Tools, Tips, and Templates for: **Project Design**

The **design phase** of the project is initiated when the project site has been determined and the restoration goals and objectives defined. The design phase will evaluate the potential range of restoration techniques capable of achieving the desired project outcomes. Design options should be continually evaluated against the project goals and objectives.

Goals and Objectives Resources

The tools included here are designed to be detailed and user-friendly. In this toolkit chapter you will find the following resources for the project design process:

- *Toolkit Resource #11*
  Project Design
  Summary Reccommendations
  A summary of key recommendations from Chapter 4 of the *Returning the Tide Guidance Manual,* "Project Design."

- *Toolkit Resource #12*
  Recommended Modeling Inputs
  Hydrologic model development requires site specific data/inputs in order to yield accurate outputs/predictions. This resource outlines the data inputs needed to develop numerical hydrology models for project design.

- *Toolkit Resource #13*
  Additional Design Resources
  A list of resources offering valuable and detailed information on a range of design techniques applicable to site specific conditions.

- **Toolkit Resource #14:**
  Modeling Inventories
  A list of websites providing information on a wide variety of available modeling software.

- **Toolkit Resource #15:**
  Hydrological Model Summary Table
  Web resources for information on a wide variety of available modeling software.

Electronic versions of these resources are available for download at ***http://www.habitat.noaa.gov/partners/toolkits/tidalhydrology.html***

Toolkit Resource #11: **Summary Recommendations**

1. Know your site. Understand important ecological and physical characteristic (historic and current).
2. Develop a site base map as this will aid in design and monitoring.
3. Remember that the optimal design still must be feasible to implement.
4. Give preference to low-maintenance (passive) strategies when possible.
5. Evaluate a range of design strategies and techniques.
6. Consider sea level rise. Strive to restore a mosaic of habitats at elevations that account for sea level rise, where possible.
7. Increase habitat edge where possible (islands, sinusoidal creeks/waterways, etc.).
8. Determine the model needed based on project specifics. Approach modelers for their opinion on best type for your project.

Toolkit Resource #12: **Recommended (Minimum) Modeling Inputs**

Input	Details / Examples
Water pulsing events	• Tidal periodicity (Daily) • Normal storm events (Weekly) • Average river floods (Annual) • Major storms (5 to 10 years) • Major river flooding (50 to 100 years) • River switching (1000 yrs)
Bathymetric data	• Surveys with sufficient data to estimate volumetric capacity • Surveys with sufficient data to identify sites where flow may be altered/interrupted
Topographic data	• Surveys with sufficient data to identify locations of water sources (i.e. creeks) • Surveys with sufficient data to identify areas of flood concern (i.e. infrastructure)
Average conditions	• Rainfall • Evaporation • Runoff
Predicted or relative sea level rise	Account for... • Sea level rise • Subsidence • Levee replacement, etc.

Toolkit Resource #13: **Additional Design Resources**

Resource	Web Address
U.S. Army Corps of Engineers: Tidal Hydraulics: Engineering Manual	*http://www.usace.army.mil/publications/eng-manuals/em1110-2-1607/basdoc.pdf*
U.S. Department of Transportation: Tidal Hydrology, Hydraulics, and Scour at Bridges	*http://www.fhwa.dot.gov/engineering/hydraulics/hydrology/hec25.cfm*
Federal Emergency Management Agency: Coastal Manual	*http://www.fema.gov/rebuild/mat/fema55.shtm*
NOAA Tides and Trends: Sea Levels Online	*http://tidesandcurrents.noaa.gov/sltrends/sltrends.shtml*

Toolkit Resource #14: **Modeling Inventories**

Inventory	Web Address
Hydrology and Statistical Software	*http://www.spatialhydrology.com/software_hydrostat.html*
Scientific Software Group	*http://www.scisoftware.com/*
Boss International	*http://www.bossintl.com/*
Environmental Modeling Systems, Inc.	*http://www.ems-i.com/Software/software.html*
U.S. Geological Survey	*http://water.usgs.gov/nrp/models.html*

Toolkit Resource #15: **Hydrological Model Summary Table**

Software	Description	Output
HEC-RAS	• Performs one-dimensional steady flow, unsteady flow, and sediment transport/mobile bed computations; • Performs water temperature modeling.	Water level Water temperature
HEC-HMS	• Simulates precipitation-runoff processes. • Applies to a wide range of geographic areas. • Ranges in applications from large river basin water supply and flood hydrology to small urban or natural watershed runoff.	Flow
WSP-2	• Computes water surface profiles in open channels. • Estimates head loss at restrictive sections, including roadways with either bridge openings or culverts. • Limits of 15 profiles and 50 cross-sections maximum.	Water level
TR20	• Provides hydrologic analyses of a watershed under present conditions. • Consists of peaks and/or flood hydrographs output. • Uses the unit hydrograph, drainage areas, times of concentration, and SCS runoff curve numbers.	Flow
RMA2	• Consists of two-dimensional, depth averaged, finite element hydrodynamic numerical model. • Computes water surface elevations and horizontal velocity components for subcritical, free-surface flow fields.	Water level
RMA4	• Accommodates all hydrodynamic options available in RMA2 (see above). • Reads RMA2 hydrodynamic solution and a TABS geometry as input. • Calculates advective diffusion equations.	Constituent Transport
HEC-6	• Calculates water surface and sediment bed surface profiles. • Computes interaction between sediment material in the streambed and the flowing water-sediment mixture.	Sediment (concentration)
SED2D	• Computes sediment loadings and bed elevation changes. • Uses hydrodynamic solution computed by RMA2 (See above).	Sediment (concentration)