DYNLET

A model for one-dimensional fluid flow from the ocean through a tidal inlet, into back bay regions, and up tributaries

- **Theory**
- **Interface**
- **Data requirements**
- **Grid generation**
- **Visualization**

DYNLET MODEL EQUATIONS

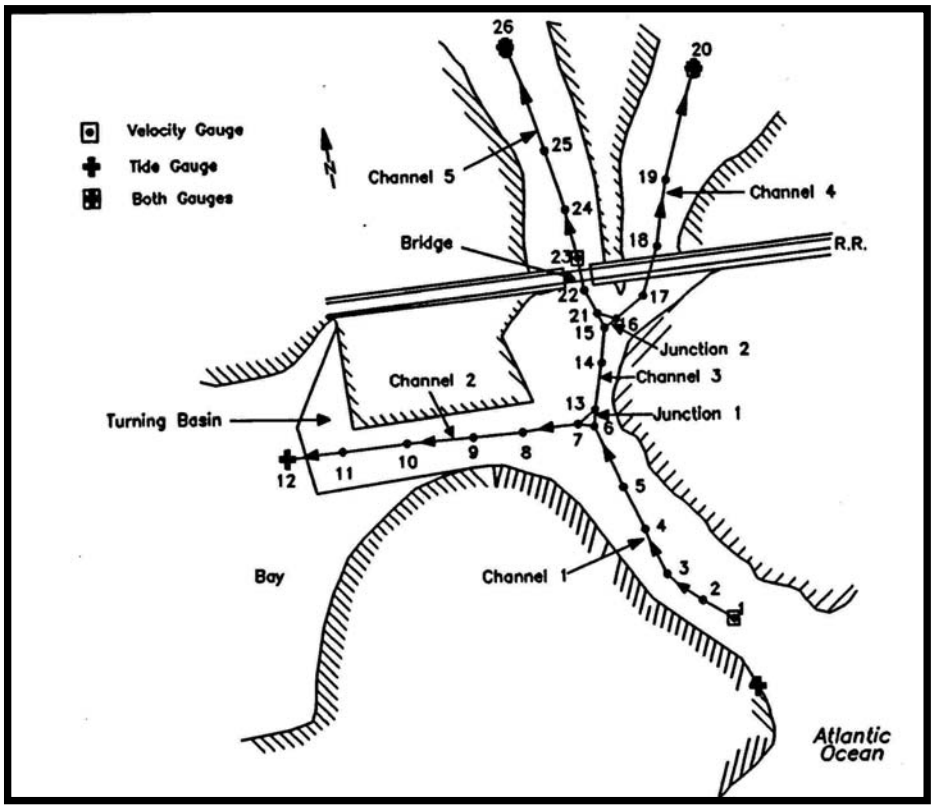
$$\frac{\partial \mathbf{Q}}{\partial \mathbf{y}} + \frac{\partial \eta}{\partial \mathbf{t}} - \mathbf{q} = \mathbf{0}$$

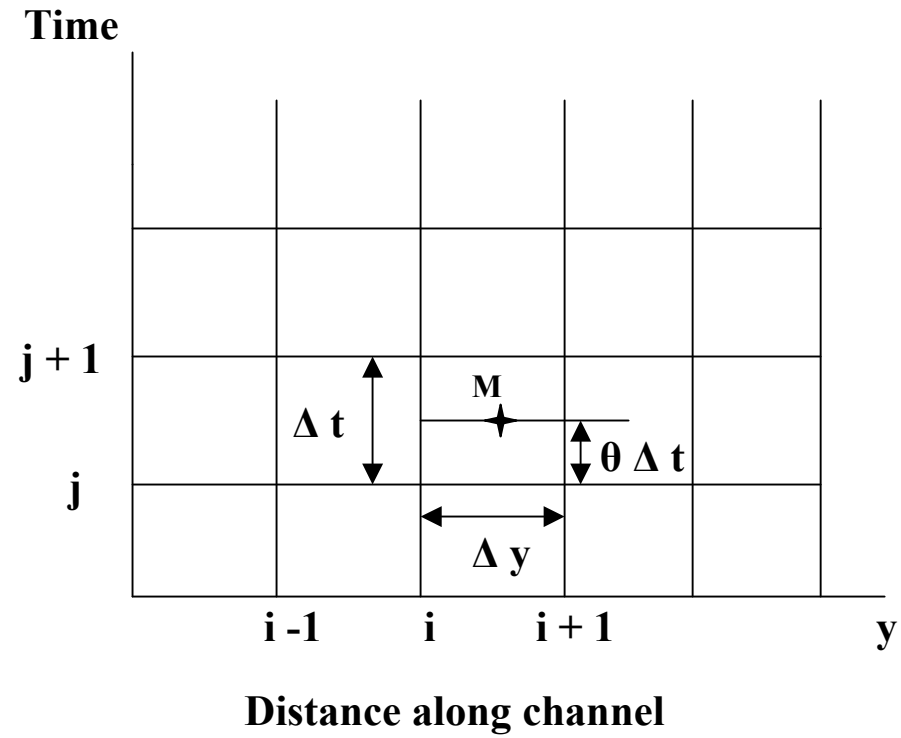
$$\frac{\partial \mathbf{Q}}{\partial \mathbf{t}} + \frac{\partial}{\partial \mathbf{y}}\left[\frac{\mathbf{Q}^2}{\eta}\right] = -\mathbf{g}\eta\mathbf{S}_\mathbf{f} + \mathbf{g}\mathbf{B}\boldsymbol{\tau}_\mathbf{s} - \mathbf{g}\eta\mathbf{S}_\mathbf{e} - \mathbf{g}\eta\frac{\partial \mathbf{z}}{\partial \mathbf{y}}$$

Solution

- **Finite Difference - Implicit**
- **Conservation of mass satisfied at junctions**

Grid Notation





Theta (θ) = 0 Explicit

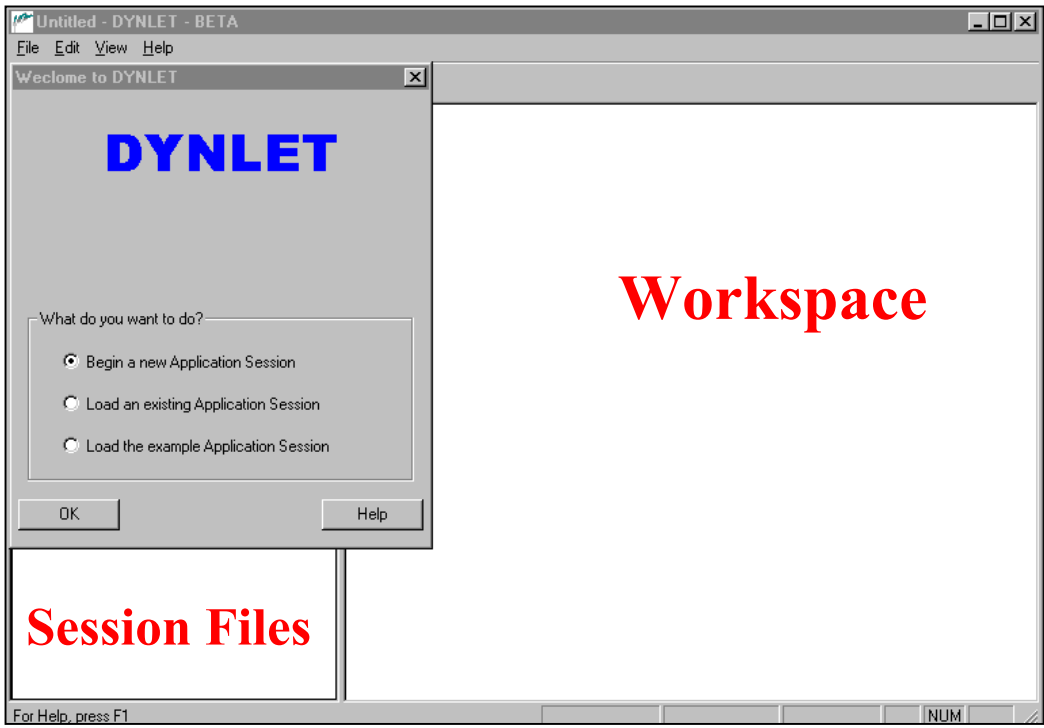
$0.5 < \theta \leq 1.0$ Implicit

Parameterization

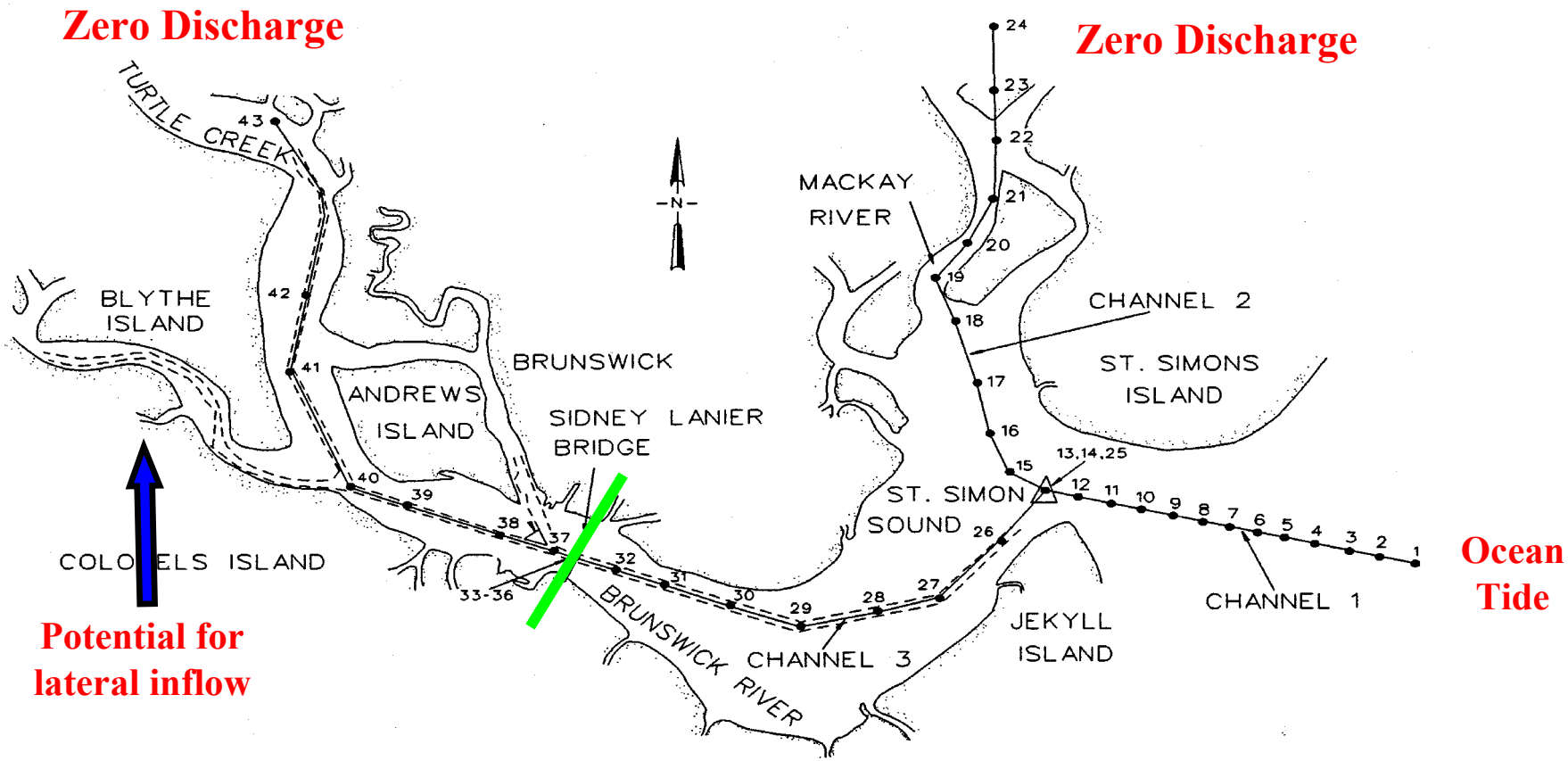
- **Friction - Mannings formulation**
- **Surface Stress -** $$\tau_s = \frac{C_D}{2} \rho_a V_w^2$$
- **Transition Losses - K_e**
- **Boundary Conditions :**
  - **Elevation and / or Discharge**
  - **Weir , rating curve , uniform flux**
  - **Sine curve , Keulegan K**

Welcome Screen

- Dual window environment
- Begin new or load existing application sessions
- Help - "Getting Started"



Example Grid

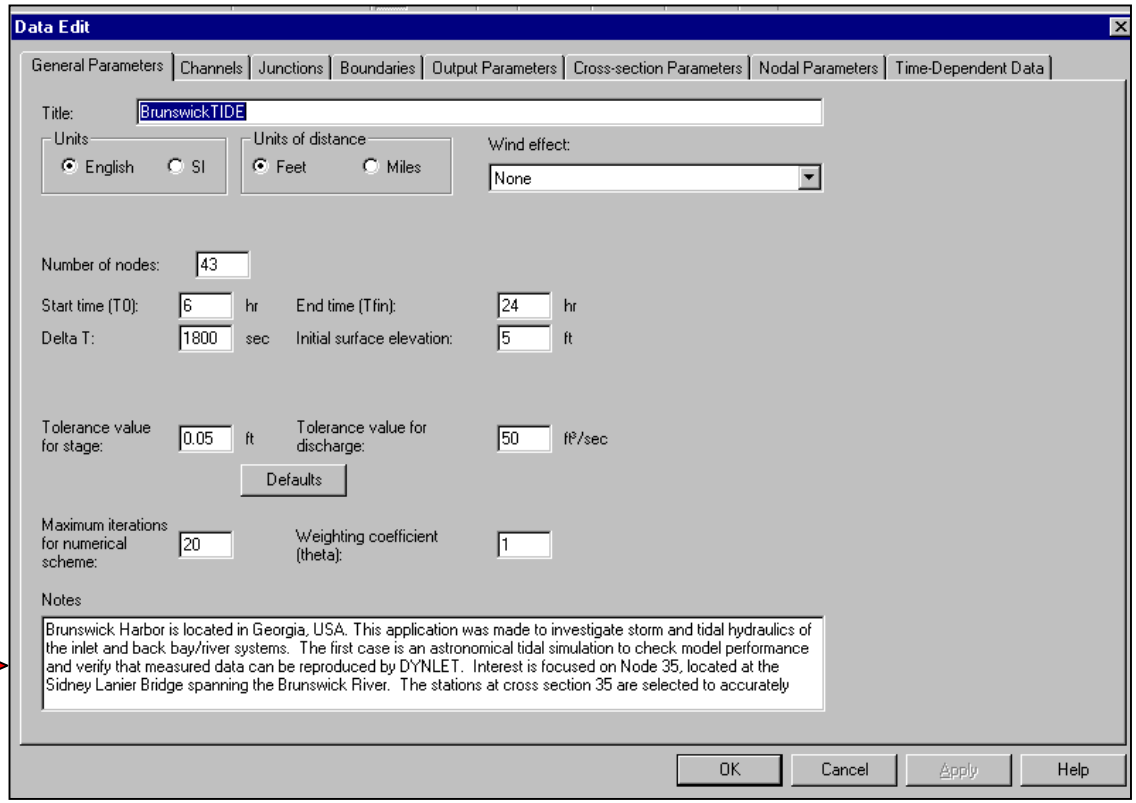


Data Edit Menu

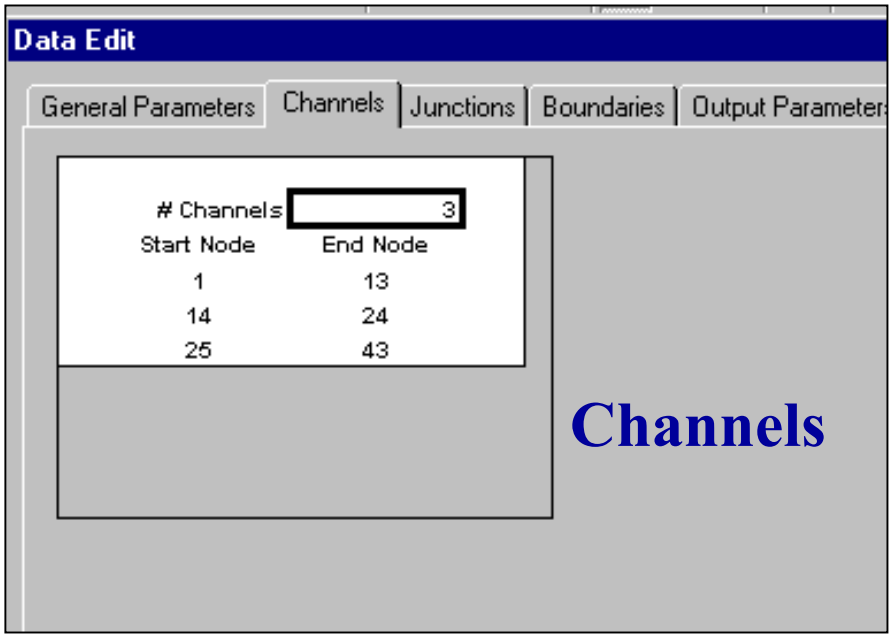
Model Parameters

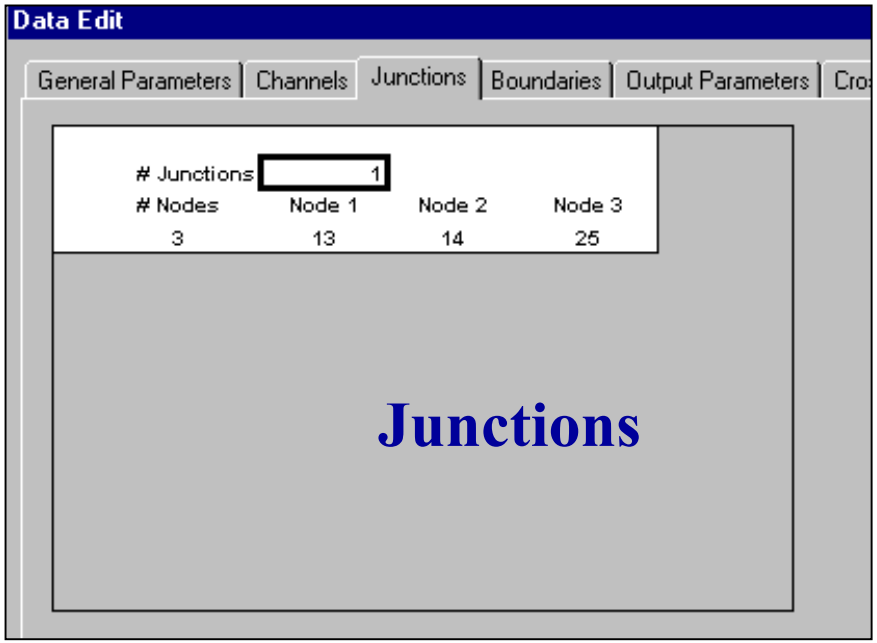
nodes
start/end time
time step
tolerances
wind effects

Simulation meta data



Channels & Junctions

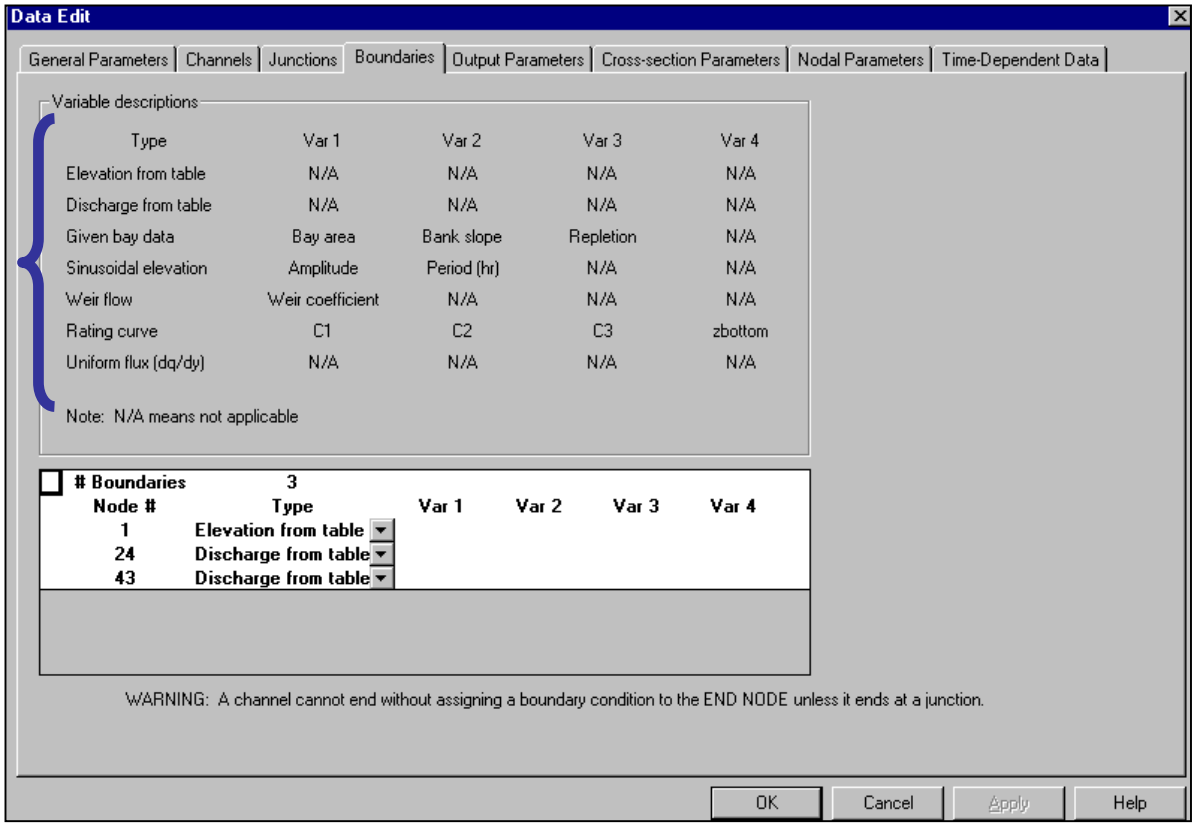




Boundary Conditions

Options

Water Elevation Table
Discharge Table
Bay Parameters
Sinusoidal - a , T
Weir Flow
Rating Curve
Uniform Flux



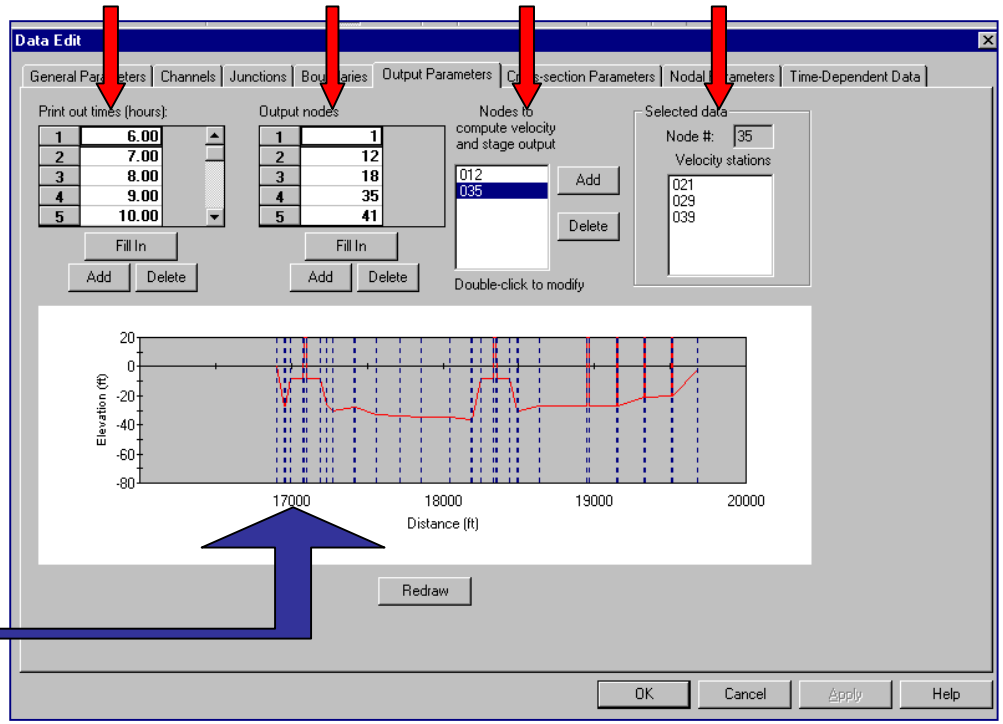
Options for Model Output

Printout - all results save at specified times

Output Nodes - Stations for saving η , Q , and X-sectional data

Velocity - nodes and X-sectional stations

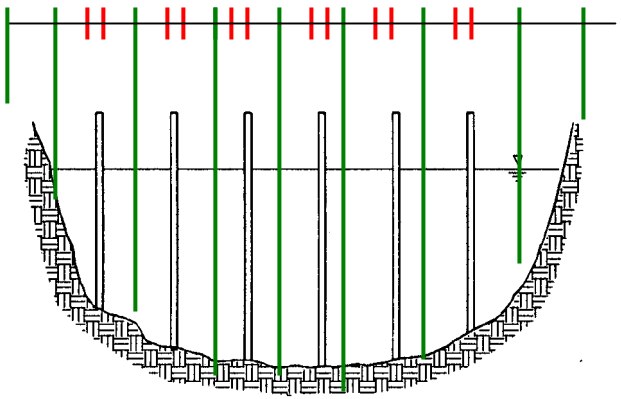
Hi-Lighted station appears on plot



Cross-section Discretization

Representation of structures

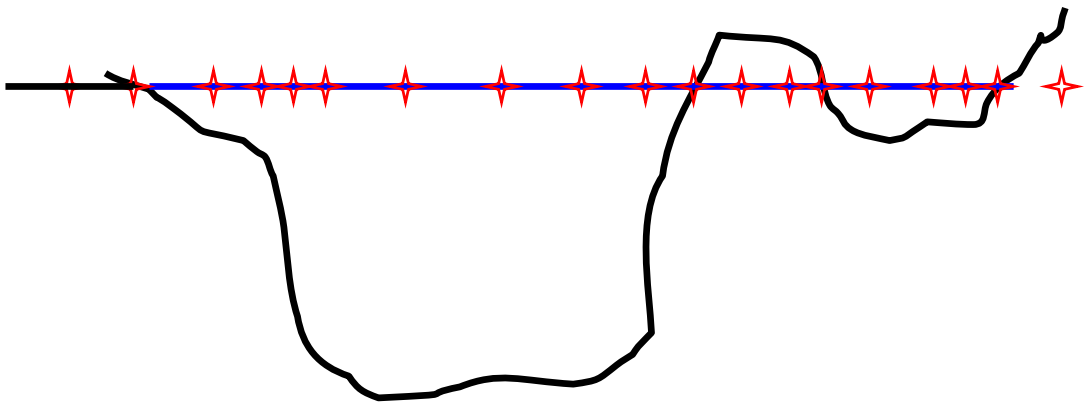
21 station points



Defines bridge piers

Defines bottom bathymetry

Model permits flooding and drying



Typical discretization - 19 stations points

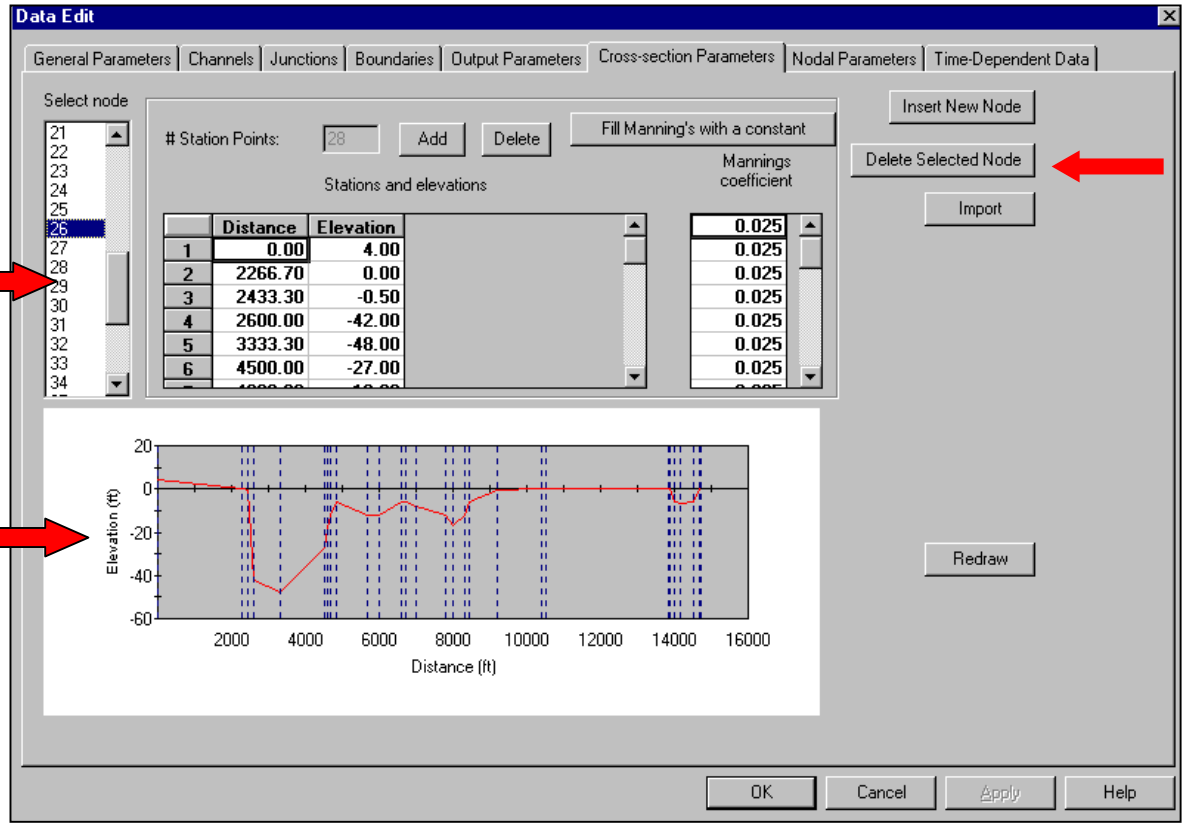
Cross-section Data

Prepare data on spread-sheet and import

Enter data directly

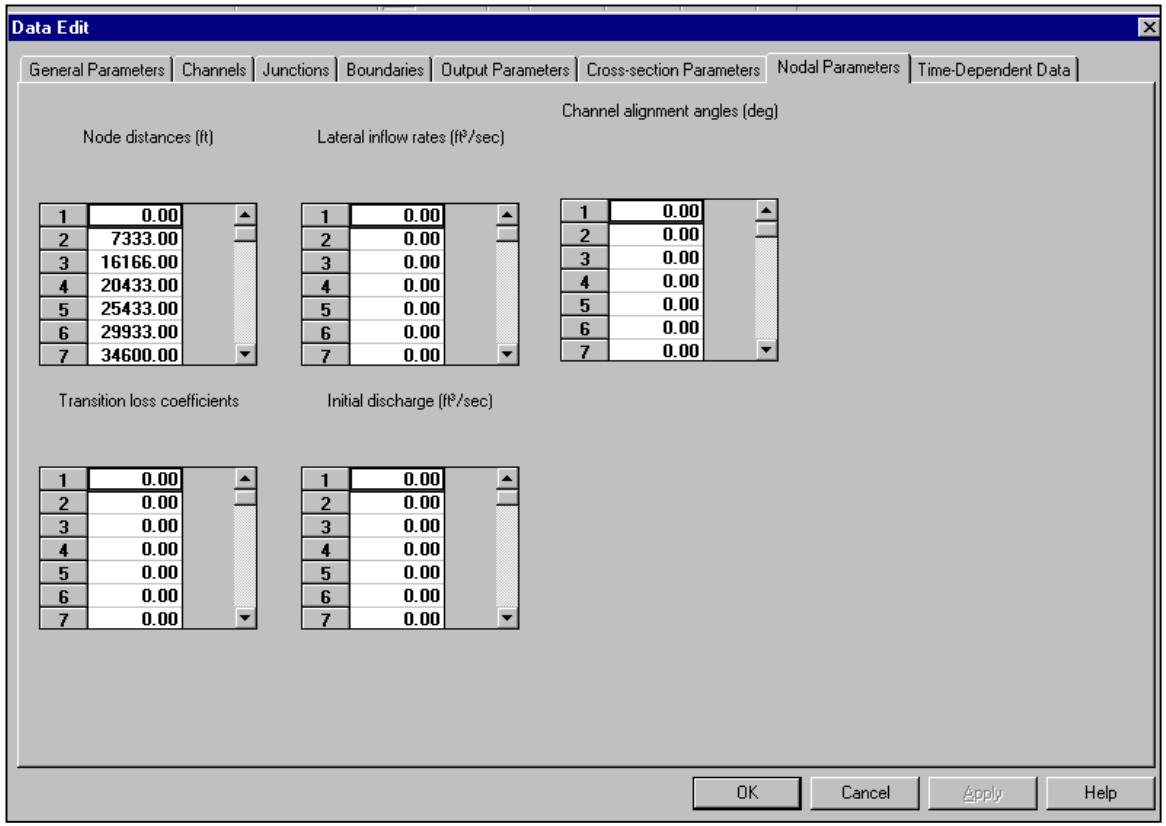
Plot below helps decision on discretization for best channel representation

Ability to insert / delete nodes



Nodal Parameters

- Distance between nodes
- Lateral inflow rates
- Channel alignment angles
- Transition loss coefficients
- Initial discharge rates



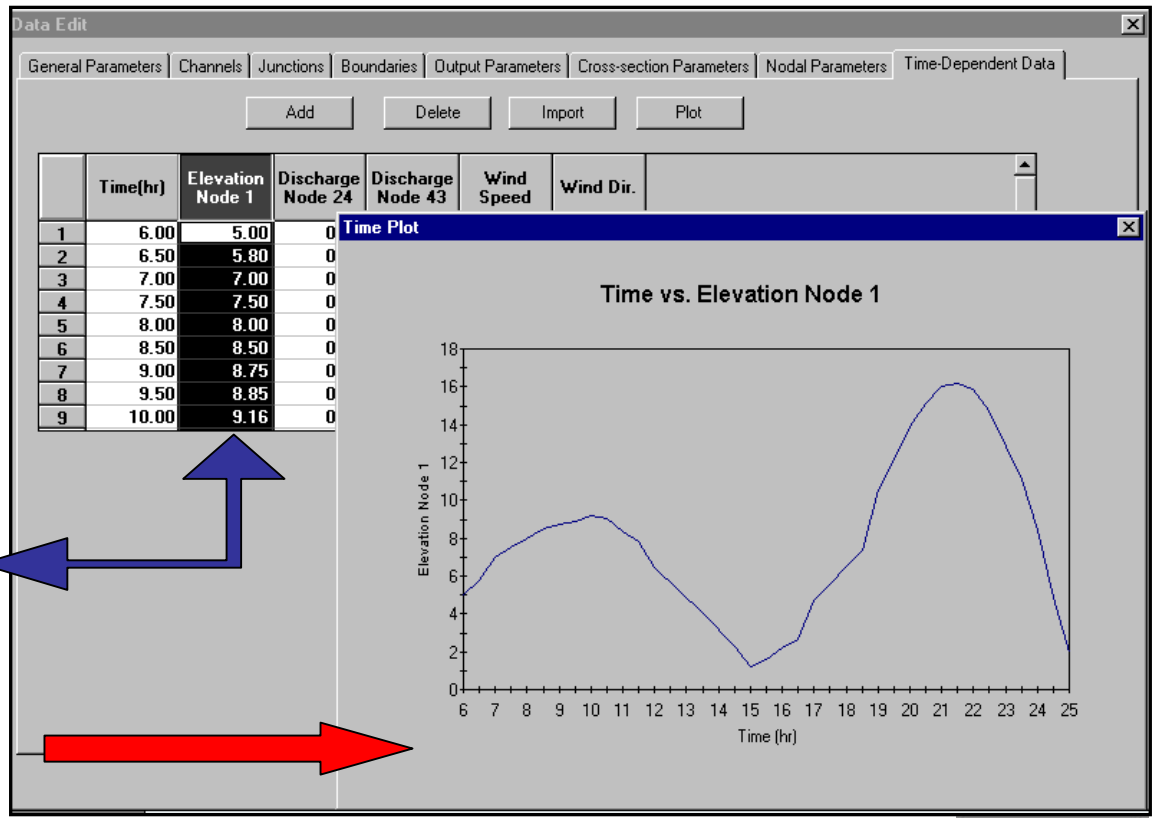
Time Dependent Data

Depending on BC selection:

Specify time series for

- **Elevation**
- **Discharge**
- **Wind Speed**
- **Wind Direction**

Plot time series curve



Display Results

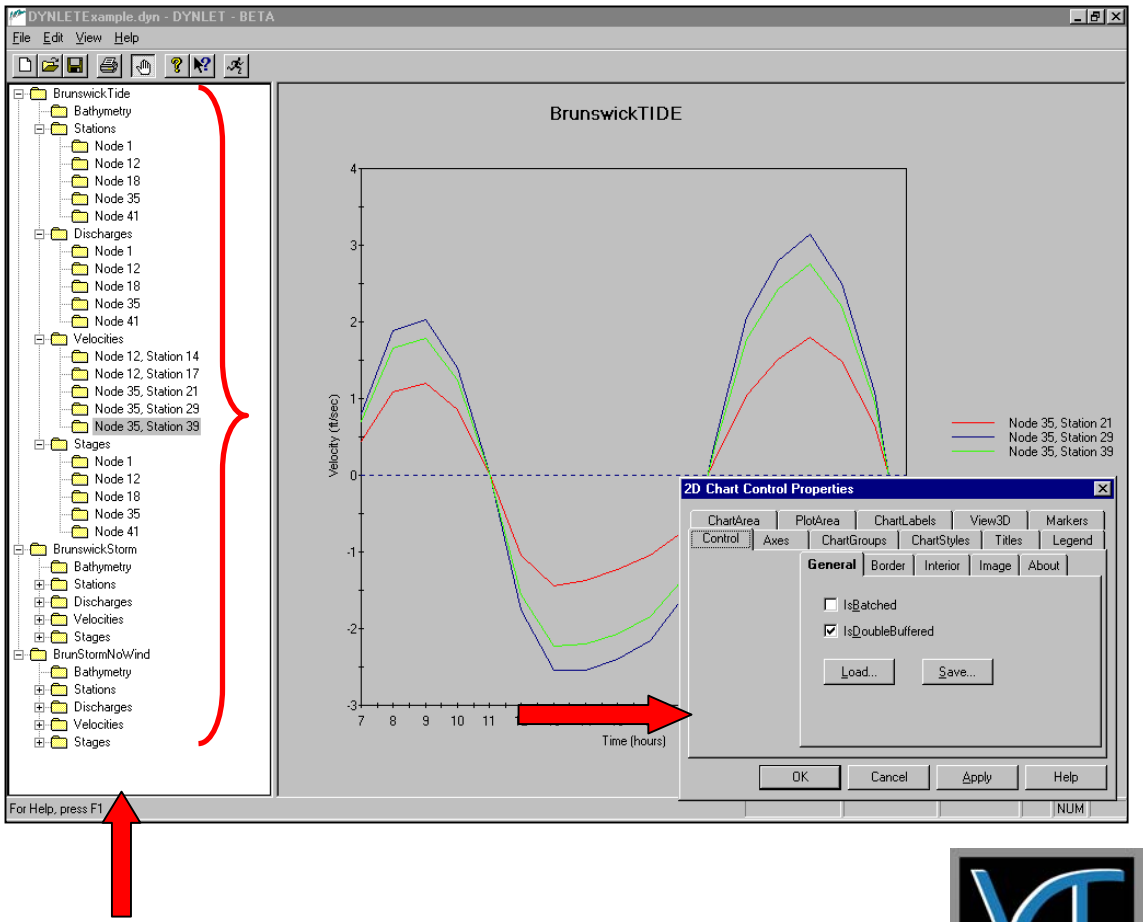
Expanding folders permits access

- **Station**
- **Discharge**
- **Velocity**
- **Stage**

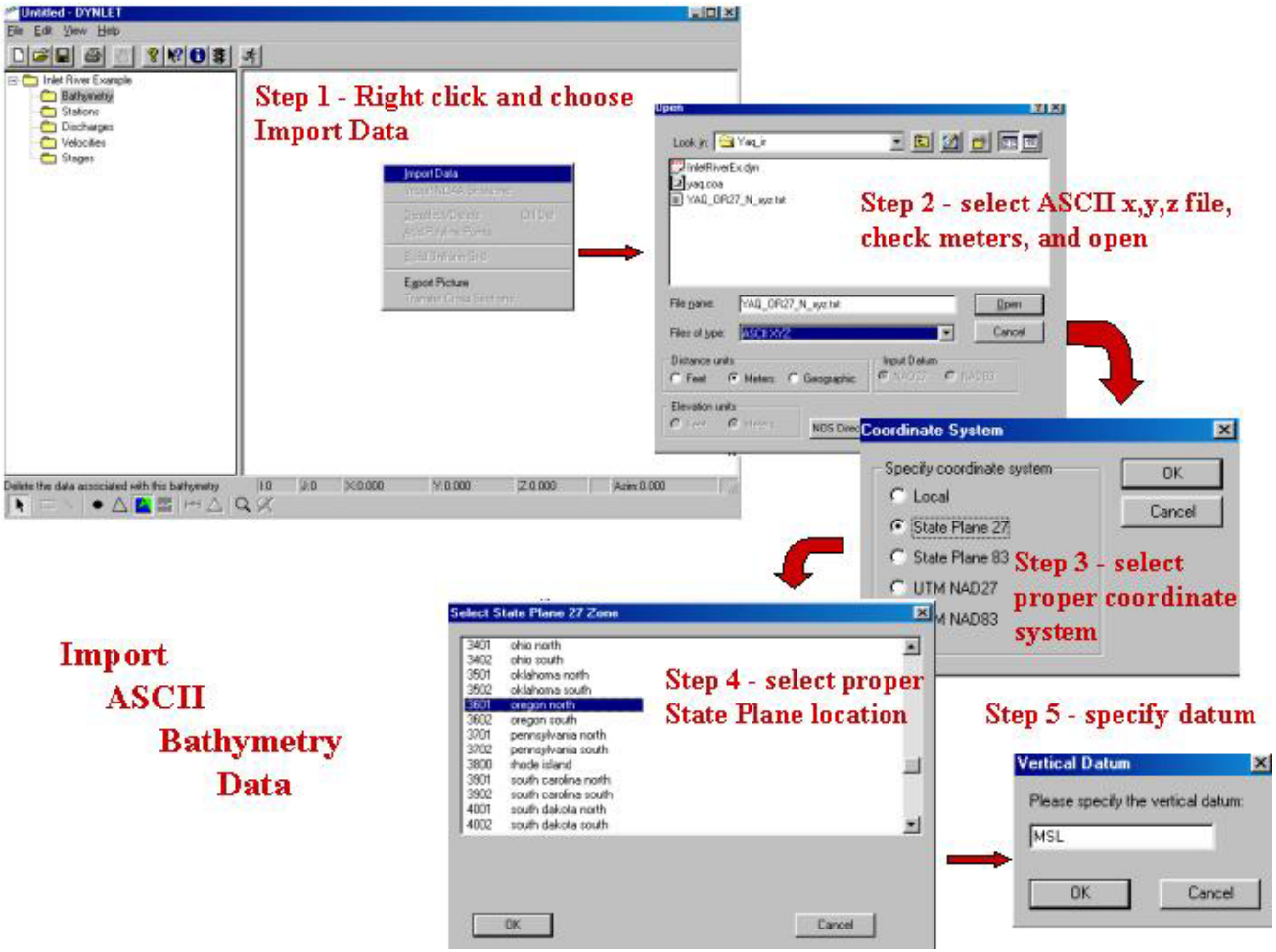
R E S U L T S

Hand Icon - holds plot for overlay

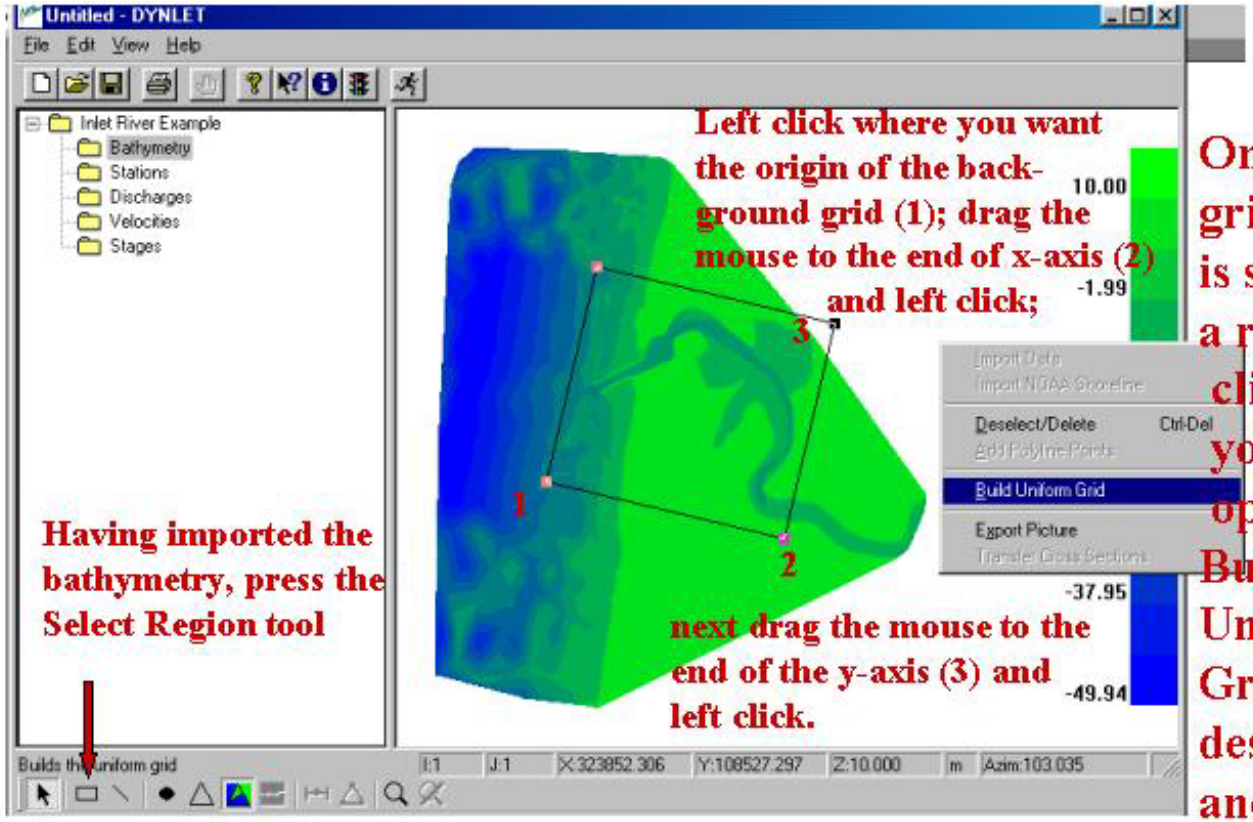
Control graphic properties



Automated Grid Generation



Background Grid



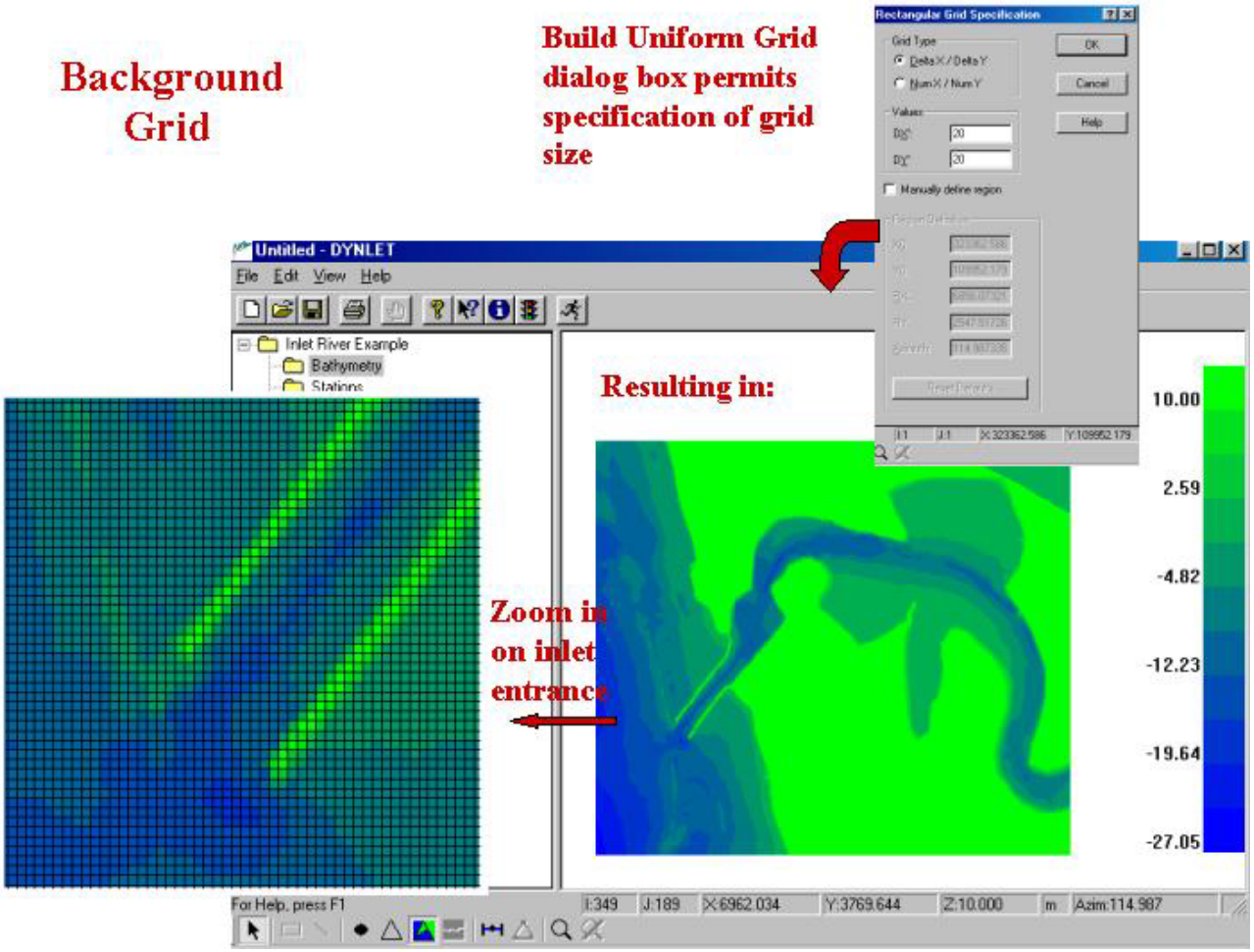
Once the grid region is selected, a right click gives you the option to Build Uniform Grid or to deselect and try again

Construct the background grid

Background Grid

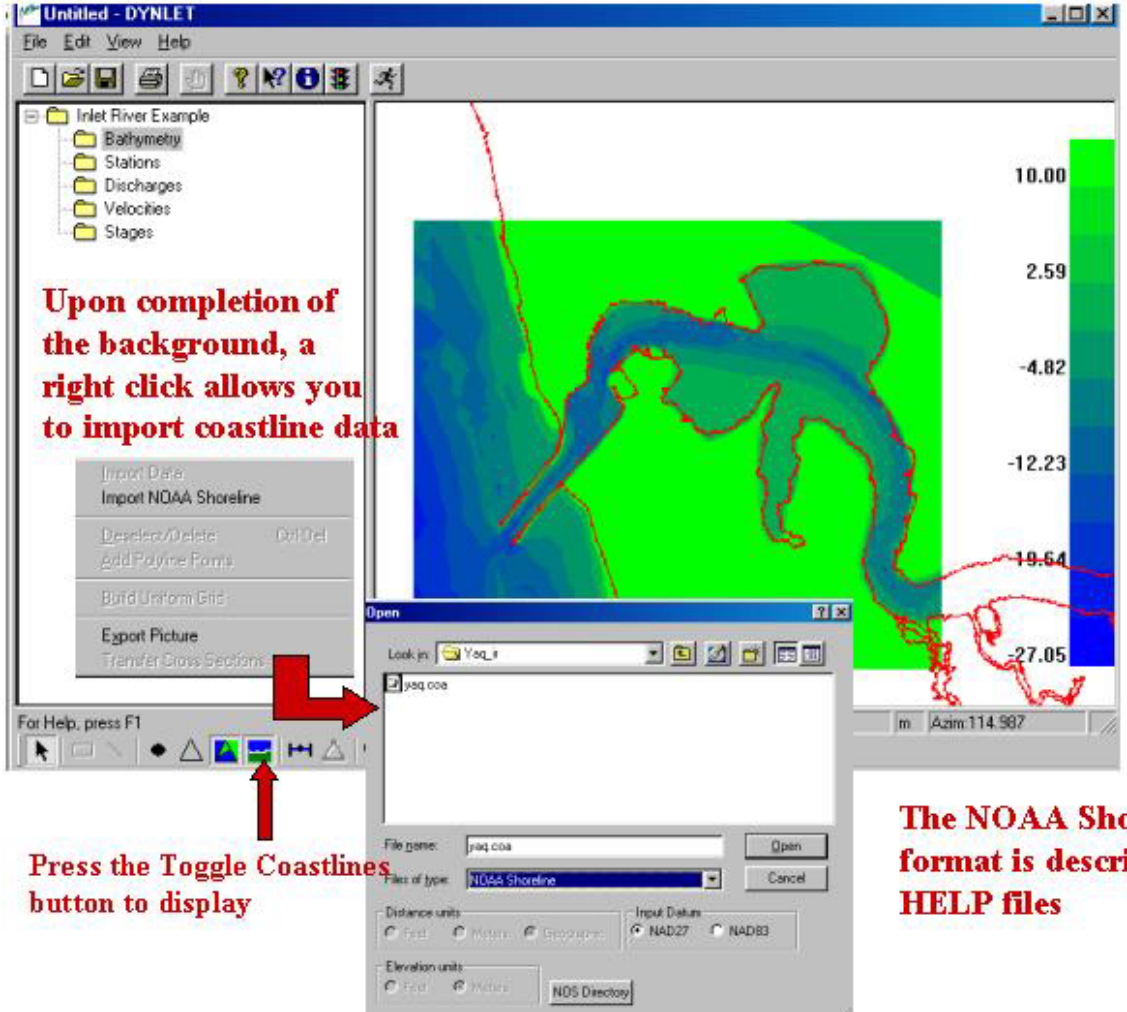
Background Grid

Build Uniform Grid dialog box permits specification of grid size



Zoom in on inlet entrance

Shoreline Data

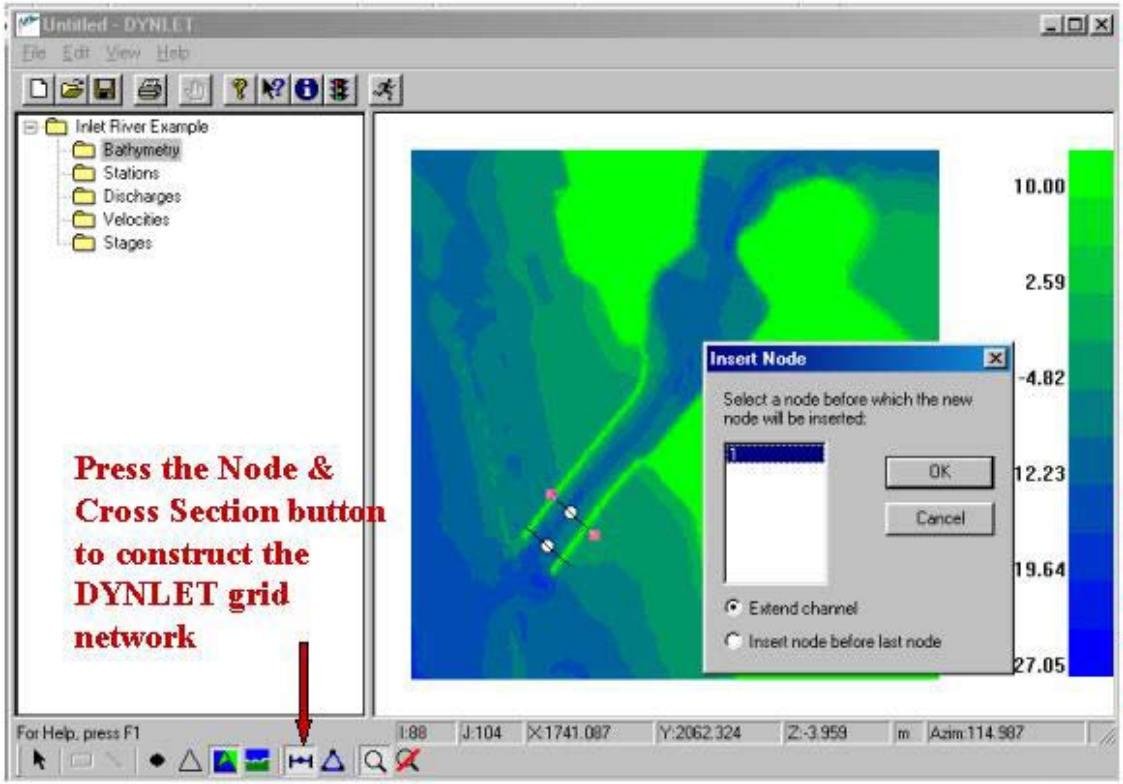


Upon completion of the background, a right click allows you to import coastline data

Press the Toggle Coastlines button to display

The NOAA Shoreline data format is described in the HELP files

Node / Cross sections



Press the Node & Cross Section button to construct the DYNLET grid network

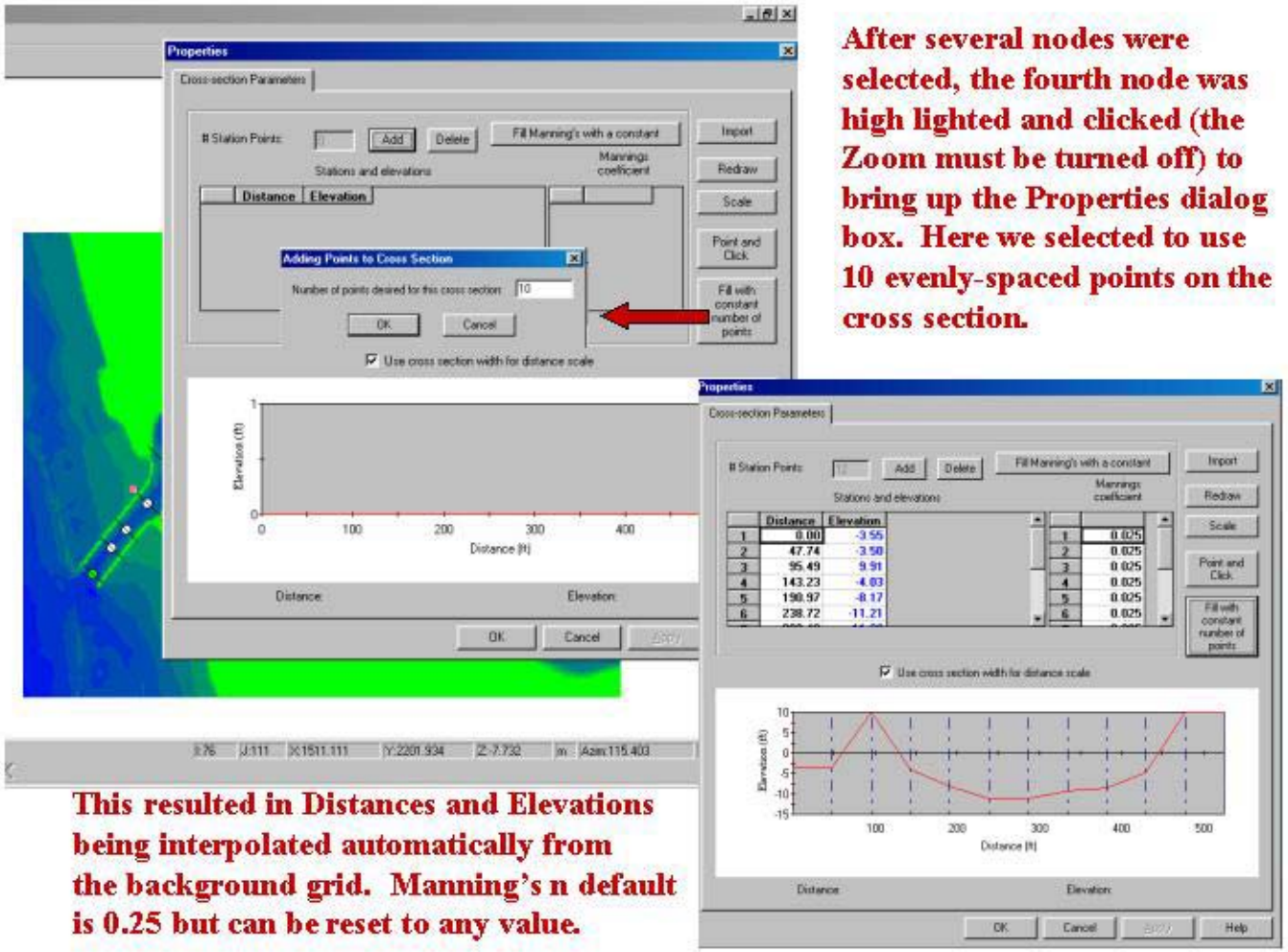
You can always edit a grid to insert or delete nodes or adjust depth or friction values.

You can zoom on a region to make the node selection.

Zoom is a toggle switch - remember to deactivate zoom while you construct the node network.

Nodes are left clicked, followed by dragging the mouse up and to the left to select one cross section endpoint and left click; then drag the mouse lower and to the right to left click the other endpoint. Proceed to the next node - you will be asked where you want to place the node.

Visualizing / Editing Grid



After several nodes were selected, the fourth node was high lighted and clicked (the Zoom must be turned off) to bring up the Properties dialog box. Here we selected to use 10 evenly-spaced points on the cross section.

This resulted in Distances and Elevations being interpolated automatically from the background grid. Manning's n default is 0.25 but can be reset to any value.