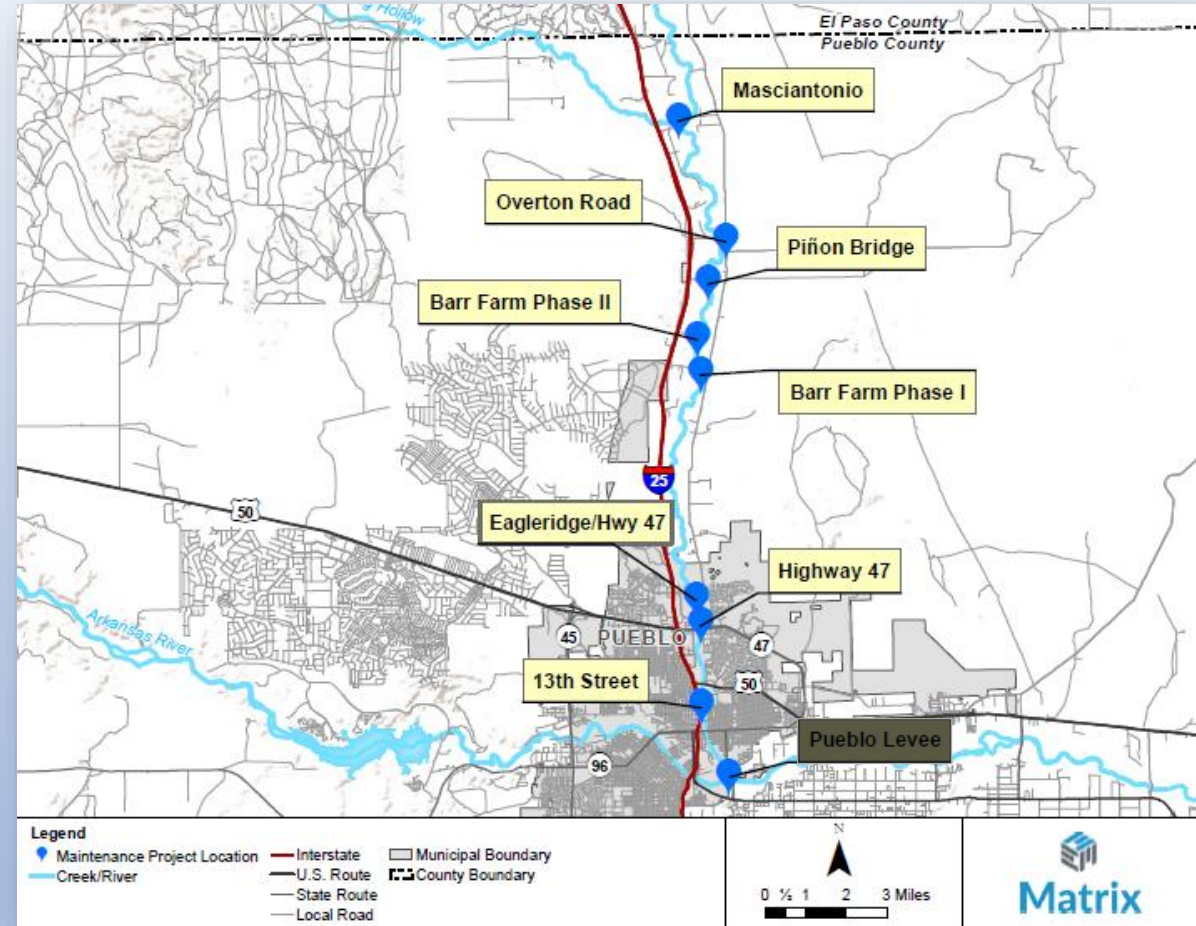




Project Effectiveness Study

February 16, 2024

Tori Mack, PE
Water Resources Engineer



Matrix

Introduction

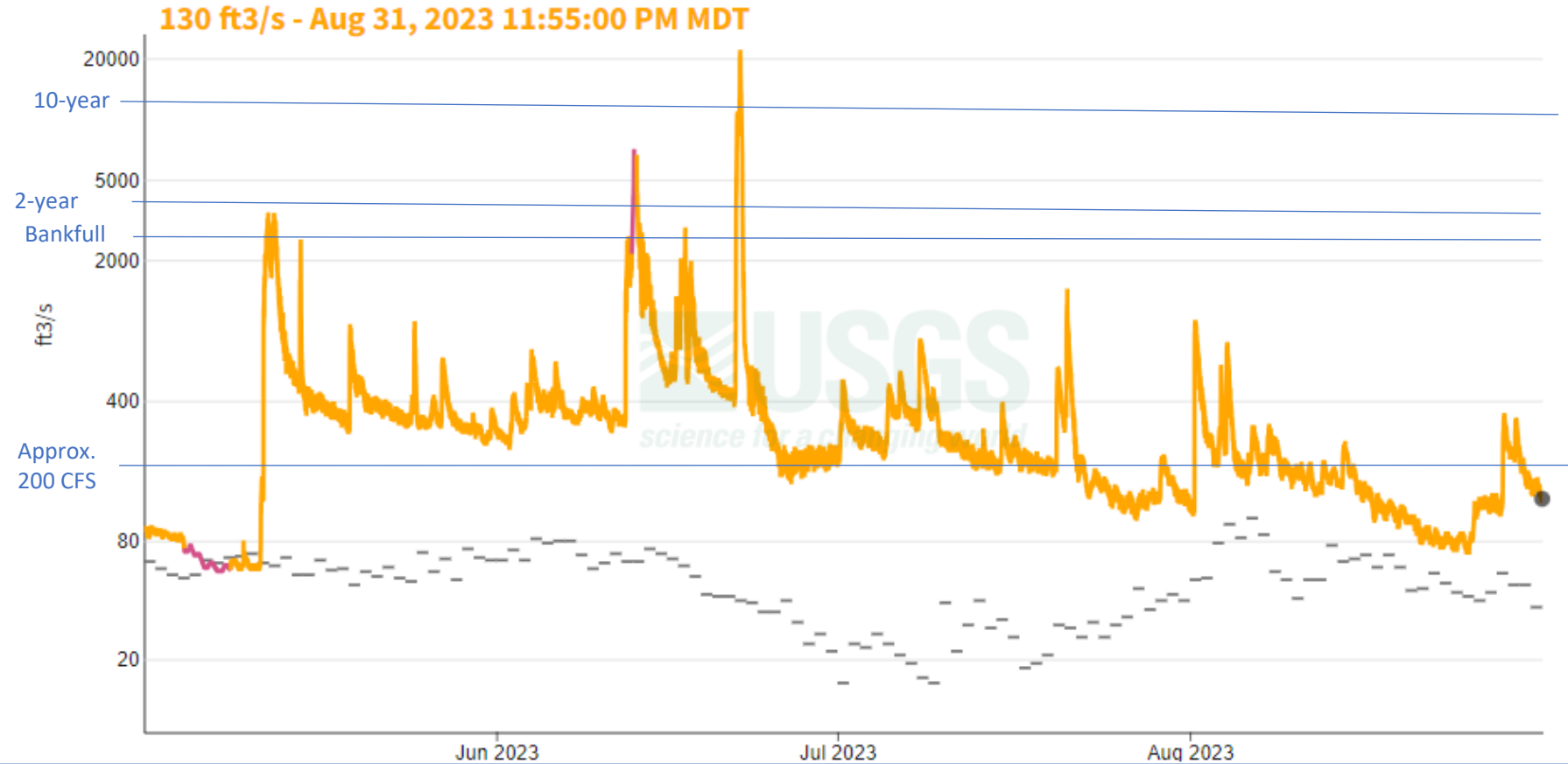
- **Assess...**
 - **Project objectives**
 - **How each project has performed in meeting these objectives**
 - **Summaries to inform public, District stakeholders, committees, and Board.**
- **Project Objectives**
 - **Mitigate flooding, erosion, and sedimentation;**
 - **Address water quality issues;**
 - **Improve drainage;**
 - **Protect open space;**
 - **Develop public recreational opportunities including open space**

Project	Start – End Dates	Construction Costs (\$)
Masciantonio Trust Bank and Young Hollow	2016-2018	\$2.0 million
Overton Road Bank Restoration	2019-2020	\$1.0 million
Pinon Bridge	2018-2019	\$2.3 million
Barr Farm, Phase 2	2019-2020	\$10.2 million (District: \$4.5 million; CDOT: \$1.5 million)
Barr Farm, Phase 1	2018-2019	
Highway 47 Bank Restoration	2017-2018	\$6.0 million
13 th Street Channel Restoration	2018-2021	\$2.6 million

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Fountain Creek at Pueblo, Co. - 07106500

May 1, 2023 - August 31, 2023
 Discharge, cubic feet per second

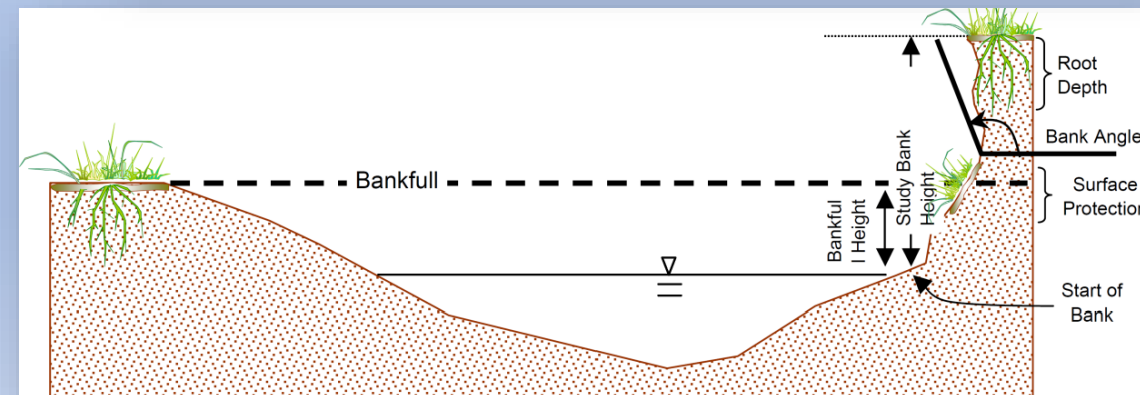


Hydrology at Highway 47

Recurrence Interval	Mean Annual Flow	Bankfull Flow	2-Year	5-Year	10-Year	June 16, 2015 Event	50-Year	100-Year	500-Year
Discharge (ft ³ /s)	158	2,990	4,600	9,500	14,400	18,500	30,200	39,600	70,000

Methodology

- Bank Assessment for Non-Point Source Consequences of Sediment (BANCS)
 - Bank Hazard Erosion Index (BEHI)
 - Near Bank Stress (NBS)
- Comparison to WARSSS Study
- Use of the CSQT

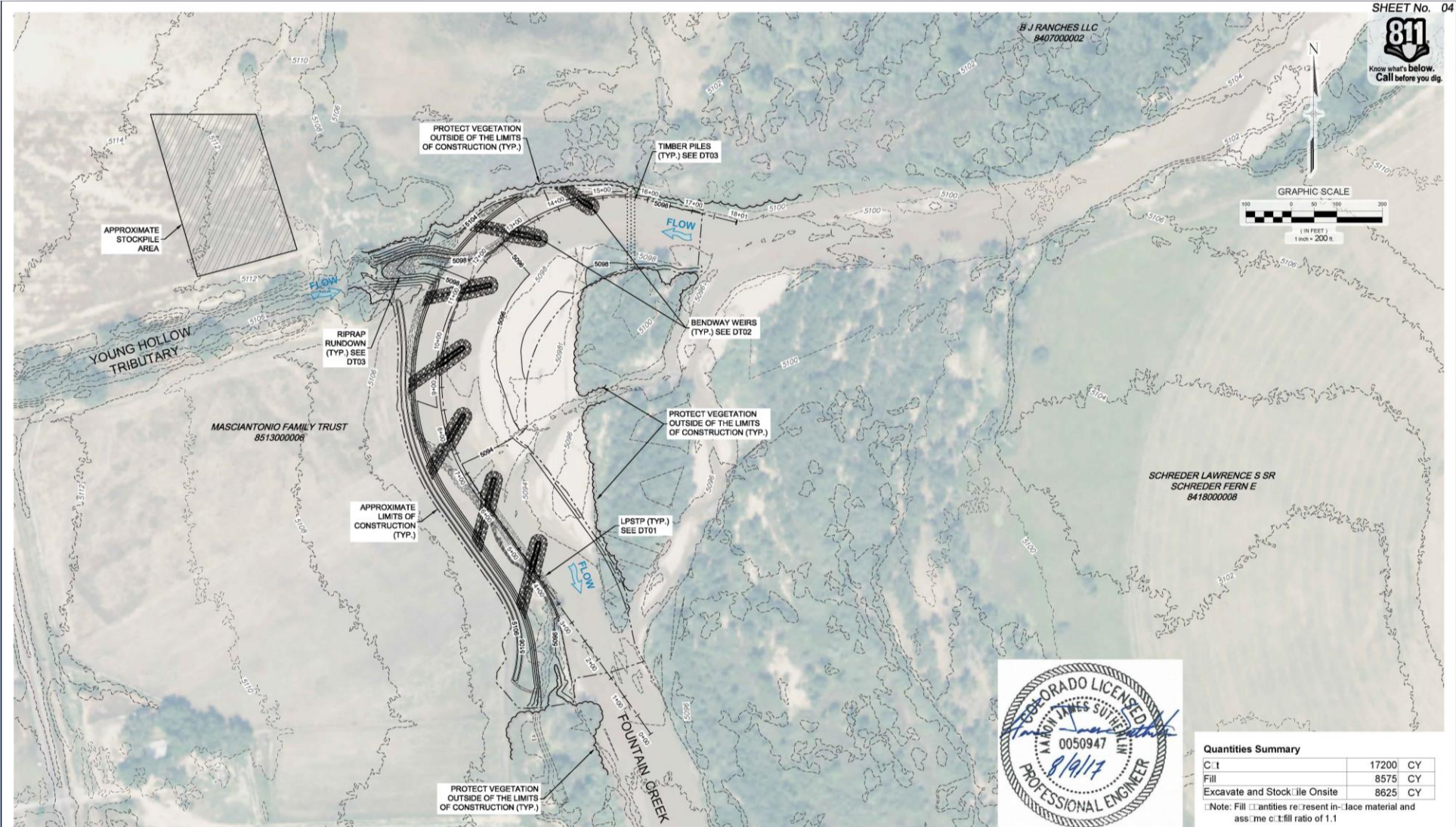


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Masciantonio Trust Bank

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Masciantonio Trust Bank

- Project Objectives
 - Restoration of eroding bank, PC003.

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Bank PC003, Looking Upstream



Pre-Project, 2017



Post-Project, 2019



Post-Project, 2023

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Bendway weir, 2023



Wetland, 2023

- **Findings**
 - **Stable site**
 - **Dense riparian vegetation**
 - **Multi-threaded channel**
- **Sediment**

Bank	Pre-Project (tons/year)	Post-Project (tons/year)
PC003	13,653	Negligible



Bank PC003, 2023

Young Hollow

- Project Objectives
 - Stabilization of crossing

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Pre-Project Crossing



Looking Downstream



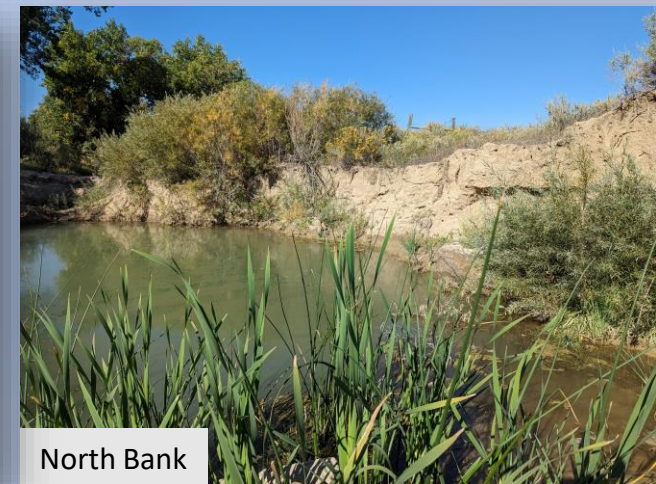
North Bank



Post-Project Crossing



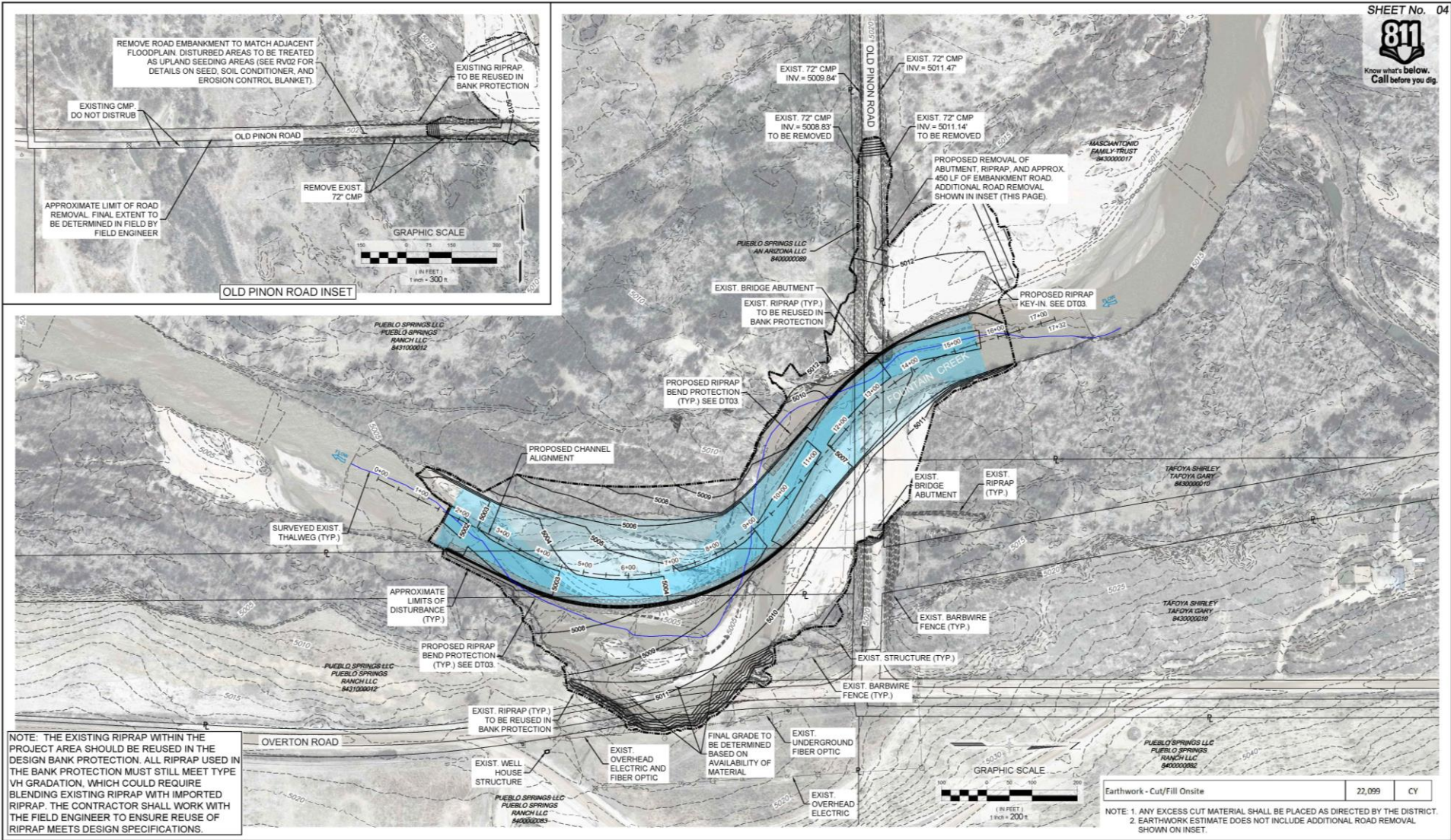
Looking Downstream



North Bank

Overton Road Bank Restoration

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Overton Road Bank Restoration

- **Project Objectives**
 - Removal of the abutments from the old Pinon Road bridge
 - Addressing a large cutbank on the eastern bank of Fountain Creek

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Bank PC070, Looking Downstream



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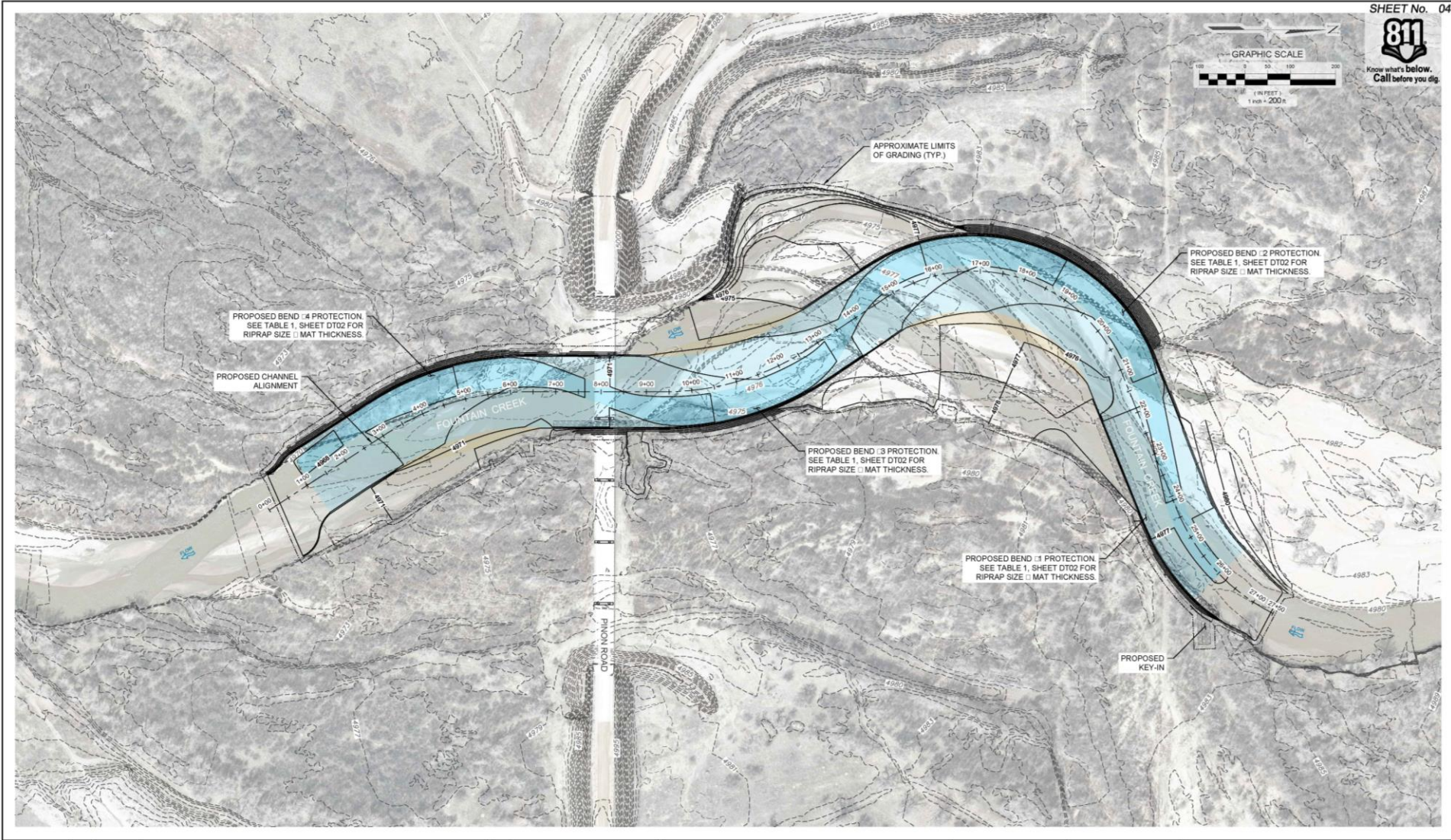
- **Findings**
 - Excessive sediment deposition
 - Potential flanking of the bend protection
- **Sediment – major bank**

Bank	Pre-Project (tons/year)	Post-Project (tons/year)
PC070	16,225	Negligible



Pinon Bridge

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Pinon Bridge

- **Project Objectives**
 - **Protection of the western guide bank**
 - **Reduction of bank erosion**

Pinon Project, Looking Upstream from the Bridge



Pre-Project, 2018



Post-Project, June 2023



Post-Project, September 2023

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Pre-Project Bank PC017

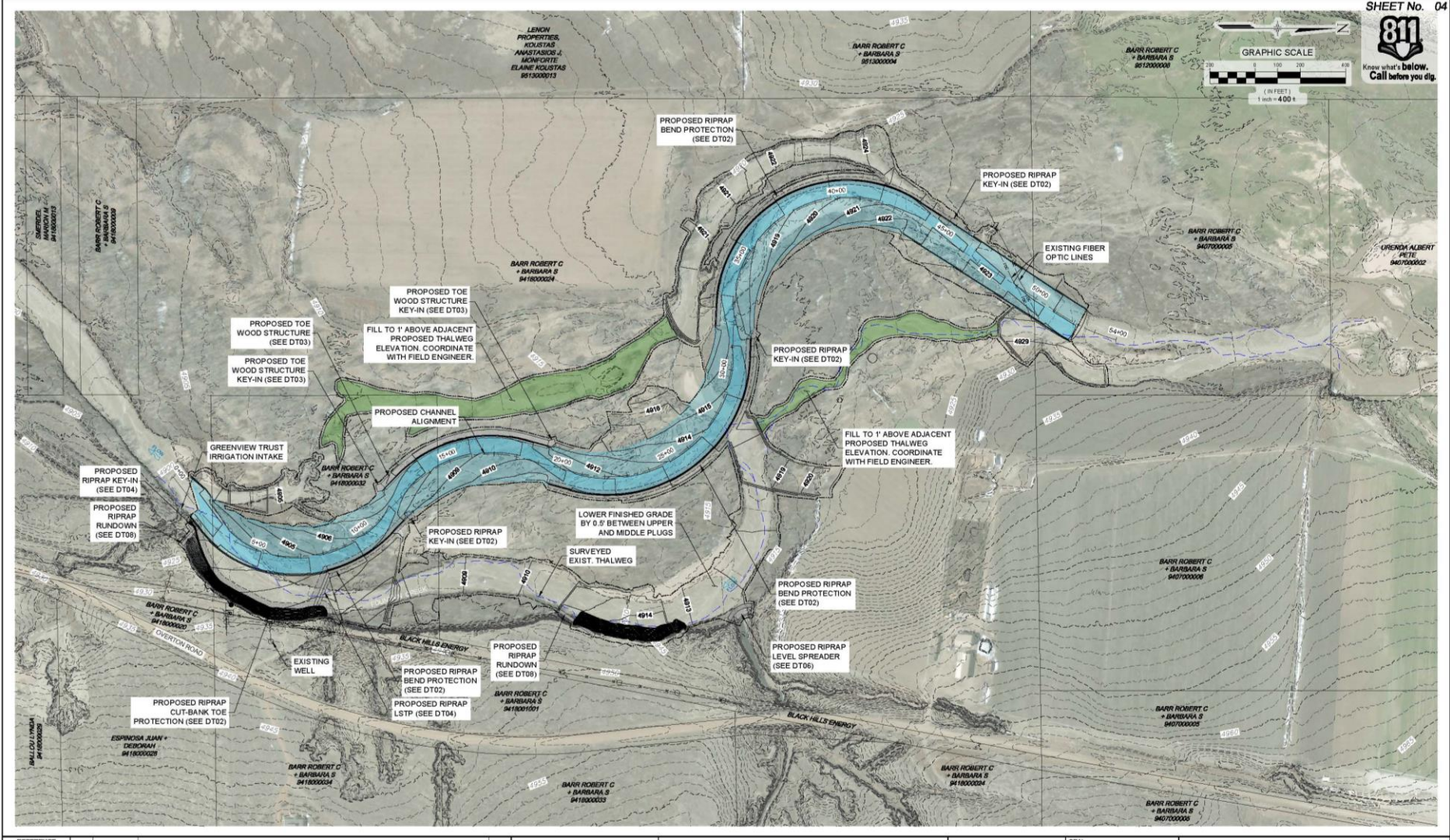
- **Findings**
 - **Flanking on downstream end of bend protection**
 - **Other components intact**
- **Sediment – major bank**

Bank	Pre-Project (tons/year)	Post-Project (tons/year)
PC017	9,242	Negligible



Barr Farms, Phase 2

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SHEET No. 04

Barr Farm, Phase 2

- Project Objectives
 - Reduction of bank erosion
 - Protection of agricultural lands



Pre-Project, 2017

Bank PC079



Construction, Winter 2020



Post-Project, June 2023

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Typical Toe Wood Condition, 2023



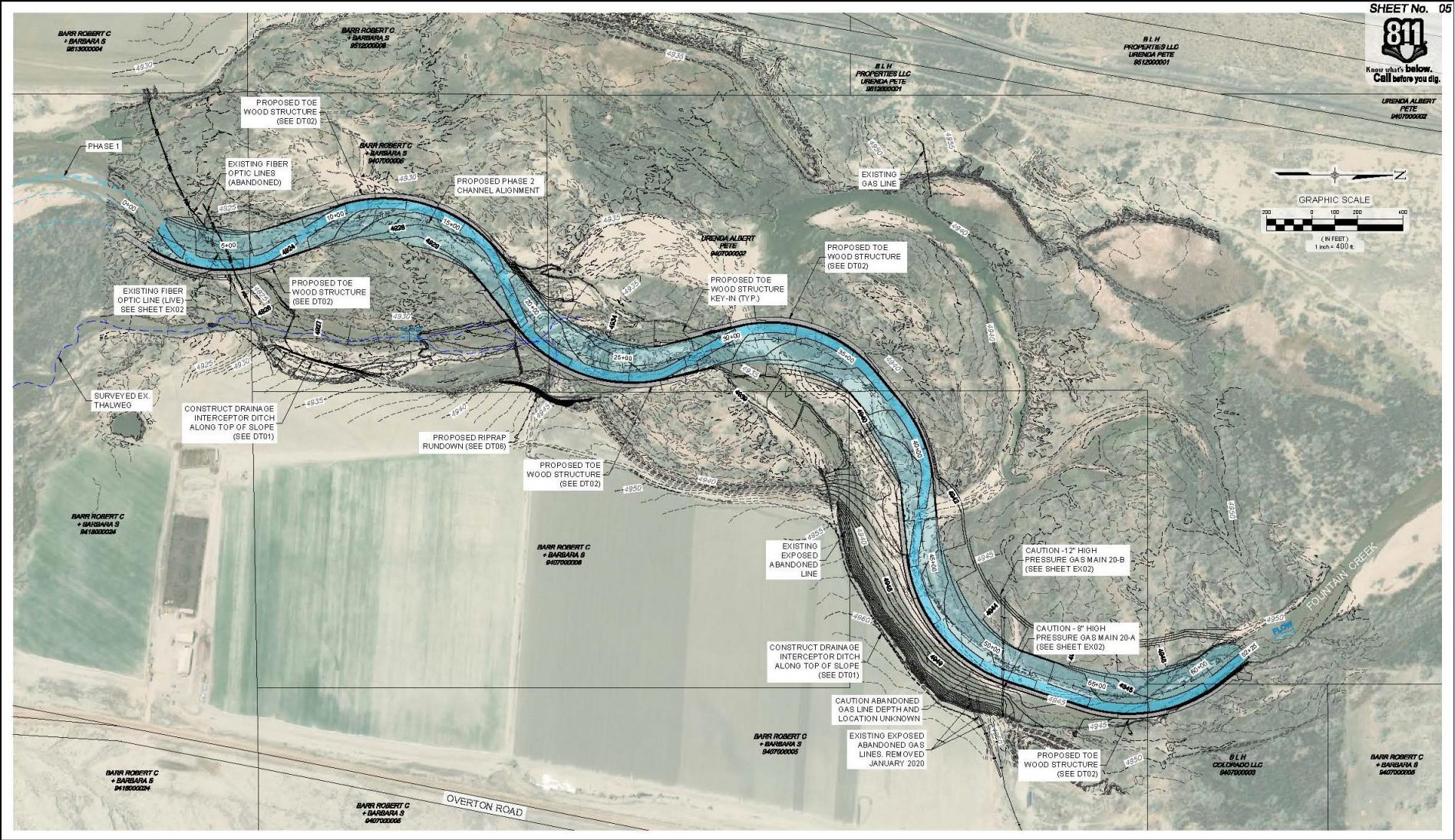
Bank Near Irrigation Pivot, 2023

- **Findings**
 - **Undermining of toe wood bank protection.**
- **Sediment**
 - **Rate = 0.19 tons/yr/ft**
 - **Post-Project total = 1,371 tons/year**

Bank ID	Pre-Project (tons/year)
PC021	2,525
PC078	27,284
PC079	19,758
PC080	5,156
Total	54,732

Barr Farm, Phase 1

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Barr Farm, Phase 1

- **Project Objectives**
 - Reduction of bank erosion
 - Protection of agricultural lands

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Bank PC082



Pre-Project, 2017



Post-Project, August 2023

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Compromised Toe Wood, August 2023

- **Findings**
 - **Undermining of toe wood bank protection.**
 - **Some riprap flanking on downstream side and aggradation in the point bars.**
- **Sediment**
 - **Rate = 0.06 tons/yr/ft**
 - **Post-Project total = 312 tons/year**

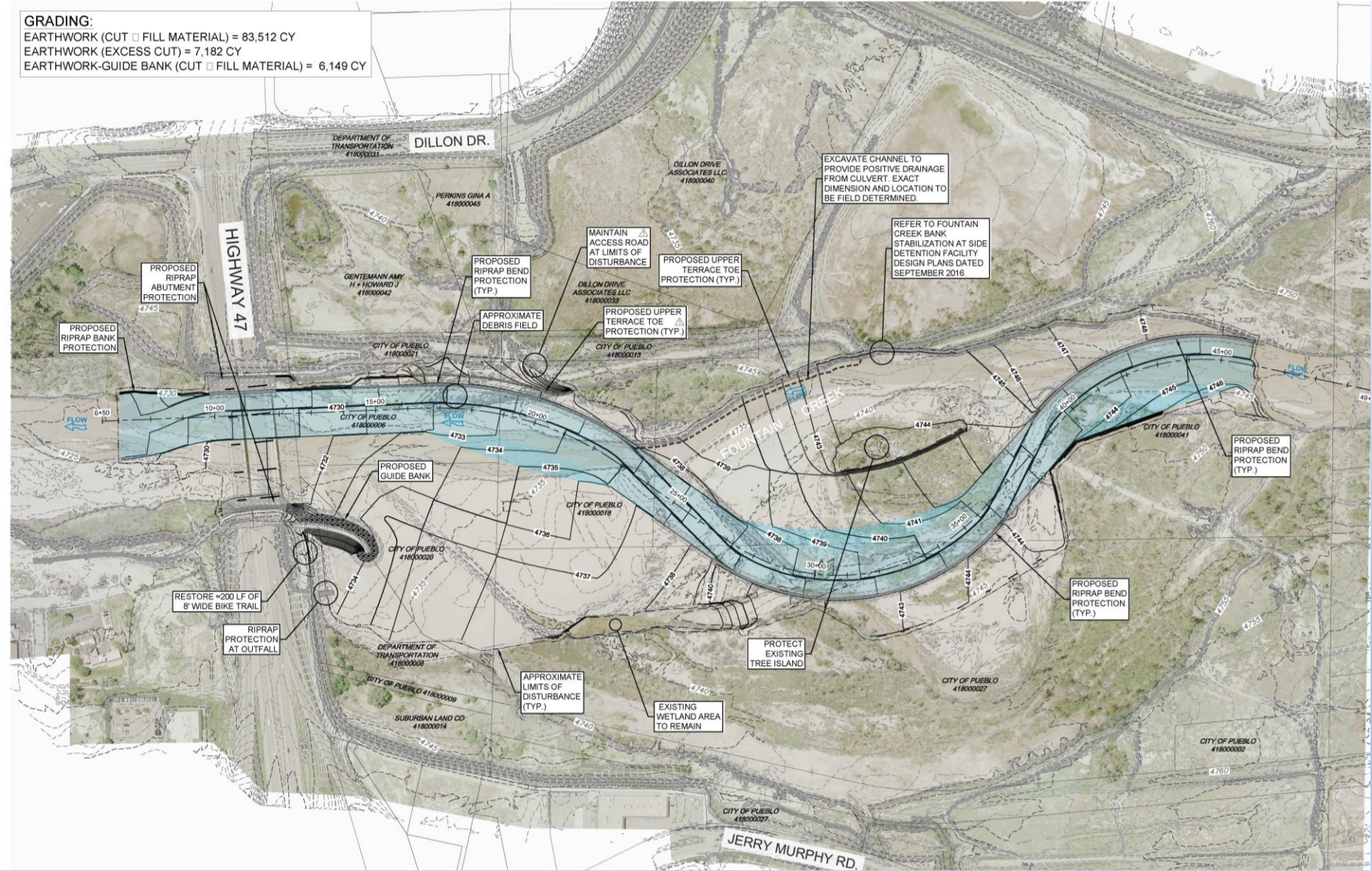


Remaining Soil Lift, August 2023

Bank ID	Estimated Erosion Rate (tons/year)
PC022	1,199
PC081	28,427
PC082	25,189
Totals	54,814

Highway 47 Bank Restoration

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Highway 47 Bank Restoration

- **Project Objectives**
 - Protection of the Highway 47 Bridge
- **Findings**
 - Significant site damage
- **Sediment**
 - Post-Project Contribution = 4,442 tons/year

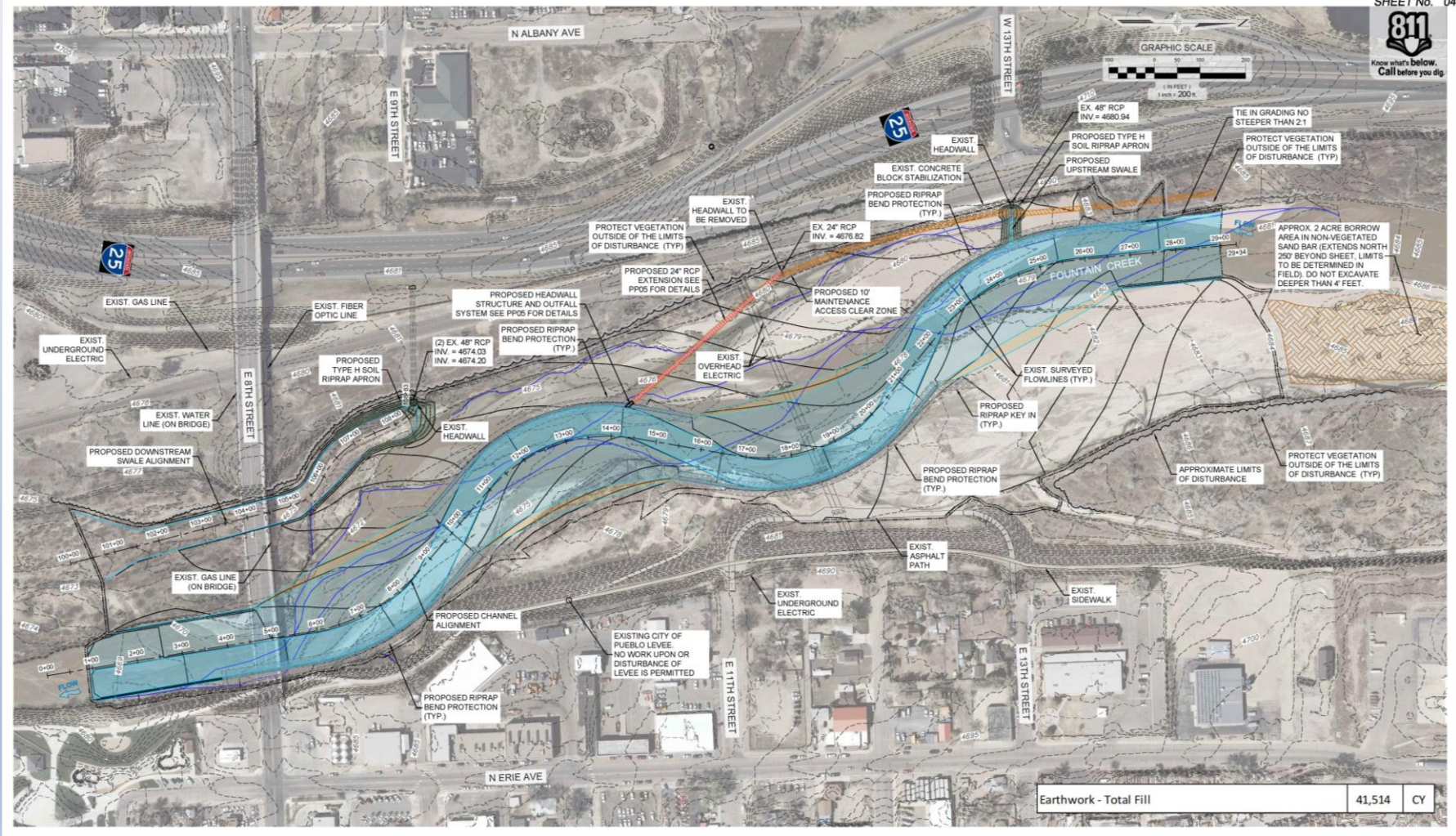
Bank ID	Estimated Erosion Rate (tons/year)
PC044	6,422
PC045	2,686
PC046	4,149
PC106	7,633
PC107	742
PC108	5,582
PC109	3,255
Totals	30,468

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13th Street Channel Restoration

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SHEET No. 04
811
Know what's below.
Call before you dig.

Earthwork - Total Fill	41,514	CY
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13th Street Channel Restoration

- **Project Objectives**
 - Reduce sediment contributions to site.
 - Protection of levee and railroad.
- **Findings**
 - Ongoing migration of thalweg

- **Sediment**
 - Rate = 0.19 tons/yr/ft
 - Post-Project total = 532 tons/year



Brush Layering on Site, 2023

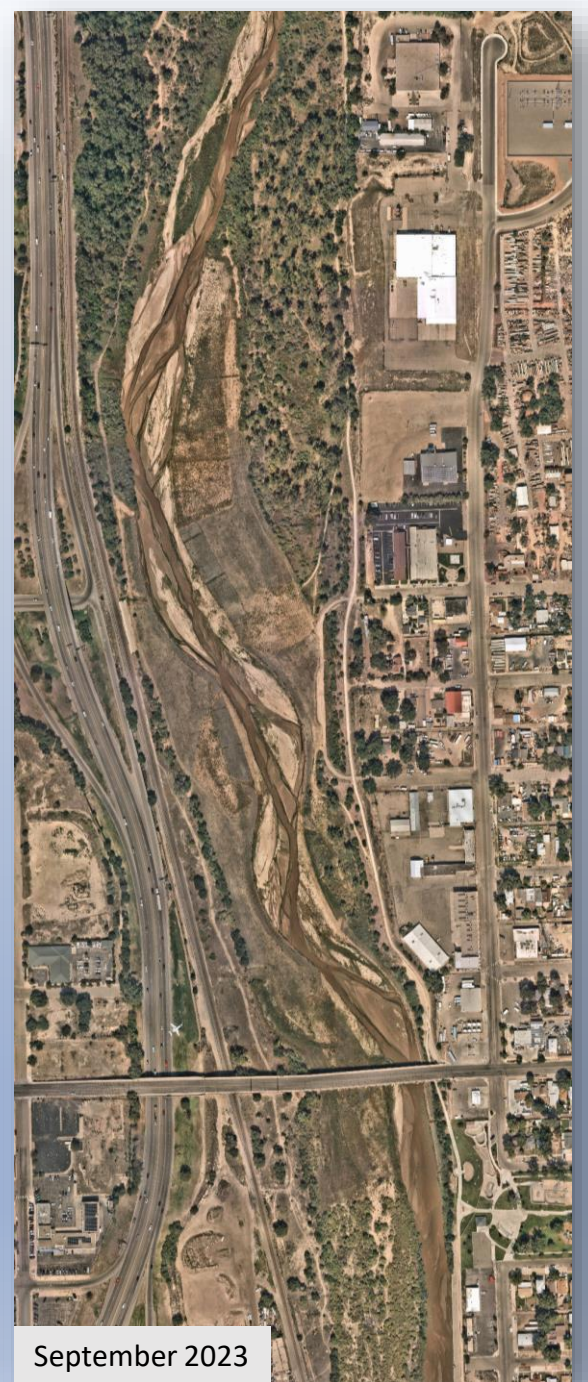


Representative Bank Erosion

Bank ID	Estimated Erosion Rate (tons/year)
PC053	2,273
PC054	1,714
PC055	3,778
PC115	3,072
PC116	4,637
Totals	15,474

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Summary

- **Lessons Learned**
 - **Rock and boulder**
 - **Revise toe wood soil lift designs**
 - **Vegetative success is key**

Project Site	Recommendation
Masciantonio Trust Bank and Young Hollow	Weed control for minimum of two years with focus on salt cedar and Russian olive.
Overton Road Bank Restoration	Monitoring of post-flood conditions in 2024. Weed control for minimum of two years with focus on salt cedar.
Pinon Bridge	Monitoring of post-flood conditions in 2024. Vegetation monitoring and weed control for minimum of two years.
Barr Farm, Phase 2	Monitoring of bend migration in 2024 and annually. Vegetation monitoring and weed control for minimum of two years.
Barr Farm, Phase 1	Monitoring of toe wood bend and confined area in 2024. Vegetation monitoring and weed control for minimum of two years.
Highway 47 Bank Restoration	Additional action recommended. In discussion. Vegetation monitoring and weed control for minimum of two years. Interseeding areas with low native cover.
13 th Street Channel Restoration	Additional action recommended. In discussion. Vegetation monitoring and weed control for minimum of two years. Interseeding areas with low native cover.