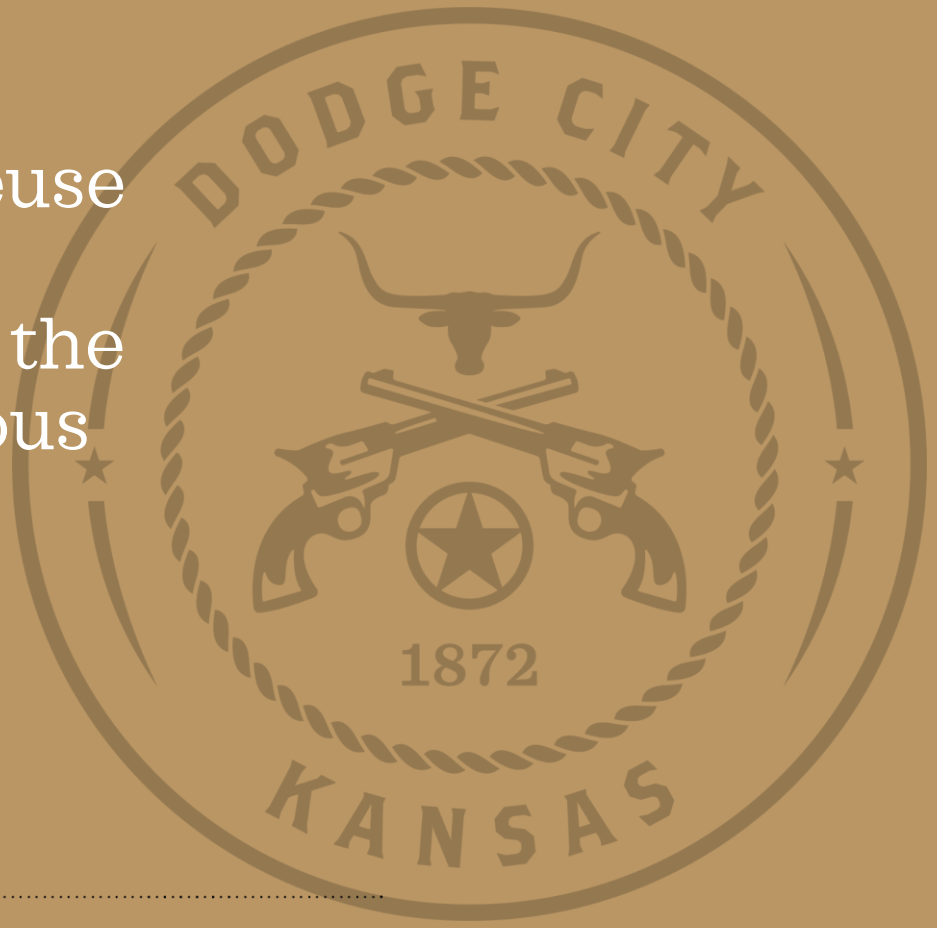
FROM EFFLUENT TO AQUIFER: RETHINKING WATER REUSE

INTRODUCTION

- Dodge City has a long history of recycling wastewater and being good stewards of the environment.
- We are always thinking of ways to enhance our wastewater recycling/reuse practices. Broadening the City's sustainability efforts will help insure the long-term viability of our most precious resource, the Ogallala Aquifer.



HISTORY OF WASTEWATER TREATEMENT IN DODGE CITY

- Pre-1984
- 1984 – Initial South WWRF Constructed
- 2004 – South WWRF Expansion #1
- 2011 – North MBR Facility Constructed
- 2017 – Biogas to RNG Facility
- 2024 – South WWRF Expansion #2
- *2027 – Proposed MAR Facility

SOUTH RECYCLING FACILITY FIGURES

Wastewater Treatment- pre-2025

- Municipal – 2.0 MGD
- Industrial – 4.5 MGD
- Total – 2.4 Billion Gallons/Year
- Biogas – 1.6 Million Cubic Feet/Day

Effluent Irrigation

- 3,000 Acres under Irrigation
- 26 Center Pivots
- ≈ 2.0 Billion Gallons/Year

NORTH RECLAMATION FACILITY

- Membrane Bioreactor (MBR) Plant
- Sized to treat 1.25 MGD (Currently treats 200,000 gallons per day.
- Treats typical municipal wastewater
- Treated Effluent (Reclaimed Water) is used to irrigate the Municipal Golf Course. (>60 MG/Y)
- Receives Wastewater flows from all new developments on the north end of town.

BIOGAS TO RNG FACILITY

- Produce 1.6 MMCF of raw biogas a day.
- Flared the gas for over 20 years.
- 2016 – Constructed a PSA Upgrading Facility along with an interconnect with NNG.
- Produce RNG for transportation fuel and inject into NNGs interstate pipeline.
- Facility was oversized and can upgrade a volume of 3.24 MMCF of biogas per day.
- Registered with two regulatory bodies (EPA and ISCC) for RNG monetization.
- Have long term sales contracts with RNG offtakers.
- Historically the facility has generated ≈$4 Million/year in revenue.

Biogas Production - Methane Capture

YEAR	MUNICIPAL (MMBtu)	INDUSTRIAL (MMBtu)	TOTAL PRODUCED (MMBtu)	BIOMETHANE SOLD (MMBtu)
2019	124,488	312,636	437,124	267,556
2020	119,300	382,857	502,157	304,301
2021	150,093	389,362	539,455	276,765
2022	108,590	358,823	467,414	227,680
2023	79,850	303,477	383,327	256,916
2024	64,318	279,861	344,179	205,619
2025*	0	325,000	325,000	260,000

Project Total Annual Revenue

Raw Gas Stream	2025	2026	2027	2028
Municipal	$ -	$ 1,000,000	$ 1,750,000	$ 2,000,000
National Beef	$ 3,137,760	$ 3,178,080	$ 4,026,600	$ 4,080,600
Hilmar	$ 1,961,100	$ 1,986,300	$ 2,013,300	$ 2,040,300
TOTAL REVENUE	$ 5,098,860	$6,164,380	$7,789,900	$8,120,900
OPEX	$1,250,000	$1,300,000	$1,350,000	$1,400,000
NET REVENUE	**$3,848,860**	**$4,864,380**	**$6,439,900**	**$6,720,900**

HILMAR CHEESE DEVELOPMENT

- **Overview of Company and Plant**
- **Wastewater Treatment Plant Expansion**

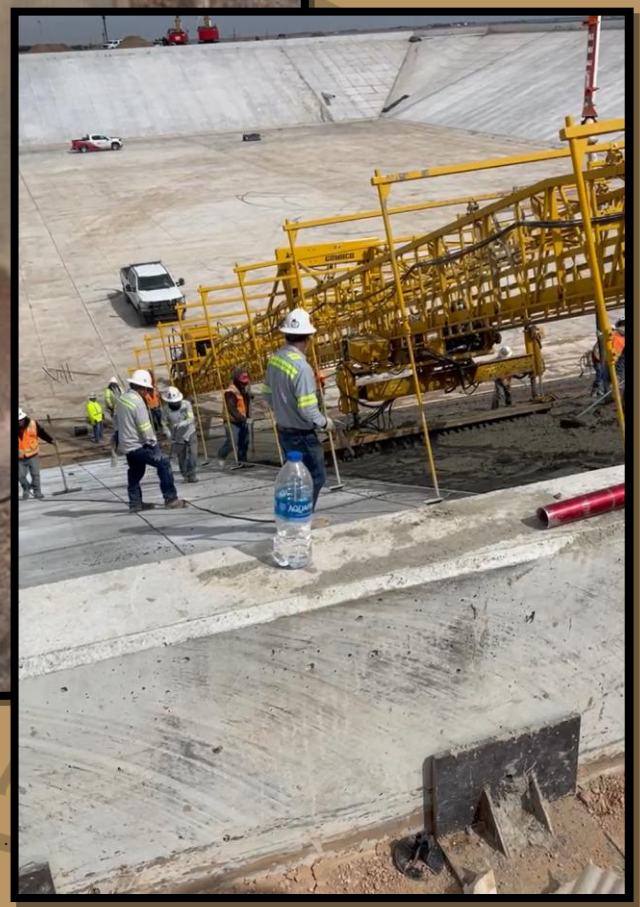
HILMAR CHEESE COMPANY

- Cheese and Whey producer.
- Two existing facilities.
- Dodge City Plant will employ 260 people & cost ≈$700 Million to construct.
- Requires Dairy Expansions & new Construction
- Capacity of 8 Million lbs of milk per day.
- Produce 1 Million lbs of cheese per day.
- Requires 800,000 gallons of water per day.
- Produces 1.5 MGD of high strength wastewater (BOD: ≈4,100 mg/L).


Future home of HCC in Dodge City, KS

SOUTH WWTP EXPANSION FOR HILMAR

- Existing South WWRF was already at 80% capacity (6.5 MGD of 8 MGD).
- Expansion was necessary to accept and treat this stream/new feedstock.
- Biogas to RNG facility has capacity for additional volumes from Hilmar feedstock.
- 85% of expansion project is eligible for IRA credit for biogas improvements ($15-20 M).
- Decision needed to be made on how to handle this new volume of treated effluent.
- Expand current center pivot irrigation practice or consider an alternative beneficial reuse option.



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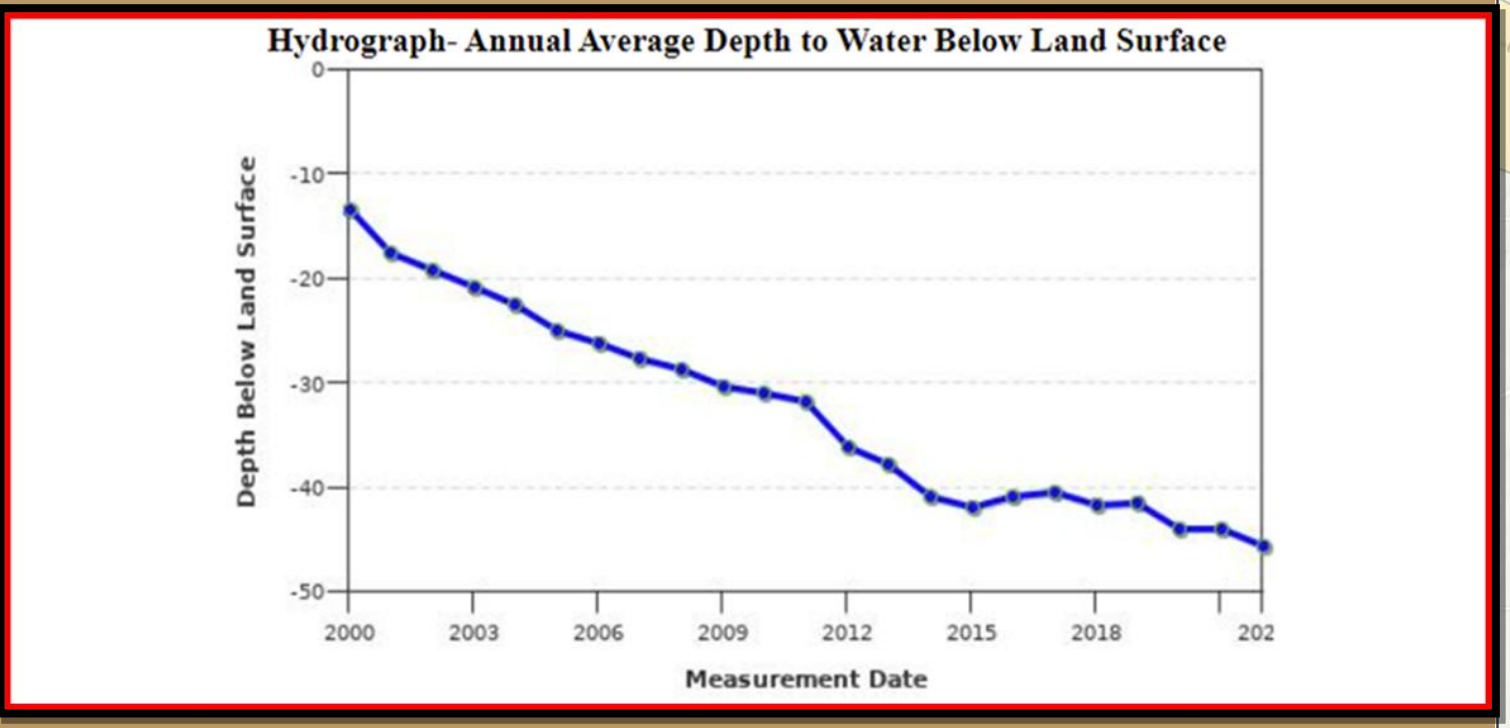
RECYCLING PRACTICES AND BENEFITS

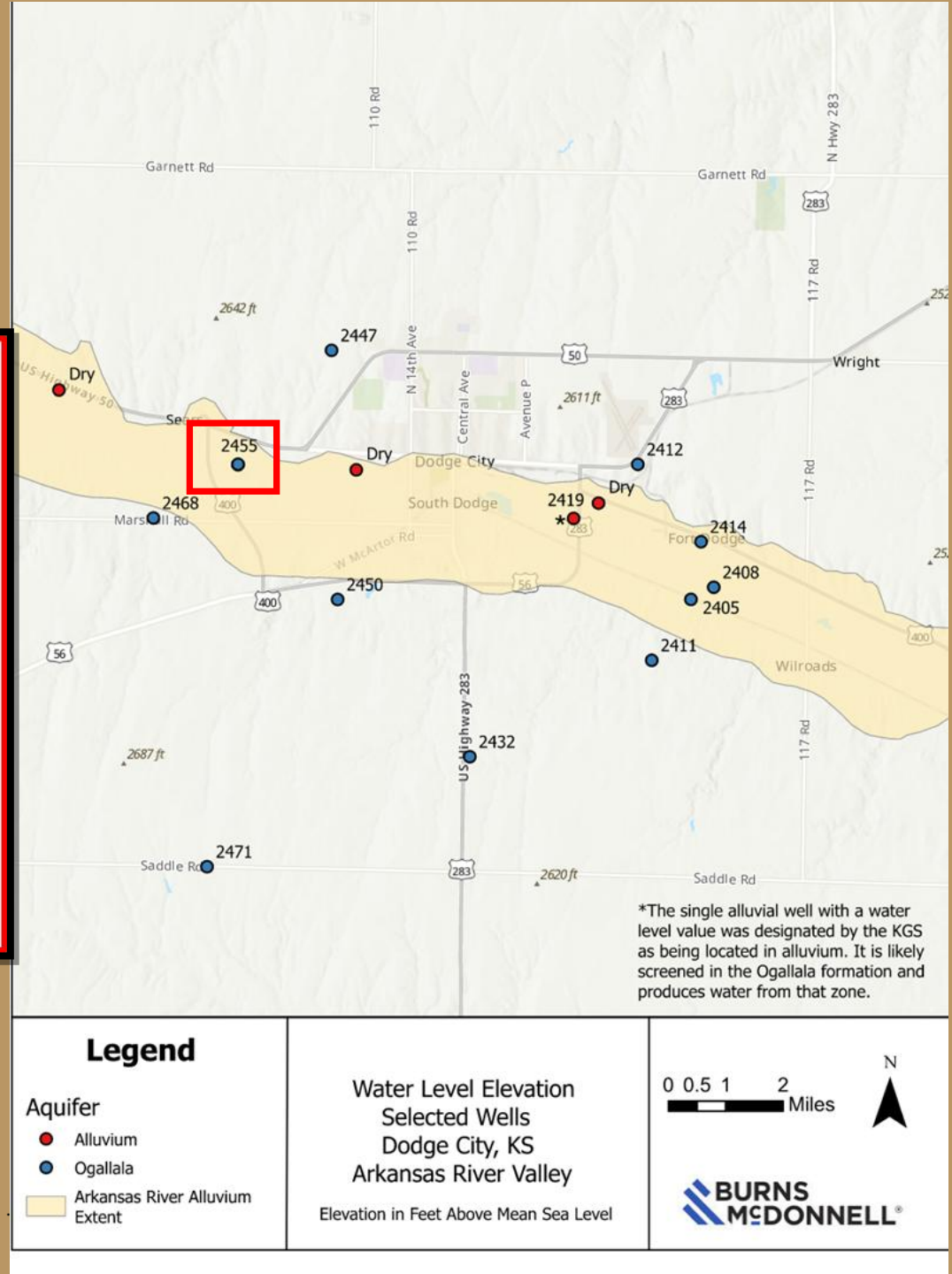
- **40-yr Crop Irrigation Agreement**
- **State of the Ogallala Aquifer**

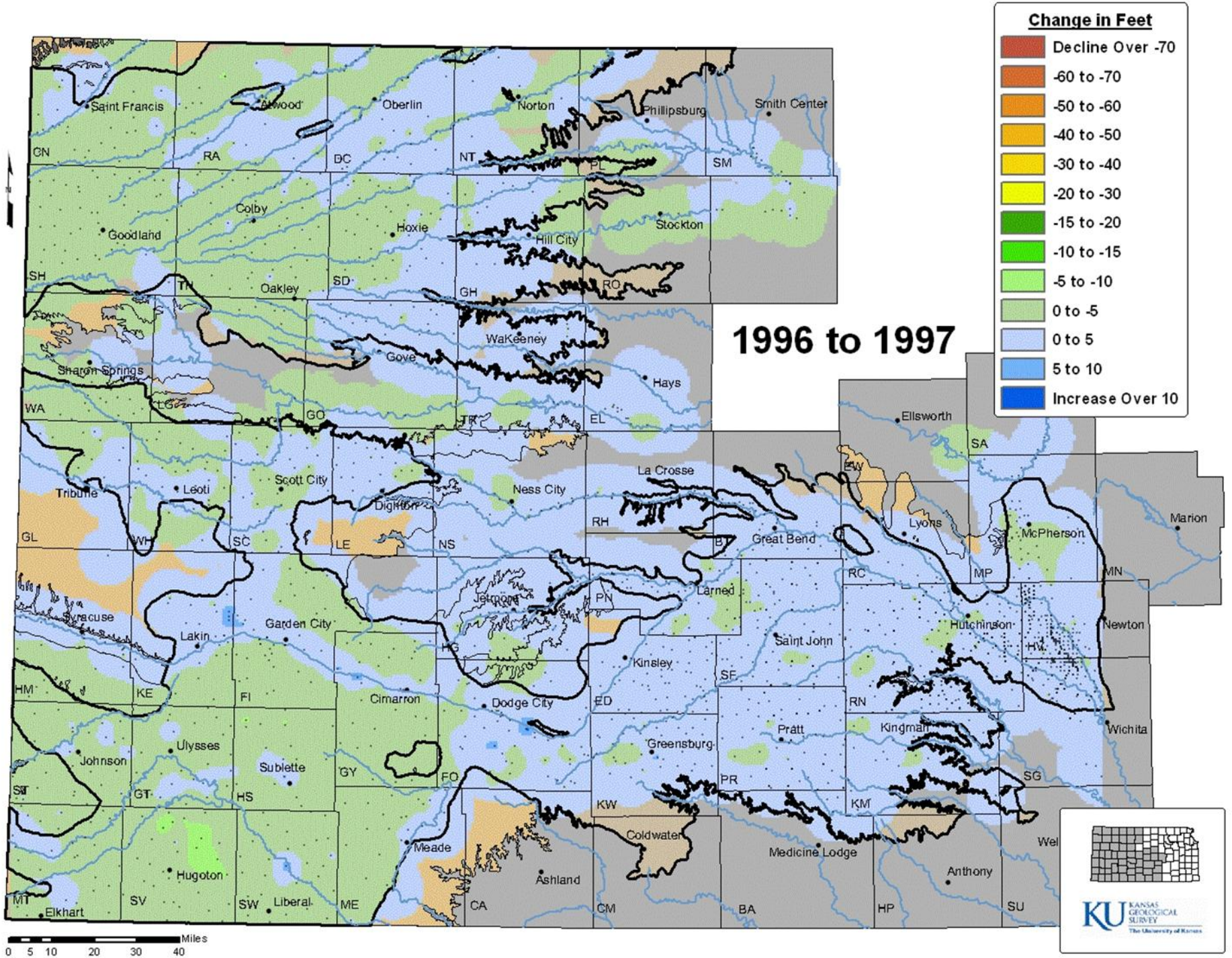
40-YR IRRIGATION AGREEMENT

- Contract with farmer partner is up for renewal in 2025.
- Original Contract volume was for 4,357 ac-ft per year of irrigation water. Have supplied over 6,000 ac-ft in recent past.
- Have ≈8,000 ac-ft available with the addition of Hilmar effluent.
- Do we expand the irrigation practice which has a significant cost?
- Could the treated effluent provide a greater benefit to the community as a whole?

STATE OF THE OGALLALA AQUIFER



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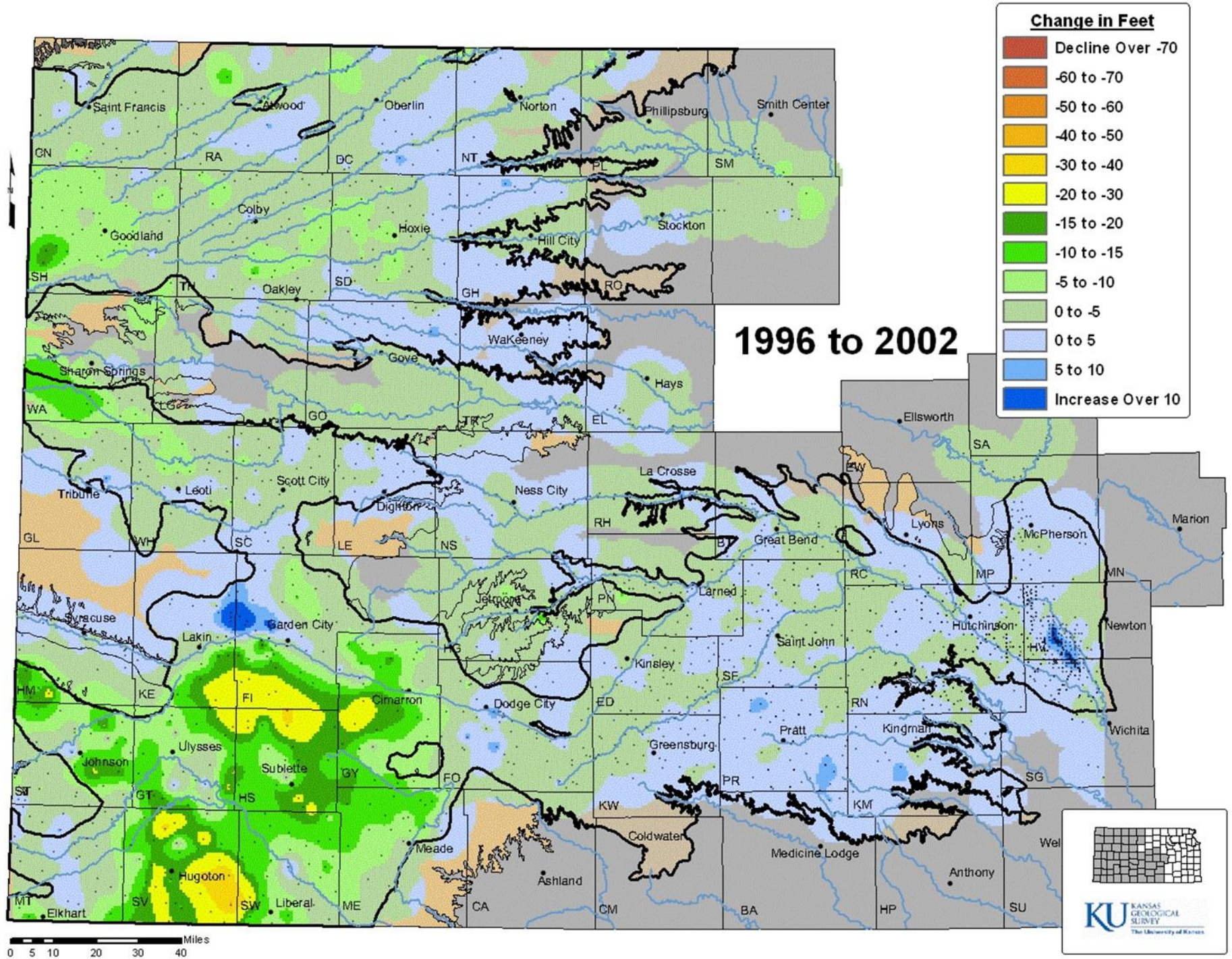
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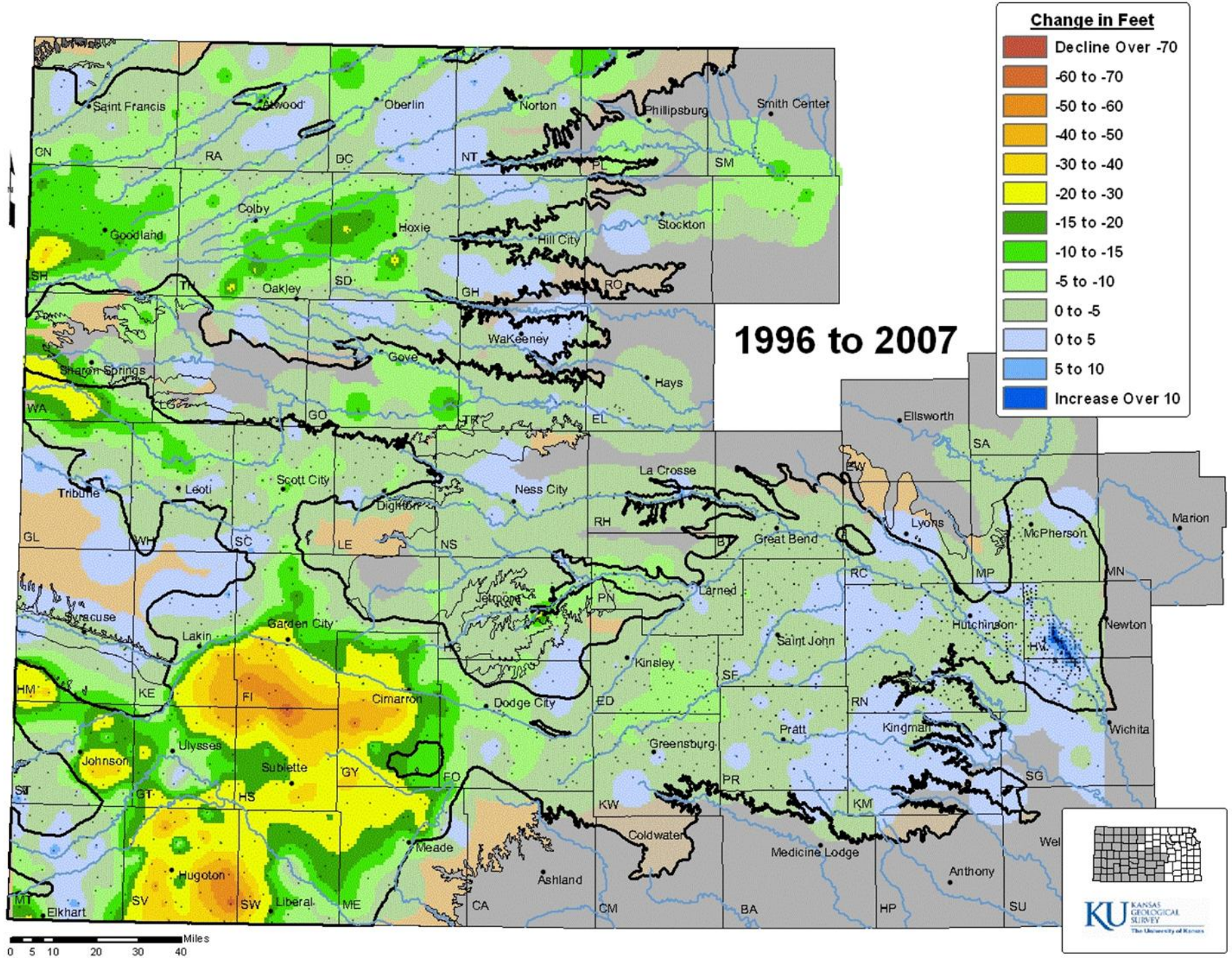
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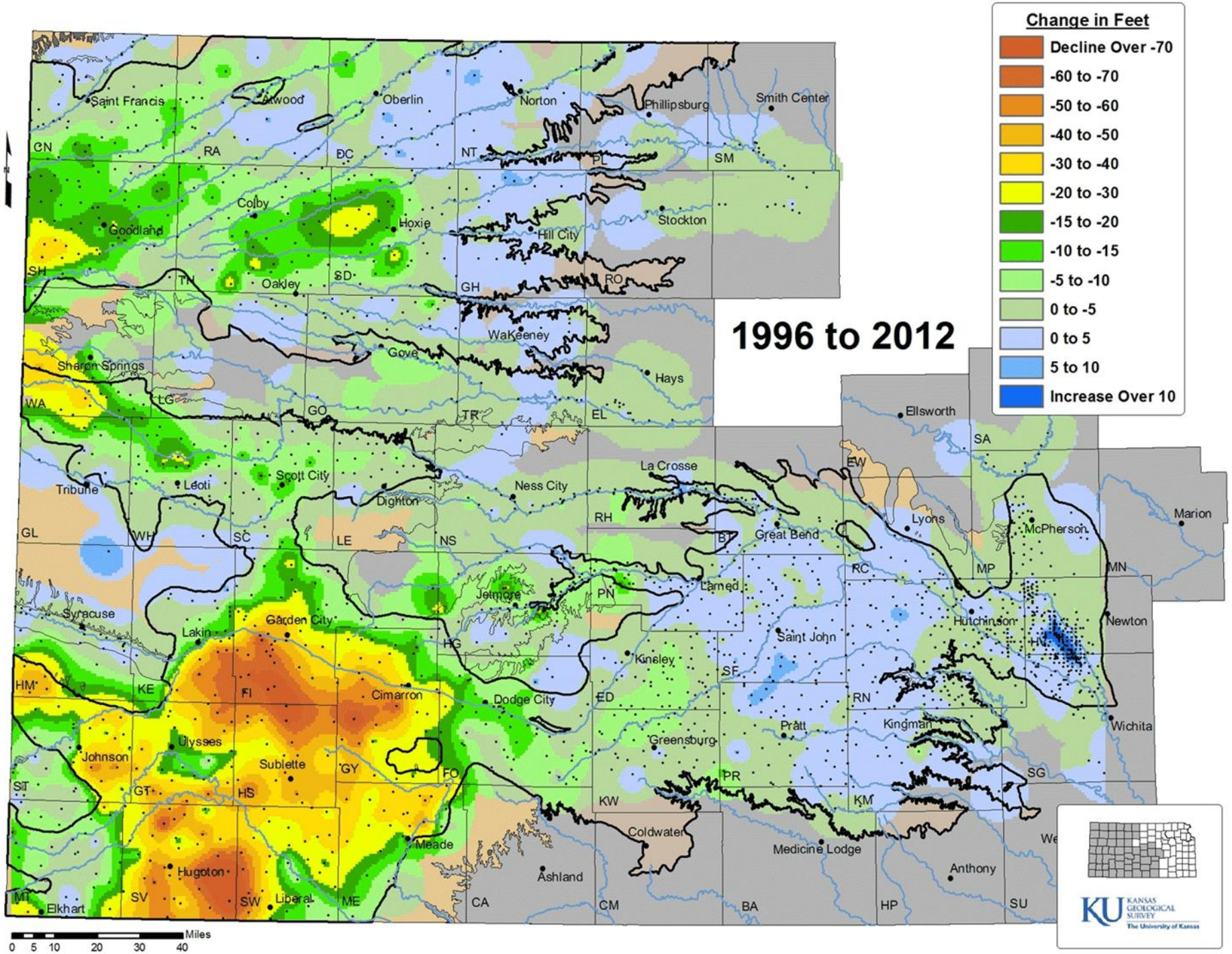
KU KANSAS GEOLOGICAL SURVEY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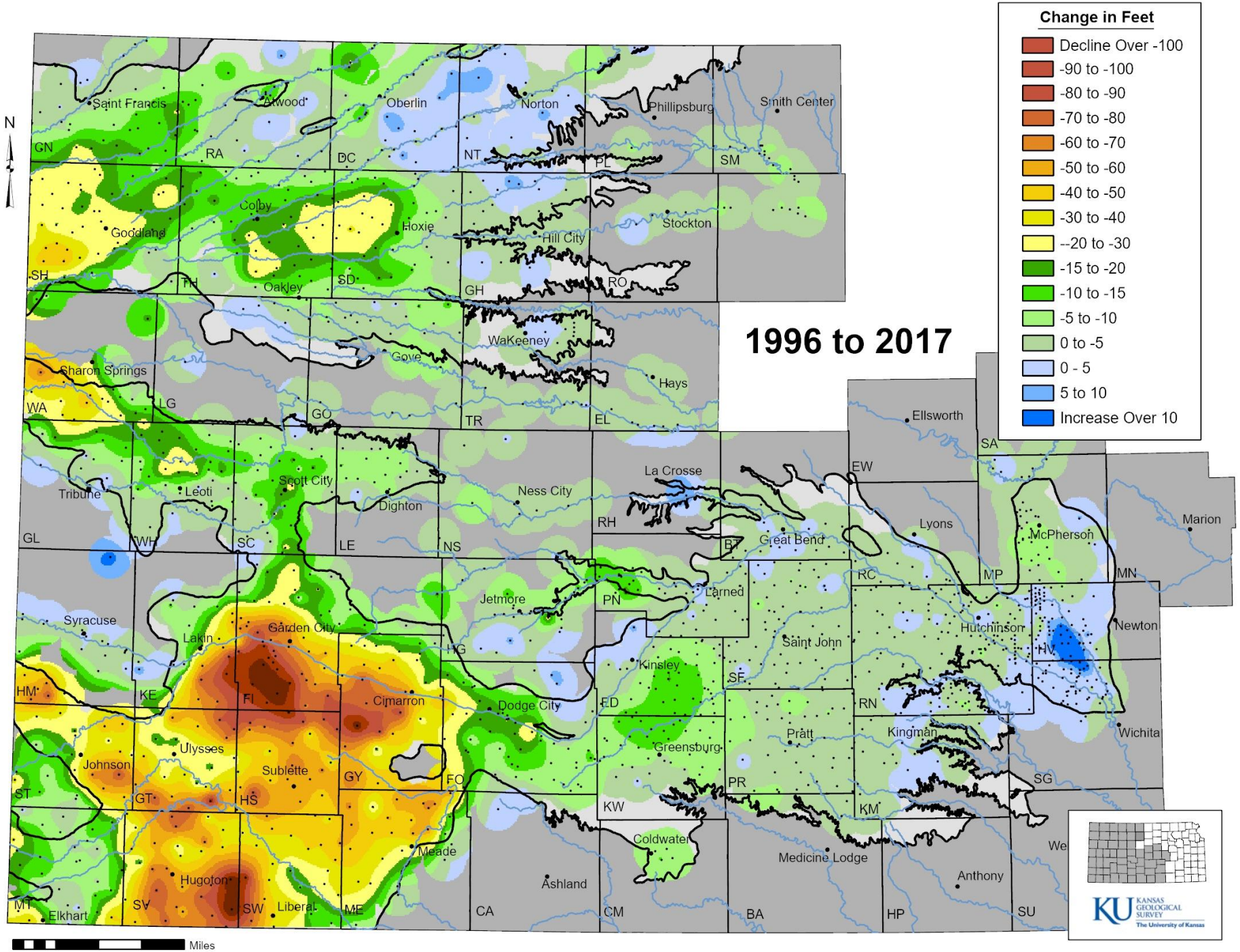
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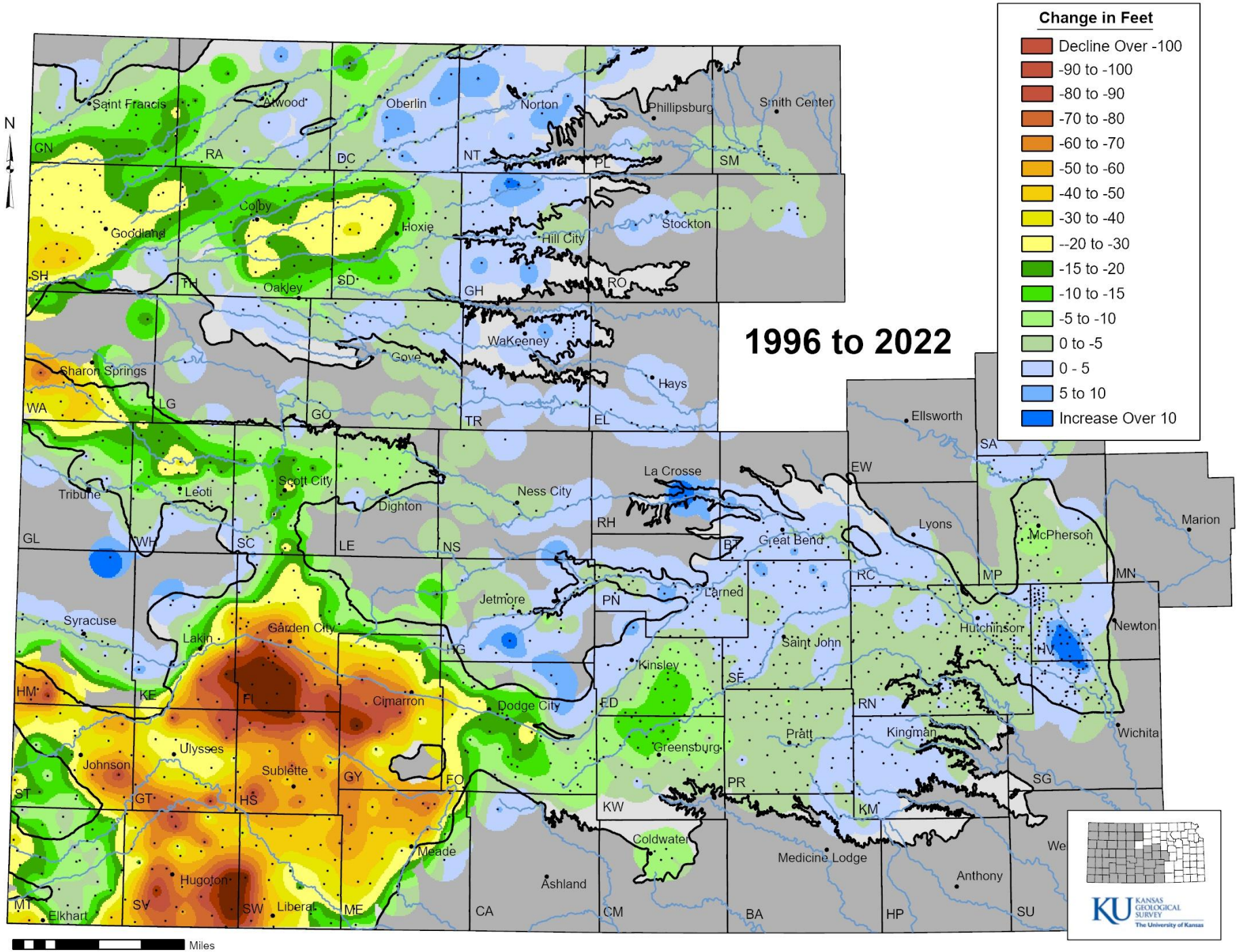
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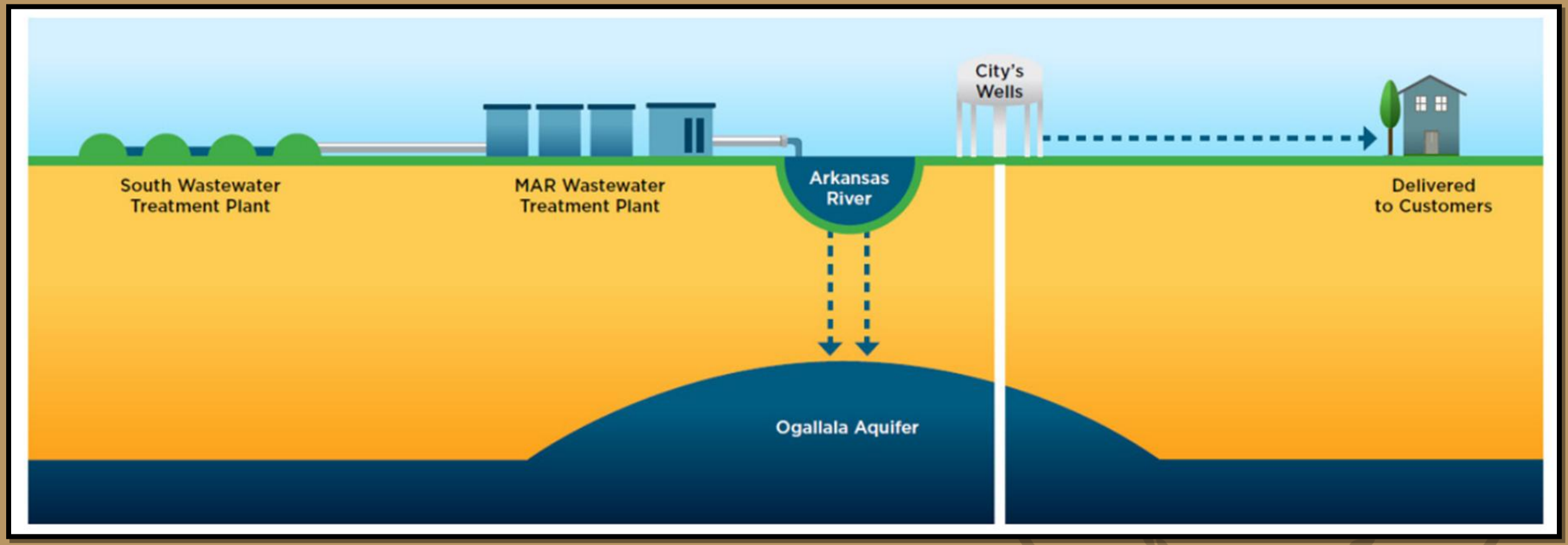
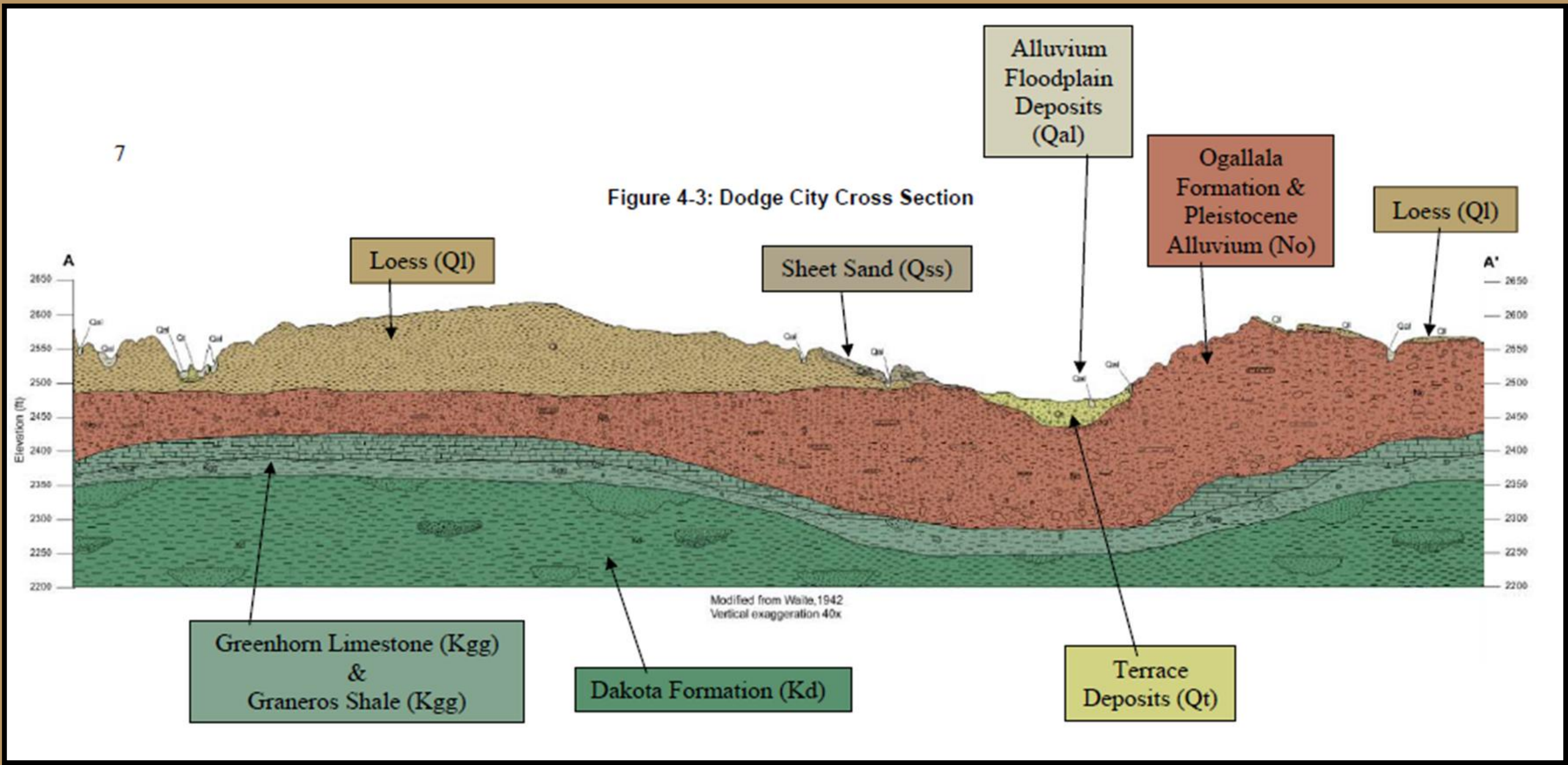
EXPLORING AQUIFER RECHARGE

- **Dodge City Water Overview**
- **Regulatory Discussion**
- **Potential Benefits**
- **Cost Benefit**
- **Antidegradation**
- **Funding**
- **Next Steps**

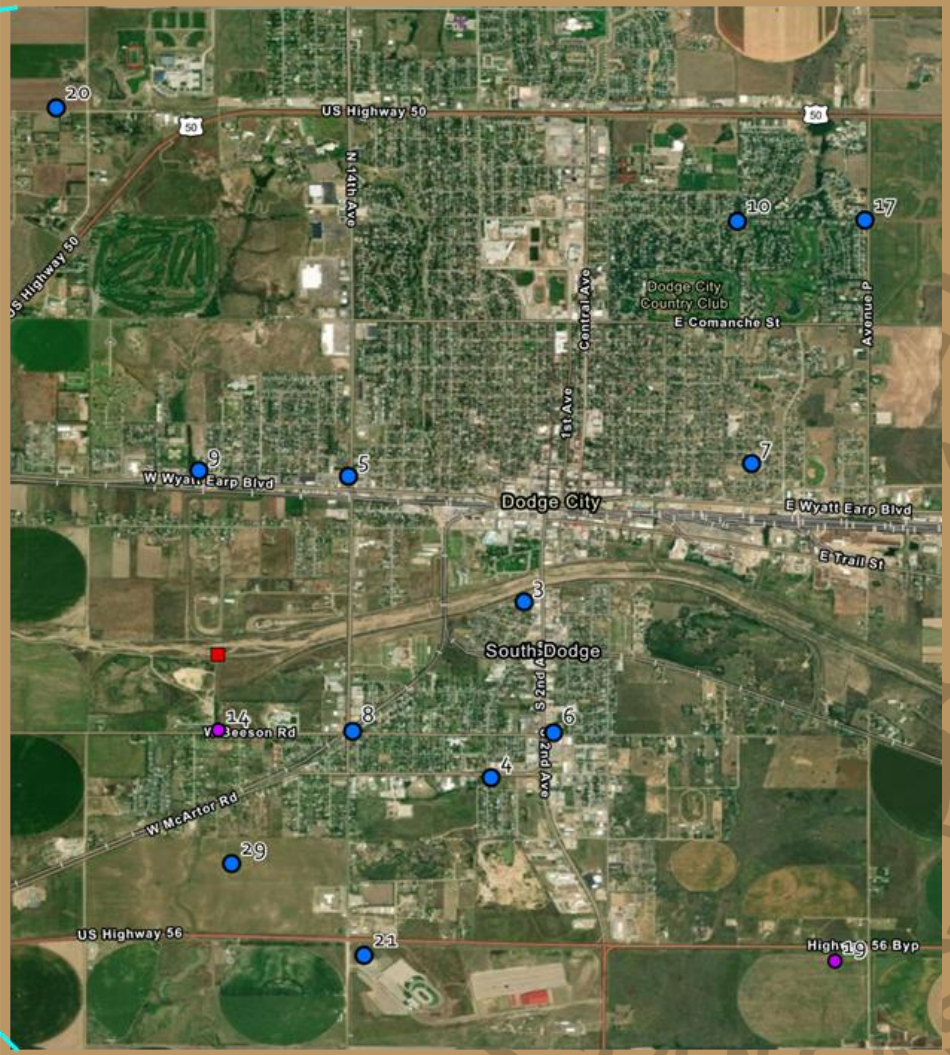
MANAGED AQUIFER RECHARGE



GEOLOGY RIPE FOR RECHARGE

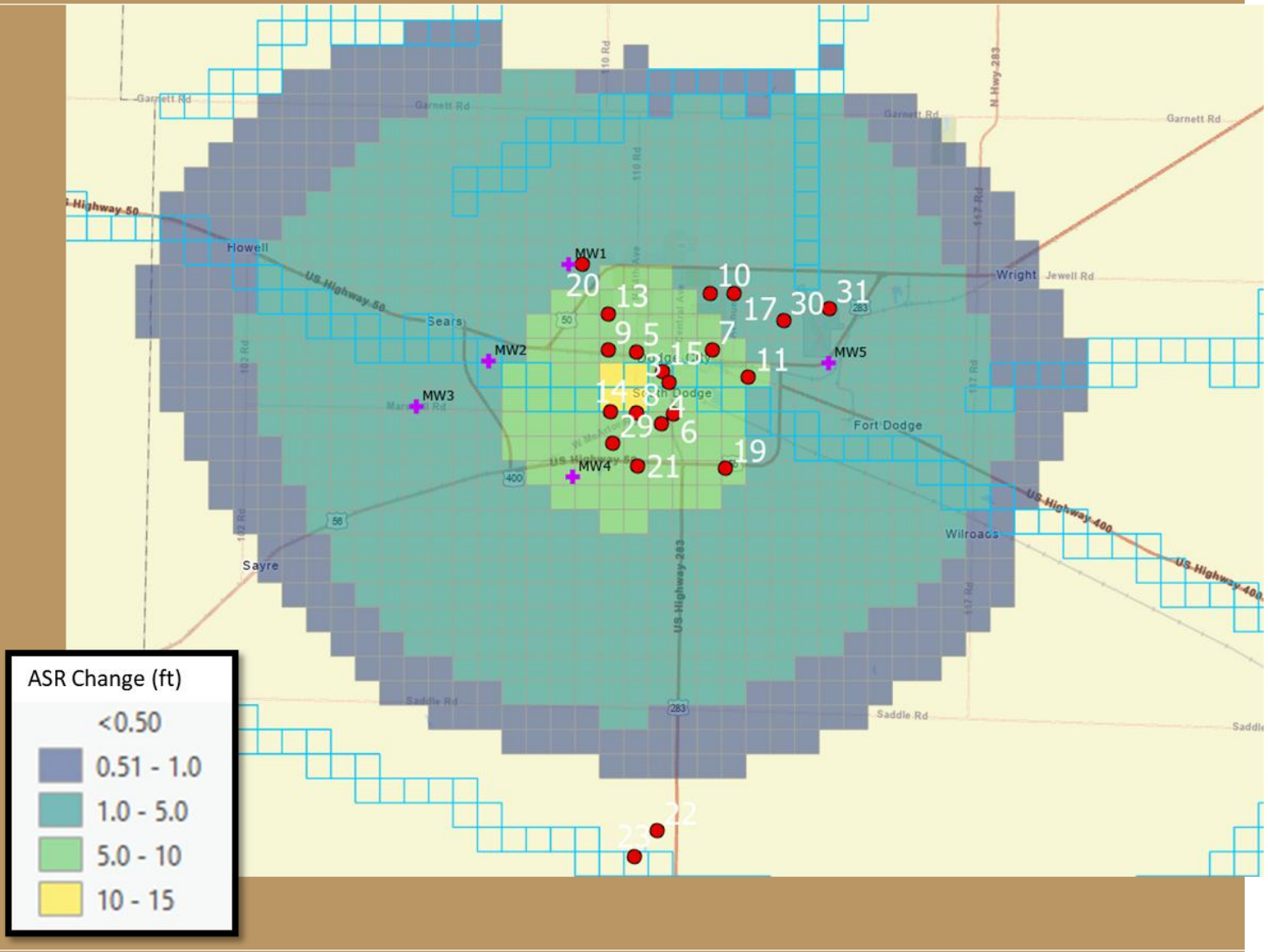


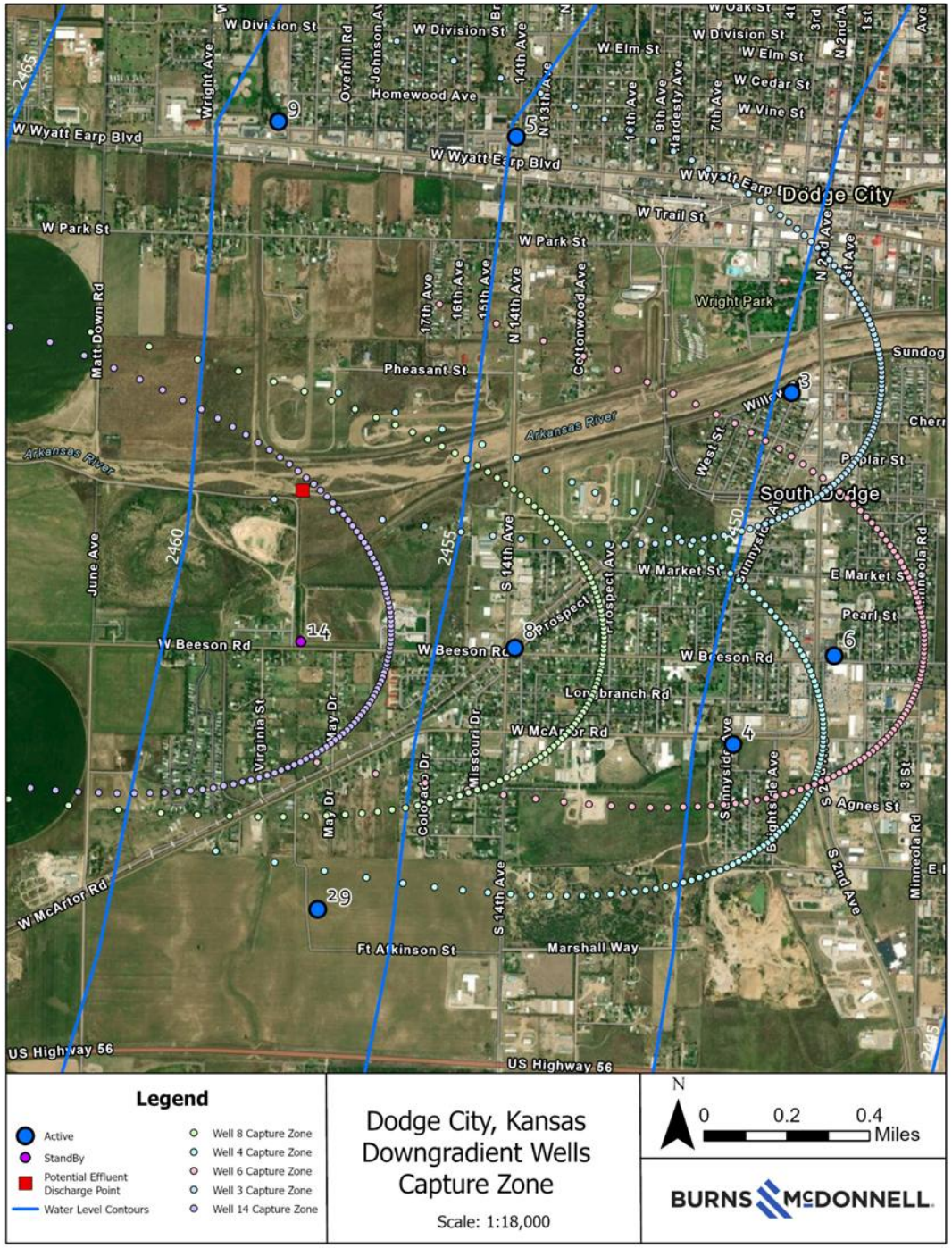
DODGE CITY WATER OVERVIEW



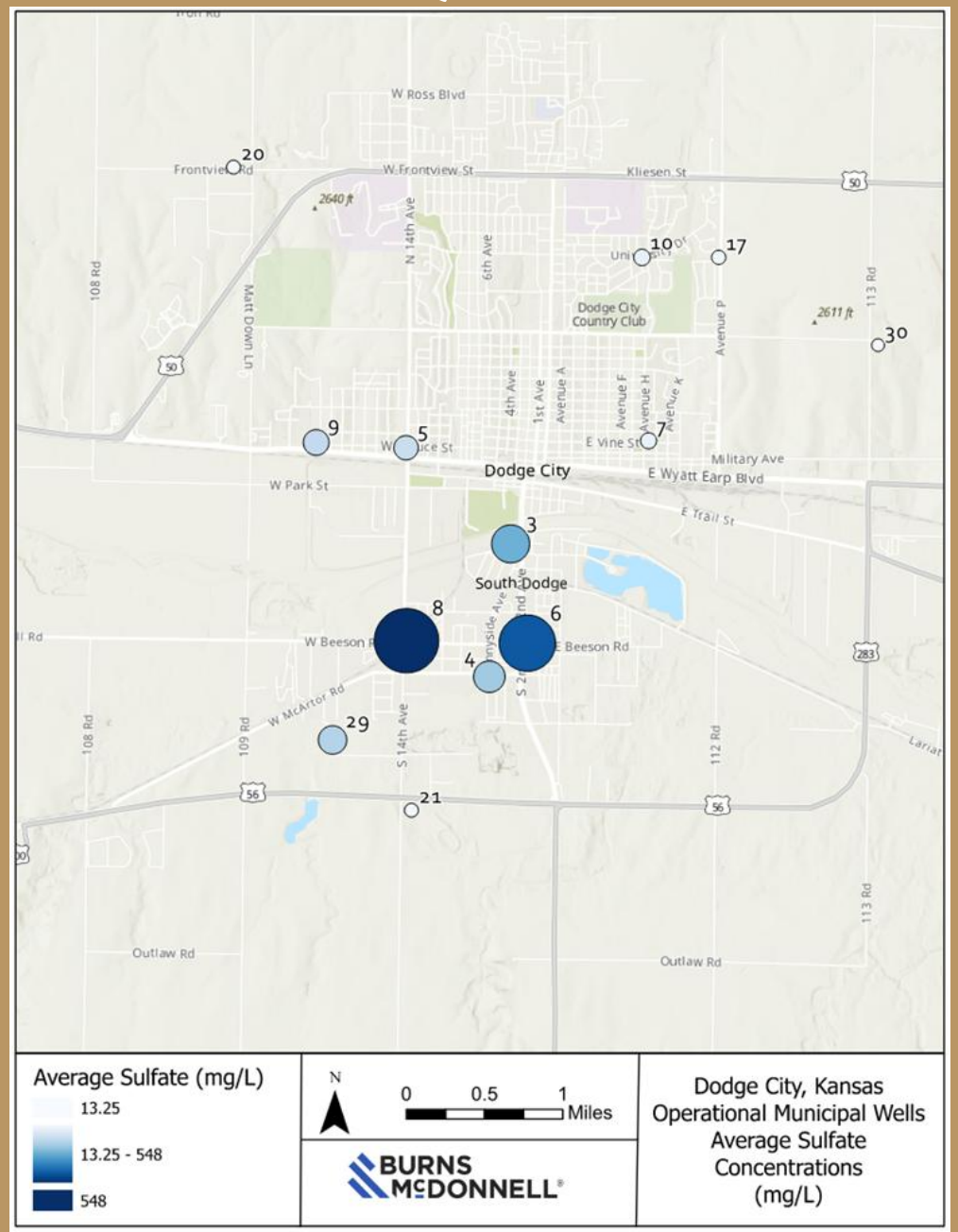
DODGE CITY

HYDRAULIC BENEFITS





WATER QUALITY



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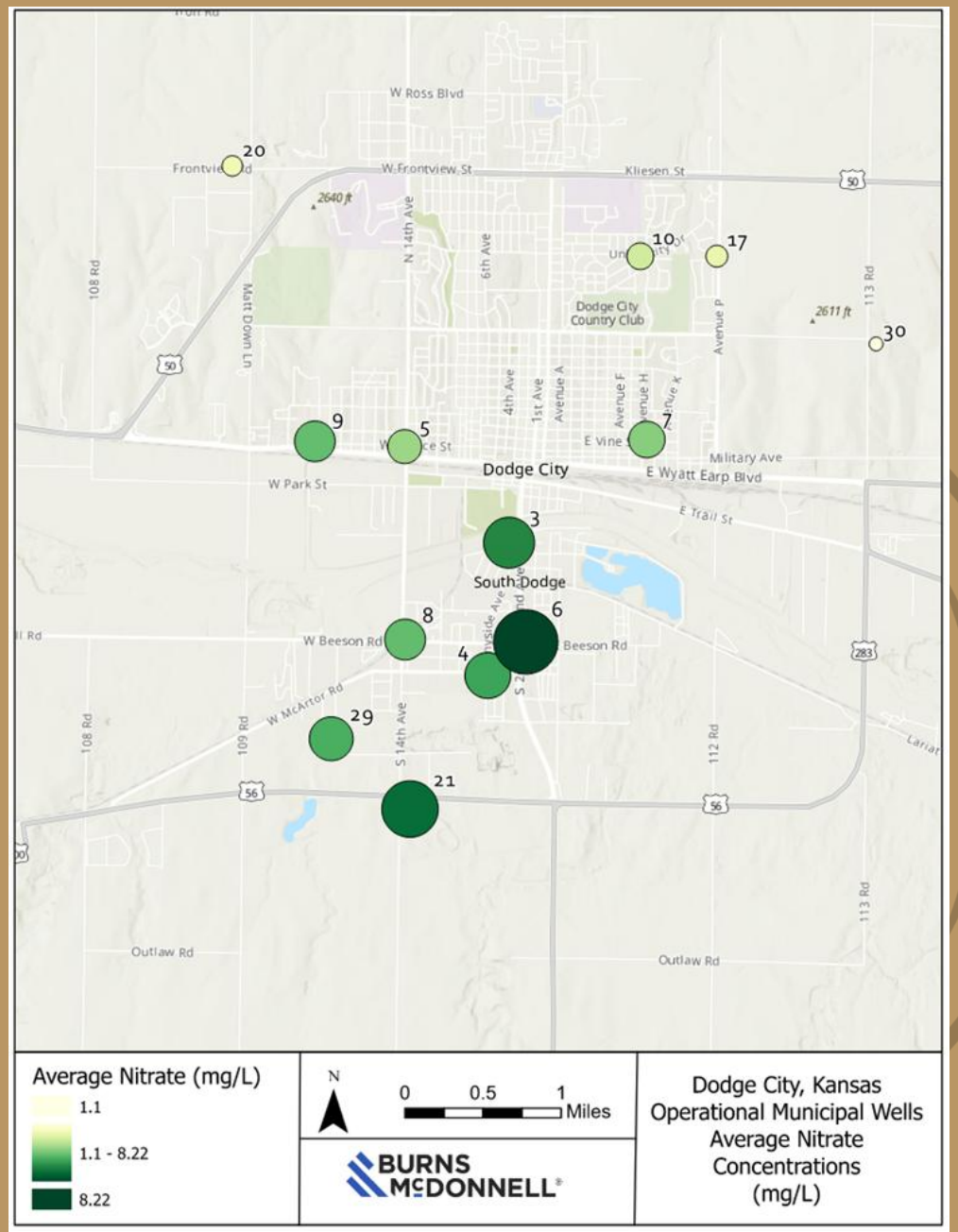


REGULATORY DISCUSSION

KDHE — Water quality and discharge

- Antidegradation
- Water reuse regulations

DWR — Water rights permitting

- Capture and beneficial use of 90% of flows
- Permitting prior to construction

Kansas — State Water Plan Initiatives

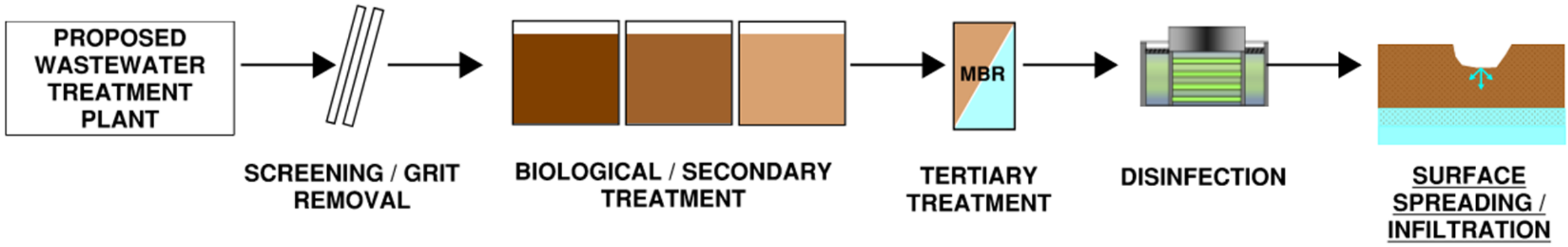
- Advocate for this project

REGULATORY DISCUSSION CONT'D

- Protect Public Health
- Protect Aquifer Quality with Hydraulic Buffer
- Water Rights

Unit Process	Log Removal Value		
	Virus	Giardia	Cryptosporidium
MBR[1]	1.0	2.5	2.5
UV Disinfection (80 mJ/cm^2)	5.0	0	0
Soil Aquifer Treatment (6-months travel time)	6.0	10	10
Total:	**12.0**	**12.5**	**12.5**
CA Requirement	12	10	10

[1]While LRV credits of 1/2.5/2.5 have been the awarded amount in California, additional reduction has been observed in operating facilities.



WATER ACQUISITION – COST TO BENEFIT

Alternative	Capital Cost	20-year NPV	Grant Funding	Volume	Cost Effectiveness
MAR WWTP	$57mm	$112.4mm	$34.25mm	3.7 MGD	$18,800 / AFY
New Wellfield	$83.2mm	$167.5mm	-	3.7 MGD	$32,400 / AFY

- New wellfield- Assume $2,300/ac-ft and 12 miles of pipeline.
- Includes nitrate treatment and distribution system cost.
- Conversion from agricultural to municipal water right incurs a reduction of 89.4%.
- MAR WWTP incorporates grant funding in cost effectiveness.

ANTIDEGREDATION

Projected Treatment Comparison to Aquifer

Constituent:	Unit:	New WWTP Effluent Concentration	Average Existing Aquifer Conditions (Downgradient Wells*)
Nitrate	mg/L	2 - 10	6.31
Phosphorus (TP)	mg/L	13	0.02
Total Dissolved Solids	mg/L	1100	823
Chloride	mg/L	182	44
Total Calcium	mg/L	87	176
Total Magnesium	mg/L	36	33
Total Potassium	mg/L	94	5.8
Total Sodium	mg/L	185	71
Hardness (CaCO3)	mg/L	436	573
Total Iron	mg/L	0.17	0.45
Total Manganese	mg/L	0.06	0.007
Total Alkalinity, CaCO3	mg/L	661	158
pH, at 21.5 C	mg/L	7.8	7.5
Total Sulfur	mg/L	64	374 (as Sulfate)

*Wells 3, 4, 6, 8

- Nitrate: Treat to below the existing aquifer condition.
- Phosphorus: To Be Determined

PROJECT FUNDING

- Current Design & Construction Estimate = $75 Million
- Bureau of Reclamation – WaterSMART: Title XVI Water Reclamation and Reuse Program
  - Funding letter in September 2024.
  - Awarded $14.25 Million, with potential increase if project scale is increased.
- Build Kansas – Advocates for the project with KDHE & DWR
  - Awarded $20 Million
- City of Dodge City

NEXT STEPS

- Phase 1 of Design has been completed.
- Modeling of the treatment process with updated water quality data from recent sampling – confirm treatment process, effluent water quality.
- KDHE permitting – effluent water quality and anti-degradation, transport of contaminants (geochemical compatibility).
- DWR permitting – modeling, water rights and capture zone.
- NEPA permitting – Environmental Assessment Report submitted

QUESTIONS?