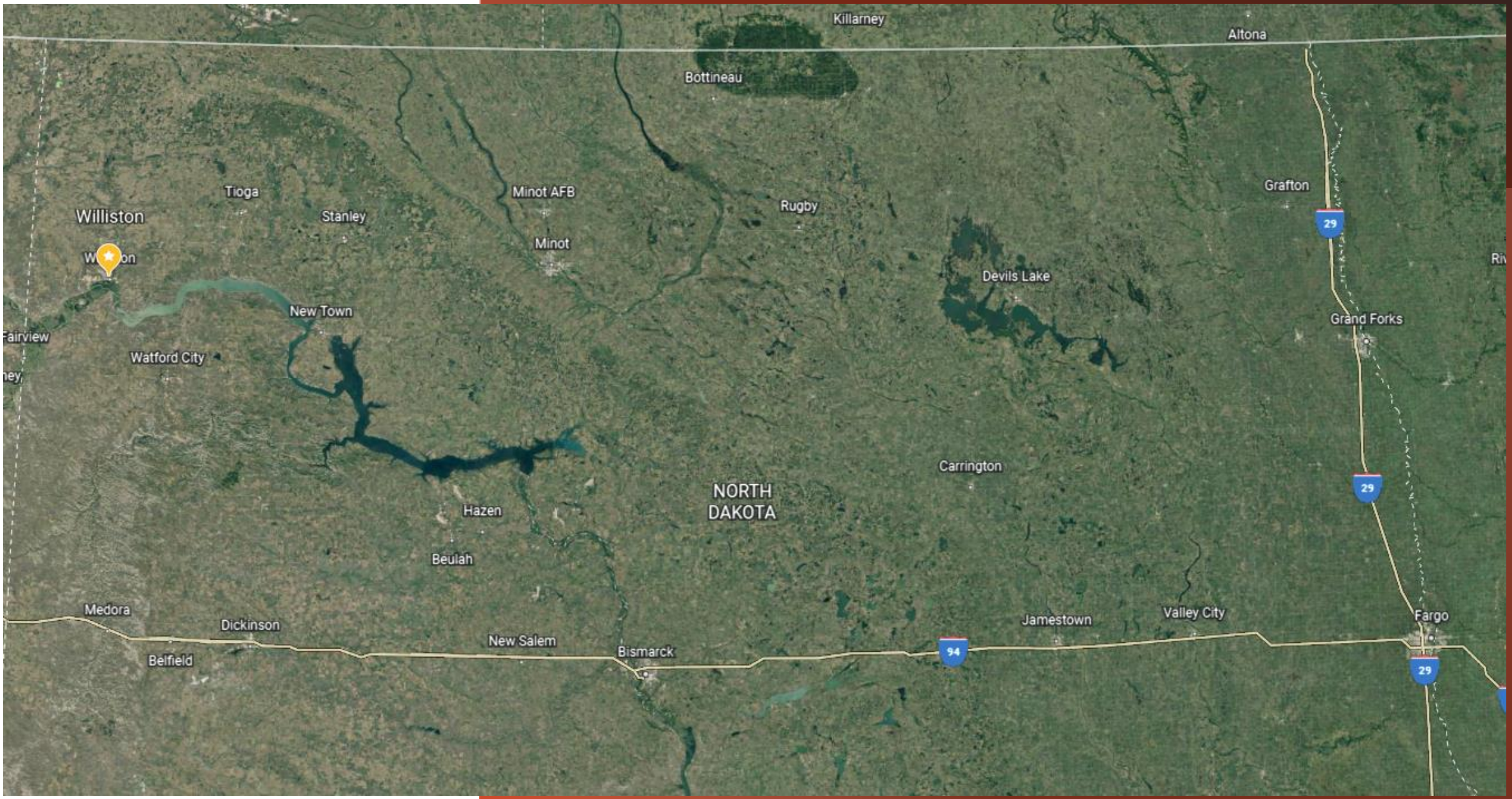
Flying J Petroleums
30 Years of Corrective Action

ASTSWMO Joint Training - 2022

Derek Kannenberg

NORTH Dakota | Environmental Quality
Be Legendary.™


Killarney
Altona
Bottineau
Tioga
Minot AFB
Rugby
Grafton
Williston
Stanley
Minot
Devils Lake
New Town
Grand Forks
Watford City
Carrington
NORTH
DAKOTA
Hazen
Beulah
Medora
Dickinson
Jamestown
Valley City
Fargo
New Salem
Bismarck
Belfield
94
29

Williston, ND

Site History

- Operated from 1954 to 1984
- 4 separate owners
- Remediation began in 1988
- CA Permit issued in 1994
- Demolition began in 1994
- 30-year post-closure date is 2024

AOCs

- 4 surface impoundments (SI)
- Upper Sand (LNAPL)
- Lower Sand (LNAPL)

MW00-16
MW87-25
MWM
MW-87-17R
MW-5R
MW-6R
MW1BR
MW1C
MWC2
MW89-07
MW87-16
MWU-1R
MW-89-06
MW1-TR
MWT3
MWW1R
GRW-95-04
MW89-05
MW-89-04
MW-J
MW-89-02
MWK
MW87-14
MW-89-03
MW-3AR
MWX-1R
MWX3
MW-B
MW-R
MW-AR
MW9R
Legend
Sampled
Gauged Only
N

MW-87-25
1864.77
MW-M
1864.27
MW-87-17R
1865.73
MW-1C
1882.43
MW-C2
1863.95
MW-87-16
1854.81
MW-89-06
1854.15
MW-T3
1865.5
MW-89-05
1863.28
MW-J
1851.73
MW-87-14
1855.52
MW-K
1847.22
MW-B
1854.11
MW-X3
1859.78
MWAR
1851.92
MW-R
1847.77
MW-90-01R
1850.43
1866
1874
1876
1880
1878
1874
1876
1872
1870
1868
1866
1864
1862
1860
1858
1856
1854
1852
1850
1848
0
130
260
520
Feet

SI Closure

- Sludges removed
- Contaminated soil removed
- Clean fill
- Capping
- Groundwater monitoring
- Completed in early 1990s
- Closed in 2015

Risk Assessment

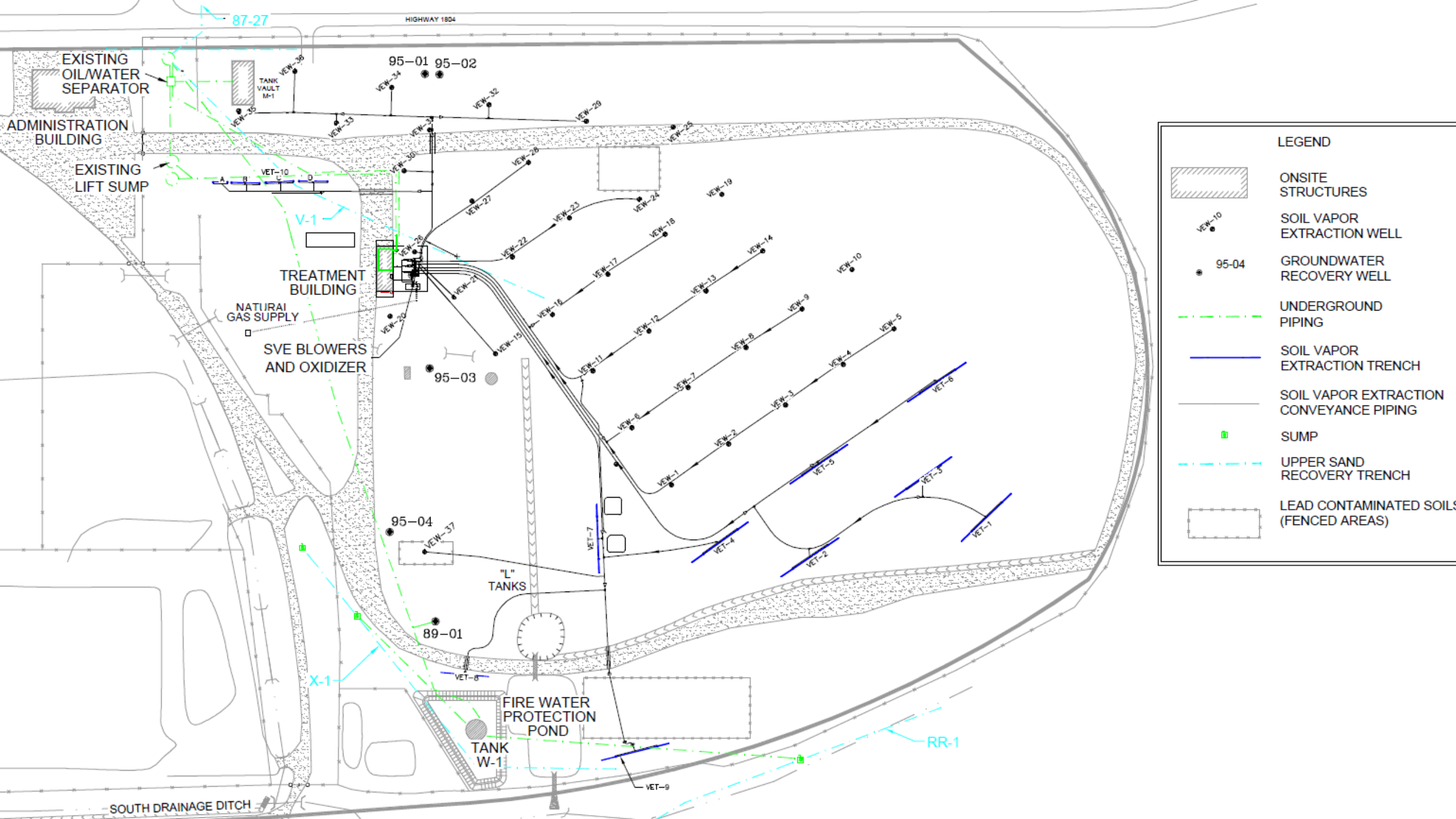
Exposure Pathway	Total Risk	Hazard Quotient
Soil		
Ingestion	1.84E-05	7.84E-02
Dermal	6.30E-06	1.65E-02
Particulate (Dust)	9.66E-06	2.48E-01
Air		
Inhalation (volatilization)	1.81E-10	4.48E-06
Groundwater		
Ingestion	0.00E+00	0.00E+00
Dermal	1.47E-07	6.20E-02
Inhalation (volatilization)	5.70E-10	1.10E-03
Sum of All Risks	**3.45E-05**	**4.06E-01**

Soil Exposure Scenario	Outside Worker default exposure scenario of 8 hours/day, 225 days/year for 25 years (see Section 5.5)
Air Exposure Scenario	Outside Worker default exposure scenario of 8 hours/day, 225 days/year for 25 years (see Section 5.5)
Groundwater Exposure Scenario	Upper Mean Construction Worker exposure scenario of 2 hours/day, 125 days/year for 1 years (see Section 5.5)

*2015

Upper Sand

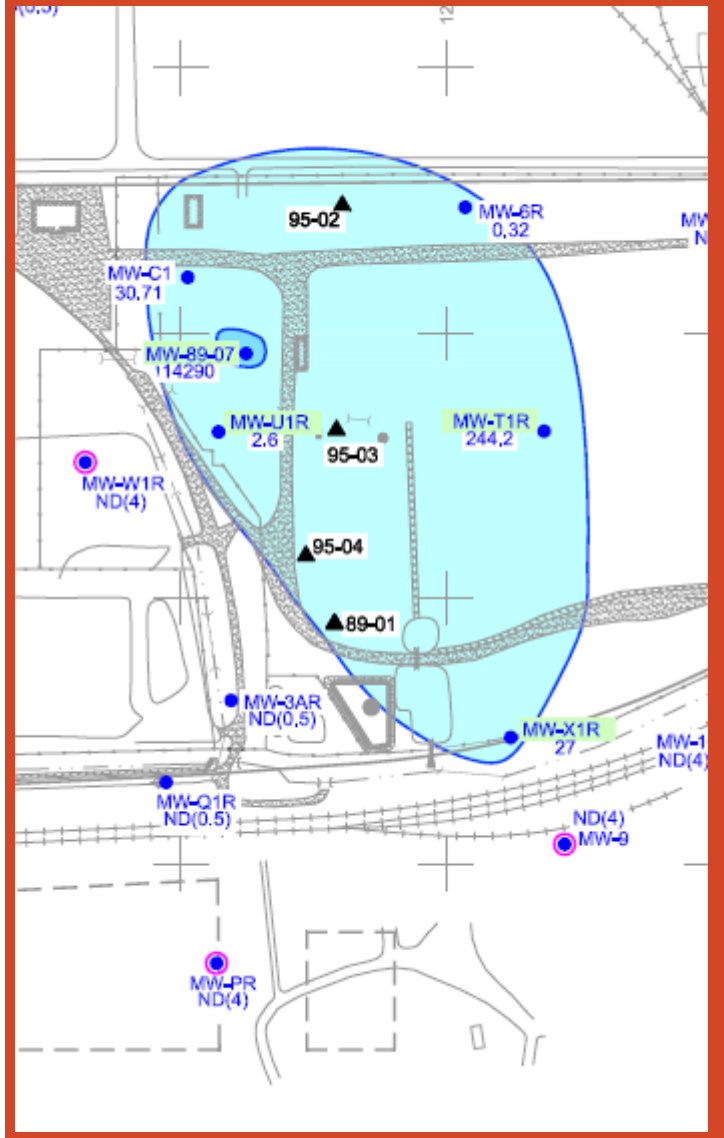
- Sand/till subsurface material with groundwater impacts
- LNAPL recovery system installed
- Groundwater treatment system constructed
- Soil vapor extraction
- Bioventing


87-27
HIGHWAY 1804
EXISTING OIL/WATER SEPARATOR
TANK VAULT M-1
95-01
95-02
ADMINISTRATION BUILDING
EXISTING LIFT SUMP
VET-10
V-1
TREATMENT BUILDING
NATURAL GAS SUPPLY
SVE BLOWERS AND OXIDIZER
95-03
95-04
"L" TANKS
89-01
X-1
FIRE WATER PROTECTION POND
TANK W-1
RR-1
SOUTH DRAINAGE DITCH
LEGEND
ONSITE STRUCTURES
SOIL VAPOR EXTRACTION WELL
95-04
GROUNDWATER RECOVERY WELL
UNDERGROUND PIPING
SOIL VAPOR EXTRACTION TRENCH
SOIL VAPOR EXTRACTION CONVEYANCE PIPING
SUMP
UPPER SAND RECOVERY TRENCH
LEAD CONTAMINATED SOILS (FENCED AREAS)

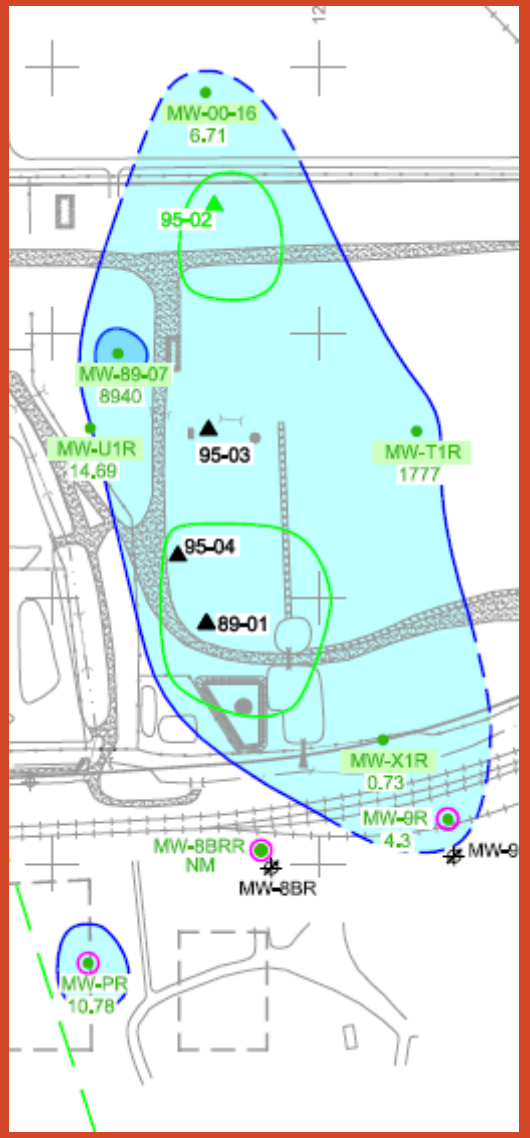
Lower Sand

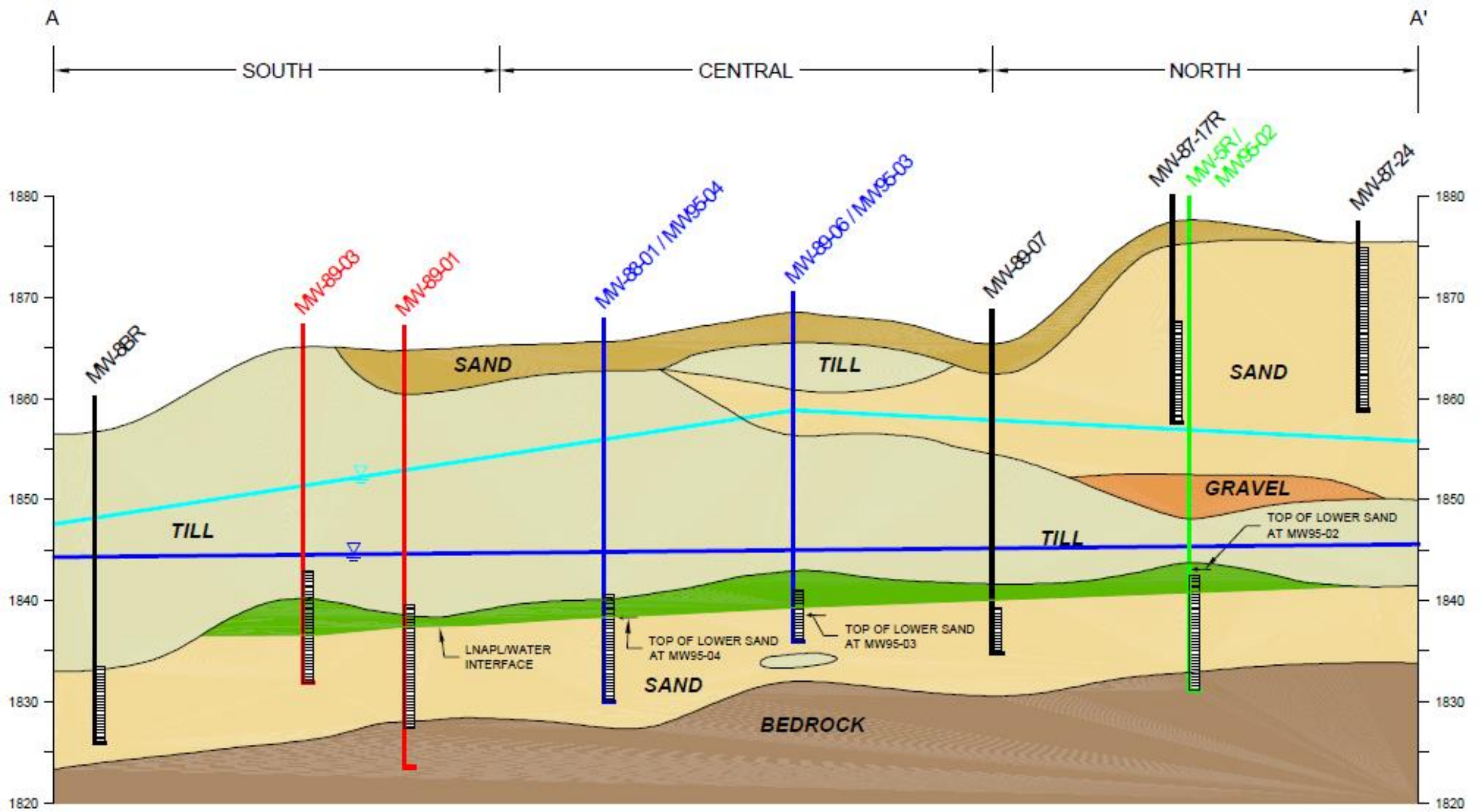
- Separated by a layer of till
- 4x LNAPL recovery wells and 2x monitoring wells
- Lift sump and air stripping
- Recovery system shut down in 2008

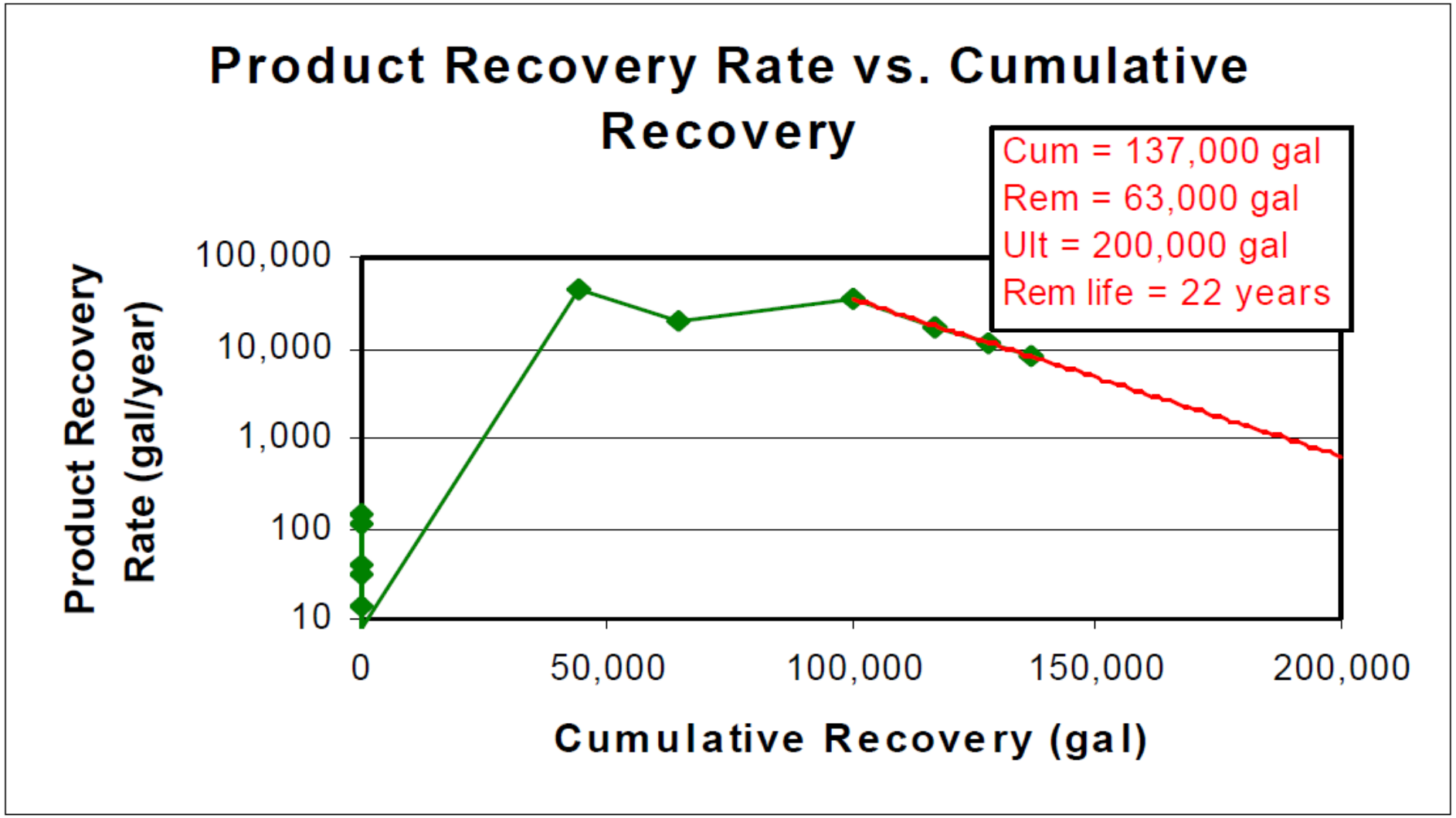
1997



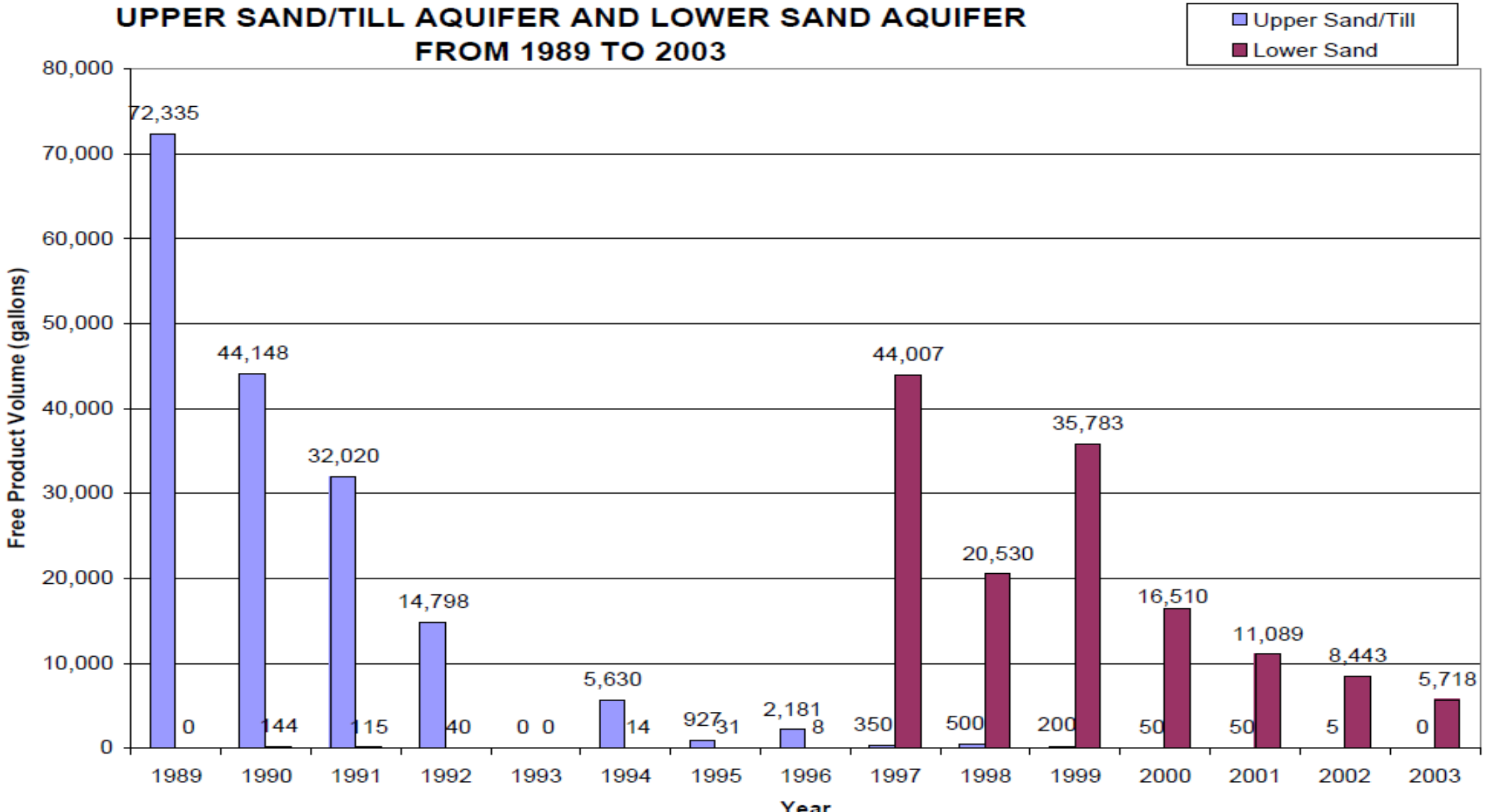
2013




A
A'
SOUTH
CENTRAL
NORTH
MW-88R
MW-89-03
MW-89-01
MW-88-01 / MW95-04
MW-88-06 / MW95-03
MW-89-07
MW-87-17R
MW-5R / MW95-02
MW-87-24
SAND
TILL
SAND
GRAVEL
TILL
TILL
TOP OF LOWER SAND AT MW95-02
LNAPL/WATER INTERFACE
TOP OF LOWER SAND AT MW95-04
TOP OF LOWER SAND AT MW95-03
SAND
BEDROCK
1880
1870
1860
1850
1840
1830
1820


Product Recovery Rate vs. Cumulative Recovery
Cum = 137,000 gal
Rem = 63,000 gal
Ult = 200,000 gal
Rem life = 22 years
Product Recovery Rate (gal/year)
100,000
10,000
1,000
100
10
0
50,000
100,000
150,000
200,000
Cumulative Recovery (gal)

HISTORICAL FREE PRODUCT YEARLY RECOVERY
UPPER SAND/TILL AQUIFER AND LOWER SAND AQUIFER
FROM 1989 TO 2003



MNA

- Studied in 2003
- Selected as a remedy in 2004
- Ongoing process monitored by the NDDEQ

Completed Remedies

- Soil vapor extraction
- LNAPL recovery
- Excavation of lead contaminated soils
- Landfarming of soils

Today

- Monitored natural attenuation
- Environmental covenants
- Institutional controls
- Groundwater in Upper/Lower Sands is contaminated and main concern
- Contaminant concentrations appear to be decreasing

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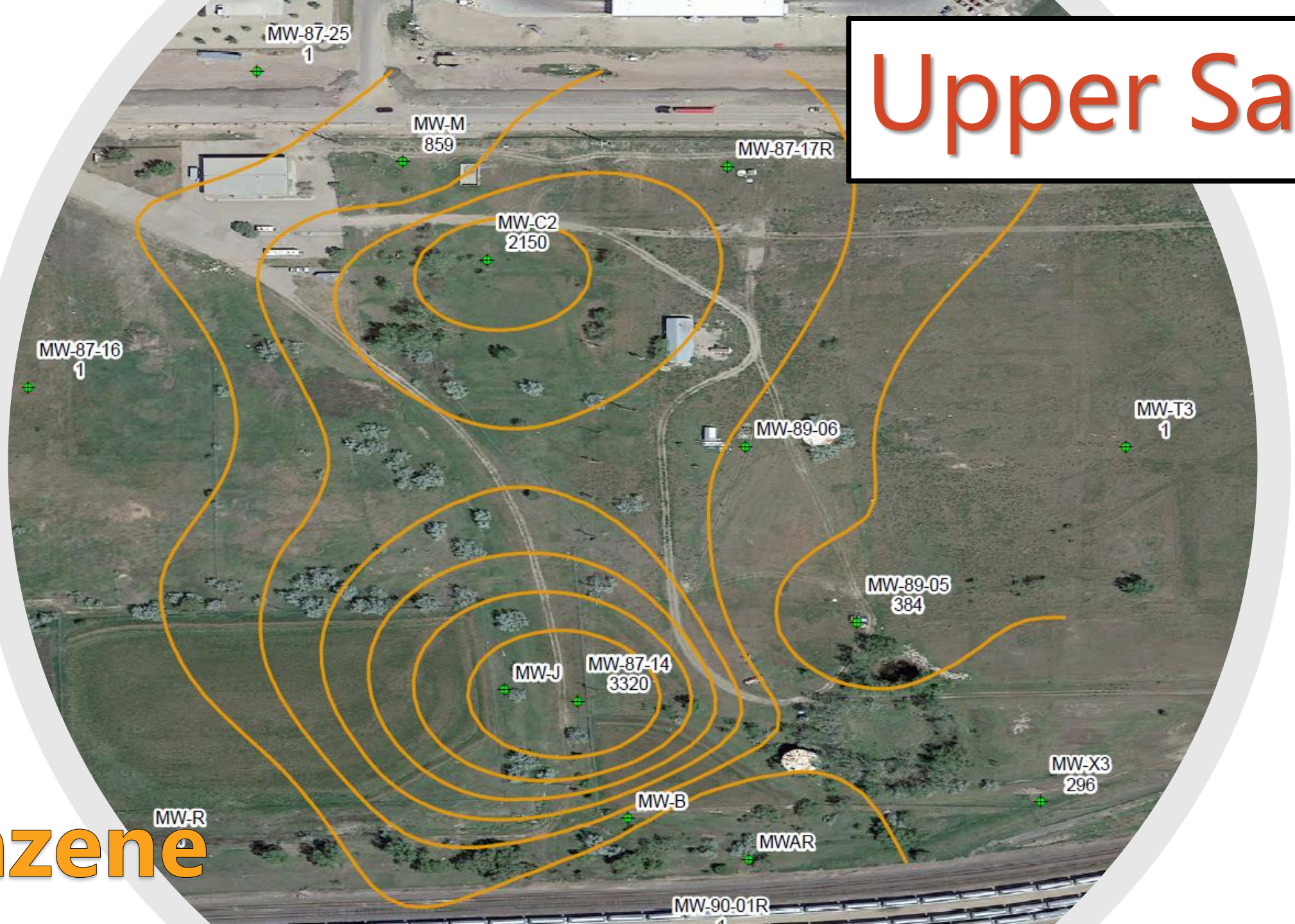
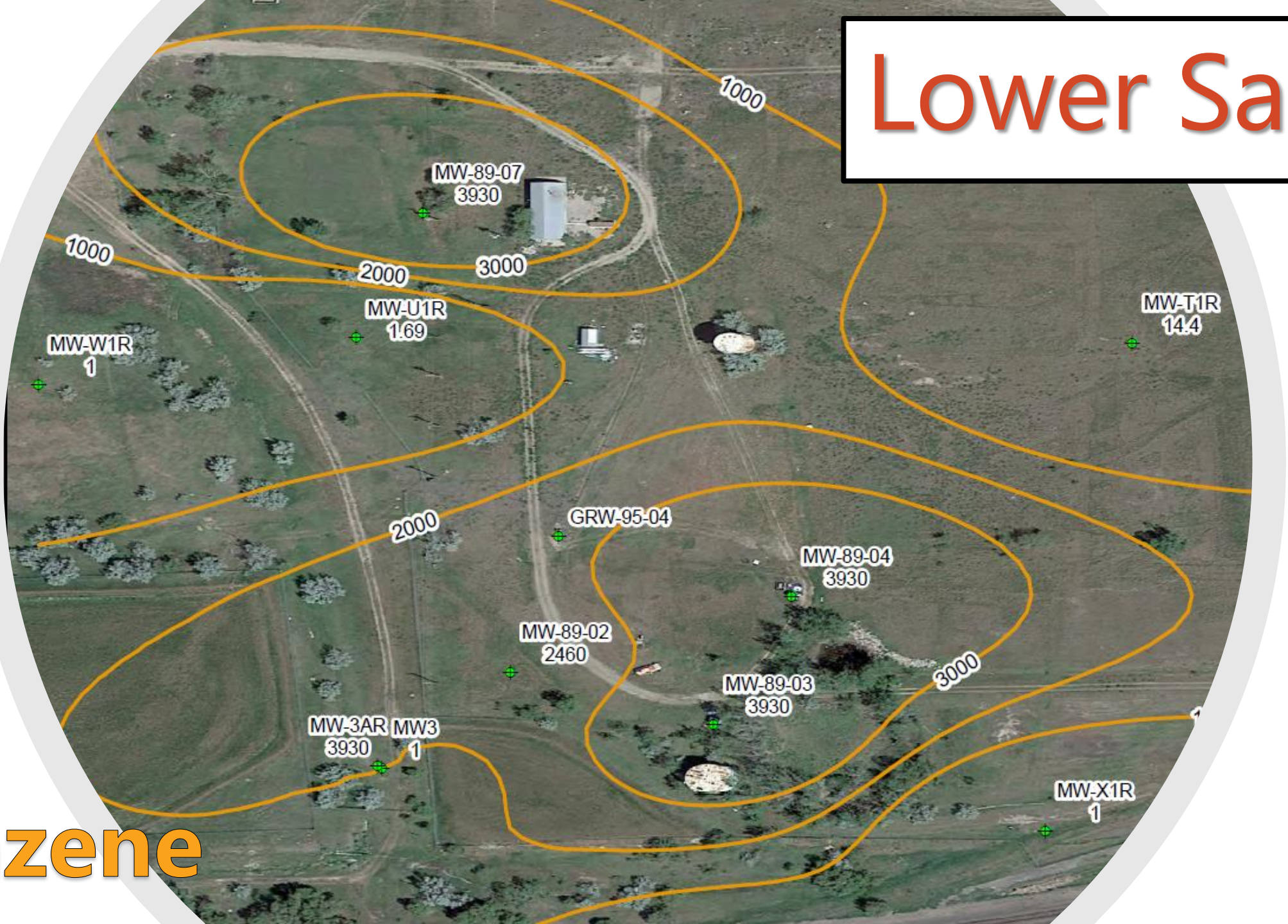


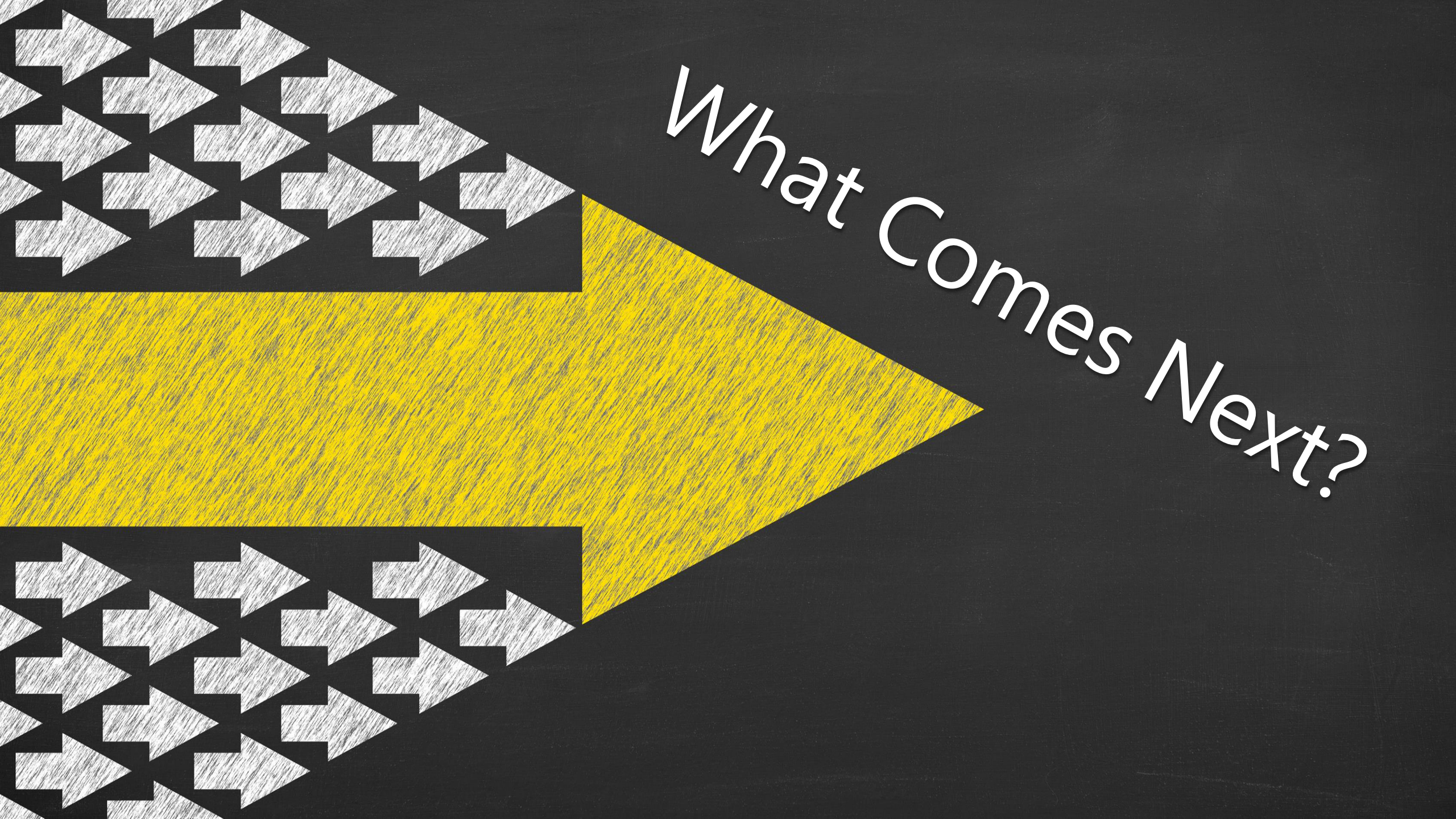
Upper Sand

Benzene


Lower Sand
1000
MW-89-07
3930
1000
2000
3000
MW-U1R
1.69
MW-W1R
1
MW-T1R
14.4
2000
GRW-95-04
MW-89-04
3930
MW-89-02
2460
3000
MW-89-03
3930
MW-3AR
3930
MW3
1
MW-X1R
1
Benzene

What have we accomplished?

- Contaminant source reduction
- Closed out the surface impoundments
- Delineated groundwater results
- Massive information library


What Comes Next?

New Developments in ND

- NDRBCA – Coming 2023!!!
- Uniform Environmental Covenants Act
- Voluntary Response Actions

There’s something else…

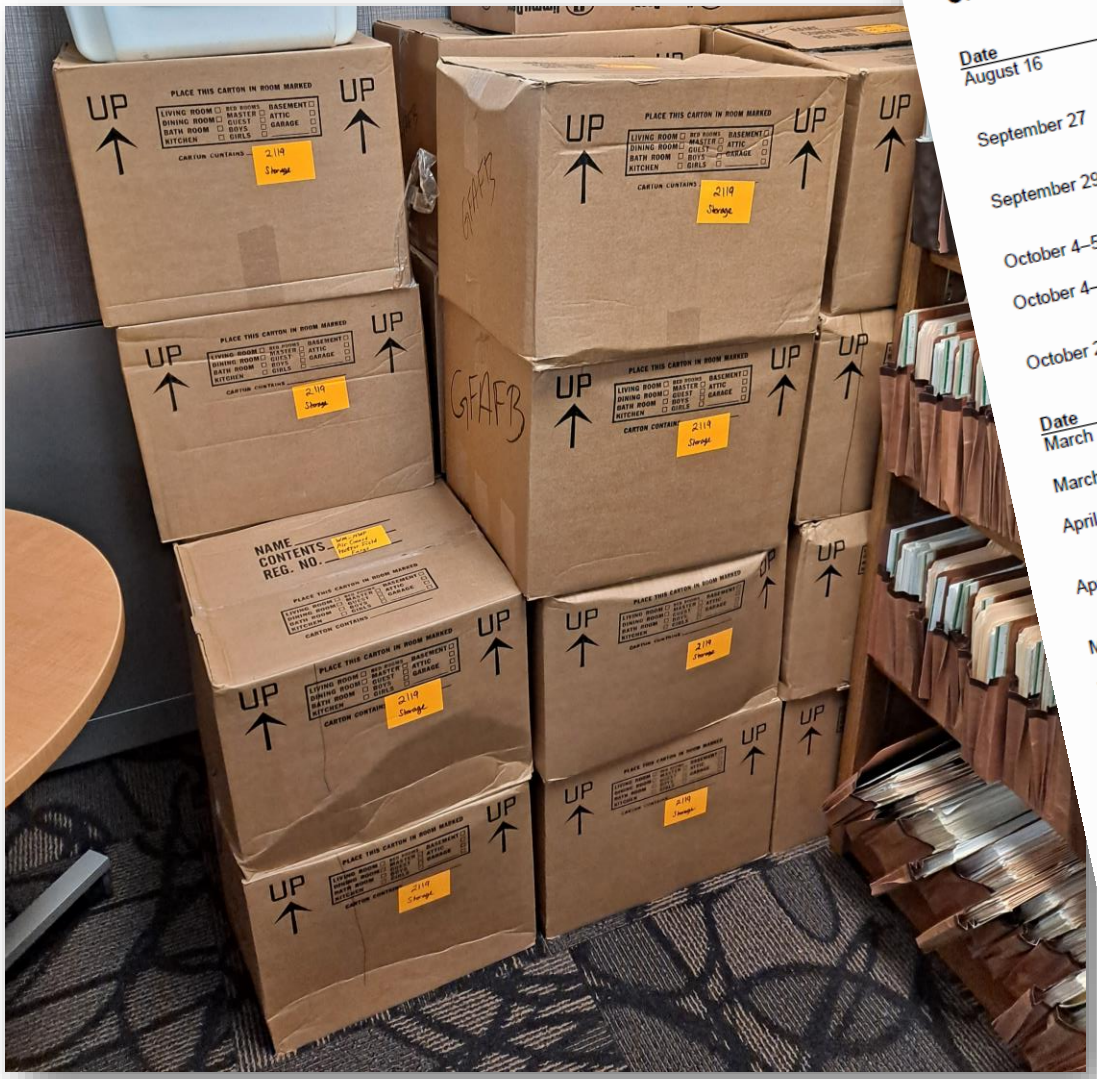


Table 1
Chronology of Events from 1992–2020

Date	2017 Events
February 17, 2017	Submittal of 2016 Annual Report Flying J Petroleums Former Refinery Williston, North Dakota
September 26-28, 2017	Annual CMI well gauging and groundwater sampling, well abandonment.

Date	2018 Events
March 23, 2018	Submittal of 2017 Annual Report Flying J Petroleums Former Refinery Williston, North Dakota
September 24-26, 2018	Annual CMI well gauging and groundwater sampling.

Date	2019 Events
March 20, 2019	Submittal of 2018 Annual Report Flying J Petroleums Former Refinery Williston, North Dakota
September 9-11, 2019	Annual CMI well gauging and groundwater sampling.
November 19, 2019	Removal of 436 gallons of recovered LNAPL from wells 89-03 and 89-04. Waste manifest 020751036.

Date	2020 Events
March 1, 2020	Submittal of 2019 Annual Report Flying J Petroleums Former Refinery Williston, North Dakota
September 28-29, 2020	Annual CMI well gauging and groundwater sampling.
October 25, 2020	Removal of two (2) Spill Buster Optical LNAPL pumps for repair.

Date	2020 Events
April 28, 2021	Submittal of 2020 Annual Report Flying J Former Refinery Williston, North Dakota
September 25-27, 2021	Annual CMI well gauging and groundwater sampling
November 19, 2021	Submittal of Corrective Action Permit Application