A National Framework for Ground Water Monitoring in the United States

GWPC Annual Forum
Nashville, TN
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Mike Wireman – US EPA

A Resource at Risk!
1) Introduction
3) Network Goals, Objectives & Management Issues
4) Network Design features and Specifications
5) Common Field Practices to Ensure Compatibility of GW Data
6) Data Standards and Management
7) Network Implementation

A National Framework for Ground-Water Monitoring in the United States

Prepared by
The Subcommittee on Ground Water of the
The Advisory Committee on Water Information

Final Version approved by the Advisory Committee on Water Information
June 2009
State GW Monitoring Efforts

Water quality monitoring

Water level monitoring
THE ROLE OF THE NGWMN IN ADDRESSING GROUND-WATER ASSESSMENT AND MANAGEMENT ISSUES.

Focused on 67 Principle aquifers
Original Network Design

**Unstressed Subnetwork**
- **Baseline Period** (5 years of data)
  - Surveillance Monitoring Points (Syndectic wells)
  - Trend Monitoring Points (Backbone wells)
- Special Studies (Rare in this network)

**Targeted Subnetwork**
- **Baseline Period** (5 years of data)
  - Surveillance Monitoring Points (Syndectic wells)
  - Trend Monitoring Points (Backbone wells)
- Special Studies

**EXPLANATION**
- At least 5 years of data are collected to establish background conditions
- Periodic census of ground-water levels and/or quality (i.e., "mass measurements" for potentiometric surface mapping)
- Fewer wells monitored regularly (i.e., seasonal variability of water levels and/or quality)
- Smaller areas to evaluate ground-water resources at risk of depletion or impairment
Distribution of Monitoring Points Within Aquifer / Aquifer System

How many?

Distribution - Stratified random sampling within blocks

Number of monitoring points

1. Specify minimum # of points per aquifer
2. Specify # of points based on a prescribed density
| Measurement Type: Baseline Measurements: Standard and extended list as needed | Aquifer Type | Flow Characteristics |
|---|---|---|---|---|
| Unconfined | Quarterly to twice per year |Quarterly to twice per year |Quarterly to twice per year |Quarterly to twice per year |
| Confined | Twice per year |Twice per year |Twice per year |Twice per year |

| Surveillance Measurements: Core analytes | Aquifer Type | Flow Characteristics |
|---|---|---|---|---|
| Unconfined “low” hydraulic conductivity (<200 ft/d), “low” recharge (<5 in/yr) | Annual |Annual |Annual |Twice per year |
| “high” hydraulic conductivity (>200 ft/d), “high” recharge (>5 in/yr) | Annual |Twice per year |Twice per year |Twice per year |
| Confined “low” hydraulic conductivity (<200 ft/d), “low” recharge (<5 in/yr) | Every 5 years |Every 5 years |Every 5 years |Every 5 years |
| “high” hydraulic conductivity (>200 ft/d), “high” recharge (>5 in/yr) | Every 2 years |Every 2 years |Every 2 years |Every 2 years |

Data made available to the NGWMN: Annually Annually Annually Annually

| Surveillance Measurements: Additional analytes | Aquifer Type | Flow Characteristics |
|---|---|---|---|---|
| All aquifer types throughout range of hydraulic conductivity | Every 5 years |Every 5 years |Every 5 years |Every 5 years |

Data made available to the NGWMN: Every 5 years Every 5 years Every 5 years Every 5 years

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## Recommended minimum water-level measurement frequency

<table>
<thead>
<tr>
<th>Measurement Type</th>
<th>Aquifer Type</th>
<th>Nearby Long-Term Aquifer Withdrawals</th>
<th>Very Few Withdrawals</th>
<th>Moderate Withdrawals</th>
<th>Many Withdrawals</th>
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</thead>
<tbody>
<tr>
<td>Baseline Measurements</td>
<td>All aquifer types</td>
<td>Once per month</td>
<td>Once per day</td>
<td>Once per hour</td>
<td></td>
</tr>
<tr>
<td>Surveillance Measurements</td>
<td>Unconfined</td>
<td>“low” hydraulic conductivity (&lt;200 ft/d), “low” recharge (&lt;5 in/yr)</td>
<td>Once per year</td>
<td>Once per quarter</td>
<td>Once per month</td>
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<tr>
<td></td>
<td>“high” hydraulic conductivity (&gt;200 ft/d), “high” recharge (&gt;5 in/yr)</td>
<td>Once per quarter</td>
<td>Once per month</td>
<td>Once per day</td>
<td></td>
</tr>
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<td>Once per quarter</td>
<td>Once per month</td>
<td>Once per day</td>
<td></td>
</tr>
<tr>
<td>Data made available to NGWMN</td>
<td>All aquifer types, throughout range of hydraulic conductivity</td>
<td>As stored in local database, but at least annually</td>
<td>As stored in local database, but at least annually</td>
<td>As stored in local database, but at least annually</td>
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</tr>
</tbody>
</table>
Chapter 5: Field Practices

• No strict requirements on specific aspects of individual data-collection programs used by NGWMN data providers

• Requires adequate documentation of techniques to ensure comparability of data and to assure quality in ground-water measurement and sampling activities.

• New technologies will be incorporated into the NGWMN as appropriate.
Chapter 6: Data Standards and Management

• Minimum Data Elements for wells and measurements are provided
• Data Portal is the most critical component, and needed early in the process
Network Implementation:

A Stepwise Approach

- Initiate Pilot Programs
- Develop Portal System
- Establish Management Structure
- Begin NGWMN with initial group of states
- Increase # of states participating
- Seek Federal funding
NGWMN Pilot Studies

- Pilot phase followed Framework approval.
- Solicitation yielded 9 statements of interest.
- Evaluation team selected 5 pilots to represent different scope/scale/IT.
- Volunteer effort with 1-year timeline.
5 State Pilot Projects
Revision of: A National Framework for Ground-Water Monitoring in the United States (June 2009)

**Changes Necessary To:**
- accommodate new understandings;
- results of 5 State pilot monitoring projects;
- to remove redundancy; make necessary corrections; address concerns of SOGW members.

**Key Areas In June 2009 Framework Document That Needed Revision:**

1. Baseline monitoring – which wells
2. Network / well classification issues
3. Density of wells in given aquifer
Network Design

Baseline Monitoring
(5 years of Data)

Subnetwork for Background Conditions
- Surveillance Points (Synoptic wells)
- Trend Points (Backbone wells)

Subnetwork for Suspected or Anticipated Changes
- Surveillance Points (Synoptic wells)
- Trend Points (Backbone wells)

Subnetwork for Known Changes
- Surveillance Points (Synoptic wells)
- Trend Points (Backbone wells)

Special Studies
- Special studies at a local scale to evaluate groundwater resources at risk.
• Provides more flexibility re: sampling frequency and well distribution
• Adds Chapter 8 - Examples of the Use of Statistics in Addressing National Ground Water Monitoring Network Questions
• Adds appendix with definition of terms
### ESTIMATED COSTS

#### State Pilot Project Capital Costs

<table>
<thead>
<tr>
<th></th>
<th>RANGE</th>
<th>AVERAGE</th>
<th>MEDIAN</th>
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</thead>
<tbody>
<tr>
<td>NEW WELL CAPITAL COSTS</td>
<td>$0 – 3,525,000</td>
<td>$1,355,900</td>
<td>$1,515,000</td>
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<td>AVERAGE PER NEW WELL COST</td>
<td>$0- $25,919</td>
<td>$13,668</td>
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<td>OTHER</td>
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<tr>
<td>ONE- TIME &amp; CAPITAL COSTS</td>
<td>$40,059-$190,025</td>
<td>$226,087</td>
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<tr>
<td>AVERAGE PER WELL COST</td>
<td>$78-$2,188</td>
<td>$314</td>
<td>$153</td>
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## ESTIMATED COSTS

### State Pilot Project O&M Costs

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<thead>
<tr>
<th></th>
<th>RANGE</th>
<th>AVERAGE</th>
<th>MEDIAN</th>
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<tbody>
<tr>
<td><strong>TOTAL</strong></td>
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<tr>
<td>ANNUAL O&amp;M COSTS</td>
<td>$67,715-</td>
<td>$1,107,294</td>
<td>$136,600</td>
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<td>$4,919,100</td>
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<tr>
<td><strong>ANNUAL O&amp;M COSTS</strong></td>
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<tr>
<td>PER TOTAL WELLS</td>
<td>$85-</td>
<td>$1,741</td>
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<td>$4,307</td>
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</tbody>
</table>
Thank You!

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The Alps above Innsbruck