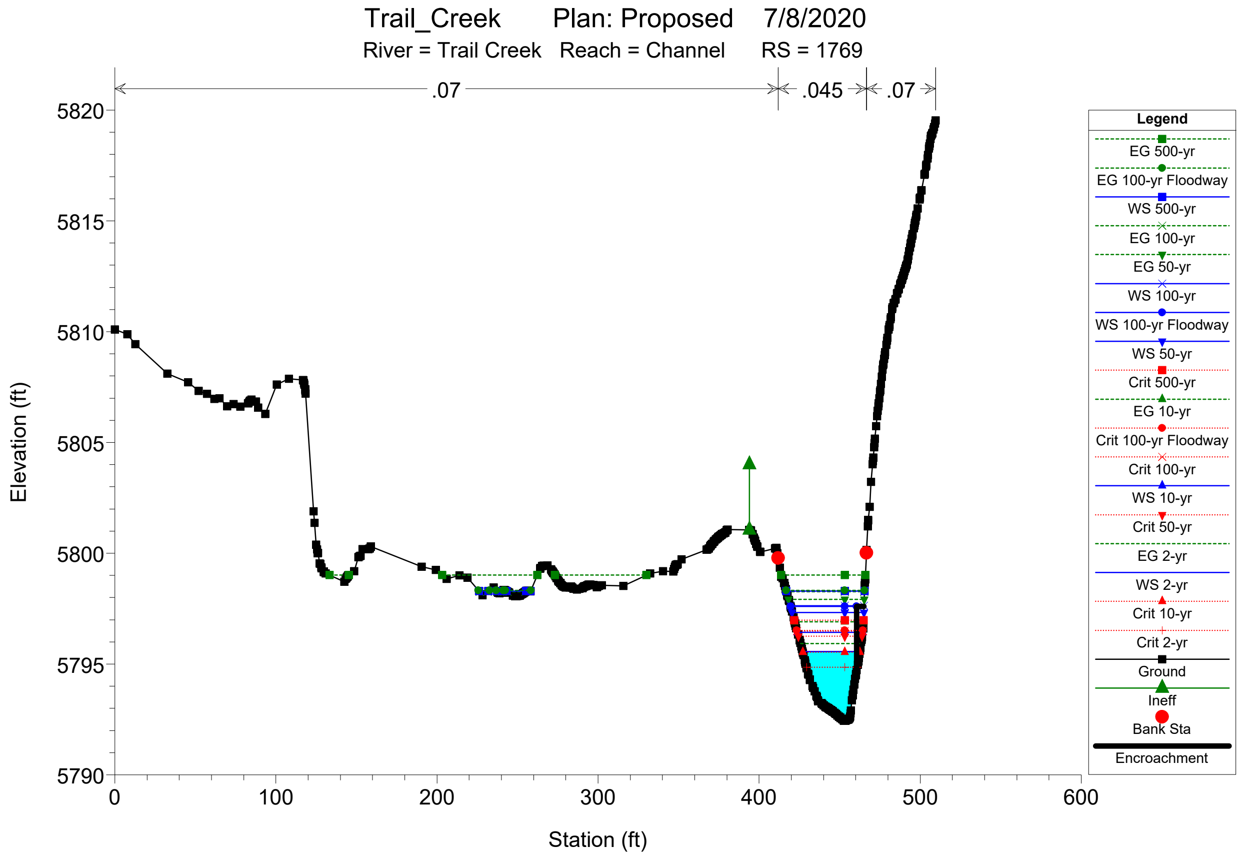
Trail_Creek Plan: Proposed 7/8/2020
River = Trail Creek Reach = Channel RS = 2075 D/S SH-75 Bridge
.07
.045
.045
.045
.07
Elevation (ft)
5830
5825
5820
5815
5810
5805
5800
5795
0
100
200
300
400
500
600
Station (ft)
Legend
EG 500-yr
EG 100-yr Floodway
EG 100-yr
EG 50-yr
WS 500-yr
Crit 500-yr
WS 100-yr Floodway
WS 100-yr
EG 10-yr
Crit 100-yr Floodway
Crit 100-yr
WS 50-yr
Crit 50-yr
WS 10-yr
EG 2-yr
WS 2-yr
Ground
Ineff
Bank Sta



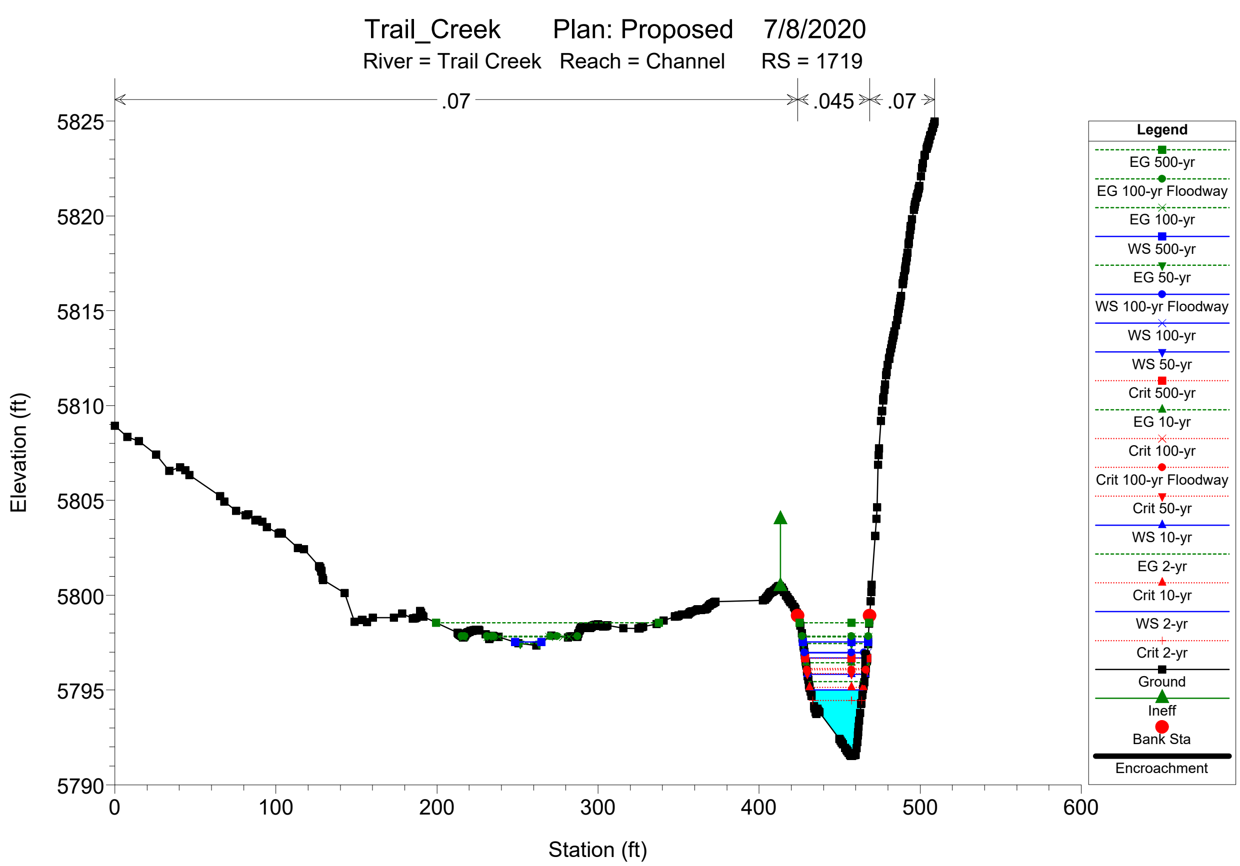
Trail_Creek Plan: Proposed 7/8/2020
River = Trail Creek Reach = Channel RS = 1984
.07
.045
.07
Elevation (ft)
Station (ft)
Legend
EG 500-yr
EG 100-yr Floodway
EG 100-yr
WS 500-yr
EG 50-yr
WS 100-yr Floodway
WS 100-yr
WS 50-yr
Crit 500-yr
EG 10-yr
Crit 100-yr
Crit 100-yr Floodway
WS 10-yr
Crit 50-yr
EG 2-yr
Crit 10-yr
WS 2-yr
Crit 2-yr
Ground
Ineff
Bank Sta
Encroachment



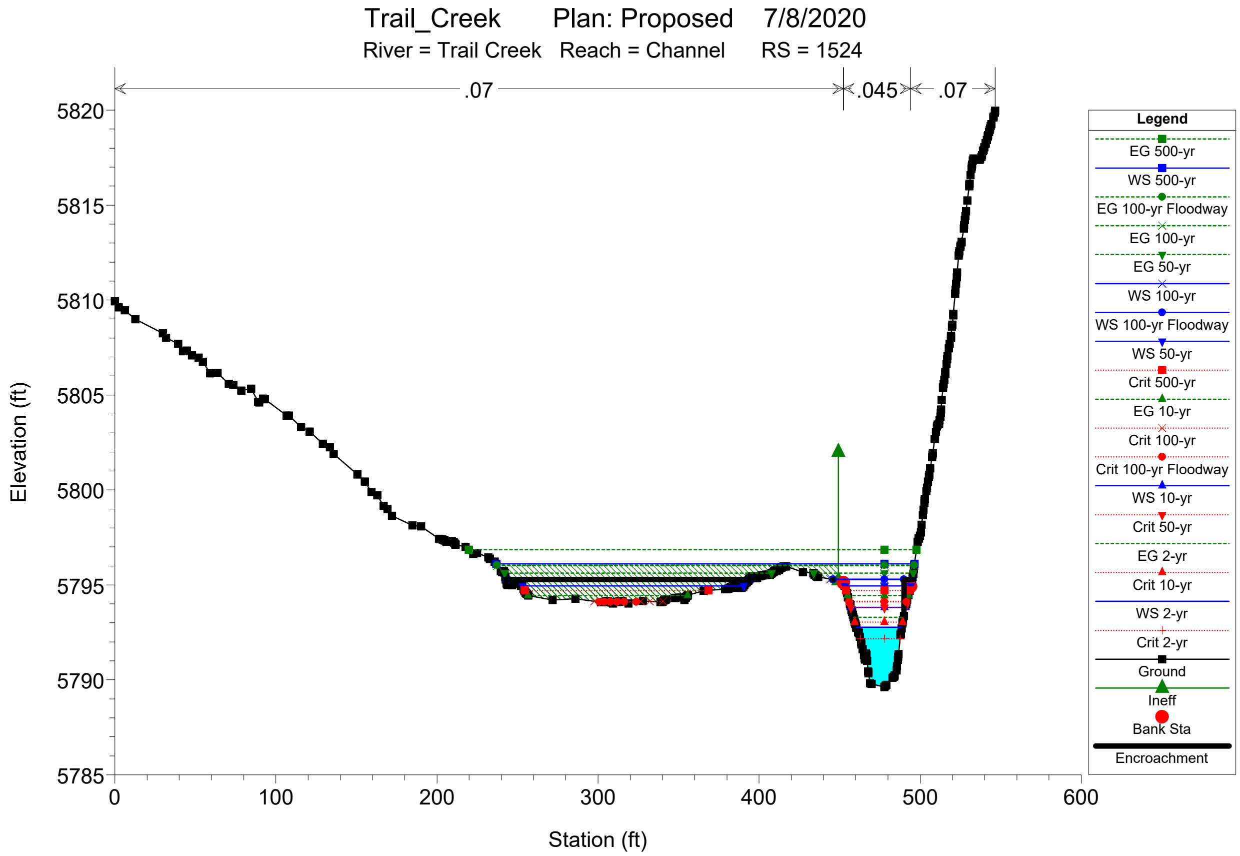
Trail_Creek Plan: Proposed 7/8/2020
River = Trail Creek Reach = Channel RS = 1824
.07
.045
.07
Elevation (ft)
Station (ft)
Legend
EG 500-yr
EG 100-yr Floodway
EG 100-yr
WS 500-yr
EG 50-yr
WS 100-yr Floodway
WS 100-yr
Crit 500-yr
WS 50-yr
EG 10-yr
Crit 100-yr Floodway
Crit 100-yr
Crit 50-yr
WS 10-yr
EG 2-yr
Crit 10-yr
WS 2-yr
Crit 2-yr
Ground
Ineff
Bank Sta
Encroachment

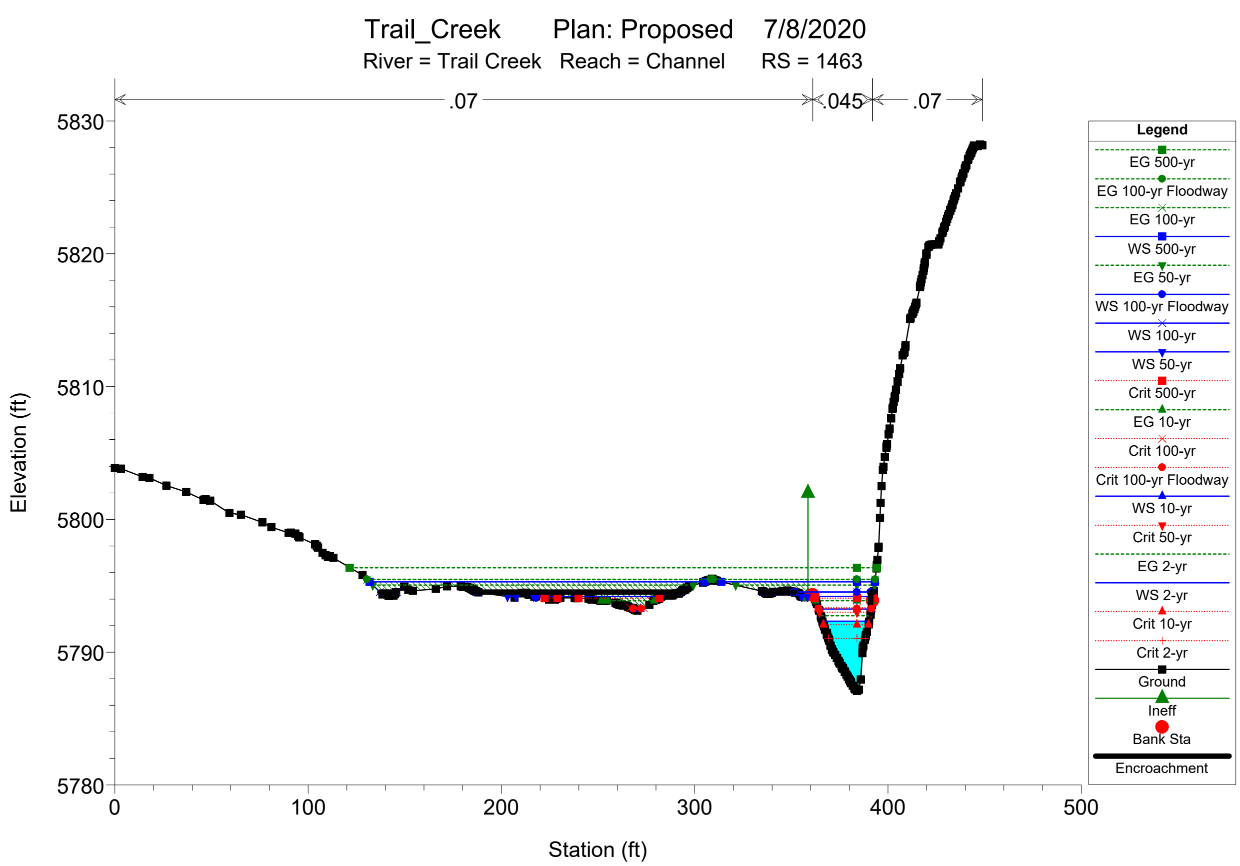


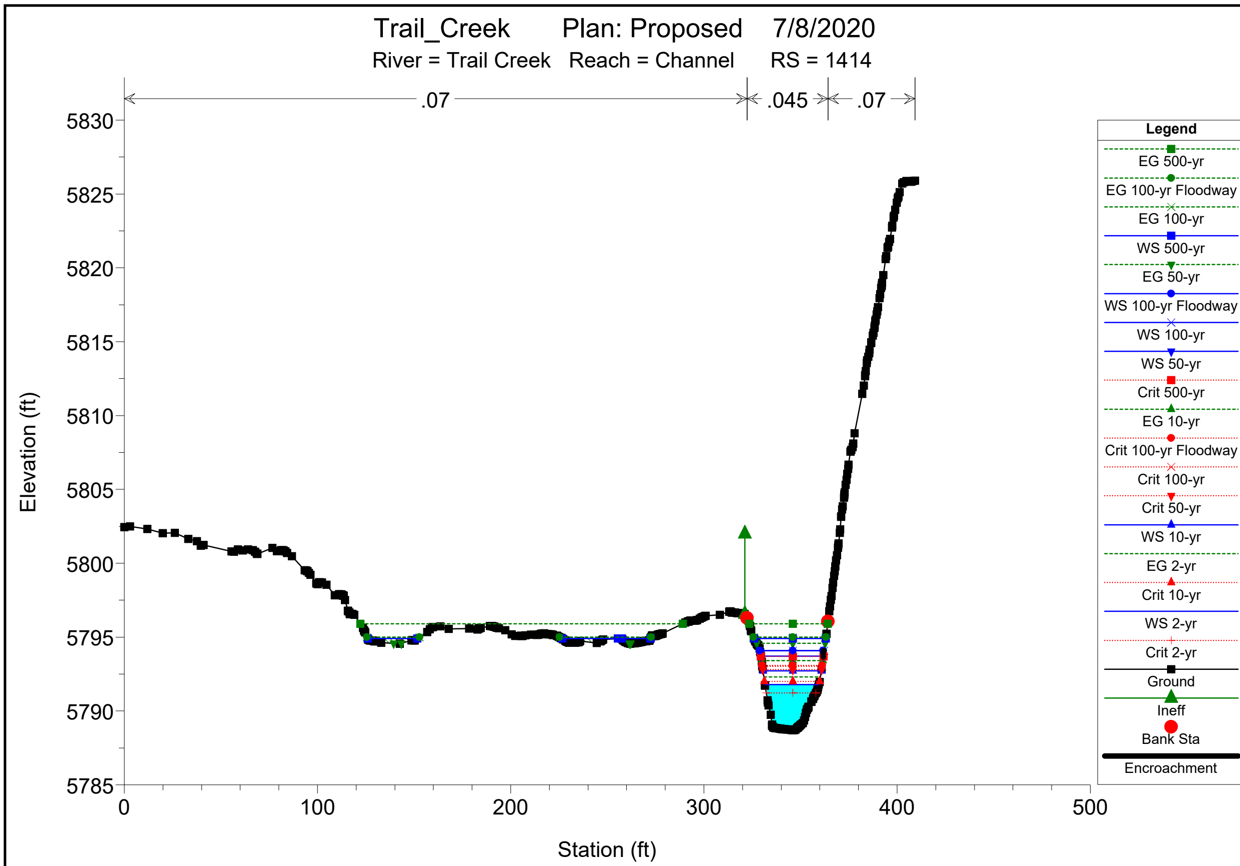
Trail_Creek Plan: Proposed 7/8/2020
River = Trail Creek Reach = Channel RS = 1769
.07
.045
.07
5820
5815
5810
5805
5800
5795
5790
Elevation (ft)
0
100
200
300
400
500
600
Station (ft)
Legend
EG 500-yr
EG 100-yr Floodway
WS 500-yr
EG 100-yr
EG 50-yr
WS 100-yr
WS 100-yr Floodway
WS 50-yr
Crit 500-yr
EG 10-yr
Crit 100-yr Floodway
Crit 100-yr
WS 10-yr
Crit 50-yr
EG 2-yr
WS 2-yr
Crit 10-yr
Crit 2-yr
Ground
Ineff
Bank Sta
Encroachment

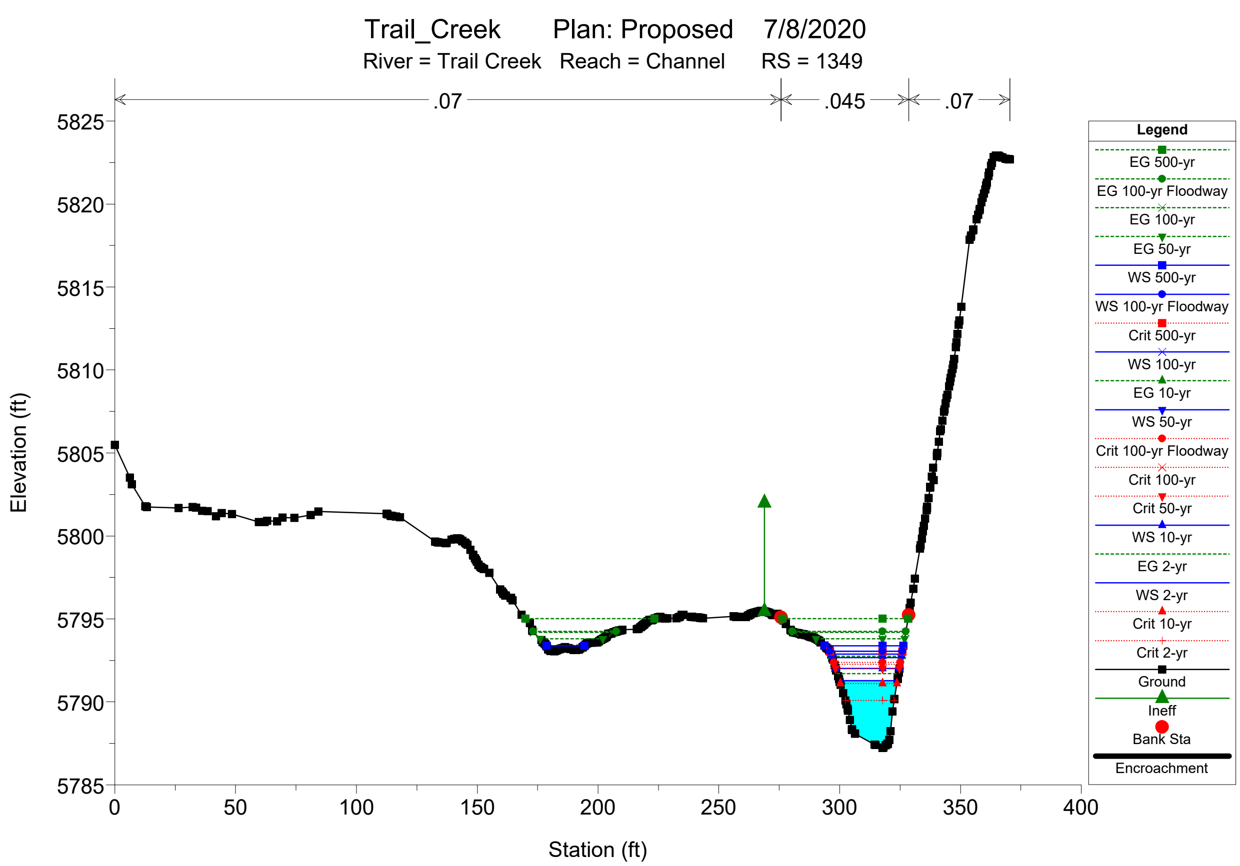


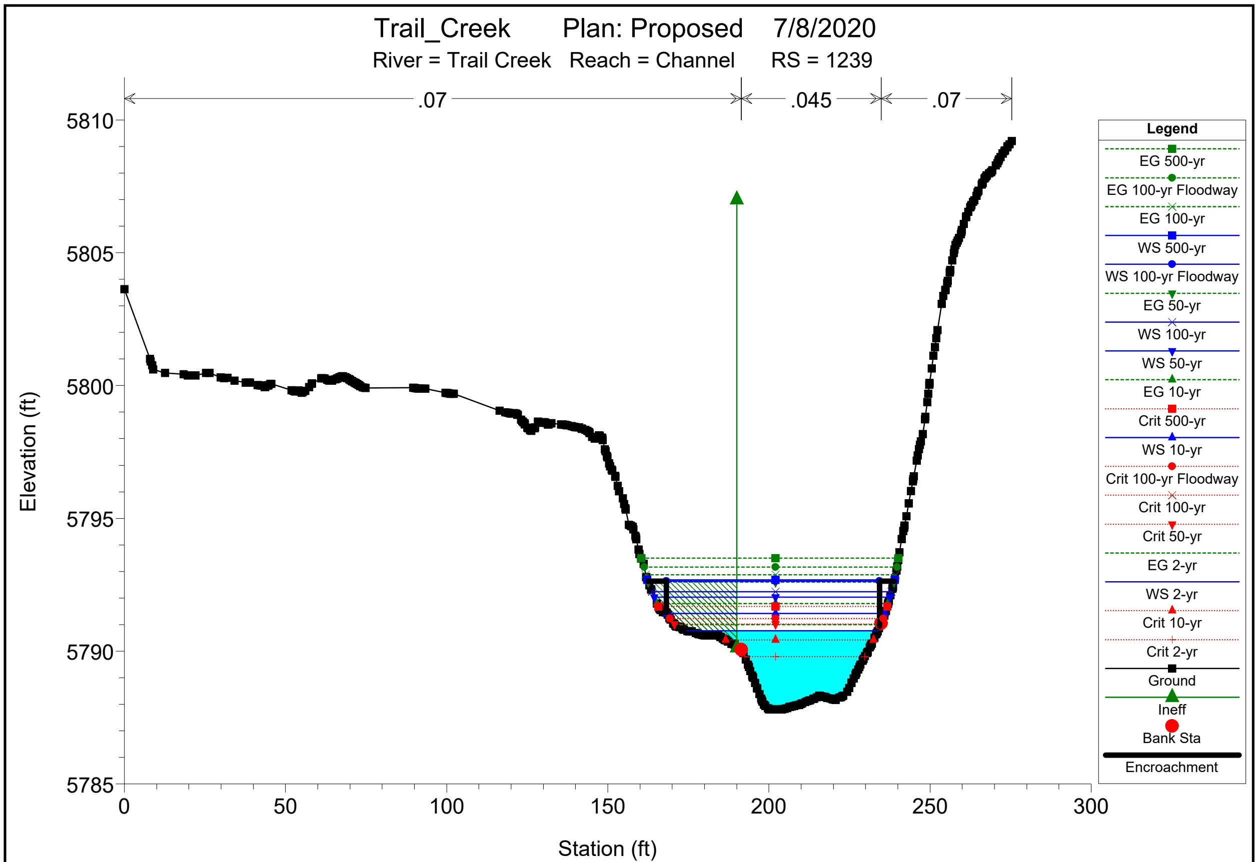
Trail_Creek Plan: Proposed 7/8/2020
River = Trail Creek Reach = Channel RS = 1719
.07
.045
.07
5825
5820
5815
5810
5805
5800
5795
5790
Elevation (ft)
0
100
200
300
400
500
600
Station (ft)
Legend
EG 500-yr
EG 100-yr Floodway
EG 100-yr
WS 500-yr
EG 50-yr
WS 100-yr Floodway
WS 100-yr
WS 50-yr
Crit 500-yr
EG 10-yr
Crit 100-yr
Crit 100-yr Floodway
Crit 50-yr
WS 10-yr
EG 2-yr
Crit 10-yr
WS 2-yr
Crit 2-yr
Ground
Ineff
Bank Sta
Encroachment


Trail_Creek Plan: Proposed 7/8/2020
River = Trail Creek Reach = Channel RS = 1524
.07
.045
.07
Elevation (ft)
5820
5815
5810
5805
5800
5795
5790
5785
0
100
200
300
400
500
600
Station (ft)
Legend
EG 500-yr
WS 500-yr
EG 100-yr Floodway
EG 100-yr
EG 50-yr
WS 100-yr
WS 100-yr Floodway
WS 50-yr
Crit 500-yr
EG 10-yr
Crit 100-yr
Crit 100-yr Floodway
WS 10-yr
Crit 50-yr
EG 2-yr
Crit 10-yr
WS 2-yr
Crit 2-yr
Ground
Ineff
Bank Sta
Encroachment

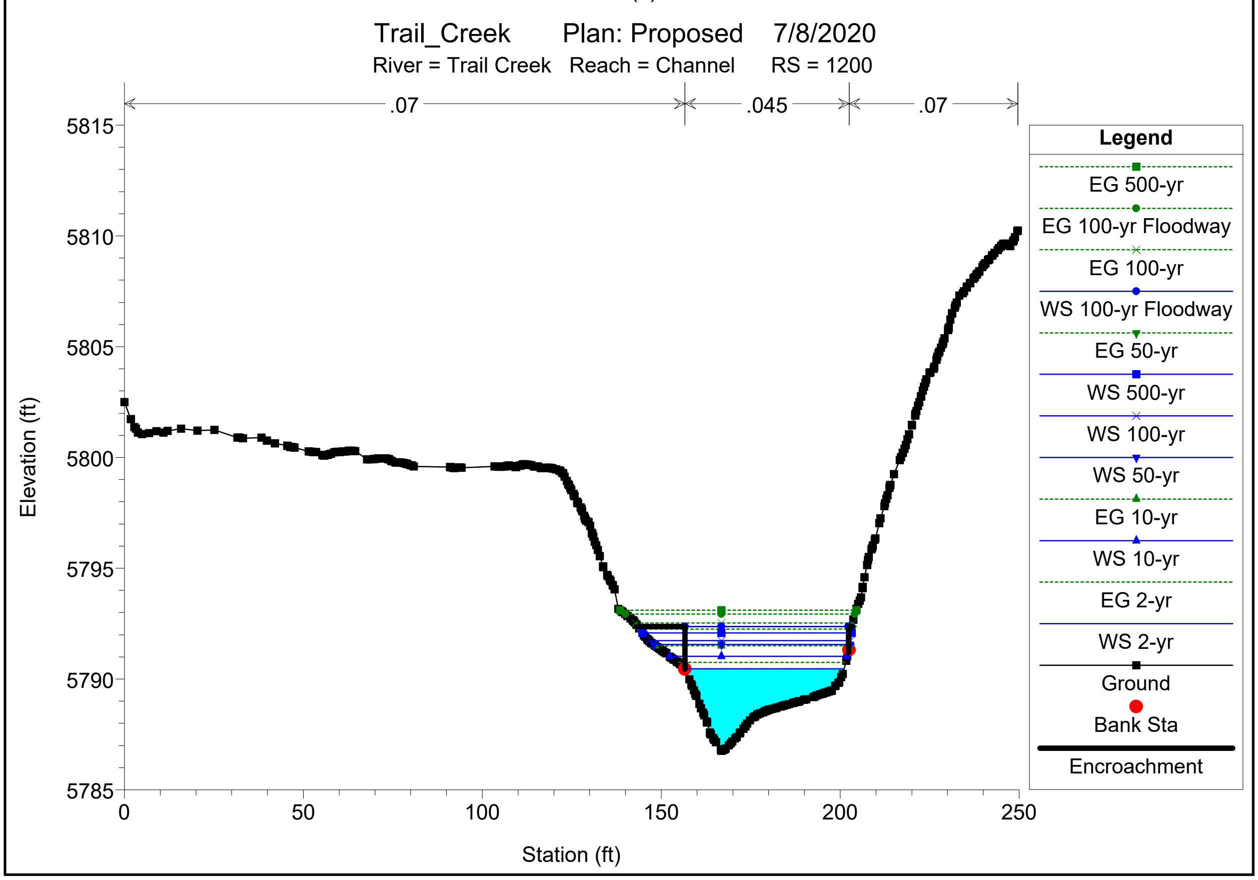

Trail_Creek Plan: Proposed 7/8/2020
River = Trail Creek Reach = Channel RS = 1463
.07
.045
.07
Elevation (ft)
5830
5820
5810
5800
5790
5780
0
100
200
300
400
500
Station (ft)
Legend
EG 500-yr
EG 100-yr Floodway
EG 100-yr
WS 500-yr
EG 50-yr
WS 100-yr Floodway
WS 100-yr
WS 50-yr
Crit 500-yr
EG 10-yr
Crit 100-yr
Crit 100-yr Floodway
WS 10-yr
Crit 50-yr
EG 2-yr
WS 2-yr
Crit 10-yr
Crit 2-yr
Ground
Ineff
Bank Sta
Encroachment


Trail_Creek Plan: Proposed 7/8/2020
River = Trail Creek Reach = Channel RS = 1414
.07
.045
.07
Elevation (ft)
Station (ft)
Legend
EG 500-yr
EG 100-yr Floodway
EG 100-yr
WS 500-yr
EG 50-yr
WS 100-yr Floodway
WS 100-yr
WS 50-yr
Crit 500-yr
EG 10-yr
Crit 100-yr Floodway
Crit 100-yr
Crit 50-yr
WS 10-yr
EG 2-yr
Crit 10-yr
WS 2-yr
Crit 2-yr
Ground
Ineff
Bank Sta
Encroachment

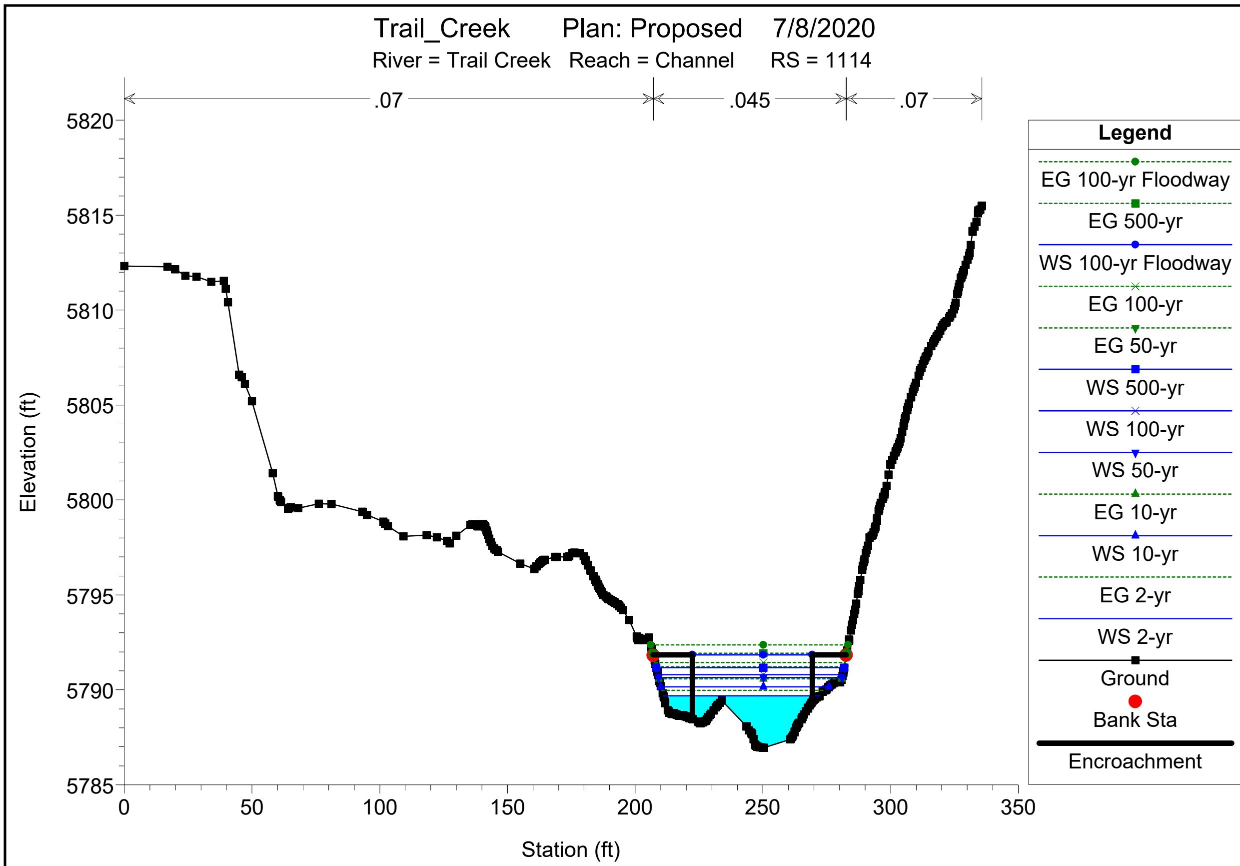

Trail_Creek Plan: Proposed 7/8/2020
River = Trail Creek Reach = Channel RS = 1349
.07
.045
.07
Elevation (ft)
Station (ft)
Legend
EG 500-yr
EG 100-yr Floodway
EG 100-yr
EG 50-yr
WS 500-yr
WS 100-yr Floodway
Crit 500-yr
WS 100-yr
EG 10-yr
WS 50-yr
Crit 100-yr Floodway
Crit 100-yr
Crit 50-yr
WS 10-yr
EG 2-yr
WS 2-yr
Crit 10-yr
Crit 2-yr
Ground
Ineff
Bank Sta
Encroachment

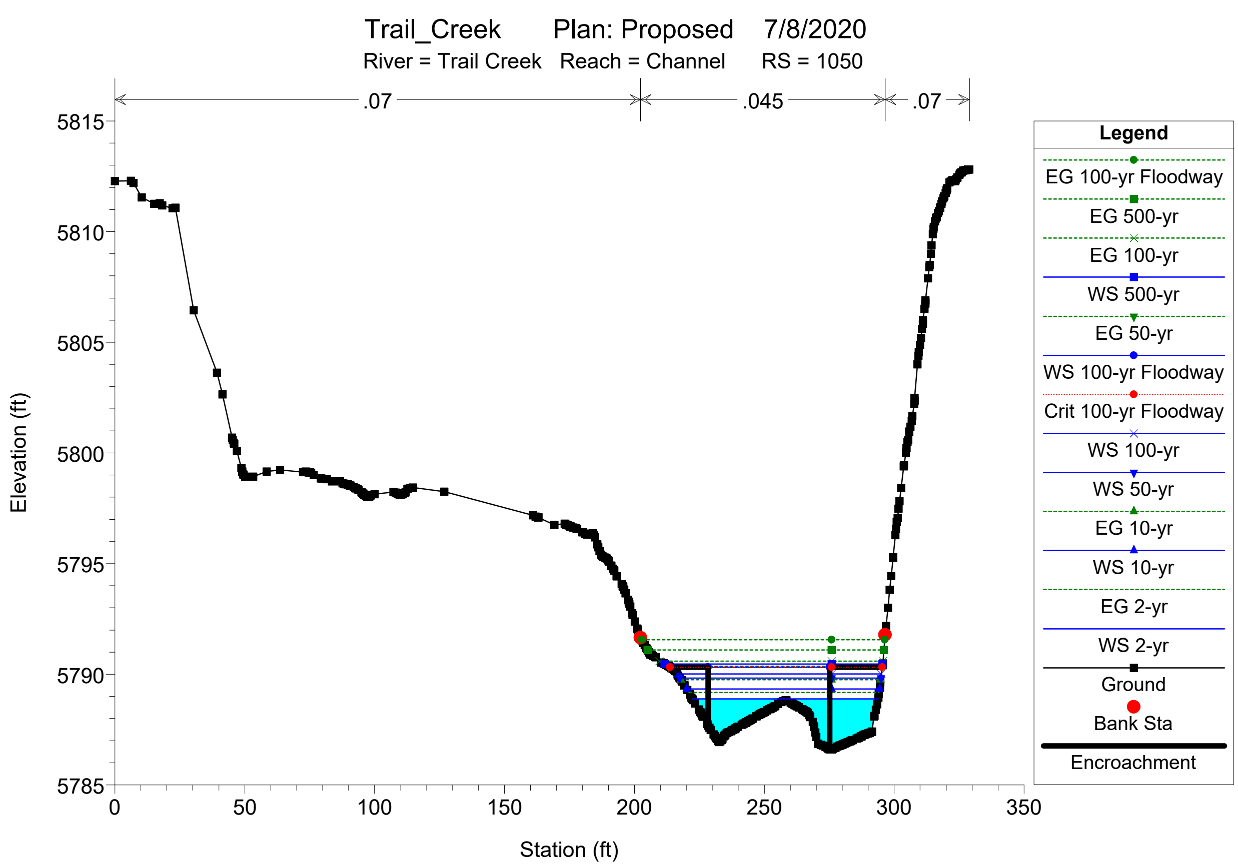


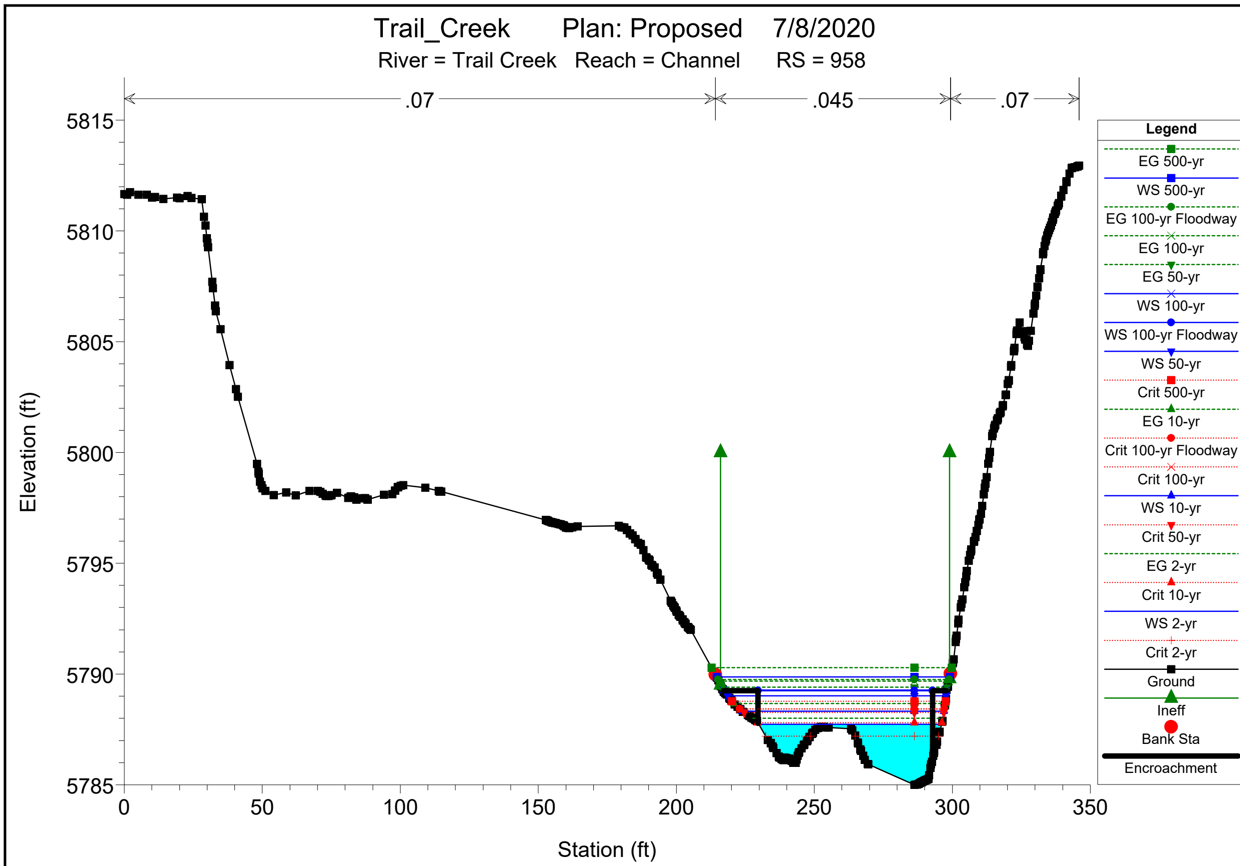
Trail_Creek Plan: Proposed 7/8/2020
River = Trail Creek Reach = Channel RS = 1239
.07
.045
.07
Elevation (ft)
Station (ft)
5810
5805
5800
5795
5790
5785
0
50
100
150
200
250
300
Legend
EG 500-yr
EG 100-yr Floodway
EG 100-yr
WS 500-yr
WS 100-yr Floodway
EG 50-yr
WS 100-yr
WS 50-yr
EG 10-yr
Crit 500-yr
WS 10-yr
Crit 100-yr Floodway
Crit 100-yr
Crit 50-yr
EG 2-yr
WS 2-yr
Crit 10-yr
Crit 2-yr
Ground
Ineff
Bank Sta
Encroachment



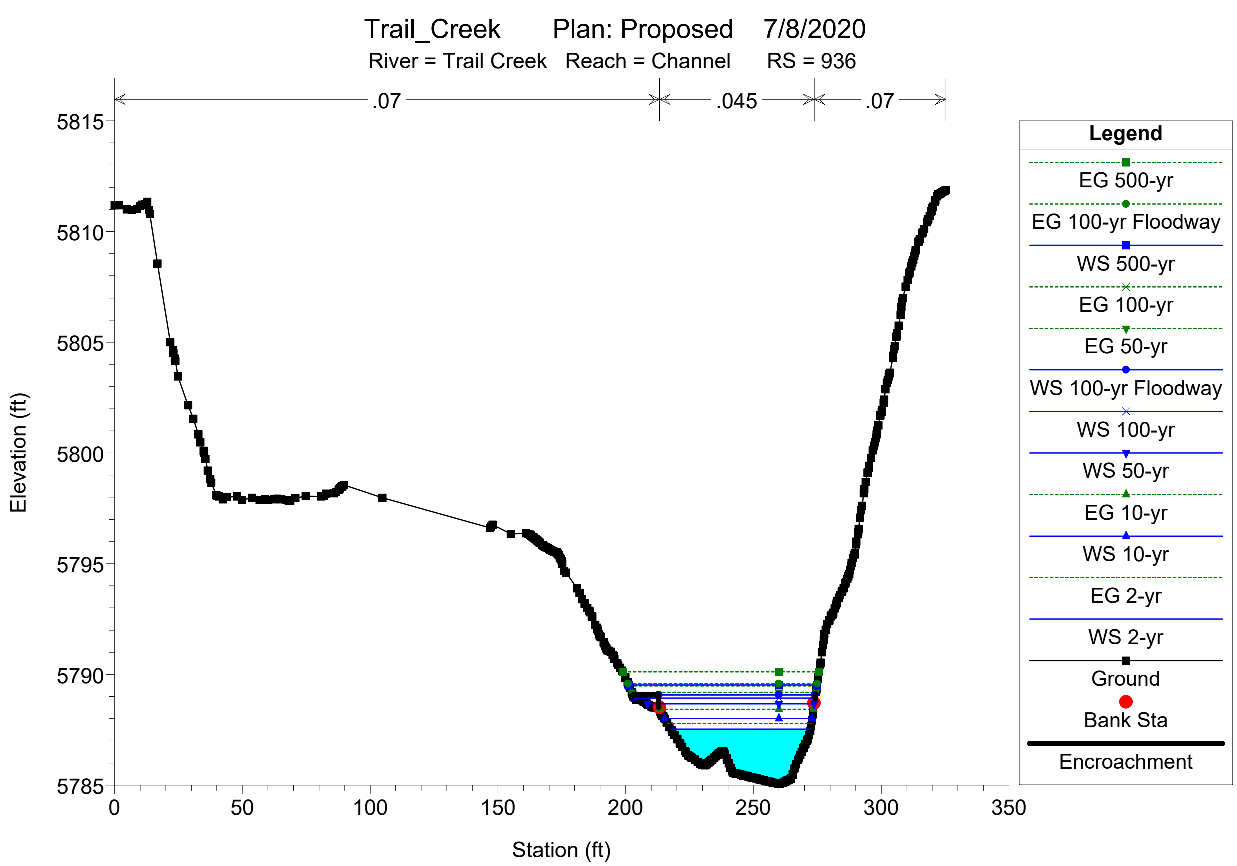
Trail_Creek Plan: Proposed 7/8/2020
River = Trail Creek Reach = Channel RS = 1200
.07
.045
.07
Elevation (ft)
Station (ft)
5815
5810
5805
5800
5795
5790
5785
0
50
100
150
200
250
Legend
EG 500-yr
EG 100-yr Floodway
EG 100-yr
WS 100-yr Floodway
EG 50-yr
WS 500-yr
WS 100-yr
WS 50-yr
EG 10-yr
WS 10-yr
EG 2-yr
WS 2-yr
Ground
Bank Sta
Encroachment


Trail_Creek Plan: Proposed 7/8/2020
River = Trail Creek Reach = Channel RS = 1114
.07
.045
.07
Elevation (ft)
Station (ft)
Legend
EG 100-yr Floodway
EG 500-yr
WS 100-yr Floodway
EG 100-yr
EG 50-yr
WS 500-yr
WS 100-yr
WS 50-yr
EG 10-yr
WS 10-yr
EG 2-yr
WS 2-yr
Ground
Bank Sta
Encroachment

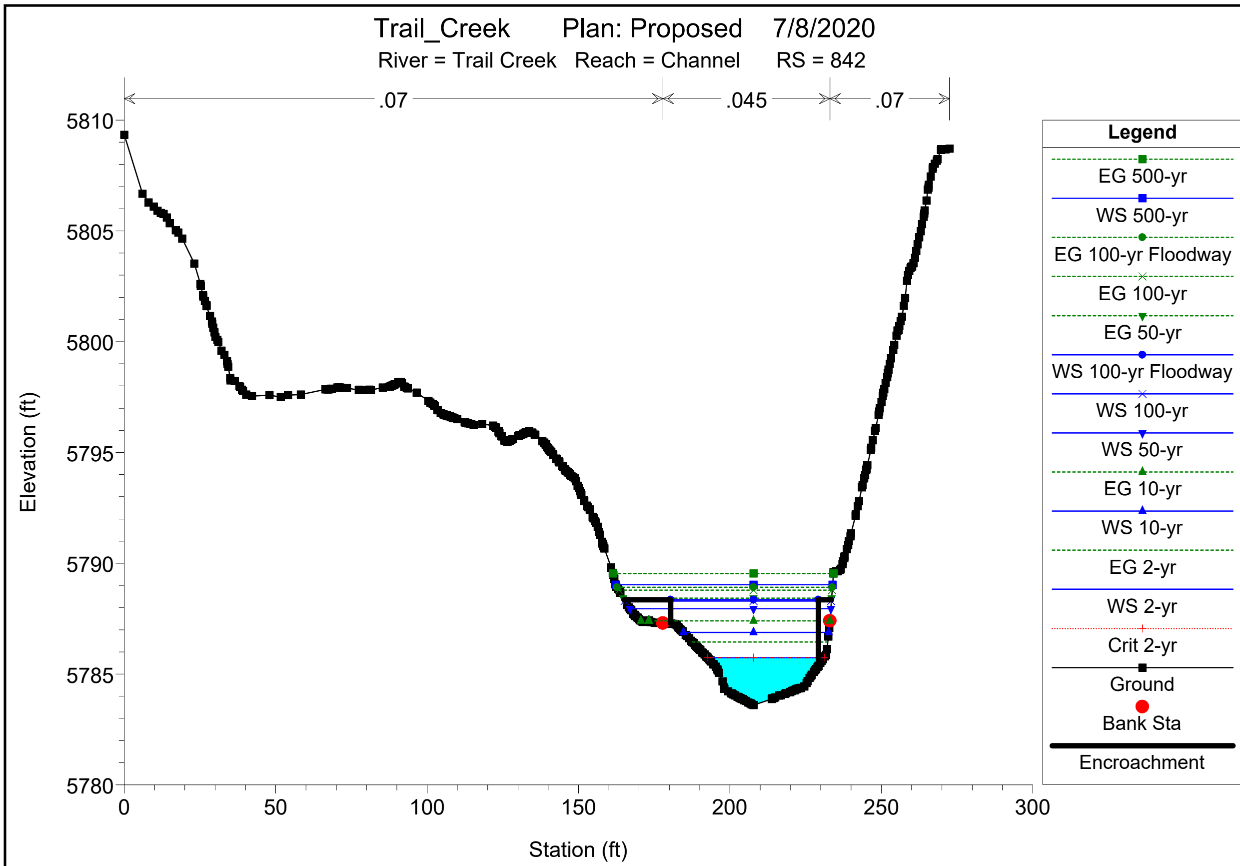

Trail_Creek Plan: Proposed 7/8/2020
River = Trail Creek Reach = Channel RS = 1050
.07
.045
.07
Elevation (ft)
Station (ft)
Legend
EG 100-yr Floodway
EG 500-yr
EG 100-yr
WS 500-yr
EG 50-yr
WS 100-yr Floodway
Crit 100-yr Floodway
WS 100-yr
WS 50-yr
EG 10-yr
WS 10-yr
EG 2-yr
WS 2-yr
Ground
Bank Sta
Encroachment

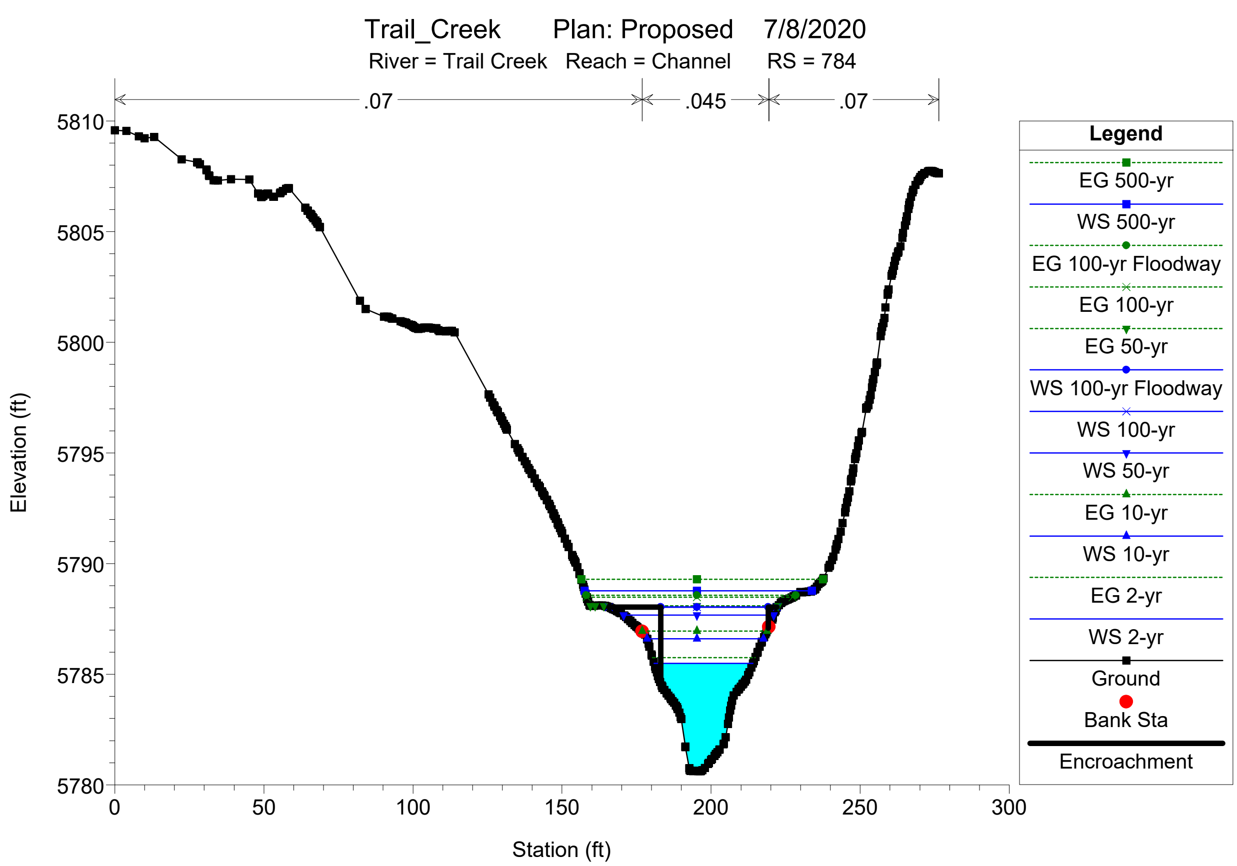


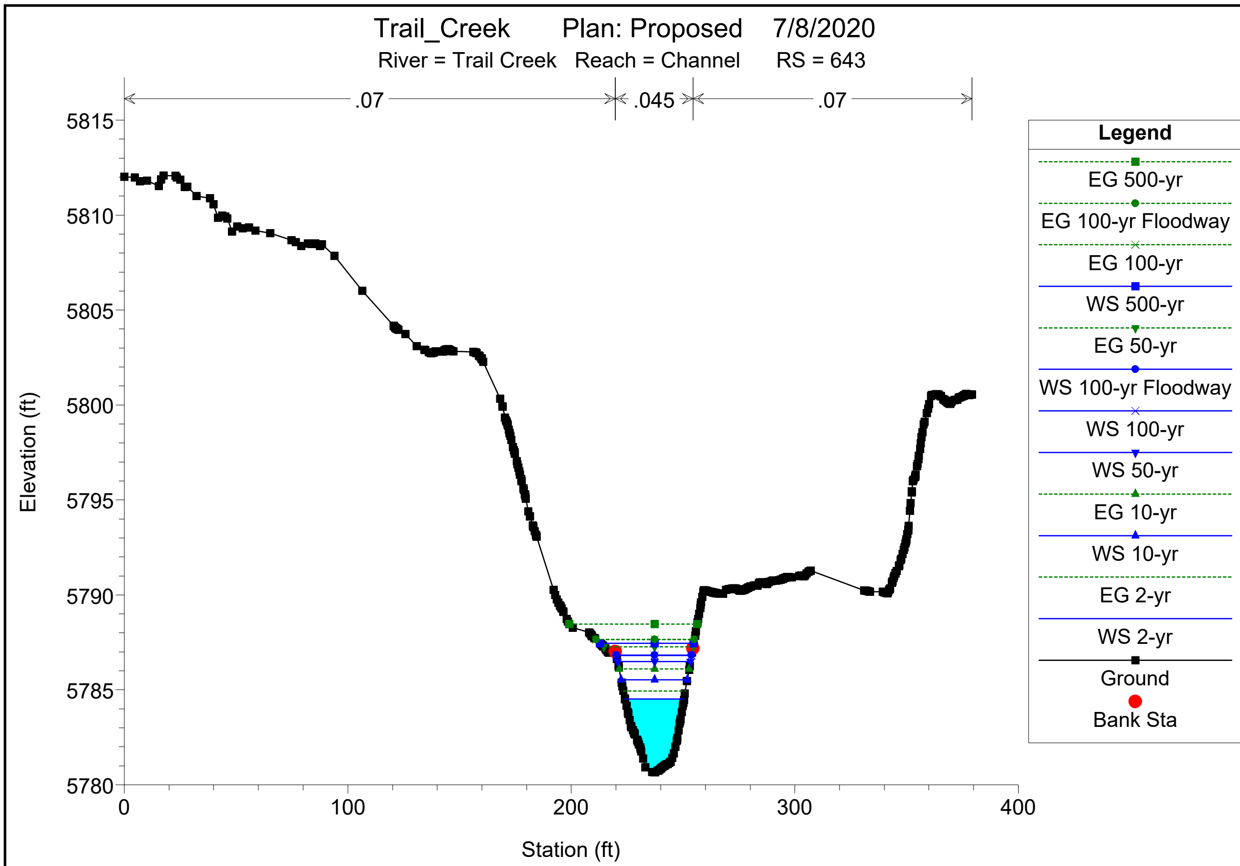
Trail_Creek Plan: Proposed 7/8/2020
River = Trail Creek Reach = Channel RS = 958
.07
.045
.07
Elevation (ft)
Station (ft)
Legend
EG 500-yr
WS 500-yr
EG 100-yr Floodway
EG 100-yr
EG 50-yr
WS 100-yr
WS 100-yr Floodway
WS 50-yr
Crit 500-yr
EG 10-yr
Crit 100-yr Floodway
Crit 100-yr
WS 10-yr
Crit 50-yr
EG 2-yr
Crit 10-yr
WS 2-yr
Crit 2-yr
Ground
Ineff
Bank Sta
Encroachment



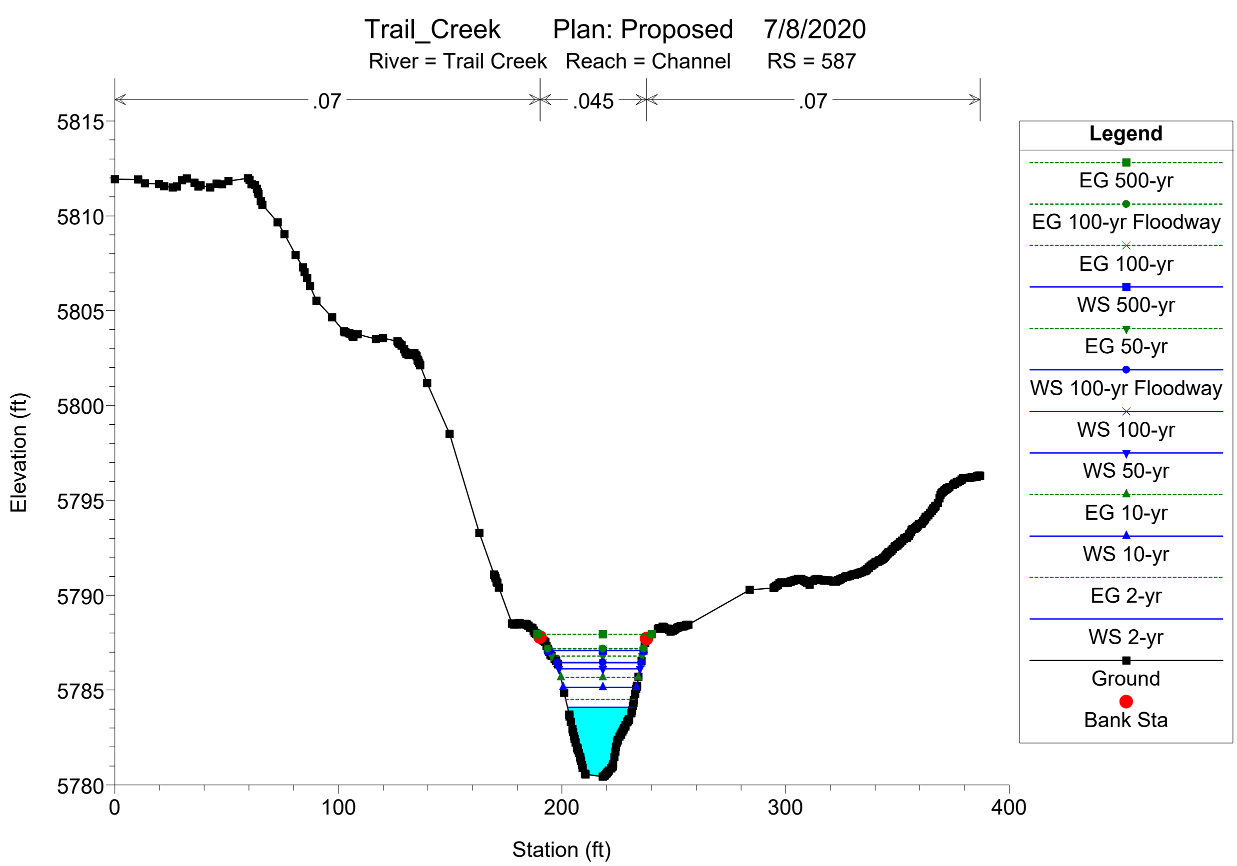
Trail_Creek Plan: Proposed 7/8/2020
River = Trail Creek Reach = Channel RS = 936
.07
.045
.07
Elevation (ft)
Station (ft)
Legend
EG 500-yr
EG 100-yr Floodway
WS 500-yr
EG 100-yr
EG 50-yr
WS 100-yr Floodway
WS 100-yr
WS 50-yr
EG 10-yr
WS 10-yr
EG 2-yr
WS 2-yr
Ground
Bank Sta
Encroachment


Trail_Creek Plan: Proposed 7/8/2020
River = Trail Creek Reach = Channel RS = 842
.07
.045
.07
Elevation (ft)
Station (ft)
Legend
EG 500-yr
WS 500-yr
EG 100-yr Floodway
EG 100-yr
EG 50-yr
WS 100-yr Floodway
WS 100-yr
WS 50-yr
EG 10-yr
WS 10-yr
EG 2-yr
WS 2-yr
Crit 2-yr
Ground
Bank Sta
Encroachment

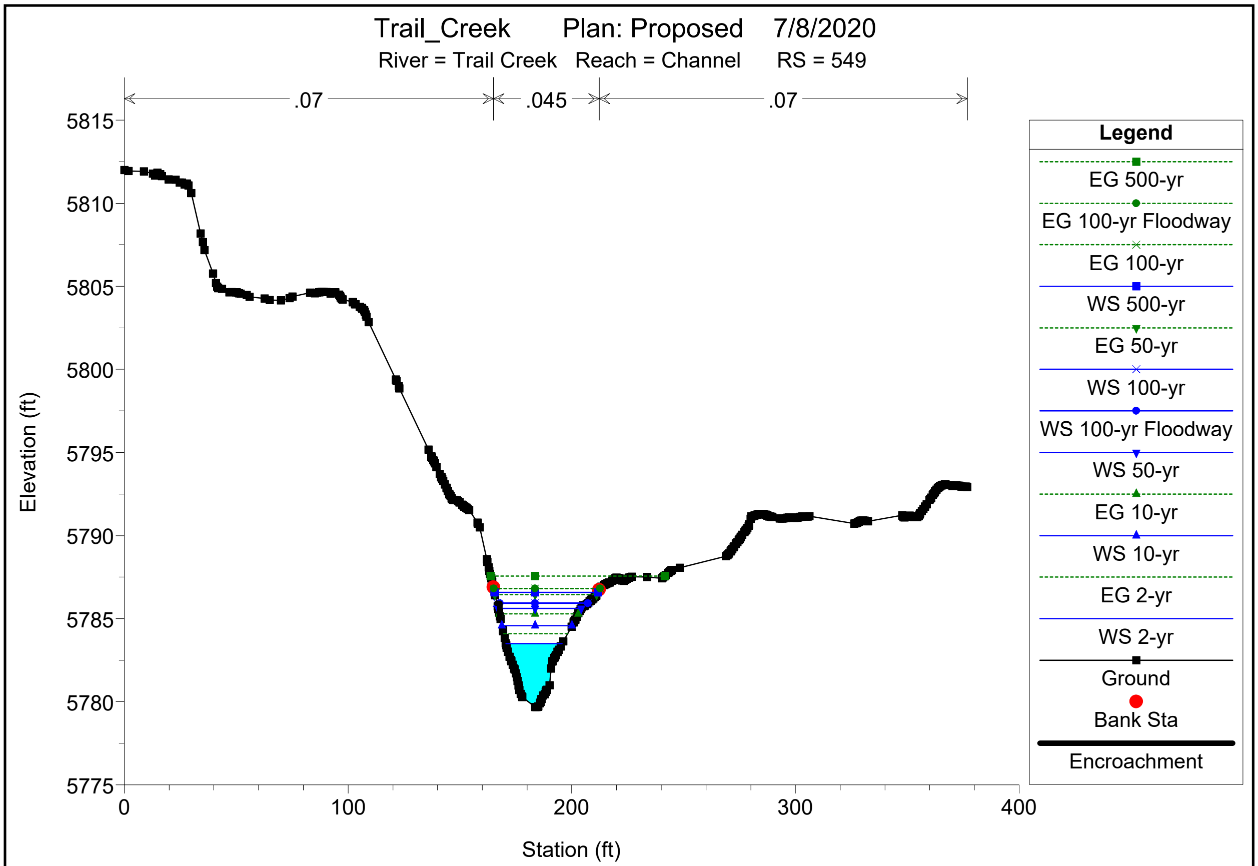

Trail_Creek Plan: Proposed 7/8/2020
River = Trail Creek Reach = Channel RS = 784
.07
.045
.07
Elevation (ft)
Station (ft)
Legend
EG 500-yr
WS 500-yr
EG 100-yr Floodway
EG 100-yr
EG 50-yr
WS 100-yr Floodway
WS 100-yr
WS 50-yr
EG 10-yr
WS 10-yr
EG 2-yr
WS 2-yr
Ground
Bank Sta
Encroachment



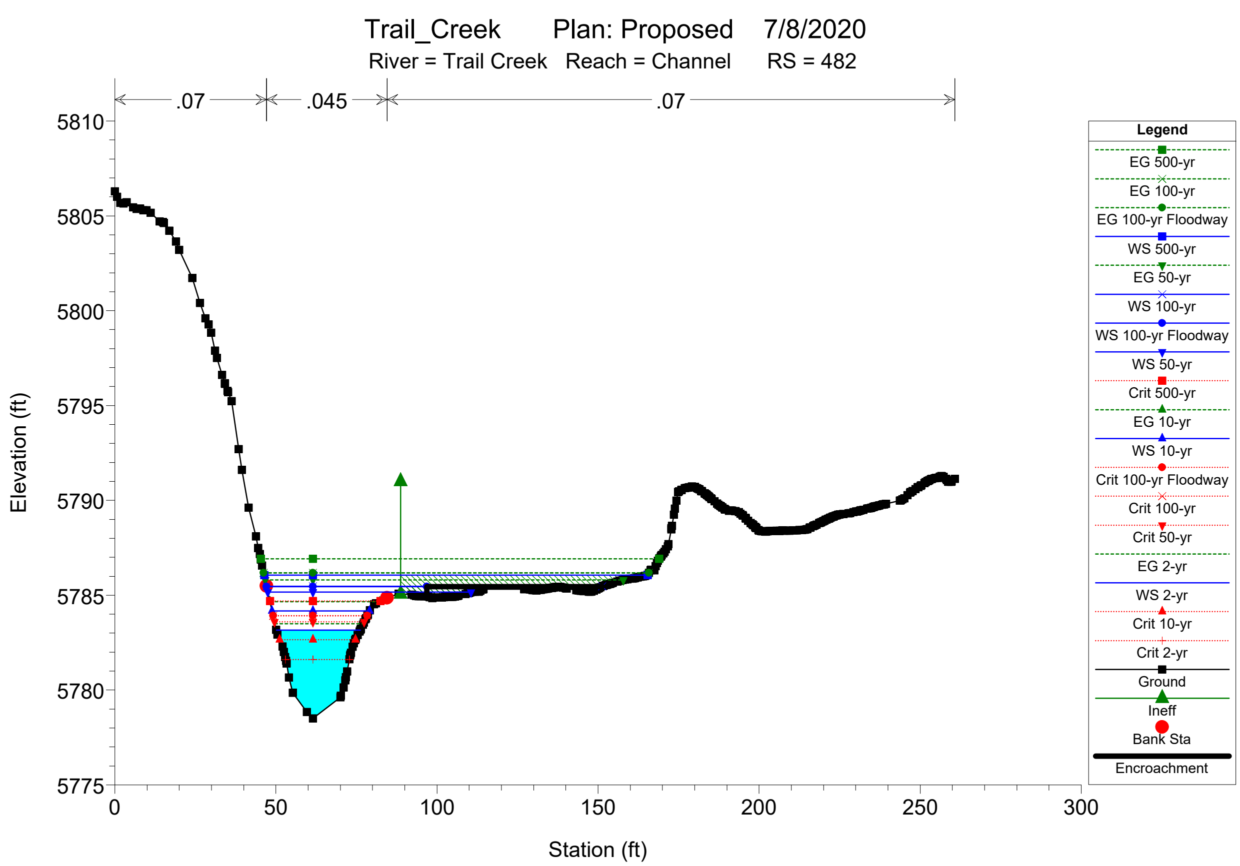
Trail_Creek Plan: Proposed 7/8/2020
River = Trail Creek Reach = Channel RS = 643
.07
.045
.07
Elevation (ft)
Station (ft)
Legend
EG 500-yr
EG 100-yr Floodway
EG 100-yr
WS 500-yr
EG 50-yr
WS 100-yr Floodway
WS 100-yr
WS 50-yr
EG 10-yr
WS 10-yr
EG 2-yr
WS 2-yr
Ground
Bank Sta



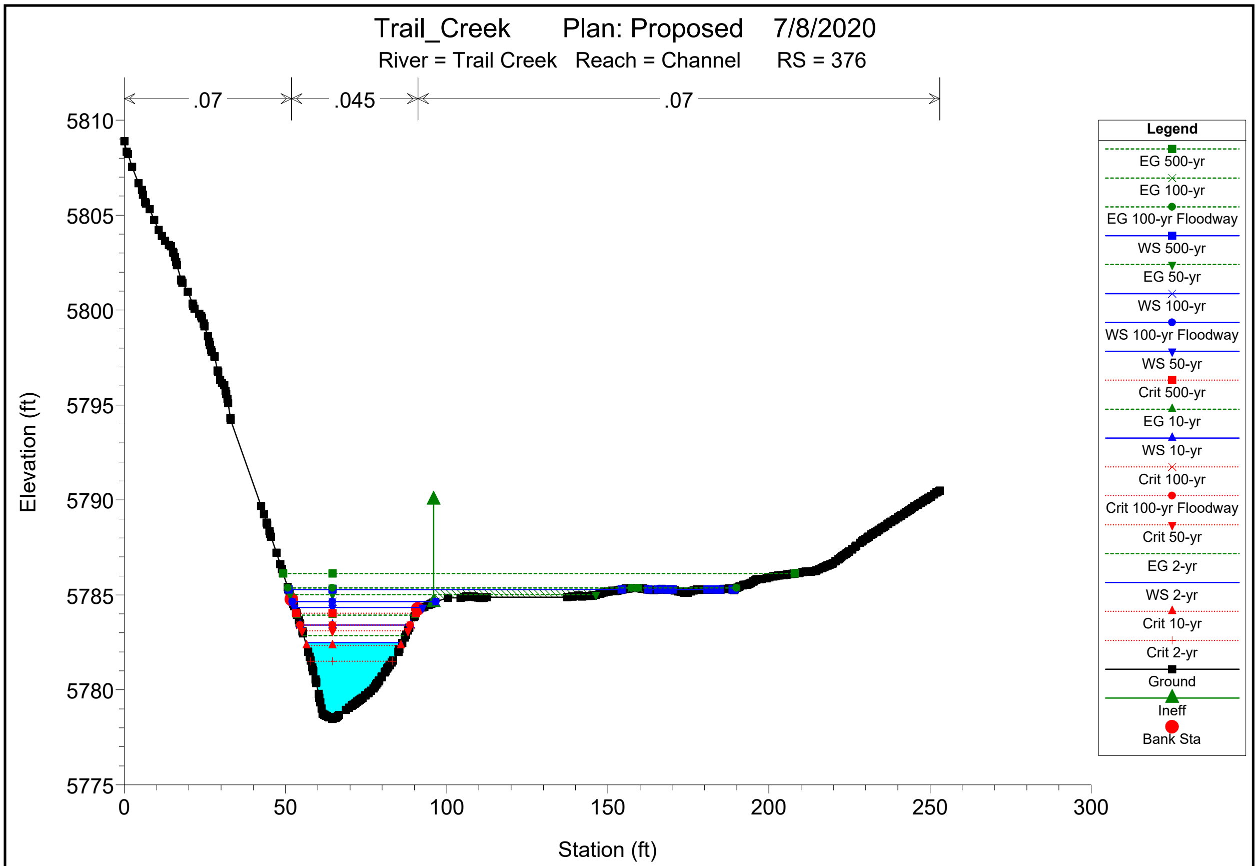
Trail_Creek Plan: Proposed 7/8/2020
River = Trail Creek Reach = Channel RS = 587
.07
.045
.07
Elevation (ft)
Station (ft)
Legend
EG 500-yr
EG 100-yr Floodway
EG 100-yr
WS 500-yr
EG 50-yr
WS 100-yr Floodway
WS 100-yr
WS 50-yr
EG 10-yr
WS 10-yr
EG 2-yr
WS 2-yr
Ground
Bank Sta

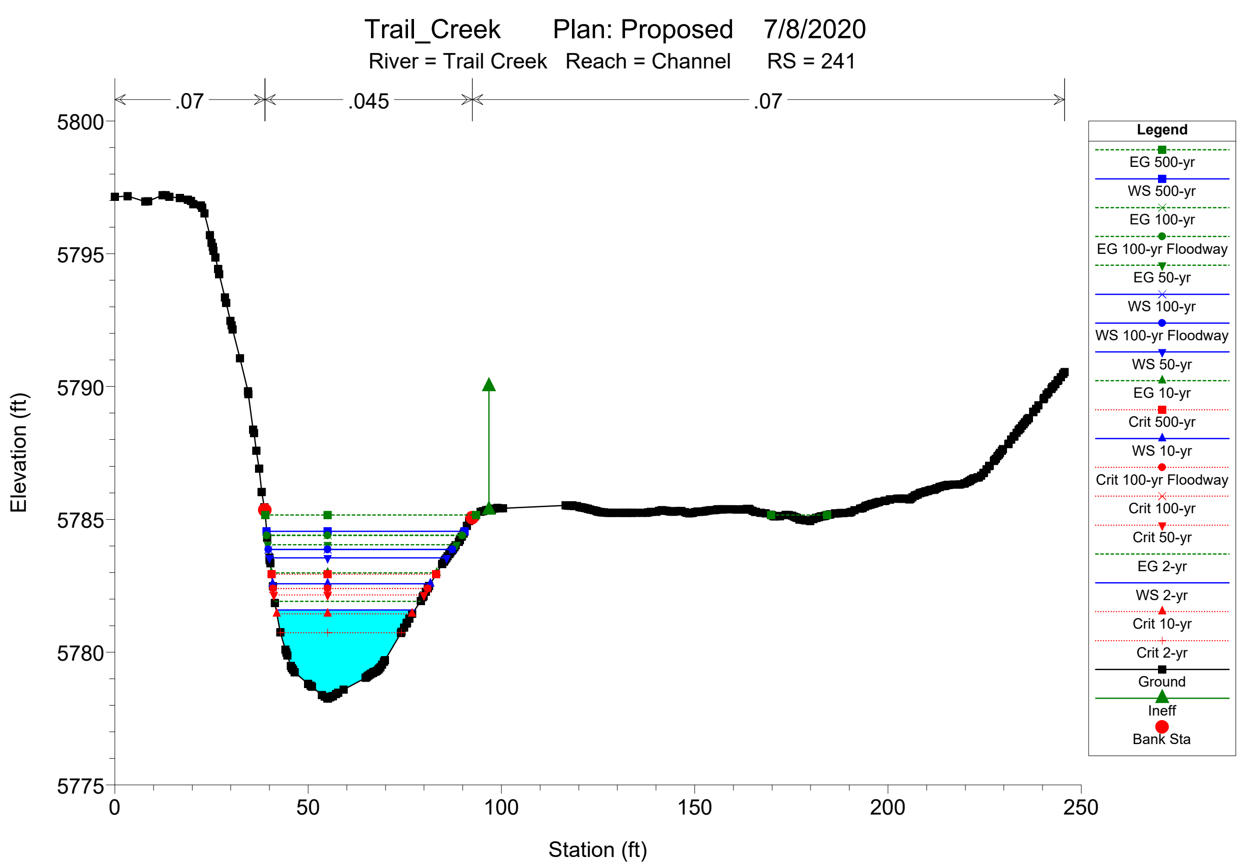


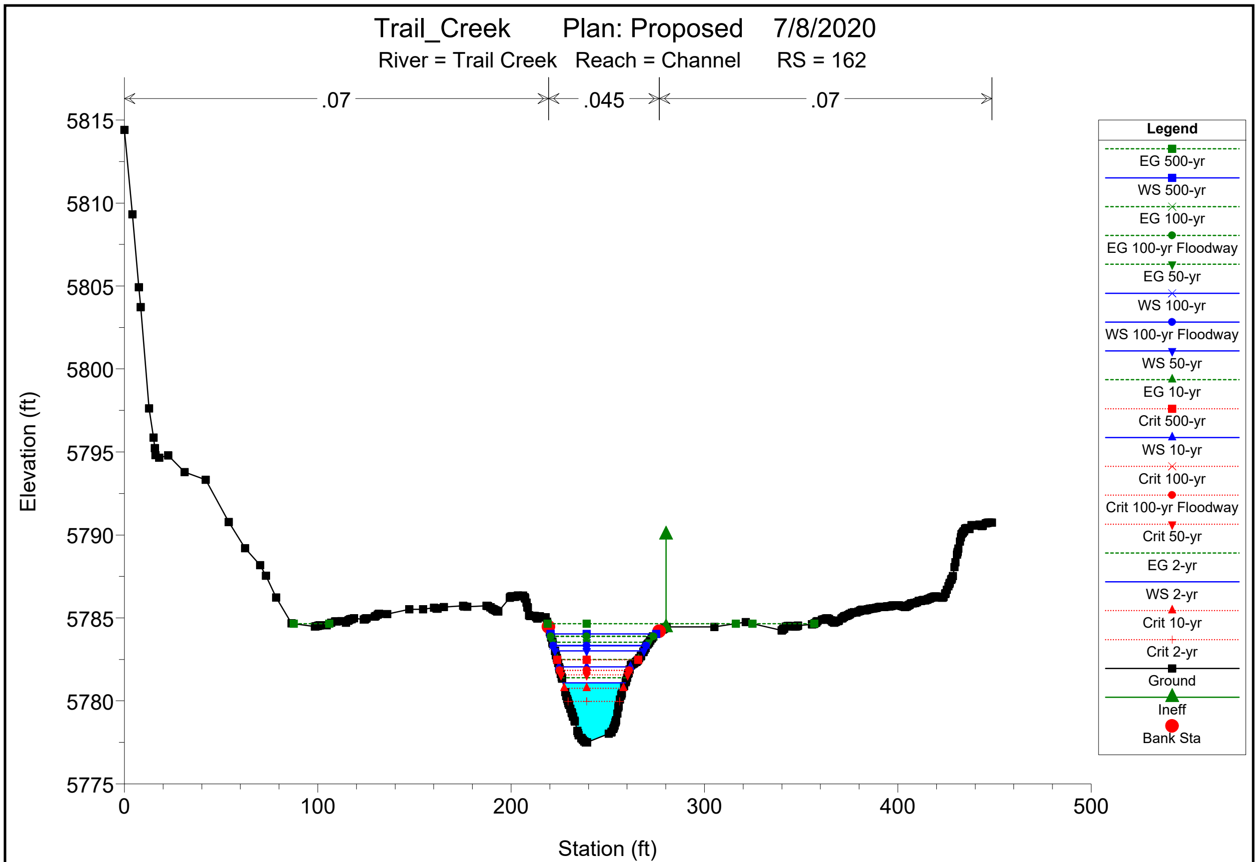
Trail_Creek Plan: Proposed 7/8/2020
River = Trail Creek Reach = Channel RS = 549
.07
.045
.07
Elevation (ft)
Station (ft)
Legend
EG 500-yr
EG 100-yr Floodway
EG 100-yr
WS 500-yr
EG 50-yr
WS 100-yr
WS 100-yr Floodway
WS 50-yr
EG 10-yr
WS 10-yr
EG 2-yr
WS 2-yr
Ground
Bank Sta
Encroachment



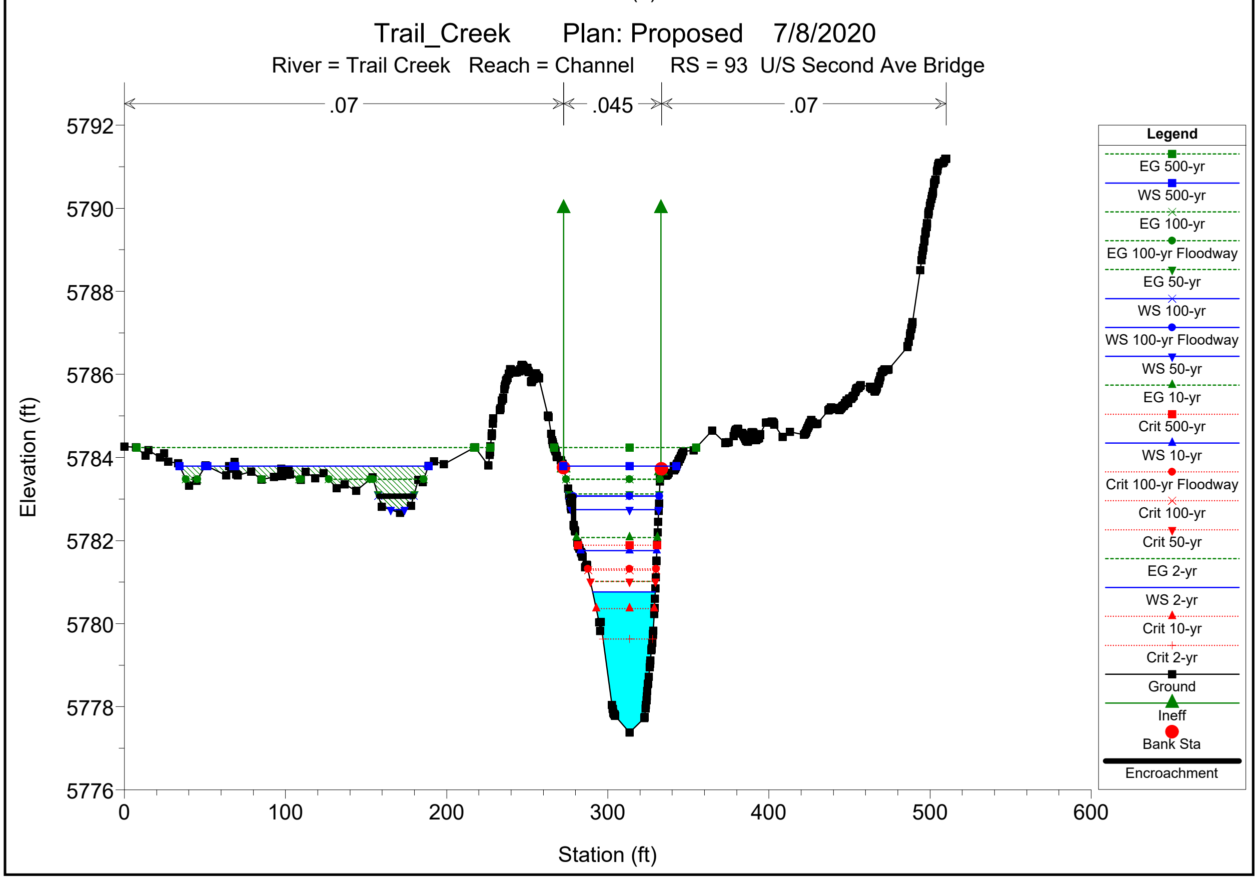
Trail_Creek Plan: Proposed 7/8/2020
River = Trail Creek Reach = Channel RS = 482
.07
.045
.07
Elevation (ft)
Station (ft)
Legend
EG 500-yr
EG 100-yr
EG 100-yr Floodway
WS 500-yr
EG 50-yr
WS 100-yr
WS 100-yr Floodway
WS 50-yr
Crit 500-yr
EG 10-yr
WS 10-yr
Crit 100-yr Floodway
Crit 100-yr
Crit 50-yr
EG 2-yr
WS 2-yr
Crit 10-yr
Crit 2-yr
Ground
Ineff
Bank Sta
Encroachment


Trail_Creek Plan: Proposed 7/8/2020
River = Trail Creek Reach = Channel RS = 376
.07
.045
.07
Elevation (ft)
Station (ft)
Legend
EG 500-yr
EG 100-yr
EG 100-yr Floodway
WS 500-yr
EG 50-yr
WS 100-yr
WS 100-yr Floodway
WS 50-yr
Crit 500-yr
EG 10-yr
WS 10-yr
Crit 100-yr
Crit 100-yr Floodway
Crit 50-yr
EG 2-yr
WS 2-yr
Crit 10-yr
Crit 2-yr
Ground
Ineff
Bank Sta

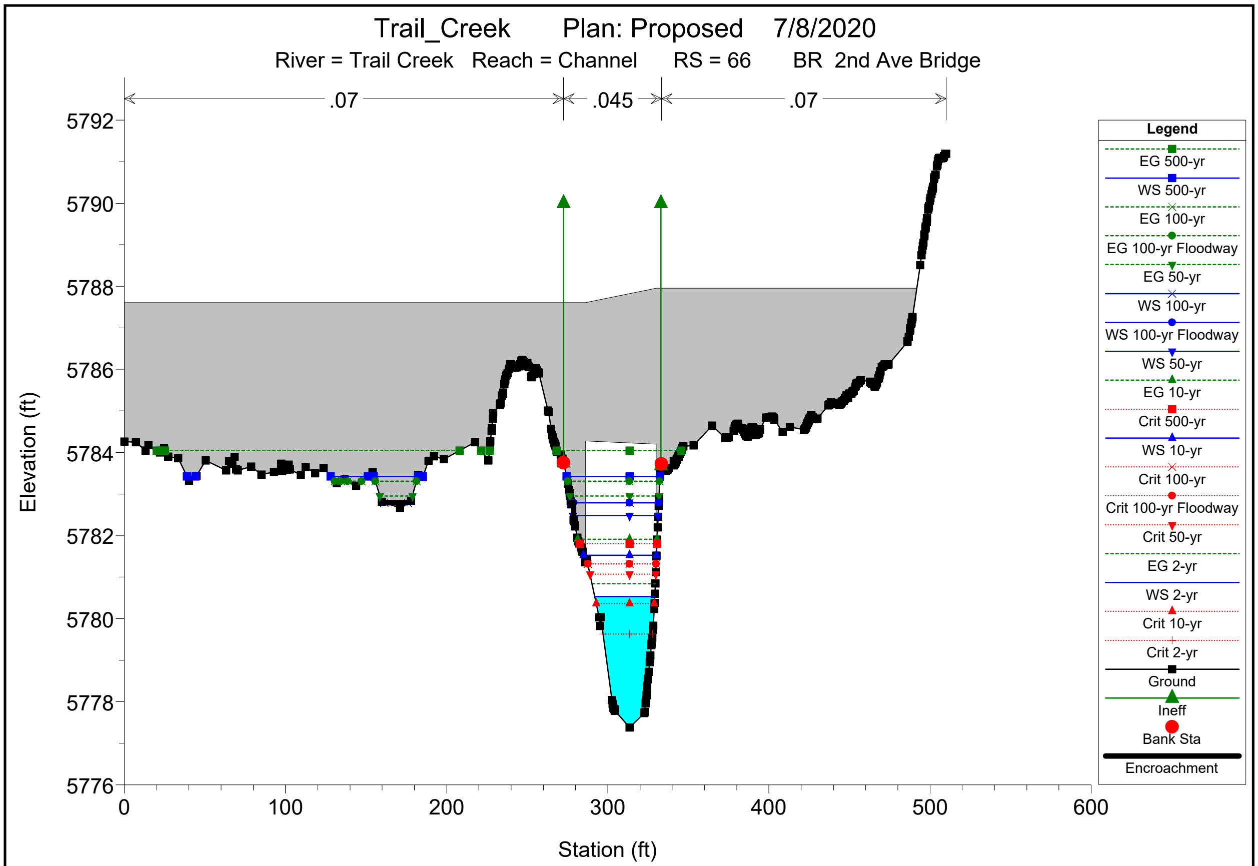

Trail_Creek Plan: Proposed 7/8/2020
River = Trail Creek Reach = Channel RS = 241
.07
.045
.07
Elevation (ft)
Station (ft)
Legend
EG 500-yr
WS 500-yr
EG 100-yr
EG 100-yr Floodway
EG 50-yr
WS 100-yr
WS 100-yr Floodway
WS 50-yr
EG 10-yr
Crit 500-yr
WS 10-yr
Crit 100-yr Floodway
Crit 100-yr
Crit 50-yr
EG 2-yr
WS 2-yr
Crit 10-yr
Crit 2-yr
Ground
Ineff
Bank Sta



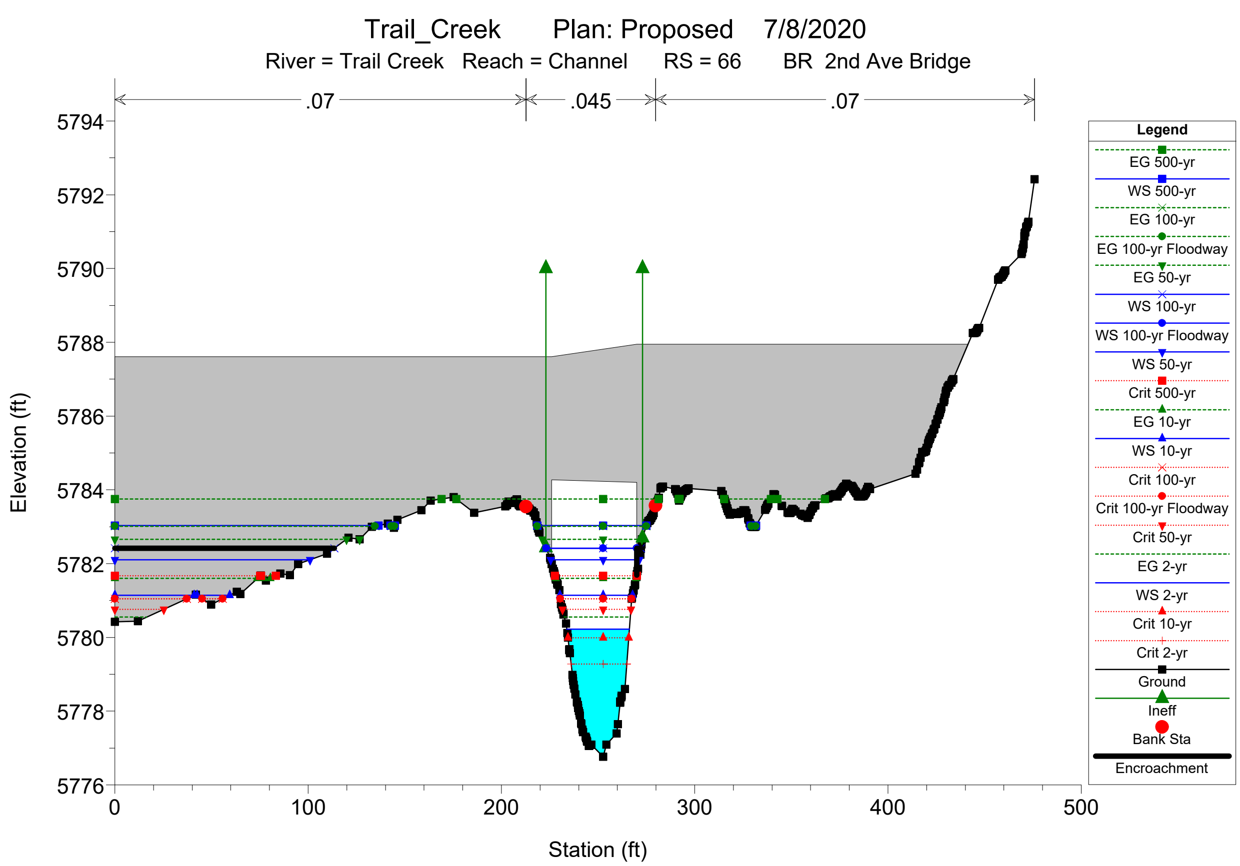
Trail_Creek Plan: Proposed 7/8/2020
River = Trail Creek Reach = Channel RS = 162
.07
.045
.07
Elevation (ft)
Station (ft)
5815
5810
5805
5800
5795
5790
5785
5780
5775
0
100
200
300
400
500
Legend
EG 500-yr
WS 500-yr
EG 100-yr
EG 100-yr Floodway
EG 50-yr
WS 100-yr
WS 100-yr Floodway
WS 50-yr
EG 10-yr
Crit 500-yr
WS 10-yr
Crit 100-yr
Crit 100-yr Floodway
Crit 50-yr
EG 2-yr
WS 2-yr
Crit 10-yr
Crit 2-yr
Ground
Ineff
Bank Sta



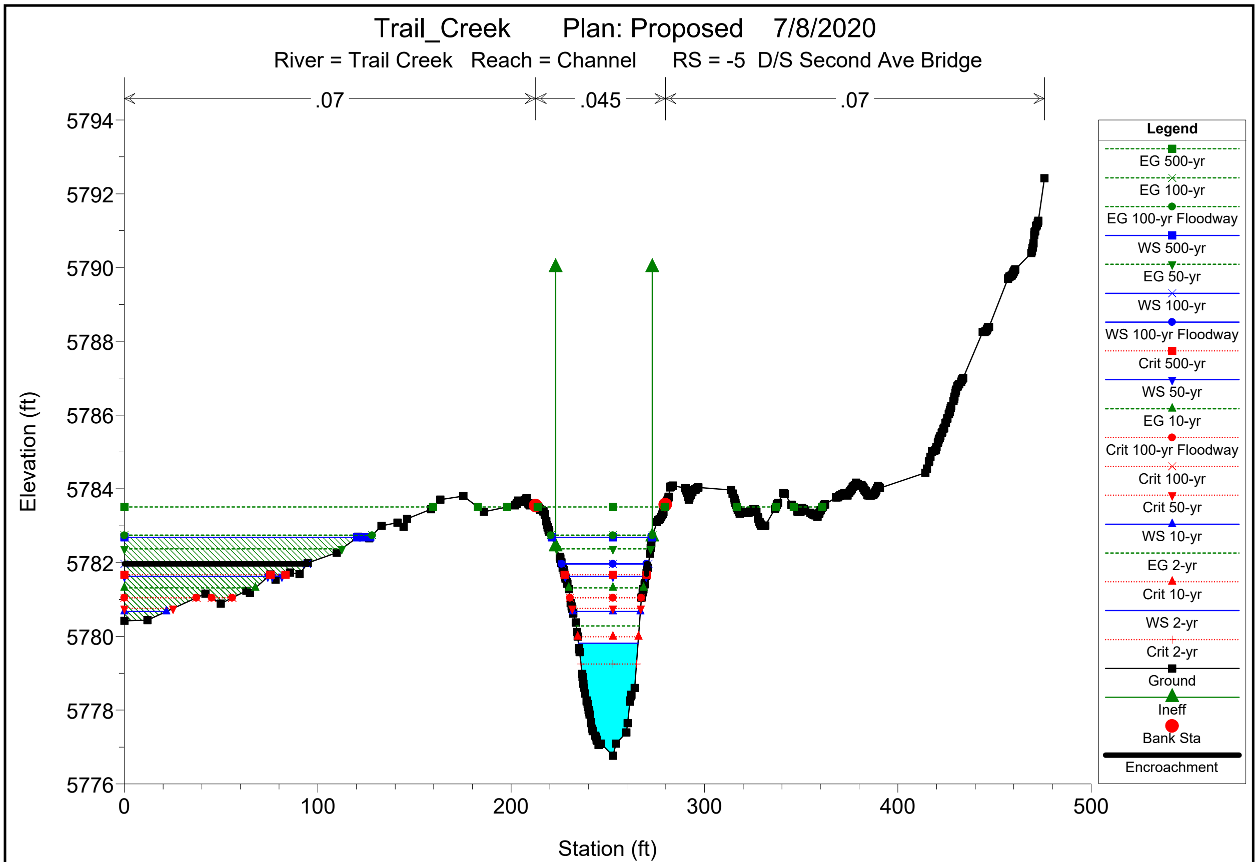
Trail_Creek Plan: Proposed 7/8/2020
River = Trail Creek Reach = Channel RS = 93 U/S Second Ave Bridge
.07
.045
.07
Elevation (ft)
Station (ft)
5792
5790
5788
5786
5784
5782
5780
5778
5776
0
100
200
300
400
500
600
Legend
EG 500-yr
WS 500-yr
EG 100-yr
EG 100-yr Floodway
EG 50-yr
WS 100-yr
WS 100-yr Floodway
WS 50-yr
EG 10-yr
Crit 500-yr
WS 10-yr
Crit 100-yr Floodway
Crit 100-yr
Crit 50-yr
EG 2-yr
WS 2-yr
Crit 10-yr
Crit 2-yr
Ground
Ineff
Bank Sta
Encroachment



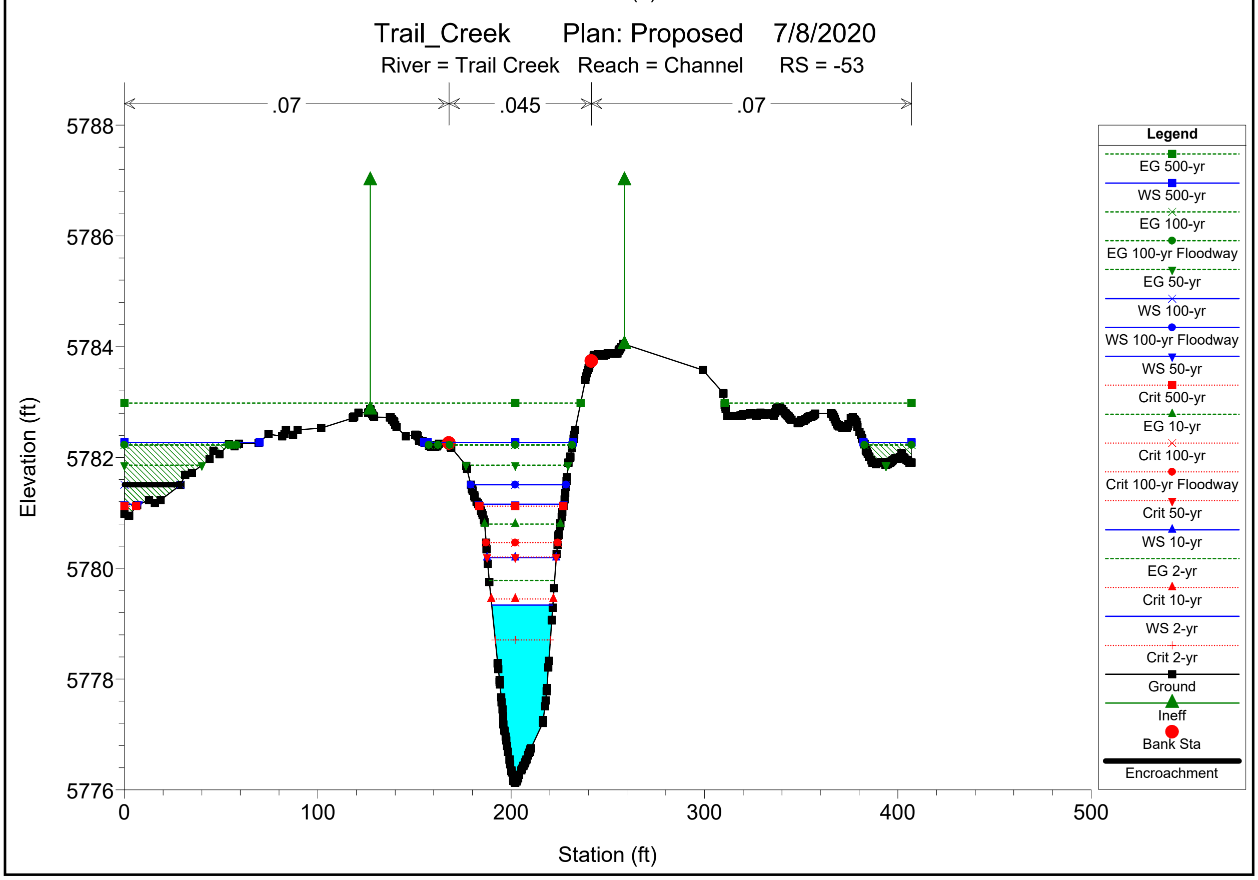
Trail_Creek Plan: Proposed 7/8/2020
River = Trail Creek Reach = Channel RS = 66 BR 2nd Ave Bridge
.07
.045
.07
Elevation (ft)
Station (ft)
Legend
EG 500-yr
WS 500-yr
EG 100-yr
EG 100-yr Floodway
EG 50-yr
WS 100-yr
WS 100-yr Floodway
WS 50-yr
EG 10-yr
Crit 500-yr
WS 10-yr
Crit 100-yr
Crit 100-yr Floodway
Crit 50-yr
EG 2-yr
WS 2-yr
Crit 10-yr
Crit 2-yr
Ground
Ineff
Bank Sta
Encroachment



Trail_Creek Plan: Proposed 7/8/2020
River = Trail Creek Reach = Channel RS = 66 BR 2nd Ave Bridge
.07
.045
.07
Elevation (ft)
Station (ft)
Legend
EG 500-yr
WS 500-yr
EG 100-yr
EG 100-yr Floodway
EG 50-yr
WS 100-yr
WS 100-yr Floodway
WS 50-yr
Crit 500-yr
EG 10-yr
WS 10-yr
Crit 100-yr
Crit 100-yr Floodway
Crit 50-yr
EG 2-yr
WS 2-yr
Crit 10-yr
Crit 2-yr
Ground
Ineff
Bank Sta
Encroachment



Trail_Creek Plan: Proposed 7/8/2020
River = Trail Creek Reach = Channel RS = -5 D/S Second Ave Bridge
.07
.045
.07
Elevation (ft)
Station (ft)
Legend
EG 500-yr
EG 100-yr
EG 100-yr Floodway
WS 500-yr
EG 50-yr
WS 100-yr
WS 100-yr Floodway
Crit 500-yr
WS 50-yr
EG 10-yr
Crit 100-yr Floodway
Crit 100-yr
Crit 50-yr
WS 10-yr
EG 2-yr
Crit 10-yr
WS 2-yr
Crit 2-yr
Ground
Ineff
Bank Sta
Encroachment



Trail_Creek Plan: Proposed 7/8/2020
River = Trail Creek Reach = Channel RS = -53
.07
.045
.07
Elevation (ft)
Station (ft)
Legend
EG 500-yr
WS 500-yr
EG 100-yr
EG 100-yr Floodway
EG 50-yr
WS 100-yr
WS 100-yr Floodway
WS 50-yr
Crit 500-yr
EG 10-yr
Crit 100-yr
Crit 100-yr Floodway
Crit 50-yr
WS 10-yr
EG 2-yr
Crit 10-yr
WS 2-yr
Crit 2-yr
Ground
Ineff
Bank Sta
Encroachment

HEC-RAS Plan: PRP River: Trail Creek Reach: Channel

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)	
Channel	3694	2-yr	360.00	5811.17	5813.84	5813.39	5814.28	0.011864	5.31	67.76	35.87	0.68
Channel	3694	10-yr	600.00	5811.17	5814.70	5814.04	5815.27	0.010095	6.02	99.69	38.39	0.66
Channel	3694	50-yr	900.00	5811.17	5815.44	5814.69	5816.20	0.010613	7.00	128.52	40.66	0.69
Channel	3694	100-yr	1020.00	5811.17	5815.72	5814.94	5816.54	0.010514	7.27	140.38	41.63	0.70
Channel	3694	500-yr	1300.00	5811.17	5816.27	5815.46	5817.25	0.010930	7.95	163.42	43.38	0.72
Channel	3694	100-yr Floodway	1020.00	5811.17	5815.64	5814.88	5816.54	0.011556	7.59	134.36	38.62	0.72
Channel	3532	2-yr	360.00	5808.96	5812.14	5811.47	5812.56	0.009484	5.19	69.32	32.78	0.63
Channel	3532	10-yr	600.00	5808.96	5813.16	5812.24	5813.64	0.009621	5.56	107.99	46.86	0.65
Channel	3532	50-yr	900.00	5808.96	5814.15	5813.09	5814.63	0.007908	5.55	162.06	60.72	0.60
Channel	3532	100-yr	1020.00	5808.96	5814.54	5813.40	5815.00	0.007511	5.42	188.26	81.39	0.58
Channel	3532	500-yr	1300.00	5808.96	5815.32	5813.88	5815.73	0.006501	5.18	251.10	158.14	0.56
Channel	3532	100-yr Floodway	1020.00	5808.96	5814.48	5813.40	5814.97	0.007090	5.58	182.65	62.00	0.57
Channel	3422	2-yr	360.00	5807.75	5811.13	5810.36	5811.55	0.008821	5.22	69.03	30.37	0.61
Channel	3422	10-yr	600.00	5807.75	5812.01	5811.18	5812.60	0.009203	6.15	97.57	34.40	0.64
Channel	3422	50-yr	900.00	5807.75	5813.00	5811.95	5813.70	0.008545	6.72	133.86	84.14	0.64
Channel	3422	100-yr	1020.00	5807.75	5813.36	5812.23	5814.09	0.008515	6.89	147.95	105.24	0.64
Channel	3422	500-yr	1300.00	5807.75	5814.02	5812.81	5814.86	0.008947	7.33	177.23	145.27	0.66
Channel	3422	100-yr Floodway	1020.00	5807.75	5813.34	5812.23	5814.09	0.008589	6.92	147.43	41.15	0.64
Channel	3418		Bridge									
Channel	3404	2-yr	360.00	5807.59	5810.97	5810.04	5811.37	0.007440	5.02	71.67	29.17	0.57
Channel	3404	10-yr	600.00	5807.59	5811.81	5810.89	5812.40	0.008750	6.15	97.57	32.95	0.63
Channel	3404	50-yr	900.00	5807.59	5812.81	5811.71	5813.52	0.008576	6.76	133.20	92.16	0.64
Channel	3404	100-yr	1020.00	5807.59	5813.15	5811.98	5813.90	0.009071	6.95	146.75	108.78	0.66
Channel	3404	500-yr	1300.00	5807.59	5813.80	5812.61	5814.65	0.009376	7.37	176.38	139.61	0.68
Channel	3404	100-yr Floodway	1020.00	5807.59	5813.13	5811.98	5813.89	0.009175	6.98	146.06	42.24	0.66
Channel	3304	2-yr	360.00	5807.12	5810.27	5809.36	5810.54	0.007867	4.14	86.87	50.67	0.56
Channel	3304	10-yr	600.00	5807.12	5811.35	5810.20	5811.62	0.004659	4.15	144.41	56.34	0.46
Channel	3304	50-yr	900.00	5807.12	5812.53	5810.71	5812.80	0.003299	4.19	214.68	114.70	0.40
Channel	3304	100-yr	1020.00	5807.12	5812.87	5810.92	5813.16	0.003228	4.30	237.22	139.58	0.40
Channel	3304	500-yr	1300.00	5807.12	5813.53	5811.35	5813.86	0.003418	4.56	285.67	195.49	0.42
Channel	3304	100-yr Floodway	1020.00	5807.12	5812.86	5810.92	5813.16	0.003176	4.38	232.79	61.19	0.40
Channel	3252	2-yr	360.00	5805.81	5809.82	5808.59	5810.18	0.005756	4.83	74.59	25.23	0.49
Channel	3252	10-yr	600.00	5805.81	5810.69	5809.43	5811.28	0.007457	6.15	97.56	27.51	0.58
Channel	3252	50-yr	900.00	5805.81	5811.77	5810.33	5812.48	0.009320	6.76	133.19	55.27	0.65
Channel	3252	100-yr	1020.00	5805.81	5812.07	5810.64	5812.83	0.009968	7.01	145.47	76.19	0.67
Channel	3252	500-yr	1300.00	5805.81	5812.57	5811.55	5813.50	0.010823	7.72	169.38	156.91	0.71
Channel	3252	100-yr Floodway	1020.00	5805.81	5812.07	5810.66	5812.83	0.009959	7.01	145.54	47.64	0.67
Channel	3189	2-yr	360.00	5806.17	5809.29	5808.66	5809.72	0.009592	5.25	68.64	32.04	0.63
Channel	3189	10-yr	600.00	5806.17	5810.19	5809.39	5810.75	0.009251	6.03	99.46	36.38	0.64
Channel	3189	50-yr	900.00	5806.17	5811.32	5810.13	5811.89	0.008420	6.07	149.96	60.45	0.62
Channel	3189	100-yr	1020.00	5806.17	5811.66	5810.40	5812.24	0.007487	6.12	171.90	113.65	0.60
Channel	3189	500-yr	1300.00	5806.17	5812.22	5811.14	5812.88	0.007114	6.56	211.21	165.49	0.59
Channel	3189	100-yr Floodway	1020.00	5806.17	5811.65	5810.36	5812.24	0.007585	6.18	167.31	54.61	0.60
Channel	3140	2-yr	360.00	5804.97	5808.89	5808.08	5809.28	0.007786	4.98	72.32	31.00	0.57
Channel	3140	10-yr	600.00	5804.97	5809.77	5808.83	5810.32	0.008256	5.93	101.20	34.64	0.61
Channel	3140	50-yr	900.00	5804.97	5810.83	5809.60	5811.45	0.009045	6.32	142.32	47.65	0.65
Channel	3140	100-yr	1020.00	5804.97	5811.23	5809.87	5811.84	0.008579	6.28	162.54	53.03	0.63
Channel	3140	500-yr	1300.00	5804.97	5811.80	5810.54	5812.49	0.008239	6.69	197.39	68.20	0.63
Channel	3140	100-yr Floodway	1020.00	5804.97	5811.23	5809.88	5811.84	0.008582	6.28	162.52	53.02	0.63
Channel	3008	2-yr	360.00	5805.03	5807.73	5807.10	5808.15	0.009400	5.19	69.41	32.58	0.63
Channel	3008	10-yr	600.00	5805.03	5808.63	5807.82	5809.19	0.008966	6.00	100.01	36.13	0.64
Channel	3008	50-yr	900.00	5805.03	5809.62	5808.55	5810.28	0.008723	6.52	138.02	48.17	0.64
Channel	3008	100-yr	1020.00	5805.03	5810.05	5808.80	5810.69	0.008871	6.42	158.89	71.24	0.64
Channel	3008	500-yr	1300.00	5805.03	5810.80	5809.35	5811.47	0.007287	6.57	197.90	83.41	0.60
Channel	3008	100-yr Floodway	1020.00	5805.03	5810.05	5808.80	5810.69	0.008858	6.42	158.97	63.61	0.64
Channel	2881	2-yr	360.00	5803.55	5806.43	5805.84	5806.90	0.010200	5.52	65.25	29.45	0.65
Channel	2881	10-yr	600.00	5803.55	5807.45	5806.59	5808.04	0.008987	6.18	97.15	33.33	0.64
Channel	2881	50-yr	900.00	5803.55	5808.54	5807.37	5809.22	0.007884	6.60	136.34	38.03	0.61
Channel	2881	100-yr	1020.00	5803.55	5808.94	5807.66	5809.64	0.007622	6.72	151.71	40.10	0.61
Channel	2881	500-yr	1300.00	5803.55	5809.80	5808.25	5810.53	0.007342	6.88	189.09	47.21	0.61
Channel	2881	100-yr Floodway	1020.00	5803.55	5808.95	5807.66	5809.65	0.007588	6.71	152.01	40.16	0.61
Channel	2815	2-yr	360.00	5800.87	5806.25	5804.65	5806.47	0.003379	3.75	96.01	32.93	0.39
Channel	2815	10-yr	600.00	5800.87	5807.28	5805.46	5807.60	0.003666	4.58	130.97	35.35	0.42
Channel	2815	50-yr	900.00	5800.87	5808.38	5806.20	5808.82	0.003500	5.31	169.64	37.82	0.42
Channel	2815	100-yr	1020.00	5800.87	5808.77	5806.45	5809.25	0.003481	5.57	183.17	38.74	0.43
Channel	2815	500-yr	1300.00	5800.87	5809.58	5807.03	5810.17	0.003498	6.15	211.54	40.68	0.44
Channel	2815	100-yr Floodway	1020.00	5800.87	5808.78	5806.43	5809.26	0.003463	5.56	183.45	38.76	0.43
Channel	2810		Bridge									

HEC-RAS Plan: PRP River: Trail Creek Reach: Channel (Continued)

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)	
Channel	2769	2-yr	360.00	5802.88	5805.53	5805.15	5806.08	0.014032	5.99	60.11	30.79	0.76
Channel	2769	10-yr	600.00	5802.88	5806.53	5805.89	5807.17	0.010531	6.40	93.80	37.70	0.69
Channel	2769	50-yr	900.00	5802.88	5807.54	5806.59	5808.30	0.008165	6.97	129.12	42.32	0.64
Channel	2769	100-yr	1020.00	5802.88	5807.86	5806.84	5808.68	0.007940	7.27	140.37	43.76	0.64
Channel	2769	500-yr	1300.00	5802.88	5808.47	5807.35	5809.47	0.008080	8.05	161.51	45.87	0.66
Channel	2769	100-yr Floodway	1020.00	5802.88	5807.88	5806.85	5808.70	0.008398	7.28	140.08	36.09	0.64
Channel	2680	2-yr	360.00	5801.68	5804.75	5803.83	5805.12	0.007042	4.90	73.51	29.71	0.55
Channel	2680	10-yr	600.00	5801.68	5805.92	5804.61	5806.37	0.006042	5.42	110.64	33.81	0.53
Channel	2680	50-yr	900.00	5801.68	5807.00	5805.39	5807.57	0.006160	6.01	149.68	39.62	0.55
Channel	2680	100-yr	1020.00	5801.68	5807.32	5805.69	5807.94	0.006497	6.27	162.65	45.80	0.56
Channel	2680	500-yr	1300.00	5801.68	5807.97	5806.25	5808.70	0.006310	6.85	189.79	62.88	0.57
Channel	2680	100-yr Floodway	1020.00	5801.68	5807.32	5805.69	5807.93	0.006533	6.28	162.38	44.83	0.56
Channel	2550	2-yr	360.00	5798.62	5803.62	5802.49	5804.10	0.008794	5.58	64.53	23.48	0.59
Channel	2550	10-yr	600.00	5798.62	5804.83	5803.60	5805.41	0.009264	6.09	98.57	33.57	0.63
Channel	2550	50-yr	900.00	5798.62	5806.06	5804.66	5806.64	0.008404	6.12	147.00	49.24	0.61
Channel	2550	100-yr	1020.00	5798.62	5806.43	5805.03	5807.03	0.007581	6.19	164.76	53.18	0.59
Channel	2550	500-yr	1300.00	5798.62	5807.23	5805.67	5807.86	0.006195	6.39	204.11	64.19	0.55
Channel	2550	100-yr Floodway	1020.00	5798.62	5806.42	5805.02	5807.02	0.007540	6.24	163.51	51.23	0.58
Channel	2439	2-yr	360.00	5797.78	5802.20	5801.64	5802.87	0.013964	6.54	55.05	22.66	0.74
Channel	2439	10-yr	600.00	5797.78	5803.00	5802.62	5804.02	0.016603	8.11	73.99	24.78	0.83
Channel	2439	50-yr	900.00	5797.78	5803.72	5803.51	5805.19	0.019369	9.73	92.51	26.01	0.91
Channel	2439	100-yr	1020.00	5797.78	5803.97	5803.82	5805.62	0.020405	10.30	98.98	26.38	0.94
Channel	2439	500-yr	1300.00	5797.78	5804.55	5804.50	5806.55	0.021769	11.35	114.51	27.33	0.98
Channel	2439	100-yr Floodway	1020.00	5797.78	5803.96	5803.82	5805.62	0.020552	10.33	98.74	26.36	0.94
Channel	2415	2-yr	360.00	5798.48	5802.06	5801.38	5802.52	0.009819	5.46	65.95	29.23	0.64
Channel	2415	10-yr	600.00	5798.48	5802.96	5802.17	5803.59	0.009989	6.39	93.90	32.76	0.67
Channel	2415	50-yr	900.00	5798.48	5803.86	5802.98	5804.67	0.009779	7.23	124.53	35.02	0.68
Channel	2415	100-yr	1020.00	5798.48	5804.18	5803.25	5805.06	0.009727	7.51	135.90	35.79	0.68
Channel	2415	500-yr	1300.00	5798.48	5804.93	5803.82	5805.91	0.009286	7.96	163.33	37.61	0.67
Channel	2415	100-yr Floodway	1020.00	5798.48	5804.17	5803.21	5805.05	0.009776	7.52	135.62	35.72	0.68
Channel	2407		Bridge									
Channel	2389	2-yr	360.00	5798.91	5801.64	5801.19	5802.20	0.012638	5.97	60.25	28.20	0.72
Channel	2389	10-yr	600.00	5798.91	5802.47	5801.97	5803.25	0.013020	7.08	84.70	31.09	0.76
Channel	2389	50-yr	900.00	5798.91	5803.26	5802.76	5804.29	0.013686	8.16	110.36	33.75	0.80
Channel	2389	100-yr	1020.00	5798.91	5803.54	5803.03	5804.66	0.013769	8.52	119.76	34.77	0.80
Channel	2389	500-yr	1300.00	5798.91	5804.10	5803.62	5805.45	0.013942	9.32	139.46	36.86	0.83
Channel	2389	100-yr Floodway	1020.00	5798.91	5803.51	5803.04	5804.65	0.014055	8.57	118.97	34.68	0.81
Channel	2300	2-yr	360.00	5797.77	5801.01	5800.14	5801.32	0.006753	4.45	80.89	37.40	0.53
Channel	2300	10-yr	600.00	5797.77	5801.94	5800.82	5802.34	0.006505	5.07	118.39	43.64	0.54
Channel	2300	50-yr	900.00	5797.77	5802.87	5801.53	5803.36	0.005958	5.60	160.80	47.51	0.54
Channel	2300	100-yr	1020.00	5797.77	5803.19	5801.80	5803.71	0.005943	5.79	176.10	49.27	0.54
Channel	2300	500-yr	1300.00	5797.77	5803.86	5802.30	5804.45	0.005923	6.18	210.30	55.14	0.55
Channel	2300	100-yr Floodway	1020.00	5797.77	5803.16	5801.77	5803.70	0.005903	5.87	173.83	46.47	0.53
Channel	2247	2-yr	360.00	5797.23	5800.58	5799.90	5800.91	0.008570	4.64	77.59	40.63	0.59
Channel	2247	10-yr	600.00	5797.23	5801.62	5800.58	5801.98	0.006527	4.79	125.26	50.87	0.54
Channel	2247	50-yr	900.00	5797.23	5802.65	5801.23	5803.03	0.005208	4.93	182.39	59.67	0.50
Channel	2247	100-yr	1020.00	5797.23	5802.99	5801.45	5803.39	0.004814	5.02	203.20	63.45	0.48
Channel	2247	500-yr	1300.00	5797.23	5803.71	5801.92	5804.14	0.004154	5.23	253.59	74.80	0.46
Channel	2247	100-yr Floodway	1020.00	5797.23	5802.89	5801.43	5803.39	0.005345	5.67	179.98	45.00	0.50
Channel	2205	2-yr	360.00	5796.09	5799.73	5799.37	5800.40	0.016113	6.58	54.70	26.66	0.81
Channel	2205	10-yr	600.00	5796.09	5800.86	5800.24	5801.58	0.011924	6.82	87.94	32.10	0.73
Channel	2205	50-yr	900.00	5796.09	5801.82	5801.07	5802.67	0.011432	7.39	121.71	38.15	0.73
Channel	2205	100-yr	1020.00	5796.09	5802.14	5801.35	5803.04	0.011401	7.59	134.41	40.47	0.73
Channel	2205	500-yr	1300.00	5796.09	5802.85	5801.98	5803.81	0.011616	7.87	165.19	47.94	0.75
Channel	2205	100-yr Floodway	1020.00	5796.09	5802.13	5801.36	5803.03	0.011577	7.63	133.64	40.35	0.74
Channel	2147	2-yr	360.00	5795.03	5799.55	5798.08	5799.84	0.004494	4.32	83.42	27.70	0.44
Channel	2147	10-yr	600.00	5795.03	5800.65	5798.89	5801.03	0.005365	4.95	121.13	37.80	0.49
Channel	2147	50-yr	900.00	5795.03	5801.63	5799.97	5802.12	0.005448	5.62	160.11	41.72	0.51
Channel	2147	100-yr	1020.00	5795.03	5801.95	5800.24	5802.48	0.005571	5.88	173.55	42.99	0.52
Channel	2147	500-yr	1300.00	5795.03	5802.62	5800.77	5803.25	0.005812	6.40	203.14	45.66	0.53
Channel	2147	100-yr Floodway	1020.00	5795.03	5801.90	5800.24	5802.47	0.005717	6.04	168.80	39.41	0.51
Channel	2135		Bridge									
Channel	2075	2-yr	360.00	5795.28	5798.79		5799.34	0.010517	5.94	60.64	24.46	0.66
Channel	2075	10-yr	600.00	5795.28	5799.49		5800.39	0.014177	7.62	78.73	27.17	0.79
Channel	2075	50-yr	900.00	5795.28	5800.20	5800.08	5801.42	0.019737	8.87	101.43	36.00	0.93
Channel	2075	100-yr	1020.00	5795.28	5800.40	5800.30	5801.77	0.020696	9.37	108.81	36.81	0.96
Channel	2075	500-yr	1300.00	5795.28	5800.90	5800.90	5802.51	0.021319	10.20	127.51	38.79	0.99
Channel	2075	100-yr Floodway	1020.00	5795.28	5800.48	5800.33	5801.78	0.019245	9.14	111.59	37.11	0.93

HEC-RAS Plan: PRP River: Trail Creek Reach: Channel (Continued)

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)	
Channel	1984	2-yr	360.00	5794.97	5798.01	5797.48	5798.36	0.009728	4.74	75.92	42.61	0.63
Channel	1984	10-yr	600.00	5794.97	5798.73	5798.09	5799.20	0.009920	5.53	108.57	49.03	0.65
Channel	1984	50-yr	900.00	5794.97	5799.45	5798.71	5800.04	0.009491	6.18	145.70	53.71	0.66
Channel	1984	100-yr	1020.00	5794.97	5799.71	5798.88	5800.34	0.009351	6.38	159.98	55.58	0.66
Channel	1984	500-yr	1300.00	5794.97	5800.29	5799.35	5800.99	0.008476	6.73	195.94	88.60	0.65
Channel	1984	100-yr Floodway	1020.00	5794.97	5799.74	5798.87	5800.44	0.009154	6.67	153.01	47.23	0.65
Channel	1824	2-yr	360.00	5793.50	5796.05	5795.70	5796.53	0.013546	5.56	64.71	36.50	0.74
Channel	1824	10-yr	600.00	5793.50	5796.88	5796.35	5797.48	0.011576	6.22	96.48	40.69	0.71
Channel	1824	50-yr	900.00	5793.50	5797.73	5797.02	5798.44	0.010400	6.75	133.38	45.75	0.70
Channel	1824	100-yr	1020.00	5793.50	5798.03	5797.22	5798.77	0.010091	6.92	147.31	47.46	0.69
Channel	1824	500-yr	1300.00	5793.50	5798.72	5797.76	5799.50	0.010098	7.09	183.44	57.23	0.70
Channel	1824	100-yr Floodway	1020.00	5793.50	5798.03	5797.24	5798.87	0.010253	7.35	138.83	39.02	0.69
Channel	1769	2-yr	360.00	5792.44	5795.57	5794.85	5795.93	0.008224	4.82	74.76	35.62	0.59
Channel	1769	10-yr	600.00	5792.44	5796.43	5795.54	5796.92	0.008118	5.57	107.65	40.60	0.60
Channel	1769	50-yr	900.00	5792.44	5797.32	5796.26	5797.92	0.007630	6.17	145.81	44.56	0.60
Channel	1769	100-yr	1020.00	5792.44	5797.63	5796.49	5798.26	0.007557	6.39	159.57	45.75	0.60
Channel	1769	500-yr	1300.00	5792.44	5798.29	5796.97	5799.01	0.007395	6.82	190.75	70.89	0.61
Channel	1769	100-yr Floodway	1020.00	5792.44	5797.60	5796.52	5798.32	0.008565	6.80	149.91	41.07	0.63
Channel	1719	2-yr	360.00	5791.53	5795.02	5794.45	5795.45	0.010488	5.31	67.82	32.89	0.65
Channel	1719	10-yr	600.00	5791.53	5795.83	5795.15	5796.44	0.010353	6.24	96.09	35.90	0.67
Channel	1719	50-yr	900.00	5791.53	5796.69	5795.87	5797.46	0.010004	7.04	127.83	38.53	0.68
Channel	1719	100-yr	1020.00	5791.53	5796.96	5796.13	5797.80	0.010154	7.38	138.26	39.12	0.69
Channel	1719	500-yr	1300.00	5791.53	5797.53	5796.68	5798.54	0.010486	8.07	161.04	56.75	0.71
Channel	1719	100-yr Floodway	1020.00	5791.53	5796.99	5796.06	5797.84	0.009994	7.41	137.57	37.05	0.68
Channel	1524	2-yr	360.00	5789.62	5792.78	5792.16	5793.30	0.011546	5.78	62.33	28.35	0.69
Channel	1524	10-yr	600.00	5789.62	5793.82	5793.04	5794.44	0.010103	6.33	94.75	33.90	0.67
Channel	1524	50-yr	900.00	5789.62	5794.94	5793.81	5795.61	0.008634	6.58	136.72	178.40	0.64
Channel	1524	100-yr	1020.00	5789.62	5795.31	5794.14	5796.01	0.007980	6.71	152.54	202.29	0.62
Channel	1524	500-yr	1300.00	5789.62	5796.10	5794.71	5796.86	0.006630	6.98	189.67	259.64	0.59
Channel	1524	100-yr Floodway	1020.00	5789.62	5795.29	5794.10	5796.04	0.008238	6.94	147.30	44.30	0.62
Channel	1463	2-yr	360.00	5787.08	5792.32	5791.04	5792.73	0.006894	5.13	70.22	24.26	0.53
Channel	1463	10-yr	600.00	5787.08	5793.25	5792.07	5793.88	0.008508	6.38	94.11	31.16	0.61
Channel	1463	50-yr	900.00	5787.08	5794.19	5793.02	5795.05	0.009475	7.41	121.48	103.48	0.65
Channel	1463	100-yr	1020.00	5787.08	5794.53	5793.35	5795.46	0.009434	7.73	132.71	160.20	0.66
Channel	1463	500-yr	1300.00	5787.08	5795.29	5794.06	5796.36	0.008762	8.32	158.94	253.01	0.65
Channel	1463	100-yr Floodway	1020.00	5787.08	5794.53	5793.27	5795.48	0.009793	7.80	131.39	39.47	0.66
Channel	1414	2-yr	360.00	5788.70	5791.79	5791.22	5792.30	0.011112	5.75	62.56	27.95	0.68
Channel	1414	10-yr	600.00	5788.70	5792.73	5792.01	5793.42	0.010441	6.66	90.03	30.26	0.68
Channel	1414	50-yr	900.00	5788.70	5793.72	5792.80	5794.58	0.009811	7.43	121.07	32.37	0.68
Channel	1414	100-yr	1020.00	5788.70	5794.07	5793.03	5794.99	0.009662	7.69	132.72	33.20	0.68
Channel	1414	500-yr	1300.00	5788.70	5794.90	5793.68	5795.90	0.009491	8.05	161.45	106.32	0.68
Channel	1414	100-yr Floodway	1020.00	5788.70	5794.08	5793.08	5795.00	0.009554	7.67	132.95	32.78	0.67
Channel	1349	2-yr	360.00	5787.23	5791.29	5790.10	5791.71	0.007022	5.23	68.90	24.05	0.54
Channel	1349	10-yr	600.00	5787.23	5792.01	5791.11	5792.75	0.010189	6.88	87.20	26.46	0.67
Channel	1349	50-yr	900.00	5787.23	5792.67	5792.03	5793.80	0.013690	8.54	105.35	28.71	0.79
Channel	1349	100-yr	1020.00	5787.23	5792.89	5792.26	5794.18	0.014981	9.13	111.70	29.43	0.83
Channel	1349	500-yr	1300.00	5787.23	5793.38	5793.03	5795.01	0.018229	10.26	126.76	48.34	0.92
Channel	1349	100-yr Floodway	1020.00	5787.23	5793.06	5792.38	5794.24	0.013315	8.73	116.82	30.12	0.78
Channel	1239	2-yr	360.00	5787.81	5790.77	5789.80	5791.00	0.004915	3.87	93.80	59.26	0.46
Channel	1239	10-yr	600.00	5787.81	5791.42	5790.42	5791.79	0.005829	4.94	122.88	67.63	0.52
Channel	1239	50-yr	900.00	5787.81	5792.04	5791.02	5792.60	0.006654	6.03	151.93	73.15	0.58
Channel	1239	100-yr	1020.00	5787.81	5792.24	5791.23	5792.88	0.006993	6.43	161.87	74.32	0.60
Channel	1239	500-yr	1300.00	5787.81	5792.68	5791.68	5793.50	0.007703	7.29	183.15	76.74	0.64
Channel	1239	100-yr Floodway	1020.00	5787.81	5792.64	5791.23	5793.16	0.005226	5.83	176.72	66.24	0.51
Channel	1200	2-yr	360.00	5786.77	5790.46		5790.76	0.007767	4.34	82.95	44.52	0.56
Channel	1200	10-yr	600.00	5786.77	5791.02		5791.50	0.009151	5.54	109.29	49.70	0.63
Channel	1200	50-yr	900.00	5786.77	5791.56		5792.26	0.010493	6.74	137.21	54.88	0.70
Channel	1200	100-yr	1020.00	5786.77	5791.73		5792.53	0.011081	7.19	146.67	56.35	0.72
Channel	1200	500-yr	1300.00	5786.77	5792.08		5793.10	0.012359	8.17	166.88	58.47	0.78
Channel	1200	100-yr Floodway	1020.00	5786.77	5792.37		5792.93	0.006507	6.01	169.68	45.71	0.55
Channel	1114	2-yr	360.00	5786.95	5789.69		5789.97	0.010840	4.23	85.01	61.31	0.63
Channel	1114	10-yr	600.00	5786.95	5790.16		5790.59	0.012193	5.23	114.73	65.76	0.70
Channel	1114	50-yr	900.00	5786.95	5790.64		5791.22	0.013222	6.08	148.01	71.80	0.75
Channel	1114	100-yr	1020.00	5786.95	5790.81		5791.44	0.013348	6.39	159.69	72.40	0.76
Channel	1114	500-yr	1300.00	5786.95	5791.18		5791.93	0.013236	6.97	186.61	73.58	0.77
Channel	1114	100-yr Floodway	1020.00	5786.95	5791.84		5792.37	0.006416	5.83	174.97	47.00	0.53
Channel	1050	2-yr	360.00	5786.60	5788.88		5789.18	0.014416	4.34	83.02	71.48	0.71
Channel	1050	10-yr	600.00	5786.60	5789.34		5789.76	0.013725	5.16	116.35	74.30	0.73
Channel	1050	50-yr	900.00	5786.60	5789.83		5790.36	0.013086	5.87	153.24	77.49	0.74
Channel	1050	100-yr	1020.00	5786.60	5790.02		5790.59	0.012652	6.08	167.90	78.60	0.73

HEC-RAS Plan: PRP River: Trail Creek Reach: Channel (Continued)

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)	
Channel	1050	500-yr	1300.00	5786.60	5790.46		5791.09	0.011731	6.37	204.03	83.91	0.72
Channel	1050	100-yr Floodway	1020.00	5786.62	5790.32	5790.32	5791.56	0.026717	8.93	114.21	46.82	1.01
Channel	958	2-yr	360.00	5785.00	5787.74	5787.20	5788.01	0.011265	4.14	86.85	66.27	0.64
Channel	958	10-yr	600.00	5785.00	5788.32	5787.80	5788.67	0.009996	4.72	127.22	73.03	0.63
Channel	958	50-yr	900.00	5785.00	5789.02	5788.26	5789.40	0.007850	4.99	180.33	79.11	0.58
Channel	958	100-yr	1020.00	5785.00	5789.28	5788.42	5789.68	0.007242	5.07	201.09	80.86	0.57
Channel	958	500-yr	1300.00	5785.00	5789.87	5788.77	5790.29	0.005919	5.20	249.81	84.46	0.53
Channel	958	100-yr Floodway	1020.00	5785.00	5789.26	5788.43	5789.75	0.008120	5.66	180.19	63.21	0.59
Channel	936	2-yr	360.00	5785.06	5787.52		5787.78	0.008223	4.09	88.09	54.58	0.57
Channel	936	10-yr	600.00	5785.06	5788.01		5788.43	0.010089	5.20	115.30	57.80	0.65
Channel	936	50-yr	900.00	5785.06	5788.67		5789.20	0.009079	5.81	155.46	65.29	0.64
Channel	936	100-yr	1020.00	5785.06	5788.92		5789.48	0.008505	5.99	172.49	70.56	0.63
Channel	936	500-yr	1300.00	5785.06	5789.52		5790.12	0.007146	6.24	215.64	73.72	0.60
Channel	936	100-yr Floodway	1020.00	5785.06	5789.08		5789.58	0.007136	5.68	179.78	61.21	0.58
Channel	842	2-yr	360.00	5783.60	5785.74	5785.74	5786.45	0.027415	6.75	53.34	38.47	1.01
Channel	842	10-yr	600.00	5783.60	5786.88		5787.41	0.011679	5.84	102.66	47.99	0.70
Channel	842	50-yr	900.00	5783.60	5787.94		5788.43	0.007246	5.61	164.72	66.28	0.58
Channel	842	100-yr	1020.00	5783.60	5788.30		5788.78	0.006244	5.63	188.64	68.25	0.55
Channel	842	500-yr	1300.00	5783.60	5789.04		5789.54	0.004960	5.76	240.50	71.66	0.51
Channel	842	100-yr Floodway	1020.00	5783.60	5788.35		5788.91	0.007034	6.00	170.07	48.82	0.57
Channel	784	2-yr	360.00	5780.62	5785.49		5785.75	0.004572	4.10	87.87	33.14	0.44
Channel	784	10-yr	600.00	5780.62	5786.61		5786.95	0.004504	4.68	128.10	39.04	0.46
Channel	784	50-yr	900.00	5780.62	5787.68		5788.09	0.004165	5.20	175.46	50.35	0.45
Channel	784	100-yr	1020.00	5780.62	5788.03		5788.49	0.004007	5.40	194.54	56.33	0.45
Channel	784	500-yr	1300.00	5780.62	5788.78		5789.29	0.003754	5.79	244.50	76.20	0.45
Channel	784	100-yr Floodway	1020.00	5780.62	5788.04		5788.57	0.004829	5.85	174.26	36.08	0.47
Channel	643	2-yr	360.00	5780.66	5784.52		5784.93	0.007304	5.16	69.71	26.50	0.56
Channel	643	10-yr	600.00	5780.66	5785.53		5786.11	0.007706	6.12	97.97	29.62	0.59
Channel	643	50-yr	900.00	5780.66	5786.49		5787.26	0.008195	7.03	128.04	32.66	0.63
Channel	643	100-yr	1020.00	5780.66	5786.82		5787.66	0.008407	7.35	138.85	33.70	0.64
Channel	643	500-yr	1300.00	5780.66	5787.46		5788.47	0.008656	8.06	163.38	41.90	0.66
Channel	643	100-yr Floodway	1020.00	5780.66	5786.82		5787.66	0.008377	7.34	139.03	33.72	0.64
Channel	587	2-yr	360.00	5780.43	5784.10		5784.51	0.007882	5.11	70.49	29.14	0.58
Channel	587	10-yr	600.00	5780.43	5785.14		5785.67	0.007435	5.84	102.67	32.86	0.58
Channel	587	50-yr	900.00	5780.43	5786.12		5786.80	0.007443	6.59	136.58	36.23	0.60
Channel	587	100-yr	1020.00	5780.43	5786.45		5787.18	0.007595	6.87	148.56	37.55	0.61
Channel	587	500-yr	1300.00	5780.43	5787.08		5787.95	0.008549	7.48	173.91	42.39	0.65
Channel	587	100-yr Floodway	1020.00	5780.43	5786.45		5787.18	0.007564	6.86	148.80	37.59	0.61
Channel	549	2-yr	360.00	5779.68	5783.49		5784.10	0.013092	6.27	57.40	25.10	0.73
Channel	549	10-yr	600.00	5779.68	5784.57		5785.29	0.011845	6.83	87.82	31.31	0.72
Channel	549	50-yr	900.00	5779.68	5785.62		5786.44	0.010708	7.28	123.65	37.14	0.70
Channel	549	100-yr	1020.00	5779.68	5785.94		5786.81	0.011229	7.48	136.35	40.87	0.72
Channel	549	500-yr	1300.00	5779.68	5786.59		5787.56	0.011411	7.90	164.64	46.15	0.74
Channel	549	100-yr Floodway	1020.00	5779.68	5785.93		5786.82	0.011196	7.54	135.31	39.33	0.72
Channel	482	2-yr	360.00	5778.50	5783.16	5781.61	5783.50	0.005248	4.66	77.18	26.04	0.48
Channel	482	10-yr	600.00	5778.50	5784.17	5782.65	5784.67	0.006331	5.69	105.46	30.28	0.54
Channel	482	50-yr	900.00	5778.50	5785.16	5783.60	5785.81	0.007297	6.46	140.01	63.06	0.59
Channel	482	100-yr	1020.00	5778.50	5785.46	5783.92	5786.17	0.007339	6.76	152.46	104.12	0.59
Channel	482	500-yr	1300.00	5778.50	5786.07	5784.69	5786.93	0.007410	7.46	177.89	119.01	0.61
Channel	482	100-yr Floodway	1020.00	5778.50	5785.46	5783.93	5786.17	0.007342	6.77	152.44	49.76	0.59
Channel	376	2-yr	360.00	5778.47	5782.49	5781.51	5782.86	0.006906	4.84	74.43	30.08	0.54
Channel	376	10-yr	600.00	5778.47	5783.42	5782.33	5783.94	0.007466	5.76	104.22	34.23	0.58
Channel	376	50-yr	900.00	5778.47	5784.35	5783.11	5785.01	0.007730	6.53	137.94	39.88	0.61
Channel	376	100-yr	1020.00	5778.47	5784.65	5783.41	5785.37	0.007704	6.81	150.75	44.52	0.61
Channel	376	500-yr	1300.00	5778.47	5785.28	5784.03	5786.13	0.007511	7.41	178.79	119.76	0.62
Channel	376	100-yr Floodway	1020.00	5778.47	5784.65	5783.41	5785.37	0.007716	6.82	150.66	44.48	0.61
Channel	241	2-yr	360.00	5778.25	5781.58	5780.73	5781.91	0.007004	4.58	78.56	35.80	0.55
Channel	241	10-yr	600.00	5778.25	5782.57	5781.45	5782.98	0.006315	5.15	116.48	40.80	0.54
Channel	241	50-yr	900.00	5778.25	5783.55	5782.15	5784.05	0.005967	5.67	158.81	45.83	0.54
Channel	241	100-yr	1020.00	5778.25	5783.87	5782.39	5784.40	0.006008	5.87	173.63	47.63	0.54
Channel	241	500-yr	1300.00	5778.25	5784.55	5782.93	5785.16	0.005952	6.26	207.70	51.18	0.55
Channel	241	100-yr Floodway	1020.00	5778.25	5783.86	5782.40	5784.40	0.006037	5.88	173.33	47.59	0.54
Channel	162	2-yr	360.00	5777.50	5781.09	5779.97	5781.40	0.005703	4.47	80.49	32.20	0.50
Channel	162	10-yr	600.00	5777.50	5782.06	5780.76	5782.49	0.006009	5.26	114.01	36.98	0.53
Channel	162	50-yr	900.00	5777.50	5783.01	5781.56	5783.54	0.006638	5.84	154.05	46.14	0.56
Channel	162	100-yr	1020.00	5777.50	5783.33	5781.83	5783.90	0.006591	6.03	169.17	48.04	0.57
Channel	162	500-yr	1300.00	5777.50	5784.03	5782.48	5784.66	0.006682	6.34	205.04	54.63	0.58
Channel	162	100-yr Floodway	1020.00	5777.50	5783.32	5781.83	5783.89	0.006657	6.05	168.58	47.98	0.57
Channel	93	2-yr	360.00	5777.38	5780.77	5779.63	5781.02	0.005024	4.01	89.71	38.74	0.46

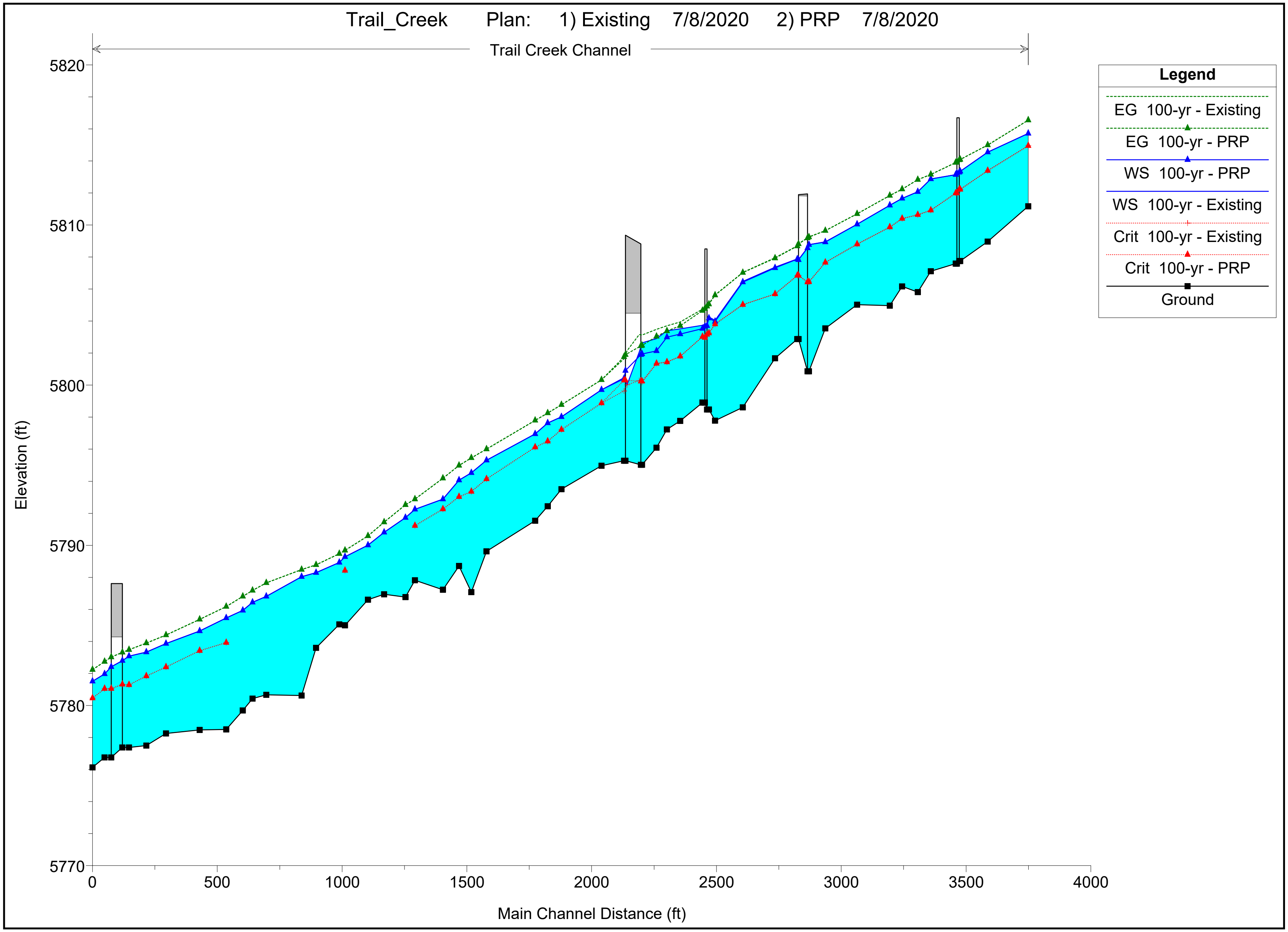
HEC-RAS Plan: PRP   River: Trail Creek   Reach: Channel (Continued)

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)	
Channel	93	10-yr	600.00	5777.38	5781.76	5780.36	5782.08	0.005084	4.55	131.95	47.46	0.48
Channel	93	50-yr	900.00	5777.38	5782.74	5781.02	5783.12	0.004658	4.93	182.54	62.74	0.47
Channel	93	100-yr	1020.00	5777.38	5783.08	5781.29	5783.48	0.004532	5.07	201.04	78.00	0.47
Channel	93	500-yr	1300.00	5777.38	5783.79	5781.89	5784.24	0.004365	5.36	242.57	222.15	0.47
Channel	93	100-yr Floodway	1020.00	5777.38	5783.07	5781.32	5783.47	0.004417	5.11	199.59	53.21	0.47
Channel	66		Bridge									
Channel	-5	2-yr	360.00	5776.76	5779.82	5779.26	5780.29	0.010643	5.49	65.52	30.86	0.66
Channel	-5	10-yr	600.00	5776.76	5780.68	5779.98	5781.31	0.010770	6.42	93.53	56.63	0.69
Channel	-5	50-yr	900.00	5776.76	5781.62	5780.76	5782.37	0.010397	6.94	129.59	121.01	0.70
Channel	-5	100-yr	1020.00	5776.76	5781.97	5781.05	5782.74	0.010161	7.06	144.50	139.41	0.69
Channel	-5	500-yr	1300.00	5776.76	5782.68	5781.67	5783.51	0.009351	7.27	178.74	176.16	0.68
Channel	-5	100-yr Floodway	1020.00	5776.76	5781.96	5781.05	5782.74	0.010034	7.08	144.11	43.83	0.69
Channel	-53	2-yr	360.00	5776.13	5779.33	5778.70	5779.78	0.010002	5.36	67.22	31.56	0.65
Channel	-53	10-yr	600.00	5776.13	5780.19	5779.45	5780.80	0.010015	6.24	96.15	35.72	0.67
Channel	-53	50-yr	900.00	5776.13	5781.15	5780.20	5781.86	0.010010	6.74	133.45	51.64	0.68
Channel	-53	100-yr	1020.00	5776.13	5781.51	5780.46	5782.23	0.010001	6.79	150.20	78.26	0.69
Channel	-53	500-yr	1300.00	5776.13	5782.27	5781.12	5782.98	0.010002	6.75	192.97	171.21	0.69
Channel	-53	100-yr Floodway	1020.00	5776.13	5781.51	5780.46	5782.23	0.010001	6.79	150.20	49.22	0.69

HEC-RAS Plan: PRP River: Trail Creek Reach: Channel

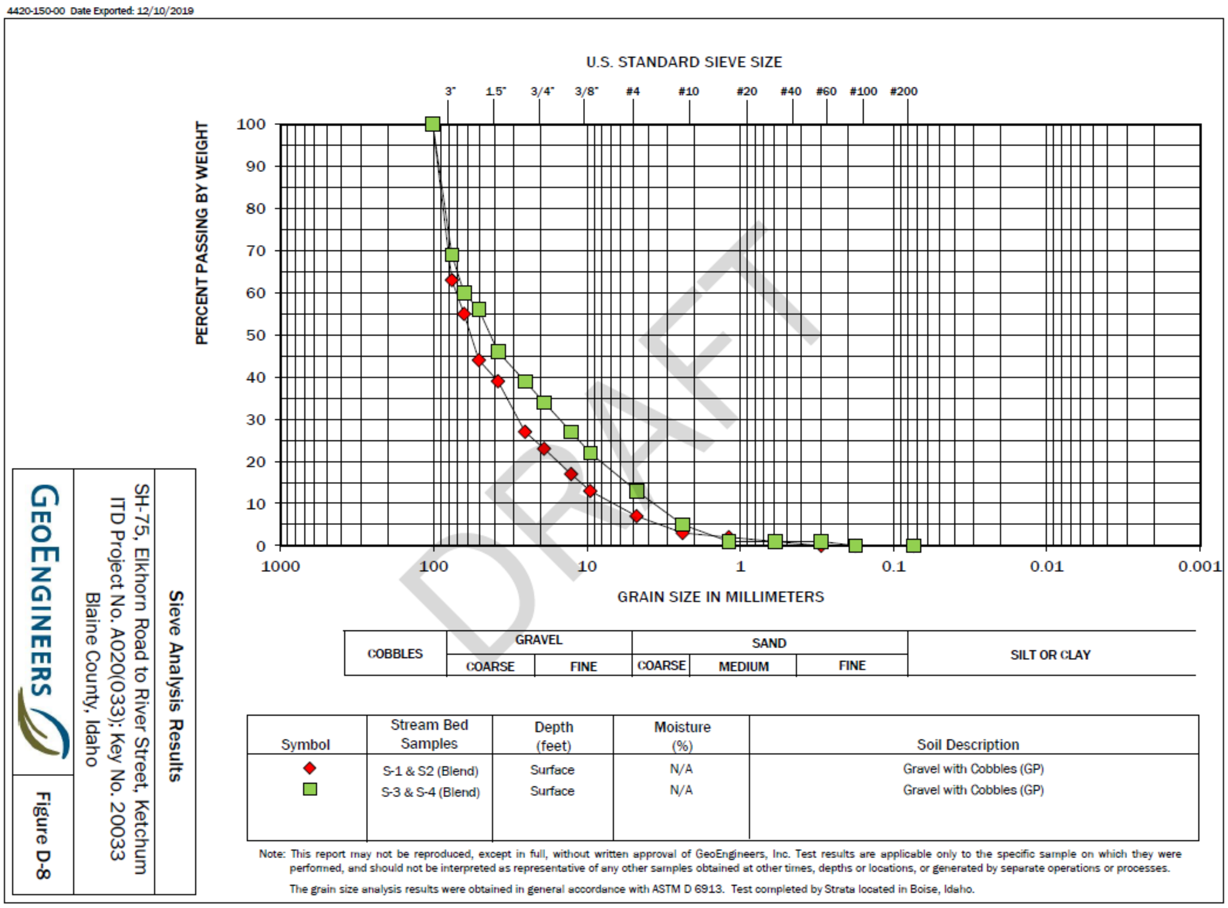
Reach	River Sta	Profile	E.G. US.	Min El Prs	BR Open Area	Prs O WS	Q Total	Min El Weir Flow	Q Weir	Delta EG	BR Sluice Coef
			(ft)	(ft)	(sq ft)	(ft)	(cfs)	(ft)	(cfs)	(ft)	
Channel	3418	2-yr	5811.55	5816.70	275.60		360.00	5816.67		0.19	
Channel	3418	10-yr	5812.60	5816.70	275.60		600.00	5816.67		0.20	
Channel	3418	50-yr	5813.70	5816.70	275.60		900.00	5816.67		0.19	
Channel	3418	100-yr	5814.09	5816.70	275.60		1020.00	5816.67		0.20	
Channel	3418	500-yr	5814.86	5816.70	275.60		1300.00	5816.67		0.21	
Channel	3418	100-yr Floodway	5814.09	5816.70	267.28		1020.00	5816.90		0.20	
Channel	2810	2-yr	5806.47	5811.81	221.26		360.00	5812.13		0.38	
Channel	2810	10-yr	5807.60	5811.81	221.26		600.00	5812.13		0.43	
Channel	2810	50-yr	5808.82	5811.81	221.26		900.00	5812.13		0.52	
Channel	2810	100-yr	5809.25	5811.81	221.26		1020.00	5812.13		0.56	
Channel	2810	500-yr	5810.17	5811.81	221.26		1300.00	5812.13		0.69	
Channel	2810	100-yr Floodway	5809.26	5811.81	221.26		1020.00	5812.13		0.56	
Channel	2407	2-yr	5802.52	5808.51	213.90		360.00	5807.91		0.33	
Channel	2407	10-yr	5803.59	5808.51	213.90		600.00	5807.91		0.34	
Channel	2407	50-yr	5804.67	5808.51	213.90		900.00	5807.91		0.38	
Channel	2407	100-yr	5805.06	5808.51	213.90		1020.00	5807.91		0.39	
Channel	2407	500-yr	5805.91	5808.51	213.90		1300.00	5807.91		0.46	
Channel	2407	100-yr Floodway	5805.05	5808.51	213.90		1020.00	5807.91		0.40	
Channel	2135	2-yr	5799.84	5804.50	319.45		360.00	5809.37		0.50	
Channel	2135	10-yr	5801.03	5804.50	319.45		600.00	5809.37		0.64	
Channel	2135	50-yr	5802.12	5804.50	319.45		900.00	5809.37		0.70	
Channel	2135	100-yr	5802.48	5804.50	319.45		1020.00	5809.37		0.72	
Channel	2135	500-yr	5803.25	5804.50	319.45		1300.00	5809.37		0.74	
Channel	2135	100-yr Floodway	5802.47	5804.50	293.13		1020.00	5811.42		0.70	
Channel	66	2-yr	5781.02	5784.28	240.55		360.00	5787.62		0.73	
Channel	66	10-yr	5782.08	5784.28	240.55		600.00	5787.62		0.76	
Channel	66	50-yr	5783.12	5784.28	240.55		900.00	5787.62		0.74	
Channel	66	100-yr	5783.48	5784.28	240.55		1020.00	5787.62		0.73	
Channel	66	500-yr	5784.24	5784.28	240.55		1300.00	5787.62		0.73	
Channel	66	100-yr Floodway	5783.47	5784.28	240.55		1020.00	5787.62		0.73	

Appendix E. HEC-RAS Output: Existing vs. Proposed Conditions



Trail_Creek Plan: 1) Existing 7/8/2020 2) PRP 7/8/2020
Trail Creek Channel
Legend
EG 100-yr - Existing
EG 100-yr - PRP
WS 100-yr - PRP
WS 100-yr - Existing
Crit 100-yr - Existing
Crit 100-yr - PRP
Ground
Elevation (ft)
5820
5810
5800
5790
5780
5770
0
500
1000
1500
2000
2500
3000
3500
4000
Main Channel Distance (ft)

Appendix F Scour and Riprap



Scour Calculation Results

Reference HEC 18, 5th Edition

Design Year: 500

Clear-Water contraction scour will exist. Use the Clear-Water analysis.

Do Coarse Bed Conditions Exist? NO ("YES" or "NO")

Contractions Scour Results:

If Clear-Water Governs	0.37	ft
If Live-Bed Governs, Minimum of ysLB and ysCW	1.61	ft

500-yr Contraction Scour: 0.37 feet

Does Vertical Contractions Scour Occur? No ("YES" or "NO")

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Are there piers within the 500-year floodplain? No ("YES" or "NO")

-- **--** **--**

Riprap Size at Abutments: D50 = 1.5 Ft

-- **--**

500-yr Scour Results (ft)			
Scour Type	Abutment 1	Abutment 2	Pier
Contraction Scour	0.37	0.37	--
Vertical Contraction Scour	--	--	--
Local Scour	--	--	--
Total Scour	0.37	0.37	0.00

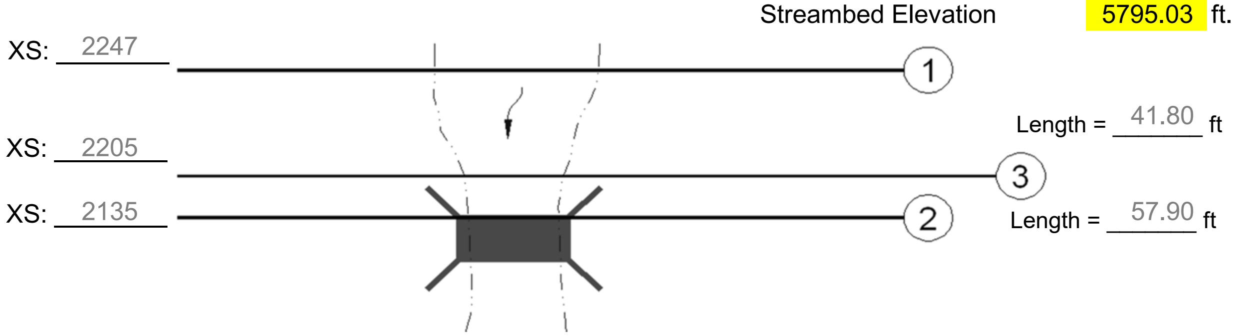
Notes: (1) Local abutment scour calculations are not required when the substructure is protected with multi-layered riprap protection. (2) If multi-layered riprap protection is proposed at the piers the local pier scour depth may be reduced by 50%.

Scour 500-yr

Streambed Particle Size (D_{50}): 1.500 in.
38.100 mm
0.1250 ft.

Determined by: Visual Inspection
Note: *Set minimum D_{50} to 0.2mm (0.008-inch) for lowe no*

Upstream Uncontracted Cross Section (XS1):	2247		Length to XS1:	41.80	ft.
Internal Upstream Cross Section (XS2):	2135		Length to XS3:	57.90	ft.
Upstream Bounding Cross Section (XS3):	2205		Low Chord Elevation:	5804.91	ft.
Long-term aggradation / degradation:	0.0	ft.	Water Surface Elevation:	5802.60	ft.
			Streambed Elevation	5795.03	ft.



Key
1. Upstream uncontracted cross section (XS output)
2. Internal bridge cross section (BR U or BR D in HEC-RAS output)
3. Upstream bounding cross section (XS output)

Determine Clear-Water or Live-Bed Flow Conditions

Ku coefficient (Enter 6.19 for SI units or 11.17 for English Units):	11.17	
Channel Hydraulic Depth Variable (from XS1), **y**:	3.97	ft.
Channel Velocity (from XS1), V:	**5.230**	**ft./s**

V_c is the critical velocity. Speeds at or above this level will transport bed material of D50 and smaller.
Use Equation 6.1 (HEC-18):

$$V_c = K_u\, y^{1/6}\, (D_{50})^{1/3}$$

V_c = 7.028 ft./s

If V_c < V Live-Bed Scour Occurs
If Vc > V Clear-Water Scour Occurs

Clear-Water contraction scour will exist. Use the Clear-Water analysis.

K_u Coefficient (Enter 0.25 for SI units or 0.0077 for English Units):	0.0077	
W, W_1, W_2 values are taken at:	at top of channel	
For Vertical Contraction Scour:		
Does overtopping of the bridge or approach roadway occur?	No	
T Superstructure Depth (including girders, deck and parapet):	2.50	ft.

Contraction Scour 500-yr

Clear-Water Scour (GOVERNS)

K_u	Coefficient (Enter 0.25 for SI units or 0.0077 for English Units):	0.0077		
y_0	Hydraulic Depth Variable (from XS2):	3.69	ft	
W	Estimated bottom or top channel width, less pier widths (XS2):	41.25	ft	at top of channel
Q	Flow through the bridge opening, or on the set-back over bank area at the bridge associated with the width, W (from XS2):	1300	cfs	
D_m	Diameter of the smallest nontransportable particle in the bed material, 1.25 * D_{50}:	0.15625	ft	
y_2	Average depth in the contracted section: Equation 6.4 (HEC-18) $y_2 = \left[\frac{0.0077Q^2}{D_m^{2/3}W^2}\right]^{3/7}$	4.06	ft	

y_s Average contraction scour depth: $y_s = y_2 - y_0$ **0.37 ft**

Equation 6.5 (HEC-18)

Riprap Sizing 100 year — Type of Abutment: Vertical

HEC-23 Rip Rap Sizing for Vertical or Spill Through Abutments

fr $V/(gy)^{1/2}$ ≤ 0.80 $D_{50} = y*(K/(S_s-1))*(V^2/gy)$

K spill through abutment = 0.89
vertical wall abutment = 1.02

fr $V/(gy)^{1/2}$ >0.80 $D_{50} = y*(K/(S_s-1))*(V^2/gy)^{0.14}$

K spill through abutment = 0.61
vertical wall abutment = 0.69

Where:

fr	(froude number at XS2)	0.78	
Abutment type (spill through or vertical wall)		Vertical	
K		1.02	
y	Depth of flow in the contracted bridge opening (depth from XS2)	4.01	ft
V	As described above for Abutments or Piers:	7.97	ft/s
S	Specific Gravity:	2.65	
g	Gravity Constant (Enter 9.81 m/s^2 for SI or 32.2 ft/s^2 for English):	32.2	ft/s^2
D_{50}		1.22	ft
D_{50}		15	in

Recommended Riprap Abutment Size per ITD Riprap Table: D50 = 18 inches

Determine Safety Factor of Riprap Design using CSU Method (Safety Factor vs Riprap Size)
(Simons, D.B. and Senturk, F., "Sediment Transport Technology", Water Resources Publications, LLC, 1992)

Project: SH-75 Bridge over Trail Creek
Project No: 20033
Location: Ketchum , ID
Designer: Mike Schubert, PE
HDR Engineering, Inc.

Given:

Flow in Channel:	360	cfs
Channel Slope, S:	0.01	ft/ft
Bed slope angle, q:	0.572939	degrees
Unit Weight of Water (γ_w):	62.4	lb/ft^3
Channel Bottom, b:	26	ft
Channel Side Slopes, zH:1V	3	
Riprap Angle of repose:	37	degrees
Riprap Angle of repose:	0.646	radians
Specific Gravity of Riprap:	2.65	
α: =atan(1/z)	0.321751	radians
α:	18.435	degrees
Φ, material angle of repose, degrees	41.000	degrees

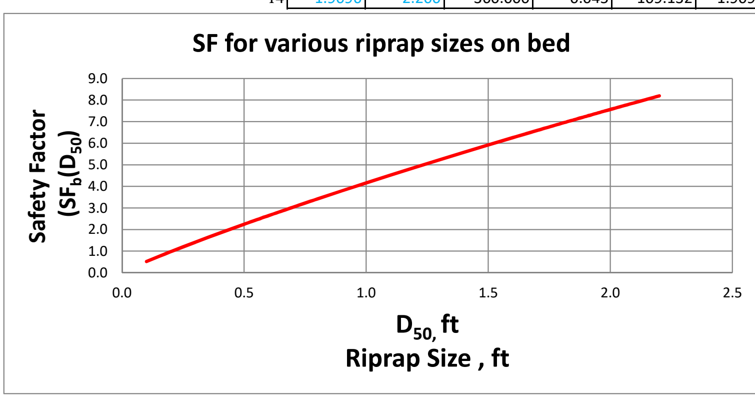
--------------------> θ: 0.0100 radians

--------------------> Φ : 0.7156 radians

Determine safety factor for riprap on channel bed:

Iterate depth until Calculated Q matches Actual Q

		(EQN)	Calculated	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
	Depth	D_{50}	Q	$n(D_{50})$	$C(D_{50})$	$d_n (D_{50})$	$A(D_{50})$	$V(D_{50})$	$P(D_{50})$	$R(D_{50})$	$\tau(D_{50})$	$\eta_b(D_{50})$	$SF_b(D_{50})$
0	1.4977	0.100	360.000	0.027	65.195	1.4977	45.669	7.883	26.000	1.756	0.935	1.906	0.521
1	1.5820	0.200	360.000	0.030	73.179	1.5820	48.639	7.402	26.000	1.871	0.987	1.007	0.982
2	1.6333	0.300	360.000	0.032	78.295	1.6333	50.470	7.133	26.000	1.941	1.019	0.693	1.420
3	1.6707	0.400	360.000	0.034	82.141	1.6707	51.813	6.948	26.000	1.993	1.043	0.532	1.841
4	1.7003	0.500	360.000	0.035	85.253	1.7003	52.881	6.808	26.000	2.034	1.061	0.433	2.251
5	1.7248	0.600	360.000	0.036	87.883	1.7248	53.771	6.695	26.000	2.068	1.076	0.366	2.650
6	1.7642	0.800	360.000	0.038	92.200	1.7642	55.207	6.521	26.000	2.123	1.101	0.281	3.422
7	1.7954	1.000	360.000	0.040	95.693	1.7954	56.349	6.389	26.000	2.167	1.120	0.229	4.166
8	1.8212	1.200	360.000	0.041	98.646	1.8212	57.301	6.283	26.000	2.204	1.136	0.193	4.886
9	1.8433	1.400	360.000	0.042	101.213	1.8433	58.119	6.194	26.000	2.235	1.150	0.168	5.584
10	1.8626	1.600	360.000	0.043	103.491	1.8626	58.837	6.119	26.000	2.263	1.162	0.148	6.263
11	1.8799	1.800	360.000	0.044	105.542	1.8799	59.479	6.053	26.000	2.288	1.173	0.133	6.924
12	1.8878	1.900	360.000	0.044	106.498	1.8878	59.776	6.023	26.000	2.299	1.178	0.126	7.248
13	1.8954	2.000	360.000	0.044	107.412	1.8954	60.059	5.994	26.000	2.310	1.183	0.121	7.568
14	1.9096	2.200	360.000	0.045	109.132	1.9096	60.589	5.942	26.000	2.330	1.192	0.110	8.198



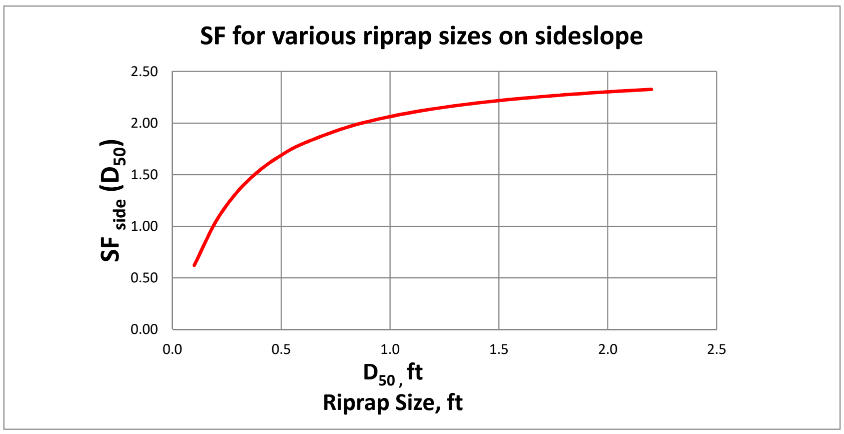
$\sin(\theta)$	0.010
$\cos(\theta)$	1.000
$\tan(\Phi)$	0.869

Assume a normal depth, d:	2.900	ft
b/d:	8.966	
K:	0.750	
$\lambda = \theta$:	0.573	degrees
α: =atan(1/z)	0.322	radians
α	18.435	degrees

sin(λ)	0.010
cos(λ)	1.000
sin(α)	0.316
cos(α)	0.949
tan(Φ)	0.869

Assume riprap trial size

	(EQN)	(11)	(12)	(13)	(14)	(15)
	D_{50}	$\tau_{side}(D_{50})$	$\eta_{side}(D_{50})$	$\beta(D_{50})$	$\eta_{sp}(D_{50})$	$SF_{side}(D_{50})$
0	0.100	0.70	1.430	62.573	1.357	0.622
1	0.200	0.74	0.755	45.764	0.651	1.048
2	0.300	0.76	0.520	35.344	0.412	1.338
3	0.400	0.78	0.399	28.590	0.296	1.542
4	0.500	0.80	0.325	23.948	0.229	1.690
5	0.600	0.81	0.274	20.592	0.186	1.801
6	0.800	0.83	0.211	16.092	0.135	1.959
7	1.000	0.84	0.171	13.224	0.106	2.064
8	1.200	0.85	0.145	11.239	0.087	2.139
9	1.400	0.86	0.126	9.784	0.074	2.195
10	1.600	0.87	0.111	8.671	0.064	2.239
11	1.800	0.88	0.100	7.791	0.057	2.274
12	1.900	0.88	0.095	7.417	0.054	2.290
13	2.000	0.89	0.090	7.079	0.051	2.303
14	2.200	0.89	0.083	6.489	0.046	2.327



(1) Strickler relationship between riprap size and flow resistance: $n(D_{50}) := 0.0395 \cdot D_{50}^{\frac{1}{6}} \cdot \frac{sec}{ft^{\frac{1}{2}}}$

Manning's equation, assuming a trapezoidal or rectangular channel:

$$\frac{Q \cdot n}{1.486 \cdot \sqrt{S}} = A \cdot R^{\frac{2}{3}} \qquad Q = \frac{1.486}{n} \cdot \left(b \cdot d + z \cdot d^2\right) \cdot \left[\left(\frac{b \cdot d + z \cdot d^2}{b \cdot 2 \cdot d \cdot \sqrt{1 + z^2}}\right)^{\frac{2}{3}}\right] \cdot \sqrt{S}$$

Solve Manning's equation for d:

(2) $C(D_{50}) := \frac{Q \cdot n(D_{50})}{1.486 \cdot \sqrt{S}}$ Channel conveyance

$d := 5 \cdot ft$ Guess value for normal depth

(3) $d_n(D_{50}) := root\left[\frac{[(b + z \cdot d) \cdot d]^{\frac{5}{3}}}{\left(b + 2 \cdot d \cdot \sqrt{1 + z^2}\right)^{\frac{2}{3}}} - C(D_{50}), d\right]$ Normal Flow Depth

Iterate Depth until Calculated Flow matches Actual Flow

(4) $A(D_{50}) := \left(b + z \cdot d_n(D_{50})\right) \cdot d_n(D_{50})$ Flow Area

(5) $V(D_{50}) := \frac{Q}{A(D_{50})}$ Flow Velocity

(6) Determine hydraulic radius, R: $P(D_{50}) := b + 2 \cdot d_n(D_{50}) \cdot \sqrt{1 + z^2}$ Wetted Perin

(7) $R(D_{50}) := \frac{A(D_{50})}{P(D_{50})}$ Hydraulic radius, based on normal depth

Check for riprap stability, based on Shields initiation of motion criterion:

(8) $\tau(D_{50}) := \gamma_w \cdot d_n(D_{50}) \cdot S$ Average shear stress on bed

(9) $\eta_b(D_{50}) := \frac{21 \cdot \tau(D_{50})}{\gamma_w \cdot (G_s - 1) \cdot D_{50}}$ Riprap stability factor

(10) $SF_b(D_{50}) := \frac{\cos(\theta) \cdot \tan(\phi)}{\sin(\theta) + \eta_b(D_{50}) \cdot \tan(\phi)}$ Safety factor for selected riprap size on channed bed

Determine Safety Factor for riprap on channel bank sideslopes:

K = 0.75 **Maximum shear stress coefficient on channel sides, K [From "*Sediment Transport: Theory and Practice*", Yang, p.44, Fig. 2.14 (Lane, 1953) or SCS Standard Dwg. No. 140, Sheet 6 of 8].**

(11) $\tau_{side}(D_{50}) := K \cdot \tau(D_{50})$ Shear stress on channel sideslope

(12) $\eta_{side}(D_{50}) := \dfrac{21 \cdot \tau_{side}(D_{50})}{\gamma_w \cdot (G_s - 1) \cdot D_{50}}$ Stability factor for channel sideslope

$\lambda := \theta$ ion for uniform flow

$\alpha := \operatorname{atan}\left(\dfrac{1}{z}\right)$ deslope angle

(13) $\beta(D_{50}) := \operatorname{atan}\left[\dfrac{\cos(\lambda)}{\left(\dfrac{2 \cdot \sin(\alpha)}{\eta_{side}(D_{50}) \cdot \tan(\phi)}\right) + \sin(\lambda)}\right]$

(14) $\eta_{sp}(D_{50}) := \eta_{side}(D_{50}) \cdot \left(\dfrac{1 + \sin(\lambda + \beta(D_{50}))}{2}\right)$ Stability factor for sideslopes

(15) $SF_{side}(D_{50}) := \dfrac{\cos(\alpha) \cdot \tan(\phi)}{\eta_{sp}(D_{50}) \cdot \tan(\phi) + \sin(\alpha) \cdot \cos(\beta(D_{50}))}$ Safety factor for riprap on sideslopes

Determine Safety Factor of Riprap Design using CSU Method (Safety Factor vs Riprap Size)
(Simons, D.B. and Senturk, F., "Sediment Transport Technology", Water Resources Publications, LLC, 1992)

Project: SH-75 Bridge over Trail Creek
Project No: 20033
Location: Ketchum , ID
Designer: Mike Schubert, PE
HDR Engineering, Inc.

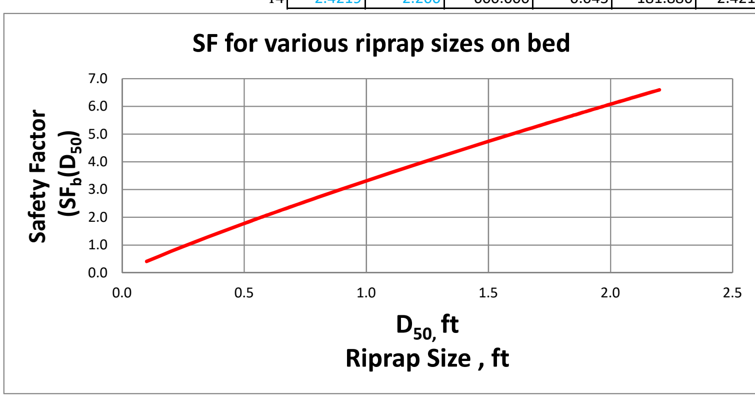
Given:

Flow in Channel:	600	cfs		
Channel Slope, S:	0.01	ft/ft		
Bed slope angle, q:	0.572939	degrees	-------------------->	θ: 0.0100 radians
Unit Weight of Water (γ_w):	62.4	lb/ft^3		
Channel Bottom, b:	26	ft		
Channel Side Slopes, zH:1V	3			
Riprap Angle of repose:	37	degrees		
Riprap Angle of repose:	0.646	radians		
Specific Gravity of Riprap:	2.65			
α: =atan(1/z)	0.321751	radians		
α:	18.435	degrees		
Φ, material angle of repose, degrees	41.000	degrees	--------------------->	Φ : 0.7156 radians

Determine safety factor for riprap on channel bed:

Iterate depth until Calculated Q matches Actual Q

		(EQN)	Calculated	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
	Depth	D_{50}	Q	$n(D_{50})$	$C(D_{50})$	$d_n (D_{50})$	$A(D_{50})$	$V(D_{50})$	$P(D_{50})$	$R(D_{50})$	$\tau(D_{50})$	$\eta_b(D_{50})$	$SF_b(D_{50})$
0	1.9057	0.100	600.000	0.027	108.658	1.9057	60.443	9.927	26.000	2.325	1.189	2.425	0.410
1	2.0116	0.200	600.000	0.030	121.965	2.0116	64.439	9.311	26.000	2.478	1.255	1.280	0.774
2	2.0760	0.300	599.995	0.032	130.492	2.0760	66.906	8.968	26.000	2.573	1.295	0.881	1.121
3	2.1229	0.400	604.304	0.034	136.901	2.1229	68.716	8.732	26.000	2.643	1.325	0.675	1.456
4	2.1600	0.500	600.000	0.035	142.088	2.1600	70.156	8.552	26.000	2.698	1.348	0.550	1.781
5	2.1907	0.600	600.000	0.036	146.472	2.1907	71.357	8.408	26.000	2.744	1.367	0.465	2.100
6	2.2401	0.800	599.999	0.038	153.666	2.2401	73.295	8.186	26.000	2.819	1.398	0.356	2.718
7	2.2790	1.000	600.000	0.040	159.489	2.2790	74.837	8.017	26.000	2.878	1.422	0.290	3.316
8	2.3114	1.200	600.000	0.041	164.409	2.3114	76.123	7.882	26.000	2.928	1.442	0.245	3.896
9	2.3390	1.400	600.000	0.042	168.688	2.3390	77.228	7.769	26.000	2.970	1.460	0.213	4.461
10	2.3632	1.600	600.000	0.043	172.484	2.3632	78.199	7.673	26.000	3.008	1.475	0.188	5.013
11	2.3848	1.800	600.000	0.044	175.904	2.3848	79.066	7.589	26.000	3.041	1.488	0.169	5.551
12	2.3947	1.900	600.000	0.044	177.496	2.3947	79.468	7.550	26.000	3.056	1.494	0.160	5.816
13	2.4042	2.000	600.000	0.044	179.020	2.4042	79.851	7.514	26.000	3.071	1.500	0.153	6.079
14	2.4219	2.200	600.000	0.045	181.886	2.4219	80.567	7.447	26.000	3.099	1.511	0.140	6.595



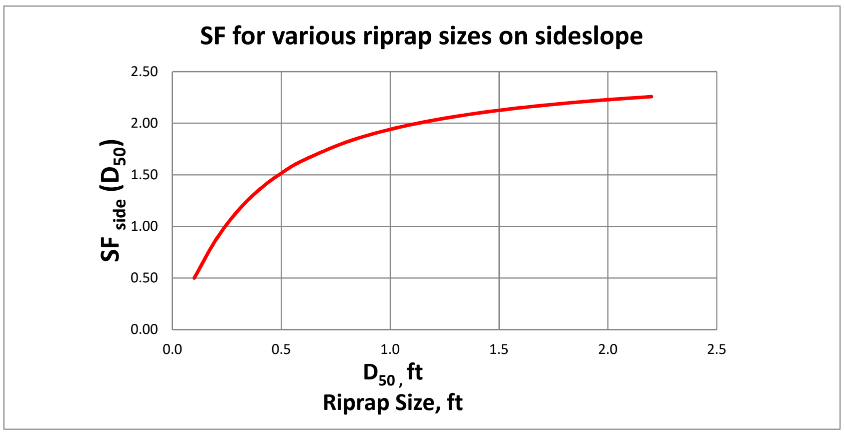
$\sin(\theta)$	0.010
$\cos(\theta)$	1.000
$\tan(\Phi)$	0.869

	$\sin(\lambda)$	0.010
	$\cos(\lambda)$	1.000
	$\sin(\alpha)$	0.316
	$\cos(\alpha)$	0.949
	$\tan(\Phi)$	0.869

Assume a normal depth, d:	2.900	ft
b/d:	8.966	
K:	0.750	
$\lambda = \theta$:	0.573	degrees
α: =atan(1/z)	0.322	radians
α	18.435	degrees

Assume riprap trial size

	(EQN)	(11)	(12)	(13)	(14)	(15)
	D_{50}	$\tau_{side}(D_{50})$	$\eta_{side}(D_{50})$	$\beta(D_{50})$	$\eta_{sp}(D_{50})$	$SF_{side}(D_{50})$
0	0.100	0.89	1.819	67.707	1.762	0.499
1	0.200	0.94	0.960	52.481	0.866	0.873
2	0.300	0.97	0.661	41.977	0.554	1.151
3	0.400	0.99	0.507	34.662	0.399	1.358
4	0.500	1.01	0.412	29.404	0.309	1.516
5	0.600	1.03	0.349	25.488	0.250	1.640
6	0.800	1.05	0.267	20.103	0.180	1.818
7	1.000	1.07	0.218	16.599	0.140	1.941
8	1.200	1.08	0.184	14.147	0.115	2.030
9	1.400	1.09	0.159	12.337	0.097	2.097
10	1.600	1.11	0.141	10.946	0.084	2.150
11	1.800	1.12	0.126	9.844	0.074	2.193
12	1.900	1.12	0.120	9.374	0.070	2.211
13	2.000	1.13	0.115	8.948	0.066	2.228
14	2.200	1.13	0.105	8.207	0.060	2.258



(1) Strickler relationship between riprap size and flow resistance: $n(D_{50}) := 0.0395 \cdot D_{50}^{\frac{1}{6}} \cdot \frac{sec}{ft^{\frac{1}{2}}}$

Manning's equation, assuming a trapezoidal or rectangular channel:

$$\frac{Q \cdot n}{1.486 \cdot \sqrt{S}} = A \cdot R^{\frac{2}{3}} \qquad Q = \frac{1.486}{n} \cdot \left(b \cdot d + z \cdot d^2\right) \cdot \left[\left(\frac{b \cdot d + z \cdot d^2}{b \cdot 2 \cdot d \cdot \sqrt{1 + z^2}}\right)^{\frac{2}{3}}\right] \cdot \sqrt{S}$$

Solve Manning's equation for d:

(2) $C(D_{50}) := \frac{Q \cdot n(D_{50})}{1.486 \cdot \sqrt{S}}$ Channel conveyance

$d := 5 \cdot ft$ Guess value for normal depth

(3) $d_n(D_{50}) := root\left[\frac{[(b + z \cdot d) \cdot d]^{\frac{5}{3}}}{\left(b + 2 \cdot d \cdot \sqrt{1 + z^2}\right)^{\frac{2}{3}}} - C(D_{50}), d\right]$ Normal Flow Depth

Iterate Depth until Calculated Flow matches Actual Flow

(4) $A(D_{50}) := (b + z \cdot d_n(D_{50})) \cdot d_n(D_{50})$ Flow Area

(5) $V(D_{50}) := \frac{Q}{A(D_{50})}$ Flow Velocity

(6) Determine hydraulic radius, R: $P(D_{50}) := b + 2 \cdot d_n(D_{50}) \cdot \sqrt{1 + z^2}$ Wetted Perin

(7) $R(D_{50}) := \frac{A(D_{50})}{P(D_{50})}$ Hydraulic radius, based on normal depth

Check for riprap stability, based on Shields initiation of motion criterion:

(8) $\tau(D_{50}) := \gamma_w \cdot d_n(D_{50}) \cdot S$ Average shear stress on bed

(9) $\eta_b(D_{50}) := \frac{21 \cdot \tau(D_{50})}{\gamma_w \cdot (G_s - 1) \cdot D_{50}}$ Riprap stability factor

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Determine Safety Factor for riprap on channel bank sideslopes:

K = 0.75 **Maximum shear stress coefficient on channel sides, K [From "*Sediment Transport: Theory and Practice*", Yang, p.44, Fig. 2.14 (Lane, 1953) or SCS Standard Dwg. No. 140, Sheet 6 of 8].**

(11) $\tau_{side}(D_{50}) := K \cdot \tau(D_{50})$ Shear stress on channel sideslope

(12) $\eta_{side}(D_{50}) := \dfrac{21 \cdot \tau_{side}(D_{50})}{\gamma_w \cdot (G_s - 1) \cdot D_{50}}$ Stability factor for channel sideslope

$\lambda := \theta$ ion for uniform flow

$\alpha := \operatorname{atan}\left(\dfrac{1}{z}\right)$ deslope angle

(13) $\beta(D_{50}) := \operatorname{atan}\left[\dfrac{\cos(\lambda)}{\left(\dfrac{2 \cdot \sin(\alpha)}{\eta_{side}(D_{50}) \cdot \tan(\phi)}\right) + \sin(\lambda)}\right]$

(14) $\eta_{sp}(D_{50}) := \eta_{side}(D_{50}) \cdot \left(\dfrac{1 + \sin(\lambda + \beta(D_{50}))}{2}\right)$ Stability factor for sideslopes

(15) $SF_{side}(D_{50}) := \dfrac{\cos(\alpha) \cdot \tan(\phi)}{\eta_{sp}(D_{50}) \cdot \tan(\phi) + \sin(\alpha) \cdot \cos(\beta(D_{50}))}$ Safety factor for riprap on sideslopes

Determine Safety Factor of Riprap Design using CSU Method (Safety Factor vs Riprap Size)
(Simons, D.B. and Senturk, F., "Sediment Transport Technology", Water Resources Publications, LLC, 1992)

Project: SH-75 Bridge over Trail Creek
Project No: 20033
Location: Ketchum , ID
Designer: Mike Schubert, PE
HDR Engineering, Inc.

Given:

Flow in Channel:	900	cfs
Channel Slope, S:	0.01	ft/ft
Bed slope angle, q:	0.572939	degrees
Unit Weight of Water (γ_w):	62.4	lb/ft^3
Channel Bottom, b:	26	ft
Channel Side Slopes, zH:1V	3	
Riprap Angle of repose:	37	degrees
Riprap Angle of repose:	0.646	radians
Specific Gravity of Riprap:	2.65	
α: =atan(1/z)	0.321751	radians
α:	18.435	degrees
Φ, material angle of repose, degrees	41.000	degrees

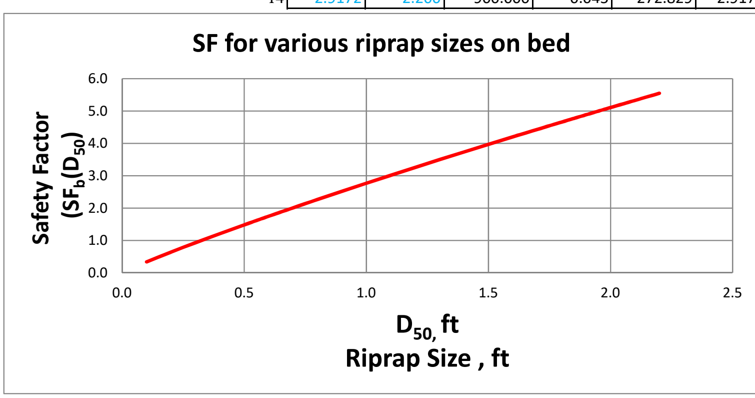
--------------------> θ: 0.0100 radians

--------------------> Φ : 0.7156 radians

Determine safety factor for riprap on channel bed:

Iterate depth until Calculated Q matches Actual Q

		(EQN)	Calculated	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
	Depth	D_{50}	Q	$n(D_{50})$	$C(D_{50})$	$d_n(D_{50})$	$A(D_{50})$	$V(D_{50})$	$P(D_{50})$	$R(D_{50})$	$\tau(D_{50})$	$\eta_b(D_{50})$	$SF_b(D_{50})$
0	2.3021	0.100	900.000	0.027	162.987	2.3021	75.753	11.881	26.000	2.914	1.437	2.930	0.340
1	2.4284	0.200	900.000	0.030	182.947	2.4284	80.832	11.134	26.000	3.109	1.515	1.545	0.642
2	2.5053	0.300	900.000	0.032	195.738	2.5053	83.969	10.718	26.000	3.230	1.563	1.063	0.931
3	2.5613	0.400	900.000	0.034	205.351	2.5613	86.273	10.432	26.000	3.318	1.598	0.815	1.210
4	2.6054	0.500	900.000	0.035	213.132	2.6054	88.106	10.215	26.000	3.389	1.626	0.663	1.482
5	2.6420	0.600	900.000	0.036	219.708	2.6420	89.634	10.041	26.000	3.447	1.649	0.560	1.748
6	2.7008	0.800	900.000	0.038	230.499	2.7008	92.104	9.772	26.000	3.542	1.685	0.430	2.267
7	2.7472	1.000	900.000	0.040	239.233	2.7472	94.069	9.567	26.000	3.618	1.714	0.350	2.769
8	2.7857	1.200	900.000	0.041	246.614	2.7857	95.707	9.404	26.000	3.681	1.738	0.295	3.258
9	2.8186	1.400	900.000	0.042	253.032	2.8186	97.116	9.267	26.000	3.735	1.759	0.256	3.735
10	2.8474	1.600	900.000	0.043	258.726	2.8474	98.355	9.151	26.000	3.783	1.777	0.226	4.201
11	2.8730	1.800	900.000	0.044	263.856	2.8730	99.461	9.049	26.000	3.825	1.793	0.203	4.659
12	2.8849	1.900	900.000	0.044	266.244	2.8849	99.973	9.002	26.000	3.845	1.800	0.193	4.884
13	2.8961	2.000	900.000	0.044	268.530	2.8961	100.462	8.959	26.000	3.864	1.807	0.184	5.107
14	2.9172	2.200	900.000	0.045	272.829	2.9172	101.376	8.878	26.000	3.899	1.820	0.169	5.547



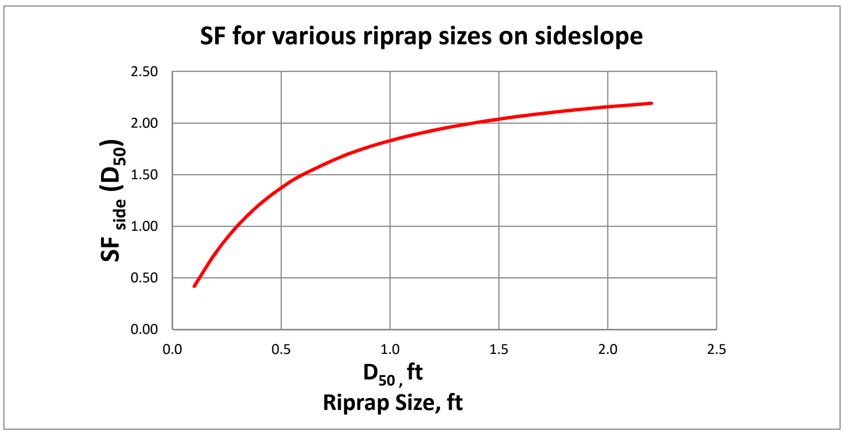
sin(θ)	0.010
cos(θ)	1.000
tan(Φ)	0.869

Assume a normal depth, d:	2.900	ft
b/d:	8.966	
K:	0.750	
$\lambda = \theta$:	0.573	degrees
α: =atan(1/z)	0.322	radians
α	18.435	degrees

$\sin(\lambda)$	0.010
$\cos(\lambda)$	1.000
$\sin(\alpha)$	0.316
$\cos(\alpha)$	0.949
$\tan(\Phi)$	0.869

Assume riprap trial size

	(EQN)	(11)	(12)	(13)	(14)	(15)
	D_{50}	$\tau_{side}(D_{50})$	$\eta_{side}(D_{50})$	$\beta(D_{50})$	$\eta_{sp}(D_{50})$	$SF_{side}(D_{50})$
0	0.100	1.08	2.197	71.165	2.151	0.418
1	0.200	1.14	1.159	57.472	1.074	0.747
2	0.300	1.17	0.797	47.301	0.695	1.007
3	0.400	1.20	0.611	39.796	0.504	1.211
4	0.500	1.22	0.497	34.176	0.390	1.373
5	0.600	1.24	0.420	29.872	0.316	1.502
6	0.800	1.26	0.322	23.795	0.227	1.695
7	1.000	1.29	0.262	19.754	0.176	1.830
8	1.200	1.30	0.222	16.890	0.143	1.930
9	1.400	1.32	0.192	14.758	0.121	2.007
10	1.600	1.33	0.170	13.112	0.104	2.068
11	1.800	1.34	0.152	11.803	0.092	2.117
12	1.900	1.35	0.145	11.244	0.087	2.139
13	2.000	1.36	0.138	10.737	0.082	2.158
14	2.200	1.37	0.127	9.852	0.074	2.193



(1) Strickler relationship between riprap size and flow resistance: $n(D_{50}) := 0.0395 \cdot D_{50}^{\frac{1}{6}} \cdot \frac{sec}{ft^{\frac{1}{2}}}$

Manning's equation, assuming a trapezoidal or rectangular channel:

$$\frac{Q \cdot n}{1.486 \cdot \sqrt{S}} = A \cdot R^{\frac{2}{3}} \qquad Q = \frac{1.486}{n} \cdot (b \cdot d + z \cdot d^2) \cdot \left[\left(\frac{b \cdot d + z \cdot d^2}{b \cdot 2 \cdot d \cdot \sqrt{1 + z^2}} \right)^{\frac{2}{3}} \right] \cdot \sqrt{S}$$

Solve Manning's equation for d:

(2) $C(D_{50}) := \frac{Q \cdot n(D_{50})}{1.486 \cdot \sqrt{S}}$ Channel conveyance

$d := 5 \cdot ft$ Guess value for normal depth

(3) $d_n(D_{50}) := \mathrm{root}\left[\frac{[(b + z \cdot d) \cdot d]^{\frac{5}{3}}}{\left(b + 2 \cdot d \cdot \sqrt{1 + z^2}\right)^{\frac{2}{3}}} - C(D_{50}), d \right]$ Normal Flow Depth

Iterate Depth until Calculated Flow matches Actual Flow

(4) $A(D_{50}) := (b + z \cdot d_n(D_{50})) \cdot d_n(D_{50})$ Flow Area

(5) $V(D_{50}) := \frac{Q}{A(D_{50})}$ Flow Velocity

(6) Determine hydraulic radius, R: $P(D_{50}) := b + 2 \cdot d_n(D_{50}) \cdot \sqrt{1 + z^2}$ Wetted Perin

(7) $R(D_{50}) := \frac{A(D_{50})}{P(D_{50})}$ Hydraulic radius, based on normal depth

Check for riprap stability, based on Shields initiation of motion criterion:

(8) $\tau(D_{50}) := \gamma_w \cdot d_n(D_{50}) \cdot S$ Average shear stress on bed

(9) $\eta_b(D_{50}) := \frac{21 \cdot \tau(D_{50})}{\gamma_w \cdot (G_s - 1) \cdot D_{50}}$ Riprap stability factor

(10) $SF_b(D_{50}) := \frac{\cos(\theta) \cdot \tan(\phi)}{\sin(\theta) + \eta_b(D_{50}) \cdot \tan(\phi)}$ Safety factor for selected riprap size on channed bed

Determine Safety Factor for riprap on channel bank sideslopes:

K = 0.75 **Maximum shear stress coefficient on channel sides, K [From "*Sediment Transport: Theory and Practice*", Yang, p.44, Fig. 2.14 (Lane, 1953) or SCS Standard Dwg. No. 140, Sheet 6 of 8].**

(11) $\tau_{side}(D_{50}) := K \cdot \tau(D_{50})$ Shear stress on channel sideslope

(12) $\eta_{side}(D_{50}) := \dfrac{21 \cdot \tau_{side}(D_{50})}{\gamma_w \cdot (G_s - 1) \cdot D_{50}}$ Stability factor for channel sideslope

$\lambda := \theta$ ion for uniform flow

$\alpha := \operatorname{atan}\left(\dfrac{1}{z}\right)$ deslope angle

(13) $\beta(D_{50}) := \operatorname{atan}\left[\dfrac{\cos(\lambda)}{\left(\dfrac{2 \cdot \sin(\alpha)}{\eta_{side}(D_{50}) \cdot \tan(\phi)}\right) + \sin(\lambda)}\right]$

(14) $\eta_{sp}(D_{50}) := \eta_{side}(D_{50}) \cdot \left(\dfrac{1 + \sin(\lambda + \beta(D_{50}))}{2}\right)$ Stability factor for sideslopes

(15) $SF_{side}(D_{50}) := \dfrac{\cos(\alpha) \cdot \tan(\phi)}{\eta_{sp}(D_{50}) \cdot \tan(\phi) + \sin(\alpha) \cdot \cos(\beta(D_{50}))}$ Safety factor for riprap on sideslopes

Determine Safety Factor of Riprap Design using CSU Method (Safety Factor vs Riprap Size)
(Simons, D.B. and Senturk, F., "Sediment Transport Technology", Water Resources Publications, LLC, 1992)

Project: SH-75 Bridge over Trail Creek
Project No: 20033
Location: Ketchum , ID
Designer: Mike Schubert, PE
HDR Engineering, Inc.

Given:

Flow in Channel:	1020	cfs
Channel Slope, S:	0.01	ft/ft
Bed slope angle, q:	0.572939	degrees
Unit Weight of Water (γ_w):	62.4	lb/ft^3
Channel Bottom, b:	26	ft
Channel Side Slopes, zH:1V	3	
Riprap Angle of repose:	37	degrees
Riprap Angle of repose:	0.646	radians
Specific Gravity of Riprap:	2.65	
α: =atan(1/z)	0.321751	radians
α:	18.435	degrees
Φ, material angle of repose, degrees	41.000	degrees

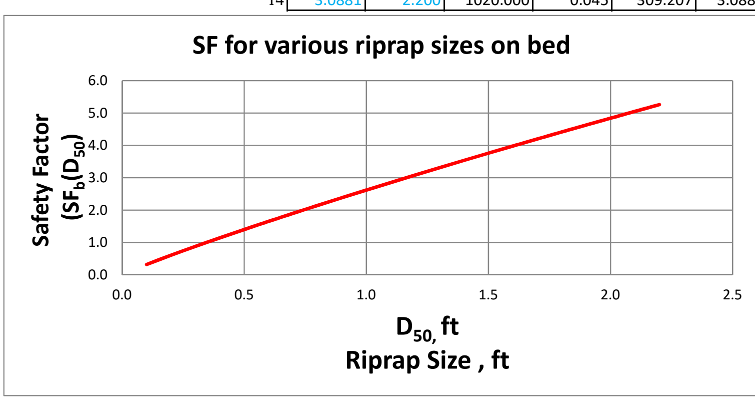
--------------------> θ: 0.0100 radians

--------------------> Φ : 0.7156 radians

Determine safety factor for riprap on channel bed:

Iterate depth until Calculated Q matches Actual Q

		(EQN)	Calculated	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
	Depth	D_{50}	Q	$n(D_{50})$	$C(D_{50})$	$d_n(D_{50})$	$A(D_{50})$	$V(D_{50})$	$P(D_{50})$	$R(D_{50})$	$\tau(D_{50})$	$\eta_b(D_{50})$	$SF_b(D_{50})$
0	2.4393	0.100	1020.000	0.027	184.719	2.4393	81.271	12.551	26.000	3.126	1.522	3.105	0.321
1	2.5726	0.200	1020.000	0.030	207.340	2.5726	86.744	11.759	26.000	3.336	1.605	1.637	0.607
2	2.6538	0.300	1020.000	0.032	221.836	2.6538	90.125	11.318	26.000	3.466	1.656	1.126	0.879
3	2.7128	0.400	1020.000	0.034	232.731	2.7128	92.609	11.014	26.000	3.562	1.693	0.863	1.143
4	2.7594	0.500	1020.000	0.035	241.550	2.7594	94.585	10.784	26.000	3.638	1.722	0.702	1.401
5	2.7980	0.600	1020.000	0.036	249.002	2.7980	96.233	10.599	26.000	3.701	1.746	0.594	1.653
6	2.8599	0.800	1020.000	0.038	261.232	2.8599	98.896	10.314	26.000	3.804	1.785	0.455	2.144
7	2.9089	1.000	1020.000	0.040	271.131	2.9089	101.016	10.097	26.000	3.885	1.815	0.370	2.620
8	2.9494	1.200	1020.000	0.041	279.496	2.9494	102.783	9.924	26.000	3.953	1.840	0.313	3.083
9	2.9841	1.400	1020.000	0.042	286.770	2.9841	104.303	9.779	26.000	4.012	1.862	0.271	3.536
10	3.0145	1.600	1020.000	0.043	293.223	3.0145	105.638	9.656	26.000	4.063	1.881	0.240	3.979
11	3.0415	1.800	1020.000	0.044	299.036	3.0415	106.832	9.548	26.000	4.109	1.898	0.215	4.414
12	3.0540	1.900	1020.000	0.044	301.743	3.0540	107.384	9.499	26.000	4.130	1.906	0.205	4.628
13	3.0659	2.000	1020.000	0.044	304.334	3.0659	107.911	9.452	26.000	4.150	1.913	0.195	4.840
14	3.0881	2.200	1020.000	0.045	309.207	3.0881	108.898	9.367	26.000	4.188	1.927	0.179	5.259



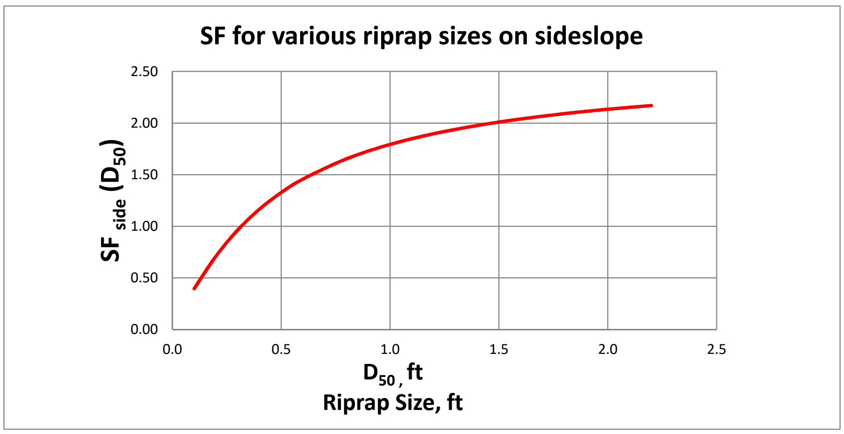
sin(θ)	0.010
cos(θ)	1.000
tan(Φ)	0.869

Assume a normal depth, d:	2.900	ft
b/d:	8.966	
K:	0.750	
$\lambda = \theta$:	0.573	degrees
α: =atan(1/z)	0.322	radians
α	18.435	degrees

$\sin(\lambda)$	0.010
$\cos(\lambda)$	1.000
$\sin(\alpha)$	0.316
$\cos(\alpha)$	0.949
$\tan(\Phi)$	0.869

Assume riprap trial size

	(EQN)	(11)	(12)	(13)	(14)	(15)
	D_{50}	$\tau_{side}(D_{50})$	$\eta_{side}(D_{50})$	$\beta(D_{50})$	$\eta_{sp}(D_{50})$	$SF_{side}(D_{50})$
0	0.100	1.14	2.328	72.126	2.286	0.396
1	0.200	1.20	1.228	58.928	1.146	0.711
2	0.300	1.24	0.844	48.922	0.744	0.965
3	0.400	1.27	0.647	41.409	0.541	1.166
4	0.500	1.29	0.527	35.709	0.419	1.328
5	0.600	1.31	0.445	31.302	0.340	1.458
6	0.800	1.34	0.341	25.024	0.244	1.655
7	1.000	1.36	0.278	20.815	0.189	1.794
8	1.200	1.38	0.235	17.818	0.154	1.897
9	1.400	1.40	0.203	15.582	0.129	1.977
10	1.600	1.41	0.180	13.851	0.112	2.041
11	1.800	1.42	0.161	12.472	0.098	2.092
12	1.900	1.43	0.153	11.883	0.093	2.114
13	2.000	1.43	0.146	11.349	0.088	2.135
14	2.200	1.45	0.134	10.415	0.079	2.171



(1) Strickler relationship between riprap size and flow resistance:

$$n(D_{50}) := 0.0395 \cdot D_{50}^{\frac{1}{6}} \cdot \frac{\text{sec}}{\text{ft}^{\frac{1}{2}}}$$

Manning's equation, assuming a trapezoidal or rectangular channel:

$$\frac{Q \cdot n}{1.486 \cdot \sqrt{S}} = A \cdot R^{\frac{2}{3}} \qquad Q = \frac{1.486}{n} \cdot \left(b \cdot d + z \cdot d^2\right) \cdot \left[\left(\frac{b \cdot d + z \cdot d^2}{b \cdot 2 \cdot d \cdot \sqrt{1 + z^2}}\right)^{\frac{2}{3}}\right] \cdot \sqrt{S}$$

Solve Manning's equation for d:

(2) $$C(D_{50}) := \frac{Q \cdot n(D_{50})}{1.486 \cdot \sqrt{S}}$$ Channel conveyance

$d := 5 \cdot \text{ft}$ Guess value for normal depth

(3) $$d_n(D_{50}) := \text{root}\left[\frac{[(b + z \cdot d) \cdot d]^{\frac{5}{3}}}{\left(b + 2 \cdot d \cdot \sqrt{1 + z^2}\right)^{\frac{2}{3}}} - C(D_{50}), d\right]$$ Normal Flow Depth

Iterate Depth until Calculated Flow matches Actual Flow

(4) $$A(D_{50}) := \left(b + z \cdot d_n(D_{50})\right) \cdot d_n(D_{50})$$ Flow Area

(5) $$V(D_{50}) := \frac{Q}{A(D_{50})}$$ Flow Velocity

(6) Determine hydraulic radius, R: $P(D_{50}) := b + 2 \cdot d_n(D_{50}) \cdot \sqrt{1 + z^2}$ Wetted Perin

(7) $$R(D_{50}) := \frac{A(D_{50})}{P(D_{50})}$$ Hydraulic radius, based on normal depth

Check for riprap stability, based on Shields initiation of motion criterion:

(8) $$\tau(D_{50}) := \gamma_w \cdot d_n(D_{50}) \cdot S$$ Average shear stress on bed

(9) $$\eta_b(D_{50}) := \frac{21 \cdot \tau(D_{50})}{\gamma_w \cdot (G_s - 1) \cdot D_{50}}$$ Riprap stability factor

(10) $$SF_b(D_{50}) := \frac{\cos(\theta) \cdot \tan(\phi)}{\sin(\theta) + \eta_b(D_{50}) \cdot \tan(\phi)}$$ Safety factor for selected riprap size on channed bed

Determine Safety Factor for riprap on channel bank sideslopes:

K = 0.75 **Maximum shear stress coefficient on channel sides, K [From "*Sediment Transport: Theory and Practice*", Yang, p.44, Fig. 2.14 (Lane, 1953) or SCS Standard Dwg. No. 140, Sheet 6 of 8].**

(11) $$\tau_{side}(D_{50}) := K \cdot \tau(D_{50})$$ Shear stress on channel sideslope

(12) $$\eta_{side}(D_{50}) := \frac{21 \cdot \tau_{side}(D_{50})}{\gamma_w \cdot (G_s - 1) \cdot D_{50}}$$ Stability factor for channel sideslope

$$\lambda := \theta$$ ion for uniform flow

$$\alpha := \operatorname{atan}\left(\frac{1}{z}\right)$$ deslope angle

(13) $$\beta(D_{50}) := \operatorname{atan}\left[\frac{\cos(\lambda)}{\left(\frac{2 \cdot \sin(\alpha)}{\eta_{side}(D_{50}) \cdot \tan(\phi)}\right) + \sin(\lambda)}\right]$$

(14) $$\eta_{sp}(D_{50}) := \eta_{side}(D_{50}) \cdot \left(\frac{1 + \sin(\lambda + \beta(D_{50}))}{2}\right)$$ Stability factor for sideslopes

(15) $$SF_{side}(D_{50}) := \frac{\cos(\alpha) \cdot \tan(\phi)}{\eta_{sp}(D_{50}) \cdot \tan(\phi) + \sin(\alpha) \cdot \cos(\beta(D_{50}))}$$ Safety factor for riprap on sideslopes

Determine Safety Factor of Riprap Design using CSU Method (Safety Factor vs Riprap Size)
(Simons, D.B. and Senturk, F., "Sediment Transport Technology", Water Resources Publications, LLC, 1992)

Project: Si
Project No: 20033
Location: Ketchum , ID
Designer: Mike Schubert, PE
HDR Engineering, Inc.

Given:

Flow in Channel:	1300	cfs
Channel Slope, S:	0.01	ft/ft
Bed slope angle, q:	0.572939	degrees
Unit Weight of Water (γ_w):	62.4	lb/ft^3
Channel Bottom, b:	26	ft
Channel Side Slopes, zH:1V	3	
Riprap Angle of repose:	37	degrees
Riprap Angle of repose:	0.646	radians
Specific Gravity of Riprap:	2.65	
α: =atan(1/z)	0.321751	radians
α:	18.435	degrees
Φ, material angle of repose, degrees	41.000	degrees

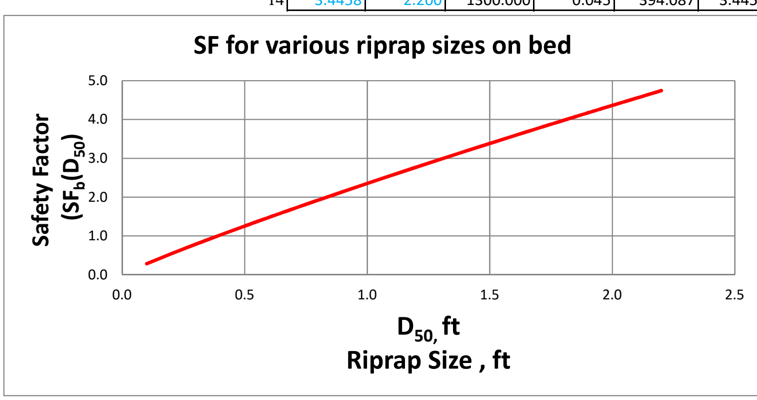
--------------------> θ: 0.0100 radians

---------------------> Φ : 0.7156 radians

Determine safety factor for riprap on channel bed:

Iterate depth until Calculated Q matches Actual Q

		(EQN)	Calculated	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
	Depth	D_{50}	Q	$n(D_{50})$	$C(D_{50})$	$d_n (D_{50})$	$A(D_{50})$	$V(D_{50})$	$P(D_{50})$	$R(D_{50})$	$\tau(D_{50})$	$\eta_b(D_{50})$	$SF_b(D_{50})$
0	2.7271	0.100	1300.000	0.027	235.426	2.7271	93.216	13.946	26.000	3.585	1.702	3.471	0.287
1	2.8750	0.200	1300.000	0.030	264.257	2.8750	99.547	13.059	26.000	3.829	1.794	1.830	0.543
2	2.9649	0.300	1299.999	0.032	282.732	2.9649	103.461	12.565	26.000	3.979	1.850	1.258	0.788
3	3.0303	0.400	1300.000	0.034	296.619	3.0303	106.337	12.225	26.000	4.090	1.891	0.964	1.025
4	3.0819	0.500	1300.000	0.035	307.858	3.0819	108.625	11.968	26.000	4.178	1.923	0.784	1.256
5	3.1247	0.600	1300.000	0.036	317.356	3.1247	110.534	11.761	26.000	4.251	1.950	0.663	1.483
6	3.1933	0.800	1300.000	0.038	332.943	3.1933	113.619	11.442	26.000	4.370	1.993	0.508	1.925
7	3.2475	1.000	1300.000	0.040	345.559	3.2475	116.075	11.200	26.000	4.464	2.026	0.413	2.354
8	3.2924	1.200	1300.000	0.041	356.220	3.2924	118.123	11.005	26.000	4.543	2.054	0.349	2.772
9	3.3308	1.400	1300.000	0.042	365.491	3.3308	119.884	10.844	26.000	4.611	2.078	0.303	3.181
10	3.3644	1.600	1300.000	0.043	373.716	3.3644	121.433	10.705	26.000	4.670	2.099	0.268	3.582
11	3.3943	1.800	1300.000	0.044	381.125	3.3943	122.816	10.585	26.000	4.724	2.118	0.240	3.976
12	3.4081	1.900	1300.000	0.044	384.575	3.4081	123.457	10.530	26.000	4.748	2.127	0.228	4.170
13	3.4213	2.000	1300.000	0.044	387.876	3.4213	124.068	10.478	26.000	4.772	2.135	0.218	4.362
14	3.4458	2.200	1300.000	0.045	394.087	3.4458	125.212	10.382	26.000	4.816	2.150	0.199	4.743



sin(θ)	0.010
cos(θ)	1.000
tan(Φ)	0.869

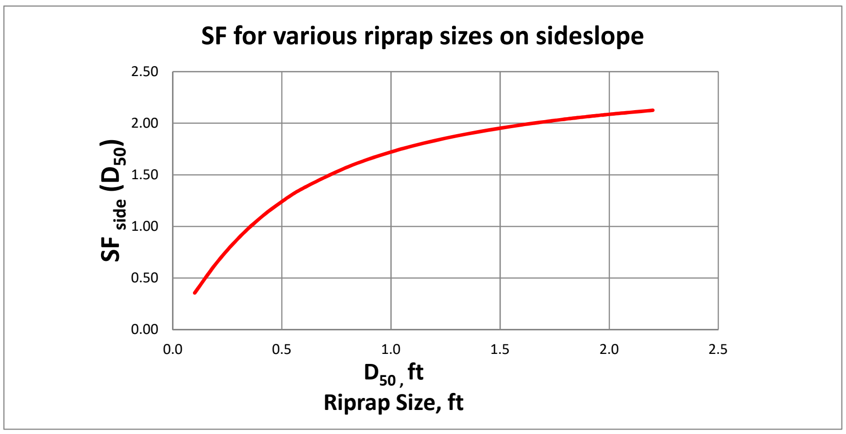
Safety Factor vs. Riprap Size
(Simons, D.B. Senturk, F.)

Assume a normal depth, d:	2.900	ft
b/d:	8.966	
K:	0.750	
$\lambda = \theta$:	0.573	degrees
α: =atan(1/z)	0.322	radians
α	18.435	degrees

$\sin(\lambda)$	0.010
$\cos(\lambda)$	1.000
$\sin(\alpha)$	0.316
$\cos(\alpha)$	0.949
$\tan(\Phi)$	0.869

Assume riprap trial size

	(EQN)	(11)	(12)	(13)	(14)	(15)
	D_{50}	$\tau_{side}(D_{50})$	$\eta_{side}(D_{50})$	$\beta(D_{50})$	$\eta_{sp}(D_{50})$	$SF_{side}(D_{50})$
0	0.100	1.28	2.603	73.854	2.567	0.356
1	0.200	1.35	1.372	61.620	1.297	0.645
2	0.300	1.39	0.943	52.001	0.848	0.885
3	0.400	1.42	0.723	44.541	0.618	1.081
4	0.500	1.44	0.588	38.735	0.481	1.241
5	0.600	1.46	0.497	34.161	0.390	1.373
6	0.800	1.49	0.381	27.517	0.280	1.575
7	1.000	1.52	0.310	22.989	0.216	1.721
8	1.200	1.54	0.262	19.731	0.176	1.831
9	1.400	1.56	0.227	17.284	0.148	1.916
10	1.600	1.57	0.201	15.382	0.127	1.984
11	1.800	1.59	0.180	13.863	0.112	2.040
12	1.900	1.60	0.171	13.212	0.105	2.064
13	2.000	1.60	0.163	12.621	0.100	2.086
14	2.200	1.61	0.150	11.589	0.090	2.126



(1) Strickler relationship between riprap size and flow resistance:

$$n(D_{50}) := 0.0395 \cdot D_{50}^{\frac{1}{6}} \cdot \frac{\text{sec}}{\text{ft}^{\frac{1}{2}}}$$

Manning's equation, assuming a trapezoidal or rectangular channel:

$$\frac{Q \cdot n}{1.486 \cdot \sqrt{S}} = A \cdot R^{\frac{2}{3}} \qquad Q = \frac{1.486}{n} \cdot \left(b \cdot d + z \cdot d^2\right) \cdot \left[\left(\frac{b \cdot d + z \cdot d^2}{b \cdot 2 \cdot d \cdot \sqrt{1 + z^2}}\right)^{\frac{2}{3}}\right] \cdot \sqrt{S}$$

Solve Manning's equation for d:

(2) $C(D_{50}) := \dfrac{Q \cdot n(D_{50})}{1.486 \cdot \sqrt{S}}$ Channel conveyance

$d := 5 \cdot \text{ft}$ Guess value for normal depth

(3) $d_n(D_{50}) := \text{root}\left[\dfrac{[(b + z \cdot d) \cdot d]^{\frac{5}{3}}}{\left(b + 2 \cdot d \cdot \sqrt{1 + z^2}\right)^{\frac{2}{3}}} - C(D_{50}), d\right]$ Normal Flow Depth

Iterate Depth until Calculated Flow matches Actual Flow

(4) $A(D_{50}) := \left(b + z \cdot d_n(D_{50})\right) \cdot d_n(D_{50})$ Flow Area

(5) $V(D_{50}) := \dfrac{Q}{A(D_{50})}$ Flow Velocity

(6) Determine hydraulic radius, R: $P(D_{50}) := b + 2 \cdot d_n(D_{50}) \cdot \sqrt{1 + z^2}$ Wetted Perin

(7) $R(D_{50}) := \dfrac{A(D_{50})}{P(D_{50})}$ Hydraulic radius, based on normal depth

Check for riprap stability, based on Shields initiation of motion criterion:

(8) $\tau(D_{50}) := \gamma_w \cdot d_n(D_{50}) \cdot S$ Average shear stress on bed

(9) $\eta_b(D_{50}) := \dfrac{21 \cdot \tau(D_{50})}{\gamma_w \cdot (G_s - 1) \cdot D_{50}}$ Riprap stability factor

(10) $SF_b(D_{50}) := \dfrac{\cos(\theta) \cdot \tan(\phi)}{\sin(\theta) + \eta_b(D_{50}) \cdot \tan(\phi)}$ Safety factor for selected riprap size on channed bed

Determine Safety Factor for riprap on channel bank sideslopes:

K = 0.75 **Maximum shear stress coefficient on channel sides, K [From "*Sediment Transport: Theory and Practice*", Yang, p.44, Fig. 2.14 (Lane, 1953) or SCS Standard Dwg. No. 140, Sheet 6 of 8].**

(11) $\tau_{side}(D_{50}) := K \cdot \tau(D_{50})$ Shear stress on channel sideslope

(12) $\eta_{side}(D_{50}) := \dfrac{21 \cdot \tau_{side}(D_{50})}{\gamma_w \cdot (G_s - 1) \cdot D_{50}}$ Stability factor for channel sideslope

$\lambda := \theta$ ion for uniform flow

$\alpha := \operatorname{atan}\left(\dfrac{1}{z}\right)$ deslope angle

(13) $\beta(D_{50}) := \operatorname{atan}\left[\dfrac{\cos(\lambda)}{\left(\dfrac{2 \cdot \sin(\alpha)}{\eta_{side}(D_{50}) \cdot \tan(\phi)}\right) + \sin(\lambda)}\right]$

(14) $\eta_{sp}(D_{50}) := \eta_{side}(D_{50}) \cdot \left(\dfrac{1 + \sin(\lambda + \beta(D_{50}))}{2}\right)$ Stability factor for sideslopes

(15) $SF_{side}(D_{50}) := \dfrac{\cos(\alpha) \cdot \tan(\phi)}{\eta_{sp}(D_{50}) \cdot \tan(\phi) + \sin(\alpha) \cdot \cos(\beta(D_{50}))}$ Safety factor for riprap on sideslopes

Appendix G ITD 210 Form

Hydraulics Structures Survey

ITD 0210 (Rev. 05-17)
itd.idaho.gov

A hydraulic report should accompany this form for natural streams with Q_{50} of 500cfs or more and canals.

Key Number	Project Number	Station	Date
20033	A020(033)	Sta. 1474+63.10, MP 128.109	7/24/20

Project Title	Local Name
SH-75, Elkhorn Rd to River St., Ketchum	SH-75 Trail Creek Bridge

Location	County
Ketchum, ID	Blaine

Roadway Identification
SH-75, Segment Code 002230

Crossing	A Tributary Of
☒ Creek ☐ River ☐ Canal	Big Wood River

Hydrologic Data

Hydrology Methods Used to Determine Design Flows
☐ USGS Website ☒ Flood Insurance Study ☐ USGS Regression Equations
☐ Other (Describe)

Description of Watershed
The Trail Creek floodplain is extensively developed, with dwellings lining the stream from one end of the city to the other.

Drainage Basin Area ☒ mi^2 ☐ acres	Community Name
69	Blaine County, Idaho and Incorporated Area

Flood Insurance Rate Map (FIRM) Panel Number*	Regulatory Floodway	If Yes, Floodway Map Panel Number*
16013C0461E	☒ Yes ☐ No	16013C0461E

*Attach 8 1/2" x 11" copy of map panel at the structure location.

Stream Data

☒ Natural Stream ☐ Canal	Months Dry, If Any	Streambed Elevation of Structure	Streambed Slope
		5795.0	0.015 ft

Stream Carries an Appreciable Amount of Ice	Ice Thickness	Stream Carries an Appreciable Amount of Driftwood
☐ Yes ☒ No	in	☐ Yes ☒ No

Character of Streambed	Describe Streambed
☒ Stable ☐ Agrading ☐ Degrading ☐ Headcutting	Gravel with cobbles

Flow Controlled	If Controlled, Explain
☒ Upstream ☐ Downstream	Sun Valley Lake

Existing Structure

☒ Bridge ☐ Culvert (Describe the Bridge or Culvert)

reinforced concrete stiffleg

General Condition	Year Constructed
Satisfactory	1980

Describe Any Existing Adverse Conditions

Type of Bridge Piers	Number of Piers	Bridge or Culvert Type	Structure Dimensions, Diameter, Etc.
☐ Spread Footings ☒ Piles	0	Bridge	Span 20 x Rise 9.3 x Length 48.5

Total Bridge Opening Area Normal to Channel	Bridge Clearance Above Q_{50} High Water	Velocity Through Structure
152 ft^2	2.17 ft	11.30 @ Inside BR DS fps

Existing Culvert Carried Flow Adequately	If No, Explain
☒ Yes ☐ No	

Distribution: Consultant – Signed Original to District/LHTAC Project Manager
District/LHTAC – Signed Original to Project File

No additional copies required

Hydraulics Structures Survey

Design Flow Data

Flood	Discharge	Water Surface Elevation	Velocity
Design [Q_{50}]*	900 cfs	5801.63 @XS2147 ft	5.62 @XS2147 fps
Base [Q_{100}]	1,020 cfs	5801.95 @XS2147 ft	5.88 @XS2147 fps
Scour [Q_{500}]	1,300 cfs	5802.62 @XS2147 ft	6.40 @XS2147 fps
Canal Flow	cfs	ft	fps

*Use Q_{50} for bridges and culverts 12 ft or more in width/diameter and for open bottom culverts. Use Q_{25} for all other culverts.

Proposed Bridge

Type prestressed concrete voided slab bridge	Ordinary High Water Elevation 5799.55 ft	Number and Length of Spans 1 @ 57.5 ft
Skew Angle 0 °	Calculated Riprap Size, D_{50} 1.5 ft	Bottom of Girder Elevation 5804.91 ft
Flow Angle to Pier °	Calculated Contraction Scour Depth 0.36 ft	Q_{50} Water Surface Elevation 5801.63 ft
Streambed Material Size, D_{50} 38 mm	Calculated Pier Scour Depth ft	Q_{50} Freeboard 3.28 ft

Proposed Culvert

Type	Dimensions	Inlet Type
Culvert Flowing Under ☐ Inlet Control ☐ Outlet Control	Invert Inlet Elevation ft	Outlet Elevation ft
Outlet Protection Required ☐ No ☐ Yes	Tailwater Elevation ft	Bottom of Gravel Course Elevation ft
Channel Change ☐ No ☐ Yes	Tailwater Depth ft	Calculated Headwater Elevation (HW) ft
Energy Dissipater (If Yes, Describe) ☐ No ☐ Yes	Culvert Slope ft	Bottom of Gravel Course Freeboard ft
Riprap Required (If Yes, D_{50}) ☐ No ☐ Yes ft	Finished Grade Elevation Centerline Roadway	HW/D Ratio
Proposed Culvert Will Carry the Base Flood (Q_{100}) Without Overtopping the Roadway ☐ No ☐ Yes		

In addition to the above information, submit and check each of the following that apply.

- ☒ A typical proposed roadway section at the structure.
- ☒ A 11" x 17" contour map of the structure site showing 1 foot contours.
- ☒ A centerline profile to the same scale as the contour map.
- ☒ A vicinity map, such as a county map, with the location of the structure clearly indicated.
- ☒ A streambed profile 500 to 1,000 feet above and below the structure.
- ☒ Riprap details (typical section, limits, size, toe embedment, etc.) for proposed locations.
- ☒ Photographs of the existing structure and channel upstream and downstream from the site.
- ☐ Channel change or canal lining details (typical section, plan and profile, and limits).
- ☒ Computations for scour based on Q_{500} or canal flow. (Attach HEC-RAS contraction scour and if applicable, pier scour report.)
- ☒ Hydraulic report. (See Design Manual for format.)
- ☐ Letter of approval from canal company or irrigation district.
- ☒ Floodplain Development Permit from the city/county if the structure is located in the 100-year floodplain.

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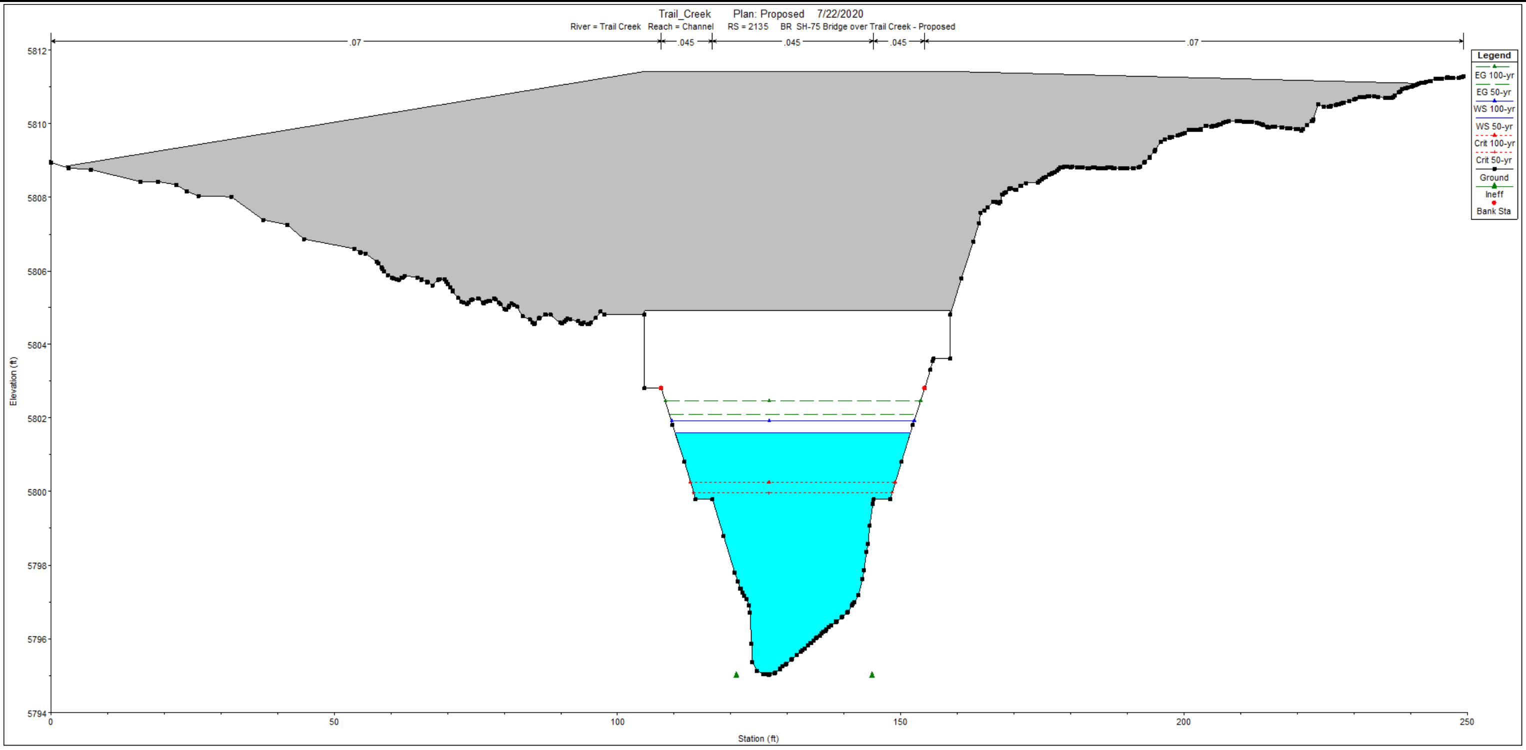
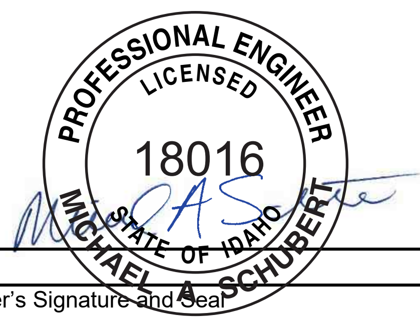
District/LHTAC – Signed Original to Project File

No additional copies required

Hydraulics Structures Survey

ITD 0210 (Rev. 05-17)
itd.idaho.gov





Prepared By	Title	Engineer's Signature and Seal
Michael Schubert, PE	Water Resources Engineer	04/21/2021

Accepted by LHTAC Administrator, Bridge Engineer, or District Engineer	Signature/Date

Distribution: Consultant – Signed Original to District/LHTAC Project Manager
District/LHTAC – Signed Original to Project File

No additional copies required

Appendix H ITD Pontis Field Inspection Report

Idaho Transportation Department
Bridge Inspection Report

Bridge Key:	17675	Structure Name:	S07500A 128.12
(6)Features Intersected:	TRAIL CREEK	(9)Location:	KETCHUM SCL
Xref Structure Name:		Admin Jurisdiction:	0004 District 4
		District:	04

Elm/Env	Element Description	Total Qty	Units	State 1	State 2	State 3	State 4
38/3	**Reinforced Concrete Slab**	1055	sq.ft	1045	10	0	0
	Asphalt roadway on a granular base in satisfactory condition. A few patches in the underside, right construction joint.						
1080/3	***Delamination/Spall/Patched Area***	10	*sq.ft*	0	10	0	0
	A few patches in the underside, right construction joint.						
215/3	**Reinforced Concrete Abutment**	152	ft	137	15	0	0
	Walls on the old center section have hairline random cracks. Wingwalls in good condition. Both abut walls have efflorescence staining at the construction joints.						
1120/3	***Efflorescence/Rust Staining***	15	*ft*	0	15	0	0
	Efflorescence staining in the construction joints and a couple hairline cracks.						
330/3	**Metal Bridge Railing**	20	ft	20	0	0	0
	Galvanized pedestrian fence along the left exterior, set on the concrete curb. Satisfactory condition.						
515/3	***Steel Protective Coating***	70	*sq.ft*	70	0	0	0
	Galvanizing is in satisfactory condition.						

Idaho Transportation Department
Bridge Inspection Report

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(6)Features Intersected:	TRAIL CREEK	(9)Location:	KETCHUM SCL
Xref Structure Name:		Admin Jurisdiction:	0004 District 4
		District:	04

Additional Information

ROADWAY APPROACHES: Asphalt roadway has several asphalt overlays with a chipseal in good condition.

SIDEWALKS/CURBS: Both concrete curbs have random hairline cracks, delamination and minor spalling. Asphalt sidewalk on the west side of the structure in satisfactory condition. Chain link fence on top of the curb, left side.

EMBANKMENT: Earth fill in good condition. Minor erosion under outside porta-rail, abutment 2 left side.

CHANNEL: Rock channel is in good condition. Inlet and outlet has rock rip-rap protection.

GUARDRAIL: Concrete porta-rail in fair condition on Lt. side with some moderate scaling on several of the sections. Not attached to the structure. Unpainted w-beam along right side. No post set in fill over structure.

SIGNS:

UTILITIES: Overhead utilities on the right side. Buried utilities along both shoulders.

NOTES: None.

INSPECTION FREQUENCY:

SCOUR:

WORK ACCOMPLISHED: Routine roadway maintenance.

Maintenance Recommendations

Recommendation	Priority	Suggested Work Assignment
Repair undermined porta rail.	Low	State Forces

Inspector's Signature: Jim Holland Digitally signed by Jim Holland DN: cn=Jim Holland, o=ITD, ou=Bridge Asset Management, email=jim.holland@itd.idaho.gov, c=US Date: 2016.07.27 08:30:47 -06'00' 07/11/2016

Inspector Number and Name: 950 - Jim Holland, ITD Bridge Inspector

Idaho Transportation Department
Bridge Inspection Report

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(6)Features Intersected:	TRAIL CREEK	(9)Location:	KETCHUM SCL
Xref Structure Name:		Admin Jurisdiction:	0004 District 4
		District:	04

Sufficiency Rating: 94.0

Deficiency:

IDENTIFICATION

(1)State:	16 Idaho
(2)District:	District 4
(3)County:	013 Blaine
(4)Place Code:	Ketchum
(5)Inventory Route:	131000750
(7)Facility Carried:	SH 75
(11)Milepoint:	128.109
(12)Base Hwy Network:	On Base Network
(13a)LRS Inventory Route:	
(13b)LRS Sub Route:	
(16)Latitude:	43° 40' 40"
(17)Longitude:	114° 21' 41"
(98)Border Bridge Code:	
(99)Border Bridge ID:	
Segment Code:	002230
Segment Under Rte:	
Segment Other Rte:	
Drawing Number:	847
Project Key Number:	276
Inspection Area:	4

STRUCTURE TYPE AND MATERIALS

(43a/b)Main Span Material/Design:
1 Concrete 7 Frame

(44a/b)Approach Span Material/Design:

(45)No. of Spans Main Unit:	1
(46)No. of Approach Spans:	0
(107)Deck Type:	1 Concrete-Cast-in-Place
(108a)Wearing Surface:	6 Bituminous
(108b)Membrane:	0 None
(108c)Deck Protection:	None

Deck Applications

CLASSIFICATION

(112)NBIS Length:	Too Short
(104)Highway System:	0 Not on NHS
(26):Functional Class:	06 Rural Minor Arterial
(100)Defense Highway:	0 Not a STRAHNET hwy
(101)Parallel Structure:	No || bridge exists
(102)Direction of Traffic:	2 2-way traffic
(103)Temporary Structure:	
(105)Federal Lands Highway:	0 N/A (NBI)
(110)Design Natl Network:	1 Part of natl network
(20)Toll Facility:	3 On free road
(21)Custodian:	State Highway Agency
(22)Owner:	State Highway Agency
(37)Historical Significance:	3 Possibly eligible for

GEOMETRIC DATA

(48)Maximum Span Length:	20.0 ft
(49)Structure Length:	20 ft
Total Length:	20 ft
(50a)Curb/Sidewalk Width Lt:	8.0 ft
(50b)Curb/Sidewalk Width Rt:	1.3 ft
(51)Width Curb to Curb:	32.8 ft
(52)Width Out to Out:	48.1 ft
(32)App Roadway Width:	30 ft
(33)Median:	0 No median
(34)Skew:	0°
(35)Structure Flared:	0 No flare
(10)Vertical Clearance:	99.99 ft
(47)Total Horiz Clearance:	32.8 ft
(53)Min Vert Clr Over Deck:	99.99 ft
(54a)Min Vert Underclr Ref:	N Feature not hwy or RR
(54b)Min Vert Underclr:	0.0 ft
(55a)Min Lat Underclr Ref Rt:	N Feature not hwy or RR
(55b)Min Lat Underclr Rt:	0.0 ft
(56)Min Lat Underclr Lt:	0.0 ft

Environmental

Environmental Concerns: No

Idaho Transportation Department
Bridge Inspection Report

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(6)Features Intersected:	TRAIL CREEK	(9)Location:	KETCHUM SCL
Xref Structure Name:		Admin Jurisdiction:	0004 District 4
		District:	04

LOAD RATING

(31)Design Load:	2 M 13.5 (H 15)
(64)Operating Rating:	61 tons / HS33.9
(66)Inventory Rating:	36 tons / HS20.0
(70)Posting:	5 At/Above Legal Loads
(41)Posting Status:	A Open, no restriction

CONDITION

(58)Deck:	6 Satisfactory
(59)Superstructure:	6 Satisfactory
(60)Substructure:	6 Satisfactory
(61)Channel/Protection:	7 Minor Damage
(62)Culvert:	N N/A (NBI)

AGE AND SERVICE

(27)Year Built:	1929
(106)Year Reconstructed:	1980
(42a)Type of Service On:	1 Highway
(42b)Type of Service Under:	5 Waterway
(28a)Lanes On: 2	(28b)Lanes Under: 0
(29)ADT:	12500
(30)Year of ADT:	2014
(109)Truck ADT:	4%
(19)Detour Length:	1 miles
Speed Limit:	25 MPH

APPRAISAL

(67)Structure Condition:	6 Equal Min Criteria
(68)Deck Geometry:	4 Tolerable
(69)Undrclear,Vert and Horiz:	N Not applicable (NBI)
(71)Waterway Adequacy:	8 Equal Desirable
(72)Approach Alignment:	8 Equal Desirable Crit
(36)Traffic Safety Features:	
(a)Bridge Rail:	0 Substandard
(b)Transition:	0 Substandard
(c)Approach Rail:	0 Substandard
(d)Approach Rail Ends:	0 Substandard
(113)Scour Critical:	8 Stable Above Footing

PROPOSED IMPROVEMENTS

(75a)Type of Work:	31 Repl-Load Capacity
(75b)Work Done By:	1 Contract
(76)Length of Improvement:	40 ft
(94)Bridge Improvement Cost:	$290,000
(95)Rdwy Improvement Cost:	$29,000
(96)Total Project Cost:	$440,000
(97)Year of Cost Estimate:	2010
(114)Future ADT:	18750
(115)Year of Future ADT:	2034
YEAR PROGRAMMED:	

NAVIGATION DATA

(38)Navigation Control:	Permit Not Required
(39)Vertical Clearance:	
(40)Horizontal Clearance:	
(111)Pier Protection:	
(116)Lift Bridge Vert Clr:	

INSPECTION

(90)Inspection Date:	7/11/2016	(91)Inspection Frequency:	48 months
(92)Supplemental Inspections Frequency:		(93)Date of Inspections:	
(a)Fracture Critical Detail:	NA	(a)FC Inspection Date:	
(b)Underwater Inspection:	NA	(b)UW Inspection Date:	
(c)Fatique Detail (OS) Inspection:	NA	(c)Fatique Detail (OS) Date:	
(d)UBIT Inspection:	NA	(d)UBIT Date:	
(e)Confined Space Inspection:	NA	(e)Confined Space Date:	
Channel Cross Section Year:			
Equipment Needed for Regular Inspection?	None		

Idaho Transportation Department
Bridge Inspection Report

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Xref Structure Name:		Admin Jurisdiction:	0004 District 4
		District:	04

WEARING SURFACE and DEAD LOAD INFORMATION

Asphalt:	8.5 *inches*	**Concrete:**	0.0 *inches*
Granular:	11.0 *inches*	**Timber:**	0.0 *inches*

POSTING INFORMATION

WEIGHT

Load Analysis Date: 08/15/2014

Load Analysis Required: N Analysis Complete

	Load Rating Analysis IR (tons)	OR (tons)		Recommended Posting(tons)	Actual Posting(tons)
H Truck	20	34			
HS Truck	36	61			
Type3 (3 axle)	30	50	**Type3 (3 axle)**		
Type 3S2 (5 axle)	48	80	**Type 3S2 (5 axle)**		
Type 3-3 (6 axle)	60	100	**Type 3-3 (6 axle)**		
			Max Axle		

HEIGHT

	Recommended	Actual
Height Posting:		

ACTUAL WIDTH POSTING

Single Lane All Vehicles: N
Single Lane Trucks/Buses: N

Idaho Transportation Department
Bridge Inspection Report

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Approach plus milepost

Right side

Idaho Transportation Department
Bridge Inspection Report

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		District:	04

Erosion under rail at northwest corner

Appendix I. City of Ketchum Floodplain Permit Status

City of Ketchum
Planning & Building

MEMO

PROJECT:	SH-75 Trail Creek Bridge Replacement
ADFP#:	P20-037
OWNER:	Bridge and Right-of-Way: Idaho Transportation Department (ITD)
REPRESENTATIVE:	Nathan Jerke, Project Manager, ITD
ENGINEER:	Mike Shubert, P.E., HDR
LOCATION:	SH-75 Bridge spanning Trail Creek, ITD right-of-way, Ketchum City Limits
ZONING:	Base Zone: N/A, right-of-way
	Overlay: Floodplain, Floodway, and Riparian Zone
ATTACHMENTS:	A. Hydraulics Report, SH-75 Trail Creek Bridge, HDR, November 15, 2020
	B. Memo, Harmony Design & Engineering, December 6, 2020

DOCUMENTS REVIEWED:

1. Memo, Harmony Design & Engineering, December 6, 2020
2. Memo, HDR, November 17, 2020
3. Hydraulics Report, SH-75 Trail Creek Bridge, with Appendices A-I, HDR, November 15, 2020
4. Memo, HDR, July 24, 2020
5. Memo, HDR, July 9, 2020
6. Hydraulics Report, SH-75 Trail Creek Bridge, with Appendices A-I, HDR, July 9, 2020
    a. Includes Engineering “No-Rise” Certificate, July 9, 2020
7. Site and vicinity photos, Brittany Skelton, June 18, 2020
8. Cross sections - locations for photos, Google Earth KMZ file, received June 4, 2020
9. Meeting notes summary, HDR, May 28, 2020
10. Memo, Harmony Design & Engineering, April 28, 2020
11. Memo, HDR, April 3, 2020

12. Application, March 30, 2020
13. Memo, HDR, March 30, 2020
14. Hydraulics Report, SH-75 Trail Creek Bridge, with Appendices A-I, HDR, April 1, 2020

BACKGROUND FACTS

1. The City of Ketchum is a municipal corporation organized under Article XII of the Idaho Constitution and the laws of the State of Idaho, Title 50, Idaho Code. Under Chapter 65, Title 67 of the Idaho Code, the City is required to pass certain ordinances regarding land use, including a zoning ordinance.

2. Pursuant to Zoning Code Title 17, Section 17.88.050(D)1, the administrator shall have the authority to consider and approve, approve with conditions, or deny applications for floodplain development permits and for waterways design review.

3. The Idaho Transportation (ITD) is developing design and construction documents for the SH-75 Bridge that spans Trail Creek in Ketchum city limits. The project is located in the floodplain and crosses the floodway. The project is anticipated to occur in FY2026.

4. HDR Engineering, on behalf of the Idaho Transportation Department (ITD) submitted documents for review in order to receive concurrence from the City of Ketchum regarding the hydraulics report in advance.

5. This memo serves to document concurrence with HDR's SH75 Trail Creek Bridge hydraulics report dated November 15, 2020.

6. ITD and their engineer, HDR, will coordinate with the City of Ketchum to obtain a permit prior to commencement of the project in FY206; a permit issued at this time would expire prior to the start of the project: City of Ketchum floodplain permits expire after one (1) year, allowed extensions may only extend a permit approval for up to an additional two (2) years.

DATED this 8th day of February, 2021

Brittany Skelton
Senior Planner, CFM

ATTACHMENTS:

A. Hydraulics Report, SH-75 Trail Creek Bridge, HDR, November 15, 2020

B. Memo, Harmony Design & Engineering, December 6, 2020

ATTACHMENT A.

Hydraulics Report, SH-75 Trail Creek Bridge, HDR, November 15, 2020

July 24, 2020

Dear Brittany Skelton, City of Ketchum,

The Idaho Transportation Department (ITD) is developing design and construction documents for the SH-75 Bridge over Trail Creek in the City of Ketchum. The project is located in the floodplain and crosses the floodway. Therefore, a floodplain development permit and no-rise are required for the project. A brief memo is attached addressing this project and how it meet or exceeds permitting criteria set forth by the City of Ketchum. The draft ITD hydraulic report is also attached.

The purpose of this submittal address the City's comments on the hydraulic report and attain the City's concurrence that the hydraulic design meets or exceeds the City's criteria and needs for floodplain development. Since the project substantially increases flood conveyance, ITD believes that the design exceeds floodplain development criteria. The City also requested ITD evaluate changes to stream stability as a result of the project. This report concludes that the project is unlikely to impact the stable channel immediately upstream and downstream of the project. ITD understands that the City cannot require the state to pay a review fee, based on similar projects completed by ITD with other public permitting agencies.

The City's ordinance indicates that construction projects should be completed within 180 days of permit issuance. Since construction for this project is not planned until 2026, additional coordination or submittals may be needed at a later date. ITD requests a conditional permit or statement of concurrence related to the hydraulic design of the stream crossing. If you have any questions related to this submittal, please contact me at 208-387-7070 or Michael.Schubert@hdrinc.com.

Sincerely,

Michael A Schubert

Michael Schubert, PE
Water Resources Engineer

HARMONY
DESIGN & ENGINEERING

Memo

PROFESSIONAL ENGINEER
REGISTERED
11539
12/6/2020
STATE OF IDAHO
JENNIFER P. ZUNG

To: Brittany Skelton, City of Ketchum

From: Jennifer Zung, PE, CFM

Date: 12/6/2020

Re: SH-75 Trail Creek Bridge

I have reviewed the revised hydraulics report for the SH-75 Trail Creek Bridge Project by HDR dated November 15, 2020, and response memo dated November 17, 2020. The report and analysis were modified in response to comments made in a memo from Harmony Design & Engineering dated April 28, 2020, and a subsequent meeting held on May 28, 2020.

All comments in the April 28, 2020 memo have been addressed satisfactorily.

END OF DOCUMENT

18 N. Main, Ste. 305 * PO Box 369 * Driggs, ID 83422
208-354-1331 * www.harmonydesigninc.com

IDAHO DEPARTMENT OF
WATER RESOURCES

322 E Front Street, Suite 648, Boise ID 83702 • PO Box 83720, Boise ID 83720-0098
Phone: 208-287-4800 • Fax: 208-287-6700 • Email: idwrinfo@idwr.idaho.gov • Website: idwr.idaho.gov

Governor Brad Little | Director Mathew Weaver

July 19, 2024

Jesse Barrus
ITD Dist. 4
216 South Date Street
Shoshone, ID 83352

RE: Joint Application for Permit No. S37-20698
Trail Creek – Bridge Replacement

Dear ITD,

The Idaho Department of Water Resources (IDWR) has reviewed your above referenced application for a permit to alter Trail Creek and has prepared a decision as provided for in Section 42-3805, Idaho Code. The conditions set forth in this permit are intended to prevent degradation of water quality, protect fish and wildlife habitat, and protect the long-term stability of the stream channel. If you cannot meet the conditions set forth in the permit, please contact this office for further consideration.

Your project has been determined to meet the Stream Channel Alteration Rules, IDAPA 37.03.07 Minimum Standards (Rule 55). You may consider this letter a permit to construct your project according to your application, received May 31, 2024, including diagrams. The project location is within Township 04 North, Range 18 East, Section 18, Boise Meridian, Blaine County, Idaho.

Project activities include replacing a bridge over Trail Creek and stabilizing a streambank adjacent to the bridge. Once dewatering measures are in place, the old bridge will be removed, and new footings will be constructed above the Ordinary High Water Mark. Approximately 74-cubic yards of clean angular rock riprap, and natural streambed material, will be discharged to reconstruct the stream channel below the bridge and help protect the abutments from scour. A new bridge deck will be set on the abutments in a way that allows a minimum of one (1) foot of freeboard between the 1% flow elevation and the low chord of the bridge. Approximately 98-feet of streambank below the bridge will be stabilized using rock and soil lifts. Approximately 106-cubic yards of clean angular rock riprap and approximately 13-cubic yards of earthen fill will be discharged to help stabilize the streambank. The newly constructed streambank will be heavily planted with native woody vegetation.

Project activities also include replacing serval culverts on unnamed ditches. It has been determined that an IDWR Stream Channel Alteration Permit will not be required for this work as provided for within Section 42-3802(d), Idaho Code.

Failure to adhere to the conditions as set forth herein can result in legal action as provided for in Section 42-3809, Idaho Code. This project is subject to the following Minimum Standards, Special and General Conditions.

MINIMUM STANDARDS:

These standards are established in the Administrative Rules of the Idaho Water Resources Board; Stream Channel Alteration Rules, IDAPA 37.03.07 dated July 1, 2021, and are enclosed with this permit.

Rule 56 – Construction Procedures
Rule 59 – Culverts and Bridges

SPECIAL CONDITIONS:

[1] All work shall be completed in accordance with the descriptions and methods on the application and diagrams, received May 31, 2024, attached herewith. This office must approve any changes prior to construction.

[2] All construction activities shall take place during low flow and in the dry to minimize turbidity, protect water quality, and comply with Idaho water quality standards.

[3] A minimum of 1-foot of freeboard shall be maintained between the low chord of the bridge and a 1% flow event, during installation.

[4] In water work shall only occur between July 15 and March 15.

[5] Along the stabilized streambank single cuttings shall be planted no greater than 2-foot intervals and bundles or rooted stock shall be planted no greater than 5-foot intervals. Vegetation shall be planted deep enough to reach low water and a native species to Idaho.

[6] Disturbed areas shall be reseeded with a native seed mix after construction to help reduce erosion.

[7] Cass Jones, IDWR Stream Protection Program 208-287-4897, shall be contacted within fourteen (14) business days after completion of in-water work.

[8] Silt fencing or other erosion/sediment control measures shall be installed between any area of earth disturbance and the water. Erosion and sediment control measures must be installed during construction, according to the manufacturer's specifications, and must be maintained until construction is completed and the disturbed ground is revegetated and stable.

[9] All temporary structures, excess excavated material, and vegetative or construction debris shall be disposed of out of the stream channel where it cannot reenter the channel. All construction debris shall be removed from the site and disposed of properly.

[10] All fuel, oil, and other hazardous materials shall be stored and equipment refueled away from the stream channel to ensure that a spill will not enter the waterway. Equipment must be free of fuel and lubricant leaks.

[11] Permittee is responsible for all work done by any contractor or sub-contractor and shall ensure any contractor who performs the work is informed of and follows all the terms and conditions of this authorization.

[12] This permit shall expire December 31, 2027.

GENERAL CONDITIONS:

1. This permit does not constitute any of the following:
    a. An easement or right-of-way to trespass or work upon property belonging to others.
    b. Other approval that may be required by Local, State or Federal Government, unless specifically stated in the special conditions above.
    c. Responsibility of IDWR for damage to any properties due to work done.
    d. Compliance with the Federal Flood Insurance Program, FEMA regulations, or approval of the local Planning and Zoning authority.

2. In accordance with Sections 55-2201 - 55-2210, Idaho Code, the applicant and/or contractors must contact Digline statewide phone number 1-800-342-1585 (Boise area 208-342-1585) not less than three working days prior to the start of any excavation for this project.

3. The permit holder or operator must have a copy of this permit at the alteration site, available for inspection at all times.

4. IDWR may cancel this permit at any time that it determines such action is necessary to minimize adverse impact on the stream channel.

Failure to adhere to conditions as set forth herein can result in legal action as provided for in Section 42-3809, Idaho Code.

If you object to the decision issuing this permit with the above conditions, you have 15 days in which to notify this office in writing that you request a formal hearing on the matter. If an objection has not been received within 15 days, the decision will be final under the provisions of IDAPA 37.03.07 (Rule 70).

Please contact Cass Jones 208-287-4897 or cass.jones@idwr.idaho.gov if you have any questions regarding this matter.

Sincerely,

Cass Jones
Stream Channel Protection
Idaho Department of Water Resources

cc: Rachel Martin, Blaine County
Sean Woodhead, Idaho Department of Environmental Quality, Twin Falls
Bradley Dawson, Idaho Department of Fish and Game, Jerome
Randal Brunmeier, Idaho Department of Lands, Jerome
U.S. Army Corps of Engineers, Boise
Aaron Golart, Idaho Department of Water Resources, Boise

056. CONSTRUCTION PROCEDURES (RULE 56).

01. Conformance to Procedures. Construction shall be done in accordance with the following procedures unless specific approval of other procedures has been given by the Director. When an applicant desires to proceed in a manner different from the following, such procedures should be described on the application. (3-18-22)

02. Operation of Construction Equipment. No construction equipment shall be operated below the existing water surface without specific approval from the Director except as follows: Fording the stream at one (1) location only will be permitted unless otherwise specified; however, vehicles and equipment will not be permitted to push or pull material along the streambed below the existing water level. Work below the water which is essential for preparation of culvert bedding or approved footing installations shall be permitted to the extent that it does not create unnecessary turbidity or stream channel disturbance. Frequent fording will not be permitted in areas where extensive turbidity will be created. (3-18-22)

03. Temporary Structures. Any temporary crossings, bridge supports, cofferdams, or other structures that will be needed during the period of construction shall be designed to handle high flows that could be anticipated during the construction period. All structures shall be completely removed from the stream channel at the conclusion of construction and the area shall be restored to a natural appearance. (3-18-22)

04. Minimizing Disturbance of Area. Care shall be taken to cause only the minimum necessary disturbance to the natural appearance of the area. Streambank vegetation shall be protected except where its removal is absolutely necessary for completion of the work adjacent to the stream channel. (3-18-22)

05. Disposal of Removed Materials. Any vegetation, debris, or other material removed during construction shall be disposed of at some location out of the stream channel where it cannot reenter the channel during high stream flows. (3-18-22)

06. New Cut of Fill Slopes. All new cut or fill slopes that will not be protected with some form of riprap shall be seeded with grass and planted with native vegetation to prevent erosion. (3-18-22)

07. Fill Material. All fill material shall be placed and compacted in horizontal lifts. Areas to be filled shall be cleared of all vegetation, debris and other materials that would be objectionable in the fill. (3-18-22)

08. Limitations on Construction Period. The Director may limit the period of construction as needed to minimize conflicts with fish migration and spawning, recreation use, and other uses. (3-18-22)

059. CULVERTS AND BRIDGES (RULE 59).

01. Culverts and Bridges. Culverts and bridges shall be capable of carrying streamflows and shall not significantly alter conditions upstream or downstream by causing flooding, turbidity, or other problems. The appearance of such installations shall not detract from the natural surroundings of the area. (3-18-22)

02. Location of Culverts and Bridges. Culverts and bridges should be located so that a direct line of approach exists at both the entrance and exit. Abrupt bends at the entrance or exit shall not exist unless suitable erosion protection is provided. (3-18-22)

03. Ideal Gradient. The ideal gradient (bottom slope) is one which is steep enough to prevent silting but flat enough to prevent scouring due to high velocity flows. It is often advisable to make the gradient of a culvert coincide with the average streambed gradient. (3-18-22)

a. Where a culvert is installed on a slope steeper than twenty percent (20%), provisions to anchor the culvert in position will be required. Such provisions shall be included in the application and may involve the use of collars, headwall structures, etc. Smooth concrete pipe having no protruding bell joints or other irregularities shall have such anchoring provisions if the gradient exceeds ten percent (10%). (3-18-22)

04. Size of Culvert or Bridge Opening. The size of the culvert or bridge opening shall be such that it is capable of passing design flows without overtopping the streambank or causing flooding or other damage. (3-18-22)

a. Design flows shall be based upon the following minimum criteria:

Drainage Area	Design Flow Frequency
Less than 50 sq. mi.	25 Years
Over 50 sq. mi. or more	50 years or greatest flow of record, whichever is more

(3-18-22)

b. For culverts and bridges located on U.S. Forest Service or other federal lands, the sizing should comply with the Forest Practices Act as adopted by the federal agencies or the Department of Lands. (3-18-22)

c. For culverts or bridges located in a community qualifying for the national flood issuance program, the minimum size culvert shall accommodate the one hundred (100) year design flow frequency. (3-18-22)

d. If the culvert or bridge design is impractical for the site, the crossing may be designed with additional flow capacity outside the actual crossing structure, provided there is no increase in the Base Flood Elevation.
(NOTE: When flow data on a particular stream is unavailable, it is almost always safe to maintain the existing gradient and cross-section area present in the existing stream channel. Comparing the proposed crossing size with others upstream or downstream is also a valuable means of obtaining information regarding the size needed for a proposed crossing.) (3-18-22)

e. Minimum clearance shall be at least one (1) foot at all bridges. This may need to be increased substantially in the areas where ice passage or debris may be a problem. Minimum culvert sizes required for stream crossings: (3-18-22)

i. Eighteen (18) inch diameter for culverts up to seventy (70) feet long; (3-18-22)

ii. Twenty-four (24) inch diameter for all culverts over seventy (70) feet long. (3-18-22)

f. In streams where fish passage is of concern as determined by the director, an applicant shall comply with the following provisions and/or other approved criteria to ensure that passage will not be prevented by a proposed crossing. (3-18-22)

g. Minimum water depth shall be approximately eight (8) inches for salmon and steelhead and at least three (3) inches in all other cases. (3-18-22)

h. Maximum flow velocities for streams shall not exceed those shown in Figure 17 in APPENDIX H, located at the end of this chapter, for more than a forty-eight (48) hour period. The curve used will depend on the type of fish to be passed. (3-18-22)

i. Where it is not feasible to adjust the size or slope to obtain permissible velocities, the following precautions may be utilized to achieve the desired situation. (3-18-22)

j. Baffles downstream or inside the culvert may be utilized to increase depth and reduce velocity. Design criteria may be obtained from the Idaho Fish and Game Department. (3-18-22)

k. Where multiple openings for flow are provided, baffles or other measures used in one (1) opening only shall be adequate provided that the opening is designed to carry the main flow during low-flow periods. (3-18-22)

05. Construction of Crossings. When crossings are constructed in erodible material, upstream and downstream ends shall be protected from erosive damage through the use of such methods as dumped rock riprap, headwall structures, etc., and such protection shall extend below the erodible streambed and into the banks at least two (2) feet unless some other provisions are made to prevent undermining. (3-18-22)

a. Where fish passage must be provided, upstream drops at the entrance to a culvert will not be permitted and a maximum drop of one (1) foot will be permitted at the downstream end if an adequate jumping pool is maintained below the drop. (3-18-22)

b. Downstream control structures such as are shown in Figure 18 in APPENDIX I, located at the end of this chapter, can be used to reduce downstream erosion and improve fish passage. They may be constructed with gabions, pilings and rock drop structures. (3-18-22)

06. Multiple Openings. Where a multiple opening will consist of two (2) or more separate culvert structures, they shall be spaced far enough apart to allow proper compaction of the fill between the individual structures. The minimum spacing in all situations shall be one (1) foot. In areas where fish passage must be provided, only one (1) opening shall be constructed to carry all low flows. Low flow baffles may be required to facilitate fish passage. (3-18-22)

07. Areas to be Filled. All areas to be filled shall be cleared of vegetation, topsoil, and other unsuitable material prior to placing fill. Material cleared from the site shall be disposed of above the high water line of the stream. Fill material shall be reasonably well-graded and compacted and shall not contain large quantities of silt, sand, organic matter, or debris. In locations where silty or sandy material must be utilized for fill material, it will be necessary to construct impervious sections both upstream and downstream to prevent the erodible sand or silt from being carried away (see Figure 19, APPENDIX J, located at the end of this chapter), Sideslopes for fills shall not exceed one and one half to one (1.5:1). Minimum cover over all culvert pipes and arches shall be one (1) foot. (3-18-22)

08. Installation of Pipe and Arch Culvert. All pipe and arch culverts shall be installed in accordance with manufacturer's recommendations. (3-18-22)

a. The culvert shall be designed so that headwaters will not rise above the top of the culvert entrance unless a headworks is provided. (3-18-22)

JOINT APPLICATION FOR PERMITS

U.S. ARMY CORPS OF ENGINEERS - IDAHO DEPARTMENT OF WATER RESOURCES - IDAHO DEPARTMENT OF LANDS

Authorities: The Department of Army Corps of Engineers (Corps), Idaho Department of Water Resources (IDWR), and Idaho Department of Lands (IDL) established a joint process for activities impacting jurisdictional waterways that require review and/or approval of both the Corps and State of Idaho. Department of Army permits are required by Section 10 of the Rivers & Harbors Act of 1899 for any structure(s) or work in or affecting navigable waters of the United States and by Section 404 of the Clean Water Act for the discharge of dredged or fill materials into waters of the United States, including adjacent wetlands. State permits are required under the State of Idaho, Stream Protection Act (Title 42, Chapter 38, Idaho Code and Lake Protection Act (Section 58, Chapter 13 et seq., Idaho Code). In addition the information will be used to determine compliance with Section 401 of the Clean Water Act by the appropriate State, Tribal or Federal entity.

Joint Application: Information provided on this application will be used in evaluating the proposed activities. Disclosure of requested information is voluntary. Failure to supply the requested information may delay processing and issuance of the appropriate permit or authorization. **Applicant will need to send a completed application, along with one (1) set of legible, black and white (8½"x11"), reproducible drawings that illustrate the location and character of the proposed project / activities to both the Corps and the State of Idaho.**

See Instruction Guide for assistance with Application. Accurate submission of requested information can prevent delays in reviewing and permitting your application. Drawings including vicinity maps, plan-view and section-view drawings must be submitted on 8-1/2 x 11 papers.

Do not start work until you have received all required permits from both the Corps and the State of Idaho

FOR AGENCY USE ONLY			
USACE NWW-	Date Received:	☐ Incomplete Application Returned	Date Returned:
Idaho Department of Water Resources No.	Date Received:	☐ Fee Received DATE:	Receipt No.:
Idaho Department of Lands No.	Date Received:	☐ Fee Received DATE:	Receipt No.:

INCOMPLETE APPLICANTS MAY NOT BE PROCESSED

1. **CONTACT INFORMATION - APPLICANT** Required:	2. **CONTACT INFORMATION - AGENT:**
Name: Jesse Barrus (District Engineer) or Scott Malone (Engineer Manager)	Name: Nathan Jerke
Company: Idaho Transportation Department (ITD) District 4	Company: Idaho Transportation Department (ITD) District 4
Mailing Address: 216 South Date Street	Mailing Address: 216 South Date Street
City: Shoshone; State: ID; Zip Code: 83352-1521	City: Shoshone; State: ID; Zip Code: 83352-1521
Phone Number (include area code): 208-886-7800; E-mail: scott.malone@itd.idaho.gov	Phone Number (include area code): 208-886-7809; E-mail: nathan.jerke@itd.idaho.gov

3. PROJECT NAME or TITLE: SH-75, Elkhorn Rd to River St		4. PROJECT STREET ADDRESS: SH-75 MP 126.4 to MP 128.2	
5. PROJECT COUNTY: Blaine	6. PROJECT CITY: Ketchum	7. PROJECT ZIP CODE: 83340	8. NEAREST WATERWAY/WATERBODY: Trail Creek
9. TAX PARCEL ID#:	10. LATITUDE: 43.667041 (approx. center) LONGITUDE: -114.355657	11a. 1/4: 11b. 1/4: 11c. SECTION: 18, 19, 30	11d. TOWNSHIP: 4N 11e. RANGE: 18E
12a. ESTIMATED START DATE: Jan 1, 2025	12b. ESTIMATED END DATE: Oct 31, 2027	13a. IS PROJECT LOCATED WITHIN ESTABLISHED TRIBAL RESERVATION BOUNDARIES? ☒ NO ☐ YES Tribe:	
13b. IS PROJECT LOCATED IN LISTED ESA AREA? ☐ NO ☒ YES		13c. IS PROJECT LOCATED ON/NEAR HISTORICAL SITE? ☒ NO ☐ YES	

14. DIRECTIONS TO PROJECT SITE: Include vicinity map with legible crossroads, street numbers, names, landmarks.

The Project begins on SH-75 at approximately mile post (MP) 126.4 and ends near MP 128.2 at the intersection of River Street. The Project may be accessed from I-84 by taking US-93 (which transitions to SH-75) north to Ketchum, Idaho. From the City of Ketchum, take Main St south which transitions to SH-75.

15. PURPOSE and NEED: ☐ Commercial ☐ Industrial ☒ Public ☐ Private ☐ Other

Describe the reason or purpose of your project; include a brief description of the overall project. Continue to Block 16 to detail each work activity and overall project.

This Project aims to improve safety and capacity on SH-75 between the Big Wood River Bridge near Elkhorn Road and River Street in the City of Ketchum in Blaine County, mileposts (MP) 126.4 to 128.2. Project development will include roadway widening with curb, gutter, sidewalk, intersection improvement, retaining walls, drainage, public involvement, and replacing a box culvert and constructing a reinforced slope along Trail Creek.

16. DETAILED DESCRIPTION OF EACH ACTIVITY WITHIN OVERALL PROJECT. Specifically indicate portions that take place within waters of the United States, including wetlands: Include dimensions; equipment, construction, methods; erosion, sediment and turbidity controls; hydrological changes: general stream/surface water flows, estimated winter/summer flows; borrow sources, disposal locations etc.:

The wetland and stream impacts are a result of road widening, bridge replacement (construction of a reinforced slope to stabilize the stream bank on Trail Creek and construction of wildlife bench), and the installation of a stormwater facility. Work within wetlands consists of fill placement for roadway widening, scour protection, and stream bank grading to increase hydraulic flow. Additionally, culvert work will be required. This will include installation of a concrete box and headwalls, modification of stormwater pond, and replacement of three irrigation culverts and irrigation crossing. Construction equipment will include rollers, backhoes, excavators, cranes, and other construction equipment typical for a roadway and bridge construction project. All materials sources will be determined by the contractor and approved by the project engineer. Waste materials will be disposed of in an approved upland location.
All bridge improvements will be located outside of the existing and proposed stream channels. The project is designed to restore a more natural channel gradient, bed, and width, and improved bank stability through the structure. New bridge footings will be constructed above OHWM. (See Attachment C, page 6 and 7). Equipment will include an excavator operating from the bank/existing roadway. The construction area below the OHWM of the open waters will be dewatered using sandbags or another similar temporary dewatering method. A qualified Biologist will capture and remove fish from the dewatered work area if needed. A pump with a fish screen will be used to transfer water. The in-water work window will be observed for construction from July 15 to March 15, which was confirmed by Idaho Department of Water Resources (IDWR) and Idaho Department of Fish and Game (IDFG), see interagency meeting minutes dated October 12 & 13, 2021.
An ITD approved Storm Water Pollution Prevention Plan (SWPPP) will be prepared for this project to comply with the Construction General permit. The SWPPP will include measures to address sediment and erosion control with both temporary and permanent measures. Critical areas including wetlands will be marked to retain and protect on Design Plans and SWPPP Plans except as allowed in 404 and other permits. The perimeter of the wetlands that are not permitted to be impacted will be clearly marked with high visibility silt fence.

17. DESCRIBE ALTERNATIVES CONSIDERED to AVOID or MEASURES TAKEN to MINIMIZE and/ or COMPENSATE for IMPACTS to WATERS of the UNITED STATES, INCLUDING WETLANDS: See Instruction Guide for specific details.

The do nothing alternative is not practicable because it does not meet the purpose and need of the project. Improvements that will not result in wetland impacts are not prudent or practicable since the highway must be widened in order to build the alternative and improve safety and capacity on SH-75 as described in the SH-75 Timmerman to Ketchum Final Environmental Impact Statement (FEIS) and Record of Decision (ROD) which was approved in August 2008.The FEIS-ROD was reevaluated in 2023 and approved by FHWA.
Tree removal along the riparian corridor will be minimized by using retaining walls and a reinforced slope along Trail Creek. The disturbed riparian area and reinforced slope will be planted with native plant species.
The existing box culvert at Trail Creek will be replaced with a clear span bridge which will improve hydrological flow and increase the amount of available aquatic habitat.

18. PROPOSED MITIGATION STATEMENT or PLAN: If you believe a mitigation plan is not needed, provide a statement and your reasoning why a mitigation plan is NOT required. Or, attach a copy of your proposed mitigation plan.

The total wetland impacts are 1,956 square feet (SF) (0.0449 acres). The total open water impacts are 1,555 SF (0.0358 acres). The streambed impacts at Trail Creek are temporary, and beneficial improvements would be about 175 SF. Additional self-mitigating stabilization will be through a vegetated wall along the stream bank for 716 SF; therefore, mitigation is not expected through the USACE. The old SH-75 bridge will be removed, and the new bridge will have a 30 feet longer span than the current design and will increase the available streambed by 1,642 SF (0.0377 acres). Mitigation will be on-site at Trail Creek for EO 11990. (The mitigation plan for FHWA is available upon request.)

19. TYPE and QUANTITY of MATERIAL(S) to be discharged below the ordinary high water mark and/or wetlands:

Material	Quantity	Unit
Dirt or Topsoil:	________	cubic yards
Dredged Material:	________	cubic yards
Clean Sand:	________	cubic yards
Clay:	________	cubic yards
Gravel, Rock, or Stone:	________	cubic yards
Concrete:	________	cubic yards
Other (describe): See Attachments :	________	cubic yards
Other (describe: ________ :	________	cubic yards
TOTAL:	________	cubic yards

20. TYPE and QUANTITY of impacts to waters of the United States, including wetlands:

Impact						
Filling:	________	acres	________	sq ft.	________	cubic yards
Backfill & Bedding:	________	acres	________	sq ft.	________	cubic yards
Land Clearing:	________	acres	________	sq ft.	________	cubic yards
Dredging:	________	acres	________	sq ft.	________	cubic yards
Flooding:	________	acres	________	sq ft.	________	cubic yards
Excavation:	________	acres	________	sq ft.	________	cubic yards
Draining:	________	acres	________	sq ft.	________	cubic yards
Other: See Attachments :	________	acres	________	sq ft.	________	cubic yards
TOTALS:	________	acres	________	sq ft.	________	cubic yards

21. HAVE ANY WORK ACTIVITIES STARTED ON THIS PROJECT? ☒ NO ☐ YES If yes, describe ALL work that has occurred including dates.

22. LIST ALL PREVIOUSLY ISSUED PERMIT AUTHORIZATIONS:

Floodplain Management Permit (3/30/2020 application, pending). A final floodplain permit application would be approved by the City of Ketchum Floodplain Administrator within 180 days prior to construction under authority of FEMA's National Flood Insurance Program (NFIP) and the City of Ketchum's floodplain management ordinance (Ordinance 1120 §17.88.070 C.1).

USACE identifies this job as --SH-75, Elkhorn Rd. to River St. (KN 20033), NWW-2020-0050 from the PJD issued January 2024.

23. ☐ YES, Alteration(s) are located on Public Trust Lands, Administered by Idaho Department of Lands

24. SIZE AND FLOW CAPACITY OF BRIDGE/CULVERT and DRAINAGE AREA SERVED: 69 Square Miles

25. IS PROJECT LOCATED IN A MAPPED FLOODWAY? ☐ NO ☒ YES If yes, contact the floodplain administrator in the local government jsrisdiction in which the project is located. A Floodplain Development permit and a No-rise Certification may be required.

26a WATER QUALITY CERTIFICATION: Pursuant to the Clean Water Act, anyone who wishes to discharge dredge or fill material into the waters of the United States, either on private or public property, must obtain a Section 401 Water Quality Certification (WQC) from the appropriate water quality certifying government entity.
See Instruction Guide for further clarification and all contact information.

The following information is requested by IDEQ and/or EPA concerning the proposed impacts to water quality and anti-degradation:
☒ NO ☐ YES Is applicant willing to assume that the affected waterbody is high quality?
☒ NO ☐ YES Does applicant have water quality data relevant to determining whether the affected waterbody is high quality or not?
☒ NO ☐ YES Is the applicant willing to collect the data needed to determine whether the affected waterbody is high quality or not?

26b. BEST MANAGEMENT PRACTICTES (BMP's): List the Best Management Practices and describe these practices that you will use to minimize impacts on water quality and anti-degradation of water quality. All feasible alternatives should be considered - treatment or otherwise. Select an alternative which will minimize degrading water quality

1.Measures will be taken to minimize the potential for debris (e.g., dirt, concrete, etc.) to enter the area of wetlands not being impacted while removing and constructing structures.
2. A spill plan will be prepared by the construction contractor and approved by ITD D4 prior to project implementation.
3. An ITD approved SWPPP will be prepared for this project. The SWPPP will include measures to address sediment and erosion control with both temporary and permanent measures. All requirements of the Water Quality Certification issued by IDEQ will be followed.
4. All disturbed soils will be reseeded following construction.
5. On-site mitigation will consist of native plantings, and retention walls at Trail Creek restoration area.
6. Dewatering may be accomplished by draining, pumping, bailing, or cribbing. If needed, temporary sump holes may be installed within the footings and abutment areas to be dewatered to create a more suitable pumping area. The water removed during footing and abutment construction will be pumped to a temporary storage location where the water will be cleaned to standards specified by Idaho Department of Environmental Quality (IDEQ) to meet the current State of Idaho requirements. If appropriate, water from the dewatering activities may be pumped to a temporary storage/treatment site, or into upland areas and allowed to flow/filter through vegetation prior to reentering the stream channel. The water behind the barrier may be pumped directly back into the stream providing the pumped water meets applicable in stream turbidity criteria.
7. Turbidity monitoring will be conducted while working on or adjacent to Trail Creek
8. All of the above will be carried out in compliance with the 2022 Construction General Permit and 2023 Standard Specifications for Highway Construction.

Through the 401 Certification process, water quality certification will stipulate minimum management practices needed to prevent degradation.

27. LIST EACH IMPACT to stream, river, lake, reservoir, including shoreline: Attach site map with each impact location.

Activity	Name of Water Body	Intermittent Perennial	Description of Impact and Dimensions	Impact Length Linear Feet
See attached narrative				
			TOTAL STREAM IMPACTS (Linear Feet):	

28. LIST EACH WETLAND IMPACT include mechanized clearing, filL excavation, flood, drainage, etc. Attach site map with each impact location.

Activity	Wetland Type: Emergent, Forested, Scrub/Shrub	Distance to Water Body (linear ft)	Description of Impact Purpose: road crossing, compound, culvert, etc.	Impact Length (acres, square ft linear ft
See attached narrative				
			TOTAL WETLAND IMPACTS (Square Feet):	

29. ADJACENT PROPERTY OWNERS NOTIFICATION REQUIREM: Provide contact information of ALL adjacent property owners below.

Name: See Attached Narrative Mailing Address: City: State: Zip Code: Phone Number *(include area code)*: E-mail:	Name: Mailing Address: City: State: Zip Code: Phone Number *(include area code)*: E-mail:
Name: Mailing Address: City: State: Zip Code: Phone Number *(include area code)*: E-mail:	Name: Mailing Address: City: State: Zip Code: Phone Number *(include area code)*: E-mail:
Name: Mailing Address: City: State: Zip Code: Phone Number *(include area code)*: E-mail:	Name: Mailing Address: City: State: Zip Code: Phone Number *(include area code)*: E-mail:
Name: Mailing Address: City: State: Zip Code: Phone Number *(include area code)*: E-mail:	Name: Mailing Address: City: State: Zip Code: Phone Number *(include area code)*: E-mail:

30. SIGNATURES: STATEMENT OF AUTHORIAZATION / CERTIFICATION OF AGENT / ACCESS

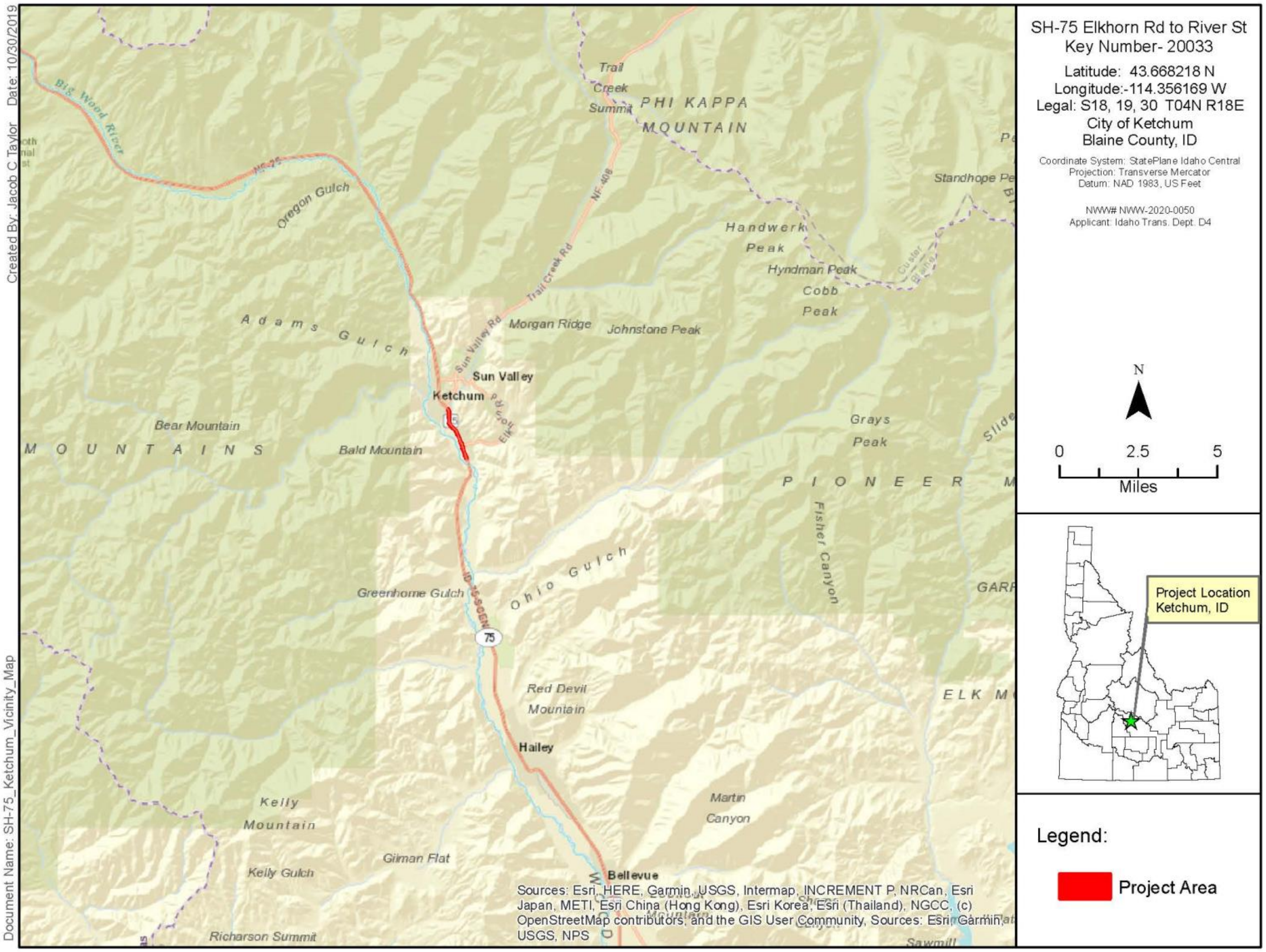
Application is hereby made for permit, or permits, to authorize the work described in this application and all supporting documentation. I certify that the information in this application is complete and accurate. I further certify that I possess the authority to undertake the work described herein; or am acting as the duly authorized agent of the applicant (Block 2). I hereby grant the agencies to which this application is made, the right to access/come upon the above-described location(s) to inspect the proposed and completed work/activities.

Signature of Applicant: ______________________ *Date:* ______________

Signature of Agent: ______________________ *Date:* 06/04/2024

This application must be signed by the person who desires to undertake the proposed activity AND signed by a duly authorized agent (see Block 1, 2, 30). Further, 18 USC Section 1001 provides that: "*Whoever, in any manner within the jurisdiction of any department of the United States knowingly and willfully falsifies, conceals, or covers up any trick, scheme, or disguises a material fact or makes any false, fictitious, or fraudulent statements or representations or makes or uses any false writing or document knowing same to contain any false, fictitious or fraudulent statements or entry, shall be fined not more than $10,000 or imprisoned not more than five years or both*".

Attachment A. Vicinity Map



Attachment B.

- 19. TYPE and QUANTITY of MATERIAL(S) to be discharged below the ordinary high water mark and/or wetlands:
- 20. TYPE and QUANTITY of impacts to waters of the United States, including wetlands:
- 27. LIST EACH IMPACT to stream, river, lake, reservoir, including shoreline: Attach site map with each impact location.
- 28. LIST EACH WETLAND IMPACT include mechanized clearing, fill excavation, flood, drainage, etc. Attach site map with each impact location.
- 29. ADJACENT PROPERTY OWNERS NOTIFICATION REQUIREM: Provide contact information of ALL adjacent property owners below.

BLOCK 19

TYPE and QUANTITY of MATERIALS to be discharged
below ordinary high water mark and/or wetlands

	Length (ft)	X-Section Area Below OHW (SF)	Plan Area (SF)	Depth (ft)	Volume (CY)	Figure	Comments
Dirt or Topsoil							
Wetland G							
-Sand and Topsoil for Pond			1100	0.5	26.2	2	1' Sand/6" Topsoil on Bottom; 6" Topsoil on Sides
-Backfill Wetland G	-	-	350.0	2	25.9	2	Backfill Remaining Area of Wetland G
Fill Sub-Total					*52.1*		
Gravel, Rock, or Stone							
Wetland G							
-Gravel Access Road			220	0.5	4.1	2	6" of 3/4" Aggregate for Access Road
-Riprap/Erosion Control	-	-	102	1.5	5.7	2	Stone Riprap for Outfall to Pond
Fill Sub-Total					*9.7*		
Concrete, Metal, & Plastic							
Wetland G							
-New 24" Pipe	70	1.5	-	-	3.9	2	
-New Outlet	-	-	5.0	4	0.7	2	
-New 12" Pipe	30	0.5	-	-	0.6	2	
Fill Sub-Total					*5.2*		
Dirt or Topsoil							
Ditch 3							
-Backfill Ditch 3	55	2	-	-	4.1	2	Backfill Ditch 3 Inlcuding Access Road
Fill Sub-Total					*4.1*		
Concrete, Metal, & Plastic							
Ditch 3							
-New Concrete Manhole (TY D)	-	-	8.6	4.5	1.4	2	
-New Sediment and Oil Trap	-	-	45	6.0	10.0	2	
Fill Sub-Total					*11.4*		
Dirt or Topsoil							
Wetland F							
-Backfill Wetland F	-	-	180	1.5	10.0	3	Backfill Wetland F During Roadway Slope Construction
Fill Sub-Total					*10.0*		
Concrete, Metal, & Plastic							
Ditch 2							
-New Concrete 18" Pipe with Steel Aprons	15	0.9	-	-	1.5	4	Install New Concrete 18" Pipe with Aprons
-New Concrete 18" Pipe with Steel Aprons	21	0.9	-	-	1.7	4	Install New Concrete 18" Pipe with Aprons
-New Concrete 18" Pipe with Steel Aprons	22	0.9	-	-	1.7	4	Install New Concrete 18" Pipe with Aprons
-New Concrete Structure	-	-	25	5.5	5.1	4	New 5'x5' Concrete Irrigation Box
Fill Sub-Total					*10.0*		
Concrete, Metal, & Plastic							
Ditch 1							Crossing Under SH-75
-New Concrete 24" Pipe	94	1.5	-	-	5.2	5	Install New Concrete 24" Pipe
-New Concrete Headwall	-	-	-	-	1.3	5	Install New Concrete 24" Headwall Rt.
-New Concrete Headwall	-	-	-	-	1.3	5	Install New Concrete 24" Headwall Lt.
Fill Sub-Total					*7.8*		

BLOCK 19

TYPE and QUANTITY of MATERIALS to be discharged
below ordinary high water mark and/or wetlands

	Length (ft)	X-Section Area Below OHW (SF)	Plan Area (SF)	Depth (ft)	Volume (CY)	Figure	Comments
Dirt or Topsoil							
Trail Creek Bridge Replacement							
Fill Soil Above Rip Rap	-	-	574.4	3	63.8	6	Soil above rip w/i OHW at Trail Creek Bridge
Fill Bench	80	3.2	-	-	9.5	6	Fill for south bench
Fill Sub-Total					*73.3*		
Gravel, Rock, or Stone							
Trail Creek Bridge Replacement							
Install Riprap	-	-	574.4	3	71.4	6	Rip rap installation w/I OHW at Trail Creek Bridge
Install Geotextile Fabric under Riprap	-	-	574.4	0	0.0	6	Geotextile fabric installation w/i OHW at Trail Creek Bridge
Fill Sub-Total					*71.4*		
Dirt or Topsoil							
Wetland A							
Wetland A Disturbed for Planting, Fill			51.2	0.5	0.9	6	Native plantings for riparian area restoration in wetland A, fill
Wetland A Temp Disturbed for Planting, Fill			22	0.5	0.4	6	Fill below OHW for Planting plan in wetland A
Fill Sub-Total					*0.9*		
Gravel, Rock, or Stone							
Wetland A							
Riprap installation in wetland			0.5	3	0.1	6	Rip rap installation w/I OHW at Trail Creek Bridge
Geotextile Fabric under Riprap in wetland			0.5	0	0.0	6	Geotextile fabric installation within Wetland, permanent
Fill Sub-Total					*0.1*		
Dirt or Topsoil							
Trail Creek Slope Stabilization							
Water Diversion (Sandbags), Temporary	125	9.0	-	-	41.7	7	Temporary water diversion
Earth Fill Above RipRap			716	0.5	13.3	7	Earth Fill Above RipRap
Fill Sub-Total					*13.3*		
Gravel, Rock, or Stone							
Trail Creek Slope Stabilization							
Installation for RipRap			716	4	106.1	7	Riprap installation in front of reinforced slope
Install Geotextile Fabric under Riprap			716	0	0.0	7	Geotextile fabric installation w/i OHW at Trail Creek Slope
Fill Sub-Total					*106.1*		
Total Project Fill					*375.4*		
Total Project Net Materials Discharged Below OHW/Wetlands					**375.4**		

BLOCK 20

TYPE and QUANTITY of impacts to
waters of the United States, including wetlands

	Length (ft)	X-Section Area Below OHW (SF)	Plan Area (SF)	Depth (ft)	Volume (CY)	Figure	Comments
Dirt or Topsoil							
Wetland G							
-Excavate for New Riprap,Perm	-	-	102.0	1.5	-5.7	2	
-Excavate for New 24" Pipe, Temp	70	3.2	-	-	-8.3	2	Temporary excavation for pipe installation
-Excavate for New 24" Pipe.Perm	70	1.5	-	-	-3.9	2	Permanent excavation for pipe installation
-Excavate for New Outlet, Temp	-	-	45	4	-6.7	2	Temporary excavation for outlet installation
-Excavate for New Outlet, Perm			5	4	-0.7	2	Permanent excavation for outlet installation
-Excavate for New 12" Pipe, Temp	30	0.8	-	-	-0.9	2	Temporary excavation for pipe installation
-Excavate for New 12" Pipe, Perm	30	0.5	-	-	-0.6	2	Permanent excavation for pipe installation
-Excavate for Pond Expansion, Perm	-	-	1100	7	-285.2	2	
-Excavate for Access Road, Perm			300	2	-22.2	2	Permanent excavation for access road
Permanent Excavation Sub-Total					*-318.3*		
Ditch 3							
-Excavate for New Manhole, Temp	-	-	20	5	-3.7	2	Temporary excavation for manhole installation
-Excavate for New Manhole, Perm	-	-	8.6	4.5	-1.4	2	Permanent excavation for manhole installation
-Excavate for New Sed and Oil Trap, Temp	-	-	81	7	-21.0	2	Temporary excavation for sed trap installation
-Excavate for New Sed and Oil Trap, Perm	-	-	45	6	-10.0	2	Permanent excavation for sed trap installation
Permanent Excavation Sub-Total					*-11.4*		
Dirt or Topsoil							
Wetland F							
-Excavate Wetland F			180	1.5	-10.0	3	Excavate Wetland F During Roadway Slope Construction
Permanent Excavation Sub-Total					*-10.0*		
Dirt or Topsoil							
Ditch 2							
-Excavate for new Concrete Structure, Temp	-	-	77	6	-17.1	4	Temporary Excavationfor New 5'x5' Irrigation Box
-Excavate for new Concrete Structure, Perm	-	-	25	5.5	-5.1	4	Permanent excavation for New 5'x5' Irrigation Box
Permanent Excavation Sub-Total					*-5.1*		
Concrete, Metal, & Plastic							
Ditch 2							
-Remove Ex. CMP 18" Pipe	10	0.9	-	-	-0.3	4	Remove Existing CMP 18" Pipe
-Remove Ex. CMP 18" Pipe	21	0.9	-	-	-0.7	4	Remove Existing CMP 18" Pipe
-Remove Ex. CMP 18" Pipe	20	0.9	-	-	-0.7	4	Remove Existing CMP 18" Pipe
Permanent Excavation Sub-Total					*-1.7*		
Dirt or Topsoil							
Ditch 1							
-Excavate for Concrete Headwall, Temp	-	-	40.0	3.5	-5.2	5	Temporary excavtion for 24" Concrete Headwall Rt.
-Excavate for Concrete Headwall, Perm	-	-	-	-	-1.3	5	Permanent excavation for 24" Concrete Headwall Rt.
-Excavate for Concrete Headwall, Temp	-	-	40.0	3.5	-5.2	5	Temporary excavtion for 24" Concrete Headwall Lt.
-Excavate for Concrete Headwall, Perm	-	-	-	-	-1.3	5	Permanent excavation for 24" Concrete Headwall Lt.
-Regrade Ditch 1	-	-	15	2	-1.1	5	Temporay Excavation - Regrade Ditch 1 after Headwall Installation
Permanent Excavation Sub-Total					*-2.6*		
Concrete, Metal, & Plastic							
Ditch 1							Crossing Under SH-75
-Remove 24" CMP	94	1.5	-	-	-5.2	5	Remove Existing 24"" Pipe
Permanent Excavation Sub-Total					*-5.2*		
Dirt or Topsoil							
Wetland D							
-Regrade Ditch 1	-	-	20	2	-1.5	5	Temporary Excavation - Regrade Ditch 1 after Headwall Install
Permanent Excavation Sub-Total					*0.0*		
Dirt or Topsoil							
Trail Creek Bridge Replacement							
Excavate to Remove Bridge & Install Riprap			574.4	6	-127.6	6	Excavation for bridge removal and riprap installation w/i OHW
Excavate Channel to Install Riprap, Temporary			1428.0	5.1	-269.7	6	Temporary excavation for rip rap installation w/i OHW, fill back
Permanent Excavation Sub-Total					*-127.6*		
Wetland A							
Wetland A Disturbed for Planting, Excavation			51.2	0.5	-0.9	6	Native plantings for riparian area restoration in wetland A, excavation
Permanent Excavation Sub-Total					*-0.9*		
Dirt or Topsoil							
Trail Creek Slope Stabilization							
Excavation for RipRap installation			716	4.5	-119.4	7	Riprap excavation in front of reinforced slope
Excavation for RipRap, Temporary			883	2	-65.4	7	Temporary excavation for rip rap installation
Permanent Excavation Sub-Total					*-119.4*		
Total Project Excavation					*-602.3*		
Total Quantity of Excavaton in WOTUS					**-602.3**		

Block 20

TYPE and QUANTITY of impacts to
waters of the United States, including wetlands

Fig. #	Backfill and Bedding	Area (AC)	Impact Area (SF)	Volume (CY)	
2	*Wetland G*	*0.0391*	*1,705*	*67.0*	Pond Expansion, Access Road and Storm Drain
2	*Ditch 3*	*0.0037*	*160*	*15.5*	Pond Expansion, Access Road and Storm Drain
3	*Wetland F*	*0.0041*	*180*	*10.0*	Roadway and Slope Construction
4	*Ditch 2*	*0.0014*	*60*	*10.0*	Install new concrete box and Replace 3 Irrigation culverts
5	*Ditch 1*	*0.0010*	*45*	*7.8*	Replace Irrigation Crossing and Add Headwalls
6	*Trail Creek Bridge Replacement*	*0.0132*	*574*	*144.7*	Install Riprap & Bench for Bridge Abutments
6	*Bridge - Geotextile*	*0.0132*	*574*	*0.0*	Install Geotextile under Riprap at Bridge Abutments
6	*Wetland A*	*0.0005*	*23*	*1.0*	Install Riprap For Bridge Abutments/Native Plantings Area
6	*Wetland A - Geotextile*	*0.0000*	*1*	*0.0*	Install Geotextile under Riprap at Bridge Abutments
7	*Trail Creek Slope Stabilization*	*0.0164*	*716*	*119.3*	Riprap installation in front of Reinforced Slope
7	*Trail Creek Slope - Geotextile*	*0.0164*	*716*	*0.0*	Riprap installation in front of Reinforced Slope
	Bedding and Backfill Sub-Total			*375.4*	

Fig. #	Excavation	Area (AC)	Impact Area (SF)	Volume (CY)	Pond Expansion, Access Road and Storm Drain
2	*Wetland G*	*0.0391*	*1,705*	*-318.3*	Pond Expansion, Access Road and Storm Drain
2	*Ditch 3*	*0.0037*	*160*	*-11.4*	Pond Expansion, Access Road and Storm Drain
3	*Wetland F*	*0.0041*	*180*	*-10.0*	Roadway and Slope Construction
4	*Ditch 2*	*0.0014*	*60*	*-6.8*	Install new concrete box and Replace 3 Irrigation culverts
5	*Ditch 1*	*0.0010*	*45*	*-7.8*	Replace Irrigation Crossing and Add Headwalls
5	*Wetland D*	*0.0005*	*20*	*0.0*	Replace Irrigation Crossing and Add Headwalls-Temporary impact only
6	*Trail Creek Bridge Replacement*	*0.0132*	*574*	*-127.6*	Excavate for Bridge Removal and Riprap Installation
6	*Wetland A*	*0.0012*	*51*	*-0.9*	Native plantings for riparian area restoration in wetland A
7	*Trail Creek Slope Stabilization*	*0.0164*	*716*	*-119.4*	Excavate for riprap in front of Reinforced Slope
	Excavation Sub-Total			*-602.3*	
	Project Net Materials Total			*-226.9*	

27. LIST EACH IMPACT to stream, river, lake, reservoir, including shoreline: Attach site map with each impact location

Table 1: Waterbody Impacts

Resource	Figure	Activity	Cowardin	Intermittent/ Perennial	Description of Impact	Permanent Impacts (SF)	Permanent Impacts (Acres)	Impact Length (LF)
Ditch 1	5	Pipe/headwalls installation	R4EM	Intermittent	Replace Irrigation Crossing and Add Headwalls	45	0.0010	22
Ditch 2	4	Pipe/Box installation	R4EM	Intermittent	Install new concrete box and Replace 3 Irrigation culverts	60	0.0014	30
Ditch 3	2	Pond Expansion & Storm Drain	R4EM	Intermittent	Pond Expansion, Access Road and Storm Drain	160	0.0037	80
Trail Creek*	6	Riprap installation	R2UB	Perennial	Bench for bridge abutments	574	0.0132	82
Trail Creek	7	Slope Stabilization (vegetated wall)	R2UB	Perennial	Riprap installation for Reinforced Slope	716	0.0164	98
					Total	1,555	0.0358	312

***175 SF increase in hydraulic opening (full opening of old culvert to full opening of new bridge)**

28. LIST EACH WETLAND IMPACT include mechanized clearing, filL excavation, flood, drainage, etc. Attach site map with each impact location.

Table 2: Wetland Impacts

Resource	Figure	Activity	Cowardin	Distance to waterbody (lin. feet)	Description of Impact	Total Impact (Sq Ft)	Total Impact (Acres)
Wetland A	6	Riprap installation	PFO	0	Install Riprap for bridge abutments, native riparian planting area	51	0.0012
Wetland D	5	Pipe/headwalls installation	PEM	0	Replace Irrigation Crossing and add headwalls	20	0.0005
Wetland F	3	Roadway Construction	PEM	120	Roadway and Slope Construction	180	0.0041
Wetland G	2	Pond Expansion & Storm Drain	PSS	0	Pond Expansion, Access Road and Storm Drain	1,705	0.0391
					Total	**1,956**	**0.0449**

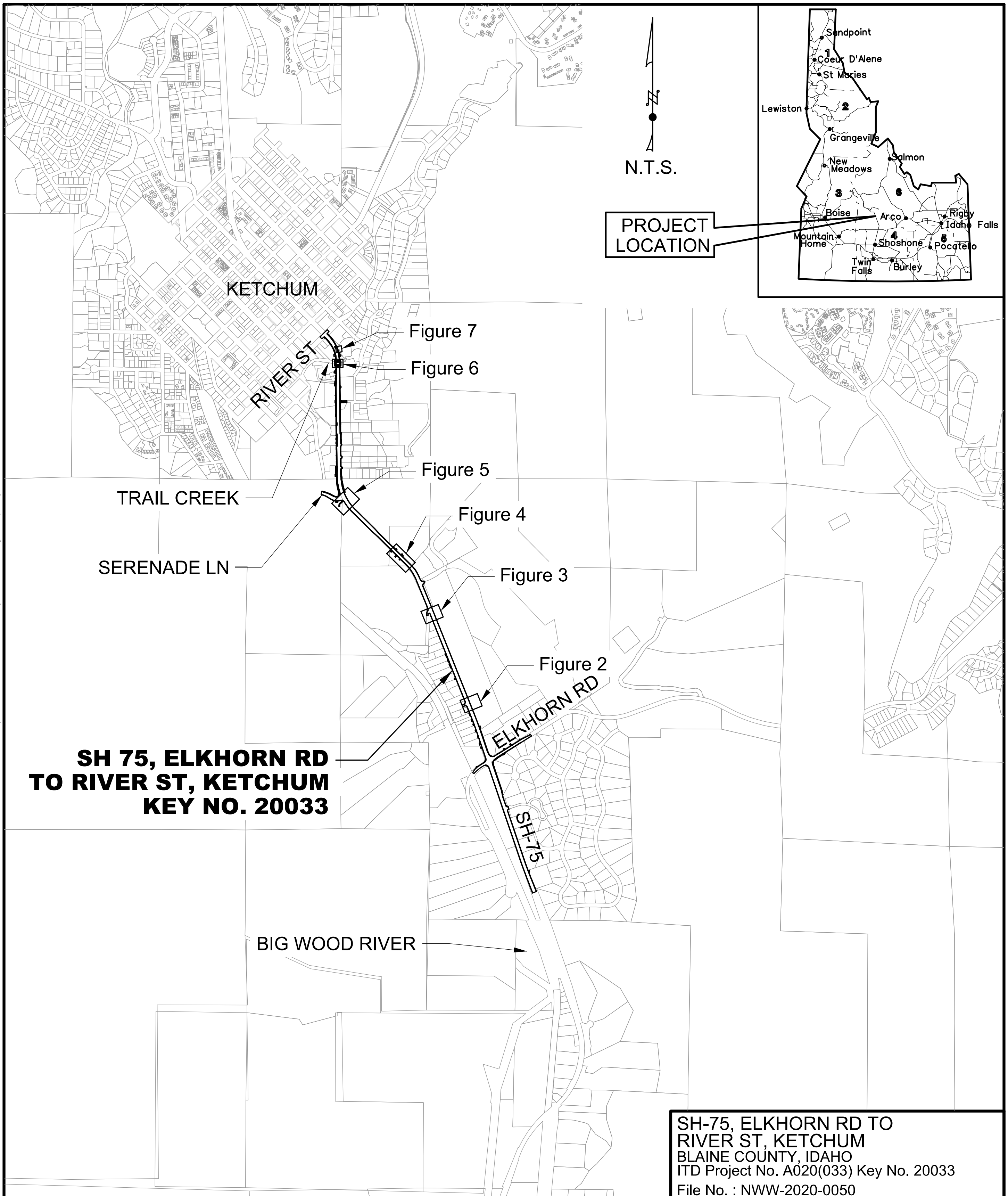
29. ADJACENT PROPERTY OWNERS NOTIFICATION: Provide contact information of ALL adjacent property owners

Table 3. Adjacent Property Owners

Assessor's Parcel No.	Adjacent Impacted Resources	Contact Name	Phone	Email	Mailing Address
RPK05030000010	Wetland F	Joseph Reali	Not Provided	Joe.reali@gmail.com	100 Neils Way, PO Box 88, Hauley, ID 83333
RPS05200050000	Wetland G Ditch 3	Weyyakin Ranch Property Owner Association	208-726-3858	scm@suncountrysv.com	PO Box 728 Ketchum, ID 83340
RPK4N180190790 **RPK4N180190780**	Ditch 2	Idaho Park Foundation Inc Kendra Kenyon	208-860-0311	office@idaholands.org	5657 WARM SPRINGS AVE BOISE, ID 83716
RPK4N180190820	Ditch 2 Ditch 1 Wetland D	Douglas Bradshaw Trustee	775-782-1959	DJBradshaw1@live.com	PO Box 7180 Gardnerville, NV 89460
RPK4N17024662M	Ditch 1 Wetland D	Sun Valley Resorts Tim Silva	208-622-2042	tsilva@sunvalley.com	PO BOX 10 SUN VALLEY, ID 83353
RPK07070030000	Trail Creek	Andora Villa Condos Will Schuckert	602-524-1797	will@edgescottsdale.com	15100 N 78th Way #207 Scottsdale, AZ 85250
RPK0000082003A	Trail Creek Wetland A	PEG Ketchum Hotel LLC	801-655-1998	Not Provided	145 W 200 N Ste 100 Provo, UT 84601
RPK0000082022A	Trail Creek	Jeffrey Barber	206-795-9321	Jeffbarber7@gmail.com	PO Box 2174 Sun Valley, ID 83353
RPK07770000000	Trail Creek	Habitat 2000 Condo Owners Tamara Code	208-726-8584	mgr.habitatontrailcreek@gmail.com	219 S 1st Ave St 101 Hailey, ID 83333
RPK09590000000	Trail Creek	Trail Creek LLC John Sahlberg	Not Provided	johntsahlberg@gmail.com	PO Box 2251 Ketchum, ID 83340

Assessor's Parcel No.	Adjacent Impacted Resources	Contact Name	Phone	Email	Mailing Address
RPK00000830020	Trail Creek	Harriman Ketchum Hotel LLC Jack Bariteau	Not Provided	jack@waypointsunvalley.com	PO Box 84 Sun Valley, ID 83353

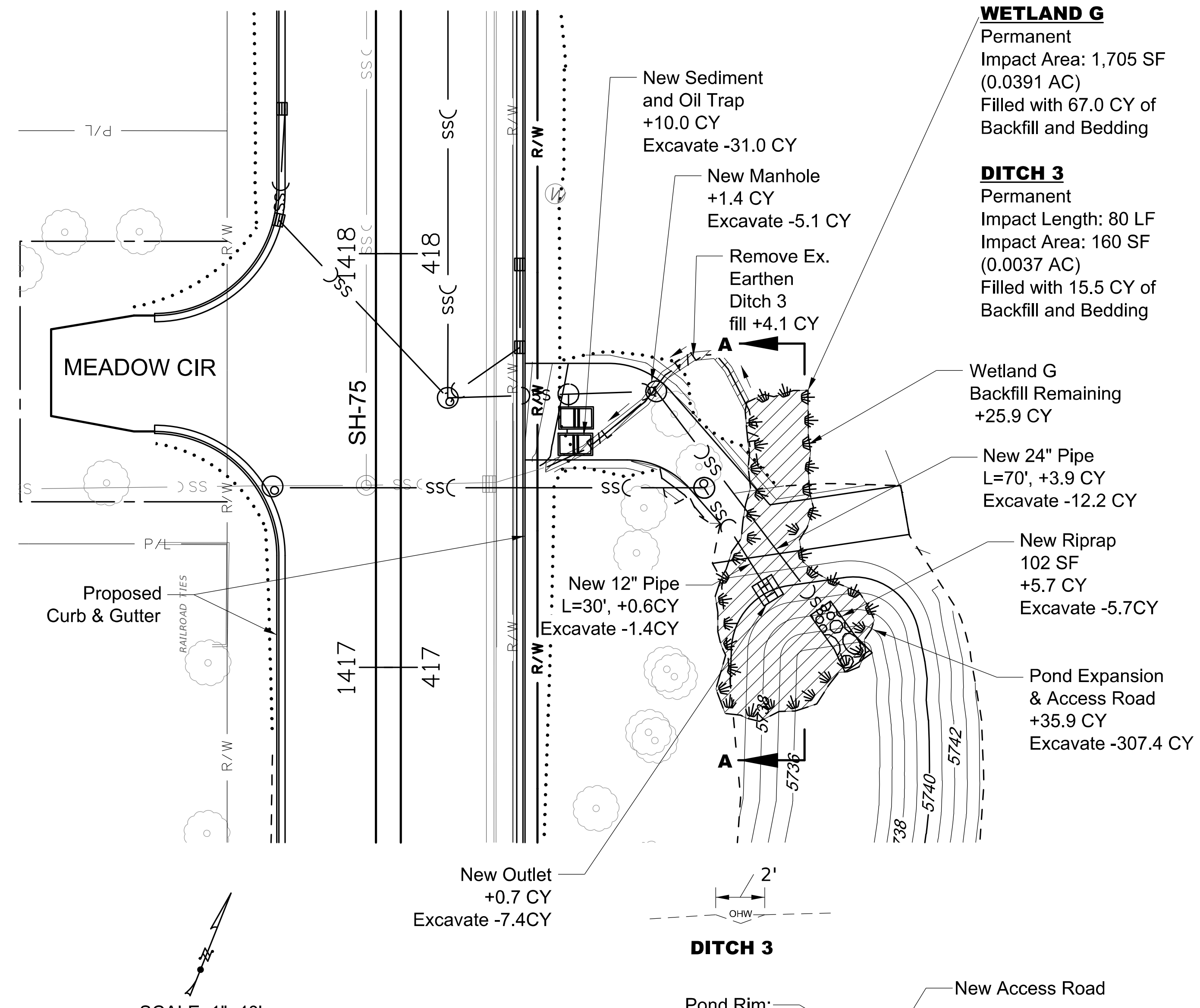
Attachment C. Plan Sheets with Impacts



SH-75, ELKHORN RD TO RIVER ST, KETCHUM
BLAINE COUNTY, IDAHO
ITD Project No. A020(033) Key No. 20033
File No. : NWW-2020-0050

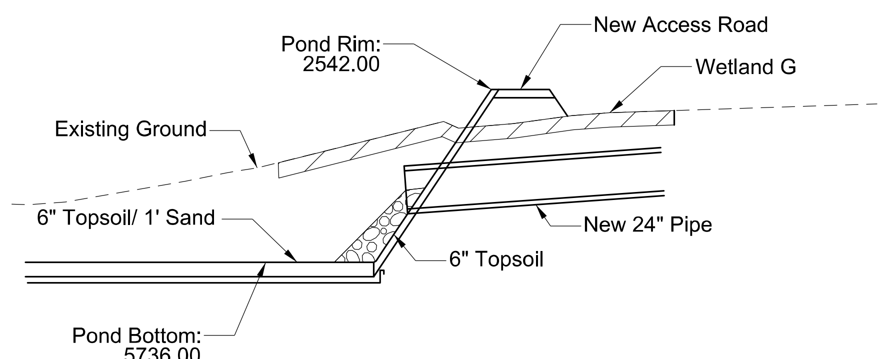
VICINITY MAP	FIGURE 1	MAY 13 2024	Sheet 1 of 7

U:\Bois\Projects\Clients\4006-ITD\314-4006-071SH-75 Elkhorn to River\99Svcs\CADD\DGN\404 permit\20033_404_Fig 01_Vicinity Map.dgn 5/14/2024 6:03:46 PM



LEGEND

— — — — —	Existing Pipe
—— F/L ——	Existing Ditch
-)SS ——	Existing Storm Sewer
–)SS ——	Proposed Storm Sewer
-)IRR ——	Proposed Irrigation Pipe
(symbol)	Wetland Boundary
— R/W ——	Existing Right-of-Way
— P/L ——	Property Line
– R/W ——	Acquired ITD Right-of-Way



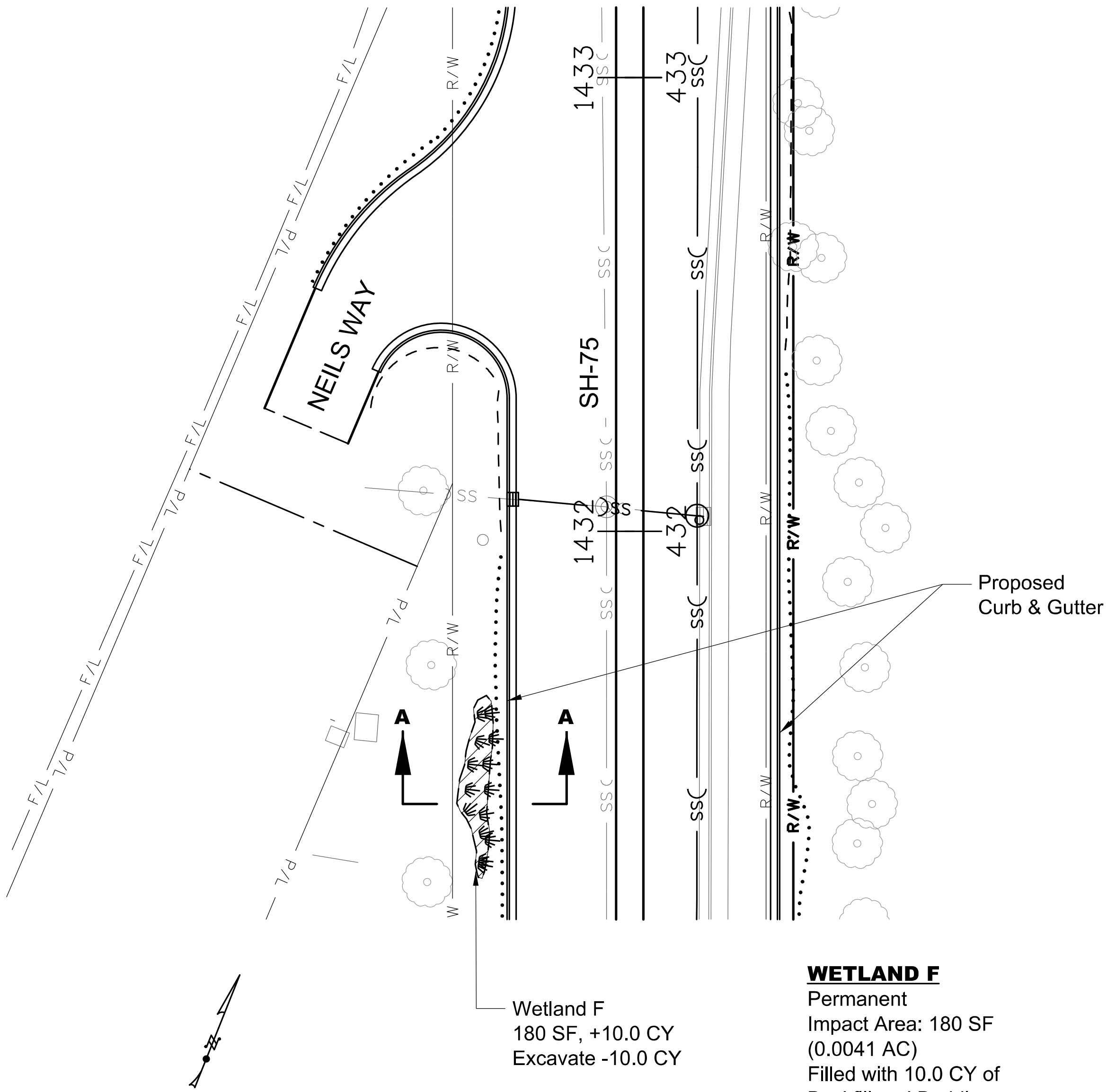
SECTION A-A

SH-75, ELKHORN RD TO
RIVER ST, KETCHUM
BLAINE COUNTY, IDAHO
ITD Project No. A020(033) Key No. 20033

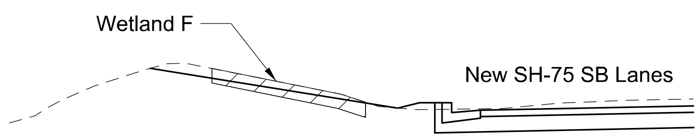
File No. : NWW-2020-0050
Waterway: DITCH 3 & WETLAND G
Proposed Activity:Pond Expansion & Storm Drain
Lat.: 43.667° N Long.: 114.356° W

Sheet 2 of 7

DITCH 3 & WETLAND G	FIGURE 2	MAY 13 2024



WETLAND F
Permanent
Impact Area: 180 SF
(0.0041 AC)
Filled with 10.0 CY of
Backfill and Bedding



SECTION A-A

LEGEND

- Existing Pipe
- F/L Existing Ditch
-)SS Existing Storm Sewer
-)SS Proposed Storm Sewer
-)IRR Prposed Irrigation Pipe
- Wetland Boundary
- R/W Existing Right-of-Way
- P/L Property Line
- R/W Acquired ITD Right-of-Way

SH-75, ELKHORN RD TO
RIVER ST, KETCHUM
BLAINE COUNTY, IDAHO
ITD Project No. A020(033) Key No. 20033

File No. : NWW-2020-0050
Waterway: WETLAND F
Proposed Activity:Roadway Construction
Lat.: 43.667° N Long.: 114.356° W

Sheet 3 of 7

WETLAND F	**FIGURE 3**	**MAY 13 2024**

U:\Bois\Projects\Clients\4006-ITD\314-4006-071SH-75 Elkhorn to River\99Svcs\CADD\DGN\404 permit\20033_404_Fig 03_WL F.dgn 5/14/2024 6:04:04 PM

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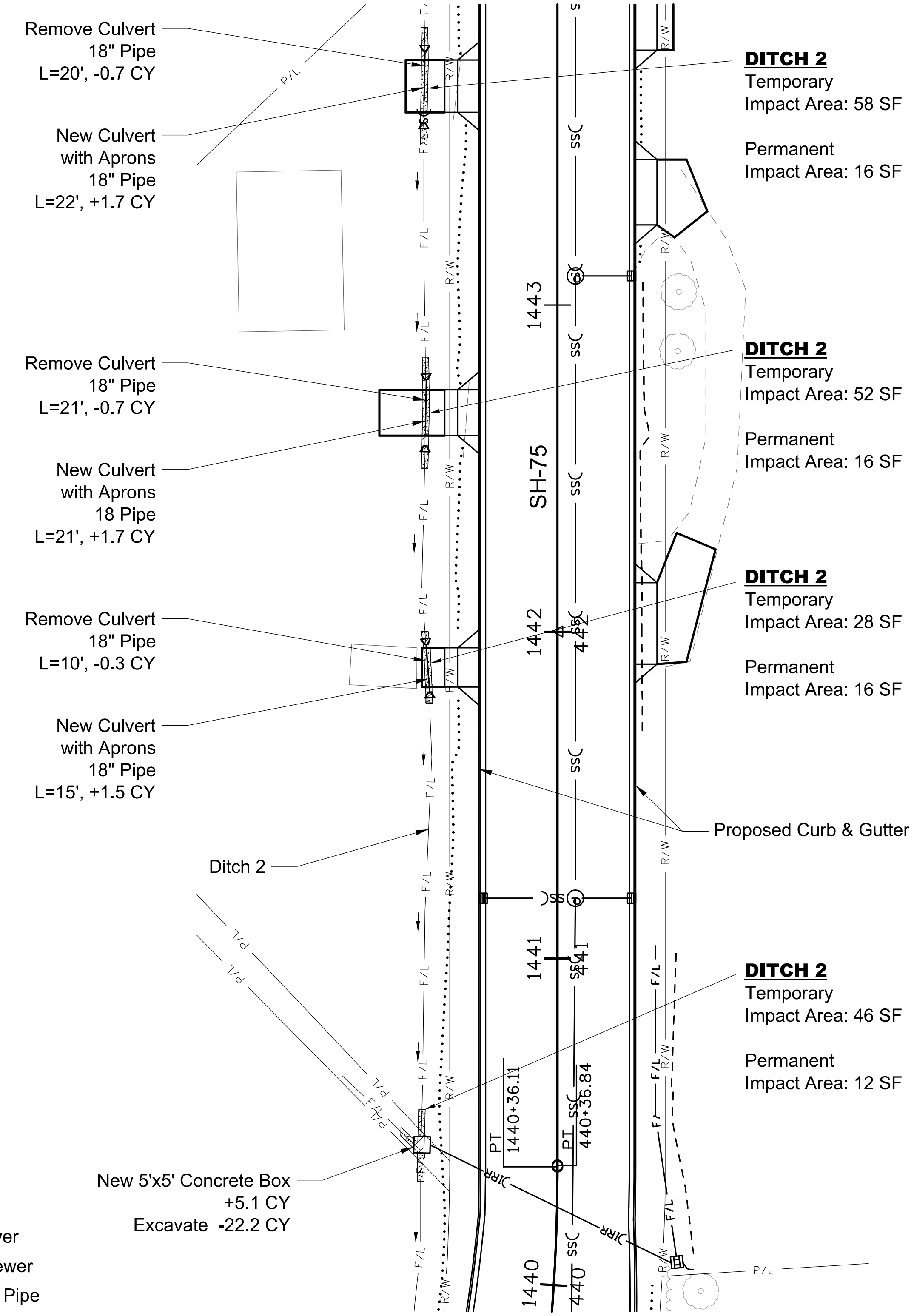
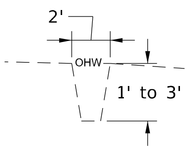
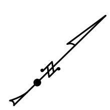




DITCH 2 TOTALS
Temporary
Impact Length: 92 LF
Impact Area: 184 SF

Permanent
Impact Length: 30 LF
Impact Area: 60 SF
(0.0014 AC)
Filled with 10.0 CY of
Backfill and Bedding



SCALE: 1"=50'

LEGEND

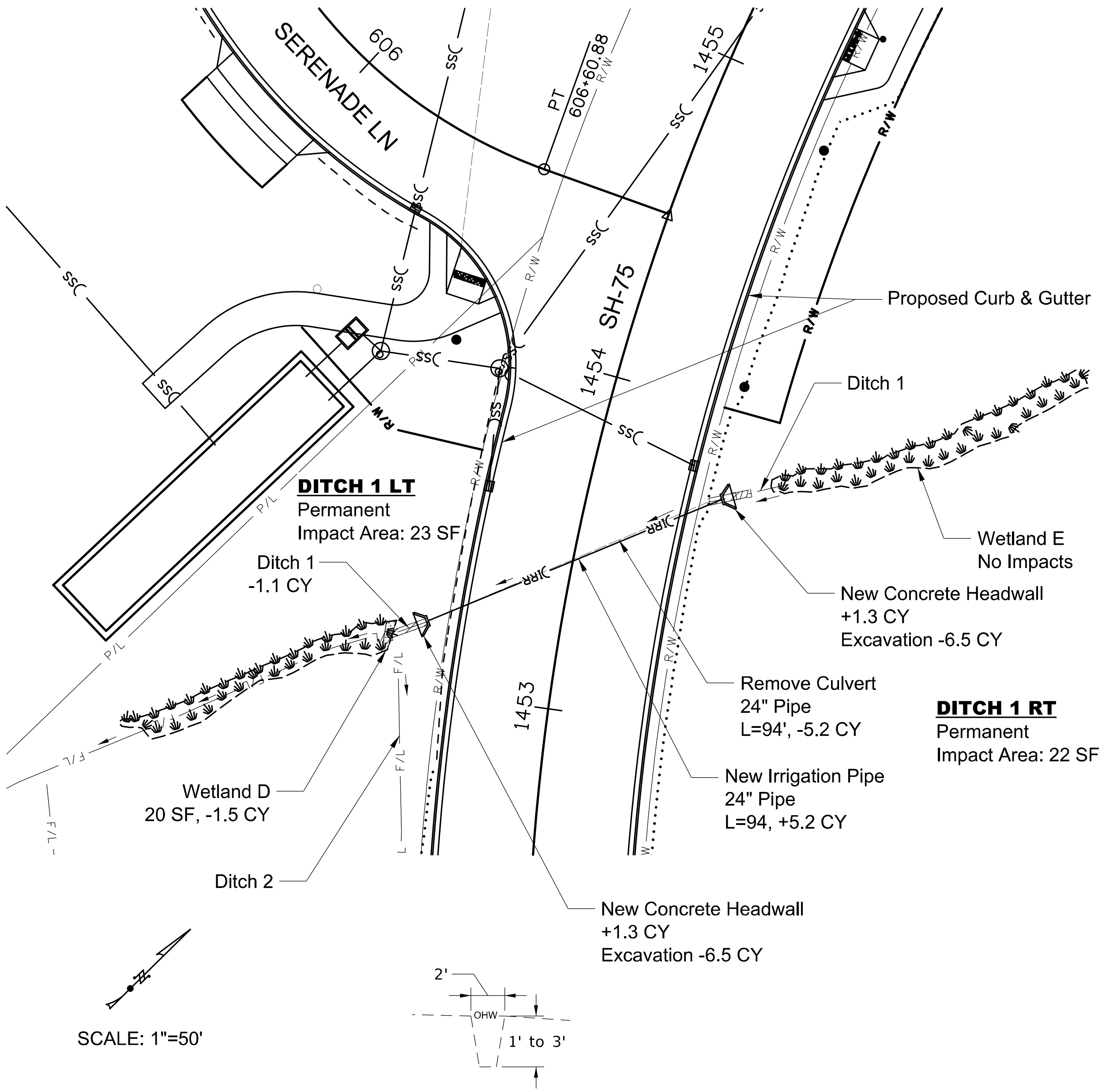
———	Existing Pipe
— F/L —	Existing Ditch
–)SS —	Existing Storm Sewer
–)SS —	Proposed Storm Sewer
—)IRR-	Proposed Irrigation Pipe
	Wetland Boundary
— R/W —	Existing Right-of-Way
- P/L —	Property Line
— R/W —	Acquired ITD Right-of-Way

SH-75, ELKHORN RD TO
RIVER ST, KETCHUM
BLAINE COUNTY, IDAHO
ITD Project No. A020(033) Key No. 20033

File No. : NWW-2020-0050
Waterway: DITCH 2
Proposed Activity:Pipe/Box Installation
Lat.: 43.667° N Long.: 114.356° W

Sheet 4 of 7

DITCH 2	FIGURE 4	MAY 13 2024



LEGEND

— — — — — —	Existing Pipe
—— F/L ——	Existing Ditch
-)SS ———	Existing Storm Sewer
-)SS ———	Proposed Storm Sewer
———)IRR-	Proposed Irrigation Pipe
	Wetland Boundary
—— R/W ——	Existing Right-of-Way
- P/L ———	Property Line
—— R/W ——	Acquired ITD Right-of-Way

DITCH 1 TOTALS
Permanent
Impact Length: 22 LF
Impact Area: 45 SF
(0.0010 AC)
Filled with 7.8 CY of
Backfill and Bedding

WETLAND D TOTALS
Temporary
Impact Area: 20 SF
(0.0005 AC)

SH-75, ELKHORN RD TO
RIVER ST, KETCHUM
BLAINE COUNTY, IDAHO
ITD Project No. A020(033) Key No. 20033
File No. : NWW-2020-0050
Waterway: DITCH 1 & WETLAND D
Proposed Activity:Pipe/Headwalls Installation
Lat.: 43.667° N Long.: 114.356° W
Sheet 5 of 7

DITCH 1 & WETLAND D	FIGURE 5	MAY 13 2024

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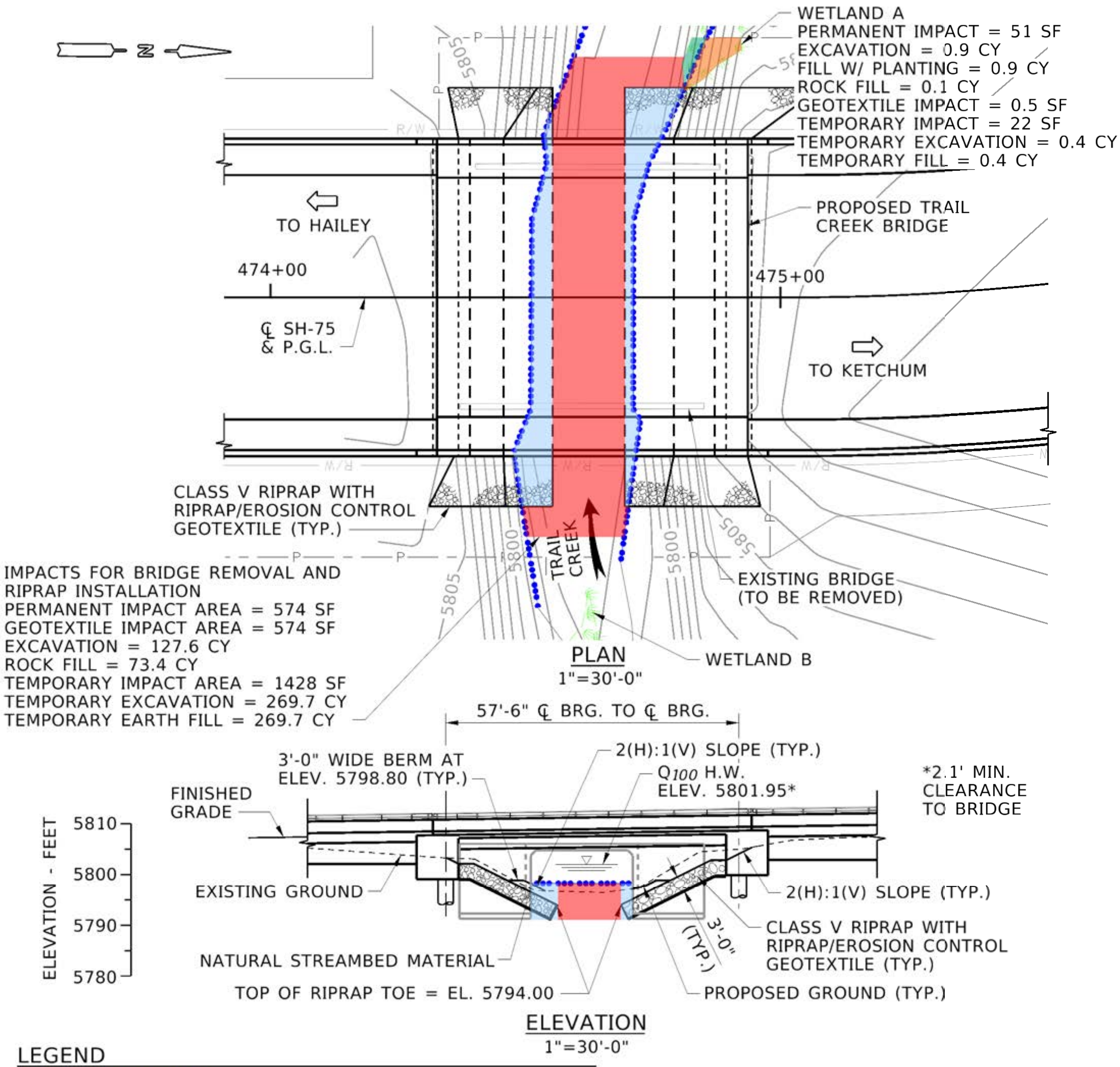


LEGEND

- ORDINARY HIGH WATER (OHW) BOUNDARY
- DELINEATED WETLAND BOUNDARY
- R/W — EXISTING RIGHT-OF-WAY
- P — — P — ACQUIRED RIGHT-OF-WAY
- PERMANENT IMPACTS BELOW OHW (574 S.F., 0.013 ACRE)
- TEMPORARY IMPACTS BELOW OHW (1428 S.F., 0.033 ACRE)
- PERMANENT IMPACTS TO WETLANDS (51 S.F., 0.001 ACRE)
- TEMPORARY IMPACTS TO WETLANDS (22 S.F., 0.001 ACRE)

EXISTING
HYDRAULIC OPENING = 158 S.F., 0.003 ACRE

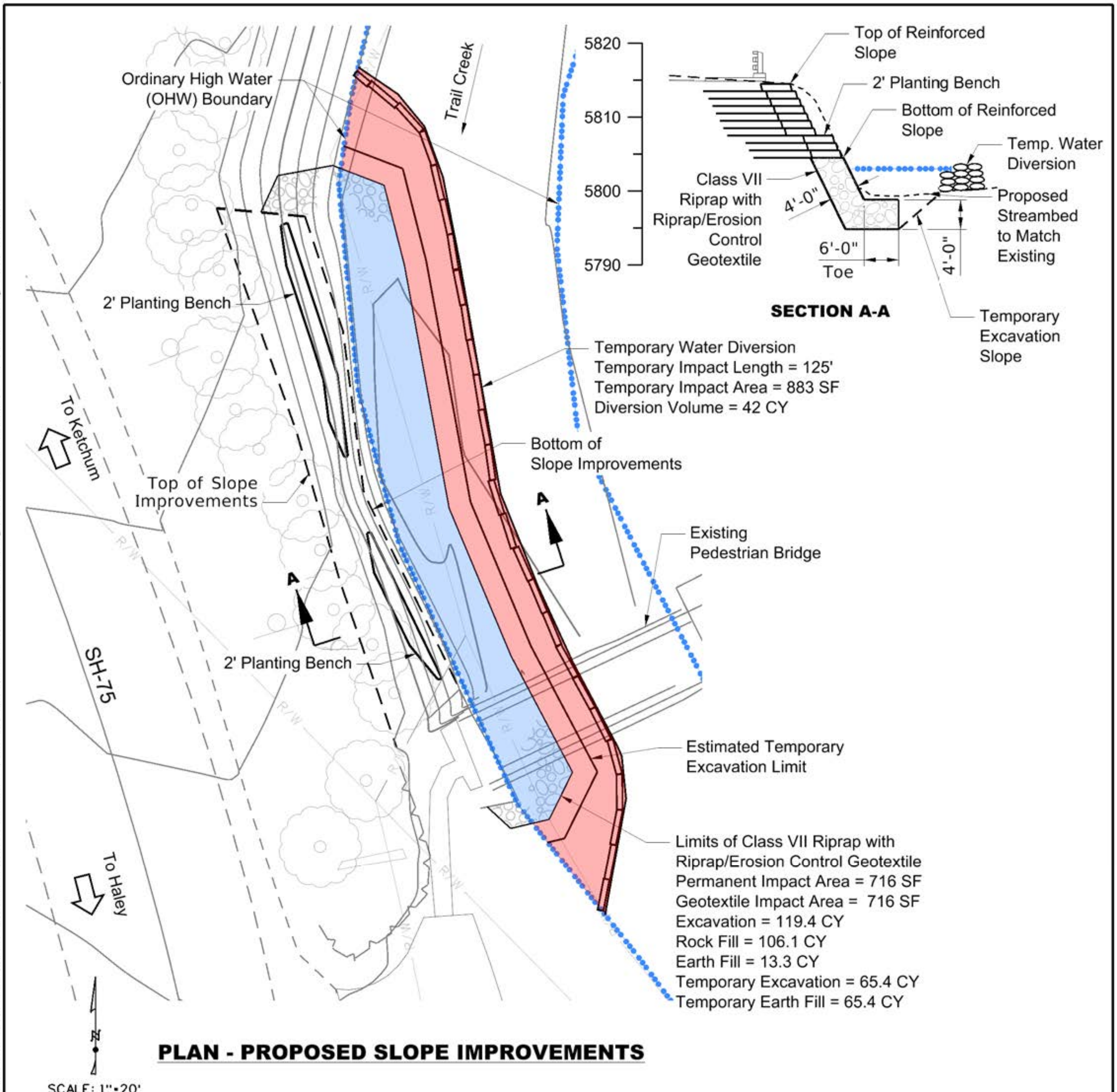
PROPOSED
HYDRAULIC OPENING = 333 S.F., 0.008 ACRE

HYDRAULIC
OPENING CHANGE = INCREASE 175 S.F., 0.004 ACRE

SH-75, ELKHORN RD TO
RIVER ST, KETCHUM
BLAINE COUNTY, IDAHO
ITD Project No. A020(003) Key No. 20033

File No. : NWW-2020-0050
Waterway: Trail Creek
Proposed Activity: Bridge Replacement
Lat.: 43.667° N Long.: 114.356° W

TRAIL CREEK BRIDGE	FIGURE 6	MAY 13 2024



LEGEND

- R/W — Existing Right-of-Way
- Ordinary High Water (OHW) Boundary
- Permanent Impacts Below OHW (716 S.F., 0.016 Acre)
- Temporary Impacts Below OHW (883 S.F., 0.02 Acre)
- Riprap

SH-75, ELKHORN RD TO RIVER ST, KETCHUM
BLAINE COUNTY, IDAHO
ITD Project No. A020(003) Key No. 20033

File No. : NWW-2020-0050
Waterway: Trail Creek
Proposed Activity: Reinforced Slope
Lat.: 43.667° Long.: 114.356°

Sheet 7 of 7

SLOPE STABILIZATION	FIGURE 7	MAY 13 2024

Memo

Date:	Friday, March 08, 2024
Project:	KN 20033; SH-75, Elkhorn Rd to River St
To:	Nathan Jerke
From:	Peter Eschbacher, PE
Subject:	Retaining Wall/ Slope Stabilization Options at Trail Creek

The SH-75 Elkhorn Rd to River St project widens SH-75 north of Serenade Lane from two lanes to two lanes, a center lane, two bike lanes, and two sidewalks. Northeast of the SH-75 bridge, Trail Creek approaches SH-75 from the west at a nearly 90-degree angle, before turning north and continuing on the east side of the road. This is where Trail Creek is at its closest proximity to SH-75, and where the widened roadway section extends beyond the existing roadway limits, shifting the top of slope towards the creek. At this location, existing trees and roots provide slope stabilization for the nearly 1:1.6 (H:V) slope. The roadway widening requires that these trees be removed. Additional measures are recommended to prevent erosion and stabilize the widened roadway embankment during highwater events on Trail Creek. The affected area is approximately 90-feet long and located between Sta. 476+20 and Sta. 477+05. Additional site improvement alternatives include installing a soldier pile retaining wall, geosynthetic mat with anchor rods, or a wrapped face geosynthetic slope.

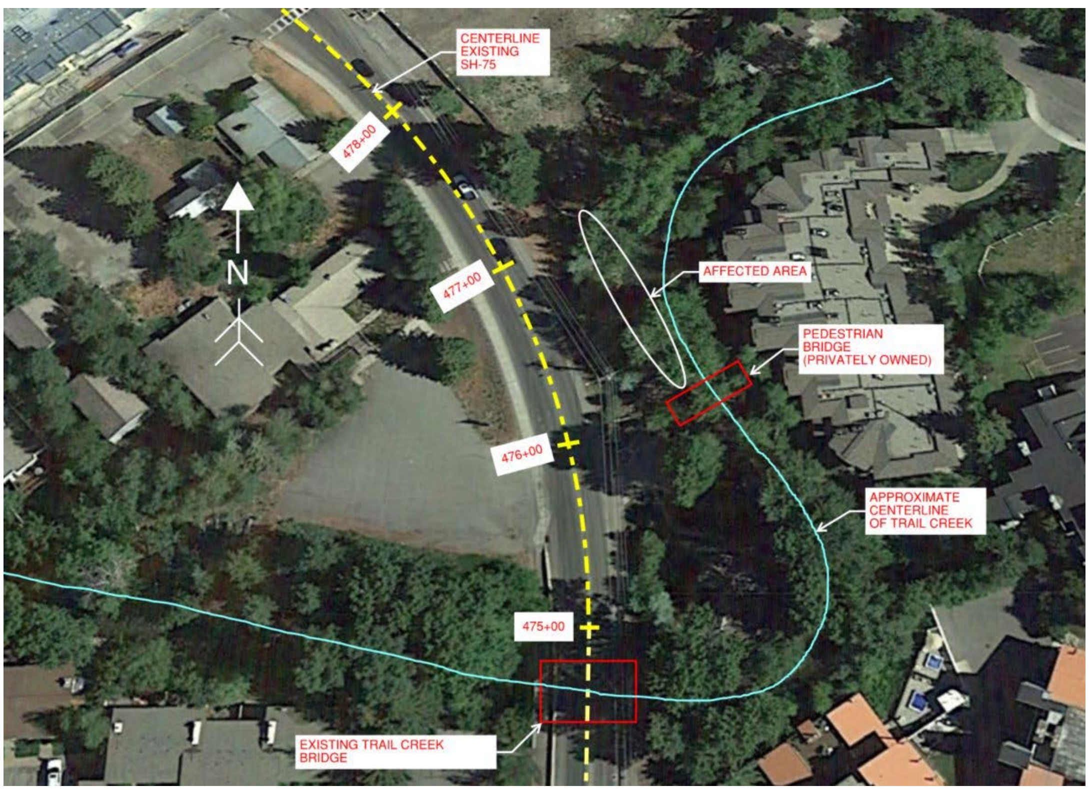


Figure 1 – Site Plan (Not to Scale)

Site Improvement Location

Recommended improvements will be located within the existing right-of-way, between the back of proposed sidewalk and Trail Creek on the east side of SH-75. The goal for this design is to stay within existing right-of-way, and not require any permanent easements, although construction easements are acceptable. Figure 1 provides a plan view with an approximate location of the proposed retaining wall or slope. The proposed retaining wall or slope will retain approximately 16 feet of fill at its highest location. There is an existing pedestrian bridge near the south end of the proposed retaining wall or slope, which can also be seen in Figure 2. The overhead power utilities shown in Figure 2 have previously been relocated.

Figure 2 - Approximate Wall or Slope Location

Alternative 1 – Soldier Pile Retaining Wall:

A soldier pile wall uses top-down construction by drilling holes, setting the piles in place in concrete, and installing concrete or timber lagging between piles. Figure 3 provides elevation and section views of an example soldier pile wall. Since the wall will be built using top-down construction, excavation on the roadway side of the wall is not required. Excavation on the creek side would be required to install timber lagging to below the low point of the creek bed. A 2:1 (H:V) slope, starting outside of the ordinary high water, would be placed in front of the wall to reduce the cantilevered length. A riprap toe would be placed on the creek side embankment to protect the wall from scour. The soldier pile wall alternative would not impact existing right-of-way but would require a temporary construction easement for riprap installation. The disadvantages of the soldier pile wall alternative are the low aesthetic value and the high unit cost. The design retained height of the wall would reach 16 feet at its highest point, which may require tiebacks. This wall would require comparatively smaller pile spacings and larger piles than the proposed soldier pile wall on SH-75 near Gem Street. The estimated construction cost for the soldier pile wall alternative is $380 per square foot of wall face area, for an estimated total of $550,000.

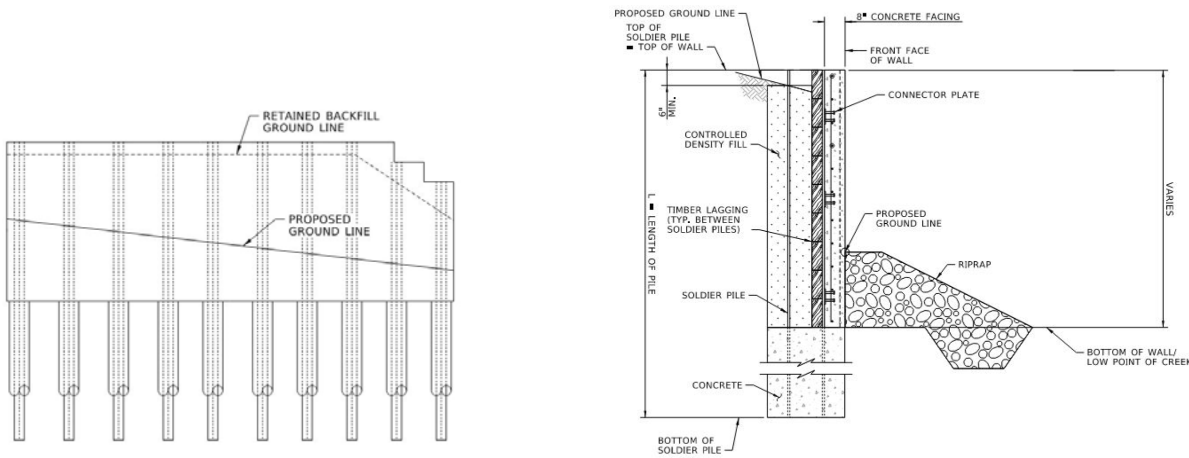


Figure 3 – Example Soldier Pile Wall Elevation & Typical Section

Alternative 2 – Geosynthetic Slope Stabilization Mat:

A geosynthetic slope stabilization mat with anchor rods consists of laying a geosynthetic mat atop a proposed slope and drilling reinforcing anchor rods into the soil beneath to allow for additional shear support to prevent soil from sliding and eroding. Figure 4 provides a section view of a geosynthetic mat with anchor rods. This alternative allows for vegetation to grow through or be planted within the geosynthetic mat, providing additional stability along the slope with a more natural look that will complement the surrounding area. See Figures 5 and 6 showing a geosynthetic mat at time of installation and matured, respectively. Irrigation is recommended until the vegetation is strongly established. A geosynthetic mat requires minimal excavation at installation when compared to other alternatives. Once the proposed slope has been cleared, graded, and compacted, the anchor rods are drilled into the proposed slope rather than excavating soil to place reinforcement within retained backfill. Limiting excavation to regrading efforts eliminates the need for temporary shoring. The maximum estimated slope of the retained soil would be ¾:1 (H:V), approximately matching the existing slope. A slope stability analysis would be required to verify the safety of this steep slope. A riprap key would be placed at the toe of the slope to protect the slope from scour. See Figure 7 for a roadway cross section. One disadvantage of this option is that it may be difficult for vegetation to be established on the steepest part of the slope, especially in arid areas. Another disadvantage is that if the slope stability analysis determines that the slope is too steep, excavation and slope reinforcement would be required. The estimated construction cost for the geosynthetic mat with anchor rods is $80 per square foot for an estimated total of $145,000.

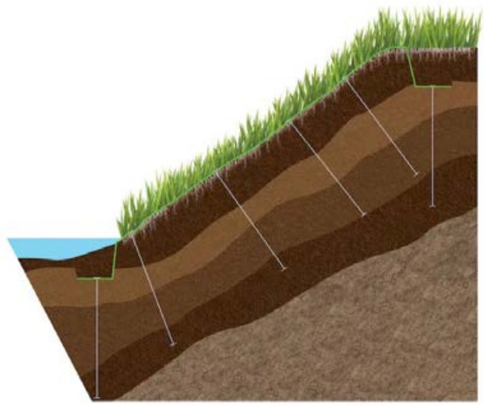


Figure 4 – Geosynthetic Mat with Anchor Rods

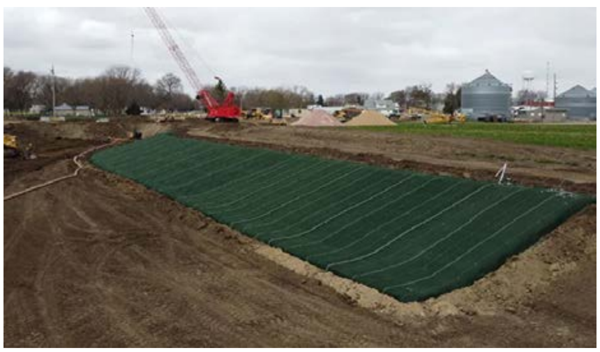


Figure 5 – Geosynthetic Mat Installed

Figure 6 – Geosynthetic Mat Matured

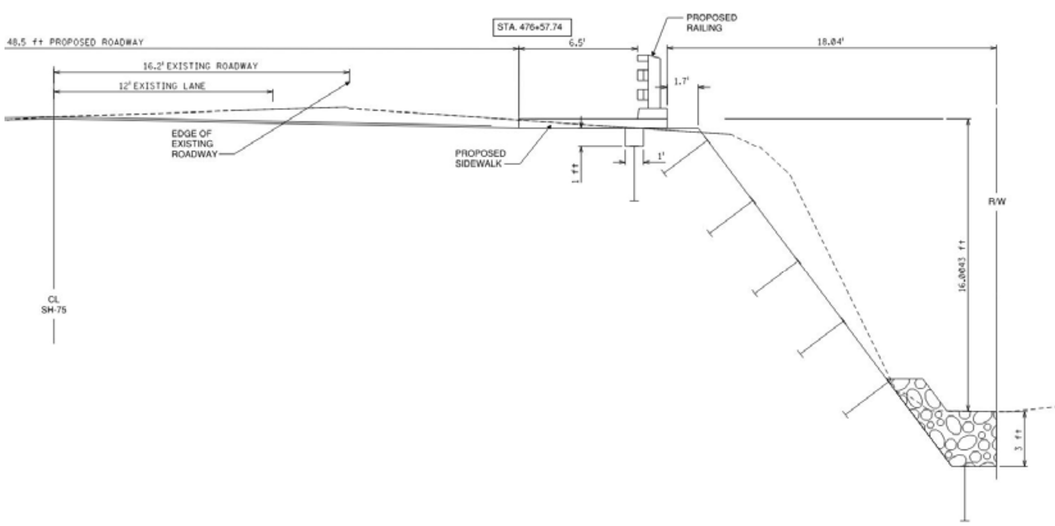


Figure 7 – Geosynthetic Mat Roadway Cross Section

Alternative 3 – Green Wrapped Face Geosynthetic Reinforced Slope

A wrapped face geosynthetic reinforced slope consists of permanent geosynthetic material that is interlaced in layers and has internal bracing, enhancing material connection and system performance. The geosynthetic material has a service life of 75 years. Figure 8 provides a section view of a wrapped face geosynthetic reinforced slope. This alternative also allows for a fully seeded face, so vegetation can grow through the geosynthetic material, providing additional stability along the slope with a more natural look that will complement the surrounding area, see Figure 9. The slope is also recommended to be built to include level benches, which would allow planting for more extensive vegetation, although it is unlikely that trees could be planted. It is recommended that willow stakes be planted on a bench above the high-water elevation, which would establish dense roots and provide further slope stability. A planting plan would be included in the specifications and would be coordinated with the City of Ketchum. Irrigation is recommended until the vegetation is strongly established. Additional primary reinforcement is required for slope heights greater than 7 feet which also requires further excavation at installation. The bottom of the slope will be set above the ordinary high water elevation to avoid regular saturation and loss of fines. This option requires excavation to install the geosynthetic reinforcement into the backfill. The reinforcement would extend horizontally 70% of the wall height (pending the stability analysis), or a minimum of 8 feet, from the front of the slope, and be excavated at a 1.5:1 (H:V) slope. This cut into the embankment would require temporary shoring for live traffic on SH-75, as it would encroach on the existing edge of pavement for a portion of the wall construction. See Figure 10 for section sketch. Temporary shoring would also be required at the approach to the pedestrian bridge. Riprap will be installed up to the bottom of the slope and a riprap key below bendway scour would be placed at the toe of the slope to protect from scour. Per discussion with GeoEngineers, the material at the base of the reinforced slope would need to be angular to provide uniform support for the reinforced zone. A combination of riprap and rock cap would likely work well in this situation. The estimated construction cost for the wrapped face geosynthetic reinforced slope alternative is $100 per square foot of slope, for an estimated total of $120,000 (including $20,000 for temporary shoring), making it cheaper than a geosynthetic mat with anchor rods, even including the temporary shoring required.

Figure 8 - Wrapped-Face Geosynthetic Reinforced Slope

Figure 9 - Wrapped-Face Geosynthetic Reinforced Slope, Installed

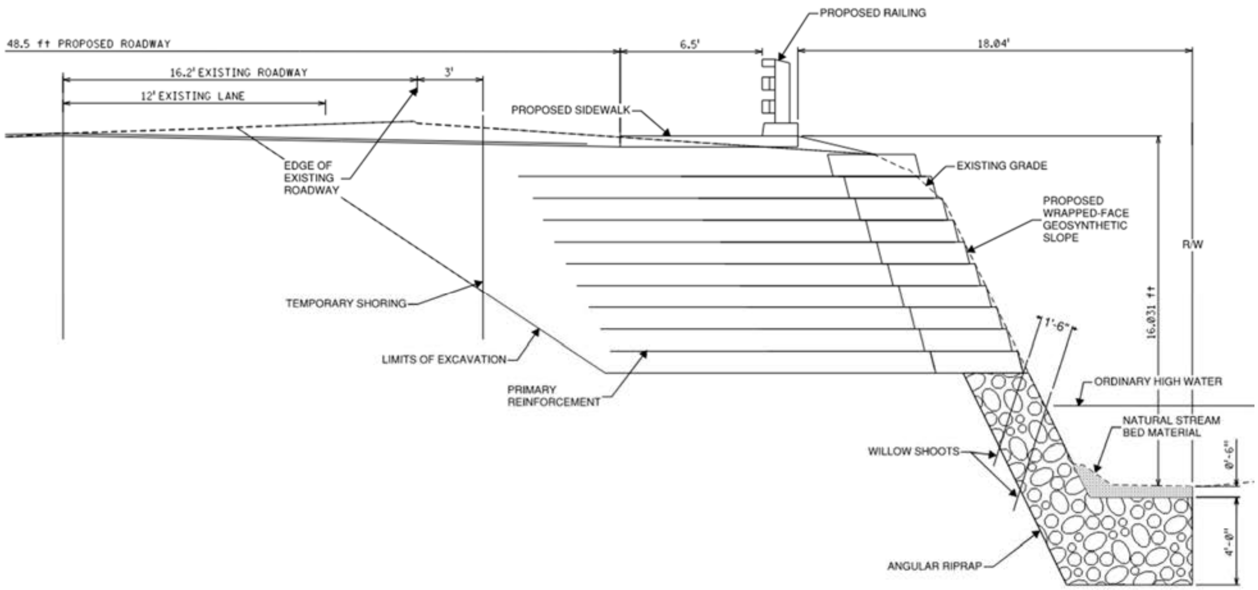


Figure 10 – Wrapped Reinforced Slope Roadway Cross Section

Recommendation

Per discussions with the City of Ketchum at the 7/19/2023 field visit, the City's preference is a green option with natural vegetation. Alternative 3, a Green Wrapped Face Geosynthetic Reinforced Slope is recommended for this site improvement along SH-75. This alternative provides a more reinforced slope that will better support a moment slab and MASH railing. Re-vegetation on a steep slope will also be more effective than the geosynthetic mat with anchor rods, with the ability to provide benches as practicable. The geosynthetic mat with anchor rods is very comparable cost wise and may be used if preferred by the City and ITD.

ALTERNATIVE COST COMPARISON		
Alternative	**Unit Cost per SF**	**Total Cost**
Alt. 1 – Soldier Pile Wall	$380	$550,000
Alt. 2 – Anchored Geosynthetic Mat	$80	$145,000
Alt. 3 – Green Wrapped Geosynthetic Reinforced Slope	$100	$120,000

Note: Costs are for structure cost comparison only, and do not include riprap or moment slab.

All alternatives will require a moment slab and MASH railing at the edge of the widened sidewalk. The edge of sidewalk is outside of the 10 ft. clear zone, but the steep slope or vertical drop presents a safety hazard for pedestrians and vehicular traffic. ITD's possible future condition could eliminate the turn lane and convert SH-75 to a four-lane section, which would place the railing within the clear zone. All alternatives also include a recommendation to add riprap along the length of the proposed improvement and in front of the west abutment of the existing pedestrian bridge. The bridge shows signs of scour and undermining, which can be seen in Figure 11. Scour countermeasures placed below ordinary highwater will need to be evaluated for project-wide environmental permitting purposes.

Figure 11 – Pedestrian Bridge & Abutment

SH 75, ELKHORN RD. TO RIVER ST., KETCHUM

Blaine County, Idaho

Wetlands Mitigation Plan for EO 11990 requirements

KEY NO. 20033

Prepared By:
Connie Jones
ITD District 4 – Senior Environmental Planner

March 27, 2023

Prepared For:
Nathan Jerke
ITD District 4 – Project Manager
Idaho Transportation Department (ITD)
216 South Date Street
Shoshone, ID
Ph: 208-886-7809
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FIGURES

LIST OF ACRONYMS AND ABBREVIATIONS

AEC	Anderson Environmental Consulting, LLC
ITD	Idaho Transportation Department
Project	SH-75 Elkhorn to River Street Project
EIS	Environmental Impact Statement
ROD	Record of Decision
MP	Mile Post
MDT	Montana Department of Transportation
USACE	United States Army Corps of Engineers
WMVC	Western Mountains Valleys and Coast

Location - The Project is located Sections 18, 19, and 30 in Township 04 North, Range 18 East, just south of the city of Ketchum on SH-75 in Blaine County, Idaho. See below**.**

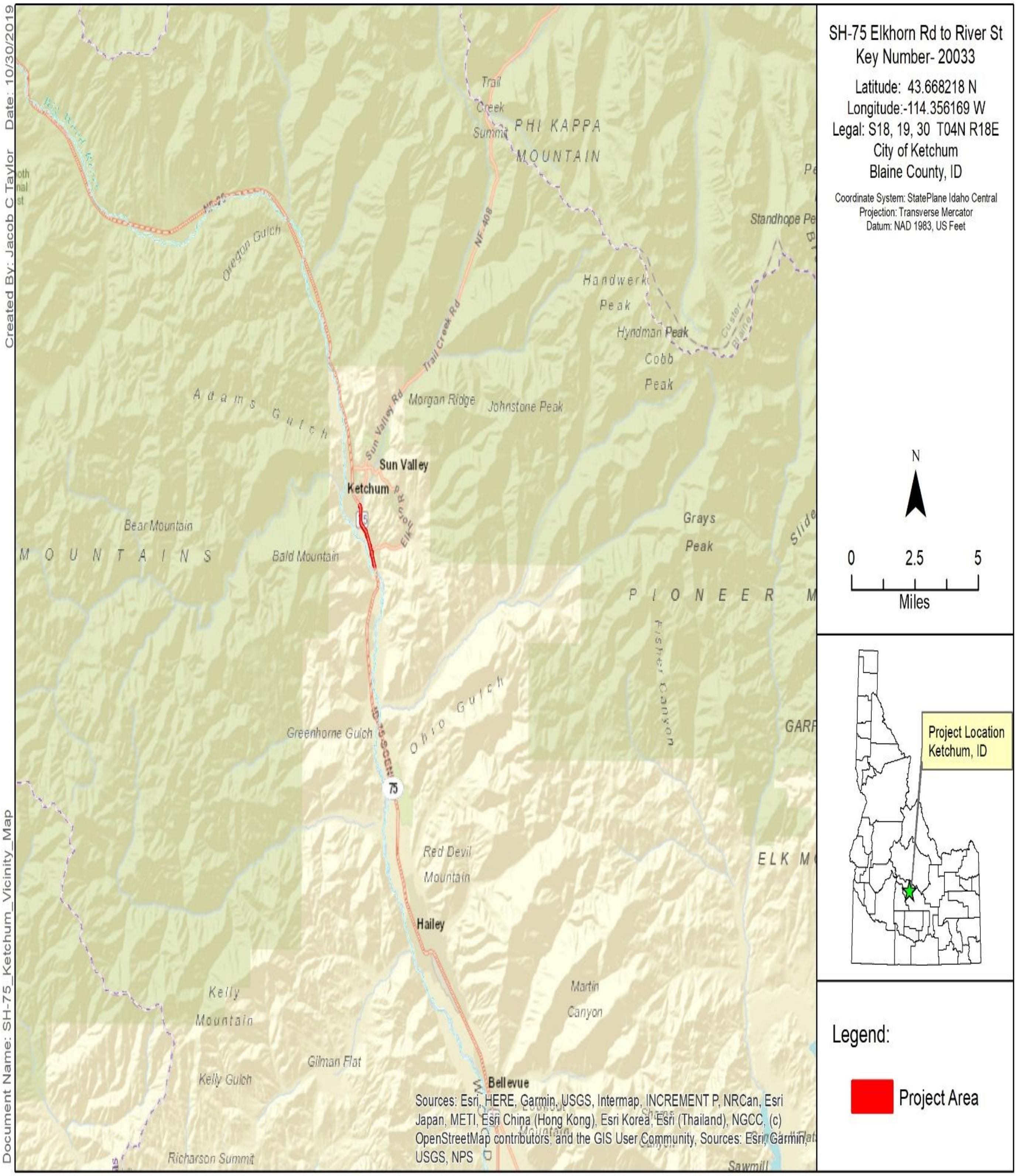


Figure 1: Vicinity Map

Project Description

This Project is the third roadway construction project to be developed from the SH-75 Timmerman to Ketchum Environmental Impact Statement (EIS)/Record of Decision (ROD) issued in August 2008. The purpose of this Project is to improve safety and capacity on SH-75 between the Big Wood River Bridge near Elkhorn Road and River Street in the City of Ketchum in Blaine County, mileposts (MP) 126.4 to 128.2. Project development will include roadway widening with curb, gutter and sidewalk, intersection improvement, retaining walls, drainage, public involvement, and replacing a box culvert over Trail Creek in Ketchum, ID.

The Project is in the Big Wood River Valley just south of the city of Ketchum, Idaho. The valley is surrounded by mountains and lies on the border between the arid west, scrub/shrub environment of southern Idaho and the western mountains, forested Rocky Mountains environments of northern Idaho. The area along the SH-75 corridor is developed and consists of residential, commercial, and some agricultural properties.

An Aquatic Resources Delineation Report was prepared by Anderson Environmental Consulting, LLC (AEC) in January of 2020. Seven wetlands were identified and delineated. See **Figure 2**. The Montana Wetland Assessment Method (MDT 2008) was used to assess the wetland categories of each wetland. This rating system differentiates wetlands based on their sensitivity to disturbance, their significance, their rarity, our ability to replace them, and the functions they provide. Wetlands are given a rating from Category I to Category IV. Category I wetlands typically have the highest functions and values and Category IV wetlands typically have the lowest.

See **Figure 2** on the following page for a map of the study area and wetlands overview.

There will be filling of three wetlands associated with this construction phase project since the highway is being rebuilt to accommodate increased traffic volumes. The do nothing alternative is not practicable because it would not correct the existing deficiency in width and the resulting safety hazards. Improvements that will not result in wetland impacts are not prudent or practicable since the highway must be widened in order to build the alternative as described in the SH-75 Timmerman to Ketchum Environmental Impact Statement (FEIS) and Record of Decision (ROD) which was approved in August 2008.

ITD’s proposal is to perform wetland restoration and enhancement within the Trail Creek local watershed on this phase of construction. To ensure that there is no net loss, a target mitigation ratio of 1.2 to 1 as recommended will be used so that if the mitigation effort is somewhat less than 100% successful, additional mitigation work will not be required to make up the difference. The current estimated impacts to existing wetlands are 2135 SF of impacts and the mitigation will be to restore 2562 SF for 1.2 times the area within the Trail Creek drainage on ITD right-of-way (R/W). The SH-75 R/W is owned by ITD.

QUALITY AND QUANTITY OF THE WETLANDS INVOLVED (Description of wetlands impacted):

Wetland A is impacted by the replacement of the structure over Trail Creek with a wider structure to carry SH-75. Wetland F is impacted by the widening of SH-75. Wetland G is impacted by the proposed storm water facility need to accommodate the drainage from SH=75. Each of these impacted wetlands is described on the following pages. See Figures 3, 4 and 5 on the following pages for a map of each of the impacted wetlands.

Document Name: SH-75 Ketchum Wetland Overview Map Created By:Jacob C Taylor Date: 10/30/2019

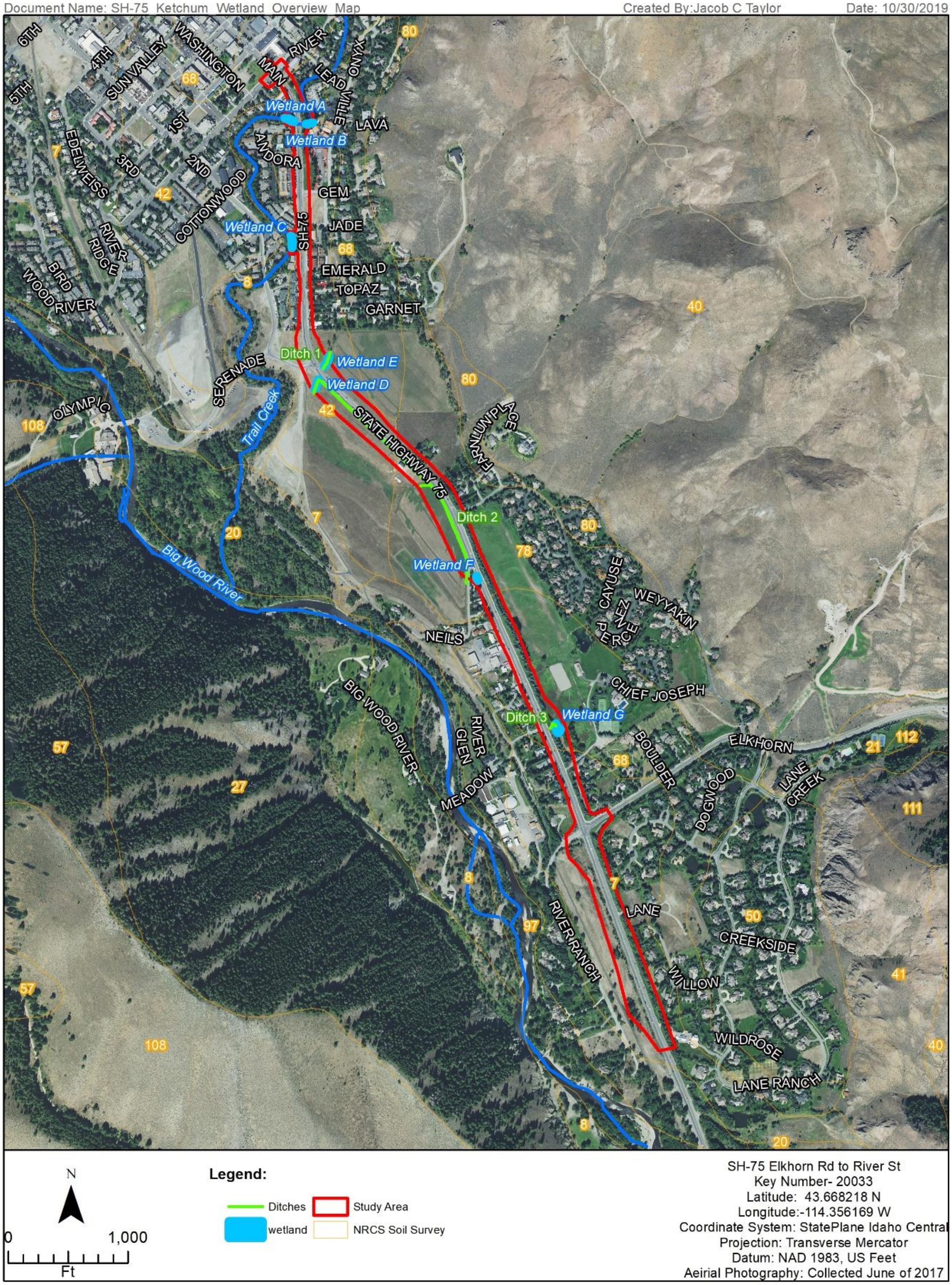


Figure 2: Weltand Overview Map

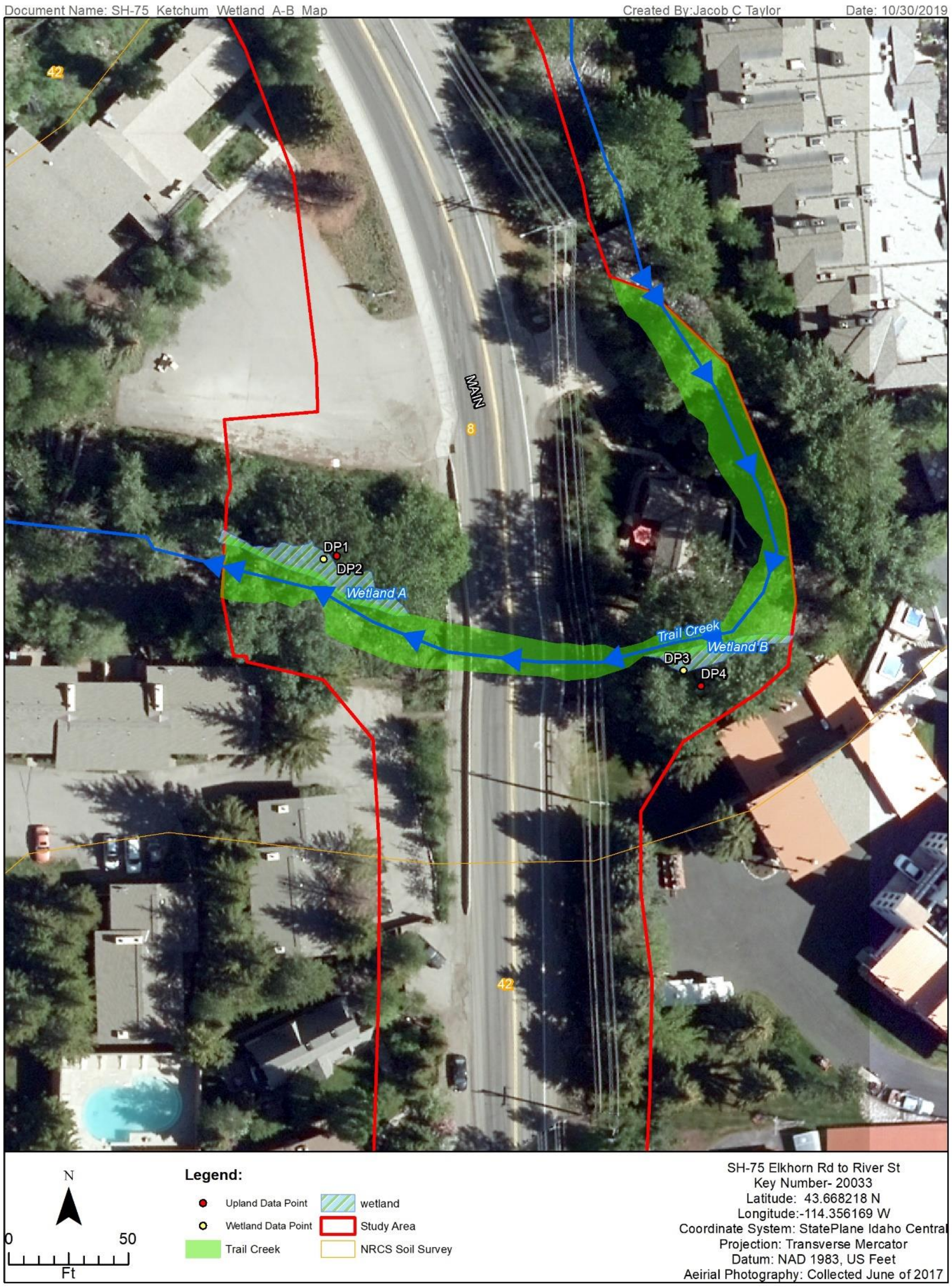


Figure 3: Wetlands A

Wetlands A is a palustrine, forested wetlands along the banks of Trail Creek and extend approximately 1-4 feet upslope from the edge of the stream. These wetlands are dominated by black cottonwood. The understory is comprised of Spike rush and Orchard grass and has approximately 70% bare ground. There are signs of seasonal flooding and alluvial shifting. This wetland is a Category III wetlands. It is rated high for sediment and shoreline stabilization. It is rated moderate for general fish habitat, short- and long-term surface water, and production export/food chain support. Trail Creek is the location for the onsite mitigation.

Figure 4: Wetland F

Wetland F is a small emergent wetland located directly adjacent to SH-75 on the slope of a landscaped berm in a residential area near MP 127.3. The wetland is seeping out of a man-made mound (5-10 feet tall) surrounded by otherwise flat ground. This hillside is landscaped and heavily irrigated and the wetland appears to receive its' hydrology from the irrigation or a leak in an irrigation line. Soils were saturated at the surface. The wetland does not appear to outlet directly to a stream or waterbody but drains to the existing ditch. Vegetation included quaking aspen saplings, cattail, reed canarygrass, lupines, Canada thistle, and Kentucky bluegrass. This wetland was rated as a Category IV. It rated high for Sediment/Nutrient/Toxicant Removal and groundwater discharge/recharge.

Figure 5: Wetland G PSS

Wetland G is a scrub-shrub wetland located at the inlet to a stormwater pond located near MP127. The stormwater system drains from a culvert flowing under SH-75, into a ditch, and then a large stormwater pond. Although there was no flowing or open water, or saturation found during the site visits, facultative wet (FACW) and obligate (OBL) species near the inlet to the stormwater pond suggested a wetland in this area. This wetland was rated as a Category IV. It rated moderately for General Wildlife Habitat, Sediment/Nutrient/Toxicant Removal and groundwater discharge/recharge.

PHOTOS

Photo PFO: Wetland A looking east

At Trail Creek, site where mitigation will take place.

Photo PFO: Wetland A looking west

At Trail Creek, site where mitigation will take place.

Photo PEM: Wetland F looking south

seeping out of a man-made mound (5-10 feet tall) surrounded by otherwise flat ground.

Photo PSS: Wetland G looking north

scrub-shrub wetland located at the inlet to a stormwater pond near MP 127 SH-75.

<u>Details of how mitigation will be achieved;</u>

ITD D4 proposes to provide compensatory mitigation for permanent impacts lo wetlands and open waters of the U.S. to be achieved by removing the existing structure and restoring a more natural stream channel for Trail Creek. Mitigation for permanent wetland impacts will occur by taking out the existing structure and then restoring the channel and stream banks. The existing structure is reinforced concrete stiffleg bridge with a clear span of 20 feet and width (parallel to creek) of 48 feet. The proposed structure would be a prestressed, concrete-voided, slab bridge with a clear span of 52 feet and a width of approximately 62 feet. The new bridge is designed such that the low chord will be higher than the existing bridge's low chords. The mitigation provided for temporary impacts to wetlands will consist of revegetating those wetlands with native wetland species.

Benefits to the more natural riparian area are:

1) The small wildlife passage benches will be constructed with native materials with a ¾ inch base cover on top of riprap.

2) Substrate within the proposed channel would be cobble similar to existing.

3) The disturbance area outside of proposed riprap will be planted with native riparian shrubs, which would include black cottonwood (Populus trichocarpa) and coyote willow (Salix exigua) within approximately 5-ft of the OHWM and quaking aspen (Populus tremuloides) and wood's rose (Rosa woodsia) beyond that. D4 would require 2 gallon pots for the Woods Rose and Quaking aspen to increase the chances of survival.

Existing Conditions:

The existing structure is a reinforced concrete stiffleg bridge with a clear span of 20 feet and width (parallel to creek) of 48 feet. The channel at above and below the bridge is incised with side slopes generally ranging from 1V:2H to 1V:3H. The creek bottom has a substrate of primarily cobble and small boulders, with some alluvial sand deposits along the banks and on the point bar upstream of the bridge. Existing banks are stabilized by tree roots and riprap (D50[1] between 0.5 and 1.0 ft.) placed above the ordinary high-water mark (OHWM) upstream and downstream of the bridge.

Proposed Conditions:

The proposed structure would be a prestressed, concrete-voided, slab bridge with a clear span of 52 feet and a width of approximately 62 feet. The bridge is designed such that the low chord clears the Q_{100} and will be over 2 ft. higher than the Q_{50} water surface elevation. A 3-ft horizontal bench will be constructed at the face of each abutment. Below these benches, a 2V:1H slope constructed out of riprap (D_{50} of 1.5 ft.) placed to a depth of 3-ft. and on top of riprap/erosion control geotextile will extend down to another 3-ft horizontal bench just above the OHWM (as defined in the Aquatic Resource Delineation Report) for wildlife passage of small mammals. The wildlife passage benches will be constructed with native materials with a ¾ inch base cover on top of riprap. Additionally, riprap will be installed along the abutment embankment for approximately 10 feet upstream and downstream of the bridge. Substrate within the proposed channel would be cobble similar to existing.

The disturbance area outside of proposed riprap will be planted with riparian shrubs, which may include black cottonwood (*Populus trichocarpa*) and coyote willow (*Salix exigua*) within approximately 5-ft of the OHWM and quaking aspen (*Populus tremuloides*) and wood's rose (*Rosa woodsia*) beyond that.

Construction Sequencing:

The Bridge will be constructed in two stages. Work within the OHWM will be within the IDFG and Idaho Department of Water Resources (IDWR) approved work window between July 15 and March 15. General construction sequencing will be determined by the contractor but is anticipated to be as follows.

- Install erosion and sediment control and spill control measures which may include silt fencing, straw waddles, and other standard best management practices
- Place temporary stream diversion measures and dewater work area. Remove any fish present in dewatered areas and release them downstream using approved methods.
- Remove portion of existing bridge using approved containment methods to ensure no debris enters the water
- Excavate streambank and channel
- Construct new abutments. Proposed substructure will be located outside the OHWM
- Place geotextile, riprap, and streambed materials and construct benches
- Construct new bridge superstructure
- Install topsoil, plantings and seed as applicable to disturbed areas
- Remove all temporary erosion and sediment control BMP's once site is stabilized

Short-Term Effects:

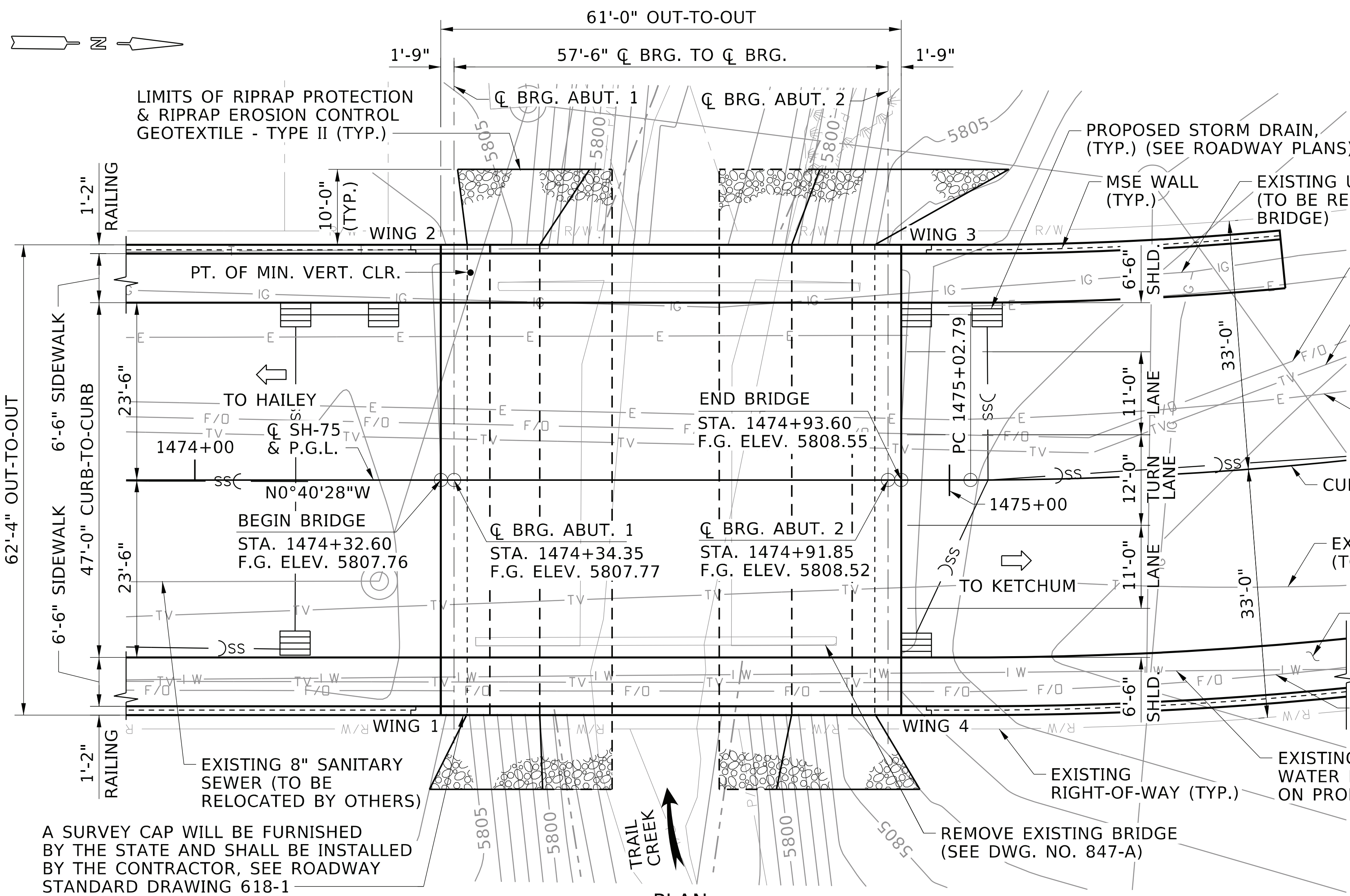
Short-term construction impacts will include potential erosion and sedimentation on disturbed soils adjacent to creek. Removal of vegetation and construction work activities may impact riparian wildlife habitat and movement through the Project area. In-water work may disturb aquatic organisms and stress fish present during construction.

Construction stormwater will be treated through the use of standard BMPs for erosion, sedimentation and spills which will be outlined in Storm Water Pollution Prevention Plan (SWPPP). BMPs may include limiting soil disturbance, controlling dust through watering, soil stabilization through revegetation, use of silt fences, and wattles, having spill kits on site, proper chemical storage and proper waste disposal.

Dewatering methods have not been approved at this time but will likely include sandbags or another temporary shoring method. A qualified Biologist will capture and remove fish from the dewatered work area if needed. Equipment will operate from the banks or existing roadway and will not enter the water.

Long-Term Effects:
The Project will have a long-term benefit to wildlife in the area by increasing water conveyance capacity and floodplain function and improving fish passage and habitat. The wider clear span and benches will allow better movement of small mammals through the Project area. Revegetation with native poplars and willows will provide habitat, shade, and erosion control in the long-term.

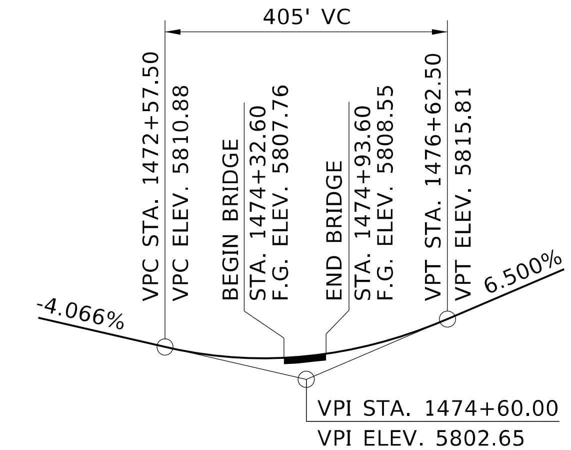
Attachments:
Bridge exhibit
Planting Plan exhibit



PLAN
1"=20'-0"

HYDRAULIC DATA

FLOOD	DISCHARGE	H.W. ELEV.	VELOCITY
DESIGN (Q_{50})	900 cfs	5801.63 ft.	5.62 fps
BASE (Q_{100})	1020 cfs	5801.95 ft.	5.88 fps
SCOUR (Q_{SC})	1300 cfs	5802.62 ft.	6.40 fps



PROFILE DATA - ℄ SH-75
NTS

HORIZONTAL ALIGNMENT CURVE DATA

℄ SH-75

CURVE 6

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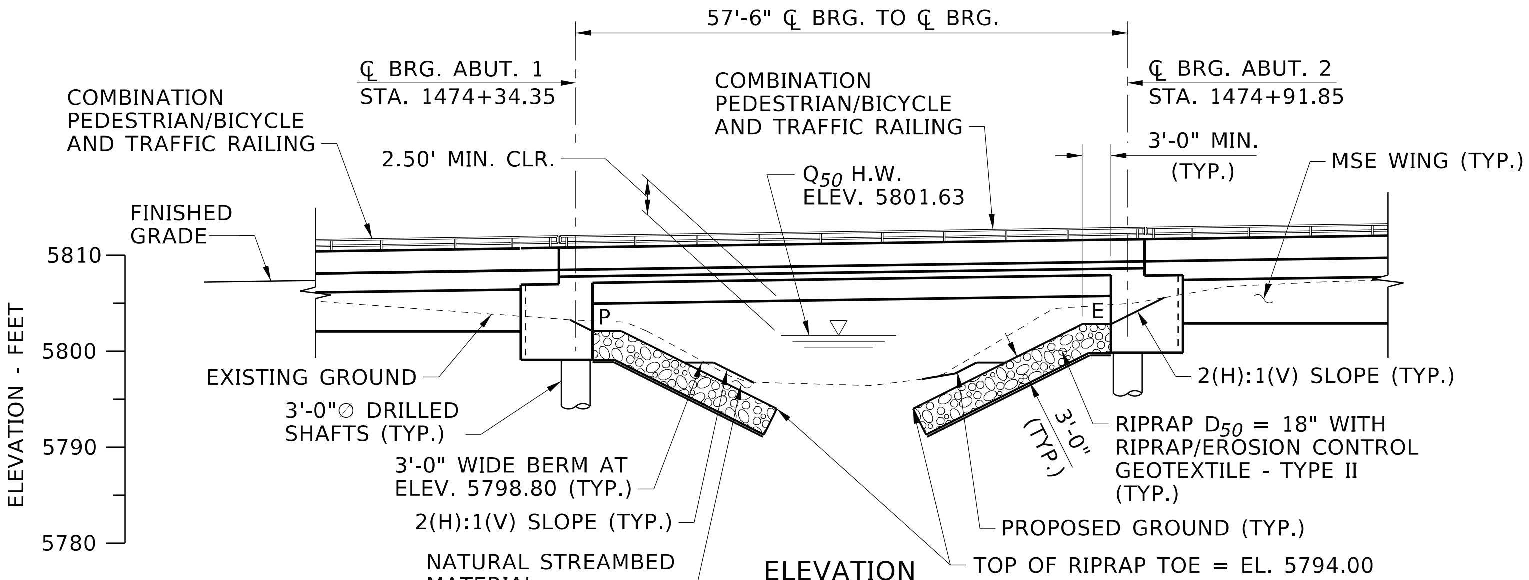
T=188.89'
L=359.75'
R=477.50'
S=2%



ELEVATION
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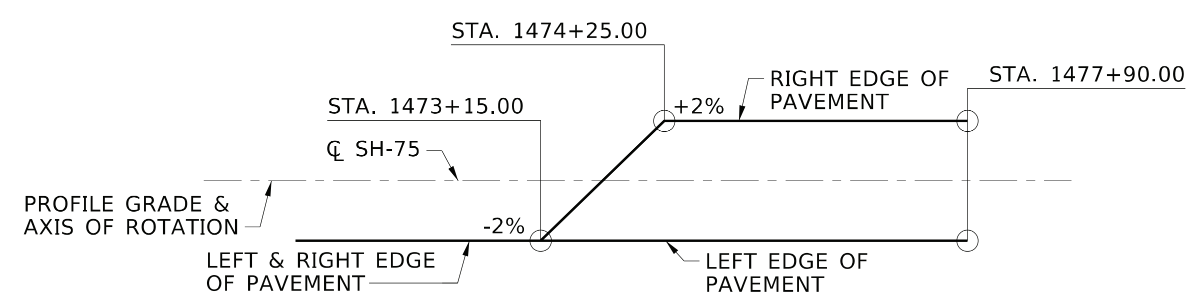

SUPERELEVATION DIAGRAM - SH-75
NTS

ORIGINAL SIGNED BY:

NOT APPROVED PRELIMINARY FOR CONSTRUCTION

DATE SIGNED: DATE

REVISIONS			
NO.	DATE	BY	DESCRIPTION
△			
△			
△			
△			
△			

DESIGNED S. DANIEL
DESIGN CHECKED M. SLEGERS
DETAILED S. WALIMAA
DWG. CHECKED M. SLEGERS
CORRECTIONS

SCALES SHOWN ARE FOR 11" X 17" PRINTS ONLY
CADD FILE NAME
DX\prj\XXXXX\ProjDev\Bridge\Plans 20033brSI_001.dgn
DRAWING DATE: FEBRUARY 2022

IDAHO TRANSPORTATION DEPARTMENT
YOUR Safety→YOUR Mobility→YOUR Economic Opportunity
HDR

ENGLISH
PROJECT NO.
A020(033)

SITUATION AND LAYOUT
61' PRESTRESSED VOIDED SLAB BRIDGE
SH-75 OVER TRAIL CREEK
STA. 1474+63.10

BRIDGE PLANS
BRIDGE KEY NO. 17676
COUNTY BLAINE
KEY NO. 20033
BRIDGE DWG. NO. 18076
SHEET 1 OF 11

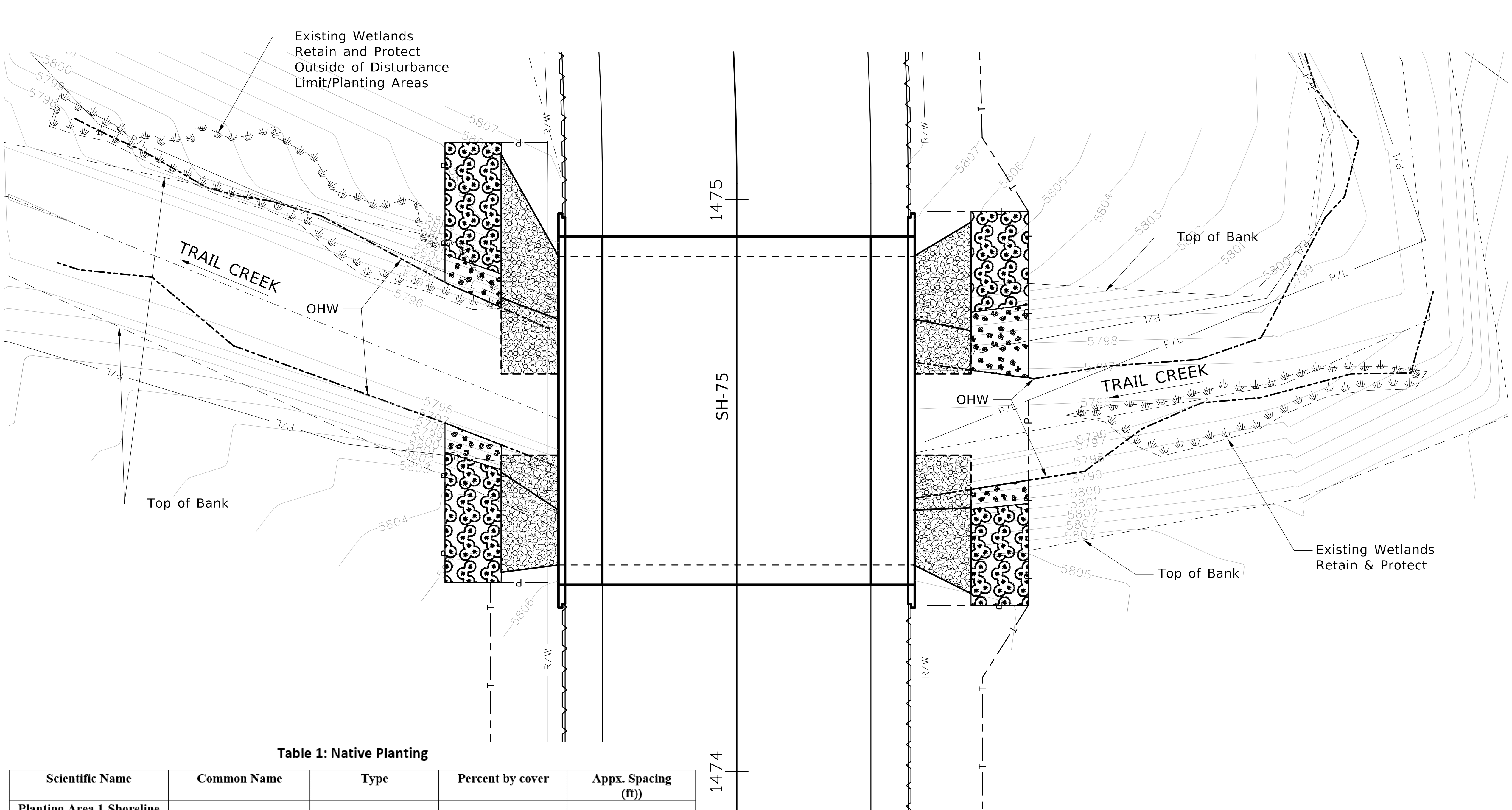

Table 1: Native Planting

Scientific Name	Common Name	Type	Percent by cover	Appx. Spacing (ft))
Planting Area 1-Shoreline				
Populus trichocarpa	Black Cottonwood	live stakes/poles	50	10
Salix exigua	Coyote Willow	live stakes/poles	50	5
Total Zone 1-Shoreline			**100**	
Planting Area 2-Riparian-Upland				
Populus tremuloides	Quaking Aspen	1-2-gallon or bareroot	50	8
Rosa Woodsii	Woods Rose	1-2-gallon or bareroot	50	8
Total Zone 2-Riparian			**100**	

****Planting Area 1**- Within 5-10 ft of the stream (Roots should reach below the water table), **Planting Area 2**- Upslope from Planting Area 1*

Construction Notes:

- Live stakes/pole plantings to appx. 24-36" and buried so that the bottom of the stakes/poles are below the OHWM of Trail Creek. Should be buried with shoots upward and at least ¾ of the pole should be buried.
- Plants should be placed at a recommended spacing of and clustered with like species as possible

LEGEND

- Zone 1 Planting Area (Shoreline) With Riparian Seeding
- Zone 2 Planting Area (Riparian) With Riparian Seeding
- Riprap areas

Scale (Feet)
10 0 10 20

NOT APPROVED FOR CONSTRUCTION
PRELIMINARY

REVISIONS			
NO	DATE	BY	DESCRIPTION

DESIGNED JLJ
DESIGN CHECKED TMJ
DETAILED TM
DRAWING CHECKED JLJ

SCALES SHOWN ARE FOR 11" X 17" PRINTS ONLY
CADD FILE NAME 20033_land_001.dgn
DRAWING DATE: February 2022

IDAHO TRANSPORTATION DEPARTMENT
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Parametrix

PROJECT NO. A020(033)

TRAIL CREEK PLANTING PLAN
SH-75, ELKHORN RD TO RIVER ST, KETCHUM

ENGLISH
COUNTY Blaine
KEY NUMBER 20033
SHEET 200 OF 249

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REFERENCES

AEC. 2020. Aquatic Resources Delineation Report SH-75 Elkhorn Road To River Street Key No. 20033. 02/26/2020

AEC. 2020. Wetland Functional Assessment Report SH-75 Elkhorn Road to River Street Key No. 20033. 03/30/2020

AEC. 2022. Memo – Trail Creek Bridge Description of existing and proposed Trail Creek bridge crossing 08/18/2022

HDR. 2021. SH-75 Trail Creek Bridge. Hydraulic Report. April 28, 2021

DEPARTMENT OF THE ARMY
U.S. ARMY CORPS OF ENGINEERS
BOISE REGULATORY OFFICE
720 EAST PARK BOULEVARD, SUITE 245
BOISE, IDAHO 83712-7757

September 17, 2024

WALLA WALLA DISTRICT
REGULATORY DIVISION

SUBJECT: NWW-2024-00333, SH-75, Elkhorn Road to River Street Road Improvements

Idaho Transportation Department, District 4 (POC Jesse Barrus)
216 South Date Street
Shoshone, Idaho 83352-1521

Dear Mr. Barrus:

We have determined that your proposed project, SH-75, Elkhorn Road to River Street, is authorized in accordance with Department of the Army (DA) **Nationwide Permit (NWP) No. 14: Linear Transportation Projects**. This project is located along State Highway 75 from mile post 126.4 to mile post 128.2, within Sections 18, 19, and 30 of Township 4 North, Range 18 East, near coordinates 43.667041º N latitude and -114.355657º W longitude, near Ketchum, Blaine County, Idaho. Please refer to File Number NWW-2024-00333 in all future correspondence with our office regarding this project.

Project activities include the discharge of approximately 376 cubic yards of fill into Trail Creek, 3 unnamed ditches, and adjacent wetlands. Activities are associated with road widening and bridge replacement in order to improve safety and compacity of State Highway 75 between Elkhorn Road and River Street in the City of Ketchum. The work within Trail Creek and adjacent wetlands entails the replacement of the existing bridge, the replacement of rip rap, and excavation and grading of the stream bank. Additional work includes the installation of a concrete irrigation box and headwalls, modification of an existing storm water retention pond, and the replacement of four irrigation culverts. Activities will permanently impact 0.0436 acres of wetlands, 0.0296 acres of streambed, and 207 linear feet of ditches. Activities will also temporarily impact 0.020 acres of stream bed for the utilization of cofferdams. All work shall be done in accordance with the enclosed drawings, titled: *SH-75, ELKHORN RD TO RIVER ST, KETCHUM (figure 2-7), dated, May 13, 2024.*

DA permit authorization is necessary because your project may involve the discharge of fill material into waters of the U.S. This authorization is outlined in Section 404 of the Clean Water Act (33 U.S.C. 1344).

You must comply with all general, regional, and special conditions for this verification letter to remain valid and to avoid possible enforcement actions. The general and regional permit conditions for *NWP No. 14: Linear Transportation Projects* are attached and also available online[1]. In addition, you must also comply with the special conditions listed below.

The following Special Conditions include:

Special Condition: The permittee is responsible for all work done by any contractor. Permittee shall ensure any contractor who performs the work is informed of and follows all the terms and conditions of this authorization. Permittee shall also ensure these terms and conditions are incorporated into engineering plans and contract specifications.

You must also comply with the conditions detailed in the attached Section 401 Water Quality Certification (WQC) issued for this project on July 29, 2024, by the Idaho Department of Environmental Quality (IDEQ). If you have any questions regarding the conditions set forth in the WQC, please contact IDEQ directly at 208-736-2190, Twin Falls Regional Office..

Nationwide Permit General Condition 30 (Compliance Certification) requires that every permittee who has received NWP verification must submit a signed certification regarding the completed work and any required mitigation. This Compliance Certification form is enclosed for your convenience and must be completed and returned to us within 30 days of your project's completion.

This letter of authorization does not convey any property rights, or any exclusive privileges and does not authorize any injury to property or excuse you from compliance with other Federal, State, or local statutes, ordinances, regulations, or requirements which may affect this work.

This verification is valid until **March 14, 2026**, unless the NWP is modified, suspended or revoked. If your project, as permitted under this NWP verification, is modified in any way you must contact our office prior to commencing any work activities. In the event that you have not completed construction of your project by March 14, 2026, please contact us at least 60-days prior to this date. A new application and verification may be required.

[1] http://www.nww.usace.army.mil/Business-With-Us/Regulatory-Division/Nationwide-Permits/

We actively use feedback to improve our delivery and provide you with the best possible service. If you would like to provide feedback, please take our online survey[2]. If you have questions or if you would like a paper copy of the survey, please contact the Walla Walla District Regulatory. For more information about the Walla Walla District Regulatory program, you can visit us online[3].

If you have any questions or need additional information about this permit authorization, you can contact Jacob Cordtz by phone at 208-433-4466, by mail at the address in the letterhead, or email at Jacob.W.Cordtz@usace.army.mil. For informational purposes, a copy of this letter has been sent to: Idaho Department of Environmental Quality and Idaho Department of Water Resources.

Sincerely,

Tracy Peak

Tracy Peak
Acting Chief, Regulatory Division

Encls
- Transfer of Nationwide Permit Form
- Compliance Certification
- Nationwide Permit 14 Terms & Conditions
- Individual Water Quality Certification
- Drawings titled: *SH-75, ELKHORN RD TO RIVER ST, KETCHUM (figure2-7), dated, May 13, 2024.*

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[2] https://regulatory.ops.usace.army.mil/customer-service-survey/
[3] http://www.nww.usace.army.mil/Business-With-Us/Regulatory-Division/

TRANSFER OF NATIONWIDE PERMIT

When the structures or work authorized by this Nationwide Permit, **NWW-2024-00333, SH-75, Elkhorn Road to River Street Road Improvements**, are still in existence at the time the property is transferred. The terms and conditions of this Nationwide Permit, including any special conditions, will continue to be binding on the new owner(s) of the property. To validate the transfer of this Nationwide Permit, the associated liabilities and compliance with the terms and conditions the transferee must sign and date below.

Name of New Owner:

Street Address:

Mailing Address:

City, State, Zip:

Phone Number:

____________________________________ __________________________

Signature of TRANSFEREE *DATE*

COMPLIANCE CERTIFICATION

US Army Corps of Engineers
Walla Walla District

Permit Number: NWW-2024-00333

Name of Permittee: Idaho Transportation Department, District 4

Date of Issuance: September 17, 2024

Upon completion of the activity authorized by this permit and any mitigation required by the permit, please sign this certification and return it to the following address:

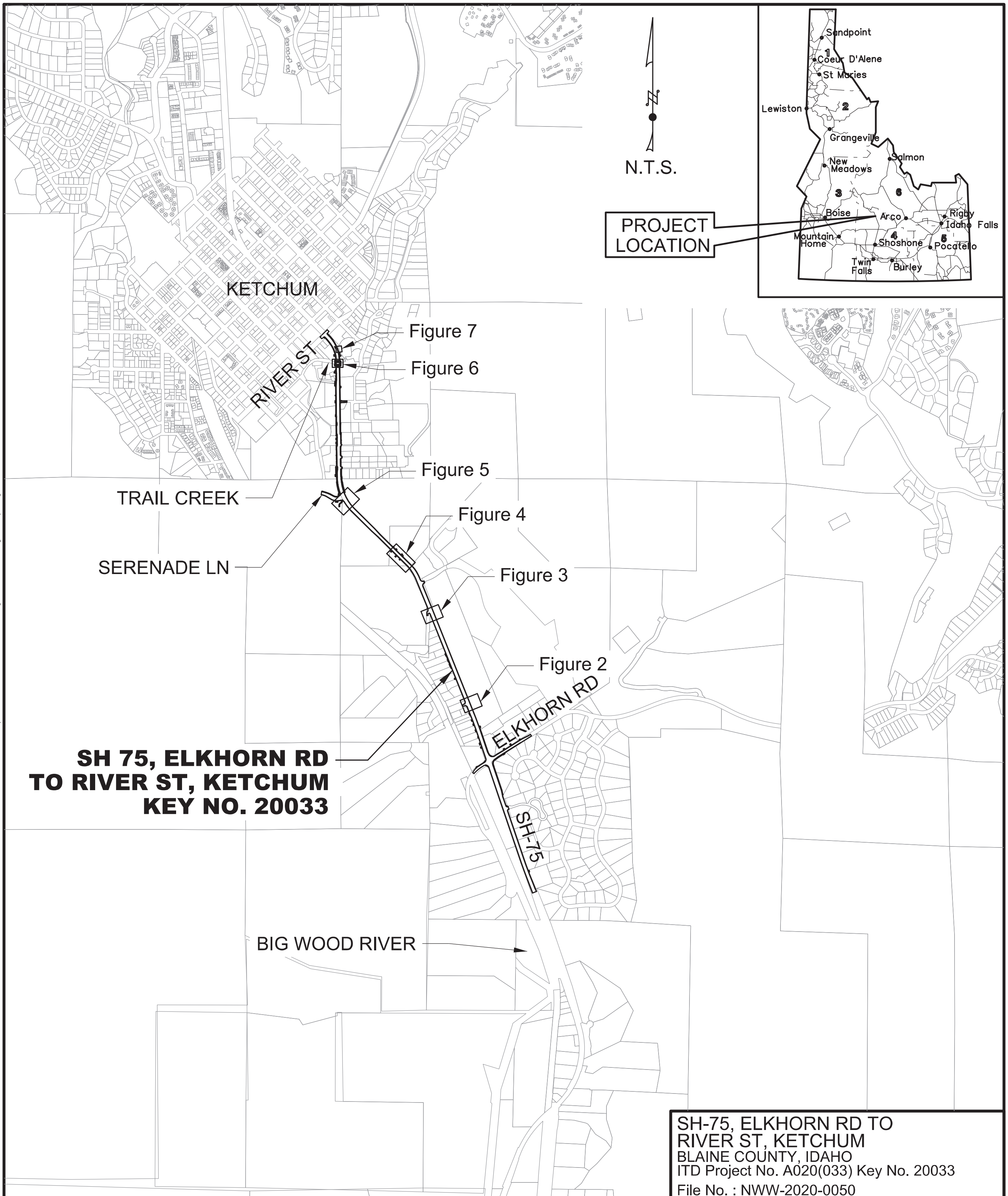
U.S. Army Corps of Engineers
Walla Walla District
Boise Regulatory Office
720 East Park Blvd., Suite 245
Boise, Idaho 83712-7757

Please note that your permitted activity is subject to a compliance inspection by a U.S. Army Corps of Engineers representative. If you fail to comply with all terms and conditions of this permit, the permit is subject to suspension, modification, or revocation and you are subject to an enforcement action by this office.

I hereby certify that the work authorized by the above-referenced permit has been completed in accordance with the terms and conditions of the said permit. The required mitigation was also completed in accordance with the permit conditions.

______________________________ ____________________

Signature of PERMITEE *DATE*

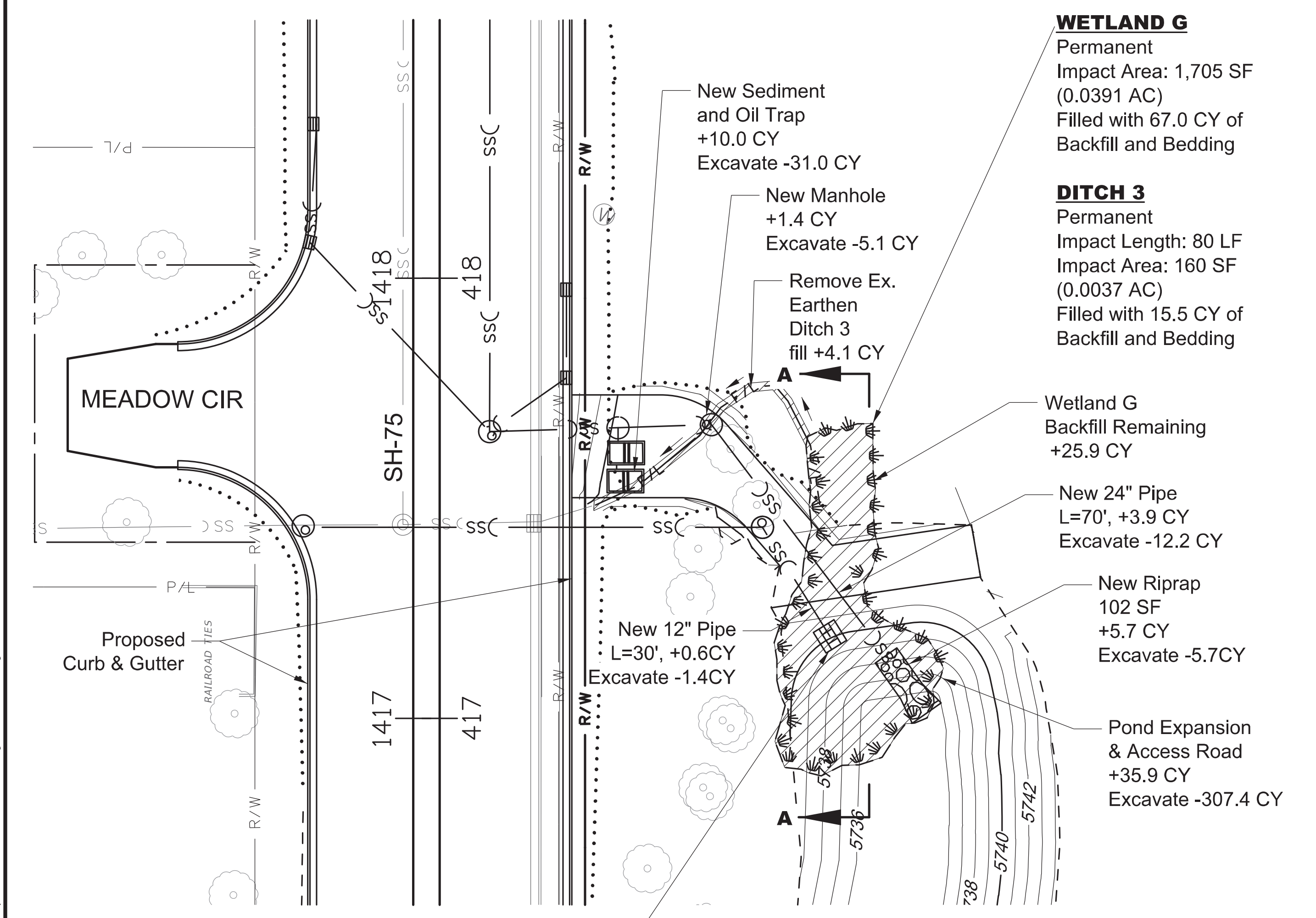


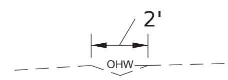
SH 75, ELKHORN RD TO RIVER ST, KETCHUM KEY NO. 20033

SH-75, ELKHORN RD TO RIVER ST, KETCHUM
BLAINE COUNTY, IDAHO
ITD Project No. A020(033) Key No. 20033
File No. : NWW-2020-0050

VICINITY MAP	FIGURE 1	MAY 13 2024	Sheet 1 of 7

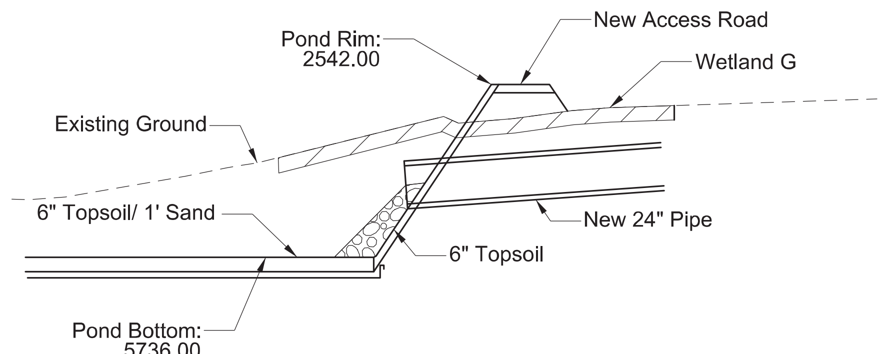
U:\Bois\Projects\Clients\4006-ITD\314-4006-07\SH-75 Elkhorn to River\99Svcs\CADD\DGN\404 permit\20033_404_Fig 01_Vicinity Map.dgn 5/14/2024 6:03:46 PM





DITCH 3

SCALE: 1"=40'



SECTION A-A

LEGEND

- Existing Pipe
- F/L — Existing Ditch
-)SS — Existing Storm Sewer
-)SS — Proposed Storm Sewer
-)IRR — Proposed Irrigation Pipe
- Wetland Boundary
- R/W — Existing Right-of-Way
- P/L — Property Line
- R/W — Acquired ITD Right-of-Way

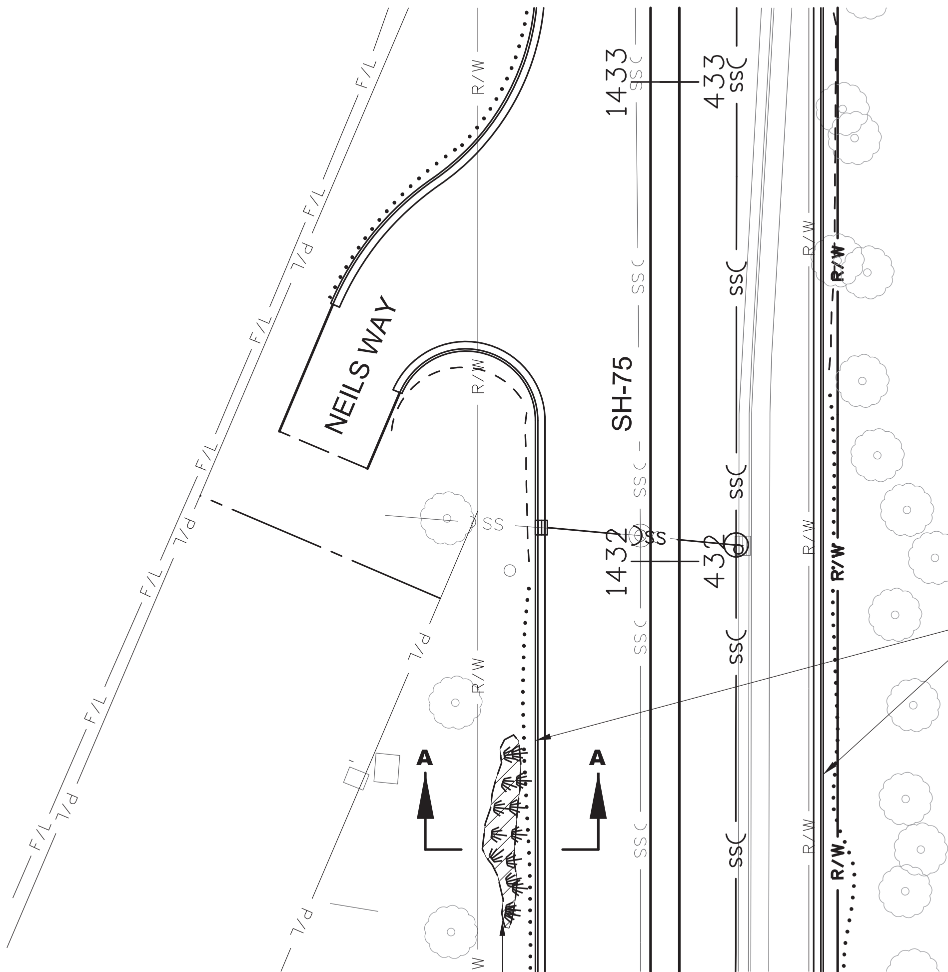
SH-75, ELKHORN RD TO
RIVER ST, KETCHUM
BLAINE COUNTY, IDAHO
ITD Project No. A020(033) Key No. 20033
File No. : NWW-2020-0050
Waterway: DITCH 3 & WETLAND G
Proposed Activity:Pond Expansion & Storm Drain
Lat.: 43.667° N Long.: 114.356° W

Sheet 2 of 7

DITCH 3 & WETLAND G	FIGURE 2	MAY 13 2024

U:\Bois\Projects\Clients\4006-ITD\314-4006-071SH-75 Elkhorn to River\99Svcs\CADD\DGN\404 permit\20033_404_Fig 02_WL G.dgn 5/14/2024 6:03:57 PM

U:\Bois\Projects\Clients\4006-ITD\314-4006-071SH-75 Elkhorn to River\99Svcs\CADD\DGN\404 permit\20033_404_Fig 03_WL F.dgn   5/14/2024   6:04:04 PM

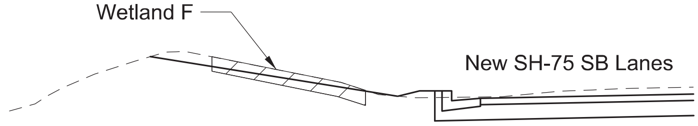


Proposed
Curb & Gutter

Wetland F
180 SF, +10.0 CY
Excavate -10.0 CY

WETLAND F
Permanent
Impact Area: 180 SF
(0.0041 AC)
Filled with 10.0 CY of
Backfill and Bedding

SCALE: 1"=40'

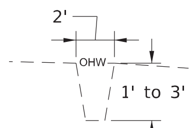


SECTION A-A

LEGEND

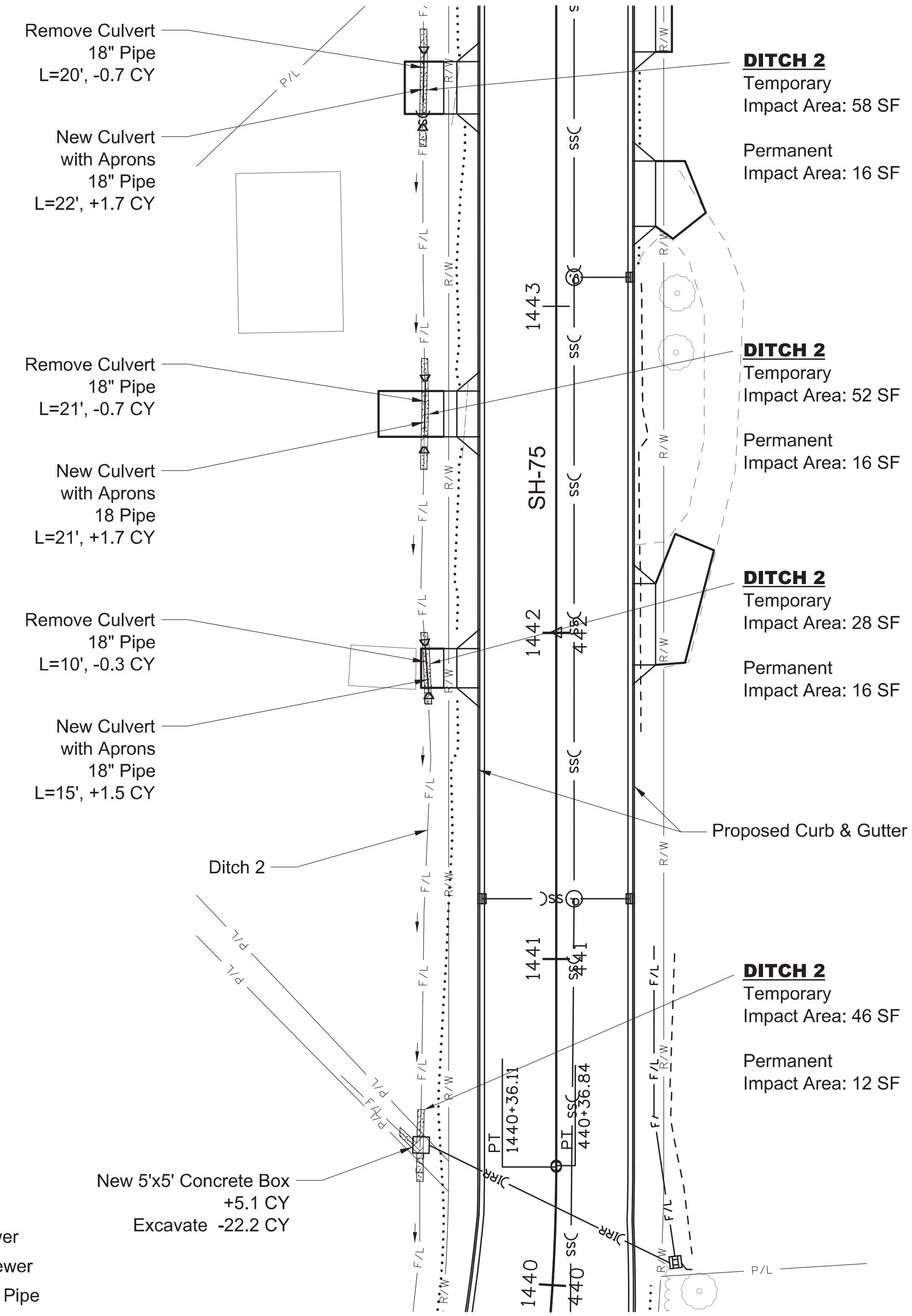
- Existing Pipe
- F/L — Existing Ditch
-)SS — Existing Storm Sewer
-)SS — Proposed Storm Sewer
-)IRR — Prposed Irrigation Pipe
- Wetland Boundary
- R/W — Existing Right-of-Way
- P/L — Property Line
- R/W — Acquired ITD Right-of-Way

WETLAND F	**FIGURE 3**	**MAY 13 2024**	SH-75, ELKHORN RD TO RIVER ST, KETCHUM BLAINE COUNTY, IDAHO ITD Project No. A020(033) Key No. 20033 File No. : NWW-2020-0050 Waterway: WETLAND F Proposed Activity:Roadway Construction Lat.: 43.667° N Long.: 114.356° W Sheet 3 of 7



DITCH 2 TOTALS
Temporary
Impact Length: 92 LF
Impact Area: 184 SF

Permanent
Impact Length: 30 LF
Impact Area: 60 SF
(0.0014 AC)
Filled with 10.0 CY of
Backfill and Bedding



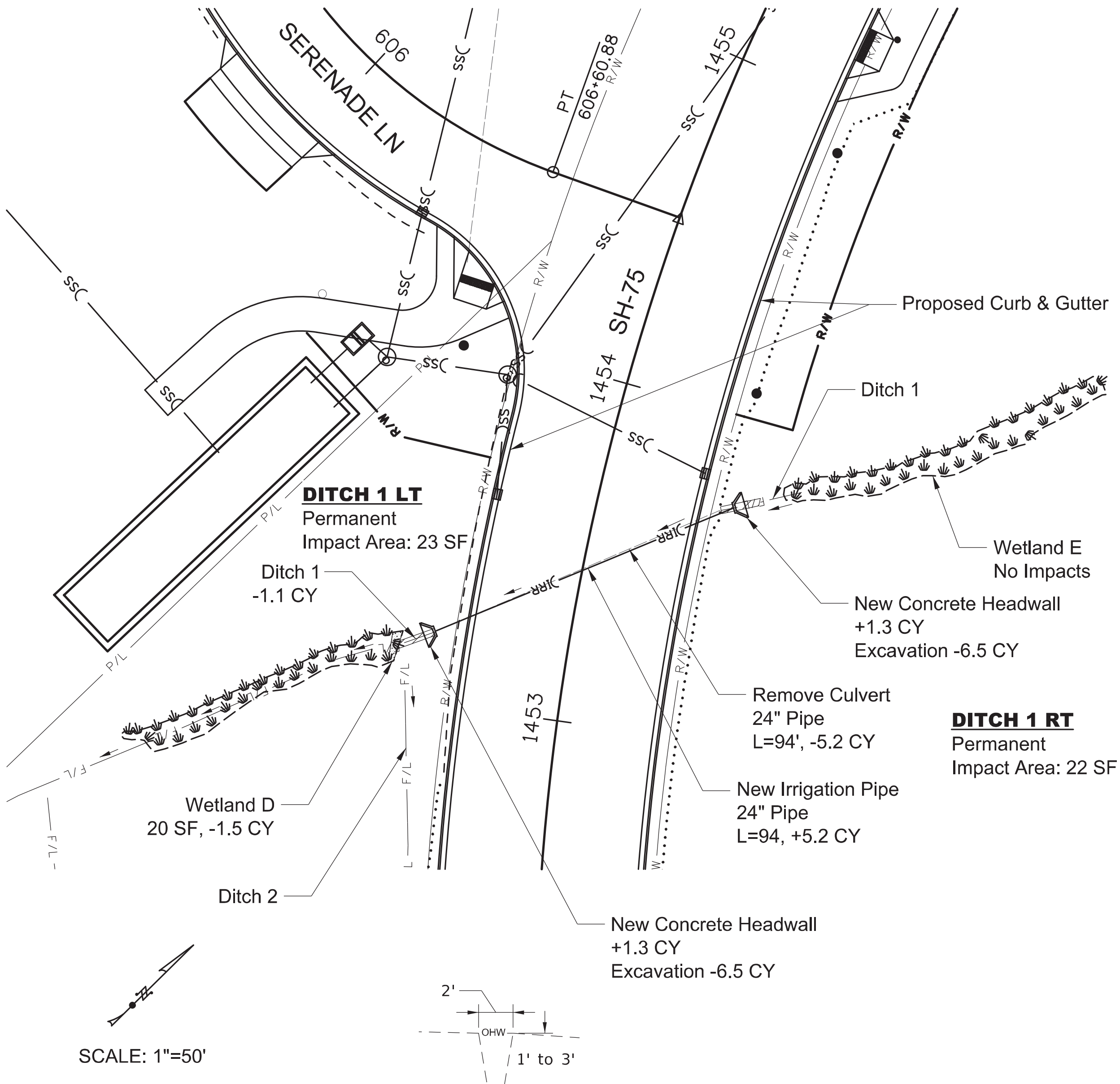
SCALE: 1"=50'

LEGEND
- Existing Pipe
- Existing Ditch
- Existing Storm Sewer
- Proposed Storm Sewer
- Proposed Irrigation Pipe
- Wetland Boundary
- Existing Right-of-Way
- Property Line
- Acquired ITD Right-of-Way

SH-75, ELKHORN RD TO
RIVER ST, KETCHUM
BLAINE COUNTY, IDAHO
ITD Project No. A020(033) Key No. 20033
File No. : NWW-2020-0050
Waterway: DITCH 2
Proposed Activity:Pipe/Box Installation
Lat.: 43.667° N Long.: 114.356° W
Sheet 4 of 7

DITCH 2	FIGURE 4	MAY 13 2024

U:\Bois\Projects\Clients\4006-ITD\314-4006-071SH-75 Elkhorn to River\99Svcs\CADD\DGN\404 permit\20033_404_Fig 05_WL D.dgn 5/14/2024 6:04:18 PM



LEGEND

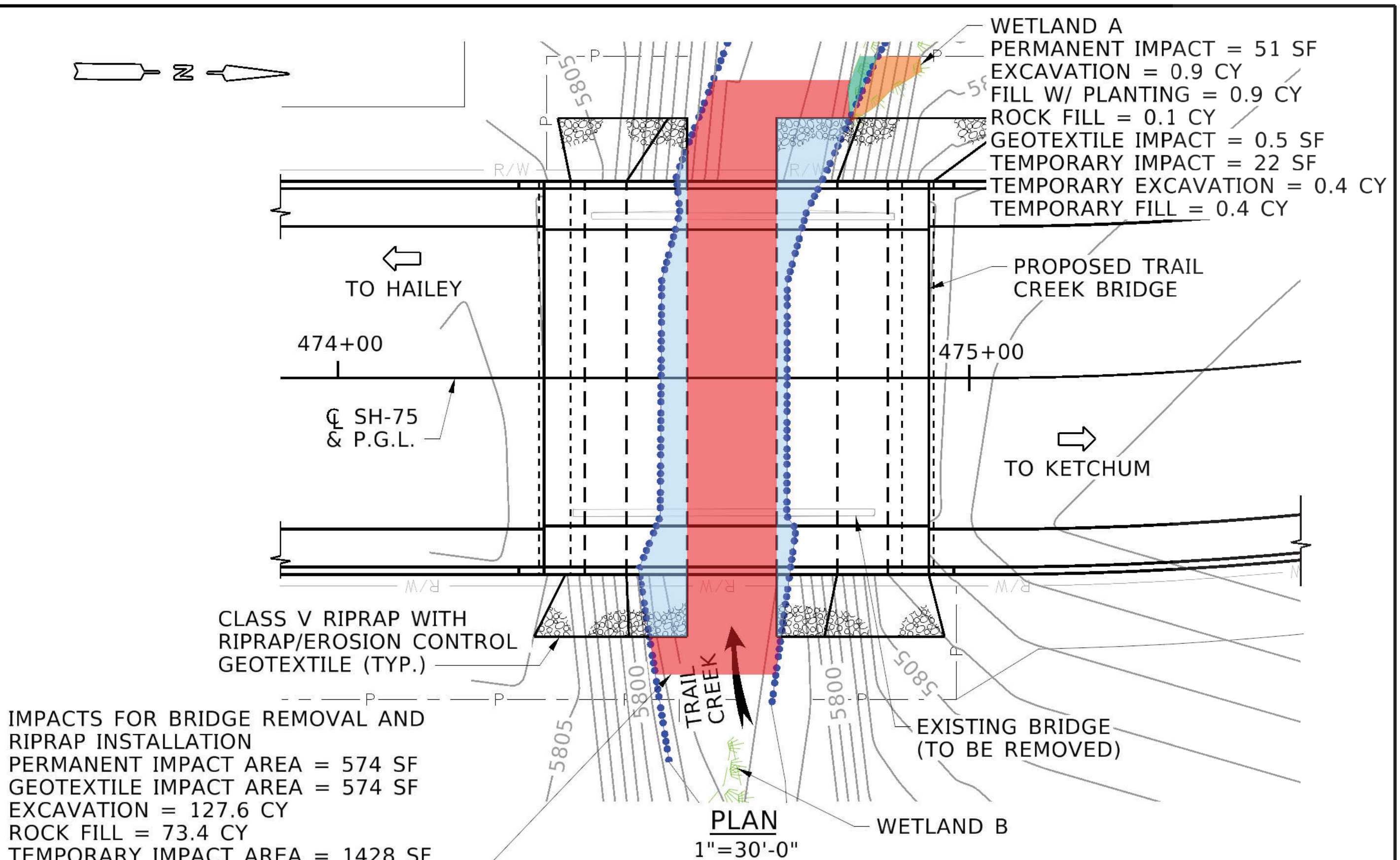
- Existing Pipe
- Existing Ditch
- Existing Storm Sewer
- Proposed Storm Sewer
- Proposed Irrigation Pipe
- Wetland Boundary
- Existing Right-of-Way
- Property Line
- Acquired ITD Right-of-Way

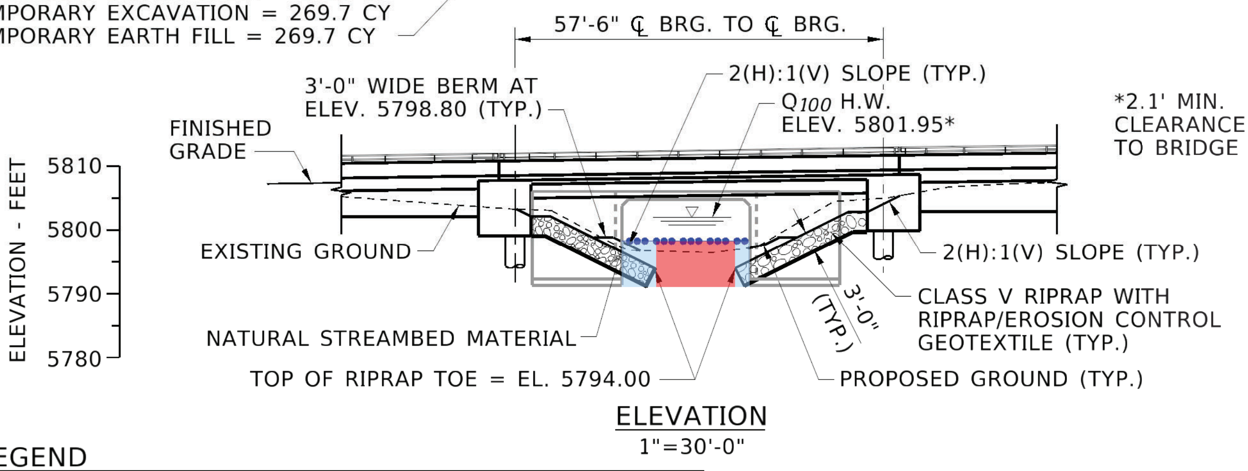
DITCH 1 TOTALS
Permanent
Impact Length: 22 LF
Impact Area: 45 SF
(0.0010 AC)
Filled with 7.8 CY of
Backfill and Bedding

WETLAND D TOTALS
Temporary
Impact Area: 20 SF
(0.0005 AC)

SH-75, ELKHORN RD TO
RIVER ST, KETCHUM
BLAINE COUNTY, IDAHO
ITD Project No. A020(033) Key No. 20033
File No. : NWW-2020-0050
Waterway: DITCH 1 & WETLAND D
Proposed Activity:Pipe/Headwalls Installation
Lat.: 43.667° N Long.: 114.356° W
Sheet 5 of 7

DITCH 1 & WETLAND D	FIGURE 5	MAY 13 2024





LEGEND

- ORDINARY HIGH WATER (OHW) BOUNDARY
- DELINEATED WETLAND BOUNDARY
- R/W — EXISTING RIGHT-OF-WAY
- P — — P — ACQUIRED RIGHT-OF-WAY
- PERMANENT IMPACTS BELOW OHW (574 S.F., 0.013 ACRE)
- TEMPORARY IMPACTS BELOW OHW (1428 S.F., 0.033 ACRE)
- PERMANENT IMPACTS TO WETLANDS (51 S.F., 0.001 ACRE)
- TEMPORARY IMPACTS TO WETLANDS (22 S.F., 0.001 ACRE)

EXISTING
HYDRAULIC OPENING = 158 S.F., 0.003 ACRE

PROPOSED
HYDRAULIC OPENING = 333 S.F., 0.008 ACRE

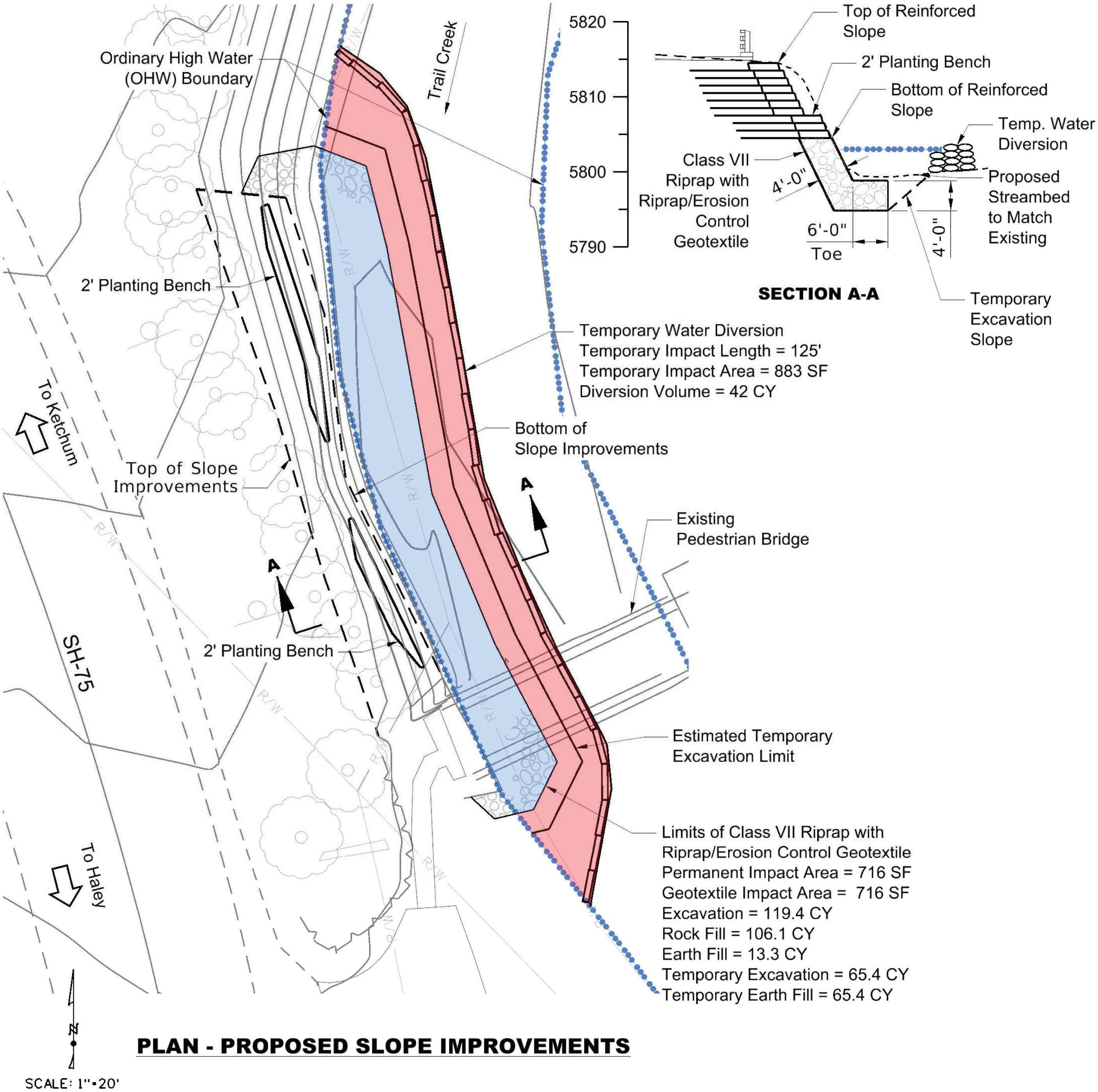
HYDRAULIC
OPENING CHANGE = INCREASE 175 S.F., 0.004 ACRE

SH-75, ELKHORN RD TO RIVER ST, KETCHUM
BLAINE COUNTY, IDAHO
ITD Project No. A020(003) Key No. 20033

File No. : NWW-2020-0050
Waterway: Trail Creek
Proposed Activity: Bridge Replacement
Lat.: 43.667° N Long.: 114.356° W

Sheet 6 of 7

TRAIL CREEK BRIDGE	FIGURE 6	MAY 13 2024



SECTION A-A

PLAN - PROPOSED SLOPE IMPROVEMENTS

LEGEND

- R/W — Existing Right-of-Way
- Ordinary High Water (OHW) Boundary
- Permanent Impacts Below OHW (716 S.F., 0.016 Acre)
- Temporary Impacts Below OHW (883 S.F., 0.02 Acre)
- Riprap

SH-75, ELKHORN RD TO
RIVER ST, KETCHUM
BLAINE COUNTY, IDAHO
ITD Project No. A020(003) Key No. 20033

File No. : NWW-2020-0050
Waterway: Trail Creek
Proposed Activity: Reinforced Slope
Lat.: 43.667° Long.: 114.356°

Sheet 7 of 7

SLOPE STABILIZATION	FIGURE 7	MAY 13 2024

NATIONWIDE PERMIT 14

Linear Transportation Projects:

Activities required for crossings of waters of the United States associated with the construction, expansion, modification, or improvement of linear transportation projects (e.g., roads, highways, railways, trails, driveways, airport runways, and taxiways) in waters of the United States. For linear transportation projects in non-tidal waters, the discharge of dredged or fill material cannot cause the loss of greater than 1/2-acre of waters of the United States. For linear transportation projects in tidal waters, the discharge of dredged or fill material cannot cause the loss of greater than 1/3-acre of waters of the United States. Any stream channel modification, including bank stabilization, is limited to the minimum necessary to construct or protect the linear transportation project; such modifications must be in the immediate vicinity of the project.

This NWP also authorizes temporary structures, fills, and work, including the use of temporary mats, necessary to construct the linear transportation project. Appropriate measures must be taken to maintain normal downstream flows and minimize flooding to the maximum extent practicable, when temporary structures, work, and discharges of dredged or fill material, including cofferdams, are necessary for construction activities, access fills, or dewatering of construction sites. Temporary fills must consist of materials, and be placed in a manner, that will not be eroded by expected high flows. Temporary fills must be removed in their entirety and the affected areas returned to pre-construction elevations. The areas affected by temporary fills must be revegetated, as appropriate.

This NWP cannot be used to authorize non-linear features commonly associated with transportation projects, such as vehicle maintenance or storage buildings, parking lots, train stations, or aircraft hangars.

Notification: The permittee must submit a pre-construction notification to the district engineer prior to commencing the activity if: (1) the loss of waters of the United States exceeds 1/10-acre; or (2) there is a discharge of dredged or fill material in a special aquatic site, including wetlands. (See general condition 32.) (Authorities: Sections 10 and 404)

Note 1: For linear transportation projects crossing a single waterbody more than one time at separate and distant locations, or multiple waterbodies at separate and distant locations, each crossing is considered a single and complete project for purposes of NWP authorization. Linear transportation projects must comply with 33 CFR 330.6(d).

Note 2: Some discharges of dredged or fill material for the construction of farm roads or forest roads, or temporary roads for moving mining equipment, may qualify for an exemption under Section 404(f) of the Clean Water Act (see 33 CFR 323.4).

Note 3: For NWP 14 activities that require pre-construction notification, the PCN must include any other NWP(s), regional general permit(s), or individual permit(s) used or intended to be used to authorize any part of the proposed project or any related activity, including other separate and distant crossings that require Department of the Army authorization but do not require pre-construction notification (see paragraph (b)(4) of general condition 32). The district engineer will evaluate the PCN in accordance with Section D, “District Engineer’s Decision.” The district engineer may require mitigation to ensure that the authorized activity results in no more than minimal individual and cumulative adverse environmental effects (see general condition 23).

WATER QUALITY CERTIFICATION, NWP 14:

Agency responsible for administration of water quality, based on project location is listed below. If DENIED, then an Individual Water Quality Certification or Waiver of Certification is required, prior to the commencement of any work activities and/or issuance of a DA verification, authorization and/or permit.

State of Idaho: **PARTIALLY DENIED;** activities requiring a Pre-Construction Notification (PCN) for NWP 14 are **not certified**.

Coeur d’Alene Tribal Lands: **DENIED**

Shoshone-Bannock Tribal Lands: **DENIED**

U.S. Environmental Protection Agency for all other Tribal Lands: **PARTIALLY DENIED:** activities are denied when the project will result in:

- Greater than 1/10 acre of impacts to waters of the U.S.; or
- Greater than 300 linear feet of impacts to waters of the U.S.

2021/2022 Nationwide Permits
Regional Conditions
Walla Walla District Regulatory Division (State of Idaho)

January 13, 2021

The following Nationwide Permit (NWP) regional conditions are required in the state of Idaho and apply to all 2021/2022 NWPs[1]. Regional conditions are established by individual Corps Districts to ensure projects result in no more than minimal adverse impacts to the aquatic environment and to address local resources concerns. This document also includes regional additions to the NWP General Conditions, notification procedures pertaining to certain NWP's, and regional additions to the definitions.

REGIONAL CONDITIONS

A. Watersheds Requiring Pre-Construction Notification, Specific to Anadromous Fish

This Regional Condition applies to all 2021/2022 NWPs.

- Pre-construction notification (PCN) will be required for the above listed nationwide permits in the geographic area as shown on Figure 1: *Watersheds Requiring Pre-Construction Notification*, dated January 6, 2021.

B. Vegetation Preservation and Replanting

- To avoid impacts to aquatic habitat and to reduce sedimentation and erosion, permittee shall avoid and minimize the removal of vegetation in waters of the U.S. to the maximum extent practicable. Areas subject to temporary vegetation removal in waters of the U.S. during construction shall be replanted with appropriate native[2] species by the end of the first growing season, unless conditioned otherwise. Permittee shall avoid introducing or spreading noxious or invasive plants[3].

- Replanted vegetation that does not survive the first growing season shall be replanted before the end of the next growing season. Re-plantings shall continue to occur until desired vegetation densities are achieved. Re-vegetation densities should be based on reference conditions.

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[1] For the list of 2021/2022 Nationwide Permits please see: https://www.nww.usace.army.mil/Business-With-Us/Regulatory-Division/Nationwide-Permits/

[2] Idaho Department of Transportation, Native Plants for Idaho Roadside Restoration and Revegetation Programs: https://itd.idaho.gov/wp-content/uploads/2016/06/RP171Roadside_Revegetation.pdf

[3] U.S. Department of Agriculture, Natural Resource Conservation Service Plant Database of introduced, invasive, and noxious plants for Idaho: https://plants.usda.gov/java/noxious?rptType=State&statefips=16.

C. De-watering & Re-watering (as applicable)

- Cofferdams shall be constructed of non-erosive material such as concrete jersey barriers, bulk bags, water bladders, sheet pile, and other similar non-erosive devices. Cofferdams may not be constructed by using mechanized equipment to push streambed material through flowing water.

- Diversion channels constructed to bypass flow around the construction site shall be lined with plastic, large rock, pipe or otherwise protected from erosion prior to releasing flows into or through the diversion channel.

- Water removed from within the coffered area shall be pumped to a sediment basin or otherwise treated to remove suspended sediments prior to its return to the waterway.

- To prevent unwanted passage of state or federally-protected fish, if present, from the coffered area, Water pipe intakes shall be screened with openings measuring < 3/32 inch to prevent entrainment of fish trapped in the coffered area.

- Should fish be present within the coffered areas contact your local Idaho Department of Fish and Game (IDFG) office prior to performing fish removal or salvage. Fish shall be collected by electrofishing, seining or dip net, or otherwise removed and returned to the waterway upstream of the project area. If electrofishing is used, the National Marine Fisheries Service (NMFS) guidelines for electrofishing should be followed[4], unless conditioned otherwise.

- Stream channels that have been dewatered during project construction shall be re-watered slowly to avoid lateral and vertical erosion of the de-watered channel, prevent damage to recently reclaimed work areas and/or damage to permitted work.

- Temporary stockpiles in waters of the United States shall be removed in their entirety so as not to form a berm or levee parallel to the stream that could confine flows or restrict overbank flow to the floodplain.

D. In-Water Structures and Complexes

- PCN notification in accordance with General Condition 32 is required for all non-federal applicants with activities involving gabion baskets placed below the ordinary high water mark.

- Stream meanders, riffle and pool complexes, pool stream structures, rock/log barbs, rock J-hooks, drop structures, sills, engineered log jams or similar structures/features when used shall be site specifically designed by an appropriate professional with experience in hydrology or fluvial geomorphology.

[4] Guidelines for Electrofishing Waters Containing Salmonids Listed Under the Endangered Species Act (June 2000) http://www.westcoast.fisheries.noaa.gov/publications/reference_documents/esa_refs/section4d/electro2000.pdf

E. Temporary Sidecasting

- Materials from exploratory trenching and installation of utility lines may be temporarily side cast into a de-watered coffered area for up to 30 days but not within flowing waters. Material from exploratory trenching and installation of utility lines in wetlands may be temporarily side cast for up to 30 days.

F. Suitability of Sediments for Open Water Disposal and us as Fill

- Sampling for determination of suitability of sediments for open water disposal or for use as fill, must comply with the Sediment Evaluation Framework for the Pacific Northwest (SEF)[5].

G. Avoidance and Minimization

- In addition to information required under General Condition 32(b), the applicant shall include information about previous discharges of fill material into waters of the United States within the project area. This is only for non-federal applicants where a PCN is required.

- Discharges of dredged or fill material into waters of the U.S., including wetlands, to meet set back requirements are not authorized under NWP.

H. Erosion Control

- Erosion control blanket or fabric used in or adjacent to waters of the U.S. shall be comprised of biodegradable material, to ensure decomposition and reduced risk to fish, wildlife and public safety, unless conditioned otherwise. If the applicant proposes to use materials other than as indicated above they must demonstrate how the use of such materials will not cause harm to fish, wildlife and public safety.

I. Reporting Requirement for Federal Permittees

- Federal Agencies with projects that require compensatory mitigation for loss of waters of the U.S. and who propose to purchase credits from an approved wetland and/or stream mitigation bank must provide proof of purchase within 30 days of when the credits were purchased. Purchase of credits from an approved mitigation bank must be IAW the Mitigation Banking Instrument of Record.

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[5] Northwest Regional Sediment Evaluation Team (RSET) 2016. Sediment Evaluation Framework for the Pacific Northwest. Prepared by the RSET Agencies, July 2016, 160 pp plus appendices. http://nwd.usace.army.mil/Missions/Civil-Works/Navigation/RSET/SEF

REGIONAL ADDITIONS TO THE GENERAL CONDITIONS

General Condition 4. Migratory Bird Breeding Areas. Regional Addition: For additional information please contact the US Fish and Wildlife Service at the following field office locations: State Office (Boise) at (208) 387-5243; Northern Idaho Field Office (Spokane) at (509) 891-6839; or the Eastern Idaho Field Office (Chubbuck) at (208) 237-6975. https://www.fws.gov/idaho/promo.cfm?id= 177175802

General Condition 6. Suitable Material. Regional Addition: Erosion control blanket or fabric used in or adjacent to waters of the U.S. shall be comprised of biodegradable material, to ensure decomposition and reduced risk to fish, wildlife and public safety, unless conditioned otherwise. If the applicant proposes to use materials other than as indicated above they must demonstrate how the use of such materials will not cause harm to fish, wildlife and public safety.

General Condition 9. Management of Water Flows. Regional Addition: To obtain information on State of Idaho definition of high water refer to Idaho Department of Water Resources (IDAPA 37.03.07. Rule 62.03.04.a). For culverts or bridges located in a community qualifying for the national flood insurance program, the minimum size culvert shall accommodate the 100-year flood design flow frequency (IDAPA 37.03.07. Rule 62.03.04.c).

General Condition 12. Soil Erosion and Sediment Controls. Regional Addition: For additional information refer to the Idaho Department of Environmental Quality Catalog of Stormwater Best Management Practices for Idaho Cities and Counties, available online at: https://www.deq.idaho.gov/public-information/laws-guidance-and-orders/guidance/.

General Condition 18. Endangered Species. Regional Addition: For additional information on ESA listed species in north Idaho please contact the US Fish and Wildlife Service (USFWS) Northern Idaho Field Office (Spokane) at (509) 893-8009, for all other counties in Idaho contact the USFWS State Office (Boise) at (208) 378-5388.

General Condition 20. Historic Properties. Regional Addition: Property is generally considered “historic” if it is at least 50 years old, and is not limited to buildings. For additional information on the potential for cultural resources in proximity to the project site, contact the Idaho State Historic Preservation Office at (208) 334-3847 located in Boise, Idaho.

NOTIFICATION PROCEDURES BY THE CORPS FOR CERTAIN NATIONWIDE PERMITS

Waivers: For nationwide permits with a waiver provision, District coordination with Idaho Department of Environmental Quality (IDEQ) and Environmental Protection Agency (tribal lands) will be conducted prior to the District Engineer making a waiver determination to ensure the proposed activity is in compliance with Section 401 Water Quality Standards.

Select Waters and Wetlands: The Corps will coordinate with the Idaho Department of Fish and Game (IDFG) for activities in the following waters and wetlands that require notification and are authorized by NWP:

- Waters: Waters: Anadromous waters as shown on Figure 1: *Watersheds Requiring Pre-Construction Notification*, dated January 6, 2021; Henry's Fork of the Snake River and its tributaries; South Fork Snake River and its tributaries; Big Lost River and its tributaries upstream of the US 93 crossing; Beaver, Camas, and Medicine Lodge Creeks; Snake River; Blackfoot River above Blackfoot Reservoir; Portneuf River; Bear River; Boise River including South Fork, North Fork and Middle Fork; Payette River including South Fork, North Fork and Middle Fork; Coeur d'Alene River, including the North Fork; St. Joe River; Priest River; Kootenai River; Big Wood River; and Silver Creek and its tributaries.

- Wetlands identified in Idaho Department of Fish and Game, Wetland Conservation Strategy as Class I, Class II and Reference Habitat Sites[6].

- Wetlands identified in the Idaho Wetland Conservation Prioritization Plan-2012[7].

NWP 27-Aquatic Habitat Restoration, Establishment, and Enhancement Activities

Prior to verification, the Corps will coordinate the project with the Idaho Department of Fish and Game for activities in perennial, fish bearing streams.

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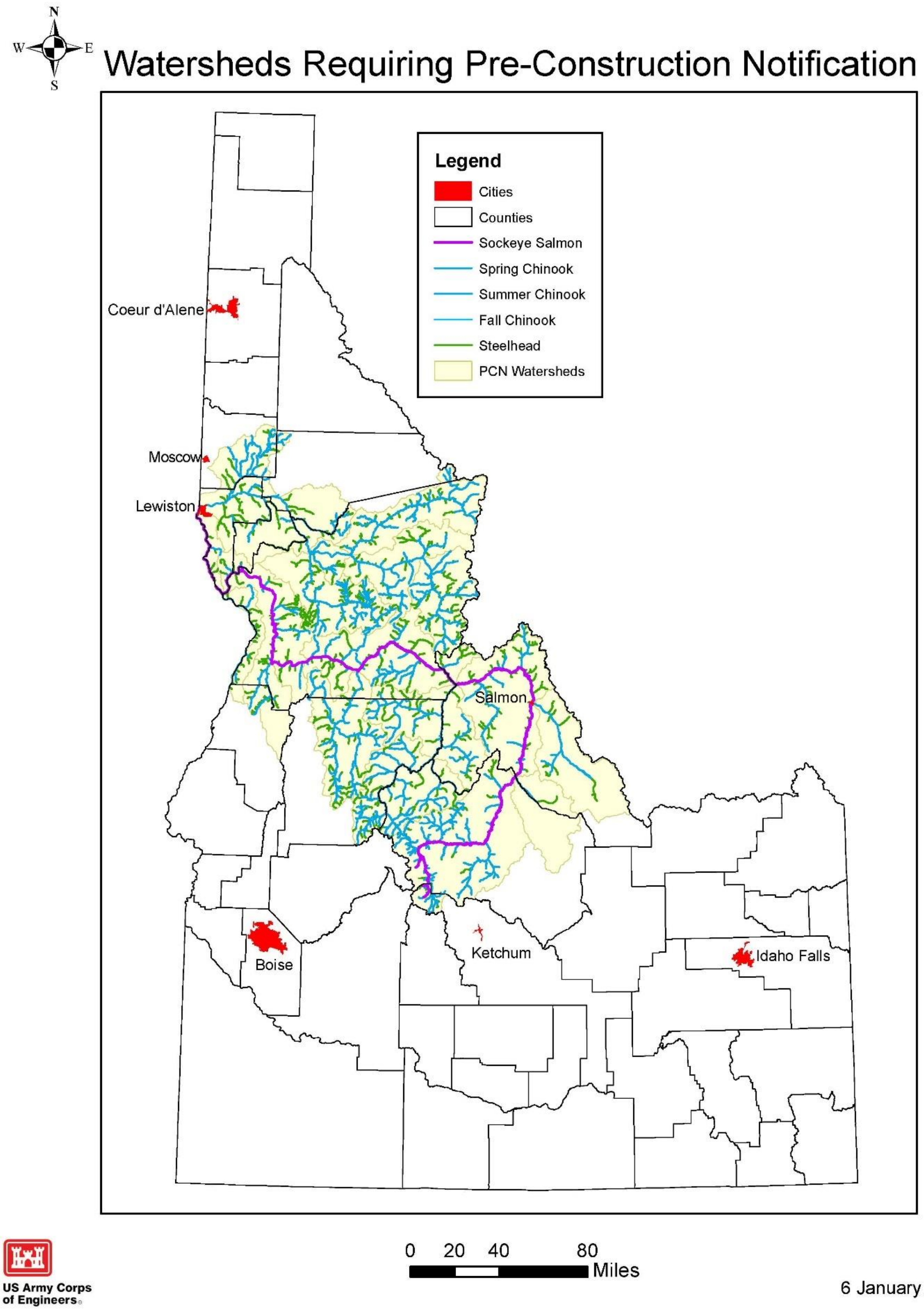
[6] Idaho Department of Fish and Game (IDFG) Wetland Conservation Strategies have been developed for the Henrys Fork Basin, Northern Idaho, Big Wood River, Southeast Idaho, East-Central Idaho and Spokane River Basin, Middle and Western Snake River and tributaries, and the Upper Snake River–Portneuf Drainage, Weiser River Basin, and West Central Mountain Valleys and adjacent wetlands. Closed basins of Beaver-Camas Creeks, Medicine Lodge Creek, Palouse River and lower Clearwater River sub-basins, Middle Fork and South Fork Clearwater Basins and Camas Prairie in northern Idaho. Refer to the internet site at: http://fishandgame.idaho.gov/content/page/wetlands-publications-idaho-natural-heritage-program#reports

[7] Murphy, C., J. Miller and A. Schmidt. 2012. https://parksandrecreation.idaho.gov/sites/default/files/uploads/documents/SCORTP/Update/Apdx%20.%20Wetlands%Priority%Plan%20(Part %20I)%Compressed1.pdf

Figure 1



6 January 2021

2021 Nationwide Permit General Conditions

Note: To qualify for NWP authorization, the prospective permittee must comply with the following general conditions, as applicable, in addition to any regional or case-specific conditions imposed by the division engineer or district engineer. Prospective permittees should contact the appropriate Corps district office to determine if regional conditions have been imposed on an NWP. Prospective permittees should also contact the appropriate Corps district office to determine the status of Clean Water Act Section 401 water quality certification and/or Coastal Zone Management Act consistency for an NWP. Every person who may wish to obtain permit authorization under one or more NWPs, or who is currently relying on an existing or prior permit authorization under one or more NWPs, has been and is on notice that all of the provisions of 33 CFR 330.1 through 330.6 apply to every NWP authorization. Note especially 33 CFR 330.5 relating to the modification, suspension, or revocation of any NWP authorization.

1. Navigation

(a) No activity may cause more than a minimal adverse effect on navigation.

(b) Any safety lights and signals prescribed by the U.S. Coast Guard, through regulations or otherwise, must be installed and maintained at the permittee's expense on authorized facilities in navigable waters of the United States.

(c) The permittee understands and agrees that, if future operations by the United States require the removal, relocation, or other alteration, of the structure or work herein authorized, or if, in the opinion of the Secretary of the Army or his or her authorized representative, said structure or work shall cause unreasonable obstruction to the free navigation of the navigable waters, the permittee will be required, upon due notice from the Corps of Engineers, to remove, relocate, or alter the structural work or obstructions caused thereby, without expense to the United States. No claim shall be made against the United States on account of any such removal or alteration.

2. Aquatic Life Movements

No activity may substantially disrupt the necessary life cycle movements of those species of aquatic life indigenous to the waterbody, including those species that normally migrate through the area, unless the activity's primary purpose is to impound water. All permanent and temporary crossings of waterbodies shall be suitably culverted, bridged, or otherwise designed and constructed to maintain low flows to sustain the movement of those aquatic species. If a bottomless culvert cannot be used, then the crossing should be designed and constructed to minimize adverse effects to aquatic life movements.

3. Spawning Areas

Activities in spawning areas during spawning seasons must be avoided to the maximum extent practicable. Activities that result in the physical destruction (e.g., through excavation, fill, or downstream smothering by substantial turbidity) of an important spawning area are not authorized.

4. Migratory Bird Breeding Areas

Activities in waters of the United States that serve as breeding areas for migratory birds must be avoided to the maximum extent practicable.

5. Shellfish Beds

No activity may occur in areas of concentrated shellfish populations, unless the activity is directly related to a shellfish harvesting activity authorized by NWPs 4 and 48, or is a shellfish seeding or habitat restoration activity authorized by NWP 27.

6. Suitable Material

No activity may use unsuitable material (e.g., trash, debris, car bodies, asphalt, etc.). Material used for construction or discharged must be free from toxic pollutants in toxic amounts (see section 307 of the Clean Water Act).

7. Water Supply Intakes

No activity may occur in the proximity of a public water supply intake, except where the activity is for the repair or improvement of public water supply intake structures or adjacent bank stabilization.

8. Adverse Effects From Impoundments

If the activity creates an impoundment of water, adverse effects to the aquatic system due to accelerating the passage of water, and/or restricting its flow must be minimized to the maximum extent practicable.

9. **Management of Water Flows**
To the maximum extent practicable, the pre-construction course, condition, capacity, and location of open waters must be maintained for each activity, including stream channelization, storm water management activities, and temporary and permanent road crossings, except as provided below. The activity must be constructed to withstand expected high flows. The activity must not restrict or impede the passage of normal or high flows, unless the primary purpose of the activity is to impound water or manage high flows. The activity may alter the pre-construction course, condition, capacity, and location of open waters if it benefits the aquatic environment (e.g., stream restoration or relocation activities).

10. **Fills Within 100-Year Floodplains**
The activity must comply with applicable FEMA-approved state or local floodplain management requirements.

11. **Equipment**
Heavy equipment working in wetlands or mudflats must be placed on mats, or other measures must be taken to minimize soil disturbance.

12. **Soil Erosion and Sediment Controls**
Appropriate soil erosion and sediment controls must be used and maintained in effective operating condition during construction, and all exposed soil and other fills, as well as any work below the ordinary high water mark or high tide line, must be permanently stabilized at the earliest practicable date. Permittees are encouraged to perform work within waters of the United States during periods of low-flow or no-flow, or during low tides.

13. **Removal of Temporary Structures and Fills**
Temporary structures must be removed, to the maximum extent practicable, after their use has been discontinued. Temporary fills must be removed in their entirety and the affected areas returned to pre-construction elevations. The affected areas must be revegetated, as appropriate.

14. **Proper Maintenance**
Any authorized structure or fill shall be properly maintained, including maintenance to ensure public safety and compliance with applicable NWP general conditions, as well as any activity-specific conditions added by the district engineer to an NWP authorization.

15. **Single and Complete Project**
The activity must be a single and complete project. The same NWP cannot be used more than once for the same single and complete project.

16. **Wild and Scenic Rivers**
(a) No NWP activity may occur in a component of the National Wild and Scenic River System, or in a river officially designated by Congress as a “study river” for possible inclusion in the system while the river is in an official study status, unless the appropriate Federal agency with direct management responsibility for such river, has determined in writing that the proposed activity will not adversely affect the Wild and Scenic River designation or study status.

(b) If a proposed NWP activity will occur in a component of the National Wild and Scenic River System, or in a river officially designated by Congress as a “study river” for possible inclusion in the system while the river is in an official study status, the permittee must submit a pre-construction notification (see general condition 32). The district engineer will coordinate the PCN with the Federal agency with direct management responsibility for that river. Permittees shall not begin the NWP activity until notified by the district engineer that the Federal agency with direct management responsibility for that river has determined in writing that the proposed NWP activity will not adversely affect the Wild and Scenic River designation or study status.

(c) Information on Wild and Scenic Rivers may be obtained from the appropriate Federal land management agency responsible for the designated Wild and Scenic River or study river (e.g., National Park Service, U.S. Forest Service, Bureau of Land Management, U.S. Fish and Wildlife Service). Information on these rivers is also available at: http://www.rivers.gov/.

17. Tribal Rights
No activity or its operation may impair reserved tribal rights, including, but not limited to, reserved water rights and treaty fishing and hunting rights.

18. Endangered Species
(a) No activity is authorized under any NWP which is likely to directly or indirectly jeopardize the continued existence of a threatened or endangered species or a species proposed for such designation, as identified under the Federal Endangered Species Act (ESA), or which will directly or indirectly destroy or adversely modify designated critical habitat or critical habitat proposed for such designation. No activity is authorized under any NWP which "may affect" a listed species or critical habitat, unless ESA section 7 consultation addressing the consequences of the proposed activity on listed species or critical habitat has been completed. See 50 CFR 402.02 for the definition of "effects of the action" for the purposes of ESA section 7 consultation, as well as 50 CFR 402.17, which provides further explanation under ESA section 7 regarding "activities that are reasonably certain to occur" and "consequences caused by the proposed action."

(b) Federal agencies should follow their own procedures for complying with the requirements of the ESA (see 33 CFR 330.4(f)(1)). If pre-construction notification is required for the proposed activity, the Federal permittee must provide the district engineer with the appropriate documentation to demonstrate compliance with those requirements. The district engineer will verify that the appropriate documentation has been submitted. If the appropriate documentation has not been submitted, additional ESA section 7 consultation may be necessary for the activity and the respective federal agency would be responsible for fulfilling its obligation under section 7 of the ESA.

(c) Non-federal permittees must submit a pre-construction notification to the district engineer if any listed species (or species proposed for listing) or designated critical habitat (or critical habitat proposed such designation) might be affected or is in the vicinity of the activity, or if the activity is located in designated critical habitat or critical habitat proposed for such designation, and shall not begin work on the activity until notified by the district engineer that the requirements of the ESA have been satisfied and that the activity is authorized. For activities that might affect Federally-listed endangered or threatened species (or species proposed for listing) or designated critical habitat (or critical habitat proposed for such designation), the pre-construction notification must include the name(s) of the endangered or threatened species (or species proposed for listing) that might be affected by the proposed activity or that utilize the designated critical habitat (or critical habitat proposed for such designation) that might be affected by the proposed activity. The district engineer will determine whether the proposed activity "may affect" or will have "no effect" to listed species and designated critical habitat and will notify the non-Federal applicant of the Corps' determination within 45 days of receipt of a complete pre-construction notification. For activities where the non-Federal applicant has identified listed species (or species proposed for listing) or designated critical habitat (or critical habitat proposed for such designation) that might be affected or is in the vicinity of the activity, and has so notified the Corps, the applicant shall not begin work until the Corps has provided notification that the proposed activity will have "no effect" on listed species (or species proposed for listing or designated critical habitat (or critical habitat proposed for such designation), or until ESA section 7 consultation or conference has been completed. If the non-Federal applicant has not heard back from the Corps within 45 days, the applicant must still wait for notification from the Corps.

(d) As a result of formal or informal consultation or conference with the FWS or NMFS the district engineer may add species-specific permit conditions to the NWPs.

(e) Authorization of an activity by an NWP does not authorize the "take" of a threatened or endangered species as defined under the ESA. In the absence of separate authorization (e.g., an ESA Section 10 Permit, a Biological Opinion with "incidental take" provisions, etc.) from the FWS or the NMFS, the Endangered Species Act prohibits any person subject to the jurisdiction of the United States to take a listed species, where "take" means to harass, harm, pursue, hunt, shoot, wound, kill, trap, capture, or collect, or to attempt to engage in any such conduct. The word "harm" in the definition of "take'' means an act which actually kills or injures wildlife. Such an act may include significant habitat modification or degradation where it actually kills or injures wildlife by significantly impairing essential behavioral patterns, including breeding, feeding or sheltering.

(f) If the non-federal permittee has a valid ESA section 10(a)(1)(B) incidental take permit with an approved Habitat Conservation Plan for a project or a group of projects that includes the proposed NWP activity, the non-federal applicant should provide a copy of that ESA section 10(a)(1)(B) permit with the PCN required by paragraph (c) of this general condition. The district engineer will coordinate with the agency that issued the ESA section 10(a)(1)(B) permit to determine whether the proposed NWP activity and the associated incidental take were considered in the internal ESA section 7 consultation conducted for the ESA section 10(a)(1)(B) permit. If that coordination results in concurrence from the agency that the proposed NWP activity and the associated incidental take were considered in the internal ESA section 7 consultation for the ESA section 10(a)(1)(B) permit, the district engineer does not need to conduct a separate ESA section 7 consultation for the proposed NWP activity. The district engineer will notify the non-federal applicant within 45 days of receipt of a complete pre-construction notification whether the ESA section 10(a)(1)(B) permit covers the proposed NWP activity or whether additional ESA section 7 consultation is required.

(g) Information on the location of threatened and endangered species and their critical habitat can be obtained directly from the offices of the FWS and NMFS or their world wide web pages at http://www.fws.gov/ or http://www.fws.gov/ipac and http://www.nmfs.noaa.gov/pr/species/esa/ respectively.

19. Migratory Birds and Bald and Golden Eagles
The permittee is responsible for ensuring that an action authorized by an NWP complies with the Migratory Bird Treaty Act and the Bald and Golden Eagle Protection Act. The permittee is responsible for contacting the appropriate local office of the U.S. Fish and Wildlife Service to determine what measures, if any, are necessary or appropriate to reduce adverse effects to migratory birds or eagles, including whether "incidental take" permits are necessary and available under the Migratory Bird Treaty Act or Bald and Golden Eagle Protection Act for a particular activity.

20. Historic Properties
(a) No activity is authorized under any NWP which may have the potential to cause effects to properties listed, or eligible for listing, in the National Register of Historic Places until the requirements of Section 106 of the National Historic Preservation Act (NHPA) have been satisfied.

(b) Federal permittees should follow their own procedures for complying with the requirements of section 106 of the National Historic Preservation Act (see 33 CFR 330.4(g)(1)). If pre-construction notification is required for the proposed NWP activity, the Federal permittee must provide the district engineer with the appropriate documentation to demonstrate compliance with those requirements. The district engineer will verify that the appropriate documentation has been submitted. If the appropriate documentation is not submitted, then additional consultation under section 106 may be necessary. The respective federal agency is responsible for fulfilling its obligation to comply with section 106.

(c) Non-federal permittees must submit a pre-construction notification to the district engineer if the NWP activity might have the potential to cause effects to any historic properties listed on, determined to be eligible for listing on, or potentially eligible for listing on the National Register of Historic Places, including previously unidentified properties. For such activities, the pre-construction notification must state which historic properties might have the potential to be affected by the proposed NWP activity or include a vicinity map indicating the location of the historic properties or the potential for the presence of historic properties. Assistance regarding information on the location of, or potential for, the presence of historic properties can be sought from the State Historic Preservation Officer, Tribal Historic Preservation Officer, or designated tribal representative, as appropriate, and the National Register of Historic Places (see 33 CFR 330.4(g)). When reviewing pre-construction notifications, district engineers will comply with the current procedures for addressing the requirements of section 106 of the National Historic Preservation Act. The district engineer shall make a reasonable and good faith effort to carry out appropriate identification efforts commensurate with potential impacts, which may include background research, consultation, oral history interviews, sample field investigation, and/or field survey. Based on the information submitted in the PCN and these identification efforts, the district engineer shall determine whether the proposed NWP activity has the potential to cause effects on the historic properties. Section 106 consultation is not required when the district engineer determines that the activity does not have the potential to cause effects on historic properties (see 36 CFR 800.3(a)).

Section 106 consultation is required when the district engineer determines that the activity has the potential to cause effects on historic properties. The district engineer will conduct consultation with consulting parties identified under 36 CFR 800.2(c) when he or she makes any of the following effect determinations for the purposes of section 106 of the NHPA: no historic properties affected, no adverse effect, or adverse effect.

(d) Where the non-Federal applicant has identified historic properties on which the proposed NWP activity might have the potential to cause effects and has so notified the Corps, the non-Federal applicant shall not begin the activity until notified by the district engineer either that the activity has no potential to cause effects to historic properties or that NHPA section 106 consultation has been completed. For non-federal permittees, the district engineer will notify the prospective permittee within 45 days of receipt of a complete pre-construction notification whether NHPA section 106 consultation is required. If NHPA section 106 consultation is required, the district engineer will notify the non-Federal applicant that he or she cannot begin the activity until section 106 consultation is completed. If the non-Federal applicant has not heard back from the Corps within 45 days, the applicant must still wait for notification from the Corps.

(e) Prospective permittees should be aware that section 110k of the NHPA (54 U.S.C. 306113) prevents the Corps from granting a permit or other assistance to an applicant who, with intent to avoid the requirements of section 106 of the NHPA, has intentionally significantly adversely affected a historic property to which the permit would relate, or having legal power to prevent it, allowed such significant adverse effect to occur, unless the Corps, after consultation with the Advisory Council on Historic Preservation (ACHP), determines that circumstances justify granting such assistance despite the adverse effect created or permitted by the applicant. If circumstances justify granting the assistance, the Corps is required to notify the ACHP and provide documentation specifying the circumstances, the degree of damage to the integrity of any historic properties affected, and proposed mitigation. This documentation must include any views obtained from the applicant, SHPO/THPO, appropriate Indian tribes if the undertaking occurs on or affects historic properties on tribal lands or affects properties of interest to those tribes, and other parties known to have a legitimate interest in the impacts to the permitted activity on historic properties.

21. <u>Discovery of Previously Unknown Remains and Artifacts</u>
Permittees that discover any previously unknown historic, cultural or archeological remains and artifacts while accomplishing the activity authorized by an NWP, they must immediately notify the district engineer of what they have found, and to the maximum extent practicable, avoid construction activities that may affect the remains and artifacts until the required coordination has been completed. The district engineer will initiate the Federal, Tribal, and state coordination required to determine if the items or remains warrant a recovery effort or if the site is eligible for listing in the National Register of Historic Places.

22. <u>Designated Critical Resource Waters</u>
Critical resource waters include, NOAA-managed marine sanctuaries and marine monuments, and National Estuarine Research Reserves. The district engineer may designate, after notice and opportunity for public comment,

additional waters officially designated by a state as having particular environmental or ecological significance, such as outstanding national resource waters or state natural heritage sites. The district engineer may also designate additional critical resource waters after notice and opportunity for public comment.

(a) Discharges of dredged or fill material into waters of the United States are not authorized by NWPs 7, 12, 14, 16, 17, 21, 29, 31, 35, 39, 40, 42, 43, 44, 49, 50, 51, 52, 57 and 58 for any activity within, or directly affecting, critical resource waters, including wetlands adjacent to such waters.

(b) For NWPs 3, 8, 10, 13, 15, 18, 19, 22, 23, 25, 27, 28, 30, 33, 34, 36, 37, 38, and 54, notification is required in accordance with general condition 32, for any activity proposed by permittees in the designated critical resource waters including wetlands adjacent to those waters. The district engineer may authorize activities under these NWPs only after she or he determines that the impacts to the critical resource waters will be no more than minimal.

23. <u>Mitigation</u>
The district engineer will consider the following factors when determining appropriate and practicable mitigation necessary to ensure that the individual and cumulative adverse environmental effects are no more than minimal:

(a) The activity must be designed and constructed to avoid and minimize adverse effects, both temporary and permanent, to waters of the United States to the maximum extent practicable at the project site (i.e., on site).

(b) Mitigation in all its forms (avoiding, minimizing, rectifying, reducing, or compensating for resource losses) will be required to the extent necessary to ensure that the individual and cumulative adverse environmental effects are no more than minimal.

(c) Compensatory mitigation at a minimum one-for-one ratio will be required for all wetland losses that exceed 1/10-acre and require pre-construction notification, unless the district engineer determines in writing that either some other form of mitigation would be more environmentally appropriate or the adverse environmental effects of the proposed activity are no more than minimal, and provides an activity-specific waiver of this requirement. For wetland losses of 1/10-acre or less that require pre-construction notification, the district engineer may determine on a case-by-case basis that compensatory mitigation is required to ensure that the activity results in only minimal adverse environmental effects.

(d) Compensatory mitigation at a minimum one-for-one ratio will be required for all losses of stream bed that exceed 3/100-acre and require pre-construction notification, unless the district engineer determines in writing that either some other form of mitigation would be more environmentally appropriate or the adverse environmental effects of the proposed activity are no more than minimal, and provides an activity-specific waiver of this requirement. This compensatory mitigation requirement may be satisfied through the restoration or enhancement of riparian areas next to streams in accordance with paragraph (e) of this general condition. For losses of stream bed of 3/100-acre or less that require pre-construction notification, the district engineer may determine on a case-by-case basis that compensatory mitigation is required to ensure that the activity results in only minimal adverse environmental effects. Compensatory mitigation for losses of streams should be provided, if practicable, through stream rehabilitation, enhancement, or preservation, since streams are difficult-to-replace resources (see 33 CFR 332.3(e)(3)).

(e) Compensatory mitigation plans for NWP activities in or near streams or other open waters will normally include a requirement for the restoration or enhancement, maintenance, and legal protection (e.g., conservation easements) of riparian areas next to open waters. In some cases, the restoration or maintenance/protection of riparian areas may be the only compensatory mitigation required. If restoring riparian areas involves planting vegetation, only native species should be planted. The width of the required riparian area will address documented water quality or aquatic habitat loss concerns. Normally, the riparian area will be 25 to 50 feet wide on each side of the stream, but the district engineer may require slightly wider riparian areas to address documented water quality or habitat loss concerns. If it is not possible to restore or maintain/protect a riparian area on both sides of a stream, or if the waterbody is a lake or coastal waters, then restoring or maintaining/protecting a riparian area along a single bank or shoreline may be sufficient. Where both wetlands and open waters exist on the project site, the district engineer will determine the appropriate compensatory mitigation (e.g., riparian areas and/or wetlands compensation) based on what is best for the aquatic environment on a watershed basis. In cases where riparian areas are determined to be the most appropriate form of minimization or compensatory mitigation, the district engineer may waive or reduce the requirement to provide wetland compensatory mitigation for wetland losses.

(f) Compensatory mitigation projects provided to offset losses of aquatic resources must comply with the applicable provisions of 33 CFR part 332.

(1) The prospective permittee is responsible for proposing an appropriate compensatory mitigation option if compensatory mitigation is necessary to ensure that the activity results in no more than minimal adverse environmental effects. For the NWPs, the preferred mechanism for providing compensatory mitigation is mitigation bank credits or in-lieu fee program credits (see 33 CFR 332.3(b)(2) and (3)). However, if an appropriate number and type of mitigation bank or in-lieu credits are not available at the time the PCN is submitted to the district engineer, the district engineer may approve the use of permittee-responsible mitigation.

(2) The amount of compensatory mitigation required by the district engineer must be sufficient to ensure that the authorized activity results in no more than minimal individual and cumulative adverse environmental effects (see 33 CFR 330.1(e)(3)). (See also 33 CFR 332.3(f).)

(3) Since the likelihood of success is greater and the impacts to potentially valuable uplands are reduced, aquatic resource restoration should be the first compensatory mitigation option considered for permittee-responsible mitigation.

(4) If permittee-responsible mitigation is the proposed option, the prospective permittee is responsible for submitting a mitigation plan. A conceptual or detailed mitigation plan may be used by the district engineer to make the decision on the NWP verification request, but a final mitigation plan that addresses the applicable requirements of 33 CFR 332.4(c)(2) through (14)

must be approved by the district engineer before the permittee begins work in waters of the United States, unless the district engineer determines that prior approval of the final mitigation plan is not practicable or not necessary to ensure timely completion of the required compensatory mitigation (see 33 CFR 332.3(k)(3)). If permittee-responsible mitigation is the proposed option, and the proposed compensatory mitigation site is located on land in which another federal agency holds an easement, the district engineer will coordinate with that federal agency to determine if proposed compensatory mitigation project is compatible with the terms of the easement.

(5) If mitigation bank or in-lieu fee program credits are the proposed option, the mitigation plan needs to address only the baseline conditions at the impact site and the number of credits to be provided (see 33 CFR 332.4(c)(1)(ii)).

(6) Compensatory mitigation requirements (e.g., resource type and amount to be provided as compensatory mitigation, site protection, ecological performance standards, monitoring requirements) may be addressed through conditions added to the NWP authorization, instead of components of a compensatory mitigation plan (see 33 CFR 332.4(c)(1)(ii)).

(g) Compensatory mitigation will not be used to increase the acreage losses allowed by the acreage limits of the NWPs. For example, if an NWP has an acreage limit of 1/2-acre, it cannot be used to authorize any NWP activity resulting in the loss of greater than 1/2-acre of waters of the United States, even if compensatory mitigation is provided that replaces or restores some of the lost waters. However, compensatory mitigation can and should be used, as necessary, to ensure that an NWP activity already meeting the established acreage limits also satisfies the no more than minimal impact requirement for the NWPs.

(h) Permittees may propose the use of mitigation banks, in-lieu fee programs, or permittee-responsible mitigation. When developing a compensatory mitigation proposal, the permittee must consider appropriate and practicable options consistent with the framework at 33 CFR 332.3(b). For activities resulting in the loss of marine or estuarine resources, permittee-responsible mitigation may be environmentally preferable if there are no mitigation banks or in-lieu fee programs in the area that have marine or estuarine credits available for sale or transfer to the permittee. For permittee-responsible mitigation, the special conditions of the NWP verification must clearly indicate the party or parties responsible for the implementation and performance of the compensatory mitigation project, and, if required, its long-term management.

(i) Where certain functions and services of waters of the United States are permanently adversely affected by a regulated activity, such as discharges of dredged or fill material into waters of the United States that will convert a forested or scrub-shrub wetland to a herbaceous wetland in a permanently maintained utility line right-of-way, mitigation may be required to reduce the adverse environmental effects of the activity to the no more than minimal level.

24. Safety of Impoundment Structures

To ensure that all impoundment structures are safely designed, the district engineer may require non-Federal applicants to demonstrate that the structures comply with established state or federal, dam safety criteria or have been designed by qualified persons. The district engineer may also require documentation that the design has been independently reviewed by similarly qualified persons, and appropriate modifications made to ensure safety.

25. <u>Water Quality</u>

(a) Where the certifying authority (state, authorized tribe, or EPA, as appropriate) has not previously certified compliance of an NWP with CWA section 401, a CWA section 401 water quality certification for the proposed discharge must be obtained or waived (see 33 CFR 330.4(c)). If the permittee cannot comply with all of the conditions of a water quality certification previously issued by certifying authority for the issuance of the NWP, then the permittee must obtain a water quality certification or waiver for the proposed discharge in order for the activity to be authorized by an NWP.

(b) If the NWP activity requires pre-construction notification and the certifying authority has not previously certified compliance of an NWP with CWA section 401, the proposed discharge is not authorized by an NWP until water quality certification is obtained or waived. If the certifying authority issues a water quality certification for the proposed discharge, the permittee must submit a copy of the certification to the district engineer. The discharge is not authorized by an NWP until the district engineer has notified the permittee that the water quality certification requirement has been satisfied by the issuance of a water quality certification or a waiver.

(c) The district engineer or certifying authority may require additional water quality management measures to ensure that the authorized activity does not result in more than minimal degradation of water quality.

26. <u>Coastal Zone Management</u>.

In coastal states where an NWP has not previously received a state coastal zone management consistency concurrence, an individual state coastal zone management consistency concurrence must be obtained, or a presumption of concurrence must occur (see 33 CFR 330.4(d)). If the permittee cannot comply with all of the conditions of a coastal zone management consistency concurrence previously issued by the state, then the permittee must obtain an individual coastal zone management consistency concurrence or presumption of concurrence in order for the activity to be authorized by an NWP. The district engineer or a state may require additional measures to ensure that the authorized activity is consistent with state coastal zone management requirements.

27. <u>Regional and Case-By-Case Conditions</u>

The activity must comply with any regional conditions that may have been added by the Division Engineer (see 33 CFR 330.4(e)) and with any case specific conditions added by the Corps or by the state, Indian Tribe, or U.S. EPA in its CWA section 401 Water Quality Certification, or by the state in its Coastal Zone Management Act consistency determination.

28. <u>Use of Multiple Nationwide Permits</u>

The use of more than one NWP for a single and complete project is authorized, subject to the following restrictions:

(a) If only one of the NWPs used to authorize the single and complete project has a specified acreage limit, the acreage loss of waters of the United States cannot exceed the acreage limit of the NWP with the highest specified acreage limit. For example, if a road crossing over tidal waters is constructed under NWP 14, with associated bank stabilization authorized by NWP 13, the maximum acreage loss of waters of the United States for the total project cannot exceed 1⁄3-acre.

(b) If one or more of the NWPs used to authorize the single and complete project has specified acreage limits, the acreage loss of waters of the United States authorized by those NWPs cannot exceed their respective specified acreage limits. For example, if a commercial development is constructed under NWP 39, and the single and complete project includes the filling of an upland ditch authorized by NWP 46, the maximum acreage loss of waters of the United States for the commercial development under NWP 39 cannot exceed 1/2-acre, and the total acreage loss of waters of United States due to the NWP 39 and 46 activities cannot exceed 1 acre.

29. <u>Transfer of Nationwide Permit Verifications</u>
If the permittee sells the property associated with a nationwide permit verification, the permittee may transfer the nationwide permit verification to the new owner by submitting a letter to the appropriate Corps district office to validate the transfer. A copy of the nationwide permit verification must be attached to the letter, and the letter must contain the following statement and signature:

"When the structures or work authorized by this nationwide permit are still in existence at the time the property is transferred, the terms and conditions of this nationwide permit, including any special conditions, will continue to be binding on the new owner(s) of the property. To validate the transfer of this nationwide permit and the associated liabilities associated with compliance with its terms and conditions, have the transferee sign and date below."

____

(Transferee)

____

(Date)

30. <u>Compliance Certification</u>
Each permittee who receives an NWP verification letter from the Corps must provide a signed certification documenting completion of the authorized activity and implementation of any required compensatory mitigation. The success of any required permittee-responsible mitigation, including the achievement of ecological performance standards, will be addressed separately by the district engineer. The Corps will provide the permittee the certification document with the NWP verification letter. The certification document will include:

(a) A statement that the authorized activity was done in accordance with the NWP authorization, including any general, regional, or activity-specific conditions;

(b) A statement that the implementation of any required compensatory mitigation was completed in accordance with the permit conditions. If credits from a mitigation bank or in-lieu fee program are used to satisfy the compensatory mitigation requirements, the certification must include the documentation required by 33 CFR 332.3(l)(3) to confirm that the permittee secured the appropriate number and resource type of credits; and

(c) The signature of the permittee certifying the completion of the activity and mitigation.

The completed certification document must be submitted to the district engineer within 30 days of completion of the authorized activity or the implementation of any required compensatory mitigation, whichever occurs later.

31. <u>Activities Affecting Structures or Works Built by the United States</u>
If an NWP activity also requires review by, or permission from, the Corps pursuant to 33 U.S.C. 408 because it will alter or temporarily or permanently occupy or use a U.S. Army Corps of Engineers (USACE) federally authorized Civil Works project (a "USACE project"), the prospective permittee must submit a pre-construction notification. See paragraph (b)(10) of general condition 32. An activity that requires section 408 permission and/or review is not authorized by an NWP until the appropriate Corps office issues the section 408 permission or completes its review to alter, occupy, or use the USACE project, and the district engineer issues a written NWP verification.

32. <u>Pre-Construction Notification</u>
(a) *Timing*. Where required by the terms of the NWP, the prospective permittee must notify the district engineer by submitting a pre-construction notification (PCN) as early as possible. The district engineer must determine if the PCN is complete within 30 calendar days of the date of receipt and, if the PCN is determined to be incomplete, notify the prospective permittee within that 30 day period to request the additional information necessary to make the PCN complete. The request must specify the information needed to make the PCN complete. As a general rule, district engineers will request additional information necessary to make the PCN complete only once. However, if the prospective permittee does not provide all of the requested information, then the district engineer will notify the prospective permittee that the PCN is still incomplete and the PCN review process will not commence until all of the requested information has been received by the district engineer. The prospective permittee shall not begin the activity until either:

(1) He or she is notified in writing by the district engineer that the activity may proceed under the NWP with any special conditions imposed by the district or division engineer; or

(2) 45 calendar days have passed from the district engineer's receipt of the complete PCN and the prospective permittee has not received written notice from the district or division engineer. However, if the permittee was required to notify the Corps pursuant to general condition 18 that listed species or critical habitat might be affected or are in the vicinity of the activity, or to notify the Corps pursuant to general condition 20 that the activity might have the potential to cause effects to historic properties, the permittee cannot begin the activity until receiving written notification from the Corps that there is "no effect" on listed species or "no potential to cause effects" on historic properties, or that any consultation required under Section 7 of the Endangered Species Act (see 33 CFR 330.4(f)) and/or section 106 of the National Historic Preservation Act (see 33 CFR 330.4(g)) has been completed. If the proposed activity requires a written waiver to exceed specified limits of an NWP, the permittee may not begin the activity until the district engineer issues the waiver. If the district or division engineer notifies the permittee in writing that an individual permit is required within 45 calendar days of receipt of a complete PCN, the permittee cannot begin the activity until an individual permit has been obtained. Subsequently, the permittee's right to proceed under the NWP may be modified, suspended, or revoked only in accordance with the procedure set forth in 33 CFR 330.5(d)(2).

(b) *Contents of Pre-Construction Notification*: The PCN must be in writing and include the following information:

(1) Name, address and telephone numbers of the prospective permittee;

(2) Location of the proposed activity;

(3) Identify the specific NWP or NWP(s) the prospective permittee wants to use to authorize the proposed activity;

(4) (i) A description of the proposed activity; the activity's purpose; direct and indirect adverse environmental effects the activity would cause, including the anticipated amount of loss of wetlands, other special aquatic sites, and other waters expected to result from the NWP activity, in acres, linear feet, or other appropriate unit of measure; a description of any proposed mitigation measures intended to reduce the adverse environmental effects caused by the proposed activity; and any other NWP(s), regional general permit(s), or individual permit(s) used or intended to be used to authorize any part of the proposed project or any related activity, including other separate and distant crossings for linear projects that require Department of the Army authorization but do not require pre-construction notification. The description of the proposed activity and any proposed mitigation measures should be sufficiently detailed to allow the district engineer to determine that the adverse environmental effects of the activity will be no more than minimal and to determine the need for compensatory mitigation or other mitigation measures.

(ii) For linear projects where one or more single and complete crossings require pre-construction notification, the PCN must include the quantity of anticipated losses of wetlands, other special aquatic sites, and other waters for each single and complete crossing of those wetlands, other special aquatic sites, and other waters (including those single and complete crossings authorized by an NWP but do not require PCNs). This information will be used by the district engineer to evaluate the cumulative adverse environmental effects of the proposed linear project, and does not change those non-PCN NWP activities into NWP PCNs.

(iii) Sketches should be provided when necessary to show that the activity complies with the terms of the NWP. (Sketches usually clarify the activity and when provided results in a quicker decision. Sketches should contain sufficient detail to provide an illustrative description of the proposed activity (e.g., a conceptual plan), but do not need to be detailed engineering plans);

(5) The PCN must include a delineation of wetlands, other special aquatic sites, and other waters, such as lakes and ponds, and perennial and intermittent streams, on the project site. Wetland delineations must be prepared in accordance with the current method required by the Corps. The permittee may ask the Corps to delineate the special aquatic sites and other waters on the project site, but there may be a delay if the Corps does the delineation, especially if the project site is large or contains many wetlands, other special aquatic sites, and other waters. Furthermore, the 45-day period will not start until the delineation has been submitted to or completed by the Corps, as appropriate;

(6) If the proposed activity will result in the loss of greater than 1/10-acre of wetlands or 3/100-acre of stream bed and a PCN is required, the prospective permittee must submit a statement describing how the mitigation requirement will be satisfied, or explaining

why the adverse environmental effects are no more than minimal and why compensatory mitigation should not be required. As an alternative, the prospective permittee may submit a conceptual or detailed mitigation plan.

(7) For non-federal permittees, if any listed species (or species proposed for listing) or designated critical habitat (or critical habitat proposed for such designation) might be affected or is in the vicinity of the activity, or if the activity is located in designated critical habitat (or critical habitat proposed for such designation), the PCN must include the name(s) of those endangered or threatenedspecies (or species proposed for listing) that might be affected by the proposed activity or utilize the designated critical habitat (or critical habitat proposed for such designation) that might be affected by the proposed activity. For NWP activities that require pre-construction notification, Federal permittees must provide documentation demonstrating compliance with the Endangered Species Act;

(8) For non-federal permittees, if the NWP activity might have the potential to cause effects to a historic property listed on, determined to be eligible for listing on, or potentially eligible for listing on, the National Register of Historic Places, the PCN must state which historic property might have the potential to be affected by the proposed activity or include a vicinity map indicating the location of the historic property. For NWP activities that require pre-construction notification, Federal permittees must provide documentation demonstrating compliance with section 106 of the National Historic Preservation Act;

(9) For an activity that will occur in a component of the National Wild and Scenic River System, or in a river officially designated by Congress as a “study river” for possible inclusion in the system while the river is in an official study status, the PCN must identify the Wild and Scenic River or the “study river” (see general condition 16); and

(10) For an NWP activity that requires permission from, or review by, the Corps pursuant to 33 U.S.C. 408 because it will alter or temporarily or permanently occupy or use a U.S. Army Corps of Engineers federally authorized civil works project, the pre-construction notification must include a statement confirming that the project proponent has submitted a written request for section 408 permission from, or review by, the Corps office having jurisdiction over that USACE project.

(c) *Form of Pre-Construction Notification*: The nationwide permit pre-construction notification form (Form ENG 6082) should be used for NWP PCNs. A letter containing the required information may also be used. Applicants may provide electronic files of PCNs and supporting materials if the district engineer has established tools and procedures for electronic submittals.

(d) *Agency Coordination*: (1) The district engineer will consider any comments from Federal and state agencies concerning the proposed activity’s compliance with the terms and conditions of the NWPs and the need for mitigation to reduce the activity’s adverse environmental effects so that they are no more than minimal.

(2) Agency coordination is required for: (i) all NWP activities that require pre-construction notification and result in the loss of greater than 1/2-acre of waters of the United States; (ii) NWP 13 activities in excess of 500 linear feet, fills greater than one cubic yard per running foot, or involve discharges of dredged or fill material into special aquatic sites; and (iii)

NWP 54 activities in excess of 500 linear feet, or that extend into the waterbody more than 30 feet from the mean low water line in tidal waters or the ordinary high water mark in the Great Lakes.

(3) When agency coordination is required, the district engineer will immediately provide (e.g., via e-mail, facsimile transmission, overnight mail, or other expeditious manner) a copy of the complete PCN to the appropriate Federal or state offices (FWS, state natural resource or water quality agency, EPA, and, if appropriate, the NMFS). With the exception of NWP 37, these agencies will have 10 calendar days from the date the material is transmitted to notify the district engineer via telephone, facsimile transmission, or e-mail that they intend to provide substantive, site-specific comments. The comments must explain why the agency believes the adverse environmental effects will be more than minimal. If so contacted by an agency, the district engineer will wait an additional 15 calendar days before making a decision on the pre-construction notification. The district engineer will fully consider agency comments received within the specified time frame concerning the proposed activity's compliance with the terms and conditions of the NWPs, including the need for mitigation to ensure that the net adverse environmental effects of the proposed activity are no more than minimal. The district engineer will provide no response to the resource agency, except as provided below. The district engineer will indicate in the administrative record associated with each pre-construction notification that the resource agencies' concerns were considered. For NWP 37, the emergency watershed protection and rehabilitation activity may proceed immediately in cases where there is an unacceptable hazard to life or a significant loss of property or economic hardship will occur. The district engineer will consider any comments received to decide whether the NWP 37 authorization should be modified, suspended, or revoked in accordance with the procedures at 33 CFR 330.5.

(4) In cases of where the prospective permittee is not a Federal agency, the district engineer will provide a response to NMFS within 30 calendar days of receipt of any Essential Fish Habitat conservation recommendations, as required by section 305(b)(4)(B) of the Magnuson-Stevens Fishery Conservation and Management Act.

(5) Applicants are encouraged to provide the Corps with either electronic files or multiple copies of pre-construction notifications to expedite agency coordination.

Idaho Department of Environmental Quality
Final Section 401 Water Quality Certification

July 29, 2024

Project Name: SH-75, Elkhorn Road to River Street (Key # 20033), NWW-2024-00333

Permit Name and Number: Nationwide Permit 14, Linear Transportation

Applicant/Authorized Agent: Jesse Barrus and Scott Malone, Idaho Transportation Department District 4

Project Location: Ketchum, Blaine County, Idaho; 43.667041°, -114.355657°

Receiving Water Body: Trail Creek

Pursuant to the provisions of Section 401(a)(1) of the Federal Water Pollution Control Act (Clean Water Act), as amended; 33 U.S.C. Section 1341(a)(1); 40 C.F.R. § 121; and Idaho Code §§ 39-101 et seq. and 39-3601 et seq., the Idaho Department of Environmental Quality (DEQ) has authority to review activities receiving federal permits or licenses and issue water quality certification decisions.

In accordance with federal regulations at 40 C.F.R. § 121.4, all project proponents must submit a request for a prefiling meeting at least thirty days in advance of submitting a certification request. A prefiling meeting request was received by DEQ on 6/25/2024. To facilitate early engagement and project coordination, DEQ accepted an opportunity to host a prefiling meeting which was conducted on 10/12/2021 and 6/25/2024, to seek clarification as well as to discuss the project and potential information needs.

Based upon review of the federal permit application, readily available water quality related materials, and certification request in accordance with 40 C.F.R. §§ 121.5 (b) and (c) and 121.7 (c), received on, 6/27/2024, DEQ, certifies that if the permittee complies with the terms and conditions imposed by the federal permit and the conditions set forth in this water quality certification, then it is reasonable for DEQ to conclude that the activity will comply with water quality requirements, including applicable requirements of the Clean Water Act §§ 301, 302, 303, 306, and 307, Idaho's "Water Quality Standards" (IDAPA 58.01.02), and other appropriate water quality requirements of state law.

Pursuant to Clean Water Act § 401 (a)(1) and 40 C.F.R. § 121.7 (d); and IDAPA 58.01.02.052.08, DEQ issued a 21-day public notice to solicit comments on the draft certification on 7/29/2024 through 8/18/2024. Any public comments received during the 21-day comment period were considered by DEQ to inform the certification decision and conditions.

This certification does not constitute authorization of the permitted activities by any other state or federal agency or private person or entity. This certification does not excuse the permit holder from the obligation to obtain any other necessary approvals, authorizations or permits.

1 Project Description

The project proposes to improve safety and capacity on SH-75 between the Big Wood River Bridge near Elkhorn Road and River Street in the City of Ketchum in Blaine County, mileposts (MP) 126.4 to 128.2. Project development will include roadway widening with curb, gutter, sidewalk, intersection improvement, retaining walls, drainage, and replacing a box culvert and constructing a reinforce slope along Trail Creek.

The total wetland impacts are 1,956 square feet (SF) (0.0449 acres) and the total open water impacts are 1,555 SF (0.0358 acres). The streambed impacts on Trail Creek are temporary, and beneficial improvements would be about 175 SF. Additional self-mitigating stabilization will be installed through a vegetated wall along the stream bank for 716 SF. The old SH-75 bridge will be removed, and the new bridge will have 30 feet longer span than the current design and will increase the available streambed by 1,642 SF (0.0377 acres). Mitigation will be on-site at Trail Creek.

The wetland and stream impacts are a result of road widening, bridge replacement (construction of a reinforce slope to stabilize the stream bank on Trail Creek and construction of a wildlife bench), and the installation of a stormwater facility. Work within wetlands consists of fill placement for roadway widening, scour protection, and streambank grading to increase hydraulic flow. Additionally, culvert work will be required. This will include installation of a concrete box and headwalls, modification of stormwater pond, and replacement of three irrigation culverts and irrigation crossing. Construction equipment will include rollers, backhoes, excavators, cranes, and other construction equipment typical for a roadway and bridge construction project. Waste material will be disposed of in an approved upland location. All bridge improvements will be located outside of the existing and proposed stream channels. The project is designed to restore a more natural channel, gradient, bed, and width, and improved bank stability through the structure. New bridge footings will be constructed above the ordinary high-water mark (OHWM). Equipment will include an excavator operating from the bank/existing roadway. The construction area below the OHWM of the open waters will be dewatered using sandbags or another similar temporary dewatering method. A qualified biologist will capture and remove fish from the dewatered work area if needed. A pump with a fish screen will be used to transfer water. The in-water work window will be observed for construction from March 15 to July 15, which was confirmed by Idaho Department of Water Resources and Idaho Department of Fish and Game.

An ITD approved site-specific Storm Water Pollution Prevention Plan (SWPPP) will be prepared for this project to comply with the Construction General Permit (CGP). The SWPPP will include measures to address sediment and erosion control with both temporary and permanent measures. Critical areas including wetlands will be marked with exclusion fencing. The perimeter of the wetlands that are not permitted will be clearly marked with high visibility silt fence.

2 Antidegradation Review

As part of its water quality standards program, Idaho has an antidegradation policy providing three levels of protection to water bodies in Idaho (IDAPA 58.01.02.051). DEQ adopted regulations to implement the antidegradation policy (IDAPA 58.01.02.052).

Tier I Protection. The first level of protection applies to all water bodies subject to Clean Water Act jurisdiction and ensures that existing uses of a water body and the level of water quality necessary to protect those existing uses will be maintained and protected (IDAPA 58.01.02.051.01; 58.01.02.052.01). Additionally, a Tier I review is performed for all new or reissued permits or licenses (IDAPA 58.01.02.052.07).

Tier II Protection. The second level of protection applies to those water bodies considered high quality and ensures that no lowering of water quality will be allowed unless necessary to accommodate important economic or social development (IDAPA 58.01.02.051.02; 58.01.02.052.08).

Tier III Protection. The third level of protection applies to water bodies that have been designated outstanding resource waters and requires that activities do not lower water quality (IDAPA 58.01.02.051.03; 58.01.02.052.09).

DEQ employs a water-body-by-water-body approach to implementing Idaho's antidegradation policy. This approach means that any water body fully supporting its beneficial uses will be considered high quality (IDAPA 58.01.02.052.05.a). Any water body not fully supporting its beneficial uses will be provided Tier I protection for that use, unless specific circumstances warranting Tier II protection are met (IDAPA 58.01.02.052.05.c). The most recent federally approved *DEQ Integrated Report* and supporting data are used to determine support status and the tier of protection (IDAPA 58.01.02.052.05).

2.1 Pollutants of Concern

The pollutant of concern for this project is sediment. As part of the § 401 water quality certification, DEQ requires the applicant to comply with various conditions to protect water quality and meet Idaho's water quality standards, including the water quality criteria applicable to these pollutant(s).

2.2 Receiving Water Body Level of Protection

This project is located on Trail Creek within the Big Wood River subbasin assessment unit (AU) 17040219SK013_04 (Trail Creek - Corral Creek to mouth). According to DEQ's *2024 Integrated Report*, this AU has the following designated beneficial uses: Cold Water Aquatic Life and Salmonid Spawning. Secondary Contact Recreation is presumed. In addition to these uses, all waters within the state are protected for agricultural and industrial water supply, wildlife habitat, and aesthetics (IDAPA 58.01.02.100). According to DEQ's 2024 Integrated Report, this receiving water body AU is fully supporting its assessed existing and presumed uses (IDAPA 58.01.02.052.05.a). As such, DEQ will provide Tier II protection in addition to Tier I for this water body (IDAPA 58.01.02.051.02; 58.01.02.051.01).

2.3 Protection and Maintenance of Existing Uses (Tier I Protection)

A Tier I review is performed for all new or reissued permits or licenses, applies to all waters subject to the jurisdiction of the Clean Water Act, and requires demonstration that existing uses and the level of water quality necessary to protect existing uses shall be maintained and protected. The numeric and narrative criteria in the water quality standards are set at levels that ensure protection of existing and designated beneficial uses.

Water bodies not supporting existing or designated beneficial uses must be identified as water quality limited, and a total maximum daily load (TMDL) must be prepared for those pollutants causing impairment. Once a TMDL is developed, discharges of causative pollutants shall be consistent with the allocations in the TMDL (IDAPA 58.01.02.055.05). Before developing the TMDL, the water quality standards require applying the antidegradation policy and implementation provisions to maintain and protect uses (IDAPA 58.01.02.055.04).

Throughout the life of the project, the applicant will implement, install, maintain, monitor, and adaptively manage best management practices (BMPs) to reduce erosion and minimize turbidity levels in receiving water bodies downstream of the project. In addition, permanent erosion and sediment controls will be implemented that will minimize or prevent future sediment contributions from the project area.

If the project is conducted according to the provisions of the project plans, federal permit and conditions of this certification, then it is reasonable for DEQ to conclude that the project will comply with the state's numeric and narrative water quality criteria. These criteria are set at levels that protect and maintain existing and designated beneficial uses.

There is no available information indicating the presence of any existing beneficial uses aside from those that are already designated and discussed above. The conditions in this certification ensure that the level of water quality necessary to protect both existing and designated uses is maintained and protected in compliance with the Tier I provisions of IDAPA 58.01.02.051.01 and 58.01.02.052.07.

2.4 High-Quality Waters (Tier II Protection)

The Trail Creek is considered high quality for Cold Water Aquatic Life and Salmonid Spawning. The water quality relevant to these uses must be maintained and protected, unless lowering water quality is necessary to accommodate important social or economic development.

To determine whether degradation will occur, DEQ must evaluate how the activities subject to the federal permit issuance will affect water quality for each pollutant that is relevant to aquatic life, salmonid spawning and recreation uses of Trail Creek (IDAPA 58.01.02.052.06). The pollutant of concern is sediment. BMPs selected to prevent degradation include measures to minimize the potential for debris (e.g., dirt, concrete, etc.) to enter the area of wetlands not being impacted while removing and constructing structures; an approved spill control and prevention plan; an approved site-specific SWPPP to address sediment and erosion control with both temporary and permanent measures; all disturbed soils will be reseeded following construction; on-site mitigation will consist of native plantings, and retention walls at Trail Creek restoration area; dewatering may be accomplished by draining, pumping, bailing, or cribbing; if needed, temporary sump holes may be installed within the footings and abutment areas to be dewatered to create a more suitable pumping area; water removed during footing and abutment construction will be pumped to a temporary storage location where the water will be cleaned to standards specified DEQ; if appropriate, water from the dewatering activities may be pumped to a temporary storage/treatment site, or into upland areas and allowed to flow/filter through vegetation prior to reentering the stream channel; water behind the barrier may be pumped directly back into the stream providing the pumped water meets applicable in stream turbidity criteria; and turbidity monitoring will be conducted while working on or adjacent to Trail Creek. The project complies with IDAPA 58.01.02.051.02 and IDAPA 58.01.02.052.06.

To maintain the ambient water quality conditions, permanent erosion and sediment controls must be implemented to minimize or prevent future sediment contributions from the project area. The provisions in the federal permit and the conditions of this certification ensure that degradation to the ID17040219SK013_04 AU or the Trail Creek will not occur.

DEQ concludes that this project complies with the Tier II provisions of IDAPA 58.01.02.051.02, 58.01.02.052.06, and 58.01.02.052.08.

3 Conditions Necessary to Ensure Compliance with Water Quality Standards or Other Appropriate Water Quality Requirements of State Law

The following conditions ensure the SH-75, Elkhorn Road to River Street, NWW-2024-00333 project complies with Idaho's water quality standards and other appropriate water quality requirements of state law applicable to Trail Creek.

3.1 General Conditions

This certification is based on review of the federal permit application, readily available water quality related materials, and certification request submitted by the Idaho Department of Transportation on 6/27/2024 and is conditioned upon the requirement that any modification (e.g., change in work windows, etc.) of the permitted activity shall first be provided to DEQ for review to determine compliance with Idaho's water quality standards.

Because DEQ is certifying only the activity described in the certification request, this condition ensures that discharges under circumstances that differ from those described in the certification request will comply with 33 U.S.C. § 1341, 40 C.F.R. § 121, and other applicable water quality requirements, including without limitation 33 U.S.C. § 1311(a), Idaho Code § 39-108, IDAPA 58.01.02.051, IDAPA 58.01.02.052, IDAPA 58.01.02.080, IDAPA 58.01.02.200, IDAPA 58.01.02.210, IDAPA 58.01.02.250, IDAPA 58.01.02.251, IDAPA 58.01.02.252, IDAPA 58.01.02.253, and IDAPA 58.01.02.400.

1. DEQ reserves the right to modify this certification in accordance with 40 C.F.R. § 121.10 if DEQ determines that, due to changes in relevant circumstances—including without limitation, changes in project activities, the characteristics of the receiving water bodies, or state water quality standards—there is no longer reasonable assurance of compliance with the water quality standards or other appropriate requirements of state law.

   Because DEQ is certifying only the activity described in the certification request based on information available at the time of certification, this condition ensures that discharges from activities not described in the certification request, or where there has been a change in the characteristics of or water quality standards applicable to the receiving water body, will comply with 33 U.S.C. § 1341, 40 C.F.R. 121, and other applicable water quality requirements, including without limitation 33 U.S.C. § 1311(a), Idaho Code § 39-108, IDAPA 58.01.02.051, IDAPA 58.01.02.052, IDAPA 58.01.02.080, IDAPA 58.01.02.200, IDAPA 58.01.02.210, IDAPA 58.01.02.250, IDAPA 58.01.02.251, IDAPA 58.01.02.252, IDAPA 58.01.02.253, and IDAPA 58.01.02.400.

2. If ownership of the project changes, the certification holder shall notify DEQ, in writing, upon transferring this ownership or responsibility for compliance with these conditions to another person or party. The new owner/operator shall request, in writing, the transfer of this water quality certification to the new name. This condition ensures that, if ownership changes, DEQ has the minimum information to support ongoing compliance with 33 U.S.C. § 1341, 40 C.F.R. 121, this water quality certification, and other applicable water quality requirements, including without limitation Idaho Code § 39-108, IDAPA 58.01.02.080, and IDAPA 58.01.02.400.

3. A copy of this certification must be kept on the job site and readily available for review by any contractor working on the project and any federal, state, or local government personnel.

   This condition ensures all responsible parties, including on-site contractors, are aware of and comply with this water quality certification and other applicable water quality requirements, including without limitation Idaho Code § 39-108, IDAPA 58.01.02.080, and IDAPA 58.01.02.400.

4. The applicant is responsible for all work done by contractors and must ensure the contractors are informed of and follow all the conditions described in this certification and the federal permit.

This condition ensures all responsible parties, including on-site contractors, comply with this water quality certification and applicable water quality requirements, including without limitation Idaho Code § 39-108, IDAPA 58.01.02.080, and IDAPA 58.01.02.400.

5. If this project disturbs more than 1-acre and there is potential for discharge of storm water to waters of the United States, then coverage under the IPDES Construction General Permit Program may be required.

   This condition ensures that work authorized under the federal permit complies with water quality requirements prohibiting unauthorized storm water discharges, including without limitation 33 U.S.C. § 1311(a), 33 U.S.C. § 1342(p), IDAPA 58.01.02.080, and IDAPA 58.01.02.400.

3.2 Fill Material

The following conditions are necessary for the protection of beneficial uses according to Idaho's water quality standards, including without limitation IDAPA 58.01.02.051, IDAPA 58.01.02.200, IDAPA 58.01.02.210, IDAPA 58.01.02.250, IDAPA 58.01.02.251, IDAPA 58.01.02.252, IDAPA 58.01.02.253, and IDAPA 58.01.02.400.

1. Fill material subject to suspension will be free of easily suspended fine material. Only clean material may be placed as fill. If dredged material is proposed for use as fill material and there is a possibility the material may be contaminated, then the permittee must assess and characterize sediment to determine the suitability of dredge material for unconfined-aquatic placement; determine the suitability of post-dredge surfaces; and predict the effect on water quality during dredging. Sediment assessment and characterization following the procedures in the *Sediment Evaluation Framework for the Pacific Northwest* (RSET 2018) satisfies this requirement. A different assessment and characterization methodology may be used if the DEQ approves the methodology in writing.
2. Temporary fills will be removed in their entirety on or before construction completion.
3. Excavated or staged fill material must be placed so it is isolated from the water edge or wetlands and not placed where it could re-enter waters of the United States.

3.3 Erosion and Sediment Control

The following conditions are necessary for the protection of beneficial uses according to Idaho's water quality standards, including without limitation IDAPA 58.01.02.051, IDAPA 58.01.02.200, IDAPA 58.01.02.250, IDAPA 58.01.02.253, and IDAPA 58.01.02.400.

1. BMPs for sediment and erosion control suitable to prevent exceedances of Idaho's water quality standards and consistency with TMDLs shall be selected and installed before starting construction at the site. One resource to evaluate appropriate BMPs is the *Idaho Catalog of Storm Water Best Management Practices* (DEQ 2020). Other resources may also be used for selecting appropriate BMPs.

2. Permanent erosion and sediment control measures will be installed to provide long-term sediment and erosion control and prevent excess sediment from entering waters of the United States.
3. Permanent erosion and sediment control measures will be installed at the earliest practicable time consistent with good construction practices and will be maintained as necessary throughout the project.
4. Structural fill or bank protection will consist of materials that are placed and maintained to withstand predictable high flows in the waters of the United States.
5. A BMP inspection and maintenance plan must be developed and implemented. At a minimum, BMPs must be inspected and maintained daily during project implementation and replaced or augmented if they are not effective.
6. All construction debris, scraps, particles, and other associated materials will be captured and properly disposed of so they cannot enter waters of the United States or cause water quality degradation.
7. Disturbed areas suitable for vegetation will be seeded or revegetated to prevent subsequent soil erosion (EPA 2000).
8. Maximum fill slopes will be material that is structurally stable once placed and does not slough into the stream channel during construction, during periods before revegetation, or after vegetation is established.
9. Sediment from disturbed areas or sediment that can be tracked by vehicles onto pavement must not leave the site in amounts reasonably expected to enter waters of the United States. Placement of clean aggregate at all construction entrances or exits and other BMPs such as truck or wheel washes, if needed, must be used when earth-moving equipment will be leaving the site and traveling on paved surfaces to prevent track-out.

3.4 Turbidity

The following conditions are necessary for the protection of beneficial uses according to Idaho's water quality standards, including without limitation IDAPA 58.01.02.051, IDAPA 58.01.02.200.08, IDAPA 58.01.02.250.02.e, IDAPA 58.01.02.253, and IDAPA 58.01.02.400.

1. Sediment resulting from this activity must be mitigated to prevent violations of the turbidity standards stipulated in Idaho's water quality standards. Any violation of this standard must be reported to the DEQ regional office immediately.
2. Containment measures such as silt curtains, geotextile fabrics, and silt fences must be implemented and properly maintained to minimize instream sediment suspension and resulting turbidity. One resource to evaluate appropriate BMPs is the *Idaho Catalog of Storm Water Best Management Practices* (DEQ 2020). Other resources may also be used for selecting appropriate BMPs.
3. All practical BMPs on disturbed banks and within the waters of the United States must be implemented to minimize turbidity. Visual observation is acceptable to determine whether BMPs are functioning properly. If a sediment plume is observed, the project may be causing an exceedance of water quality standards, and the permittee must inspect the condition of the project BMPs. If the BMPs appear to be functioning

improperly, then corrective action must be taken, and the permittee must modify the activity or implement additional BMPs (this may also include modifying existing BMPs).

4. If the project continues to have a visual sediment plume after BMPs have been inspected and modified, turbidity monitoring consistent with Table 1, is required.

   a. A properly and regularly calibrated turbidimeter is required for sample collection measurements to be analyzed in the field. The turbidimeter should be calibrated before each use or according to the manufacturer's recommendations. The calibration log should be maintained and made available to DEQ upon request. Instantaneous grab samples may be collected for field analysis and taken to a laboratory for analysis as needed. When turbidity monitoring is required, a grab sample must be collected at an undisturbed area immediately upstream from the in-water disturbance or discharge to establish background turbidity levels. Background turbidity, latitude/longitude, date, and time must be recorded before monitoring downstream. A sample must be collected immediately downstream from the in-water disturbance or point of discharge and within the visible sediment plume. The turbidity, latitude/longitude, date, and time must be recorded for each sample. The downstream sample must be taken immediately following the upstream sample to obtain meaningful and representative results.

   b. Results from the downstream sampling location must be compared to the upstream sample location or background turbidity to determine whether project activities are causing an exceedance of Idaho's water quality standards. If the downstream turbidity is 50 nephelometric turbidity units (NTUs) or greater than the upstream turbidity, then the project is causing an exceedance of the water quality standards. Any exceedance of the turbidity standard must be reported to the appropriate DEQ regional office within 24-hours of the sample event.

   c. Earth-disturbing activities may continue once turbidity readings return to within 50 NTU over background instantaneously, or if turbidity has exceeded 25 NTU over background for more than 10 consecutive days, once turbidity readings have no longer exceeded 25 NTU over background for at least 24 consecutive hours.

   d. Copies of daily logs for turbidity monitoring must be available to DEQ upon request. The report must describe all exceedances and subsequent corrective actions taken, including the effectiveness of the action.

Table 1. Turbidimeter monitoring and sampling when a plume is observed.

Turbidity Above Background[a]	Monitoring/Sampling Frequency[a]	Additional Actions Required
0 to 24 NTU	Visual monitoring every 2 hours	None
25 to 49 NTU	Sample every 2 hours	STOP work after 8 hours in every 24-hour period
25 NTU for 10 or more consecutive days	Sample before and after following instructions[b]	**STOP work and follow instructions[b]; notify DEQ regional office**
50 NTU or more	Sample before and after following instructions[c]	**STOP work and follow instructions[c]; notify DEQ regional office**

a. Sample and report turbidity three times at each location. Use the maximum value of three samples to determine compliance following Table 1 directions.

b. Instructions: If BMPs appear to be functioning properly, then the permittee must modify the activity or implement corrective action such as installing additional BMPs (this may include modifying existing BMPs) until additional sampling indicates turbidity standards are met. Sampling can cease when a sediment plume is no longer observed. Work can commence when a sediment plume is no longer observed, and measurements are consecutively below 25 NTU.
c. Instructions: If BMPs appear to be functioning properly, then the permittee must modify the activity or implement corrective action such as installing additional BMPs (this may include modifying existing BMPs) until additional sampling indicates turbidity standards are met. Sampling can cease when a sediment plume is no longer observed. Work can commence when a sediment plume is no longer observed, and measurements are below 50 NTU.

3.5 In-Water Work

The following conditions are necessary for the protection of beneficial uses according to Idaho's water quality standards, including without limitation IDAPA 58.01.02.051, IDAPA 58.01.02.200, IDAPA 58.01.02.250, IDAPA 58.01.02.253, and IDAPA 58.01.02.400.

1. Work in open water must be kept to a minimum and only when necessary. Equipment shall work from an upland site to minimize disturbance of waters of the United States. If this is not practicable, take appropriate measures to ensure disturbance to the waters of the United States is minimized.
2. Construction affecting the bed or banks shall occur only during periods of low flow and/or corresponding with appropriate in-water work periods for aquatic life.
3. Fording the channel is not permitted. Build temporary bridges or other structures if crossings are necessary.
4. Temporary crossings shall be perpendicular to channels and located in areas with the least impact. The temporary crossings must be supplemented with clean gravel or treated with other mitigation methods at least as effective in reducing impacts. Temporary crossings must be removed as soon as possible after the project is completed or the crossing is no longer needed.
5. Heavy equipment working in wetlands shall be placed on mats or suitably designed pads to prevent damage to the wetlands.
6. In-water activities in spawning areas shall be avoided to the maximum extent practicable during spawning and incubation periods.
7. Work in waters of the United States shall be restricted to areas specified in the application.
8. Measures shall be taken to prevent wet concrete from entering waters of the United States when placed in forms and/or from truck washing.
9. Activities that construct and maintain intake structures must include adequate fish exclusion screening devices to prevent fish entrainment or capture.
10. Stranded fish found in dewatered segments should be moved to a location (preferably downstream) with water.
11. To minimize sediment transport, stream channel or streambank stabilization must be completed before returning water to a dewatered segment.

3.6 Vegetation Protection and Restoration

The following conditions are necessary for the protection of beneficial uses according to Idaho's water quality standards, including without limitation IDAPA 58.01.02.051, IDAPA 58.01.02.200, IDAPA 58.01.02.250, IDAPA 58.01.02.253, and IDAPA 58.01.02.400.

1. To the maximum extent practical, staging areas and access points should be placed in open, upland areas.
2. Fencing and other protective barriers should be used to mark the construction areas.
3. Where possible, alternative equipment should be used (e.g., spider hoe or crane).
4. If authorized work results in unavoidable vegetative disturbance, native riparian and wetland vegetation shall be successfully reestablished to benefit water quality at pre-project levels or improved at the completion of authorized work.

3.7 Management of Hazardous or Deleterious Materials

The following conditions are necessary for the protection of beneficial uses according to Idaho's water quality standards, including without limitation IDAPA 58.01.02.051, IDAPA 58.01.02.080, IDAPA 58.01.02.200, IDAPA 58.01.02.400, IDAPA 58.01.02.800, and IDAPA 58.01.02.850.

1. Petroleum products and hazardous, toxic, and/or deleterious materials shall not be stored, disposed of, or accumulated adjacent to or in the immediate vicinity of waters of the United States. Adequate measures and controls must ensure that those materials will not enter waters of the United States because of high water, precipitation runoff, wind, storage facility failure, accidents, or unauthorized third-party activities.
2. Secondary containment is required for chemical materials.
3. Vegetable-based hydraulic fluid should be used on equipment operating in or directly adjacent to the channel if this fluid is available.
4. Daily inspections of all fluid systems on equipment to be used in or near waters of the United States shall ensure no leaks or potential leaks exist before equipment use. A logbook of daily equipment inspections shall be kept on site and provided to DEQ upon request.
5. Equipment and machinery shall be removed from the vicinity of the waters of the United States before refueling, repair, and/or maintenance.
6. Equipment and machinery shall be steam cleaned of oils and grease in an upland location or staging area with appropriate wastewater controls and treatment capability before entering waters of the United States. Any wastewater or wash water must not enter waters of the United States.
7. Emergency spill response procedures shall be in place and include a spill response kit (e.g., oil absorbent booms or other equipment).
8. If an unauthorized release of hazardous material to waters of the United States or to land occurs and there is a likelihood it will enter waters of the United States, the responsible persons in charge must:
   a. Make every reasonable effort to abate and stop a continuing spill.

b. Make every reasonable effort to contain spilled material so it will not reach surface or ground waters of the United States.
c. Call 911 if immediate assistance is required to control, contain, or clean up the spill. If no assistance is needed in cleaning up the spill, contact the appropriate DEQ regional office during normal working hours or Idaho State Communications Center after normal working hours (1-800-632-8000). If the spilled volume is above federal reportable quantities, contact the National Response Center (1-800-424-8802).
d. Contact Twin Falls Regional Office: (208) 736-2190.

9. Collect, remove, and properly dispose of spill and cleanup materials in a manner approved by DEQ.

3.8 Culverts

The following conditions to control erosion, sediment, and turbidity are necessary for the protection of beneficial uses according to Idaho's water quality standards, including without limitation IDAPA 58.01.02.200 and IDAPA 58.01.02.250.

1. To prevent road surface and culvert bedding material from entering a stream, culvert crossings must include BMPs to retain road base and culvert bedding material. For perennial waters, the permittee should consider Idaho's "Stream Channel Alterations Rules" (IDAPA 37.03.07). Another source of BMPs for culvert installation are found in the "Rules Pertaining to the Idaho Forest Practices Act" (IDAPA 20.02.01). Examples of BMPs include, but are not limited to: parapets, wing walls, inlet and outlet rock armoring, compaction, suitable bedding material, antiseep barriers such as bentonite clay, or other acceptable roadway retention systems.
2. The culvert must not constrict the stream channel and shall not be angled so the outflow is directed toward the streambank. The culvert's flow line shall match the existing stream invert at its entrance and exit. Adequate grade control must be installed to prevent channel down cutting or excessive deposition from occurring.
3. Culverts for fish-bearing waterways shall be installed so they do not impede fish passage.
4. The culvert outflow shall be armored with riprap to provide erosion control. This riprap will be clean, angular, dense rock that is free of fines and resistant to aquatic decomposition.
5. Culverts shall be sized appropriately to maintain the natural drainage patterns.

3.9 Treated Wood

The following condition meets Idaho 's water quality standards, including without limitation IDAPA 58.01.02.200 and IDAPA 58.01.02.210.

This condition ensures that toxic chemicals are not introduced into waters of the United States. The *Guidance for the Use of Wood Preservatives and Preserved Wood Products In or Around Aquatic Environments* (DEQ 2008) must be considered when using treated wood materials in the aquatic environment. The DEQ guidance references the *Best Management Practices for the*

*Use of Treated Wood in Aquatic and Wetland Environments (*Western Wood Preservers Institute et al. 2011). This BMP document provides recommended guidelines for producing and installing treated wood products for use in sensitive environments.

3.10 Dredge Material Management

Upland disposal of dredged material must prevent the material from reentering waters of the United States.

This condition ensures that there is no unauthorized discharge from upland disposal sites according to 33 U.S.C. § 1311(a) and Idaho's water quality requirements, including without limitation Idaho Code § 39-108, IDAPA 58.01.02.080, and IDAPA 58.01.02.400

3.11 Pollutants/Toxins

In conformance with IDAPA 58.01.02.200, the use of chemicals such as sterilants, growth inhibitors, fertilizers, and deicing salts during construction should be limited to the best estimate of optimum application rates. All reasonable measures shall be taken to avoid excess application and introduction of chemicals into waters of the United States.

4 Required Notification

The permittee must notify the Twin Falls Regional Office when authorized work begins and if the applicant or organization is transferred or changes.

5 Right to Appeal Final Certification

The final § 401 Water Quality Certification may be appealed by submitting a petition to initiate a contested case, pursuant to Idaho Code § 39-107(5) and the "Rules of Administrative Procedure before the Board of Environmental Quality" (IDAPA 58.01.23), within 35-days of the date of the final certification.

Questions or comments regarding the actions taken in this certification should be directed to Sean Woodhead, Twin Falls Regional office, 208-736-2190, sean.woodhead@deq.idaho.gov.

Sue Switzer
Regional Administrator
Twin Falls Regional Office

References

DEQ (Idaho Department of Environmental Quality). 2008. *Guidance for the Use of Wood Preservatives and Preserved Wood Products in or Around Aquatic Environments*. Boise, ID: DEQ. https://www2.deq.idaho.gov/admin/LEIA/api/document/download/4838

DEQ (Idaho Department of Environmental Quality). 2020. *Idaho Catalog of Storm Water Best Management Practices*. Boise, ID: DEQ. https://www.deq.idaho.gov/water-quality/wastewater/storm-water/

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EPA (US Environmental Protection Agency). 2000. *National Menu of Best Management Practices (BMPs) for Stormwater.* https://www.epa.gov/npdes/national-menu-best-management-practices-bmps-stormwater

RSET (Northwest Regional Sediment Evaluation Team). 2018. *Sediment Evaluation Framework for the Pacific Northwest*. Prepared by the RSET Agencies.

Western Wood Preservers Institute, Wood Preservation Canada, Southern Pressure Treaters' Association, and Southern Forest Products Association. 2011. *Best Management Practices: For the Use of Treated Wood in Aquatic and Wetland Environments.* Vancouver, WA: Western Wood Preservers Institute.