Water Resource Management using GIS

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Distribution of water surfaces on Earth

HYDROSPHERE: EARTH'S WATER SPHERE

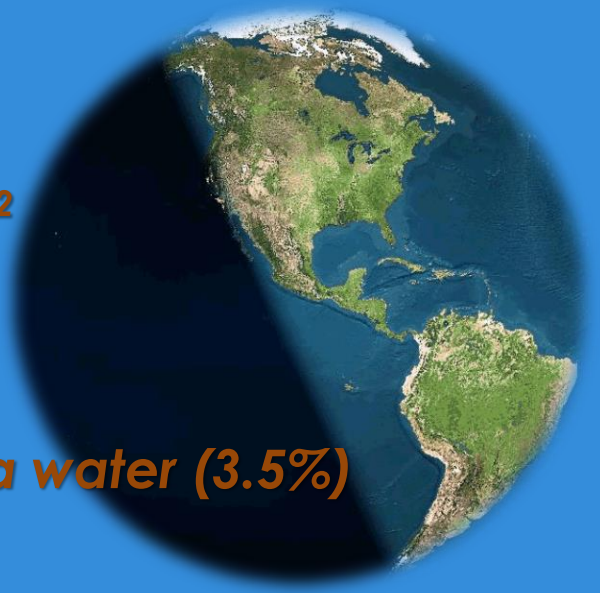
Earth's surface

***Total mass*:** *1.4×10^{18} tons*

***Total volume of water on Earth*:** *1,386 million km²*

71% water ***29% land***

***Area covered by ocean*:** *361 million km²*



***Average salinity of Earth's oceans*:** *35 gm/kg of sea water (3.5%)*

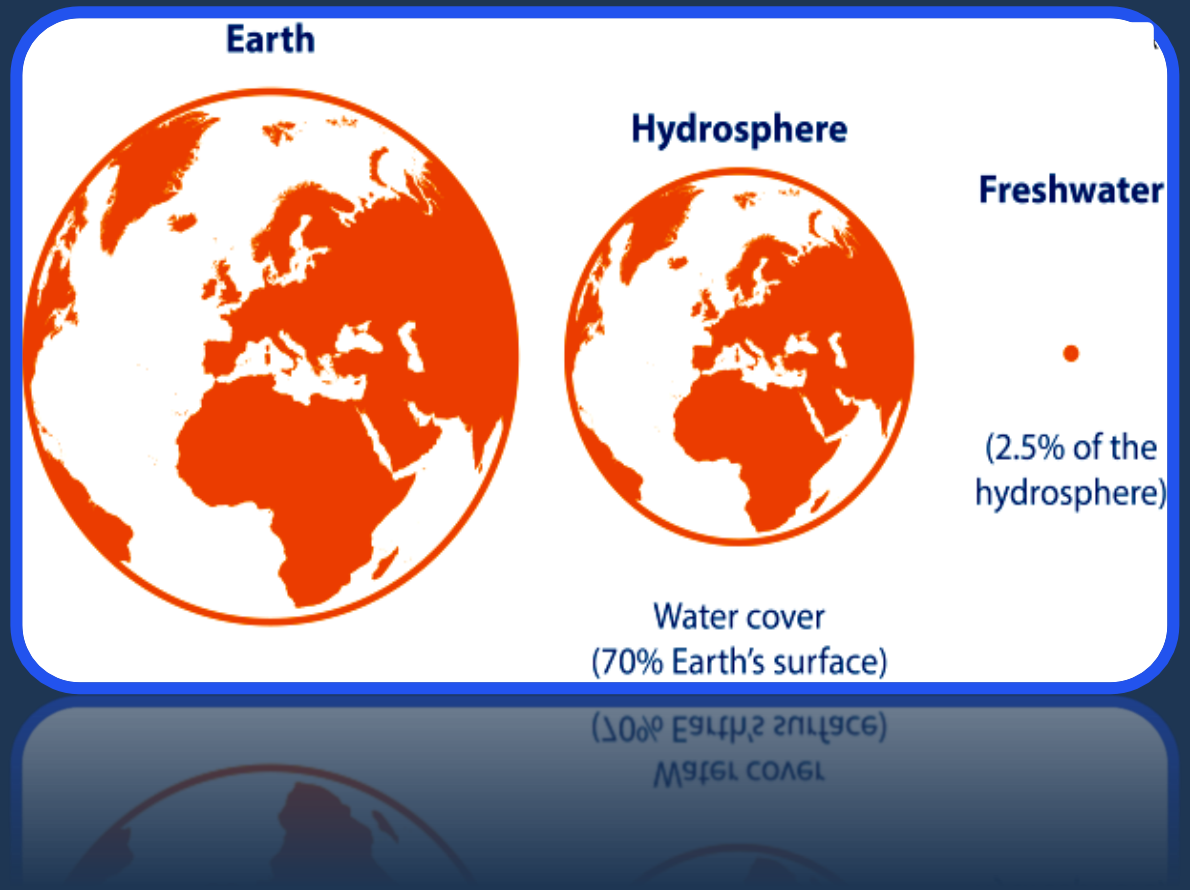
- Contains approximately 1.4 billion km^3 water
- Over 97% water is in the oceans

EARTH'S WATER RESOURCE

- ≈ Ocean water: 97.2 %
- ≈ Glaciers &other ice: 2.15 %
- ≈ Groundwater: 0.61 %
- ≈ Fresh water lakes: 0.009 %
- ≈ Inland seas: 0.008 %
- ≈ Soil Moisture: 0.005 %
- ≈ Atmosphere: 0.001 %
- ≈ Rivers: 0.0001 %

Water Resources

EARTH'S WATER RESOURCE

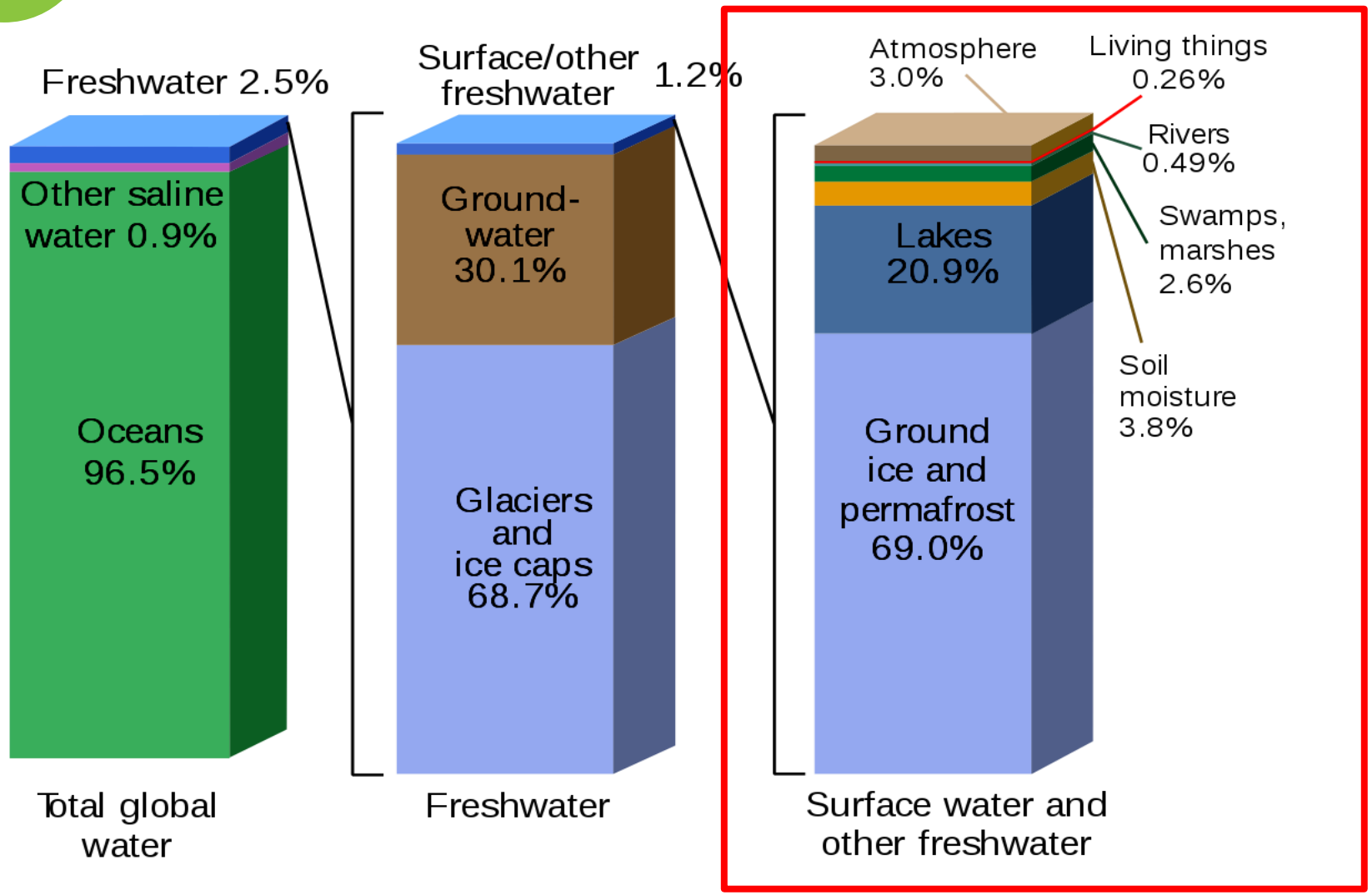


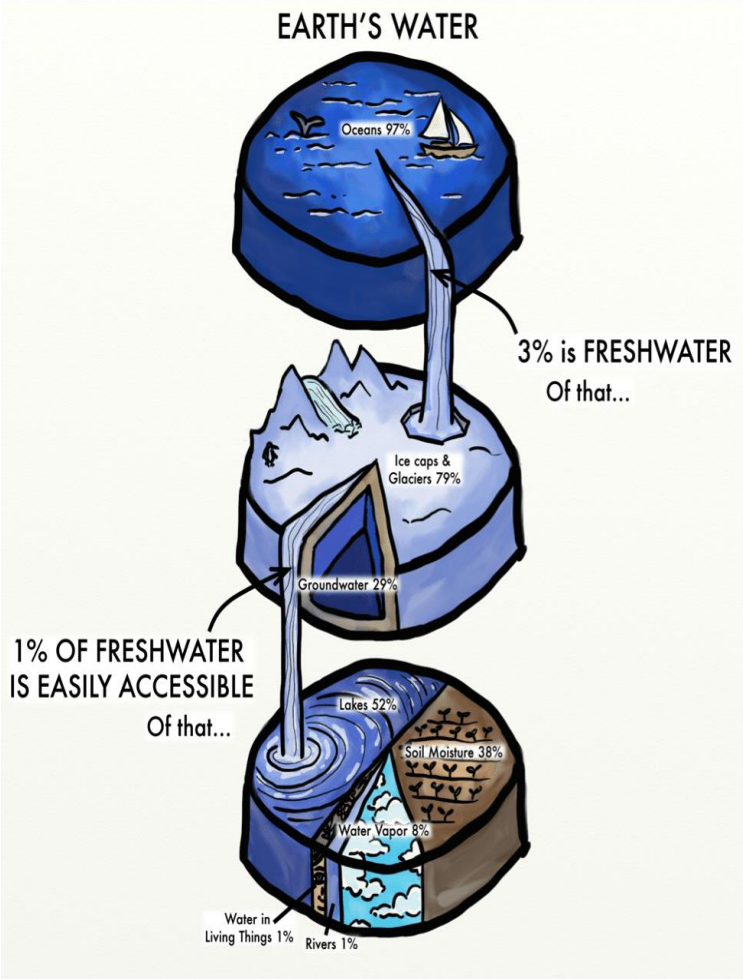
0.023%

Water accounts for a mere 0.023% of the earth's total mass.

Of that, only a small percentage (about 0.3 %), is even usable by humans. The other 99.7 percent is in the oceans, soils, icecaps, and floating in the atmosphere. Still, much of the 0.3 percent that is useable is unattainable.

FRESHWATER DISTRIBUTION





Source: USGS

Water Resource Management

WATER RESOURCE MANAGEMENT

Water Resources Management (WRM) is the process of planning, developing, and managing water resources, in terms of both water quantity and quality, across all water uses. It includes the institutions, infrastructure, incentives, and information systems that support and guide water management.

Source: WORLDBANK, 2017

Challenges in WRM

CHALLENGES IN WRM

According to World Bank estimates,

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This is where, Data and Information systems are needed for an **Integrated Water Resource Management Scheme,** in sectors of -

- ✓ Water Resource Monitoring,
- ✓ Decision Making Under Uncertainty,
- ✓ Systems Analyses,
- ✓ Hydro-meteorological Forecast And Warning

GIS in WRM

GIS IN WRM

WATER QUALITY ANALYSIS

→ Water quality modeling
→ Use of GPS / photographic tie-points
→ Use of passive and active water quality monitoring systems

WATERSHED MANAGEMENT

→ Terrain modeling
→ Flow modeling
→ Debris flow probability
→ Stream Order Analysis

HYDRO GEODATABASE

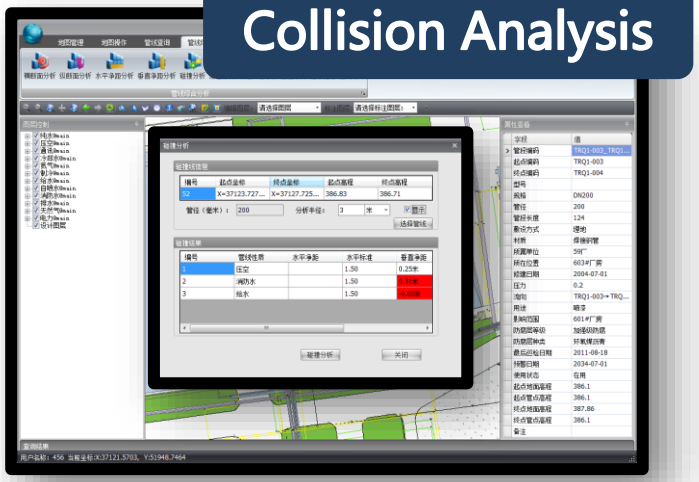
FLOOD MANAGEME

→ Flood plain delineation
→ Channel characteristics
→ Inundation modeling
→ Infrastructure analysis
→ Risk modeling and mitigation

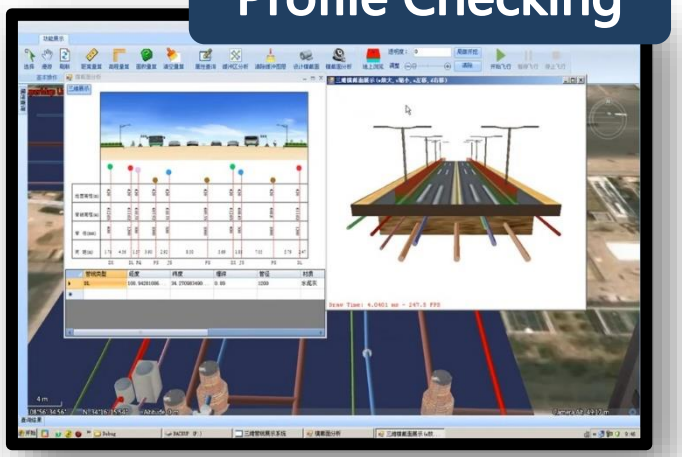
GROUNDWATER MODELING

→ Modeling subsurface, flow – rate, advection, concentration
→ Well and spring models.

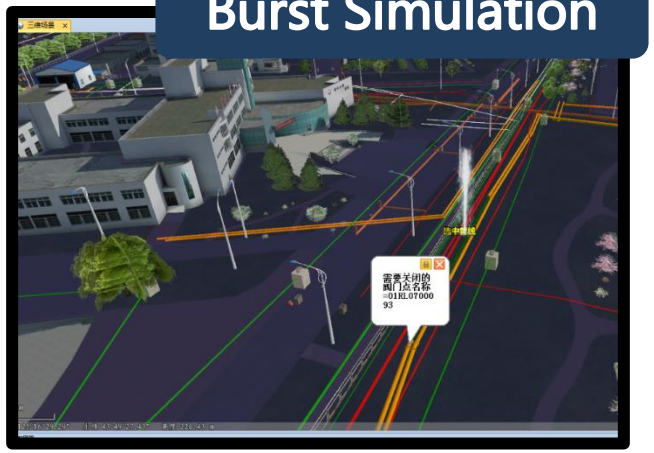
Collision Analysis



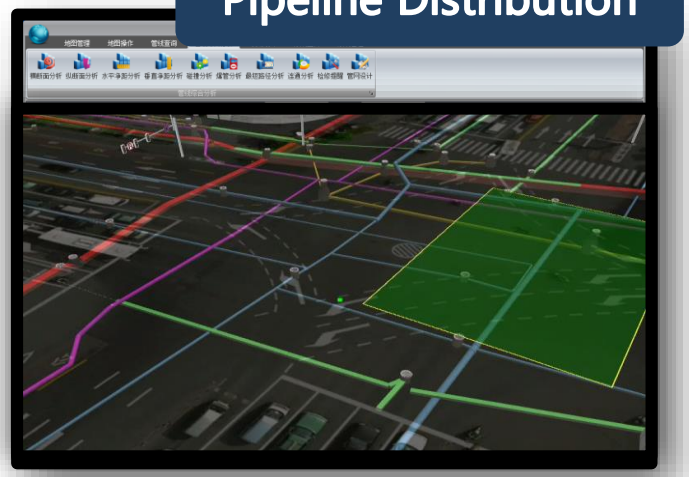
Profile Checking



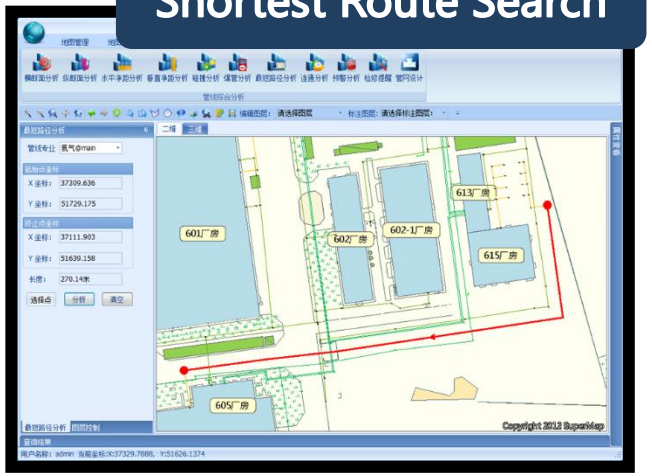
Burst Simulation



Pipeline Distribution



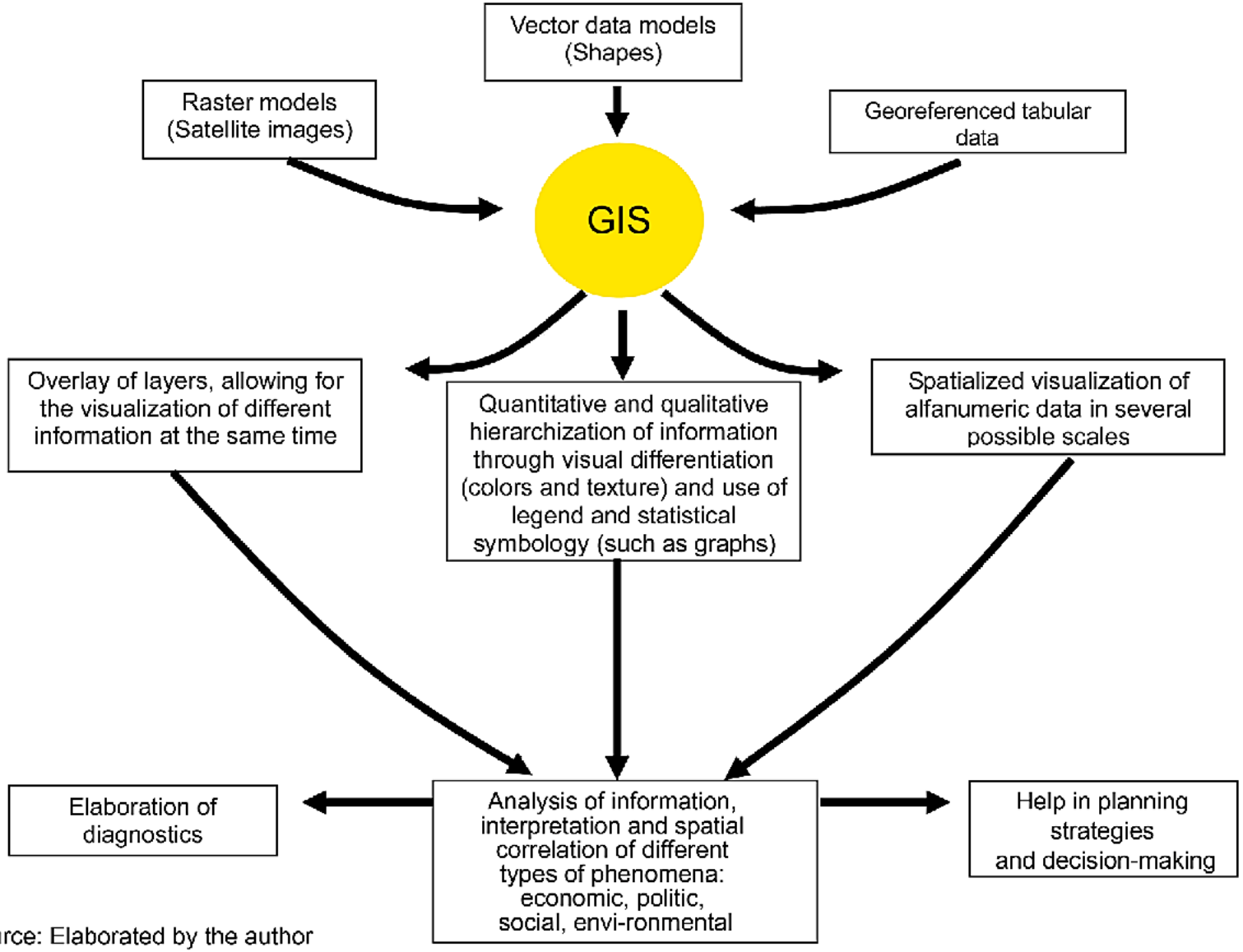
Shortest Route Search



Pipeline Excavation

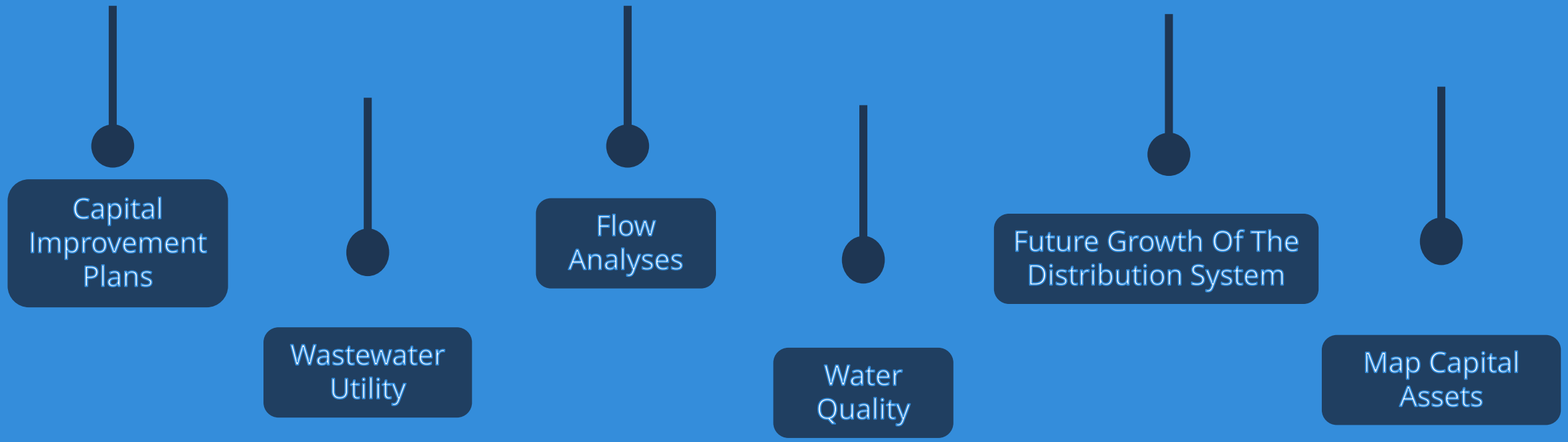
GIS IN WRM

APPLICATION MECHANISM OF GIS IN WRM



Source: Elaborated by the author

GIS Hydro Modeling



It efficiently parameterizes input data of various hydrologic and water quality models to represent spatial and temporal characteristic of factors affecting hydrologic components (surface, subsurface, groundwater, etc.) and pollutant generation (nonpoint pollution) and transport with water via surface or infiltration, thus flowing into streams.

THANK YOU