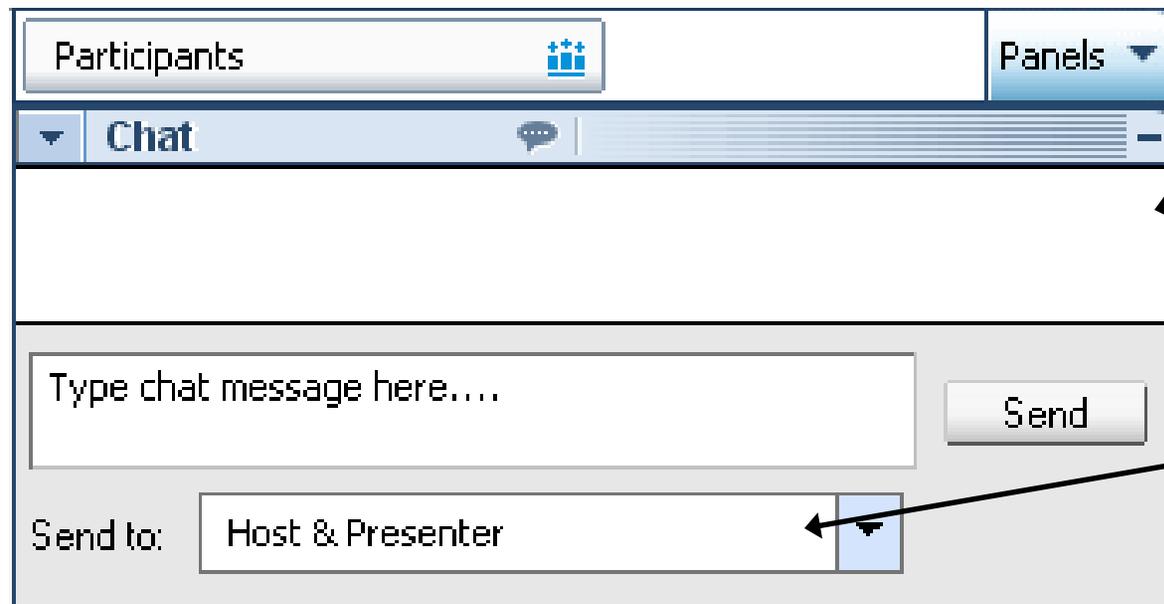


Can you see my screen?
Can you hear me?

Please type your answer in to the chat panel



Type your message here

Change "Send to:" to "All Participants"

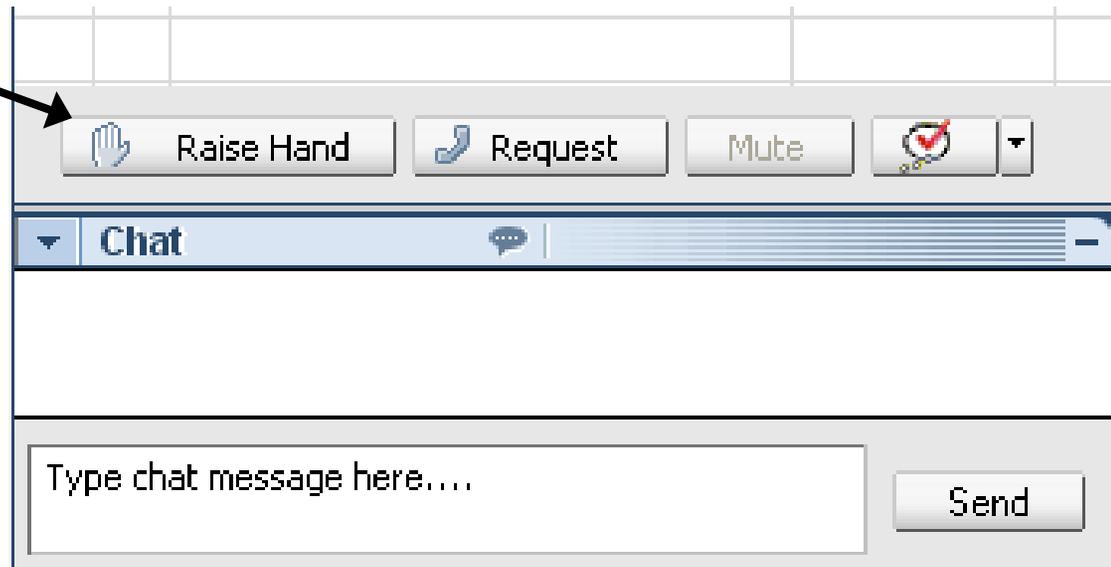
Using Webex

If you wish to communicate with me and/or the group, you can use the **chat window**.

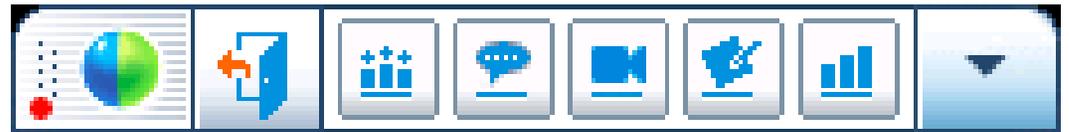
When I begin the presentation, I will mute everyone. If you wish to speak and be heard, raise your hand and I will unmute you.

Webex

- If you want to ask a question out loud and/or to share your desktop, you will need to be unmuted. Click the “Raise Hand” button to let me know that you wish to speak.



Webex: using the chat panel



During the presentation, click on the chat panel button to open the chat panel.

Developing Irregular Cross-
START RECORDING
sections for DSM2-Hydro

START RECORDING

START RECORDING

Brad Tom

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Suisun Marsh Planning Section
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Acknowledgements

- Ralph Finch
- Nicky Sandhu
- Parviz Nader-Tehrani

Problem Statement

to describe 3D bathymetry data to
hydro, a 1D model

Use CSDP to create model geometry

- Create a minimal representative data set based on the bathymetry data set
- place less emphasis on unreliable or less representative data
- evaluate the effects of proposed changes

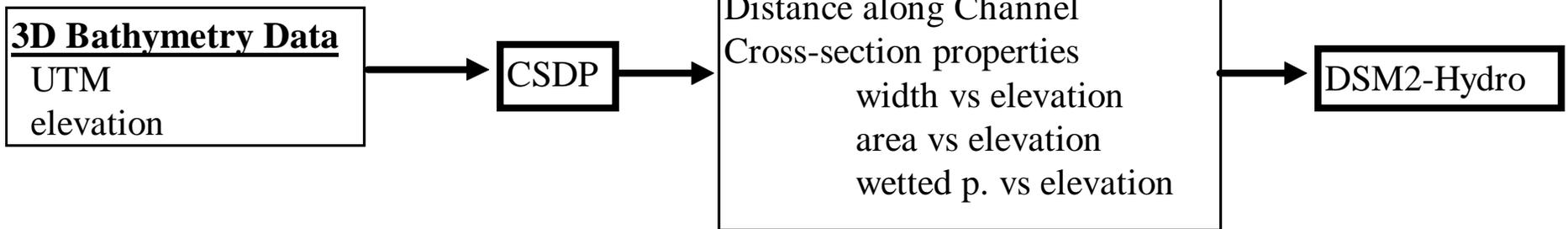
Outline

- Introduction to CSDP
- Problems to avoid
- Demonstration of CSDP
- CSDP Example problem(?)

CSDP

- replaces BDD
- written in Java
 - also an object-oriented language
 - platform independent
 - easier to maintain than C++
- available on DMS web page
 - <http://baydeltaoffice.water.ca.gov/modeling/deltamodeling/models/csdp>

Geometry Development

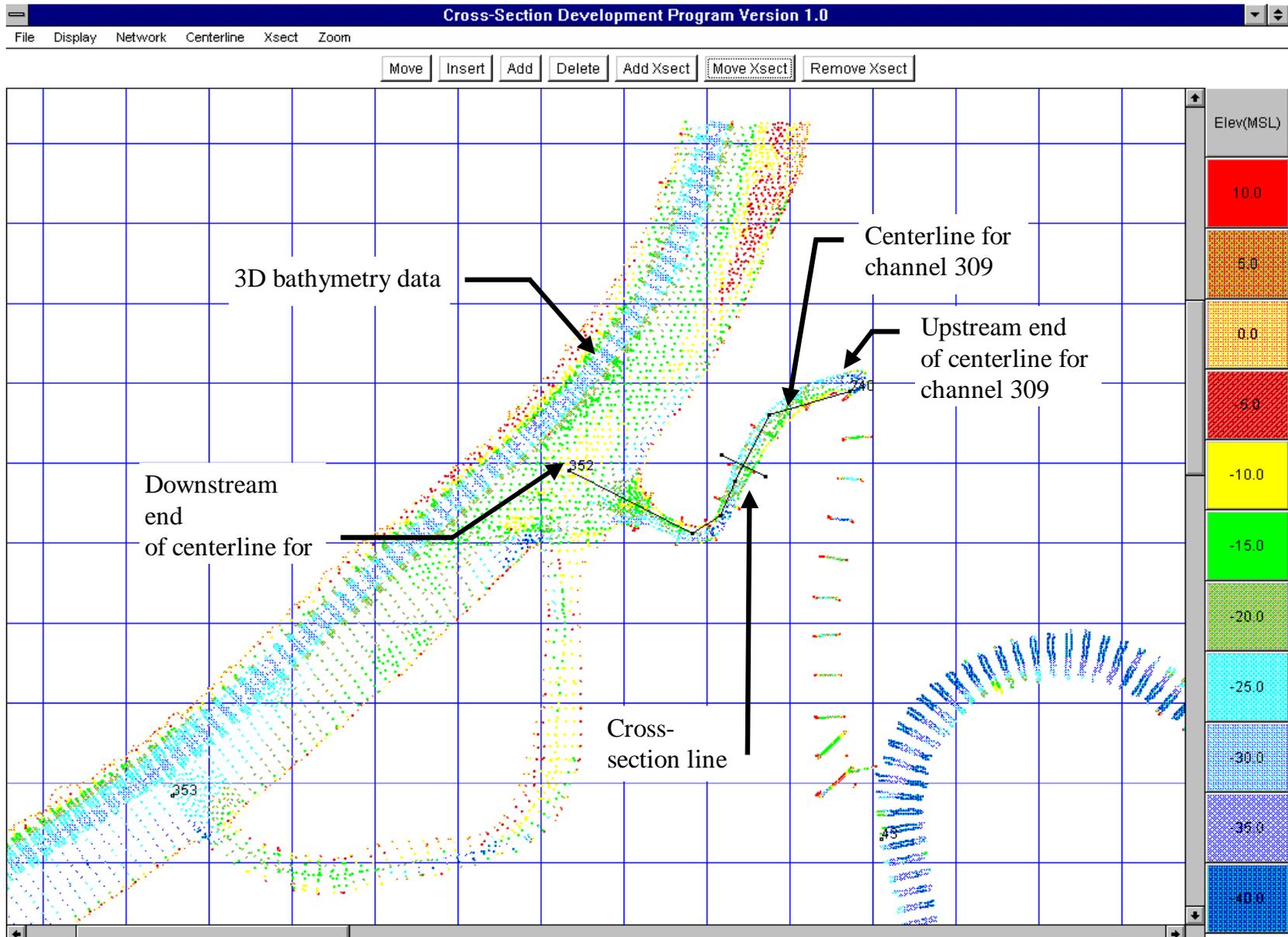


3D Bathymetry Data

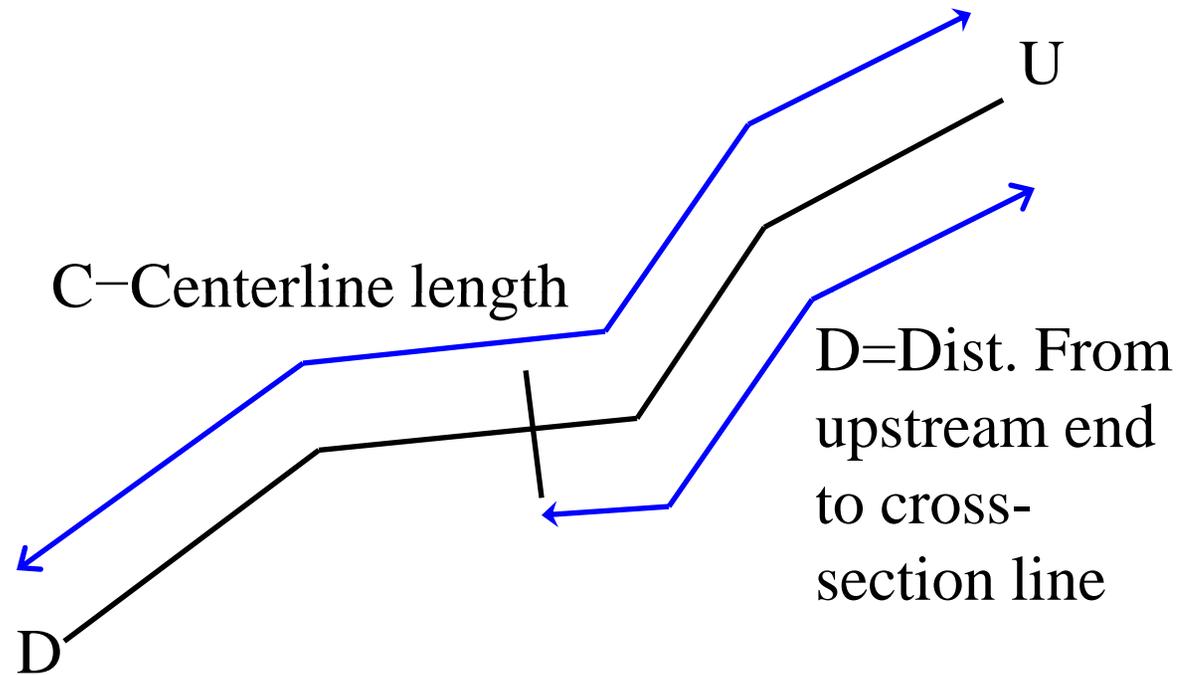
```
;HorizontalDatum: UTMNAD83
;HorizontalZone: 10
;HorizontalUnits: Meters
;VerticalDatum: NGVD29
;VerticalUnits: USSurveyFeet
;Filetype: bathmetry
;NumElements: 382117
630611.64,4193254.73,-14.54,1934,NOAA,N71-00500
630664.06,4193277.77,-8.53,1934,NOAA,N71-00501
630637.85,4193266.25,-12.54,1934,NOAA,N71-00502
```

Column	Description
1	Easting(west/east UTM zone 10 NAD27 coord.)
2	Northing(north/south UTM zone 10 NAD27 coord.)
3	elevation, ft(NGVD)
4	year of survey
5	source of data or name of survey
6	description of data point(currently not used)

CSDP



Cross-section Normalized Distance



$$N = D/C$$

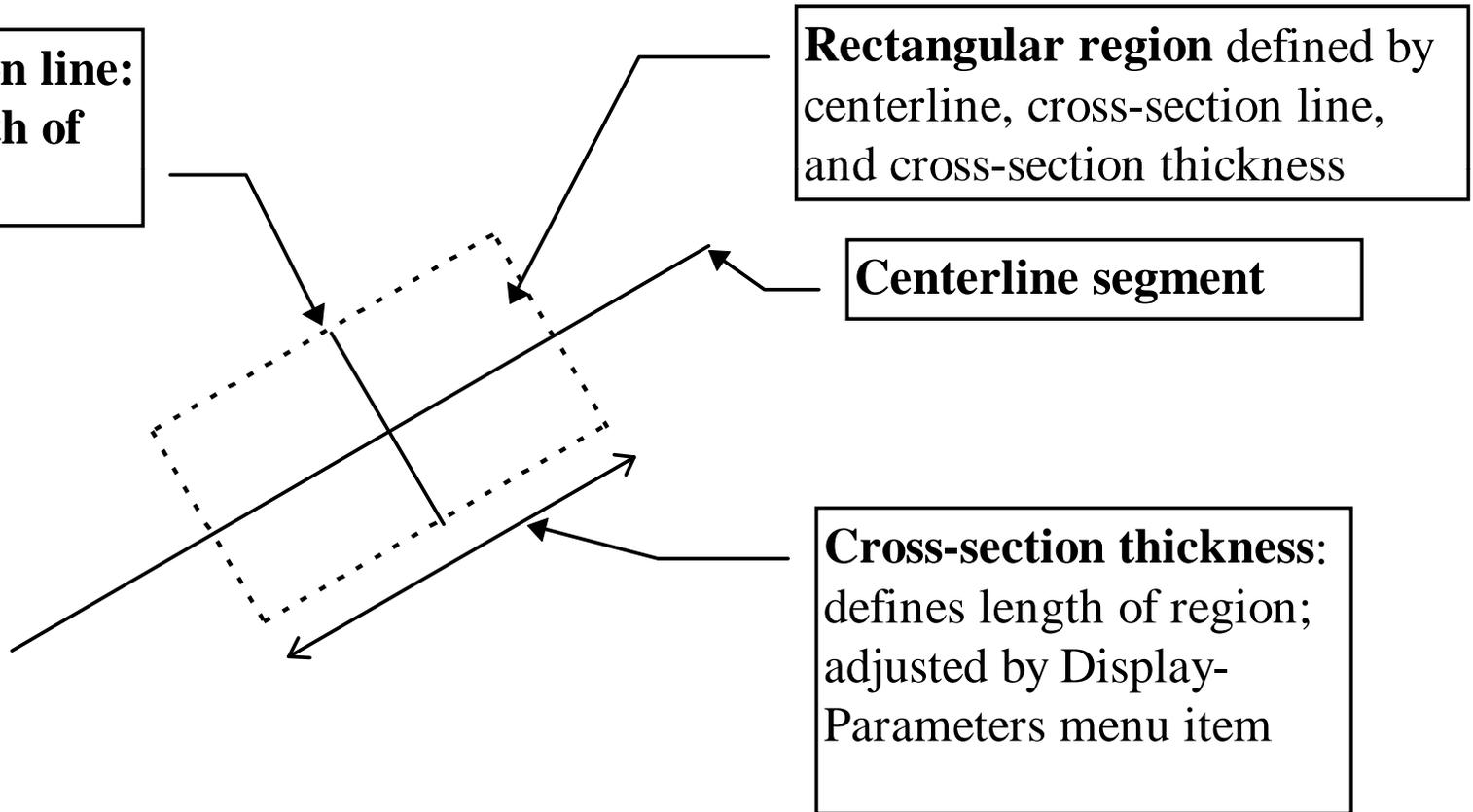
Data selection

Cross-section line:
defines width of
region

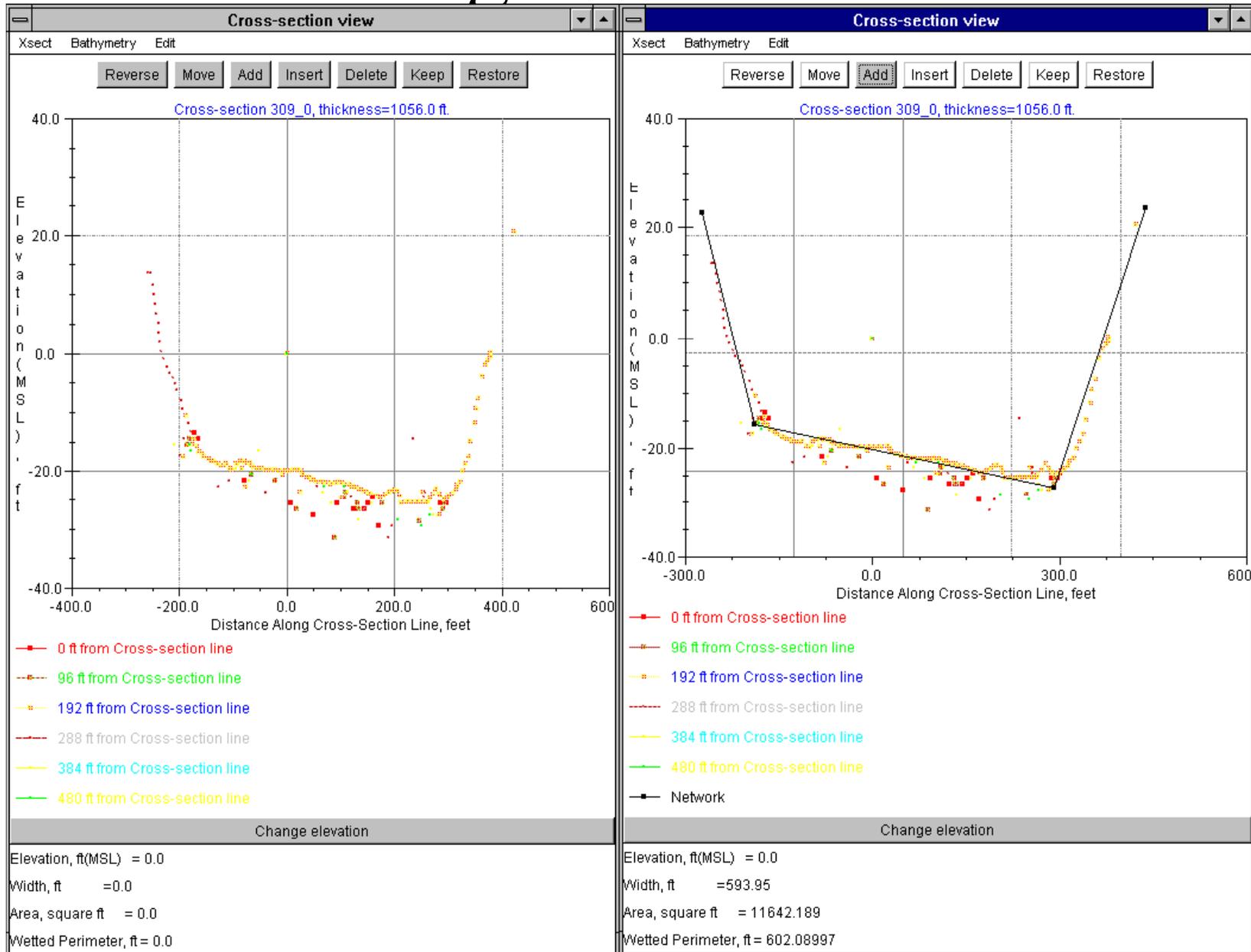
Rectangular region defined by
centerline, cross-section line,
and cross-section thickness

Centerline segment

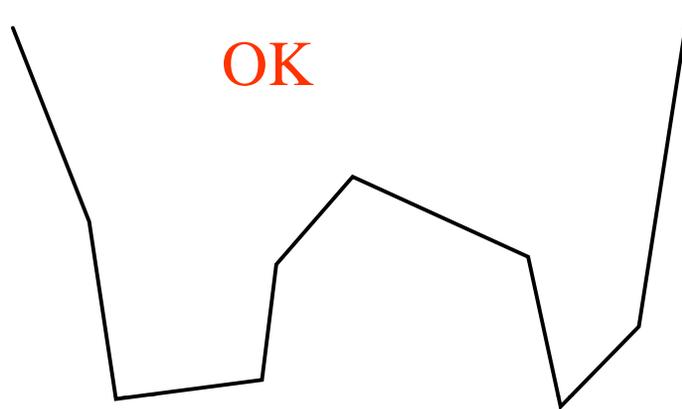
Cross-section thickness:
defines length of region;
adjusted by Display-
Parameters menu item



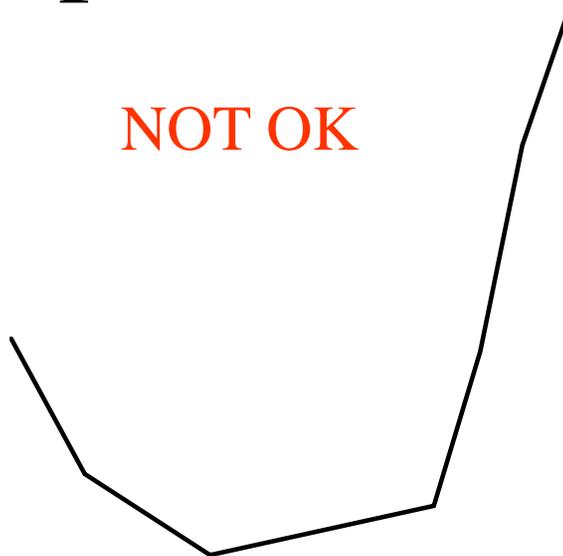
Drawing Cross-sections



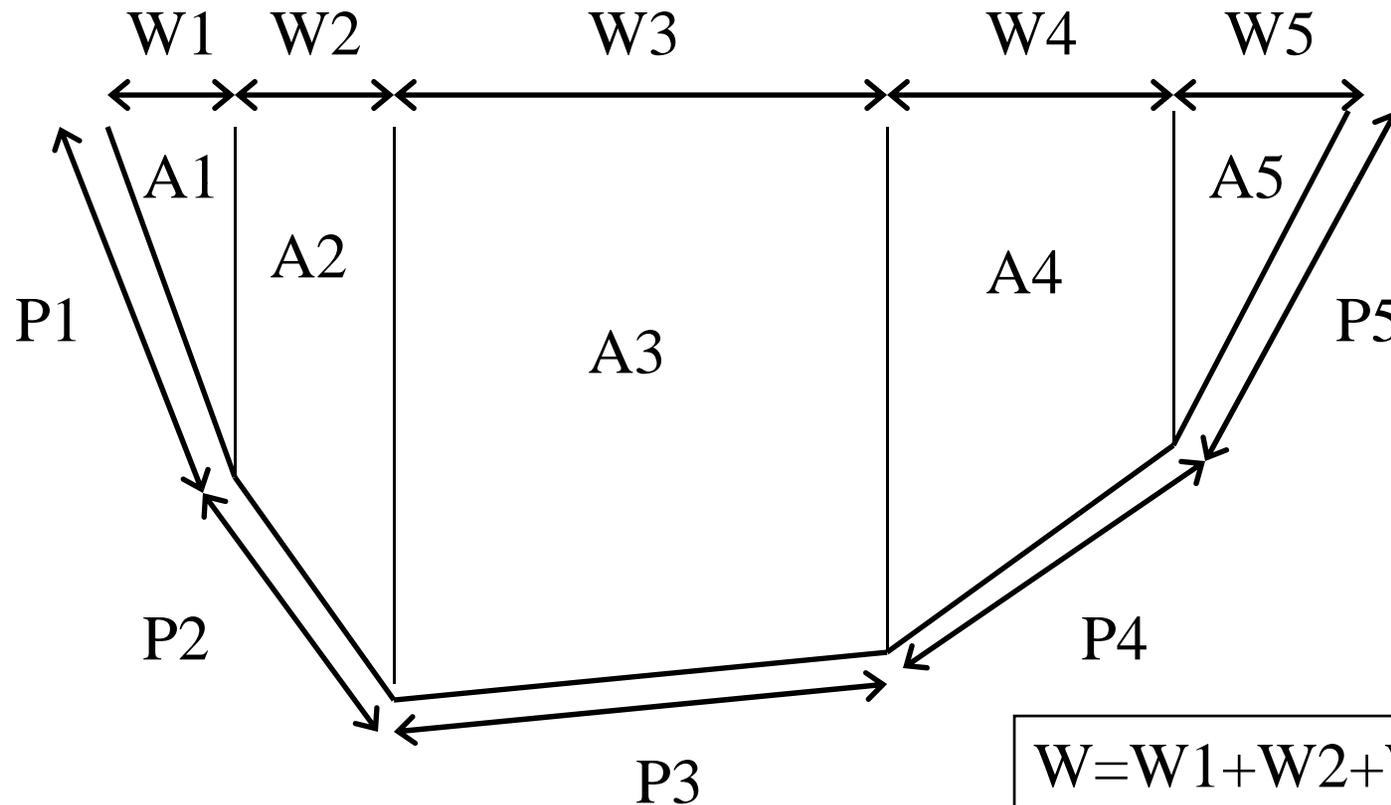
“W” shaped cross-section



“J” shaped cross-section

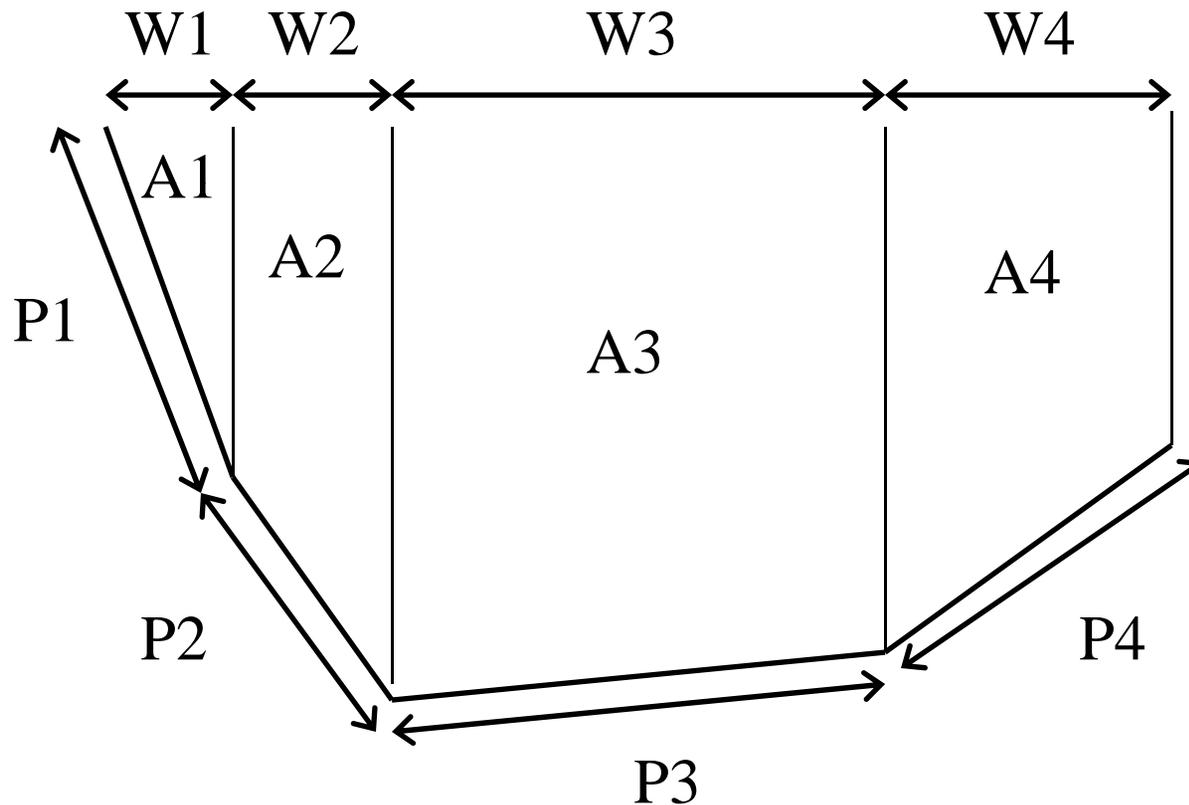


Calculation of Conveyance Characteristics



$$\begin{aligned} W &= W_1 + W_2 + W_3 + W_4 + W_5 \\ A &= A_1 + A_2 + A_3 + A_4 + A_5 \\ P &= P_1 + P_2 + P_3 + P_4 + P_5 \end{aligned}$$

Why J-Shaped cross-section is a bad idea



Area is not much smaller,
But wetted perimeter is!
Result:
inaccurate estimation of conveyance characteristics

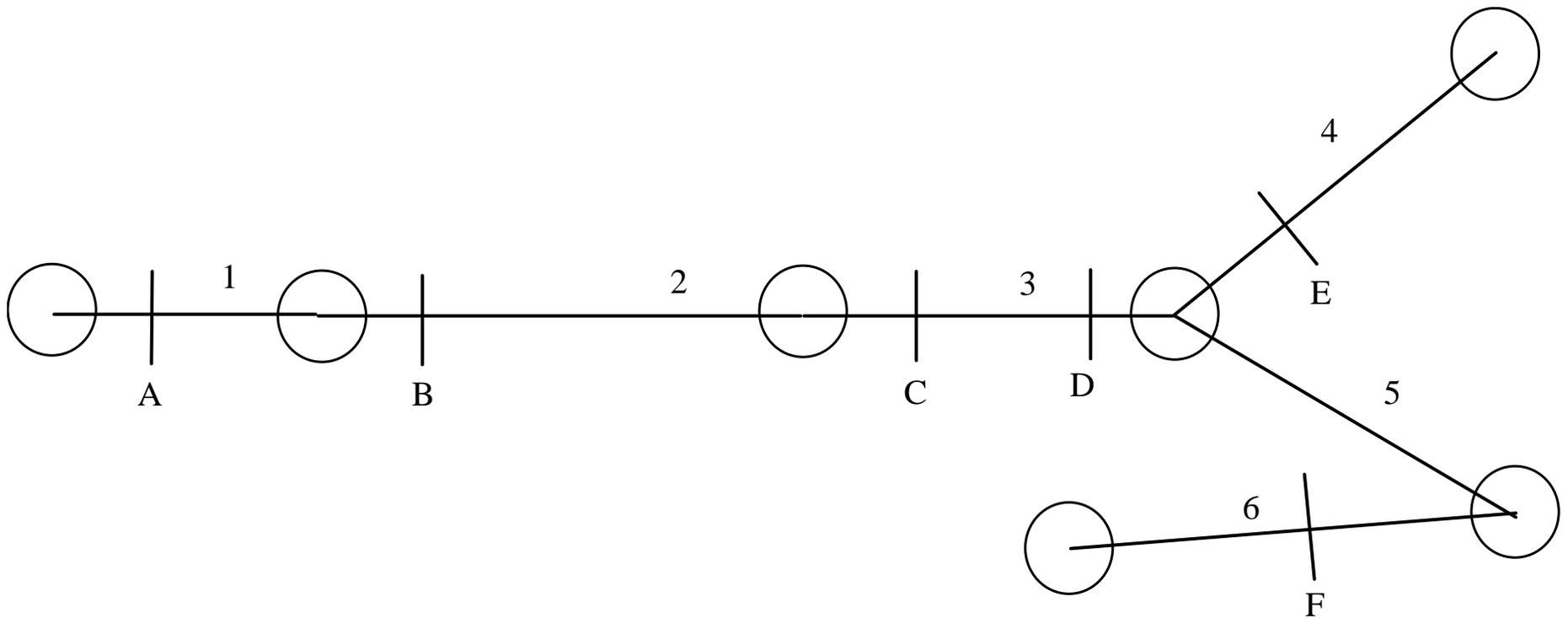
Cross-section Interpolation

- results in a virtual (interpolated) cross-section at every computational point
- done automatically by Hydro
- limits the use of rectangular cross-sections

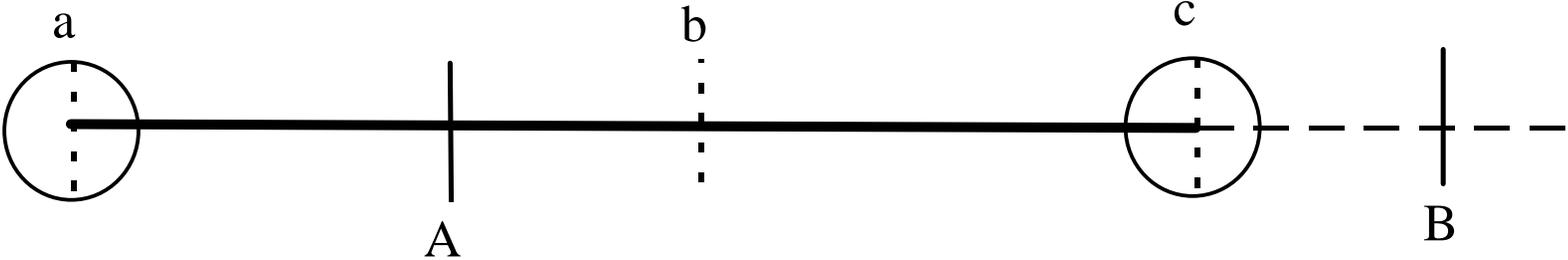
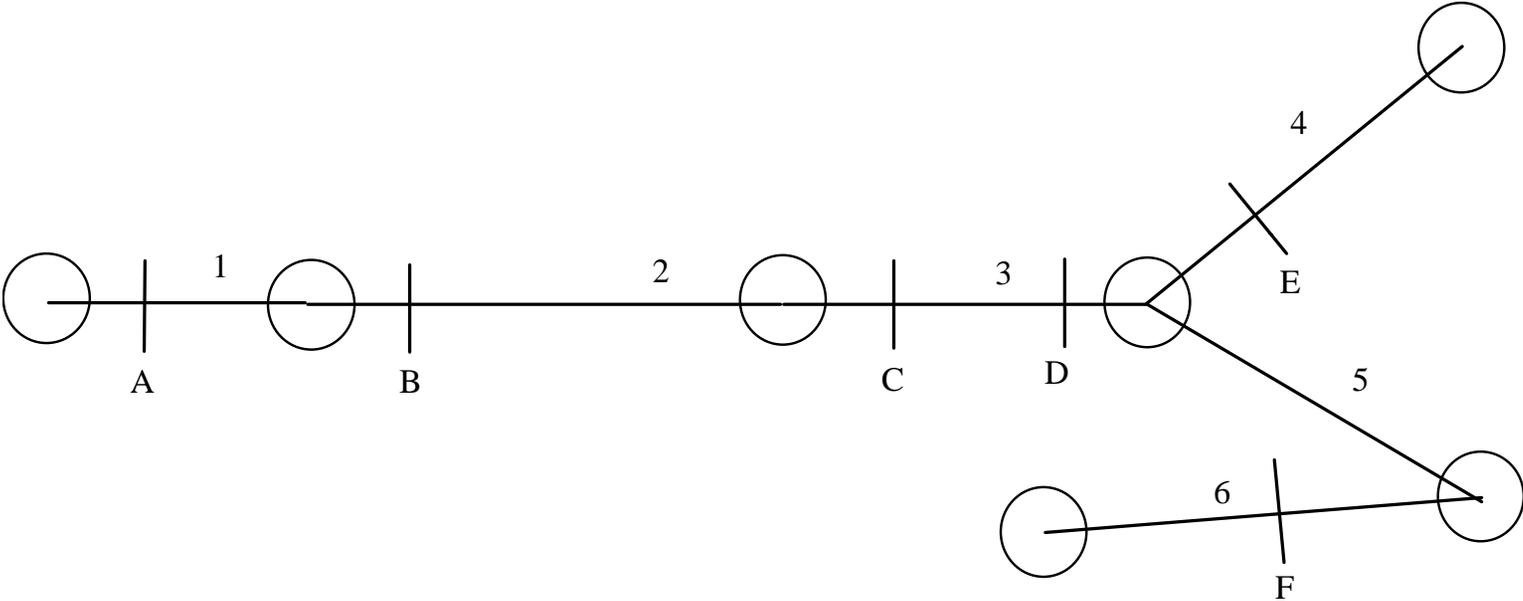


Cross-section Interpolation

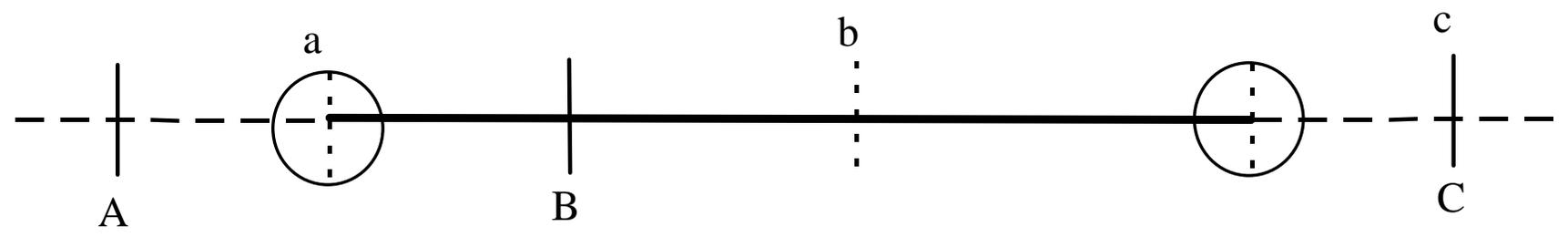
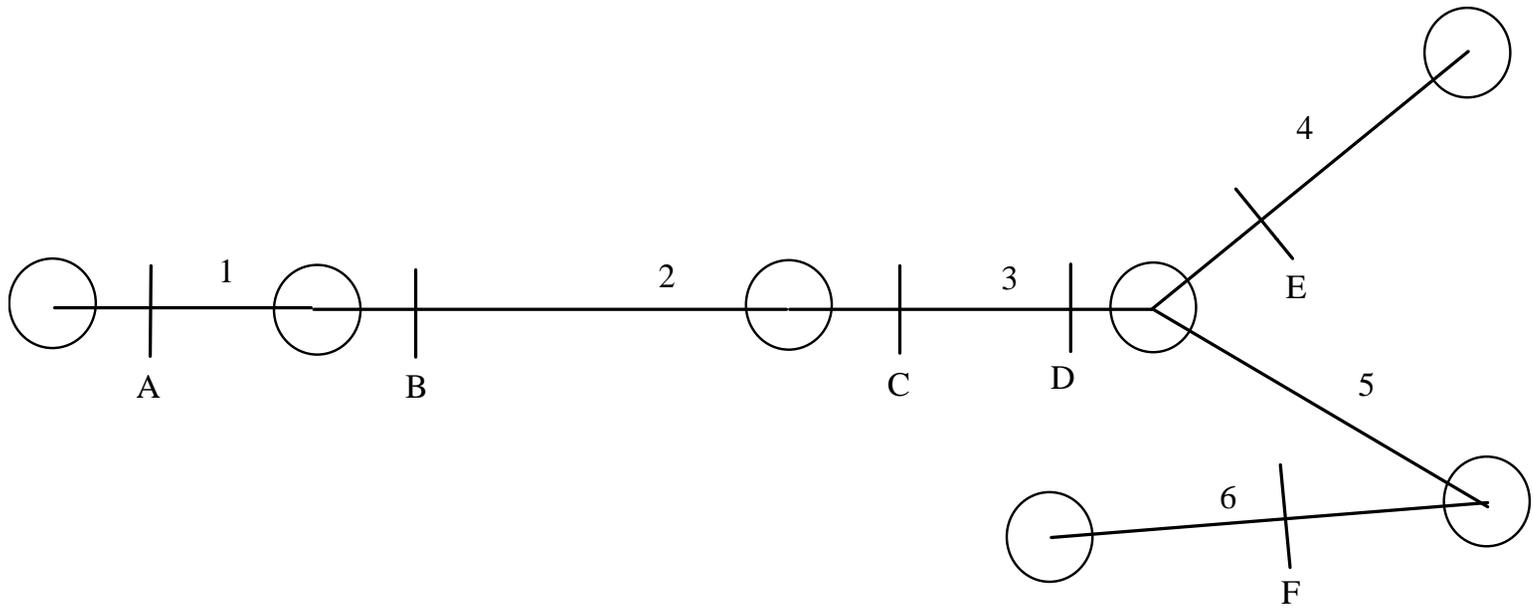
Example



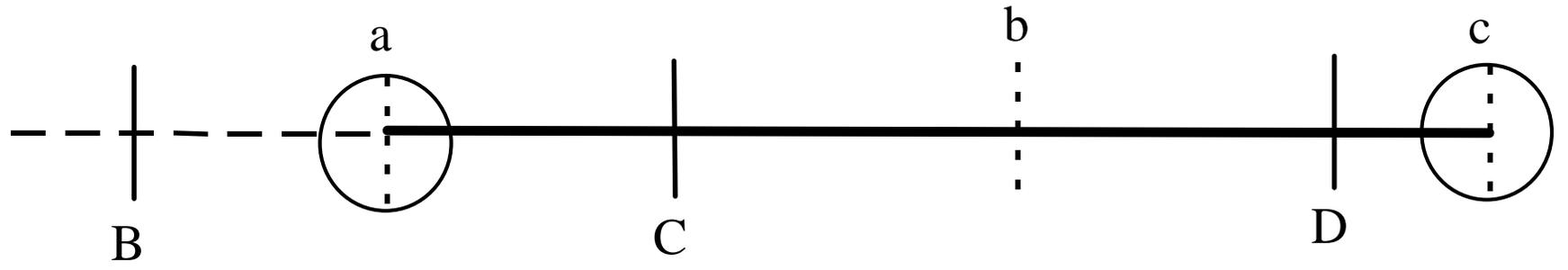
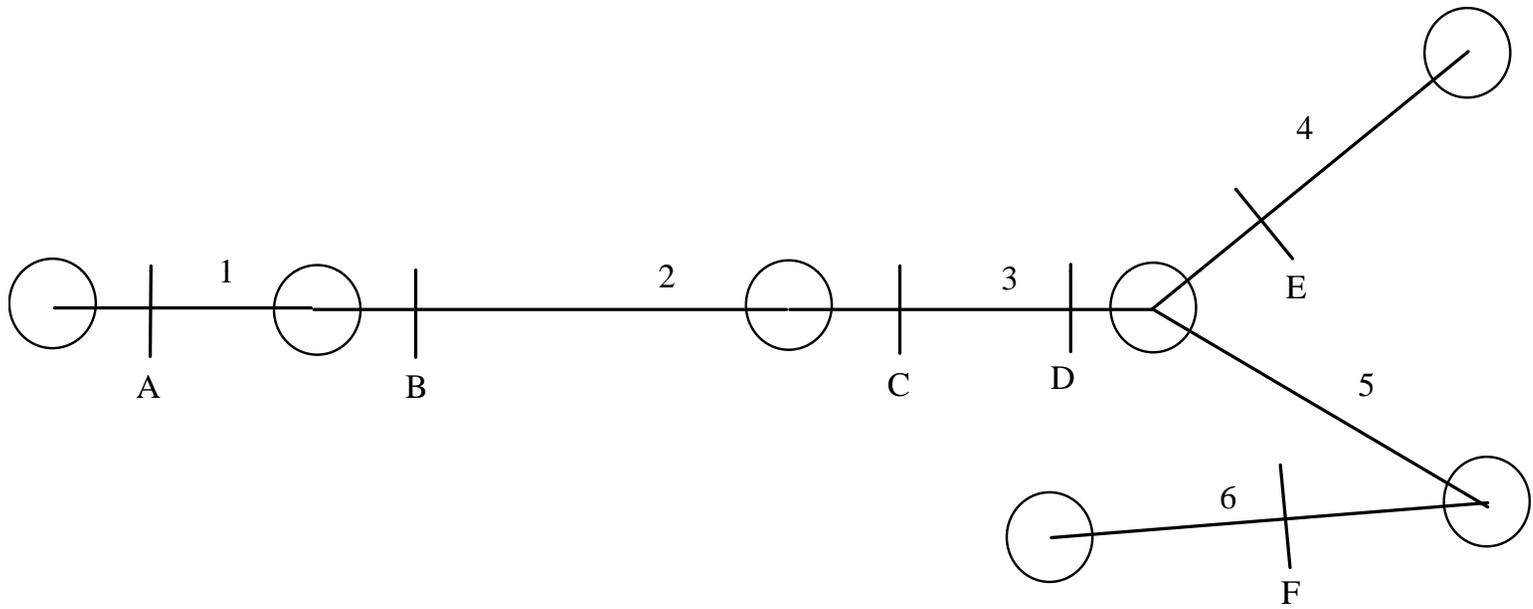
Channel 1



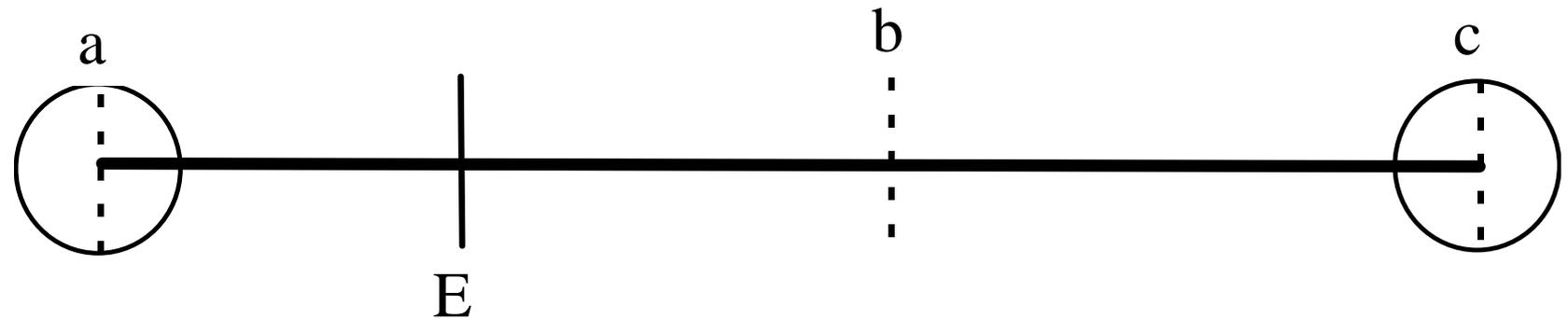
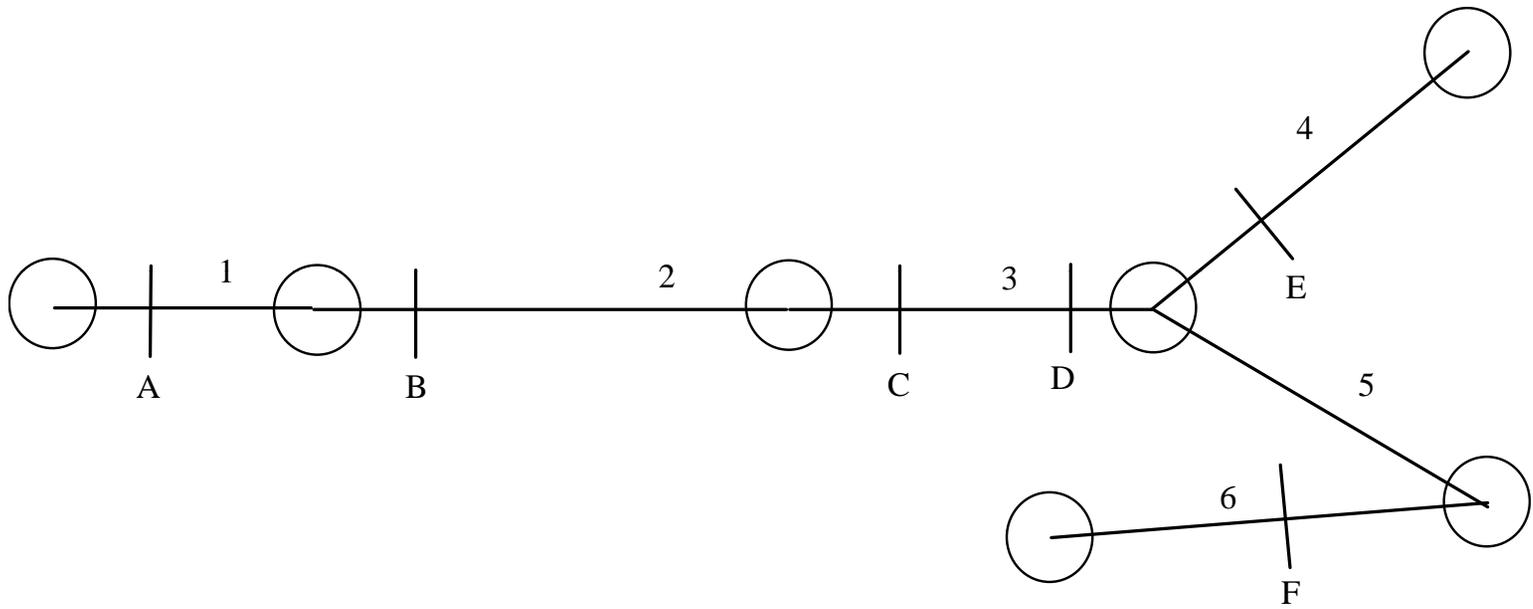
Channel 2



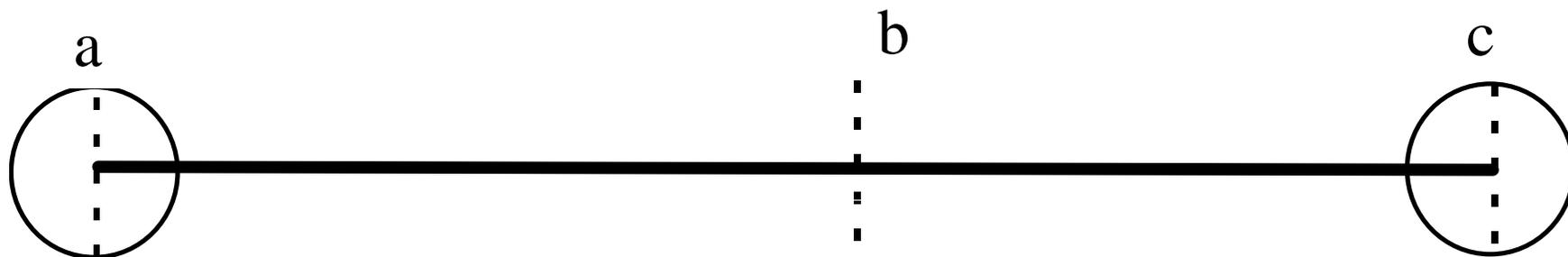
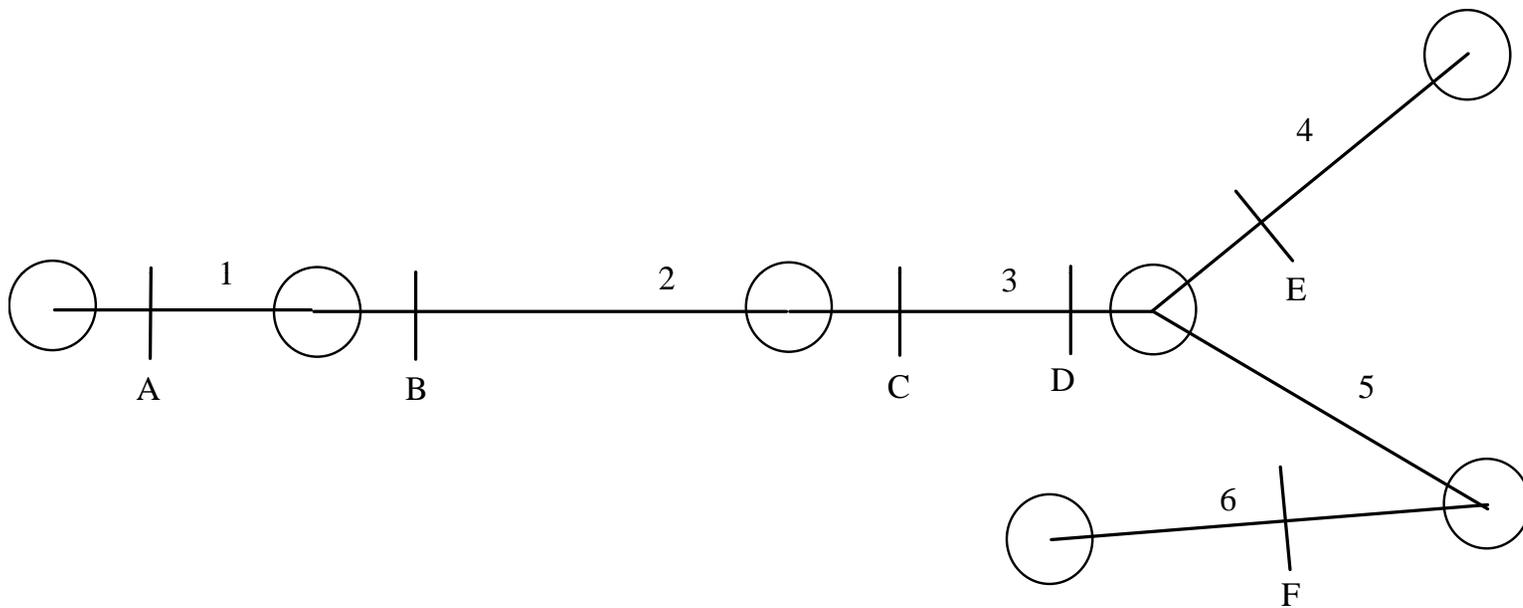
Channel 3



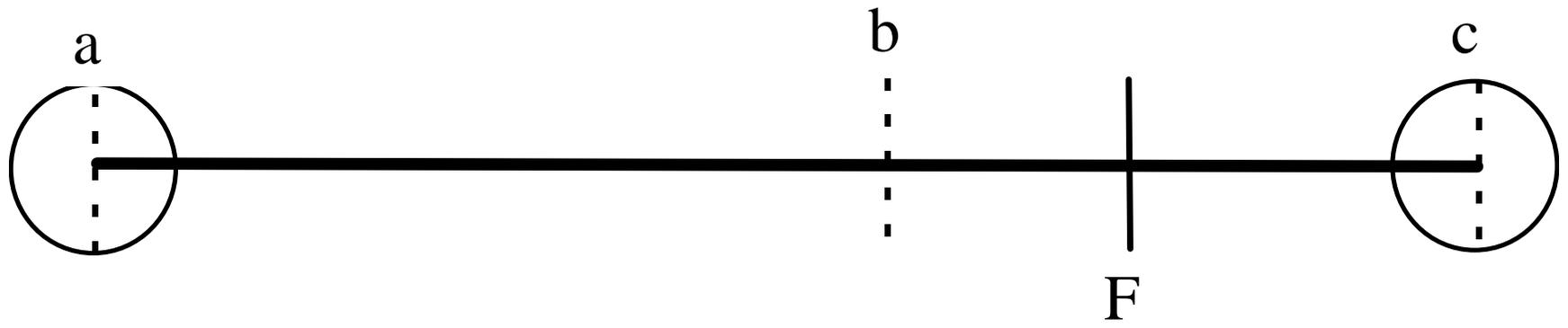
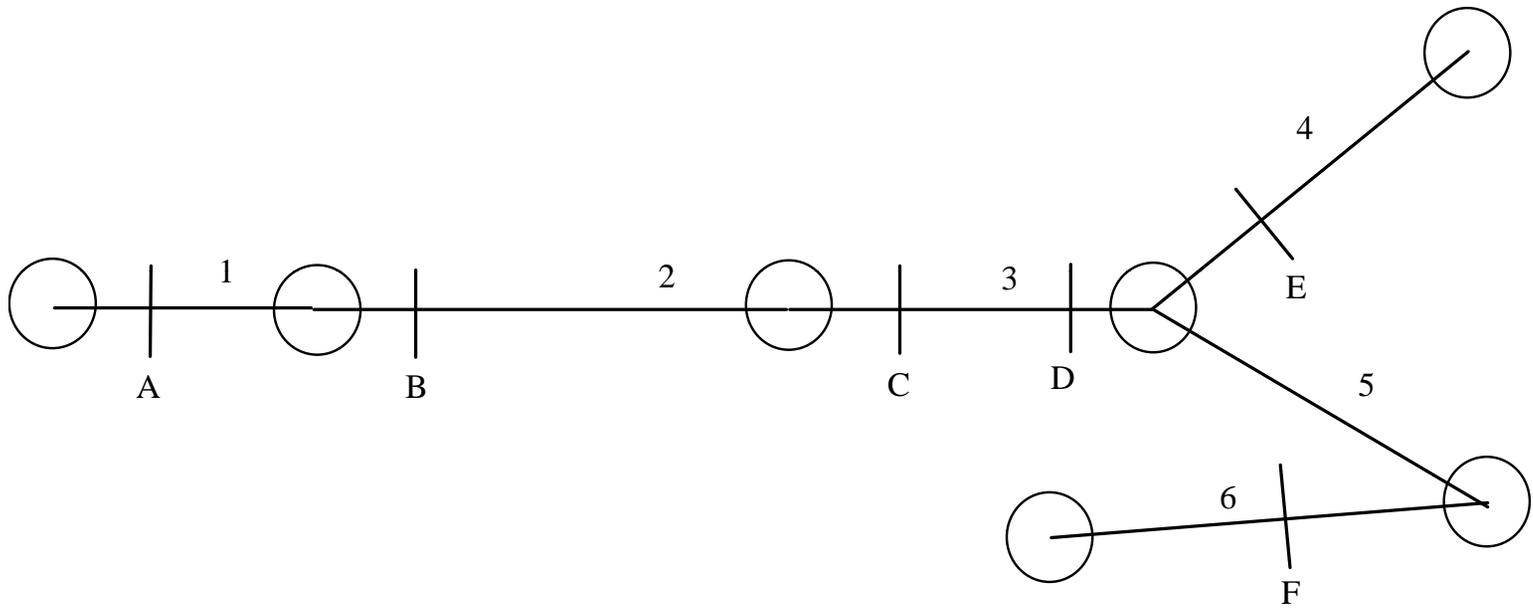
Channel 4



Channel 5



Channel 6



DSM2 Virtual Cross-Sections

VIRTUAL CROSS-SECTION LOOKUP TABLE

Channel	1,Virtual Section	1				
Height	Width	Area	Wet_p	Z Centroid	min_elev	
0.00	192.00	0.00	192.00	0.00	-5.10	
5.10	192.00	979.20	202.20	2.55	-5.10	
100.00	192.00	19200.00	392.00	50.00	-5.10	
Channel	1,Virtual Section	2				
Height	Width	Area	Wet_p	Z Centroid	min_elev	
0.00	192.00	0.00	192.00	0.00	-5.10	
5.10	192.00	979.20	202.20	2.55	-5.10	
100.00	192.00	19200.00	392.00	50.00	-5.10	
Channel	1,Virtual Section	3				
Height	Width	Area	Wet_p	Z Centroid	min_elev	
0.00	192.00	0.00	192.00	0.00	-5.10	
5.10	192.00	979.20	202.20	2.55	-5.10	
100.00	192.00	19200.00	392.00	50.00	-5.10	

Problems to avoid

- Convergence Failures-big changes within channel
- negative dC onveyance
- interpolated negative dC onveyance

Convergence Failures

- model will not converge if large changes in NGVD area within a channel
max NGVD area $\geq 2 * \text{min NGVD area}$
- If a channel dries up or overflows, could be the result of a convergence failure
- to find channels with potential convergence problems, run Hydro with printlevel 5
- to correct: adjust cross-sectional areas or assign cross-sections to ends of channels to prevent interpolation

Negative dConveyance

$$K = \left(\frac{1.486}{n} \right) AR^{\frac{2}{3}}$$

$$\text{since } R = \frac{A}{P}$$

$$K = \left(\frac{1.486}{n} \right) \frac{A^{\frac{2}{3}}}{P^{\frac{2}{3}}}$$

$$\frac{\partial K}{\partial Z} = \left(\frac{\partial K}{\partial A} \frac{\partial A}{\partial Z} + \frac{\partial K}{\partial P} \frac{\partial P}{\partial Z} \right)$$

$$\frac{\partial K}{\partial Z} = \left(\frac{1.486}{n} \right) \left(\frac{5}{3} \frac{A^{\frac{2}{3}}}{P^{\frac{2}{3}}} \frac{\partial A}{\partial Z} + \left(-\frac{2}{3} \right) \frac{A^{\frac{2}{3}}}{P^{\frac{5}{3}}} \frac{\partial P}{\partial Z} \right)$$

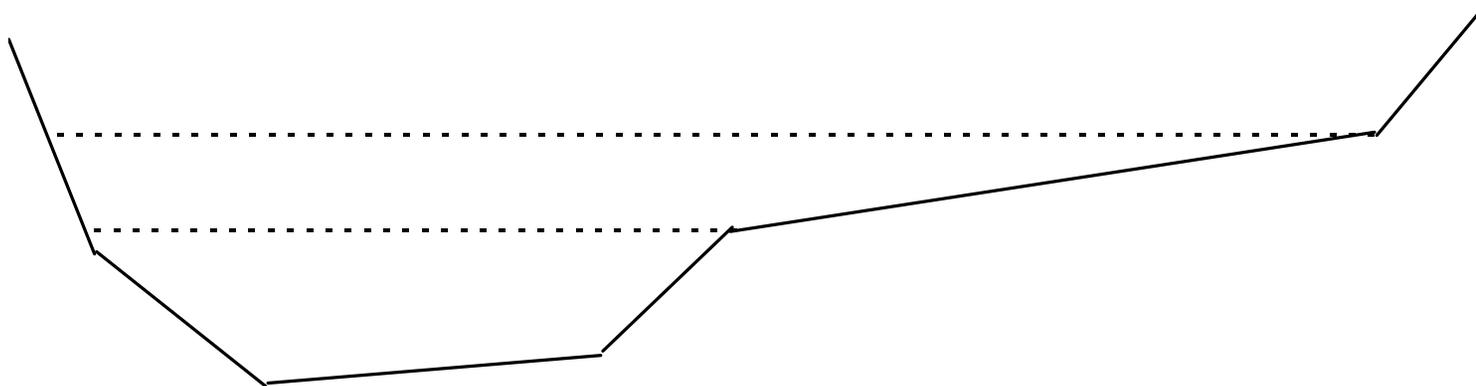
$$\text{If } \frac{\partial K}{\partial Z} < 0, \text{ then}$$

$$\frac{5}{3} \frac{A^{\frac{2}{3}}}{P^{\frac{2}{3}}} \frac{\partial A}{\partial Z} + \left(-\frac{2}{3} \right) \frac{A^{\frac{2}{3}}}{P^{\frac{5}{3}}} \frac{\partial P}{\partial Z} < 0$$

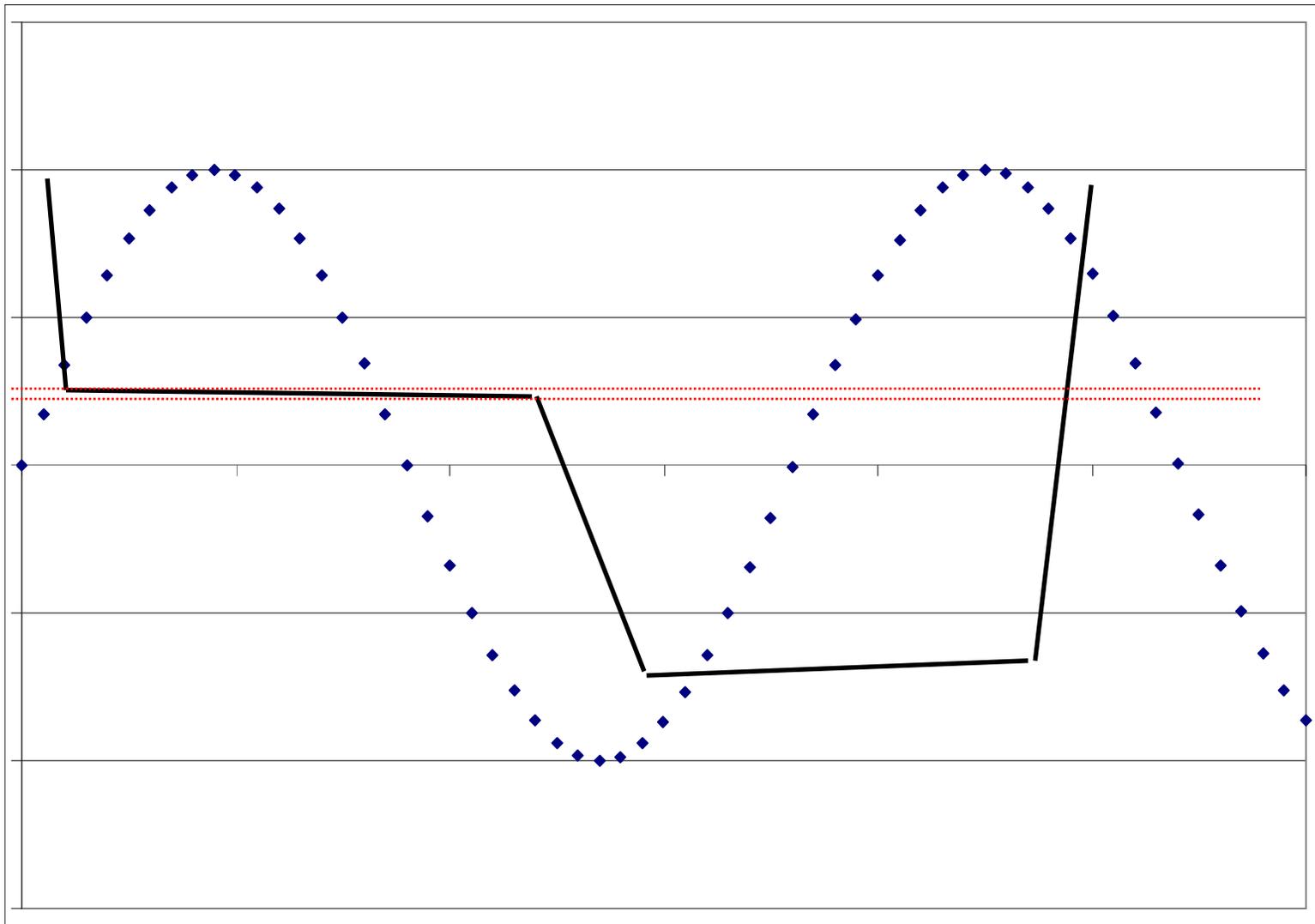
$$\text{Or } 5 \frac{\partial A}{\partial Z} < 2R \frac{\partial P}{\partial Z}$$

Negative dConveyance

- derivative of conveyance wrt height
- caused by small line segment slopes
- model run will fail if water level enters a portion of any cross-section with $-dk$
- identify by running Hydro with printlevel 5
- try to remove $-dk$ in $-5 \text{ ft} < Z > 15 \text{ ft NGVD}$
- A convergence failure could cause water level to go outside of its normal range, cause a $-dk$ error.
- eliminate by changing slope



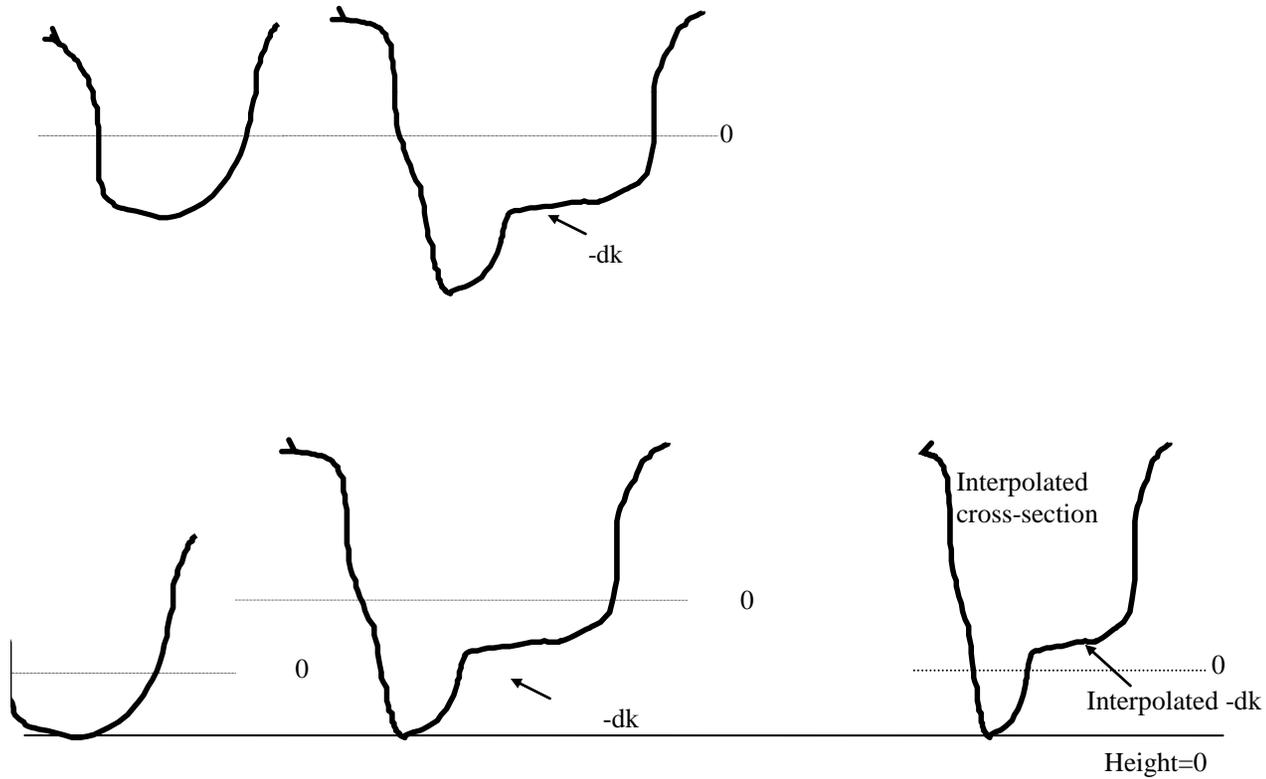
Negative dConveyance



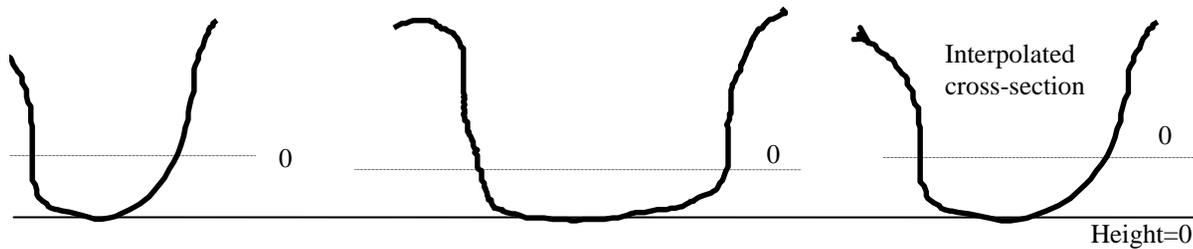
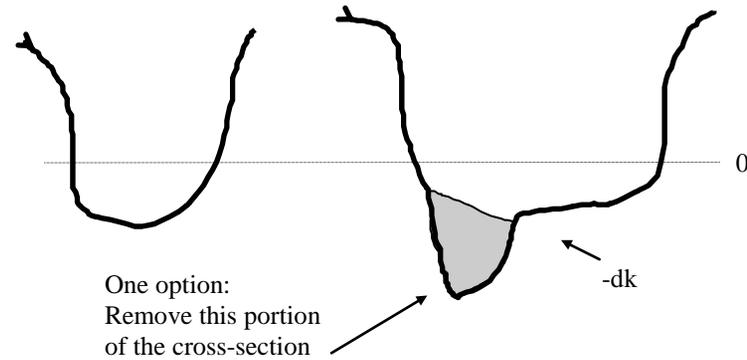
Interpolated Negative dConveyance

- occurs in virtual(interpolated) cross-sections
- usually caused by differences in bottom elevation
- to correct:
 - change bottom elevation(s)
 - assign cross-section to end(s) of channel to prevent interpolation from adjacent channel(s)

Interpolated Negative dConveyance



Correcting Interpolated Negative dConveyance



CSDP Output files--DSM2 irregular cross-section input

irregular_xsects.inp

```
IRREG_GEOM
CHAN      DIST      FILENAME
  6      0.62093    ./6_0.62093.txt
  7      0.25863    ./7_0.25863.txt
  7      0.86019    ./7_0.86019.txt
  8      0.13301    ./8_0.13301.txt
  9      0.18331    ./9_0.18331.txt
  9      0.89620    ./9_0.89620.txt
 11      0.05921    ./11_0.05921.txt
END
```

Don't edit
this file!

irregular_xsects_copy.inp

```
IRREG_GEOM
CHAN      DIST      FILENAME
327      0          ./327_0.44122.txt
  1      0          ./1u.txt
309      LENGTH    ./tmsred.txt
END
```

DSM2 irregular cross-section input

Cross-section: 105_0.75640

Elev(MSL)	A	P	W	Rh	Xc	Zc
100.00	108887.6	1164.4	1026.1	93.5	86.6	47.7
-1.43	9631.0	939.9	931.0	10.2	-1.4	-6.7
-8.86	3481.9	728.5	724.1	4.8	-94.7	-11.7
-12.13	1451.9	519.6	517.5	2.8	-182.9	-14.4
-13.05	1003.7	458.6	456.7	2.2	-227.6	-15.6
-13.75	706.3	394.9	393.2	1.8	-275.8	-16.7
-14.00	636.5	167.0	165.3	3.8	-288.8	-17.1
-14.68	541.1	116.6	115.1	4.6	-300.5	-17.6
-21.64	0.0	40.4	40.4	0.0	-308.7	-21.6

X: -421.68 -360.62 -328.87 -288.44 -232.02 -20.80 98.01 162.39 247.35 564.60
604.42
Y: 100.00 -12.13 -21.64 -21.64 -14.00 -13.75 -8.86 -14.68 -13.05 -1.43 100.00

What to do if you get a $-dk$ error

- Use the “H” value and bottom elevation to calculate the elevation of the $-dk$
- Do any of the irregular cross-sections have $-dk$ at this elevation? If no, it’s interpolated $-dk$.
- If it’s not interpolated $-dk$: should the water be entering this part of the cross-section?
 - If yes, then determine which cross-section(s) are used to create the virtual cross-section, and edit cross-section(s).
 - If no, then it’s really a convergence failure

What to do if a channel dries up

- Check all input for errors (fixed and time-varying)
- What is the H value?
 - If large negative value, it's definitely a convergence problem.
 - If small, possibilities are:
 - Is it early in the run? May need to adjust initial conditions. An initial stage that is too high or too low can cause a channel to dry up.
- Does this channel dry up in reality?
 - If yes, then options are:
 - remove channel from grid
 - Make cross-section(s) deeper, either by removing irregular cross-sections or by editing them
 - If no:
 - Does the channel almost dry up in reality? Consider making the cross-sections deeper.
 - Does the channel never come close to drying up in reality? If initial conditions are ok, consider modifying geometry to remove large cross-sectional area changes.

What to do if a channel overflows

- Check all input (fixed and time-varying)
- Check virtual cross-sections for large changes in cross-sectional area and adjust.

CSDP Installation

- Download and execute the csdpsetup.exe file from <http://baydeltaoffice.water.ca.gov/modeling/deltamodeling/models/csdp/index.html>
- The setup program creates c:\semms.env and c:\semmsconLib\. Do not rename or remove these.

Cross-Section Development Program Version 2.53

----- Semmscon Test Results -----

Input: utm27x, utm27y=629355.0,4199384.0

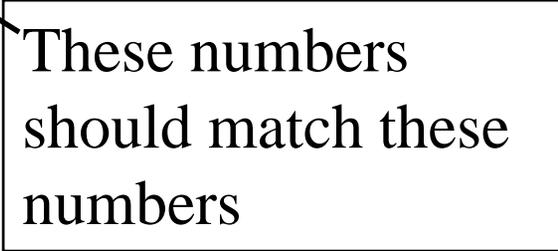
NOTE: the following values should be

629258.5972470464 and 4199579.604951745

If they are not, there may be a problem with the installation of the coordinate conversion routines

result of utm27ToUtm83:

utm83x, utm83y=629258.5972470464,4199579.604951745



These numbers
should match these
numbers

CSDP Demonstration

- Add bathymetry data to database
- select data
 - centerline
 - cross-section line
- draw and edit cross-sections
- create DSM2 input files
- run Hydro
- -dConveyance & convergence failures