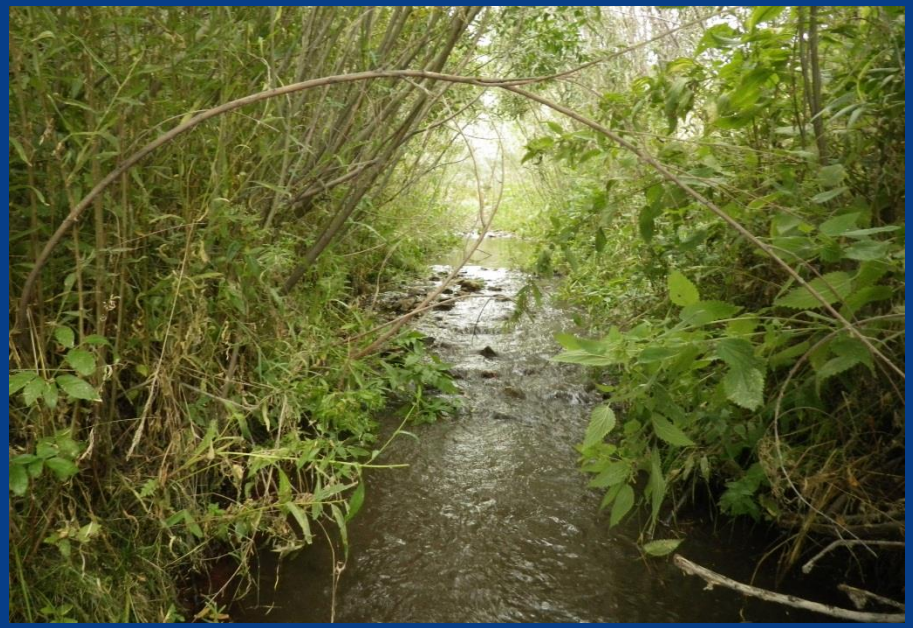
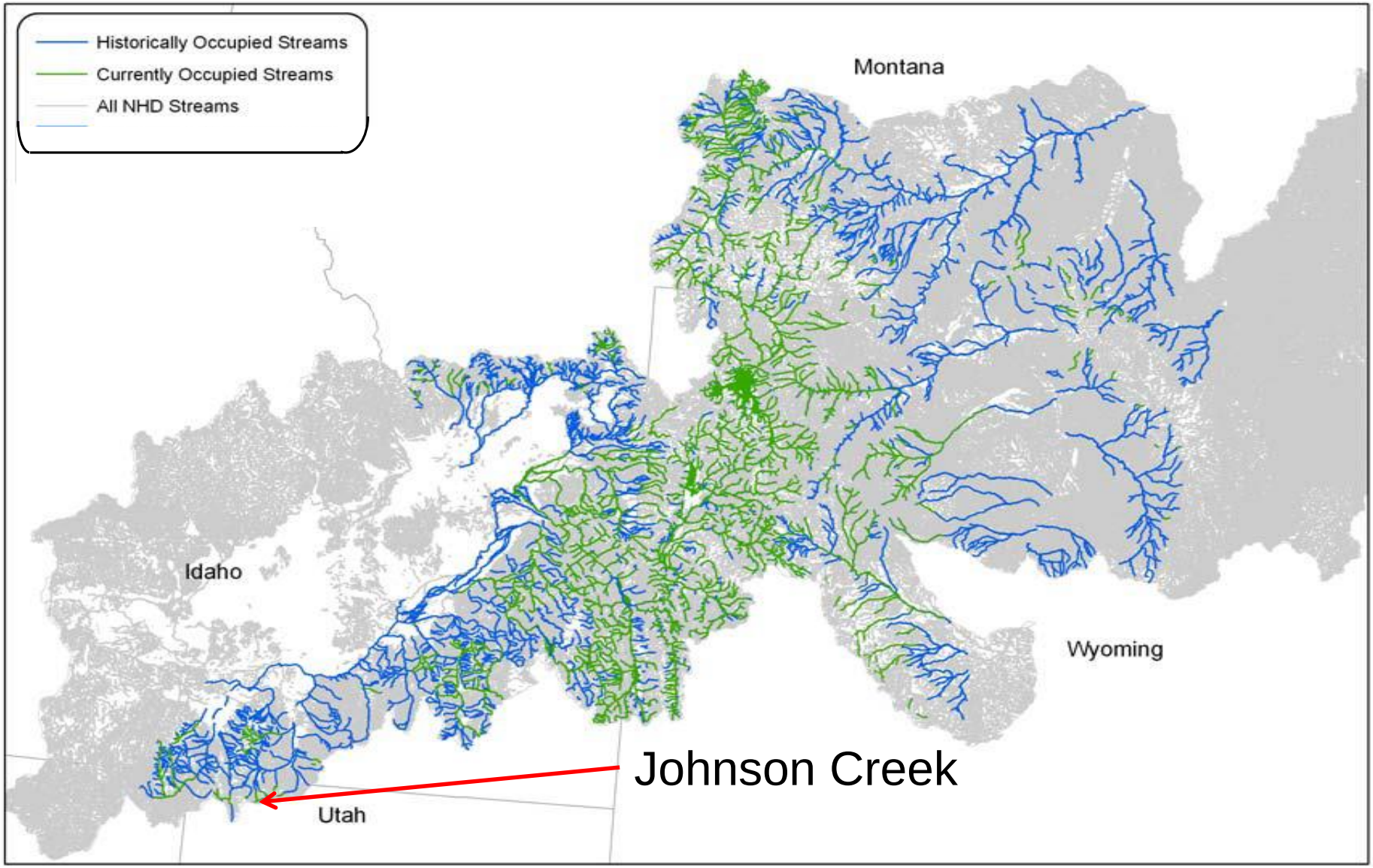
Hydraulic analysis and risk assessment of a proposed fish barrier for Johnson Creek, Utah.

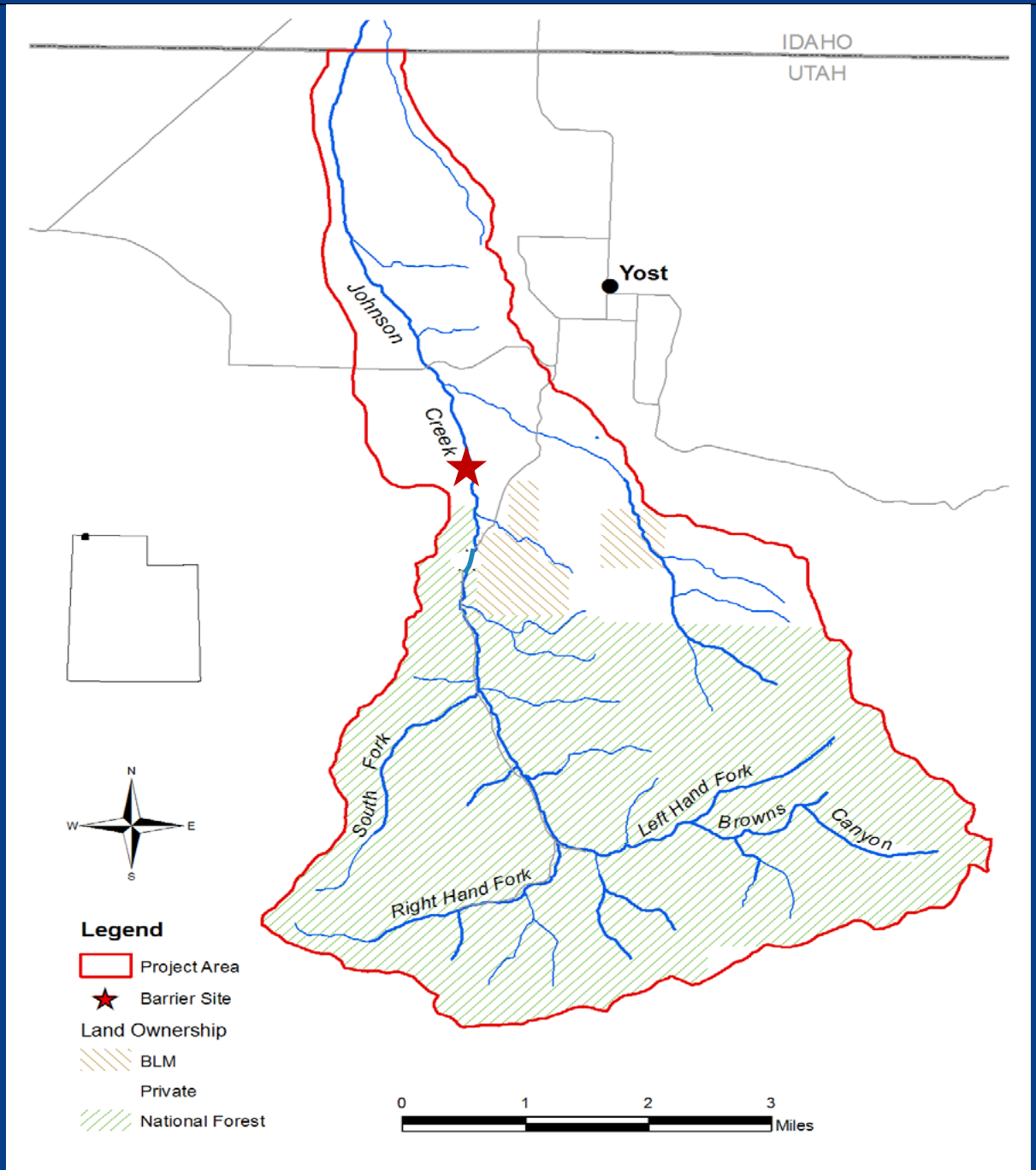
Hydraulic & Risk Assessment of Fish Barrier Alternatives on Johnson Creek, Utah




Idaho
Idaho Falls
Blackfoot
Pocatello
Twin Falls
Burley
Gros Ventre Wilderness
Caribou National Forest
Johnson Creek
Logan
Brigham City
Ogden
Layton
Bountiful
Salt Lake City
Rock Springs
Ashley National Forest

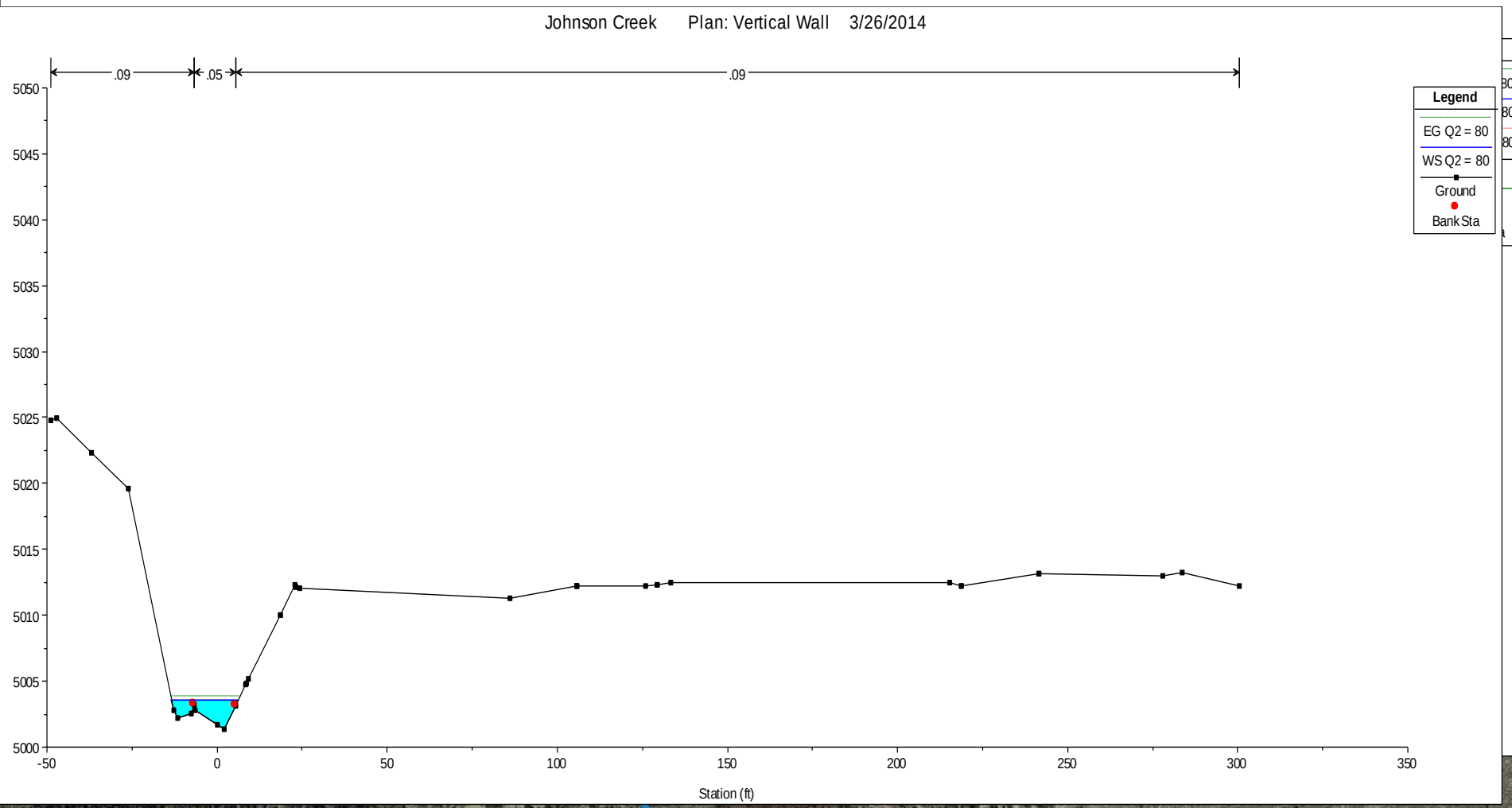


Yellowstone Cutthroat Distribution


IDAHO
UTAH
Yost
Johnson
Creek
South Fork
Left Hand Fork
Browns
Canyon
Right Hand Fork
N
W
E
S
Legend
Project Area
Barrier Site
Land Ownership
BLM
Private
National Forest
0
1
2
3
Miles

Stop Brook Trout
100 year flood =
326 cfs

Johnson Creek Plan: Vertical Wall 3/26/2014




8 22. 2008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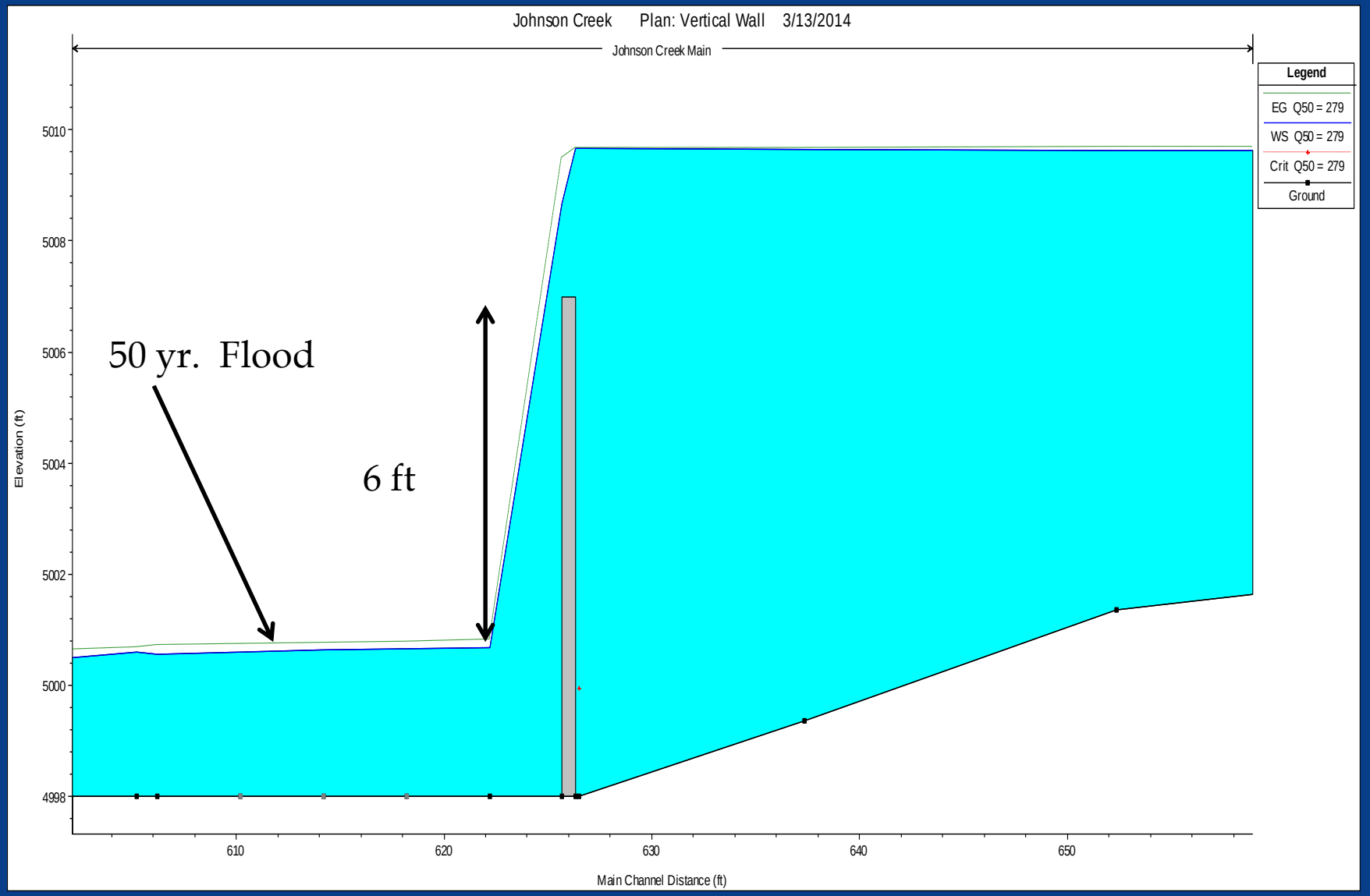
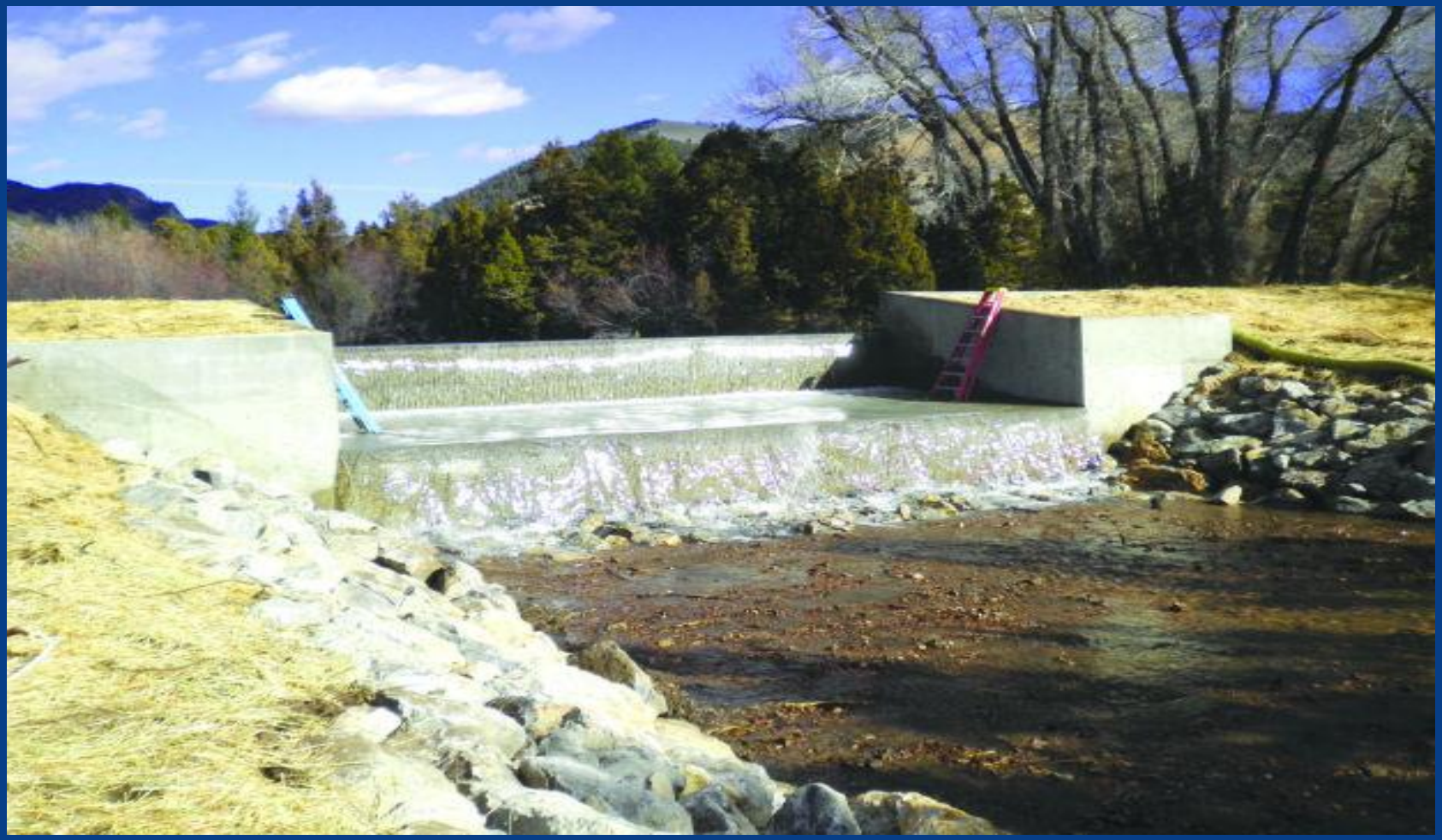
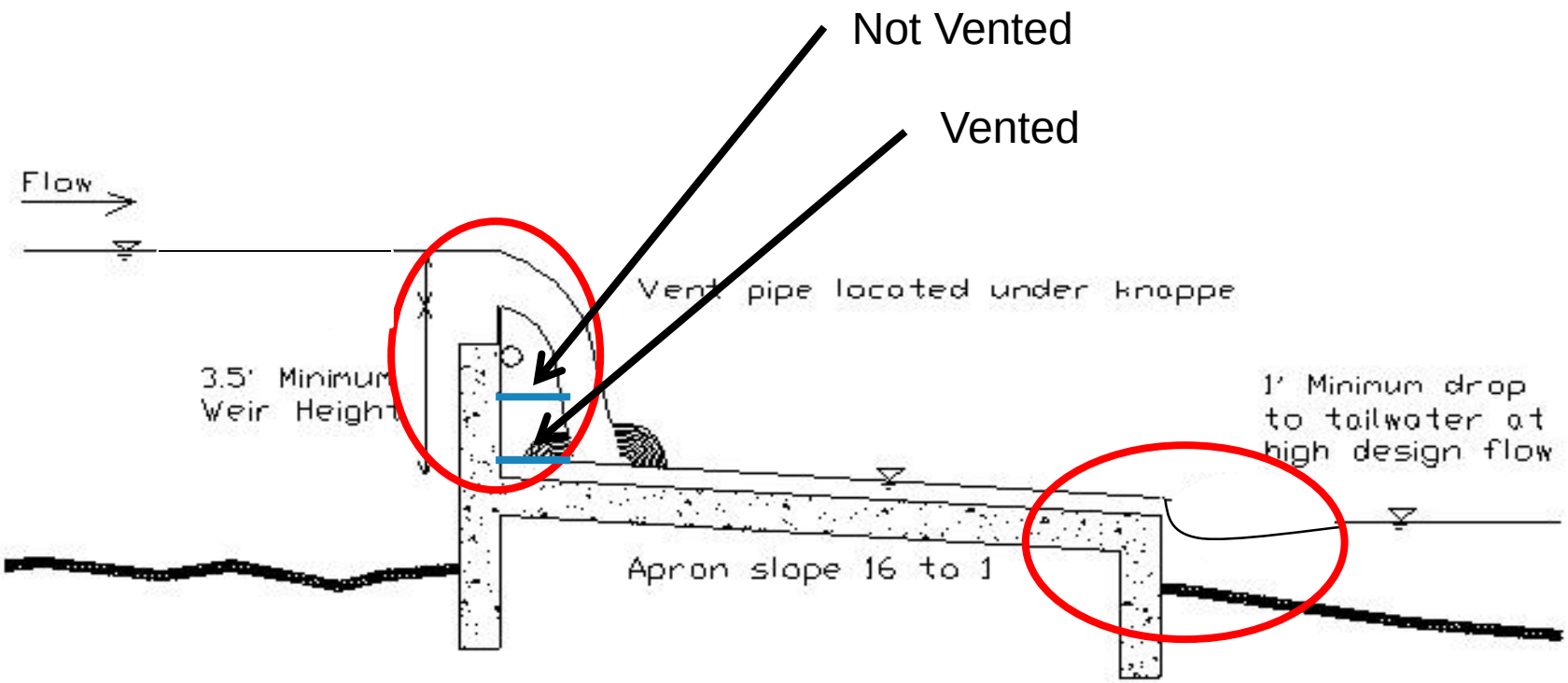

Johnson Creek Plan: Vertical Wall 3/13/2014
Johnson Creek Main
Legend
EG Q50 = 279
WS Q50 = 279
Crit Q50 = 279
Ground
50 yr. Flood
6 ft
Elevation (ft)
5010
5008
5006
5004
5002
5000
4998
610
620
630
640
650
Main Channel Distance (ft)



Greenhorn Creek Fish Barrier, Montana



Velocity Barrier

USBR

Relative Performance Index

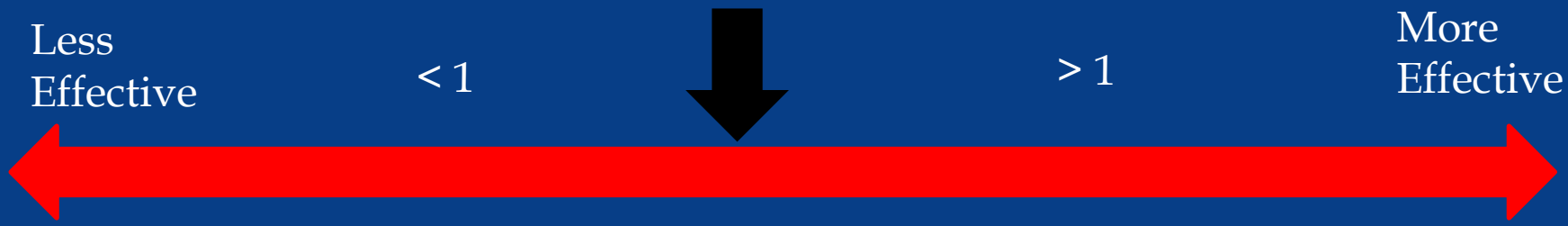
1.) EFFECTIVENESS = 4 COMPONENTS

2.) STABILITY = 2 COMPONENTS

Relative Performance Index

1.) EFFECTIVENESS

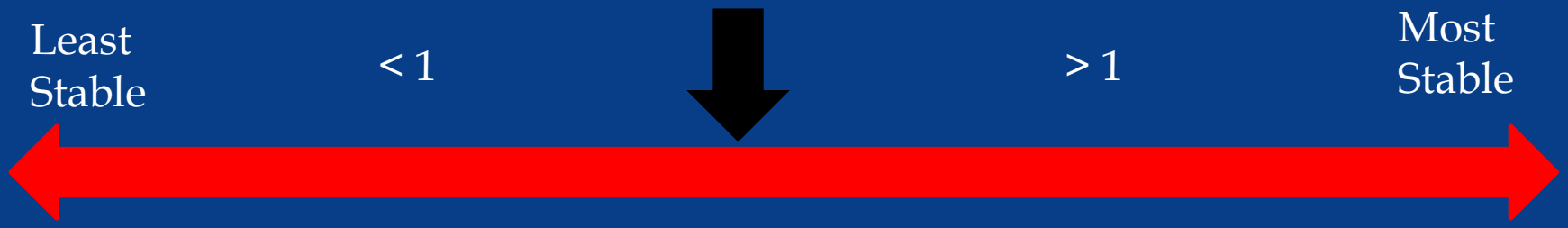
- Free Overfall (Weir Height)
- Burst Speed
- Prolonged Speed
- Apron Elevation



Relative Performance Index

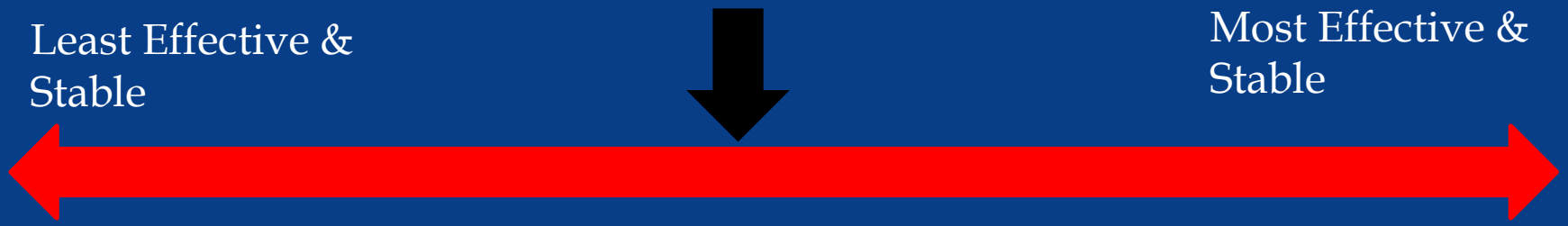
1.) STABILITY

- Water Impounded
- Dam Freeboard



Relative Performance Index

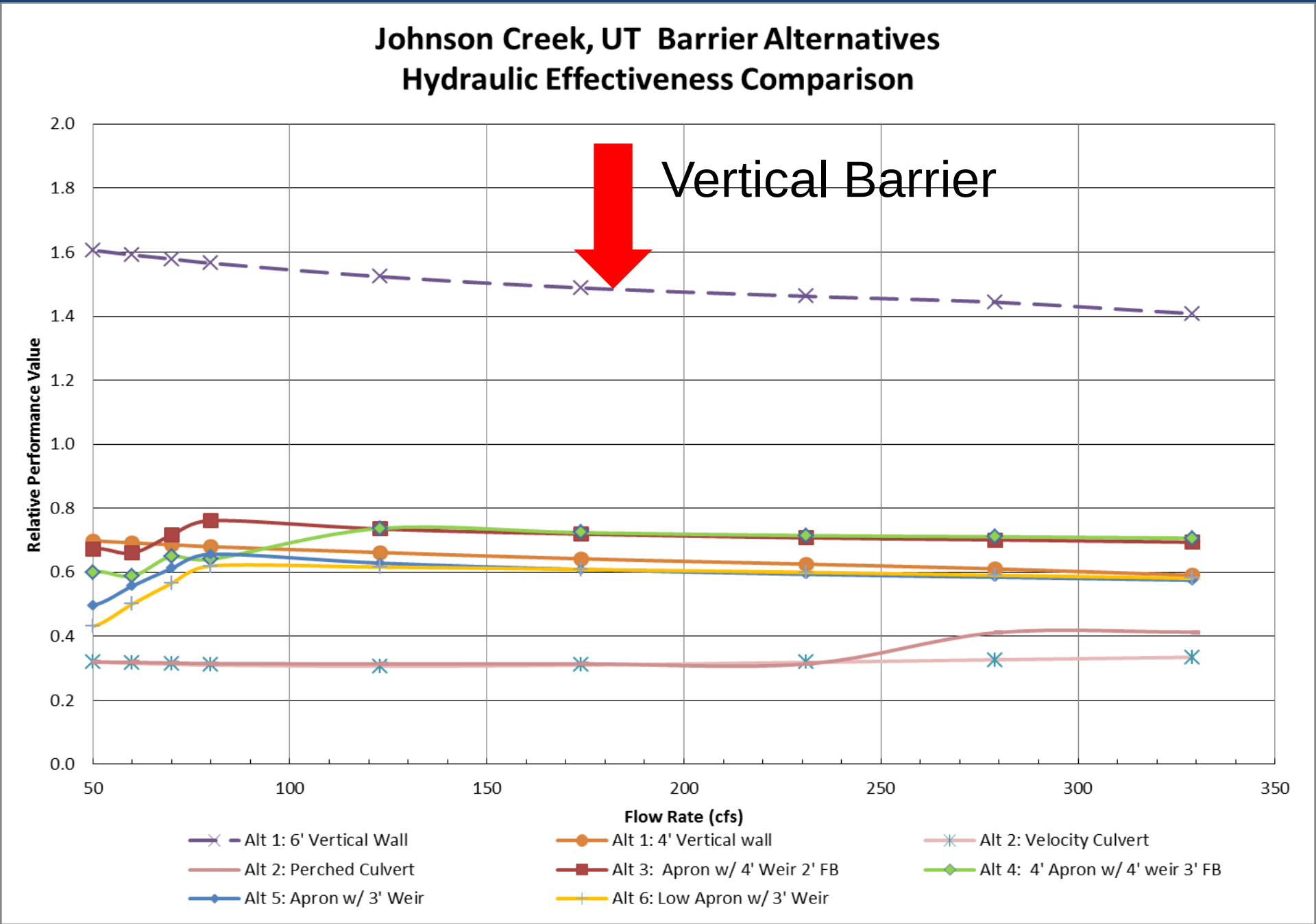
$$RPC = \frac{(Weir + Burst + Prolonged + Apron + Impounded + FB)}{6}$$



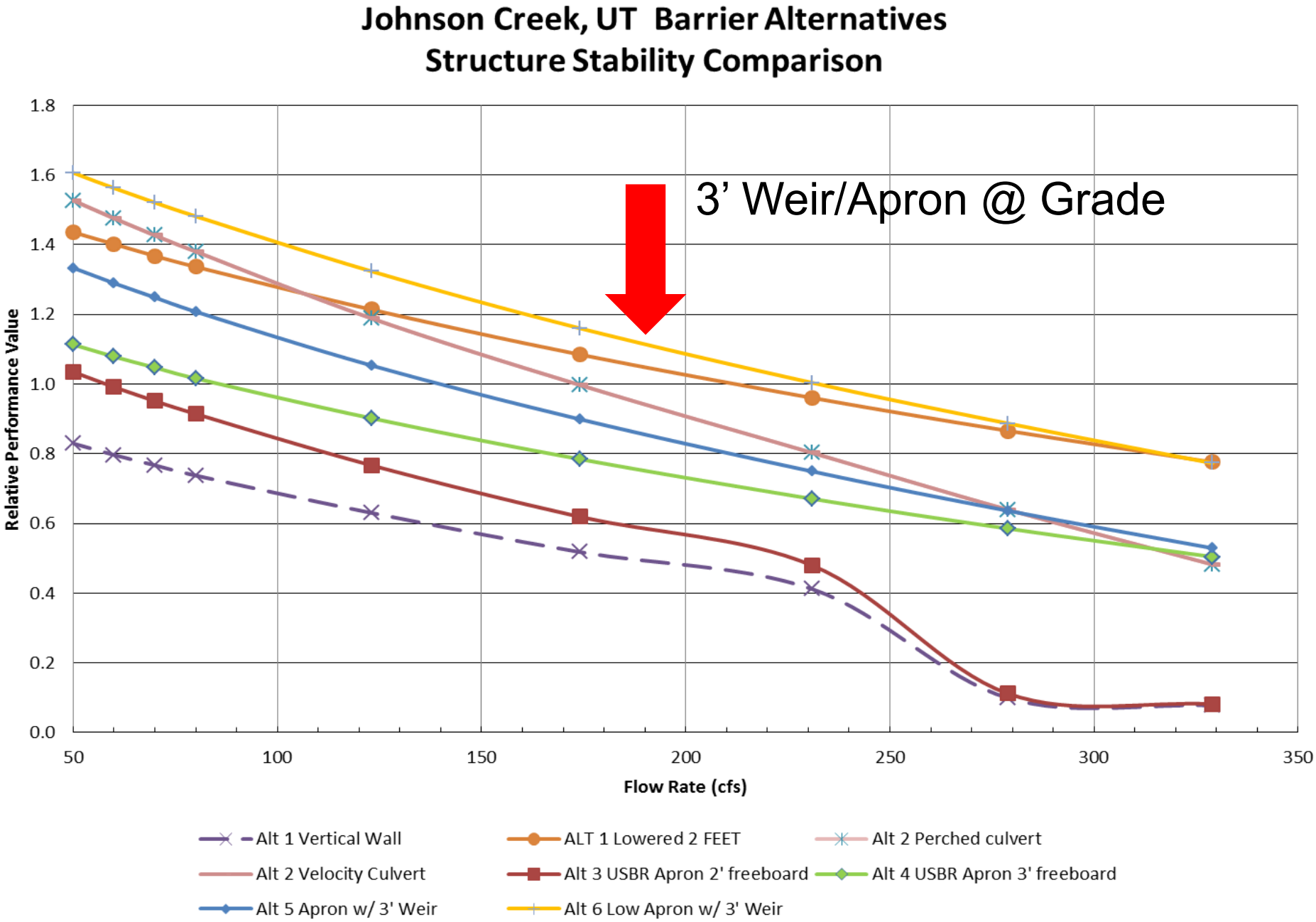
Additional Considerations

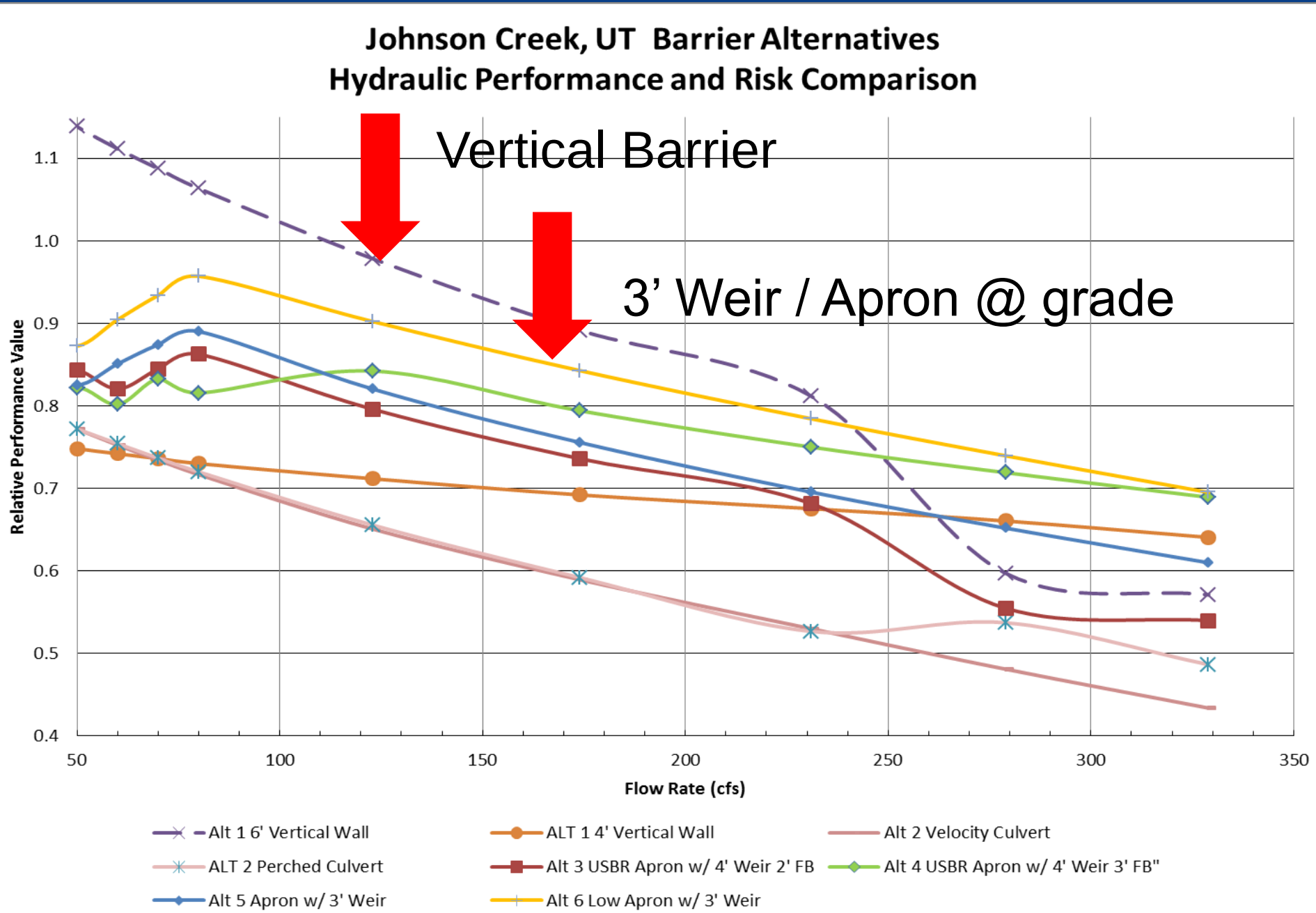
Cost vs. Risk of Reinvasion

Is this Cost Effective / Prohibitive ?


Johnson Creek, UT Barrier Alternatives
Hydraulic Effectiveness Comparison
Vertical Barrier
Relative Performance Value
2.0
1.8
1.6
1.4
1.2
1.0
0.8
0.6
0.4
0.2
0.0
50
100
150
200
250
300
350
Flow Rate (cfs)
Alt 1: 6' Vertical Wall
Alt 1: 4' Vertical wall
Alt 2: Velocity Culvert
Alt 2: Perched Culvert
Alt 3: Apron w/ 4' Weir 2' FB
Alt 4: 4' Apron w/ 4' weir 3' FB
Alt 5: Apron w/ 3' Weir
Alt 6: Low Apron w/ 3' Weir


8. 22. 2008


Johnson Creek, UT Barrier Alternatives
Structure Stability Comparison
3' Weir/Apron @ Grade
Relative Performance Value
1.8
1.6
1.4
1.2
1.0
0.8
0.6
0.4
0.2
0.0
50
100
150
200
250
300
350
Flow Rate (cfs)
Alt 1 Vertical Wall
ALT 1 Lowered 2 FEET
Alt 2 Perched culvert
Alt 2 Velocity Culvert
Alt 3 USBR Apron 2' freeboard
Alt 4 USBR Apron 3' freeboard
Alt 5 Apron w/ 3' Weir
Alt 6 Low Apron w/ 3' Weir


Johnson Creek, UT Barrier Alternatives
Hydraulic Performance and Risk Comparison
Vertical Barrier
3' Weir / Apron @ grade
Relative Performance Value
1.1
1.0
0.9
0.8
0.7
0.6
0.5
0.4
50
100
150
200
250
300
350
Flow Rate (cfs)
Alt 1 6' Vertical Wall
ALT 1 4' Vertical Wall
Alt 2 Velocity Culvert
ALT 2 Perched Culvert
Alt 3 USBR Apron w/ 4' Weir 2' FB
Alt 4 USBR Apron w/ 4' Weir 3' FB"
Alt 5 Apron w/ 3' Weir
Alt 6 Low Apron w/ 3' Weir

The Goal

Design an effective & stable barrier in an appropriate location that has minimal effects on the stream system

What is Needed for Successful Barriers?

- Comprehensive barrier design manual
- Better understanding of target species
- More precise hydrology predictions
- Site Location & stream type (geomorphically stable & effects of barrier on stream)
- Consistent long-term monitoring & maintenance
- Better hydraulic data at proposed barrier (3-D)
- Learn from our successes & mistakes

Additional Considerations

- Understand the risks of installing a barrier
- Understand that barriers are not a long-term solution to control non native species
- Invasion vs. isolation

All things considered, an artificial barrier should be regarded as a stopgap measure; ultimately, the only permanent method for securing populations of Colorado River cutthroat trout will be removal of nearby nonnative trout populations and reestablishment of connectivity to larger stream networks (Hepworth et al. 2002).

Thanks

- Dale White: Forest Hydrologist, Gallatin N.F. Montana
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- Matt McKell: Aquatic Biologist, Utah DNR
- Mark Lacy: Fish Biologist, White River N.F Colorado
- Mark Weinhold: Forest Hydrologist, White River N.F. Colorado

Questions