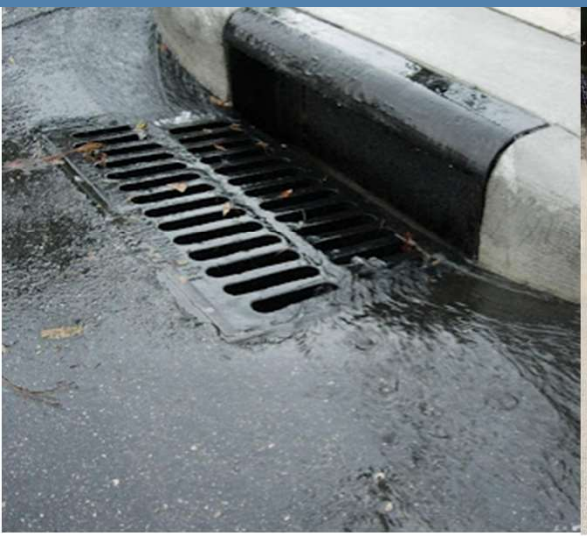
FY22 MS4 Municipal Assistance Grant
Continued Phosphorous Control Planning and Initiation of Implementation

Workshop #1: All About the Loads: Baseline Loads



March 8, 2022
1:00 PM to 2:30 PM

Brown AND Caldwell

Charles River Watershed Association

Charles River Watershed Association

CRWA's mission is to protect, restore, and enhance the Charles River and its watershed through science, advocacy, and law.

- Founded in 1965 by concerned citizens
- One of oldest watershed associations in the country
- Work with EPA, state agencies, and 35 watershed municipalities
- Interdisciplinary staff
- Program Areas:
  - River Science
  - Stormwater
  - Climate Change Adaptation
  - Law, Advocacy, and Policy





Today's Agenda

1:00 PM Welcome & Introductions

1:10 PM Technical Presentation

2:00 PM Breakout Rooms

- Room #1: Charles River Communities – discussion on potential impact of EPA's pending Residual Designation Authority (RDA) on required reduction goals
- Room #2: Lakes and Ponds Communities – Understanding your calculations

2:10 PM Open Discussion and Q&A

2:25 PM Next Steps

2:30 PM Adjourn

Feel free to use the chat during the Technical Presentation

During the open discussion and Q&A please use the "**Raise Hand**" Feature and you will be called on

Welcome & Introductions

Project Team

Charles River Watershed Association

Julie Wood
DEPUTY DIRECTOR

Julia Hopkins
COMMUNICATIONS & OUTREACH MANAGER

Brown AND Caldwell

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MassDEP:
Laura Schiffman, Ph.D., STATEWIDE STORMWATER PROGRAM COORDINATOR

U.S. EPA:
Newton Tedder,
SENIOR PERMIT WRITER, STORMWATER AND CONSTRUCTION SECTION

A brief word from EPA & MassDEP

Welcome & Introductions

Project Overview

Help communities subject to the MS4GP Appendix F related to TMDLs for phosphorus in the Charles River Watershed and watersheds of various lakes and ponds throughout Massachusetts

- Funded by a MassDEP FY22 MS4 Municipal Assistance Grant
- Furthering Phosphorus Control Plan (PCP) templates developed during FY21
- Content based on input from a survey sent out by CRWA in preparation of the grant application
- Series of workshops with technical matter & community to community information sharing
- Cost-benefit resource based on recent real-world examples in Massachusetts

Project Goals

- Support compliance with MS4 General Permit
- Facilitate information sharing
- Provide cost-benefit reference
- Share talking points to garner support for MS4, specifically phosphorus reduction, efforts
- Provide strategies for incorporating climate vulnerable and EJ communities into MS4 efforts

Overview of Workshop Series

Workshop Title	Date & Time	Key Goals
Workshop 1: All About the Loads – Baseline Loads, Impact from EPA's RDA	3/8 1-3pm	✔ Provide baseline load methodology ✔ Updating baseline load due to development ✔ Update and discuss RDA
Workshop 2: Private BMPs – How to Get Credits, and Managing with Non-structural Controls	4/5 1-3pm	✔ Provide methodology for tracking non-structural BMPs ✔ Review data requirements for private BMP tracking ✔ Best-practices open forum ✔ Regulatory guidance
Workshop 3: Public BMPs – Maximizing the Cost-Benefit Equation	5/10 1-3pm	✔ Present updated BMP cost data ✔ Panel discussion on public BMP wins
Q&A	5/24 1-3pm	✔ Ask regulators questions about the Permit and Phosphorus Control Planning

How does this information fit into the PCP?

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CRWA developed phosphorus control plan resources, including a template which communities can use to complete upcoming MS4 Permit requirements

- Find them on our website at: https://www.crwa.org/phosphorus-control-planning-support.html

Poll Questions for Workshop 1

I personally would consider myself this familiar with the MS4 General Permit Appendix F requirements as they relate to my municipality **(single choice):**	What is your community's progress preparing the written PCP due by June 30, 2023 (end of Permit Year 5) **(multiple choice)?**	What piece of the PCP do you hope to get help with from these workshops **(multiple choice)**?
• Not familiar at all • Somewhat familiar • Very familiar but I have to re-check the permit • I could transcribe the permit in my sleep	• Not started • Outlined • Pieces developed as required by the permit (e.g., legal analysis, funding source assessment) • In process with permit year 4 requirements • Started permit year 5 requirements (planned structural and non structural BMPs, implementation schedule, costs, etc. • Started implementation of non-structural • Started trying structural BMPs	• Select PCP area (entire watershed or urbanized area only) • Understanding EPA's calculations • When to update your baseline and submit to EPA • How to get non-structural BMP credits • Understanding cost/benefit and how that feeds into implementation schedule • O&M of private BMPs • Data tracking and information management • Recent cost estimates from other communities

Poll Results

I personally would consider myself this familiar with the MS4 General Permit Appendix F requirements as they relate to my municipality **(single choice):**	What is your community's progress preparing the written PCP due by June 30, 2023 (end of Permit Year 5) **(multiple choice)?**	What piece of the PCP do you hope to get help with from these workshops **(multiple choice)**?
• 2/54 Not familiar at all • 27/54 Somewhat familiar • 22/54 Very familiar but I have to re-check the permit • 3/54 I could transcribe the permit in my sleep	• 4/50 Not started • 11/50 Outlined • 13/50 Pieces developed as required by the permit (e.g., legal analysis, funding source assessment) • 24/50 In process with permit year 4 requirements • 7/50 Started permit year 5 requirements (planned structural and non structural BMPs, implementation schedule, costs, etc. • 6/50 Started implementation of non-structural • 5/50 Started trying structural BMPs	• 4/53 Select PCP area (entire watershed or urbanized area only) • 19/53 Understanding EPA's calculations • 5/53 When to update your baseline and submit to EPA • 6/53 How to get non-structural BMP credits • 10/53 Understanding cost/benefit and how that feeds into implementation schedule • 1/53 O&M of private BMPs • 3/53 Data tracking and information management • 5/53 Recent cost estimates from other communities

Workshops Focused on Understanding the Phosphorus Control Requirements of MS4 Permit

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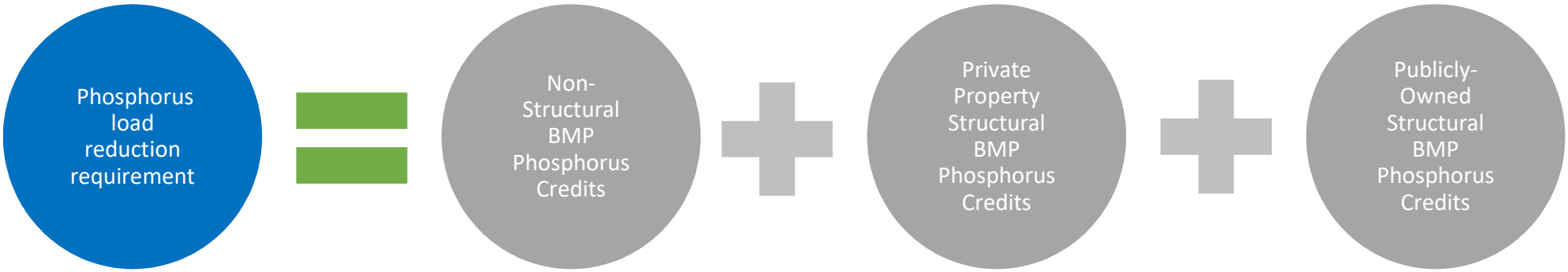
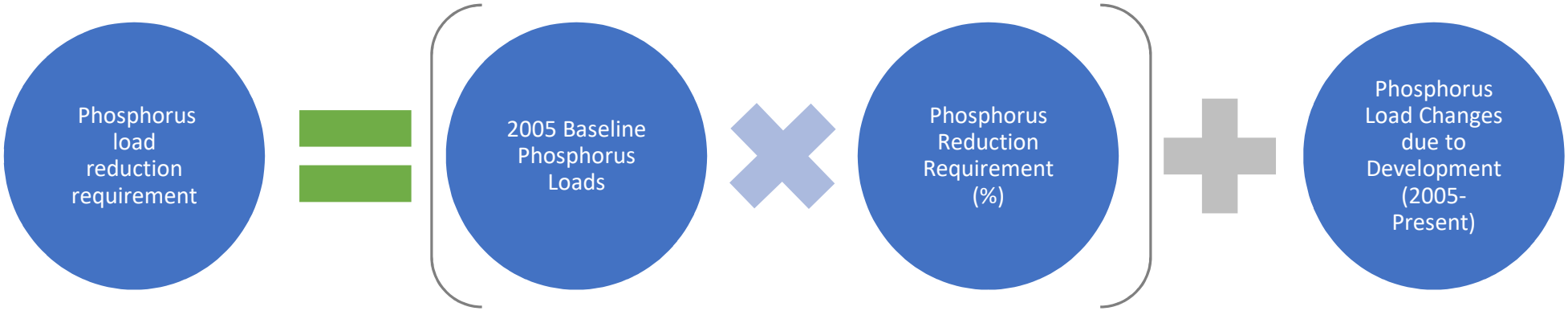
Workshop 1

Workshop 2

Workshop 3



Phosphorus Load Reduction Requirements



Baseline Phosphorus Load Reduction Requirements - Charles River Communities

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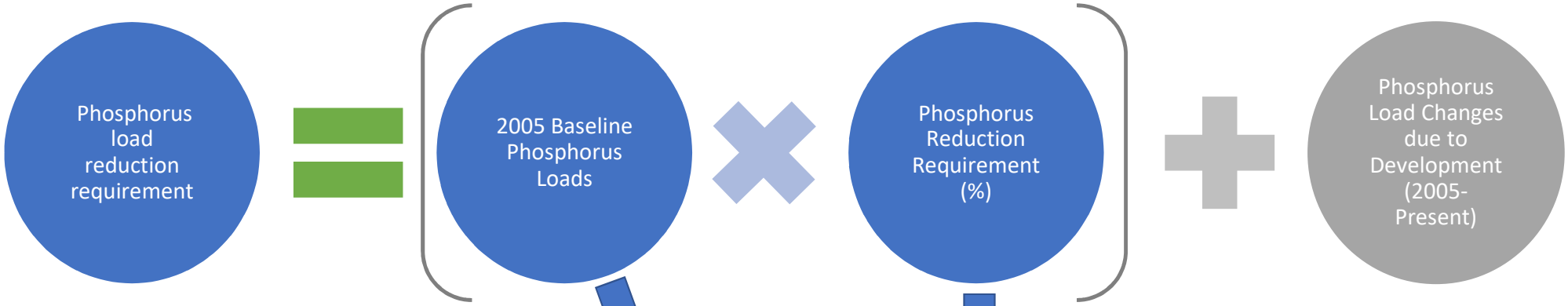

Charles River Communities 2005 Baseline and Reduction Requirement both given

Community	Baseline Phosphorus Load, kg/yr	Stormwater Phosphorus Load Reduction Requirement kg/yr	Allowable Phosphorus Load, kg/yr	Stormwater Percent Reduction in Phosphorus Load (%)
Arlington	106	68	38	64%
Ashland	67	28	39	42%
Bellingham	947	398	549	42%
Belmont	202	105	97	52%
Boston[9]	6886	4145	2741	60%
Brookline	1,635	968	667	59%
Cambridge	512	317	195	62%

Need to select PCP area:

- Jurisdictional area
- Urbanized area withing jurisdiction

Baseline Phosphorus Load Reduction Requirements - Lakes and Pond Communities

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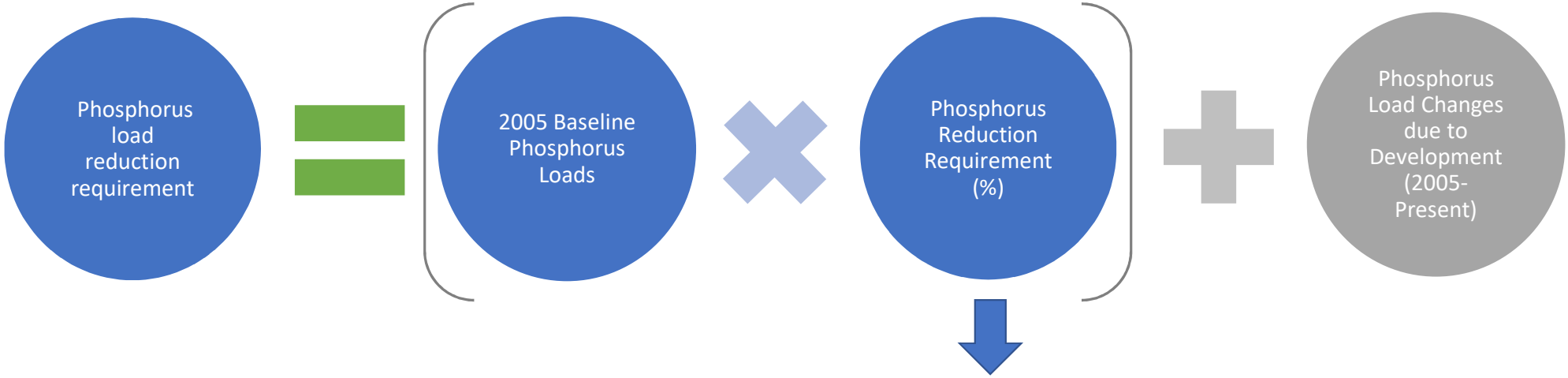

Watershed boundaries were not available when EPA developed the MS4 Permit

Lakes and Ponds Communities must calculate their own baseline phosphorus load

Lakes and Ponds: Only Reduction Requirement is given

Primary Municipality	Waterbody Name	Required Percent Reduction
Auburn	Leesville Pond	31%
	Auburn Pond	24%
	Eddy Pond	0%
	Pondville Pond	8%
	Stoneville Pond	3%
Charlton	Buffumville Lake	28%
	Dresser Hill Pond	17%
	Gore Pond	14%
	Granite Reservoir	11%
	Jones Pond	13%
	Pierpoint Meadow Pond	27%

Need to select LPCP area:

- Jurisdictional area in watershed
- Urbanized watershed area within jurisdictional
- (Urbanized stormwater catchment area)

Part 1: 2005 Baseline Phosphorus Loads

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Why is Workshop 1 focusing on baseline phosphorus loads?

- Phase 1 of PCP is due July 2023
  - Defining scope of Phosphorus Control Plan area is due this year
  - Lakes and Pond baseline loads are due this year
  - Charles River Communities that want to request revision to baseline loads should make this year
- Lakes and Ponds Communities – Need to perform these calculations
- Charles River Communities
  - May want to request a revision of their baseline loads
  - Transparency: Communities have the right to know how these values were calculated
  - MS4 Permit requires communities to determine changes in phosphorus loads due to development from 2005-present
    - MS4 Permit prescribes a project-by-project accounting approach to account for changes due to development
      - Heavy lift to do this for all development over the last 17 years
    - Alternative approach: use the same approach used to calculated baseline phosphorus loads with up-to-date GIS layers (e.g., impervious area, land use) to estimate loads for current conditions
      - Much easier to implement than the project-by-project approach

Charles River Communities May Request a Revision of the Baseline Phosphorus Load

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Revision request process discussed in Appendix F, page 5, 3rd paragraph (F.A.I.1.a.3)

- Communities may submit more accurate 2005 *land use* data to EPA
  - Impervious area?
  - DCR/DOT areas?
- Submit request (along with relevant data files) with year 4 annual report
- Proceed with existing reduction requirements in Permit until Permit is revised
- Benefits of estimating your baseline phosphorus load
  - Potential for reduction in baseline phosphorus load
  - Helpful for understanding where phosphorus is being generated
- Situations where revision request may be appropriate
  - EPA may not have identified all of the properties under jurisdictional control by another permittee

The Permittee may submit more accurate land use data from 2005, which is the year chosen as the baseline land use for the purposes of permit compliance, for EPA to recalculate baseline phosphorus stormwater loads for use in future permit reissuances. Updated land use maps, land areas, characteristics, and MS4 area and catchment delineations shall be submitted to EPA along with the year 4 annual report in electronic GIS data layer form for consideration for future permit requirements[5]. Until such a time as future permit requirements reflect information submitted in the year 4 annual report, the permittee shall use the Baseline Phosphorus Load, Stormwater Phosphorus Reduction Requirement and Allowable Phosphorus Load Table F-2 (if its PCP Area is the permittee's entire jurisdiction) or Table F-3 (if its PCP Area is the regulated area only) to calculate compliance with milestones for Phase 1, 2, and 3 of the PCP.

DCR and DOT Land Areas used to Develop Baseline Phosphorus Loads - Charles River Communities

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If DCR and DOT property areas in your community are less than the values in the table, you may want to request a revision of your baseline phosphorus load

Municipality	Urbanized Area Ownership (ac)				Nonurbanized Area Ownership (ac)				Total Area Ownership (ac)			
	Muni.	DCR	DOT	Total	Muni.	DCR	DOT	Total	Muni.	DCR	DOT	Total
Arlington	234	17	2	254	-	-	-	-	234	17	2	254
Ashland	405	-	1	405	-	-	-	-	405	-	1	405
Bellingham	4,823	-	188	5,011	1,109	-	0	1,110	5,932	-	188	6,120
Belmont	780	45	6	831	-	-	-	-	780	45	6	831
Boston	14,616	1	1	14,618	-	-	-	-	14,616	1	1	14,618
Brookline	4,194	86	43	4,322	-	-	-	-	4,194	86	43	4,322
Cambridge	845	103	28	976	-	-	-	-	845	103	28	976
Dedham	3,762	606	192	4,560	-	-	-	-	3,762	606	192	4,560
DoverU	2,366	168	0	2,533	5,379	222	-	5,601	7,744	390	0	8,134
Foxborough	12	-	0	13	-	-	-	-	12	-	0	13
Franklin	14,285	664	294	15,243	331	72	-	403	14,616	737	294	15,646
Holliston	10,119	-	34	10,153	1,775	-	-	1,775	11,894	-	34	11,928
Hopedale	683	-	11	694	2	-	-	2	685	-	11	696
Hopkinton	1,950	-	49	1,999	138	-	0	139	2,088	-	49	2,138
Lexington	2,695	47	342	3,083	37	-	-	37	2,732	47	342	3,120
Lincoln	3,317	-	1	3,318	2,159	-	-	2,159	5,476	-	1	5,477
Medfield	5,509	238	2	5,748	1,426	1	0	1,427	6,934	239	2	7,175
Medway	7,201	-	12	7,213	151	-	-	151	7,352	-	12	7,364
Mendon	39	-	5	43	157	-	1	157	196	-	5	201
Milford	6,328	2	316	6,646	1,400	-	53	1,453	7,727	2	369	8,099
Millis	3,522	-	0	3,522	4,179	-	0	4,179	7,701	-	0	7,702
Natick	5,227	2	53	5,282	823	-	-	823	6,049	2	53	6,104
Needham	7,181	470	228	7,878	8	0	-	8	7,189	470	228	7,887
Newton	10,885	285	238	11,408	-	-	-	-	10,885	285	238	11,408
Norfolk	9,410	117	5	9,532	29	-	-	29	9,438	117	5	9,561
Sherborn	1,764	-	-	1,764	6,219	0	-	6,220	7,983	0	-	7,984
Somerville	888	2	28	918	-	-	-	-	888	2	28	918
Walpole	1,403	-	5	1,407	-	-	-	-	1,403	-	5	1,407
Waltham	7,631	293	206	8,129	-	-	-	-	7,631	293	206	8,129
Watertown	2,248	92	8	2,348	-	-	-	-	2,248	92	8	2,348
Wayland	312	-	30	342	-	-	-	-	312	-	30	342
Wellesley	6,198	96	109	6,403	-	-	-	-	6,198	96	109	6,403
Weston	9,331	129	341	9,801	-	-	-	-	9,331	129	341	9,801
Westwood	2,060	1	68	2,128	240	-	-	240	2,300	1	68	2,369
Wrentham	4,654	90	180	4,924	613	43	11	667	5,267	133	191	5,591

Source:
Spreadsheet sent from Mark Voorhees to Matt Davis by email on 4/16/2021
Filename: 12 2015 CRW_LU_Imp_Analysis.xlsx
Worksheet: 'whle chls HSG comp PLER 12 2015'
Cells copied: A37:J3066

Development of Baseline Phosphorus Loads – Lake and Pond Communities

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Option 1

Use Methodology in 2016 MS4 Permit, Appendix F, Attachment 1

- Calculate area of each land use group in watershed catchment
- Multiply areas by phosphorus export loading rates (PLERs) in Table 1-1
- Table 1-1 makes a lot of assumptions about land use, impervious area, soil types that may or may not be representative of catchment

Option 2

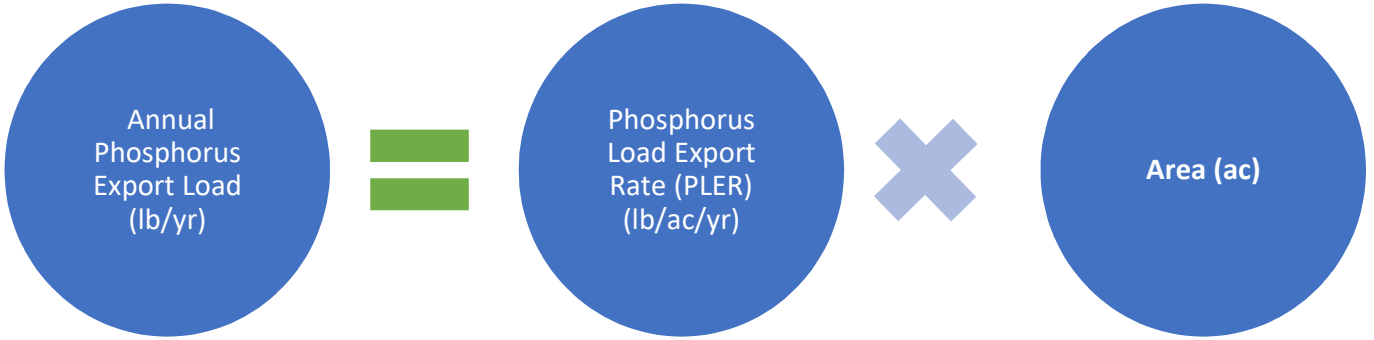
Use the Methodology EPA used for Charles River Communities and detailed in this workshop

- Note: Nutrient Source Identification Report Addendum: Methods (Neponset River Watershed Association, 2021) provides guidance on this process but some of its values need to be updated

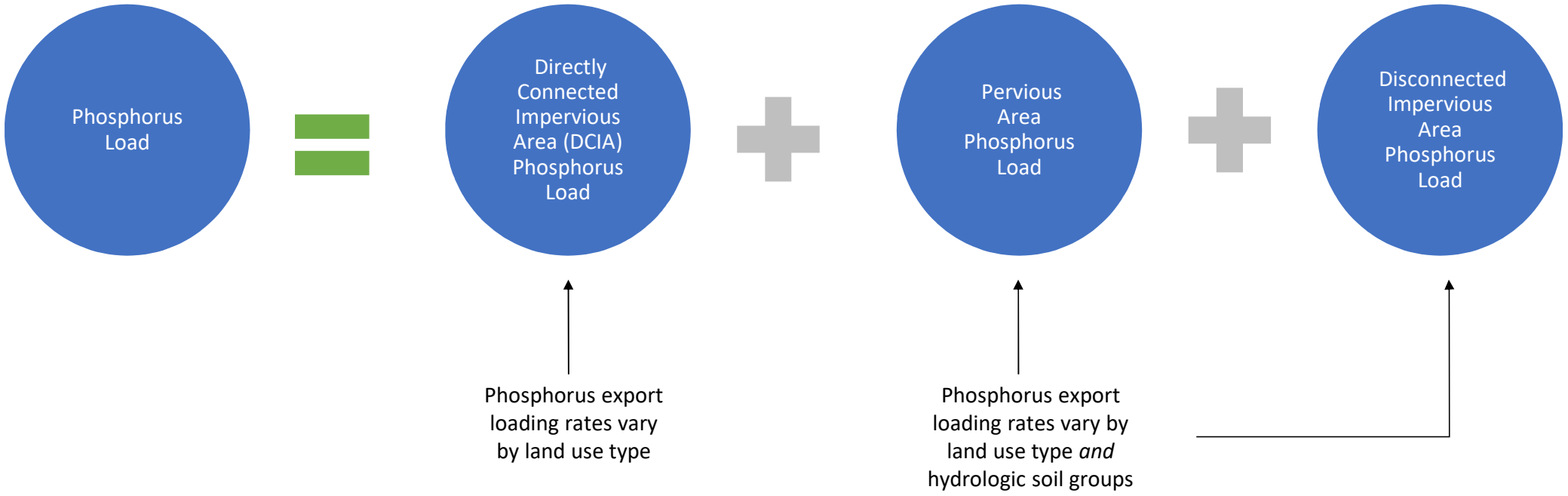
Table 1-1. Annual composite phosphorus load export rates

Land Cover	Representative DCIA, %	Composite PLERs, lb/ac/yr	Composite PLERs, kg/ha/yr
Commercial	57	1.13	1.27
Industrial	67	1.27	1.42
High Density Residential	36	1.04	1.16
Medium Density Residential	16	0.49	0.55
Low Density Residential	11	0.30	0.34
Freeway	44	0.73	0.82
Open Space	8	0.26	0.29
Agriculture	0.4	0.45	0.50
Forest	0.1	0.12	0.13

Basic Principle of Phosphorus Export Load Calculations



Loads Calculated Separately for DCIA and Pervious Areas



Phosphorus Export Rates by Land Uses and Soil Types

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Table 1-2: Proposed average annual distinct P Load export rates for use in estimating P Load reduction credits the MA MS4 Permit

Phosphorus Source Category by Land Use	Land Surface Cover	P Load Export Rate, lbs/acre/year	P Load Export Rate, kg/ha/yr
Commercial (Com) and Industrial (Ind)	Directly connected impervious	1.78	2.0
	Pervious	See* DevPERV	See* DevPERV
Multi-Family (MFR) and High-Density Residential (HDR)	Directly connected impervious	2.32	2.6
	Pervious	See* DevPERV	See* DevPERV
Medium -Density Residential (MDR)	Directly connected impervious	1.96	2.2
	Pervious	See* DevPERV	See* DevPERV
Low Density Residential (LDR) - "Rural"	Directly connected impervious	1.52	1.7
	Pervious	See* DevPERV	See* DevPERV
Highway (HWY)	Directly connected impervious	1.34	1.5
	Pervious	See* DevPERV	See* DevPERV
Forest (For)	Directly connected impervious	1.52	1.7
	Pervious	0.13	0.13
Open Land (Open)	Directly connected impervious	1.52	1.7
	Pervious	See* DevPERV	See* DevPERV
Agriculture (Ag)	Directly connected impervious	1.52	1.7
	Pervious	0.45	0.5
*Developed Land Pervious (DevPERV)- Hydrologic Soil Group A	Pervious	0.03	0.03
*Developed Land Pervious (DevPERV)- Hydrologic Soil Group B	Pervious	0.12	0.13
*Developed Land Pervious (DevPERV) - Hydrologic Soil Group C	Pervious	0.21	0.24
*Developed Land Pervious (DevPERV) - Hydrologic Soil Group C/D	Pervious	0.29	0.33
*Developed Land Pervious (DevPERV) - Hydrologic Soil Group D	Pervious	0.37	0.41

Source: MA MS4 Permit Appendix F, Attachment 1

Phosphorus Loading Rates from Table 1-2 (Reformatted)

P Land Use Code Description	P Loading Export Rate (lb/ac/yr)					
	Directly Connected Impervious Area	Pervious Area				
		HSG A	HSG B	HSG C	HSG C/D	HSG D
Commercial	1.78	0.03	0.12	0.21	0.29	0.37
Industrial	1.78	0.03	0.12	0.21	0.29	0.37
High-density residential	2.32	0.03	0.12	0.21	0.29	0.37
Medium-density residential	1.96	0.03	0.12	0.21	0.29	0.37
Low-density residential	1.52	0.03	0.12	0.21	0.29	0.37
Highway	1.34	0.03	0.12	0.21	0.29	0.37
Forest	1.52	0.13	0.13	0.13	0.13	0.13
Open land	1.52	0.03	0.12	0.21	0.29	0.37
Agriculture	1.52	0.45	0.45	0.45	0.45	0.45

By the way, don't use these values for baseline phosphorus estimates. (More on this later)

Goal: Populate Area Values in this Table

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P Land Use Code Description	Area (ac)								
	Total	Impervious	Pervious HSG A	Pervious HSG B	Pervious HSG C	Pervious HSG C/D	Pervious HSG D	Pervious HSG Unknown	Pervious Total
Commercial	504.9	362.0	37.1	14.4	35.4	1.1	54.9	0.0	142.9
Industrial	149.7	147.8	0.4	0.2	0.4	0.0	0.6	0.0	1.8
High-density residential	84.3	51.5	5.1	2.0	4.8	0.2	7.5	0.0	32.8
Medium-density residential	92.0	57.7	8.4	3.3	8.0	0.3	12.5	0.0	34.3
Low-density residential	59.3	47.4	2.6	1.0	2.5	0.1	3.9	0.0	11.8
Highway	389.0	211.6	44.3	17.3	42.3	1.3	65.6	0.0	177.4
Forest	873.4	601.6	81.9	31.9	78.1	2.5	121.2	0.0	271.8
Open land	939.2	630.6	65.0	25.3	61.9	1.9	96.1	0.0	308.6
Agriculture	563.7	311.5	38.7	15.1	36.9	1.2	57.3	0.0	252.2

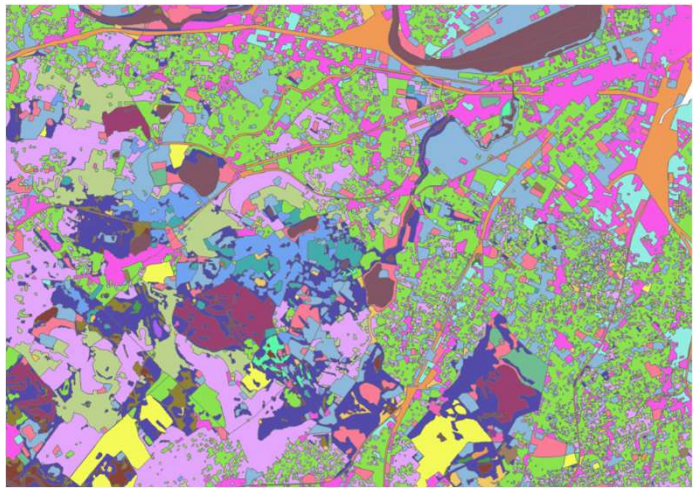
After these values are developed, they can be plugged into the table that generates the Phosphorus Export Loads. Populate this table and the hard work is done.

Use GIS Data to Calculate Areas for 2005 Conditions

Land Use	MassGIS Data: Land Use (2005) | Mass.gov
Soil Types	MassGIS Data: Soils SSURGO-Certified NRCS | Mass.gov
Impervious Surface	MassGIS Data: Impervious Surface 2005 | Mass.gov
Areas to ignore (MassDOT, DCR properties)	MassGIS Data: Department of Conservation and Recreation Roads & Trails | Mass.gov MassGIS Data: Massachusetts Department of Transportation (MassDOT) Roads | Mass.gov Other (e.g., combined sewer area, non-urbanized area)
Municipal Boundaries	MassGIS Data: Municipalities | Mass.gov

Start by Clipping Land Use and Soil GIS Layers to Area of Interest

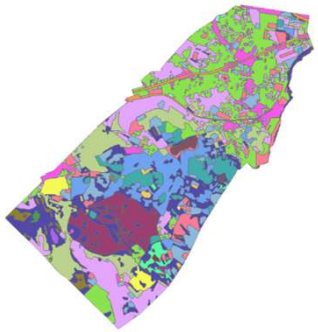
Land Use



Municipal Boundary (Brookline)

Clip Operation

Brookline Land Use



Note: If your PCP Area is your urbanized area, clip to your municipal urbanized area

Need to Reconcile MassGIS Land Use Codes with EPA Phosphorus Land Use

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Charles River Watershed Association

MassGIS 2005 Land Use GIS Layer has 33 different land use types

but

Phosphorus load export rates are available for 10 land use types

FID	Shape	LU05_DESC	LUCODE
0	Polygon	Non-Forested Wetland	4
1	Polygon	Forest	3
2	Polygon	Open Land	6
3	Polygon	Non-Forested Wetland	4
4	Polygon	Forested Wetland	37
5	Polygon	Non-Forested Wetland	4
6	Polygon	Forested Wetland	37
7	Polygon	Very Low Density Residential	38
8	Polygon	Cropland	1
9	Polygon	Water	20
10	Polygon	Forest	3
11	Polygon	Cropland	1
12	Polygon	Very Low Density Residential	38
13	Polygon	Open Land	6
14	Polygon	Very Low Density Residential	38
15	Polygon	Very Low Density Residential	38
16	Polygon	Very Low Density Residential	38
17	Polygon	Non-Forested Wetland	4
18	Polygon	Non-Forested Wetland	4
19	Polygon	Forest	3

Table 1-2: Proposed average annual distinct P Load export rates for use in estimating P Load reduction credits the MA MS4 Permit

Phosphorus Source Category by Land Use	Land Surface Cover	P Load Export Rate, lbs/acre/year	P Load Export Rate, kg/ha/yr
Commercial (Com) and Industrial (Ind)	Directly connected impervious	1.78	2.0
	Pervious	See* DevPERV	See* DevPERV
Multi-Family (MFR) and High-Density Residential (HDR)	Directly connected impervious	2.32	2.6
	Pervious	See* DevPERV	See* DevPERV
Medium -Density Residential (MDR)	Directly connected impervious	1.96	2.2
	Pervious	See* DevPERV	See* DevPERV
Low Density Residential (LDR) - "Rural"	Directly connected impervious	1.52	1.7
	Pervious	See* DevPERV	See* DevPERV
Highway (HWY)	Directly connected impervious	1.34	1.5
	Pervious	See* DevPERV	See* DevPERV
Forest (For)	Directly connected impervious	1.52	1.7
	Pervious	0.13	0.13
Open Land (Open)	Directly connected impervious	1.52	1.7
	Pervious	See* DevPERV	See* DevPERV
Agriculture (Ag)	Directly connected impervious	1.52	1.7
	Pervious	0.45	0.5

Use MS4 Permit, Appendix F, Attachment 1, Table 1-3 for Cross-Reference

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Table 1-3: Crosswalk of MassGIS land-use categories to land-use groups for P Load Calculations

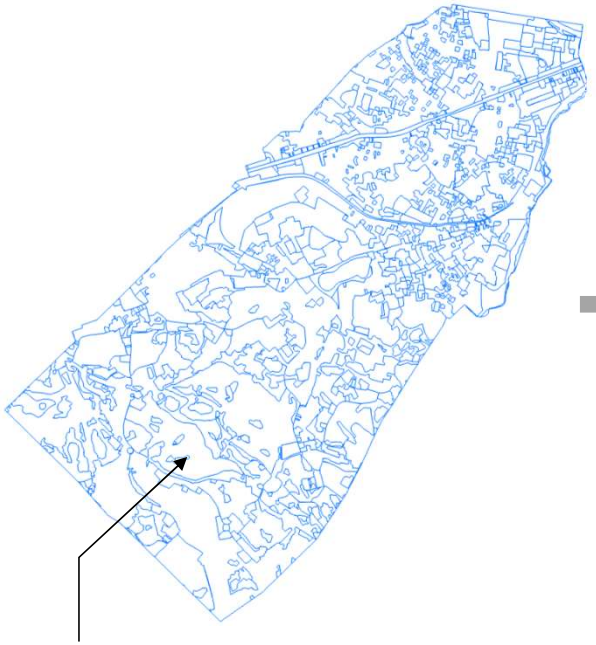
Mass GIS Land Use LU_CODE	Description	Land Use group for calculating P Load - 2013/14 MA MS4
1	Crop Land	Agriculture
2	Pasture (active)	Agriculture
3	Forest	Forest
4	Wetland	Forest
5	Mining	Industrial
6	Open Land includes inactive pasture	open land
7	Participation Recreation	open land
8	spectator recreation	open land
9	Water Based Recreation	open land
10	Multi-Family Residential	High Density Residential
11	High Density Residential	High Density Residential
12	Medium Density Residential	Medium Density Residential
13	Low Density Residential	Low Density Residential
14	Saltwater Wetland	Water
15	Commercial	Commercial
16	Industrial	Industrial
17	Urban Open	open land
18	Transportation	Highway
19	Waste Disposal	Industrial
20	Water	Water
23	cranberry bog	Agriculture
24	Powerline	open land
25	Saltwater Sandy Beach	open land
26	Golf Course	Agriculture
29	Marina	Commercial
31	Urban Public	Commercial
34	Cemetery	open land
35	Orchard	Forest
36	Nursery	Agriculture
37	Forested Wetland	Forest
38	Very Low Density residential	Low Density Residential
39	Junkyards	Industrial
40	Brush land/Successional	Forest

Add EPA Phosphorus Land Use Groups (PLUG) to MassGIS 2005 Land Use GIS Layer

FID	Shape	LU05_DESC	LUCODE	PLUG
0	Polygon	Non-Forested Wetland	4	Forest
1	Polygon	Forest	3	Forest
2	Polygon	Open Land	6	Open Land
3	Polygon	Non-Forested Wetland	4	Forest
4	Polygon	Forested Wetland	37	Forest
5	Polygon	Non-Forested Wetland	4	Forest
6	Polygon	Forested Wetland	37	Forest
7	Polygon	Very Low Density Residential	38	Low-Density Residential
8	Polygon	Cropland	1	Agriculture
9	Polygon	Water	20	Water
10	Polygon	Forest	3	Forest
11	Polygon	Cropland	1	Agriculture
12	Polygon	Very Low Density Residential	38	Low-Density Residential
13	Polygon	Open Land	6	Open Land
14	Polygon	Very Low Density Residential	38	Low-Density Residential
15	Polygon	Very Low Density Residential	38	Low-Density Residential
16	Polygon	Very Low Density Residential	38	Low-Density Residential
17	Polygon	Non-Forested Wetland	4	Forest
18	Polygon	Non-Forested Wetland	4	Forest
19	Polygon	Forest	3	Forest

Union the Land Use and Soils GIS Layers

Land Use



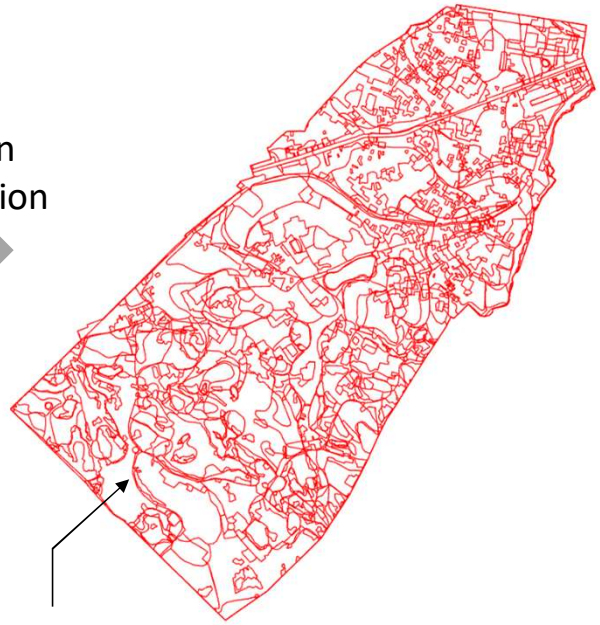
Each polygon has a Phosphorus Land Use Group (PLUG)

Soil

Each polygon has a Hydrologic Soil Group (HSG)

Union Operation

Land Use/Soil



Each polygon has a PLUG and HSG

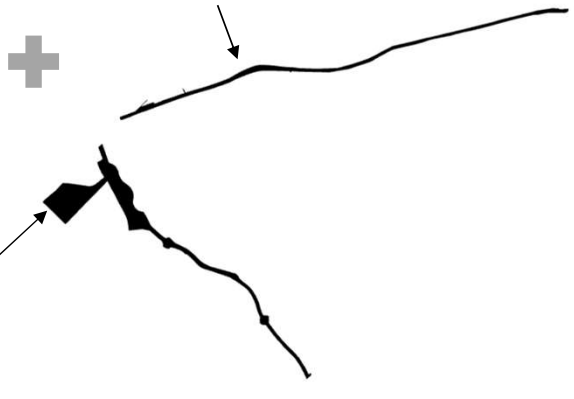
Remove Areas to Ignore

Land Use/Soil

Each polygon has a Phosphorus Land Use Group (PLUG)

Areas to Ignore

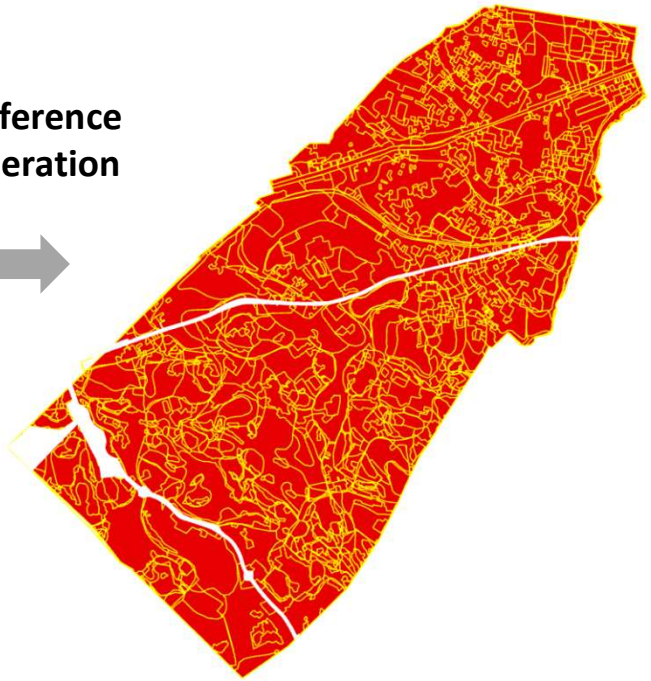
MassDOT Roadway



DCR Property

Difference Operation

Revised Land Use/Soil

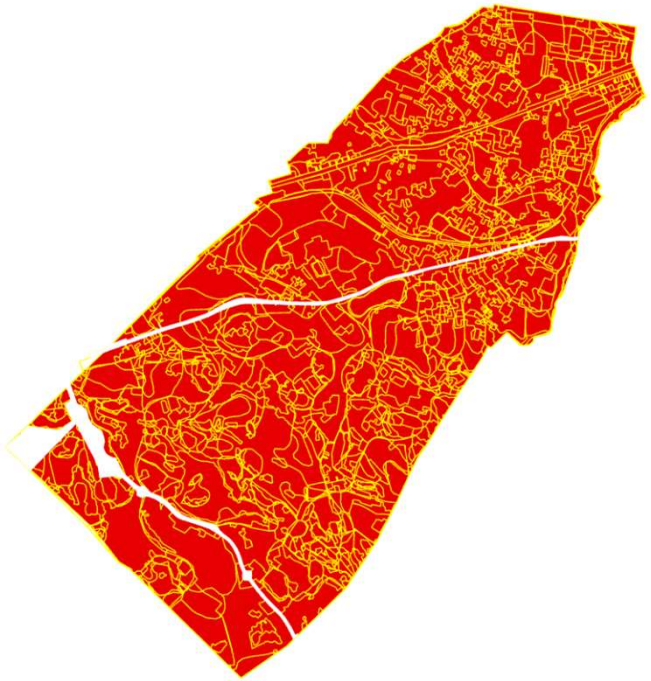


Calculate Impervious Area for each Revised Land Use/Soil Polygon

Brown AND Caldwell

Charles River Watershed Association

Revised Land Use/Soil



+

Impervious Area

Need to Convert IA to DCIA

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Phosphorus Land Use Group	Total Area (ac)	Impervious Area (ac)	Percent Impervious	Directly Connected Impervious Area (ac)	P Loading Export Rate (lb/ac/yr)	P Export Load (lb/yr)
Commercial	613.0	265.2	43%			
Industrial	675.4	443.6	66%			
High-density residential	120.3	106.5	89%			
Medium-density residential	811.1	571.9	71%			
Low-density residential	123.0	119.7	97%			
Highway	86.8	35.3	41%			
Forest	523.6	178.1	34%			
Open land	175.3	138.5	79%			
Agriculture	895.2	701.2	78%			
Total	4,023.6	2,559.9	64%			

Calculating DCIA: Sutherland Equation

Brown AND Caldwell

Charles River Watershed Association

$$\text{\% Directly Connected Impervious Area} = A \times (\text{\% Impervious Area}/100)^{B}$$

Where *A*, *B* are coefficients that vary based on land use.

Example: for commercial land uses, A = 0.4, B = 1.2, and assuming IA = 80%,

$\text{\% DCIA} = 0.4 \times (80)^{1.2}$

% DCIA = 77%

Sutherland Equation Coefficients

- EPA's Methodology to Calculate Baseline Estimates of Impervious Area (IA) and Directly Connected Impervious Area (DCIA) for Massachusetts Communities

  https://www3.epa.gov/region1/npdes/stormwater/ma/IA-DCIA-Calculation-Methodology.pdf

- Memorandum (Draft), Dated 1/14/2014, Mark Voorhees, Overview of Methodology to Calculate Baseline Stormwater Phosphorus Loads and Phosphorus Load Reduction Requirements for Charles River

Phosphorus Land Use Group	A	B
Commercial	0.4	1.2
Industrial	0.4	1.2
Multi-Family	0.4	1.2
High-Density Residential	0.4	1.2
Medium-Density Residential	0.1	1.5
Low-Density Residential	0.1	1.5
Highway	0.1	1.5
Forest	0.01	2
Open Land	0.1	1.5
Agricultural	0.01	2

Source: Values from Voorhees 2014 memo. Do not use the values in the EPA document IA-DCIA-Calculation-Methodology.pdf

Calculate DCIA Phosphorus Load

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Phosphorus Land Use Group	Directly Connected Area Phosphorus Load								
	Total Area (ac)	Impervious Area (ac)	Percent Impervious	Sutherland Coeffs A	Sutherland Coeffs B	Percent Directly Connected Impervious Area (%)	Directly Connected Impervious Area (ac)	P Loading Export Rate (lb/ac/yr)	P Export Load (lb/yr)
Commercial	613.0	265.2	43%	0.4	1.2	36.8%	225.3	1.78	401.1
Industrial	675.4	443.6	66%	0.4	1.2	60.7%	409.8	1.78	729.4
High-density residential	120.3	106.5	89%	0.4	1.2	86.8%	104.4	2.32	242.3
Medium-density residential	811.1	571.9	71%	0.1	1.5	59.2%	480.2	1.96	941.1
Low-density residential	123.0	119.7	97%	0.1	1.5	95.9%	118.0	1.52	179.4
Highway	86.8	35.3	41%	0.1	1.5	25.9%	22.5	1.34	30.1
Forest	523.6	178.1	34%	0.01	2	11.6%	60.6	1.52	92.0
Open land	175.3	138.5	79%	0.1	1.5	70.3%	123.2	1.52	187.2
Agriculture	895.2	701.2	78%	0.01	2	61.4%	549.3	1.52	834.9
Total	4,023.6	2,559.9	64%			52%	2,093.2		3,637.5

User-provided values
EPA-provided values
Calculated values

These values are from Appendix F, Attachment 1, Table 1-2

Calculate Pervious Area Phosphorus Load

Brown AND Caldwell

Charles River Watershed Association

	Pervious Area Phosphorus Load																			
	Perv HSG Area (ac)							Phosphorus Export Loading Rate (lb/ac/yr)						Phosphorus Load (lb/yr)							
Phosphorus Land Use Group	A	B	C	C/D	D	Unk	Total	A	B	C	C/D	D	Unk	A	B	C	C/D	D	Unk	Total	P Export Load (lb/yr)
Commercial	49.7	96.5	90.4	3.7	91.9	15.8	347.8														
Industrial	35.6	25.4	44.2	42.7	48.9	35.0	231.8														
High-density residential	2.0	1.2	3.9	1.8	3.3	1.6	13.8														
Medium-density residential	72.0	78.7	5.7	46.3	8.2	28.3	239.3														
Low-density residential	0.3	0.3	0.8	0.4	0.9	0.7	3.3														
Highway	1.4	15.9	11.6	5.0	2.8	14.9	51.5														
Forest	89.6	40.1	59.6	14.7	75.7	65.9	345.5														
Open land	9.8	11.5	3.2	0.7	1.3	10.2	36.7														
Agriculture	29.2	46.5	12.6	33.6	33.1	38.9	194.0														
Total	289.6	316.0	232.0	148.9	265.9	211.3	1,463.7														

What are the Pervious Area Phosphorus Export Loading Rates?

Baseline Condition Phosphorus Loading Export Rates for Pervious Areas Differ from Values in MS4 Permit

Brown AND Caldwell

Charles River Watershed Association

Phosphorus Loading Rates from MS4 Permit, Appendix F, Attachment 1, Table 1-2 (Reformatted)

P Land Use Code Description	P Loading Export Rate (lb/ac/yr)					
	Directly Connected Impervious Area	Pervious Area				
		HSG A	HSG B	HSG C	HSG C/D	HSG D
Commercial	1.78	0.03	0.12	0.21	0.29	0.37
Industrial	1.78	0.03	0.12	0.21	0.29	0.37
High-density residential	2.32	0.03	0.12	0.21	0.29	0.37
Medium-density residential	1.96	0.03	0.12	0.21	0.29	0.37
Low-density residential	1.52	0.03	0.12	0.21	0.29	0.37
Highway	1.34	0.03	0.12	0.21	0.29	0.37
Forest	1.52	0.13	0.13	0.13	0.13	0.13
Open land	1.52	0.03	0.12	0.21	0.29	0.37
Agriculture	1.52	0.45	0.45	0.45	0.45	0.45

Don't use these values for baseline phosphorus estimates.

Use Phosphorus Loading Export Rates for Pervious Areas for Baseline from Voorhees Memo (2014)

Brown AND Caldwell

Charles River Watershed Association

P Land Use Code Description	P Loading Export Rate (lb/ac/yr) Pervious Area Soil Type				
	HSG A	HSG B	HSG C	HSG C/D	HSG D
Commercial	0.04	0.18	0.36	0.46	0.54
Industrial	0.04	0.18	0.36	0.46	0.54
High-density residential	0.04	0.18	0.36	0.46	0.54
Medium-density residential	0.04	0.18	0.36	0.46	0.54
Low-density residential	0.04	0.18	0.36	0.46	0.54
Highway	0.04	0.18	0.36	0.46	0.54
Forest	0.11	0.14	0.19	0.21	0.23
Open land	0.04	0.18	0.36	0.46	0.54
Agriculture	0.07	0.29	0.6	0.76	0.91

Note: Values from Voorhees Memo (2014), Attachment C, Table C-1. Values converted from kg/ha/yr. to lb./ac/yr. and rounded to decimal places.

Calculate Pervious Area Phosphorus Load

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	Pervious Area Phosphorus Load																			
	Perv HSG Area (ac)							Phosphorus Export Loading Rate (lb/ac/yr)						Phosphorus Load (lb/yr)						
Phosphorus Land Use Group	A	B	C	C/D	D	Unk	Total	A	B	C	C/D	D	Unk	A	B	C	C/D	D	Unk	Total	P Export Load (lb/yr)
Commercial	49.7	96.5	90.4	3.7	91.9	15.8	347.8	0.04	0.18	0.36	0.46	0.54	0.36	2.0	17.4	32.5	1.7	49.6	5.7	108.8	509.93
Industrial	35.6	25.4	44.2	42.7	48.9	35.0	231.8	0.04	0.18	0.36	0.46	0.54	0.36	1.4	4.6	15.9	19.7	26.4	12.6	80.5	809.90
High-density residential	2.0	1.2	3.9	1.8	3.3	1.6	13.8	0.04	0.18	0.36	0.46	0.54	0.36	0.1	0.2	1.4	0.8	1.8	0.6	4.9	247.14
Medium-density residential	72.0	78.7	5.7	46.3	8.2	28.3	239.3	0.04	0.18	0.36	0.46	0.54	0.36	2.9	14.2	2.1	21.3	4.4	10.2	55.0	996.14
Low-density residential	0.3	0.3	0.8	0.4	0.9	0.7	3.3	0.04	0.18	0.36	0.46	0.54	0.36	0.0	0.0	0.3	0.2	0.5	0.2	1.3	180.65
Highway	1.4	15.9	11.6	5.0	2.8	14.9	51.5	0.04	0.18	0.36	0.46	0.54	0.36	0.1	2.9	4.2	2.3	1.5	5.4	16.3	46.39
Forest	89.6	40.1	59.6	14.7	75.7	65.9	345.5	0.11	0.14	0.19	0.21	0.23	0.19	9.9	5.6	11.3	3.1	17.4	12.5	59.8	151.85
Open land	9.8	11.5	3.2	0.7	1.3	10.2	36.7	0.04	0.18	0.36	0.46	0.54	0.36	0.4	2.1	1.2	0.3	0.7	3.7	8.3	195.53
Agriculture	29.2	46.5	12.6	33.6	33.1	38.9	194.0	0.07	0.29	0.60	0.76	0.91	0.60	2.0	13.5	7.6	25.5	30.1	23.4	102.1	937.01
Total	289.6	316.0	232.0	148.9	265.9	211.3	1,463.7							18.7	60.4	76.4	74.9	132.4	74.2	437.0	4,074.5

User-provided values

EPA-provided values

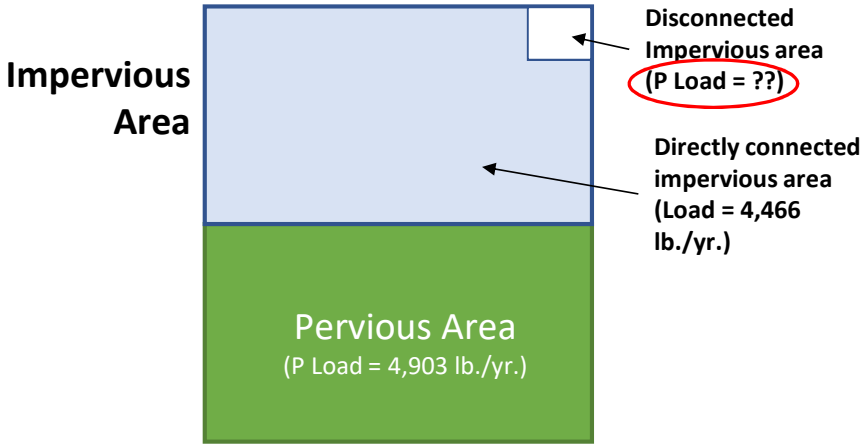
Calculated values

Use HSG C Phosphorus Export Loading Rate for Unknown soil types

Summary of Baseline Phosphorus Loads so Far…

Phosphorus Land Use Group	Annual Phosphorus Export (lb/yr)		
	DCIA	Pervious Area	Total
Commercial	401.1	509.9	911.0
Industrial	729.4	809.9	1,539.3
High-Density Residential	242.3	247.1	489.4
Medium-Density Residential	941.1	996.1	1,937.3
Low-Density Residential	179.4	180.6	360.0
Highway	30.1	46.4	76.5
Forest	92.0	151.8	243.9
Open Land	187.2	195.5	382.7
Agricultural	834.9	937.0	1,771.9
Total	3,637.5	4,074.5	7,712.1

Almost there, need to account for loads from Disconnected Impervious Areas



Calculating Phosphorus Load from Disconnected Impervious Areas

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Charles River Watershed Association

Impervious Area minus Disconnected Impervious Area

Total Phosphorus Load divided by Total Pervious HSG Area

	Impervious Area (ac)			Pervious Area Phosphorus Load															
				Perv HSG Area (ac)							Phosphorus Load (lb/yr)							Composite Pervious Area Phosphorus Export Loading Rate (lb/ac/yr)	Annual Disconnected Area Phosphorus Load (lb/yr)
Phosphorus Land Use Group	Total	Directly Connected	Disconnected	A	B	C	C/D	D	Unk	Total	A	B	C	C/D	D	Unk	Total		
Commercial	265.2	225.3	39.9	49.7	96.5	90.4	3.7	91.9	15.8	347.8	2.0	17.4	32.5	1.7	49.6	5.7	108.8	0.3	12.5
Industrial	443.6	409.8	33.8	35.6	25.4	44.2	42.7	48.9	35.0	231.8	1.4	4.6	15.9	19.7	26.4	12.6	80.5	0.3	11.8
High-density residential	106.5	104.4	2.1	2.0	1.2	3.9	1.8	3.3	1.6	13.8	0.1	0.2	1.4	0.8	1.8	0.6	4.9	0.4	0.7
Medium-density residential	571.9	480.2	91.7	72.0	78.7	5.7	46.3	8.2	28.3	239.3	2.9	14.2	2.1	21.3	4.4	10.2	55.0	0.2	21.1
Low-density residential	119.7	118.0	1.6	0.3	0.3	0.8	0.4	0.9	0.7	3.3	0.0	0.0	0.3	0.2	0.5	0.2	1.3	0.4	0.6
Highway	35.3	22.5	12.8	1.4	15.9	11.6	5.0	2.8	14.9	51.5	0.1	2.9	4.2	2.3	1.5	5.4	16.3	0.3	4.0
Forest	178.1	60.6	117.5	89.6	40.1	59.6	14.7	75.7	65.9	345.5	9.9	5.6	11.3	3.1	17.4	12.5	59.8	0.2	20.3
Open land	138.5	123.2	15.4	9.8	11.5	3.2	0.7	1.3	10.2	36.7	0.4	2.1	1.2	0.3	0.7	3.7	8.3	0.2	3.5
Agriculture	701.2	549.3	151.9	29.2	46.5	12.6	33.6	33.1	38.9	194.0	2.0	13.5	7.6	25.5	30.1	23.4	102.1	0.5	80.0
Total				289.6	316.0	232.0	148.9	265.9	211.3	1,463.7	18.7	60.4	76.4	74.9	132.4	74.2	437.0		154.5

Composite PLER multiplied by Disconnected Impervious Area

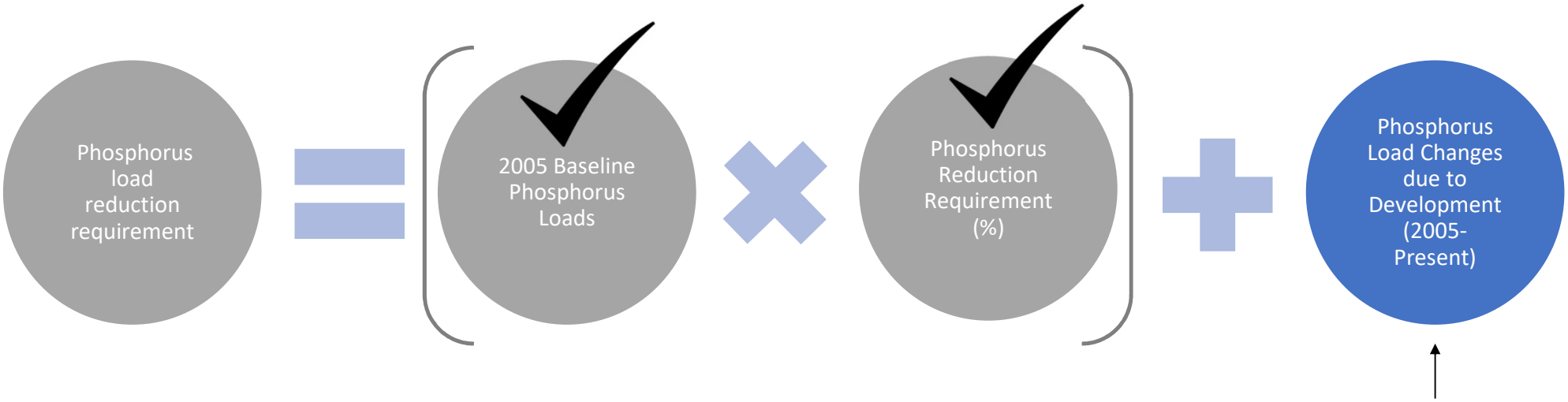
Total Baseline Phosphorus Load

Brown AND Caldwell

Charles River Watershed Association

Phosphorus Land Use Group	Annual Phosphorus Export (lb/yr)			
	DCIA	Disconnected Imperious Area	Pervious Area	Total
Commercial	401.1	12.5	509.9	923.5
Industrial	729.4	11.8	809.9	1,551,0
High-Density Residential	242.3	0.7	247.1	490.1
Medium-Density Residential	941.1	21.1	996.1	1,937.3
Low-Density Residential	179.4	0.6	180.6	360.0
Highway	30.1	4.0	46.4	80.7
Forest	92.0	20.3	151.8	264.2
Open Land	187.2	3.2	195.5	286.2
Agricultural	834.9	80.0	937.0	1,851.9
Total	3,637.5	154.5	4,074.5	7,866.6

Part 2: P Load Changes due to Development



Must be updated annually in Annual Report starting in Year 5

Now that we understand the baseline phosphorus load calculations, how do we update to loads present-day conditions?

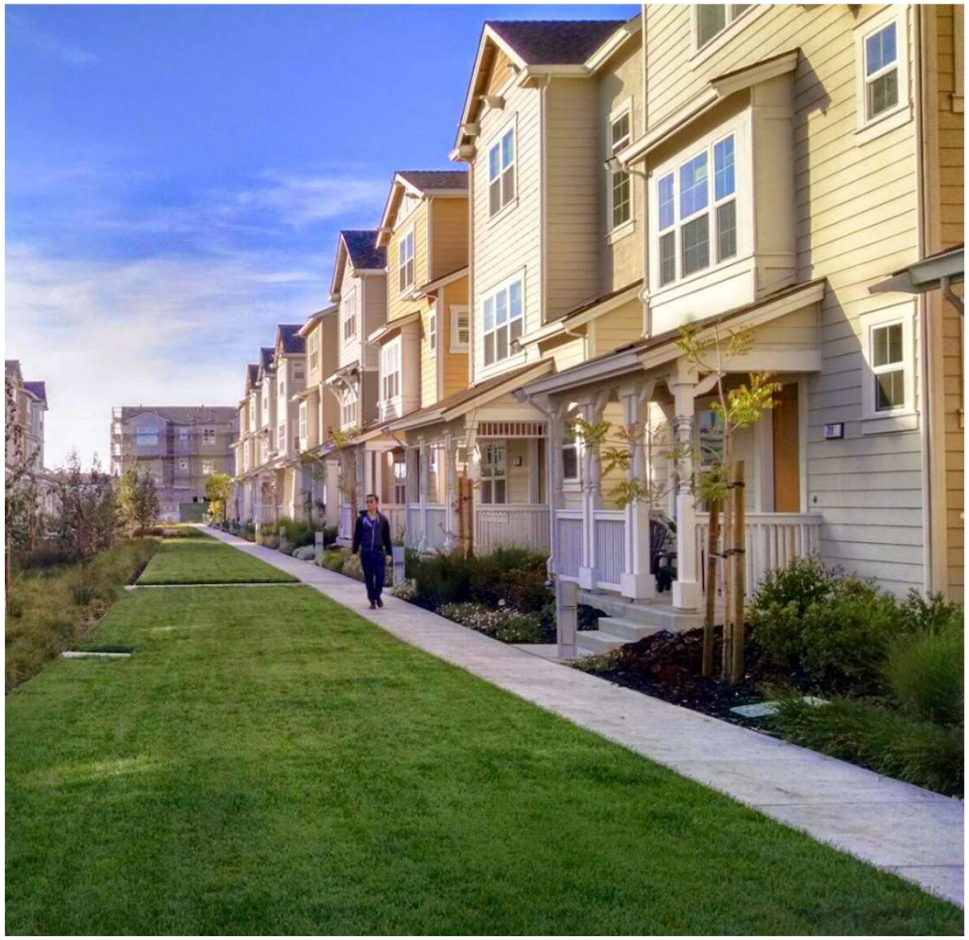
Updating P Loads to Current Conditions

Option 1: Project-by-project

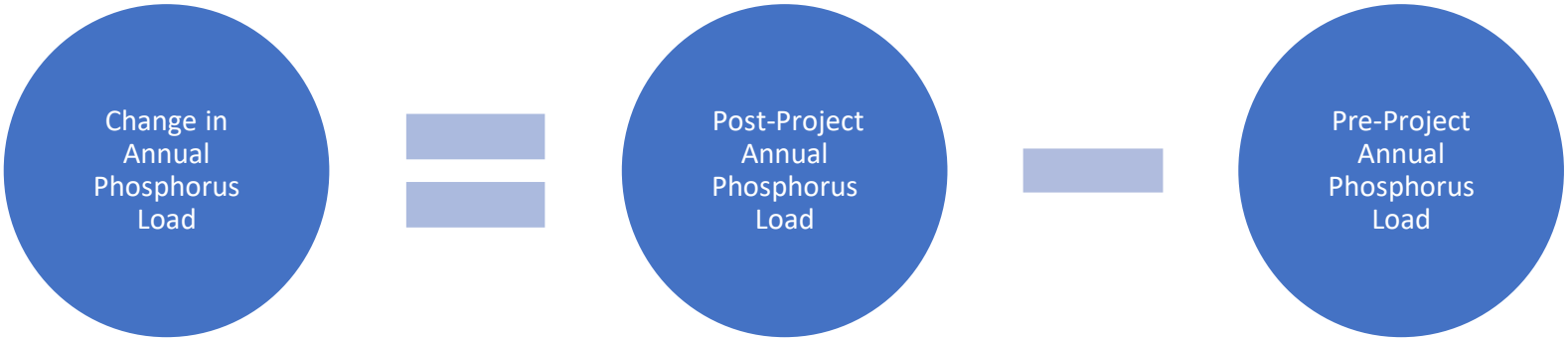
- Methodology described in MS4 Permit, Appendix F, Attachment 1
- Data intensive
- Can be used for past projects (i.e., 2005 – 2022), but Option 2 may be better for these
- Will be required for future projects (2023+)

Option 2: Area-wide phosphorus calculation (aka, “catch-up” method)

- Update GIS layers to current conditions
  - Impervious area
  - Land use
- Use the methodology detailed in this workshop to calculate area-wide phosphorus loads
- Preferred method for past projects (i.e., 2005-2022)
- Can’t be used for future projects (2023+), project-by-project method will be required



Option 1: Project-by-Project Approach



Applies to:

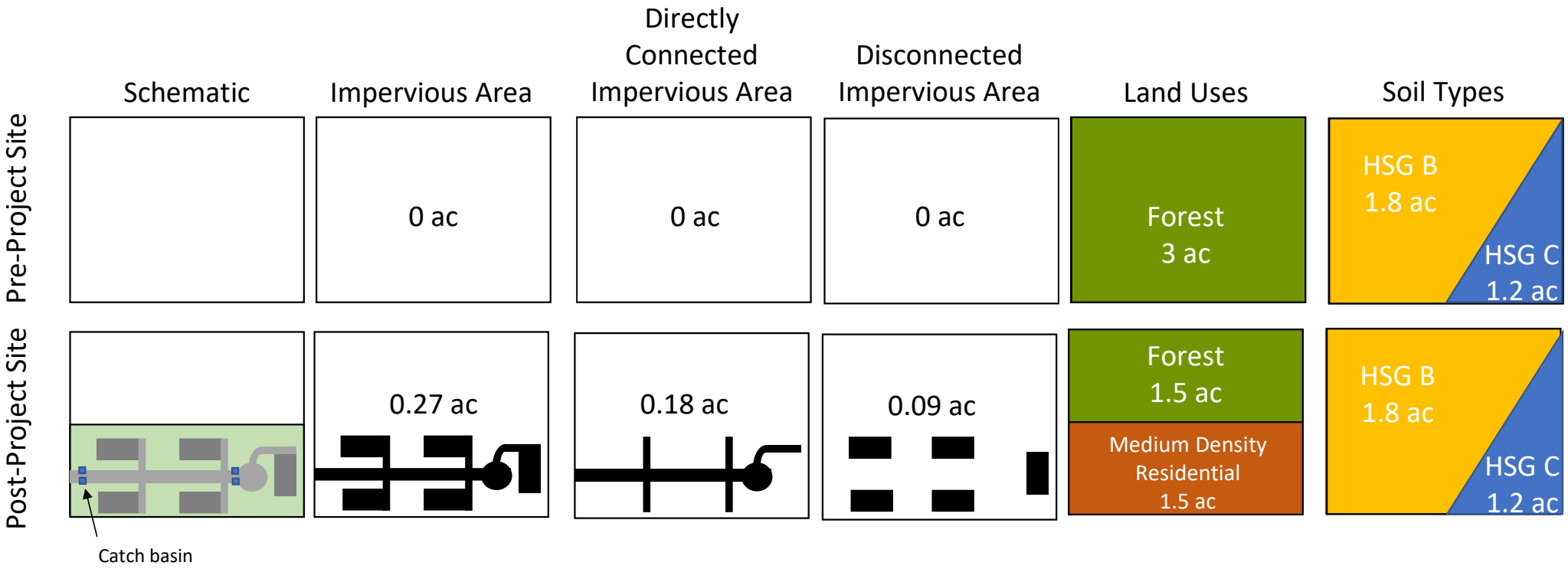
- PCP area for full jurisdictional area: all projects
- PCP area for urbanized area within jurisdiction: only projects in the urbanized area

Project Example for Charles River Community Implementing PCP in Entire Jurisdictional Area

Brown AND Caldwell

Charles River Watershed Association

1.5 acres of a 3-acre forested parcel are converted to medium-density residential housing



Note: Don't use Sutherland Equation for calculating DCIA, determine it directly.

Phosphorus Loading Export Rates

Brown AND Caldwell

Charles River Watershed Association

When calculating changes in phosphorus loads due to development, use the Phosphorus Loading Export Rates in MS4 Permit, Appendix F, Attachment 1, Table 1-2

Phosphorus Loading Rates from Table 1-2 (Reformatted)

P Land Use Code Description	P Loading Export Rate (lb/ac/yr)					
	Directly Connected Impervious Area	Pervious Area				
		HSG A	HSG B	HSG C	HSG C/D	HSG D
Commercial	1.78	0.03	0.12	0.21	0.29	0.37
Industrial	1.78	0.03	0.12	0.21	0.29	0.37
High-density residential	2.32	0.03	0.12	0.21	0.29	0.37
Medium-density residential	1.96	0.03	0.12	0.21	0.29	0.37
Low-density residential	1.52	0.03	0.12	0.21	0.29	0.37
Highway	1.34	0.03	0.12	0.21	0.29	0.37
Forest	1.52	0.13	0.13	0.13	0.13	0.13
Open land	1.52	0.03	0.12	0.21	0.29	0.37
Agriculture	1.52	0.45	0.45	0.45	0.45	0.45

Example Calculation of Phosphorus Loads for a Project

Brown AND Caldwell

Charles River Watershed Association

Pre-Project Condition

			Directly Connected Area			Pervious Area									Disconnected Impervious Area			
						Perv HSG Area (ac)			PLER (lb/ac/yr)		P Export Load (lb/yr)							
Phosphorus Land Use Group	Total Area (ac)	Imp Area (ac)	DCIA (ac)	PLER (lb/ac/yr)	P Export Load (lb/yr)	B	C	Total	B	C	B	C	Total	P Export Load (lb/yr)	Disconnected Impervious Area draining to HSG (ac)	Composite Pervious Area PLER (lb/ac/yr)	P Export Load (lb/yr)	Total P Export Load (lb/yr)
Medium-density residential	0.00	0.00	0.00	1.96	-	-	-	-	0.12	0.21	-	-	-	-	-	-	-	-
Forest	3.00	0.00	0.00	1.52	-	1.80	1.20	3.00	0.13	0.13	0.23	0.16	0.39	0.39	-	0.13	-	0.39
					-									0.39				0.39

Post-Project Condition

			Directly Connected Area			Pervious Area									Disconnected Impervious Area			
						Perv HSG Area (ac)			PLER (lb/ac/yr)		P Export Load (lb/yr)							
Phosphorus Land Use Group	Total Area (ac)	Imp Area (ac)	DCIA (ac)	PLER (lb/ac/yr)	P Export Load (lb/yr)	B	C	Total	B	C	B	C	Total	P Export Load (lb/yr)	Disconnected Impervious Area draining to HSG (ac)	Composite Pervious Area PLER (lb/ac/yr)	P Export Load (lb/yr)	Total P Export Load (lb/yr)
Medium-density residential	1.50	0.27	0.18	1.96	0.4	0.56	0.67	1.23	0.12	0.21	0.07	0.14	0.21	0.21	0.09	0.17	0.0	0.58
Forest	1.50	0.00	0.00	1.52	-	1.02	0.48	1.50	0.13	0.13	0.13	0.06	0.20	0.20	-	0.13	-	0.20
					0.35									0.40				0.77

Change in phosphorus load = 0.77 lb/yr – 0.39 lb/yr = 0.38 lb/yr

Assuming the community's phosphorus reduction load was 100 lb/yr, it has now increased to 100.38 lb/yr

Phosphorus Loads Example – Lakes and Pond Community using Subcatchments as LPCP Area

Brown AND Caldwell

Charles River Watershed Association

Pre-Project Condition

Phosphorus Land Use Group	Total Area (ac)	Imp Area (ac)	Directly Connected Area			Pervious Area									Disconnected Impervious Area			Total P Export Load (lb/yr)
			DCIA (ac)	PLER (lb/ac/yr)	P Export Load (lb/yr)	Perv HSG Area (ac)			PLER (lb/ac/yr)		P Export Load (lb/yr)			P Export Load (lb/yr)	Disconnected Impervious Area draining to HSG (ac)	Composite Pervious Area PLER (lb/ac/yr)	P Export Load (lb/yr)	
						B	C	Total	B	C	B	C	Total					
Medium-density residential	0.00	0.00	0.00	1.96	-	-	-	-	0.12	0.21	-	-	-	-	-	-	-	-
Forest	0.00	0.00	0.00	1.52	-	-	-	-	0.13	0.13	-	-	-	-	-	-	-	-
					-									-				-

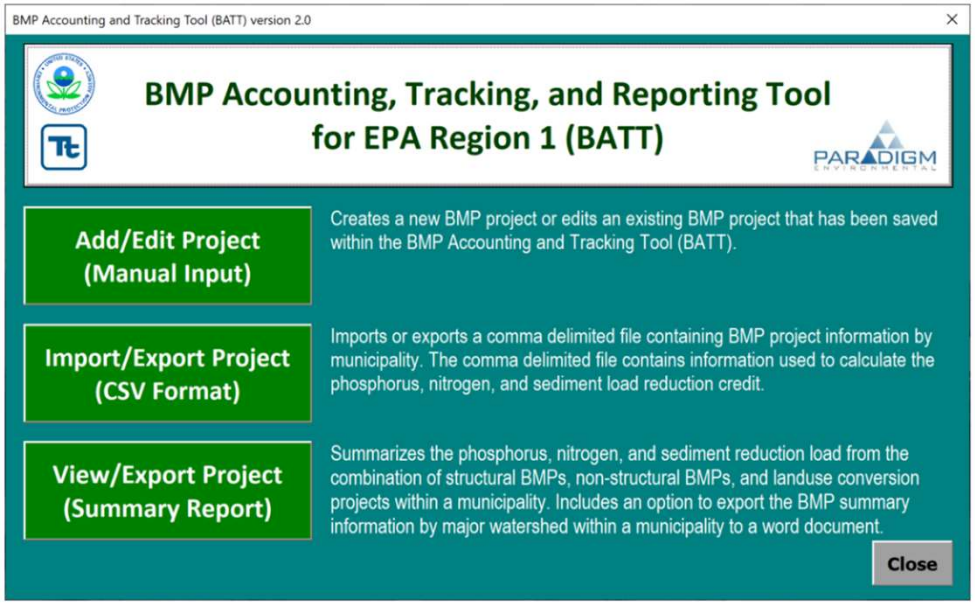
Post-Project Condition

Phosphorus Land Use Group	Total Area (ac)	Imp Area (ac)	Directly Connected Area			Pervious Area									Disconnected Impervious Area			Total P Export Load (lb/yr)
			DCIA (ac)	PLER (lb/ac/yr)	P Export Load (lb/yr)	Perv HSG Area (ac)			PLER (lb/ac/yr)		P Export Load (lb/yr)			P Export Load (lb/yr)	Disconnected Impervious Area draining to HSG (ac)	Composite Pervious Area PLER (lb/ac/yr)	P Export Load (lb/yr)	
						B	C	Total	B	C	B	C	Total					
Medium-density residential	1.50	0.27	0.18	1.96	0.4	0.56	0.67	1.23	0.12	0.21	0.07	0.14	0.21	0.21	0.09	0.17	0.0	0.58
Forest	1.50	0.00	0.00	1.52	-	1.02	0.48	1.50	0.13	0.13	0.13	0.06	0.20	0.20	-	0.13	-	0.20
					0.35									0.40				0.77

Change in phosphorus load = 0.77 lb/yr – 0.0 lb/yr = 0.77 lb/yr

Assuming the community's phosphorus reduction load was 100 lb/yr, it has now increased to 100.77 lb/yr

Best Management Practice Accounting and Tracking Tool (BATT)



https://www.epa.gov/npdes-permits/stormwater-tools-new-england

Option 2: Annually Update Impervious Area, Land Use GIS Layers and Recalculate Area-Wide P Loads

Brown AND Caldwell

Charles River Watershed Association

- Set up process to update impervious area and land use periodically (e.g., annually, quarterly)
- 2016 Land Use GIS Layer
- Use:
  - Up-to-date orthoimagery (e.g., MassGIS, NearMap.com)
  - Building permits
- Frequently updated impervious layer supports
  - Stormwater fee
  - Stormwater modeling
  - Heat island analysis
  - Resiliency planning
- This approach not in MS4 Permit, but EPA has indicated that this would be acceptable for 2005-2022

Workshop #1: All About the Loads: Baseline Loads, Impact from EPA's RDA, and Managing with Non-structural Controls

BREAKOUT SESSIONS

Room #1: Charles River Watershed Communities - Potential impacts of EPA's residual designation authority (RDA) on Permittee's baseline phosphorus load and required reduction goals

Room #2: Lakes and Ponds Communities - Preparing the Baseline, Load Reduction, and Allowable Load Calculations Yourself



Workshop #1: All About the Loads: Baseline Loads, Impact from EPA's RDA, and Managing with Non-structural Controls

BREAKOUT SESSIONS

Room #1: Charles River Watershed Communities - Potential impacts of EPA's residual designation authority (RDA) on Permittee's baseline phosphorus load and required reduction goals



A Reminder about RDA

https://www.epa.gov/npdes/epas-residual-designation-authority

Final TMDL for Nutrients in the Upper/Middle Charles River (PDF 2.2 MB)

Final TMDL for Nutrients in the Upper/Middle Charles River:Appendix (PDF 111.41 KB)

Final Phosphorus TMDL Report for the Lower Charles River Basin (PDF 1.77 MB)

EPA's Residual Designation Authority

EPA and the authorized states regulate stormwater discharges from regulated municipal separate storm sewer systems (MS4s), industrial activities, and construction sites under section 402(p) of the Clean Water Act. These stormwater discharges require NPDES permits. For details, see the NPDES stormwater program.

In addition, EPA can use its "residual designation" authority under 40 CFR 122.26(a)(9)(i)(C) and (D) (PDF)(23 pp, 224 K, About PDF) to require NPDES permits for other stormwater discharges or category of discharges on a case-by-case basis when it determines that:

- the discharges contribute to a violation of water quality standards,
- are a significant contributor of pollutant to federally protected surface waters, or
- controls are needed for the discharge based on wasteload allocations that are part of "total maximum daily loads" (TMDLs) that address the pollutant(s) of concern.

Small MS4s that are not already required to have NPDES permit coverage can be designated for regulation under 40 CFR 123.35(b) (PDF)(2 pp, 135 K, About PDF).

In addition, designation can be requested by petition.

Stormwater discharges pose a serious threat to the nation's water bodies. EPA is committed to working with the states and its partners to ensure that effective programs and activities are implemented to meet water quality objectives. Residual designation is one tool for achieving necessary pollutant reductions.

Residual Designation Authority (RDA) for the Charles River Watershed

- A May 9, 2019 petition from the Conservation Law Foundation and Charles River Watershed Association asked EPA to exercise its residual designation (RD) authority to regulate certain stormwater discharges from privately owned commercial, institutional, industrial, and multi-family residential properties that are one acre or greater in the Charles River watershed.
- EPA worked with the Consensus Building Institute (CBI), an independent, non-partisan facilitator with no stake in the outcome to hold stakeholder meetings during Fall 2020
- EPA is currently preparing a response to the petition
- More information at:
  - https://www.epa.gov/npdes/epas-residual-designation-authority
    https://www.epa.gov/charlesriver/environmental-challenges-charles-river#ResidualDesignationAuthority
  - https://www.epa.gov/charlesriver/epa-region-1-petition-review-stakeholder-engagement-process-faqs

How could RDA Help your community?

Brown AND Caldwell

Charles River Watershed Association

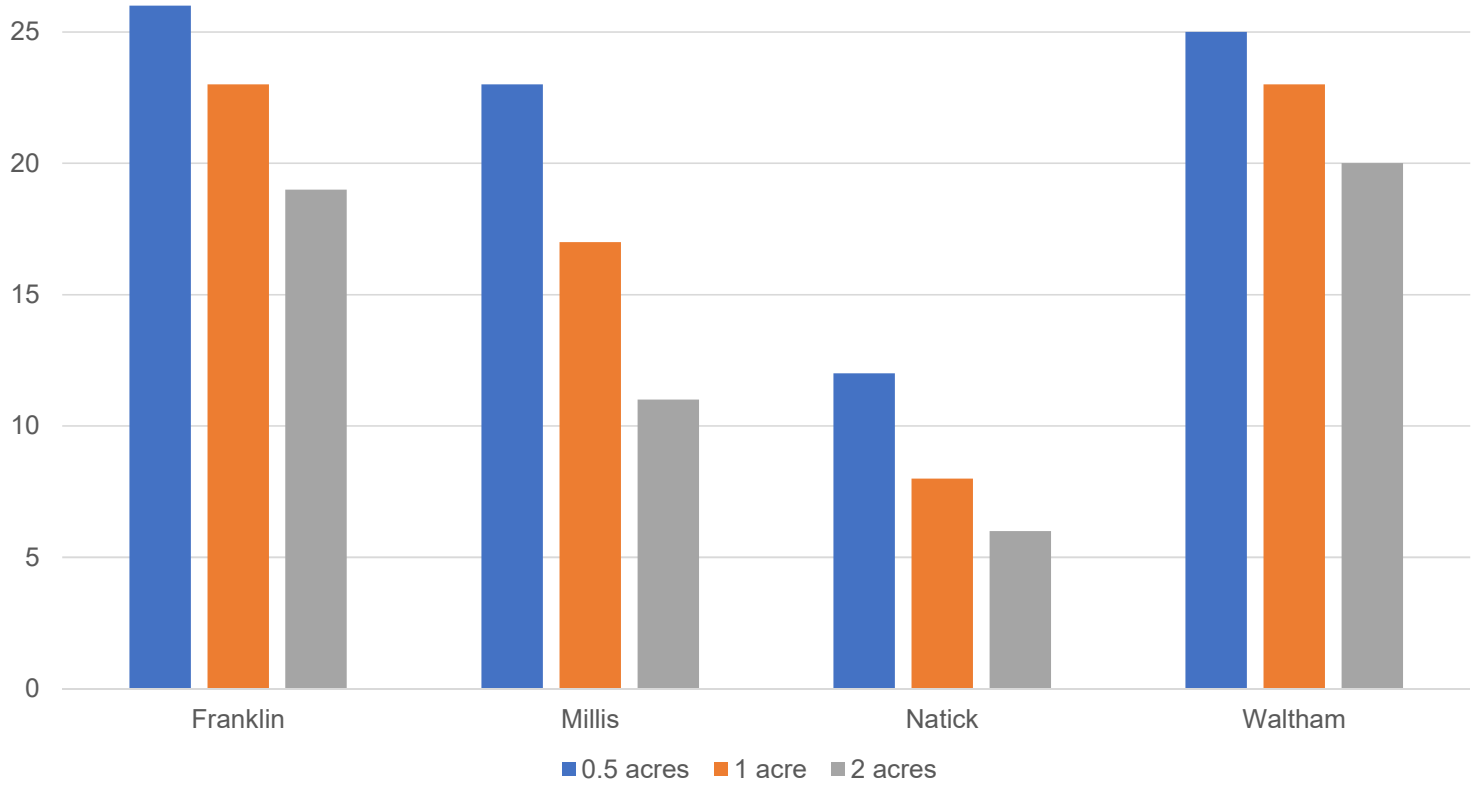
RDA is anticipated to require private sites to reduce phosphorus loading consistent with the TMDL – here are some examples of the benefit

Community	Entire Watershed (Table F-2)	If RDA Captures private **parcels with 0.5 acre or more impervious area**			If RDA Captures private **parcels with 1 acre or more impervious area**			If RDA Captures **private parcels with 2 acre or more impervious area**		
	Approximate Required Load Reduction	Approx. # parcels	Load from those parcels assumming 65% Reduction	% of Required Load Reduction	Approx. # parcels	Load from those parcels assumming 65% Reduction	% of Communities Required Load Reduction	Approx. # parcels	Load from those parcels assumming 65% Reduction	% of Communities Required Load Reduction
Brookline	2,150	230	230	11%	85	160	7%	40	105	5%
Franklin	2,250	300	585	26%	180	515	23%	105	420	19%
Millis	675	90	155	23%	45	115	17%	20	75	11%
Natick	1,100	96	135	12%	40	90	8%	15	65	6%
Waltham	3,900	490	990	25%	290	890	23%	180	770	20%

How could RDA Help your community?

Charles River Watershed Association

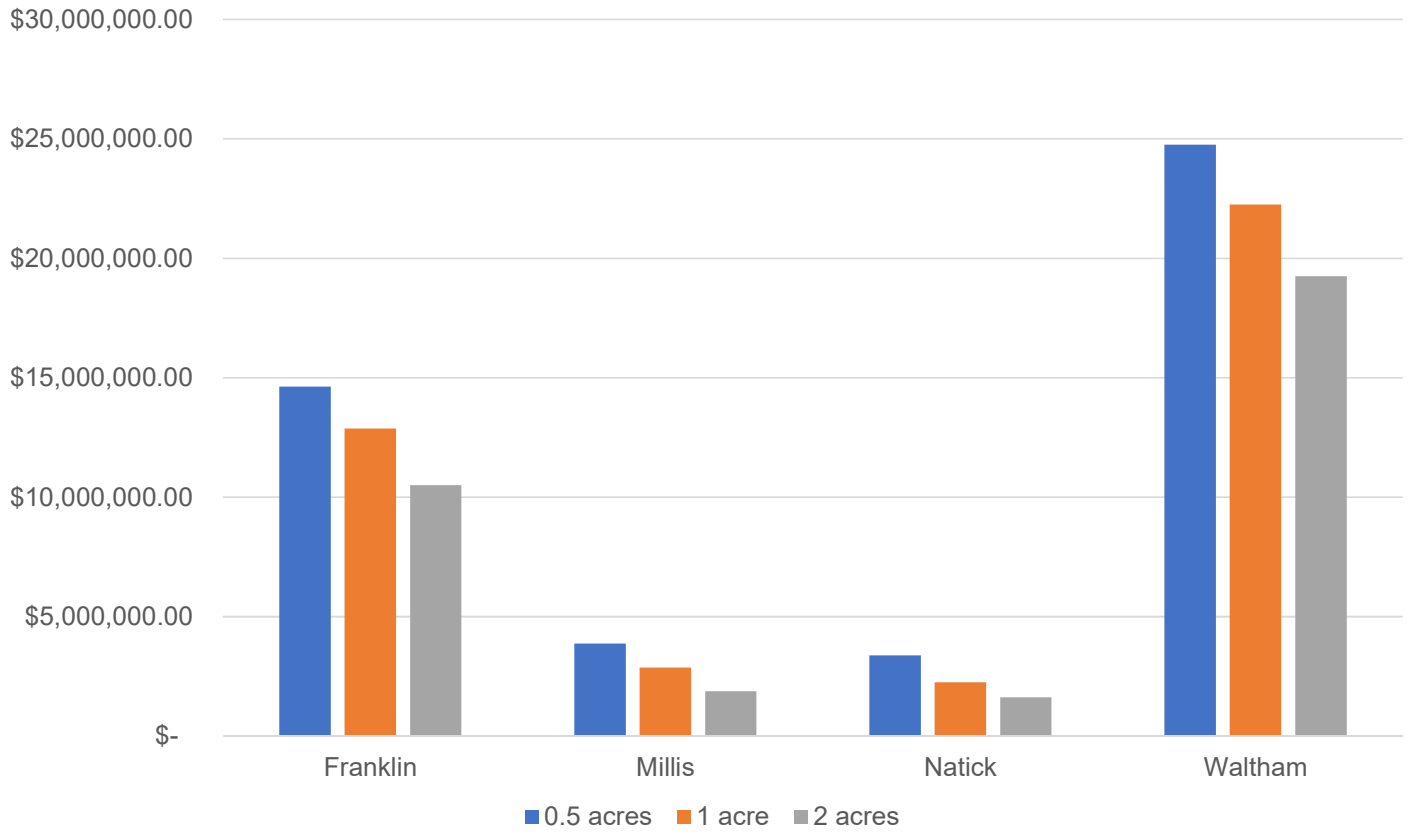
RDA is anticipated to require private sites to reduce phosphorus loading consistent with the TMDL – here are some examples of the benefit



How could RDA Help your community?

Charles River Watershed Association

RDA is anticipated to require private sites to reduce phosphorus loading consistent with the TMDL – here are some examples of the benefit



Baseline Phosphorus Load Reduction Requirements

Charles River Communities

Charles River Watershed Association

Community	Stormwater Phosphorus Load Reduction Requirement, Entire Jurisdiction in Charles River (kg/yr)	Stormwater Phosphorus Load Reduction Requirement, Urbanized Area Only in Charles River (kg/yr)	Stormwater Phosphorus Load Reduction Requirement, Entire Jurisdiction in Charles River (lb/yr)	Stormwater Phosphorus Load Reduction Requirement, Urbanized Area Only in Charles River (lb/yr)	Difference
Arlington	68	68	149.9	149.9	0
Ashland	28	28	61.7	61.7	0
Bellingham	398	352	877.4	776	101.4
Belmont	105	105	231.5	231.5	0
Boston	4145	4145	9138.1	9138.1	0
Brookline	968	968	2134.1	2134.1	0
Cambridge	317	317	698.9	698.9	0
Dedham	404	404	890.7	890.7	0
Dover	180	82	396.8	180.8	216.1
Foxborough	0	0	0	0	0
Franklin	1012	1007	2231.1	2220.1	11
Holliston	496	466	1093.5	1027.4	66.1
Hopedale	47	47	103.6	103.6	0
Hopkinton	89	88	196.2	194	2.2
Lexington	242	241	533.5	531.3	2.2
Lincoln	127	84	280	185.2	94.8
Mass-DCR	91	89	200.6	196.2	4.4

Community	Stormwater Phosphorus Load Reduction Requirement, Entire Jurisdiction in Charles River (kg/yr)	Stormwater Phosphorus Load Reduction Requirement, Urbanized Area Only in Charles River (kg/yr)	Stormwater Phosphorus Load Reduction Requirement, Entire Jurisdiction in Charles River (lb/yr)	Stormwater Phosphorus Load Reduction Requirement, Urbanized Area Only in Charles River (lb/yr)	Difference
Medfield	345	335	760.6	738.5	22
Medway	400	390	881.8	859.8	22
Mendon	11	6	24.3	13.2	11
Milford	809	798	1783.5	1759.3	24.3
Millis	301	200	663.6	440.9	222.7
Natick	486	456	1071.4	1005.3	66.1
Needham	974	974	2147.3	2147.3	0
Newton	2365	2365	5213.9	5213.9	0
Norfolk	286	285	630.5	628.3	2.2
Sherborn	156	52	343.9	114.6	229.3
Somerville	400	400	881.8	881.8	0
Walpole	37	37	81.6	81.6	0
Waltham	1755	1755	3869.1	3869.1	0
Watertown	703	703	1549.8	1549.8	0
Wayland	19	19	41.9	41.9	0
Wellesley	821	821	1810	1810	0
Weston	375	375	826.7	826.7	0
Westwood	150	143	330.7	315.3	15.4
Wrentham	210	196	463	432.1	30.9

Yellow Rows: Communities with load differences based on selected PCP Area

Workshop #1: All About the Loads: Baseline Loads, Impact from EPA's RDA, and Managing with Non-structural Controls

BREAKOUT SESSIONS

Room #2: Lakes and Ponds Communities - Preparing the Baseline, Load Reduction, and Allowable Load Calculations Yourself



Communities with Lake/Pond Phosphorus TMDL

A reminder on communities with these requirements

Communities subject to the MS4GP Appendix F related to TMDLs for phosphorus in watersheds of various lakes and ponds throughout Massachusetts

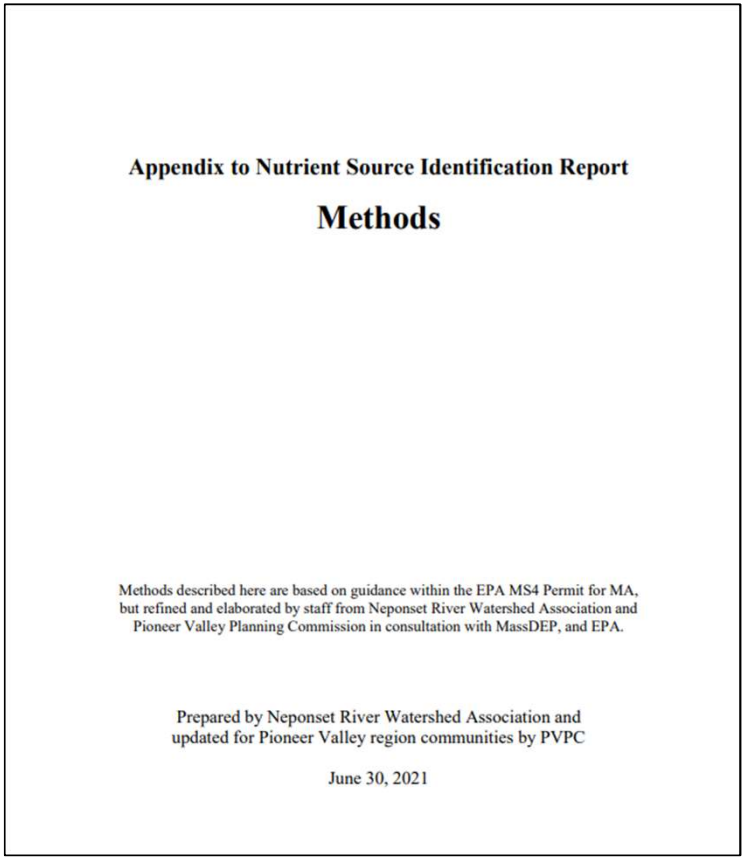
Communities noted in red are not listed in the permit but have MS4 area in the watershed of another lake or pond with a phosphorus TMDL, and therefore must prepare and develop a PCP despite not being listed in the permit

Communities with an asterisk (*) are already required to address the phosphorus TMDL, but there are one or more additional lakes/ponds not listed in the permit.

Amherst	Ludlow
Auburn	Millbury *
Boylston	Oxford *
Charlton *	Paxton
Dudley *	Shrewsbury
Gardner	Spencer *
Grafton	Springfield
Granby	Stow
Hadley	Sutton
Harvard	Templeton
Hudson	West Boylston
Leicester	Westminster
Ludlow	Wilbraham
Leicester *	Winchendon *

Notes on Neponset River Watershed's *Appendix to Nutrient Source Identification Report*

- Do not use Appendix F, Attachment 1, Table 1-2 phosphorous loading export rates for baseline calculations, use values provide in this presentation
- Do not use the Sutherland equations shown in Table 4 of the *Appendix to Nutrient Source Identification Report*, use values provided in this presentation
- Need to include loads from disconnected impervious areas



Appendix to Nutrient Source Identification Report

Methods

Methods described here are based on guidance within the EPA MS4 Permit for MA, but refined and elaborated by staff from Neponset River Watershed Association and Pioneer Valley Planning Commission in consultation with MassDEP, and EPA.

Prepared by Neponset River Watershed Association and updated for Pioneer Valley region communities by PVPC

June 30, 2021

Figure out your Requirements

- **EPA provides you with:**
- Town name
- Waterbody name
- Required percent reduction in phosphorus

You must figure out:

- Is Urbanized/Regulated Area in the watershed of a lake or pond with a phosphorus TMDL? (see next slide)
- If so, do I have discharges from my MS4 in this watershed? (from town-specific MS4 mapping)

MassDEP's Watershed Based Planning Tool

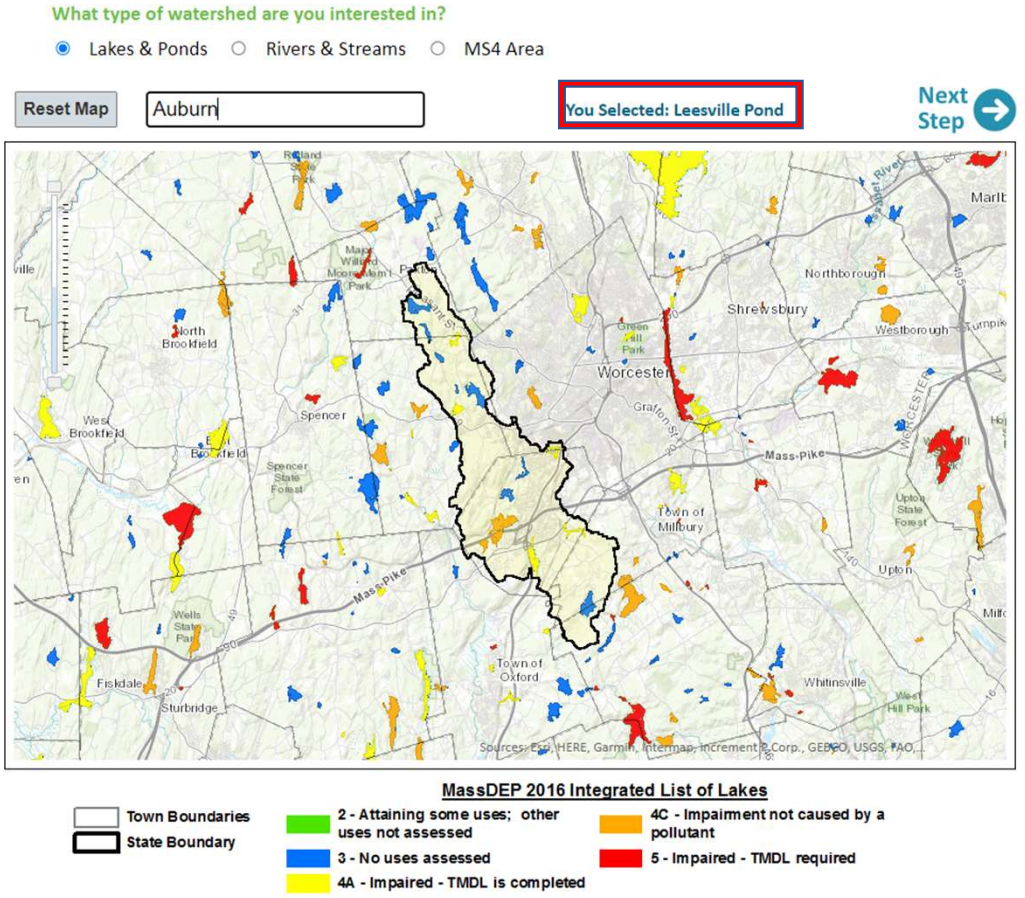
Brown AND Caldwell

Charles River Watershed Association

Use this tool to

- Locate lake/pond of interest
- Identify watershed of lake/pond
- Confirm your MS4 area is in the watershed
- View Land Use and Impervious Cover maps of the watershed
- For the drainage sub-basin shapefile, download from MassGIS

https://prj.geosyntec.com/MassDEPWBP/Home



Notes:

- Auburn Pond, Aldrich Lake East, Smiths Pond
- Locate using MassMapper
- Found under DEP 2002 Integrated List Lakes
- Since moved into a stream/river segment on Integrated List of Waters, but TMDL still applies per EPA

Other approved methods clarified in previous MS4 Muni Assistance Grant by NepRWA & PVPC

- Assisted various communities with preparing Nutrient Source Identification Reports
- EPA confirmed: methodology is same for lake and ponds with phosphorus, but guidance is different than provided through this presentation

- Resources available here:
  - https://yourcleanwater.org/wp-content/uploads/2021/10/Methods-Appendix-June-30-20201.pdf
  - https://yourcleanwater.org/member-resources/nsp-tools/
  - http://www.pvpc.org/projects/nitrogen-source-identification-reports
  - https://pvpc.maps.arcgis.com/apps/webappviewer/index.html?id=7a956adcb90f4d109ce4851bf2a8c1e1

Thank you for attending

Upcoming Workshops – Tuesdays from 1:00 to 3:00 PM

- April 5 Workshop #2: Private BMPs: How to Get Credits
- May 10 Workshop #3: Public BMPs: Maximizing the Cost-Benefit Equation
- May 24 Question & Answer Session EPA, MassDEP, and Project Team

Data Request for Workshop #3 – Costs and Benefits of Public Stormwater BMPs

Three options for sharing information until April 5:

- Populate an excel-based template
- Send us files which include information about BMP costs
- Participate in a phone interview with our team

Questions? Contact Iris Seto at iseto@crwa.org

Thank you for attending

Website Resources

- https://www.crwa.org/phosphorus-control-planning-support.html
- More detail on each workshop
- Links to register
- PCP Templates & resources from FY21

Please submit your questions!

- Our team will work to address them in the remaining workshops & at the Q&A session

Scan QR code to get to website, register, and submit questions

Connect with Us!

email: charles@crwa.org
newsletter: https://www.crwa.org/river-current.html

@charlesriverwatershed

@charlesriverwatershed

@charlesriver

BrownandCaldwell.com

Phosphorus Export Rates by Land Uses and

Charles River Watershed Association

Phosphorus Loading Rates from Table 1-2 (Reformatted)

P Land Use Code Description	P Loading Export Rate (lb/ac/yr) Pervious Area Soil Type				
	HSG A	HSG B	HSG C	HSG C/D	HSG D
Commercial	0.04	0.18	0.36	0.46	0.54
Industrial	0.04	0.18	0.36	0.46	0.54
High-density residential	0.04	0.18	0.36	0.46	0.54
Medium-density residential	0.04	0.18	0.36	0.46	0.54
Low-density residential	0.04	0.18	0.36	0.46	0.54
Highway	0.04	0.18	0.36	0.46	0.54
Forest	0.11	0.14	0.19	0.21	0.23
Open land	0.04	0.18	0.36	0.46	0.54
Agriculture	0.07	0.29	0.6	0.76	0.91

Source: Voorhees Memo (2014), Attachment C, Table C-1. Values converted from kg/ha/yr. to lb./ac/yr. and rounded to decimal places.

P Land Use Code Description	P Loading Export Rate (lb/ac/yr) Directly Connected Impervious Area	Pervious Area				
		HSG A	HSG B	HSG C	HSG C/D	HSG D
Commercial	1.78	0.03	0.12	0.21	0.29	0.37
Industrial	1.78	0.03	0.12	0.21	0.29	0.37
High-density residential	2.32	0.03	0.12	0.21	0.29	0.37
Medium-density residential	1.96	0.03	0.12	0.21	0.29	0.37
Low-density residential	1.52	0.03	0.12	0.21	0.29	0.37
Highway	1.34	0.03	0.12	0.21	0.29	0.37
Forest	1.52	0.13	0.13	0.13	0.13	0.13
Open land	1.52	0.03	0.12	0.21	0.29	0.37
Agriculture	1.52	0.45	0.45	0.45	0.45	0.45

Source: MA MS4 Permit Appendix F, Attachment