Road Workshop

July 12, 2016
Charlie Baeder, Belgrade Regional Conservation Alliance
Belgrade Lakes Watershed

• 180 square miles
• 7 major lakes (30 square miles): East Pond, North Pond, McGrath Pond, Salmon Lake, Great Pond, Long Pond, Messalonskee Lake
• 13 towns: Augusta, Belgrade, Manchester, Mercer, Mount Vernon, New Sharon, Norridgewock, Oakland, Readfield, Rome, Sidney, Smithfield, Vienna
• 10,000 residents + non-residents + tourists
Watershed Seasonal Homes 2010

<table>
<thead>
<tr>
<th>Variable</th>
<th>Belgrade Lakes Watershed</th>
<th>State of Maine</th>
<th>Kennebec County</th>
<th>Somerset County</th>
</tr>
</thead>
<tbody>
<tr>
<td>Total Population</td>
<td>10,529</td>
<td>9,970</td>
<td>1,274,923</td>
<td>1,328,361</td>
</tr>
<tr>
<td>Males</td>
<td>5,081</td>
<td>4,947</td>
<td>587,126</td>
<td>610,379</td>
</tr>
<tr>
<td>Females</td>
<td>5,448</td>
<td>5,023</td>
<td>687,797</td>
<td>717,982</td>
</tr>
</tbody>
</table>

Vacant Housing Units

Seasonal Homes

Seasonal Homes as Percentage of Total Housing Units

- 33.8%
- 34.0%

Families

- 3,072
- 2,954
- -3.8%

Average Family Size

- 2.8
- 2.7
- -4.9%

Single Mothers

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</thead>
<tbody>
<tr>
<td>White Population</td>
<td>10,329</td>
<td>9,772</td>
<td>1,236,014</td>
<td>1,264,971</td>
</tr>
<tr>
<td>Black/African American Population</td>
<td>17</td>
<td>27</td>
<td>6,760</td>
<td>15,707</td>
</tr>
<tr>
<td>AIAN Population</td>
<td>24</td>
<td>28</td>
<td>7,098</td>
<td>8,568</td>
</tr>
<tr>
<td>Asian Population</td>
<td>44</td>
<td>28</td>
<td>9,111</td>
<td>13,571</td>
</tr>
<tr>
<td>Other Race Population</td>
<td>27</td>
<td>18</td>
<td>3,293</td>
<td>4,603</td>
</tr>
<tr>
<td>Two or more races</td>
<td>83</td>
<td>98</td>
<td>12,647</td>
<td>20,941</td>
</tr>
<tr>
<td>Hispanic/Latino Population</td>
<td>55</td>
<td>82</td>
<td>9,360</td>
<td>16,935</td>
</tr>
</tbody>
</table>

Source: US Census Bureau, 2000 and 2010 Census, Summary File 1 data. AIAN denotes American Indian and Alaska Native.
Shorefront Property Values as a % of Total Valuation

Sidney 16.8%
Oakland 26%
Belgrade 65%
Mount Vernon 65%
Rome 80%
Lakes - Economic Impacts

• Property values
• Drinking Water – 65% of state
• Real estate sales, rentals
• Construction - primary and 2nd home
• Landscaping, remodeling
• Tourism
• Recreation, Boating, Fishing
Statewide Economic Impact

• Tourism - $15 billion (source: Bangor Daily News)
• Lakes - $3.5 billion (source: Maine DEP)
• Lakes - 52,000 Maine jobs (source: Maine DEP)
Canadian Experimental Lakes Area (#226)

- Pristine lake divided in two
- P added to only one side

less than 10 ppb

greater than 20 ppb

Source: ELA, Fisheries and Oceans Canada
Phosphorus and Water Quality

- Erosion to lakes is accelerated by land use including residential and commercial development, roads, agriculture, forestry – activities that disturb soils
- Phosphorus is carried to lakes attached to dirt
- Phosphorus is also an ingredient of human, animal, and plant waste – septic systems are a major source of phosphorus to lakes
- **Phosphorus (P)** is a nutrient – a small amount is necessary for life – too much phosphorus stimulates excessive plant and algae growth – it is all about moderation
- 5-10 *parts per billion* (ppb) = a clear lake, BUT 20+ ppb = an algae bloom lake
WQ issues are the result of multiple external factors
– 4 “controllable” factors ~70% of problem
  » Development
    • Residential, Commercial
  » Roads
    • Town, State, Private (road association)
    • Driveways
  » Septic systems
  » Agriculture/Forestry
– Less controllable ~30% of problem
  » Atmospheric
  » Natural deposition (leaves etc)
External and Internal “P” Loading

External Loading (Dirt, Waste)
- Development
- Roads
- Septic
- Ag/Forestry
- Atmospheric, Natural (leaves, etc)

Internal Loading (Phosphorus in Lake Sediments)
- “Anoxic” Factor = No Oxygen (<1 ppm) → P Release
- Estimated at 5-30% of total loading
1. Phosphorus defines phytoplankton
2. Phytoplankton define the thermocline
3. The thermocline defines the deep oxygen
4. Dead Bugs drive anoxia
5. Anoxia releases phosphorus
6. Phosphorus mixes upward in the fall
7. More phosphorus is available next year
Anoxic Areas of Great Pond in 1988
Anoxic Areas of Great Pond in 2015
Great Pond Temperature – 2015

HOT (78°F)

COLD (50°F)
Great Pond Oxygen – 2015
Great Pond Oxygen (ppm) – 2015

NORMAL

ANOXIC

2
Increased Precipitation Trends

• Recent USGS studies indicate an overall trend estimated at **-10% to +40%** over the next 40 years based on USGS stream gauges in the Northeast and Mid-Atlantic (average +15%).

• Maine DOT is increasingly building new culverts and bridges using 100-year flood estimates instead of 25-year flood estimates.
Observed Change in Very Heavy Precipitation – 1958-2012

Map showing the change in very heavy precipitation across the United States from 1958 to 2012. The map uses different shades to represent the percentage change in precipitation. For example, states in green show an increase of 16%, while states in yellow show a decrease of 12%.
Flood magnitude results

- 78 of 103 gauges (76%) show an upward trend in flood magnitude over time.
- 25 (24%) have a p-value less than 0.1.

After Collins (2009) and Armstrong et al. (in review)
Flood frequency results

- 72 of 90 gauges (80%) show \( \uparrow \) POT/WY over time
- 32 (36%) have \( p < 0.1 \)

after Armstrong et al. (2012) and Armstrong et al. (in review)