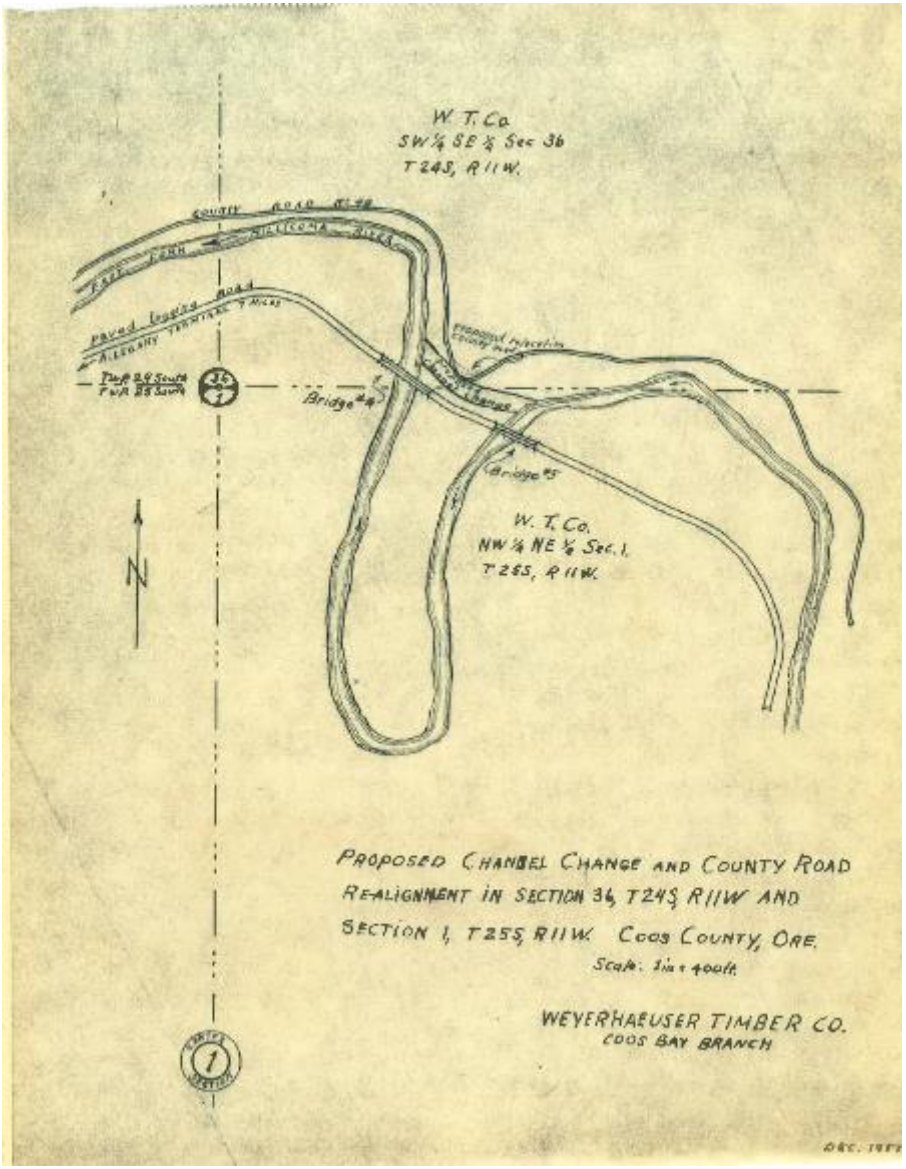
East Fork Oxbow Project

Jason Richardson, P.E.

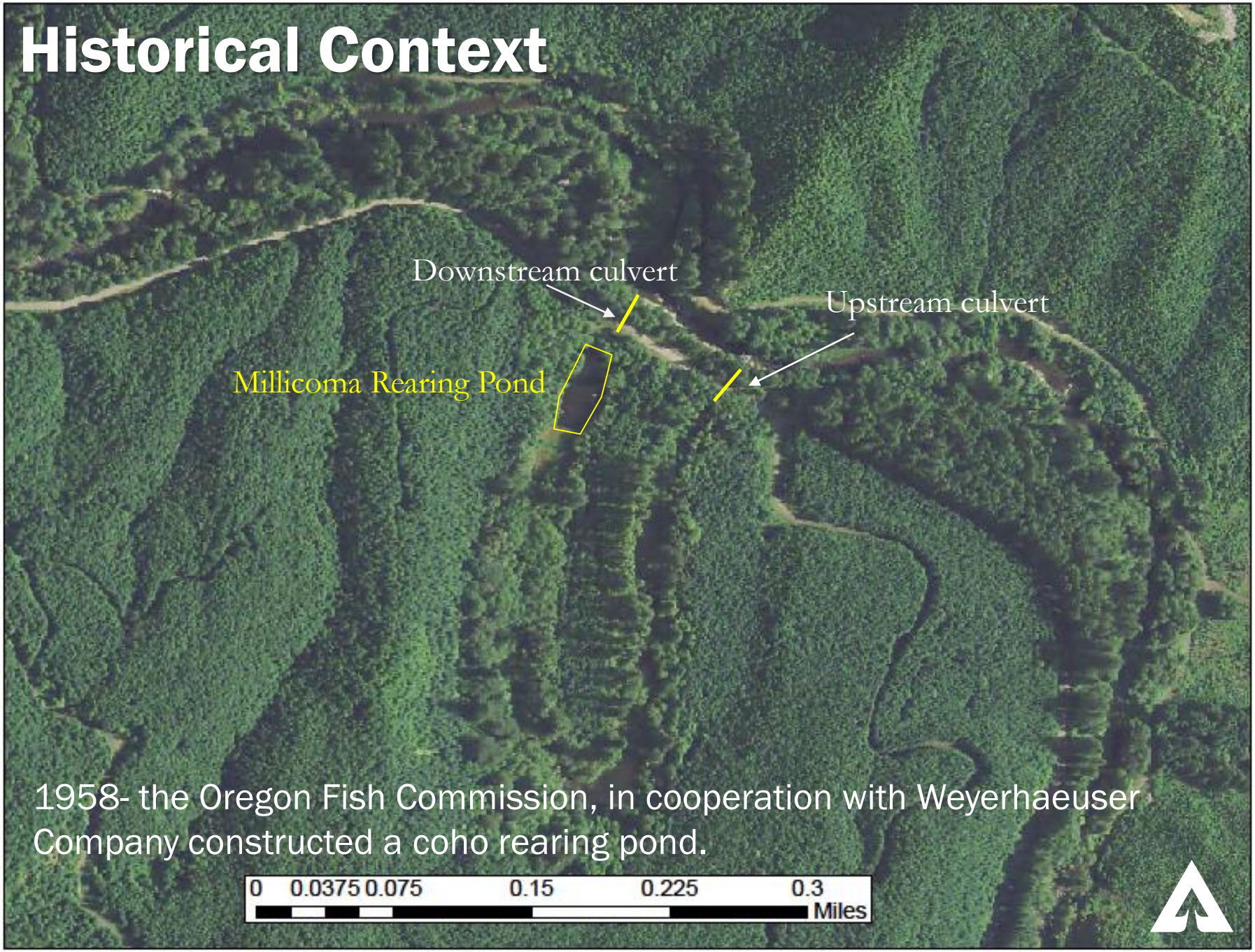
Location: Coos Bay, Oregon on the Weyerhaeuser Millicoma Tree Farm.

Historic Site Background

- Weyerhaeuser obtained permits through Oregon Game Commission and US Army Corps of Engineers.
- 1958- Two bridges were removed and bypass chute was constructed.
- Re-routed East Fork Millicoma River.
- Disconnected 0.6 miles of river habitat.
- Steep chute limits fish passage.



Historical Context



1958- the Oregon Fish Commission, in cooperation with Weyerhaeuser Company constructed a coho rearing pond.

Historical Context

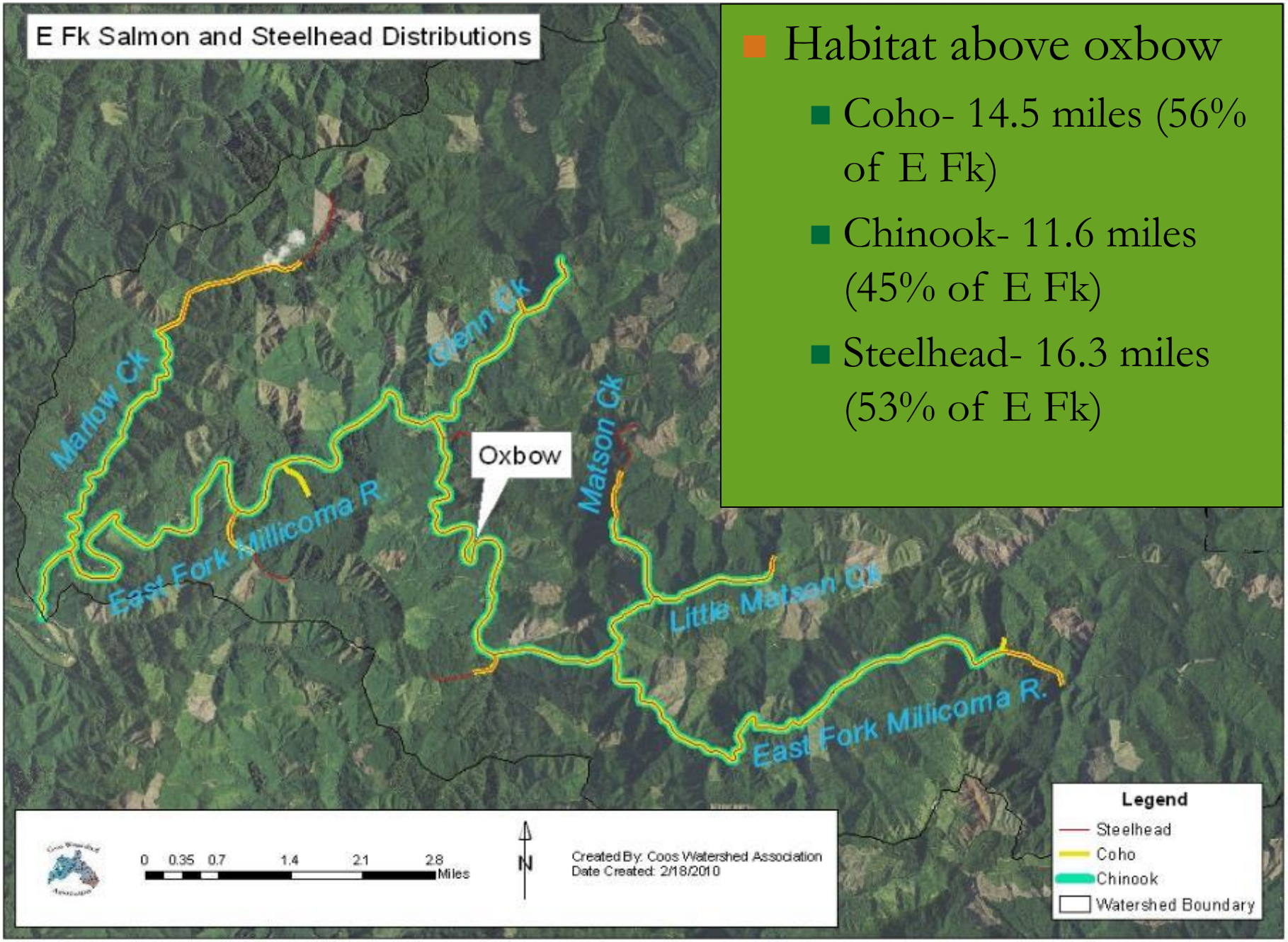
- **1962 Millicoma rearing pond was abandoned due to problems with disease and predation.**

Historical Context

- **Bypass chute-drops 16ft in 150 yards over a series of 3 bedrock steps/shelves.**

Historical Context

- 1992 – Weyerhaeuser and ODF&W constructed a fish ladder in the old rearing pond to provide winter habitat for juvenile fishes.
- 1992 to 2016 Inflow to fish ladder is frequently blocked with wood making passage difficult.


E Fk Salmon and Steelhead Distributions
Habitat above oxbow
Coho- 14.5 miles (56% of E Fk)
Chinook- 11.6 miles (45% of E Fk)
Steelhead- 16.3 miles (53% of E Fk)
Marlow Ck
Glenn Ck
Matson Ck
Oxbow
East Fork Millicoma R
Little Matson Ck
East Fork Millicoma R.
0 0.35 0.7 1.4 2.1 2.8
Miles
N
Created By: Coos Watershed Association
Date Created: 2/18/2010
Legend
Steelhead
Coho
Chinook
Watershed Boundary

Analysis for next steps

Weyerhaeuser and Coos Watershed Association (CWA) decide to team up to explore solutions:

Multiple Technical Assistant Grants to Analysis Optimal Future Solution:

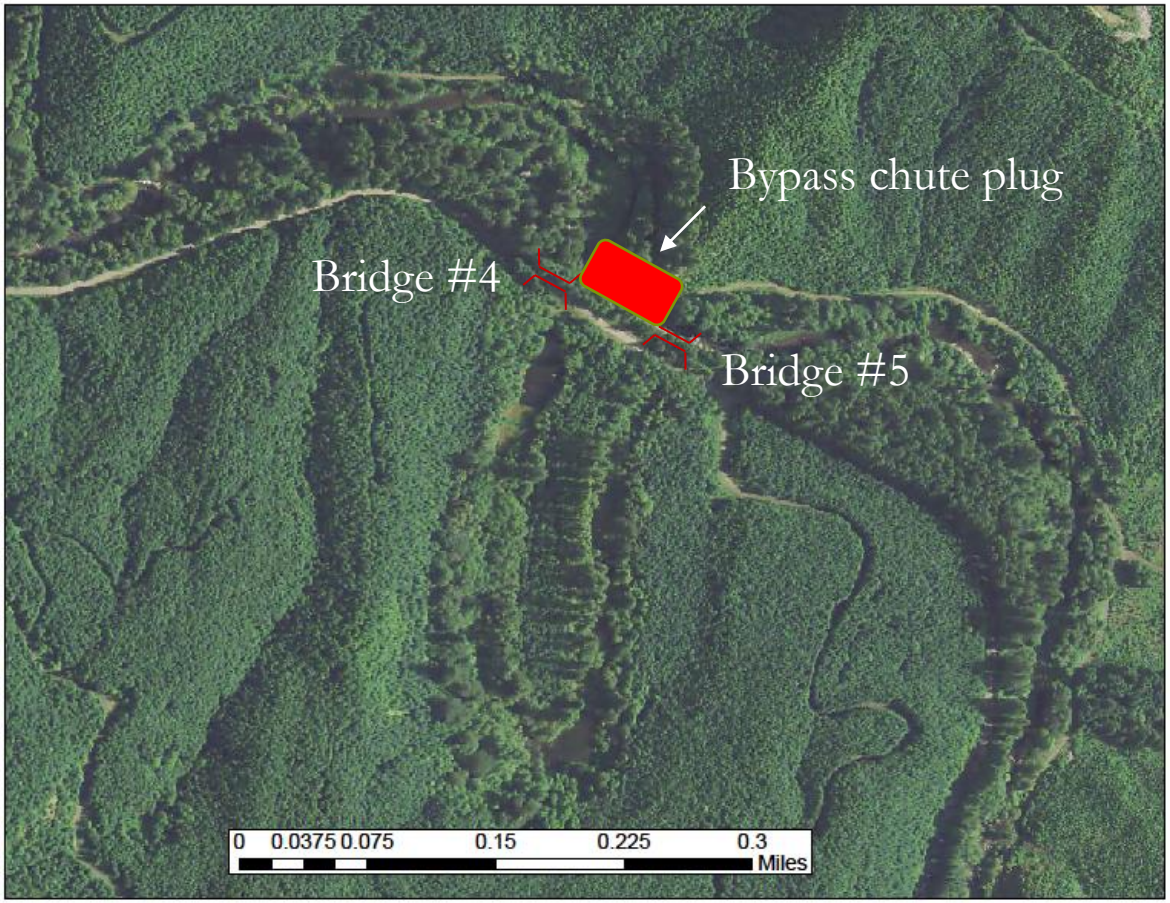
1. **Access fish passage conditions through existing bypass chute.**
2. **Compare impact of design alternatives on fish passage and rearing habitat in the vicinity of the oxbow.**
3. **Evaluate impact of design alternatives on spawning habitat.**
4. **Develop recommendation for future action.**

Design Alternatives

1. No Action.
2. Full Oxbow Reconnect
3. Partial Oxbow Reconnect
4. Mainline Road Relocation
5. Bypass Chute Fish Passage Improvements.

Design Alternatives

1. No Action.
2. **Full Oxbow Reconnect**
3. Partial Oxbow Reconnect
4. Mainline Road Relocation
5. Bypass Chute Fish Passage Improvements.



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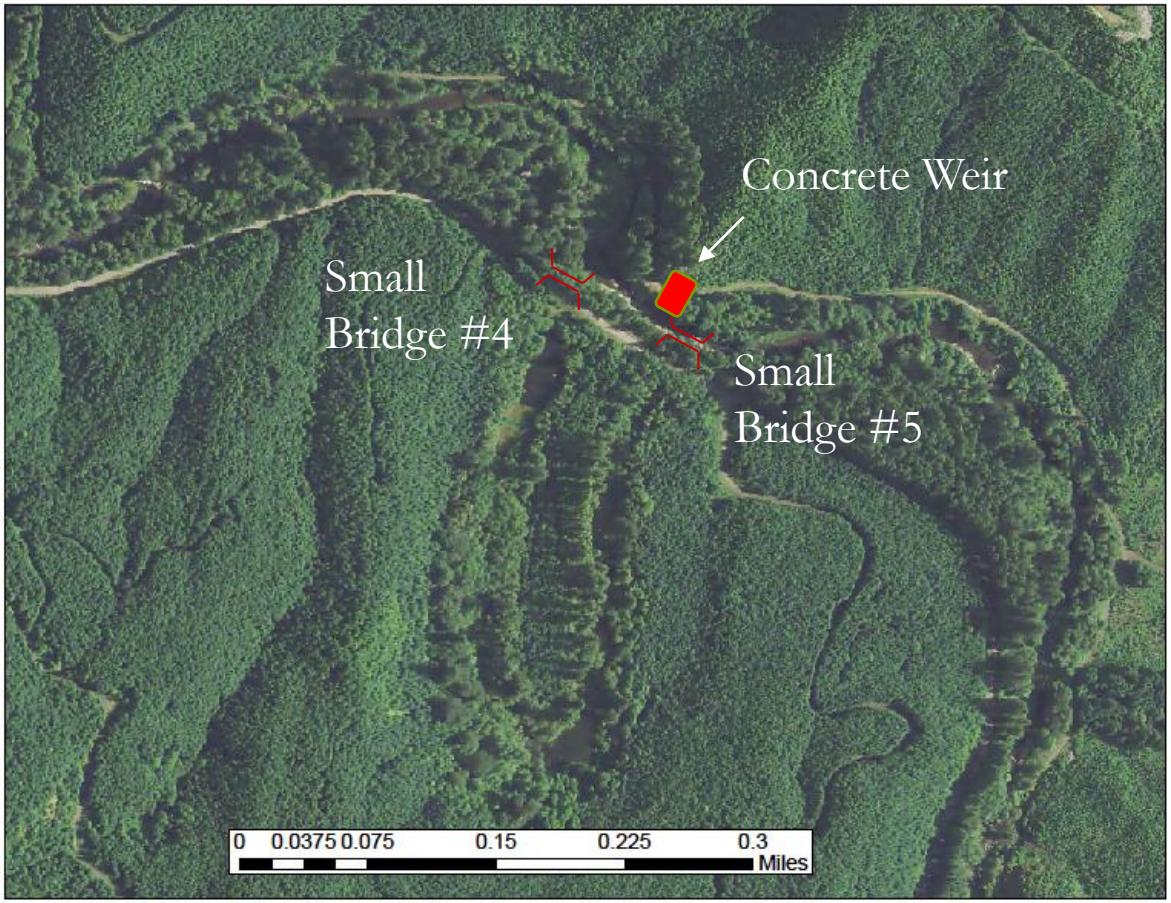

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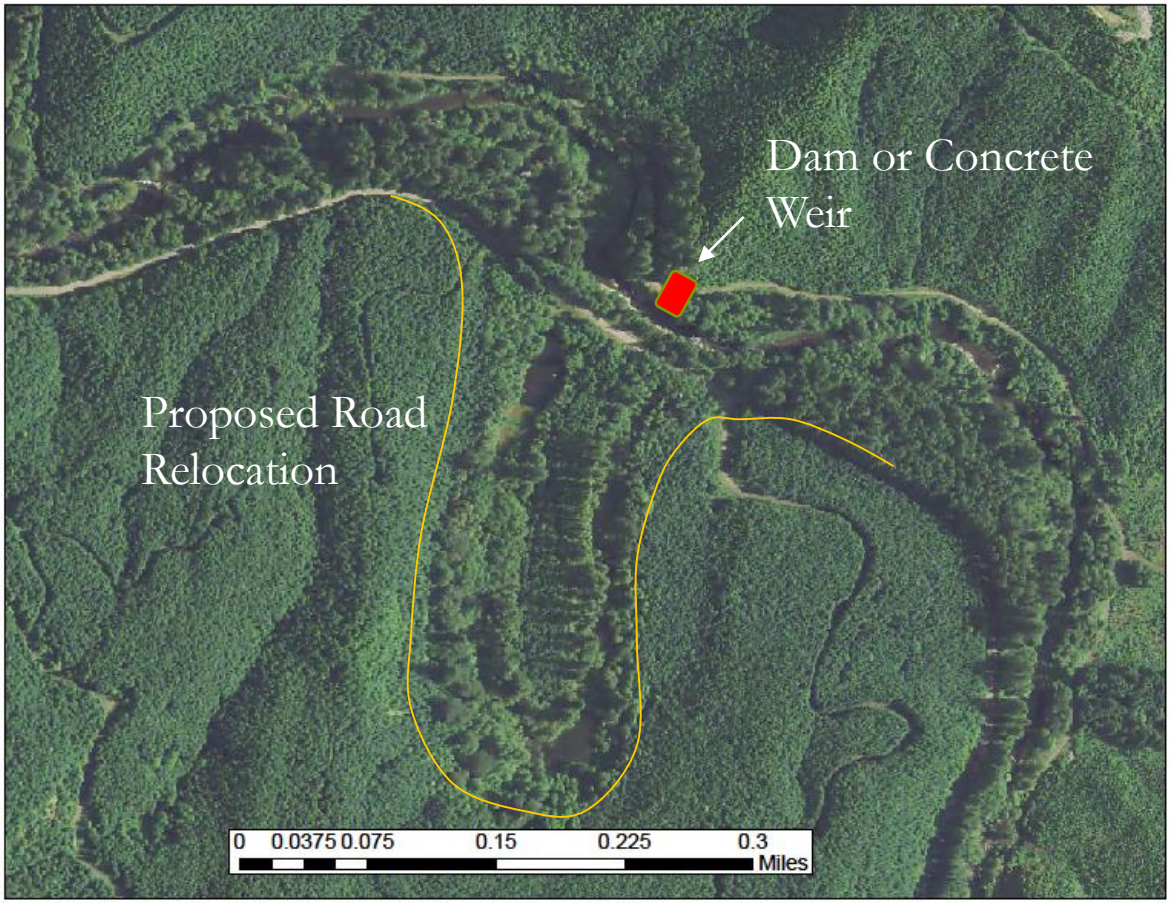

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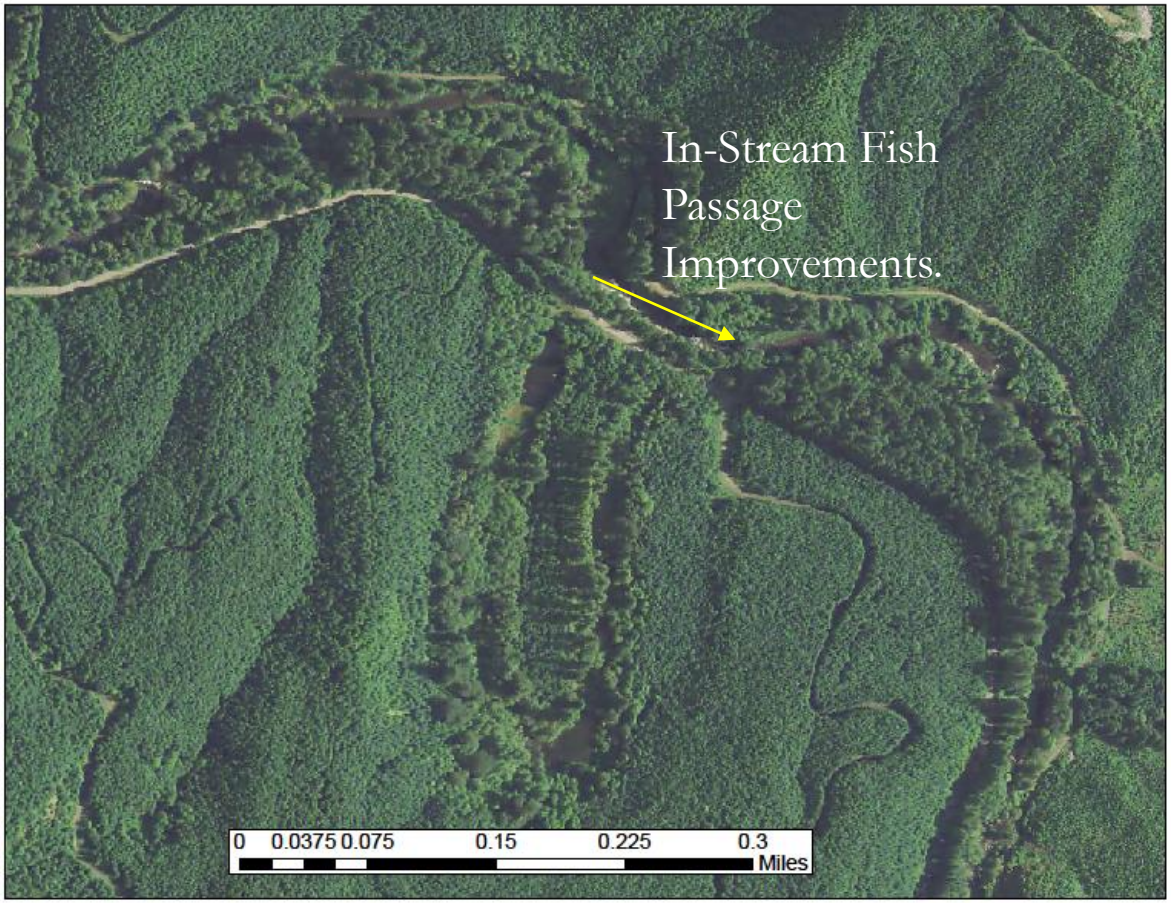


Evaluating Design Alternatives.

Hydraulic Modeling:

- **Fish Passage.**
- **Habitat in Oxbow.**

Bypass Chute Dec 16, 2009

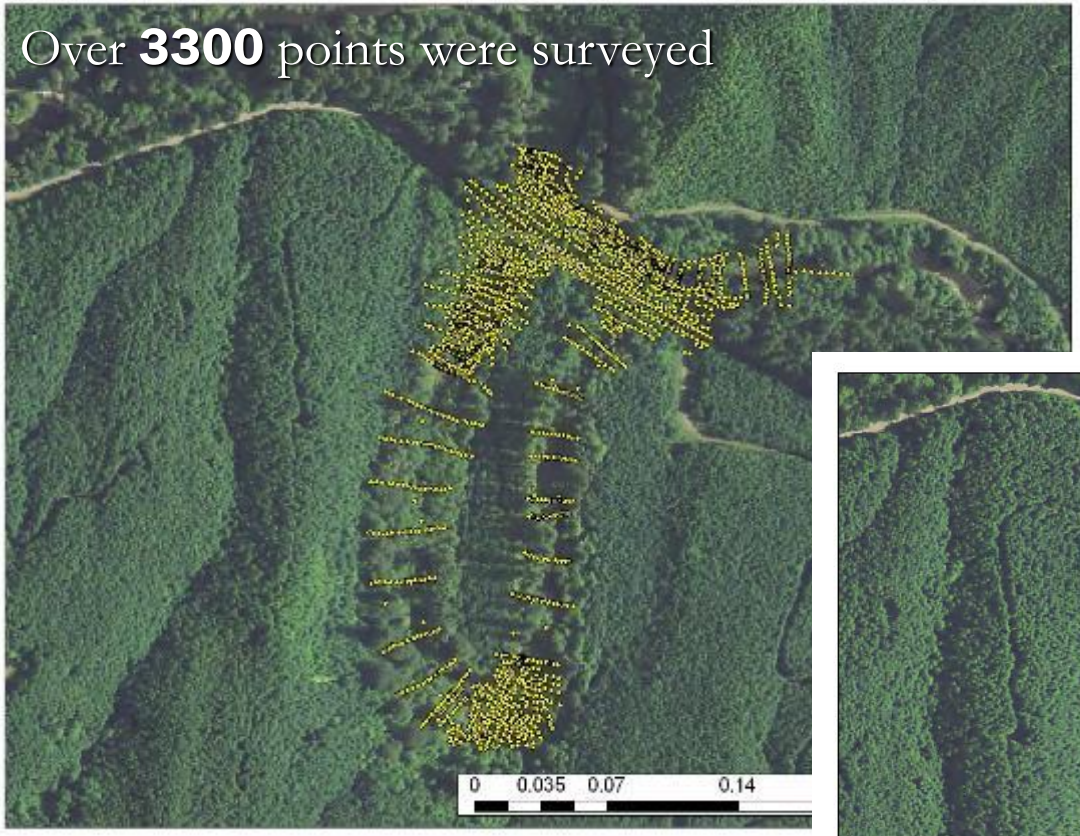
Geometric Survey

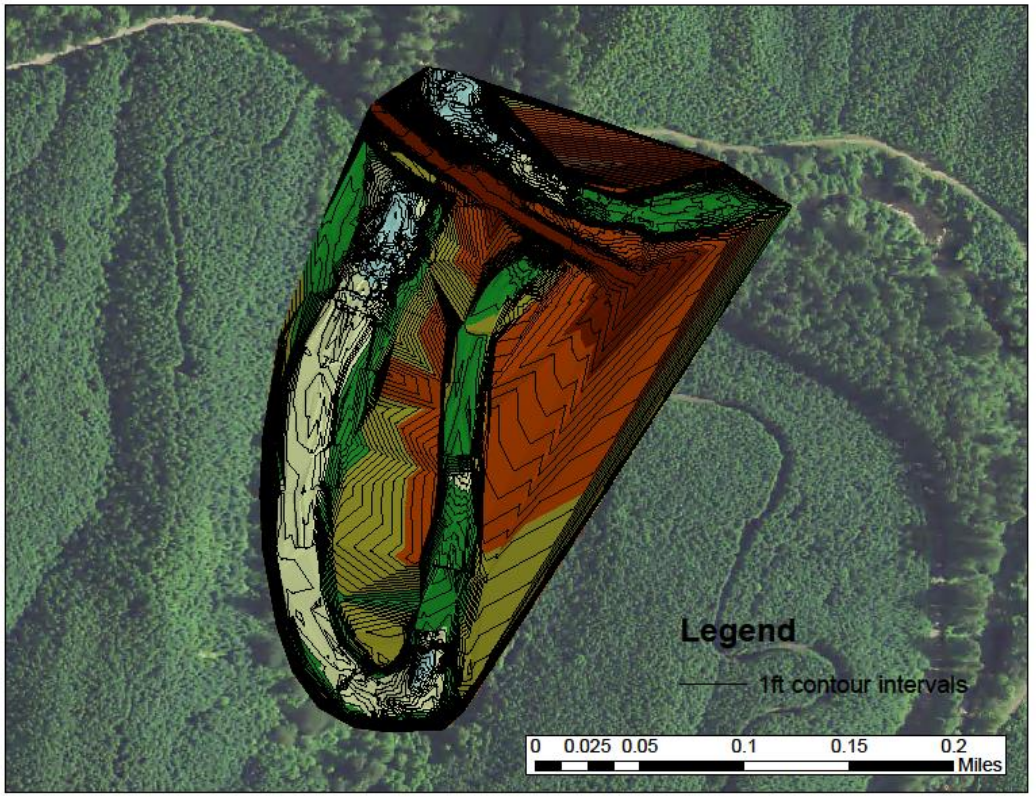
Survey-Total Station

Abandoned Meander Pool.

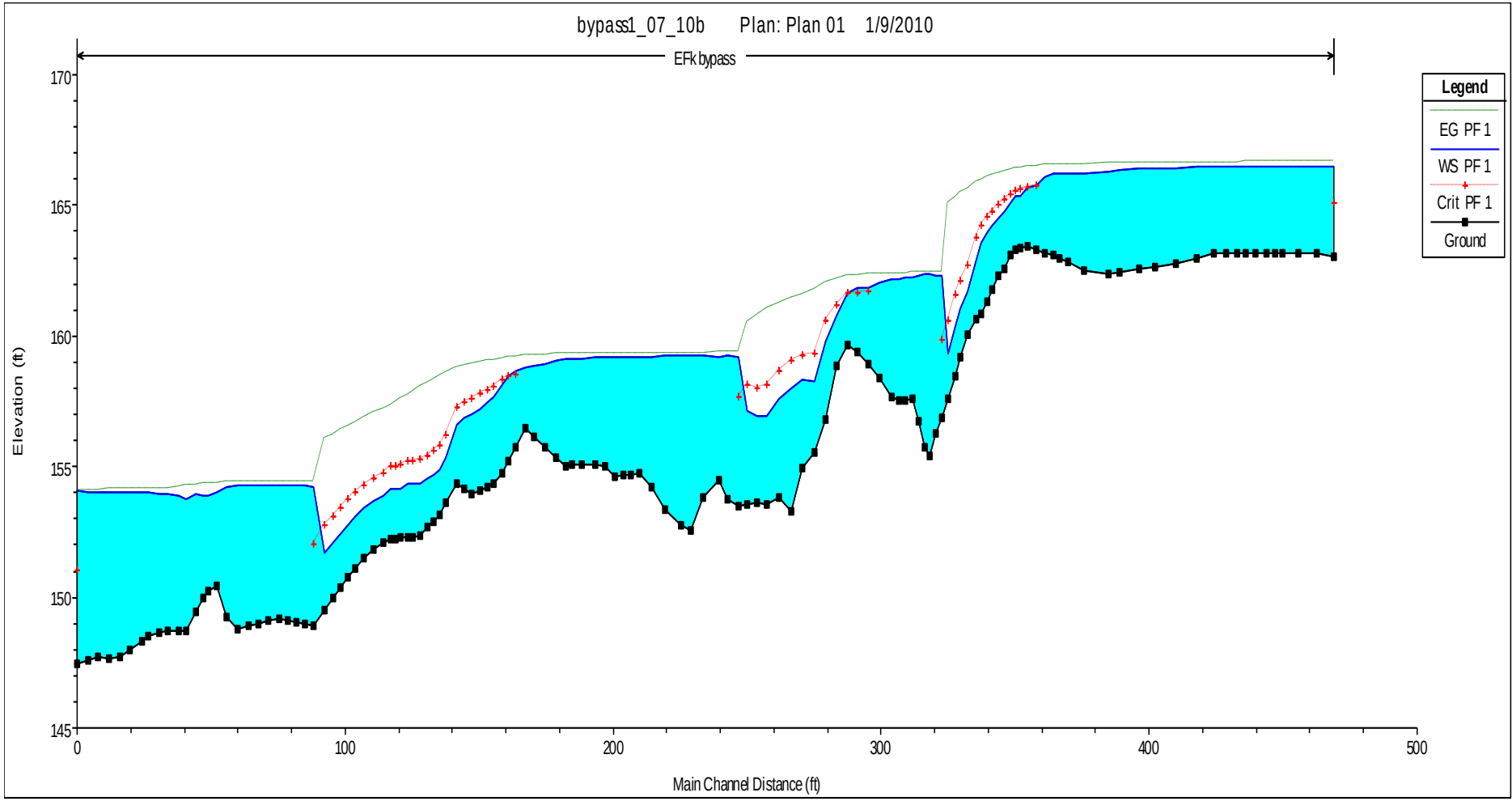
Bypass Chute.

Geometric Survey



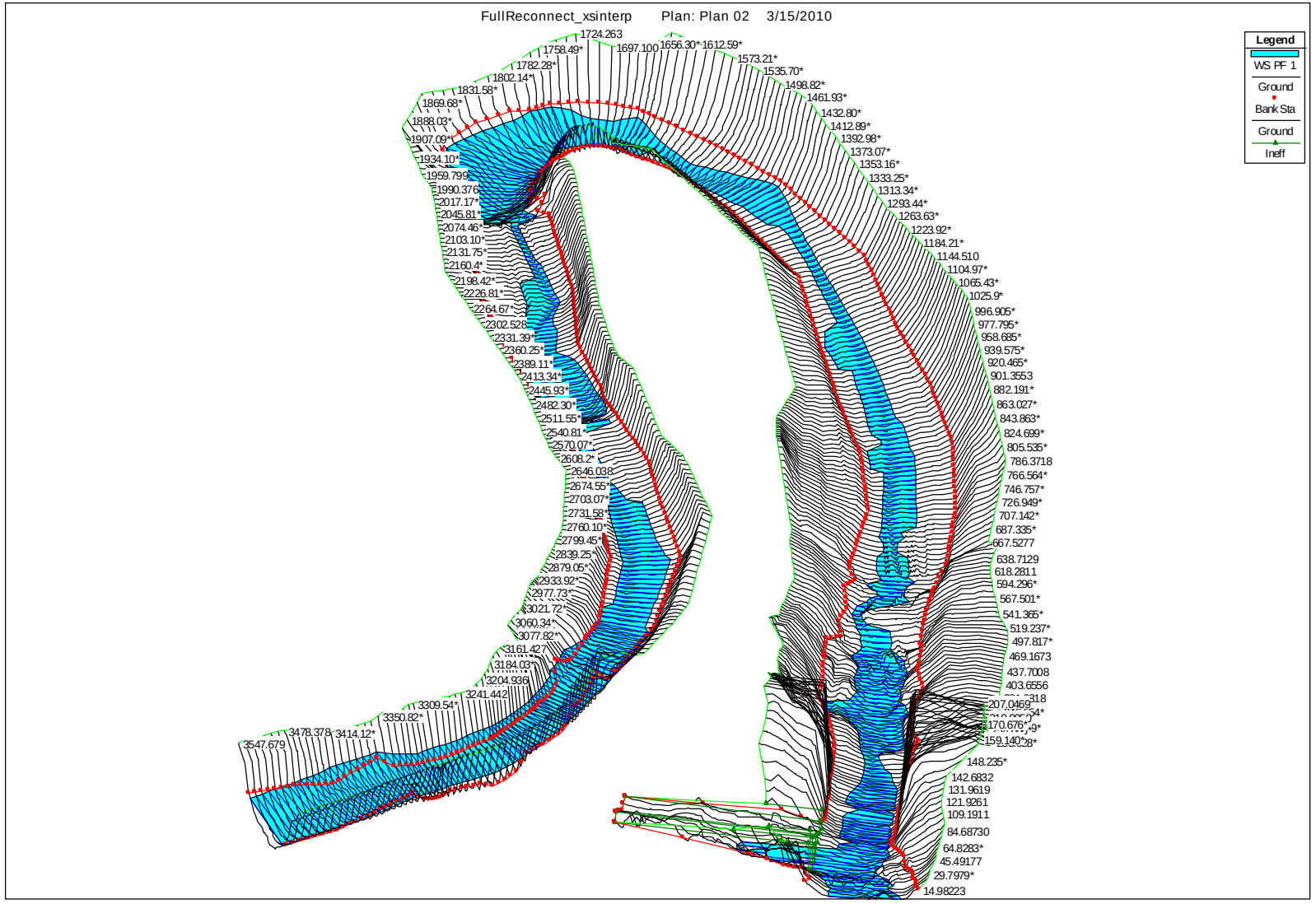


Hydraulic Modeling



Bypass Chute (Sample flow).

Hydraulic Modeling

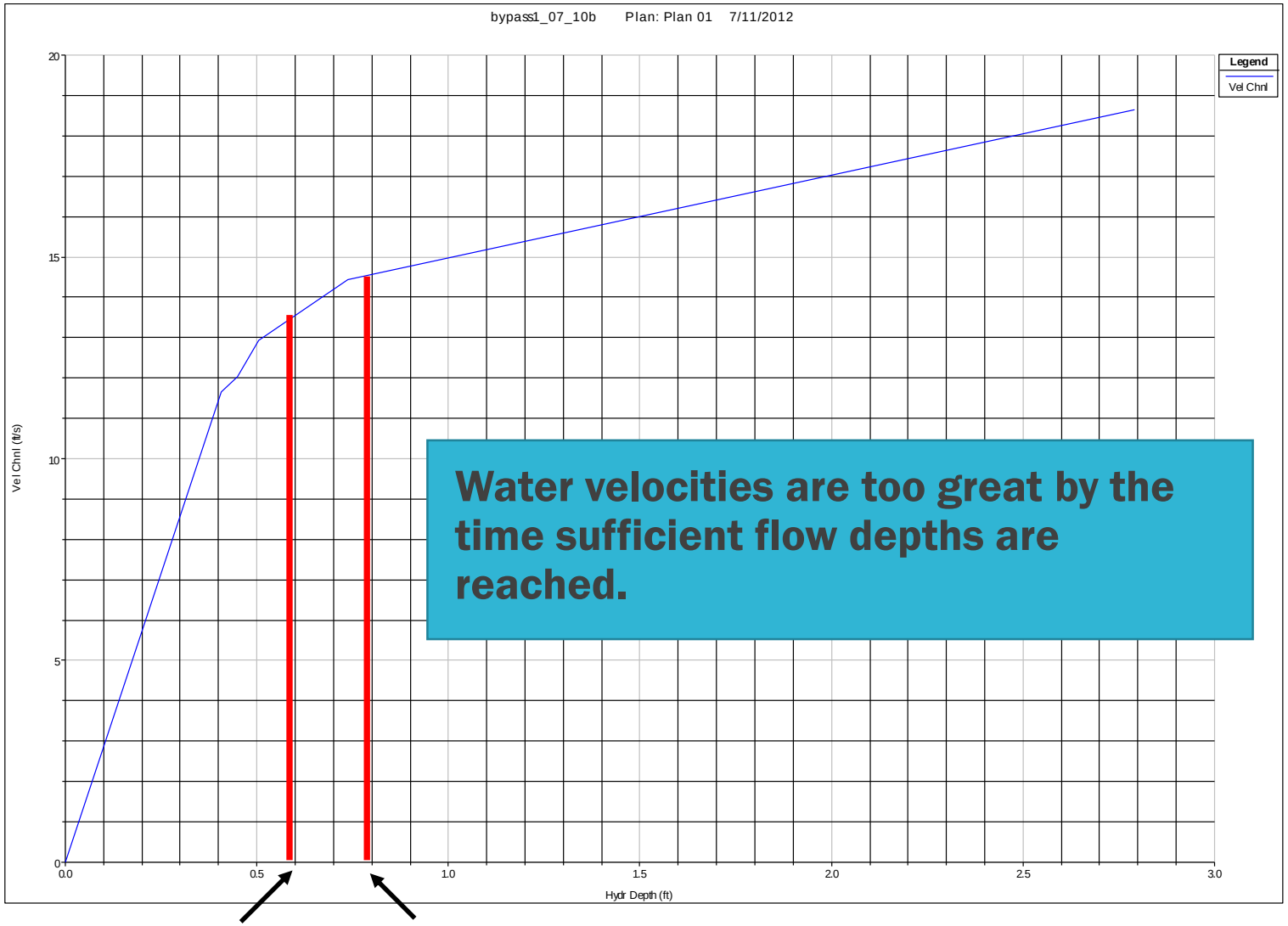


Oxbow Channel

Fish Passage Analysis

- Relate minimum passable flow depth to discharge.
- Relate maximum passable velocities to discharge.

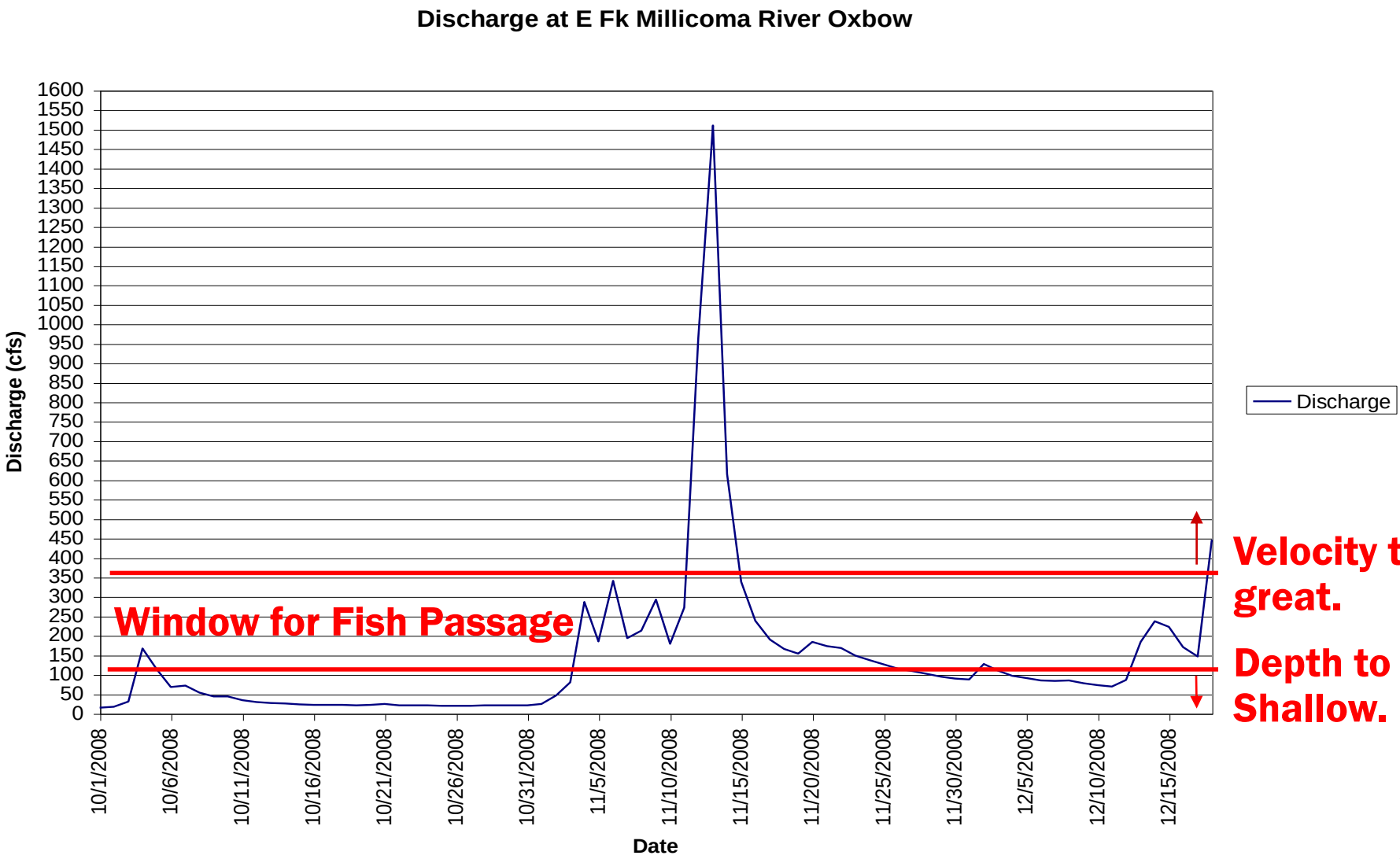
Fish Passage Limitation



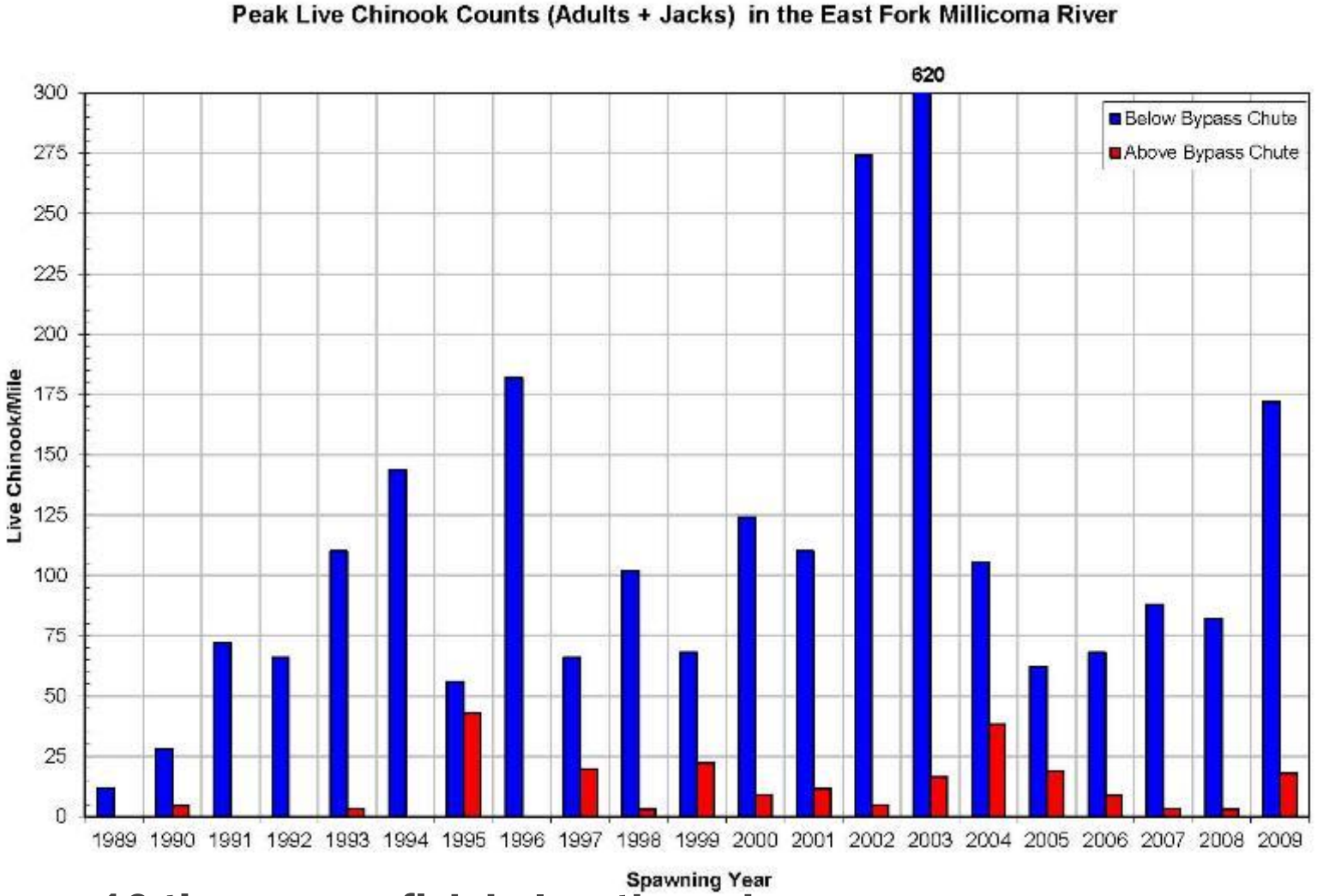
Coho = 0.59 ft.

Chinook = 0.79 ft.

Fish Passage Analysis



Fish Benefits



10 times more fish below than above.

ODF&W spawning survey data above and below Oxbow.

Oxbow Summer Habitat

Potential Summer Rearing Habitat:

Species	Summer Density/m^2 *	Area (m^2) #	Summer Rearing Potential
Coho	0.767116123	13,365	10,253
Steelhead	0.02375008	13,365	317
Cutthroat	0.014079808	13,365	188

*Data from 14 ODFW surveys done between 2000-2008 in 8 reaches of the E Fork Millicoma River.

Area based on modeling results for median Aug/Sept Discharge of 19 cfs.

Oxbow Spawning Habitat

- **Particularly important to Chinook Channel Slope:**
  - **Oxbow = 0.5%**
  - **Average East Fork Chinook habitat = 2.5%**
- **Net increase for Chinook spawning area by over 5%**

Results From Research

- Determined:
  - Percent of time fishes can navigate bypass.
  - Current smolt production vs. potential production for various scenarios.
  - Increased spawning habitat.
  - Determined the importance of improved connectivity for adult and juvenile fishes.

Recommended Solution: Full Reconnection

- Joint Core of Engineering Permits/DSL permits.
- Approval letter from State Historical Preservation Office (SHPO).
- Approval letter from Coquille Indian Tribe.
- Approval letter from Oregon Department of Fish & Wildlife (ODF&W)
- Permits from Oregon Dept. Forestry

Joint Permit Application

This is a joint application, and must be sent to both agencies, who administer separate permit programs. Alternative forms of permit applications may be acceptable; contact the Corps and DSL for more information.

Date Stamp

U.S. Army Corps of Engineers Portland District	Oregon Department of State Lands
Corps Action ID Number	DSL Number

(1) APPLICANT AND LANDOWNER CONTACT INFORMATION

	Applicant	Property Owner (if different)	Authorized Agent (if applicable) ☐ Consultant ☐ Contractor
Contact Name	Jon A. Souder	Jason Richardson	
Business Name	Coos Watershed Assoc.	Weyerhaeuser Timberlands	
Mailing Address 1	P.O. Box 5860	98674 Dellwood Ln.	
Mailing Address 2			
City, State, Zip	Charleston, OR 97420	Coos Bay, OR 97420	
Business Phone	(541) 888-5922	(541) 269-9336	
Cell Phone	(541) 404-7356		
Fax	(541) 888-6111		
Email	jsouder@cooswatershed.org	Jason.Richardson@weyerhaeuser.com	

(2) PROJECT INFORMATION

A. Provide the project location.

Project Name	Tax Lot #	Latitude & Longitude*
EF Millicoma Oxbow Reconnection	25SR11W01TL0010000	43.438081; -123.948149
Project Address / Location	**City (nearest)**	**County**
M.P. 7 Weyerhaeuser Lane	Allegany	Coos

Township	Range	Section	Quarter/Quarter
26 South	11 West	1	NE

From Allegany, go 0.9 mi. E on E. Fork Rd. to Kruse Ln., turn R, then immediately L onto Weyerhaeuser Ln.

B. What types of waterbodies or wetlands are present in your project area? (Check all that apply.)

☒ River/Stream ☐ Non-Tidal Wetland ☐ Lake / Reservoir / Pond
☐ Estuary or Tidal Wetland ☐ Other ☐ Pacific Ocean

Waterbody or Wetland Name**	River Mile	6th Field HUC Name	6th Field HUC (12 digits)
East Fork Millicoma River	18.5	E.F. Millicoma	171003040402

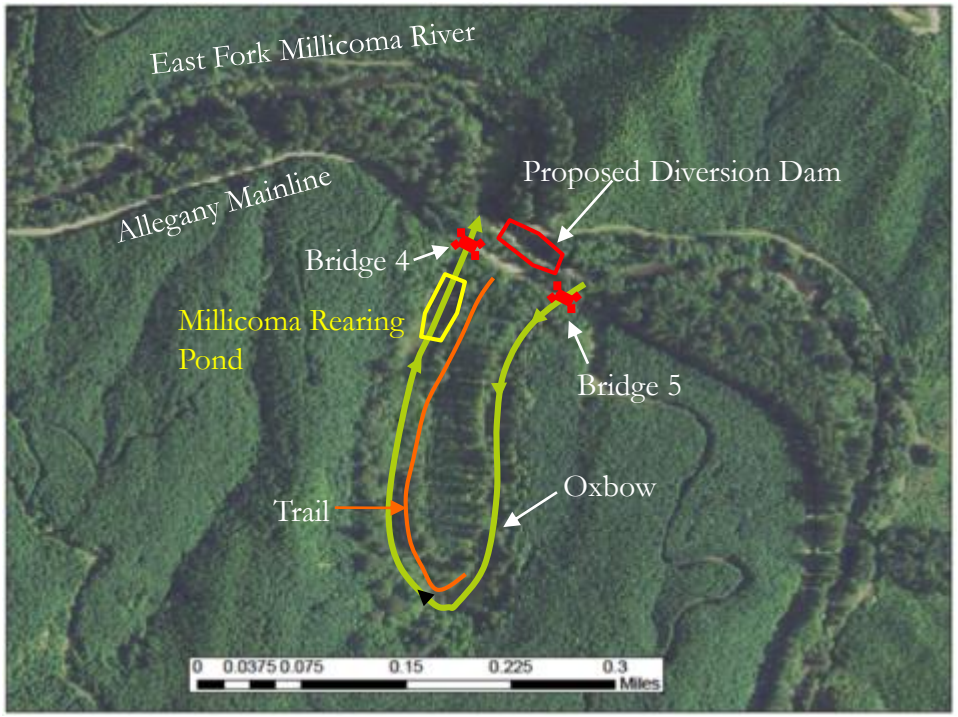
C. Indicate the project category. (Check all that apply.)

☐ Commercial Development ☐ Industrial Development ☐ Residential Development
☐ Institutional Development ☐ Agricultural ☐ Recreational
☒ Transportation ☒ Restoration ☐ Bank Stabilization
☐ Dredging ☐ Utility lines ☐ Survey or Sampling
☐ In- or Over-Water Structure ☐ Maintenance ☐ Other:

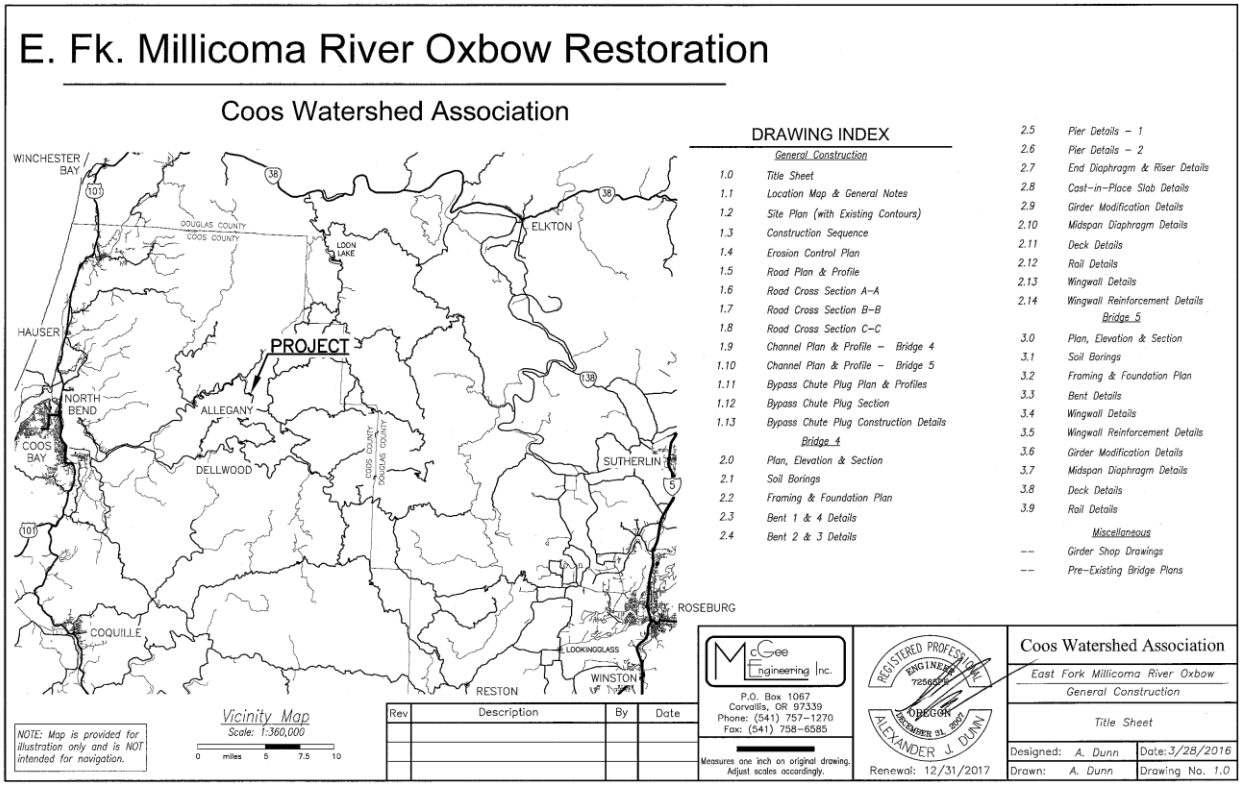
* In decimal format (e.g., 44.9399, -123.0283)
** If there is no official name for the wetland or waterway, create a unique name (such as "Wetland 1" or "Tributary A").

Project Development

- 2006: Weyerhaeuser, CWA & ODF&W began collaborations.
- 2008 & 2012: Worked with OWEB on technical assistant grants for project development, designs, and permit acquisition
  - Full reconnection of the historic Oxbow channel
- 2015: Project 100% funded.
  - Primary funder was an OWEB Restoration Grant.
  - Other grants from ODFW, ODOT, ODFW R&E, USFWS, CTCLUSI
  - Match from Weyerhaeuser

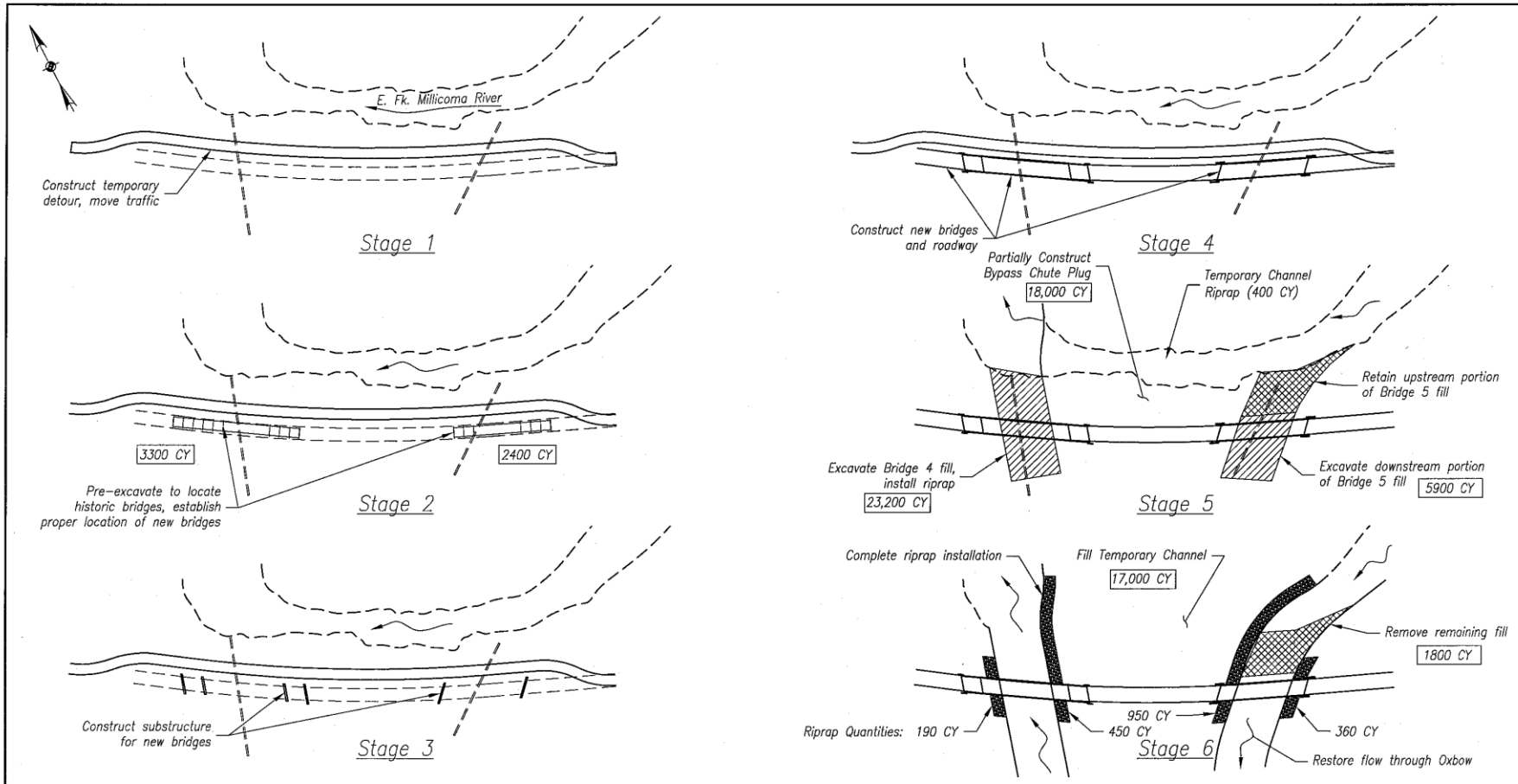


Project Design
Building the team.



- **Weyerhaeuser Engineers & CWA: Onsite project managers.**
- **McGee Engineering developed bridge & plug designs.**
- **Bridge construction by West Coast Contractors.**
- **Girders supplied by Knife River.**
- **LBA Contract Cutting Inc. “Dirt Work”.**

Project Design
Stages of Work.



Note: All quantities shown are in bank cubic yards.

Rev	Description	By	Date

McGee Engineering Inc.
P.O. Box 1067
Corvallis, OR 97339
Phone: (541) 757-1270
Fax: (541) 758-6585

Measures one inch on original drawing. Adjust scales accordingly.

REGISTERED PROFESSIONAL ENGINEER 72565PE OREGON DECEMBER 31, 2007 ALEXANDER J. DUNN

Renewal: 12/31/2017

Coos Watershed Association

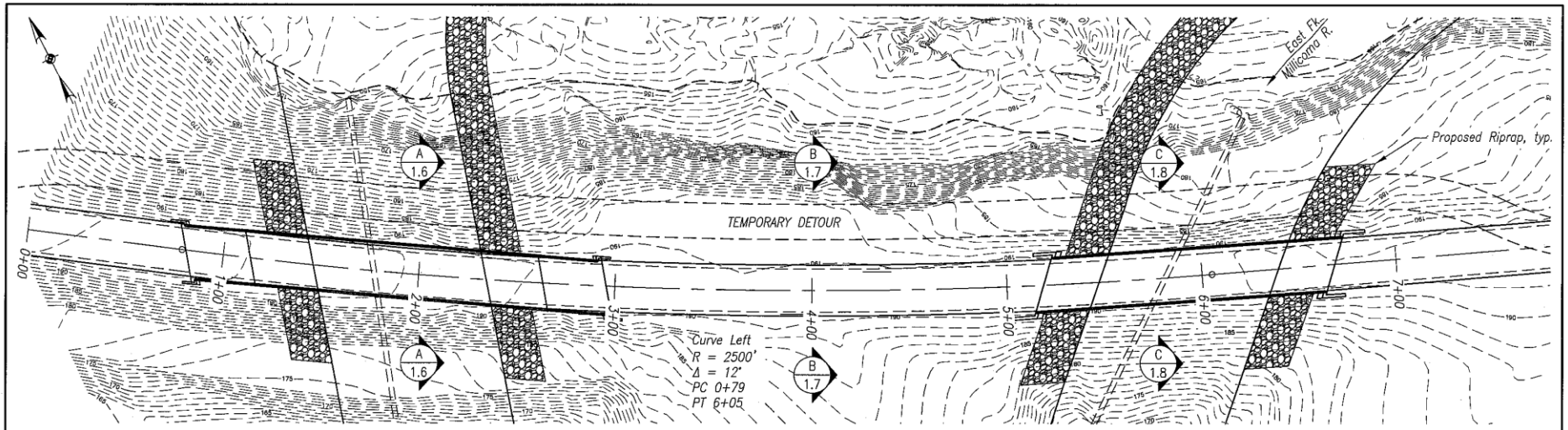
East Fork Millicoma River Oxbow

General Construction

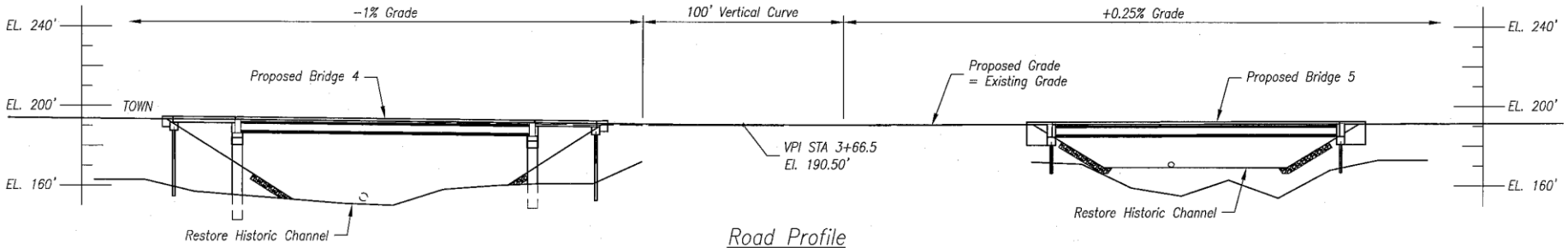
Construction Sequence

Designed: A. Dunn	Date: 3/28/2016
Drawn: M. Jacobson	Drawing No. 1.3

Plan Overview



Road Plan
Scale: 1" = 50'



Road Profile
Scale: 1" = 50'

Rev	Description	By	Date

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Fax: (541) 758-6585

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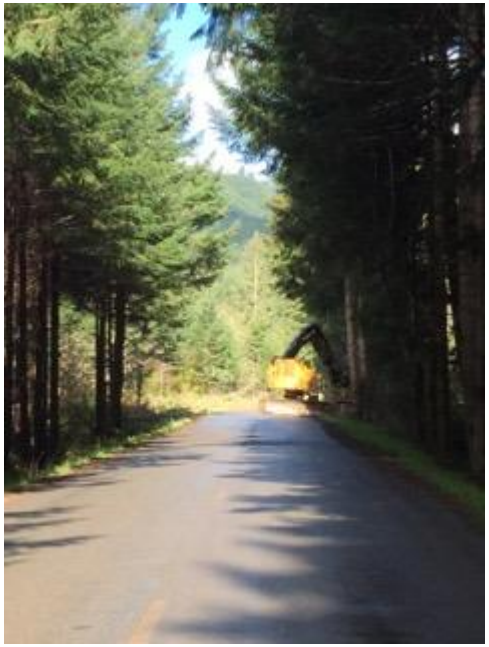
REGISTERED PROFESSIONAL ENGINEER 72568PE OREGON DECEMBER 31, 2007 ALEXANDER J. DUNN
Renewal: 12/31/2017

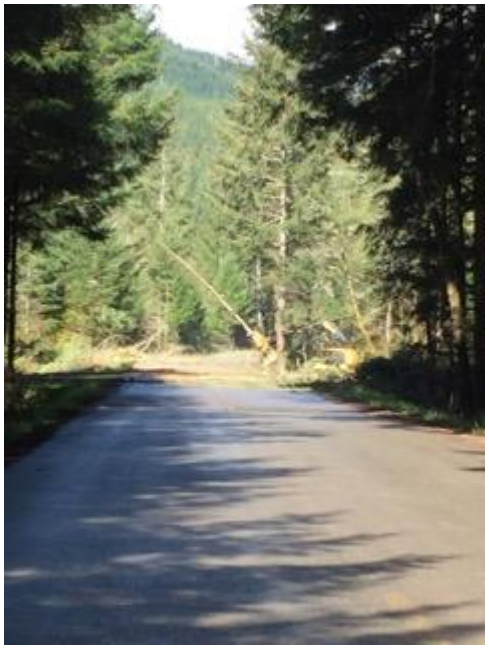
Coos Watershed Association
East Fork Millicoma River Oxbow
General Construction
Road Plan & Profile

Designed: A. Dunn	Date: 3/28/2016
Drawn: M. Jacobson	Drawing No. 31.5

Stage #1 “Detour”

March 28th Started cutting trees.

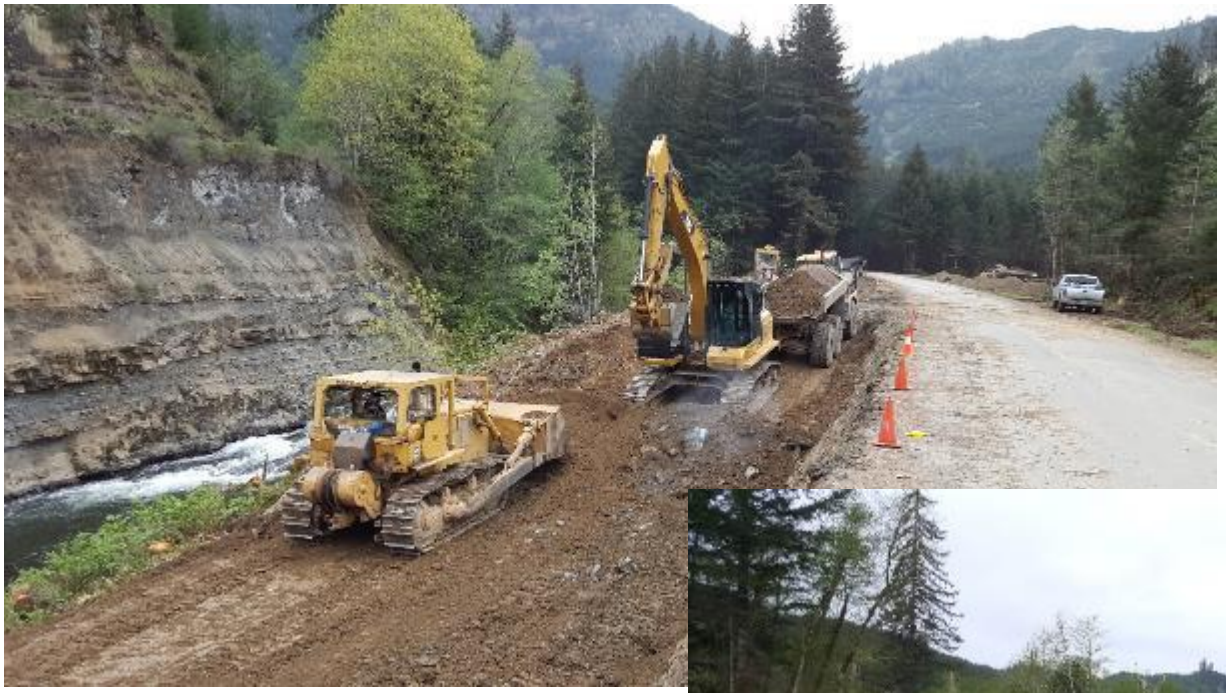




- Log and Grub all the trees off the fills above the “high water mark”

Stage #1 “Detour”

April 8th-15th built the detour.



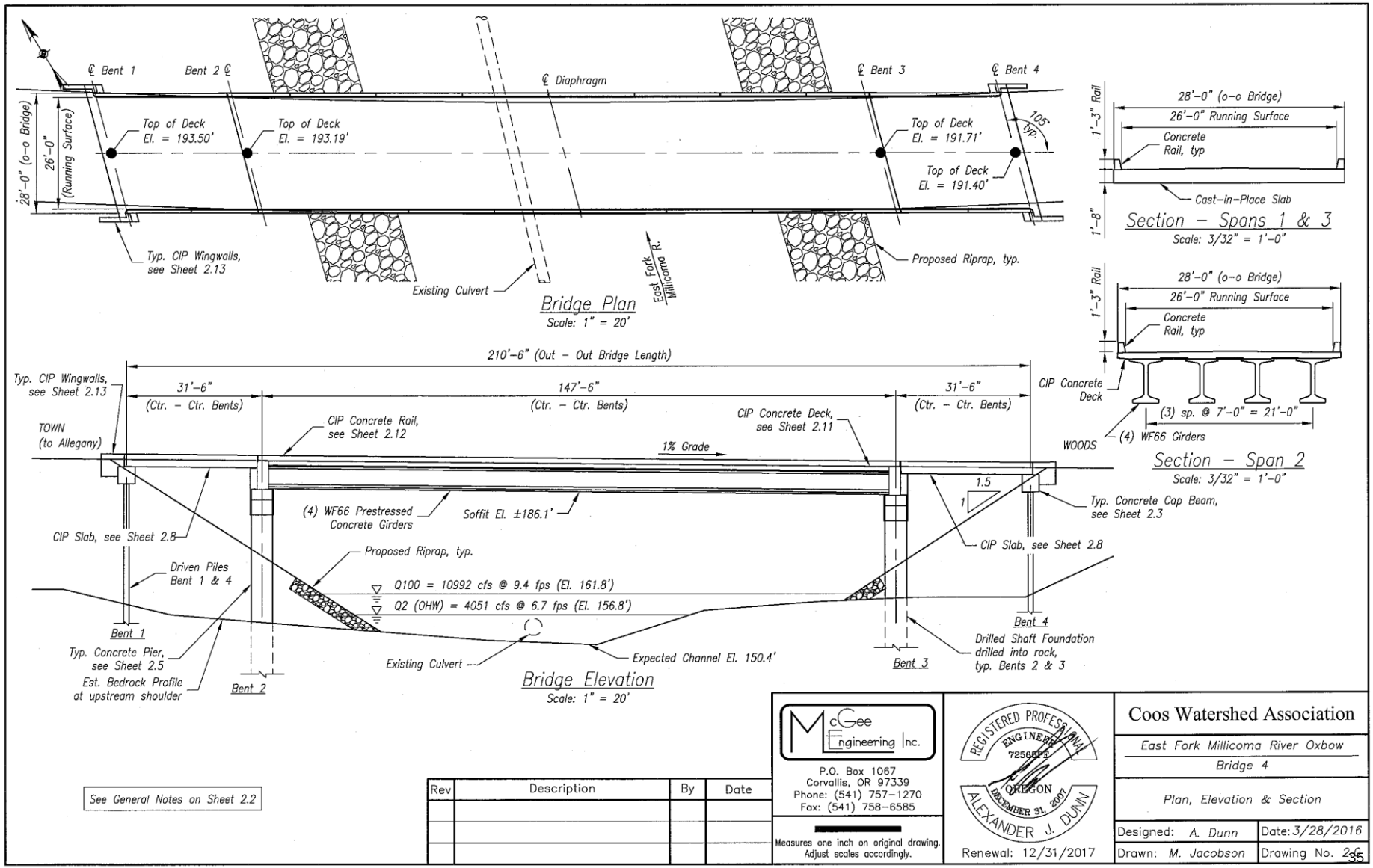
- Build and rock detour next to bridges to keep traffic flowing.

Stage #2 “Pre-excavation at bridge sites”

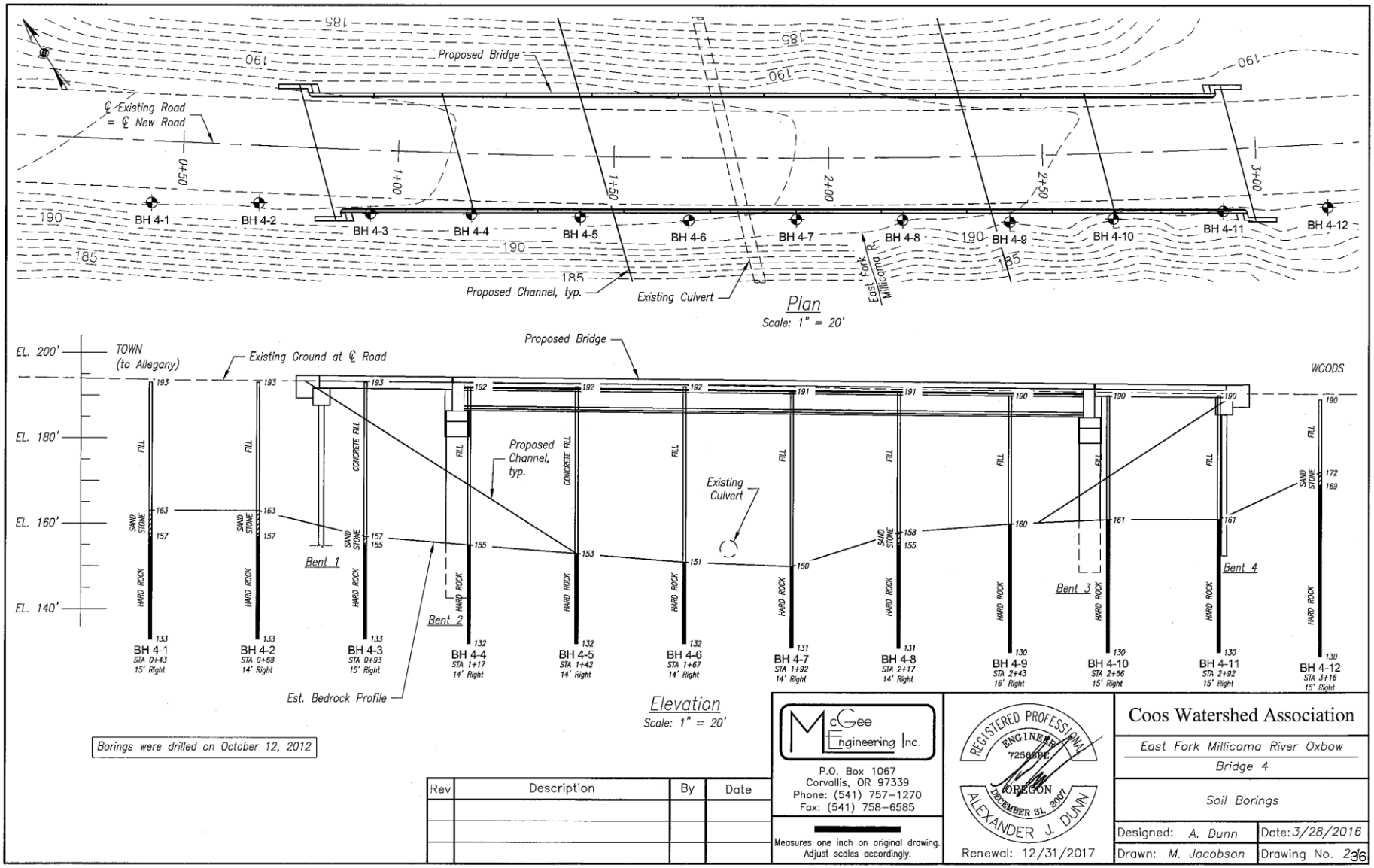
April 18th-22nd dug out fills to below bridge working height.

- Remove fills below superstructure heights of new bridges.
- Approx. 6,000 yds. of fill.

Bridge #4 Plans



Bridge #4
Soil Borings



Borings were drilled on October 12, 2012

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Fax: (541) 758-6585

Measures one inch on original drawing. Adjust scales accordingly.

REGISTERED PROFESSIONAL ENGINEER 72562PE OREGON DECEMBER 31, 2007 ALEXANDER J. DUNN

Renewal: 12/31/2017

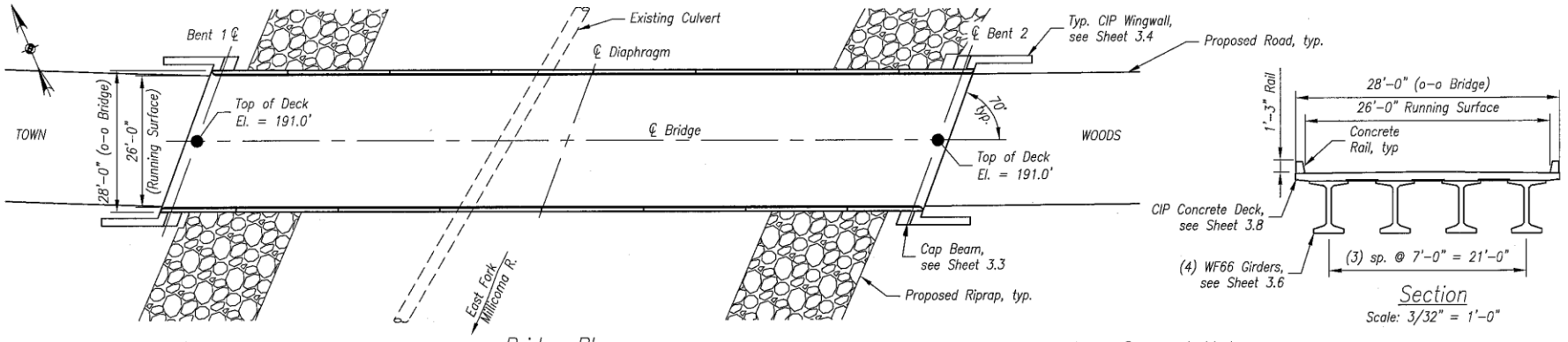
Coos Watershed Association

East Fork Millicoma River Oxbow Bridge 4

Soil Borings

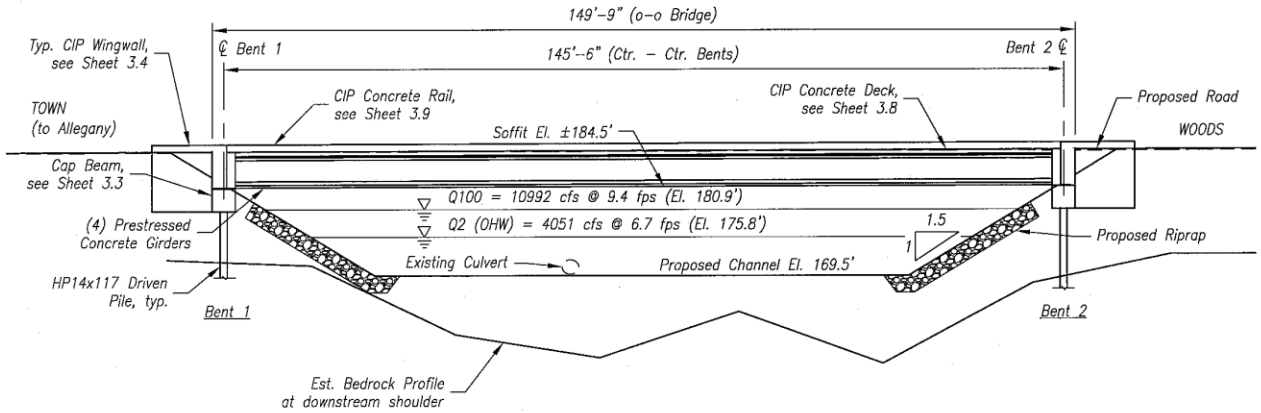
Designed: A. Dunn	Date: 3/28/2016
Drawn: M. Jacobson	Drawing No. 2

Bridge #5 Plans



Bridge Plan
Scale: 1" = 20'

Section
Scale: 3/32" = 1'-0"



Bridge Elevation
Scale: 1" = 20'

General Notes

1) The concrete to be used on this project is f'c = 4000 psi, 4-7% entrained air, 3/4" min. large aggregate size. The slump shall not exceed 4.5" as measured at the truck chute at any time during placement. Concrete stabilizers may be used to delay hydration with specific approval of Engineer.

2) The reinforcing steel shall meet requirements of ASTM A615, Grade 60. Bars shall be placed no closer than 2" to formed or finished surfaces, nor closer than 3" to soil when cast against soil surfaces. Splices shall be as follows: #4 bar @ 18", #6 bar @ 27". No splices are allowed in #8 bars.

3) The piles shall be HP14x117 (A36) pile driven to 110 ton bearing capacity or refusal. Additional driven pile (beyond 15' order length) shall be paid at $70/LF plus $175 per splice, limited to one splice per pile. Pruyn rock tips (or equal) shall be installed on each pile. The Engineering News Equation shall be used to equate set to capacity. Provide the Engineer with pile hammer data before beginning pile driving (minimum energy 20,000 ft-lbs).

4) WF66 Girders are dimensionally noncompliant material from the West Vancouver Freight Access Project, 2012, manufactured by Knife River Prestress, Harrisburg, OR (KRC Project No. 28500).

Rev	Description	By	Date

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Fax: (541) 758-6585

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REGISTERED PROFESSIONAL ENGINEER 72568PE OREGON DECEMBER 31, 2007 ALEXANDER J. DUNN

Renewal: 12/31/2017

Coos Watershed Association

East Fork Millicoma River Oxbow

Bridge 5

Plan, Elevation & Section

Designed: A. Dunn	Date: 3/22/2016
Drawn: A. Dunn	Drawing No. 3.0

Stage #3 “Construct substructures”

Bridge #4 dig holes in fill to bedrock

Stage #3 “Construct substructures”

April 23rd–27th attach and backfill piers.

- Bridge #4 Constructing bent #2.
- Approx. 5,000 yds. of fill and challenged with working below river grade.

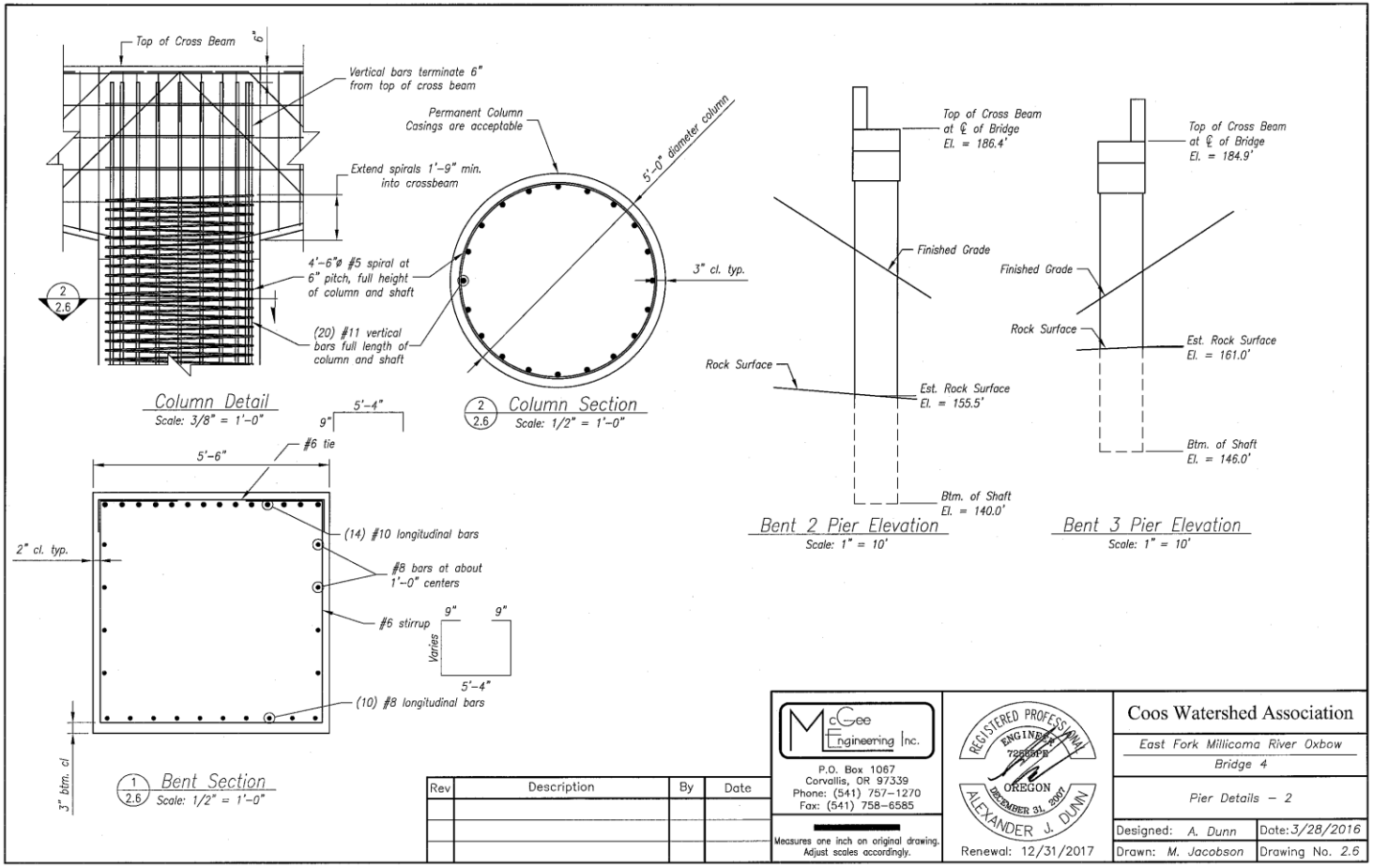
Stage #3 “Construct substructures”

April 23rd–27th attach and backfill piers.

- Bridge #4 Constructing bent #3.
- Approx. 5,000 yds. of fill.
- Dry hole.

Stage #3 "Construct substructures"

April 28th-May 2nd drill shafts.



- **CMP 5 ft. Diameter and approx. 20-25 ft. to reach from bedrock to bottom of hammer head.**
- **Drilled shafts need to penetrate rock 15 ft.**

Stage #3 “Construct substructures”

April 28th-May 2nd drill shafts.

- Bridge #4 bent #3 & #4 drilling the shafts.
- Each holes takes about 1 day to drill and clean out.

Stage #3 “Construct substructures
May 3rd-5th pour shafts.

- Bridge #4 Pouring the concrete piers at bent #2 & #3.
- Concrete required being boom pumped from the bottom of shaft up.
- Concrete testing was done on site.

Stage #3 “Construct substructures”

May 6th-23rd build hammer heads.

Bridge #4 Constructing hammerheads.

Stage #3 “Construct substructures”

Bridge #4 Constructing hammerheads.

Stage #3 “Construct Substructures”

Bridge #4 bents 1 & 4 pile driven, bents 2 & 3 piers and hammerheads completed.

Stage #3 “Construct substructures”

April 27th-May 12th complete all of Bridge #5 substructure.

Bridge #5: HP14x117 driven piles at 6ft-6inch centers with cast in place concrete bents.

Stage #3 “Construct substructures”

April 27th-May 12th complete all of Bridge #5 substructure

Bridge #5 bents 1 & 2 pile driven and concrete bents poured.

Stage #4 “Construct superstructures”

May 13th–June 30th finish construction of bridge #5.

- Knife River trucked in the 150 ft. long bulb-T girders with manned steer cars with an overall length of 195 ft.
- Two cranes where used to place girders on bents into their permanent locations.

Stage #4 “Construct superstructures”
Knife River Bulb-T Girders

- Knife River provided the semi used beams to this project for a discounted rate.
- Beams had to be retro fitted to fit this location.

Stage #4 “Construct superstructures”

May 13th–June 30th finish construction of bridge #5.

- Bridge #5 Once the girders are set diaphragms and wing walls are constructed.
- On top of the girders false work was constructed to pour the deck and curbs.

Stage #4 Constructing superstructures”

June 6th pour Bridge #4 deck.

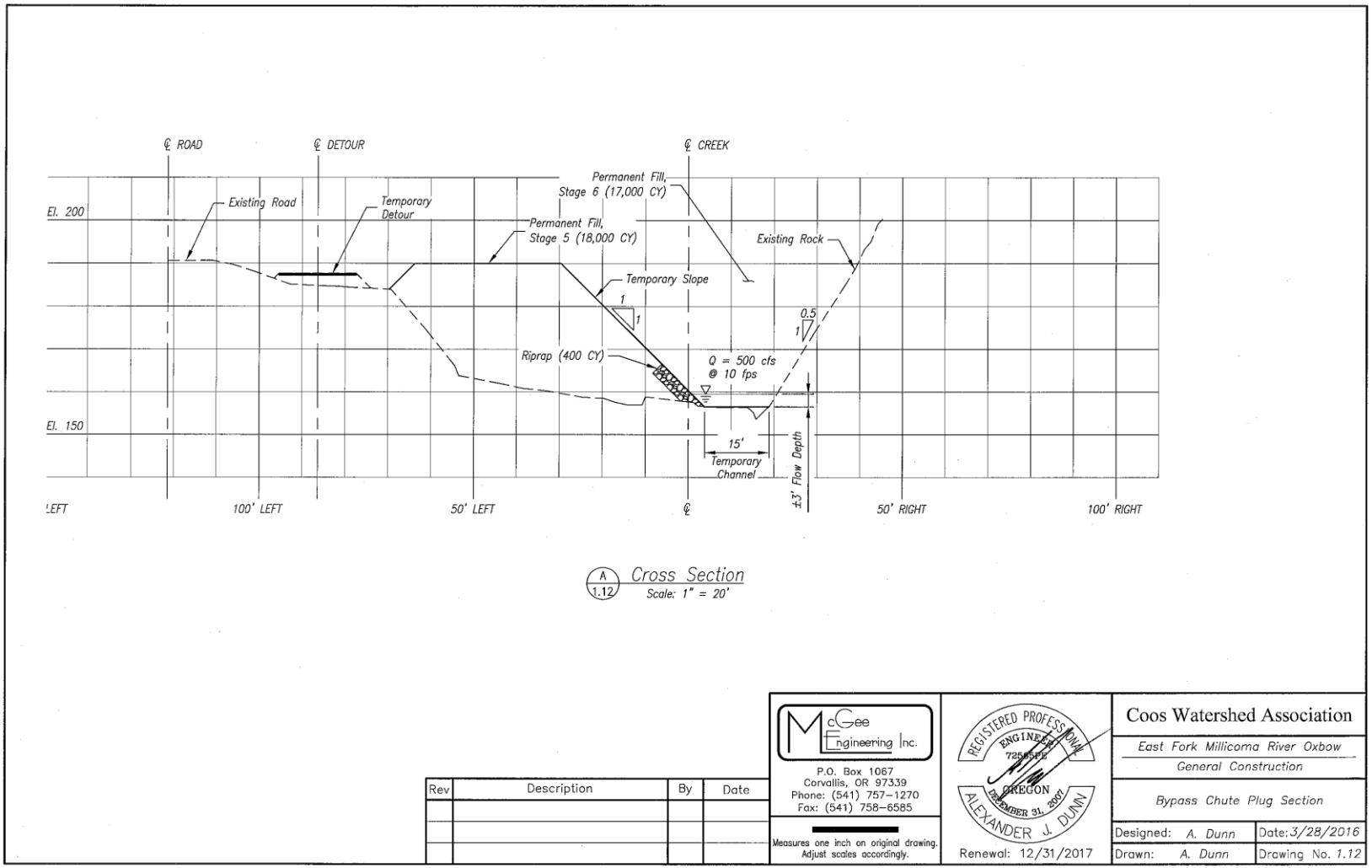
- Bridge #4 Girders are set and diaphragms are poured.
- On top of the girders false work was constructed for the deck and curbs.
- Once span two is completed approach spans 1 and 3 are cast in place with curbs and wing walls.

Stage #4 “Construct superstructures”
May 22nd – June 30th finish construction of Bridge #4

- After the concrete is all poured, the concrete was lab tested for strength.
- Once the required strengths were reached the forms were removed and the bridge was ready for traffic.

Partial Bypass Chute Plug Cross Section

Start of "In Water Work"



- **Channel reduced down to 15 ft. to pass summer flows.**
- **Approx. fill 27,000 yds.**

Stage #5 “Partially Bypass plug & Rip Raping”.

July 5th-Aug 22nd.

- Grub and remove all stumps and woody material along fill.
- Construct access ramp to start building the bypass chute plug.
- Engineers set control points for the toe of new channel.

Stage #5 “Partially Bypass plug & Rip Raping”.

July 5th-Aug 22nd.

- The general bypass chute plug was constructed in max lifts of 24 inch's.
- Excavator placed rip rap along wetted toe of fill to eliminate erosion of fill.

Stage #5 “Partially Bypass plug & Rip Raping”.

July 5th-Aug 22nd.

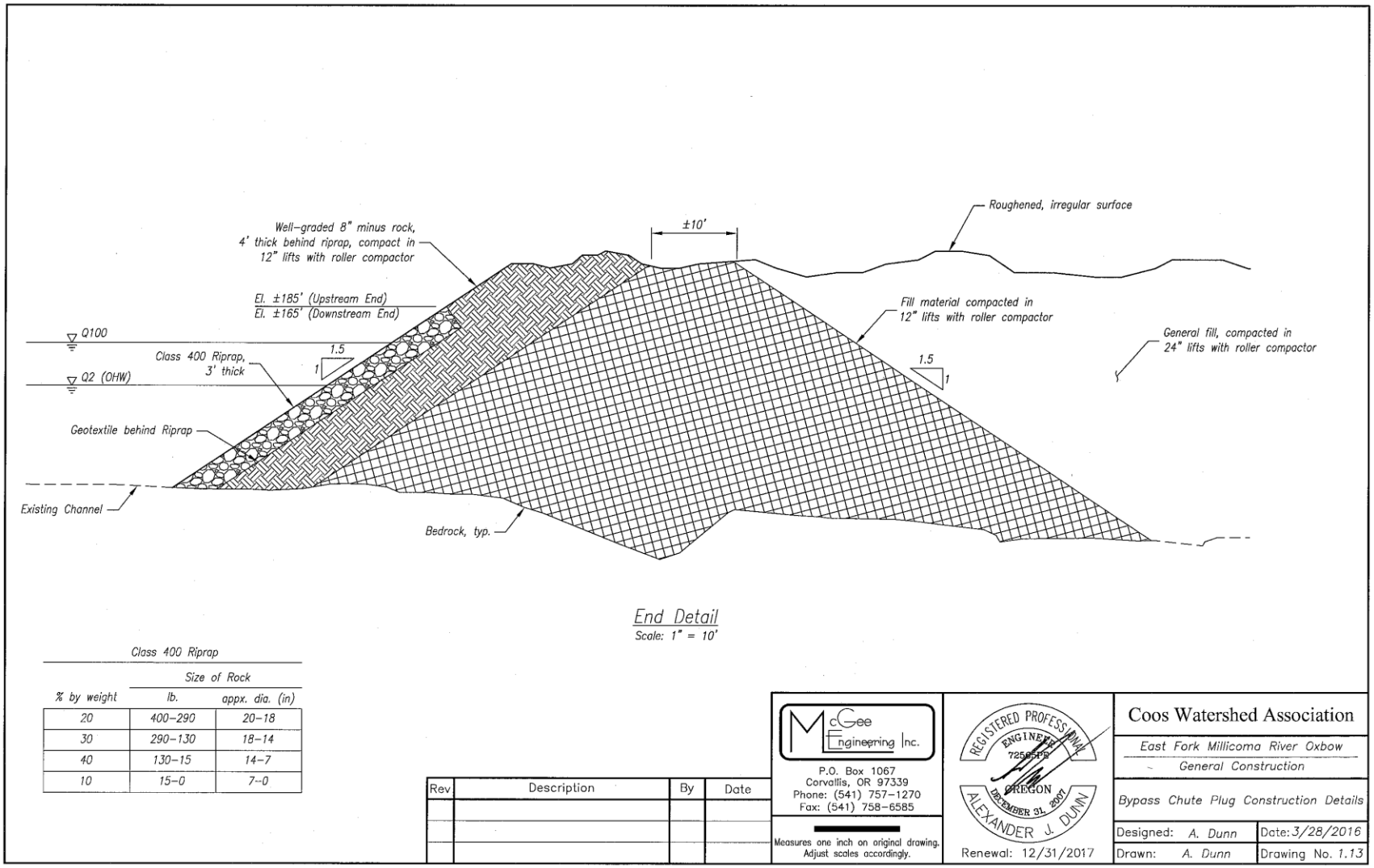
- D-8 Cat, 324 Cat excavator, Off Hwy 25 ton haul truck and sheep's foot roller removed fill under both bridges to construct the bypass chute plug.

Stage #5 “Partially Bypass plug & Rip Raping”.

July 5th-Aug 22nd.

- Once the fills were removed, but before river was re-introduced final rip rapping was placed under the bridges at a 1.5 to 1 slope.

Final Bypass Chute Plug Construction Details



- **The final Bypass Chute Plug would require 17,000 more yards of material.**

Stage #6 “Re-route river, finish bypass plug & rip rap”.

August 23rd-September 12th.

- Three six inch river pumps were used for 24 hours to re-prime the oxbow before moving the river.

Stage #6 “Re-route river, finish bypass plug & rip rap”.

August 23rd-September 12th.

- The three six inch river pumps also helped maintain river depths on the coffer dam built to protect the engineered fill on the bypass plug.

Stage #6 “Re-route river, finish bypass plug & rip rap”.
August 23rd-September 12th.

- August 23rd: diverted entire flow into Oxbow.
- Approximately 30 volunteers helped with fish salvage.
- The river would take 38 hours after being diverted to fully reconnect.

Fish salvage safety meeting August 23rd 8:00 AM.

Fish salvage August 23rd 2:00 PM.

Stage #6 “Re-route river, finish bypass plug & rip rap”.
August 23rd-September 12th.

- Engineered fill behind the coffer dam August 23rd 5:00 PM.
- Coffer dam at top of bypass chute plug August 24th 6:30 AM.
- River now has a natural 1/4 mile pool backed up before bridge #5.

Stage #6 “Re-route river, finish bypass plug & rip rap”.

August 23rd-September 12th.

- After the river was diverted the remaining fills were placed and final rip rapping along toe of new bypass chute plug.

Final Stats of East Fork Oxbow Project

Started March 28th and finished up September 12th 2016.

- Original Bridge #4 215 ft. long wood trestle bridge.
- New Bridge #4 210 ft. long concrete bridge.
- Original Bridge #5 164 ft. long wood trestle bridge.
- New Bridge #5 150 ft. long concrete bridge.

- Cost of Bridges: $90/square foot.
- Total fill removal and construction of bypass chute plug: $4/TMY.
- Total Cost of project came in well under plan.

Bridge #4 Before and After

Looking upstream at bridge

Aug 28, 2014

Dec 22, 2016

Looking downstream at bridge

Oct 23, 2007

Aug 28, 2014

Dec 22, 2016

Bridge #5 Before and After

★ Looking downstream at bridge ★ Looking upstream at bridge

Aug 28, 2014

Dec 22, 2016

Aug 28, 2014

Dec 22, 2016

Bridge #5 Before and After

Bridge #5 Looking downstream towards bypass chute.

Oct 12, 2009

July 11, 2016

Aug 22, 2016

Sept 21, 2016

Dec 6, 2016

Bridge #5 Before and After

Bridge #5 Looking downstream into the Oxbow channel.

Oct 2007

Aug 23, 2016

Sept 21, 2016

Dec 9, 2016

Bridge #5 Before and After

Bridge #4 Looking upstream into the Oxbow channel.

Oct 23, 2007

July 1, 2016

Aug 15, 2016

Sept 21, 2016

Dec 6, 2016

Bridge #5 Before and After

Bridge #4 Looking downstream into the Bypass Chute.

Oct 23, 2007

June 9, 2016

Aug 31, 2016

Sept 21, 2016

Dec 6, 2016

Future Monitoring Plans

- **Coos Watershed has developed 6-year monitoring program to assess the effectiveness of the reconnection on fish passage.**
  - **Spawning Surveys**
  - **Snorkel Surveys**
  - **Passage Window Analysis**
  - **Topographic Surveys**

First Chinook spotted in the Oxbow channel in 58 years!

Weyerhaeuser Project Partners.

Coos Watershed Association

McGee Engineering Inc.

U.S. Fish & Wildlife Service

Oregon Fish & Wildlife

Oregon Watershed Enhancement Board

OWEB

Oregon Department of Transportation

Knife River

An MDU Resources Company

Restoration & Enhancement

protecting Oregon's investment

Oregon Department of Fish and Wildlife

Confederated Tribes of Coos-Lower Umpqua-Siuslaw

West Coast Contractors
LBA Contract Cutting, Inc.
Coos Bay Timber Operators
Bandon Concrete
Dave Strain

Questions?

Looking into the Oxbow channel from Bridge 4 after snow event (1/5/2017)