It's all about Balance:
Using a watershed model to evaluate costs, benefits and trade-offs for Monponsett Ponds watershed

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- [4]US EPA Region 1, Boston, MA

Issues identified in Monponsett Pond Watershed

- EPA Region 1 reached out to towns in the Taunton River watershed to identify those interested in testing new version of EPA watershed management tool (WMOST)
- Cathy Drinan responded on behalf of Monponsett Pond Watershed Workgroup

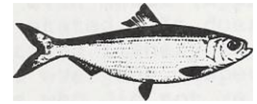
Water Quantity

- Outflow from pond to Stump Brook does not resemble natural flow regime and does not support fish migration and the downstream ecosystems
- Brockton water diversions reduce volume, and reverse the flow of water between ponds
- High pond elevation can cause flooding when it rains
- Low pond elevation does not support recreational use
- Monponsett Pond towns have water restrictions, no restrictions in Brockton

Water Quality related

- Phosphorus loads, blue green algae blooms
- Bacteria – potential impact of high water levels on septic systems
- Beach closures
- Flow reversal
- Water quality degradation
- No dedicated source of funding for water quality testing for the Ponds

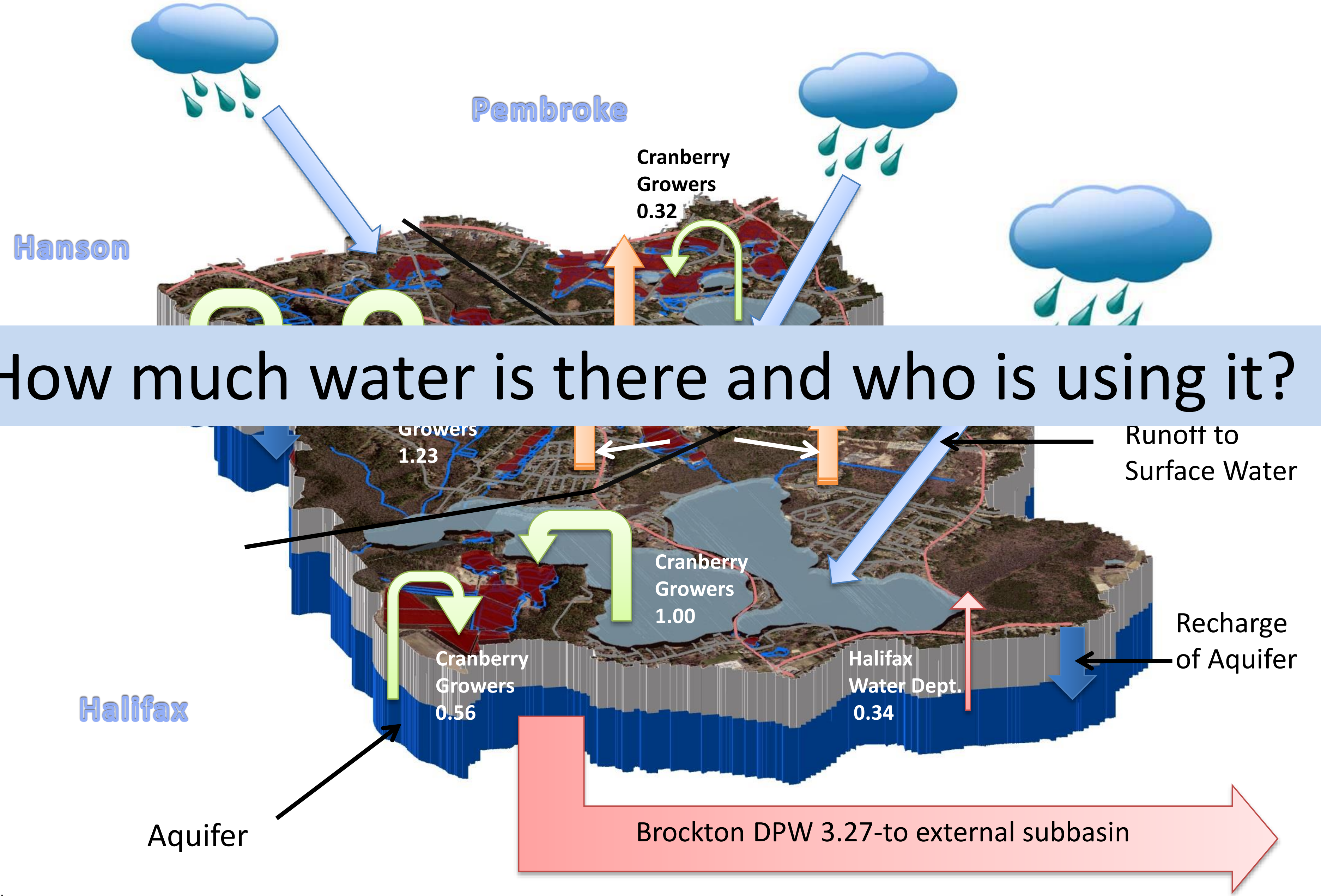



Watershed Management Optimization Support Tool (WMOST)

- **Accounting tool for water**
- **Identify goals**
- **Evaluate integrated management practices**
  - **Stormwater**
  - **Drinking water**
  - **Wastewater**
  - **Land conservation**
- **Optimize costs while finding solutions**

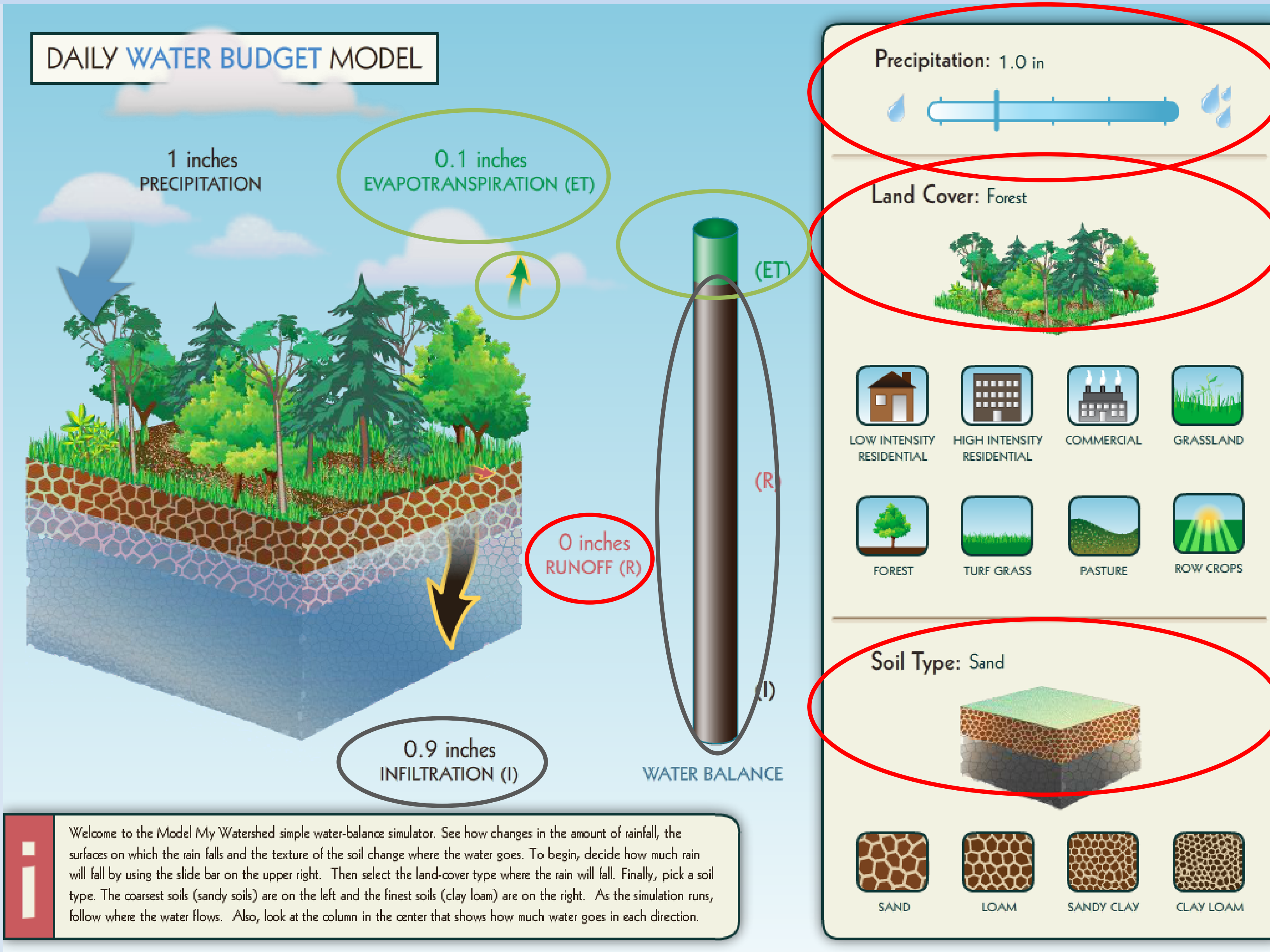
How much water is there and who is using it?



Notes:
Units are million gallons per day
Values are average annual reported values for 2000 through 2004 as summarized in WMA tool
Private users are households on private well water and users with withdrawals less than 100,000 gallons per day

A. Morrison

Where is the rainfall going?



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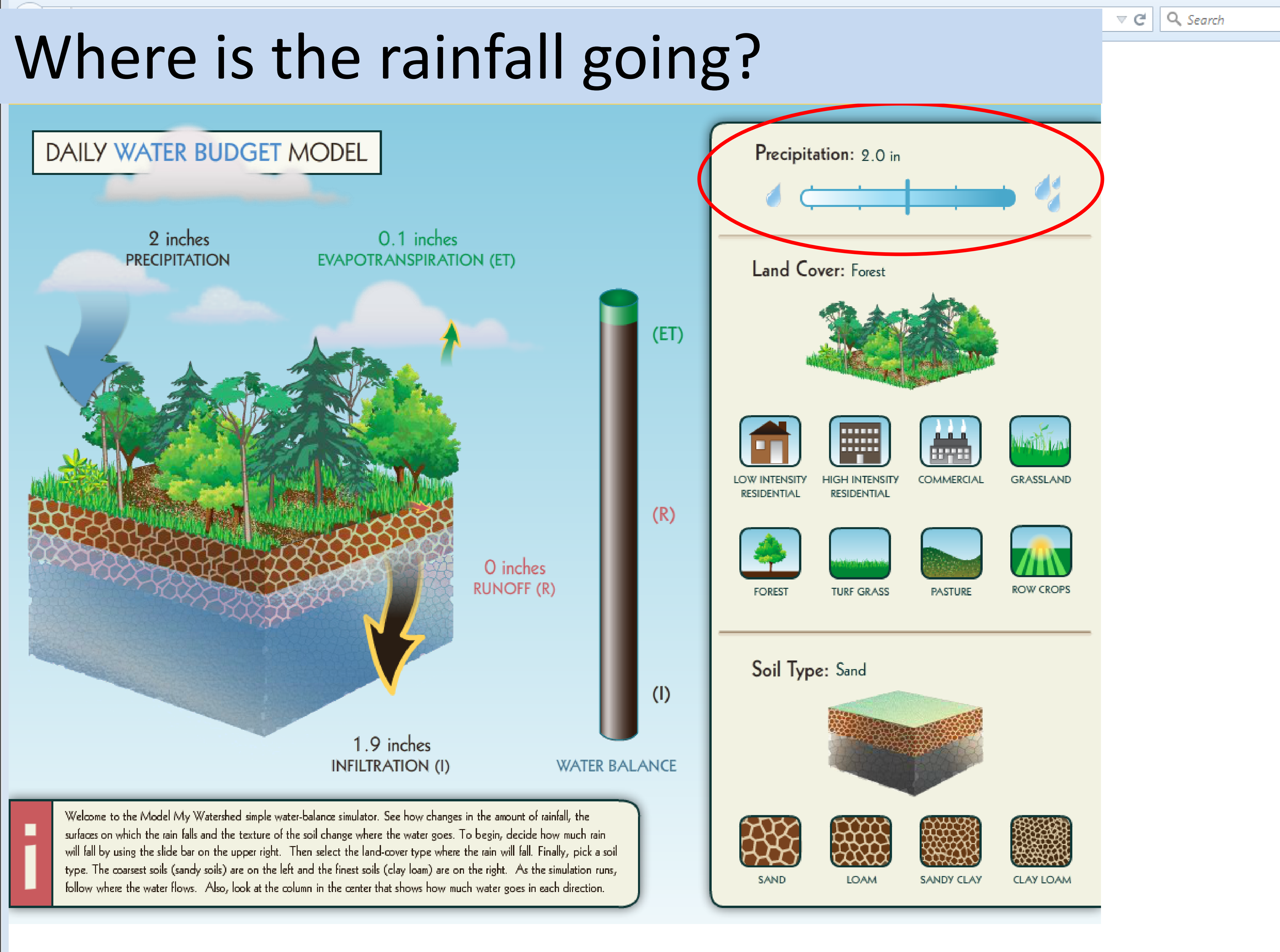

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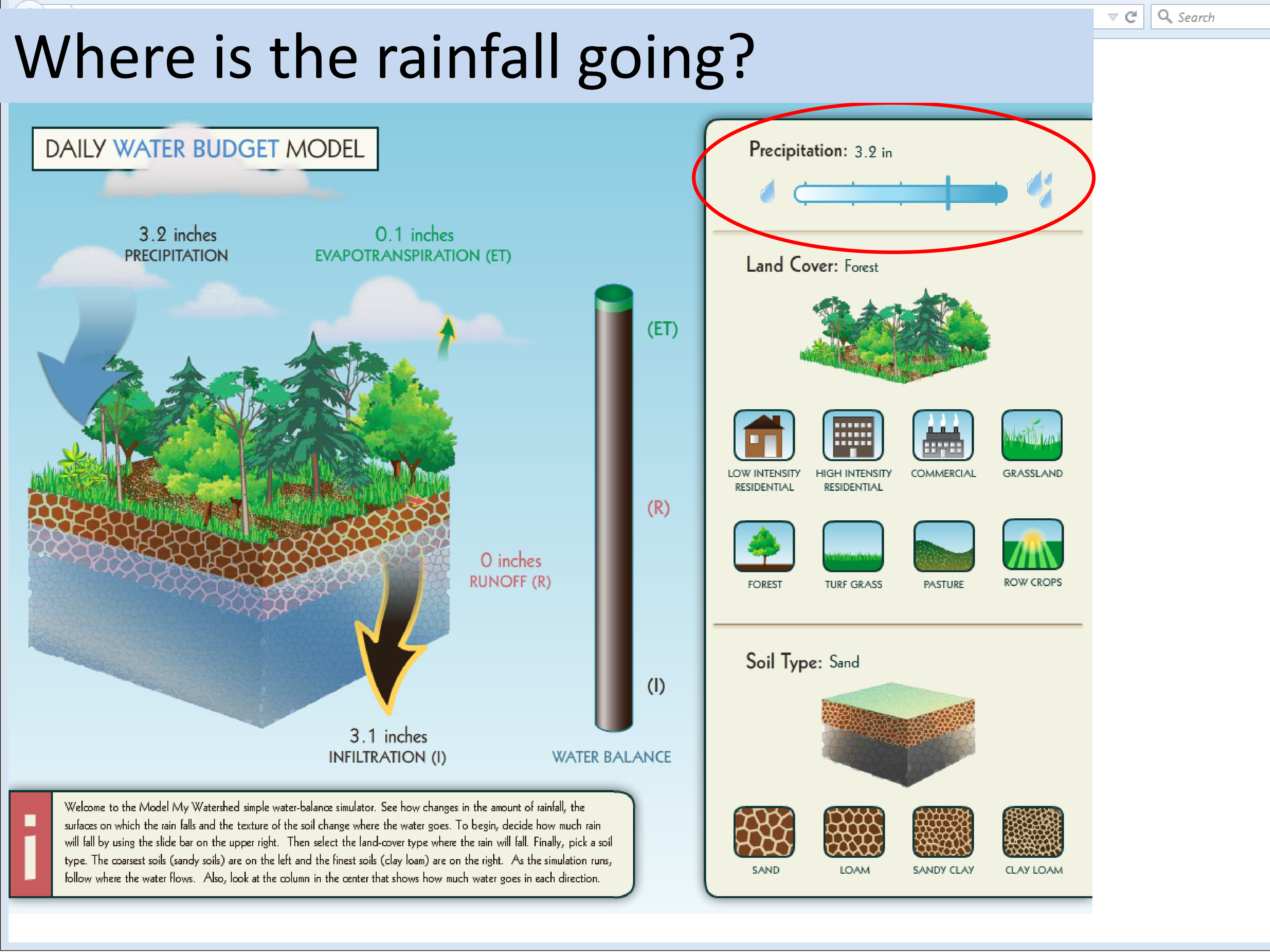

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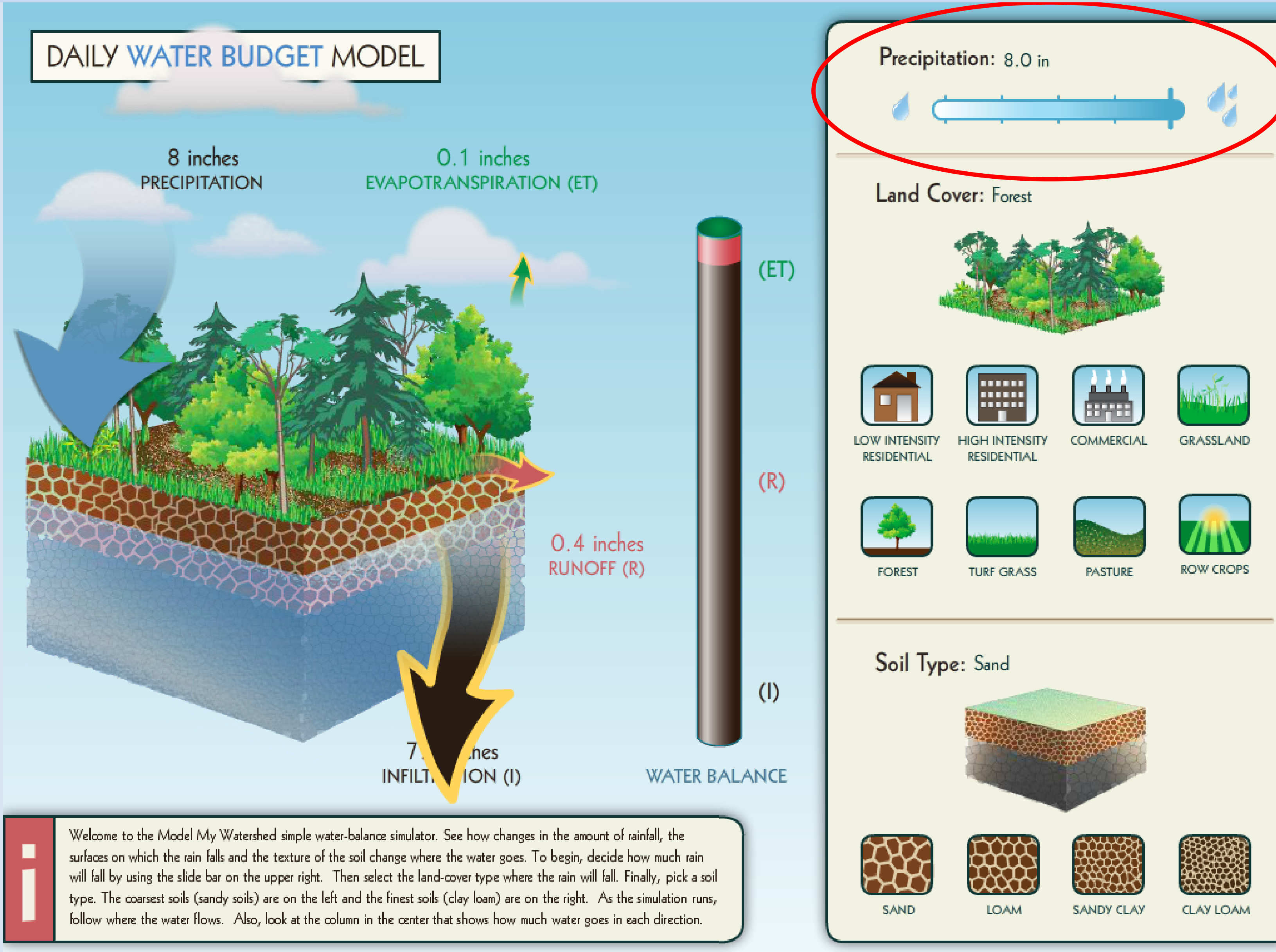

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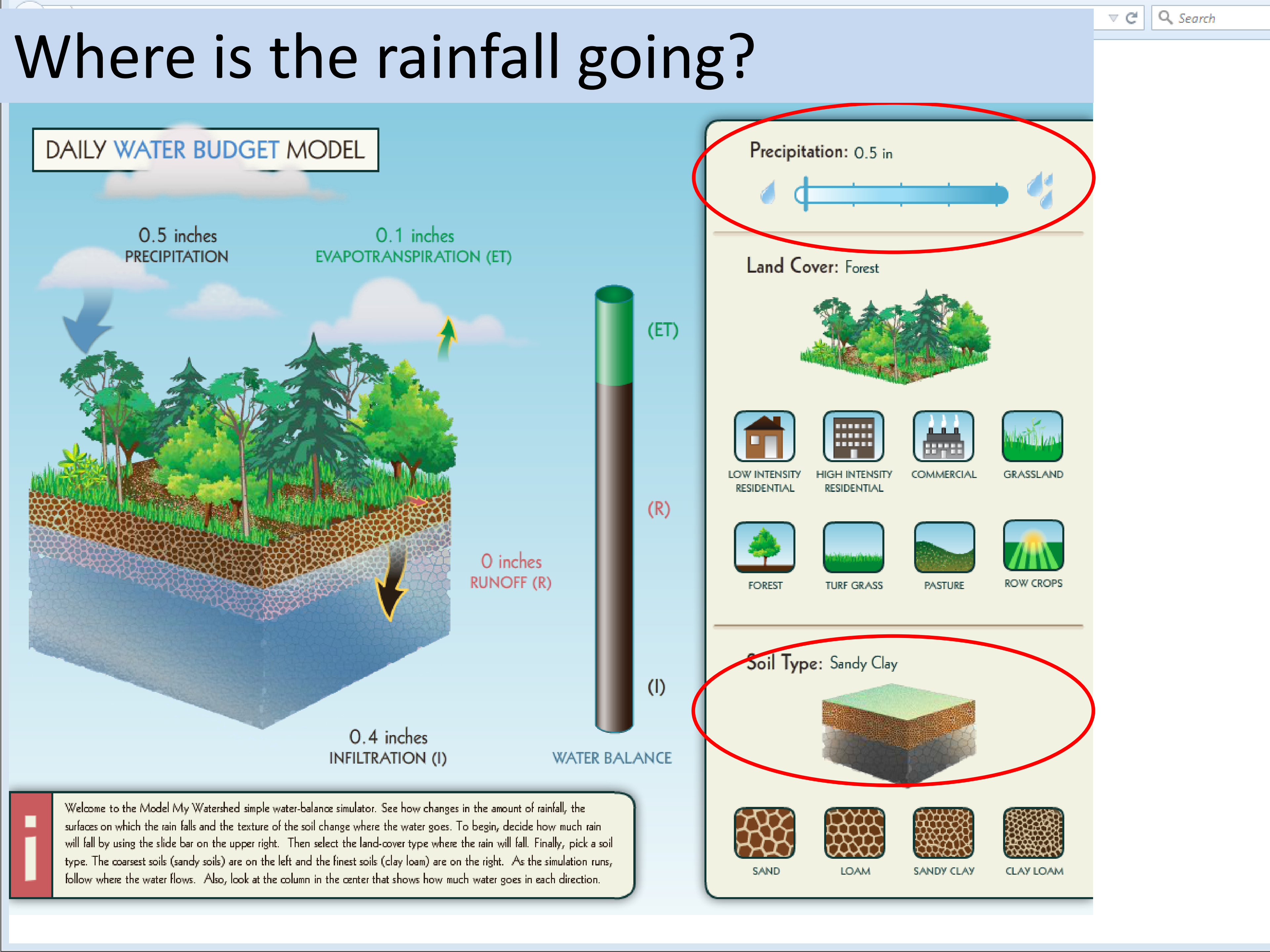

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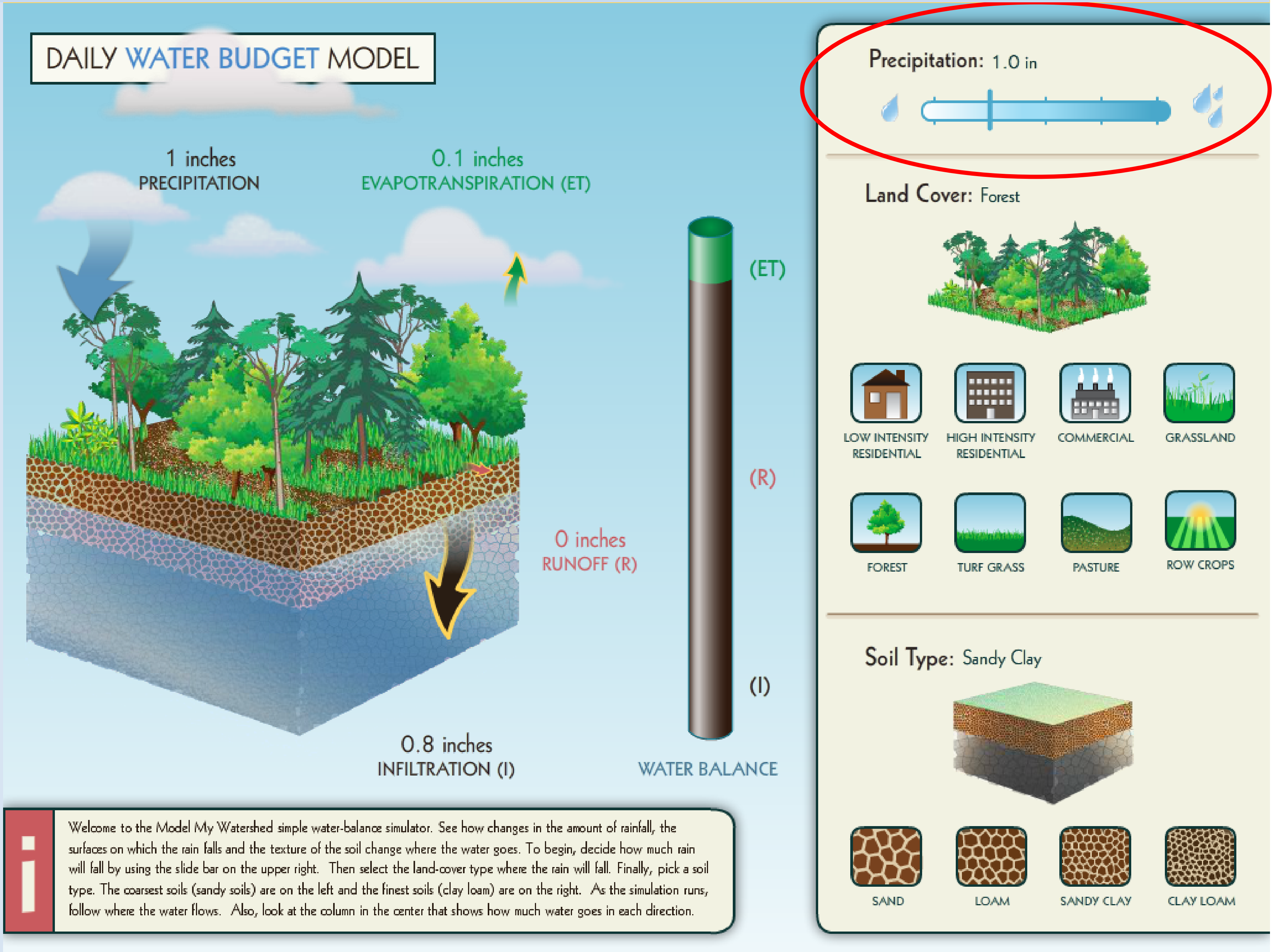

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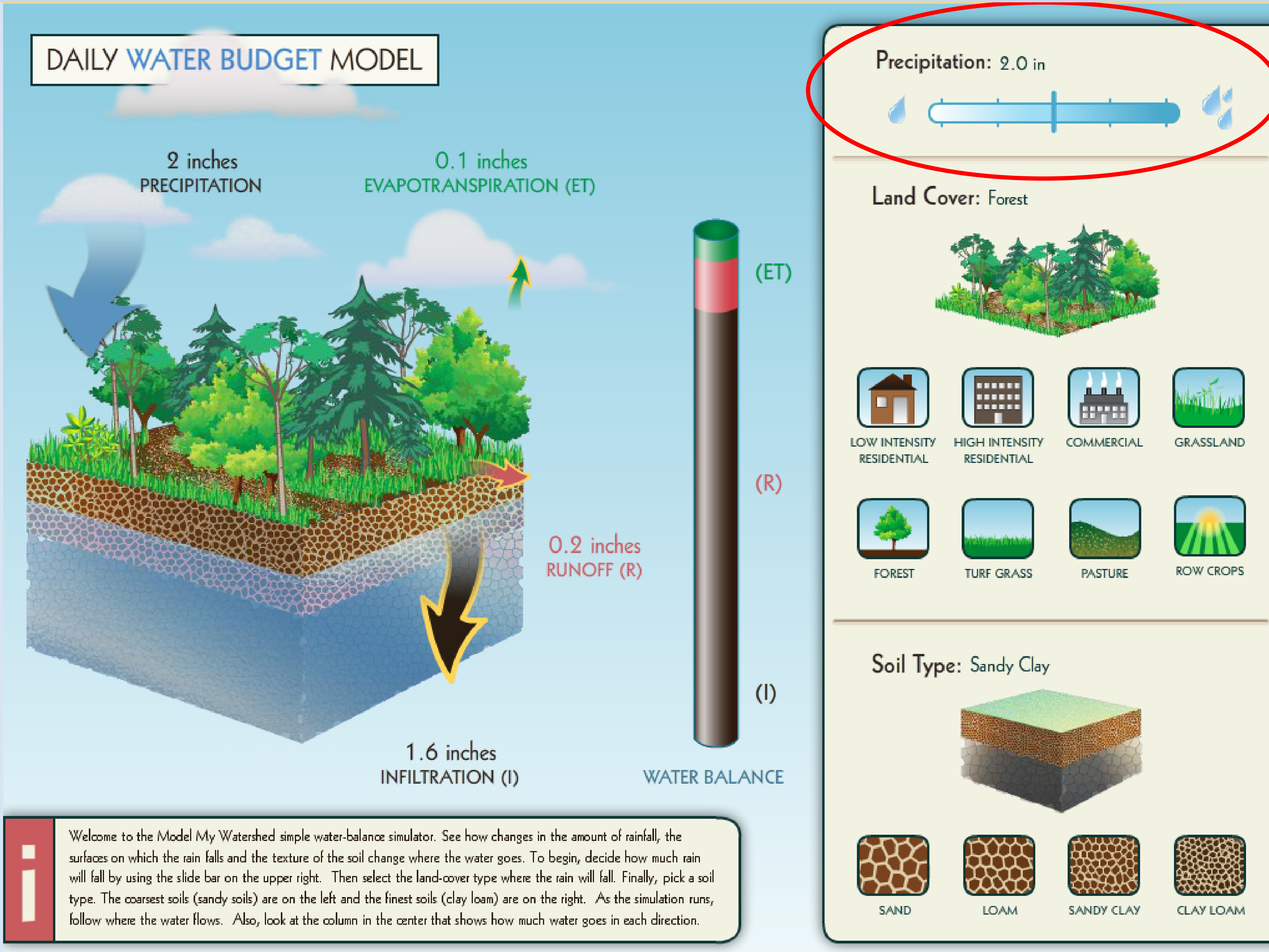

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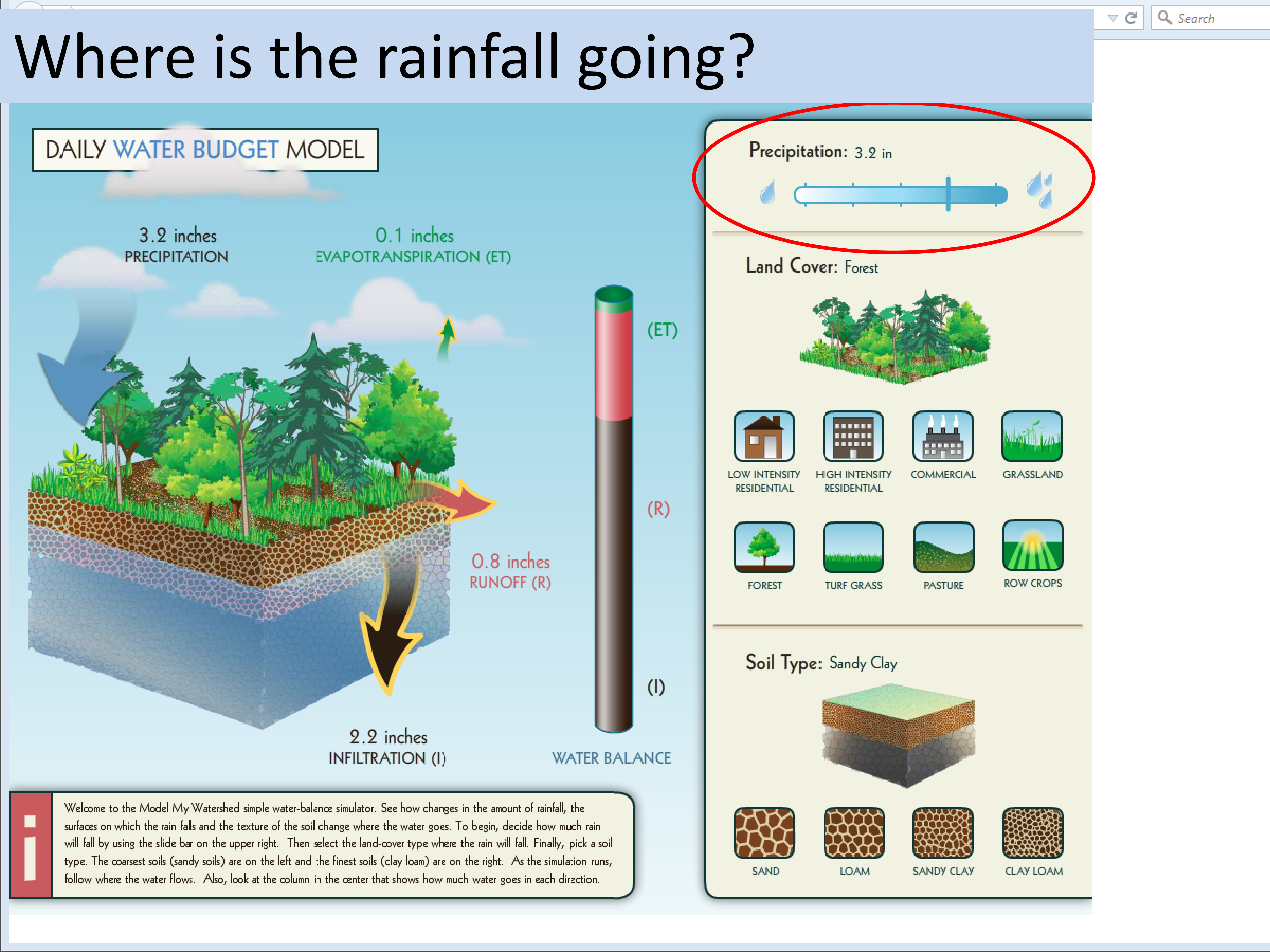

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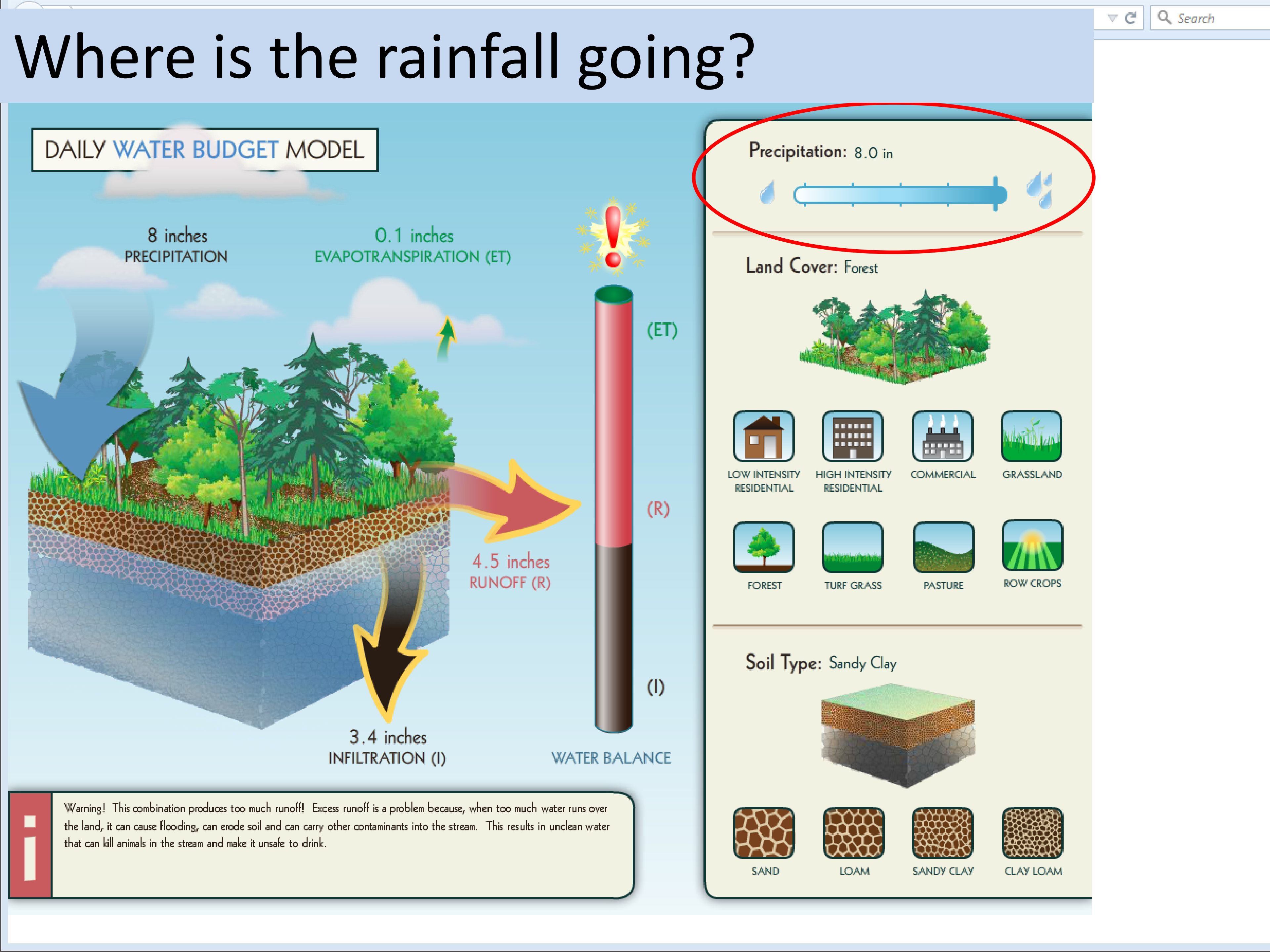

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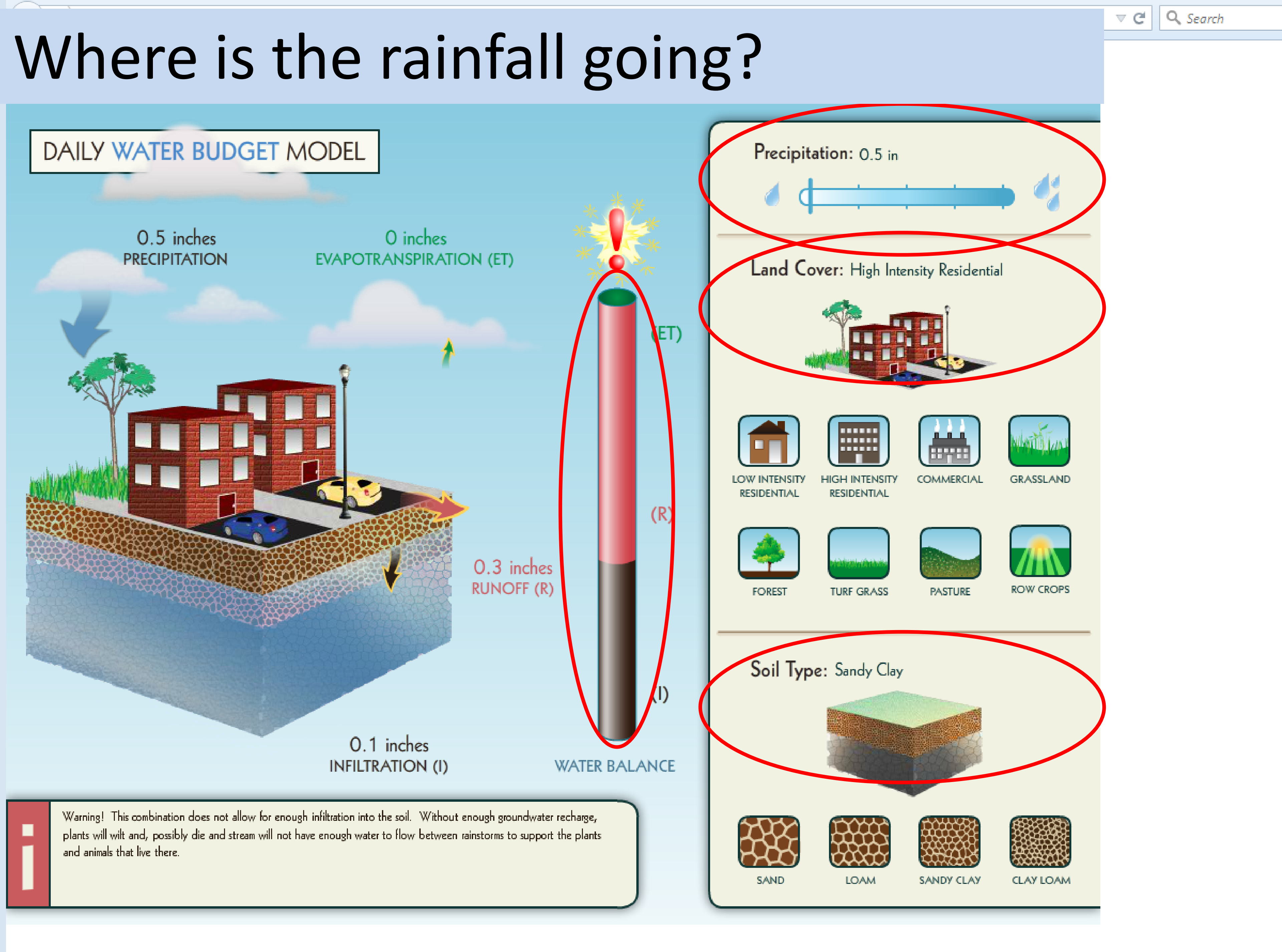

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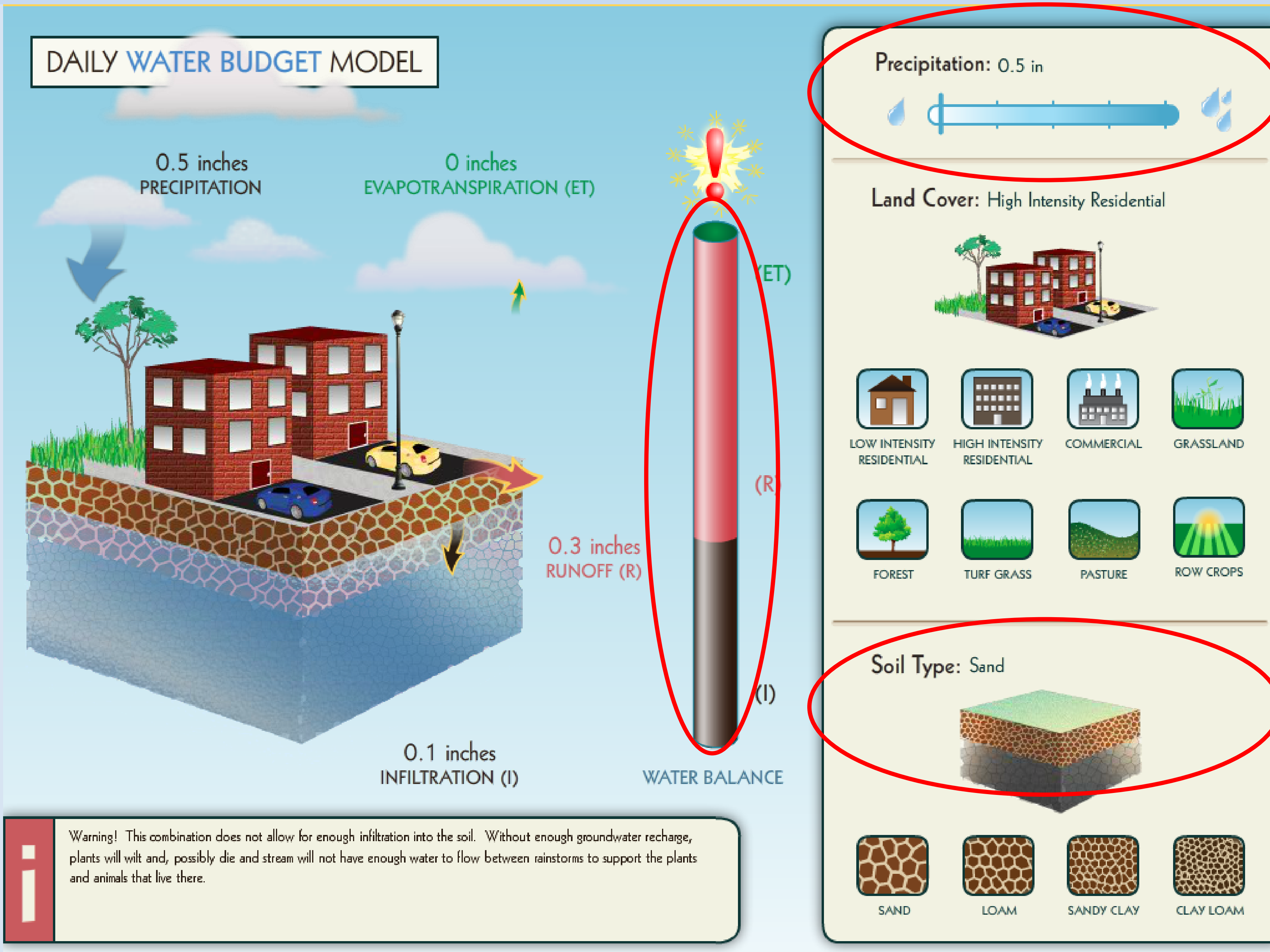

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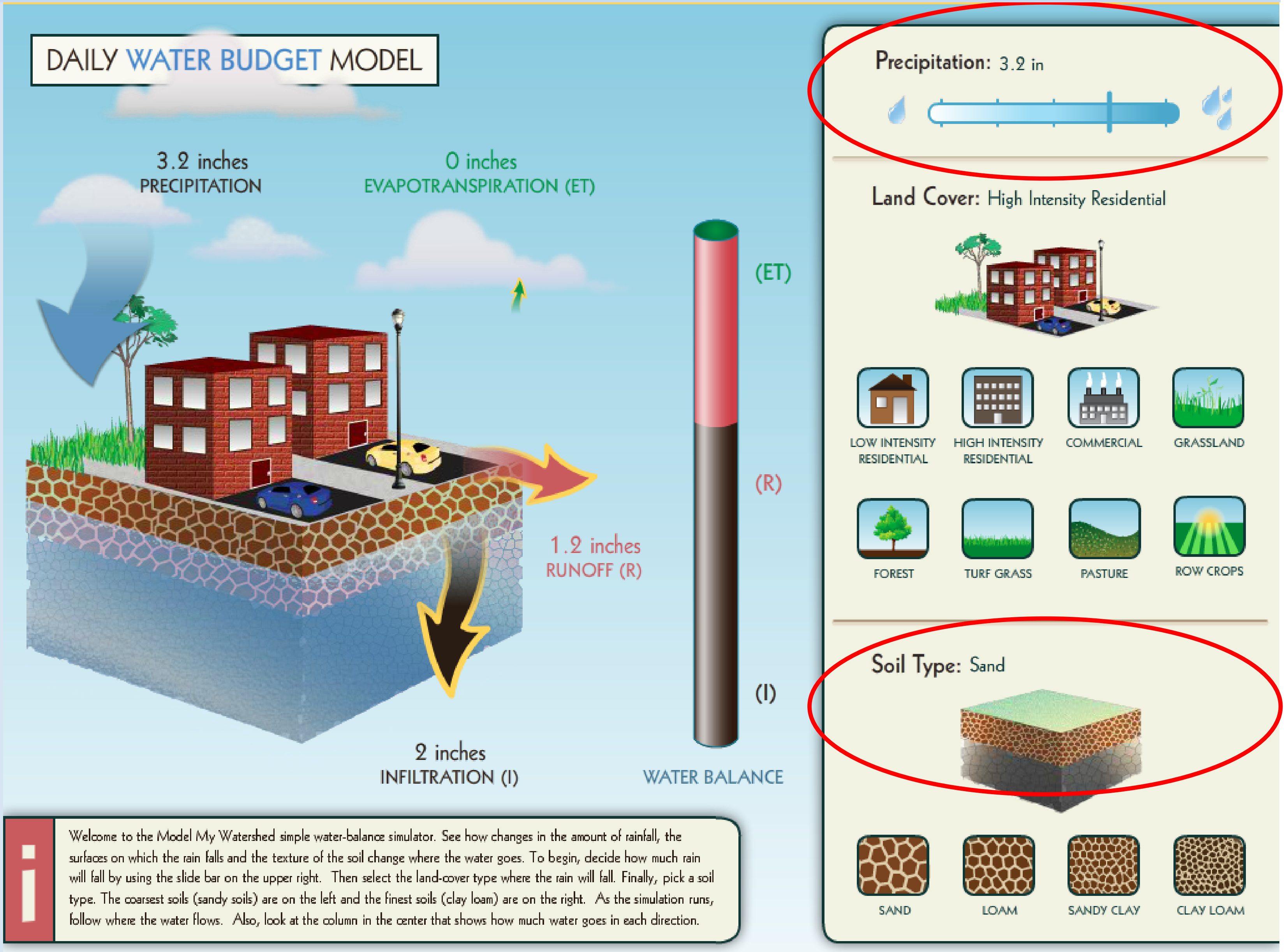

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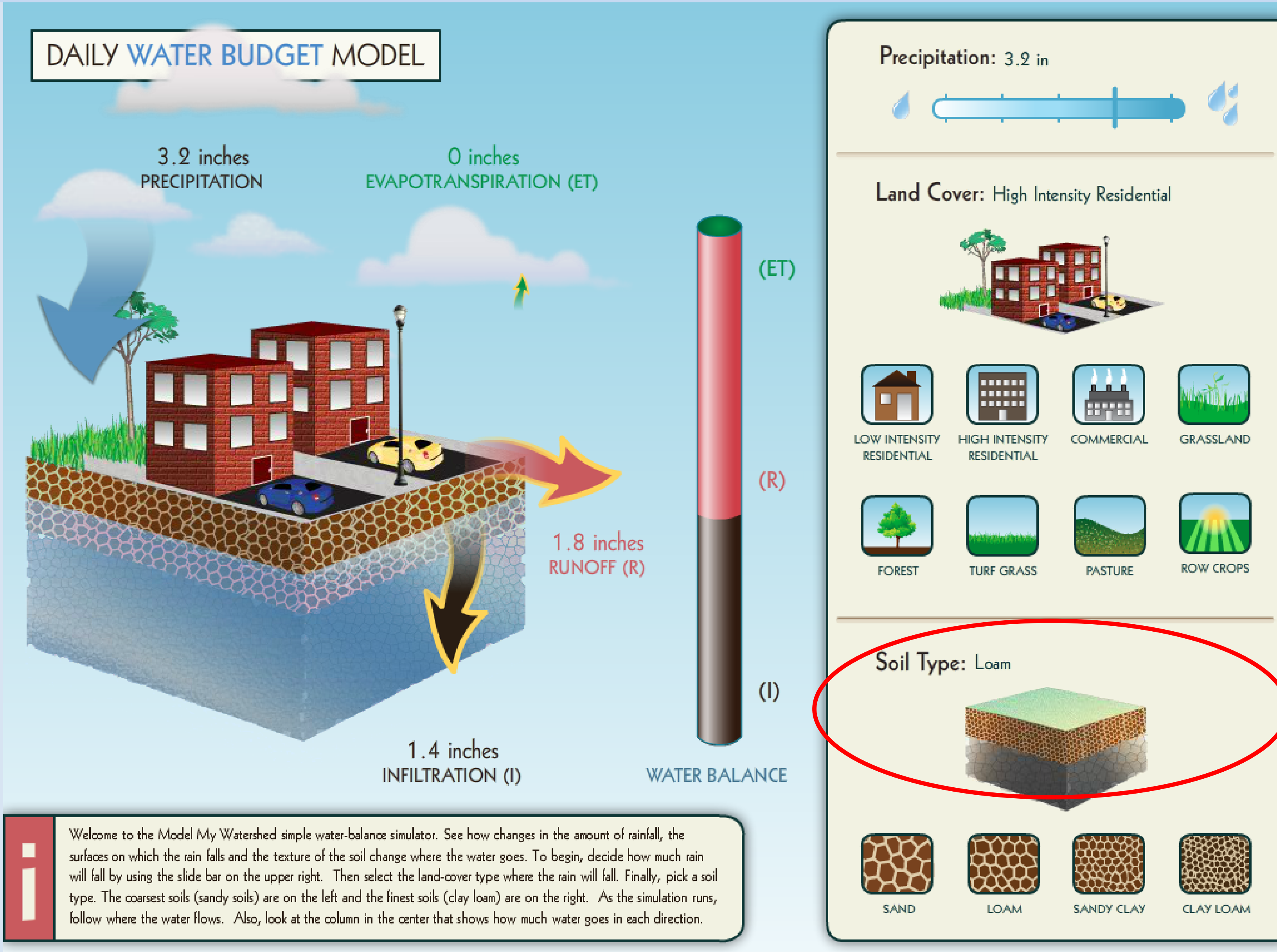

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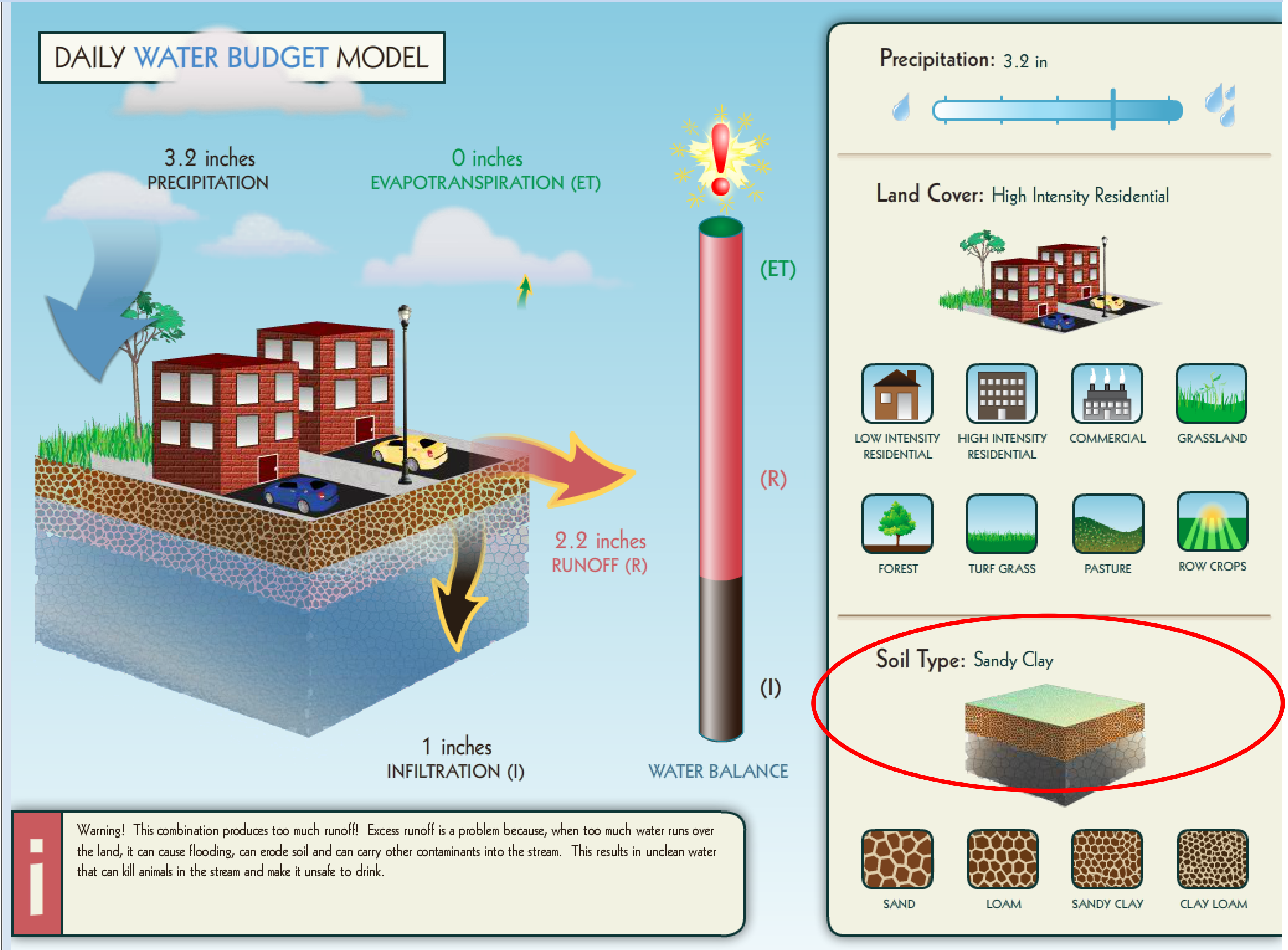


WMOST accounts for variation in weather, soils, land-use, and water extractions and returns in affecting the water balance.

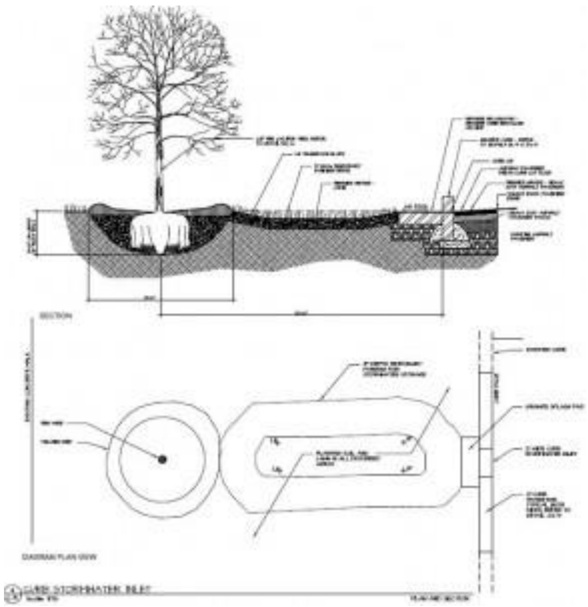
What scenarios did we examine?

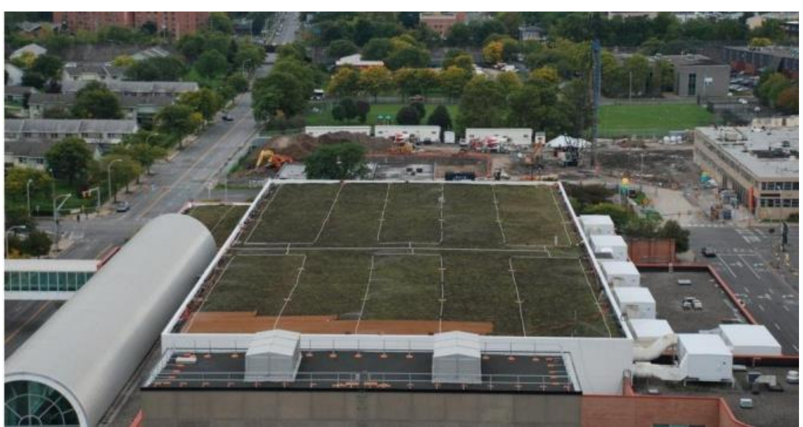
- Historic weather period covering both wet and dry years (2002 – 2006)
- Ranges in pond level (tradeoff between flooding costs and avail storage for water supply)
- Targets for pond outflow (passage for herring and other fish, cedar swamp protection)
- Timing and magnitude of water diversions from MP to Silver Lake

Which management practices did we consider?

- Water conservation
  - UnAccounted for Water status (leaks)
  - Reduced demand
- Alternative water sources
  - InterBasin Transfers from within Halifax
  - Substitution of Aquaria water source for Brockton
- Green infrastructure best management practices
- Aquifer Storage and Recharge

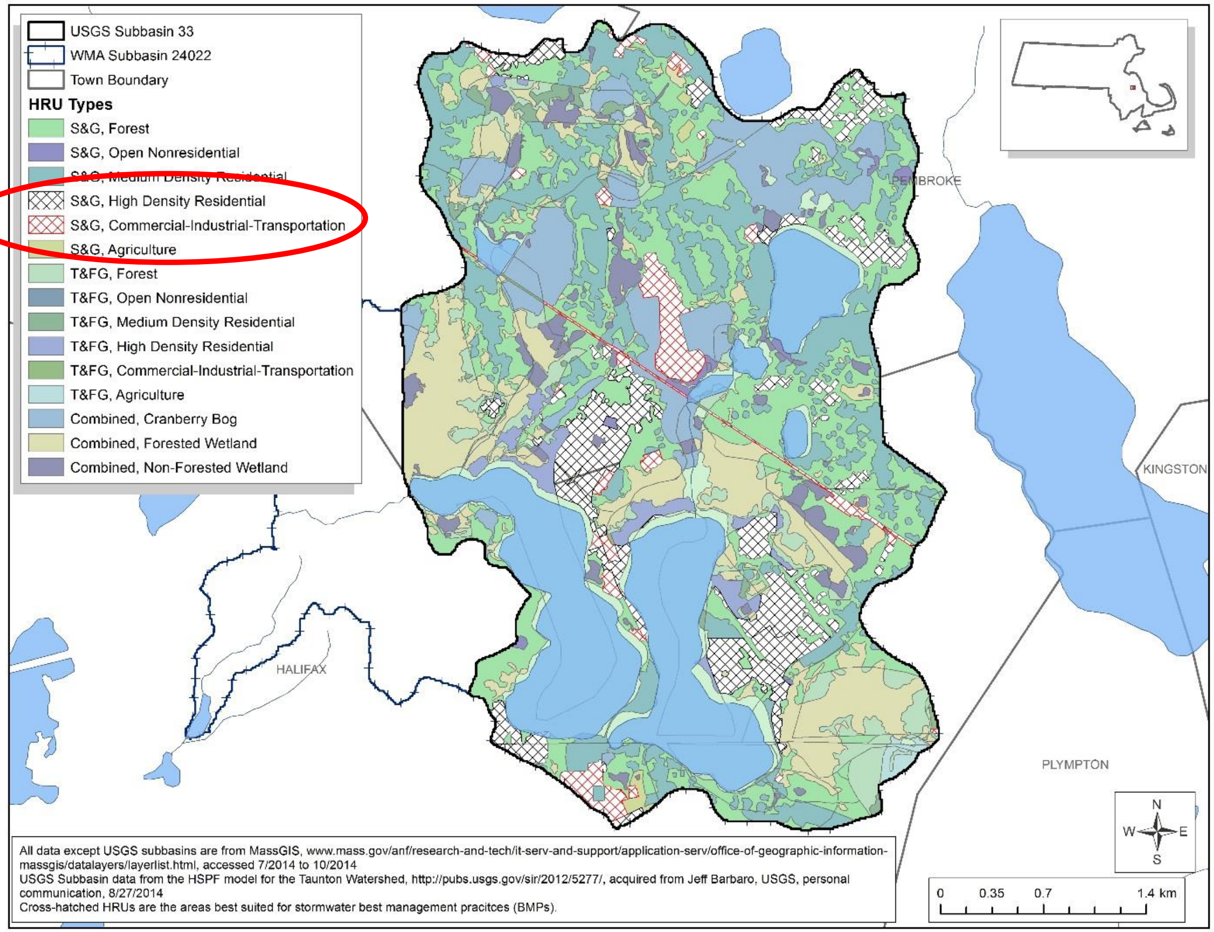
Green Infrastructure examples





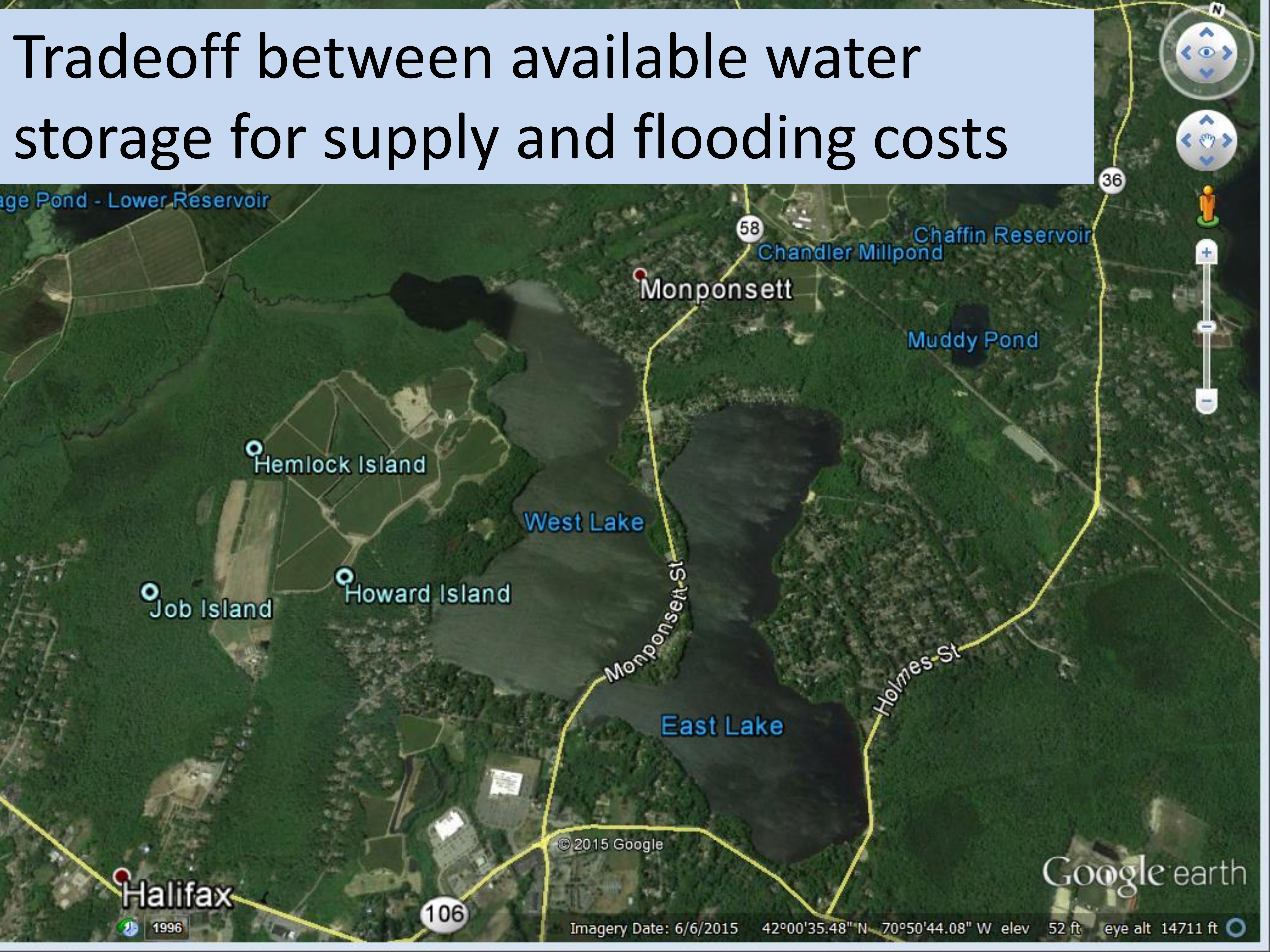
Areas for least cost GI BMP placement for increasing water supply and outflows*

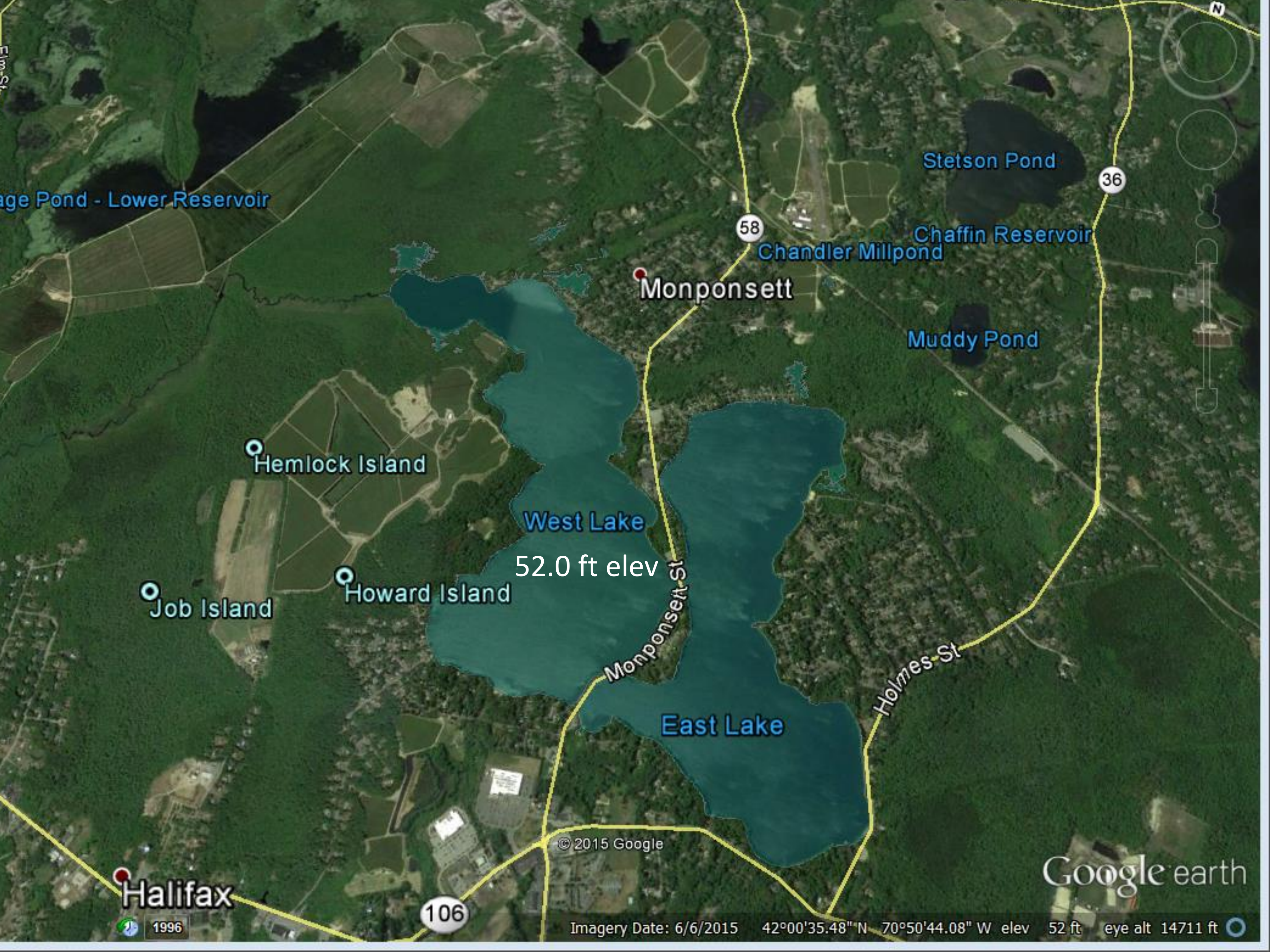
Sand & gravel, high density (322 acres) residential or commercial land (61 acres)



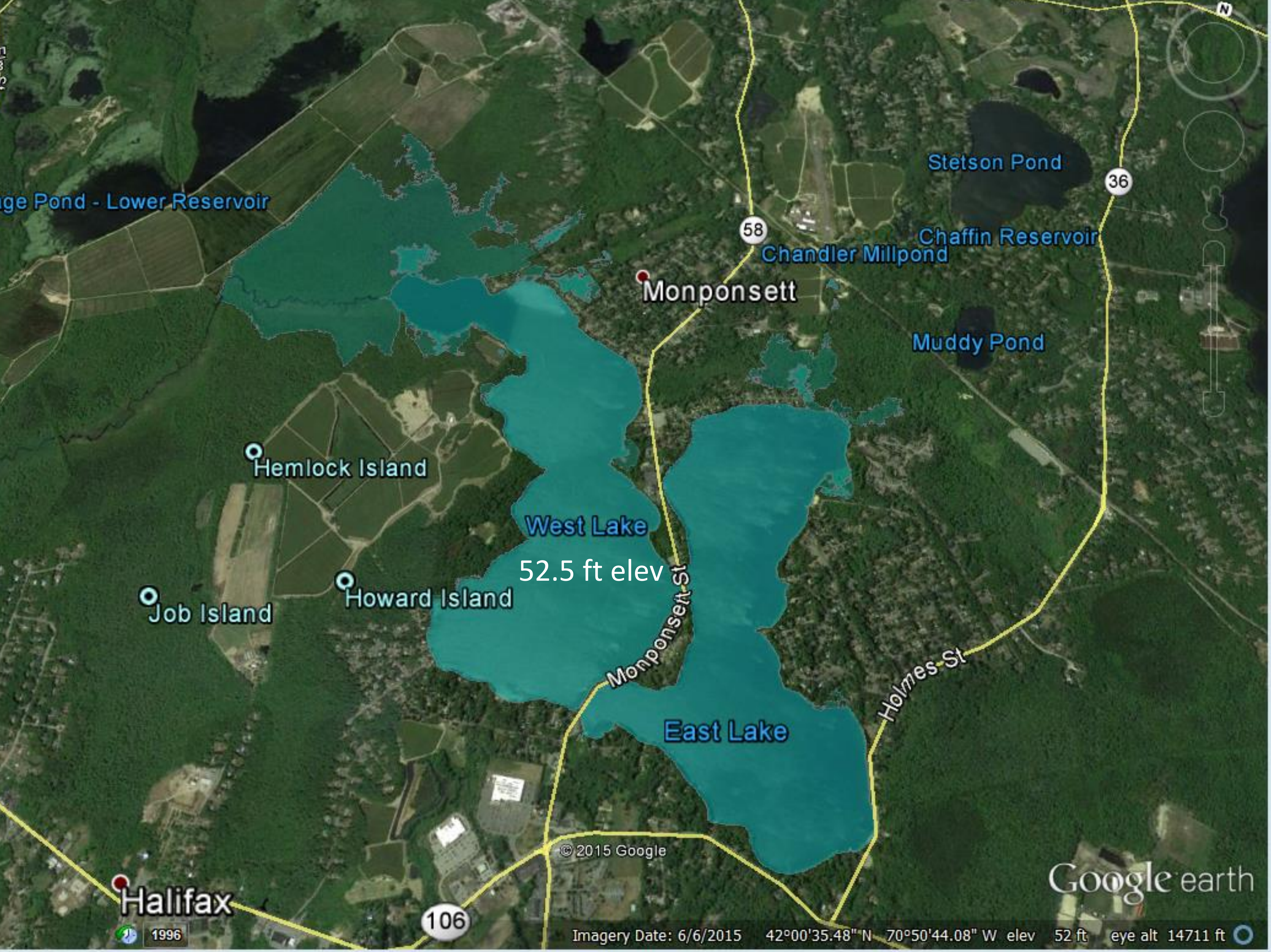
*Other factors may influence final selections

Tradeoff between available water storage for supply and flooding costs





age Pond - Lower Reservoir
Stetson Pond
36
58
Chaffin Reservoir
Chandler Millpond
Monponsett
Muddy Pond
Hemlock Island
West Lake
52.0 ft elev
Howard Island
Job Island
Monponsett St
Holmes St
East Lake
© 2015 Google
Google earth
Halifax
106
1996
Imagery Date: 6/6/2015 42°00'35.48" N 70°50'44.08" W elev 52 ft eye alt 14711 ft



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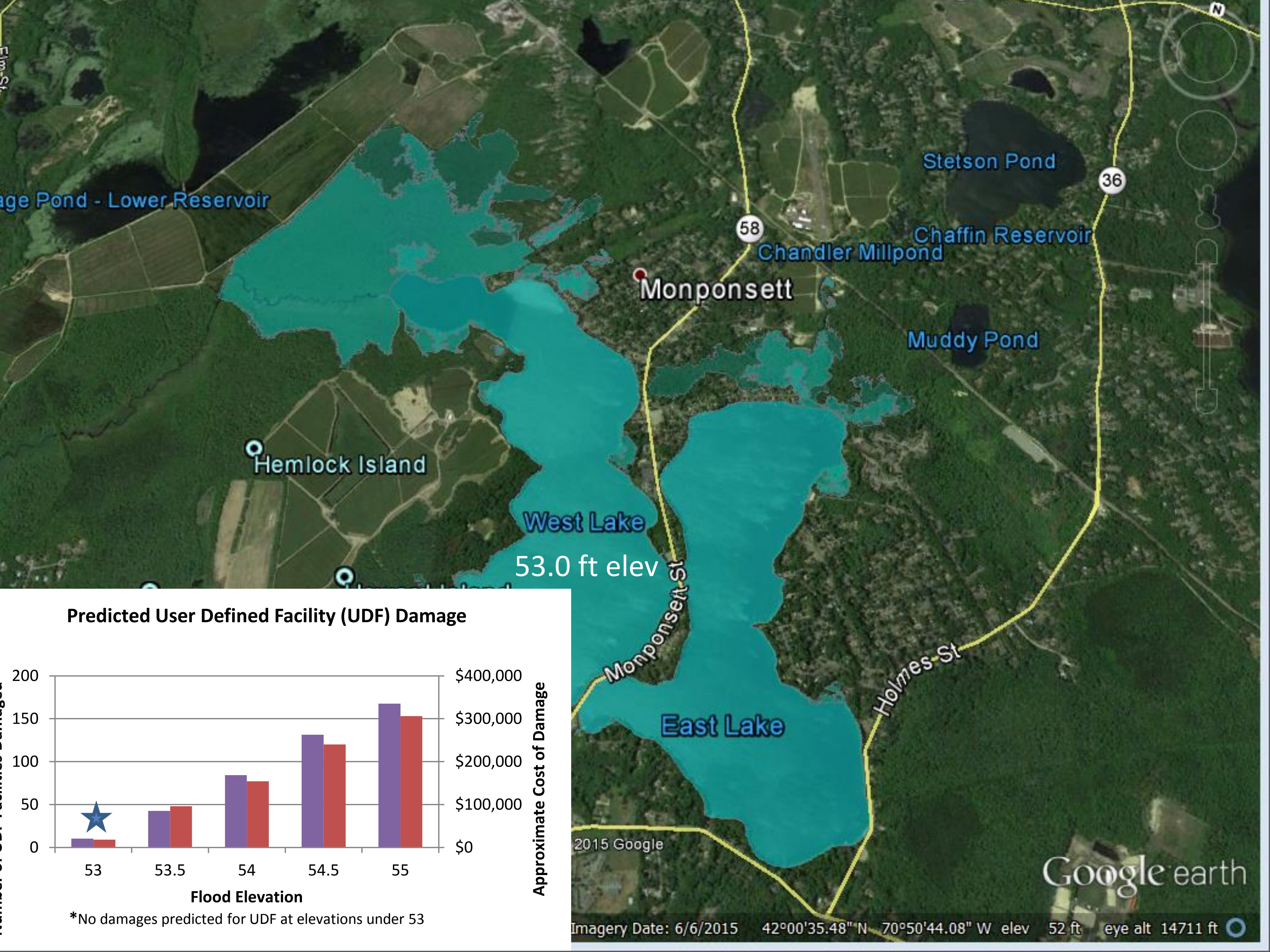
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Imagery Date: 6/6/2015 42°00'35.48" N 70°50'44.08" W elev 52 ft eye alt 14711 ft
Predicted User Defined Facility (UDF) Damage
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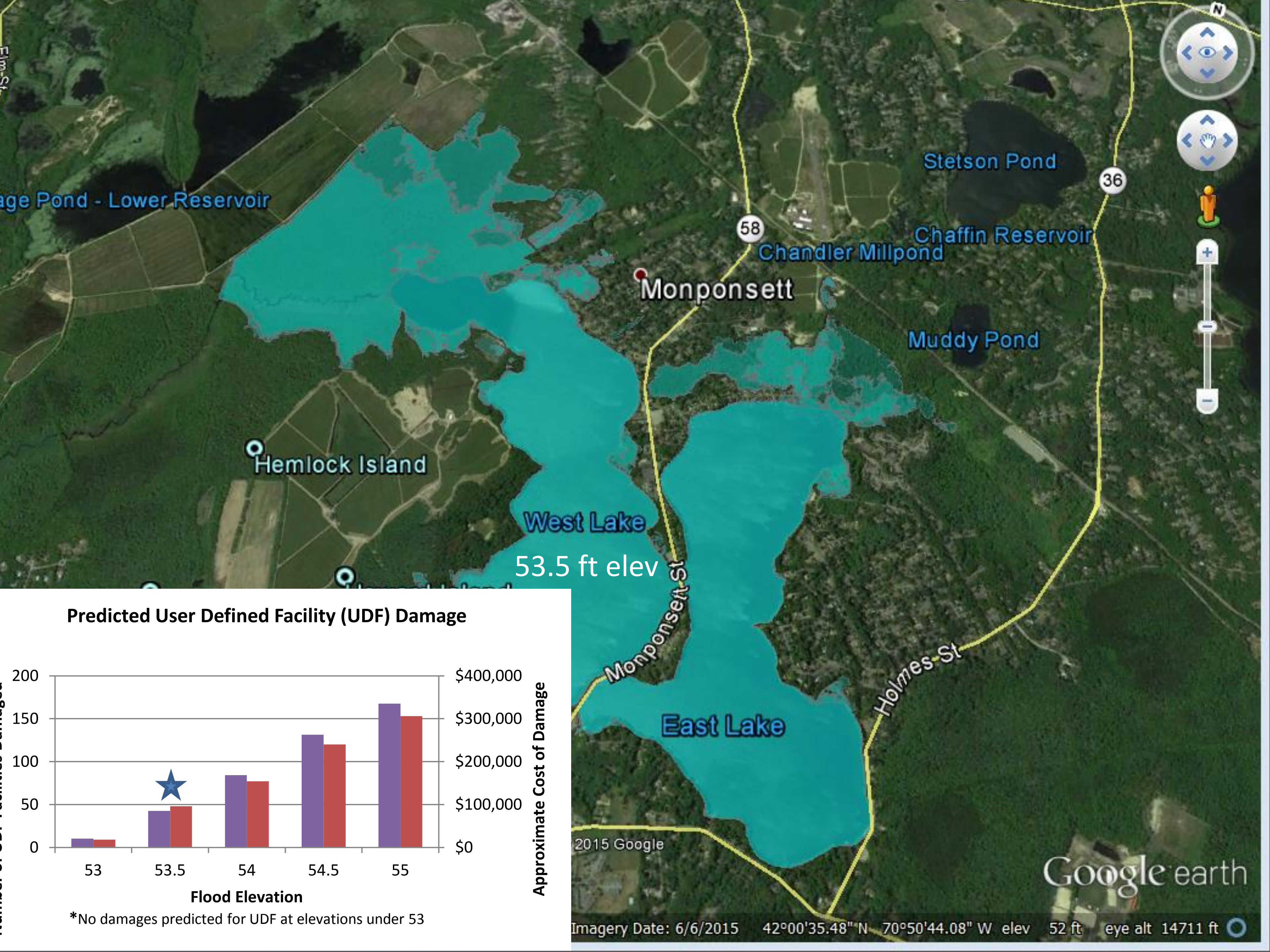
Flood Elevation
Approximate Cost of Damage
*No damages predicted for UDF at elevations under 53



53.5 ft elev
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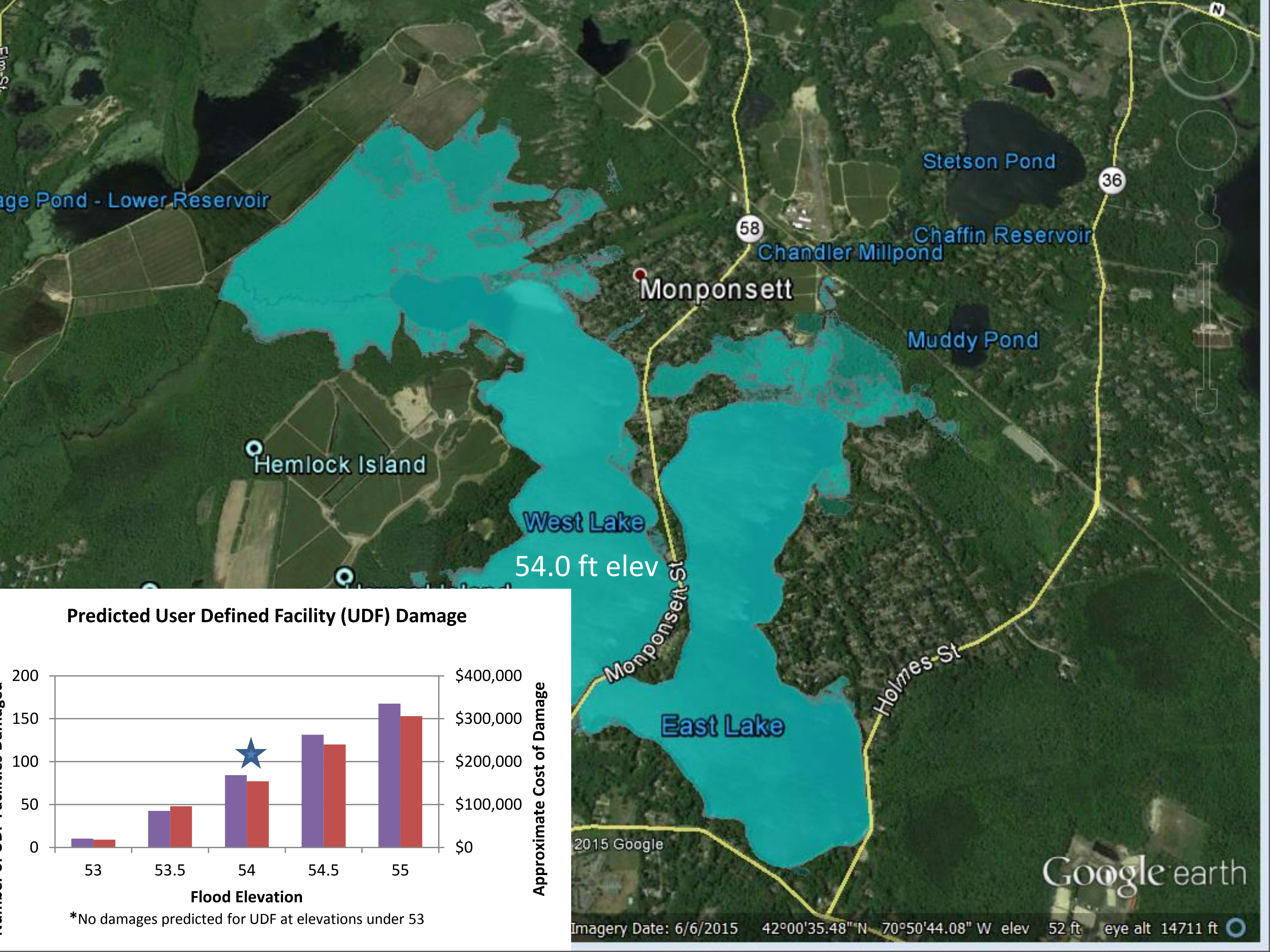
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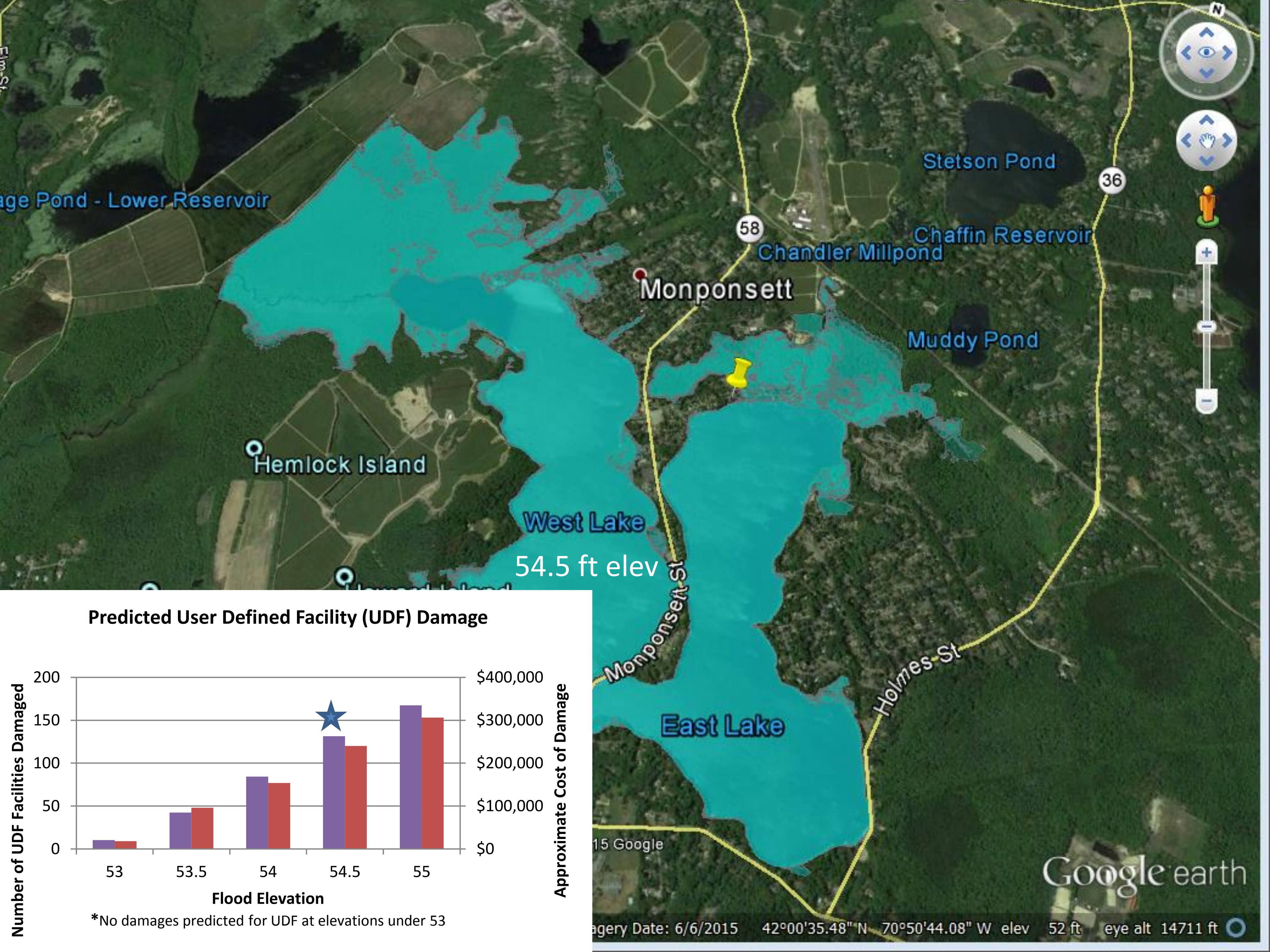

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Google earth
agery Date: 6/6/2015 42°00'35.48" N 70°50'44.08" W elev 52 ft eye alt 14711 ft
Predicted User Defined Facility (UDF) Damage
Number of UDF Facilities Damaged
200
150
100
50
0
Approximate Cost of Damage
$400,000
$300,000
$200,000
$100,000
$0
53
53.5
54
54.5
55
Flood Elevation
*No damages predicted for UDF at elevations under 53

Burrage Pond - Lower Reservoir
Stetson Pond
Center Hill Rd
Chaffin Reservoir
Chandler Millpond
Muddy Pond
Monponsett
Monponsett Ponds
Lake St
Hemlock Island
West Lake
Howard Island
Job Island
Monponsett St
East Lake
Paradise Ln
Pine St N
Woodbine Ave
Charles St
Squantum Ave
Snow St
Pleasant St
Holly St
Jordan Rd
Hemlock Rd
Buttonwood Rd
Hickory Rd
Chestnut Rd
Twin Lakes Dr
Annawon Dr
Cedar Ln
Ridge Rd
Baker St
Cross St
Hillside Ave
Lingan St
Pemmican Way
3rd Ave
Stoney Weir Rd
Clyde O Bosworth Rd
Thompson St
High St E
Cinder Rd
Oak St
Dartmouth St
Princeton St
Harvard St
Garden Rd
Colby Dr
Aldana Rd
106
36
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Example scenarios at 53 ft maximum pond level and cost

- The 25th percentile of historic (unimpacted) streamflows (5.58 cfs) can be maintained with water level range of 52.0 to 53.0 ft if:
  - Halifax demand maintained at 2009-2013 levels
  - Brockton diversions are eliminated entirely
  - Green infrastructure stormwater BMPs are implemented on 14 acres of developed land
  - Infrequent deficits are allowed (3 days, 109 million gallons total)
  - Estimated annual cost*:
    - Water supply: $483,284 ($16,526 less than historic 2002-2006 period of record)
    - Flooding (estimated building damages**): $20,601

* Includes both annualized capital costs and operations and maintenance

** Based on generic FEMA flood depth-cost curves in HAZUS

Example scenarios at 53.5 ft maximum pond level and cost

- The 25th percentile of historic (unimpacted) streamflows (5.58 cfs) can be maintained with water level range of 52.0 to 53.5 ft if:
  - Halifax demand maintained at 2009-2013 levels
  - Brockton diversions are eliminated entirely
  - Estimated annual cost*:
    - Water supply: $466,514 ($33,296 less than historic 2002-2006 period of record)
    - Flooding costs (buildings**): $84,889

OR

* Includes both annualized capital costs and operations and maintenance

** Based on generic FEMA flood depth-cost curves in HAZUS

Example scenarios at <u>53.5 ft</u> maximum pond level and cost

- The 25th percentile of historic (unimpacted) streamflows (5.58 cfs) can be maintained with water level range of 52.0 to 53.5 ft if:
  - Halifax demand maintained at 2009-2013 levels
  - Brockton diversions are maintained at 2009-2013 levels <u>minus</u> the amount required to bring leaks down to Water Mgt Act requirements (reduce UAW by 1.6% to 10%)
  - Green infrastructure stormwater BMPs are implemented on 270 acres of developed land
  - Aquifer Storage and Recharge is implemented ($$$)
  - Estimated annual cost: $9.6 million

OR

Example scenarios at 53.5 ft maximum pond level and cost

- The 25th percentile of historic (unimpacted) streamflows (5.58 cfs) can be maintained with water level range of 52.0 to 53.5 ft if:
  - Halifax demand maintained at 2009-2013 levels
  - Brockton diversions are maintained at 2009-2013 levels minus the 3 MGD capacity of the Aquaria desalination plant to supply water to Brockton
  - Green infrastructure stormwater BMPs are implemented on 53 acres of developed land
  - Some water is transferred to MP within Halifax but from outside the MP watershed (“interbasin transfer”)
  - Infrequent deficits occur (2 days, 50.6 million gallons total)
  - Estimated annual cost:
    - Water supply: $529,645 ($28,469 more than historic 2002-2006 period of record)
    - Flooding costs (buildings**): $84,889

Summary

- The Monponsett Ponds system is highly constrained, with a very tight operating range
- Competing water uses generate tradeoffs
- 25th percentile of unimpaired flows to Stump Brook could be met (but with occasional water deficits) based on historic climate period with wet and dry years for pond level range of 52 to 53.0 or 53.5 ft
- Green infrastructure stormwater BMPs a common least-cost solution in scenarios tested

Next steps

- Consider effect of management actions on water quality as well as quantity
- Need for a regional integrated water management solution
  - Potential effect of GI BMPs in upper Taunton in moderating flooding costs
  - Potential effect of GI BMPs in upper Taunton on groundwater supply (reducing need for diversions)
- Other tools available to guide implementation
  - EPA BMP siting tool (parcel-specific)
  - OptiTool with WMOST v3 (water quality protection)*

* Available next year

Questions?

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