Source: http://www.nbcnews.com/storyline/flint-water-crisis/flint-michigan-declares-state-emergency-amid-lead-drinking-water-scare-n480636

Flint

A Cautionary Tale

What happened?

What else happened?

Corrosion control not implemented

Residents' concerns about water quality continually dismissed by MDEQ and EPA

Independent studies showed alarming problem with lead

- Flint Water Study (Virginia Tech)
- Blood Lead Level (Hurley Medical Center)

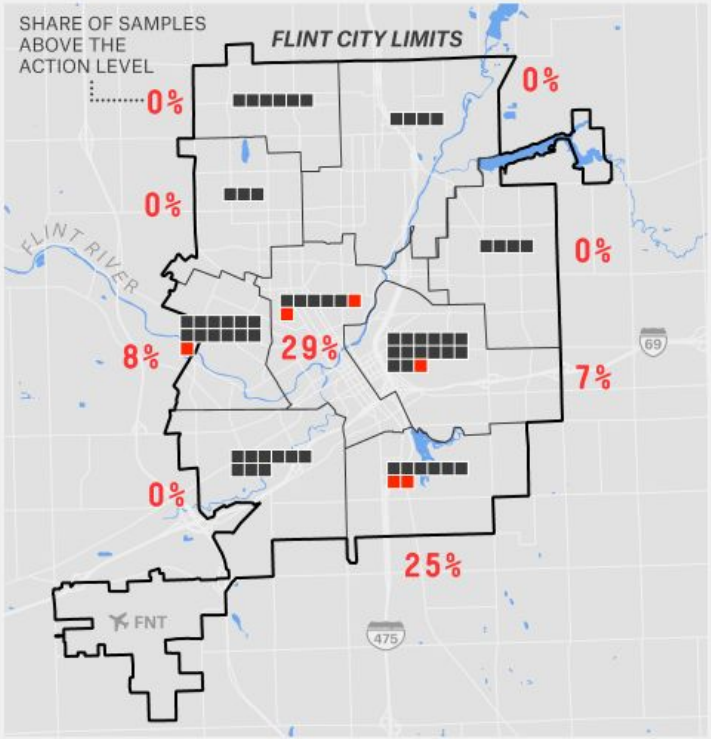
Water sampling in two separate studies

How the sampling and results from city and state testing and the Flint Water Study compare, by ward

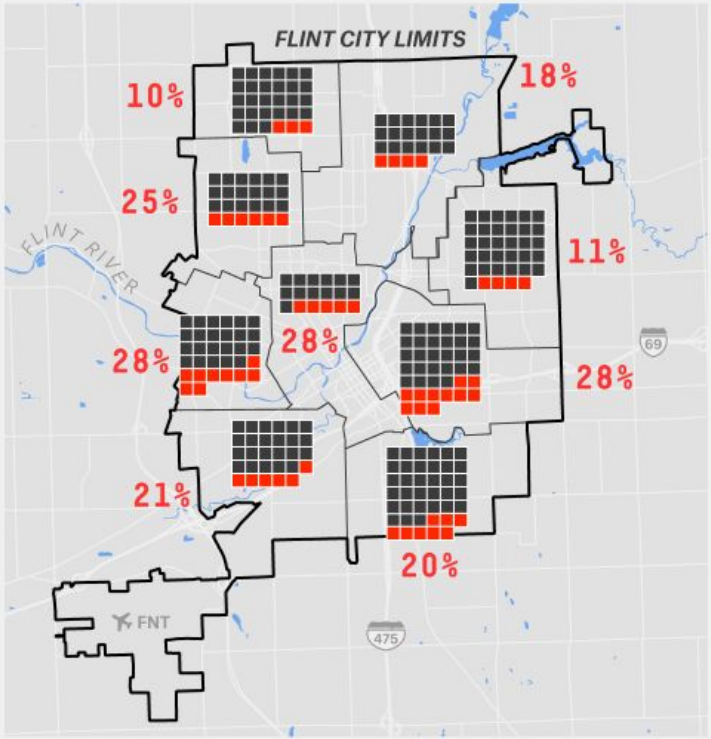
WATER SAMPLES

■ BELOW EPA ACTION LEVEL (15 PPB) ■ ABOVE ACTION LEVEL

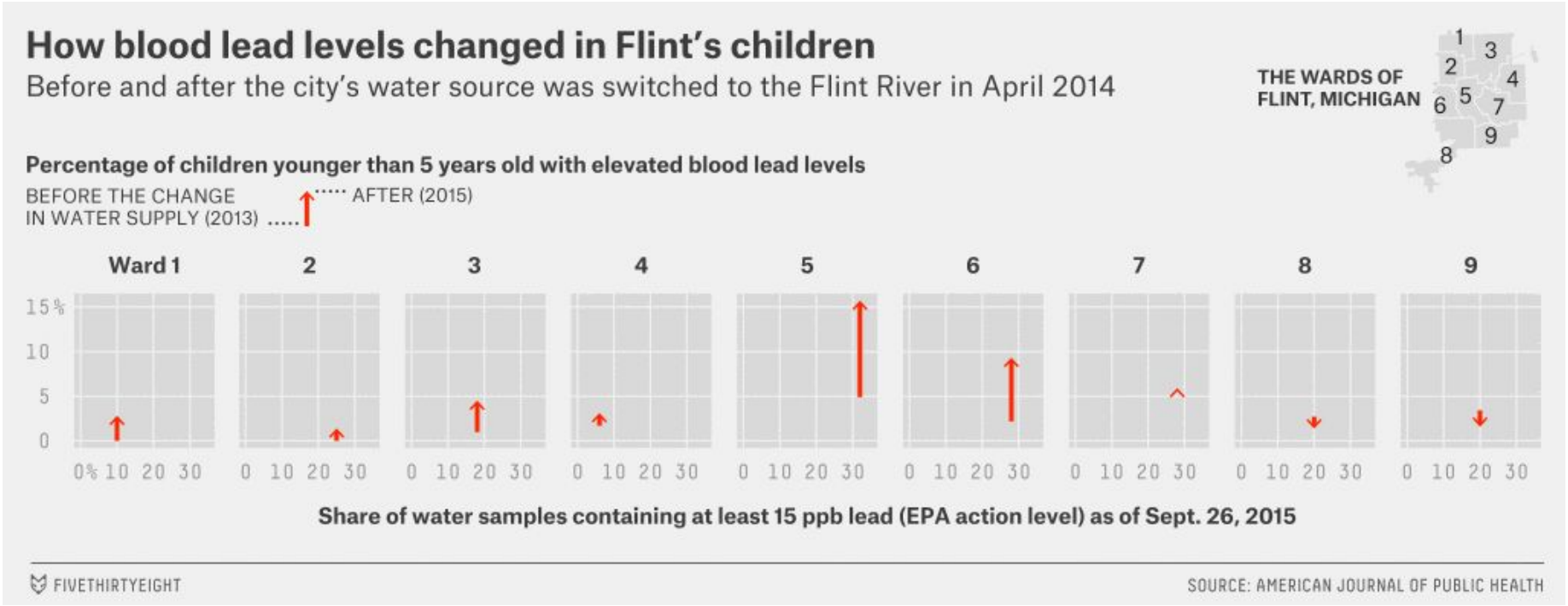
Michigan Department of Environmental Quality



Flint Water Study's analysis



Source: https://fivethirtyeight.com/features/what-went-wrong-in-flint-water-crisis-michigan/



Source: https://fivethirtyeight.com/features/what-went-wrong-in-flint-water-crisis-michigan/

What's the problem with lead?

Neurotoxin

No safe level of exposure

Can increase incidences of:

- Miscarriages
- Attention deficit hyperactivity disorder
- Learning disabilities
- Potentially violent behavior

Can decrease:

- Birth weight
- IQ
- Cognitive function

Why?
How?

Physical infrastructure

- Aging water service lines
- Corrosivity of Flint River

Mismanagement

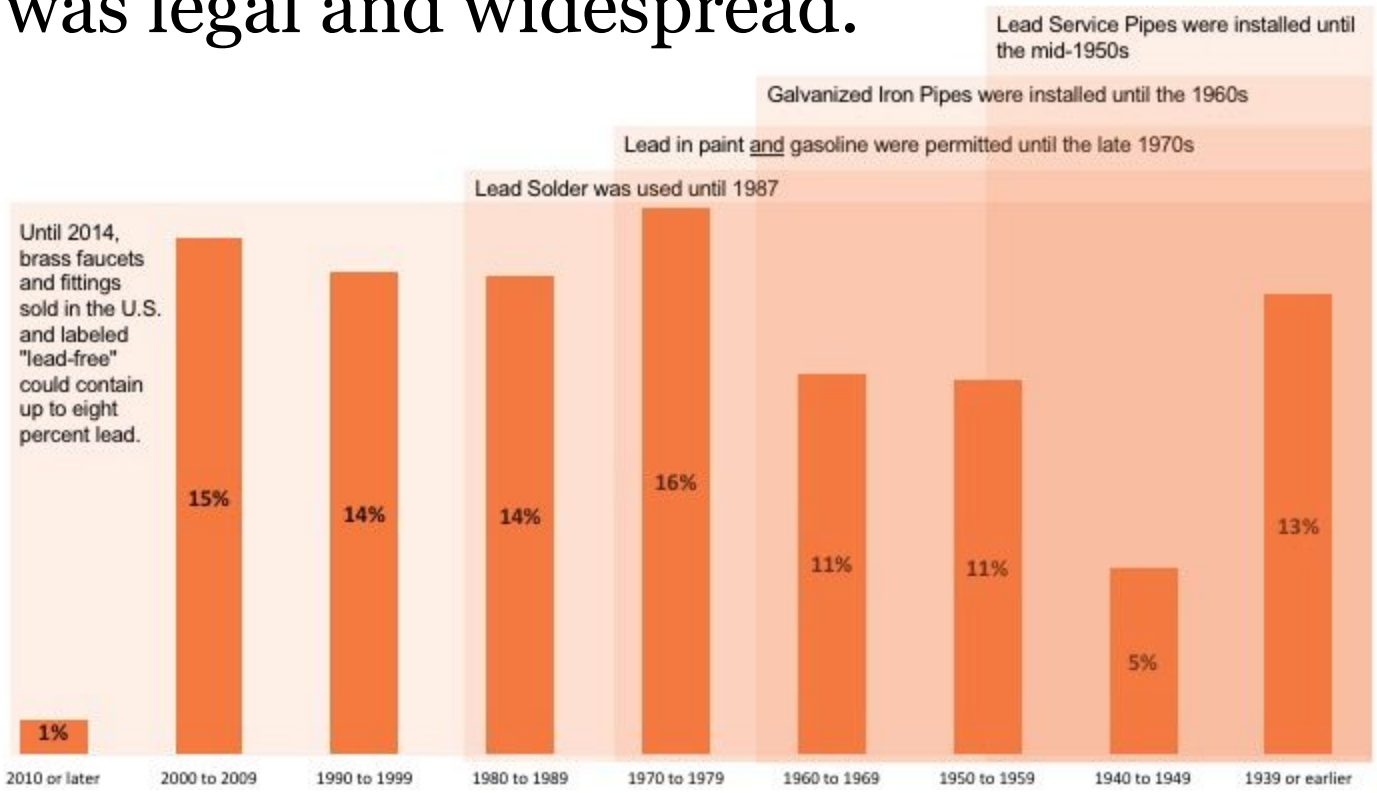
- Undersampling
- Improper sampling protocol

Socio-economic factors

- Accusations of environmental racism

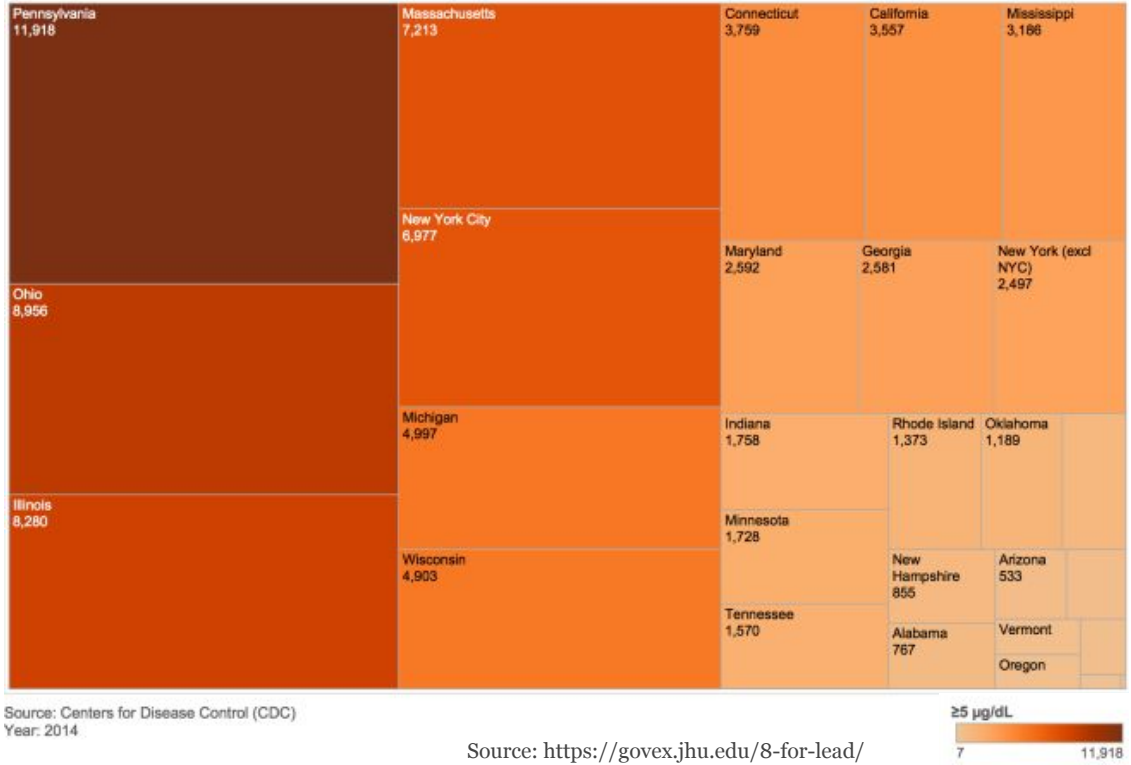
We all have a lead problem.

Over 70% of US housing stock was built while lead use was legal and widespread.



Source: https://govex.jhu.edu/8-for-lead/

Children with elevated blood lead levels can be found all across the county.



Source: https://govex.jhu.edu/8-for-lead/

Assistance Program for Lead in School Drinking Water

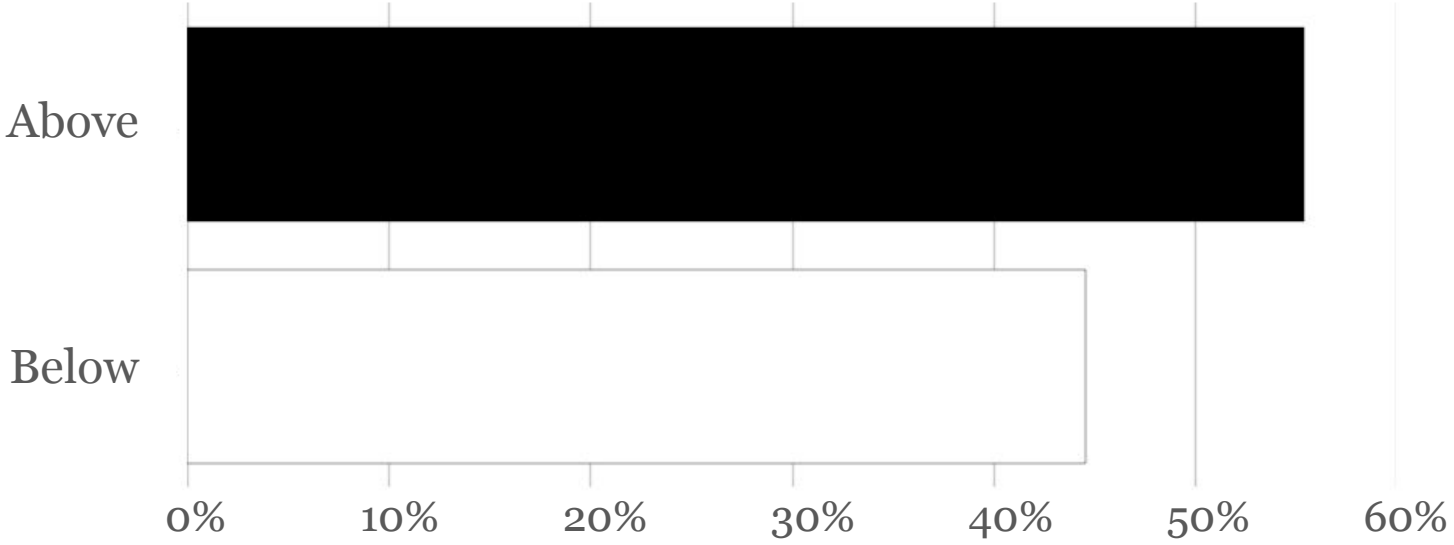
MassDEP Technical Assistance Program

Funding to provide drinking water sampling and analysis for lead and copper

Open to public schools, early education, and early child care facilities

Since April 2016, 875 schools have participated

Over **55%** of schools had at least one sample with lead concentrations above the action level.



Is water quality in Massachusetts related to the same issues as it was in Flint?

Can I use data about
schools & public water supplies
to learn what influences
lead concentrations in drinking
water at Massachusetts schools?

Can I use data about
schools & public water supplies
to learn what influences
lead concentrations in drinking
water at Massachusetts schools?

Schools

What features might be important to predicting lead concentrations?

Physical Infrastructure

- Age of building
- Value of parcel

Socio-economic factors

- Environmental justice status
- Type of school

Public water supplies

What features might be important to predicting lead concentrations?

Physical infrastructure

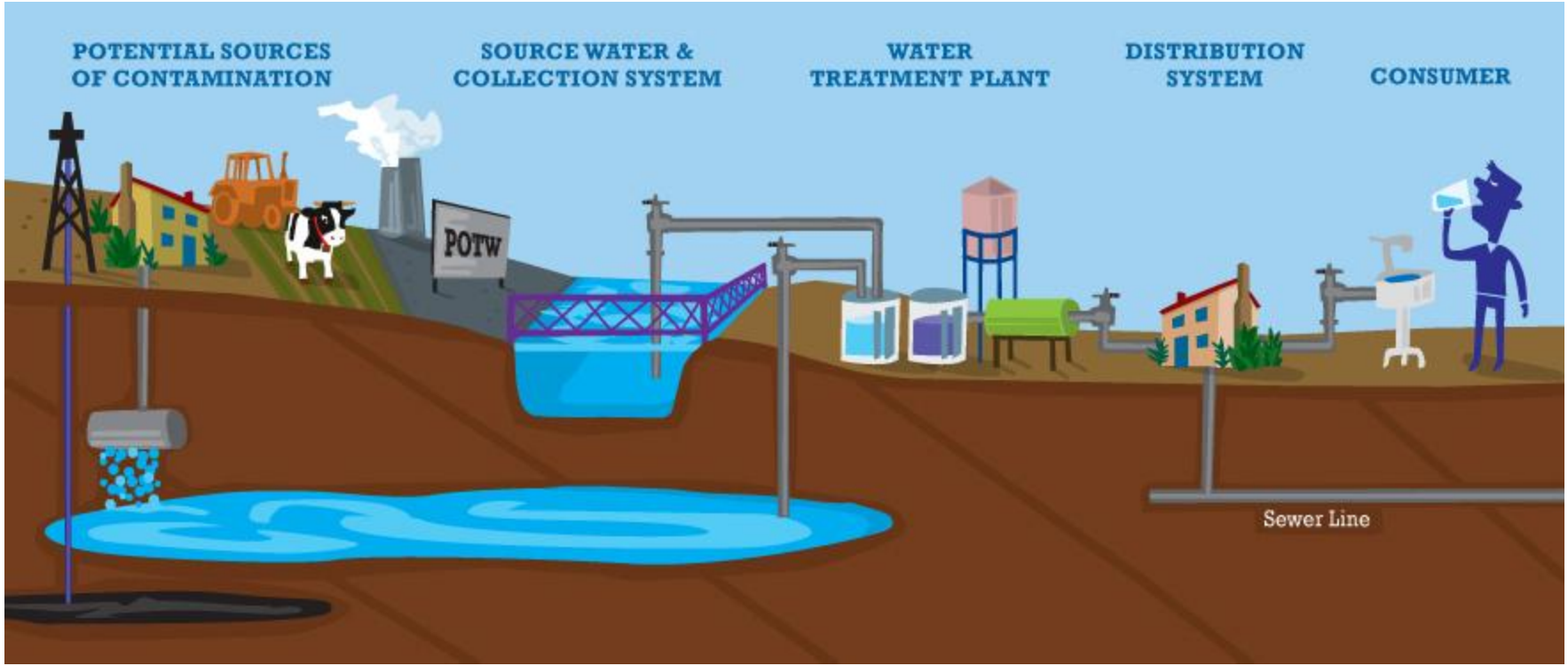
- Type and size of system
- Type of source

Management indicators

- MWRA
- Compliance status
- Response to lead survey

Physical infrastructure

Public Water Systems 101



http://www.swaptexas.org/wp-content/uploads/2016/05/WaterSourcesProcess.jpg

Massachusetts Public Water Systems 101

Water systems classifications

Community

- Year-round service to at least 25 year-round residents
- Ex: town water system

Non-community, non-transient

- Intermittent service to at least 25 of the same people
- Ex: workplace or school

Non-community, non-transient

- Intermittent service to 25 different people
- Ex: restaurant or campground

Types of sources

Groundwater only

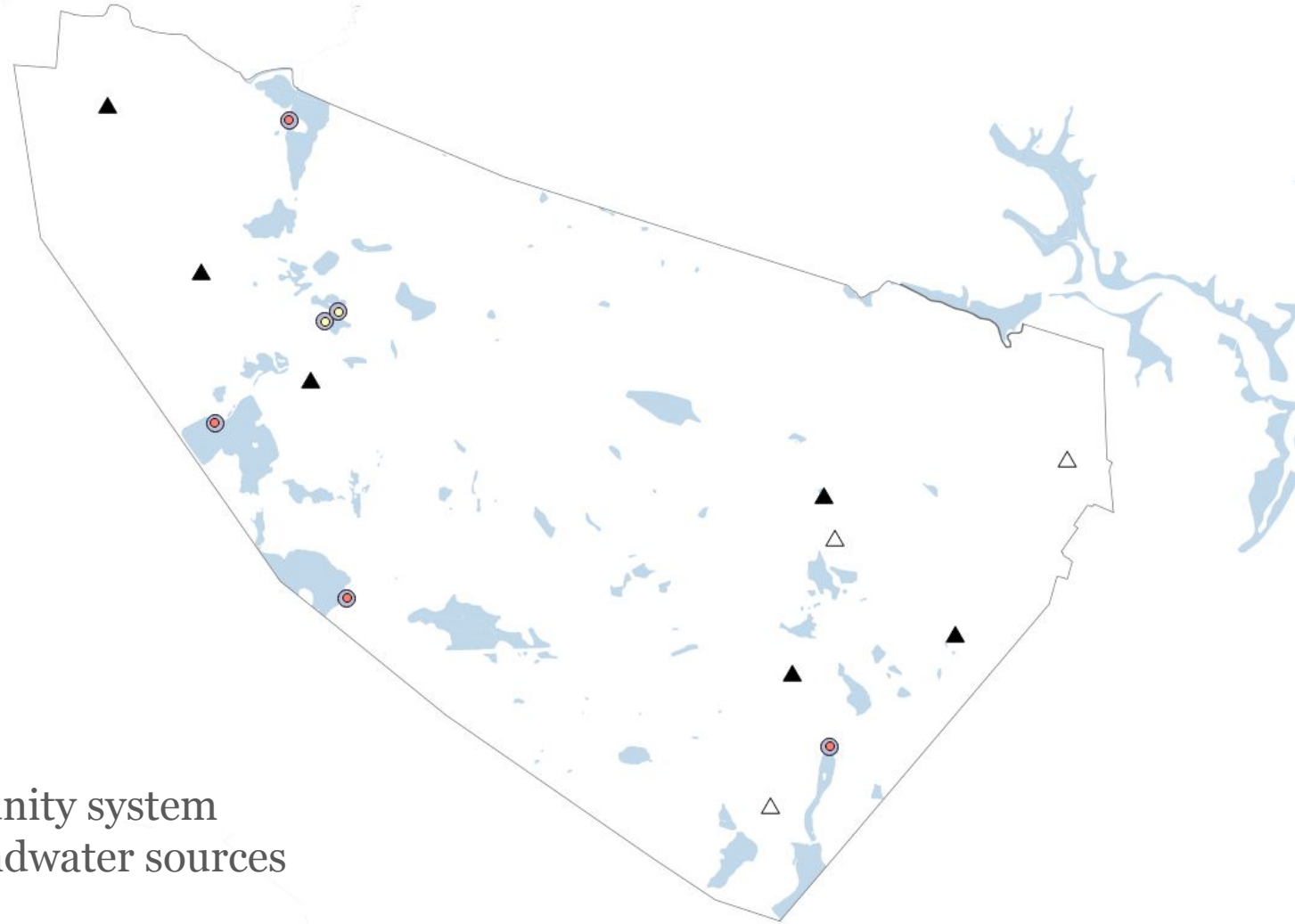
Surface water only

Mix of groundwater and surface water

If Massachusetts has three different water system classes and three different water sources, how many different types of systems are there in the state?

Peabody

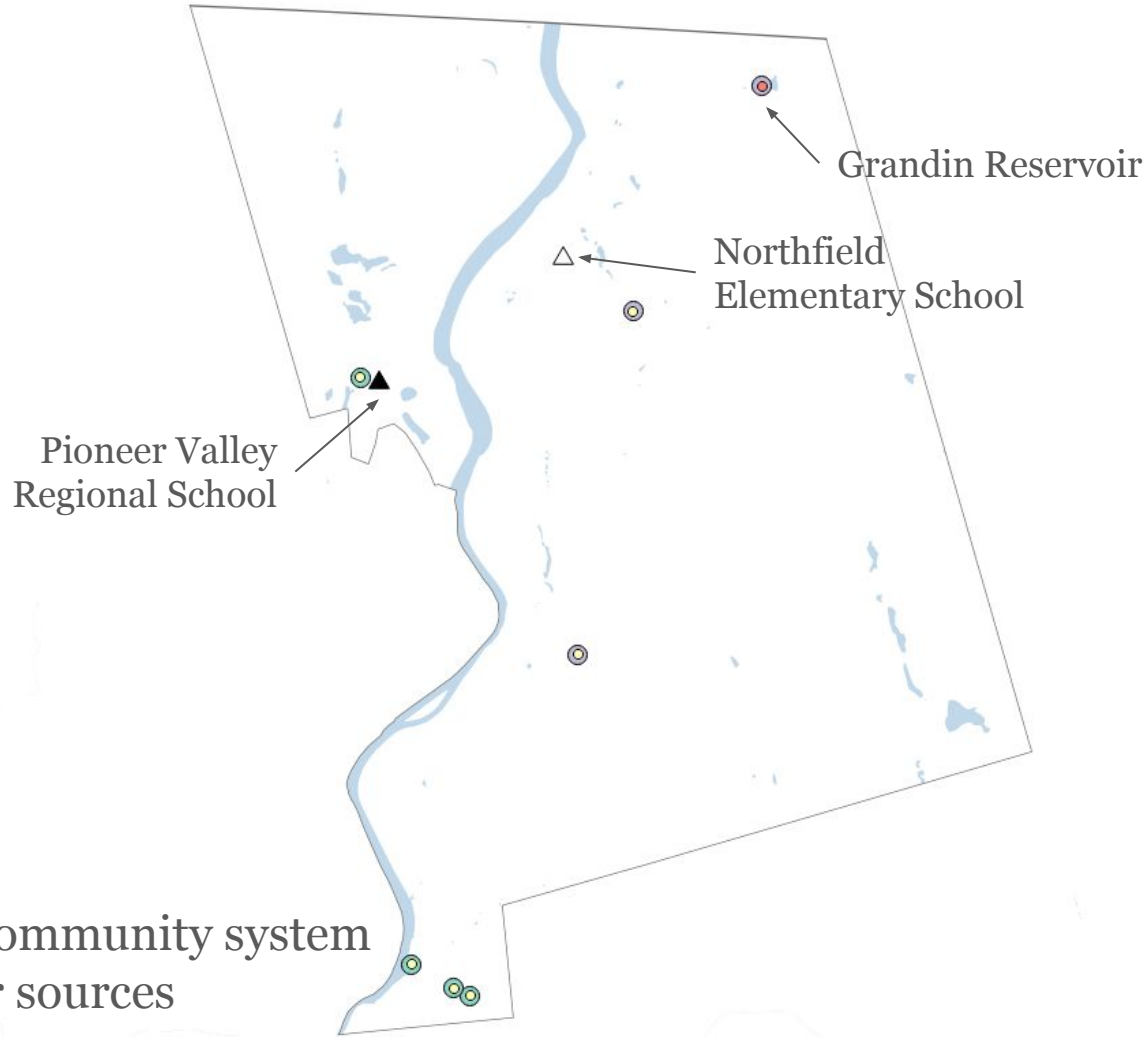
- Community
- Non-community
- Surface water
- Groundwater
- School - above PBAL
- School - below PBAL



Municipal community system
Surface and groundwater sources

Northfield

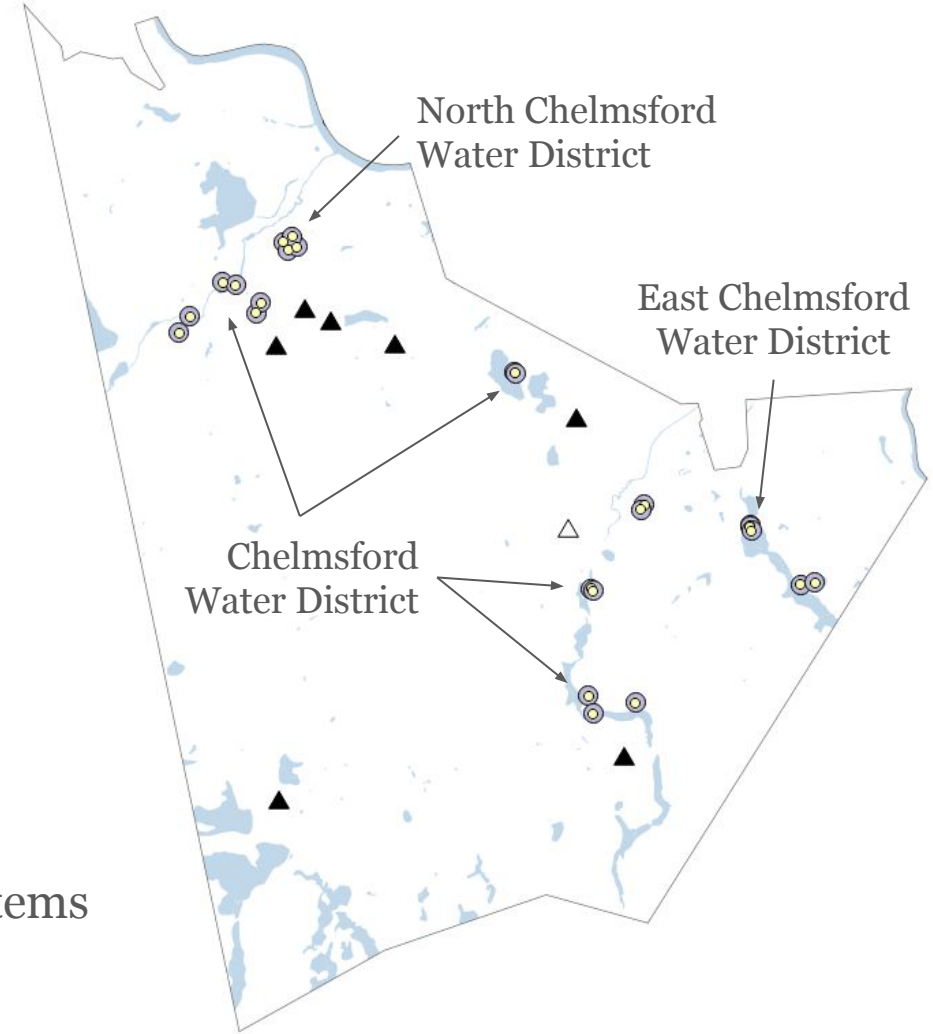
- Community
- Non-community
- Surface water
- Groundwater
- School - above PBAL
- School - below PBAL



Municipal community system
Municipal non-transient non-community system
Surface water and groundwater sources

Chelmsford

- Community
- Non-community
- Surface water
- Groundwater
- School - above PBAL
- School - below PBAL

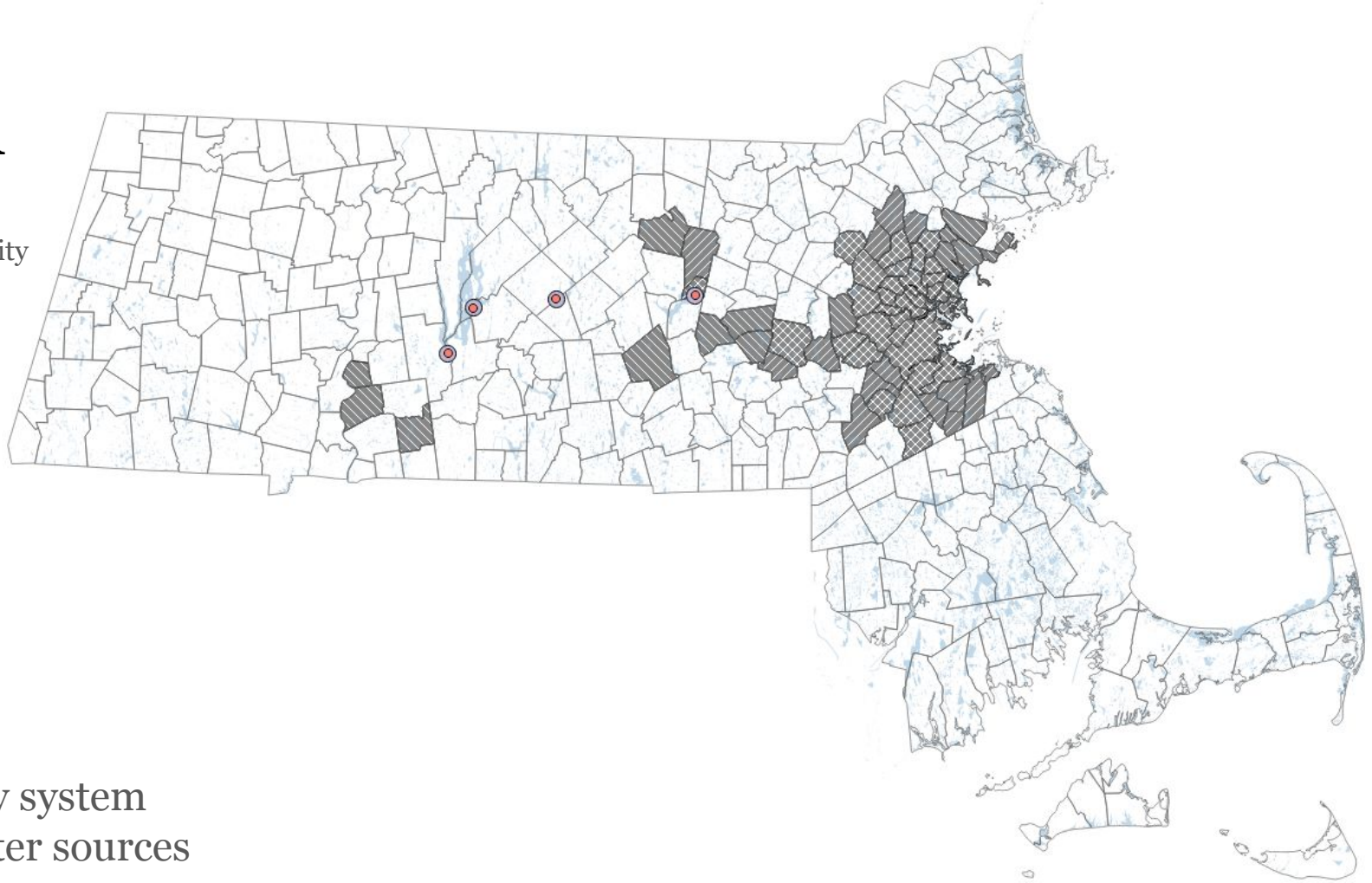


Multiple municipal community systems
Groundwater sources only

Management Indicators

MWRA

- Community
- Non-community
- Surface water
- Groundwater



Community system
Surface water sources

Lead and Copper Rule

Federal regulation implemented by MassDEP and EPA

Focused on reducing corrosiveness of drinking water

Requires semi-annual to annual monitoring, based on past performance

Establishes Lead Action Level (PBAL) of 15 mg/L

Voluntary survey conducted during Summer 2016

Schools & Public water supplies

What features might be important to predicting lead concentrations?

Physical infrastructure

- Age of building
- Value of parcel
- Type and size of PWS
- Type of water source

Management indicators

- MWRA
- Compliance with LCR reporting
- Response to lead survey

Socio-economic factors

- Environmental justice status
- Type of school

Prediction time

Will a school will have at least one sample with a concentration above the lead action level?

Classification

Dummy

- Most frequent

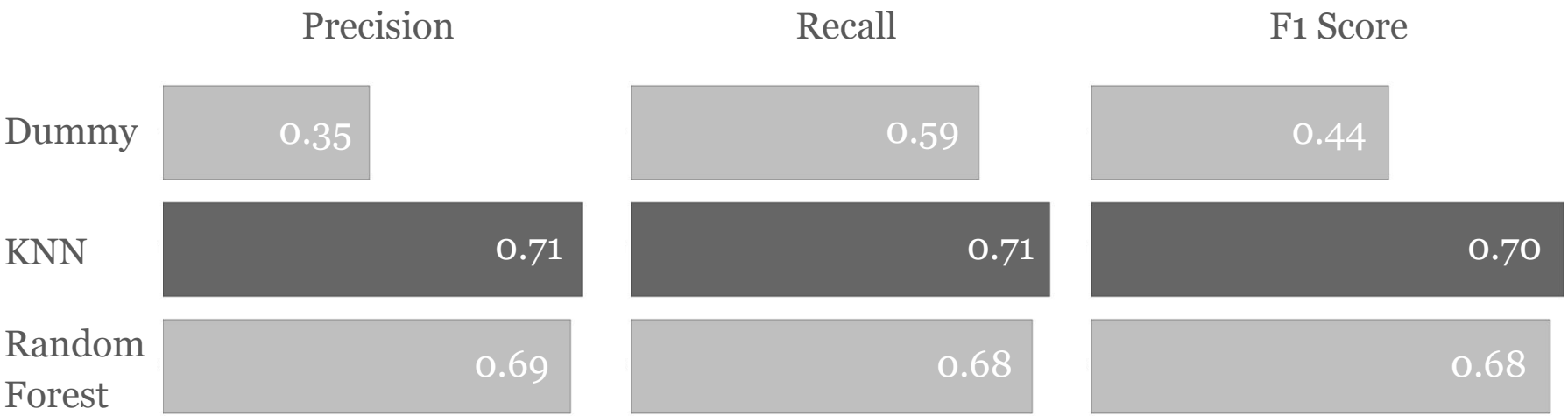
KNN - grid search

- 63 neighbors
- Weighted distance

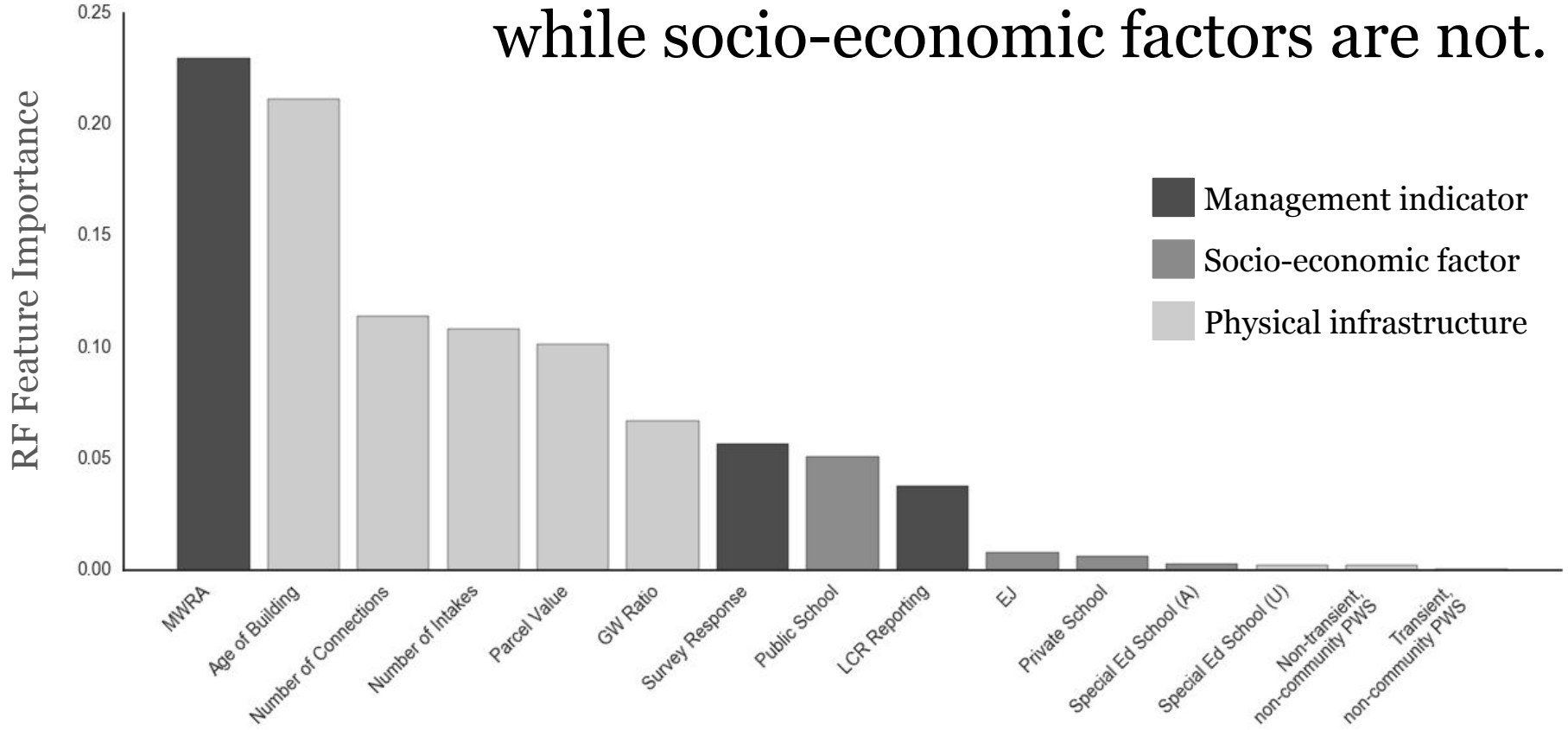
Random Forest - random search

- 500 trees
- Limited to depth of 5

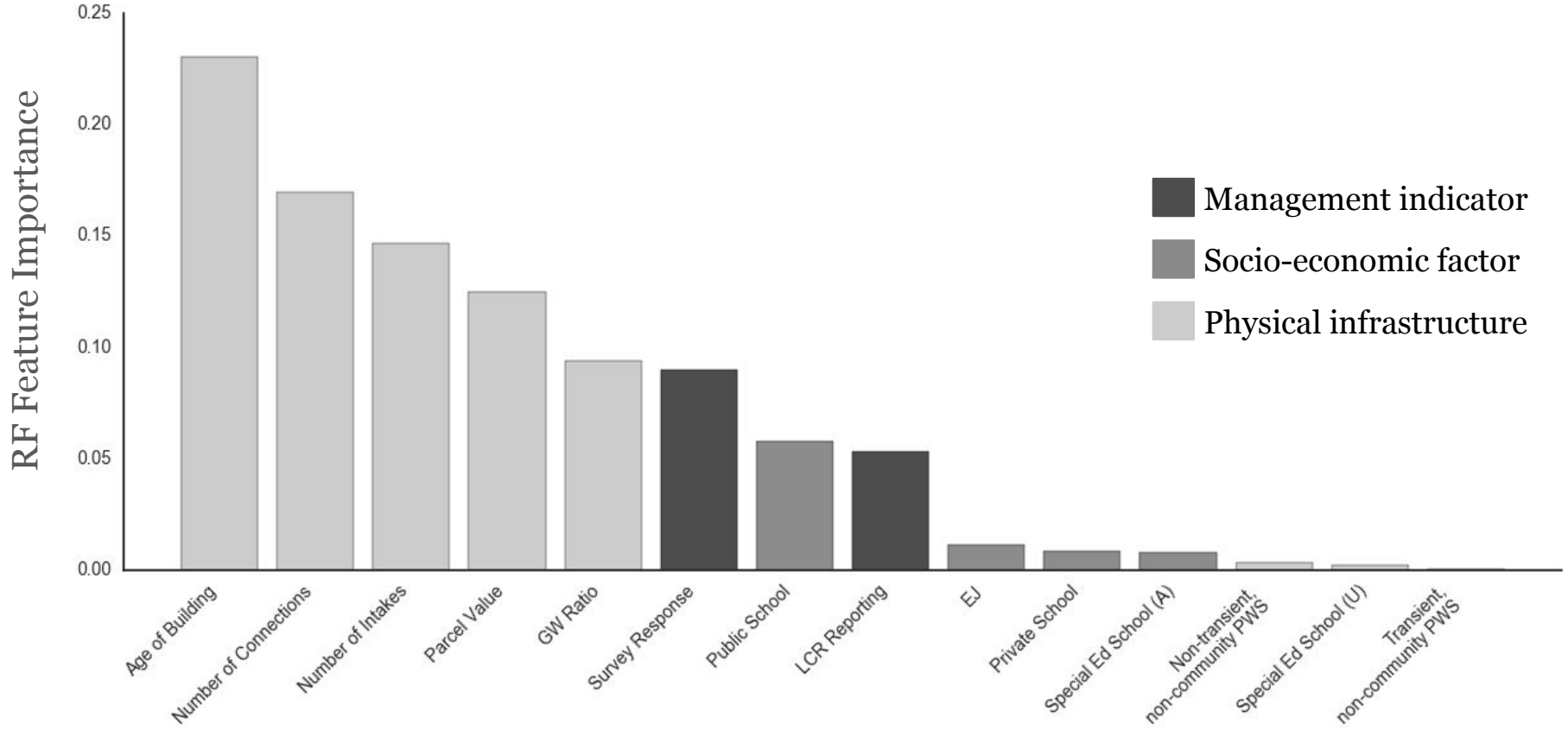
KNN outperformed on precision, recall, and f1 score.



Physical infrastructure features are important, while socio-economic factors are not.



MWRA influences feature importance.



Does Massachusetts have the same issues as Flint?

Thankfully, no.