United States Environmental Protection Agency

Technical Roundtables on EPA's Study of the Potential Impacts of Hydraulic Fracturing on Drinking Water Resources

WATER ACQUISITION

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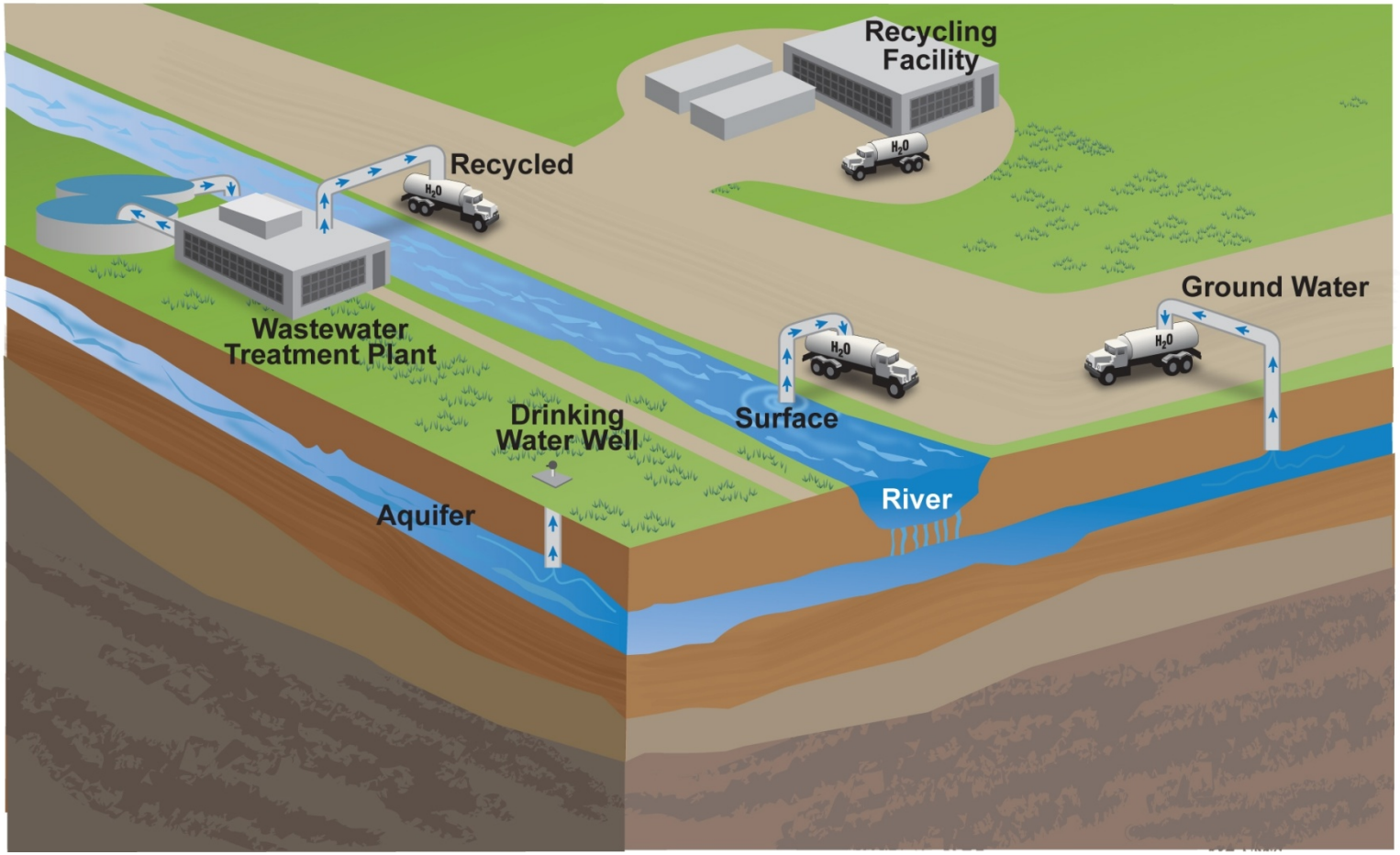
Water Acquisition



What are the possible impacts of large volume water withdrawals from ground and surface waters on drinking water resources?

Water Acquisition Research Projects

Secondary Research Questions	Applicable Research Projects
1. How much water is used in hydraulic fracturing operations, and what are the sources of this water?	Literature Review Service Company Analysis Well File Review FracFocus Analysis Water Availability Modeling
2. How might water withdrawals affect short- and long-term water availability in an area with hydraulic fracturing activity?	Literature Review Water Availability Modeling
3. What are the possible impacts of water withdrawals for hydraulic fracturing operations on local water quality?	Literature Review

Analysis of Existing Data: Literature Review

Data Sources

- Existing papers and reports, focusing on peer-reviewed literature.

Anticipated Data

- Volumes and sources of water used in hydraulic fracturing fluids.
- Local impacts to water availability in areas with hydraulic fracturing activities.
- Water quality impacts from ground and surface water withdrawals.

Research Progress

- Identification, review, and evaluation of existing literature is underway.
- Barnett, Eagle Ford, Haynesville, and Bakken shales have undergone most thorough analyses.

Next Steps

- Continue to review and assess literature related to water acquisition according to research questions in the study plan.

Analysis of Existing Data: Service Company Data

Data Sources

- Data and information provided by nine hydraulic fracturing service companies.

Anticipated Data

- Volumes, quality, and sources of water used in Hydraulic Fracturing fluids from 2005–2010.

Research Progress

- Preliminary data analyses near completion.

Next Steps

- Discuss data with service companies.

Analysis of Existing Data: Well File Review

Data Sources

- Well-specific records provided by nine oil and gas operators.

Anticipated Data

- Volumes and sources of water used in hydraulic fracturing for 333 wells hydraulically fractured in 2009 and 2010.

Research Progress

- Data compilation from the well files is underway.

Next Steps

- Continue compiling data from well files.
- Review data with oil and gas operators.
- Analyze water usage.

Analysis of Existing Data: FracFocus

Data Sources

- National registry for chemicals used in hydraulic fracturing.

Anticipated Data

- Volumes, types, and sources of water used in hydraulic fracturing; well depths; and oil and gas production organized by geographic location, as reported by oil and gas operating companies.

Research Progress

- Data were compiled, checked for quality, and are being organized for analysis.
- Analysis underway to address research questions.
- Discussing analysis with Ground Water Protection Council.

Next Steps

- Summarize data.
- Analyze water usage.

Water Availability Modeling

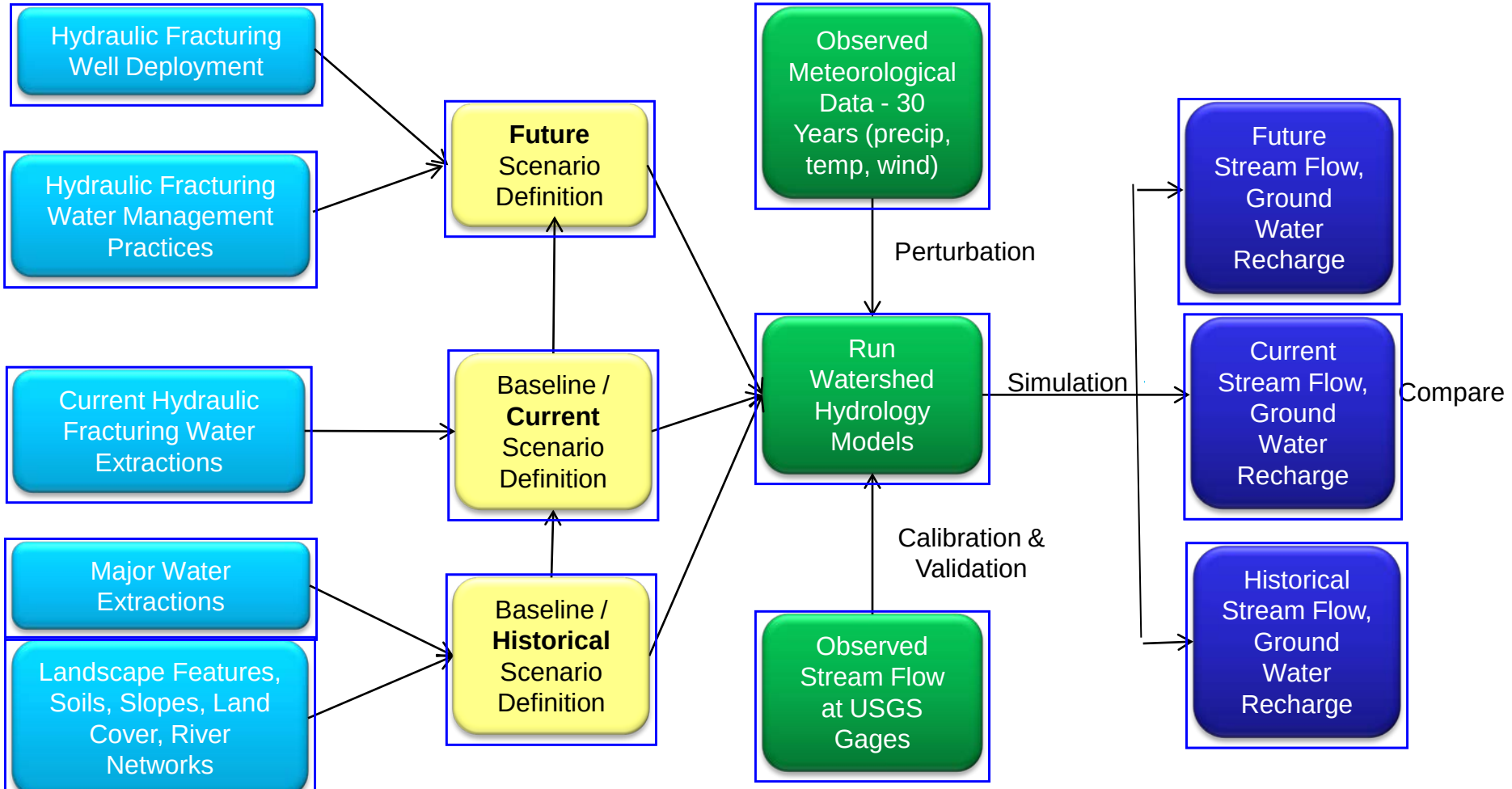
OBJECTIVE:

To evaluate possible impacts of large-volume water withdrawals for hydraulic fracturing on water availability in representative basins under hypothetical yet possible future scenarios.

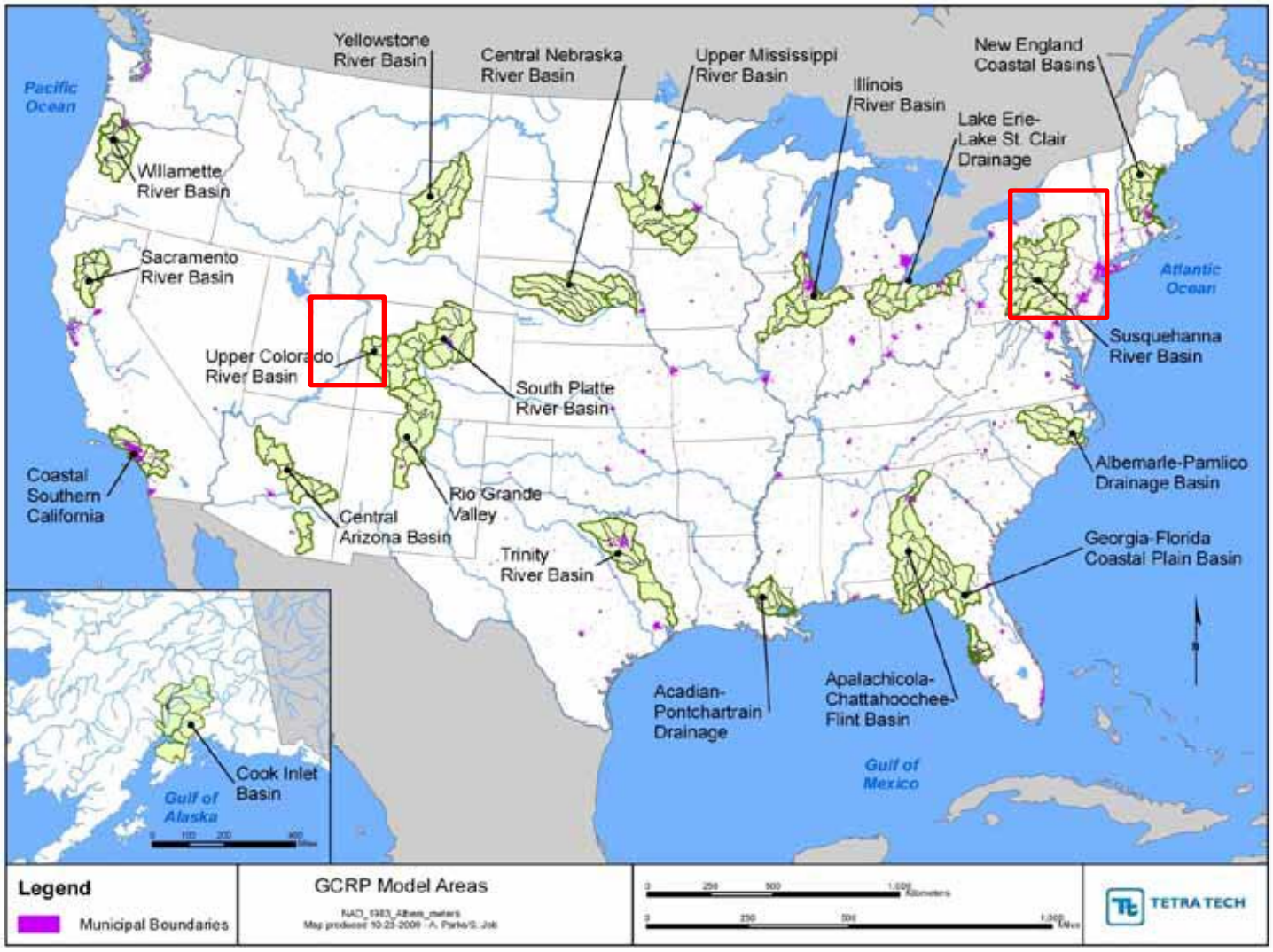
APPROACH:

1. Select representative watersheds from semi-arid and humid climates for scenario evaluations.
2. Establish baseline representation of watershed hydrological conditions using historical observed water balance and observed major USGS use designations, such as agriculture or energy.
3. Modify baselines to include water withdrawal supporting hydraulic fracturing operations.
4. Design future scenarios for (1) business as usual; (2) energy plus; and (3) green technology.
5. Conduct analyses of potential changes in stream flows and ground water recharge among historical, current, and future scenarios.

Critical Path for Modeling Approach

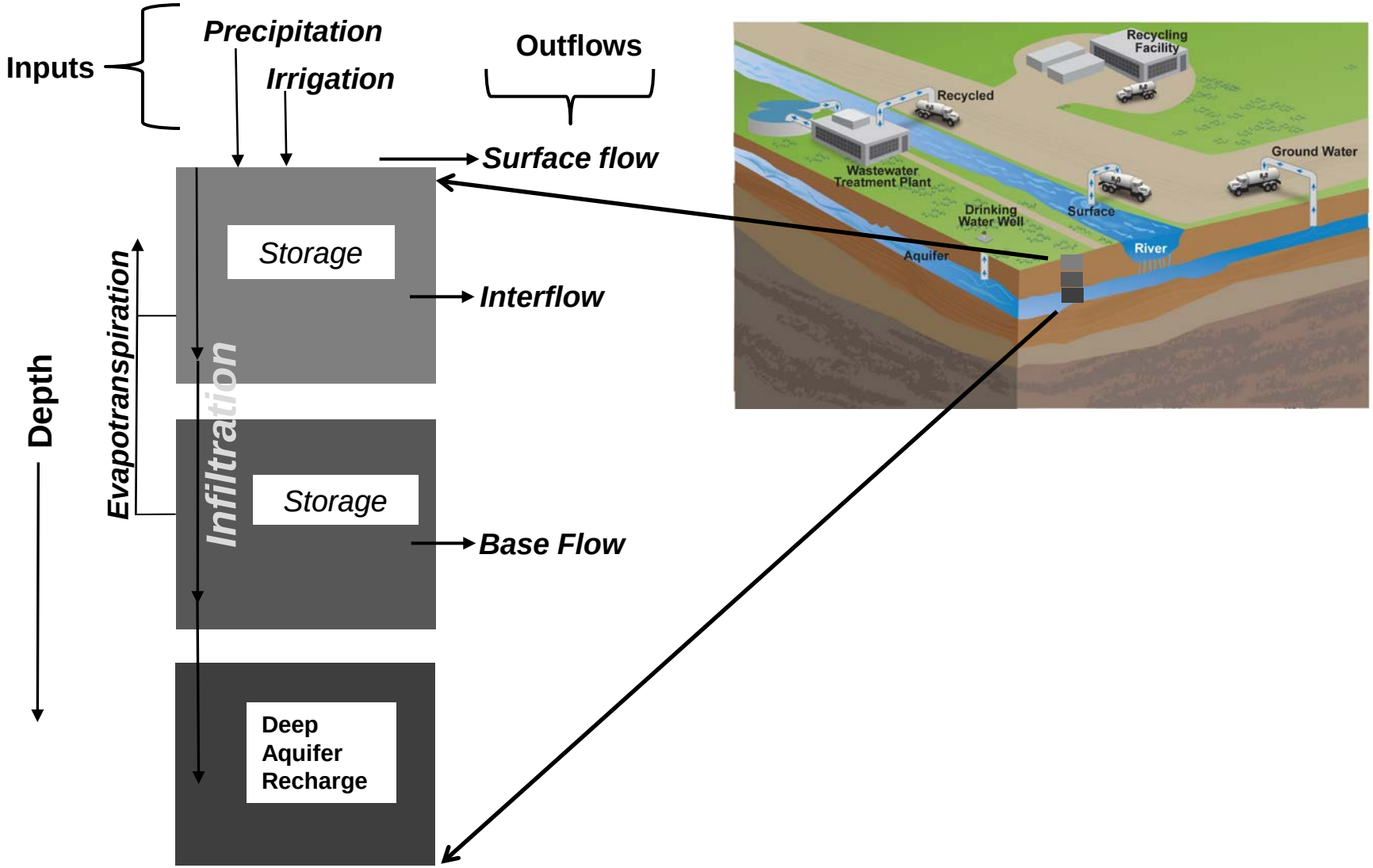


Study Watersheds



EPA 20 Watershed Study also shown in Johnson et al. 2012. J Water Resources Planning and Management. Doi:10.1061/(ASCE)WR.1943-5454.0000175

Watershed Hydrology Model: "Fill and Spill"



Future Scenarios

Model Assumptions		Future Scenarios– Upper Colorado River Basin (UCRB) and Susquehanna River Basin (SRB)		
		Business as Usual	**Energy Plus**	**Green Technology**
Hydraulic Fracturing Well Deployment*§		Current deployment schedules	**Maximum** projected development	Current deployment schedules
Hydraulic Fracturing Water Management	UCRB	Fresh water for drilling and dust abatement, 100% recycling produced water†	Fresh water for drilling and dust abatement, 100% recycling produced water†	**Fresh water for drilling only**, 100% recycling produced water†
	SRB	Current fresh water use, 13% recycling produced water‡	Current fresh water use, 13% recycling produced water‡	Reduced fresh water use, **29% recycling produced water**‡

*U.S. Energy Information Administration; §- U.S. Geological Survey; ‡ - Susquehanna River Basin Commission and Colorado Oil and Gas Conservation Commission; † - Bureau of Land Management

Water Availability Modeling

Research Progress

- Existing information has been collected from the Susquehanna River Basin Commission and Colorado Oil and Gas Conservation Commission and is being reviewed to parameterize the model to run the scenarios.
- Models are being calibrated and validated for representation of baseline (historical 2000/2005 and current 2010) conditions, including water withdrawals to support hydraulic fracturing.

Next Steps

- Resources permitting, a ground-water-dependent watershed study will be designed, with model simulations to follow.

Questions for Discussion

- What data are available on rate of recycling that would help EPA improve predictions of the green technology scenario?
- What ground-water-dependent watershed could EPA consider for an additional model evaluation?