Moving Towards Integrated Management and Use of Groundwater and Surface Water Resources in NH

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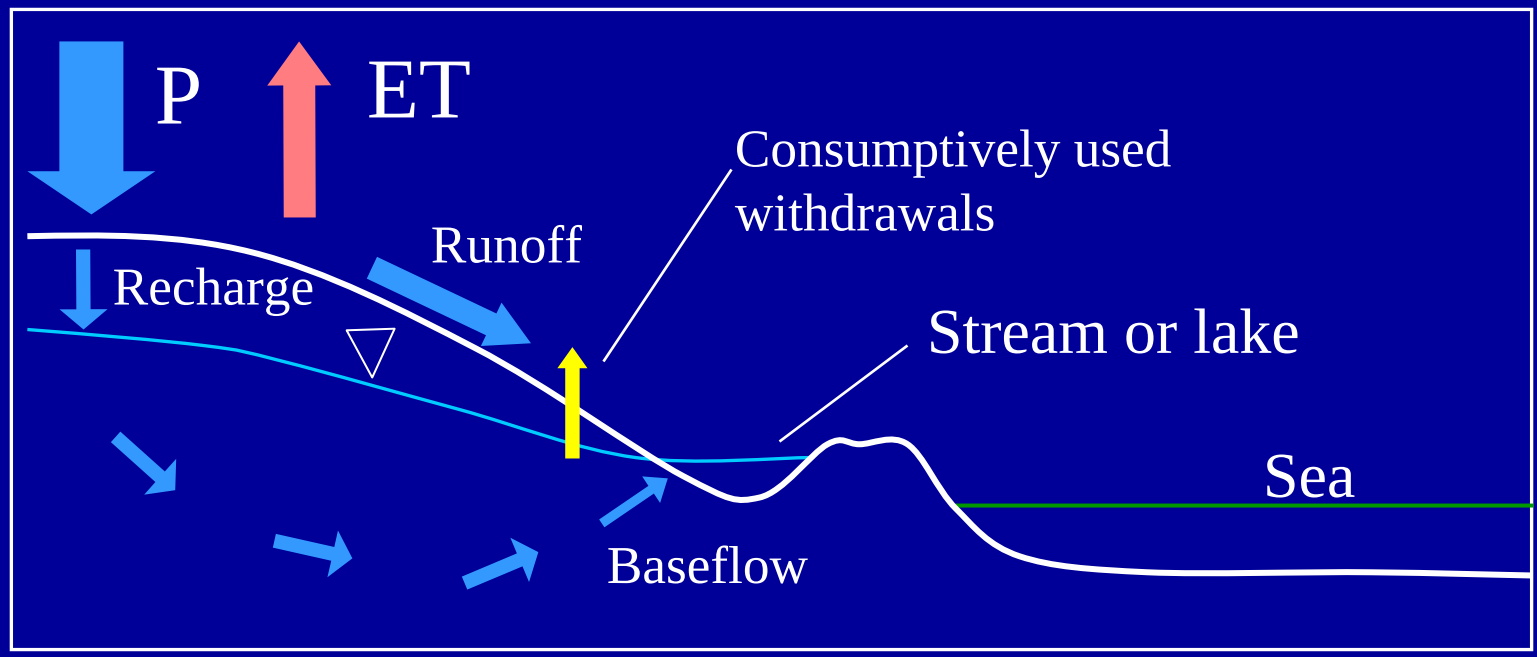
The water balance: Essential for understanding human effects on hydrologic systems

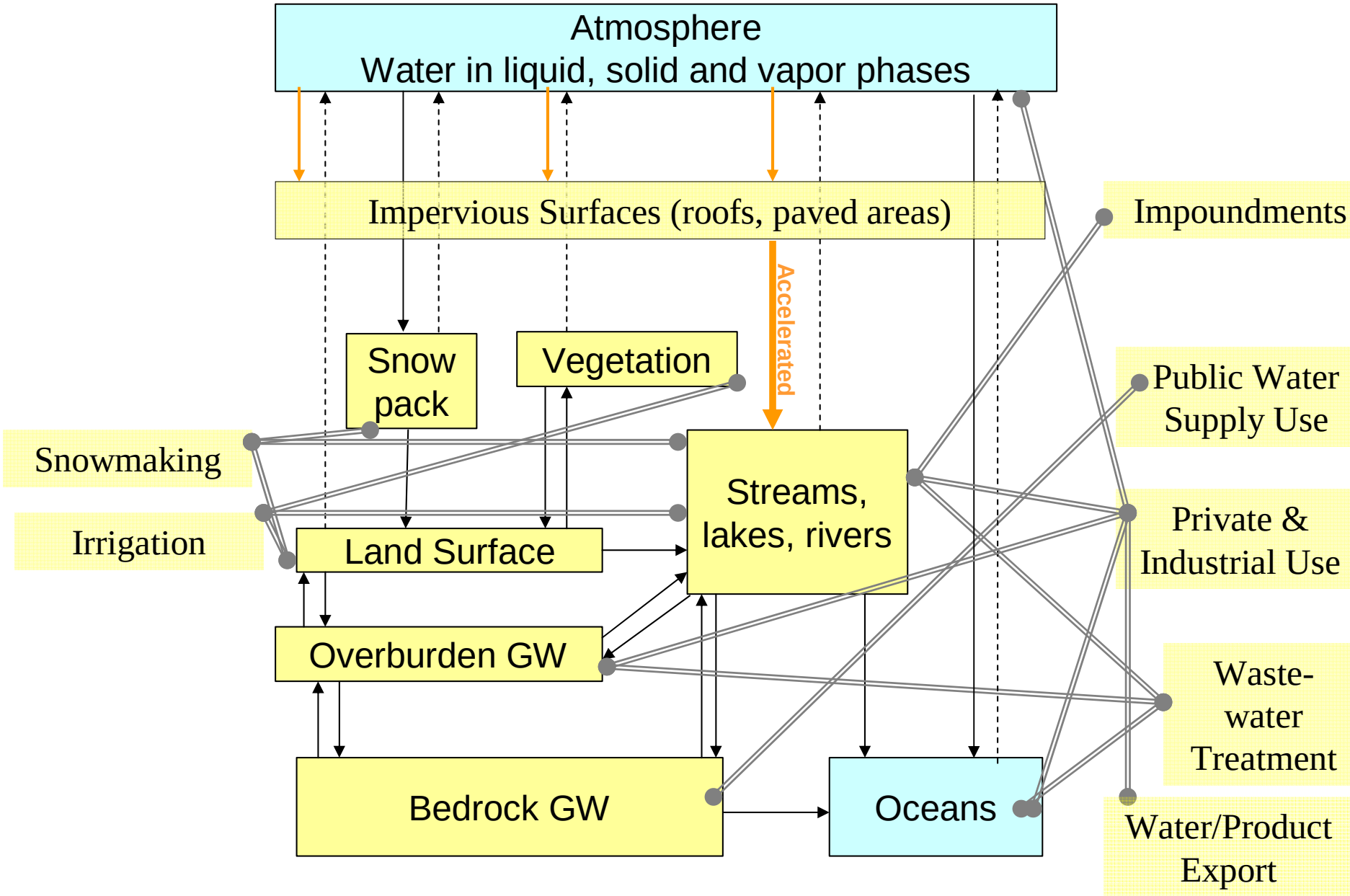


P – ET = Runoff + Baseflow

Runoff + Baseflow – Consumptive Use +/- Stored Water = Streamflow *(on a long-term average basis)*

From USGS-MA

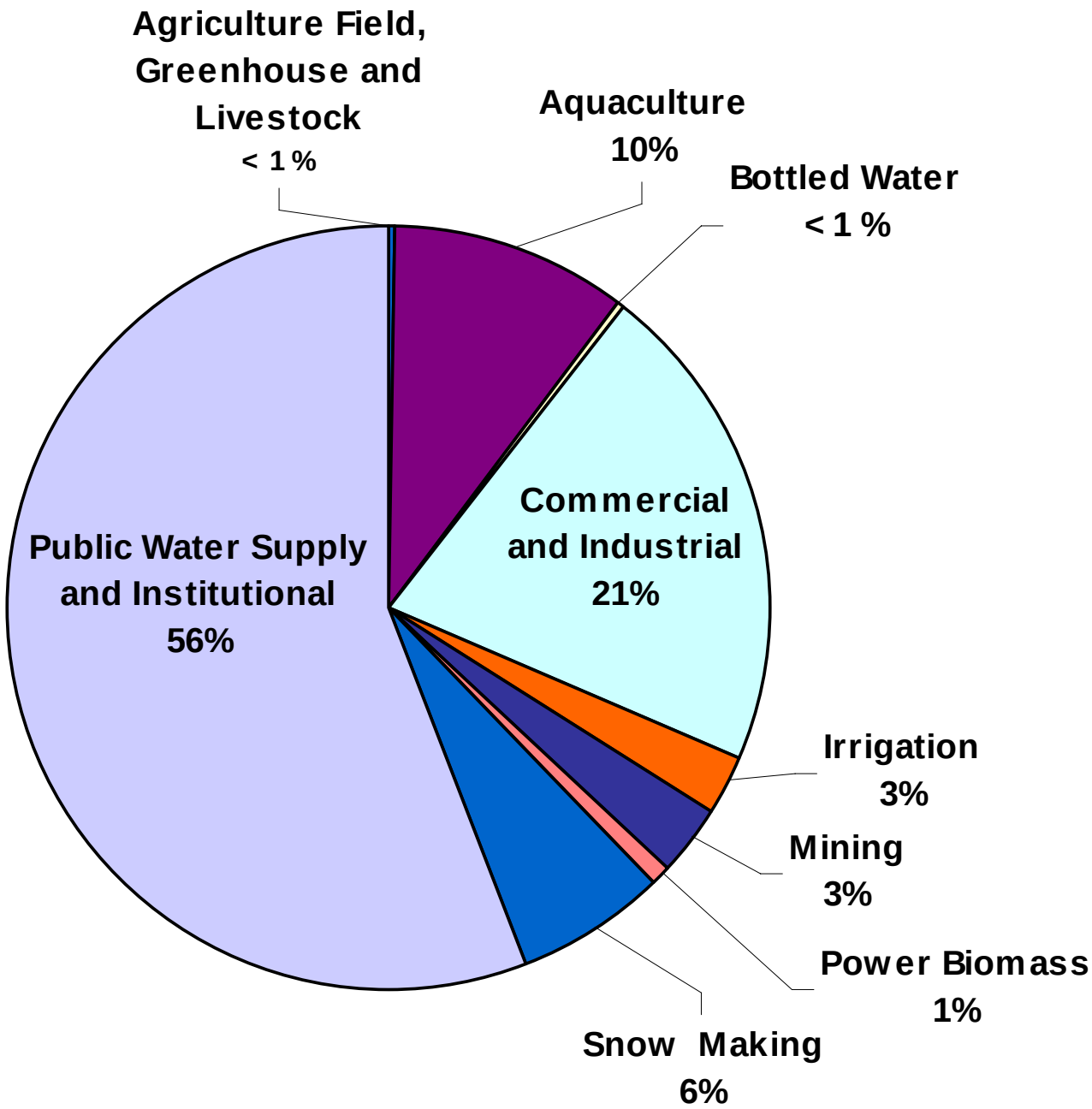
Generalized Hydrologic Cycle with Human Influence



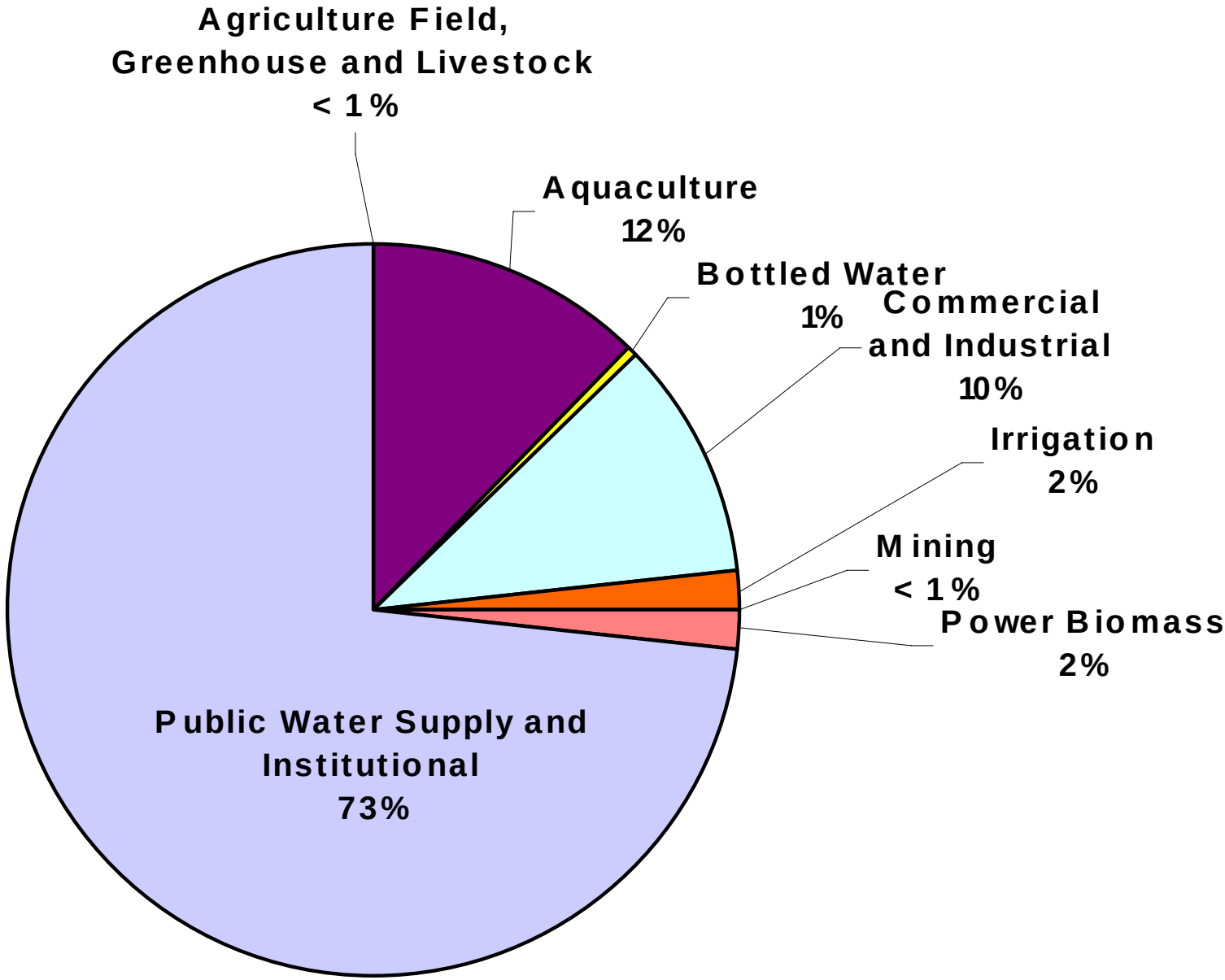
Regulatory and Outreach Programs

- Water use registration and reporting
- Water use efficiency
- Stormwater management
- Dam management
- Wastewater management
- Water withdrawal permitting
- Groundwater quality protection
- Planning/Smart Growth/Low Impact Development
- Data collection

Water Use in New Hampshire - 2004



Groundwater Use in New Hampshire - 2004



Water Use Registration and Reporting

- Since 1988, water users withdrawing, transferring or discharging more than 20,000 gallons per day had to register and report water use

- Since 2005, DES has clear authority to enforce these rules

  (see RSA 488 - www.gencourt.state.nh.us/rsa/html/NHTOC/NHTOC-L-488.htm)

Water Use – Water Efficiency

- State law (RSA 485.61) requires new permitted water withdrawals to comply with water efficiency standards - 2002

- State has developed 20 fact sheets and case studies for water efficiency

  (see www.des.state.nh.us/h2o_conservation.htm)

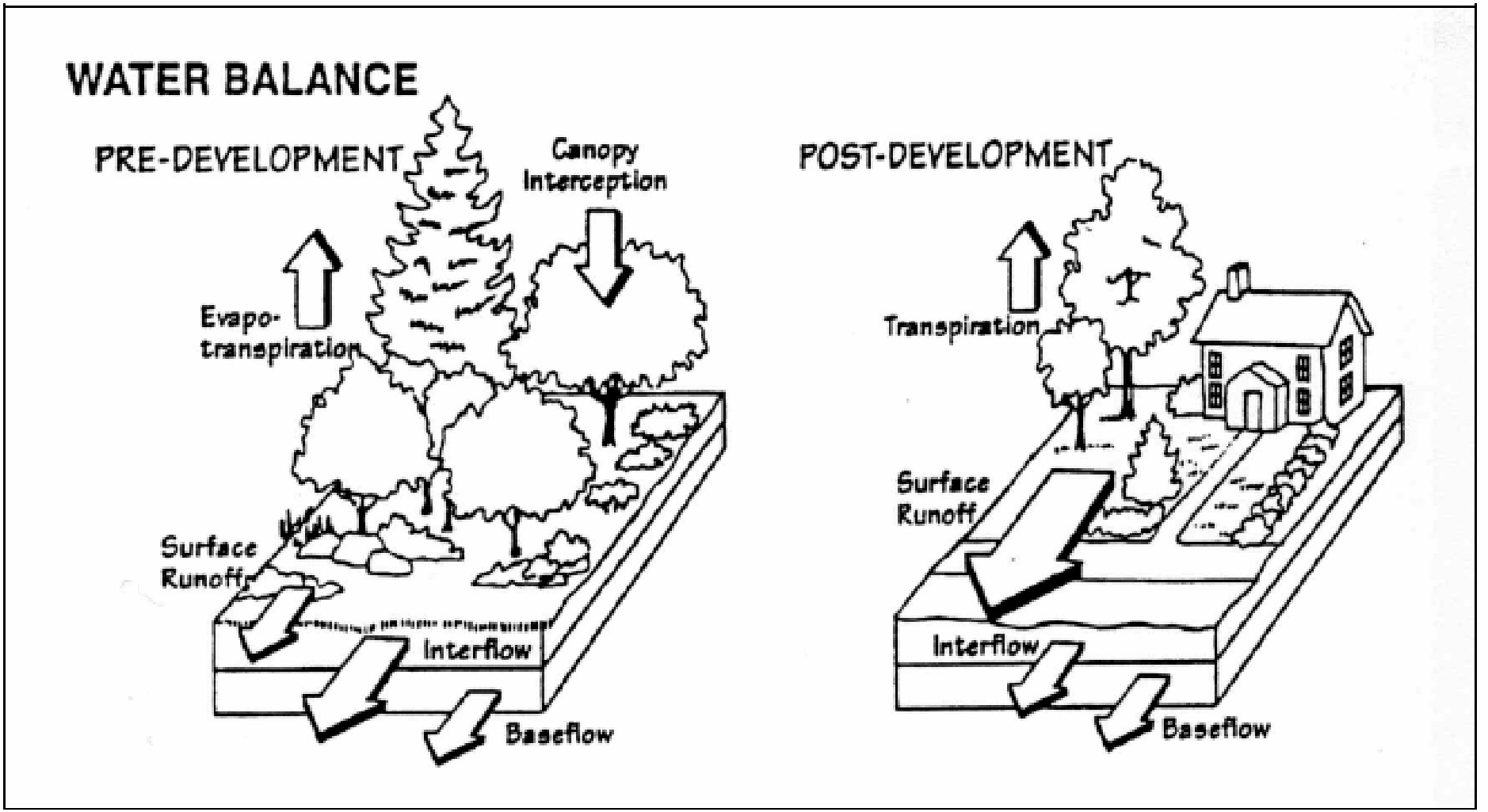


Figure 1: Typical Pre- and Post-Development Water Balance Source: Maryland Department of the Environment Stormwater Manual

Stormwater Management

- **Voluntary**

  Managing Stormwater as a Valuable Resource (see www.des.state.nh.us/DWSPP/stormwater.pdf)

- **Regulatory**

  Land Alteration Regulations – Proposed rules now encourage onsite recharge. Old rule prohibited on-site recharge

  NPDES Stormwater Permits – Surface water quality regulations pushing facilities towards recharging water

Stormwater
(continued)

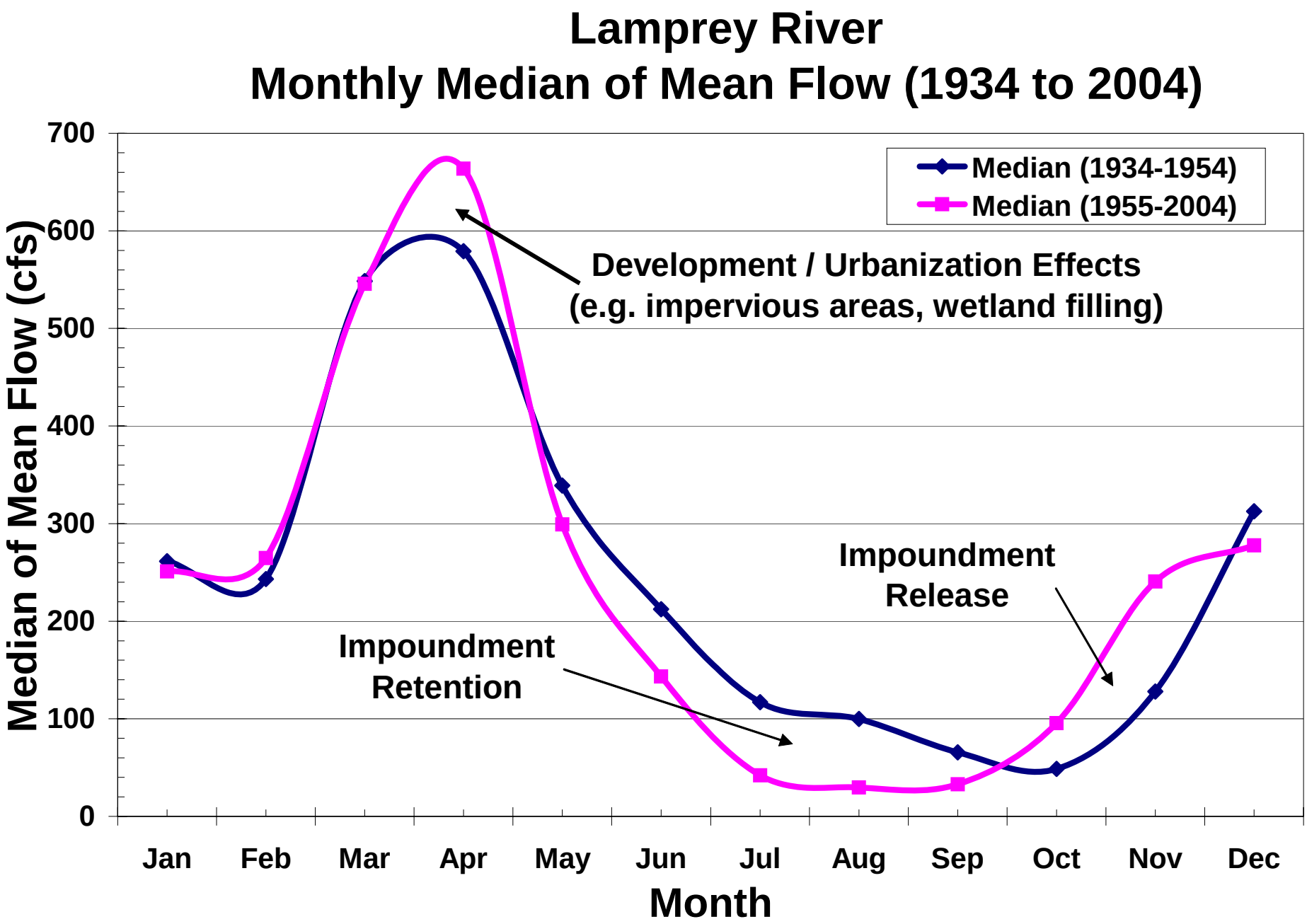
- Newmarket and Seabrook are studying high flow surface water diversions and storage in above and below ground reservoirs (NH Artificial Recharge Guidance Document)

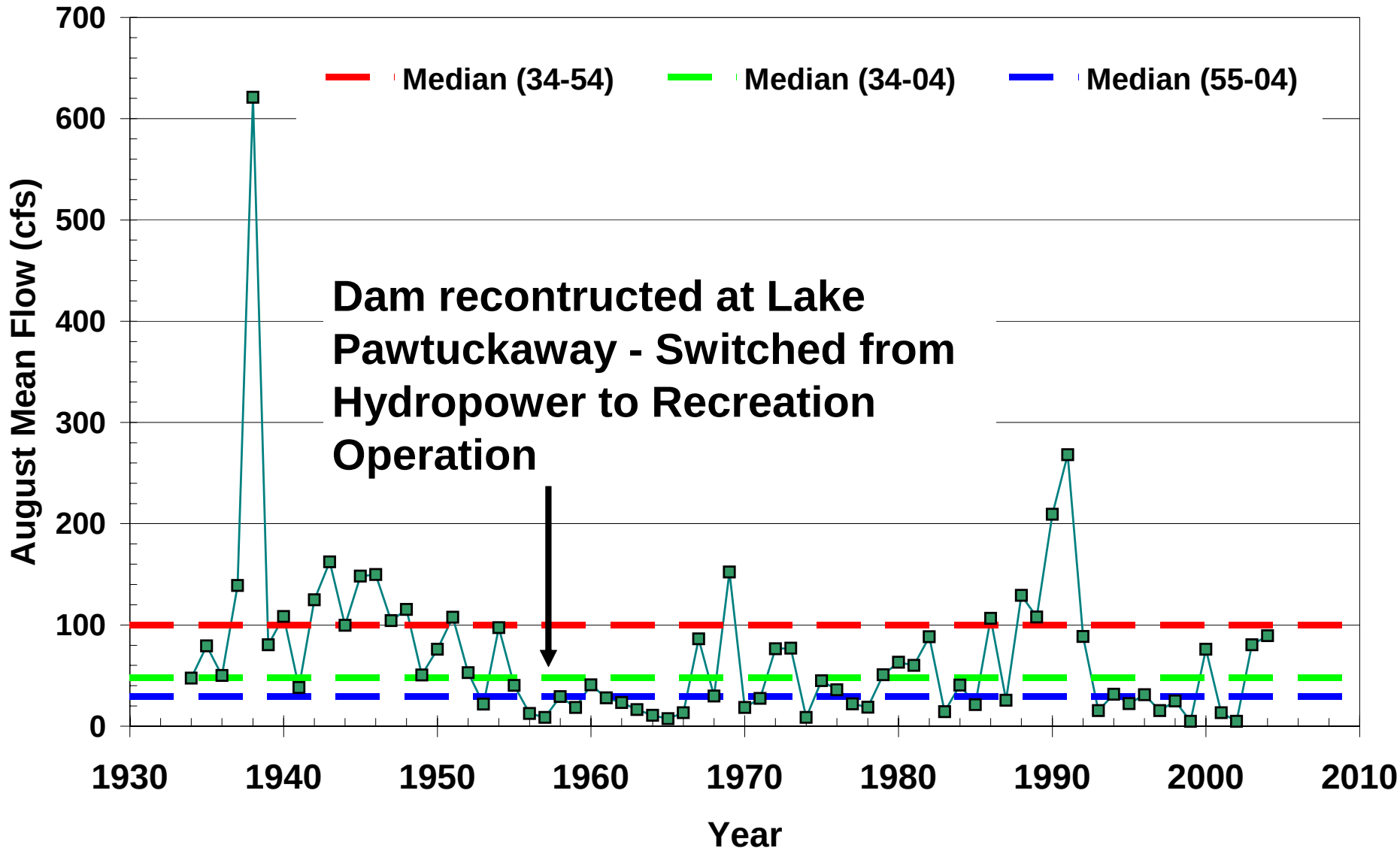
- Dover has recharged aquifers with surface water for decades.

- DES and Office of Energy and Planning have numerous Smart Growth and Low Impact Development resources and guidance documents.

Dam Management

- Impoundments most often used to support recreation or flood control
- Recreation – Capture all water and maintain a full lake level during summer months. Draw lake levels down during the winter
- Flood control – Capture high flow. Release captured water as soon as possible.
- Typical impoundment management strategies are not supportive of downstream ecological or human water supply needs


Lamprey River
Monthly Median of Mean Flow (1934 to 2004)
Median (1934-1954)
Median (1955-2004)
Development / Urbanization Effects
(e.g. impervious areas, wetland filling)
Impoundment
Release
Impoundment
Retention
Median of Mean Flow (cfs)
700
600
500
400
300
200
100
0
Jan
Feb
Mar
Apr
May
Jun
Jul
Aug
Sep
Oct
Nov
Dec
Month


Lamprey River - August
Median (34-54)
Median (34-04)
Median (55-04)
Dam recontructed at Lake Pawtuckaway - Switched from Hydropower to Recreation Operation
August Mean Flow (cfs)
Year
700
600
500
400
300
200
100
0
1930
1940
1950
1960
1970
1980
1990
2000
2010

Studies Looking at Dam Management & Water Use

- Pilot instream flow studies for the Souhegan and Lamprey Rivers

  (see www.des.state.nh.us/Rivers/instream/isf_rules.htm)

- Merrimack River Planning Project (also evaluating water quality)

(see www.nae.usace.army.mil/projects/ma/merrimack/merrimack.htm)

Wastewater Management

- **DES developed guidance for land application of wastewater**
  (See www.des.state.nh.us/DWSPP/pdf/groundwater_discharge.pdf)

- **DES has worked with City of Portsmouth to assess wastewater use opportunities. DES is currently developing a guidance document.**
  (see www.nhep.unh.edu/resources/pdf/water_reuse_feasibility -cop-06.pdf)

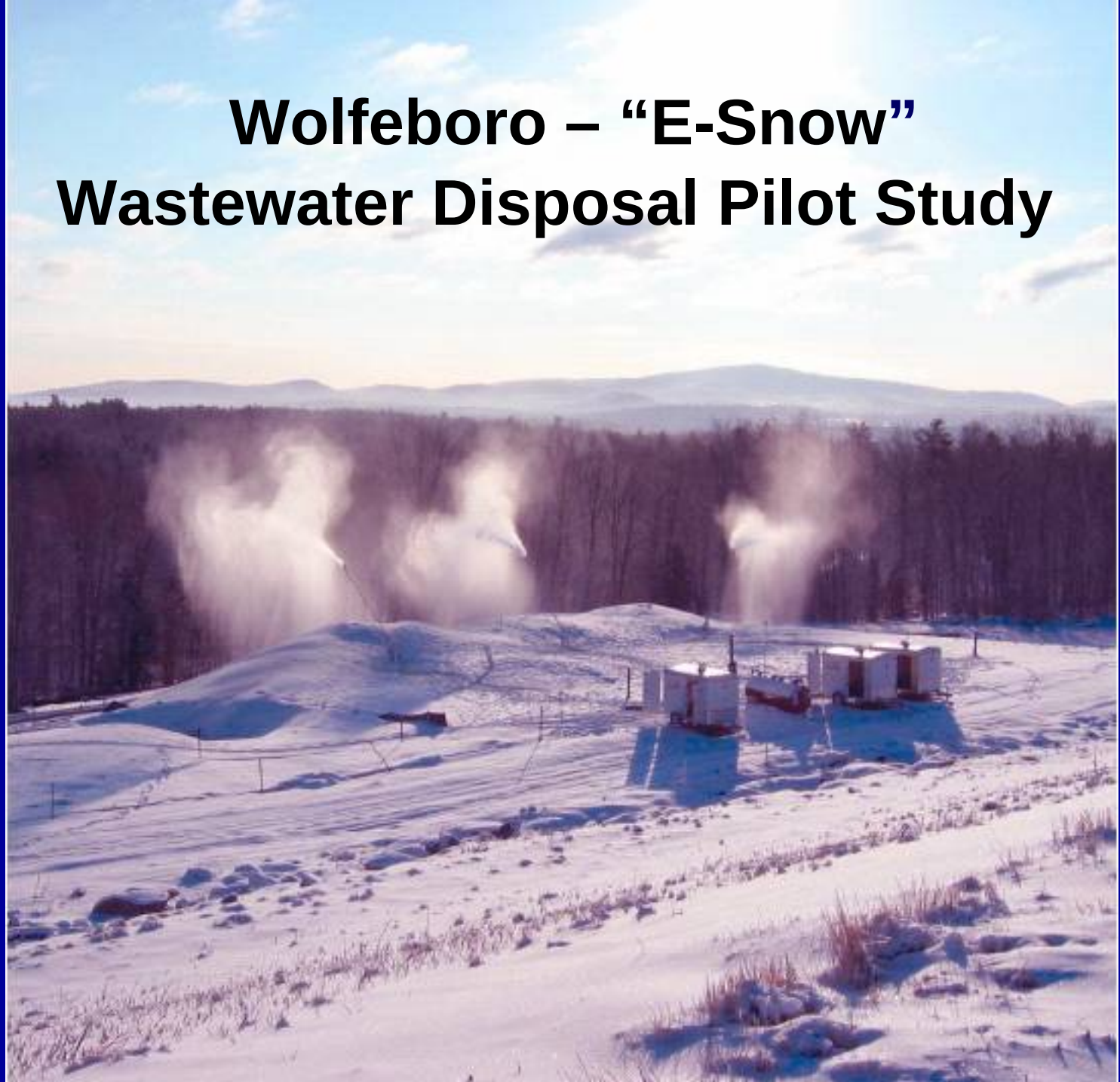
Emerging Wastewater Management Issue

2007 Northeast Water Science Forum

Pharmaceuticals and Personal Care Products: State of the Science: August 8-9, Portland, Maine

http://www.neiwpcc.org/ppcpconference/index.asp

Wolfeboro – “E-Snow”
Wastewater Disposal Pilot Study



Groundwater Withdrawal Permitting

- Large groundwater withdrawal permits required for all new withdrawals exceeding 57,600 gallons over any 24-hour period.
- Applicants must demonstrate no adverse impacts will occur to water resources or water users (including impacts to instream flow).
- Two public hearings/comment periods are associated with the permitting process.
- Most comprehensive groundwater withdrawal permitting process in 30 eastern water law states
- Permit process generally takes 1-2 years to complete

New Surface Water Withdrawals

- Subject to 401 Water Quality Certificate Process
- Must protected designated uses of surface water body – including instream flow needs.
  (see www.des.state.nh.us/wmb/Section401/)

Protect Groundwater Quality to Protect Quantity

Non-regulatory

- Land protection
- Public education
- Outreach to businesses
- Voluntary inspection

Regulatory (DES has developed a database of local regulations and ordinances)

- Zoning, etc.
- Groundwater Reclassification
- Best management practices/Mandatory inspections

(see http://www.des.state.nh.us/DWSPP/)

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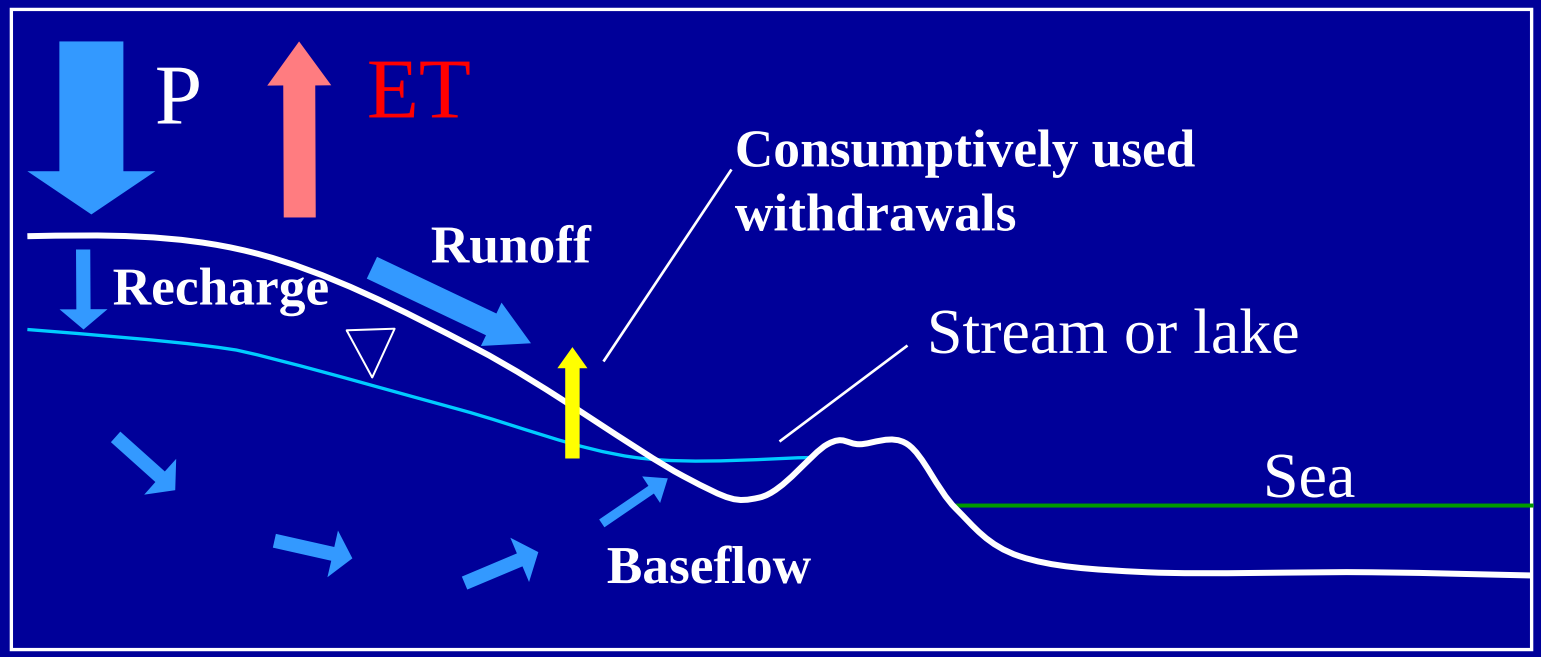
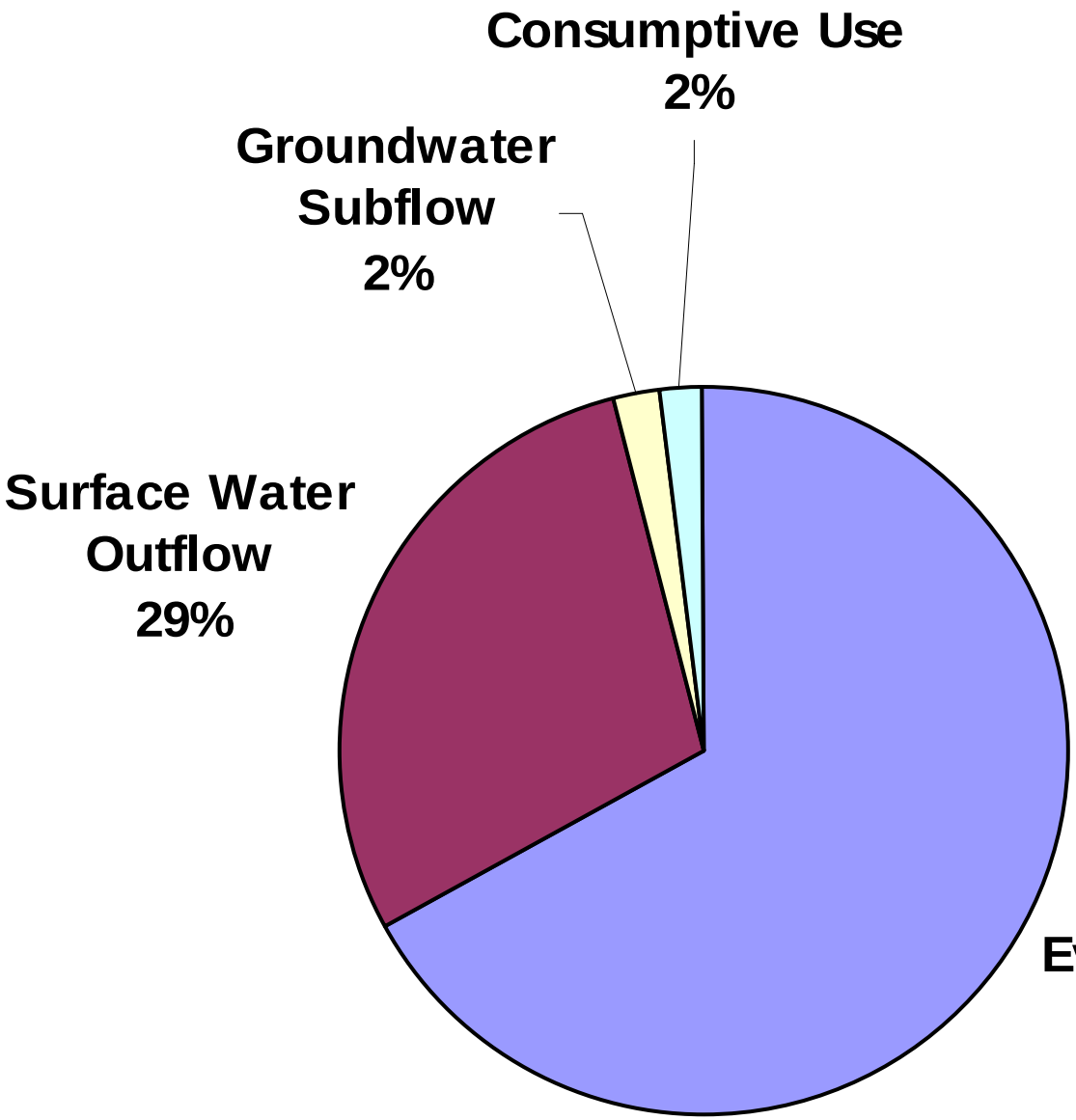


P – ET = Runoff + Baseflow

Runoff + Baseflow – Consumptive Use +/- Stored Water = Streamflow

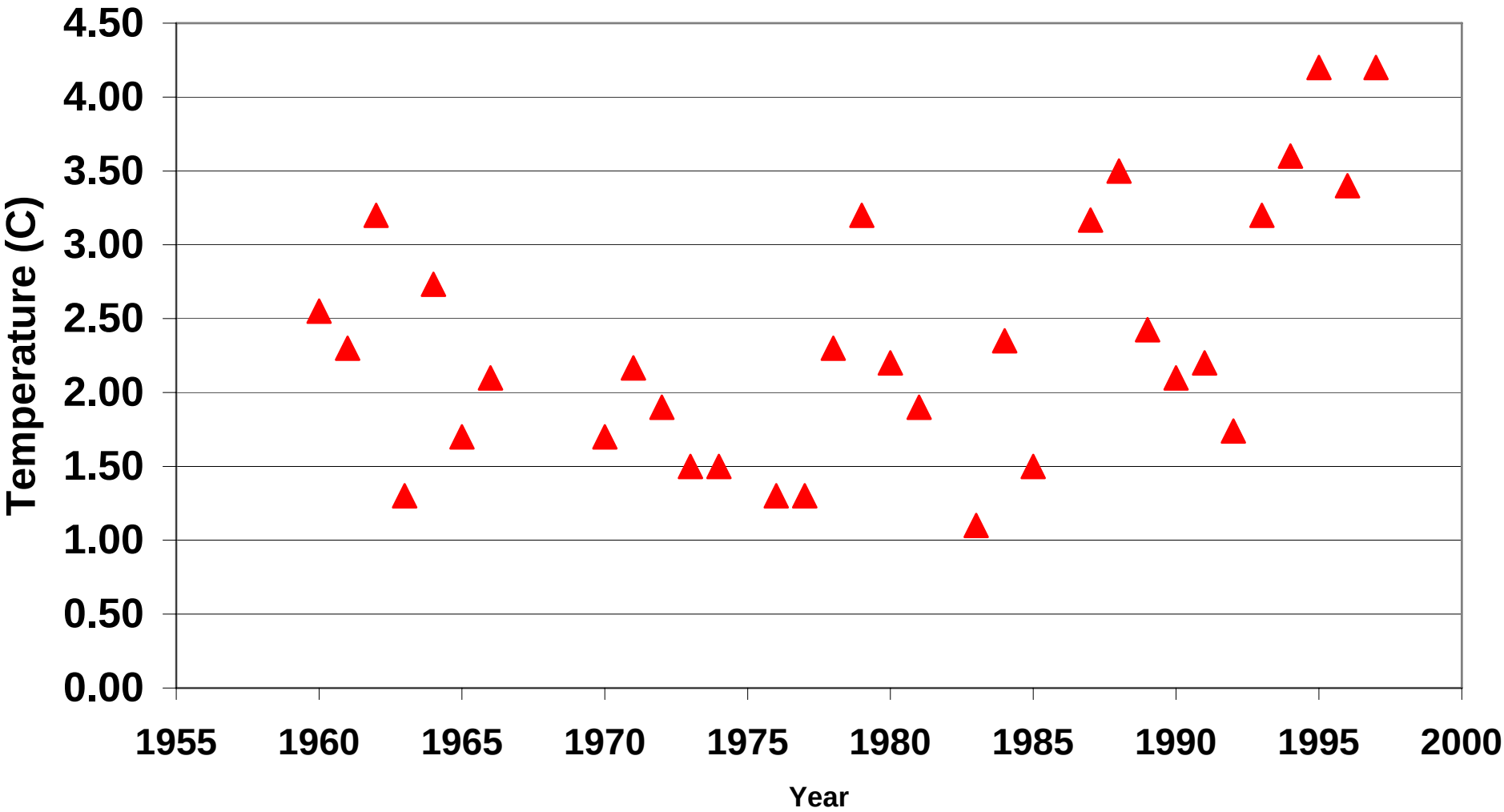
(on a long-term average basis)

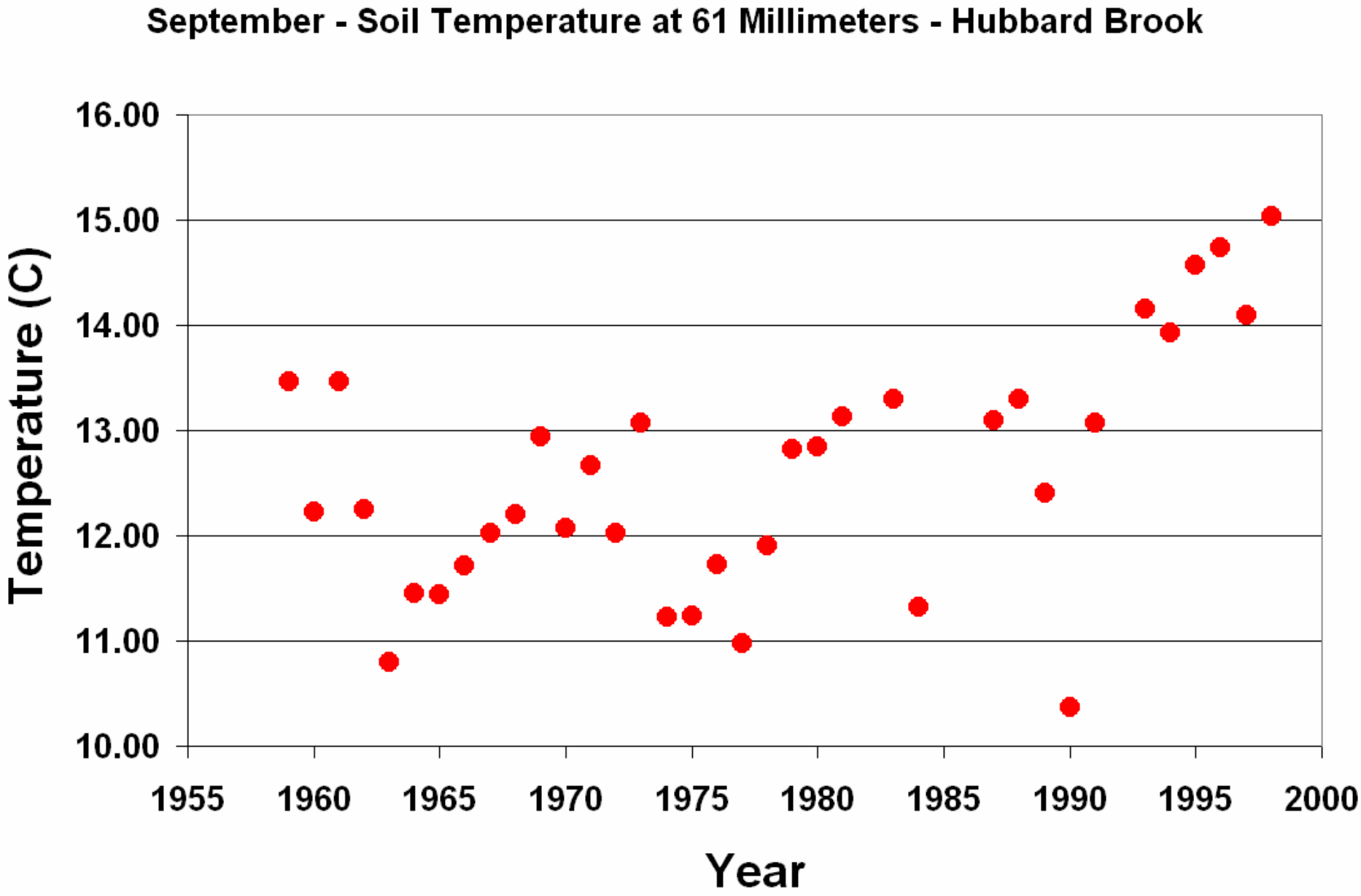
Average Disposition of 4200 Billion Gallons/Day of Precipitation in the Conterminous US.

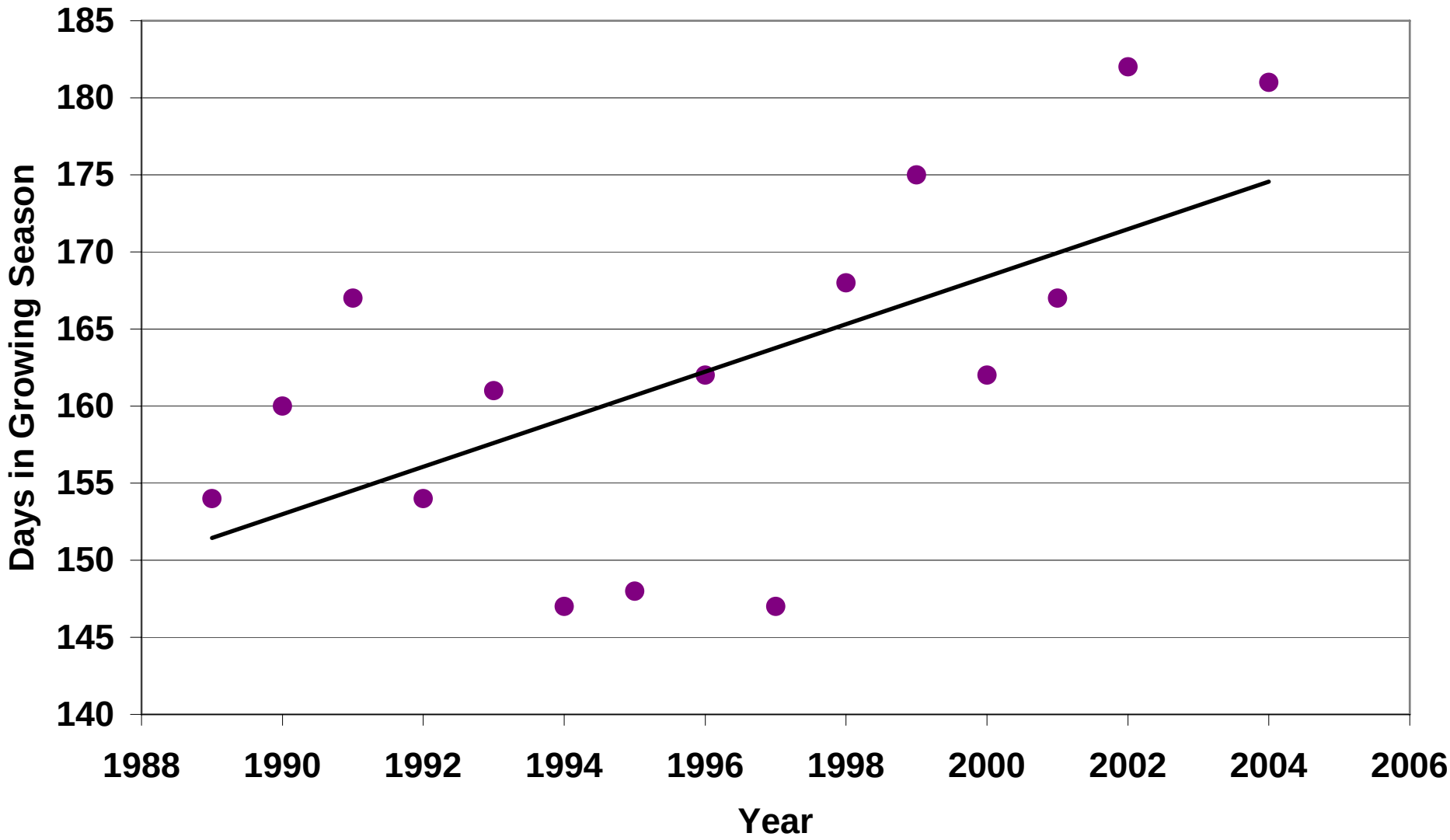


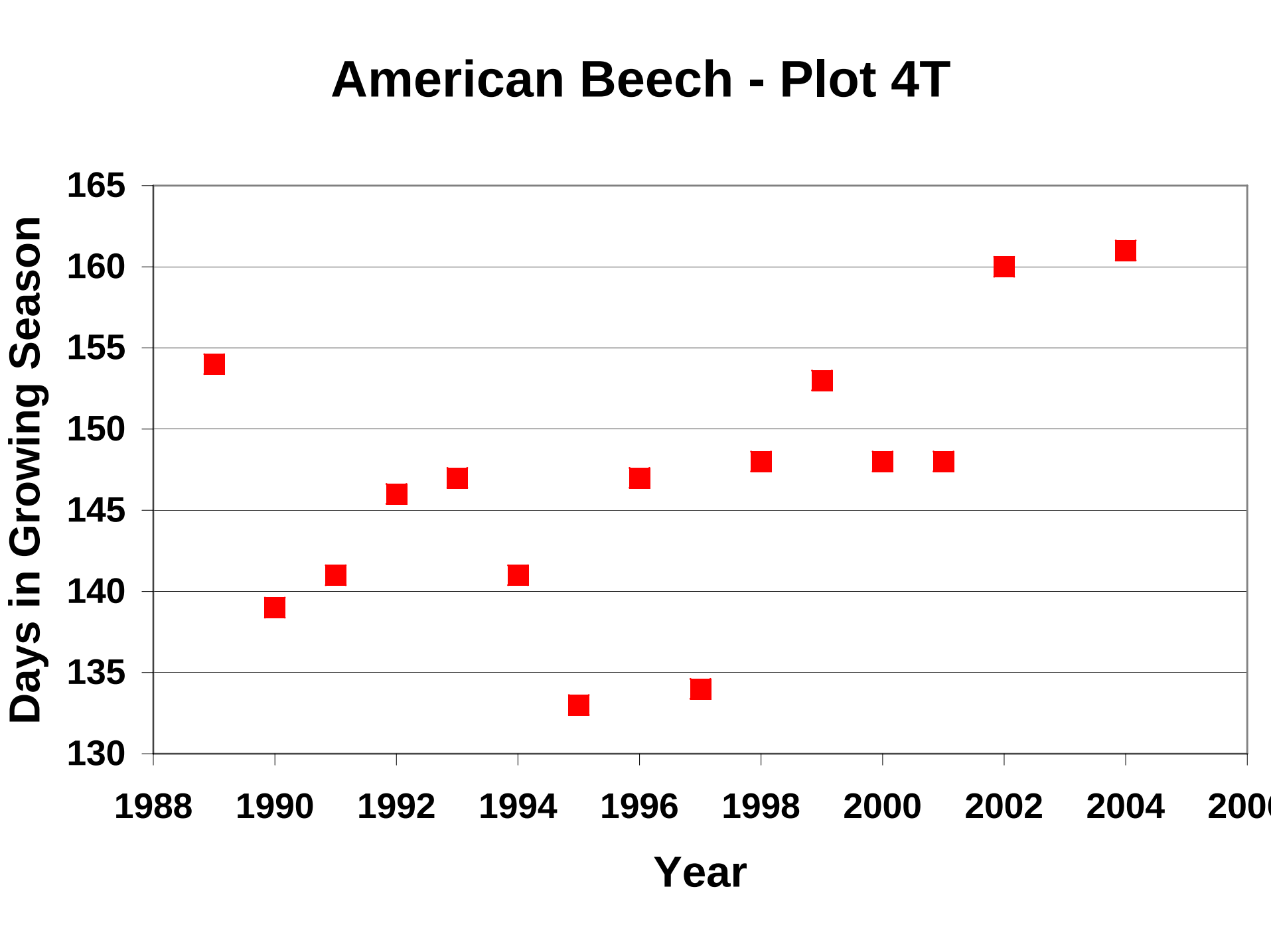
(source: Data from U.S. Geological Survey, 1990).

March - Soil Temperature at 61 Millimeters - Hubbard Brook




September - Soil Temperature at 61 Millimeters - Hubbard Brook
16.00
15.00
14.00
13.00
12.00
11.00
10.00
Temperature (C)
1955
1960
1965
1970
1975
1980
1985
1990
1995
2000
Year


Sugar Maple - 5B - Hubbard Brook
Days in Growing Season
185
180
175
170
165
160
155
150
145
140
1988
1990
1992
1994
1996
1998
2000
2002
2004
2006
Year


American Beech - Plot 4T
Days in Growing Season
165
160
155
150
145
140
135
130
1988
1990
1992
1994
1996
1998
2000
2002
2004
Year

Growing season in Hubbard Brook monitoring sites estimated to be increasing

0.2 days per year

Phenology of a Northern Hardwood Forest Canopy

By Andrew D . Richardson

Global Change Biology (2006) 12, 1174–1188, doi: 10.1111/j.1365-2486.2006.01164.x

Pulling All the Parts Together

HB 1609 – Groundwater Management Study

- DES is required to determine how much water a seacoast watershed has, how much is currently used, and how much will be needed in 10 years

- DES must use existing data to complete the project

- DES is required to work with municipalities to develop a Groundwater Management Plan that promotes integrated water resources management and hypothetically could be used to make permit decisions in the future.

HB 1609 (continued)

- Pilot study will likely occur in the Exeter River Watershed
- Outline of the plan developed
- Methodology report currently being prepared.
- DES must report its progress to the Groundwater Commission and coordinate with stakeholders.

Biggest Challenge to Integrated Water Resource Management

- Public knowledge/interest/education - focusing on only one aspect of the water budget
- Funding for long-term data collection
- Funding/financial incentives to make improvements
- Competing stakeholder interests
- Integrating professional disciplines