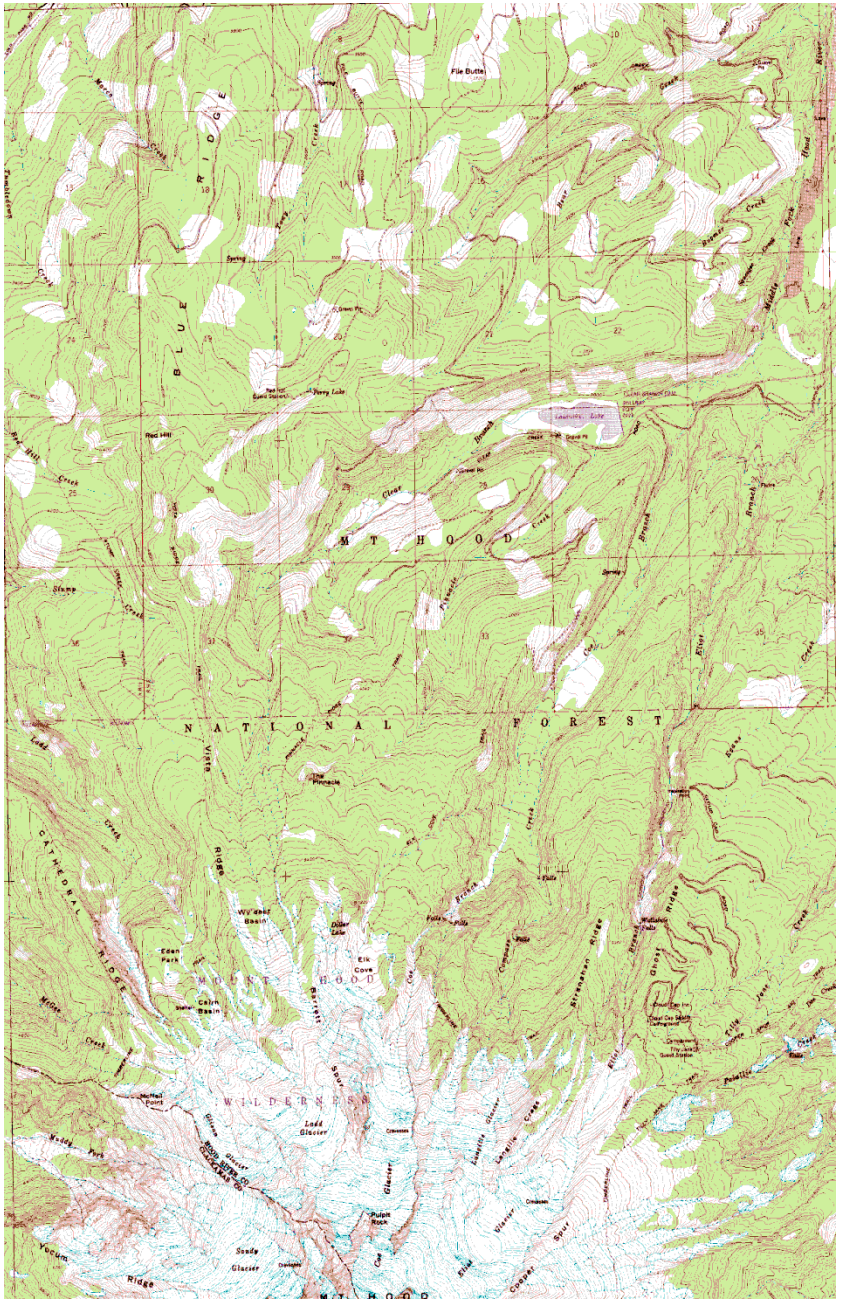
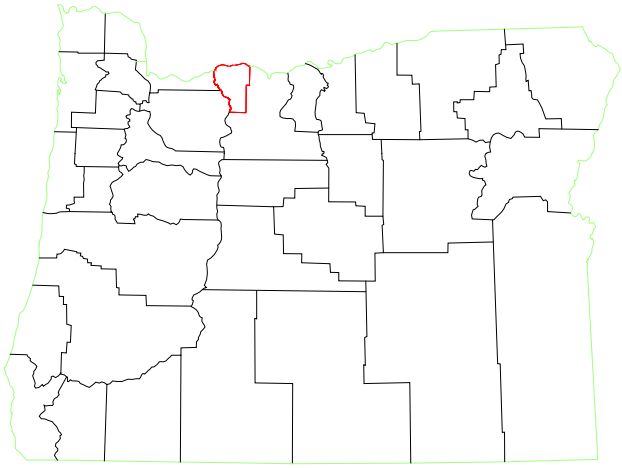
Laurance Lake Reservoir Course Project

Laurance Lake

Laurance Lake

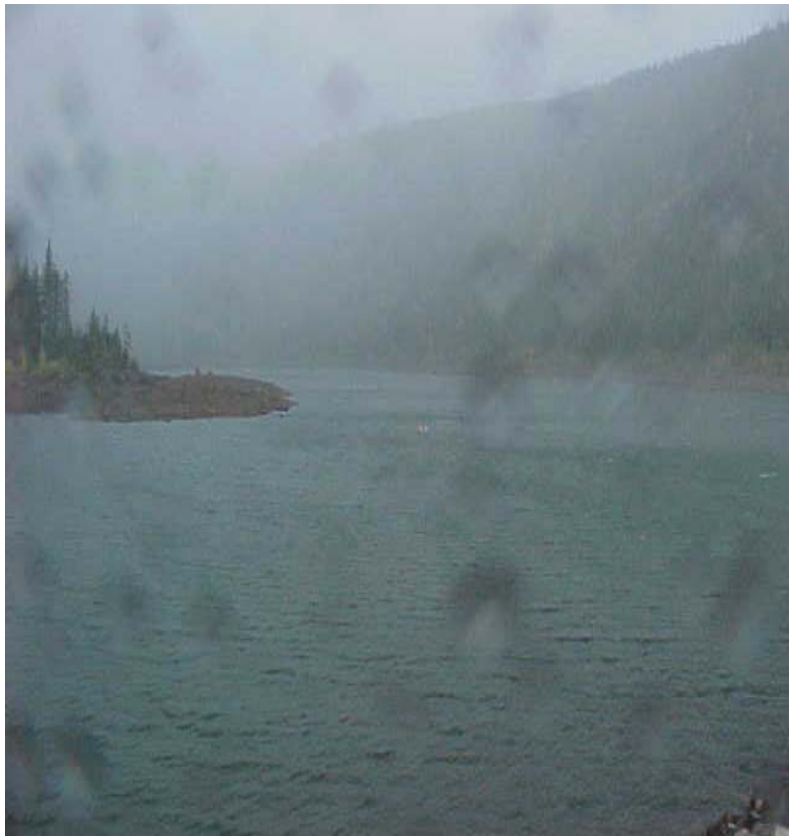


Laurance Lake



POPULATION OF HOOD RIVER COUNTY
Approximately 20,000

Laurance Lake - Irrigation



- Built in 1968 for Irrigation Storage:
  - Provides Irrigation to 2,590 hectares
  - Stores 3,565 acre feet at full pool
  - 48.5 hectares
  - Retrofitted offsite in 1985 for hydro power production

Fish – Laurance Lake

- Fish present:
  - Bull trout (*Salvelinus confluentus)*
    - Threatened
  - Rainbow trout (*Oncorhynchus mykiss)*
    - Wild rainbow
    - Early 70’s stocked with winter steelhead
    - Stocked annually since 1978 with catchable rainbows
  - Cutthroat trout (*Oncorhynchus clarkii)*
  - Small mouth bass
    - Illegally introduced

Recreation

Recreation

- Camping
- Fishing
- Boating (non-motorized only)
- Picnicking

Clean Water Act

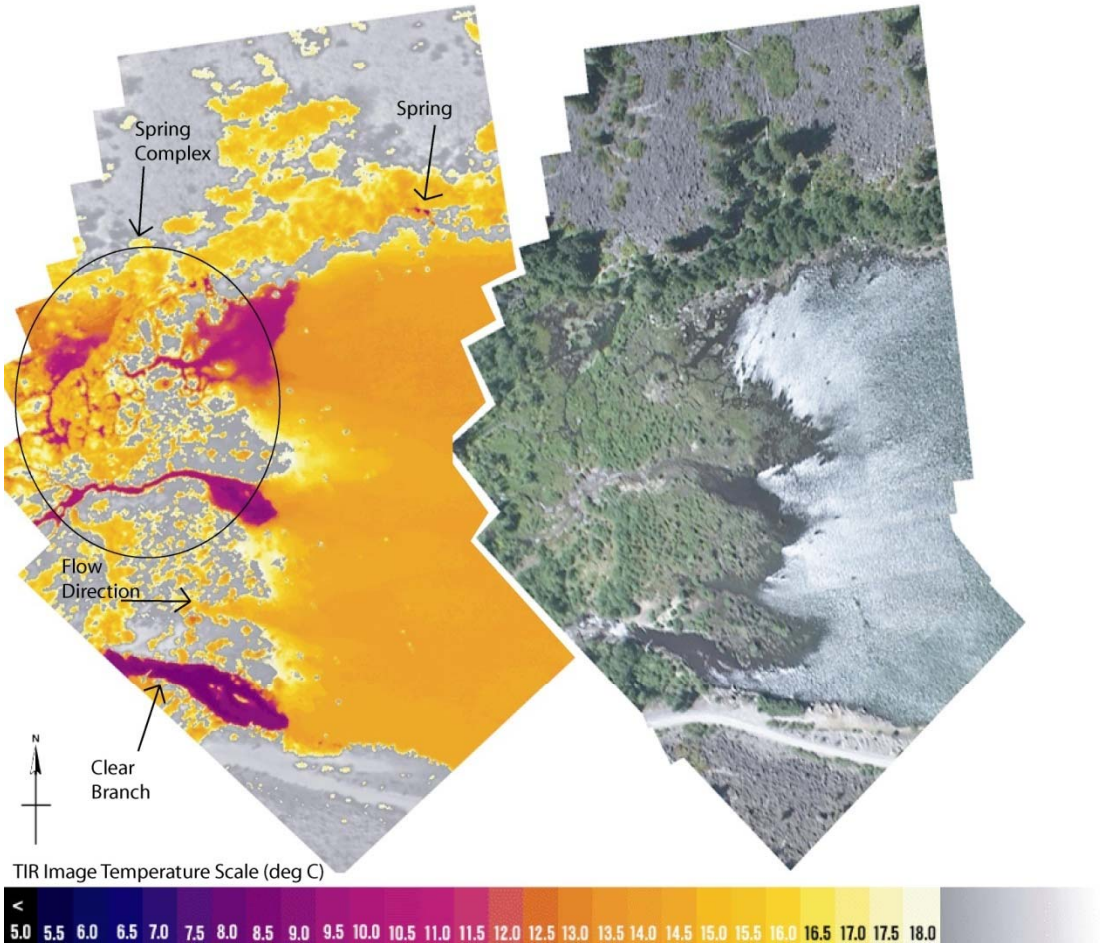
Temperature

- Laurance Lake continually feeds water to MFID from the bottom of the reservoir.
- Cold water is depleted by August or September and the temperature in Clear Branch below the dam is raised beyond the State's standard.
    - 10°C

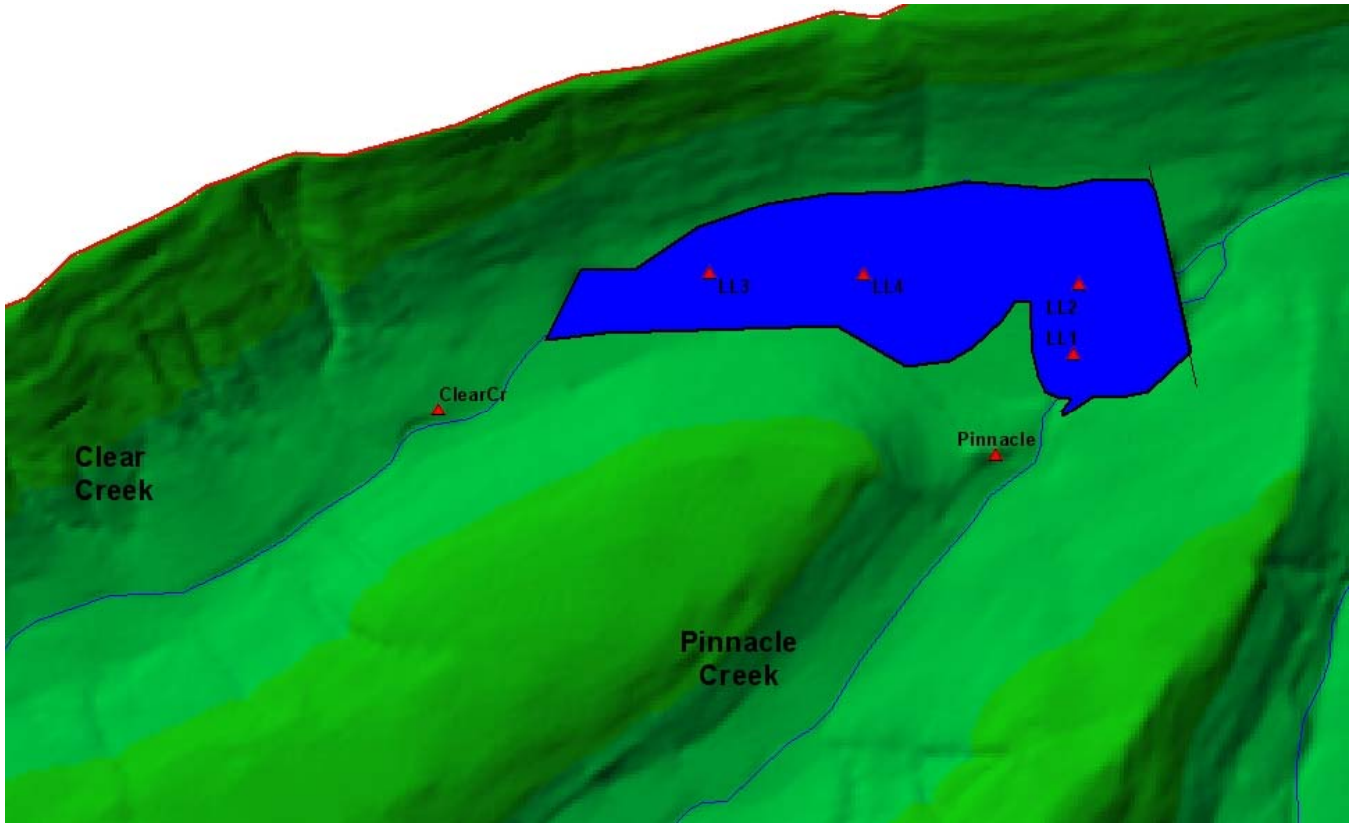
Endangered Species Act
Bull trout

- Bull trout (*Salvelinus confluentus)*
- Critical habitat
  - Clear Branch
  - Pinnacle Creek
  - Laurance Lake ?

Infrared Flight (FLIR)



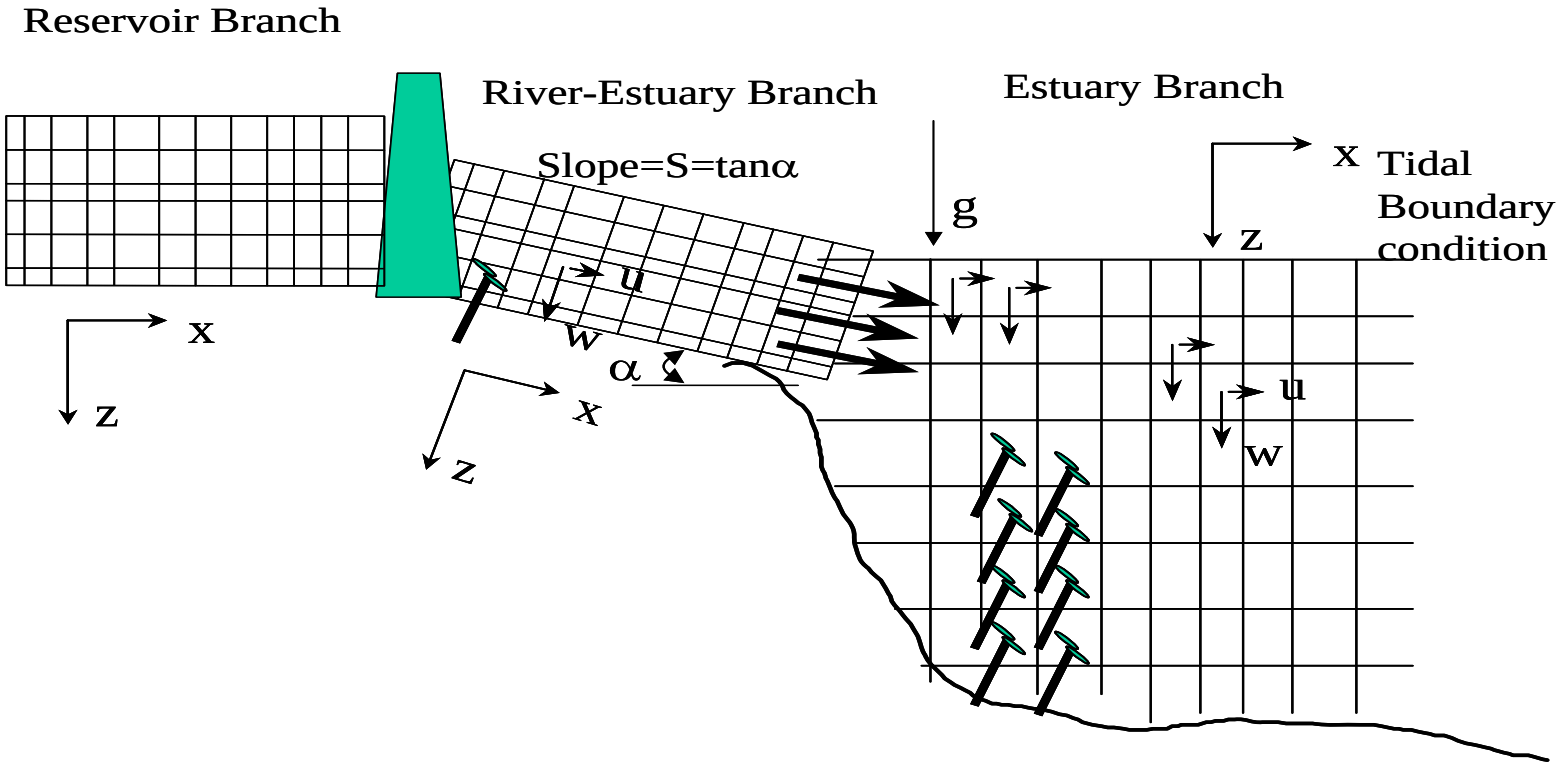
Monitoring Sites



Site ID	Description
CC	Clear Creek above Reservoir
PC	Pinnacle Creek above Reservoir
LL1	at Pinnacle Creek Branch
LL2	near dam
LL3	, middle
LL4	near upstream end

Model Choice: CE-QUAL-W2 River Basin Model Version 3

2-D (vertical-longitudinal), unsteady finite difference model for hydrodynamics and water quality for rivers, reservoirs, lakes, estuaries supported by the Waterways Experiment Station, Vicksburg, MS, USA

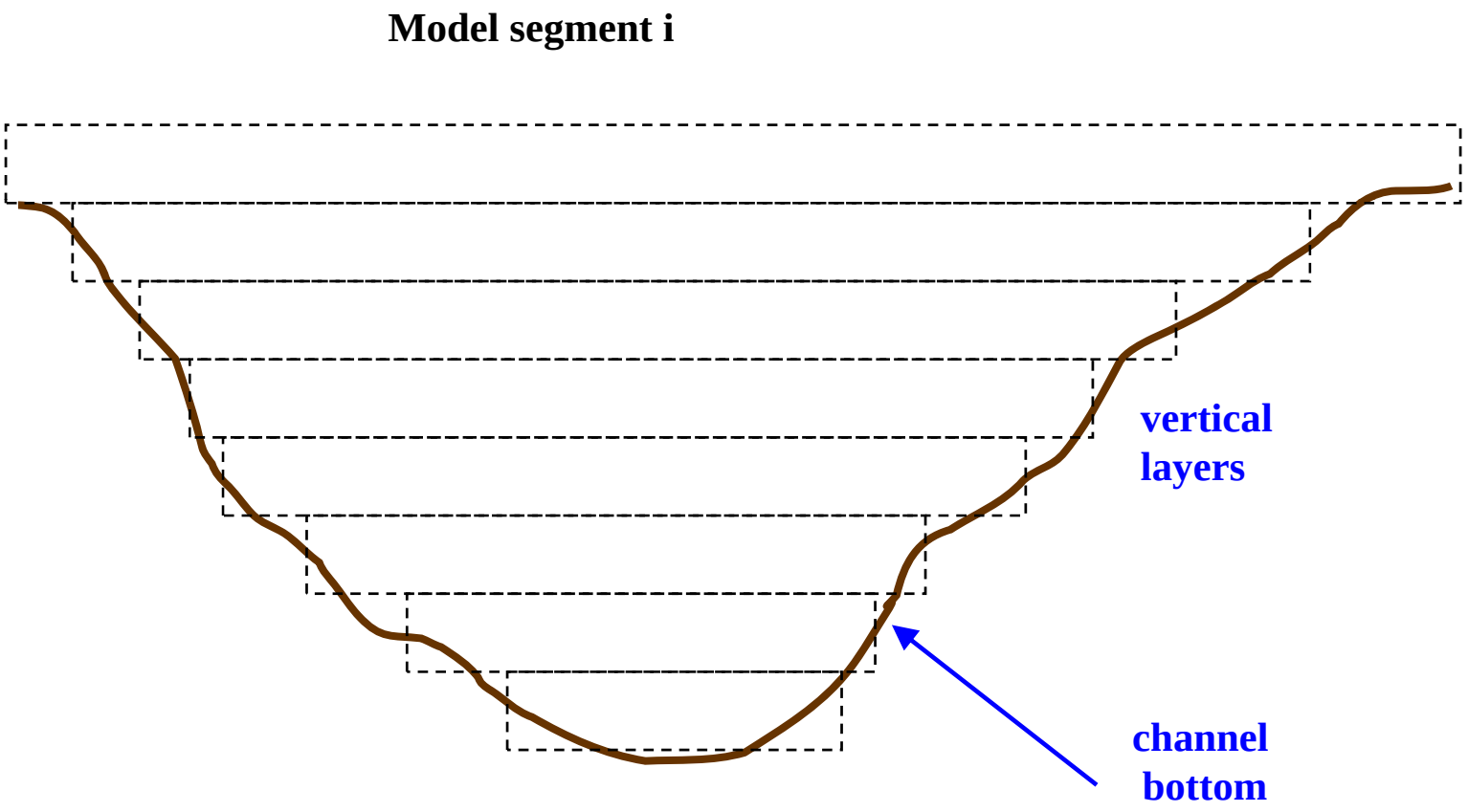


CE-QUAL-W2 Version 3 Water Quality Modeling Capabilities

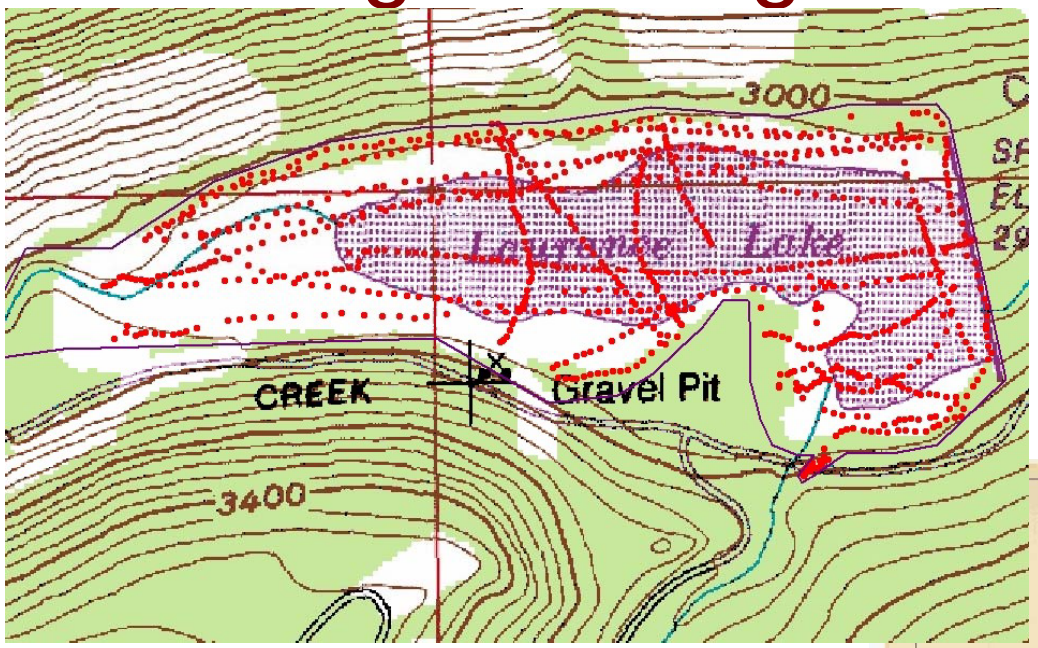
- Temperature, velocity (U, W), Water surface elevation
- TDS
- # Arbitrary Constituents (such as bacteria, tracer, water age, toxics)
- # Inorganic suspended solids groups
- labile and refractory dissolved organic matter groups
- Dissolved and particulate silica
- Total inorganic carbon
- Labile/refractory particulate organic matter fractions
- # different algal groups
- # different periphyton groups
- NH_4-N
- PO_4-P
- NO_3-N+NO_2-N
- Iron
- # CBOD groups
- Alkalinity
- pH and carbonate system
- Sediment Model (0 order, 1^{st} order)

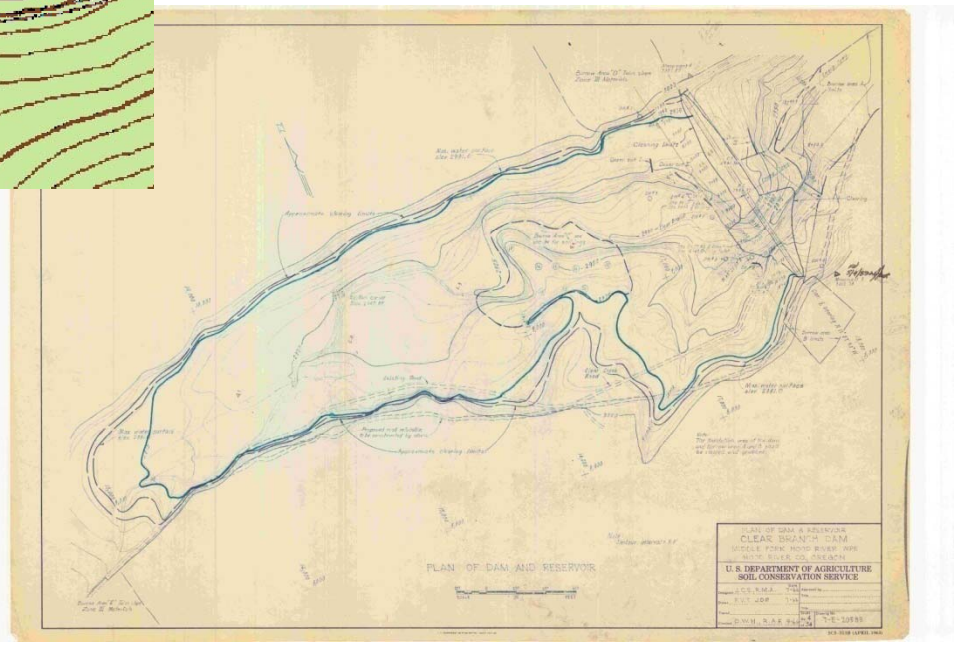
CE-QUAL-W2 Version 3.5

River Basin Reservoir Model 2-D longitudinal-vertical

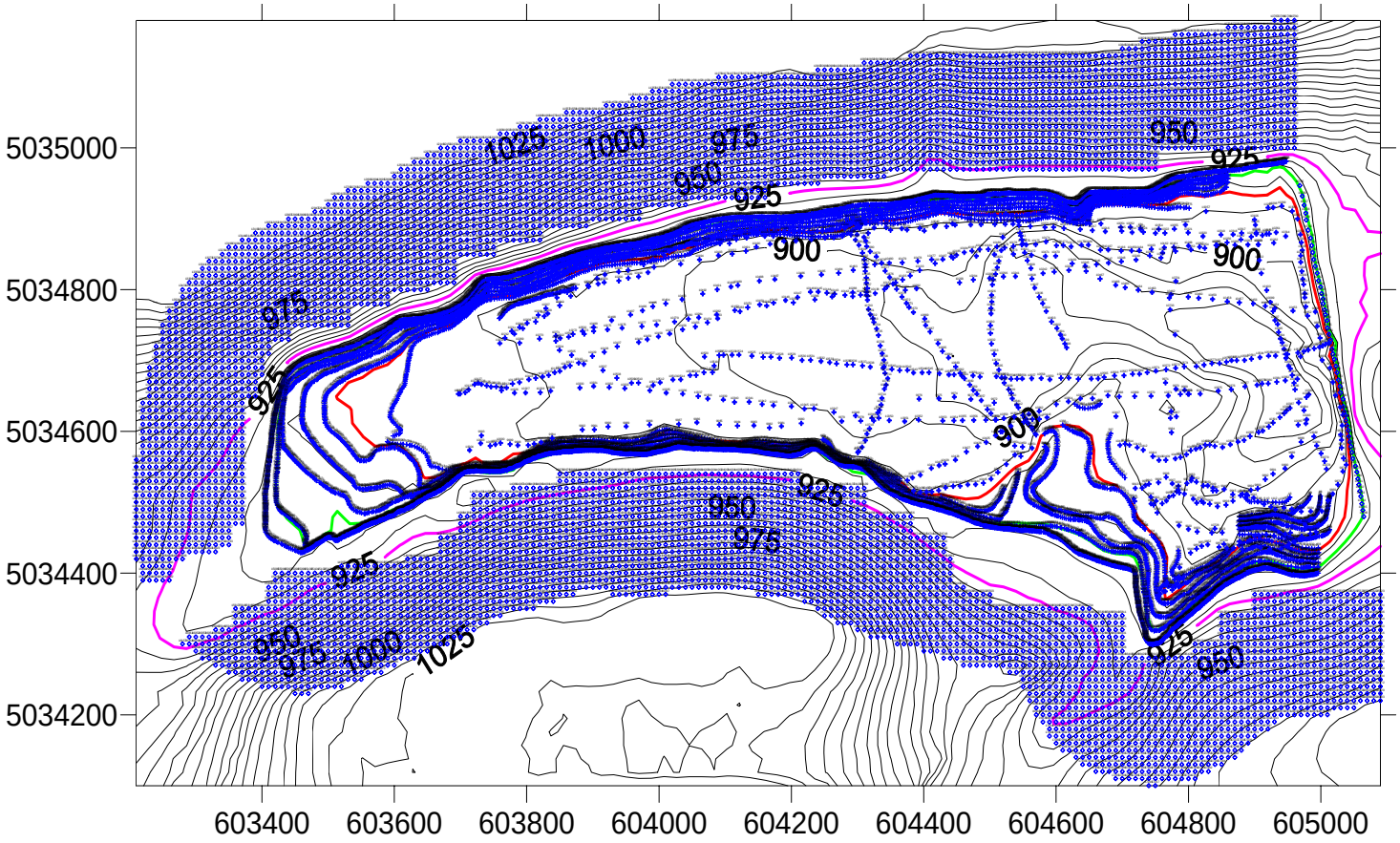


Model Bathymetry – developed from soundings and digitized drawing



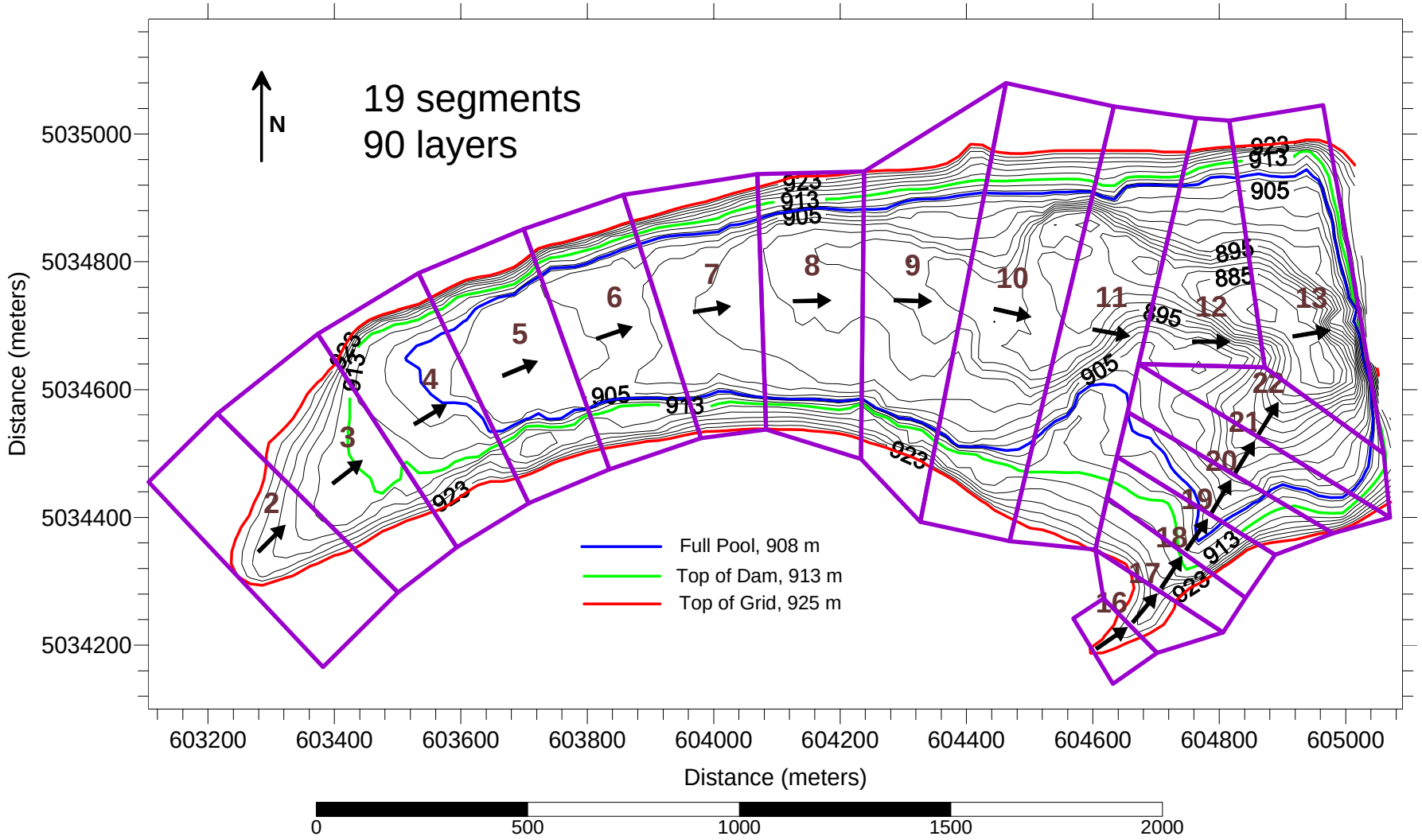


Model Bathymetry



Model Bathymetry

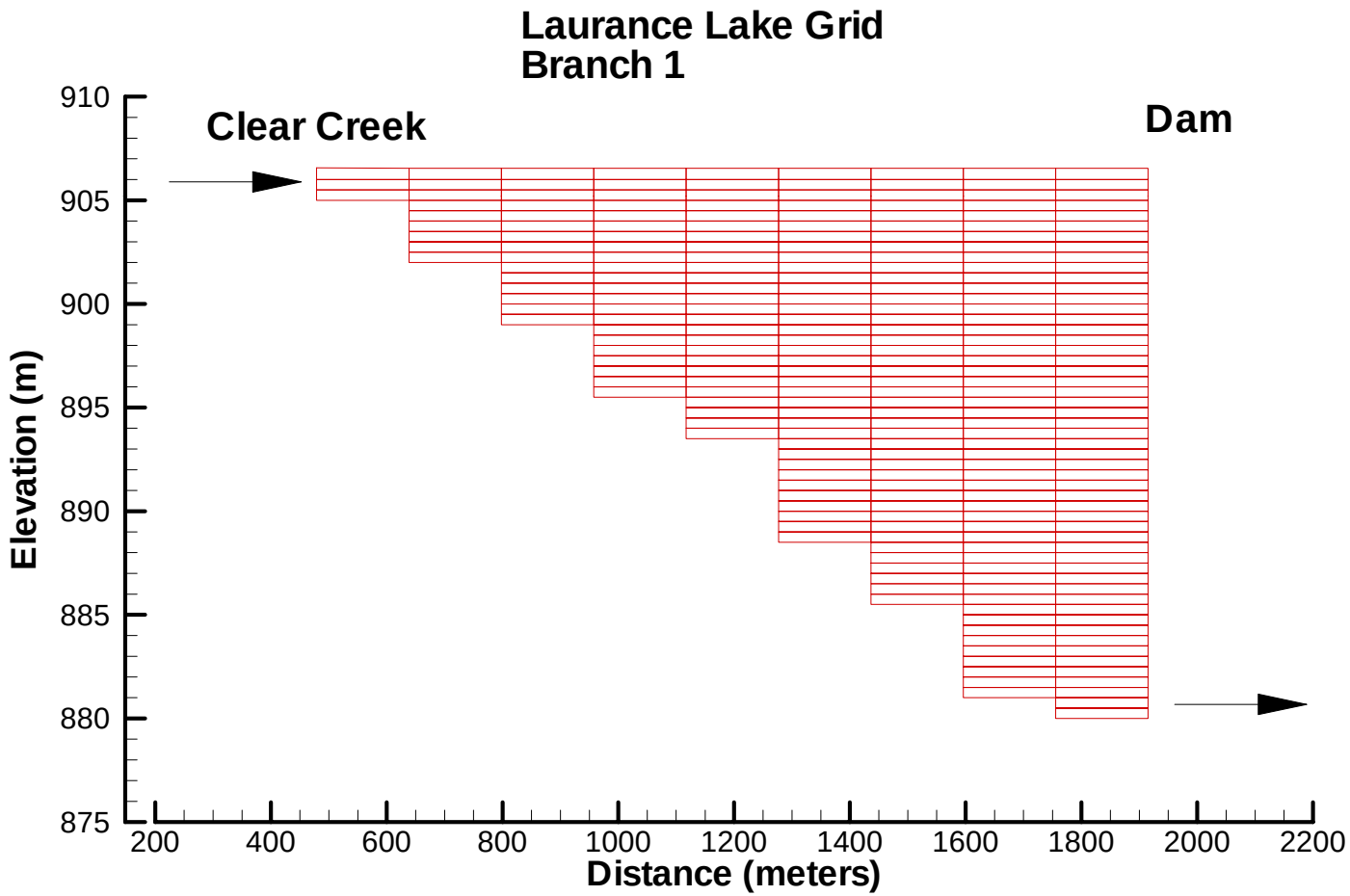
Segment Lengths
Branch 1 : 160 meters
Branch 2 : 71 meters



Model Bathymetry

19 segments
90 layers

0.5 meter layer thickness



Meteorological Inputs Required by Model

- Air Temperature
- Dew Point Temperature
- Wind Direction
- Wind Speed
- Cloud Cover
- Short Wave Solar Radiation

Meteorological Data

- Laurance Lake

May 1, 2003 thru

September 8, 2003

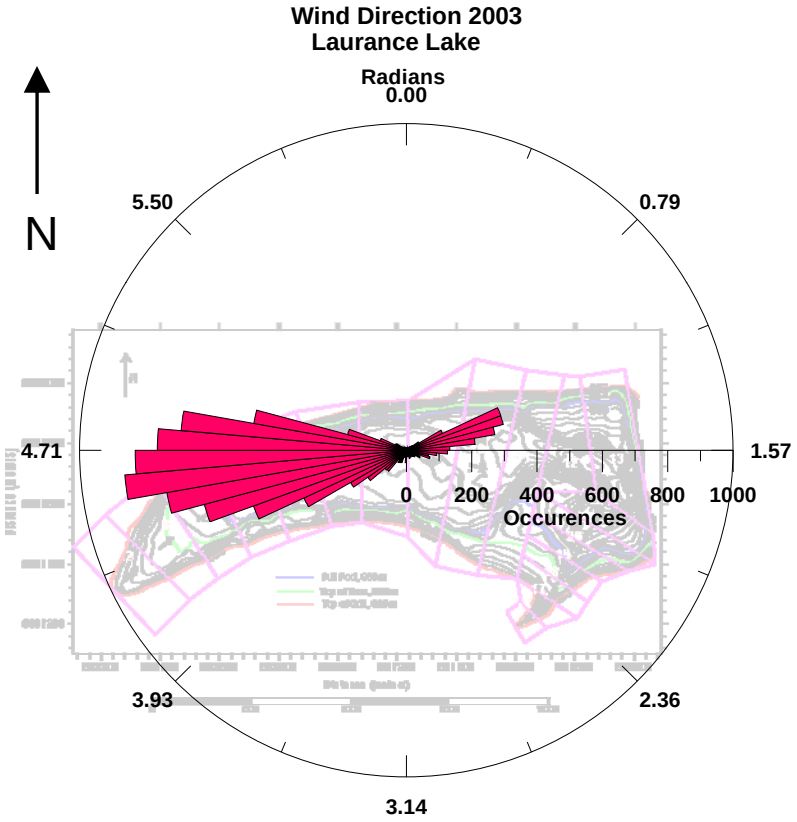
- Parkdale

September 9, 2003 thru

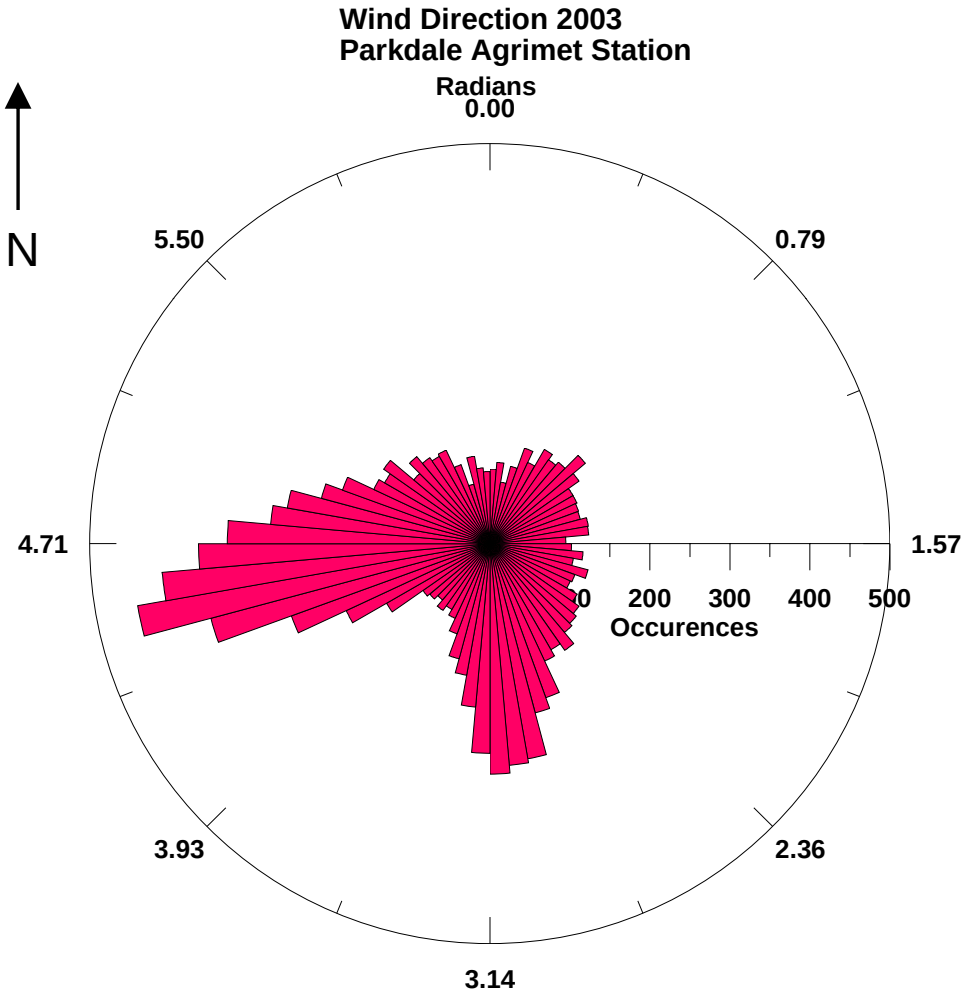
April 30, 2004

(wind starting 8/6/03)

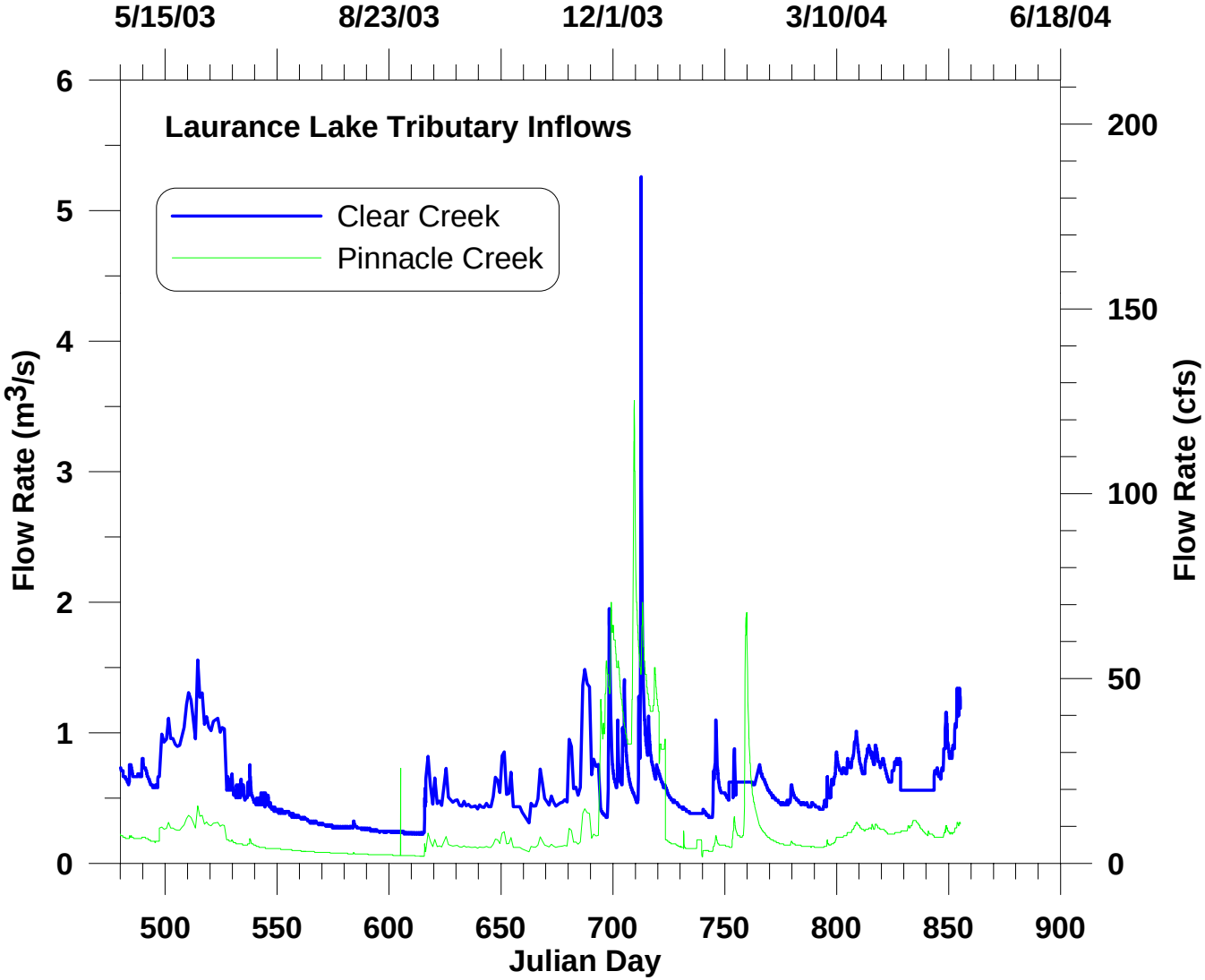
Meteorological Input - Wind Direction



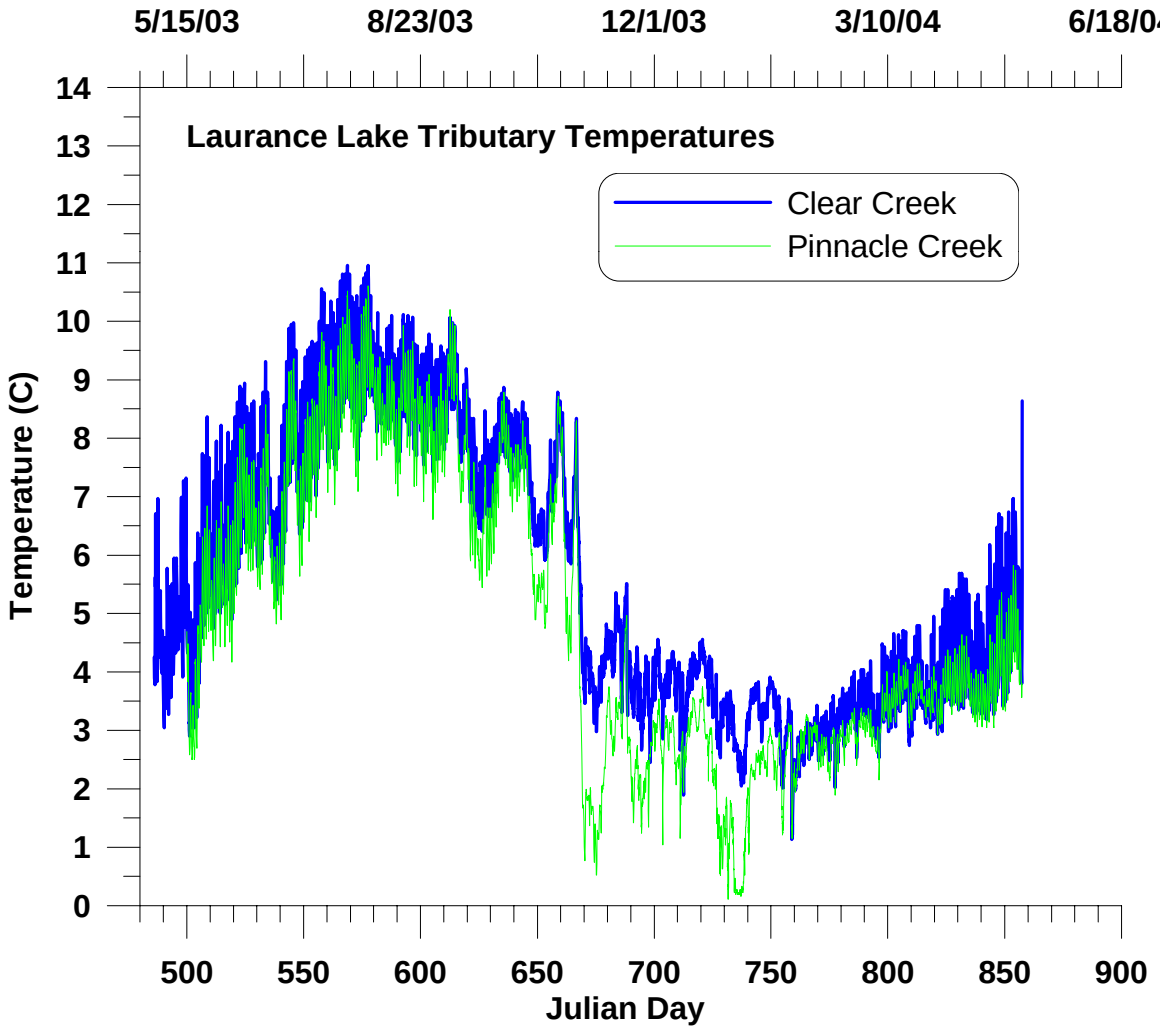
Meteorological Input - Wind Direction



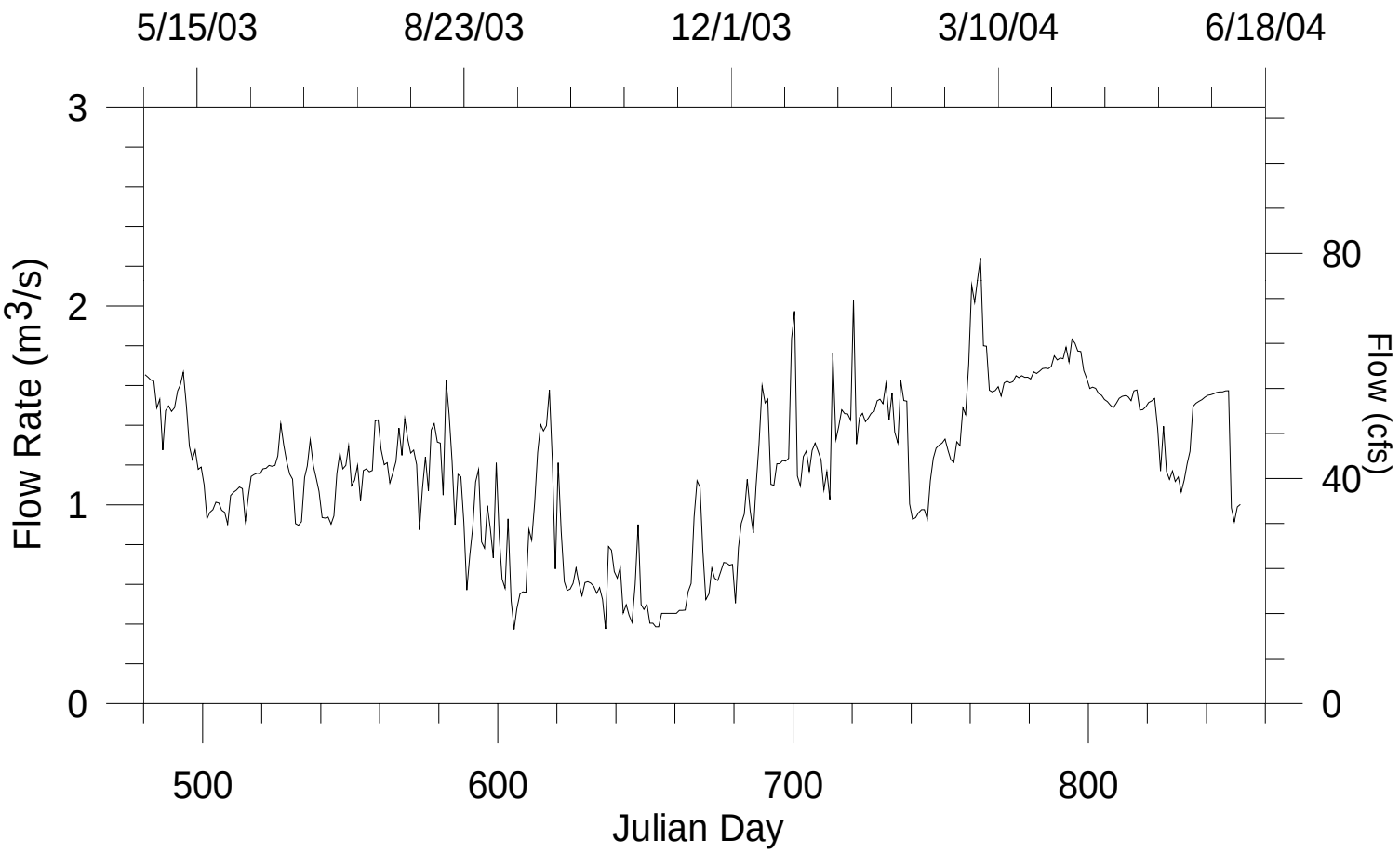
Tributary Flow Rates
Developed from continuous data, regressions



Tributary Temperatures
Developed from Continuous data



Lake Outflow

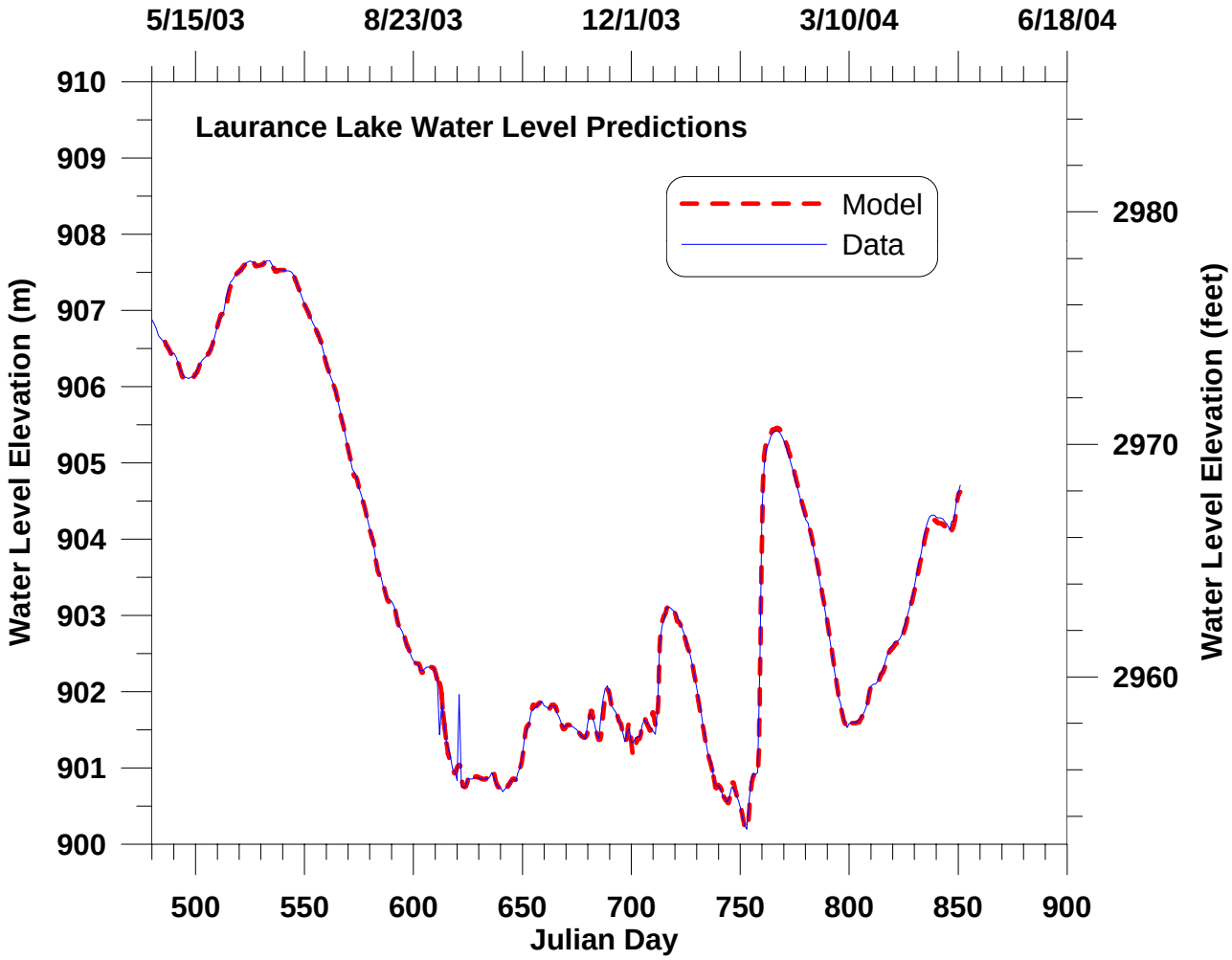


Model Calibration

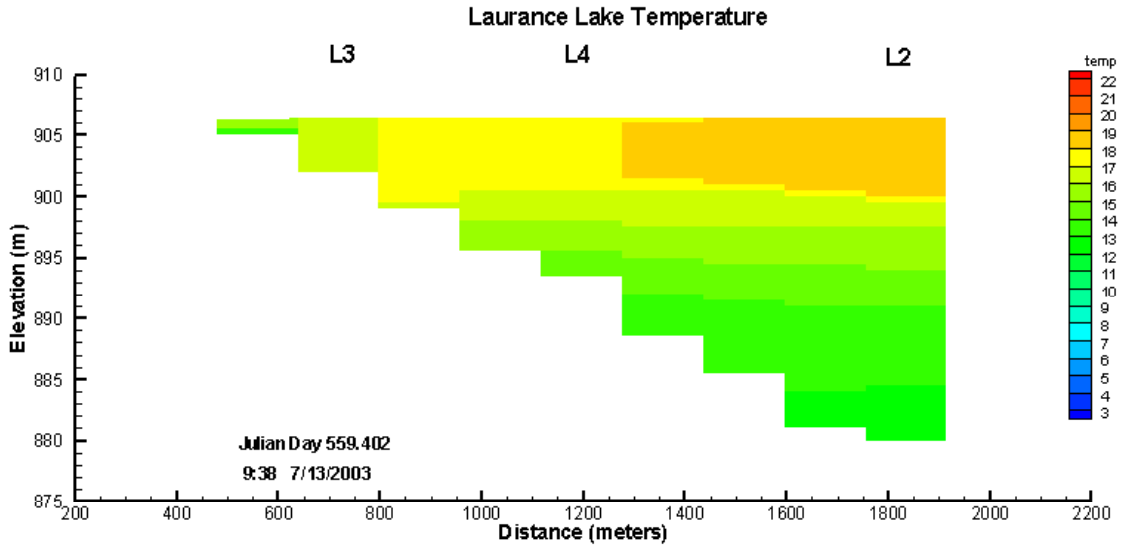
- Time Period: May 1, 2003 thru April 30,2004
- Water Level Data
- Temperature Measurements

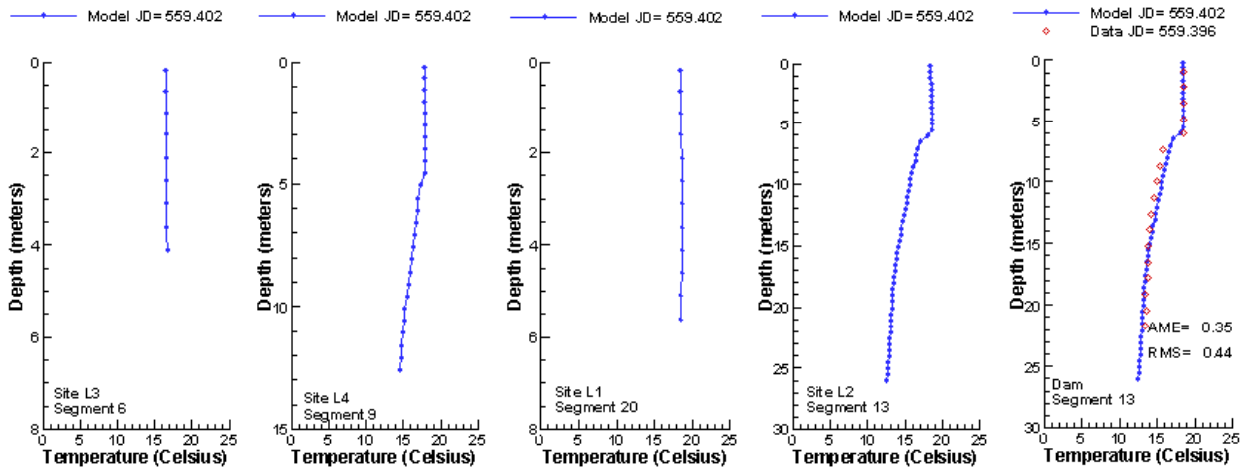
  - vertical profiles in lake

Water Level Predictions



Temperature Calibration





Project Object

- Calibrate Model For Water Level and Temperature
- Develop management alternative to reduce temperature outflows