Free Tools to Assess Ecosystem Services and Values of Trees

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What is i-Tree?

www.itreetools.org

A series of tools to quantify ecosystem services and values from trees

- i-Tree Eco
- i-Tree Streets
- i-Tree Design
- i-Tree Vue
- i-Tree Species
- i-Tree Canopy
- i-Tree Hydro

i-Tree Quantifies Tree and Forest Resources

www.itreetools.org

Structure

- Number of Trees, species distribution, canopy cover, etc.

Functions / Ecosystem Services

- Energy
- Air pollution
- Carbon
- Biogenic VOC emissions

Management needs

- Pest risk
- Tree health
- Exotic/invasive spp.

$ Value

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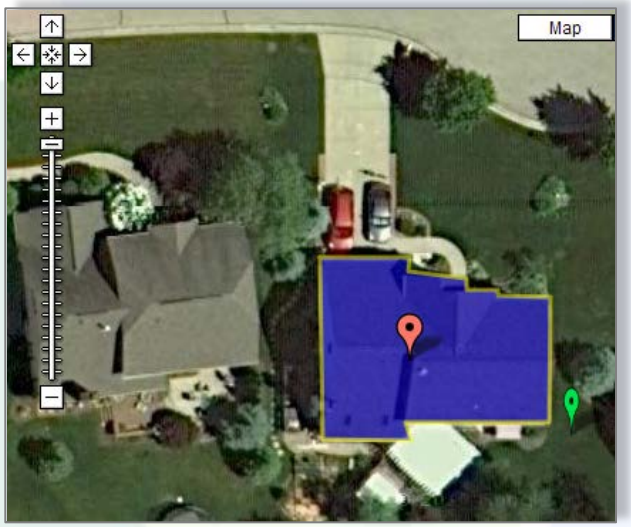
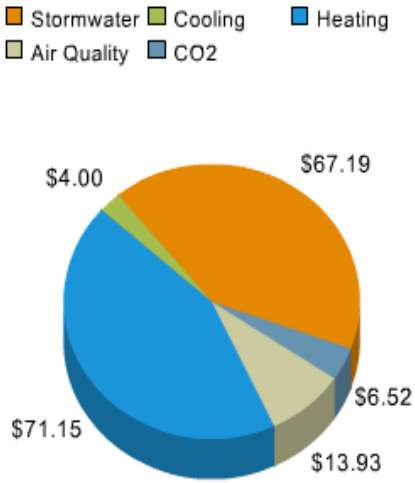
i-Tree Design



Northern pin oak
Quercus ellipsoidalis

Easily estimates ecosystem services of trees in your yard using Google Maps and i-Tree



Breakdown of your tree's benefits

This 21 inch Northern pin oak provides overall benefits of: $163 every year.

While some functional benefits of trees are well documented, others are difficult to quantify (e.g., human social and communal health). Trees' specific geography, climate, and interactions with humans and infrastructure is highly variable and makes precise calculations that much more difficult. Given these complexities, the results presented here should be considered initial approximations-a general accounting of the benefits produced by urban street-side plantings.

Benefits of trees do not account for the costs associated with trees' long-term care and maintenance.

If this tree is cared for and grows to 26 inches, it will provide $195 in annual benefits.

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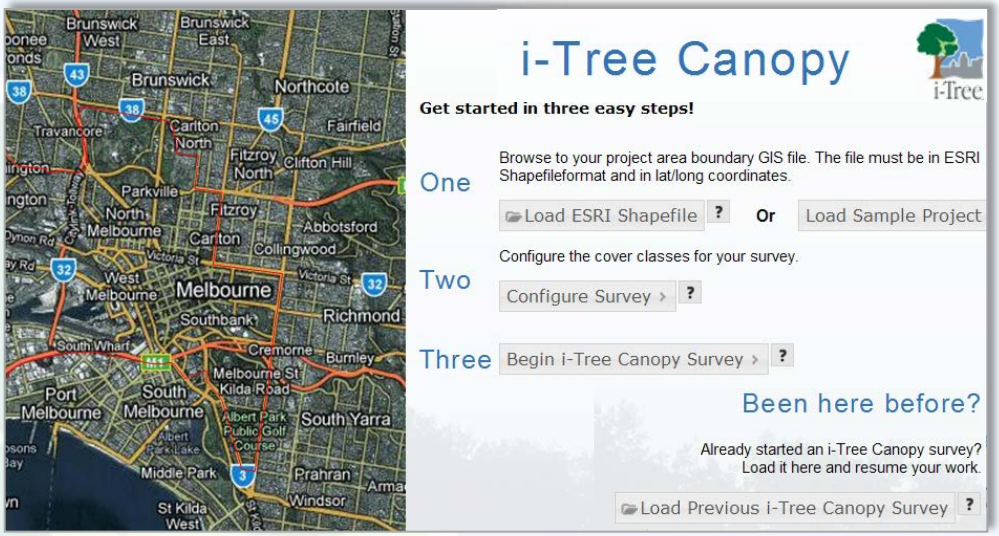
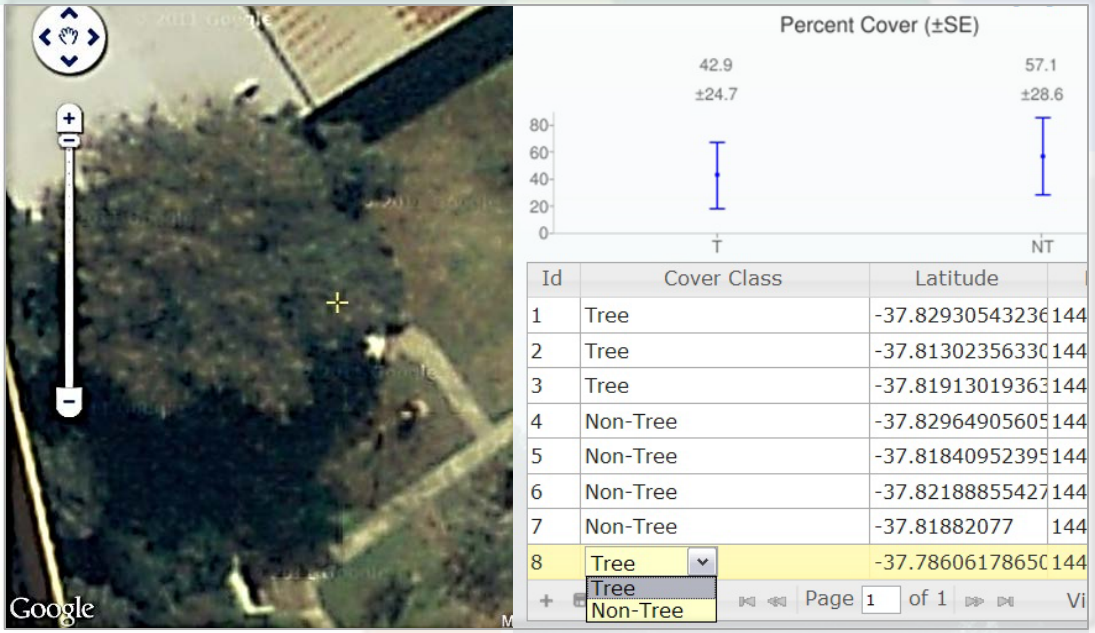
i-Tree Canopy





Determines % tree cover

- Easy & Fast
- World-wide
- Web-based

i-Tree is a Cooperative Initiative

DAVEY

Arbor Day Foundation

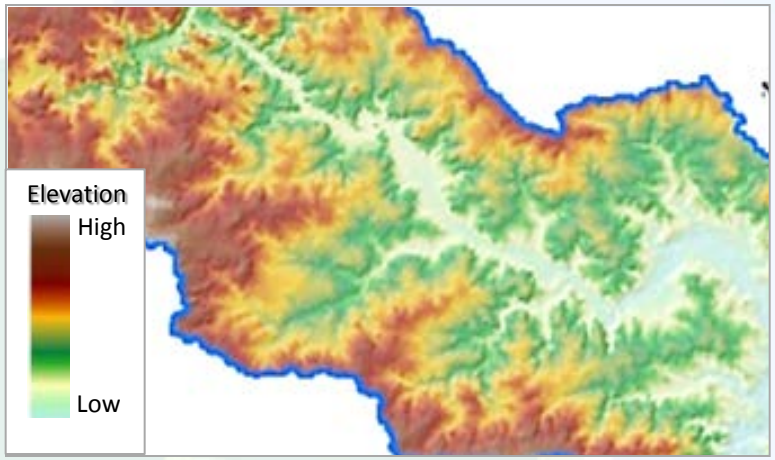
sma SOCIETY OF MUNICIPAL ARBORISTS

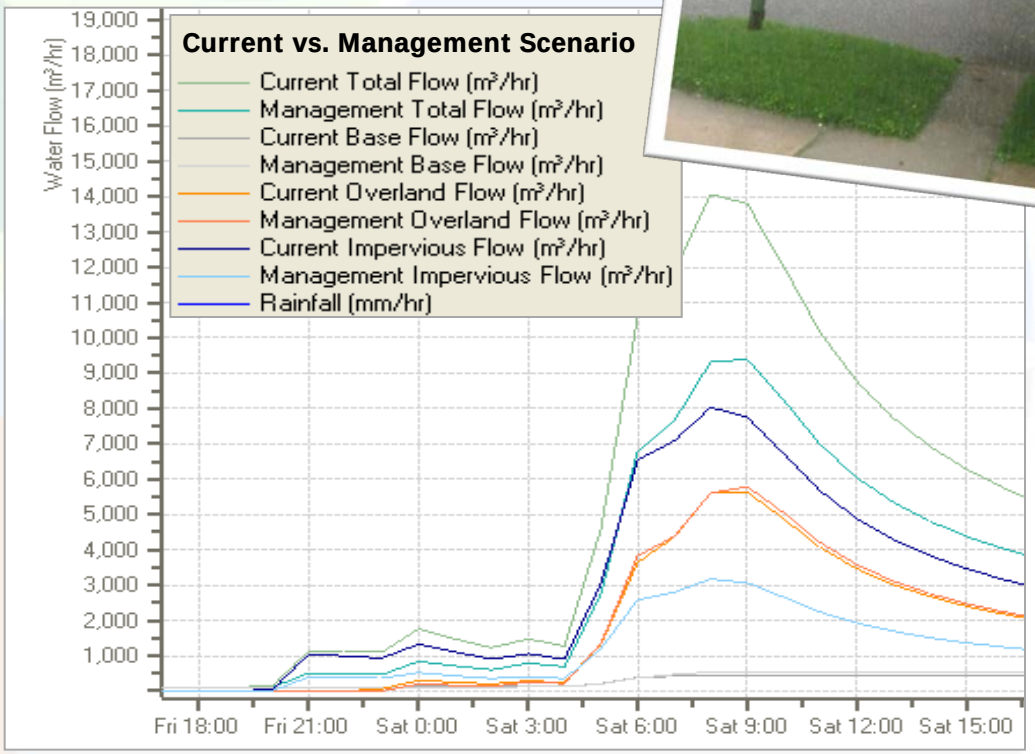
ISA

Casey Trees

www.itreetools.org

i-Tree Hydro





Quantifies effects of:

- Tree cover
- Impervious cover

on:

- Stream flow
- Water quality

Hydro Inputs

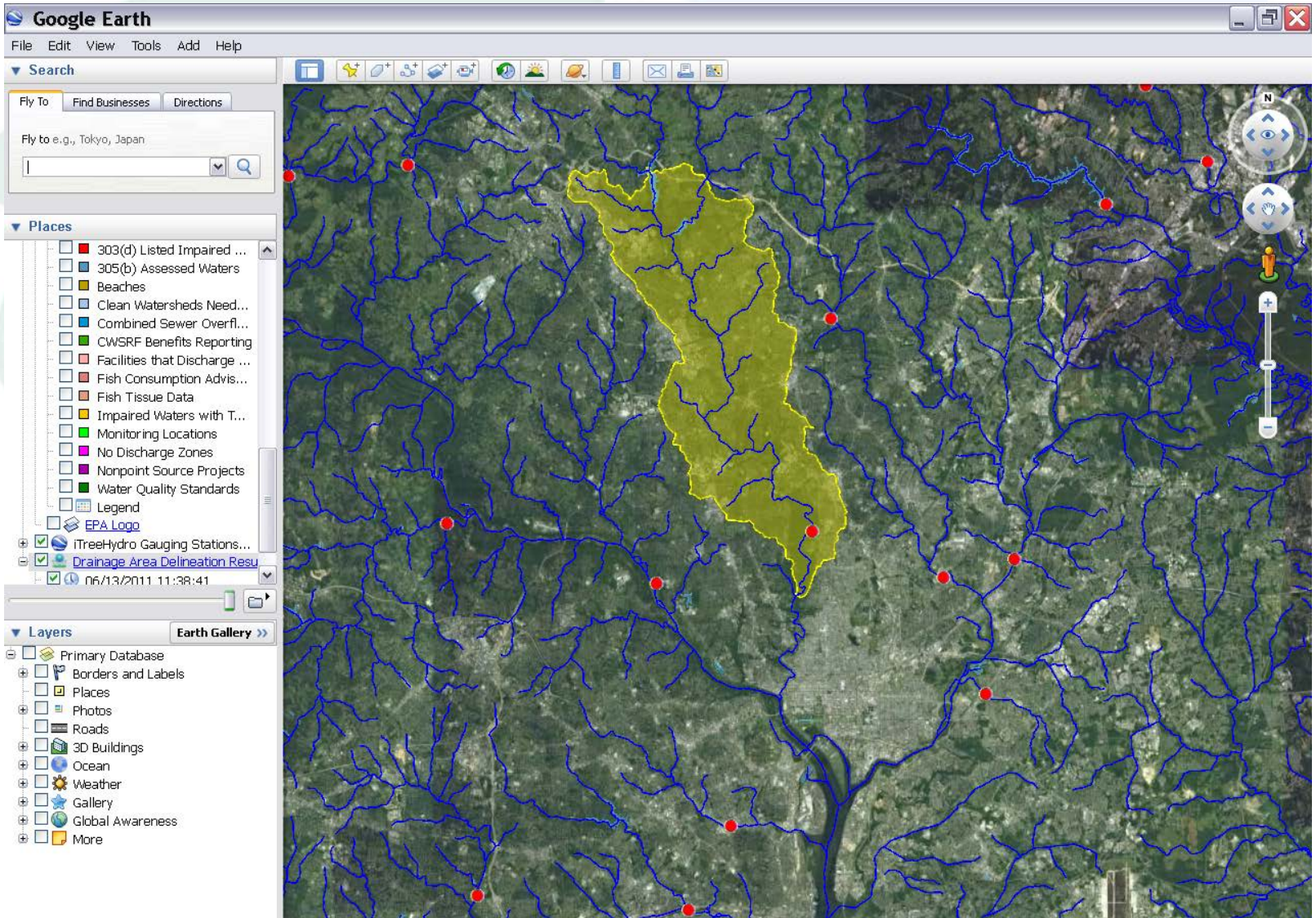
- **Hourly discharge data (USGS)**
- **Digital elevation map (USGS)**
- **Hourly weather data**
  - Evaporation data calculated from weather data
- **Structural information on watershed**
  - Tree cover
  - Impervious cover
  - Shrub and grass cover
  - LAI

Hydro Outputs

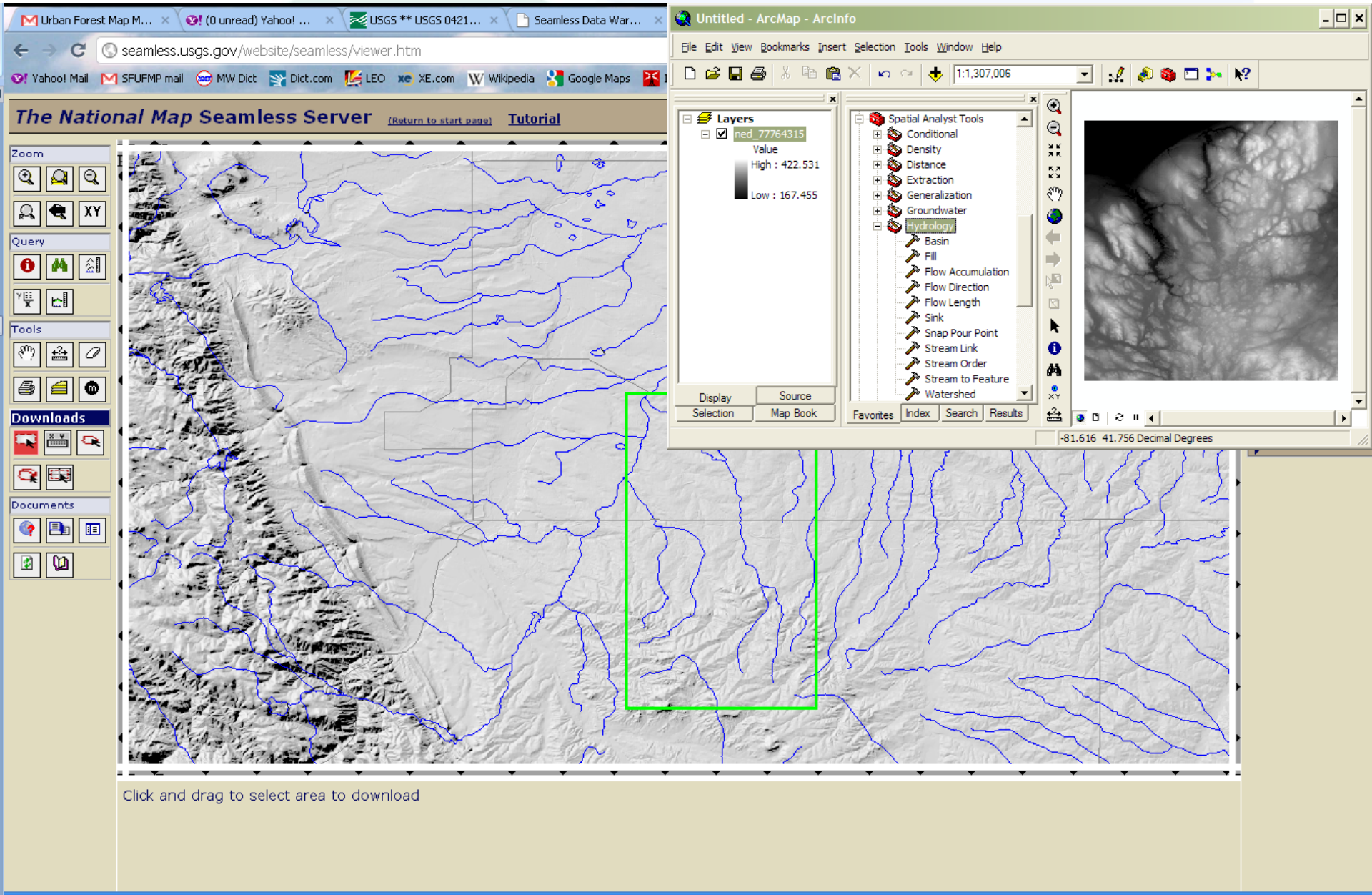
- **For each time step (1 hour for these simulations):**
  - Canopy interception
  - Depression storage
  - Infiltration
  - Evapotranspiration
  - Surface and subsurface (base flow) runoff
  - Channel discharge (total runoff)
  - Water quality (EMC)

Step 1: Determine watershed

EPA Waters and gauging station data



Step 2: DEM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USGS ** USGS 0421...
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File Edit View Bookmarks Insert Selection Tools Window Help
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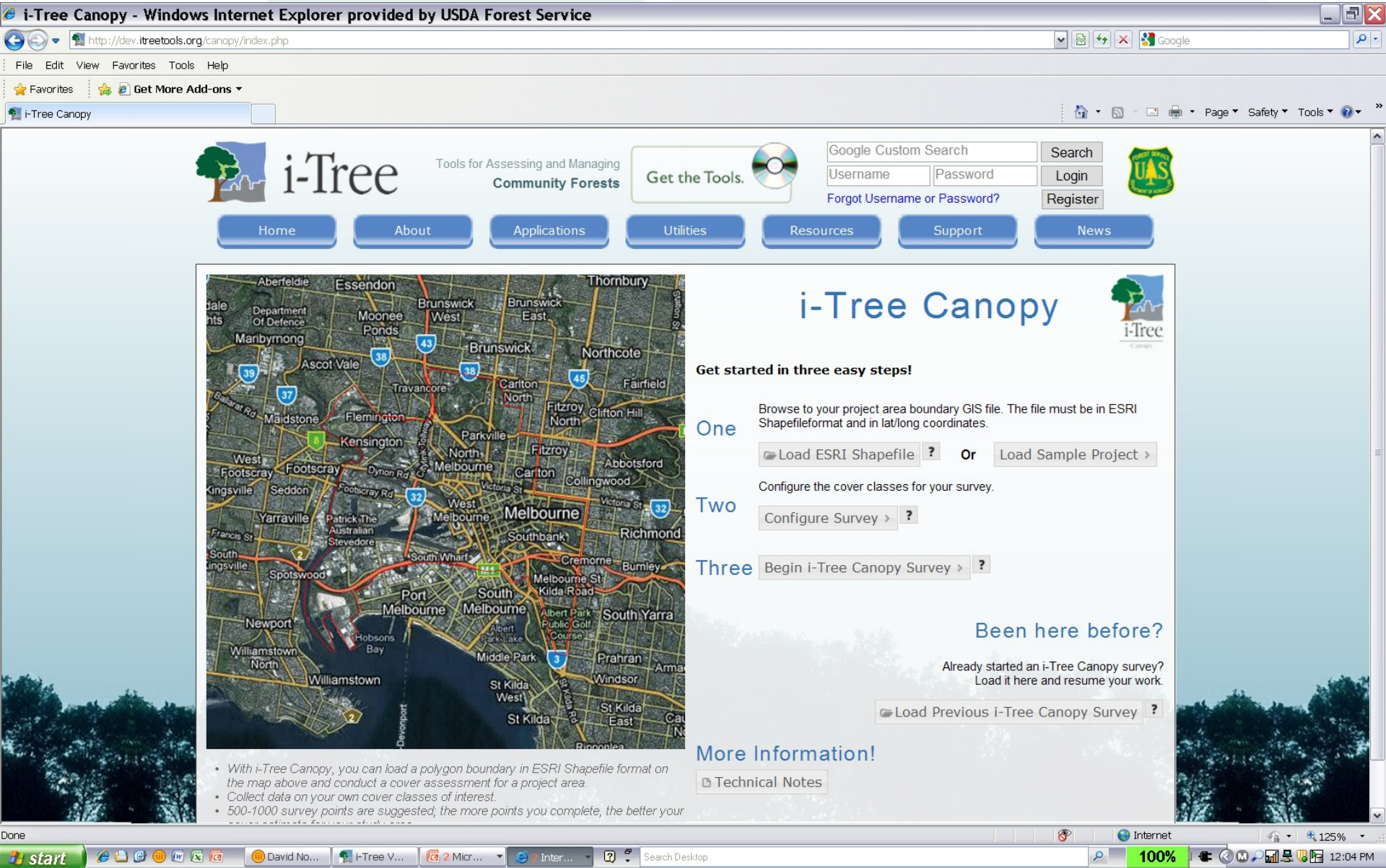
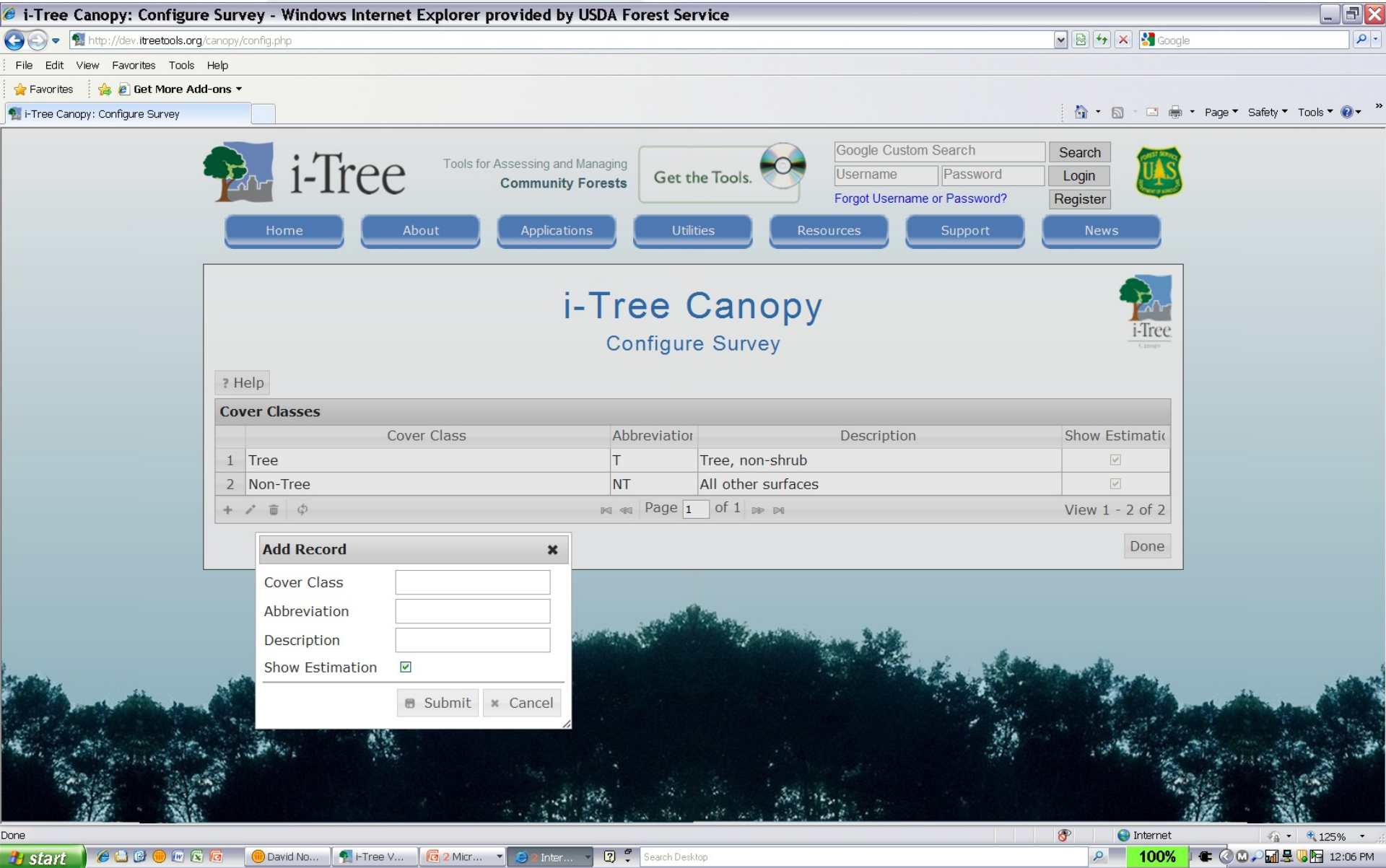
High : 422.531
Low : 167.455
Display
Source
Selection
Map Book
Spatial Analyst Tools
Conditional
Density
Distance
Extraction
Generalization
Groundwater
Hydrology
Basin
Fill
Flow Accumulation
Flow Direction
Flow Length
Sink
Snap Pour Point
Stream Link
Stream Order
Stream to Feature
Watershed
Favorites
Index
Search
Results
-81.616 41.756 Decimal Degrees

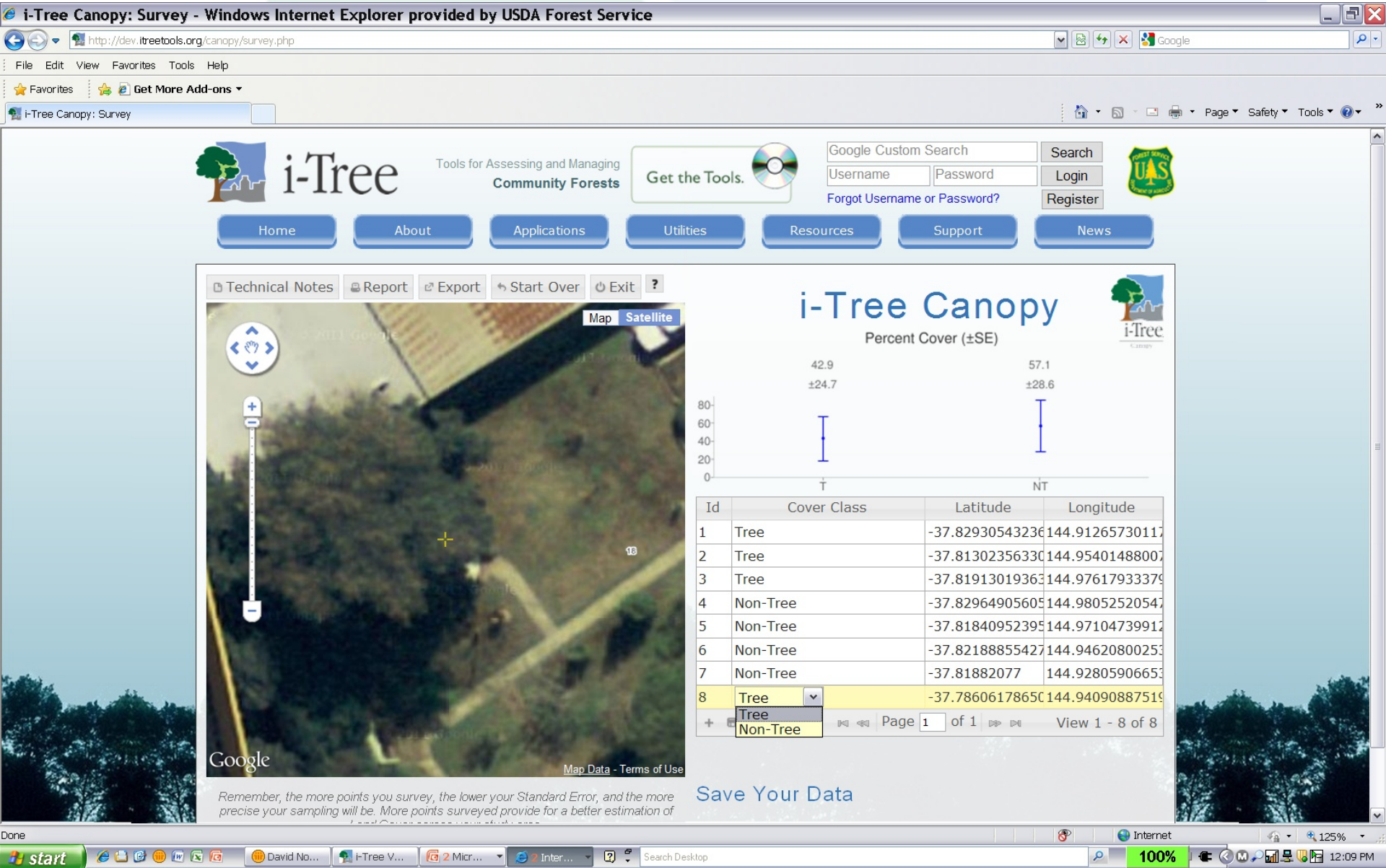
Step 3: Cover Attributes



You choose the cover classes

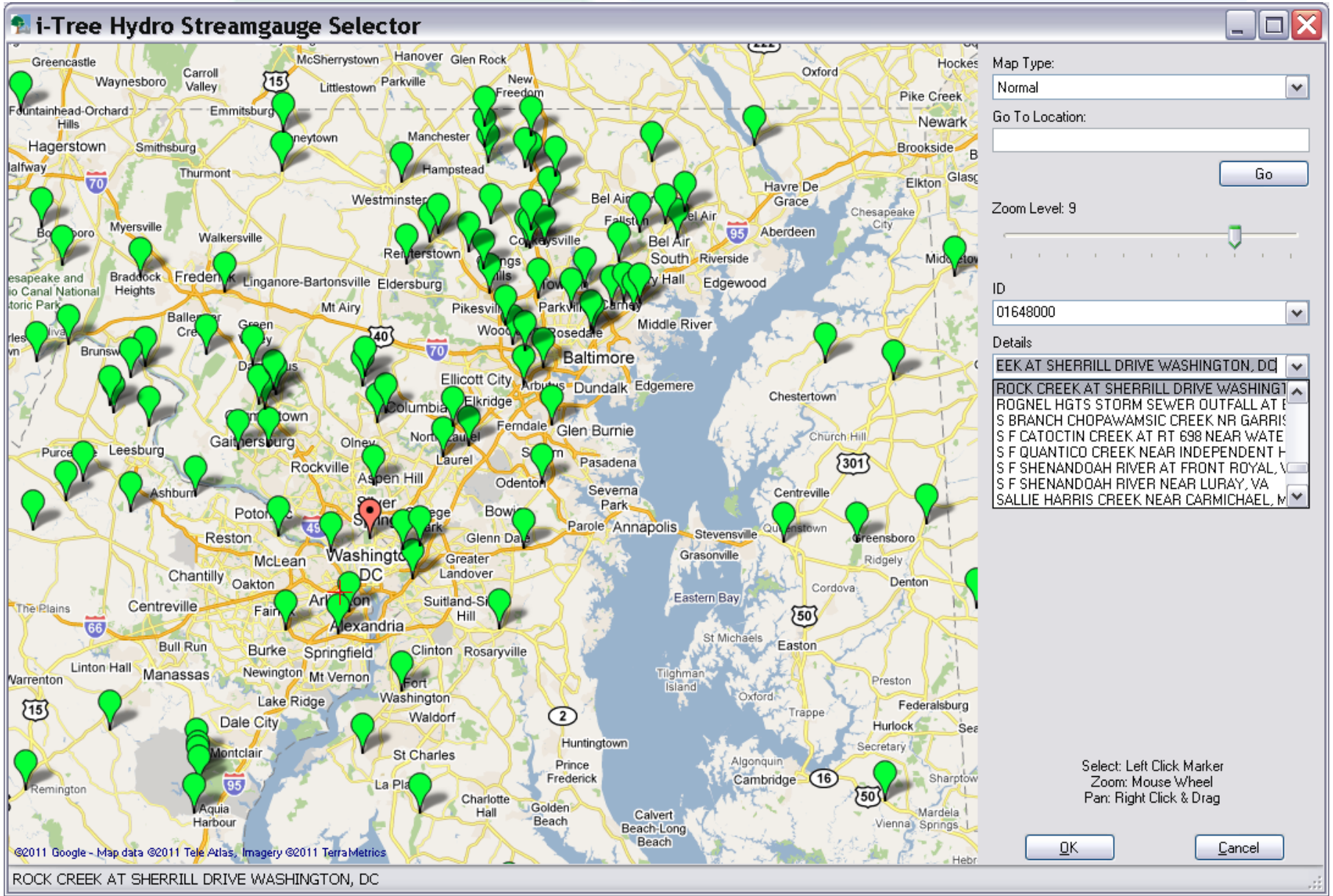


Classify random points

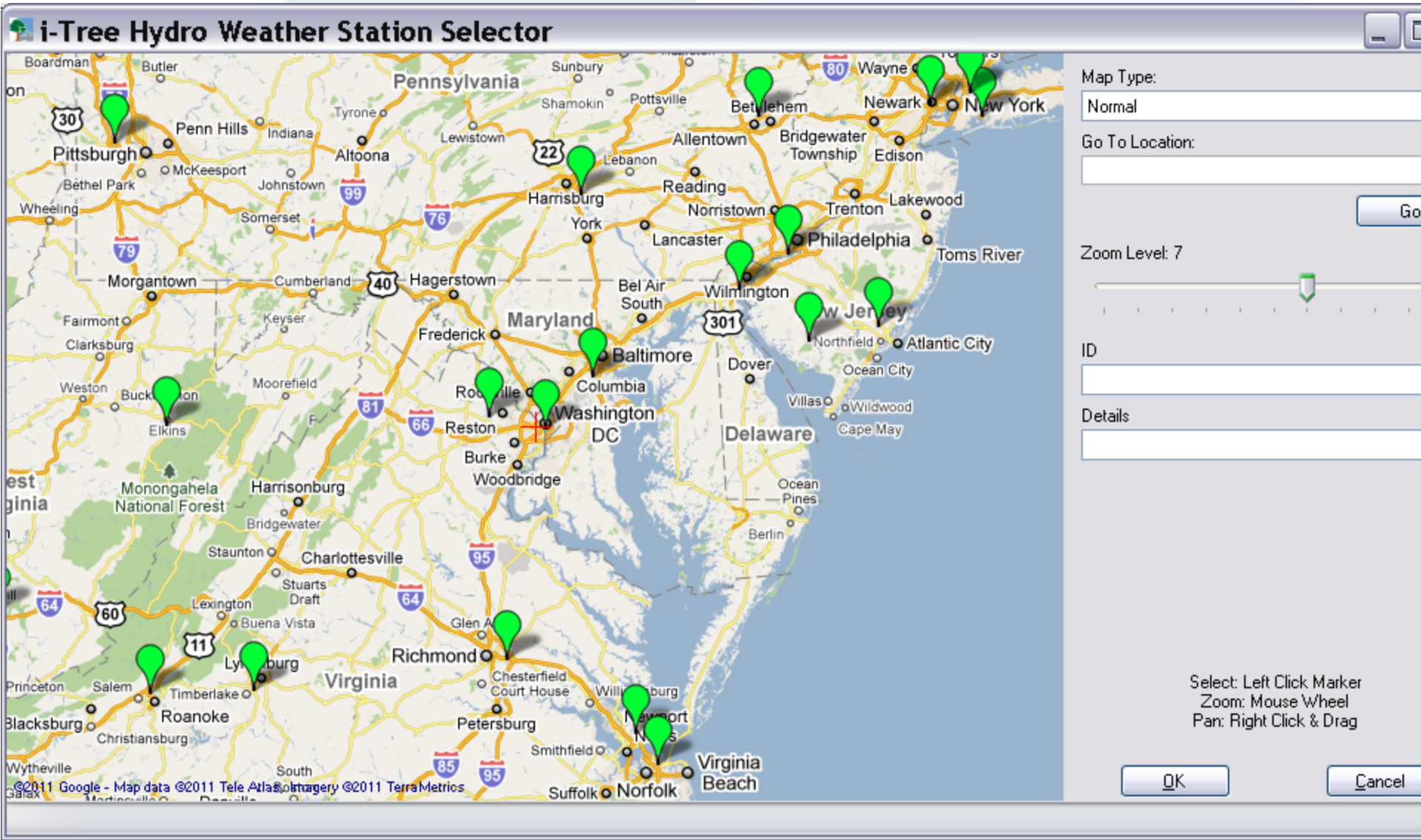


Step 4: Start Hydro

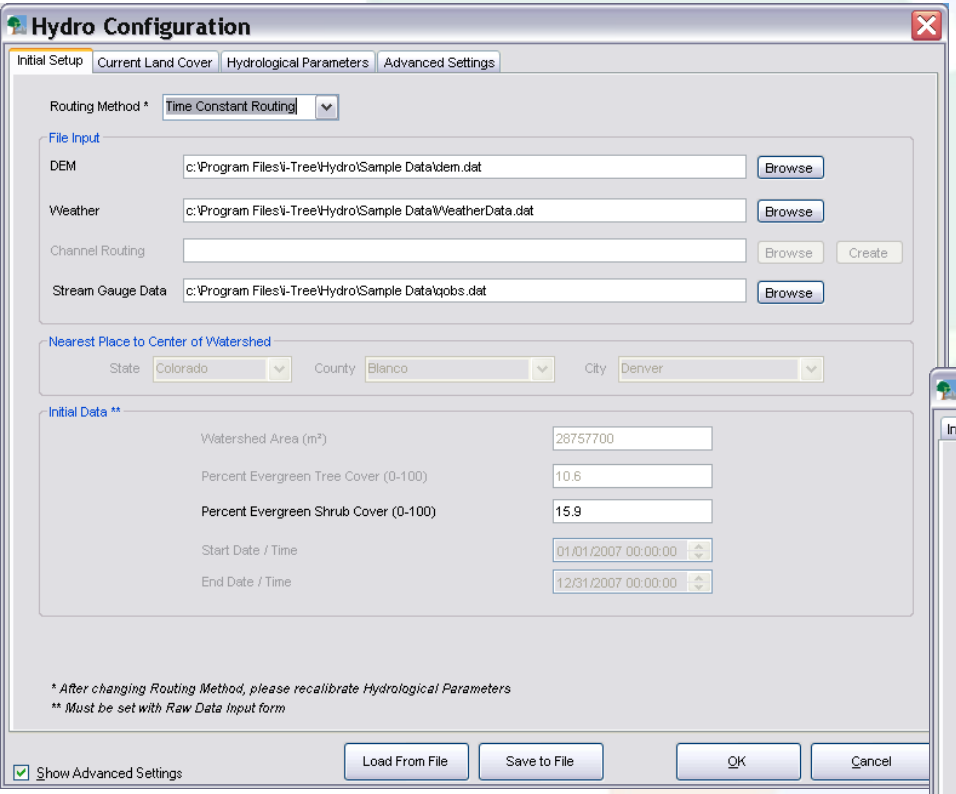
Extract Steam Data

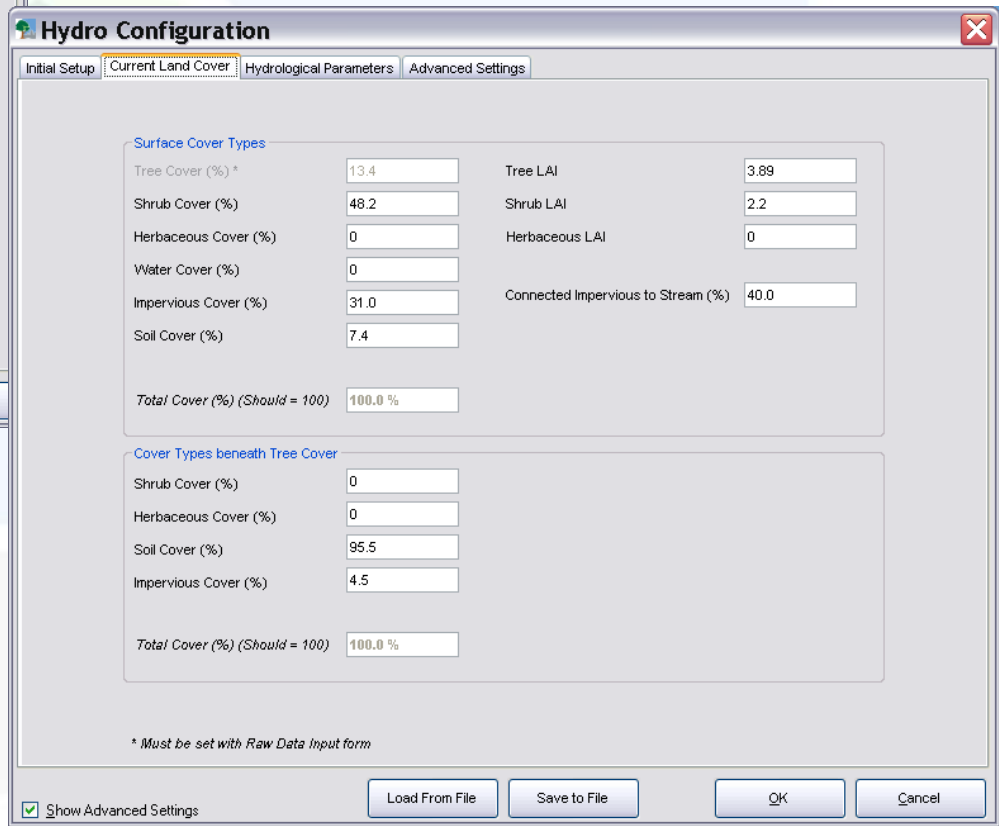


Extract Weather Data

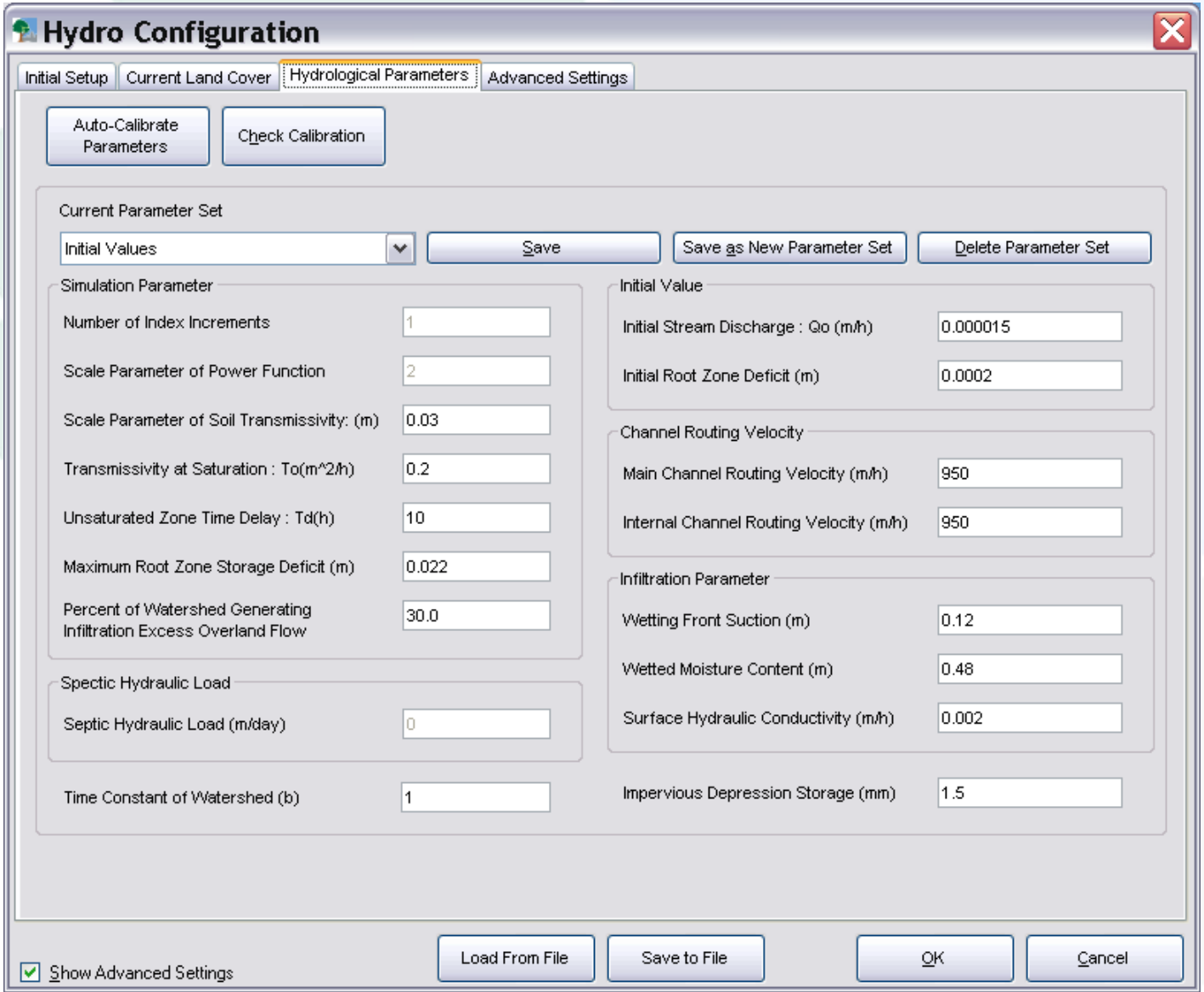


Load files and enter cover data

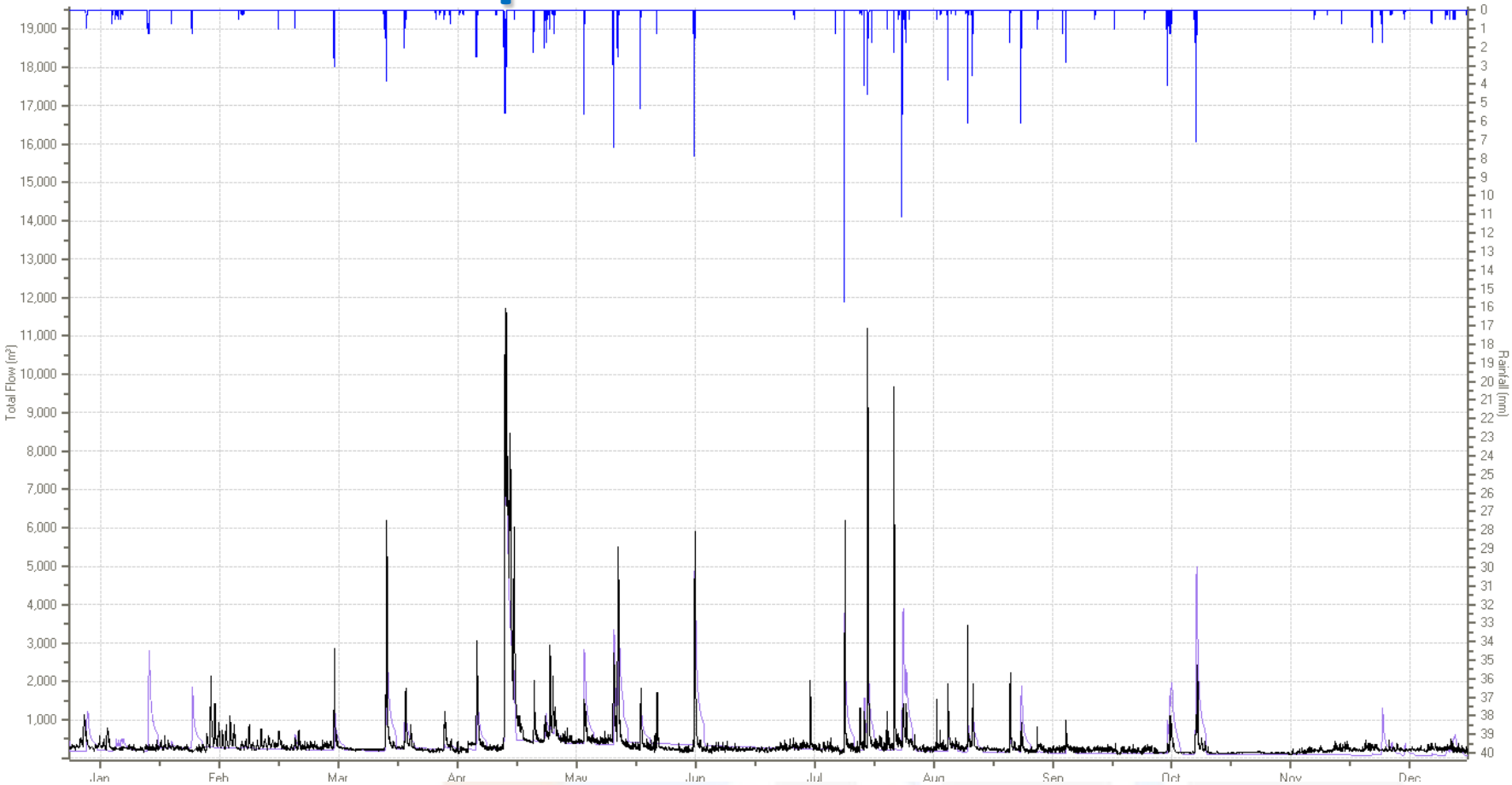




Step 5: Calibrate Model



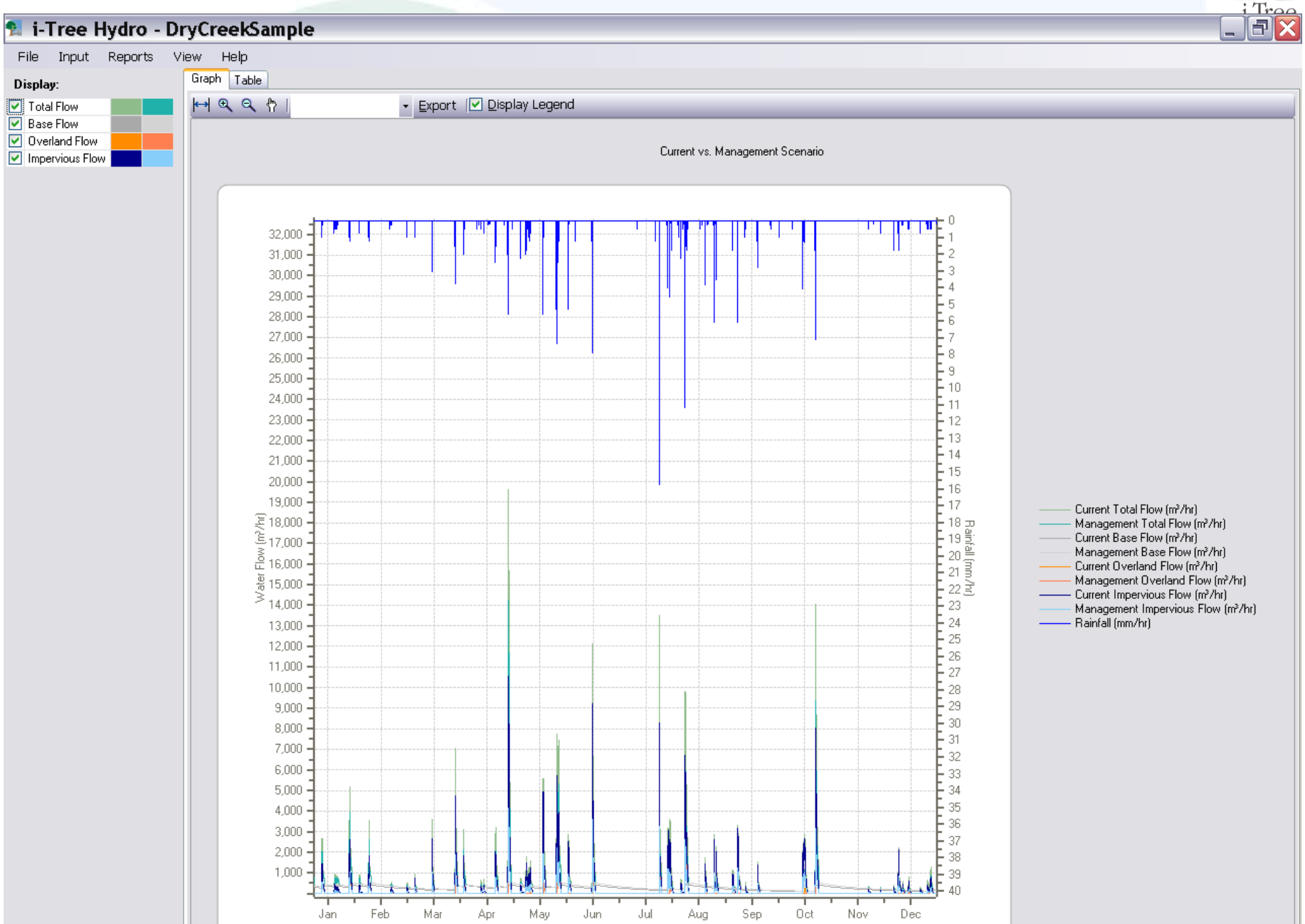
Calibration Graph



Calibration coefficients and percent connected impervious area for select watersheds

	Calibration Coefficients			% Connected
Watershed	Peak Flow	Base Flow	Balanced Flow	Impervious
Accotink	0.32	0.49	0.58	65
Baisman Run	0.55	0.63	0.70	20
Gwynns Falls	0.51	0.45	0.61	65
Mill Creek	0.62	0.10	0.43	65
Pond Branch	0.55	0.26	0.55	65
Rock Creek	0.56	0.53	0.67	65

Step 6: Model Scenarios



i-Tree Hydro - DryCreekSample

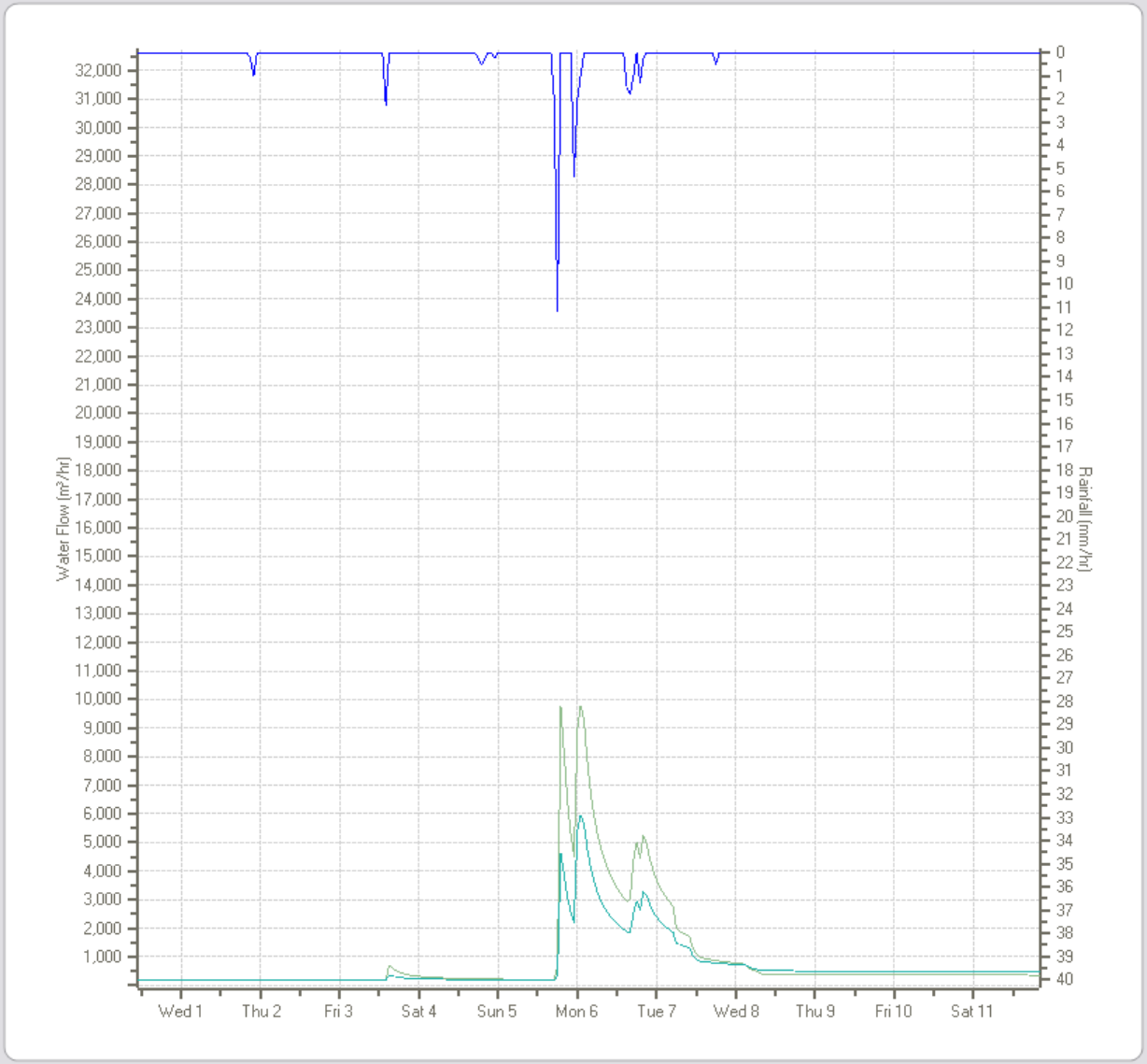
File Input Reports View Help

Display:

- [x] Total Flow
- [ ] Base Flow
- [ ] Overland Flow
- [ ] Impervious Flow

Graph | Table

Export | Display Legend



i-Tree Hydro - DryCreekSample

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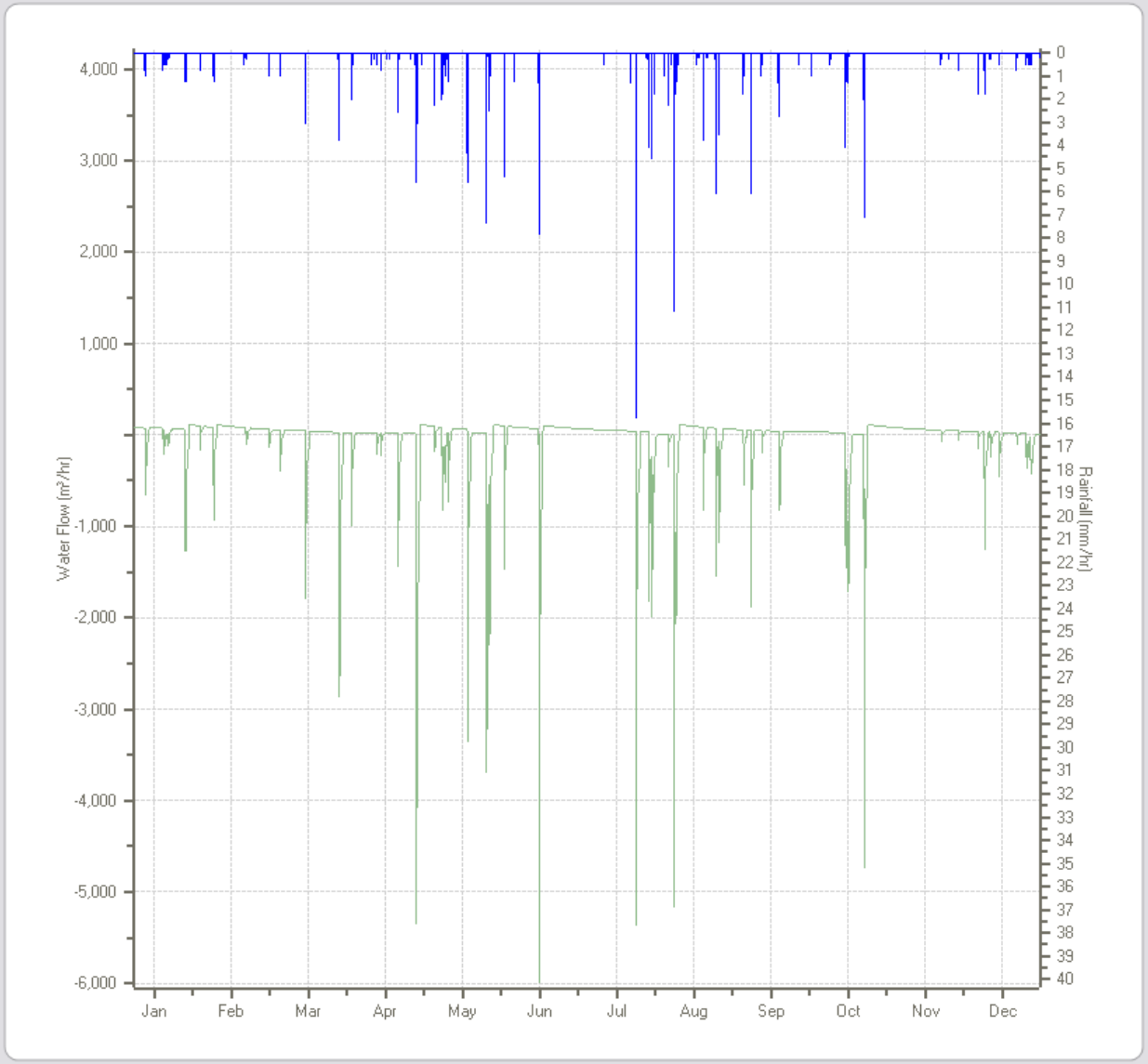
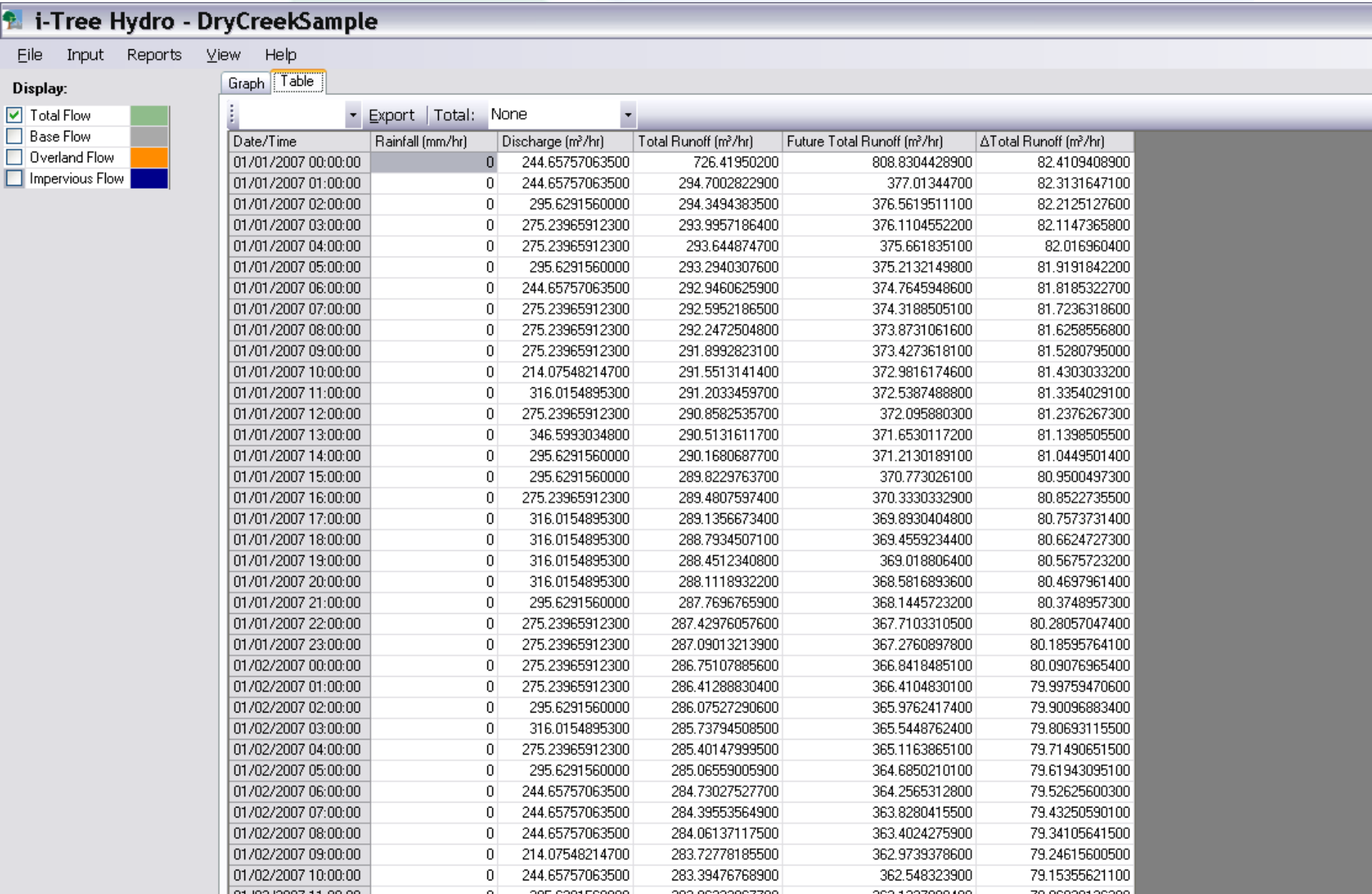


Table Outputs



Date/Time	Rainfall (mm/hr)	Discharge (m³/hr)	Total Runoff (m³/hr)	Future Total Runoff (m³/hr)	ΔTotal Runoff (m³/hr)
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01/01/2007 01:00:00	0	244.65757063500	294.7002822900	377.01344700	82.3131647100
01/01/2007 02:00:00	0	295.6291560000	294.3494383500	376.5619511100	82.2125127600
01/01/2007 03:00:00	0	275.23965912300	293.9957186400	376.1104552200	82.1147365800
01/01/2007 04:00:00	0	275.23965912300	293.644874700	375.661835100	82.016960400
01/01/2007 05:00:00	0	295.6291560000	293.2940307600	375.2132149800	81.9191842200
01/01/2007 06:00:00	0	244.65757063500	292.9460625900	374.7645948600	81.8185322700
01/01/2007 07:00:00	0	275.23965912300	292.5952186500	374.3188505100	81.7236318600
01/01/2007 08:00:00	0	275.23965912300	292.2472504800	373.8731061600	81.6258556800
01/01/2007 09:00:00	0	275.23965912300	291.8992823100	373.4273618100	81.5280795000
01/01/2007 10:00:00	0	214.07548214700	291.5513141400	372.9816174600	81.4303033200
01/01/2007 11:00:00	0	316.0154895300	291.2033459700	372.5387488800	81.3354029100
01/01/2007 12:00:00	0	275.23965912300	290.8582535700	372.095880300	81.2376267300
01/01/2007 13:00:00	0	346.5993034800	290.5131611700	371.6530117200	81.1398505500
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01/01/2007 16:00:00	0	275.23965912300	289.4807597400	370.3330332900	80.8522735500
01/01/2007 17:00:00	0	316.0154895300	289.1356673400	369.8930404800	80.7573731400
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01/01/2007 20:00:00	0	316.0154895300	288.1118932200	368.5816893600	80.4697961400
01/01/2007 21:00:00	0	295.6291560000	287.7696765900	368.1445723200	80.3748957300
01/01/2007 22:00:00	0	275.23965912300	287.42976057600	367.7103310500	80.28057047400
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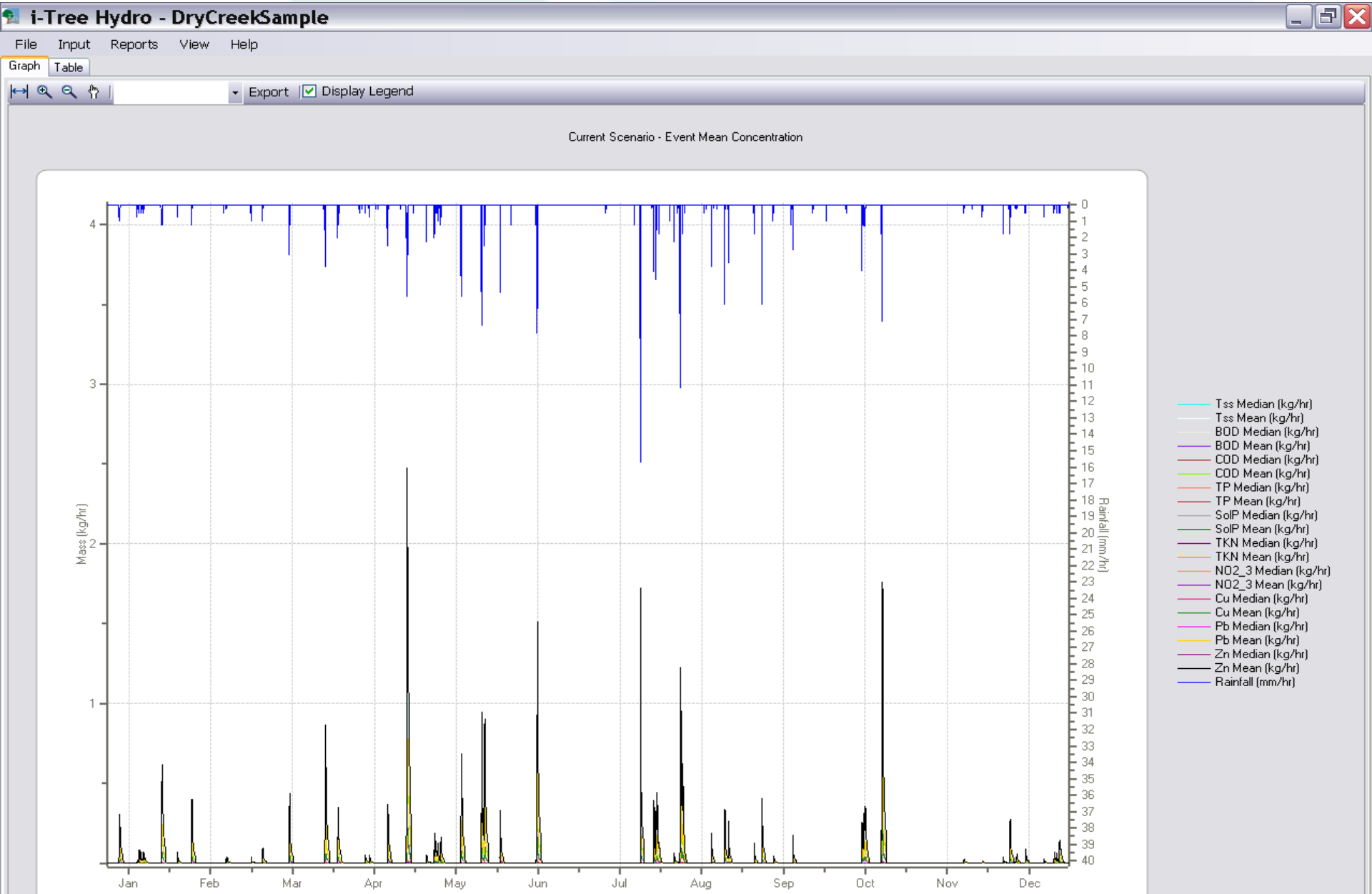
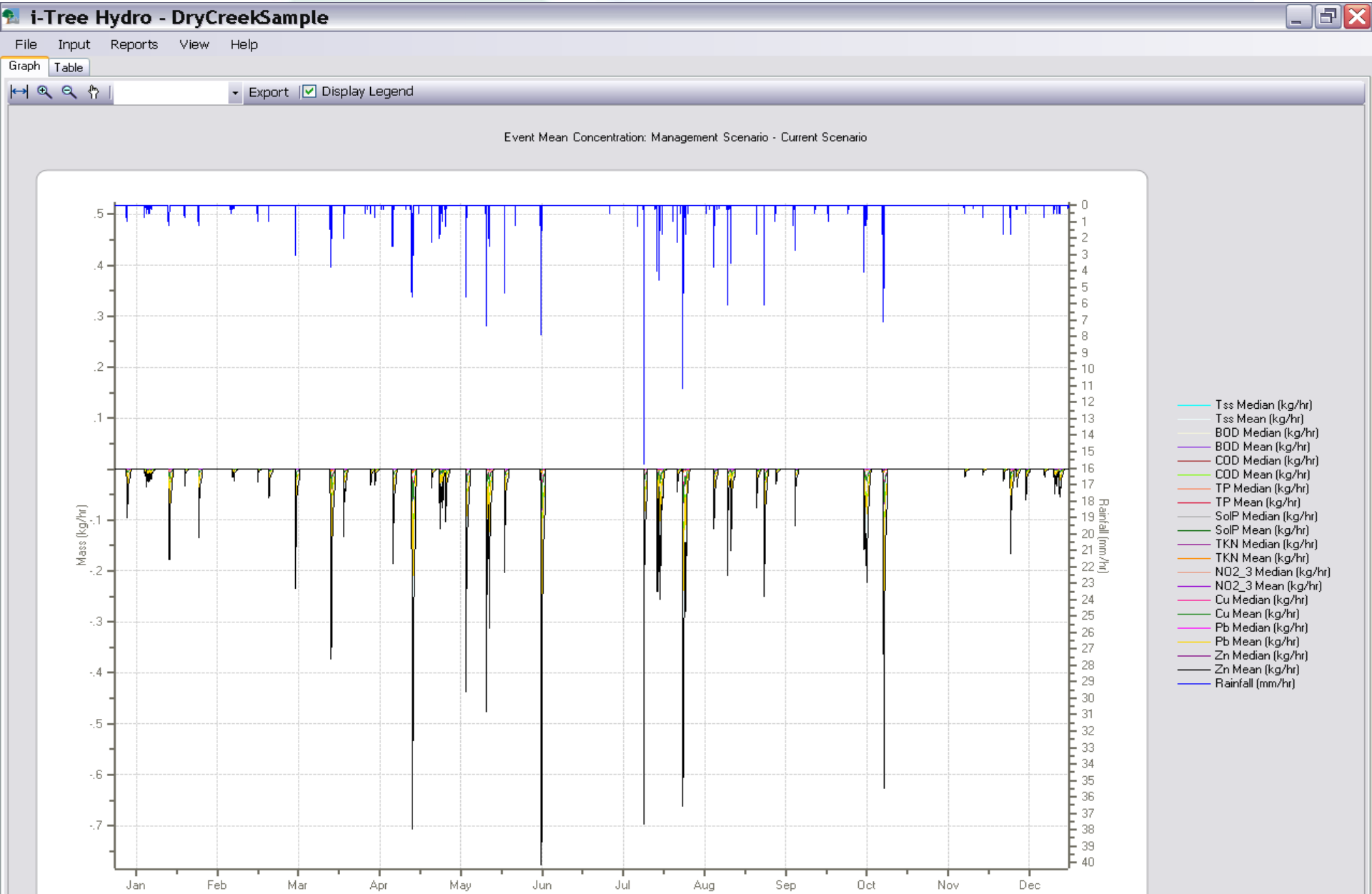
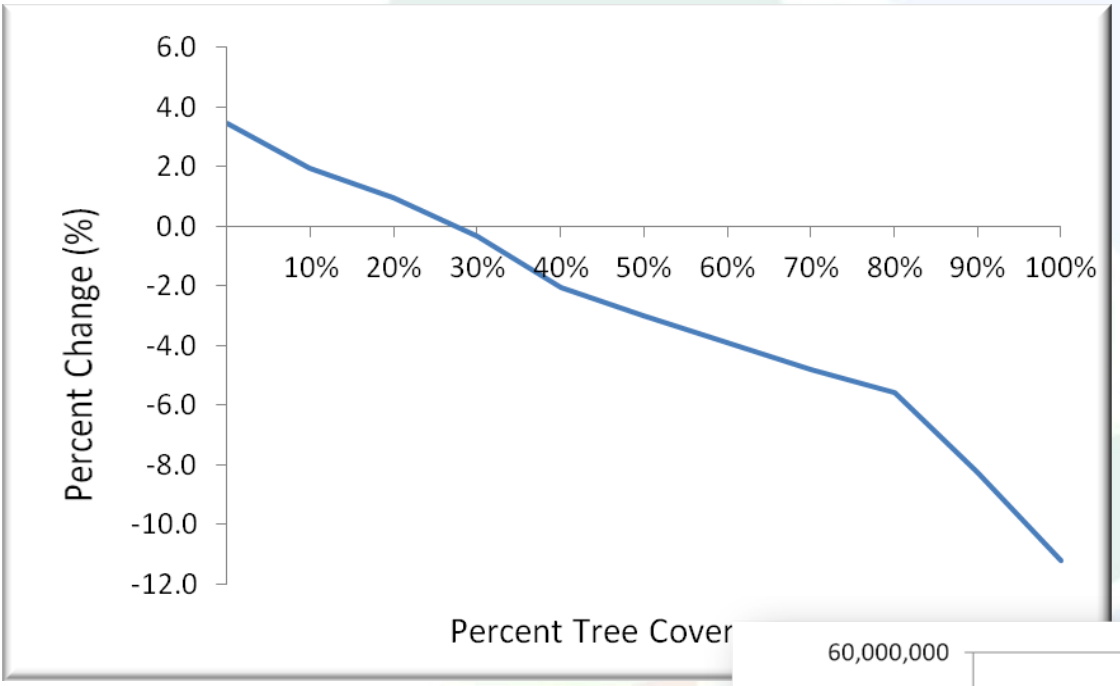
Water Quality (EMC)

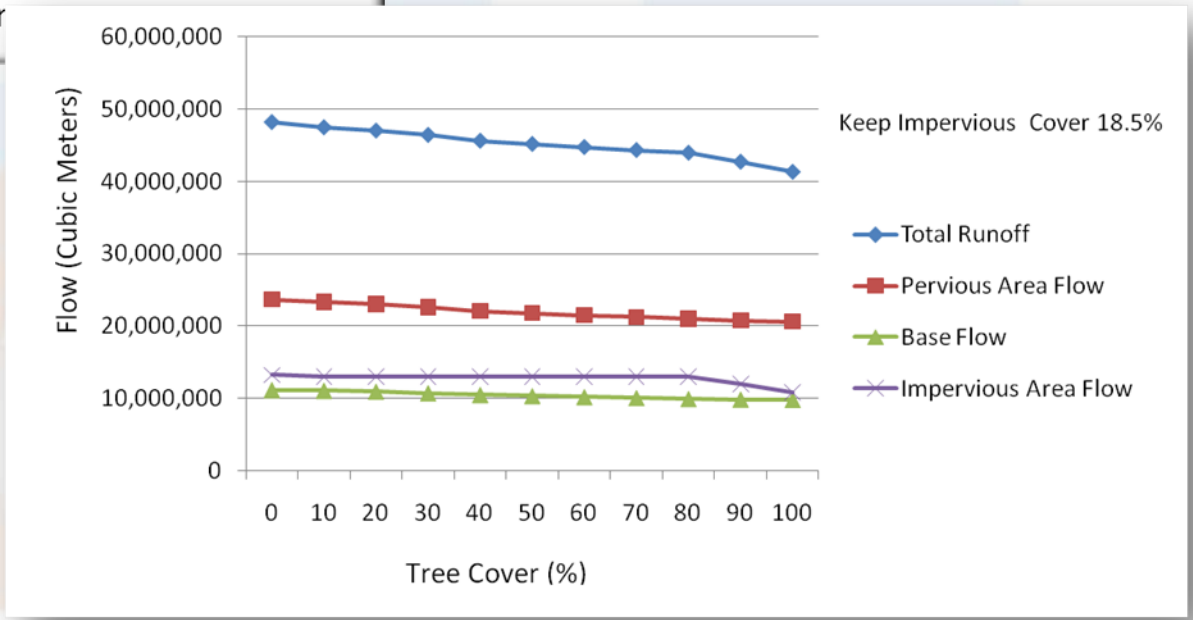


EMC – contrasting scenarios

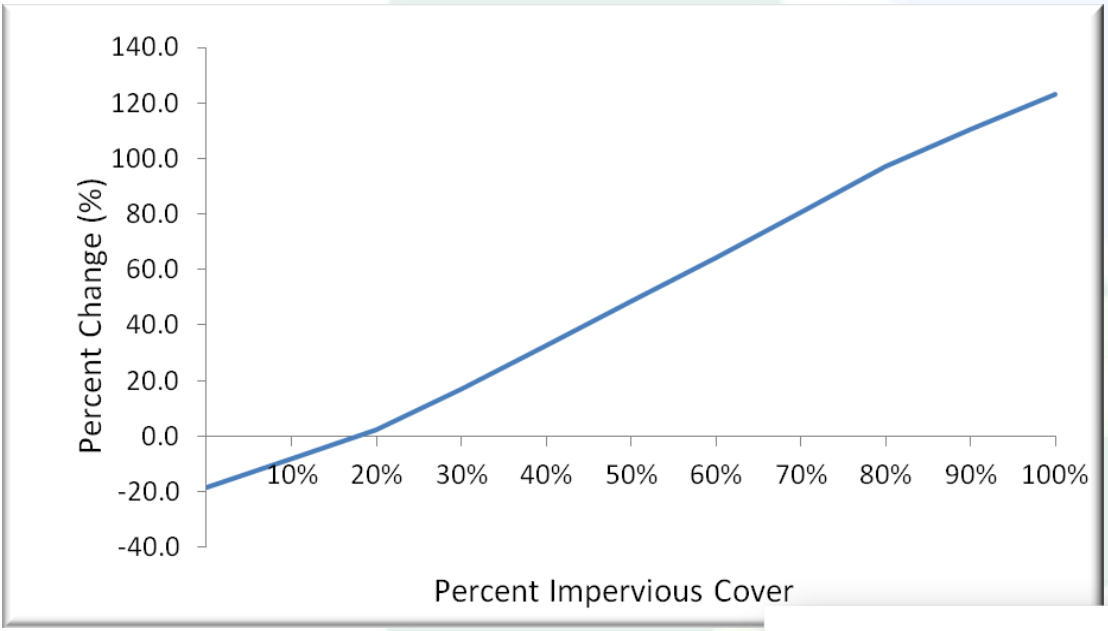


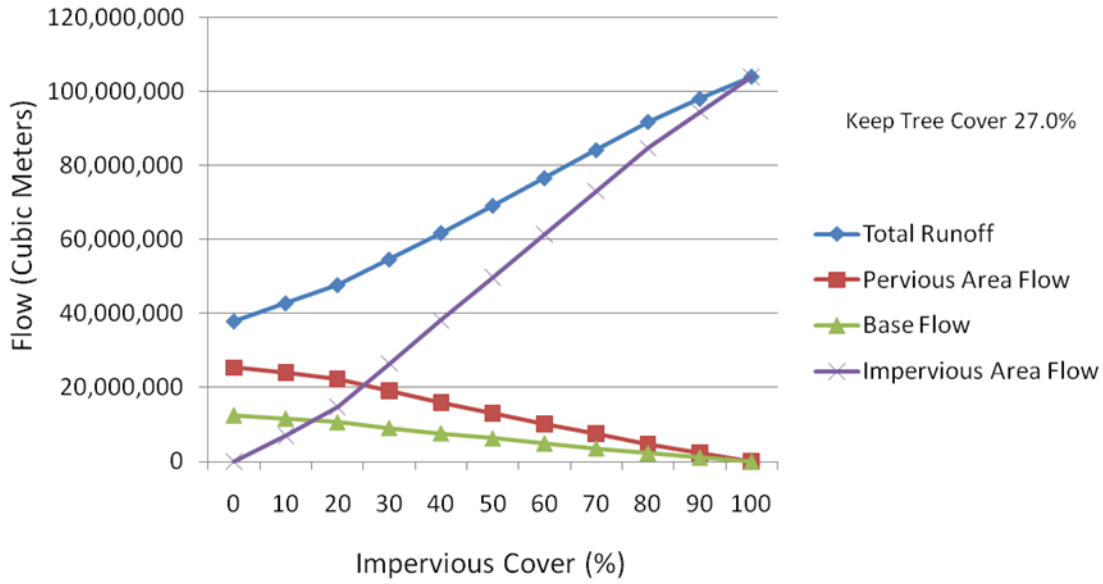
USFS Graphs (Rock Creek)





USFS Graphs (Rock Creek)





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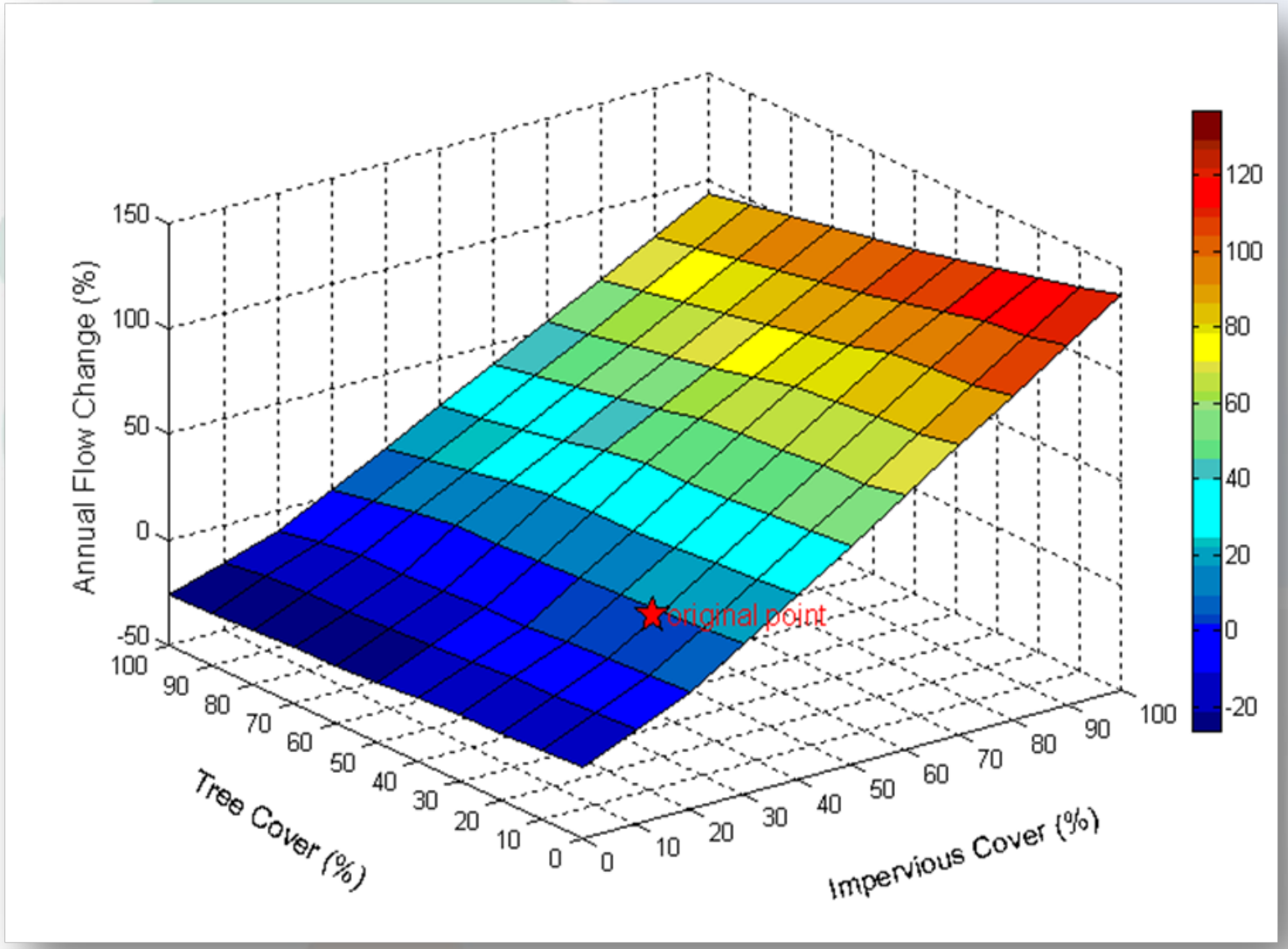

Next versions

- Snow melt routine (completed)
- More fully distributed cells
- NEXRAD precipitation data
- Linking to i-Tree Eco and Design (non-watershed based)

Summary

- **i-Tree is free and available to use**
  - www.itreetools.org
- **Free tech support, manuals, forum**
- **Version 5 will be out in Spring 2012**
  - Improvements to Hydro model
- **Looking for input on types of outputs and analyses desired for Hydro**
  - Released in 2011

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nrs.fs.fed.us/units/urban