

# Chesapeake Bay Program Modeling

## Phase 5





# Collaborators

- CBP
- EPA
- CRC
- UMCES
- NRCS
- all state agencies
- USGS
- MD and VA
- U of MD.
- MDE
- ICPRB
- DCR
- U of MD
- VIMS

# The right size for segmentation

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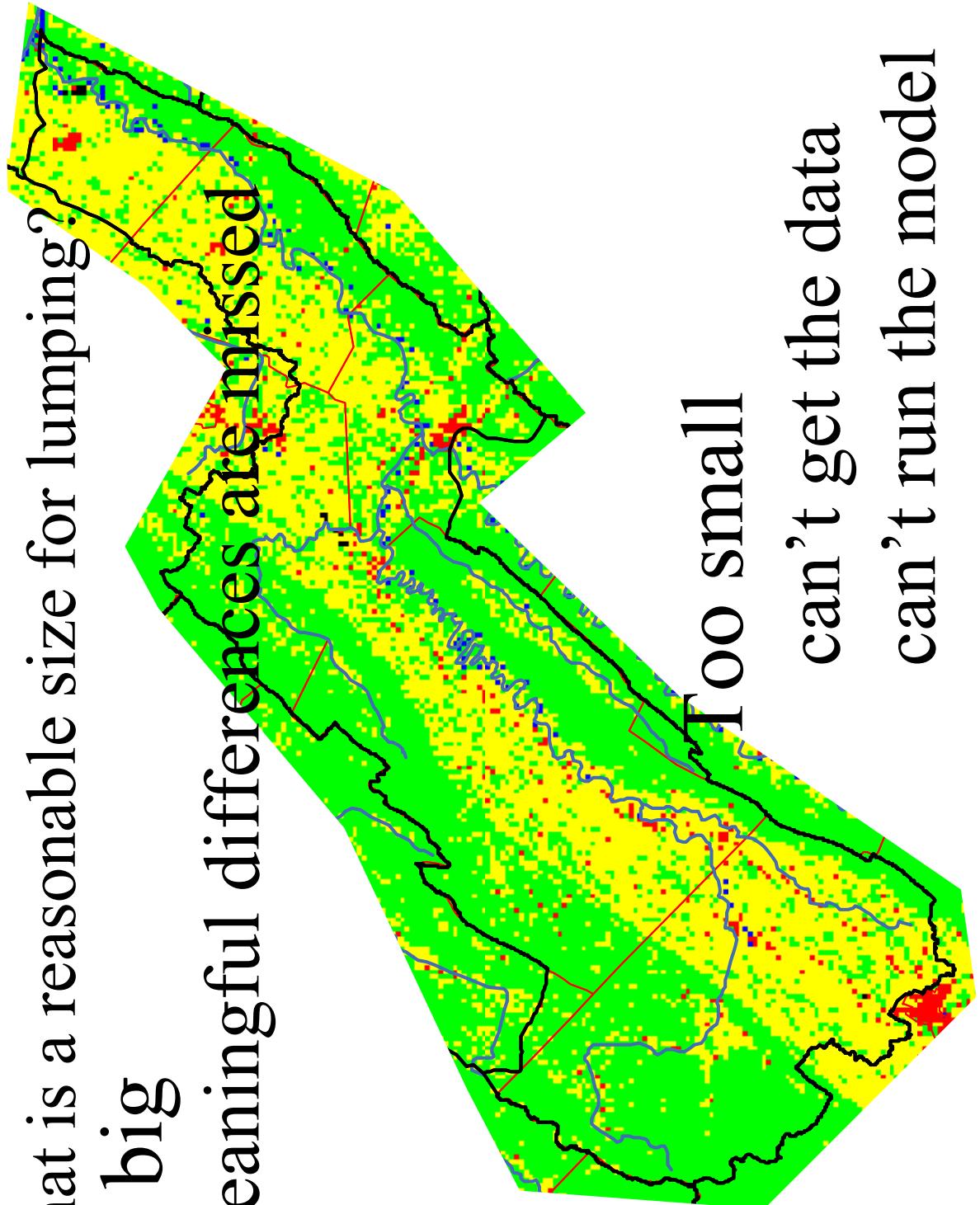


# HSPF - lumped model

What is a reasonable size for lumping?

Too big

meaningful differences are missed



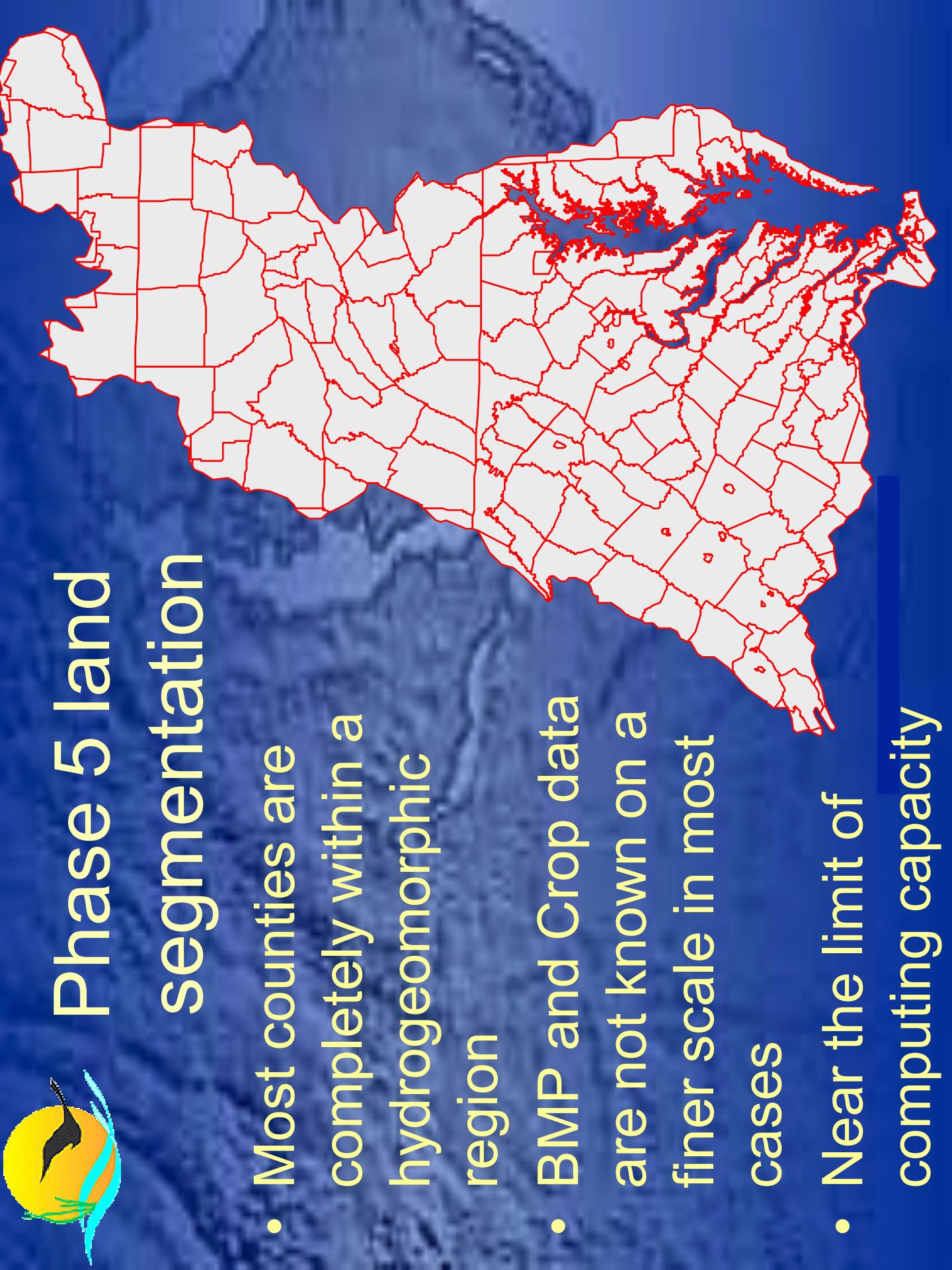
can't get the data

can't run the model



# Phase 5 land segmentation

- Most counties are completely within a hydrogeomorphic region
- BMP and Crop data are not known on a finer scale in most cases
- Near the limit of computing capacity





# Phase 5 River Segmentation

- Greater than 100 cfs
- Has a flow gage
- Near the limit of meaningful data
- Consistent criterion

or



# Putting the land and river together

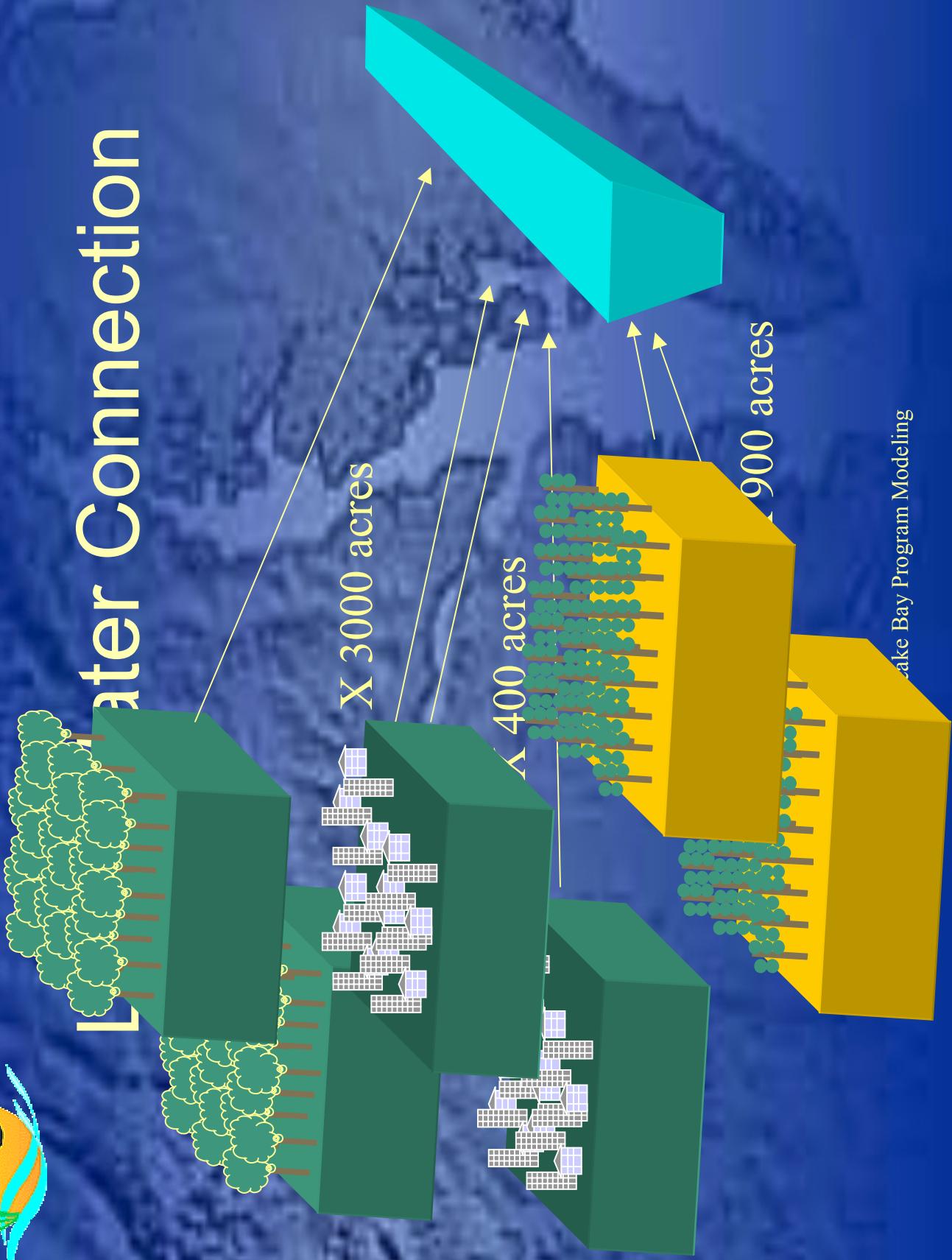


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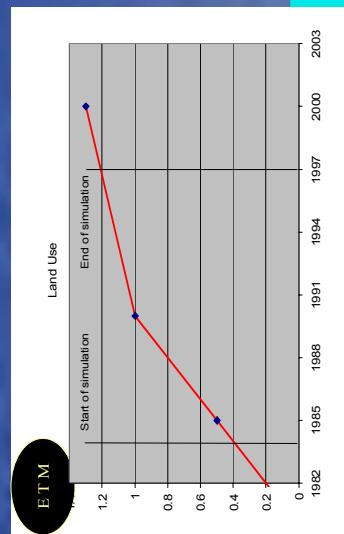
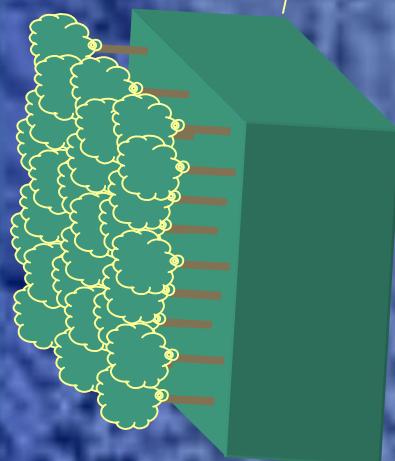
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# Water Connection

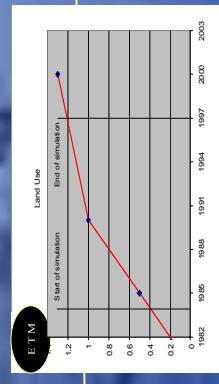


# Land-Water Connection

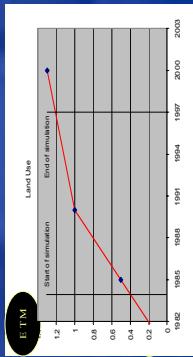


X 3000 acres

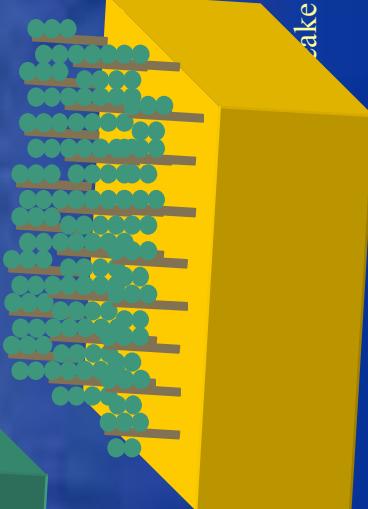
X 400



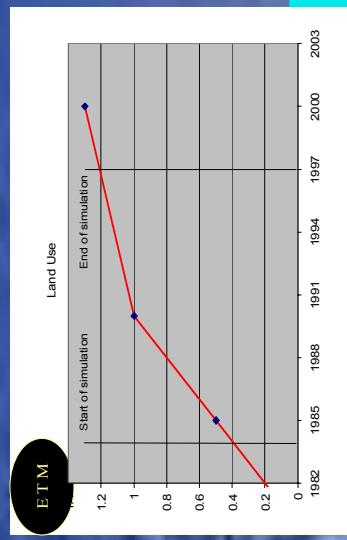
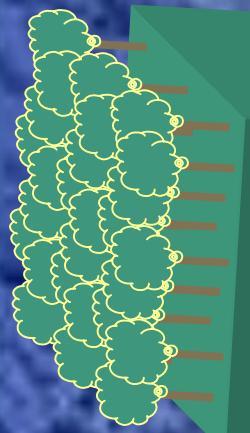
X 900 acres



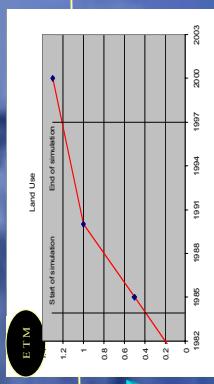
Lake Bay Pro



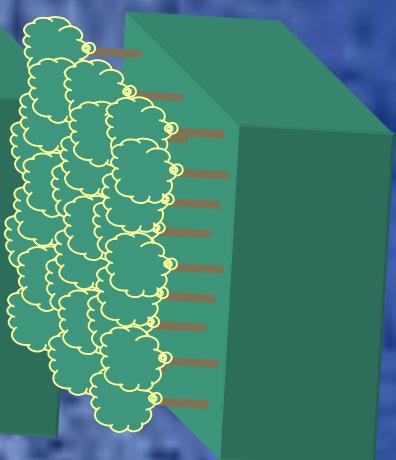
# Land-Water Connection



X 3000 acres



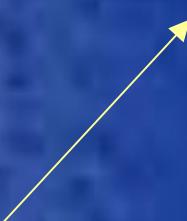
X 400



X 230 acres



X 1200 acres



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# Running the model





Nutrient Application  
Database

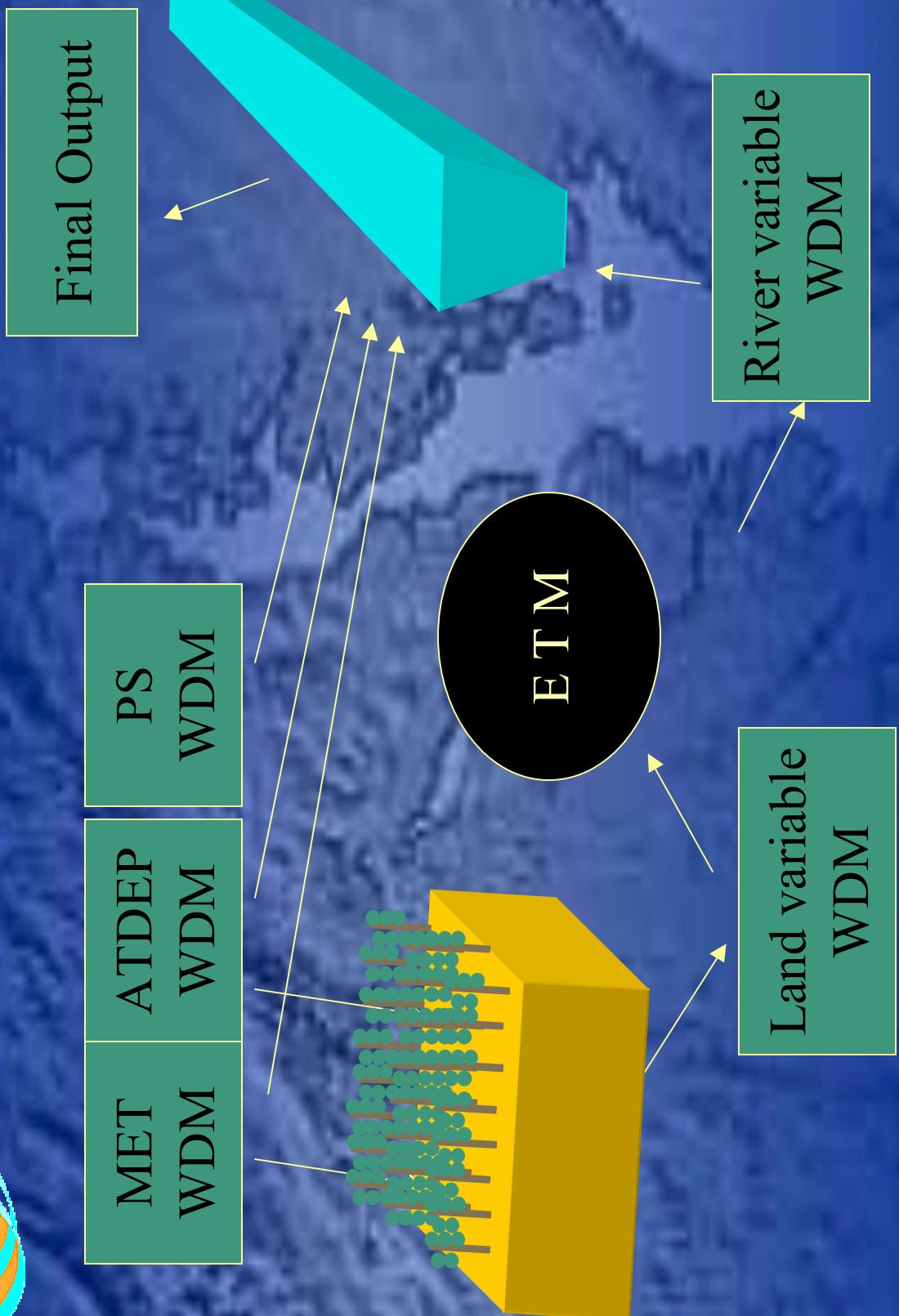
Physical Description  
Database

Land Use Acreage  
Database

Process Parameter  
Database



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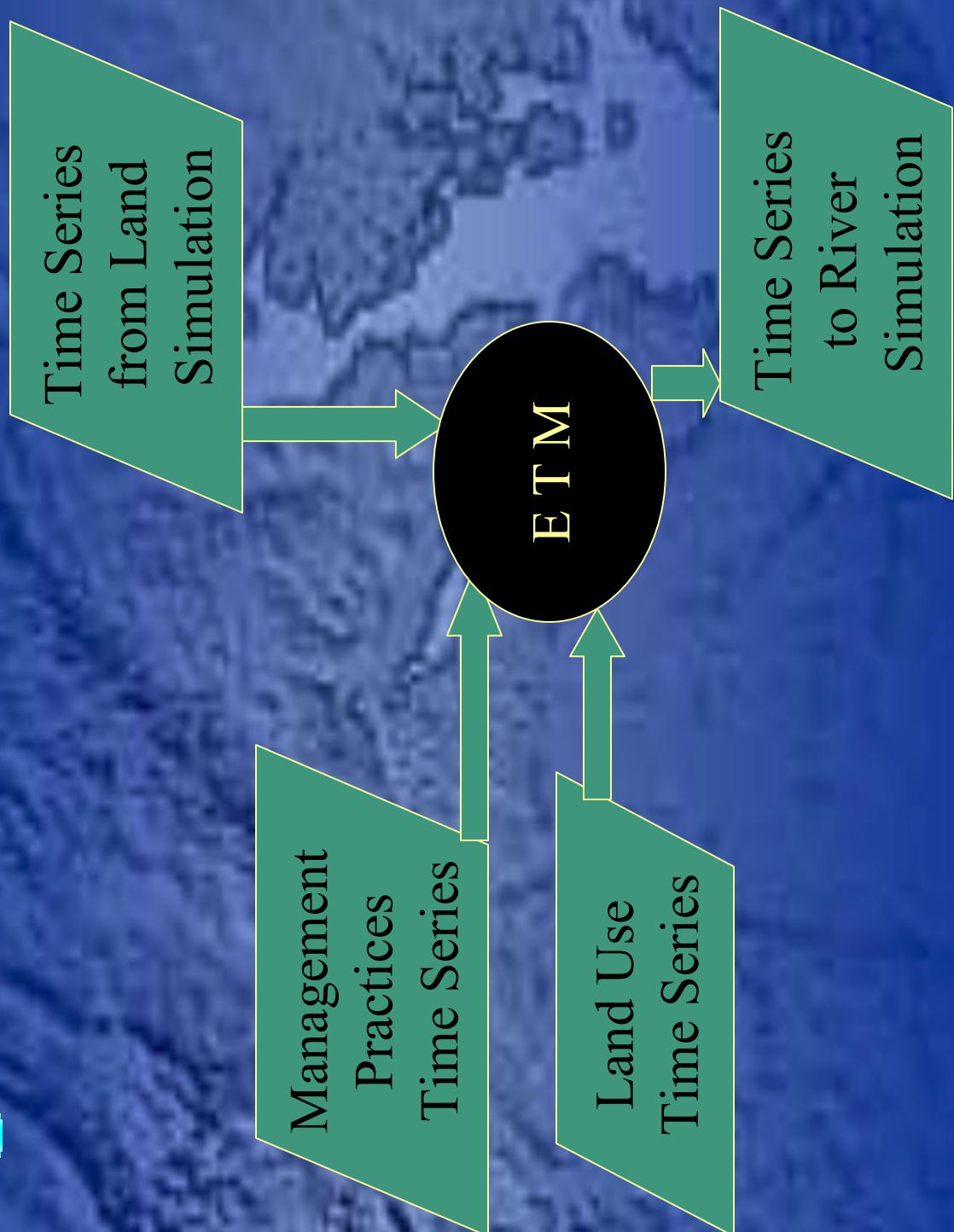


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ETM



# External Transfer Module



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# P5.D1 - Time varying calculation

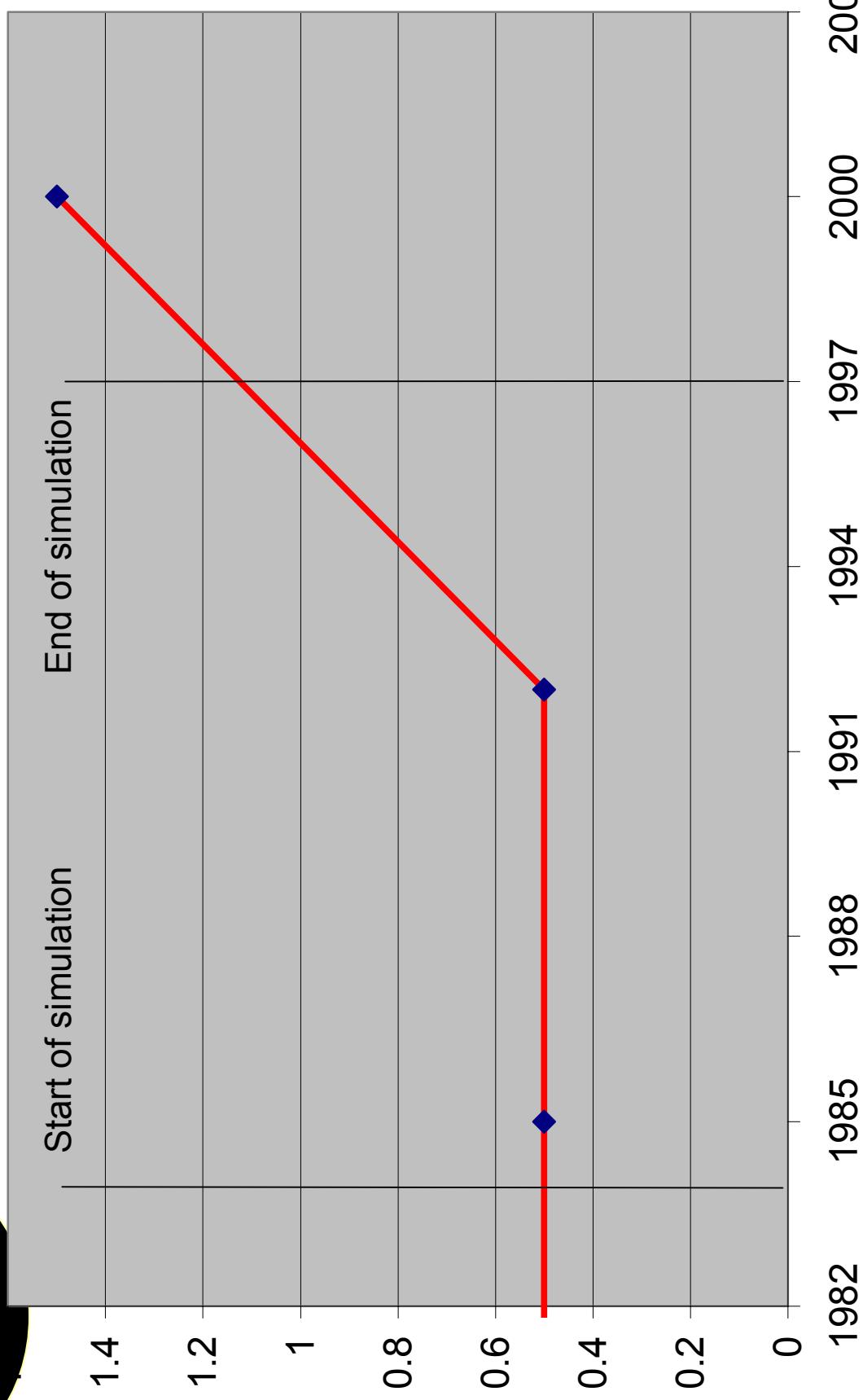


E T M



E T M

BMPs



E T M

Land Use

Start of simulation      End of simulation

1.2

1

0.8

0.6

0.4

0.2

0

1982 1985 1988 1991 1994 1997 2000 2003

Start of simulation

End of simulation

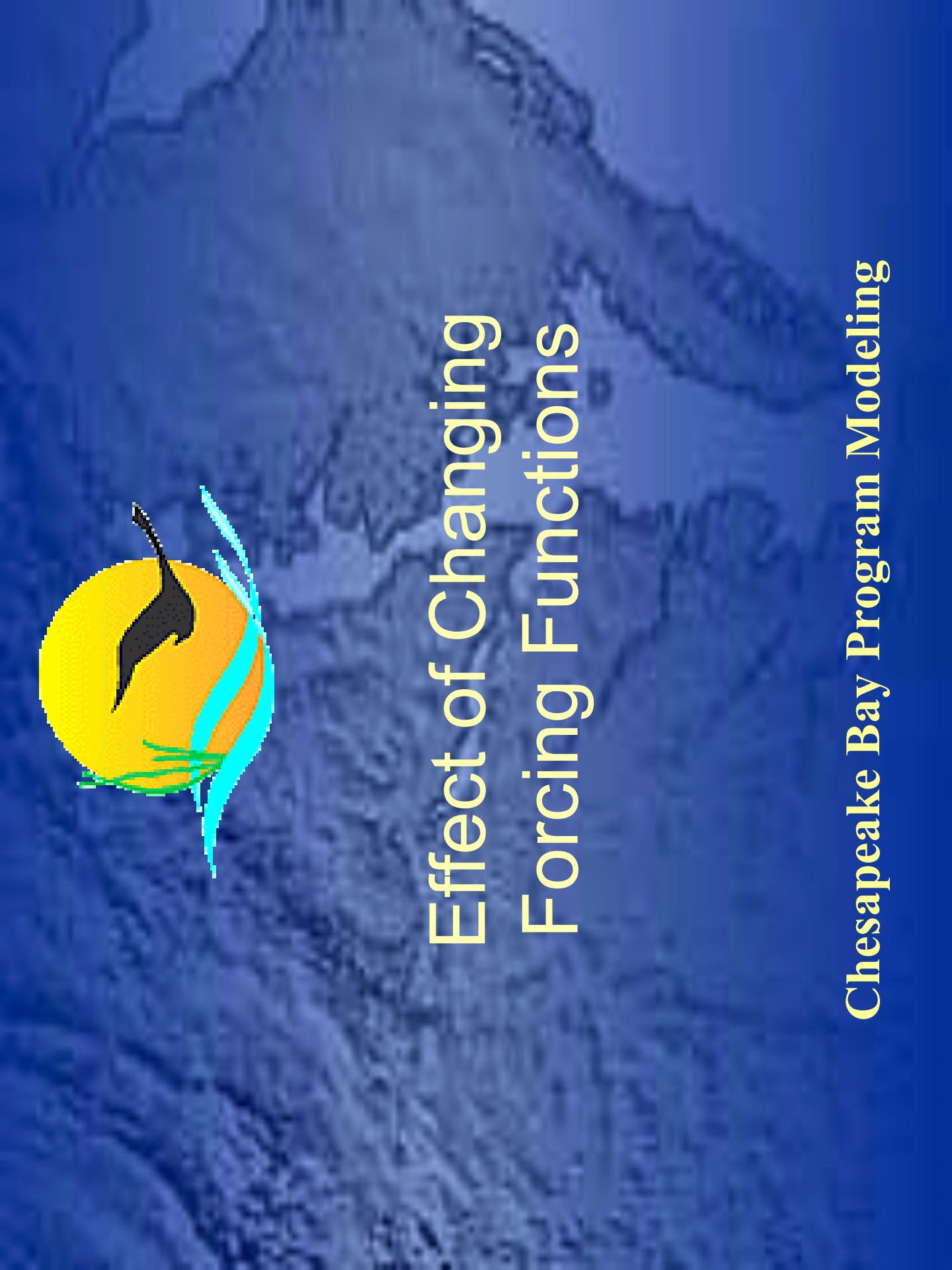
Start of simulation

End of simulation



# Other ETM Opportunities

- Seasonality
- Urban flow considerations
- Performance under extreme weather
- Design life consideration
- Ability to add any new BMP
- Subgrid effects



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# Effect of Changing Forcing Functions

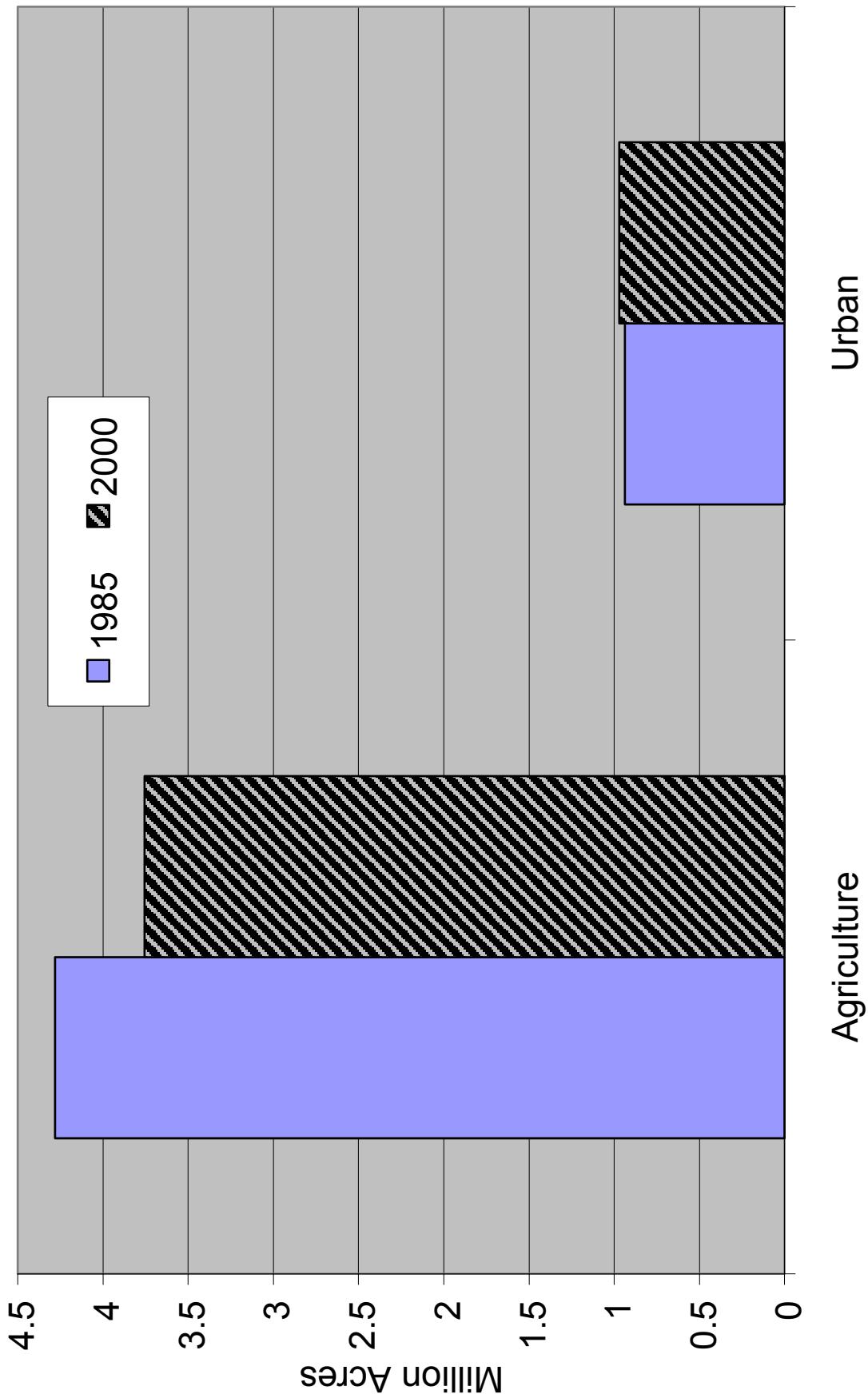




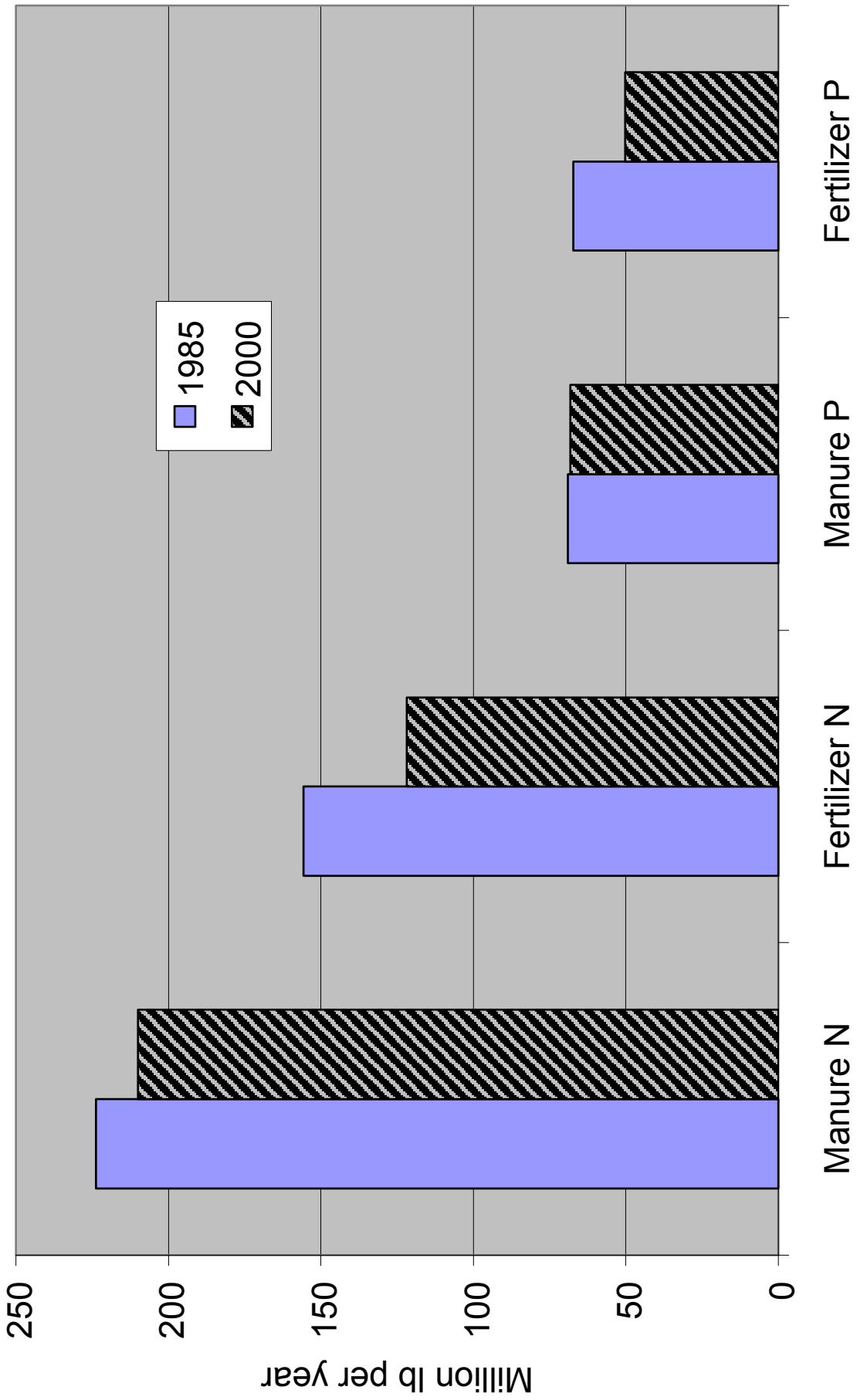
# Basic Hypocrisy

- Management actions affect delivery of nutrients to the Chesapeake Bay
- We can calibrate a watershed model over 17 years of observations without changing management actions

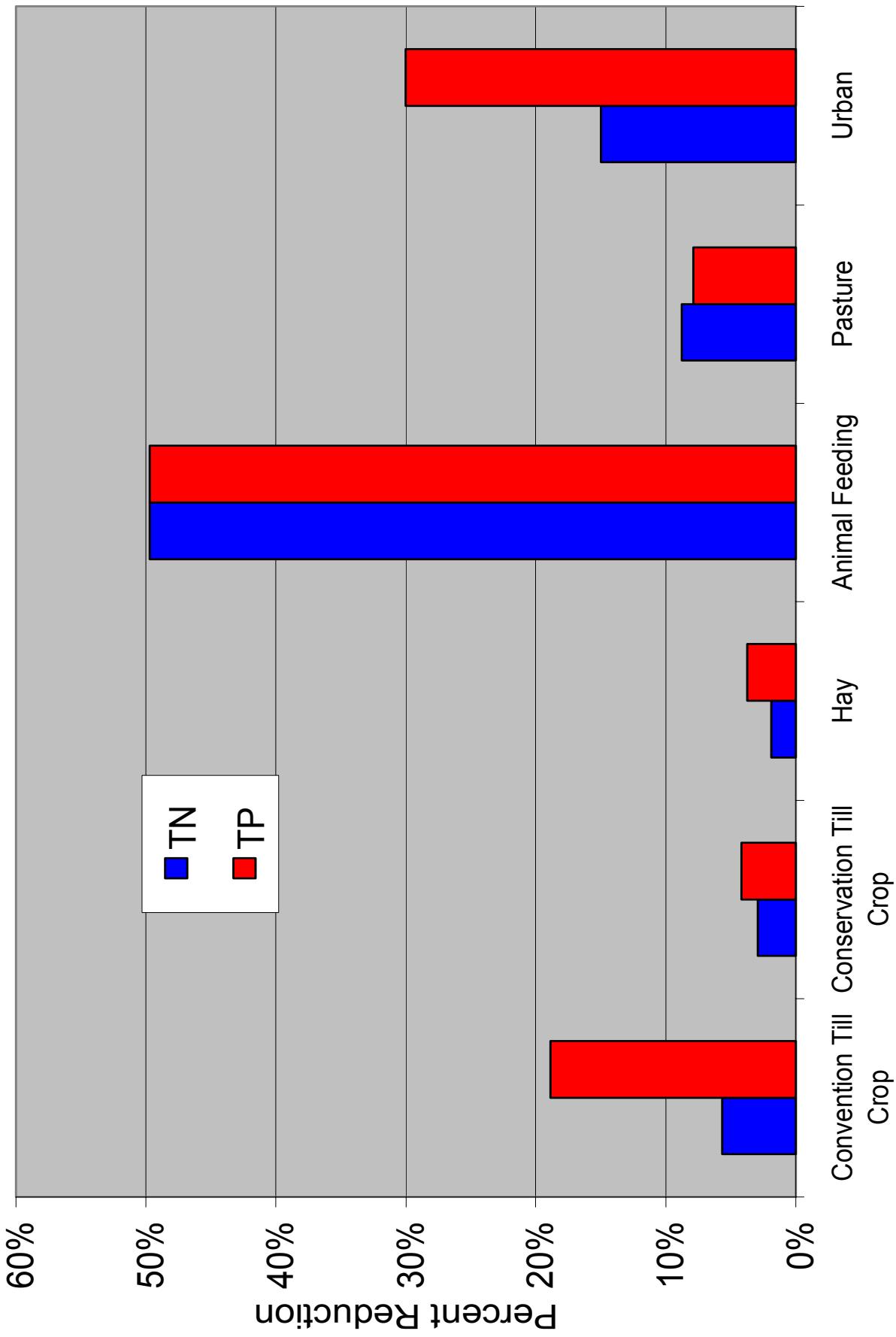
## Selected Susquehanna Land Use



## Agricultural Nutrient Applications in the Susquehanna Basin

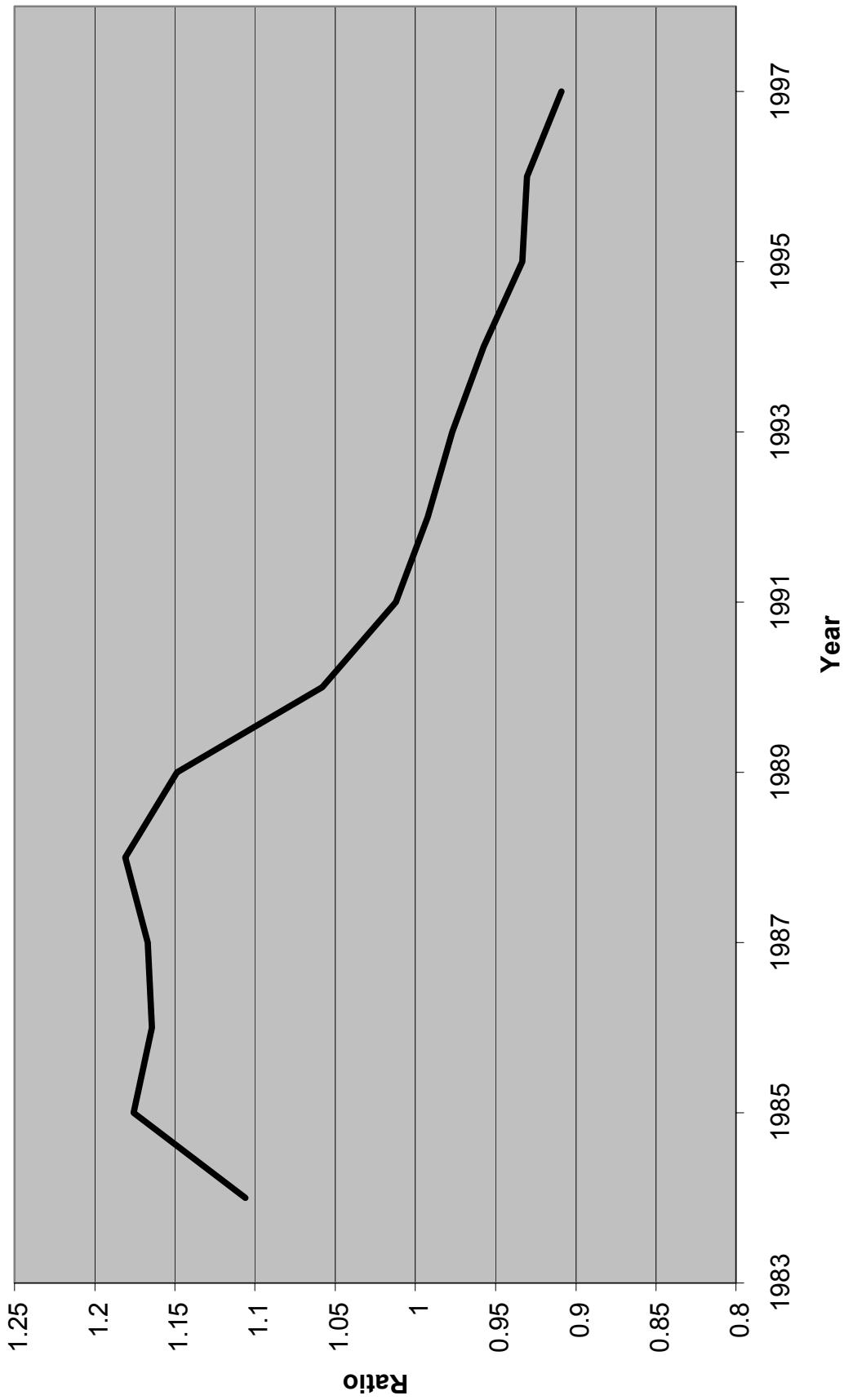


## Reduction of Nutrient Export in the Susquehanna Due to Management





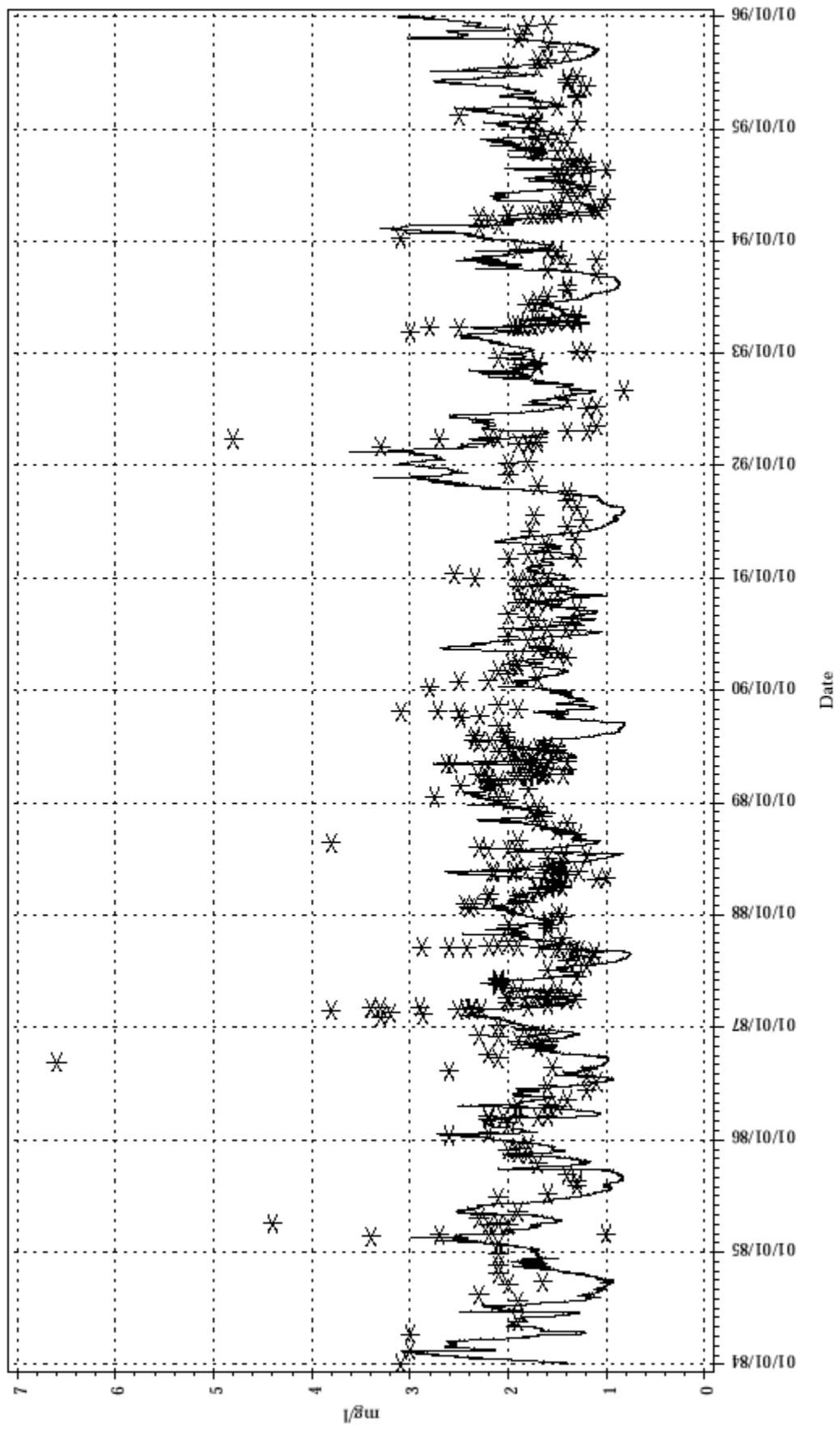
## Variable / Steady by year in the Susquehanna (TN load)



# Susquehanna River at Segment 140 - Constant Anthro Forcings Observed and Simulated versus Time

## Total Nitrogen

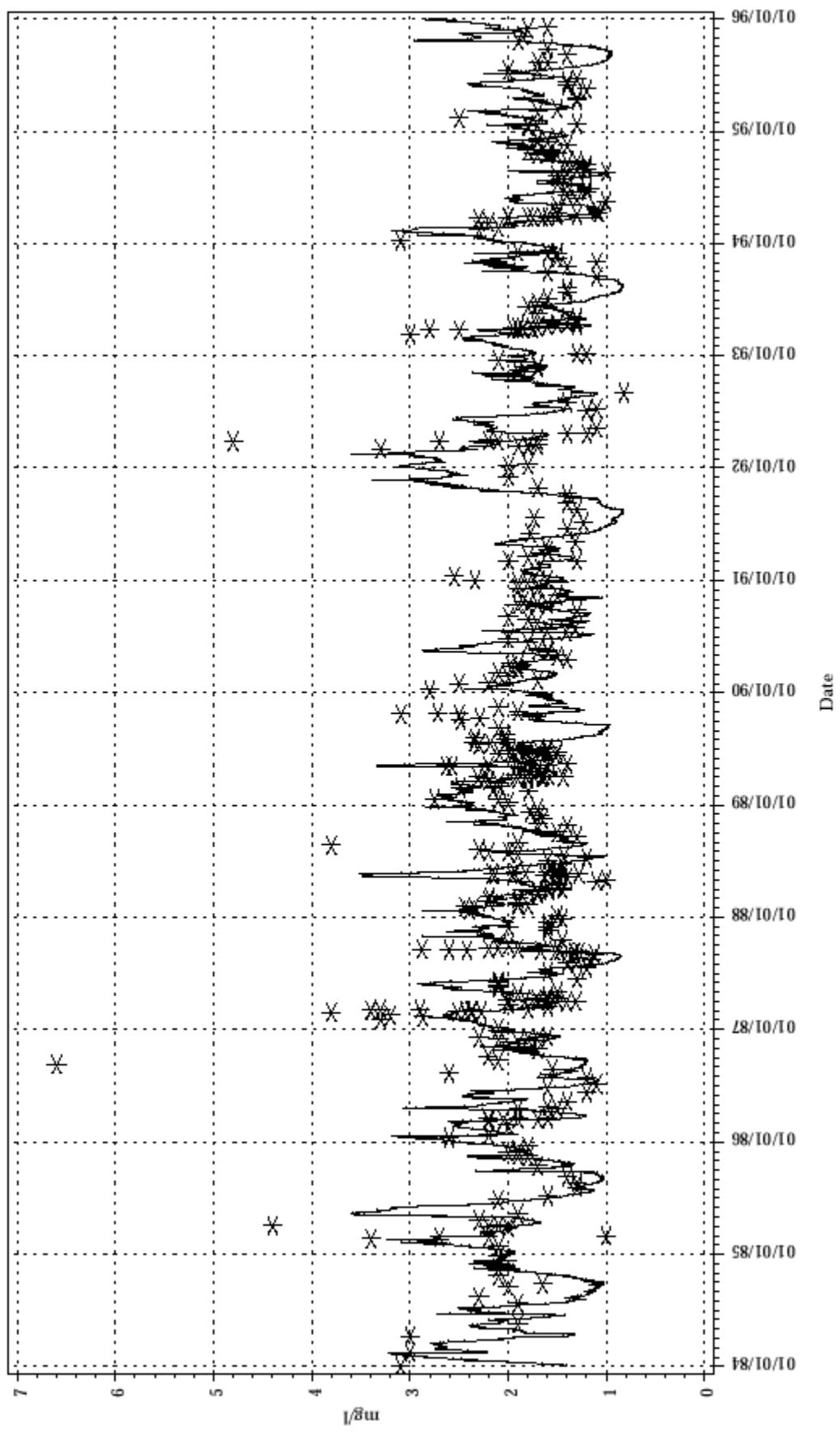
(\*=Observed, -=Simulated)



# Susquehanna River at Segment 140 - Variable Anthro Forcings Observed and Simulated versus Time

## Total Nitrogen

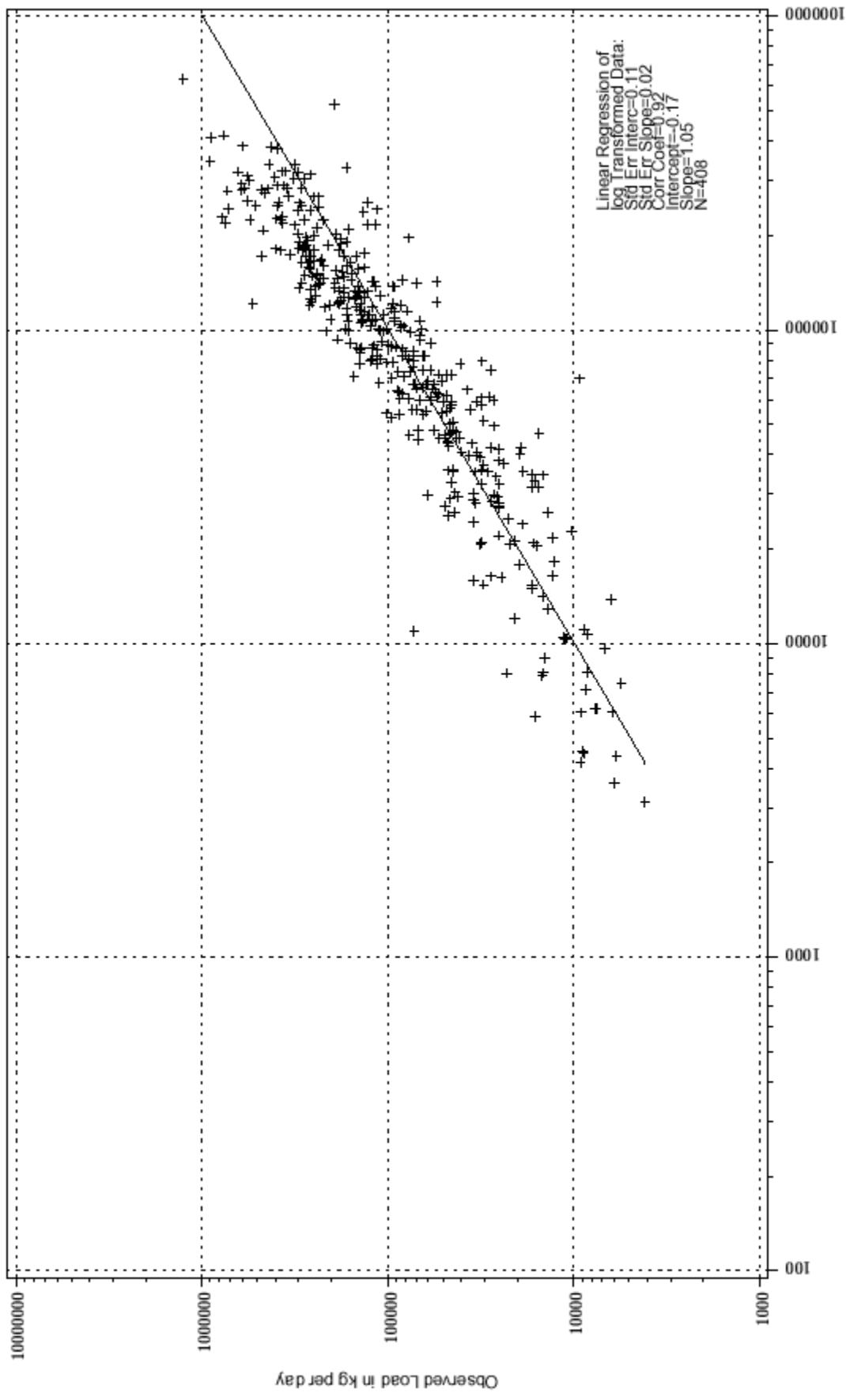
(\*=Observed, -=Simulated)



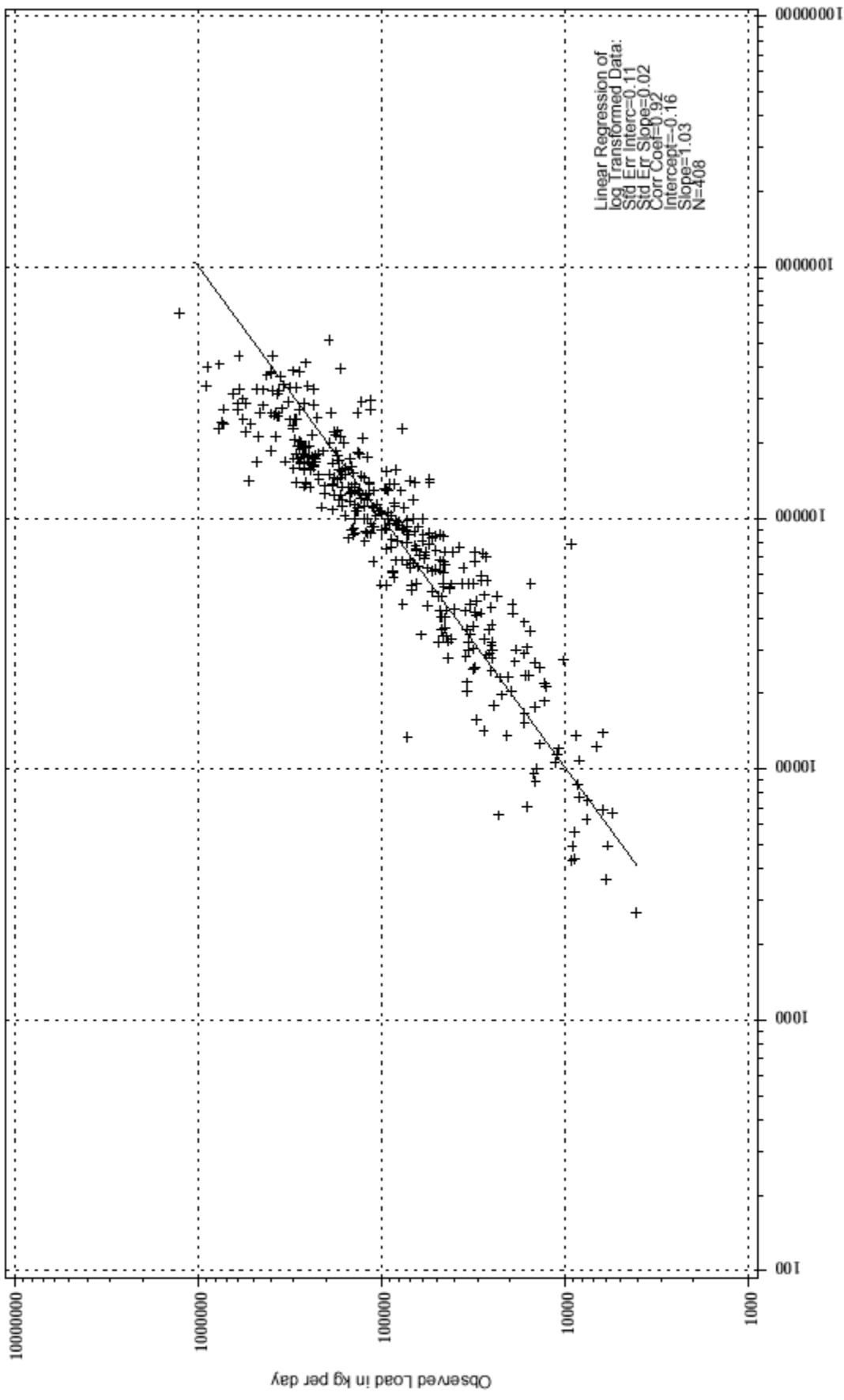
# Susquehanna River at Segment 140 - Constant Anthro Forcings

## Total Nitrogen Observed Load vs Simulated Load

Paired Daily Values

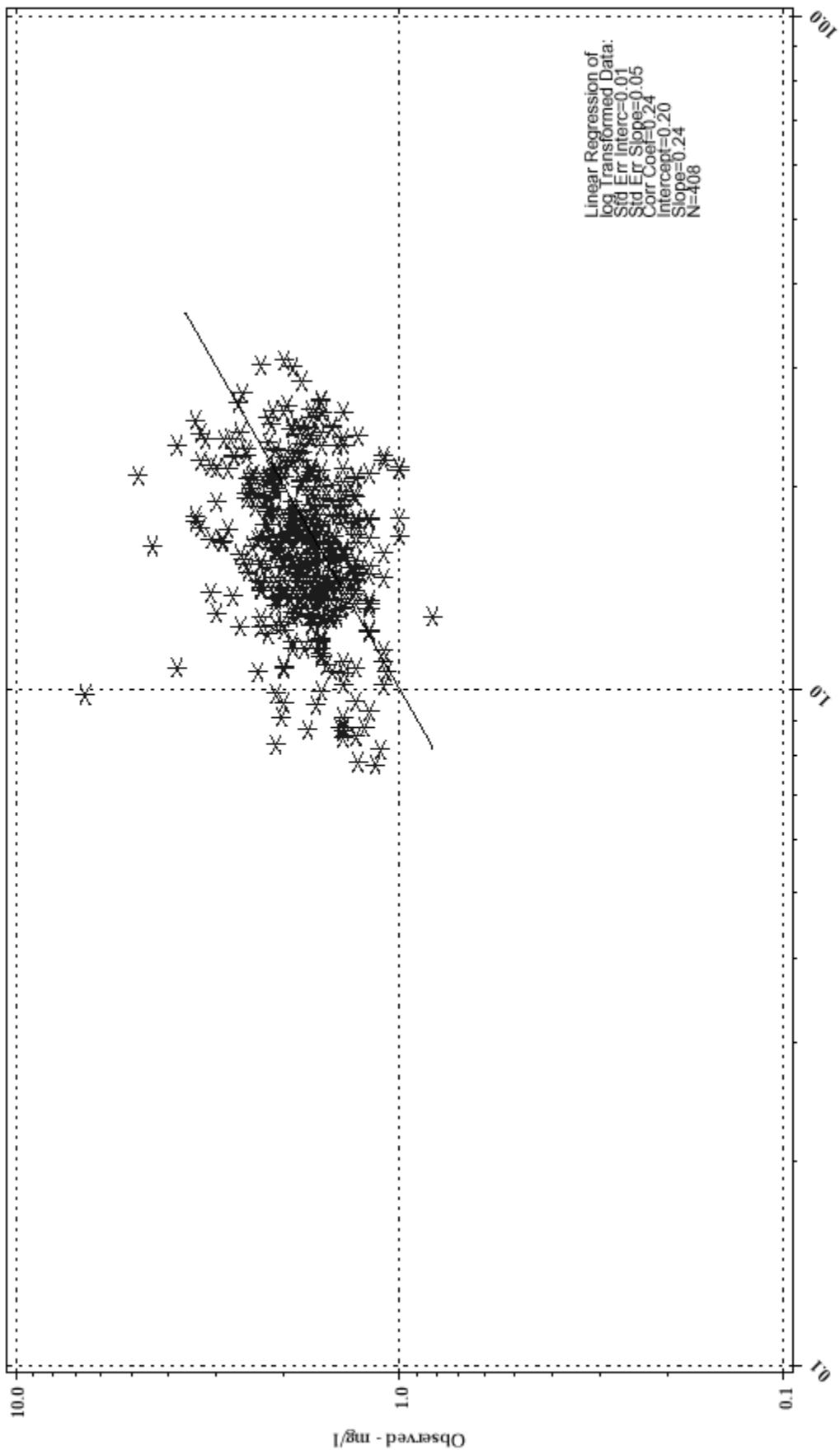


# Susquehanna River at Segment 140 - Variable Anthro Forcings Total Nitrogen Observed Load vs Simulated Load Paired Daily Values



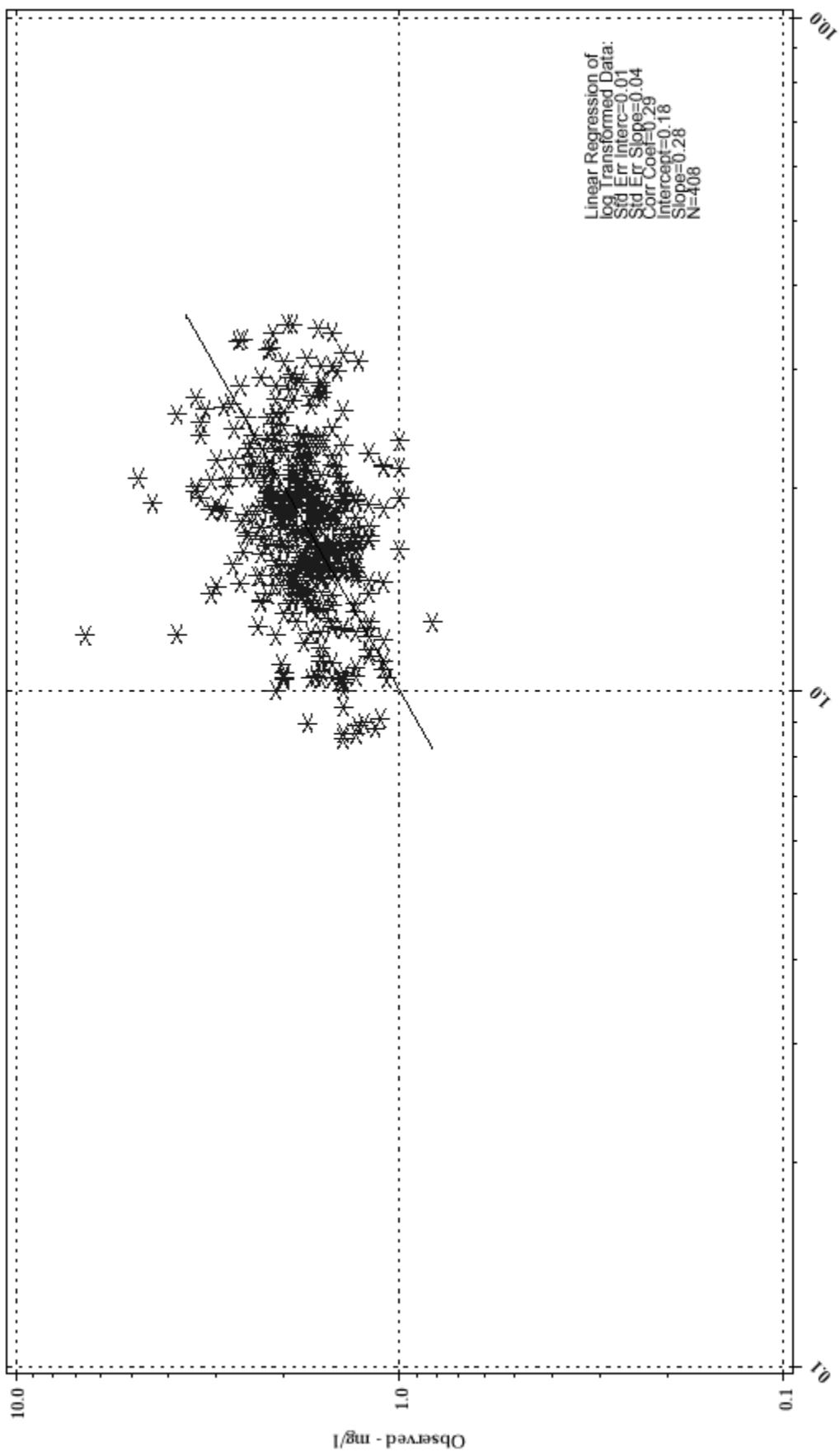
# Susquehanna River at Segment 140 - Constant Anthro Forcings

## Scatter Plot and Regression of Simulated versus Observed with Ideal Line Total Nitrogen: 01JAN84 - 01JAN96

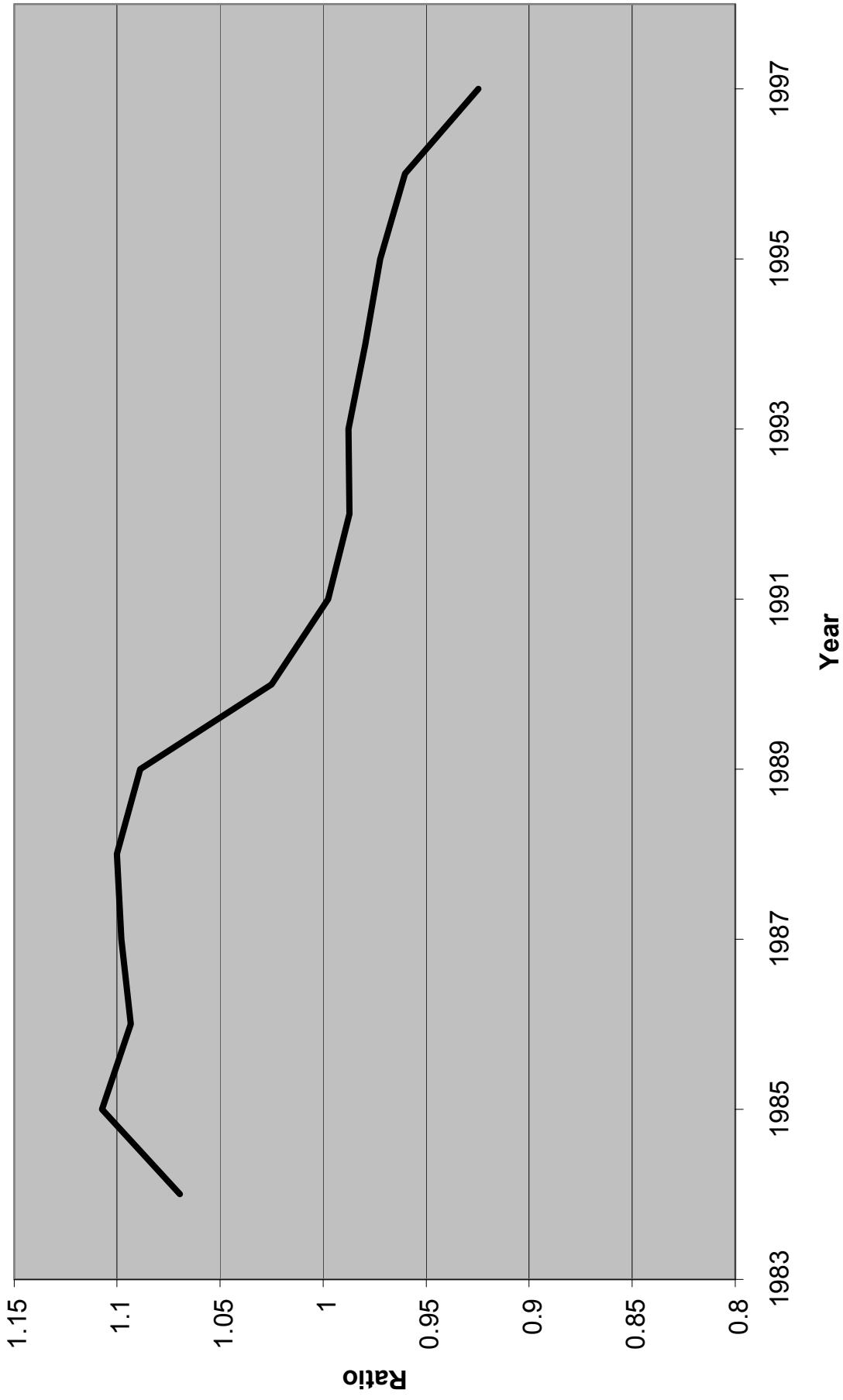


# Susquehanna River at Segment 140 - Variable Anthro Forcings

## Scatter Plot and Regression of Simulated versus Observed with Ideal Line Total Nitrogen: 01JAN84 - 01JAN96



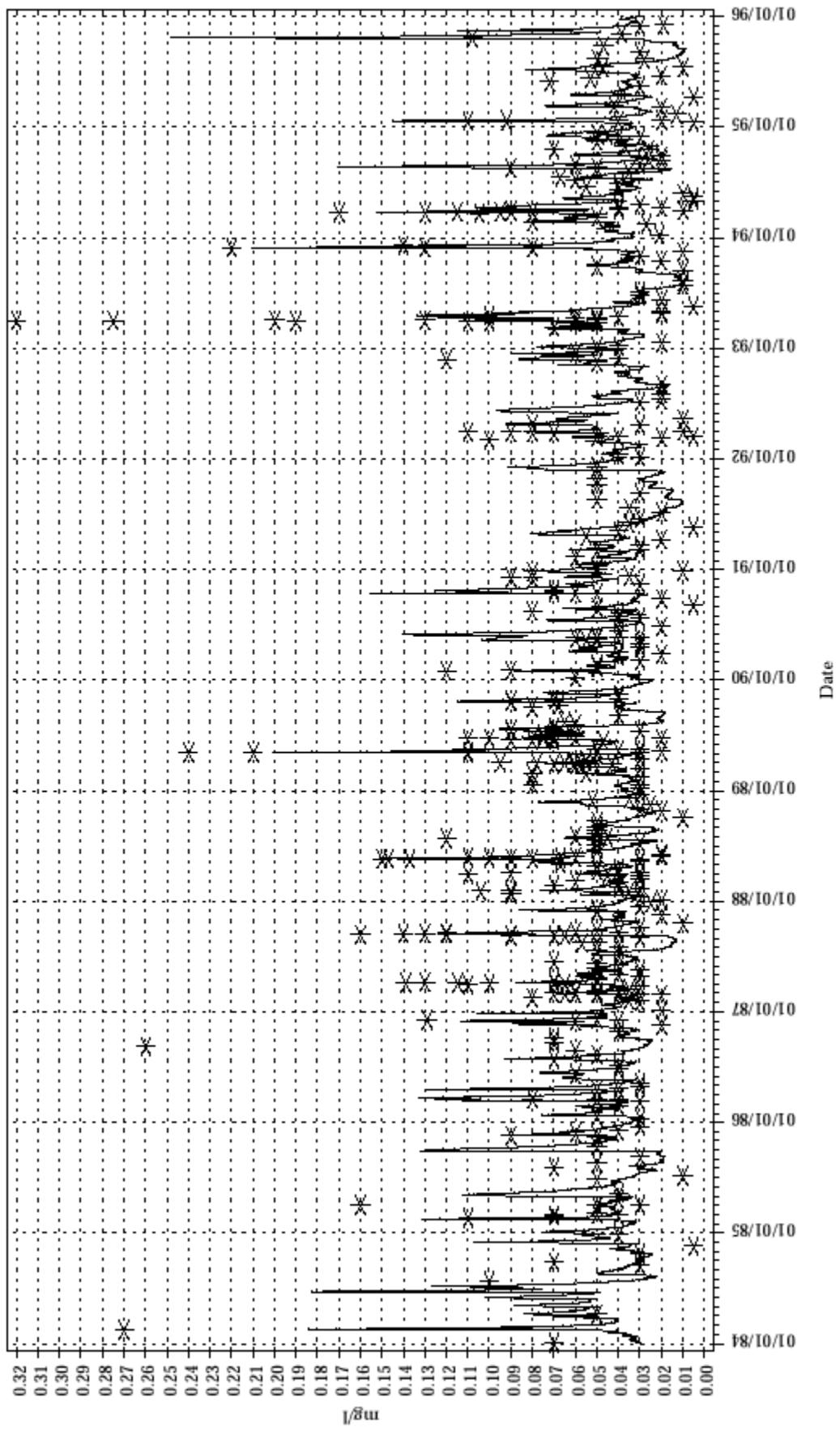
## Variable / Steady by year in the Susquehanna (TP Load)



# Susquehanna River at Segment 140 - Constant Anthro Forcings Observed and Simulated versus Time

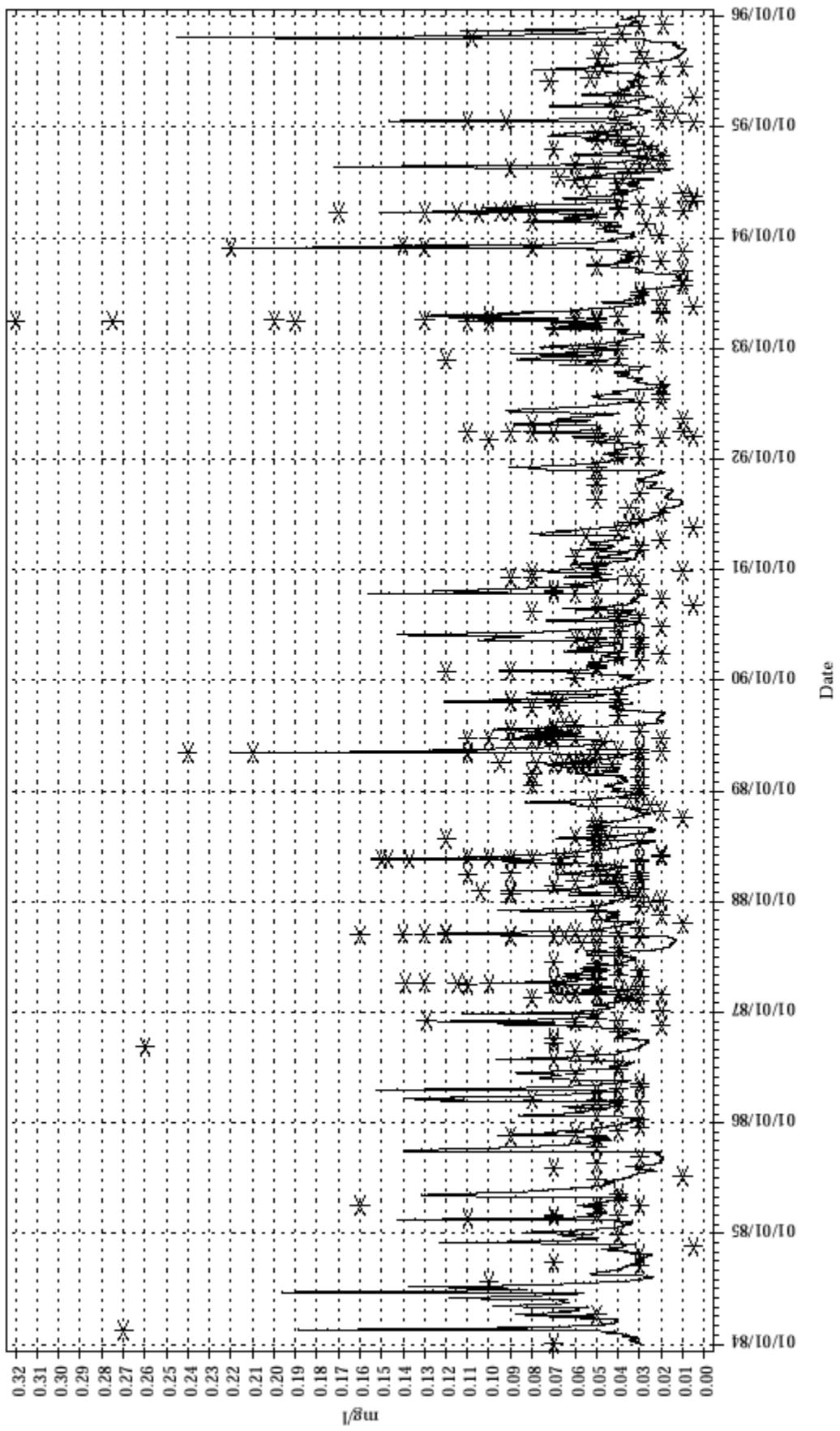
## Total Phosphorus

(\*=Observed, -=Simulated)

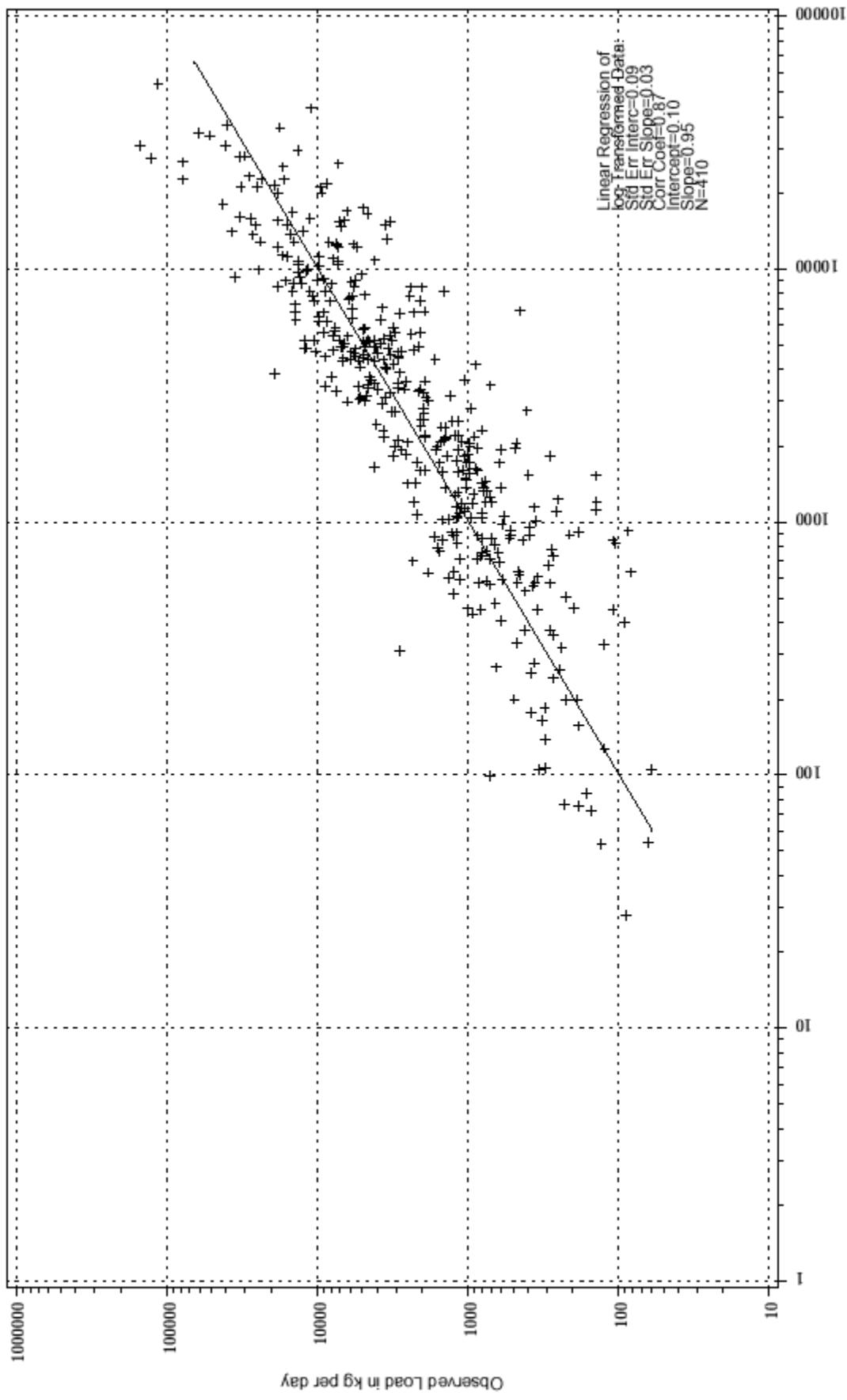


# Susquehanna River at Segment 140 - Variable Anthro Forcings Observed and Simulated versus Time Total Phosphorus

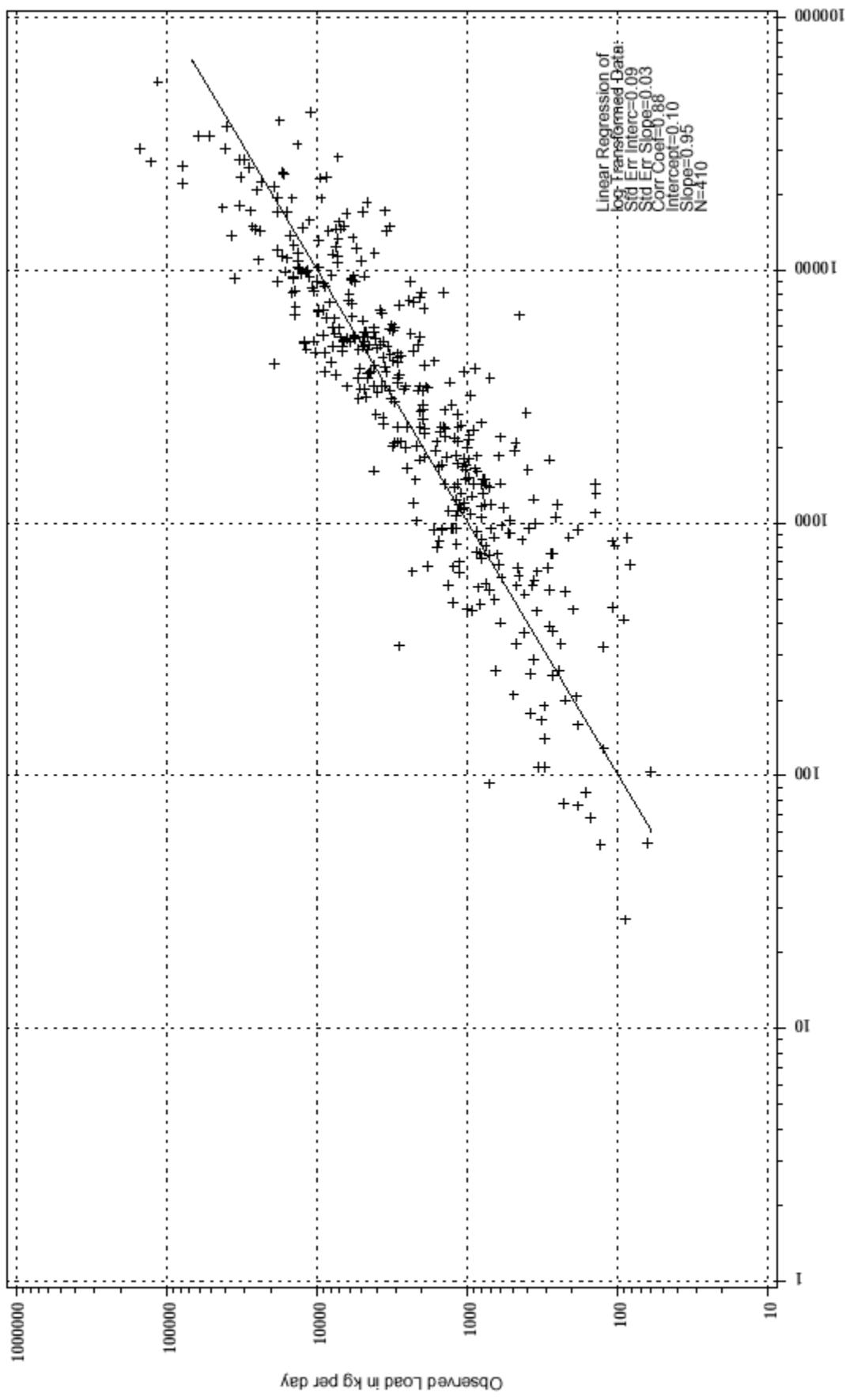
(\*=Observed, -=Simulated)



# Susquehanna River at Segment 140 - Constant Anthro Forcings Total Phosphorus Observed Load vs Simulated Load Paired Daily Values

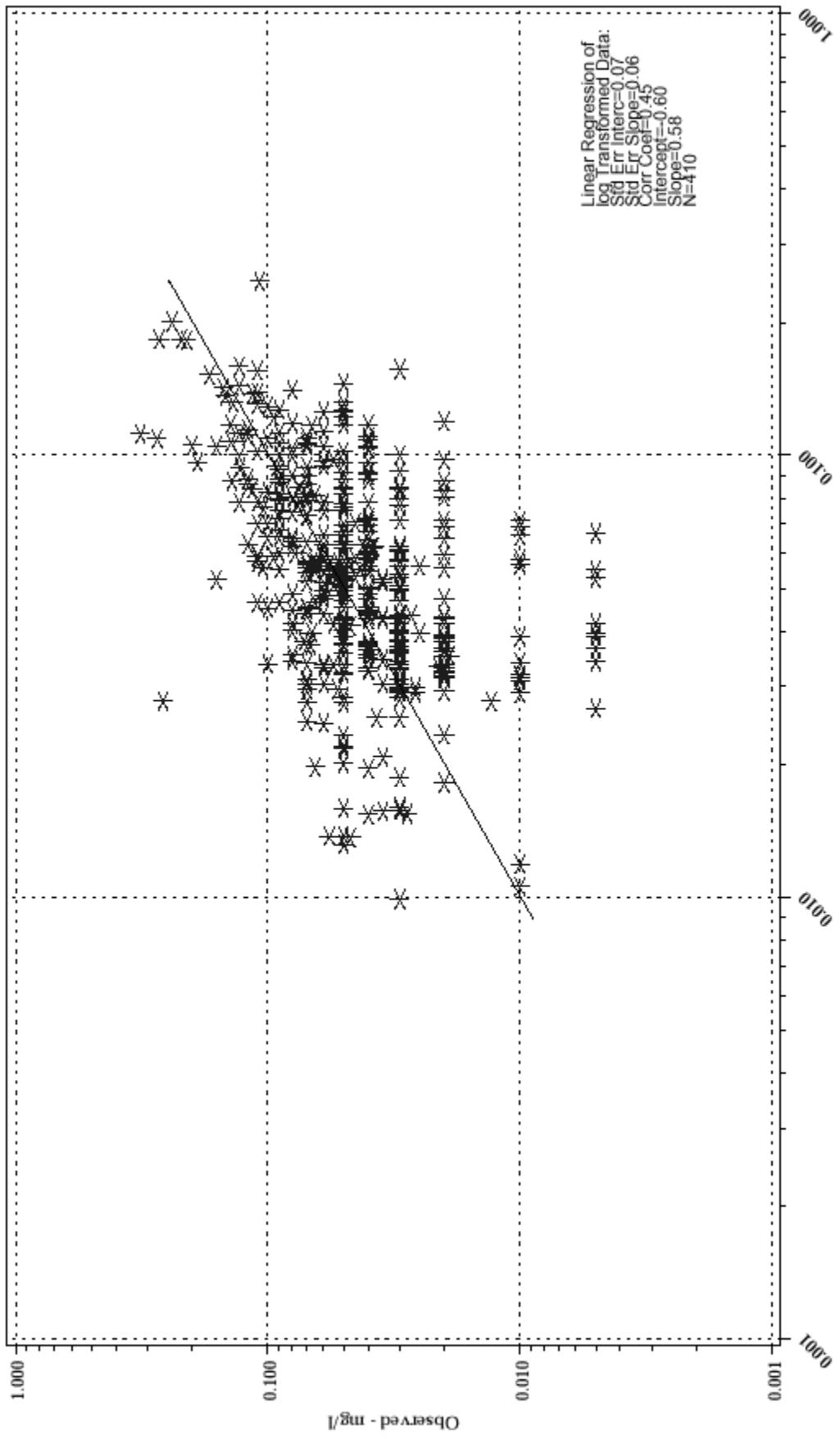


# Susquehanna River at Segment 140 - Variable Anthro Forcings Total Phosphorus Observed Load vs Simulated Load Paired Daily Values



# Susquehanna River at Segment 140 - Constant Anthro Forcings

## Scatter Plot and Regression of Simulated versus Observed with Ideal Line Total Phosphorus: 01JAN84 - 01JAN96



# Susquehanna River at Segment 140 - Variable Anthro Forcings

## Scatter Plot and Regression of Simulated versus Observed with Ideal Line Total Phosphorus: 01JAN84 - 01JAN96

