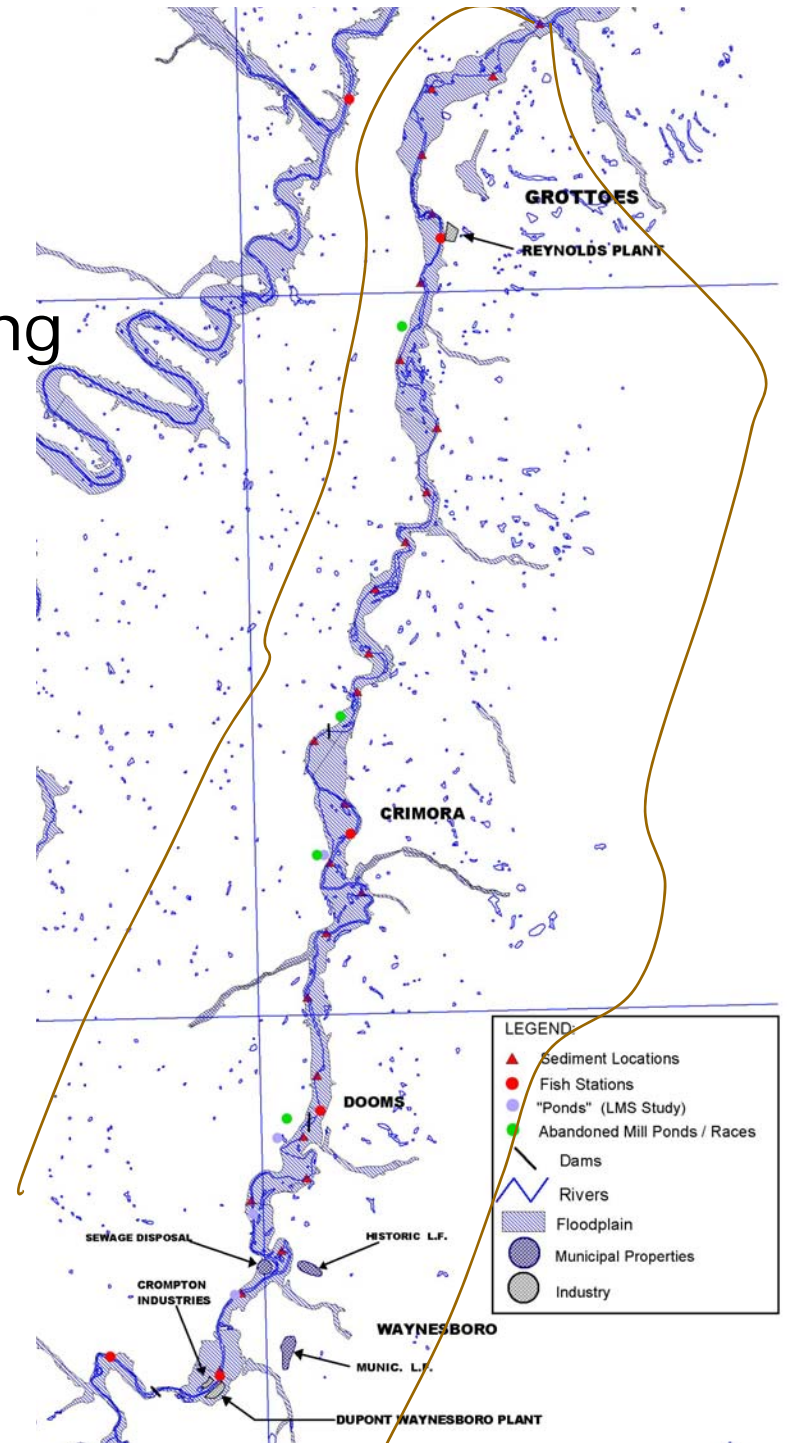


South River Science Team Meeting October 21, 2003

Water Budget Calculation South River Drainage Basin

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Water Budget Evaluation Purpose

- Characterize general water balance in the basin
- Determine a range for groundwater contribution to South River flow
- Evaluate potential for sub-aqueous springs to identify potential significant groundwater sources
- Expand to understand solids balance in the basin

Data Sources

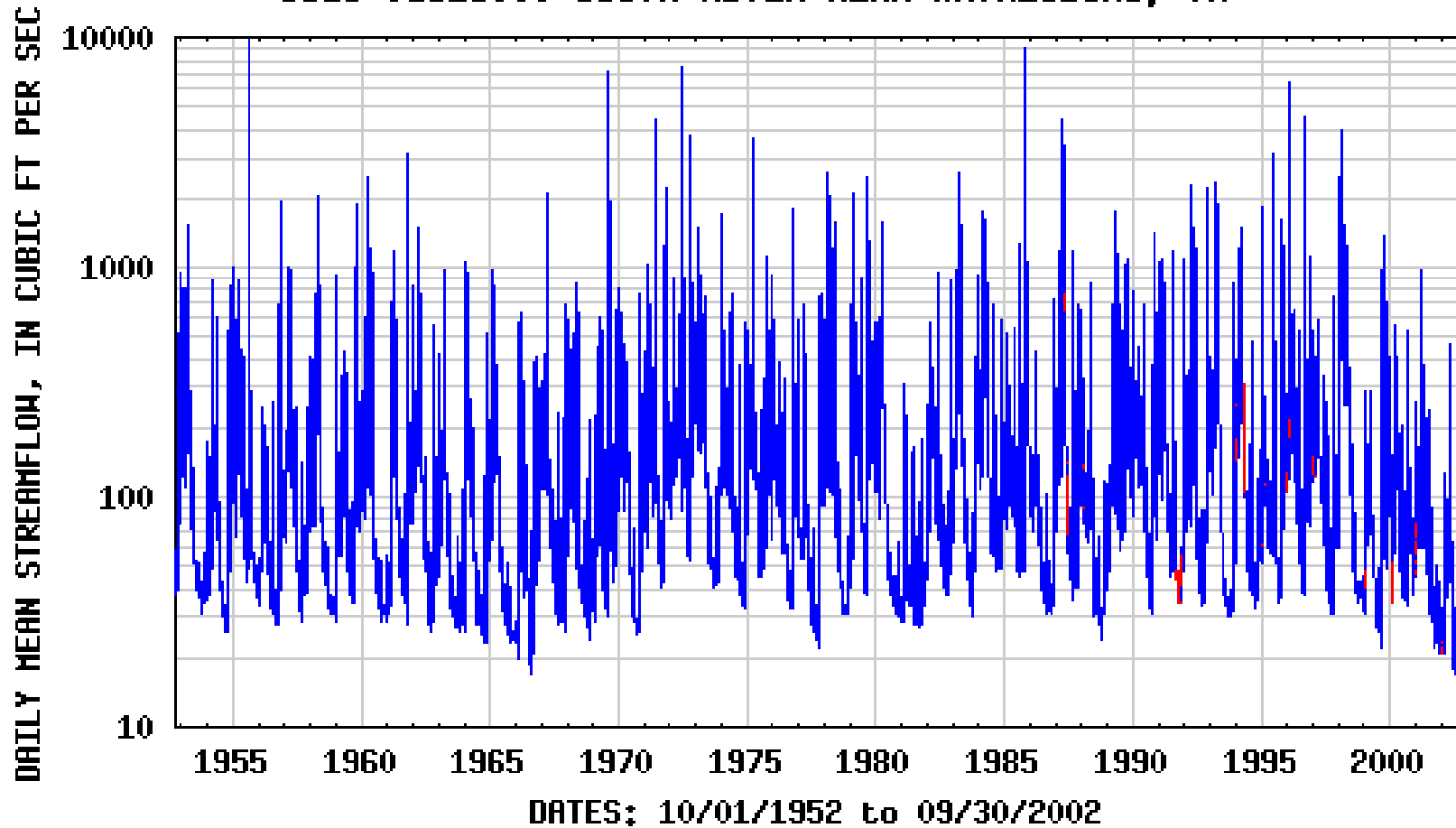
- USGS Gaging Stations (1970s to 2002)
- State Climatologic Data
- VADEQ Discharge/Withdrawal Permits
- Engineering Feasibility Study, LMS 1981
- Hydrogeologic Study of the Waynesboro Nurseries Inc., Tethys 1988
- Geology of Waynesboro, Gaithright et. al. 1977
- Maptech, per. com. 9-03

Approach

- Use mean annual statistics
- Evaluate basin - 2 methods
 - using hydrologic (river flow) data
 - using climatologic data
- Compare results for verification
- Look for anomalies that could indicate a significant localized GW discharge (potential source identification)



USGS 01626000 SOUTH RIVER NEAR WAYNESBORO, VA

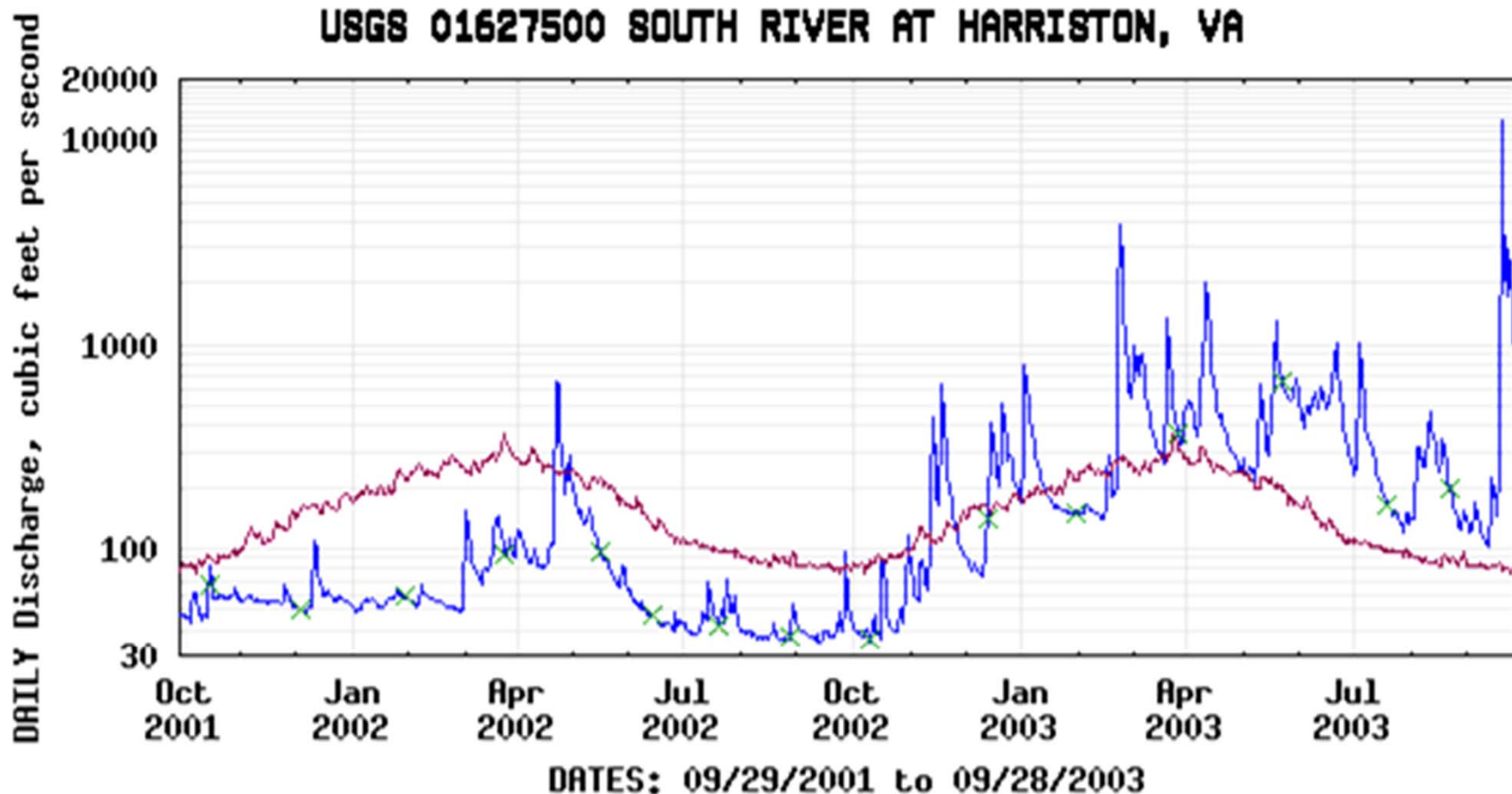


EXPLANATION

— DAILY MEAN STREAMFLOW

— ESTIMATED STREAMFLOW

USGS 01627500 SOUTH RIVER AT HARRISTON, VA

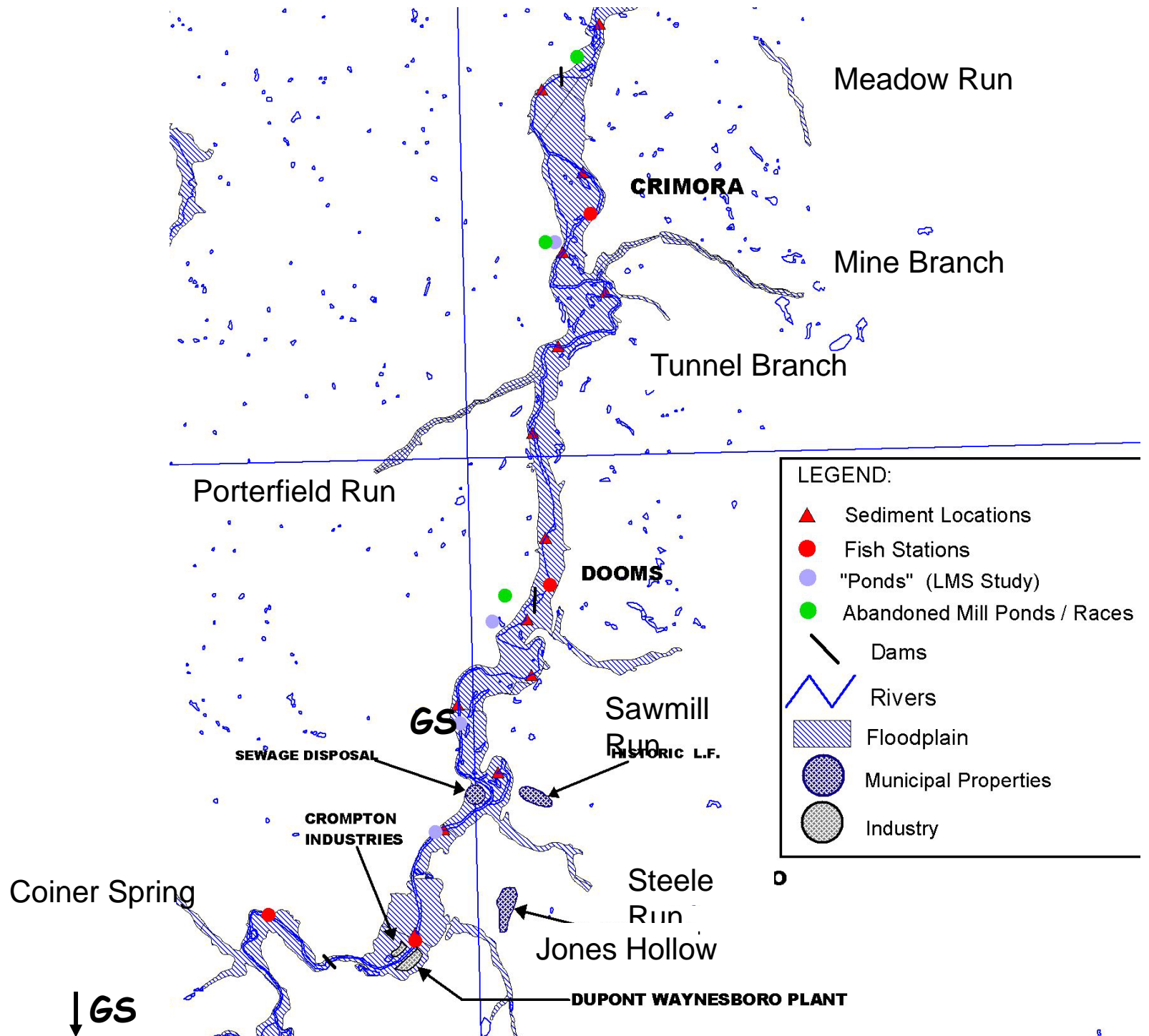


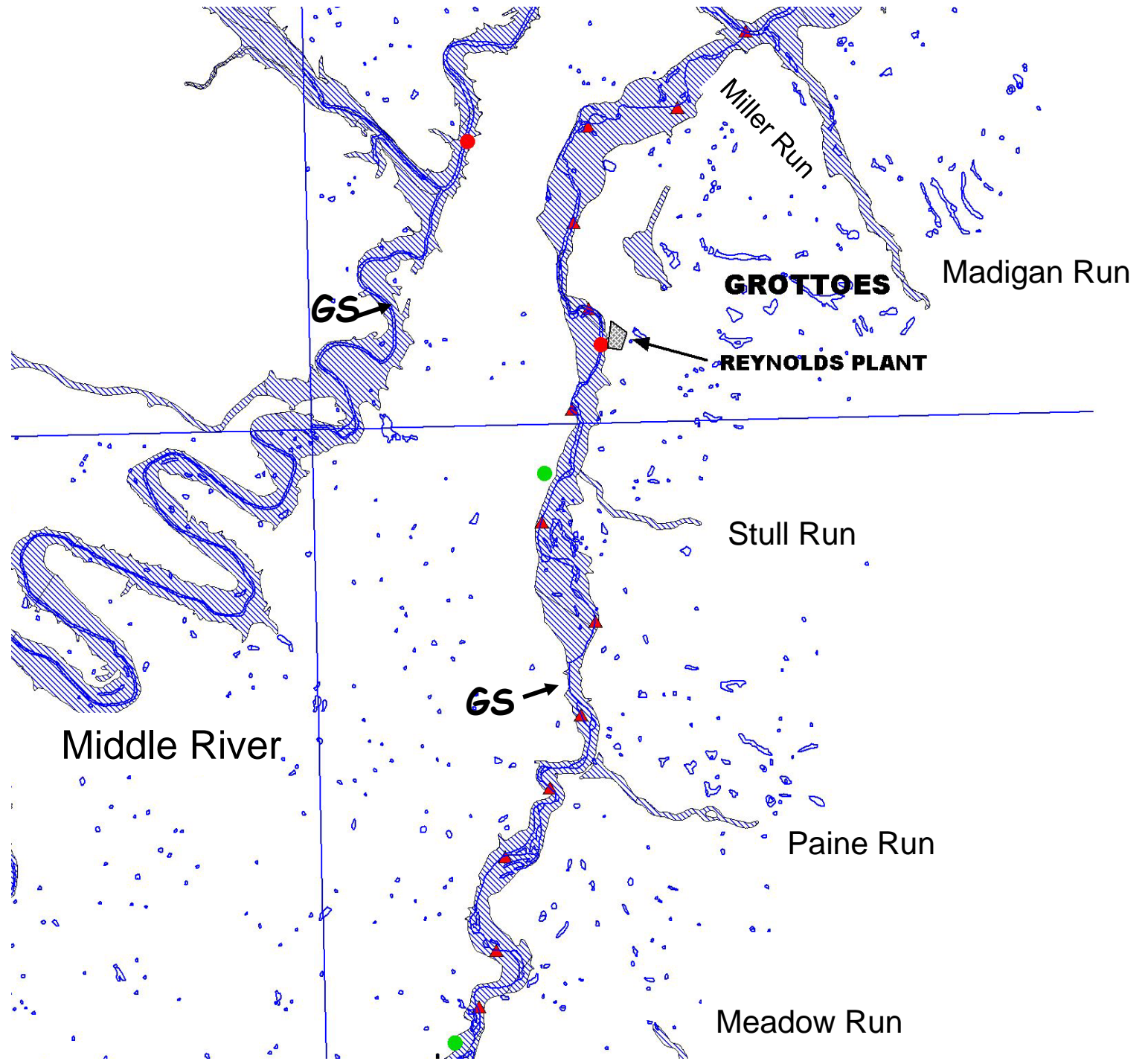
EXPLANATION

— DAILY MEAN DISCHARGE

— MEDIAN DAILY STREAMFLOW BASED ON 60 YEARS OF RECORD

× MEASURED Discharge





Drainage Basin Summary

- From source to confluence with North River 234.4 mi² area
- The ratios of river flow to drainage area are relatively consistent ~1.2 cfs/ mi² (based on 3 gaging stations)
- Flow of South River at Port Republic is est. 282 cfs (16.3"/yr)
- Estimated flow of North River at Port Republic is 700 cfs

Hydrologic Approach

Groundwater Contribution to South River Flow

$$\text{River Flow} = \text{GW discharge} + \text{Runoff} + \text{Permitted Discharges}$$

- Varying Reports on GW contribution
 - Hydrographs suggest GW contribution is ~30% of total river flow
 - MapTech Basins Model upstream of Waynesboro indicate GW contribution is ~50%
 - WNI Hydrogeologic Study, Tethys, 1988 shows GW contribution from alluvial plain ~70%

Climatologic Approach

$$PPT = \text{Evapotranspiration} + \text{Runoff} + \text{GW Infil.} \\ + \text{Permitted Discharges} - \text{Withdrawals}$$

$$\text{River flow} = \text{GW discharge} + \text{Runoff} + \text{Permitted discharges}$$

- Inputs to equation
 - Precipitation 35.54"/yr
 - Average of Staunton and Stuart's Draft stations (36.18 to 34.9")
 - Evapotranspiration estimated 19.54"/yr (55% PPT)
 - Permitted discharges and withdrawals amount to small net loss of 5 cfs annualized (0.29")
 - Equates to river flow of 277 cfs or 16"/yr
- Results comparable to Hydrograph evaluation (277 cfs vs. 282 cfs)

Water Budget - Conclusions

- Hydrologic and climatologic data are comparable in the 234 mi² watershed
- Total budget available to South River (runoff and groundwater seepage) is 16 to 16.31"/yr but proportion of groundwater is still uncertain
- GW discharge could make up 30 to 50% of total river flow
- Data does not have the spatial resolution to identify specific areas of higher GW discharge and potential dissolved sources