The Life Hydraulic
"Fluid" Ethics Amid Uncertainty

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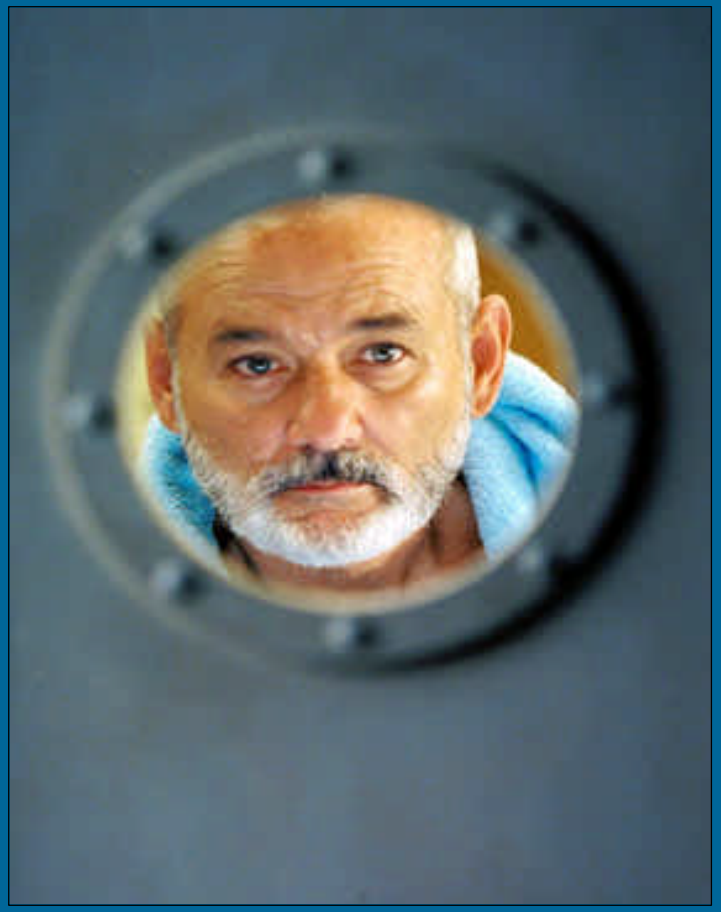
I’d like to try to address two related issues

- The challenges we face as groundwater scientists when we are caught in a “values collision” (and what about our own values?)
- The complications that uncertainty introduces

This is a presentation with many questions and few answers.



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As Inspiration, Mary Anderson's "Ground Water Ethics" editorial in *Ground Water* (V. 45, N. 4)

- Extending Leopold's "Land Ethic" to a "Ground Water Ethic"
  - "examine each questions in terms of what is ethically and esthetically right, as well as what is economically expedient"
- Runs counter to UNESCO thesis that "intensive use of ground water is beneficial and ethical if development is 'well designed and controlled.'"

Why is this important?

- “Value” hierarchies are already imposed on groundwater (rule and statute)
- Conflicts in values will become heightened as water becomes a limiting resource
- Groundwater scientists, as “experts” will be in the middle of this conflict
- Don’t we have enough problems sorting out conflicting uses without throwing in preservation for the sake of preservation?

There are multiple levels of conflicting beneficial demands on groundwater

“PUBLIC” BENEFICIAL USE

“COMMERCIAL” BENEFICIAL USE

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Examples of competing beneficial uses in Minnesota

- Public water supply
- Power plant cooling water
- Irrigation
- biofuels
- Industrial processing
- Mine dewatering

There are conflicts as to whether or not groundwater should be used at all

USE

PRESERVATION

Examples of “non-use” or preservation

- Preserving base flow to streams and wetlands
- Preserving vertical head distributions in calcareous fens
- Preventing drops in Lake stage
- Preserving current conditions for use by future generations

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The conflict of values may be couched in other terms that we use:

- “sustainability”
- “safe yield”
- “withdrawal less than recharge”

As Groundwater Professionals, we serve many “masters”

Our “boss” or manager

- Measures how we meet the goals of the organization we work for
- Imposes on us the values of profitability, efficiency, team work, etc…

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As Groundwater Professionals, we serve many “masters”

Our clients or constituents

- Engages us in professional endeavors and pays for our livelihood
- Values advocacy and results

As Groundwater Professionals, we serve many “masters”

Elected (or trying to get elected)
Representatives

- Balancing potentially conflicting constituent needs in a political process
- Values consensus and lack-of-controversy

As Groundwater Professionals, we serve many “masters”

Lawyers

- Advocates who “jealously guard” their clients interests
- Values process, precedent, and law

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As Groundwater Professionals, we serve many “masters”

The “Public”

- The human beneficiaries of groundwater
- Values having their cake and eating it, too
- Needs everyone to “do their job”

We typically work to accommodate as many values as possible by

- Minimizing well interference effects
- Minimizing effects on base flows
- Preventing “mining” (depletion of storage)
- Minimizing adverse effects on wetlands

We find ourselves in the role of NOT making Choices between different values

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Sometimes, we rely on the regulator-consultant “dance” of conflict resolution (the client-advocate model)

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CONSULTANT

- How much can I help my client “get away” with?
- How can we overwhelm you with experts and studies?

Government and Policy

REGULATOR

- How can I hide behind rules and procedures?
- How can I avoid public outrage and not make a decision

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We have two additional “masters”…

The “Science” of Hydrogeology

The Natural Resource called “Ground-Water”

My Operating Premise (which may be wrong)…

- We may get ourselves into trouble (ethically speaking) when we introduce our values into our practice, EXCEPT FOR
- The value of practicing our science to the best of our abilities, and
- Our unique role as scientific custodians of the natural resource *groundwater*

We run the risk of jeopardizing our credibility when we inject other values into our role

- Our analyses and conclusions (even in unrelated evaluations) can become suspect
- But this raises the question, “If not us, then who?”

Our companion in this *Life Hydraulic*

As groundwater scientists, we are often asked to provide the answer

- At what rate can this well safely be pumped?
- Will existing wells be adversely affected?
- Will base flow in this trout stream drop?
- Will groundwater upwelling in this calcareous fen be reduced?
- What will be the drawdown in 50 years?

We swim in sources of uncertainty

- Incomplete knowledge of the Underground World
- Simplification, assumptions, and conceptualization
- Transients
- Non-uniqueness of our solutions
- Inability to test at large scales
- Inability to directly measure important parameters

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Dealing with Uncertainty is our greatest technical and ethical challenge

- Our job is to characterize and predict what we cannot “see” (at least the weatherman has the luxury of looking out the window)
- How do we explain uncertainty without losing all credibility? (A broken clock is accurate twice a day, right?)
- How do we explain the risks that come with uncertainty?
- What do we do when someone wants to use uncertainty as a political or legal bludgeon?
- What happens if we’re wrong?

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How can we quantify uncertainty?

- Some approaches may obscure uncertainty or address a small part of uncertainty (e.g., sensitivity analyses)
- Quantification needs to focus on the reliability of the prediction
- There is uncertainty in quantifying uncertainty

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Communicating risk from uncertainty

- Just because you are the groundwater expert, does NOT mean that you should assume the risk from uncertainty.
- Risk is part of the liability for those with “skin in the game” – the level of acceptable risk is a business (and policy) decision
- Our role is to communicate risk from uncertainty so that others can understand it and make decisions – they need the benefit of our *professional judgments*

A final thought – groundwater…

- Can’t be seen
- Can’t be boated or swum
- Can’t be fished
- Can’t frame a beautiful sunset
- Doesn’t inspire poem or song