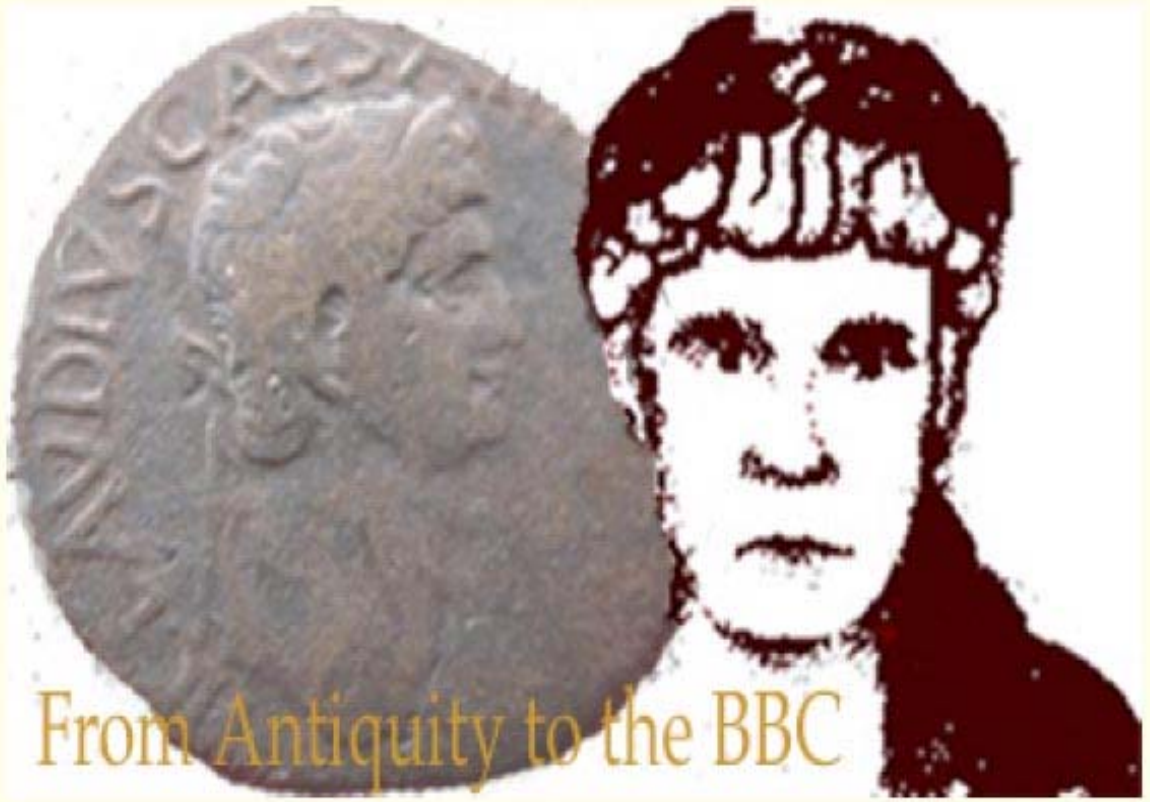
I, CLAVDIVS PROJECT



I, Clavdivs

I, CLAVDIVS PROJECT

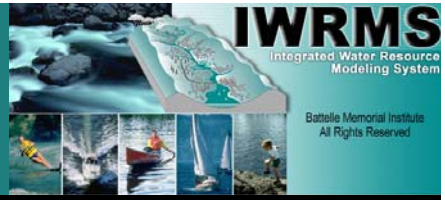
I, VVorms

Integrated Water Resource Modeling System
IWRMS

A System of

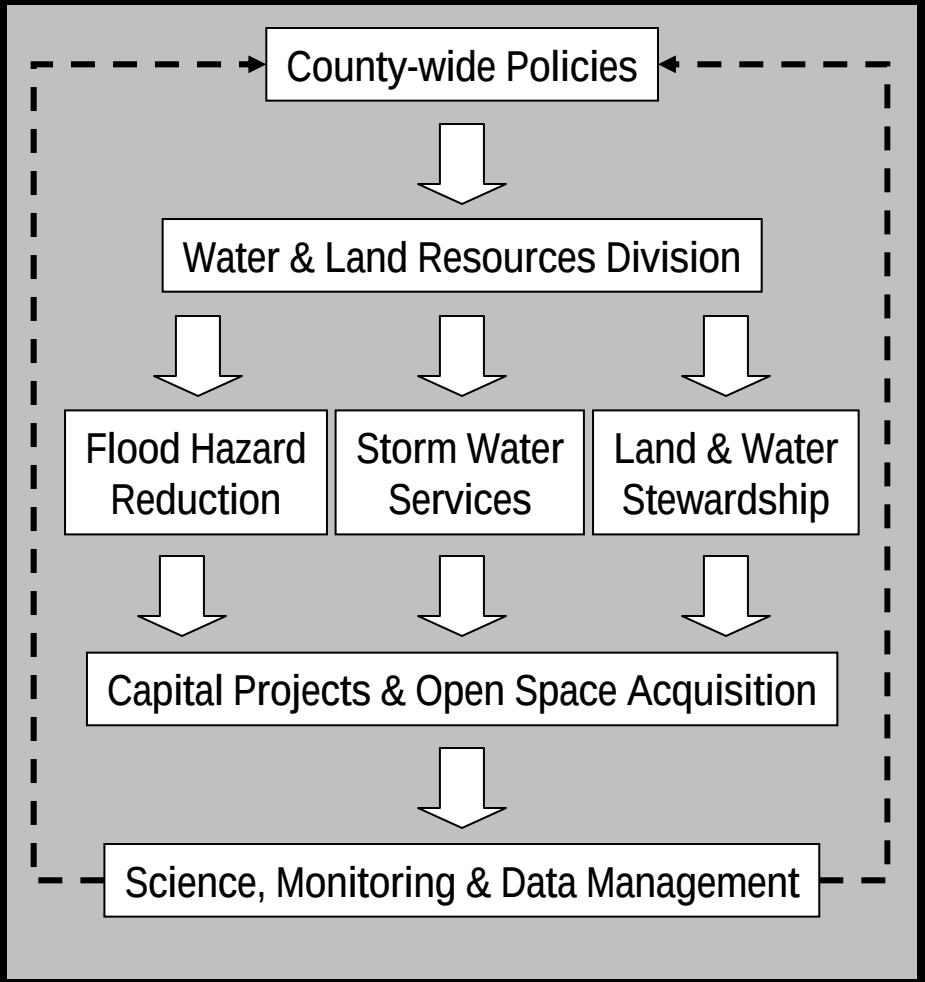
Integrated Modeling for Water Resource Management

Problem Background

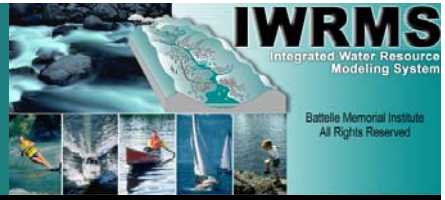


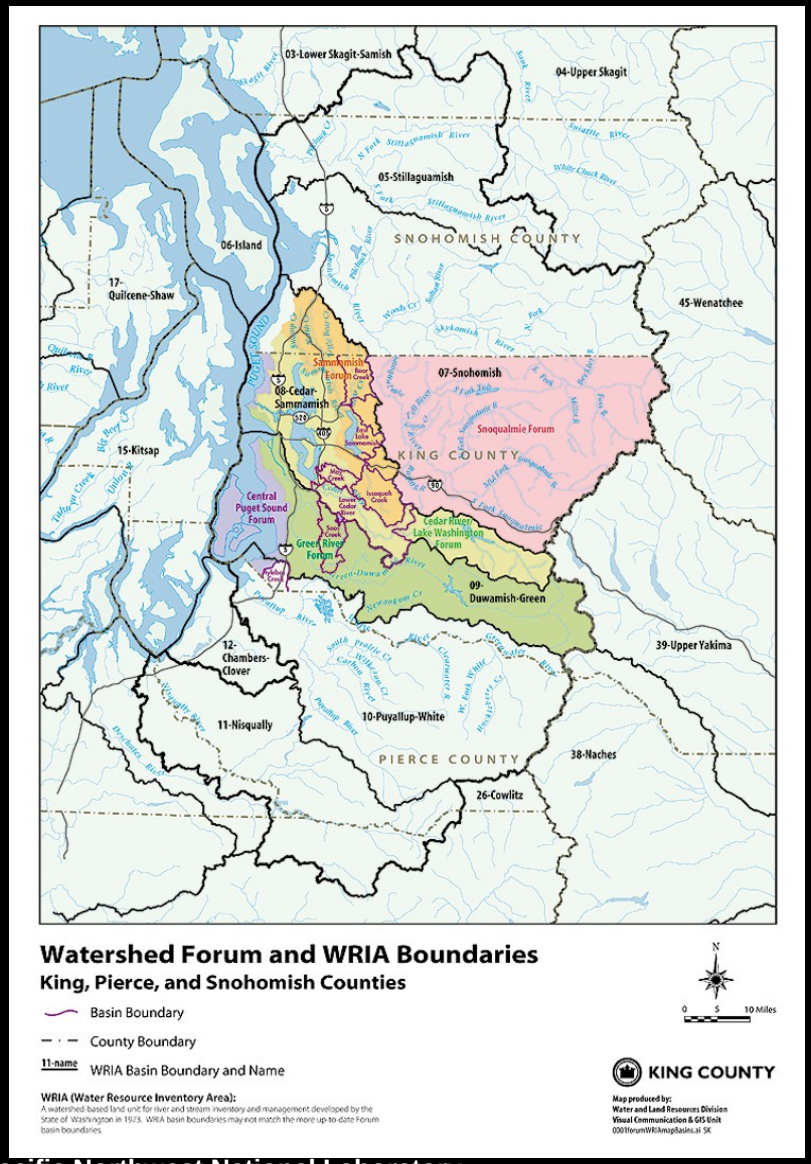
King County Department of Natural Resources & Parks

- Science, Monitoring and Data Management group responsible for evaluating existing County practices and providing science input to County policy making
- Needs "integrated" modeling capability to support scientific investigations and planning efforts



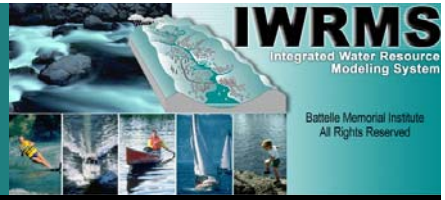
Project Goals





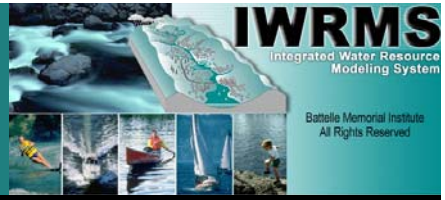
- Integrate disparate set of computational models (land use, watershed, lake, river, and estuary) to model water quantity and quality in Puget Sound region
- Develop integrated suite of tools – from problem conception, through modeling, to visualization/ communication – to support the needs of modelers, water quality planners, and natural resource management
- Flexible/extensible – not all models identified at this time

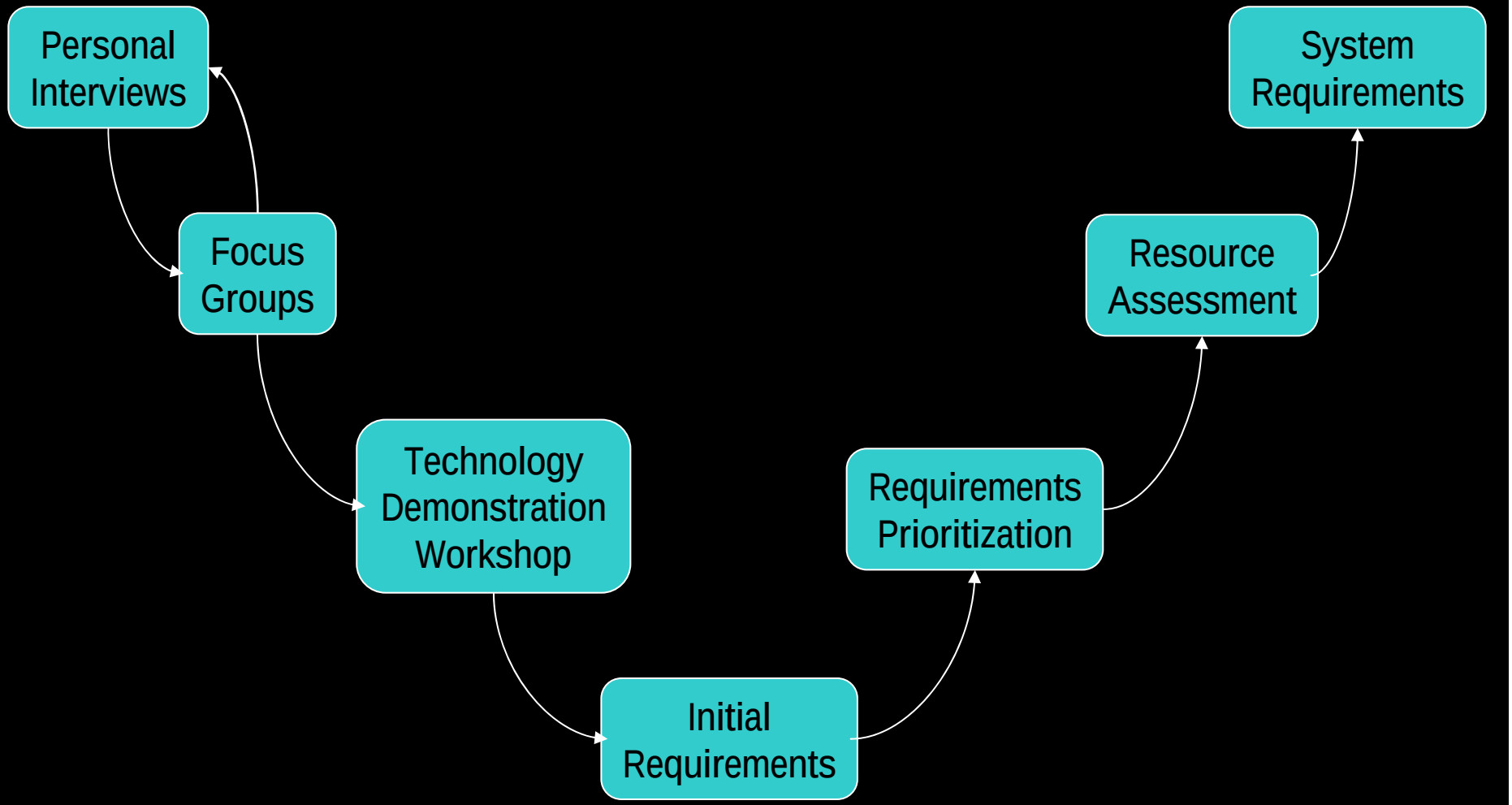
PNNL Goals



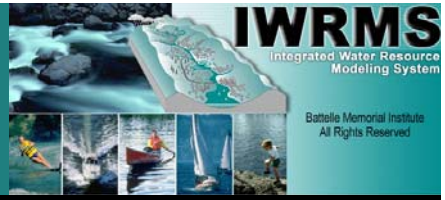
- Provide flexible, extensible *capability* for model integration and its application to King County/DNRP's problems
- Develop a robust solution that can
  - be applied in other geographic domains
  - Integrate models other than watershed/lake/river
  - Integrate tools other than scientific models
  - Enable users to integrate models/tools without programmer involvement
- Use this effort as model for other jurisdictions/organizations with similar needs

Requirements Gathering



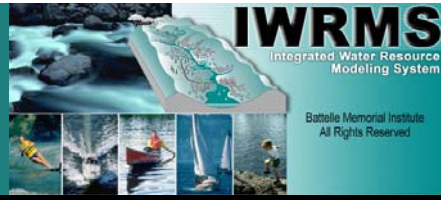


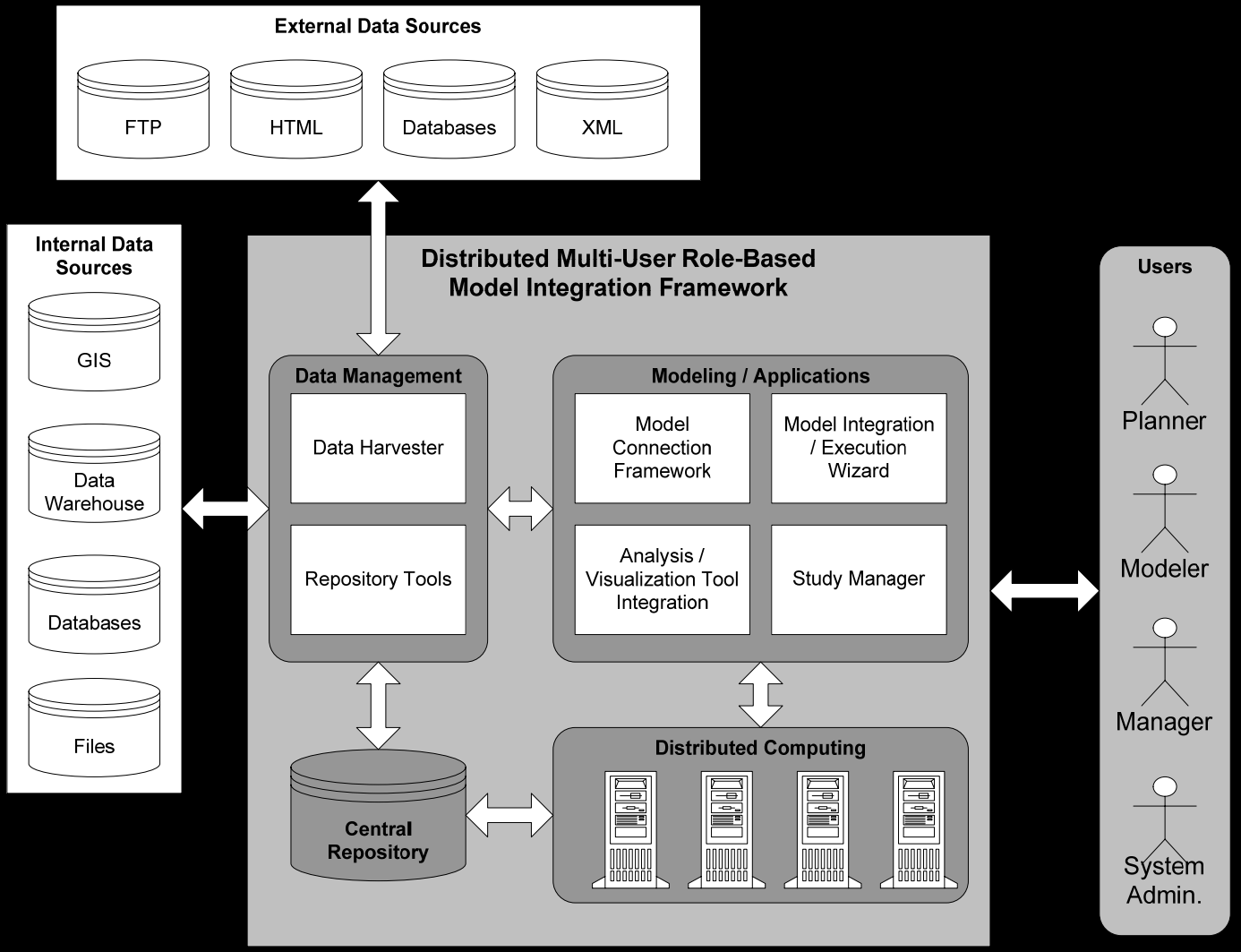
Requirements Analysis



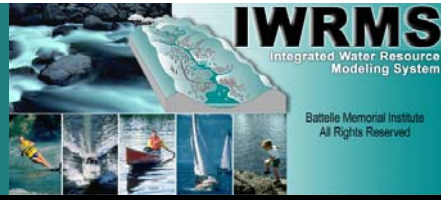
- Wide and varied needs to support a variety of model usage scenarios
- Building on top of PNNL's Framework for Risk Analysis of Multimedia Environments System (FRAMES) would best meet County needs with available funding
- Incorporate 3rd-party commercial off-the shelf software where feasible
  - Data analysis & visualization
  - Distributed computing
- Use participatory design process since many potential users didn't have clear picture of their needs.

IWRMS Computing Architecture



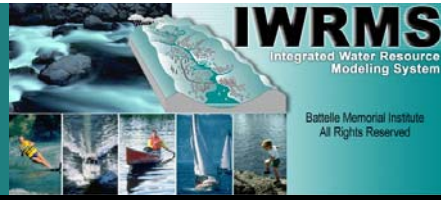


Model Connection Framework



- Facilitates seamless transfer of information between the variety of models and data sources
- FRAMES is the basis for our MCF
  - Previously developed by PNNL (nearly a decade of research and development)
  - Allows for plug-and-play interchangeability of modelling simulation elements
- Currently extending FRAMES to support collaboration among multiple, simultaneous users

Model Integration Wizard



Model Integration Wizard - Map Output

Dictionaries:
- WSOUT1
  - ALK
  - CLAY
  - DO
  - ECOL
  - Flow
  - ISS
  - NodeNum
  - SAND
  - SILT
  - Time

Value (mg/L): undefined
Year: undefined
Time: undefined
NodeNum: undefined
Test

north-s.plt | north2-s.plt | north3-s.plt

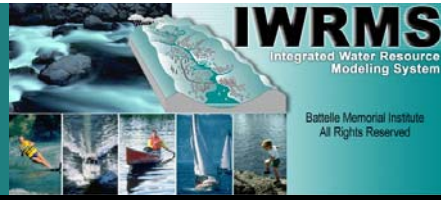
```
Nort HSPF FILE FOR DRIVING SEPARATE PLOT PROGRAM
Nort Time interval:    60 mins          Last month in printou
Nort No. of curves plotted:  Point-valued:  0   Mean-valued:
Nort Label flag:  0          Pivl:    4          Idelt:   1
Nort Plot title:   North Creek
Nort Y-axis label:
Nort Scale info:  Ymin:   0.0000              Threshold:-0.
Nort              Ymax:   1500.0
Nort              Time:   20.000     intervals/inch
Nort Data for each curve (Point-valued first, then mean-valu
Nort Label                    LINTYP     INTEQ     COLCOD
Nort Flow Rate                     0         0          0
Nort Alkanlinity                   0         0          0
Nort Water Temperatur              0         0          0
Nort Sand                          0         0          0
Nort Silt                          0         0          0
Nort Clay                          0         0          0
Nort Suspended Sed                 0         0          0
```

Tables: New

Text Spans: New

Step 4 of 4: Output Data Specifications

Data Harvester



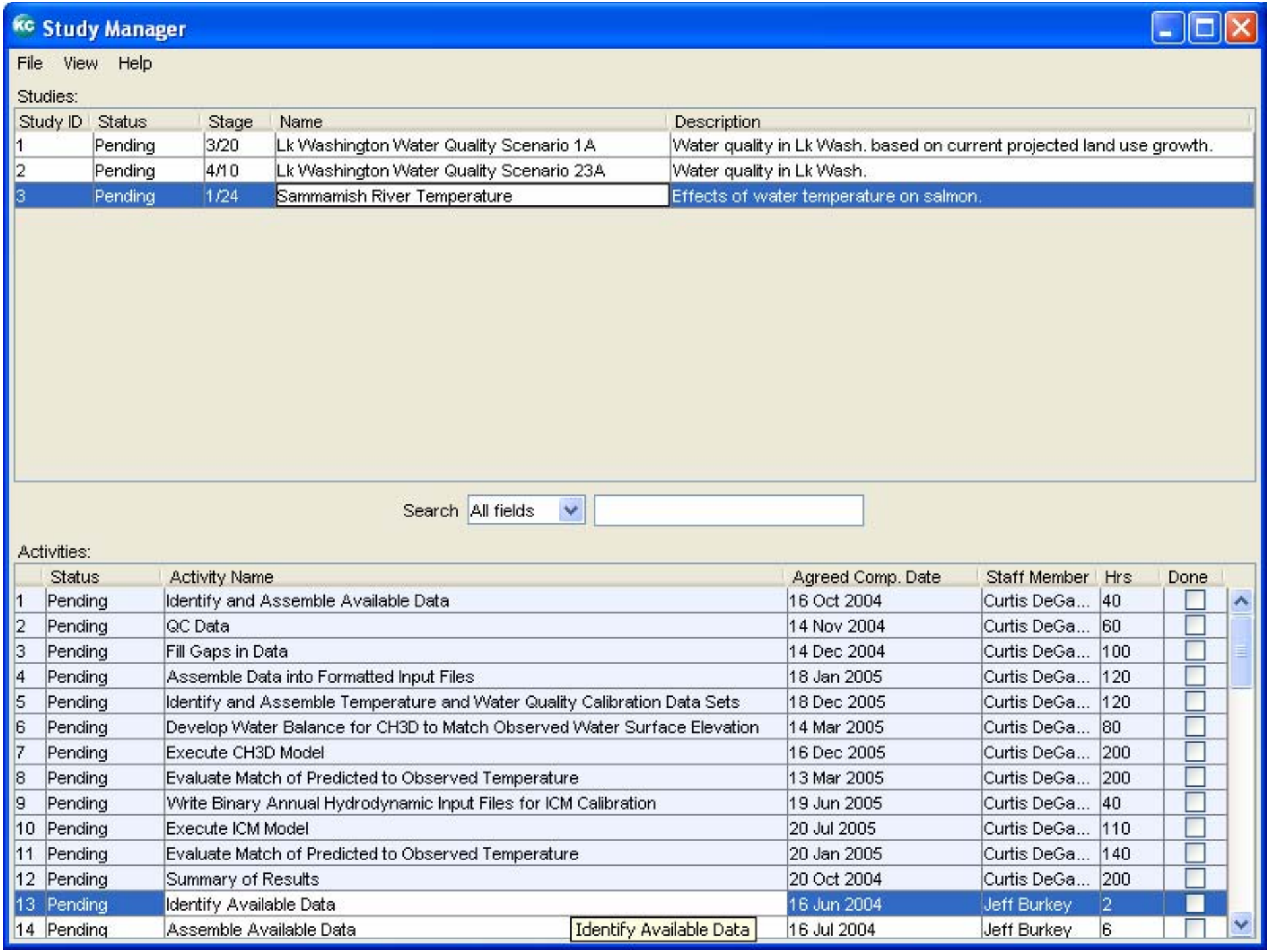
Data Harvester Manager d3k076

File Edit View Help

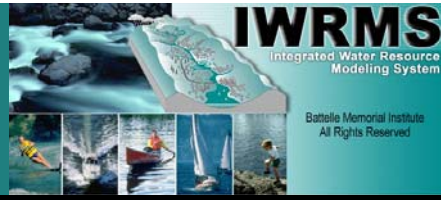
Data Harvests:

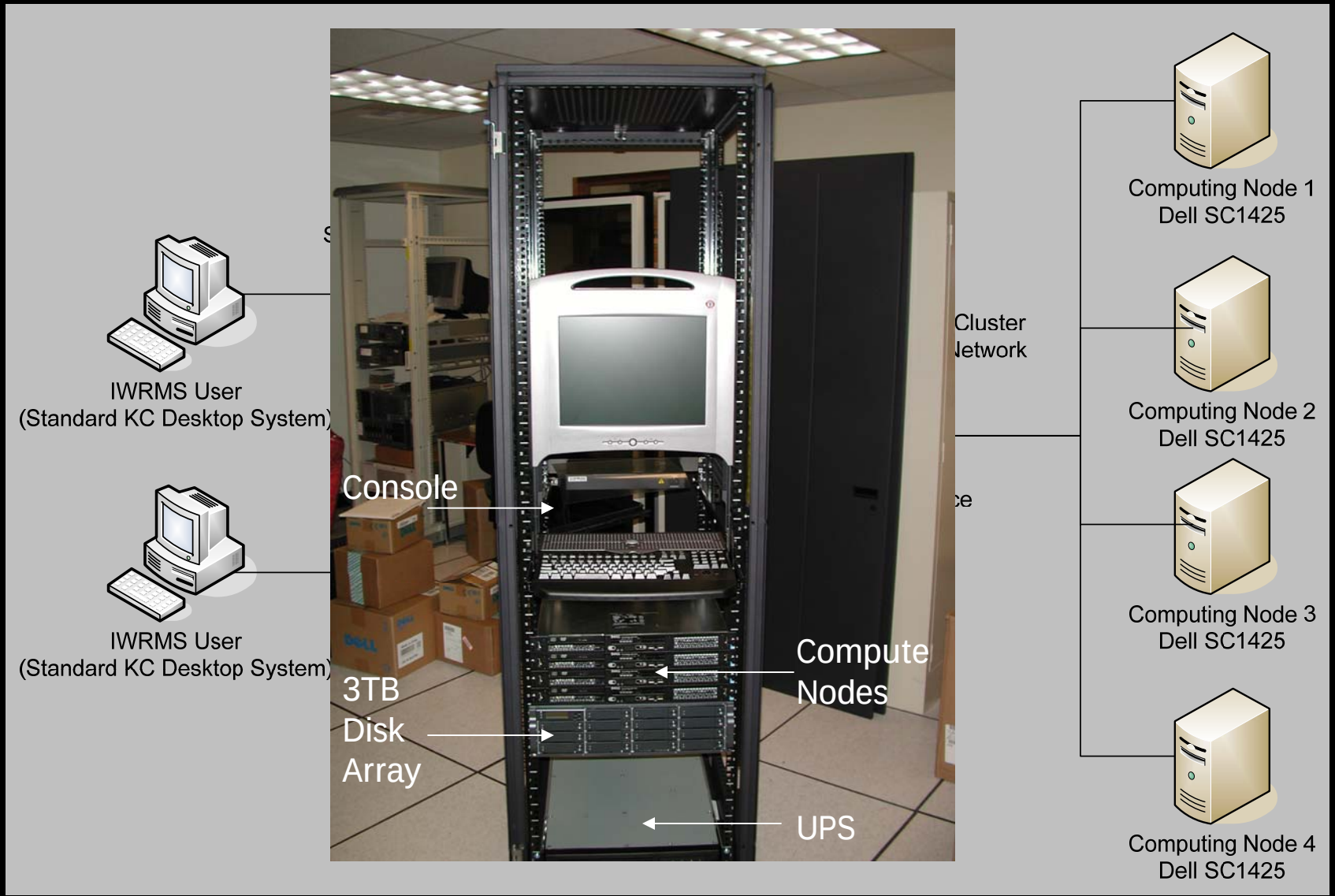
Name	Frequency	Status	Description	
Lk Washington 1A	Daily	Completed	Water quality in Lk Wash. based on current projected land use growth.	
Lk Washington 23A	Monthly	In Progress	Water quality in Lk Wash.	
Sammamish River	Once	Failed	Effects of temperature on salmon.	

Filter Data Harvests by all fields

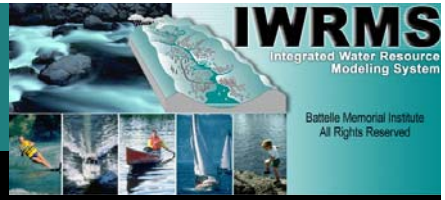

Study Manager
File
View
Help
Studies:
Study ID
Status
Stage
Name
Description
1
Pending
3/20
Lk Washington Water Quality Scenario 1A
Water quality in Lk Wash. based on current projected land use growth.
2
Pending
4/10
Lk Washington Water Quality Scenario 23A
Water quality in Lk Wash.
3
Pending
1/24
Sammamish River Temperature
Effects of water temperature on salmon.
Search
All fields
Activities:
Status
Activity Name
Agreed Comp. Date
Staff Member
Hrs
Done
1 Pending Identify and Assemble Available Data 16 Oct 2004 Curtis DeGa... 40
2 Pending QC Data 14 Nov 2004 Curtis DeGa... 60
3 Pending Fill Gaps in Data 14 Dec 2004 Curtis DeGa... 100
4 Pending Assemble Data into Formatted Input Files 18 Jan 2005 Curtis DeGa... 120
5 Pending Identify and Assemble Temperature and Water Quality Calibration Data Sets 18 Dec 2005 Curtis DeGa... 120
6 Pending Develop Water Balance for CH3D to Match Observed Water Surface Elevation 14 Mar 2005 Curtis DeGa... 80
7 Pending Execute CH3D Model 16 Dec 2005 Curtis DeGa... 200
8 Pending Evaluate Match of Predicted to Observed Temperature 13 Mar 2005 Curtis DeGa... 200
9 Pending Write Binary Annual Hydrodynamic Input Files for ICM Calibration 19 Jun 2005 Curtis DeGa... 40
10 Pending Execute ICM Model 20 Jul 2005 Curtis DeGa... 110
11 Pending Evaluate Match of Predicted to Observed Temperature 20 Jan 2005 Curtis DeGa... 140
12 Pending Summary of Results 20 Oct 2004 Curtis DeGa... 200
13 Pending Identify Available Data 16 Jun 2004 Jeff Burkey 2
14 Pending Assemble Available Data 16 Jul 2004 Jeff Burkey 6
Identify Available Data

Distributed Computing



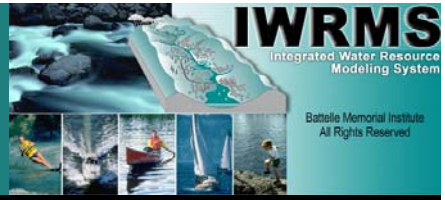


Project Status



- Demonstrations of initial system functionality in July 2004 and January 2005
- Currently focused on subsystem integration
- Viz/Analysis tool integration to start in Spring ‘05
- “beta” release expected in July 2005
- Initial system delivery scheduled for December 2005

Expected Results



- Greater speed in producing usable information from existing data
- Ability to use data in new ways...to answer questions that couldn't be answered before
- Ability to inform water resource sampling programs