



Floyd Hill - SWEEP Committee Meeting #3

Meeting Summary

May 14, 2020, 1:00 PM to 4:00 PM

Virtual Meeting - Google Hangouts

1. Welcome and Agenda Review

Vanessa Henderson, CDOT, welcomed the group, explained some basics of the online format and Google Hangouts platform, and did a roll call of participants:

- Amy Saxton, Clear Creek County
- Anthony Pisano, Atkins
- Billy Bunch, Environmental Protection Agency (EPA)
- Carol Coates, Atkins
- Chase Taylor, Pinyon Environmental
- Gary Frey, Trout Unlimited
- Holly Huyck, Upper Clear Creek Watershed Association
- Jim Ford, Black Hawk
- Jordan Falzetti, Atkins
- Joe Walter, Colorado Parks and Wildlife (CPW)
- Josh Giovannetti, CDOT
- Keith Hidalgo, Atkins
- Kevin Shanks, THK
- Kristin Salamack, US Fish and Wildlife Service (CDOT liaison)
- Mandy Whorton, Peak Consulting Group
- Matt Hubner, EPA
- Matt Montgomery, US Army Corps of Engineers (USACE)
- Melinda Urban, Federal Highway Administration (FHWA)
- Neil Ogden, CDOT
- Paul Winkle, CPW
- Becky Pierce, CDOT
- Scott Garncarz, Colorado Department of Public Health and Environment, Water Quality Control Division
- Stephanie Gibson, FHWA
- Tammy Eggers, Atkins
- Tom Matthews, US Forest Service
- Valerie Thompson-Van Ryzin, US Forest Service



Vanessa reviewed the agenda and thanked everyone for the robust participation. The presentation from the meeting is attached to these notes for reference.

2. Project Status and Alternatives

Vanessa reviewed project updates since the SWEEP Committee met in October 2018 ahead of the 109/110 ballot initiatives. After the failure of those initiatives, CDOT reassessed and regrouped in 2019, completing existing conditions surveys and reports and continuing to pursue Project funding. CDOT also developed a new alternative, the Canyon Viaduct Alternative. The new CDOT Administration also conducted a 10-year project planning effort to identify a 10-year pipeline of priority projects for the state. The Floyd Hill Project was validated as a priority through this process, and in late 2019, CDOT obtained funding to complete the EA including both the Tunnel and Canyon Viaduct Alternatives. The EA is expected to be released in Fall 2020 with a public hearing in late Fall 2020/early Winter 2021. A decision document would be released in Spring 2021 if construction funding for the Project is identified.

Vanessa reviewed the Project alternatives. She explained that the major Project elements are the same in both alternatives but differ in how they are implemented between US 6 and Hidden Valley interchanges (referred to as the central section of the Project).

Gary Frey asked about the current thinking on the tunnel design length. Vanessa said it was about 2,200 feet.

3. Water Quality and Aquatic Conditions

Mandy Whorton reviewed the existing conditions in the Project area and reviewed the SWEEP framework and issues raised in the previous 2017 and 2018 meetings. Clear Creek, Beaver Brook, Sawmill Gulch, and Johnson Gulch are all located within the Project Area, and Clear Creek is located adjacent to I-70 throughout the western portion of the project from US 6 to the Veterans Memorial Tunnels. Clear Creek through the Project area is highly valued for rafting, fishing, and recreation. While there are some areas with wetlands and riparian habitat, much of the creek is channelized and constrained. Beaver Brook crosses I-70 in the eastern portion of the project and, within the project area, supports high-quality wetland and riparian habitat, including potential Preble's Meadow Jumping Mouse habitat. Both Clear Creek and Beaver Brook have regulated floodplains and fall under Section 404 jurisdiction and Senate Bill 40 (SB 40) certification. Sawmill Gulch and Johnson Gulch flow to Clear Creek and are under Section 404 jurisdiction. Neither has a regulated floodplain, and Sawmill Gulch lacks riparian habitat under SB 40 certification requirements.

The SWEEP MOU and Implementation Matrix considerations for project development nearly all apply to the Project. Issues raised at previous SWEEP meetings include water quality, including coordination of best management practices (BMPs) with maintenance practices; wetlands; and issues associated with realigning Clear Creek.



Question: In the stream relocation area will you be reducing the width of the creek?

Answer: No, the width won't change. But the stream channel takes up most of the space so there isn't a lot of room to widen the channel or do any bank mitigation in this area. Tammy Eggers confirmed that the flow would be the same and that to meet peak flows, the channel could not narrow.

Question: What is planned for the wetlands around Black Hawk intake? Are you planning to construct additional wetlands in this area?

Answer: This is identified as an area where there is potential for mitigation to occur, but the team is aware that any work in the area cannot affect Black Hawk's water intake.

4. Water Quality

Stochastic Empirical Loading and Dilution Model (SELDM) Modeling

Jordan Falzetti provided an overview of the SELDM model and its use for the Project to inform the design and water quality approach.

Question: How were the differences between the alternatives analyzed with respect to the proposed scenario?

Answer: The Project was not analyzed separately for the different alternatives because the model is not detailed enough for that. The existing conditions were compared to the results for the Project (both alternatives).

Josh Giovannetti explained that CDOT hasn't had a lot of experience using SELDM modeling and for this project, it is being used primarily as a guideline to look at treatment effectiveness.

Holly Huyck said she is very familiar with the model based on her previous experience at CDOT in helping to develop and implement it. She suggested that the differences for the total impervious surface for each alternative should be calculated, and if it is more than 10 percent, additional analysis/modeling may be appropriate. She offered that an offline discussion might be beneficial. Josh said he would work with Vanessa to set up a meeting to discuss the details offline. (Subsequent to the meeting, Atkins provided impervious surface numbers. The existing is 68 acres, the Tunnel Alternative is 90 acres, and the Canyon Viaduct Alternative is 89 acres.)

BMP Selection

Jordan reviewed the Project's pollutant-focused, tiered approach to water quality. The approach incorporates formal water quality BMPs, such as detention basins, to mitigate the majority of roadway runoff and informal water quality BMPs, such as vegetated ditches, to mitigate roadway runoff with site constraints. He noted that, as discussed at the last SWEEP meeting in October 2018, the Sediment Control Action Plan (SCAP)-recommended BMPs focused on traction sand treatment and numerous, small facilities that were difficult for CDOT maintenance to access and maintain. The proposed BMPs reflect the new approach and have been updated to reflect changes in Project alternatives.



Jordan reviewed the water quality needs and proposed BMPs by Project section. In the east section (Floyd Hill), the main issue is chlorides, and because of the steep grade at Floyd Hill, this area receives both high and frequent application of de-icers. The primary treatment is through vegetated shoulders and engineered ditches. Constructed wetlands are also being considered in the area where de-icing agents concentrate; if they are successfully established, they can be very effective with uptake of chlorides.

In the central and west sections (Clear Creek), sediments, including metals, and chlorides need to be treated. In this area, larger basins could be included and are proposed under both the Tunnel and Canyon Viaduct Alternatives. The Tunnel Alternative has opportunities for larger basins in comparison to the Canyon Viaduct Alternative.

Question: What was the percentage of chloride reduction assumed for the BMPs in the model?

Answer: Between 1 and 10 percent for ponds and between 10 and 20 percent for swales

Question: How will the swales be maintained?

Answer: CDOT maintenance would maintain swales. Because pollutants would flow over natural vegetation on the way to swales to help removal (vegetation uptake), so even if swales are not well maintained, the system would still reduce pollutants and concentration of chloride. Josh stated that these are initial recommendations that will be refined in the next level of design.

Question: Is there evidence of arsenic in the area that would make it a concern? It was an issue on the Superfund site upstream.

Answer: Josh reviewed the Twin Tunnels Monitoring Report and noted that arsenic was not monitored, and after double checking the list of pollutants, said arsenic is listed on the MS4 Permit. Holly said the Colorado Water Quality Control Commission (CWQCC) is holding off on standards for arsenic because it is naturally occurring and found in almost every watershed in the state. Further, if arsenic was being treated, the same recommendations would apply as to other metals that are being captured in sediment ponds.

Holly expressed support for including larger detention facilities in the design because they are easier and more efficient for CDOT maintenance to clear out, which makes them more effective.

(Subsequent to the meeting, Atkins provided criteria in how pollutants were selected as project area in not in CDOT's municipal separate storm sewer system (MS4) Permit area. Pollutant selection was based on the EPA's 2016 Waterbody Report, with this section of Clear Creek having a 303(d) listed impairment for cadmium, lead, temperature, and zinc. Upon further review, stakeholder coordination recommended additional pollutants to review which finalize the pollutants of concern as cadmium, chloride, copper, lead, sediment (total suspended solids), and zinc.

Question: Did you consider the potential for airborne chlorides? University of Northern Colorado (UNC) did a study on Straight Creek in 2007 that indicated that airborne chlorides



disturbed from vehicles driving on dry roads were aerosolizing and damaging the pine forest up to 100 yards away.

Answer: This would be similar to other re-entrained particles that CDOT has BMPs, like street sweeping, to mitigate. Holly explained that CDOT has sponsored at least three different studies, and they don't all agree with each other. A common conclusion is that avoiding overspray in the application is one of the most effective ways to reduce chlorides in roadside vegetation. Also, it appears mag chloride affects riparian and aspens less than the evergreen trees, probably because it is applied during winter when plants and trees are dormant.

5. Wetlands and Waters of the US

Chase Taylor reviewed preliminary Project direct impacts for wetlands and open waters. The Tunnel and Canyon Viaduct Alternatives have slightly different impacts, as do the North and South frontage road options for the Tunnel Alternative. The largest Project impact is from relocation of Clear Creek at the west end of the Project, which is common to the alternatives and both design options.

Small impacts, less than an acre total, to many of the delineated waters would occur under all Project alternatives and design options. Wetland impacts are less than one-thousandth of an acre under all alternatives (40 to 44 square feet).

The proposed relocation of Clear Creek under both Project alternatives and design options represents the majority of Project impacts and is the focus of further discussion in this meeting regarding mitigation and enhancement opportunities.

Question: The numbers in the tables are hard to read. Is information presented in linear feet for the streams? That is usually how impacts are presented.

Answer: Matt said that the USACE likes to see acres and square feet as well, particularly in comparing alternatives. Chase confirmed the impacts are presented with all three metrics.

Question: Billy Bunch asked if the relocation of Clear Creek was considered a permanent or temporary impact, and is a full loss of those stream segments expected? Would mitigation be proposed?

Answer: These are considered permanent impacts because the creek would be relocated but the volume of water and width of the channel are not changing. The team is planning to mitigate for this as permanent impact but unlikely to be able to include much mitigation in the direct impact area.

Question: Is FACWet being performed for adjacent wetlands to inform the indirect impacts?

Answer: FACWet was performed for all delineated wetlands, not just those affected so that information is available. Indirect impacts associated with ground disturbance would be avoided with CDOT standard specifications for keeping a distance from known wetlands.

Section 404 Permitting

Becky Pierce reviewed Section 404 permitting.



The relocation of Clear Creek does not appear to fall under any Nationwide permit, and CDOT is planning for an Individual Permit. Matt confirmed that an Individual Permit would be needed.

Matt and Vanessa discussed permitting in preparation for the SWEEP meeting, and USACE recommended an informal Section 404/NEPA Merger process be followed. Vanessa provided the draft purpose and need and other background materials to Matt, and he indicated that he thought the documentation would be sufficient for the informal Merger process and would be able to be used by USACE in its permitting. Becky said since this is an EA, it is the choice of CDOT and the USACE to determine whether to follow the Merger process, and CDOT agrees that an informal process makes sense.

Other impacts of the Project meet Nationwide permit conditions, but Matt clarified that if any of the single crossings for a linear project result in a need for an Individual Permit, USACE expects all impacts would be permitted under that Individual Permit.

Becky mentioned that the Colorado Stream Quantification Tool (CSQT) may be applicable since impacts are primarily to open waters. Billy and Matt both said that the CSQT may be helpful in determining the amount of mitigation required. Depending on the scores for the CSQT, it is unlikely that the linear feet of impact would result in a 1:1 mitigation requirement because it is unlikely that all would be considered "functional feet" units in the assessment.

Both USACE and EPA expressed interest and availability to be involved in the early Project planning to advise on permitting.

Scott Gancarz noted that if an Individual Permit is required, a Section 401 water quality certification will also be needed, and CDOT will need to work with the Water Quality Control Division to obtain that. Becky said this was an oversight not to mention; CDOT does very few Individual Permits, usually 1 to 2 per year, and thanked him for the reminder.

6. Relocation of Clear Creek

Mandy provided an overview of the relocation area, and Antony Pisano described the design reasons for the relocation. The team looked at a number of options but due to the design speeds of the existing curves, stopping sight distance around the curves, location of the Veterans Memorial Tunnels, and the canyon constraints and large required rock cuts, there are no feasible avoidance alternatives that can meet purpose and need and highway design and safety criteria.

Mandy showed a simulation of the creek relocation, which mostly affects the north bank of the creek, which is a steep riprap embankment. Downstream, there are several areas with wider existing riparian areas that present opportunities for enhancements. Paul Winkle provided an overview of his work monitoring trout populations in the Project area over the past 5 years. He said that this stretch of Clear Creek supports a wild brown trout population and that CPW stocks rainbow trout in the area, but they have not taken hold, which is common in areas where brown trout are dominant. The number of fish has continued to increase as the habitat has improved, which has been a result of habitat enhancement and improvements in water quality. Although the numbers are up, the trout are not large



compared to those downstream of reservoirs; large trout in Clear Creek might be 12 to 14 inches. In 2014, Paul conducted a redd survey, and identified almost 50 redds in the stretch of Clear Creek between US 6 and Veterans Memorial Tunnels; he plans to do another survey in the fall, which could also inform enhancement opportunities.

Additionally, areas where the I-70 footprint is smaller present opportunities to lay back slopes and open up the floodplain. Kevin Shanks stated that the Canyon Viaduct Alternative presented the most opportunities for creek enhancements because there was less highway infrastructure next to the creek. Holly asked for clarification about the potential differences in terms of percentage. Kevin said he had not calculated percentages, but estimated it was substantial - maybe 50 percent more. Billy noted that the CSQT could help quantify and compare options. Mandy showed the area in Google Earth, and Kevin reviewed specific locations of potential for enhancements, particularly at the bends. Kevin described the Twin Tunnels mitigation and working with CPW. Unlike the Project relocation area, one of the issues with the Twin Tunnels section was that it was too wide to provide pool-riffle-run sequences. Paul explained that the pools are particularly important for winter habitat. Holly asked how deep the pools were and if they had filled in. The deepest pools in that section are six feet deep or so, and they have not filled in with material. The spring runoff seems to flush them out. Kevin explained that the CPW biologist had carefully considered rock placement and direction to flow to ensure that they flushed naturally. Paul noted that the willow plantings had not survived but otherwise, the design was holding up well.

Kevin described several of the mitigation details from the Twin Tunnels project that were being reviewed for application on downstream Floyd Hill improvements.

Matt and Billy both stated that enhancements to riparian and aquatic habitat would be appropriate for Section 404 compensatory mitigation. The Project will need to show a functional lift for the stream, not necessarily a 1:1 linear foot of improvements. For instance, for the 1,200 feet of affected creek, perhaps the functional units may be 700 feet, which would establish the mitigation target. Billy asked to be included in 404 mitigation discussions.

Question: Gary asked about shading and if there were opportunities to develop riparian habitat that would have less sun exposure.

Answer: Right now, the north side of bank doesn't have much vegetation; if a bench could be added where willows, cottonwoods, and other plants could establish, this would create shading. Kevin said that although the Twin Tunnels project willow plantings failed, maybe there were lessons in including more diverse plantings and selecting willows that are better suited to higher elevations. The willows at the Black Hawk Sanitation District may be better, and Jim can help coordinate. Becky said the willows came from the mitigation site, which is just 300 feet higher in elevation, so she did not think this was an issue.

Question: If improved, would this stretch qualify for a re-stocking program?

Answer: CPW currently stocks rainbow trout in the Project area. While it is difficult for other species to compete with a strong brown trout population, creek enhancements might help the stocked rainbows establish.



7. Wrap-Up and Action Items

Mandy asked the group if there were any additional comments or thoughts. Gary and Holly said that they liked what was presented and thought things were on the right track. No one voiced any concerns.

Mandy summarized the next steps. Next week, there will be a site visit led by CPW to look at some of the mitigation opportunities. The mitigation plan will be developed further, and the team will continue to coordinate with the USACE and EPA on Section 4040 permitting and with CPW for SB 40 certification. It is anticipated that the planned enhancements can serve multiple mitigation commitments as well as the intention of the SWEEP MOU to improve aquatic and water quality conditions when possible. By mid-summer, the team should have a good handle on impacts and mitigation, which will be discussed with the Technical Team before completing the EA.

Action Items

- Hold an offline meeting to discuss SELDM (Josh, Vanessa, Holly, Jordan, and others)
- Conduct initial site visit to review mitigation opportunities (Paul, Kevin, and others)
- Conduct redd survey in fall 2020 (Paul)
- Prepare CSQT to inform mitigation requirements and effectiveness (timing and responsibility TBD)



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I-70 Floyd Hill SWEEP Meeting #3

May 14, 2020



- Project Updates and Status
- Overview of Project Alternatives
- Existing Conditions and SWEEP Issues
- Water Quality
- Wetlands and Waters of the US
- Clear Creek Relocation
- Next Steps and Action Items





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Project Updates



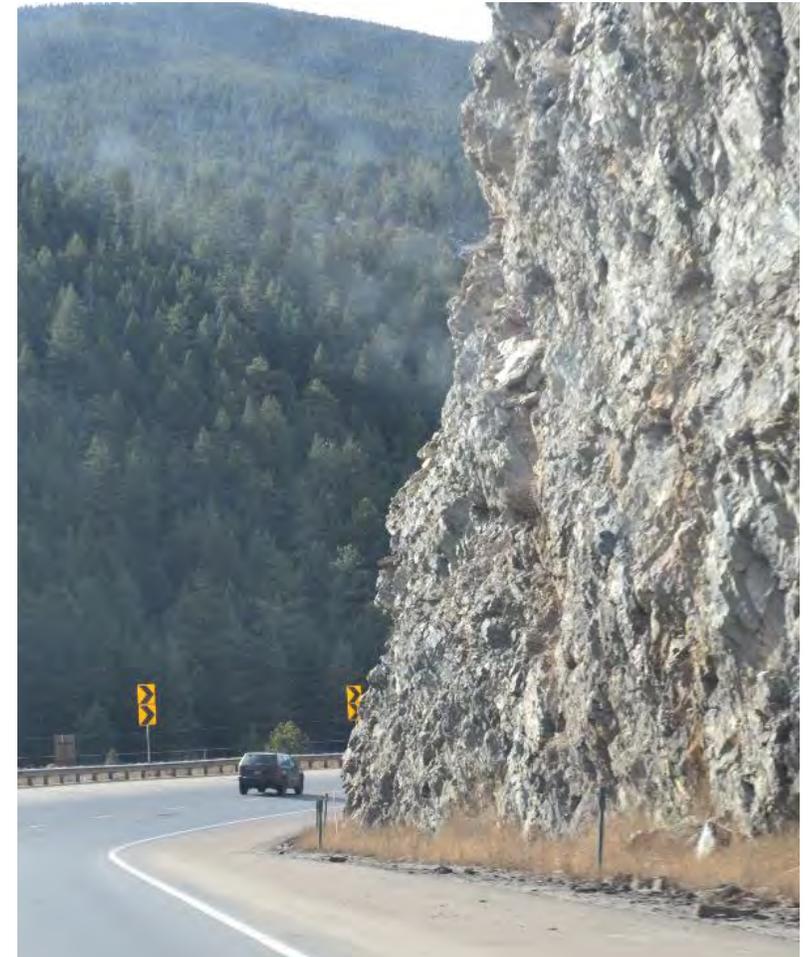
Project Updates

- Environmental Assessment initiated in summer 2017
- Developed Tunnel Alternative in 2018 as proposed action for ballot initiatives 109/110
 - SWEEP meetings in April and October 2018
- Reassessed and regrouped in 2019
 - Completed existing conditions surveys and reports
 - Developed Canyon Viaduct Alternative as additional alternative
 - Confirmed project priority in 10-year plan through statewide planning effort with new CDOT administration
 - Continued to pursue funding; HPTE initiated financial study
- EA funded and resumed in late 2019/early 2020
 - Public Meeting #2 - February 2020
 - Environmental Assessment - Fall 2020
 - Public Hearing - Late Fall 2020/early Winter 2021
 - Decision document - Spring 2021 (if construction funding is identified)



Alternatives Overview: Major Project Elements

- Add third westbound I-70 travel lane from top of Floyd Hill through the Veterans Memorial Tunnels
- New frontage road connection between US 6 and Hidden Valley interchanges
- Improve traffic operations at interchanges and intersections within the project limits
- Enhance safety by flattening curves to improve design speeds and stopping sight distance
- Improve the Clear Creek Greenway
- Reduce animal-vehicle conflicts and improve wildlife connectivity





Environmental Assessment Alternatives

- No Action Alternative
 - Replace westbound I-70 bridge in its current location, and continue regular highway maintenance
- Tunnel Alternative
 - Major elements
 - New tunnel for westbound I-70 near US 6 interchange
 - Realign eastbound I-70 on the current highway footprint
 - Construct a frontage road between US 6 and Hidden Valley, either north or south of Clear Creek
- Canyon Viaduct Alternative
 - Major elements of the Proposed Action
 - Realign both eastbound and westbound I-70 between US 6 and Hidden Valley on a viaduct
 - Construct the frontage road on the current I-70 alignment





East Section: Floyd Hill to US 6



FLOYD HILL

US 40

US 6



Central Section: US 6 to Hidden Valley TUNNEL ALTERNATIVE



US 6 to I-70
eastbound on ramp

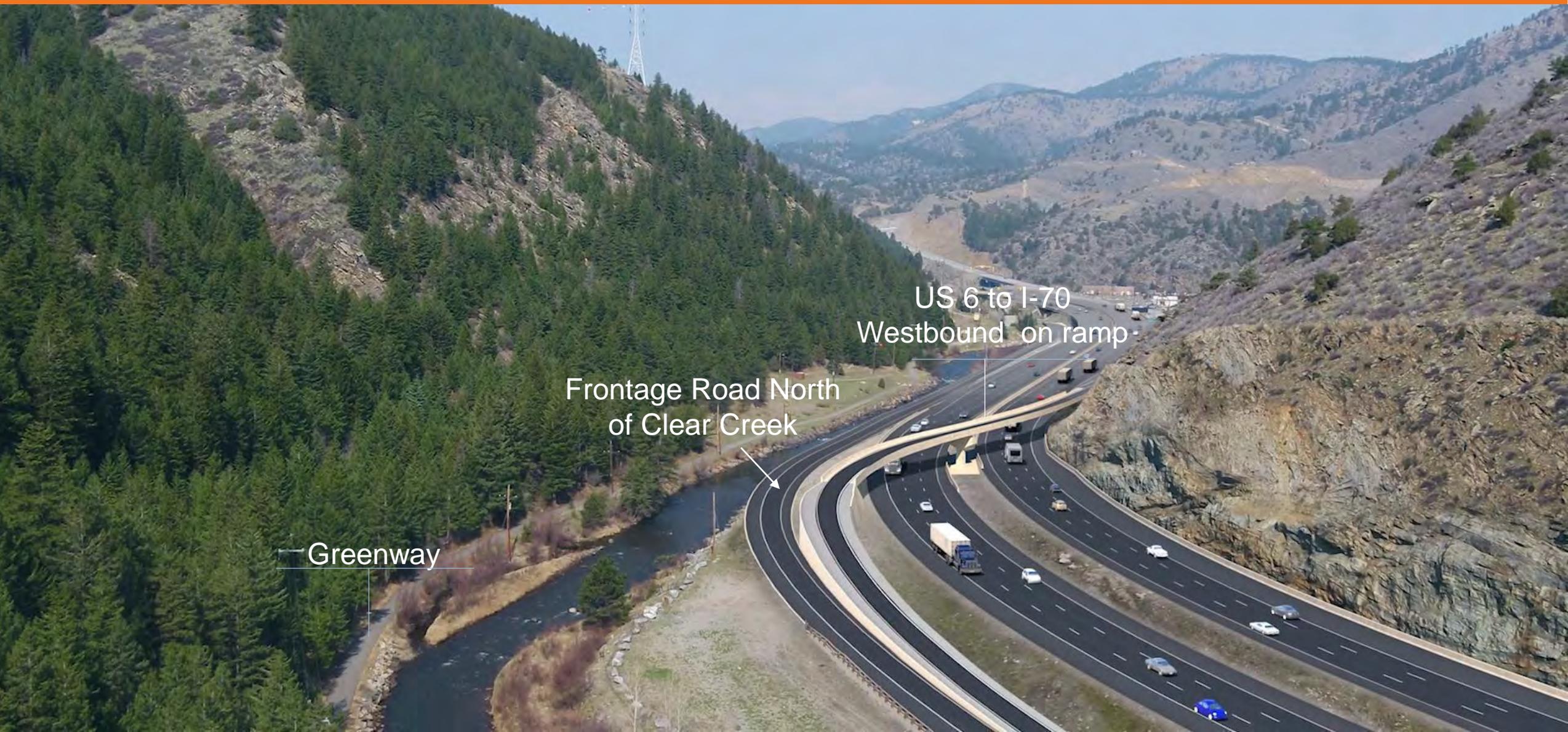
Frontage Road

Greenway

I-70 westbound to
US 6 off ramp



Central Section: US 6 to Hidden Valley TUNNEL ALTERNATIVE, North Frontage Road



Greenway

Frontage Road North
of Clear Creek

US 6 to I-70
Westbound on ramp



Central Section: US 6 to Hidden Valley TUNNEL ALTERNATIVE, South Frontage Road



US 6 to I-70 Westbound
on ramp

Frontage Road South
of Clear Creek

Clear Creek

Greenway



Central Section: US 6 to Hidden Valley CANYON VIADUCT ALTERNATIVE





Central Section: US 6 to Hidden Valley CANYON VIADUCT ALTERNATIVE



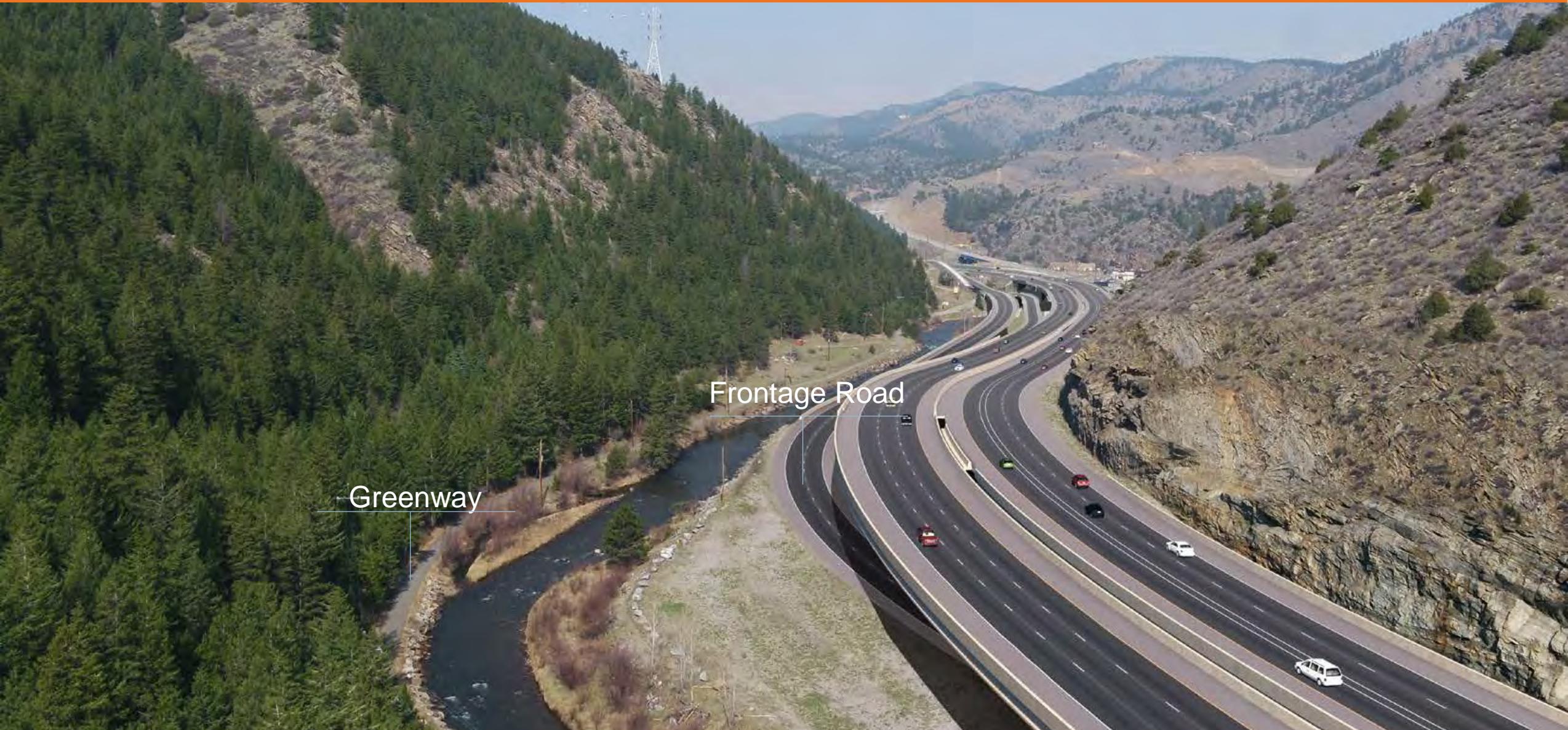
Greenway

Clear Creek

Frontage Road



Central Section: US 6 to Hidden Valley CANYON VIADUCT ALTERNATIVE



Frontage Road

Greenway



West Section: Hidden Valley to Veterans Memorial Tunnels



Realign ~1,200 feet
of Clear Creek



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Water Quality and Aquatic Conditions



Water Quality and Aquatic Conditions

- Clear Creek water quality

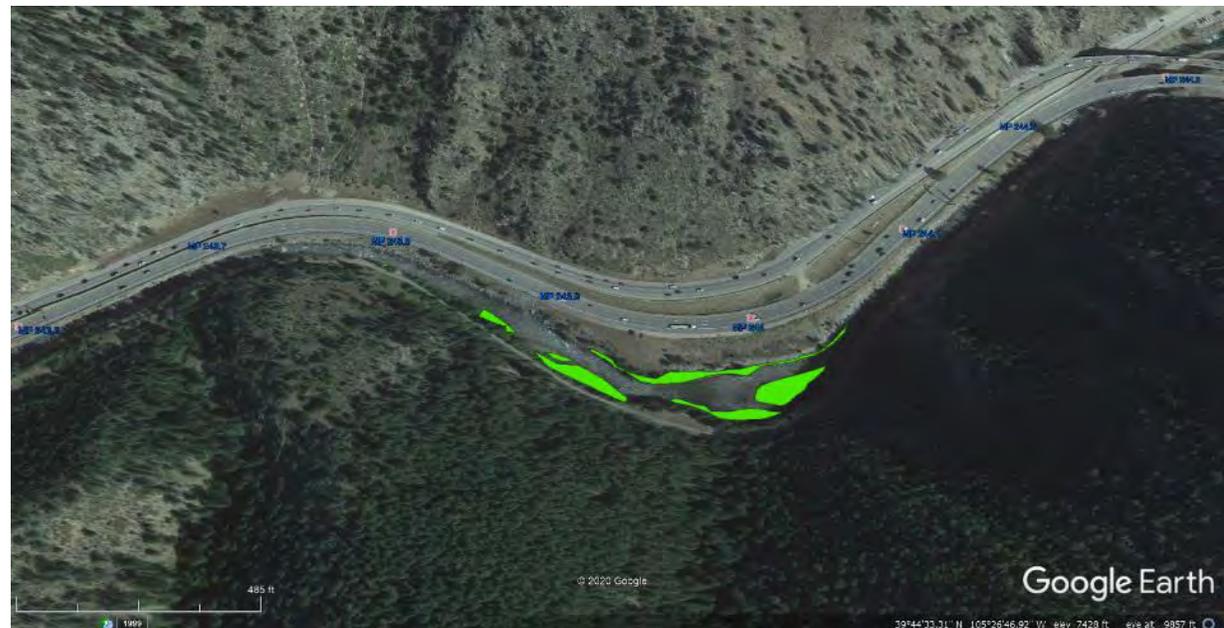
- Impaired for metals from mining and naturally occurring metals in soils/mineralized rock
- Black Hawk drinking water intake
- Decreasing use of traction sand and increased use of deicers
- SCAP BMPs implemented for projects upstream; one existing WQ pond in Project area (near Black Hawk water intake)

- Clear Creek condition

- Areas of significant channelization throughout
- Wider floodplain areas support riparian habitat/wetlands
- Regulated floodplain

- Clear Creek fishery

- Clear Creek is a high value fishery
- Brown trout spawning upstream; increasing density
- Aquatic connectivity is not an issue



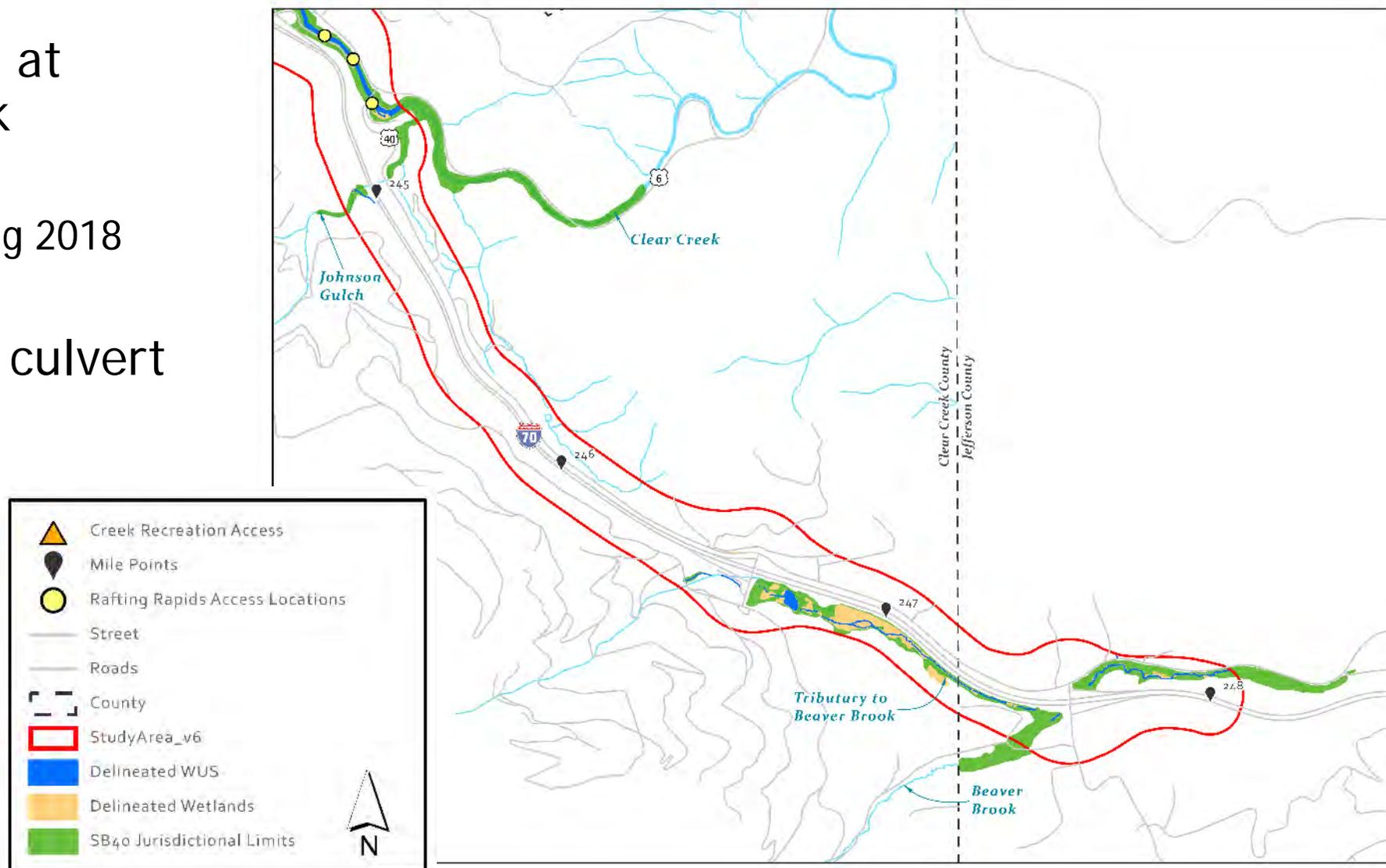
- Other streams and gulches

- Johnson Gulch, Sawmill Gulch, Beaver Brook also impaired for metals
- Sawmill Gulch lacks riparian vegetation for SB 40
- Beaver Brook
 - Brook trout spawning 1-mile upstream of Project
 - Regulated Floodplain



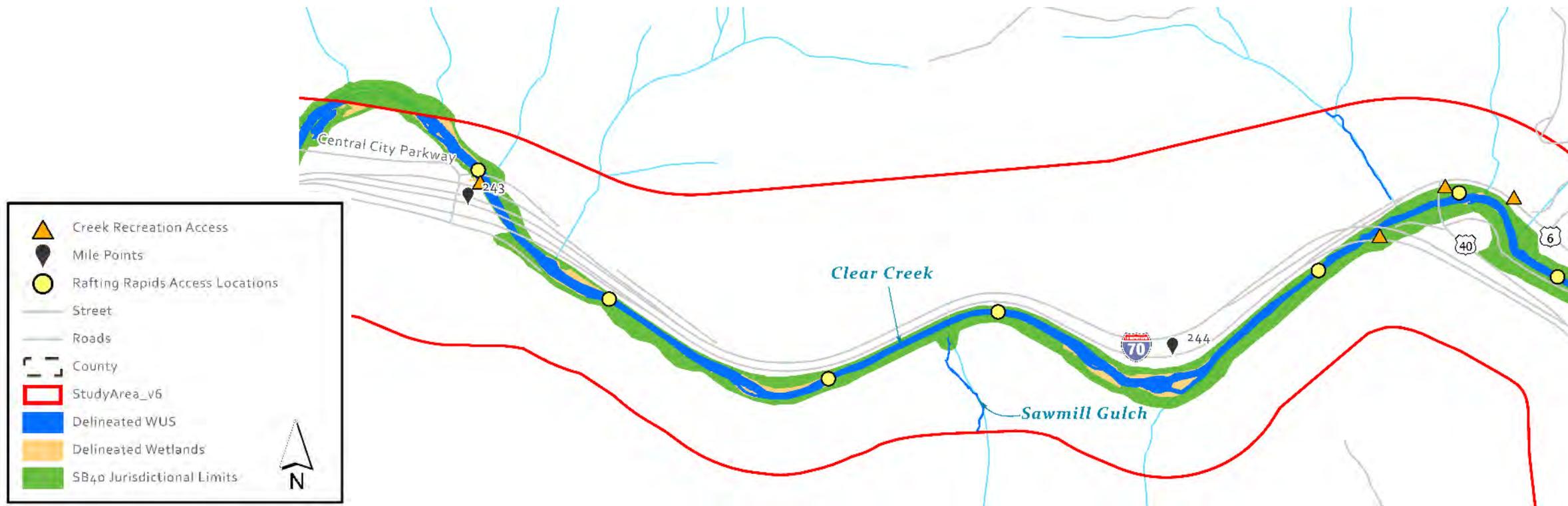
Existing Conditions: East Section

- Wetland complex at Beaver Brook (elk meadows)
 - Fen testing in Aug 2018 (negative)
- Johnson Gulch in culvert under I-70





Existing Conditions: Central Section



- Numerous recreational points, including rafting rapids and fishing accesses
- Greatest potential for creek enhancement in the Project area
- Areas near Black Hawk intake and Sawmill Gulch are wider and support wetlands



Existing Conditions: West Section



- Previous Creek Restoration project upstream (Twin Tunnels)
- Highly constrained and channelized
- Area of Clear Creek realignment



SWEEP Commitments and Considerations

SWEEP MOU and Implementation Matrix considerations in project development

- Sediment management
- Section 303(d) impaired waters
- Mining wastes and mineralized rock
- Wetlands protection
- Special status species
- Aquatic species as recreational resource
- Information and research needs

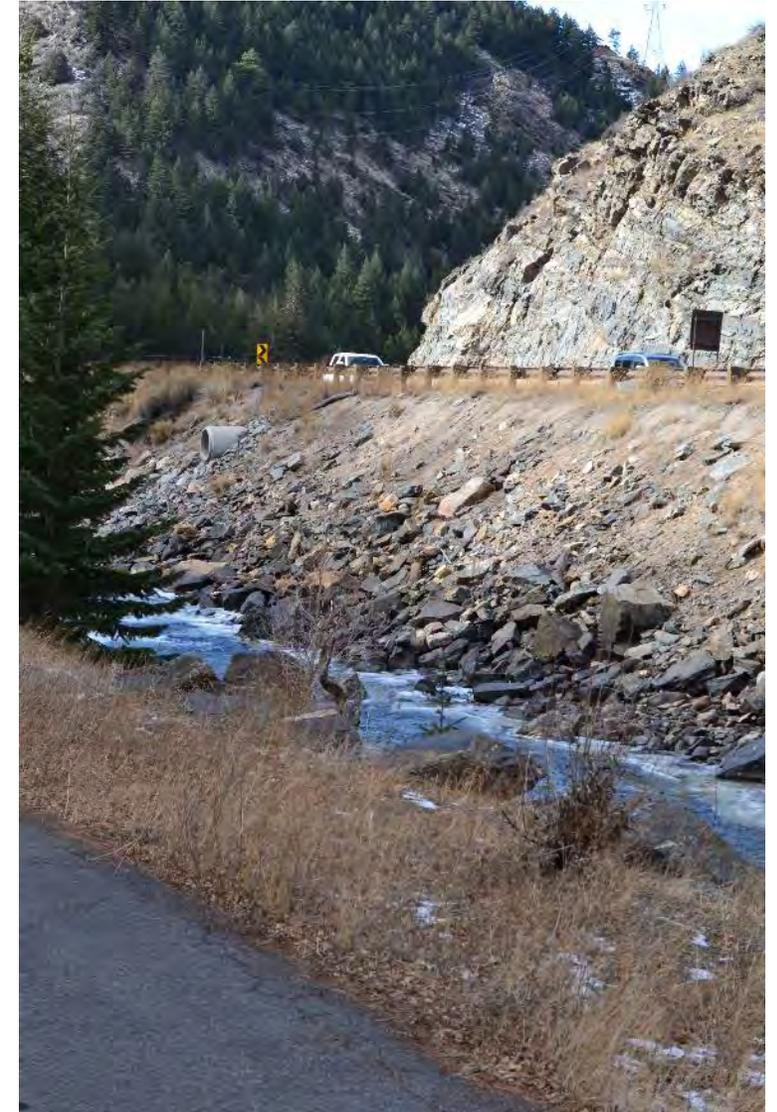
PEIS Commitments for Tier 2 Projects

- Delineate wetlands using the latest approved USACE methodology
- Identify and analyze impacts to fens if applicable
- Functional Assessment of wetlands using FACWet
- Determine jurisdictional and non-jurisdictional wetlands
- More detailed analysis of direct and indirect impacts on aquatic resources
- Develop specific and detailed mitigation strategies and measures
- Develop specific best management practices



Issues Raised at Previous SWEEP Meetings

- Water quality
 - Chlorides and effects on water quality and vegetation
 - Increased sedimentation / contaminants from frontage road maintenance, rock cut areas, snow plowing over the creek
 - Potential for truck overturning and hazmat spills
- Coordination with maintenance
 - BMP design, location, and maintenance
 - Winter maintenance practices
- Wetlands
 - Complex at Beaver Brook (elk meadows)
 - Wetland functional assessment
- Realigning Clear Creek
 - Creek geology
 - Sediment and turbidity





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Water Quality

SELDM Model Factsheet

The Stochastic Empirical Loading and Dilution Model (SELDM) is a stochastic model that uses Monte Carlo methods to determine the effect of runoff on receiving waters. It is primarily used as a screening mechanism for projects' environmental impacts.

Four Scenarios:

- Existing Conditions
- Proposed Conditions, using no BMPs
- **Proposed Conditions, using extended detention basins (EDB)**
- **Proposed Conditions, using vegetated swales.**

Highway site inputs

- Drainage area = Combined area of I-70, US 6, Central City Parkway, and CR314.
- Drainage length = Veteran's Memorial Tunnel to the top of Floyd Hill
- Basin Development Factor = Proposed improvements cause an increase in peak runoff potential on a scale of 0 to 12.

Scenario	Drainage Area (ac)	Drainage Length (ft)	Basin Development Factor
Existing	105.18	28875.74	2
Proposed	124.77	28875.74	5

Preliminary Results:

Constituent	Existing vs Proposed No BMP (%)	Existing vs Proposed with Ponds (%)	Existing vs Proposed with Swales (%)
TSS	+18.62	-68.91	-66.67
Chloride	+18.65	+0.95	-20.19
Cadmium*	+18.64	-47.86	-80.90
Copper*	+18.65	-61.61	-68.9
Lead	+18.65	-9.44	-25.97
Zinc*	+18.64	-36.83	-37.73

*Used regional pollutant loading data

Loading Concentration Data:

- CDOT report Interstate 70 Mountain Corridor Storm Event/Snowmelt Water Quality Monitoring.

Data on the efficiency of applicable BMPs:

- USGS Statistical Study for SELDM Inputs

Data on the efficiency of BMPs on chlorides:

- Transportation Research Board *Synthesis 449: Strategies to Mitigate the Impacts of Chloride*.

Water Quality Approach:

- Application of SCAP recommendations is no longer applicable
- No MS4 Permit.
- Focus on addressing specific pollutants of concern.

Water Quality: SELDM

- Modeling Goals
- Inputs
- Results inform design
 - Define WQ Approach
 - SCAP
 - No MS4



Water Quality: BMP Selection

Pollutant Focused, Tiered Approach to Water Quality

- Formal WQ BMPs proposed to mitigate the majority of the Roadway Runoff
 - Extended Detention Basins: Highly effective for sediment and metal removal
 - Constructed Wetlands: Highly effective for treatment of de-icing agents as it dilutes Chlorides and maximizes uptake

Extended Detention Basin - Sediment and Metals



Constructed Wetlands - Deicing Agents / Chlorides via Dilution and Uptake)





Water Quality : BMP Selection

Pollutant Focused, Tiered Approach to Water Quality

- Informal WQ BMPs proposed to mitigate roadway runoff with site constraints
 - Vegetated ditches
 - Stilling Basins
 - Engineered ditches with check dams
- Effective removal for sediment and metals and diluting chlorides

Vegetated Ditch w/ Stilling Basins (Bridge Sections) - Sediments and Metals



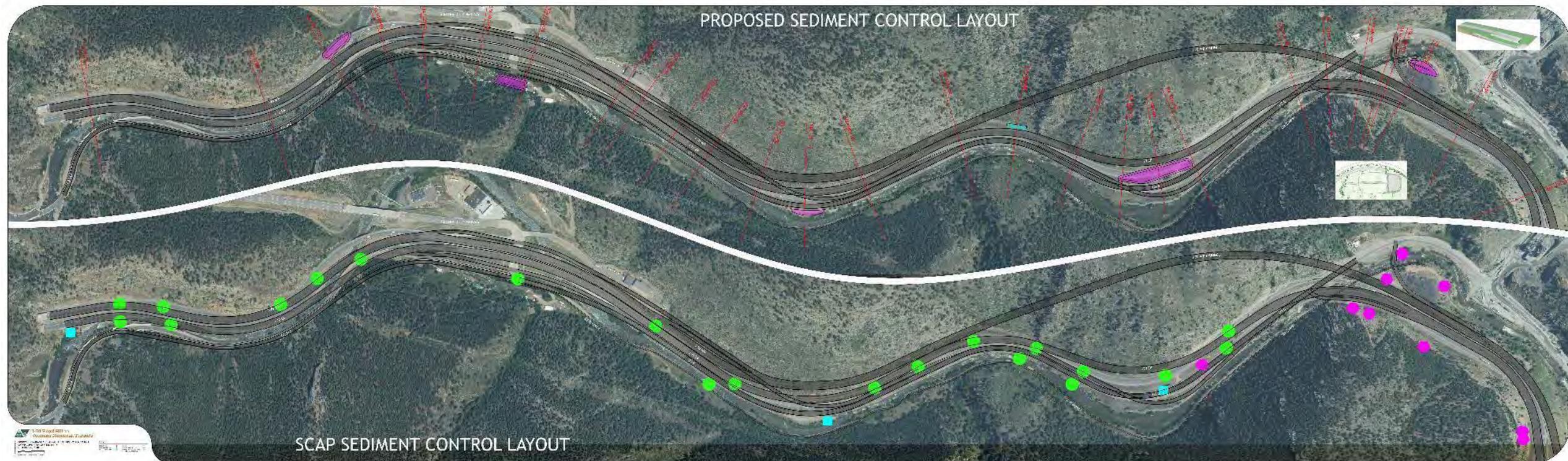
Engineered Ditch with check dams - Deicing agents





Water Quality : BMP Selection

- SWEEP Meeting No. 2 (October 25, 2018): Review of materials presented
 - CDOT transitioned to using de-icing agents in lieu of traction sand
 - SCAP-recommended BMPs focused on traction sand and present maintenance challenges
- Proposed BMPs have been updated to reflect changes in Design Options





Water Quality : BMP Selection

- Project Section
 - East
 - Central
 - West
- WQ Watersheds
 - Floyd Hill
 - Clear Creek
 - Tunnel
 - Canyon

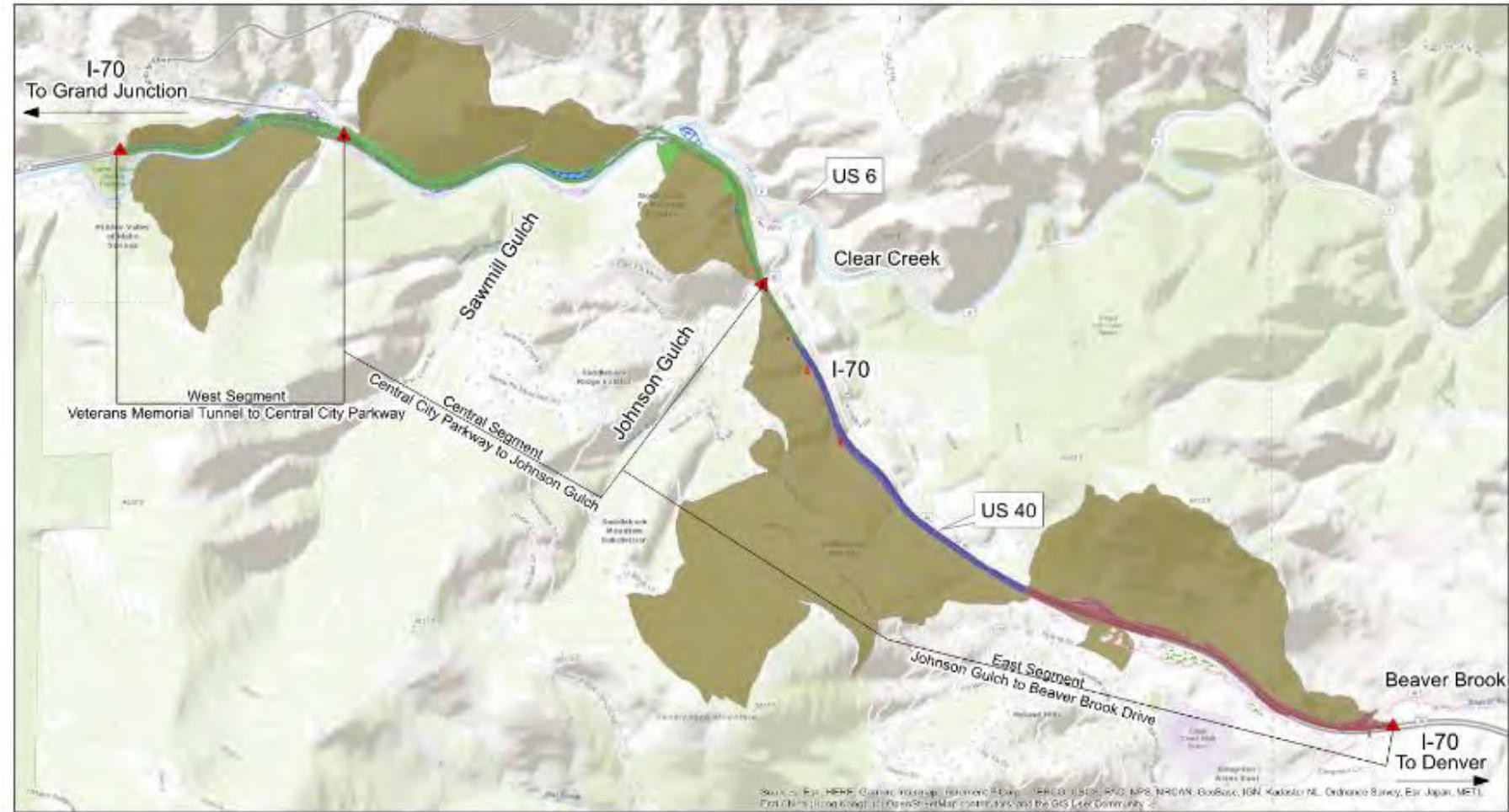
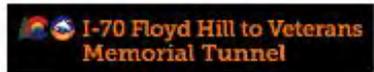


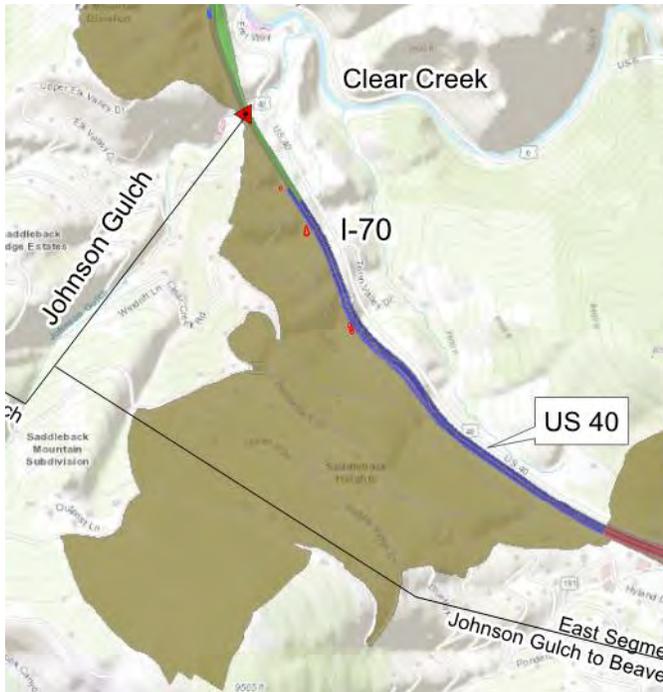
Figure 1: Project Basin Map
I-70 Floyd Hill to Veteran Memorial Tunnel Project





Water Quality: East Section (Floyd Hill)

- Chlorides and Sediment
- Vegetated shoulders/slopes provide natural treatment over flowpaths
- Engineered Ditches provide dilution and uptake
- Constructed Wetlands provide dilution and uptake



Vegetated Shoulders/slopes



Constructed Wetlands and Engineered Ditches

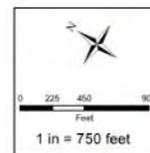
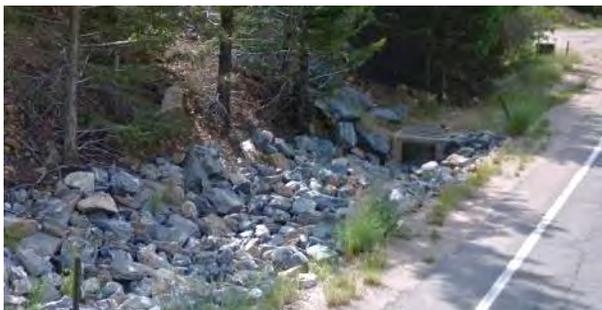


May 14, 2020

SWEEP Meeting



Water Quality: East Section (Floyd Hill)



Legend	
	Existing Wetlands
	Streams
	Extended Detention Basin
	Engineered Ditch
	Constructed Wetland
	ONSITE - Clear Creek
	ONSITE - Johnson Gulch
	ONSITE - Beaver Brook
	OFFSITE

Water Quality Design - Clear Creek
Floyd Hill





Water Quality: Central and West Sections (Clear Creek)

- Sediment, Metals, Chlorides
- Extended Detention Basins captures sediments and treats metals
- Sediment Basins captures sediment
- Vegetated ditches provide natural treatment over flowpaths
- Engineered Ditches provide dilution and uptake

Extended Detention Basins



Sediment Basins





Water Quality: BMP Locations, Clear Creek: Tunnel Alternative



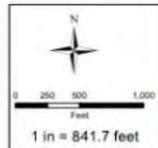
Legend

SCAP Recommendation	Existing Wetlands	Proposed BMPs
Inlet Sediment Trap	Streams	Extended Detention Basin
Sediment Basin		
Loading Dock Trap		

Water Quality Design - Clear Creek
Option 1 - Tunnel Alternative



Water Quality: BMP Locations, Clear Creek: Canyon Alternative



Legend	
SCAP Recommendation	Proposed BMPs
■ Inlet Sediment Trap	■ Extended Detention Basin
■ Sediment Basin	■ Engineered Ditch
■ Loading Dock Trap	■ Constructed Wetland
Existing Wetlands	Streams

Water Quality Design - Clear Creek
Option 5 - Canyon Alternative





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Wetlands and Waters of the US



Wetlands and Waters of the US

Permanent Impacts

- Impacts based on project design as of May 5, 2020.
- Permanent impacts would result from the widening and realignment of I-70 and Frontage Road, replacement of existing bridges, installation of bridge piers, and bank stabilization associated with roadway reconfiguration.

Alternative	Permanent Impact (Acres)	Permanent Impacts (Square Feet)	Linear Feet of Impact	Assumed Jurisdictional Status ¹
Tunnel Alternative (North Frontage Road Option)	0.908	39,565	1,575	Jurisdictional
Tunnel Alternative (South Frontage Road Option)	0.912	39,746	1,652	Jurisdictional
Canyon Viaduct Alternative	0.929	40,458	1,835	Jurisdictional

¹Jurisdictional status assumed based on conditions in the field and review of maps and aerial imagery. Only the U.S. Army Corps of Engineers (USACE) has the authority to determine what is jurisdictional.

Wetlands

Alternative	Permanent Impact (Acres)	Permanent Impacts (Square Feet)	Classification ¹	Assumed Jurisdictional Status ²
Tunnel Alternative (North Frontage Road Option)	0.001	44	PEM and PSS	NA
Tunnel Alternative (South Frontage Road Option)	0.001	40	PEM	NA
Canyon Viaduct Alternative	0.001	44	PEM and PSS	NA

¹Cowardin et al., 1979

²Jurisdictional status assumed based on conditions in the field and review of maps and aerial imagery. Only USACE has the authority to determine what is jurisdictional.

Notes:

PEM = palustrine emergent

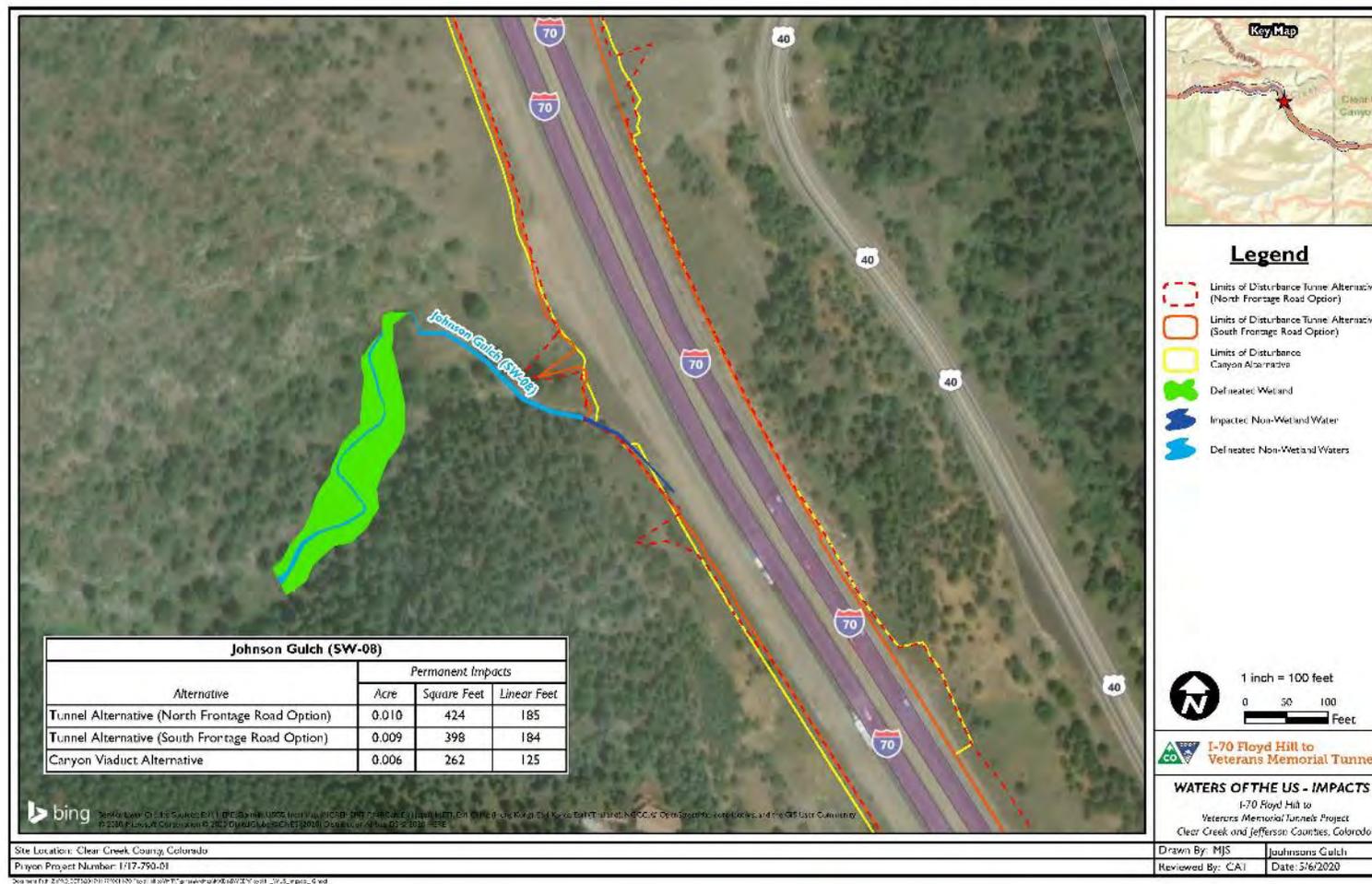
PSS = palustrine scrub-shrub



Wetlands and Waters of the US

Johnson Gulch (SW-08)

- Impacts vary slightly between action alternatives
- Impacts from:
 - Road widening
 - Grading for toe-of-slope
 - Road stabilization

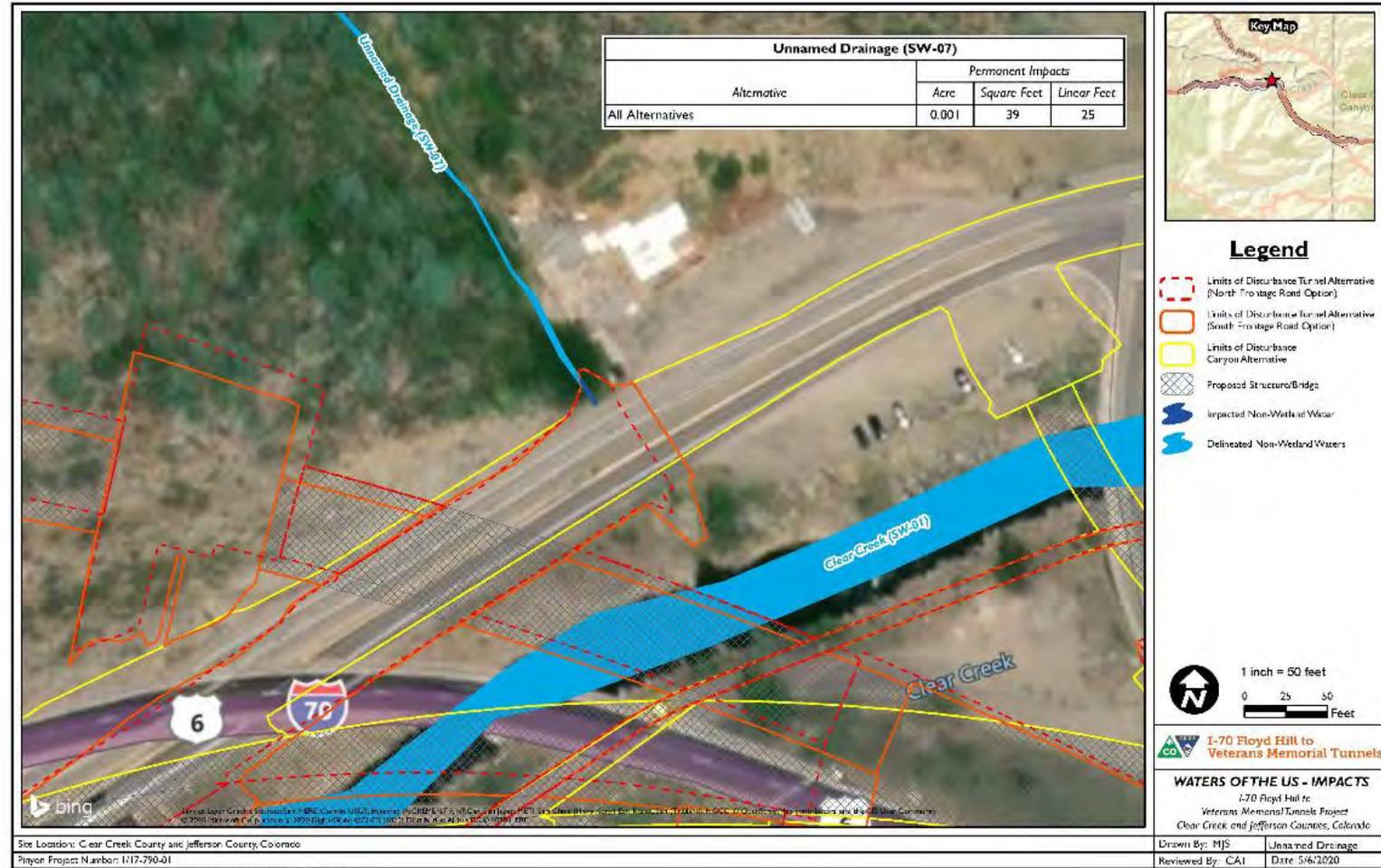




Wetlands and Waters of the US

Unnamed Drainage (SW-07)

- Impacts are the same for action alternatives
- Impacts from:
 - Slope stabilization for US 6



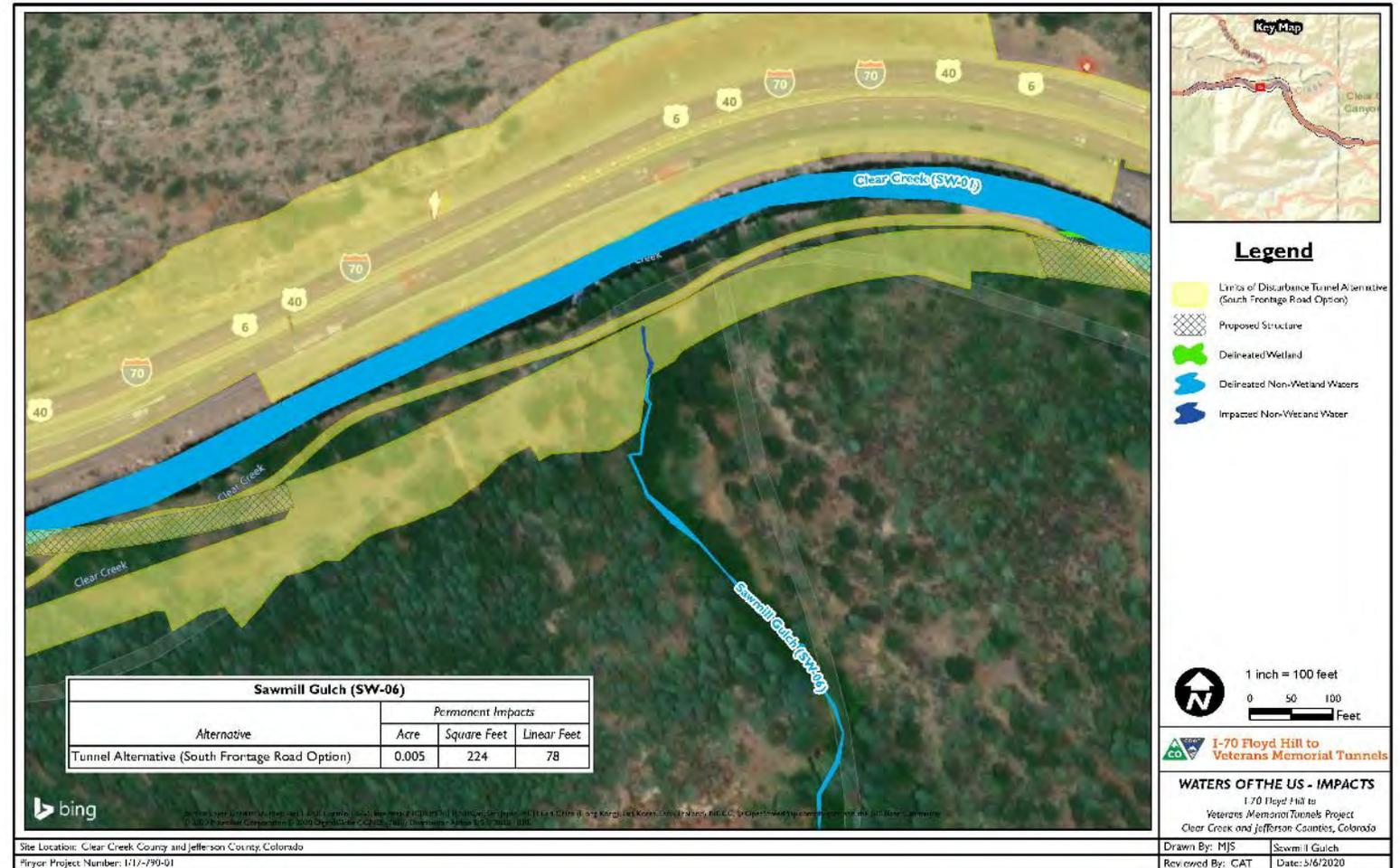


Wetlands and Waters of the US

Sawmill Gulch (SW-06)

Tunnel Alternative, South Frontage Road Option

- Impacts from:
 - Grading activities
 - New road alignment
 - Slope stabilization



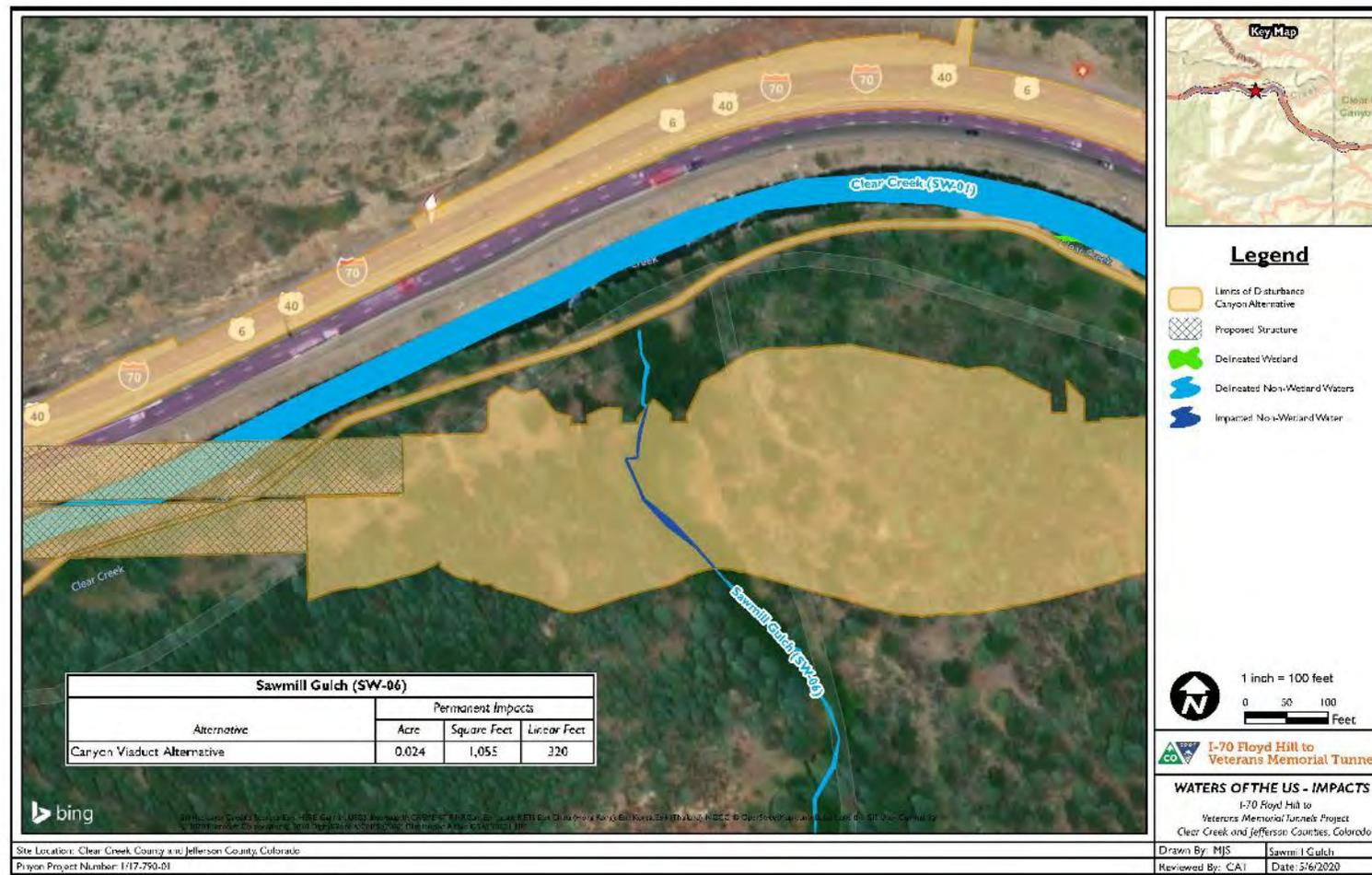


Wetlands and Waters of the US

Sawmill Gulch (SW-06)

Canyon Viaduct Alternative

- Impacts from:
 - Grading activities
 - New road alignment
 - Slope stabilization



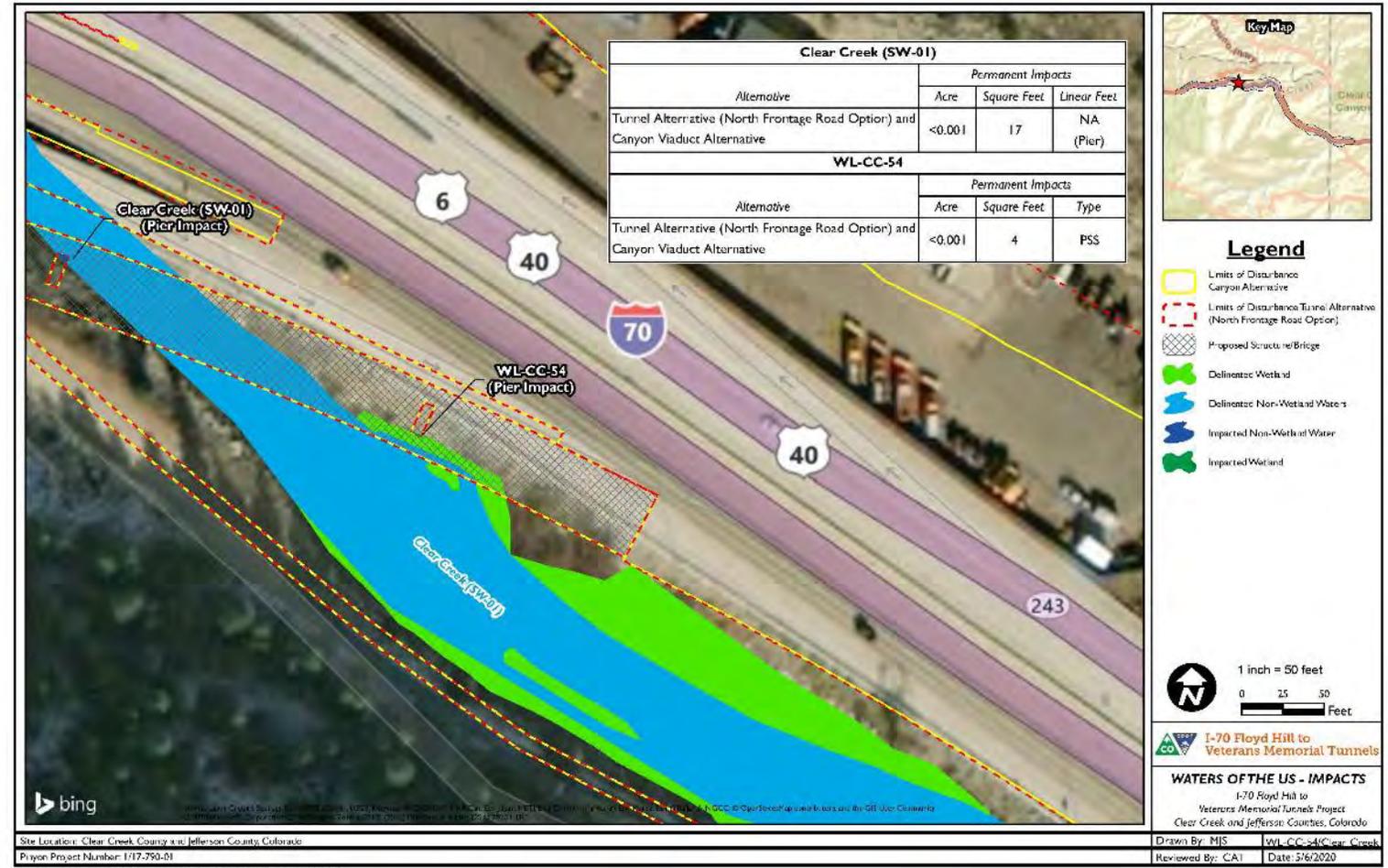


Wetlands and Waters of the US

Clear Creek (SW-01/WL-CC-54)

Tunnel Alternative, North Frontage Road Option) and Canyon Viaduct Alternative

- Impacts from
 - Installation of new Bridge Piers



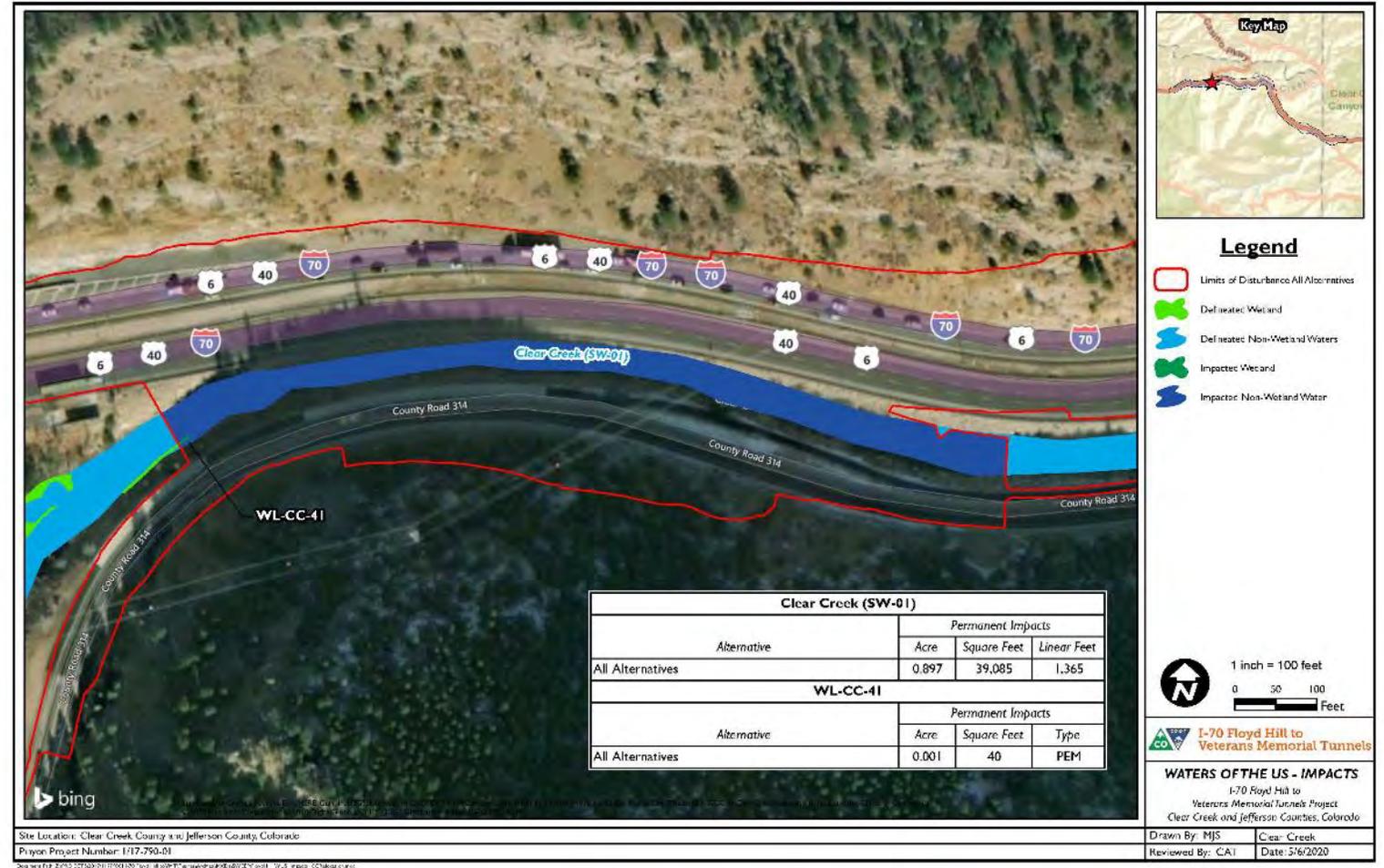


Wetlands and Waters of the US

Clear Creek (SW-01/WL-CC-41)

All Action Alternatives

- Impacts are the same for action alternatives
- Realignment of Clear Creek for new road layout (I-70 and CR 314)





Wetlands and Waters of the US

Temporary Impacts

- Vegetation removal
- Earthmoving
- Bridge demolition
- Grading activities
- Surface runoff during construction





Wetlands and Waters of the US

Indirect Impacts

- Shading over Clear Creek
- Noxious weeds
- Increased impervious surfaces post construction
- Water Quality





Section 404 Permitting

- Relocation of Clear Creek does not appear to fall under any Nationwide Permit; an Individual Permit is anticipated
- Other impacts could meet Nationwide Permit conditions if permitted separately
- Permitting discussion
 - Informal NEPA/404 Merger process
 - Single vs multiple permits
 - Stream Quantification Tool





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Department of Transportation

Relocation of Clear Creek

February 13, 2020



Relocation of Clear Creek



~1,200 linear feet
realigned



Need for Realignment

- I-70 Alignment
 - 55-mph design speed (curve radii)
 - Stopping sight distance
 - Rock cuts
 - Alignment with existing tunnels
- County Road 314/Greenway alignment
 - Minimal cross section width
 - Rock cuts to the south
- Hydraulics and floodplain



Limited Opportunities for Enhancements within Realignment Area





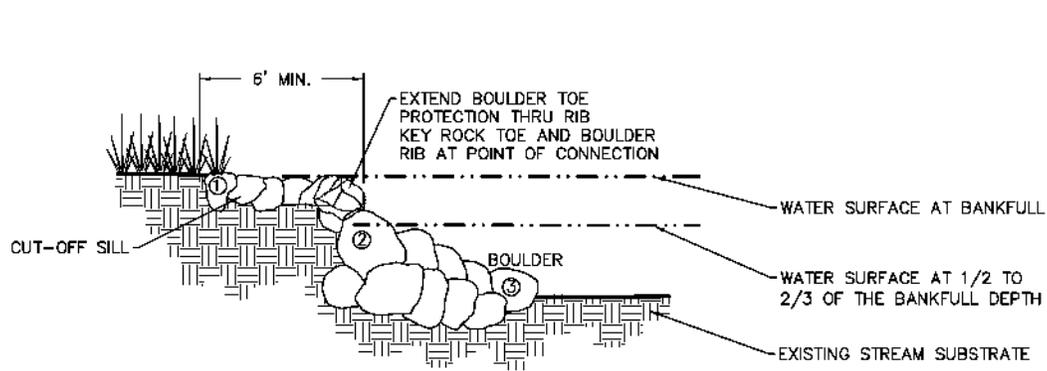
Downstream Enhancement Opportunities

- Wider existing riparian areas
- Areas where I-70 footprint is smaller and can be reclaimed (differs by alternative); open up floodplain and lay back slopes
- Other opportunities to improve (and balance) rafting and creek access

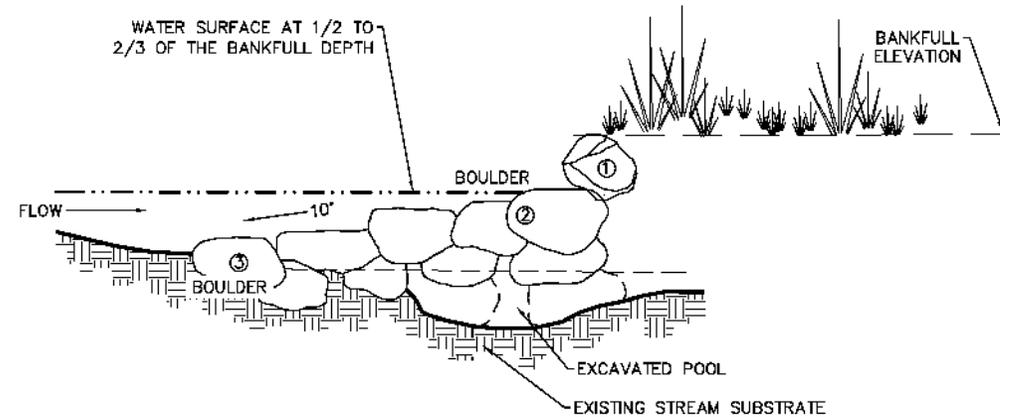




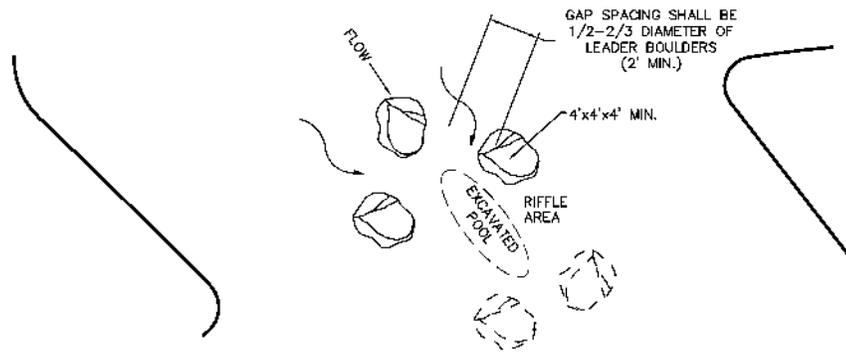
Potential Mitigation Details for Direct Relocation Area (from Twin Tunnels)



BOULDER RIB – CROSS SECTION
N.T.S.



BOULDER RIB – PROFILE VIEW
N.T.S.



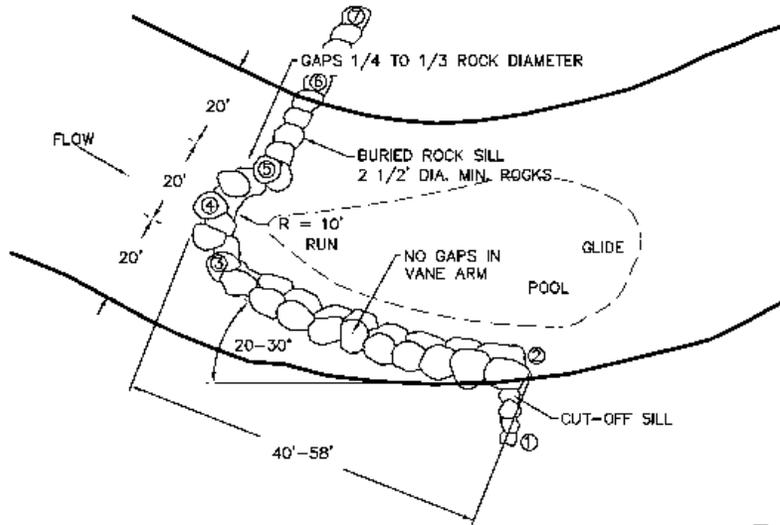
1. BOULDER CLUSTERS SHALL BE PLACED ADJACENT TO THE THALWEG.

BOULDER CLUSTER – PLAN VIEW
N.T.S.

- EACH BOULDER PLACED INTO THE ACTIVE CHANNEL MOVING OUT FROM THE BANK SHOULD BE SET AT A LOWER ELEVATION USING A SLOPE OF 10%
- GAPS BETWEEN BOULDERS SHOULD BE $\frac{1}{2}$ TO $\frac{2}{3}$ OF THE BOULDER DIAMETER
- RIBS SHOULD ALTERNATE FROM ONE SIDE OF THE CHANNEL TO THE OTHER AT A SPACING OF 0.5 BANKFULL WIDTHS RESULTING IN INCREASED SINUOSITY.
- BOULDER SHALL BE KEYED INTO THE BANK
- MINIMUM BOULDER SIZE SHALL BE APPROXIMATELY 3'X3'X4'
- PLACEMENT OF ROCK WILL BE FIELD DIRECTED BASED ON INDIVIDUAL ROCK CHARACTERISTICS



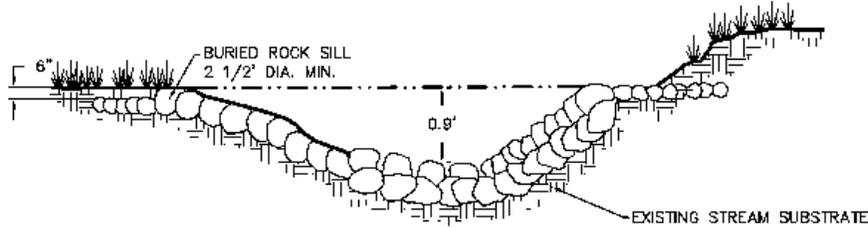
Potential Mitigation Details for Downstream Enhancements (from Twin Tunnels)



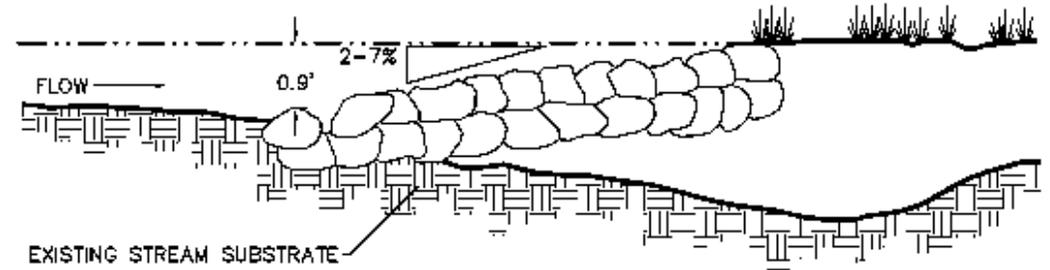
ROCK J-HOOK VANE - PLAN VIEW
N.T.S.



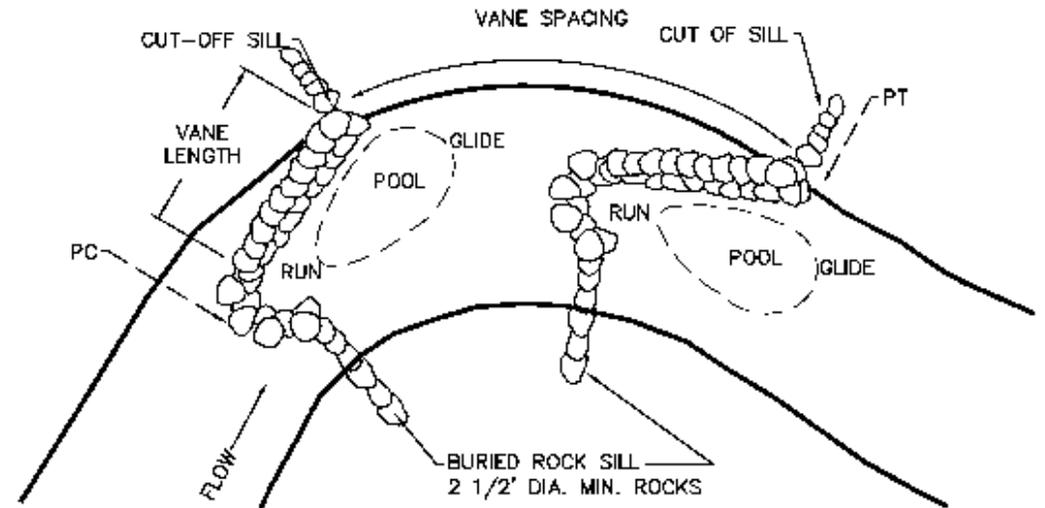
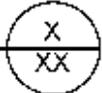
- NOTES:
1. J-HOOK POINTS 3, 4 AND 5 SHALL BE PLACED AT A RADIUS OF 10'
 2. PLACEMENT OF ROCK WILL BE FIELD DIRECTED BASE ON INDIVIDUAL ROCK CHARACTERISTICS.
 3. J-HOOK ROCKS SHALL BE 4-5' DIA. X 2-3' HEIGHT.



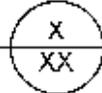
ROCK J-HOOK VANE - CROSS SECTION VIEW
N.T.S.



ROCK J-HOOK VANE - PROFILE VIEW
N.T.S.



ROCK J-HOOK VANE SPACING
N.T.S.



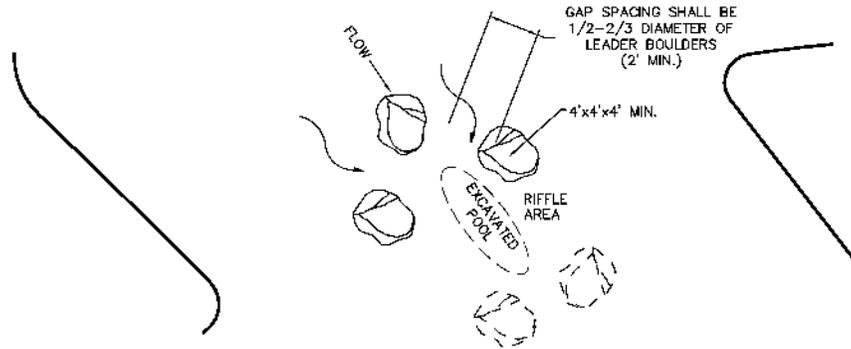


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Department of Transportation

Questions / Comments?

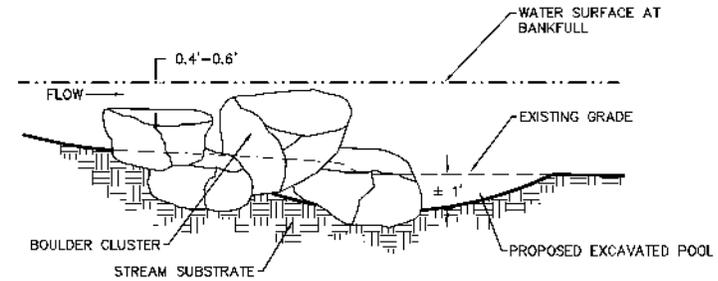


Twin Tunnels Mitigation Project Details



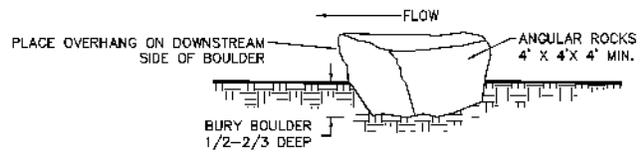
1. BOULDER CLUSTERS SHALL BE PLACED ADJACENT TO THE THALWEG.

BOULDER CLUSTER – PLAN VIEW
N.T.S.



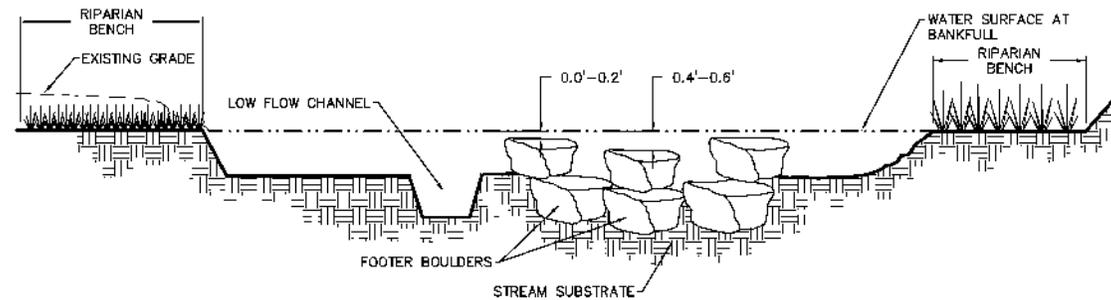
1. BOULDER CLUSTERS SHALL BE OF VARIABLE HEIGHT AND AT THE DISCRETION OF THE ENGINEER (FIELD DIRECTED).

BOULDER CLUSTER – PROFILE
N.T.S.



1. SEE PLANS FOR BOULDER PLACEMENT LOCATIONS.
2. BOULDER CLUSTERS MAY CONSIST OF 3-5 ROCK CLUSTERS. (FIELD DIRECTED).
3. PLACEMENT OF ROCK WILL BE FIELD DIRECTED BASED ON INDIVIDUAL ROCK CHARACTERISTICS.

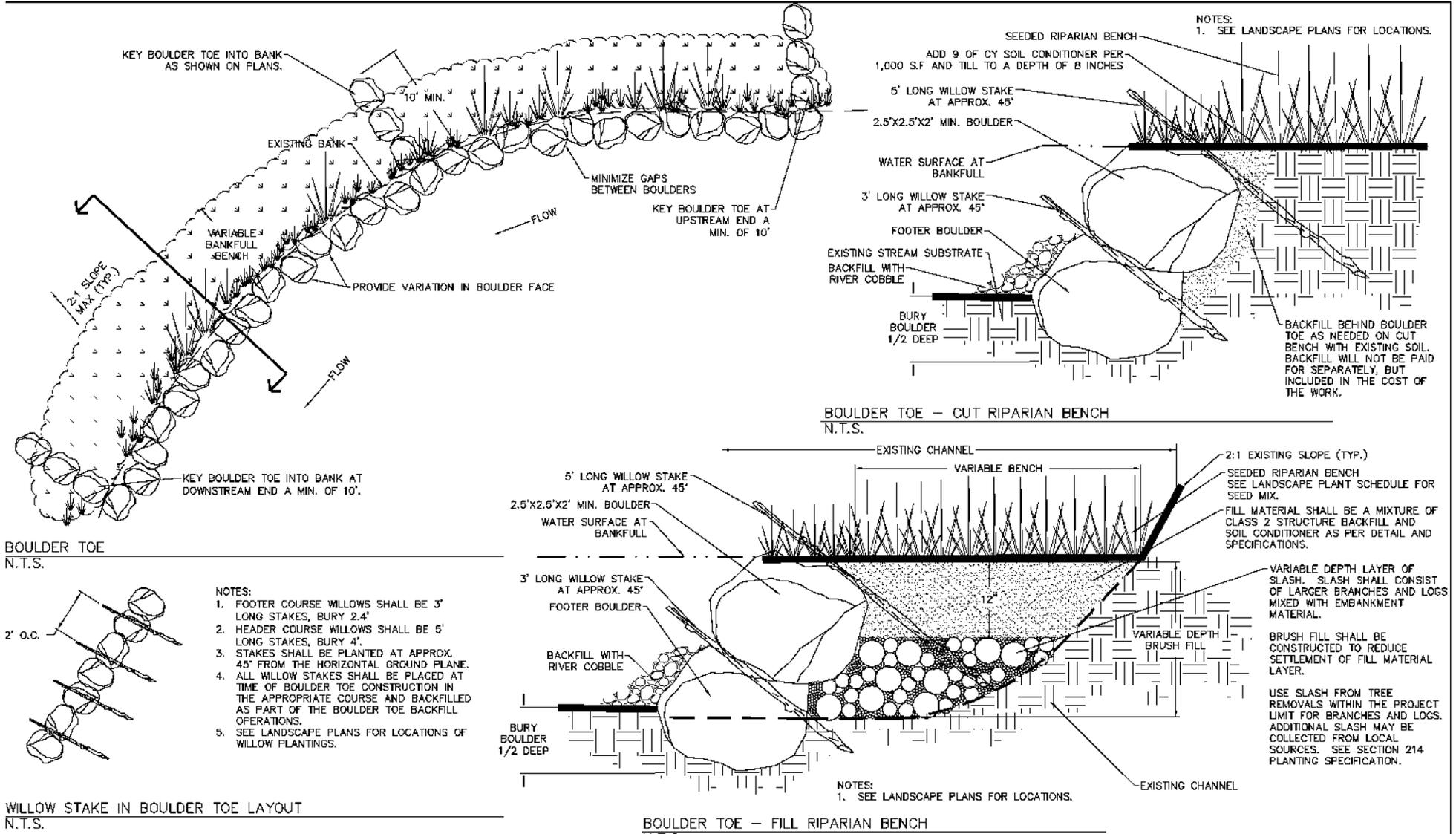
BOULDER PLACEMENT
N.T.S.



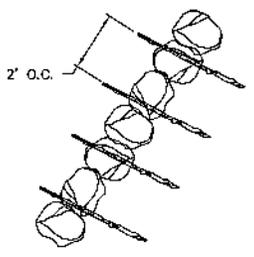
BOULDER CLUSTER – CROSS SECTION
N.T.S.



Twin Tunnels Mitigation Project Details



BOULDER TOE
N.T.S.



- NOTES:
1. FOOTER COURSE WILLOWS SHALL BE 3' LONG STAKES, BURY 2.4'
 2. HEADER COURSE WILLOWS SHALL BE 5' LONG STAKES, BURY 4'
 3. STAKES SHALL BE PLANTED AT APPROX. 45° FROM THE HORIZONTAL GROUND PLANE.
 4. ALL WILLOW STAKES SHALL BE PLACED AT TIME OF BOULDER TOE CONSTRUCTION IN THE APPROPRIATE COURSE AND BACKFILLED AS PART OF THE BOULDER TOE BACKFILL OPERATIONS.
 5. SEE LANDSCAPE PLANS FOR LOCATIONS OF WILLOW PLANTINGS.

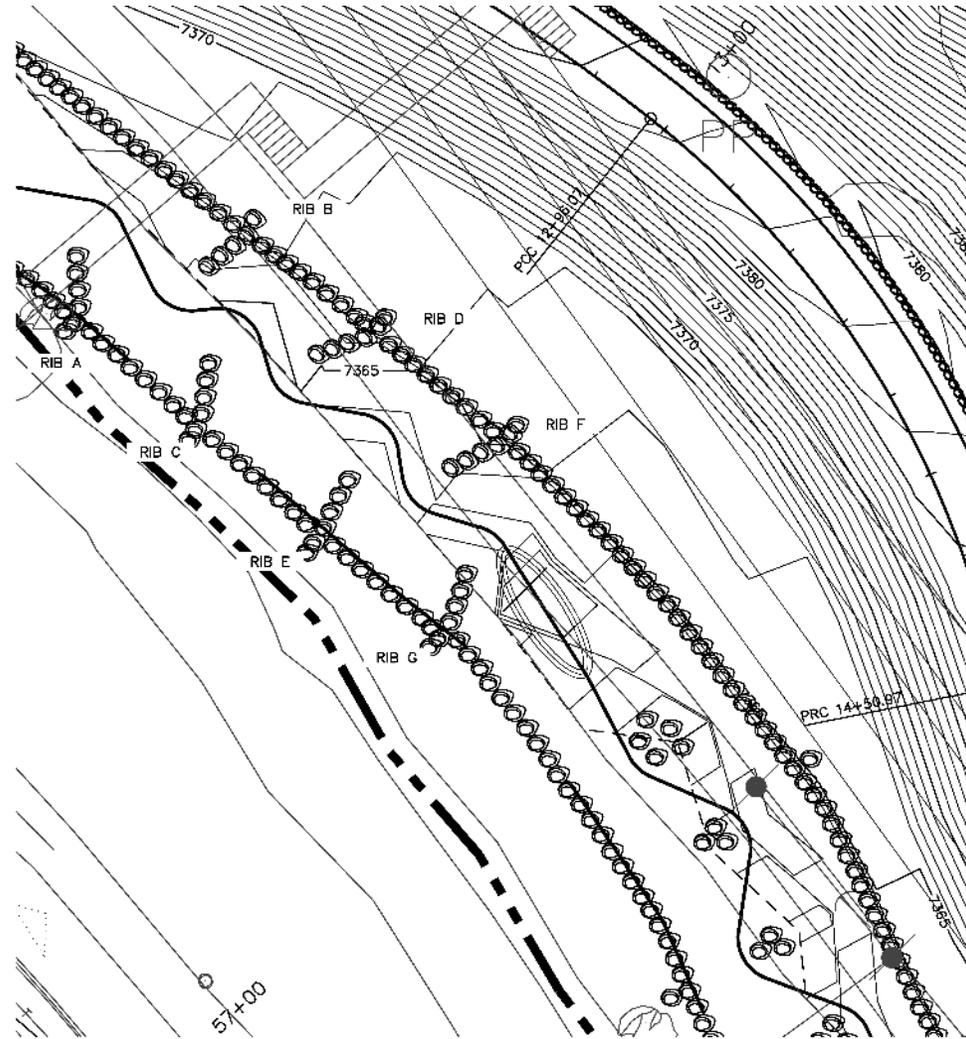
WILLOW STAKE IN BOULDER TOE LAYOUT
N.T.S.

BOULDER TOE - CUT RIPARIAN BENCH
N.T.S.

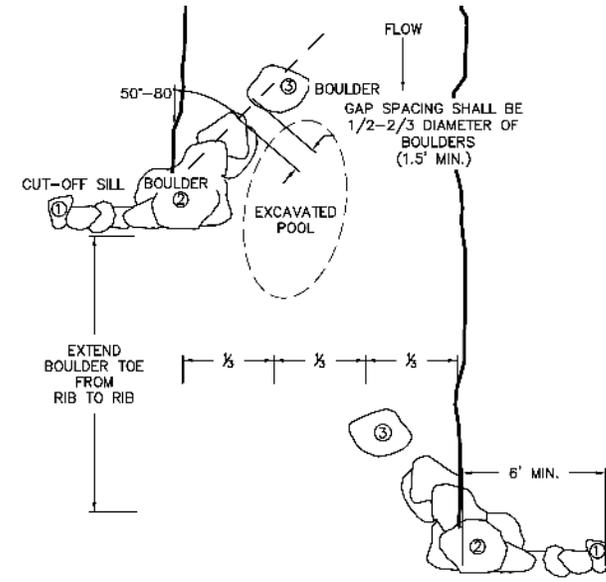
BOULDER TOE - FILL RIPARIAN BENCH
N.T.S.



Twin Tunnels Mitigation Project Details



BOULDER RIB – PLAN VIEW
1" = 30'-0"



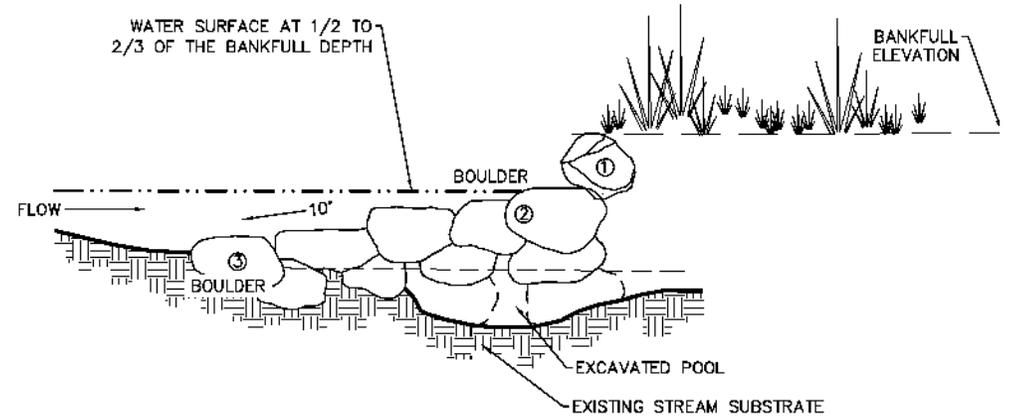
BOULDER RIB (TYP.)
N.T.S.

BOULDER RIB INFORMATION

RIB No.	OVERALL LENGTH	ANGLE FROM BANK (DEGREES)	BOULDER① ELEV. BACK ROCK OF TOE		BOULDER② ELEV. ROCK AT BANK		BOULDER③ ELEV. END ROCK IN CHANNEL	
			Elevation	North/East	Elevation	North/East	Elevation	North/East
A	15.8'	50	7368.90	695840.57	7368.08	695845.233	7366.50	695861.072
				1006708.952		1006715.677		1006712.170
B	13.4'	78.5	7368.50	695896.657	7367.21	695864.206	7365.87	695855.458
				6958163.396		695821.277		695836.609
C	15.5'	57	7367.80	1006736.557	7366.97	1006740.415	7365.42	1006742.623
				695846.585		695841.335		695836.106
D	15.8'	58.5	7367.40	1006783.067	7366.55	1006780.050	7364.97	1006765.164
				695792.545		695768.207		695810.022
E	14.4'	74.5	7366.90	1006764.206	7365.94	1006768.207	7364.50	1006774.440
				695821.887		695816.773		695809.910
F	15.3'	66.5	7366.30	1006885.584	7365.53	1006809.316	7364.00	1006795.665
				695769.124		695773.588		695788.190
G	15.4'	60.5	7365.90	1006792.116	7365.04	1006796.174	7363.50	1006801.213

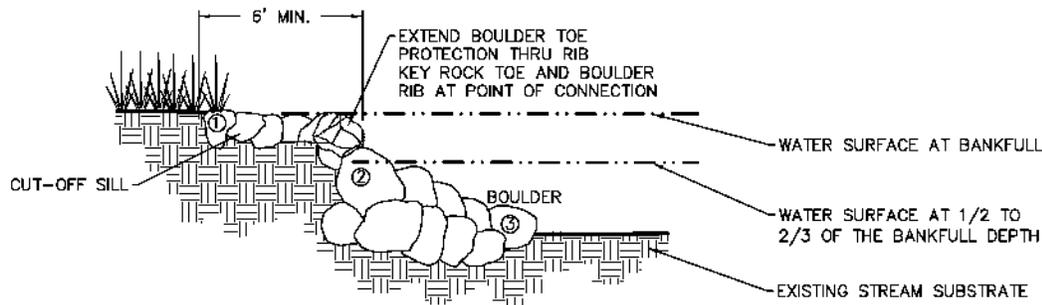


Twin Tunnels Mitigation Project Details



BOULDER RIB – PROFILE VIEW
N.T.S.

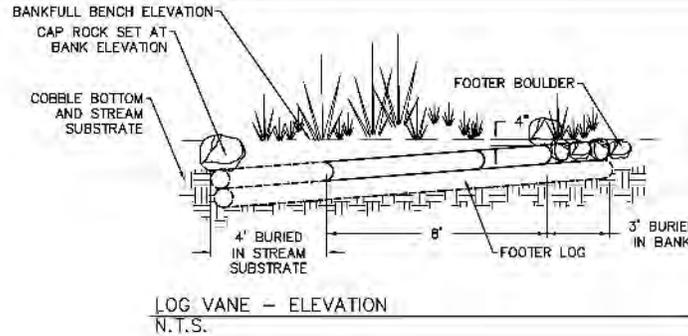
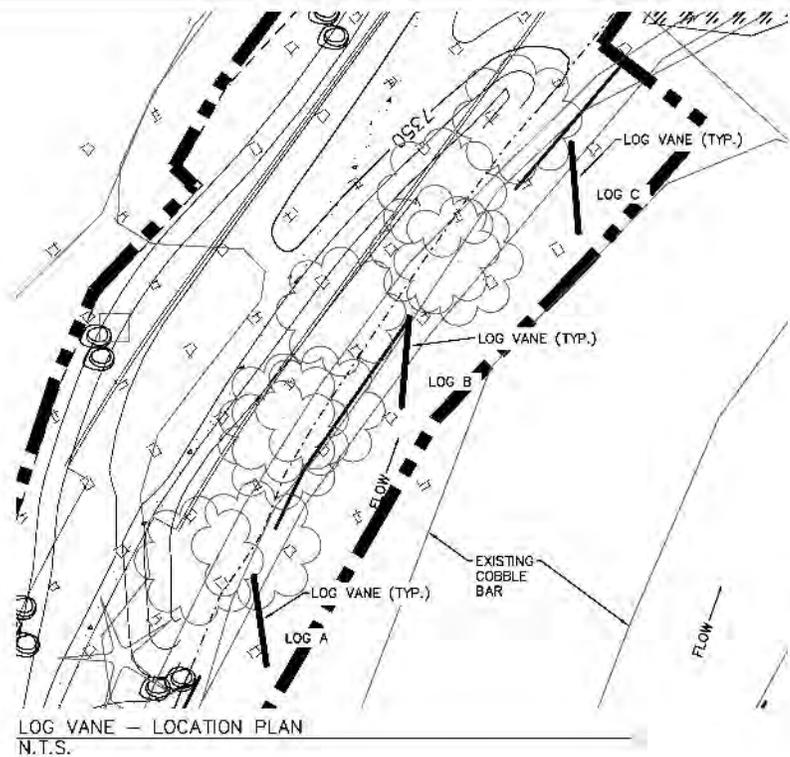
- EACH BOULDER PLACED INTO THE ACTIVE CHANNEL MOVING OUT FROM THE BANK SHOULD BE SET AT A LOWER ELEVATION USING A SLOPE OF 10%
- GAPS BETWEEN BOULDERS SHOULD BE $\frac{1}{2}$ TO $\frac{2}{3}$ OF THE BOULDER DIAMETER
- RIBS SHOULD ALTERNATE FROM ONE SIDE OF THE CHANNEL TO THE OTHER AT A SPACING OF 0.5 BANKFULL WIDTHS RESULTING IN INCREASED SINUOSITY.
- BOULDER SHALL BE KEYED INTO THE BANK
- MINIMUM BOULDER SIZE SHALL BE APPROXIMATELY 3'X3'X4'
- PLACEMENT OF ROCK WILL BE FIELD DIRECTED BASED ON INDIVIDUAL ROCK CHARACTERISTICS



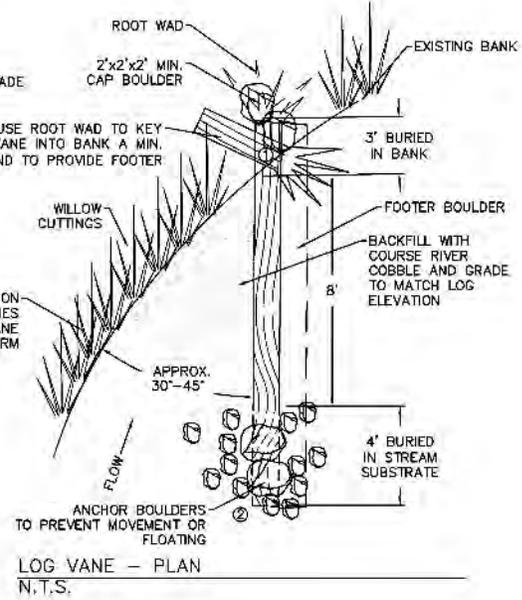
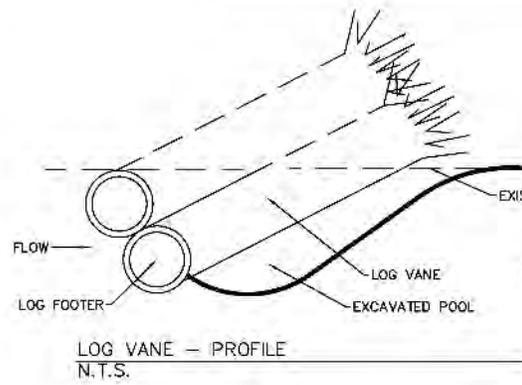
BOULDER RIB – CROSS SECTION
N.T.S.



Twin Tunnels Mitigation Project Details



- LOGS SHALL BE 12" DIA. MIN.
- ROOT WAD SHALL BE COVERED IN BANK BY CAP ROCKS.
- LOGS SHALL BE DE-LIMBED AND FREE OF BRANCHES.
- ELEVATIONS SHALL BE DETERMINED IN THE FIELD BASED ON EXISTING CHANNEL ELEVATIONS.
- FISH SPAWNING AREAS SHALL BE FLAGGED BEFORE CONSTRUCTION BEGINS AND WILL BE A NON-DISTURBANCE ZONE.
- LOG VANE LOCATIONS MAY BE ADJUSTED OR ELIMINATED IN THE FIELD TO ACCOUNT FOR FISH SPAWNING AREAS AND BEDROCK CONDITIONS AT THE DISCRETION OF THE ENGINEER (FIELD DIRECTED).

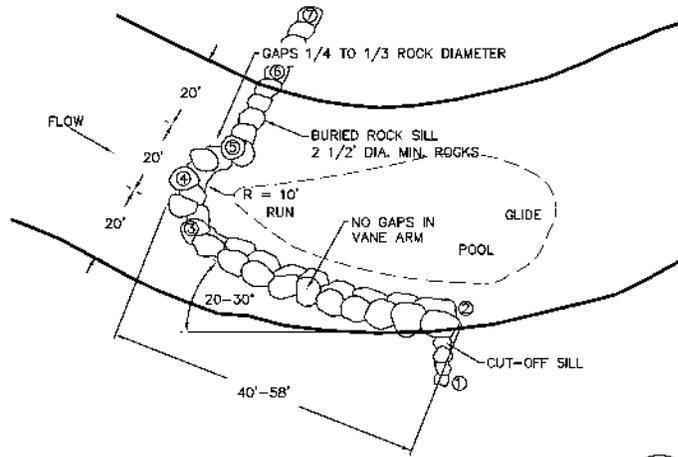


LOG VANE No.	LOG LENGTH	ANGLE FROM BANK	LOG	
			Elevation	North/East
A	15	35 Deg.	① 696062.616	1007544.651
			② 696047.665	1007593.869
B	15	30 Deg.	① 696034.726	1007566.751
			② 696019.779	1007565.488
C	15	45 Deg.	① 695993.056	1007541.788
			② 695978.206	1007543.905



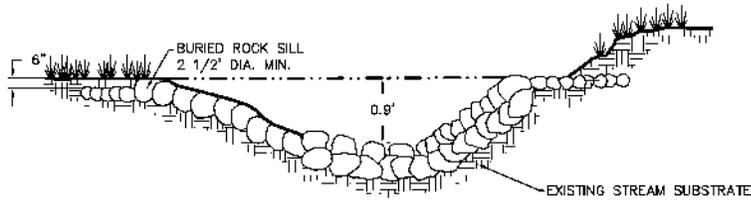


Twin Tunnels Mitigation Project Details

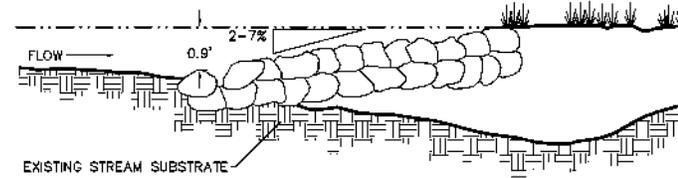


ROCK J-HOOK VANE – PLAN VIEW
N.T.S. (X XX)

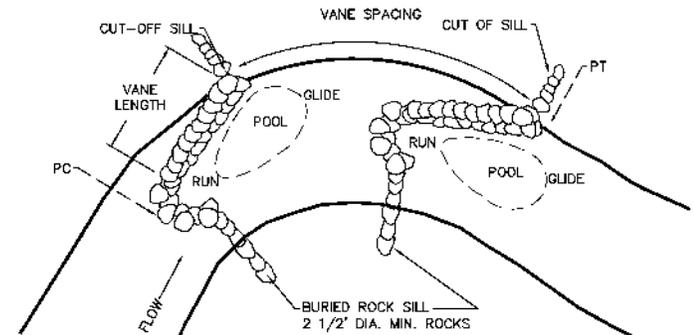
- NOTES:
1. J-HOOK POINTS 3, 4 AND 5 SHALL BE PLACED AT A RADIUS OF 10'
 2. PLACEMENT OF ROCK WILL BE FIELD DIRECTED BASE ON INDIVIDUAL ROCK CHARACTERISTICS.
 3. J-HOOK ROCKS SHALL BE 4-5' DIA. X 2-3' HEIGHT.



ROCK J-HOOK VANE – CROSS SECTION VIEW
N.T.S. (X XX)



ROCK J-HOOK VANE – PROFILE VIEW
N.T.S. (X XX)

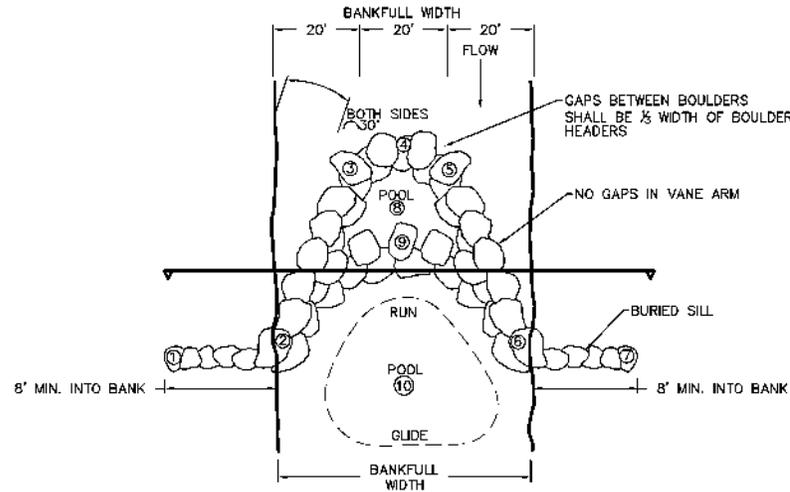


ROCK J-HOOK VANE SPACING
N.T.S. (X XX)

		J-HOOK INFORMATION								
J-HOOK No.	VANE ARM LENGTH	ANGLE FROM BANK	BOULDER 1		BOULDER 2		BOULDER 3		BOULDER 4	
			Elevation	North/East	Elevation	North/East	Elevation	North/East	Elevation	North/East
1	40	30 Degrees	7362.6	1007104.201	7362.0	1007106.018	7359.9	1007092.443	7359.4	1007097.068
			BOULDER 5		BOULDER 6		BOULDER 7			
2	40	30 Degrees	7359.9	1007106.709	7360.1	1007117.410	7360.3	1007124.709		
			BOULDER 1		BOULDER 2		BOULDER 3		BOULDER 4	
			7355.0	1007473.715	7355.0	1007470.338	7354.6	1007438.944	7354.1	1007425.903
			BOULDER 5		BOULDER 6		BOULDER 7			
			7354.6	1007426.437	7356.0	1007409.487	7358.5	1007389.967		



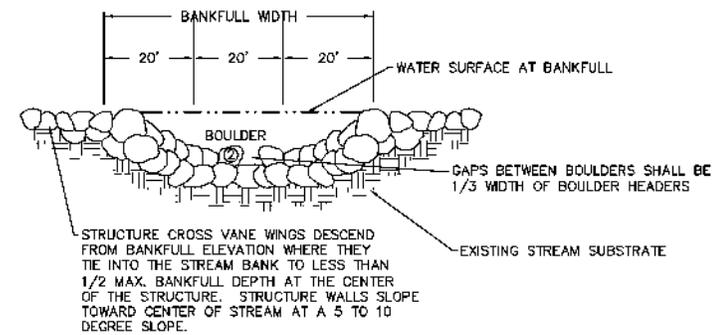
Twin Tunnels Mitigation Project Details



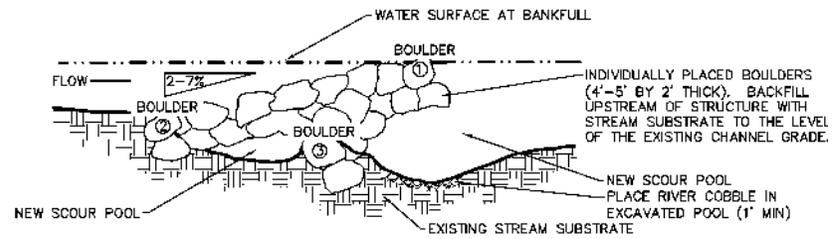
INDIVIDUALLY PLACED FOOTER ROCKS 4' TO 5' BY 2' THICK (MIN. TWO ROWS OF FOOTER ROCKS PLACED TIGHTLY TOGETHER WITH INTERSTITIAL SPACES FILLED WITH COBBLE AND GRAVEL).

CROSS VANE – PLAN VIEW
N.T.S.

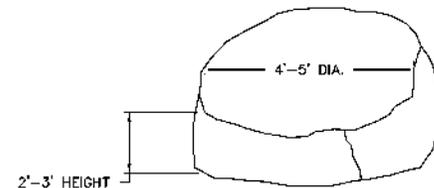
POINT	Northing	Easting	Elevation
1	695752.253	1007484.138	7349.0
2	695751.960	1007492.149	7349.0
3	695699.272	10047509.4	7348.0
4	695695.573	1007518.726	7347.9
5	695696.538	1007528.212	7348.0
6	695749.985	1007551.516	7349.0
7	695749.588	1007559.564	7349.0
8	695701.581	1007520.927	7347.0
9	695707.465	1007520.152	7347.5
10	695717.802	1007520.397	7345.0



CROSS VANE – CROSS SECTION
N.T.S.



CROSS VANE – PROFILE
N.T.S.

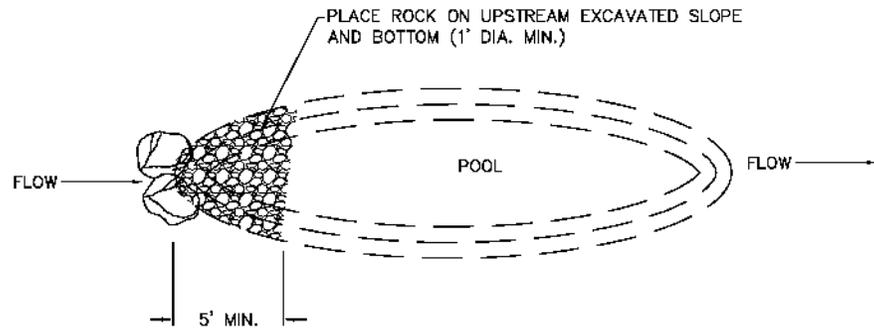


PLACEMENT OF ROCK WILL BE FIELD DIRECTED BASED ON INDIVIDUAL ROCK CHARACTERISTICS.

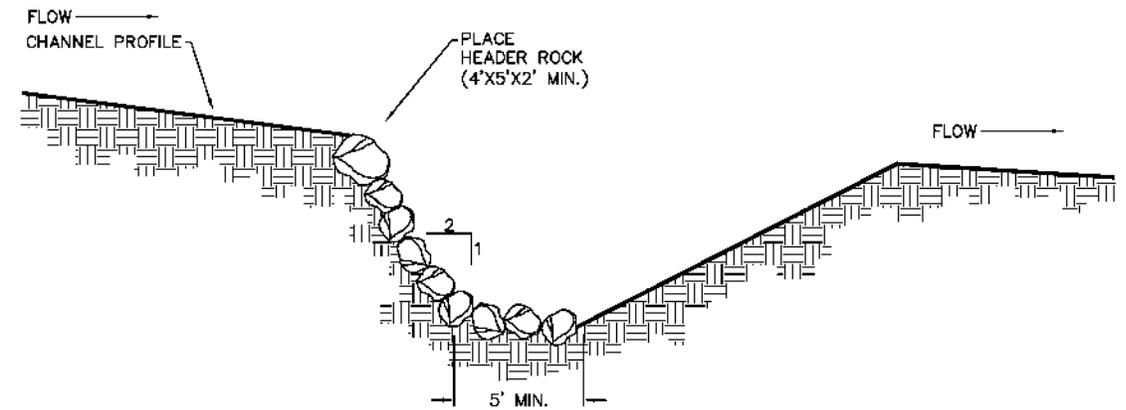
TYPICAL BOULDER HEADER/FOOTER
N.T.S.



Twin Tunnels Mitigation Project Details



TYPICAL POOL PLAN VIEW
N.T.S.



NOTE:
1. POOL ARMORING IS TO BE USED ONLY UNDER FIELD DIRECTION.

TYPICAL POOL PROFILE VIEW
N.T.S.