

BASAL CAMBRIAN STATIC GEOLOGICAL MODEL COMPLETED

Plains CO₂ Reduction (PCOR) Partnership Phase III Task 16 – Milestone M34

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BASAL CAMBRIAN STATIC GEOLOGICAL MODEL COMPLETED

GEOLOGICAL MODEL

Plains CO₂ Reduction (PCOR) Partnership followup to the work performed to establish the baseline geological characterization of the Basal Cambrian saline system in the greater Williston Basin area of North Dakota, South Dakota, and Montana was the development of a 2-D geologic model. The completed 2-D model incorporates the geologic data collected in the baseline characterization effort and distributes the various rock properties throughout the study region through geostatistical methods. Data regarding depth, thickness, and porosity were distilled to produce components needed to compute the CO₂ storage resource of this saline system following the E_{saline} formula detailed by the U.S. Department of Energy methodology.

$$\text{CO}_2 \text{ Volume} = \text{Total Formation Thickness} \times \text{Total Porosity} \times \text{CO}_2 \text{ Density} \times \text{Cell Area} \\ (\text{Total Formation Area}) \times \text{Storage Efficiency Coefficient (storage efficiency coefficient of 2.4\% was used)} \\ \text{[Eq. 1]}$$

A significant effort was put forth to match the work done on the U.S. side of the study region with the data sets generated by Alberta Innovates – Technology Futures (AITF) for the Canadian side. All necessary gridded interpolations on the U.S. side were combined with the Canadian grids by what amounts to a diffusive aggregation method near the U.S.–Canadian border to form a seamless CO₂ storage volume for the entire Basal Cambrian study region. This aggregation method involved feathering the Canadian data near the border and joining them to the data on the U.S. side. This allowed the geostatistical processing functions to interpolate across the border and avoid the development of edge effect at the border. Once the calculation on the U.S. side was completed, it was clipped out and joined to the existing Canadian portion to form the seamless map shown in Figure 1. This novel approach worked well for joining the two data sets, but the development of a unified model that can avoid this work-around would be preferred. The preferred method will be employed during the construction of the 3-D geologic model.

The final gridded values for storage were built on a grid size of 7500', and the map projection was changed to a U.S. Geological Survey-based equal area equal azimuth projection. The total storage resource for the region using a storage efficiency coefficient of 2.4% was determined to be 147 Gt. Roughly 60% (92 Gt) of the storage resource is in Canada with the remaining 40% (55 Gt) found on the U.S. side of the study region.

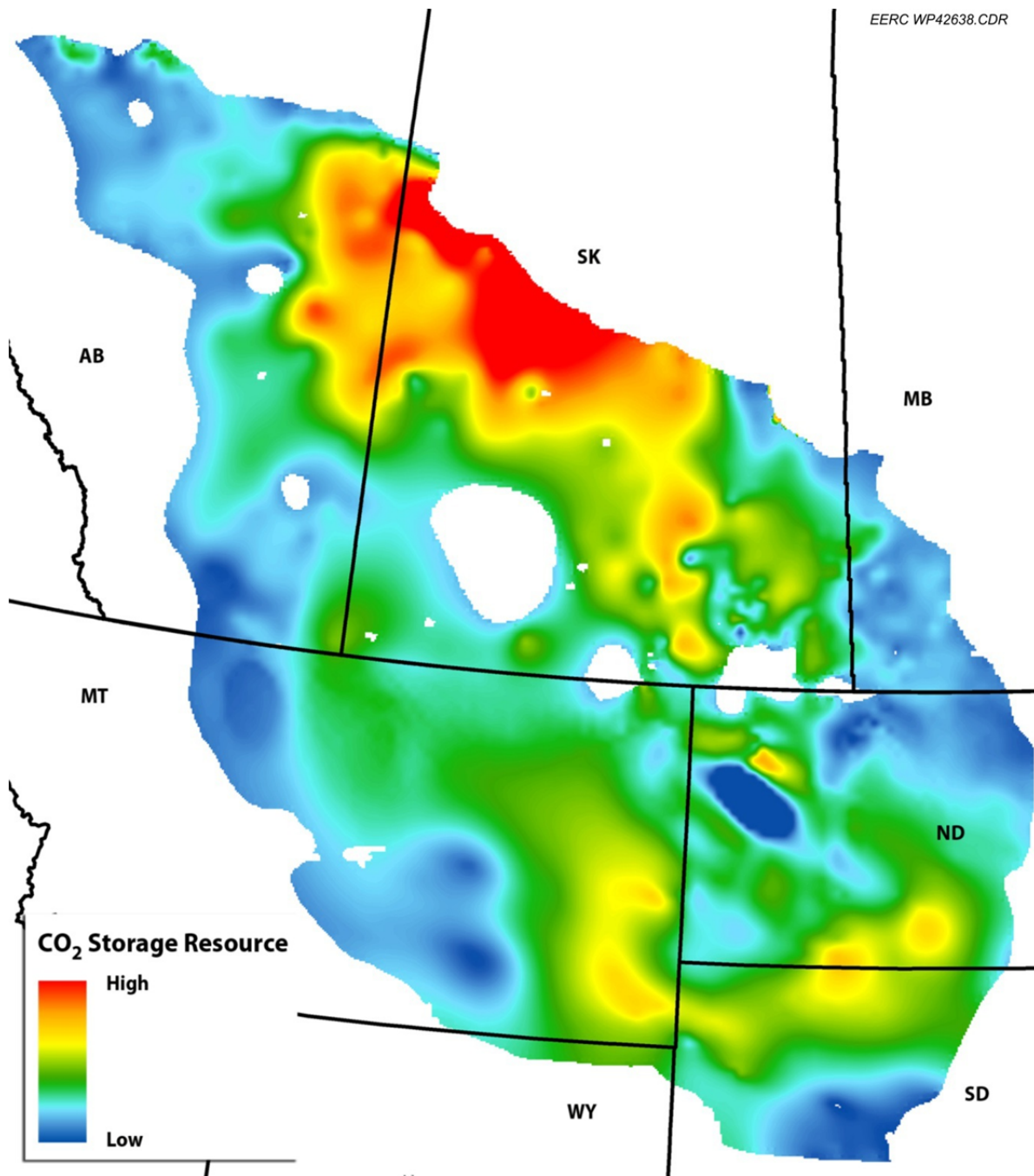


Figure 1. CO₂ storage resource map of the Basal Cambrian saline aquifer.