

Charles A Salt Extent and Thickness

Williston Basin, North Dakota

Travis D. Stollendorf
2022

Summary

A total of 2,579 wells were examined to determine the lateral extent and cumulative (net) thickness of the Charles A salt (Charles Formation, Madison Group), of which 1,768 contained Charles A salt as identified in well logs. As mapped the Charles A salt covers ~5.8 million acres (~23.6 billion m²) of North Dakota's subsurface (fig. 1). Net thicknesses vary dramatically (fig. 2) and range from 0 to 166 ft (0 to 51 m). Volumetrically, there is over 528 million acre-feet (652 million m³) of Charles A salt in North Dakota. Subsea depths range between -4,366' SSTVD (6,642' TVD) to -6,932' SSTVD (9,461' TVD). Isopach map, well data, associated shapefiles, subsea and TVD structure maps are included.

Methodology

Wells with digital logs containing gamma ray (GR), bulk density (RHOB), and deep resistivity (RESD) curves were examined and interpreted to determine the lateral extent and net vertical thickness of the Charles A salt. Net salt thickness from digital logs was calculated using a combined cutoff methodology with RHOB (< 2.3 g/cm³) and RESD (> 200 ohms). All calculated net salt thicknesses were manually checked to remove erroneous data. Isopach and structure maps were subsequently created using these data.

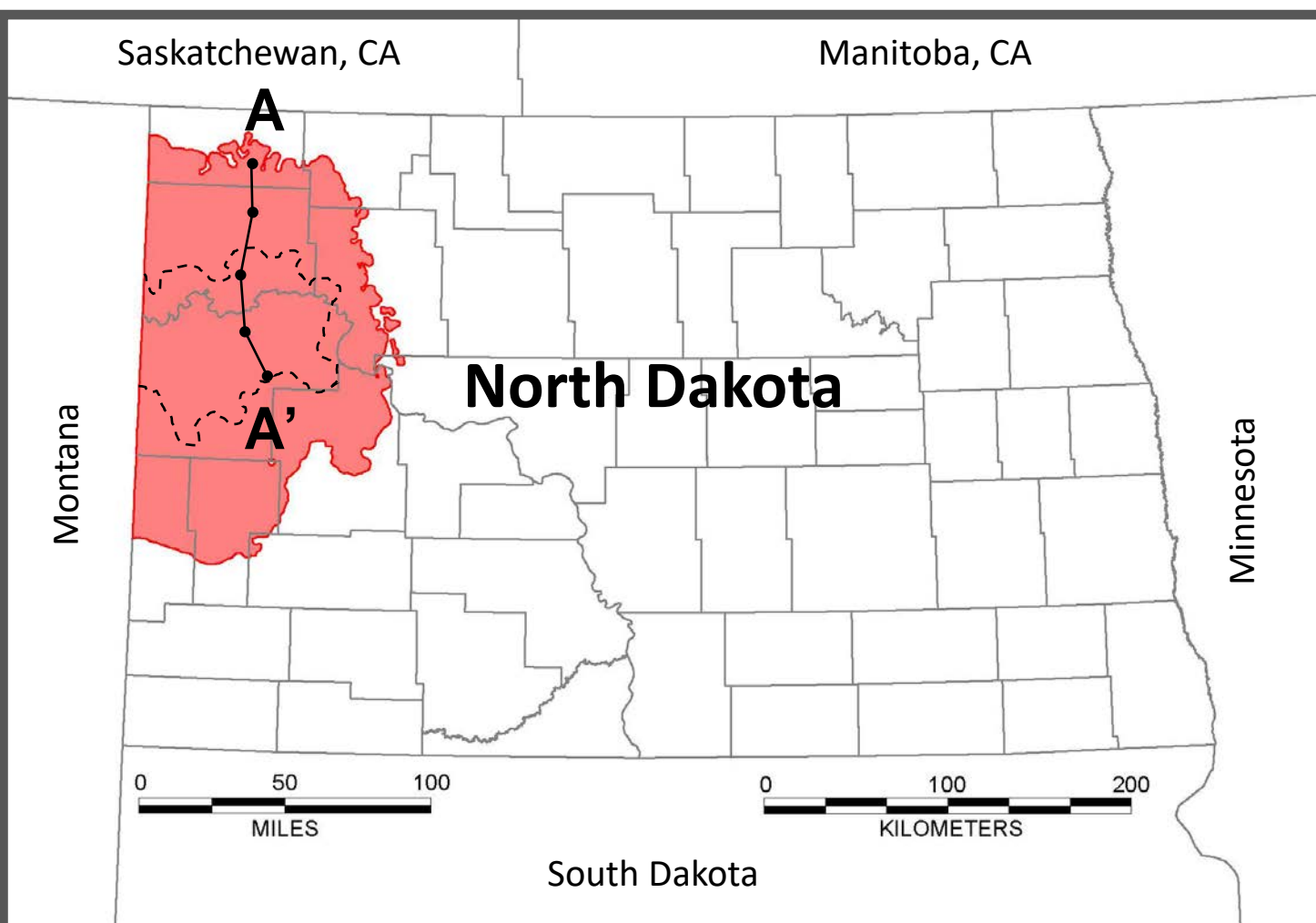
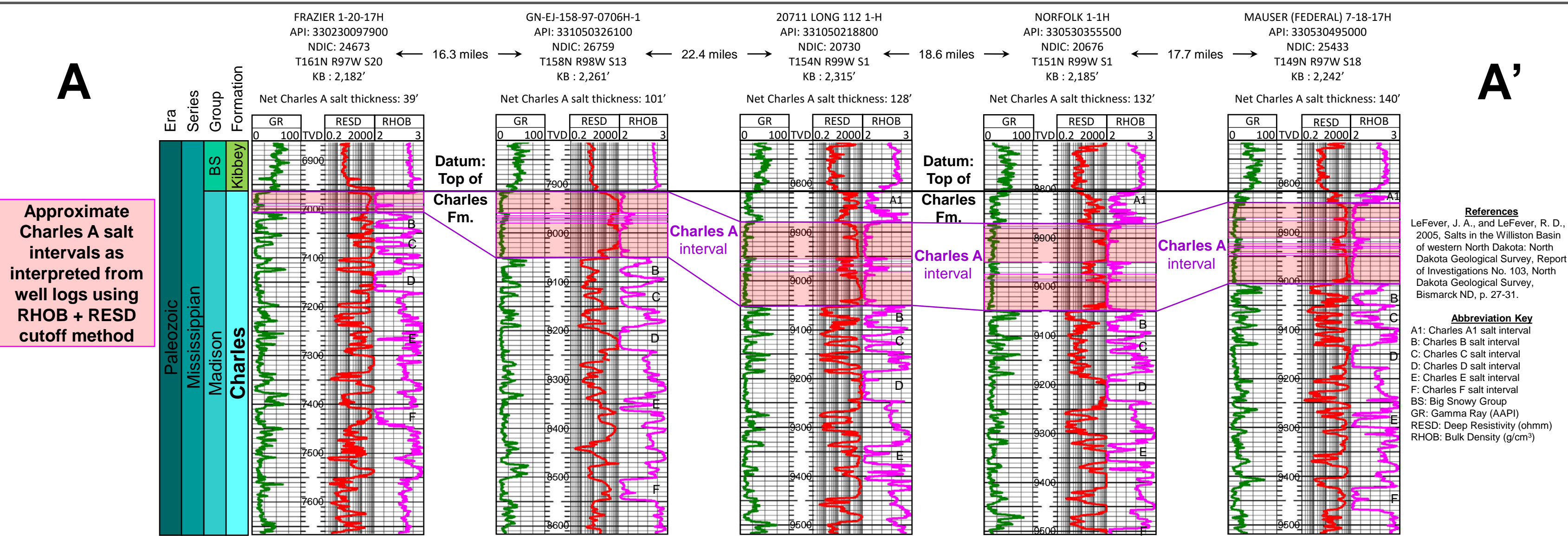


Figure 1. (LEFT) Location map showing the lateral extent of the Charles A salt in pink. The **black dashed line** represents the approximate lateral extent of the overlying Charles A1 salt (LeFever & LeFever, 2005). The black circles represent the approximate location of the corresponding wells in the stratigraphic cross-section in Figure 2 (below).

Figure 2. (BELOW) Five example well logs of the Charles A interval and surrounding strata from west-central North Dakota plotted in a stratigraphic cross-section utilizing the Charles Formation (Madison Group) top as the datum. Spanning most of the basin, these wells show similar sediment packages in the Charles Formation with variable net salt thicknesses. The Charles A salt lies at or near the top of the Charles Formation which contains alternating deposits of carbonates and evaporites. The top of the Charles A interval (**upper purple line**) is defined as the top of the uppermost salt, except where the less extensive Charles A1 salt is present and varies regionally. The Charles A1 lateral extent is represented by the black dashed line in Fig. 1 (left). The base of this interval (**lower purple line**) is defined as the base of the uppermost salt, except where the smaller Charles A1 salt is present and similarly varies regionally. Where the Charles A1 salt interval is present, the Charles A is the second uppermost salt interval in the Charles Formation. The approximate location of other Charles salt intervals are labeled in each RHOB track on the cross-section below.





Charles A Salt Thickness

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POSTED WELL DATA

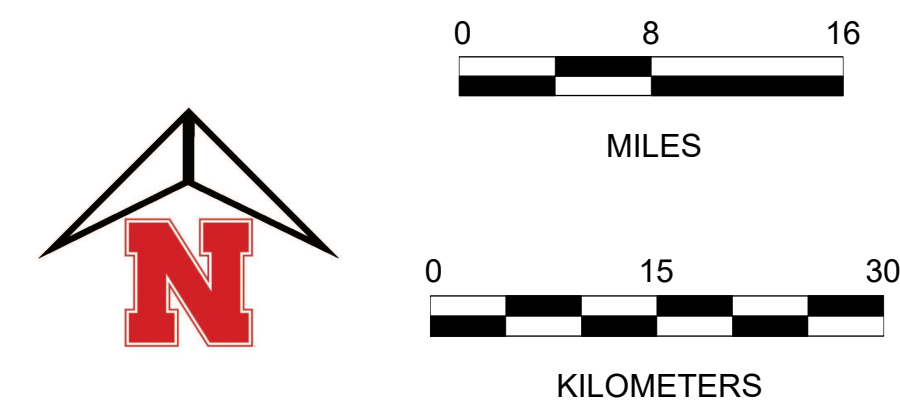
Charles A Salt Thickness (ft)

WELL SYMBOLS

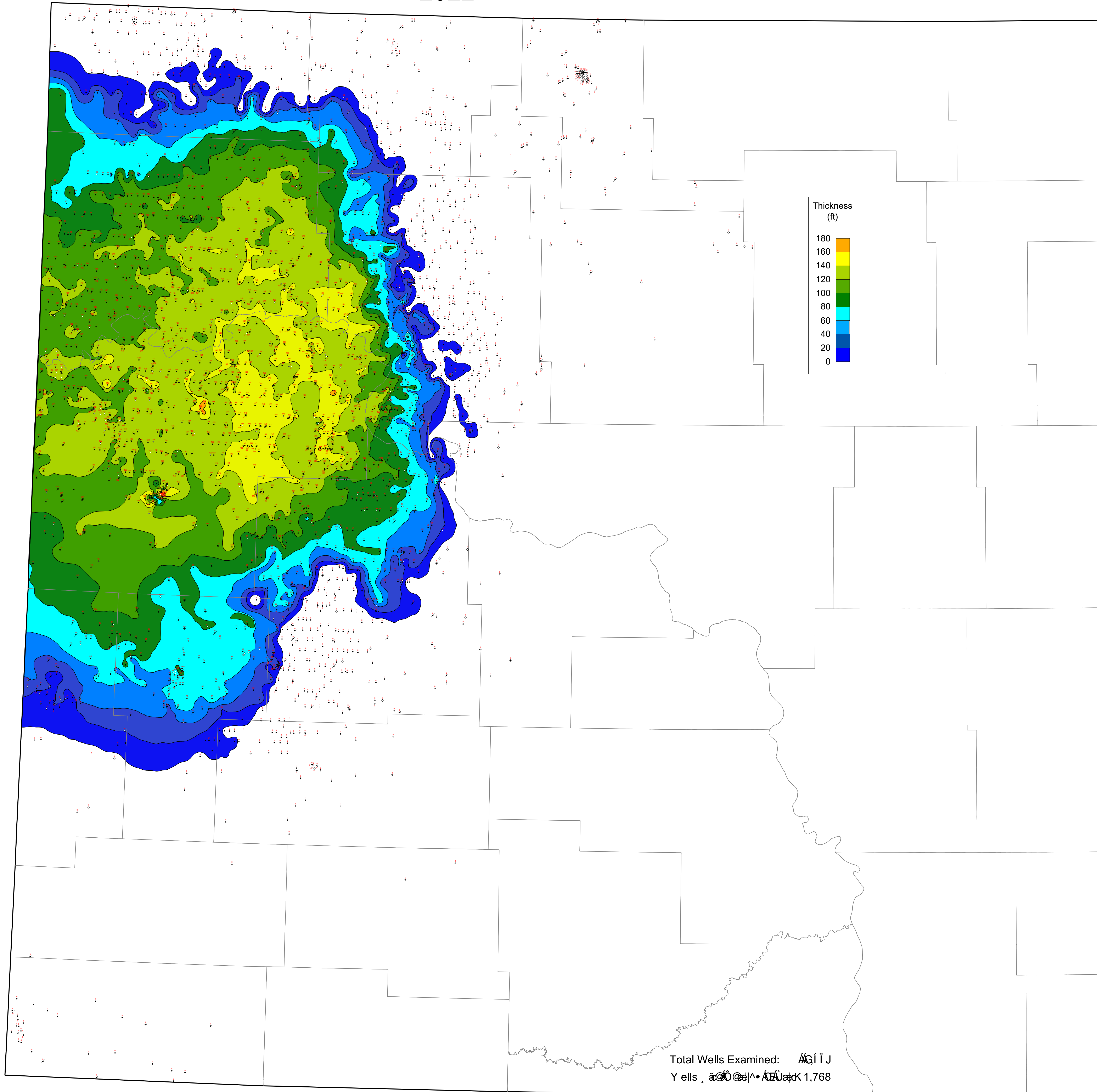
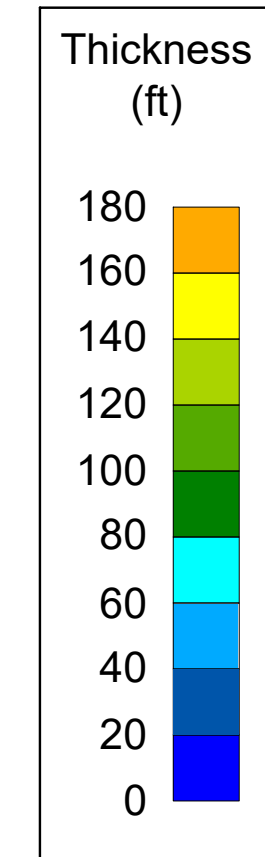
- Dry Hole, With Show of Gas
- Dry Hole, With Show of Oil & Gas
- Dry Hole, With Show of Oil
- Dry Hole
- Gas Well
- Injection Well
- Injection Well
- Junked
- Oil & Gas Well
- Oil Well
- Other (Observation, Service, Disposal)
- Plugged and Abandoned
- Plugged And Abandoned Oil and Gas Well
- Plugged & Abandoned Oil Well
- Plugged Gas Well
- Plugged Oil Well
- Shut-in Oil and Gas
- Temporarily Abandoned

MAP PROJECTION

North Dakota North 3301
North American Datum 1927 (NAD27)
XY IN US FEET
Blue Marble Projection Details
Datum: North American Datum 1927 (NAD27)
Ellipsoid: Clarke 1866
Projection: Lambert Conformal Conic (2-Parallel)
Central Meridian: -100.5000000
False Easting: 2000000.00 US Survey Feet (usft)
False Northing: 0.00 US Survey Feet (usft)
Latitude Of Origin: 47.0000000
Standard Parallel1: 47.4333333
Standard Parallel2: 48.7333333
Scale Factor At Origin: 1
EPSG: 32020



Contour Interval: 20 ft



Total Wells Examined: 1,768
Wells with Charles A Salt: 1,768



Charles A Salt Structure SSTVD

Williston Basin, North Dakota

Travis D. Stollendorf

2022

MAP DATA

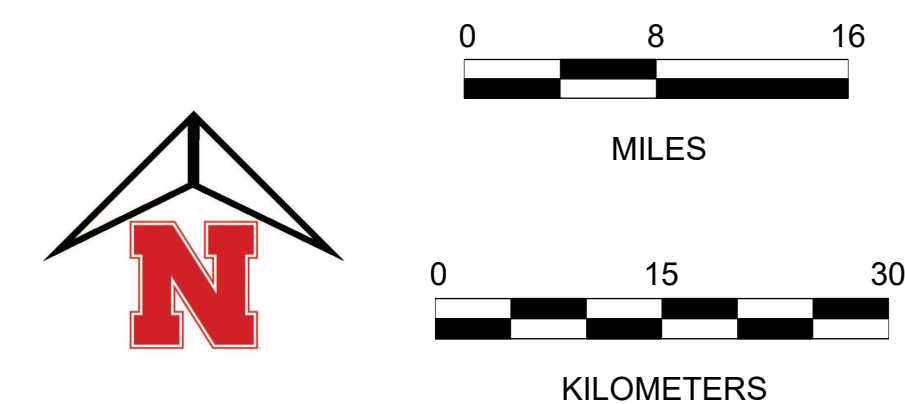
Charles A Salt structure picked on the uppermost occurrence of salt in the Charles A evaporite interval

WELL SYMBOLS

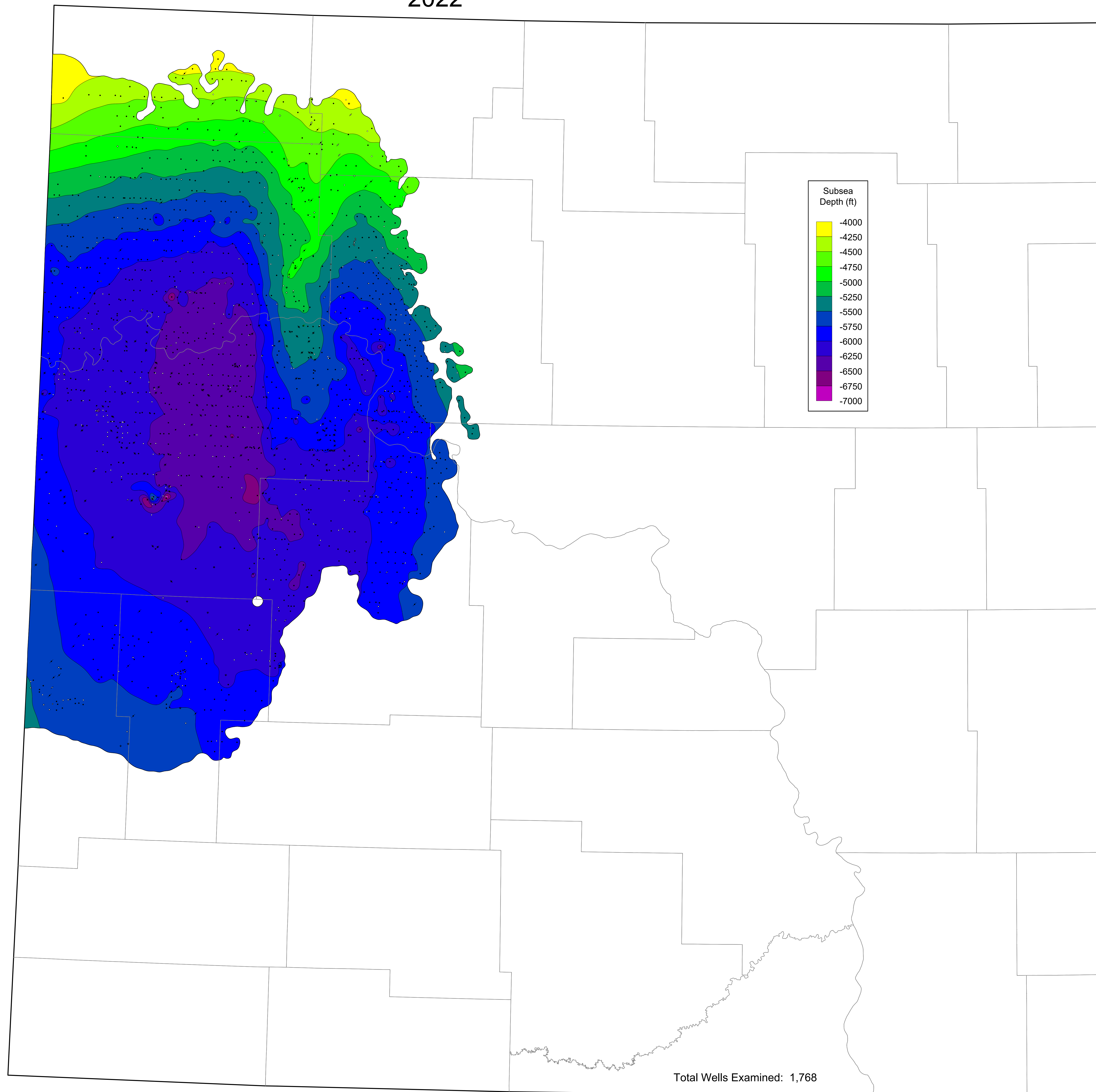
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Standard Parallel1: 47.4333333
Standard Parallel2: 48.7333333
Scale Factor At Origin: 1
EPSG: 32020



Subsea Contour Interval: 250 ft



Total Wells Examined: 1,768



Charles A Salt Structure TVD

Williston Basin, North Dakota

Travis D. Stolldorf
2022

MAP DATA

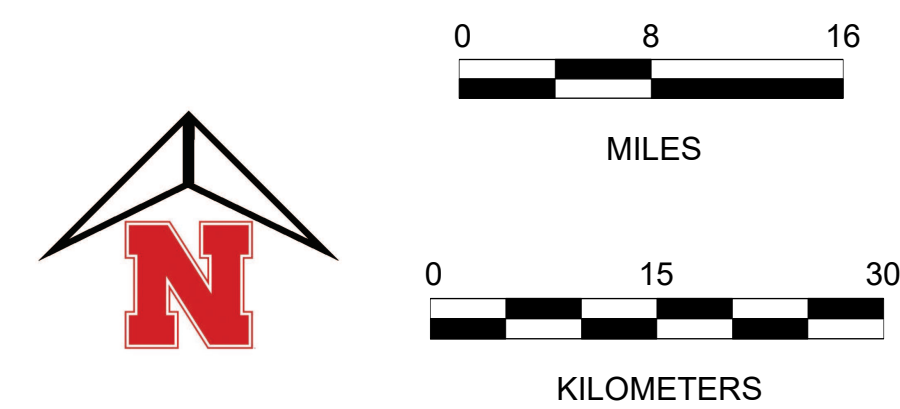
Charles A Salt structure picked on the uppermost occurrence of salt in the Charles A evaporite interval

WELL SYMBOLS

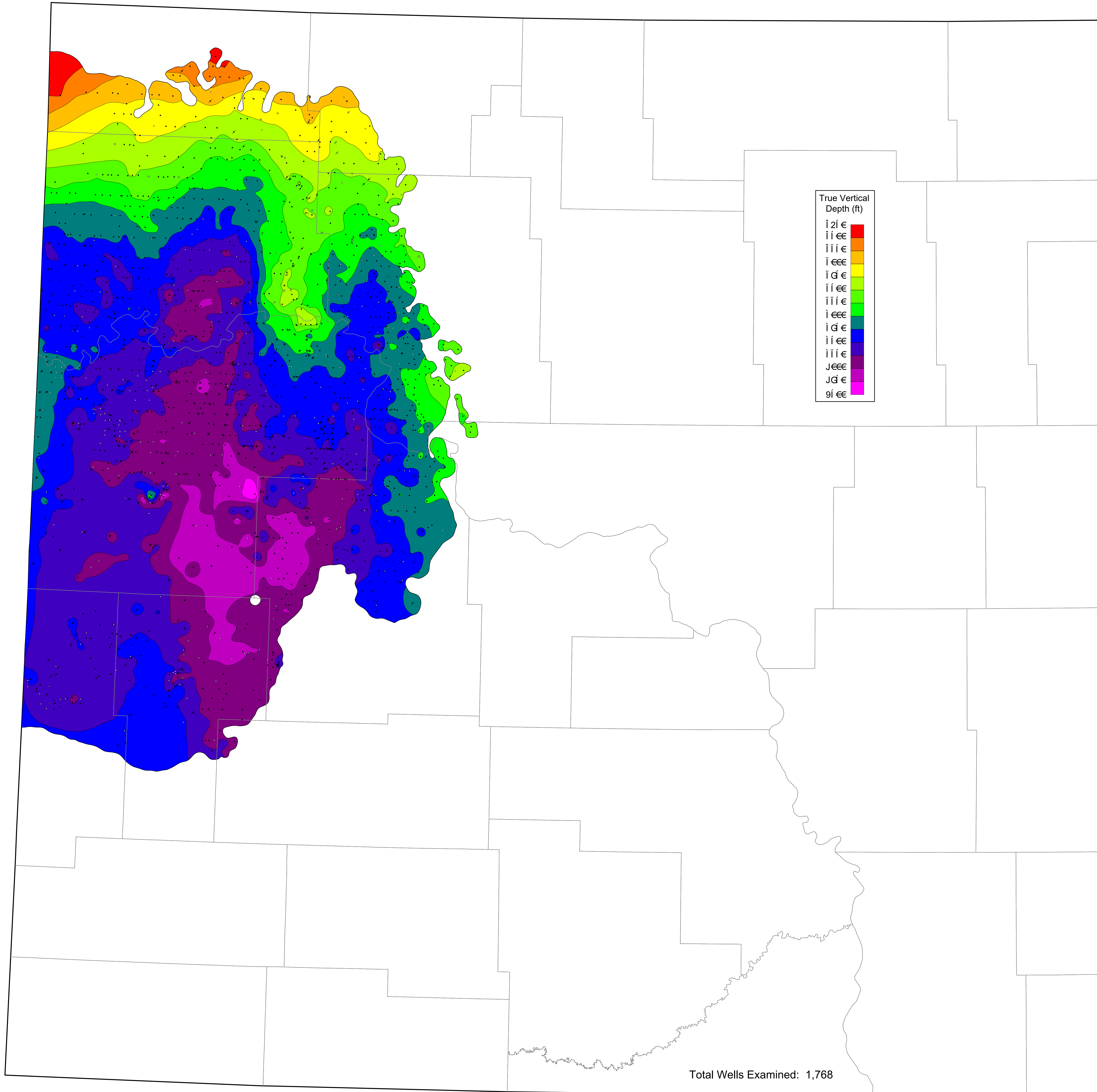
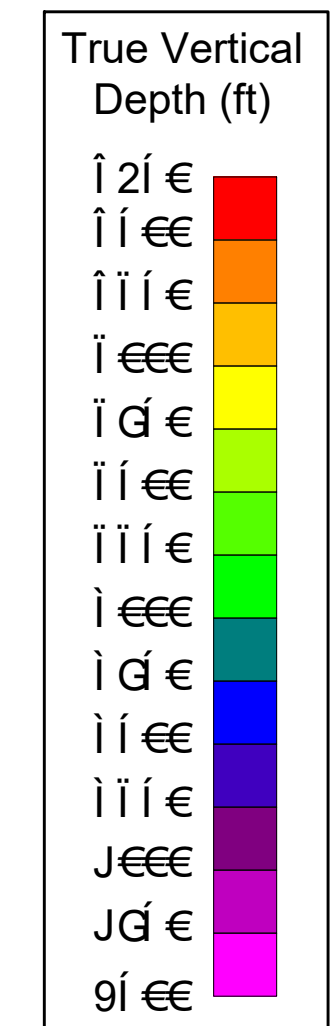
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EPSG: 32020



TVD Contour Interval: 250 ft



Total Wells Examined: 1,768