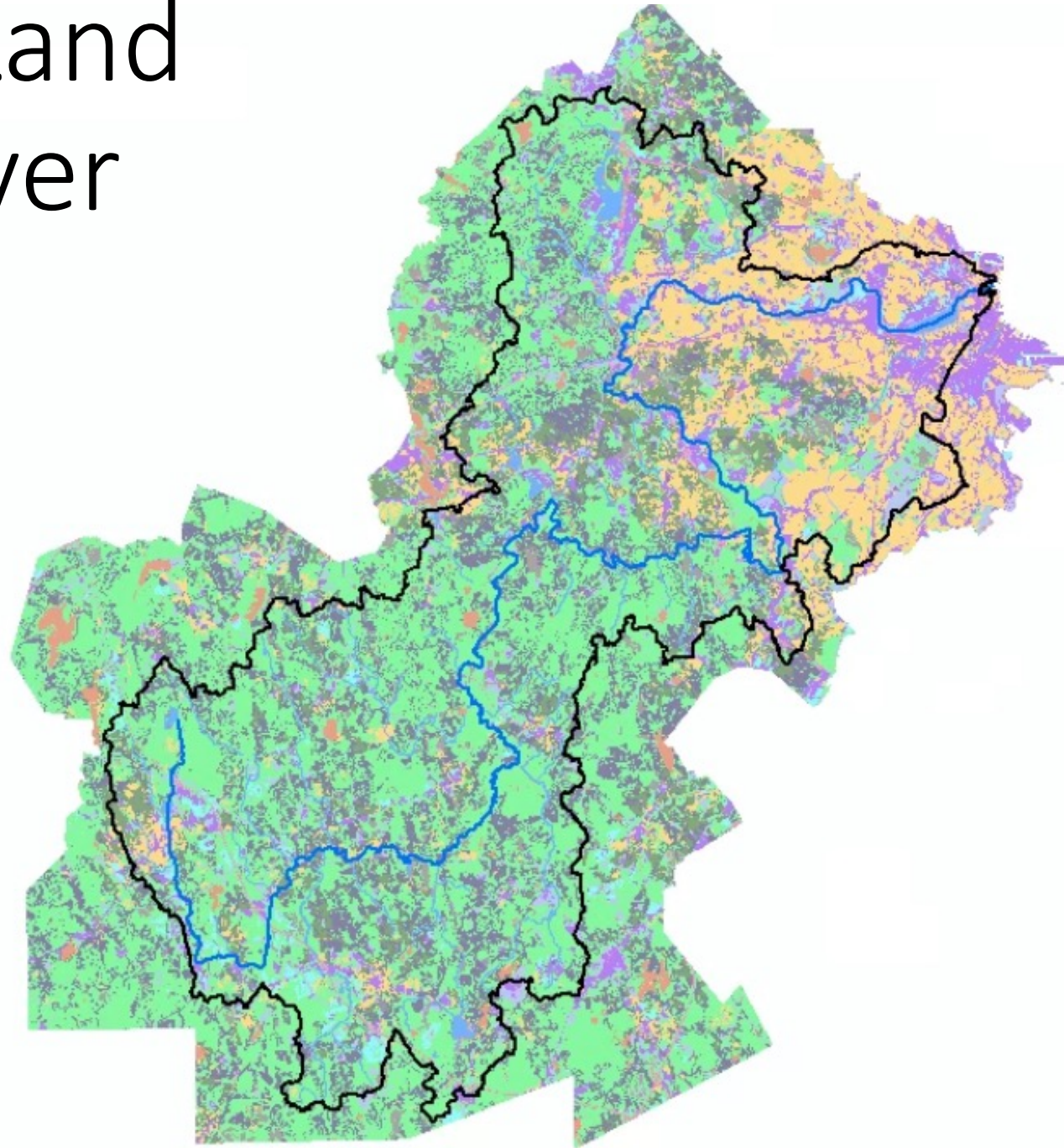


# Tracking Changes in Land Use in the Charles River Watershed



**NEWEA 1.23.24**

Max Rome | [mrome@crwa.org](mailto:mrome@crwa.org) | 617.540.5650 x 1076

Stormwater Program Manager

Charles River Watershed Association

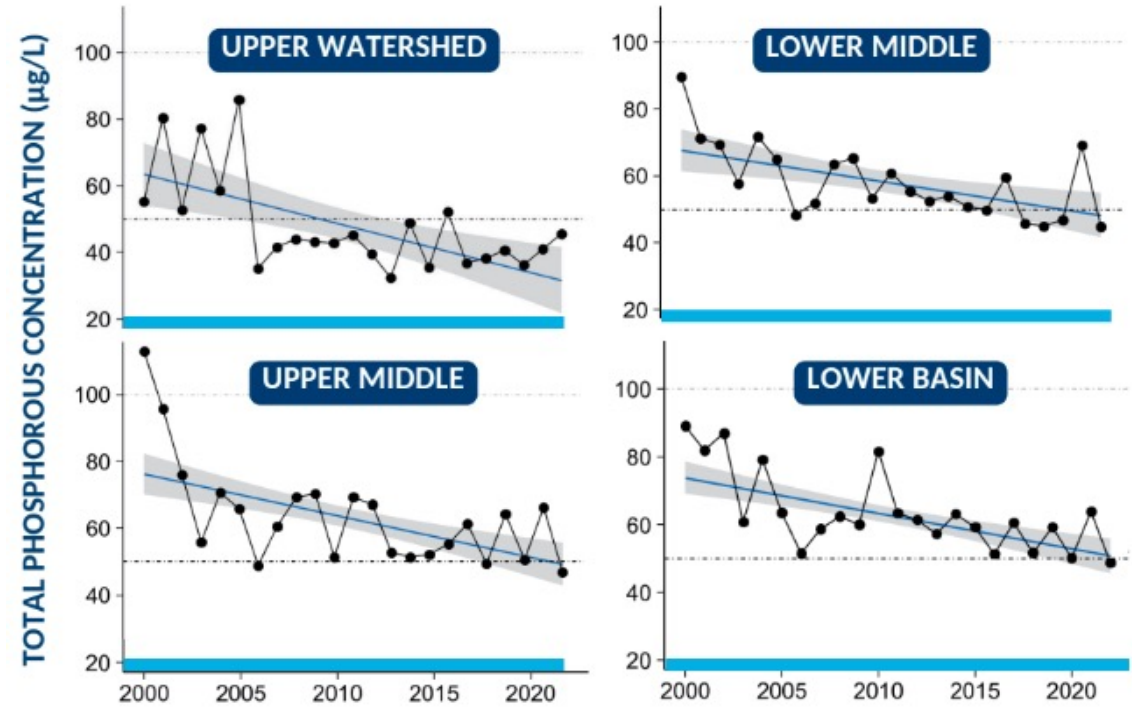
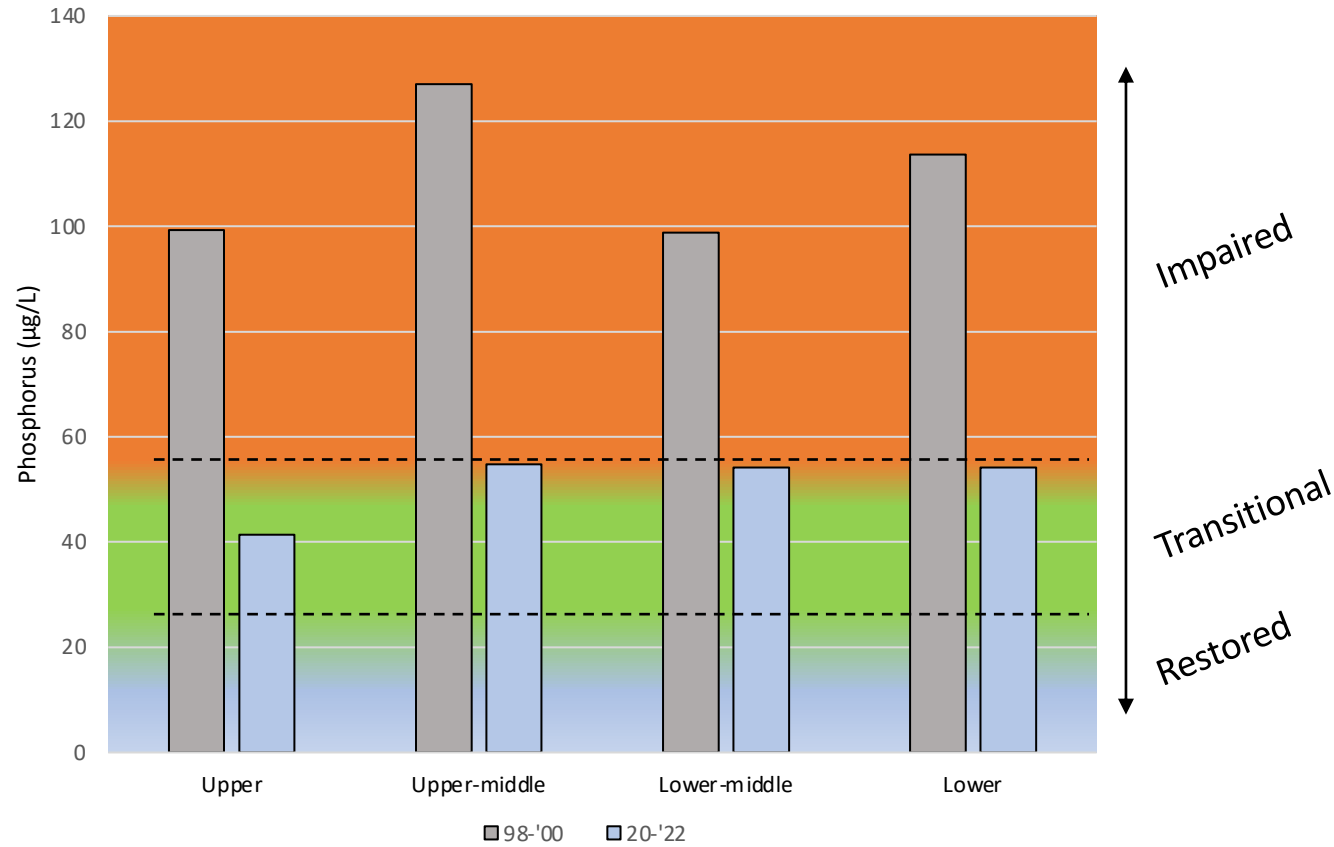
# Motivation

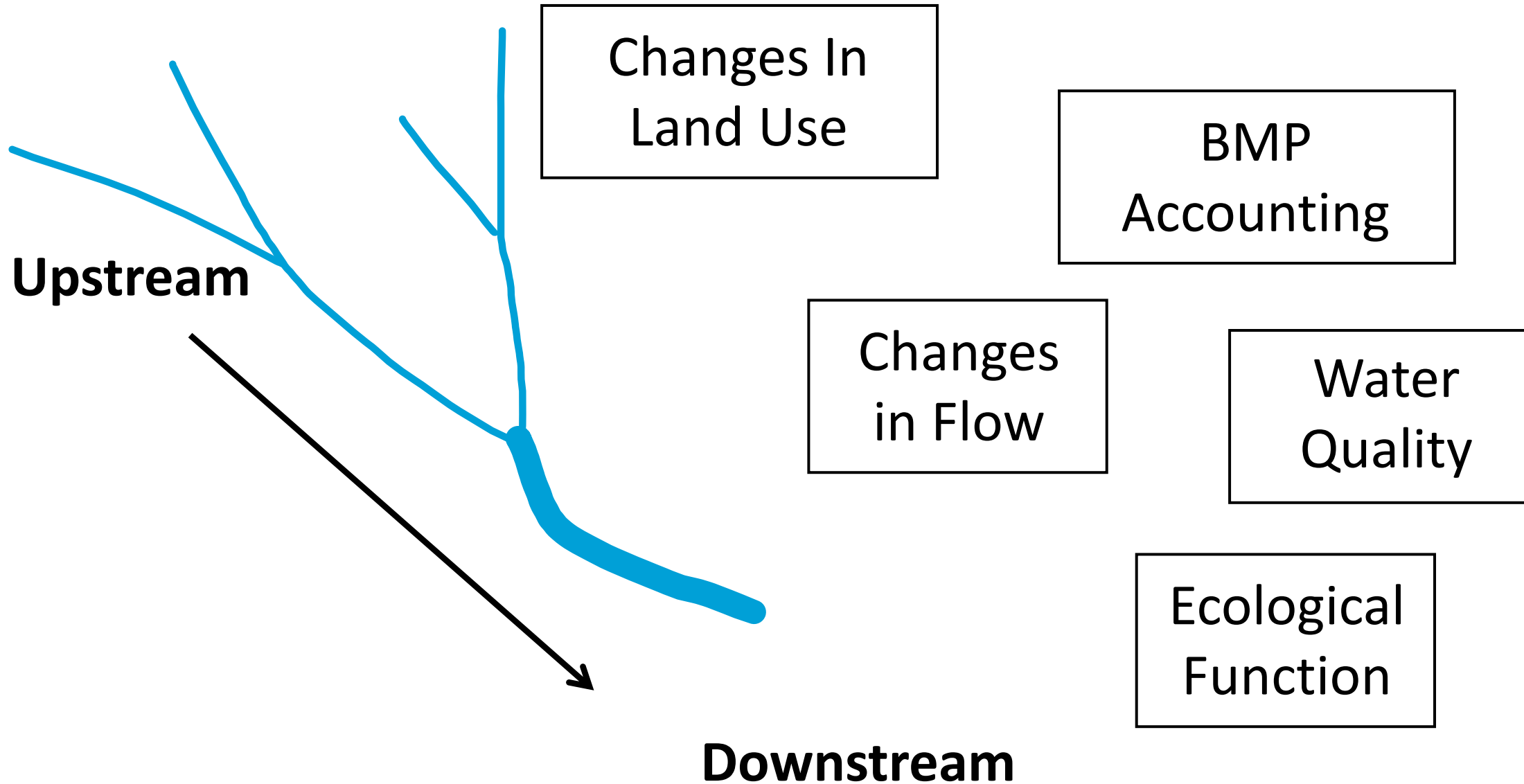
- Support Municipal MS4 reporting
- Track progress toward TMDL
- A swimmable and restored Charles River

Work Funded by FY 23 MS4  
Municipal Assistance Grant



## Decreasing Phosphorus Concentrations across the watershed







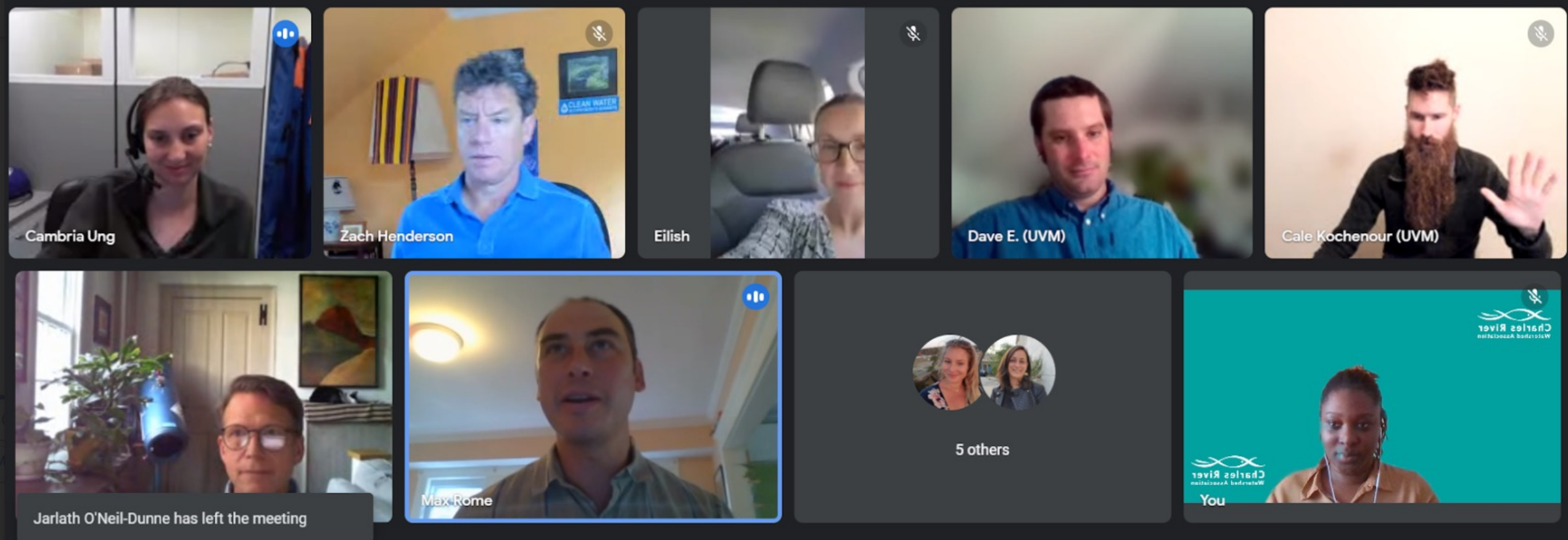
# Technical Advisory Committee (THANK YOU)

## Technical Advisory Committee

Newton Tedder – EPA Region 1  
Laura Schifman – MassDEP  
Craig Austin – MassGIS  
Cambria Ung – City of Cambridge  
Corey Eilish – Town of Wellesley  
Lucica Hillier – City of Somerville  
Matt Davis – Brown and Caldwell  
Zach Henderson – Woodard and Curran

## Project Team

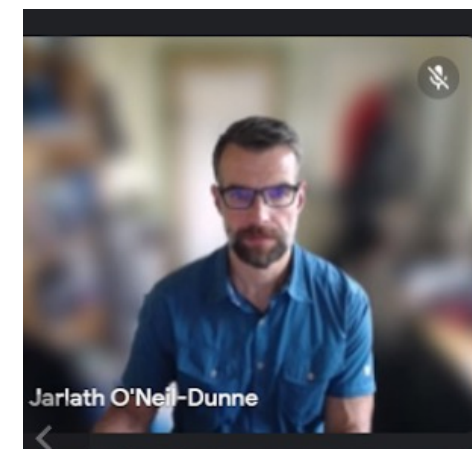
CRWA:  
Max Rome, Sarah Traore, Conrad Crawford  
UVM Spatial Analysis Lab:  
Jarlath O’Neil-Dunne, Dave Erickson, Cale Kochenour





## Jarlath Patrick Macbeth O'Neil-Dunne 1974-2023

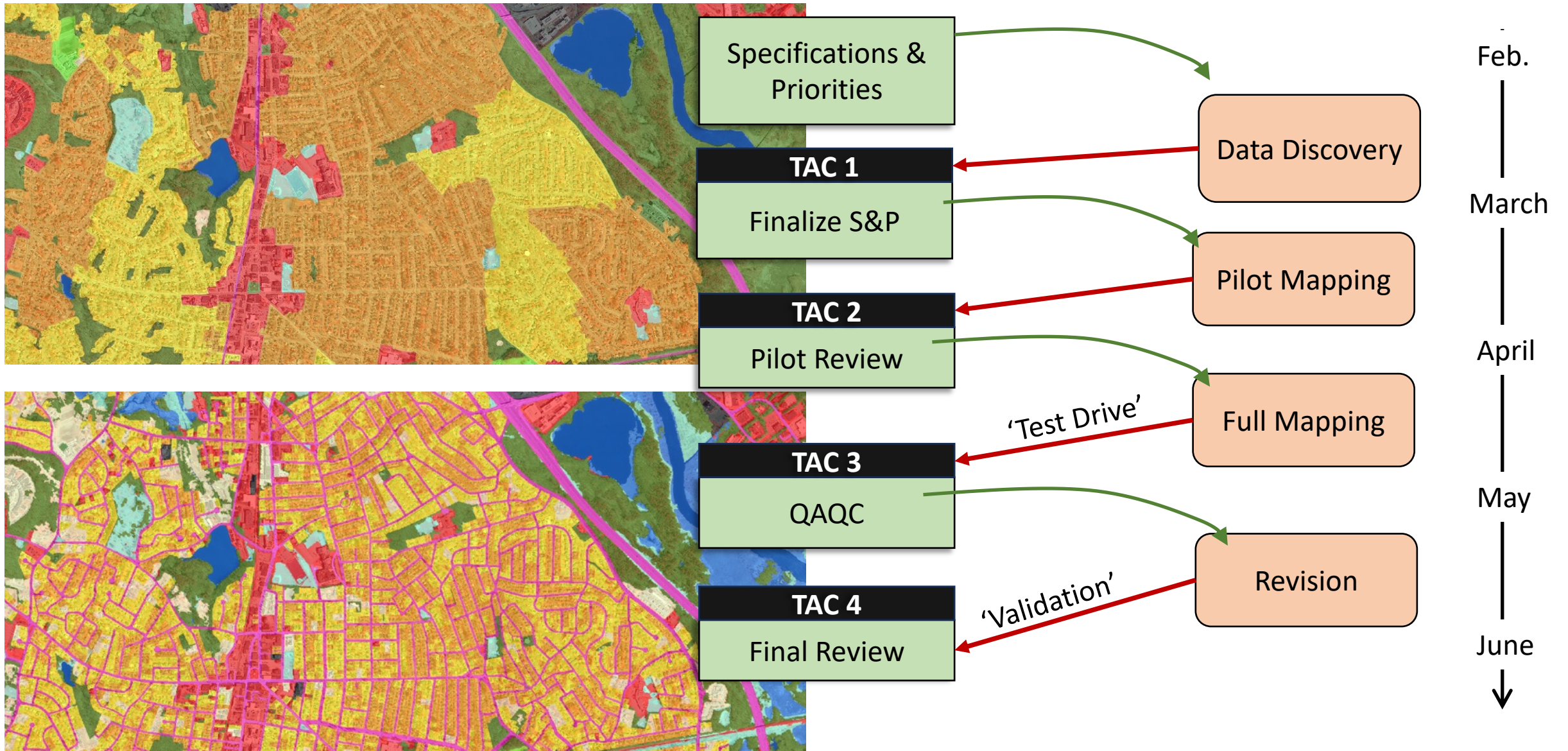
It is with profound sorrow and much love that we mourn the passing of Jarlath O'Neil-Dunne at 49 years old, who died of a heart attack while Nordic Skiing with friends in his beloved Vermont. He loved his family, especially his three beautiful children; he loved his friends, his work and his workouts; he loved and loved and loved. Jarlath was a giant among men. For the many of us who knew him, he was a real-life superhero who was stronger, fitter, kinder, and more empathetic than one would think possible. He was a father, husband, son, brother, award winning mentor, friend, confidant, community builder, creative mind, all-weather bike commuter, pitch master, traveling bard, and a comedy show for any and all.



**Memorial Fund**



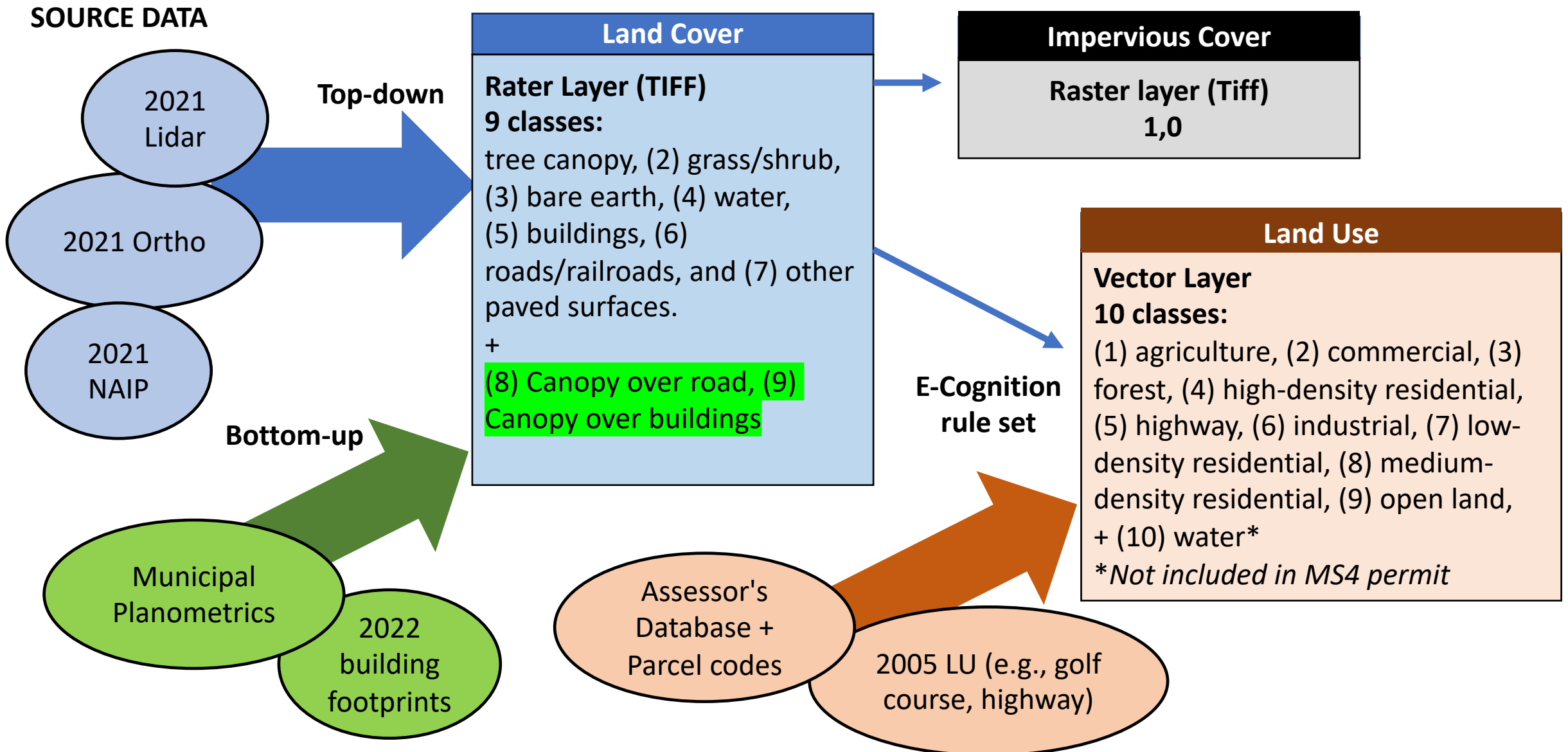
# Process



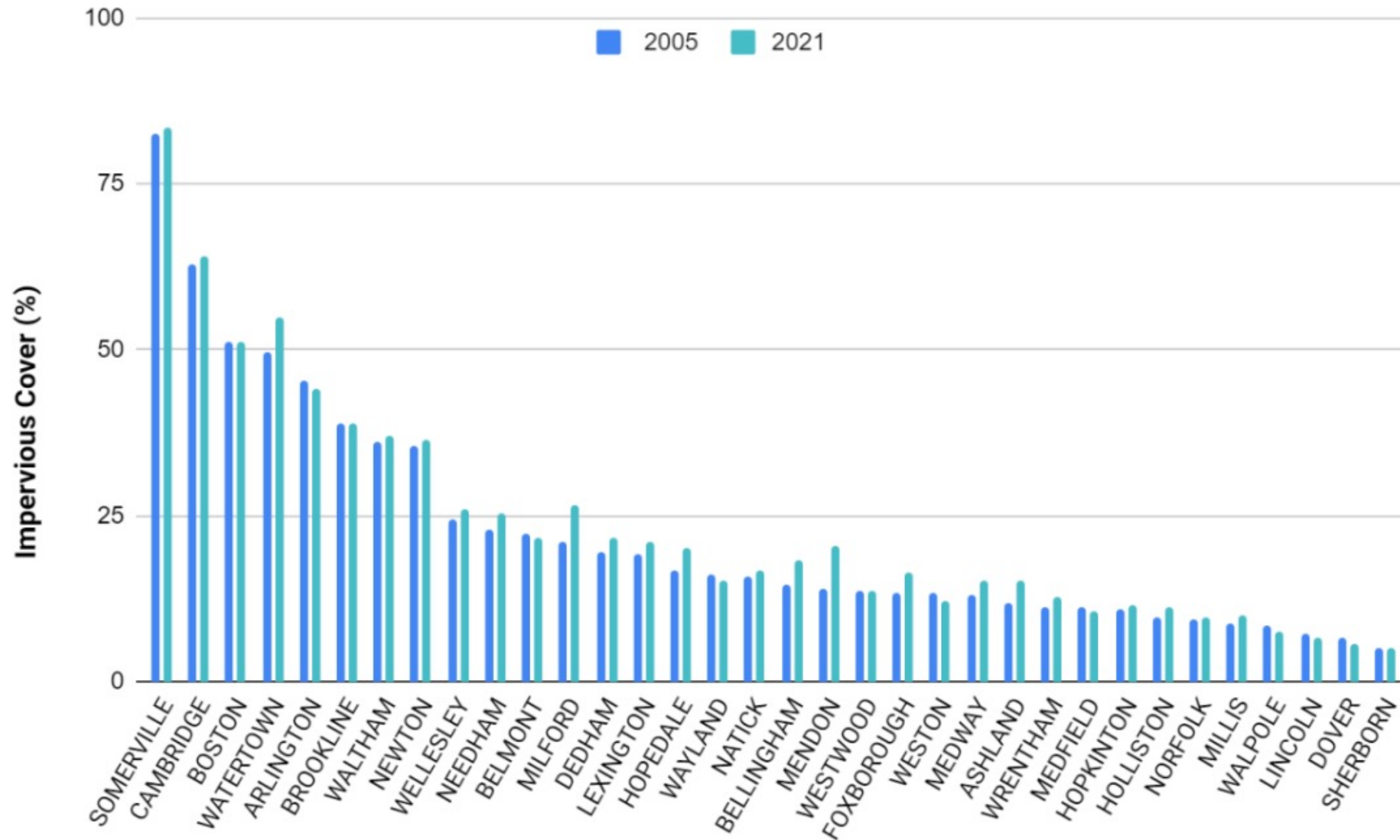
## Consensus project goals:

1. Emphasis on accurate updated (a) Land Use and (b) Land Cover shapefiles that can be used at the basis for regular updates
2. Replicable method (“cookbook”) for future updates to land classification and impervious area
3. “Top-down” mapping
4. Functional Land Use classification consistent with MS4 permit and existing PLERs as specified by the permit (9 land uses, one parcel might have multiple land uses)

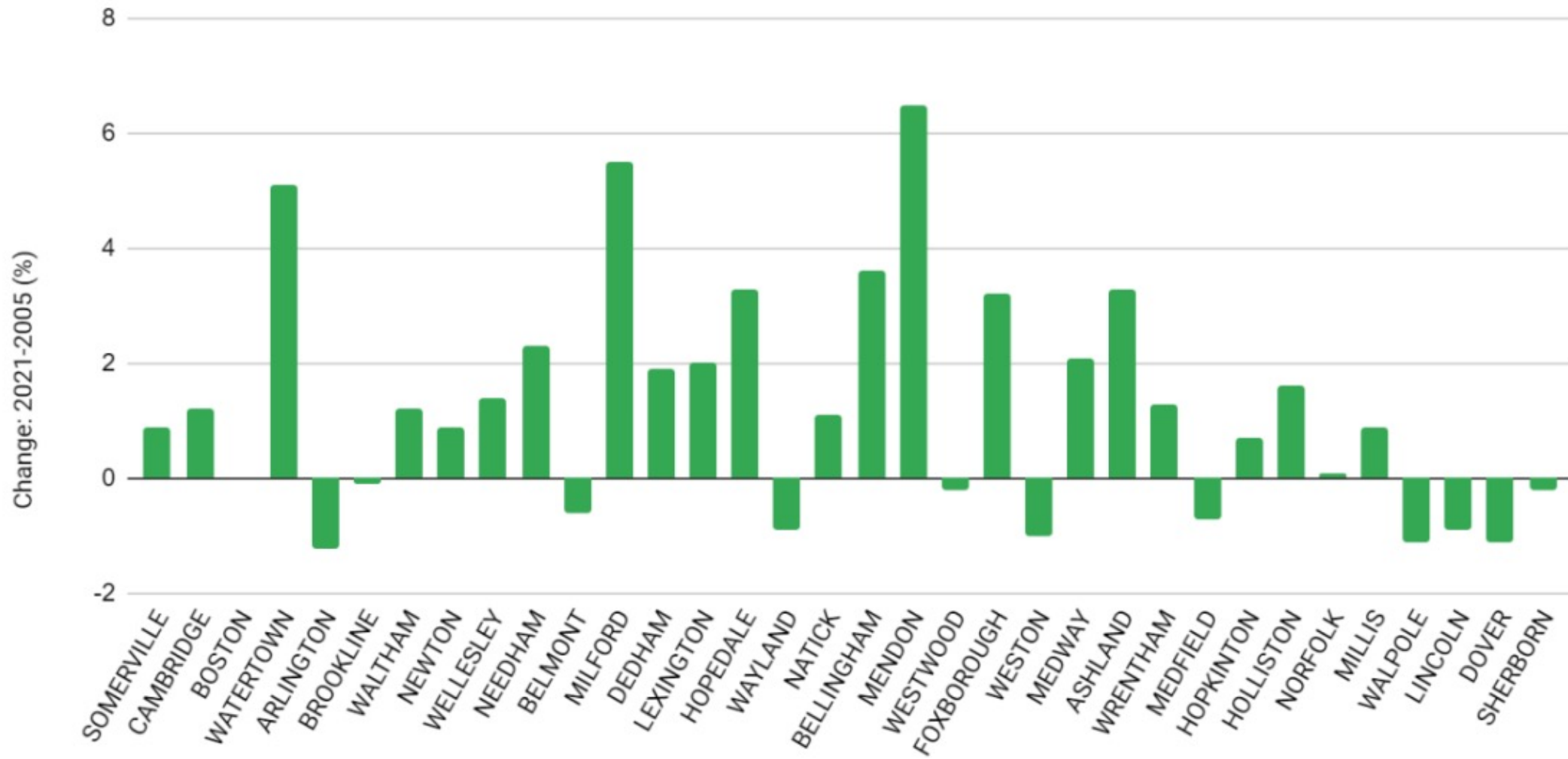




# Changes in the Impervious Cover

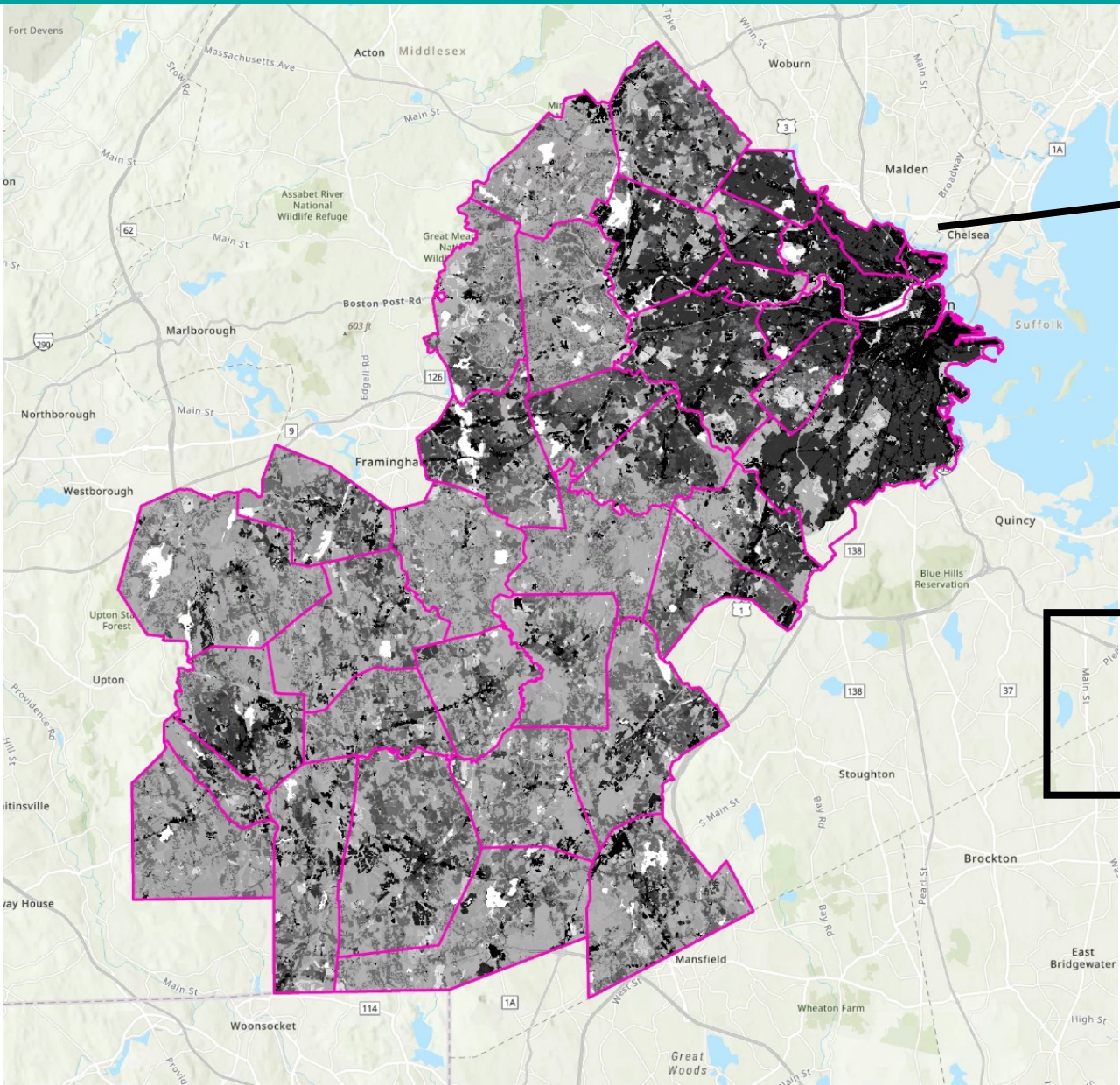


# Changes in Impervious Cover





# From LULC to Phosphorus Loading

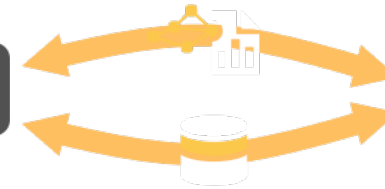


Land Use

## Impervious / Soil Type

	Impervious	A	B	C	C/D	D	U*
Commercial	1	2	3	4	5	6	7
Industrial	8	9	10	11	12	13	14
High Density Residential	15	16	17	18	19	20	21
Medium Density Residential	22	23	24	25	26	27	28
Low Density Residential	29	30	31	32	33	34	35
Highway	36	27	38	39	40	41	42
Forest	43	44	45	46	47	48	49
Open Land	50	51	52	53	54	55	56
Agricultural	57	58	59	60	61	62	63
Water	64	65	66	67	68	69	70

R



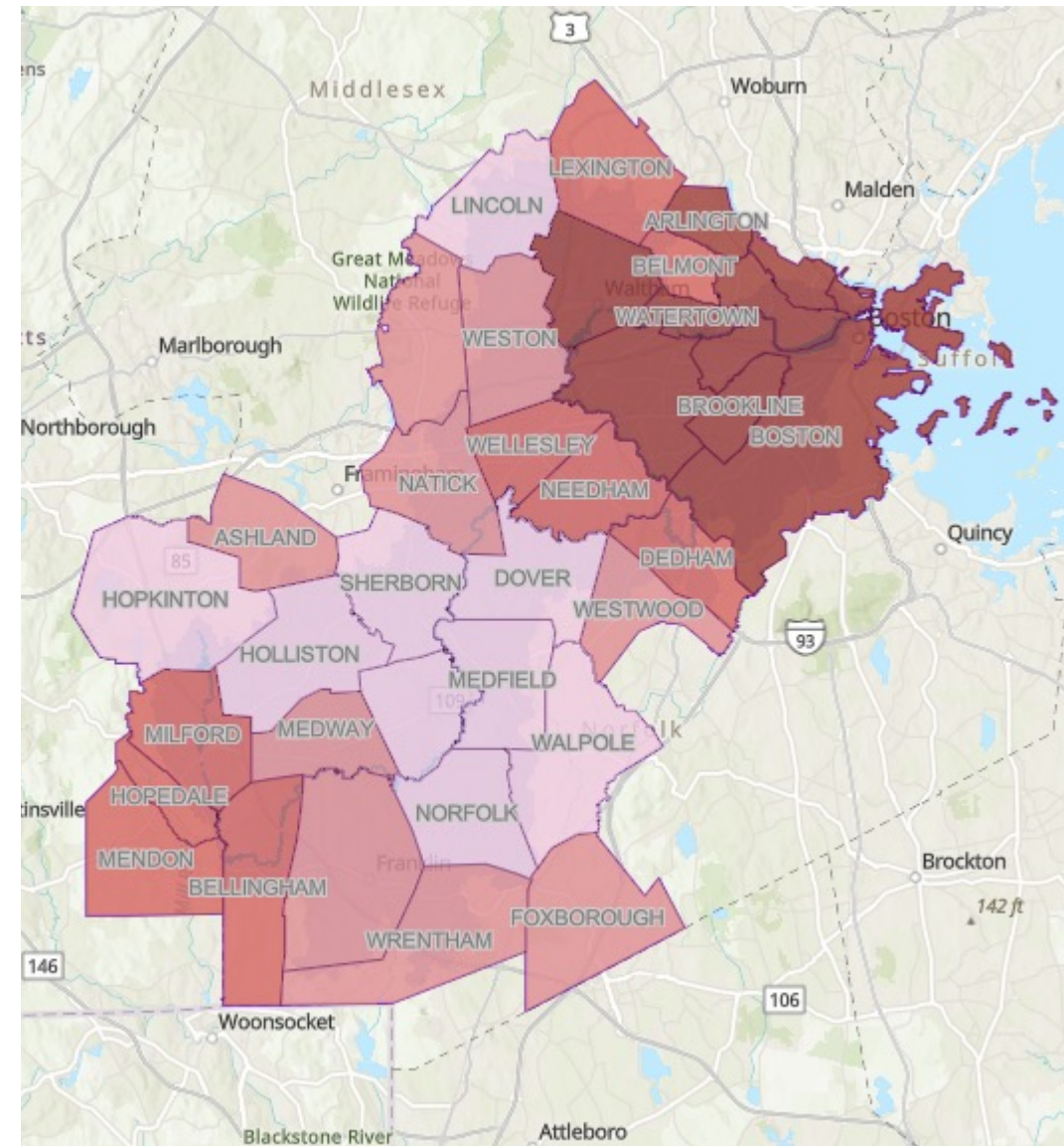
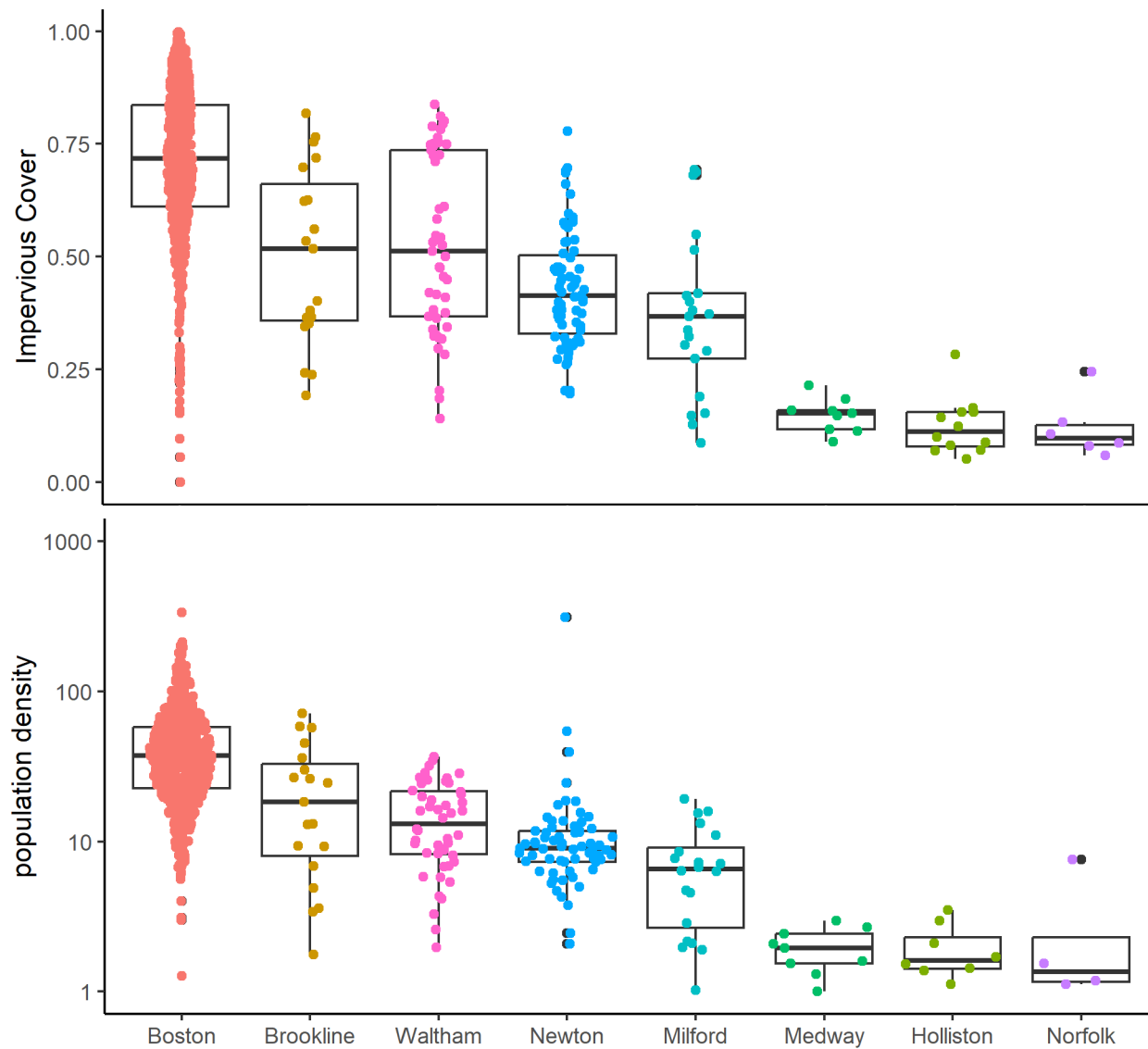
ArcGIS

Phosphorus Land Use Group	Total Area (ac)	Impervious Area (ac)	Percent Impervious	Directly Connected Impervious Area					Annual Phosphorus Export Load (lb/yr)	Pervious Area Phosphorus Load														
				Sutherland		Percent Directly Connected Impervious Area (%)	Connecte d Impervious Area (ac)	Loading Rate (lb/acre/yr)		Perv HSG Area (ac)					Phosphorus Export Loading Rate (lb/acre/yr)									
				A	B					A	B	C	C/D	D	Unk	A	B	C	C/D	D	Unk			
Commercial			0%	0.4	1.2	0.0%	0.0	1.78	-	-	-	-	-	-	-	-	-	0.04	0.18	0.36	0.46	0.54	0.36	
Industrial			0%	0.4	1.2	0.0%	0.0	1.78	-	-	-	-	-	-	-	-	-	0.04	0.18	0.36	0.46	0.54	0.36	
High-density residential			0%	0.4	1.2	0.0%	0.0	2.32	-	-	-	-	-	-	-	-	-	0.04	0.18	0.36	0.46	0.54	0.36	
Medium-density residential			0%	0.1	1.5	0.0%	0.0	1.96	-	-	-	-	-	-	-	-	-	0.04	0.18	0.36	0.46	0.54	0.36	
Low-density residential			0%	0.1	1.5	0.0%	0.0	1.52	-	-	-	-	-	-	-	-	-	0.04	0.18	0.36	0.46	0.54	0.36	
Highway			0%	0.1	1.5	0.0%	0.0	1.34	-	-	-	-	-	-	-	-	-	0.04	0.18	0.36	0.46	0.54	0.36	
Forest			0%	0.01	2	0.0%	0.0	1.52	-	-	-	-	-	-	-	-	-	0.11	0.14	0.19	0.21	0.23	0.19	
Open land			0%	0.1	1.5	0.0%	0.0	1.52	-	-	-	-	-	-	-	-	-	0.04	0.18	0.36	0.46	0.54	0.36	
Signature			0%	0.01	2	0.0%	0.0	1.52	-	-	-	-	-	-	-	-	-	0.07	0.29	0.60	0.78	0.91	0.60	
Total			0%			0%																		

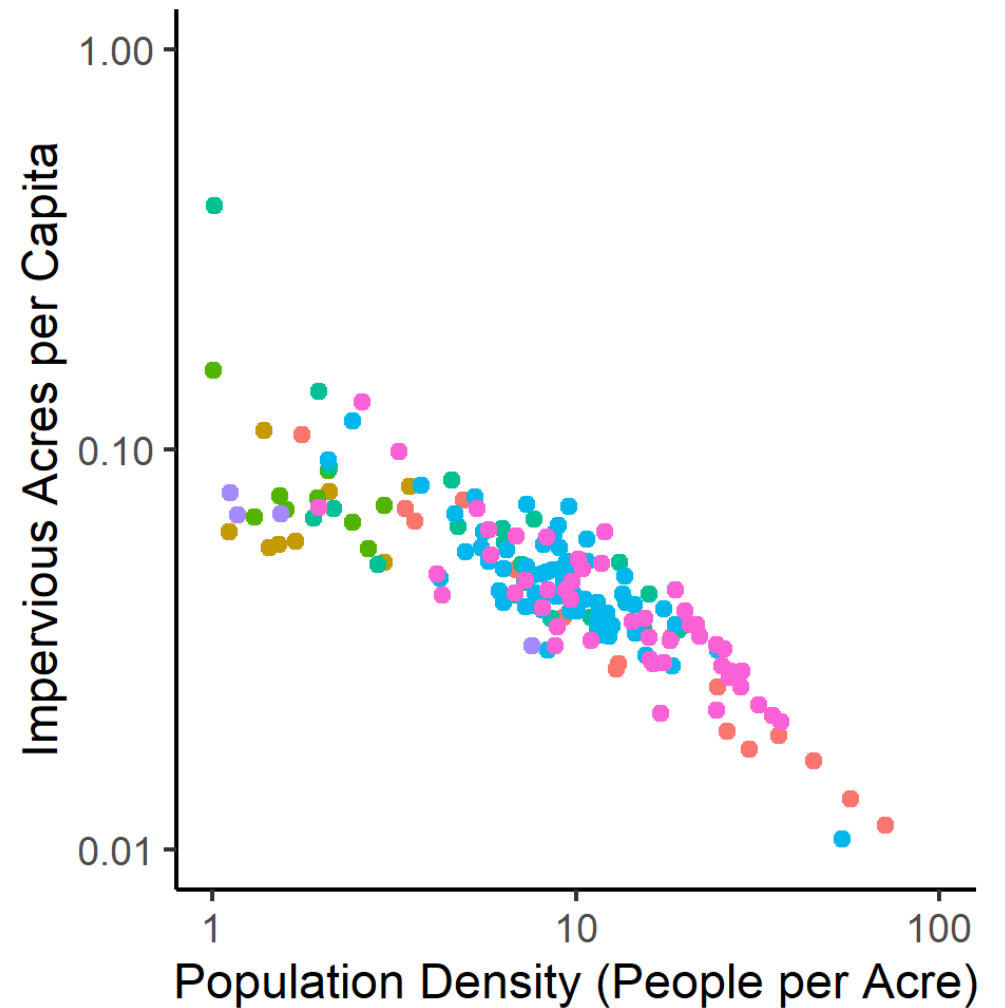
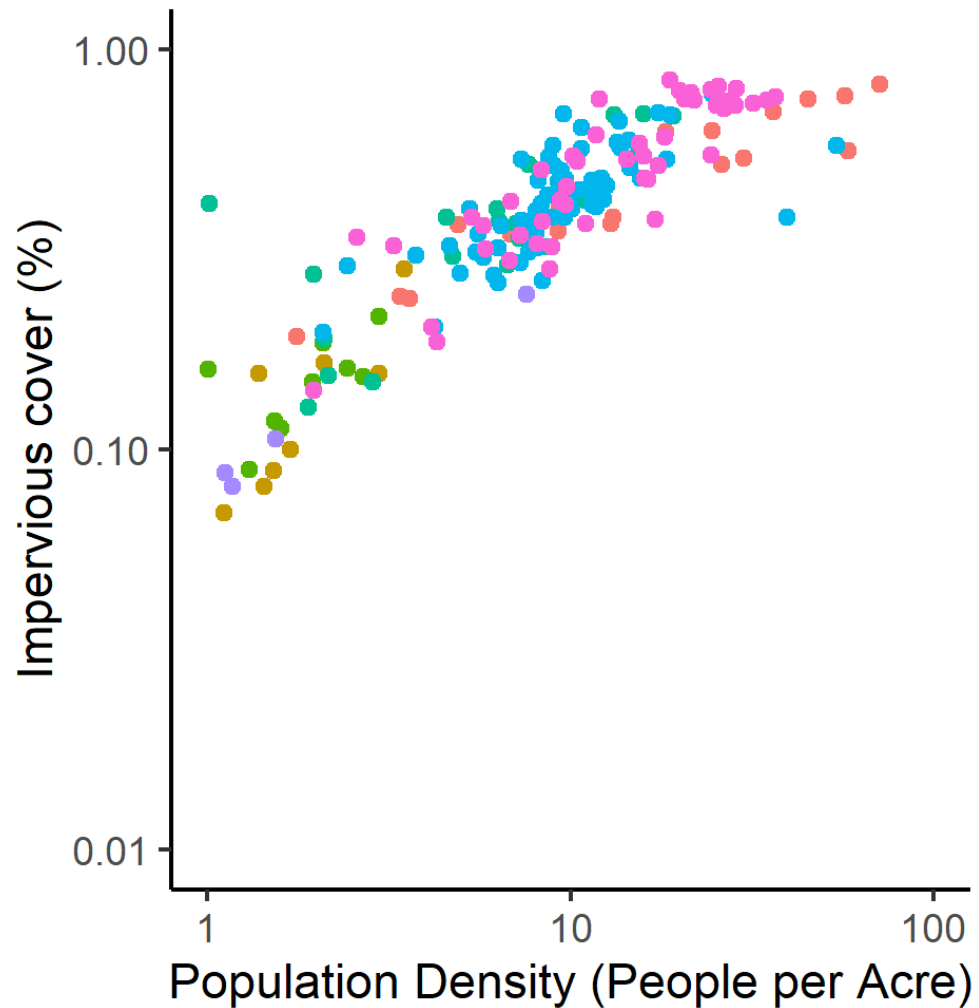
## Phosphorus Load & Summary Statistic



# Loading and Population (example)

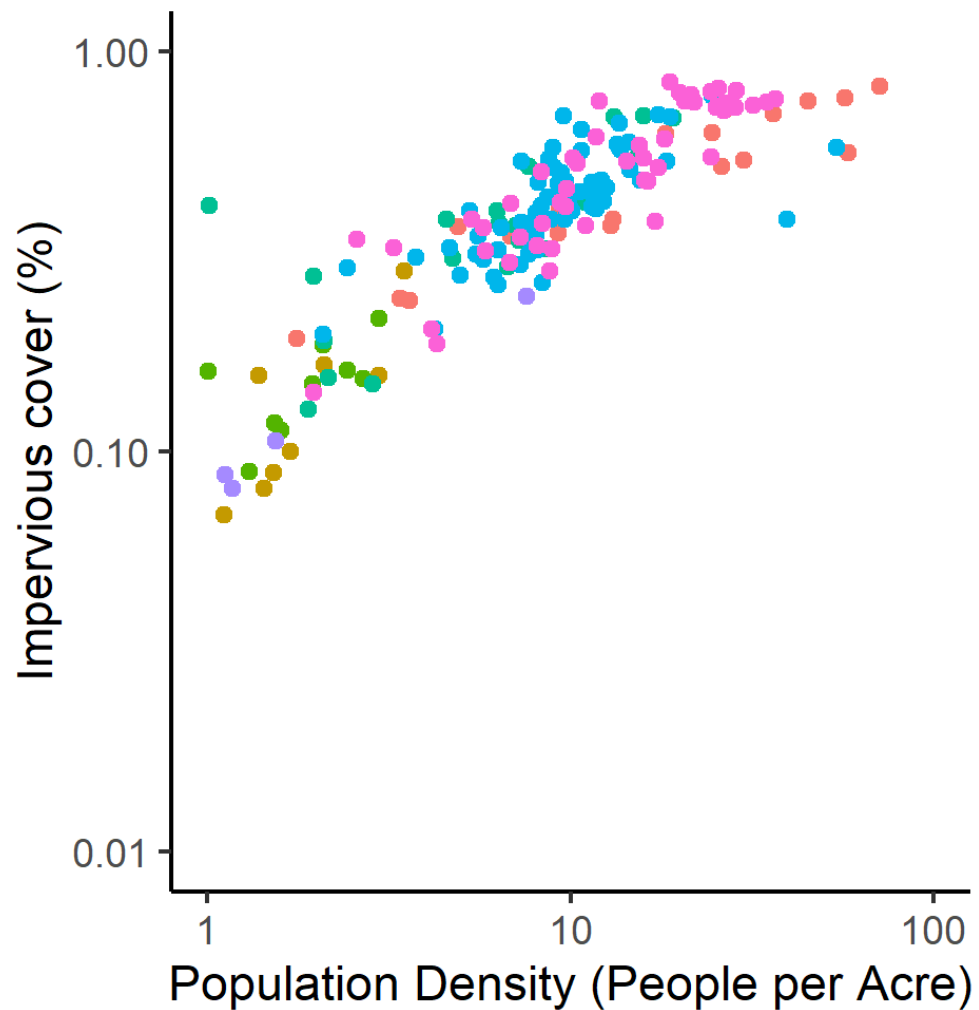


# Loading and Population (example)



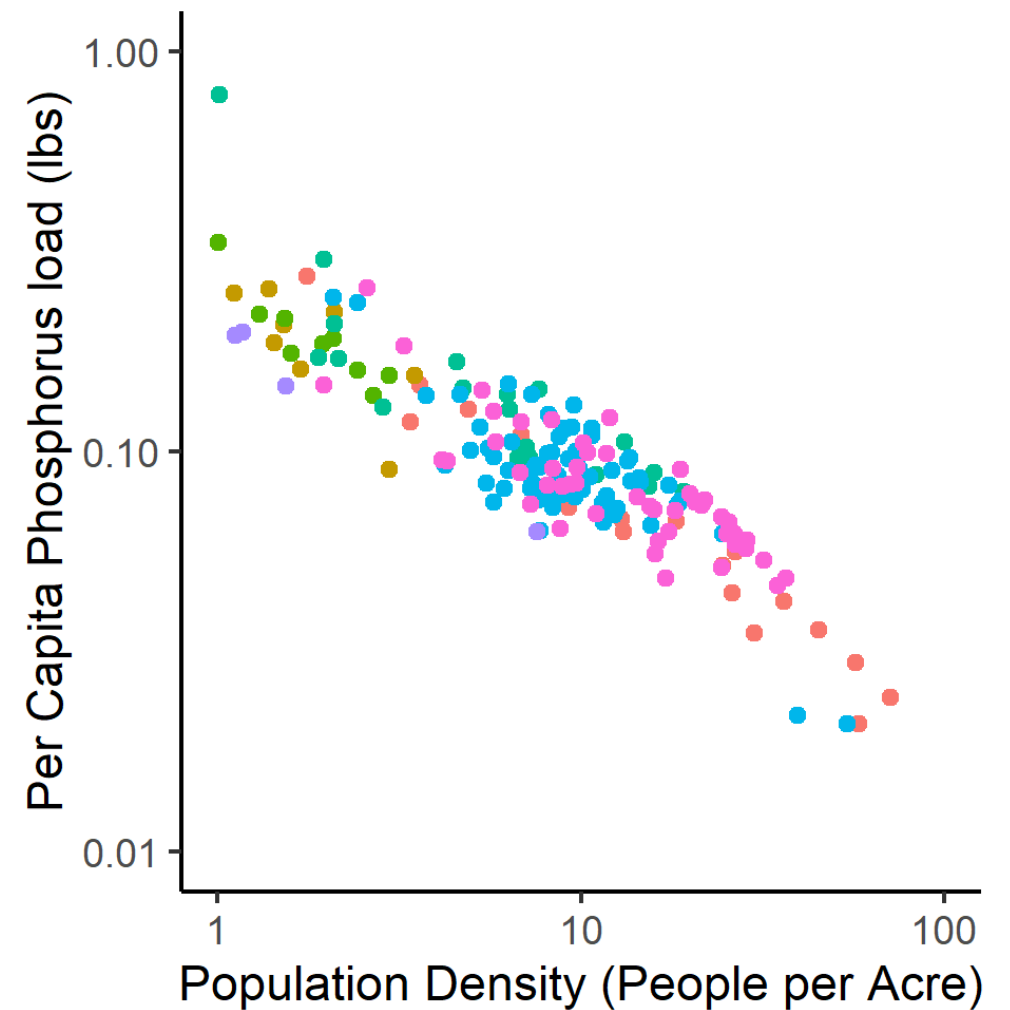


# Phosphorus and Population (example)

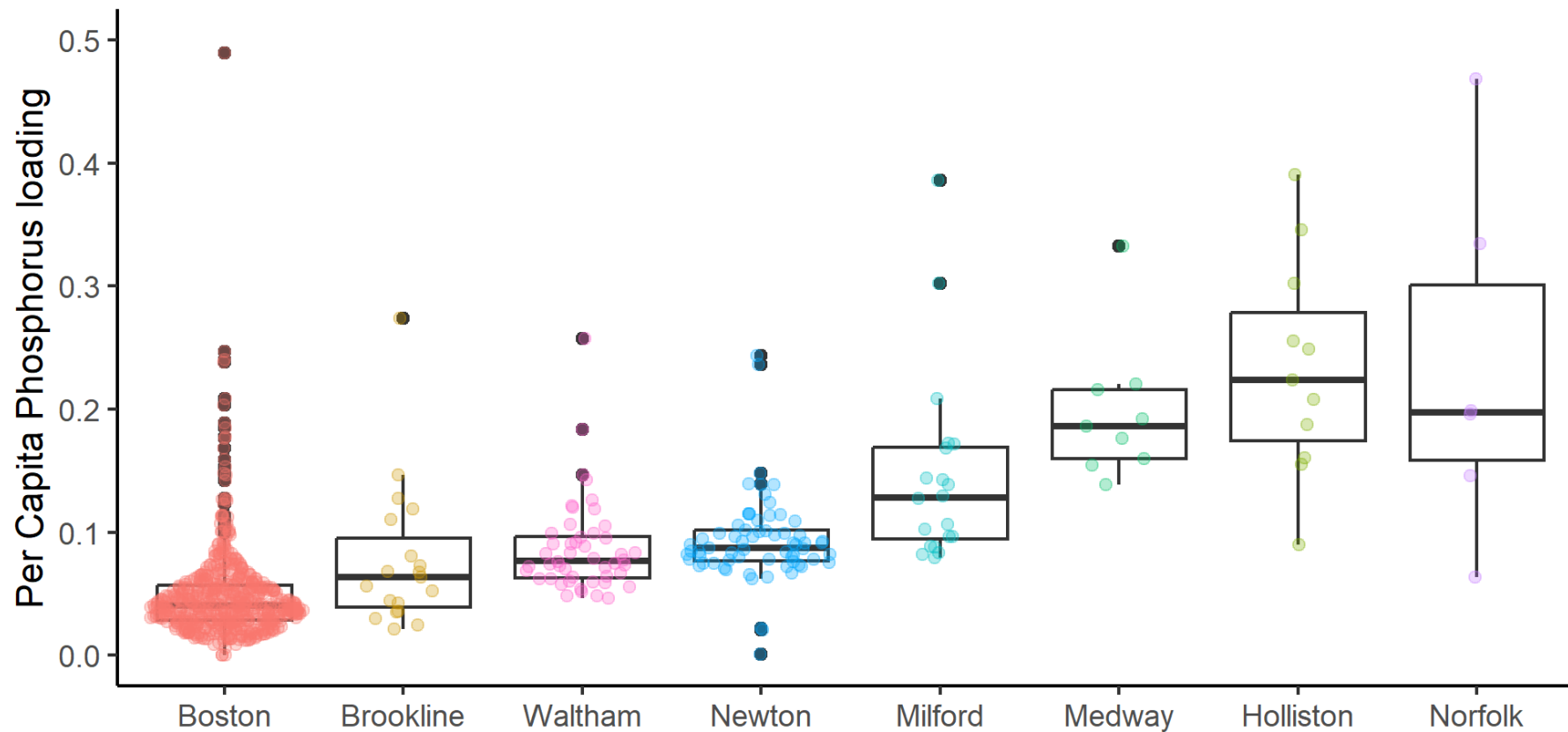


## Municipality

- Brookline
- Holliston
- Medway
- Milford
- Newton
- Norfolk
- Waltham

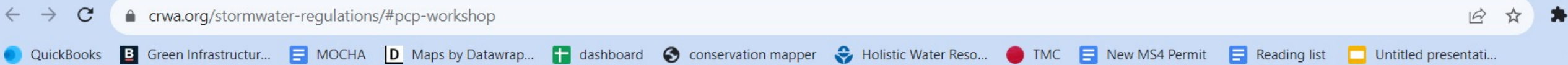


# Phosphorus and Population (example)



Median Per Capita P loading in Holliston is **6X** that of Boston

# Accessing the data




## Helping Cities & Towns Reduce Phosphorus:

In 2022, we hosted a workshop series to help municipal leaders create plans for reducing phosphorus pollution to meet the [Massachusetts Municipal Stormwater \(MS4\) permit](#) over the coming years with funding from [MA Department of Environmental Protection \(DEP\)](#) and experts from EPA and engineering firm [Brown & Caldwell](#).

[Workshop #1: Baseline Loads](#) 

[Workshop #2: Non-Structural & Private BMPs](#) 

[Workshop #3: Public BMPs](#) 

[Question & Answer Session](#) 

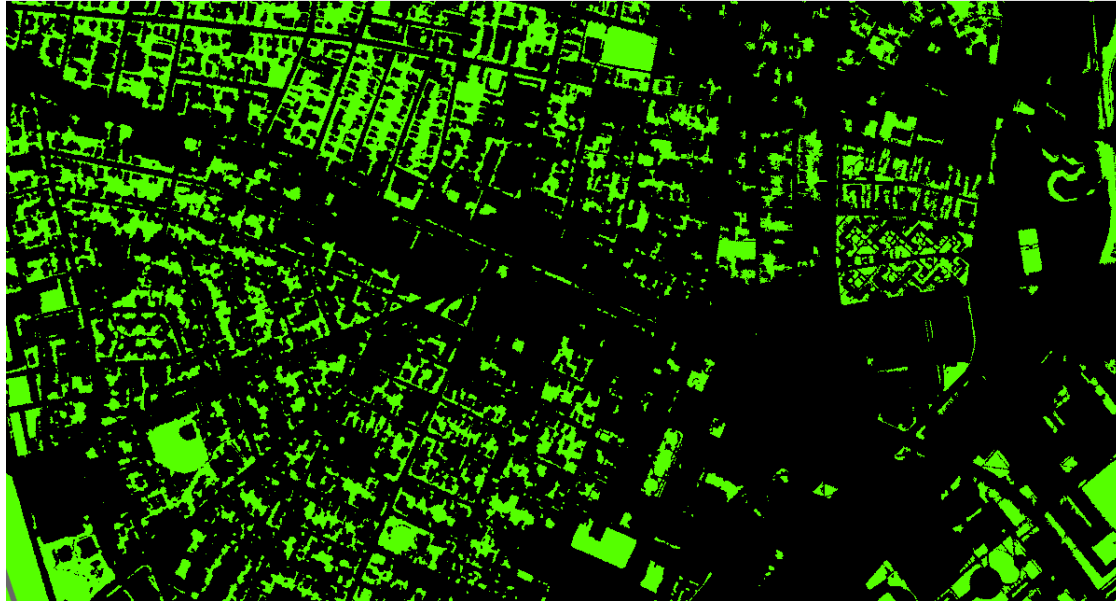
[Phosphorus Control Planning \(PCP\) Templates](#) 

[Updated Land Use + Land Cover Maps](#) 

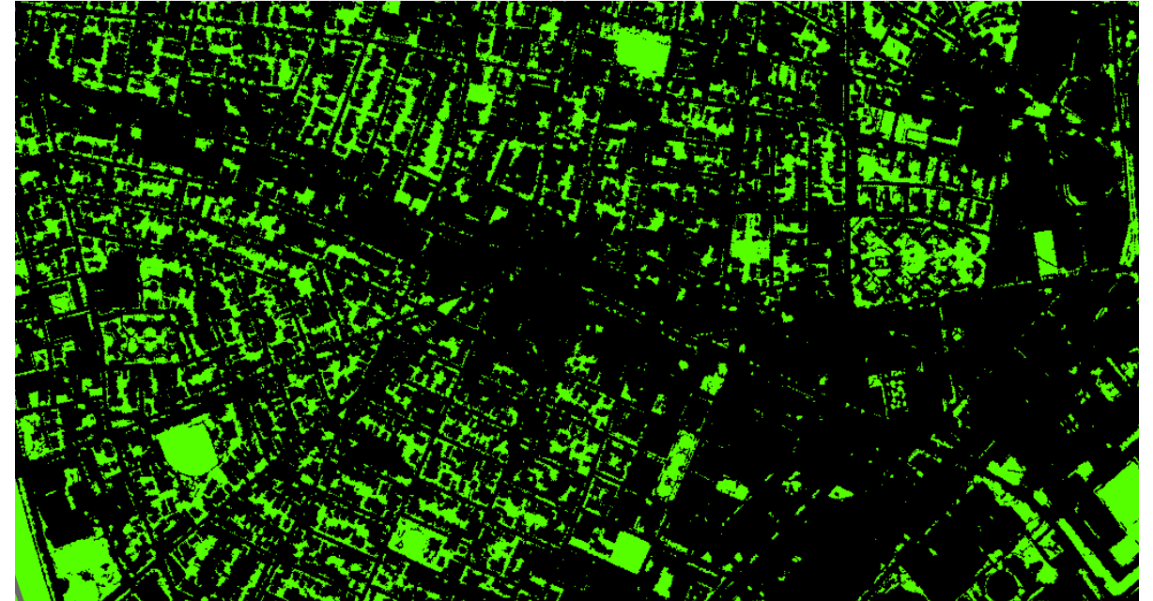


# Change in Impervious Cover

2005



2021

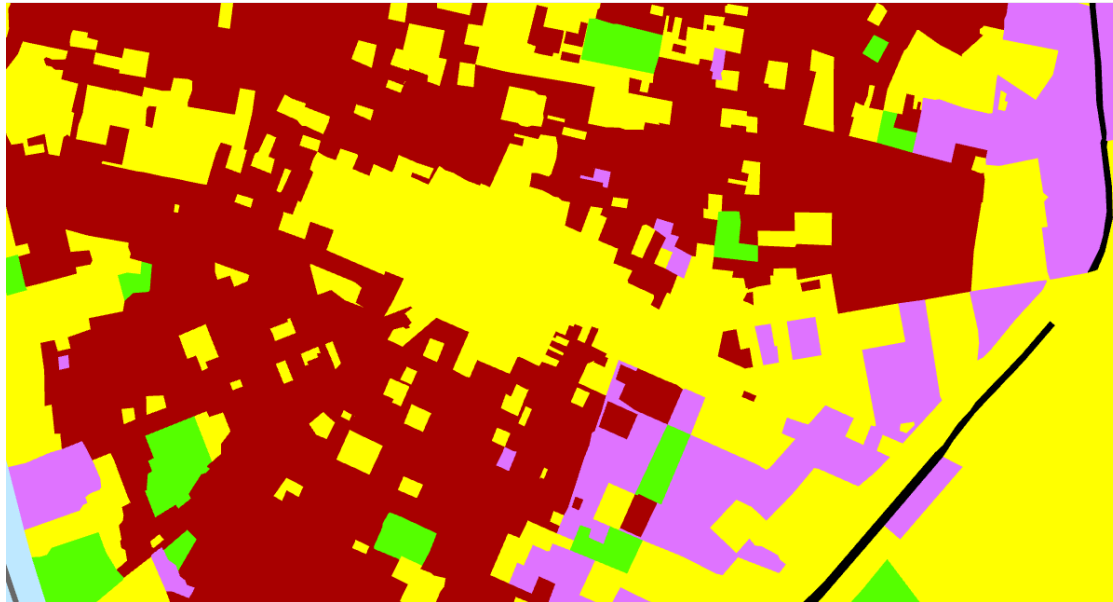


1.2% increase

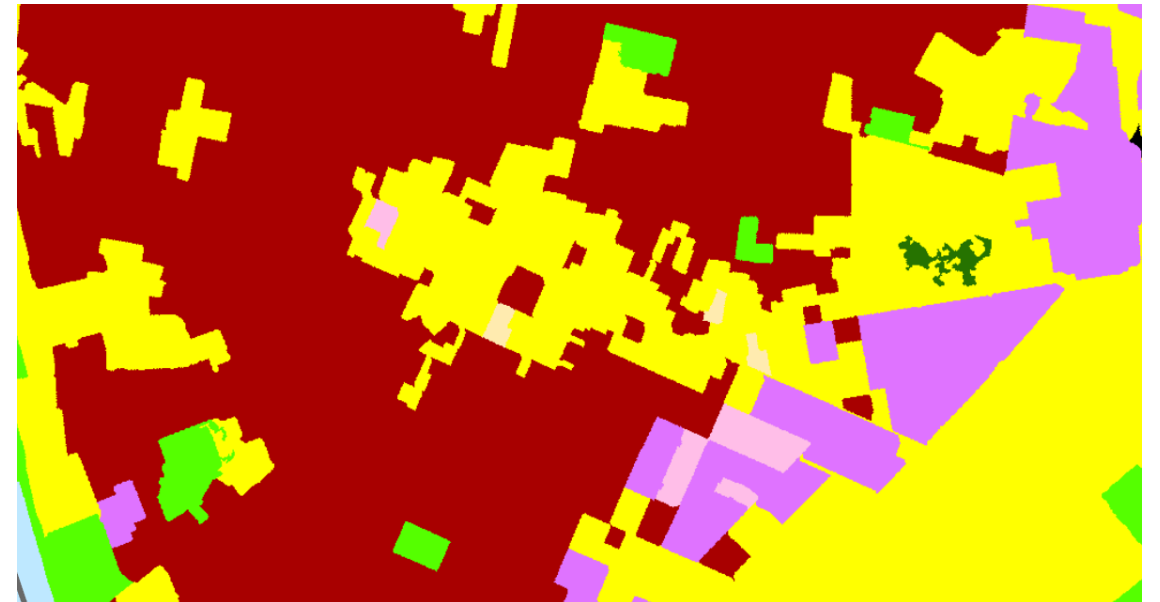


# Change in Land Use

2005

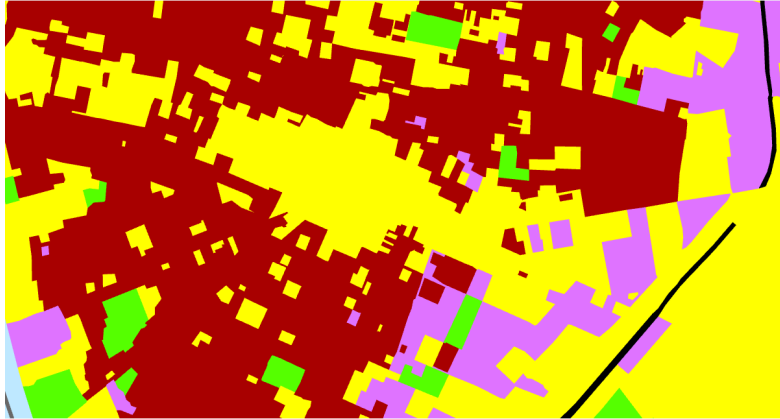


2021

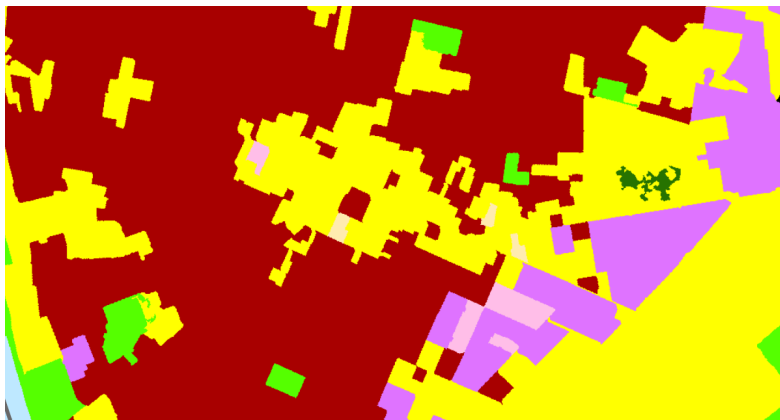


# Change in Land Use

2005



2021



Summary Table: Land Use Change from 2005 to 2021

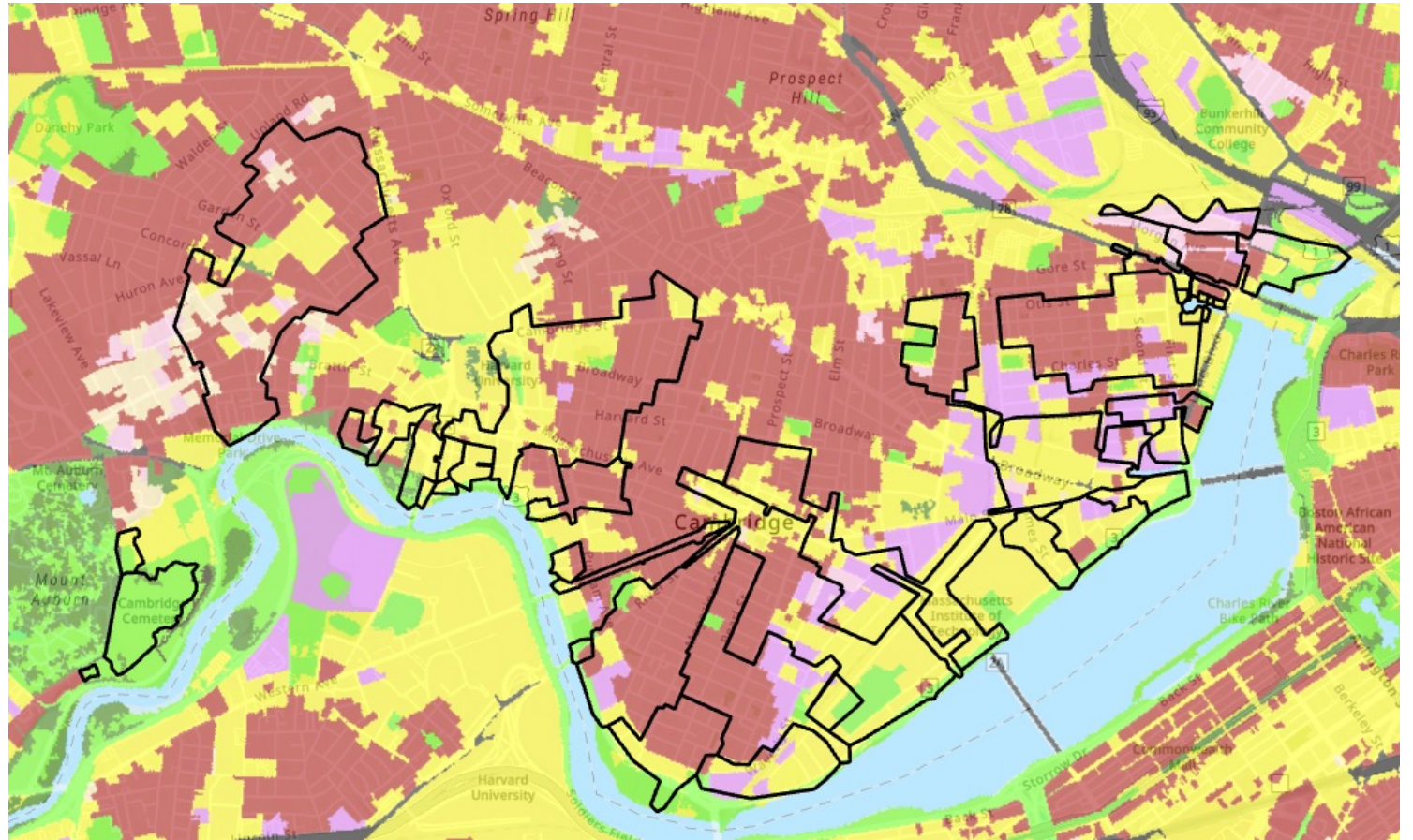
	2005 (Acres)	2021 (Acres)	Change (Acres)
Commercial	805	663	-142
Forest	4	18	14
High Density Residential	605	721	116
Highway	24	5	-19
Industrial	137	104	-33
Low Density Residential	3	28	26
Medium Density Residential	14	33	19
Open Land	61	82	21
Water	2	1	-1
<b>Total Area (Acres)</b>	<b>1654</b>	<b>1654</b>	<b>0</b>





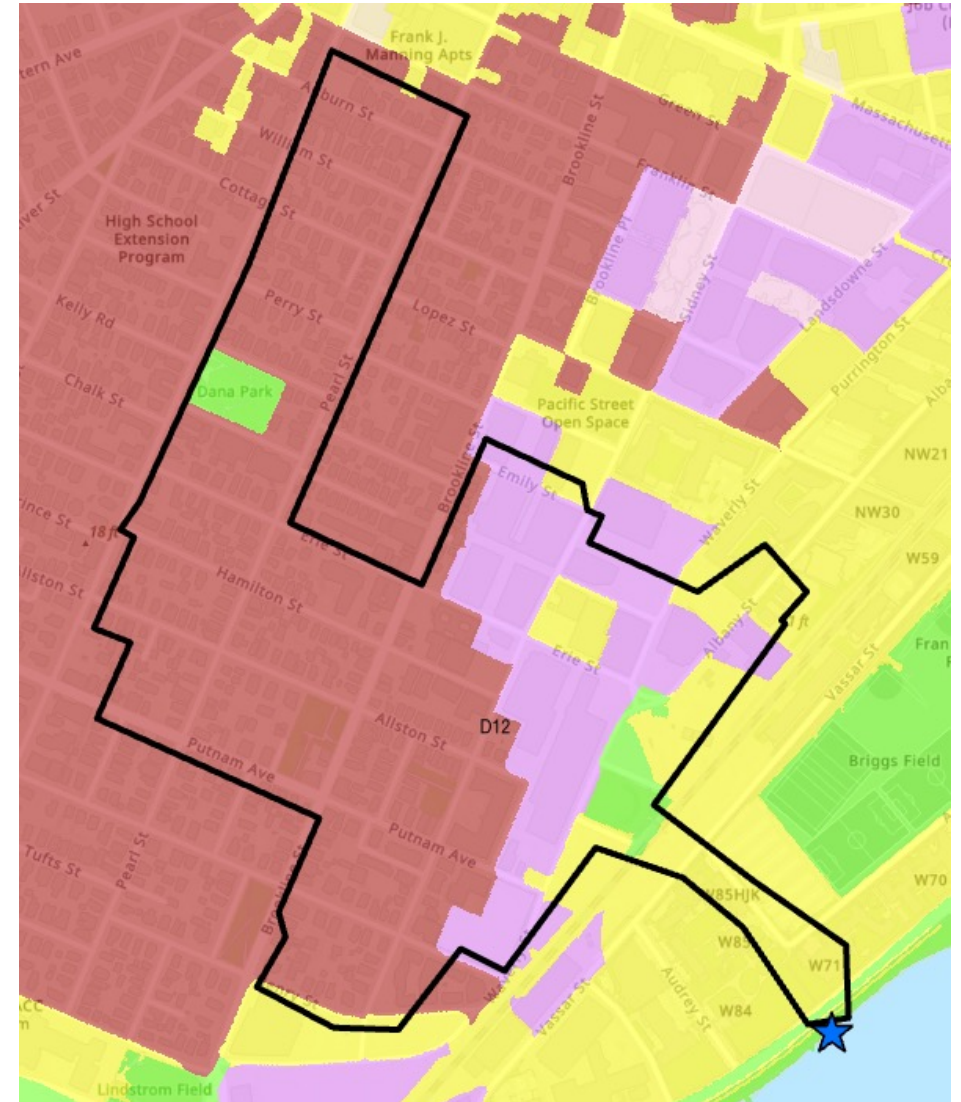
# Phosphorus Loading

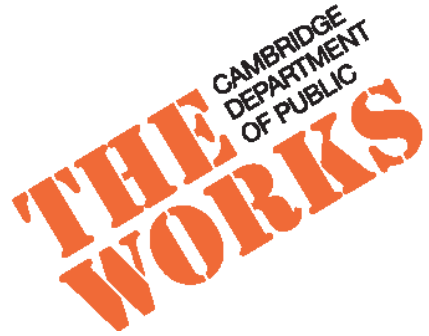
- 2021 Load: 2,424 lbs P/yr
- 6% increase from baseline



# Phosphorus Loading

- Calculate load for individual outfall catchments
- Evaluate reduction from treatment options to support cost benefit analysis





# Cambria Ung

Stormwater Program Manager

[cung@cambridgema.gov](mailto:cung@cambridgema.gov)

617.349.9730



1. Use the data!
2. Understanding change throughout the watershed.
3. Open Source process to simplify loading calculations?
4. Regular LULC updates coordinated with MS4 reporting timeline?



Thank You

