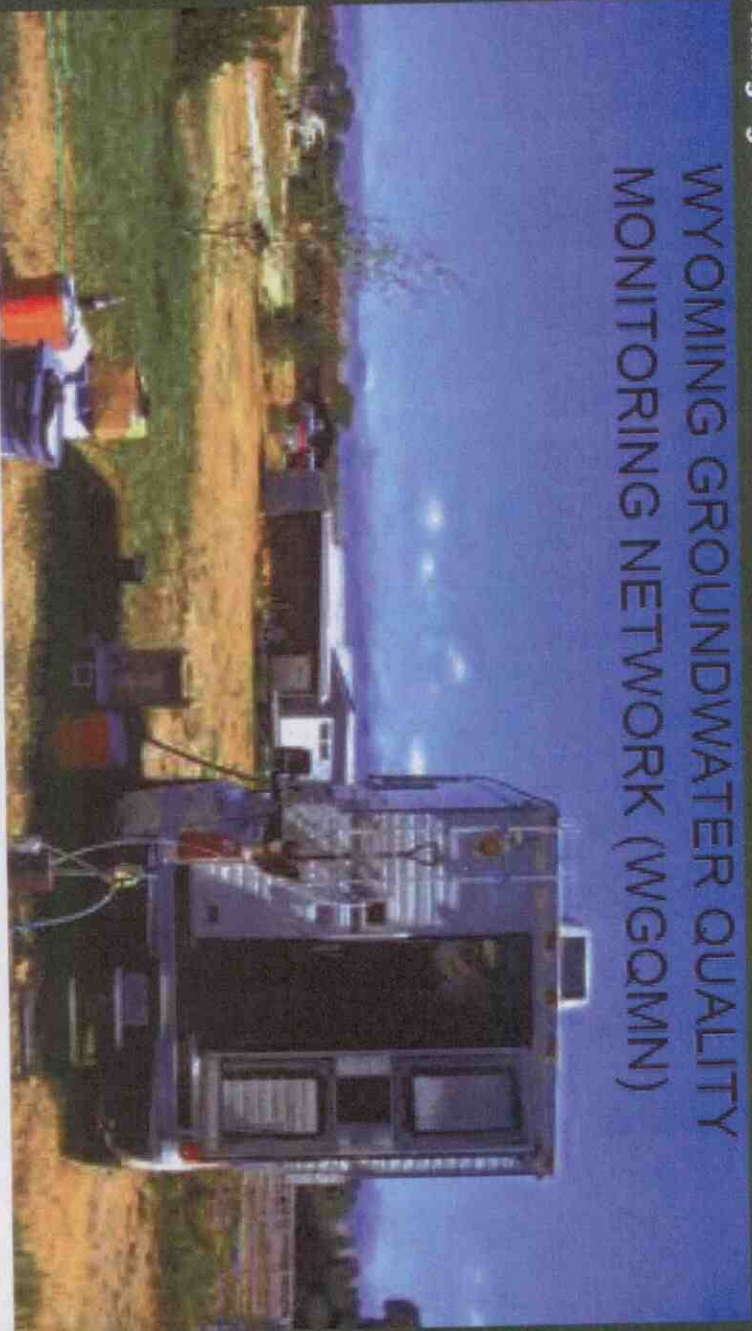




WYOMING GROUNDWATER QUALITY MONITORING NETWORK (WGQMN)



Laramie/Albany County Environmental Advisory
Committee Meeting
August 3, 2017
with the www.usgs.gov www.wgqmn.org
Greg Boughton

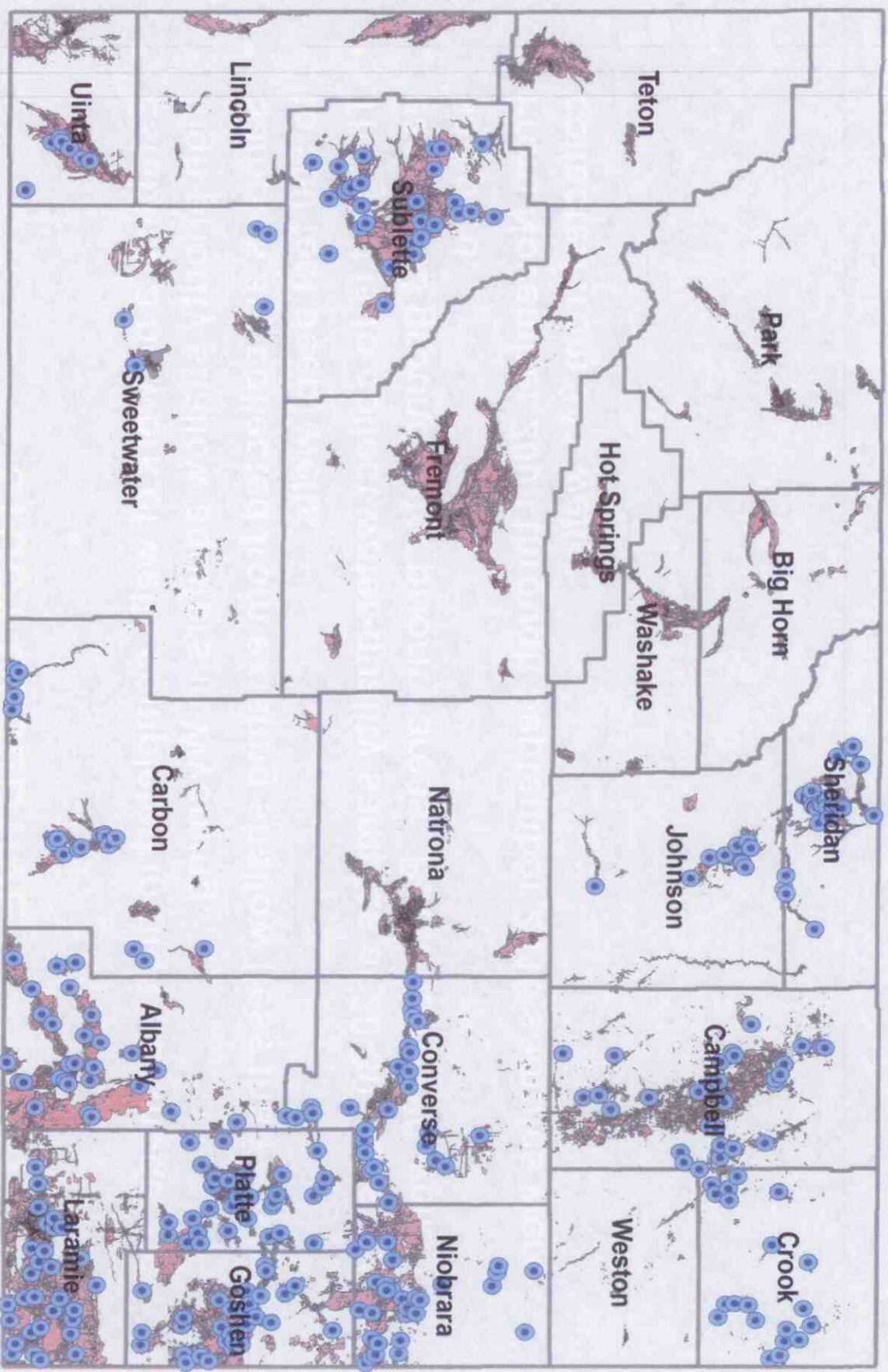
U.S. Department of the Interior
U.S. Geological Survey

PROJECT BACKGROUND

- Cooperative program with the Wyoming Department of Environmental Quality.
- Ambient or baseline monitoring will be conducted in “priority” areas where groundwater has been identified as an important resource susceptible to contamination.

1202

WGQMN



STUDY OBJECTIVE

- Establish a network of wells completed in high and moderate-high priority shallow aquifers in Wyoming.
- Samples are collected from existing shallow (less than or equal to 500 feet deep) wells.
- The goal is to collect water-quality samples at 20-30 wells within each of 33 groundwater priority areas. Potentially 990 wells sampled.
- From November 2009 through September 2016 samples were collected from 341 wells.

ANALYTE LIST (SUPPLEMENTAL ANALYTES IN BLUE)

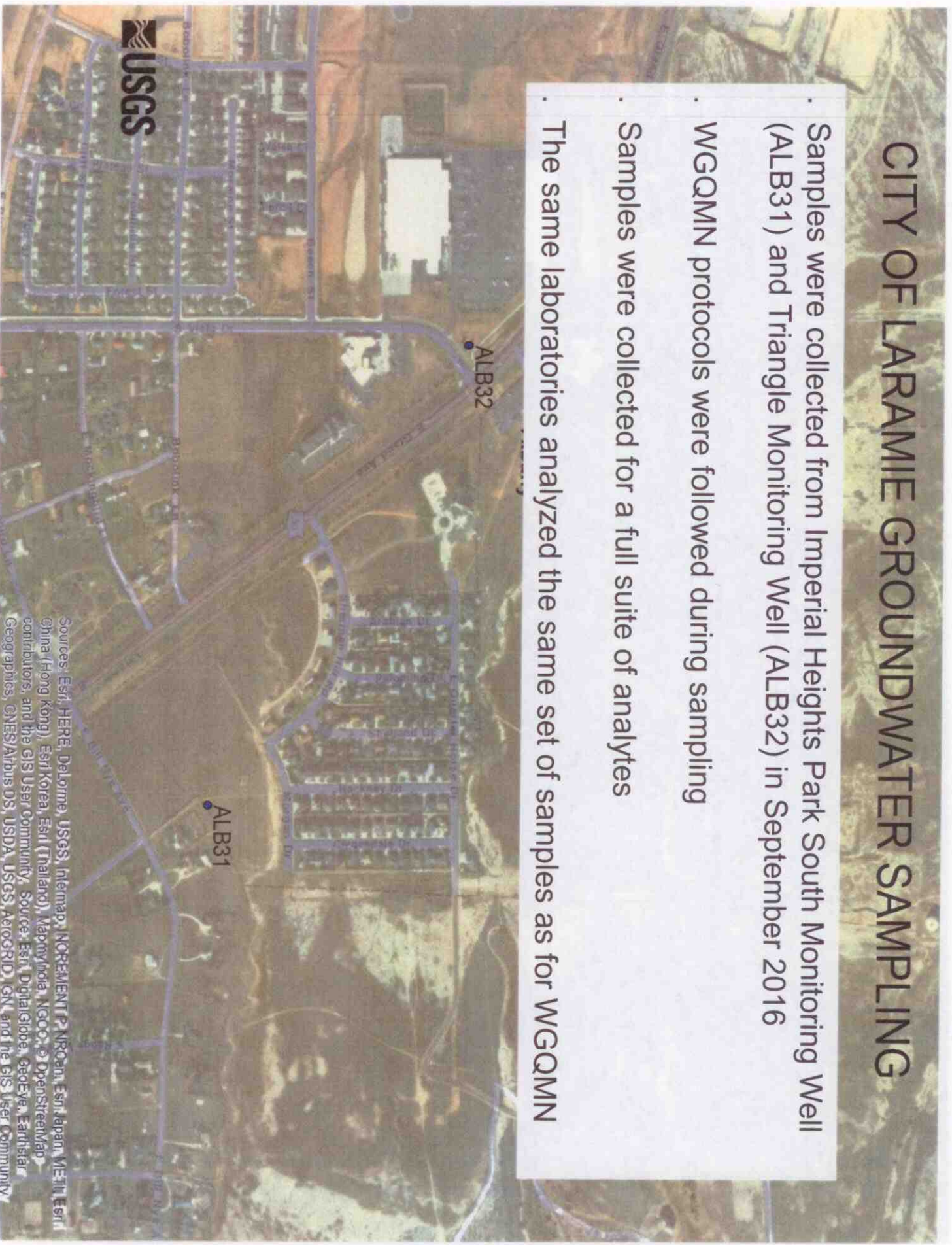
- Alkalinity
- Major ions and dissolved solids
- Trace elements
- Nutrients and dissolved organic carbon
- Radionuclides (**gross-alpha radioactivity, gross-beta radioactivity, radon, and uranium**)
- Environmental isotopes (protium / deuterium, **tritium**)
- Volatile organic compounds
- Gasoline range organics
- Diesel range organics
- Dissolved hydrocarbon gases (methane, ethene, ethane)
- **Wastewater compounds**
- Coliform bacteria

ANALYTICAL LABORATORIES

- USGS National Water-Quality Laboratory
- TestAmerica
- US EPA Region 8
- Eberline Services
- Reston Stable Isotope Laboratory
- USGS Stable Isotope and Tritium Laboratory (Isotope Tracers)

CITY OF LARAMIE GROUNDWATER SAMPLING

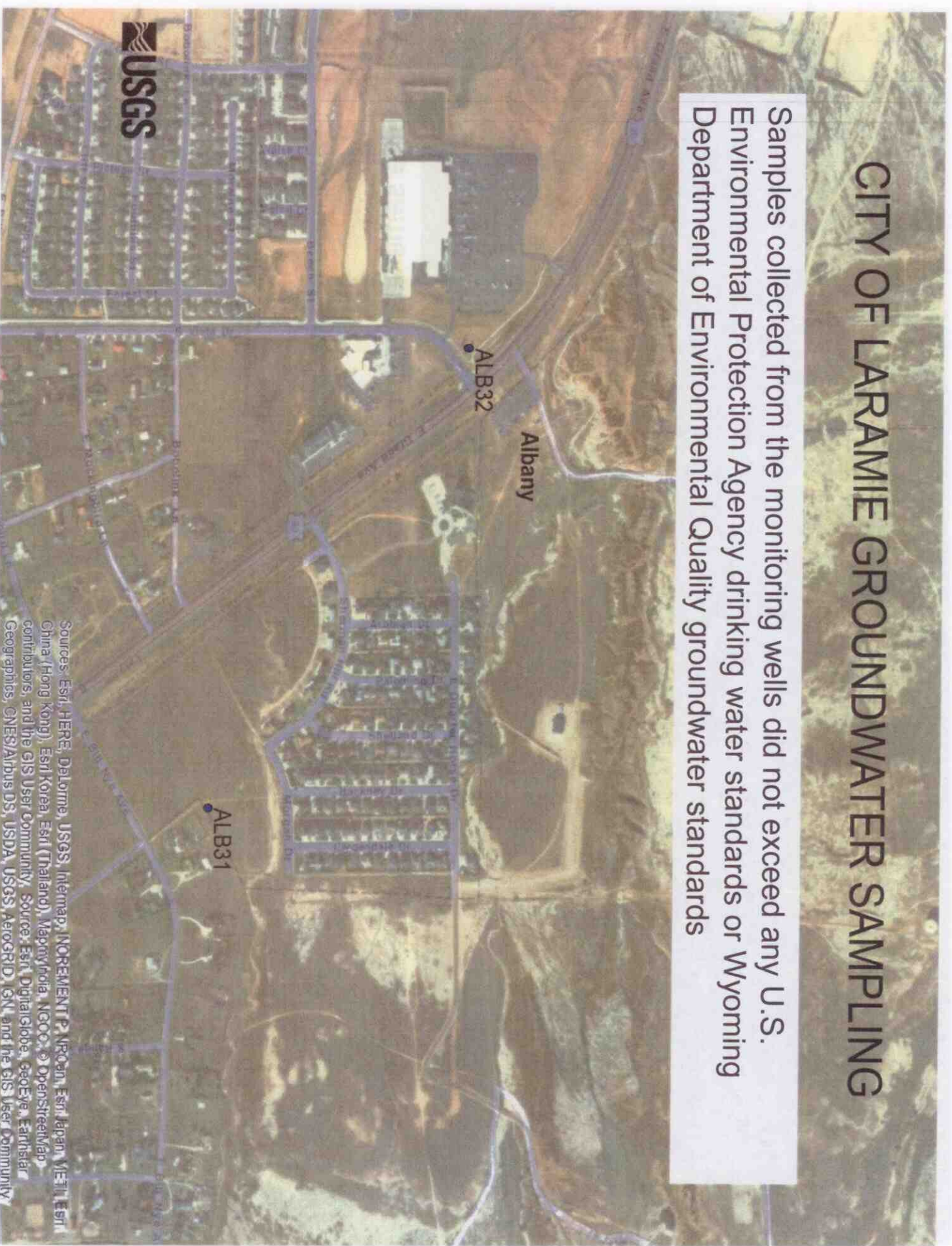
- Samples were collected from Imperial Heights Park South Monitoring Well (ALB31) and Triangle Monitoring Well (ALB32) in September 2016
- WGQMN protocols were followed during sampling
- Samples were collected for a full suite of analytes
- The same laboratories analyzed the same set of samples as for WGQMN



Sources: Esri, HERE, DeLorme, USGS, Intermap, INCREMENT P, NRCan, Esri, Japan, METI, Esri, China (Hong Kong), Esri Korea, Esri (Thailand), MapmyIndia, NGCO, © OpenStreetMap contributors, and the GIS User Community. Source: Esri, DigitalGlobe, GeoEye, Earthstar Geographics, CNES/Airbus DS, USDA, USGS, AeroGRID, IGN, and the GIS User Community

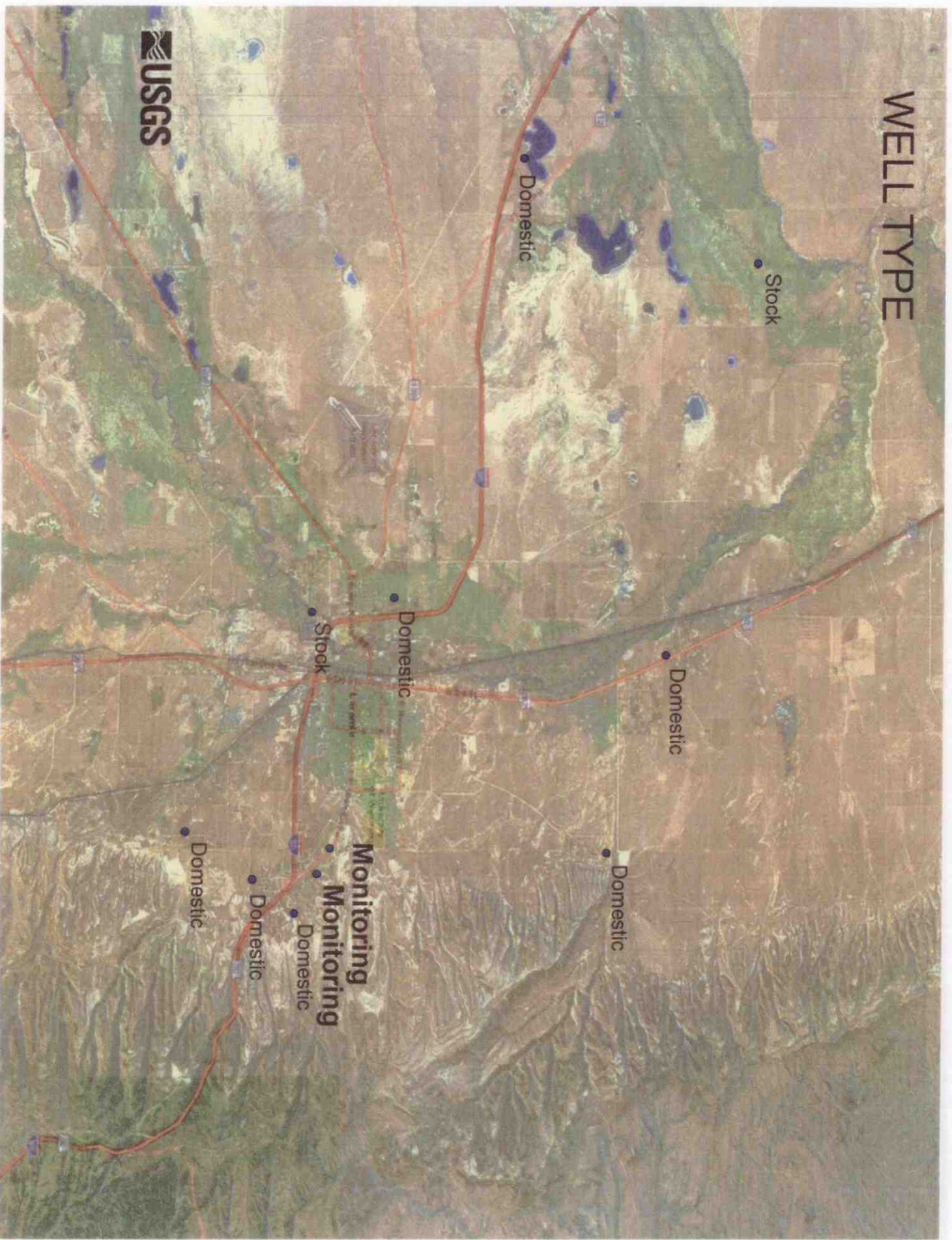
CITY OF LARAMIE GROUNDWATER SAMPLING

Samples collected from the monitoring wells did not exceed any U.S. Environmental Protection Agency drinking water standards or Wyoming Department of Environmental Quality groundwater standards

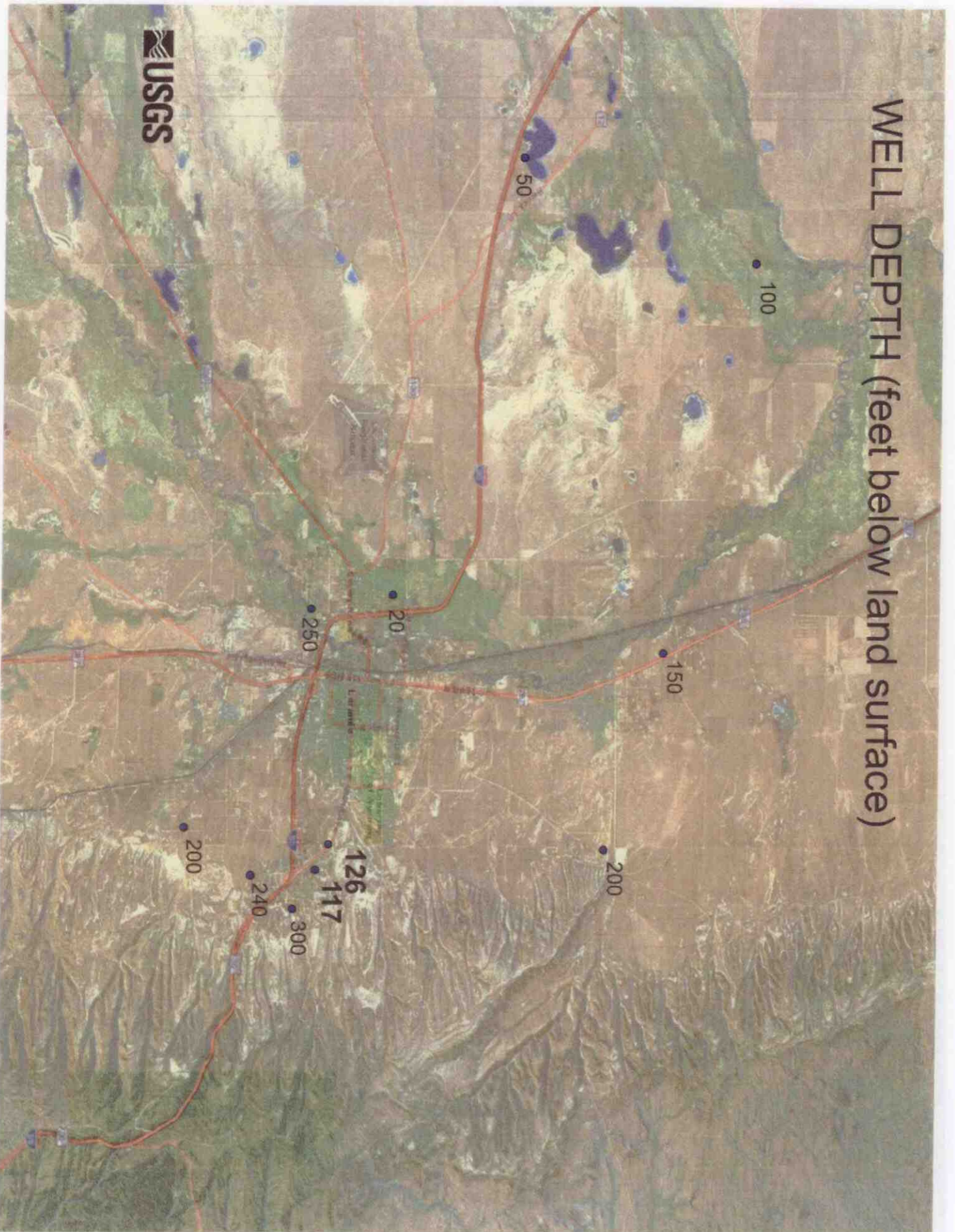


Sources: Esri, HERE, DeLorme, USGS, Intermap, INCREMENT P, NRCan, Esri Japan, METI, Esri China (Hong Kong), Esri Korea, Esri (Thailand), Mapbox, Swisstopo, Mapbox Intelligence, Swisstopo, and the GIS User Community. Source: Esri, DigitalGlobe, GeoEye, Earthstar Geographics, CNES/Airbus DS, USDA, USGS, AeroGRID, IGN, and the GIS User Community

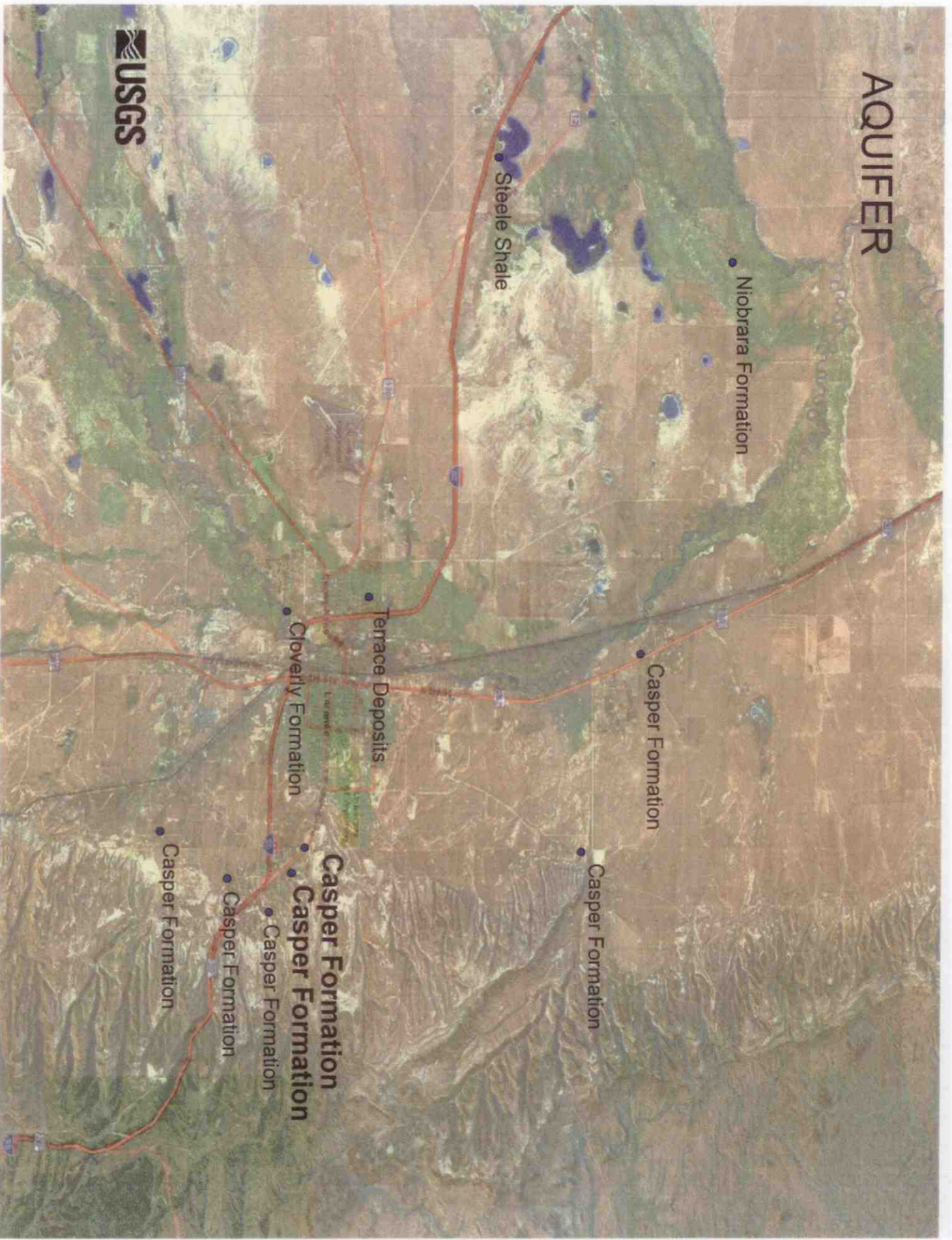
WELL TYPE



WELL DEPTH (feet below land surface)



AQUIFER



Niobrara Formation

Steele Shale

Terrace Deposits

Cloverly Formation

Casper Formation

Casper Formation

Casper Formation

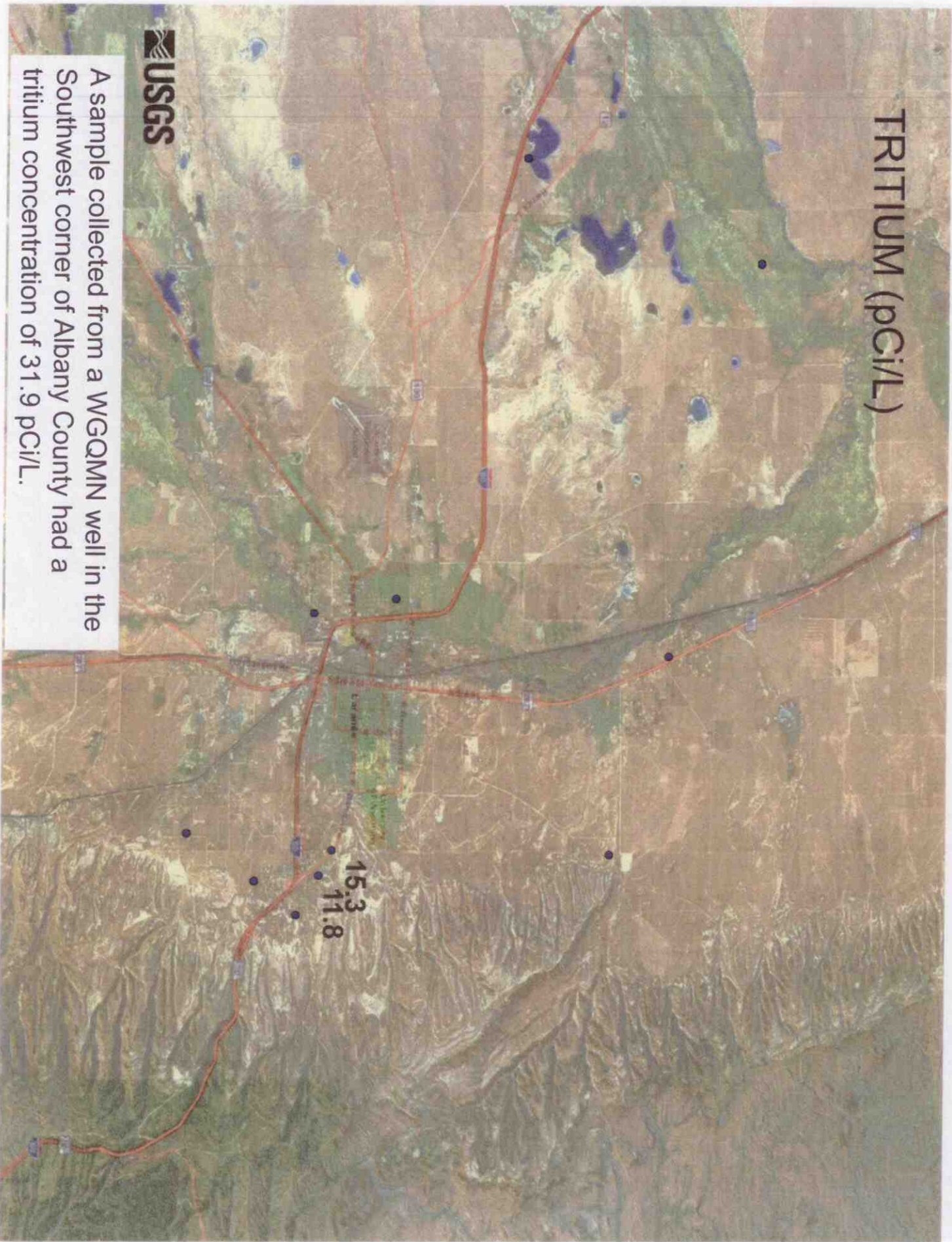
Casper Formation

Casper Formation

Casper Formation



TRITIUM (pCi/L)

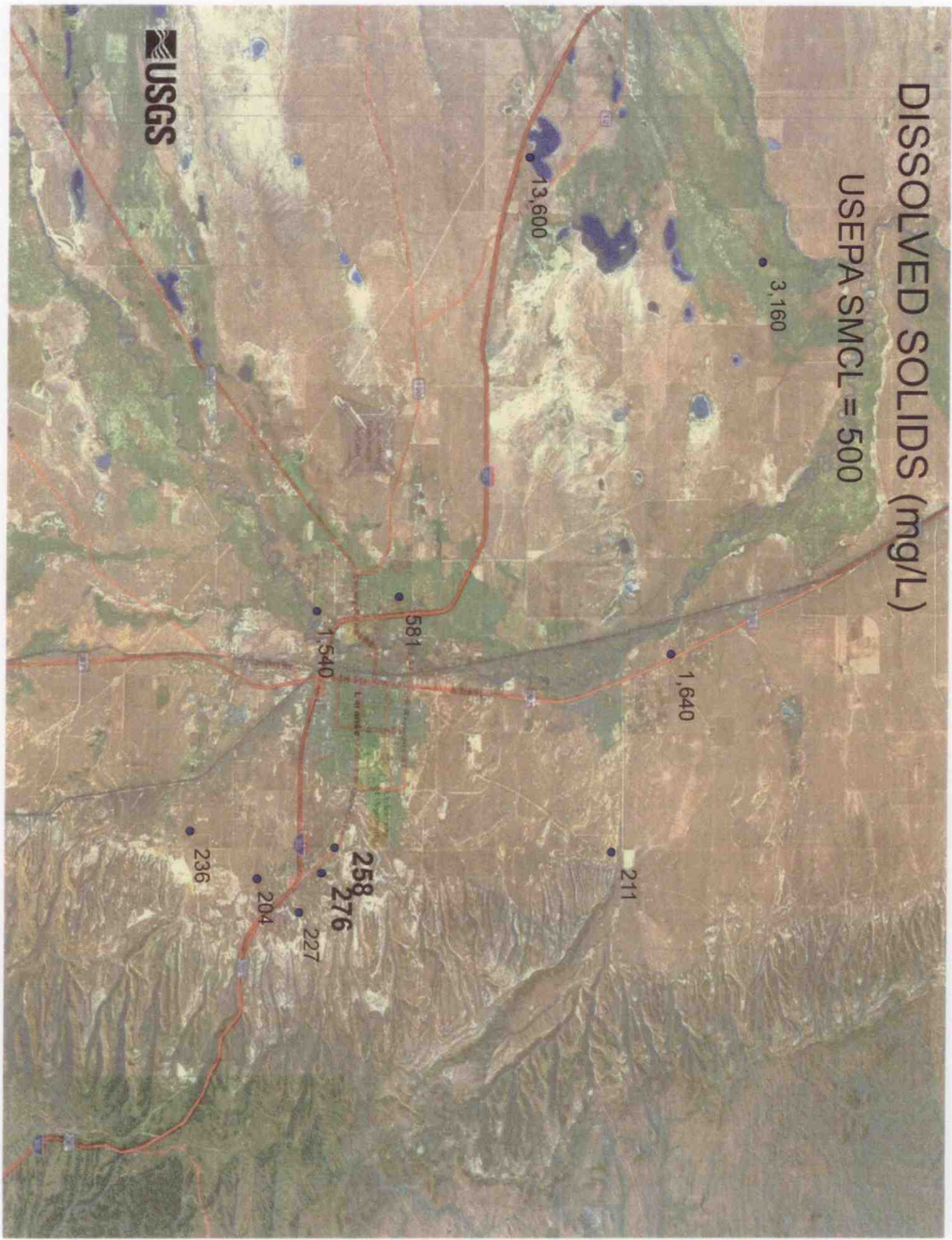


A sample collected from a WGQMN well in the Southwest corner of Albany County had a tritium concentration of 31.9 pCi/L.



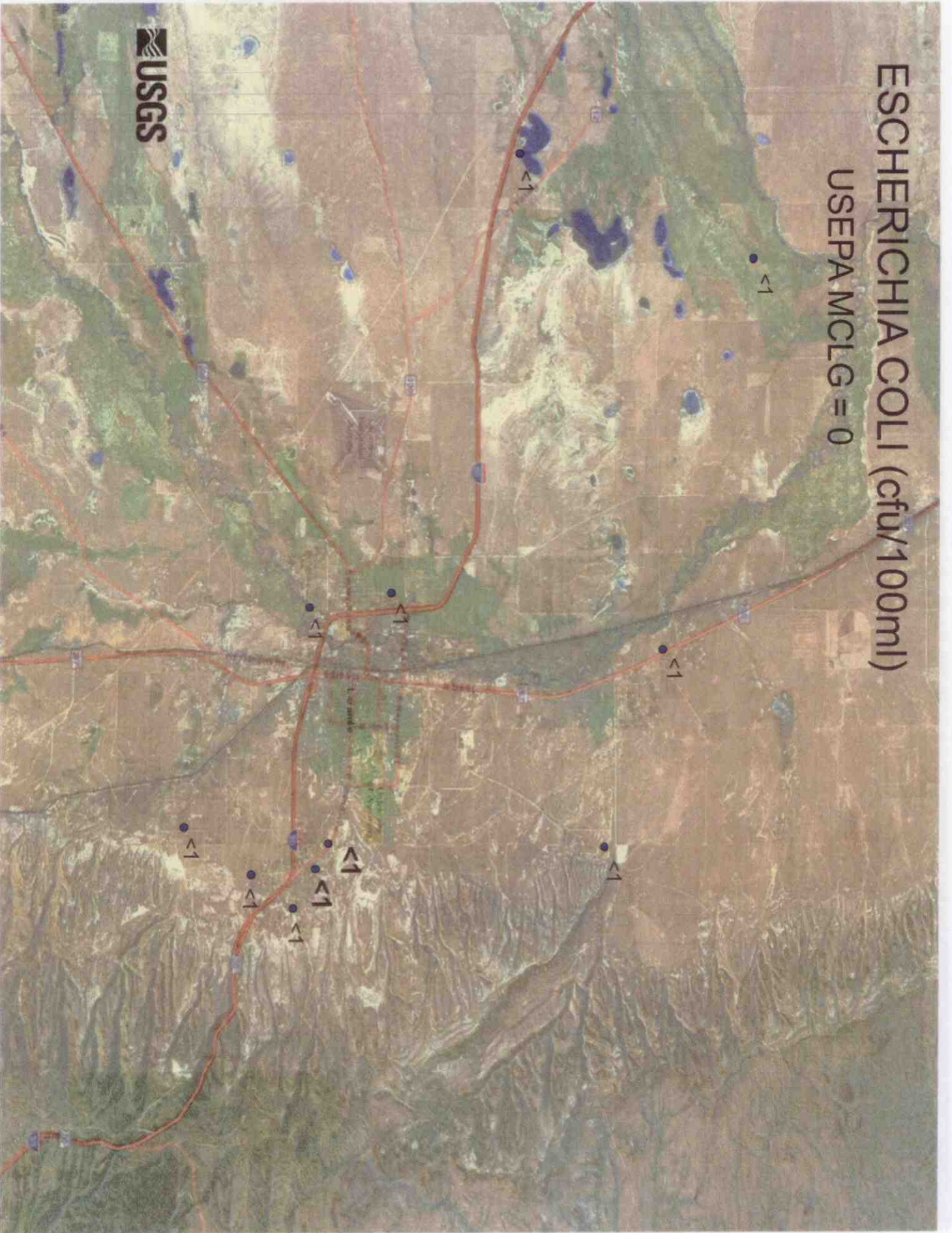
DISSOLVED SOLIDS (mg/L)

USEPA SMCL = 500



ESCHERICHCIA COLI (cfu/100ml)

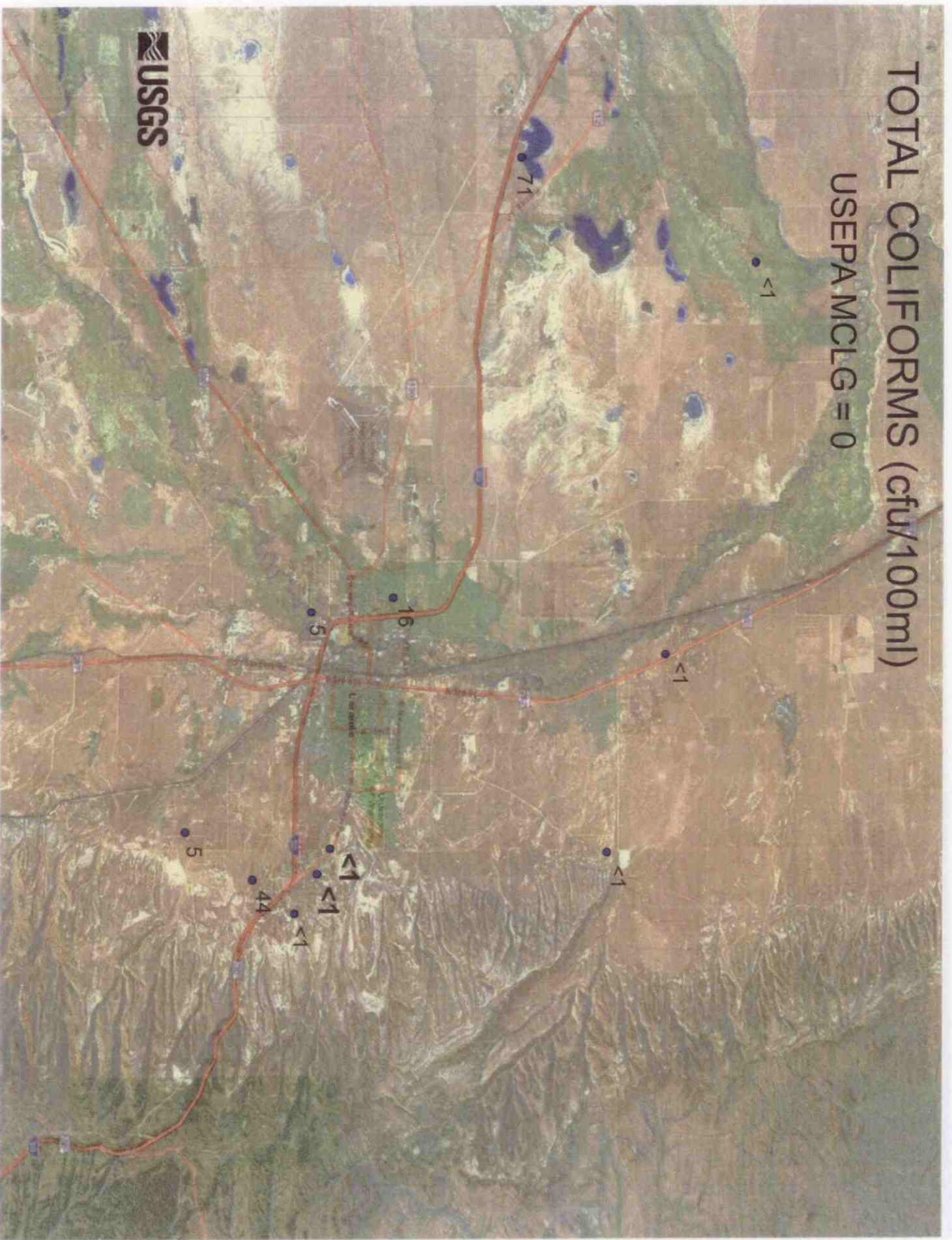
USEPA MCLG = 0



USGS

TOTAL COLIFORMS (cfu/100ml)

USEPA MCLG = 0

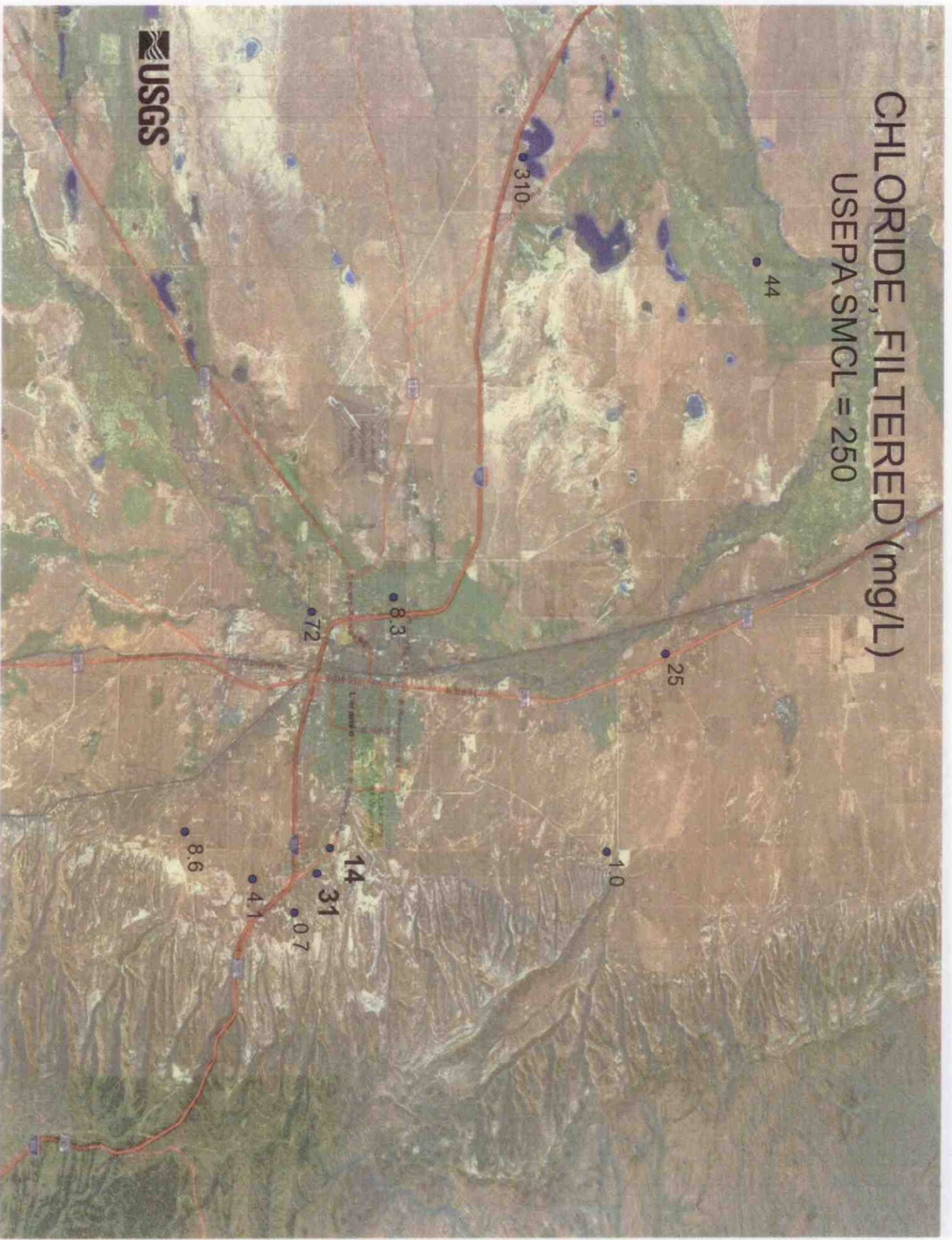


SODIUM, FILTERED (mg/L)



CHLORIDE, FILTERED (mg/L)

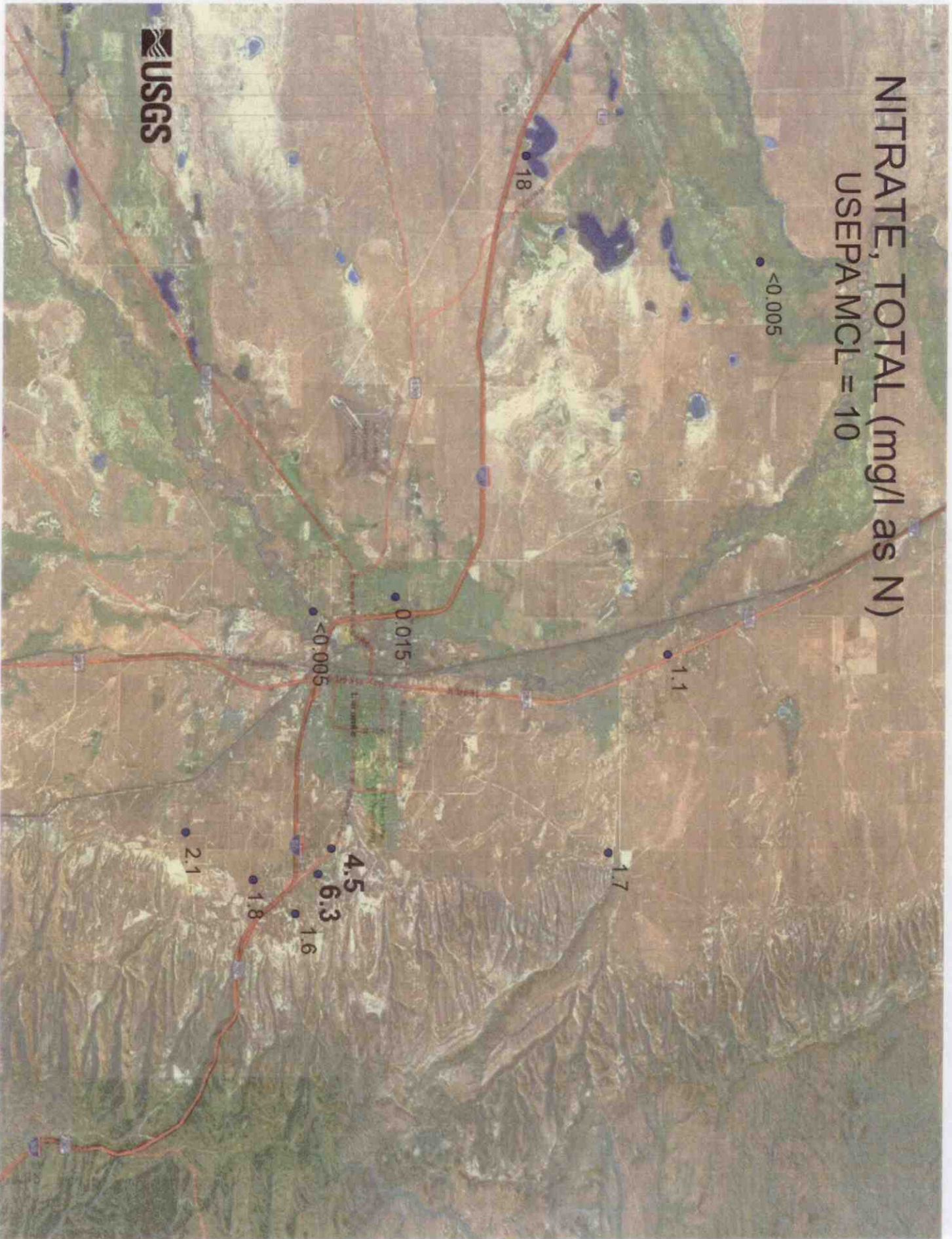
USEPA SMCL = 250



USGS

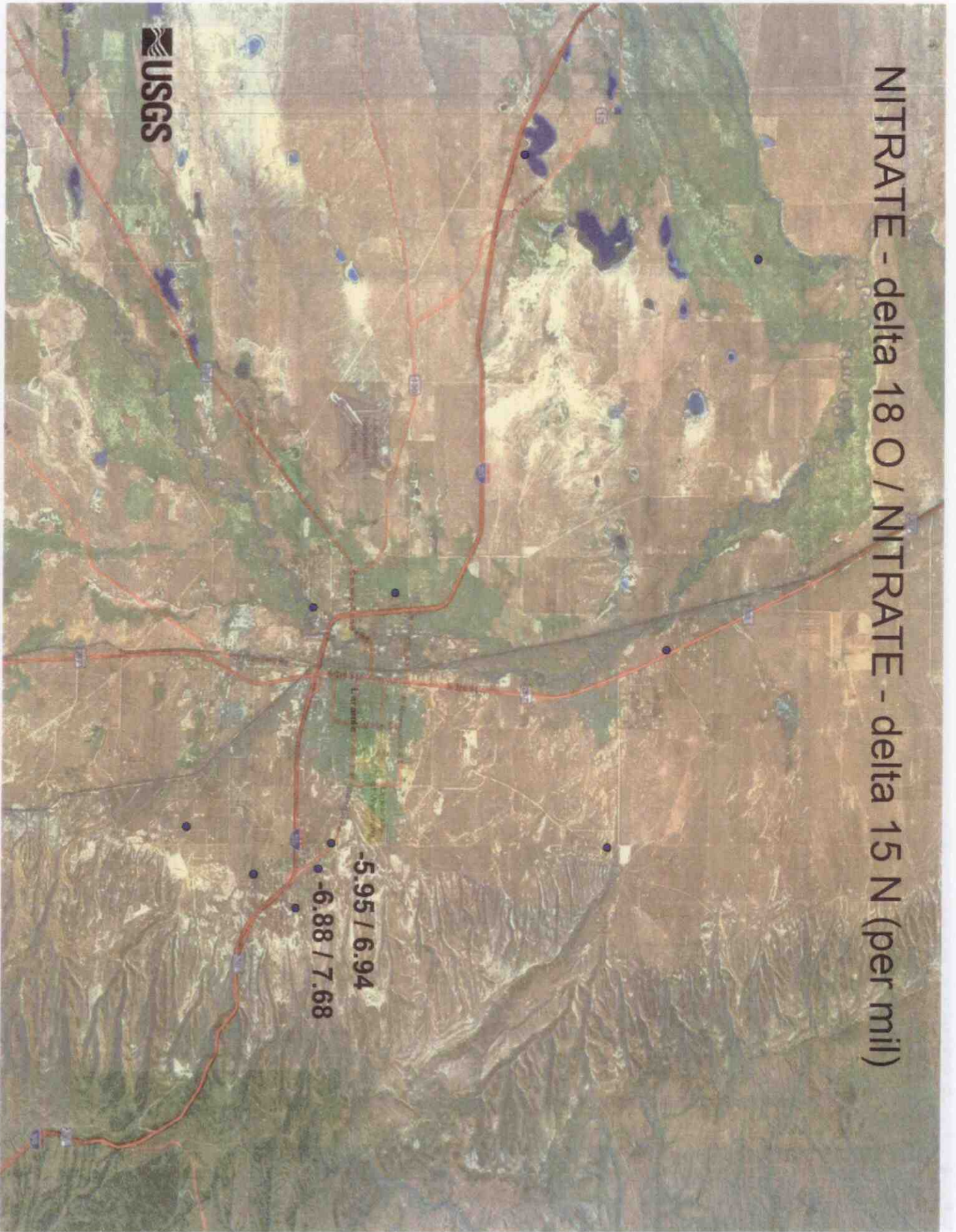
NITRATE, TOTAL (mg/l as N)

USEPA MCL = 10

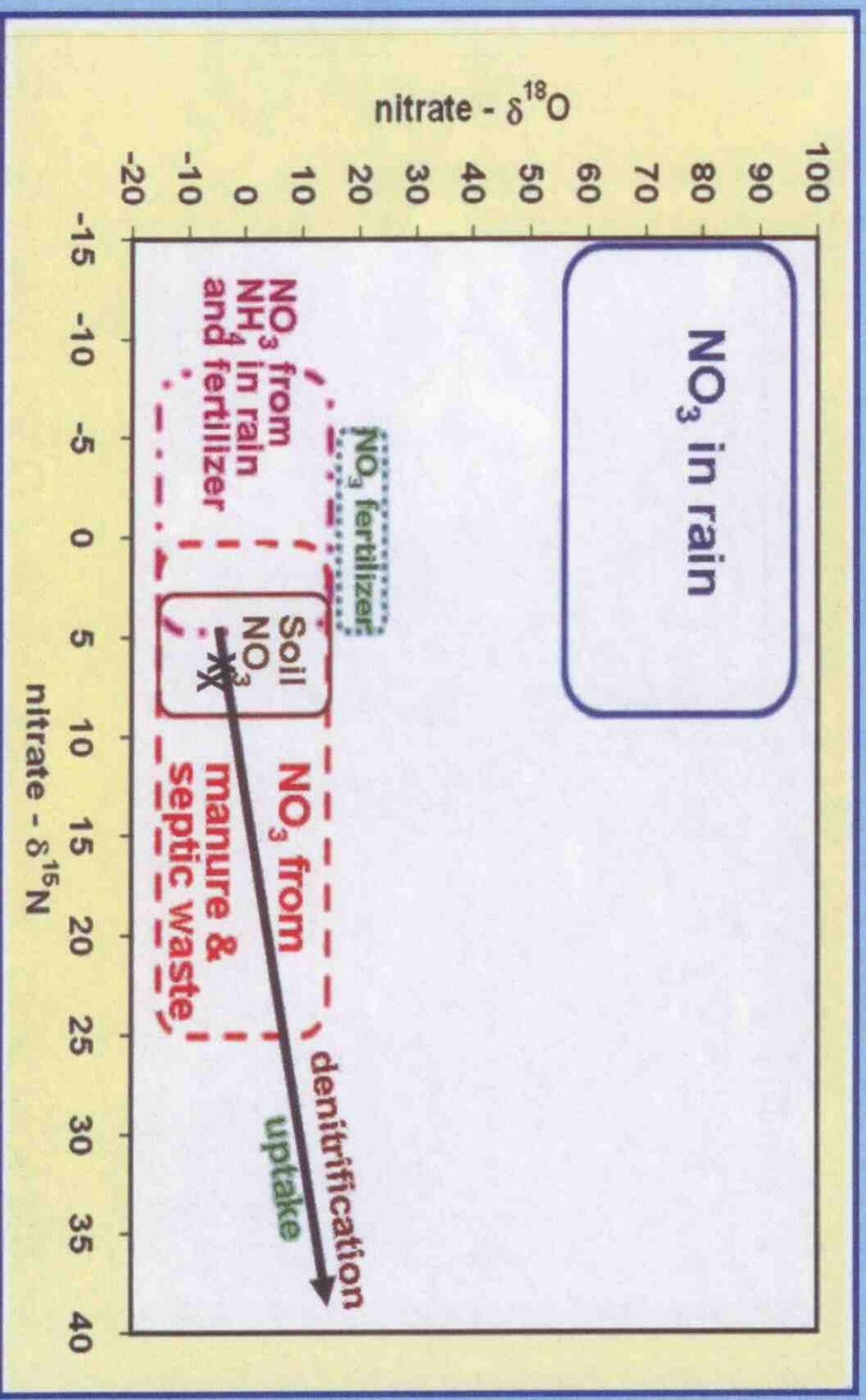


USGS

NITRATE - delta 18 O / NITRATE - delta 15 N (per mil)



Different sources of NO₃ often have different and characteristic $\delta^{15}\text{N}$ and $\delta^{18}\text{O}$ values, and NO₃-consuming processes often cause distinctive shifts in $\delta^{15}\text{N}$ and $\delta^{18}\text{O}$ values



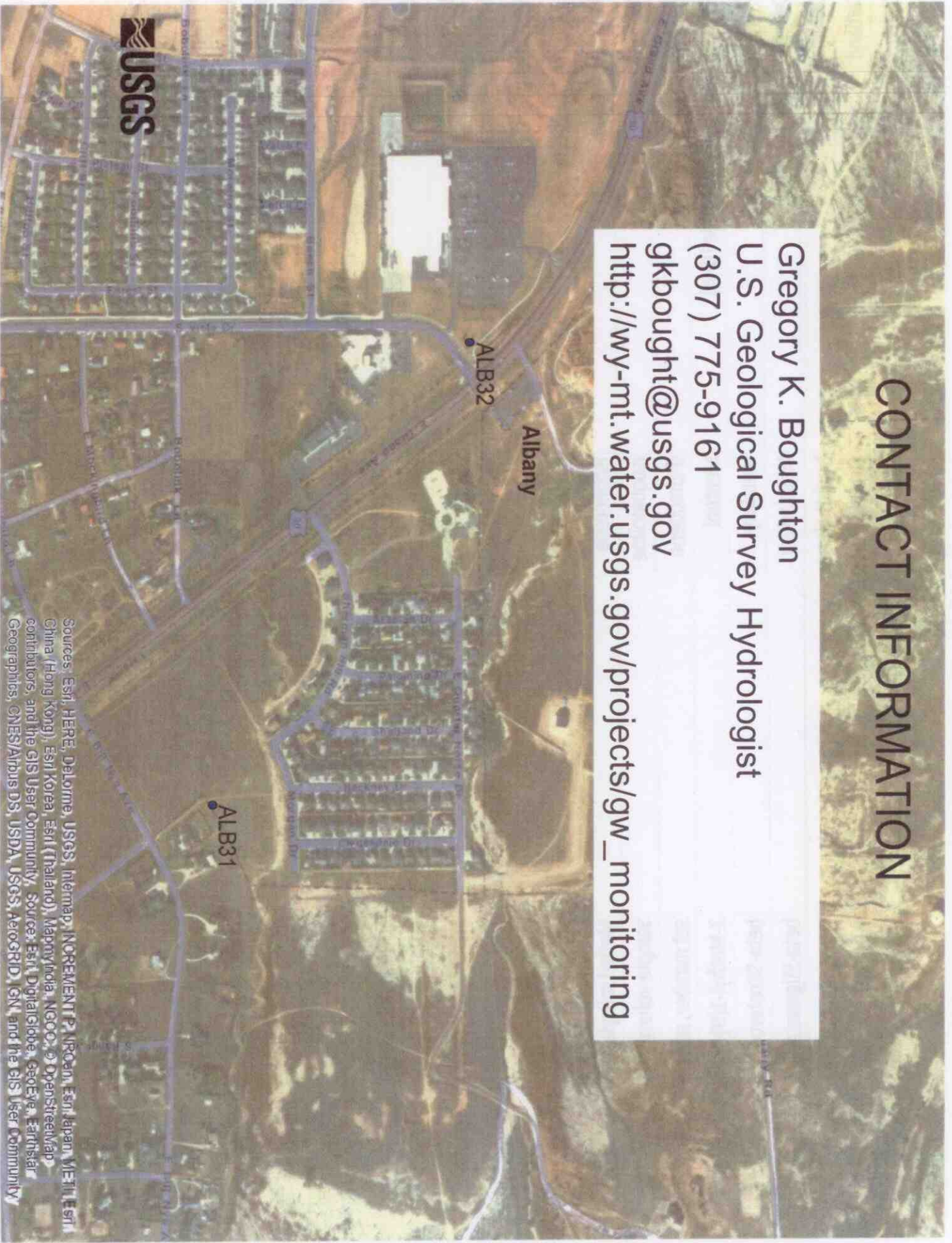
NO WASTEWATER COMPOUNDS WERE DETECTED

Choline	Cholesterol	p-Cresol
i-beta-Coprostanol	Isopropylbenzene	4-Cumylphenol
i-n-Octylphenol	Fluoranthene-d10 (surrogate)	para-Nonylphenol (total) (branched)
i-Nonylphenol diethoxylate (NP2EO), all isomers	Decafluorobiphenyl (surrogate)	4-tert-Octylphenol
i-tert-Octylphenol diethoxylate, aka OP2EO	N,N-diethyl-meta-tolamide (DEET)	Phenanthrene
i-tert-Octylphenol monoethoxylate, aka OP1EO	Diazinon	Phenol
i-Methyl-1H-benzotriazole	Triethyl citrate (ethyl citrate)	Tributyl phosphate
Anthraquinone	Tetrachloroethylene	Triphenyl phosphate
Acetophenone	Fluoranthene	Tris(2-butoxyethyl)phosphate
Acetyl hexamethyl tetrahydronaphthalene (AHTN)	Hexahydrohexamethylcyclopentabenzopyran (HHC6B)	Tris(2-chloroethyl)phosphate
Anthracene	Indole	Prometon
1,4-Dichlorobenzene	Isoborneol	Pyrene
benzo[a]pyrene	Isophorone	Methyl salicylate
benzophenone	Isoquinoline	Sample volume
Bromacil	d-Limonene	set number, schedule 1433
i-tert-Butyl-4-hydroxy anisole (BHA)	Menthol	3-Methyl-1(H)-indole (Skatole)
Caffeine	Metaxyl	beta-Sitosterol
Caffeine-d9 (surrogate)	Metolachlor	beta-Stigmastanol
Camphor	Naphthalene	Tribromomethane
Carbaryl	1-Methylnaphthalene	Triclosan
Carbazole	2,6-Dimethylnaphthalene	Tris(dichloroisopropyl)phosphate
Chlorpyrifos	2-Methylnaphthalene	



CONTACT INFORMATION

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http://wy-mt.water.usgs.gov/projects/gw_monitoring



Sources: Esri, HERE, DeLorme, USGS, Intermap, INCREMENT P, NRCan, Esri Japan, METI, Esri China (Hong Kong), Esri Korea, Esri (Thailand), Mapbox, Swisstopo, Mapbox India, NCCO, © OpenStreetMap contributors, and the GIS User Community, Source: Esri, DigitalGlobe, GeoEye, Earthstar Geographics, CNES/Airbus DS, USDA, USGS, AeroGRID, IGN, and the GIS User Community