Understanding the Flint water crisis

- Forensic policy analysis
- Reconciling policy theories
- Identifying potential solutions
Timeline: institutional decision analysis (first cut)

Flint water crisis timeline

Flint as institutional failure

- Failing the letter *and the spirit of the law*
  - Implications of institutional failure
  - Beyond Michigan, Flint, and infrastructure
  - Other challenges and crises

- Policy process
  - Federalism and role clarity
  - Fiscal austerity at all levels
  - Politicization and partisanship

- Decision-making process
  - Culture and commitment
  - Information and procedures
  - Judgment and empowerment

- Regulatory process
  - Compliance
  - Enforcement
  - Response
## Contributing and interactive factors

- Professionalsupport
- Chainofcommand
- Consultants
- Coopertion
- Conflictsofinterest
- Policypriorities
- Pipeline
- Infrastructure
- Publicrelations
- Loopholes
- Incompetence
- Protocols
- Technicalities
- Pressure
- Legalities
- Ethics
- Empowerment
- Inexperience
- Bureaucracy
- Accountability
- Environmentaljustice
- Pathdependency

## Water federalism and regulation in the U.S.

<table>
<thead>
<tr>
<th>Water quality</th>
<th>Water quantity</th>
<th>Water funding</th>
<th>Water prices</th>
</tr>
</thead>
<tbody>
<tr>
<td>Federal</td>
<td>Congress and EPA</td>
<td>Court review as applicable</td>
<td>Congress and EPA</td>
</tr>
<tr>
<td>Interstate</td>
<td>Basin commissions</td>
<td>Basin commissions</td>
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<tr>
<td>States</td>
<td><strong>Primacy agencies</strong> (health &amp; environmental)</td>
<td>Resource agencies</td>
<td>Revolving loan funds (SRF)</td>
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<tr>
<td>Substate</td>
<td>Management districts (varies)</td>
<td>Management districts (varies)</td>
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<tr>
<td>Local</td>
<td>Local health departments</td>
<td>Local zoning and fire officials (pressure)</td>
<td>Local financing (bonds)</td>
</tr>
</tbody>
</table>
Federal water-quality legislation and goals

**Clean Water Act**
To achieve “fishable and swimmable waters” through pollution control, wastewater treatment, and stormwater management

**Safe Drinking Water Act**
To achieve drinking water quality that is as close as feasible to where there will be no known or anticipated adverse impacts on human health with an adequate margin of safety.

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**Federal Safe Drinking Water Act (SDWA)**

- SDWA is democratically established federal law
  - Equal protection under uniform protective and preventive standards and multiple barriers to contamination informed by public-health and environmental science
  - While there is no “right” to drinking water, there is an obligation of systems to deliver compliant water
  - Compliance is not discretionary, regardless of structural or fiscal conditions
  - Variances and exemptions are narrow and uncommon (Michigan reported none in 2014)

- Goals under the act are meant to achieve a level of drinking water quality as close as feasible to that at which there are **no known or anticipated adverse impacts to human health including an adequate margin of safety**
Regulatory compliance as decision-making constraint

![Diagram showing feasible solution set between SDWA compliant and Noncompliant categories]

Regulatory chains of command

- A culture of compliance foregoes the need for oversight and enforcement
- Weak links and poor response argue for institutional reform

Federal EPA (standards) — Regional EPA (oversight) — State primacy agency (enforcement) — Water system operator (compliance)

State government — Local government
Core elements of the SDWA

- Microbial contaminants
- Chemical, metal, and radiological contaminants
- Disinfectants and disinfection byproducts
- Contaminant candidate listing
- Monitoring and reporting
- Public information and notice
- System capacity and planning
- Funding (DWSRF) and incentives
- Variances and exemptions
- Six-year regulatory review

Regulating water contaminants under the SDWA

- **Regulatory framework**
  - National Primary Drinking Water Regulation – legally enforceable standards
  - National Secondary Drinking Water Regulation – non-enforceable guidelines
  - Maximum Contaminant Level Goal (MCLG) – non-enforceable goals
  - Maximum Contaminant Level (MCL) – enforceable
  - Treatment Technique – enforceable

- **Evaluation of contaminants**
  - Adverse health effects
  - Carcinogenicity
  - Sensitive sub-populations

- **Multiple barriers to contamination**
  - Source water assessment and protection
  - Qualified water treatment operators
  - Integrity of water distribution systems
  - Informed public (notice, CCR reports)

- **EPA emergency powers**
Lead and Copper Rule (LCR)

- **Persistent challenge of lead**
  - MCLG for lead is 0 and there is no MCL
  - Concerns about clarity of testing protocols and loopholes
  - Action level (AL) requires treatment in the form of optimized corrosion control
  - Corrosion control is well known and accepted practice
  - SRF funding can be used for lead pipe removal and replacement
  - NDWAC urged a proactive approach in December 2015
  - EPA has enhanced LCR oversight and will revise the rule in 2017

- **Government, regulatory, and water industry responsibilities**
  - Operational practices and infrastructure affect water quality
  - Remediation is complicated by service line ownership and property rights
  - Lead has not been addressed primarily due to lack of political will at all levels

Capacity assurance requirements

- States must ensure that all new community and nontransient noncommunity water systems demonstrate technical, managerial and financial capacity for compliance prior to start-up

- States must develop and implement a strategy to assist existing public water systems in acquiring and maintaining technical, managerial, and financial capacity, including
  - Methods or criteria to identify systems and prioritize need
  - Factors that encourage or impede capacity development
  - Authority and resources to:
    - Provide assistance for compliance
    - Encourage partnerships
    - Promote training and certification
Capacity development for existing systems

- **Michigan strategy**
  - Reactive based on noncompliance
  - Noncompliance triggers financial assessment
  - Systems must accept assistance

- **Enhancing capacity development**
  - Proactive engagement with communities
  - Fiscally distressed list on a watch list
  - Support for sustainable infrastructure

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Technical issues in Flint

- Qualifications and experience of internal staff
- Testing and monitoring protocols
- Complex treatment challenge
- Need for corrosion control study
- Consulting studies and reports
- Application of accepted practices
- Professional support networks (AWWA)
Managerial issues in Flint

- Professional staffing levels
- Operator certification and experience
- Empowerment to act

Flint organizational chart
Financial issues in Flint

- Severe fiscal distress and state emergency management
- Significant transfers as well as reserves associated with pipeline

Flint water rates

- All utility rates have regressive impacts particularly with high fixed charges
- Water rates should not be used as a taxing mechanism
- Financial and rate reforms are needed to address equity and affordability
- The state is providing $30 mil. in bill relief
Flint customers and consumption

- Water usage is declining everywhere due to efficiency, prices, other factors
- Legacy cities have also lost economic activity and population
- Sales in Flint have plummeted and peak usage is relative low

Water systems: five products, one set of pipes

- Consumption: drinking and cooking
- Personal hygiene: washing and sanitation
- Home hygiene: laundry and cleaning
- Discretionary: irrigation and other outdoor uses
- Fire protection
Water infrastructure needs

- Invisible water infrastructure is aging
  - Loss of both water and energy
  - Main breaks also jeopardize quality
- Michigan’s 20-year water infrastructure need (EPA, 2011)
  - A state with significant needs
  - $13.8 billion total
  - $9.5 billion for transmission and distribution
Financing lead service-line replacement

- Environmental remediation funds (“superfund”)
- Federal or state tax credits
- City or utility financed with low-cost loans
- Customers on their own or shared
- Transfer ownership to utility (ratepayers)
- Finance and recover in utility revenue requirements

Flint forward: building tomorrow’s infrastructure

- Sustainable infrastructure supports healthy and prosperous communities
  - Recognize that infrastructure supply and demand are dynamic
  - Don’t build tomorrow’s infrastructure for yesterday’s demand
  - Place a priority on public health and welfare

- Strategies
  - Optimize systems in the course of infrastructure renovation
  - Leverage investment resources across infrastructure types
  - Modernize the infrastructure with available technologies
  - Integrate infrastructure planning and projects
  - Coordinate infrastructure oversight across agencies
Infrastructure optimization

- **Engineering as both challenge and solution**
  - Impulse to replace everything in kind (pipe for pipe)
  - Genetic algorithm optimization models can be use
  - Need for prudent investment (possibly economic regulation)

Sustainable water systems

- Sustainable systems live within ecological, economic, and equity tolerances
- Optimal service level is constrained by compliance with mandates and standards

<table>
<thead>
<tr>
<th>Price revenues relative to expenditures</th>
<th>Expenditures relative to optimal compliant service level</th>
</tr>
</thead>
<tbody>
<tr>
<td>&lt; 1 price revenues are below expenditures (“price avoidance”)</td>
<td>&lt; 1 expenditures are below optimum (“cost avoidance”)</td>
</tr>
<tr>
<td>&lt; 1 price revenues are below expenditures (“price avoidance”)</td>
<td>Deficient system</td>
</tr>
<tr>
<td>= 1 price revenues are equal to expenditures</td>
<td>Underinvesting system</td>
</tr>
<tr>
<td>&gt; 1 price revenues are above expenditures (“profit seeking”)</td>
<td>Revenue-diverting system</td>
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Thinking about a new drinking water paradigm

- Aspire to affordable universal service
- Plan to reoptimize and modernize systems
- Provide economic fire protection
- Install advanced metering systems
- Price fire protection costs based on property size or value
- Meet basic needs as a “byproduct”
- Price outdoor usage aggressively and encourage alternatives
- Coordinate with other infrastructure providers

Lessons learned

- Regulatory institutions are much maligned until we experience crisis
  - Flint is now the quintessential example
- Institutional failure has consequences – measured in lost security, trust, and lives
  - Our institutions are only as good as the people we entrust to serve them
  - Integrity of people and infrastructure are connected
- Institution reform in the face of failure is a step toward justice
  - Sound institutions support sound infrastructure and public health