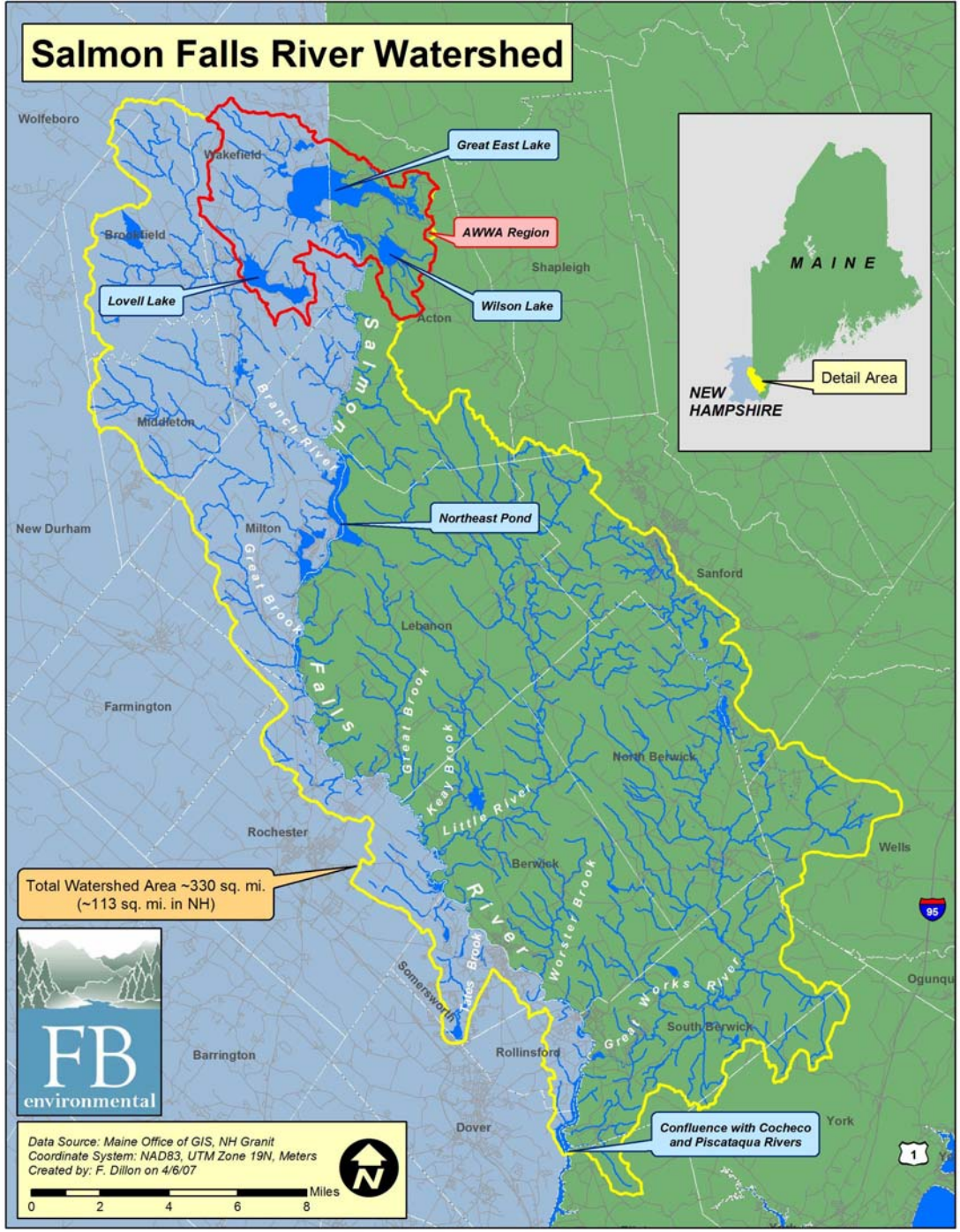
Acton Wakefield Watersheds Alliance

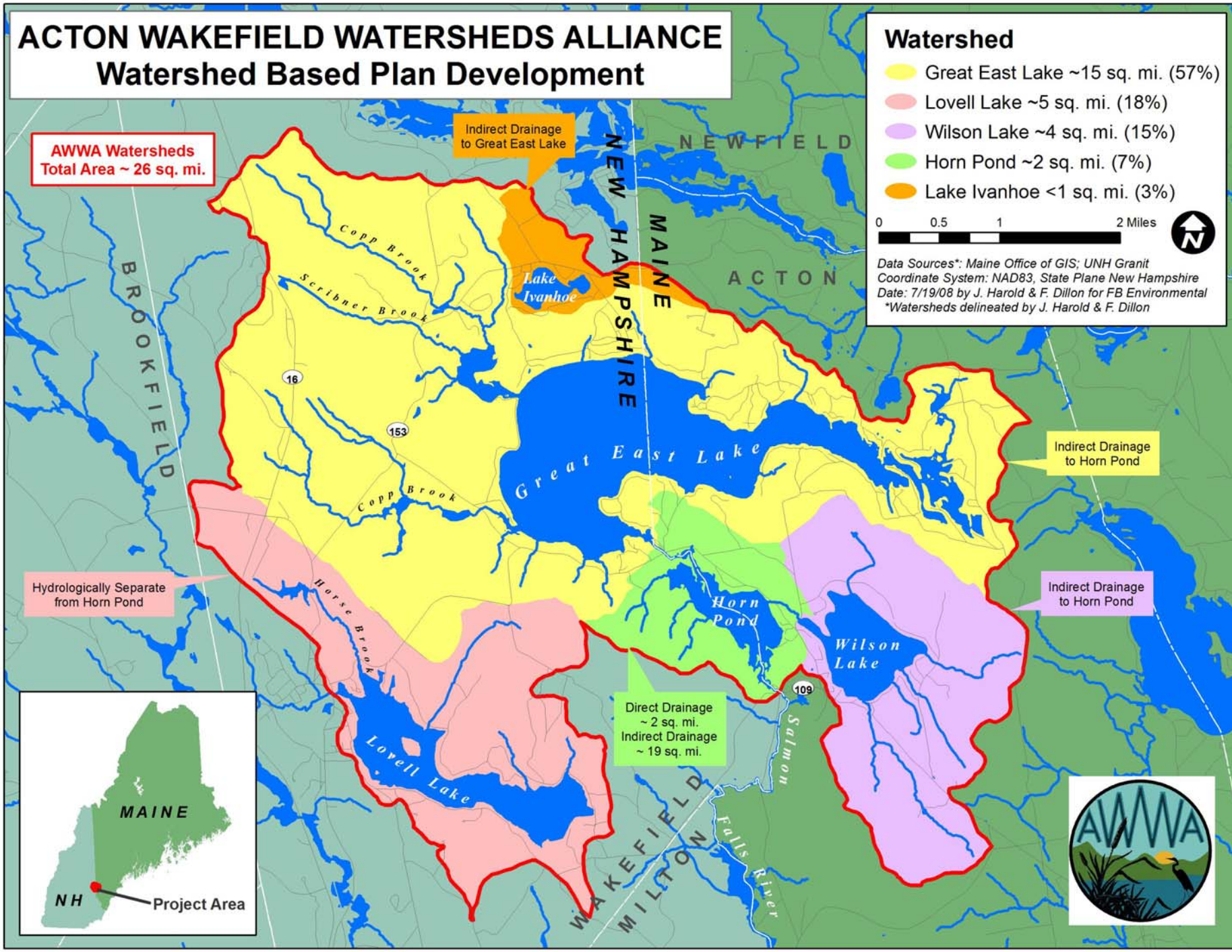
WBMP Tools: *Buildout Analysis & Municipal Ordinance Review*

NH Waters Conference November 21, 2009

Forrest Bell
FB Environmental Associates

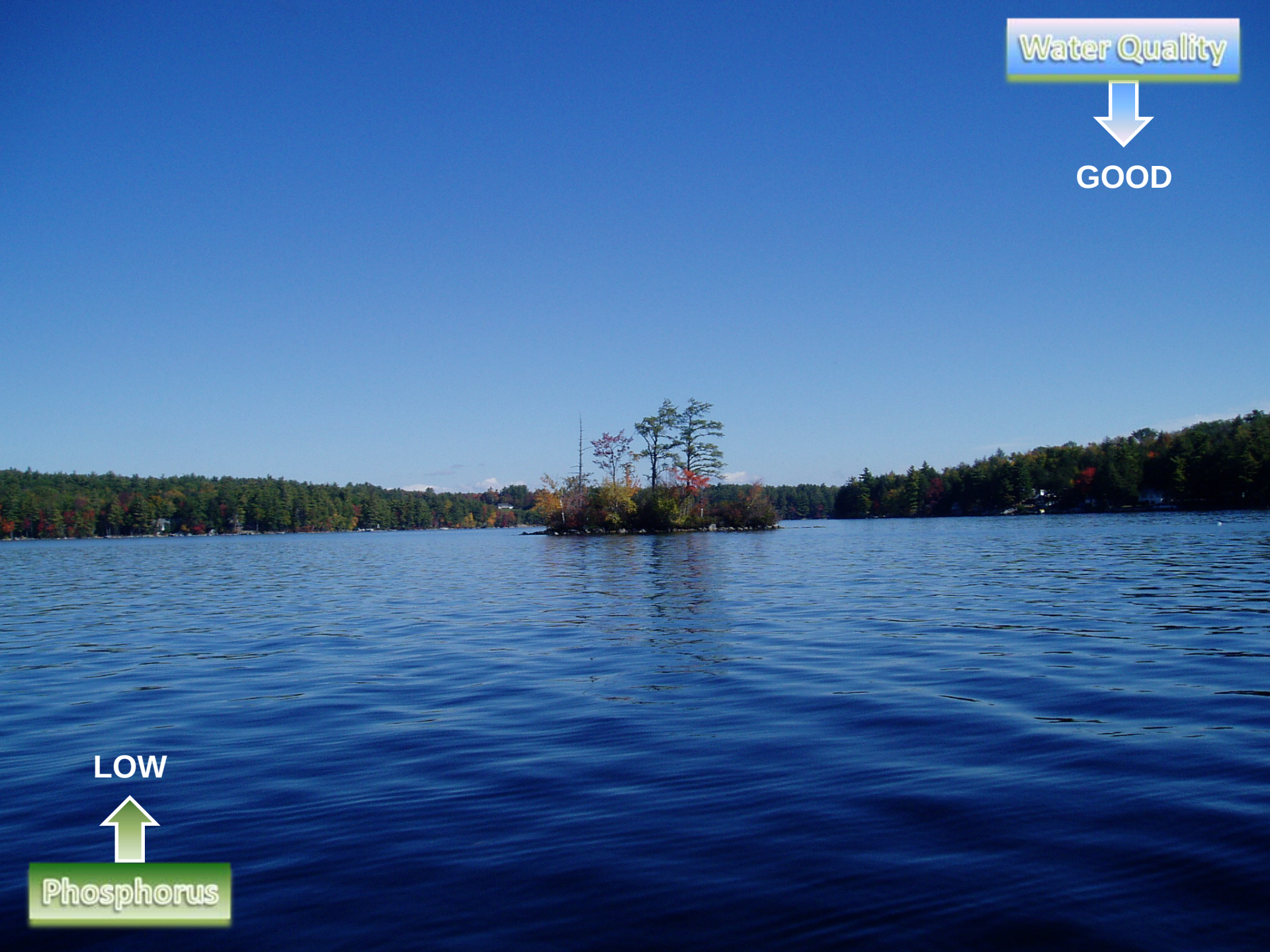
Linda Schier
Acton Wakefield Watersheds Alliance

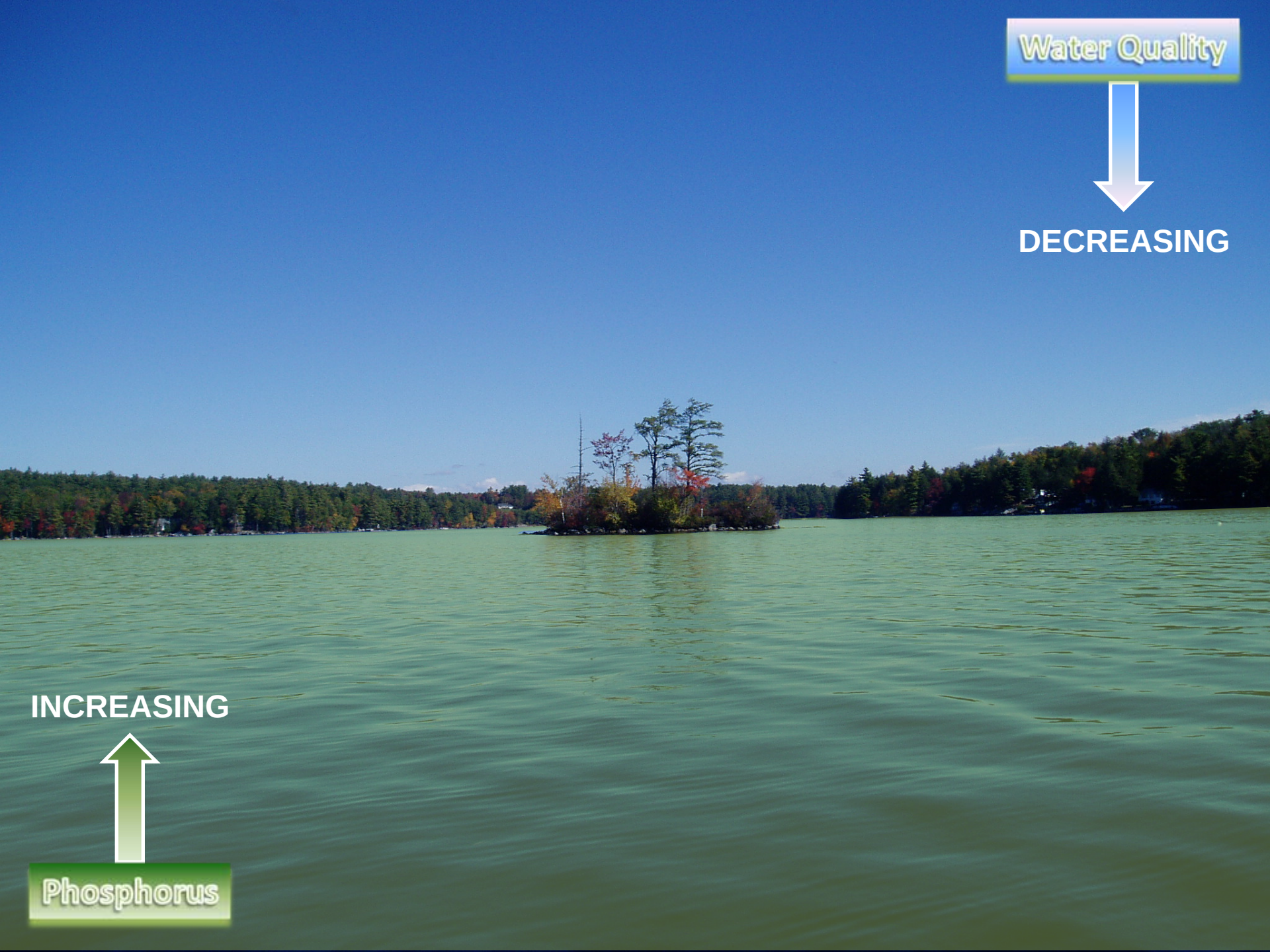

Salmon Falls River Watershed
Great East Lake
AWWA Region
Lovell Lake
Wilson Lake
Northeast Pond
Wolfeboro
Wakefield
Brookfield
Shapleigh
Acton
Middleton
New Durham
Milton
Sanford
Lebanon
Farmington
North Berwick
Rochester
Wells
Berwick
Ogunqu
Barrington
Rollinsford
South Berwick
Dover
York
Salmon Falls River
Branch River
Great Brook
Keay Brook
Little River
Worster Brook
Great Works River
Yates Brook
Somersworth
MAINE
NEW HAMPSHIRE
Detail Area
Total Watershed Area ~330 sq. mi.
(~113 sq. mi. in NH)
Confluence with Cocheco and Piscataqua Rivers
FB environmental
Data Source: Maine Office of GIS, NH Granit
Coordinate System: NAD83, UTM Zone 19N, Meters
Created by: F. Dillon on 4/6/07
Miles
0 2 4 6 8
N
95
1

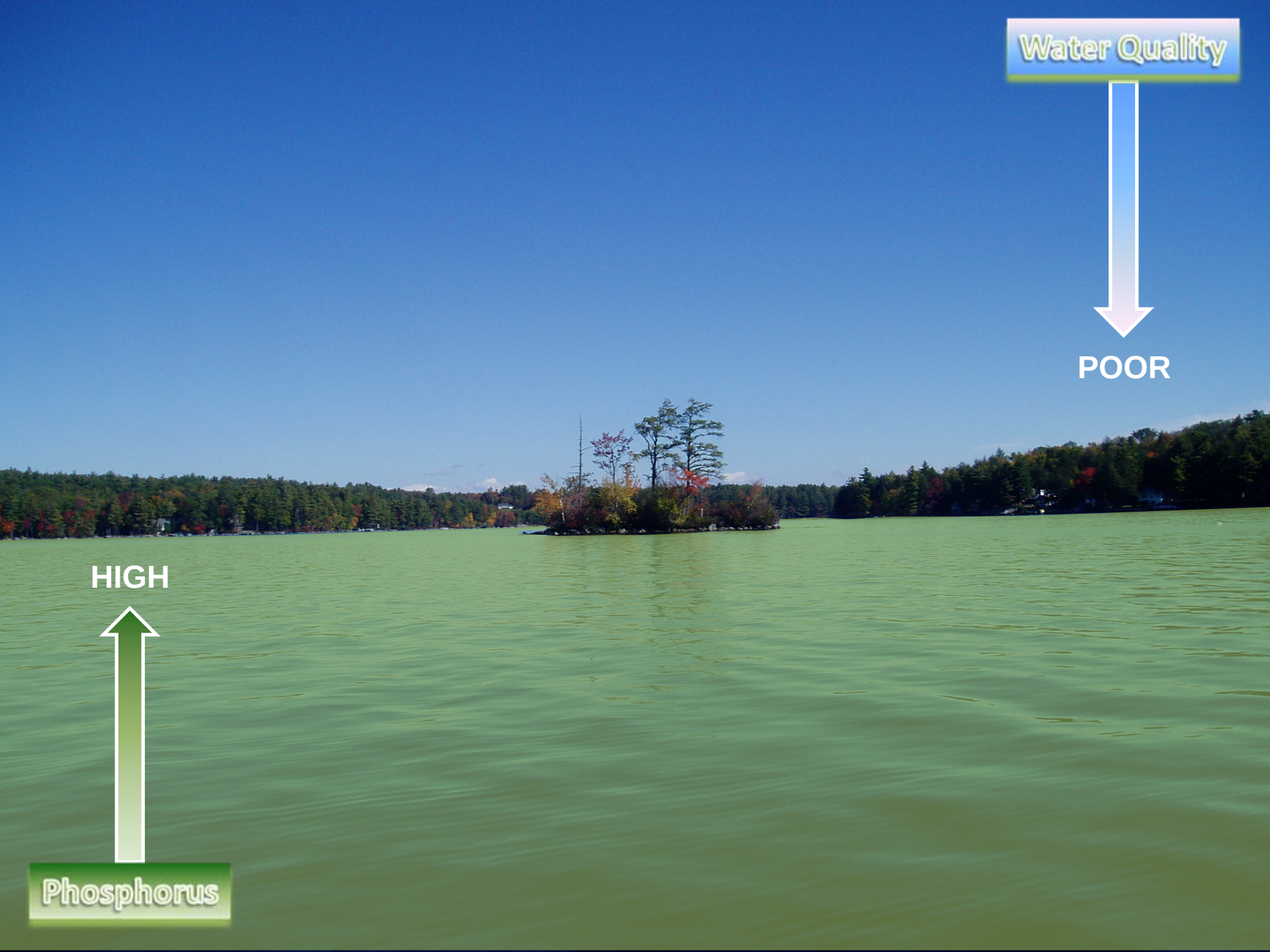

ACTON WAKEFIELD WATERSHEDS ALLIANCE
Watershed Based Plan Development
AWWA Watersheds
Total Area ~ 26 sq. mi.
Watershed
Great East Lake ~15 sq. mi. (57%)
Lovell Lake ~5 sq. mi. (18%)
Wilson Lake ~4 sq. mi. (15%)
Horn Pond ~2 sq. mi. (7%)
Lake Ivanhoe <1 sq. mi. (3%)
0 0.5 1 2 Miles
Data Sources*: Maine Office of GIS; UNH Granit
Coordinate System: NAD83, State Plane New Hampshire
Date: 7/19/08 by J. Harold & F. Dillon for FB Environmental
*Watersheds delineated by J. Harold & F. Dillon
Indirect Drainage to Great East Lake
NEWFIELD
NEW HAMPSHIRE
MAINE
ACTON
BROOKFIELD
Copp Brook
Scribner Brook
Lake Ivanhoe
Great East Lake
Indirect Drainage to Horn Pond
Hydrologically Separate from Horn Pond
Horse Brook
Horn Pond
Wilson Lake
Indirect Drainage to Horn Pond
Direct Drainage ~ 2 sq. mi.
Indirect Drainage ~ 19 sq. mi.
Lovell Lake
Salmon Falls River
WAKEFIELD
MILTON
16
153
109
MAINE
NH
Project Area
AWWA

Experimental Lake Area Study (Fisheries and Oceans Canada)

- **Top-to-bottom curtain divides lake in two**
- **Carbon and nitrogen added to one side; Carbon, nitrogen and <u>phosphorus</u> added to other side**


Water Quality
GOOD
LOW
Phosphorus


Water Quality
DECREASING
INCREASING
Phosphorus


Water Quality
POOR
HIGH
Phosphorus

AWWA High Quality Waters Project

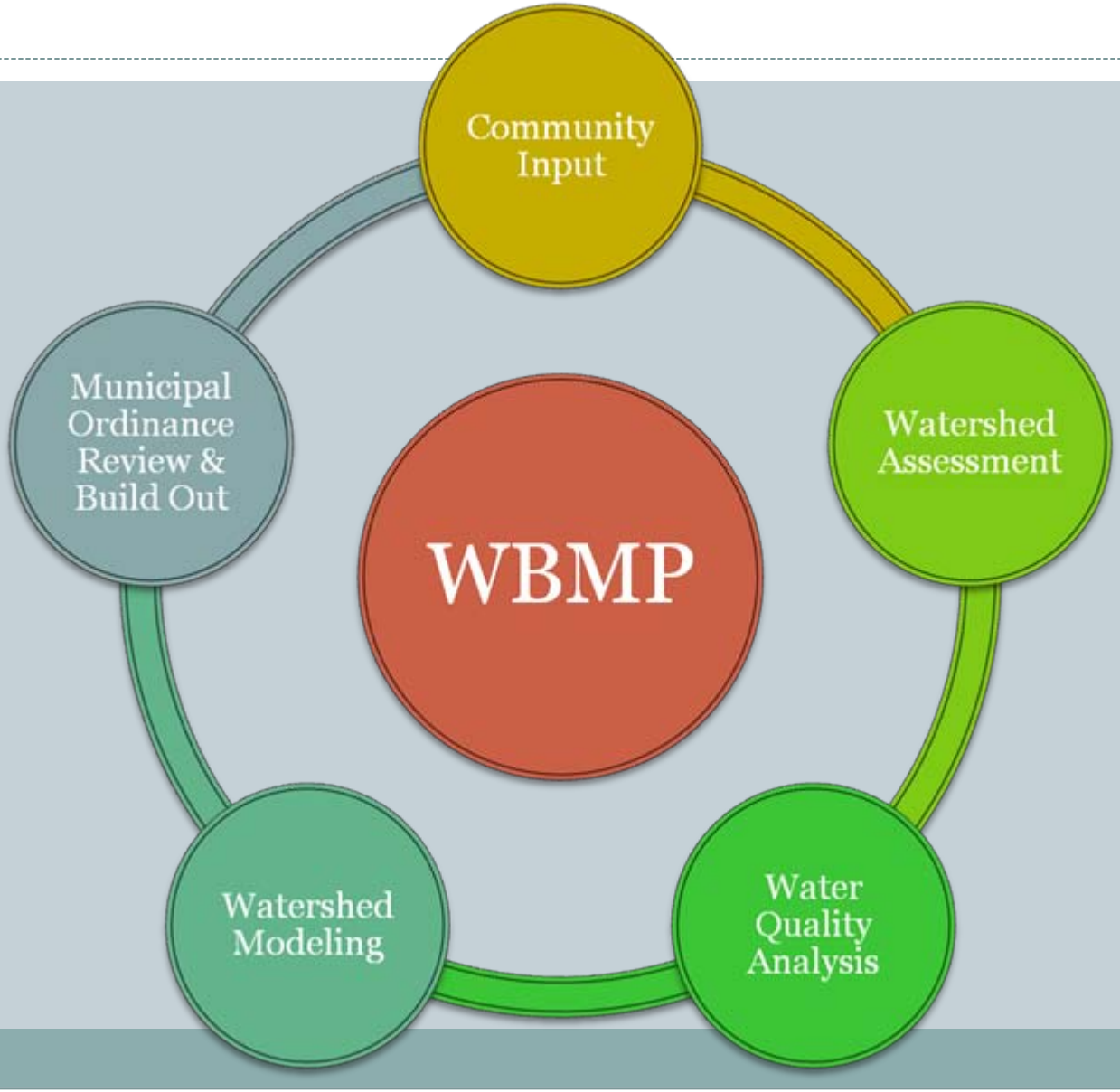
Goal

- **Protect and maintain high quality waters in the Acton Wakefield Region – headwaters of the Salmon Falls River**

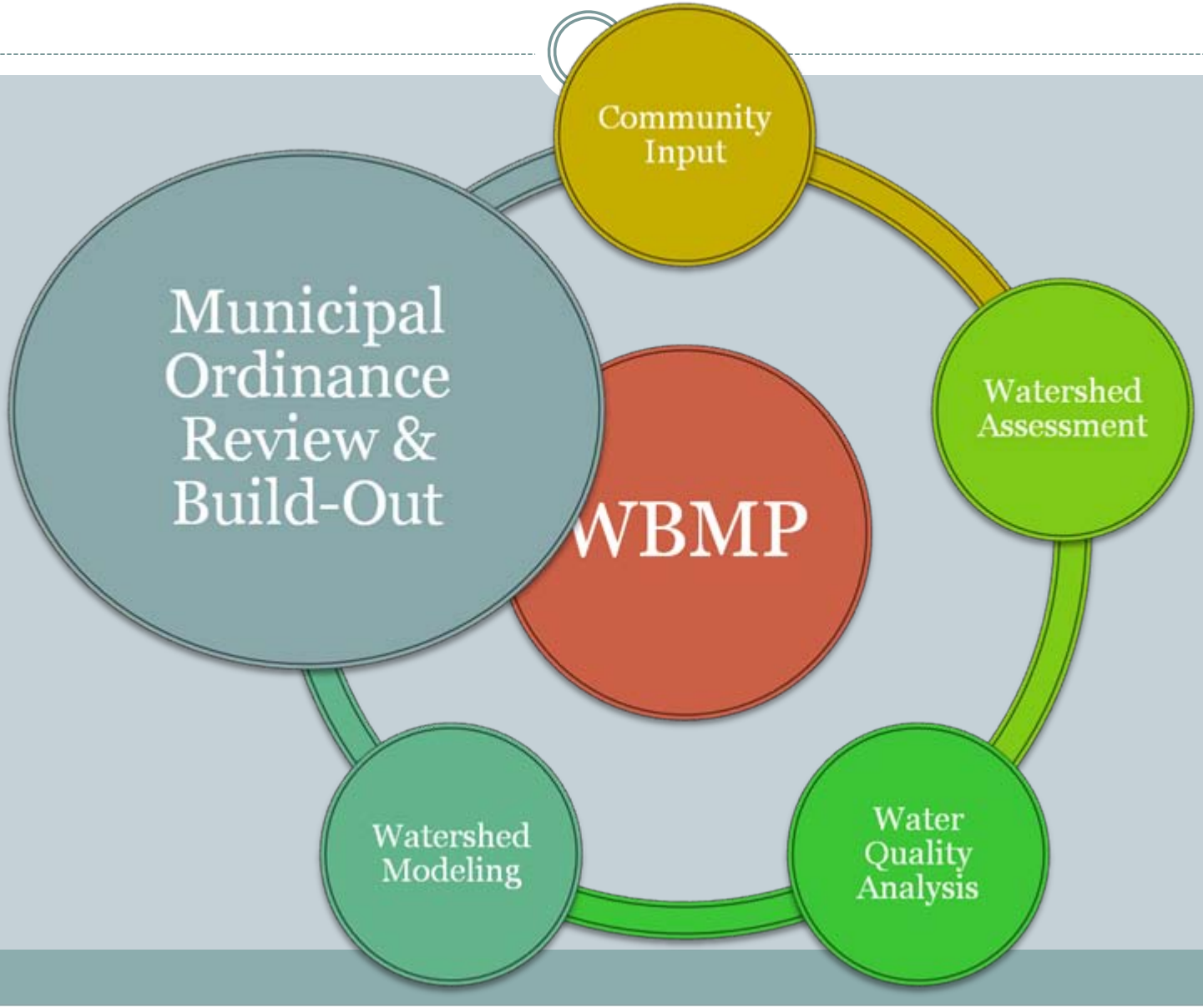
Some Challenges:

- **36% area growth rate projected by 2025**
- **Projected decrease of forest land by 5.4%**
- **Polluted runoff (roads, residences)**

AWWA Project Overview



Incorporate Results into WBMP



Acton Wakefield Watersheds Alliance Municipal Ordinance Review

Linking Development Rules to Water Quality Protection

Methods

- CWP (1998) – Code and Ordinance Worksheet
- 22 Model Development Principles
- 66 Site Planning Benchmarks

Municipal Ordinance Review- Categories for Comparison (CWP, 1998)

- Transportation infrastructure (car habitat)
- Residential and commercial development (parcel habitat)
- Open spaces and natural areas (wildlife habitat)

Results for Wakefield, NH

HABITAT TYPE	CWP Maximum	*Acton's Score*	Adequate	Needs Improvement	*Wakefield's Score*	Adequate	Needs Improvement
Transportation Infrastructure	35	21		√	17		√
Residential & Commercial Development	36	26		√	30		√
Open Spaces & Natural Areas	24	24	√		21		√
Totals:	**95**	**71**	**75%** ←	**% Total**	**68**	**72%** ←	**% Total**

SCORING (A total of 95 points are available):	
Your Community's Score	
90- 100 %	Congratulations! Your community is a real leader in protecting streams, lakes, and estuaries. Keep up the good work.
80 - 89 %	Your local development rules are pretty good, but could use some tweaking in some areas.
79 - 70 %	Significant opportunities exist to improve your development rules. Consider creating a site planning roundtable.
60 - 69 %	Development rules are inadequate to protect your local aquatic resources. A site planning roundtable would be very useful.
less than 60 %	Your development rules definitely are not environmentally friendly. Serious reform of the development rules is needed.

Ordinance/Regulation Recommendations

- A watershed or region - wide P control ordinance for all new development.
- Reduction or removal of grandfathering (for both subdivisions & shoreland zone).
- Ordinance revisions to encourage cluster development & open space.
- Ordinance revisions to require Low Impact Development principles with individual building permits.

Recommendations (continued)

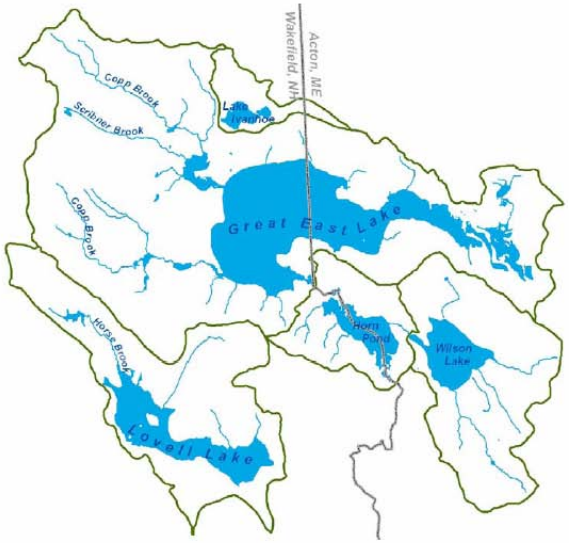
- Increasing fines for non - compliance, especially in the shoreland zone.
- Prohibiting the use of phosphorus lawn fertilizer unless a soil test determines it is needed.
- Establishing a septic system maintenance tracking program to identify inadequate or failing systems.
- Prohibiting the use of phosphate-based detergents.

Buildout Analysis

Acton Wakefield Watershed Alliance

Buildout Analysis

Acton, ME & Wakefield, NH



September 2009

Prepared by:
FB Environmental Associates, Inc.
97A Exchange St., Suite 305
Portland, ME 04101

Buildout Analysis

How Much?

- How Much Land is Currently Available for Development?

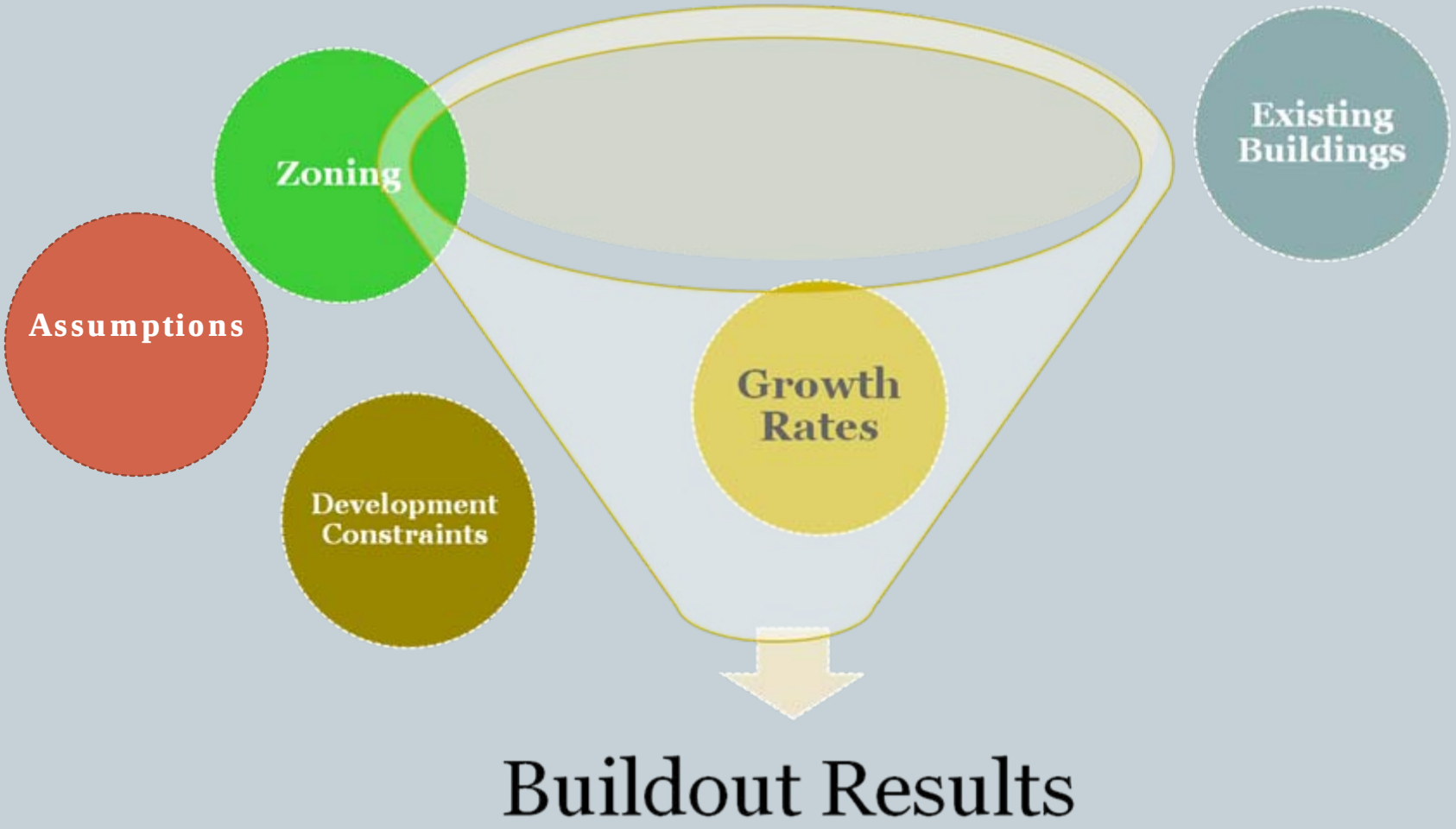
Where & When?

- Where & When Will Development Occur?

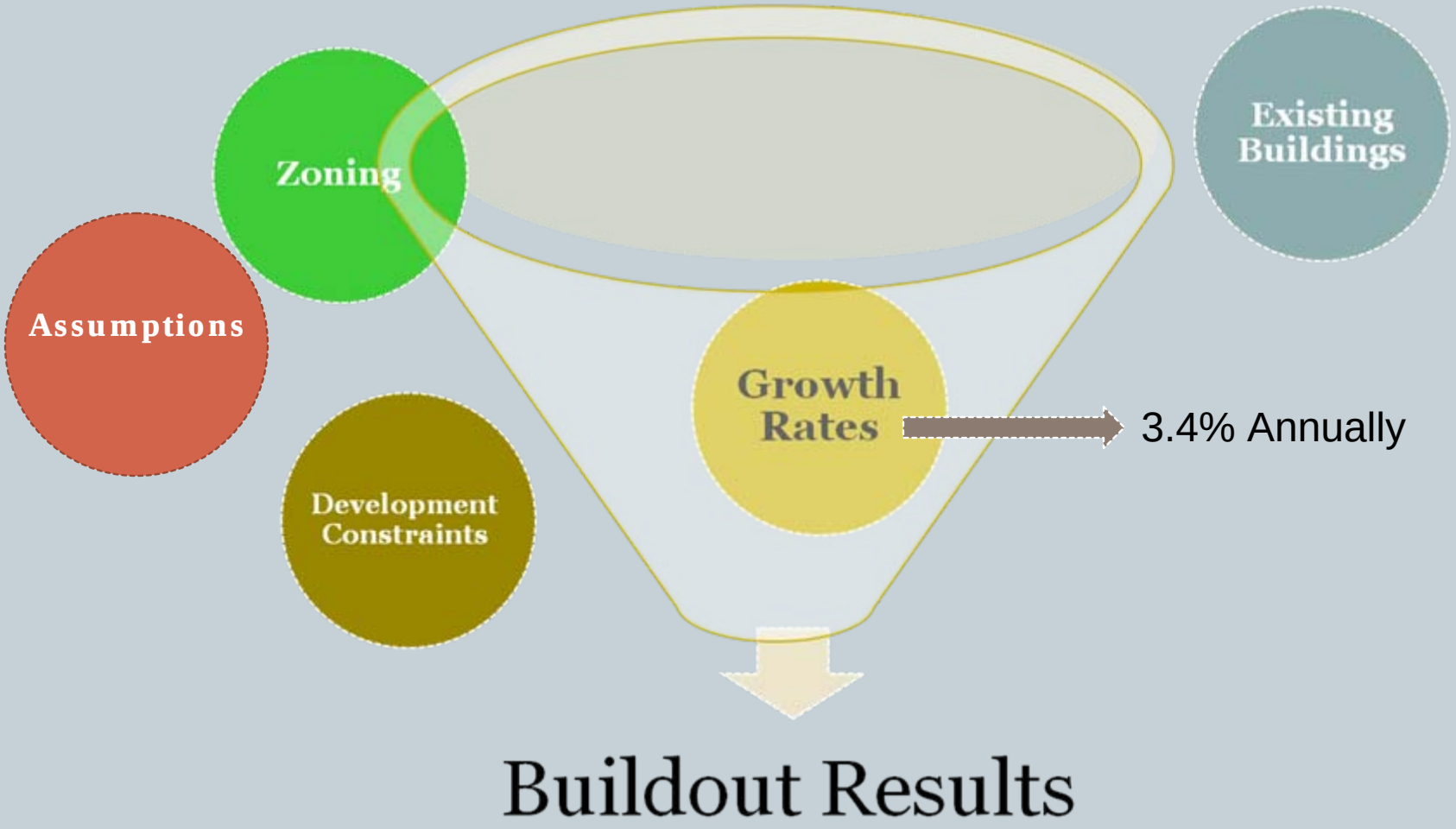
Effects?

- What are the Impacts from Future Development?

Buildout Analysis



Buildout Analysis



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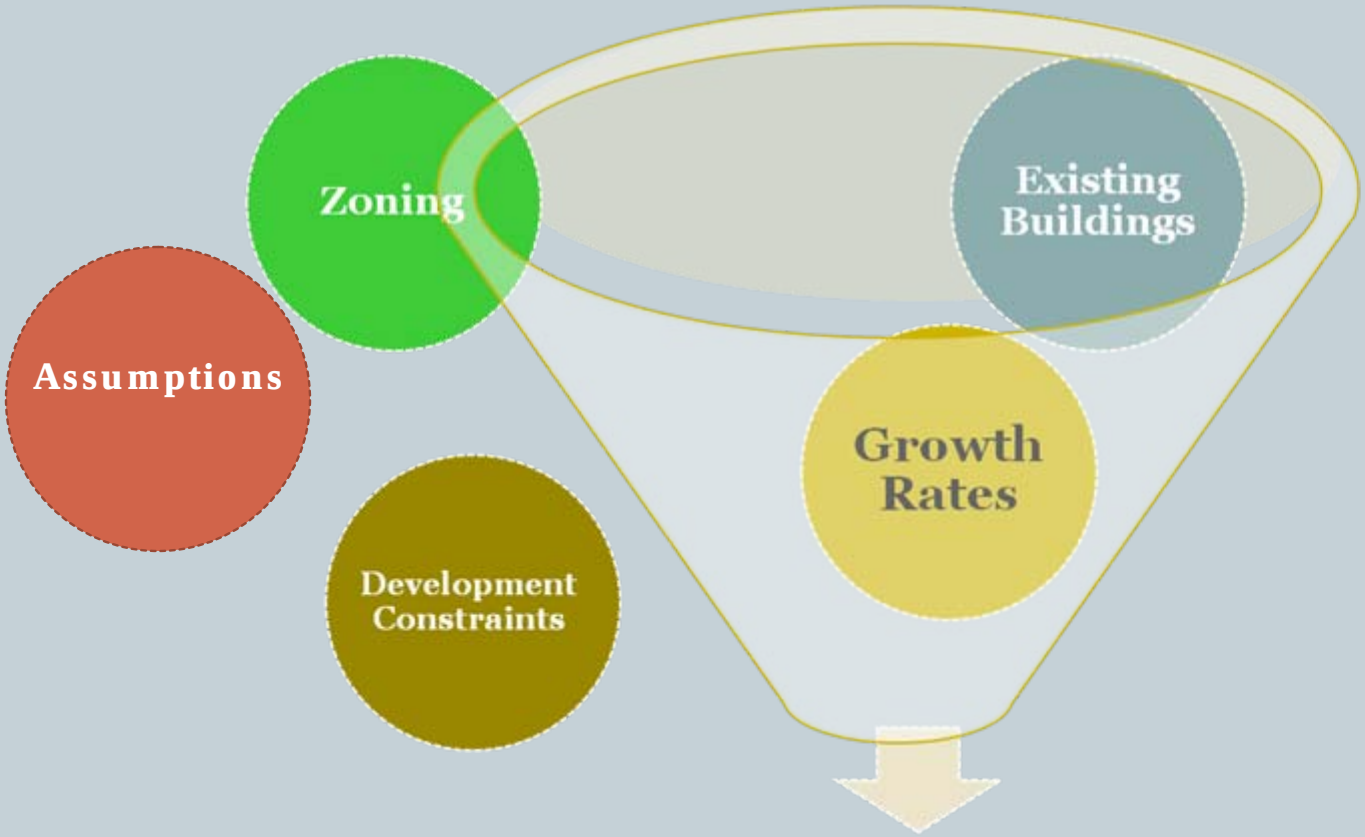
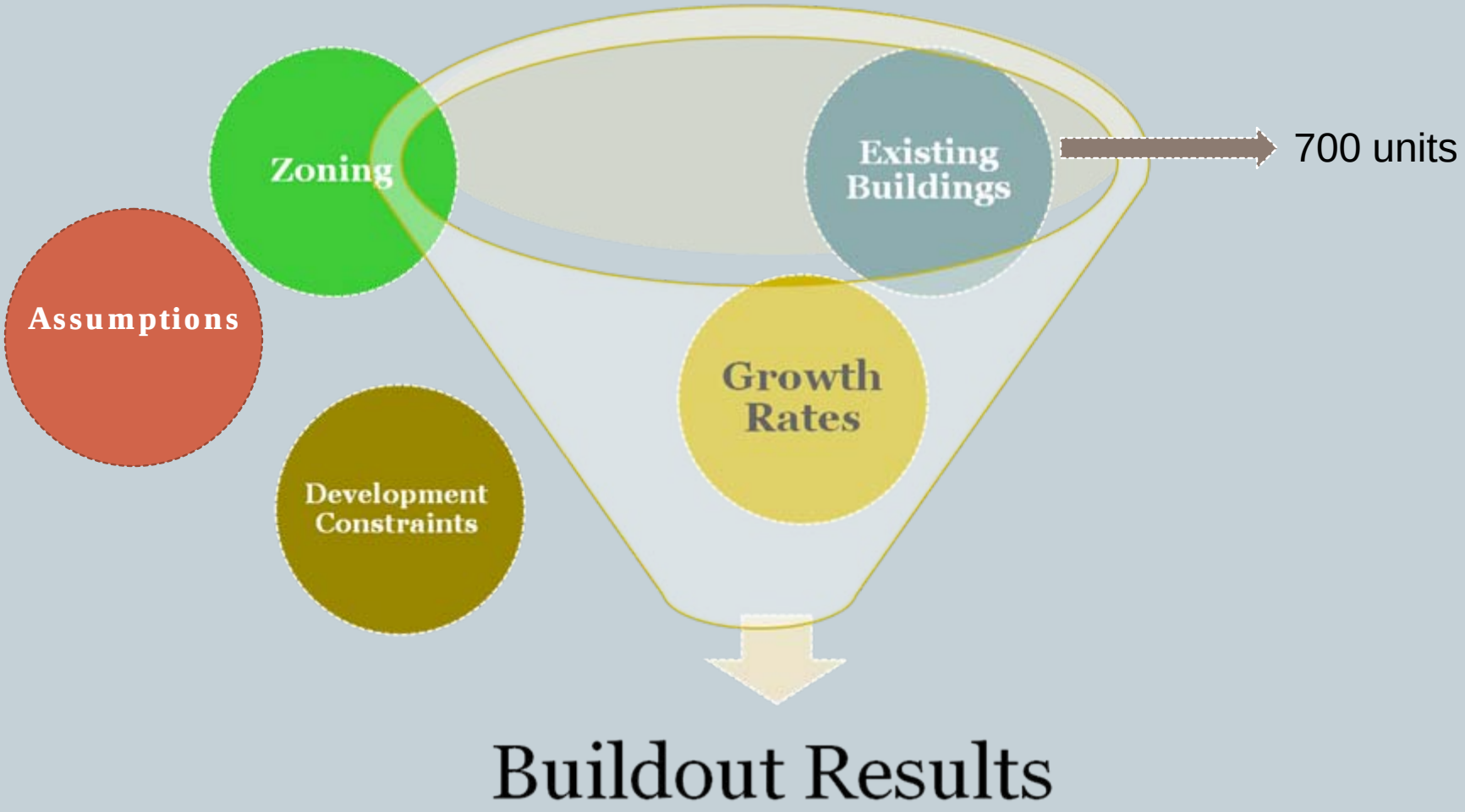
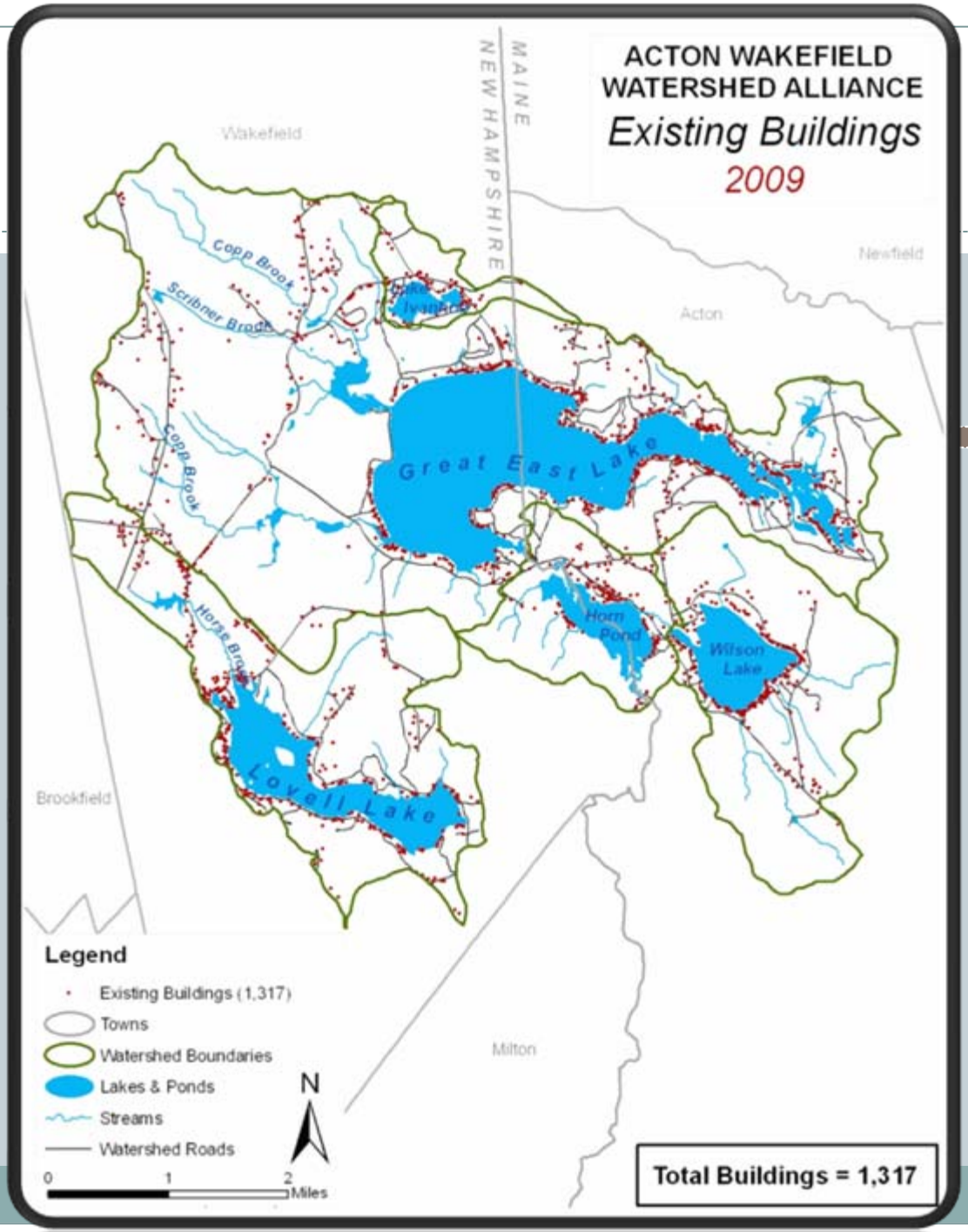


Buildout Results

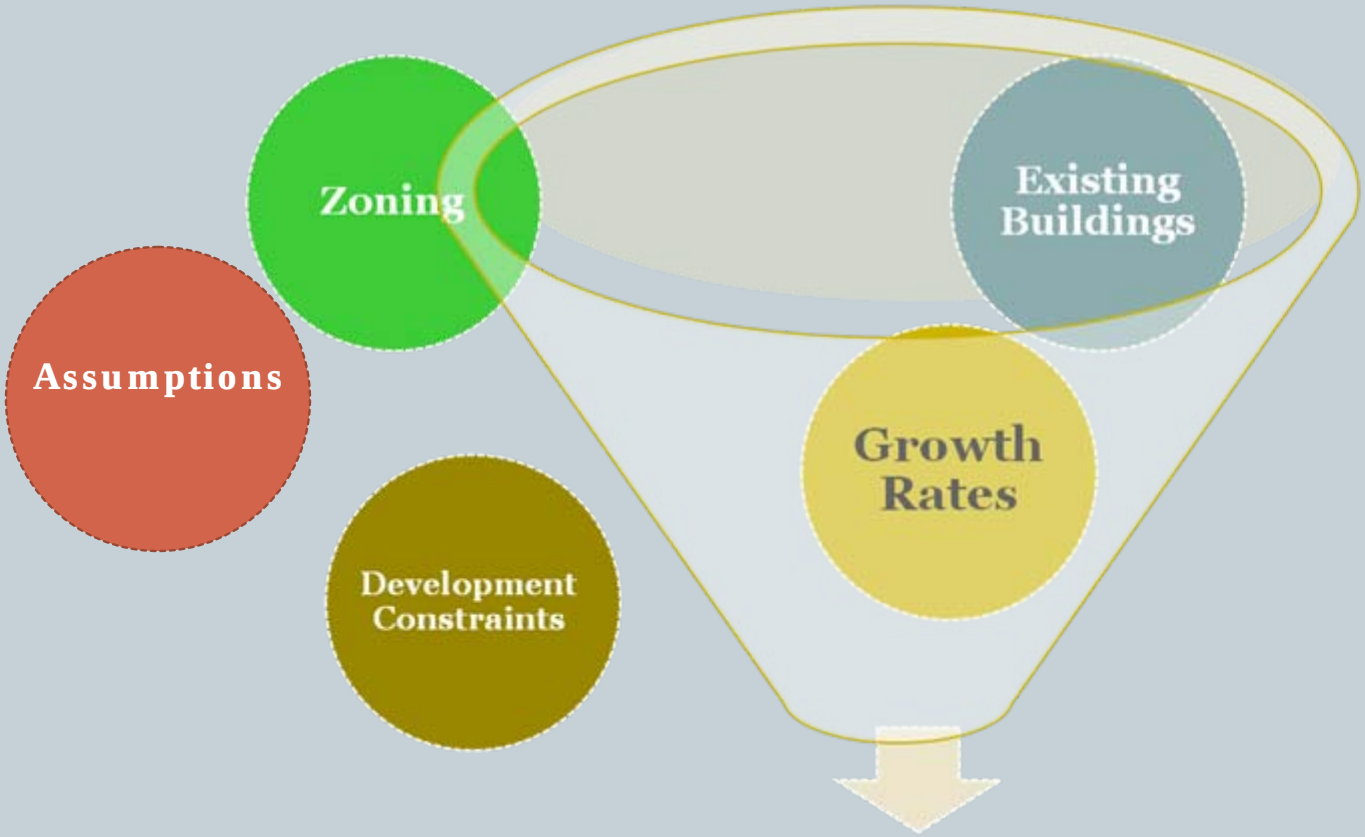
Buildout Analysis




ACTON WAKEFIELD
WATERSHED ALLIANCE
Existing Buildings
2009
MAINE
NEW HAMPSHIRE
Wakefield
Newfield
Acton
Brookfield
Milton
Copp Brook
Scribner Brook
Horse Brook
Great East Lake
Horn Pond
Wilson Lake
Lovell Lake
Legend
Existing Buildings (1,317)
Towns
Watershed Boundaries
Lakes & Ponds
Streams
Watershed Roads
N
0
1
2
Miles
Total Buildings = 1,317

700 units

Buildout Analysis



Buildout Results

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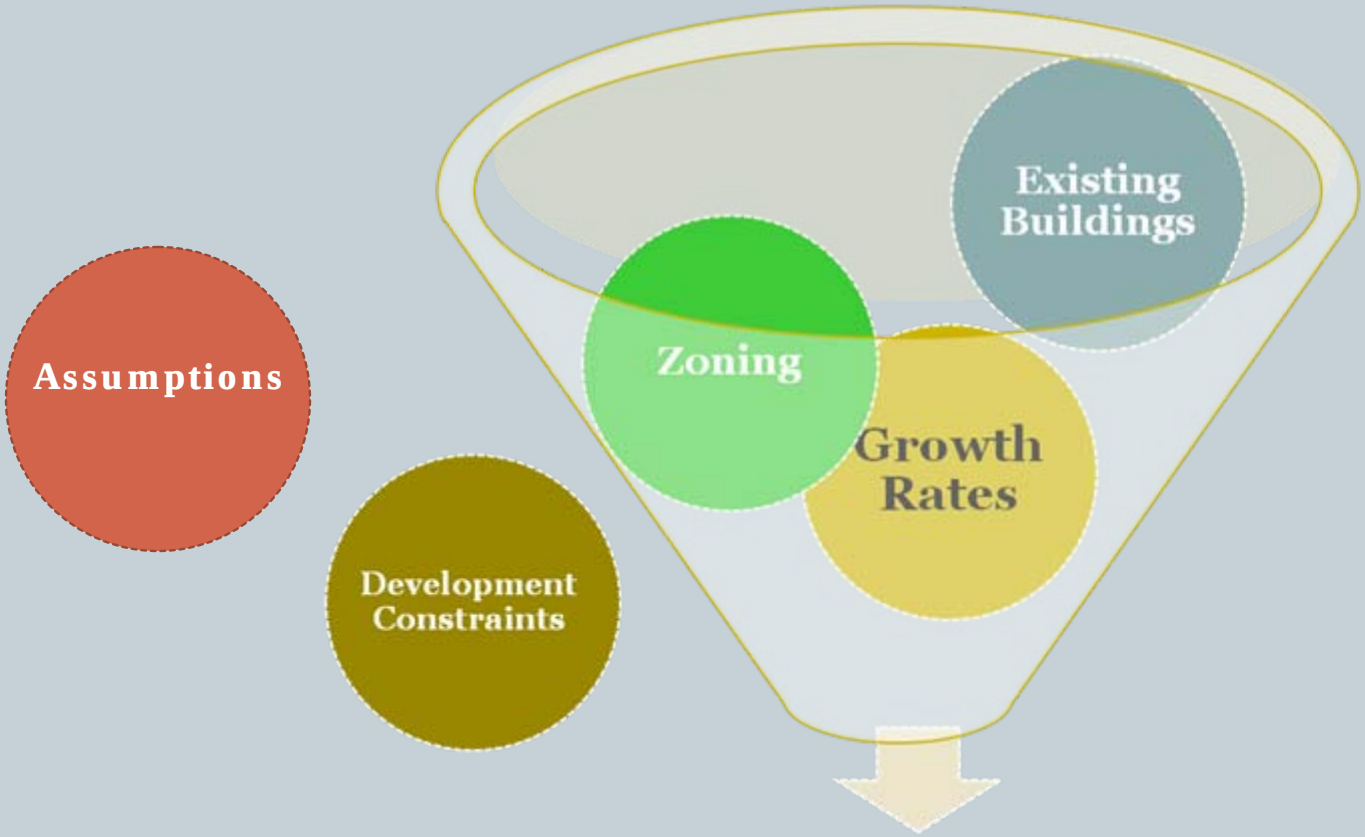

Buildout Results

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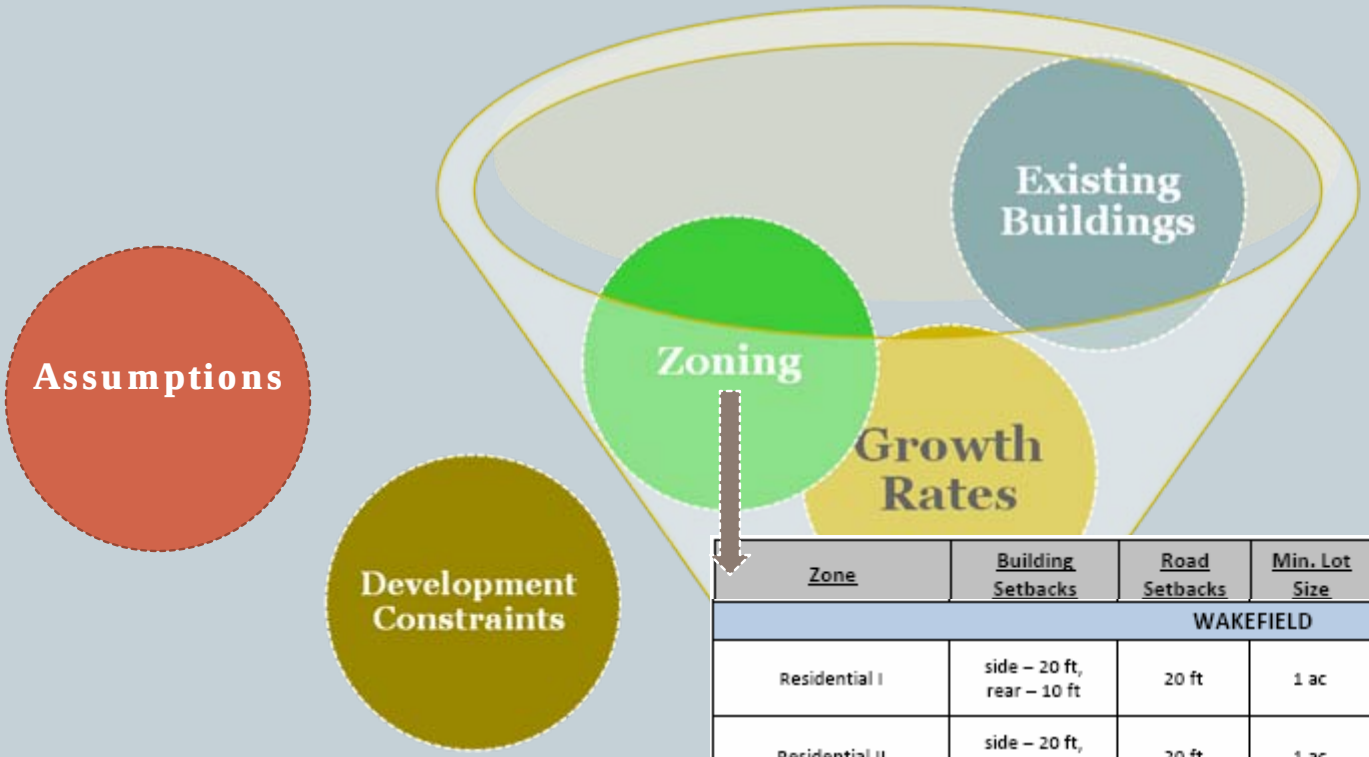
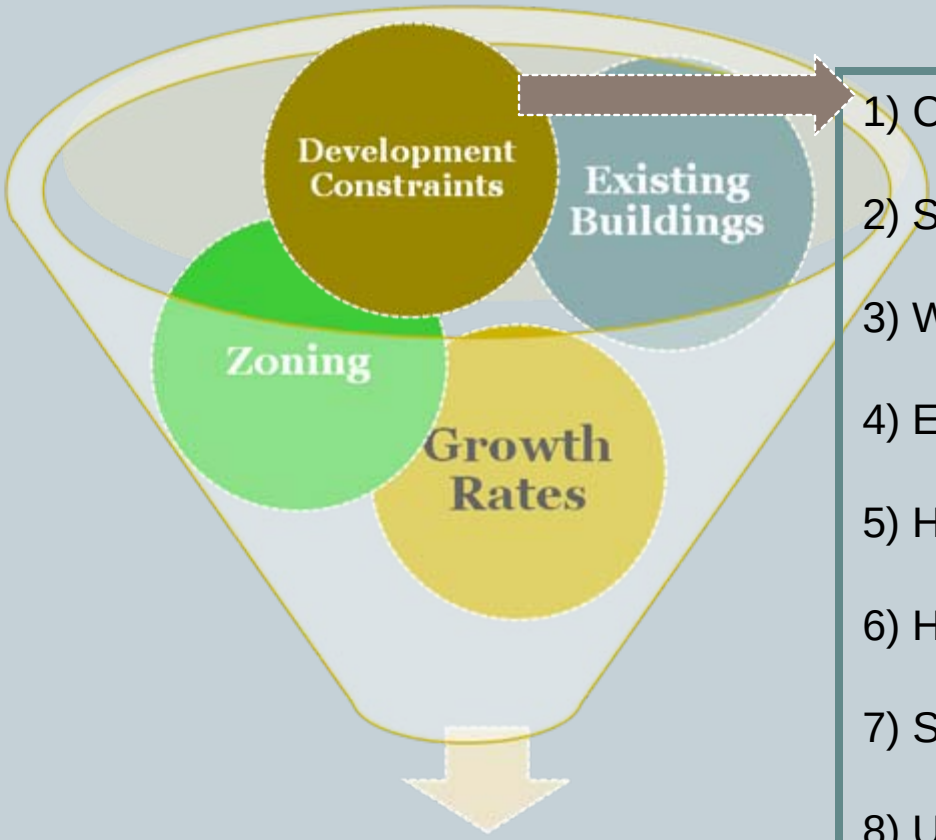


Zone	Building Setbacks	Road Setbacks	Min. Lot Size	Lot Coverage	Right-of-Ways	Building Size Restrictions
WAKEFIELD						
Residential I	side – 20 ft, rear – 10 ft	20 ft	1 ac	NA	50 ft	Min. Living Area - 1,150 ft^2, Max. Height – 35 ft
Residential II	side – 20 ft, rear – 10 ft	20 ft	1 ac	NA	50 ft	Min. Living Area - 1,150 ft^2, Max. Height – 35 ft
Residential III – Rural	side – 50 ft, rear – 10 ft	50 ft	3 ac	NA	50 ft	Min. Living Area - 1,150 ft^2, Max. Height – 35 ft
Business & Commercial	side – 20 ft, rear – 10 ft	20 ft	20,000 ft^2	NA	50 ft	Max. Height – 35 ft
Village/ Residential	side – 20 ft, rear – 10 ft	20 ft	20,000 ft^2	NA	50 ft	Min. Living Area - 1,150 ft^2, Max. Height – 35 ft
Agricultural	side – 20 ft, rear – 15 ft	50 ft	5 ac	NA	50 ft	Min. Living Area - 1,150 ft^2, Max. Height – 35 ft

Bui

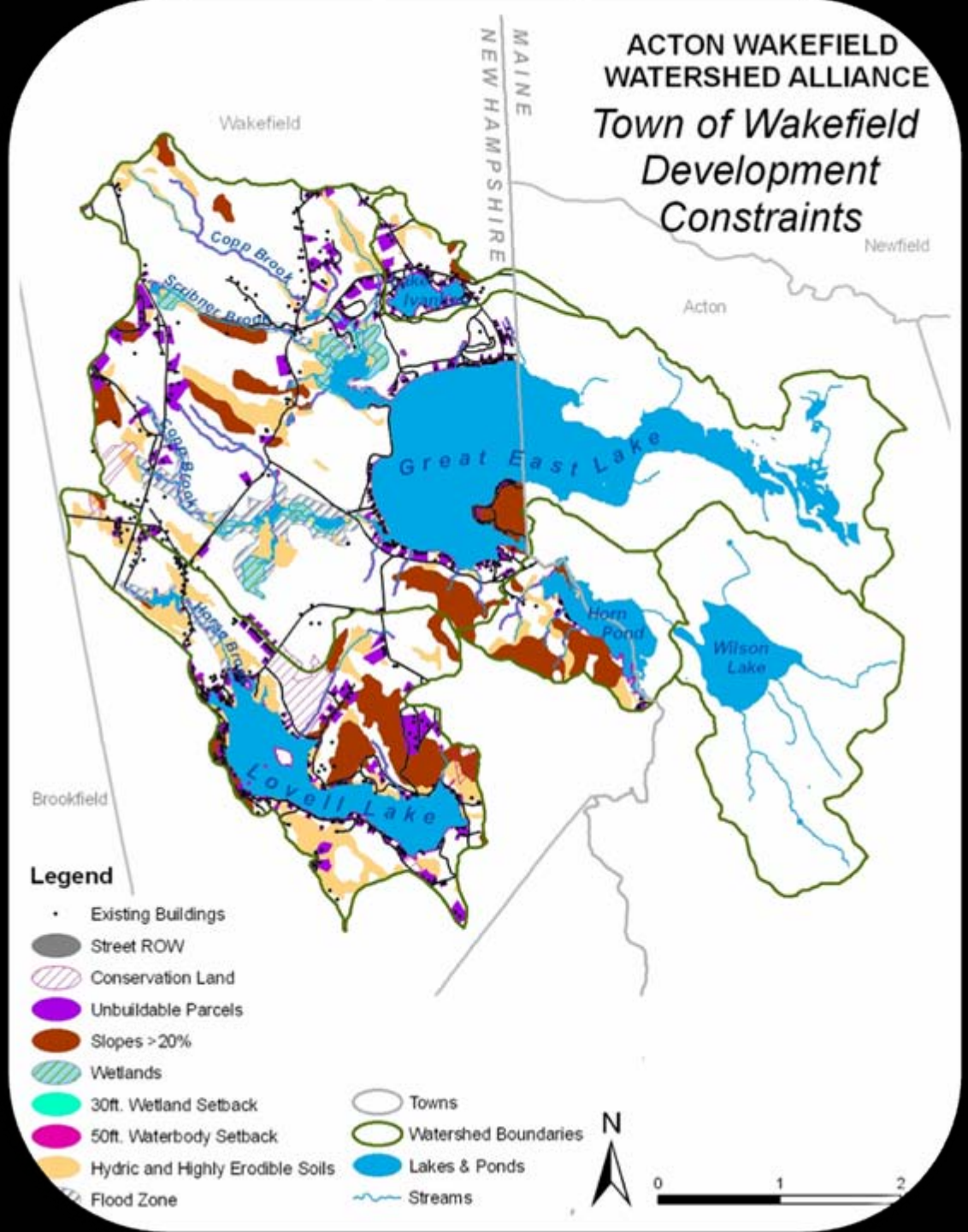
Buildout Analysis

Assumptions



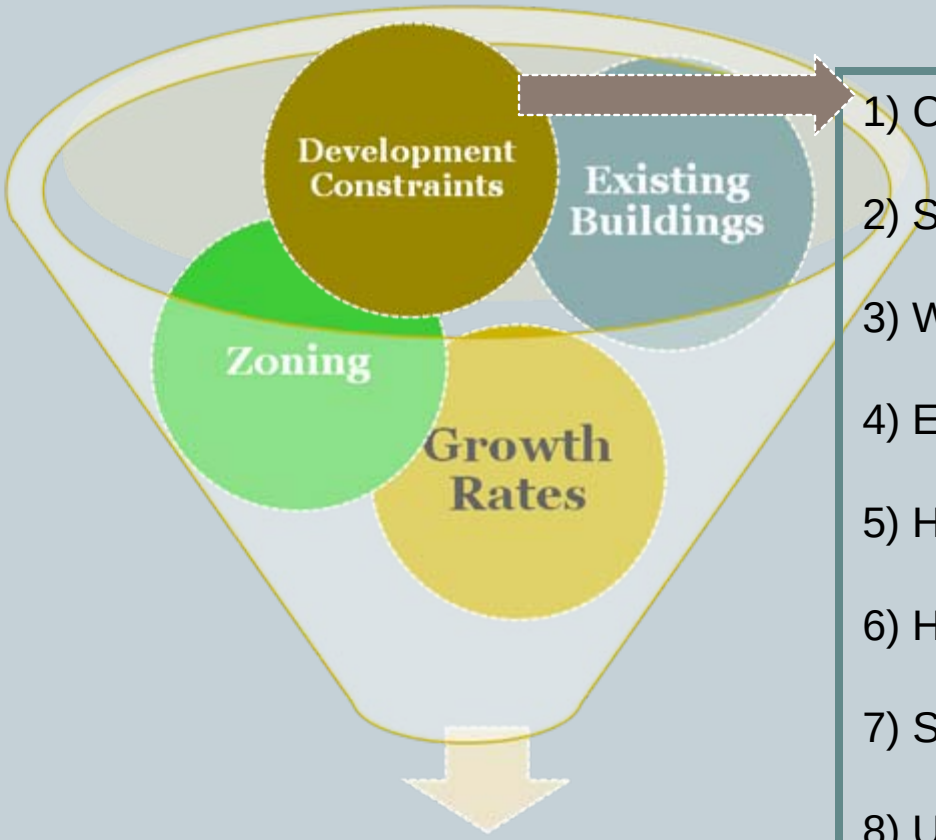
Buildout Results

1) Conservation Land
2) Steep Slopes
3) Wetlands
4) Existing Buildings
5) Hydric Soils
6) Highly Erodible Soils
7) Street ROW (50')
8) Unbuildable Parcels
9) Shoreland Zoning


ACTON WAKEFIELD
WATERSHED ALLIANCE
Town of Wakefield
Development
Constraints
MAINE
NEW HAMPSHIRE
Wakefield
Newfield
Acton
Brookfield
Copp Brook
Scribner Brook
Great East Lake
Horn Pond
Wilson Lake
Lovell Lake
Legend
Existing Buildings
Street ROW
Conservation Land
Unbuildable Parcels
Slopes >20%
Wetlands
30ft. Wetland Setback
50ft. Waterbody Setback
Hydric and Highly Erodible Soils
Flood Zone
Towns
Watershed Boundaries
Lakes & Ponds
Streams
N
0
1
2

Buildout Analysis

Assumptions



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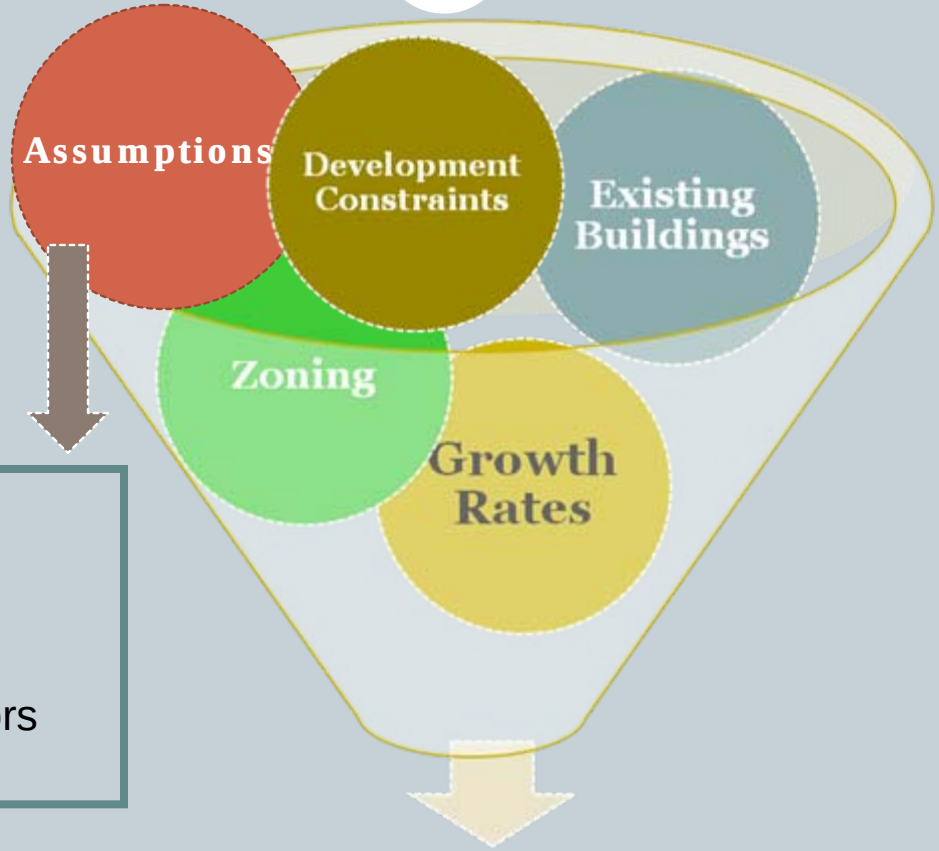
Buildout Analysis

Buildout Results

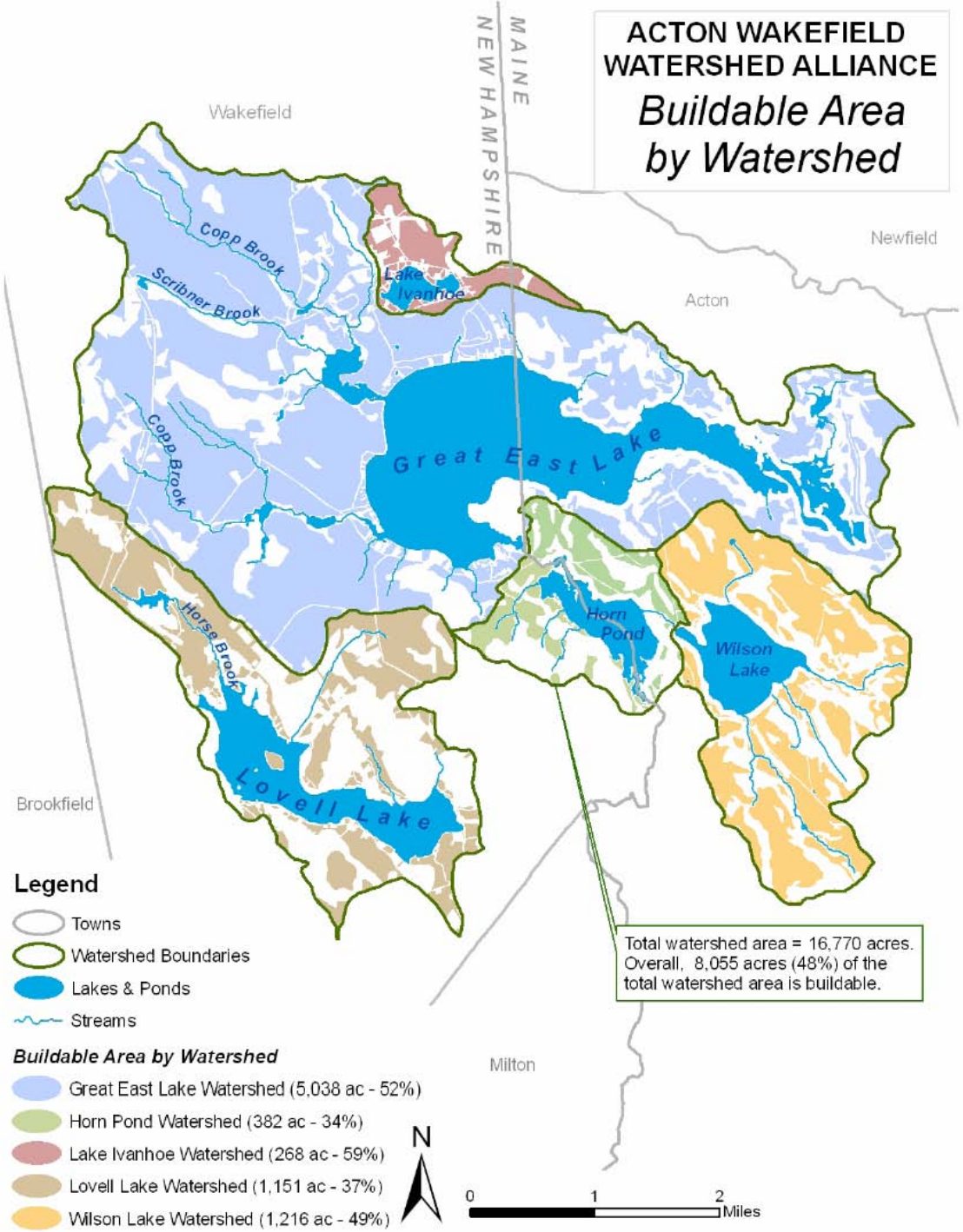
Buildout Analysis



1) Min. Separation

2) Street ROW's

3) Efficiency Factors


ACTON WAKEFIELD WATERSHED ALLIANCE
Buildable Area by Watershed
MAINE
NEW HAMPSHIRE
Wakefield
Newfield
Acton
Brookfield
Milton
Copp Brook
Scribner Brook
Lake Ivanhoe
Great East Lake
Horse Brook
Lovell Lake
Horn Pond
Wilson Lake
Total watershed area = 16,770 acres. Overall, 8,055 acres (48%) of the total watershed area is buildable.
Legend
Towns
Watershed Boundaries
Lakes & Ponds
Streams
Buildable Area by Watershed
Great East Lake Watershed (5,038 ac - 52%)
Horn Pond Watershed (382 ac - 34%)
Lake Ivanhoe Watershed (268 ac - 59%)
Lovell Lake Watershed (1,151 ac - 37%)
Wilson Lake Watershed (1,216 ac - 49%)
N
0
1
2
Miles

Buildout Results

Buildable Land

Total Wakefield: 5,648 Acres (52%)

Total Acton: 2,407 Acres (41%)

Total Watershed: 8,055 Acres (48%)

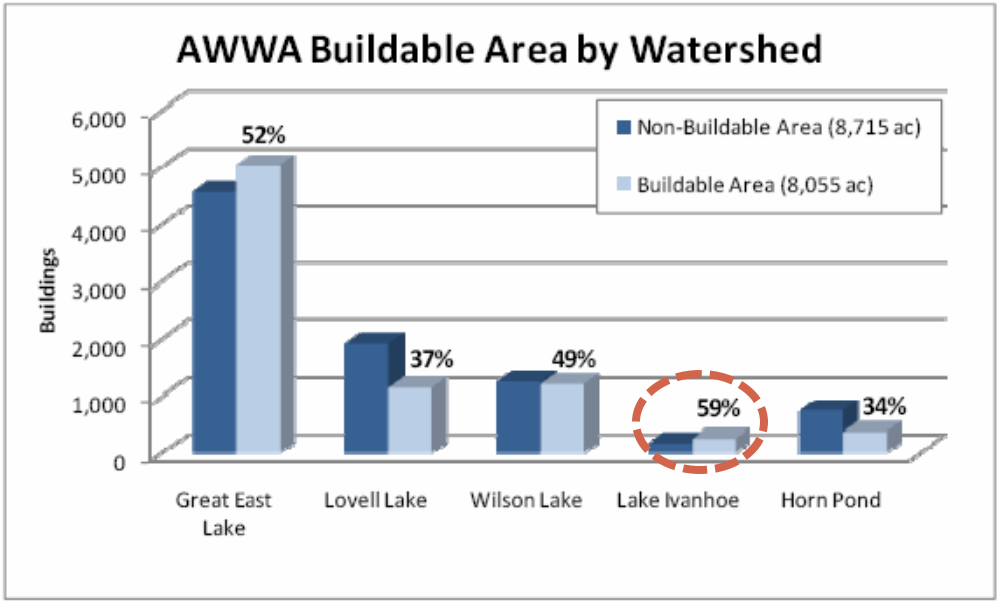
Buildout Results

Buildable Land

Total Wakefield: 5,648 Acres (52%)

Total Acton: 2,407 Acres (41%)

Total Watershed: 8,055 Acres (48%)



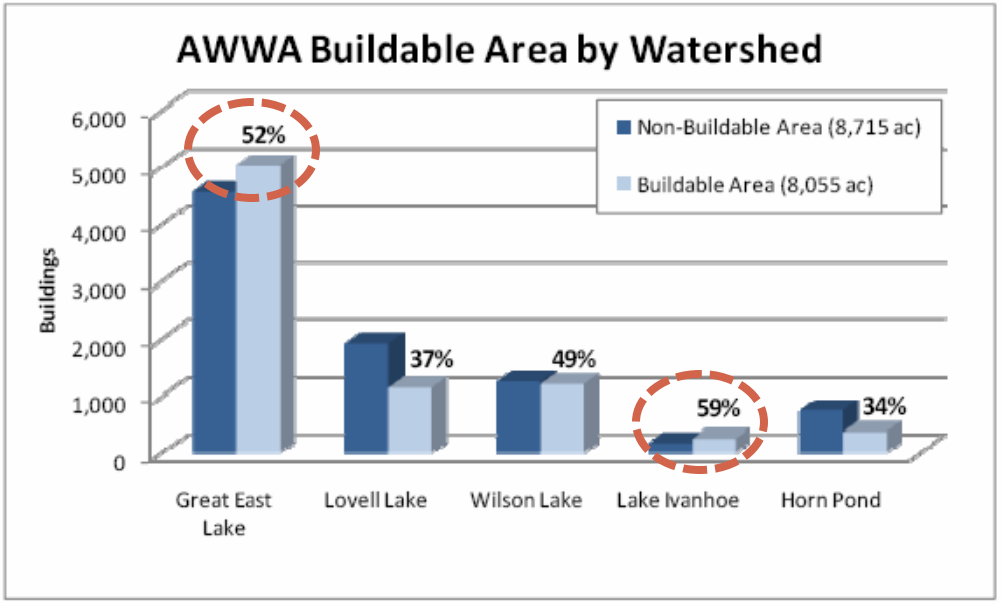
Buildout Results

Buildable Land

Total Wakefield: 5,648 Acres (52%)

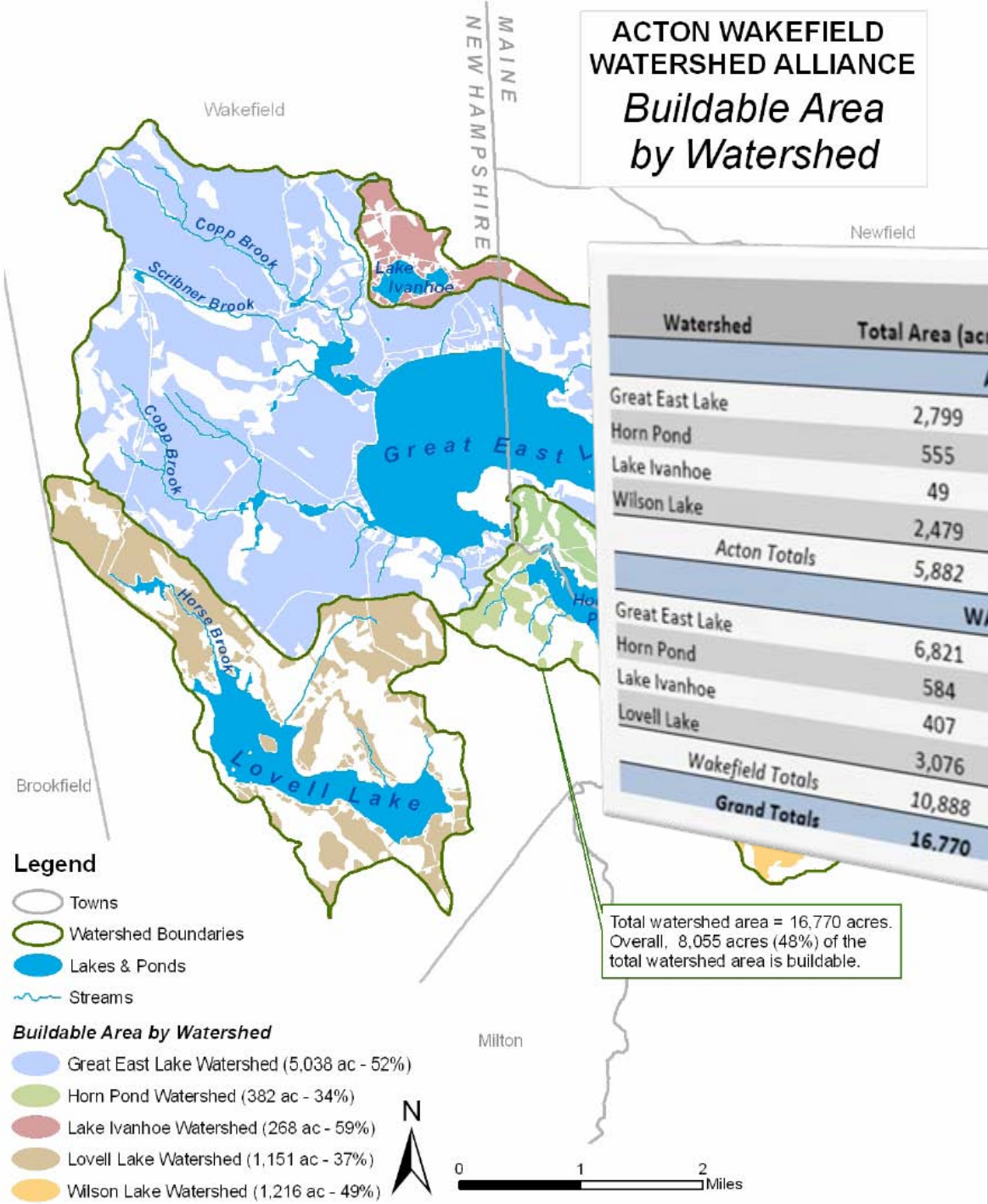
Total Acton: 2,407 Acres (41%)

Total Watershed: 8,055 Acres (48%)



ACTON WAKEFIELD WATERSHED ALLIANCE

Buildable Area by Watershed

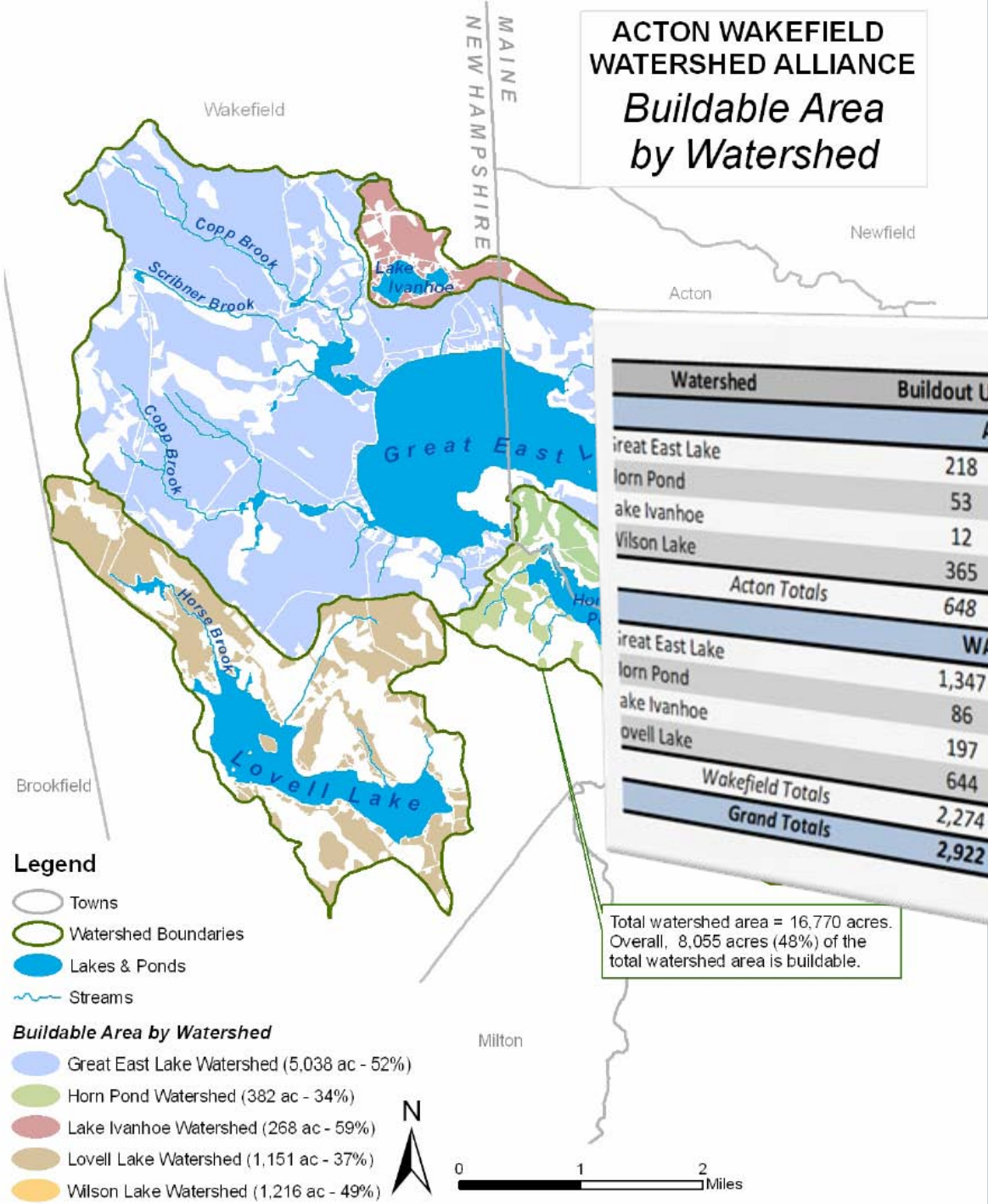


Watershed	Total Area (acres)	Buildable Area (acres)	Percent Buildable Area
ACTON			
Great East Lake	2,799	937	33%
Horn Pond	555	213	38%
Lake Ivanhoe	49	41	84%
Wilson Lake	2,479	1,216	49%
Acton Totals	5,882	2,407	*41%*
WAKEFIELD			
Great East Lake	6,821	4,101	60%
Horn Pond	584	169	29%
Lake Ivanhoe	407	227	56%
Lovell Lake	3,076	1,151	37%
Wakefield Totals	10,888	5,648	52%
Grand Totals	**16,770**	**8,055**	**48%**

Total watershed area = 16,770 acres. Overall, 8,055 acres (48%) of the total watershed area is buildable.

ACTON WAKEFIELD WATERSHED ALLIANCE

Buildable Area by Watershed

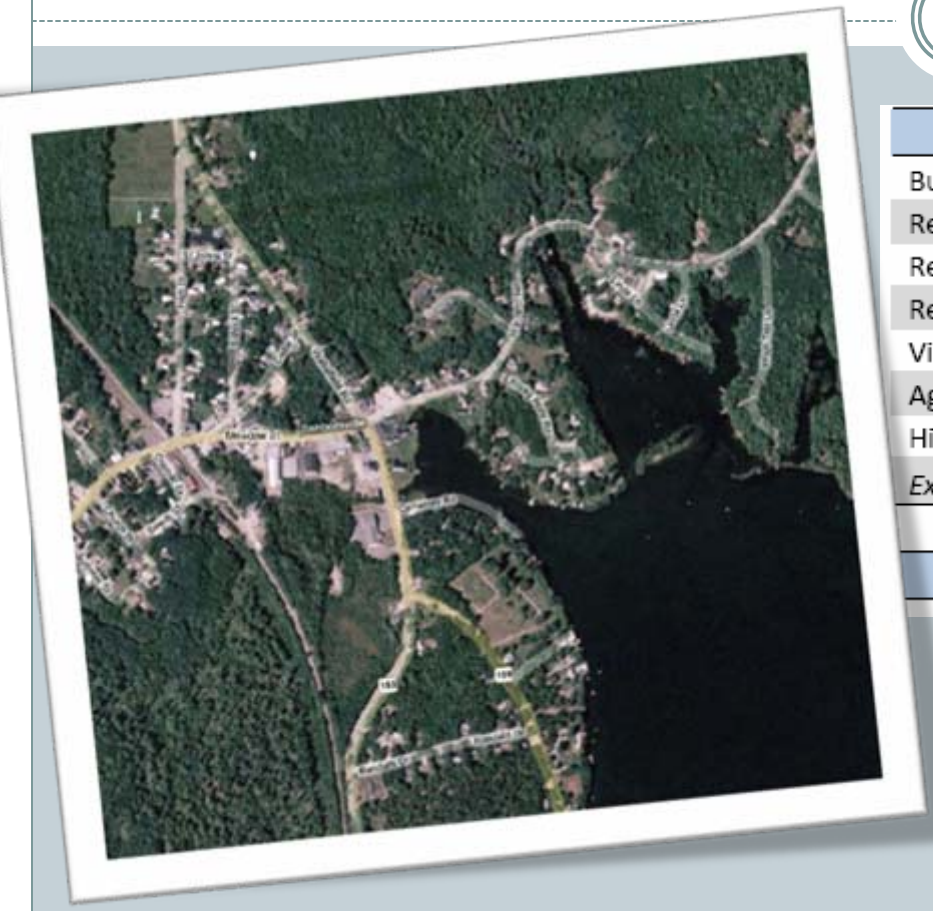


Watershed	Buildout Units	Existing Units	Total
ACTON			
reat East Lake	218	338	556
orn Pond	53	93	146
ake Ivanhoe	12	2	14
Wilson Lake	365	184	549
Acton Totals	*648*	*617*	*1265*
WAKEFIELD			
reat East Lake	1,347	327	1,674
orn Pond	86	17	103
ake Ivanhoe	197	55	252
ovell Lake	644	301	945
Wakefield Totals	*2,274*	*700*	*2974*
Grand Totals	***2,922***	***1,317***	***4,239***

Total watershed area = 16,770 acres. Overall, 8,055 acres (48%) of the total watershed area is buildable.

Buildout Results

# of New Units



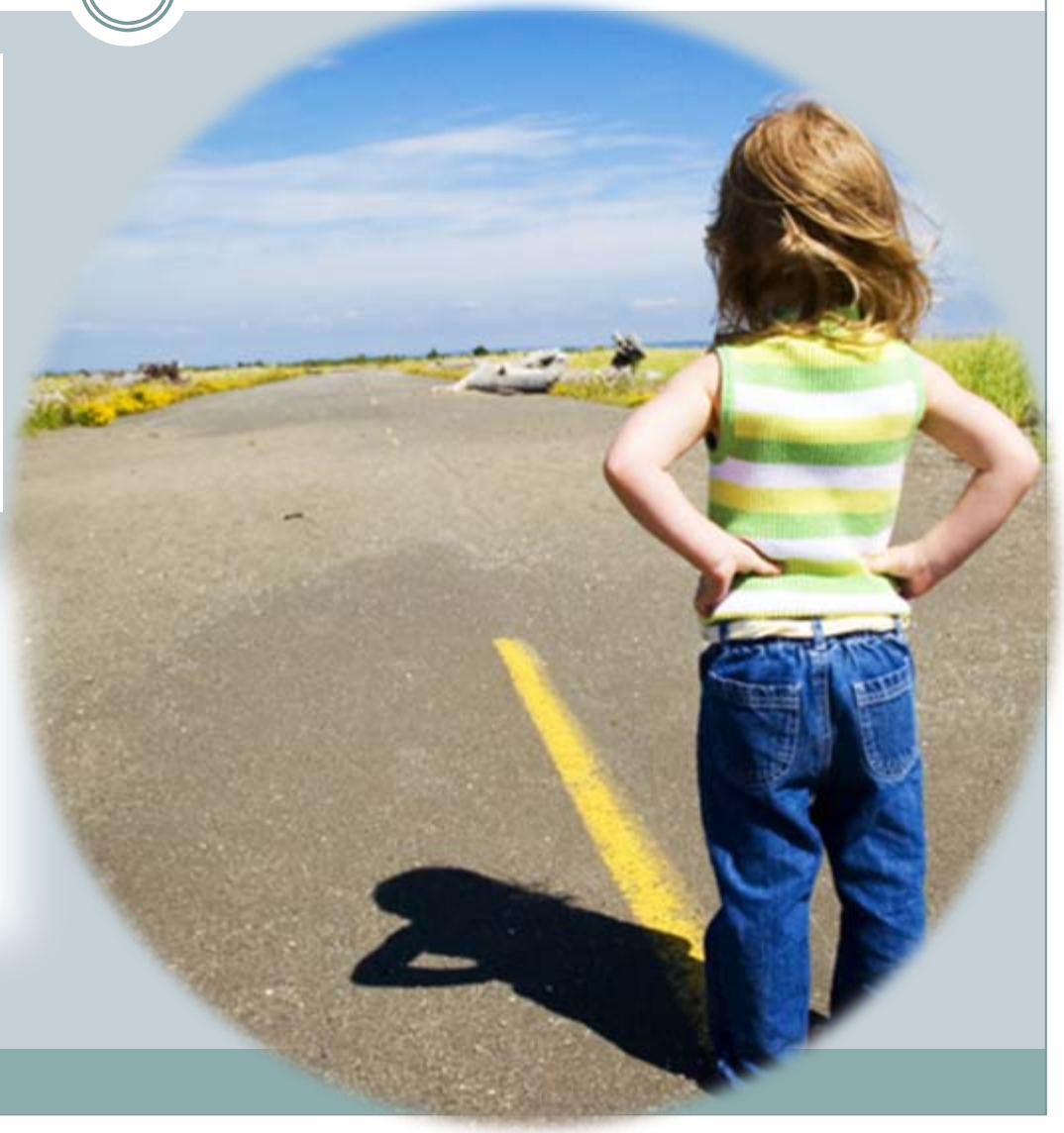
WAKEFIELD	
Business & Commercial	116
Residential I	145
Residential II	661
Residential III - Rural	956
Village	16
Agricultural	356
Historic	24
Existing Buildings	700
Wakefield Totals	*2,974*
Grand Totals	***4,239***

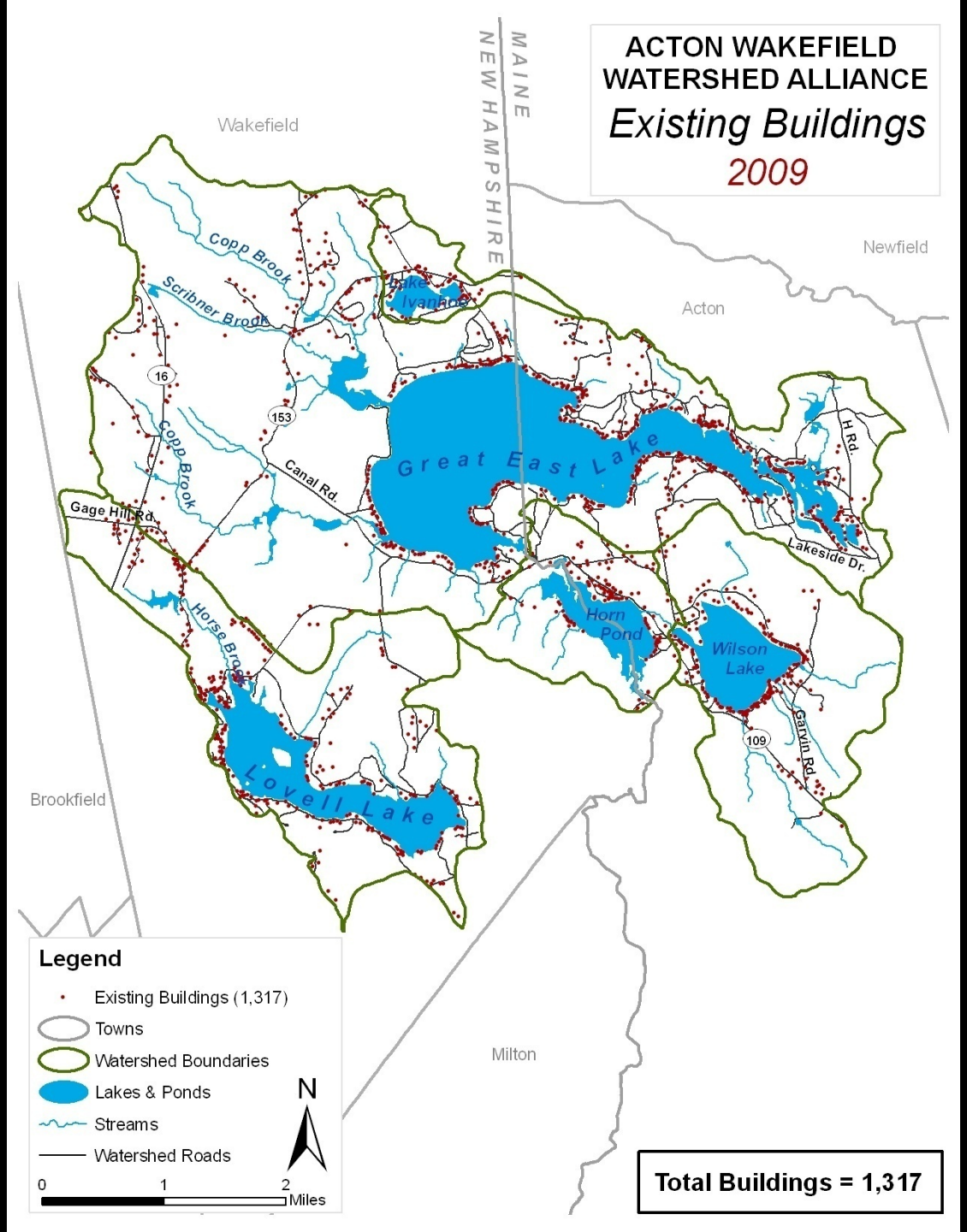
Buildout Results

Time Scope Analysis

Buildout Date	Total New Buildings	Total Buildings (Incl. Existing)
2015	164	864
2020	319	1,019
2025	501	1,201
2030	717	1,417
2035	973	1,673
2040	1,273	1,973
2045	1,630	2,330
2050	2,051	2,751
2054	2,274	2,974

* Parcels Closest to Road 1st




ACTON WAKEFIELD
WATERSHED ALLIANCE
Existing Buildings
2009
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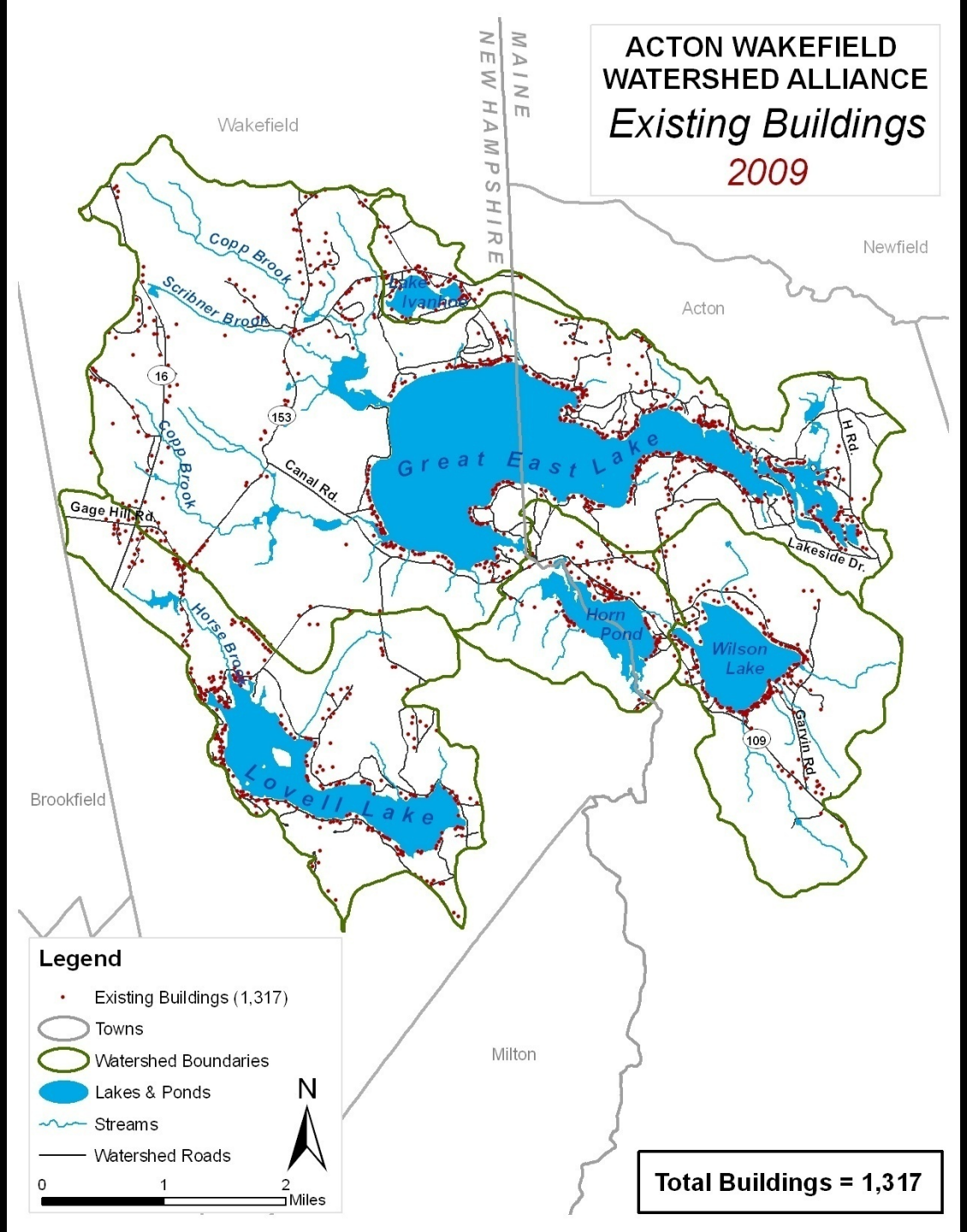
NEW HAMPSHIRE
Wakefield
Newfield
Acton
Brookfield
Milton
Copp Brook
Scribner Brook
Lake Ivanhoe
Great East Lake
Canal Rd.
Gage Hill Rd.
Horse Brook
Lovell Lake
Horn Pond
Wilson Lake
Garvin Rd.
Lakeside Dr.
H Rd.
16
153
109
Legend
Existing Buildings (1,317)
Towns
Watershed Boundaries
Lakes & Ponds
Streams
Watershed Roads
N
0
1
2
Miles
Total Buildings = 1,317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WATERSHED ALLIANCE
Existing Buildings
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NEW HAMPSHIRE
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Copp Brook
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Canal Rd.
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16
153
109
Legend
Existing Buildings (1,317)
Towns
Watershed Boundaries
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Streams
Watershed Roads
N
0
1
2
Miles
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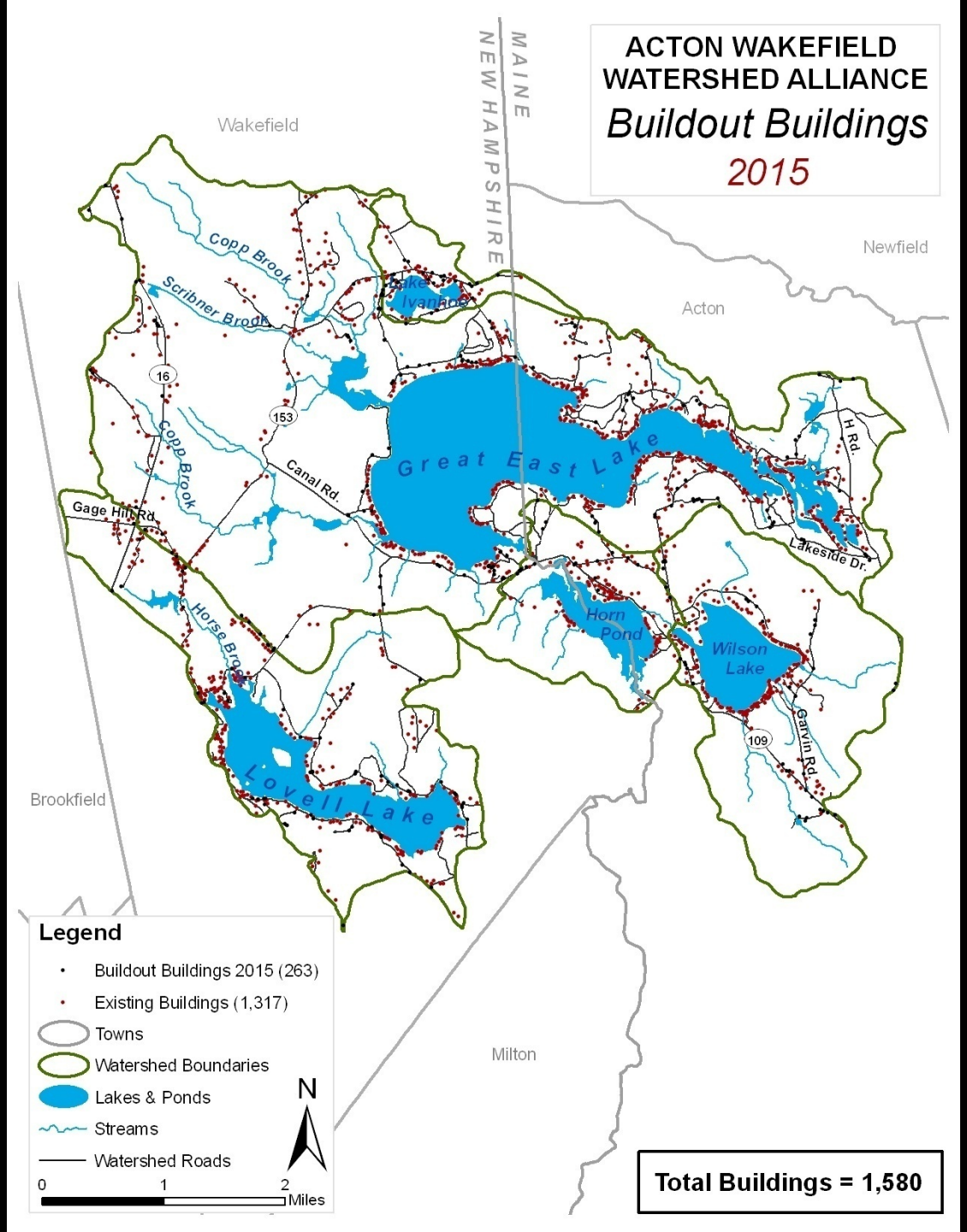
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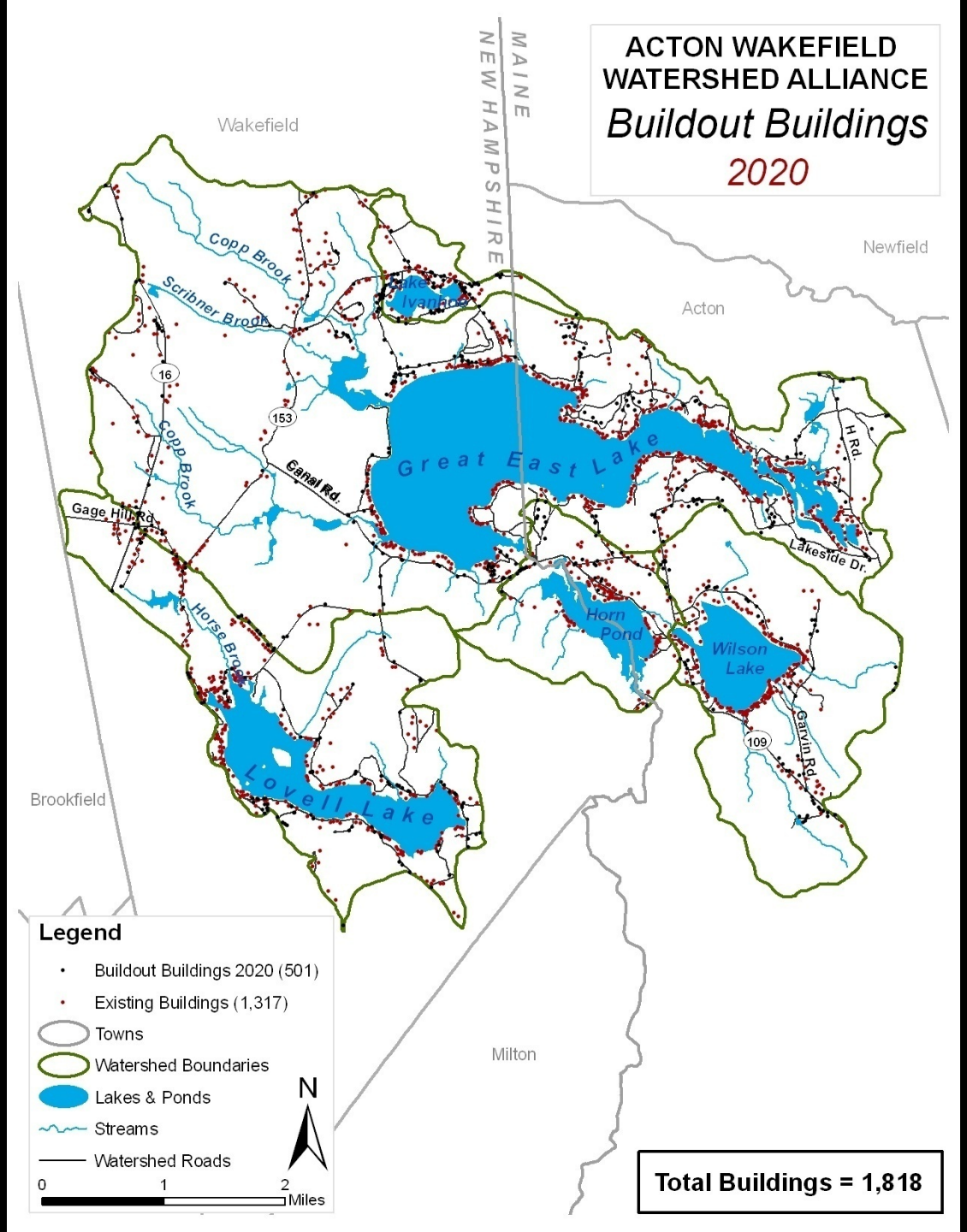
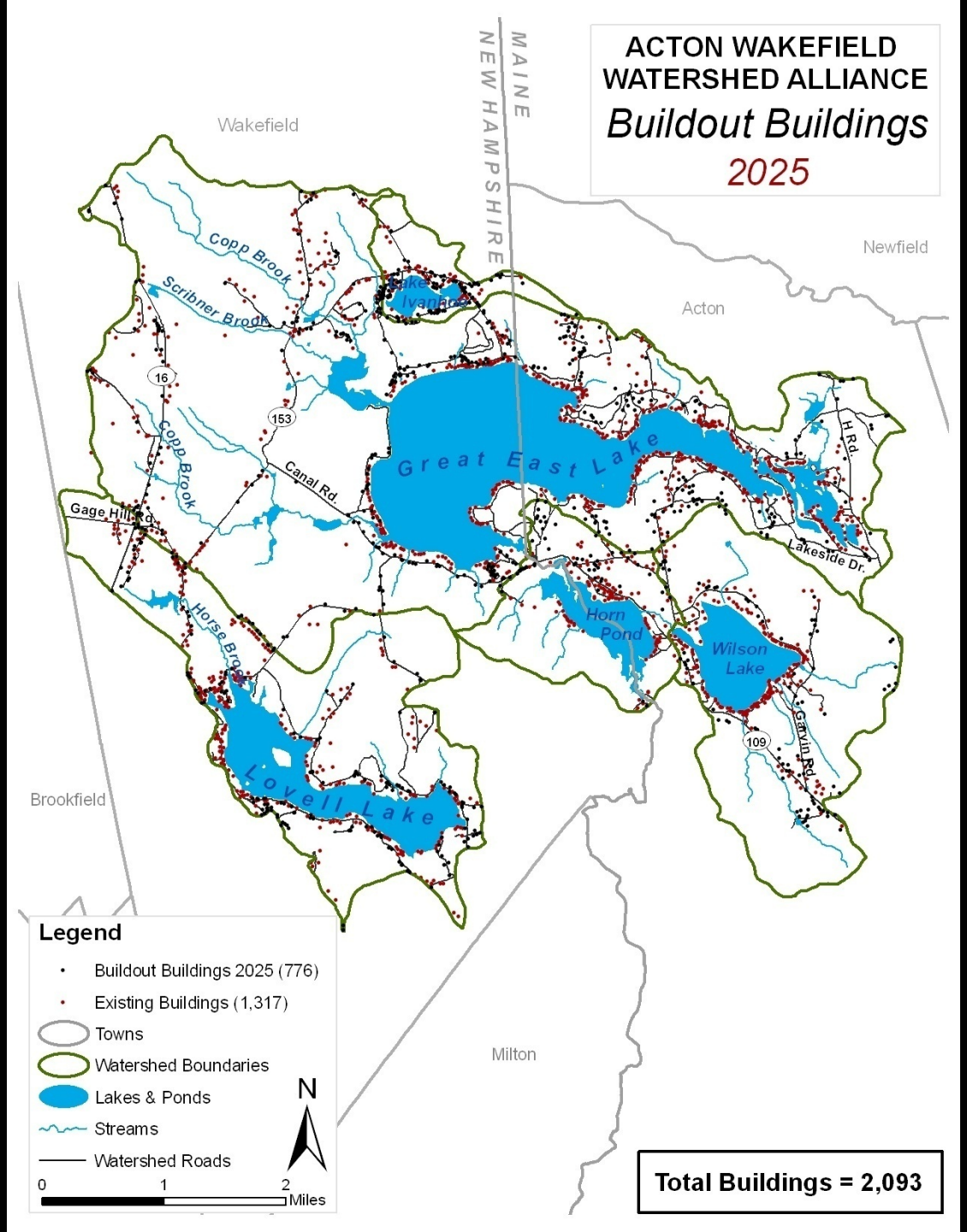
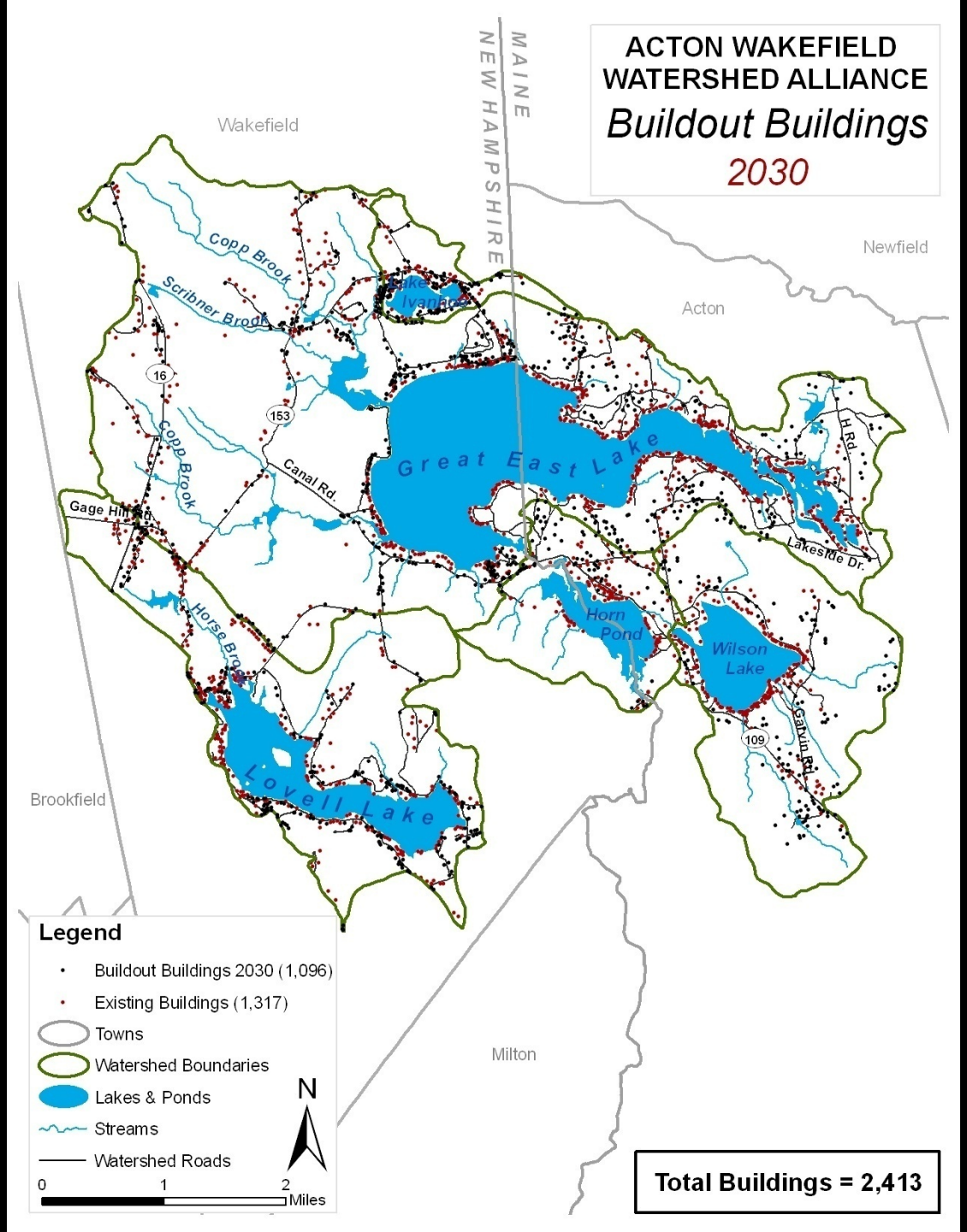
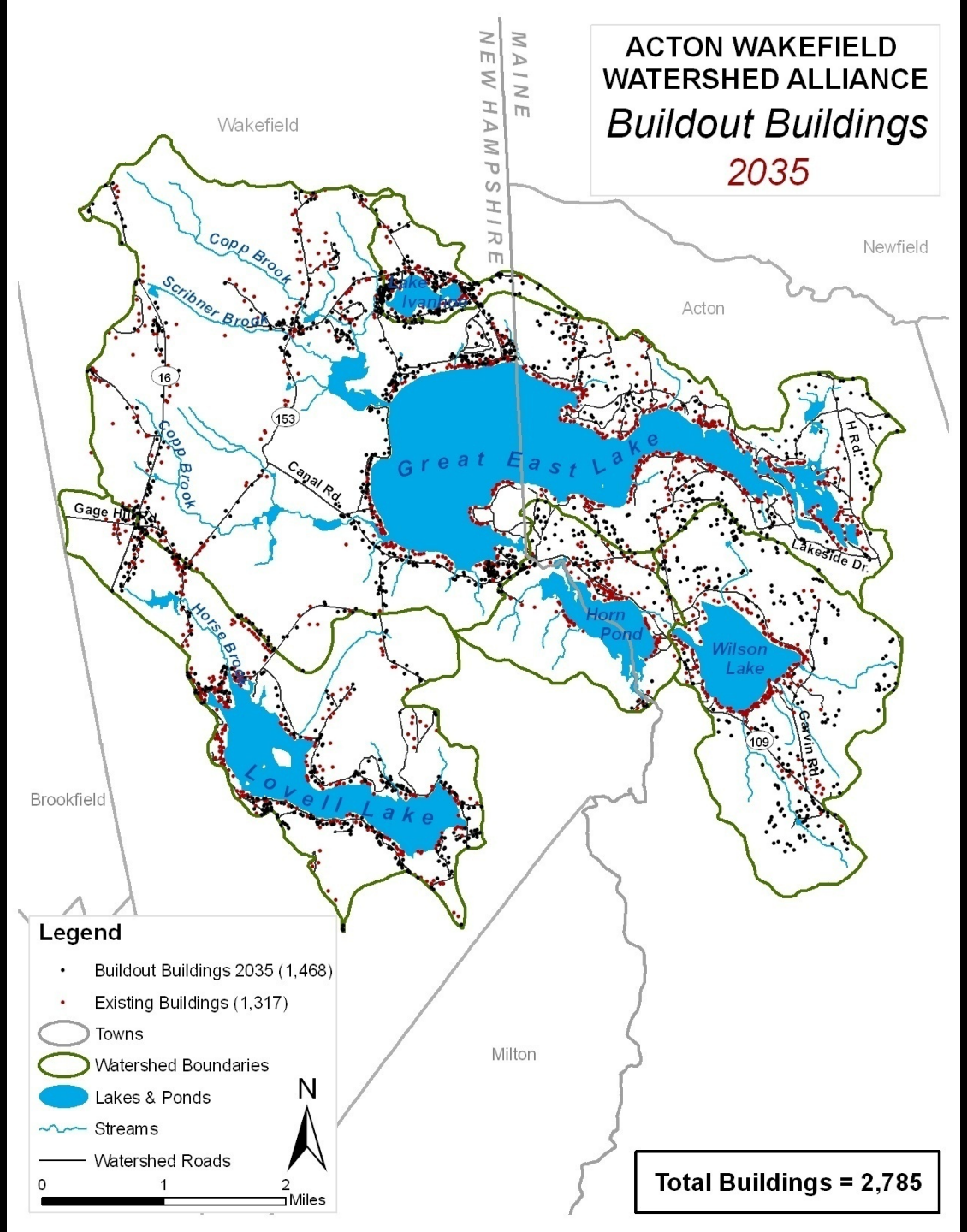
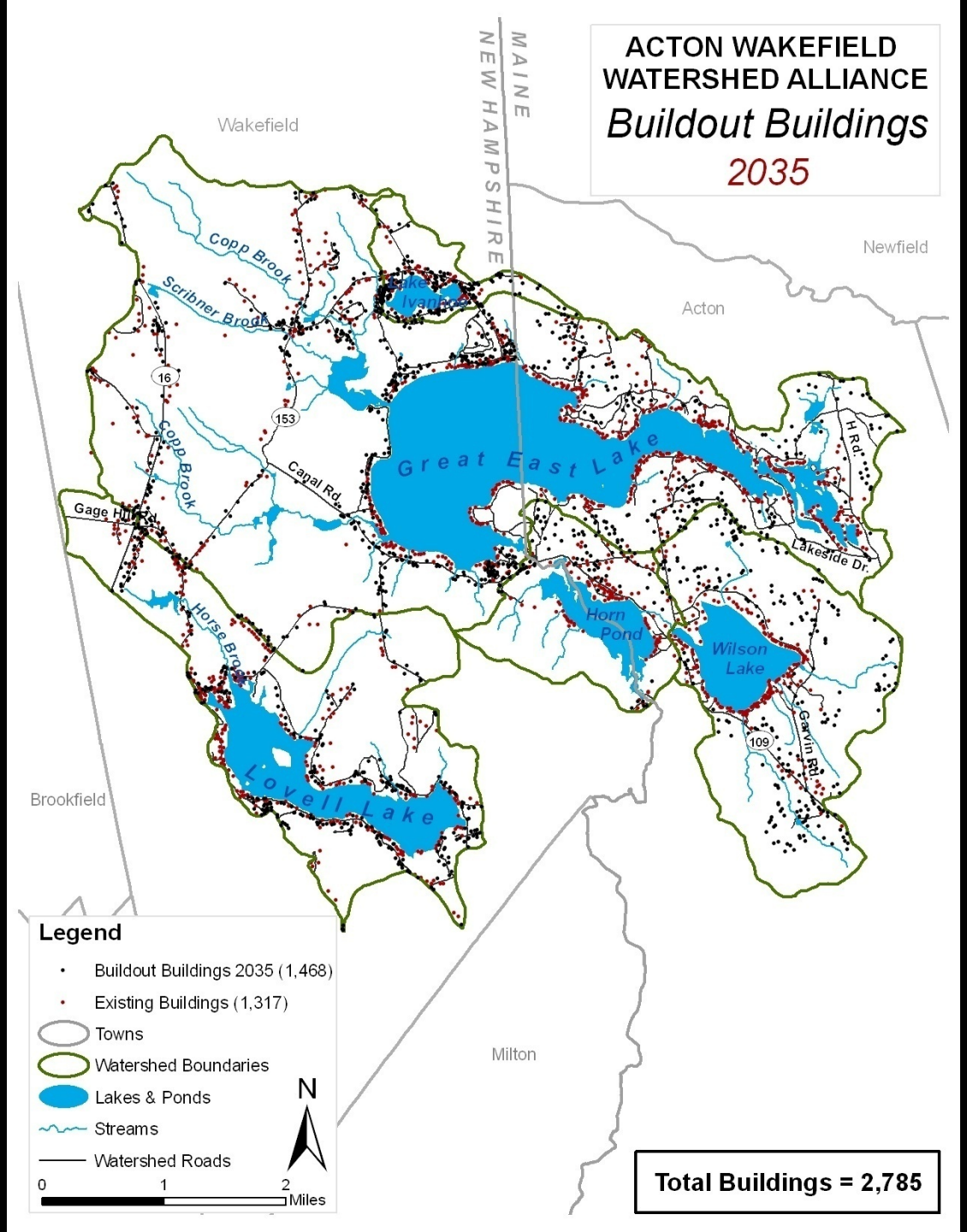
WATERSHED ALLIANCE
Buildout Buildings
2015
MAINE
NEW HAMPSHIRE
Wakefield
Newfield
Acton
Brookfield
Milton
Copp Brook
Scribner Brook
Lake Ivanhoe
Great East Lake
Canal Rd.
Gage Hill Rd.
Horse Brook
Lovell Lake
Horn Pond
Wilson Lake
Lakeside Dr.
H Rd.
Garvin Rd.
16
153
109
Legend
Buildout Buildings 2015 (263)
Existing Buildings (1,317)
Towns
Watershed Boundaries
Lakes & Ponds
Streams
Watershed Roads
N
0
1
2
Miles
Total Buildings = 1,580

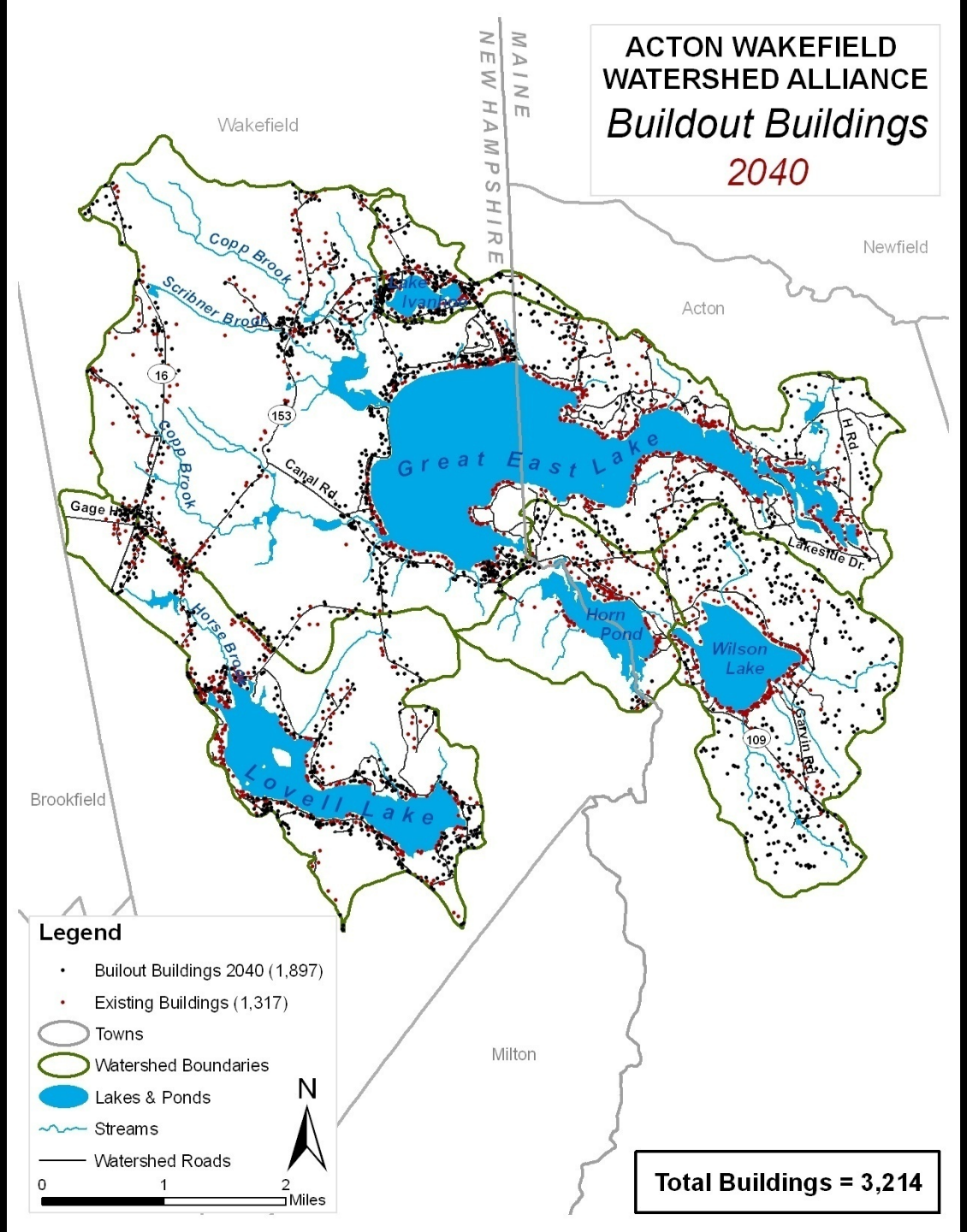

ACTON WAKEFIELD
WATERSHED ALLIANCE
Buildout Buildings
2020
MAINE
NEW HAMPSHIRE
Wakefield
Newfield
Acton
Brookfield
Milton
Copp Brook
Scribner Brook
Lake Ivanhoe
Great East Lake
Horse Brook
Lovell Lake
Horn Pond
Wilson Lake
Canal Rd.
Gage Hill Rd.
Lakeside Dr.
H Rd.
Garvin Rd.
16
153
109
Legend
Buildout Buildings 2020 (501)
Existing Buildings (1,317)
Towns
Watershed Boundaries
Lakes & Ponds
Streams
Watershed Roads
N
0
1
2
Miles
Total Buildings = 1,818

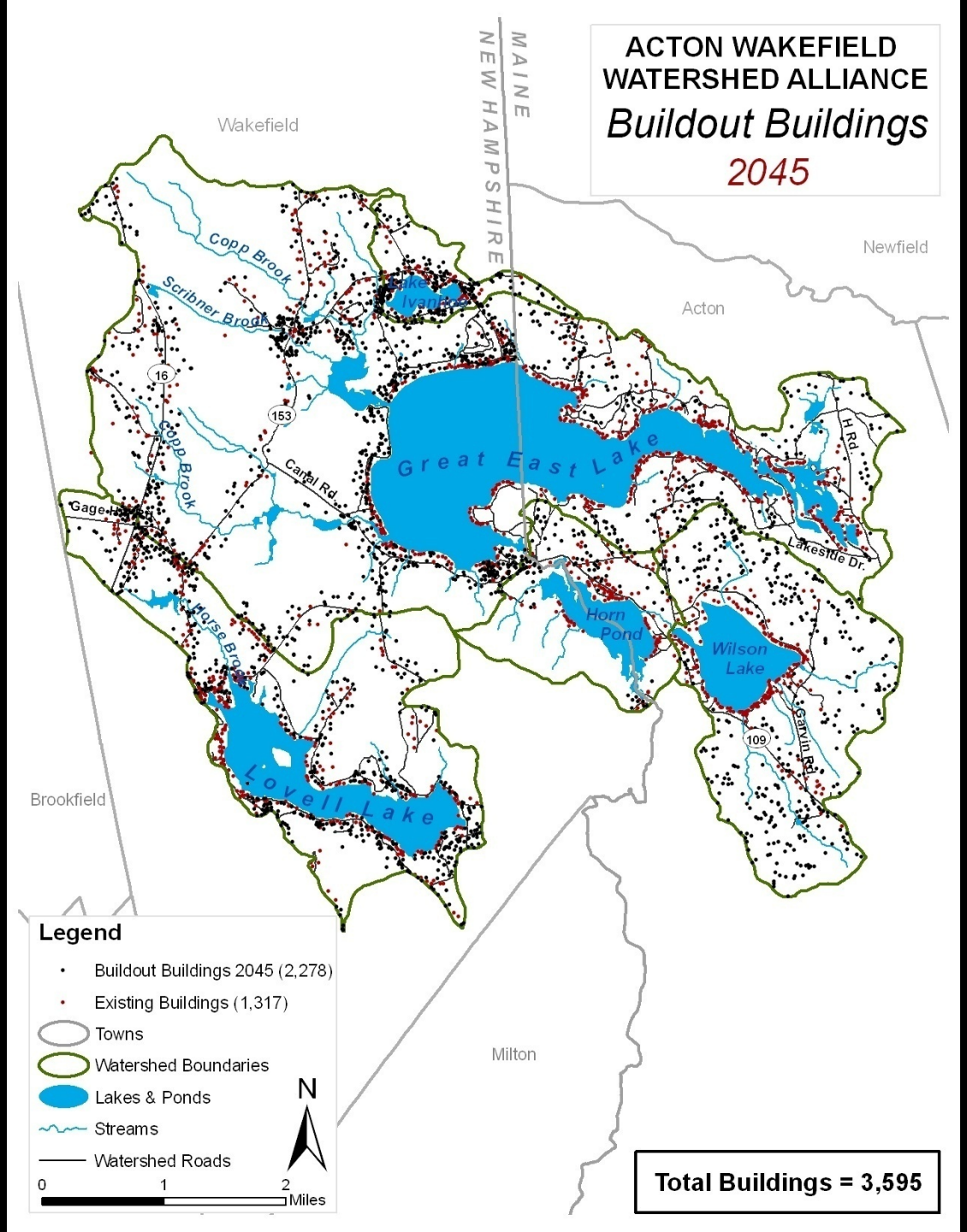

ACTON WAKEFIELD
WATERSHED ALLIANCE
Buildout Buildings
2025
MAINE
NEW HAMPSHIRE
Wakefield
Newfield
Acton
Brookfield
Milton
Copp Brook
Scribner Brook
Lake Ivanhoe
Great East Lake
Horse Brook
Lovell Lake
Horn Pond
Wilson Lake
Canal Rd.
Gage Hill Rd.
Lakeside Dr.
H Rd.
Garvin Rd.
16
153
109
Legend
Buildout Buildings 2025 (776)
Existing Buildings (1,317)
Towns
Watershed Boundaries
Lakes & Ponds
Streams
Watershed Roads
N
0
1
2
Miles
Total Buildings = 2,093

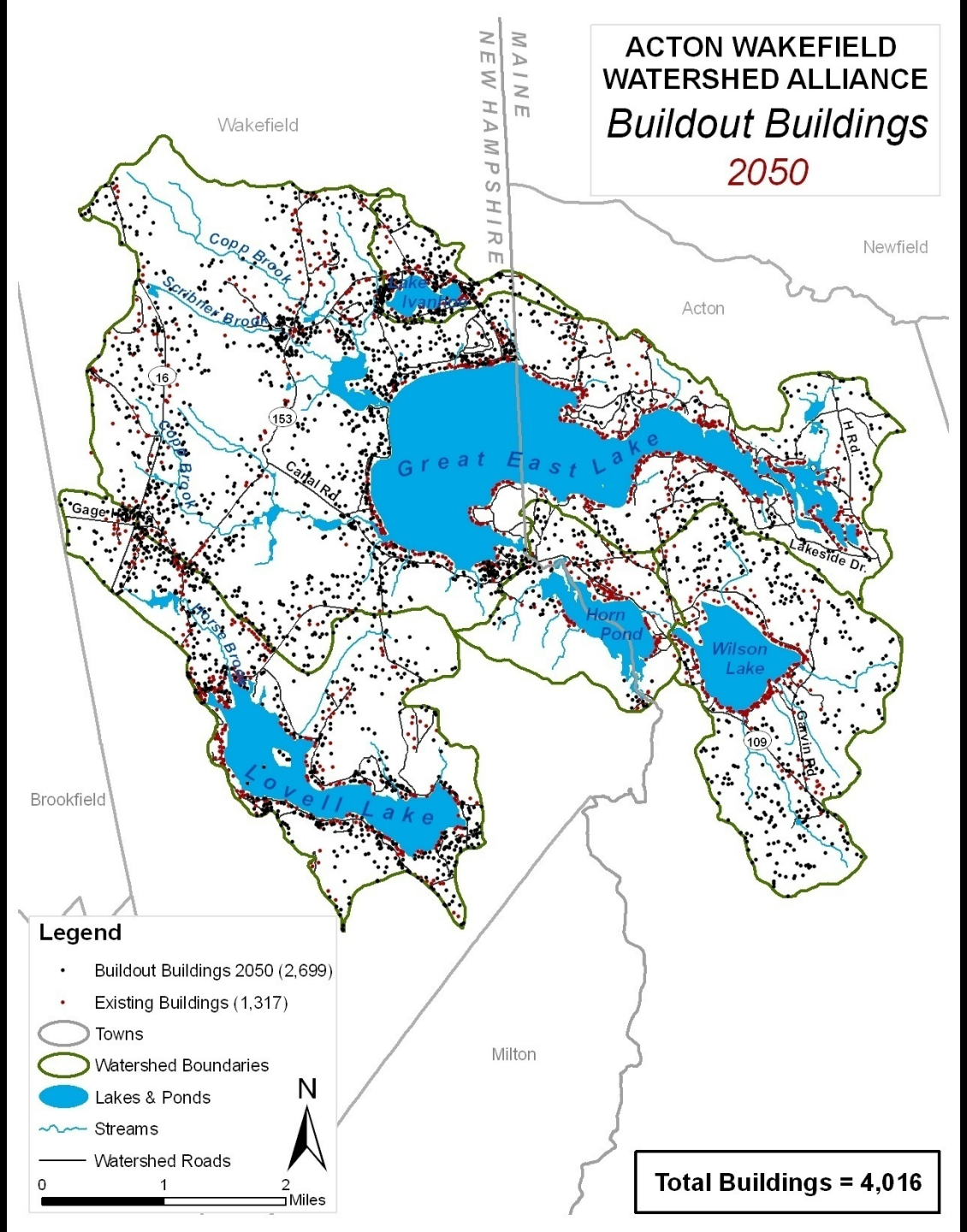

ACTON WAKEFIELD
WATERSHED ALLIANCE
Buildout Buildings
2030
MAINE
NEW HAMPSHIRE
Wakefield
Newfield
Acton
Brookfield
Milton
Copp Brook
Scribner Brook
Lake Ivanhoe
Great East Lake
Canal Rd.
Gage Hill Rd.
Horse Brook
Lovell Lake
Horn Pond
Wilson Lake
Lakeside Dr.
H Rd.
Calvin Rd.
16
153
109
Legend
Buildout Buildings 2030 (1,096)
Existing Buildings (1,317)
Towns
Watershed Boundaries
Lakes & Ponds
Streams
Watershed Roads
N
0
1
2
Miles
Total Buildings = 2,413

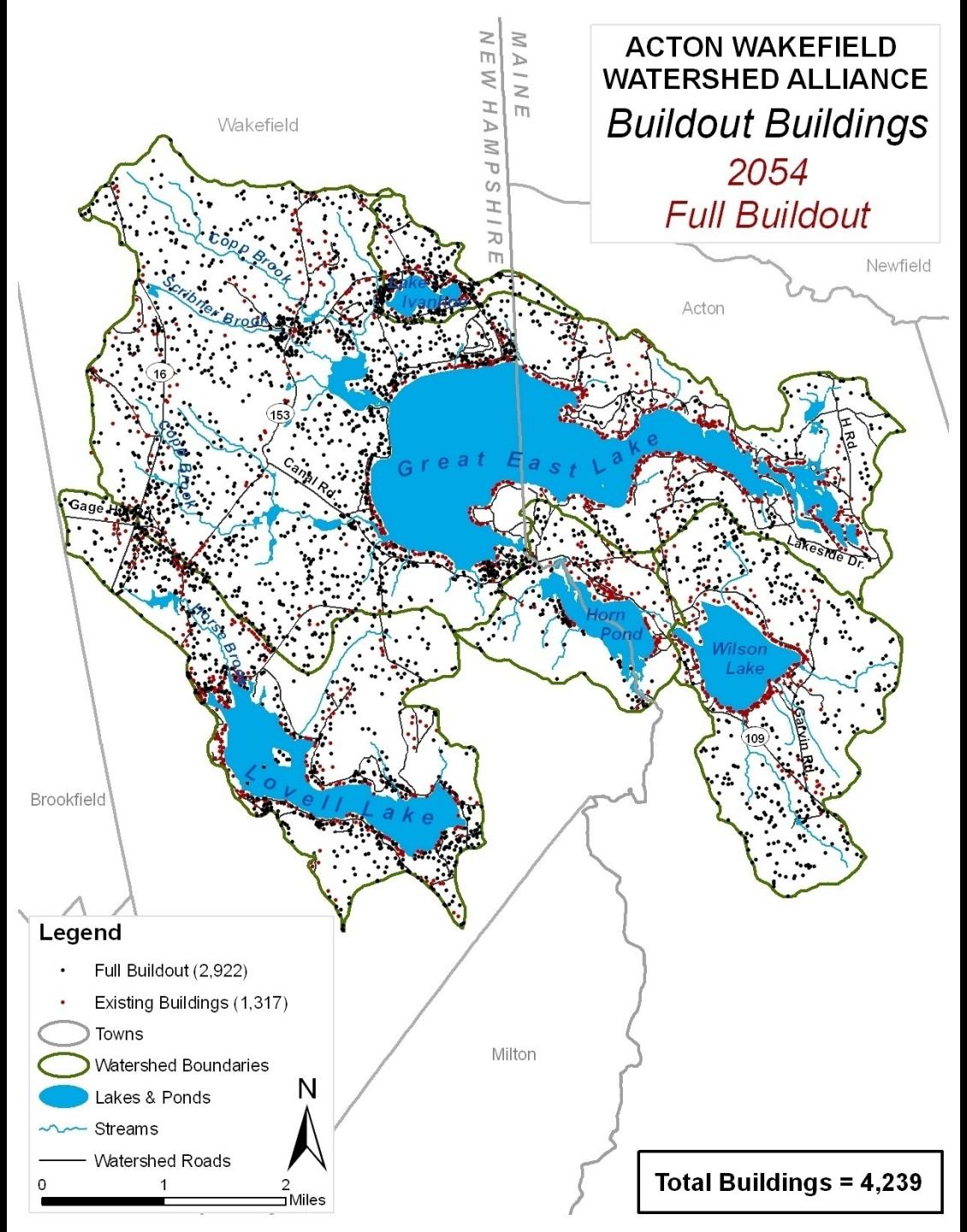

ACTON WAKEFIELD
WATERSHED ALLIANCE
Buildout Buildings
2035
MAINE
NEW HAMPSHIRE
Wakefield
Newfield
Acton
Brookfield
Milton
Copp Brook
Scribner Brook
Lake Ivanhoe
Great East Lake
Horn Pond
Wilson Lake
Lovell Lake
Horse Brook
Gage Hill Rd.
Canal Rd.
H Rd.
Lakeside Dr.
Garvin Rd.
16
153
109
Legend
Buildout Buildings 2035 (1,468)
Existing Buildings (1,317)
Towns
Watershed Boundaries
Lakes & Ponds
Streams
Watershed Roads
N
0
1
2
Miles
Total Buildings = 2,785


ACTON WAKEFIELD
WATERSHED ALLIANCE
Buildout Buildings
2035
MAINE
NEW HAMPSHIRE
Wakefield
Newfield
Acton
Brookfield
Milton
Copp Brook
Scribner Brook
Lake Ivanhoe
Great East Lake
Horn Pond
Wilson Lake
Lovell Lake
Horse Brook
Gage Hill Rd.
Canal Rd.
H Rd.
Lakeside Dr.
Garvin Rd.
16
153
109
Legend
Buildout Buildings 2035 (1,468)
Existing Buildings (1,317)
Towns
Watershed Boundaries
Lakes & Ponds
Streams
Watershed Roads
N
0
1
2
Miles
Total Buildings = 2,785


ACTON WAKEFIELD
WATERSHED ALLIANCE
Buildout Buildings
2040
MAINE
NEW HAMPSHIRE
Wakefield
Newfield
Acton
Brookfield
Milton
Copp Brook
Scribner Brook
Lake Ivanhoe
Great East Lake
Canal Rd.
Gage Hill
Horse Brook
Lovell Lake
Horn Pond
Wilson Lake
Lakeside Dr.
H Rd.
Garvin Rd.
16
153
109
Legend
Builout Buildings 2040 (1,897)
Existing Buildings (1,317)
Towns
Watershed Boundaries
Lakes & Ponds
Streams
Watershed Roads
N
0
1
2
Miles
Total Buildings = 3,214

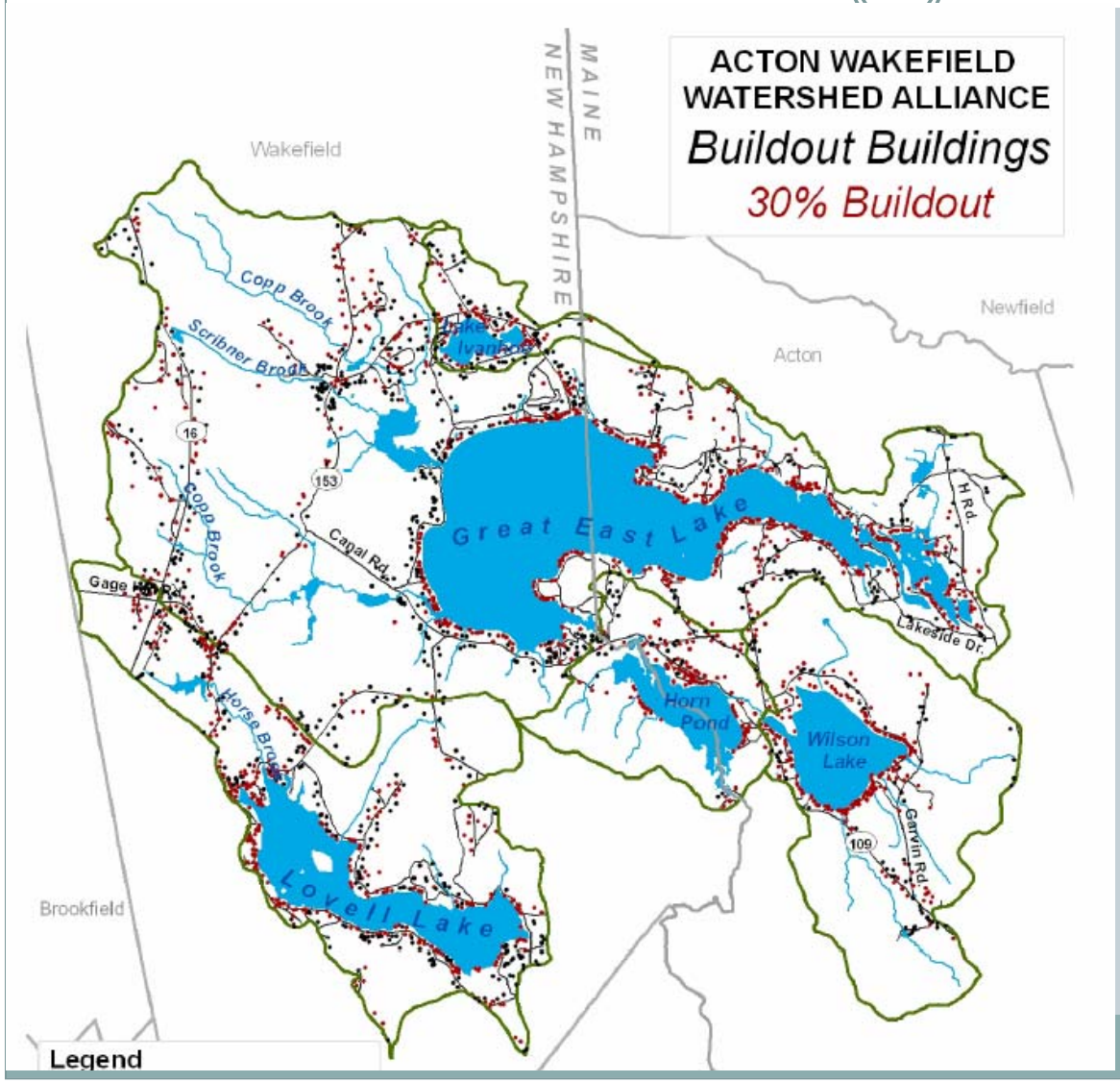

ACTON WAKEFIELD
WATERSHED ALLIANCE
Buildout Buildings
2045
MAINE
NEW HAMPSHIRE
Wakefield
Newfield
Acton
Brookfield
Milton
Copp Brook
Scribner Brook
Lake Ivanhoe
Great East Lake
Horn Pond
Wilson Lake
Lovell Lake
Horse Brook
Canal Rd.
Gage Hill
Lakeside Dr.
H Rd.
Garvin Rd.
16
153
109
Legend
Buildout Buildings 2045 (2,278)
Existing Buildings (1,317)
Towns
Watershed Boundaries
Lakes & Ponds
Streams
Watershed Roads
N
0
1
2
Miles
Total Buildings = 3,595


ACTON WAKEFIELD
WATERSHED ALLIANCE
Buildout Buildings
2050
MAINE
NEW HAMPSHIRE
Wakefield
Newfield
Acton
Brookfield
Milton
Copp Brook
Scribner Brook
Lake Ivanhoe
Great East Lake
Horn Pond
Wilson Lake
Lovell Lake
Canal Rd.
Gage Hill Rd.
Horse Brook
Lakeside Dr.
H Rd.
Garvin Rd.
16
153
109
Legend
Buildout Buildings 2050 (2,699)
Existing Buildings (1,317)
Towns
Watershed Boundaries
Lakes & Ponds
Streams
Watershed Roads
N
0
1
2
Miles
Total Buildings = 4,016


ACTON WAKEFIELD
WATERSHED ALLIANCE
Buildout Buildings
2054
Full Buildout
MAINE
NEW HAMPSHIRE
Wakefield
Newfield
Acton
Brookfield
Milton
Copp Brook
Scribner Brook
Lake Ivanhoe
Great East Lake
Horn Pond
Wilson Lake
Lovell Lake
Canal Rd.
Gage Hill
Horse Brook
H Rd.
Lakeside Dr.
Garvin Rd.
16
153
109
Legend
Full Buildout (2,922)
Existing Buildings (1,317)
Towns
Watershed Boundaries
Lakes & Ponds
Streams
Watershed Roads
N
0
1
2
Miles
Total Buildings = 4,239

Buildout Results

Additional Phosphorus Loading



P loading: 86 kg (190 lbs)

With BMPs: 3 kg (6 lbs)

Buildout Results

Additional Phosphorus Loading

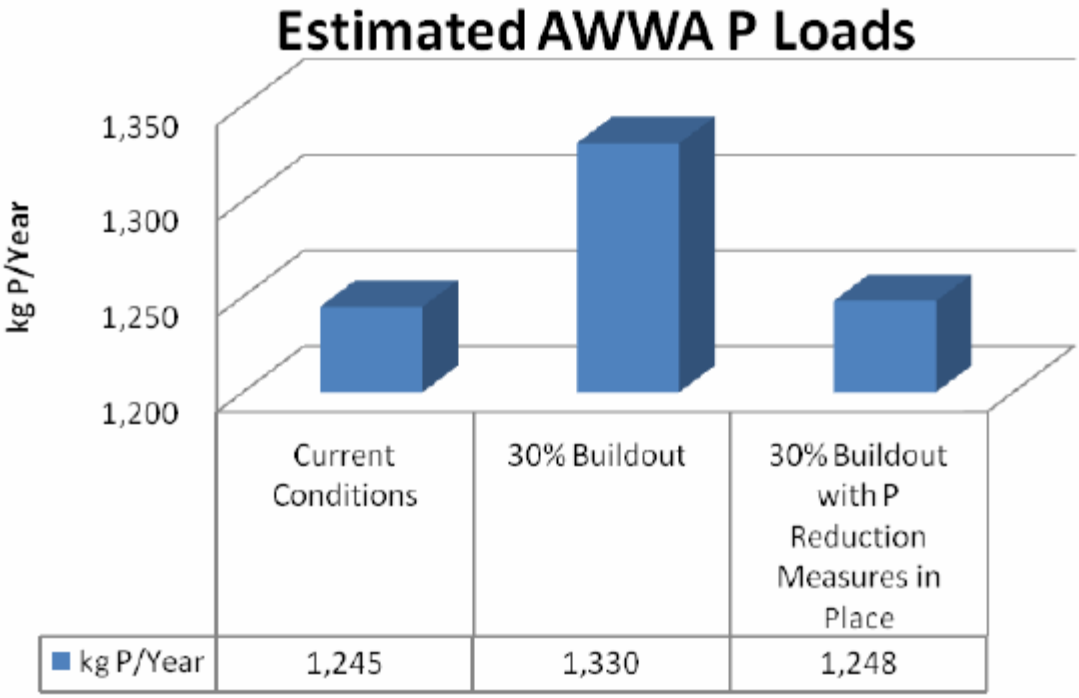


Figure 16: AWWA Phosphorus Loads Under Existing and Future Conditions

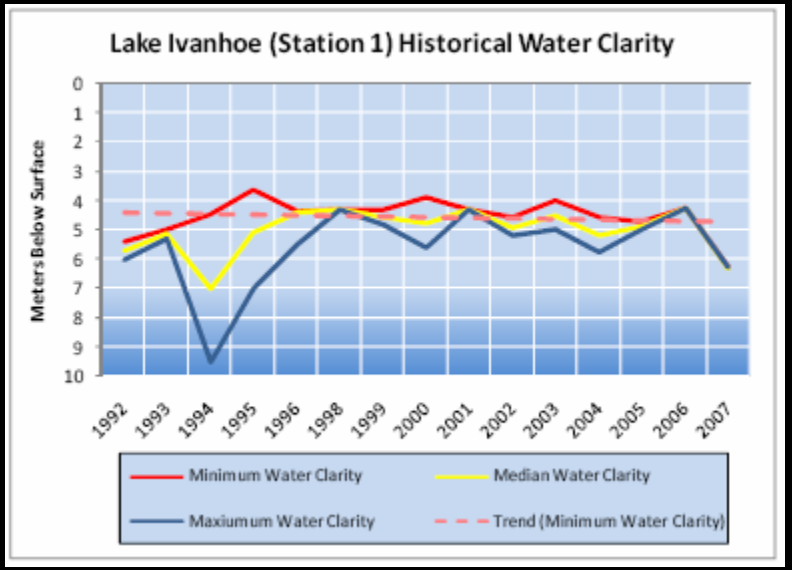
CASE STUDY

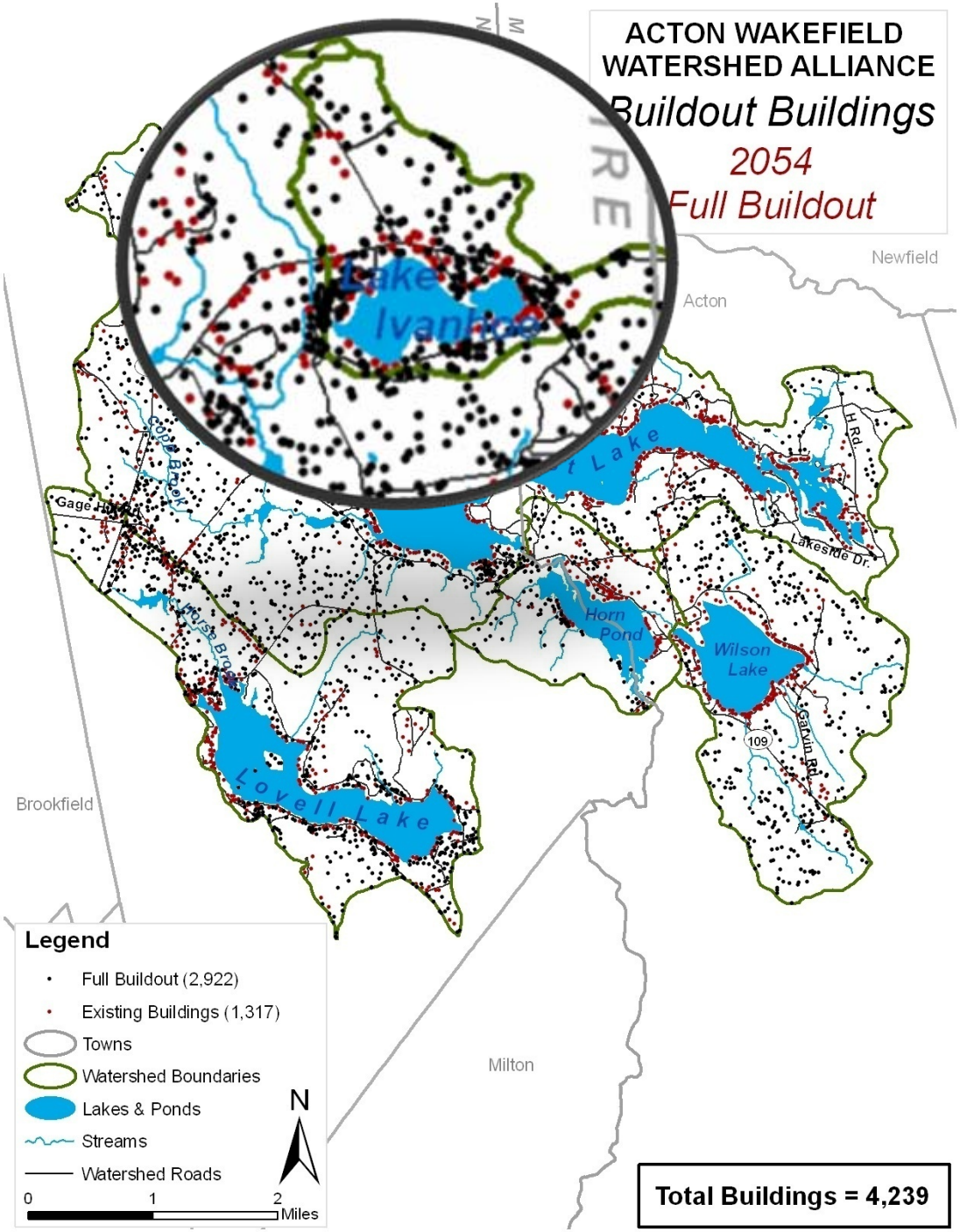
LAKE IVANHOE:

Smallest Watershed- 407 acres

Highest % Buildable Land -56%

17 YRS WQ DATA

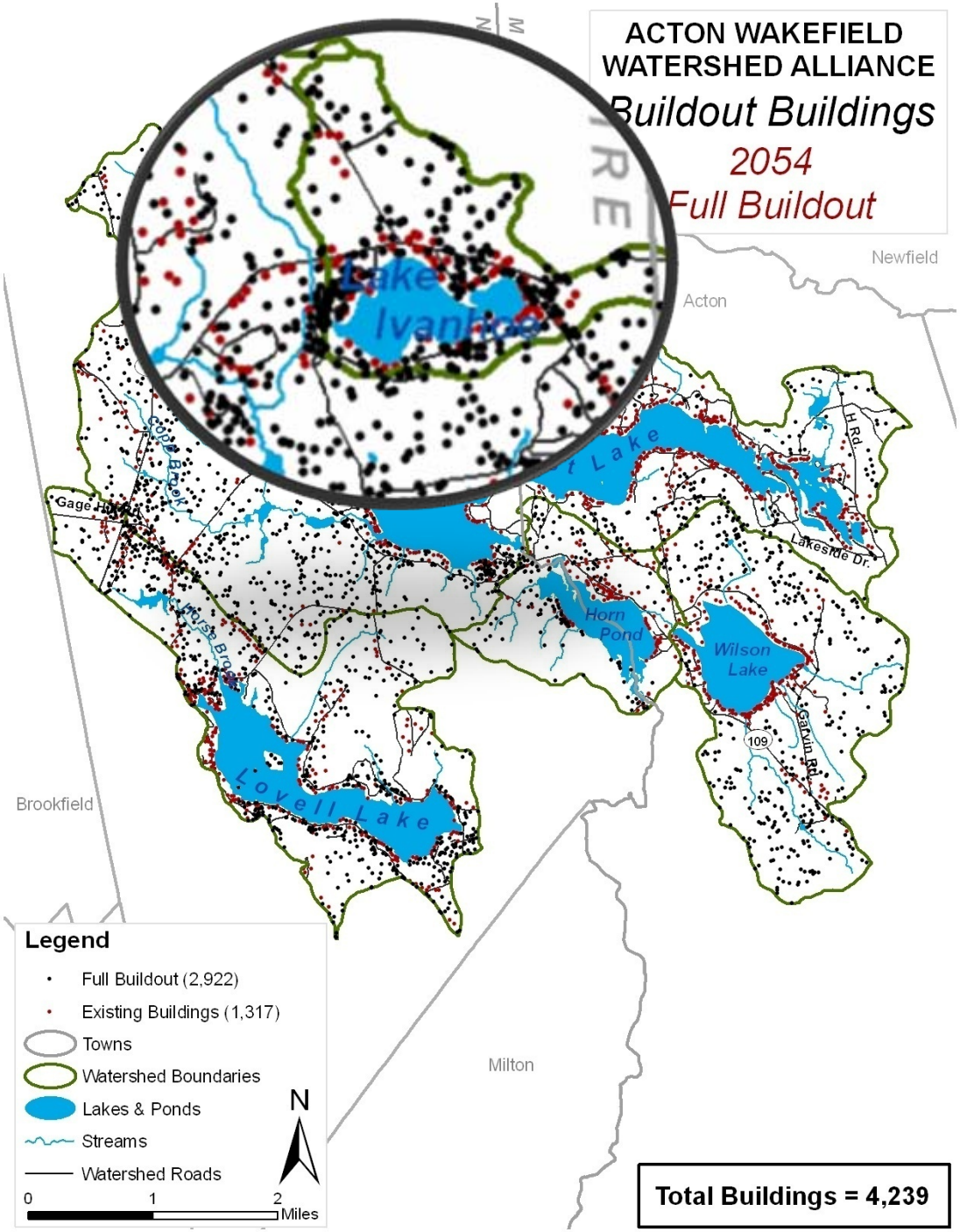




CASE STUDY

LAKE IVANHOE:

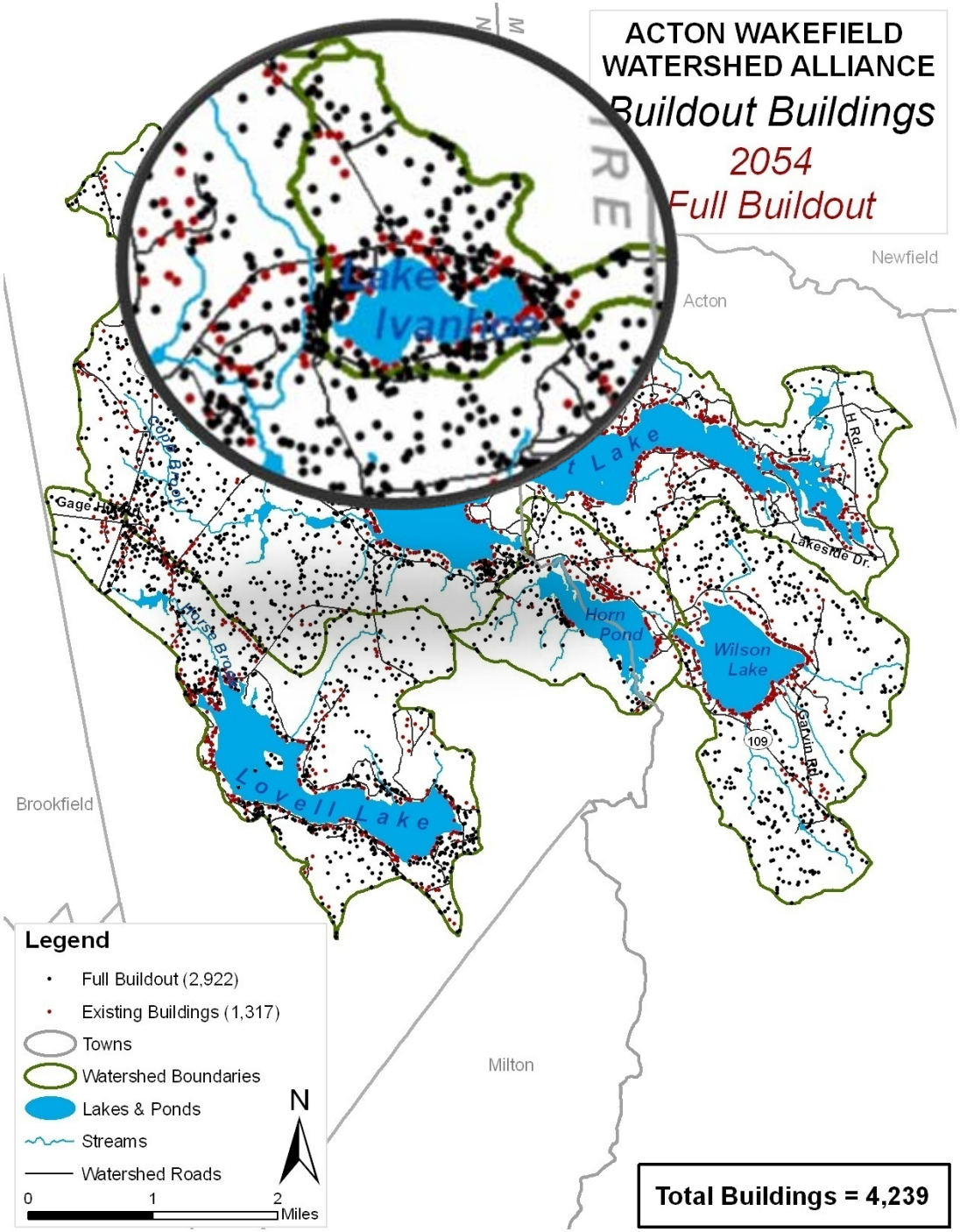
Recommended Management Strategy for Ivanhoe:



CASE STUDY
LAKE IVANHOE:

Recommended Management Strategy for Ivanhoe:

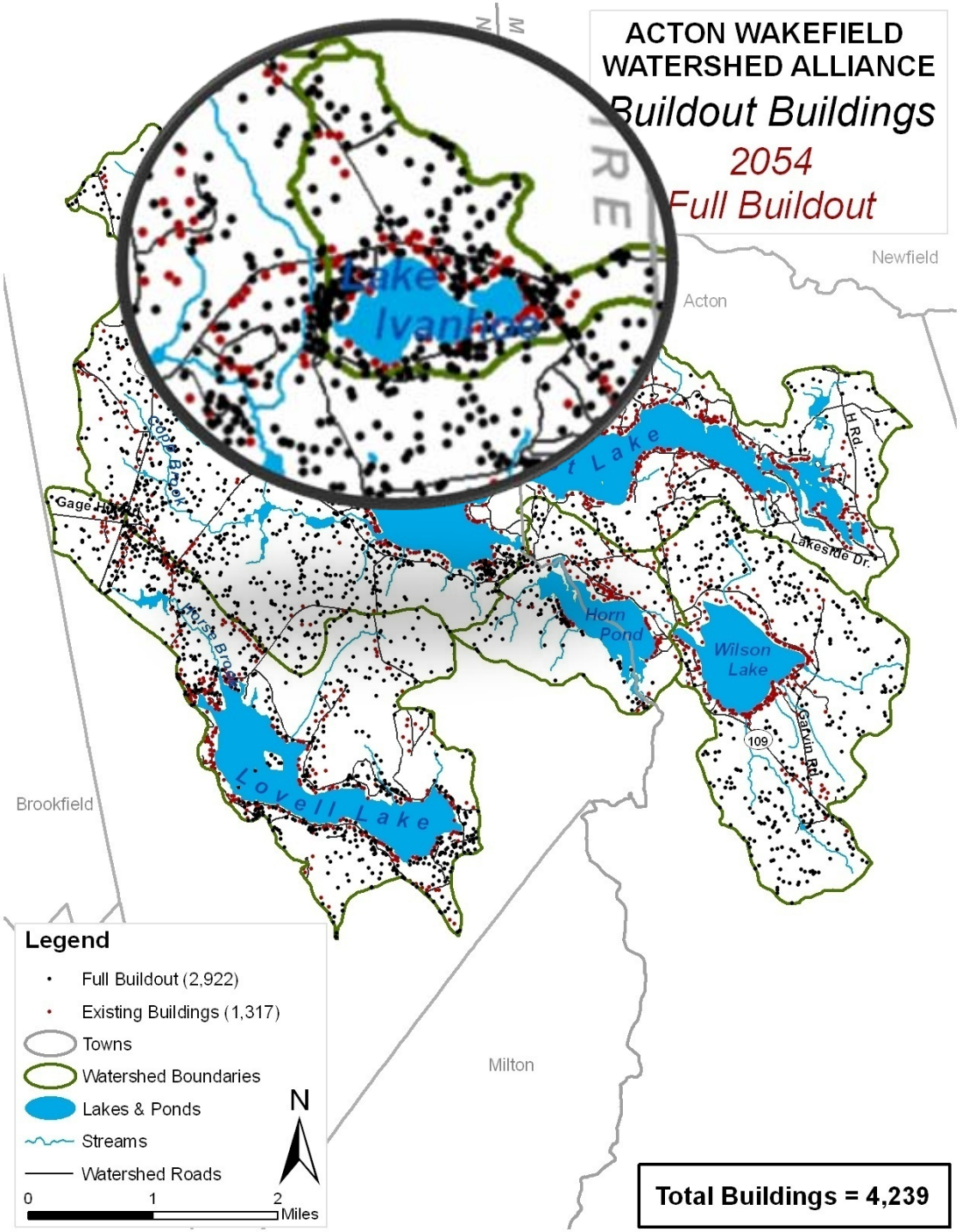
No New P Inputs



CASE STUDY
LAKE IVANHOE:

Recommended Management Strategy for Ivanhoe:

No New P Inputs

Implement Local P Controls

Increase Min. Shoreland Zoning