Central Appalachian Basin (SECARB)

Presented to:
Coal-Seq VI
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SECARB Coal Group Team

- Southern States Energy Board
- Virginia Center for Coal and Energy Research Virginia Tech
- Marshall Miller and Associates, Inc.
- Geological Survey of Alabama
- University of Alabama
- Southern Company
- Kentucky Geological Survey
- Advanced Resources International
- Eastern Coal Council

SECARB Coal Projects
Contributing Partners

- Alawest
- Alpha Natural Resources
- AMVEST
- Buckhorn Coal
- CCP2 Project
- CDX Gas
- CNX Gas
- CONSOL Energy
- Cumberland Resources Corporation
- Dart Oil & Gas
- Denbury Resources
- Dominion E&P
- Dominion Resources
- Eastman Chemical
- EPRI
- Equitable Production
- Institute for Clean Energy Technology (MSU)
- International Coal Group
- GeoMet
- McJunkin Appalachian
- Norfolk Southern
- Natural Resource Partners
- Oak Ridge National Laboratory
- Penn Virginia
- Pine Mountain Oil & Gas
- Piney Land
- Pocahontas Land
- RMB Earth Science Consultants
- Univ. British Columbia

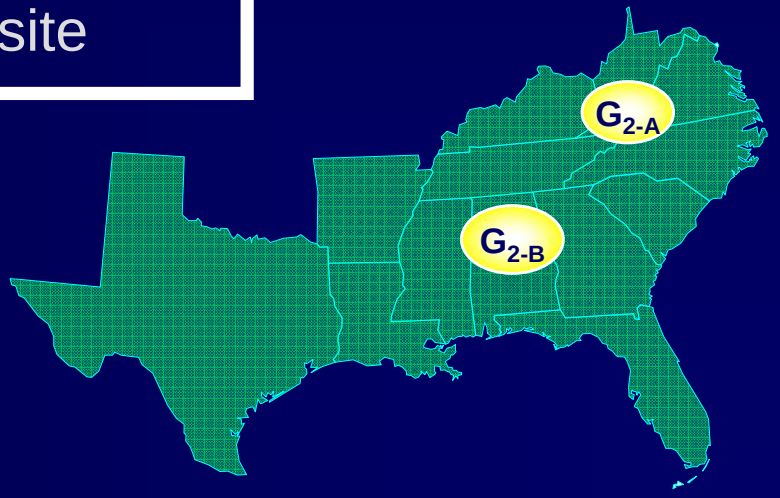
SECARB Coal Projects

CO_2 ECBM recovery:

- Unmineable coals can provide sequestration and add economic value
- At least 1,000 MMT CO_2 of feasible capacity in the targeted areas

Two Field Validation Sites:

- Central Appalachian Basin, $G_{2\text{-}A}$
- Black Warrior Basin, $G_{2\text{-}B}$
- Inject 1,000 tons of CO_2 at each site



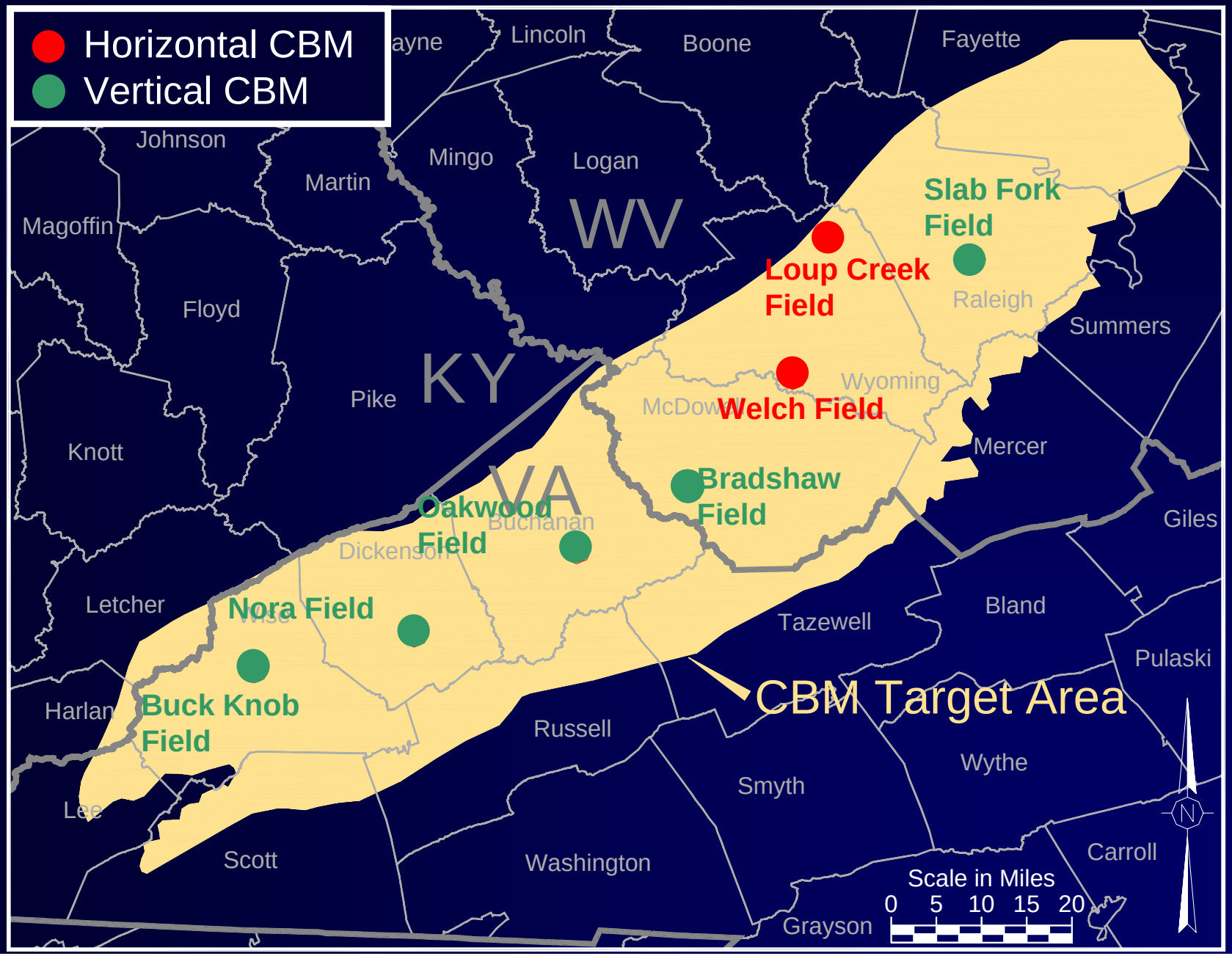
SECARB Coal Group
Phase II Project Tasks

- Regional Characterization and Site Selection
- Reservoir Modeling
- Core Hole Drilling and Evaluation
- Pilot Preparation and Risk Analysis
- Pilot Project Operations
- Interpretation and Assessment
- Public Outreach
- Technology Transfer

Central Appalachian Field Test – Progress Overview

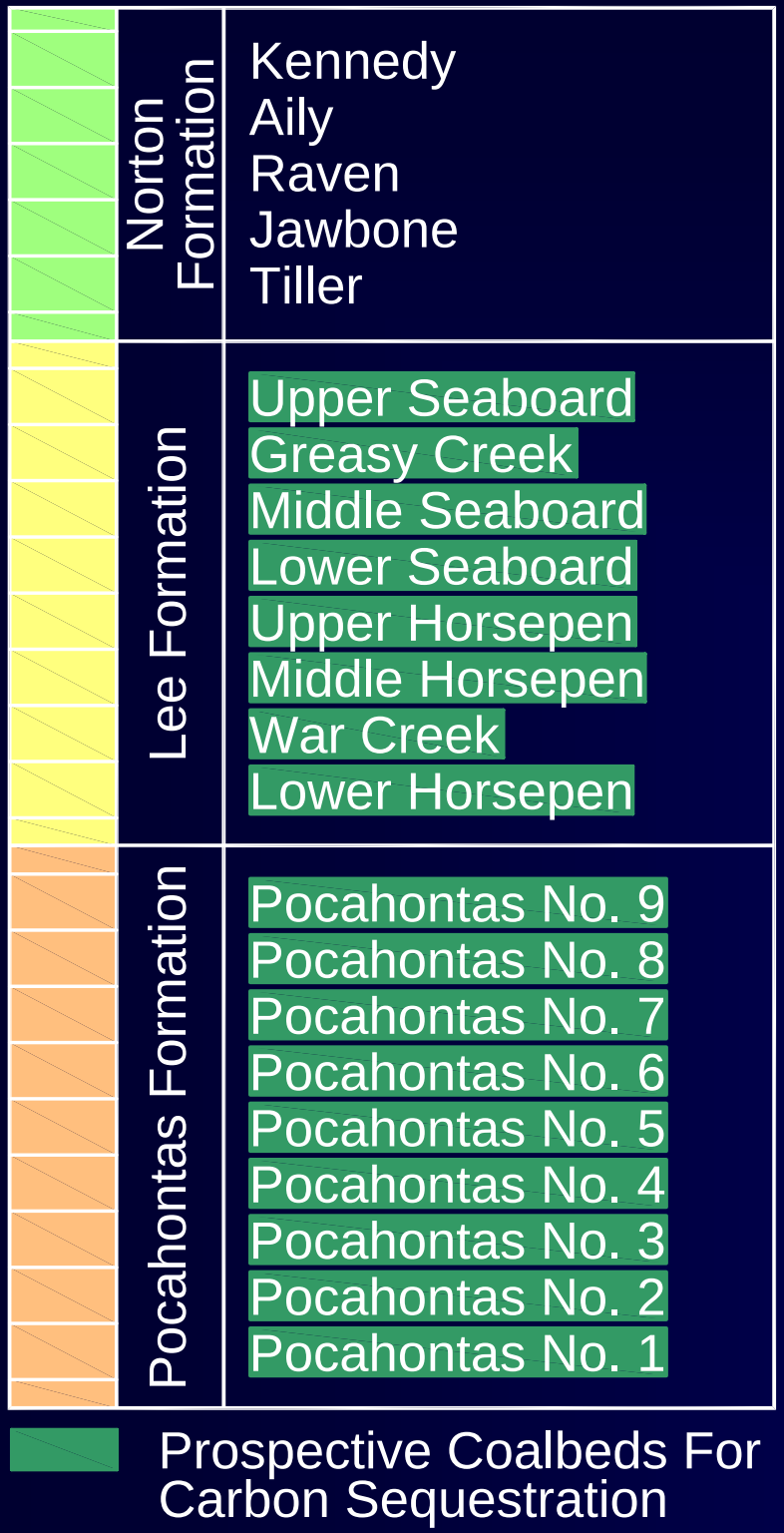
- Finalized Sequestration and ECBM Assessment for Central Appalachian Basin
- Developed a suite of geologic maps for sequestration and ECBM analysis
- Selected a donated CNX Gas well for field test
- Finalized indemnification and operating agreements with CNX Gas and Buckhorn Coal Company
- Conducted required safety training from CNX Gas
- Completed and submitted NEPA Questionnaire
- Working with EPA and Virginia Department of Mines, Minerals and Energy on permitting requirements
  - UIC Permit Application
  - Corehole Permitting

Study Area CBM Fields



Central Appalachian Basin

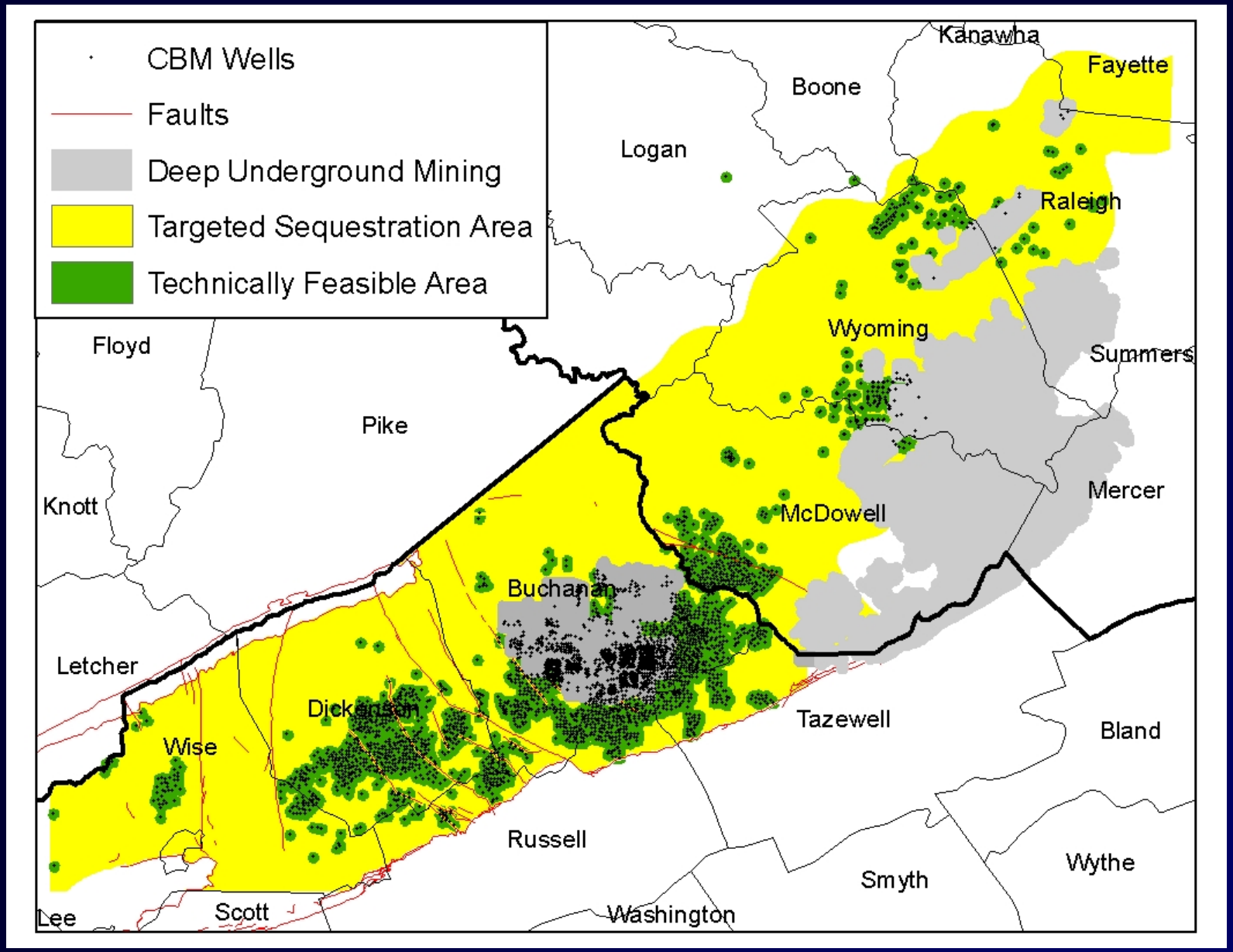
Generalized Stratigraphic Column



Evaluation Criteria
Carbon Sequestration and ECBM Potential

- Thickness, rank and gas content of coals developed for CBM production
- Areas where CBM production has been established (*higher expected carbon dioxide injectivity and existing infrastructure*)
- Excludes deep mine areas (*potential leakage of injected carbon dioxide because of subsidence*)

Evaluated Sequestration Area



Sequestration Potential

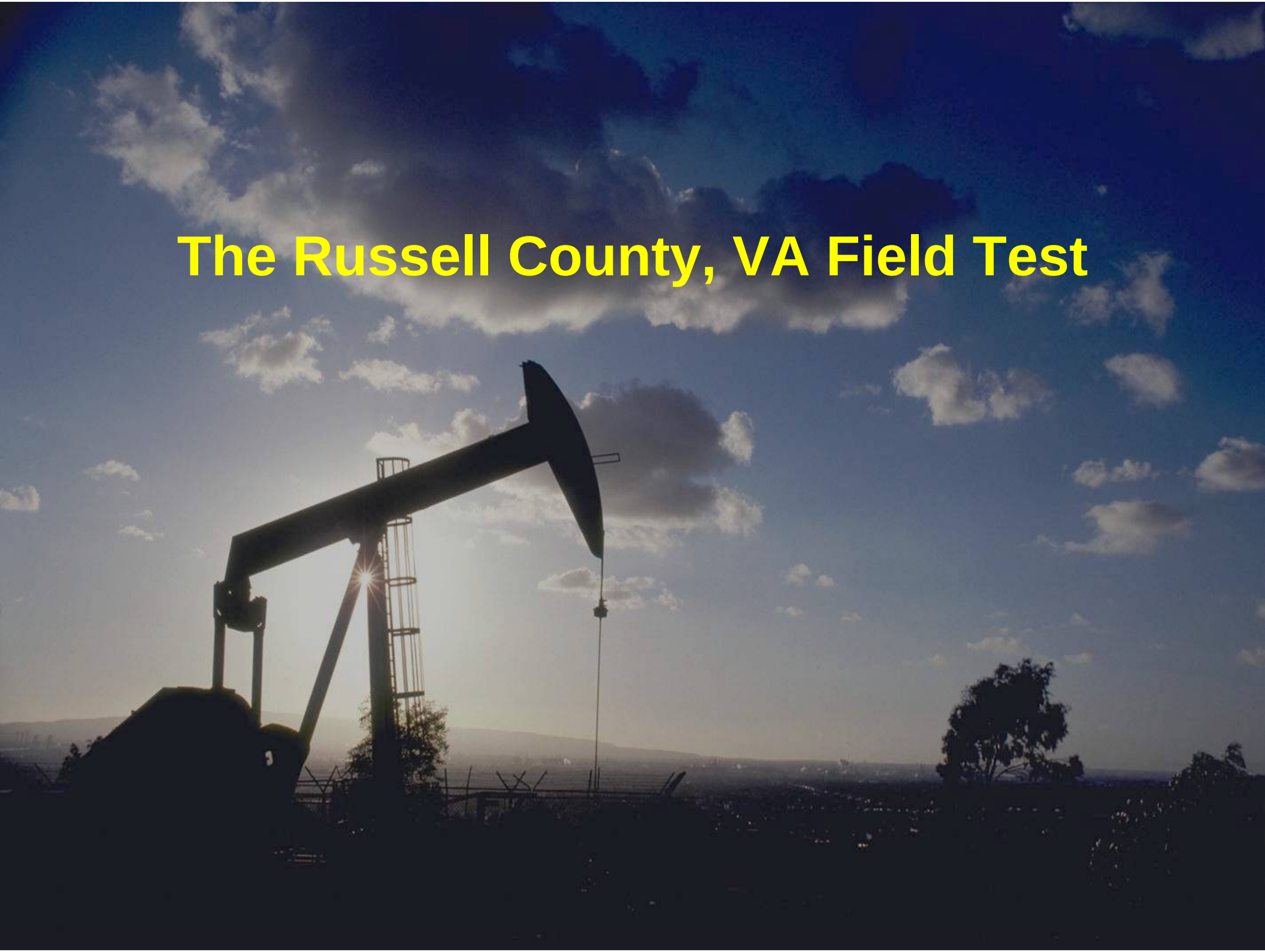
Phase II Study Areas	
Storage capacity in all non-mining areas	23.1 Tcf (1,341 MMt)
Storage only in developed CBM areas	6.86 Tcf (398 MMt)

West Virginia portion of study area has 8.88 Tcf total storage capacity and 1.49 Tcf storage capacity in CBM development areas.

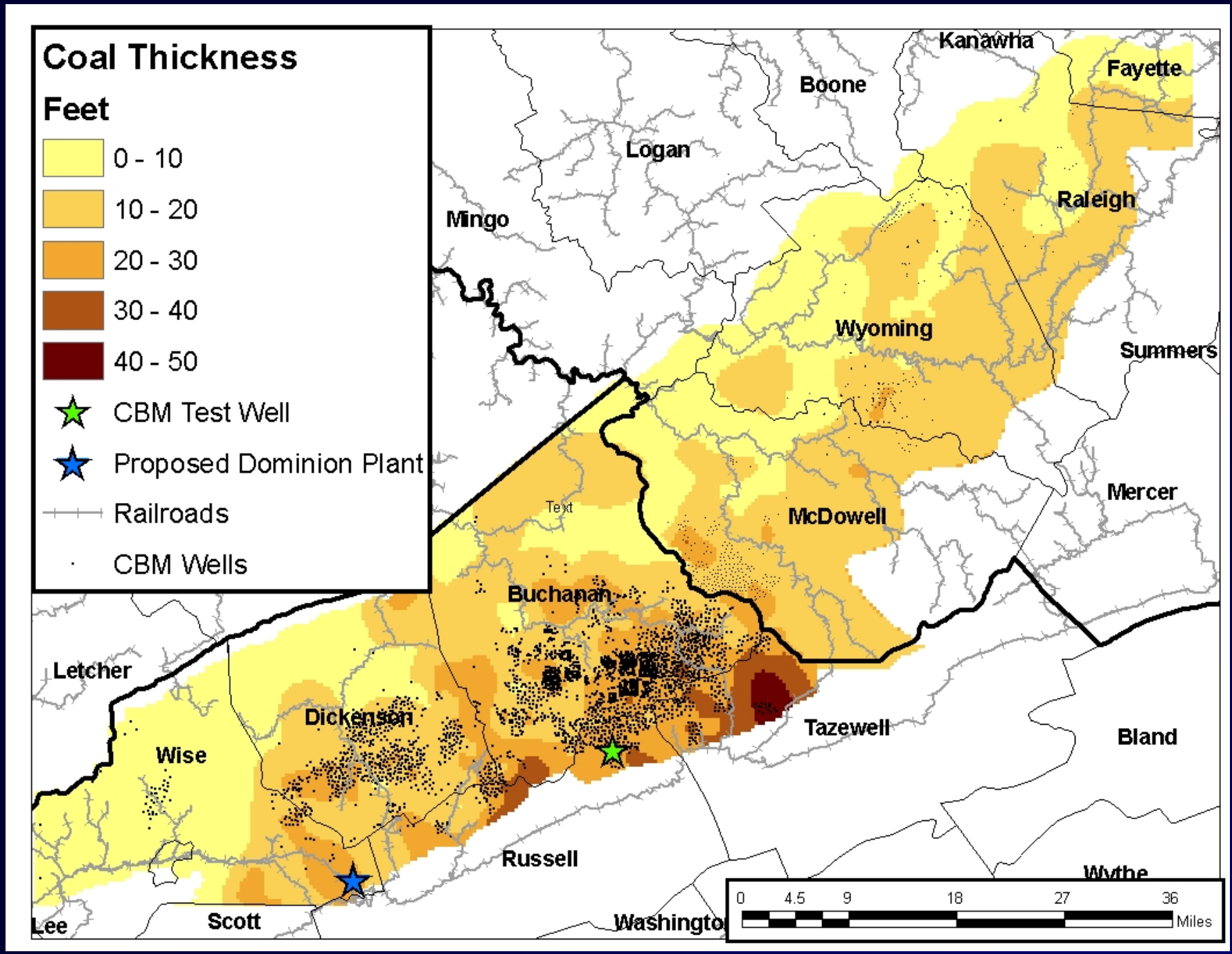
Enhanced CBM Potential

Phase II Study Areas	
ECBM potential in all non-mining areas	2.49 Tcf
ECBM only in developed CBM areas	0.79 Tcf

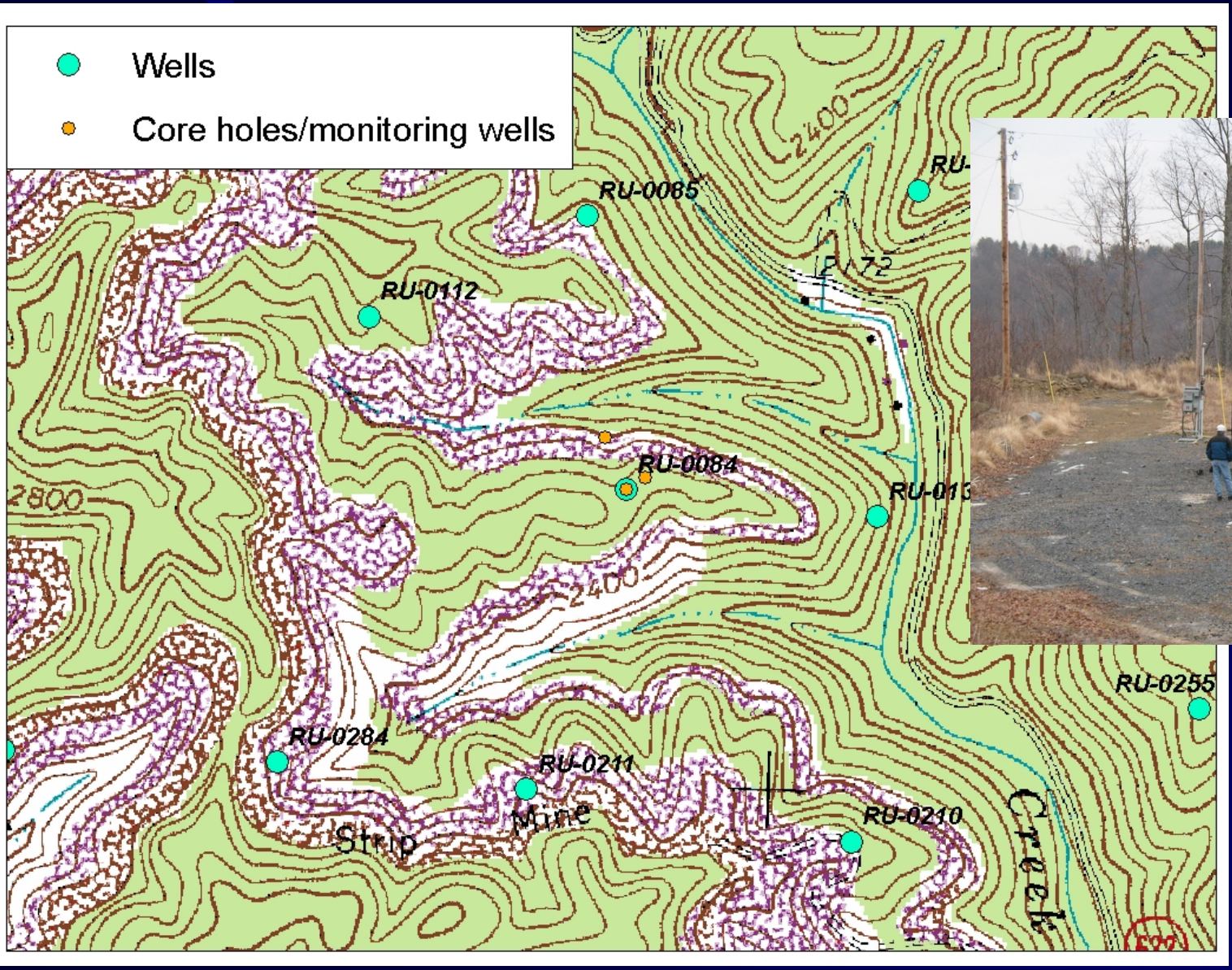
West Virginia portion of study area has 0.80 Tcf total ECBM potential and 0.14 Tcf ECBM potential in CBM development areas.


The Russell County, VA Field Test

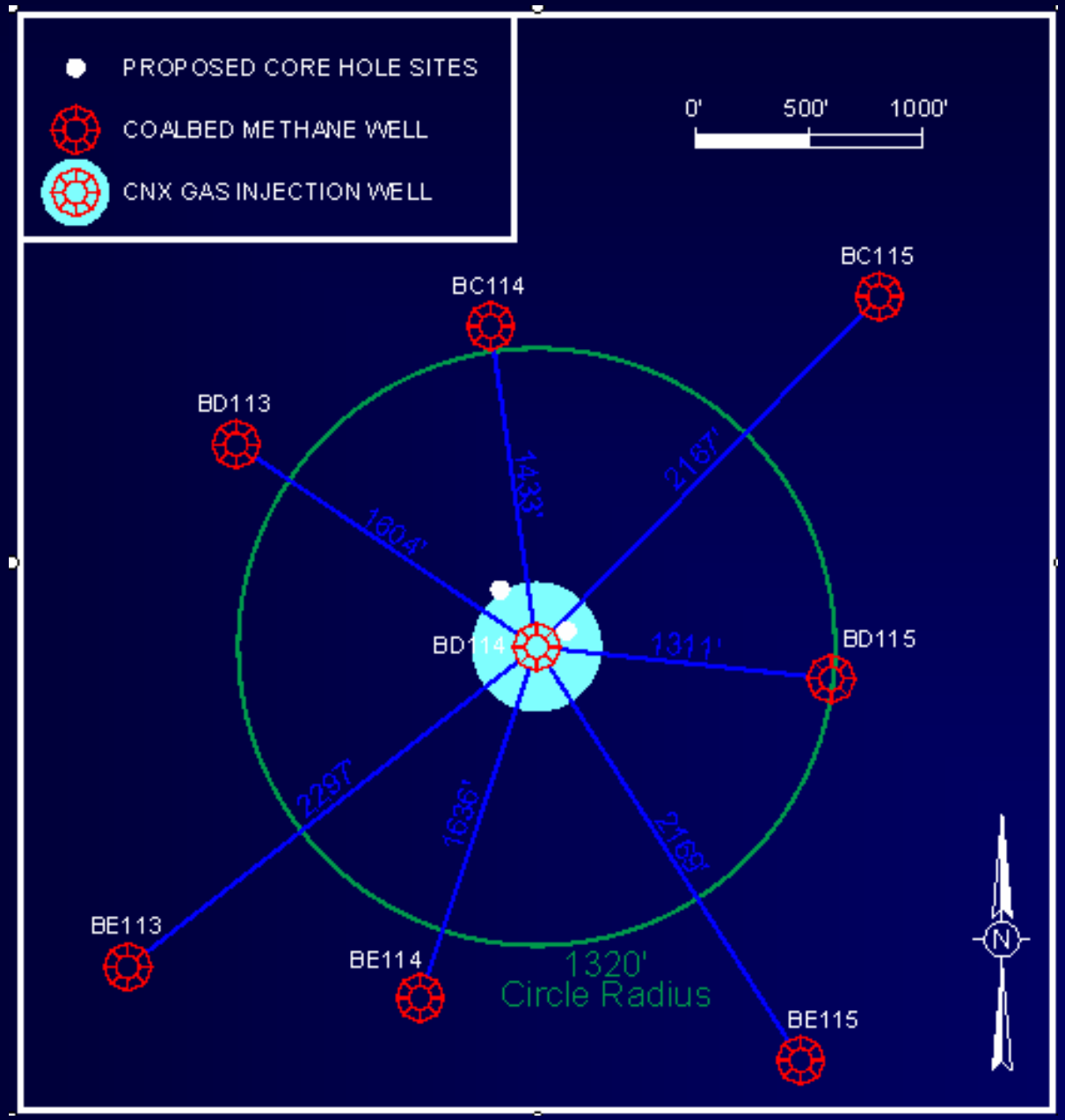
CNX Gas Field Test Location

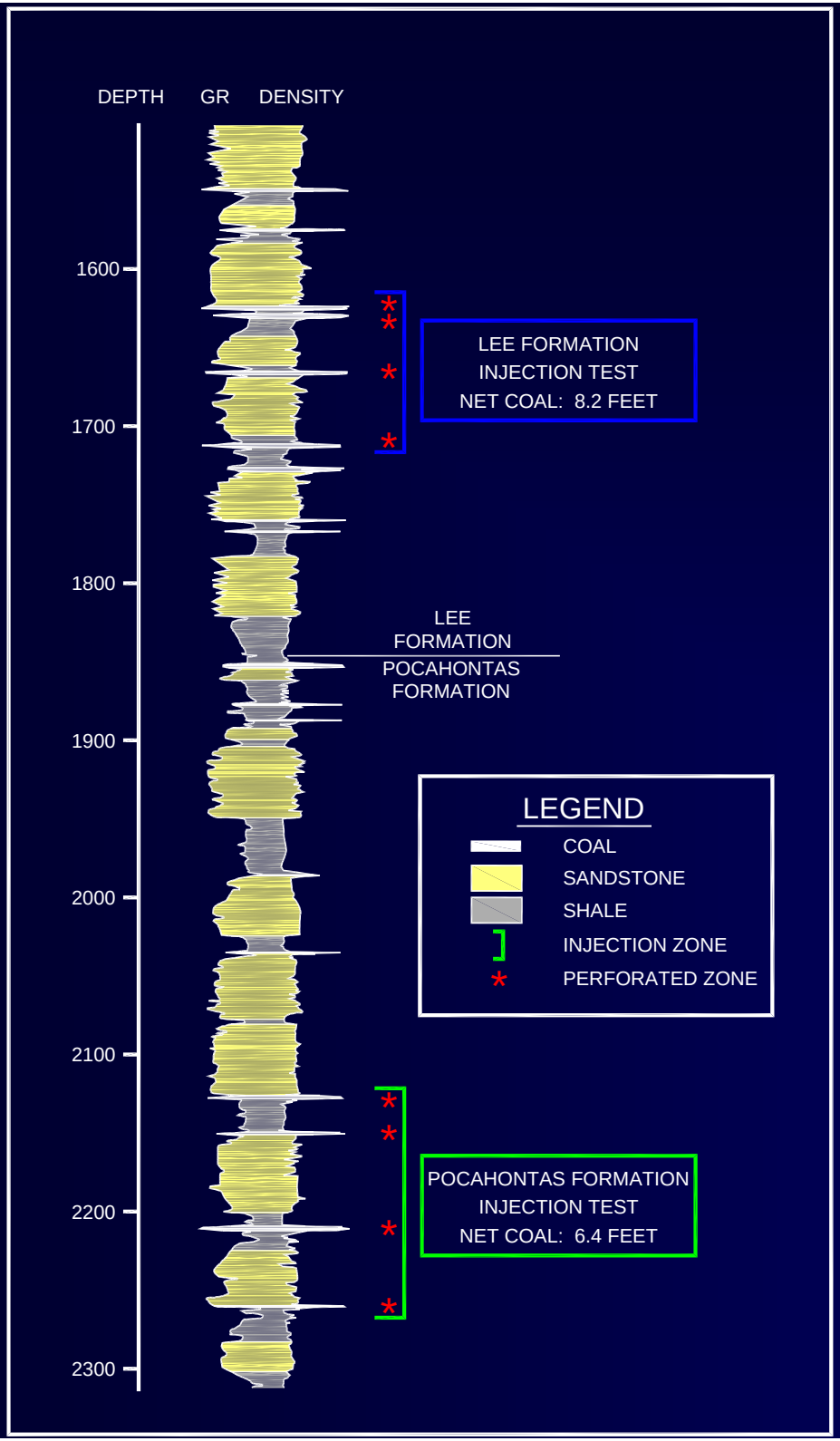


Virginia Pilot Test Site



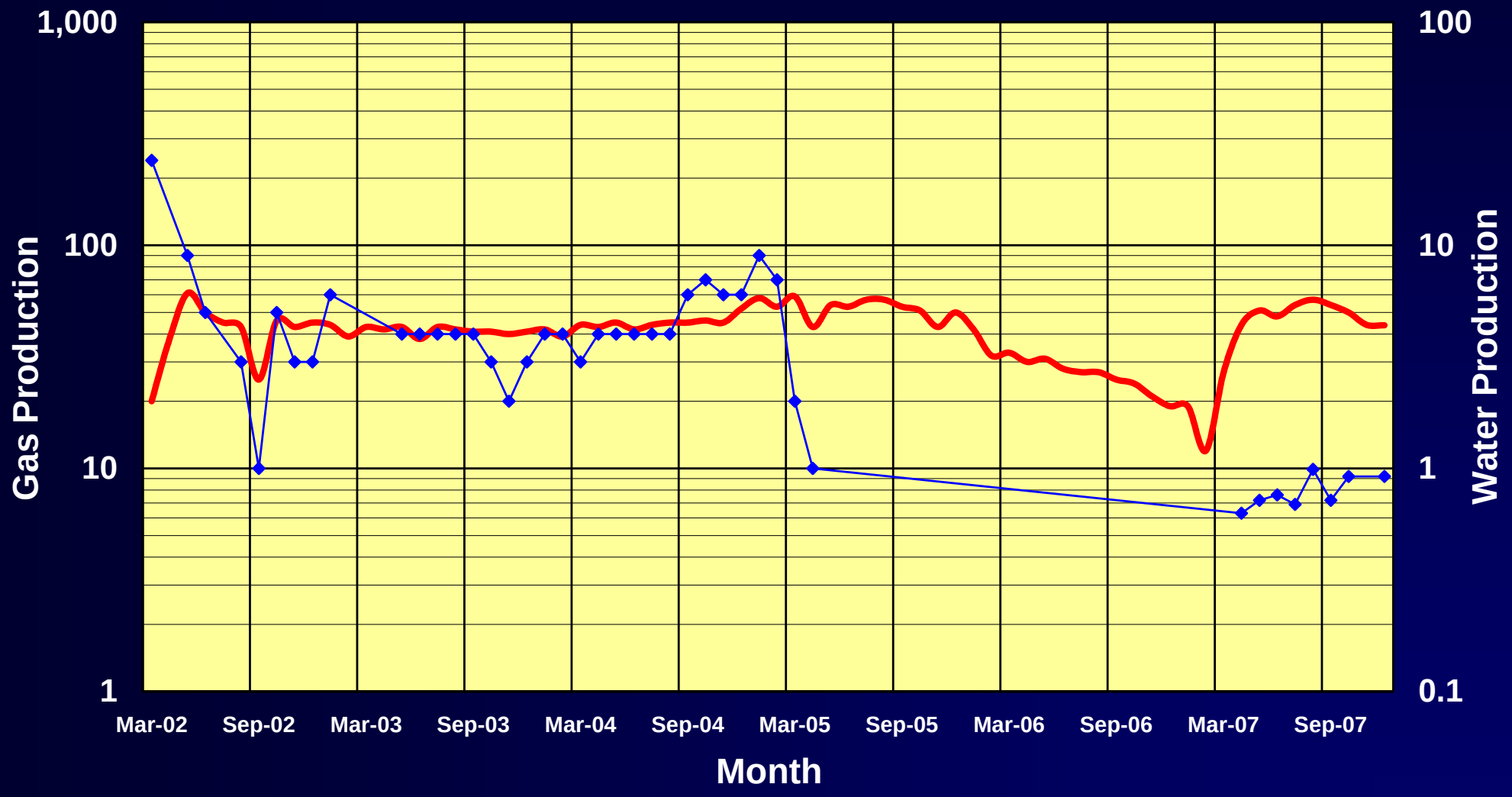
Offset CBM Wells





Proposed Injection Zones Well BD-114

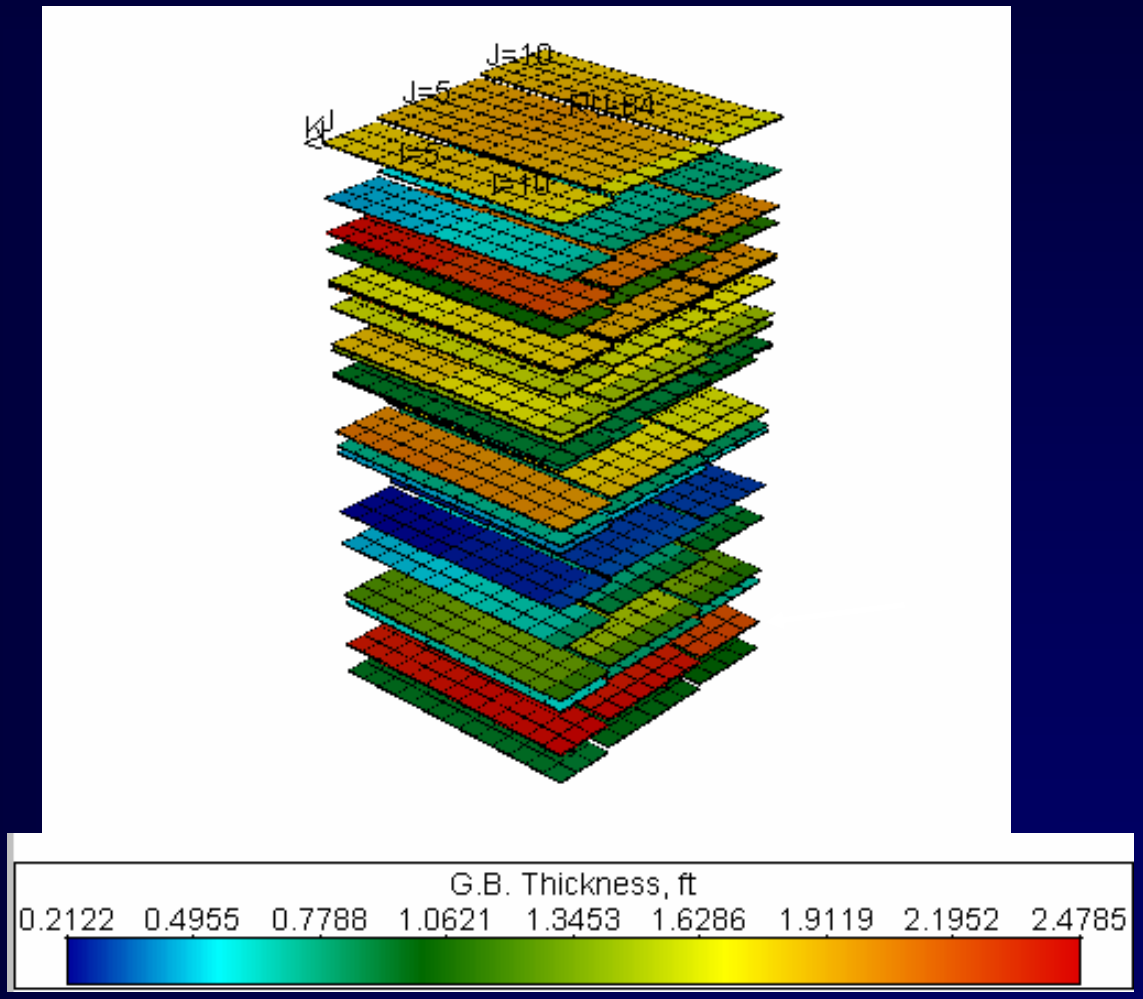
Injection Well Production History



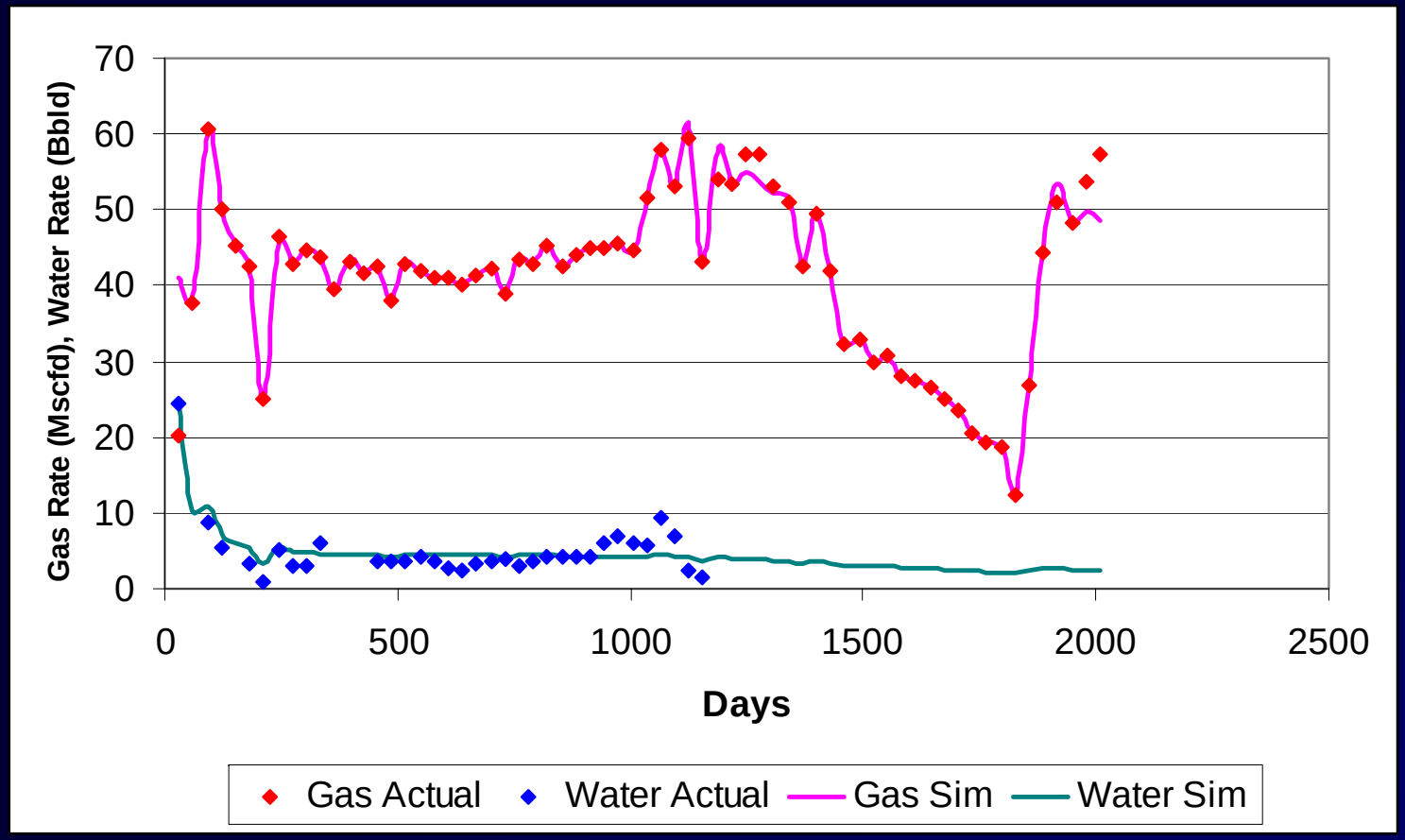
Pilot Area Gas Composition

Well No.	Methane (%)	Nitrogen (%)	CO^2 (%)	Oxygen (%)	Ethane (%)	Propane (%)	Btu Content
BC114	97.01	.54	1.87	.01	.557	.015	994
BC115	97.11	.57	2.08	.01	.216	.010	989
BD113	96.58	.50	2.49	.03	.392	.002	987
BD114	96.62	.68	2.33	.02	.351	.002	986
BE114	95.67	1.02	1.80	.02	1.418	.059	998
BE113	95.24	1.02	1.91	.01	1.744	.067	999
BD115	97.01	.83	1.35	.02	.740	.033	998
BE115	96.59	.65	1.89	.00	.822	.019	995
Average	**96.48**	**.73**	**1.97**	**.02**	**.780**	**.026**	**993**

Model 3D View: Thickness



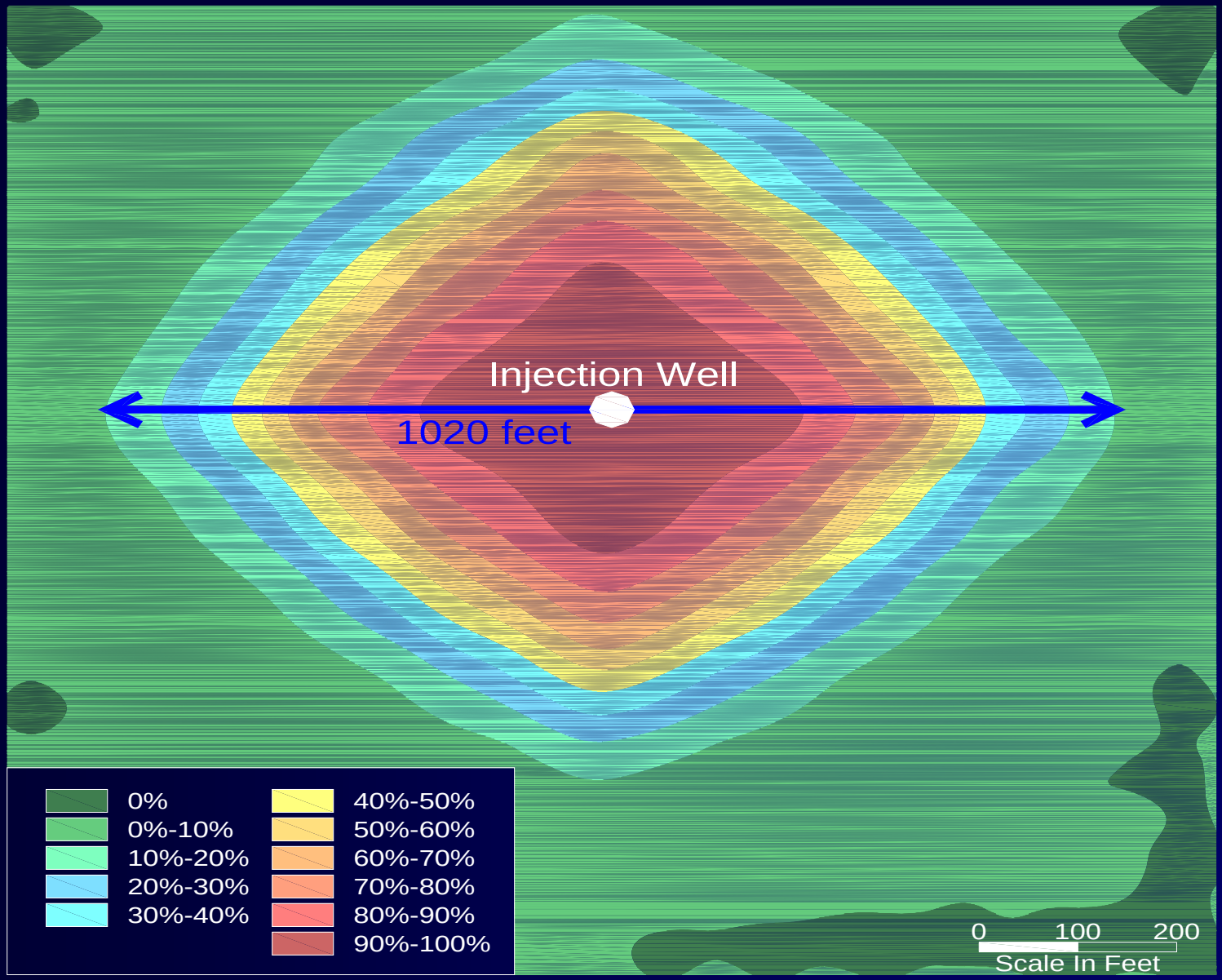
History Match Results



Injection Test Plume Model

- Growth of the CO_2 plume was modeled in all test layers (coal seams)
- The plume growth was essentially radial in all layers
- As expected, the growth is largest in the most permeable layer, the Pocahontas No. 3 coal seam
- Radial growth occurs to approximately 550 feet from injection well BD-114

CO_2 Plume – Pocahontas No. 3
Percent CO_2 Saturation



Test Schedule

- Site selection (Complete): 04/07 – 12/07
- Approvals and Permitting: 02/08 – 07/08
- Soil Gas Monitoring: 03/08 – 09/09
- Coring: 04/08 – 06/08
- Formation testing: 05/08 – 06/08
- Install injection equipment: 07/08 – 08/08
- Injection testing: 08/08 – 01/09
- Site closure: 06/09 – 09/09

Core Hole Testing

- Geophysical logs: gamma ray, caliper, density, neutron, induction, temperature
- Desorption testing to determine current methane gas content
- Methane, nitrogen, and carbon dioxide adsorption isotherms
- Petrographic analyses of core samples
- Injection-falloff tests of Lee and Pocahontas formation injection intervals

Measurement, Monitoring and Verification

- Monitor CO_2 soil flux levels near the injection well
- Monitor pressure and gas composition at core holes
- Monitor casing pressures and gas and water production rates at adjacent CBM wells
- Monitor ambient CO_2 levels

Current Issues

- NEPA and DOE operational approval
- Core hole permitting and change in requirements
- Class V injection permit (EPA Region 3) and timing issues
- Core rig and service vendor availability