Selecting the Right Model

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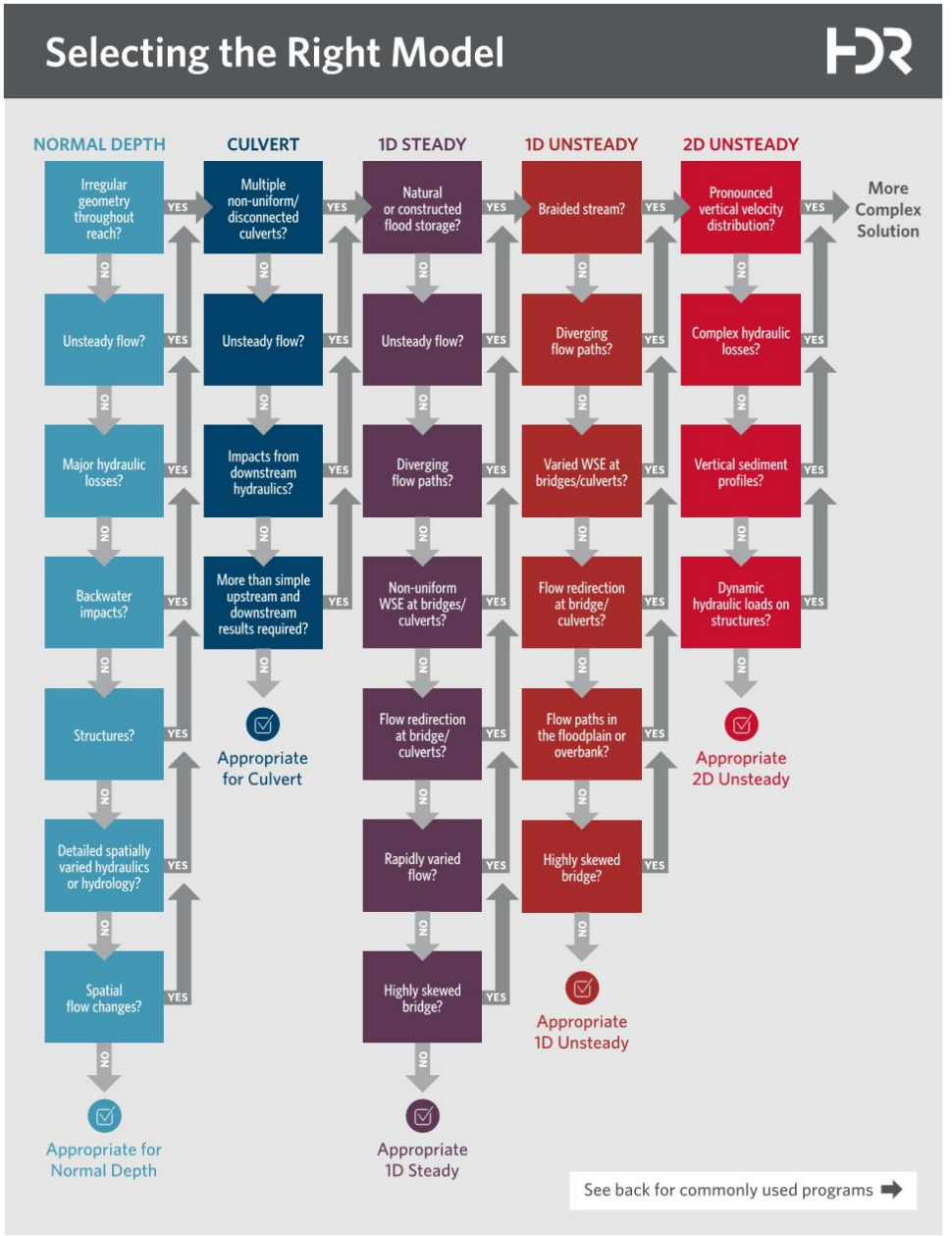
Importance of Model Selection

- Project Management
  - Appropriate use of available budget
  - Schedule management
- Data Needs
  - Input
  - Output
- Risks
  - Hydraulics represent huge risks
  - Lack of detail may not identify risks
  - Simplifications can overestimate risk
  - Wrong analysis can be more costly



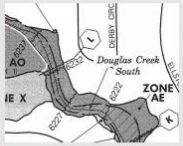
Importance of Model Selection

- Finding the right tool
  - Leverage the tools capabilities
  - Proprietary vs Open Source
  - Future Users
- Available Programs
  - Not an endorsement or recommendation
- Comments/Improvements
  - Email us

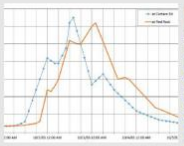
Available Programs

NORMAL DEPTH
- FlowMaster
- Hydraulic Toolbox

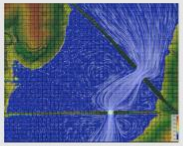
CULVERT
- HY-8
- CulvertMaster
- UD-Culvert



1D STEADY
- HEC-RAS
- MIKE 11
- XPSWMM
- SWMM 5



1D UNSTEADY
- HEC-RAS
- MIKE 11
- XPSWMM
- SWMM 5
- TUFLOW



2D UNSTEADY
- HEC-RAS
- SRH-2D
- Flo2D
- MIKE 21
- TUFLOW
- XPSWMM
- RiverFlow2D
- TrimR2D
- MIKE FLOOD
- SWMM 5

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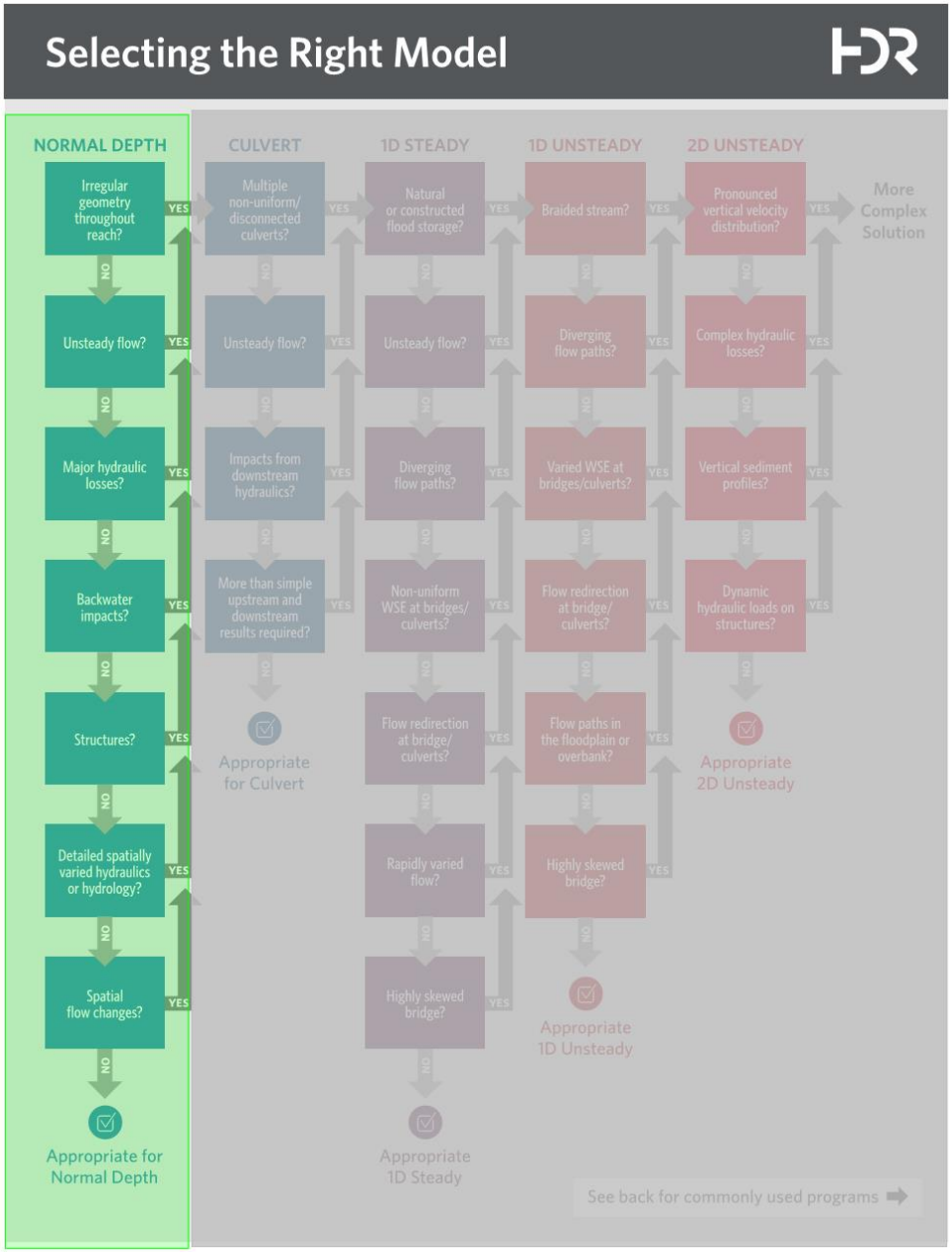
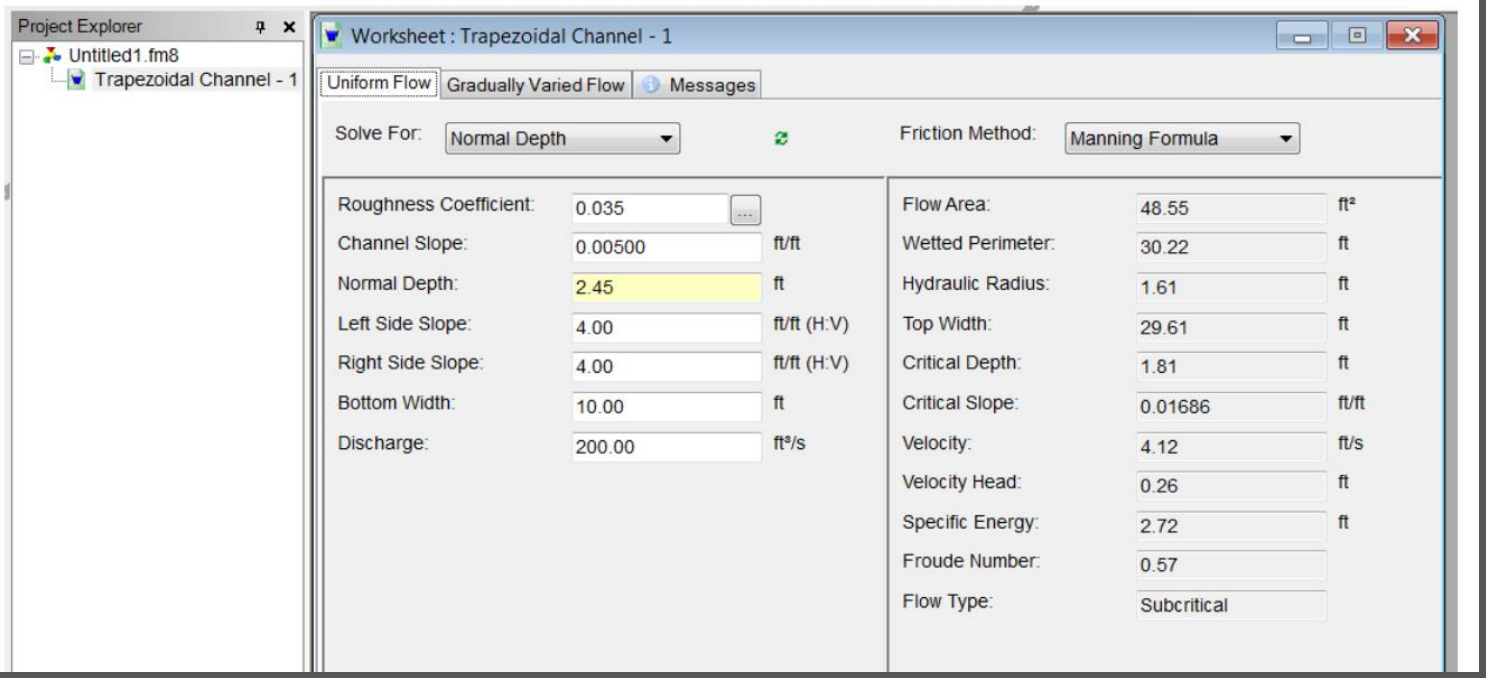
Normal Depth

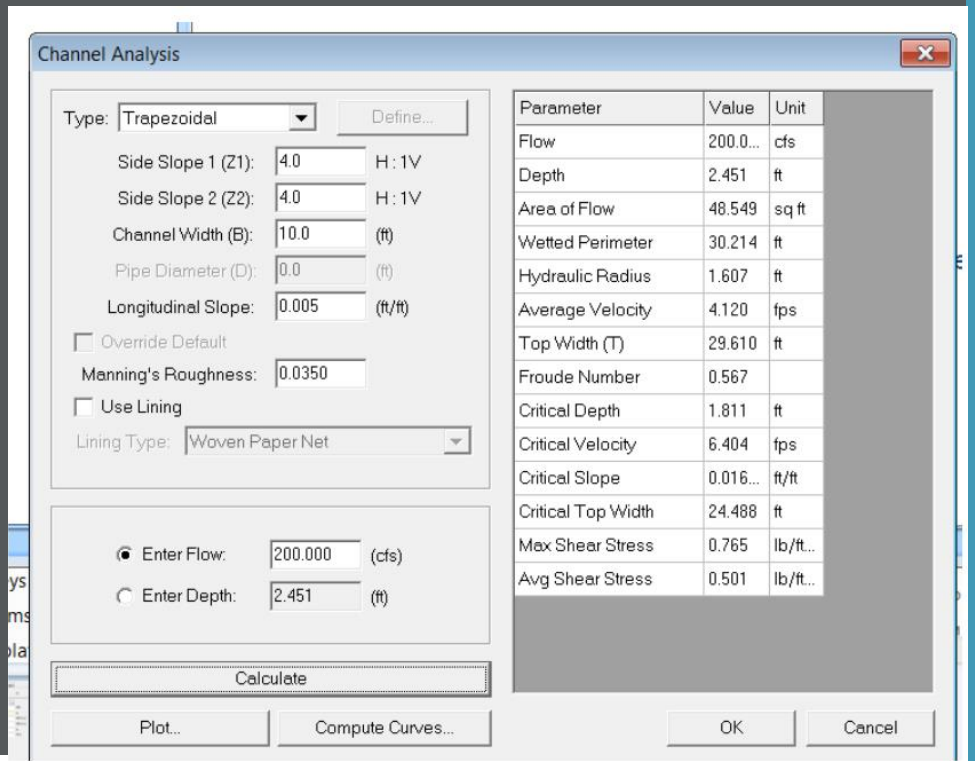
- Irregular Geometry
- Unsteady Flow
- Hydraulic losses
- Backwater Impacts
- Structures
- Spatially varied H&H
- Spatial flow change



- Irrigation channels
- Roadside ditches
- Curb & gutters
- Gutter pans
- Sidewalk chases

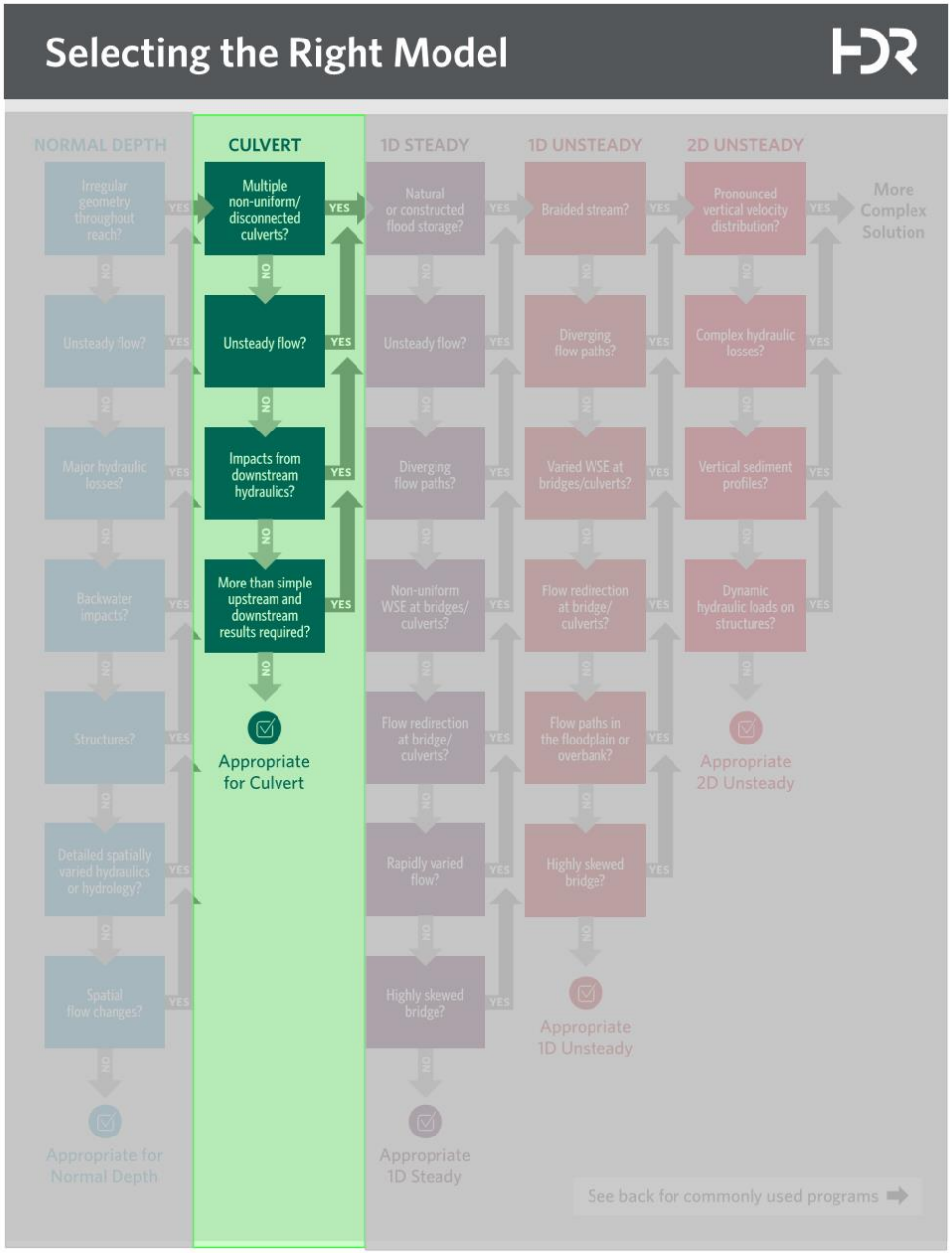


- Simple input
- Simple output

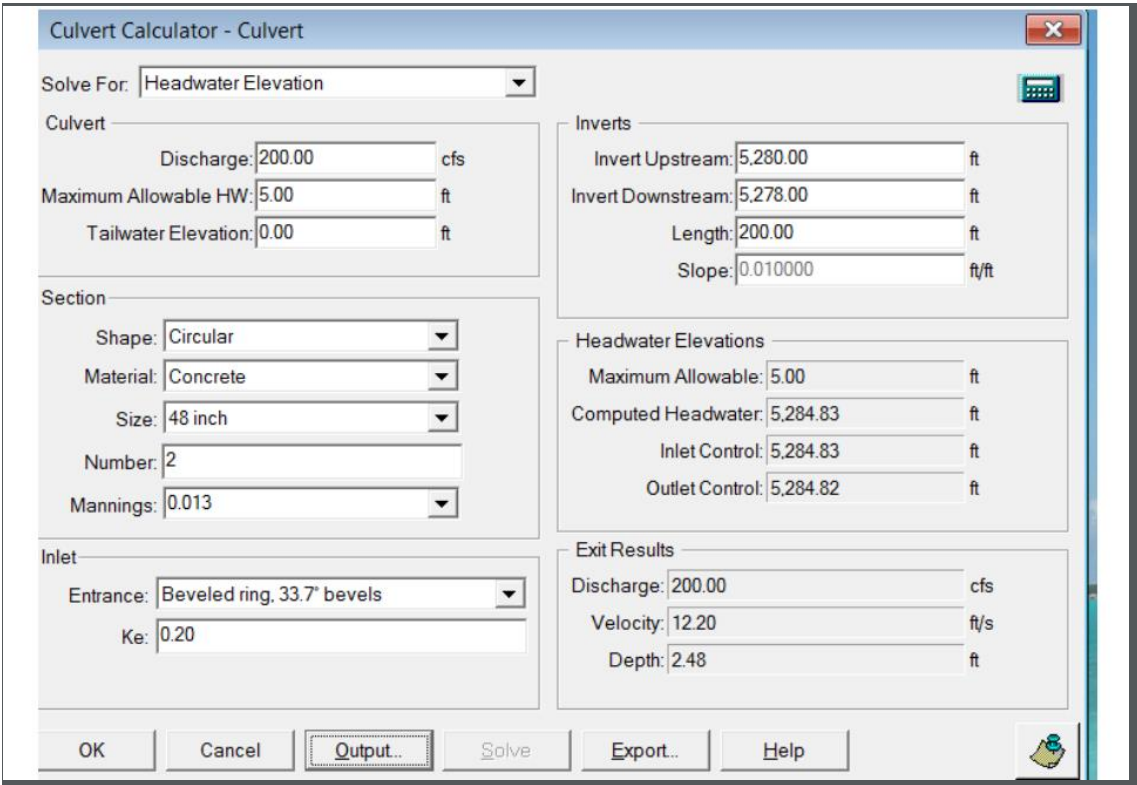


Culvert

- Multiple, non-uniform openings
- Disconnected culverts
- Unsteady Flow
- Unknown downstream WSEL
- Need more than simple upstream/downstream hydraulic result



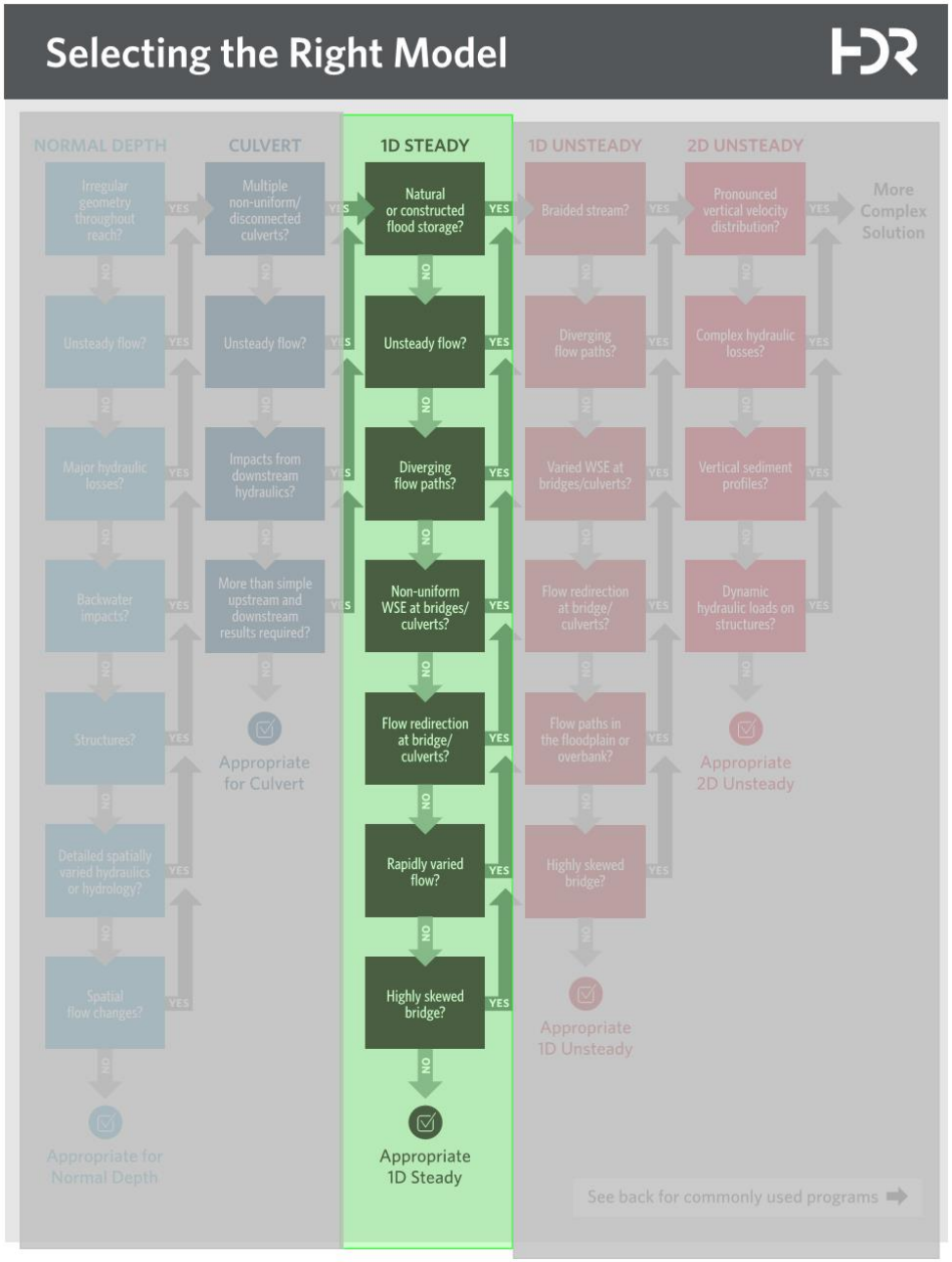
- Single Barrel
- Multiple Barrel
- Standard culvert shape
- Simplistic Overtopping



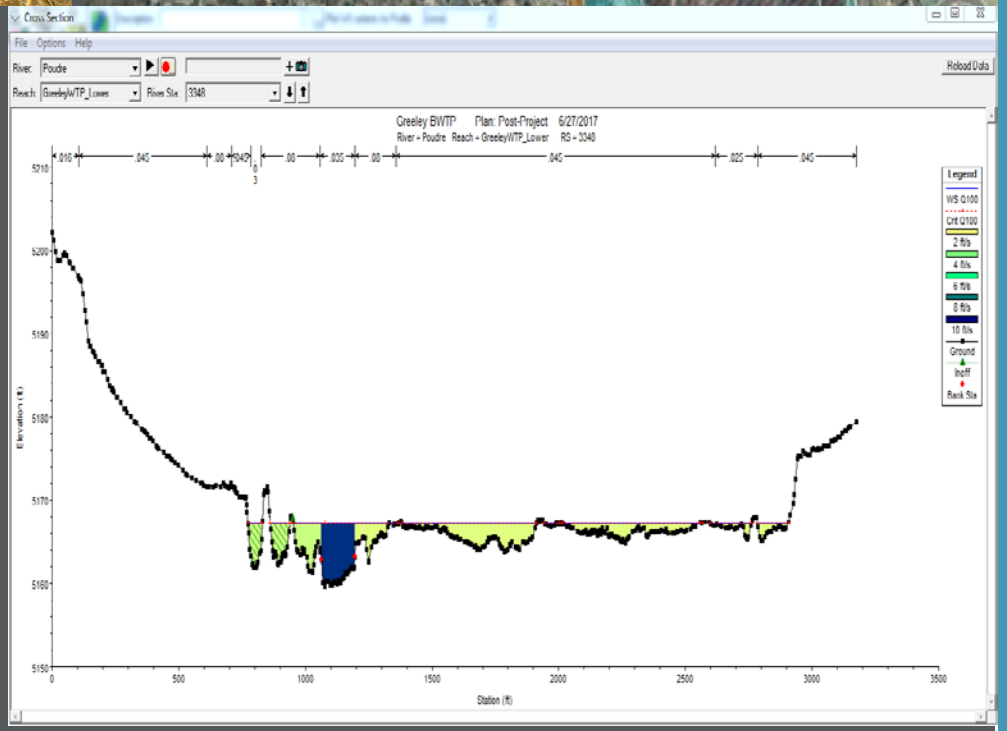
- Simple Input
- Simple Output

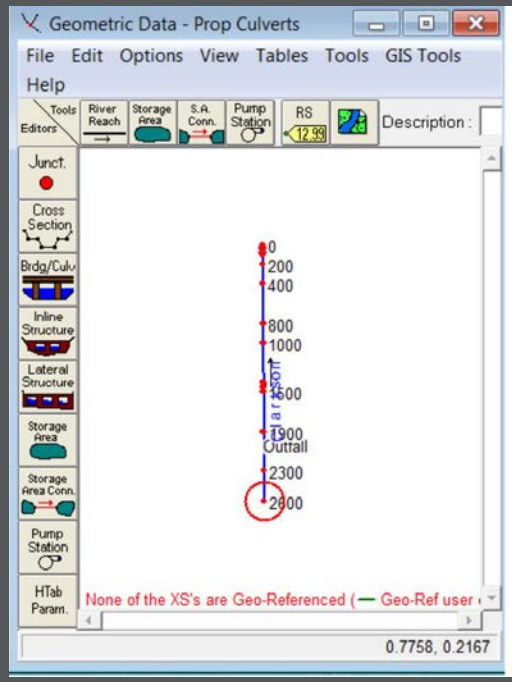
1D Steady State

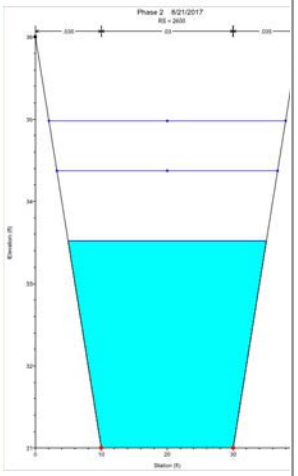
- Natural or constructed flood storage
- Unsteady flow
- Diverging flow paths
- Varied WSEL at bridges/culverts
- Flow redirection
- Rapidly varied flow
- Need for sediment transport results

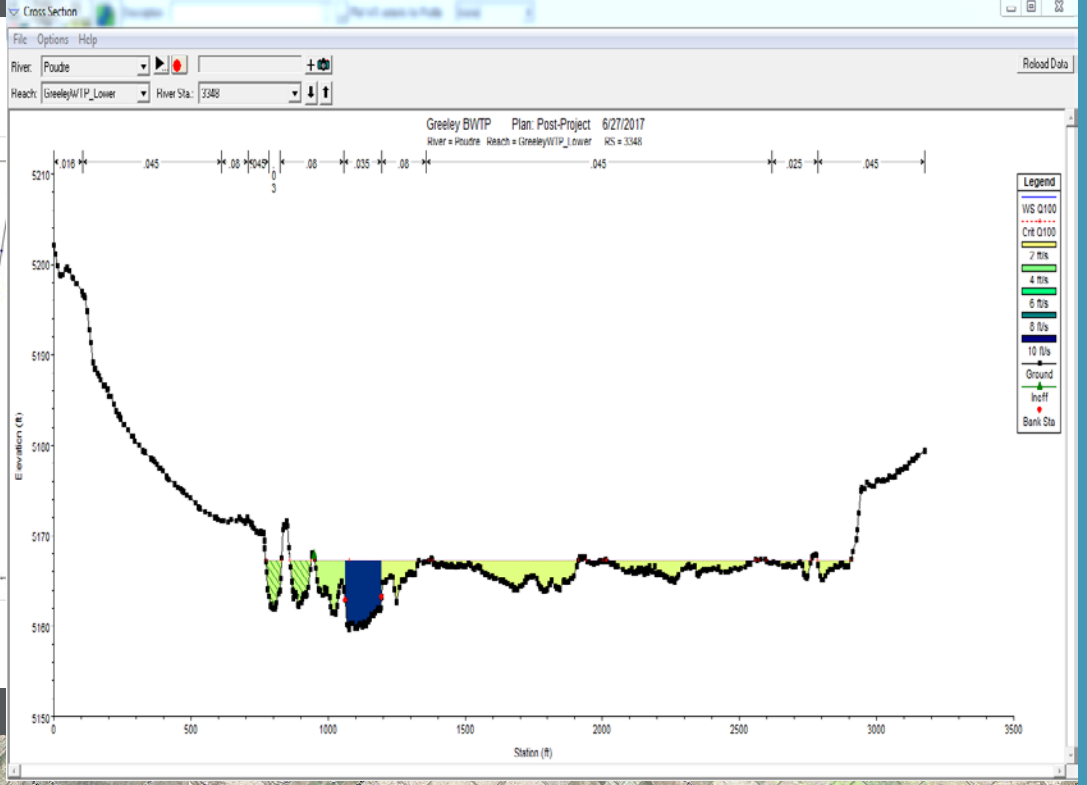


- Channels with varying vegetation/roughness
- Multiple channel reaches
- Bridges
- Culverts
- Parallel Floodplains





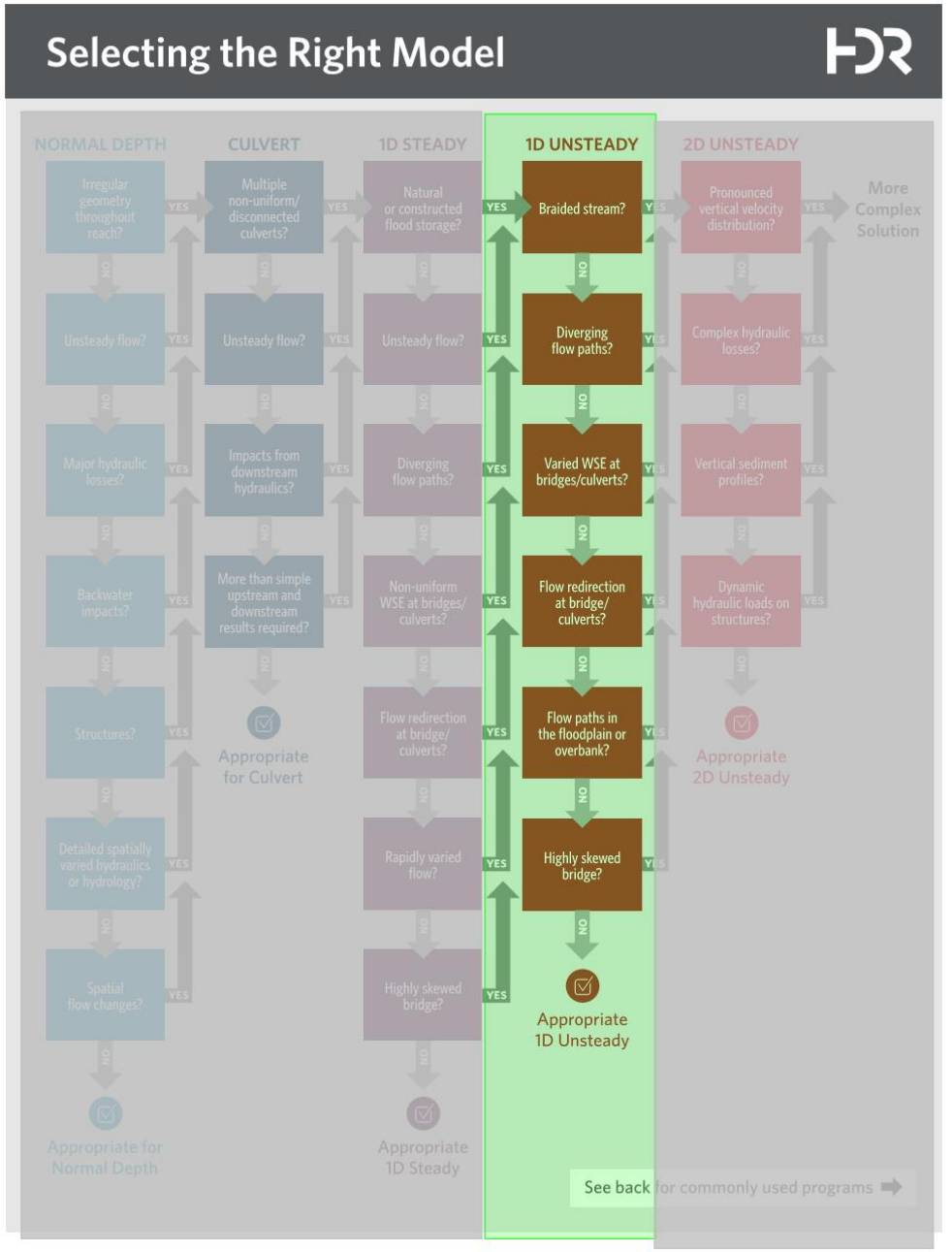


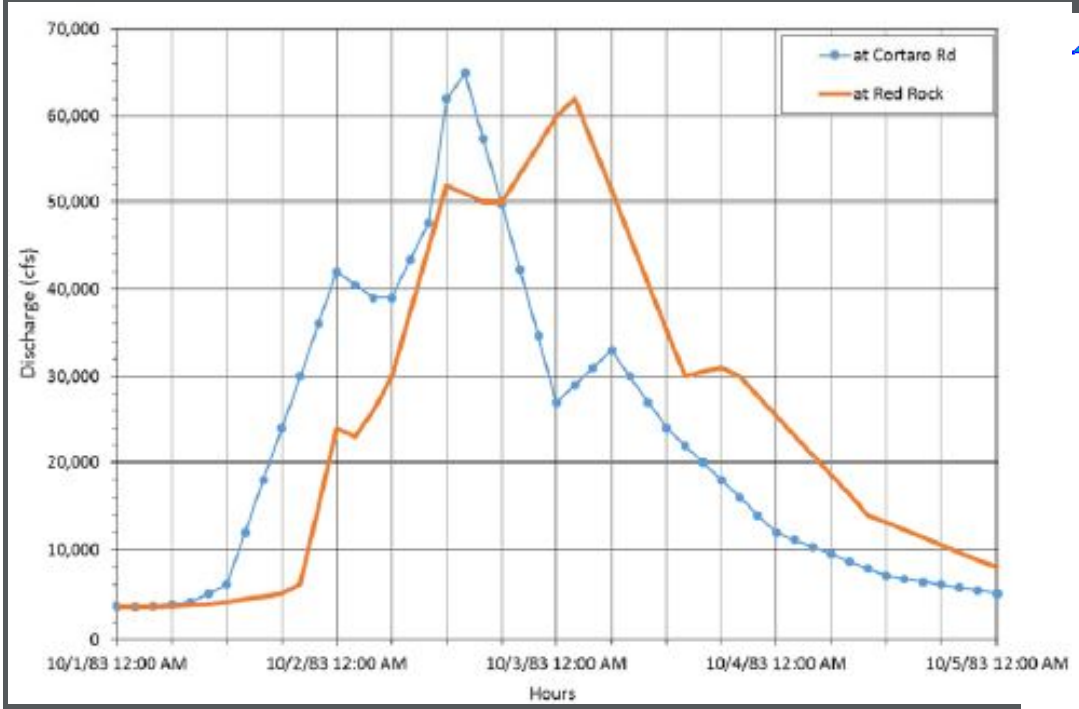


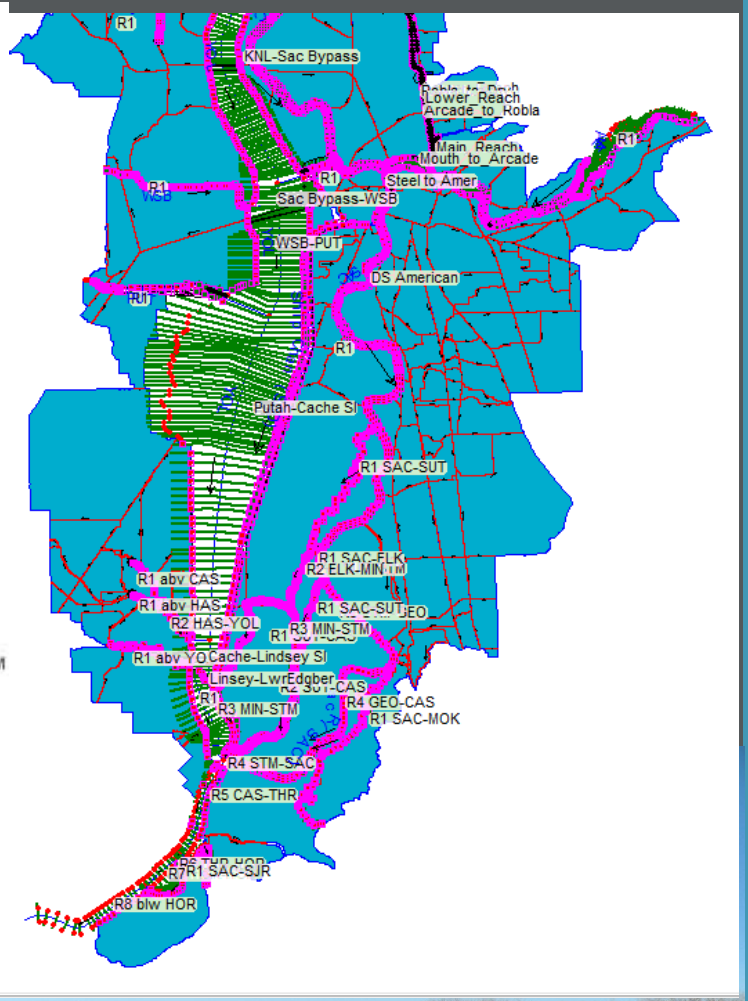
- Wide range of applications
  - Bridge analysis
  - Scour analysis
  - Channel design
  - FEMA Permitting
  - Simple prismatic channels
  - Complex channel section geometry

1D Unsteady State

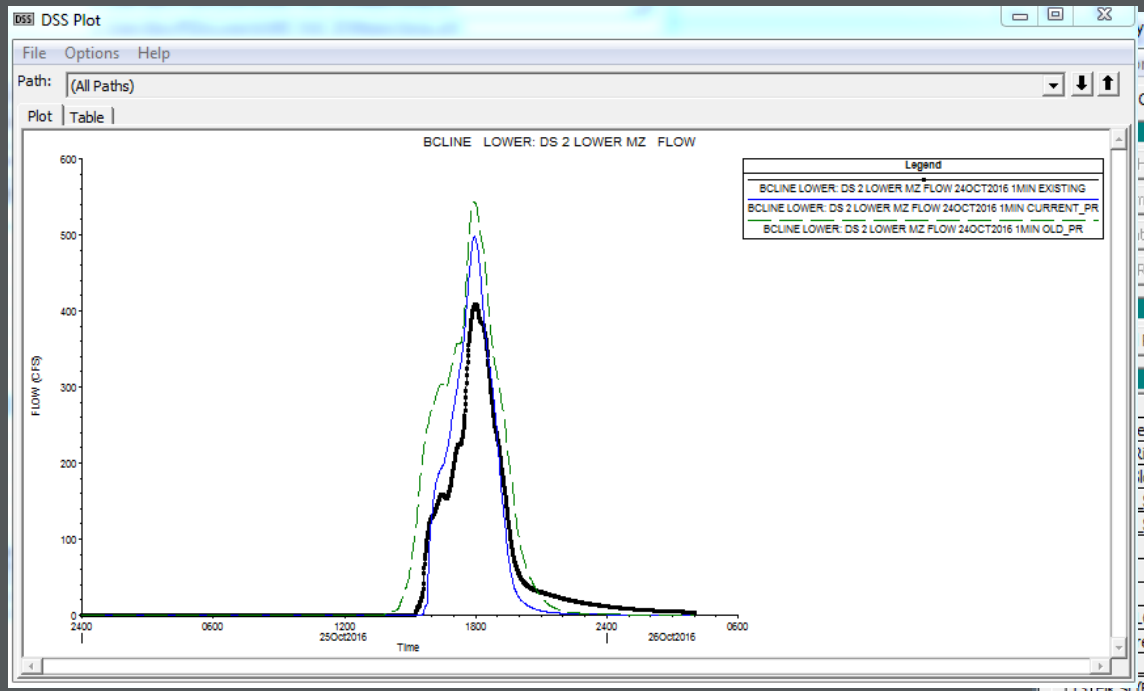
- Braided Streams
- Diverging flow paths
- Varied WSE at bridges/culverts
- Highly skewed bridges

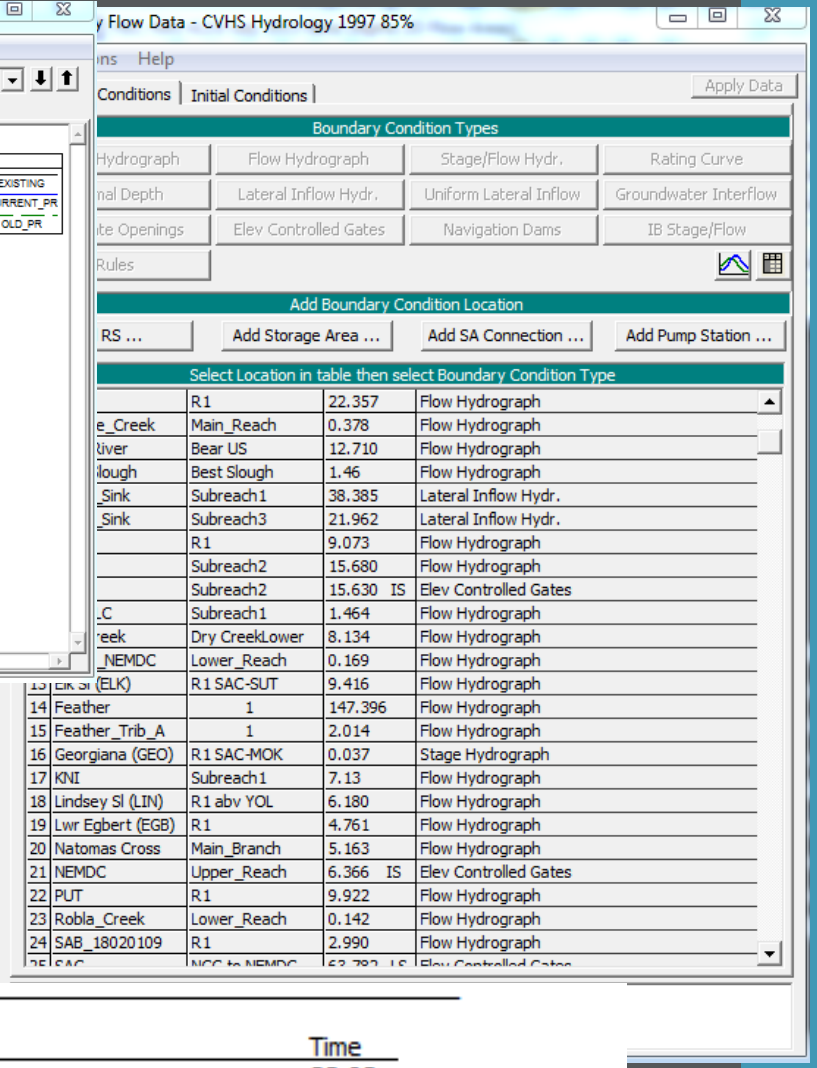






- Flood routing (Volume!)
  - Floodplain storage
  - Looped hydrograph
  - Split flow timing
- Storm durations
- Sediment transport
- Tides or Reservoir operations





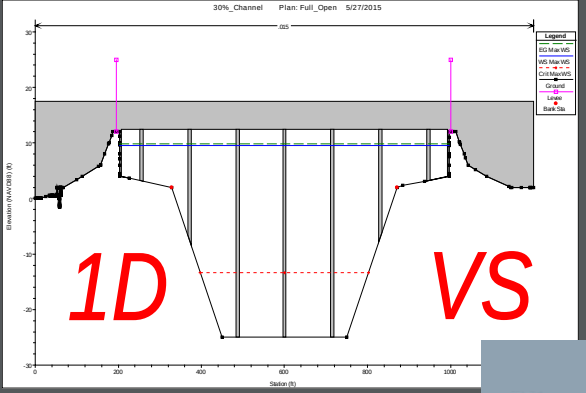
		R1	22.357	Flow Hydrograph
	e_Creek	Main_Reach	0.378	Flow Hydrograph
	River	Bear US	12.710	Flow Hydrograph
	lough	Best Slough	1.46	Flow Hydrograph
	_Sink	Subreach1	38.385	Lateral Inflow Hydr.
	_Sink	Subreach3	21.962	Lateral Inflow Hydr.
		R1	9.073	Flow Hydrograph
		Subreach2	15.680	Flow Hydrograph
		Subreach2	15.630 IS	Elev Controlled Gates
	_C	Subreach1	1.464	Flow Hydrograph
	reek	Dry CreekLower	8.134	Flow Hydrograph
	_NEMDC	Lower_Reach	0.169	Flow Hydrograph
13	Elk Sl (ELK)	R1 SAC-SUT	9.416	Flow Hydrograph
14	Feather	1	147.396	Flow Hydrograph
15	Feather_Trib_A	1	2.014	Flow Hydrograph
16	Georgiana (GEO)	R1 SAC-MOK	0.037	Stage Hydrograph
17	KNI	Subreach1	7.13	Flow Hydrograph
18	Lindsey Sl (LIN)	R1 abv YOL	6.180	Flow Hydrograph
19	Lwr Egbert (EGB)	R1	4.761	Flow Hydrograph
20	Natomas Cross	Main_Branch	5.163	Flow Hydrograph
21	NEMDC	Upper_Reach	6.366 IS	Elev Controlled Gates
22	PUT	R1	9.922	Flow Hydrograph
23	Robla_Creek	Lower_Reach	0.142	Flow Hydrograph
24	SAB_18020109	R1	2.990	Flow Hydrograph

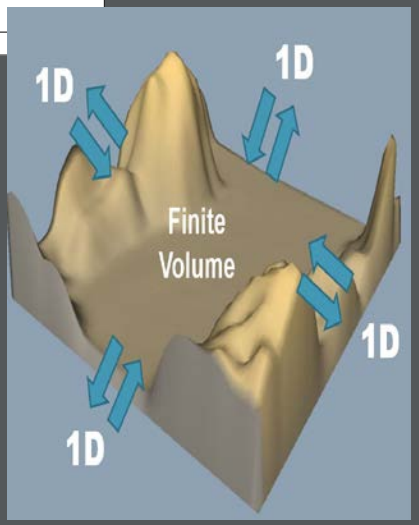
- More complex analysis
  - Hydrographs
  - Computational stability
  - Model run times
- More output data
  - Animated WSE
  - Durations of flow
  - Volumes of flow
- More experience needed

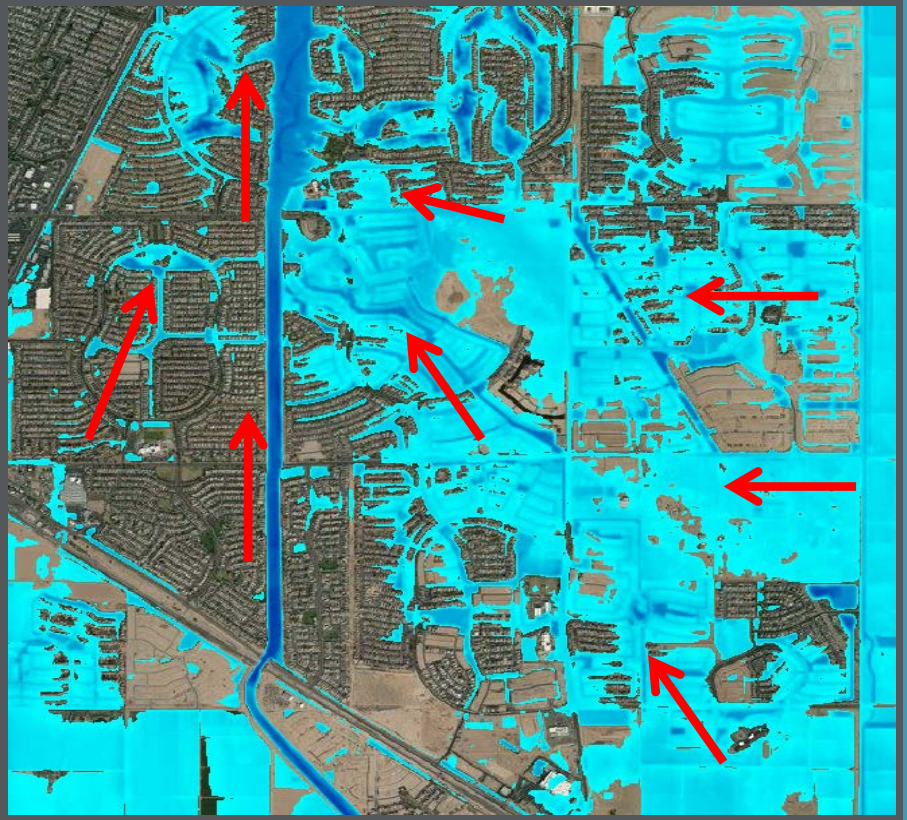
Task	Time
Writing Geometry	23.03 sec
Writing Event Conditions	0.16 sec
Preprocessing Geometry(64)	1 min 3.30 sec
Unsteady Flow Computations(64)	1 hours 19 min 27 sec
Writing to DSS(64)	3 min 30.91 sec
Post-Processing(64)	16 min 55.88 sec
Computing Maps	0.31 sec
Complete Process	1 hours 41 min 21 sec

2D

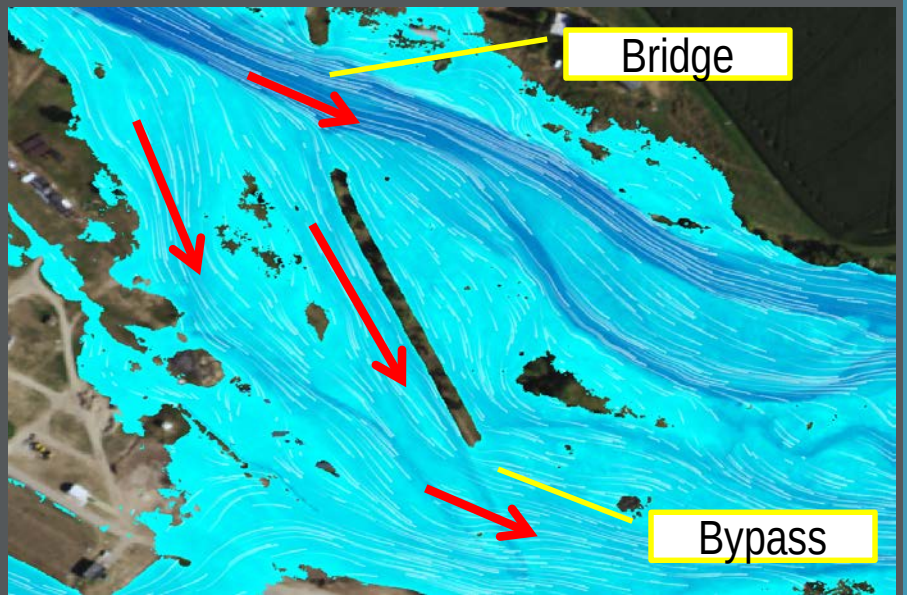
- Vertical velocity distribution
- Complex hydraulic losses
- Vertical sediment profiles
- Need dynamic hydraulic loads on structures

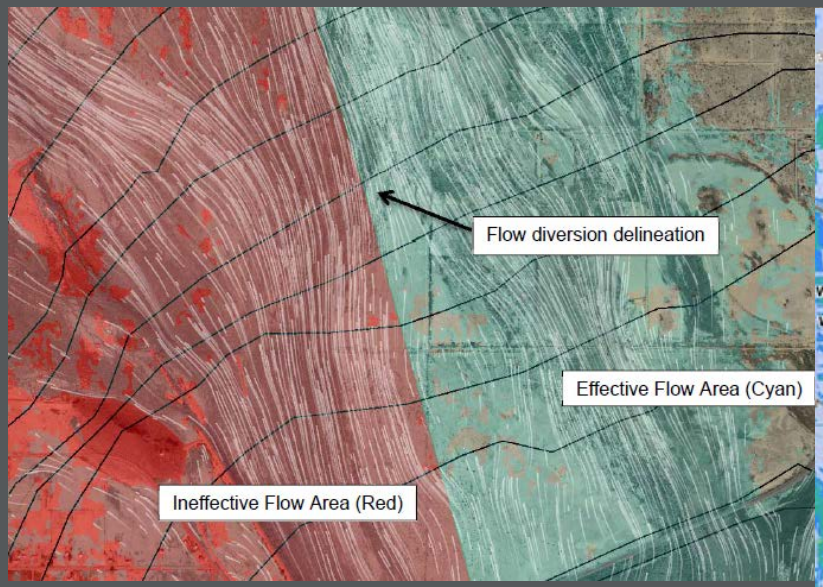


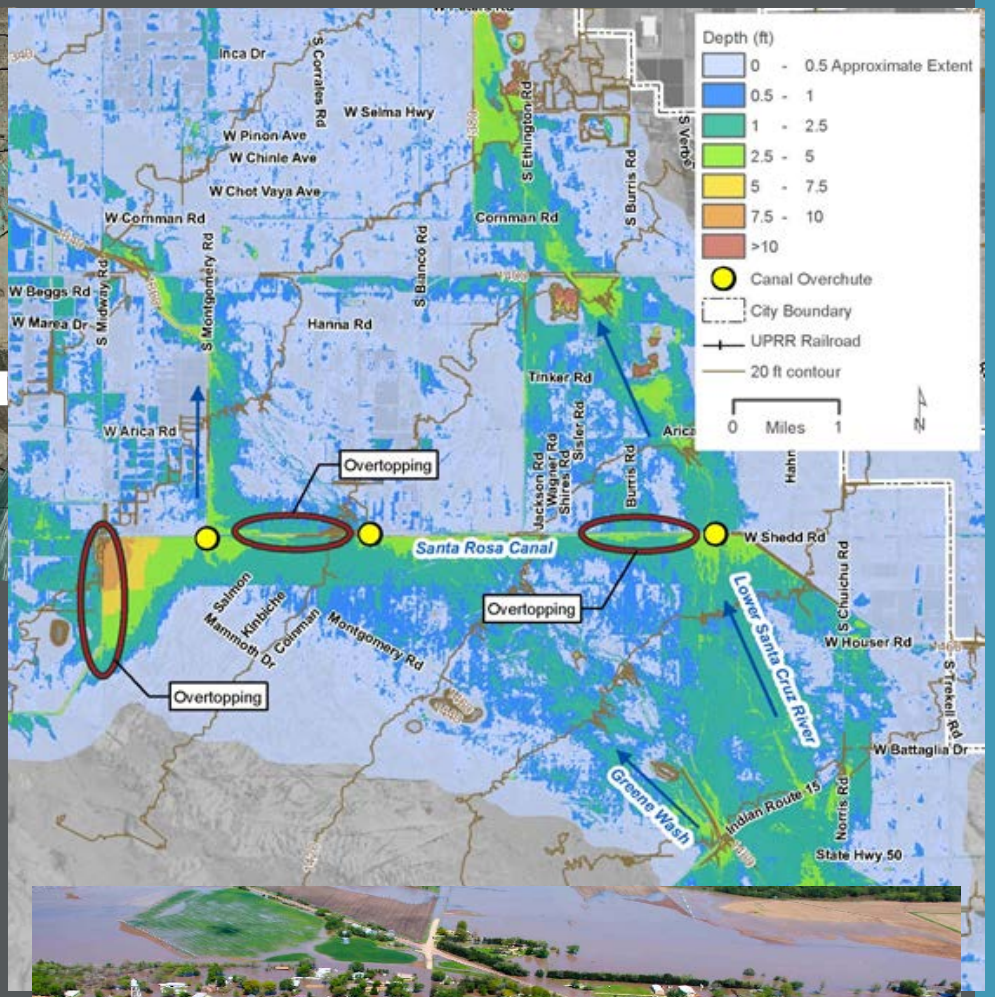




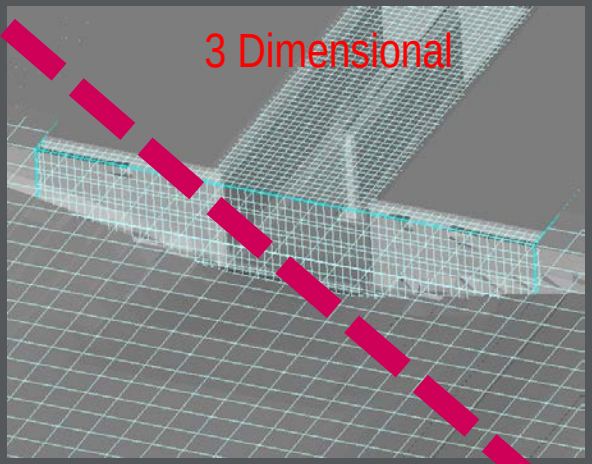
- Split flow paths
  - Bridges
  - Braided systems
  - Complex floodplains
- Non-uniform WSE
- Highly skewed bridges
- Floodplain storage







- More spatial detail
  - More terrain data
- Great for visualizations
  - Easy to understand
- Informative for 1D models
- Requires experience


3 Dimensional

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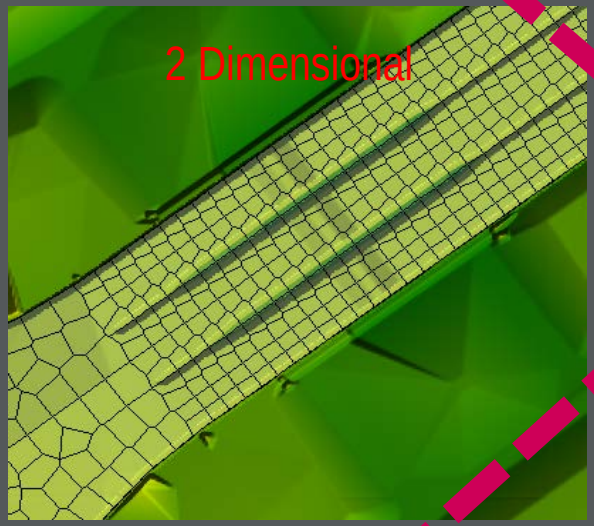
2 Dimensional

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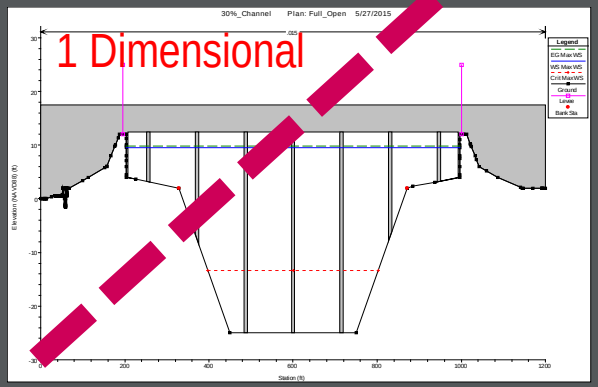
30%_Channel Plan: Full_Open 5/27/2015
1 Dimensional
Legend
EG Max WS
WS Max WS
Crit Max WS
Ground
Levee
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Elevation (WA VOID) (ft)
Station (ft)

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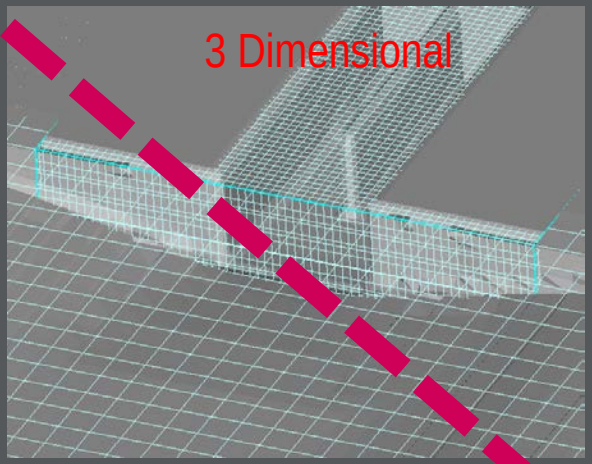
3 Dimensional

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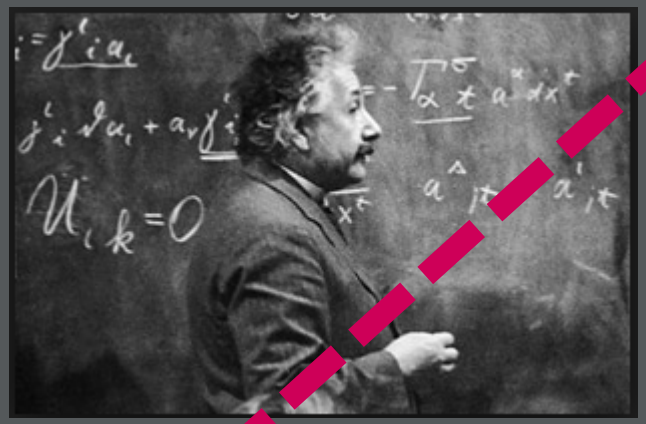

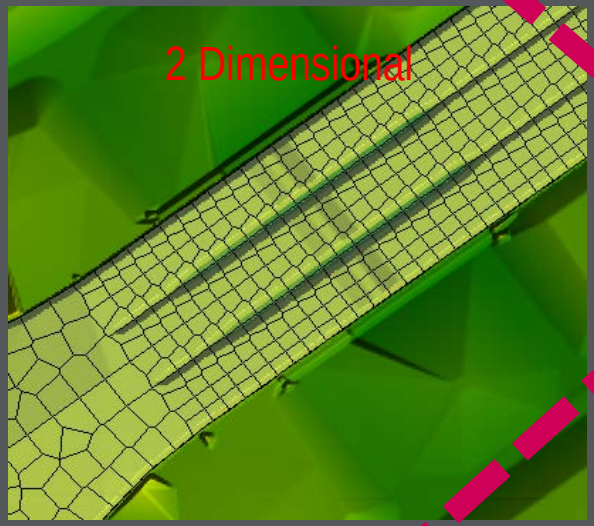
2 Dimensional

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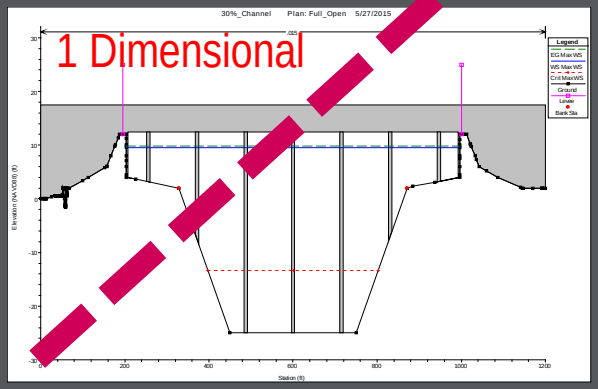
7X8=5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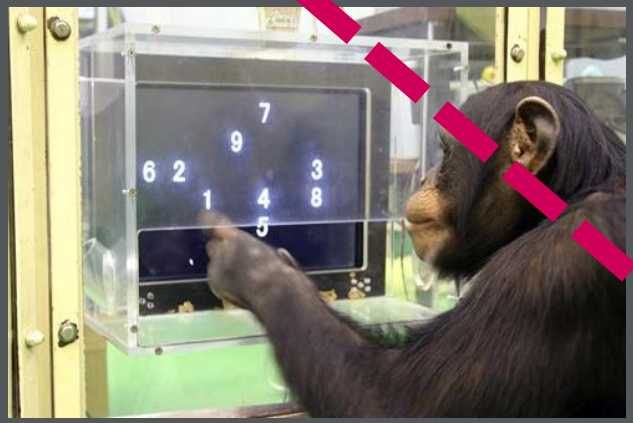
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Questions

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