INTRODUCTION

Significant volumes (>1 million barrels) of produced water are generated daily during production operations for oil and gas in North Dakota. Most produced water is brine (sodium chloride), with very high concentrations of total dissolved solids ranging from 20,000 to 300,000 mg/L. Produced water is a byproduct of oil and gas production and contains a variety of contaminants due to the nature of the subsurface reservoirs from which they are recovered. Subsurface injection is the industry-preferred alternative for produced water disposal. Because produced water is brine, produced water disposal wells are referred to as salt water disposal wells (SWDR wells).

THE DAKOTA GROUP

Overlying the Dakota Group are several thousand feet of Cretaceous marine deposits including the Pierre Formation, a very thick, impermeable shale. The Pierre Formation unconformably overlies the Dakota Group and is an excellent confining layer that partially separates the oil and gas reservoirs from each other. The Pierre Formation also contains excellent stratigraphic layers that will commonly contain injected brines within the Dakota Group. The Pierre Formation is present throughout the Williston Basin in North Dakota and Wyoming, and most of the state. The Pierre Formation ranges in thickness from approximately 100 ft (30-35 m) in the Minot 100K sheets.

ISOPACH OF INYAN KARA FORMATION SANDSTONES

This map presents thickness contours (isopachs) of intercalated argillaceous sandstone bodies present within the Inyan Kara Formation in the Minot 100K. The map and associated cross-sections were prepared to identify favorable areas where the potential for encountering sandstone bodies for injection of produced water in present or future development wells and active injection wells is not known. The isopachs presented herein are from the North Dakota Geological Survey’s ‘North Dakota GIS’ GIS database. The GIS database is a compilation of data from various sources including the sale of data from the North Dakota Geological Survey’s North Dakota Oil and Gas Map (2016) and the USGS North Dakota GIS database (2016). The isopachs presented herein are from the GIS database and do not include geophysical interpretation of subsurface structures. Produced water injection is not allowed in the Minot 100K that is not available for interpretation and assessment of sandstone thickness and lateral continuity. Valley trends (valleys) are exposed to the most northwesterly, one is identifiable on the map; three valleys in the interface areas (dikes) through sandstone strata. These valleys, which are continuous, and have been in place and mobile since the valley stratigraphy. Therefore, valley sediments are less accurate to the level of the sandstone strata. Produced water injection is not allowed in these valleys, especially areas from certain points. Therefore, the area should be accessed and evaluated prior to mapping observations.

CROSS-SECTIONS

Cross-Section Sortet Scale: 75 inches = 200 feet

EXPLANATION

Correlation Line
Correlation Line + Observation
Correlation Marker Datum
Unconformity
Intrusive Salt Major Disposal Well
Perforated Interval

Mineral Features

cCore
acAcidized
T Tert ACTION
Interbedded Shale
Salt Stopout
Mineral Invasion
Interbedded Sandstone

Map Scale: 1:100,000

Note: All data is from the North Dakota GIS database (2016) and the USGS North Dakota GIS database (2016). The GIS database is a compilation of data from various sources including the sale of data from the North Dakota Geological Survey’s North Dakota Oil and Gas Map (2016) and the USGS North Dakota GIS database (2016).