Environmental Justice
and the SDWA
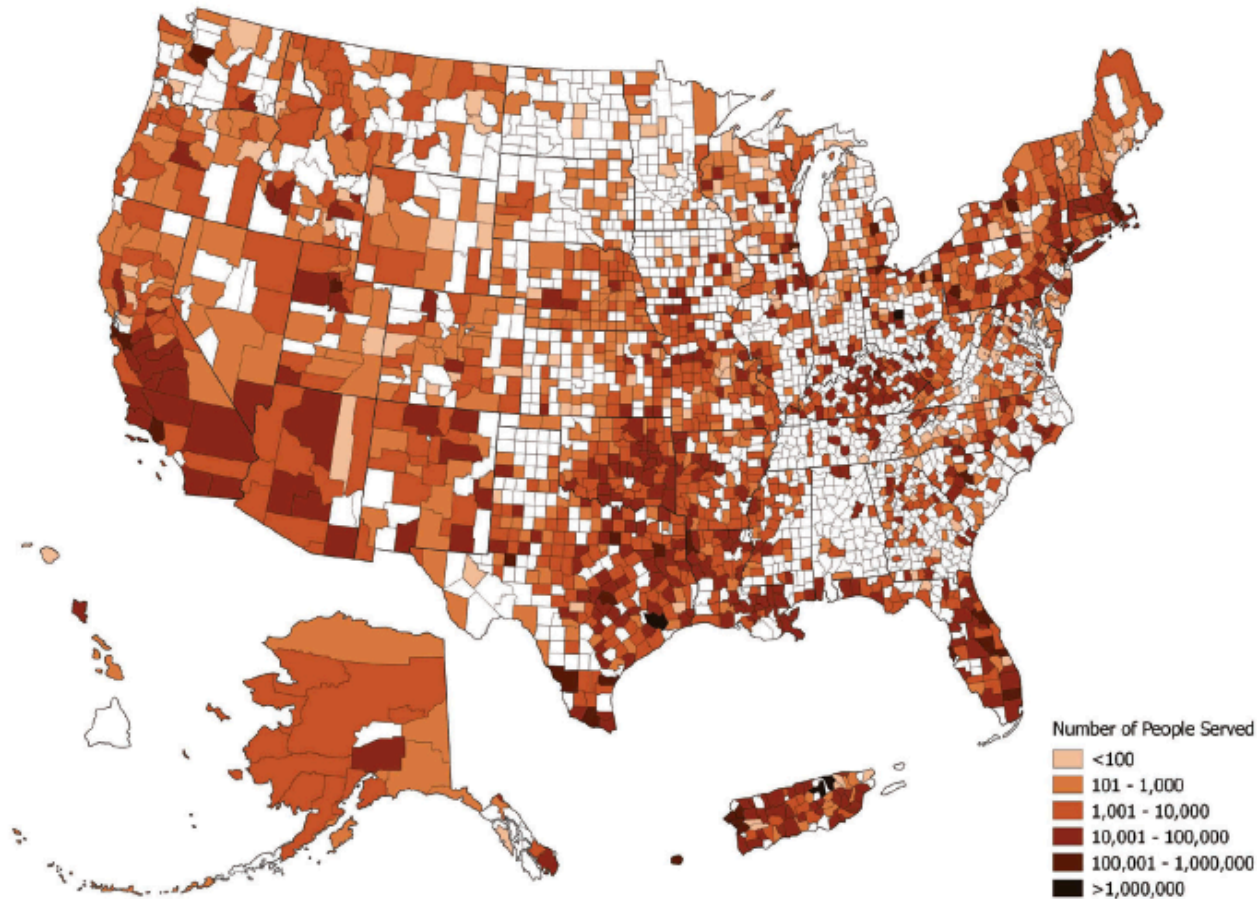
Agenda

- Who is disproportionately affected?
- Why are they disproportionately affected?
- What is being done?
- How can we conceptualize the full set of processes influencing disparities?

Number of People Served
- <100
- 101 - 1,000
- 1,001 - 10,000
- 10,001 - 100,000
- 100,001 - 1,000,000
- >1,000,000

https://www.nrdc.org/resources/threats-tap-widespread-violations-water-infrastructure

TABLE 2: VIOLATIONS OF THE SAFE DRINKING WATER ACT IN CALENDAR YEAR 2015 RANKED BY POPULATION SERVED[M]

RULE NAME	POPULATION SERVED	NUMBER OF VIOLATIONS	NUMBER OF SYSTEMS
All Violations	76,922,570	80,834	18,094
Combined Disinfectants and Disinfection Byproducts Rules[n]	25,173,431	11,311	4,433
Lead and Copper Rule	18,350,633	8,044	5,367
Total Coliform Rule	17,768,807	10,261	5,233
Combined Surface, Ground Water, and Filter Backwash Rules[o]	17,312,604	5,979	2,697
Right-to-Know ("Consumer Confidence") Rule	14,422,712	7,906	5,030
Public Notification Rule	8,381,050	13,202	3,394
Nitrates and Nitrites Rule	3,867,431	1,529	971
Volatile Organic Contaminants Rule	3,451,072	10,383	406
Synthetic Organic Contaminants Rule	2,669,594	6,864	311
Arsenic Rule	1,842,594	1,537	573
Radionuclides Rule	1,471,364	2,297	523
Inorganic Contaminants Rule	1,312,643	1,505	224
Miscellaneous Rules	3,718	16	10

https://www.nrdc.org/sites/default/files/threats-on-tap-water-infrastructure-protections-report.pdf

Who is experiencing SDWA violations?

In what systems are these violations occurring?

(c)

Distribution of MCL Violation by Type of Server

Serving to Community: Total Number 681, Number Violated 459

Serving to Non-Community: Total Number 290, Number Violated 129

■ Total Number   ■ Number Violated
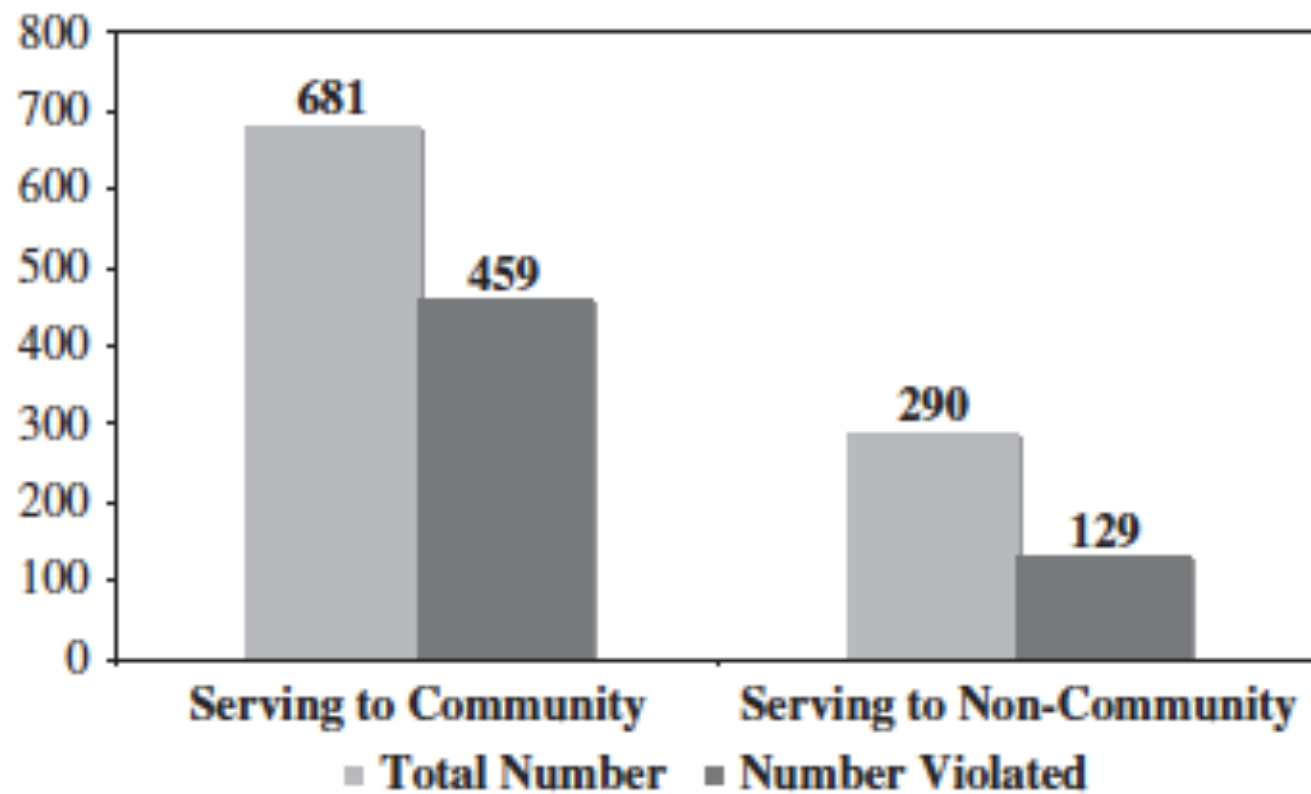
Rahman 2010 Determinants of Non-Compliance

(d) Distribution of PWS Systems by Type of Ownership

364

473

134

■ Private ■ Public ■ Mixed
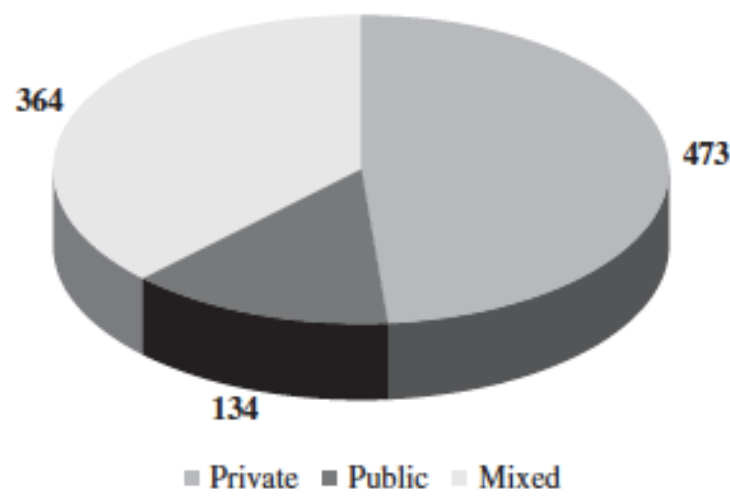
(e) Distribution of MCL Violation by Type of Ownership

Number Violated/Not Violated

Privately Owned: 152, 321
Publicly Owned: 38, 96
Mixed Owned: 193, 171

■ Not Violated ■ Violated
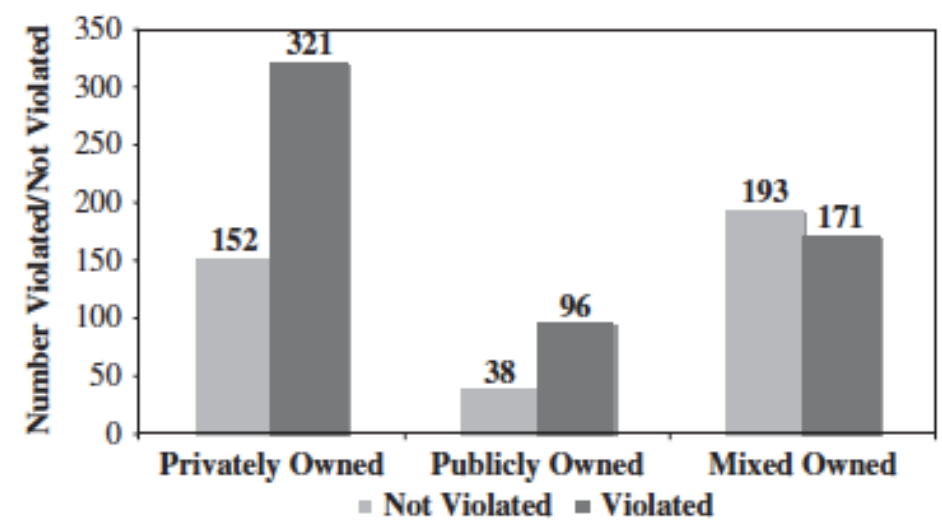
Rahman 2010 Determinants of Non-Compliance

Probit Estimates for Determinants of MCL Violation

Variable	Coefficient	SE	P Value
Intercept	−0.5317**	0.2192	.0153
Population served by the PWS (thousands)	0.2498**	0.1115	.025
Groundwater as the source of water	0.1383	0.2028	.4954
PWS's urban location of source wells	0.4535	0.09	.6145
Privately owned PWS	0.4522*	0.1039	.0001
Publicly owned PWS	0.5324*	0.1585	.0008
PWS serving to community	0.3998*	0.0965	.0001
Population served × private ownership	−0.1871	0.1147	.1028
Population served × public ownership	−0.1765	0.1167	.1303
Log likelihood ratio	95.044*		
Sample size	971		

*Significant at 1% level of significance; **significant at 5% level of significance.

Health-based Violations,
by System Size in 2013

TABLE 4 CWSs in states with health-based violations as a percent of all CWSs in states

Size of CWS (Population Served)	CWSs With Health-based Violations		All CWSs		Systems With Violations
	Number	%	Number	%	%
Very small (≤ 500)	3,018	57.25	27,607	55.30	10.9
Small (501–3,300)	1,365	25.89	13,358	26.76	10.2
Medium (3,301–10,000)	530	10.05	4,832	9.68	11.0
Large (10,001–100,000)	343	6.51	3,714	7.44	9.2
Very large (> 100,000)	16	0.30	410	0.82	3.9
Total	5,272	100.00	49,921	100.00	10.6

Chi square (p-value)—0.968, CWSs—community water systems

Rubin et al 2013 Evaluating Violations in Drinking Water Regulations

Monitoring & Reporting Violations, by System Size in 2013

TABLE 5 Number and percent of CWSs with monitoring and reporting violations as a percentage of all CWS in states

Size of CWS (Population Served)	Systems With MR Violations		All CWSs		Systems With Violations
	Number	*%*	*Number*	*%*	*%*
Very small (≤ 500)	9,271	65.38	27,607	55.30	33.6
Small (501–3,300)	3,245	22.88	13,358	26.76	24.3
Medium (3,301–10,000)	997	7.03	4,832	9.68	20.6
Large (10,001–100,000)	610	4.30	3,714	7.44	16.4
Very large (> 100,000)	58	0.41	410	0.82	14.1
Total	14,181	100.00	49,921	100.00	28.4

Chi square (p-value)—0.325, CWSs—community water systems, MR—monitoring and reporting

Rubin et al 2013 Evaluating Violations in Drinking Water Regulations

Public Notification & Community Confidence Reporting Violations, by System Size in 2013

TABLE 6   Number and percent of CWSs with PN/CCR violations as a percent of all CWSs in states

Size of CWS (Population Served)	CWSs With PN/CCR Violations		All CWSs		Systems With Violations %
	Number	*%*	*Number*	*%*	
Very small (≤ 500)	5,423	68.38	27,607	55.30	19.6
Small (501–3,300)	1,730	21.82	13,358	26.76	13.0
Medium (3,301–10,000)	458	5.78	4,832	9.68	9.5
Large (10,001–100,000)	307	3.87	3,714	7.44	8.3
Very large (> 100,000)	12	0.15	410	0.82	2.9
Total	7,930	100.00	49,921	100.00	15.9

Chi square (ρ-value—0.098, CWSs—community water systems, PN/CCR—public notification/consumer confidence report

Rubin et al 2013 Evaluating Violations in Drinking Water Regulations

In 2007

- 0.5% to 1% of US residences did not have piped water. Many of these are in low income communities which have no piped water

- 8% of Native Americans in the USA did not have piped water. 11% did not have safe piped water.

- 16% of tribally owned and operated systems had a health-based violation compared with 7% nationwide

- 74% of the water systems in California that violated the nitrate MCL were located in low-income Hispanic communities

- Lead service lines are more common in older neighborhoods, which are often disproportionately low income and minority

Negative Binomial Regression Predicting SDWA Violations 2010–2013

	(1)		(2)	
	Coefficient	Standard Error	Coefficient	Standard Error
Lagged violations	0.800**	(0.016)	0.800**	(0.016)
SES	−0.121**	(0.023)	−0.059*	(0.027)
% Hispanic	0.004**	(0.001)	−0.001	(0.002)
% Black	0.000	(0.001)	−0.002	(0.002)
Hisp × SES			−0.004**	(0.001)
Black × SES			−0.003*	(0.001)
Logged population served	−0.123**	(0.016)	−0.112**	(0.017)
Groundwater supply	−0.665**	(0.043)	−0.660**	(0.043)
Purchased water supply	−0.583**	(0.046)	−0.573**	(0.046)
New system	−0.246**	(0.058)	−0.229**	(0.059)
Constant	−1.108**	(0.155)	−1.112**	(0.156)
Observations	51,889		51,889	
AIC	36,819.194		36,802.909	
Log likelihood	−18,348.970		−18,338.455	
LR-test (χ^2)		20.28**		

NOTE: Models also include state and year fixed effects. Significance levels: **<0.01; *<0.05.
LR-test of whether interactive model improves on no interaction model.

Switzer et al 2017 Class, Race, Ethnicity, and Justice in Safe Drinking Water Compliance

FIGURE 1

Marginal Effect of Race/Ethnicity on Health Violations
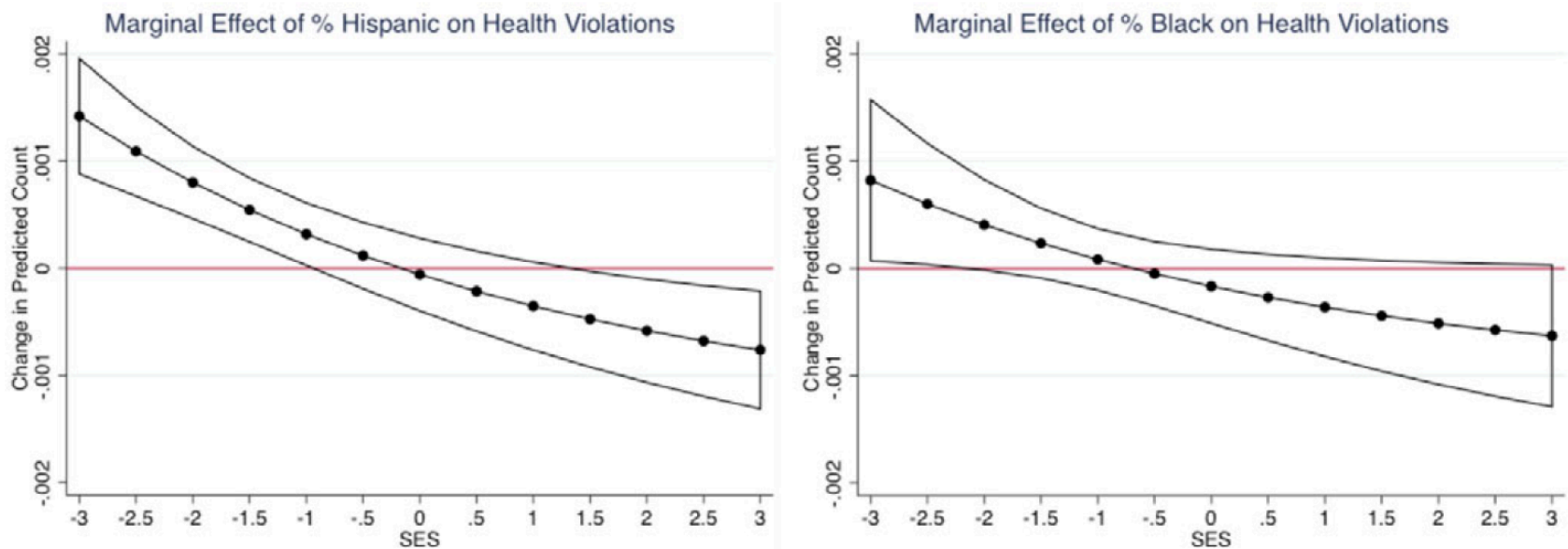
NOTE: Figure depicts 95 percent confidence intervals.

Switzer et al 2017 Class, Race, Ethnicity, and Justice in Safe Drinking Water Compliance

Who does not explain why!

Why might some communities be more likely to have violations?

Why might some communities be more likely to have violations?

- Poorer initial water quality

- Less resources

- Lower capacities

- Older infrastructure

- Poor enforcement

Compliance Risk

What happens if non-compliant?
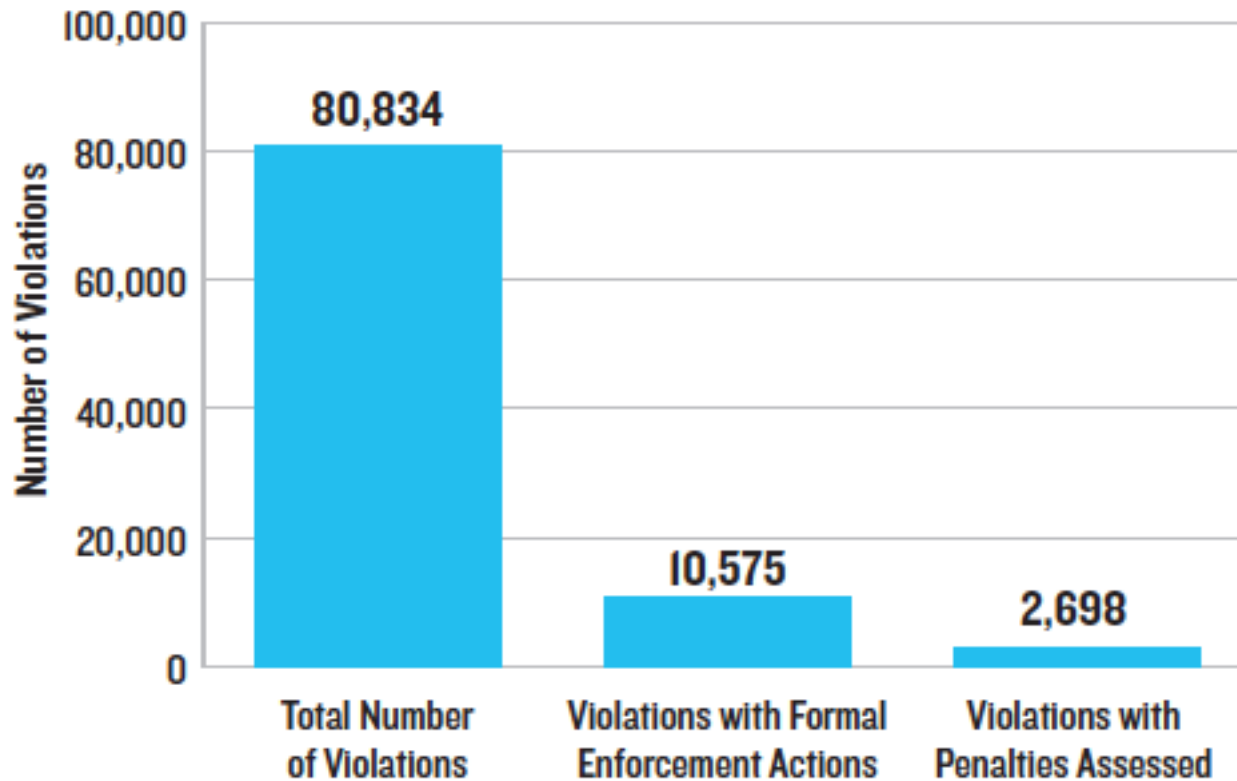
- Reminder letters
- Warning letters, notices of violation
- Field visits
- Citations
- Administrative orders
- Referral to state attorneys
- Penalties
- Emergency orders to take action
- Criminal charges

FORMAL ENFORCEMENT ACTIONS FOR VIOLATIONS OF THE SAFE DRINKING WATER ACT
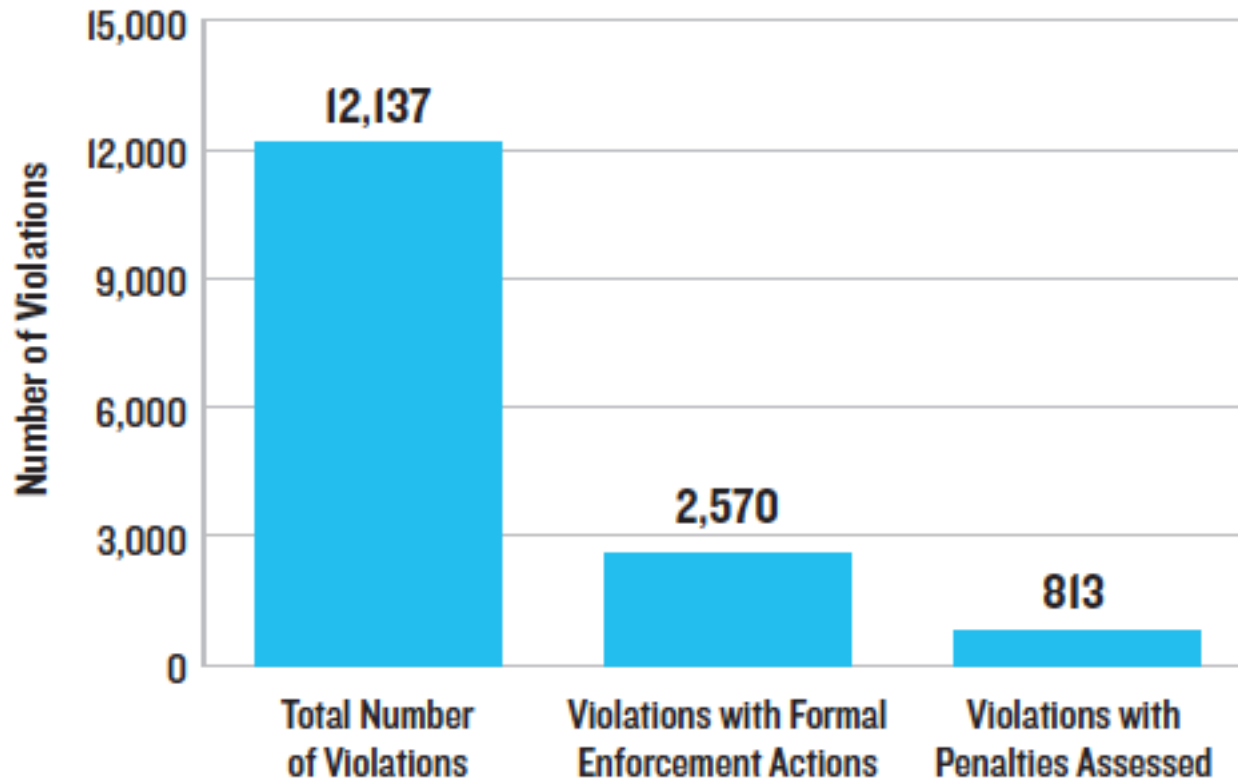
(For 2015)

https://www.nrdc.org/sites/default/files/threats-on-tap-water-infrastructure-protections-report.pdf

FORMAL ENFORCMENT ACTIONS FOR HEALTH-BASED VIOLATIONS OF THE SAFE DRINKING WATER ACT

(For 2015)

https://www.nrdc.org/sites/default/files/threats-on-tap-water-infrastructure-protections-report.pdf

	Clean Air Act (ZINB)		Clean Water Act (NBRM)	
% Poverty	−0.024*	−0.025*	−0.014*	−0.013**
	(0.011)	(0.010)	(0.006)	(0.006)
Median household income ($1000s)	0.032**	0.031**	−0.007	−0.005
	(0.010)	(0.011)	(0.006)	(0.006)
% Nonwhite	−0.003		−0.001	
	(0.004)		(0.002)	
% Black		−0.002		−0.001
		(0.004)		(0.002)
% Hispanic		−0.002		−0.005†
		(0.003)		(0.003)
% Voter turnout	−0.003	−0.003	−0.003	−0.003
	(0.004)	(0.004)	(0.002)	(0.002)
% College educated	−0.019	−0.018	0.009	0.007
	(0.013)	(0.013)	(0.006)	(0.007)
% Owner–occupied housing	−0.051**	−0.050**	−0.013**	−0.013**
	(0.007)	(0.007)	(0.004)	(0.004)
% Manufacturing employment	0.005*	0.005†	0.002†	0.002*
	(0.003)	(0.003)	(0.001)	(0.001)
Population (1000s)	0.002**	0.002**	−0.000*	−0.000*
	(0.000)	(0.001)	(0.000)	(0.000)
Population density	−0.059*	−0.059*	0.024**	0.026**
	(0.026)	(0.026)	(0.008)	(0.008)
Land area	0.164**	0.162**	0.028	0.032†
	(0.034)	(0.034)	(0.017)	(0.0017)
Nonattainment status	0.505**	0.504**		
	(0.100)	(0.100)		
Border county	0.117**	0.117*		
	(0.045)	(0.046)		
EPA inspections$_{t-1}$	0.122**	0.121**	0.033**	0.033**
	(0.019)	(0.019)	(0.012)	(0.011)
No. facilities	−0.000	−0.000	0.180**	0.180**
	(0.000)	(0.000)	(0.019)	(0.019)
Observations	49248	49248	25634	25634
Chi–square (d.f.)	39173.7**	39166.1*	23882.6**	23898.2**
	(79)	(80)	(26)	(27)
Vuong test	29.1**	29.1**		

Konisky 2009 Inequities in Enforcement

	Clean Air Act (ZINB)		Clean Water Act (NBRM)	
% Poverty	−0.024*	−0.025*	−0.014*	−0.013**
	(0.011)	(0.010)	(0.006)	(0.006)
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	(0.010)	(0.011)	(0.006)	(0.006)
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	(0.004)		(0.002)	
% Black		−0.002		−0.001
		(0.004)		(0.002)
% Hispanic		−0.002		−0.005†
		(0.003)		(0.003)
% Voter turnout	−0.003	−0.003	−0.003	−0.003
	(0.004)	(0.004)	(0.002)	(0.002)
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	(0.007)	(0.007)	(0.004)	(0.004)
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	(0.002)	(0.002)	(0.001)	(0.001)
Population (1000s)	0.002**	0.002**	−0.000*	−0.000*
	(0.000)	(0.001)	(0.000)	(0.000)
Population density	−0.059*	−0.059*	0.024**	0.026**
	(0.026)	(0.026)	(0.008)	(0.008)
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	(79)	(80)	(26)	(27)
Vuong test	29.1**	29.1**		

Konisky 2009 Inequities in Enforcement

What is being done to remedy the situation?

1994 Clinton's Executive Order 12898

Federal Actions to Address Environmental Justice in Minority Populations and Low-Income populations

USA Official Federal Definition of Environmental Justice

"the fair treatment and meaningful involvement of all people regardless of race, color, national origin, or income with respect to the development, implementation, and enforcement of environmental laws, regulations, and policies"

(EPA 2004)

Environmental Justice in Massachusetts
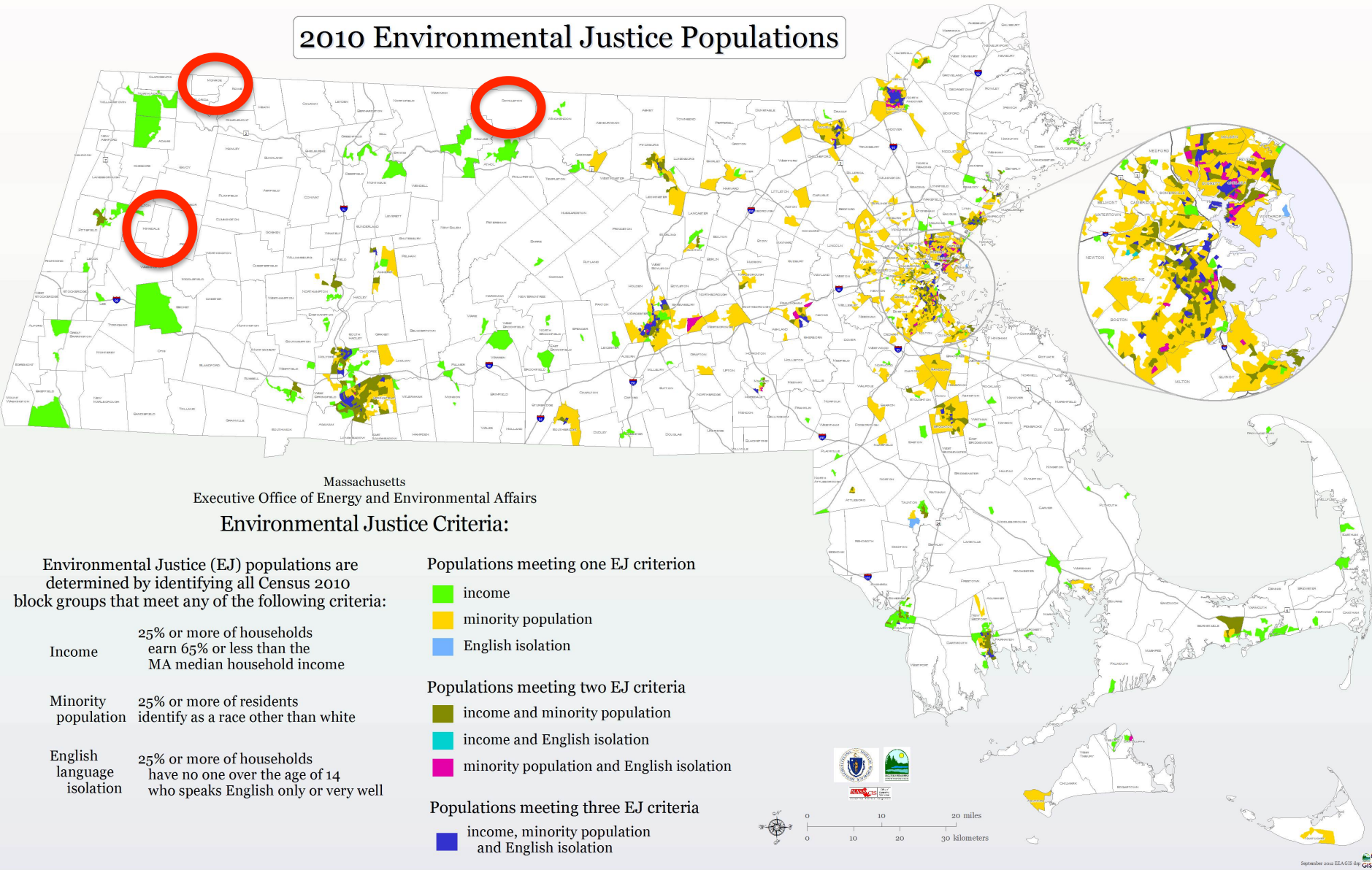
2002 Environmental Justice Policy

2014 Executive Order 552

The Massachusetts policy defines EJ populations as neighborhoods that meet one or more of the following criteria:

- Median annual household income <=65% of the statewide
- 25 percent of the residents are minority
- 25 percent of the residents are foreign born
- 25 percent of the residents are lacking English language proficiency.

2010 Environmental Justice Populations

Massachusetts
Executive Office of Energy and Environmental Affairs

Environmental Justice Criteria:

Environmental Justice (EJ) populations are determined by identifying all Census 2010 block groups that meet any of the following criteria:

Income — 25% or more of households earn 65% or less than the MA median household income

Minority population — 25% or more of residents identify as a race other than white

English language isolation — 25% or more of households have no one over the age of 14 who speaks English only or very well

Populations meeting one EJ criterion

- income
- minority population
- English isolation

Populations meeting two EJ criteria

- income and minority population
- income and English isolation
- minority population and English isolation

Populations meeting three EJ criteria

- income, minority population and English isolation

http://maps.massgis.state.ma.us/map_ol/ej.php

USA Official Federal Definition of Environmental Justice

"the **fair treatment** and **meaningful involvement** of all people regardless of race, color, national origin, or income with respect to the development, implementation, and enforcement of environmental laws, regulations, and policies"

(EPA 2004)

Reasons for Lower Enforcement

- **Intentional discrimination:** deliberate decisions made by public actors.

- **Logic of collective action**. To the extent that government behavior is influenced by the political capacity of potentially affected populations, communities with lower levels of political capacity (wealth, education, group organizational skills) are less likely to overcome free rider problems and pressure government into strictly enforcing environmental laws.

1994 Clinton's Executive Order 12898

Federal Actions to Address Environmental Justice in Minority Populations and Low-Income populations

Environmental Justice in Massachusetts
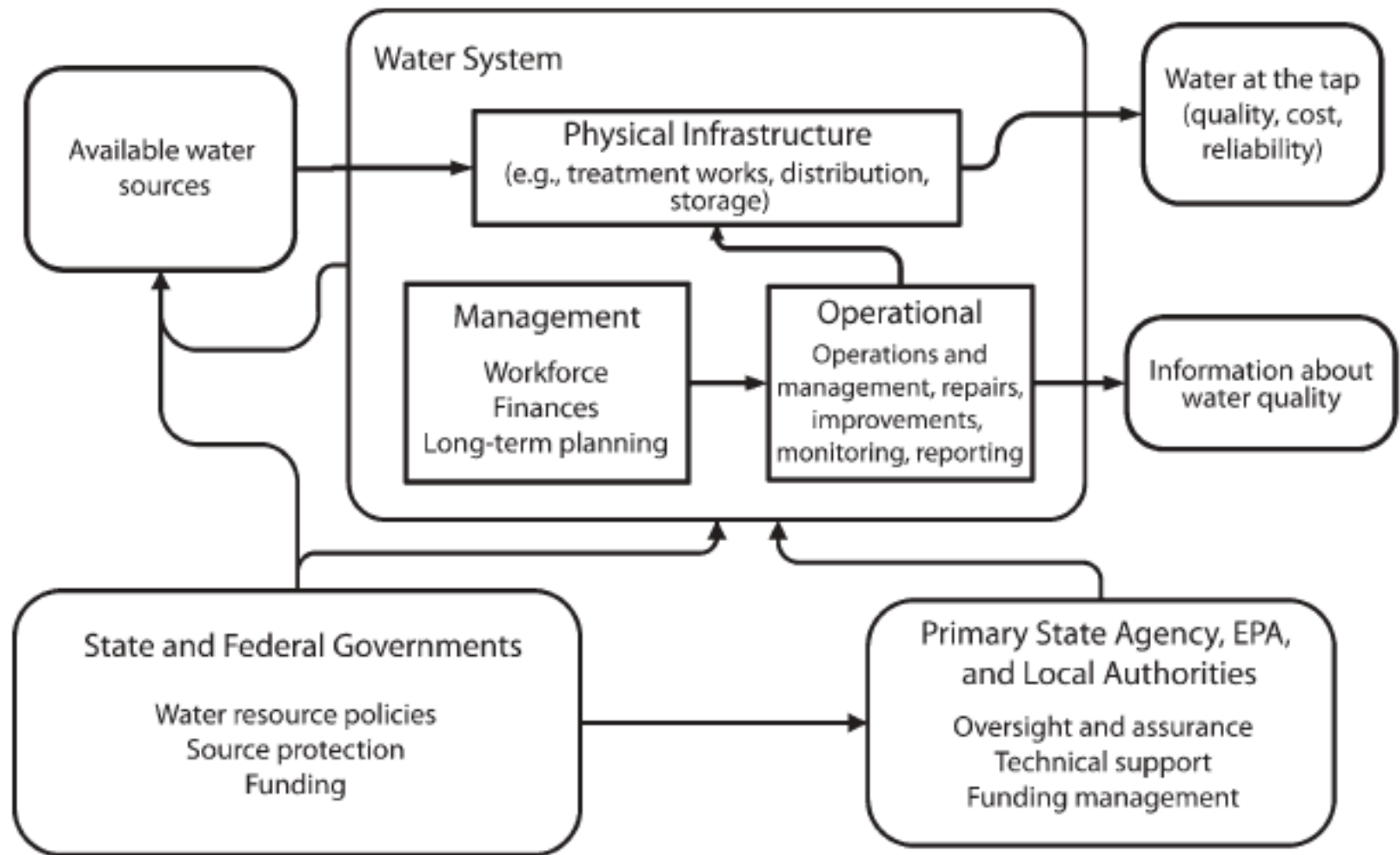
2002 Environmental Justice Policy

2014 Executive Order 552, updated 2017

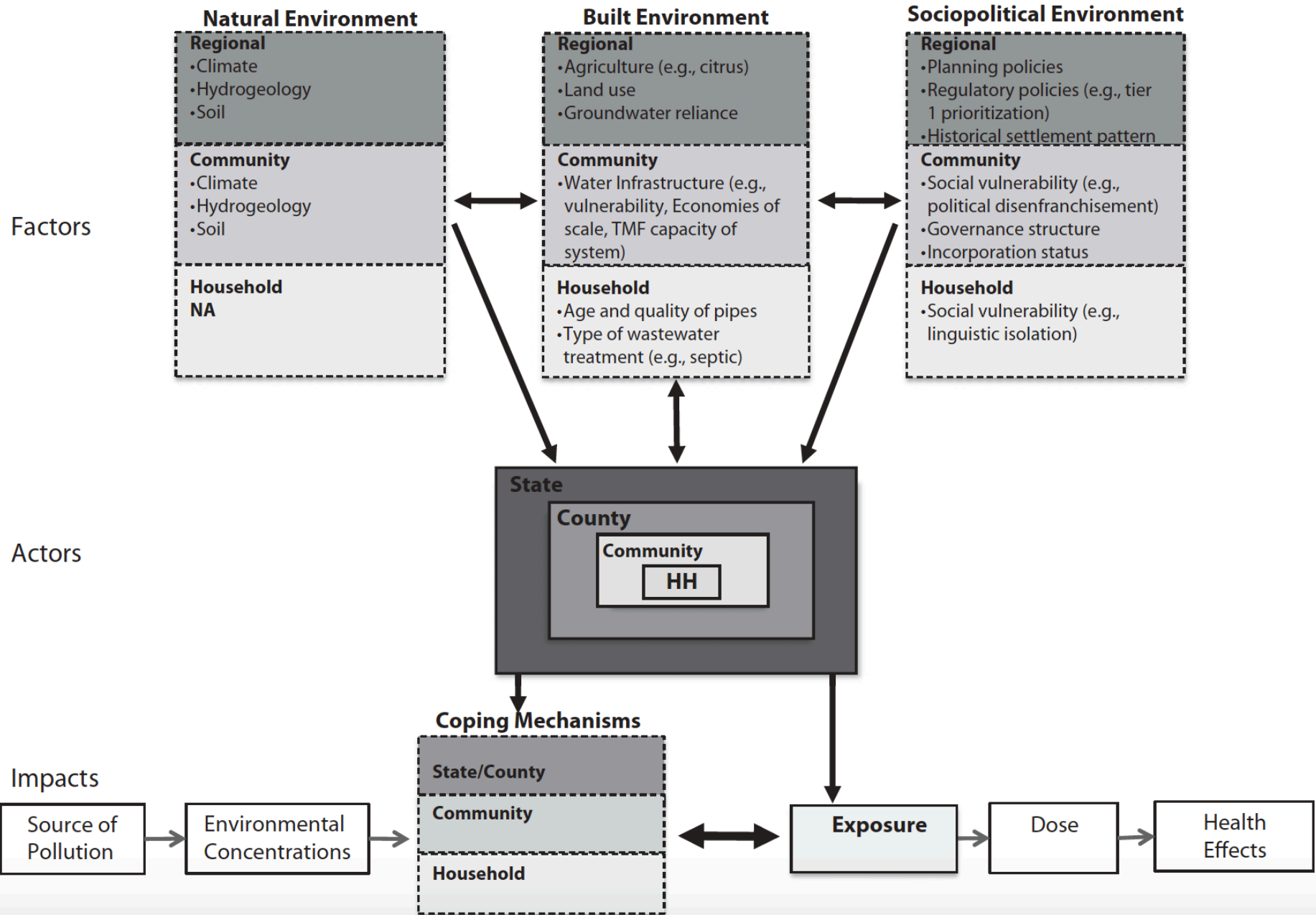The Massachusetts policy defines EJ populations as neighborhoods that meet one or more of the following criteria:

– Median annual household income <=65% of the statewide

– 25 percent of the residents are minority

– 25 percent of the residents are foreign born

– 25 percent of the residents are lacking English language proficiency.

State & Federal Support for EJ

- SDWA requires all states to have capacity development strategies.

- The Drinking Water and Clean Water State Revolving Funds allow for additional subsidization of disadvantaged communities

- EPA funds the National Rural Water Association and the Rural Community Assistance Partnership

- EPA provides training, technical assistance

Water System

Available water sources

Physical Infrastructure
(e.g., treatment works, distribution, storage)

Water at the tap
(quality, cost, reliability)

Management
Workforce
Finances
Long-term planning

Operational
Operations and management, repairs, improvements, monitoring, reporting

Information about water quality

State and Federal Governments
Water resource policies
Source protection
Funding

Primary State Agency, EPA, and Local Authorities
Oversight and assurance
Technical support
Funding management

Note. EPA = Environmental Protection Agency.

VanderSlice 2011 Drinking Water and Environmental Disparities

Balazs and Ray 2013 Drinking Water Disparities Framework

Hypotheses…
from Water Economics Lecture

- Capacity constraints
  - Lack of funding (or ability to raise capital)

Hypotheses…
from Water Institutions Lecture

- Capacity constraints
  - Human resources
  - Technical expertise
- Institutional barriers
  - Lack of autonomy
  - Culture of conservatism
- Regulatory barriers
  - Too many, too difficult to understand, keep track of
  - Do not match the situation on the ground
- Psychological barriers
  - Willingness to accept the risk of the water hazards

Hypotheses…
from today's lecture

- Insufficient enforcement
  - Not enforced
  - Sanctions are not high enough to spark action
- Political barriers
  - Those affected by non-compliance have no voice