MIDDLE DEVONIAN

Reservoir rocks from the Middle Devonian are the Winnipegosis, Prairie Salt and Dawson Bay formations (figure FP - 15. 1). These units consist of carbonate and evaporite sequences deposited on a marginal marine shelf. Consisting mostly of shallow intertidal deposits, the rocks were also deposited as pinnacal and patch reefs on slope breaks over shallow parts of the shelf (Anna, 2010). Source rocks for Middle Devonian are thought to be thin organic rich limy shale layers interbedded with limestone layers within the Winnipegosis and possibly Ashern shale. Maturity modeling has shown these rocks to be thermally mature in the deeper parts of the basin. Hydrocarbon production is concentrated on the Nesson Anticline and northeast Montana where thick, high porosity dolomites are abundant (figure FP - 15.2, 15.3 & 15.4). Oil traps are considered structural in nature. Accumulations occur where structures having full structural closure or prominent structural nosing combine with lateral and downdip porosity reduction (Anna, 2010). Middle Devonian production is relatively spase, confined to only 116 wells in the Williston Basin. Despite this, average oil production is close to 300 MBO per well, with some wells over 1 MMBO.

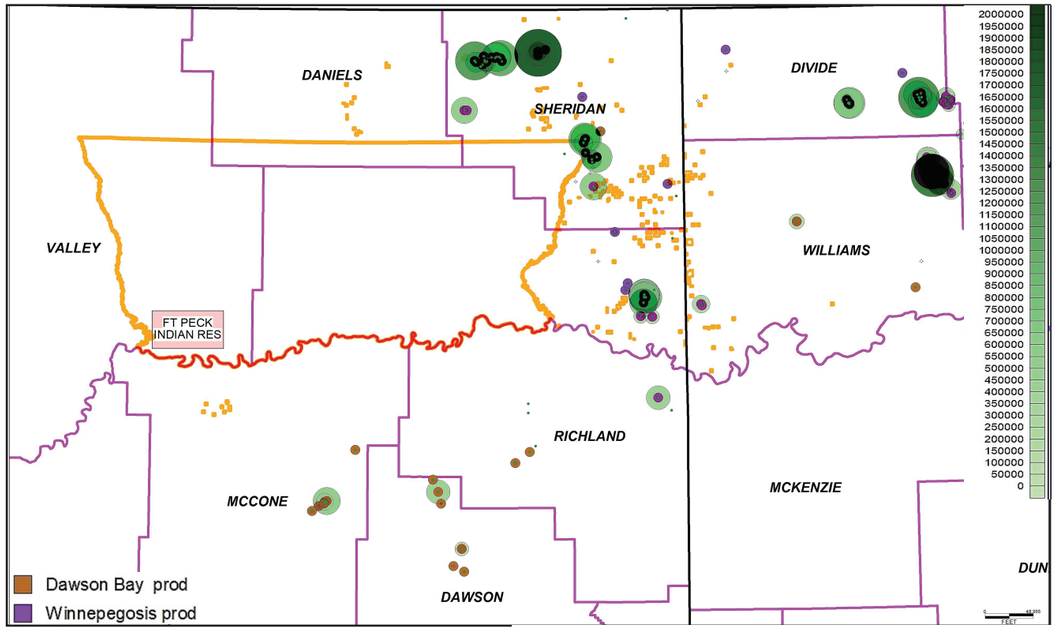


Figure FP - 15.2. Middle Devonian producing wells with oil |

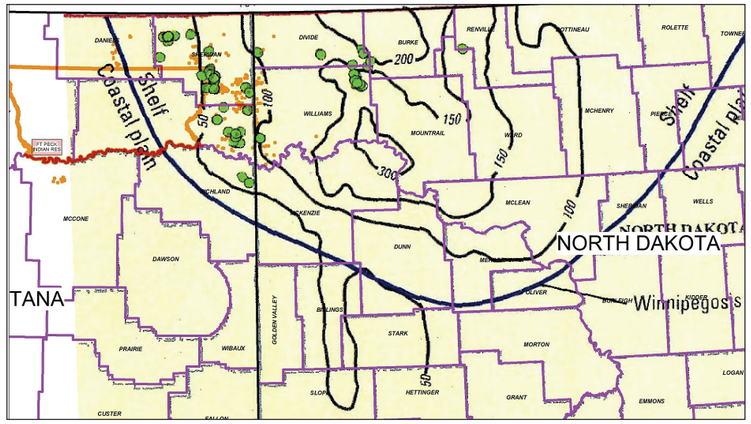


Figure FP -15.3. Winnipegosis isopach across the Williston Basin (modified from Anna, 2010).

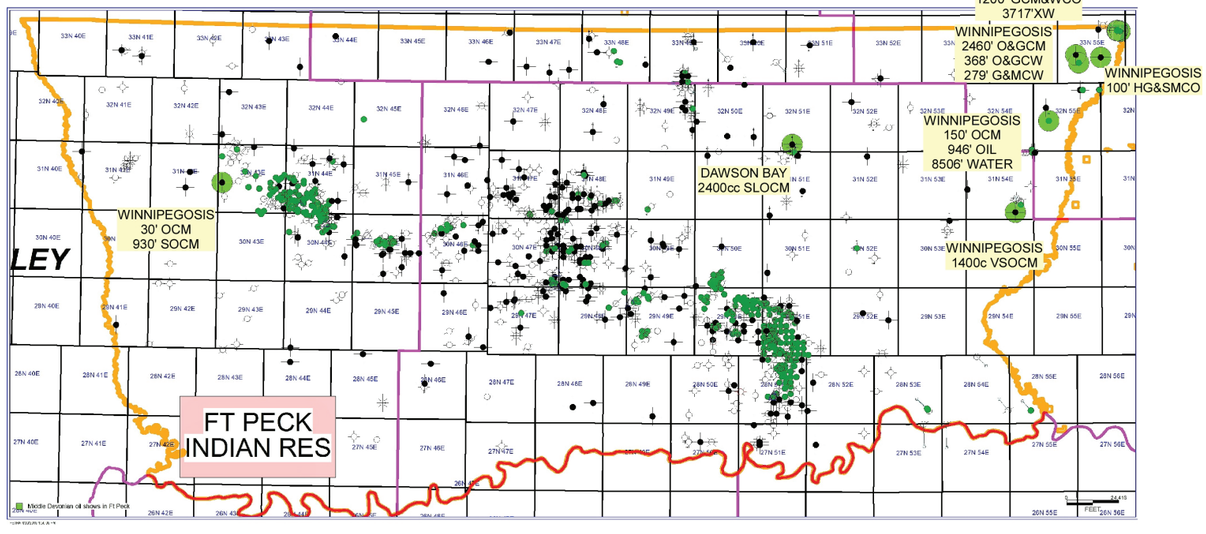


Figure FP - 15.4. Winnipegosis and Dawson Bay oil shows within Fort Peck IR from DST and production test data.

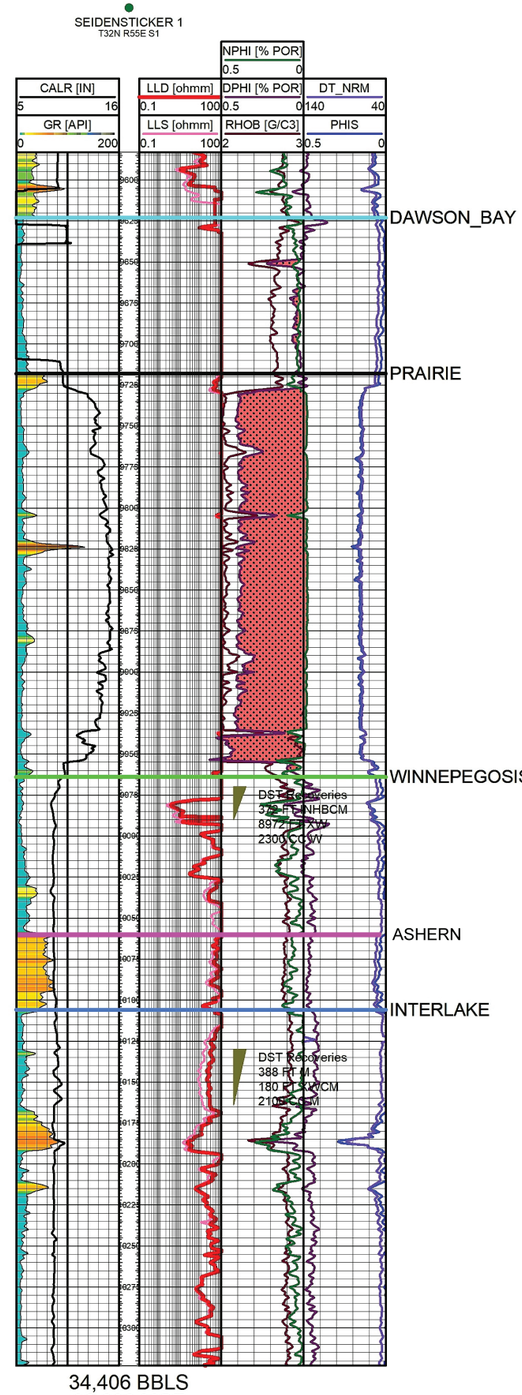


Figure FP - 15.1. Middle Devonian type log.

Red River Structure Contour Map
Reserve Field, Sheridan County, MT

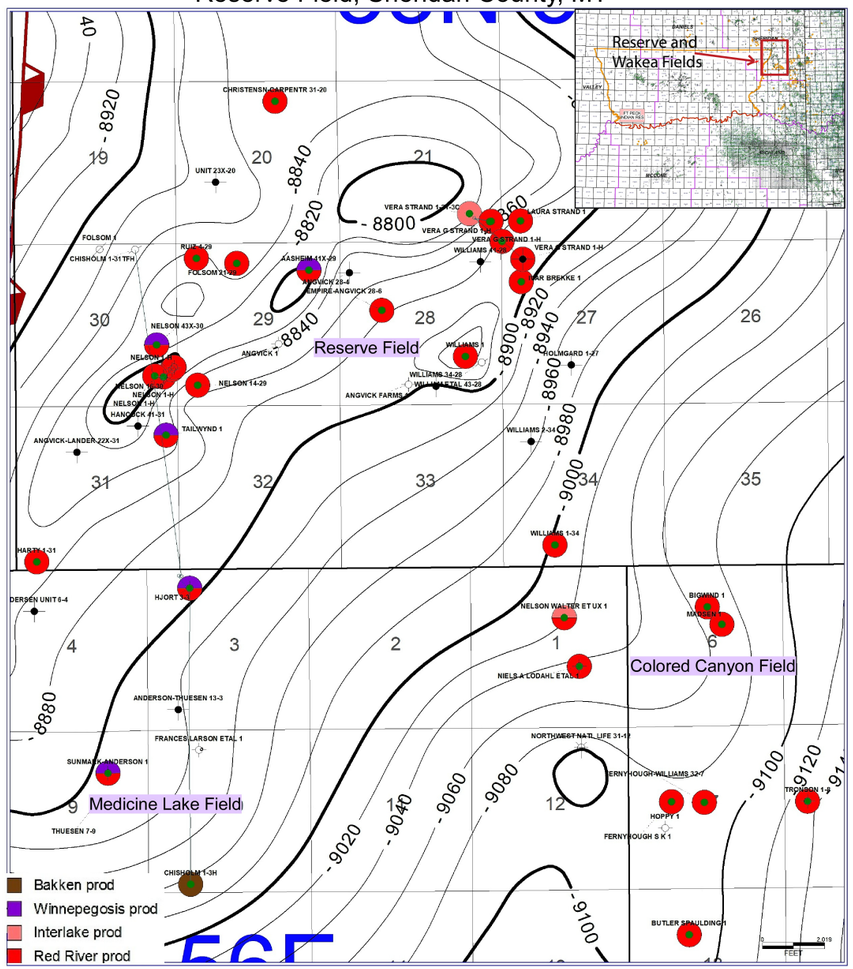


FIGURE FP-16.1. Reserve Field structure map (updated 2019).

ORDOVICIAN RED RIVER PLAY

GENERAL CHARACTERISTICS - The Red River is the second most productive formation in the Williston Basin. Reservoirs are dolomites and dolomitic limestones formed from bioclastic mounds, and tidal flat deposits.

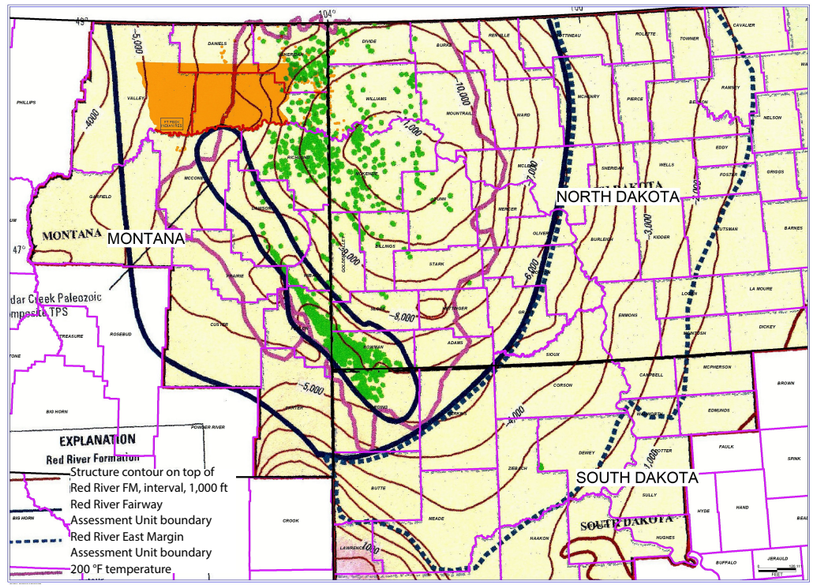
Major accumulations are found on structural noses such as Nesson and Cedar Creek Anticlines. Smaller fields are found in fold structures draped over basement fault blocks, or small, carbonate mounds (see Figures FP-16.1 & 16.3). Most of the production is on the extreme eastern side of the Fort Peck Reservation (Figure FP - 16.2).

Source rocks are thermally mature to overmature at the basin center, and pinch out on the basin flanks. Winnipeg and Red River shales are thought to be the primary source rocks. Hydrocarbon generation and migration are estimated to have begun in late Paleozoic time.

FORMATION:	Ordovician Red River Lithology: Red River "A", dense dolomite fractured on top of structure; "B" - locally continuous, fine sucrosic dolomite; "C" - isolated pods of fine sucrosic dolomite; "D" - discontinuous layers of fine to medium dolomite.
POROSITY:	variable, 6-15% porosity
OIL/GAS COLUMN:	no information
OTHER FORMATIONS WITH SHOWS:	Mississippian Ratcliffe, Mission Canyon

Analog Fields (* denotes fields lying within the Reservation)

(2018) **Reserve Field**	2,670,000 BO	10 wells
(2018) **Wakea Field**	3,320,000 BO	8 wells



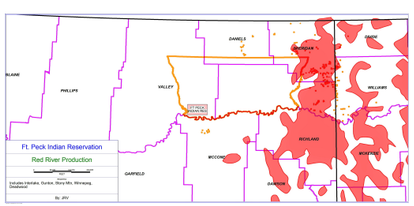
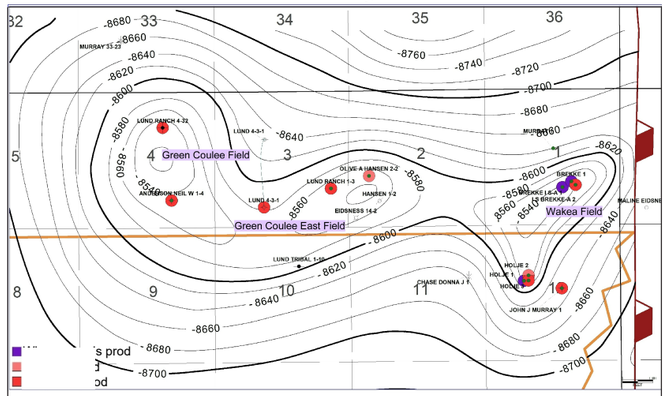


FIGURE FP-16.2. Structure of Ordovician Red River Formation within the Williston Basin and surrounding areas, including 200 F temperature boundary, Fort Peck Reservation (modified after Anna, 2003). Generalized location map of the Red River Production is shown to the left.

FORMATION:	Ordovician Red River
AVERAGE DEPTH:	10,700 ft
PERMEABILITY:	No information
AVERAGE NET PAY THICKNESS:	6 feet
OTHER INFORMATION:	Production is from Red River Winnipegosis, Interlake, Nisku Gunton and Duperow

Wakea and Green Coulee Fields
Wakia and Green Coulee Fields
Red River Structure Contour
Sheridan County, MT



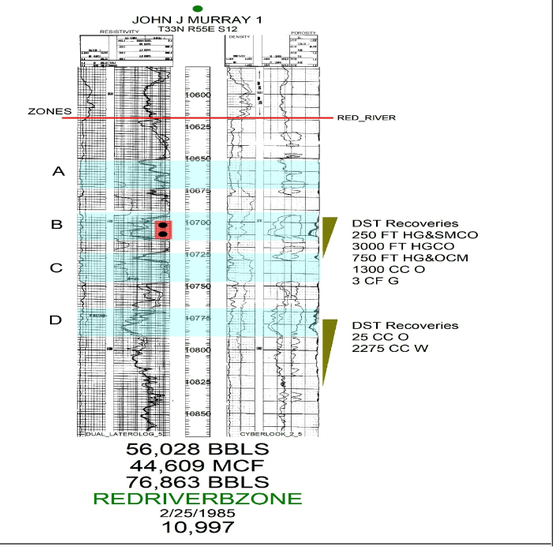


FIGURE FP-16.3. Wakea field and type log. Top of Red River is datum with a contour interval of 20' (updated 2019).

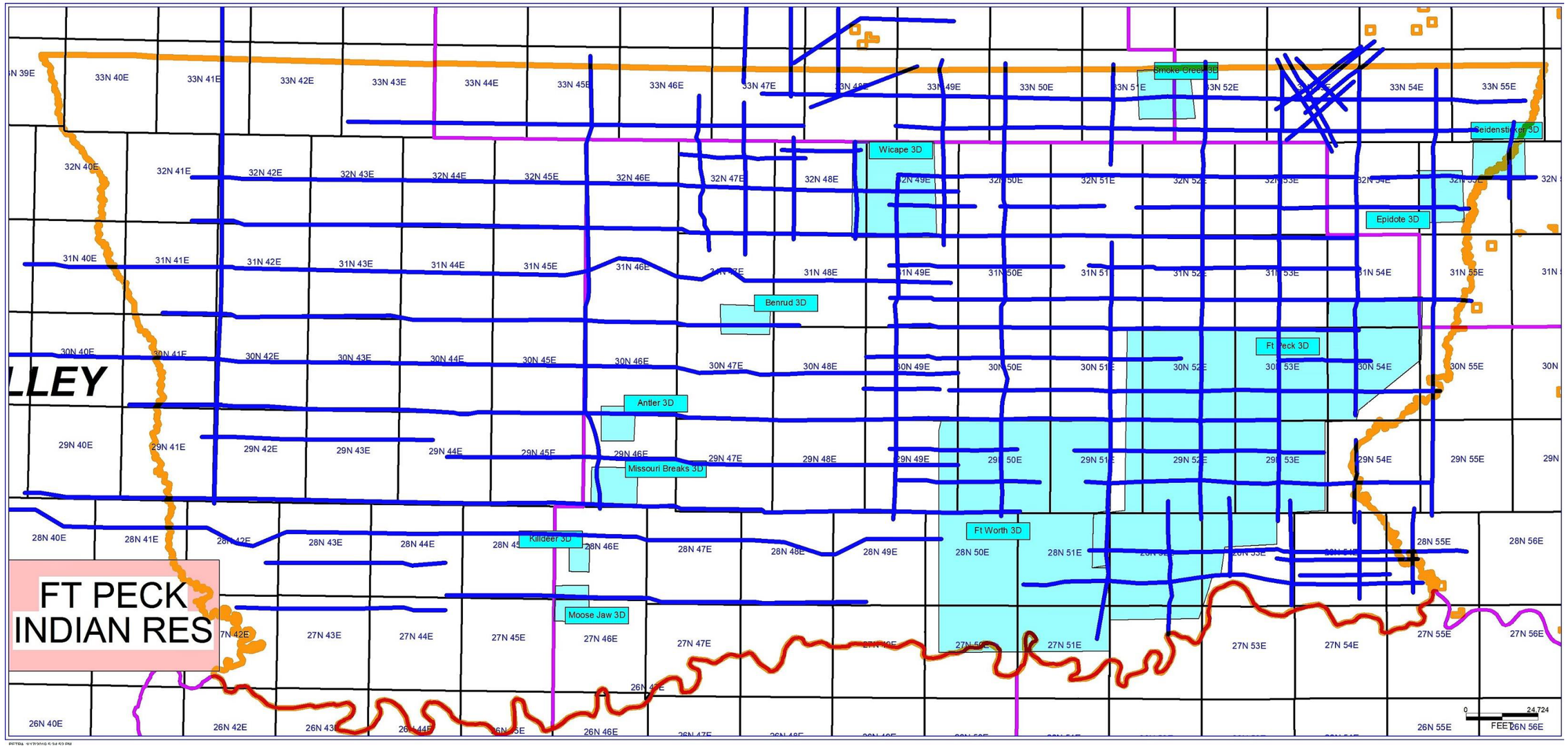


Figure FP - 17.1. Map showing 2D (blue lines) and 3D seismic (aqua rectangles) locations on the Fort Peck Reservation

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