Yakima River Decision Support System – Prototype Development

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Purpose

To summarize and display consequences to a wide range of resource values resulting from various water management scenarios.

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What is a scenario?

- Basis of comparison
  - Compares a baseline with an alternative

    or
  - Compares two alternatives
- Involves modification of operating rules

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Scenario generation and testing

- Feasibility
- Risk
- Effectiveness

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Feasibility

- Physical
- Legal
- Economic
- Social

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Premise of Risk Analysis

- All alternatives will fail sooner or later
  - How often?
  - Under what circumstances?
  - Contingency planning

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Effectiveness

- Does the alternative achieve what was intended?
- In comparison, how well does it perform?

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1	**Yakima River DSS**		**RunDate:**	**3/20/2006**								
2	**Resource Score**		**Baseline:**	**NO ACTION**				**1961**	**to**		**1971**	
3	**Summary**		**Alternative:**	**RW070406#1**				**1961**	**to**		**1971**	
4												
5			**Stream Reach**									
6	**Resource Category**	**Time Window**	**Cle Elum**		**Kittitas**		**Union Gap**		**Wapato**		**Naches**	
7			Δ Area	Pct Chg	Δ Area	Pct Chg	Δ Area	Pct Chg	Δ Area	Pct Chg	Δ Area	Pct Chg
8												
9												
10	**Spring Chinook**											
11	**Spawning/incubation***	Sept/Oct-March		-21		98						5
12	**Frg**	March-May		0		-1						-70
13	**Sub-yearling (Spring-summer)**	June-Sept		39		-64		-64		-64		98
14	**Sub-yearling (winter)**	Oct-May		54		87		87		87		95
15	**Adult holding**	April-Sept		-64		5		5		5		-53
16												
17	**Fall Chinook**											
18	**Spawning/incubation***	Oct/Nov-March						-68		-70		
19	**Frg**	March-April						69		78		
20	**Sub-yearling (Spring-summer)**	May-June						-10		-97		
21												
22	**Coho**											
23	**Spawning/incubation***	Nov/Dec-March		-10		12		49		16		-47
24	**Frg**	April-May		11		53		91		-74		78
25	**Sub-yearling (Spring-summer)**	June-Sept		45		82		-18		69		32
26	**Sub-yearling (winter)**	Oct-April		77		-7		-13		-23		-19
27												
28	**Steelhead**											
29	**Spawning/incubation***	March/April-July		68		94		81		48		81
30	**Frg**	July-August		-85		-39		-60		-28		-63
31	**Sub-yearling (Spring-summer)**	September		41		-14		-56		-18		51
32	**Sub-yearling (winter)**	October-April		100		51		31		88		50
33	**Sub-adults**	May-August		33		68		22		76		-88
34	**Adult holding**	September-March		-35		91		-93		86		27
35												
36	**Resident Rainbow**											

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37	Spawning/incubation*	Feb/May-July	-32		50		-69		92		61	
38	Frg	July-August	57		32		19		21		59	
39	Sub-gearling (Spring-summer)	September	27		-14		-58		-89		-12	
40	Sub-gearling (winter)	October-April	77		-84		50		-5		-65	
41	Sub-adults	May-August	50		13		75		-5		-34	
42												
43	**Brown Trout**											
44	Spawning/incubation	October/Nov-March	85		58		-38		-87		-49	
45	Frg	April-May	26		62		82		-50		-41	
46	Sub-gearling (Spring-summer)	June-Sept	9		-58		-17		95		-26	
47	Sub-gearling (winter)	Oct- May	94		-40		-10		80		-64	
48	Sub-adults	all year?	43		-96		-76		3		-57	
49												
50	**Temperature**		Cle Elum		Kittitas		Union Gap		Wapato		Naches	
51	Δ Days > Threshold C		Δ Days	Pct Chg	Δ Days	Pct Chg	Δ Days	Pct Chg	Δ Days	Pct Chg	Δ Days	Pct Chg
52	Minor Increase Δ C			-90		-35		-54		-27		-2
53	Moderate Increase Δ C			33		63		-5		-23		-74
54	Major Increase Δ C			-96		-3		-55		-52		34
55												
56	**Water Division Deliveries**		Kittitas		Roza		Sunnyside		Wapato		Tieton	
57	Δ AF < Target		Δ AF	Pct Chg	Δ AF	Pct Chg	Δ AF	Pct Chg	Δ AF	Pct Chg	Δ AF	Pct Chg
58	Minor shortage Δ AF			25		-97		-31		78		-97
59	Moderate shortage Δ AF			30		64		-68		-44		-60
60	Major shortage Δ AF			-73		-40		9		-9		24
61												
62	**Flood Frequency**		Umtanum				Union Gap			Naches (NRYW)		
63	Δ Days by Return Period		Δ Days	Pct Chg			Δ Days	Pct Chg		Δ Days	Pct Chg	
64	5-year			-25				79			-47	
65	10-year			86				-69			88	
66	25-year			-26				-48			-55	
67	100-year			-2				-10			-37	
68												
69	**Reservoir storage**		Cle Elum		Keechelus		Kachess			Bumping	Rimrock	
70	Rule curve violations		Δ Days	Pct Chg	Δ Days	Pct Chg	Δ Days	Pct Chg		Δ Days	Pct Chg	Δ Days	Pct Chg
71	Drought watch			-83		35		-86			51		-20
72	Drought warning			42		32		-3			11		88
73												
74	Spills											
75	Minor spills			54		32		-9			-56		18
76	Moderate spills			-8		-65		11			49		-39
77	Major spills			70		70		23			45		-18
78												

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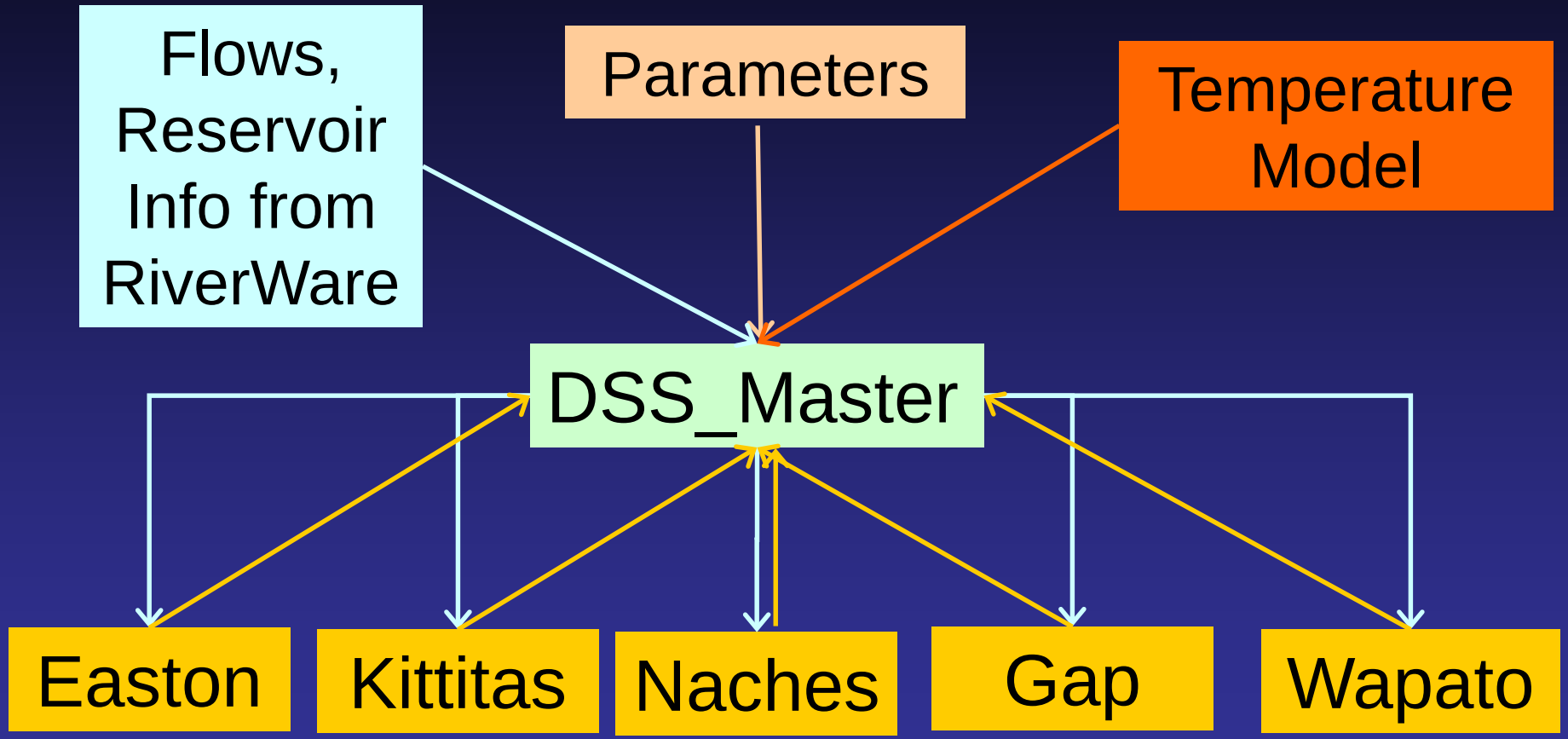
Layout and Information Flow



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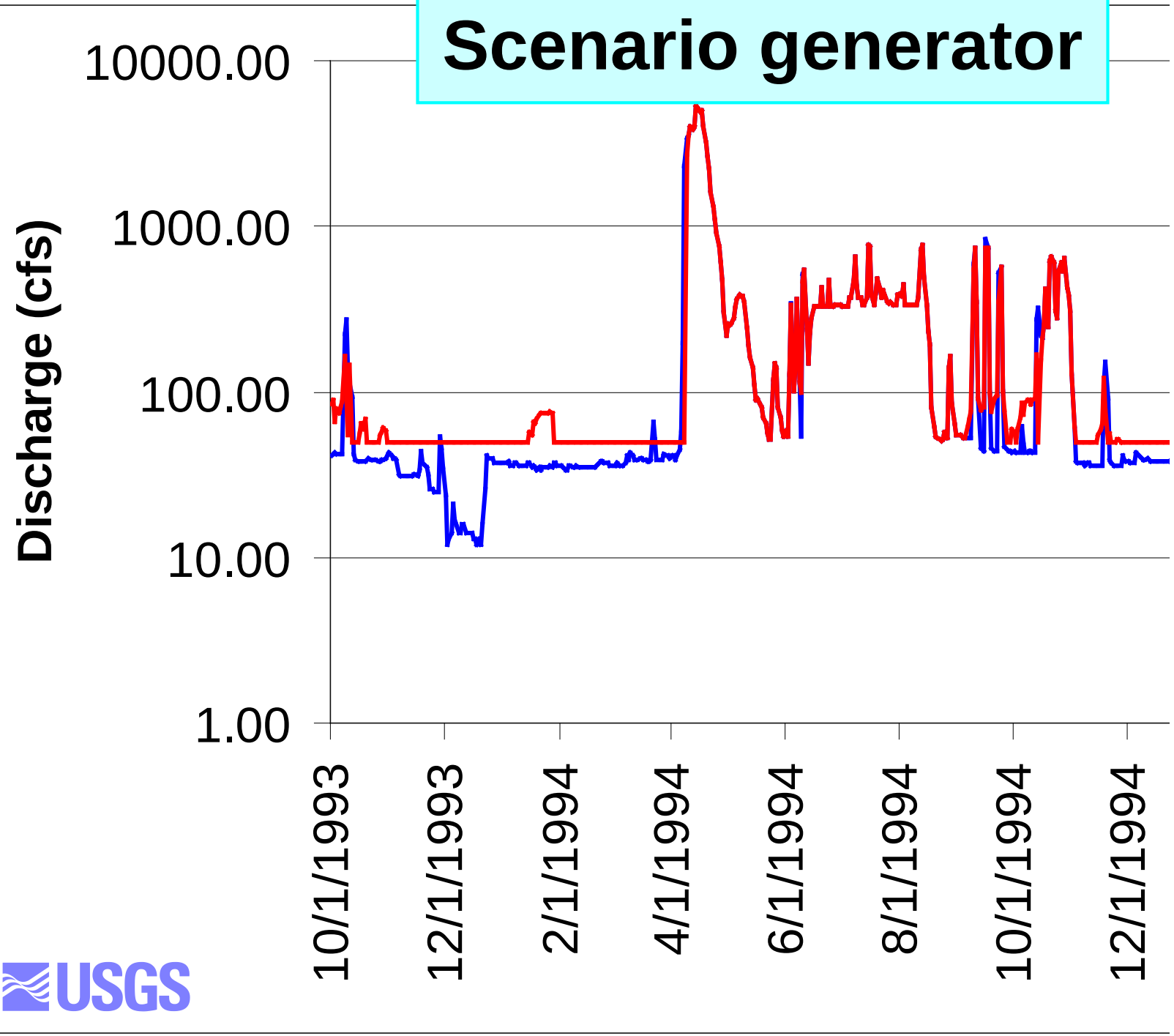
Scenario generator



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Habitat Time Series

- Depths and velocities simulated for individual discharges.
- Hydraulic characteristics reclassified in GIS to create maps of target-specific habitat.
- Flow time series converted to habitat by interpolation from discharge-habitat relationship.

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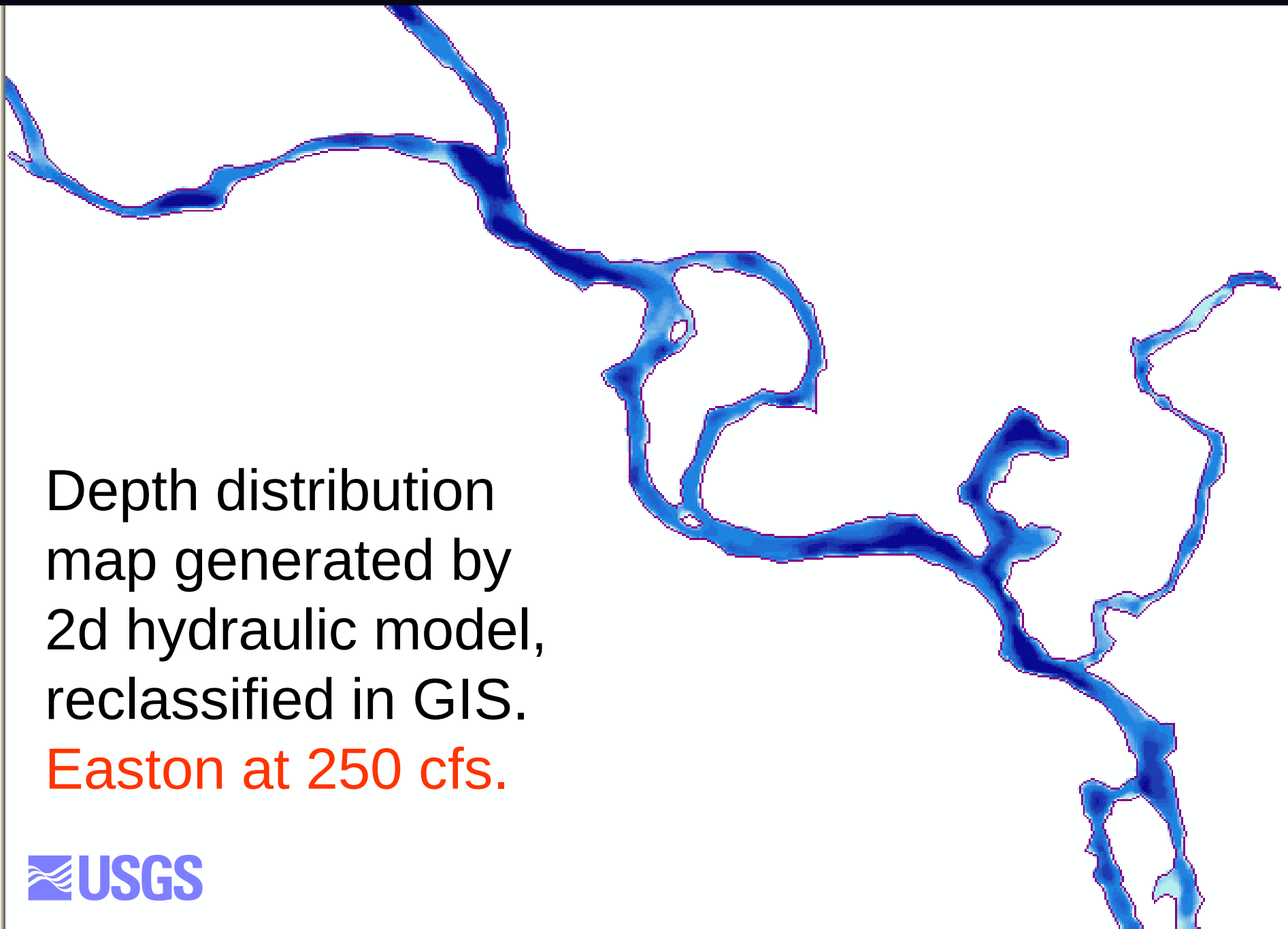

Depth distribution map generated by 2d hydraulic model, reclassified in GIS.

Easton at 250 cfs.

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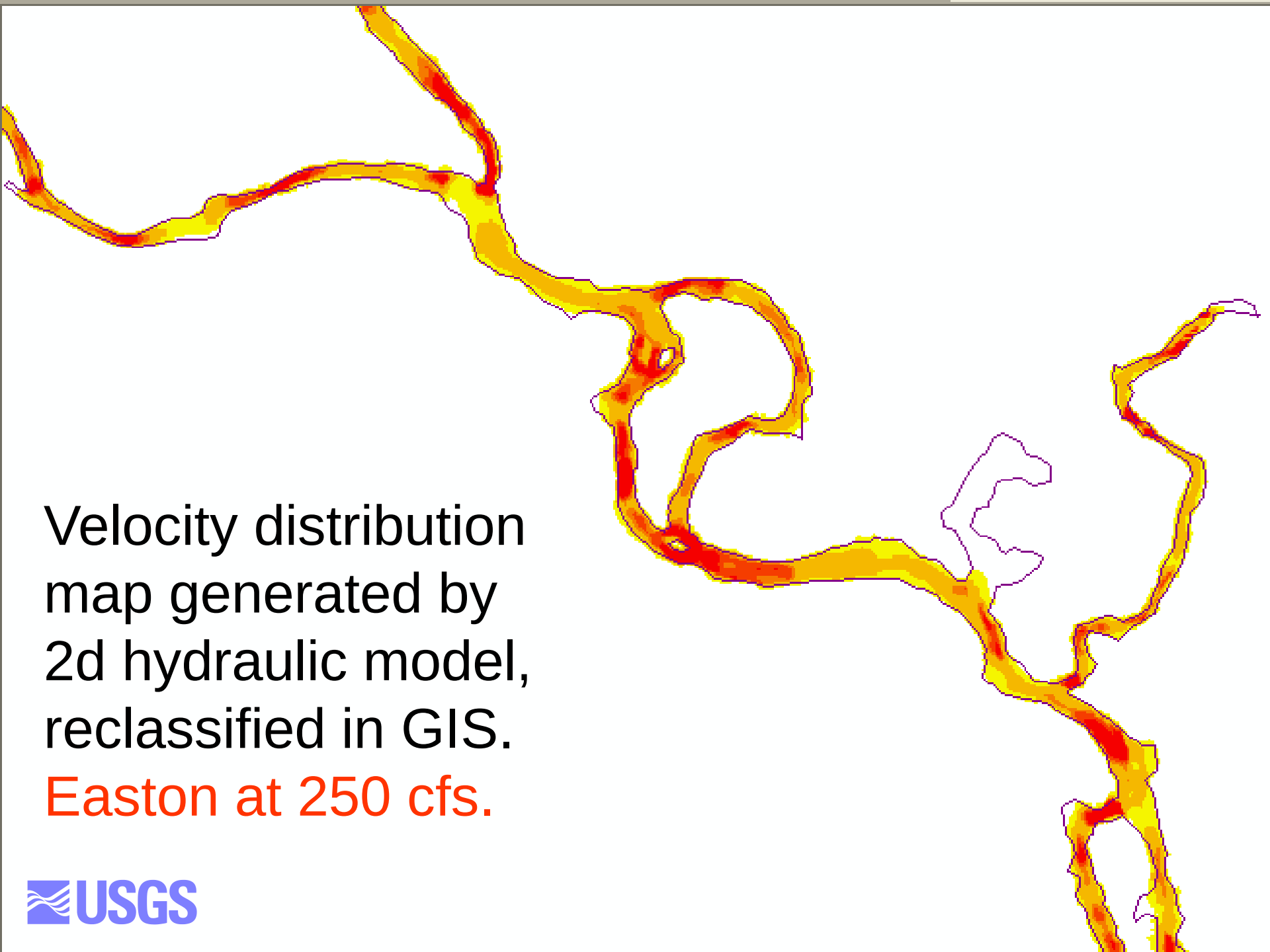

Velocity distribution map generated by 2d hydraulic model, reclassified in GIS.

Easton at 250 cfs.

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Hydraulic Variables Reclassified According to Habitat Criteria

- Specific for each target species and life stage.

- Reclassification bins defined by consensus of professional opinion

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DELPHI Questionnaire

Species/ Lifestage	D min	D max	V min	V max
Round 1				
STSP				
STINC				
STFRY				
STSYR				
STSYO				
ASTHOLD				

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DELPHI Summarized Responses

Species/ Lifestage	D min			D max			V min			V max		
Round 1	25%	median	75%	25%	median	75%	0.25	median	75%	25%	median	75%
STSP	0.16	0.20	0.24	0.70	1.00	1.38	0.24	0.30	0.35	1.00	1.00	1.00
STINC	0.10	0.10	0.17	1.50	2.00	2.50	0.18	0.25	0.31	1.45	2.00	3.00
STFRY	0.08	0.10	0.10	0.28	0.45	0.51	0.00	0.00	0.02	0.30	0.30	0.30
STSYR	0.15	0.19	0.25	1.05	1.20	1.25	0.05	0.06	0.10	0.75	0.82	0.90
STSYO	0.14	0.19	0.23	2.00	3.00	4.00	0.00	0.00	0.00	0.31	0.37	0.44
ASTHOLD	1.00	1.00	1.00	3.00	3.00	3.00	0.30	0.30	0.30	0.70	0.70	0.70

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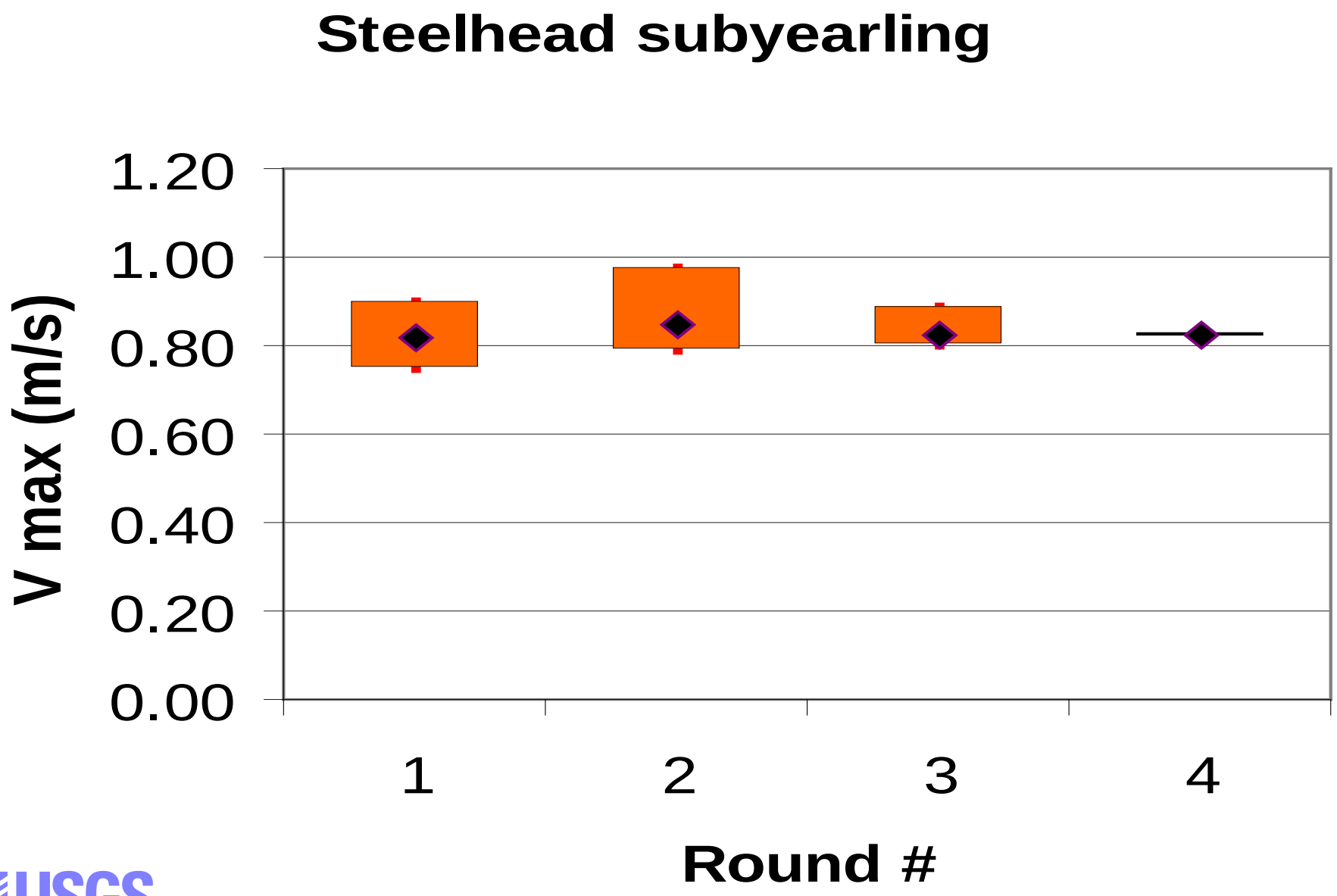
Delphi - Convergence



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Hydraulic Habitat Classification Bins for Steelhead from Delphi Panel

	English (ft &fps)			
	Dmin(bin)	Dmax(bin)	Vmin(bin)	Vmax(bin)
STSP	0.7	3.3	1.0	3.3
STINC	0.5	5.7	0.8	5.2
STFRY	0.3	1.6	0.0	1.0
STSYR	0.7	4.3	0.3	2.7
STSYO	1.0	9.0	0.0	0.9
STY+	0.8	6.6	0.5	3.0
STOUT	0.8	12.7	2.3	8.0
ASTHOLD	1.6	9.8	0.6	2.4

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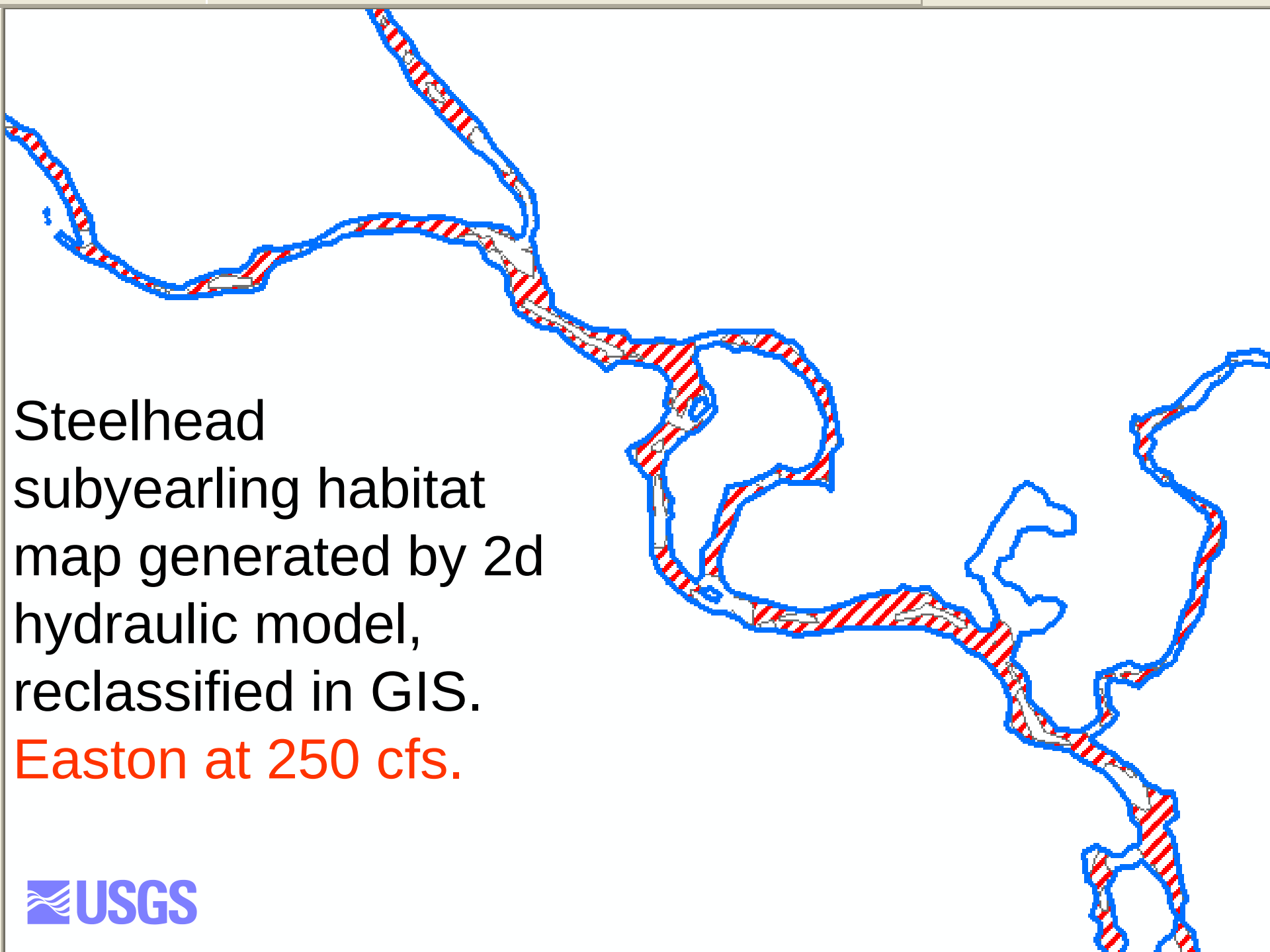

Steelhead subyearling habitat map generated by 2d hydraulic model, reclassified in GIS.

Easton at 250 cfs.

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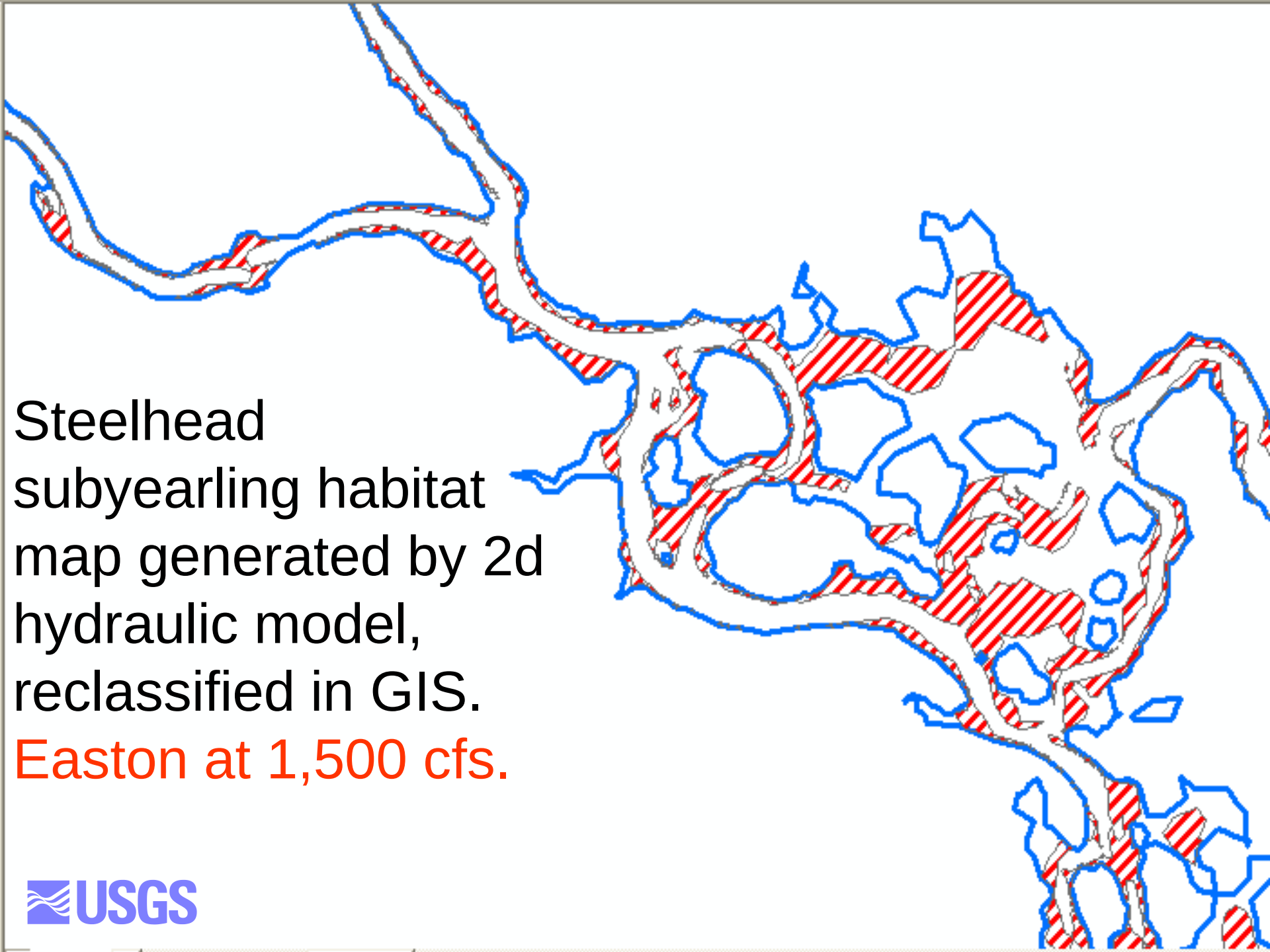

Steelhead subyearling habitat map generated by 2d hydraulic model, reclassified in GIS.

Easton at 1,500 cfs.

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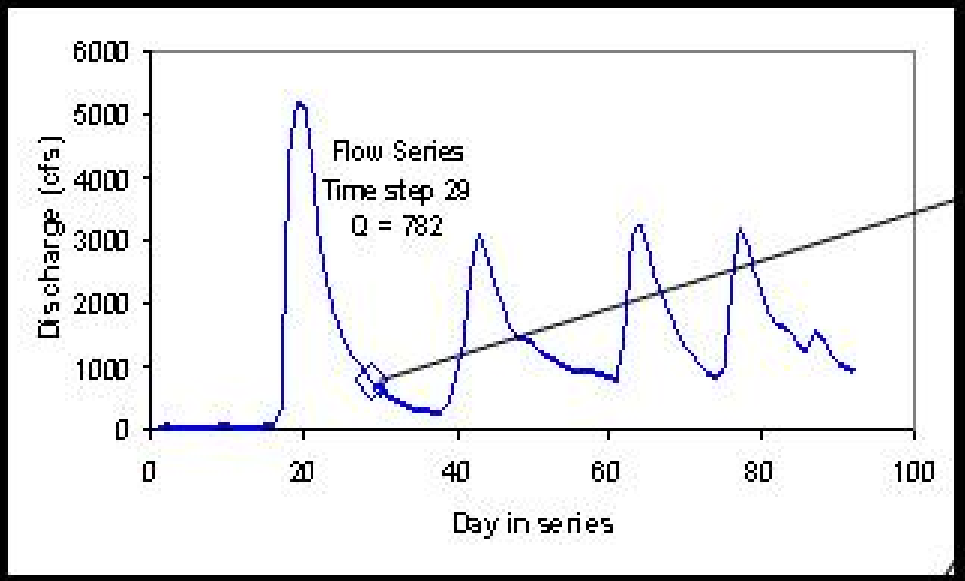
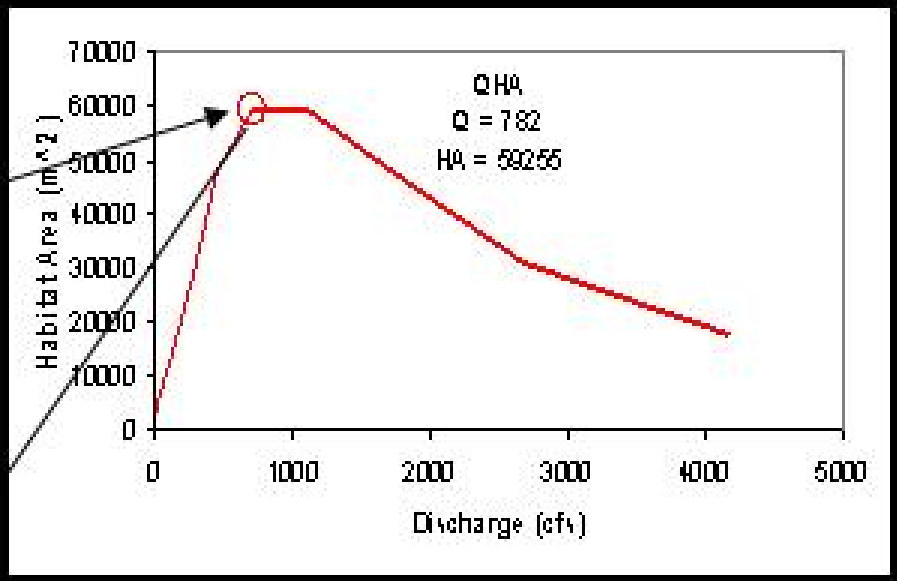
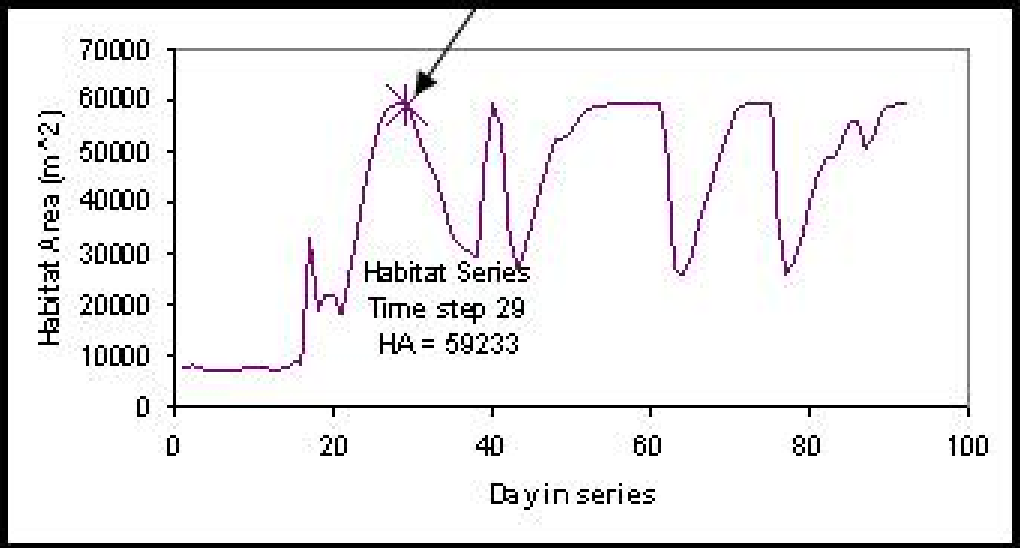
Habitat Time Series







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Habitat Persistence

Habitat areas calculated as the intersection of suitable patches at two different discharges.

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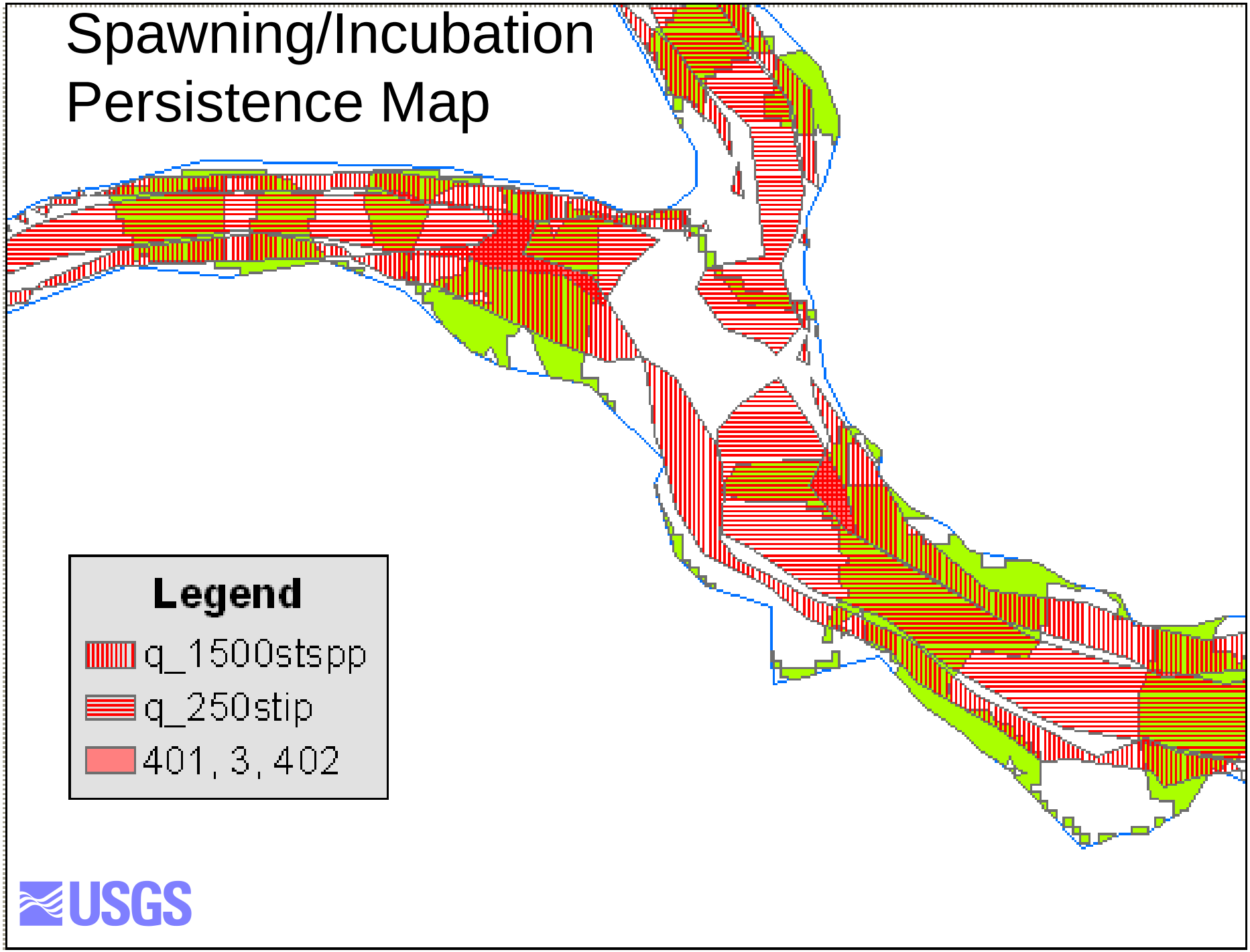
Spawning/Incubation Persistence Map



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Temperature Time Series (hypothetical)

SNTEMP Model being calibrated by USGS/Tacoma.

Hydrologic data from Riverware used as input.

Daily time series of water temperatures at study sites generated for baseline and alternatives.

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Temperature Time series

- Temperature thresholds set on Parameters page: minor, moderate, major violations of thresholds.
- Scoring based on number of days threshold exceeded.
- Temperatures also used to define spawning and incubation periods.

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Water Division Deliveries

- Compares irrigation deliveries to targets for water year.
- Scoring based on volumes of annual shortages.
- Thresholds for minor, moderate, major spills set on Parameters page.

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Flood Frequency

- Calculates difference in frequency of floods of different magnitudes (recurrence intervals).
- Increases in small (e.g., 5-yr, 10yr) events scored positively. Increases in large (e.g., 25-yr, 100-yr) events scored negatively.

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Reservoir Storage

- Scoring based on frequency of rule-curve triggers that alter operations (e.g., reduced releases to conserve storage).

- Increases in frequency scored negatively. Separate scoring for different rule curve triggers.

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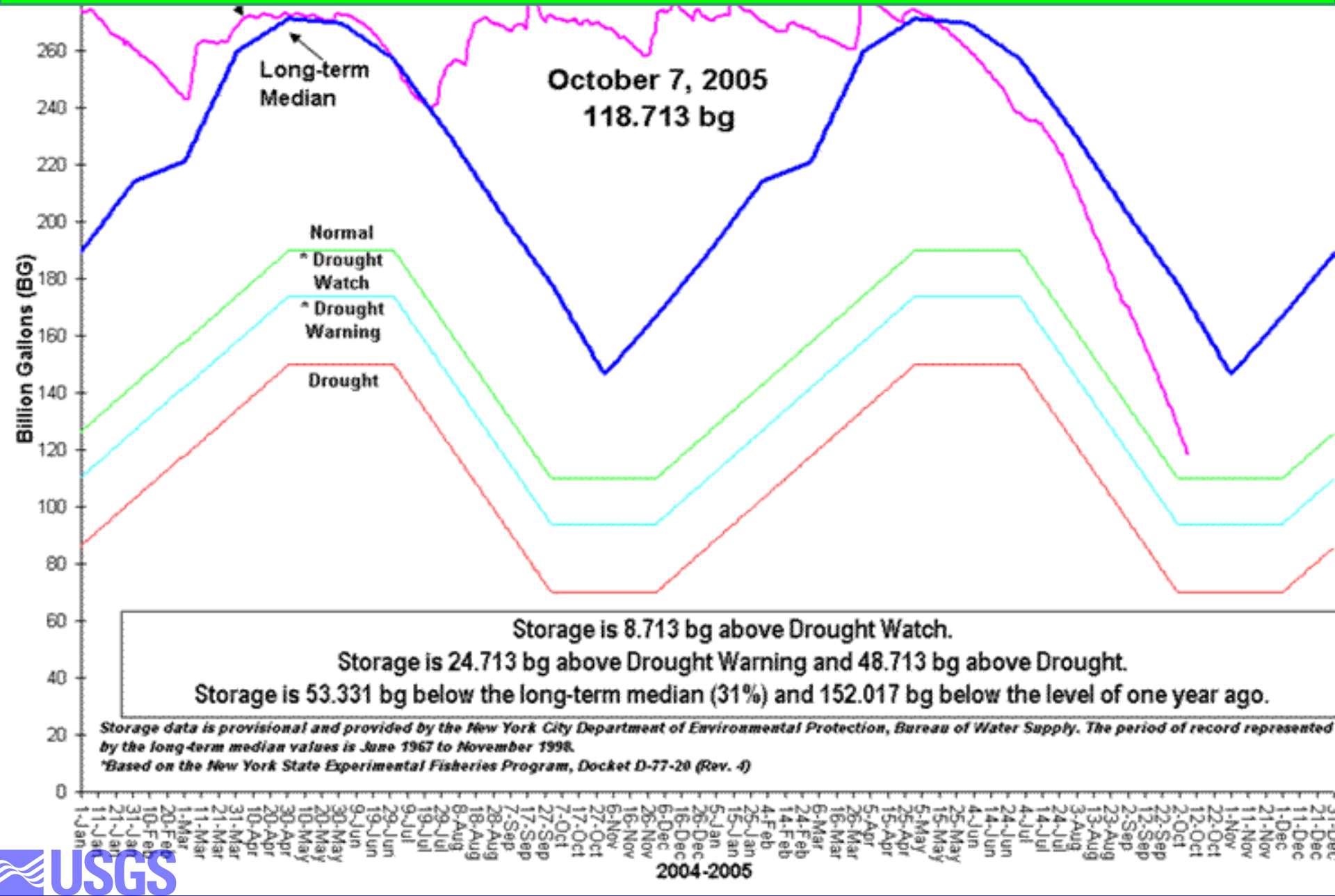
Reservoir Storage



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Spills

Calculated as difference in discharge immediately below dams and outlet capacities.

Scoring based on difference in spill-days under baseline and alternative.

Thresholds for minor, moderate, major spills set on Parameters page.

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Parameters Page

Parameters	Units	Default		New Value	
Run date	**MM/DD/YYYY**	Today			
Scenario Labels	Baseline	NO ACTION			
	Alternative	RW070406#1			
Spawning temperature window	**deg C**	Upper Threshold	Lower Threshold	Upper threshold	Lower Threshold
Spring chinook		12.8	5.6		
Fall chinook		14	6		
Coho					
Steelhead					
Resident rainbow trout					
Brown trout		12.8	6.1		
Incubation temperature window	**deg C**				
Spring chinook		12.8	4.5		
Fall chinook					
Coho		12.4	1.3		
Steelhead					
Resident rainbow trout					
Brown trout		13	5		
Degree-days to hatching	**deg C X days**				
Spring chinook		900			
Fall chinook					
Coho		620			
Steelhead					
Resident rainbow trout					
Brown trout		850			

Parameters Page (bottom half)

				Cle Elum	**Kittitas**
Suitable Summer Temperatures	**deg C**	19.1	4.5		
Threshold violation criteria	**deg C**				
Minor		2			
Moderate		4			
Major		>4			
Delivery Shortage criteria	**% of Target**			**Kittitas**	**Roza**
Minor	<	10			
Moderate					
Major	>	50			
Spill Magnitude	**% TOTAL Q**				
				Cle Elum	**Keechelus**
Minor	<	10			
Moderate					
Major	>	50			

Contact Us!
We want your feedback.

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