Jacobs Challenging today. Reinventing tomorrow.

SAME Monthly Meeting
Zink Dam Improvements

Brooke Caviness, PE
Lars Ostervold, PE
November 2020

CH2MHILL

MERRICK & COMPANY

LANDPLAN CONSULTANTS INCORPORATED

MESHEK & ASSOCIATES, LLC

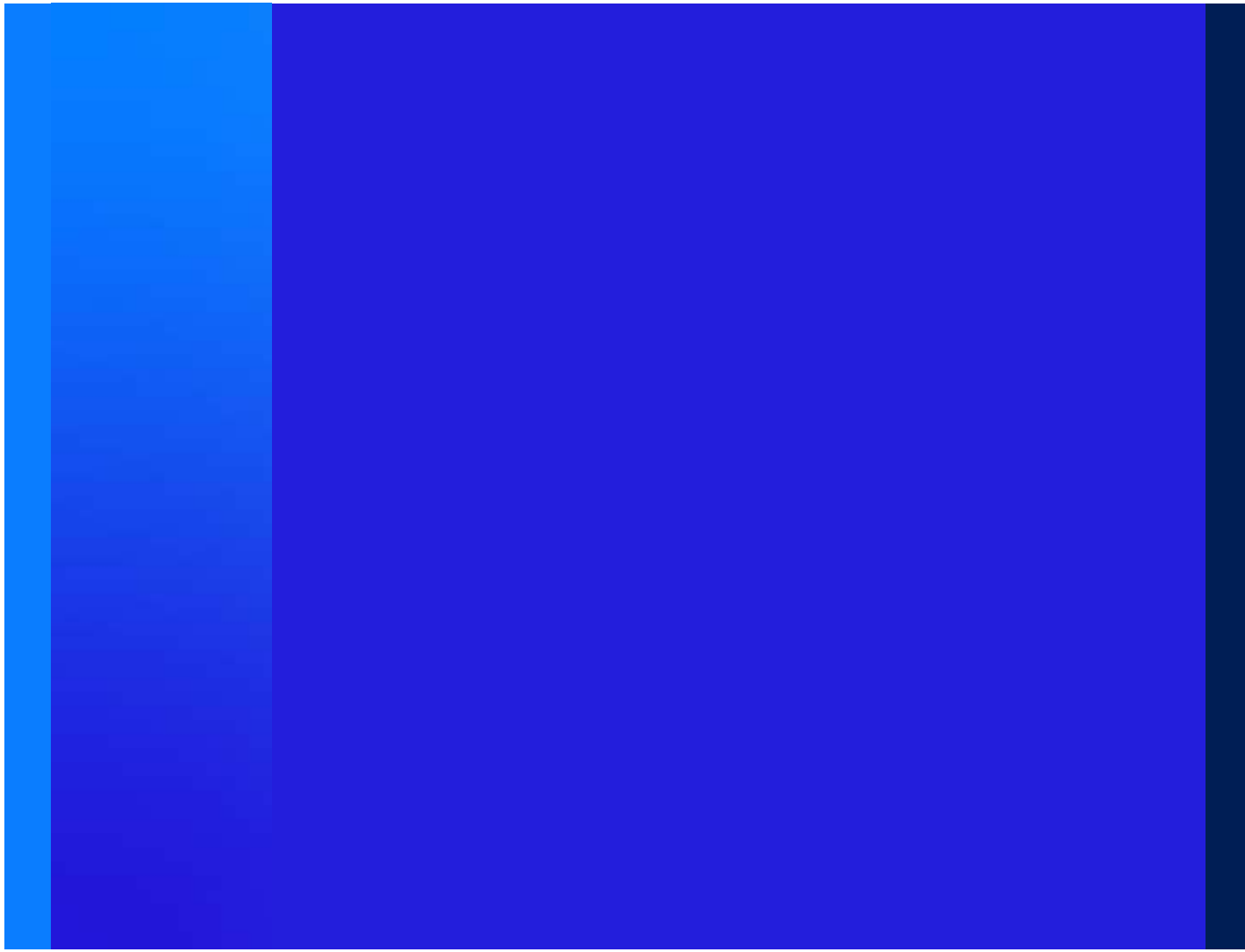
MICHAEL VAN VALKENBURGH ASSOCIATES INC

CITY OF TULSA OKLAHOMA

CITY OF Tulsa
A New Kind of Energy

Agenda

- History
- Recent Background
- Design Elements
- Construction



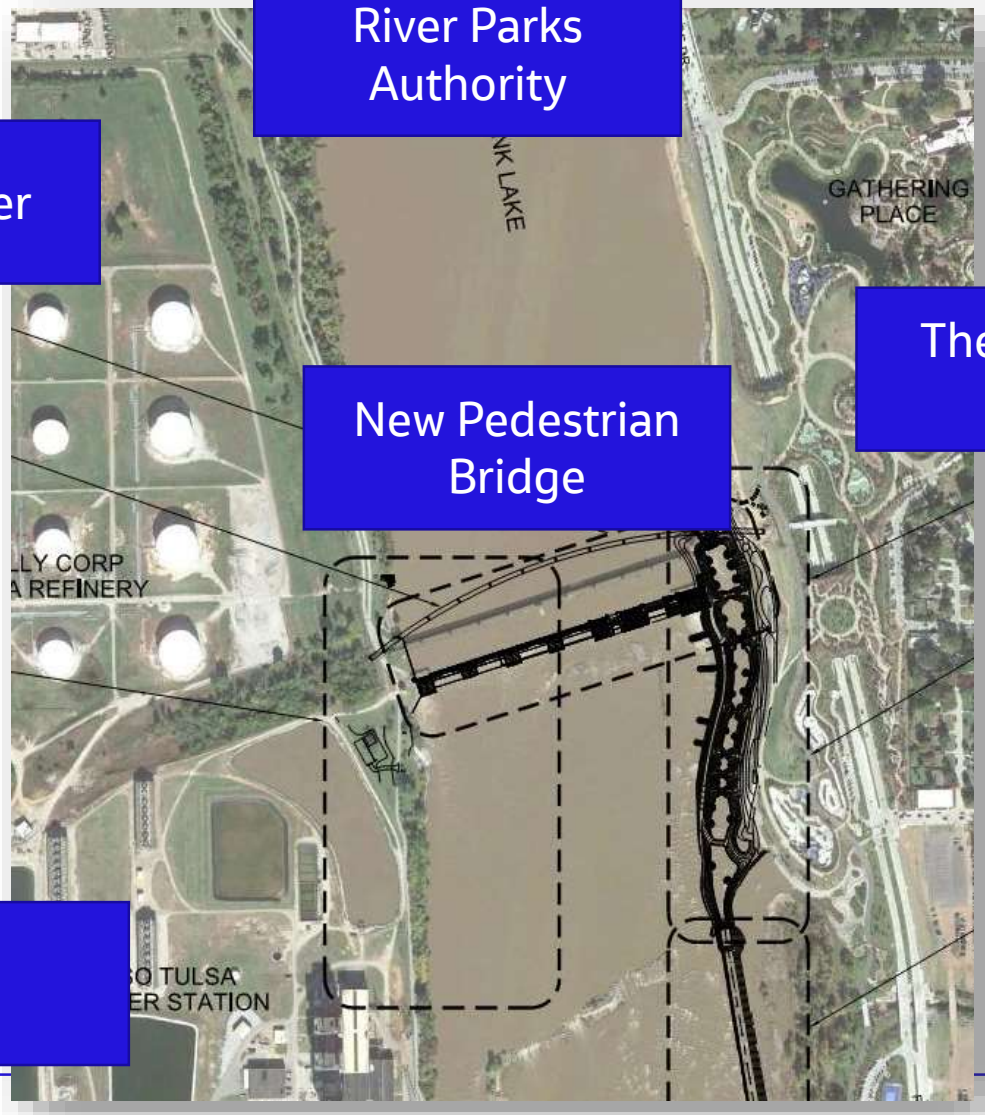
Project Involvement

River Parks Authority

Holly Frontier

USACE
SWPA

CITIZEN STAKEHOLDERS



New Pedestrian Bridge

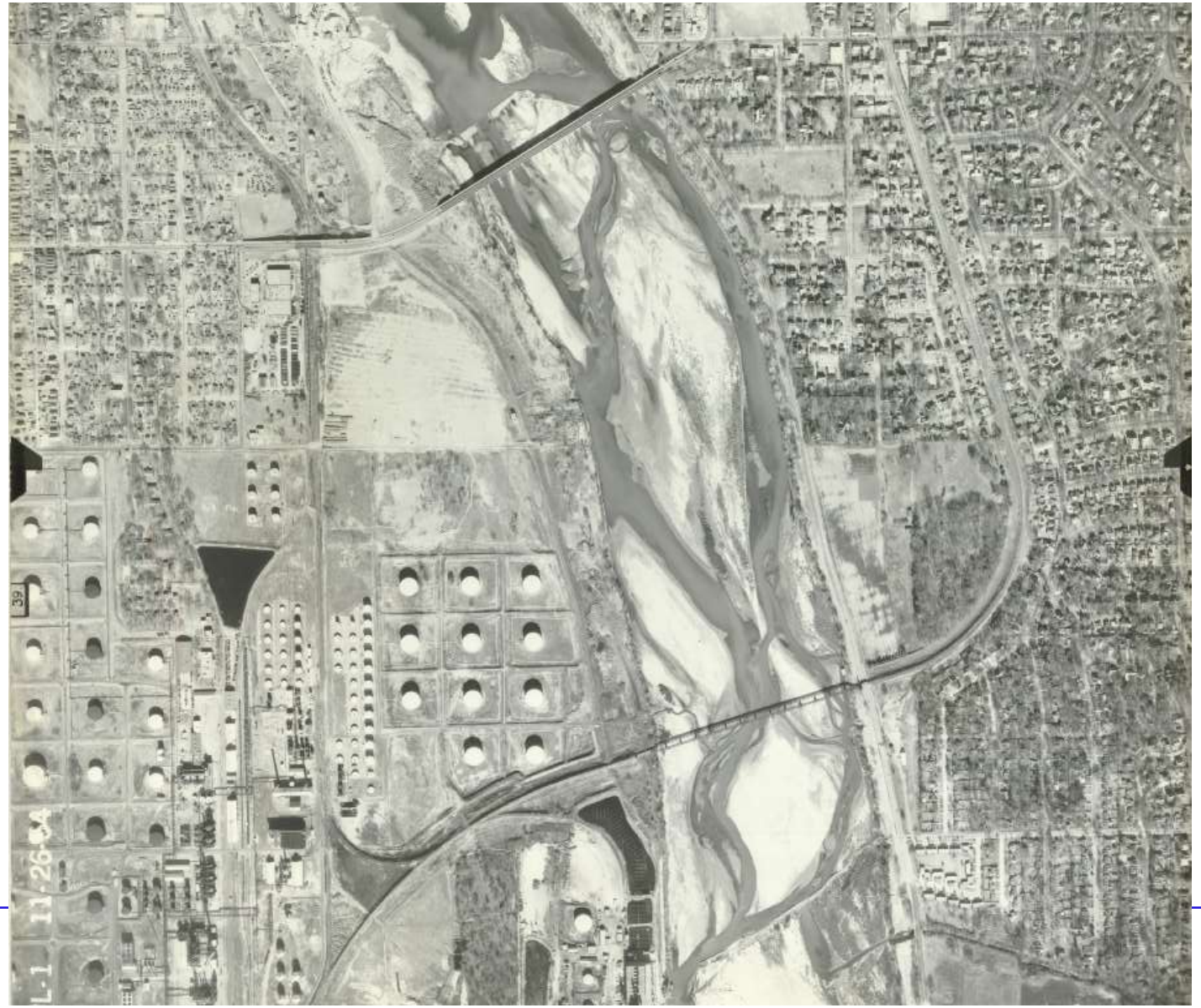
The Gathering Place

PSO

City of Tulsa
Tulsa County
CH2M HILL
INCOG

History

1954 – Pre-Keystone Dam



Keystone Dam

- Authorized by the Flood Control Act of 1950
- 1956: Construction Started
- 1964: Completion for flood control
- 1968: Commercial operation of hydropower
- Cost: $123 million
- 1968: Re-regulating dam complete 7 miles downstream
  - 16 deaths at the structure
  - Removed in 1980's

https://www.swt.usace.army.mil/Locations/Tulsa-District-Lakes/Oklahoma/Keystone-Lake/History/, accessed November 15, 2020

1966 – Keystone Dam Operational

1970's

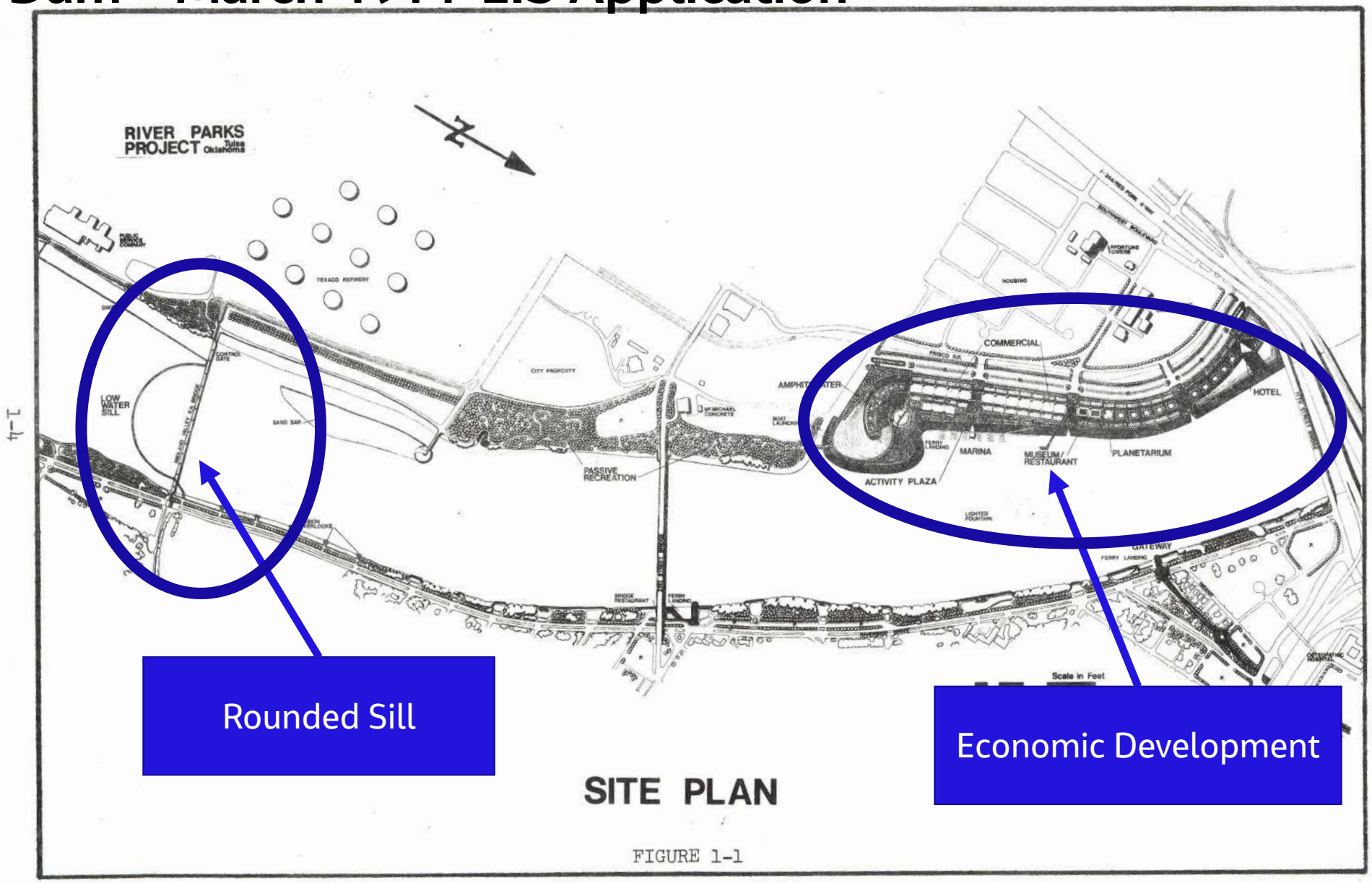
- 1973 – KRMG's first Great Raft Race
- 1974 – River Parks Authority (RPA) created
- 1974 – Tulsa received Midland Valley Bridge title – converted to pedestrian bridge
- 1974 – RPA hired architect Roy Harrover
- 1975 – Harrover plan – released
  - Low water dam at pedestrian bridge
  - Amphitheater
  - Ferries, shopping, entertainment
- 1979 – first Oktoberfest (on east side, moved to west side in 1981)
- 1980 – proposed retail area property sold, reinvested to build the dam

Tulsa Mayors during this time
Bob LaFortune – 1970-1978
Jim Inhofe – 1978-1984

1977 – 10 years post Keystone

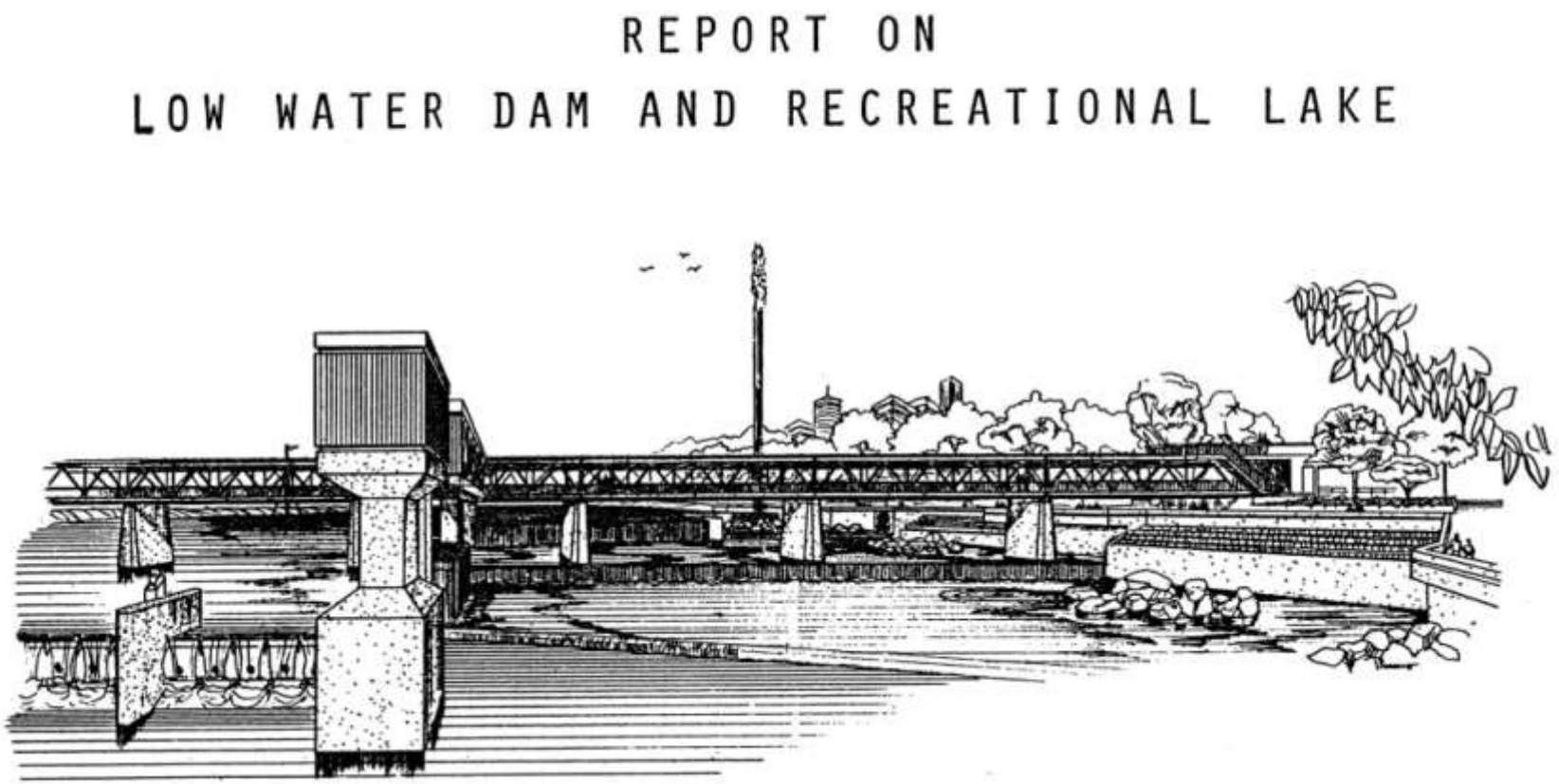
Amphitheater
West Festival Park

Zink Dam – March 1977 EIS Application



Report on Low Water Dam and Recreational Lake – October 1977

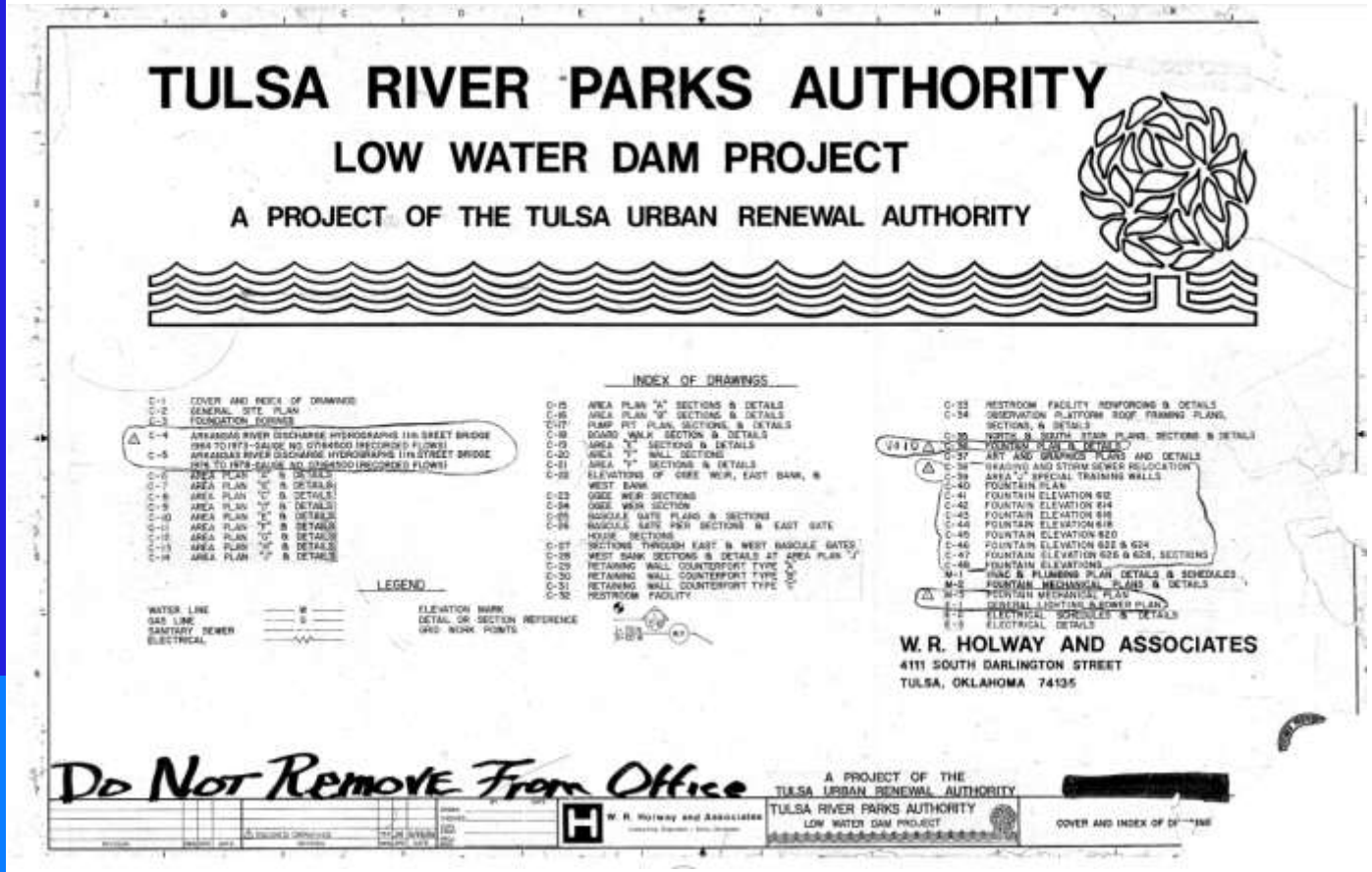
- Fountain – 100’ tall
- Bascule gates
- No channeled flow to PSO



Existing Zink dam

- W. R. Holway and Associates (Engineer of Record)
- Constructed in 1982
- 7 feet in height (above river channel)
- 1,030 feet in length
- Ogee spillway design
- 880' fixed dam
- 5' high bascule gates; 3 sections at 50’ each
  - 1 west bank, 2 east bank

Original Zink Dam Construction



TULSA RIVER PARKS AUTHORITY

LOW WATER DAM PROJECT

A PROJECT OF THE TULSA URBAN RENEWAL AUTHORITY

INDEX OF DRAWINGS

LEGEND

W. R. HOLWAY AND ASSOCIATES
4111 SOUTH DARLINGTON STREET
TULSA, OKLAHOMA 74135

Do Not Remove From Office

A PROJECT OF THE TULSA URBAN RENEWAL AUTHORITY

TULSA RIVER PARKS AUTHORITY
LOW WATER DAM PROJECT

Original Zink Dam Construction

Original Zink Dam Construction

Zink Dam Survived the 1986 Flood

Driftwood Snags in Fountain

Driftwood is entangled in Blair Fountain, 29th Street and Riverside Drive, Wednesday after debris released from Keystone a tanker lodged Sunday in the pedestrian bridge structure has been secured to the bridge. It will be removed when the river

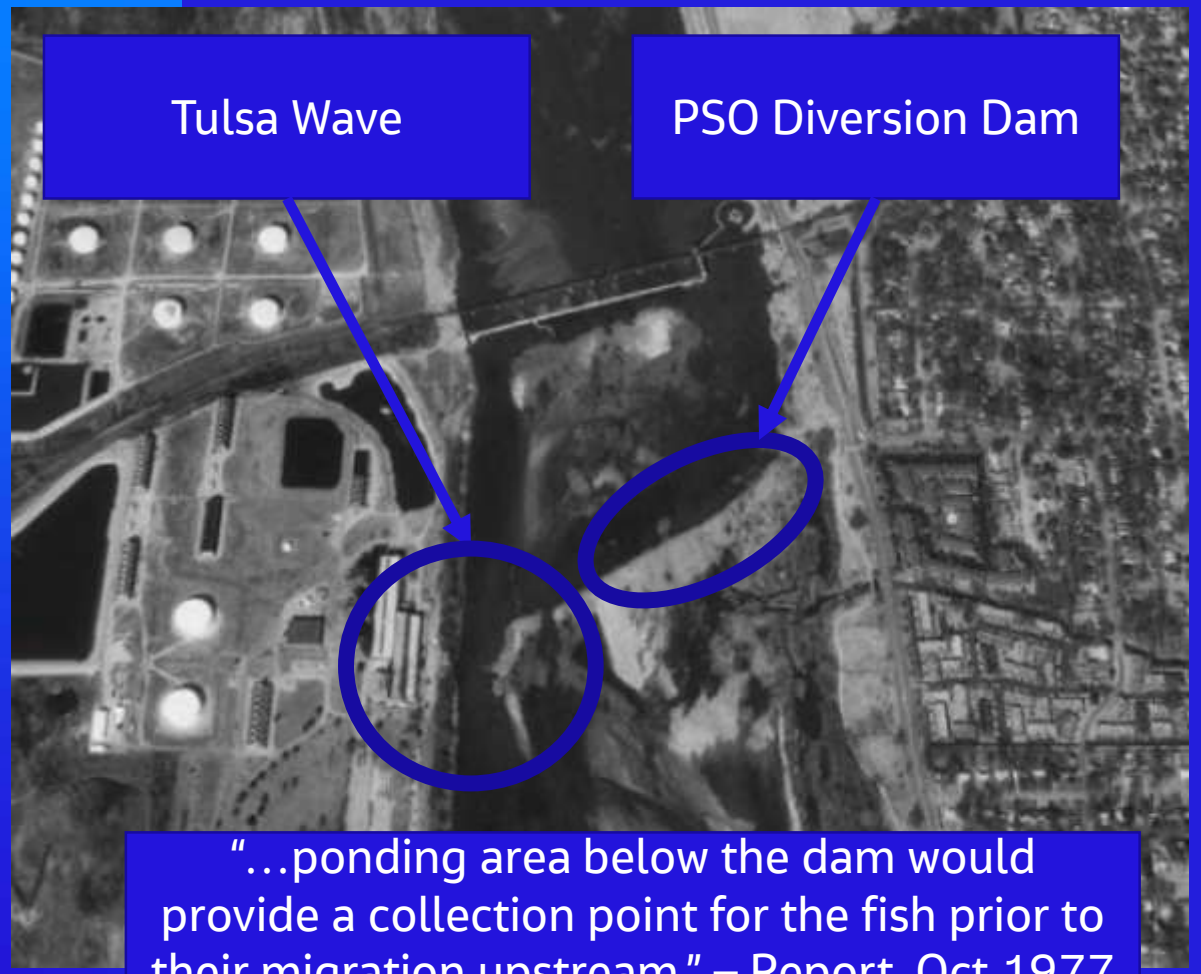
World Staff Photo by Steve Crane

Movin' On?

A tanker trailer floating from Sand Springs down the Arkansas River becomes wedged against the Pedestrian Bridge Sunday afternoon. The tanker rests along the bridge's walkway, where floodwaters have "popped out" several boards in the walkway, said Fire Department Hazardous Materials Officer Mike Linville. Engineers declared the bridge structurally sound, however. The tanker, which has no cab, lodged beneath the 11th Street railroad bridge earlier Sunday, but resumed its journey downstream when the water level dropped. The tanker's Sand Springs owner said it has been empty two years and was last used to haul water, Linville said. When the river recedes further, "it's a good question about what the water's going to do with it," he said.

World Staff Photo by John D. Ferguson

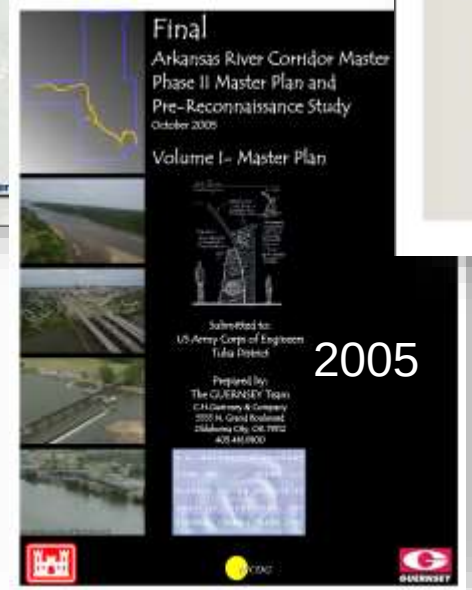
The Tulsa Wave

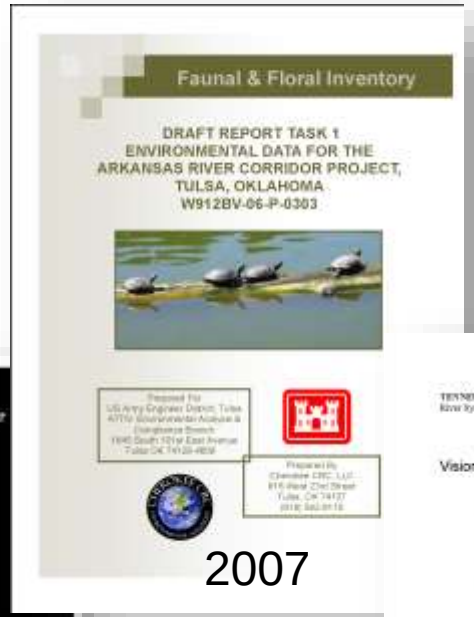


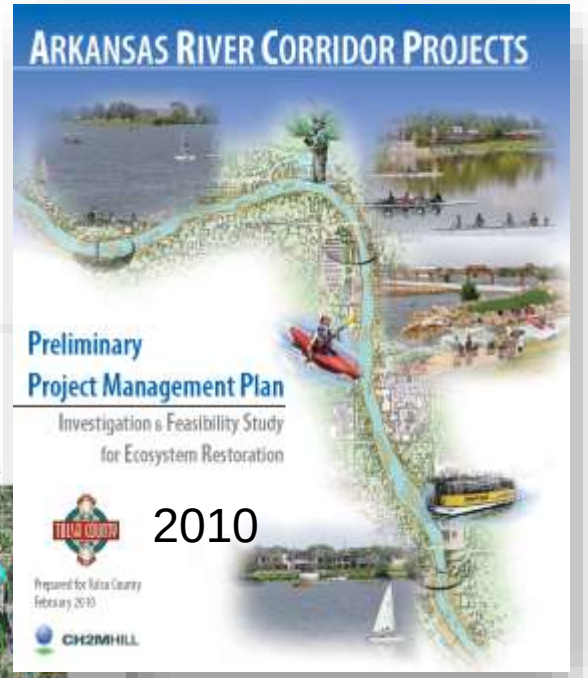
1995 aerial

Current Background

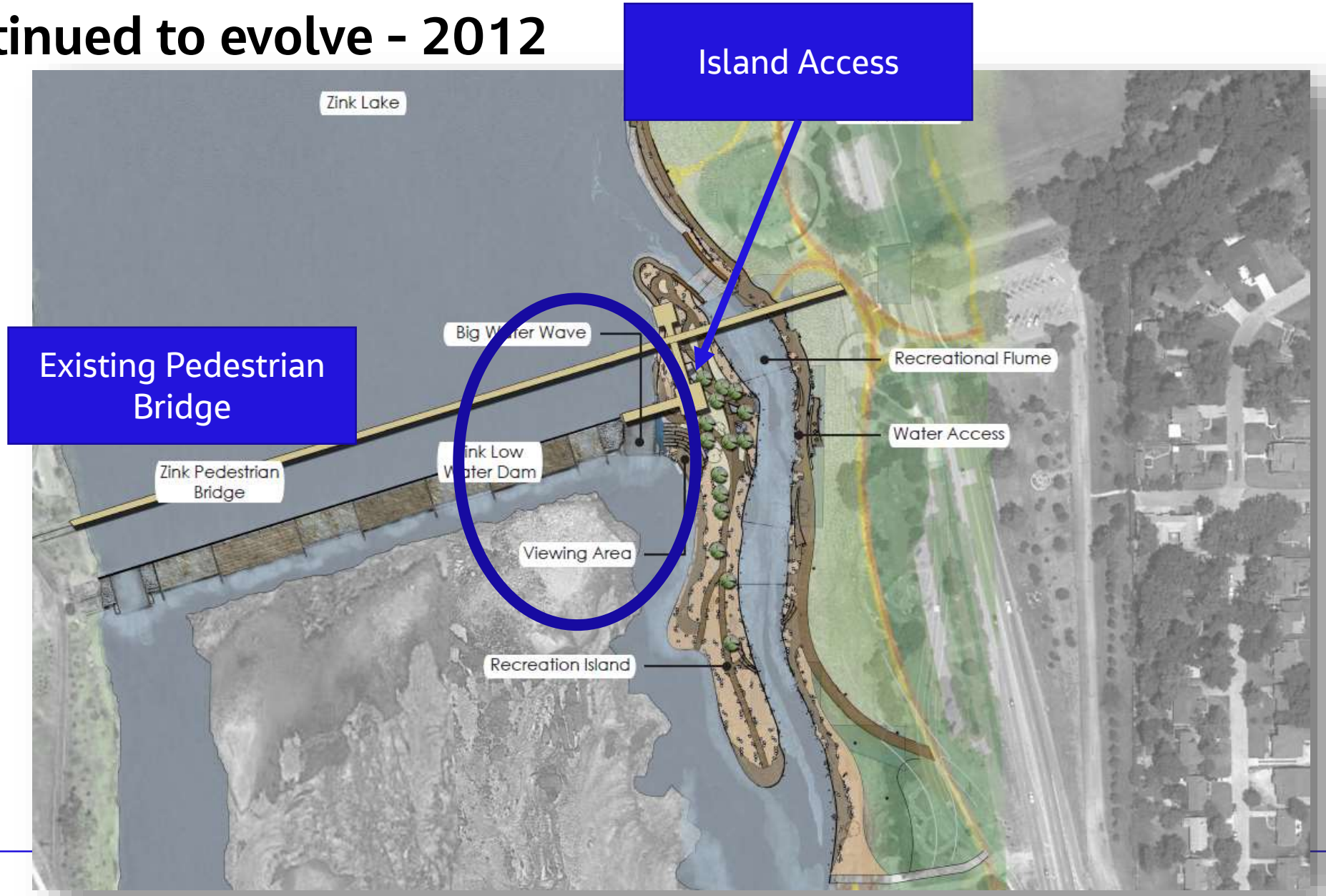
Project Has Involved Significant Planning & Design Effort



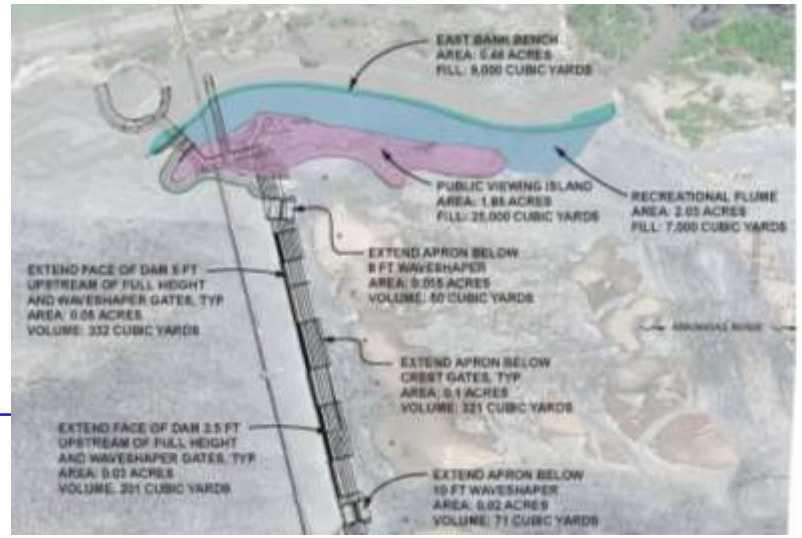




Design continued to evolve - 2012

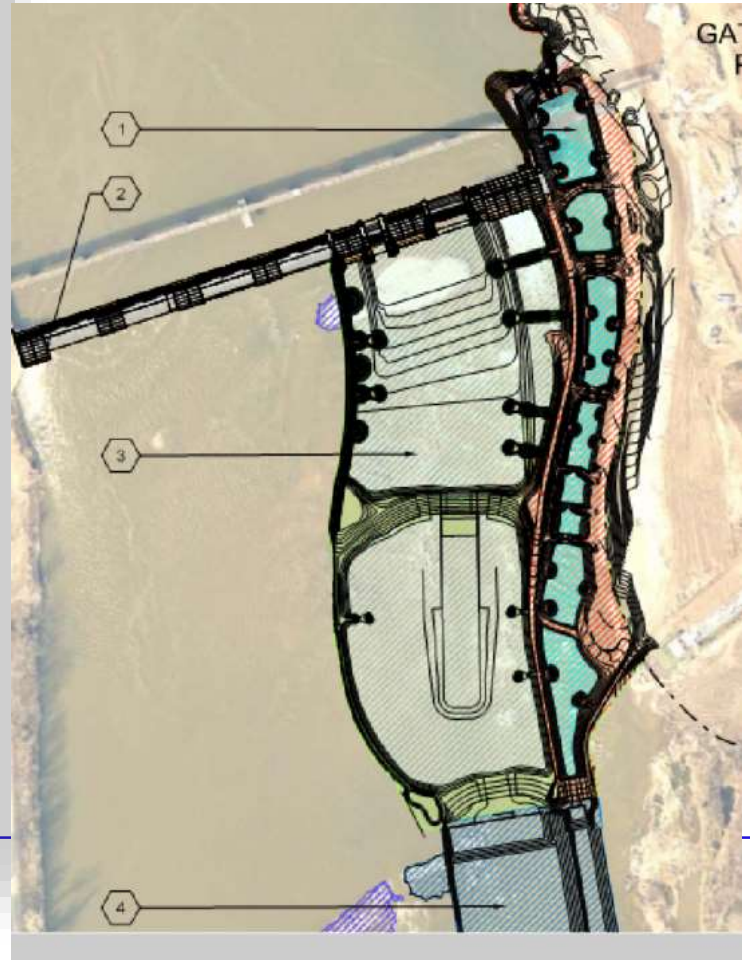


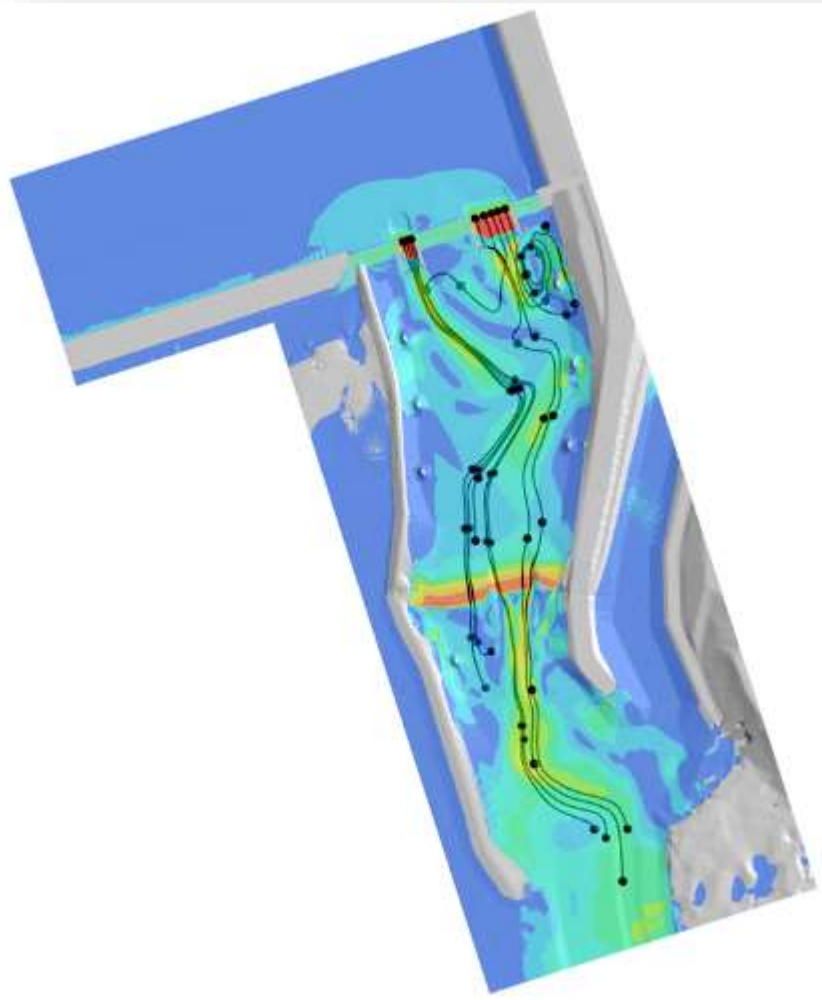
Design continued to evolve - 2015



Pedestrian bridge

Design continued to evolve - 2017

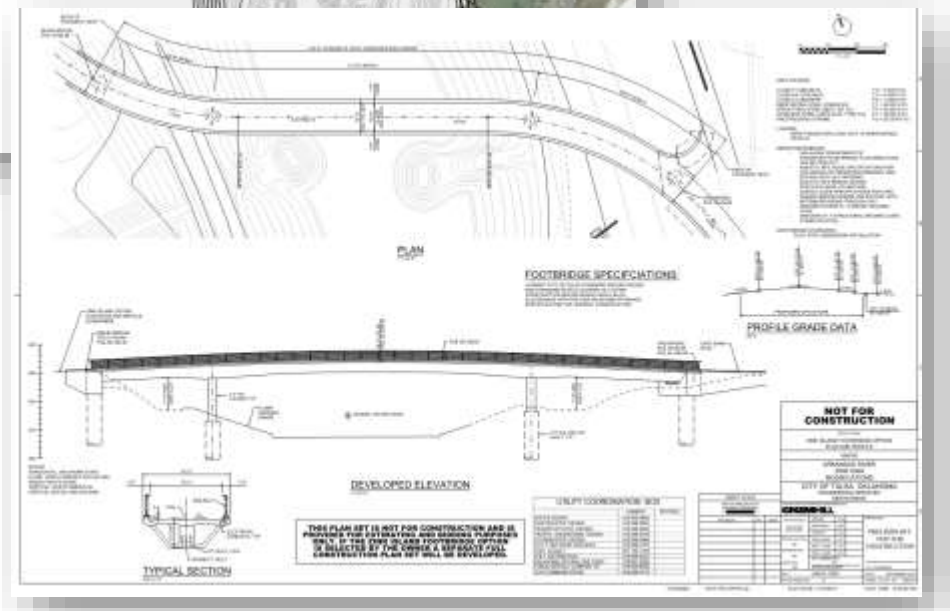




Design has continued to evolve - 2018

Design continued to evolve - 2019

Design continued to evolve - 2020



Historical Project Drivers

- Prominence of Tulsa Wave
- Maintenance Challenges of Existing Zink Dam
- Improved Environmental Conditions
- Lack of Regulated Flows
- Dangerous Undertow of the Ogee Weir

May 1964: the County and City hired HTB for river feasibility study and master plan. Street Commissioner Bob LaFortune and County Attorney David Hall visited San Antonio's Riverwalk and Austin's Town Lake.

It's been a Tulsa idea since 1964, and it was still a major theme in community forums held by then-Mayor Bill LaFortune in 2002 to gauge what citizens wanted the city to invest in most.

Vision Tulsa vote approved April 5, 2016. $63M

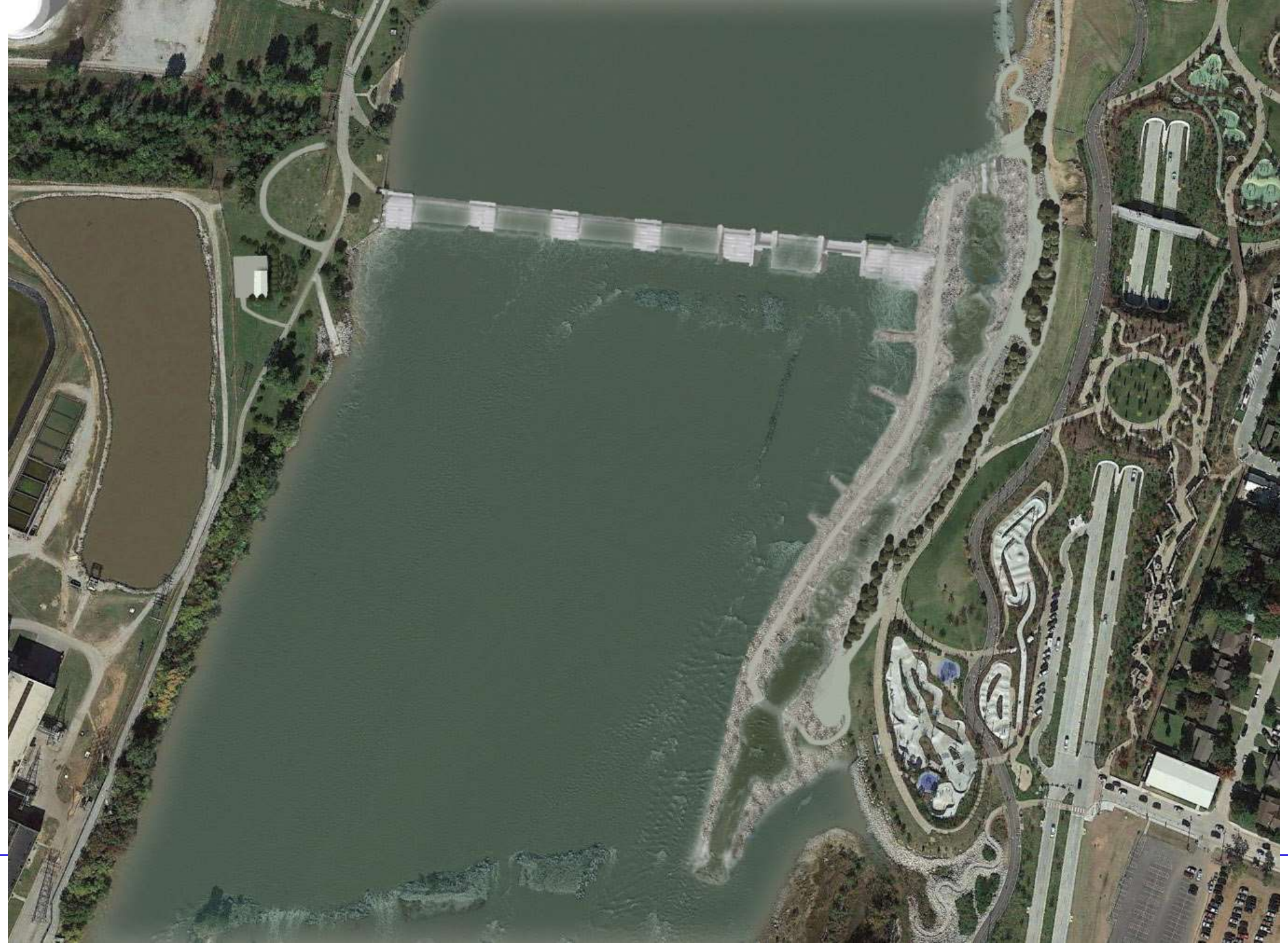
- *$48M for Zink Dam and Bank Stabilization*
- *$15M for Zink Pedestrian Bridge*

– https://www.publicradiotulsa.org/, 2020

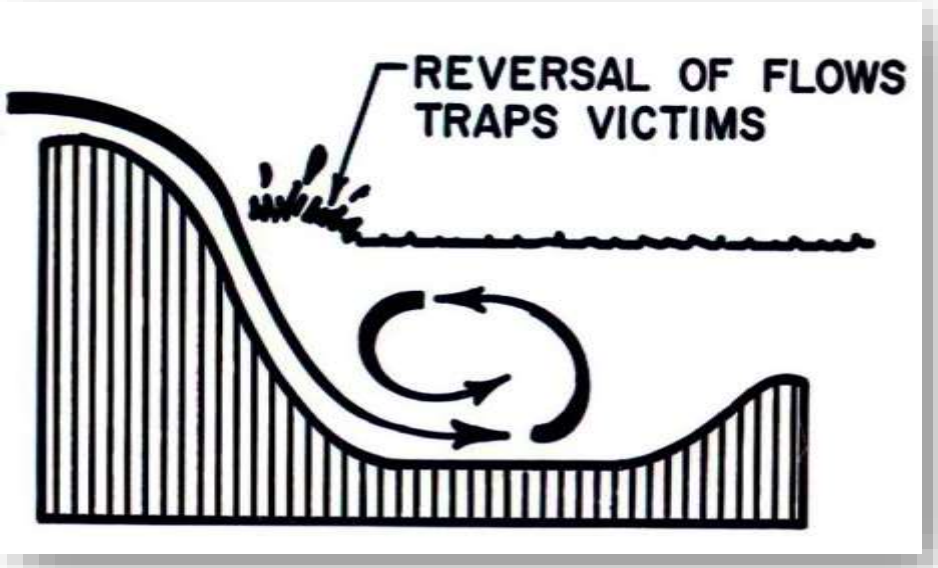
Final Design Elements

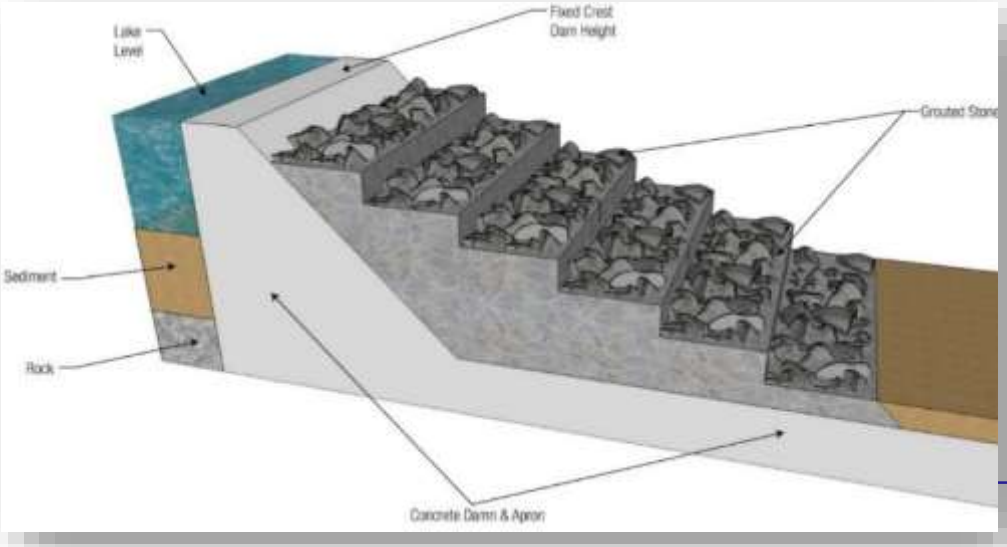
Zink Dam Modifications Project

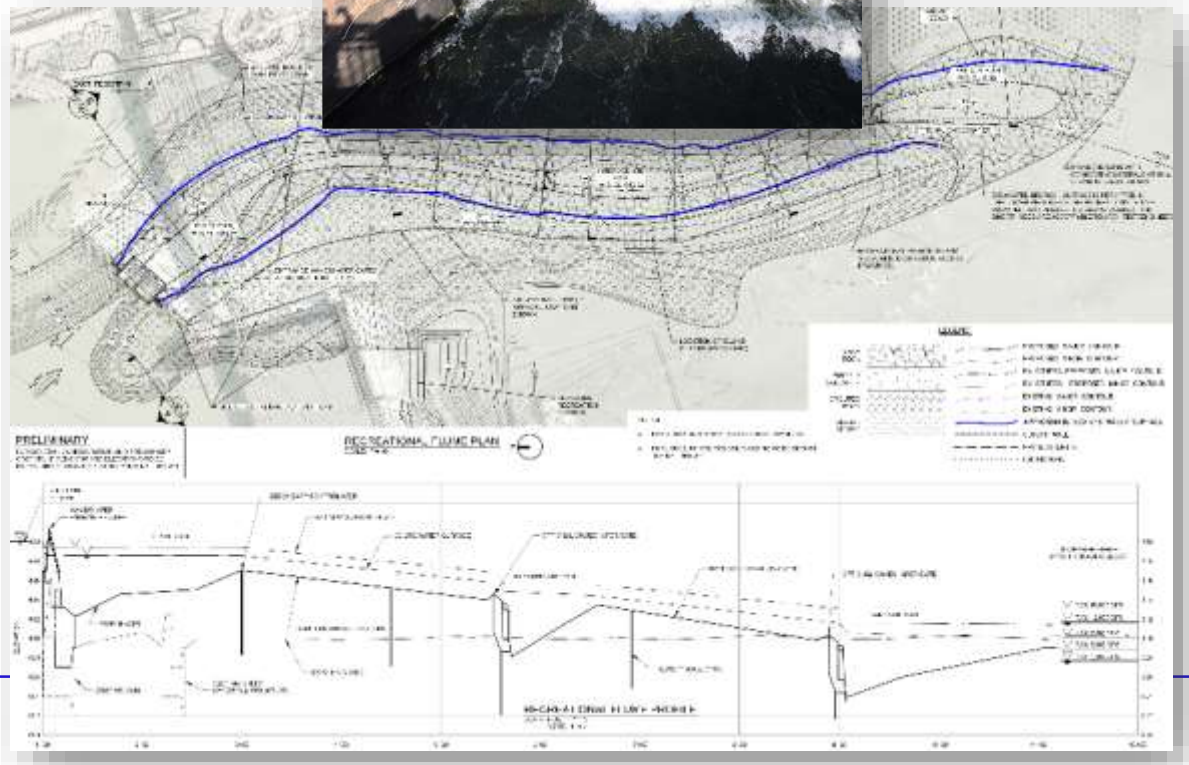
- Increase pool depth to 10 feet
- Increase Zink Lake to reach upstream of I-244 bridge
- Additional gates, total of 54% of the dam face area
  - 432’ full height gates
  - 400’ crest gates
  - 197’ fixed dam
- Public Access/Recreational Improvements
- Bank Stabilization
- Compensatory Mitigation/Preservation
- Roller mitigation on fixed dam and crest gates



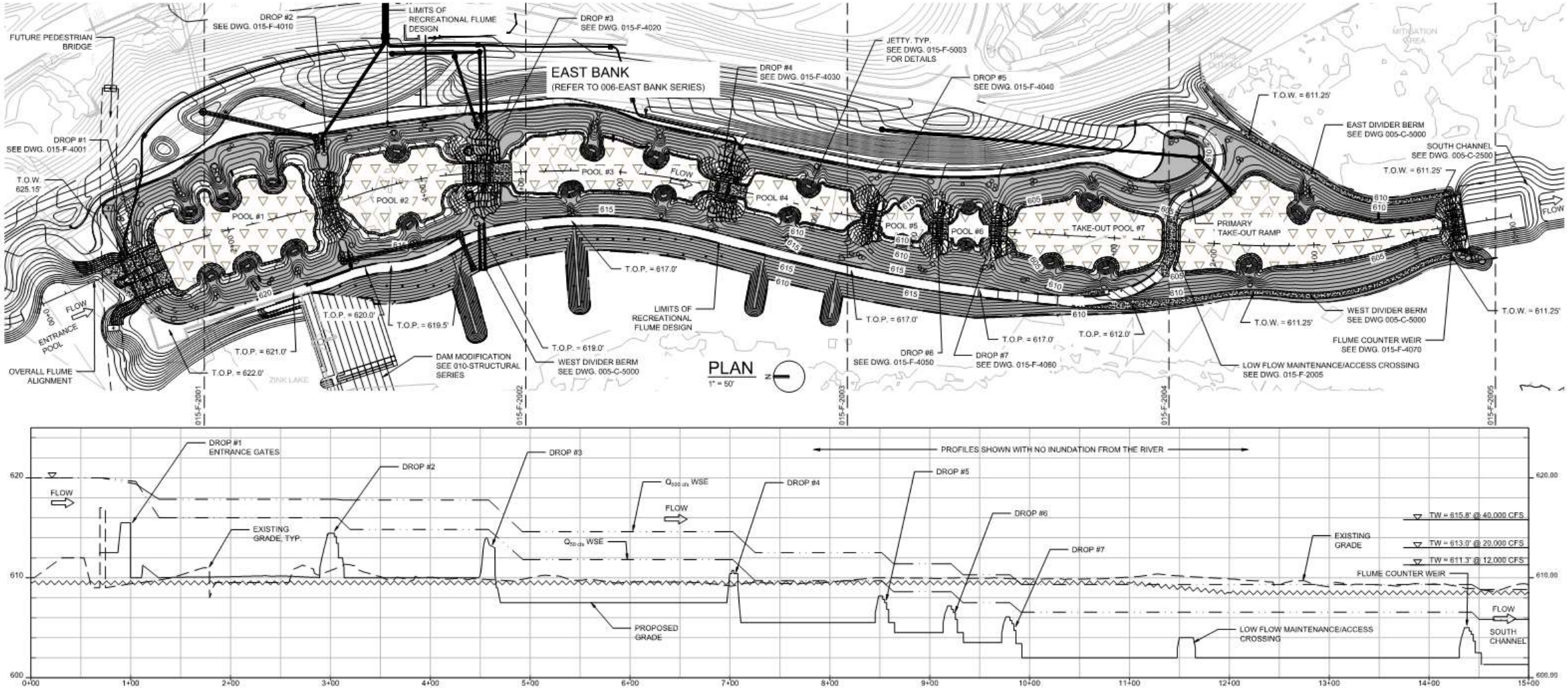
Open Channel Flow







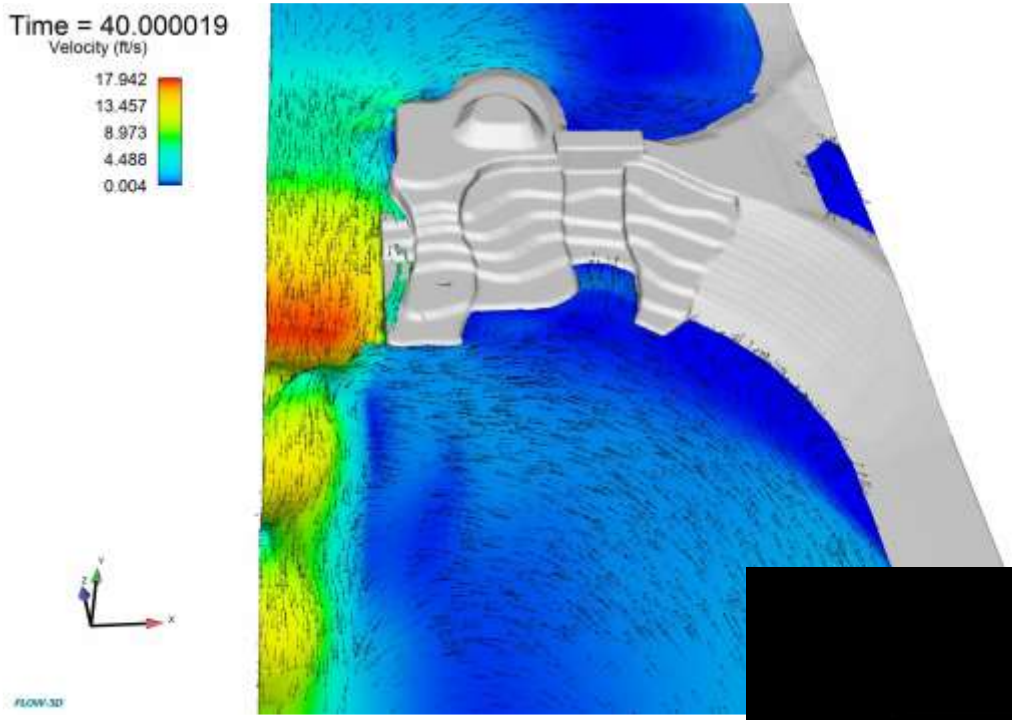
Recreational flume

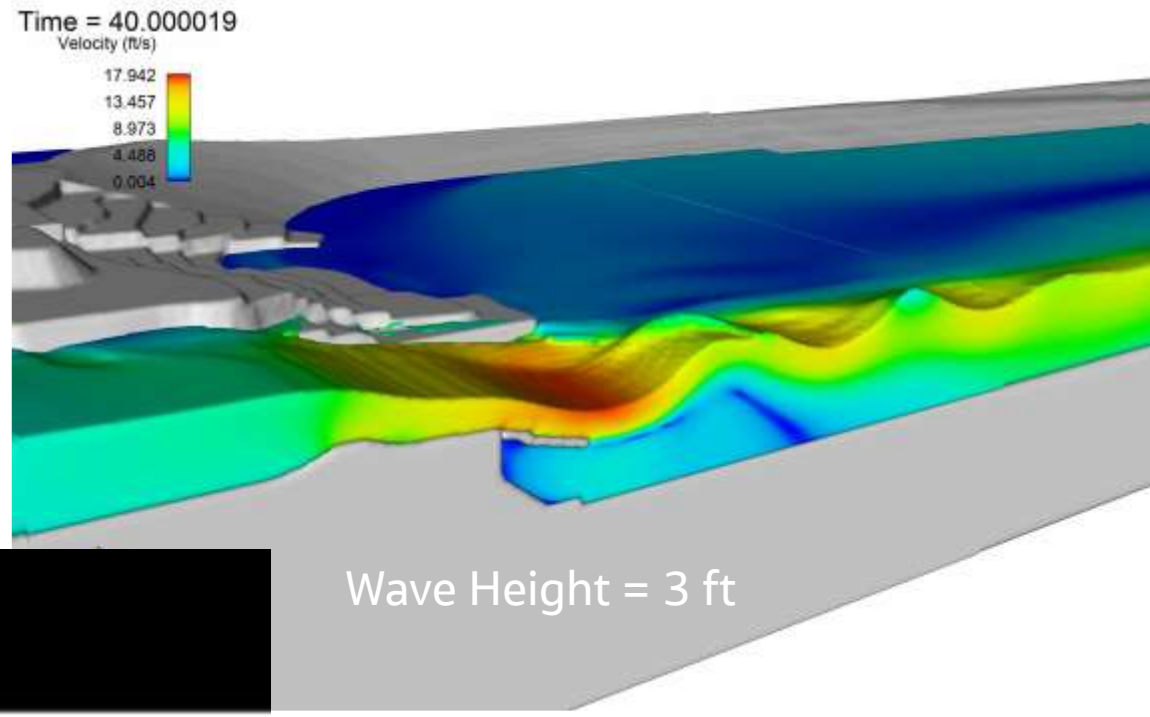


East Bank

Animated Modeling

GREEN WAVE AT 500CFS





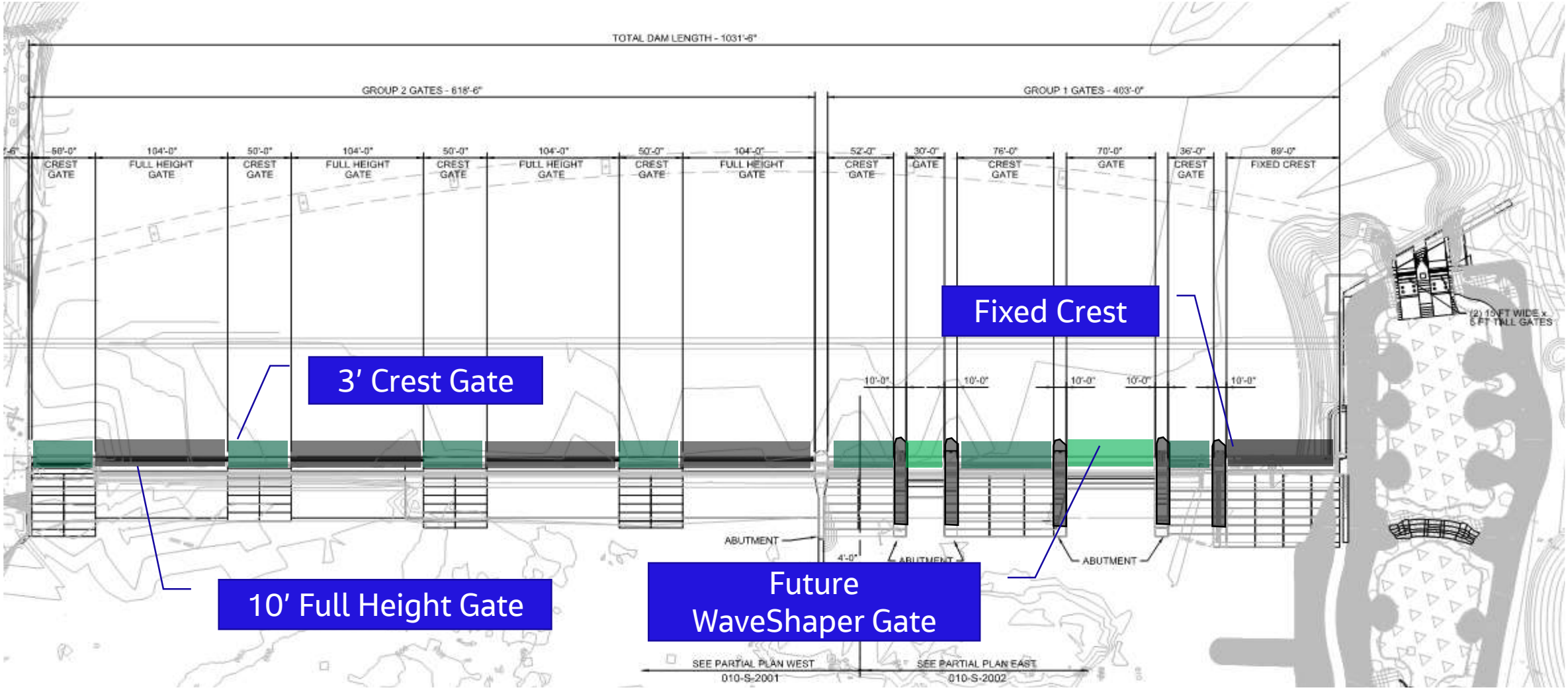
Wave Height = 3 ft

[redacted]

McLaughlin Whitewater
design group
A DIVISION OF MERRICK & COMPANY

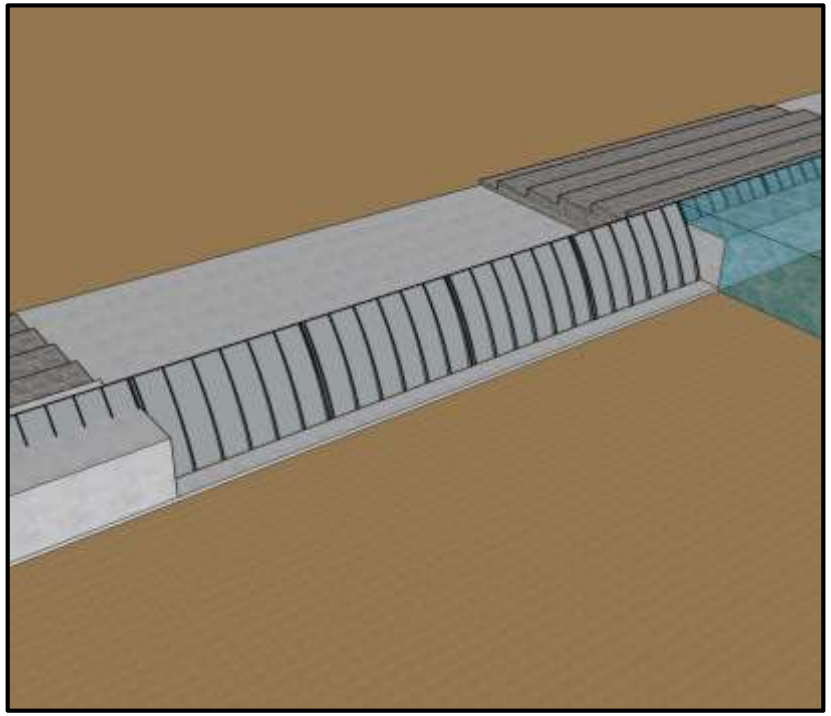
[redacted]

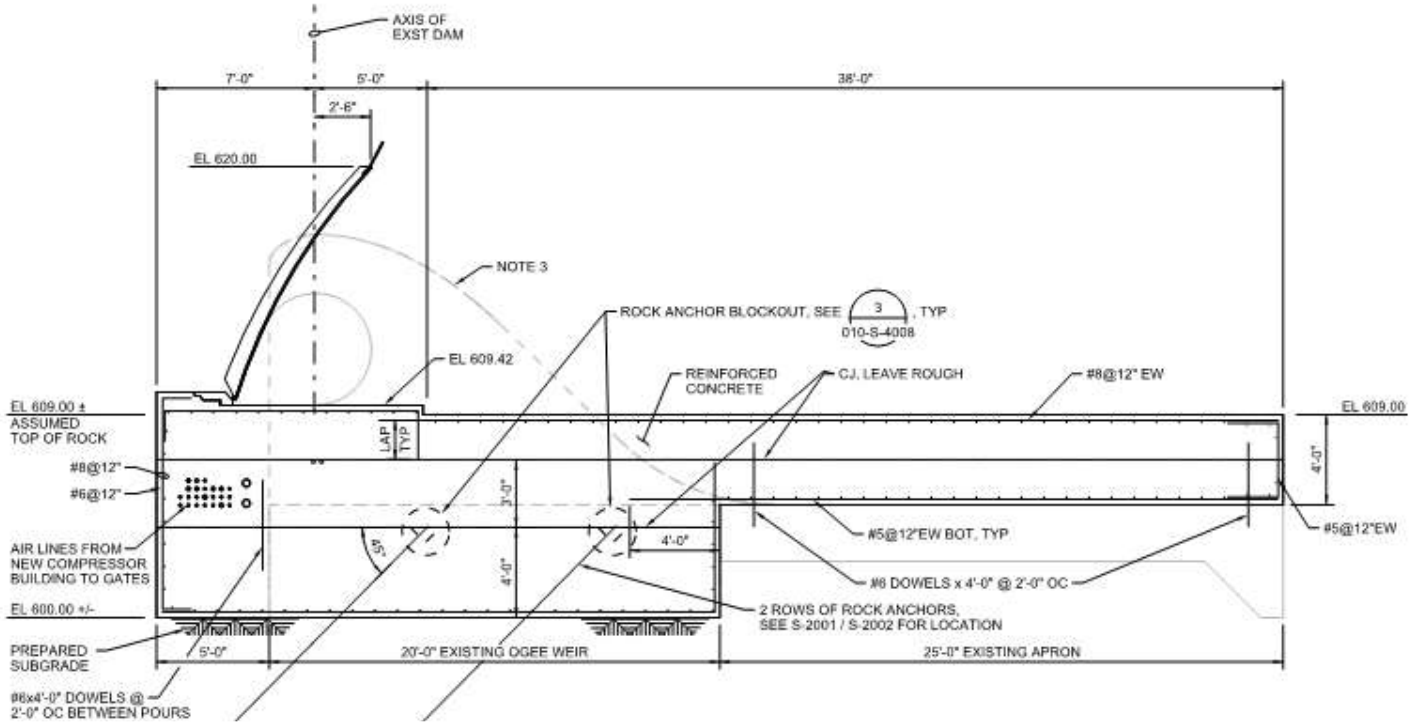
Gate Layout

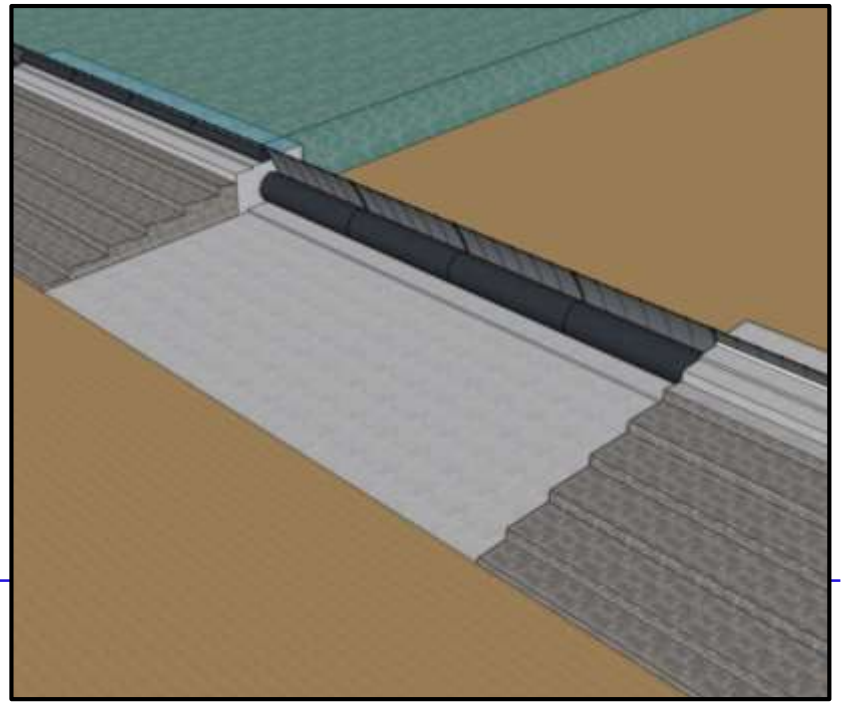

TOTAL DAM LENGTH - 1031'-6"
GROUP 2 GATES - 618'-6"
GROUP 1 GATES - 403'-0"
50'-0" CREST GATE
104'-0" FULL HEIGHT GATE
50'-0" CREST GATE
104'-0" FULL HEIGHT GATE
50'-0" CREST GATE
104'-0" FULL HEIGHT GATE
50'-0" CREST GATE
104'-0" FULL HEIGHT GATE
52'-0" CREST GATE
30'-0" GATE
76'-0" CREST GATE
70'-0" GATE
36'-0" CREST GATE
89'-0" FIXED CREST
(2) 10 FT WIDE x 5 FT TALL GATES
10'-0"
10'-0"
10'-0"
10'-0"
10'-0"
ABUTMENT
4'-0"
ABUTMENT
ABUTMENT
SEE PARTIAL PLAN WEST 010-S-2001
SEE PARTIAL PLAN EAST 010-S-2002
3' Crest Gate
Fixed Crest
10' Full Height Gate
Future WaveShaper Gate

Gate layout

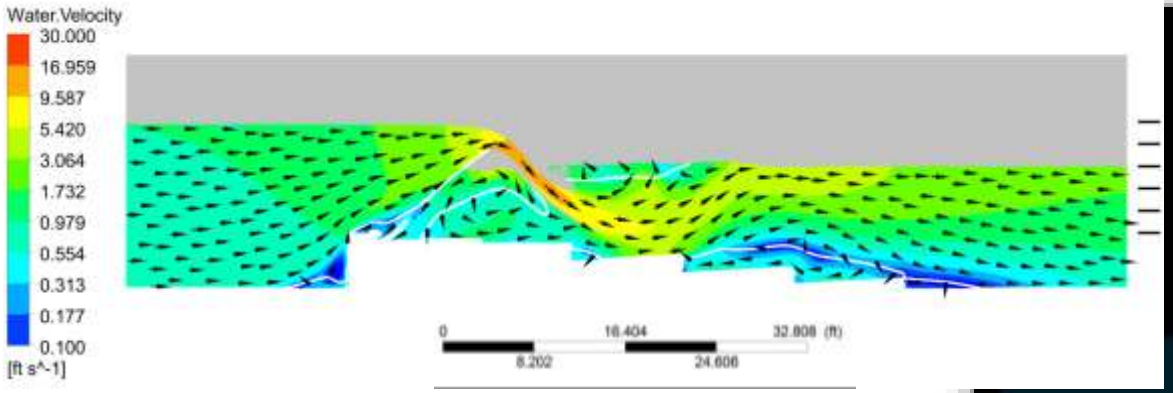
- Full Height Gates
  - 10 ft High Gates

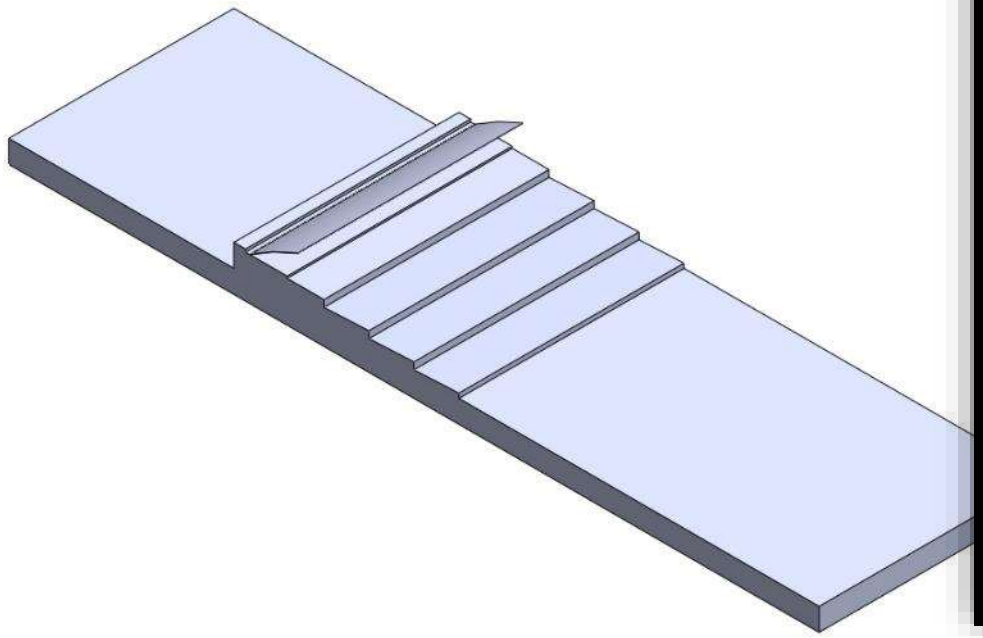


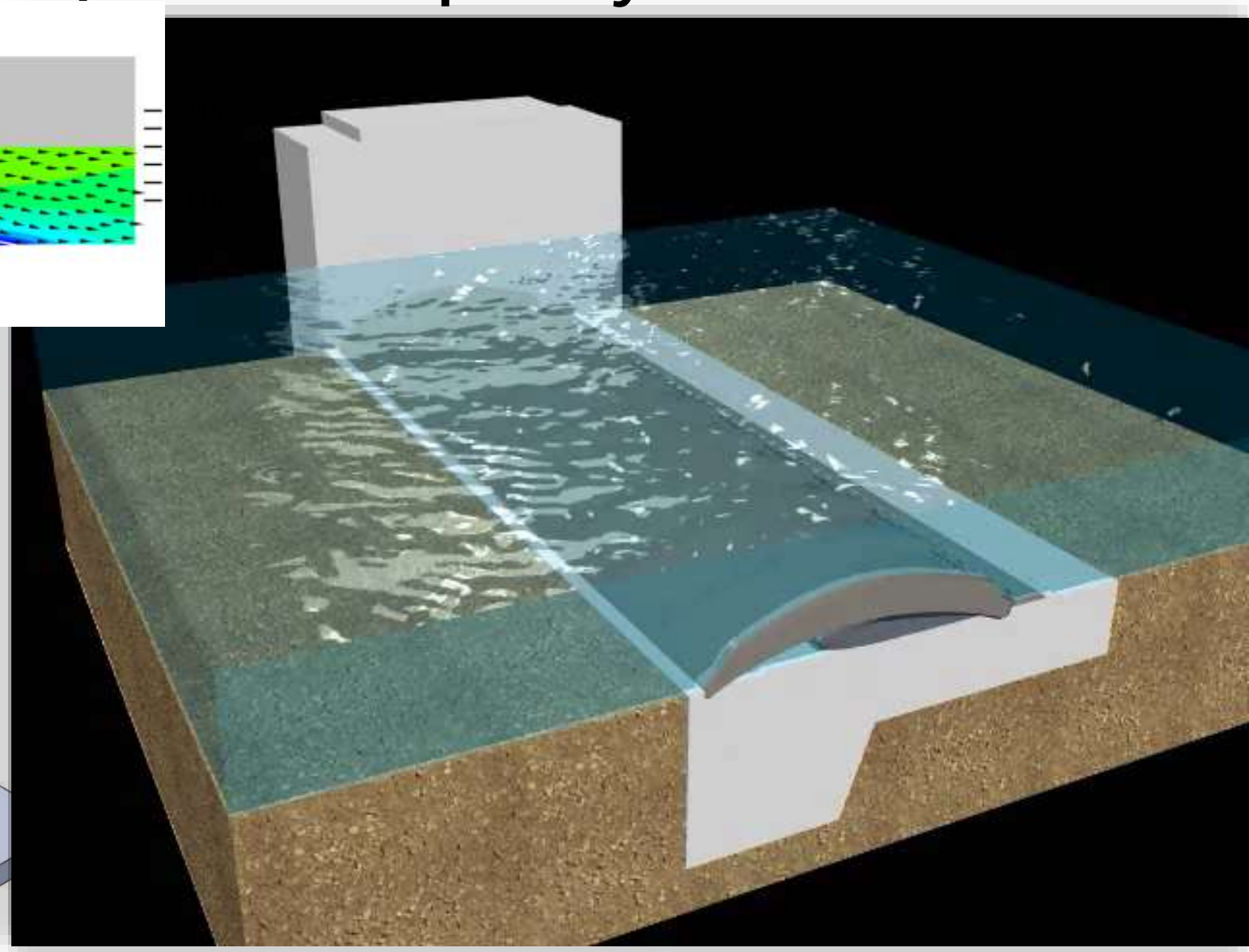




Gate Design Provides Unique Operational Capability



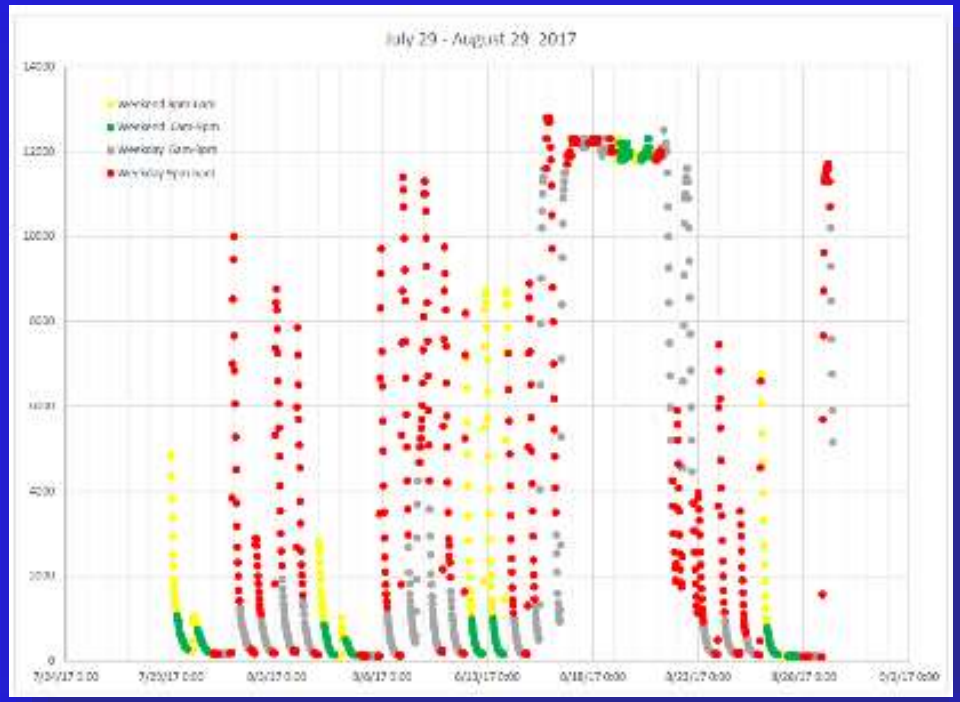




Improving Collaboration

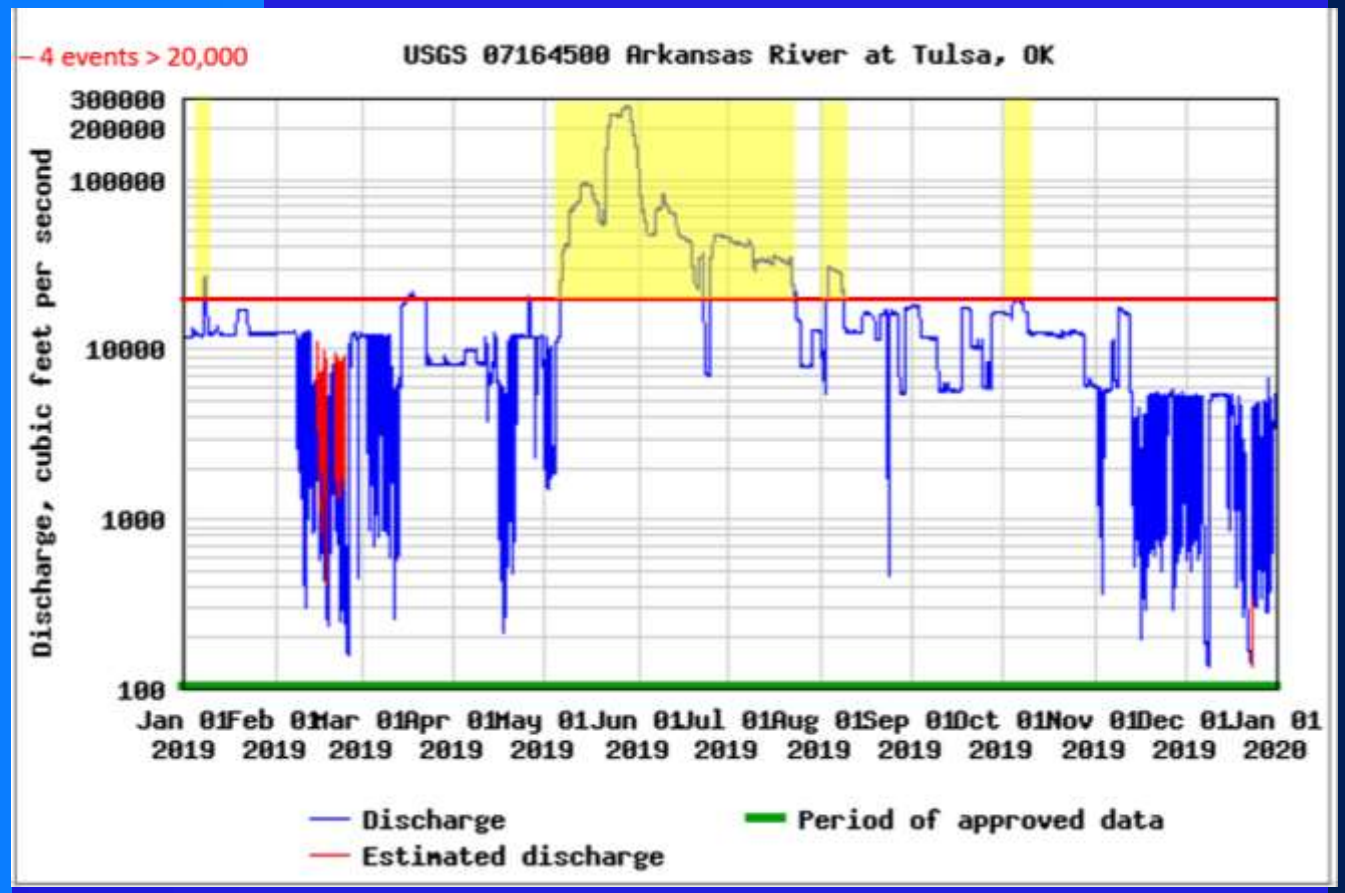
- Prime Contractor: Crossland Construction Company
- Inspection: City of Tulsa and HNTB

- Managing Variable Flows
- Sharing Risk between Owner and Contractor
- Incentives/disincentives
  - Support scheduled public events
- Synchronization between Bridge & Dam



Biggest Risk: High River Flows

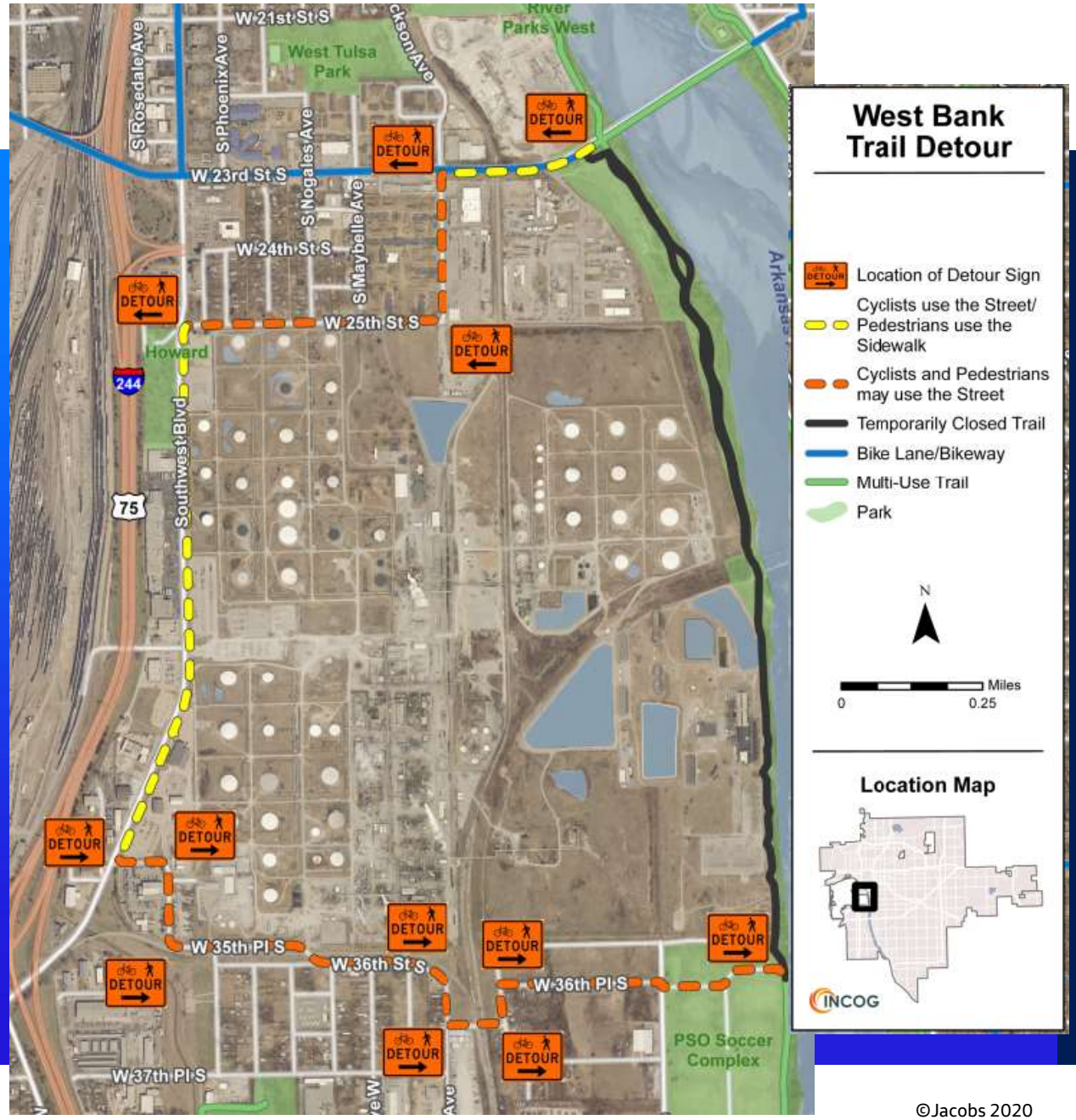
- Establish maximum working flowrate
  - 20,000 cfs
- Establish maximum coffer protection
  - 40,000 cfs
- Risk shared between Owner and Contractor
  - Standby time above 20,000 cfs
  - Breach conditions specified and compensated



Construction!

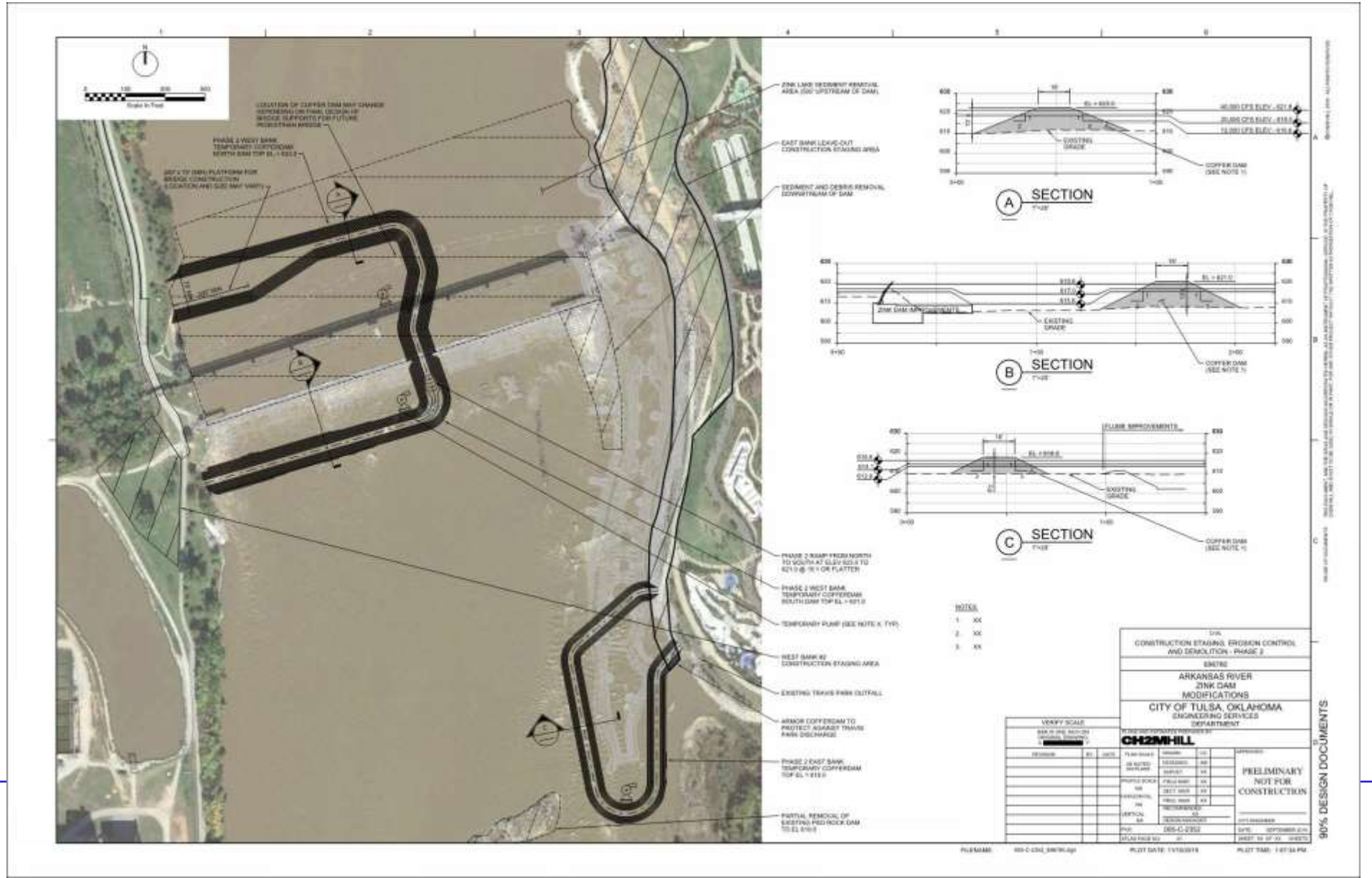
Ground Breaking! August 13, 2020

Trail Connectivity and Detours

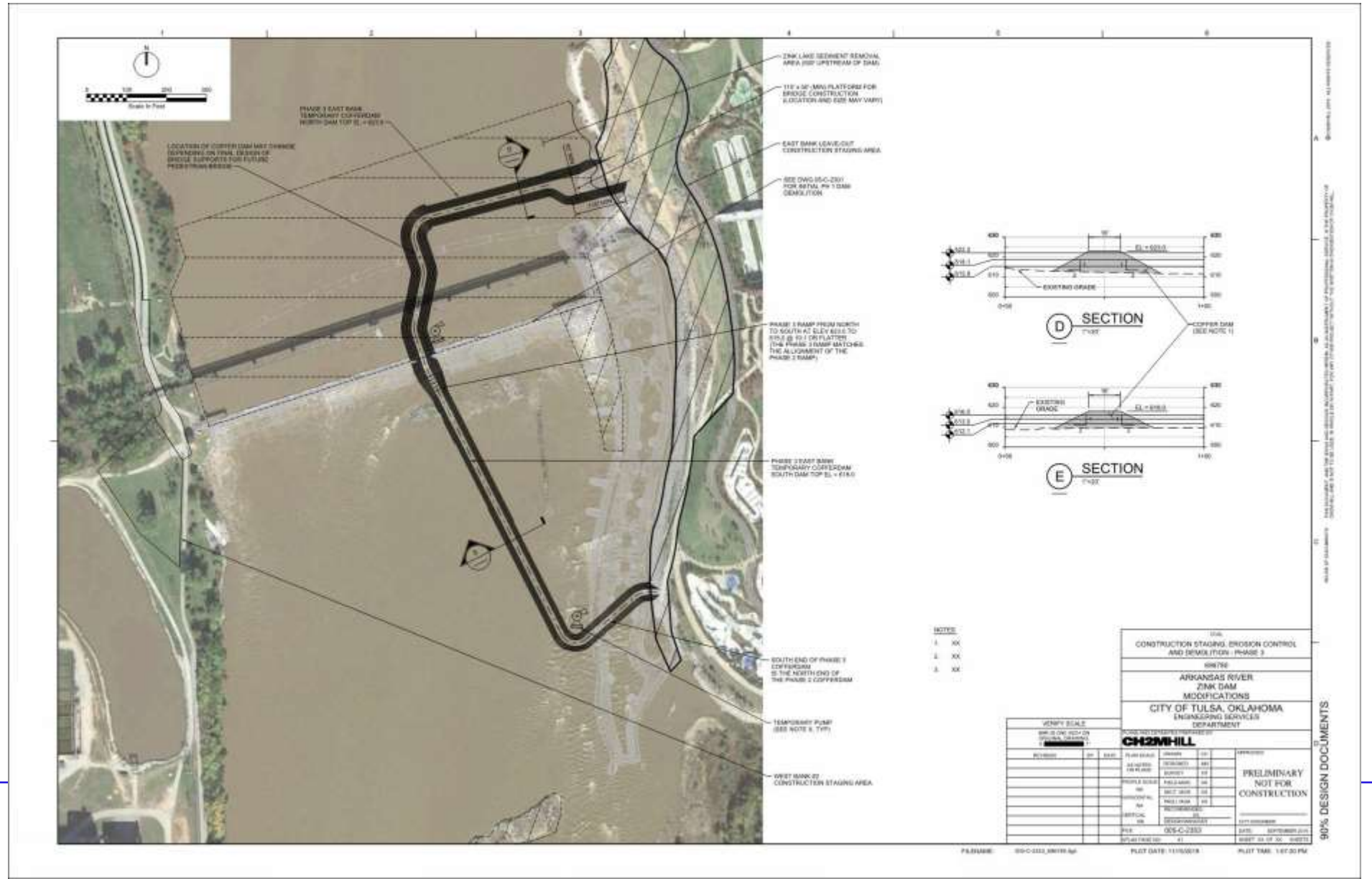


Construction phase 1 – East demolition

Construction phase 2 – West side



Construction Phase 3 – East side



18 hours after NTP

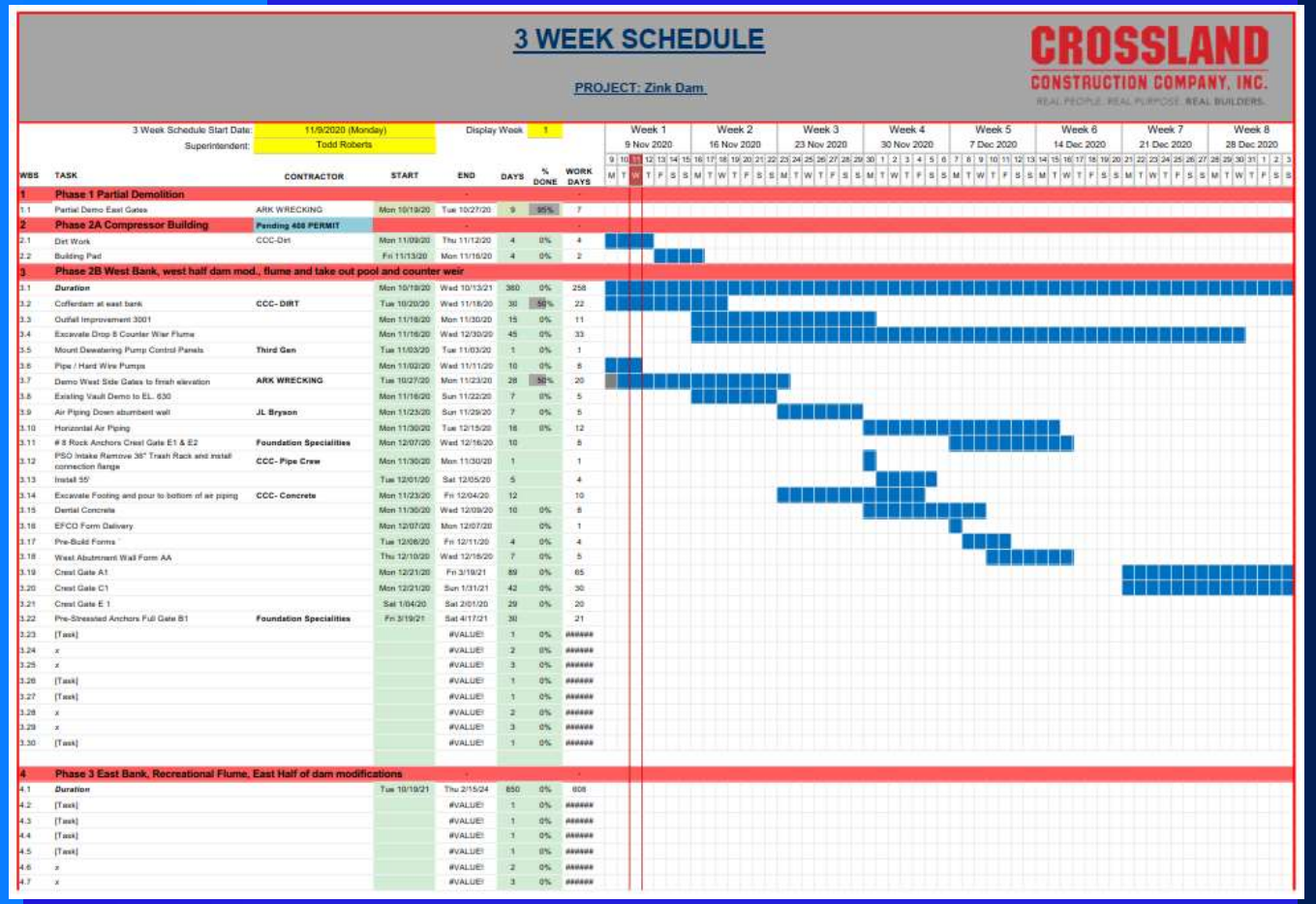
Fish Relocation back into the River

Demolition Continues

New Pedestrian Bridge Pending Permitting

Schedule

- NTP
  - 19 October 2020
- Phase 2a
  - 240 Days
- Phase 2
  - 360 Days
- Phase 3
  - 840 Days
- Improved Zink Dam
  - Early 2023!



3 WEEK SCHEDULE

PROJECT: Zink Dam

CROSSLAND CONSTRUCTION COMPANY, INC.

REAL PEOPLE. REAL PURPOSE. REAL BUILDERS.

3 Week Schedule Start Date: 11/9/2020 (Monday) | Display Week: 1

Superintendent: Todd Roberts

WBS	TASK	CONTRACTOR	START	END	DAYS	% DONE	WORK DAYS
1	**Phase 1 Partial Demolition**			-			-
1.1	Partial Demo East Gates	ARK WRECKING	Mon 10/19/20	Tue 10/27/20	9	95%	7
2	**Phase 2A Compressor Building**	**Pending 404 PERMIT**		-			-
2.1	Dirt Work	CCC-Dirt	Mon 11/09/20	Thu 11/12/20	4	0%	4
2.2	Building Pad		Fri 11/13/20	Mon 11/16/20	4	0%	2
3	**Phase 2B West Bank, west half dam mod., flume and take out pool and counter weir**						
3.1	*Duration*		Mon 10/19/20	Wed 10/13/21	360	0%	258
3.2	Cofferdam at east bank	CCC- DIRT	Tue 10/20/20	Wed 11/18/20	30	50%	22
3.3	Outfall Improvement 3001		Mon 11/16/20	Mon 11/30/20	15	0%	11
3.4	Excavate Drop 8 Counter Wier Flume		Mon 11/16/20	Wed 12/30/20	45	0%	33
3.5	Mount Dewatering Pump Control Panels	Third Gen	Tue 11/03/20	Tue 11/03/20	1	0%	1
3.6	Pipe / Hard Wire Pumps		Mon 11/02/20	Wed 11/11/20	10	0%	8
3.7	Demo West Side Gates to finish elevation	ARK WRECKING	Tue 10/27/20	Mon 11/23/20	28	50%	20
3.8	Existing Vault Demo to EL. 630		Mon 11/16/20	Sun 11/22/20	7	0%	5
3.9	Air Piping Down abumbent wall	JL Bryson	Mon 11/23/20	Sun 11/29/20	7	0%	5
3.10	Horizontal Air Piping		Mon 11/30/20	Tue 12/15/20	16	0%	12
3.11	# 8 Rock Anchors Crest Gate E1 & E2	Foundation Specialities	Mon 12/07/20	Wed 12/16/20	10		8
3.12	PSO Intake Remove 36" Trash Rack and install connection flange	CCC- Pipe Crew	Mon 11/30/20	Mon 11/30/20	1		1
3.13	Install 55'		Tue 12/01/20	Sat 12/05/20	5		4
3.14	Excavate Footing and pour to bottom of air piping	CCC- Concrete	Mon 11/23/20	Fri 12/04/20	12		10
3.15	Dental Concrete		Mon 11/30/20	Wed 12/09/20	10	0%	8
3.16	EFCO Form Delivery		Mon 12/07/20	Mon 12/07/20		0%	1
3.17	Pre-Build Forms		Tue 12/08/20	Fri 12/11/20	4	0%	4
3.18	West Abutment Wall Form AA		Thu 12/10/20	Wed 12/16/20	7	0%	5
3.19	Crest Gate A1		Mon 12/21/20	Fri 3/19/21	89	0%	65
3.20	Crest Gate C1		Mon 12/21/20	Sun 1/31/21	42	0%	30
3.21	Crest Gate E 1		Sat 1/04/20	Sat 2/01/20	29	0%	20
3.22	Pre-Stressed Anchors Full Gate B1	Foundation Specialities	Fri 3/19/21	Sat 4/17/21	30		21
3.23	[Task]			#VALUE!	1	0%	######
3.24	x			#VALUE!	2	0%	######
3.25	x			#VALUE!	3	0%	######
3.26	[Task]			#VALUE!	1	0%	######
3.27	[Task]			#VALUE!	1	0%	######
3.28	x			#VALUE!	2	0%	######
3.29	x			#VALUE!	3	0%	######
3.30	[Task]			#VALUE!	1	0%	######
4	**Phase 3 East Bank, Recreational Flume, East Half of dam modifications**			-			-
4.1	*Duration*		Tue 10/19/21	Thu 2/15/24	850	0%	608
4.2	[Task]			#VALUE!	1	0%	######
4.3	[Task]			#VALUE!	1	0%	######
4.4	[Task]			#VALUE!	1	0%	######
4.5	[Task]			#VALUE!	1	0%	######
4.6	x			#VALUE!	2	0%	######
4.7	x			#VALUE!	3	0%	######

Week 1 9 Nov 2020 | Week 2 16 Nov 2020 | Week 3 23 Nov 2020 | Week 4 30 Nov 2020 | Week 5 7 Dec 2020 | Week 6 14 Dec 2020 | Week 7 21 Dec 2020 | Week 8 28 Dec 2020

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