

KAW LAKE WATER SUPPLY STUDY

BARTLESVILLE WATER RESOURCES
COMMITTEE

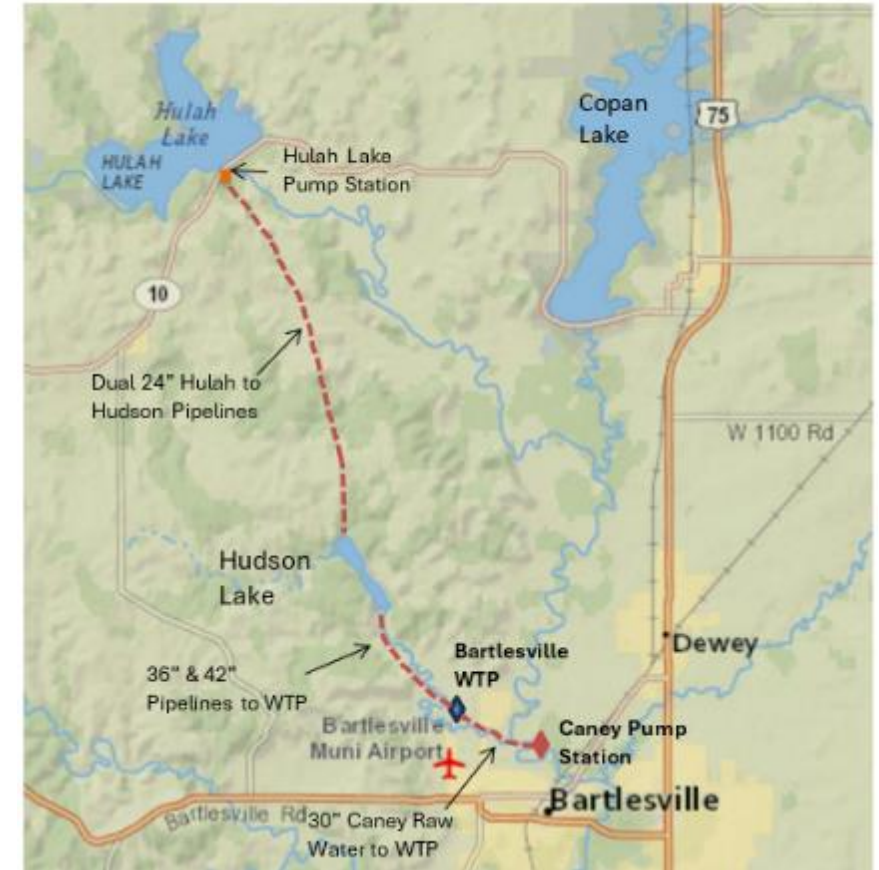
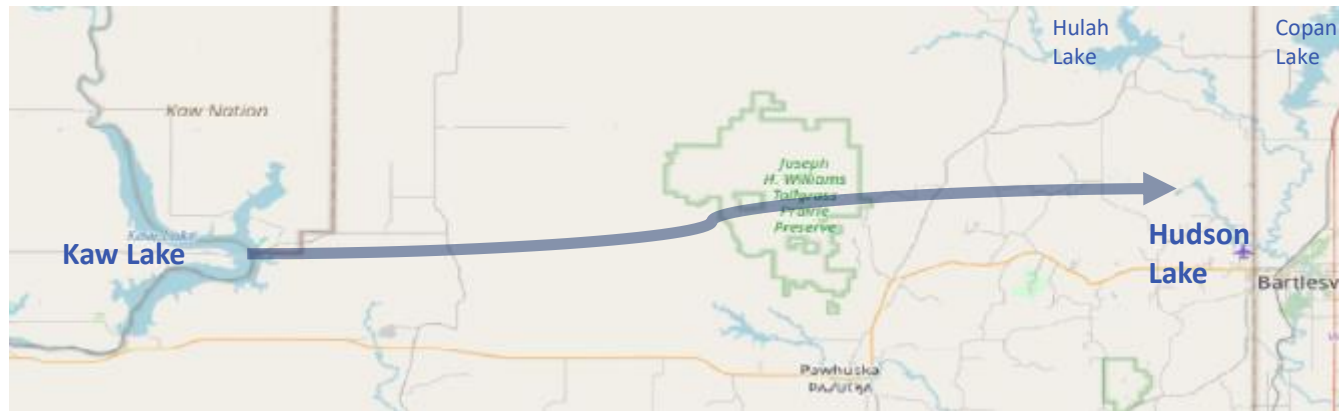
DECEMBER 19, 2024



STUDY SCOPE AND OBJECTIVES

Scope and Objectives are to develop:

- Infrastructure options to convey Kaw Lake water to Bartlesville's Hudson Lake
- Construction and operational cost estimates

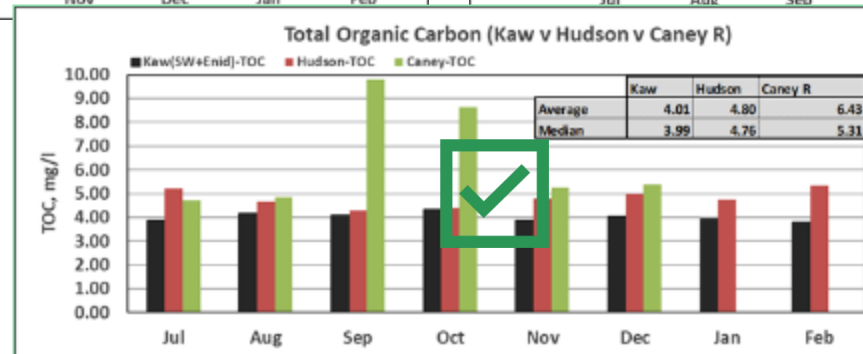
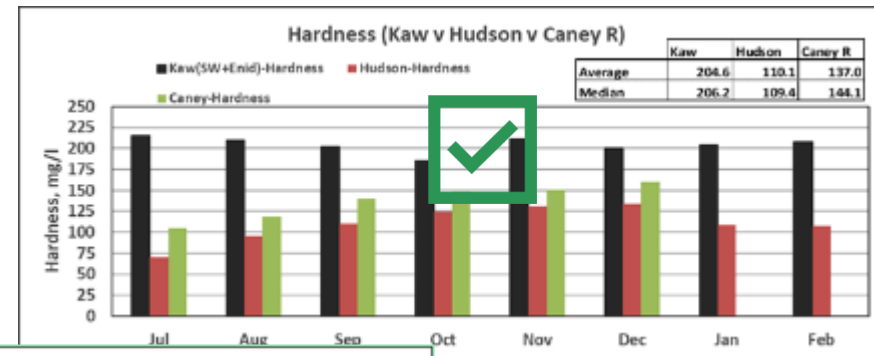
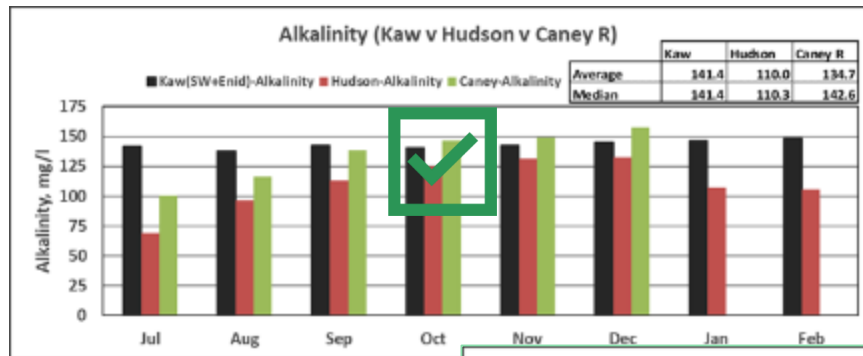
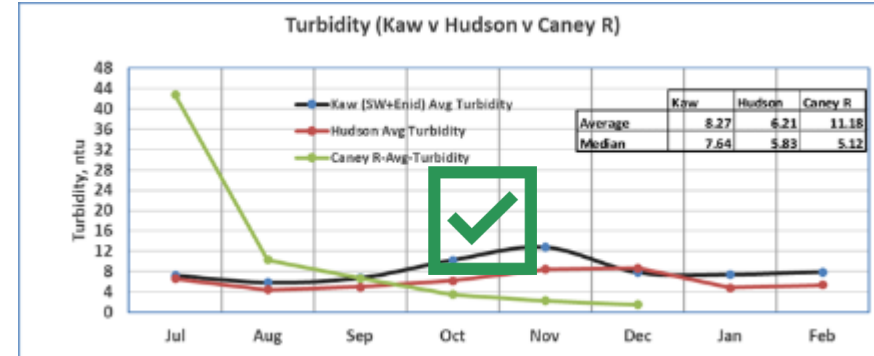
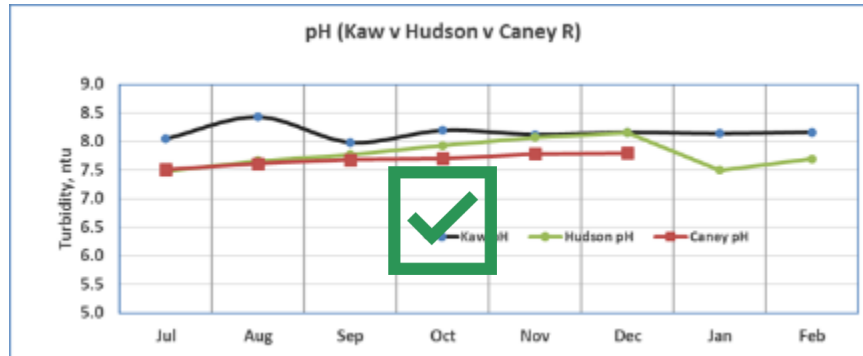


KAW LAKE WATER QUALITY

Data Sources:

- Oklahoma Water Resources Board (OWRB)
- Oklahoma Department of Environmental Quality (ODEQ)
- US Geological Survey (USGS)
- US Army Corps of Engineers (USACE)
- Kaw Nation Environmental Department
- City of Stillwater
- City of Enid
- City of Ponca City

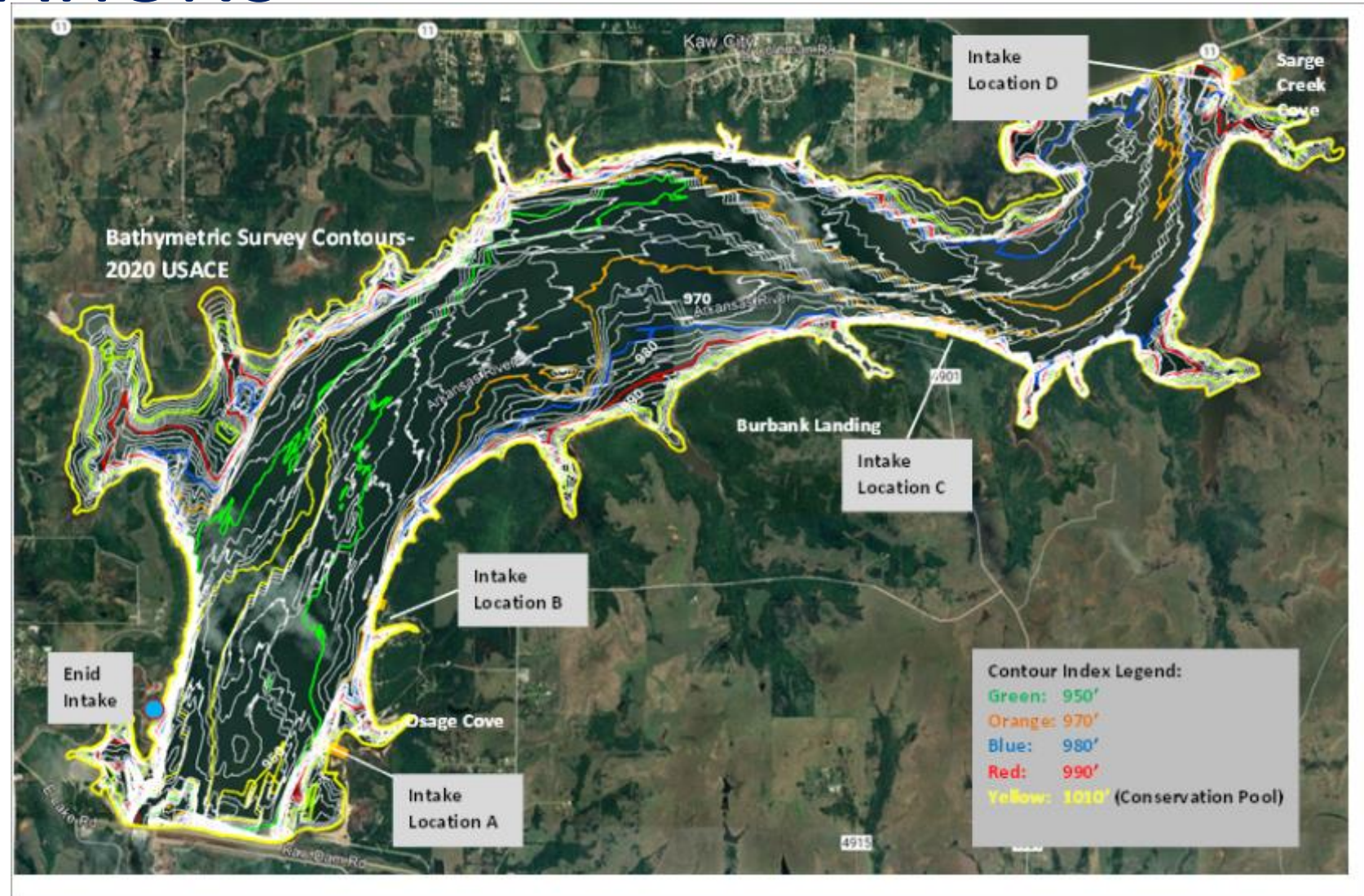
CONVENTIONAL WATER QUALITY PARAMETERS



OTHER POLLUTANTS OF CONCERN

- As to the presence of other pollutants (PFAS, CECs, etc.) of concern, very limited data was available for this study.
- Kaw Lake drainage basin is large extending from Oklahoma, to Kansas, Colorado, and a small portion of New Mexico with well established aerospace, military, and other industrial complexes.
- If Bartlesville decides to pursue the Kaw Lake supply, we recommend Bartlesville to include more detailed evaluation for these pollutants including sampling from Kaw Lake.

KAW LAKE POTENTIAL INTAKE LOCATIONS



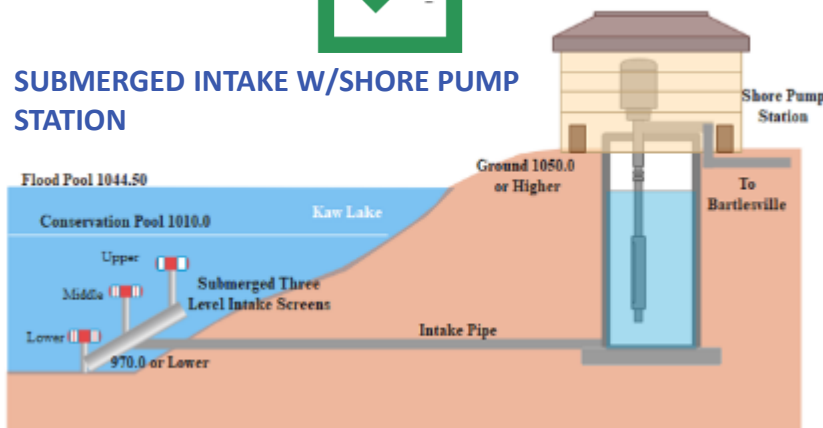
STILLWATER AND ENID INTAKES



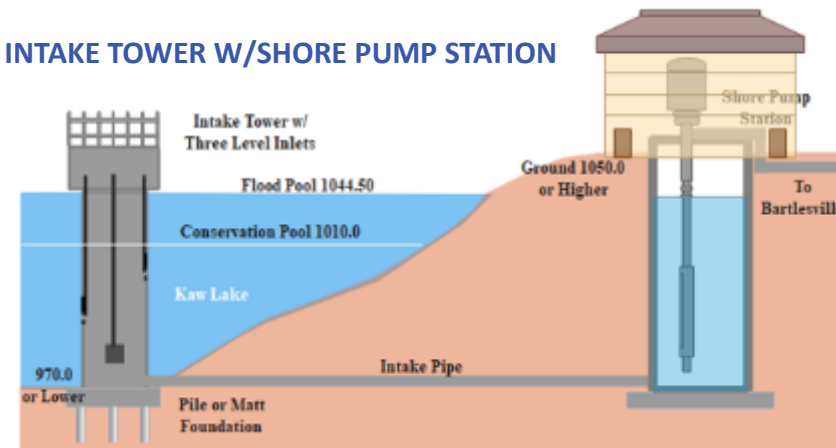
INTAKE TYPES



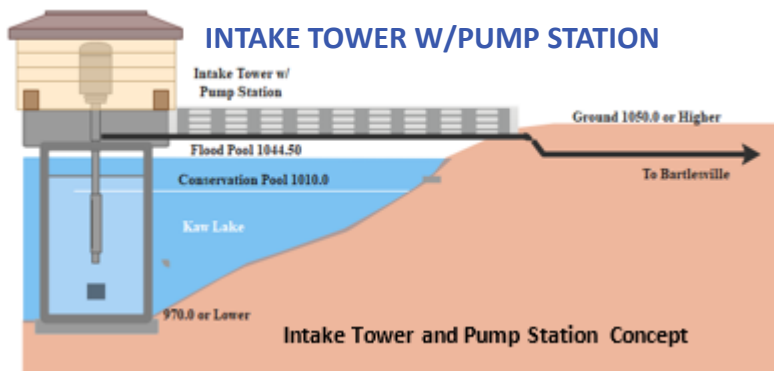
SUBMERGED INTAKE W/SHORE PUMP STATION



INTAKE TOWER W/SHORE PUMP STATION



INTAKE TOWER W/PUMP STATION



Chamco.com/floating-pump-station

FLOATING INTAKE/PUMP STATION



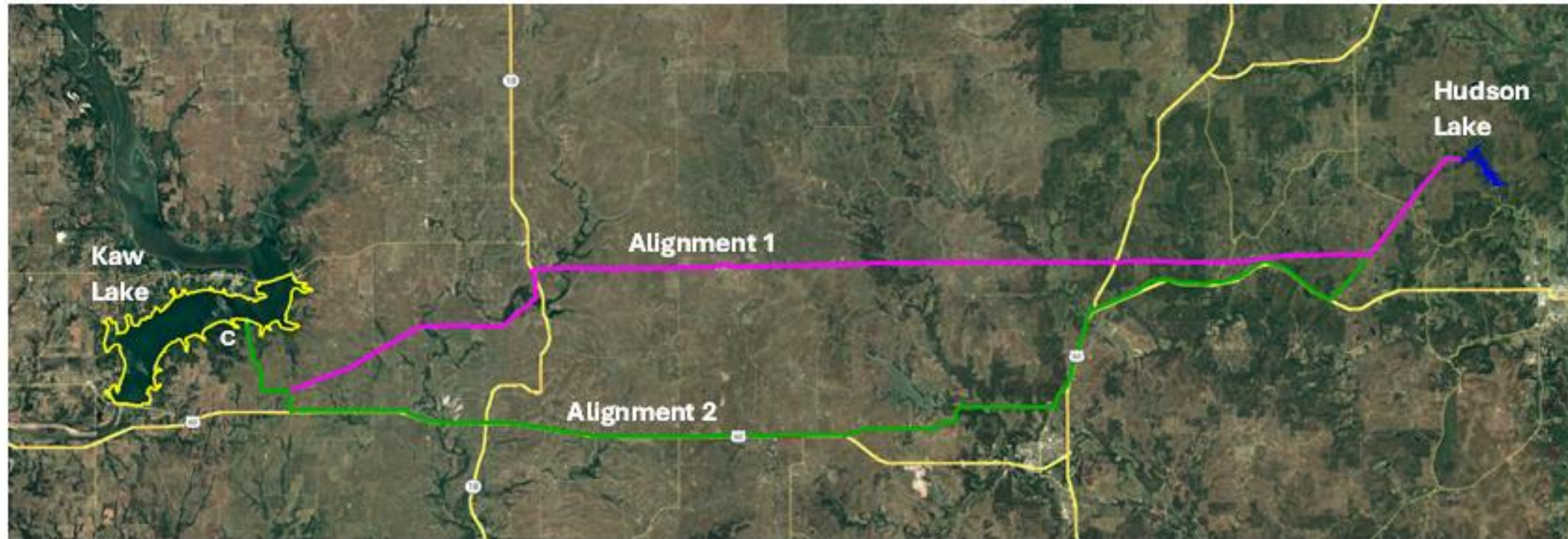
PERMIT REQUIREMENTS

- Federal
 - Section 401, Section 404, Section 408, and Section 10 permits.
- State
 - Water Right Permit from OWRB
 - Permit to Construct from ODEQ
- Tribal Nation
 - Potential Water Rights

PIPELINE ALIGNMENT

- Considerations
 - Alignment length, hydraulics and line access.
 - Highway, roadway, creeks, streams and petroleum pipeline crossings.
 - Potential wetlands and environmentally sensitive areas.
 - Initial environmental investigations.
 - Potential for wholesale customer connections.
 - Overall constructability and cost.

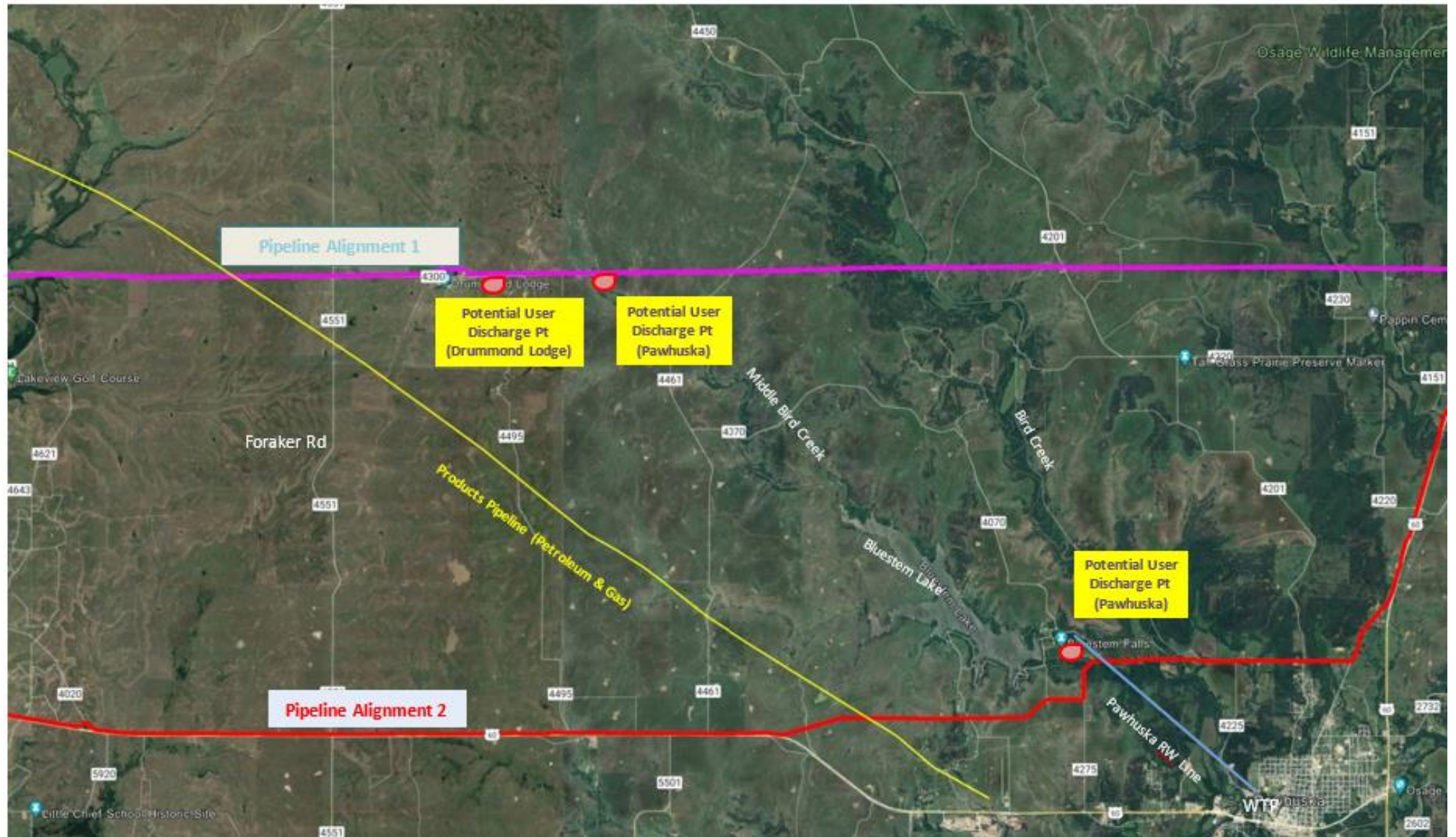
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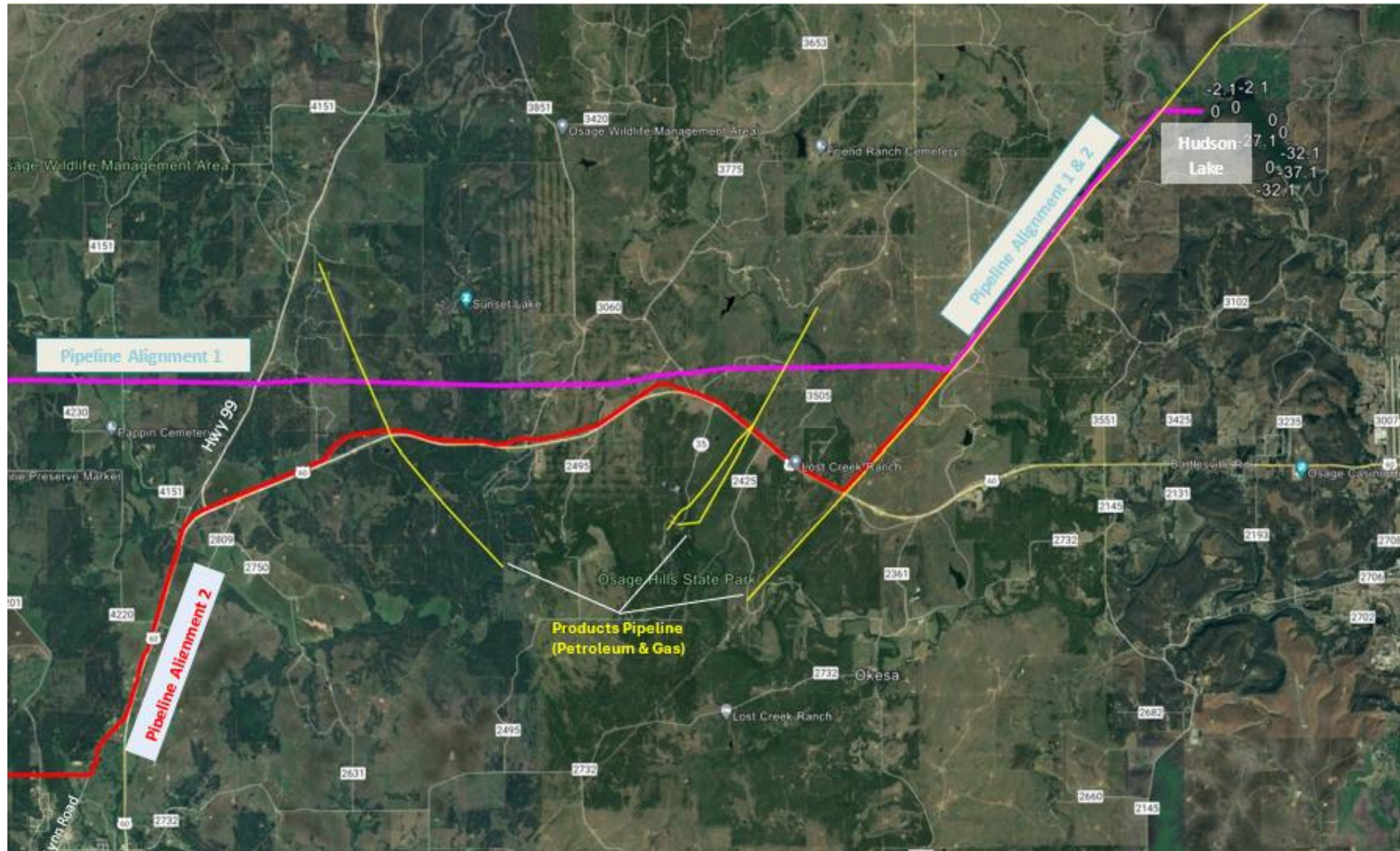
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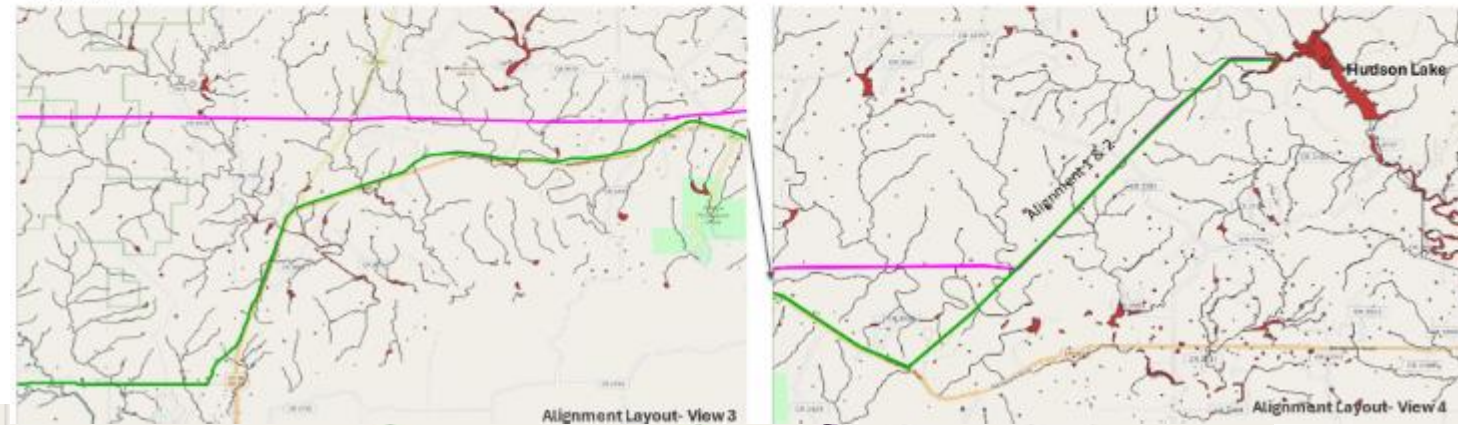
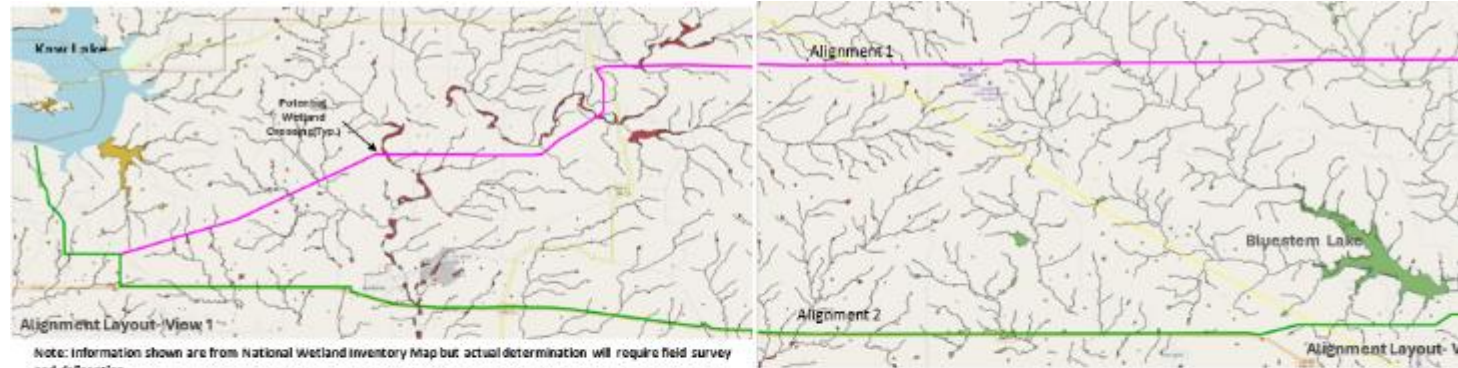
PIPELINE ALIGNMENT



PIPELINE ALIGNMENT



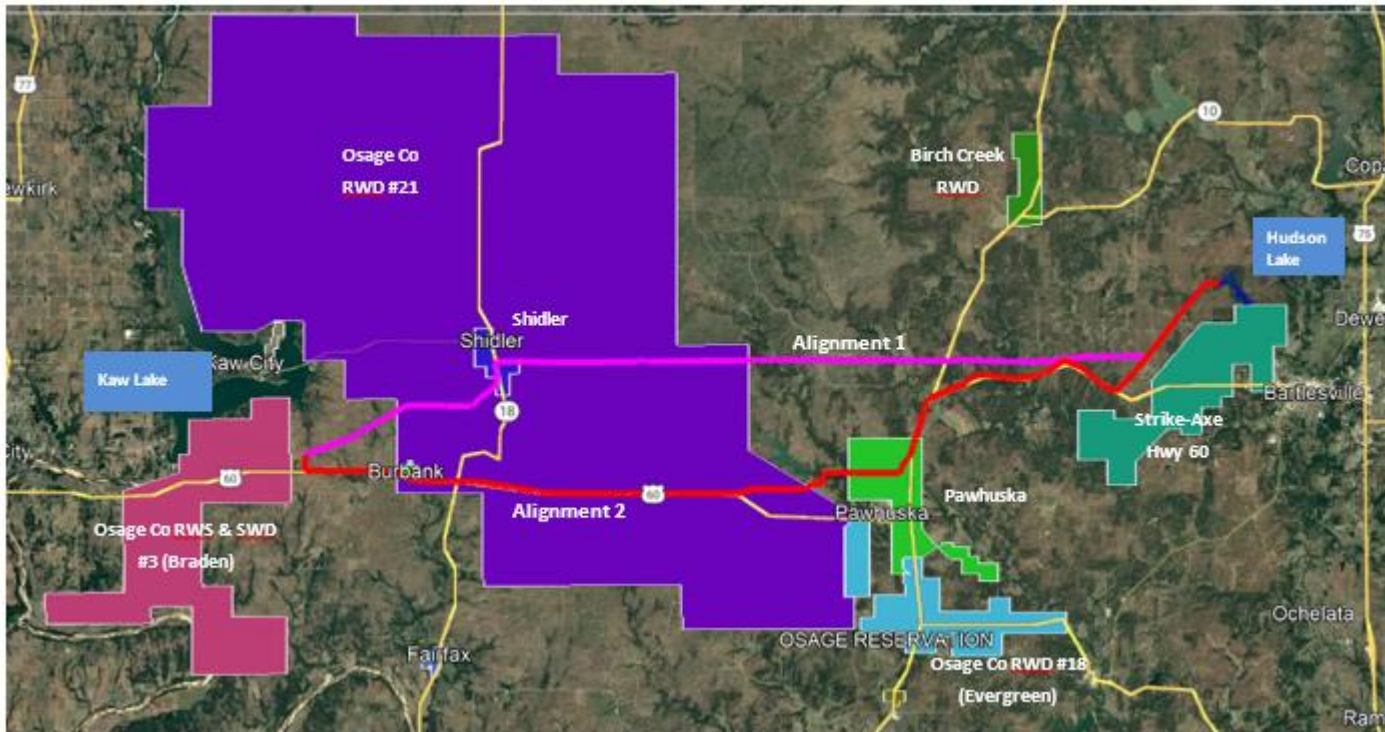
PIPELINE ALIGNMENT-ENVIRONMENTAL



PIPELINE ALIGNMENT- EXISTING WATER SYSTEMS

Water System Name	Population Served	Avg. Demand (MGD)*	Source Water
OSAGE CO RWD #21	1575	0.158	LAKE CHARLOTTE
SHIDLER	404	0.040	RWD#21
OSAGE CO RWS & SWMD #3	867	0.087	Ponca City & Pawhuska
GRAYHORSE RWD	100	0.010	Fairfax
FAIRFAX	1655	0.166	Fairfax Lake & Well 1
PAWHUSKA	4060	0.406	Lake/Clear Creek Intake/Pawhuska Lake
OSAGE CO RWD # 5	561	0.056	Barnsdall

* Demand estimate assumes DEQ guideline of 100 GPCD



PERMIT REQUIREMENTS (PIPELINE)

- Federal
 - Section 401 and Section 404- depending on potential wetland crossings.
- State
 - Permit to Construct from ODEQ.
- Tribal Nation
 - Osage Mineral Council- Subsurface Mineral Rights.

CONCEPTUAL COST ESTIMATES

- Kaw Lake Storage Fee.
- OWRB Water Use (Water Right) Permit Fee.
- Osage Mineral Council
- Infrastructures:
 - Intake and Pump Station.
 - Pipeline Conveyance.

KAW LAKE STORAGE FEE


- For 14 MGD, 15,638 acre-feet, Storage Fee =\$16,009,089*
- For 18 MGD, 20,164 acre-feet, Storage Fee =\$20,642,491*
- For 22 MGD, 24,644 acre-feet, Storage Fee =\$25,228,802*

*Plus, annual maintenance cost share as determined by USACE

OSAGE MINERAL COUNCIL

- To Be Determined.

INTAKE AND PUMP STATION



	Intake Types		
	Submerged Intake with Onshore Pump Station (Type 1)	Free Standing Intake with Onshore Pump Station (Type 2)	Free Standing Intake Combined with Pump Station (Type 3)
Submerged Screen Intake	\$6,480,000	N/A	N/A
Intake Tower & Piping	N/A	\$9,458,000	\$12,499,000
Tunnel Intake Pipe	\$3,376,000	\$3,088,000	N/A
Access Bridge	N/A	N/A	\$6,016,000
Onshore Pump Station	\$34,708,000	\$39,088,000	N/A
Offshore Pump Station	N/A	N/A	\$29,720,000
Other Costs ²	\$7,340,000	\$8,401,000	\$7,891,000
Total Estimate of Probable Cost ¹	\$51,904,000	\$60,035,000	\$56,126,000
Note: ¹ Includes 35% Contingency, 2024 Cost Assumptions ² Other Costs include engineering/survey/permits			

PIPELINE CONVEYANCE

	Alignment 1		Alignment 2	
	48.7 Miles		52.9 Miles	
	14 MGD or 18 MGD	22 MGD	14 MGD or 18 MGD	22 MGD
Pipeline	\$162,346,000	\$173,692,700	\$179,206,350	\$193,935,000
Breakout or One Way Tank ¹	\$3,656,300	\$4,687,500	\$4,743,750	\$4,743,750
Other Costs:				
Environmental	\$622,300	\$622,300	\$663,000	\$663,000
Survey	\$345,600	\$345,600	\$426,000	\$426,000
Easements	\$2,656,300	\$2,656,300	\$2,885,400	\$2,885,400
Engineering	\$19,920,200	\$21,405,600	\$22,074,000	\$23,841,400
Permits	\$480,000	\$480,000	\$500,000	\$500,000
Total Estimate of Probable Co.	\$190,027,000	\$203,890,000	\$210,499,000	\$226,995,000
Note: ¹ Includes 30% Contingency, 2024 Cost Assumptions				
² Other Costs include engineering/survey/permits				

TOTAL PROJECT COST

(SECURE WATER RIGHTS, PERMITS, DESIGN AND CONSTRUCTION)

	Alignment 1 (Intake Location C)			Alignment 2 (Intake Location C)		
	48.7 Miles			52.9 Miles		
	14 MGD	18 MGD	22 MGD	14 MGD	18 MGD	22 MGD
Kaw Water Storage Fee (USACE)*	\$16,009,089	\$20,642,491	\$25,228,802	\$16,009,089	\$20,642,491	\$25,228,802
Submerged Intake Screen & Shore PS	\$46,498,000	\$49,074,000	\$51,904,000	\$46,498,000	\$49,074,000	\$51,904,000
Pipeline Conveyance	\$190,027,000	\$190,027,000	\$203,890,000	\$210,499,000	\$210,499,000	\$226,995,000
Other Costs						
Osage Mineral Council	TBD	TBD	TBD	TBD	TBD	TBD
OWRB Water Rights	TBD	TBD	TBD	TBD	TBD	TBD
Total Estimate of Probable Cost ¹	\$252,534,089	\$259,743,491	\$281,022,802	\$273,006,089	\$280,215,491	\$304,127,802
Note: * Plus, annual maintenance cost share as determined by USACE						

ANNUAL OPERATIONAL COST

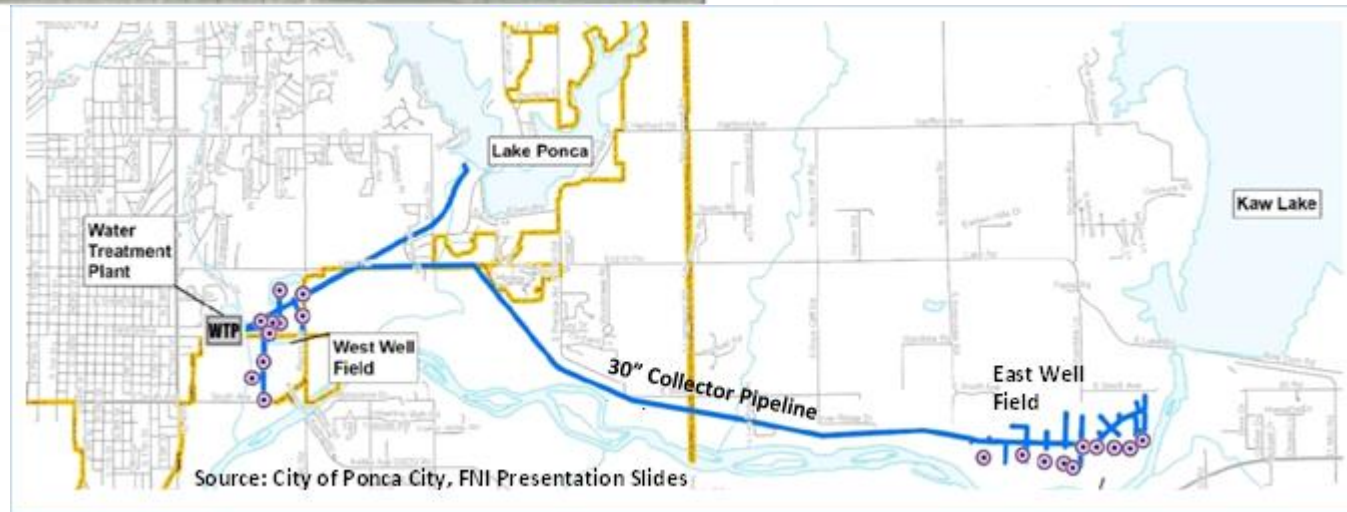
(IN-SERVICE OR IN-STANDBY MODE)

ANNUAL OPERATION AND MAINTENANCE (O&M) COST SUMMARY						
	Alignment 1 (Intake Location C)			Alignment 2 (Intake Location C)		
	48.7 Miles			52.9 Miles		
	14 MGD	18 MGD	22 MGD	14 MGD	18 MGD	22 MGD
KAW SUPPLY (IN-SERVICE)^a						
Pipeline and Breakout/One-way Tank	\$43,000	\$43,000	\$43,000	\$50,300	\$50,300	\$50,300
Intake and Pump Station	\$1,362,900	\$2,041,200	\$2,137,400	\$975,600	\$1,943,800	\$2,234,900
Total (System In-Service)	\$1,405,900	\$2,084,200	\$2,180,400	\$1,025,900	\$1,994,100	\$2,285,200
KAW SUPPLY (NOT IN SERVICE)^b						
Pipeline and Breakout/One-way Tank	\$43,000	\$43,000	\$43,000	\$50,300	\$50,300	\$50,300
Intake and Pump Station	\$19,300	\$25,700	\$28,900	\$16,200	\$25,700	\$28,900
Total (System Not In Service)	\$62,300	\$68,700	\$71,900	\$66,500	\$76,000	\$79,200

Notes: ^a In-Service operation assumes 24x7 operation at the flow rate shown. ^b When "Not-in-Service" pumps are assumed one day/month operation.



DISCUSSIONS & QA



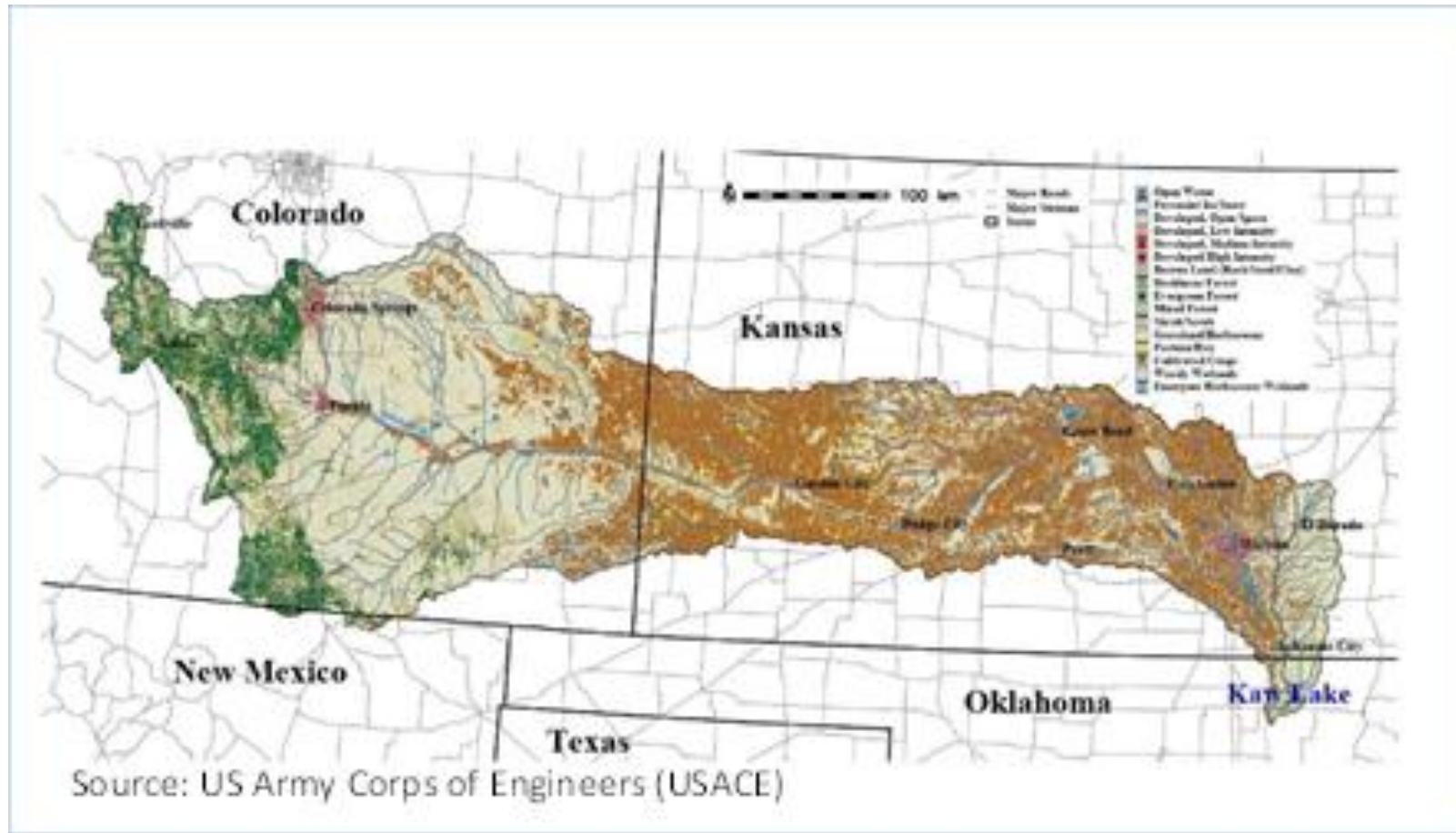


Table 1-2 Kaw Lake Physical and Flow Characteristics

Parameter	Units
Lake Elevation (Conservation Pool)	1,010.0 ft. <u>NGVD</u>
Lake Surface Area (Conservation Pool)	14,260 ac
Lake Volume (Conservation Pool)	344,043 ac-ft
Total Drainage Area (contributing)	38,771 <u>mi²</u>
Mean Depth	24.1 ft.
Maximum Depth (Conservation Pool)	79 ft.
Shoreline Length	116.4 mi
Annual Inflow, Average 1922 – 2021 [Water Years]	2,047,370 ac-ft
Annual Inflow, 2021 [Calendar Year]	2,071,041 ac-ft
Hydraulic Residence Time, 2021 [Calendar Year]	70.38 d
Source: US Army Corps of Engineers (USACE)	

Table 1-3 Kaw Lake Historical Siltation Summary

Survey Period	<u>Storage @ Below Conservation Pool EL 1010.0' (acre-feet)</u>	% Reduction in Storage Since 1975	Surface Area (acres)
1975	431,120	0.0%	16,890.0
1986	406,540	6.0%	16,750.0
1995	382,623	12.7%	16,165.0
2010	382,818	12.6%	15,700.0
2015	362,511	18.9%	15,056.0
2020	344,044	25.3%	14,257.6
Source: US Army Corps of Engineers (USACE) Bathymetric Survey			