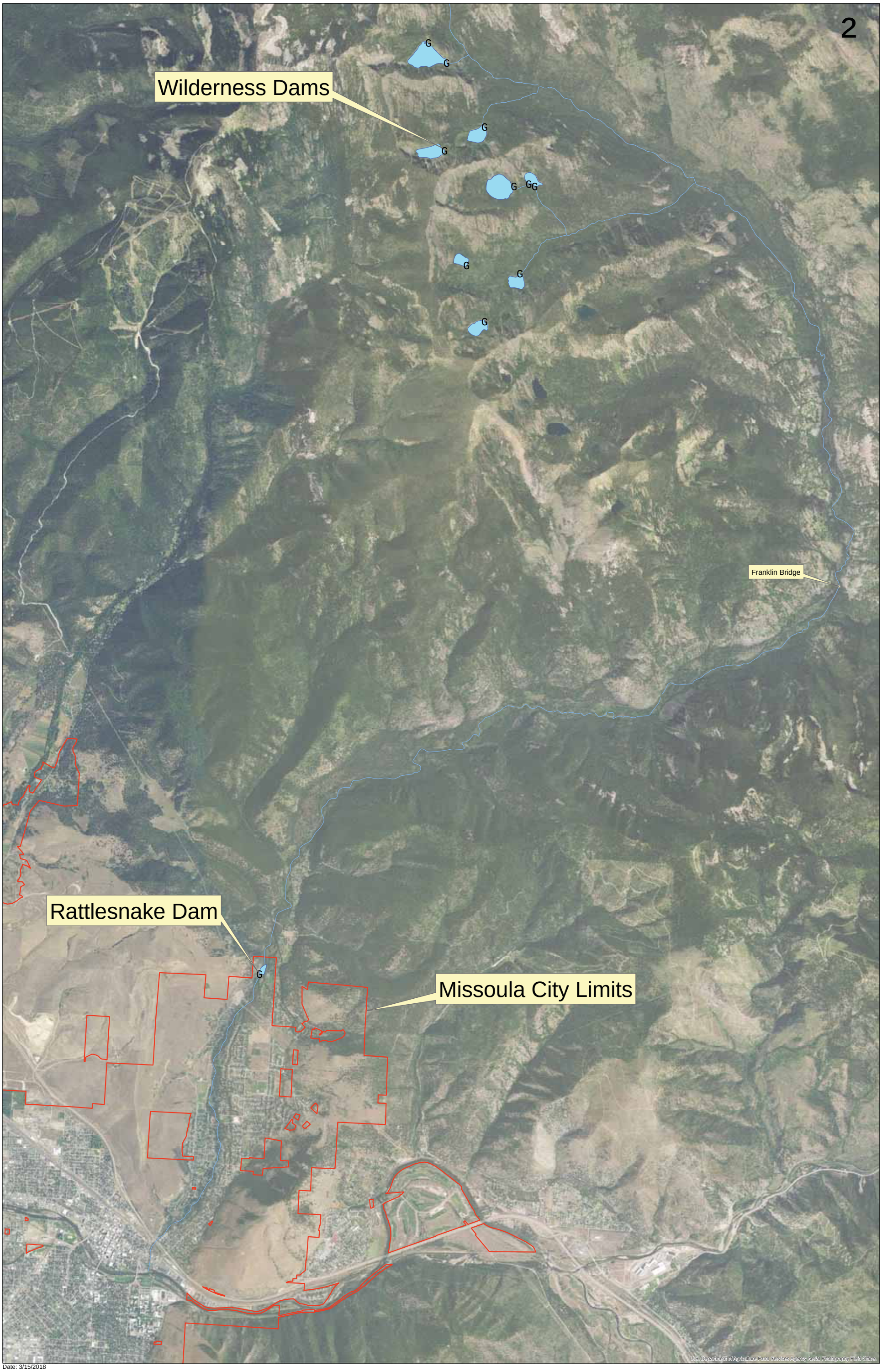
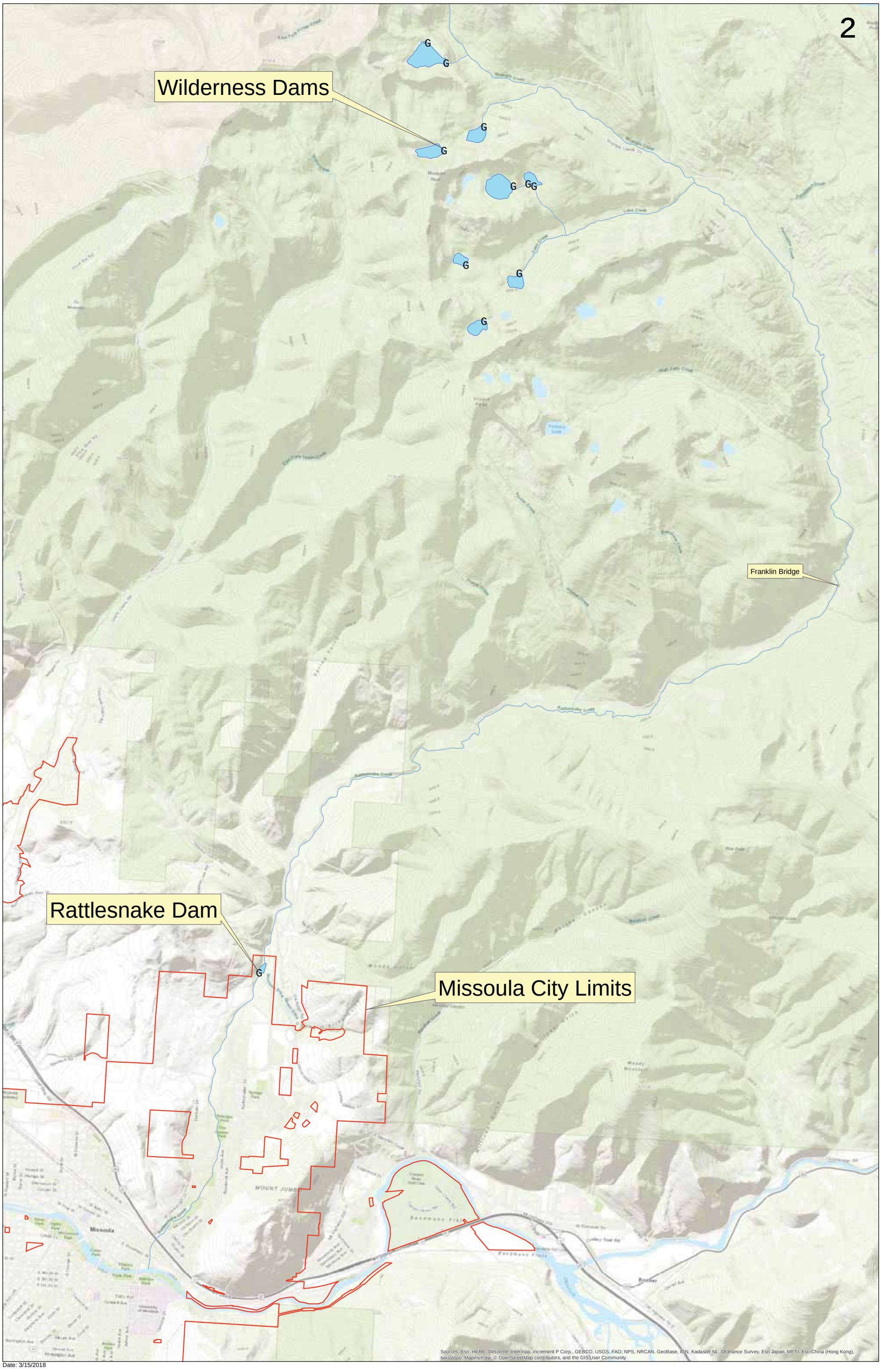
Missoula Water: Wilderness Lakes and Rattlesnake Dam Overview



Date: 3/15/2018

Missoula Water: Wilderness Lakes and Rattlesnake Dam Overview



Date: 3/15/2018

Rattlesnake Dam

History

- Original dam built around 1901
- Purpose of dam was to divert water out of streambed; it never provided any flood control or power generation
- Concrete dam and 3 million gallon settling pond constructed in 1924
- Wilderness dams were constructed from 1915-1921 to augment summertime stream flows
- Rattlesnake Creek was only water source until 1935, at which point first 3 wells were drilled
- Rattlesnake Creek continued to be primary water source until Giardia outbreak occurred in 1983; it has not been used since

Present Day

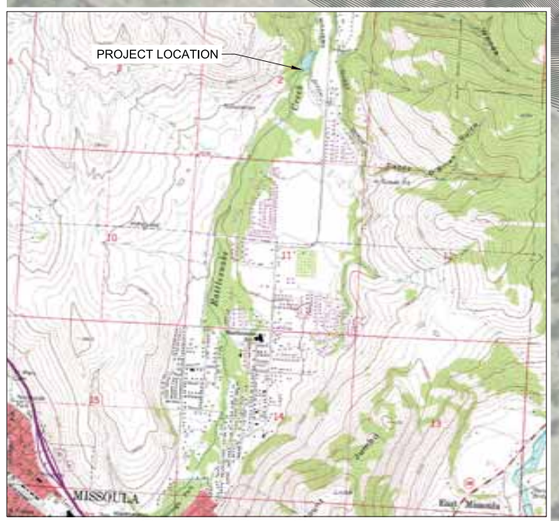
- Water rights are valuable and have been protected from threat of abandonment by a series of ongoing actions
- As the City analyzes options for the intake dam, the City is working to ensure it protects its Rattlesnake Creek water rights
- Leaving dam in place costs ~ $15k/year in ongoing maintenance
- The dam structure is highly deteriorated and either needs to be replaced or removed relatively soon; it is not an emergency
- Constructing a water treatment plant on Rattlesnake Creek is not feasible due to low flows during peak water demands

RATTLESNAKE CREEK DAM MITIGATION STUDY - EXISTING INFRASTRUCTURE

Morrison Maierle
engineers ▪ surveyors ▪ planners ▪ scientists

WILLIAMS DITCH
FEMA ZONE A SFHA (100-YR FLOODPLAIN)
DANIEL SPOON
ACCESS ROAD TO RATTLESNAKE DRIVE
RIPRAP STABILIZATION
TRAIL RUNS ALONG EAST PROPERTY LINE
PROPERTY LINE
RATTLESNAKE CREEK
CONCRETE RETAINING WALLS
BURIED TELEPHONE
CONCRETE DIVERSION & INTAKE STRUCTURE
GARAGE
SEWER LINE
RESERVOIR AREA
CITY OF MISSOULA
CABIN
FISH LADDER
TV, PHONE, ELECTRICAL HOUSE
WATER LINE
RATTLESNAKE CREEK DAM
FISH LADDER CONCRETE OUTLET STRUCTURE
SEPTIC FIELD
RECORDS SHOW 30" Ø WOOD PIPE APPROXIMATELY 11 LF UPSTREAM OF DAM FACE, DEPTH UNKNOWN
FISH LADDER STEEL BAFFLES (TYP.)
ACTIVE WELL
SCREEN HOUSES
CONCRETE PIPE TERMINAL
CONCRETE RETAINING WALLS
RATTLESNAKE CREEK
RECORDS SHOW TUNNEL FROM SCREEN HOUSE TO PIPE TERMINAL
30" Ø BURIED STEEL PIPE
RECORDS SHOW 30" Ø WOOD STAVE RUNNING SOUTH FROM PIPE TERMINAL
CHLORINE HOUSE
BURIED 30" Ø STEEL PIPE RUNS APPROXIMATELY 900 LF TO UNDERGROUND RESERVOIR (IN USE BY CITY WATER SYSTEM).
BURIED 1,000 GALLON PROPANE TANK APPROXIMATELY 8 LF EAST OF BUILDING
GENERATOR BUILDING
ACCESS ROAD TO DUNCAN DRIVE

50 25 0 50 100
SCALE IN FEET



SITE LOCATION MAP

R:\61330\01 - RATTLESNAKE\ACAD\CIVIL\EXISTING INFRASTRUCTURE PRESENTATION FIGURE.DWG PLOTTED BY DAVID A. HALLSTEN ON Mar/16/2018

Background and Introduction

- The Montana Power Company constructed the lower Rattlesnake dam in the early 1900s, along with nine other additional dams in the present day Rattlesnake Wilderness, to augment the water supply for the City of Missoula. In 1979, Montana Power Company sold the dams and water rights to Mountain Water Company. Mountain Water Company stopped using Rattlesnake Creek as the water supply for Missoula in 1983.

- In 2017 the City acquired the approximately 45 acre lower Rattlesnake dam property and water rights, along with the additional Rattlesnake Wilderness dams, through purchase of the former Mountain Water Company. Mountain Water Company is now known as Missoula Water, and is a publicly-owned utility, owned and operated for the benefit of Missoula and its residents.

- The 15 miles of creek above the dam support resident and migratory populations of native bull trout, a species listed as threatened under the federal Endangered Species Act, and native westslope cutthroat trout, a Montana species of concern.

- The importance of clean water and healthy riparian zones is articulated in numerous Missoula land use plans, including the 2015 Our Missoula City Growth Policy, 2010 Conservation Lands Management Plan, and the Missoula Urban Area Open Space Plan 2006 Update, as well as state and federal conservation priorities.

- The dam property is bounded by the City's Rattlesnake Greenway to the south and the Rattlesnake Recreation Area to the north, which combine to create an important recreational corridor between the Missoula urban area and the Rattlesnake Wilderness. The dam site has potential to significantly augment this recreation corridor and add to the recreational benefits of the area.

- Mitigating and restoring the dam site has the potential to restore habitat for native fish, improve water quality in Rattlesnake Creek and provide additional scenic open space and recreational opportunities for the Missoula community.

- Trout Unlimited has experience developing and implementing large-scale ecological restoration projects in western Montana, working with local governments to execute such projects and securing grant and other funding to support such projects.

- Montana Fish, Wildlife and Parks has experience implementing fish-passage mitigation projects at the Rattlesnake Dam and other dam sites and continues to monitor fisheries populations in Rattlesnake Creek.

- The City, MFWP and TU have formed a partnerships to work collaboratively to plan and potentially implement a mitigation and restoration project at the dam to address site restoration, fisheries, public recreation, public safety and liability.

Project Vision

The City of Missoula, Trout Unlimited and Montana Fish, Wildlife and Parks are invested in the Missoula community and the stewardship of Rattlesnake Creek resources. Since the Rattlesnake Creek Dam has been determined by the City to be inoperable and non-essential, mitigating and restoring the dam site has potential to restore habitat for native fish and terrestrial wildlife, improve water quality, reduce maintenance costs and provide scenic open space and recreational opportunities for the Missoula community.

Therefore, the City, TU and MFWP desire to work collaboratively to plan and implement a restoration project at the dam that will remove existing manmade infrastructure and fully re-naturalize the site. Following restoration of the site, the land will be managed as City public open space in conjunction with the greater Rattlesnake Greenbelt System of Conservation Lands.

Project Goals

- **Goal 1**: Minimize the City's costs of operation and maintenance of infrastructure at the dam, reservoir and intake structure, and minimize the long-term maintenance costs necessary to manage the site as public open space.

- **Goal 2**: Reduce public safety hazards and/or eliminate potential liability hazards.

- **Goal 3**: Rehabilitate stream, floodplain and hillslope processes to approximate reference or natural conditions.

- **Goal 4**: Promote upstream passage and habitat conditions that support all life stages of native fish and aquatic organisms. Incorporate habitat heterogeneity and connectivity for terrestrial wildlife on the site.

- **Goal 5**: Include future use of the site for public recreation in the project design and construction process, and where possible, incorporate design elements to help balance recreation with habitat conservation goals.

Project Assumptions

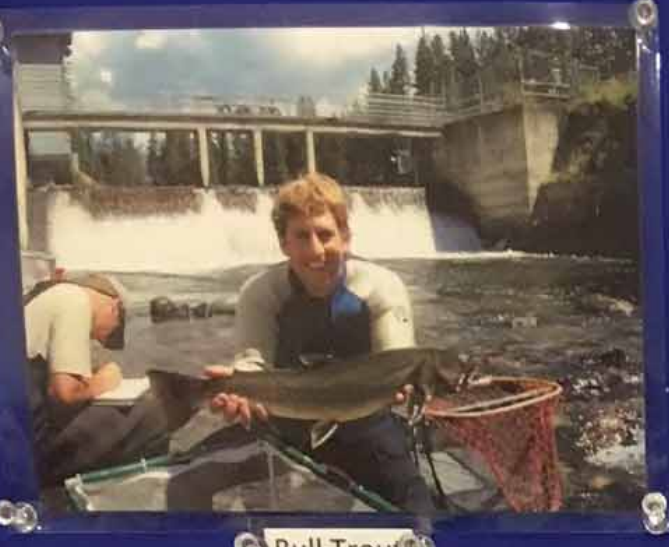
- The City of Missoula owns the water utility, the lower Rattlesnake Creek dam, and the water rights on Rattlesnake Creek.
- Enhancing safety and providing environmental and recreational benefits, while reducing long term costs, are a priority for the City and the public.
- The lower Rattlesnake Dam was not built for flood control or electricity generation
- The dam is currently inoperable as a backup water supply for the Missoula water system, and there is a current cost of at least $15,000 per year for basic maintenance and operations of the site.
- The project will be completed with safety and cost/benefit as primary criteria
- The project will not affect current rates for Missoula Water customers
- The project will not jeopardize the water rights (approx. 50 cfs) on Rattlesnake Creek held by the City of Missoula/Missoula Water
- The project will be implemented using the best available science, engineering/technology available, and public input.

Photos of the Project Site

Project Timeline

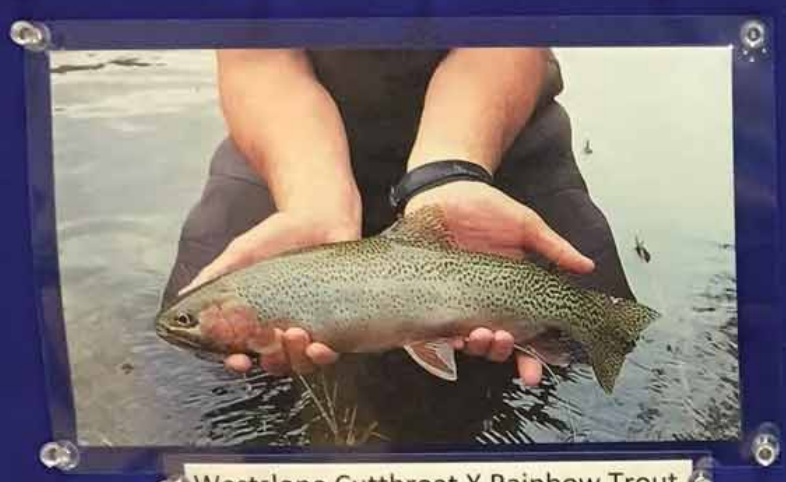
Activity	Timeframe
Conceptual Design Alternatives	Winter 2018
Public Scoping and Review	Spring 2018
Preliminary Design	Spring/Summer 2018
Further Data Collection	Summer 2018
Fundraising and Project Planning	Spring/Fall 2018
Planning and Permitting	Winter 2019
Final Design and Bid Documents	Spring 2019
Site Preparation and Construction Phase I	Summer/Fall 2019
Construction Phase II and Site Closure	Summer/Fall 2020
Revegetation and Recreation Enhancement	Summer/Fall 2021
Project Monitoring	2021-2025

Rattlesnake Creek Fishery

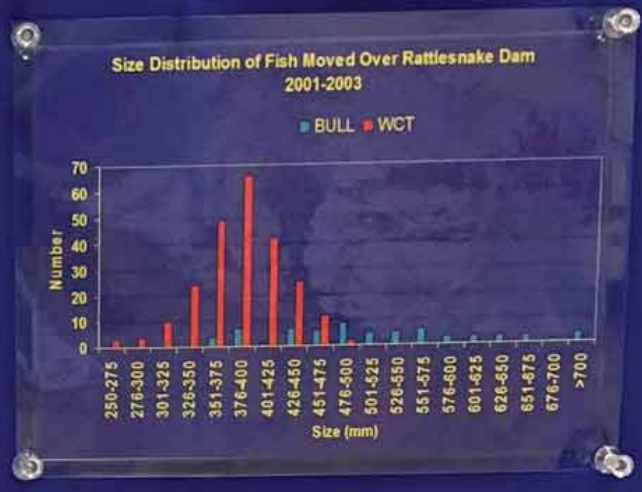


Bull Trout

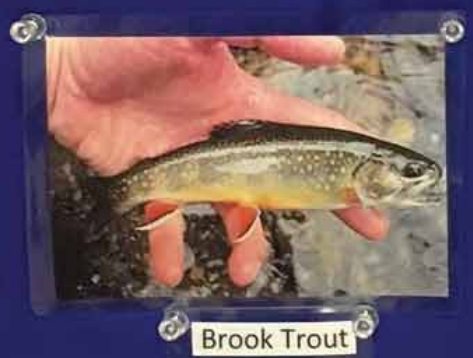
Westslope Cutthroat Trout



Westslope Cutthroat X Rainbow Trout



Brown Trout

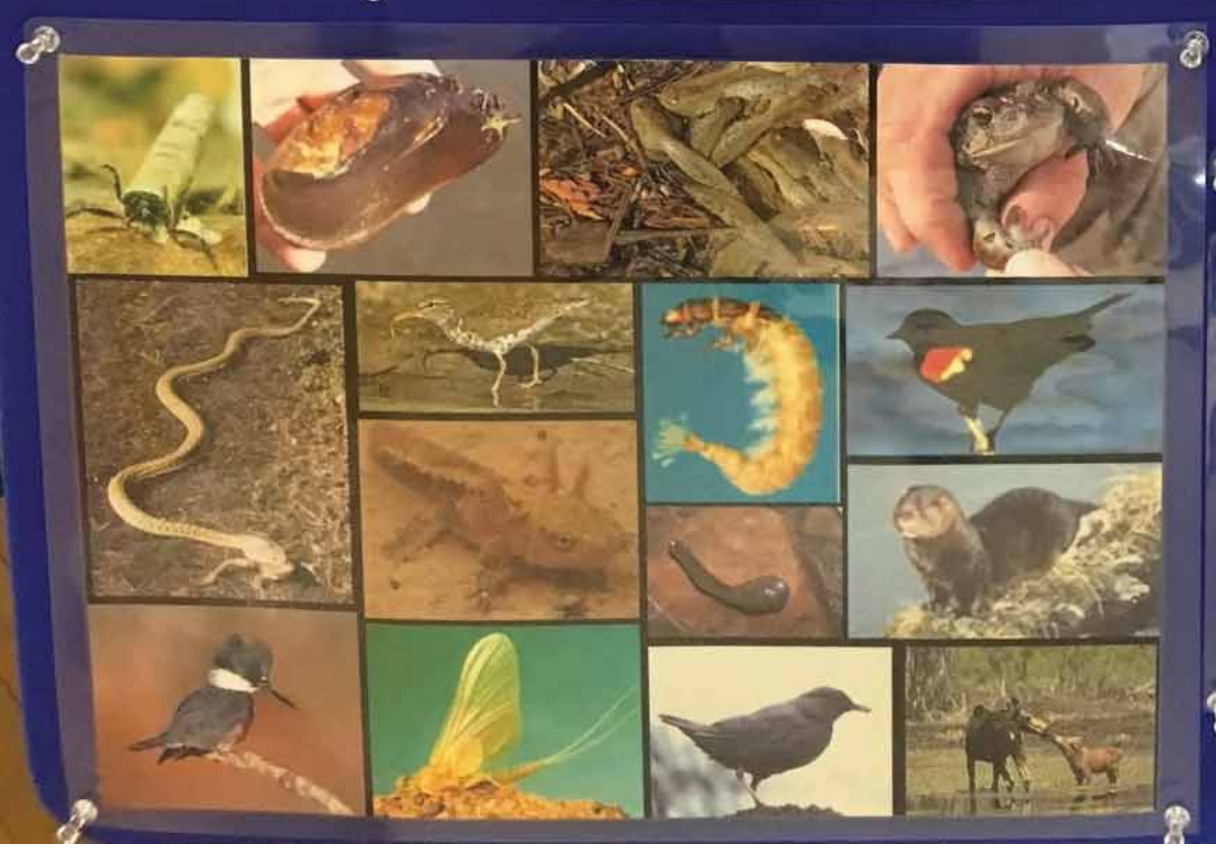


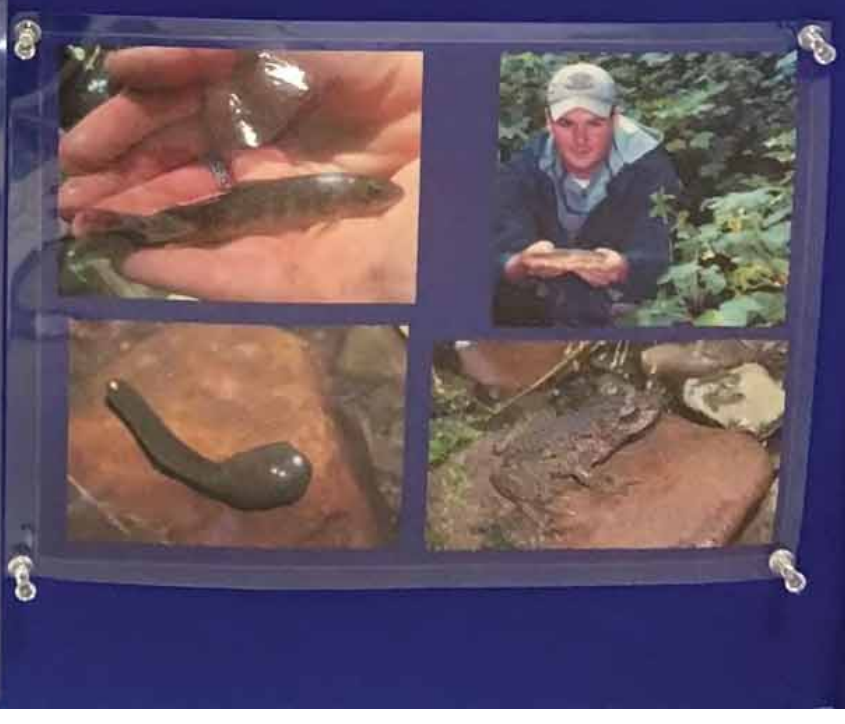
Brook Trout

Mountain Whitefish

Columbia Slimy Sculpin

High Species Diversity in Stream and Riparian Areas



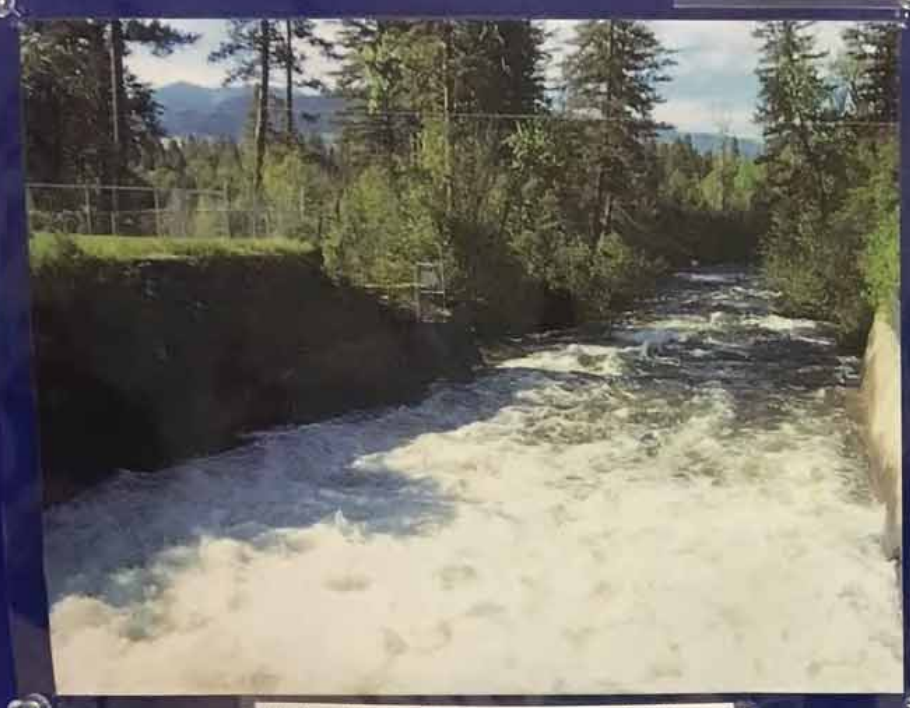


Rattlesnake Creek and Missoula Water Company Dam

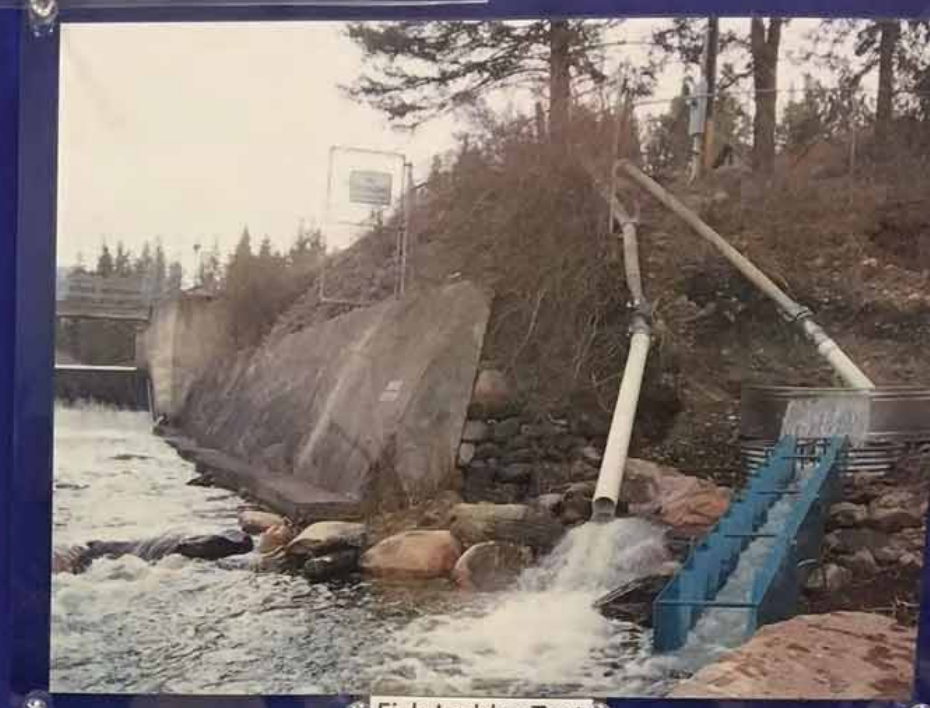
Fisheries Assessment and Upstream Fish Passage

Ladd Knotek and Caleb Uerling, Montana Fish Wildlife & Parks

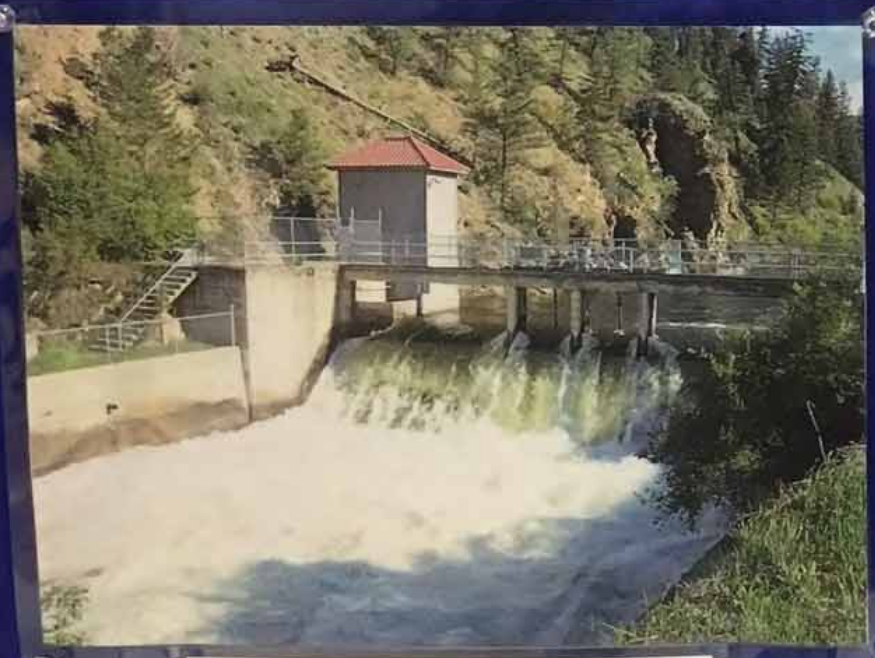
Rattlesnake Creek Fish Passage



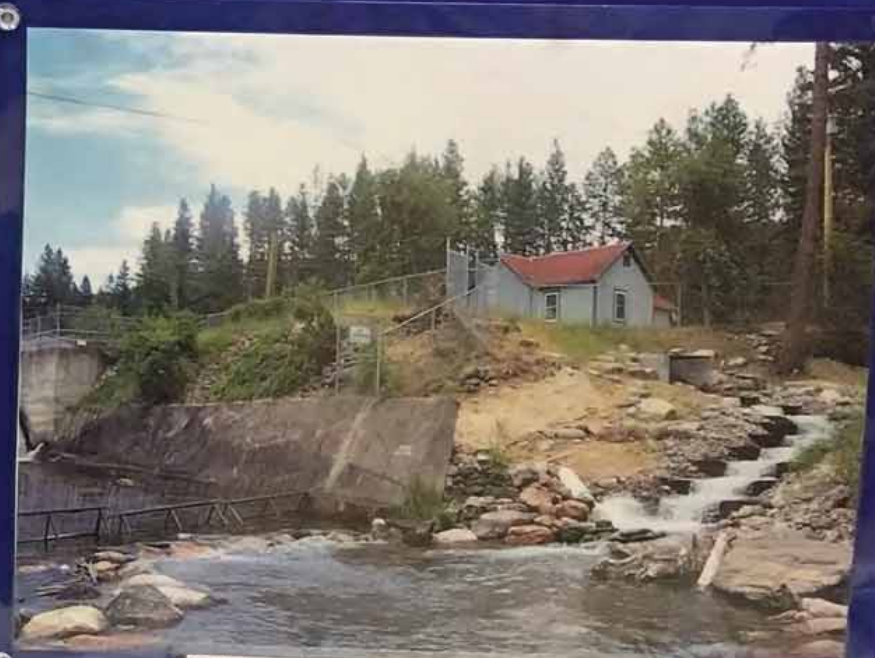
Hydraulics Below Dam at High Water



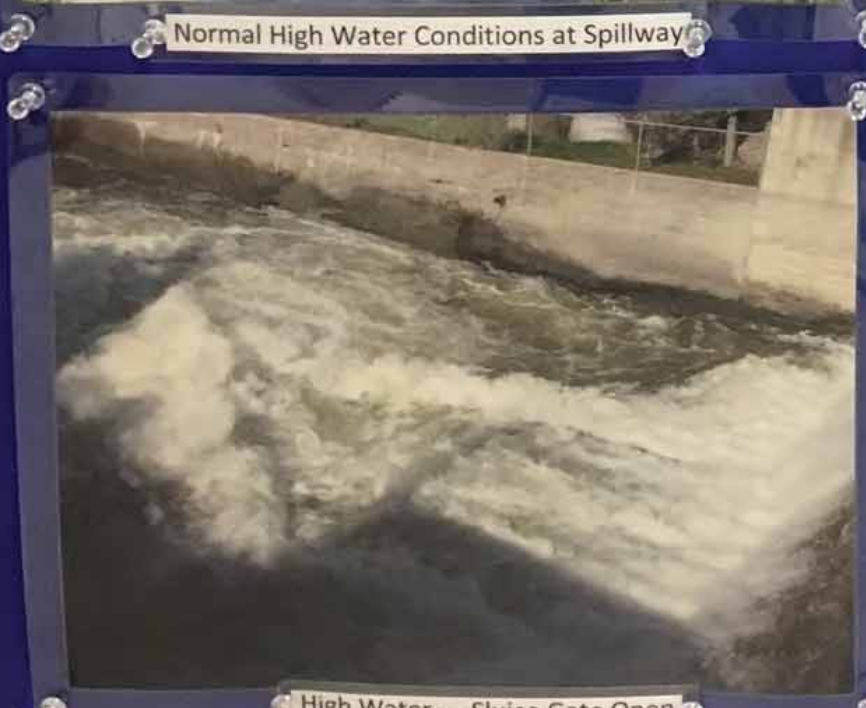
Fish Ladder Test



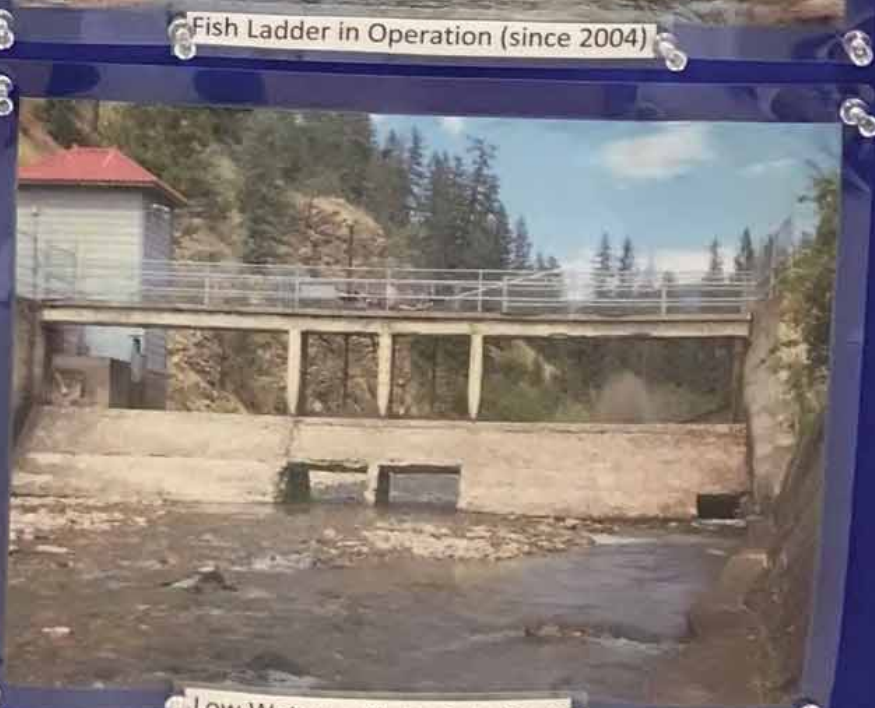
Normal High Water Conditions at Spillway



Fish Ladder in Operation (since 2004)

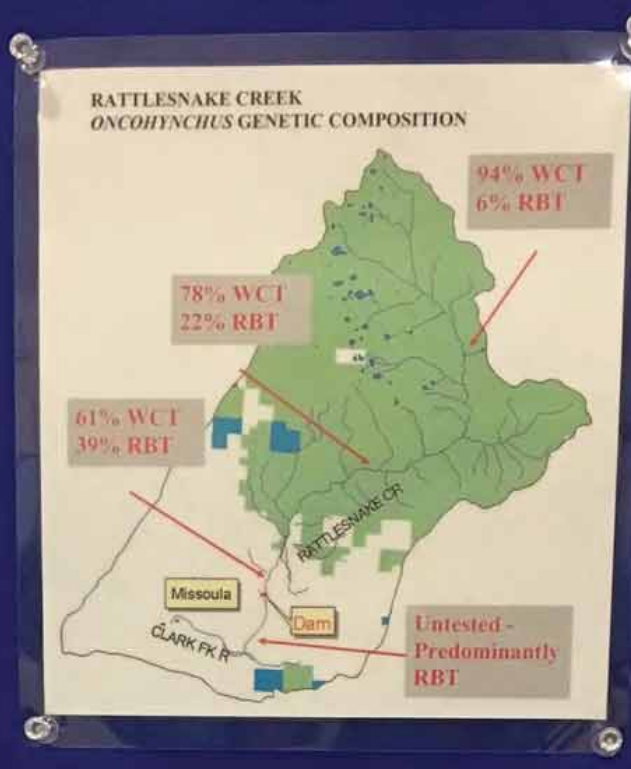


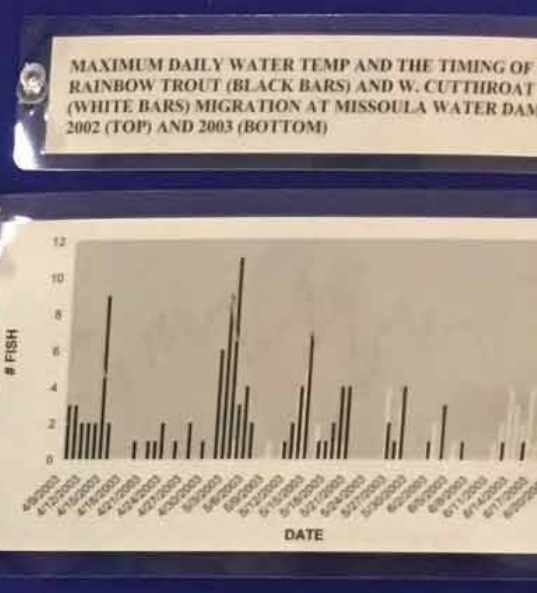
High Water — Sluice Gate Open

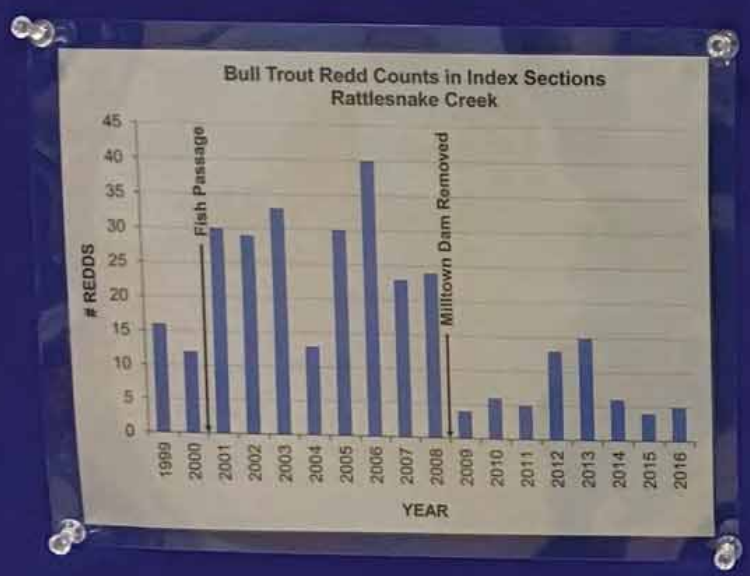


Low Water — Sluice Gate Open

Addressing Fisheries Limitations at Rattlesnake Dam







COMPARISON OF FISH SPECIES COMPOSITION ABOVE AND BELOW MISSOULA WATER DAM

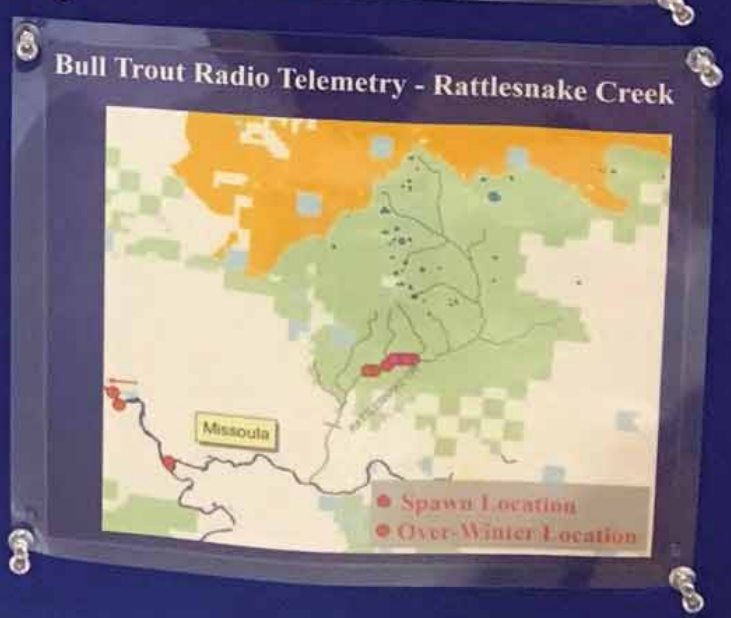
Species	Native/ Introduced	Found Upstream of MWC Dam?	Found Downstream of MWC Dam?
Brook Trout	Introduced	Yes	Yes
Brown Trout	Introduced	Yes[1]	Yes
Bull Trout	Native	Yes	Yes
Mountain Whitefish	Native	Yes	Yes
Rainbow Trout	Introduced	Yes	Yes
Sculpin spp.	Native	Yes	Yes
Westslope Cutthroat Trout	Native	Yes	Yes
Yellowstone Cutthroat Trout	Introduced	Yes[2]	Yes

[1] No brown trout were detected or reported upstream of MWC Dam prior to 1999
[2] Yellowstone cutthroat trout genes (0.1%) were detected in 1986, but not in 2001

SUMMARY OF ADULT SALMONIDS CAPTURED AFTER ASCNDING RATTLESNAKE FISH LADDER IN 2003

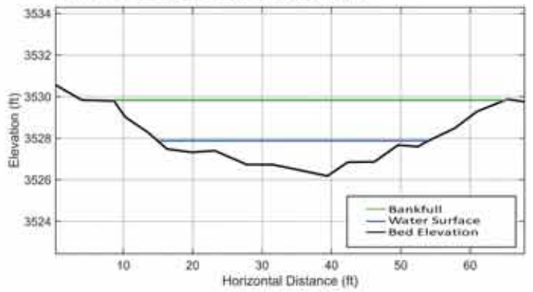
Species	Adults Captured	Period of Capture	Size Range
Rainbow Trout	84	Apr 19 – Jun 19	279-508 mm
W. Cutthroat Trout	63	Apr 19 – Jun 18	296-462 mm
Cutthroat X Rainbow	56	Apr 22 – Jun 21	260-490 mm
Bull Trout	13	Jun 30 - Aug 4	377-653 mm
Brown Trout	1	May 15	380 mm
Mountain Whitefish	0	-	-
Brook Trout	0	-	-

Rattlesnake Creek Bull Trout and Cutthroat Trout Telemetry

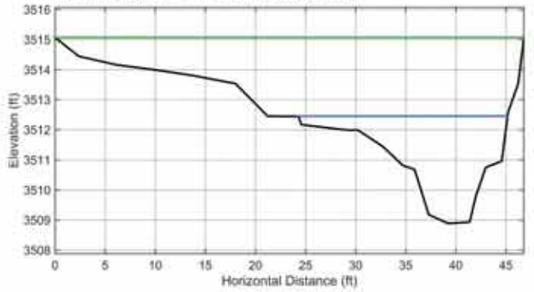


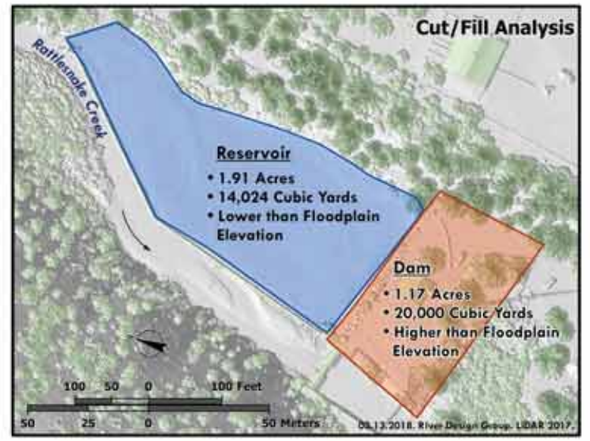
RATTLESNAKE CREEK DAM MITIGATION STUDY - DATA COLLECTION AND ASSESSMENT SUMMARY

Cross Section 2 - Riffle Habitat Unit



Cross Section 5 - Pool Habitat Unit





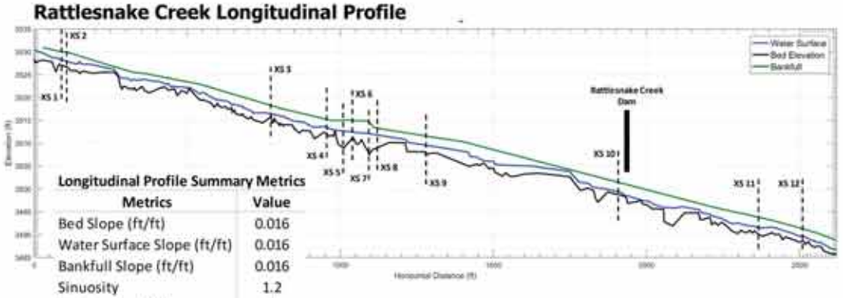
Cross-Section Data Summary

Metric	XS 2 Riffle	XS 5 Pool
Bankfull Width (ft)	56.2	46.6
Mean Depth (ft)	2.2	2.5
Max Depth (ft)	3.6	6.1
Bankfull Area (ft^2)	125.6	117.4
Width/Depth Ratio	25.1	18.3

Pebble Count Summary

Dx	Size Class	Average (mm) n=4
16	coarse gravel	25
35	very coarse gravel	52
50	small cobble	73
65	small cobble	95
84	large cobble	133
95	lare cobble	190

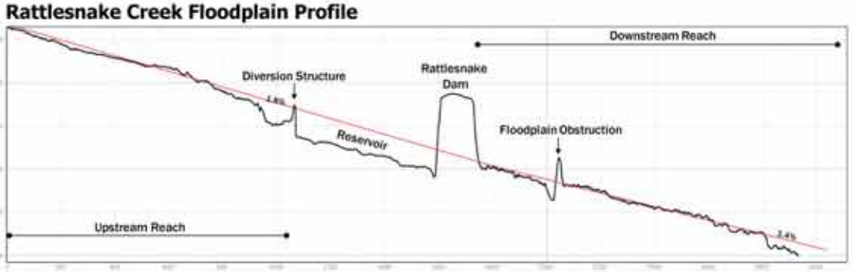
Rattlesnake Creek Longitudinal Profile

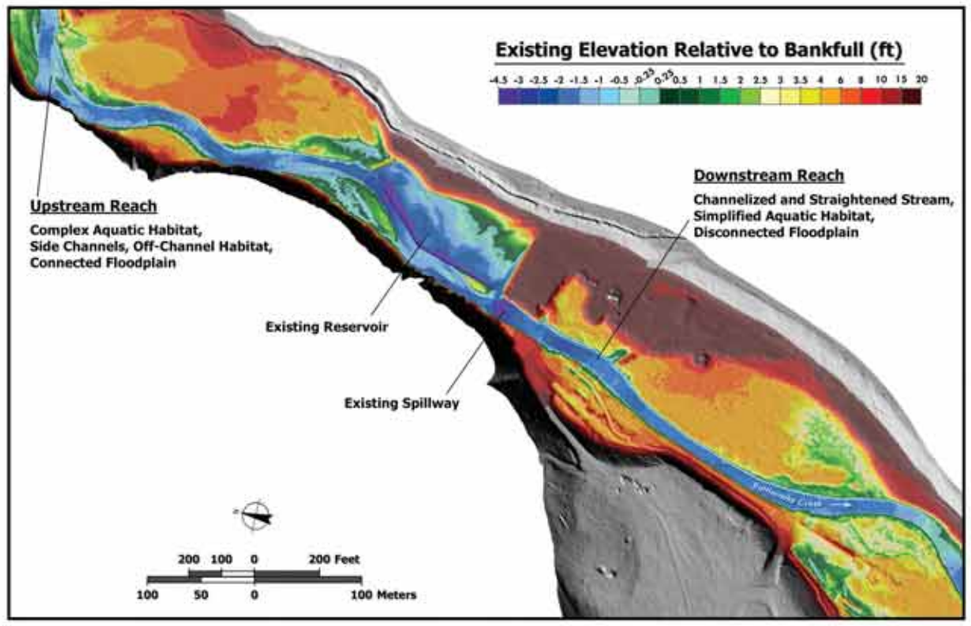


Longitudinal Profile Summary Metrics

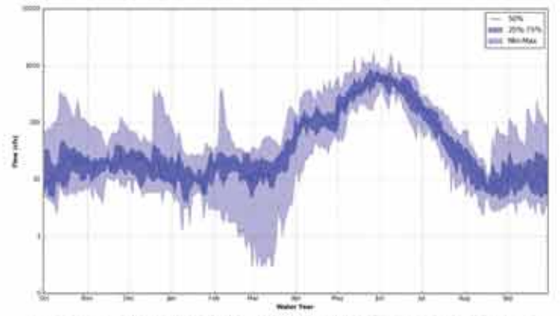
Metrics	Value
Bed Slope (ft/ft)	0.016
Water Surface Slope (ft/ft)	0.016
Bankfull Slope (ft/ft)	0.016
Sinuosity	1.2
Pool Spacing (ft)	75

Rattlesnake Creek Floodplain Profile





Rattlesnake Creek Hydrograph



Mean annual hydrograph for Rattlesnake Creek (solid blue line). The range of minimum and maximum values are shaded in light blue and the inner quartile (25th to 75th percentiles of the mean) are shown in darker blue.

Preliminary flood frequency analysis results (cfs).

Annual Chance (Percent)	Return Interval (Years)	FEMA Flood Insurance Study	USGS Regional Regression Equations	USGS Bulletin 17C Methods
66.7	L.5 (bankfull)		600	499
20	5		977	1097
10	10	1905	1210	1462
4	25		1430	2001
2	50	2690	1620	2462
1	100	3000	1800	2977

RATTLESNAKE CREEK DAM MITIGATION STUDY - COMPLETED ACTIVITIES

PLANNING

MEMORANDUM OF AGREEMENT BETWEEN CITY OF MISSOULA, TROUT UNLIMITED AND MONTANA FISH, WILDLIFE AND PARKS

RETAINED TECHNICAL SERVICES OF RIVER DESIGN GROUP, INC. AND MORRISON-MAIERLE INC. THROUGH COMPETITIVE PROCUREMENT

UAS (DRONE) AERIAL IMAGERY

PRELIMINARY WATER RIGHTS ANALYSIS

INSTALLED REAL-TIME STREAMFLOW GAGE IN GREENOUGH PARK

COLLECTED SHRUB AND TREE SEEDS ON RATTLESNAKE CREEK TO GROW OUT AT PARKS AND RECREATION NURSERY

COMPLETED DRAFT SITE ASSESSMENT AND CONCEPTUAL DESIGN REPORT

DATA COLLECTION

TOPOGRAPHIC SURVEY USING LIDAR (LIGHT DETECTION AND RANGING)

LIDAR ANALYSIS AND MAPPING

INFRASTRUCTURE SURVEY AND MAPPING OF
- BUILDINGS
- UTILITIES
- DAM AND RESERVOIR

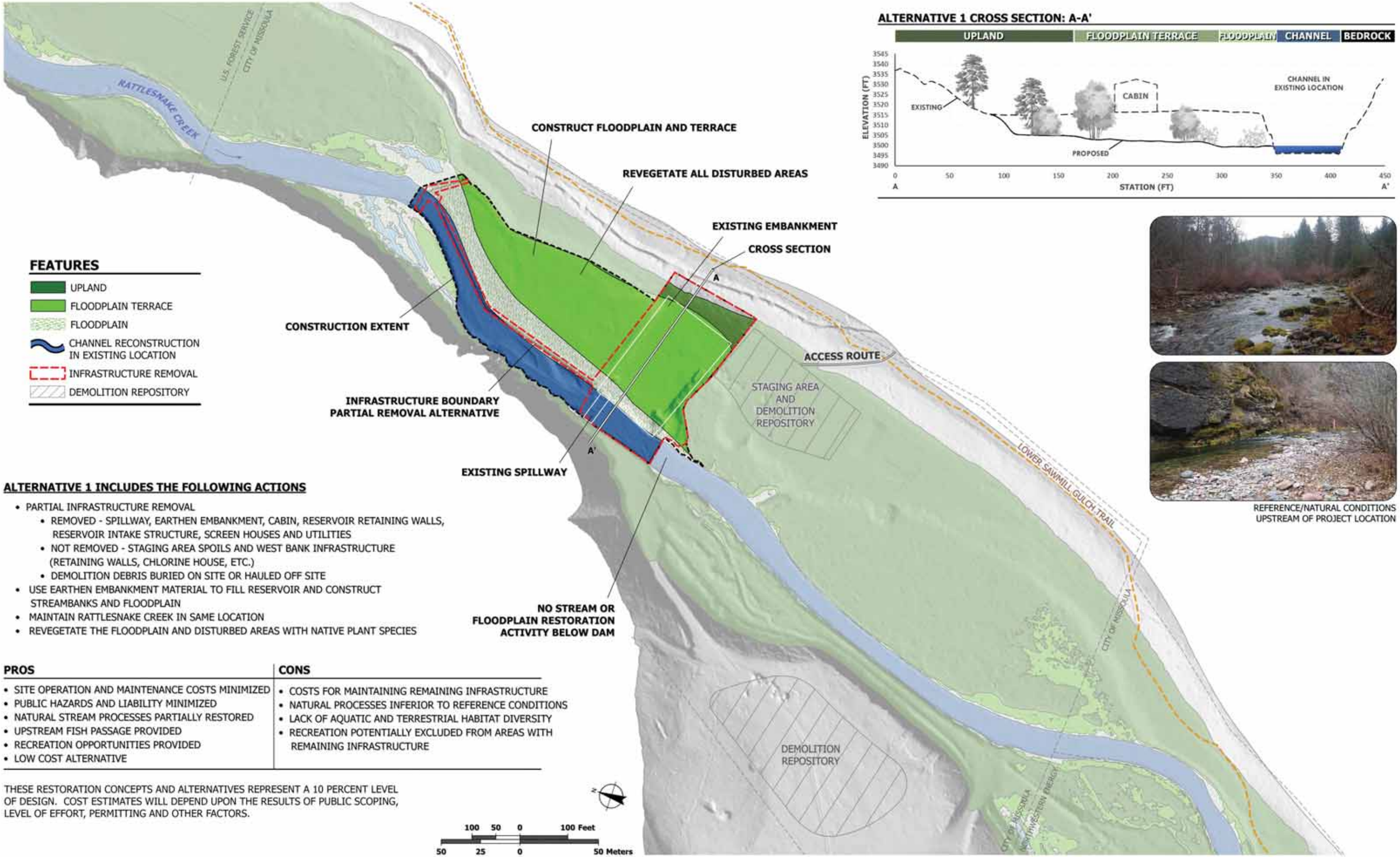
GEOMORPHIC ASSESSMENT
- LONGITUDINAL PROFILE SURVEY
- CROSS-SECTION SURVEYS
- STREAM SUBSTRATE SURVEY (PEBBLE COUNT)

HYDROLOGIC ANALYSIS
- BANKFULL ESTIMATE
- PEAK FLOW ANALYSIS

CONCEPTUAL EARTHWORK (CUT VS. FILL) ANALYSIS

RATTLESNAKE CREEK DAM MITIGATION STUDY - DRAFT RESTORATION ALTERNATIVE 1

Conceptual Design -Not For Construction-



ALTERNATIVE 1 CROSS SECTION: A-A'

REFERENCE/NATURAL CONDITIONS
UPSTREAM OF PROJECT LOCATION

ALTERNATIVE 1 INCLUDES THE FOLLOWING ACTIONS

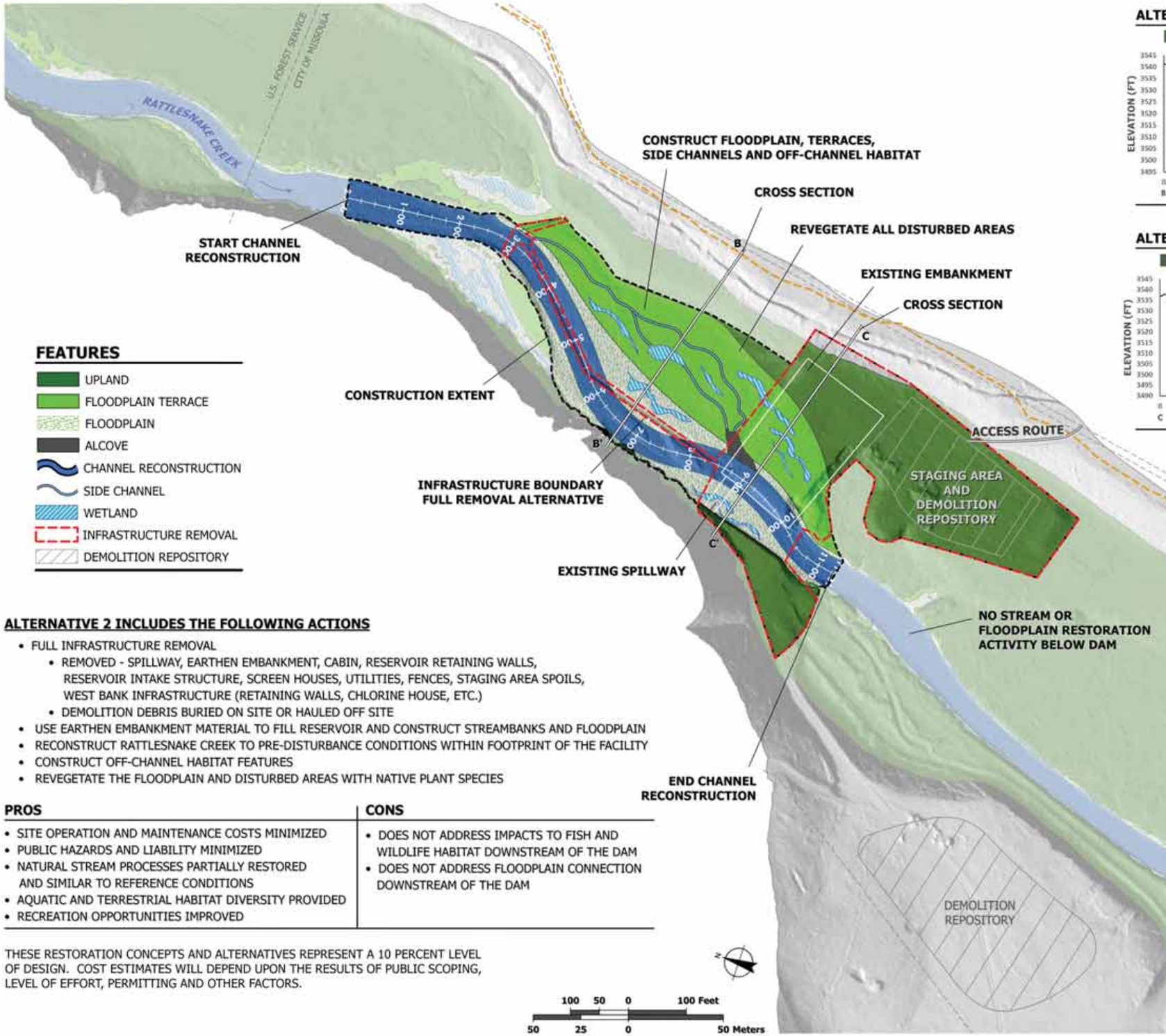
- PARTIAL INFRASTRUCTURE REMOVAL
  - REMOVED - SPILLWAY, EARTHEN EMBANKMENT, CABIN, RESERVOIR RETAINING WALLS, RESERVOIR INTAKE STRUCTURE, SCREEN HOUSES AND UTILITIES
  - NOT REMOVED - STAGING AREA SPOILS AND WEST BANK INFRASTRUCTURE (RETAINING WALLS, CHLORINE HOUSE, ETC.)
  - DEMOLITION DEBRIS BURIED ON SITE OR HAULED OFF SITE
- USE EARTHEN EMBANKMENT MATERIAL TO FILL RESERVOIR AND CONSTRUCT STREAMBANKS AND FLOODPLAIN
- MAINTAIN RATTLESNAKE CREEK IN SAME LOCATION
- REVEGETATE THE FLOODPLAIN AND DISTURBED AREAS WITH NATIVE PLANT SPECIES

PROS	CONS
• SITE OPERATION AND MAINTENANCE COSTS MINIMIZED	• COSTS FOR MAINTAINING REMAINING INFRASTRUCTURE
• PUBLIC HAZARDS AND LIABILITY MINIMIZED	• NATURAL PROCESSES INFERIOR TO REFERENCE CONDITIONS
• NATURAL STREAM PROCESSES PARTIALLY RESTORED	• LACK OF AQUATIC AND TERRESTRIAL HABITAT DIVERSITY
• UPSTREAM FISH PASSAGE PROVIDED	• RECREATION POTENTIALLY EXCLUDED FROM AREAS WITH REMAINING INFRASTRUCTURE
• RECREATION OPPORTUNITIES PROVIDED	
• LOW COST ALTERNATIVE	

THESE RESTORATION CONCEPTS AND ALTERNATIVES REPRESENT A 10 PERCENT LEVEL OF DESIGN. COST ESTIMATES WILL DEPEND UPON THE RESULTS OF PUBLIC SCOPING, LEVEL OF EFFORT, PERMITTING AND OTHER FACTORS.

RATTLESNAKE CREEK DAM MITIGATION STUDY - DRAFT RESTORATION ALTERNATIVE 2

Conceptual Design -Not For Construction-



FEATURES

- UPLAND
- FLOODPLAIN TERRACE
- FLOODPLAIN
- ALCOVE
- CHANNEL RECONSTRUCTION
- SIDE CHANNEL
- WETLAND
- INFRASTRUCTURE REMOVAL
- DEMOLITION REPOSITORY

ALTERNATIVE 2 INCLUDES THE FOLLOWING ACTIONS

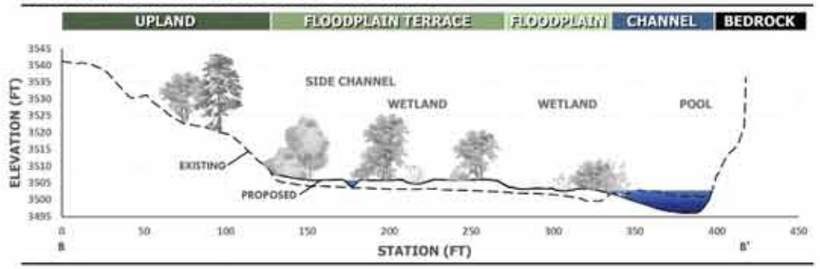
- FULL INFRASTRUCTURE REMOVAL
  - REMOVED - SPILLWAY, EARTHEN EMBANKMENT, CABIN, RESERVOIR RETAINING WALLS, RESERVOIR INTAKE STRUCTURE, SCREEN HOUSES, UTILITIES, FENCES, STAGING AREA SPOILS, WEST BANK INFRASTRUCTURE (RETAINING WALLS, CHLORINE HOUSE, ETC.)
  - DEMOLITION DEBRIS BURIED ON SITE OR HAULED OFF SITE
- USE EARTHEN EMBANKMENT MATERIAL TO FILL RESERVOIR AND CONSTRUCT STREAMBANKS AND FLOODPLAIN
- RECONSTRUCT RATTLESNAKE CREEK TO PRE-DISTURBANCE CONDITIONS WITHIN FOOTPRINT OF THE FACILITY
- CONSTRUCT OFF-CHANNEL HABITAT FEATURES
- REVEGETATE THE FLOODPLAIN AND DISTURBED AREAS WITH NATIVE PLANT SPECIES

PROS	CONS
• SITE OPERATION AND MAINTENANCE COSTS MINIMIZED • PUBLIC HAZARDS AND LIABILITY MINIMIZED • NATURAL STREAM PROCESSES PARTIALLY RESTORED AND SIMILAR TO REFERENCE CONDITIONS • AQUATIC AND TERRESTRIAL HABITAT DIVERSITY PROVIDED • RECREATION OPPORTUNITIES IMPROVED	• DOES NOT ADDRESS IMPACTS TO FISH AND WILDLIFE HABITAT DOWNSTREAM OF THE DAM • DOES NOT ADDRESS FLOODPLAIN CONNECTION DOWNSTREAM OF THE DAM

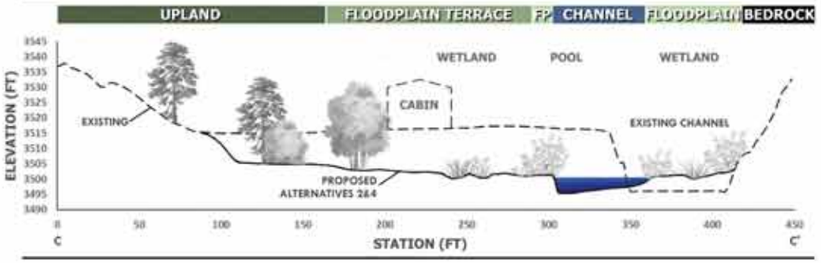
THESE RESTORATION CONCEPTS AND ALTERNATIVES REPRESENT A 10 PERCENT LEVEL OF DESIGN. COST ESTIMATES WILL DEPEND UPON THE RESULTS OF PUBLIC SCOPING, LEVEL OF EFFORT, PERMITTING AND OTHER FACTORS.

100 50 0 100 Feet
50 25 0 50 Meters

ALTERNATIVES 2 & 4 CROSS SECTION: B-B'



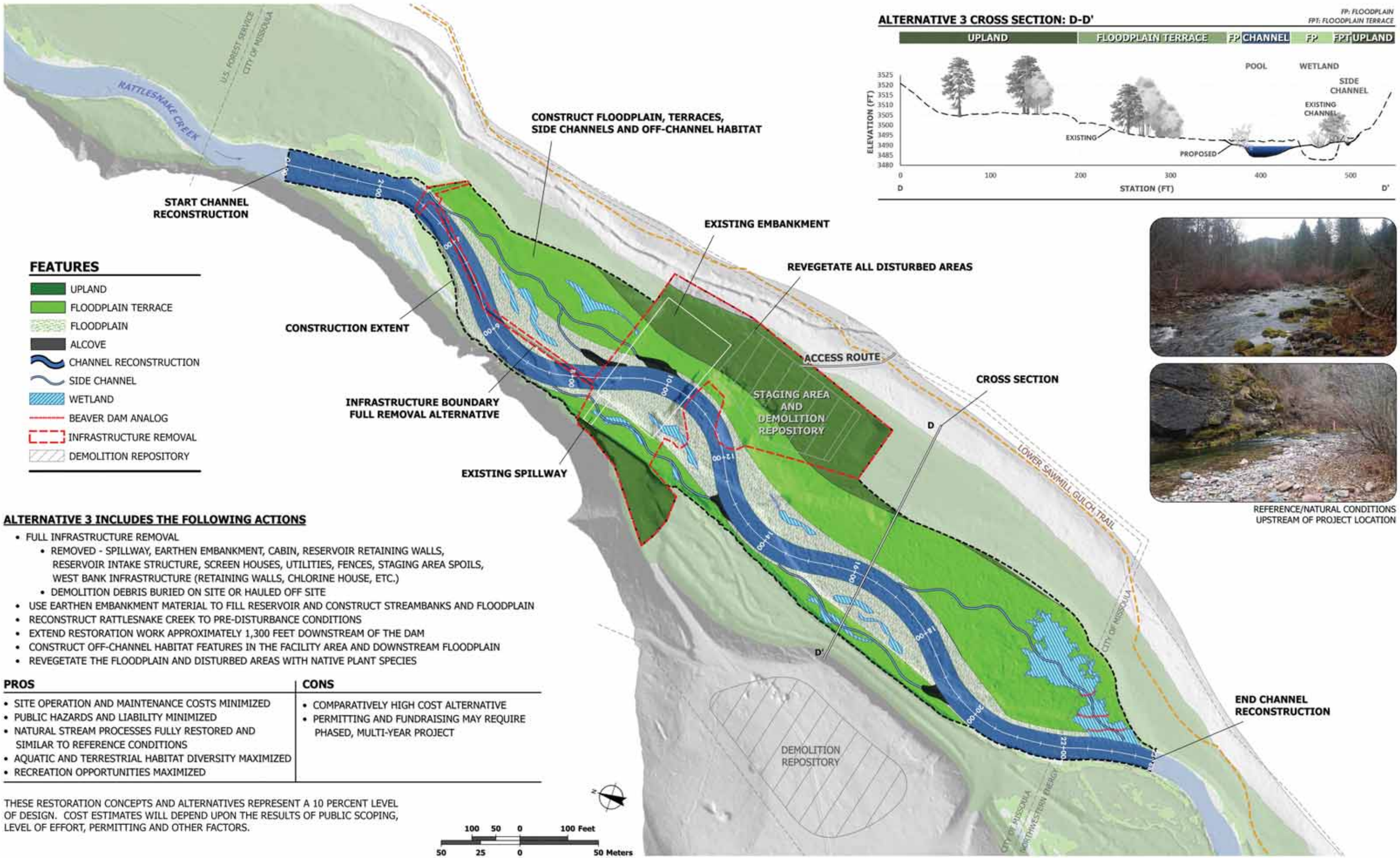
ALTERNATIVES 2 & 4 CROSS SECTION: C-C'



REFERENCE/NATURAL CONDITIONS UPSTREAM OF PROJECT LOCATION

RATTLESNAKE CREEK DAM MITIGATION STUDY - DRAFT RESTORATION ALTERNATIVE 3

Conceptual Design -Not For Construction-



FEATURES

- UPLAND
- FLOODPLAIN TERRACE
- FLOODPLAIN
- ALCOVE
- CHANNEL RECONSTRUCTION
- SIDE CHANNEL
- WETLAND
- BEAVER DAM ANALOG
- INFRASTRUCTURE REMOVAL
- DEMOLITION REPOSITORY

ALTERNATIVE 3 CROSS SECTION: D-D'

FP: FLOODPLAIN
FPT: FLOODPLAIN TERRACE

REFERENCE/NATURAL CONDITIONS UPSTREAM OF PROJECT LOCATION

ALTERNATIVE 3 INCLUDES THE FOLLOWING ACTIONS

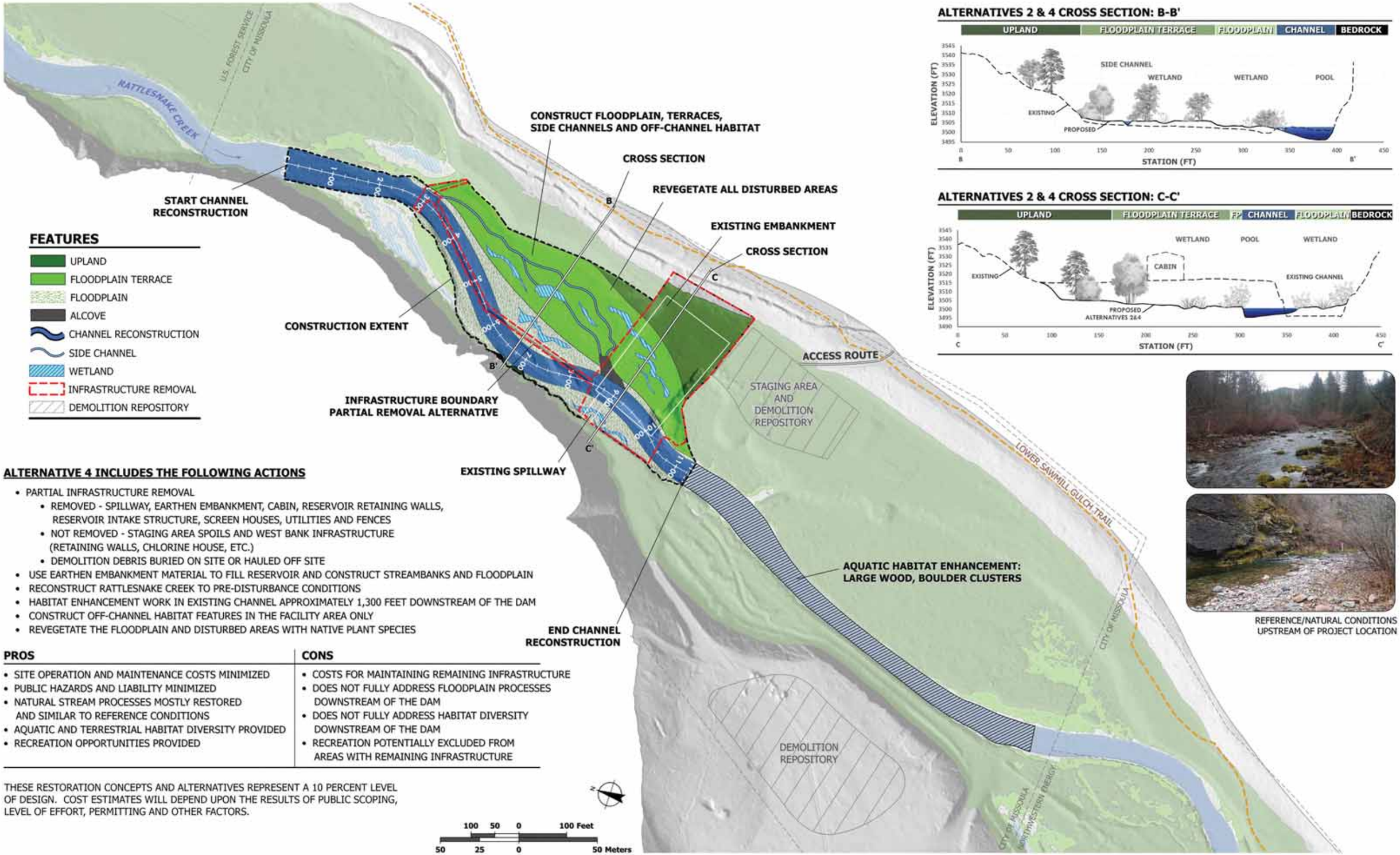
- FULL INFRASTRUCTURE REMOVAL
  - REMOVED - SPILLWAY, EARTHEN EMBANKMENT, CABIN, RESERVOIR RETAINING WALLS, RESERVOIR INTAKE STRUCTURE, SCREEN HOUSES, UTILITIES, FENCES, STAGING AREA SPOILS, WEST BANK INFRASTRUCTURE (RETAINING WALLS, CHLORINE HOUSE, ETC.)
  - DEMOLITION DEBRIS BURIED ON SITE OR HAULED OFF SITE
- USE EARTHEN EMBANKMENT MATERIAL TO FILL RESERVOIR AND CONSTRUCT STREAMBANKS AND FLOODPLAIN
- RECONSTRUCT RATTLESNAKE CREEK TO PRE-DISTURBANCE CONDITIONS
- EXTEND RESTORATION WORK APPROXIMATELY 1,300 FEET DOWNSTREAM OF THE DAM
- CONSTRUCT OFF-CHANNEL HABITAT FEATURES IN THE FACILITY AREA AND DOWNSTREAM FLOODPLAIN
- REVEGETATE THE FLOODPLAIN AND DISTURBED AREAS WITH NATIVE PLANT SPECIES

PROS	CONS
• SITE OPERATION AND MAINTENANCE COSTS MINIMIZED • PUBLIC HAZARDS AND LIABILITY MINIMIZED • NATURAL STREAM PROCESSES FULLY RESTORED AND SIMILAR TO REFERENCE CONDITIONS • AQUATIC AND TERRESTRIAL HABITAT DIVERSITY MAXIMIZED • RECREATION OPPORTUNITIES MAXIMIZED	• COMPARATIVELY HIGH COST ALTERNATIVE • PERMITTING AND FUNDRAISING MAY REQUIRE PHASED, MULTI-YEAR PROJECT

THESE RESTORATION CONCEPTS AND ALTERNATIVES REPRESENT A 10 PERCENT LEVEL OF DESIGN. COST ESTIMATES WILL DEPEND UPON THE RESULTS OF PUBLIC SCOPING, LEVEL OF EFFORT, PERMITTING AND OTHER FACTORS.

RATTLESNAKE CREEK DAM MITIGATION STUDY - DRAFT RESTORATION ALTERNATIVE 4

Conceptual Design -Not For Construction-



FEATURES

- UPLAND
- FLOODPLAIN TERRACE
- FLOODPLAIN
- ALCOVE
- CHANNEL RECONSTRUCTION
- SIDE CHANNEL
- WETLAND
- INFRASTRUCTURE REMOVAL
- DEMOLITION REPOSITORY

ALTERNATIVE 4 INCLUDES THE FOLLOWING ACTIONS

- PARTIAL INFRASTRUCTURE REMOVAL
  - REMOVED - SPILLWAY, EARTHEN EMBANKMENT, CABIN, RESERVOIR RETAINING WALLS, RESERVOIR INTAKE STRUCTURE, SCREEN HOUSES, UTILITIES AND FENCES
  - NOT REMOVED - STAGING AREA SPOILS AND WEST BANK INFRASTRUCTURE (RETAINING WALLS, CHLORINE HOUSE, ETC.)
  - DEMOLITION DEBRIS BURIED ON SITE OR HAULED OFF SITE
- USE EARTHEN EMBANKMENT MATERIAL TO FILL RESERVOIR AND CONSTRUCT STREAMBANKS AND FLOODPLAIN
- RECONSTRUCT RATTLESNAKE CREEK TO PRE-DISTURBANCE CONDITIONS
- HABITAT ENHANCEMENT WORK IN EXISTING CHANNEL APPROXIMATELY 1,300 FEET DOWNSTREAM OF THE DAM
- CONSTRUCT OFF-CHANNEL HABITAT FEATURES IN THE FACILITY AREA ONLY
- REVEGETATE THE FLOODPLAIN AND DISTURBED AREAS WITH NATIVE PLANT SPECIES

PROS	CONS
• SITE OPERATION AND MAINTENANCE COSTS MINIMIZED	• COSTS FOR MAINTAINING REMAINING INFRASTRUCTURE
• PUBLIC HAZARDS AND LIABILITY MINIMIZED	• DOES NOT FULLY ADDRESS FLOODPLAIN PROCESSES DOWNSTREAM OF THE DAM
• NATURAL STREAM PROCESSES MOSTLY RESTORED AND SIMILAR TO REFERENCE CONDITIONS	• DOES NOT FULLY ADDRESS HABITAT DIVERSITY DOWNSTREAM OF THE DAM
• AQUATIC AND TERRESTRIAL HABITAT DIVERSITY PROVIDED	• RECREATION POTENTIALLY EXCLUDED FROM AREAS WITH REMAINING INFRASTRUCTURE
• RECREATION OPPORTUNITIES PROVIDED	

THESE RESTORATION CONCEPTS AND ALTERNATIVES REPRESENT A 10 PERCENT LEVEL OF DESIGN. COST ESTIMATES WILL DEPEND UPON THE RESULTS OF PUBLIC SCOPING, LEVEL OF EFFORT, PERMITTING AND OTHER FACTORS.

ALTERNATIVES 2 & 4 CROSS SECTION: B-B'

ALTERNATIVES 2 & 4 CROSS SECTION: C-C'

REFERENCE/NATURAL CONDITIONS UPSTREAM OF PROJECT LOCATION

PUBLIC USE ON THIS NEW CITY OPEN SPACE

Summer & Fall 2018: **Finalize natural resource inventories on site. Catalog flora and fauna, identify important habitats, map invasive species.**

Winter 2018/19: **Development of a recreation management plan based on resource inventories.**

- **Recreational management plan describes tail locations, defines types of use, access points, and actions to balance rec. use with conservation goals.**
- **Missoula's Conservation Lands Advisory Committee (CLAC) recommends parcel designations and recreation management plans to Missoula Parks and Recreation Board (MPRB).**

Spring 2019: **Adoption of recreation management plan by the Missoula Parks and Recreation Board.**

Construction of trails occurs following dam removal and site restoration

Sign up to be notified of MPRB & CLAC meetings through the City's website

https://www.ci.missoula.mt.us/notifyme

UPPER RATTLESNAKE
Public Lands

USFS Rattlesnake Rec. Area

Missoula Water Reservoir Prop.

North Hills Sunlight Property

NW Energy Substation

Power Park Ped. Bridge

Rattlesnake Greenbelt

Mt. Jumbo Saddle Area

Msla. County Baseball Fields

UofM PEAS Farm

Mtn. View Ped. Bridge

Rattlesnake Elementary

UNNAME 17

UNNAMED

SIESTA

SAWMILL GULCH

WOODS GULCH

MADERA

UPPER WILDCAT

WILDCAT

UNNAME 17

BLACK FOX

UNNAMED ROAD

UNNAME 35

STRAWBERRY RIDGE

BLACK FOX

RATTLESNAKE

UNNAME 17

LARCH

CHOKECHERRY

ELK RIDGE

ASPEN

CASTLE PINES

RATTLESNAKE

FOX HOLLOW

LARCH

JUNIPER

ASPEN

TAMARACK

GEORGANNA

ELK RIDGE

OLD ORCHARD

TIMBERLANE

DUNCAN

GAME

FOX FARM

HERITAGE

LINCOLN

WILD FOX

FOX FIELD

UNNAMED ROAD

LINCOLNWOOD

CREEK CROSSING

CREEKWOOD

LINCOLN

LINCOLN

FIELDSTONE

STONE

CORNERSTONE

JUMBO SADDLE

TEDDY TURN

UNNAME 19

UNNAMED

TULIP

APPLE HOUSE

BROOKSIDE

LOWER LINCOLN HILLS

SUNFLOWER

SEPTEMBER

CLARKIA

CUMMINS

LILLY

COLUMBINE

OLD POND

MARTINWOOD

MOUNTAIN VIEW

STANLEY

MOUNTAIN VIEW

SAINT ANN

WILLOWBROOK

GREENBRIER

HIGHLAND

WOODLAND

PINEVIEW

Legend

Exisiting Public Trails

Missoula Roads

OWNERSHIP

U.S. Forest Service

City of Missoula Lands

0.25 0 0.25 0.25 Miles

POTENTIAL PUBLIC ACCESS PLAN
Across Msla. Water & N.W. Energy Land

UNNAME 17

BLACK FOX

UNNAME 35

BLACK FOX

Maintenance Road
No Public Access

UNNAME 17

Potential Trail
Construction Zone

NORTHWESTERN ENERGY PROP.
Potential Trails and Parking area on
this side of Rattlesnake Creek Dependant
on Easement from N.W. Energy
(negotions in progress)

UNNAMED ROAD

DUNCAN

exisiting
easement

existing
easement

Potential parking lot &
trailhead straddling public
ROW and NWE property

RATTLESNAKE

Legend

- Current City Trails
- Potential Trails
- missoula roads

OWNERSHIP

- UNITED STATES OF AMERICA
- City Conservation Lands

200 100 0 200 Yards