Update on EPA's Prospective Case Studies

Technical Workshop: Case Studies to Assess Potential Impacts of Hydraulic Fracturing on Drinking Water Resources

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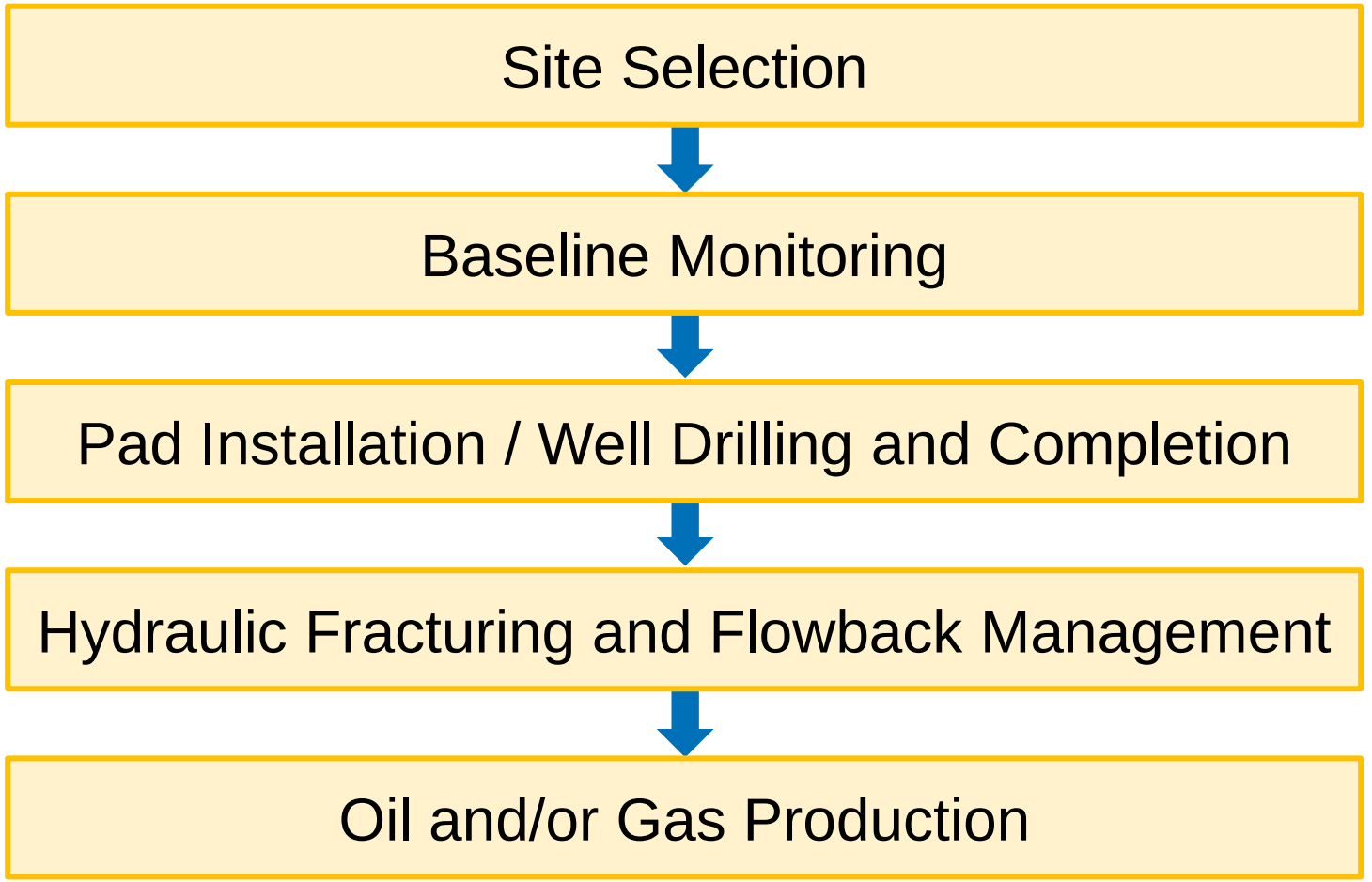
Prospective Case Study Goals

- Understand how site-specific hydraulic fracturing practices prevent impacts to drinking water resources
- Evaluate any changes in water quality over time

Study Approach

Follows development of production well



Site Selection

Example **environmental management practices** conducted by well operator

- Consider nearby water resources, slope, etc.

Research Approach

EXAMPLE GOALS	EXAMPLE IMPLEMENTATION TASKS
• New development area • Relatively shallow ground water of good quality • Nearby surface water resources with access for monitoring • Site topography provides good access for monitoring wells • Cooperative landowners (access)	• Review historical oil and gas activities and distances • Evaluate potential water quality impacts from local pre-existing land uses • Determine distance and flow path to surface water resources • Identify existing nearby ground water wells • Gather pre-existing water quality information • Site visit to confirm • Sign access agreements

Baseline Monitoring

Example **environmental management practices** conducted by well operator

- Conduct water quality monitoring

Research Approach

EXAMPLE GOALS	EXAMPLE IMPLEMENTATION TASKS
• Install monitoring network • Conduct baseline monitoring • Document baseline water quality	• Determine depth, direction and rate of ground water flow • Drill, log and install monitoring wells at multiple depths • Establish surface water monitoring locations • Conduct four quarterly water quality and flow monitoring events

Pad Installation / Well Drilling and Completion

Example **environmental management practices** conducted by well operator

- Install liners, construct berms
- Install casing and cement, conduct mechanical integrity tests
- Construct secondary containment for tanks/impoundments

Research Approach

EXAMPLE GOALS	EXAMPLE IMPLEMENTATION TASKS
• Document well construction details • Document well integrity • Assess any impacts to water quality	• Observe pad construction • Observe drilling and completion of production well • Monitor ground and surface water for any impacts • Receive company-provided details on geology, casing materials and depths, cement details and evaluation tools, mechanical integrity test results, etc.

Hydraulic Fracturing and Flowback Management

Example **environmental management practices** conducted by well operator

- Choice of hydraulic fracturing fluid components
- Fracture propagation assessment / microseismic monitoring
- Pressure monitoring
- Post-fracture mechanical integrity testing

Research Approach

EXAMPLE GOALS	EXAMPLE IMPLEMENTATION TASKS
• Document hydraulic fracturing and flowback process • Document fracture propagation • Document pressure monitoring • Document post-fracture mechanical integrity testing • Assess any impacts to water quality	• Observe hydraulic fracturing operations • Monitor ground and surface water for any impacts • Sample flowback • Receive company-provided microseismic data; hydraulic fracturing reports on fluid volumes, pressure curves and chemical additives; mechanical integrity test results; etc.

Oil and/or Gas Production

Example **environmental management practices** conducted by well operator

- Monitor oil, gas and water production

Research Approach

EXAMPLE GOALS	EXAMPLE IMPLEMENTATION TASKS
• Document water management practices • Evaluate any changes to water quality • Evaluate for any delayed impacts to ground or surface water	• Confirm with operator produced water management volumes and disposal methods • Monitor produced water for four quarters • Conduct four quarterly water quality and flow monitoring events

Collaboration is Key

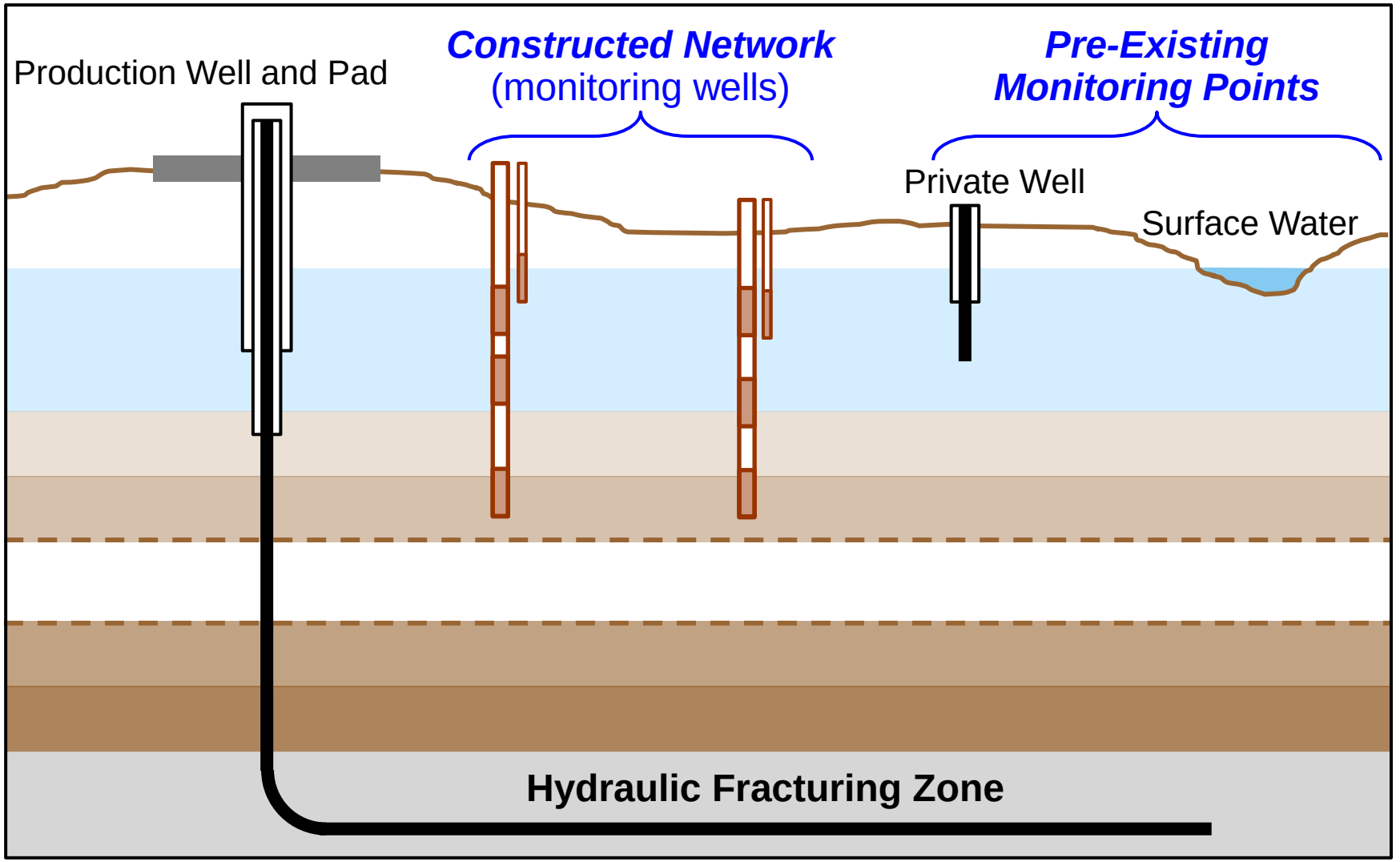
Partners: US EPA, US Department of Energy, US Geological Survey, host well owner/operator, state agencies, landowners and others

- Design
- Observation
- Interpretation

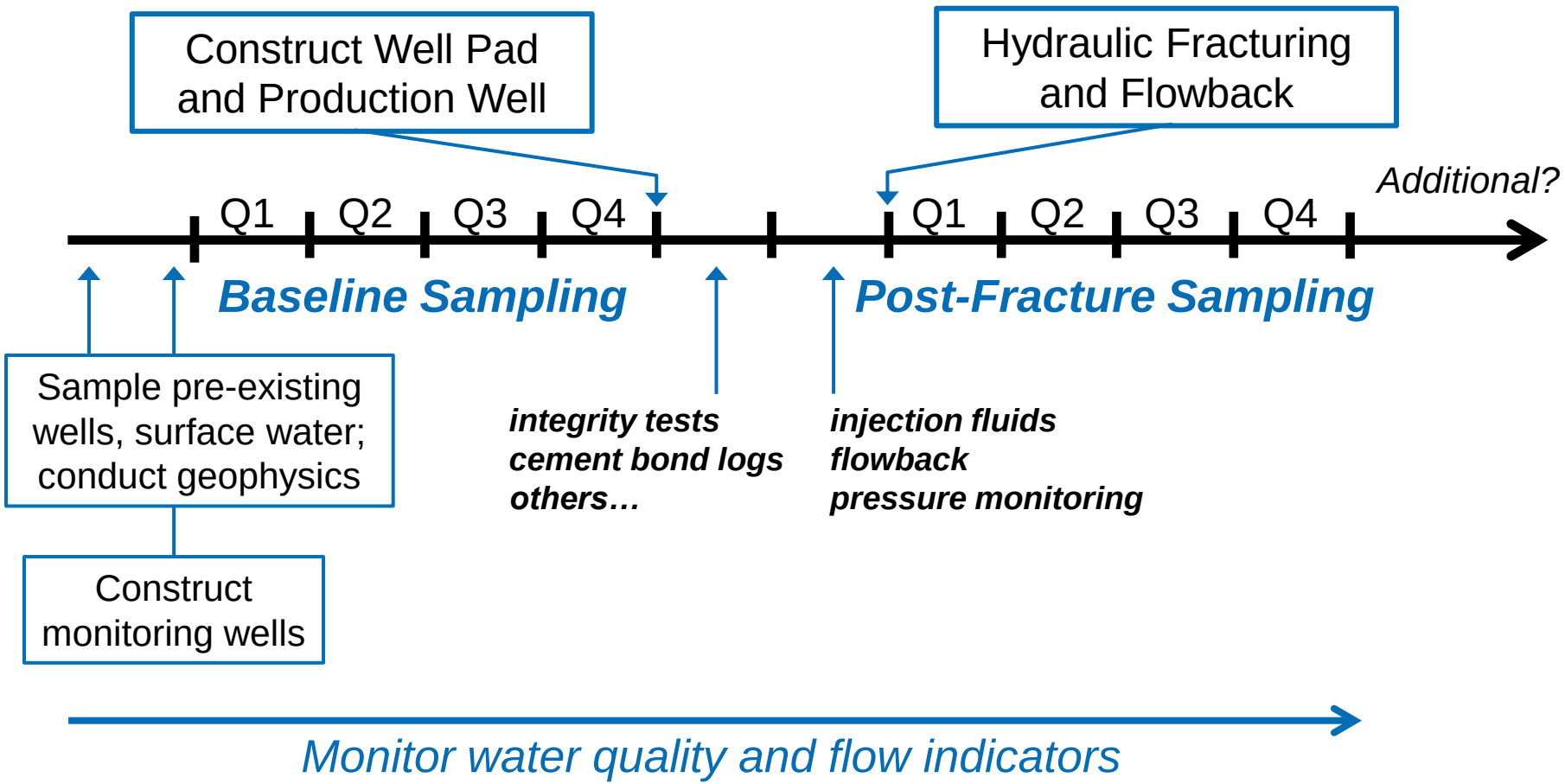
Water Quality Monitoring

- **Use pre-existing monitoring points**
  - Private, public, industrial, agricultural wells
  - Springs and surface water bodies within local drainage system
- **Install additional targeted monitoring wells**
  - Location, depth and number depend on local ground water depth, flow rate and direction
  - Target anticipated flow paths within aquifers

Conceptual Framework for Monitoring



Anticipated Timeline



Technical Challenges

- **Legacy or active fossil fuel extraction and other land use**
  - Existing historical/active fossil fuel extraction (oil, gas or coal), other commercial/private sources (USTs)
  - Prior industrial or commercial activity

    Affects analyte choice and interpretation

- **Site-specific aquifer properties**
  - Direction of ground water flow within study area
  - Rate of ground water flow

    Affects monitoring well location and frequency/duration of sampling

Implementation Challenges

- **Access**
  - Involves well owner/operator and landowner
- **Timing**
  - Well development
  - Corridor planning and development

Best approaches to manage research and commercial timelines?