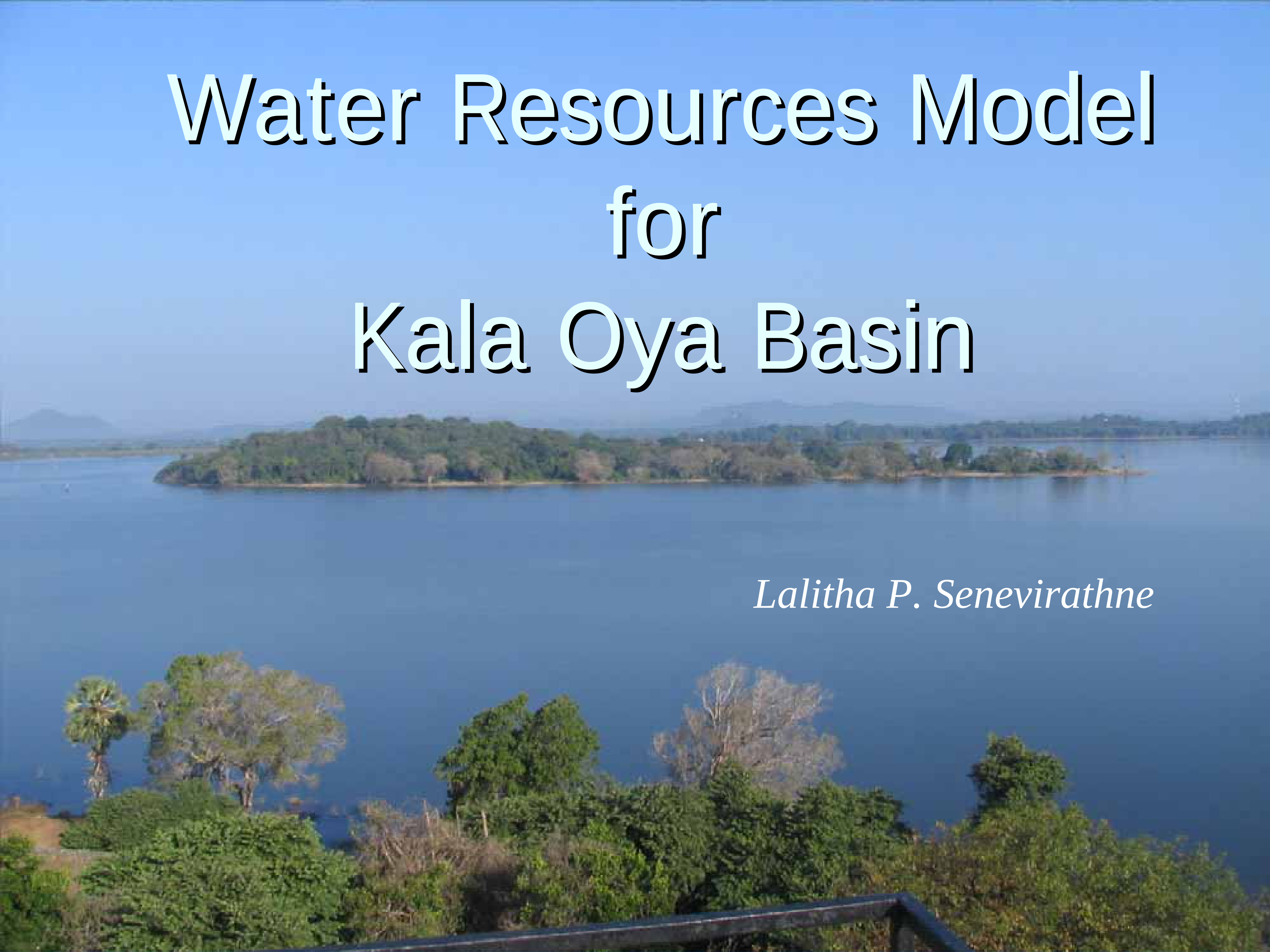
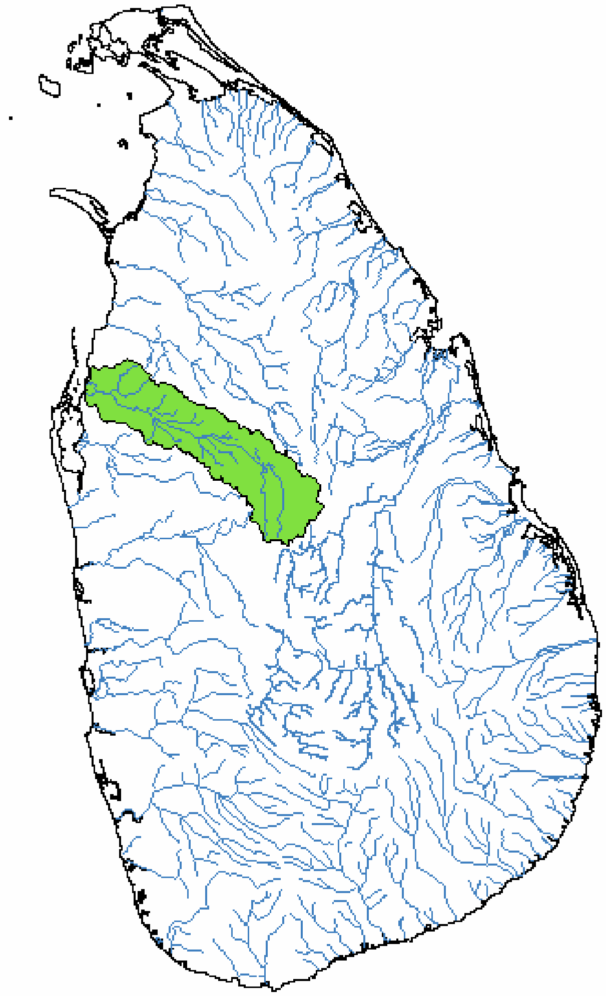
Water Resources Model for Kala Oya Basin

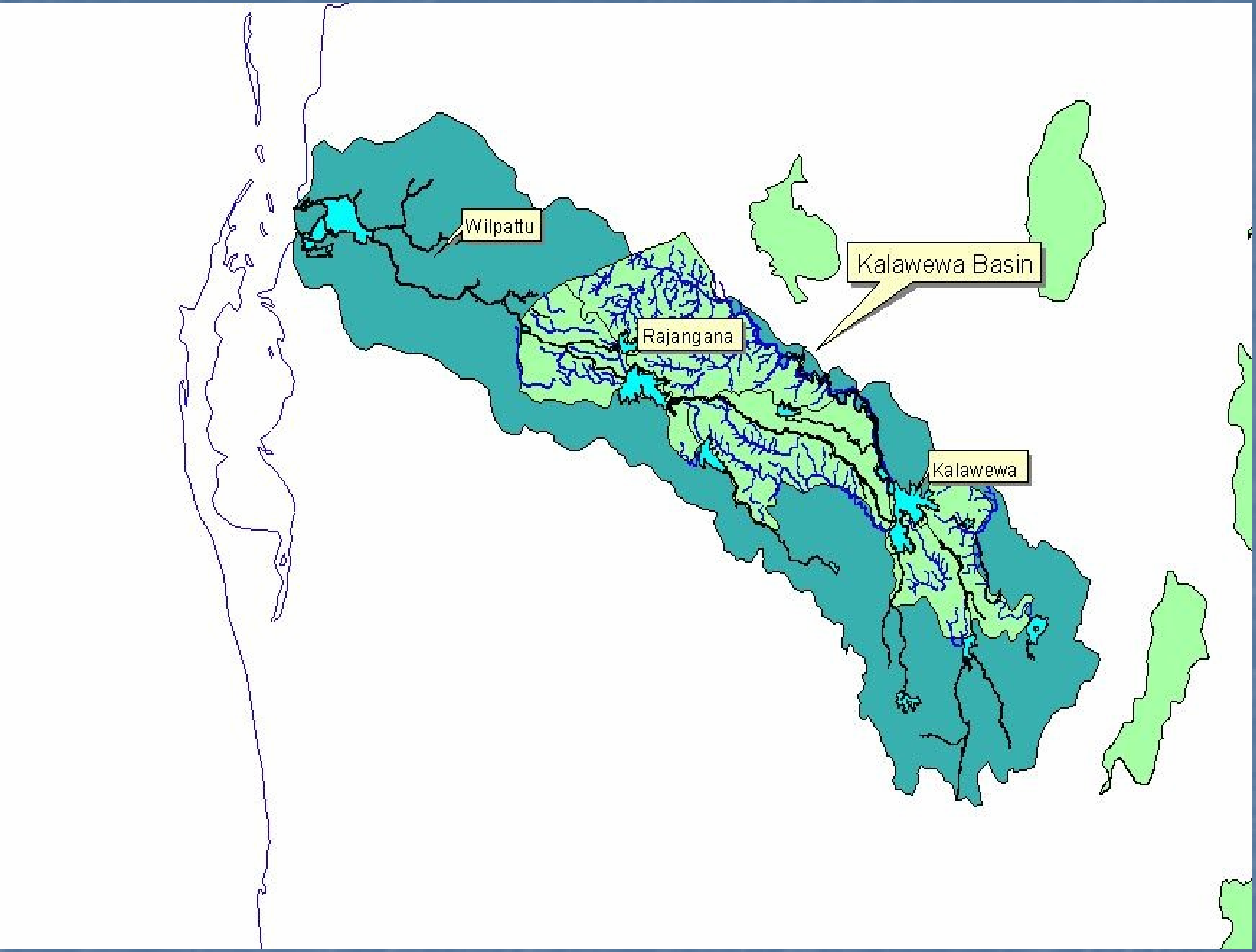
Lalitha P. Senevirathne



Location of Kalawewa basin



Kalawewa basin



- Area
  2825 km^2
- Annual Average Rainfall
  1298 mm
- Annual Average Rainfall varies 1700 mm at South Eastern part
  1200 mm at Northwestern part
- Local Inflow to the basin

  343 MCM /yr
- Diversion to the basin
  448 MCM/yr
- Average runoff factor
  11%

Objectives of a model in water resource planning

- To Understand:
  - The Existing System
- To make predictions on
  - The implication of various policies
  - The Effects due to change in hydrology or change in components
  - The success and failure rates or the risks of the projects
  - Flow in and out of the lakes

Features

- Developed by South Florida Water Management District
- Written on Linux operating system
- The governing equations :
    - two dimensional Saint Venant equations without the inertia terms,
    - the 2-D ground water equations
- Uses a Hydraulic Simulation Engine (HSE)

HSE

- Has the Capability to simulate;

  - 2-Dimensional Overland Flow
  - 2-Dimensional Ground water flow
  - 1 Dimensional Flow in canal Network
  - Flow in and out of the lakes

- Fully integrated, all the equations are solved simultaneously

Major Components

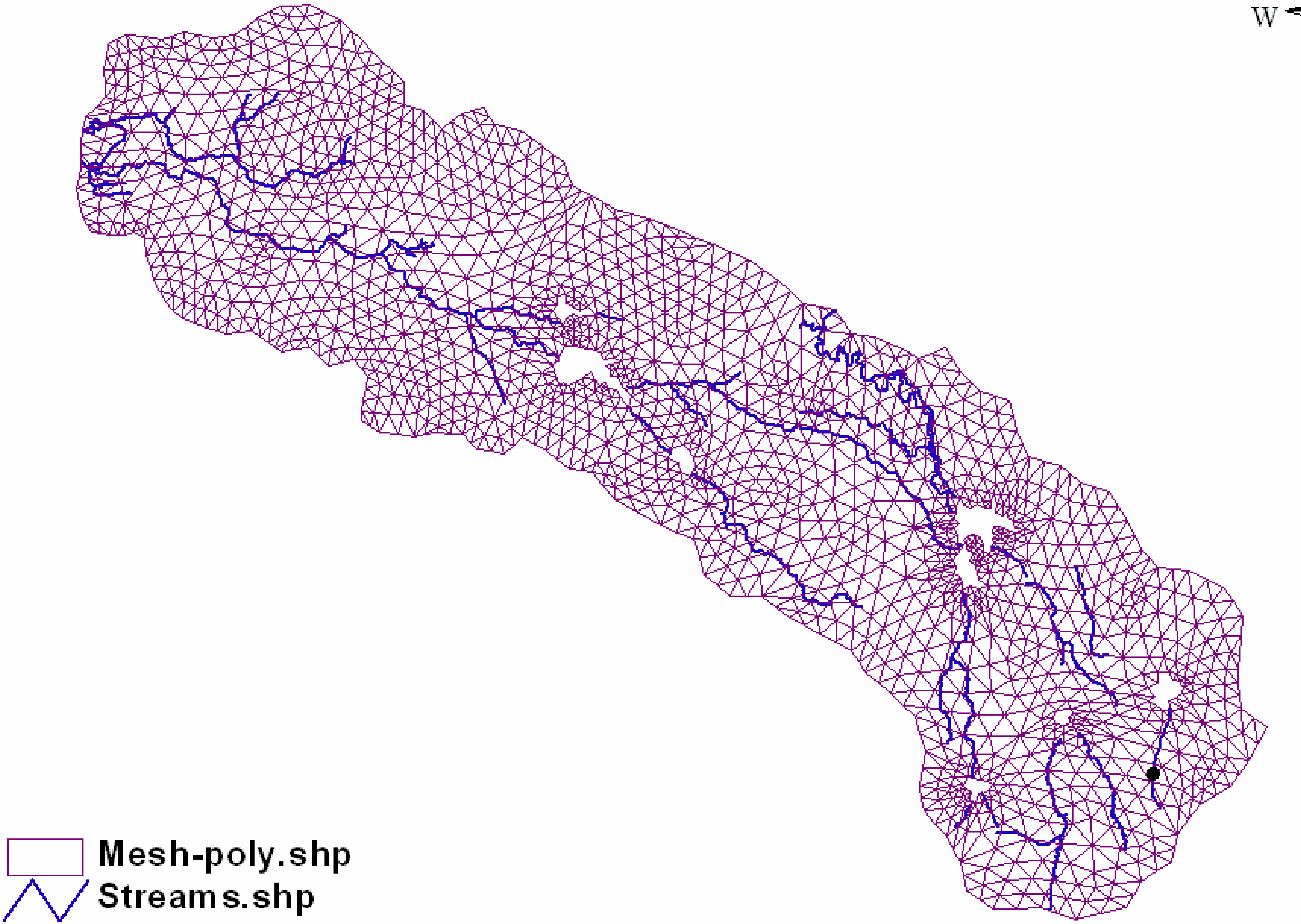
- Unstructured Triangular Mesh – Generated by GMS
- Water Bodies – reservoirs, cells etc. contains water but does not move it

(Known objects that contain known quantities of water)

- Water Movers – Canals, Spills, Sluices,seepage paths

(Known objects that determine the exact quantity of water passing between them)

The Traingular mesh of Kala Oya Basin with Streams



The steps......

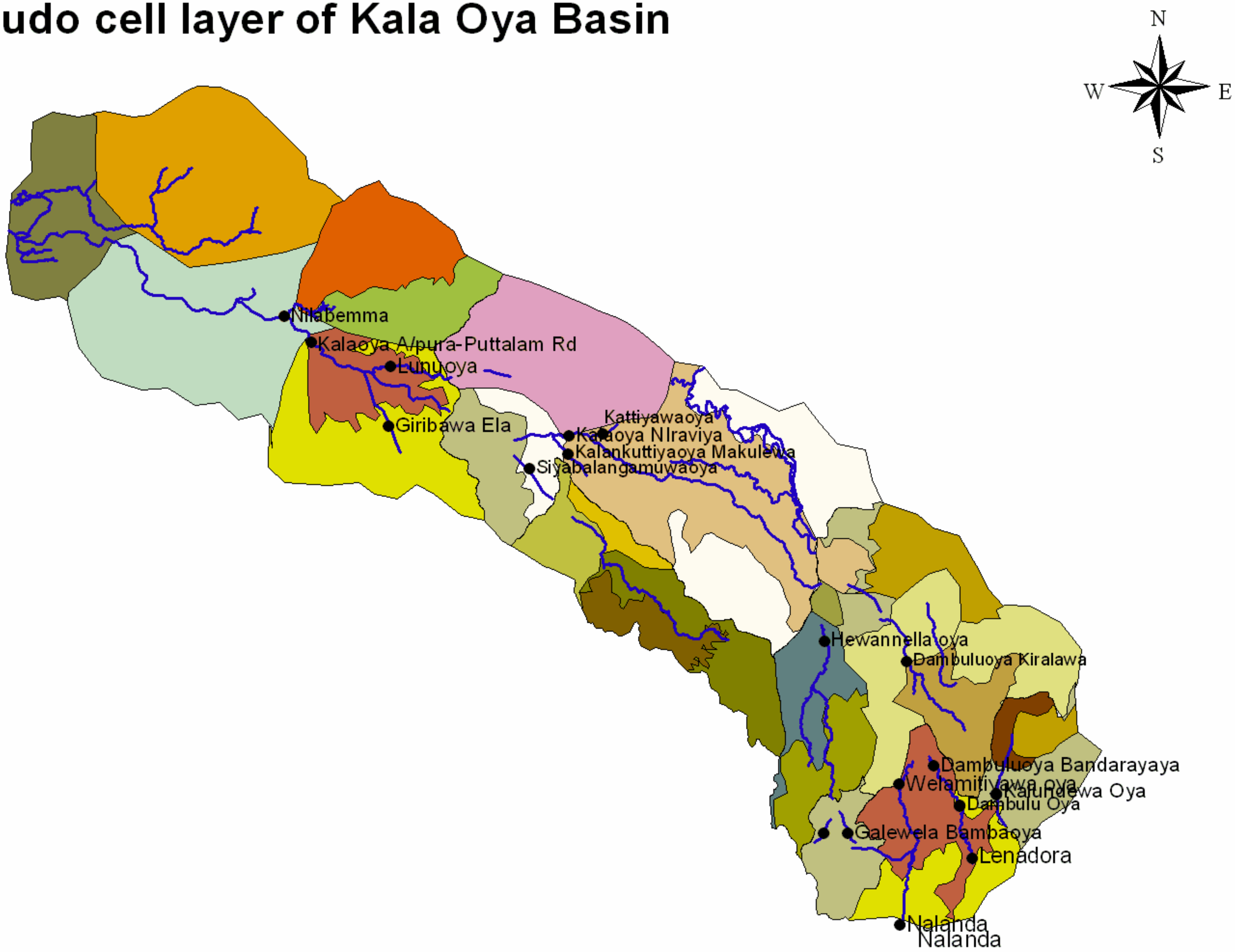
- Generation of a mesh for the Kala-Oya basin.
- Creation of topographical data set
- Creation of a canal network data file
- Creation of rainfall data sets using DSSVUE
- Creation of GIS coverage for the mesh area.
- Creation of pseudo cell layer
- Creation of Index files to be used in XML
- Forming the components of the model
- Running the model
- Calibration and testing

Pseudo cells

- To simulate the local hydrology within an area
  - holds the same water content placed in their own macro-hydrological settings
- used to simulate
  - agricultural patterns
  - small creek and tributary flow
  - urban hydrology etc.
- created to suit the micro catchments
- water budgeting within a pseudo cell;

$$R_{rech} = P - E + I - \frac{dU_s}{dt} - \frac{dD}{dt}$$

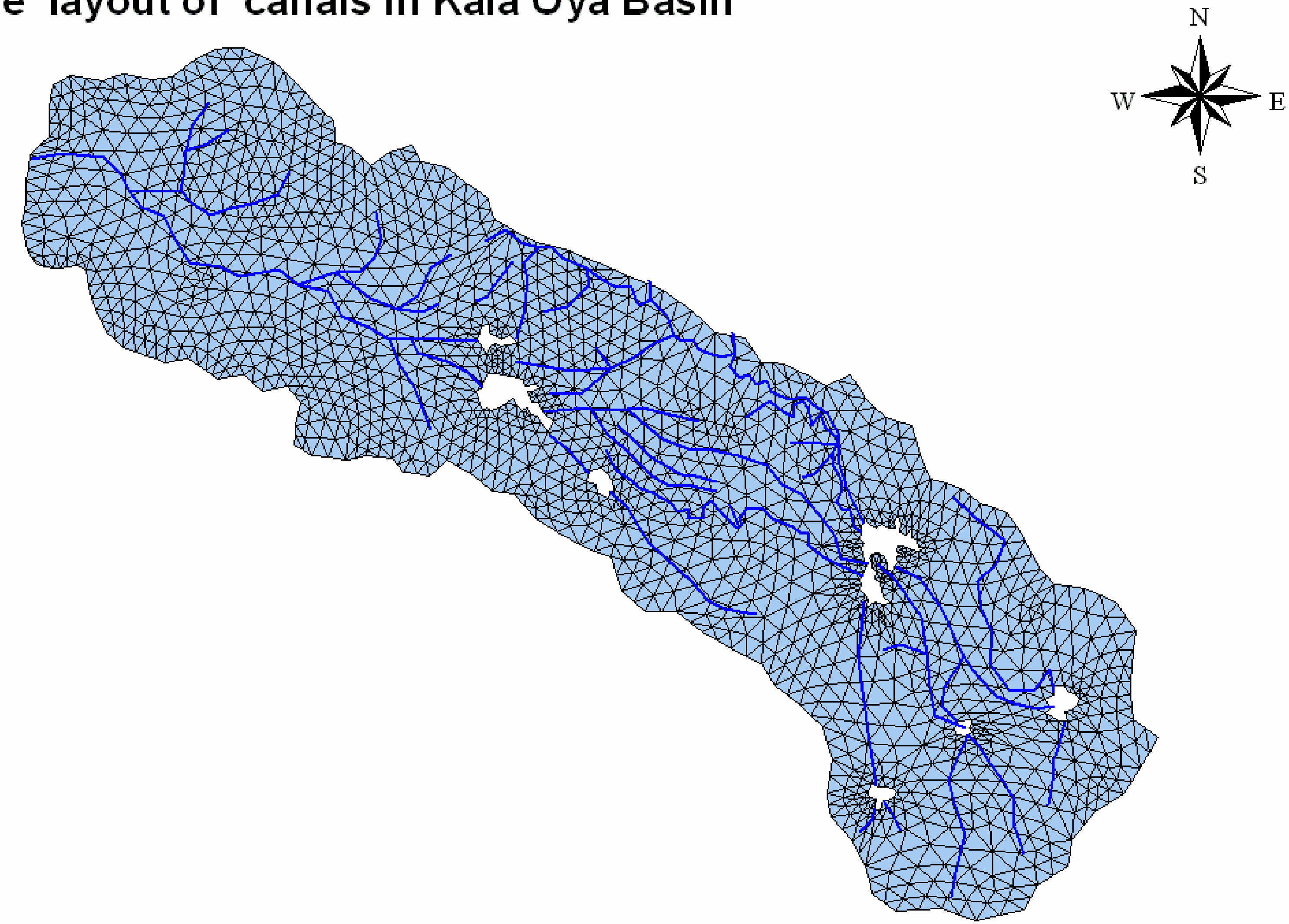
Pseudo cell layer of Kala Oya Basin



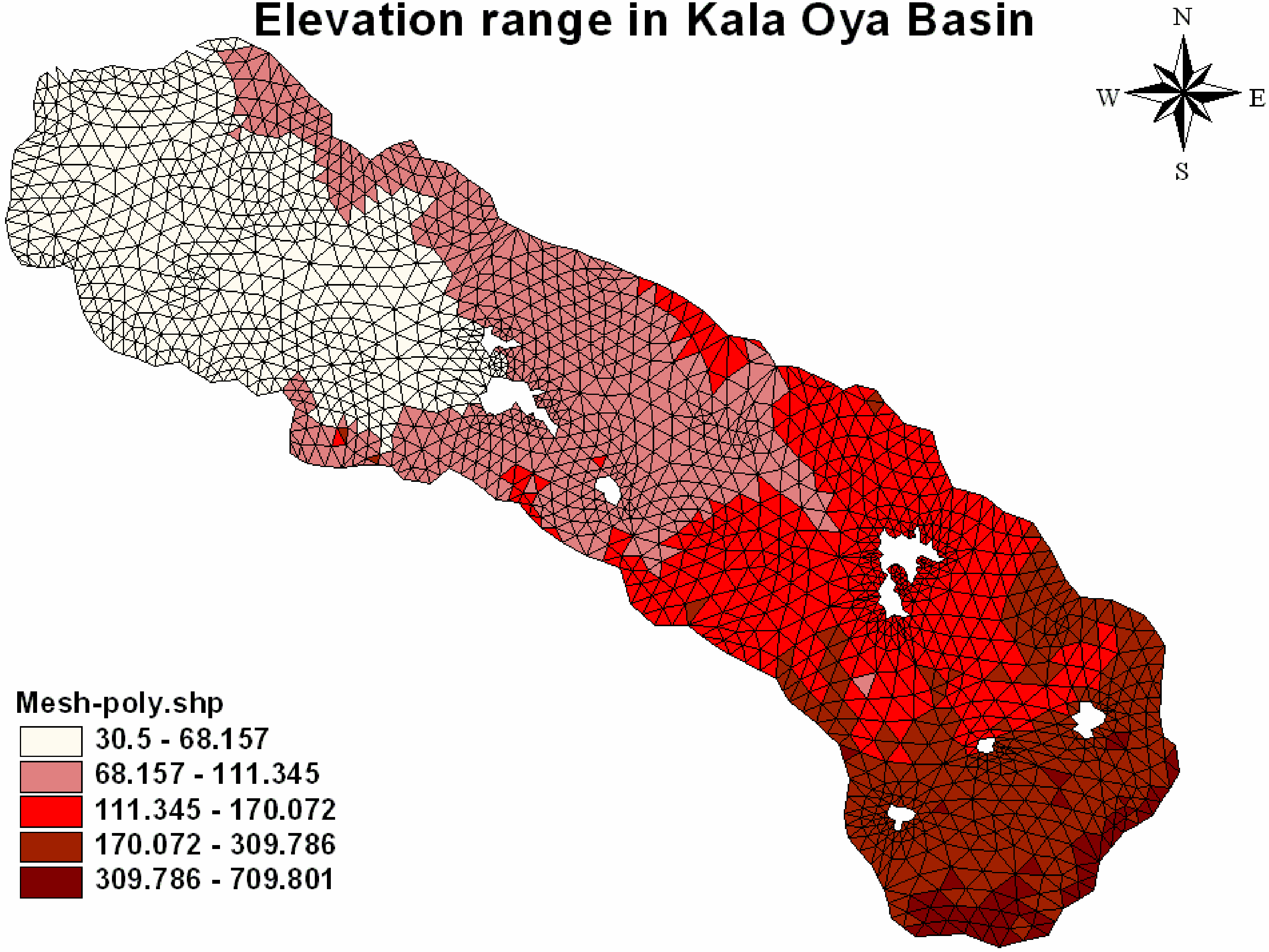
Data Needs

- Topographical Data
- River and Canal cross section data
- Reservoir stage- area and Stage-Capacity data

The layout of canals in Kala Oya Basin



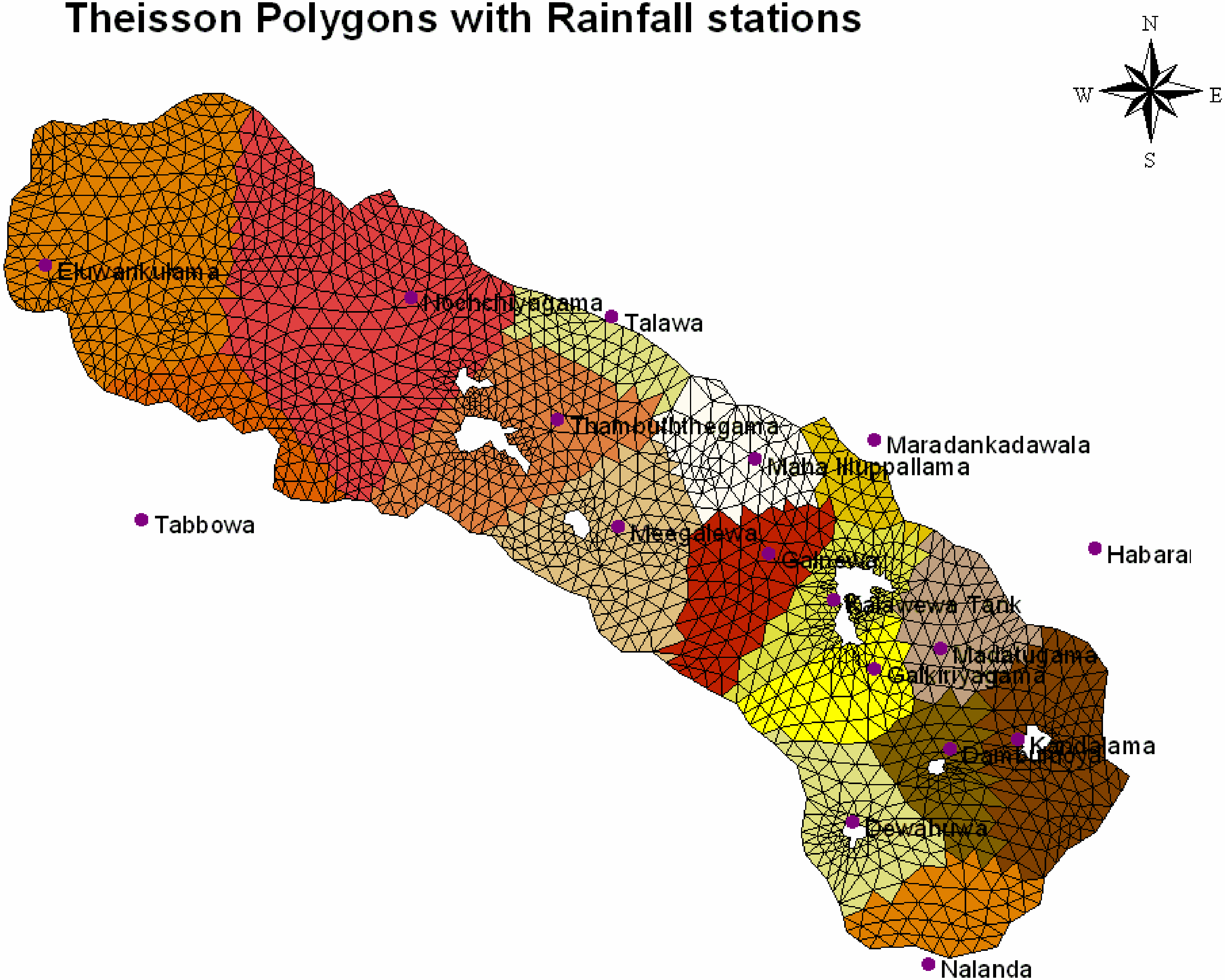
Elevation range in Kala Oya Basin



Data Needs Contd..

- Time Dependent
  - Rainfall Data
  - Evapo transpiration data
  - Inflow and outflow time series data (Including Diversion)
  - Water level boundary condition data

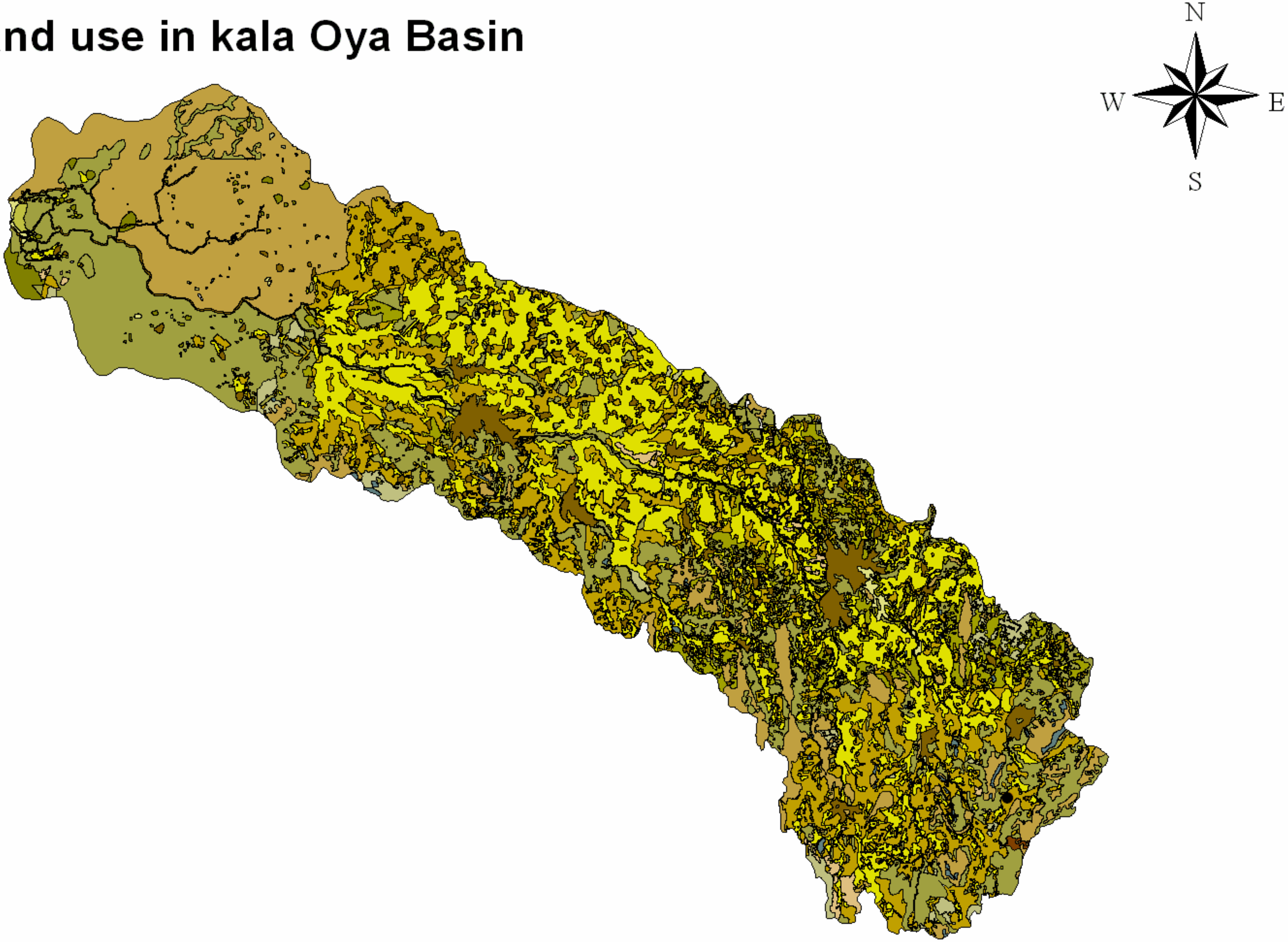
Theisson Polygons with Rainfall stations



Data Needs Contd..

- Manning’s roughness
- Crop coefficients
- Land use related parameters
- Storage coefficients of soil layers
- Transmissivities and conductivities of soil layers
- Information of major structures

Land use in kala Oya Basin



Land use categories within the basin

- Coconut
- Other plantations
- Paddy
- Garden
- Marsh
- Scrub
- Rock
- Tanks
- Forest
- Grassland

Data Needs Contd..

- For Calibration
  - Runoff data
  - Ground water levels

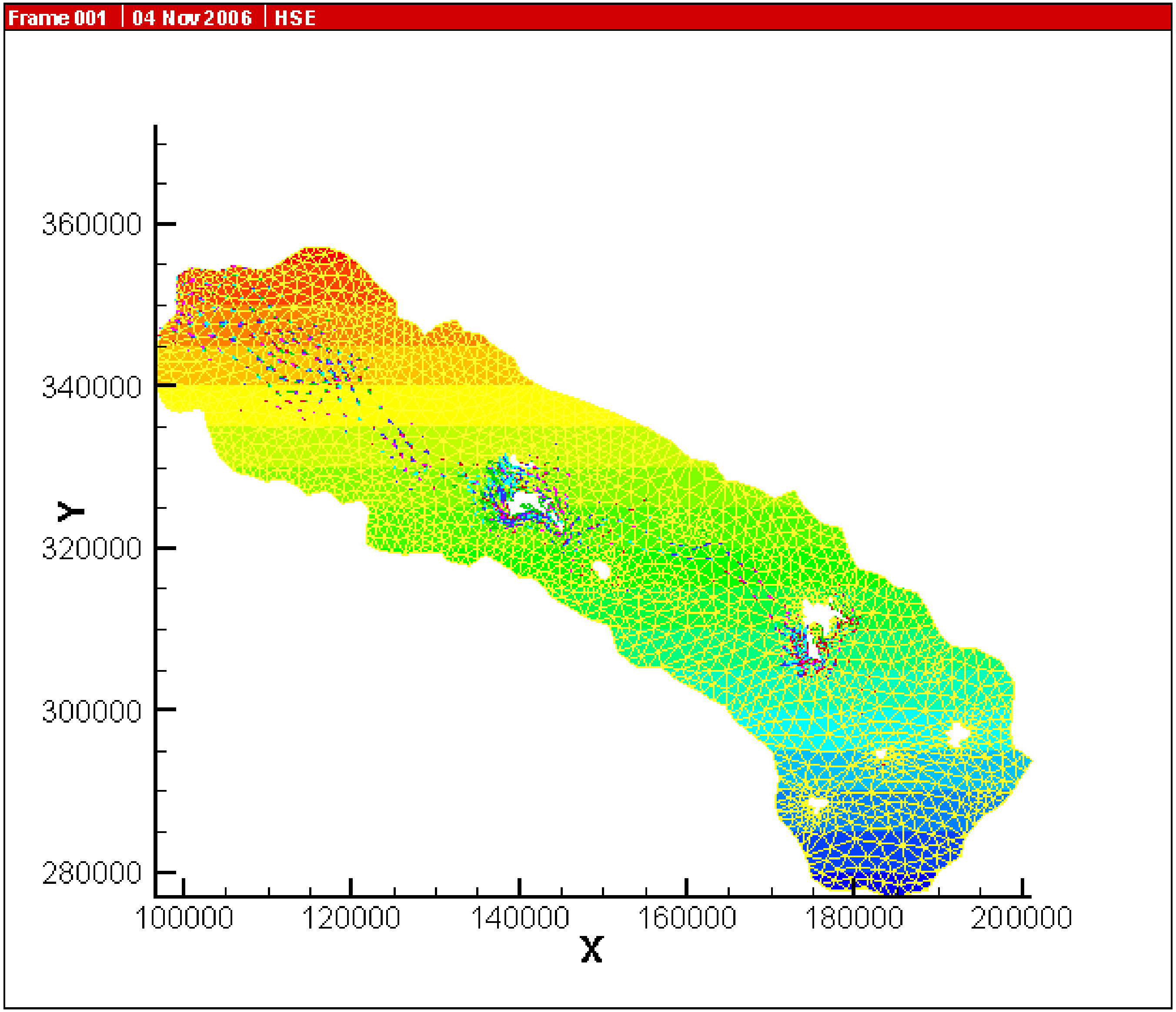
Out Put Options

- Global Monitor
- Budget Package
- Cell Monitor -Can monitor individual cells
- Segment Monitor- Can monitor individual Canal segments

Present Status

- ***Data Entering Completed***
  - Topographical data
  - Reservoir data
  - Land use data
  - Rainfall data
  - Evapo transpiration data
  - Runoff data
  - Ground water levels
  - Canal Data
  - Inflow and outflow time series data (Including Diversion)

Visualization of results using TECPLOT




Thank You..