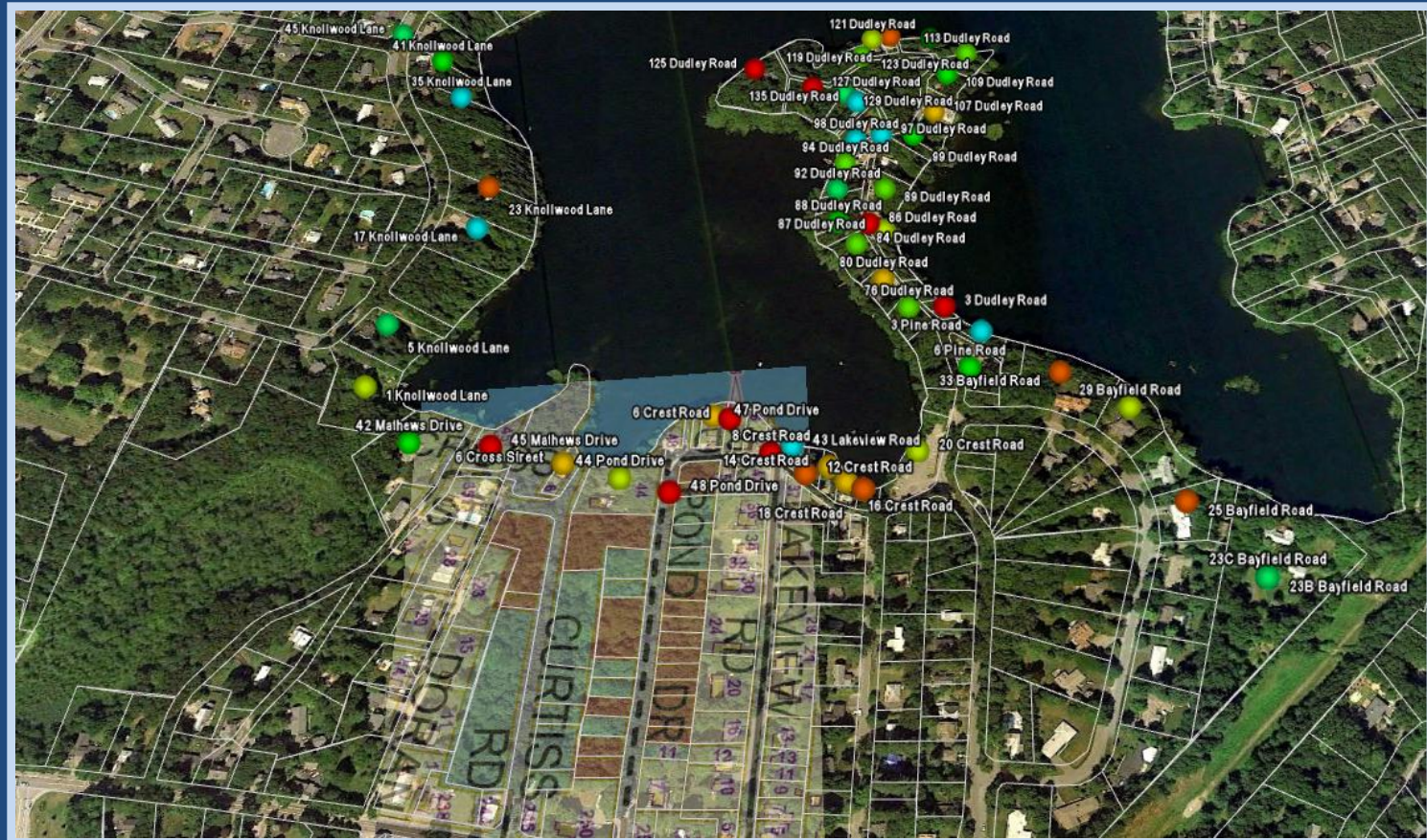


WSWQC - East Dudley Septic Study

Developed by Toni Moores,

Presented June 13, 2012 by Mike Lowery, Bob Goldsmith to the

Wastewater Management District Commission





What's the Surface Water Quality Committee?

Selectmen-appointed, volunteer, modest budget,
limited authority

Mission: Health of Wayland's Surface Waters:

Sudbury River

Heard Pond

North Pond of Lake Cochituate

Dudley Pond



What does SWQC Do ?

- Assessment & Monitoring
- Invasive Weed Control
- **Control and Reduce Nutrients:**
Septic Systems, Surface Water Runoff
- **Education & Coordination:**
Health, Conservation, Public Works, Selectmen, Community Preservation, Recreation, Schools Lake associations & Interest Groups, State Reps, the DCR.

East Dudley Septic Study – why?



- Gather data for a TMDL
'Total Maximum Daily Load'
a **phosphorus budget** for Dudley Pond
- Assess available septic information 'quality'
- **Inform land use decisions**, improve septic regulations, prioritize enforcement and remediation.
- Consolidate data for WWMD, DAAC, Planning Board, BoH, Selectmen, and Conservation.

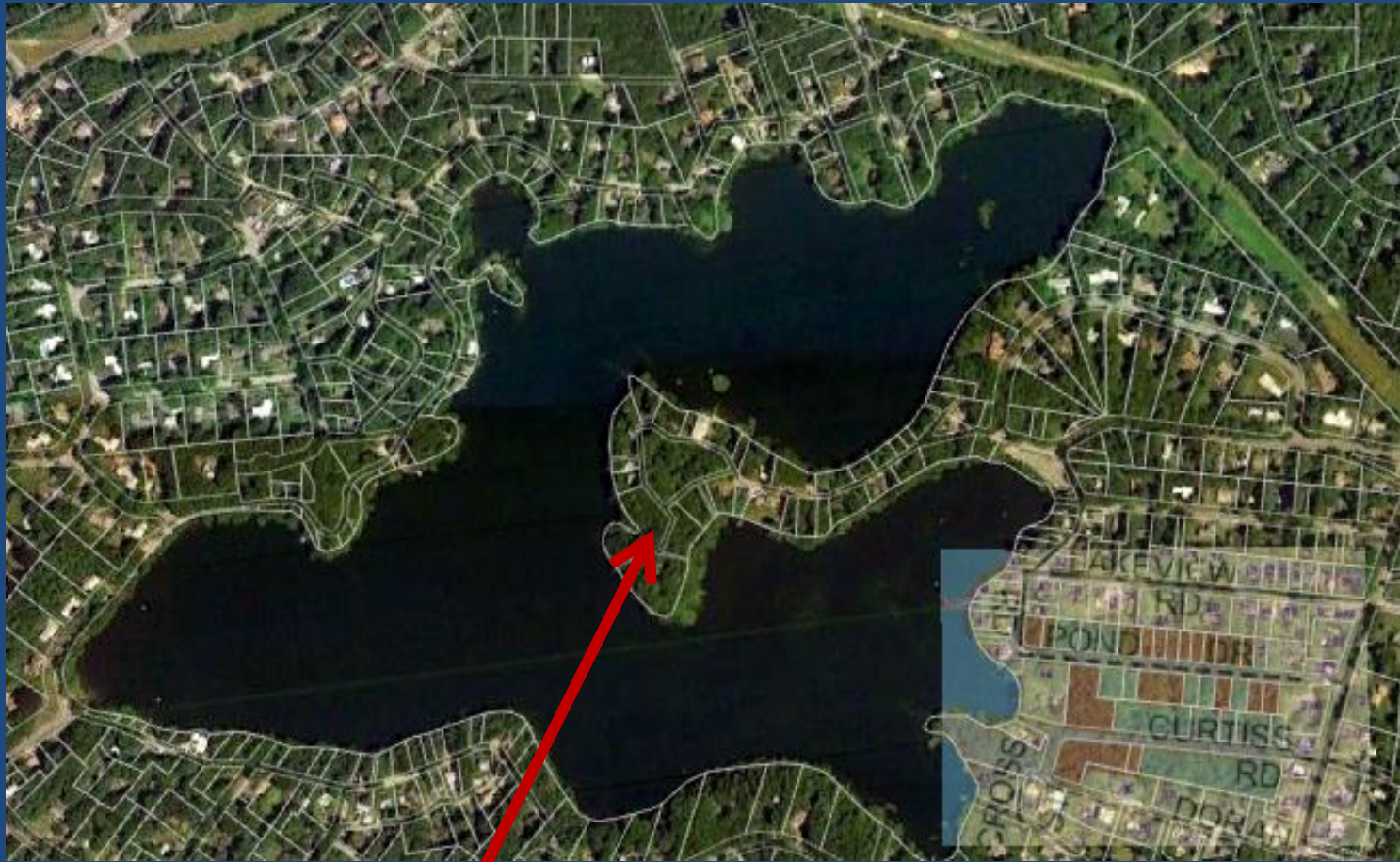
E. Dudley Area Septic Study - Content

- Assesses relative phosphorus contribution of septic systems to Dudley Pond health
- Creates a prioritization model by septic characteristics
- Database of 50 parcels in the most sensitive areas – more parcels to be analyzed in the future.
- Identifies missing or limited data

What's Dudley Pond like? - Demographics

- Dense—
Small lots
- Septic
systems
close to
water
- Permanent
residences
began in
the 30s

Many older
septic
systems



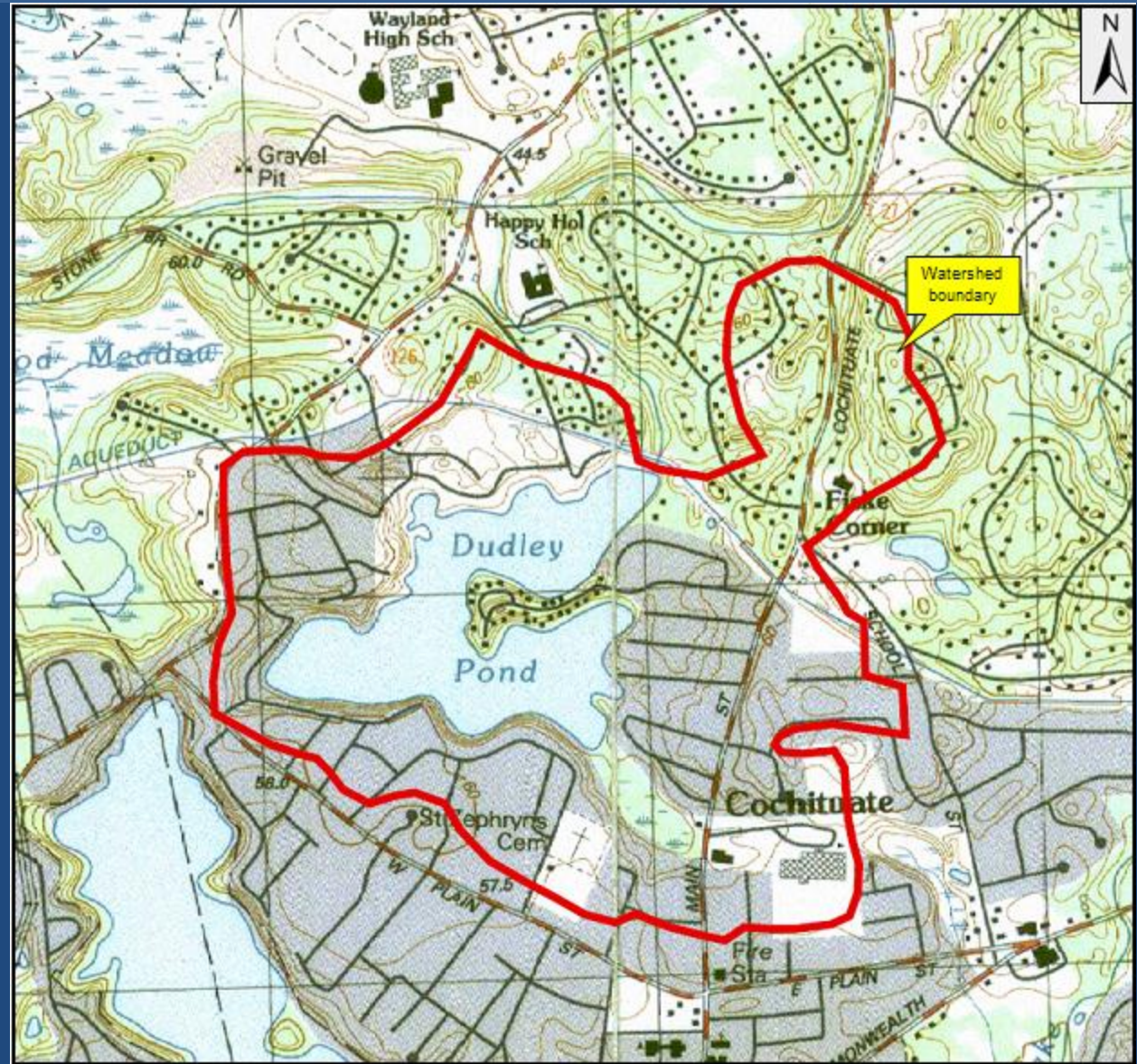
Systems in Failure, including breakout and
year-long forced weekly pumping by BoH

Dudley Area Parcels

What's Dudley Pond Like? - Watershed

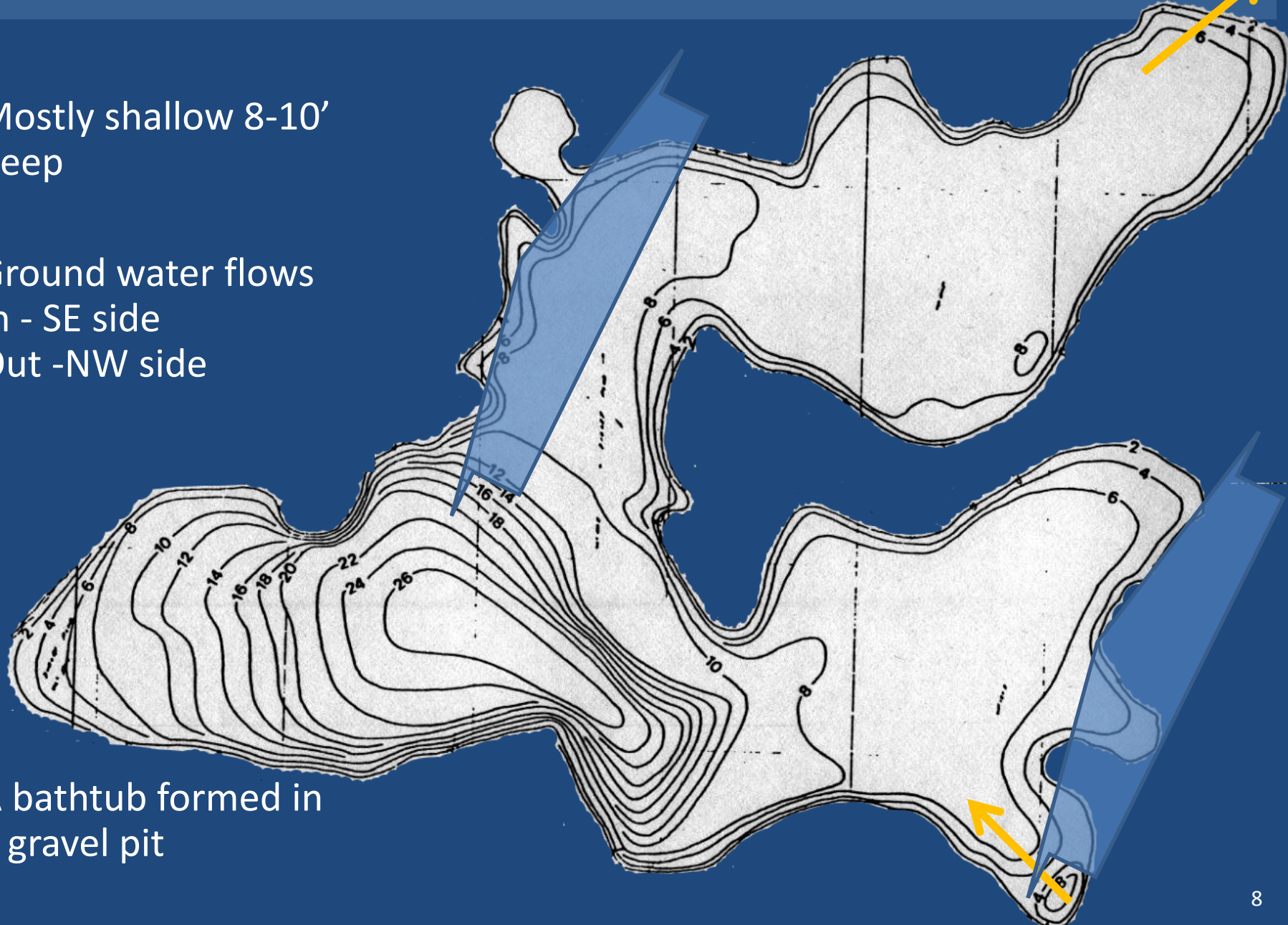
Small surface watershed.

Groundwater flow is more significant than surface water flow

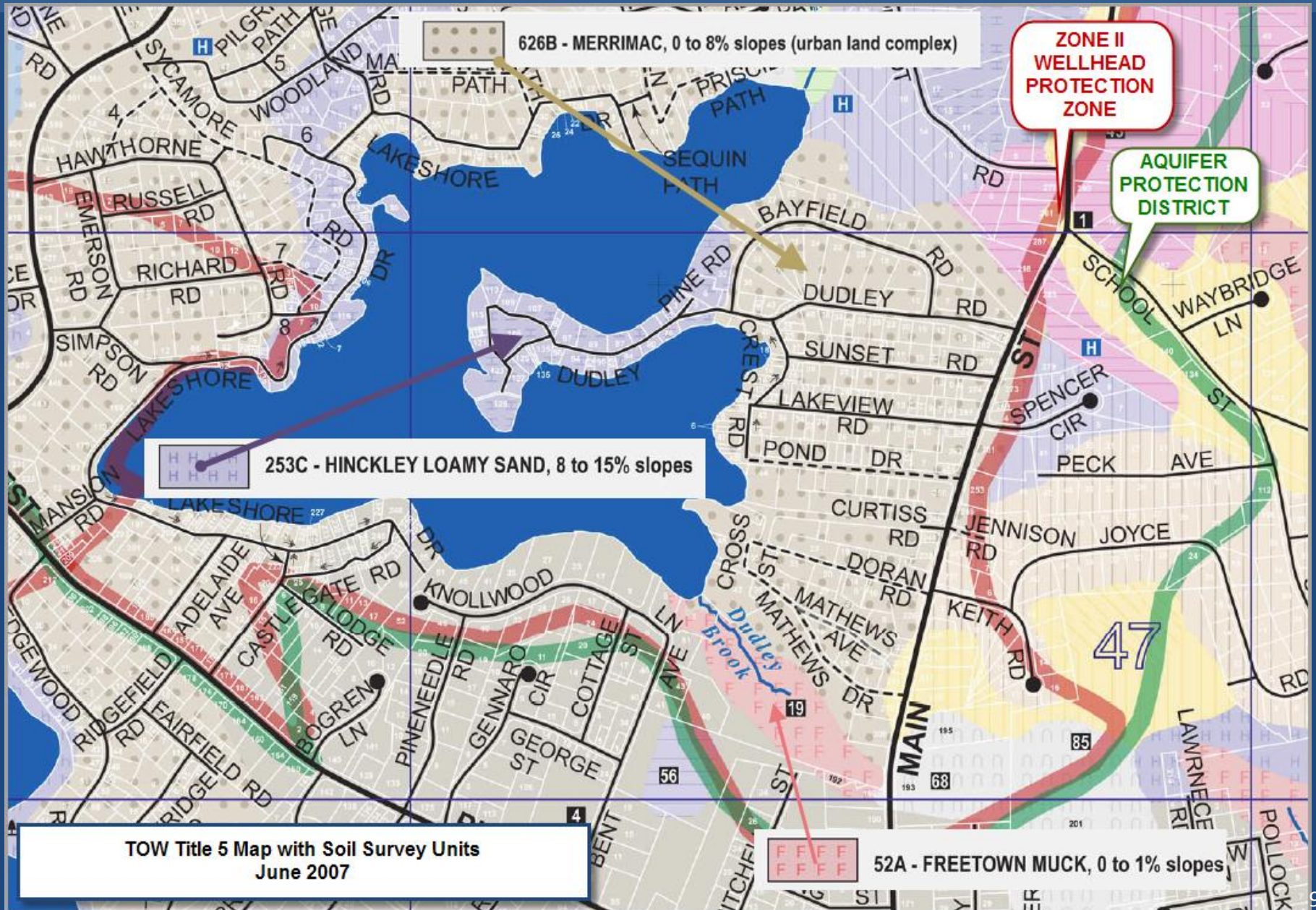


What's Dudley Pond like? – Depth & Flows

- Mostly shallow 8-10' deep
- Ground water flows
In - SE side
Out -NW side
- A bathtub formed in
a gravel pit



What's Dudley Pond like? – Soils



“Merrimac Urban Complex 626B”

MnB-Merrimac-Urban land complex, 0 to 8 percent slopes. This map unit consists of nearly level and undulating Merrimac soil and similar soils and areas of Urban land on broad plains. The Merrimac soil is very deep and somewhat excessively drained,

Soil properties of the Merrimac soil:

- *Permeability:* Moderate or moderately rapid in the surface layer and the subsoil and rapid or very rapid in the substratum.
 - *Available water capacity:* Moderate.
 - *Soil reaction:* Very strongly acid to moderately acid throughout.
 - *Depth to bedrock:* More than 60 inches.
 - *Depth to the seasonal high water table:* More than 6 feet.
- Hydrologic group:* A.

The Merrimac soil has no major limitations for building site development or for local roads and streets. If the soil is used as sites for septic tank absorption fields, ground water pollution is a hazard. Because of rapid or very rapid permeability, the soil readily absorbs but does not adequately filter the effluent.

What's Dudley Pond like? – Water Quality



U.S. ENVIRONMENTAL PROTECTION AGENCY

Watershed Assessment, Tracking & Environmental Results

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You are here: [EPA Home](#) » [Water](#) » [WATERS](#) » [Water Quality Assessment and TMDL Information](#) » Waterbody Quality Assessment Report

[Return to home page](#)

On This Page

- [Causes of Impairment](#)
- [TMDLs That Apply to This Waterbody](#)
- [Previous Causes of Impairment Now Attaining All Uses](#)

State: [Massachusetts](#)

Waterbody ID:

Other ID: MA82029

State List ID: MA82029

Location: Wayland; 82029

State Waterbody Type: Lake/Reservoir/Pond

EPA Waterbody Type: Lakes, Reservoirs, and Ponds

Water Size: 84

Units: acres

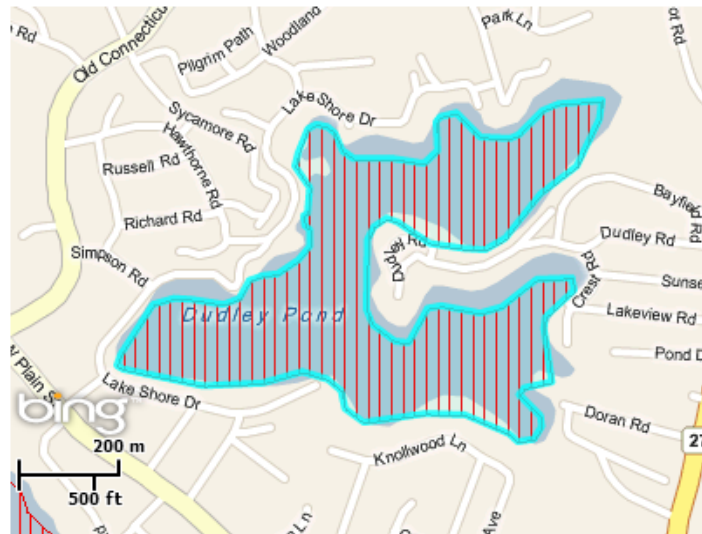
Watershed Name: [Concord](#)

[Waterbody History Report](#)

Data are also available for these years: [2004](#)

[2002](#) [1998](#) [1996](#)

2006 Waterbody Report for Dudley Pond



Click on the waterbody for an interactive map

2008 Same Status on
MA DEP 303d list to US EPA

**CATEGORY 5 - most impaired,
requiring a TMDL**

Causes of Impairment for Reporting Year 2006

[Description of this table](#)

Cause of Impairment	Cause of Impairment Group	State TMDL Development Status
Organic Enrichment/Low Dissolved Oxygen	Organic Enrichment/Oxygen Depletion	TMDL needed
Turbidity	Turbidity	TMDL needed

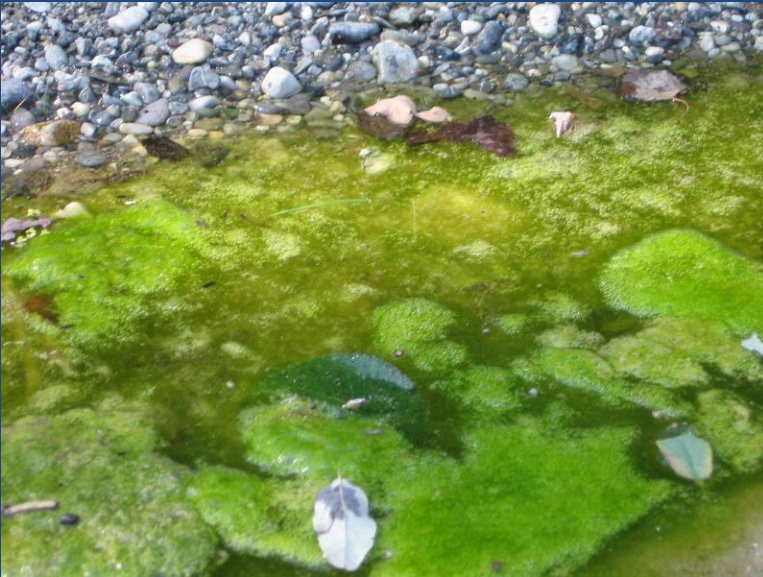
Results of Nutrients – Eurasian Milfoil



Dudley looks good today – What's the problem?

Its a money pit -- Annual invasive weed control– diver hand pulling and herbicide costs \$20,000-\$80,000 annually (DPA pays 25%)

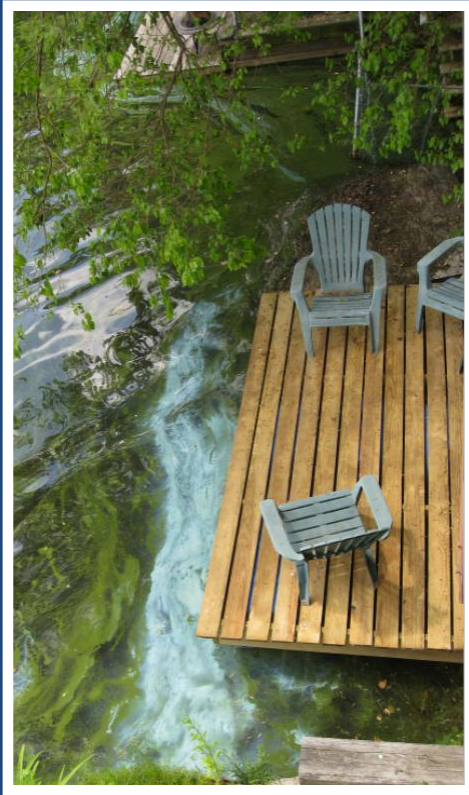
It's Close to Eutrophication:



Invasive weeds and algae
LOVE the nutrient rich waters of
Dudley Pond

What enjoys nutrients if milfoil is suppressed?

- *Algal blooms - Cyanobacteria!*



2009



2010

Why does Dudley Pond Have Milfoil?



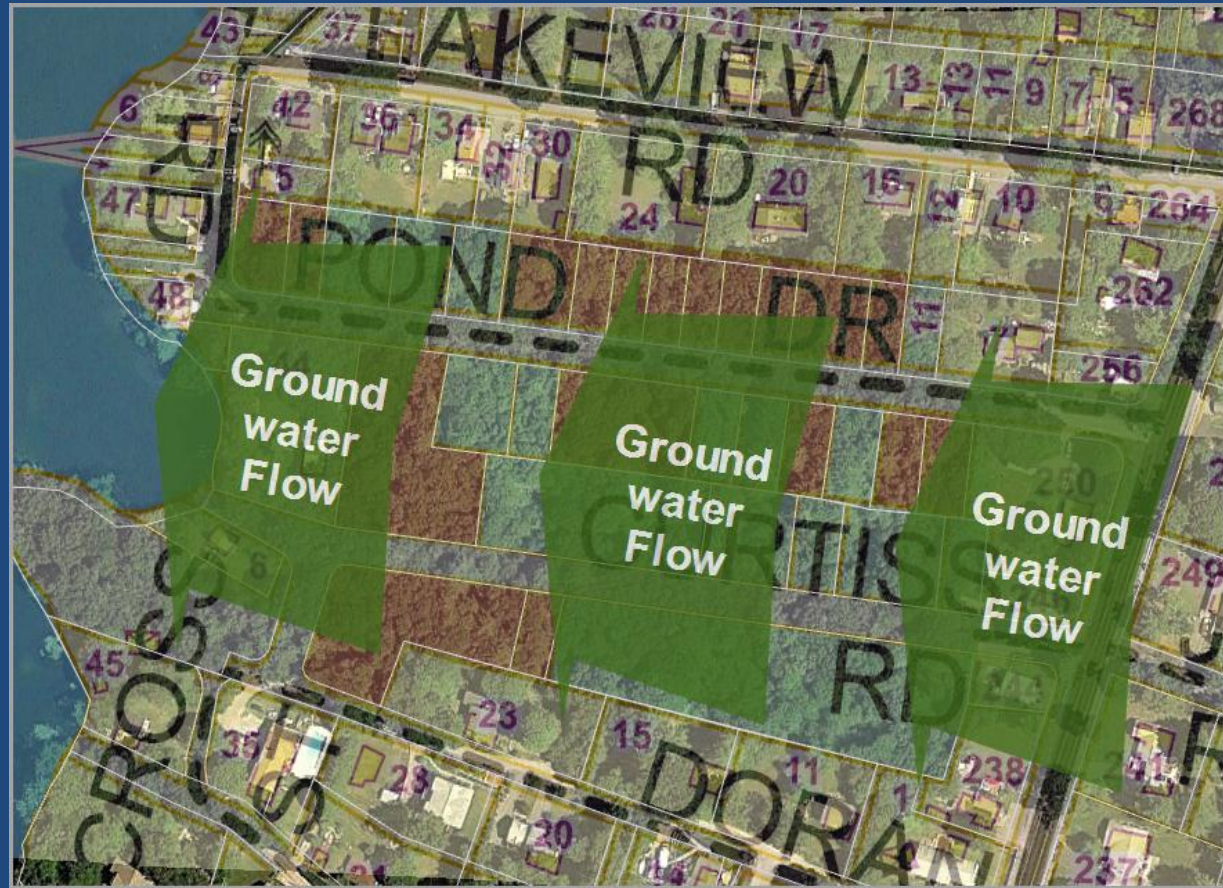
Phosphorus and Nitrogen from surface water runoff (fertilizer) and groundwater (septic)

Nutrient Reduction Schemes

- SWQC position: land use must ***Contribute to Nutrient Reduction!***
- ***Possibilities:***
 - *Erosion Control, paving, catch basins*
 - *Community WWTP serving parcels with septic systems close to Dudley Pond –possibly multiple sites.*
 - *Off-site alternatives*
 - *Middle School fields*
 - *MWRA connections to Natick or Framingham sewers*

Why are the Dudley Area parcels important?

- Ground water flows toward the pond
- Sandy soils - may conduct Phosphorus to the pond
- An increase of use could add nutrients



1983 Diagnostic/Feasibility Study of Dudley Pond
I.E.P. Chapter 2, p 10.

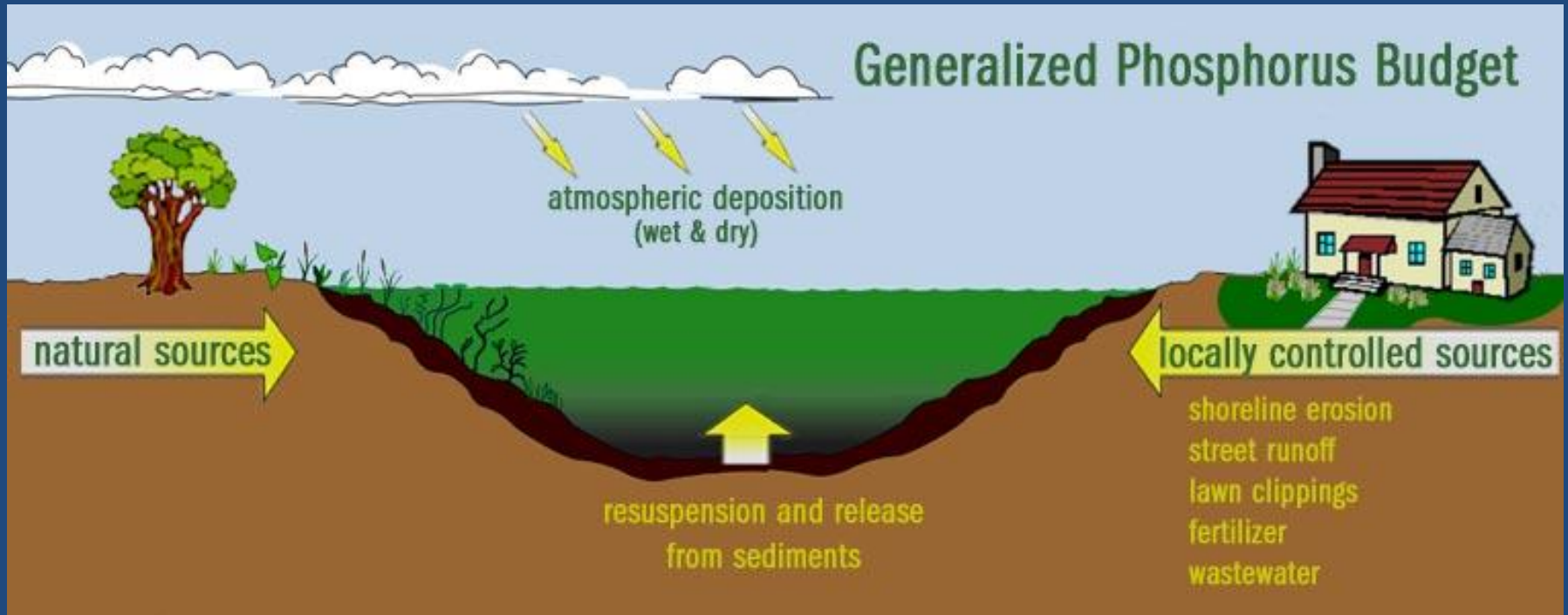
Town Meeting voted to evaluate using Middle School fields:



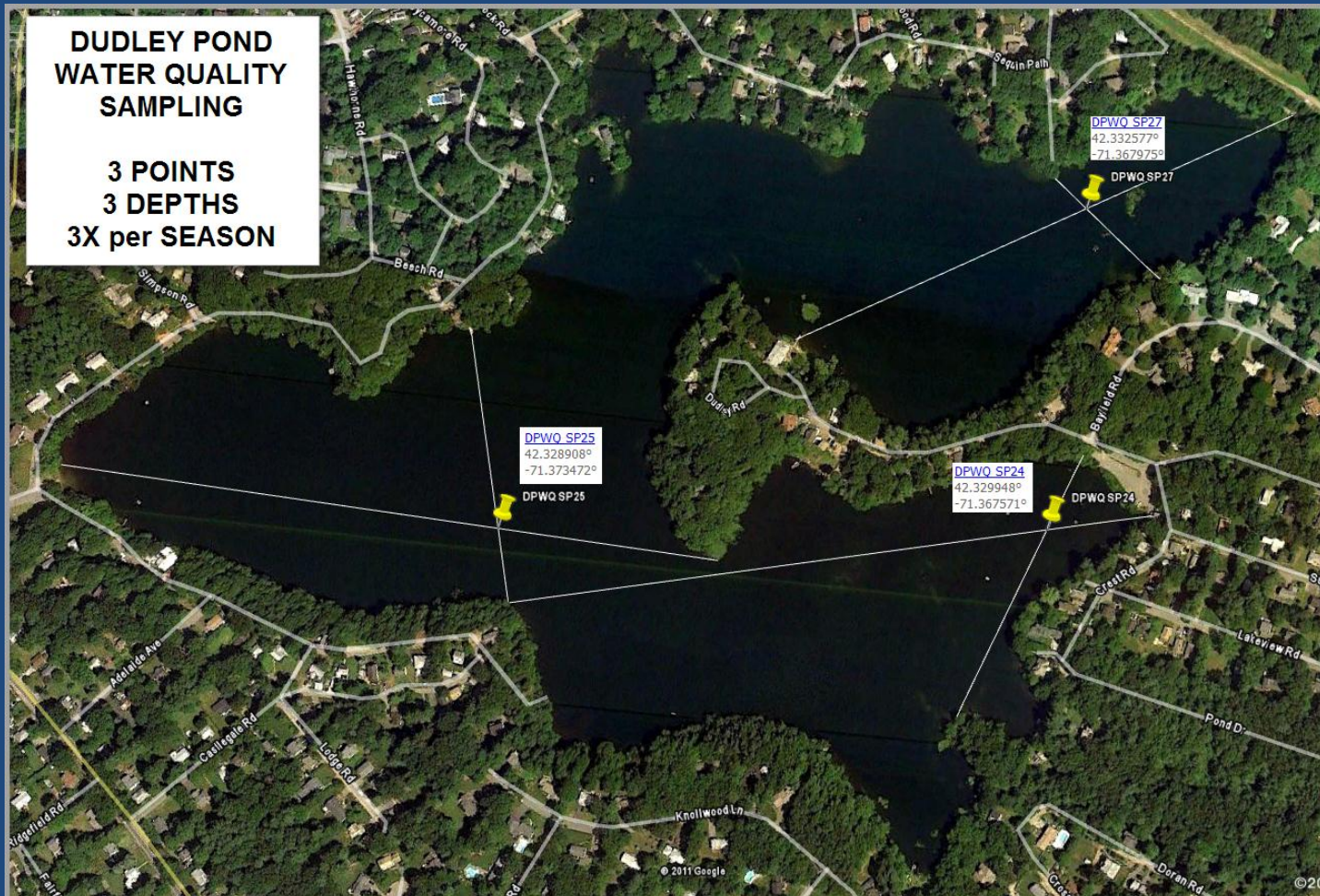
Nutrient Reduction is a must for long term health of Dudley Pond

What are the Sources of N & P?

- Septic leachate
- Surface water runoff
Improved mid-80's with EPA-funded paving and drainage improvements.
- Sediment mixing & other natural sources



2011, 2012 Water Quality Sampling



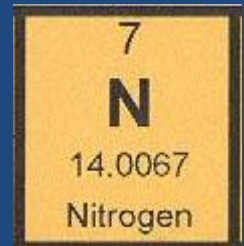
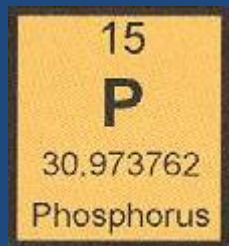
COLLECTED:

Date, Time
Weather
Barometric
Pressure
Location
Depth
pH
ORP
Dissolved
Oxygen
Dissolved
Oxygen %
Saturation
Temperature
Secchi Depth

ANALYSIS: Total Phosphorus (as P), Orthophosphate (as P)
Ammonia (as N), Nitrate/Nitrite (as N), Total Nitrogen (as N)
Chlorophyll α

Won't New Septic Systems Help?

- Somewhat, but a **new Title-5 compliant septic system DOES NOT** itself remove nitrogen and phosphorus!
- Nitrogen compounds dissolve and move, Phosphorus is adsorbed by loamy and clay soils – if you have them, Dudley Pond does not.
- Extra treatment can remove N, P from leachate



Introduction – E. Dudley Septic Study

- Purpose – To Summarize a SWQC Study of Select Dudley Pond Septic Systems
 - Background
 - The Symptoms
 - The Problem
 - Septic System Study
 - Why Dudley Pond?
 - What was done?
 - Results
 - Recommendations
 - Conclusions & Data Uses

Background - Symptoms

- Excessive amounts of algae and weeds (Milfoil) fueled by high phosphorus (P) concentrations
- Loss of recreational, property & aesthetic values
- MA DEP designation Category 5 Impaired Water Body (organic enrichment, low DO, turbidity and exotic species)

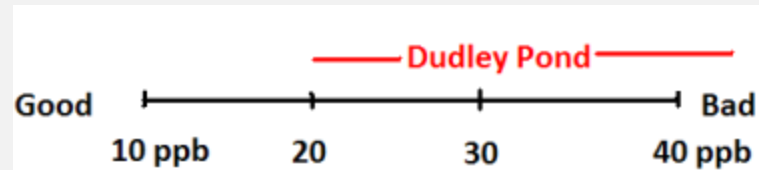
Background: Costs since 1980

Program	Funding Source	Cost
Chemical treatments: 1968, 1970, 1974,1976,1977,1978	ToW, MA DEQE	unknown
Hydro-raking: 1981, 1983, 1984,1985, 1986, 1987, 1989	Unknown	unknown
Pave, Grade, Drains –Stormwater Improvements	75% EPA, 25% ToW	\$540,000
Drainage Middle School	90% DEP, 10% ToW & DPA	\$70,000
Water Circulators	ToW (CPA)	\$35,000
Diver Hand Pulling	ToW 47%, DPA 25%, MA 28%	\$116,000
Herbicide	ToW 46%, DPA 43%, MA 11%	\$179,000
Weevils	MA 100%	\$25,000
Mechanical Harvesting	MA 100%	\$25,000
TOTALS	ToW 31%, DPA 11%, MA 58%	\$990,000

Some data may be missing, some data area approximations.

Background – The Problem

- Phosphorus Concentrations
- Major P Sources need to be identified, quantified & minimized
 - Rainwater runoff – 2007 study completed, quantities can be estimated, watershed mailings completed
 - Septage – Need to identify, quantify & minimize this source
- Weed Nutrient Pandemic – Dudley Pond not unique



**One Person's Septage (1 – 1.5 lb Phosphorus/yr) =
1,900 lbs/year wet weeds =
\$267/year of DPA/TOW Funds**

Dudley Pond Septic Study

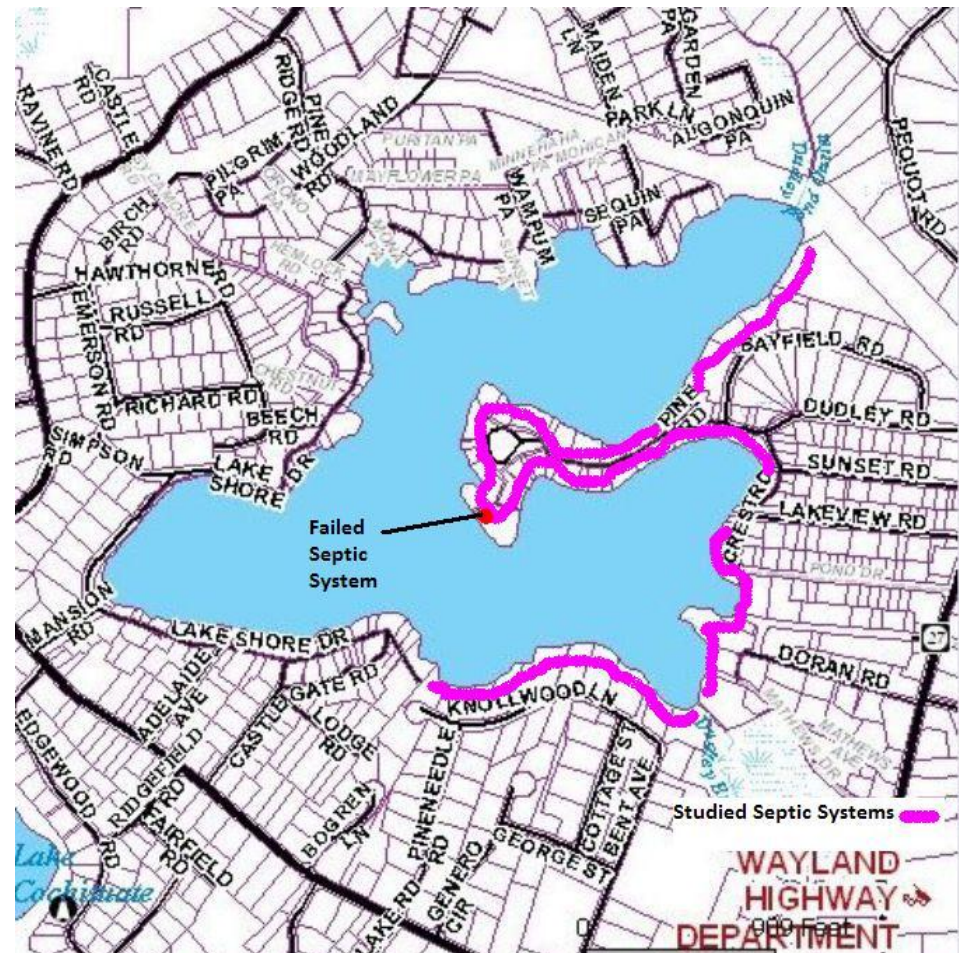
- **Why Study Dudley Pond Septic Systems?**
 - \$\$\$\$\$ Largest annual TOW/DPA weed management expenditures
 - Density of abutting houses & septic systems (106)
 - EPA estimates 25% failure rate of MA septic systems
 - Little systematic Dudley Pond Septic information

Dudley Pond Septic Study

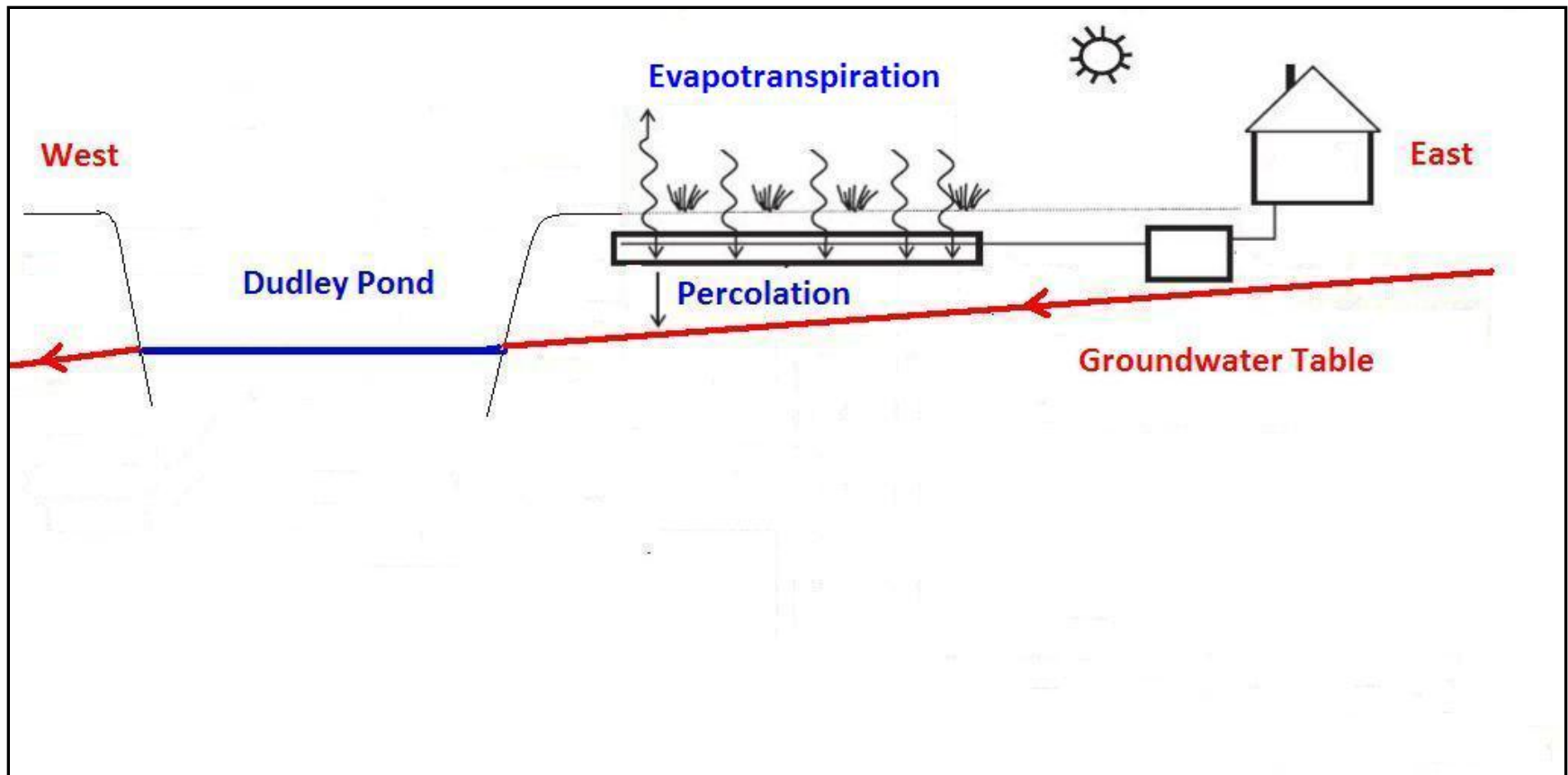
Septic Systems Studied

Why study abutters on east side?

- Density of septic systems - 50/106
- Groundwater hydrology



Dudley Pond Groundwater Hydrology: East to West flow



Data Gathered & Sources

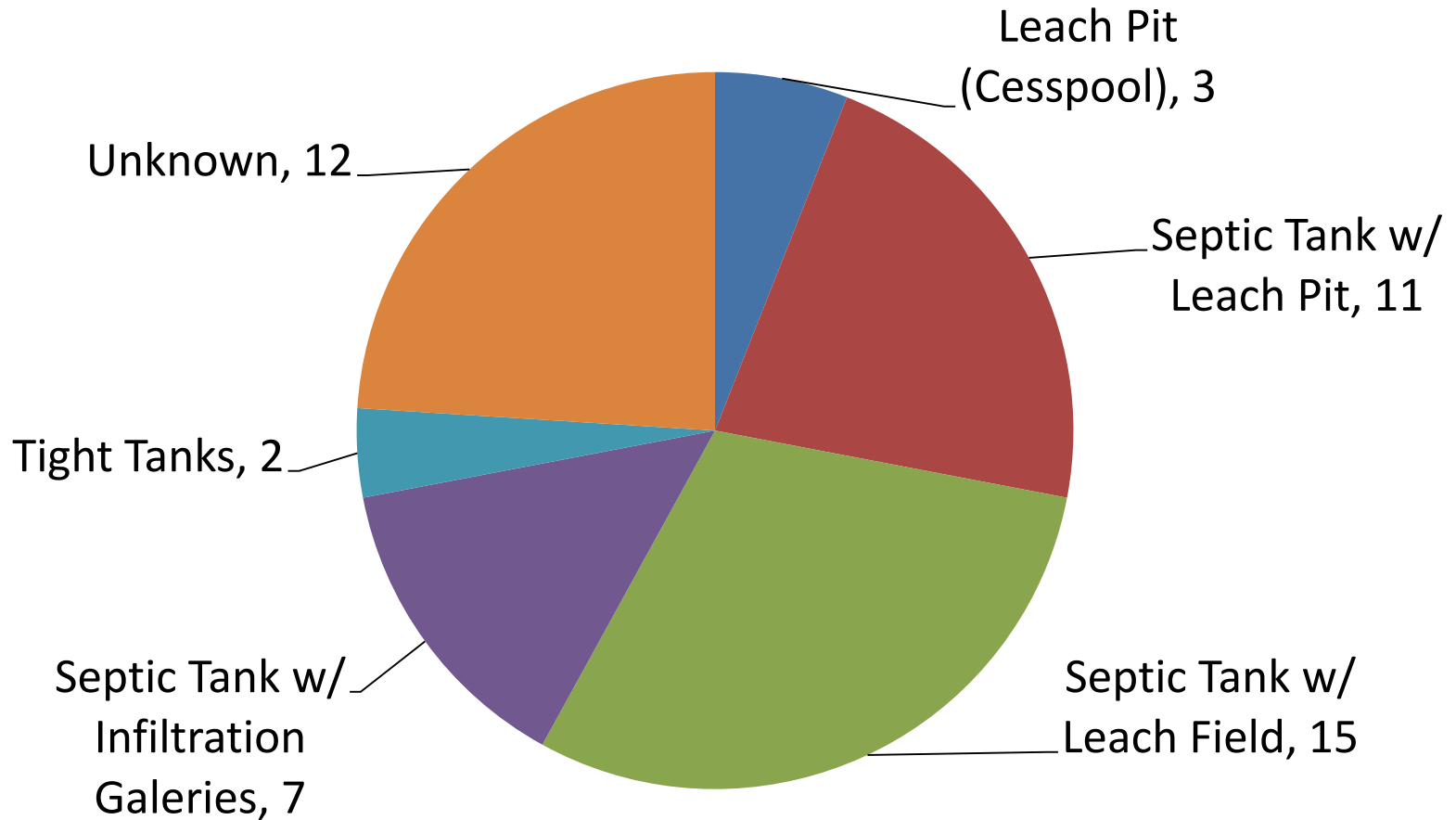
Data Item	Source
Addresses & Owner	TOW Maps & Voter Reg.
Number of systems users	Voter Registrations
Water usage – 2 year average	BoPW files
Septic System Types	BoH files
Ages of Septic Systems	BoH files
Systems with MA 'Title V'	BoH files
Proximity of Groundwater	BoH files
Percolation Rates	BoH files
Distance from Pond	BoH files
Year Last Pumped	BoH files

Results - Statistics

- Number of systems studied - 50 out of 106
- Number of system users – 103 +/-
- Pounds per year of Phosphorus – 155 lbs +/-
- Water Usage (Avg. last 2 years)
 - 50 cu ft/yr – 14,900 cubic feet per/yr
 - Average household - 5,400 cu ft/yr
 - Average per capita usage – 54 gal/person/day

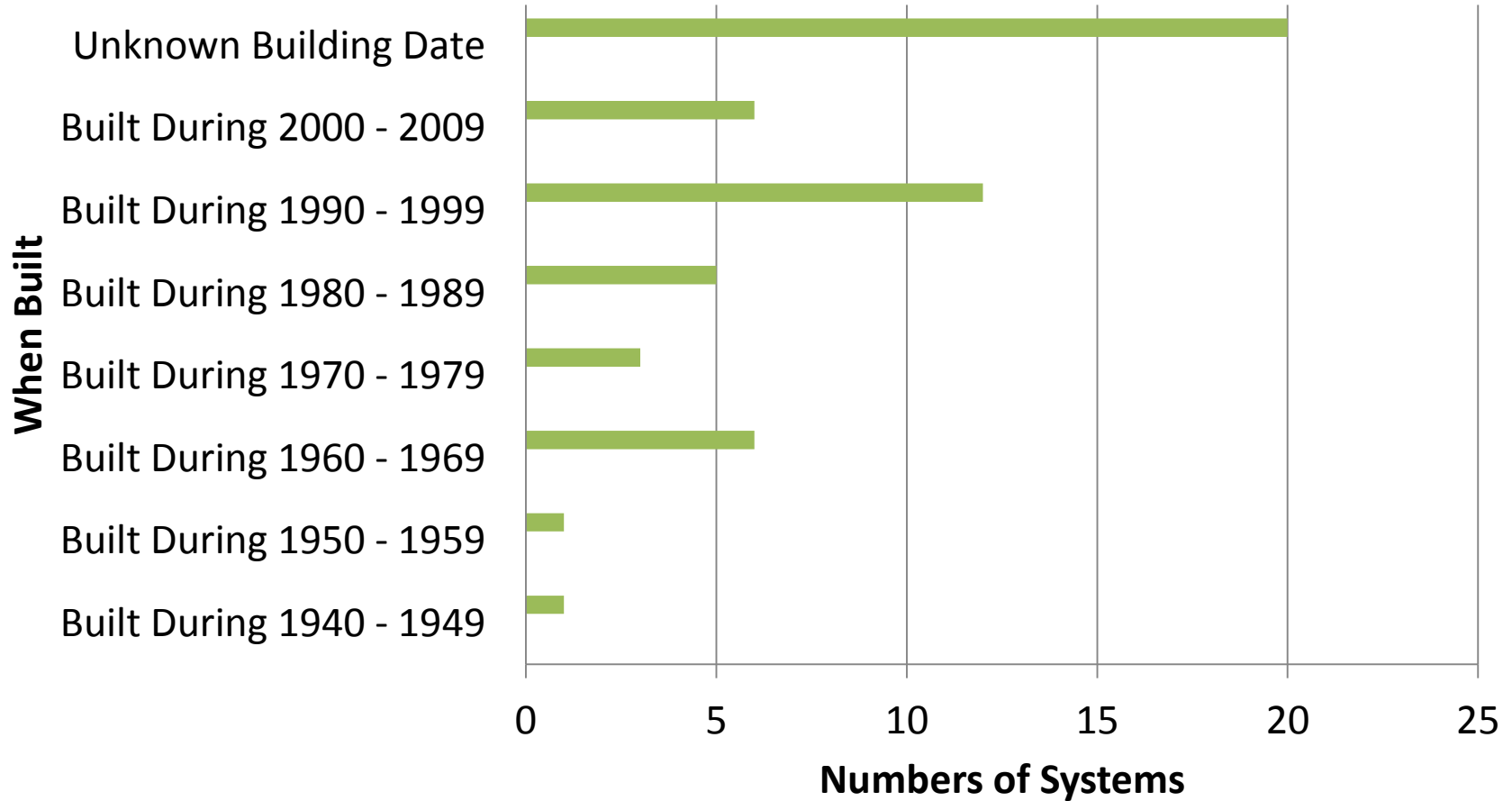
Results:

System Types & Numbers



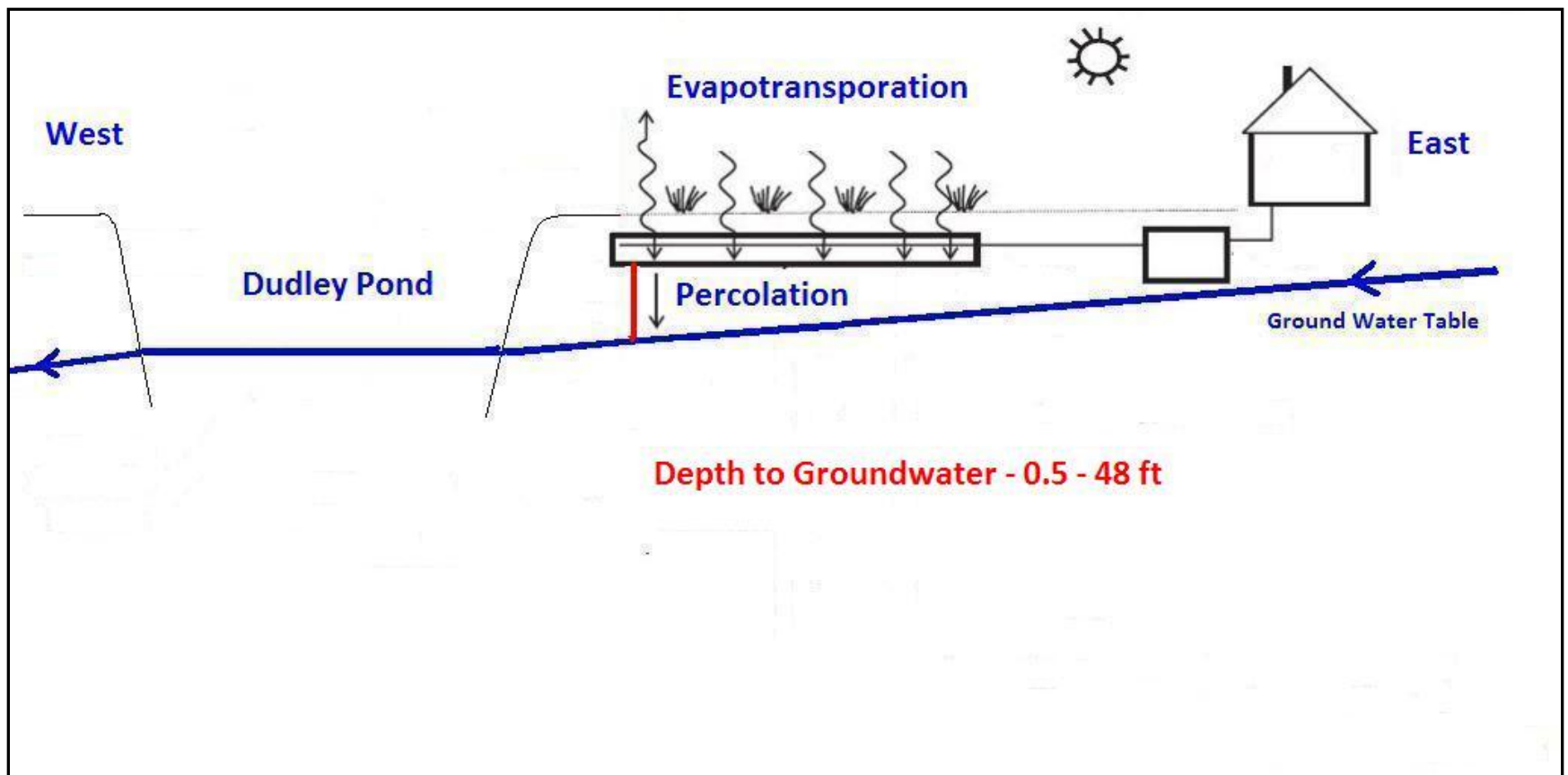
Results:

Systems Ages



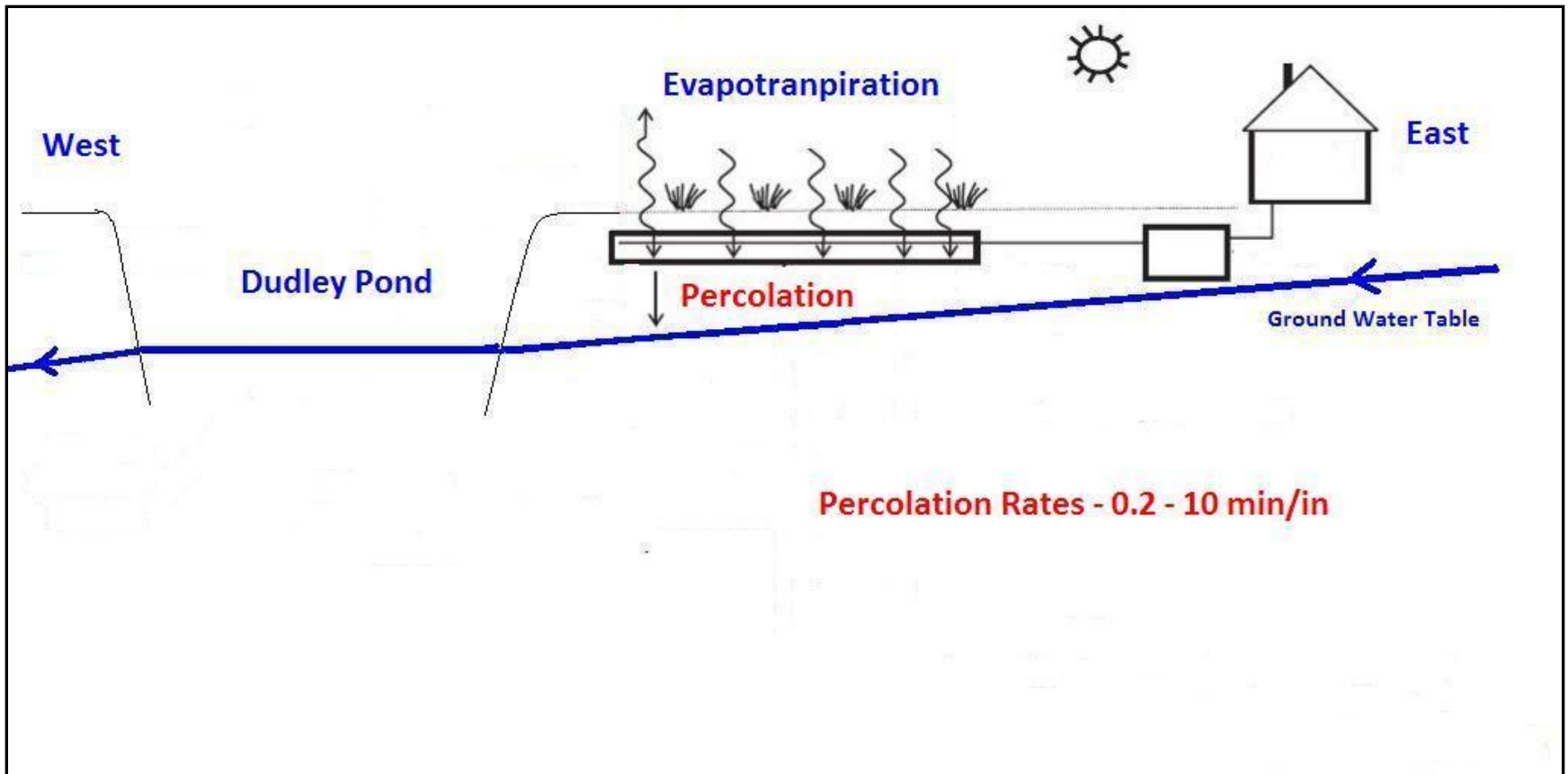
Results:

Depth to Groundwater



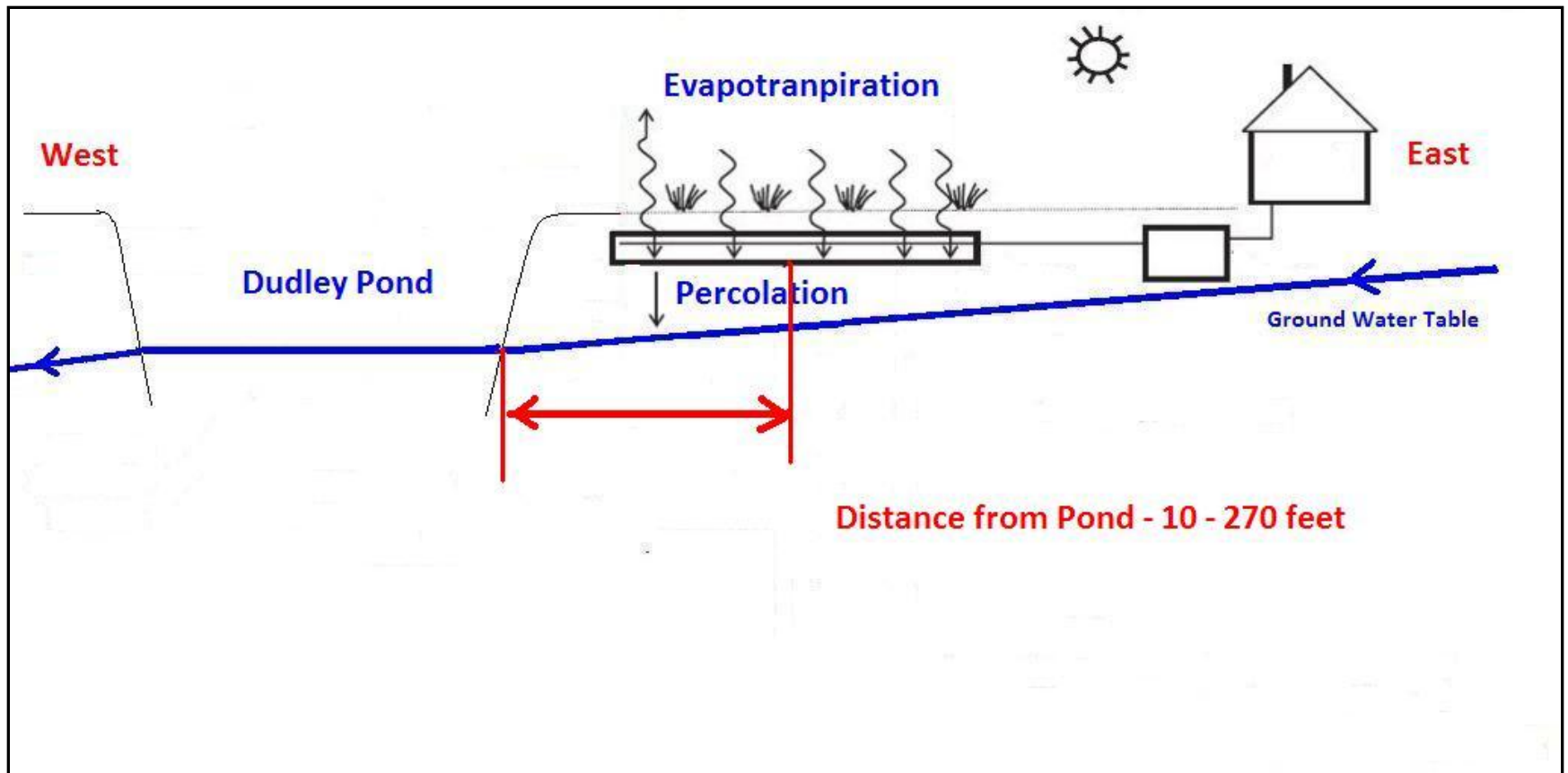
Results:

Percolation Rates



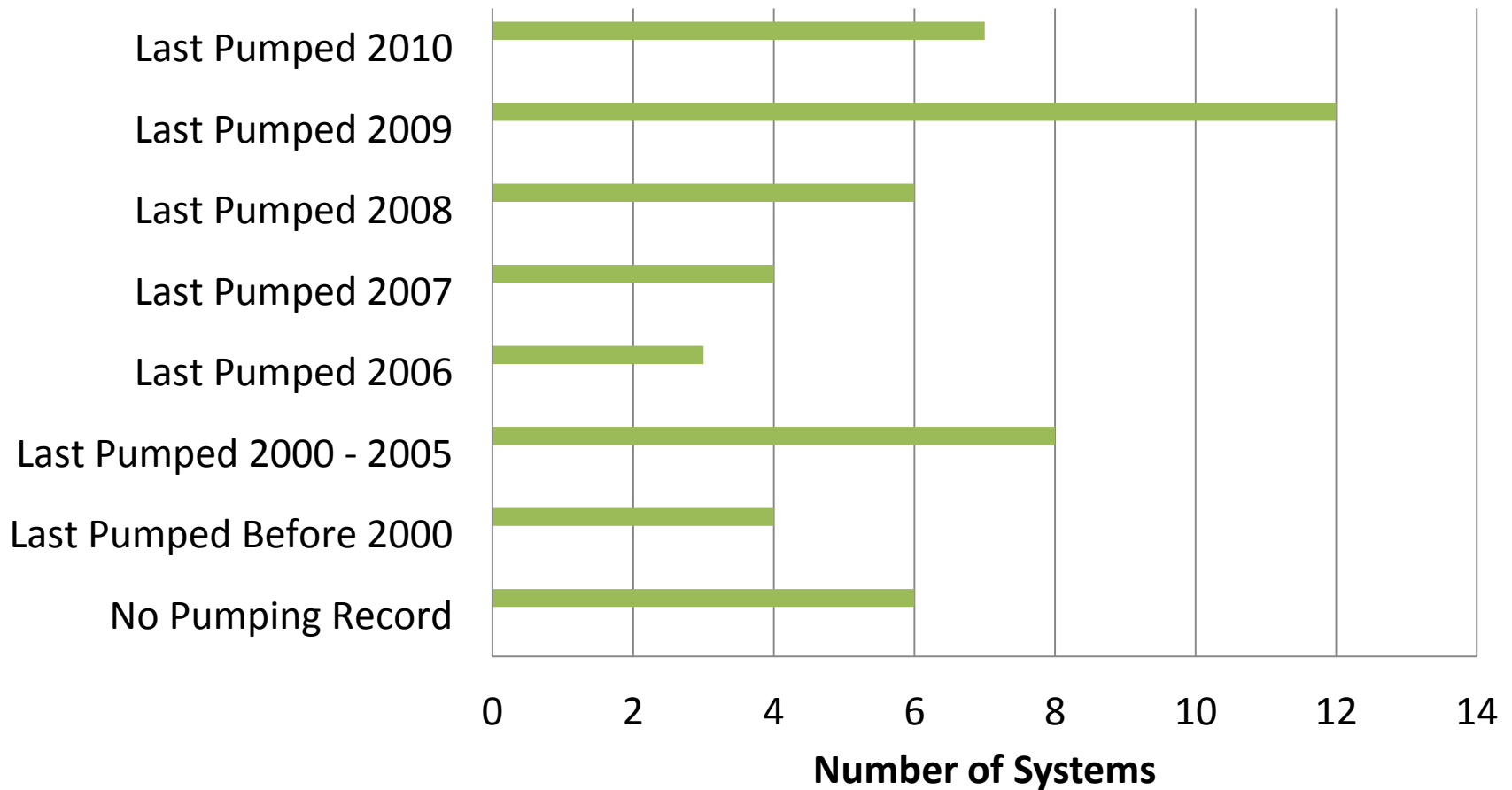
Results:

Distance from Pond



Results:

Pumping Records



Septic Scoring

SCORING FUNCTIONS

Legend	Score	Type	New Date	Score	Title V	Score
?	8	Unknown	?	10	?	10
Failed	50	Leaking	1900	10	N	8
LP	10	Cess Pool	1960	9	Y	0
ST-IG	6	Septic tank Infiltration gallery	1970	8		
ST-LF	2	Septic Tank Leach field	1980	7	Drawing	Score
ST-LP	4	Septic Tank Leach Pit	1990	6	N	10
Tight	5	Tank that accumulates sewage and is periodically pumped	2000	5	Partial	5
			2005	3	Y	0
			2010	1		
			2015	0		

Perc m/in	Score	Ft to Pond	Score	Pumped	Score	Leach-GW	Score
0.1	8	?	10	?	10	0	10
1	6	0	9	1985	10	4	9
2	4	25	8	1999	8	6	8
5	2	50	7	2000	6	8	7
10	1	75	6	2002	5	10	6
		100	5	2004	4	12	5
		125	4	2006	3	14	4
		150	3	2008	2	16	3
		175	2	2009	1	18	2
		200	1	2010	0	20	1
				2015	0	100	0

B	C	D	E	F	G	H	I	J	K	L	M	N	
Weighting Factors	2.5		1.0		1.0		1.0		1.0		0.3		
Name	People	People-score	cu ft/yr	WaterUse-score	SysType	Type-score	NewDate	New-score	Title-V	TitleV-score	Drawing	Drawing-score	
	O	P	Q	R	S	T	U	V	W	X	Y	Z	AA
	1.0				0.5			1.5			2.0		
	Grade-EL	GW-EL	Leach-EL	Leach-GW	Prox-score	Perc m/in	Perc-score	Ft to Pond	Dist-score	LastPump	Pump-score	#P/yr	TOTAL-SCORE

Septic Scorecard

	A	B	C	D	E	F	G	H	I	J	K	L	M	N
1		Weighting Factors		2.5		1.0		1.0		1.0		1.0		0.3
2	Address	Name	People	People-score	cu ft/yr	WaterUse-score	SysType	Type-score	NewDate	New-score	Title-V	TitleV-score	Drawing	Drawing-score
3	125 Dudley Road	Pauplis on 123's lot	3	6	9200	6.13	Failed	50	?	10	N	8	N	10
4	6 Crest Road	Mahlowitz	5	10	11250	7.50	ST-LP	4	1980	7	N	8	Y	0
5	45 Mathews Drive	Griggs	4	8	5250	3.50	ST-LP	4	1962	9	N	8	Y	0
6	48 Pond Drive	Portyrata	5	10	7300	4.87	ST-LF	6	?	10	N	8	Y	0
7	8 Crest Road	Young	1	2	1400	0.93	?	8	?	10	N	8	N	10
8	18 Crest Road	Santaspago	3	6	8300	5.53	ST	10	?	10	N	8	N	10
9	25 Bayfield Road	Mitnik	3	6	9750	6.50	ST-LF	6	1975	8	N	8	Partial	5
10	119 Dudley Road	Pompeo	2	4	2500	1.67	?	8	1991	6	N	8	N	10
11	23 Knollwood Lane	Leung	3	6	10950	7.30	ST-LP	4	?	10	N	8	N	10
12	33 Bayfield Road	Morss	5	10	11550	7.70	ST-LF	6	2005	3	N	8	Y	0
13	12 Crest Road	Beaulieu	1	2	3400	2.27	ST-LF	6	1985	7	N	8	Y	0
14	47 Pond Drive	Merette	3	6	14900	9.93	ST-LG	6	1992	6	N	8	Y	0

	O	P	Q	R	S	T	U	V	W	X	Y	Z	AA
					1.0		0.5		1.5		2.0		
	Grade-EL	GW-EL	Leach-EL	Leach-GW	Prox-score	Perc m/in	Perc-score	Ft to Pond	Dist-score	LastPump	Pump-score	#P/yr	TOTALS SCORE
	172	150	163	13.0	5	2	4	?	10	2009	1	4.5	115.6
	161	150	153	3.0	10	2	4	70	7	1995	10	7.5	94.0
	160	157	158.5	1.5	10	0.2	8	70	7	?	10	6	89.0
	166	150	160	10.0	6	2	4	270	1	?	10	7.5	83.4
	166	150	158	8.0	7	2	4	?	10	1992	10	1.5	78.4
	156	150	153	3.0	10	2	4	?	10	2010	0	4.5	78.0
	156	150	153	3.0	10	2	4	?	10	2009	1	4.5	73.8
	164	150	157	7.0	8	2	4	?	10	2001	6	3	73.2
	190	150	184	34.0	1	2	4	?	10	2004	4	4.5	72.8
	159.6	152.8	156.1	3.3	10	2	4	100	5	2009	1	7.5	71.2
	164	150	154	4.0	9	2	4	70	7	?	10	1.5	69.8
	159.4	150.5	154.5	4.0	9	2	4	100	5	2007	3	4.5	69.4

Clickable Septic Data Map:

enables tailored outreach to individual households



Study Recommendations

- Review – WWMD, BoH, DPA, ConCom, Planning & BoS
- Systems with high scores - review and choose actions
 - Continue public education programs
 - Seek funding & complete a study (TMDL) to:
 - Determine max permissible daily phosphorus load for Pond
 - Identify relative sizes of sources (Runoff vs. Septic)
 - Identify phosphorus minimization opportunities
- Consider watershed by-laws re septic systems and landscape fertilizer use
 - Expand the study to include systems between Dudley Pond and Route 27 (99 additional properties)

Evaluate East Dudley Pond septic management alternatives

Study Conclusions

- Dudley Pond's symptoms are telling us the existing nutrient (phosphorus) load is too large.
- Public education and participation must increase.
- The symptoms (weeds) will continue to need annual funding and management .
- Structural changes are necessary to reduce nutrients. We look for WWMDC support.
- Phosphorus from septic systems and surface water runoff must be reduced.

Thanks for your attention & your efforts.



Wayland Surface Water Quality Committee