Evaluation of Geologic Carbon Storage Resource Estimates (SREs) of Cambrian Ordovician Units within the CarbonSAFE Prefeasibility Study Region Subtasks 4.2 and 4.3 –
Topical Report

March 1, 2017 through May 30, 2019

Cristian R. Medina[a], Kevin M. Ellett[a], and John A. Rupp[b]

[b]*Indiana Geological and Water Survey, Indiana University, 420 N. Walnut Avenue, Bloomington, IN 47404*

[b]*School of Public and Environmental Affairs Indiana University, 1315 E. Tenth Street, Bloomington, IN 47405*

Report Number: DOE/ FE0029445-7
U.S. DOE Cooperative Agreement Number: DE-FE0029445
CARBONSAFE ILLINOIS EAST SUB-BASIN

Principal Investigator: Dr. Hannes Leetaru
Business Contact: Illinois State Geological Survey
615 E. Peabody Drive
Champaign, IL 61820-7406

Executive Summary

This report by the Indiana Geological & Water Survey (IGWS) assessed the storage resource estimate (SRE) of Cambrian-Ordovician stratigraphic units located within the CarbonSAFE prefeasibility area within the Illinois Basin. A comprehensive data set of wireline logs and petrophysical information was used. These data include core analysis for porosity and permeability, and existing well data including location and stratigraphic information.

This report includes storage resource estimates (SREs) for four potential storage reservoirs (Upper Ordovician Trenton Limestone/Black River Group, Middle Ordovician St. Peter Sandstone, Lower Ordovician and Upper Cambrian Knox Supergroup, including a separate assessment for the lower Knox Potosi Dolomite.

The resultant SREs volumes are displayed using georeferenced maps and boxplots. The latter allow for comparing data statistics (mean values and variability) between five methods employed for the SRE calculations. Differences observed in SRE results from the five methods are mainly attributable to differences in the data used for porosity in each method. ArcMap 10.5.1 software was used to portray SREs to help visualize spatial variance of estimates for each methodology, and more importantly, to highlight those areas having the greatest total storage potential estimates.

Table of Contents

1. Introduction

In unconfined storage units, after the CO_2 is injected, a portion of the CO_2 will migrate to the highest portion of the saline formation where it accumulates against the cap rock, which prevents further vertical movement (Bentham and Kirby, 2005). At that point, the injected CO_2 then will migrate laterally, following the normal hydrodynamic flow regime of the region (usually towards shallower areas). However, it must be emphasized that flow velocities in deep geologic systems occur at rates measured in feet per hundreds or thousands of years.

Commercial sequestration in saline formations has been successful in the Sleipner field of Norway, and the U.S. Department of Energy is involved in a small-scale demonstration project in the Oligocene Frio Formation of Texas (Hovorka et al., 2001). Several testing and pilot studies took place in the United States during Phase II of the Regional Carbon Sequestration Partnerships (U.S. Department of Energy, 2004, 2005).

The U.S. Department of Energy has identified several categories of geologic reservoirs for potential CO_2 sequestration (U.S. Department of Energy, 1999, 2004, 2005). Of these categories, four are considered important for the CarbonSAFE prefeasibility area of study: (1) deep saline formations, (2) oil and gas fields, (3) unmineable coal beds, and (4) organic-rich (carbonaceous) shales.

The Carbon Storage Assurance and Facility Enterprise (CarbonSAFE) is a DOE-led effort to develop an integrated CCS storage complex constructed and permitted for operation in 2025. The regional characterization work conducted by the Indiana Geological & Water Survey (IGWS) consisted of the calculation of Storage Resource Estimates (SREs) for Cambrian-Ordovician reservoirs using five methodologies, which are explained in more details in the following chapters of this report: (1) SREs using a fixed value of porosity; (2) using an average porosity (per well, per unit) from wireline-derived porosity; (3) using an average porosity for each unit, for the entire region, from wireline-derived porosity; (4) a depth-dependent porosity model (St. Peter and Mt. Simon Sandstone only); and (5) SREs using National Energy Technology Laboratory's CO_2 Storage prospeCtive Resource Estimation Excel aNalysis (CO_2-SCREEN). All methods used the same values for thickness for each unit. However, the areal extent of each assessment was limited by the data available for each method.

2. Study Area--Illinois Basin

The study area includes the southeastern portion of the Illinois Basin and includes portions of the states of Illinois and Indiana (Figure 2.1). The subsurface geology of this region can be described as a thick sequence of relatively undeformed Paleozoic rocks lying unconformable on top of Precambrian basement.

The subsurface data were interpreted to portray the general structural and thickness configurations of these three rock sequences. Thickness and structure maps are provided for the following horizons (in descending stratigraphic order): Maquoketa Group, Trenton/Black River equivalents, St. Peter Sandstone, and Knox Supergroup (and Lower Knox Potosi Dolomite).

This report provides a regional assessment of the potential for geologic carbon sequestration in the Cambrian-Ordovician sequence located within the prefeasibility area within the Illinois Basin, consisting of the calculation of the Storage Resource Estimates (SREs) using a series of methodologies. The present work will add to the existing literature of storage capacity estimation performed in other saline aquifers (Medina et al., 2011; Medina and Rupp, 2012; Ellett et al., 2013; Greb et al., 2012; Goodman et al., 2011, 2016; Sanguinito et al., 2017, 2018). Specifically, this investigation builds upon preliminary studies of the storage resource potential in the Illinois Basin (Greb et al., 2012; Harris et al., 2014; Barnes et al., 2017).

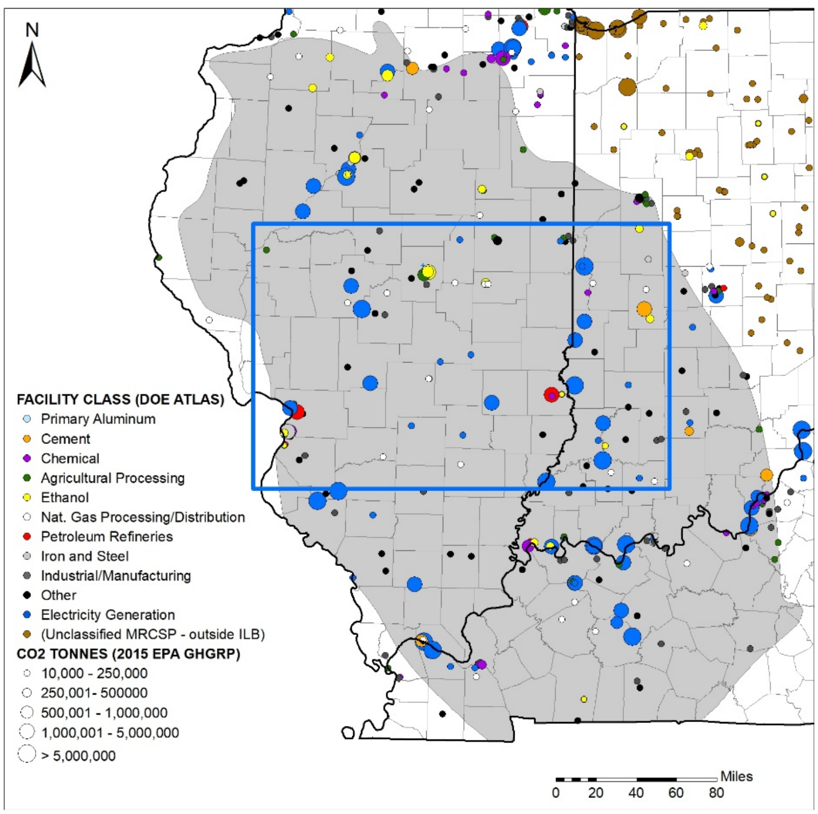


Figure 2.1. Map of the study area indicating CO_2 sources sorted and labeled based on sector and magnitude of emission. Blue rectangle indicates the prefeasibility area.

3. Assessment of Storage for Ordovician-Cambrian Units

The evaluation of the Paleozoic stratigraphy in this study focused on five intervals as reservoirs: (1) Upper Ordovician carbonates of the Trenton/Galena Limestone and Black River/Platteville Group. This interval has not been identified as a potential reservoir target (Ellett et al., 2013), but due to its stratigraphic position, we will assess its potential for storage as it may have local reservoirs; (2) Upper to Middle Ordovician of the St. Peter Sandstone, which is a potential CO_2 storage reservoir with good porosity in some areas; (3) Upper Cambrian Knox Supergroup, which is the thickest of the five intervals assessed. Dolostones of the Knox Supergroup and equivalents are regionally extensive and have storage reservoir potential; (4) Upper Cambrian Potosi Dolomite, which includes the lower portions of the Knox Supergroup; and (5) Upper Cambrian Mount Simon Sandstone (Figure 3.1).

We propose a quantification of the SREs in five units using different assumptions and values of porosity depending on the sources of data information for porosity. This methodological approach will result in different values of SREs at each well location. This analysis and assessment provide a preliminary evaluation of sites and regions with higher potential for geologic carbon sequestration. We provide these maps so managers, policy makers, and/or drillers can have a preliminary idea of the storage resources available in different areas across the CarbonSAFE prefeasibility region before more detailed reservoir characterization takes place.

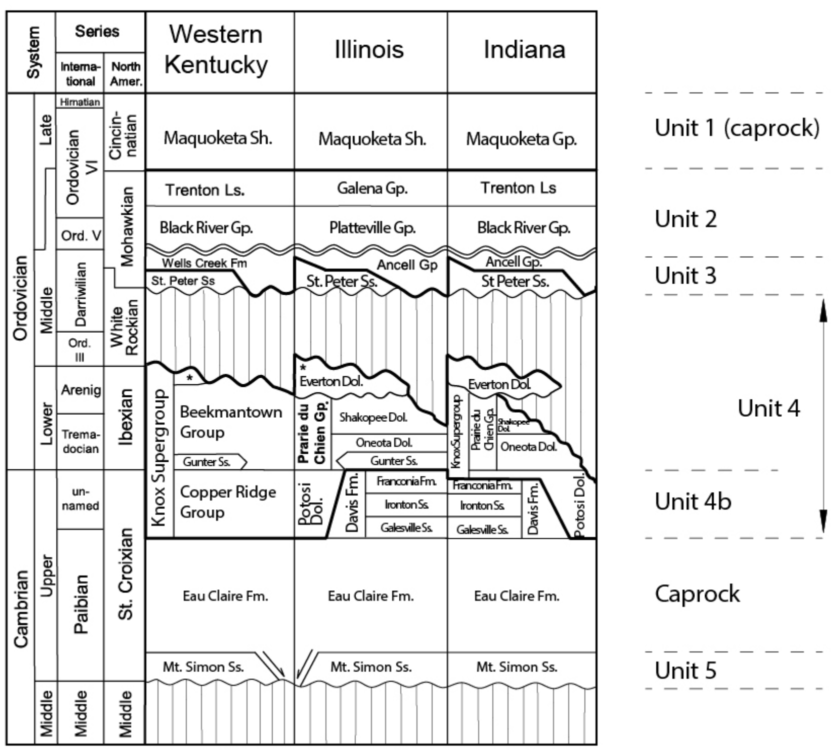


Figure 3.1. Stratigraphic correlation chart for the main units under assessment in the CarbonSAFE prefeasibility region. The Eau Claire Formation has not been included in this assessment. However, the reader can read Lahann et al., 2014 for results about the sealing capacity of this unit.

4. Methodology

The standard DOE methodology for calculation of SRE is initially utilized to calculate the volumes of CO_2 that can be stored in the reservoir units under assessment. This method uses a simple multiplication of the area, thickness, porosity and an efficiency factor to generate a volumetric value (e.g., Goodman et al., 2011). Although this method provides a reasonable SRE, other methods have also been developed for SRE calculations. For this assessment, we decided to use multiple methods and compare the results of those methods. In addition to the standard method, a hierarchical set of other methods is used in an effort to evaluate resource variability and possible identify sources of uncertainty and therefore improve the accuracy of the volumetric-based estimates. All methods use the extent, thickness, and porosity of the formation. How porosity is calculated for each method, however, varies. In many cases where SREs are calculated, the area of interest or the projected area to which the assessed unit extends is required to estimate storage resources (U.S. DOE, 2015). However, in this study, we report SREs in units of mass per areal unit (i.e., MMTons/km^2). This approach eliminates the uncertainty associated with the lateral distribution and presence of any given unit, but allows the users to utilize information from other published studies concerning lateral displacement and plume distribution from modeling and flooding experiments.

Structure depth and isopach maps of the units analyzed (Appendix 1) were generated using data managed in Petra® Geological Interpretation Software and interpolation capabilities available in ArcMap (v. 10.5.1) Information on porosity from geophysical well logs has been collected from multiple states from the CarbonSAFE-prefeasibility region.

4.1. Data Compilation Efforts

Stratigraphic tops, porosity data, Shapefiles, and geophysical logs that represent the stratigraphic units under study were compiled from multiple states within the CarbonSAFE-prefeasibility region. These data were input into Petra® software for further processing and analysis. The challenges associated with data compilation from multiple sources are (1) data quality, in particular, of those older vintage wireline logs, and (2) correlation of stratigraphic units across state boundaries. To properly estimate porosity from wireline logs such as neutron (NPHI), sonic (DT), or density (RHOB), an extensive effort of quality assurance and quality control (QA/QC) was undertaken. Those wells with anomalous behavior, or with evident poor quality, were not included in the analysis. Stratigraphic tops were carefully checked to ensure consistency throughout the region.

4.2. Storage Capacity Estimates for Saline Aquifers

Five methods were employed to generate the storage resource estimates presented in this report. The rationale for using multiple methods is that differences in data availability and density provide opportunities for different types of estimates. If methods are sequentially attempted based on available data, then a hierarchy of results can be estimated, and assessed for statistical accuracy and robustness. Different methods may be more accurate for different types of data and units.

The volumetric calculations used throughout this study are based on the DOE/NETL method described by Goodman et al. (2011), which is considered the standard method for storage resource calculations in the US by the Department of Energy, with nation-wide results reported on a biennial basis in the Carbon Utilization and Storage Atlas (U.S. DOE, 2015). The Storage Resource Estimate (SRE) following the standard method uses the general expression:

$$SRE_{CO_2} = Area * Thickness * Porosity * Density_{CO_2} * E_{saline} \quad [1]$$

where E_{saline} is the efficiency factor applied to the theoretical maximum volume in an effort to determine what fraction of the pore space can effectively store CO_2 (U.S. DOE, 2015).

Appendix B in The Carbon Sequestration Atlas of the United States and Canada introduced a discussion of these storage efficiency factors and their use in making regional storage capacity calculations and suggests a range of values between 0.4%-8.2% (E=0.004-0.8) (Appendix 2).

Rearranging equation [1] and applying the proper conversion factors, we obtain:

$$SRE = \rho_{CO_2} * \emptyset * h_n * E_{saline} * 0.3048 * 10^6 * 10^{-9} \qquad [2]$$

where SRE = CO_2 storage capacity in metric tons per unit of area [MM Tons/km^2]; ρ_{CO2} = CO_2 density [kg/m^3]; $\emptyset$ = porosity [-]; h_n = net thickness [ft.]; and E = storage efficiency factor [-]. In order to obtain a value of SRE in metrics, we use the conversion factors 0.3048 [m/ft.]; 10^6 [m^2/km^2]; and 10^{-9} [MM Tons/kg]. The resulting value is a unit of mass per unit area [MM Tons/km^2]. To estimate the total SRE for any given county, we simply calculate the values of SREs explained above by the total area of the county, which is done using the toolsets provided by GIS via ArcMap (v. 10.5.1) software. A workflow illustrating the methodology applied to represent the results from SREs estimates is displayed in Figure 4.1.

In order to account for the variability of CO_2 density, we incorporated pressure and temperature values into the density following the equations and tabulated values outlined by Duan and Sun (2003) (Figure 4.2). To do this, we assumed a linear relationship between depth, temperature and pressure relationship as follows:

$P = 0.0032 * d$ [3]
$T = 2.38 * P + 12.8$ [4]
$\rho = 0.1859 * T + 710.49$ [5]

Where P is pressure (MPa), d is depth (ft.) assigned to the middle point of the formation thickness, T is temperature (degC), and ρ is density (kg/m^3). Equation [5] was derived from a lookout table provided by DOE-NETL's SCREEN, which is based on Duan and Sun (2003).

Therefore, equations [1-2] can be written as:

$$SRE = 0.0003048 * \rho_{CO2} * \emptyset_{ave} * h_n * E_{saline} \qquad [6]$$

where SRE = CO_2 storage capacity in metric tons per unit of area [MM Tons/km^2]; ρ_{CO2} = CO_2 density [kg/m^3]; $\emptyset_{ave}$ = average porosity [-]; h_n = net thickness [ft.]; and E_{saline} = storage efficiency factor [-].

The number of data points varies from method to method, and, in general, tends to decrease with depth and older stratigraphic intervals (Figure 4.3; Table 4.1).

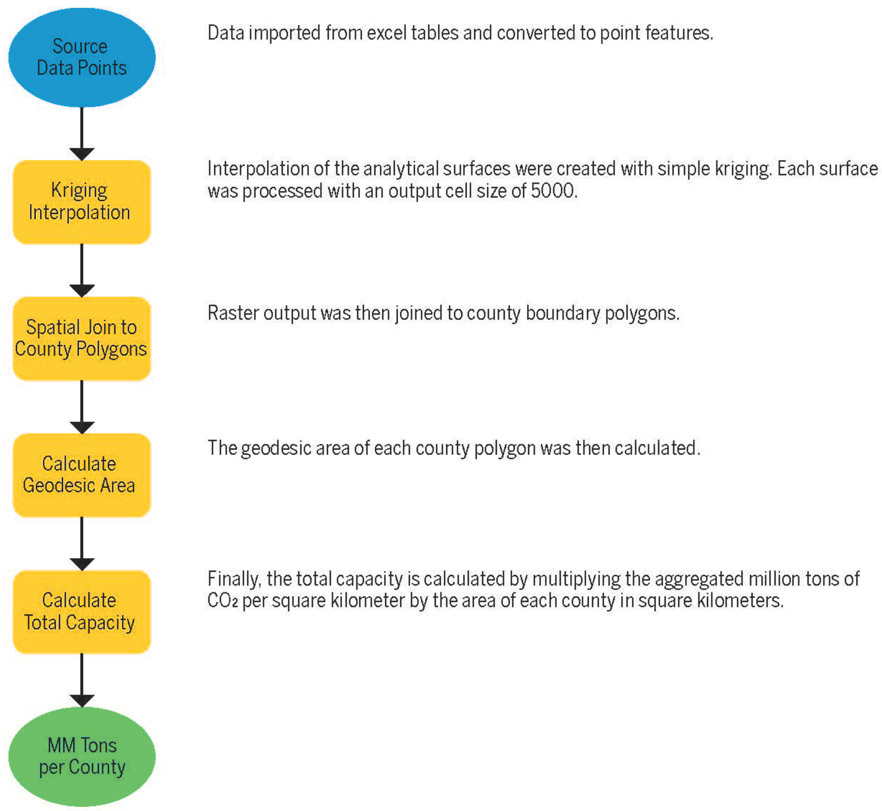


Figure 4.1: ESRI's ArcGIS (ArcMap 10.5.1) workflow applied in this study to generate isopach, structure and SREs maps.

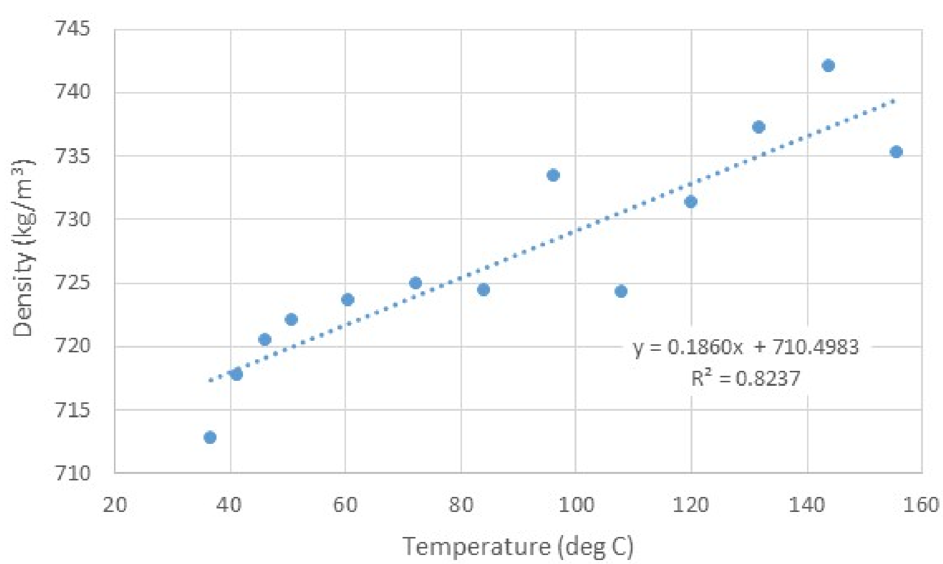


Figure 4.2. CO2 density versus temperature derived from Duan and Sun (2003).

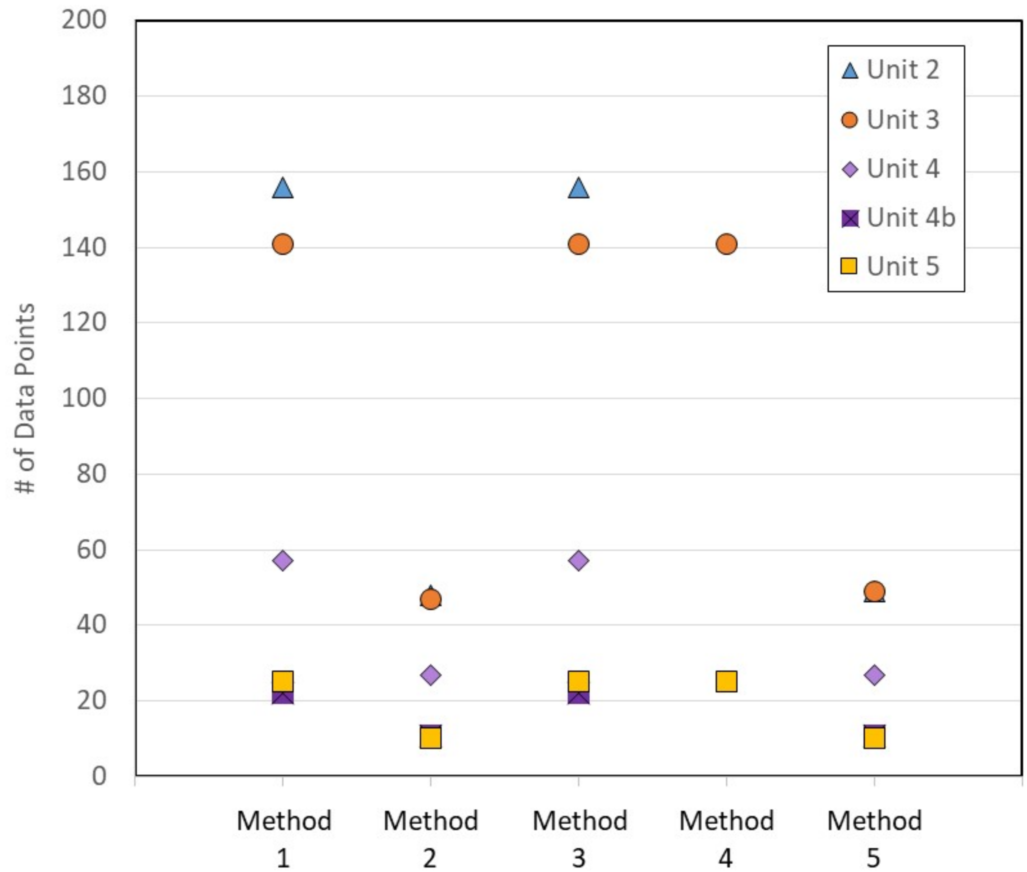


Figure 4.3. Dot plot chart illustrating number of data points for each method and unit. Each data point represents a well under assessment.

Table 4.1. Number of wells used in each method. A graphic representation of this is available in figure 4.3.

		# of Wells				
		Unit 2	Unit 3	Unit 4	Unit 4b	Unit 5
Method I	Average porosity	162	147	60	22	27
Method II	Wireline logs (per well)	49	48	28	11	11
Method III	Wireline logs (regional average)	162	147	60	22	27
Method IV	Diagenetic model	--	147	--	--	27
Method V	DOE/NETL SCREEN	50	50	28	11	11

4.2.1. Method 1: SREs using a single, constant value of porosity

This method is equivalent to the method used by DOE and published in all five editions of the Atlas (U.S. DOE, 2007, 2008, 2010, 2012, 2015), as described in the previous paragraphs. It is the simplest of the methods used. Storage resource estimates (SRE) are based on the assumption of a constant (average) value of porosity throughout all the units (ϕ=10%).

Replacing the porosity values (ϕ=0.1) in equation [6], we can estimate SREs as follows:

$$SRE_I = 0.00003048 * \rho * h_n * E_{Px} \qquad [7]$$

where E_{px} is the efficiency factor associated with the P_{10}, P_{50}, and P_{90} percent probability range (Appendix 2).

This method is equivalent to the method used by DOE and published in all five editions of the Atlas (U.S. DOE, 2007, 2008, 2010, 2012, 2015).

4.2.2. Method 2: SREs using an average porosity (per well, per unit) from wireline-derived porosity

This method uses the average wireline-derived porosity (neutron, sonic, or density logs) at each well to estimate SRE. When more than one type of geophysical log (neutron, sonic and/or density) provides porosity for an individual well, the best log type was selected based on close inspection of data distribution of porosity (histogram analyses) and average porosity value of equivalent intervals from wells in the vicinity of the well under analysis.

Values of porosity were estimated from wireline logs using the set of equations included in Appendix 3. Once all the identified wells have been identified and checked under QA/QC, we estimated SREs at each well location follows:

$$SRE_{II} = 0.0003048 * \rho_{CO2} * \phi_{log-ave} * h_n * E_{px} \qquad [8]$$

Where ρ_{CO2} = CO_2 density [kg/m^3]; $\phi_{log\text{-}ave}$ is the average value of wireline-derived porosity for the interval under evaluation, h_n is the thickness of the unit, and E_{px} is the efficiency factor.

4.2.3. Method 3: SREs using an average porosity for each unit, for the entire region, from wireline-derived porosity

This method uses the regional average of wireline-derived porosity (neutron, sonic, or density logs) in Petra® Software to estimate SRE. Values of porosity were estimated from wireline logs using the set of equations included in Appendix 3. This method differs from method 2 because in method 3 we have chosen one single value for porosity, per unit, for the entire CarbonSAFE region.

Therefore, the SRE calculated for this method can be expressed as:

$$SRE_{III} = 0.0003048 * \rho_{CO2} * \phi_{regional\ log-ave} * h_n * E_{px} \quad [9]$$

where ρ_{CO2} = CO_2 density [kg/m^3]; $\phi_{regional\ log\text{-}ave}$ is the regional average value of wireline-derived porosity for the interval under evaluation (one single value for the entire analysis), h_n is the thickness of the unit, and E_{saline} is the efficiency factor.

4.2.4. Method 4: SRE using a depth-dependent porosity model (St. Peter and Mt. Simon Sandstone only)

Diagenetic compaction is a factor that reduces porosity. Studies of porosity from core data and wireline logs in the CarbonSAFE-prefeasibility and neighboring regions suggest that diagenetic compaction results in a decrease in porosity with increasing depth. Method 4 incorporates a depth-dependent porosity model for SREs assessment for units 3 and 5 (St. Peter Sandstone and Mount Simon, respectively), assuming that diagenetic compaction took place and reduced porosity with increasing depth (i.e., Bloch, 1991; Brown, 1997; Ehrenberg and Nadeau, 2005; Ehrenberg et al., 2008, 2009; Hoholick et al., 1984; Medina et al., 2011). This methodology uses the equations that represent the exponential decrease of porosity published for the St. Peter Sandstone and Mt. Simon Sandstone (Hoholick et al., 1984).

The general form for these equations are:

$\emptyset(z) = A * e^{-B*z}$ [10]

This equation allows the calculation of SREs by integrating the values of porosity in the depth interval for each well under study that has information on top and bottom for each unit.

$$SRE_{IV} = 0.0003048 * \rho_{CO2} * h_n * E_{saline} * \int_{z_{top}}^{z_{bottom}} \emptyset(z)dz \quad [11]$$

where Z_{top} and Z_{bottom} are the measured depths (ft.) of the top and bottom of units, respectively.

Replacing [10] into [11]:

$$SRE_{IV} = 0.0003048 * \rho_{CO2} * h_n * E_{saline} * \int_{z_{top}}^{z_{bottom}} A * e^{-B*z} \, dz \quad [12]$$

Solving the integral, we obtain:

$$SRE_{IV} = 0.0003048 * A * B * \rho_{CO2} * h_n * E_{saline} \left(e^{-B*z_{top}} - e^{-B*z_{bottom}}\right) \quad [13]$$

The values of A and B used in this study are as follows: A=30.8; B=0.00032 (St. Peter Sandstone); A=31.16; B=0.00026 (Mount Simon Sandstone) (Hoholick et al., 1984).

4.2.5. Method 5: SREs using National Energy Technology Laboratory's CO_2 ¬Storage Prospective Resource Estimation Excel Analysis (CO_2-SCREEN).

Method 5 is NETL's CO_2 Storage Prospective Resource Estimation Excel Analysis (CO_2-SCREEN) (Goodman et al., 2016). CO_2-SCREEN is a tool developed by the US-DOE-NETL and is intended to aid users with SRE estimation in saline aquifers. CO_2-SCREEN is a user-friendly Excel spreadsheet that can be completed with basic reservoir information (input), and linked to a GoldSim Player model that generates ten thousand realizations of SREs via Monte Carlo simulations (Sanguinito et al., 2018).

This tool allows for a maximum of 300 data points, each one consisting of thickness, mean porosity, mean pressure and mean temperature, and their associated standard deviations. In addition, a lithology and depositional environment can be input to allow more characteristic efficiency factors for specific types and grouping of rock strata. In this work we used the auto-populated values of efficiency factors, which are assigned based on lithology and depositional environments.

SRE_{P10}, $SRE_{P50,}$ and SRE_{P90} are the storage resources estimated calculated by SCREEN for efficiency factors associated with P10, P50, and P90 percentiles (E_{10}, E_{50}, and E_{90}, respectively). Because this methodology is still in development, it should be used for reference only. Results from this method, however, can be compared to the results from the other methods for a more robust assessment of SREs for the CarbonSAFE-prefeasibility region. More details of this methodology are provided at the NETL's Energy Data Exchange (EDX) at https://edx.netl.doe.gov/dataset/co2-screen-users-manual.

5. **Results and conclusions**

The evaluation of the storage resource estimates for the Paleozoic units in this study focused on five intervals as reservoirs: 1) limestone and dolomite from the Trenton/Black River Group (Upper Ordovician), 2) the Middle Ordovician St. Peter Sandstone, 3) primary target reservoir rocks of the upper Cambrian and Lower Ordovician and Upper Cambrian Knox Supergroup, including a separate assessment for the lower Knox Potosi Dolomite (Unit 4b), and 5) Mount Simon Sandstone.

In the present study, application of a five-part hierarchical approach generated a suite of estimates of storage resources (SREs). For a complete list of results from all methodologies, see Appendix 4.

A statistical summary of the SREs results by method and unit for the three reservoir-bearing units is shown in Table 5.1. Values from Appendix 4 are used in the box-and-whisker plot (Appendix 5), which shows the minimum, first quartile, median, third quartile, and maximum results from the different methods.

Statisticians refer to this type of statistics as a five-number summary, and it consists of representing each five-number summary as a box with "whiskers." The box is bounded on the top by the third quartile and on the bottom by the first quartile. The median divides the box. The whiskers are error bars: One extends upward from the third quartile to the maximum, and the other extends downward from the first quartile to the minimum (Figure 5.1).

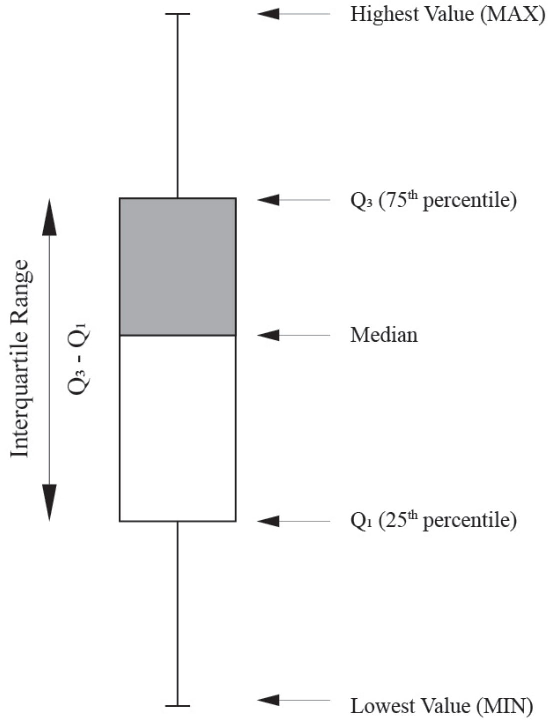


Figure 5.1. Illustration of a box and whisker plot—also called a box plot—, indicating the five-number summary of a set of data, which is presented in Appendices 4 and 7. Values that fall between the median and Q3 are shown in gray for better visualization purpose only (Appendix 5).

Table 5.1. SREs summary for methodologies in this study.

METHOD	Description of method used for calculating SREs	Average SRE values (MMTon/km^2)*														
		Unit 2			Unit 3			Unit 4			Unit 4b			Unit 5		
		SRE_{P10}	SRE_{P50}	SRE_{P90}	SRE_{P10}	SRE_{P50}	SRE_{P90}	SRE_{P10}	SRE_{P50}	SRE_{P90}	SRE_{P10}	SRE_{P50}	SRE_{P90}	SRE_{P10}	SRE_{P50}	SRE_{P90}
1	Assumming a constant value of porosity (10%)	0.05	0.18	0.47	0.05	0.08	0.26	0.25	0.84	2.03	0.11	0.36	0.86	0.18	0.61	1.48
2	Using average porosity (at each well) from wireline logs	0.02	0.08	0.22	0.02	0.08	0.24	0.15	0.51	1.22	0.08	0.25	0.60	0.13	0.43	1.05
3	Using average porosity (single value) from wireline logs	0.02	0.08	0.22	0.02	0.08	0.25	0.16	0.53	1.27	0.05	0.17	0.42	0.19	0.63	1.54
4	Assuming a diagenetic reduction of porosity with depth*	-	-	-	0.03	0.12	0.36	-	-	-	-	-	-	0.11	0.37	0.90
5	Using NETL's CO2 Storage prospeCtive Resource Estimation Excel aNalysis (SCREEN)	0.01	0.04	0.17	0.01	0.04	0.15	0.10	0.38	1.18	0.06	0.22	0.63	0.10	0.38	1.12

*To convert to MMTon/acre, multiply by 247.1.

To better understand the storage resources available across the partnership region, we report the SREs in million tons of CO_2 per square kilometer (MMTons CO_2/Km^2). In addition to these charts, results are shown in a series of georeferenced maps in which total SREs are shown per county (due to the number of maps, we are including those results from method 3 only, using EP10, Ep50, and EP90 for five units assessed, for a total of 15 maps for SREs) (Appendix 6).

5.1. Prospective Reservoirs

SREs in the CarbonSAFE-prefeasibility region suggest that there is sufficient storage capacity in the carbonate and clastics reservoirs of the Cambrian-Ordovician units in the Midwestern region.

5.2. Storage Capacity Estimates

These methodologies suggest that using a single value for the porosity of 10 percent (Method 1) results in an overestimation of SRE (Appendix 5).

Results listed in table 5.1 and in boxes and whiskers charts in Appendix 5 reveal that SREs calculated by different methods, not surprisingly result in different values. As pointed out, a complete list of resultant SREs is available in Appendix 4.

Regional scale SREs could possibly benefit from the use of efficiency factors that incorporate increased accuracy in the area, thickness, and porosity. These “intermediate” efficiency factors will increase to reflect the decrease in uncertainty (e.g., Ellett et al., 2013; Gorecki et al., 2009a, b; Peck et al., 2014).

Results in this report do not include local factors that should be included in the site-scale analysis (i.e., details of the local geology). Future work should incorporate dynamic aspects of reservoir performance during and after injection (Figure 5.2). This study is exploratory in nature and does not intend to determine which method is “better” or “worse than”, but rather, sets the stage for future consideration of integration of different methods based on robustness and availability.

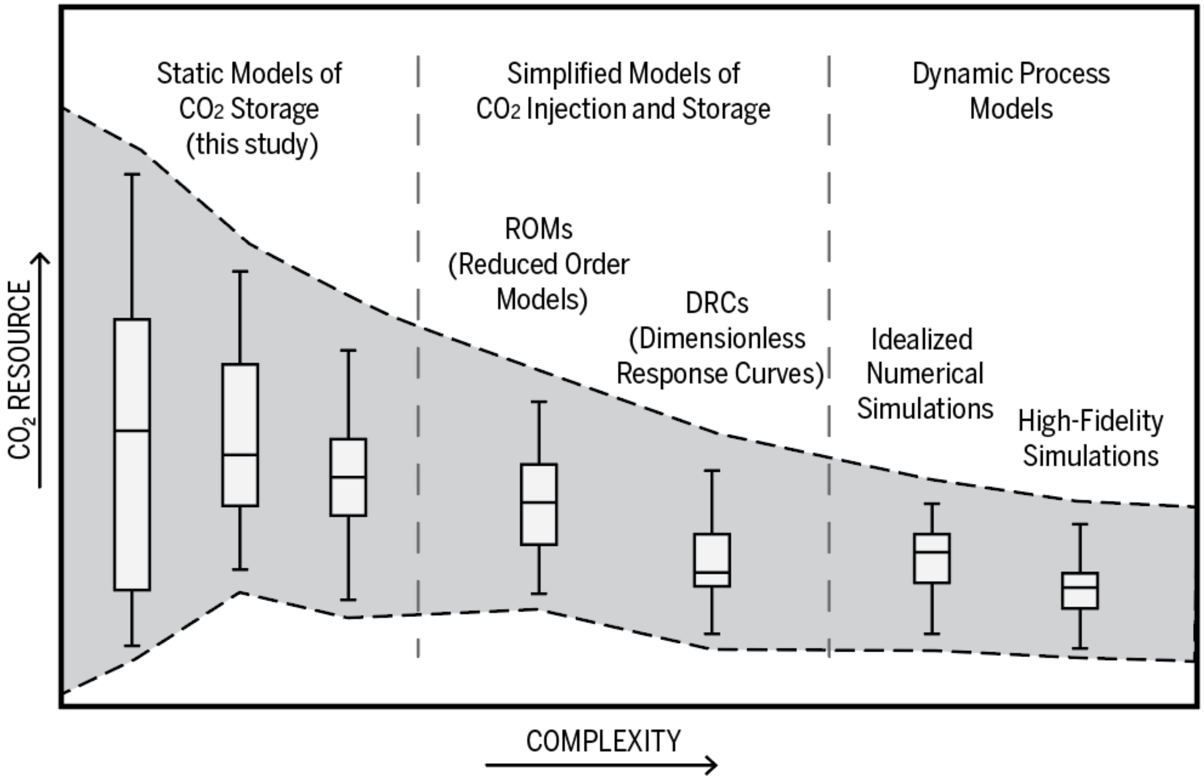


Figure 5.2. Schematic representation of the reduction of values (and variability) of SREs as a function of the conceptual model chosen for porosity.

6. References cited

Asquith, G. B., and C. R. Gibson, 1982, Basic well log analysis for geologists, Tulsa, Okla., USA, American Association of Petroleum Geologists, Methods in exploration series, 216 p.

Barnes, D. A., K. M. Ellett, and J. A. Rupp, 2017, Geologic-carbon-sequestration potential of the Ordovician St. Peter Sandstone, Michigan and Illinois Basins, United States: Environmental Geosciences, v. 24, no. 1, p. 15-49.

Bentham, M., and G. Kirby, 2005, CO_2 Storage in Saline Aquifers: Oil & Gas Science and Technology—Rev. IFP, v. 60, No. 3, p. 559-567.

Bloch, S., 1991, Empirical prediction of porosity and permeability in sandstones: AAPG Bulletin, v. 75, p. 1145-1160.

Brown, A., 1997, Porosity variation in carbonates as a function of depth: Mississippian Madison Group, Williston Basin, in Kupecz, J.A., Gluyas, J., and Bloch, S., eds., Reservoir quality prediction in sandstones and carbonates: AAPG Memoir 69, p. 29-46.

Duan, Z., and Sun, R., 2003, An improved model calculating CO2 solubility in pure water and aqueous NaCl solutions from 273 to 533 K and from 0 to 2000 bar: Chemical Geology, v. 193, no. 3-4, p. 257-271.

Ehrenberg, S. N. and P. H. Nadeau, 2005, Sandstone vs. carbonate petroleum reservoirs: A global perspective on porosity-depth and porosity-permeability relationships: AAPG Bulletin, v. 89, p. 435-445.

Ehrenberg, S. N., Nadeau, P. H., and O. Steen, 2008, A megascale view of reservoir quality in producing sandstones from the offshore Gulf of Mexico: AAPG Bulletin, v. 92, p. 145-164.

Ehrenberg, S. N., Nadeau, P. H., and O. Steen, 2009, Petroleum reservoir porosity versus depth: Influence of geological age: AAPG Bulletin, v. 93, p. 1281-1296.

Ellett, K., Zhang, Q., Medina, C., Rupp, J., Wang, G., and T. Carr, 2013, Uncertainty in Regional-scale Evaluation of CO_2 Geologic Storage Resources—comparison of the Illinois Basin (USA) and the Ordos Basin (China): Energy Procedia, v. 37, no. 0, p. 5151-5159.

Goodman, A., Hakala, A., Bromhal, G., Deel, D., Rodosta, T., Frailey, S., Small, M., Allen, D., Romanov, V., Fazio, J., Huerta, N., McIntyre, D., Kutchko, B., and G. Guthrie, 2011, U.S. DOE methodology for the development of geologic storage potential for carbon dioxide at the national and regional scale: International Journal of Greenhouse Gas Control, v. 5, no. 4, p. 952-965.

Goodman, A., Sanguinito, S., and J. S. Levine, 2016, Prospective CO_2 saline resource estimation methodology: Refinement of existing US-DOE-NETL methods based on data availability: International Journal of Greenhouse Gas Control, v. 54, Part 1, p. 242-249.

Greb, S., Bowersox, J. R., Solis, M. P., Harris, D. C., Riley, R. A., Rupp, J. A., Kelley, M., and N. Gupta, 2012, Ordovician Knox carbonates and sandstones of the eastern midcontinent: Potential geologic carbon storage reservoirs and seals, in Derby, J. R., Fritz, R. D., Longacre, S. A., Morgan, W. A., and C. A. Sternbach, eds., The great American carbonate bank: The geology and economic resources of the Cambrian – Ordovician Sauk megasequence of Laurentia, AAPG Memoir 98, p. 1077-1101.

Gorecki, C. D., Holubnyak, Y. I., Ayash, S. C., Bremer, J. M., Sorensen, J. A., Steadman, E. N., and J. A. Harju, 2009a, A new classification system for evaluating CO_2 storage resource/capacity estimates, SPE International Conference on CO_2 Capture, Storage, and Utilization, Volume SPE Paper 126421: San Diego, California.

Gorecki, C. D., Sorensen, J. A., Bremer, J. M., Knudsen, D. J., Smith, S. A., Steadman, E. N., and J. A. Harju, 2009b, Development of storage coefficients for determining the effective CO_2 storage resource in deep saline formations, SPE International Conference on CO_2 Capture, Storage, and Utilization, Volume SPE Paper 126444: San Diego, California.

Harris, D. C., Ellett, K., and J. Rupp, 2014, Geologic characterization and carbon storage resource estimates for the Knox Group, Illinois Basin, Illinois, Indiana, and Kentucky: University of Illinois, DOE/FE0002068-19.

Hoholick, J. D., Metarko, T., and P. E. Potter, 1984, Regional variations of porosity and cement: St. Peter and Mount Simon Sandstones in Illinois Basin.: AAPG Bulletin, v. 68, no. 6, p. 753-764.

Hovorka, S. D., Doughty, C., Knox, P. R., Green, C. T., Pruess, K., and S. M. Benson, 2001, Evaluation of brine-bearing sands of the Frio Formation, Upper Texas Gulf Coast for geological sequestration of CO_2, in First National Conference on Carbon Sequestration, 2001: U.S. Department of Energy, National Energy Technology Laboratory, 13 p.

Kolata, D. R., Graese, A. M., Lithostratigraphy and depositional environments of the Maquoketa Group (Ordovician) in northern Illinois, 1983, Illinois State Geological Survey, Circular 528, 49 p.

Lahann, R., Rupp, J., Medina, C. R., 2014, An evaluation of the seal capacity and CO_2 retention properties of the Eau Claire Formation (Cambrian). Environmental Geosciences, v. 21, no. 3, p. 83-106.

Medina, C. R., Rupp, J. A., and D. A. Barnes, 2011, Effects of reduction in porosity and permeability with depth on storage capacity and injectivity in deep saline aquifers: A case study from the Mount Simon Sandstone aquifer: International Journal of Greenhouse Gas Control, v. 5, p. 146-156.

Medina, C. R., and J. A. Rupp, 2012, Reservoir characterization and lithostratigraphic division of the Mount Simon Sandstone (Cambrian): Implications for estimations of geologic sequestration storage capacity: Environmental Geosciences, v. 19, no. 1, p. 1-15.

Medina, C. R., Mastalerz, M., and J. A. Rupp, 2017, Characterization of porosity and pore-size distribution using multiple analytical tools: Implications for carbonate reservoir characterization in geologic storage of CO_2: Environmental Geosciences, v. 24, no. 1, p. 51-72.

Sanguinito, S., Goodman, A. L., and J. S. Levine, 2017, NETL CO_2 Storage prospeCtive Resource Estimation Excel aNalysis (CO2-SCREEN) User's Manual; NETL-TRS-6-2017; NETL Technical Report Series; U.S. Department of Energy, National Energy Technology Laboratory: Pittsburgh, PA, 2017; p 28.

Sanguinito, S., Goodman, A. L., and Sams, J. I., 2018, CO2-SCREEN tool: Application to the Oriskany sandstone to estimate prospective CO2 storage resource: International Journal of Greenhouse Gas Control, v. 75, p. 180-188.

Sing, K. S., 1985, Reporting physisorption data for gas/solid systems with special reference to the determination of surface area and porosity: Pure and Applied Chemistry, 57, 603-619.

Schlumberger, 1972, The Essentials of log interpretation practice, Schlumberger Publication. 58 p.

Tamulonis, K. L., Jordan, T. E., and B. Slater, 2011, Carbon dioxide storage potential for the Queenston Formation near the AES Cayuga coal-fired power plant in Tompkins County, New York: Environmental Geosciences, v. 18, no. 1, p. 1-17.

U.S. Department of Energy, 1999, Carbon sequestration research and development: Office of Fossil Energy, Office of Science, Washington, D.C., December, 195 p.

U.S. Department of Energy, 2002, CO_2 capture and storage in geologic formations: Office of Fossil Energy, NCCTI Energy Technologies Group, CO_2 Capture and Storage Working Group, Washington, D.C., White paper prepared for the National Climate Change Technology Institute, 34 p.

U.S. Department of Energy, 2004, Carbon sequestration technology roadmap and program plan: National Energy Technology Laboratory, 24 p.

www.fe.doe.gov/programs/sequestration/publications/programplans/2004/SequestrationRoadmap 4-29-04.pdf.

U.S. Department of Energy, 2005, Carbon sequestration, technology roadmap and program plan 2005: National Energy Technology Laboratory, 26 p.

http://www.fe.doe.gov/programs/sequestration/publications/programplans/2005/sequestration_roadmap_2005.pdf.

U.S. Department of Energy, Office of Fossil Energy, National Energy Technology Laboratory, 2007, Carbon Sequestration Atlas of the United States and Canada (First Edition), 86 p.

U.S. Department of Energy, Office of Fossil Energy, National Energy Technology Laboratory, 2008, Carbon Sequestration Atlas of the United States and Canada (Second Edition), 140 p.

U.S. Department of Energy, Office of Fossil Energy, National Energy Technology Laboratory, 2010, Carbon Sequestration Atlas of the United States and Canada (Third Edition), 160 p.

U.S. Department of Energy, Office of Fossil Energy, National Energy Technology Laboratory, 2012, Carbon Sequestration Atlas of the United States and Canada (Fourth Edition), 129 p.

U.S. Department of Energy, Office of Fossil Energy, National Energy Technology Laboratory, 2015, Carbon Sequestration Atlas of the United States and Canada (Fifth Edition), 113 p.

Wyllie, M. R. J., Gregory, A. R., and L. W. Gardner, 1956, Elastic wave velocities in heterogeneous and porous media: Geophysics, v. 21, no. 1, p. 41-70.

APPENDIX 1: Isopach and Structure Maps

Figure A1.1. Isopach map (thickness) of the Maquoketa Group and equivalent units (unit 1). Areas where the top of the unit is shallower than 2,500 feet are grayed out.

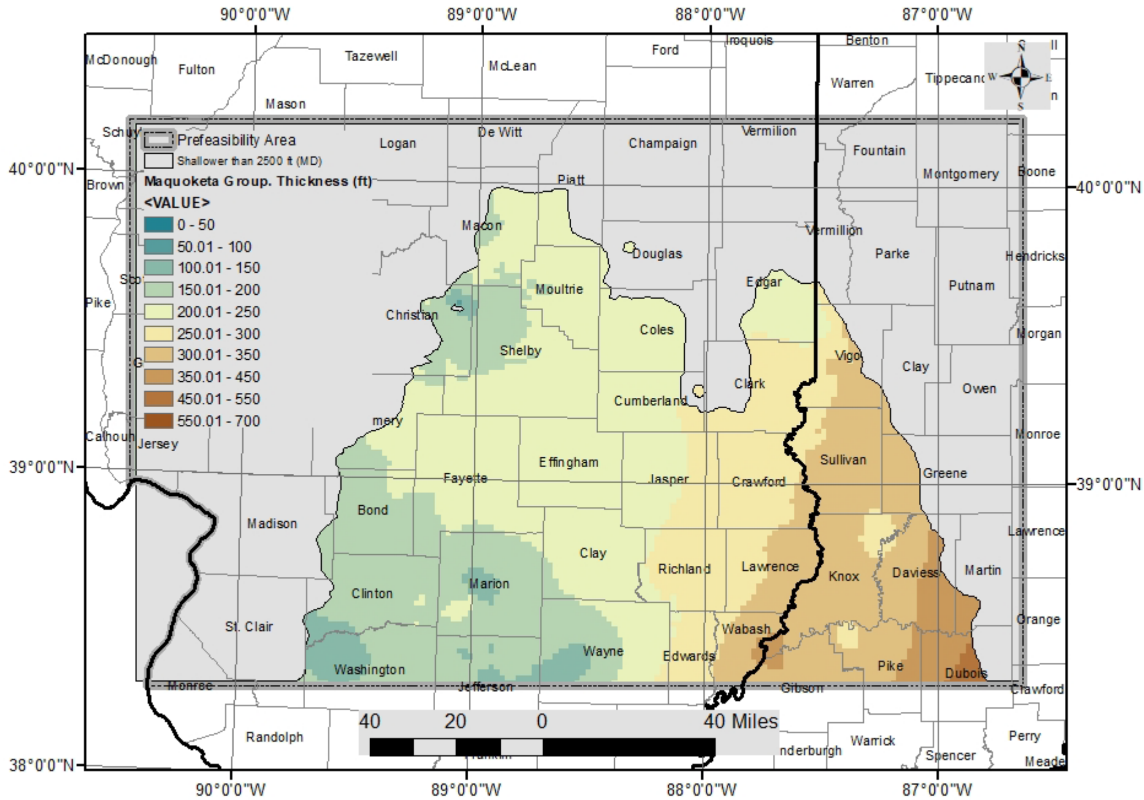


Figure A1.2. Measured depth (in feet) of the Maquoketa Group (unit 1). Areas where the top of the unit is shallower than 2,500 feet are grayed out.

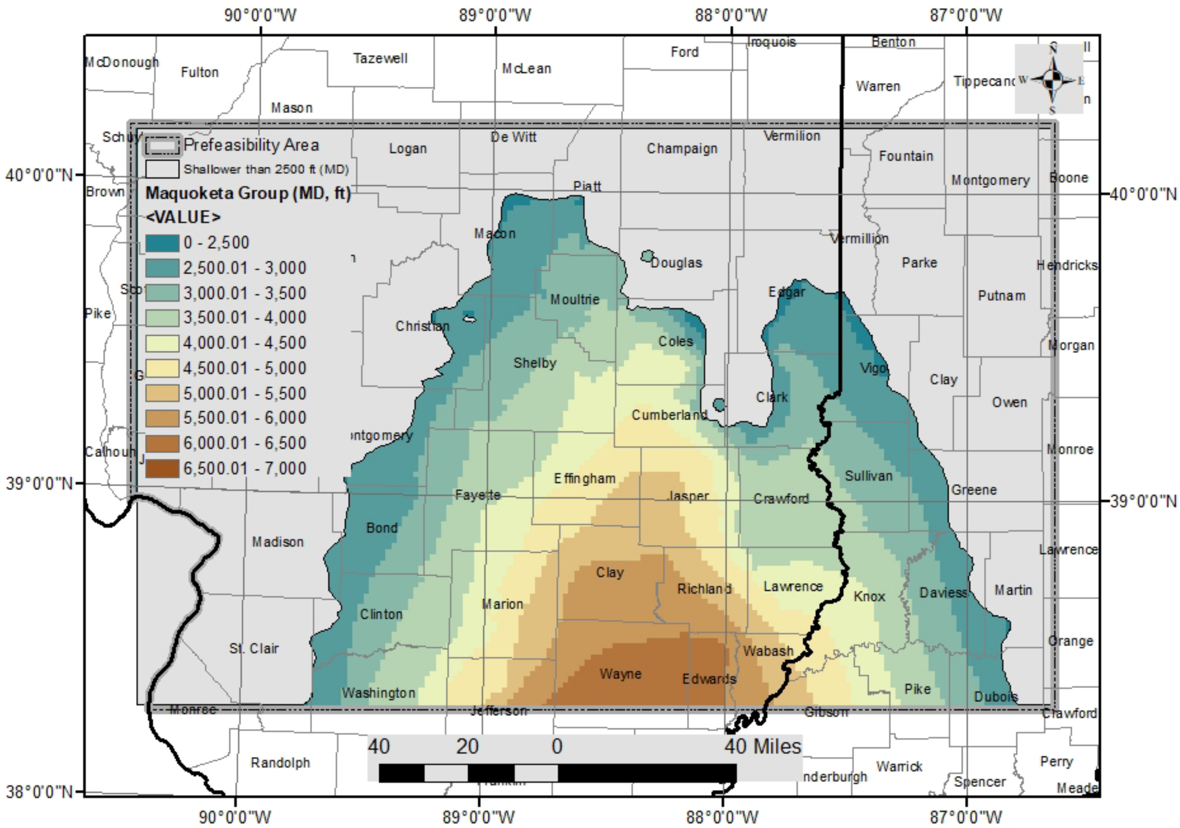


Figure A1.3. Isopach map (thickness) of the Trenton/Black River Group (unit 2). Areas where the top of the unit is shallower than 2,500 feet or deeper than 8,000 feet are grayed out.

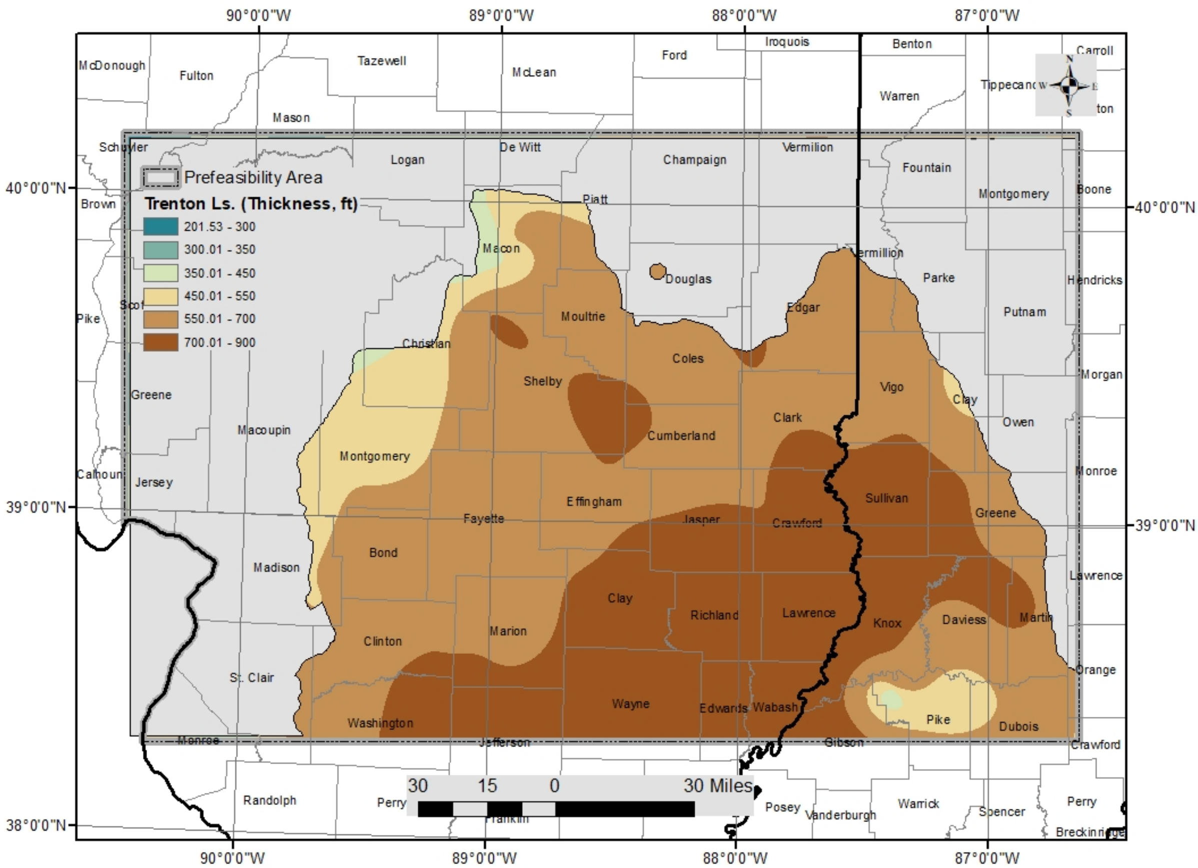


Figure A1.4. Measured depth (in feet) of the Trenton/Black River Group (unit 2). Areas where the top of the unit is shallower than 2,500 feet or deeper than 8,000 feet are grayed out.

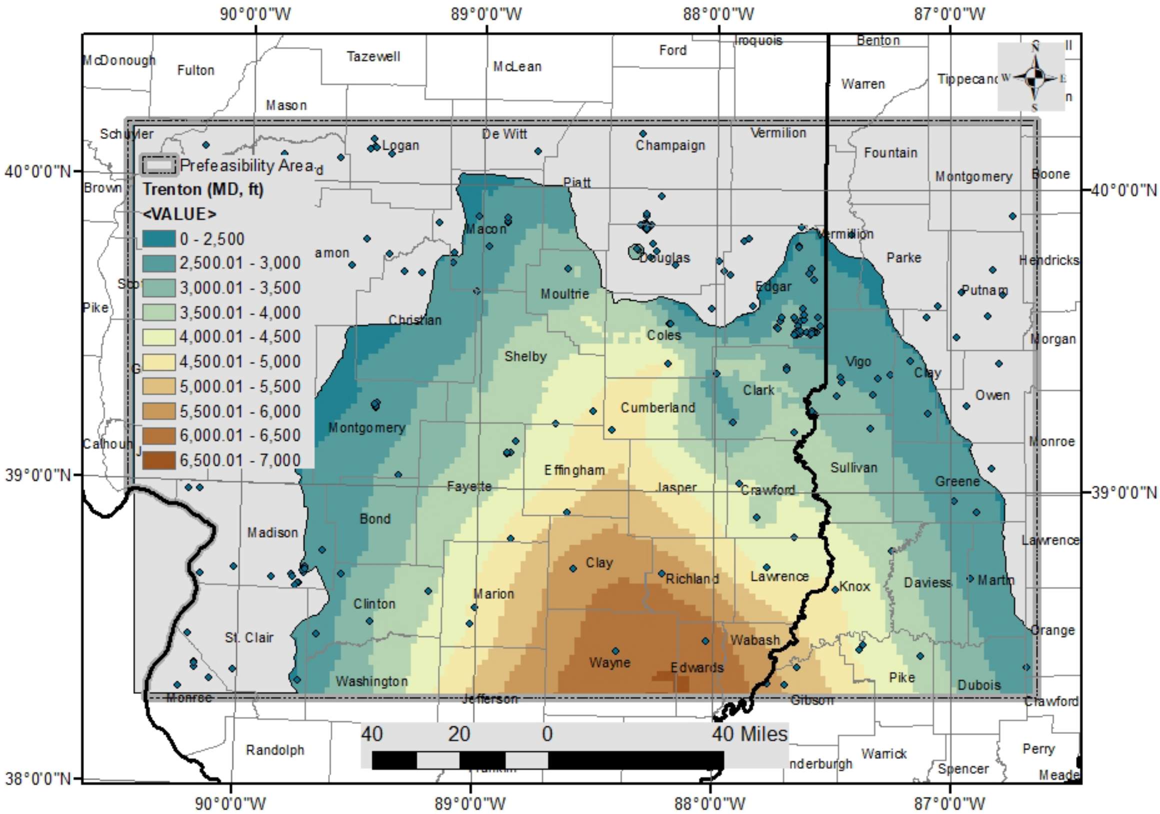


Figure A1.5. Isopach map (thickness) of the St. Peter Sandstone (unit 3). Areas where the top of the unit is shallower than 2,500 feet or deeper than 8,000 feet are grayed out.

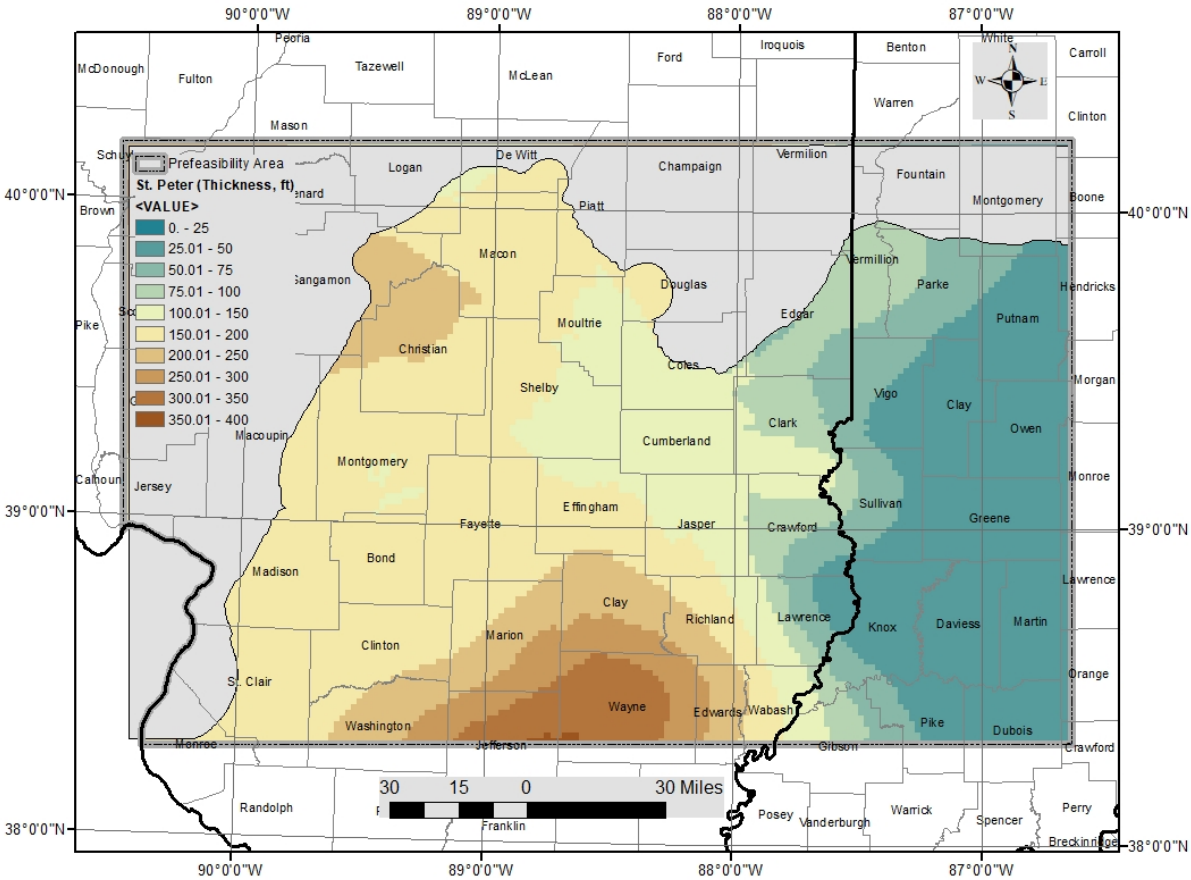


Figure A1.6. Measured depth (in feet) of the St. Peter Sandstone (unit 3). Areas where the top of the unit is shallower than 2,500 feet or deeper than 8,000 feet are grayed out.

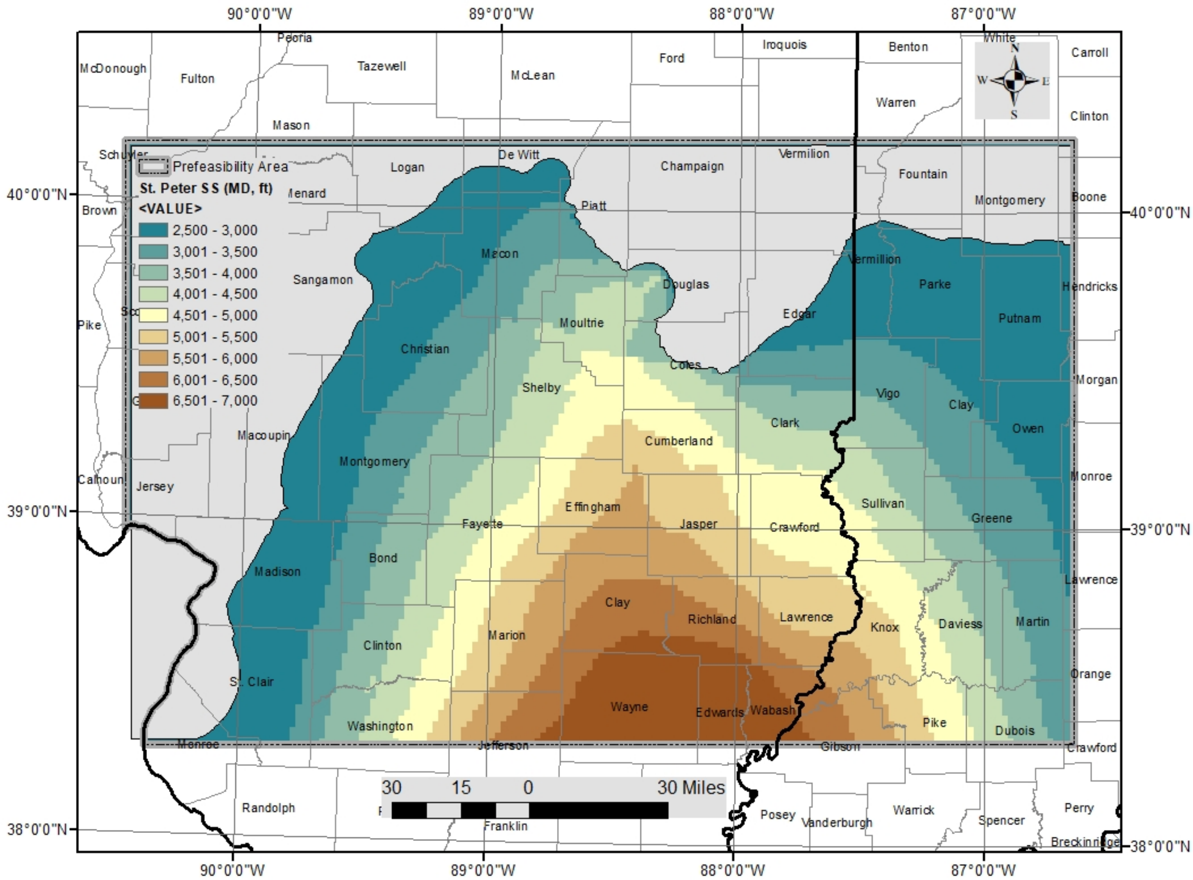


Figure A1.7. Isopach map (thickness) of the Knox Supergroup (unit 4). Areas where the top of the unit is shallower than 2,500 feet are grayed out.

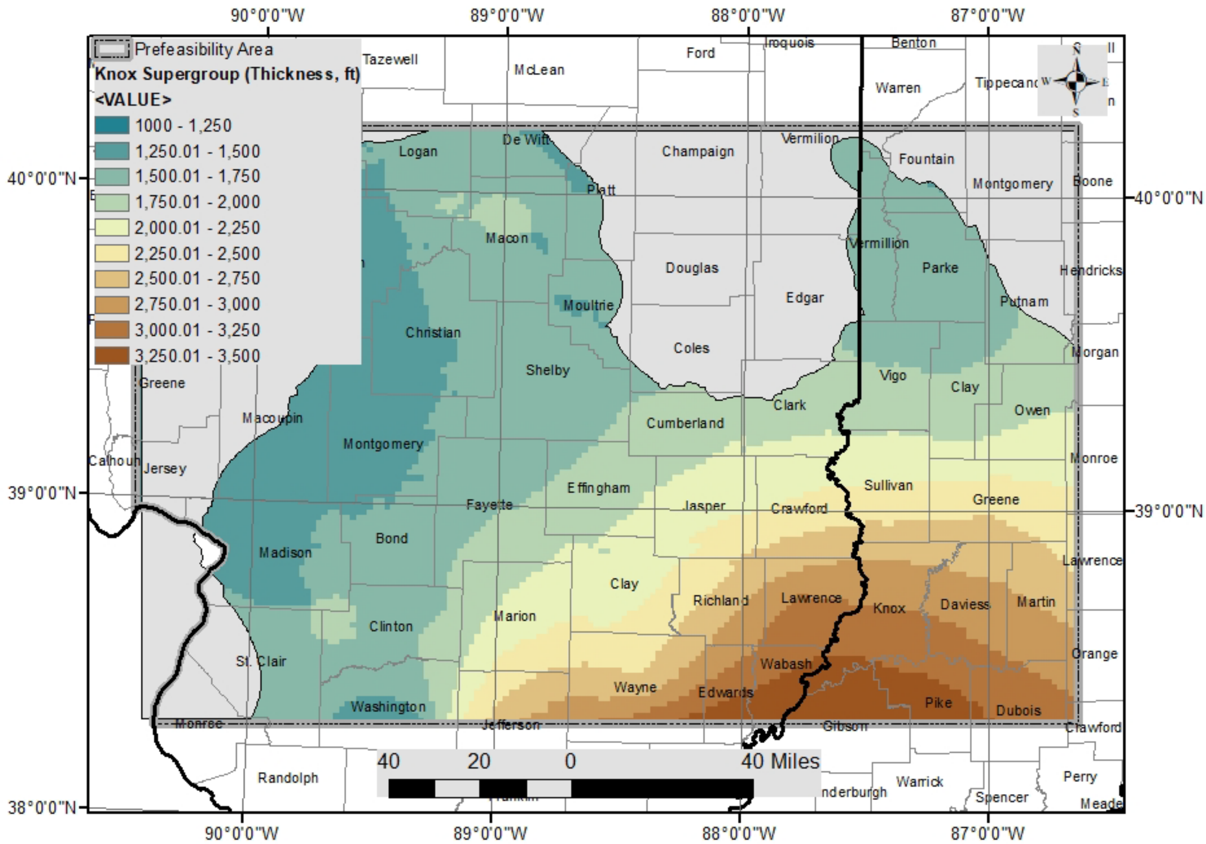


Figure A1.8. Measured depth (in feet) of the Knox Supergroup (unit 4). Areas where the top of the unit is shallower than 2,500 feet are grayed out.

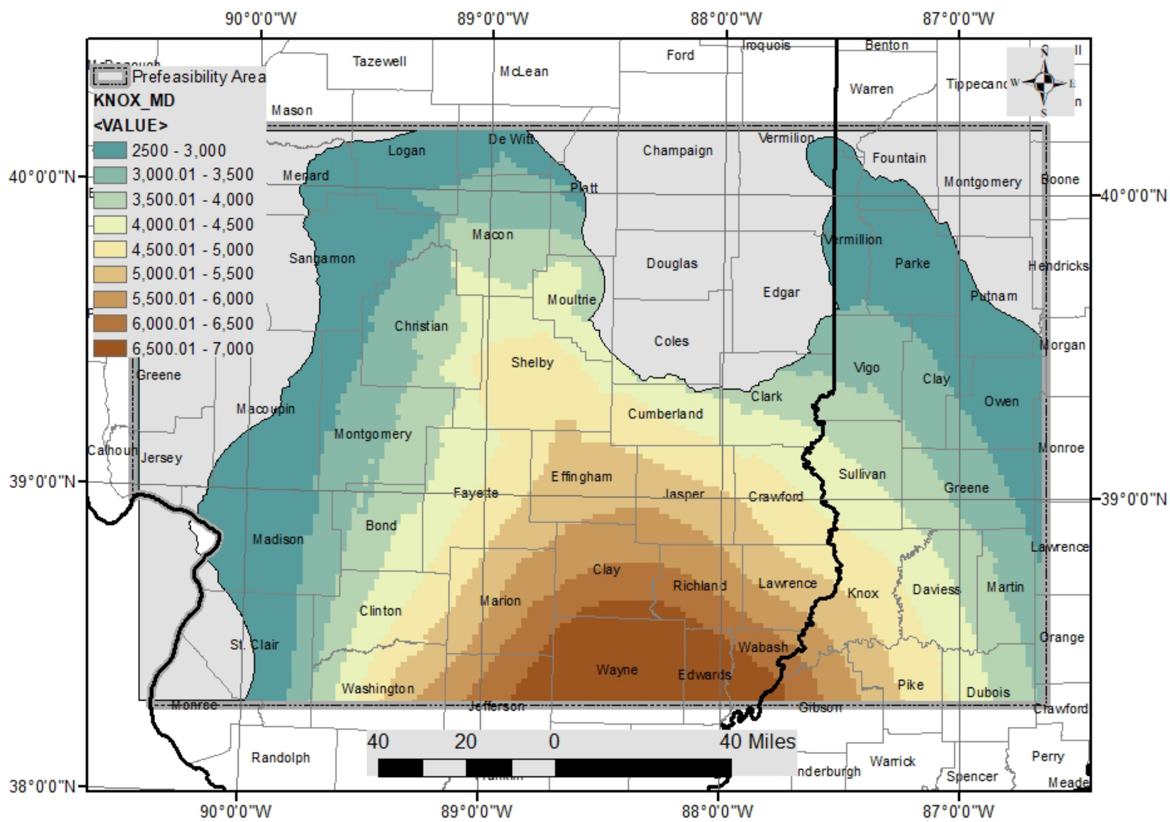


Figure A1.9. Isopach map (thickness) of the Potosi Dolomite (unit 4b).

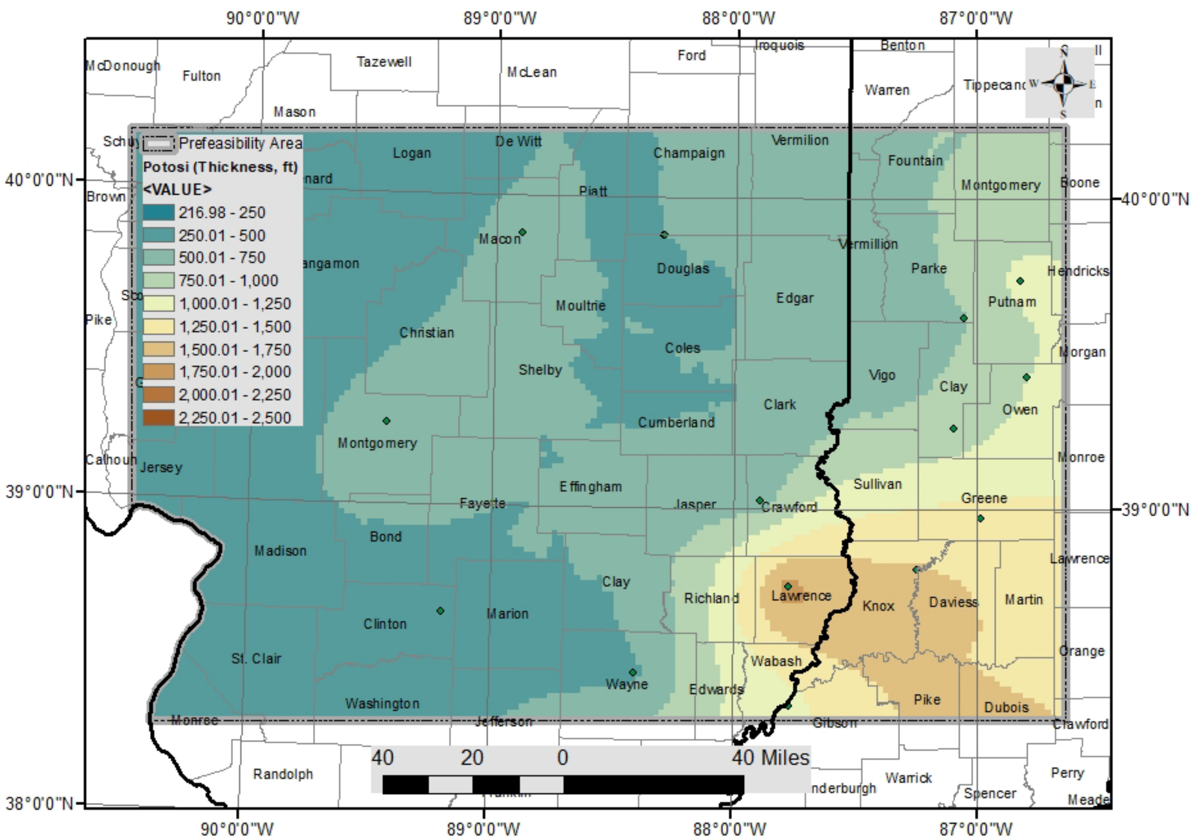


Figure A1.10. Measured depth (in feet) of the Potosi Dolomite (unit 4b).

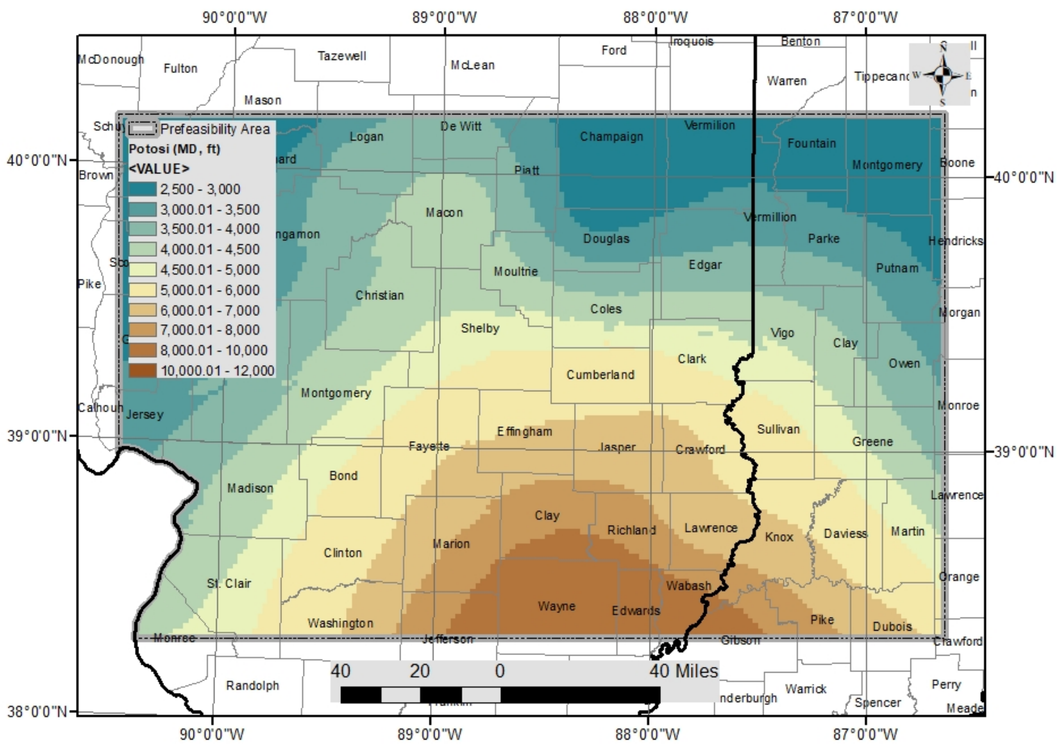


Figure A1.11. Isopach map (thickness) of the Eau Claire Formation ("caprock". No number designation).

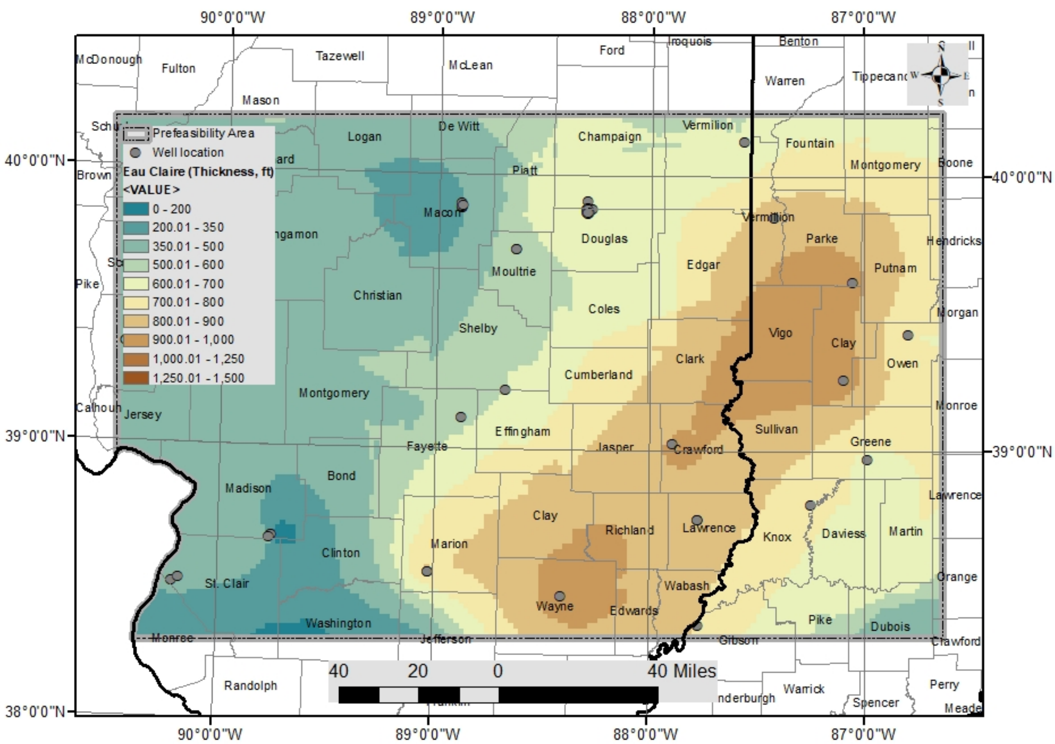


Figure A1.12. Measured depth (in feet) of the Eau Claire Formation ("caprock". No number designation).

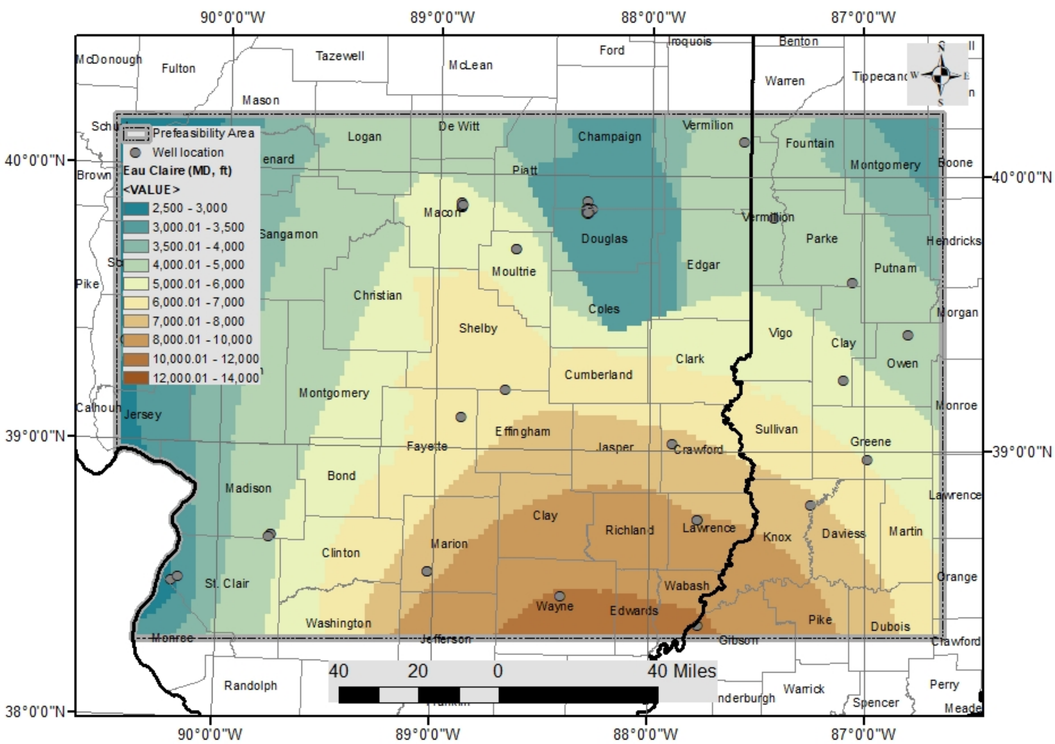


Figure A1.13. Isopach map (thickness) of the Mount Simon Sandstone (unit 5).

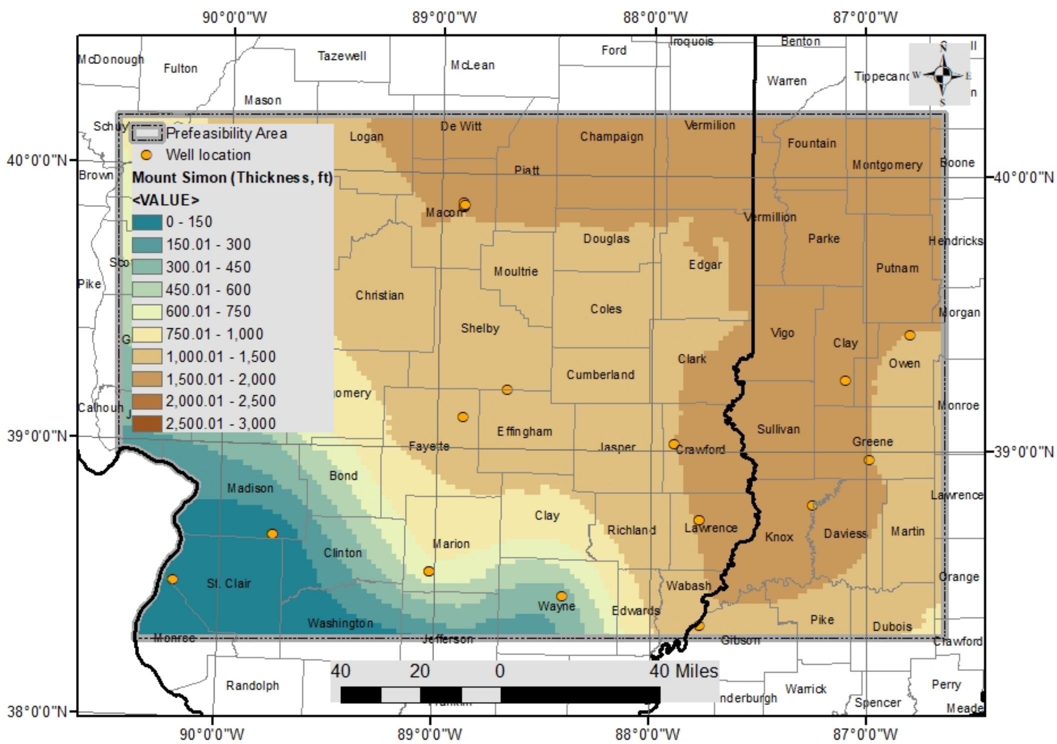
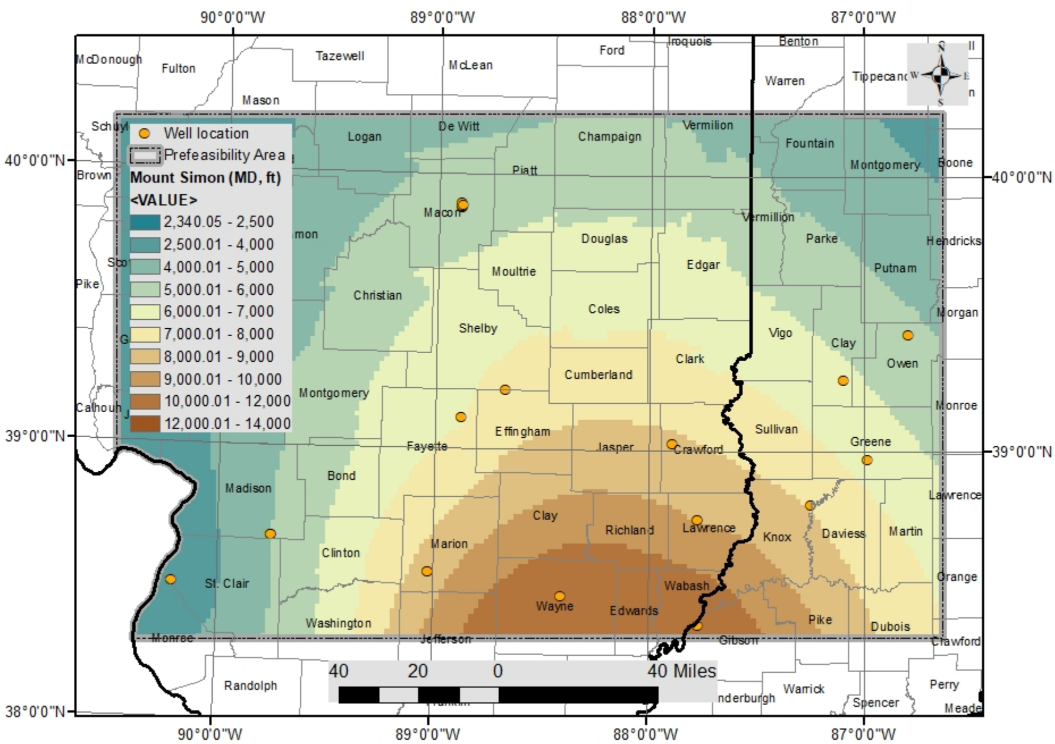


Figure A1.14. Measured depth (in feet) of the Mount Simon Sandstone (unit 5).



APPENDIX 2: Efficiency factors (E) used in this study (values in %)

ID	State	Efficiency Factors (E)														
		P_{10}	P_{50}	P_{90}	P_{10}	P_{50}	P_{90}	P_{10}	P_{50}	P_{90}	P_{10}	P_{50}	P_{90}	P_{10}	P_{50}	P_{90}
		Unit 2			Unit 3			Unit 4			Unit 4b			Unit 5		
106875	Indiana	0.419	1.496	3.951	0.661	2.694	8.169	0.661	2.200	5.319	0.669	2.197	5.281	0.661	2.193	5.333
107208	Indiana	0.420	1.498	3.946	0.662	2.692	8.161	0.659	2.199	5.314	0.668	2.195	5.293	0.661	2.192	5.329
117407	Indiana	0.421	1.497	3.935	0.667	2.697	8.157	0.658	2.197	5.308	0.667	2.196	5.316	0.660	2.195	5.321
118307	Indiana	0.420	1.497	3.943	0.665	2.698	8.173	0.659	2.197	5.308	0.668	2.196	5.306	0.660	2.196	5.326
122844	Indiana	0.420	1.497	3.940	0.665	2.698	8.195	0.660	2.196	5.305	0.668	2.201	5.302	0.661	2.200	5.332
125110	Indiana	0.421	1.499	3.926	0.668	2.705	8.157	0.658	2.196	5.301	0.664	2.186	5.354	0.678	2.185	5.314
125296	Indiana	0.420	1.499	3.936	0.666	2.696	8.154	0.658	2.199	5.304	0.668	2.193	5.309	0.662	2.189	5.327
126424	Indiana	0.421	1.498	3.931	0.665	2.689	8.133	0.657	2.198	5.314	0.665	2.193	5.303	0.664	2.185	5.329
126785	Indiana	0.421	1.496	3.911	0.672	2.708	8.094	0.659	2.195	5.291	0.667	2.186	5.375	0.664	2.185	5.329
136949	Indiana	0.420	1.500	3.905	0.663	2.740	8.061	0.659	2.195	5.291	0.667	2.186	5.375	0.664	2.185	5.329
144489	Indiana	0.420	1.505	3.913	0.665	2.719	8.060	0.665	2.194	5.264	0.667	2.186	5.375	0.664	2.185	5.329
152617	Indiana	0.419	1.495	3.954	0.662	2.690	8.177	0.661	2.201	5.320	0.670	2.199	5.288	0.658	2.193	5.332
152652	Indiana	0.419	1.495	3.954	0.662	2.692	8.175	0.661	2.201	5.317	0.671	2.200	5.275	0.658	2.194	5.336
152735	Indiana	0.419	1.507	3.911	0.666	2.723	8.067	0.661	2.196	5.241	0.667	2.196	5.316	0.660	2.195	5.321
152875	Indiana	0.419	1.507	3.911	0.666	2.723	8.067	0.661	2.196	5.241	0.670	2.199	5.288	0.658	2.193	5.332
155163	Indiana	0.417	1.497	3.962	0.664	2.694	8.174	0.664	2.203	5.310	0.676	2.198	5.285	0.656	2.204	5.338
155634	Indiana	0.419	1.495	3.954	0.662	2.692	8.175	0.661	2.201	5.317	0.671	2.200	5.275	0.658	2.194	5.336
156024	Indiana	0.418	1.496	3.953	0.664	2.693	8.180	0.661	2.200	5.306	0.674	2.208	5.288	0.656	2.201	5.333
156748	Indiana	0.421	1.499	3.931	0.667	2.698	8.170	0.656	2.196	5.309	0.667	2.193	5.333	0.664	2.190	5.336
157268	Indiana	0.421	1.498	3.932	0.667	2.699	8.181	0.657	2.199	5.299	0.668	2.196	5.324	0.660	2.197	5.325
157271	Indiana	0.421	1.497	3.933	0.666	2.700	8.180	0.657	2.199	5.299	0.668	2.196	5.324	0.660	2.197	5.325
157272	Indiana	0.421	1.498	3.932	0.667	2.699	8.181	0.657	2.199	5.299	0.668	2.196	5.324	0.660	2.197	5.325
157445	Indiana	0.421	1.497	3.933	0.666	2.700	8.180	0.657	2.199	5.299	0.668	2.196	5.324	0.660	2.197	5.325
157501	Indiana	0.421	1.499	3.931	0.667	2.698	8.170	0.656	2.196	5.309	0.667	2.193	5.333	0.664	2.190	5.336
158005	Indiana	0.420	1.497	3.943	0.665	2.698	8.173	0.659	2.197	5.308	0.668	2.196	5.306	0.660	2.196	5.326
158009	Indiana	0.421	1.496	3.938	0.667	2.697	8.165	0.658	2.197	5.308	0.667	2.196	5.316	0.660	2.195	5.321
158028	Indiana	0.419	1.495	3.954	0.662	2.690	8.177	0.661	2.201	5.320	0.670	2.199	5.288	0.658	2.193	5.332
158069	Indiana	0.420	1.500	3.905	0.663	2.740	8.061	0.657	2.197	5.305	0.668	2.196	5.324	0.660	2.197	5.325
158090	Indiana	0.420	1.500	3.905	0.663	2.740	8.061	0.661	2.201	5.320	0.670	2.199	5.288	0.658	2.193	5.332
158982	Indiana	0.422	1.502	3.908	0.667	2.714	8.077	0.659	2.200	5.261	0.670	2.199	5.288	0.658	2.193	5.332
160065	Indiana	0.421	1.497	3.946	0.662	2.690	8.162	0.659	2.199	5.314	0.668	2.195	5.293	0.661	2.192	5.329
160648	Indiana	0.422	1.501	3.921	0.664	2.718	8.112	0.663	2.194	5.278	0.668	2.195	5.293	0.661	2.192	5.329
160835	Indiana	0.421	1.499	3.922	0.671	2.703	8.155	0.660	2.200	5.265	0.667	2.186	5.316	0.660	2.195	5.321
160847	Indiana	0.419	1.499	3.926	0.672	2.706	8.129	0.660	2.200	5.265	0.667	2.186	5.375	0.661	2.192	5.329
160855	Indiana	0.420	1.502	3.912	0.670	2.710	8.084	0.660	2.196	5.266	0.667	2.186	5.375	0.661	2.192	5.329
164480	Indiana	0.421	1.497	3.933	0.666	2.699	8.173	0.657	2.197	5.305	0.668	2.196	5.324	0.660	2.197	5.325
164778	Indiana	0.420	1.497	3.942	0.665	2.696	8.174	0.659	2.197	5.308	0.668	2.196	5.306	0.660	2.196	5.326
166184	Indiana	0.420	1.497	3.944	0.666	2.696	8.184	0.661	2.195	5.302	0.671	2.205	5.304	0.659	2.201	5.338
166645	Indiana	0.421	1.497	3.935	0.667	2.697	8.157	0.658	2.197	5.308	0.667	2.196	5.316	0.660	2.195	5.321

Appendix 2 (cont.)

ID	State	Efficiency Factors (E)														
		P_{10}	P_{50}	P_{90}	P_{10}	P_{50}	P_{90}	P_{10}	P_{50}	P_{90}	P_{10}	P_{50}	P_{90}	P_{10}	P_{50}	P_{90}
		Unit 2			Unit 3			Unit 4			Unit 4b			Unit 5		
ADM	Illinois	0.422	1.498	3.950	0.661	2.702	8.204	0.660	2.193	5.349	0.660	2.220	5.228	0.659	2.199	5.328
120010025601	Illinois	0.421	1.503	3.969	0.655	2.698	8.206	0.666	2.199	5.281	0.676	2.186	5.292	0.662	2.210	5.319
120090012403	Illinois	0.422	1.501	3.964	0.661	2.697	8.223	0.666	2.199	5.281	0.676	2.186	5.292	0.662	2.210	5.319
120090015300	Illinois	0.422	1.501	3.964	0.661	2.697	8.223	0.666	2.199	5.281	0.676	2.186	5.292	0.662	2.210	5.319
120092231100	Illinois	0.422	1.501	3.964	0.661	2.697	8.223	0.666	2.199	5.281	0.676	2.186	5.292	0.662	2.210	5.319
120170001900	Illinois	0.423	1.497	3.968	0.660	2.698	8.223	0.666	2.199	5.281	0.676	2.186	5.292	0.662	2.210	5.319
120190012100	Illinois	0.422	1.502	3.939	0.665	2.709	8.166	0.661	2.194	5.309	0.660	2.220	5.228	0.659	2.199	5.328
120190023100	Illinois	0.422	1.500	3.939	0.665	2.704	8.192	0.658	2.196	5.339	0.660	2.220	5.228	0.659	2.199	5.328
120190034701	Illinois	0.422	1.500	3.937	0.665	2.706	8.185	0.658	2.196	5.319	0.660	2.220	5.228	0.659	2.199	5.328
120190126200	Illinois	0.422	1.500	3.939	0.665	2.704	8.192	0.658	2.196	5.339	0.660	2.220	5.228	0.659	2.199	5.328
120210225400	Illinois	0.423	1.496	3.955	0.663	2.701	8.204	0.662	2.194	5.343	0.660	2.220	5.228	0.659	2.199	5.328
120232603800	Illinois	0.421	1.497	3.933	0.666	2.701	8.178	0.658	2.199	5.298	0.669	2.197	5.312	0.660	2.198	5.330
120272454800	Illinois	0.421	1.497	3.957	0.663	2.699	8.168	0.666	2.201	5.299	0.672	2.194	5.297	0.664	2.207	5.331
120330895700	Illinois	0.420	1.497	3.938	0.665	2.701	8.180	0.661	2.194	5.302	0.668	2.199	5.311	0.661	2.200	5.332
120333567100	Illinois	0.421	1.497	3.934	0.666	2.701	8.184	0.660	2.196	5.302	0.668	2.199	5.311	0.661	2.207	5.332
120352139400	Illinois	0.421	1.496	3.944	0.666	2.701	8.192	0.662	2.194	5.318	0.666	2.204	5.323	0.660	2.205	5.328
120390039100	Illinois	0.421	1.500	3.949	0.663	2.711	8.186	0.662	2.192	5.317	0.660	2.220	5.228	0.659	2.199	5.328
120390041300	Illinois	0.421	1.500	3.949	0.663	2.711	8.186	0.662	2.192	5.317	0.660	2.220	5.228	0.659	2.199	5.328
120390041400	Illinois	0.421	1.500	3.949	0.663	2.711	8.186	0.662	2.192	5.317	0.660	2.220	5.228	0.659	2.199	5.328
120392094800	Illinois	0.422	1.499	3.953	0.663	2.709	8.197	0.663	2.190	5.334	0.660	2.220	5.228	0.659	2.199	5.328
120392101200	Illinois	0.422	1.499	3.953	0.663	2.709	8.197	0.663	2.190	5.334	0.660	2.220	5.228	0.659	2.199	5.328
120410068200	Illinois	0.422	1.498	3.938	0.666	2.702	8.182	0.657	2.195	5.339	0.661	2.204	5.305	0.659	2.199	5.328
120410105300	Illinois	0.422	1.500	3.939	0.665	2.704	8.192	0.658	2.196	5.339	0.660	2.220	5.228	0.659	2.199	5.328
120410113100	Illinois	0.422	1.500	3.939	0.665	2.704	8.192	0.658	2.196	5.339	0.660	2.220	5.228	0.659	2.199	5.328
120410113200	Illinois	0.422	1.500	3.939	0.665	2.704	8.192	0.658	2.196	5.339	0.660	2.220	5.228	0.659	2.199	5.328
120410113400	Illinois	0.422	1.499	3.938	0.665	2.702	8.193	0.657	2.194	5.344	0.661	2.204	5.305	0.659	2.199	5.328
120410114100	Illinois	0.422	1.499	3.938	0.665	2.702	8.193	0.657	2.194	5.344	0.661	2.204	5.305	0.659	2.199	5.328
120410114200	Illinois	0.422	1.499	3.938	0.665	2.702	8.193	0.657	2.194	5.344	0.661	2.204	5.305	0.659	2.199	5.328
120450084301	Illinois	0.422	1.498	3.936	0.666	2.703	8.171	0.658	2.193	5.331	0.663	2.194	5.323	0.666	2.195	5.324
120450110000	Illinois	0.422	1.499	3.933	0.667	2.701	8.178	0.658	2.193	5.331	0.663	2.194	5.323	0.666	2.195	5.324
120450121000	Illinois	0.422	1.498	3.936	0.666	2.703	8.171	0.658	2.193	5.331	0.663	2.194	5.323	0.666	2.195	5.324
120472430900	Illinois	0.420	1.498	3.942	0.667	2.702	8.159	0.662	2.195	5.296	0.672	2.204	5.310	0.659	2.204	5.334
120492245100	Illinois	0.422	1.495	3.945	0.664	2.703	8.191	0.662	2.194	5.318	0.666	2.204	5.323	0.660	2.205	5.328
120492311700	Illinois	0.422	1.495	3.948	0.664	2.704	8.181	0.665	2.198	5.291	0.668	2.198	5.309	0.660	2.207	5.325
120510157200	Illinois	0.423	1.493	3.954	0.663	2.696	8.207	0.663	2.195	5.324	0.662	2.199	5.344	0.662	2.205	5.327
120510330901	Illinois	0.423	1.493	3.954	0.663	2.696	8.207	0.663	2.195	5.324	0.662	2.199	5.344	0.662	2.205	5.327
120512485401	Illinois	0.422	1.494	3.951	0.665	2.699	8.180	0.664	2.200	5.301	0.670	2.197	5.311	0.661	2.206	5.324
120570083100	Illinois	0.421	1.503	3.969	0.655	2.698	8.206	0.666	2.199	5.281	0.660	2.220	5.228	0.659	2.199	5.328
120570094700	Illinois	0.421	1.503	3.969	0.655	2.698	8.206	0.666	2.199	5.281	0.660	2.220	5.228	0.659	2.199	5.328
120570118600	Illinois	0.423	1.497	3.968	0.660	2.698	8.223	0.666	2.199	5.281	0.660	2.220	5.228	0.659	2.199	5.328
120570137900	Illinois	0.421	1.503	3.969	0.655	2.698	8.206	0.666	2.199	5.281	0.660	2.220	5.228	0.659	2.199	5.328
120570195200	Illinois	0.421	1.503	3.969	0.655	2.698	8.206	0.666	2.199	5.281	0.660	2.220	5.228	0.659	2.199	5.328
120590331600	Illinois	0.420	1.501	3.963	0.670	2.700	8.142	0.668	2.197	5.278	0.671	2.200	5.285	0.663	2.204	5.335
120650345000	Illinois	0.420	1.502	3.955	0.668	2.700	8.142	0.666	2.198	5.290	0.673	2.199	5.278	0.663	2.206	5.335
120670002400	Illinois	0.421	1.503	3.969	0.655	2.698	8.206	0.666	2.199	5.281	0.671	2.200	5.285	0.663	2.204	5.335
120670020000	Illinois	0.421	1.503	3.969	0.655	2.698	8.206	0.666	2.199	5.281	0.671	2.200	5.285	0.663	2.204	5.335
120710031700	Illinois	0.421	1.503	3.969	0.655	2.698	8.206	0.666	2.199	5.281	0.660	2.220	5.228	0.659	2.199	5.328
120750004800	Illinois	0.420	1.505	3.935	0.664	2.716	8.151	0.662	2.191	5.298	0.660	2.220	5.228	0.659	2.199	5.328
120770151101	Illinois	0.421	1.502	3.951	0.667	2.700	8.155	0.666	2.199	5.293	0.673	2.198	5.287	0.664	2.207	5.331
120950039500	Illinois	0.421	1.503	3.969	0.655	2.698	8.206	0.666	2.199	5.281	0.673	2.198	5.287	0.664	2.207	5.331
120950058400	Illinois	0.421	1.503	3.969	0.655	2.698	8.206	0.666	2.199	5.281	0.673	2.198	5.287	0.664	2.207	5.331
120950058500	Illinois	0.421	1.503	3.969	0.655	2.698	8.206	0.666	2.199	5.281	0.673	2.198	5.287	0.664	2.207	5.331
120950058900	Illinois	0.421	1.503	3.969	0.655	2.698	8.206	0.666	2.199	5.281	0.673	2.198	5.287	0.664	2.207	5.331
121010742500	Illinois	0.421	1.497	3.939	0.665	2.702	8.184	0.660	2.196	5.305	0.668	2.201	5.302	0.661	2.200	5.332
121010742501	Illinois	0.421	1.497	3.939	0.665	2.702	8.184	0.660	2.196	5.305	0.668	2.201	5.302	0.661	2.200	5.332

Appendix 2 (cont.)

ID	State	Efficiency Factors (E)														
		Unit 2			Unit 3			Unit 4			Unit 4b			Unit 5		
		P_{10}	P_{50}	P_{90}	P_{10}	P_{50}	P_{90}	P_{10}	P_{50}	P_{90}	P_{10}	P_{50}	P_{90}	P_{10}	P_{50}	P_{90}
121010895700	Illinois	0.420	1.497	3.938	0.665	2.701	8.180	0.661	2.194	5.302	0.668	2.199	5.311	0.661	2.200	5.332
121050073900	Illinois	0.420	1.504	3.947	0.663	2.716	8.152	0.662	2.191	5.298	0.660	2.220	5.228	0.659	2.199	5.328
121050089000	Illinois	0.420	1.504	3.947	0.663	2.716	8.152	0.662	2.191	5.298	0.660	2.220	5.228	0.659	2.199	5.328
121070019901	Illinois	0.422	1.497	3.957	0.664	2.705	8.202	0.659	2.186	5.379	0.660	2.220	5.228	0.659	2.199	5.328
121070021600	Illinois	0.422	1.497	3.952	0.665	2.703	8.208	0.660	2.193	5.349	0.660	2.220	5.228	0.659	2.199	5.328
121070035701	Illinois	0.422	1.497	3.957	0.664	2.705	8.202	0.659	2.186	5.379	0.660	2.220	5.228	0.659	2.199	5.328
121090033600	Illinois	0.421	1.503	3.969	0.655	2.698	8.206	0.666	2.199	5.281	0.660	2.220	5.228	0.659	2.199	5.328
121090044000	Illinois	0.421	1.503	3.969	0.655	2.698	8.206	0.666	2.199	5.281	0.660	2.220	5.228	0.659	2.199	5.328
121090071700	Illinois	0.421	1.503	3.969	0.655	2.698	8.206	0.666	2.199	5.281	0.660	2.220	5.228	0.659	2.199	5.328
121132195600	Illinois	0.420	1.504	3.948	0.663	2.717	8.168	0.662	2.192	5.317	0.660	2.220	5.228	0.659	2.199	5.328
121150010300	Illinois	0.422	1.498	3.949	0.663	2.701	8.211	0.660	2.193	5.349	0.660	2.220	5.228	0.659	2.199	5.328
121152341500	Illinois	0.422	1.498	3.950	0.661	2.702	8.204	0.660	2.193	5.349	0.660	2.220	5.228	0.659	2.199	5.328
121152343800	Illinois	0.422	1.498	3.950	0.661	2.702	8.204	0.660	2.193	5.349	0.660	2.220	5.228	0.659	2.199	5.328
121152346000	Illinois	0.422	1.498	3.950	0.661	2.702	8.204	0.660	2.193	5.349	0.660	2.220	5.228	0.659	2.199	5.328
121190062700	Illinois	0.422	1.491	3.968	0.668	2.697	8.219	0.663	2.210	5.328	0.660	2.220	5.228	0.659	2.199	5.328
121190087600	Illinois	0.422	1.497	3.969	0.663	2.698	8.140	0.666	2.203	5.296	0.676	2.186	5.292	0.662	2.210	5.319
121190087601	Illinois	0.422	1.497	3.969	0.663	2.698	8.140	0.666	2.203	5.296	0.676	2.186	5.292	0.662	2.210	5.319
121190087700	Illinois	0.422	1.497	3.969	0.663	2.698	8.140	0.666	2.203	5.296	0.676	2.186	5.292	0.662	2.210	5.319
121190087702	Illinois	0.422	1.497	3.969	0.663	2.698	8.140	0.666	2.203	5.296	0.676	2.186	5.292	0.662	2.210	5.319
121210519800	Illinois	0.421	1.497	3.957	0.663	2.699	8.168	0.666	2.201	5.299	0.672	2.194	5.297	0.664	2.207	5.331
121250006300	Illinois	0.423	1.497	3.968	0.660	2.698	8.223	0.666	2.199	5.281	0.676	2.186	5.292	0.662	2.210	5.319
121330002800	Illinois	0.422	1.502	3.973	0.665	2.700	8.131	0.667	2.203	5.299	0.676	2.186	5.292	0.662	2.215	5.305
121350176000	Illinois	0.423	1.492	3.956	0.661	2.698	8.194	0.663	2.197	5.348	0.676	2.186	5.292	0.660	2.200	5.335
121352332700	Illinois	0.423	1.492	3.956	0.661	2.698	8.194	0.663	2.197	5.348	0.676	2.186	5.292	0.660	2.200	5.335
121352394500	Illinois	0.423	1.492	3.956	0.661	2.698	8.194	0.663	2.197	5.348	0.676	2.186	5.292	0.660	2.200	5.335
121370017800	Illinois	0.423	1.493	3.964	0.663	2.698	8.220	0.667	2.175	5.438	0.676	2.186	5.292	0.659	2.199	5.328
121370034600	Illinois	0.423	1.493	3.964	0.663	2.698	8.220	0.667	2.175	5.438	0.660	2.220	5.228	0.659	2.199	5.328
121370034900	Illinois	0.424	1.488	3.972	0.663	2.698	8.220	0.667	2.175	5.438	0.676	2.186	5.292	0.659	2.199	5.328
121372201600	Illinois	0.424	1.488	3.972	0.663	2.698	8.220	0.667	2.187	5.438	0.676	2.186	5.292	0.659	2.199	5.328
121390015000	Illinois	0.422	1.495	3.952	0.662	2.705	8.184	0.662	2.194	5.343	0.660	2.220	5.228	0.659	2.199	5.328
121430041800	Illinois	0.418	1.501	3.984	0.655	2.721	8.190	0.664	2.187	5.324	0.676	2.186	5.292	0.659	2.199	5.328
121430046800	Illinois	0.418	1.501	3.984	0.655	2.721	8.190	0.664	2.187	5.324	0.676	2.186	5.292	0.659	2.199	5.328
121430083300	Illinois	0.420	1.504	3.965	0.655	2.697	8.237	0.664	2.198	5.295	0.676	2.186	5.292	0.659	2.199	5.328
121452323400	Illinois	0.422	1.500	3.954	0.665	2.702	8.140	0.666	2.203	5.294	0.673	2.188	5.270	0.663	2.206	5.327
121452430400	Illinois	0.421	1.500	3.954	0.667	2.703	8.153	0.666	2.199	5.293	0.673	2.198	5.287	0.664	2.207	5.331
121452888200	Illinois	0.422	1.500	3.955	0.665	2.699	8.132	0.665	2.203	5.300	0.676	2.186	5.292	0.663	2.206	5.327
121490010100	Illinois	0.422	1.501	3.964	0.661	2.697	8.223	0.666	2.199	5.281	0.660	2.220	5.228	0.659	2.199	5.328
121490018900	Illinois	0.422	1.501	3.964	0.661	2.697	8.223	0.666	2.199	5.281	0.660	2.220	5.228	0.659	2.199	5.328
121490020500	Illinois	0.424	1.497	3.943	0.688	2.693	8.292	0.666	2.203	5.294	0.673	2.188	5.270	0.663	2.206	5.326
121492102000	Illinois	0.423	1.497	3.968	0.660	2.698	8.223	0.666	2.199	5.281	0.660	2.220	5.228	0.659	2.199	5.328
121630314100	Illinois	0.424	1.502	3.963	0.665	2.701	8.152	0.667	2.203	5.299	0.676	2.186	5.292	0.662	2.215	5.305
121632577400	Illinois	0.422	1.500	3.965	0.665	2.697	8.126	0.666	2.203	5.296	0.676	2.186	5.292	0.662	2.210	5.319
121632577401	Illinois	0.422	1.500	3.965	0.665	2.697	8.126	0.666	2.203	5.296	0.676	2.186	5.292	0.662	2.210	5.319
121652550800	Illinois	0.420	1.502	3.955	0.668	2.700	8.142	0.666	2.198	5.290	0.673	2.199	5.278	0.663	2.206	5.335
121672547200	Illinois	0.424	1.494	3.957	0.664	2.700	8.200	0.662	2.183	5.386	0.660	2.220	5.228	0.659	2.199	5.328
121672547201	Illinois	0.424	1.494	3.957	0.664	2.700	8.200	0.662	2.183	5.386	0.660	2.220	5.228	0.659	2.199	5.328
121672547202	Illinois	0.424	1.494	3.957	0.664	2.700	8.200	0.662	2.183	5.386	0.660	2.220	5.228	0.659	2.199	5.328
121672547203	Illinois	0.424	1.494	3.957	0.664	2.700	8.200	0.662	2.183	5.386	0.660	2.220	5.228	0.659	2.199	5.328
121672553300	Illinois	0.423	1.495	3.962	0.662	2.702	8.188	0.662	2.183	5.386	0.660	2.220	5.228	0.659	2.199	5.328
121690035800	Illinois	0.423	1.497	3.968	0.660	2.698	8.223	0.666	2.199	5.281	0.660	2.220	5.228	0.659	2.199	5.328
121892329000	Illinois	0.421	1.499	3.956	0.667	2.703	8.157	0.667	2.201	5.293	0.670	2.193	5.279	0.664	2.207	5.331
121892433300	Illinois	0.421	1.499	3.956	0.667	2.703	8.157	0.667	2.201	5.293	0.670	2.193	5.279	0.664	2.207	5.331
121910773100	Illinois	0.421	1.497	3.950	0.665	2.702	8.160	0.665	2.197	5.290	0.670	2.200	5.298	0.661	2.205	5.329
121930469400	Illinois	0.420	1.498	3.941	0.669	2.698	8.163	0.664	2.195	5.292	0.671	2.202	5.298	0.659	2.205	5.332
121990253100	Illinois	0.420	1.502	3.956	0.669	2.697	8.141	0.666	2.198	5.289	0.673	2.198	5.287	0.664	2.207	5.331
1211523552000	Illinois	0.422	1.498	3.950	0.661	2.702	8.204	0.660	2.193	5.349	0.660	2.220	5.228	0.659	2.199	5.328

Appendix 2 (cont.)

ID	State	Efficiency Factors (E)														
		P_{10}	P_{50}	P_{90}	P_{10}	P_{50}	P_{90}	P_{10}	P_{50}	P_{90}	P_{10}	P_{50}	P_{90}	P_{10}	P_{50}	P_{90}
		Unit 2			Unit 3			Unit 4			Unit 4b			Unit 5		
1602700244000	Kentucky	0.417	1.492	3.962	0.662	2.694	8.188	0.663	2.200	5.338	0.660	2.220	5.228	0.656	2.202	5.340
1609100048000	Kentucky	0.417	1.492	3.962	0.662	2.694	8.188	0.663	2.200	5.338	0.660	2.220	5.228	0.656	2.202	5.340
16027002420000	Kentucky	0.417	1.492	3.962	0.662	2.694	8.188	0.663	2.200	5.338	0.673	2.198	5.287	0.656	2.202	5.340
16111000010000	Kentucky	0.418	1.492	3.966	0.662	2.694	8.170	0.662	2.200	5.332	0.667	2.190	5.263	0.658	2.193	5.322
16111000020000	Kentucky	0.418	1.492	3.966	0.662	2.694	8.170	0.662	2.200	5.332	0.667	2.190	5.263	0.658	2.193	5.322
16163001540000	Kentucky	0.418	1.493	3.962	0.661	2.692	8.172	0.662	2.200	5.332	0.667	2.190	5.263	0.658	2.193	5.322
16163003370000	Kentucky	0.418	1.493	3.962	0.661	2.692	8.172	0.662	2.200	5.332	0.667	2.190	5.263	0.658	2.193	5.322

APPENDIX 3: Formulae for estimating porosity from wireline logs

To calculate porosity using wireline logs, we applied the following equations (Asquith and Gibson, 1982)

3.1.- Sonic Log (Wyllie et al., 1956).

$$\emptyset_{sonic} = \frac{\Delta t_{log} - \Delta t_{ma}}{\Delta t_f - \Delta t_{ma}}$$

Where:
$\emptyset_{sonic} = sonic\ derived\ porosity$;
$\Delta t_{ma} = interval\ transit\ time\ of\ the\ matrix$ (Table A3.1);
$\Delta t_{log} =\ interval\ transit\ time\ of\ formation$; and
$\Delta t_f = interval\ transit\ time\ of\ the\ fluid\ in\ the\ well\ bore\ (in\ fresh\ mud = 189)$

Table A3.1: Interval Transit Times for Different Matrices used in the Sonic Porosity Formula (after Schlumberger, 1972)

	Δt_{ma} (µsec/ft)
Sandstone	55.5-51.0
Limestone	47.6
Dolomite	43.5
Anhydrite	50
Salt	67

3.2.- Density Log.

$$\emptyset_{den} = \frac{\rho_{ma} - \rho_b}{\rho_{ma} - \rho_f}$$

Where:
$\rho_{den} = density\ derived\ porosity$;
$\rho_{ma} = matrix\ density\ (Table\ A3.2)$;
$\rho_b = formation\ bulk\ density$; and
$\rho_f\ fluid\ density\ (1.0\ for\ fresh\ mud)$.

Table A3.2: Matrix Densities of Common Lithologies used in the Density Porosity Formula (after Schlumberger, 1972)

	ρ_{ma} (gm/cc)
Sandstone	2.648
Limestone	2.71
Dolomite	2.876
Anhydrite	2.977
Salt	2.032

APPENDIX 4: Tabular data for all wells used in this study, for all methods.

Table A4.1 SREs values, unit 2

ID	Method 1 (MMTons/Km^2)			Method 2 (MMTons/Km^2)			Method 3 (MMTons/Km^2)			Method 5 (MMTons/Km^2)		
	E_{P10}	E_{P50}	E_{P90}	E_{P10}	E_{P50}	E_{P90}	E_{P10}	E_{P50}	E_{P90}	E_{P10}	E_{P50}	E_{P90}
117407	0.0589	0.2094	0.5503	0.0164	0.0582	0.1530	0.0276	0.0980	0.2577	0.0034	0.0239	0.1540
118307	0.0630	0.2244	0.5913	0.0210	0.0749	0.1973	0.0295	0.1051	0.2769	0.0062	0.0382	0.2000
107208	0.0491	0.1750	0.4609	0.0182	0.0649	0.1709	0.0230	0.0819	0.2158	0.0035	0.0191	0.0963
166184	0.0793	0.2824	0.7441	0.0237	0.0844	0.2224	0.0371	0.1322	0.3485	0.0148	0.0650	0.2404
121010742501	0.0773	0.2752	0.7240	0.0252	0.0897	0.2360	0.0362	0.1289	0.3390	0.0201	0.0781	0.2525
121910773100	0.0745	0.2647	0.6984				0.0349	0.1239	0.3270			
120272454800	0.0624	0.2218	0.5861	0.0151	0.0538	0.1420	0.0292	0.1039	0.2744			
120510157200	0.0602	0.2126	0.5630				0.0282	0.0995	0.2636			
120650345000	0.0873	0.3120	0.8218	0.0306	0.1093	0.2880	0.0409	0.1461	0.3848	0.0200	0.0876	0.3062
121010742500	0.0750	0.2670	0.7024	0.0465	0.1656	0.4357	0.0351	0.1250	0.3289	0.0429	0.1558	0.4303
121190087600	0.0490	0.1739	0.4611				0.0230	0.0814	0.2159			
121452323400	0.0669	0.2376	0.6265	0.0223	0.0792	0.2087	0.0313	0.1113	0.2933	0.0091	0.0482	0.2291
121490020500	0.0262	0.0925	0.2436				0.0123	0.0433	0.1141			
121630314100	0.0437	0.1549	0.4087				0.0205	0.0726	0.1914			
121892329000	0.0675	0.2408	0.6353				0.0316	0.1127	0.2975			
120333567100	0.0654	0.2326	0.6114	0.0173	0.0616	0.1620	0.0306	0.1089	0.2863	0.0066	0.0365	0.1746
121210519800	0.0676	0.2405	0.6354	0.0233	0.0828	0.2188	0.0317	0.1126	0.2975	0.0172	0.0701	0.2297
121452888200	0.0635	0.2256	0.5948	0.0217	0.0772	0.2035	0.0297	0.1056	0.2785	0.0072	0.0422	0.2167
121892433300	0.0716	0.2554	0.6738	0.0114	0.0407	0.1075	0.0335	0.1196	0.3155	0.0021	0.0165	0.1176
121132195600	0.0349	0.1252	0.3286	0.0298	0.1068	0.2803	0.0164	0.0586	0.1539	0.0032	0.0142	0.0568
121490018900	0.0279	0.0993	0.2622				0.0131	0.0465	0.1228			
120750004800	0.0373	0.1337	0.3496	0.0200	0.0718	0.1877	0.0175	0.0626	0.1637	0.0010	0.0056	0.0295
121050073900	0.0363	0.1300	0.3411				0.0170	0.0609	0.1597			
120190126200	0.0497	0.1767	0.4642	0.0851	0.3026	0.7947	0.0233	0.0828	0.2174	0.0108	0.0420	0.1289
120410113100	0.0503	0.1790	0.4701				0.0236	0.0838	0.2201			
120410113400	0.0513	0.1822	0.4786				0.0240	0.0853	0.2241			
121050089000	0.0362	0.1297	0.3402				0.0169	0.0607	0.1593	0.0002	0.0011	0.0066
120390041300	0.0403	0.1434	0.3774				0.0189	0.0671	0.1767			
120710031700	0.0331	0.1183	0.3126				0.0155	0.0554	0.1464			
121492102000	0.0294	0.1043	0.2764				0.0138	0.0488	0.1294			
121370034600	0.0361	0.1274	0.3382				0.0169	0.0596	0.1584			
164778	0.0667	0.2373	0.6250	0.0152	0.0542	0.1429	0.0312	0.1111	0.2927	0.0039	0.0263	0.1608
ADM	0.0429	0.1522	0.4015	0.0179	0.0637	0.1679	0.0201	0.0713	0.1880	0.0055	0.0326	0.1689
1602700244000	0.0645	0.2304	0.6120	0.0089	0.0319	0.0848	0.0302	0.1079	0.2866	0.0010	0.0088	0.0778
157501	0.0564	0.2009	0.5269	0.0316	0.1124	0.2948	0.0264	0.0941	0.2467	0.0071	0.0445	0.2377
156024	0.0741	0.2651	0.7004	0.0089	0.0320	0.0845	0.0347	0.1241	0.3280	0.0026	0.0165	0.0901
120472430900	0.0764	0.2721	0.7162				0.0358	0.1274	0.3354			
121010895700	0.0728	0.2594	0.6824				0.0341	0.1215	0.3195			
121390015000	0.0542	0.1918	0.5070				0.0254	0.0898	0.2374			
121930469400	0.0857	0.3056	0.8039				0.0401	0.1431	0.3764			
121990253100	0.1081	0.3865	1.0180				0.0506	0.1810	0.4767			
1602700242000	0.0682	0.2437	0.6472	0.0175	0.0626	0.1663	0.0319	0.1141	0.3031	0.0035	0.0248	0.1465
1611100001000	0.0639	0.2283	0.6066	0.0175	0.0625	0.1662	0.0299	0.1069	0.2841	0.0013	0.0066	0.0332
1611100002000	0.0633	0.2263	0.6015				0.0296	0.1060	0.2816			
1616300154000	0.0659	0.2353	0.6246	0.0196	0.0700	0.1858	0.0309	0.1102	0.2925	0.0019	0.0119	0.0702
1616300337000	0.0682	0.2435	0.6463				0.0319	0.1140	0.3026			
125110	0.0468	0.1665	0.4363	0.0129	0.0459	0.1203	0.0219	0.0780	0.2043	0.0044	0.0227	0.0984
152652	0.0579	0.2068	0.5467	0.0127	0.0454	0.1201	0.0271	0.0968	0.2560	0.0030	0.0205	0.1269
155163	0.0648	0.2325	0.6156	0.0576	0.2069	0.5478	0.0303	0.1089	0.2883	0.0421	0.1706	0.5737
120492245100	0.0592	0.2099	0.5540	0.0175	0.0619	0.1634	0.0277	0.0983	0.2594	0.0092	0.0440	0.1760

Table A4.1 SREs values, unit 2 (Cont.)

ID	Method 1 (MMTons/Km^2)			Method 2 (MMTons/Km^2)			Method 3 (MMTons/Km^2)			Method 5 (MMTons/Km^2)		
	E_{P10}	E_{P50}	E_{P90}	E_{P10}	E_{P50}	E_{P90}	E_{P10}	E_{P50}	E_{P90}	E_{P10}	E_{P50}	E_{P90}
120010025601	0.0247	0.0883	0.2333				0.0116	0.0413	0.1092			
120090012403	0.0272	0.0970	0.2562				0.0128	0.0454	0.1200			
120090015300	0.0261	0.0931	0.2459				0.0122	0.0436	0.1151			
120092231100	0.0265	0.0945	0.2494				0.0124	0.0442	0.1168			
120170001900	0.0302	0.1069	0.2834				0.0141	0.0501	0.1327			
120190012100	0.0422	0.1505	0.3948	0.0147	0.0525	0.1377	0.0198	0.0705	0.1849	0.0012	0.0061	0.0290
120190023100	0.0531	0.1888	0.4960				0.0249	0.0884	0.2323			
120190034701	0.0485	0.1728	0.4533				0.0227	0.0809	0.2123			
120210225400	0.0375	0.1328	0.3510				0.0176	0.0622	0.1644			
120232603800	0.0687	0.2442	0.6419	0.0657	0.2333	0.6132	0.0322	0.1144	0.3006	0.0579	0.2178	0.6248
120330895700	0.0731	0.2605	0.6853				0.0342	0.1220	0.3209			
120352139400	0.0618	0.2196	0.5791				0.0290	0.1028	0.2712	0.0045	0.0258	0.1286
120390039100	0.0402	0.1430	0.3765	0.0141	0.0501	0.1318	0.0188	0.0670	0.1763	0.0026	0.0150	0.0773
120390041400	0.0391	0.1392	0.3662				0.0183	0.0652	0.1715			
120392094800	0.0418	0.1487	0.3920				0.0196	0.0696	0.1835			
120392101200	0.0383	0.1360	0.3587				0.0179	0.0637	0.1680			
120410068200	0.0545	0.1932	0.5078				0.0255	0.0905	0.2378			
120410105300	0.0520	0.1849	0.4855				0.0244	0.0866	0.2274			
120410113200	0.0504	0.1793	0.4710				0.0236	0.0840	0.2205			
120410114100	0.0513	0.1822	0.4786				0.0240	0.0853	0.2241			
120410114200	0.0530	0.1880	0.4940				0.0248	0.0881	0.2313			
120450084301	0.0600	0.2132	0.5599				0.0281	0.0998	0.2622			
120450110000	0.0552	0.1962	0.5148				0.0259	0.0919	0.2411			
120450121000	0.0578	0.2056	0.5400				0.0271	0.0963	0.2529			
120492311700	0.0636	0.2252	0.5948	0.0262	0.0929	0.2454	0.0298	0.1054	0.2785	0.0128	0.0628	0.2705
120510330901	0.0584	0.2063	0.5463				0.0274	0.0966	0.2558			
120512485401	0.0624	0.2209	0.5842				0.0292	0.1035	0.2736			
120570083100	0.0295	0.1054	0.2784				0.0138	0.0493	0.1304			
120570094700	0.0252	0.0900	0.2378				0.0118	0.0421	0.1113			
120570118600	0.0295	0.1043	0.2765				0.0138	0.0489	0.1295			
120570137900	0.0265	0.0946	0.2499				0.0124	0.0443	0.1170			
120570195200	0.0266	0.0949	0.2507				0.0124	0.0444	0.1174			
120590331600	0.1081	0.3865	1.0204				0.0506	0.1810	0.4778			
120670002400	0.0224	0.0801	0.2117				0.0105	0.0375	0.0991			
120670020000	0.0232	0.0827	0.2185				0.0109	0.0387	0.1023			
120770151101	0.0771	0.2751	0.7240	0.0100	0.0355	0.0935	0.0361	0.1288	0.3390	0.0021	0.0161	0.1008
120950039500	0.0269	0.0962	0.2541				0.0126	0.0450	0.1190			
120950058400	0.0261	0.0932	0.2463				0.0122	0.0437	0.1153			
120950058500	0.0284	0.1014	0.2679				0.0133	0.0475	0.1255			
120950058900	0.0289	0.1031	0.2722				0.0135	0.0483	0.1275			
121070019901	0.0357	0.1267	0.3350				0.0167	0.0593	0.1569			
121070021600	0.0350	0.1242	0.3277				0.0164	0.0581	0.1534			
121070035701	0.0358	0.1270	0.3358				0.0168	0.0595	0.1572			
121090033600	0.0249	0.0889	0.2350				0.0117	0.0416	0.1100			
121090044000	0.0270	0.0965	0.2550				0.0127	0.0452	0.1194			
121090071700	0.0344	0.1227	0.3240	0.0495	0.1767	0.4667	0.0161	0.0574	0.1517	0.0040	0.0160	0.0517
121150010300	0.0403	0.1430	0.3770				0.0189	0.0669	0.1765			
121152341500	0.0418	0.1482	0.3908				0.0196	0.0694	0.1830			
121190062700	0.0380	0.1342	0.3569				0.0178	0.0628	0.1671			
121190087601	0.0508	0.1801	0.4776				0.0238	0.0843	0.2236			

Table A4.1 SREs values, unit 2 (Cont.)

ID	Method 1 (MMTons/Km^2)			Method 2 (MMTons/Km^2)			Method 3 (MMTons/Km^2)			Method 5 (MMTons/Km^2)		
	E_{P10}	E_{P50}	E_{P90}	E_{P10}	E_{P50}	E_{P90}	E_{P10}	E_{P50}	E_{P90}	E_{P10}	E_{P50}	E_{P90}
121190087700	0.0508	0.1802	0.4777				0.0238	0.0844	0.2237			
121250006300	0.0351	0.1242	0.3292				0.0164	0.0582	0.1542			
121350176000	0.0471	0.1663	0.4409				0.0221	0.0779	0.2065			
121352332700	0.0470	0.1660	0.4400				0.0220	0.0777	0.2061			
121352394500	0.0468	0.1654	0.4384	0.0257	0.0907	0.2403	0.0219	0.0774	0.2053	0.0087	0.0496	0.2430
121370017800	0.0351	0.1237	0.3284				0.0164	0.0579	0.1538			
121370034900	0.0335	0.1177	0.3144	0.0416	0.1460	0.3898	0.0157	0.0551	0.1472	0.0081	0.0327	0.1305
121372201600	0.0347	0.1216	0.3248				0.0162	0.0570	0.1521			
121430041800	0.0308	0.1106	0.2934				0.0144	0.0518	0.1374			
121430046800	0.0301	0.1079	0.2864				0.0141	0.0505	0.1341			
121430083300	0.0288	0.1032	0.2721				0.0135	0.0483	0.1274			
121452430400	0.0732	0.2612	0.6886	0.0140	0.0498	0.1313	0.0343	0.1223	0.3225	0.0038	0.0243	0.1512
121490010100	0.0033	0.0118	0.0311				0.0015	0.0055	0.0145			
121632577400	0.0559	0.1986	0.5251				0.0262	0.0930	0.2459			
121632577401	0.0560	0.1987	0.5254				0.0262	0.0931	0.2460			
121652550800	0.0974	0.3478	0.9160				0.0456	0.1629	0.4289			
121672547201	0.0375	0.1321	0.3498				0.0175	0.0619	0.1638			
121672547202	0.0375	0.1321	0.3498				0.0175	0.0619	0.1638			
121672553300	0.0370	0.1308	0.3467	0.0179	0.0634	0.1681	0.0173	0.0613	0.1624	0.0025	0.0184	0.1162
121690035800	0.0289	0.1023	0.2712				0.0135	0.0479	0.1270			
106875	0.0537	0.1919	0.5069				0.0252	0.0898	0.2374			
122844	0.0746	0.2658	0.6994				0.0349	0.1244	0.3275			
125296	0.0569	0.2029	0.5326				0.0266	0.0950	0.2494			
126424	0.0532	0.1893	0.4969				0.0249	0.0887	0.2327			
126785	0.0468	0.1662	0.4345				0.0219	0.0778	0.2035			
136949	0.0457	0.1634	0.4253				0.0214	0.0765	0.1991			
144489	0.0365	0.1308	0.3400				0.0171	0.0612	0.1592			
152617	0.0494	0.1763	0.4663				0.0231	0.0825	0.2183			
152875	0.0382	0.1372	0.3561				0.0179	0.0642	0.1667			
155634	0.0561	0.2001	0.5291	0.0164	0.0585	0.1548	0.0263	0.0937	0.2478	0.0043	0.0277	0.1632
156748	0.0560	0.1993	0.5227				0.0262	0.0933	0.2447			
157268	0.0623	0.2215	0.5816	0.0185	0.0658	0.1727	0.0292	0.1037	0.2723	0.0071	0.0401	0.1886
157271	0.0638	0.2267	0.5958	0.0133	0.0472	0.1239	0.0299	0.1062	0.2790	0.0043	0.0252	0.1332
157272	0.0611	0.2172	0.5701	0.0193	0.0685	0.1800	0.0286	0.1017	0.2670	0.0060	0.0357	0.1922
157445	0.0635	0.2258	0.5932	0.0152	0.0540	0.1420	0.0297	0.1057	0.2778	0.0052	0.0304	0.1535
158005	0.0617	0.2198	0.5792	0.0289	0.1031	0.2715	0.0289	0.1029	0.2712	0.0172	0.0737	0.2638
158009	0.0591	0.2102	0.5532				0.0277	0.0984	0.2590			
158028	0.0468	0.1672	0.4422				0.0219	0.0783	0.2070			
158090	0.0387	0.1382	0.3598				0.0181	0.0647	0.1685			
158982	0.0406	0.1447	0.3763	0.0138	0.0492	0.1281	0.0190	0.0677	0.1762	0.0009	0.0049	0.0248
160065	0.0544	0.1935	0.5099				0.0255	0.0906	0.2388			
160648	0.0400	0.1423	0.3716	0.0217	0.0771	0.2013	0.0187	0.0666	0.1740	0.0017	0.0084	0.0394
160847	0.0474	0.1694	0.4434				0.0222	0.0793	0.2076			
160855	0.0445	0.1591	0.4144				0.0208	0.0745	0.1941			
164480	0.0618	0.2196	0.5769	0.0221	0.0785	0.2063	0.0289	0.1029	0.2702	0.0084	0.0459	0.2049
158069	0.0432	0.1542	0.4015				0.0202	0.0722	0.1880			
121152343800	0.0608	0.2158	0.5691				0.0285	0.1010	0.2665			
121152346000	0.0576	0.2043	0.5388				0.0270	0.0957	0.2523			
1211523552000	0.0568	0.2014	0.5311				0.0266	0.0943	0.2487			
1609100048000	0.0588	0.2102	0.5582	0.0245	0.0875	0.2323	0.0275	0.0984	0.2614	0.0108	0.0560	0.2448
1211900877020	0.0597	0.2116	0.5610				0.0279	0.0991	0.2627			
1213300028000	0.0527	0.1873	0.4953				0.0247	0.0877	0.2319			
1216725472000	0.0375	0.1321	0.3498				0.0175	0.0619	0.1638			
1216725472030	0.0375	0.1321	0.3498				0.0175	0.0619	0.1638			
166645	0.0022	0.0078	0.0206				0.0010	0.0037	0.0097			
160835	0.0480	0.1710	0.4474				0.0225	0.0801	0.2095			

Table A4.2 SREs values, unit 3

ID	Method 1 (MMTons/Km^2)			Method 2 (MMTons/Km^2)			Method 3 (MMTons/Km^2)			Method 4 (MMTons/Km^2)			Method 5 (MMTons/Km^2)		
	E_{P10}	E_{P50}	E_{P90}	E_{P10}	E_{P50}	E_{P90}	E_{P10}	E_{P50}	E_{P90}	E_{P10}	E_{P50}	E_{P90}	E_{P10}	E_{P50}	E_{P90}
117407	0.0098	0.0177	0.0535	0.0039	0.0159	0.0482	0.0043	0.0173	0.0523	0.0048	0.0195	0.0589	0.0031	0.0138	0.0449
118307	0.0079	0.0142	0.0429				0.0034	0.0138	0.0419	0.0036	0.0146	0.0441	0.0022	0.0093	0.0301
107208	0.0208	0.0374	0.1134	0.0109	0.0441	0.1338	0.0090	0.0365	0.1108	0.0134	0.0547	0.1658	0.0050	0.0240	0.0945
166184	0.0428	0.0771	0.2342	0.0024	0.0098	0.0297	0.0186	0.0754	0.2288	0.0071	0.0288	0.0874	0.0008	0.0053	0.0319
121010742501	0.0138	0.0249	0.0755	0.0029	0.0118	0.0358	0.0060	0.0243	0.0737	0.0036	0.0146	0.0443	0.0025	0.0107	0.0361
121910773100	0.1396	0.2519	0.7610				0.0606	0.2461	0.7434	0.0182	0.0739	0.2234			
120272454800	0.0519	0.0935	0.2830	0.0249	0.1012	0.3062	0.0224	0.0914	0.2765	0.0160	0.0650	0.1968			
120510157200	0.0547	0.0987	0.3005				0.0237	0.0964	0.2936	0.0175	0.0710	0.2161			
120650345000	0.0712	0.1281	0.3862	0.0109	0.0442	0.1332	0.0310	0.1251	0.3773	0.0083	0.0334	0.1008	0.0060	0.0320	0.1394
121010742500	0.0148	0.0267	0.0808	0.0053	0.0216	0.0654	0.0064	0.0261	0.0790	0.0039	0.0157	0.0476	0.0051	0.0208	0.0651
121190087600	0.0638	0.1150	0.3469				0.0276	0.1123	0.3389	0.0341	0.1388	0.4188			
121452323400	0.0905	0.1629	0.4910	0.0230	0.0933	0.2812	0.0392	0.1592	0.4797	0.0269	0.1093	0.3294	0.0178	0.0800	0.2857
121490020500	0.0733	0.1319	0.4060				0.0329	0.1288	0.3966	0.0814	0.3188	0.9815			
121630314100	0.0530	0.0953	0.2875				0.0229	0.0931	0.2809	0.0516	0.2097	0.6327			
120333567100	0.0253	0.0456	0.1382	0.0053	0.0214	0.0650	0.0110	0.0446	0.1351	0.0074	0.0299	0.0905	0.0042	0.0186	0.0688
121210519800	0.0592	0.1067	0.3228	0.0324	0.1318	0.3989	0.0256	0.1042	0.3154	0.0147	0.0599	0.1812	0.0308	0.1265	0.3960
121452888200	0.0779	0.1401	0.4223	0.0233	0.0945	0.2849	0.0338	0.1369	0.4126	0.0276	0.1119	0.3372	0.0208	0.0862	0.2831
121892433300	0.1351	0.2436	0.7350	0.0114	0.0461	0.1390	0.0587	0.2380	0.7181	0.0291	0.1179	0.3557	0.0062	0.0327	0.1480
121132195600	0.0751	0.1356	0.4078	0.0317	0.1299	0.3905	0.0323	0.1325	0.3984	0.0597	0.2445	0.7351	0.0056	0.0269	0.1204
121490018900	0.0549	0.0986	0.3007				0.0236	0.0964	0.2938	0.0549	0.2238	0.6822			
120750004800	0.0679	0.1225	0.3677	0.0550	0.2251	0.6754	0.0293	0.1197	0.3592	0.0582	0.2378	0.7136	0.0083	0.0371	0.1425
121050073900	0.0799	0.1443	0.4332	0.0664	0.2722	0.8170	0.0344	0.1410	0.4232	0.0743	0.3043	0.9134	0.0067	0.0321	0.1226
120190126200	0.0657	0.1185	0.3590	0.0479	0.1945	0.5894	0.0285	0.1157	0.3507	0.0529	0.2149	0.6510	0.0089	0.0416	0.1778
120410113100	0.0654	0.1179	0.3571				0.0283	0.1151	0.3489	0.0544	0.2211	0.6699			
120410113400	0.0601	0.1084	0.3286				0.0261	0.1059	0.3210	0.0503	0.2042	0.6191			
121050089000	0.0793	0.1431	0.4296				0.0341	0.1398	0.4197	0.0740	0.3032	0.9102	0.0062	0.0275	0.1022
120390041300	0.0681	0.1231	0.3718				0.0294	0.1203	0.3632	0.0425	0.1736	0.5243			
120710031700	0.0160	0.0288	0.0875				0.0068	0.0281	0.0855	0.0161	0.0664	0.2021			
121370034600	0.0833	0.1507	0.4589				0.0362	0.1472	0.4484	0.0608	0.2473	0.7532			
164778	0.0141	0.0254	0.0770	0.0033	0.0135	0.0409	0.0061	0.0248	0.0753	0.0047	0.0192	0.0581	0.0025	0.0117	0.0410
1602700244000	0.0170	0.0306	0.0931	0.0075	0.0303	0.0922	0.0074	0.0299	0.0910	0.0084	0.0343	0.1043	0.0055	0.0250	0.0884
157501	0.0151	0.0271	0.0821	0.0136	0.0551	0.1670	0.0065	0.0265	0.0802	0.0086	0.0348	0.1053	0.0079	0.0388	0.1475
156024	0.0191	0.0343	0.1043	0.0038	0.0156	0.0473	0.0083	0.0335	0.1019	0.0042	0.0169	0.0514	0.0025	0.0124	0.0484
120472430900	0.0928	0.1674	0.5055				0.0404	0.1635	0.4938	0.0121	0.0489	0.1475			
121010895700	0.0085	0.0154	0.0467				0.0037	0.0151	0.0456	0.0023	0.0092	0.0280			
121390015000	0.0357	0.0646	0.1954				0.0154	0.0631	0.1909	0.0129	0.0528	0.1597			
121930469400	0.0545	0.0981	0.2970				0.0238	0.0959	0.2901	0.0070	0.0281	0.0850			
121990253100	0.0484	0.0869	0.2622				0.0211	0.0849	0.2562	0.0057	0.0229	0.0690			
1602700242000	0.0039	0.0071	0.0215	0.0005	0.0020	0.0061	0.0017	0.0069	0.0210	0.0021	0.0085	0.0258	0.0004	0.0016	0.0057
1611100001000	0.0042	0.0076	0.0232	0.0015	0.0060	0.0182	0.0018	0.0075	0.0226	0.0033	0.0136	0.0413	0.0003	0.0012	0.0060
1611100002000	0.0052	0.0094	0.0285				0.0023	0.0092	0.0278	0.0041	0.0167	0.0507			
1616300154000	0.0033	0.0059	0.0178	0.0014	0.0055	0.0168	0.0014	0.0057	0.0174	0.0022	0.0090	0.0274	0.0005	0.0023	0.0106
1616300337000	0.0055	0.0100	0.0303				0.0024	0.0098	0.0296	0.0037	0.0149	0.0451			
125110	0.0488	0.0880	0.2656	0.0306	0.1237	0.3732	0.0212	0.0860	0.2594	0.0276	0.1116	0.3366	0.0188	0.0881	0.3323
152652	0.0111	0.0200	0.0609	0.0035	0.0142	0.0430	0.0048	0.0196	0.0595	0.0044	0.0178	0.0542	0.0029	0.0125	0.0428
155163	0.0066	0.0118	0.0359	0.0019	0.0079	0.0240	0.0028	0.0115	0.0350	0.0020	0.0080	0.0243	0.0016	0.0072	0.0245
120492245100	0.0402	0.0727	0.2203	0.0209	0.0853	0.2584	0.0174	0.0710	0.2152	0.0110	0.0449	0.1359	0.0195	0.0816	0.2585
120010025601	0.0435	0.0781	0.2376				0.0185	0.0763	0.2322	0.0417	0.1719	0.5228			
120090012403	0.0592	0.1063	0.3241				0.0255	0.1038	0.3166	0.0576	0.2351	0.7167			
120090015300	0.0605	0.1086	0.3313				0.0260	0.1061	0.3236	0.0575	0.2344	0.7148			

Table A4.2 SREs values, unit 3 (Cont.)

ID	Method 1 (MMTons/Km^2)			Method 2 (MMTons/Km^2)			Method 3 (MMTons/Km^2)			Method 4 (MMTons/Km^2)			Method 5 (MMTons/Km^2)		
	E_{P10}	E_{P50}	E_{P90}	E_{P10}	E_{P50}	E_{P90}	E_{P10}	E_{P50}	E_{P90}	E_{P10}	E_{P50}	E_{P90}	E_{P10}	E_{P50}	E_{P90}
120092231100	0.0680	0.1222	0.3726				0.0293	0.1194	0.3640	0.0610	0.2490	0.7591			
120170001900	0.0597	0.1076	0.3279				0.0257	0.1051	0.3203	0.0524	0.2144	0.6535			
120190012100	0.0727	0.1311	0.3953	0.0543	0.2213	0.6673	0.0314	0.1281	0.3862	0.0570	0.2321	0.6998	0.0114	0.0519	0.2253
120190023100	0.0559	0.1008	0.3054				0.0242	0.0985	0.2984	0.0442	0.1796	0.5441			
120190034701	0.0681	0.1228	0.3715				0.0295	0.1200	0.3630	0.0461	0.1875	0.5672			
120210225400	0.0948	0.1711	0.5199				0.0410	0.1672	0.5079	0.0501	0.2042	0.6203			
120232603800	0.0814	0.1469	0.4447	0.0745	0.3024	0.9156	0.0301	0.1222	0.3700	0.0254	0.1030	0.3120	0.0437	0.2404	1.0899
120330895700	0.0085	0.0153	0.0464				0.0037	0.0150	0.0453	0.0023	0.0092	0.0278			
120352139400	0.0412	0.0745	0.2259				0.0179	0.0728	0.2207	0.0095	0.0386	0.1170	0.0026	0.0142	0.0607
120390039100	0.0730	0.1320	0.3985	0.0477	0.1952	0.5893	0.0315	0.1290	0.3894	0.0463	0.1895	0.5723	0.0229	0.1112	0.4407
120390041400	0.0629	0.1137	0.3432				0.0272	0.1111	0.3353	0.0385	0.1573	0.4749			
120392094800	0.0662	0.1197	0.3621				0.0286	0.1169	0.3538	0.0352	0.1438	0.4350			
120392101200	0.0157	0.0284	0.0859				0.0068	0.0277	0.0839	0.0106	0.0433	0.1310			
120410068200	0.0493	0.0890	0.2693				0.0214	0.0869	0.2631	0.0397	0.1612	0.4880			
120410105300	0.0595	0.1073	0.3250				0.0258	0.1048	0.3175	0.0497	0.2019	0.6117			
120410113200	0.0643	0.1159	0.3513				0.0279	0.1133	0.3432	0.0536	0.2180	0.6604			
120410114100	0.0624	0.1125	0.3411				0.0271	0.1099	0.3332	0.0519	0.2107	0.6387			
120410114200	0.0660	0.1190	0.3607				0.0286	0.1162	0.3524	0.0546	0.2218	0.6726			
120450084301	0.0183	0.0331	0.0999				0.0080	0.0323	0.0976	0.0115	0.0465	0.1405			
120450110000	0.0216	0.0389	0.1178				0.0094	0.0380	0.1151	0.0140	0.0565	0.1711			
120450121000	0.0235	0.0425	0.1284				0.0102	0.0415	0.1255	0.0155	0.0630	0.1904			
120492311700	0.0742	0.1343	0.4064	0.0209	0.0850	0.2571	0.0322	0.1312	0.3970	0.0156	0.0637	0.1926	0.0161	0.0736	0.2617
120510330901	0.0534	0.0965	0.2938				0.0232	0.0943	0.2870	0.0171	0.0696	0.2119			
120512485401	0.0552	0.0996	0.3020				0.0240	0.0973	0.2951	0.0133	0.0539	0.1634			
120570083100	0.0655	0.1176	0.3577				0.0279	0.1149	0.3494	0.0545	0.2247	0.6835			
120570094700	0.0625	0.1123	0.3416				0.0266	0.1097	0.3337	0.0518	0.2137	0.6499			
120570118600	0.0979	0.1764	0.5376				0.0421	0.1723	0.5252	0.0838	0.3428	1.0448			
120570137900	0.0590	0.1059	0.3220				0.0251	0.1034	0.3145	0.0473	0.1948	0.5925			
120570195200	0.0589	0.1058	0.3218				0.0251	0.1034	0.3144	0.0502	0.2069	0.6294			
120590331600	0.0198	0.0356	0.1073				0.0086	0.0348	0.1049	0.0024	0.0098	0.0297			
120670002400	0.0366	0.0658	0.2001				0.0156	0.0643	0.1955	0.0352	0.1450	0.4410			
120670020000	0.0481	0.0863	0.2626				0.0205	0.0844	0.2566	0.0466	0.1921	0.5843			
120770151101	0.0383	0.0688	0.2078	0.0143	0.0580	0.1752	0.0166	0.0672	0.2030	0.0092	0.0373	0.1125	0.0125	0.0532	0.1768
120950039500	0.0543	0.0976	0.2967				0.0231	0.0953	0.2899	0.0481	0.1981	0.6026			
120950058400	0.0475	0.0852	0.2592				0.0202	0.0832	0.2532	0.0428	0.1762	0.5361			
120950058500	0.0655	0.1175	0.3575				0.0279	0.1148	0.3493	0.0578	0.2381	0.7242			
120950058900	0.0691	0.1240	0.3772				0.0294	0.1212	0.3685	0.0608	0.2508	0.7627			
121070019901	0.0340	0.0614	0.1862				0.0147	0.0600	0.1819	0.0222	0.0905	0.2743			
121070021600	0.0503	0.0909	0.2760				0.0218	0.0888	0.2696	0.0317	0.1287	0.3908			
121070035701	0.0444	0.0803	0.2434				0.0192	0.0784	0.2378	0.0299	0.1220	0.3700			
121090033600	0.1204	0.2162	0.6576				0.0513	0.2112	0.6425	0.1125	0.4635	1.4099			
121090044000	0.0884	0.1587	0.4827				0.0376	0.1550	0.4716	0.0774	0.3189	0.9701			
121090071700	0.0334	0.0599	0.1823	0.0227	0.0936	0.2846	0.0142	0.0586	0.1781	0.0304	0.1253	0.3812	0.0021	0.0103	0.0453
121150010300	0.0671	0.1210	0.3679				0.0290	0.1183	0.3594	0.0349	0.1422	0.4322			
121152341500	0.0679	0.1225	0.3719				0.0293	0.1197	0.3634	0.0314	0.1282	0.3893			
121190062700	0.0611	0.1105	0.3367				0.0267	0.1079	0.3290	0.0521	0.2103	0.6410			
121190087700	0.0314	0.0566	0.1708				0.0136	0.0553	0.1669	0.0163	0.0664	0.2004			
121250006300	0.0770	0.1387	0.4229				0.0331	0.1356	0.4131	0.0660	0.2698	0.8223			
121350176000	0.0534	0.0966	0.2935				0.0231	0.0944	0.2867	0.0259	0.1056	0.3207			
121352332700	0.0366	0.0661	0.2008				0.0158	0.0646	0.1962	0.0179	0.0732	0.2222			

Table A4.2 SREs values, unit 3 (Cont.)

ID	Method 1 (MMTons/Km^2)			Method 2 (MMTons/Km^2)			Method 3 (MMTons/Km^2)			Method 4 (MMTons/Km^2)			Method 5 (MMTons/Km^2)		
	E_{P10}	E_{P50}	E_{P90}	E_{P10}	E_{P50}	E_{P90}	E_{P10}	E_{P50}	E_{P90}	E_{P10}	E_{P50}	E_{P90}	E_{P10}	E_{P50}	E_{P90}
121352394500	0.0450	0.0814	0.2473	0.0194	0.0793	0.2408	0.0195	0.0796	0.2416	0.0216	0.0881	0.2675	0.0166	0.0718	0.2286
121370017800	0.0441	0.0798	0.2430				0.0192	0.0779	0.2374	0.0329	0.1339	0.4079			
121370034900	0.0980	0.1777	0.5412	0.0946	0.3847	1.1720	0.0427	0.1736	0.5287	0.0699	0.2842	0.8656	0.0244	0.1347	0.6480
121372201600	0.0805	0.1460	0.4448				0.0351	0.1426	0.4345	0.0570	0.2320	0.7067			
121430041800	0.0492	0.0892	0.2686				0.0210	0.0872	0.2624	0.0397	0.1649	0.4964			
121430046800	0.0504	0.0913	0.2749				0.0215	0.0892	0.2686	0.0408	0.1693	0.5096			
121430083300	0.0449	0.0805	0.2459				0.0191	0.0787	0.2403	0.0373	0.1536	0.4689			
121452430400	0.0602	0.1085	0.3273	0.0095	0.0383	0.1157	0.0262	0.1060	0.3198	0.0139	0.0562	0.1696	0.0049	0.0267	0.1173
121632577400	0.0544	0.0979	0.2950				0.0236	0.0957	0.2882	0.0262	0.1062	0.3198			
121632577401	0.0553	0.0994	0.2995				0.0239	0.0971	0.2926	0.0266	0.1077	0.3246			
121652550800	0.0869	0.1563	0.4712				0.0378	0.1527	0.4603	0.0083	0.0336	0.1013			
121672547201	0.0862	0.1557	0.4728				0.0374	0.1521	0.4619	0.0506	0.2057	0.6247			
121672547202	0.0862	0.1557	0.4728				0.0374	0.1521	0.4619	0.0506	0.2057	0.6247			
121672553300	0.0692	0.1251	0.3791	0.0353	0.1438	0.4360	0.0300	0.1222	0.3704	0.0415	0.1695	0.5136	0.0191	0.0924	0.3577
121690035800	0.1066	0.1922	0.5857				0.0459	0.1877	0.5722	0.0983	0.4022	1.2259			
106875	0.0114	0.0206	0.0625				0.0049	0.0201	0.0611	0.0055	0.0224	0.0679			
122844	0.0049	0.0089	0.0270				0.0021	0.0087	0.0264	0.0012	0.0049	0.0149			
144489	0.0118	0.0213	0.0632				0.0051	0.0208	0.0618	0.0105	0.0429	0.1271			
152617	0.0088	0.0159	0.0482				0.0038	0.0155	0.0471	0.0050	0.0202	0.0614			
152875	0.0076	0.0136	0.0404				0.0033	0.0133	0.0395	0.0065	0.0265	0.0785			
155634	0.0043	0.0077	0.0233	0.0026	0.0104	0.0317	0.0018	0.0075	0.0227	0.0019	0.0076	0.0231	0.0021	0.0093	0.0307
156748	0.0052	0.0094	0.0286				0.0023	0.0092	0.0279	0.0030	0.0119	0.0362			
157268	0.0082	0.0148	0.0448	0.0037	0.0150	0.0454	0.0036	0.0144	0.0438	0.0032	0.0130	0.0394	0.0033	0.0139	0.0443
157271	0.0148	0.0266	0.0806	0.0047	0.0190	0.0576	0.0064	0.0260	0.0788	0.0054	0.0217	0.0658	0.0040	0.0170	0.0562
157272	0.0131	0.0236	0.0716	0.0058	0.0234	0.0709	0.0057	0.0231	0.0700	0.0055	0.0224	0.0680	0.0053	0.0217	0.0680
157445	0.0144	0.0260	0.0788	0.0053	0.0213	0.0645	0.0063	0.0254	0.0770	0.0052	0.0212	0.0643	0.0041	0.0187	0.0652
158005	0.0144	0.0260	0.0787	0.0078	0.0318	0.0963	0.0063	0.0254	0.0768	0.0067	0.0272	0.0824	0.0057	0.0260	0.0929
158009	0.0065	0.0118	0.0357				0.0028	0.0115	0.0349	0.0033	0.0134	0.0406			
158028	0.0176	0.0317	0.0965				0.0076	0.0310	0.0943	0.0097	0.0395	0.1200			
158090	0.0111	0.0203	0.0597				0.0048	0.0198	0.0583	0.0096	0.0399	0.1173			
158982	0.0196	0.0355	0.1056	0.0202	0.0821	0.2444	0.0085	0.0347	0.1032	0.0162	0.0661	0.1965	0.0033	0.0156	0.0658
160065	0.0085	0.0153	0.0464				0.0037	0.0149	0.0453	0.0050	0.0202	0.0613			
160648	0.0432	0.0782	0.2334	0.0226	0.0925	0.2759	0.0187	0.0764	0.2280	0.0350	0.1433	0.4276	0.0039	0.0185	0.0783
160847	0.0121	0.0218	0.0656				0.0053	0.0213	0.0641	0.0085	0.0343	0.1030			
160855	0.0177	0.0319	0.0952				0.0077	0.0312	0.0930	0.0135	0.0545	0.1626			
164480	0.0111	0.0201	0.0608	0.0048	0.0195	0.0592	0.0048	0.0196	0.0594	0.0050	0.0204	0.0618	0.0044	0.0180	0.0568
1609100048000	0.0039	0.0071	0.0215	0.0012	0.0048	0.0147	0.0017	0.0069	0.0210	0.0016	0.0065	0.0198	0.0009	0.0041	0.0143
1216725472000	0.0862	0.1557	0.4728				0.0374	0.1521	0.4619	0.0506	0.2057	0.6247			
1216725472030	0.0862	0.1557	0.4728				0.0374	0.1521	0.4619	0.0506	0.2057	0.6247			
152735	0.0171	0.0309	0.0914				0.0074	0.0301	0.0893	0.0144	0.0590	0.1747			
160835	0.0154	0.0277	0.0837				0.0067	0.0271	0.0817	0.0104	0.0419	0.1266			

Table A4.3 SREs values, unit 4

ID	Method 1 (MMTons/Km^2)			Method 2 (MMTons/Km^2)			Method 3 (MMTons/Km^2)			Method 5 (MMTons/Km^2)		
	E_{P10}	E_{P50}	E_{P90}	E_{P10}	E_{P50}	E_{P90}	E_{P10}	E_{P50}	E_{P90}	E_{P10}	E_{P50}	E_{P90}
117407	0.2743	0.9166	2.2143	0.1684	0.5626	1.3591	0.1719	0.5745	1.3879	0.1392	0.5001	1.3756
118307	0.3653	1.2178	2.9426	0.2867	0.9556	2.3091	0.2290	0.7633	1.8444	0.2334	0.8468	2.3950
107208	0.3328	1.1099	2.6823	0.1466	0.4889	1.1815	0.2086	0.6956	1.6812	0.0539	0.2803	1.3206
166184	0.5085	1.6886	4.0785	0.2504	0.8315	2.0085	0.3187	1.0583	2.5563	0.2226	0.7555	2.0388
121910773100	0.3651	1.2071	2.9064				0.2288	0.7566	1.8217			
120272454800	0.2569	0.8485	2.0431	0.0263	0.0868	0.2091	0.1610	0.5318	1.2805			
120510157200	0.2453	0.8123	1.9703				0.1537	0.5091	1.2349			
120650345000	0.6420	2.1174	5.0955	0.1905	0.6284	1.5122	0.4024	1.3271	3.1937	0.1552	0.5720	1.6317
121010742500	0.4215	1.4016	3.3865	0.3337	1.1096	2.6809	0.2642	0.8785	2.1225	0.3024	1.0429	2.7507
121190087600	0.2102	0.6959	1.6729				0.1318	0.4362	1.0485			
121452323400	0.1837	0.6078	1.4605	0.0946	0.3129	0.7519	0.1151	0.3809	0.9154	0.0788	0.2793	0.7721
121490020500	0.1657	0.5482	1.3173				0.1038	0.3436	0.8256			
121630314100	0.2289	0.7562	1.8192				0.1435	0.4739	1.1402			
121892329000	0.1448	0.4779	1.1495	0.0476	0.1572	0.3782	0.0908	0.2995	0.7205	0.0444	0.1512	0.3846
120333567100	0.3217	1.0702	2.5843	0.1682	0.5594	1.3508	0.2016	0.6708	1.6198	0.1453	0.5141	1.4103
121210519800	0.3108	1.0267	2.4722	0.1017	0.3359	0.8089	0.1948	0.6435	1.5495	0.0535	0.2415	0.9190
121452888200	0.2255	0.7471	1.7973	0.1359	0.4502	1.0831	0.1413	0.4682	1.1265	0.1176	0.4097	1.1140
121892433300	0.3472	1.1460	2.7564	0.1001	0.3306	0.7951	0.2176	0.7183	1.7276	0.0605	0.2564	0.8806
121132195600	0.1796	0.5947	1.4430	0.1523	0.5044	1.2237	0.1126	0.3728	0.9044	0.0622	0.2756	0.9985
121490018900	0.1816	0.5993	1.4390				0.1138	0.3756	0.9019			
120750004800	0.1505	0.4980	1.2045	0.0699	0.2315	0.5598	0.0943	0.3121	0.7549	0.0114	0.0651	0.3421
121050073900	0.1497	0.4954	1.1981	0.0862	0.2853	0.6900	0.0938	0.3105	0.7509	0.0106	0.0575	0.2922
120190126200	0.2148	0.7164	1.7418	0.0708	0.2361	0.5740	0.1346	0.4490	1.0917	0.0174	0.1009	0.4986
120410113100	0.2140	0.7139	1.7356				0.1342	0.4474	1.0878			
120410113400	0.2185	0.7301	1.7779				0.1369	0.4576	1.1143			
121050089000	0.1495	0.4949	1.1969				0.0937	0.3102	0.7502	0.0005	0.0065	0.0779
120390041300	0.1925	0.6374	1.5464				0.1207	0.3995	0.9693			
120710031700	0.1764	0.5824	1.3983				0.1106	0.3650	0.8764			
121370034600	0.1591	0.5191	1.2979				0.0997	0.3254	0.8135			
164778	0.4045	1.3484	3.2582	0.2085	0.6951	1.6796	0.2535	0.8452	2.0422	0.1451	0.5767	1.8338
1602700244000	0.3874	1.2866	3.1212	0.1515	0.5033	1.2209	0.2428	0.8064	1.9562	0.0949	0.3913	1.3281
157501	0.2311	0.7737	1.8704	0.1891	0.6330	1.5301	0.1449	0.4849	1.1723	0.1604	0.5579	1.5148
121390015000	0.2225	0.7380	1.7975				0.1395	0.4625	1.1266			
1611100001000	0.3773	1.2547	3.0408	0.2324	0.7728	1.8730	0.2365	0.7864	1.9059	0.1422	0.5677	1.8744
1611100002000	0.4043	1.3444	3.2582				0.2534	0.8426	2.0422			
125110	0.2239	0.7474	1.8041	0.1135	0.3789	0.9147	0.1403	0.4684	1.1307	0.0445	0.2291	1.0200
120390039100	0.1950	0.6455	1.5661	0.0747	0.2474	0.6003	0.1222	0.4046	0.9816	0.0289	0.1438	0.6385
120390041400	0.1956	0.6475	1.5710				0.1226	0.4058	0.9847			
120410105300	0.2159	0.7201	1.7507				0.1353	0.4513	1.0973			
120410113200	0.2116	0.7058	1.7160				0.1326	0.4424	1.0755			
120410114100	0.2175	0.7267	1.7698				0.1363	0.4555	1.1092			
120410114200	0.2110	0.7052	1.7173				0.1323	0.4420	1.0763			
120950039500	0.1541	0.5085	1.2209				0.0966	0.3187	0.7652			
120950058500	0.1497	0.4941	1.1863				0.0938	0.3097	0.7436			
121090071700	0.1558	0.5141	1.2344	0.1896	0.6258	1.5026	0.0976	0.3222	0.7737	0.0364	0.1471	0.6143
121152341500	0.2051	0.6819	1.6632				0.1286	0.4274	1.0424			
121452430400	0.3337	1.1014	2.6510	0.1237	0.4084	0.9829	0.2091	0.6903	1.6615	0.0907	0.3483	1.0489
126424	0.2439	0.8161	1.9732				0.1529	0.5115	1.2367			
126785	0.1772	0.5902	1.4224				0.1111	0.3699	0.8915			
136949	0.1127	0.3753	0.9046				0.0706	0.2353	0.5670			
160648	0.0867	0.2872	0.6908	0.1086	0.3596	0.8650	0.0544	0.1800	0.4330	0.0283	0.1185	0.4829
121152343800	0.2520	0.8377	2.0432				0.1579	0.5251	1.2806			
121152346000	0.2603	0.8655	2.1111				0.1632	0.5425	1.3232			
1211523552000	0.2588	0.8603	2.0982				0.1622	0.5392	1.3151			
1609100048000	0.5265	1.7486	4.2419	0.2871	0.9534	2.3128	0.3300	1.0960	2.6587	0.2506	0.8871	2.3807
1211900877020	0.2378	0.7872	1.8925				0.1491	0.4934	1.1861			
1213300028000	0.2200	0.7266	1.7480				0.1379	0.4554	1.0956			

Table A4.4 SREs values, unit 4b

ID	Method 1 (MMTons/Km^2)			Method 2 (MMTons/Km^2)			Method 3 (MMTons/Km^2)			Method 5 (MMTons/Km^2)		
	E_{P10}	E_{P50}	E_{P90}	E_{P10}	E_{P50}	E_{P90}	E_{P10}	E_{P50}	E_{P90}	E_{P10}	E_{P50}	E_{P90}
117407	0.1243	0.4088	0.9898	0.0695	0.2285	0.5532	0.0603	0.1984	0.4803	0.0544	0.2068	0.5871
118307	0.2008	0.6597	1.5936	0.1461	0.4801	1.1598	0.0974	0.3201	0.7733	0.1169	0.4299	1.2145
107208	0.1932	0.6351	1.5312	0.0179	0.0588	0.1418	0.0938	0.3082	0.7430	0.0029	0.0224	0.1542
166184	0.1670	0.5488	1.3200	0.0817	0.2684	0.6455	0.0810	0.2663	0.6405	0.0729	0.2547	0.6667
121910773100	0.0668	0.2193	0.5281				0.0324	0.1064	0.2563			
120272454800	0.0628	0.2051	0.4953				0.0305	0.0995	0.2403			
121010742500	0.2716	0.8946	2.1554	0.2300	0.7577	1.8256	0.1318	0.4341	1.0459	0.2069	0.7200	1.8570
120333567100	0.0947	0.3118	0.7532	0.0373	0.1229	0.2968	0.0460	0.1513	0.3655	0.0316	0.1110	0.3087
121452888200	0.0405	0.1311	0.3173	0.0256	0.0827	0.2002	0.0197	0.0636	0.1539	0.0217	0.0757	0.2046
121490018900	0.0518	0.1744	0.4107				0.0252	0.0846	0.1993			
120390041300	0.0709	0.2386	0.5618				0.0344	0.1158	0.2726			
121370034600	0.0286	0.0961	0.2263				0.0139	0.0466	0.1098			
164778	0.2245	0.7376	1.7818	0.1140	0.3745	0.9046	0.1089	0.3579	0.8646	0.0753	0.2998	0.9546
157501	0.1058	0.3482	0.8468	0.0793	0.2608	0.6342	0.0514	0.1690	0.4109	0.0648	0.2349	0.6433
120390039100	0.0706	0.2376	0.5595	0.0053	0.0180	0.0424	0.0343	0.1153	0.2715	0.0004	0.0042	0.0435
120390041400	0.0738	0.2483	0.5848				0.0358	0.1205	0.2838			
120410113200	0.0743	0.2498	0.5884				0.0360	0.1212	0.2855			
121152341500	0.0774	0.2605	0.6134				0.0376	0.1264	0.2976			
121452430400	0.0680	0.2224	0.5349	0.0286	0.0934	0.2248	0.0330	0.1079	0.2596	0.0214	0.0796	0.2413
126424	0.1382	0.4555	1.1012				0.0670	0.2210	0.5343			
126785	0.1165	0.3818	0.9388				0.0565	0.1853	0.4556			
136949	0.0660	0.2165	0.5324				0.0320	0.1051	0.2583			

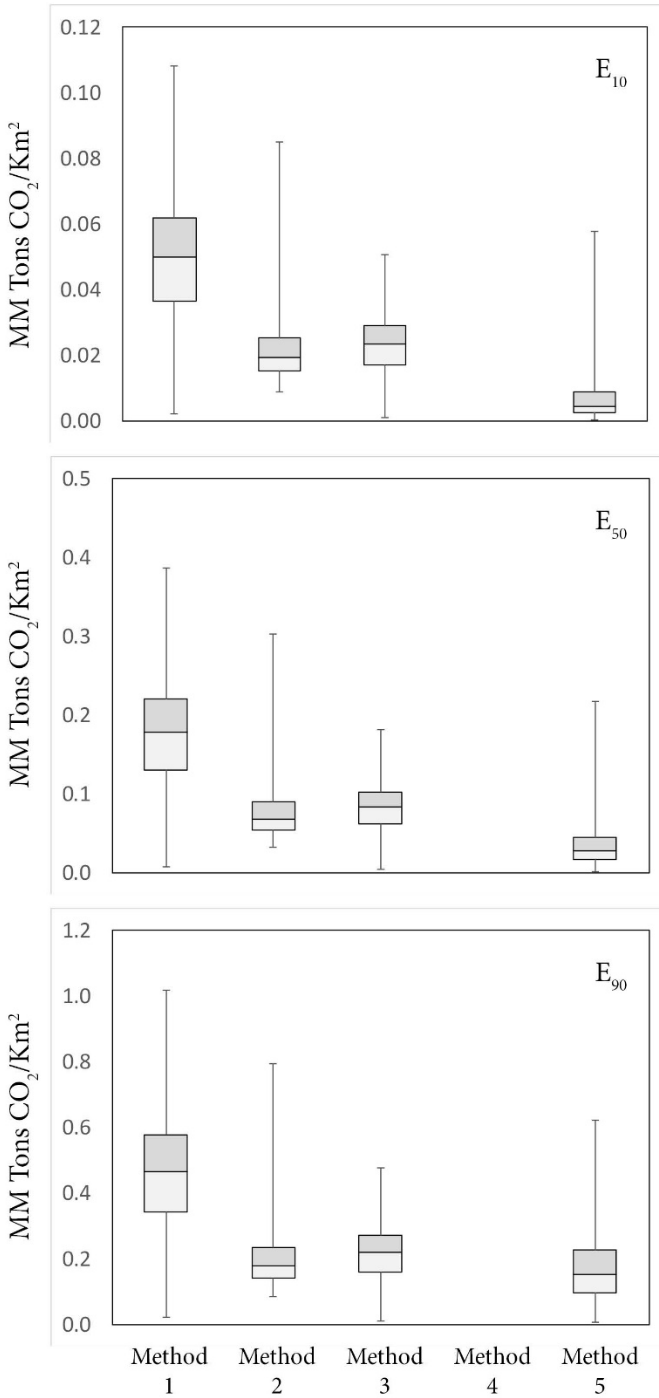
Table A4.5 SREs values, unit 5 (Cont.)

ID	Method 1 (MMTons/Km^2)			Method 2 (MMTons/Km^2)			Method 3 (MMTons/Km^2)			Method 4 (MMTons/Km^2)			Method 5 (MMTons/Km^2)		
	E_{P10}	E_{P50}	E_{P90}	E_{P10}	E_{P50}	E_{P90}	E_{P10}	E_{P50}	E_{P90}	E_{P10}	E_{P50}	E_{P90}	E_{P10}	E_{P50}	E_{P90}
117407	0.2225	0.7398	1.7937	0.1636	0.5439	1.3187	0.2313	0.7691	1.8646	0.1135	0.3774	0.9151	0.1331	0.4858	1.4005
118307	0.2182	0.7261	1.7613	0.1286	0.4280	1.0384	0.2268	0.7548	1.8310	0.1002	0.3333	0.8086	0.0913	0.3610	1.1239
107208	0.1687	0.5590	1.3594	0.2121	0.7028	1.7091	0.1753	0.5811	1.4132	0.1089	0.3608	0.8774	0.1997	0.6746	1.7140
166184	0.2107	0.7038	1.7069	0.0506	0.1690	0.4098	0.2190	0.7316	1.7744	0.0309	0.1031	0.2501	0.0253	0.1189	0.4659
121010742501	0.2244	0.7469	1.8105	0.1546	0.5148	1.2477	0.2332	0.7765	1.8822	0.0560	0.1865	0.4521	0.1078	0.4284	1.3618
121910773100	0.0529	0.1766	0.4268				0.0550	0.1836	0.4437	0.0087	0.0289	0.0699			
120510157200	0.1931	0.6429	1.5530				0.2008	0.6684	1.6145	0.0849	0.2825	0.6824			
121010742500	0.0926	0.3082	0.7469	0.0915	0.3048	0.7388	0.0962	0.3204	0.7765	0.0258	0.0860	0.2085	0.0753	0.2744	0.7908
120333567100	0.2192	0.7320	1.7687				0.2278	0.7610	1.8387	0.0677	0.2262	0.5466			
121210519800	0.1057	0.3513	0.8486	0.1284	0.4270	1.0314	0.1098	0.3652	0.8822	0.0334	0.1109	0.2680	0.1205	0.4149	1.0505
121490018900	0.0723	0.2413	0.5846				0.0752	0.2509	0.6077	0.1046	0.3491	0.8457			
120710031700	0.1063	0.3546	0.8591				0.1105	0.3687	0.8931	0.1606	0.5360	1.2984			
121492102000	0.0842	0.2809	0.6805				0.0875	0.2920	0.7074	0.1120	0.3736	0.9051			
164778	0.2811	0.9355	2.2695	0.0732	0.2436	0.5910	0.2923	0.9726	2.3593	0.0872	0.2902	0.7040	0.0291	0.1494	0.7011
ADM	0.2183	0.7282	1.7642	0.2286	0.7627	1.8478	0.2269	0.7570	1.8340	0.1331	0.4442	1.0760	0.1815	0.6742	1.9492
1611100001000	0.1083	0.3608	0.8756	0.0747	0.2488	0.6039	0.1126	0.3751	0.9102	0.0815	0.2714	0.6586	0.0416	0.1861	0.6803
120492245100	0.1601	0.5353	1.2935				0.1664	0.5565	1.3447	0.0634	0.2118	0.5119			
121152341500	0.2350	0.7840	1.8992				0.2443	0.8150	1.9744	0.1413	0.4716	1.1424			
125296	0.2184	0.7220	1.7567				0.2270	0.7506	1.8262	0.1458	0.4820	1.1727			
126424	0.2331	0.7671	1.8709				0.2424	0.7975	1.9450	0.1994	0.6562	1.6003			
126785	0.2328	0.7661	1.8684				0.2420	0.7964	1.9423	0.2389	0.7860	1.9171			
158069	0.2168	0.7214	1.7481				0.2254	0.7499	1.8173	0.2632	0.8757	2.1221			
121152343800	0.2353	0.7849	1.9016				0.2446	0.8160	1.9768	0.1415	0.4720	1.1435			
121152346000	0.2353	0.7849	1.9016				0.2446	0.8160	1.9768	0.1415	0.4720	1.1435			
1211523552000	0.2353	0.7849	1.9016				0.2446	0.8160	1.9768	0.1415	0.4720	1.1435			

APPENDIX 5:

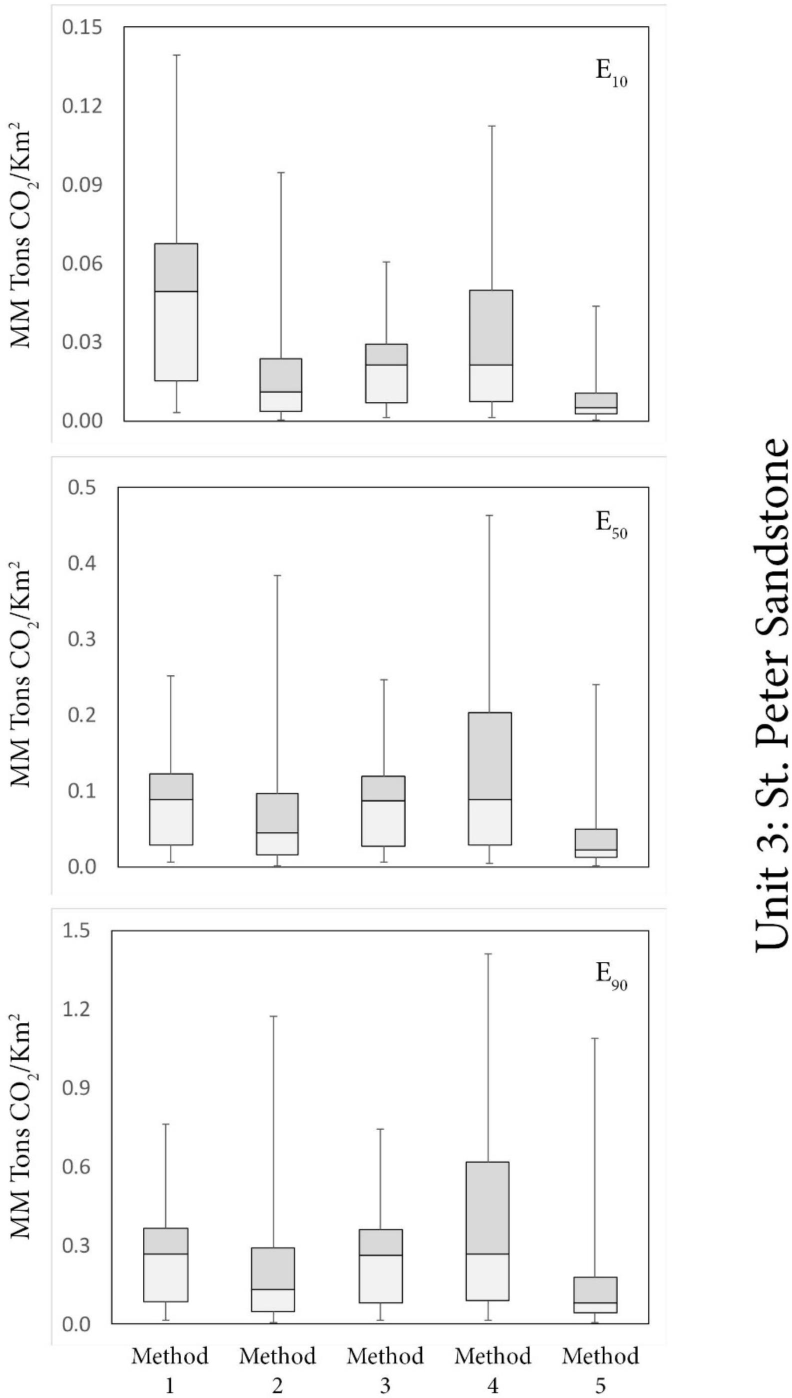
A5.1. "Boxes and Whiskers" chart (sorted by units), illustrating SREs for all 5 methods. Instead of showing the mean and the standard error, the box-and-whisker plot shows the minimum, first quartile, median, third quartile, and maximum of a set of data. Statisticians refer to this set of statistics as a five-number summary (source data in Appendix 4).

Boxes and Whiskers (Cont.)

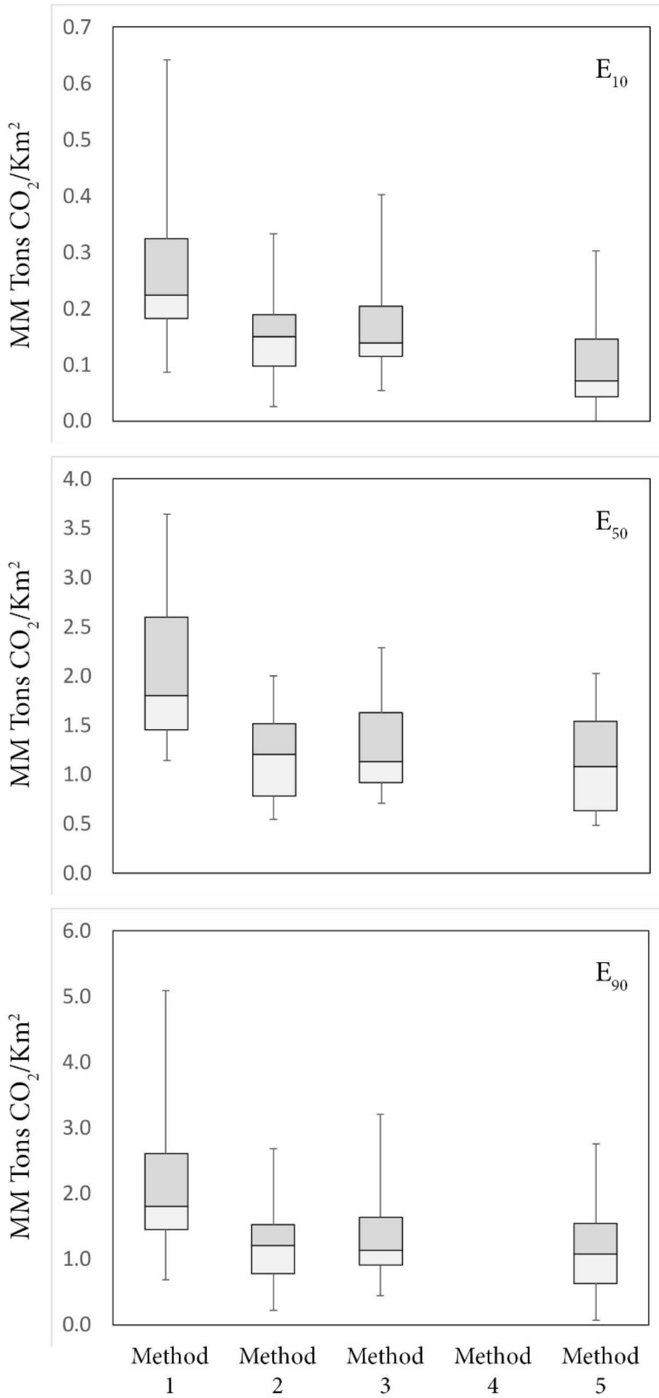


Unit 2: Trenton Ls./Black River Gp.

Boxes and Whiskers (Cont.)

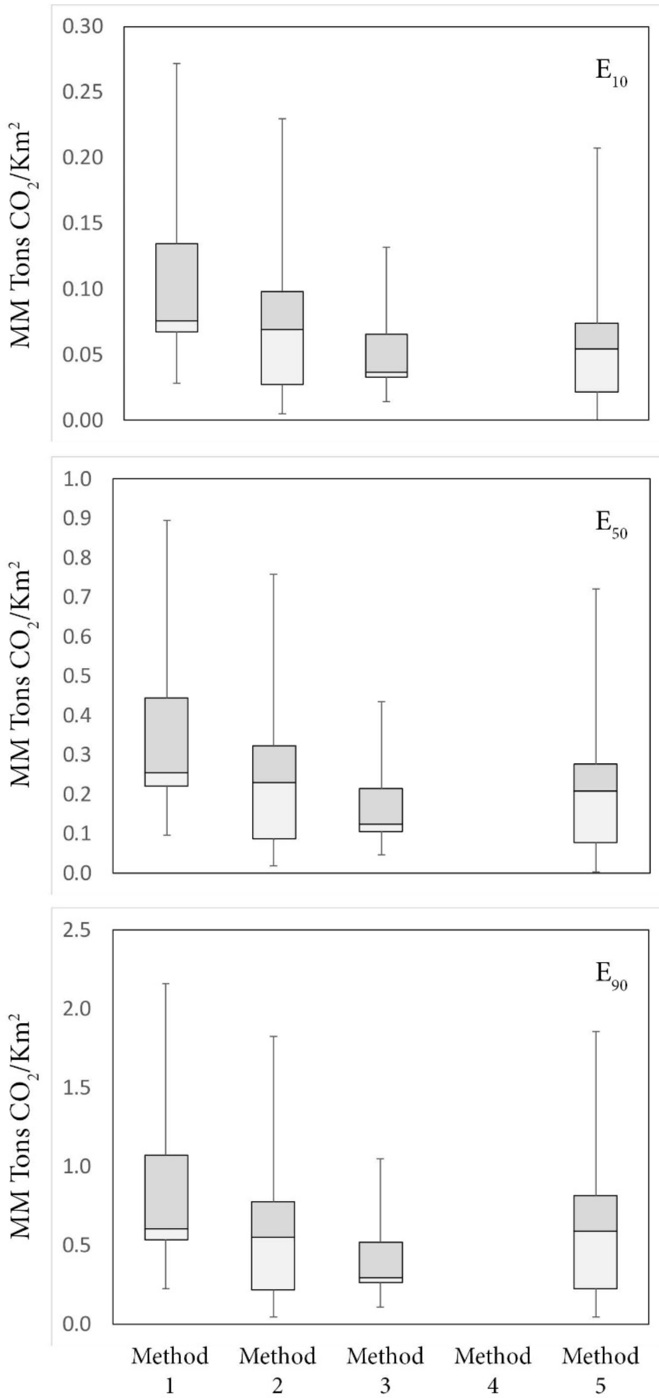


Boxes and Whiskers (Cont.)



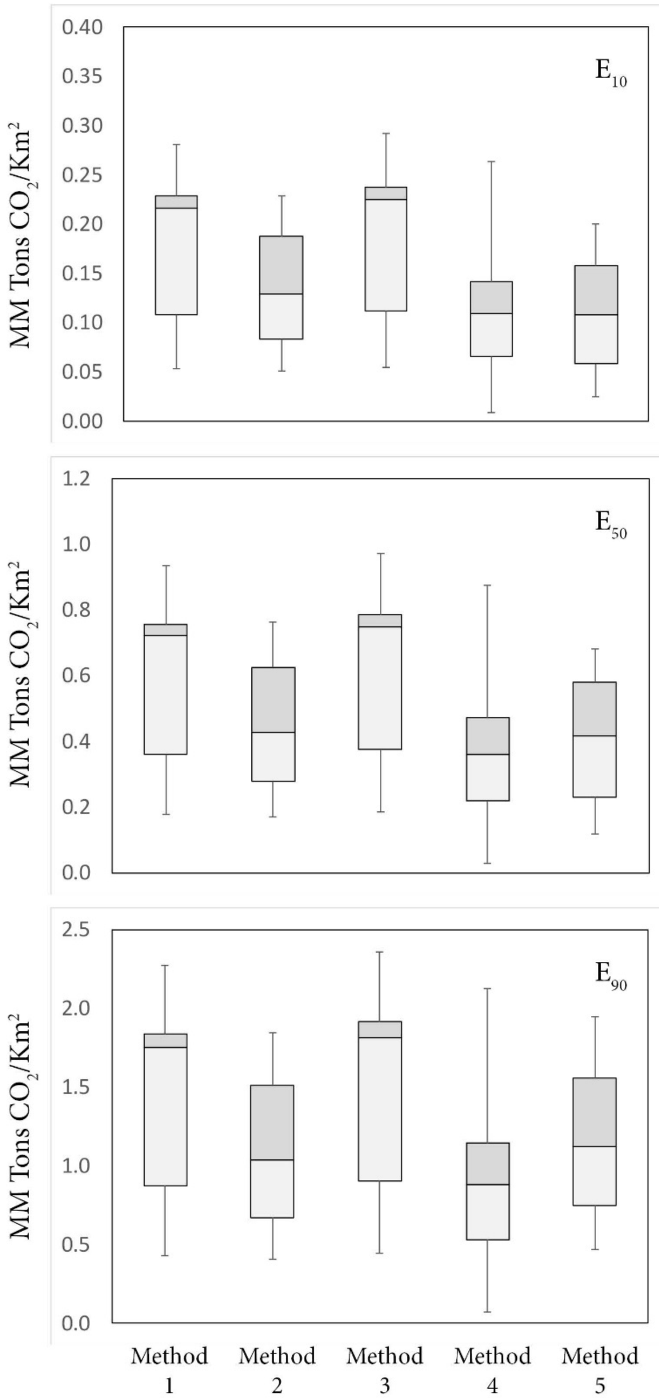
Unit 4: Knox Supergoup

Boxes and Whiskers (Cont.)



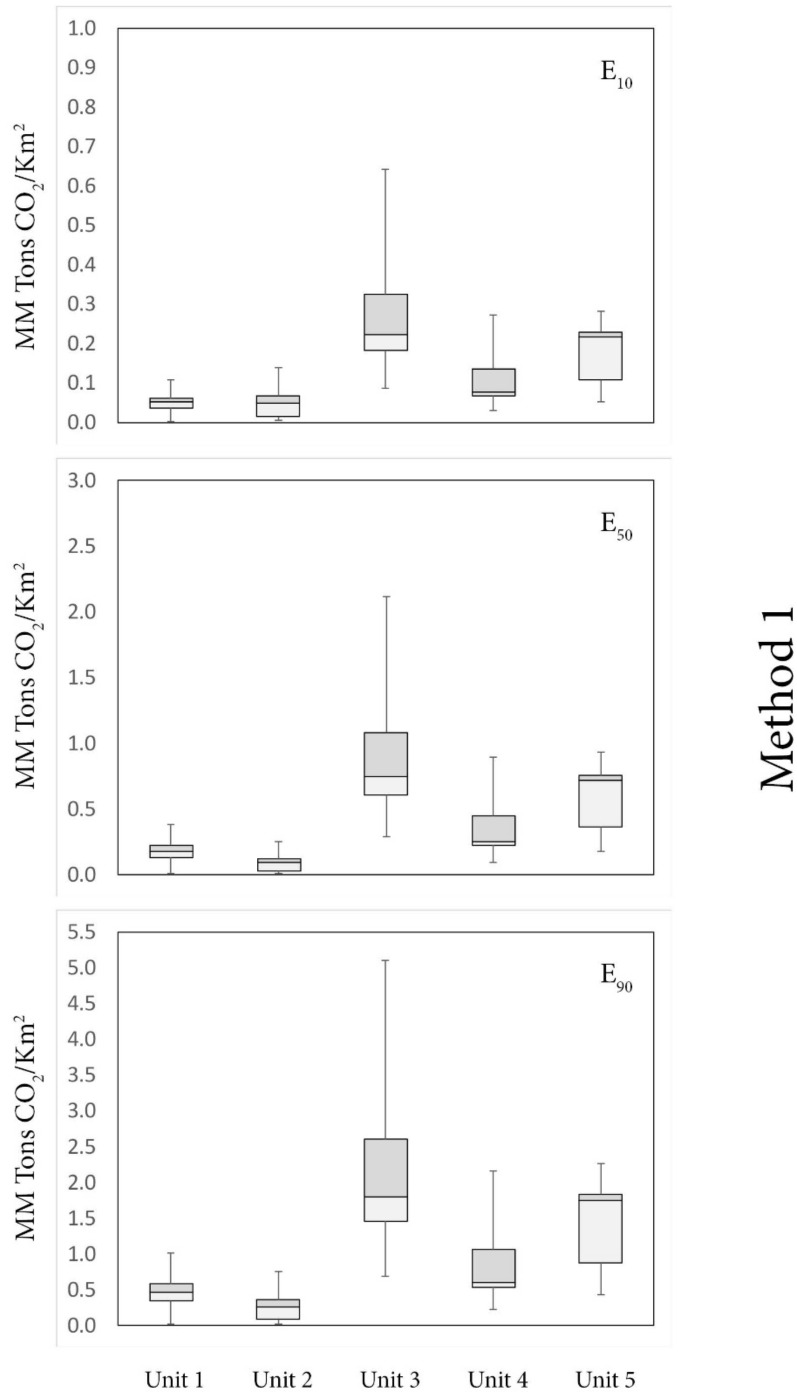
Unit 4b: Potosi Dolomite

Boxes and Whiskers (Cont.)

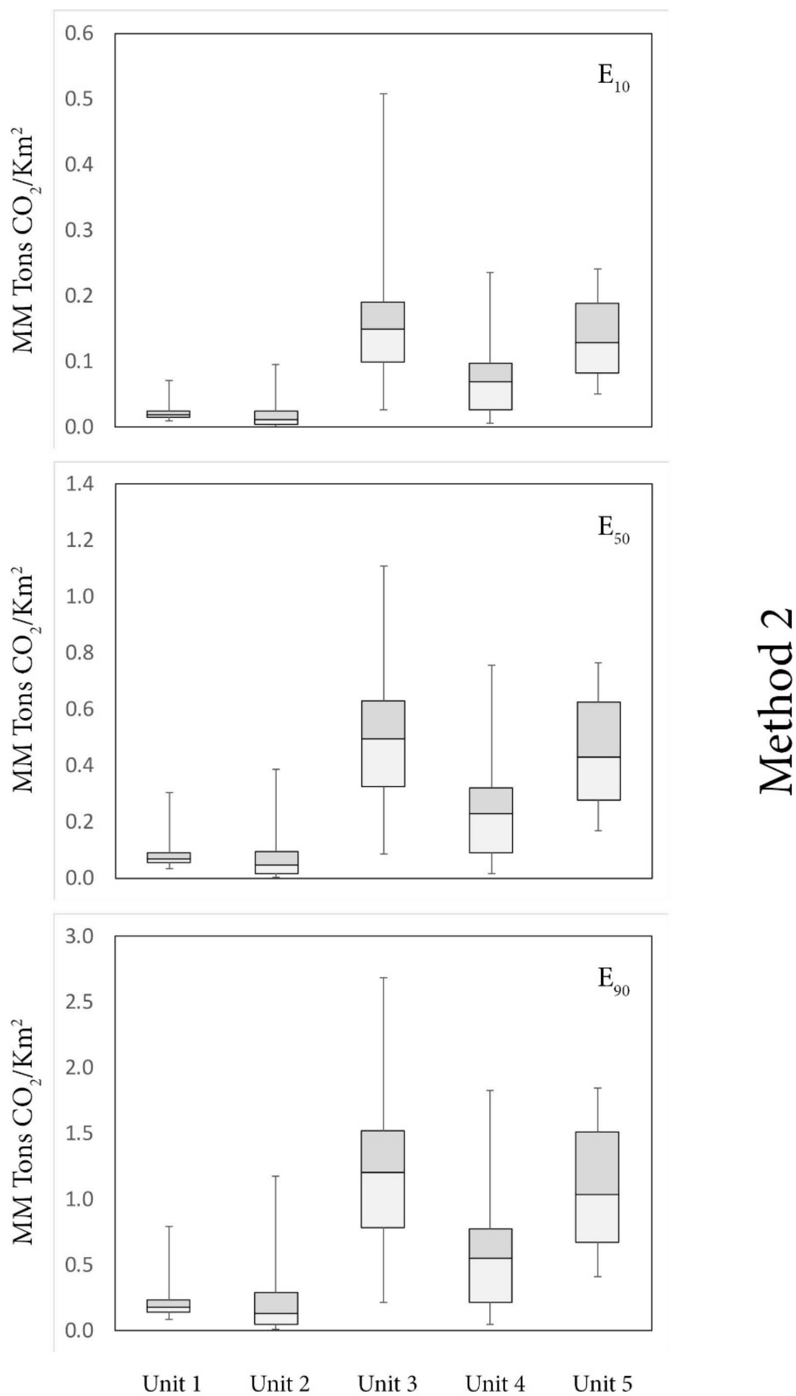


Unit 5: Mount Simon Sandstone

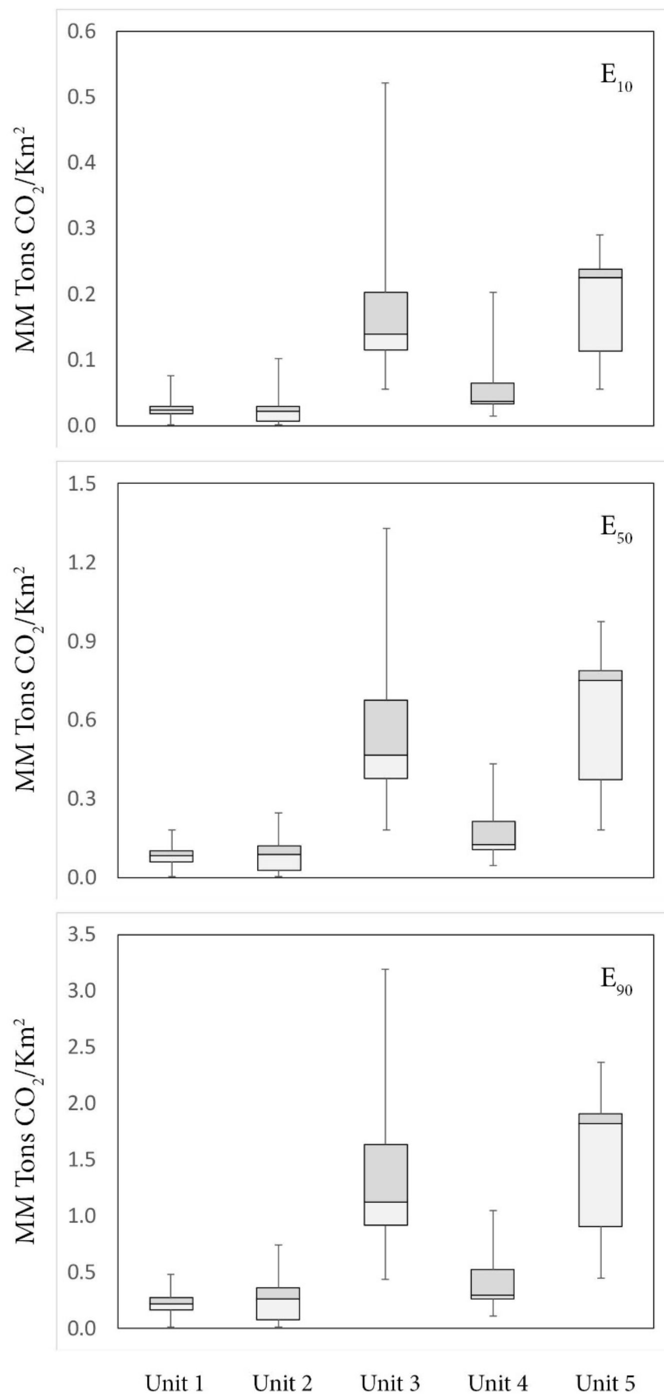
A5.2. "Boxes and Whiskers" chart (sorted by method), illustrating SREs all 5 units. Note that method 4 was only applied to units 3 and 5 (source data in Appendix 4).



Boxes and Whiskers (Cont.)

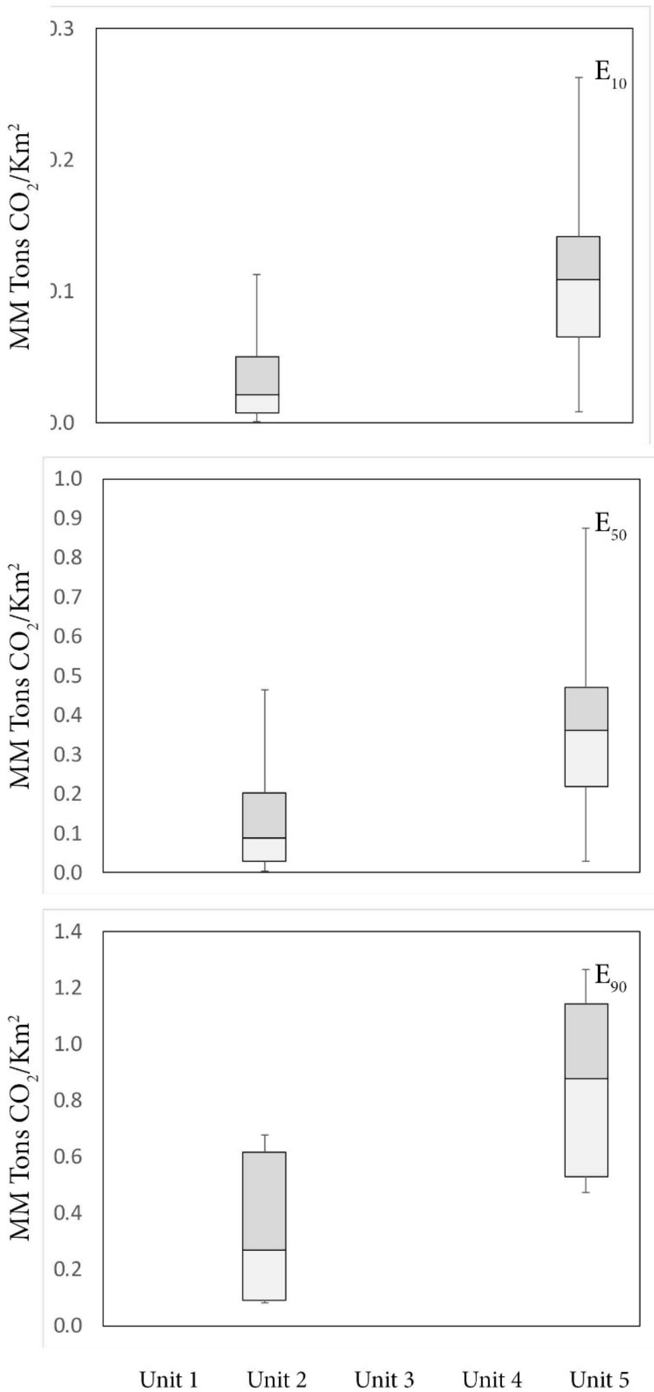


Boxes and Whiskers (Cont.)



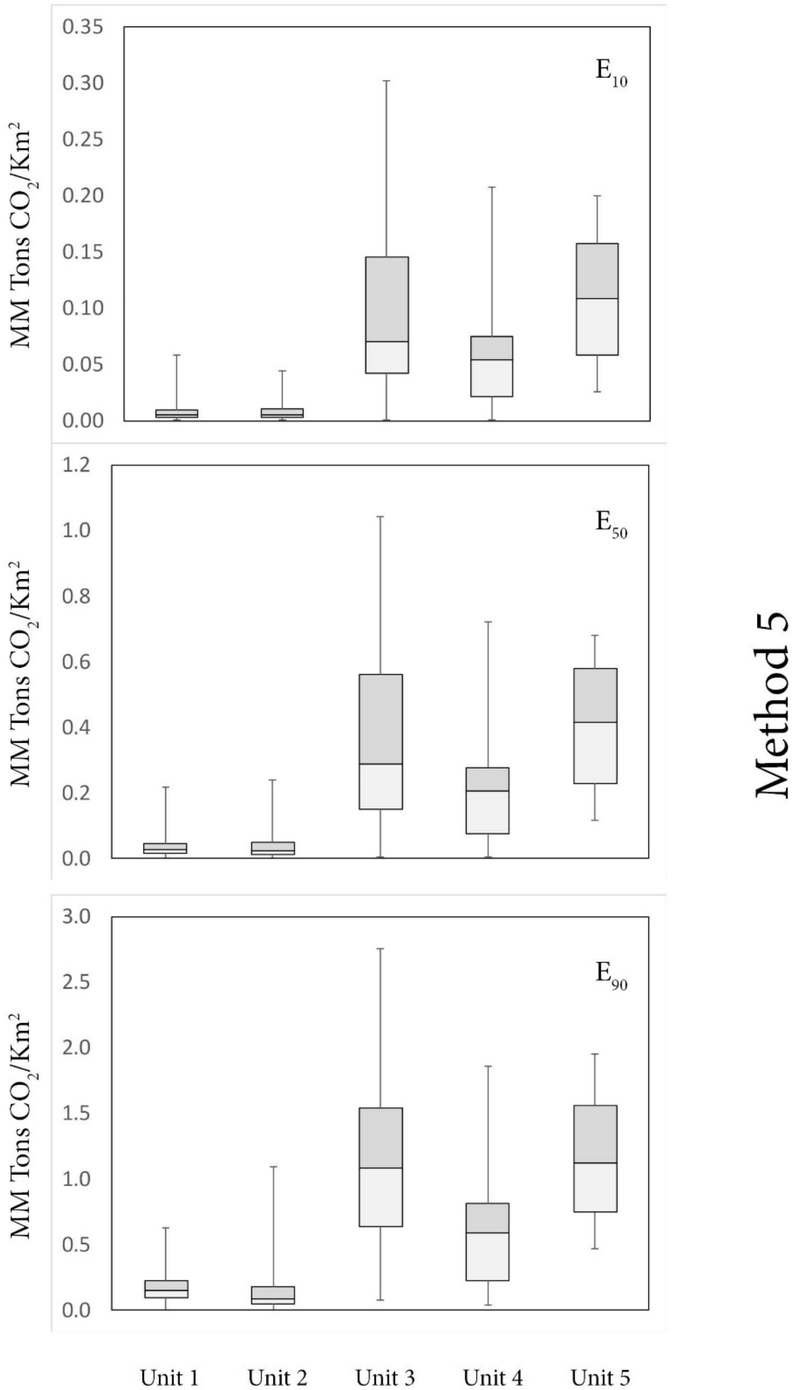
Method 3

Boxes and Whiskers (Cont.)



Method 4

Boxes and Whiskers (Cont.)



APPENDIX 6: Maps portraying SREs calculated using Method 3. Values are total SREs per county (or the portion of the county displayed in maps), in Million Tons. Areas where the top of the unit is shallower than 2,500 feet or deeper than 10,000 feet are grayed out.

Figure A6.1. Storage resource estimates (SREs) for the Trenton/Black River Group (unit 2). This map represents results from Method 1 with efficiency factor E_{p100} (E=1). Values are total storage capacity, per county.

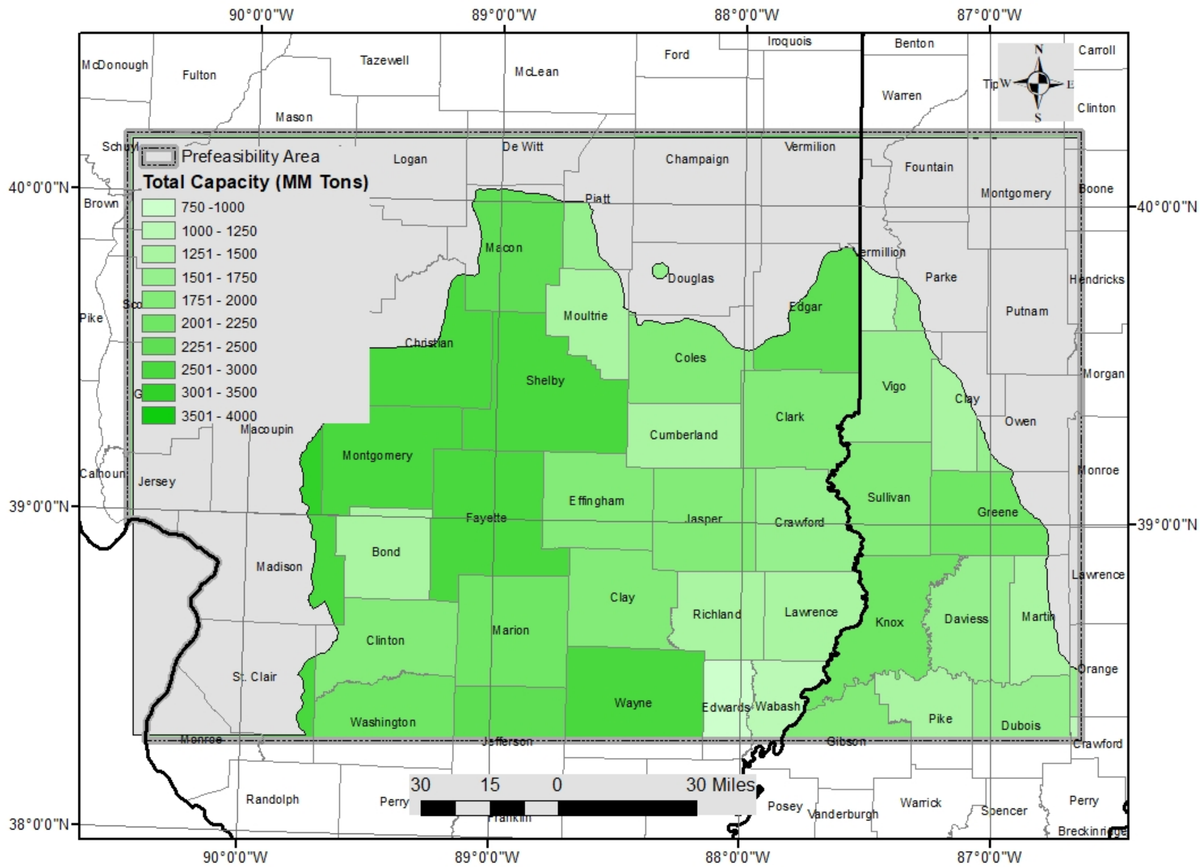


Figure A6.2. Storage resource estimates (SREs) for the Trenton/Black River Group (unit 2). This map represents results from Method 1 with efficiency factor E_{p100} (E=1). Values are total storage capacity per unit area, per county.

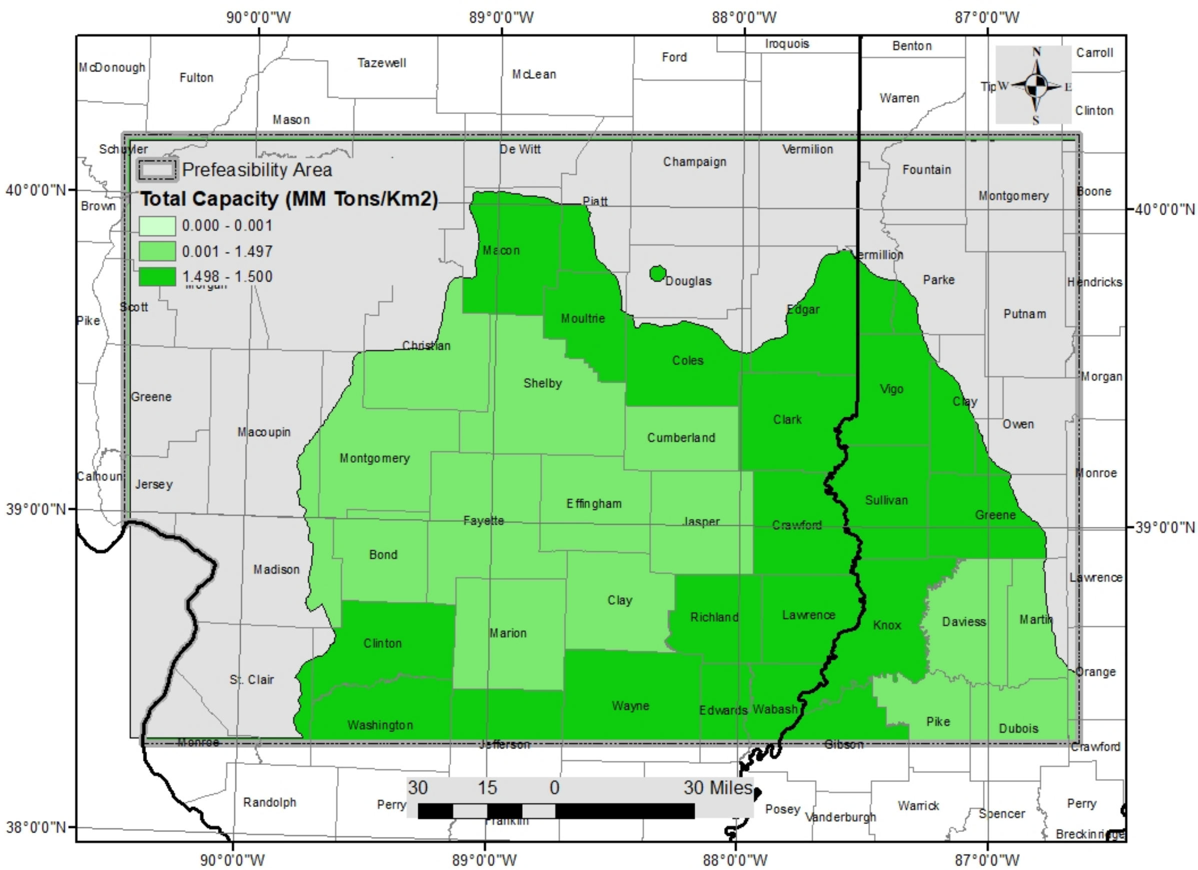


Figure A6.3. Storage resource estimates (SREs) for the St. Peter Sandstone (unit 3). This map represents results from Method 1 with efficiency factor E_{p100} (E=1). Values are total storage capacity, per county.

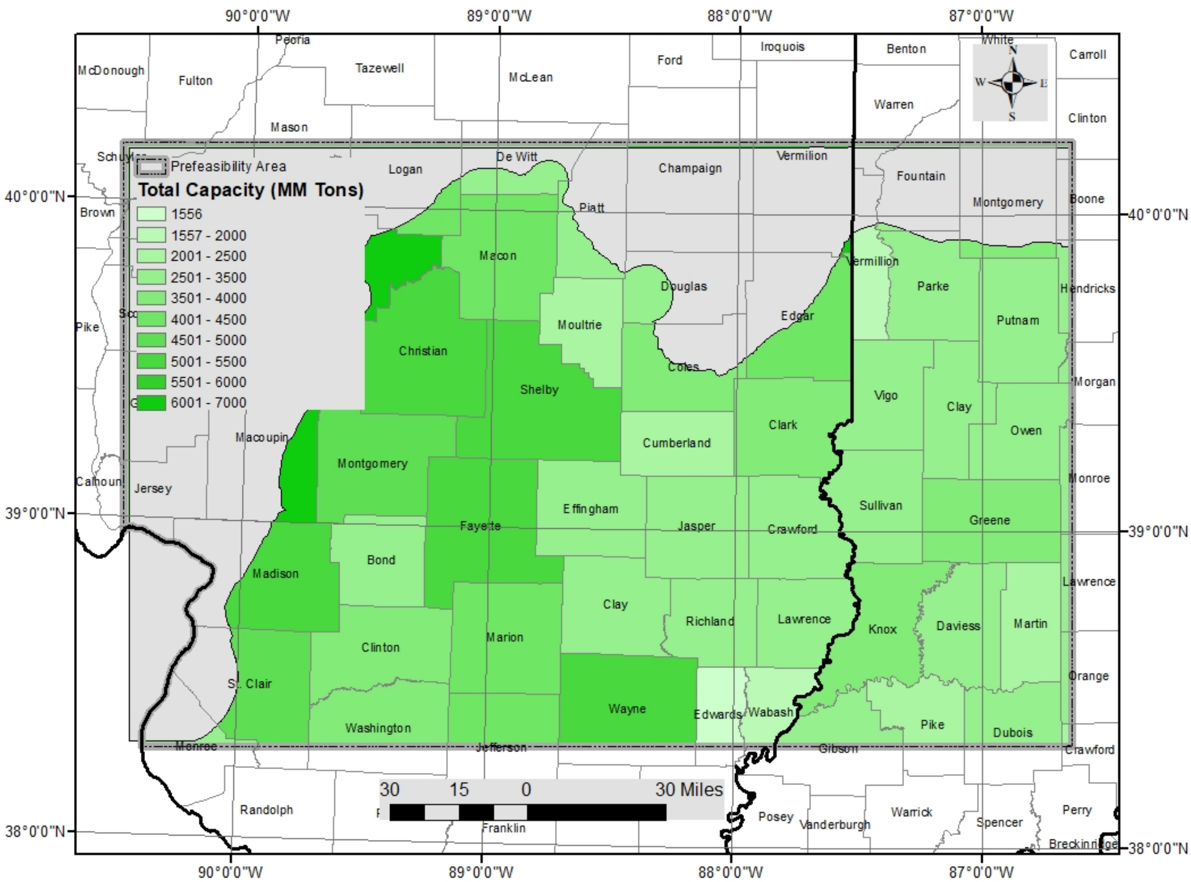


Figure A6.4. Storage resource estimates (SREs) for the St. Peter Sandstone (unit 3). This map represents results from Method 1 with efficiency factor E_{p100} (E=1). Values are total storage capacity per unit area, per county.

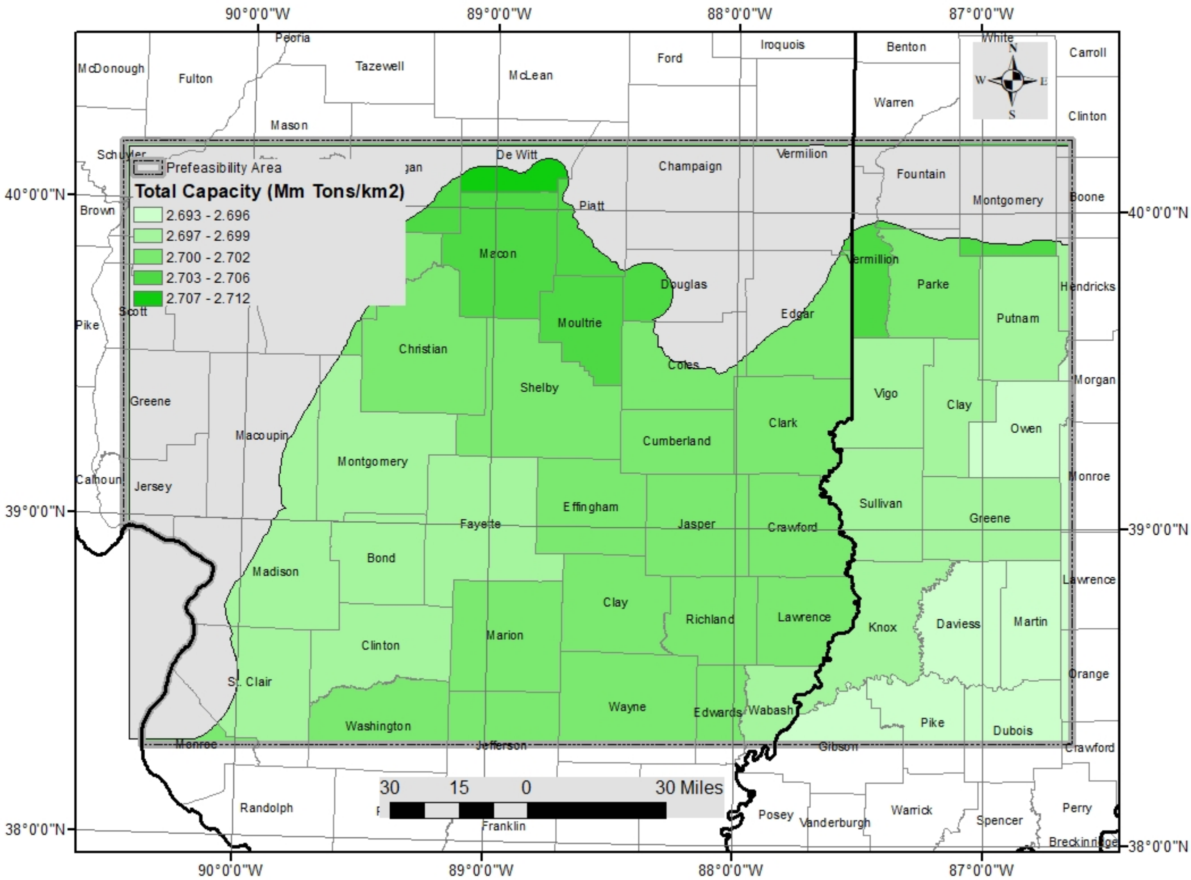


Figure A6.5. Storage resource estimates (SREs) for the Potosi Dolomite (unit 4b). This map represents results from Method 1 with efficiency factor E_{p100} (E=1). Values are total storage capacity, per county.

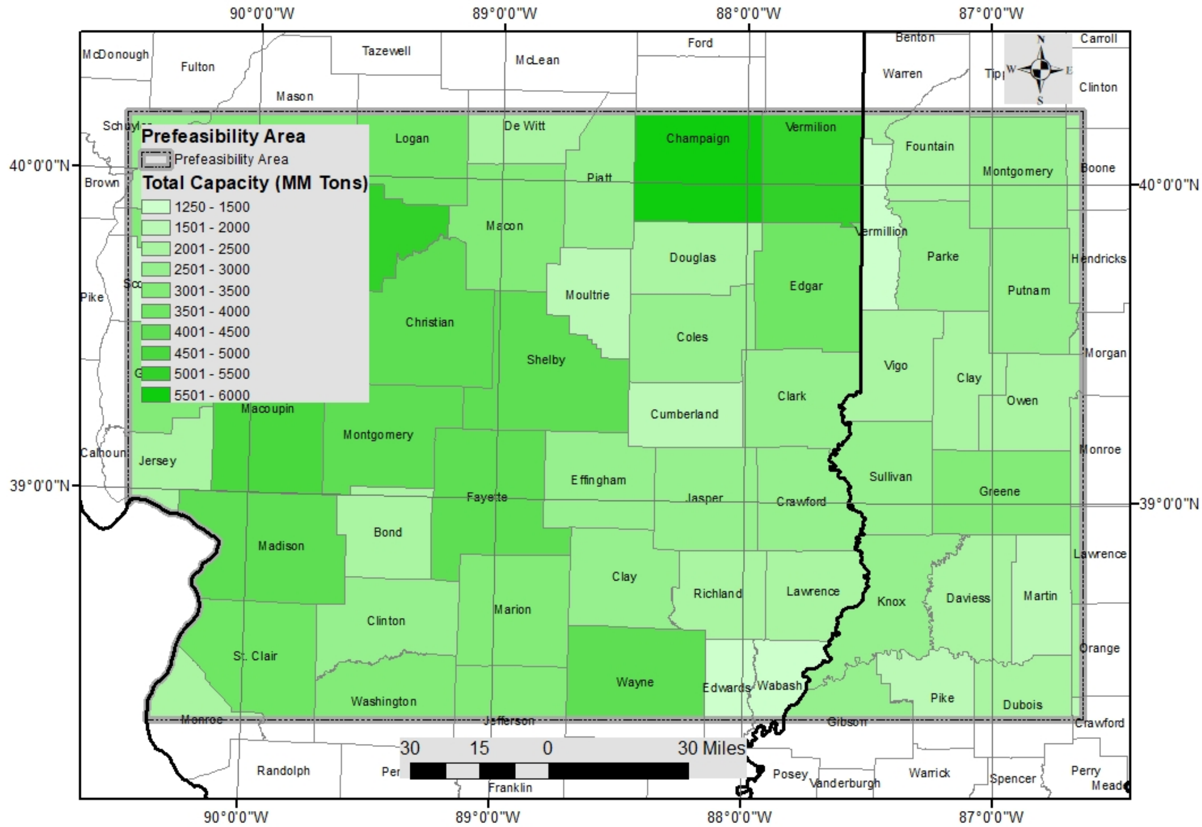


Figure A6.6. Storage resource estimates (SREs) for the Potosi Dolomite (unit 4b). This map represents results from Method 1 with efficiency factor E_{p100} (E=1). Values are total storage capacity per unit area, per county.

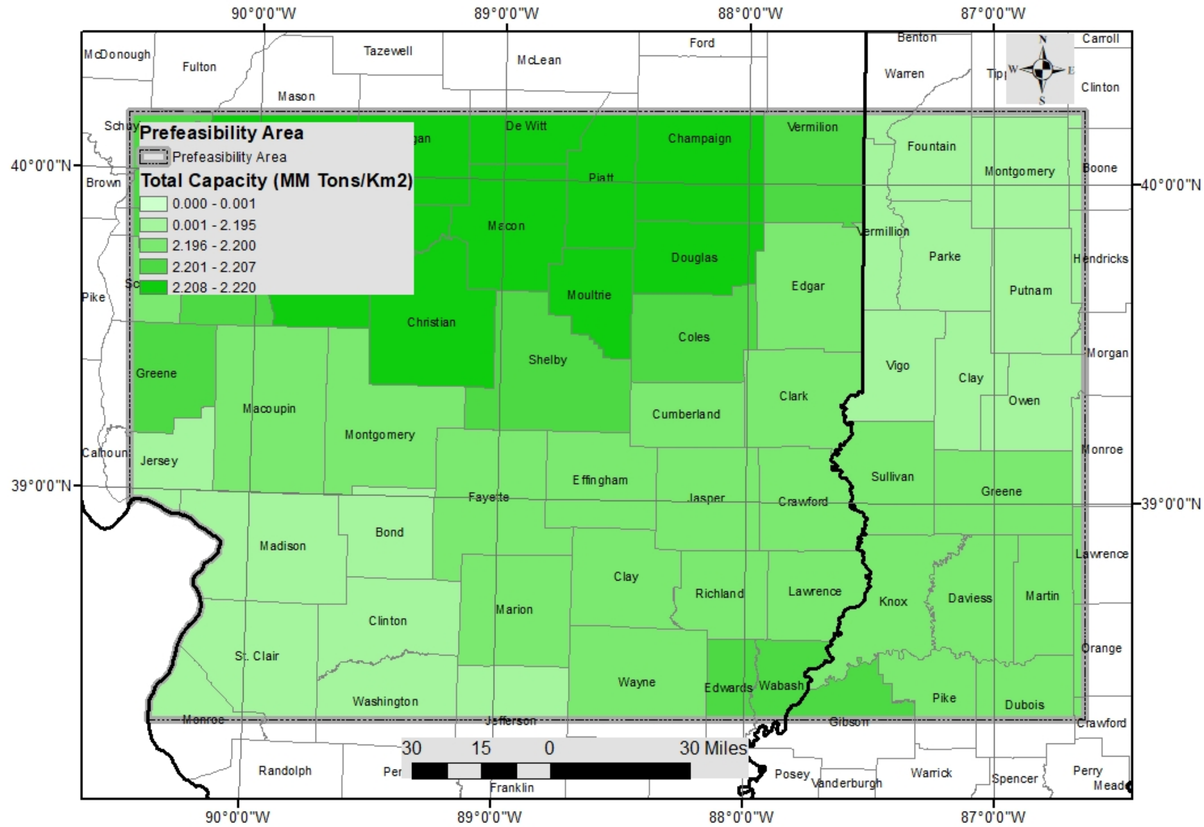


Figure A6.7. Storage resource estimates (SREs) for the Knox Supergroup (unit 4). This map represents results from Method 1 with efficiency factor E_{p100} (E=1). Values are total storage capacity, per county.

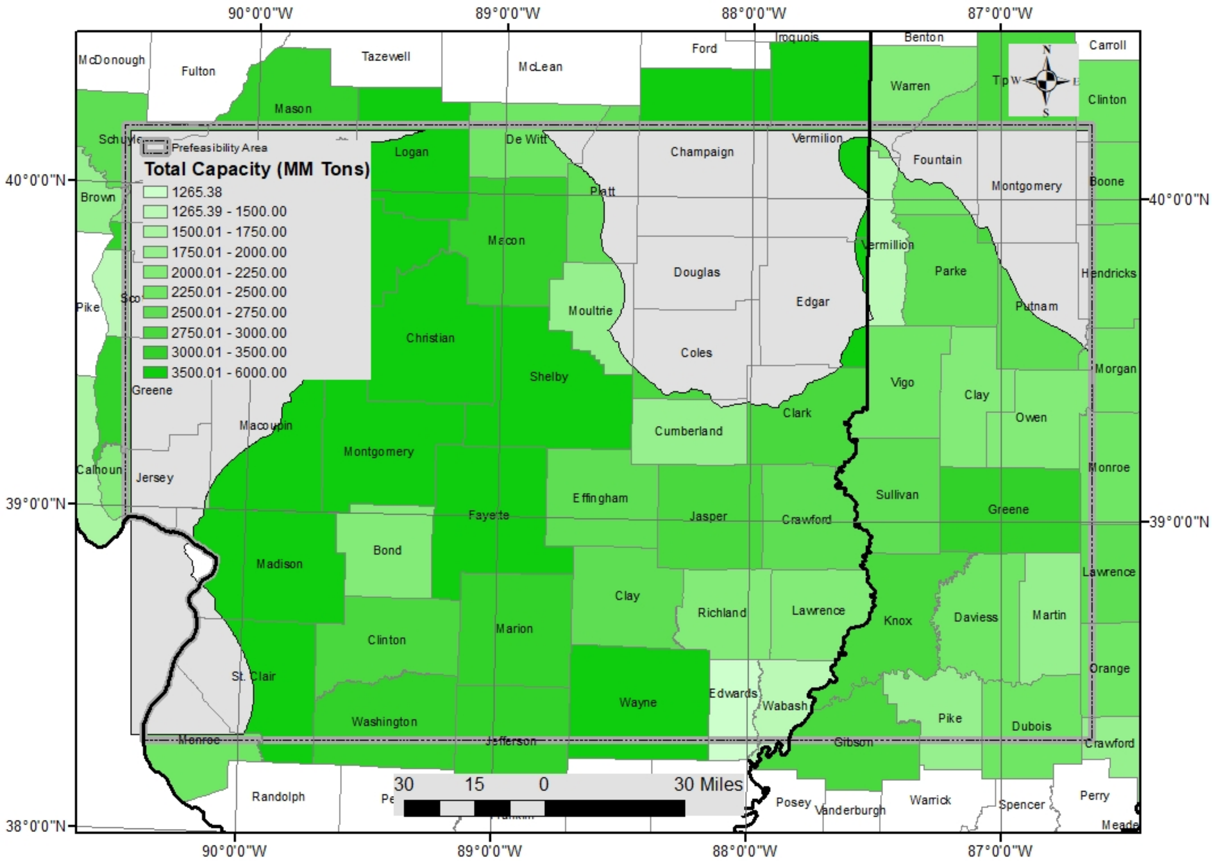


Figure A6.8. Storage resource estimates (SREs) for the Knox Supergroup (unit 4). This map represents results from Method 1 with efficiency factor E_{p100} (E=1). Values are total storage capacity per unit area, per county.

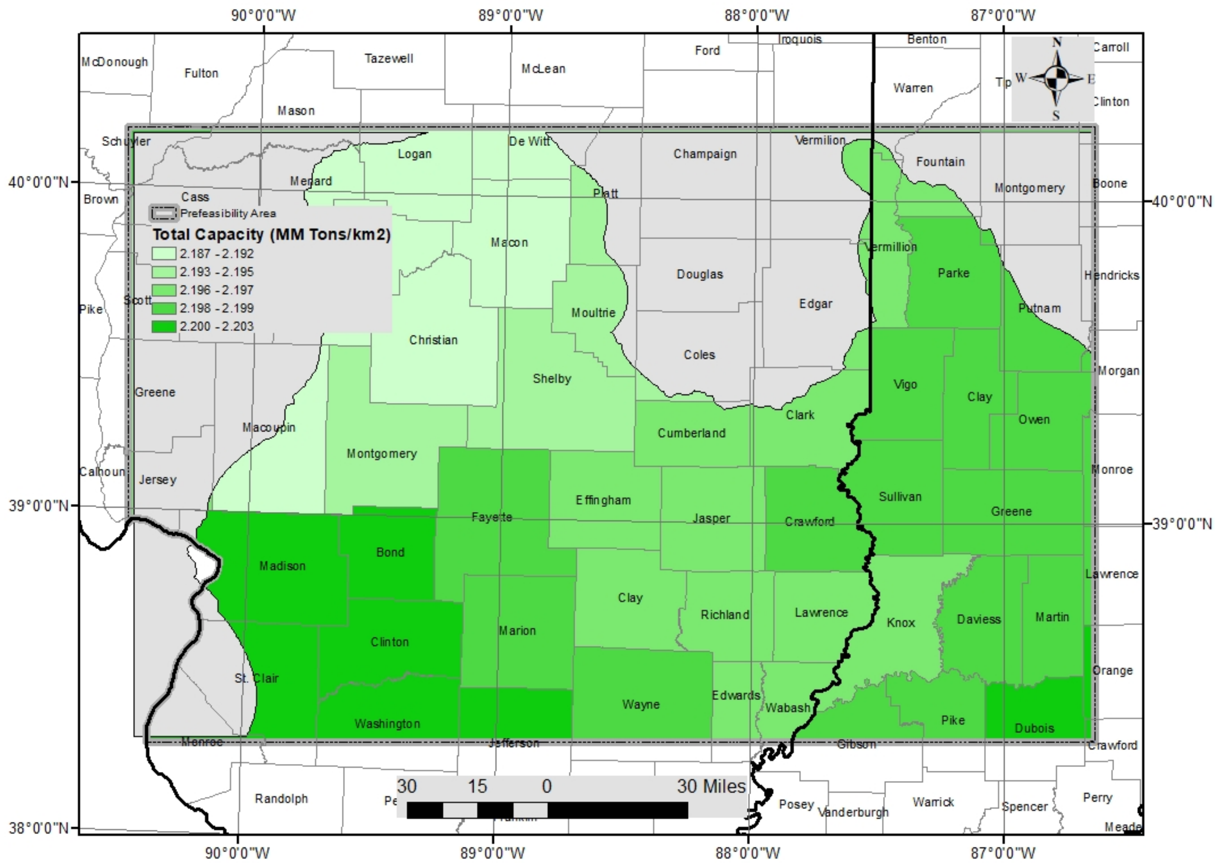


Figure A6.9. Storage resource estimates (SREs) for the Mount Simon Sandstone (unit 5). This map represents results from Method 1 with efficiency factor E_{p100} (E=1). Values are total storage capacity, per county.

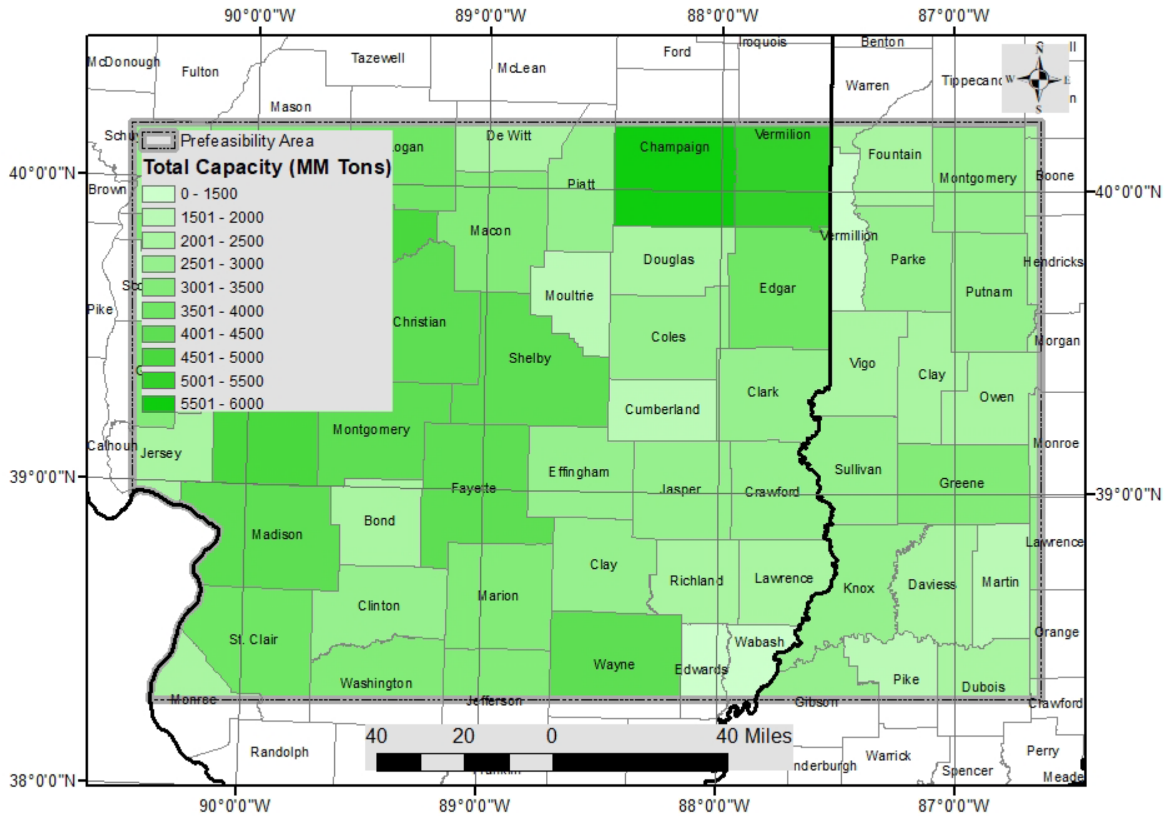
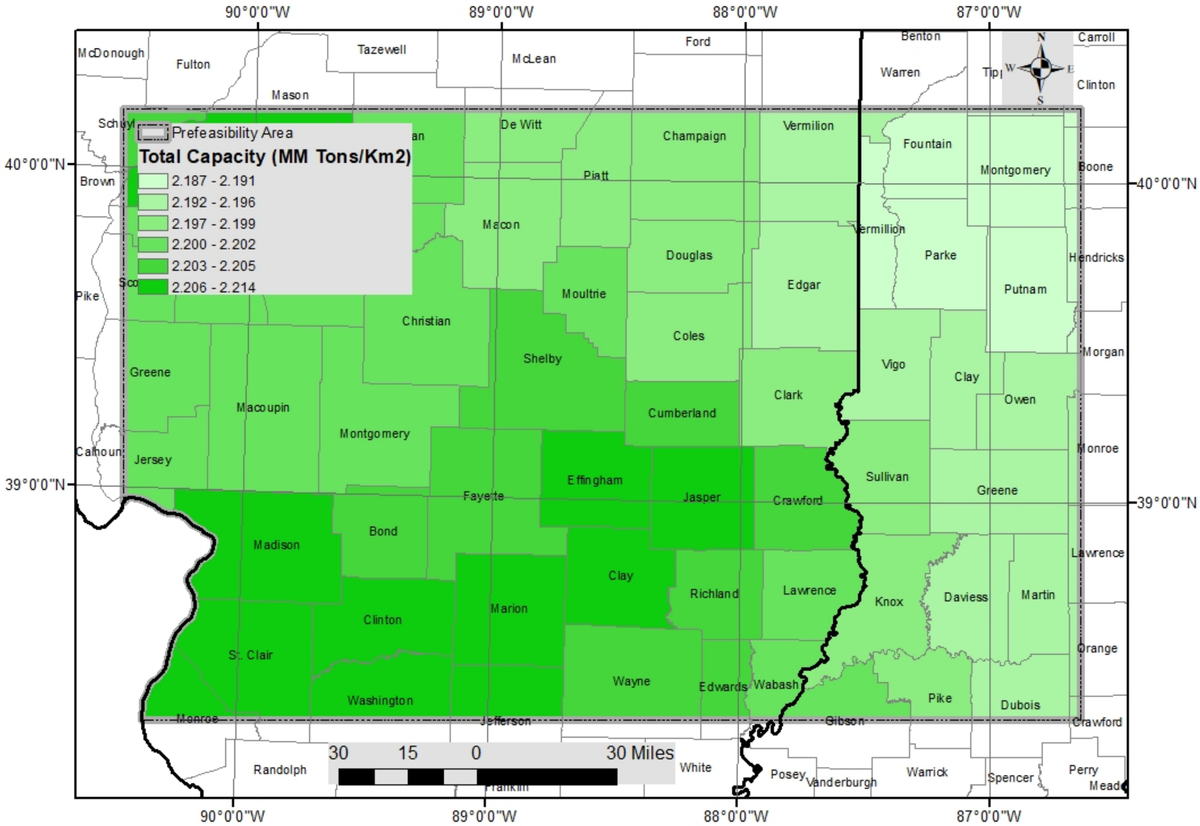


Figure A6.10. Storage resource estimates (SREs) for the Mount Simon Sandstone (unit 5). This map represents results from Method 1 with efficiency factor E_{p100} (E=1). Values are total storage capacity per unit area, per county.



APPENDIX 7: Statistical summary of data presented in Appendix 4

Method 1

	U2			U3			U4			U4b			U5		
Mean	0.050	0.177	0.466	0.047	0.085	0.256	0.253	0.839	2.029	0.109	0.358	0.862	0.183	0.610	1.478
n		156			141			57			22			25	
Minimum	0.002	0.008	0.021	0.003	0.006	0.018	0.087	0.287	0.691	0.029	0.096	0.226	0.053	0.177	0.427
Q1	0.036	0.130	0.340	0.016	0.029	0.088	0.182	0.599	1.443	0.067	0.220	0.533	0.108	0.361	0.876
Median	0.050	0.177	0.465	0.050	0.091	0.275	0.220	0.730	1.778	0.076	0.255	0.601	0.218	0.722	1.757
Q3	0.062	0.220	0.579	0.067	0.121	0.368	0.311	1.027	2.472	0.135	0.444	1.073	0.233	0.766	1.868
Maximum	0.108	0.387	1.020	0.140	0.252	0.761	0.642	2.117	5.096	0.272	0.895	2.155	0.281	0.936	2.270

Method 2

	U2			U3			U4			U4b			U5		
Mean	0.024	0.084	0.223	0.020	0.080	0.240	0.152	0.505	1.221	0.076	0.250	0.603	0.131	0.435	1.054
n		156			141			57			22			25	
Minimum	0.009	0.032	0.085	0.001	0.002	0.006	0.026	0.087	0.209	0.005	0.018	0.042	0.051	0.169	0.410
Q1	0.015	0.054	0.142	0.004	0.016	0.048	0.097	0.322	0.774	0.027	0.088	0.213	0.079	0.263	0.638
Median	0.019	0.067	0.176	0.011	0.044	0.134	0.147	0.489	1.182	0.070	0.229	0.553	0.129	0.428	1.035
Q3	0.025	0.090	0.237	0.024	0.098	0.296	0.190	0.631	1.521	0.098	0.321	0.775	0.161	0.537	1.301
Maximum	0.085	0.303	0.795	0.095	0.385	1.172	0.334	1.110	2.681	0.230	0.758	1.826	0.229	0.763	1.848

Method 3

	U2			U3			U4			U4b			U5		
Mean	0.023	0.083	0.218	0.020	0.082	0.250	0.158	0.526	1.272	0.053	0.174	0.418	0.190	0.634	1.537
n		156			141			57			22			25	
Minimum	0.001	0.004	0.010	0.001	0.006	0.017	0.054	0.180	0.433	0.014	0.047	0.110	0.055	0.184	0.444
Q1	0.017	0.061	0.159	0.007	0.028	0.086	0.114	0.376	0.904	0.033	0.107	0.259	0.113	0.375	0.910
Median	0.023	0.083	0.218	0.022	0.089	0.269	0.138	0.458	1.114	0.037	0.124	0.292	0.227	0.751	1.826
Q3	0.029	0.103	0.271	0.029	0.118	0.359	0.195	0.644	1.550	0.065	0.215	0.521	0.242	0.796	1.942
Maximum	0.051	0.181	0.478	0.061	0.246	0.743	0.402	1.327	3.194	0.132	0.434	1.046	0.292	0.973	2.359

Method 4

	U2			U3			U4			U4b			U5		
Mean	-	-	-	0.029	0.119	0.361	-	-	-	-	-	-	0.111	0.370	0.899
n		-			141			-			-			25	
Minimum	-	-	-	0.001	0.005	0.015	-	-	-	-	-	-	0.009	0.029	0.070
Q1	-	-	-	0.008	0.033	0.101	-	-	-	-	-	-	0.068	0.226	0.547
Median	-	-	-	0.025	0.103	0.312	-	-	-	-	-	-	0.109	0.361	0.877
Q3	-	-	-	0.050	0.204	0.620	-	-	-	-	-	-	0.142	0.472	1.144
Maximum	-	-	-	0.113	0.464	1.410	-	-	-	-	-	-	0.263	0.876	2.122

Method 5

	U2			U3			U4			U4b			U5		
Mean	0.009	0.041	0.171	0.008	0.040	0.153	0.101	0.382	1.183	0.061	0.222	0.625	0.101	0.377	1.124
n		49			49			27			11			10	
Minimum	0.000	0.001	0.007	0.000	0.001	0.006	0.001	0.007	0.078	0.000	0.004	0.044	0.025	0.119	0.466
Q1	0.003	0.017	0.096	0.003	0.013	0.045	0.040	0.149	0.626	0.022	0.078	0.223	0.050	0.208	0.724
Median	0.005	0.028	0.154	0.005	0.024	0.088	0.079	0.280	1.049	0.054	0.207	0.587	0.100	0.388	1.087
Q3	0.009	0.046	0.229	0.011	0.052	0.178	0.145	0.563	1.573	0.074	0.277	0.811	0.130	0.471	1.391
Maximum	0.058	0.218	0.625	0.044	0.240	1.090	0.302	1.043	2.751	0.207	0.720	1.857	0.200	0.675	1.949