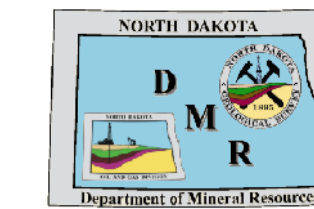
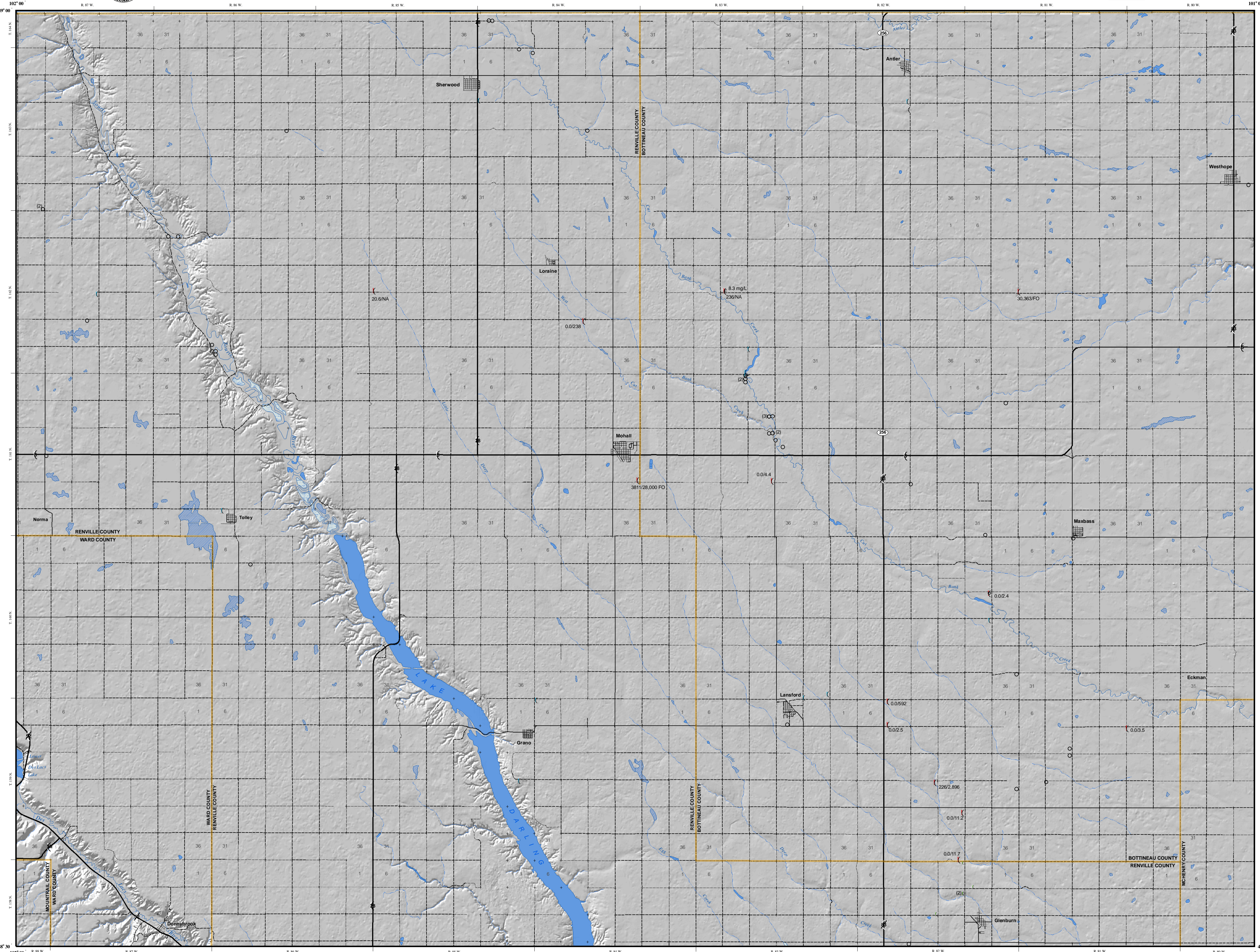


Shallow Gas Field Screening in the Mohall 100K Sheet, North Dakota



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The investigation of shallow natural gas occurrences within existing ground-water observation wells in Bottineau and Renville Counties was conducted from September 12, 2006 to September 15, 2006. A total of 110 observation well sites, consisting of historic and existing ground-water observation wells, drilled in the area for the purposes of ground-water monitoring of unconsolidated and shallow bedrock aquifers, were reviewed prior to the field component of this investigation.

75 of these observation well sites in the Mohall quadrangle were selected to be visited in the field to (1) determine the existence of the well, (2) verify its location, and (3) perform field screening for natural gas occurrences. 44 observation well sites were not found during the investigation, suggesting that these wells have either been abandoned or destroyed. Six locations were not visited. 25 well site locations were verified to have a ground-water observation well at their prescribed point and were subsequently field screened.

Each of the wells were field screened for the presence of combustible gasses using a portable flame-ionization detector (FID) calibrated to methane (101 ppm low-span or 10,000 ppm high-span) in air. The FID was used solely for field screening on all wells. Instrument response was collected at the top of casing (TOC) and just above the groundwater/air interface (GWI), after the collection of a water level reading within the well using an electric well tape.

Of the existing wells, 13 returned positive FID responses, ranging from 2.4 to 30,362 ppm as methane. One well (162-83-15CCC) was found to be flowing at less than one gallon per minute at the top of casing (TOC) and was bubbling gas continuously at the top of the well (Figure 1). A ground-water sample was collected from this well and analyzed for dissolved methane. Laboratory analysis confirmed the presence of methane at 8.3 mg/L. A second well (162-81-CCC) bubbled gas at the groundwater/air interface within the observation well, which was audible at the TOC.

Occurrence of the majority of FID responses are constrained to areas in the western part of Bottineau County and eastern part of Renville County where historic (ca. 1900) shallow natural gas production has occurred. Stock wells and individual private or municipal water supply wells were not considered as a part of this investigation. Adjacent areas in McHenry and Ward Counties shown on this map were also not included.

FID field screening is not a stand-alone analytical tool. It must be used in conjunction with additional analytical methods and procedures. A positive FID instrument response indicates that the presence of methane is highly likely at the well since the instrument is selectively sensitive to methane and is calibrated specifically to a predetermined concentration of methane in air. However, excessive moisture (i.e. humidity) and low oxygen levels or high values of carbon dioxide can influence FID response. A confirmatory gas analysis is required to determine and quantify the absolute presence and concentration of methane and other hydrocarbons that may be present in conjunction with FID field screening results.

The reconnaissance level field screening results presented here are intended to aid in the selection of future candidate observation well locations and/or areas to conduct additional sampling and analysis and potentially focus future field investigative efforts.



Figure 1. View of the TOC of observation well 162-83-15CCC showing methane gas bubbles rising through the water column at the top of the well. Diameter of PVC observation well containing gas bubbles is 2-in.

Explanation

Geologic Symbols

- () 2262,896 (TOC/GWI) Existing observation well with a positive numerical FID instrument response in parts per million (ppm) as methane, at the top of casing (TOC) and/or the ground-water/air interface (GWI).
- ⊕ Flowing Well
- 8.3mg/L Dissolved concentration of methane in groundwater. Reported in parts per million (mg/L).
- FO FID Instrument Flame Out
- NA Not Analyzed
- () Existing observation well, no FID response at TOC and/or the GWI.
- () Well sites not visited during this investigation.
- Historical observation well location. No existing well at well site location visited. Well presumed abandoned or destroyed.
- ⊗ Nested wells; locations not separable at this location.
- (3) Indicates number of wells drilled at same coordinates.

Other Features

- Water
- Water - Intermittent
- Marsh
- River/Stream - Perennial
- Stream - Intermittent
- County Boundary
- Section Corners
- Federal Highway
- State Highway
- Paved Road
- Unpaved Road

Scale 1:100,000

Miles 0 1 2 3 4
Kilometers 0 2 4 6 8

Mercator Projection 1983 North American Datum
Standard parallel 48° 30' Central meridian 101° 30'
USGS NED Shaded Relief - Vertical Exaggeration 9x

Mohall 100K Sheet, North Dakota

12° 30' 1982 Magnetic North Declination at Center of Sheet

Kenmare	Mohall	Bottineau
Stanley	Minot	Valva
Parshall	Garrison	Drake

Adjoining 100K Maps

Cartographic Compilation: Elroy L. Kosham