River Road Park Bank Stabilization
City of Boerne
2025 Urban Riparian Symposium

Tami Norton, PE, PG, CFM, PMP, ENV SP

Ecosystem Planning & Restoration

February 20, 2025

City of Boerne

Project Location

Project Team

City Project Manager – Paul Barwick, Special Projects Director

Design Team

- Ecosystem Planning and Restoration (EPR) – stream bank stabilization
- Terra Design Group (TDG) – park landscaping
- Unintech Consulting Engineers, Inc. – structural

Construction Contractor

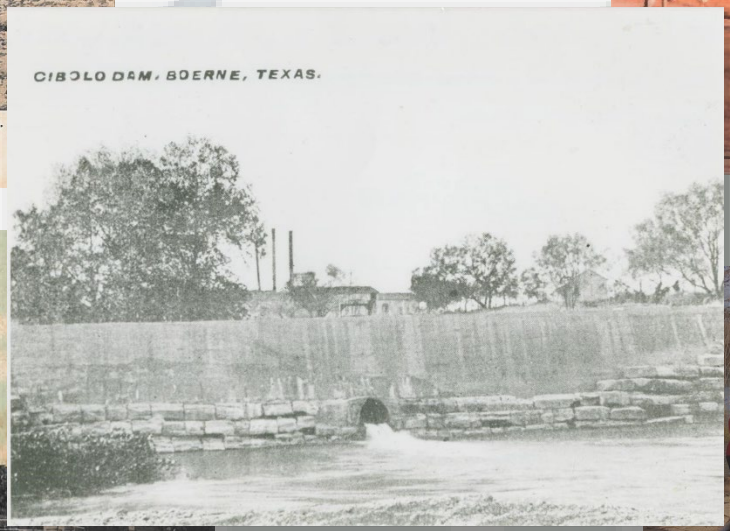
- Agave Design Studio

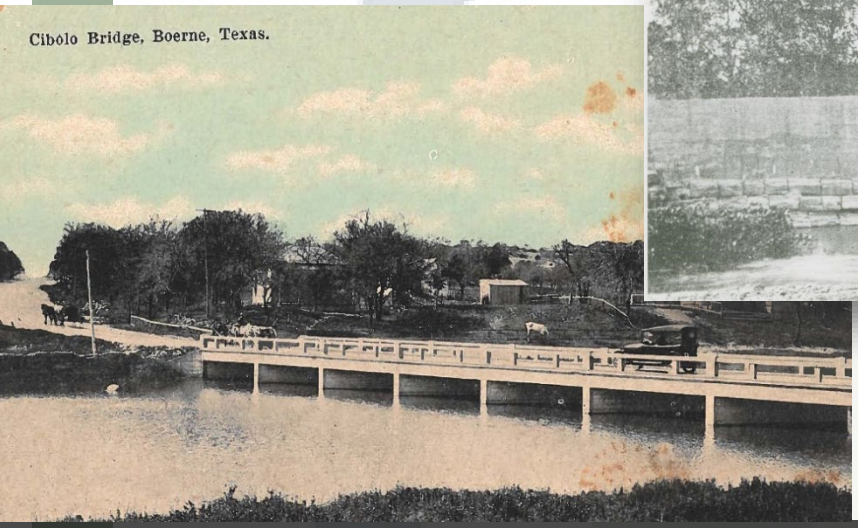
Purpose & Goals

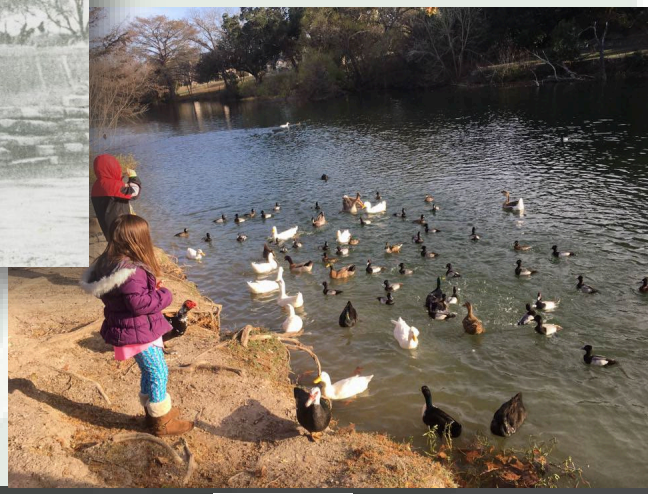
Purpose - re-establish approximately 1,400-LF of Cibolo Creek riverbank profile, prevent ongoing bank erosion, and protect existing park amenities.

Goals – preserve the character and historic use of the park using natural and green solutions to the extent possible.

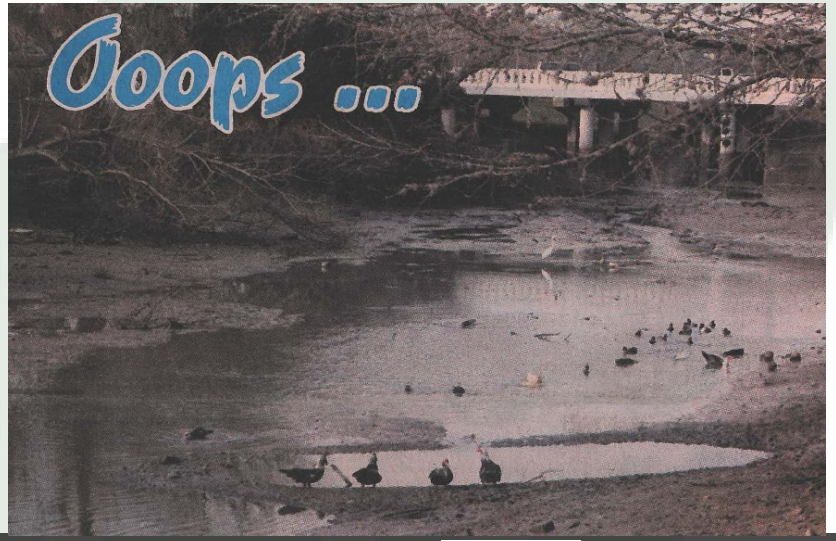
Historical Context – Uses/Impacts





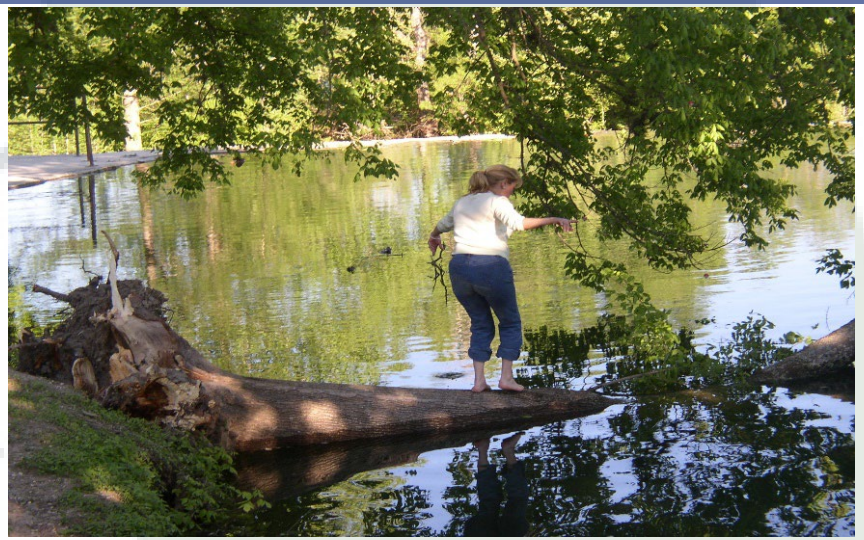


Historic Context - Drought & Ooops..



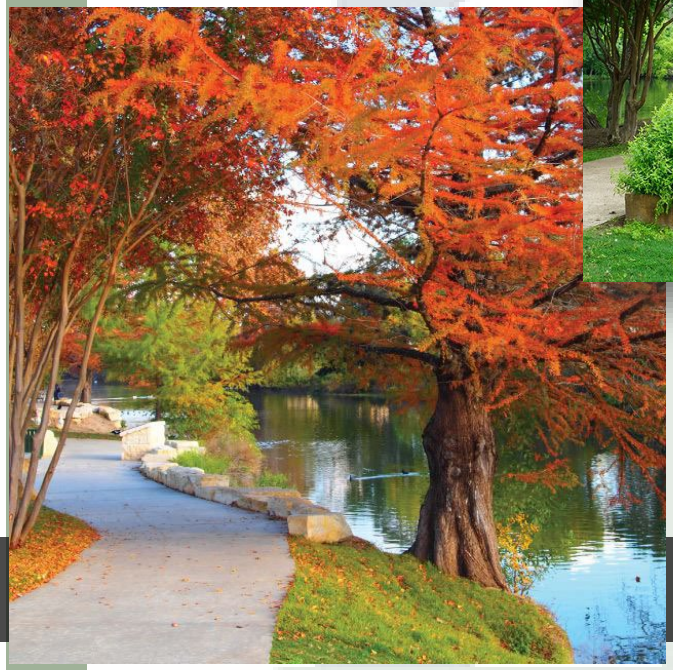
Historic Context – Flood Damage

River Road Park – Pre 2011



River Road Park – Pre 2011

River Road Park – Post 2011




Cibolo Trail, River Road Park

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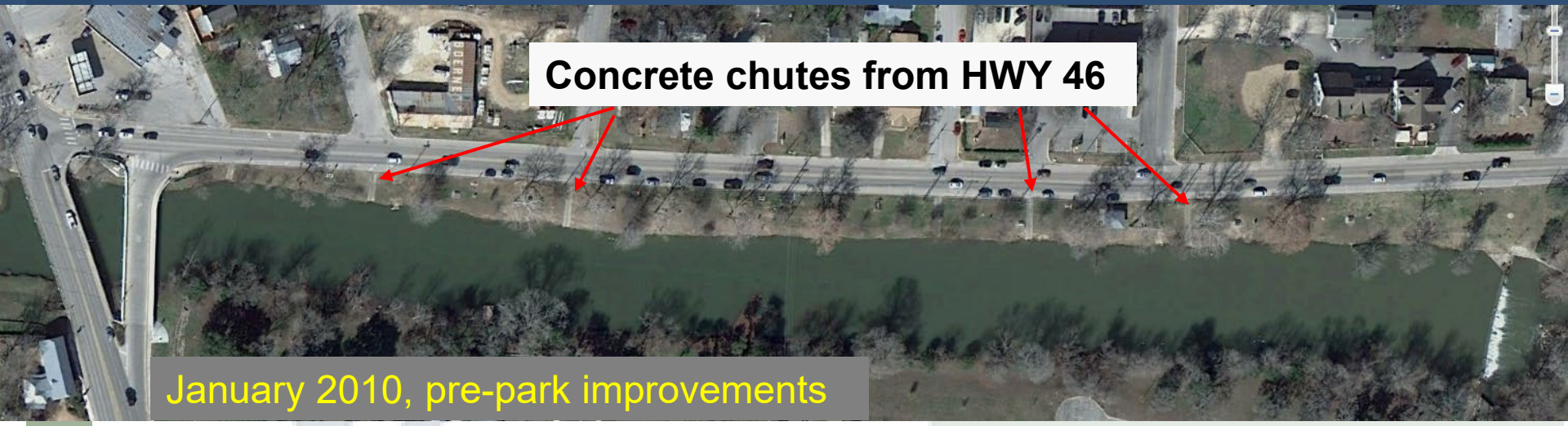
Highway 46 Drainage



January 2010, pre-park improvements

February 2013, post-park improvements

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Fast Forward 10 years to 2021

West end of project

- **Vegetation – grass mowed to bank**

Pre-Project

Existing landscape boulders & exposed irrigation pipe

- **Bare banks, exposed roots**

Pre-Project

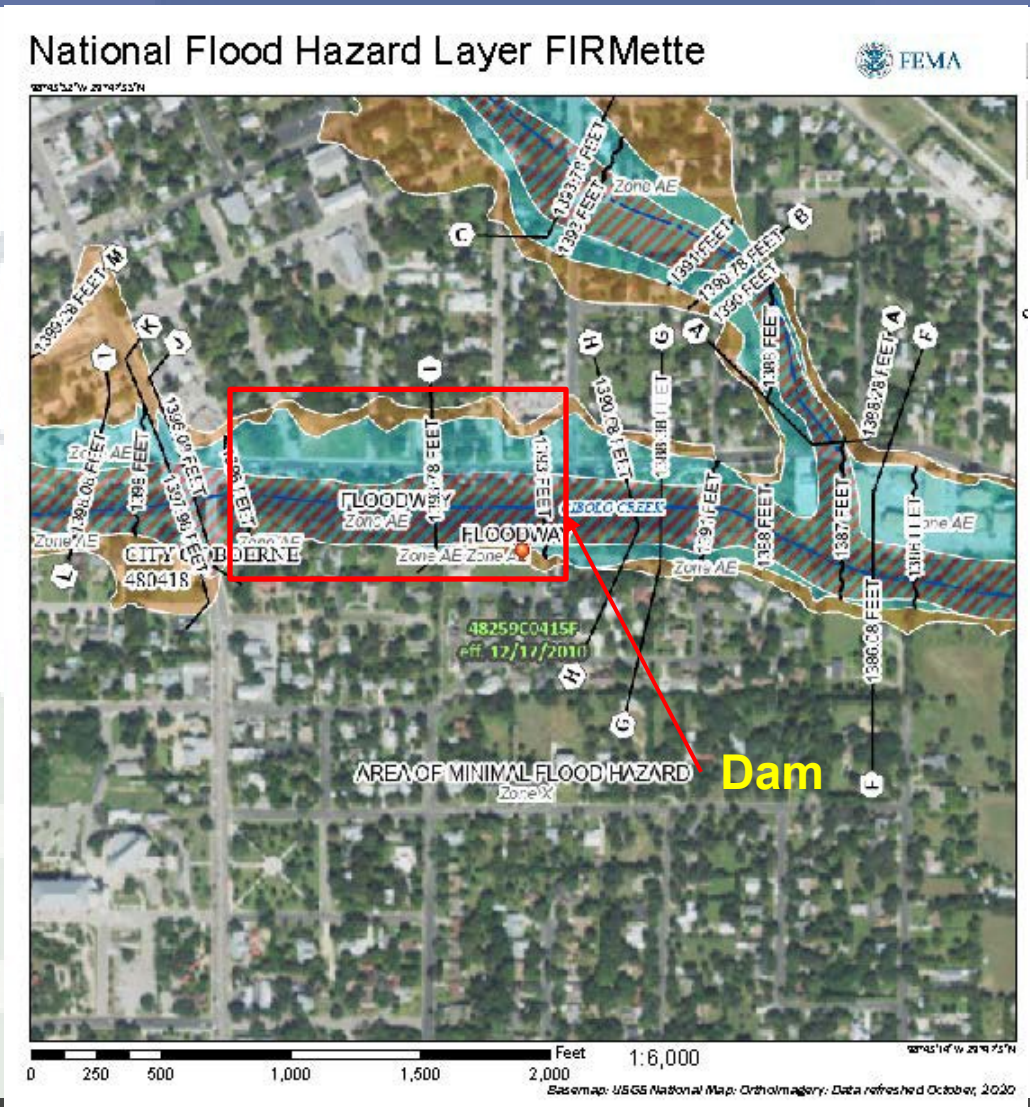
Boulder landscape, exposed roots

- **Little to no vegetated buffer**

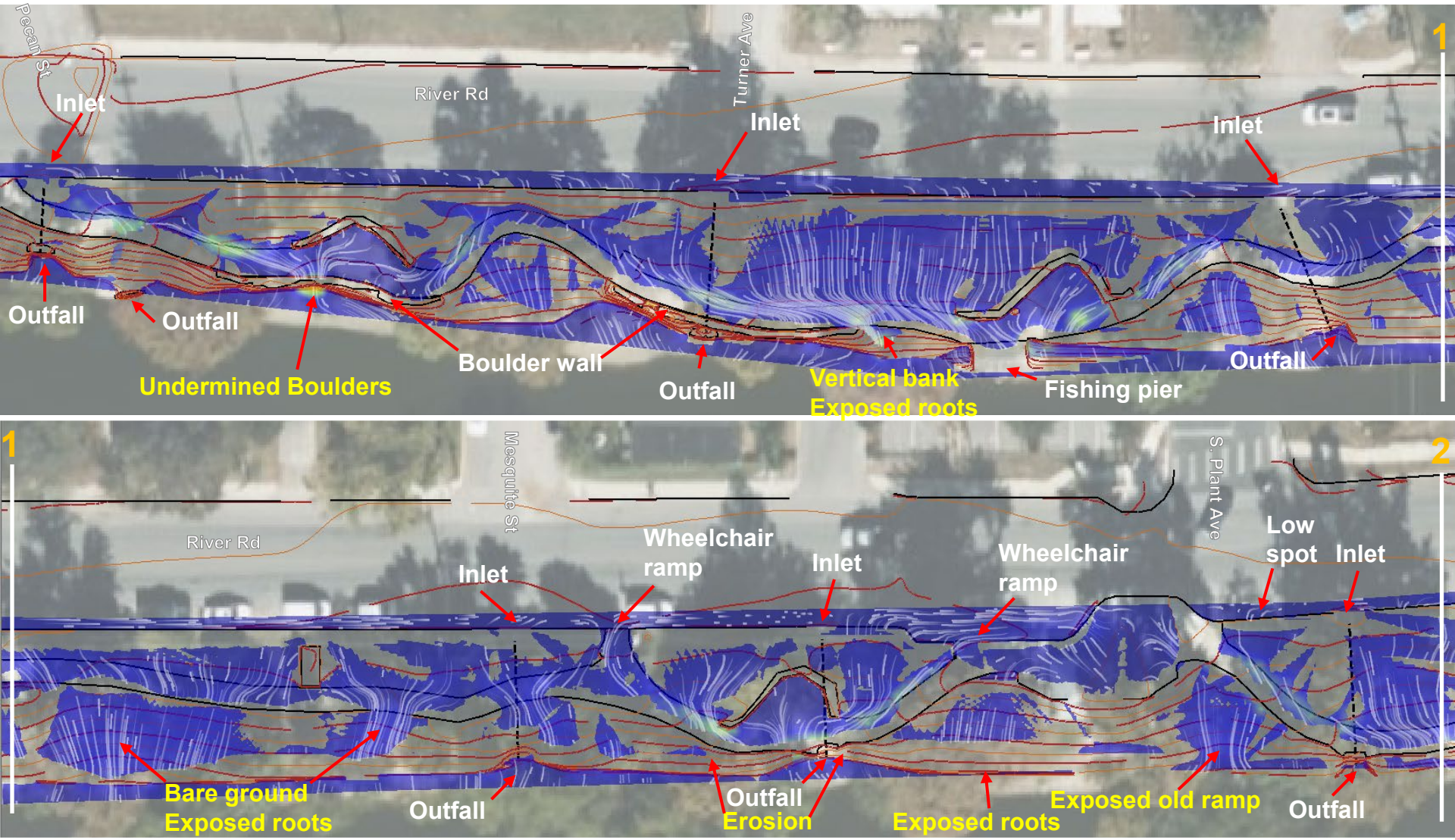
Preliminary Hydraulic Modeling

Riverine hydraulics

- Effective FEMA Floodplain
- Project in backwater due to dam
- Velocities/Shear Stresses not very high along embankment and overbank



Preliminary Hydraulic Modeling



2D model to show overland flow paths through park

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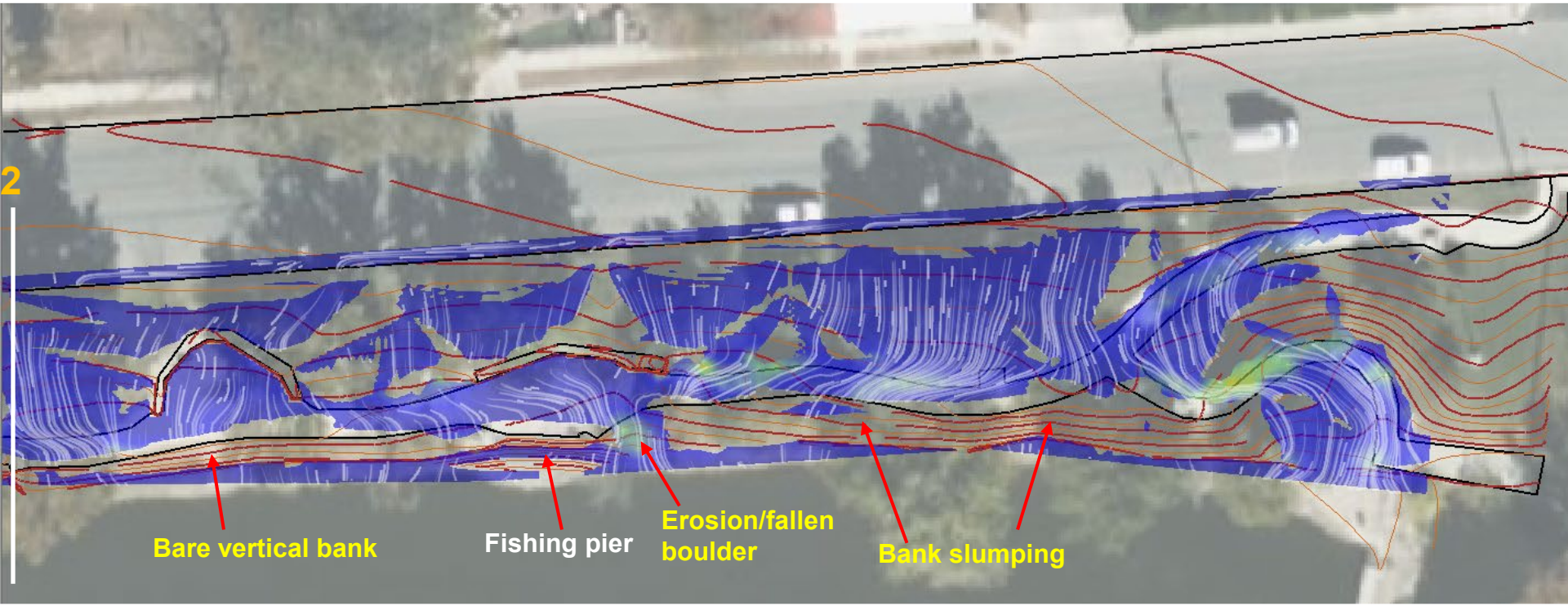
Preliminary Hydraulic Modeling



Observation - Overland flow paths through the park and over the sidewalk correlate with areas of bank erosion and slumping.

2D model to show overland flow paths through park

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Erosional Processes

Soil erosion on creek side of sidewalk

- **Pedestrian traffic and ducks destroying vegetation and trampling banks**

Erosional Processes

Dirt deposited on sidewalk

- **Overland flow and soil from park**

Erosional Processes

Bank slumping

- **Overland flow from park, water flowing over sidewalk**

Erosional Processes

Water ponding along HWY 46 between and at inlet locations

- **Some flow overtopping curb**

Design Goals

- Rebuild the river embankment profile, protect the Cypress trees
- Provide vegetative buffer between sidewalk and riverbank
- Slow down overland flow within the park with landscaping
- Limit pedestrian access to bank but provide dedicated locations for fishing and viewing the creek
- Use natural approaches and native vegetation

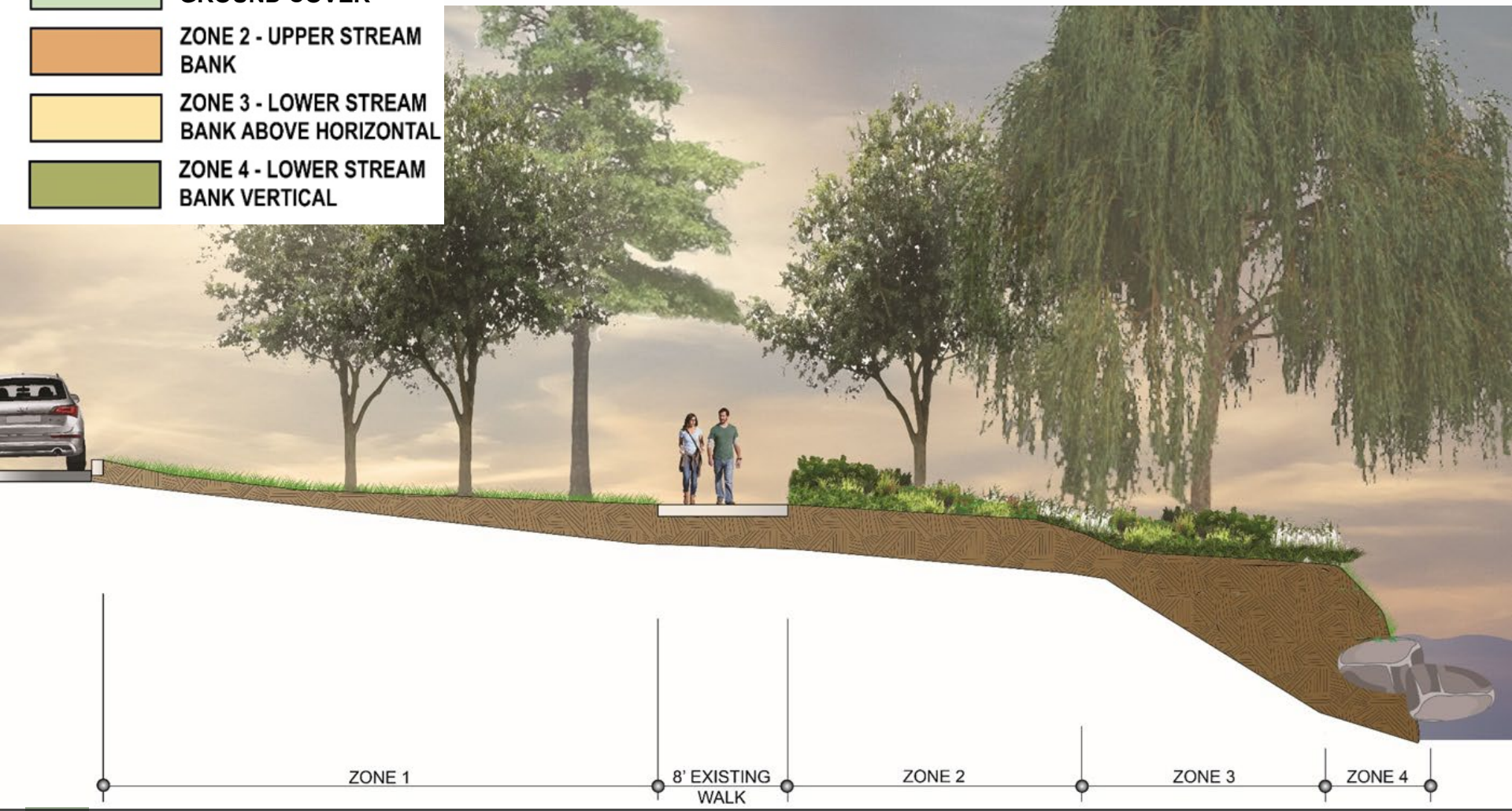
Bank Stabilization Treatment Zones

ZONE 1 - GRASS / NATIVE GROUND COVER

ZONE 2 - UPPER STREAM BANK

ZONE 3 - LOWER STREAM BANK ABOVE HORIZONTAL

ZONE 4 - LOWER STREAM BANK VERTICAL

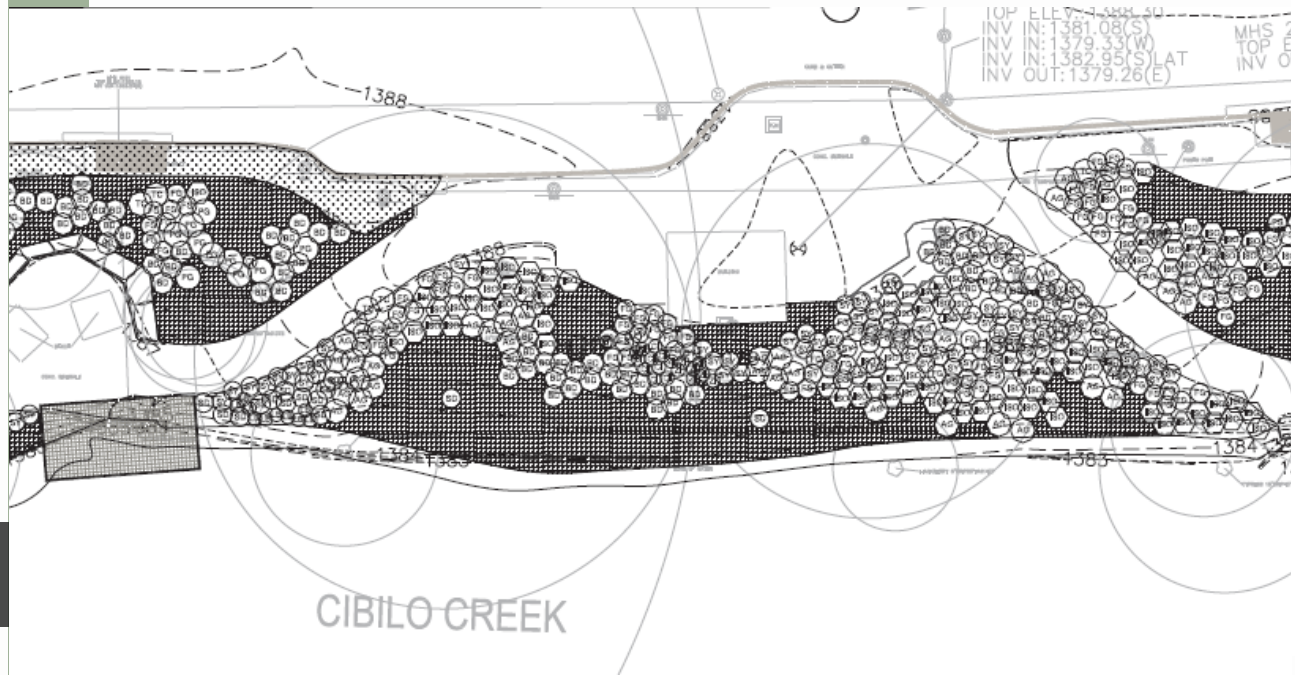


Design Approach

Slow Down Run-off Through the Park

Zones 1, 2 and 3

- Preserve grassed areas near HWY 46
- Plant native species to provide ground cover in shaded areas and bare ground.
- Provide vegetative buffer between the sidewalk and the top of the steep stream embankment.



GRASSES AND VINES

SYMBOL	TOTAL QTY.	COMMON NAME	BOTANICAL NAME	SIZE	CONT.	REMARKS
LM	20	LINDHEIMER MUHLY	MUHLENBERGIA LINDHEIMERI	5 GAL.	CONT	SPACE AS INDICATED
ISO	193	INLAND SEA OATS	CHASMANTHIUM LATIFOLIUM	3 GAL.	CONT	SPACE AS INDICATED
CI	164	COPPER IRIS	IRIS FULVA	3 GAL.	CONT	SPACE AS INDICATED
RL	0	RAIN LILY	HABRANTHUS ROBUSTUS	3 GAL.	CONT	SPACE AS INDICATED
MS	0	MUHLY, SEEP	MUHLENBERGIA REVERCHONII	3 GAL	CONT	SPACE AS INDICATED
LB	31	LITTLE BLUESTEM	ANDROPOGON GLOMERTUS	3 GAL.	CONT	SPACE AS INDICATED
IG	19	INDIAN GRASS	SORGHASTRUM NUTUNS	3 GAL.	CONT	SPACE AS INDICATED
PG	100	PLATEAU GOLDENEYE	VIGUIERA DENTATA	5 GAL.	CONT	SPACE AS INDICATED
ZI	160	ZIG ZAG IRIS	IRIS BREVICAULIS	3 GAL.	CONT	SPACE AS INDICATED
CS	1,900	CEDAR SEDGE	CAREX PLANOSTACHYS KUNZE	6'	CONT	TRIANGULAR SPACING AT 18" O.C.
SOG	100	SIDEOATS GRAMA	BOUTELOUA CURTIPENDULA	1 GAL.	CONT	SPACE AS INDICATED
AM	106	ARAPAHO MUHLY	MUHLENBERGIA UTILIS	3 GAL.	CONT	SPACE AS INDICATED
TG	0	TEXAS SACAHUISTA	NOLINA TEXANA	3 GAL.	CONT	SPACE AS INDICATED
SG	9	SOCIETY GARLIC	TULBAGHIA VIOLACEA	3 GAL.	CONT	SPACE AS INDICATED
FG	244	MEXICAN FEATHER GRASS	NASSELLA tenuissima	5 GAL.	CONT	SPACE AS INDICATED

PERENNIALS / GROUND COVERS

SYMBOL	TOTAL QTY.	COMMON NAME	BOTANICAL NAME	SIZE	CONT.	REMARKS
PC	50	MOUNTAIN PEA	ORBEXILUM SP.	6"	CONT.	TRIANGULAR SPACING AT 12" O.C.
LW	750	NEW GOLD LANTANA	LANTANA X HYBRIDA 'NEW GOLD'	6'	CONT.	TRIANGULAR SPACING AT 12" O.C.
SD	10,225	STRAGGLER DAISY	GALYPTOCARPUS VIALIS	3 GAL.	CONT.	SPACE AS INDICATED
LPT	148	LANTANA, PURPLE TRAILING	LANTANA MONTEVIDENSIS	6"	CONT.	TRIANGULAR SPACING AT 12" O.C.

SHRUBS

SYMBOL	TOTAL QTY.	COMMON NAME	BOTANICAL NAME	SIZE	CONT.	REMARKS
WM	5	DWARF WAX MYRTLE	MYRICA PUSILLA	5 GAL.	CONT.	SPACE AS INDICATED
TC	128	TURK'S CAP	MALVAVISCUS ARBOREUS	3 GAL.	CONT.	SPACE AS INDICATED
AG	149	ARGARITA	MAHONIA TRIFOLIOLATA	5 GAL.	CONT.	SPACE AS INDICATED
BD	209	BLACKFOOT DAISY	MELAMPODIUM LEUCANTHUM	5 GAL.	CONT.	SPACE AS INDICATED
SY	202	SAN ANGELO YUCCA	YUCCA REVERCHONII	5 GAL.	CONT.	SPACE AS INDICATED
RY	122	RED YUCCA	HESPERALOE PARVIFLORA	5 GAL.	CONT.	SPACE AS INDICATED

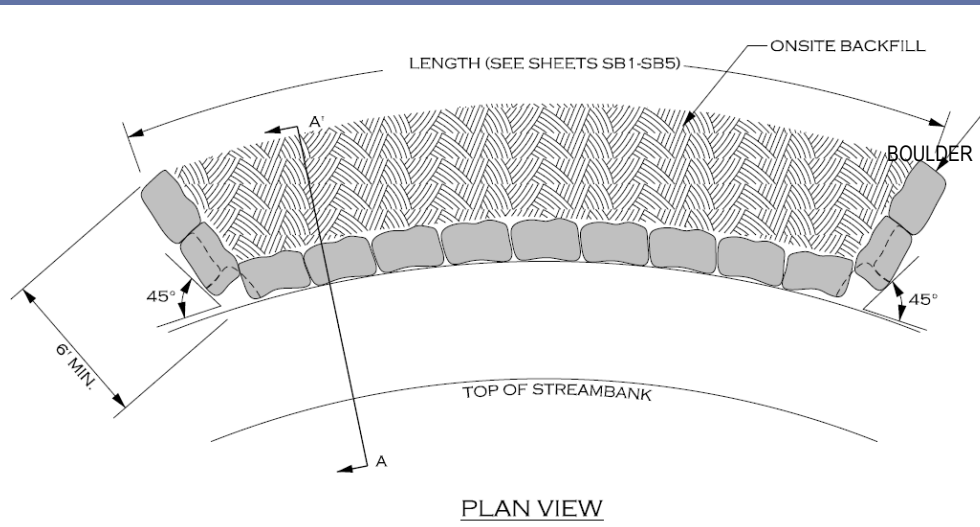
TURF

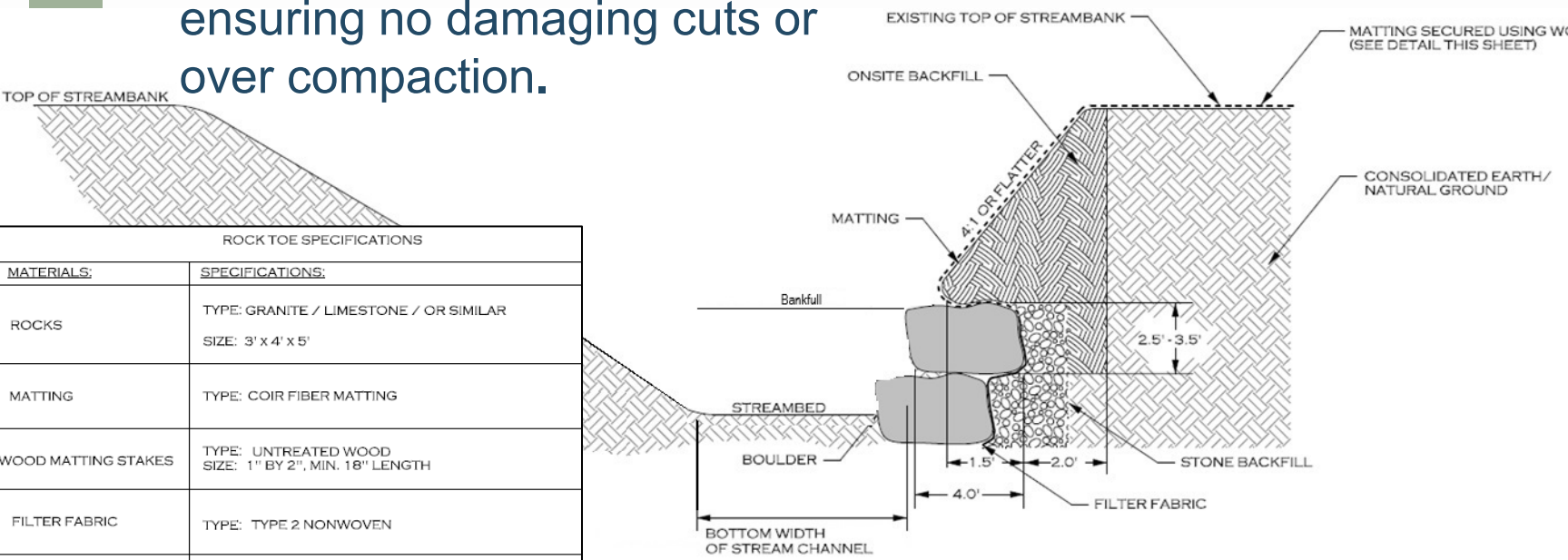
SYMBOL	TOTAL QTY.	COMMON NAME	BOTANICAL NAME		REMARKS
	13,352	ZOYSIA	POACEAE CHLORIDOIDEAE	SOLID SOD	REMOVE GRASS AND TILL TO A 2" DEPTH BEFORE PLACING SOD

Design Approach

Zone 4 – Embankment Stability

- Install rock sill boulder toe protection as foundation for the embankment.
- Grade embankment to 4:1 (3:1 max) use material from the river as allowable.
- Protect the Cypress roots by ensuring no damaging cuts or over compaction.





ROCK TOE SPECIFICATIONS

MATERIALS:	SPECIFICATIONS:
ROCKS	TYPE: GRANITE / LIMESTONE / OR SIMILAR SIZE: 3' x 4' x 5'
MATTING	TYPE: COIR FIBER MATTING
WOOD MATTING STAKES	TYPE: UNTREATED WOOD SIZE: 1" BY 2", MIN. 18" LENGTH
FILTER FABRIC	TYPE: TYPE 2 NONWOVEN
STONE BACKFILL	ABC (CRUSHER RUN #7) AND AASHTO #1 (50/50 MIX)

Design Approach

Permanent Seeding

No.	Scientific Name	Common Name	Wetland Indicator Status*
Grasses			
1	*Andropogon gerardii*	Big bluestem	FACU
2	*Andropogon virginicus*	Broomsedge	FACU
3	*Bothriochloa barbinodis*	Cane bluestem	FACU
4	*Bouteloua curtipendula*	Sideoats grama	NI
5	*Chasmanthium latifolium*	Inland seaoats	FACU
6	*Elymus canadensis*	Prairie wildrye	FACU
7	*Elymus virginicus*	Virginia wildrye	FAC
8	*Eriochloa sericea*	Texas cupgrass	NI
9	*Leptochloa dubia*	Green sprangletop	NI
10	*Panicum virgatum*	Switchgrass	FAC
11	*Paspalum floridanum*	Florida paspalum	FACW
12	*Setaria scheelei*	Southwestern bristlegrass	NI
13	*Setaria vulpiseta*	Plains bristlegrass	NI
14	*Sorghastrum nutans*	Indiangrass	FACU
15	*Sporobulus airoides*	Alkali sacaton	FAC
16	*Sporobulus compositus*	Tall dropseed	NI
17	*Sporobulus cryptandrus*	Sand dropseed	FACU
18	*Tridens muticus*	Slim tridens	FACU
19	*Tripsacum dactyloides*	Eastern gamagrass	FAC
Native Wildflowers			
1	*Asclepisa incarnata*	Swamp milkweed	FACW
2	*Cephalanthus occidentalis*[A]	Button bush	OBL
3	*Chamaecrista fasciculata*	Partridge pea	FACU
4	*Coreopsis tinctoria*	Plains coreopsis	FAC
5	*Desmanthus illinoensis*	Illinois bundleflower	FACU
6	*Dracopis amplexicaulis*	Clasping coneflower	FAC
7	*Engelmannia peristenia*	Cutleaf daisy	NI
8	*Helianthus angustifolius*	Swamp sunflower	FAC
9	*Helianthus maximiliani*	Maximillan sunflower	FACU
10	*Lobelia cardinalis*	Cardinal flower	FACW
11	*Monarda citriodora*	Lemon mint	NI
12	*Oenothera speciosa*	Pink evening primrose	NI
13	*Rudbeckia hirta*	Black-eyed susan	FACU
14	*Verbesina virginica*	Frostweed	FACU

* - National Wetland Plant List, Version 3.4 (2018), Great Plains Region.
NI - No indicator

[A] - Shrub species

Total Zone 4 - Stablization Seeding	0.2	acre(s)

Temporary Seeding

Scientific Name	Common Name	Bulk Rate (lbs/ac)	Planting Dates[A]
Secale cereale	Cereal rye grain	50	September to December (Cool Season)
Leptochloa dubia	Green Sprangletop	5	March to August (Warm Season)

[A] - Dates are subject to change according to weather patterns

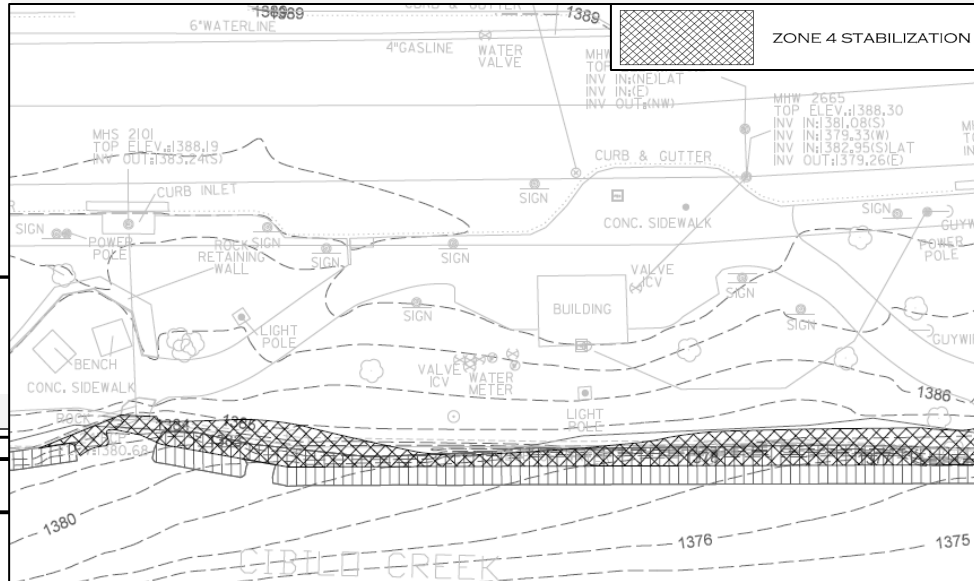
Total Zone 4 - Temporary Seeding	0.2	acre(s)

Zone 4 – Seeding and Plantings

Provide stability on steep embankment and shade

Scientific Name	Common Name	Minimum Container Size	% by Species
Trees and Shrubs			
Amorhpa roemeriana	Texas indigo bush	1 gal	25%
Cephalanthus occidentalis	Button bush	1 gal	10%
Cornus drummondii	Roughleaf Dogwood	1 gal	10%
Salix nigra	Black Willow	3 gal	10%
Taxodium distichum	Bald Cypress	5 gal	25%
Grasses			
Tripsacsum dactyloides	Eastern Gamagrass	1 gal	10%
Panicum virgatum	Switchgrass	1 gal	10%
	Total		**100%**

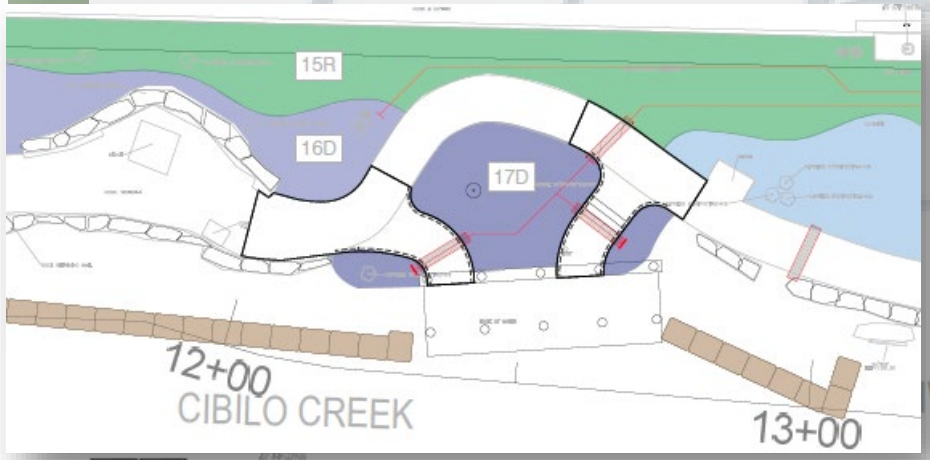
Total Zone 4 - Stablization Vegetation	0.2	acre(s)

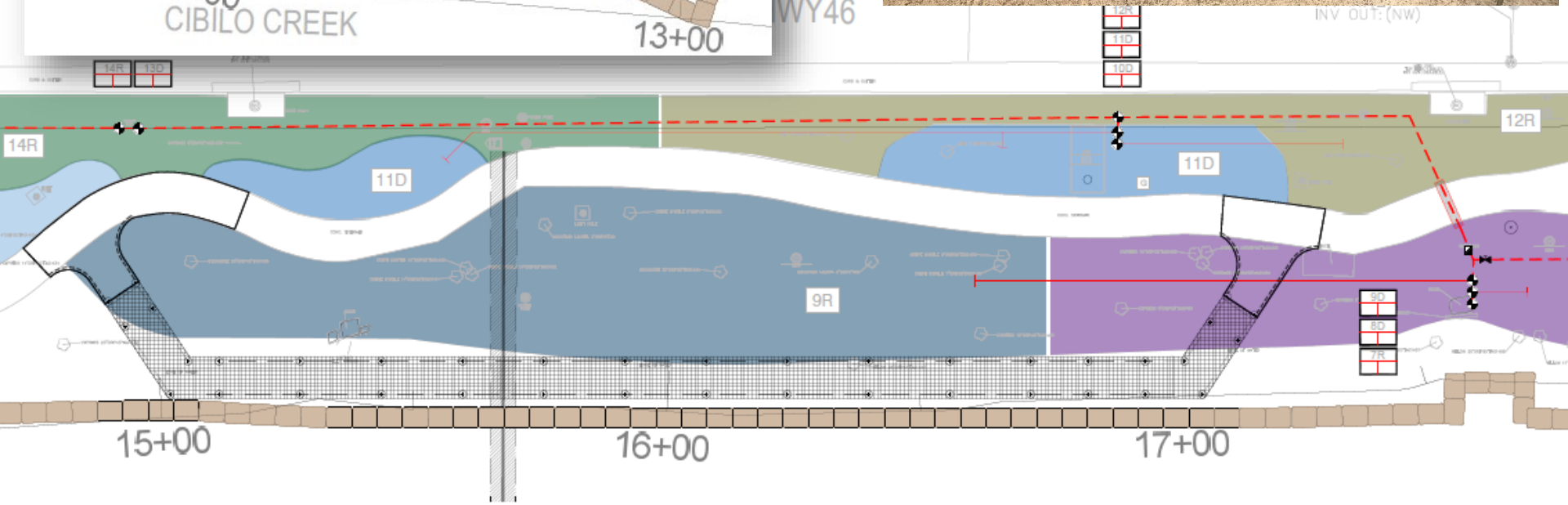


Design Approach

Water Access and Viewsheds

- Install 3 new fishing piers
- Install 250-LF boardwalk



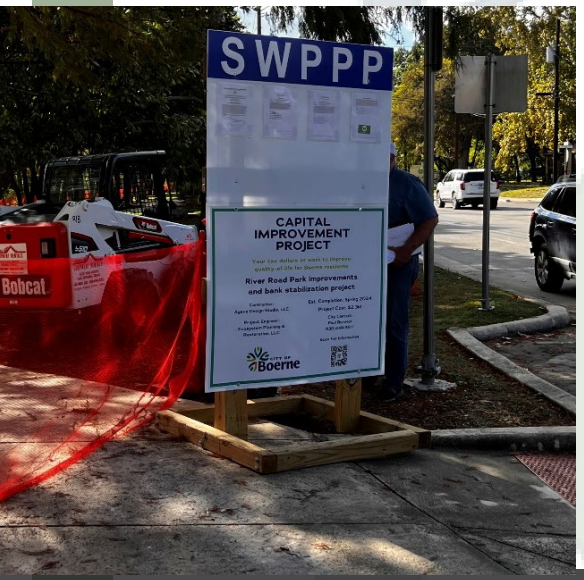


Permitting

USACE – Section 404, Nationwide Permit 13

City of Boerne – Floodplain Development Permit, Grading Permit

TCEQ – Stormwater Pollution Prevention Plan (SWPPP)



Construction Cost Estimate

EEOCC - $2.12 million;

Low Bid/Actual Cost - $2.2 million

- **Stream Bank Stabilization** - $585,000
  - 870-LF Rock Sill with Bank Grading, $565,500
  - 1500-SY Coir Fiber Matting, $15,750
  - Zone 4 Seeding and Vegetation, $3,800
- **Structural - $514,000**
  - 255-LF Boardwalk, $396,500
  - 3 Fishing Piers, $106,200
- **Irrigation - $58,000**
- **Plantings - $353,000**

PLANTING		
20	EA	Lindheimer Muhly
195	EA	Inland Sea Oats
164	EA	Copper Iris
31	EA	Little Bluestem
19	EA	Indian Grass
105	EA	Plateau Goldeneye
160	EA	Zig Zag Iris
1900	EA	Cedar Sedge
100	EA	Sideoats Grama
106	EA	Arapaho Muhly
9	EA	Society Garlic
252	EA	Mexican Feather Grass
50	EA	Mountan Pea
750	EA	New Gold Lantana
5945	EA	Straggler Daisy
148	EA	Lantana Purple Trailing
5	EA	Dwarf Wax Mrytle
131	EA	Turks Cap
152	EA	Argarita
209	EA	Blackfoot Daisy
202	EA	San Angelo Yucca
122	EA	Red Yucca
13352	SF	Zoysia

Construction Phase

Dewatering and Haul Road

- Pumped water over dam
- Lots of sediment/muck build-up

September 26, 2023

City of Boerne

EPR Ecosystem Planning & Restoration

Construction Phase

October 24, 2023

Construction Phase

November 2023

Construction Phase

Early January 2024

Construction Phase

Late January 2024

Construction Phase

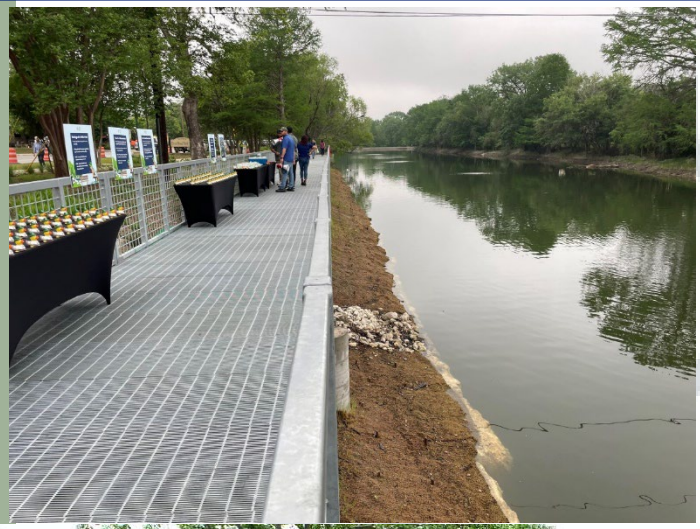
February 12, 2024

Construction Phase

March 3, 2024

Construction Phase

April 17, 2024 – Ribbon Cutting



Fish Habitat and Water Quality

- Removal of Sediment
- Root Wads on opposite riverbank
- 5 Metal fish habitat structure (local high school welding class)
- 10 aerators installed

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Challenges & Lessons Learned

- **Rain – several rain fall events caused some delays**
- **Structural Submittals / Approvals – on-site changes due to actual site conditions**
  - **Shifted one fishing pier approximately 10-ft**
  - **Overhead Utility conflict with drilling rig caused design change to boardwalk**
  - **ADA Compliance for connectors**

Challenges & Lessons Learned

- River material not suitable for fill for embankment (too much clay)
- Protecting Cypress trees and roots

Questions & Answers

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EWRI - SAT Chapter Meeting