

**SIRG Grant Project:
Enabling Continental Scale Water
Resources Management: Adding Value
to State and Federal Agency Large
Heterogeneous Data Sets**

Julia Wiener, ESE Student

Faculty Advisors:

Loring Nies, School of Civil Engineering

Chad Jafvert, School of Civil Engineering

Si Luo, Department of Computer Sciences

Overarching SIRG Objectives

- Capture, curate and analyze existing U.S. EPA, USGS and State agency data sets
- Develop novel approaches for processing, visualizing and validating these data

Initial question

- What is a river's water use rate?
- When you withdraw water downstream, was it previously used upstream? If so, how much are we reusing the water of the rivers? How many times?
- What would this imply in terms of inter-jurisdiction regulation/ collaboration/ research?
- Case Study : Mississippi River

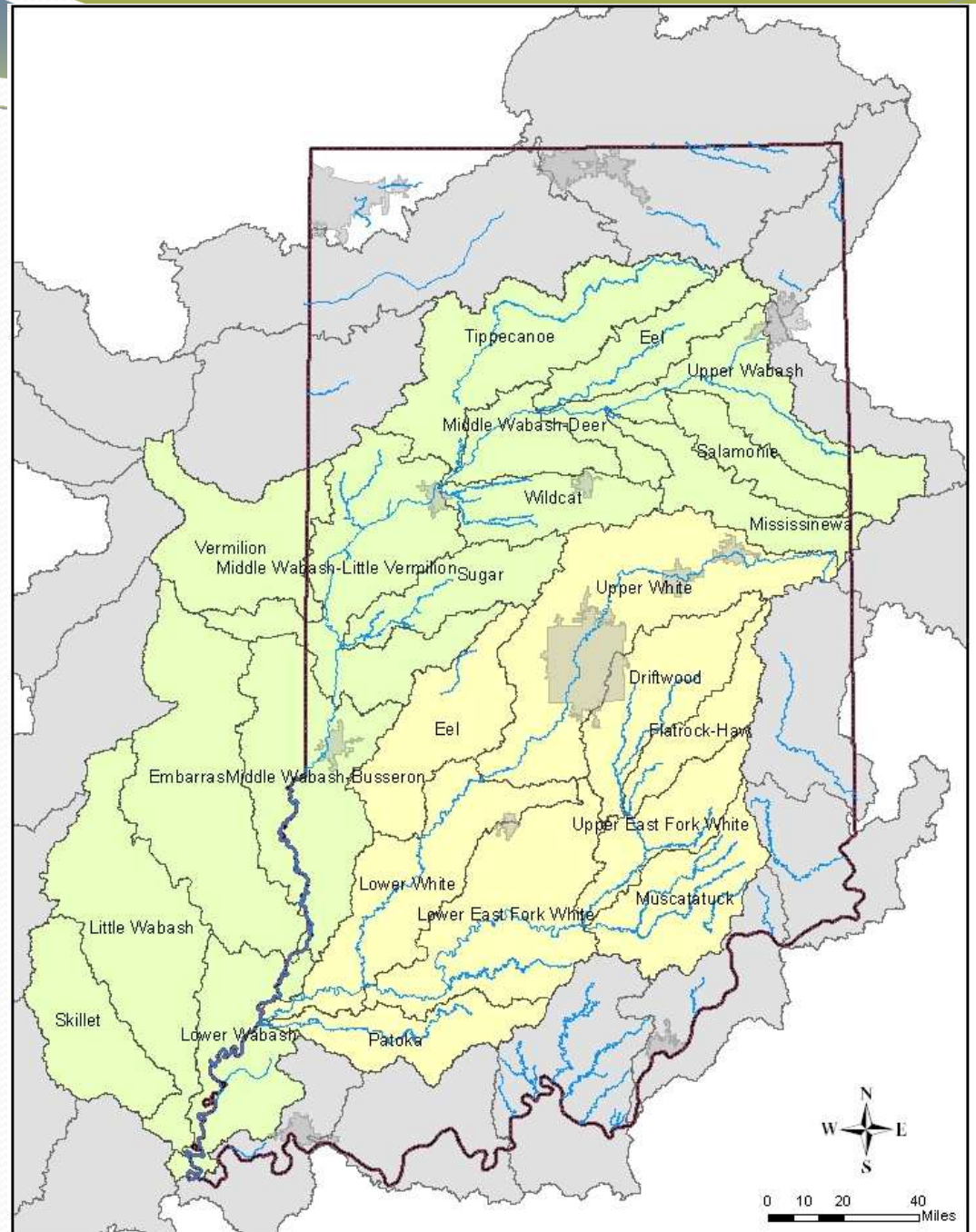
Preliminary study:

Water Balance on a Smaller Basin

- White – Wabash

Objective:

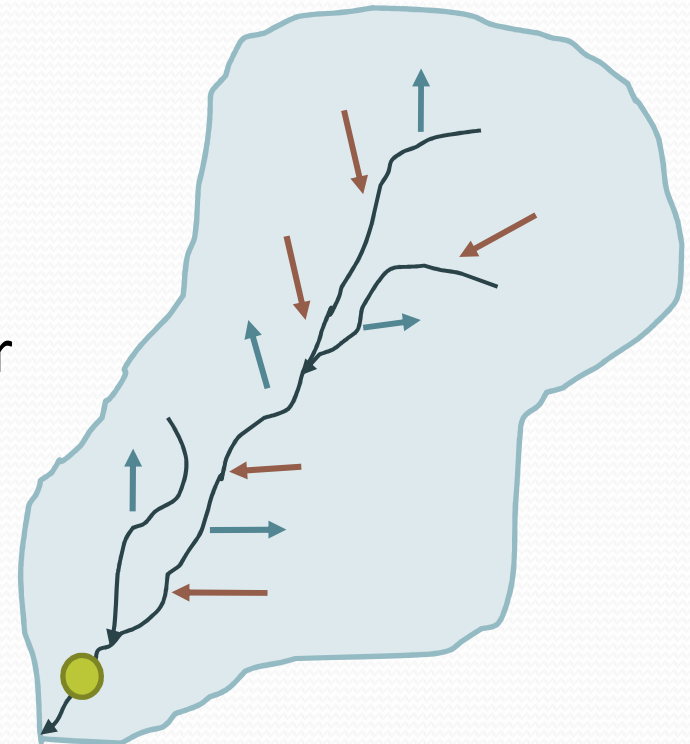
Develop a methodology



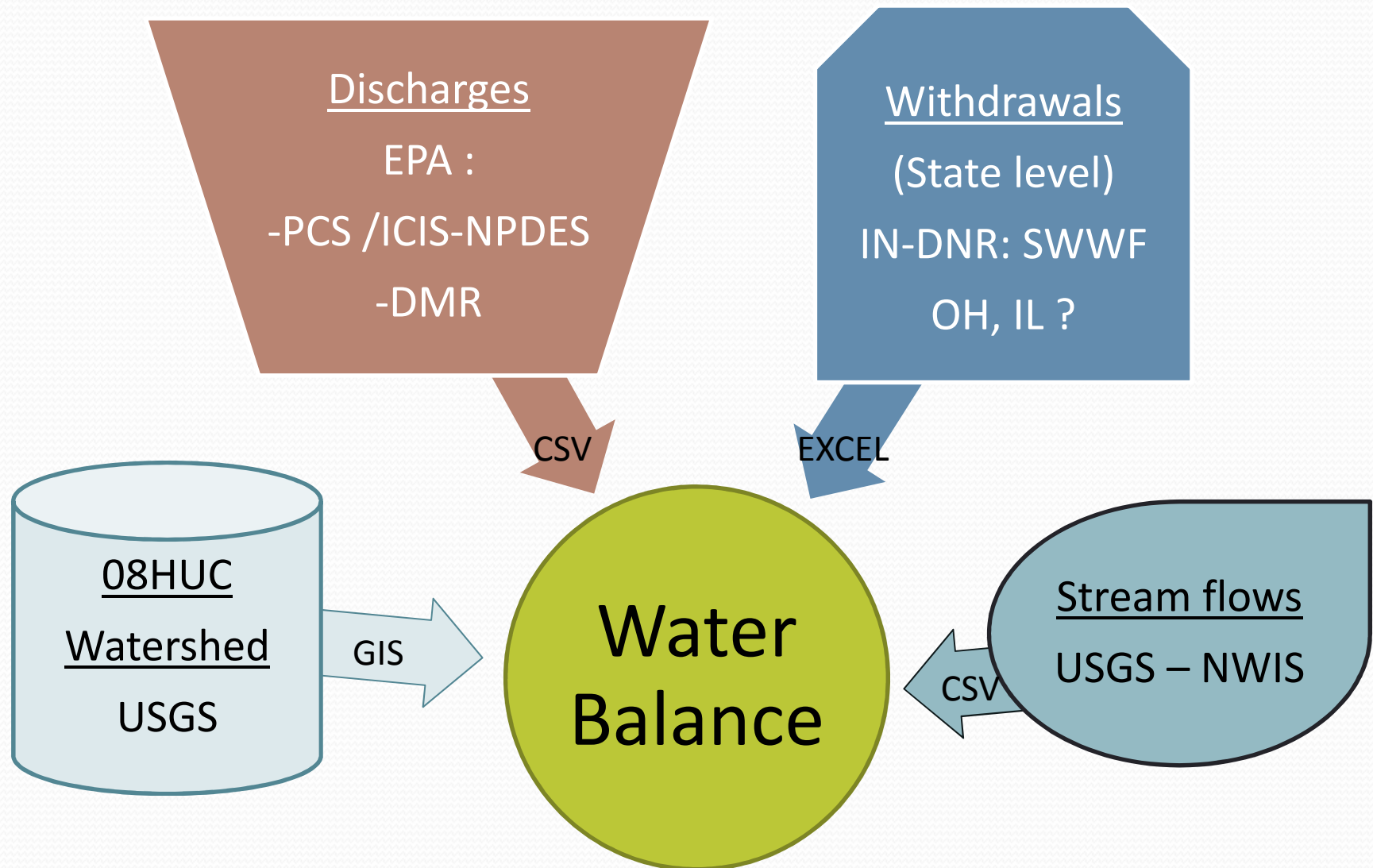
0512 Wabash Watershed - 08HUC Watersheds

Theoretical Basis

- Assess water reuse by:
 - Determining volume of water DISCHARGED into streams and river water bodies
 - Take US Geological Survey (USGS) gauging station STREAM FLOW measures as reference
- Evaluate the relationship between discharges and surface waters stream flow.
- Compare with volume of surface water WITHDRAW
- Work at different Hydrologic Unit Code (HUC) Levels



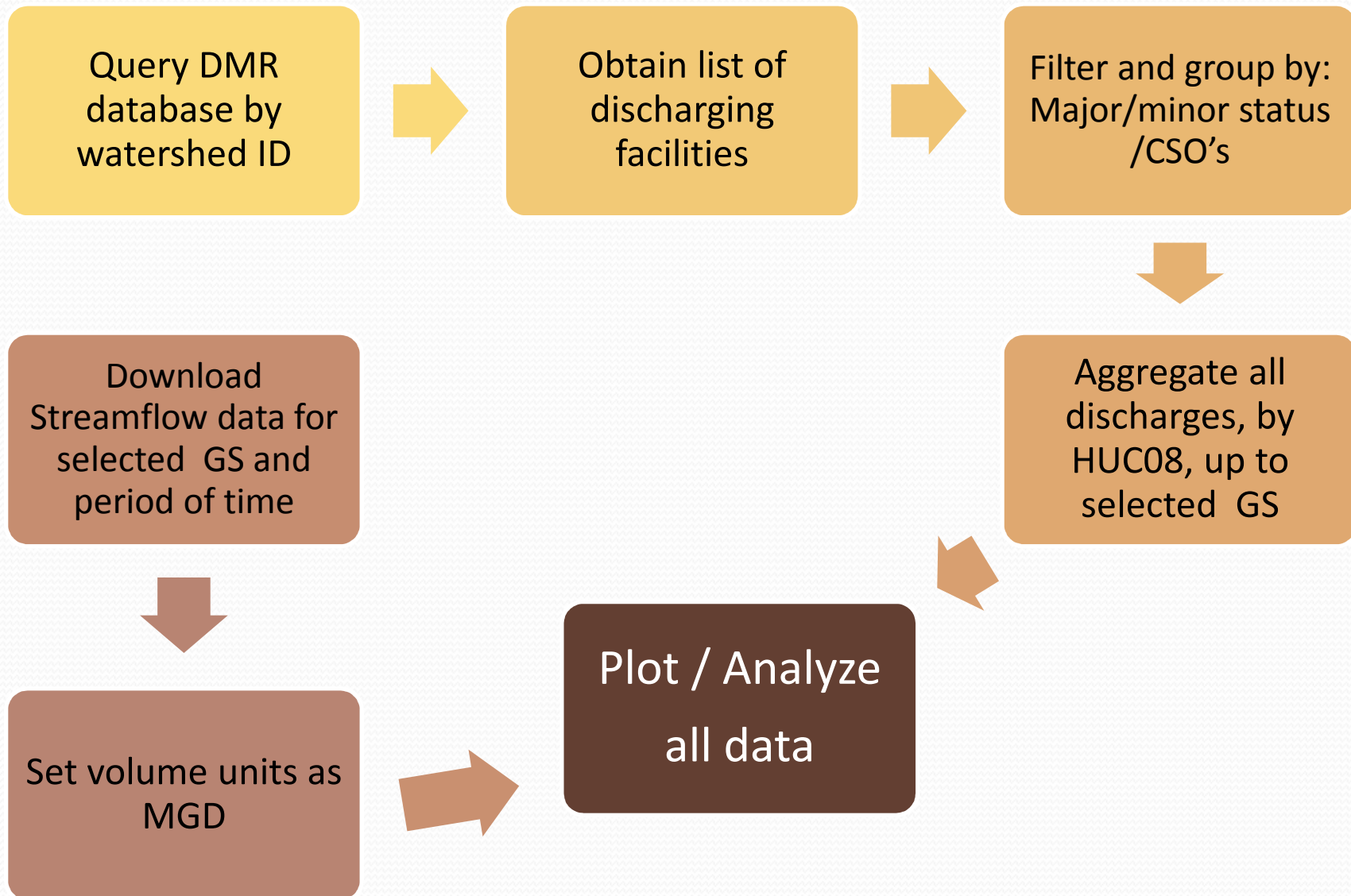
Preliminary datasets



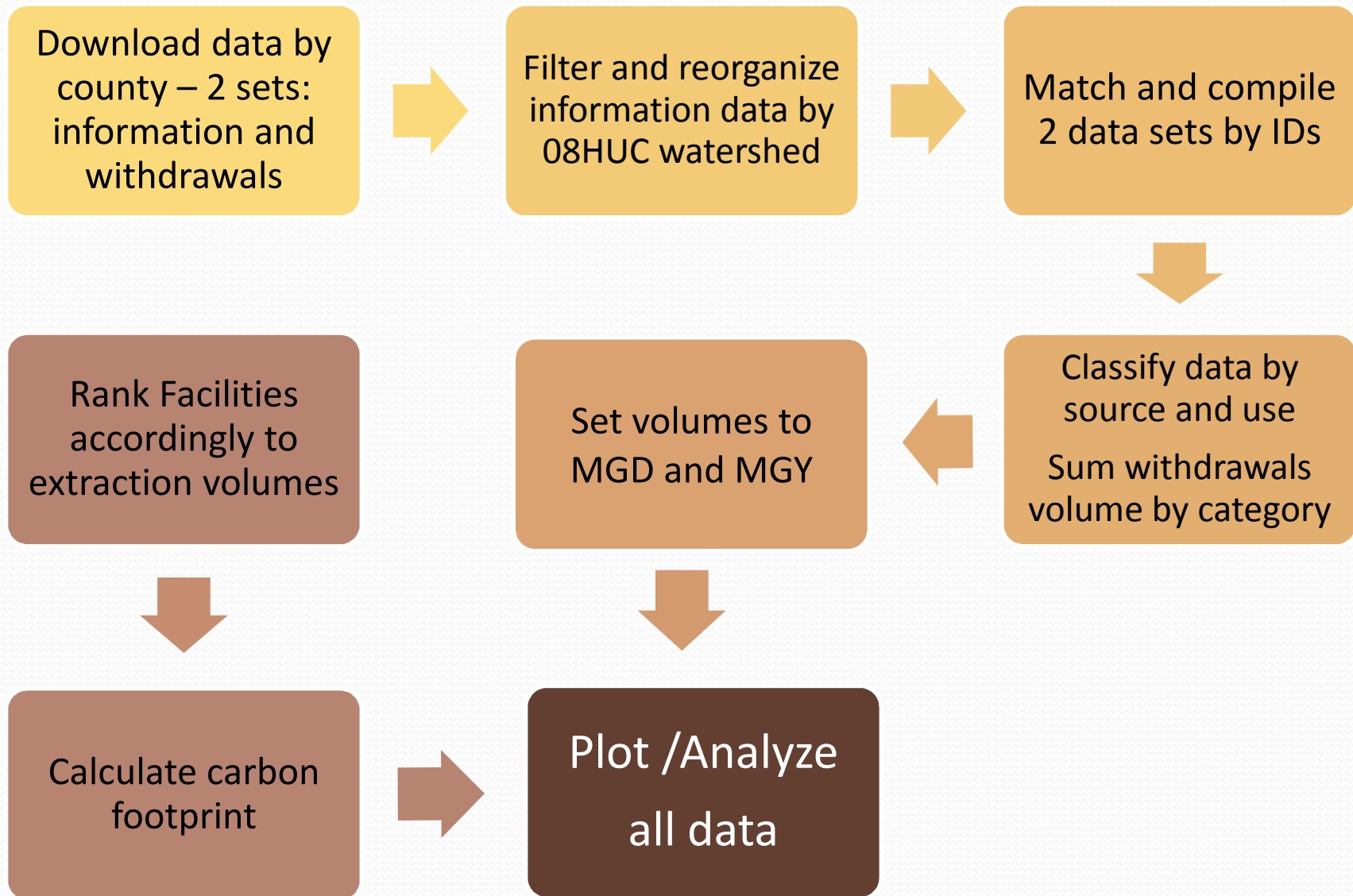
Challenges

- Obtaining complete datasets
- Data completeness and accuracy
- Massive amount of water data collected and archived continuously
- Little coordination, integration or organization of the heterogeneous data sets
- There is a need to enable a wider and more research-oriented access to large-scale water resources data

Methodology – Discharges data



Methodology – Withdrawals data

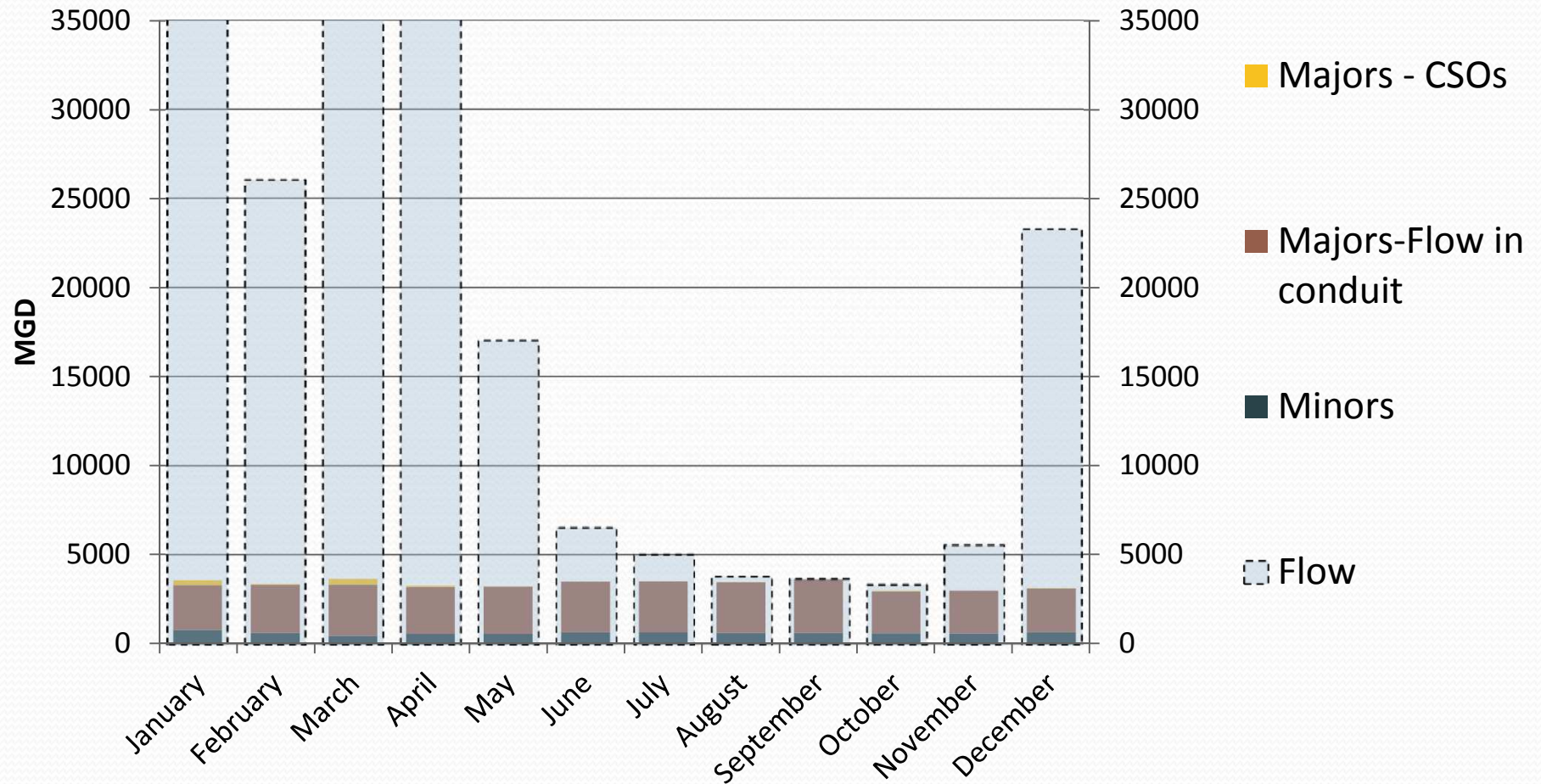


Results

- Integrated geospatial + temporal water use database for Wabash Watershed
 - Quantitative data:
 - Stream flows (time-series)
 - Volume of water withdrawals / discharges
 - Qualitative data:
 - Discharges / withdrawals characterization
 - Watersheds water use and reuse profiles
- Key element: Watershed Hydrologic Unit Code (HUC) – Natural Boundaries vs Political Boundaries

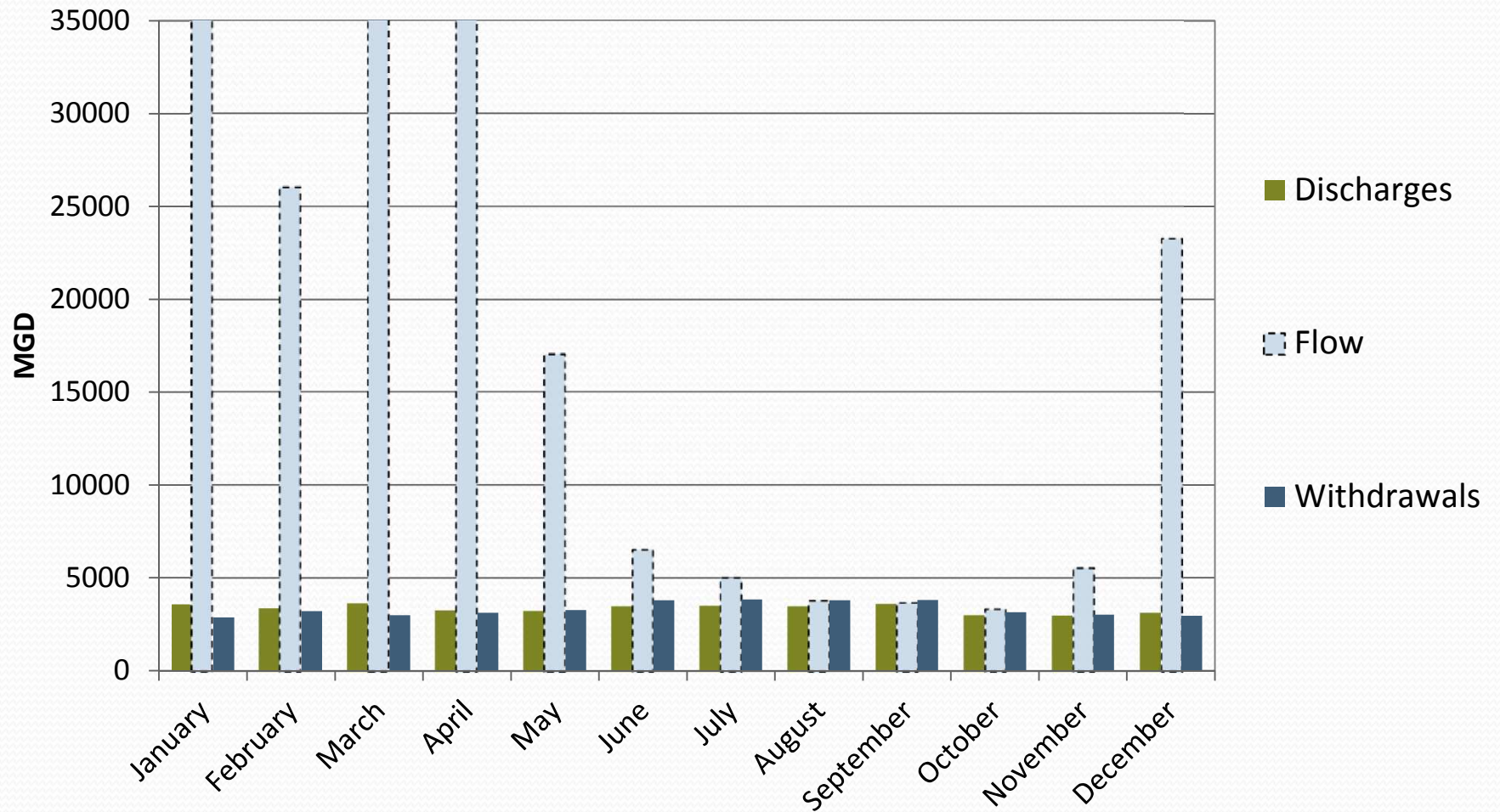
Results

Wabash Watershed - USGS 03377500 – 2007
Discharges / Streamflow relationship



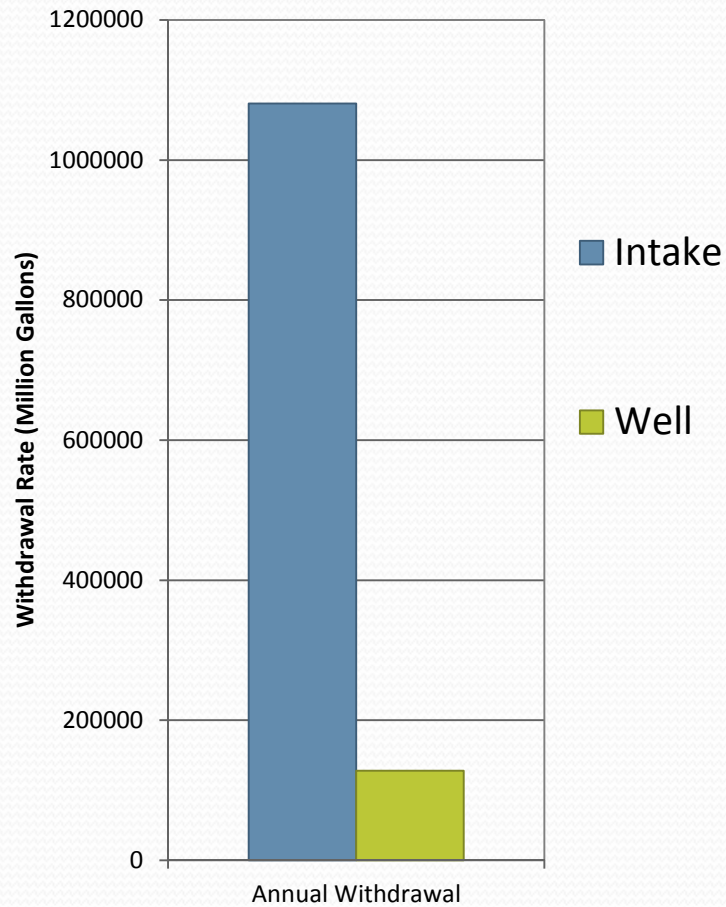
Results

Wabash Watershed - USGS 03377500 - 2007
Discharges, Stream Flow, and Withdrawal volumes comparison

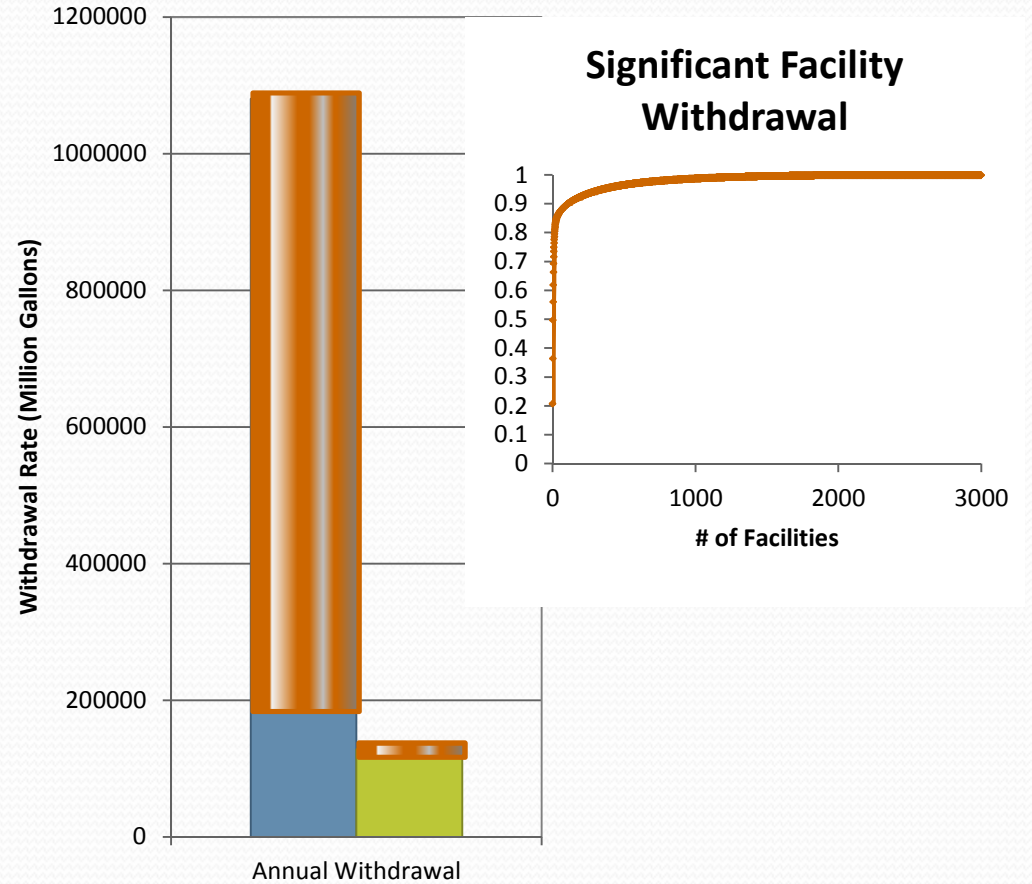


Results

Total Annual Withdrawal Comparison for Wabash Watershed



Total Annual Withdrawal for Energy Production at Wabash Watershed

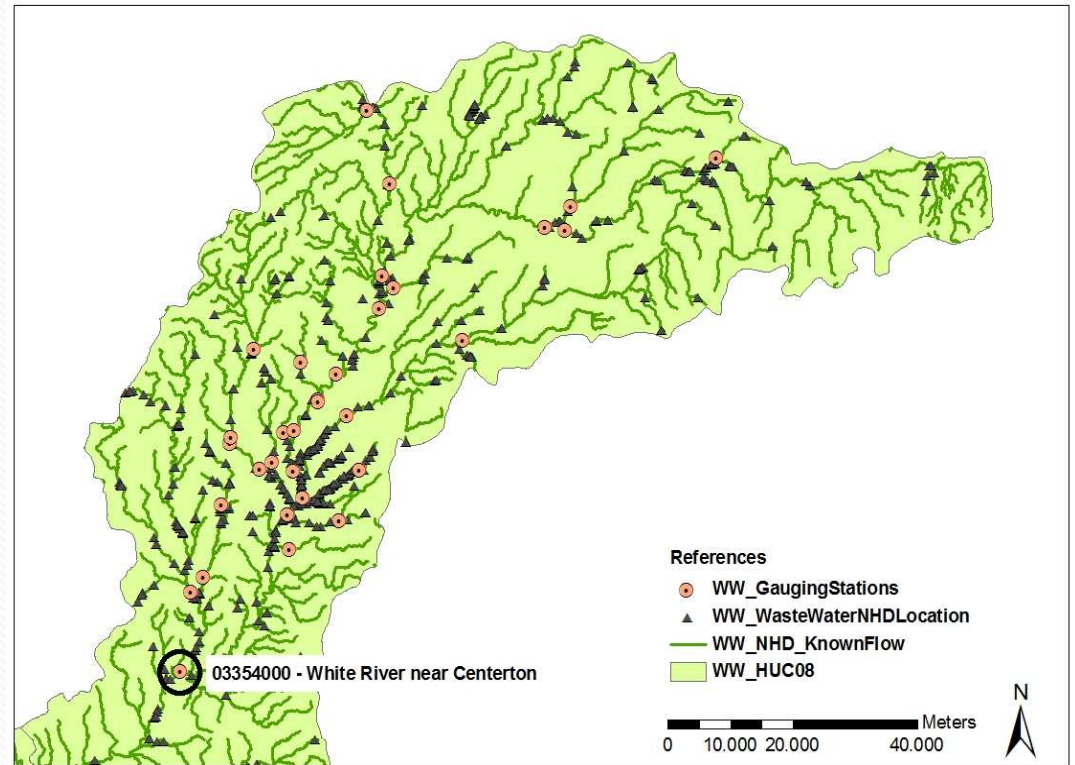


Significance

- Relevance of results:
 - Low flow months “used” water ranges between 10 – 80%
 - Withdrawals characterization
 - + Further analysis
- Relevance of holistic approach – Knowledge of the extent of unplanned water reuse and withdrawals situation will lead to further discussion about managing our water resources
- Relevance of data management: data acquisition and storage prepared for this type of research

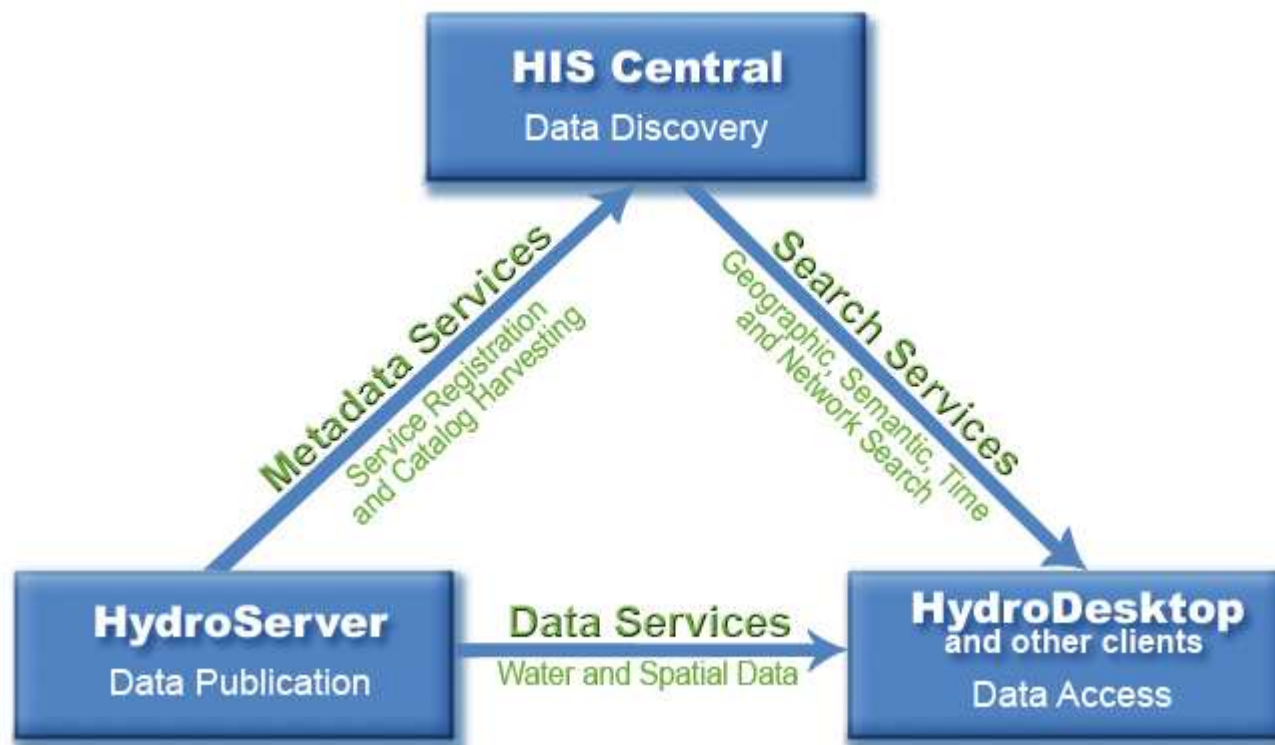
GIS Approach

- Great visual tool
- Good for first approach and data publication
- Inconsistencies among existing data sets
- Need to develop specific datasets



Potential: Integration

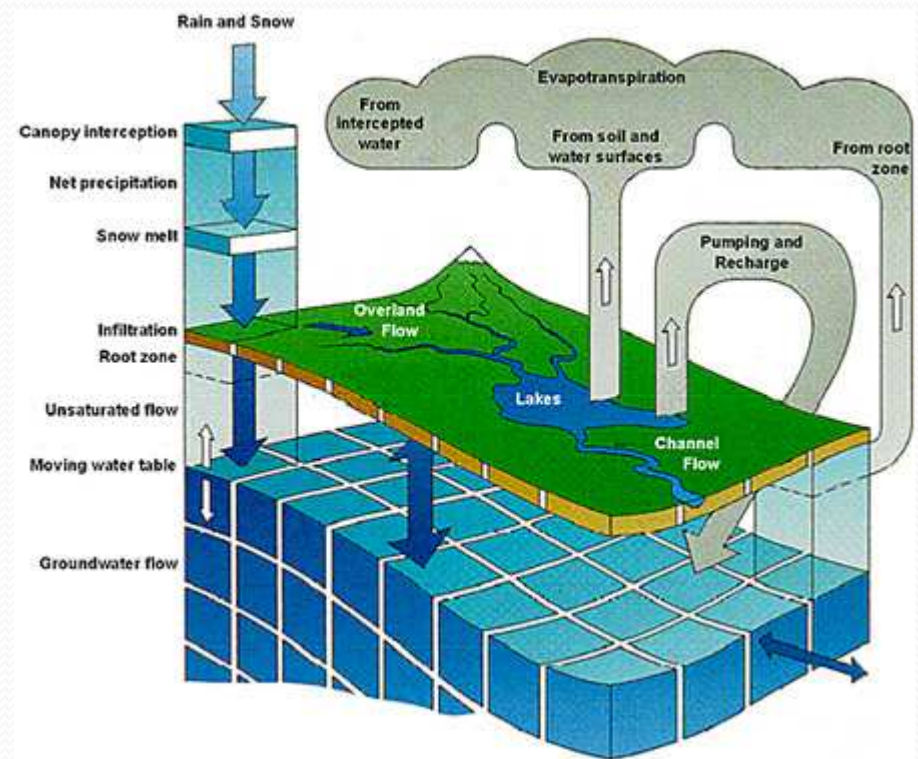
- CUAHSI : Hydrologic Information System



Source: CUAHSI webpage

Potential: More Research

- Great enthusiasm from Hydrologists for collaboration
- Decades have been devoted to developing hydrologic models
- Unfortunately these models do not account for human discharges data, that account for 10 – 100% of river flow!
- “Human water cycle”



Source: <http://mikebydhi.com>

Next steps

- Continue working on data issues – dataset building
- Write a Paper with preliminary results on Wabash Watershed
- Submit Proposals for enlarging database and extending analysis to Mississippi Watershed



Time for Questions

Thank you!