NOAA's National Weather Service Reservoir Simulations for the Major Flood of April 2005

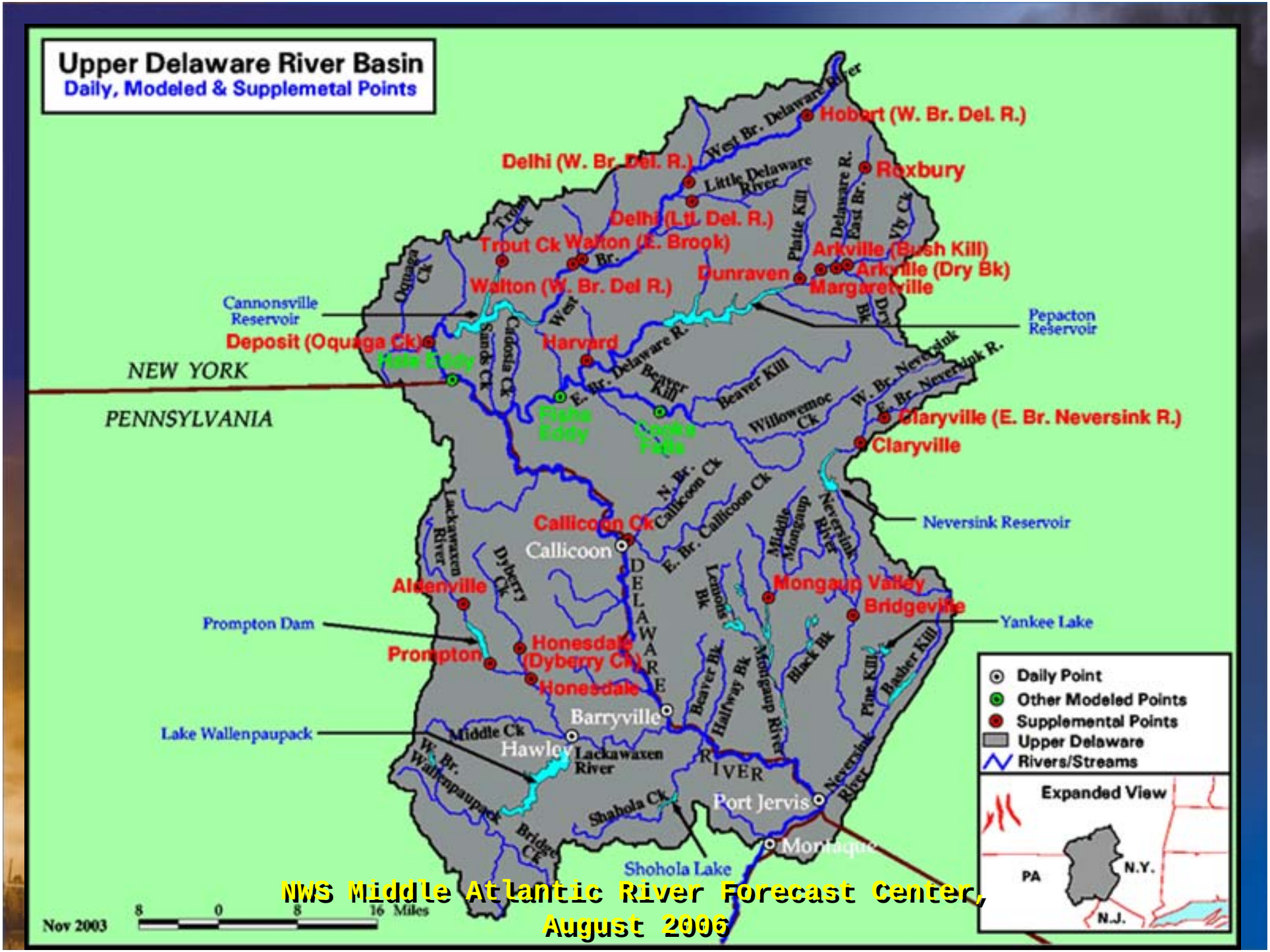
Ted Rodgers

Hydrologist

Middle Atlantic River Forecast Center, State College, PA

Outline

- Overview of Upper Delaware Basin
- Limit on Application of Results
- 5 Case Scenarios and the Actual Event
- Results (Differences in Stage and Flow)
- Conclusions (Effects of Dams on Flood Crests)
- Downstream Effects (in Stage to Trenton)



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Limits on Application of Results

- The methodology used for these simulations is based on output from the MARFC's hydrologic forecast model, and MARFC believes the results in this report are reasonably accurate. However, it should be noted that this model is optimized for operational river forecasting, not hydraulic engineering studies.
- The results are hypothetical cases based on a single flood event on April 2-4, 2005. Results are insufficient for accurately predicting the impacts of hypothetical reservoir voids on other past or future flood events.

Limits on Application of Results

- This modeling effort is strictly hypothetical in that, among other things, the void conditions analyzed do not take into consideration either New York City's water supply needs or the water supply needs of the lower basin parties who may prefer to have water stored in the reservoirs for releases at a later point in time. Also, this report does not address New York City's obligation to manage the water supply system prudently for water supply purposes, to ensure a safe and adequate supply for nine million people who rely on the City's water. In addition, the scenarios modeled do not reflect the City's release obligations under the 1954 Supreme Court Decree governing operations of the Cannonsville and Pepacton reservoirs. Also, the report does not consider the potential adverse water quality impacts of maintaining drawdown conditions in these reservoirs.

- **Case 1 – No Reservoir / Pass Outflow as Inflow**
- Cannonsville and Pepacton – Substituted inflow for outflow in the model.

- **Case 2 – Void about 2.5 billion gallons**

Initial Pool Elevations March 27	Cannonsville 1135.7 ft	Pepacton 1270.6 ft
Pool Elevations 8 am April 1st	Cannonsville 1148.5 ft	Pepacton 1278.5 ft

- **Case 3 – Void about 5 billion gallons**

Initial Pool Elevations March 27	Cannonsville 1134.0 ft	Pepacton 1269.0 ft
Pool Elevations 8 am April 1st	Cannonsville 1147.0 ft	Pepacton 1277.0 ft

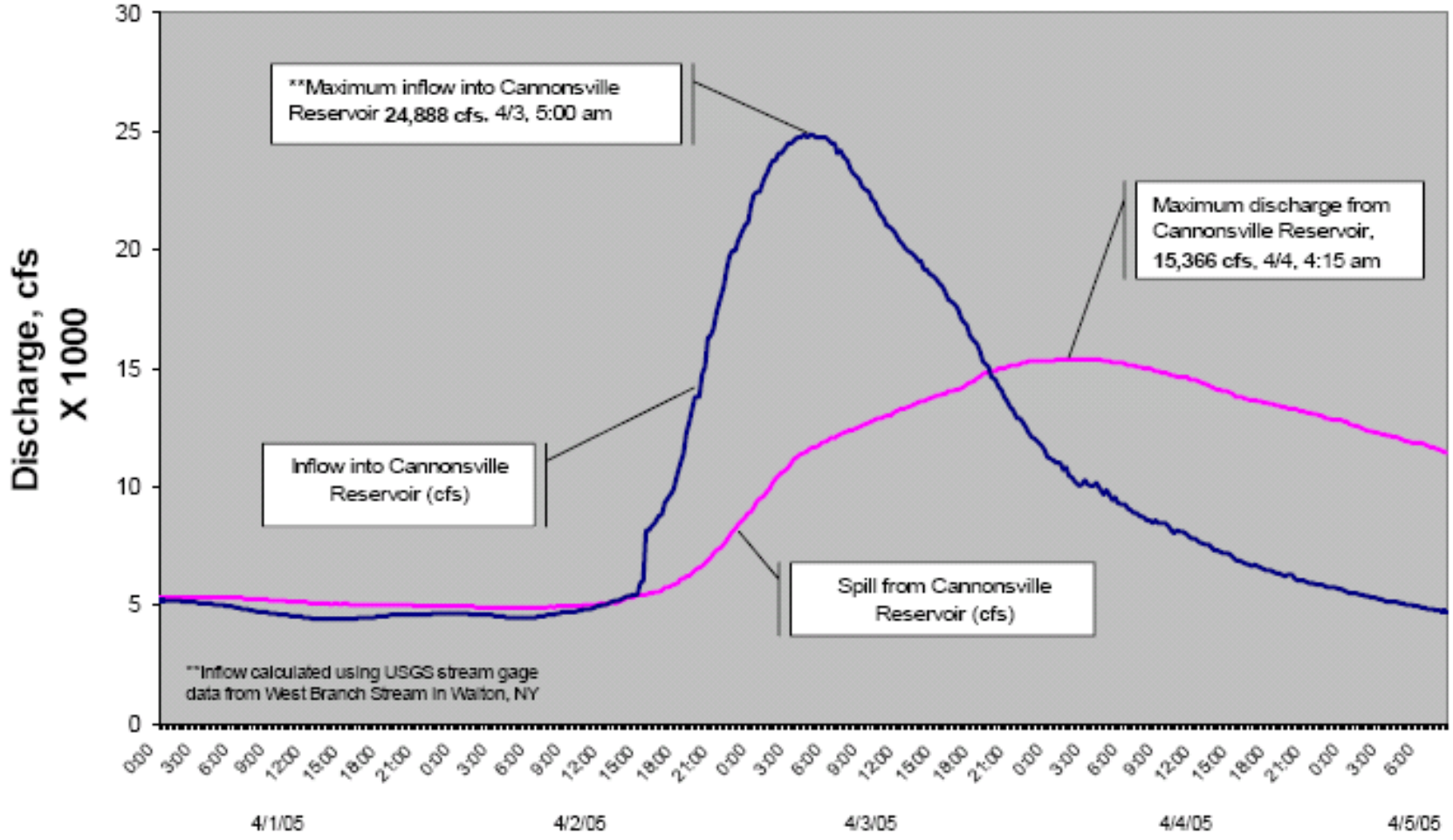
- **Case 4 – Void 10 billion gallons**

Initial Pool Elevations March 27	Cannonsville 1129.9 ft	Pepacton 1266.3 ft
Pool Elevations 8 am April 1st	Cannonsville 1143.3 ft	Pepacton 1274.5 ft

- **Case 5 – No Spill**
- Outflow set to zero in the model. No spill contributions on crests from Cannonsville and Pepacton.

Cannonsville Reservoir, Inflow vs. Spill Discharge

Storm Event April 1-5, 2005



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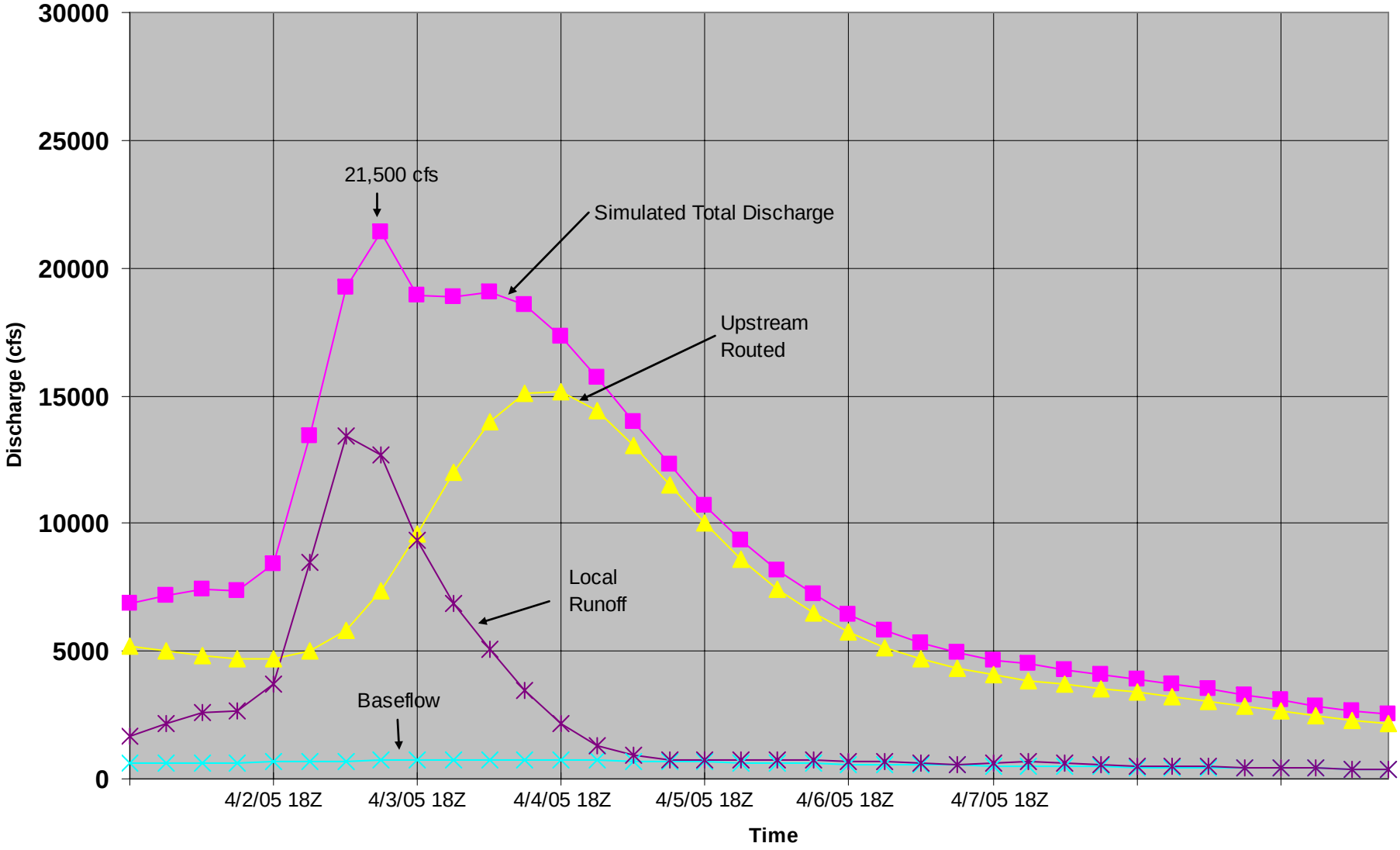
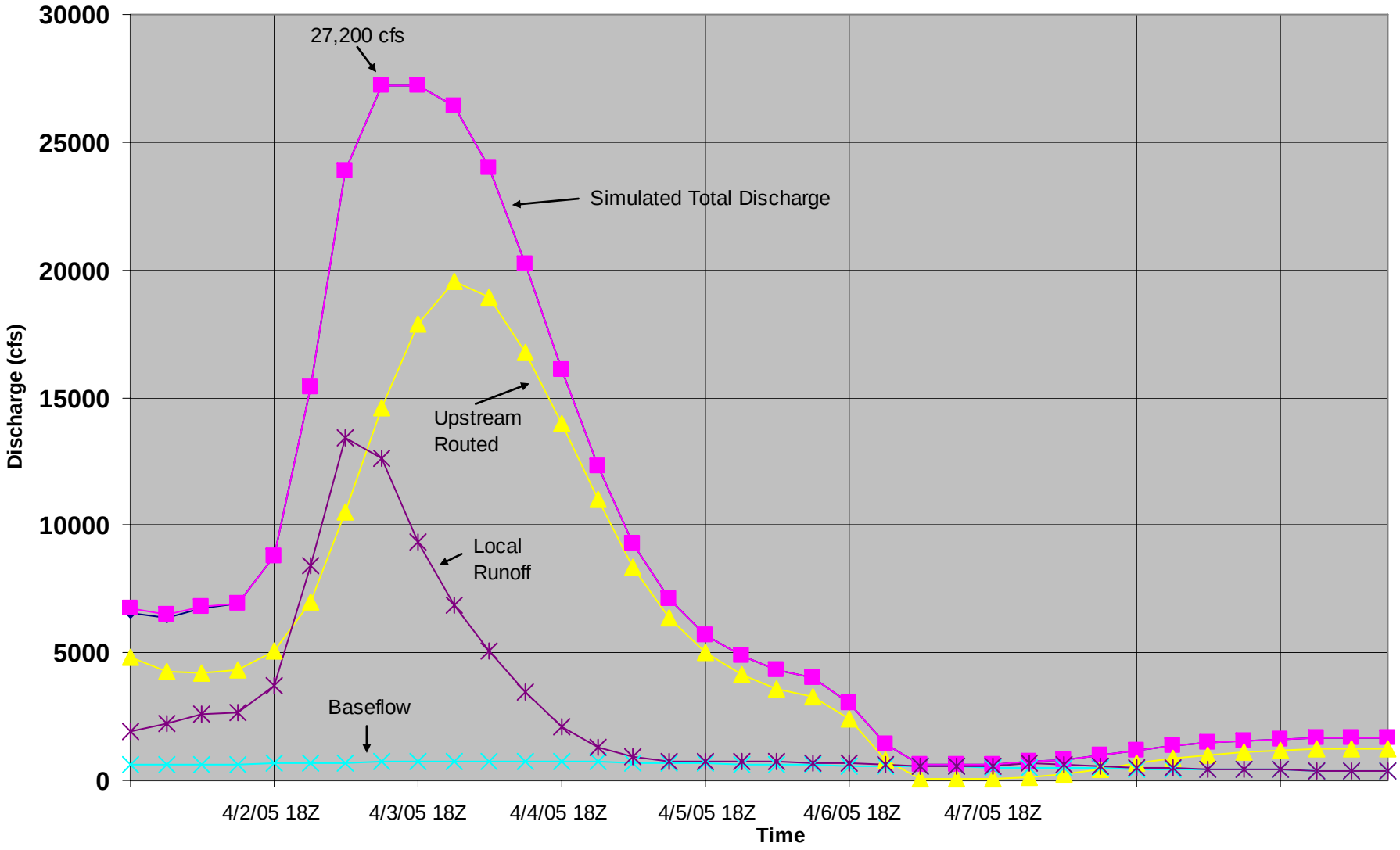

Hale Eddy (original)
30000
25000
20000
15000
10000
5000
0
Discharge (cfs)
21,500 cfs
Simulated Total Discharge
Upstream
Routed
Local
Runoff
Baseflow
4/2/05 18Z
4/3/05 18Z
4/4/05 18Z
4/5/05 18Z
4/6/05 18Z
4/7/05 18Z
Time



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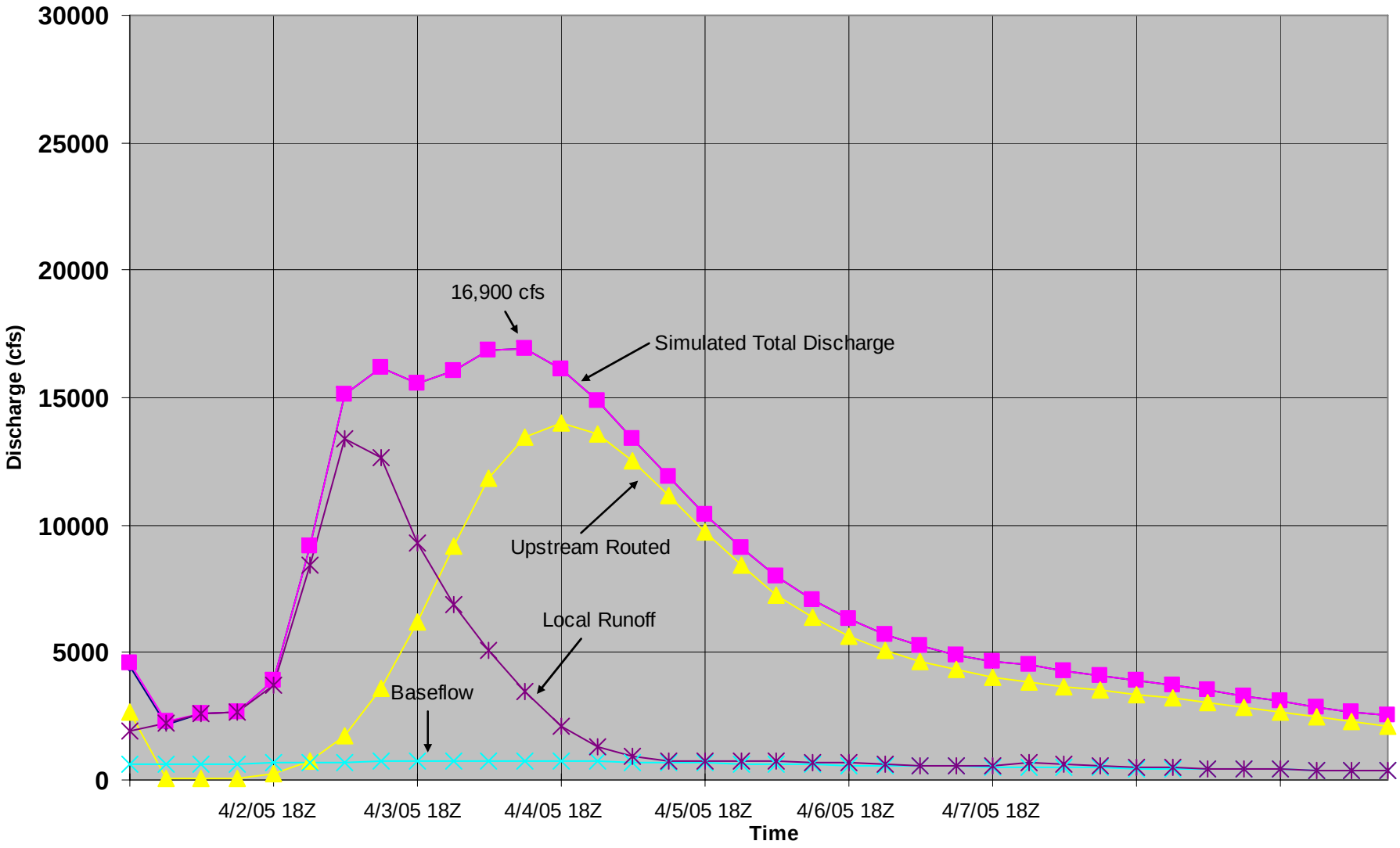

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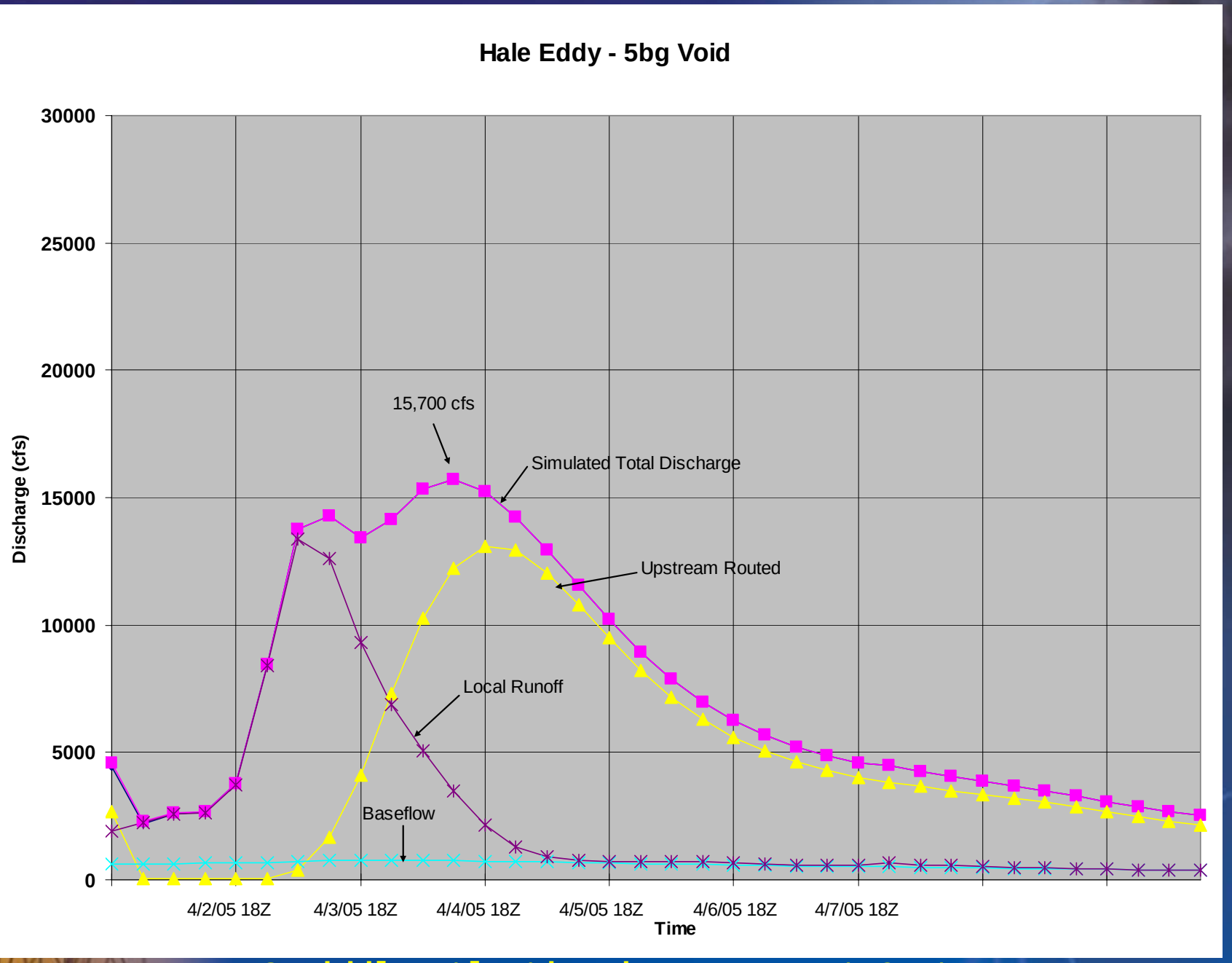
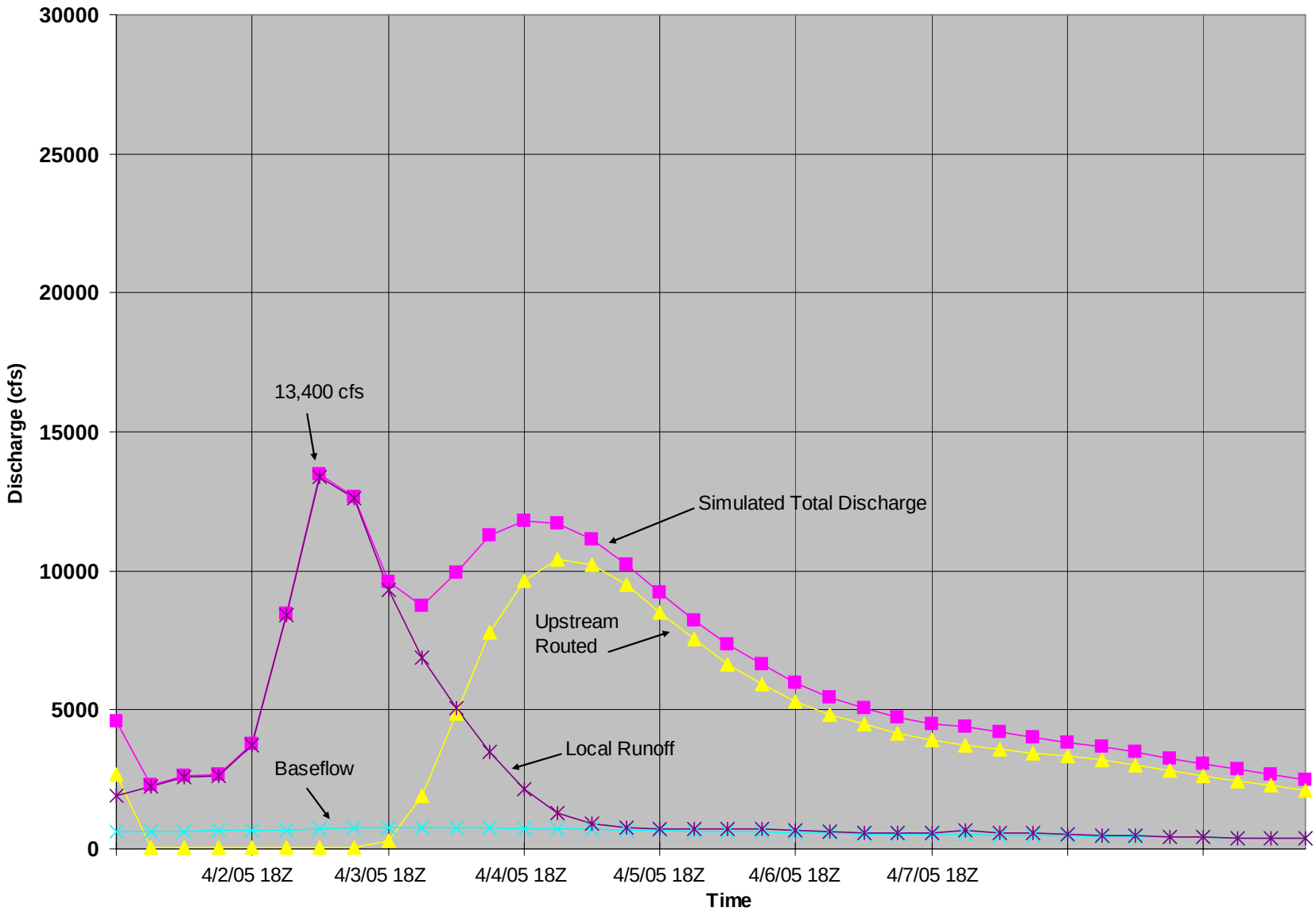
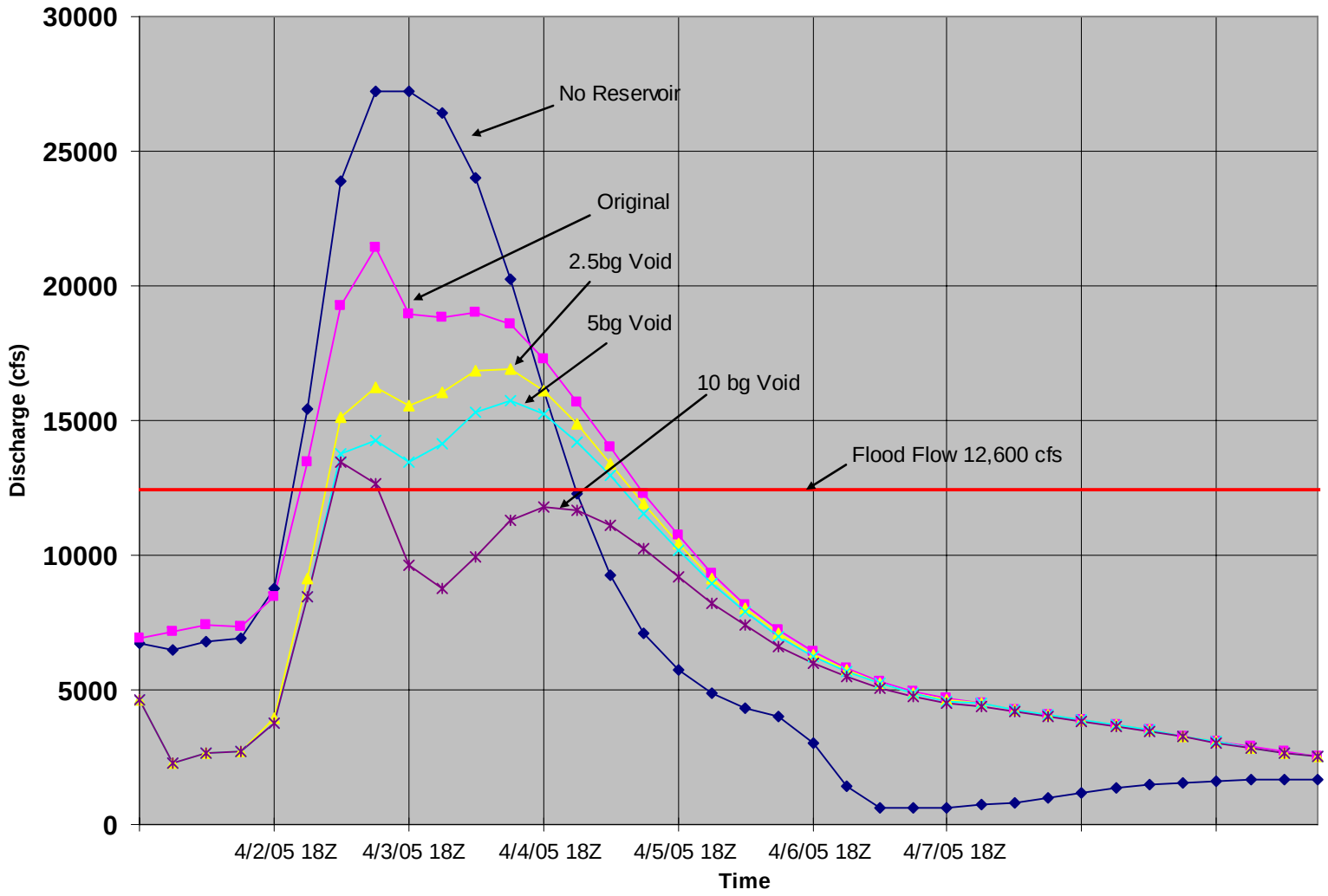
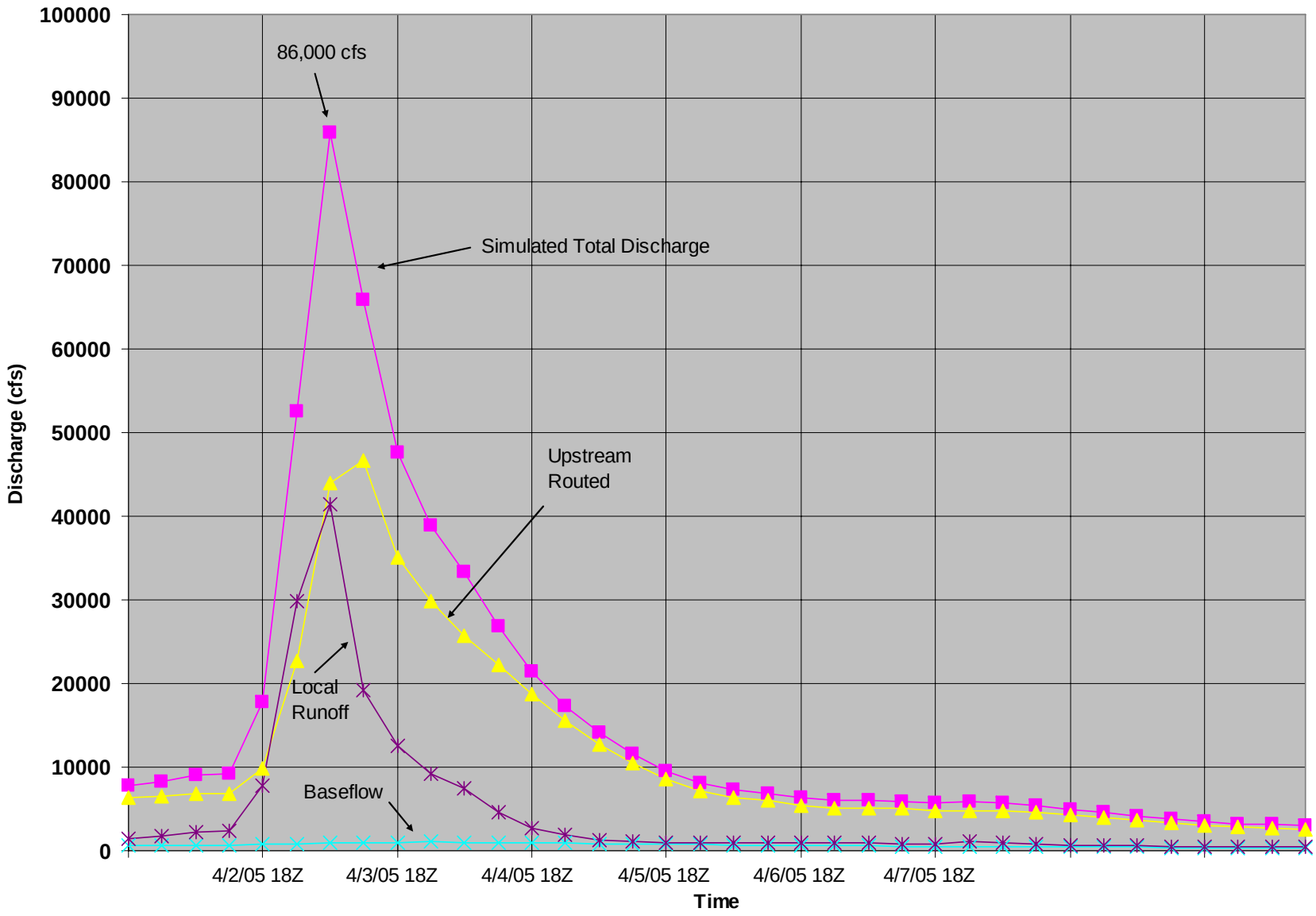
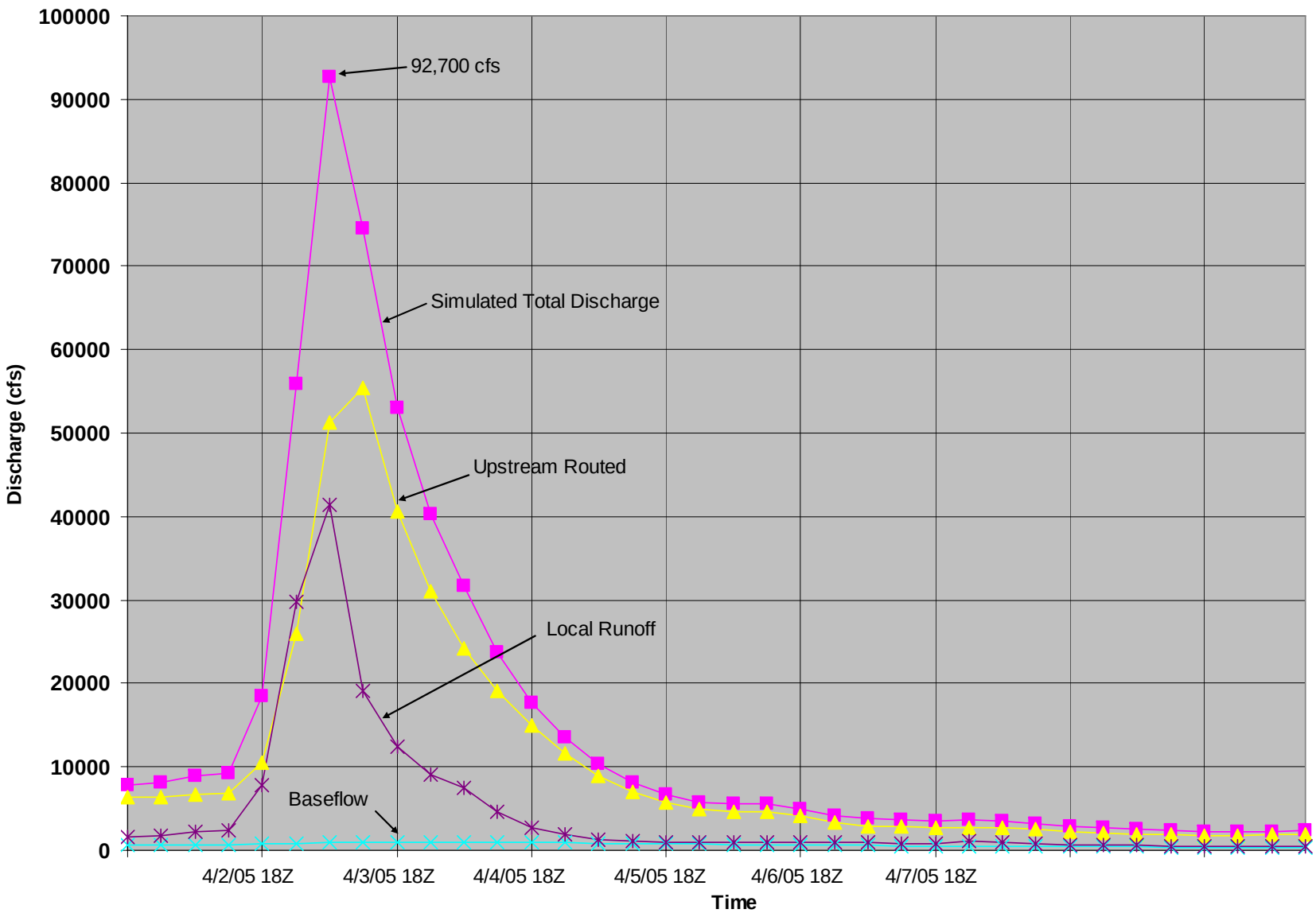

Hale Eddy - 5bg Void
30000
25000
20000
15000
10000
5000
0
Discharge (cfs)
15,700 cfs
Simulated Total Discharge
Upstream Routed
Local Runoff
Baseflow
4/2/05 18Z
4/3/05 18Z
4/4/05 18Z
4/5/05 18Z
4/6/05 18Z
4/7/05 18Z
Time


Hale Eddy - 10bg Void
30000
25000
20000
15000
10000
5000
0
Discharge (cfs)
13,400 cfs
Simulated Total Discharge
Upstream
Routed
Local Runoff
Baseflow
4/2/05 18Z
4/3/05 18Z
4/4/05 18Z
4/5/05 18Z
4/6/05 18Z
4/7/05 18Z
Time


Hale Eddy (all scenarios)
30000
25000
20000
15000
10000
5000
0
Discharge (cfs)
No Reservoir
Original
2.5bg Void
5bg Void
10 bg Void
Flood Flow 12,600 cfs
4/2/05 18Z
4/3/05 18Z
4/4/05 18Z
4/5/05 18Z
4/6/05 18Z
4/7/05 18Z
Time


Fishs Eddy (original)
100000
90000
80000
70000
60000
50000
40000
30000
20000
10000
0
Discharge (cfs)
86,000 cfs
Simulated Total Discharge
Upstream
Routed
Local
Runoff
Baseflow
4/2/05 18Z
4/3/05 18Z
4/4/05 18Z
4/5/05 18Z
4/6/05 18Z
4/7/05 18Z
Time



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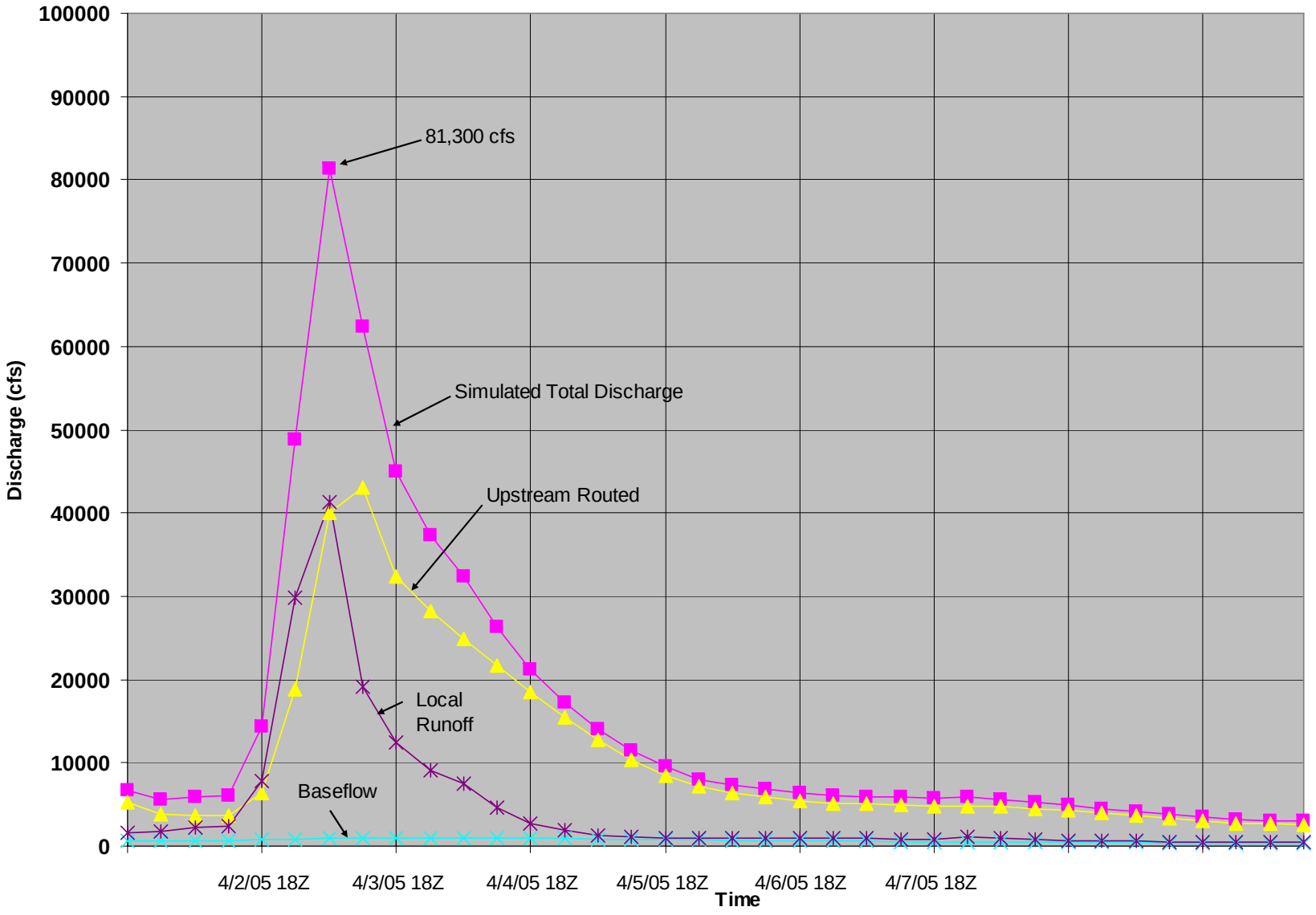

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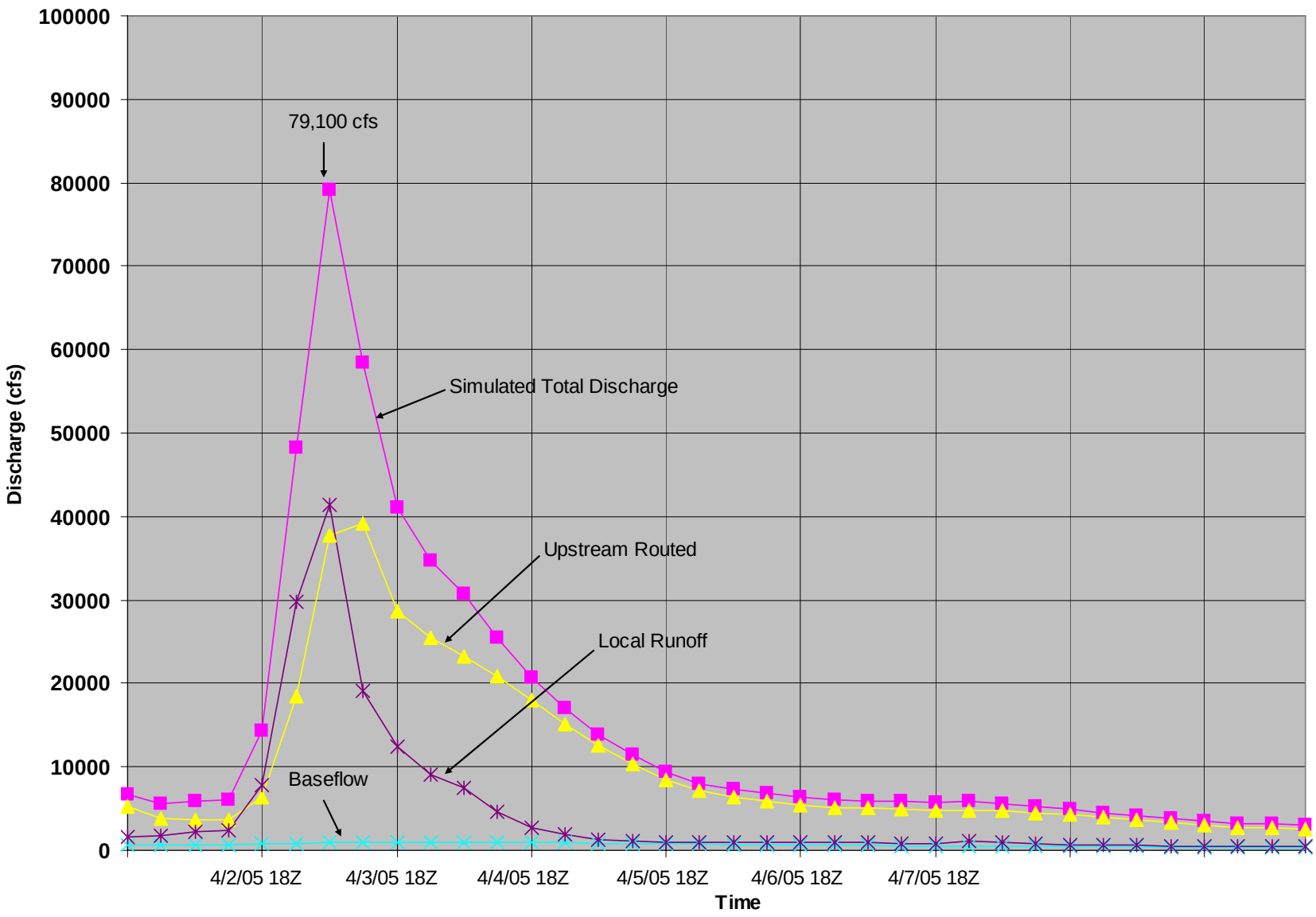

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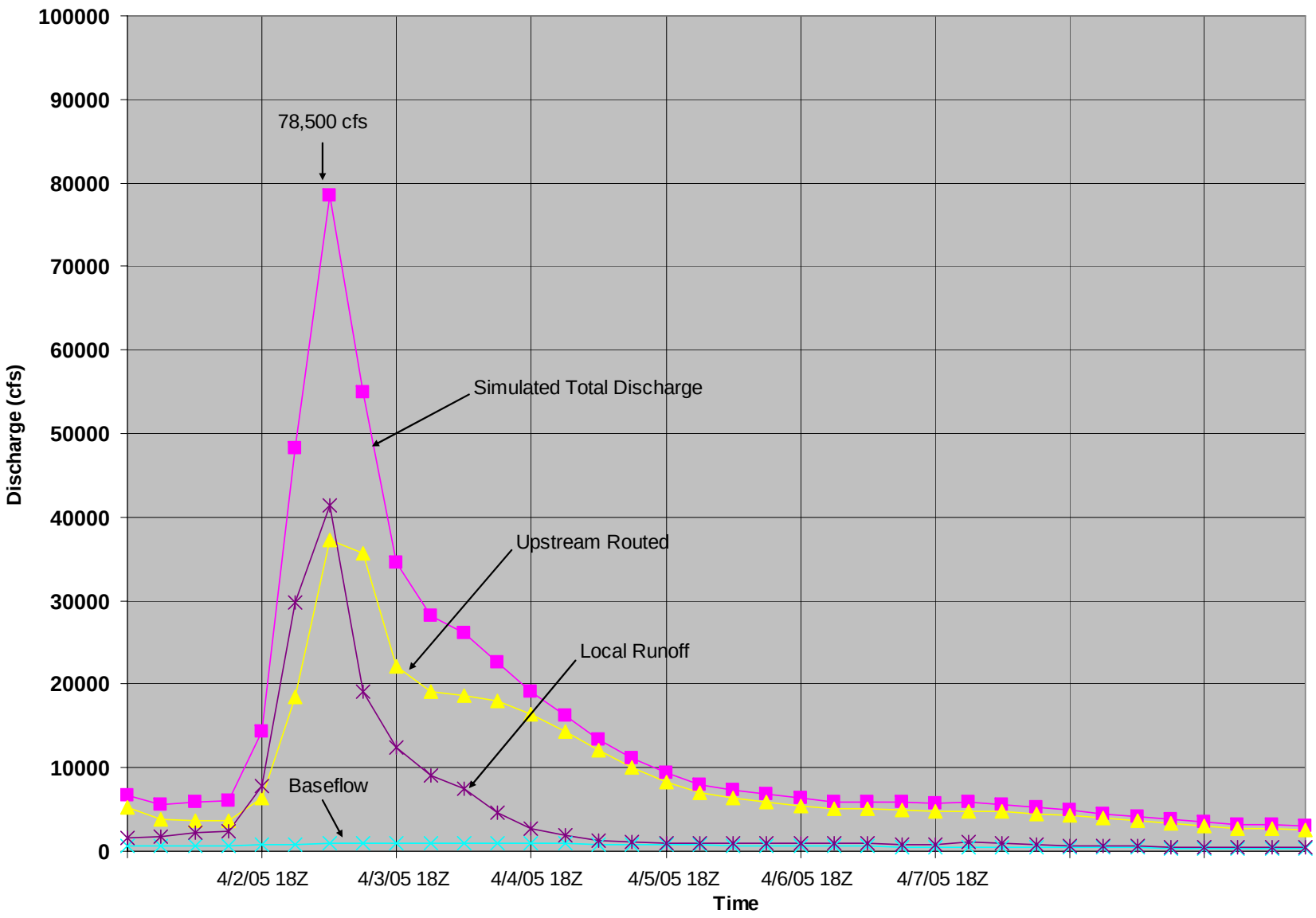
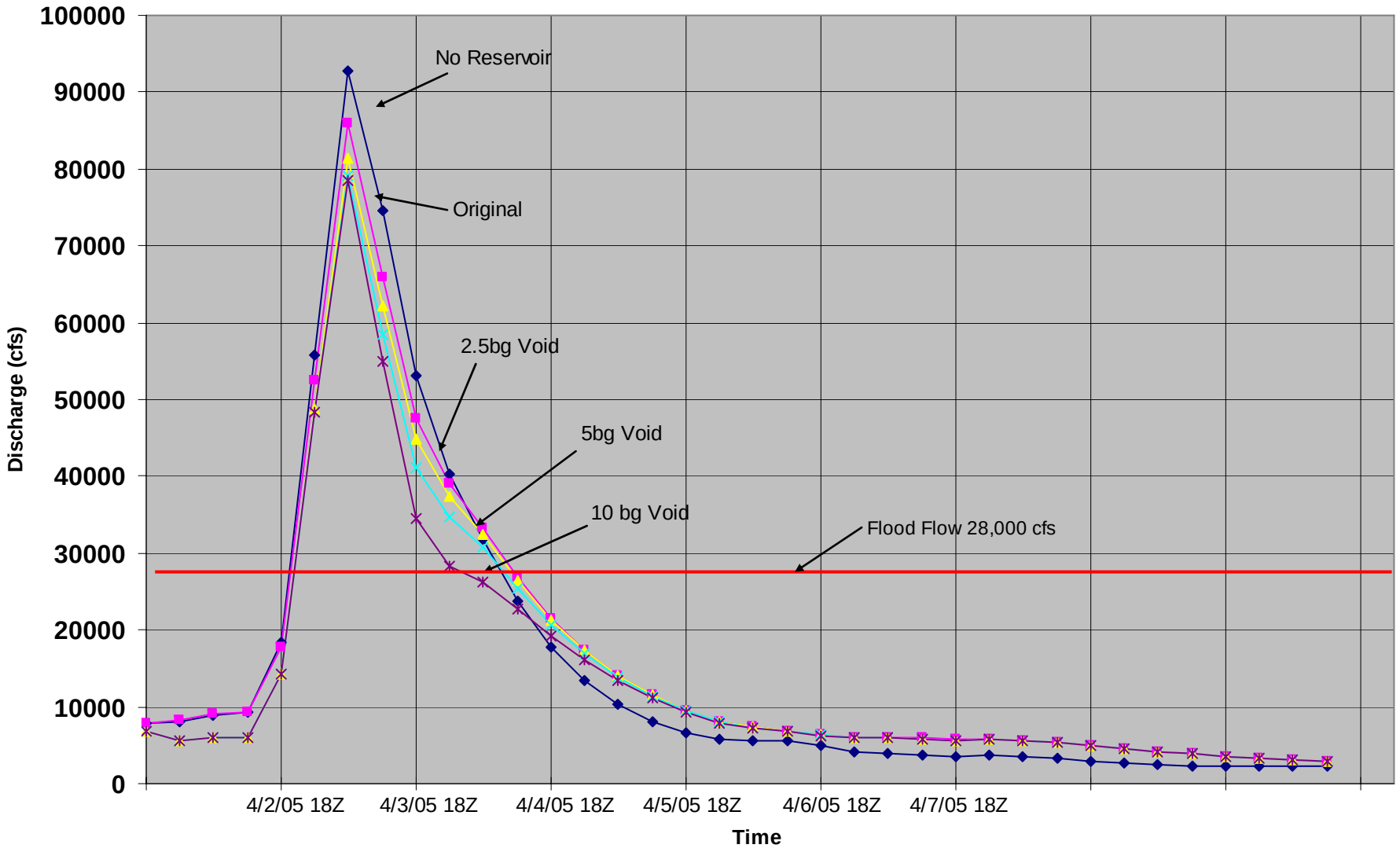

Fishs Eddy - 10bg Void
Discharge (cfs)
100000
90000
80000
70000
60000
50000
40000
30000
20000
10000
0
78,500 cfs
Simulated Total Discharge
Upstream Routed
Local Runoff
Baseflow
4/2/05 18Z
4/3/05 18Z
4/4/05 18Z
4/5/05 18Z
4/6/05 18Z
4/7/05 18Z
Time

Fishs Eddy (all scenarios)



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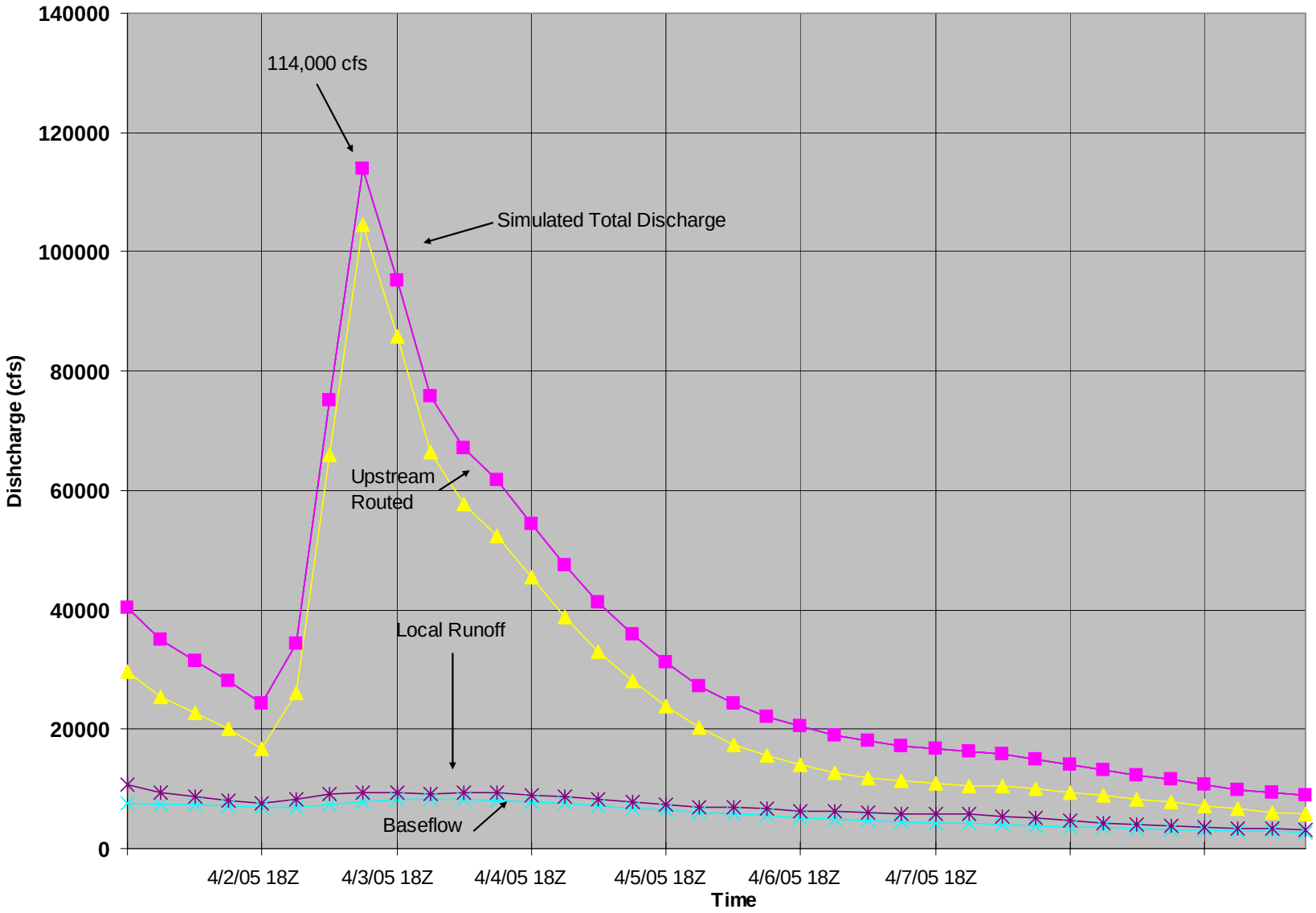

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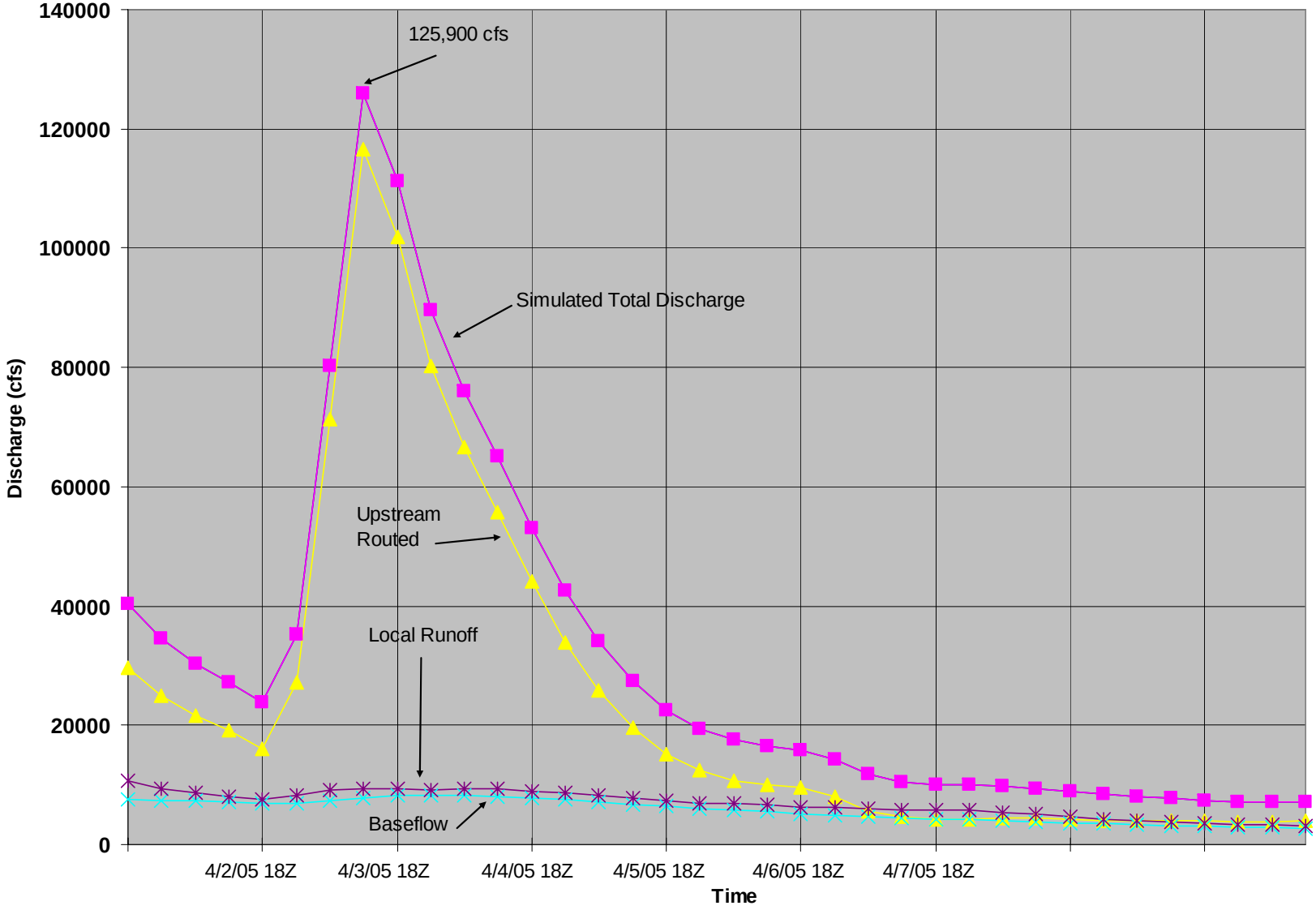
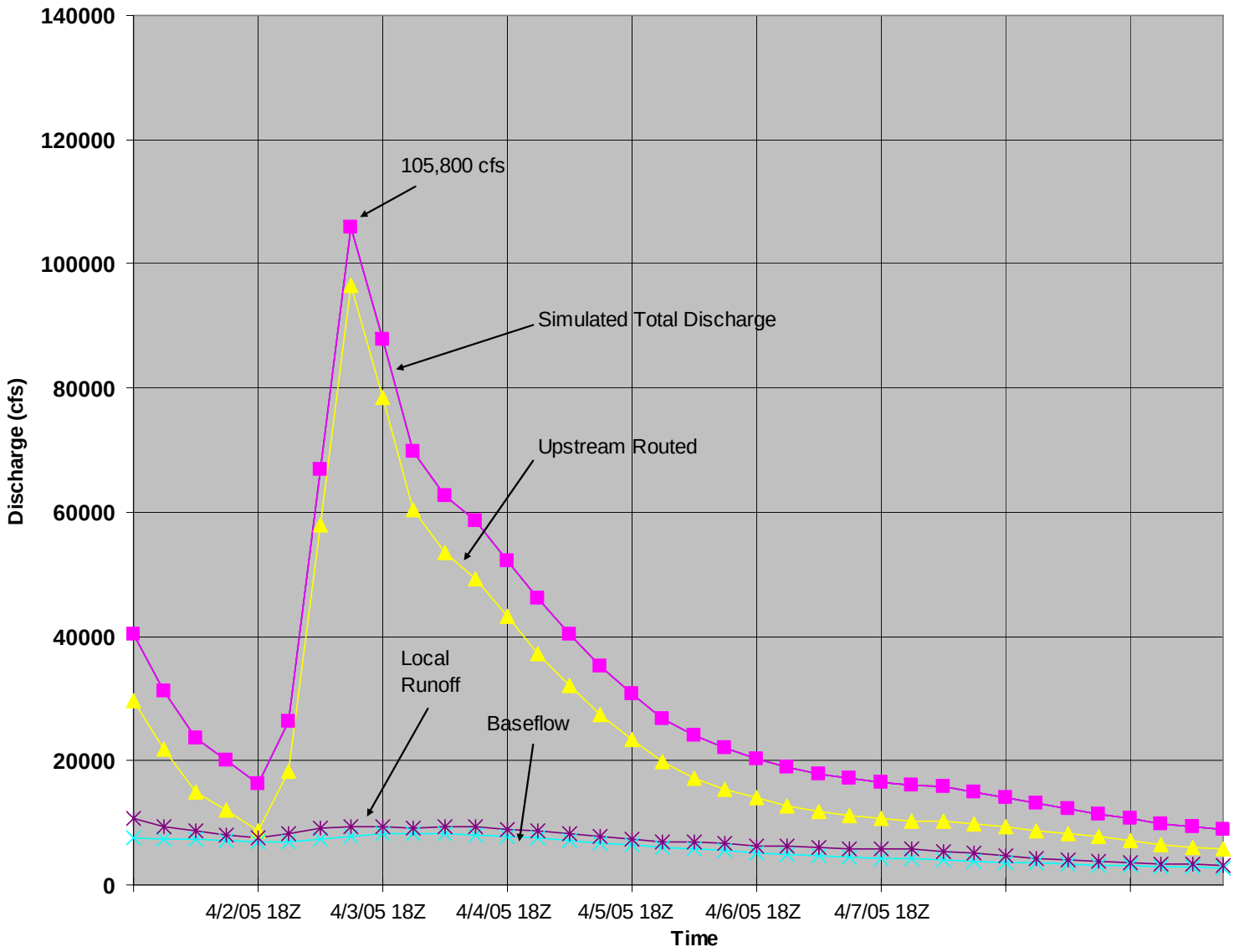
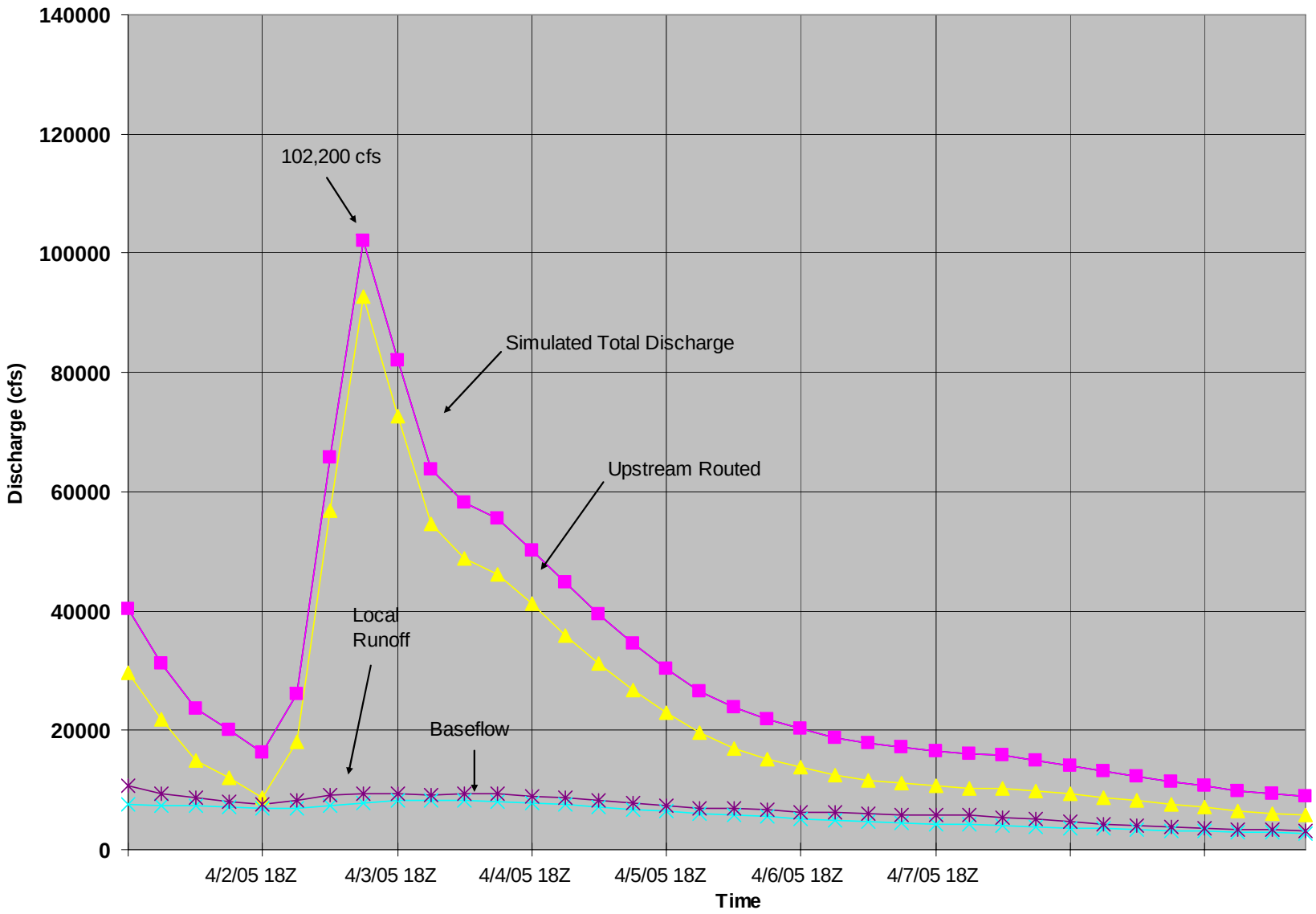

Callicoon - No Reservoir
140000
120000
100000
80000
60000
40000
20000
0
Discharge (cfs)
125,900 cfs
Simulated Total Discharge
Upstream
Routed
Local Runoff
Baseflow
4/2/05 18Z
4/3/05 18Z
4/4/05 18Z
4/5/05 18Z
4/6/05 18Z
4/7/05 18Z
Time


Callicoon - 2.5bg Void
140000
120000
100000
80000
60000
40000
20000
0
Discharge (cfs)
105,800 cfs
Simulated Total Discharge
Upstream Routed
Local
Runoff
Baseflow
4/2/05 18Z
4/3/05 18Z
4/4/05 18Z
4/5/05 18Z
4/6/05 18Z
4/7/05 18Z
Time



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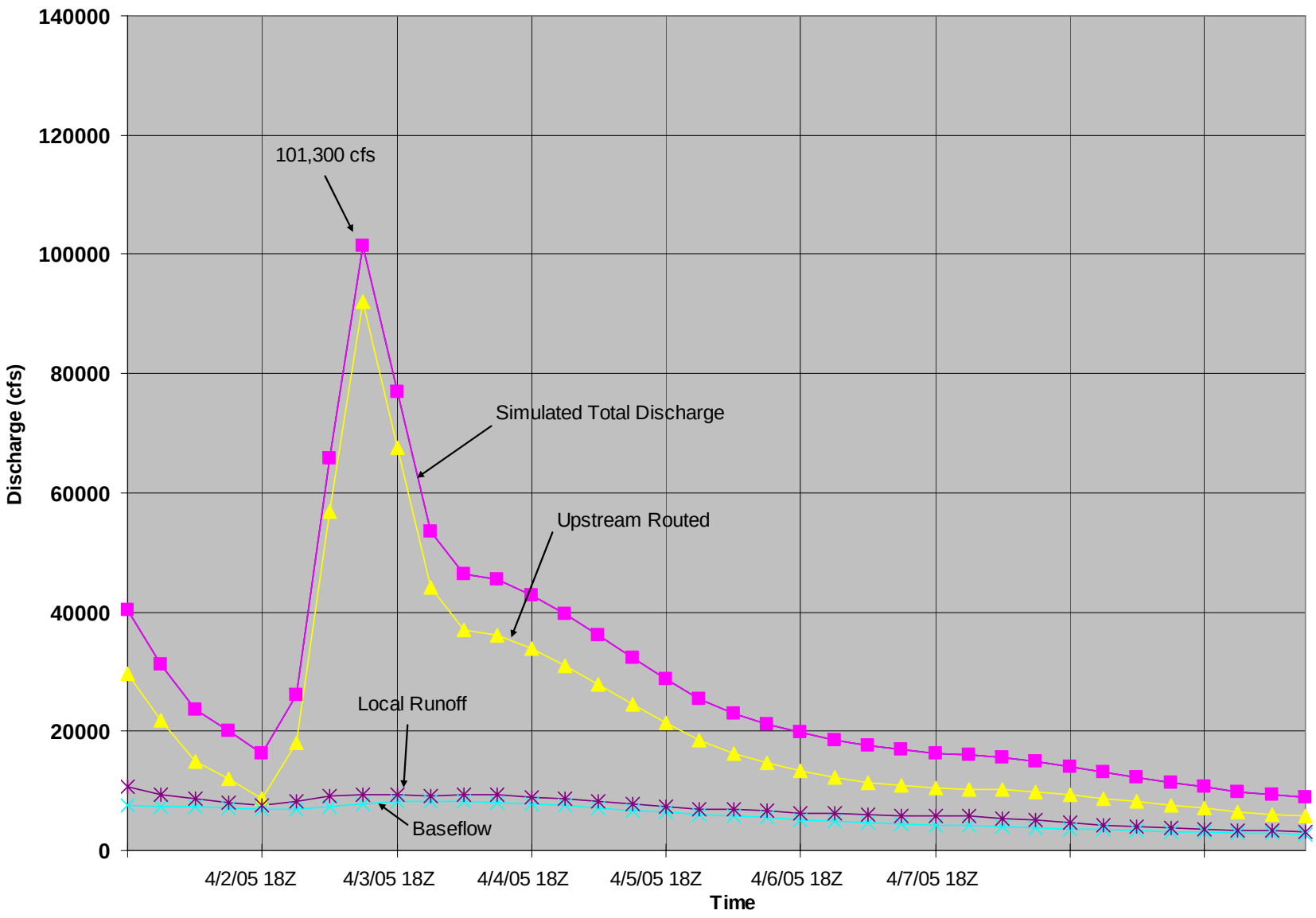

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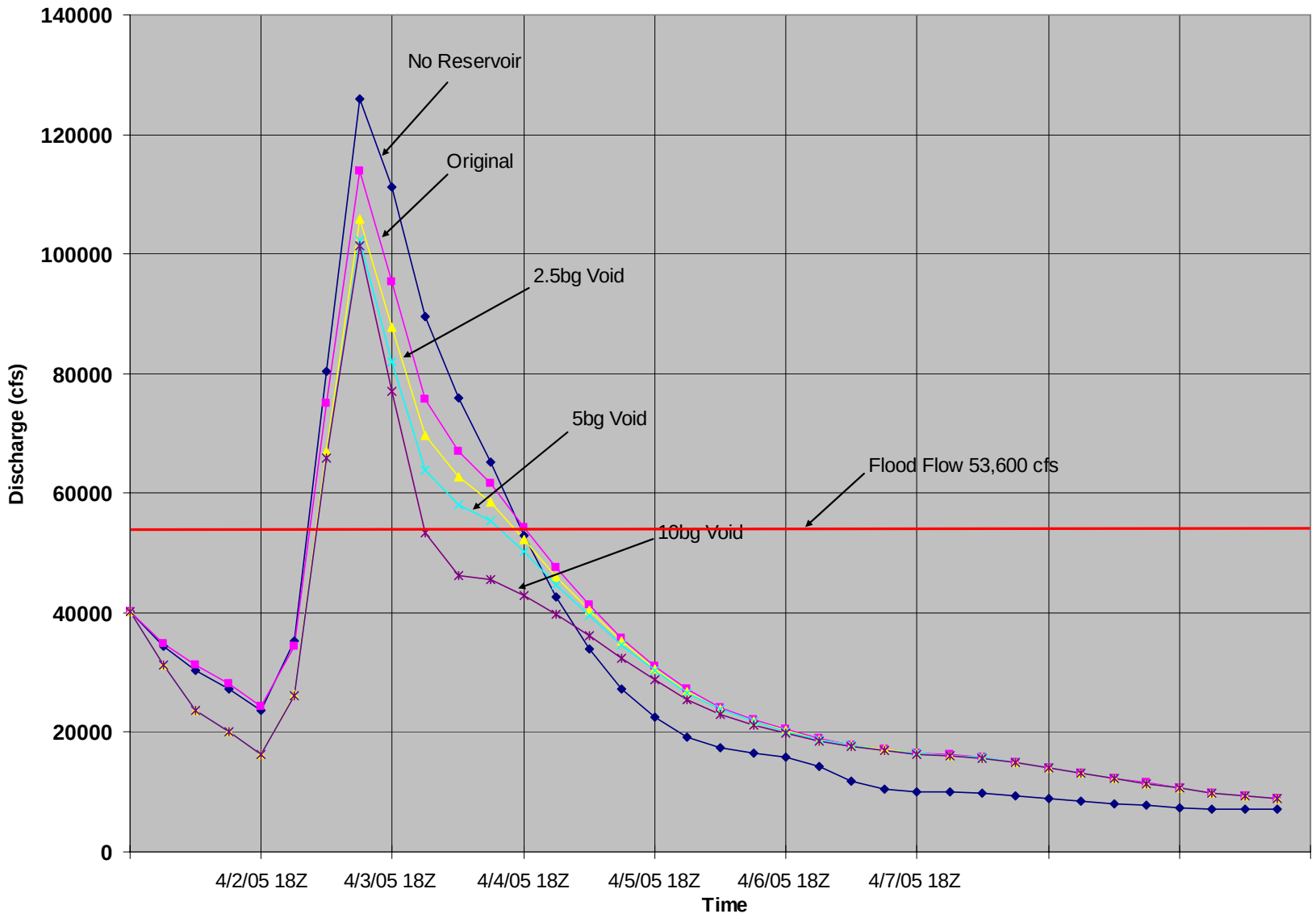

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Results in Stage (ft)

Table 1

Actual Max Pool Elevations and Crests (USGS) in feet from the event and Results (+/-) on crests from Case Simulations (+ above actual event; - below actual event)

	Actual	Case 1 No Res	Case 2 Void ~2.5bg	Case 3 Void ~5bg	Case 4 Void 10bg+	Case 5 No Spill
Cannonsville	1156.79 ft		1156.4 ft	1156.2 ft	1155.3 ft	1150.0 ft
Pepacton	1283.69 ft		1283.5 ft	1283.3 ft	1282.8 ft	1280.0 ft
Hale Eddy	14.12 ft	+2.2 ft	-1.1 ft	-1.5 ft	-2.4 ft	-2.4 ft
Fishs Eddy	22.49 ft	+1.0 ft	-0.7 ft	-1.0 ft	-1.1 ft	-1.1 ft
Callicoon	17.97 ft	+1.1 ft	-0.8 ft	-1.1 ft	-1.2 ft	-1.2 ft

Results in Flow (cfs)

Table 2

Observed and Estimated Max Flows in CFS (cubic feet per second) from MARFC's operational forecast model using the most recent USGS rating curves as of April 2006 and Results (+/-) on crests from Case Simulations (o – observed, e – estimated, + above actual event, - below actual event)

	Discharge	Case 1 No Res	Case 2 Void ~2.5bg	Case 3 Void ~5bg	Case 4 Void 10bg+	Case 5 No Spill
Hale Eddy	21,500 cfs (o)	+5700 cfs	-4600 cfs	-5800 cfs	-8100 cfs	-8100 cfs
Fishs Eddy	86,000 cfs (e)	+6700 cfs	-4700 cfs	-6900 cfs	-7500 cfs	-7500 cfs
Callicoon	114,000 cfs (e)	+11900 cfs	-8200 cfs	-11800 cfs	-12700 cfs	-12700 cfs

Conclusions

- 1) Even though the Cannonsville and Pepacton Reservoirs spilled, the effect of having these two reservoirs in the watershed reduced flood crests by 1.0 to 2.2 ft at Hale Eddy, Fishs Eddy and Callicoon.
- 2) The effect of reducing pool levels at Cannonsville and Pepacton Reservoirs by roughly 2.5 to 5 billion gallons in these simulations has the effect of reducing downstream crests by 0.7 to 1.5 ft at Hale Eddy, Fishs Eddy and Callicoon.
- 3) The effect of reducing pool levels at Cannonsville and Pepacton Reservoirs by 10 billion gallons or more in these simulations has the same effect on crests as a No Spill scenario. The delayed spill reduces 1.1 to 2.4 ft on crests at Hale Eddy, Fishs Eddy and Callicoon. The crest is driven entirely by initial surface runoff.

Downstream Effects

- In addition to Hale Eddy, Fishs Eddy and Callicoon, the National Weather Service examined effects of the reservoirs further downstream to Barryville, Port Jervis, Montague, Tocks Island, Belvidere, Riegelsville and Trenton. Comparing the No Reservoir Case (this includes the removal of Cannonsville, Pepacton, Neversink, Rio and Wallenpaupack) to the actual observations, the reservoirs reduced flood crests by 0.5 to 1.5 feet at the downstream points.
- However, the National Weather Service did not explicitly model the reservoirs at Neversink, Rio and Wallenpaupack. Assumptions which include inflows to these reservoirs, areal size of these drainage basins and surface runoff amounts were made to simulate the effects of removing these reservoirs from the basin. The results obtained were based on rough approximations. Therefore, this information should only be considered a ballpark estimate.

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THE END

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