Water Evaluation And Planning (WEAP)

Model objectives

- WEAP ("Water Evaluation And Planning" system) is a user-friendly software tool that fully integrates water supply, demand, water quality and ecological considerations for water resources planning.
- WEAP is developed by the Stockholm Environment Institute's Boston Center at the Tellus Institute. The Hydrologic Engineering Center of the US Army Corps of Engineers funded significant enhancements.
- WEAP applications generally include several steps.
    - Study definition: The time frame, spatial boundary, system components and configuration of the problem are established.
    - Current accounts: A snapshot of actual water demand, pollution loads, resources and supplies for the system are developed.
    - Scenarios: Alternative sets of future assumptions are developed based on policies, costs and factors that affect demand, pollution, supply and hydrology. Scenarios are constructed consisting of alternative sets of assumptions or policies. (Possible scenario opportunities are presented in the next section.)
    - Evaluation: The scenarios are evaluated with regard to water sufficiency, costs and benefits, compatibility with environmental targets, and sensitivity to uncertainty in key variables.

Main features

- Integrated Approach: Unique approach for conducting integrated water resources planning assessments
- Stakeholder Process: Transparent structure facilitates engagement of diverse stakeholders in an open process
- Water Balance: A database maintains water demand and supply information to drive mass balance model on a link-node architecture
- Simulation Based: Calculates water demand, supply, flows, and storage, and pollution generation, treatment and discharge under varying hydrologic and policy scenarios
- Policy Scenarios: Evaluates a full range of water development and management options, and takes account of multiple and competing uses of water systems
- User-friendly Interface: Graphical drag-and-drop GIS-based interface with flexible model output graphics and tables

Model components

- WEAP is comprehensive, straightforward and easy-to-use, and attempts to assist rather than substitute for the skilled planner.
- WEAP operates in many capacities:
    - Water balance database: WEAP provides a system for maintaining water demand and supply information.
    - Scenario generation tool: WEAP simulates water demand, supply, flows, and storage, and pollution generation, treatment and discharge.
    - Policy analysis tool: WEAP evaluates a full range of water development and management options, and takes account of multiple and competing uses of water systems.
- Scenario analysis is central to WEAP. Scenarios are used to explore the model with an enormous range of "what if" questions, such as:
    - What if population growth and economic development patterns change?
    - What if reservoir operating rules are altered?
    - What if groundwater is more fully exploited?
    - What if water conservation is introduced?
    - What if ecosystem requirements are tightened?
    - What if new sources of water pollution are added?
    - What if a conjunctive use program is established to store excess surface water in underground aquifers?
    - What if a water recycling program is implemented?
    - What if a more efficient irrigation technique is implemented?
    - What if the mix of agricultural crops changes?
    - What if climate change alters demand and supplies?
- WEAP consists of five main views
    - Schematic–GIS tools for configuring your system. Drag and drop to create and position. Add ArcView or other standard GIS vector or raster files as background layers. Instant access to data and results for any node.
    - Data–Model building: create variables and relationships, enter assumptions and projections

using mathematical expressions, and dynamically link to Excel.
    - Results–Detailed and flexible display of all model outputs, both in graphical and tabular form.
    - Overviews–Design a bird's-eye view to highlight key indicators in your system.
    - Notes–Document your data and assumptions.

Model compliance

Technical capabilities

- Highlights of technical capabilities:
    - Integrated water resources planning system
    - GIS-based, graphical drag and drop interface
    - Model-building tool
    - User-created variables and modeling equations
    - Dynamic links to spreadsheets & other models
    - Embedded linear program solves allocation equations
    - Flexible and expandable data structures
    - Powerful reporting system including graphs
    - Context-sensitive help and User Guide
    - Minimal requirements: runs under Windows 95/98/ 2000/NT on a Pentium computer with 32 MB RAM
- Operating on the basic principle of water balance accounting, WEAP is applicable to municipal and agricultural systems, single sub-basins or complex river systems.
- Moreover, WEAP can address a wide range of issues, e.g., sectoral demand analysis, water conservation, water rights and allocation priorities, groundwater and stream flow simulations, reservoir operations, hydropower generation, pollution tracking, ecosystem requirements, and project benefit-cost analyses.
- The analyst represents the system in terms of its various supply sources (e.g., rivers, creeks, groundwater, and reservoirs); withdrawal, transmission and wastewater treatment facilities; ecosystem requirements, water demands and pollution generation.

- The data structure and level of detail may be easily customized to meet the requirements of a particular analysis, and to reflect the limits imposed by restricted data.

User friendliness

- An intuitive GIS-based graphical interface provides a simple yet powerful means for constructing, viewing and modifying the configuration–the user designs a schematic of the water system using the mouse to “drag and drop” system elements, which can all be overlaid on a map built from ArcView and other standard GIS and graphic files.
- Data for any component can be edited directly by clicking it on the schematic.
- With WEAP’s highly flexible and comprehensive reporting system, the user may customize reports by selecting metric or English water units, years and format (e.g., absolute levels, percent shares or growth rates).
- Specific report configurations can be saved as “favorites,” which can be combined into “overviews”–bird’s eye views of key system indicators.
- All tables can be exported directly into Excel. Model calculations run in minutes.
- WEAP is available both in English and in Chinese. (An option on the WEAP menu switches between the two languages.)

Sustainability

- A free copy of WEAP is available for immediate download. It is fully functional except that the "Save Data" feature is disabled. To fully activate your copy of WEAP, a valid License
  is required.

- Free licenses available for not-for-profit organizations in developing countries
- Licensed users are entitled to free upgrades and technical support. If your computer is connected to the internet, WEAP will automatically notify you when upgrades are available.
- Stockholm Environment Institute (SEI-B) offers a range of services to assist you in your use of WEAP, including training, data preparation, collaboration on integrated water planning, and customized WEAP software enhancements.
