MICHIGAN HYDROLOGIC FRAMEWORK

MICHIGAN HYDROLOGIC FRAMEWORK

Facilitate statewide sustainable water management (both surface and groundwater) through centralized access to:

- Integrated hydrologic models
- Up to date hydrologic data
- Comprehensive hydrologic analysis

MICHIGAN HYDROLOGIC FRAMEWORK

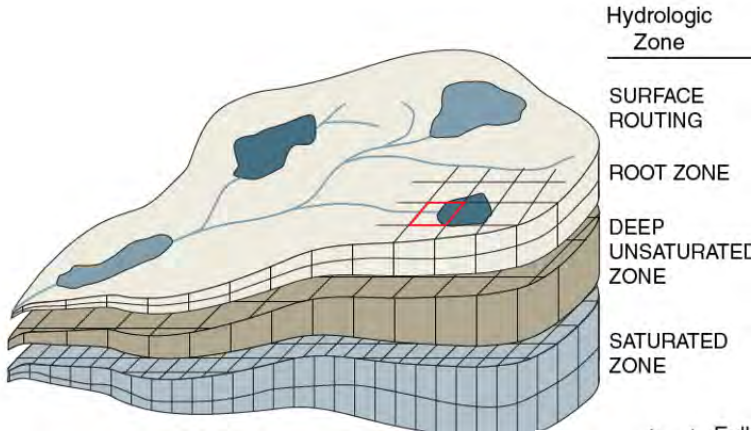
The Framework will enhance the WWAP and other water related programs. It will build on the work done to create the WWAT; and add data, science advances in modeling, and increased computing power, that weren't available ten plus years ago.

MICHIGAN HYDROLOGIC FRAMEWORK

Model creation will be expedited by:

- GIS linked data bases and web services
- Access to existing models (input and output)

Hydrologic Models

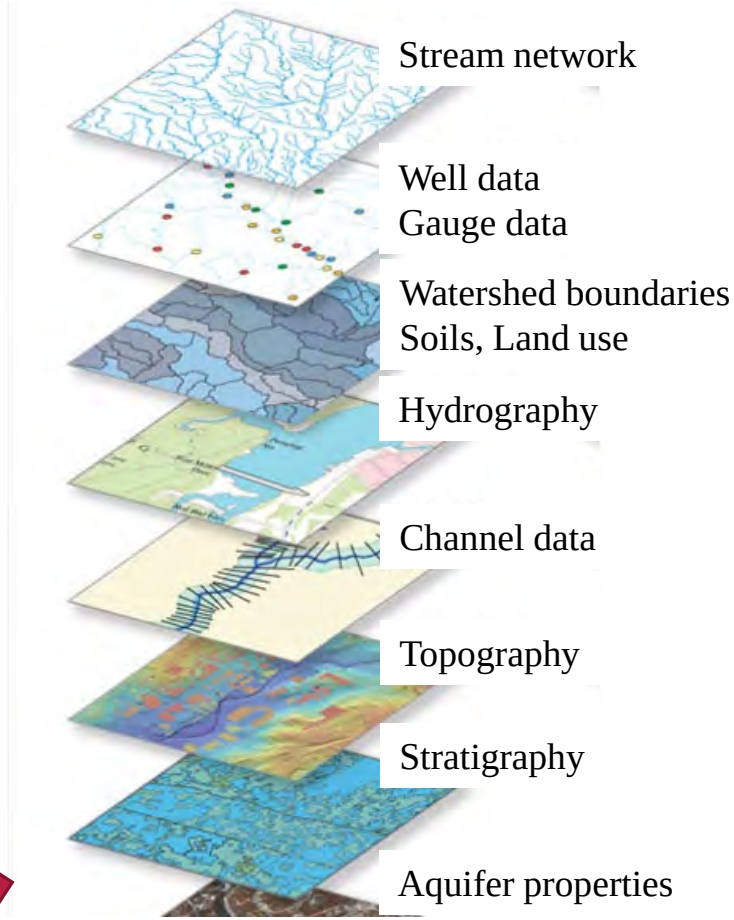


Kendall (2009)

Input

Output

GIS Data Layers (Framework)



Real World

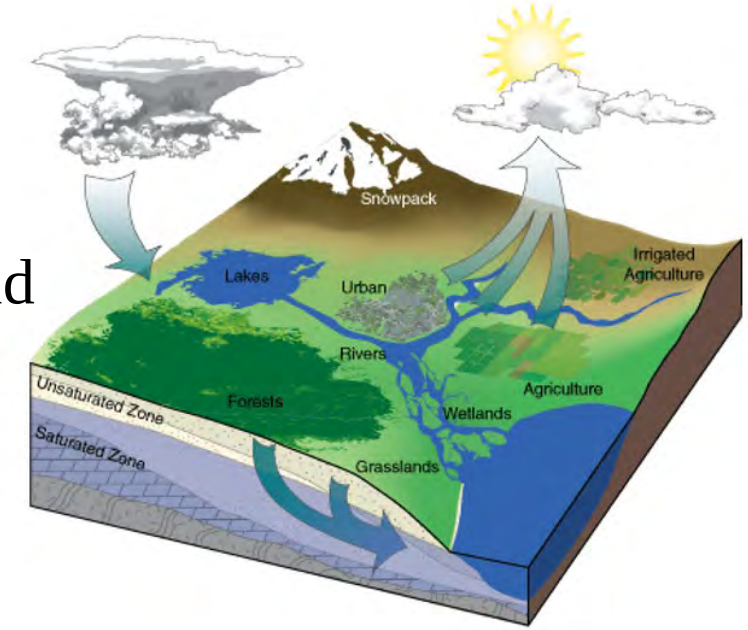


Figure 1 From the "real world", hydrologic data can be measured and physical attributes can be geographically described, and stored in GIS layers. These can be used to create hydrologic models, and the output can be analyzed and stored in GIS layers.

MICHIGAN HYDROLOGIC FRAMEWORK

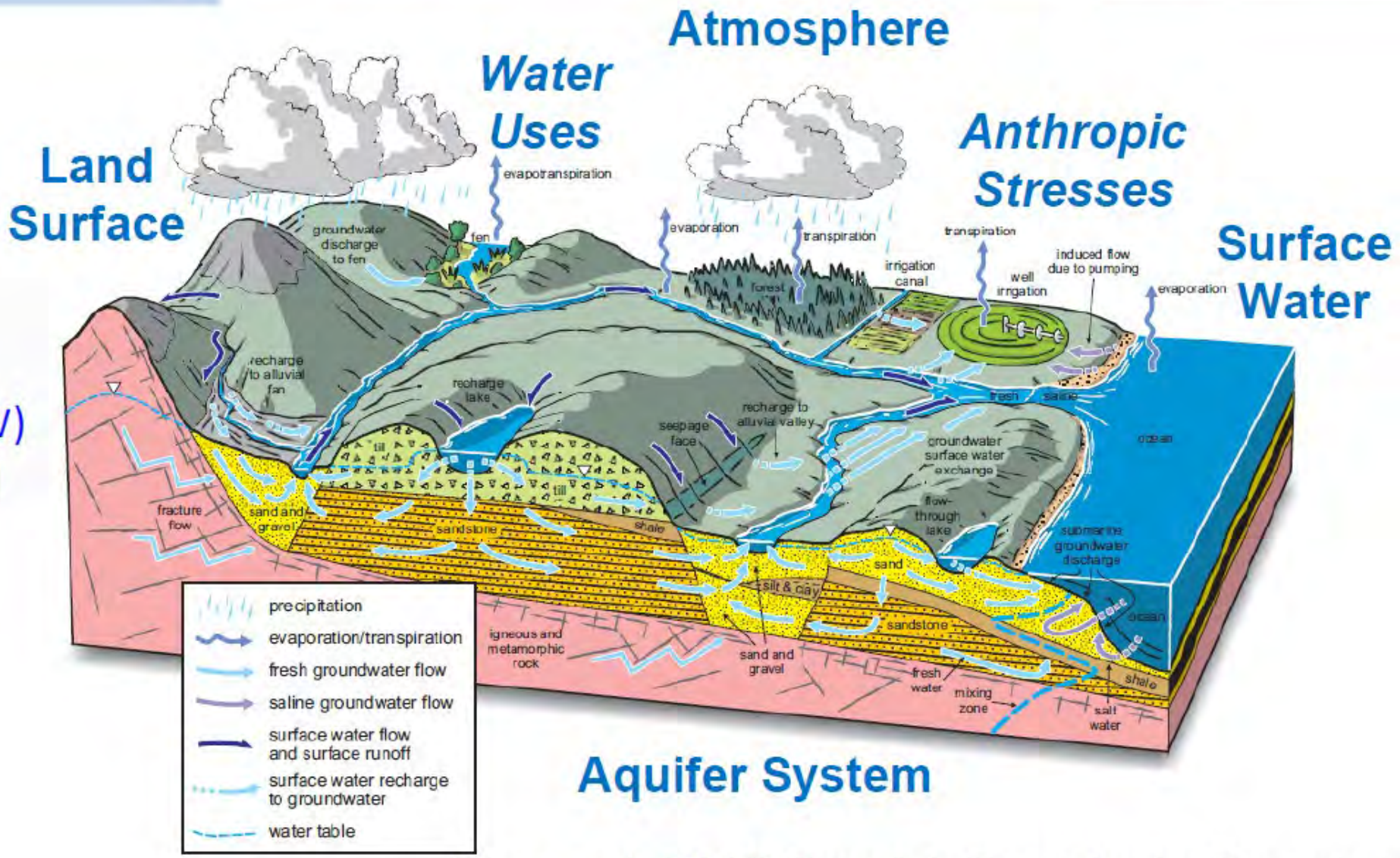
Categories of GIS data layers:

- Climate/Weather data
- Surface process model data
- Hydrogeologic and Groundwater model data
- Water use/water return
- Water infrastructure
- Hydrologic data

Flow System Components

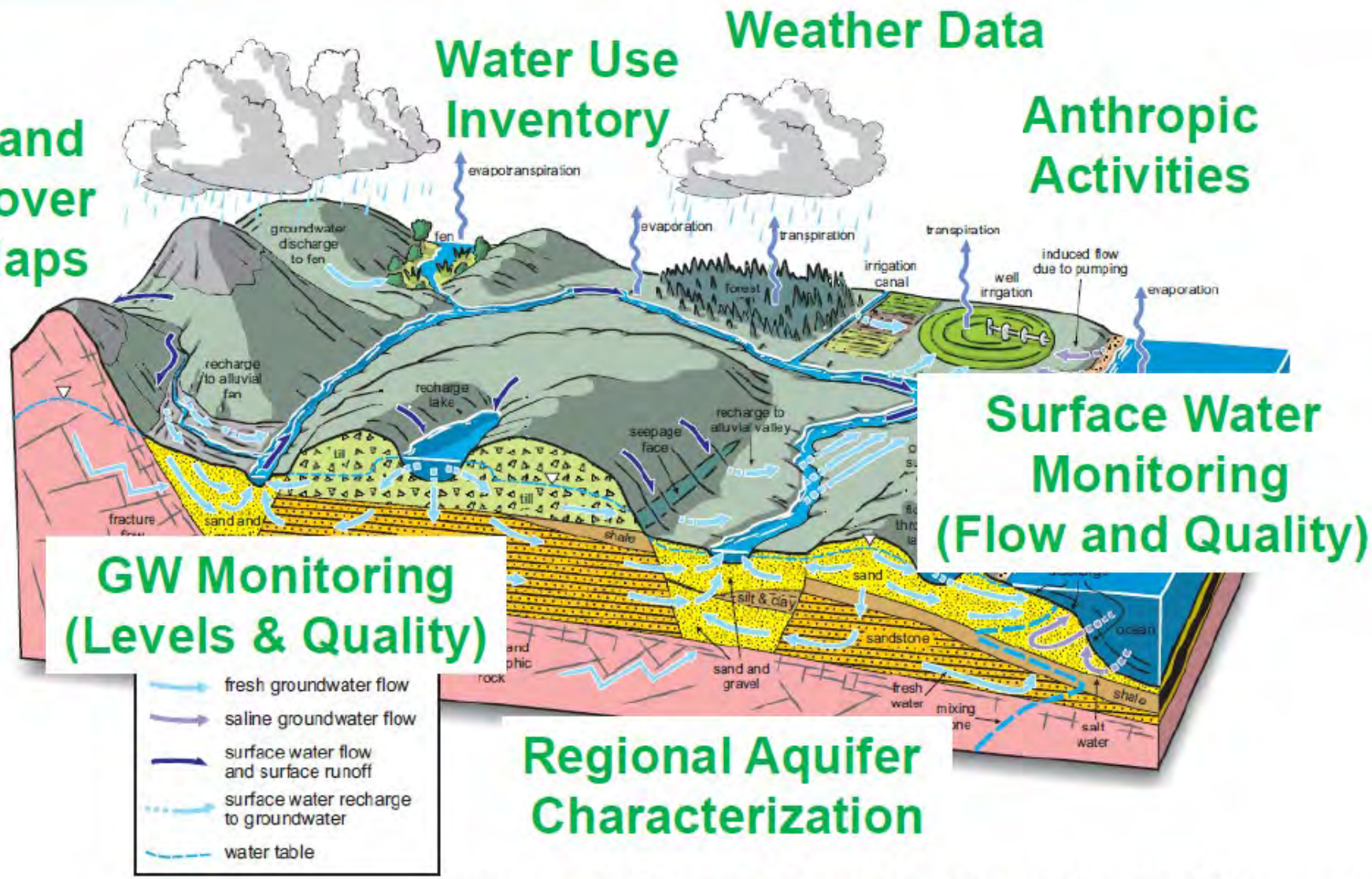
3 domains:

- Atmosphere
- Hydrosphere (SW)
- Geosphere (GW)



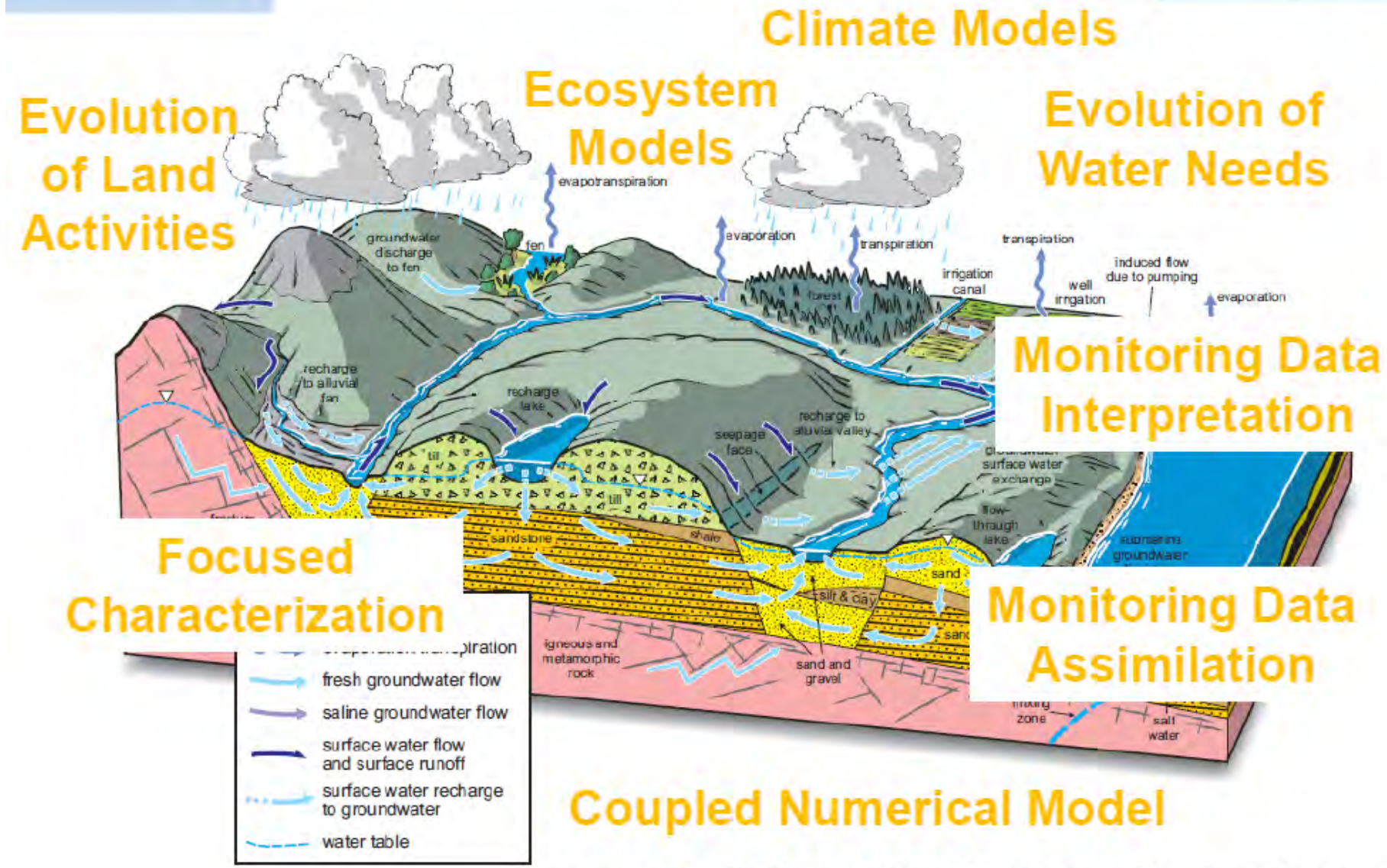
Rivera, ed. (2014) Canada's Groundwater Resources

Knowledge about the Flow System



Rivera, ed. (2014) Canada's Groundwater Resources

Understanding of the Flow System



Rivera, ed. (2014) Canada's Groundwater Resources

MICHIGAN HYDROLOGIC FRAMEWORK

Models reflect our understanding of the hydrologic cycle. They are used to quantify our water resources and project how systems will respond to change. The analysis allows evaluation of management options.

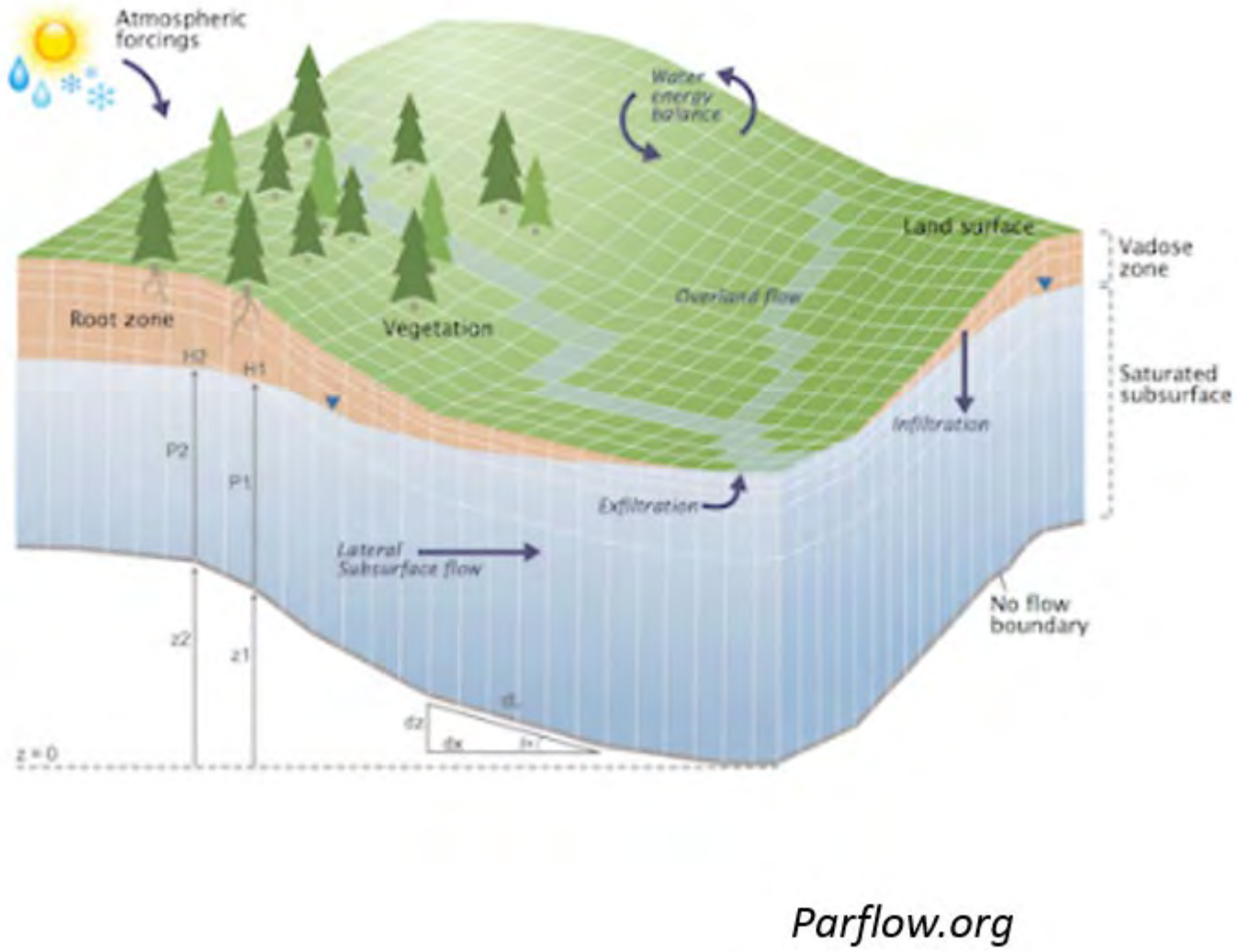
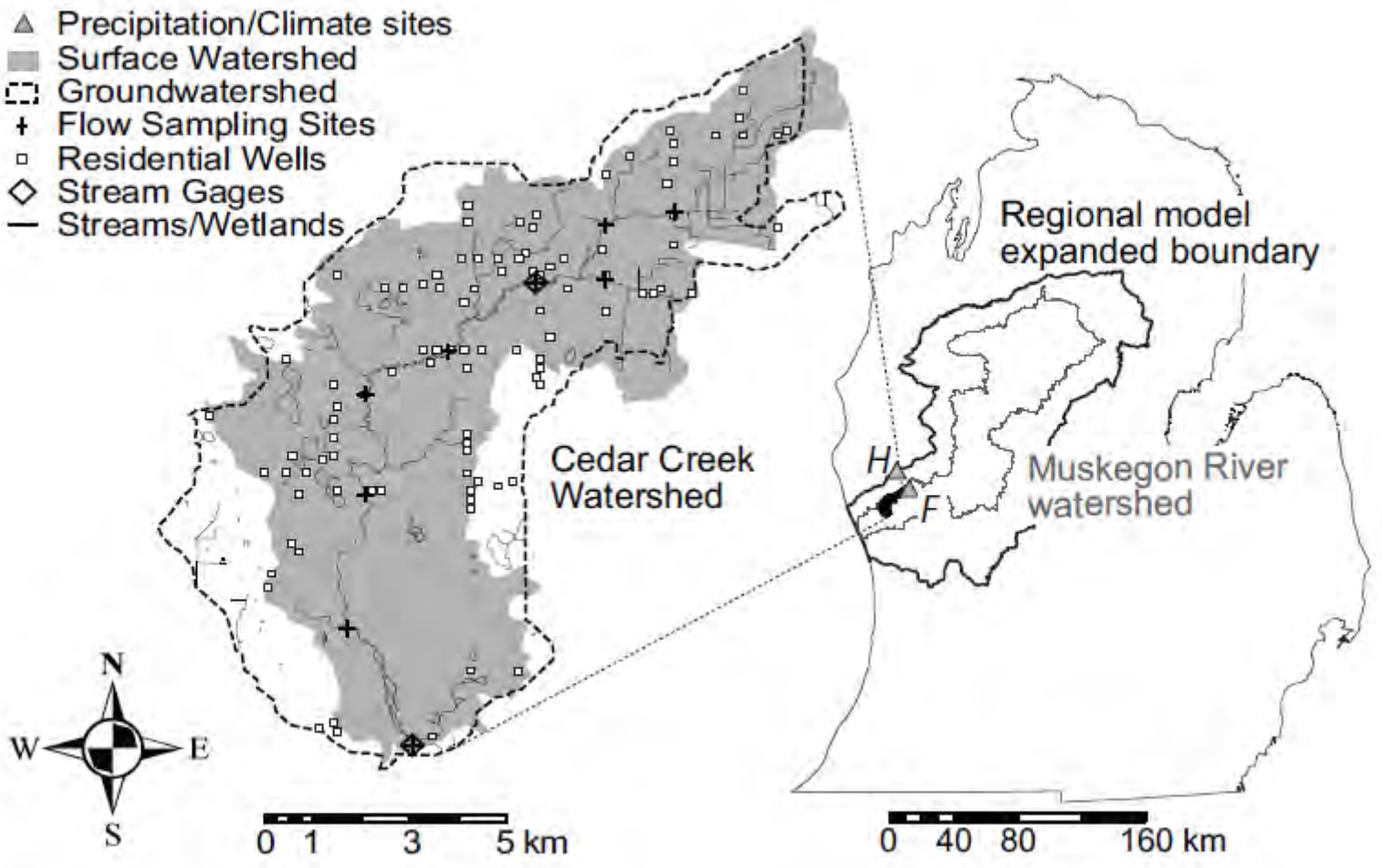


Figure 2 An example of how surface and groundwater models can be coupled through an interconnected grid.

Example of nested, detailed model, created from larger scale model:



Kendall, 2009

Models in WWAT

Surface Water: Multiple linear regression using selected landscape variables.

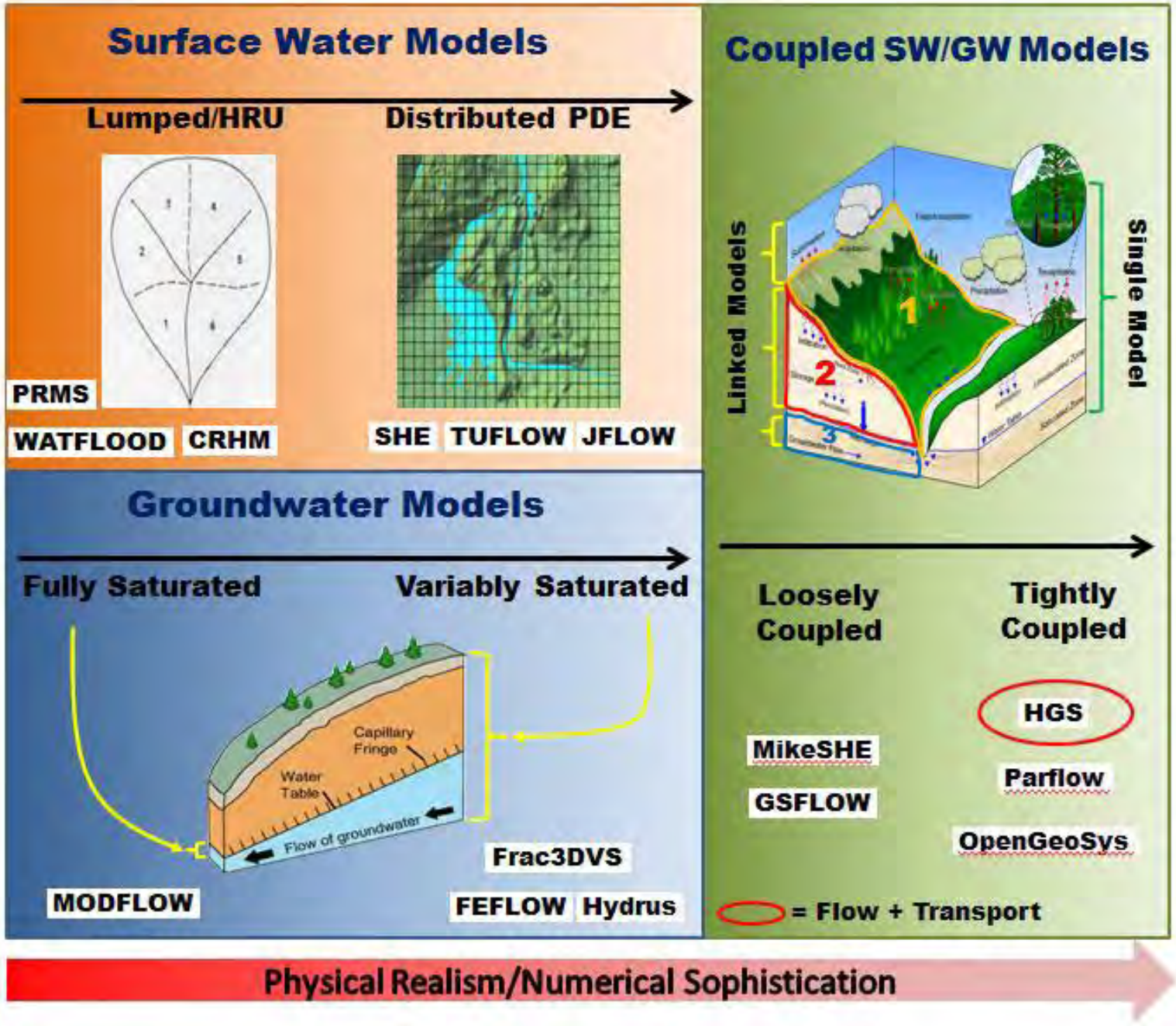
Groundwater: Analytical model using simplified assumptions regarding aquifer geometry and properties.

Site Specific Review

Incorporates flow measurements into statistical analysis.

Needs more realistic models for streamflow depletion.

Incorporate improved information back into the screening tool to reduce unnecessary SSRs.



aquanty

MICHIGAN HYDROLOGIC FRAMEWORK

Create regional scale groundwater models (watershed based, roughly a county or two in size) where more refined understanding of the water resources is needed. Examples:

- St. Joseph County
- Montcalm County
- Branch County

MICHIGAN HYDROLOGIC FRAMEWORK

Summary of Framework capabilities:

- Statewide GIS data bases
- Incorporate model results into decision framework
- Access data, analysis, and model results
- Create Smartmap
- Incorporate new data and analysis
- Facilitate creation of models that link climate, surface water and groundwater

MICHIGAN HYDROLOGIC FRAMEWORK

Examples of state water management programs that will benefit enhanced modeling capabilities and data accessibility:

- Protecting property from flood damage
- Designing and evaluating the resiliency of critical public infrastructure to water extremes (floods and droughts)
- Protecting aquatic ecosystems from adverse resource impacts
- Protecting water quality and drinking water supplies

MICHIGAN HYDROLOGIC FRAMEWORK

Data collection should be an integral part of maintaining the MHF:

- Implement a robust statewide network of monitoring wells
- Upgrade the streamflow monitoring network
- Initiate a long term 3-D groundwater resource mapping program

MICHIGAN HYDROLOGIC FRAMEWORK

- Work Plan first year:
  - 1st Phase - detailed planning - work w/stakeholders to determine how will be used, create mockup interface, outline data storage and retrieval, plan model and data inputs/outputs
  - 2nd Phase – design and development – build web interface, develop services, access offsite data
  - Begin development of regional models. First model will be test case and example of how it can be incorporated into the framework.

MICHIGAN HYDROLOGIC FRAMEWORK

- Work Plan second year:
  - 3rd Phase – testing with users – ensure all services, protocols and data sharing methods work.
  - 4th Phase – roll out prototype version – user training sessions and materials, correct bugs and defects, improve usability and performance
  - Continue work on regional models.

MICHIGAN HYDROLOGIC FRAMEWORK

- Work Plan third year:
  - 5th Phase – final version – designed, tested, rolled out
  - Complete work on regional models.

MICHIGAN HYDROLOGIC FRAMEWORK

- Project Budget:
  - Framework development $ 850,000
  - Regional model development $1,200,000
  - Total $2,050,000

MICHIGAN HYDROLOGIC FRAMEWORK

Michigan Hydrologic Framework Team:

- David A. Hamilton, The Nature Conservancy
- Andrea Munoz-Hernandez, DEQ
- Howard W. Reeves, USGS
- Jill Van Dyke, DEQ

MICHIGAN HYDROLOGIC FRAMEWORK

Work Plan Team:

- Jeremiah Asher, Institute of Water Research, MSU
- David A. Hamilton, The Nature Conservancy
- Howard W. Reeves, USGS