Utah Lake
Nutrient Model Selection

Nicholas von Stackelberg, P.E.
Utah Lake Modeling Group Meeting
October 4, 2016

UTAH DEPARTMENT *of* ENVIRONMENTAL QUALITY

WATER QUALITY

Model Selection Overview

1. Model selection presentations in summer and fall 2015
2. Draft Utah Lake Nutrient Model Selection Report circulated for comment in Dec 2015
3. Utah Lake Modeling Group meeting in Feb 2016
4. Final Utah Lake Nutrient Model Selection Report issued July 2016

ENVIRONMENTAL QUALITY
WATER QUALITY

Recommended Model

- Coupled hydrodynamic and water quality model
  - Hydrodynamic model: EFDC
  - Water quality model: WASP
- Link water quality model to ecological response endpoints

EFDC (Environmental Fluid Dynamic Code)

➤ EPA supported public domain software

➤ 3-D hydrodynamic model

➤ Widely applied to rivers, lakes, reservoirs, wetlands, estuaries, and coastal ocean regions

➤ Physical characteristics of the waterbody

- Horizontal grid: curvilinear-orthogonal
- Vertical grid: sigma terrain following

➤ Solves transport equations for salinity, temperature, suspended cohesive and non-cohesive sediment, dissolved and adsorbed contaminants, and a dye tracer

➤ Simulates drying and wetting in shallow areas, representation of hydraulic control structures, and vegetative resistance

ENVIRONMENTAL QUALITY
WATER QUALITY

EFDC Sediment Transport

➢ Simulates wind-induced currents and wave effects on lakebed shear stress either internally or through externally linked model

➢ Simulates multiple size classes of cohesive and noncohesive sediment

➢ Sediment processes function library has a wide range of accepted parameterizations for settling, deposition, resuspension and bed load transport

➢ Sediment bed is represented by multiple layers that includes a number of armoring representations for noncohesive sediment

➢ Dynamic prediction of bed layer thickness, void ratio and pore water advection

➢ The sediment transport component can operate in a morphological mode with full coupling with the hydrodynamic component to represent dynamic evolution of bed topography

ENVIRONMENTAL QUALITY
WATER QUALITY

WASP (Water Quality Simulation Program)

➢ EPA supported public domain software

➢ Widely applied to TMDLs & Numeric Nutrient Criteria (NNC)

➢ Capabilities of Version 8:

- DO, pH, temperature
- TN, TP
- Phytoplankton (up to 5 groups)
- Benthic algae (up to 3 groups)
- Zooplankton
- Macrophytes
- Sediment diagenesis

➢ Limitations:

- No macroinvertebrates/fish
- Simplified P sorption dynamics to sediment

ENVIRONMENTAL QUALITY
WATER QUALITY

Modeling Approach

- ➢ Model build and calibration to be completed by University of Utah funded through grant from EPA Office of Research and Development
  - • Coordination with EPA Region 8 and DWQ through MOU
  - • DWQ participation on modeling team
- ➢ Model application to numeric nutrient criteria and WLA/TMDL by DWQ
- ➢ Food web model: to be determined
  - • Macroinvertebrates and fish
  - • JRFBWQC lead developer?

ENVIRONMENTAL
QUALITY
WATER QUALITY

Discussion

<u>Utah Lake Nutrient Model</u>

Nicholas von Stackelberg, P.E.

(801) 536-4374

nvonstackelberg@utah.gov