Boulder County

Land Use

Courthouse Annex • 2045 13th Street • Boulder, Colorado 80302 • Tel: 303.441.3930 • Fax: 303.441.4856
Mailing Address: P.O. Box 471 • Boulder, Colorado 80306 • **www.bouldercounty.org**

MEMO TO: Agencies and Adjacent Property Owners
FROM: Christian Martin, CFM, Planner II – Flood Recovery
DATE: October 18, 2016
RE: Docket LU-16-0030

Docket LU-16-0030: Boulder County (Fourmile Canyon Creek Restoration)

Request: LISU application to undertake a stream restoration project on Fourmile Canyon Creek involving 10,848 cubic yards of earthworks.

Location: Parcels 146111000021, 146111000023, 146111000024, 146111002001, 146111002006, 146111002007, 146111002008, 146111002009, 146111002010, 146111002013, 146111003010, 146111005003, 146111006002, 146111006004,146111008005, 146111008006, 146111008007, 146111008008, 146112000040, 146112000041, located at Fourmile Canyon Creek along Lee Hill Drive, Wagonwheel Drive and Pinto Drive, in Sections 11 and 12, T1N, R71W.

Zoning: Forestry (F) and Rural Residential (RR) Zoning Districts

Applicant: George Gerstle, Boulder County Department of Transportation

Agent: Clarissa Hageman, Boulder County Department of Transportation

Limited Impact Special Review is required of proposed uses that may have greater impacts on services, neighborhoods, or the environment than those allowed by right under the Boulder County Land Use Code. This process will review conformance of the proposed use with the Boulder County Comprehensive Plan and the Land Use Code.

This process includes a public hearing before the Board of County Commissioners. Adjacent property owners and holders of liens, mortgages, easements or other rights in the subject property are notified of this hearing. The Land Use staff and County Commissioners value comments from individuals and referral agencies. Please check the appropriate response below or send a letter. Late responses will be reviewed as the process permits; all comments will be made part of the public record and given to the applicant. Only a portion of the submitted documents may have been enclosed; you are welcome to review the entire file at the Land Use Department. If you have any questions regarding this application, please contact me at (303) 441-3930 or cpmartin@bouldercounty.org.

Please return responses to the above address by **November 2, 2016.**

_____ We have reviewed the proposal and have no conflicts.
_____ Letter is enclosed.

Signed_____ PRINTED Name_____

Agency or Address _____

Limited Impact Special Use Review Submittal Checklist Form

Project Identification

Project Name: Sourmile Canyon Creek Restoration ~~EFSU~~	
Pre-application Planner: ELISHA	
Process Type: LISU	
Date: 4/20/2016	

Application Materials

The purpose of this checklist is to assist applicants in preparing a Limited Impact Special Use Review application. The planner at your Pre-Application Conference will guide you through this checklist and clarify what information is required for your specific project type and location.

The information listed in the Application Checklist may be required, depending on the type of proposal. Please indicate that the information has been enclosed with your application and referral packets by checking the box labeled "Attached" (Article 3-203 of the Land Use Code has detailed information about application materials).

Fees

A billing system is used by the County to assess fees for a Limited Impact Special Use Review. Applicants are billed at a per-hour rate based on which staff are assigned the application (you are not billed for the Pre-Application Conference).

Listed below are examples that would contribute to protracted reviews and added costs:

- Changes to the proposal after submission
- Significant community response or controversies
- Confusing or inadequate application materials
- Larger scale projects

Application Deposit

A non-refundable deposit of $400.00 is required at the time of application. This $400 deposit is credited toward your final bill.

Submittal Requirements Checklist

	Materials #25 SIGN DEPOSIT	Land Use Packet	Referral Packets	Attached
1	Application Form & Fee Schedule	✓	✓	
2	Fee Agreement ~~20~~ N/A			
3	Fact Sheet(s) / EARTHWORK CALC's	✓	✓	
4	Building Lot Determination Letter			
5	Building Plans/Elevation Drawings			
6	Narrative/~~Development Report~~	✓	✓	
7	Engineering Reports*			
8	Referral Packets & Referral Agency List	✓		
9	Site Plan	✓	✓	
10	Vicinity Map	✓	✓	
11	Water and Sewer Information			
12	Plan and Profile – Grading/Erosion control	✓	✓	
13	~~Landscape~~/Erosion Control Plan	✓	✓	
14	Traffic Report PLAN & Narrative	✓	✓	
15	Title Information O&E's	✓		
16	HB 1088 Form (Mineral Interest Cert.)			
17	Historic Preservation Referral Form			
18	Limited Impact Special Use Submittal Checklist Form (this form)	✓		
19	Other: Re-vegetation Plan & seed mix	✓	✓	
20	Other: STAGING & ACCESS	✓	✓	

* **Engineering Reports** must be certified by a licensed Professional Engineer (P.E.) depending on the type of application. An Engineering Report will include plan and profile, soils characteristics, earthwork manipulations and calculations, drainage plans, geotechnical evaluations, and traffic reports. If you are required to submit an Engineering Report, please discuss the details of the report with your planner.

Referral Agencies

The materials identified in the checklist above by the Pre-Application Conference planner must be included in your referral packets. You will be required to prepare referral packets for the agencies in the attached list, as directed by the Pre-Application Conference planner.

Please include a copy of this form with your application. For general information about preparing referrals, please read the Land Use Department publication ***Referral Packet Mailing Guidelines.***

Certification

I certify that all required materials are properly in the referral packets for the above application, and that packets have the proper mailing and first class postage. I understand that error in preparation of the packets may result in a delay in processing the application.

Applicant's Printed Name: Clarissa Hageman, Project Engineer	Date: October 14, 2016
Applicant's Signature: Clarissa J. Hageman	Phone: (303) 441-1610

General Description of Application Materials

1. **Application Form**

   The application form is to be completed and signed by all property owners (provided in the packet).

2. **Application Fee**

   An application fee of $400.00 is to be submitted with the application.

3. **Fee Agreement**

   A fee agreement is to be to be completed and signed (see Land Use publication ***Fee Agreement*** provided in the Limited Impact Special Use Review packet).

   Additional fees are based on the amount of staff time involved in the review and processing the application.

4. **Title Information/Building Lot Determination Letter**

   Include ownership information (list of all owners and interest owners) and title reports for all properties included in the Limited Impact Special Use Review request (see Land Use publication ***Title Information*** provided in the Limited Impact Special Use Review packet), and Building Lot Determination Letter from Boulder County.

5. **Vicinity Map**

   8½" x 11" map of the surrounding area.

6. **Site Plan**

   Original Site Plans are to be provided **to scale** and must be legible. Plans can be submitted up to 36" x 24" in size, or may be as small as 8½" x 11" as long as they are legible. Submitted Site Plans must depict all existing boundaries and existing improvements, as well as any proposed additions (if applicable). Site Plans may consist of multiple sheets if necessary to properly depict existing and proposed information.

   To Scale: System of drawing a building so that each inch of a drawing corresponds to a certain dimension in reality. In the case of using a¼ inch scale, a wall ¼ of an inch long in a drawing represents a wall 1 foot long in reality.

7. **Building Elevations Drawings**

   Building Elevation Drawings are also to be provided to scale and must be legible. Plans can be submitted up to 36" x 24" in size, or may be as small as 8½" x 11" as long as they are legible. The Building Elevation Drawings are drawings of each of the outside facing walls of a building. Building Elevation Drawings of an entire building are to include all 4 sides: one drawing of the front; one drawing of the back; and one drawing each for each of the sides of the structure.

   Building Elevation Drawings should show the placement of such details as the windows, the doors, the height, pitch, and shape of the roof, and the type of texture or siding that will be placed on the exterior walls.

8. **Narrative/Development Report**

   Provide a detailed written description, discussion of applicable standards, and the justification for the proposal and development report as required and described in Article 3-203 (F) of the Land Use Code (see Land Use publication Code Excerpt: Limited Impact Special Use).

9. **Plan and Profile Must Include the Following:**

   - **Existing and Proposed Contour Lines for the Entire Lot** – Intervals must be no greater than feet for 50 feet around all disturbances, however, the remaining portions of the property may have larger (i.e. 20' or 40') interval contours.
   - **Benchmarks** – Source of topography lines.
   - **Retaining Walls** – With details.
   - **Cross Sections and Station Points** – No more than every 100 feet.
   - **Collection and Redirection of Drainage.**

10. **Referral Packets**

    As part of the Limited Impact Special Use application process the Boulder County Land Use Department refers applications to various county departments, agencies (as necessary), adjacent property owners, and/or other interested parties.

    The application materials/documents to be referred are collectively referred to as the "**Referral Packet**."

    It is the responsibility of the applicant to assemble their Referral Packets in appropriate envelopes with the correct mailing addresses and postage. The completed Referral Packets should be submitted with the rest of the application materials. **The Boulder County Land Use Department** shall be the return address.

11. **Adjacent Property Owners (APOs)**

    Property owners within 1,500 feet of properties under review are notified of the application and subsequent public hearings. No referral packets for APOs are required with submission of your application, as the Land Use Department sends postcard notification to these persons. Please be aware that you will be charged for postage of said postcards, with the exception of postcards sent for Site Plan Review and Site Plan Review Waiver dockets.

12. **Mineral Interest Certification**

    If the proposal includes any new surface development certification of notification of all affected mineral interest holders is required in accordance with Article 65.5 of Title 24, Colorado Revised Statutes (H.B. 01-1088, effective July 1, 2001).

13. **Post-Approval Requirements**

Boulder County Land Use Department

Courthouse Annex Building
2045 13th Street • PO Box 471 • Boulder, Colorado 80302
Phone: 303-441-3930 • Fax: 303-441-4856
Email: planner@bouldercounty.org
Web: www.bouldercounty.org/lu
Office Hours: Mon., Wed., Thurs., Fri. 8 a.m. to 4:30 p.m.
Tuesday 10 a.m. to 4:30 p.m.

Shaded Areas for Staff Only
Intake Stamp

Application Form

Project Number		Project Name	
☒ Limited Impact Special Use ☐ Limited Impact Special Use Waiver ☐ Modification of Special Use ☐ Site Plan Review ☐ Site Plan Review Waiver ☐ Subdivision Exemption ☐ Exemption Plat ☐ 1041 State Interest Review ☐ Other:	Application Deadline: First Wednesday of the Month ☐ Variance ☐ Appeal	Application Deadline: Second Wednesday of the Month ☐ Sketch Plan ☐ Preliminary Plan ☐ Final Plat ☐ Resubdivision (Replat) ☐ Special Use/SSDP	☐ Rezoning ☐ Road/Easement Vacation ☐ Location and Extent ☐ Road Name Change

Location(s)/Street Address(es) Full list of parcels attached				
Boulder, CO 80302				
Subdivision Name				
Lot(s)	Block(s)	Section(s) 11	Township(s) 1 North	Range(s) 71 West
Area in Acres	Existing Zoning Rural Residential & Forestry	Existing Use of Property		Number of Proposed Lots
Proposed Water Supply		Proposed Sewage Disposal Method		

Applicants:

Applicant/Property Owner George Gerstle - Director, Boulder County Transportation Department			Email Address ggerstle@bouldercounty.org	
Mailing Address P.O. Box 471				
City Boulder	State CO	Zip Code 80306	Phone (303) 441-3955	Fax
Applicant/Property Owner/Agent/Consultant			Email Address	
Mailing Address				
City	State	Zip Code	Phone	Fax

Agent/Consultant Clarissa Hageman - Stream Restoration Project Engineer, Boulder County Transportation Department			Email Address chageman@bouldercounty.org	
Mailing Address P.O. Box 471				
City Boulder	State CO	Zip Code 80306	Phone (303) 441-1610	Fax

Certification (Please refer to the Regulations and Application Submittal Package for complete application requirements.)

I certify that I am signing this Application Form as an owner of record of the property included in the Application. I certify that the information and exhibits I have submitted are true and correct to the best of my knowledge. I understand that all materials required by Boulder County must be submitted prior to having this matter processed. I understand that public hearings or meetings may be required. I understand that I must sign an Agreement of Payment for Application processing fees, and that additional fees or materials may be required as a result of considerations which may arise in the processing of this docket. I understand that the road, school, and park dedications may be required as a condition of approval.

I understand that I am consenting to allow the County Staff involved in this application or their designees to enter onto and inspect the subject property at any reasonable time, without obtaining any prior consent.

All landowners are required to sign application. If additional space is needed, attach additional sheet signed and dated.

Signature of Property Owner	Printed Name George Gerstle, Director - Boulder County Transportation Department	Date 10/14/16
Signature of Property Owner	Printed Name	Date

The Land Use Director may waive the landowner signature requirement for good cause, under the applicable provisions of the Land Use Code.

Fourmile Canyon Creek
Stream Restoration
Participating Properties

Number	PARCEL_NO	Property Address
1	146112000040	0 Lee Hill Dr.
2	146112000041	927 Lee Hill Dr.
3	146111000021	1073 Lee Hill Dr.
4	146111000023	67 Wagonwheel Gap Rd.
5	146111000024	388 Wagonwheel Gap Rd.
6	146111002001	400 Wagonwheel Gap Rd.
7	146111002013	491 Wagonwheel Gap Rd.
8	146111002006	565 Wagonwheel Gap Rd.
9	146111002007	597 Wagonwheel Gap Rd.
10	146111002008	0 Wagonwheel Gap Rd.
11	146111002009	0 Wagonwheel Gap Rd.
12	146111002010	753 Wagonwheel Gap Rd.
13	146111003010	778 Wagonwheel Gap Rd.
14	146111005003	909 Wagonwheel Gap Rd.
15	146111006004	938 Wagonwheel Gap Rd.
16	146111008005	1037 Wagonwheel Gap Rd.
17	146111006002	1604 Wagonwheel Gap Rd.
18	146111008006	55 Pinto Dr.
19	146111008007	123 Pinto Dr.
20	146111008008	157 Pinto Dr.

Limited Impact Special Use Review Fact Sheet

Project Identification

Project Name: Fourmile Canyon Creek Stream Restoration
Property Address/Location: Sec 11&12, T1N, R71W - see parcel numbers above
Current Owner: see attached list
Size of Property in Acres: 127.35 (total for all impacted parcels)

The applicant(s) is/are required to complete each section of this Limited Impact Special Use Review Fact Sheet even if the information is duplicated elsewhere in the application. Completed Fact Sheets reduce the application review time which helps expediate the Director's Determination. Please make duplicates of this Limited Impact Special Use Review Fact Sheet if the project involves more than two structures.

Determining Floor Area

If an existing wall(s) and/or roof(s) are removed and a new wall(s)/roof(s) are constructed, the associated floor area due to the new wall(s)/roof(s) are considered new construction and must be included in the calculation of floor area for the Limited Impact Special Use Review and shown on this Fact Sheet.

Structure #1 Information

N/A

Type of Structure: (e.g. residence, studio, barn, etc.)					
Total Existing Floor Area: (Finished + Unfinished square feet including garage if attached.)			sq. ft.	**Deconstruction:**	sq. ft.
Are new floor areas being proposed where demolition will occur? ❑ **Yes** (include the new floor area square footage in the table below) ❑ **No**					
Proposed Floor Area (New Construction Only)					
	Finished	**Unfinished**	**Total**		
Basement:	sq. ft.	sq. ft.	sq. ft.	**Height** (above existing grade)	
First Floor:	sq. ft.	sq. ft.	sq. ft.	**Exterior Wall Material**	
Second Floor:	sq. ft.	sq. ft.	sq. ft.	**Exterior Wall Color**	
Garage: ❑ Detached ❑ Attached	sq. ft.	sq. ft.	sq. ft.	**Roofing Material**	
Covered Deck:	sq. ft.	sq. ft.	sq. ft.	**Roofing Color**	
Total:	sq. ft.	sq. ft.	sq. ft.	**Total Bedrooms**	

Structure #2 Information

Type of Structure: (e.g. residence, studio, barn, etc.)					
Total Existing Floor Area: (Finished + Unfinished square feet including garage if attached.)			sq. ft.	**Deconstruction:**	sq. ft.
Are new floor areas being proposed where demolition will occur? ❑ **Yes** (include the new floor area square footage in the table below) ❑ **No**					
Proposed Floor Area (New Construction Only)					
	Finished	**Unfinished**	**Total**		
Basement:	sq. ft.	sq. ft.	sq. ft.	**Height** (above existing grade)	
First Floor:	sq. ft.	sq. ft.	sq. ft.	**Exterior Wall Material**	
Second Floor:	sq. ft.	sq. ft.	sq. ft.	**Exterior Wall Color**	
Garage: ❑ Detached ❑ Attached	sq. ft.	sq. ft.	sq. ft.	**Roofing Material**	
Covered Deck:	sq. ft.	sq. ft.	sq. ft.	**Roofing Color**	
Total:	sq. ft.	sq. ft.	sq. ft.	**Total Bedrooms**	

Grading Calculation

Cut and fill calculations are necessary to evaluate the disturbance of a project and to verify whether or not a Limited Impact Special Use Review (LISR) is required. A Limited Impact Special Use Review is required when grading for a project involves more than 500 cubic yards (minus normal cut/fill and backfill contained within the foundation footprint).

If grading totals are close to the 500 yard trigger, additional information may be required, such as a grading plan stamped by a Colorado Registered Professional Engineer.

Earth Work and Grading

This worksheet is to help you accurately determine the amount of grading for the property in accordance with the Boulder County Land Use Code. Please fill in all applicable boxes.

Note: Applicant(s) must fill in the shaded boxes even though foundation work does not contribute toward the 500 cubic yard trigger requiring Limited Impact Special Use Review. Also, all areas of earthwork must be represented on the site plan.

Earth Work and Grading Worksheet:

	Cut	Fill	Subtotal
Driveway and Parking Areas	0	0	0
Berm(s)	0	0	0
Other Grading debris removal & stream channel grading	9,658 cyds	1,190 cyds	10,848 cyds
Subtotal	9,658 cyds	1,190 cyds	10,848 cyds Box 1

* If the total in Box 1 is greater than 500 cubic yards, then a Limited Impact Special Review is required.

	Cut	Fill	Total
Foundation	0	0	0
		Material cut from foundation excavation that will be removed from the property	0

Excess Material will be Transported to the Following Location:

Excess Materials Transport Location:
Excess materials will be used for on site or off site Boulder County stream or road projects, where appropriate. Any materials that cannot be used for these projects will be transported by the contractor to an appropriate disposal facility.

Is Your Property Gated and Locked?

Note: If county personnel cannot access the property, it could cause delays in reviewing your application.

Certification

I certify that the information submitted is complete and correct. I agree to clearly identify the property (if not already addressed) and stake the location of the improvements on the site within four days of submitting this application. I understand that the intent of the Site Plan Review process is to address the impacts of location and type of structures, and that modifications may be required. Site work will not be done prior to issuance of a Grading or Building Permit.

Signature	Date
Clarissa J. Hugeman	10/14/2016

Fourmile Canyon Creek Stream Restoration Project Narrative

The Boulder County Transportation Department proposes to sponsor stream habitat restoration within segments of Fourmile Canyon Creek that were scoured, degraded, and aggraded by flooding in September 2013. The narrative describes the project location, existing conditions, project description, activities, objectives, and restoration strategies.

I. Project Description

The proposed project will include approximately 10,900 cubic yards of earth moved to restore approximately 7,240 linear feet of creek corridor along 1.4 miles of stream. Approximately speaking, 9,700 cubic yards of earthwork will be cut and 1,200 cubic yards will be fill. This will leave approximately 8,500 cubic yards to be moved off-site or used on site during road or stream reconstruction.

A total of 20 properties are included in the project area. Of these, one is owned and managed by the City of Boulder and the remaining 19 are private properties. Two of these properties include conservation easements, one with the City of Boulder and another with Boulder County. Properties in the project area are shown in the attached table and the staging and cut and fill map.

A. Project Objectives and Design Strategies

A Watershed Master Plan was not developed for Fourmile Canyon Creek. The project goal is to establish the physical, chemical, and biological self-regulating functions of the river system that emulate the natural stable form within the constraints imposed by landscape conditions. Project objectives include:

- To restore the natural channel to the extent practical
- To restore aquatic and terrestrial habitat and ecological connectivity
- To reduce flood risk to infrastructure and private property
- To integrate stream restoration strategies with changes to Wagonwheel Gap Road & Pinto Drive

Rehabilitation strategies include the establishment of a bankfull channel, asset protection, and the restoration of floodplain connectivity where viable. The project will increase channel and floodplain complexity through modification of the plan and profile of the creek, including the placement of root wads, boulder clusters, soil lifts, and numerous other geomorphic and habitat features in the channel and on the floodplain. The proposed project will use earthwork, stream realignment, in-stream structures, and native plantings to provide erosion control and reconnect the stream to the floodplain. Project design details are included in the enclosed project plans. The project will:

- Realign portions of the stream channel and bank stabilization using boulder bank protection, root wads, and tow wood with soil wrapped lifts to control erosion;
- Revegetate the channel edge, lower and upper riparian zones, and upland areas to improve habitat and control erosion;
- Place engineered rock and rock-and-log step pools and constructed riffles in select locations to increase aquatic habitat diversity; and
- Place rock cross-vanes, boulder and log j-hook vanes, converging boulder clusters, root wads, and tow wood in select locations to control velocity and add habitat complexity.

B. Construction Activities & Plan Set

Boulder County contracted a stream restoration design engineer to develop enhanced 30 percent design plans. In conjunction with these plans, the design engineer will assist Boulder County in construction oversight to field-fit the 30% design, allowing the designer to customize the design to field conditions during construction. The project is intended to be constructed with proposed road reconstruction to reduce construction costs and residential impacts. The estimated construction time frame is beginning of spring or summer of 2017 and must be completed 220 days after construction begins.

The attached Stream Restoration Staging Areas Plan indicates the locations of cut and fill along the project area, calls out property owners, parcel numbers, and property addresses within the project area, potential stream access points during construction, and possible staging areas located in the floodplain. Actual staging areas will be identified prior to construction. The project will be accessed from Wagonwheel Gap Road and Pinto Drive. The anticipated haul routes include the transport of materials from Fourmile Canyon Creek to the greater Boulder County area via Pinto Drive and Wagonwheel Gap Road between the upper extent of the project limits and Lee Hill Drive west of the City of Boulder. We anticipate approximately 280 trips along the proposed route will be required assuming 40 trips with flatbed trucks and 240 trips with side dump trucks. This assumes that the trucks will be carrying less than full capacity to safely navigate canyon roads. No areas of concern have been identified on the proposed haul route. Road closures may occur as a result of road reconstruction, but none are anticipated for the proposed stream restoration. This information will be updated by the contractor and submitted to the County upon award of the construction contract.

An erosion control memo is attached to provide the contractor with guidelines to be used in obtaining a stormwater construction management permit. The revegetation plan consists of planting non-invasive, local riparian vegetation along the channel edge, the lower riparian area, and the upper riparian area. Some floodplain revegetation beyond this depth may be implemented in select areas where stream realignment requires replacing coverage. Revegetation includes a riparian seed mix and discrete installation of woody plants. While a focused invasive species removal is not proposed, best management practices will be used to avoid invasive species introduction and to reduce noxious weed growth. A detailed landscaping and revegetation plan is included with the attached plan set.

C. Special Land Use Review Criteria

While the proposed project area includes wetlands, the project would not result in any permanent losses to these or other water features. All impacts are temporary and associated with repositioning sediment to create the appropriate channel plan and profile. Although some boulders, rootwads, and other large woody debris will be used to create the desired geomorphic and habitat features (and may be imported to the site), they will not cause the permanent loss of channel or wetlands.

Additionally, the project constitutes nearly 1.5 miles of stream reconstruction that will be performed in conjunction with road rehabilitation that will require the construction of culverts and bridges. As a result, the project will change the base flood elevation within the watershed.

D. Permits and Communications

The following permits have either received concurrence or are currently being pursued:

- **National Environmental Protection Act (NEPA) -** In June 2016, the US Fish and Wildlife Service concurred that the project will have no adverse impacts on threatened and endangered species.
- **Section 106 -** In June 2016, the State Historical Preservation Office (SHPO) concurred that the project will have no adverse effects on cultural resources.
- **Army Corps 404 Nationwide 37 Permit -** In August 2016, a 404 nationwide 37 permit application was submitted to the U.S. Army Corps of Engineers and is under review.
- **FEMA Conditional Letter of Map Revision (CLOMR) -** The CLOMR will be submitted to FEMA in October 2016.
- **Boulder County Floodplain Development Permit and Grading Permit –** FDP and Grading Permit applications will be submitted upon approval of the Boulder County Review process.
- **Conservation Easements -** Communications with the City and County are ongoing.

II. Site Description

A. Project Location

The proposed project limits begin approximately 1 mile west of the intersection of Lee Hill Drive and U.S. Highway 36, at the downstream end of 927 Lee Hill Drive and extend for approximately 1.4 miles to the upstream end of 157 Pinto Drive. The elevation in this reach ranges from 5,700 to 8,500 feet with a channel slope between 2 and 5 percent.

B. Existing Conditions

The watershed encompasses over 7 square miles at an elevation of 6,000 to 8,500 feet above mean sea level. Typical vegetation includes ponderosa pine, shrubs, and grassland. The project area includes three small wetland areas covering less than 0.1 acres. Watershed geology consists of mostly granite with some siltstone and sandstone. Most soils are well-drained with a high rate of infiltration. The channel slope ranges from 2 to 5 percent with estimated bankfull flows between 120 and 130 cfs. The channel has poor to good stability and is gravel-dominated with some cobble, sand, silt, and clay. The stream conditions range from aggrading to degrading, slightly to deeply entrenched, moderately to highly sinuous, and contain riffle/pool and cascade/pool sequences.

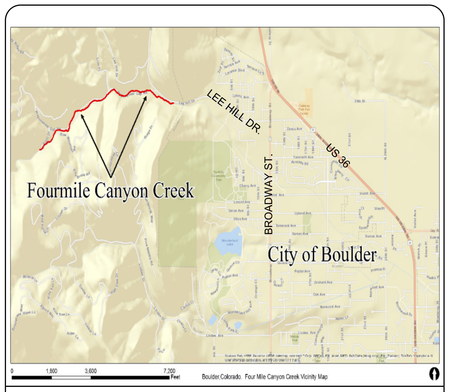
Several natural disasters in recent years have impacted watershed health. In September of 2010, the Fourmile Canyon fire damaged the upper watershed and impacted its hydrology. Prior to the fire, residents observed stream flows that dropped to a trickle during the dry season. Since then, the stream has been observed to flow year round. Floods in 2013 and 2015 further impacted the stream by straightening the creek alignment, over widening the channel cross section, and modifying the channel profile through the cutting and depositing of sediment. Aquatic and terrestrial habitat was severely impacted or destroyed and most riparian vegetation was removed. The results of these disasters are unstable channel conditions and a general inability of the existing channel to move water and sediment efficiently through the system without resulting in channel degradation, aggradation, and bank erosion. Much of the earth stabilizing riparian and upland vegetation was stripped during the floods, further reducing the stream stability. Above average precipitation received during the summer of 2015 has resulted in faster than expected regrowth of natural and invasive vegetation. However, a general lack of riparian vegetation still exists.

STATE	BAKER PROJECT REFERENCE NO.	SHEET NO.	TOTAL SHEETS
CO	138200	1	38

FOURMILE CANYON CREEK

LOCATION: *WAGONWHEEL GAP ROAD AND LEE HILL DRIVE TO ANNE U WHITE TRAIL HEAD*

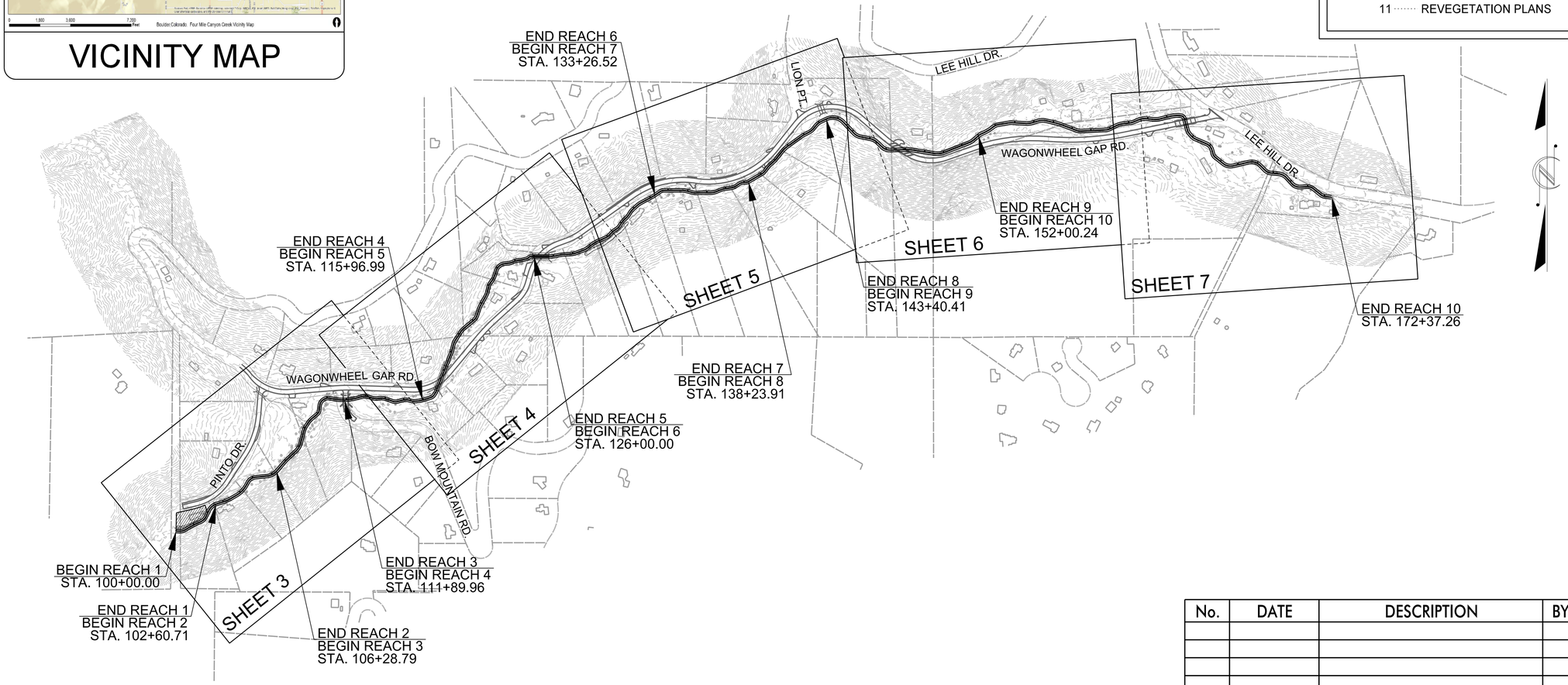
TYPE OF WORK: *30% STREAM RESTORATION PLANS*



VICINITY MAP

INDEX OF SHEETS

1 ..... TITLE SHEET
1-A ..... STREAM CONVENTIONAL SYMBOLS GENERAL NOTES
2 - 2D ..... DETAILS
3 - 7 ..... PLAN SHEETS
8 - 10 ..... PROFILE SHEETS
X-1 - X-22 ..... CROSS SECTIONS
11 ..... REVEGETATION PLANS



No.	DATE	DESCRIPTION	BY	APPROVED

PROJECT: 138200 FOURMILE CANYON CREEK

GRAPHIC SCALES

50 0 50 100
PLANS

50 0 50 100
PROFILE (HORIZONTAL)

10 0 10 20
PROFILE (VERTICAL)

PRELIMINARY DESIGN DATA

		UPSTREAM OF LION POINT	DOWNSTREAM OF LION POINT	
DESIGN REACH LENGTH	=	4,340	2,897	ft
BANKFULL XSEC AREA	=	21.4	24.3	sq ft
BANKFULL WIDTH	=	18.5	19.5	ft
AVERAGE BANKFULL DEPTH	=	1.2	1.2	ft
W/D RATIO	=	16	15.7	
DRAINAGE AREA	=	4.97	7.19	sq mi

PREPARED FOR
BOULDER COUNTY
DEPARTMENT OF TRANSPORTATION

Boulder County

CONTACT: CLARISSA HAGEMAN, PE

Michael Baker INTERNATIONAL
Michael Baker Engineering Inc.
165 South Union Boulevard, Suite 200
Lakewood, COLORADO 80228
Phone: 720.514.1100
Fax: 720.514.1120

TBD
LETTING DATE:

LUCAS BABBITT, PE, CFM
PROJECT ENGINEER

PROJECT ENGINEER

SIGNATURE: *P.E.*

GENERAL NOTES

1. THE CONTRACTOR IS REQUIRED TO INSTALL INSTREAM STRUCTURES USING AN EXCAVATOR OR EQUIVALENT WITH A HYDRAULIC THUMB OF SUFFICIENT SIZE TO PLACE BOULDERS, LOGS, AND ROOTWADS.

2. WORK IS BEING PERFORMED AS AN ENVIRONMENTAL RESTORATION PLAN. THE CONTRACTOR SHOULD MAKE ALL REASONABLE EFFORTS TO REDUCE SEDIMENT LOSS AND MINIMIZE DISTURBANCE OF THE SITE WHILE PERFORMING THE CONSTRUCTION WORK.

3. CONTRACTOR SHALL CALL UTILITY NOTIFICATION CENTER OF COLORADO 2 - BUSINESS DAYS IN ADVANCE BEFORE DIGGING, GRADING, OR EXCAVATION FOR THE MARKING OF UNDERGROUND MEMBER UTILITIES.

4. PROPOSED CHANNEL ALIGNMENT IS INTENDED TO CAUSE MINIMAL DISTURBANCE TO THE EXISTING TREES AND VEGETATION. THE ENGINEER RESERVES THE RIGHT TO MAKE FIELD-FIT CHANGES TO THESE PLANS AND DETAILS TO FURTHER REDUCE DISTURBANCE.

5. NO FIELD FIT CHANGES SHALL BE MADE WITHOUT ENGINEER BEING PRESENT ON-SITE AND WITHOUT APPROVAL.

6. THIS IS A PRELIMINARY PLAN SET THAT WAS COMPLETED TO EVALUATE MAJOR DESIGN FEATURES PRIOR TO ADVANCING TO THE DESIGN-BUILD PHASE. CONSTRUCTION SHALL NOT BEGIN, OR CONTINUE, WITHOUT ENGINEER BEING PRESENT. AS SUCH, THE ENGINEER RESERVES THE RIGHT TO MAKE DESIGN MODIFICATIONS TO IMPROVE STREAM FUNCTION AND/OR CONSTRUCTABILITY. MODIFICATIONS COULD INCLUDE, BUT ARE NOT LIMITED TO, GRADING MODIFICATIONS, CHANGE IN MATERIAL TYPE, CHANGE IN MATERIAL SIZE, CHANGE IN MATERIAL PLACEMENT, ETC.

7. CONSTRUCTION SHALL BEGIN AT THE UPSTREAM END OF THE PROJECT AT STA 100+00 AND CONTINUE TO THE DOWNSTREAM END AT STA 172+37.26 IN ORDER TO AVOID DAMAGING PREVIOUSLY COMPLETED WORK.

8. THE CONTRACTOR SHALL CONFIRM THE RECEIPT OF ALL NECESSARY PERMITS AND APPROVALS BEFORE THE START OF CONSTRUCTION.

9. THE CONTRACTOR SHALL CONDUCT THEIR OPERATIONS IN SUCH A WAY THAT THE AREA OF DISTURBANCE IS MINIMIZED. ALL EXISTING TREES, SHRUBS AND VEGETATION SHALL BE PROTECTED UNLESS OTHERWISE NOTED ON THE DRAWINGS. NO TREES SHALL BE REMOVED WITHOUT APPROVAL FROM LANDOWNER, ENGINEER, AND BOULDER COUNTY.

10. FOR ALL SITE GRADING, SMOOTH, PARABOLIC TRANSITIONS SHALL BE MADE BETWEEN CHANGES IN SLOPE.

11. THE CONTRACTOR SHALL BE SOLELY RESPONSIBLE FOR PROVIDING STABLE EXCAVATIONS AND TEMPORARY SLOPES AND FOR SATISFYING ALL APPLICABLE FEDERAL, STATE AND LOCAL REGULATIONS.

12. CONSTRUCTION OF THE PROPOSED WORK WILL TAKE PLACE WITHIN THE CHANNEL AND WATER CONTROL MEASURES WILL BE REQUIRED. THE CONTRACTOR SHALL BE RESPONSIBLE FOR THE ACCEPTANCE AND CONTROL OF DRAINAGE WATER FROM AREAS ADJACENT TO FOURMILE CANYON CREEK AND ITS TRIBUTARIES INCLUDING STORMWATER OUTFALLS. THE CONTRACTOR SHALL BE SOLELY RESPONSIBLE FOR ESTABLISHING MEANS AND METHODS OF GROUND AND SURFACE WATER CONTROL APPROPRIATE FOR CONSTRUCTION IN ACCORDANCE WITH THE REQUIREMENTS OF THE PROJECT DRAWINGS AND SPECIFICATIONS AND ALL APPLICABLE FEDERAL, STATE AND LOCAL REGULATIONS AND ALL PERMITS.

13. THE CONTRACTOR SHALL BE RESPONSIBLE FOR PROTECTING AND MAINTAINING IN CONTINUOUS OPERATION, ALL EXISTING STRUCTURES, NOT ALL POTENTIALLY IMPACTED STRUCTURES MAY BE SHOWN ON THE DRAWINGS AND IT IS THE CONTRACTOR'S RESPONSIBILITY TO IDENTIFY AND PROTECT ALL STRUCTURES INCLUDING BUT NOT LIMITED TO STREETS, CURB AND GUTTER, BRIDGE PIERS AND ABUTMENTS, CREEK BANK PROTECTION OF VARIOUS TYPES, CREEK DROP STRUCTURES, SIGNS, PEDESTRIAN WALKS, RETAINING WALLS AND FENCING. IN THE EVENT THAT A STRUCTURE OR UTILITY IS DAMAGED DURING CONSTRUCTION THE CONTRACTOR SHALL IMMEDIATELY NOTIFY BOULDER COUNTY IN WRITING AND MAKE REPAIRS IN ACCORDANCE WITH BOULDER COUNTY REQUIREMENTS.

14. ALL CONSTRUCTION SHALL BE IN ACCORDANCE WITH THE STANDARDS OF BOULDER COUNTY UNLESS SPECIFICALLY DETAILED OTHERWISE ON THESE PLANS AND ASSOCIATED SPECIFICATIONS.

15. THE CONTRACTOR SHALL MAINTAIN AT THE SITE AT ALL TIMES ONE SIGNED COPY OF THE PROJECT DRAWINGS AND SPECIFICATIONS, ONE COPY OF BOULDER COUNTY STANDARDS, AND ONE COPY OF ALL REQUIRED PERMITS.

16. THE CONTRACTOR SHALL BE RESPONSIBLE FOR PREPARING AND SUBMITTING AS-BUILT DRAWINGS TO BOULDER COUNTY.

17. THE CONTRACTOR SHALL PREPARE AND MAINTAIN THE STORMWATER MANAGEMENT PLAN AND OBTAIN THE NATIONAL POLLUTION DISCHARGE ELIMINATION SYSTEM (NPDES) PERMIT THROUGH THE COLORADO DEPARTMENT OF PUBLIC HEALTH (CDPHE).

18. THE CONTRACTOR SHALL PROVIDE DAILY ON-SITE SURVEY CONTROL TO THE LEVEL OF DETAIL REQUIRED TO EVALUATE CONSTRUCTION VERSUS THESE DESIGN PLANS.

GROUND COORDINATE TABLE:

PT#	NORTHING	EASTING	ELEVATION	DESCRIPTION
401	266,824.52	56,029.71	5780.4	#5 REBAR w/1-1/4" ORANGE PLASTIC CAP
402	265,571.50	56,625.58	N/A	#5 REBAR w/1-1/4" ORANGE PLASTIC CAP
403	266,345.15	51,185.07	N/A	#5 REBAR w/1-1/4" ORANGE PLASTIC CAP

NOTES:
1. THE BASIS OF COORDINATES FOR THIS MAP IS THE NORTH AMERICAN DATUM OF 1983-2011 (NAD 83 (2011)) U.S. SURVEY FEET, BASED LOCALLY UPON THE DAVID EVANS AND ASSOCIATES, INC. CONTROL POINT DEA CP 402 FOR GROUND COORDINATE SCALE FACTOR DETERMINATION.
2. THE BASIS OF ELEVATIONS FOR THIS MAP IS THE NORTH AMERICAN VERTICAL DATUM OF 1988 (NAVD 88), BASED LOCALLY UPON THE CP 401.
3. TO MODIFY GROUND CONTROL TO COLORADO STATE PLANE NORTH ZONE; ADD 1,000,000 FEET TO NORTH COORDINATE, ADD 3,000,000 FEET TO EAST COORDINATE AND MULTIPLY BY 1/CFS (COMBINED SCALE FACTOR = 1/1.000319292 = 0.999680809.
4. FIELDWORK FOR CONTROL WAS COMPLETED NOVEMBER 2013.
5. SET 18" LONG #5 REBAR w/1-1/4"

19. THE PROJECT ENGINEER SHALL BE ON-SITE DURING CONSTRUCTION TO HELP INTERPRET DESIGN PLANS.

20. THE PROPOSED PLANS ARE BASED ON NOVEMBER 2013 LiDAR INFORMATION AND NOT DETAILED SURVEY DATA. AS A RESULT, EXISTING TOPOGRAPHY INFORMATION SHOWN ON THIS PLAN SET IS APPROXIMATE ONLY AND ACTUAL CONDITIONS MAY VARY.

21. FLOOD DEBRIS REMOVAL IS PART OF THIS PROJECT AND CONSISTS OF WOODY MATERIAL AND ALLUVIUM. THE LOCATION AND QUANTITY OF FLOOD DEBRIS REMOVAL HAS NOT BEEN DETERMINED. FLOOD DEBRIS REMOVAL WILL BE DETERMINED BY THE ENGINEER DURING CONSTRUCTION.

22. SOME SECTIONS OF CREEK HAVE BEGUN, AND WILL CONTINUE TO HEAL AND WILL NOT REQUIRE RESOTRATION. THESE LOCATIONS HAVE BEEN IDENTIFIED ON THE PLANS. THESE LOCATIONS WILL BE IDENTIFIED BY ENGINEER DURING CONSTRUCTION.

STREAM CONVENTIONAL SYMBOLS

- OUTLET PROTECTION
- ROCK CROSS VANE
- CONSTRUCTED RIFFLE
- ROOT WAD
- STREAM REALIGNMENT REQUIRED AS A RESULT OF ROADWAY IMPROVEMENTS
- EXISTING STREAM ALIGNMENT
- BANKFULL CHANNEL EXTENTS
- EXISTING PROPERTY BOUNDARY
- EXISTING STRUCTURE / HOMES
- EXISTING ROAD CROSSING
- PROPOSED ROAD CROSSING
- POOL
- EXISTING RIGHT OF WAY
- LOG STEP POOL
- BOULDER STEP POOL
- EXISTING MAJOR CONTOUR
- EXISTING MINOR CONTOUR
- EXISTING DECIDUOUS TREE
- EXISTING CONIFEROUS TREE
- LOG J-HOOK VANE
- BOULDER J-HOOK VANE
- CONVERGING BOULDER CLUSTER
- BOULDER BANK PROTECTION
- TOE WOOD BANK PROTECTION

**NOTE: ALL ITEMS ABOVE MAY NOT BE USED ON THIS PROJECT

BAKER PROJECT REFERENCE NO.	SHEET NO.
138200	1A

PROJECT ENGINEER

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BAKER PROJECT REFERENCE NO.	SHEET NO.
138200	2

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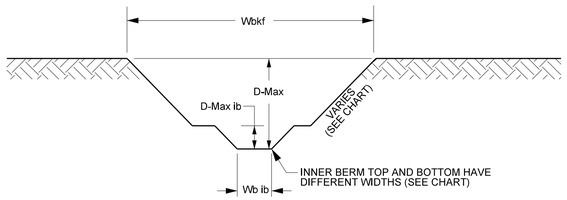
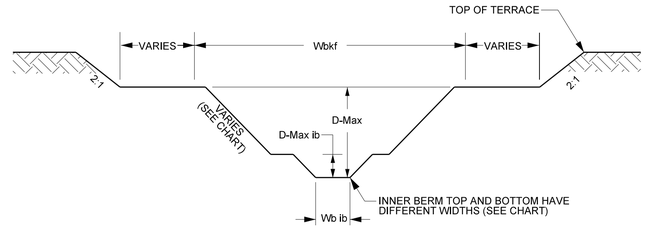
TYPICAL RIFFLE, POOL, AND BANKFULL BENCH CROSS SECTIONS

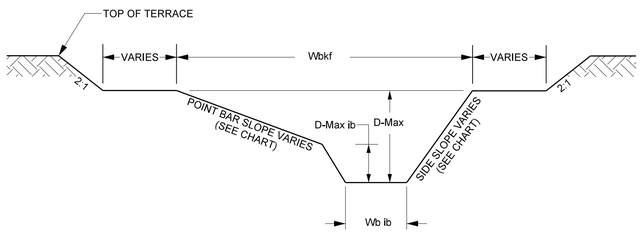
NTS



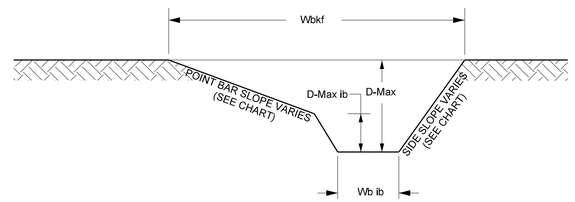
RIFFLE A-A



RIFFLE WITH BANKFULL BENCH



POOL B-B



POOL WITH BANKFULL BENCH

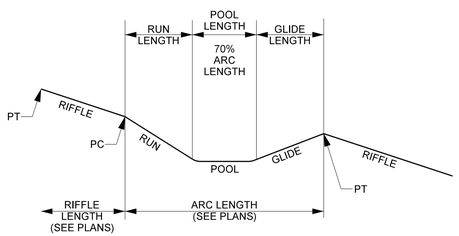
NOTES:

1. DURING CONSTRUCTION CORNERS OF DESIGN CHANNEL WILL BE ROUNDED AND A THALWEG WILL BE SHAPED PER DIRECTION OF ENGINEER.
2. POOL SHOWN ABOVE IS RIGHT BANK POOL ONLY.

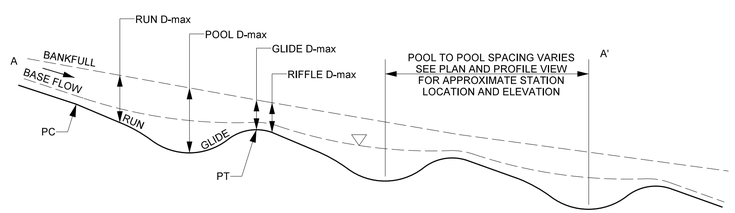
RIFFLE				POOL			
XS 1 UPSTREAM OF LION POINT STA 100+00 to 111+90 and 115+97 to 143+40	XS 2 UPSTREAM OF LION POINT STA 111+90 to 115+97	XS 3 DOWNSTREAM OF LION POINT 143+90 to 152+00	XS 4 DOWNSTREAM OF LION POINT 152+00 to 172+37	POOL - MIN AREA	POOL - MAX AREA	POOL WITH BOULDERS	
18.5	16.5	19.5	17.5	18.0	19.0	18.0	WIDTH BANKFULL (Wbkf) (FT)
1.2	1.2	1.2	1.3	1.4	1.5	1.5	AVERAGE DEPTH (D) (FT)
1.8	1.8	1.9	1.9	2.5	2.7	2.6	MAXIMUM DEPTH (D-Max) (FT)
16.0	14.1	15.7	13.8	13.0	12.3	12.0	WIDTH TO DEPTH RATIO (Wbkf/D)
2.5	2.5	2.5	2.5	0.5	0.5	2.0	SIDE SLOPE (V:H)
0.8	0.8	0.8	0.8	3.0	3.1	1.8	INNER BERM SIDE SLOPE (V:H)
21.4	19.4	24.3	22.2	25.0	29.4	27.0	BANKFULL XSEC AREA (FT^2)
2.4	1.4	2.3	1.3	-	-	-	INNER BERM BENCH WIDTH (Wbnch) (FT)
8.5	8.5	9.5	9.5	9.0	10.0	9.5	INNER BERM WIDTH TOP (W ib) (FT)
6.5	6.5	7.5	7.5	4.5	5.0	4.5	INNER BERM WIDTH BOTTOM (Wb ib) (FT
0.6	0.6	0.7	0.7	1.0	1.1	1.0	INNER BERM AVERAGE DEPTH (D ib) (FT)
0.8	0.8	0.8	0.8	1.3	1.4	1.3	INNER BERM MAX DEPTH (D-max ib) (FT)
13.9	13.9	14.3	14.3	9.2	9.5	9.9	INNER BERM W/D RATIO (W ib/D ib)
5.2	5.2	6.3	6.3	8.8	10.5	9.1	INNER BERM AREA (A ib) (FT^2)

TYPICAL PROFILE SECTION

NTS



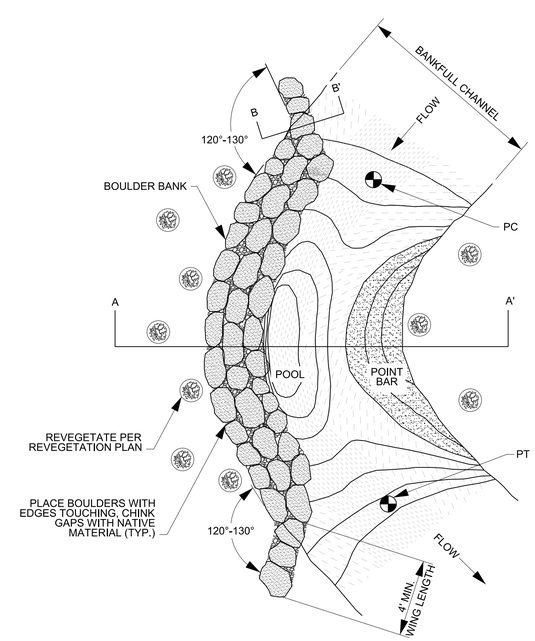
STREAM FACET	RANGE OF FACET SLOPE RATIOS *AVG. WATER SURFACE SLOPE VARIES BY REACH (SEE PLANS) RATIO OF AVG. SLOPE TO FACET SLOPE	
	MIN	MAX
RIFFLE	SEE PLANS & PROFILE	
RUN	1.30	4.00
POOL	0.001	0.003
GLIDE	0.200	0.600

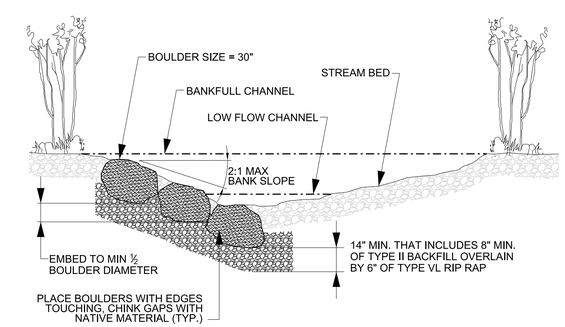


STREAM FACET	RANGE OF MAX DEPTHS			
	UPSTREAM OF LION POINT		DOWNSTREAM OF LION POINT	
	MIN	MAX	MIN	MAX
RIFFLE	1.8		1.9	
RUN	1.8	2.3	1.9	2.6
POOL	2.4	2.7	2.7	2.9
GLIDE	1.4	1.7	1.5	1.8

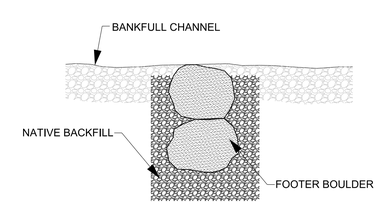
BOULDER BANK PROTECTION

NTS





CROSS SECTION A - A'



CROSS SECTION B - B'

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BAKER PROJECT REFERENCE NO.	SHEET NO.
138200	2A

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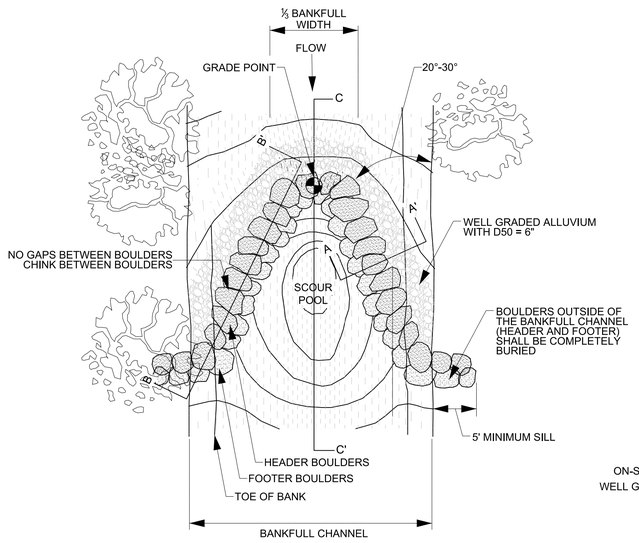
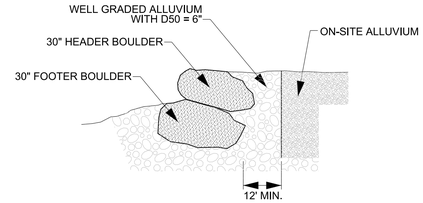
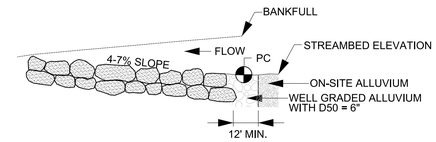
ROCK CROSS VANE
NTS

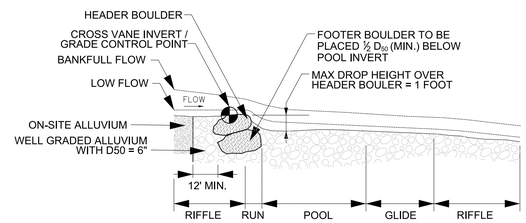




CROSS SECTION A - A'

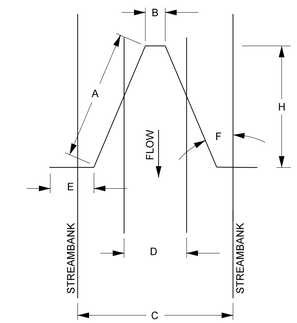


CROSS SECTION B - B'



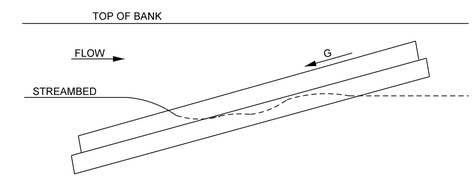
PROFILE C - C'

CROSS VANE TYPICAL
NTS



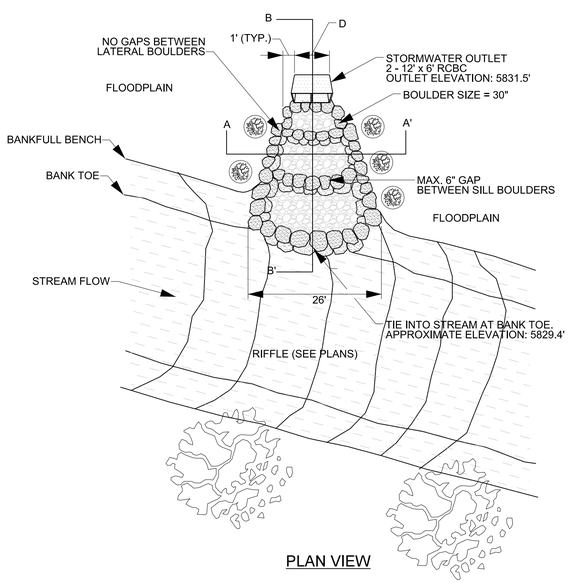
PLAN VIEW

		UPSTREAM OF LION POINT		DOWNSTREAM OF LION POINT	
		XS1	XS2	XS3	XS4
A	VANE ARM LENGTH	16.5 ft	14.8 ft	17.4 ft	15.6 ft
B	INVERT LENGTH	6.1 ft	5.4 ft	6.4 ft	5.8 ft
C	BANKFULL WIDTH	18.5 ft	16.5 ft	19.5 ft	17.5 ft
D	BOTTOM WIDTH	8.5 ft	8.5 ft	9.5 ft	9.5 ft
E	SILL LENGTH	5.0 ft	5.0 ft	5.0 ft	5.0 ft
F	VANE ARM ANGLE	22.0°	22.0°	22.0°	22.0°
G	VANE ARM SLOPE	10.9%	12.2%	10.9%	12.1%
H	STRUCTURE LENGTH	15.3 ft	13.7 ft	16.2 ft	14.5 ft

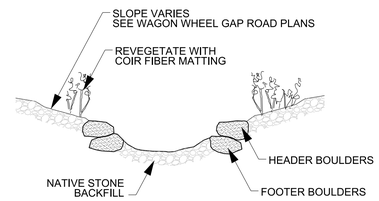


PROFILE VIEW

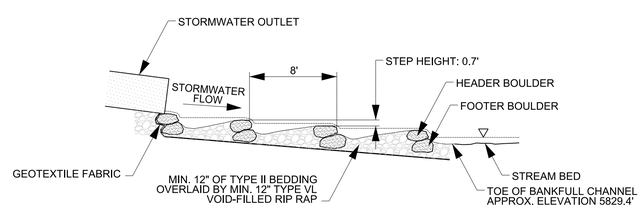
OUTLET PROTECTION
NTS



PLAN VIEW

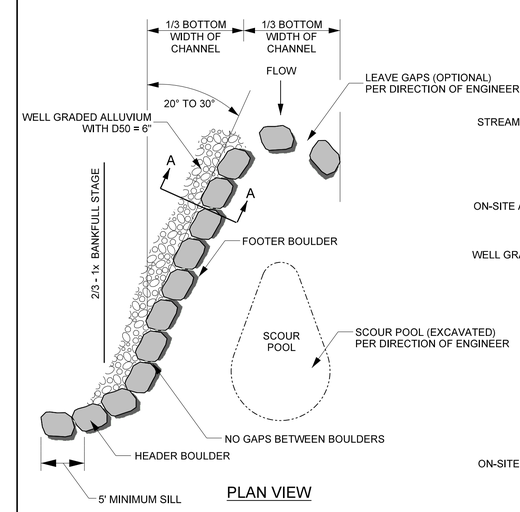


CROSS SECTION A - A'

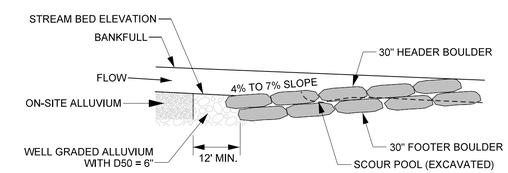


PROFILE B - B'

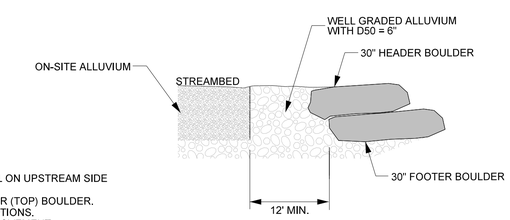
BOULDER J-HOOK VANE
NTS



PLAN VIEW



PROFILE VIEW



SECTION A - A

NOTES FOR ALL VANE STRUCTURES:

1. DIG A TRENCH BELOW THE BED FOR FOOTER BOULDERS AND PLACE FILL ON UPSTREAM SIDE OF VANE ARM, BETWEEN THE ARM AND STREAMBANK.
2. START AT BANK AND PLACE FOOTER BOULDERS FIRST AND THEN HEADER (TOP) BOULDER.
3. CONTINUE WITH STRUCTURE, FOLLOWING ANGLE AND SLOPE SPECIFICATIONS.
4. AN EXTRA BOULDER CAN BE PLACED IN SCOUR POOL FOR HABITAT IMPROVEMENT.
5. USE HAND PLACED STONE TO FILL GAPS ON UPSTREAM SIDE OF HEADER AND FOOTER BOULDERS.
6. AFTER ALL STONE BACKFILL HAS BEEN PLACED, FILL IN THE UPSTREAM SIDE OF THE STRUCTURE WITH ON-SITE ALLUVIUM TO THE ELEVATION OF THE TOP OF THE HEADER BOULDER.

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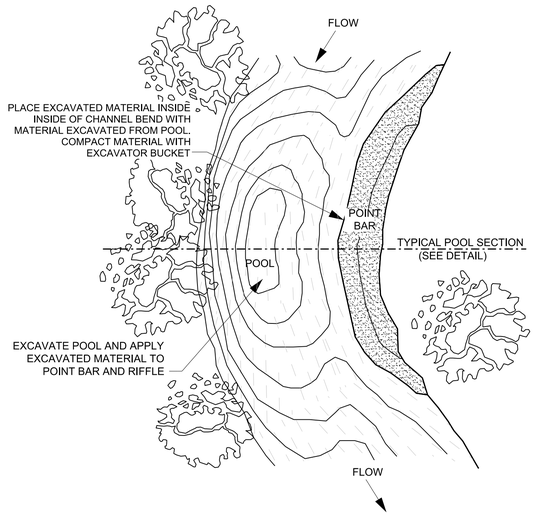
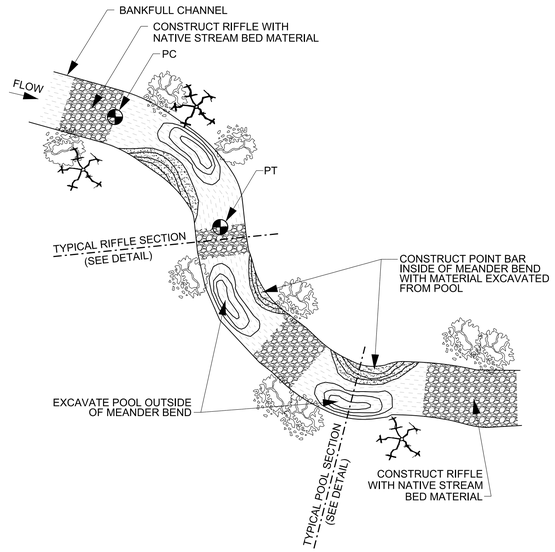
CONSTRUCTED POOL AND POINT BAR

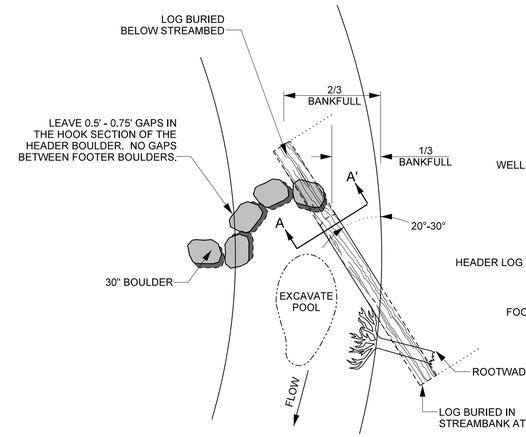
NTS



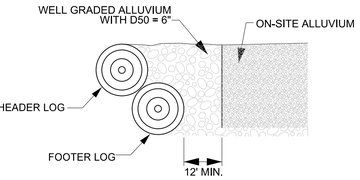


GRADE CONTROL LOG J-HOOK VANE

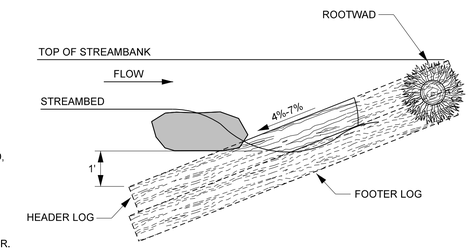
NTS



PLAN VIEW



SECTION A - A'



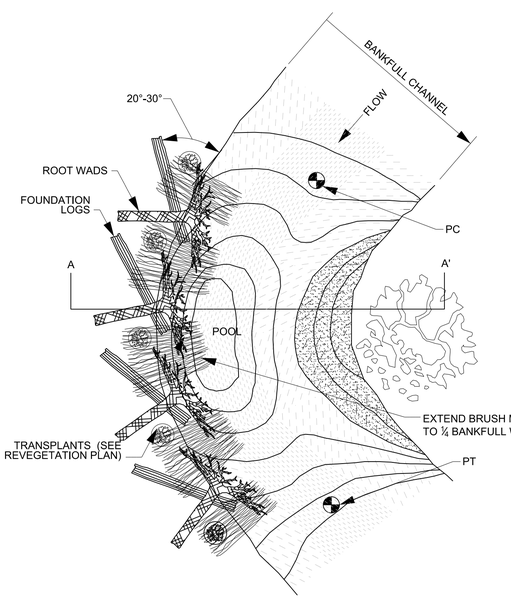
PROFILE VIEW

NOTES:

1. LOGS SHOULD BE AT LEAST 10" IN DIAMETER, RELATIVELY STRAIGHT, HARDWOOD, AND RECENTLY HARVESTED.
2. SOIL SHOULD BE COMPACTED WELL AROUND BURIED PORTIONS OF LOG.
3. ROOTWADS SHOULD BE PLACED BENEATH THE HEADER LOG AND PLACED SO THAT IT LOCKS THE HEADER LOG INTO THE BANK. SEE ROOTWAD DETAIL.
4. BOULDERS SHOULD BE PLACED ON TOP OF HEADER LOG FOR ACHORING.
5. HEADER BOULDERS TO BE PLACED 0.5 TO 0.75 FEET APART.
6. TRANSPLANTS CAN BE USED INSTEAD OF ROOWADS, PER DIRECTION OF ENGINEER.

ROOT WADS

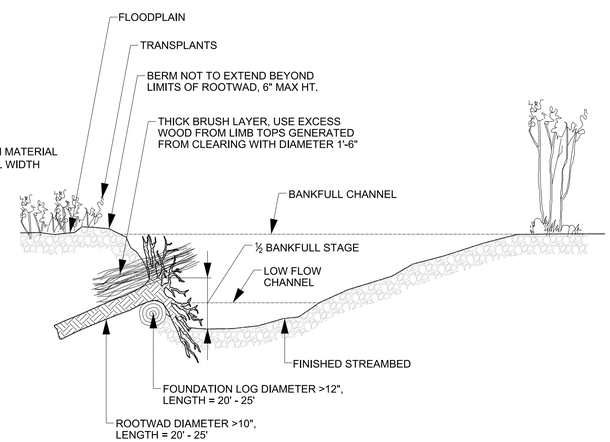
NTS



PLAN VIEW

NOTES:

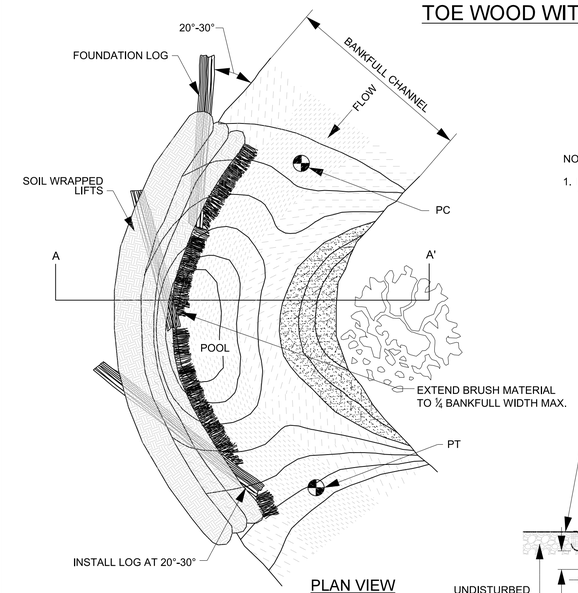
1. IF THE ROOT WAD CANNOT BE DRIVEN INTO THE BANK OR THE BANK NEEDS TO BE RECONSTRUCTED, THE TRENCHING METHOD SHOULD BE USED. THIS METHOD REQUIRES THAT A TRENCH BE EXCAVATED FOR THE LOG PORTION OF THE ROOT WAD. IN THIS CASE, A FOOTER LOG SHOULD BE INSTALLED UNDERNEATH THE ROOT WAD IN A TRENCH EXCAVATED PARALLEL TO THE BANK AND BELOW THE STREAMBED. ONE-THIRD OF THE ROOT WAD SHOULD REMAIN BELOW NORMAL BASE FLOW CONDITIONS.
2. BANK PROTECTION SHALL BE EXTENDED A MINIMUM OF 10 FEET UPSTREAM OF PC 10 FEET DOWNSTREAM OF PT UNLESS OTHERWISE NOTED.



CROSS SECTION A - A'

TOE WOOD WITH SOIL WRAPPED LIFT

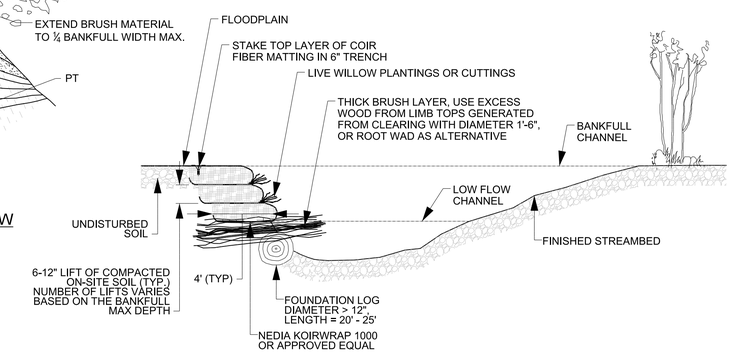
NTS



PLAN VIEW

NOTES:

1. BANK PROTECTION SHALL BE EXTENDED A MINIMUM OF 10 FEET UPSTREAM OF PC 10 FEET DOWNSTREAM OF PT UNLESS OTHERWISE NOTED.



CROSS SECTION A - A'

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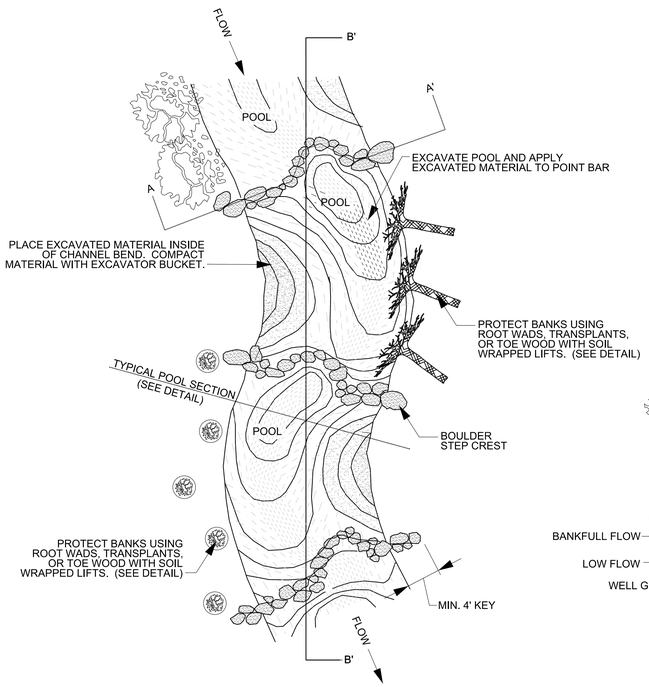
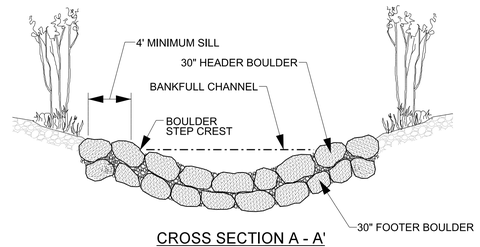
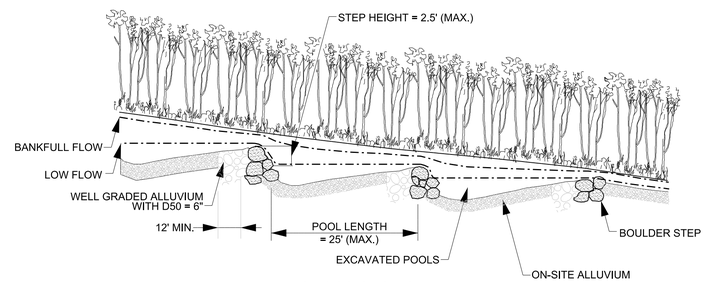
ROCK STEP POOL

NTS





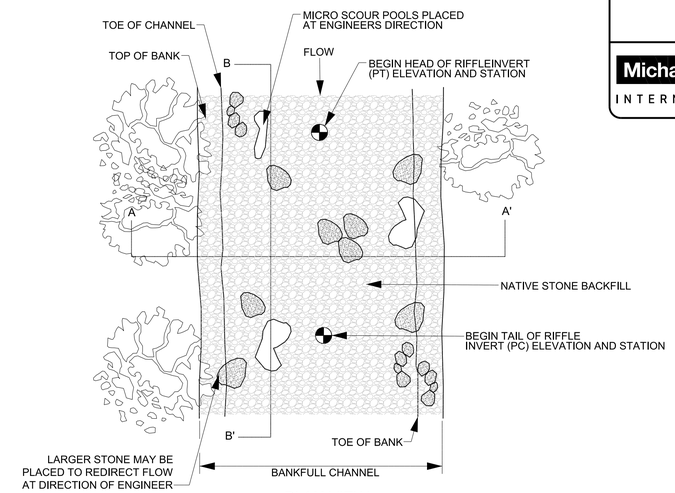
CROSS SECTION A - A'



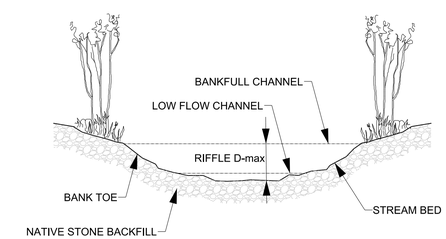
CROSS SECTION B - B'

CONSTRUCTED RIFFLE

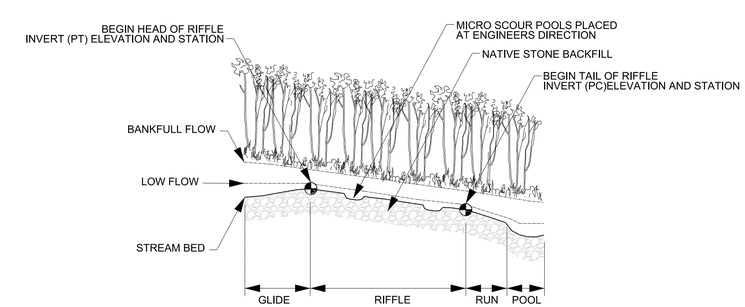
NTS



PLAN VIEW



CROSS SECTION A - A'



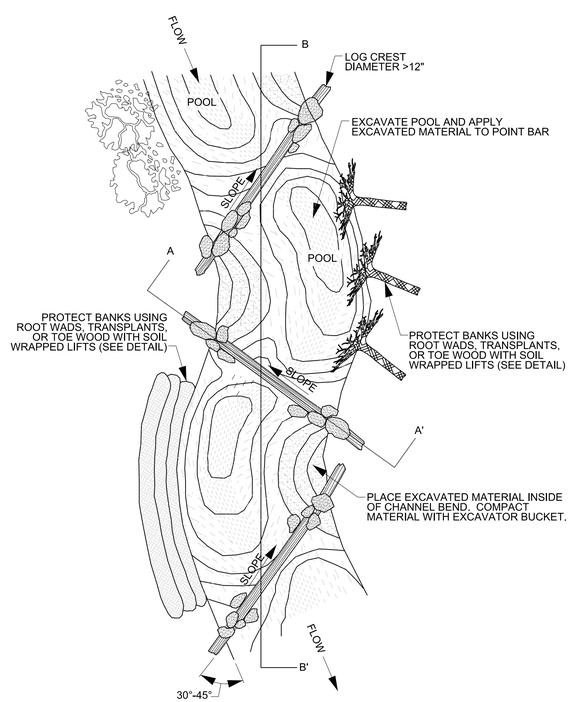
PROFILE B - B'

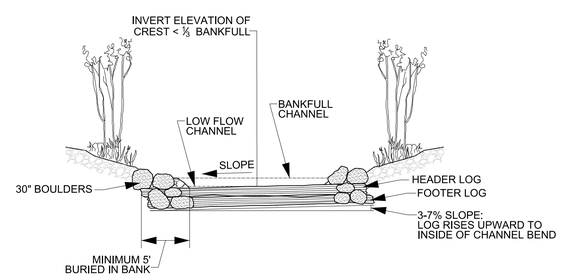
NOTES:

1. UNDERCUT CHANNEL BED ELEVATION AS NEEDED TO ALLOW FOR LAYERS OF STONE TO ACHIEVE FINAL GRADE.
2. INSTALL STONE BACKFILL, COMPACTED TO GRADE.
3. FINAL CHANNEL BED SHAPE SHOULD BE ROUNDED, SMOOTH, AND CONCAVE, WITH THE ELEVATION OF THE BED 0.2 FT DEEPER IN THE CENTER THAN AT THE EDGES.
4. NOT ALL RIFFLE LOCATIONS SHOWN ON PLANS NEED TO BE COMPLETELY RECONSTRUCTED, SOME JUST NEED TO BE RESHAPED.

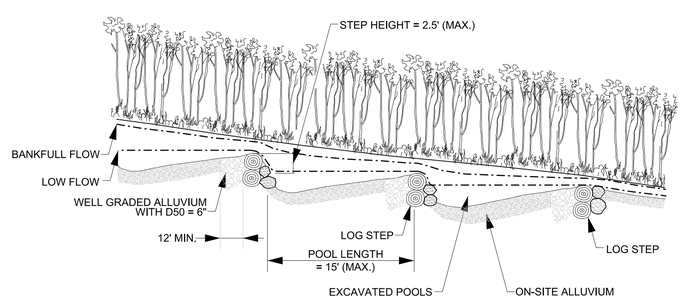
ROCK AND LOG STEP POOL

NTS





CROSS SECTION A - A'



CROSS SECTION B - B'

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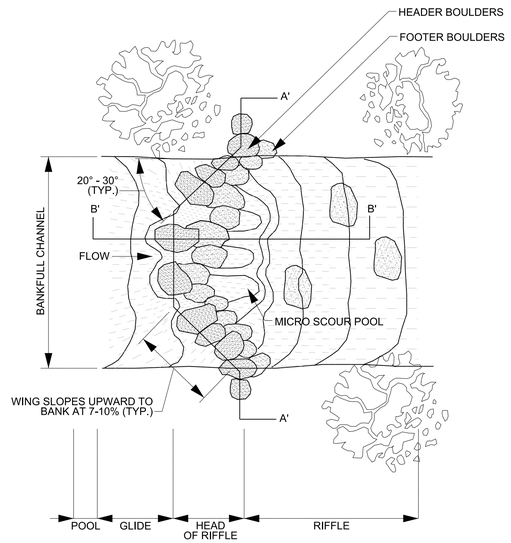
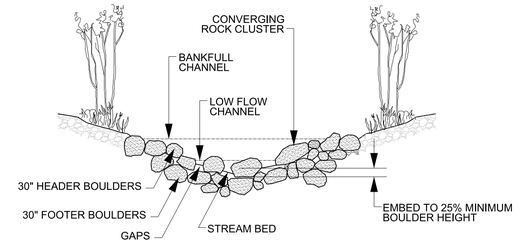
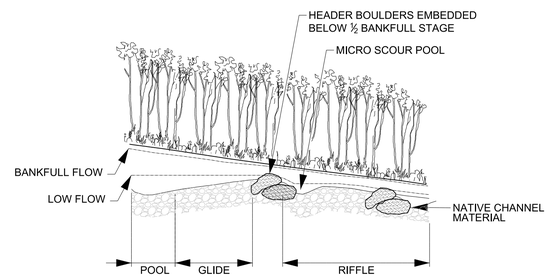
CONVERGING BOULDER CLUSTER
NTS



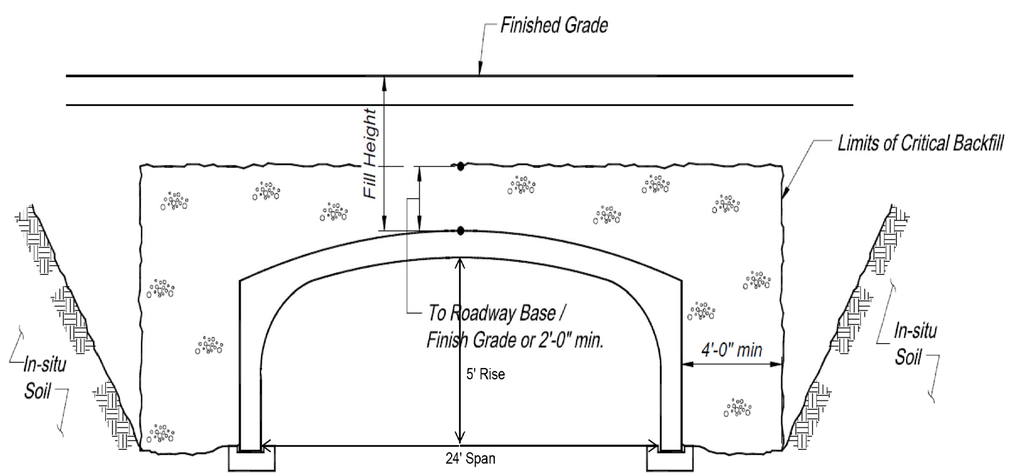


CROSS SECTION A - A'



PROFILE B - B'

CONSPAN PRECAST BRIDGE
NTS



CON/SPAN B-Series Precast Bridge Unit with i-Series Invert

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138200	3

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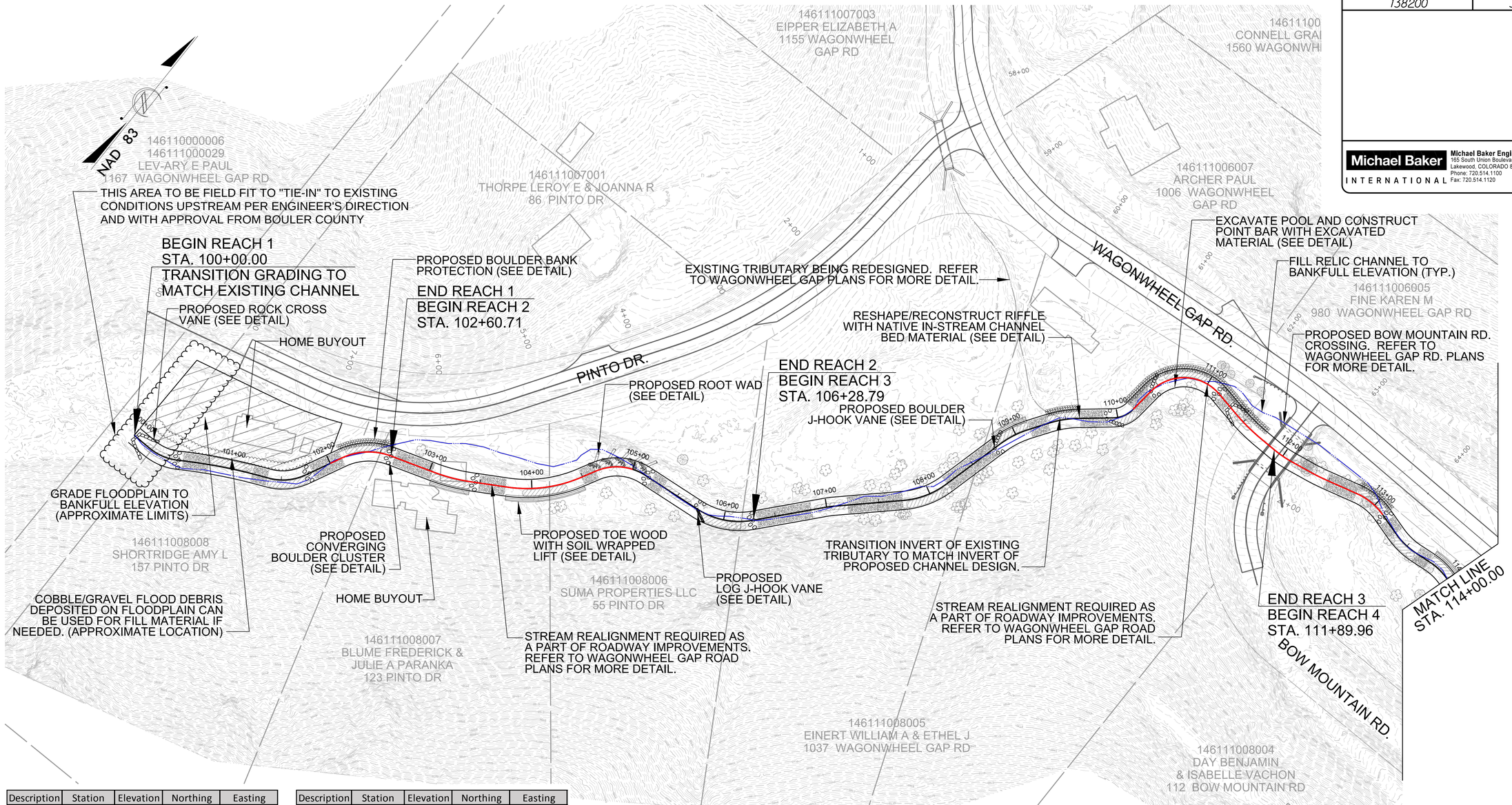

Description	Station	Elevation	Northing	Easting
BEGIN	100+00.00	6022.50	264815.57	51403.97
PC	100+19.10	6021.95	264815.17	51423.07
PT	100+49.09	6021.09	264823.08	51451.55
PC	101+37.59	6018.55	264863.89	51529.97
PT	101+74.20	6016.43	264888.62	51555.93
PC	102+12.32	6014.22	264922.81	51572.79
PT	102+60.71	6011.42	264953.63	51608.42
PC	103+04.39	6008.89	264967.08	51649.98
PT	103+40.80	6006.78	264981.91	51683.15
PC	103+76.09	6004.74	264999.68	51713.64
PT	104+48.06	6000.57	265050.79	51763.02
PC	104+64.02	5999.64	265064.84	51770.58
PT	105+13.46	5996.78	265091.18	51810.11
PC	105+72.27	5994.75	265096.94	51868.64
PT	106+28.79	5992.79	265122.18	51917.72
PC	106+98.02	5990.40	265174.26	51963.32
PT	107+08.02	5990.05	265181.47	51970.25
PC	107+73.64	5987.78	265226.55	52017.94
PT	108+18.33	5986.23	265264.51	52040.40

Description	Station	Elevation	Northing	Easting
PC	108+81.74	5984.04	265325.88	52056.38
PT	109+13.77	5982.93	265354.92	52069.51
PC	109+33.58	5982.25	265371.34	52080.60
PT	109+62.87	5981.23	265392.93	52100.23
PC	109+95.58	5980.10	265413.73	52125.49
PT	110+17.02	5979.36	265432.15	52135.37
PC	110+40.88	5977.59	265455.88	52137.84
PT	111+14.94	5972.09	265494.92	52190.81
PC	111+38.46	5970.35	265490.32	52213.87
PT	111+74.17	5967.69	265486.49	52249.32
PC	111+89.96	5966.52	265486.20	52265.12
PT	112+10.47	5965.00	265487.72	52285.54
PC	112+30.17	5964.83	265491.00	52304.96
PT	112+47.79	5964.68	265494.69	52322.18
PC	112+79.90	5964.40	265502.80	52353.26
PT	113+12.25	5964.12	265502.34	52385.21
PC	113+34.25	5963.46	265496.18	52406.33
PT	113+61.09	5962.67	265493.65	52432.89

FOURMILE CANYON CREEK PLAN VIEW

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SCALE (FT)

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138200	4

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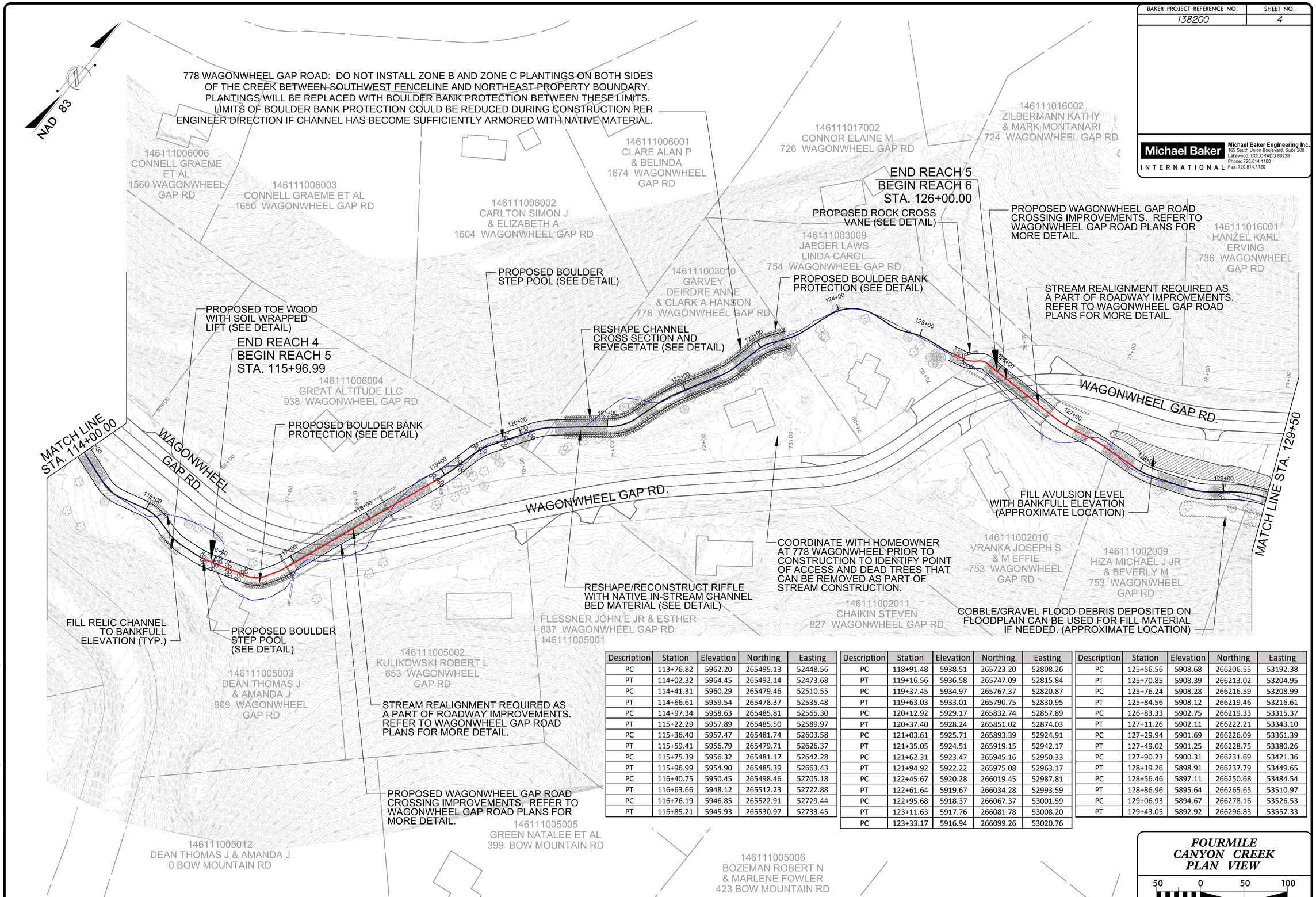

Description	Station	Elevation	Northing	Easting
PC	113+76.82	5962.20	265495.13	52448.56
PT	114+02.32	5964.45	265492.14	52473.68
PC	114+41.31	5960.29	265479.46	52510.55
PT	114+66.61	5959.54	265478.37	52535.48
PC	114+97.34	5958.63	265485.81	52565.30
PT	115+22.29	5957.89	265485.50	52589.97
PC	115+36.40	5957.47	265481.74	52603.58
PT	115+59.41	5956.79	265479.71	52626.37
PC	115+75.39	5956.32	265481.17	52642.28
PT	115+96.99	5954.90	265485.39	52663.43
PC	116+40.75	5950.45	265498.46	52705.18
PT	116+63.66	5948.12	265512.23	52722.88
PC	116+76.19	5946.85	265522.91	52729.44
PT	116+85.21	5945.93	265530.97	52733.45

Description	Station	Elevation	Northing	Easting
PC	118+91.48	5938.51	265723.20	52808.26
PT	119+16.56	5936.58	265747.09	52815.84
PC	119+37.45	5934.97	265767.37	52820.87
PT	119+63.03	5933.01	265790.75	52830.95
PC	120+12.92	5929.17	265832.74	52857.89
PT	120+37.40	5928.24	265851.02	52874.03
PC	121+03.61	5925.71	265893.39	52924.91
PT	121+35.05	5924.51	265919.15	52942.17
PC	121+62.31	5923.47	265945.16	52950.33
PT	121+94.92	5922.22	265975.08	52963.17
PC	122+45.67	5920.28	266019.45	52987.81
PT	122+61.64	5919.67	266034.28	52993.59
PC	122+95.68	5918.37	266067.37	53001.59
PT	123+11.63	5917.76	266081.78	53008.20
PC	123+33.17	5916.94	266099.26	53020.76

Description	Station	Elevation	Northing	Easting
PC	125+56.56	5908.68	266206.55	53192.38
PT	125+70.85	5908.39	266213.02	53204.95
PC	125+76.24	5908.28	266216.59	53208.99
PT	125+84.56	5908.12	266219.46	53216.61
PC	126+83.33	5902.75	266219.33	53315.37
PT	127+11.26	5902.11	266222.21	53343.10
PC	127+29.94	5901.69	266226.09	53361.39
PT	127+49.02	5901.25	266228.75	53380.26
PC	127+90.23	5900.31	266231.69	53421.36
PT	128+19.26	5898.91	266237.79	53449.65
PC	128+56.46	5897.11	266250.68	53484.54
PT	128+86.96	5895.64	266265.65	53510.97
PC	129+06.93	5894.67	266278.16	53526.53
PT	129+43.05	5892.92	266296.83	53557.33

FOURMILE CANYON CREEK PLAN VIEW

50 0 50 100
SCALE (FT)

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Description	Station	Elevation	Northing	Easting
PC	129+87.18	5890.79	266314.51	53597.76
PT	130+14.45	5889.57	266330.24	53619.80
PC	130+29.34	5888.96	266341.19	53629.88
PT	130+45.53	5888.30	266351.71	53642.14
PC	130+63.68	5887.56	266361.83	53657.21
PT	130+80.31	5886.88	266373.62	53668.77
PC	130+97.07	5886.19	266387.72	53677.84
PT	131+19.46	5885.28	266404.97	53692.02
PC	131+39.62	5884.45	266418.95	53706.55
PT	131+56.71	5883.75	266432.24	53717.23
PC	131+71.09	5883.17	266444.50	53724.74
PT	131+90.07	5882.39	266459.06	53736.81
PC	132+21.15	5881.12	266479.92	53759.85
PT	132+45.58	5880.12	266493.92	53779.80
PC	133+08.84	5877.79	266523.57	53835.67
PT	133+26.52	5877.14	266532.77	53850.77

Description	Station	Elevation	Northing	Easting
PC	133+56.71	5876.03	266549.96	53875.57
PT	133+78.90	5875.22	266556.55	53896.42
PC	134+64.88	5872.05	266557.10	53982.40
PT	134+96.65	5870.88	266553.34	54013.86
PC	135+30.94	5869.62	266545.05	54047.13
PT	135+47.90	5869.00	266543.65	54063.96
PC	135+64.17	5868.39	266544.91	54080.18
PT	135+85.43	5867.58	266545.44	54101.42
PC	136+12.73	5866.55	266544.66	54128.72
PT	136+52.00	5865.07	266551.61	54167.08
PC	136+73.36	5864.26	266559.67	54186.86
PT	136+97.30	5863.07	266565.77	54209.94
PC	137+27.13	5861.25	266569.61	54239.52
PT	137+52.23	5859.62	266578.21	54262.88
PC	137+76.40	5858.14	266591.40	54283.13
PT	137+93.24	5857.12	266596.52	54298.98
PC	138+07.78	5856.23	266597.21	54313.50
PT	138+23.91	5855.24	266601.75	54328.81

Description	Station	Elevation	Northing	Easting
PC	139+01.65	5850.49	266641.00	54395.91
PT	139+25.83	5849.02	266657.06	54413.77
PC	139+44.88	5847.85	266672.40	54425.07
PT	139+65.95	5846.94	266687.93	54439.26
PC	139+87.78	5846.00	266702.40	54455.59
PT	140+06.65	5845.18	266716.03	54468.61
PC	140+59.10	5842.91	266756.83	54501.56
PT	140+94.84	5841.36	266781.30	54527.47
PC	141+80.82	5837.64	266831.43	54597.32
PT	142+04.63	5836.61	266843.78	54617.66
PC	142+26.40	5835.67	266853.62	54637.08
PT	142+58.46	5834.28	266873.70	54661.76
PC	142+76.38	5833.50	266887.69	54672.94
PT	143+10.00	5832.05	266908.46	54699.02
PC	143+40.41	5830.73	266921.65	54726.43
PT	144+34.84	5826.59	266905.73	54813.30

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138200	5

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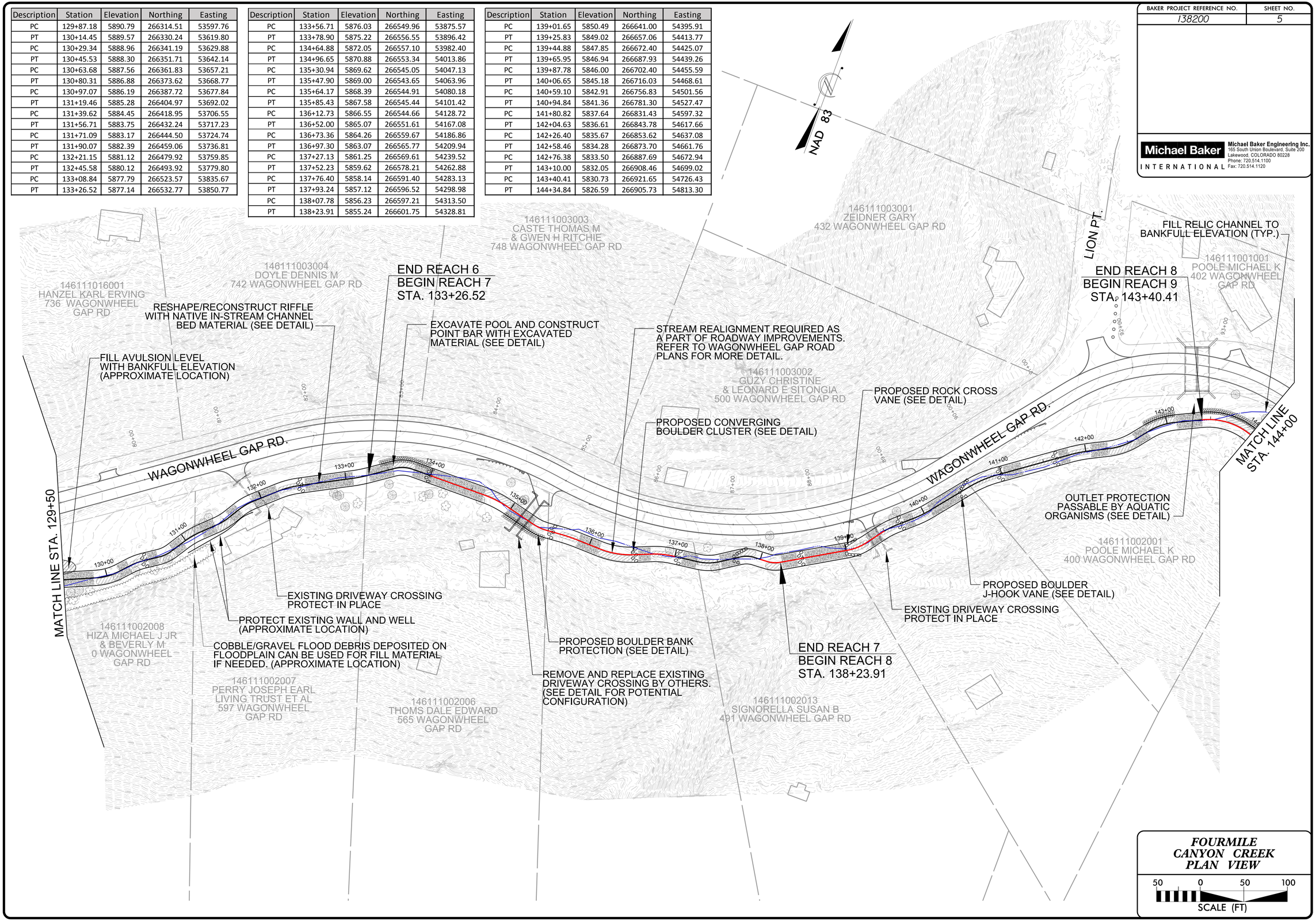

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138200	6

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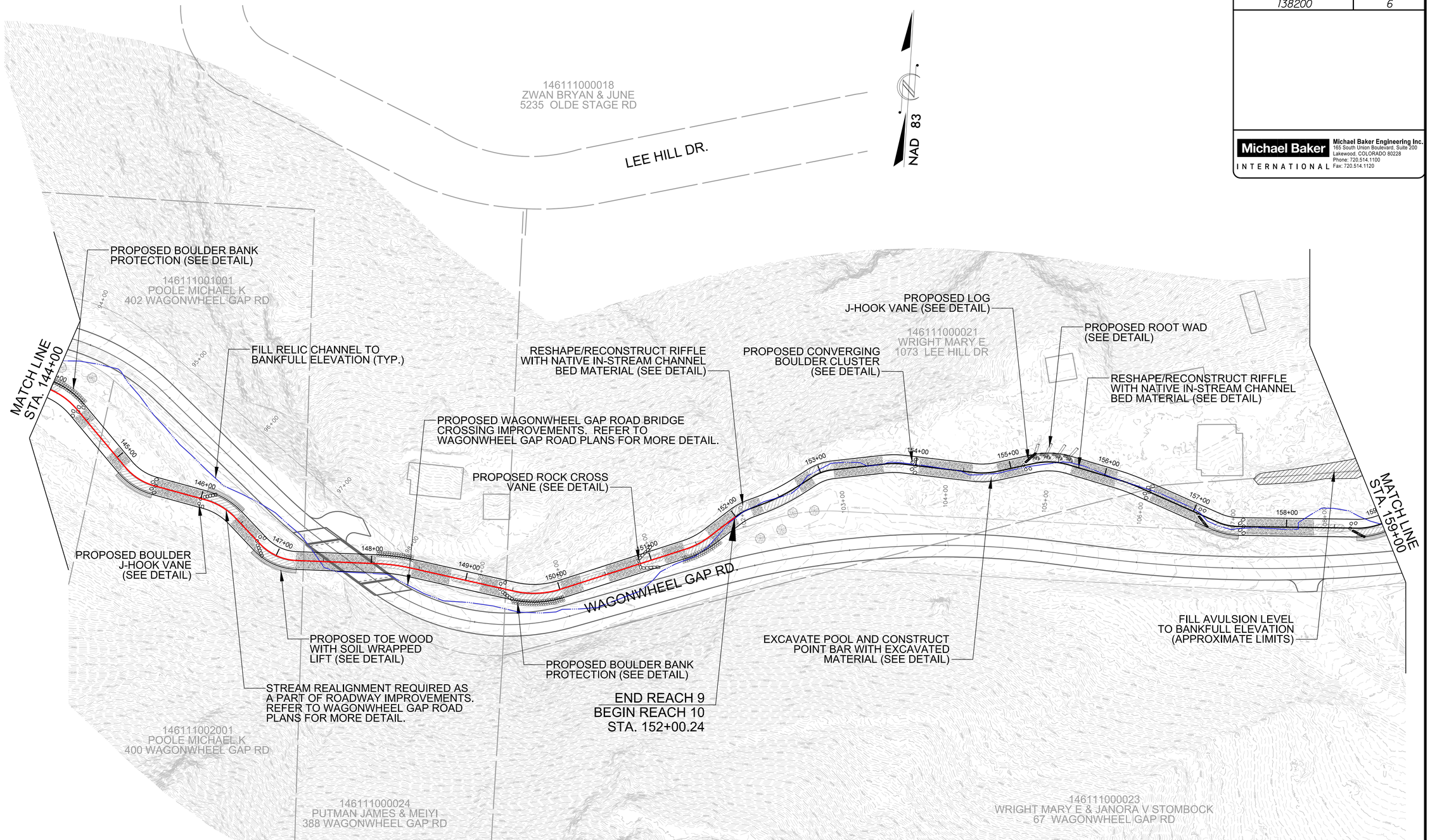

Description	Station	Elevaton	Northing	Easting
PC	145+13.36	5823.14	266848.83	54867.40
PT	145+49.68	5821.54	266831.43	54898.65
PC	146+04.78	5819.13	266820.20	54952.59
PT	146+41.82	5817.50	266803.38	54985.08
PC	146+79.44	5815.91	266777.74	55012.61
PT	147+22.03	5814.11	266763.00	55051.43
PC	148+05.47	5810.59	266765.02	55134.86
PT	148+41.87	5809.05	266762.60	55171.13
PC	149+51.54	5804.42	266745.38	55279.43
PT	150+01.70	5802.30	266750.71	55328.72

Description	Station	Elevaton	Northing	Easting
PC	151+37.21	5796.58	266800.10	55454.91
PT	151+65.62	5795.38	266814.72	55479.11
PC	152+00.24	5793.92	266837.37	55505.29
PT	152+17.23	5793.25	266846.43	55519.58
PC	152+29.10	5792.78	266851.23	55530.44
PT	152+72.61	5791.07	266873.02	55568.01
PC	152+90.13	5790.39	266883.40	55582.13
PT	153+13.08	5789.48	266892.33	55603.04
PC	153+66.99	5787.37	266901.62	55656.15
PT	153+87.45	5786.56	266902.82	55676.52

Description	Station	Elevaton	Northing	Easting
PC	154+60.69	5783.68	266898.76	55749.66
PT	154+85.41	5782.71	266901.44	55774.11
PC	155+24.05	5781.19	266911.90	55811.31
PT	155+61.70	5779.72	266912.76	55848.56
PC	156+13.33	5777.69	266901.09	55898.85
PT	156+38.59	5776.69	266893.85	55923.03
PC	157+26.31	5773.25	266863.42	56005.31
PT	157+49.99	5772.32	266859.84	56028.55
PC	158+73.37	5767.47	266865.84	56151.79
PT	159+01.84	5766.35	266873.15	56179.08

FOURMILE CANYON CREEK PLAN VIEW

50 0 50 100
SCALE (FT)

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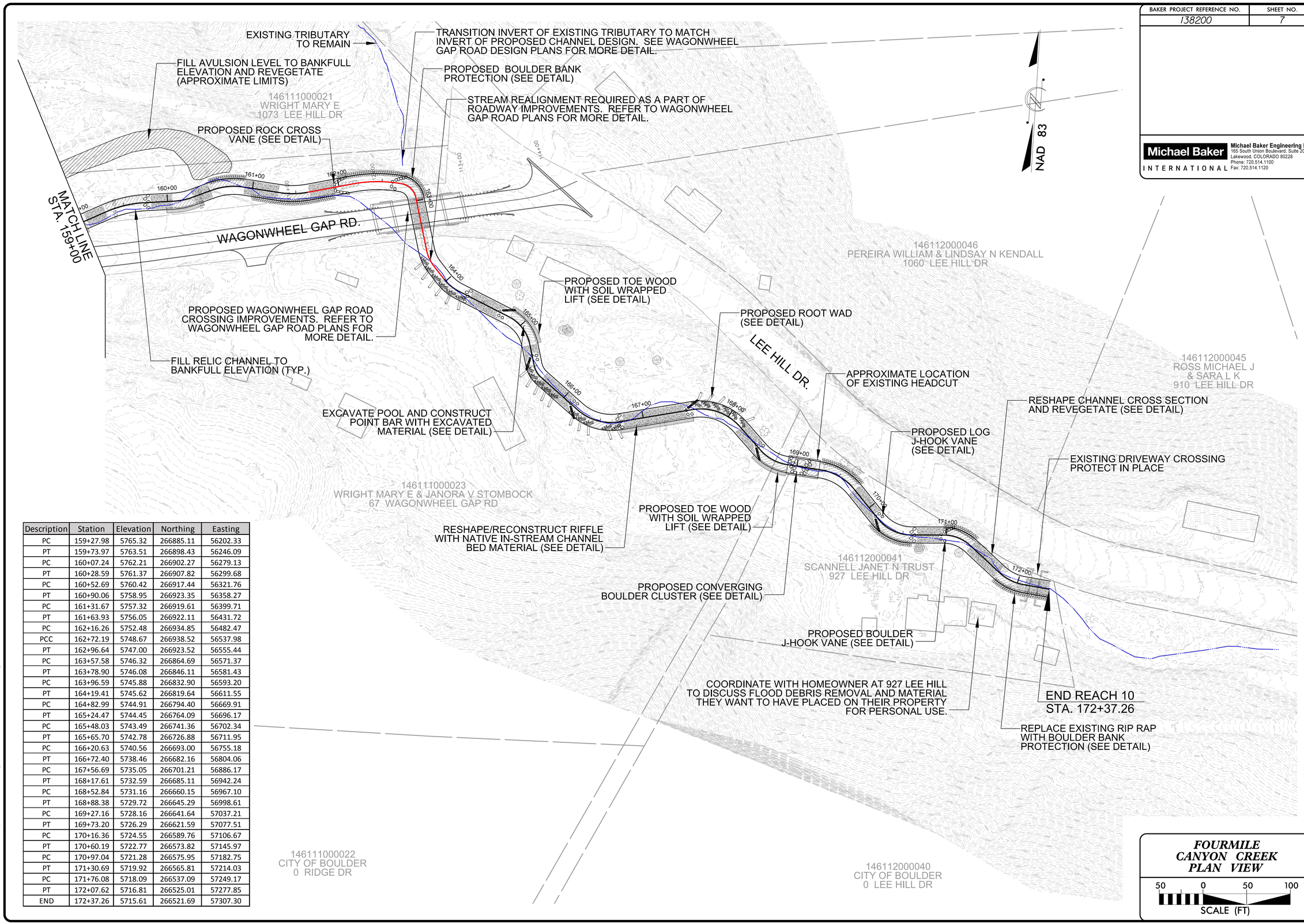
BAKER PROJECT REFERENCE NO.	SHEET NO.
138200	7

Michael Baker INTERNATIONAL
Michael Baker Engineering Inc.
165 South Union Boulevard, Suite 200
Lakewood, COLORADO 80228
Phone: 720.514.1100
Fax: 720.514.1120



Description	Station	Elevation	Northing	Easting
PC	159+27.98	5765.32	266885.11	56202.33
PT	159+73.97	5763.51	266898.43	56246.09
PC	160+07.24	5762.21	266902.27	56279.13
PT	160+28.59	5761.37	266907.82	56299.68
PC	160+52.69	5760.42	266917.44	56321.76
PT	160+90.06	5758.95	266923.35	56358.27
PC	161+31.67	5757.32	266919.61	56399.71
PT	161+63.93	5756.05	266922.11	56431.72
PC	162+16.26	5752.48	266934.85	56482.47
PCC	162+72.19	5748.67	266938.52	56537.98
PT	162+96.64	5747.00	266923.52	56555.44
PC	163+57.58	5746.32	266864.69	56571.37
PT	163+78.90	5746.08	266846.11	56581.43
PC	163+96.59	5745.88	266832.90	56593.20
PT	164+19.41	5745.62	266819.64	56611.55
PC	164+82.99	5744.91	266794.40	56669.91
PT	165+24.47	5744.45	266764.09	56696.17
PC	165+48.03	5743.49	266741.36	56702.34
PT	165+65.70	5742.78	266726.88	56711.95
PC	166+20.63	5740.56	266693.00	56755.18
PT	166+72.40	5738.46	266682.16	56804.06
PC	167+56.69	5735.05	266701.21	56886.17
PT	168+17.61	5732.59	266685.11	56942.24
PC	168+52.84	5731.16	266660.15	56967.10
PT	168+88.38	5729.72	266645.29	56998.61
PC	169+27.16	5728.16	266641.64	57037.21
PT	169+73.20	5726.29	266621.59	57077.51
PC	170+16.36	5724.55	266589.76	57106.67
PT	170+60.19	5722.77	266573.82	57145.97
PC	170+97.04	5721.28	266575.95	57182.75
PT	171+30.69	5719.92	266565.81	57214.03
PC	171+76.08	5718.09	266537.09	57249.17
PT	172+07.62	5716.81	266525.01	57277.85
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BAKER PROJECT REFERENCE NO.	SHEET NO.
138200	8

Michael Baker INTERNATIONAL
Michael Baker Engineering Inc.
165 South Union Boulevard, Suite 200
Lakewood, COLORADO 80228
Phone: 720.514.1100
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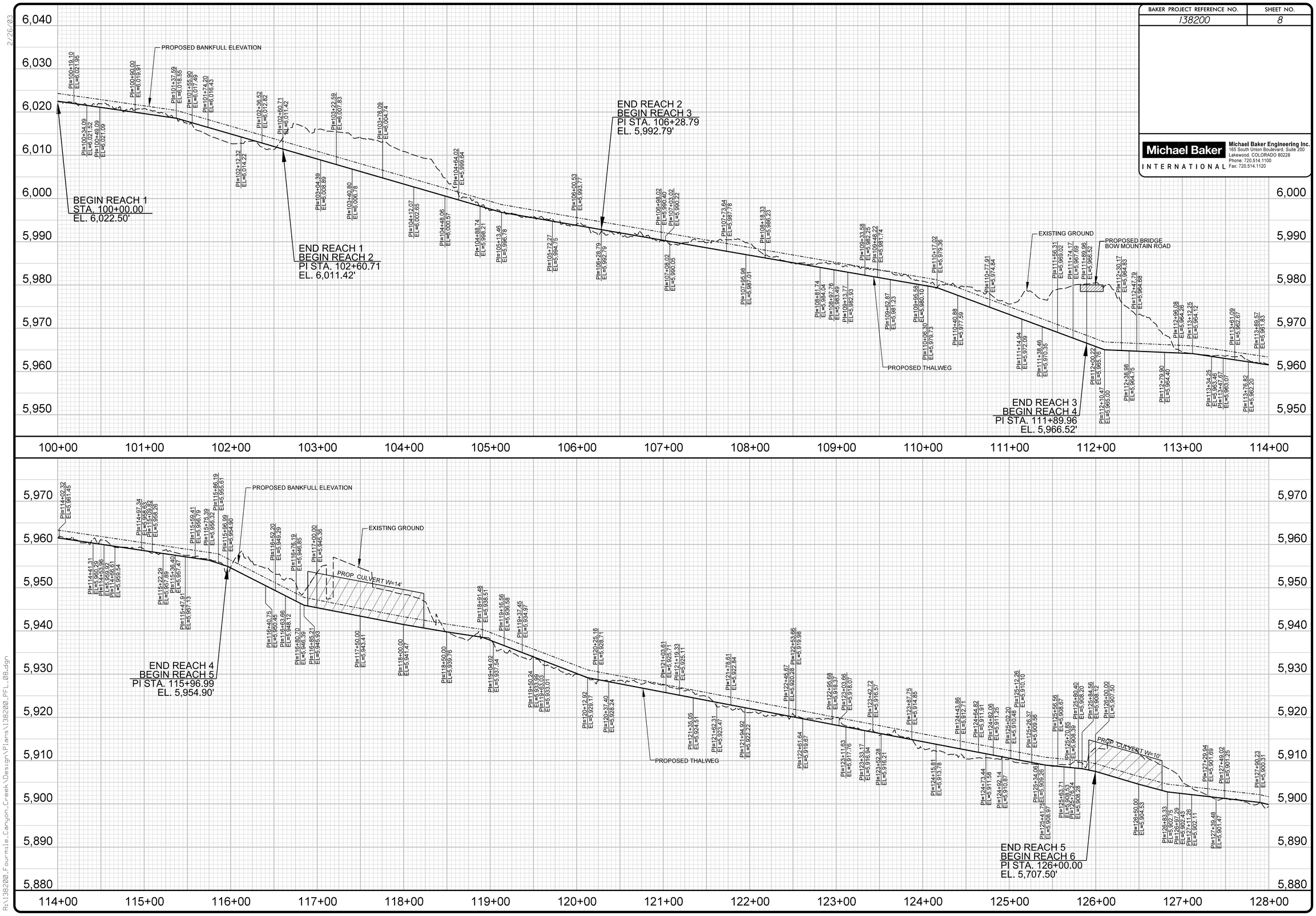

2/26/03

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BAKER PROJECT REFERENCE NO.	SHEET NO.
138200	9

Michael Baker INTERNATIONAL
Michael Baker Engineering Inc.
165 South Union Boulevard, Suite 200
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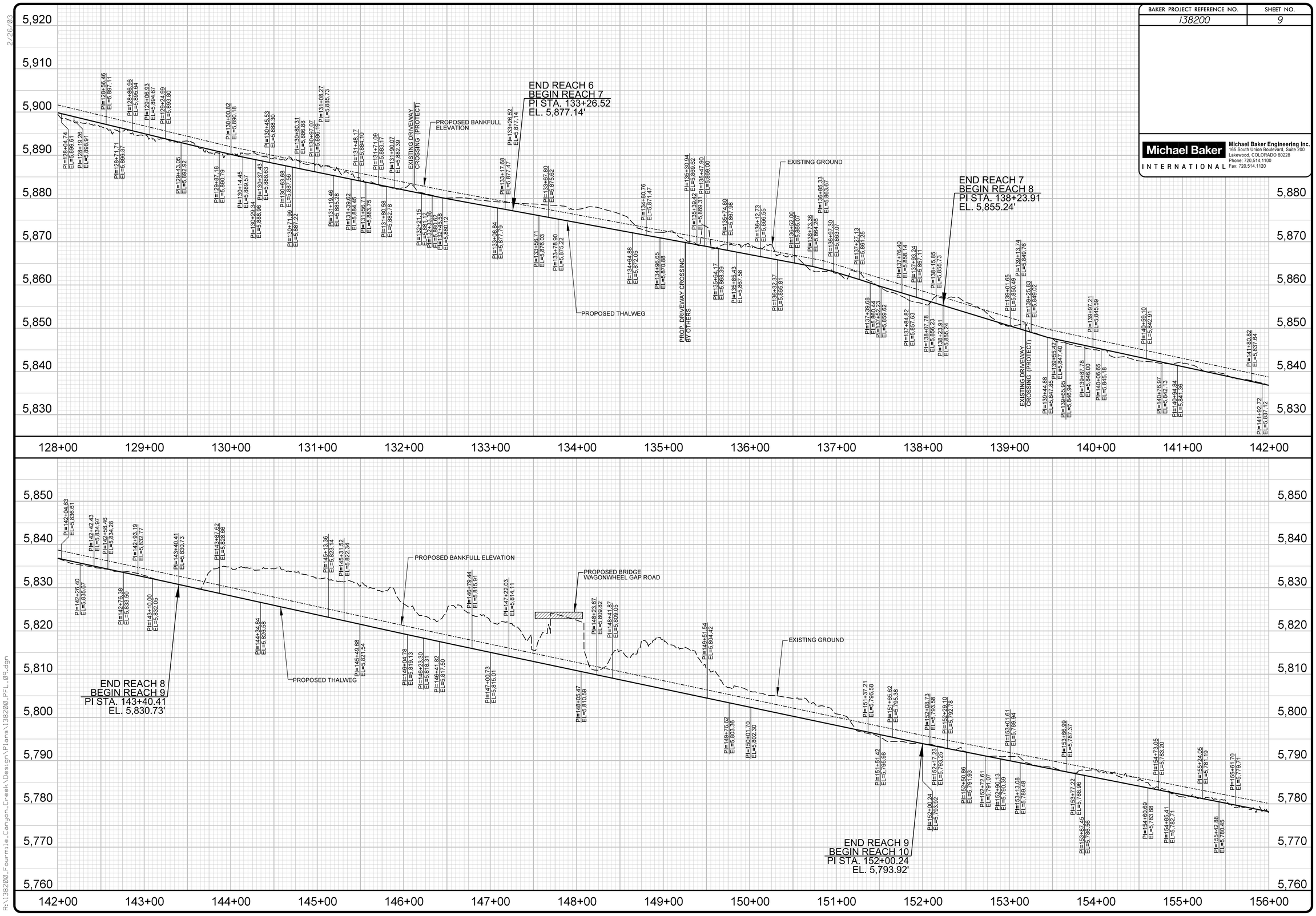
Phone: 720.514.1100
Fax: 720.514.1120



2/26/03

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BAKER PROJECT REFERENCE NO.	SHEET NO.
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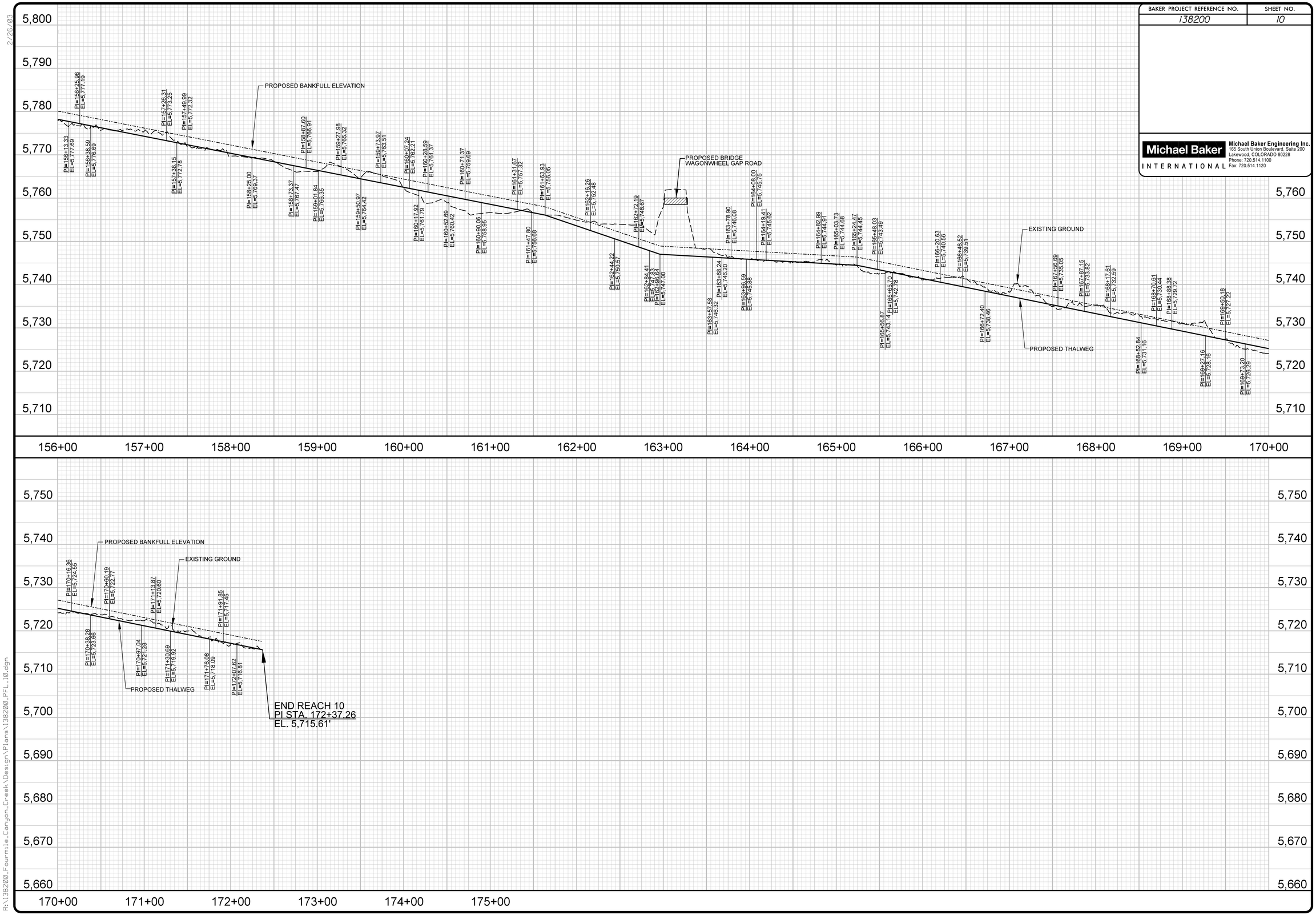
Michael Baker INTERNATIONAL
Michael Baker Engineering Inc.
165 South Union Boulevard, Suite 200
Lakewood, COLORADO 80228
Phone: 720.514.1100
Fax: 720.514.1120



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BAKER PROJ. REFERENCE NO.	SHEET NO.
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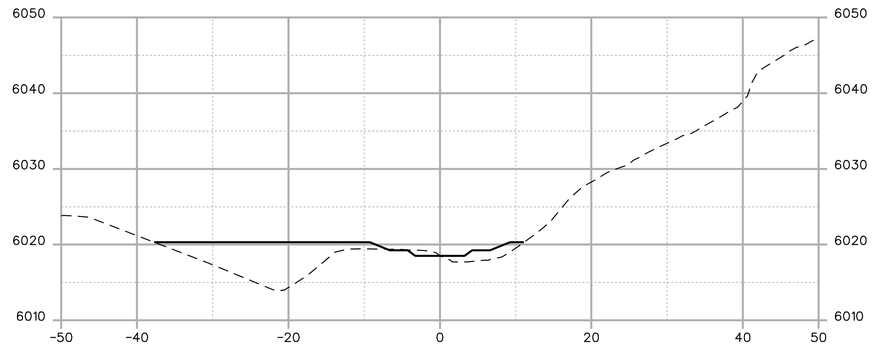

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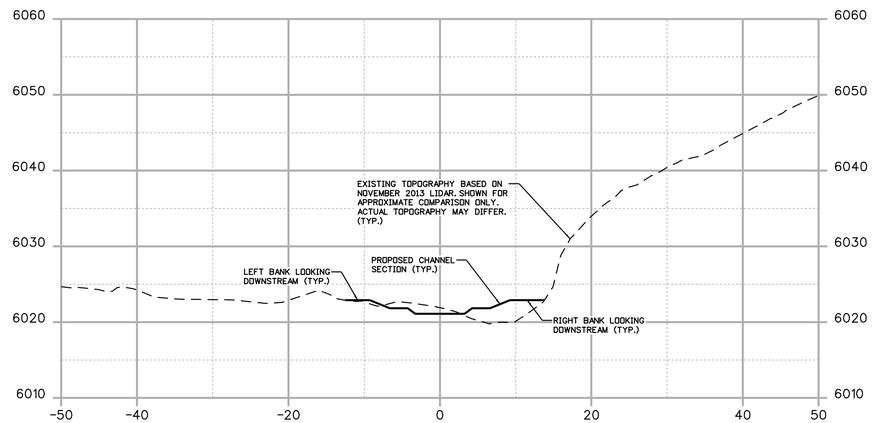

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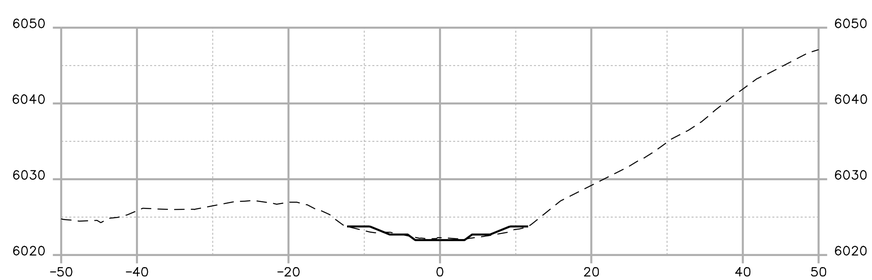

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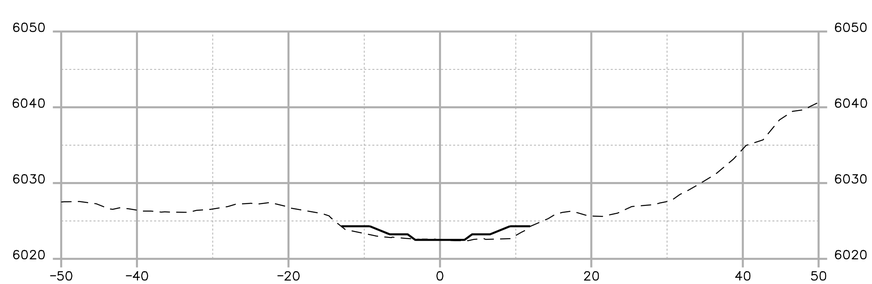
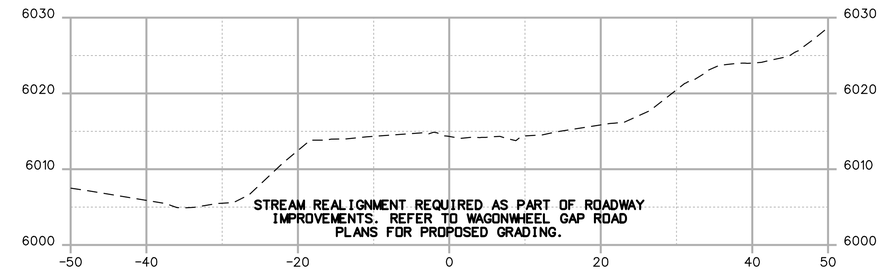


STA. 100+00.00



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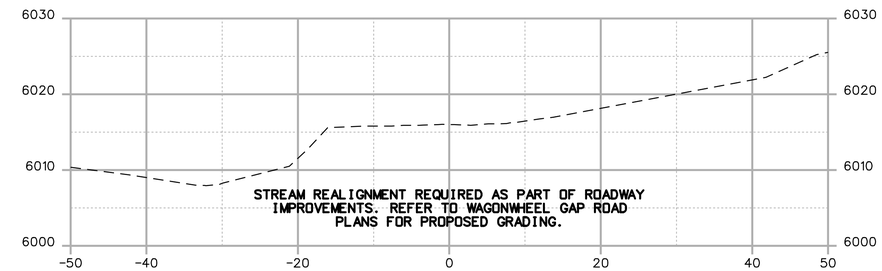

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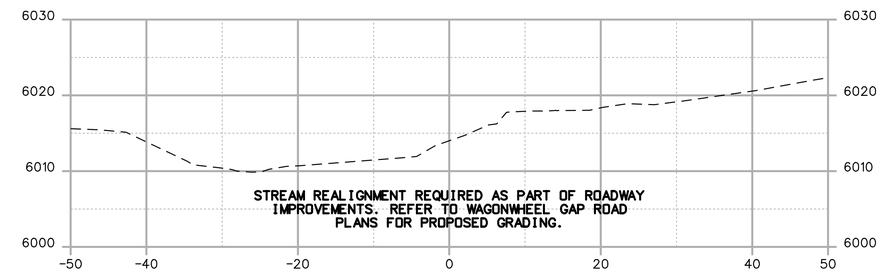

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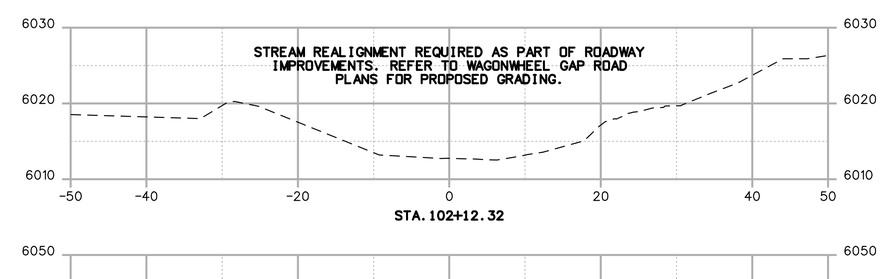

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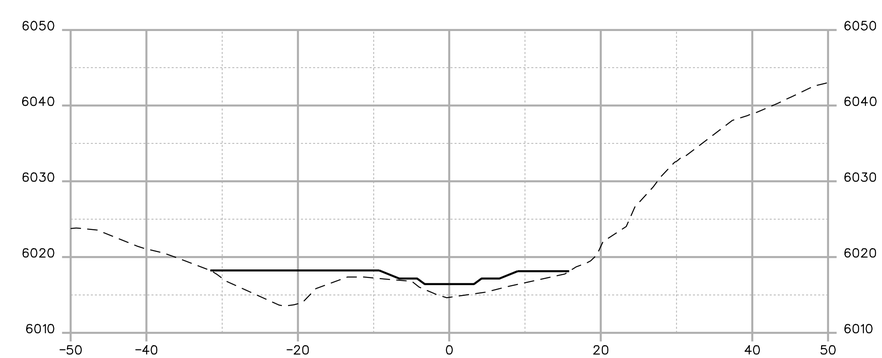

STA. 101+74.20

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BAKER PROJ. REFERENCE NO.	SHEET NO.
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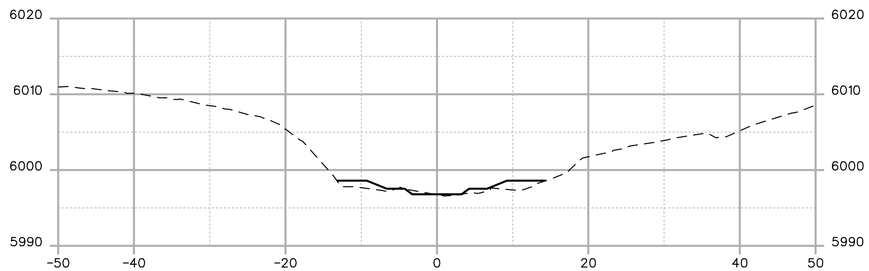

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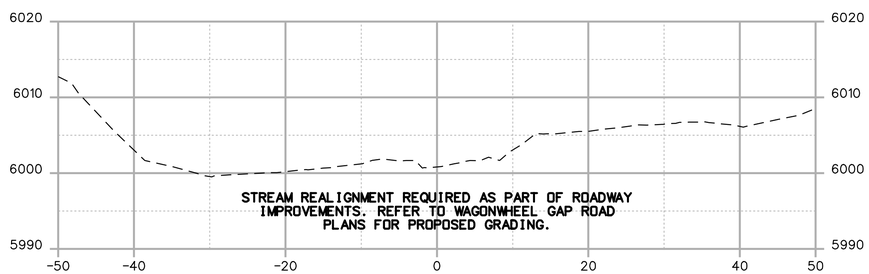
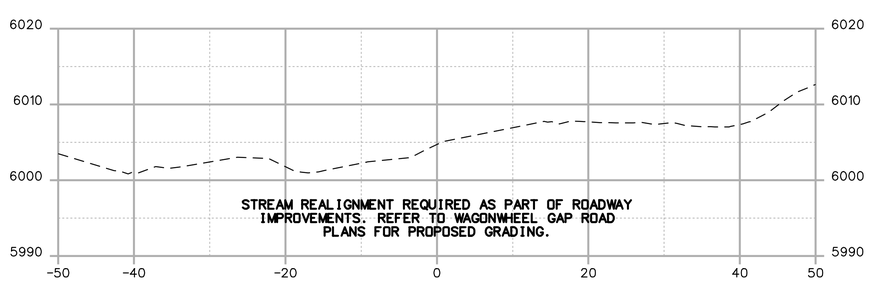


STA. 104+64.02



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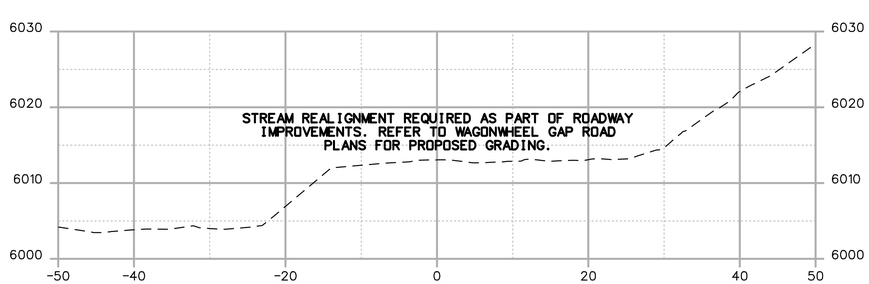

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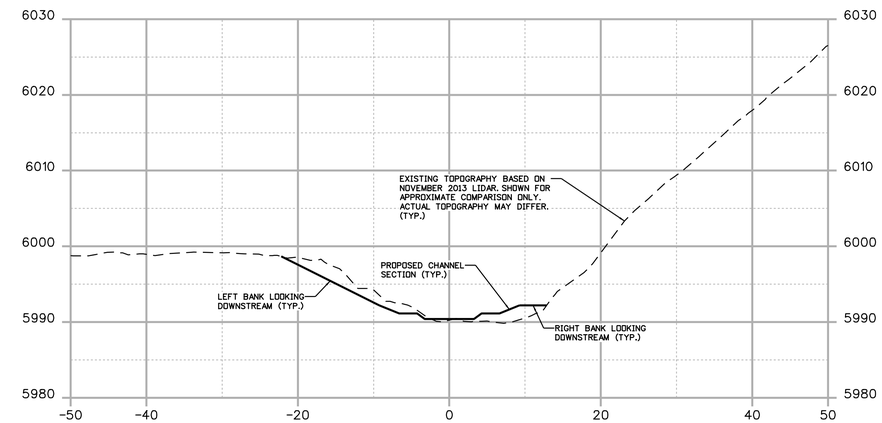

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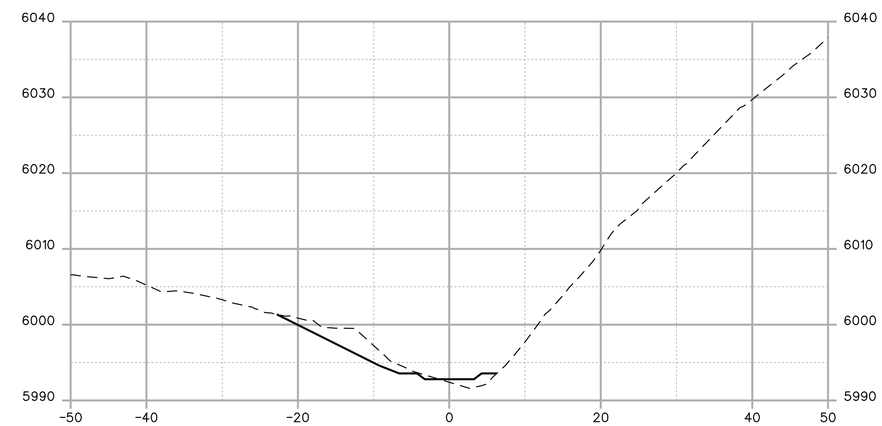
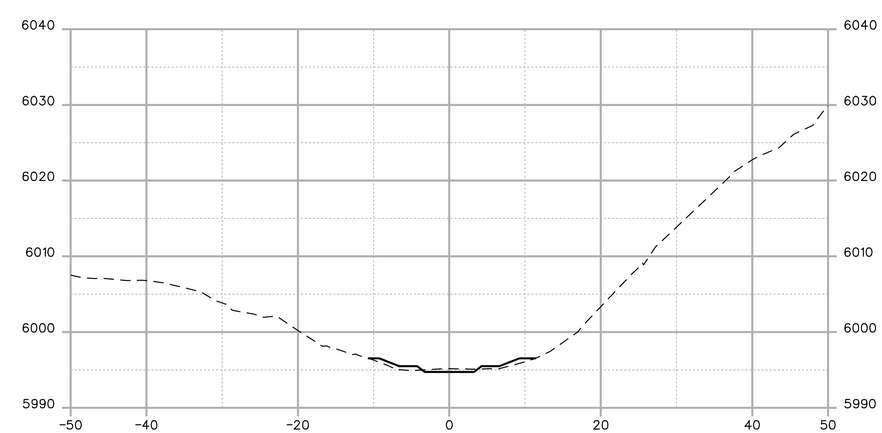


STA. 106+28.79



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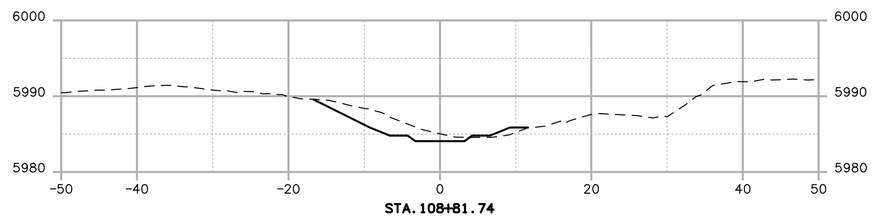
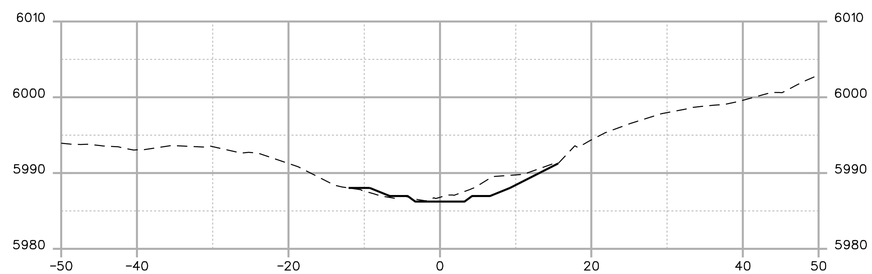
BAKER PROJ. REFERENCE NO.	SHEET NO.
138200	X-3



STA. 108+81.74



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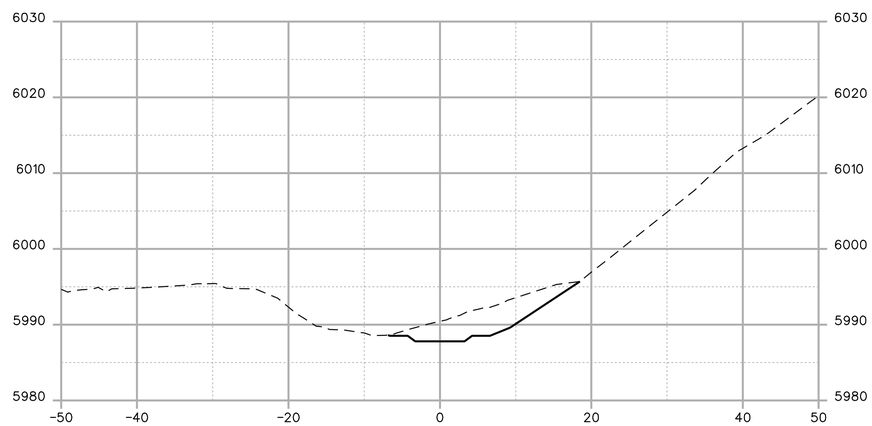

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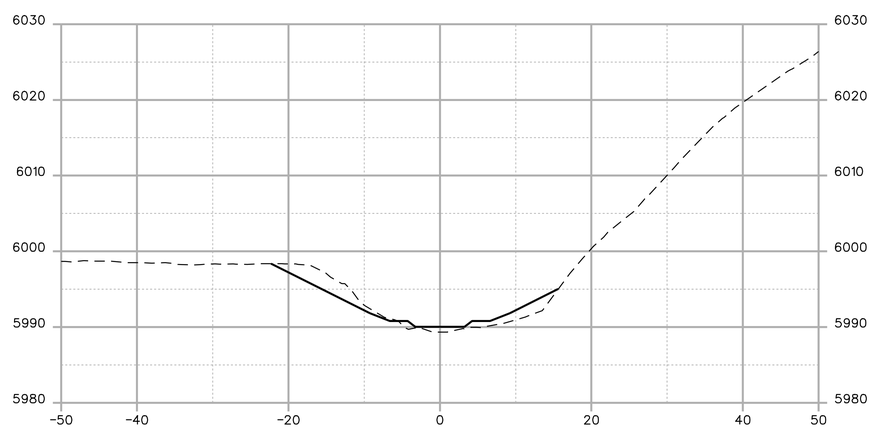

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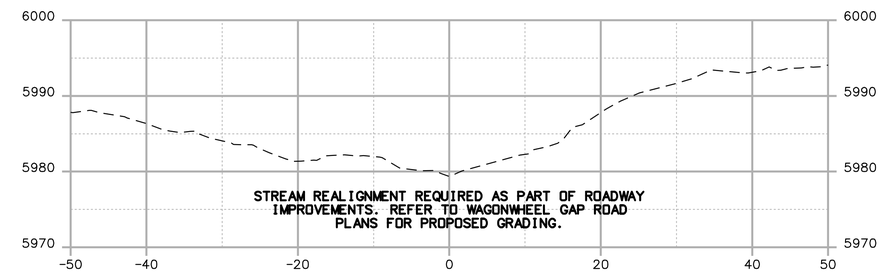
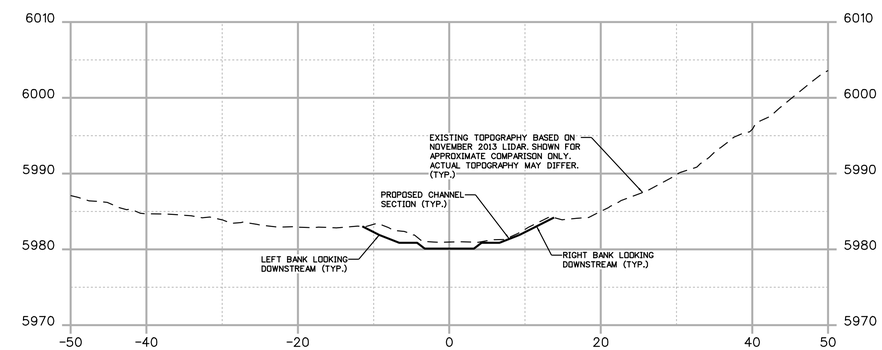


STA. 110+17.02



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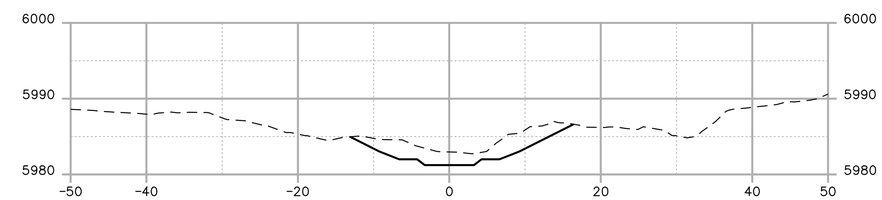

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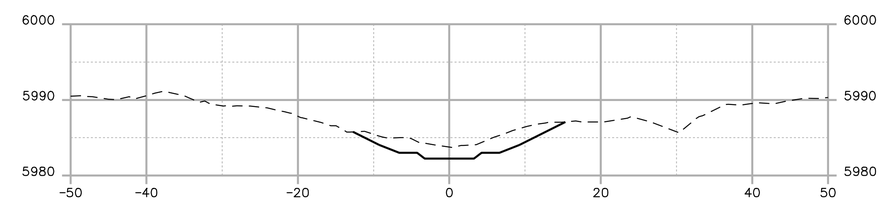

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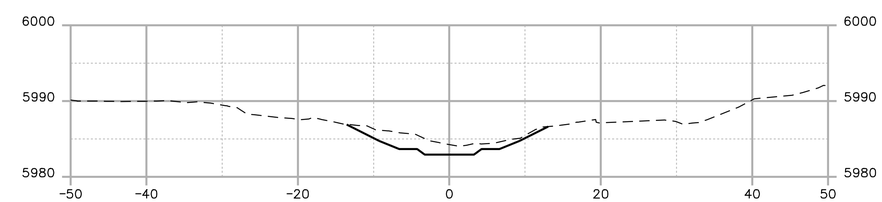

STA. 109+13.77

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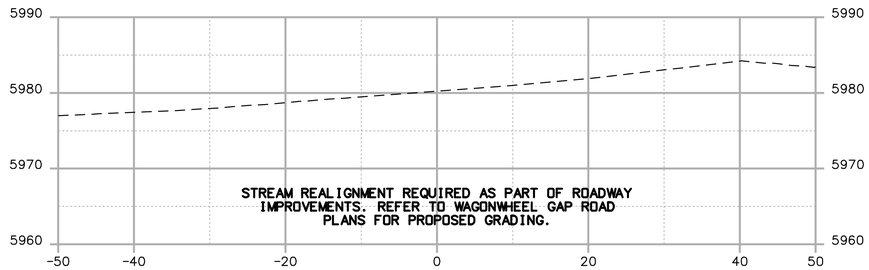
0 5 10

BAKER PROJ. REFERENCE NO.	SHEET NO.
138200	X-4



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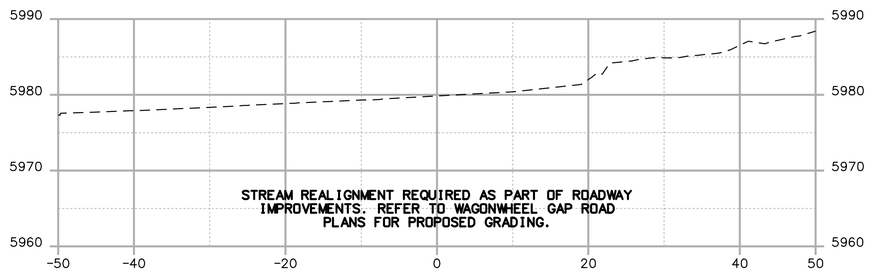

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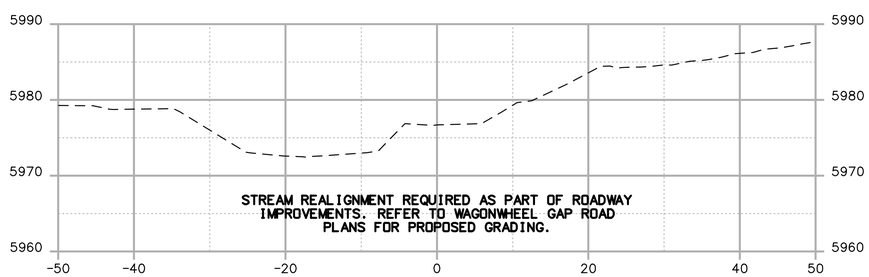

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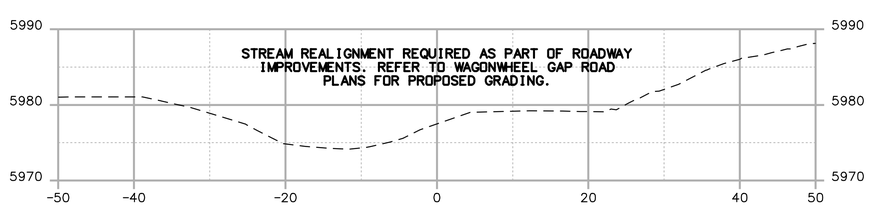

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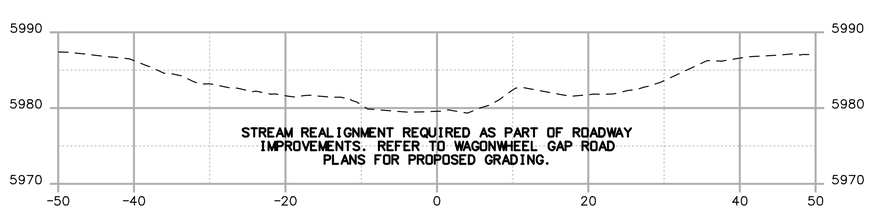

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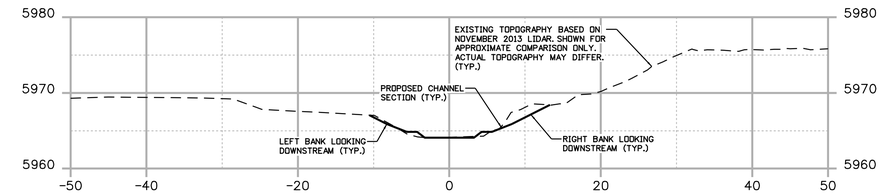
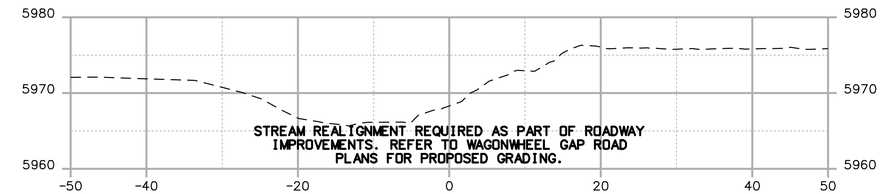


STA. 113+12.25



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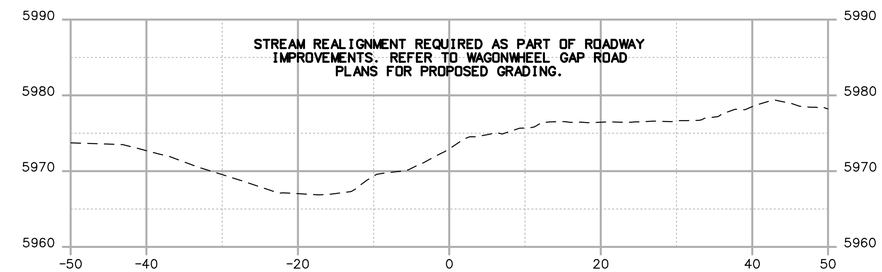

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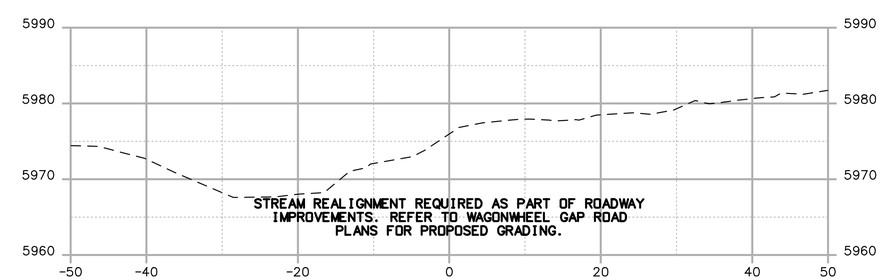

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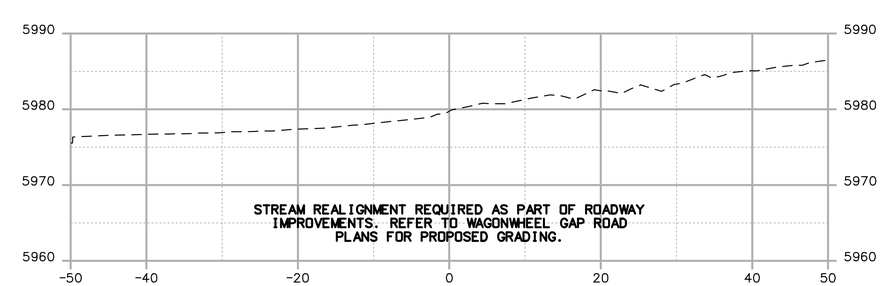

STA. 112+10.47

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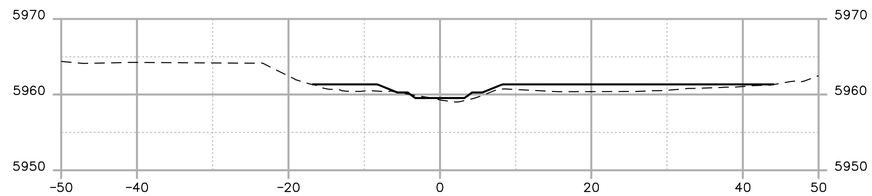
0 5 10

BAKER PROJ. REFERENCE NO.	SHEET NO.
138200	X-5



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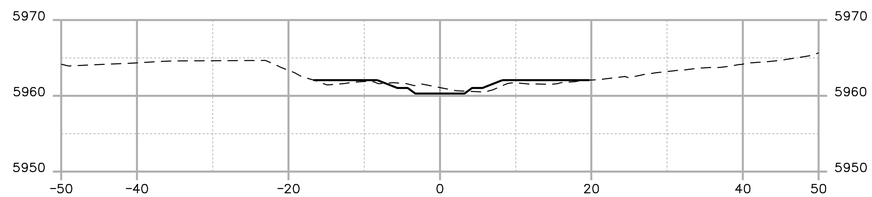

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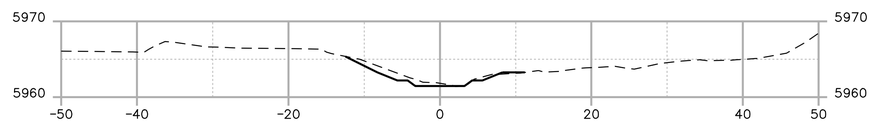

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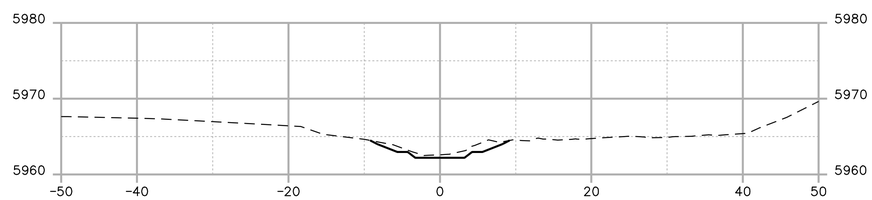

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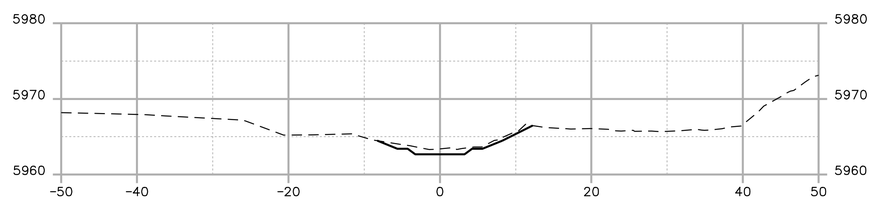
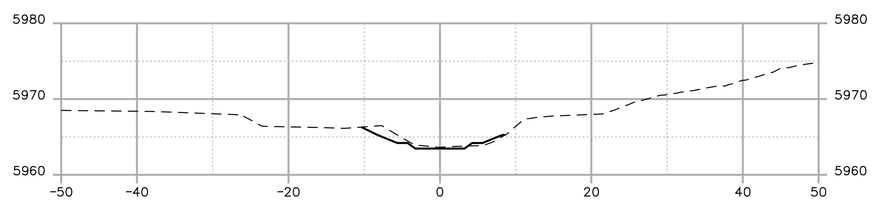
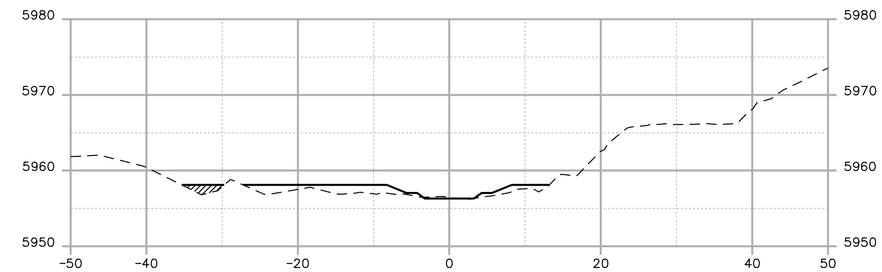


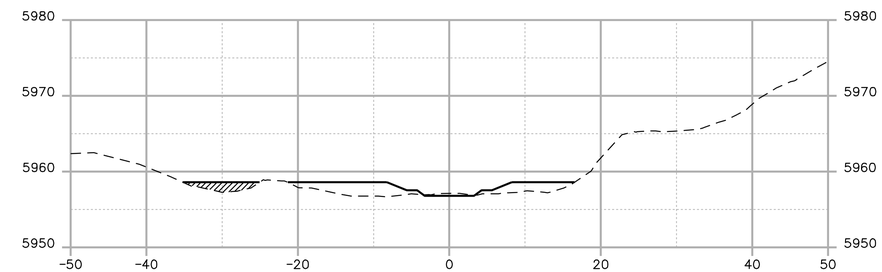
STA. 113+61.09



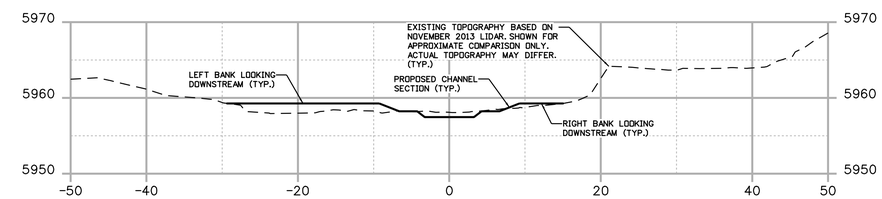
STA. 113+34.25



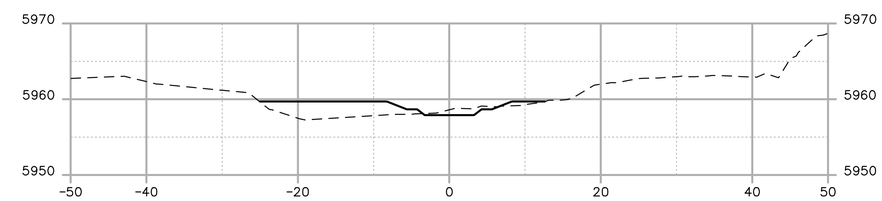
STA. 115+75.39



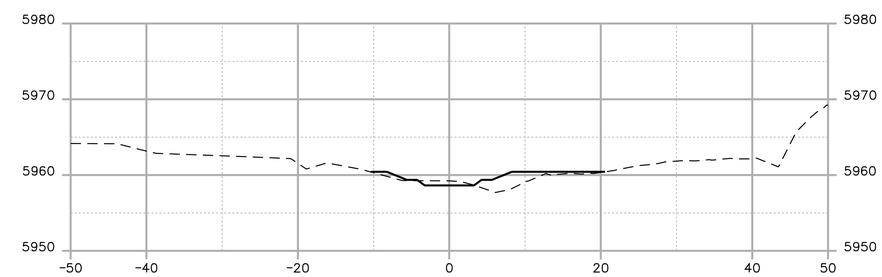
STA. 115+59.41



STA. 115+36.40



STA. 115+22.29

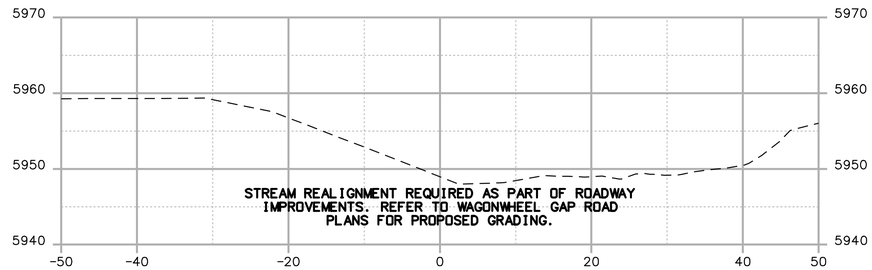


STA. 114+97.34

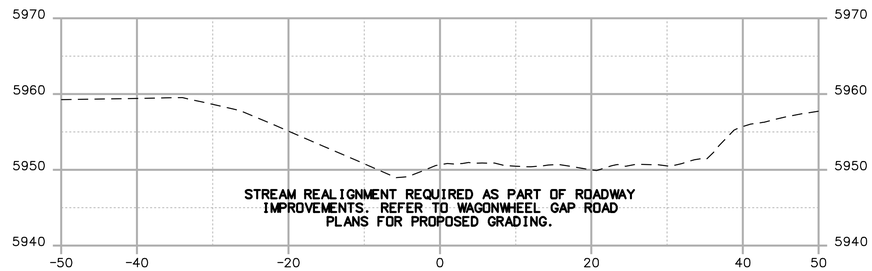
JR.Mills 10:43:58 AM pw:\\DCPWAPP1.bkr.mbakercorp.com:pwprod\Documents\Projects\Lakewood_Office\Boulder_County_Emergency_Transportation\T04\05_Design\13_Stream Restoration\Cross Sections\138200_XS-Sheets.dgn

0 5 10

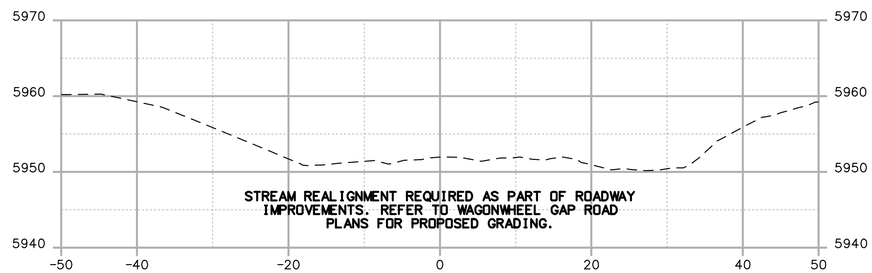
BAKER PROJ. REFERENCE NO.	SHEET NO.
138200	X-6



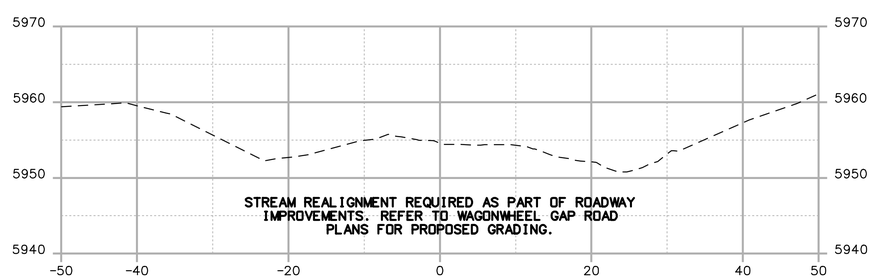
STA. 116+85.21



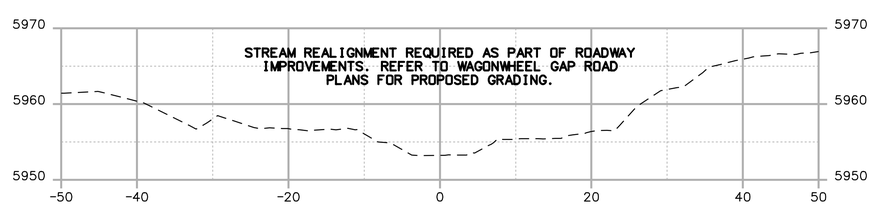
STA. 116+76.19



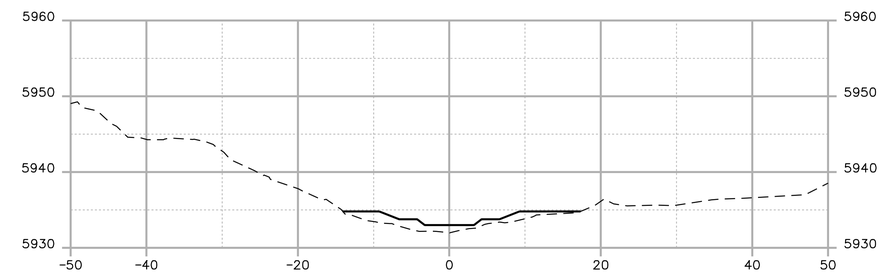
STA. 116+63.66



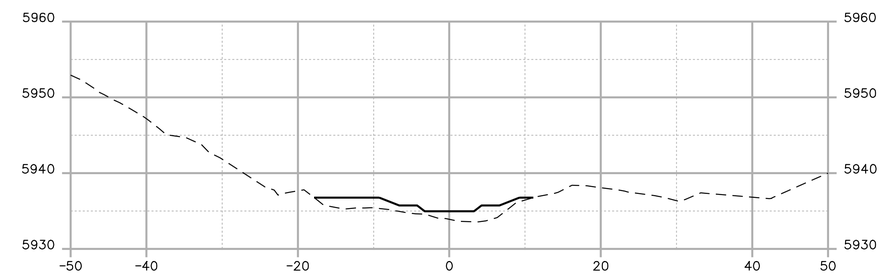
STA. 116+40.75



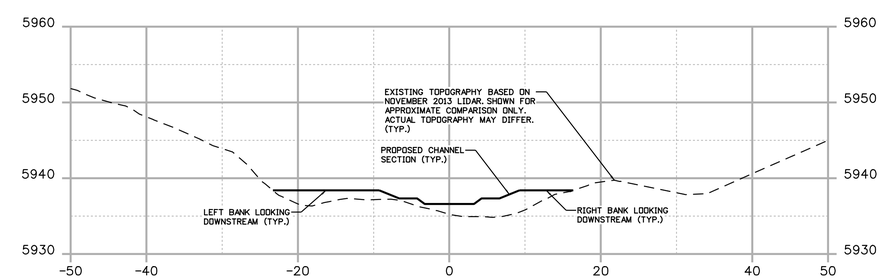
STA. 115+96.99



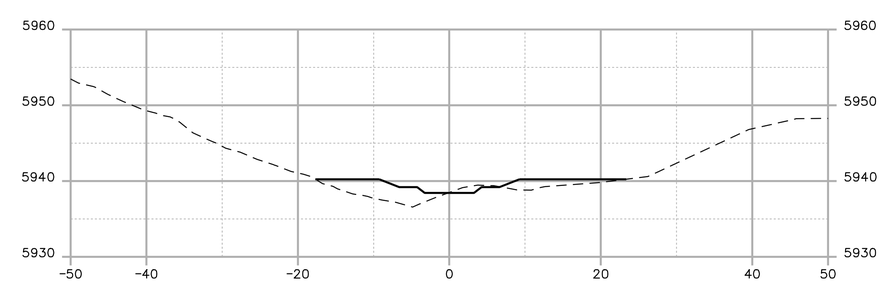
STA. 119+63.03



STA. 119+37.45



STA. 119+16.56

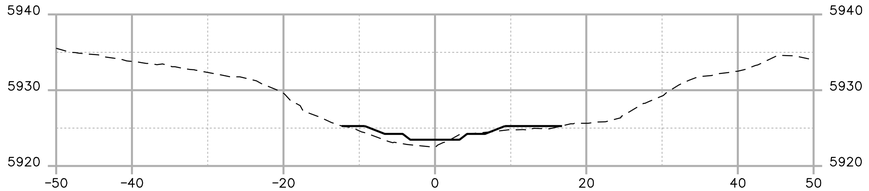


STA. 118+91.48

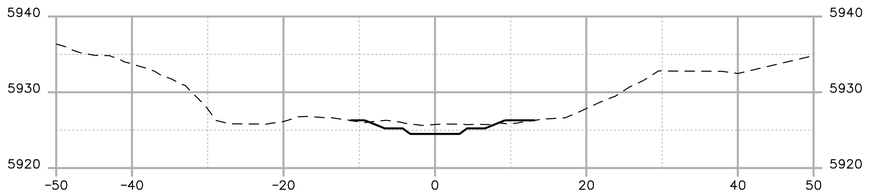
JR.Mills 8-03-10 AM pw:\\DCPWAPP1.bkr.mbakercorp.com:pwprod\Documents\Projects\Lakewood_Office\Boulder_County_Emergency_Transportation\T04\05_Design\13_Stream Restoration\Cross Sections\138200_XS-Sheets.dgn

0 5 10

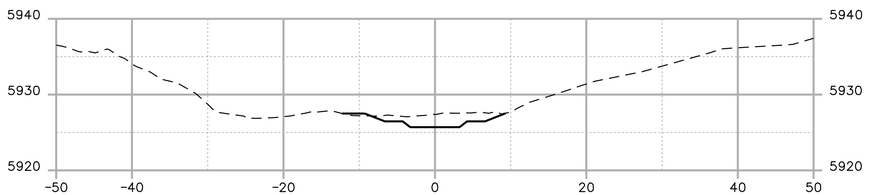
BAKER PROJ. REFERENCE NO.	SHEET NO.
138200	X-7



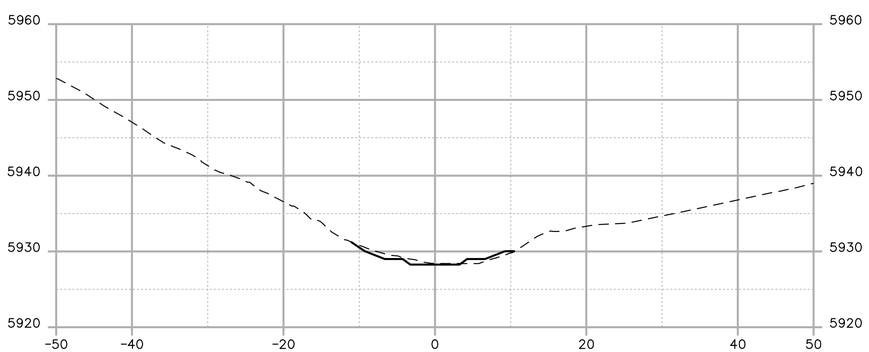
STA. 121+62.31



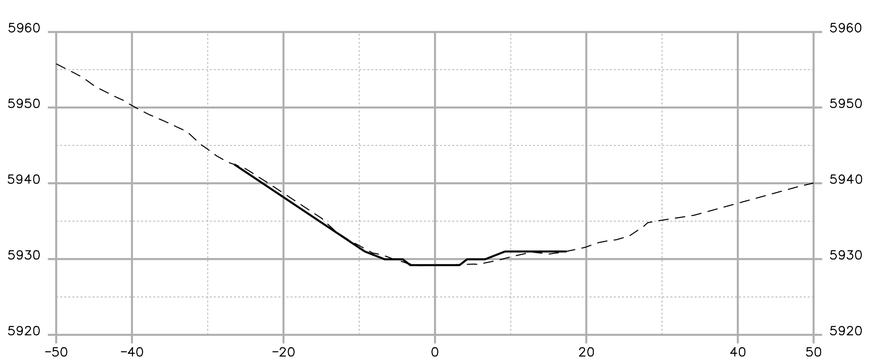
STA. 121+35.05



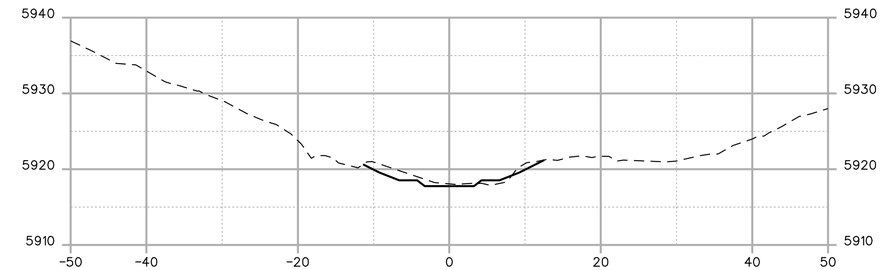
STA. 121+03.61



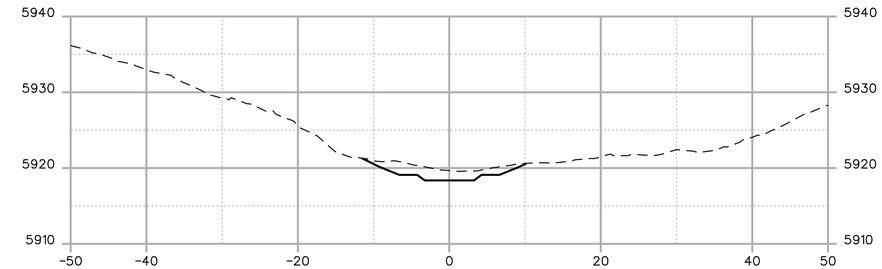
STA. 120+37.40



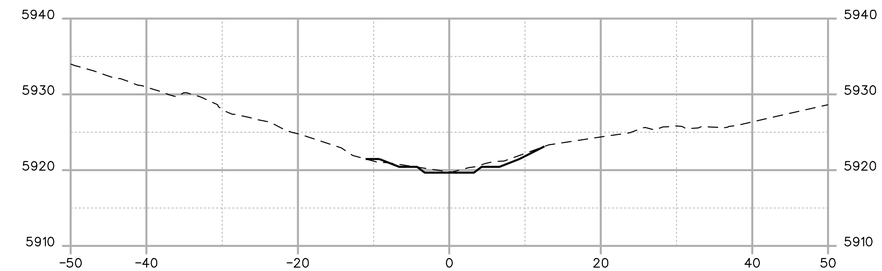
STA. 120+12.92



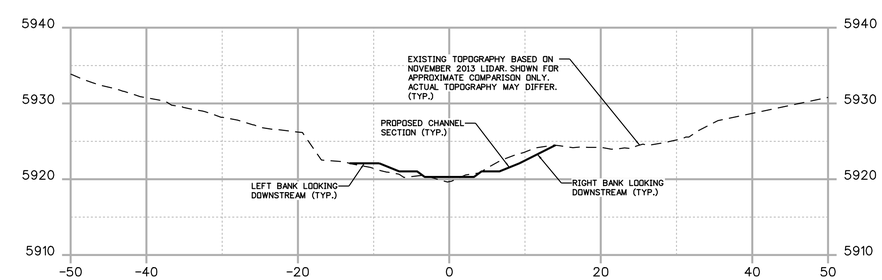
STA. 123+11.63



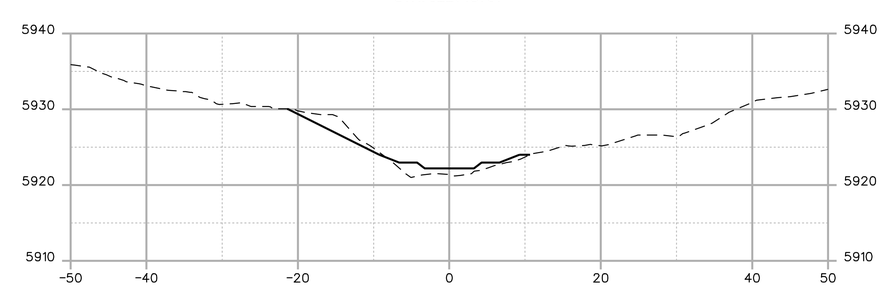
STA. 122+95.68



STA. 122+61.64



STA. 122+45.67

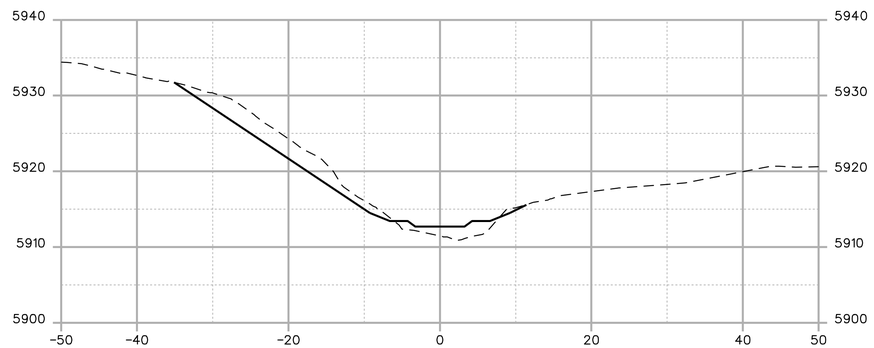


STA. 121+94.92

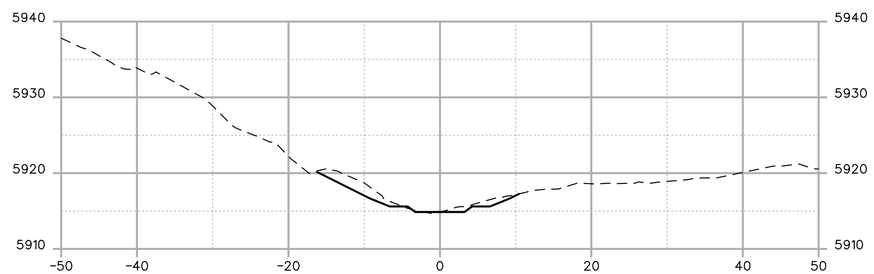
JR.Mills 10:44:43 AM pw:\\DCPWAPP1.bkr.mbakercorp.com:pwprod\Documents\Projects\Lakewood_Office\Boulder_County_Emergency_Transportation\T04\05_Design\13_Stream Restoration\Cross Sections\138200_XS-Sheets.dgn

0 5 10

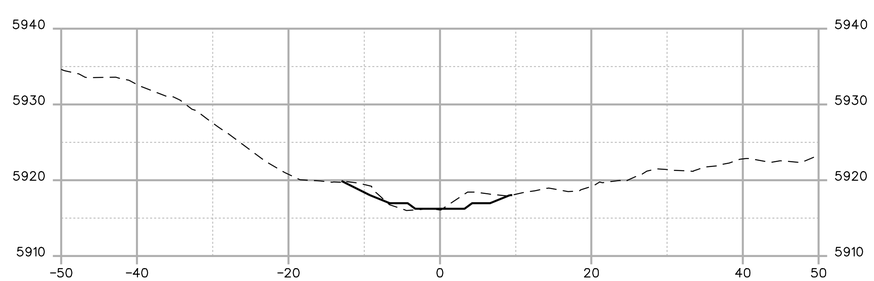
BAKER PROJ. REFERENCE NO.	SHEET NO.
138200	X-8



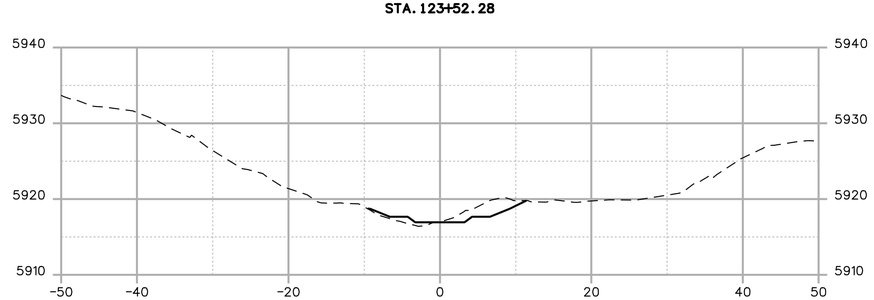
STA. 124+43.86



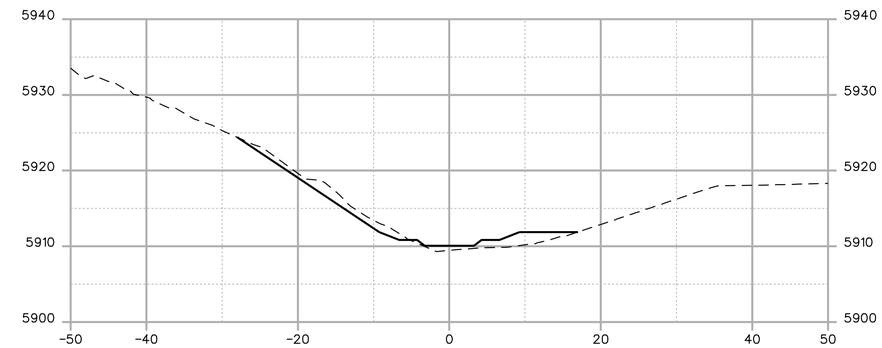
STA. 123+87.75



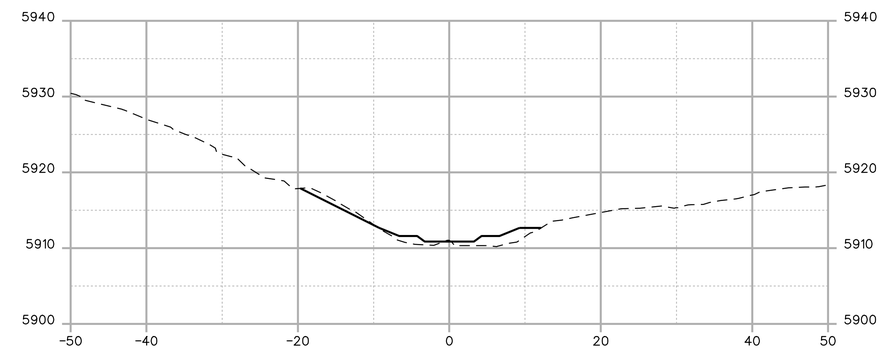
STA. 123+52.28



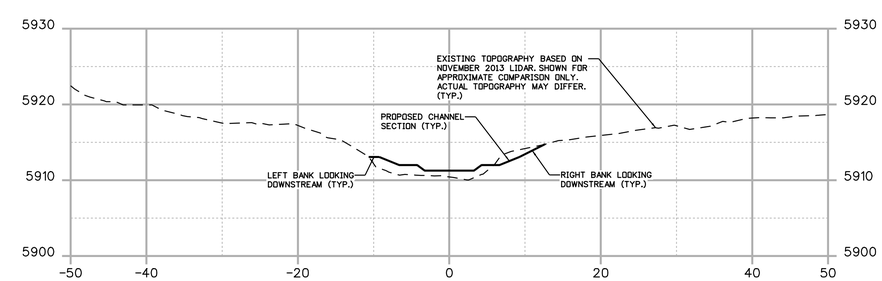
STA. 123+33.17



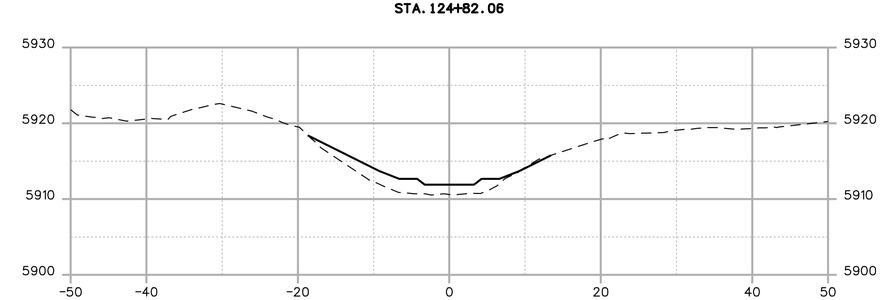
STA. 125+12.26



STA. 124+92.14



STA. 124+82.06

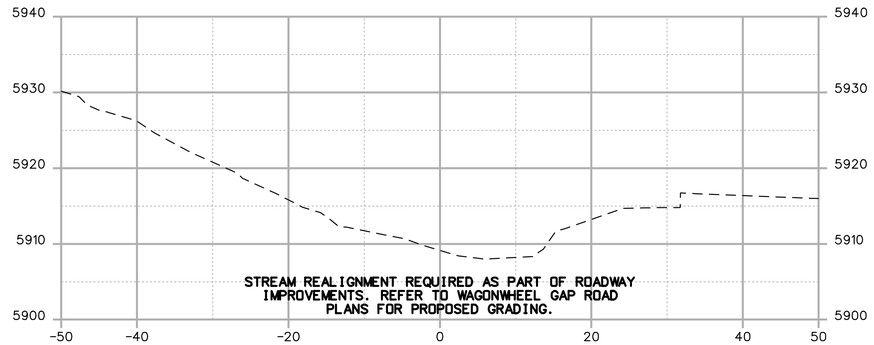


STA. 124+64.82

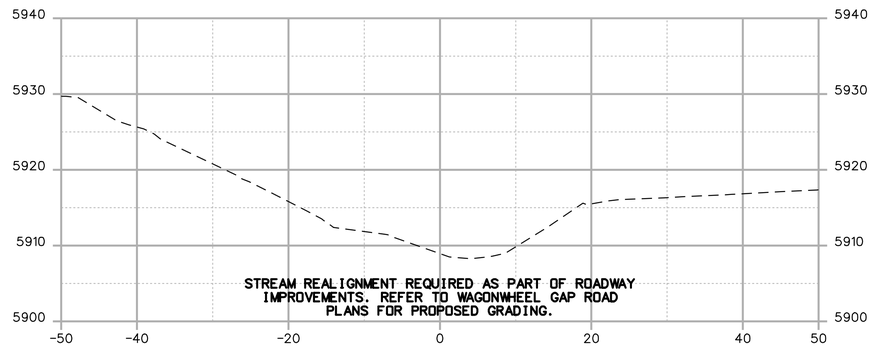
JR.Mills 10:45:31 AM pw:\\DCPWAPP1.bkr.mbakercorp.com:pwprod\Documents\Projects\Lakewood_Office\Boulder_County_Emergency_Transportation\T04\05_Design\13_Stream Restoration\Cross Sections\138200_XS-Sheets.dgn

0 5 10

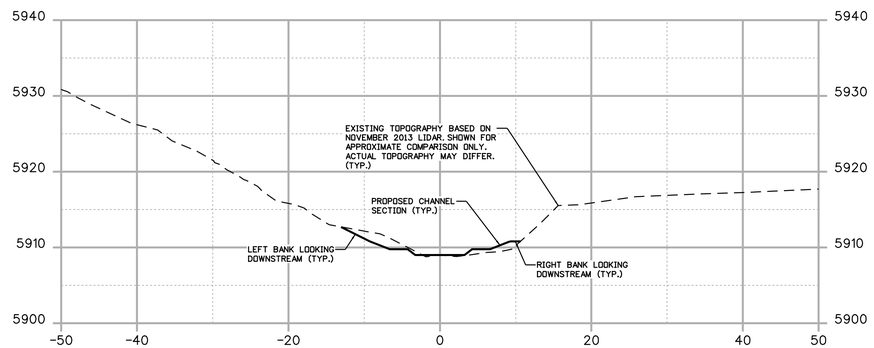
BAKER PROJ. REFERENCE NO.	SHEET NO.
138200	X-9



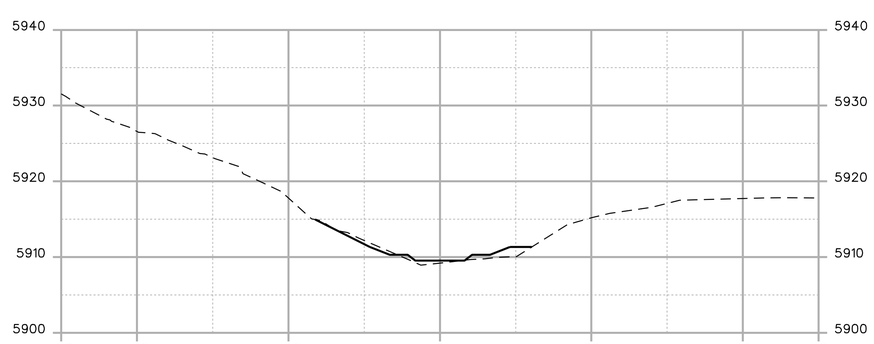
STA. 125+70.85



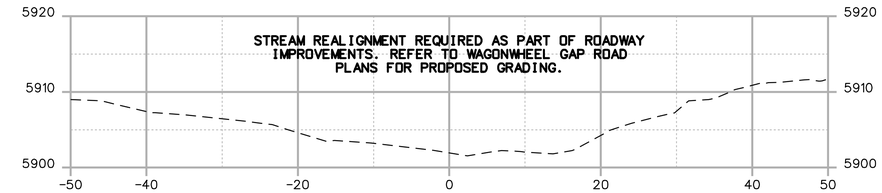
STA. 125+56.56



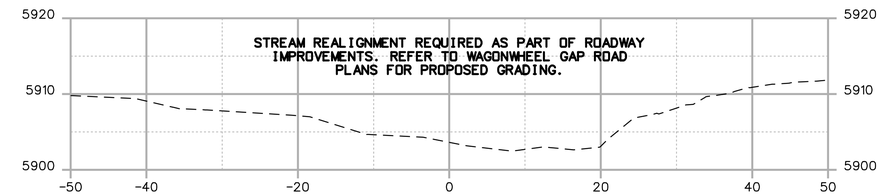
STA. 125+41.75



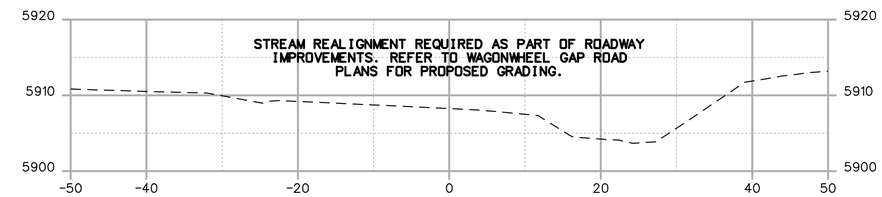
STA. 125+26.37



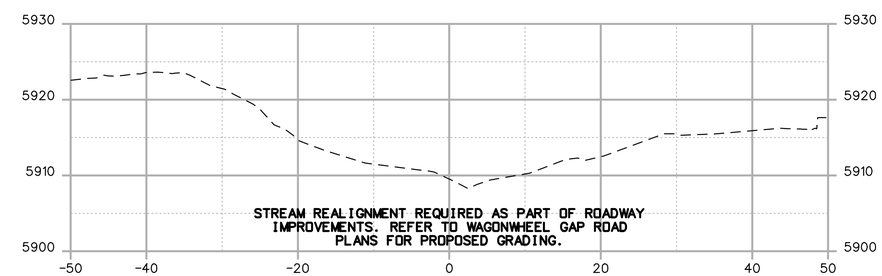
STA. 127+29.94



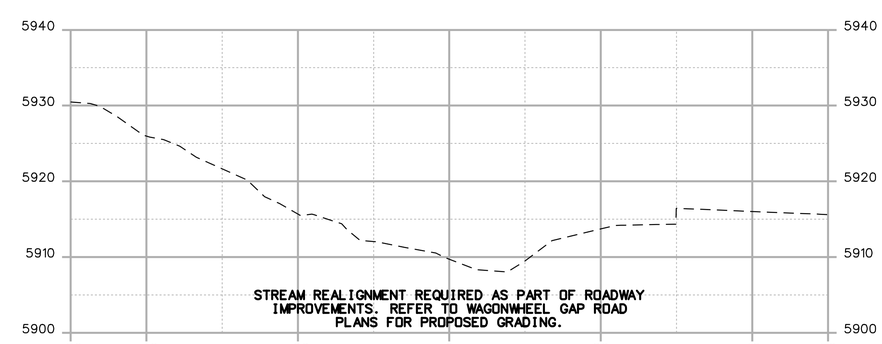
STA. 127+11.26



STA. 126+83.33



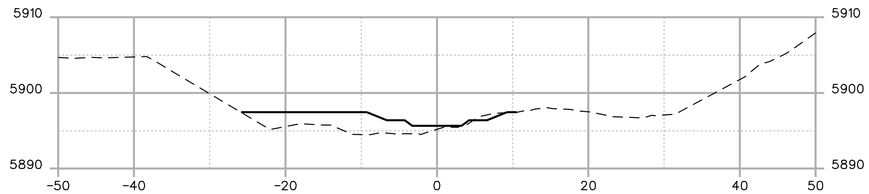
STA. 125+84.56



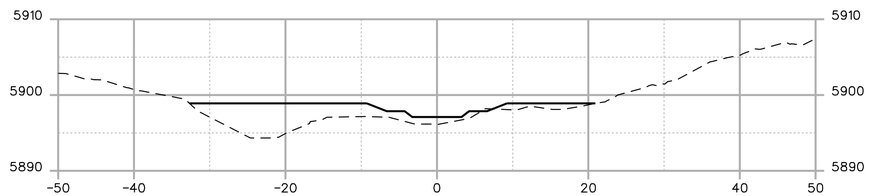
STA. 125+76.24

JR.Mills 8:04:01 AM pw:\\DCPWAPP1.bkr.mbakercorp.compwprod\Documents\Projects\Lakewood_Office\Boulder_County_Emergency_Transportation\T04\05_Design\13_Stream Restoration\Cross Sections\138200_XS-Sheets.dgn

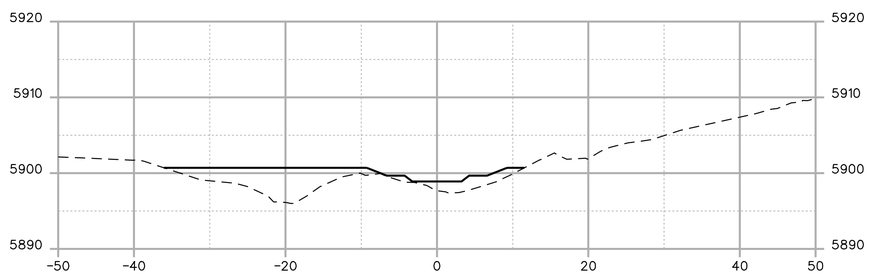
BAKER PROJ. REFERENCE NO.	SHEET NO.
138200	X-10



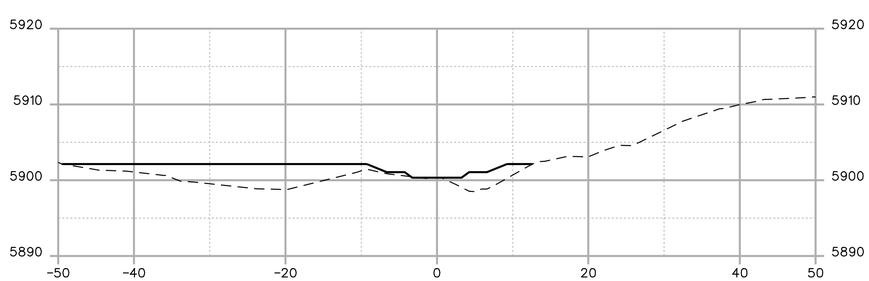
STA. 128+86.96



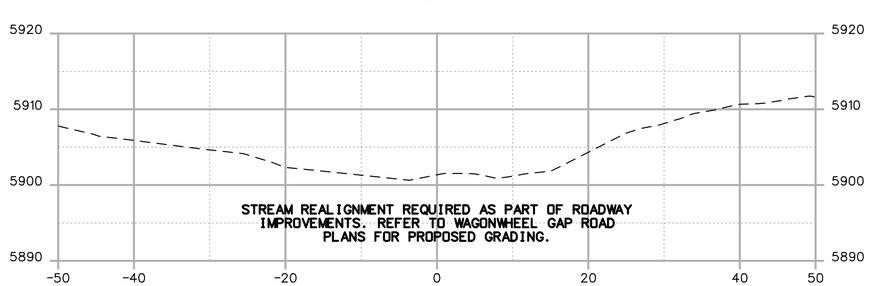
STA. 128+56.46



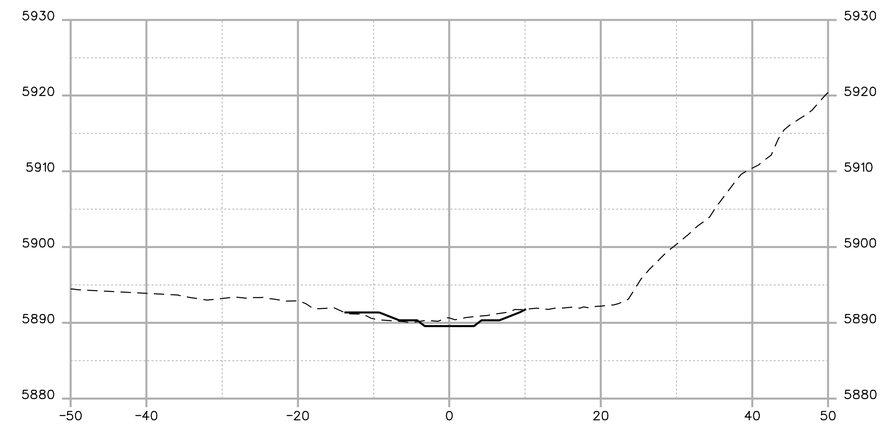
STA. 128+19.26



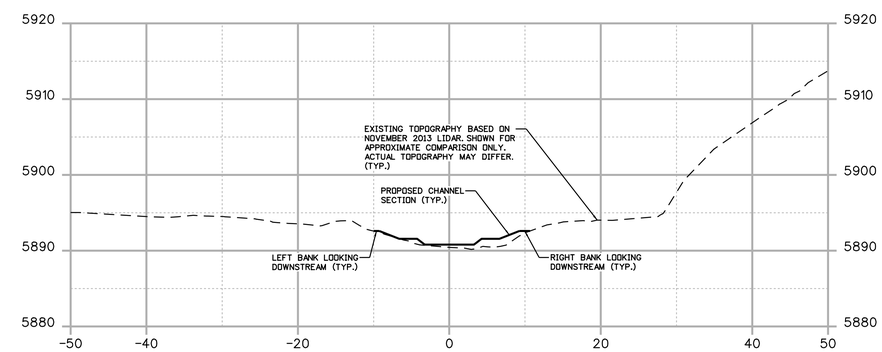
STA. 127+90.23



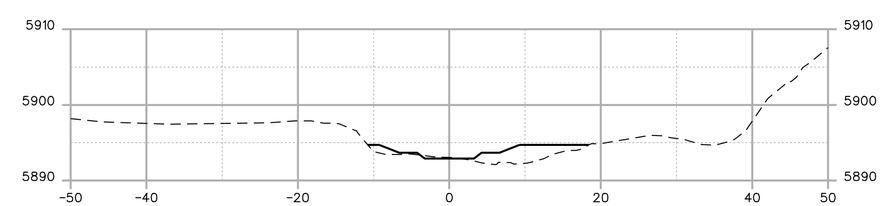
STA. 127+49.02



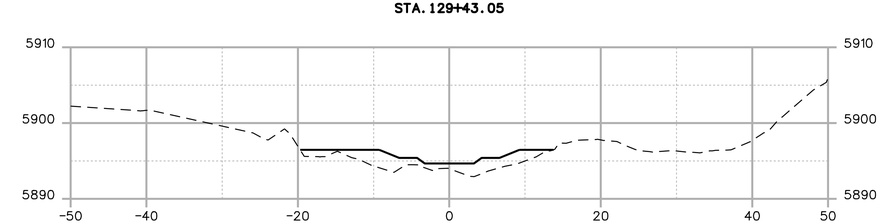
STA. 130+14.45



STA. 129+87.18



STA. 129+43.05

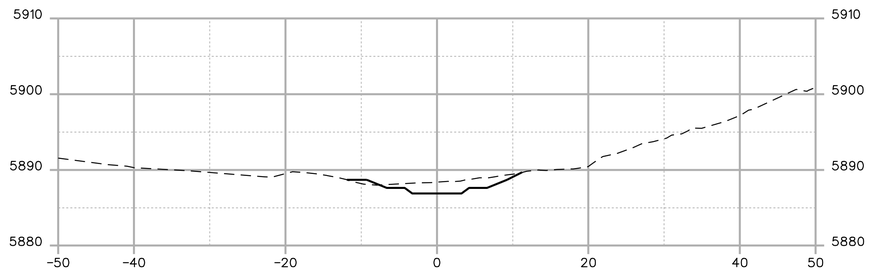


STA. 129+06.93

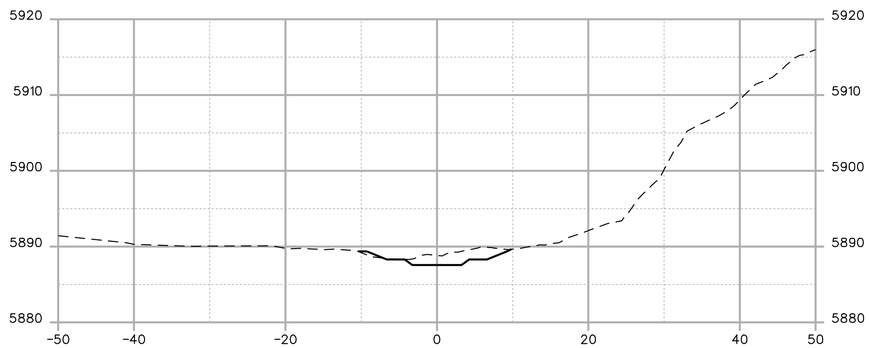
JR.Mills 8:04:22 AM pw:\\DCPWAPP1.bkr.mbakercorp.com:pwprod\Documents\Projects\Lakewood_Office\Boulder_County_Emergency_Transportation\T04\05_Design\13_Stream Restoration\Cross Sections\138200_XS-Sheets.dgn

0 5 10

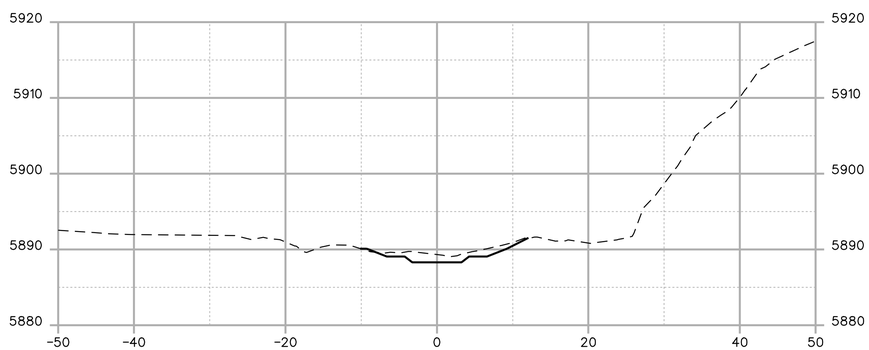
BAKER PROJ. REFERENCE NO.	SHEET NO.
138200	X-11



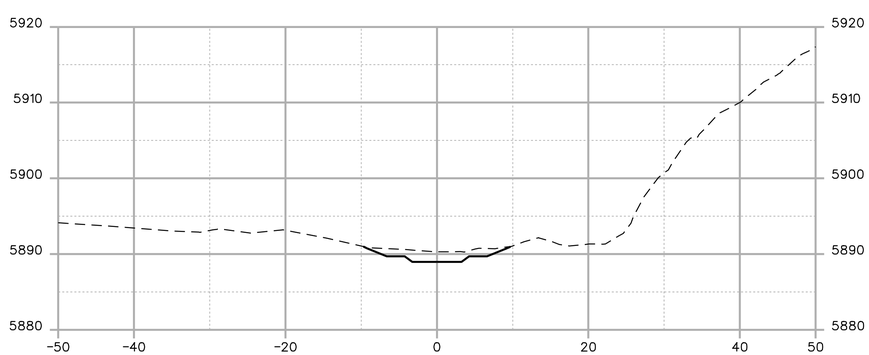
STA. 130+80.31



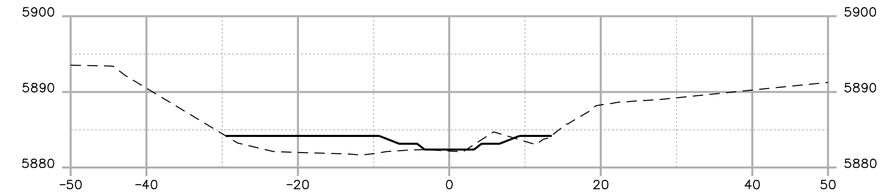
STA. 130+63.68



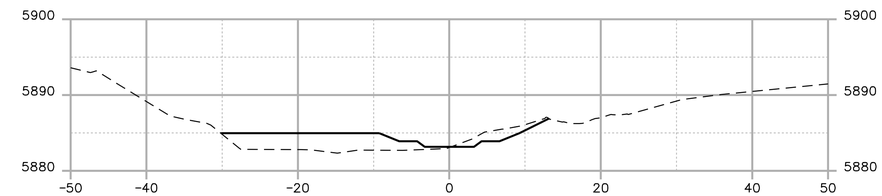
STA. 130+45.53



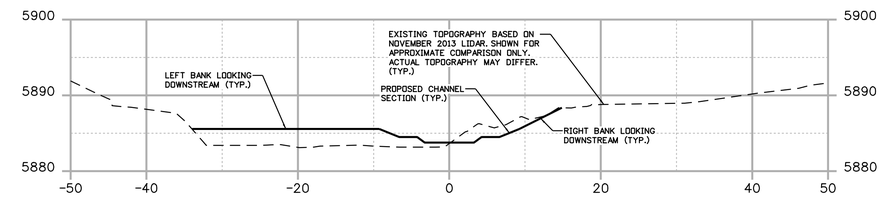
STA. 130+29.34



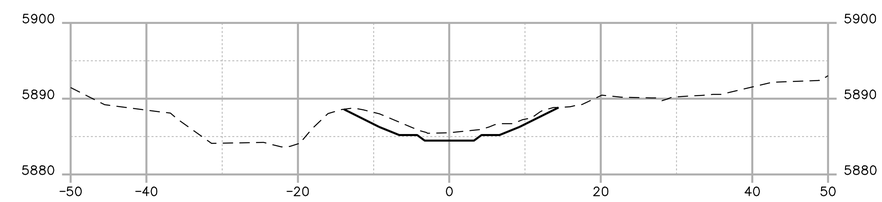
STA. 131+90.07



STA. 131+71.09



STA. 131+56.71



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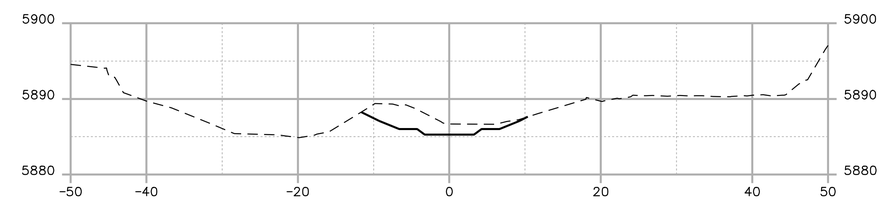
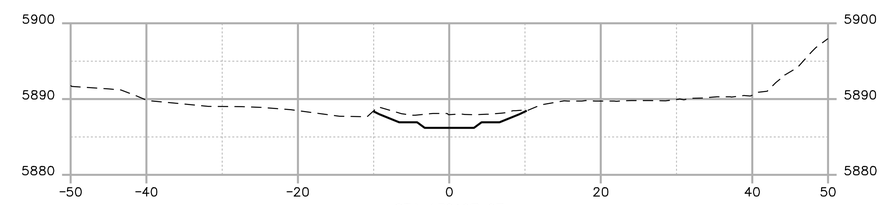


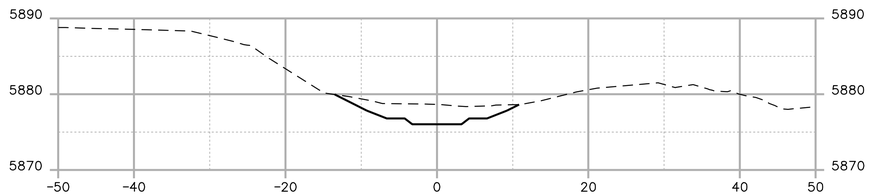
STA. 131+19.46



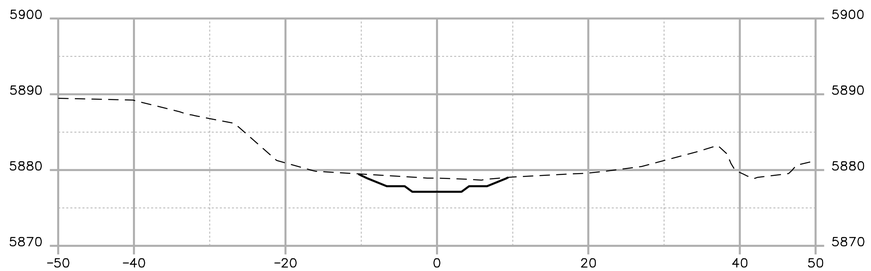
STA. 130+97.07

JR.Mills 8:04:39 AM pw:\\DCPWAPP1.bkr.mbakercorp.com:pwprod\Documents\Projects\Lakewood_Office\Boulder_County_Emergency_Transportation\T04\05_Design\13_Stream Restoration\Cross Sections\138200_XS-Sheets.dgn

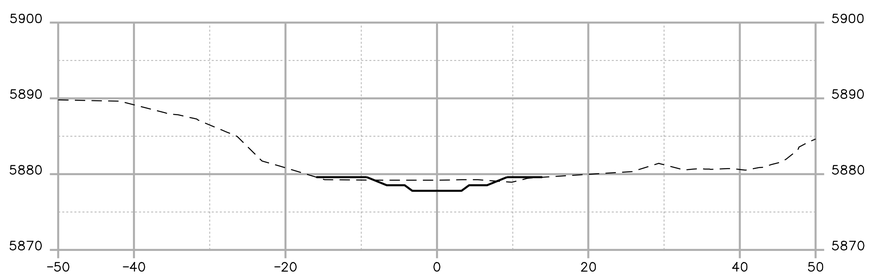
BAKER PROJ. REFERENCE NO.	SHEET NO.
138200	X-12



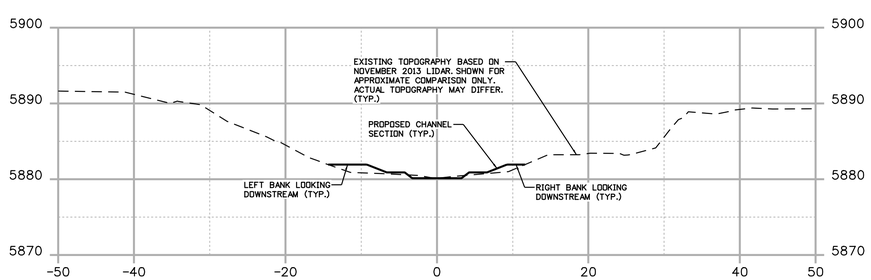
STA. 133+56.71



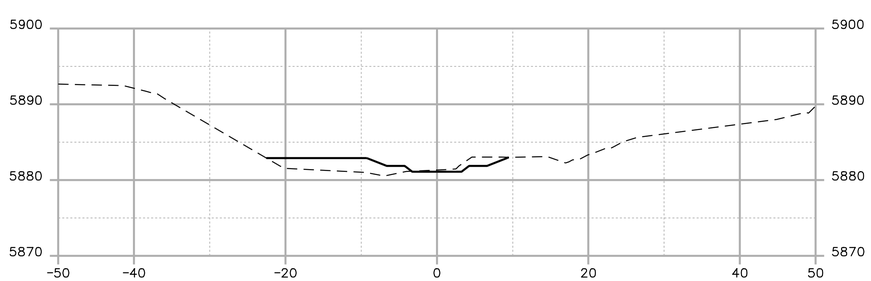
STA. 133+26.52



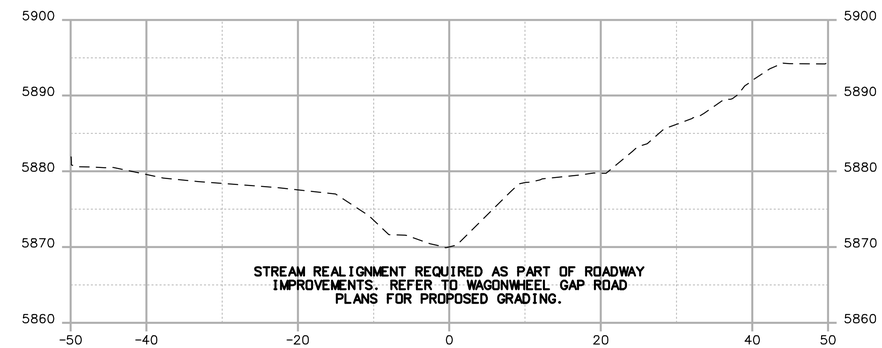
STA. 133+08.84



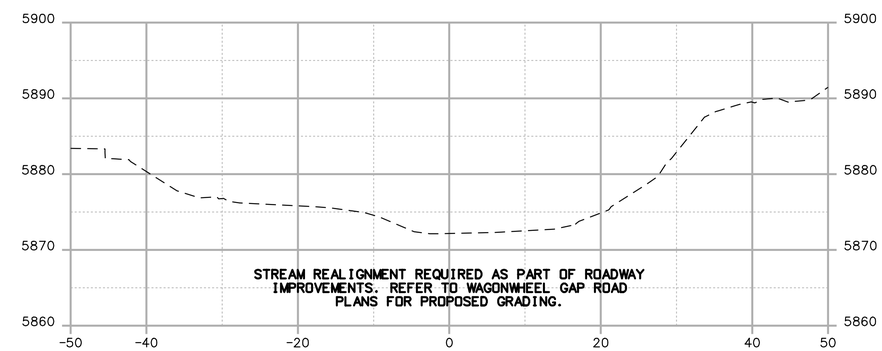
STA. 132+45.58



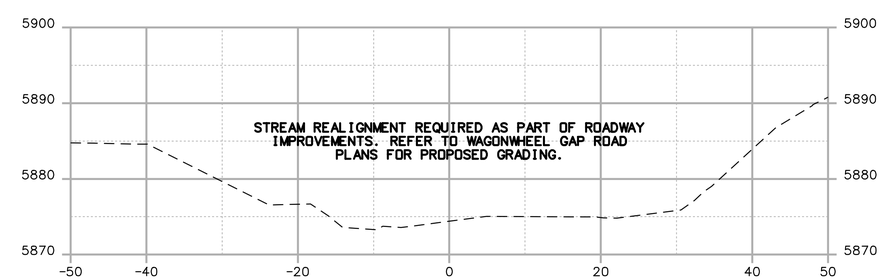
STA. 132+21.15



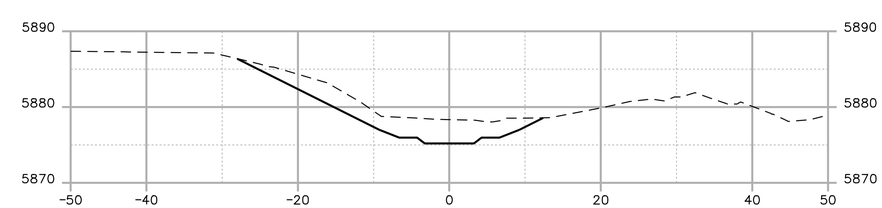
STA. 135+30.94



STA. 134+96.65



STA. 134+64.88

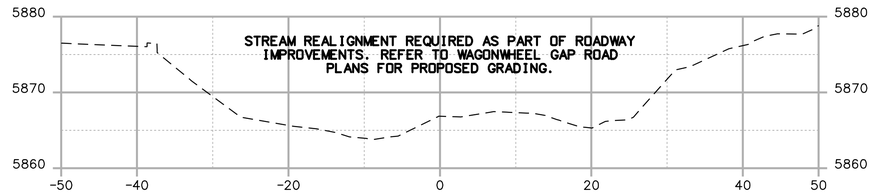


STA. 133+78.90

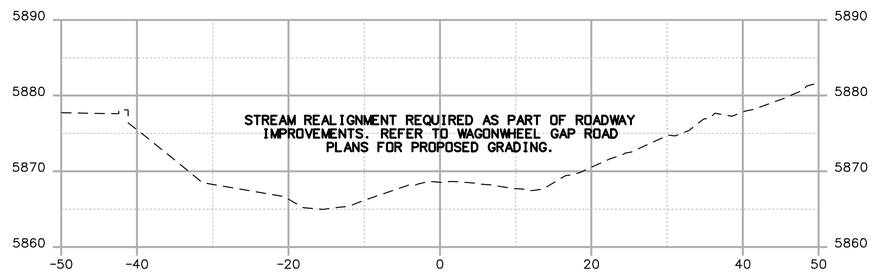
JR.Mills 8:05:19 AM pw:\\DCPWAPP1.bkr.mbakercorp.com:pwprod\Documents\Projects\Lakewood_Office\Boulder_County_Emergency_Transportation\T04\05_Design\13_Stream Restoration\Cross Sections\138200_XS-Sheets.dgn

BAKER PROJ. REFERENCE NO.	SHEET NO.
138200	X-13

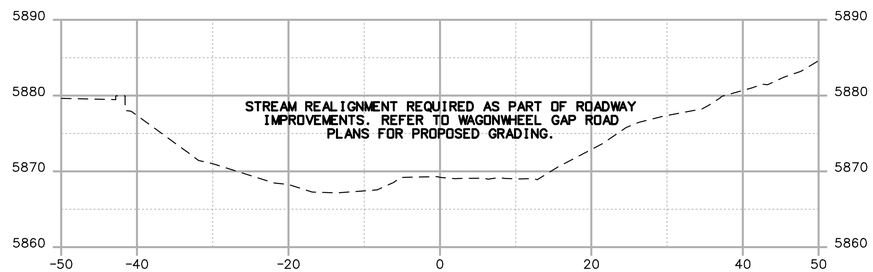
0 5 10



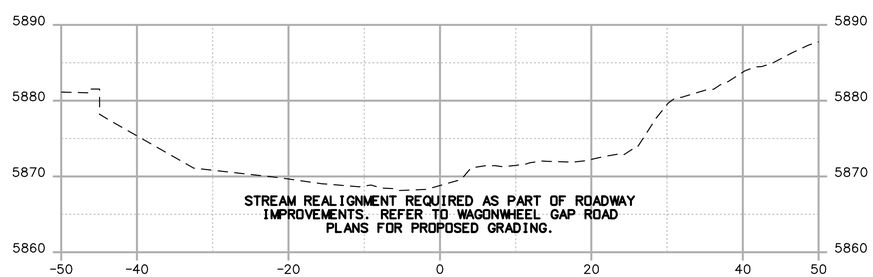
STA. 136+52.00



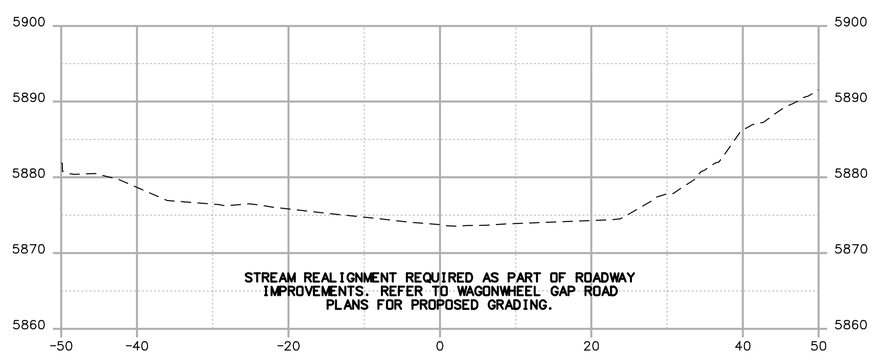
STA. 136+12.73



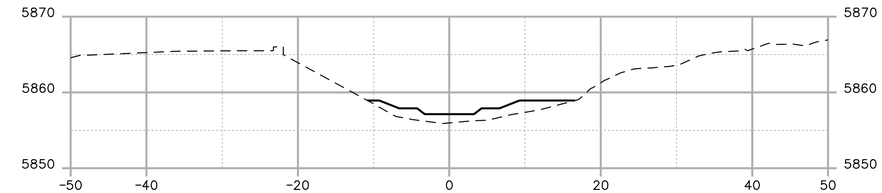
STA. 135+85.43



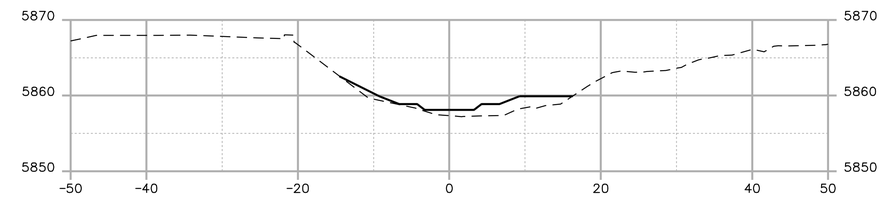
STA. 135+64.17



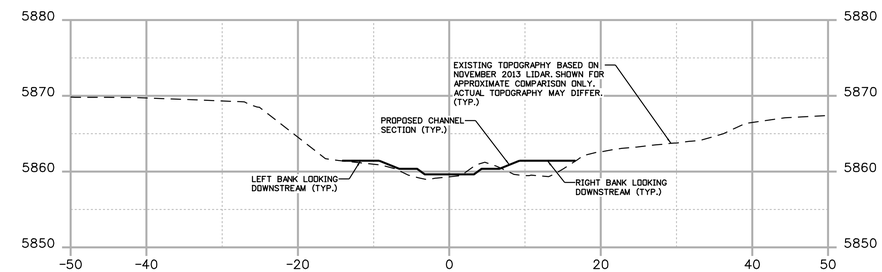
STA. 135+47.90



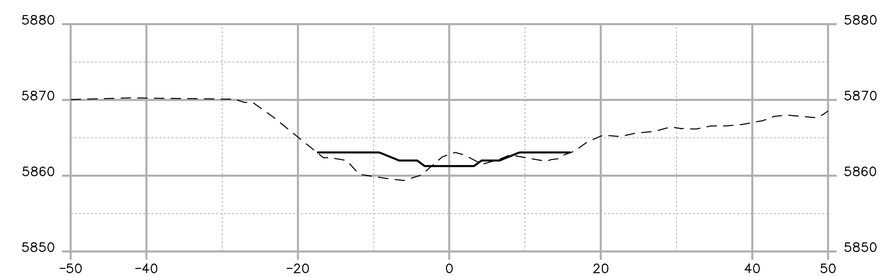
STA. 137+93.24



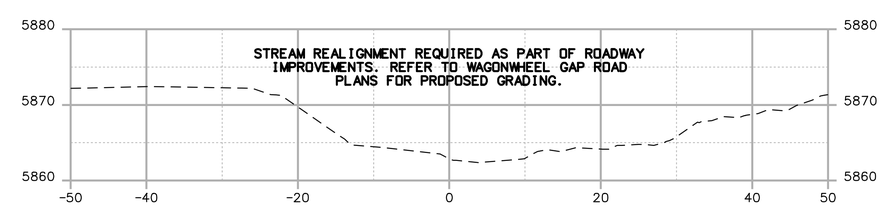
STA. 137+76.40



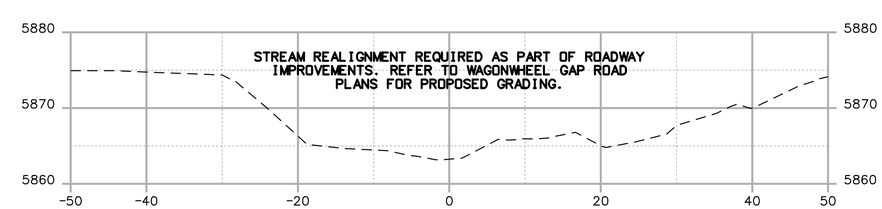
STA. 137+52.23



STA. 137+27.13



STA. 136+97.30

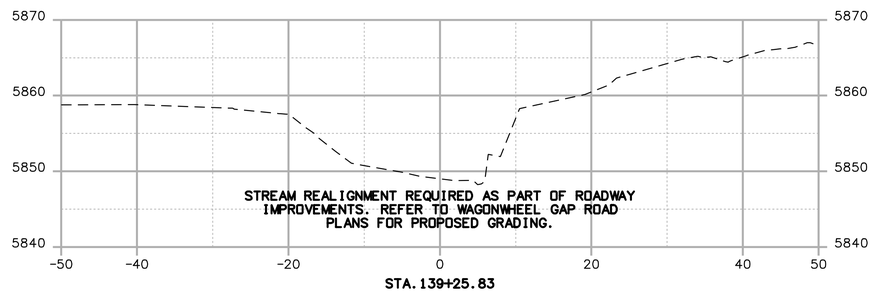


STA. 136+73.36

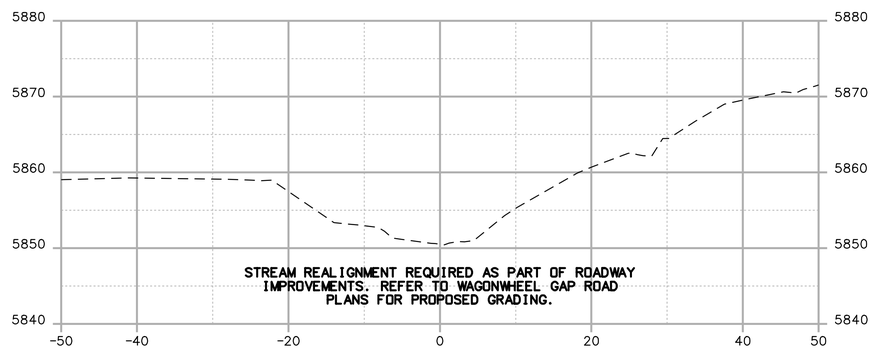
JR.Mills 11:09:38 AM pw:\\DCPWAPP1.bkr.mbakercorp.com:pwprod\Documents\Projects\Lakewood_Office\Boulder_County_Emergency_Transportation\T04\05_Design\13_Stream Restoration\Cross Sections\138200_XS-Sheets.dgn

0 5 10

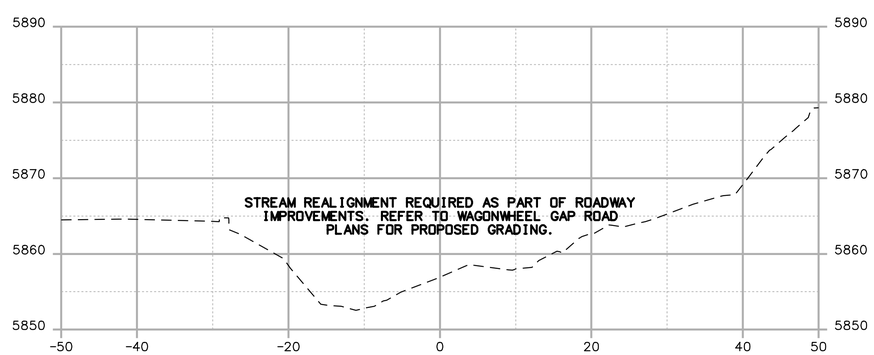
BAKER PROJ. REFERENCE NO.	SHEET NO.
138200	X-14



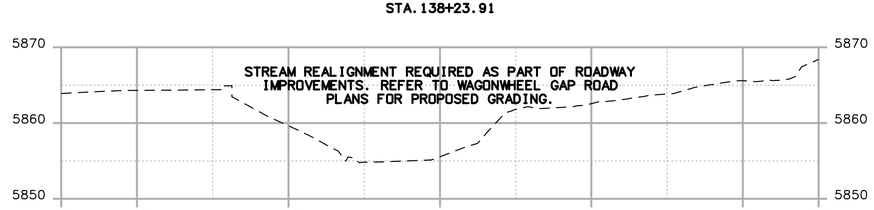
STA. 139+25.83



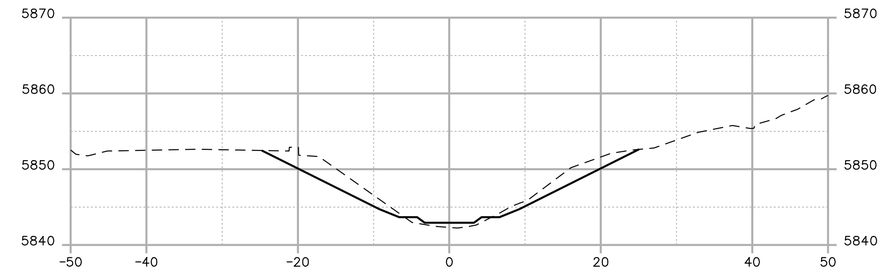
STA. 139+01.65



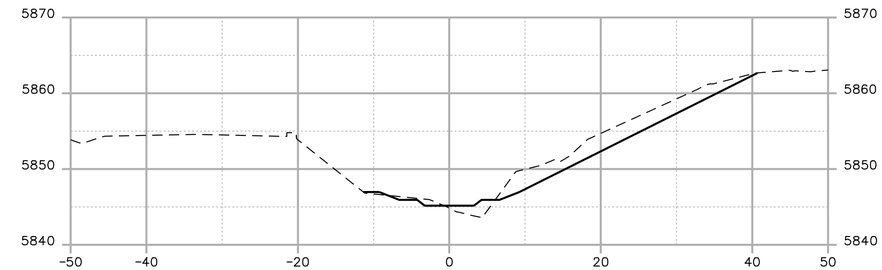
STA. 138+23.91



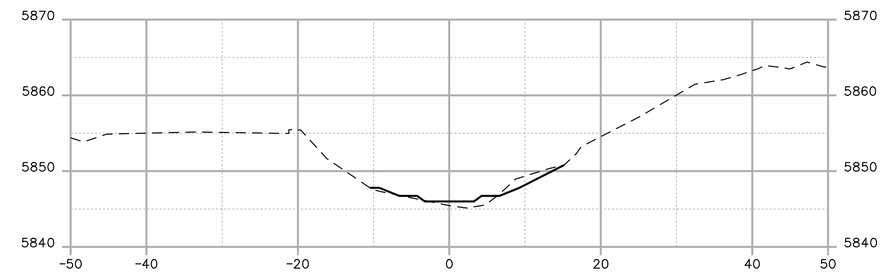
STA. 138+07.78



STA. 140+59.10



STA. 140+06.65



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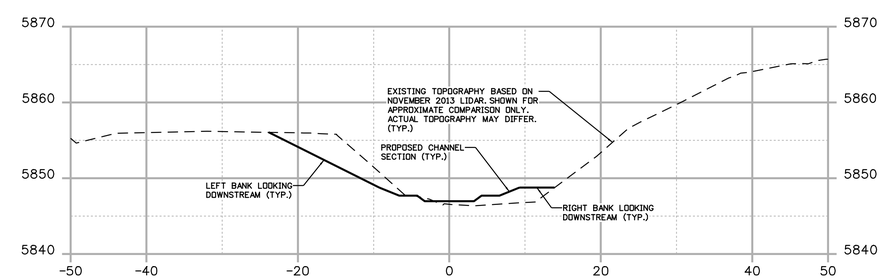

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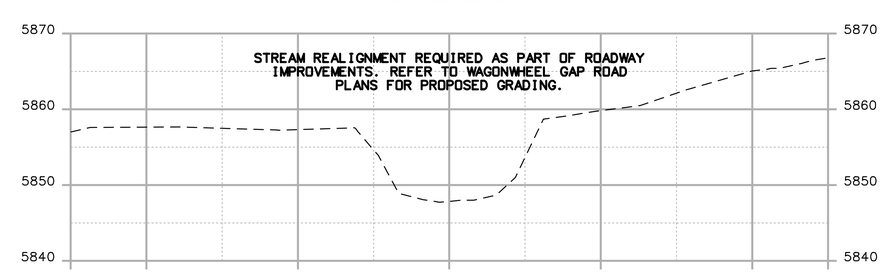
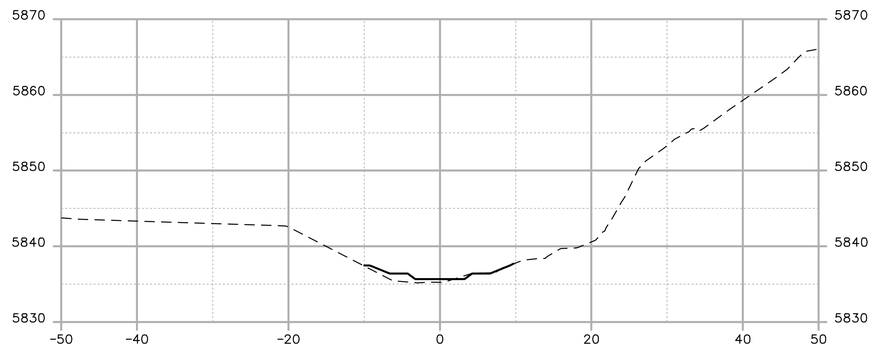


STA. 139+44.88

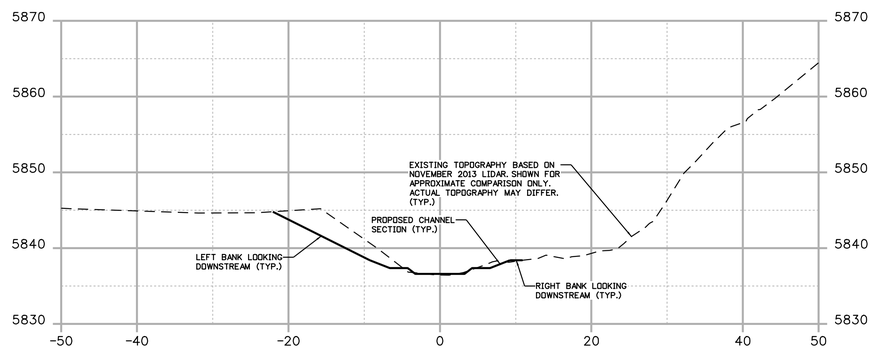
JR.Mills 11:10:16 AM pw:\\DCPWAPP1.bkr.mbokercorp.com:pwprod\Documents\Projects\Lakewood_Office\Boulder_County_Emergency_Transportation\T04\05_Design\13_Stream Restoration\Cross Sections\138200_XS-Sheets.dgn

0 5 10

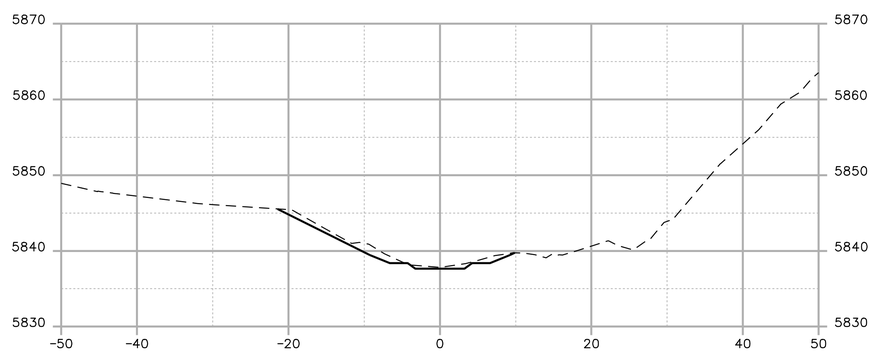
BAKER PROJ. REFERENCE NO.	SHEET NO.
138200	X-15



STA. 142+26.40



STA. 142+04.63



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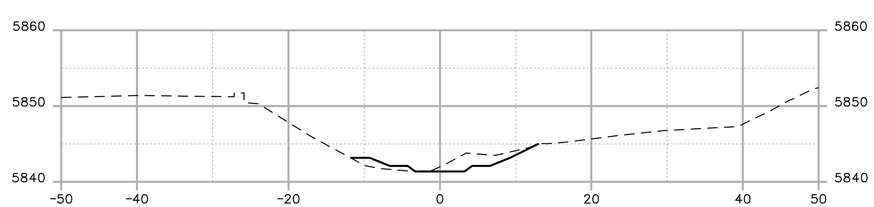

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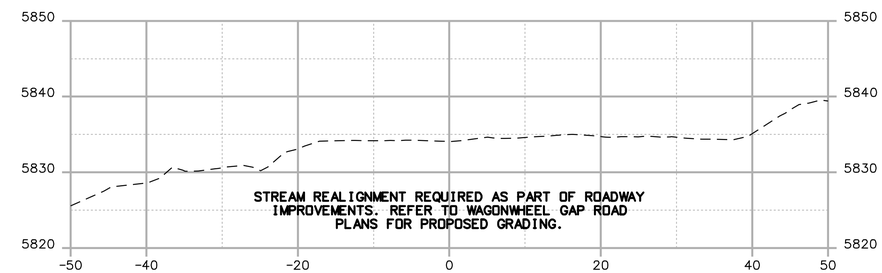
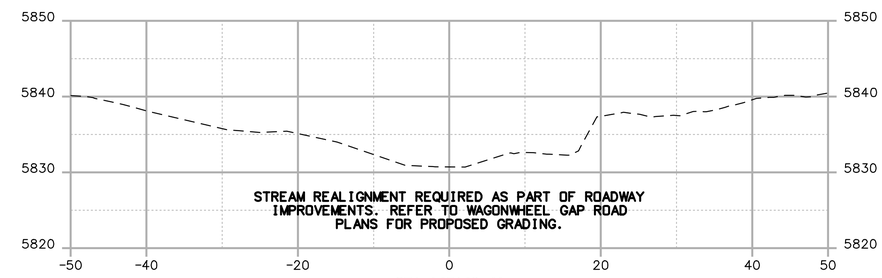


STA. 144+34.84



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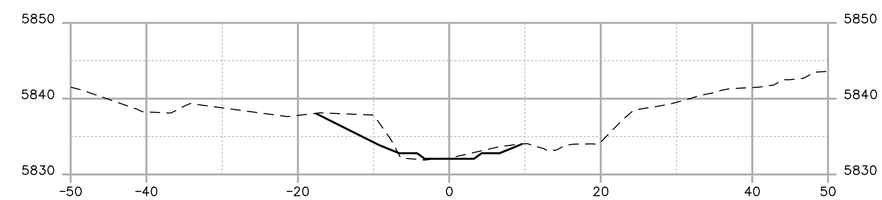
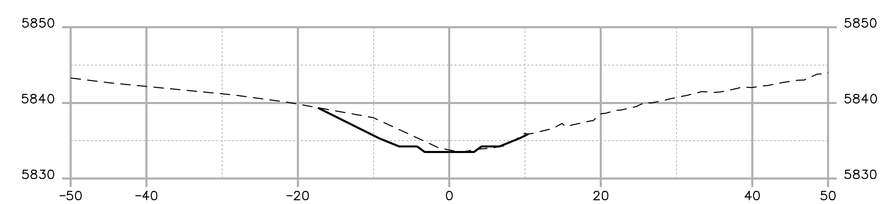
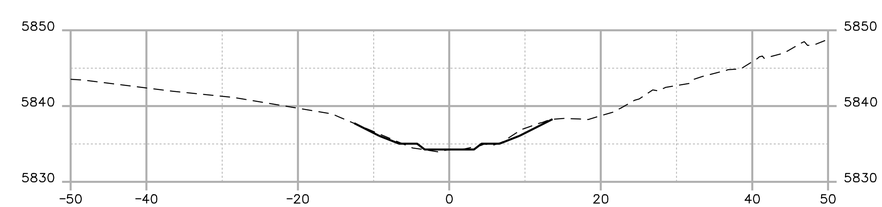


STA. 143+10.00



STA. 142+76.38

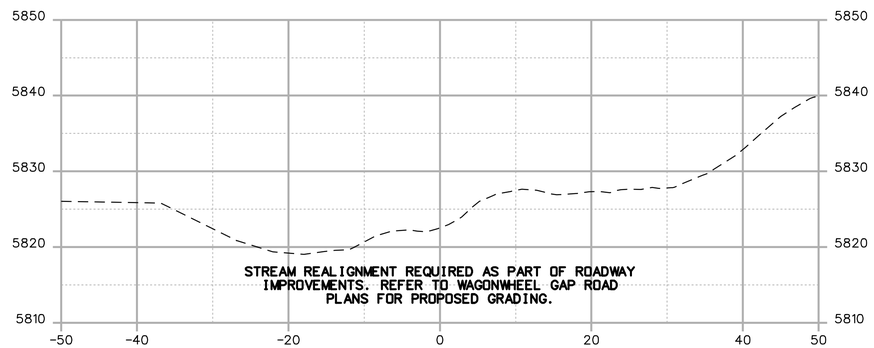


STA. 142+58.46

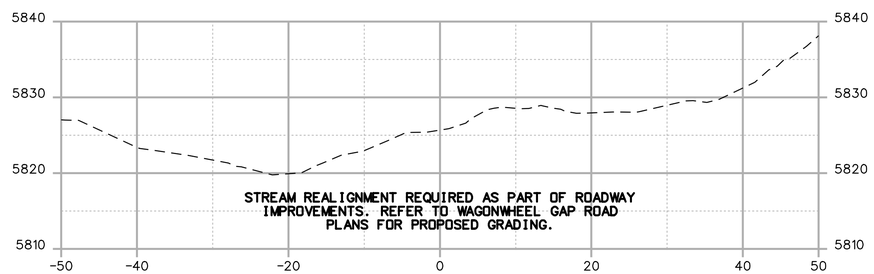
JR.Mills 11:10:57 AM pw:\\DCPWAPP1.bkr.mbakercorp.com:pwprod\Documents\Projects\Lakewood_Office\Boulder_County_Emergency_Transportation\T04\05_Design\13_Stream Restoration\Cross Sections\138200_XS-Sheets.dgn

0 5 10

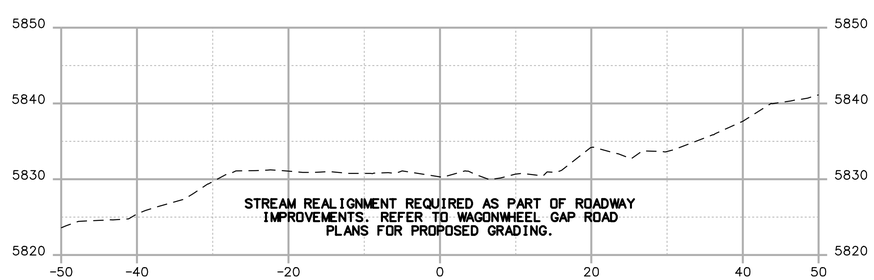
BAKER PROJ. REFERENCE NO.	SHEET NO.
138200	X-16



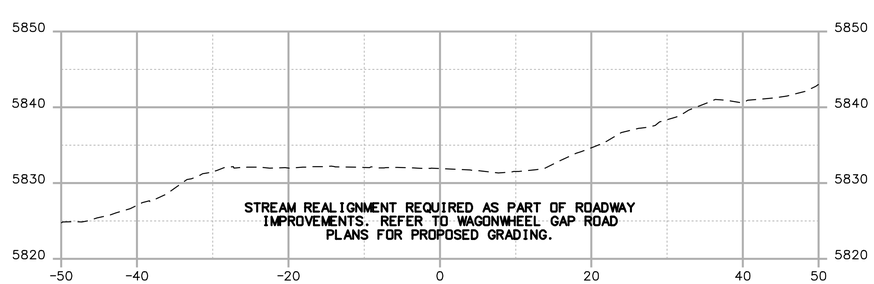
STA. 146+41.82



STA. 146+04.78



STA. 145+49.68



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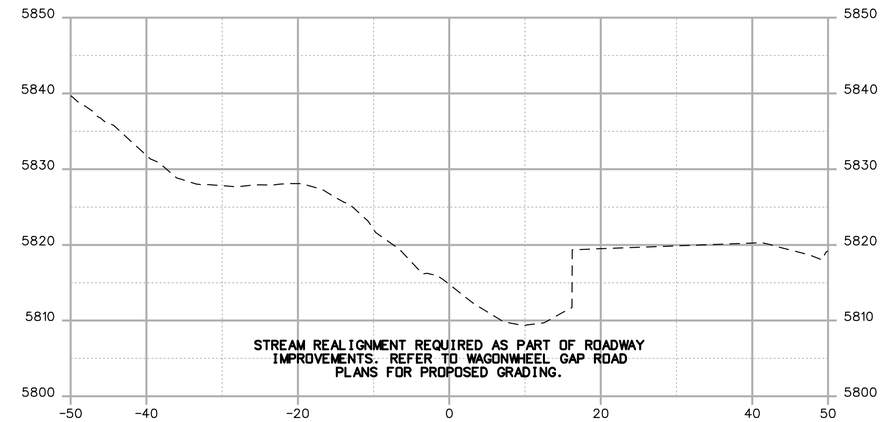

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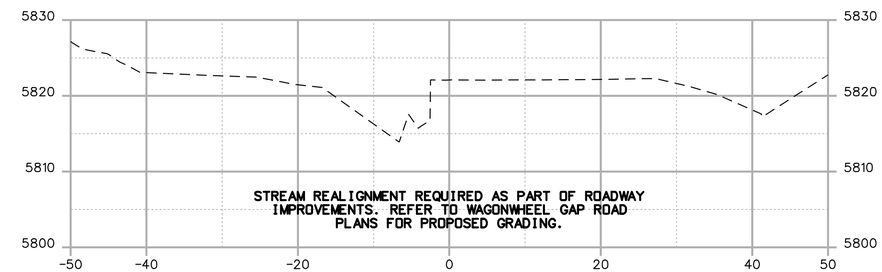

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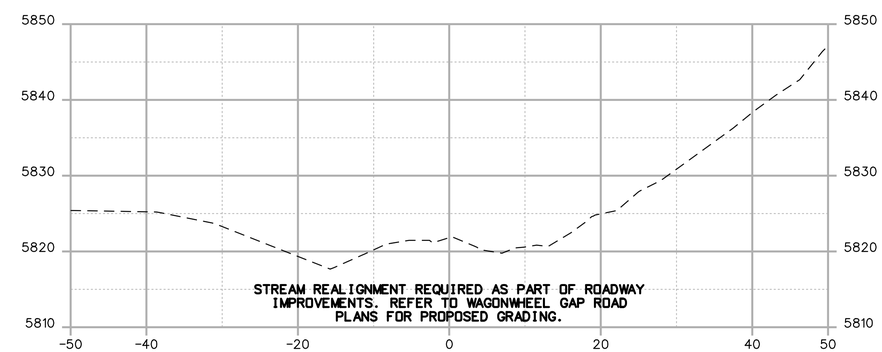
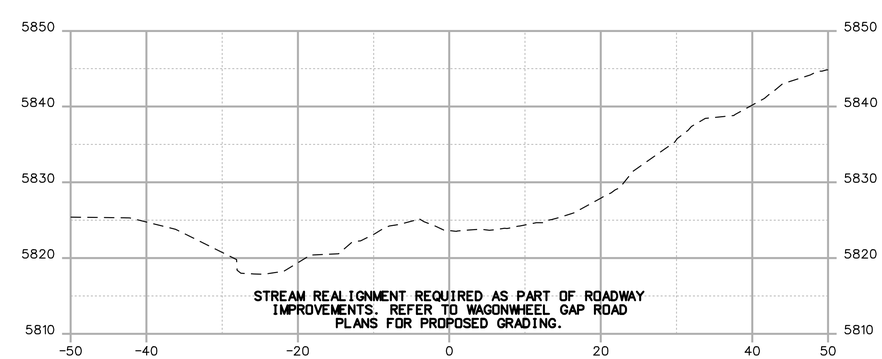


STA. 147+22.03

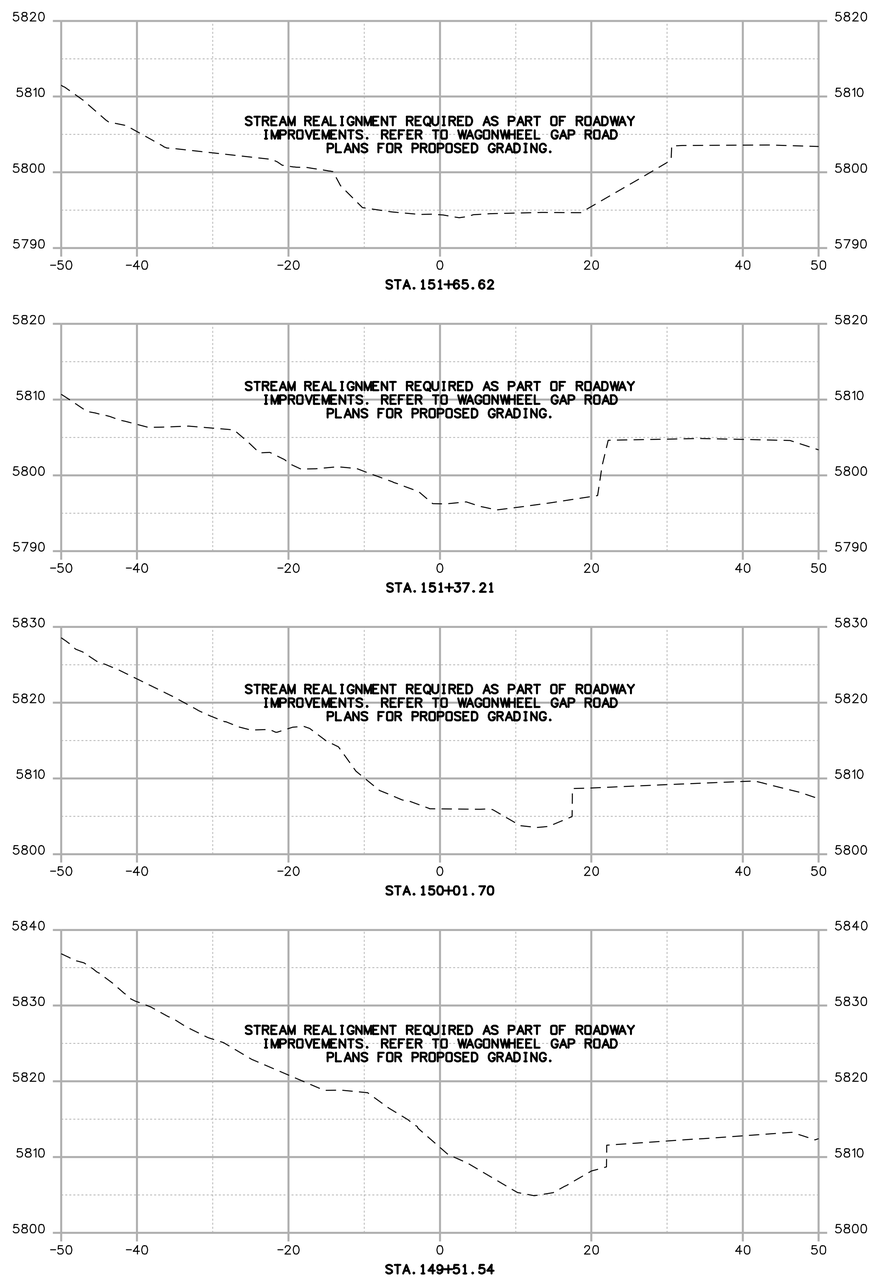


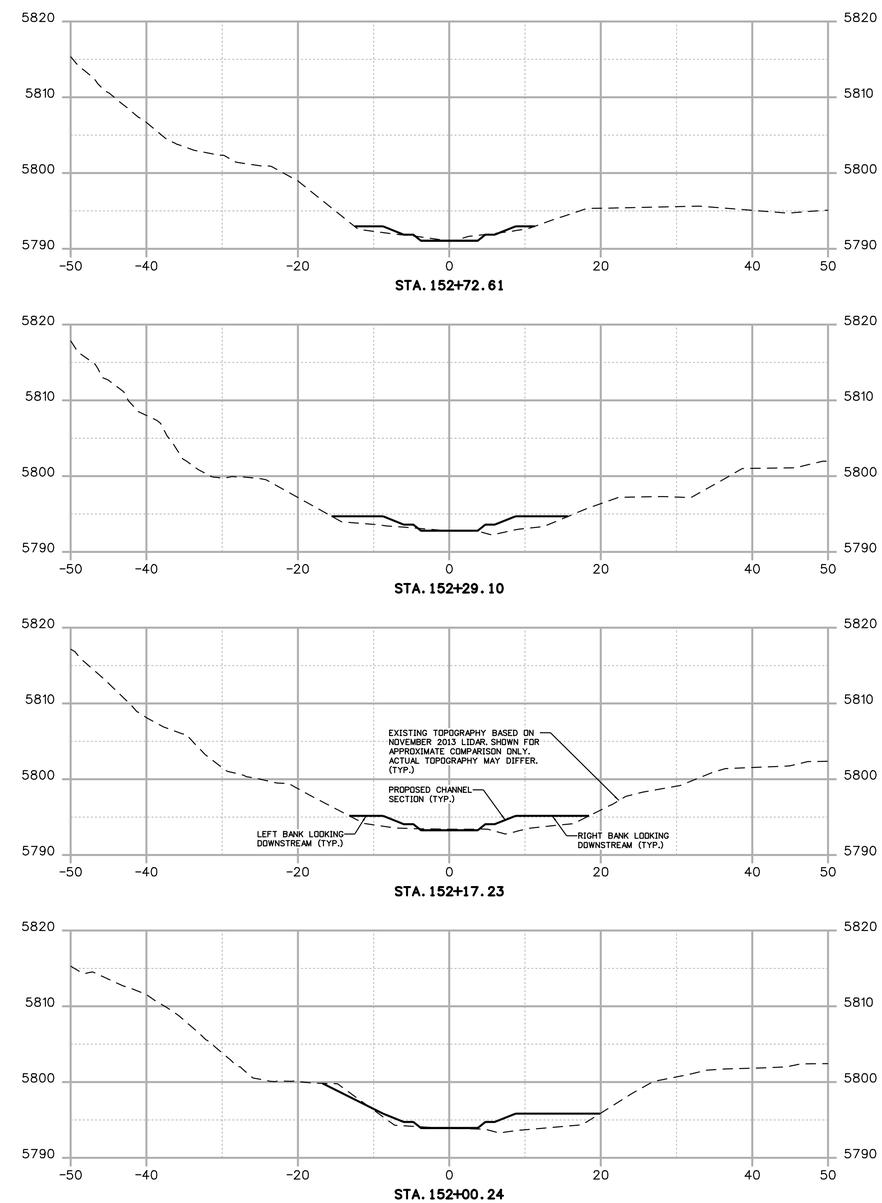
STA. 146+79.44

JR.Mills 9:32:44 AM pw:\\DCPWAPP1.bkr.mbakercorp.com:pwprod\Documents\Projects\Lakewood_Office\Boulder_County_Emergency_Transportation\T04\05_Design\13_Stream Restoration\Cross Sections\138200_XS-Sheets.dgn

0 5 10

BAKER PROJ. REFERENCE NO.	SHEET NO.
138200	X-17





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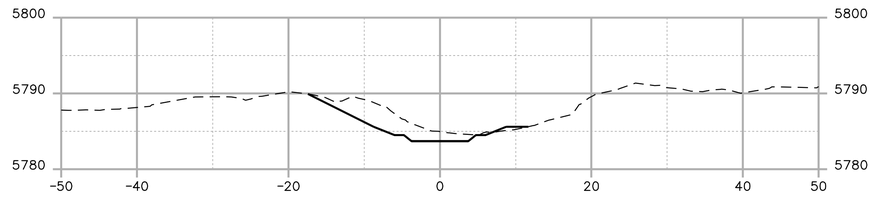
BAKER PROJ. REFERENCE NO.	SHEET NO.
138200	X-18

0 5 10



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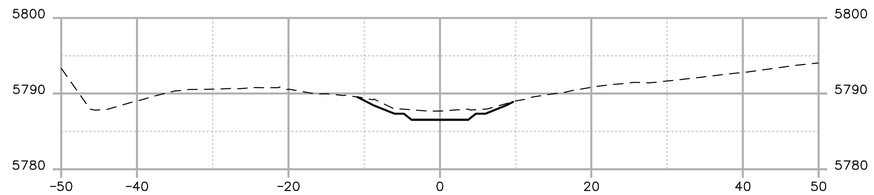

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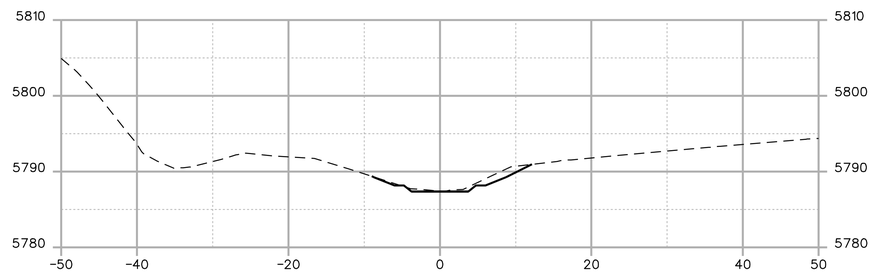

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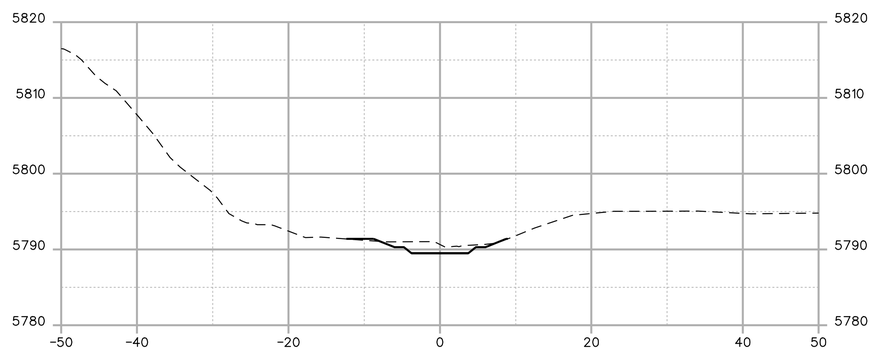

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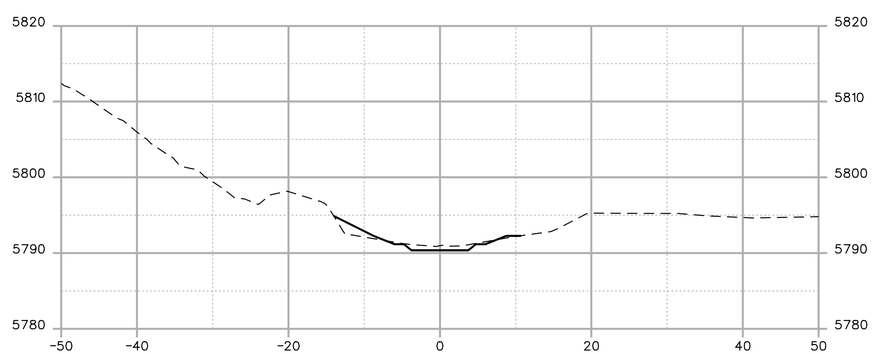

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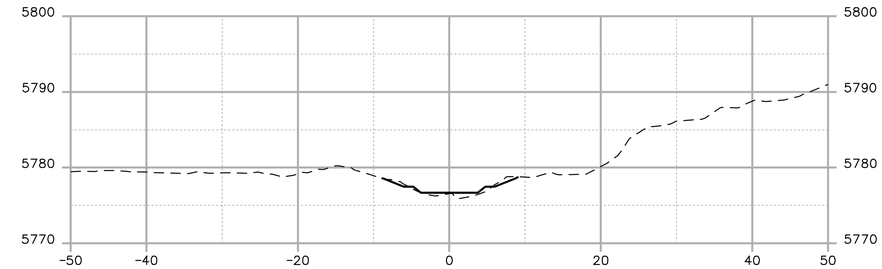

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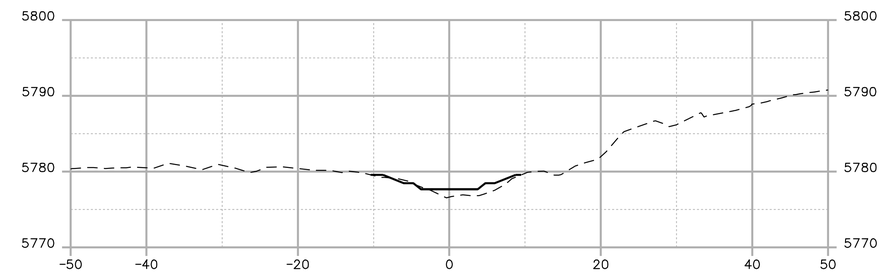

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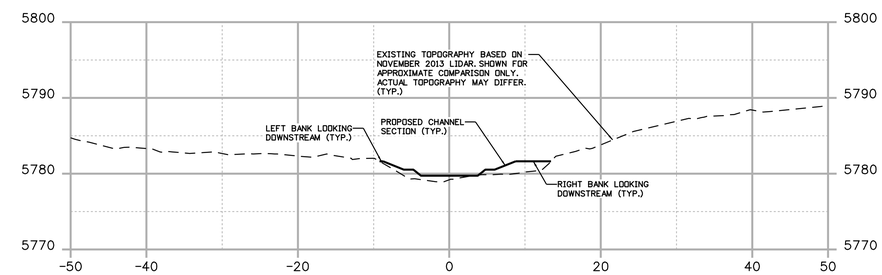

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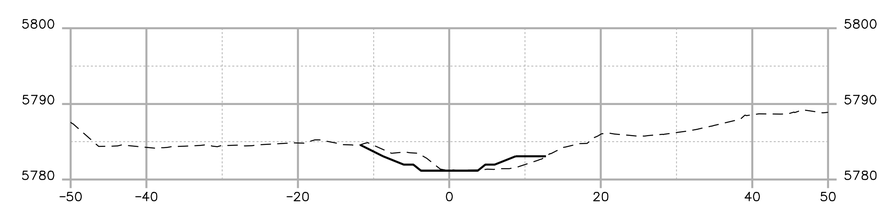

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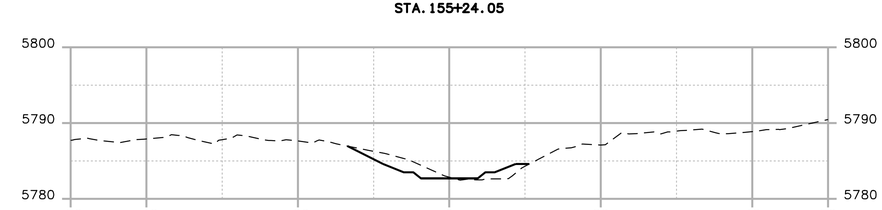
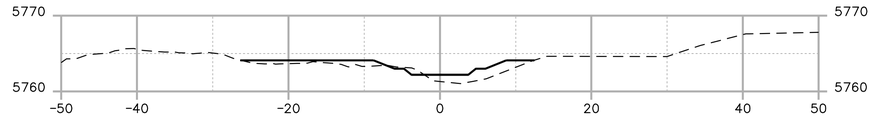


STA. 154+85.41

JR.Mills 9:33:27 AM pw:\\DCPWAPP1.bkr.mbakercorp.com:pwprod\Documents\Projects\Lakewood_Office\Boulder_County_Emergency_Transportation\T04\05_Design\13_Stream Restoration\Cross Sections\138200_XS-Sheets.dgn

BAKER PROJ. REFERENCE NO.	SHEET NO.
138200	X-19

0 5 10



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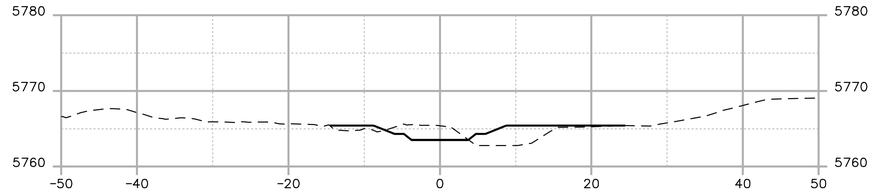

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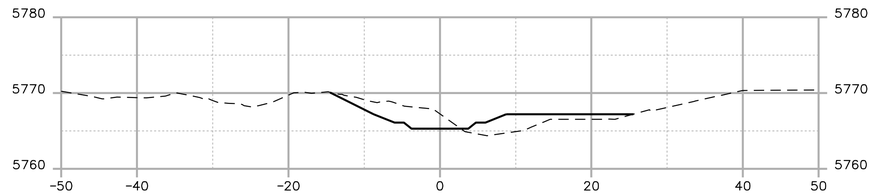
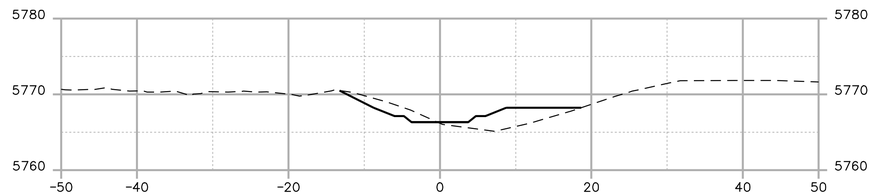


STA. 159+27.98



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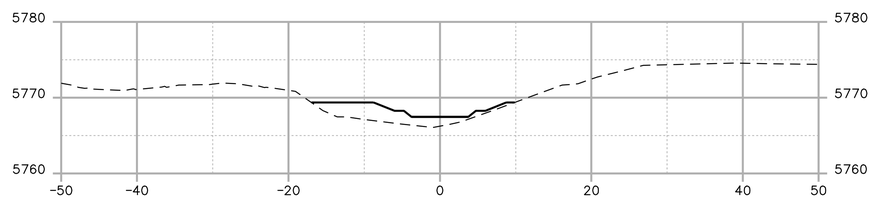

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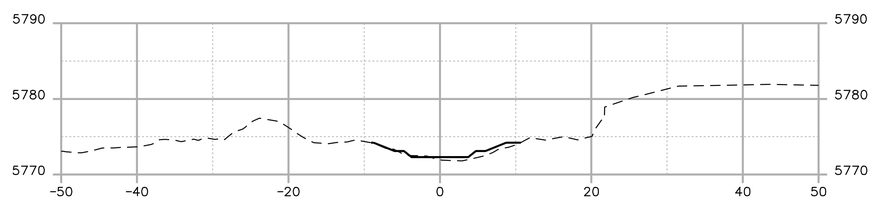

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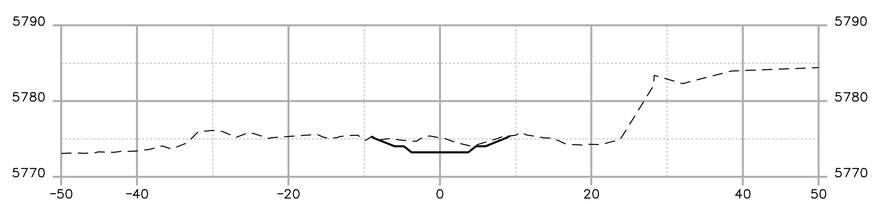

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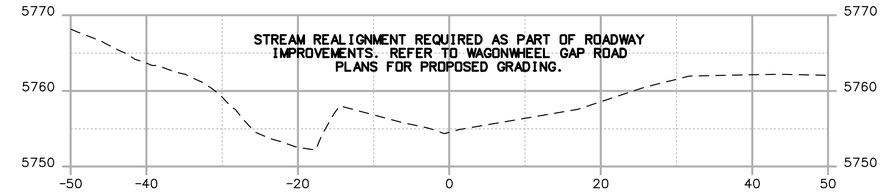

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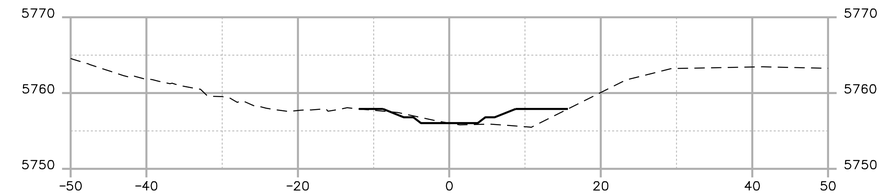

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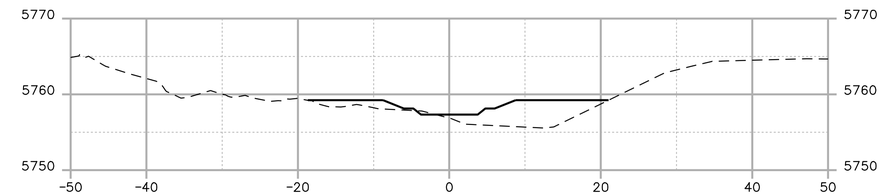

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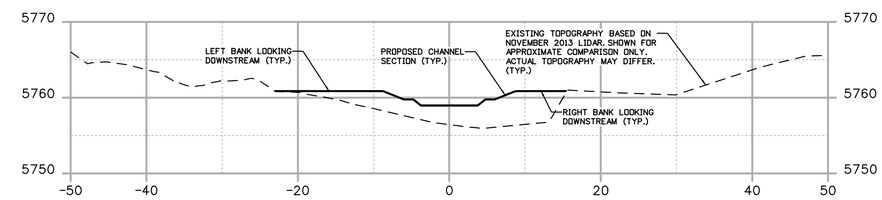

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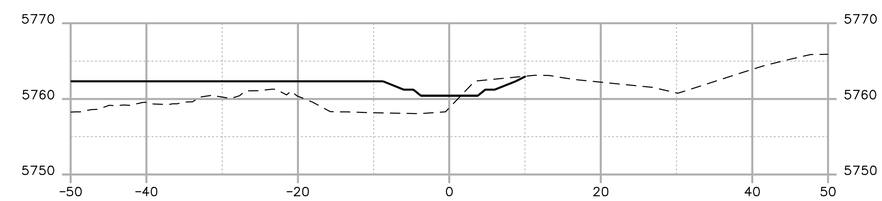
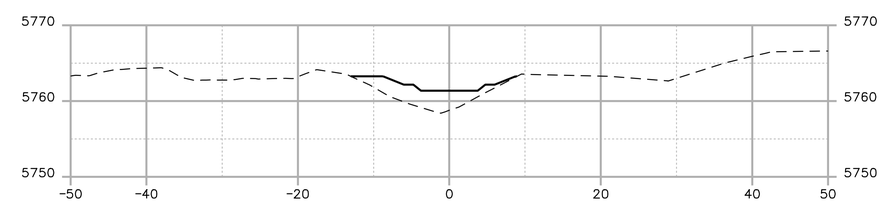


STA. 160+52.69



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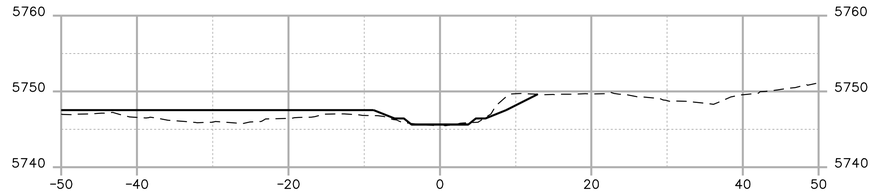
JR.Mills 9:33:48 AM pw:\\DCPWAPP1.bkr.mbakercorp.com:pwprod\Documents\Projects\Lakewood_Office\Boulder_County_Emergency_Transportation\T04\05_Design\13_Stream Restoration\Cross Sections\138200_XS-Sheets.dgn

0 5 10

BAKER PROJ. REFERENCE NO.	SHEET NO.
138200	X-20



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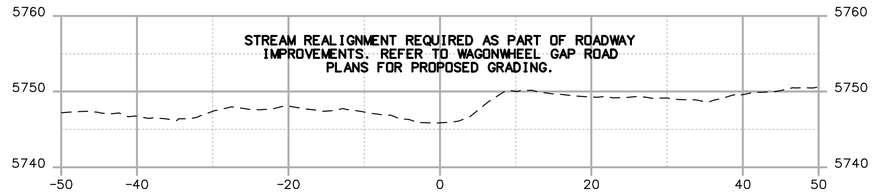
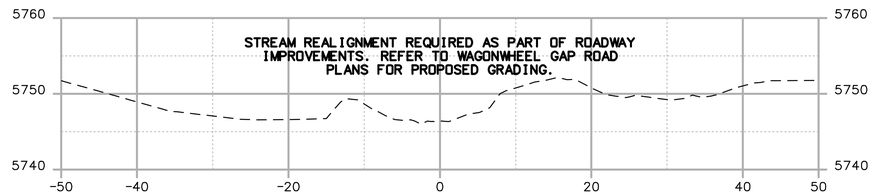
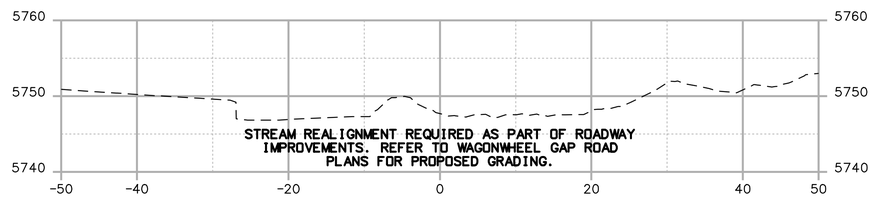


STA. 163+96.59



STA. 163+78.90



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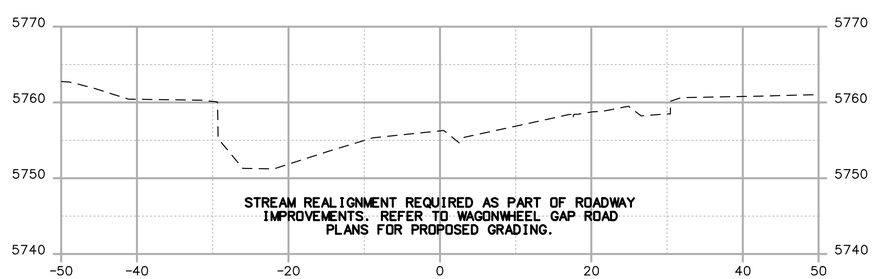

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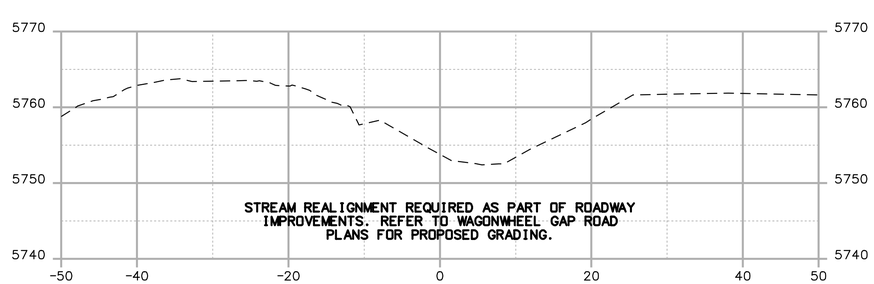
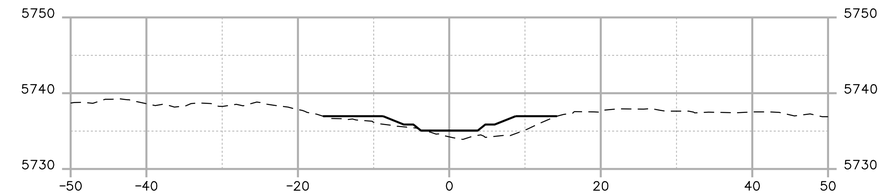
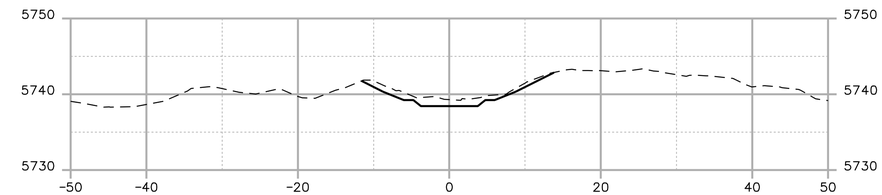


STA. 162+72.19



STA. 167+56.69



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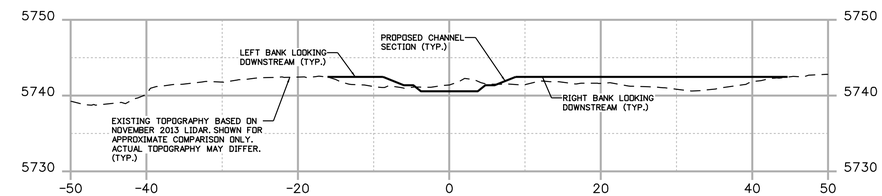
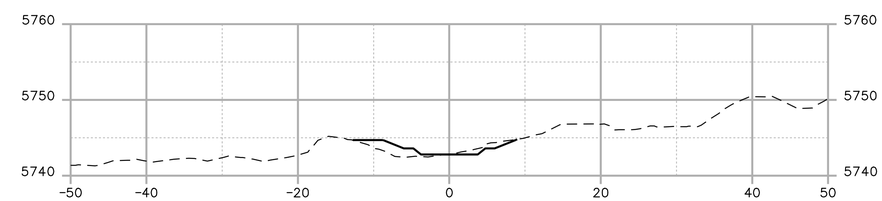


STA. 166+20.63



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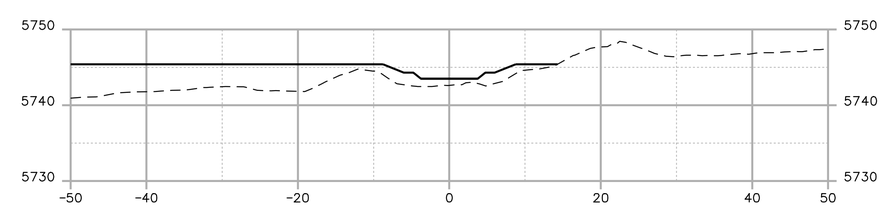

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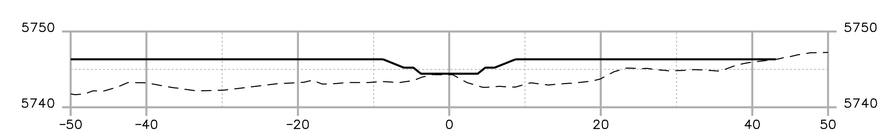

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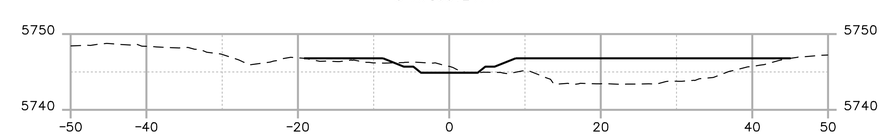

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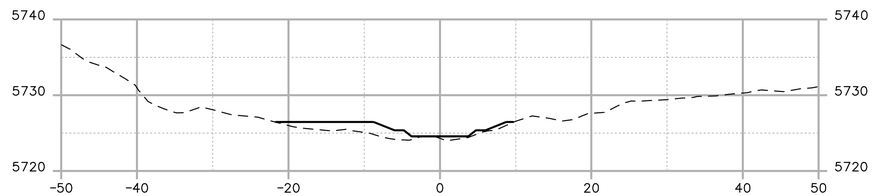
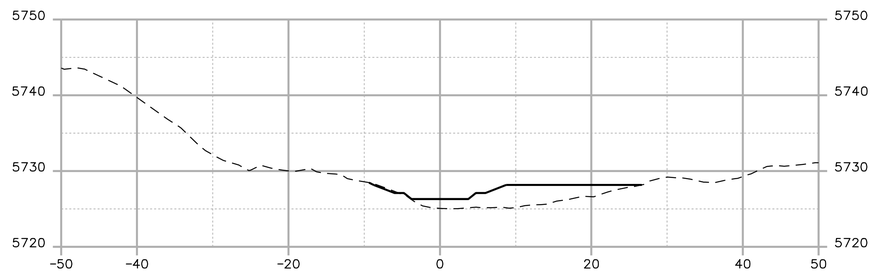
JR.Mills 9:34:12 AM pw:\\DCPWAPP1.bkr.mbakercorp.com:pwprod\Documents\Projects\Lakewood_Office\Boulder_County_Emergency_Transportation\T04\05_Design\13_Stream Restoration\Cross Sections\138200_XS-Sheets.dgn

0 5 10

BAKER PROJ. REFERENCE NO.	SHEET NO.
138200	X-21



STA. 170+16.36



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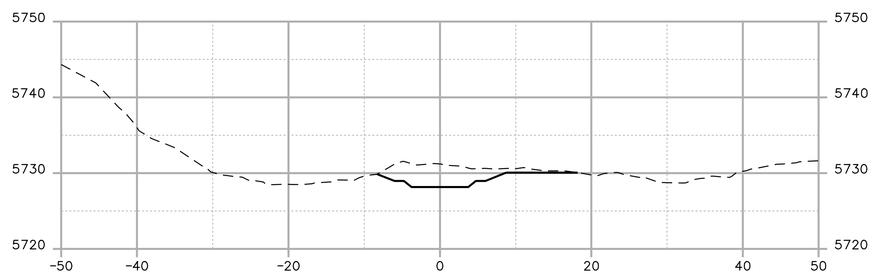
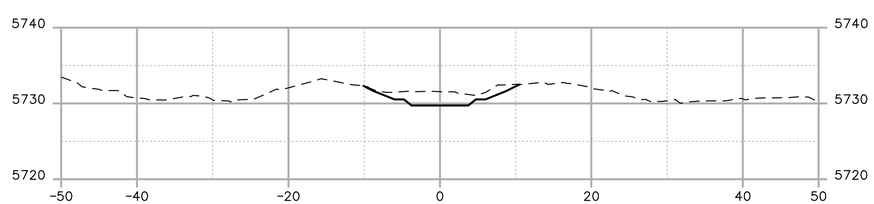
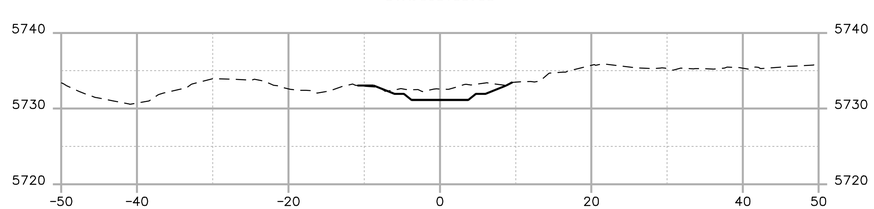


STA. 169+27.16



STA. 168+88.38



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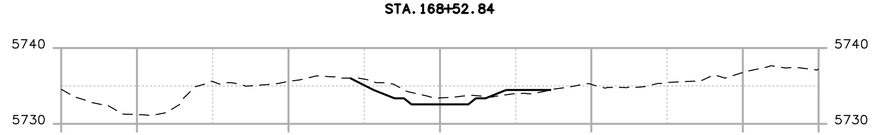
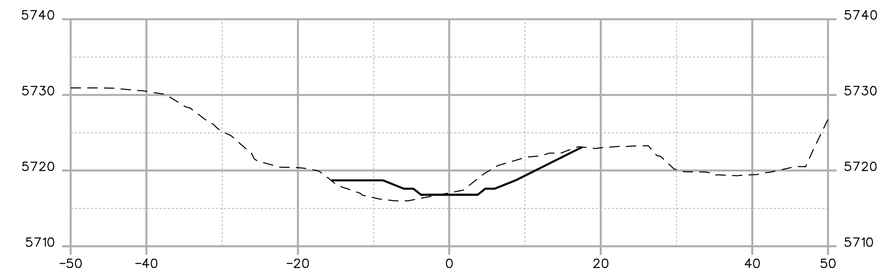
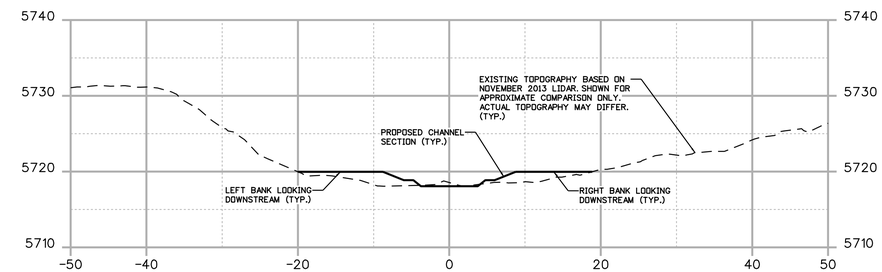


STA. 168+17.61



STA. 172+07.62



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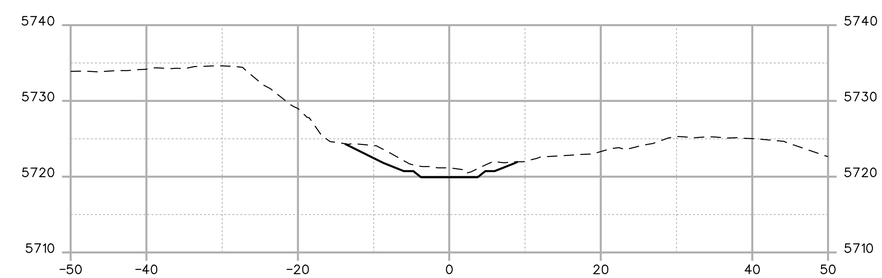

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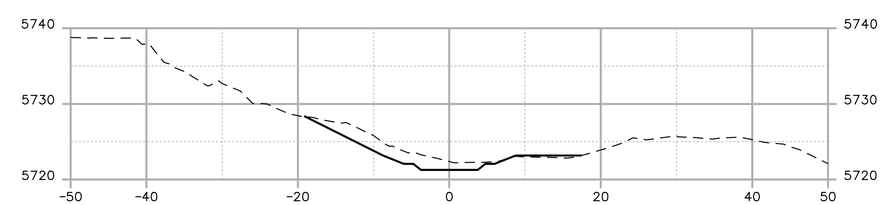
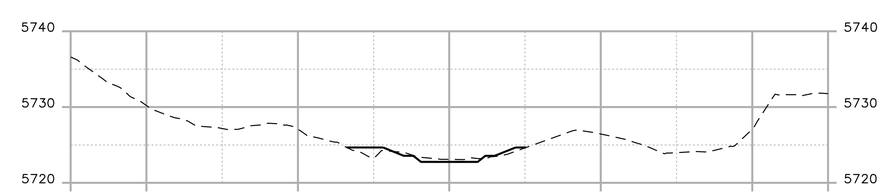


STA. 170+97.04

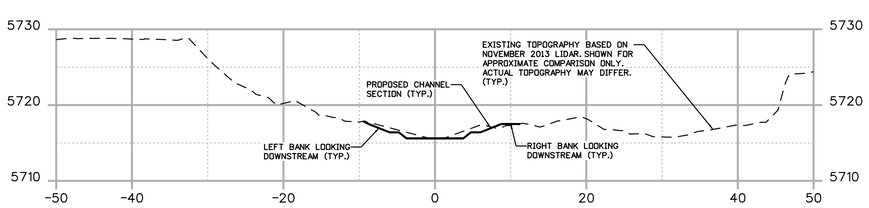


STA. 170+60.19

JR.Mills 9:34:32 AM pw:\\DCPWAPP1.bkr.mbakercorp.compwprod\Documents\Projects\Lakewood_Office\Boulder_County_Emergency_Transportation\T04\05_Design\13_Stream Restoration\Cross Sections\138200_XS-Sheets.dgn

0 5 10

BAKER PROJ. REFERENCE NO.	SHEET NO.
138200	X-22



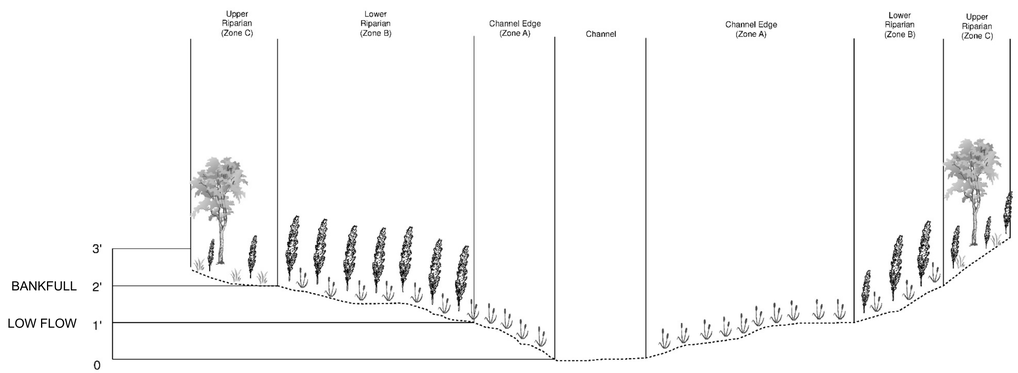
STA. 172+37.26

JR.Mills 9:34:52 AM pw:\\DCPWAPP1.bkr.mbakercorp.com:pwprod\Documents\Projects\Lakewood_Office\Boulder_County_Emergency_Transportation\T04\05_Design\13_Stream Restoration\Cross Sections\138200_XS-Sheets.dgn

BAKER PROJECT REFERENCE NO.	SHEET NO.
138200	11

Michael Baker INTERNATIONAL
Michael Baker Engineering Inc.
165 South Union Boulevard, Suite 200
Lakewood, COLORADO 80228
Phone: 720.514.1100
Fax: 720.514.1120

Typical Cross Section



REVEGETATION PLANTING ZONES FOR DESIGN REACHES

REACH	CHANNEL EDGE ZONE A	LOWER RIPARIAN ZONE B	UPPER RIPARIAN ZONE C	RIPARIAN SEED
1		X	X	X
2		X	X	X
3		X	X	X
4	X	X	X	X
5	X	X	X	X
6	X	X	X	X
7	X	X	X	X
8	X	X	X	X
9	X	X	X	X
10	X	X	X	X

X = INDICATES TYPE OF PLANTINGS TO BE APPLIED TO EACH REACH

Table 1: Plants Needed for Restoration[1]

Common Name	Scientific Name	Plant Size (cubic inch)	Plants per Acre
Zone A: Channel Edge[2]			
Nebraska sedge	*Carex nebrascensis*	10	882
Emory's sedge	*Carex emoryi*	10	1,470
Creeping spikerush	*Eleocharis palustris*	10	882
Baltic rush	*Juncus balticus*	10	1,470
Red-tinge bulrush	*Scirpus microcarpus*	10	882
		Total	**5,586**
Zone B: Lower Riparian[2]			
Peachleaf willow	*Salix amygdaloides*	40	1,000
Peachleaf willow	*Salix amygdaloides*	3' cutting	500
Narrowleaf willow	*Salix exigua*	40	2,500
Narrowleaf willow	*Salix exigua*	3' cutting	500
Dewystem willow	*Salix irrorata*	40	2,000
Dewystem willow	*Salix irrorata*	3' cutting	500
		Total	**7,000**
Zone C: Upper Riparian[3]			
Rubber rabbitbrush	*Ericameria nauseosus*	40	50
Narrowleaf cottonwood	*Populus angustifolia*	40	500
Plains cottonwood	*Populus deltoides*	40	500
American plum	*Prunus americana*	40	75
Chokecherry	*Prunus virginiana*	40	75
Common snowberry	*Symphoricarpos alba*	40	75
Golden current	*Ribes aureum*	40	50
Woods' rose	*Rosa woodsii*	40	75
		Total	**1,400**

[1]Zone A is 0-1', Zone B is 1-2', and Zone C is 2-2.5' above channel; planting will only occur in discrete pockets based on final grading
[2]Based on approximately 3-foot centers
[3]Based on approximately 6-foot centers

Table 2: Riparian Seed Mix[1]

[1]Nomenclature follows PLANTS Database (NRCS 2015); seeding rate based on hand-broadcasting; any substitutions must be native to Colorado and from a US or Canada seed source.

Type	Common Name	Scientific Name	Variety[2]	Seeds per Pound[3]	Seeds per Square Foot	Pounds of Pure Live Seed/Acre
Graminoids	Indian ricegrass	*Acnatherum hymenoides*	Paloma	141,000	3.9	1.2
	Sideoats grama	*Bouteloua curtipendula*	Butte or Pierre	191,000	5.3	1.2
	Blue grama[3]	*Bouteloua gracilis*[3]	Birds Eye, Alma, or Lovington	825,000	11.4	0.6
	Slender wheatgrass	*Elymus trachycaulus*	White River or San Luis	159,000	4.4	1.2
	Idaho fescue[3]	*Festuca idahoensis*[3]	Winchester	450,000	8.3	0.8
	Fowl mannagrass	*Glyceria striata*	-	180,000	8.3	2.0
	Needle and thread	*Hesperostipa comata*	-	115,000	5.3	2.0
	Prairie junegrass[3]	*Koeleria macrantha*[3]	-	2.3 million	5.3	0.1
	Baltic rush[3]	*Juncus balticus*[3]	-	10.9 million	25.0	0.1
	Torrey's rush[3]	*Juncus torreyi*[3]	-	12.3 million	28.2	0.1
	Green needlegrass	*Nassella viridula*	Cucharas or Lodorm	181,000	4.2	1.0
	Western wheatgrass	*Pascopyrum smithii*	Arriba	110,000	10.1	4.0
	Fowl bluegrass[3]	*Poa palustris*[3]	-	3.2 million	7.3	0.1
	Sandberg bluegrass[3]	*Poa secunda*[3]	Sims Mesa or High Plains	1 million	6.9	0.3
	Bluebunch wheatgrass	*Pseudoroegneria spicata*	P7	140,000	6.4	2.0
	Little bluestem	*Schizachyrium scoparium*	Pastura, Cimarron, or Camper	260,000	6.0	1.0
	Prairie cordgrass	*Spartina pectinata*	-	197,000	4.5	1.0
Forbs	Common yarrow[3]	*Achillea millefolium*[3]	-	2.7 million	6.2	0.1
	Rocky Mountain bee plant	*Cleome serrulata*	-	66,000	3.0	2.0
	Golden tickseed[3]	*Coreopsis tinctoria*[3]	-	1.4 million	3.2	0.1
	Blanketflower	*Gaillardia aristata*	Meriweather	132,000	1.5	0.5
	Showy goldeneye[3]	*Heliomeris multiflora*[3]	-	1 million	2.3	0.1
	Rocky Mountain penstemon	*Penstemon strictus*	Bandera	490,000	2.2	0.2
	American vetch	*Vicia americana*	-	33,000	0.8	1.0
Bulk	Rice hulls	-	-	-	-	2.3
				Total	**170.0**	**25.0**

[2]Sources: NRCS 2015, Granite Seed 2015, Western Native Seed 2015, NSN 2015
[3]Bag separately if drill-seeding

Notes:

- All planting zones will be seeded with the Riparian Seed Mix (Table 2). Seeding will only be performed between September 1 and when the ground is frozen, and when the ground is thawed and June 1, unless approved by a qualified ecologist.
- Woody plants (Zones B and C) will be installed in discrete pockets. The exact locations will be based on the final grading and determined after grading is complete.
- Compost (300 cubic yards per acre) will be mixed with native soil in discrete pockets within the restoration areas. Exact locations will be determined by the presence of adequate native soil.
  - Compost will have the following characteristics:
    a. pH: 5.5-8.0
    b. Moisture content: 35-55 percent
    c. Particle size: pass through 1-inch screen or smaller
    d. Stability: stable to highly stable, providing nutrients for plant growth
    e. Maturity/growth screening: demonstrate ability to enhance plant growth
    f. Soluble salt concentration: 2.5 dS (mmhos/cm) or less preferred
    g. Organic matter content: 30-70 percent
  - Suggested compost source: A-1 Organic, Eaton, Colorado 970-454-3492 or an approved equal.
- All willow cuttings must be harvested while dormant and planted within 3 to 14 days (after soaking—completely submerged)
- All containerized plants will be inspected by a qualified ecologist prior to planting. Any dead, dying, stressed, or badly "rootbound" plants will be rejected.
- A qualified ecologist will direct and supervise all plantings
- All seed will be hand-broadcast and lightly raked by hand to encourage contact with the soil
- All seeded areas will be mulched with certified weed-free straw and tackified with a cellulose-based tackifier (or hydromulched). No hay mulch will be used on the site.
- No fertilizers will be used on the site
- In an attempt to avoid the continued spreading of noxious weeds, all discrete populations of Colorado List A or B noxious weeds found in or within 100 feet of the restoration area will be sprayed with the appropriate herbicide(s) prior to construction
- All finish grades will be rough (plus or minus 4 inches), and all straight edges and right angles will be avoided
- No equipment will be allowed in the restoration area after seeding or planting.
- Any trees to be removed for the project will be removed during the non-nesting season for migratory birds (between September 1 and March 31)
- All best management practices (BMPs) used shall be selected, installed, implemented, and maintained according to good engineering, hydrologic and pollution control practices.
- The use of chemicals such as soil stabilizers, dust palliatives, herbicides, growth inhibitors, fertilizers, deicing salts, etc., shall be in accordance with the manufacturer's recommended application rates, frequency, and instructions. These chemicals shall not be used, stored, or stockpiled within 50 horizontal feet of Fourmile Canyon Creek.
- Construction equipment, fuels, lubricants, and other petroleum distillates shall not be stored or stockpiled within 50 horizontal feet of Fourmile Canyon Creek. Equipment fueling and servicing shall occur only within approved designated areas.

FOURMILE CANYON CREEK REVEGETATION PLAN

R:\138200_Fourmile_Canyon_Creek\Design\Plans\138200_PSH_11.dgn

Boulder County Land Use Department

2045 13th Street, Boulder, CO 80302 303-441-3930 www.bouldercounty.org\lu

Land Use PreApplication Map: Vicinity

Boulder County- Fourmile Canyon Creek Restoration

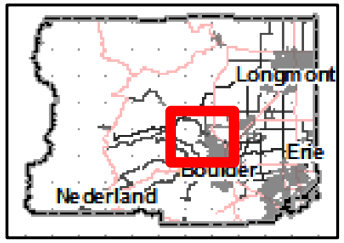
Parcel.No's:146111000021, 146111000023, 146111000024,14611002001,146111002006, 14611002007,146111002008,146111002009,146111002013,146111002010, 146111003010, 146111005003,146111006002,146111006004, 146111008005,146111008006,146111008007, 146111008008,146112000040, 146112000041

Legend

- Subject Property
- Intermittent Stream
- Perennial Stream
- Municipalities
- Subdivisions

NORTH 0 1 Miles

Area of Detail Date: 10/11/2016



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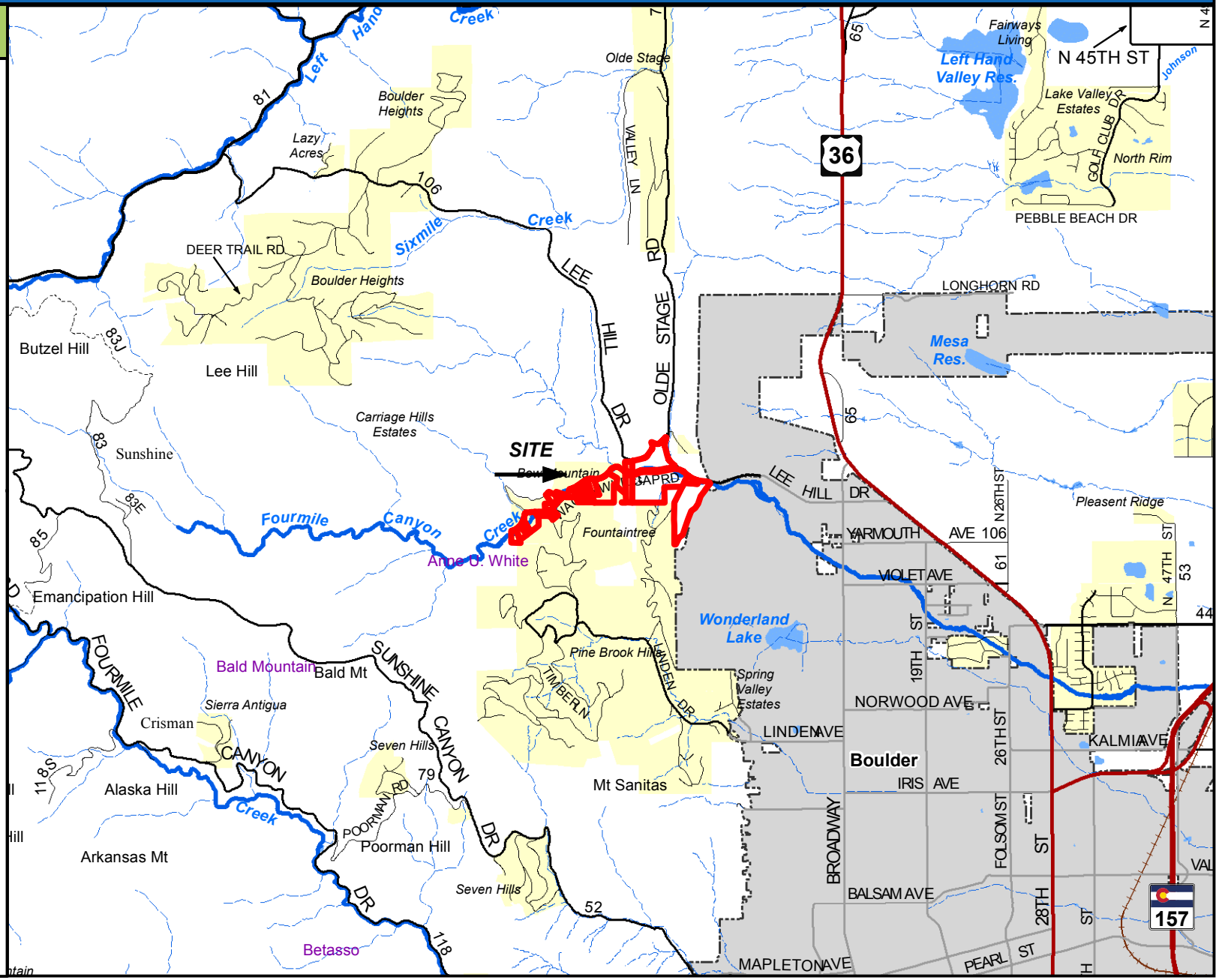
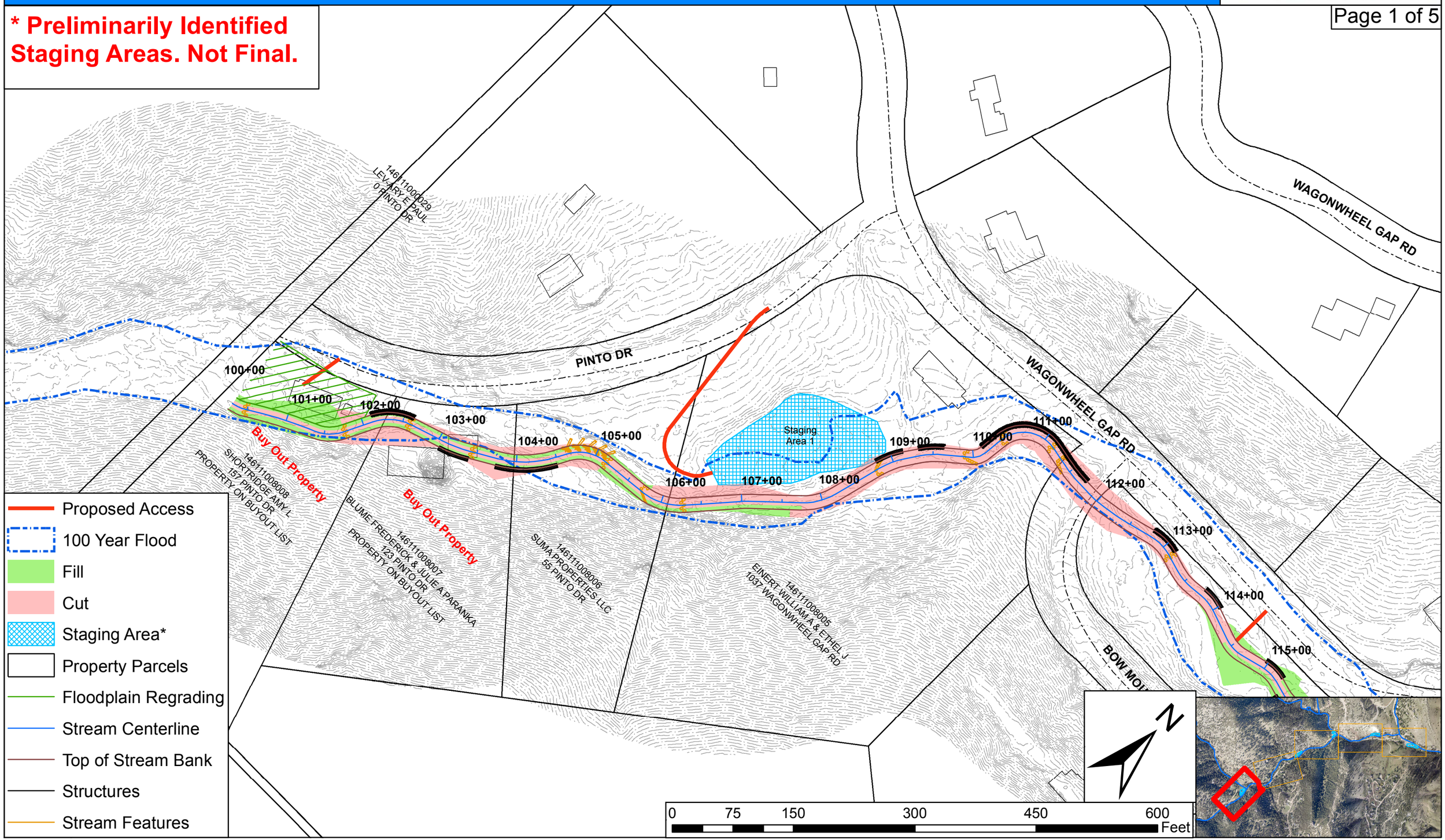


Fourmile Canyon Creek - Material Staging* & Cut Fill

Michael Baker INTERNATIONAL

*** Preliminarily Identified Staging Areas. Not Final.**



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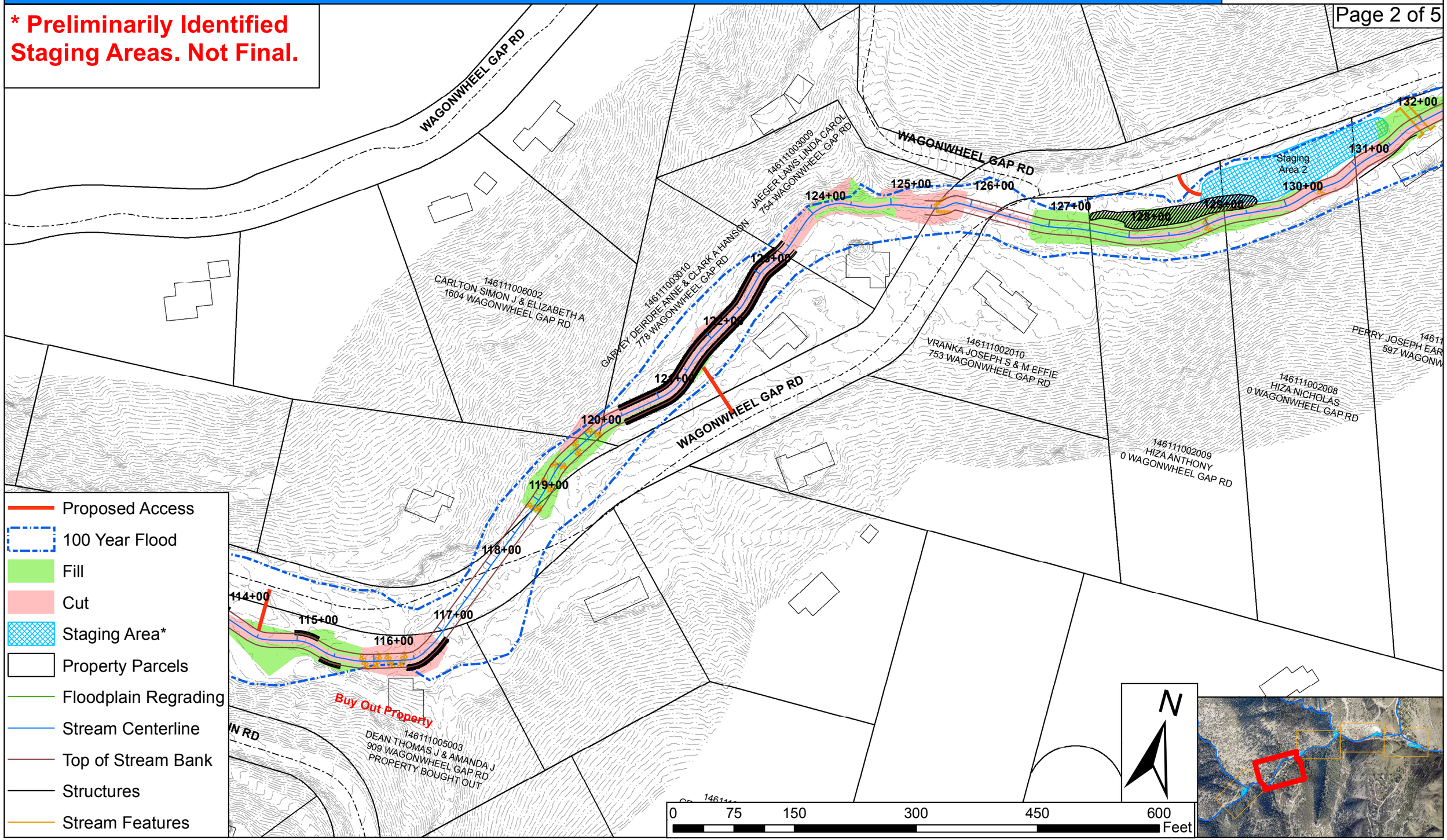

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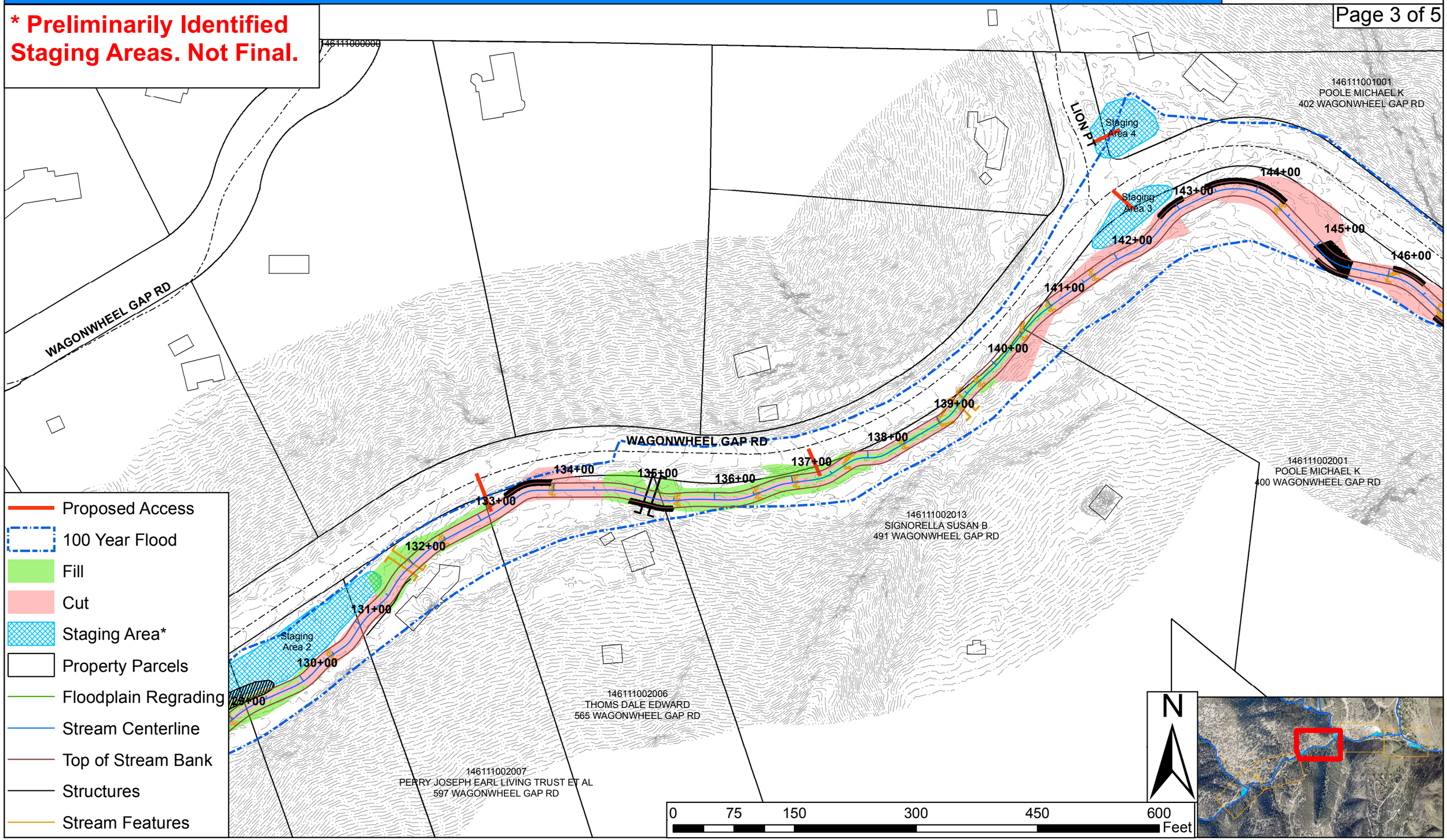

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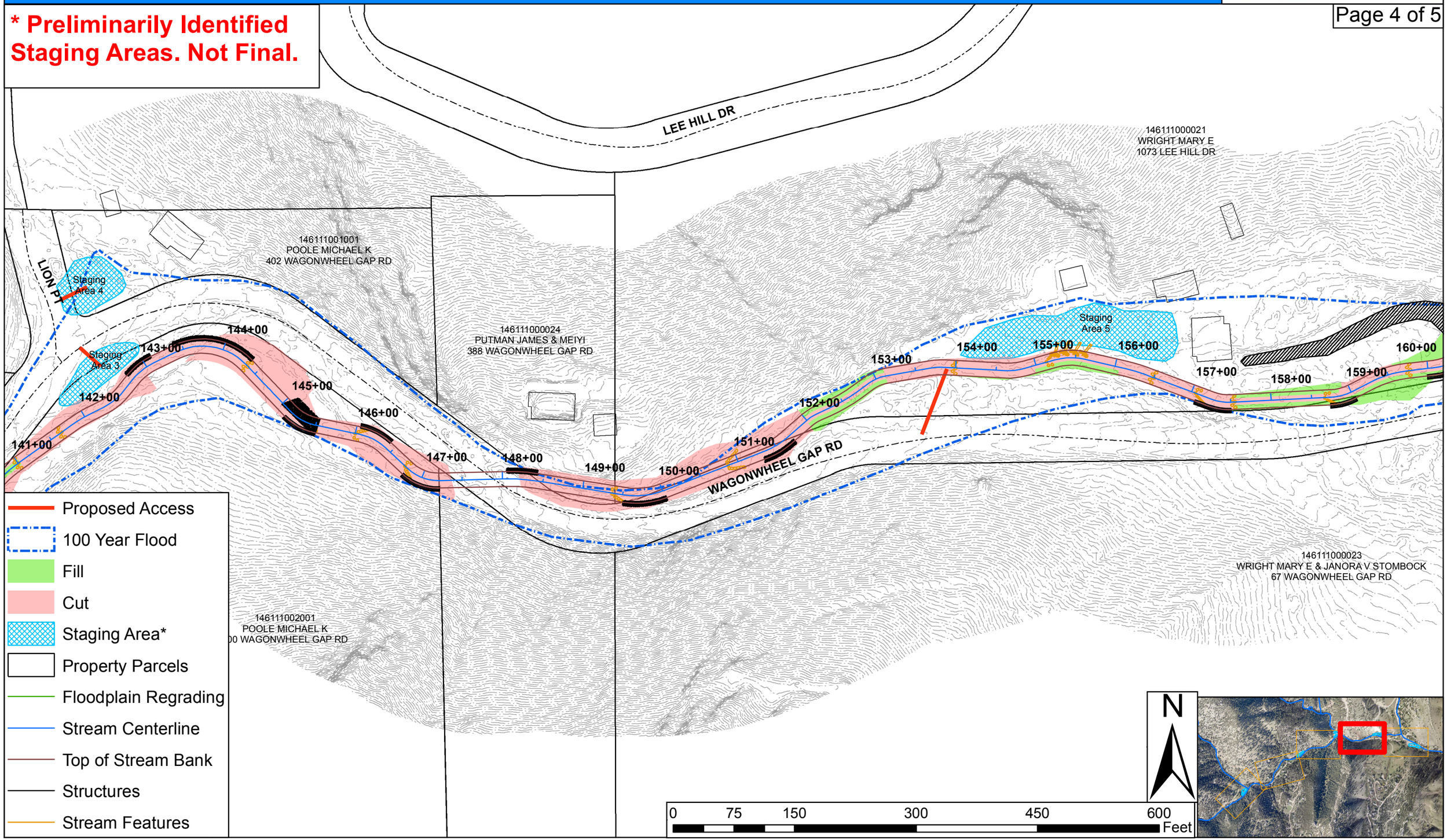

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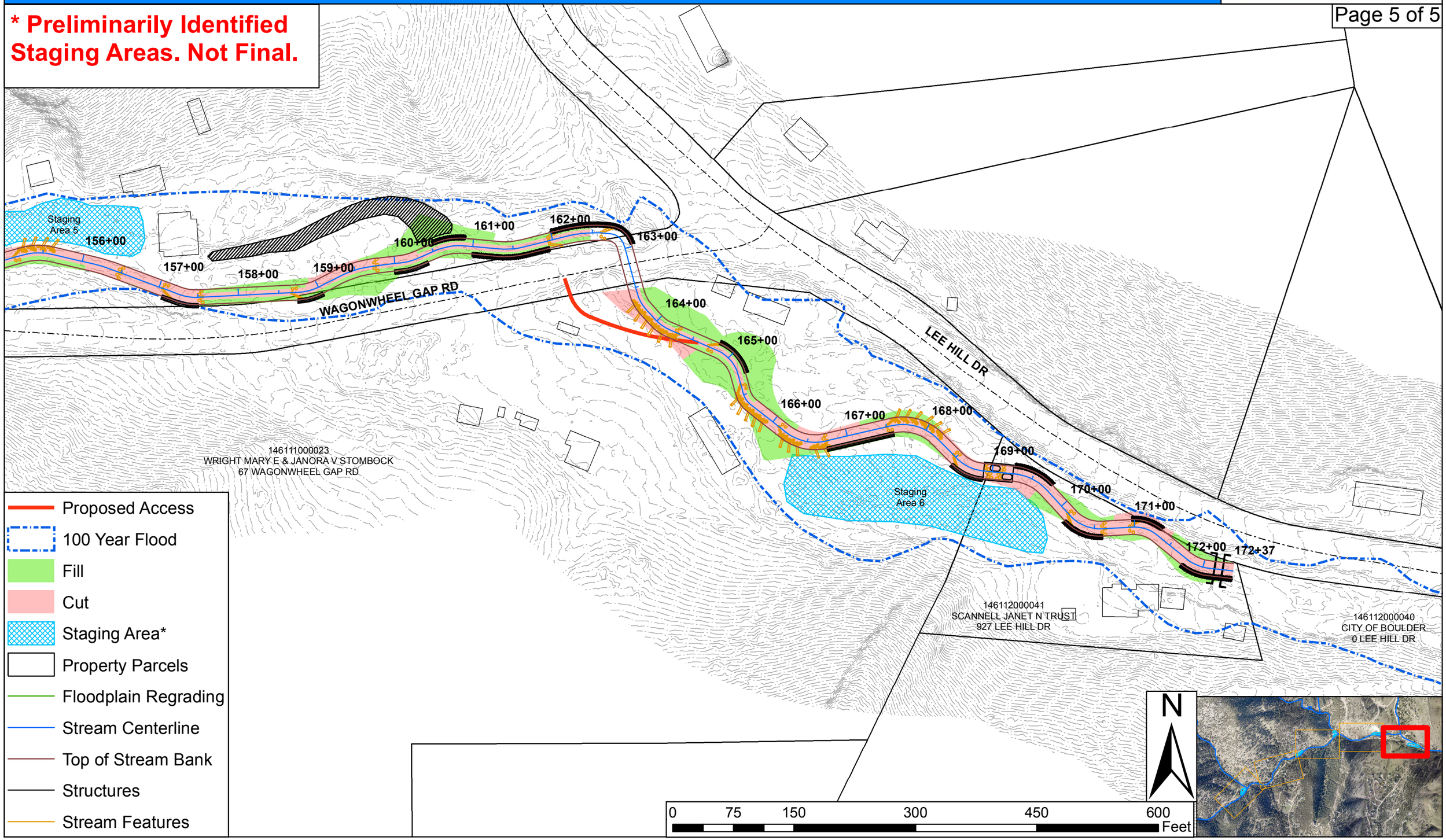

MEMORANDUM

TO: Clarissa Hageman, Boulder County Department of Transportation

FROM: Lucas Babbitt, PE, CFM, Michael Baker International, Inc.

DATE: September 30, 2016

SUBJECT: Fourmile Canyon Creek Stream Restoration
Draft Erosion Control Memorandum

DRAFT

INTRODUCTION

Under contract with Boulder County, Michael Baker International (Baker) has been tasked with preparing engineering design and construction plans and specifications (completed to the 30% design level) for stream restoration on Fourmile Canyon Creek, a tributary to Boulder Creek. Fourmile Canyon Creek experienced significant flood-related damages as a result of the September 2013 flood event. Baker has completed the 30% stream restoration design for Fourmile Canyon Creek, documenting the conditions of Fourmile Canyon Creek and providing details of the restoration design in a Design Memorandum and Construction Plans and Specifications. The purpose of this technical memorandum is to identify temporary erosion control measures that are associated with the construction phase of the stream restoration project. An erosion control plan is not part of this memo.

TEMPORARY EROSION CONTROL MEASURES

The following are the temporary erosion control measures that are associated with construction. Note that disturbances of one-acre or more will require a CDPHE Stormwater Construction Permit. General Erosion Control BMPs shall be implemented to prevent the erosion of soil, and as necessary, Sediment Control BMPs shall be required to remove sediment from runoff. Measures include:

- Prepare a site-specific erosion control plan outlining erosion and sediment control BMPs.
- Minimize the amount of disturbed soil. Keep construction activities limited to areas only necessary to complete the required activity.
- Unless construction plans specify and requisite permits have been obtained, avoid all construction activities in wetlands and riparian areas.
- Remove and stockpile topsoil prior to grading and shaping. To the extent possible, return topsoil to the pre-disturbance location.
- Schedule excavation and soil removal such that the smallest possible area will be unprotected from erosion for the shortest time practical.

- Avoid construction work in flowing or standing water. Provide temporary facilities to divert flowing water around work areas. Provide dewatering measures to remove water from work areas. If unavoidable, minimize the extent and time that work is performed in water. Diversion and dewatering includes the flowing creek, and any additional flowpaths, such as stormwater runoff, seeps, and springs.
- Provide sediment barriers (silt fence) along the slopes of disturbed (cut or fill) soil.
- Protect the perimeter of water bodies from runoff from excavated materials or other stockpiled construction materials placed near the water body.
- Seed disturbed areas that will be unprotected for extended periods of time.
- Preserve native vegetation to the maximum extent possible in work areas. Undisturbed buffer strips of natural vegetation should be left on streambanks where possible.
- Install sediment basins to settle and filter sediment from disturbed, eroding, or stockpiled areas to eliminate or reduce the amount of sediment entering a water body.
- Operate equipment in a manner that prevents inadvertent dumping or spilling of excavated or transported material.

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