TMDL Overview

Lake Tahoe TMDL Symposium

Presented by:
Dave Roberts
Lahontan RWQCB
Presentation Overview

- Provide overview of TMDL program
- Introduce the TMDL development phases
- Discuss the use of Clarity Model for development of load reduction strategies
- Discuss the use of planning tools and their potential use in Implementation and Allocation Planning
TMDL Background

Total Maximum Daily Load = Water Quality Restoration Plan

✓ Mandated by Federal Clean Water Act since 1972
✓ Section 303(d) of the CWA requires states to identify and list impaired surface waters
Parts of a TMDL

- Problem Statement
- Numeric Target
- Source Analysis
- Linkage Analysis
- Margin of Safety
- Pollutant Load Allocations
- Implementation Plan (CA)
- Monitoring Plan
TMDL Development Phases

Phase I
Product: Technical TMDL
- Determines Current Loading
- Determines Basin-wide Load Reduction Needs

Phase II
Product: Final TMDL
- Identify Load Reduction Possibilities
- Allocates Pollutant Load Reductions
- Implementation Plan
- TMDL Implementation Tool Box

Phase III
Product: Implementation and Monitoring
- Basin-wide Management System
- Adaptive Management System
PHASE I

Established Water Quality Standards
Determine Source Loading
Perform Linkage Analysis
Determine Assimilative Capacity
Develop Technical TMDL

PHASE II

Initiate Phase II Projects (Tool Box)
Develop Load Reduction Distributions
Select Load Reduction Distribution
Develop Implementation Plan
ID Measurable Indicators
Develop Monitoring Plan

PHASE III

Develop Final TMDL
Approval
Implementation, Monitoring & Refinement
Established Water Quality Objectives

**Lahontan**
Secchi disk transparency shall not be decreased below the levels recorded in 1967-71
= 30 meters (~ 97 ft.)

**TRPA**
Winter (December-March) mean Secchi disk transparency: 33.4m. (~ 110 ft.)

**NDEP/Lahontan**
The vertical extinction coefficient must be less than 0.08 per meter when measured at any depth below the first meter
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PHASE III
Major Source Categories

Atmospheric
• By primary source
• In-basin vs. out-of-basin

Upland
• Urban - commercial, residential, transportation, recreation
• Forested - undisturbed, roads/trail, fire, ski areas, management action

Groundwater

Stream Channel Erosion
• Load predictions from all 63 tributaries

* Fine Particle loadings for all sources types
Linkage Models

Atmospheric
- UCD - MM5 historic climate reconstruction

Upland
- Tetra Tech - LSPC (Hydrology and Loading)
- Hydroikos - Statistical Modeling
- Geosyntec - SWMM (Pilot BMP modeling)

Groundwater
- USACE - groundwater loading model

Stream Channel Erosion
- National Sedimentation Laboratory - CONCEPTS/AnnAGNPS

Lake Response
- UCD - Lake Tahoe Clarity Model (hydrodynamics, water quality, optical properties)
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PHASE I

PHASE II

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Assimilative Capacity

The amount of a contaminant load that can be discharged to a specific water body without exceeding water quality standards.
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Technical TMDL

Primary Products:

1) Accurate estimation of current loading

2) Assimilative capacity = TMDL

3) Basis for establishing load reduction allocations and implementation planning

4) Provides range of constituent load reductions for achieving desired clarity
Conceptual Load Reduction Model

Parameters are for illustrative purposes only
Conceptual Clarity Improvement Curves

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# Example Load Reduction Matrix

<table>
<thead>
<tr>
<th>Load Reduction Opportunities</th>
<th>Effectiveness</th>
<th>Cost</th>
<th>Constraints</th>
<th>Etc.</th>
<th>Estimated Load Reduction</th>
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</thead>
<tbody>
<tr>
<td><strong>URBAN</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
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<tr>
<td>U-1 Infiltration</td>
<td>4</td>
<td>$</td>
<td>2</td>
<td>tbd</td>
<td>xx kg/yr</td>
</tr>
<tr>
<td>U-2 Wetland Treatment</td>
<td>7</td>
<td>$$$</td>
<td>7</td>
<td>tbd</td>
<td>xx kg/yr</td>
</tr>
<tr>
<td>U-3 Source Control</td>
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<td>1</td>
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</tr>
<tr>
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<td>$$$</td>
<td>8</td>
<td>tbd</td>
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</tr>
<tr>
<td><strong>ATMOSPHERIC</strong></td>
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<td></td>
<td></td>
</tr>
<tr>
<td>A-1 Vehicle Emission Control</td>
<td>4</td>
<td>$$</td>
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</tr>
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<td>3</td>
<td>tbd</td>
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</tr>
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<td>tbd</td>
<td>xx kg/yr</td>
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<tr>
<td><strong>STREAM CHANNELS</strong></td>
<td></td>
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<td></td>
<td></td>
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<tr>
<td>ST-1 Stream Restoration</td>
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</tr>
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<td><strong>GROUND WATER</strong></td>
<td></td>
<td></td>
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<tr>
<td>GW-1 Fertilizer Management</td>
<td>3</td>
<td>$$</td>
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<td>tbd</td>
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<tr>
<td><strong>FORESTED AREAS</strong></td>
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<tr>
<td>FA-1 Road Management</td>
<td>6</td>
<td>$$$</td>
<td>6</td>
<td>tbd</td>
<td>xx kg/yr</td>
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<td>FA-2 Trail Management</td>
<td>5</td>
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<td>4</td>
<td>tbd</td>
<td>xx kg/yr</td>
</tr>
</tbody>
</table>

**Total Possible Load Reduction** | xx kg/yr

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PHASE II

Approve

Implementation, Monitoring & Refinement

PHASE III
# Watershed Model
## Land-use Classifications

<table>
<thead>
<tr>
<th>Land Use Description</th>
<th>Pervious/Impervious</th>
<th>Subcategory Name</th>
<th>Number</th>
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</thead>
<tbody>
<tr>
<td>Water Body</td>
<td>Impervious</td>
<td>Water Body</td>
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<tr>
<td></td>
<td>Pervious</td>
<td>Residential_SFP</td>
<td>2</td>
</tr>
<tr>
<td>Single Family Residential</td>
<td>Impervious</td>
<td>Residential_SFI</td>
<td>3</td>
</tr>
<tr>
<td></td>
<td>Pervious</td>
<td>Residential_MFI</td>
<td>4</td>
</tr>
<tr>
<td>Multi Family Residential</td>
<td>Impervious</td>
<td>CICU-Pervious</td>
<td>5</td>
</tr>
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<td></td>
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<tr>
<td></td>
<td></td>
<td>Roads_Secondary</td>
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<td></td>
<td></td>
<td>Roads_Unpaved</td>
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<tr>
<td></td>
<td>Pervious</td>
<td>Ski_Areas-Pervious</td>
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<tr>
<td>Transportation</td>
<td>Pervious</td>
<td>Veg_Unimpacted</td>
<td>11</td>
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<tr>
<td></td>
<td></td>
<td>Veg_Recreational</td>
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<td></td>
<td>Veg_Burned</td>
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<td></td>
<td></td>
<td>Veg_Harvest</td>
<td>13</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Veg_Turf</td>
<td>14</td>
</tr>
<tr>
<td>Vegetated</td>
<td></td>
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Example Load Reduction Distributions

A
Urban (34%): U-2, U-6, U-14, U-26, U-56, U-78
Atmospheric (12%): A-3, A-7, A19, A43
Stream Channels (20%): ST-10, ST-34, ST-43
Ground Water (12%): GW-2, GW-4, GW-18
Forested Areas (22%): FA-11, FA-23, FA-25
TOTAL REDUCTION = 15,000 kg tbd/yr

B
Urban (20%)
Atmospheric (25%)
Stream Channels (25%)
Ground Water (15%)
Forested Areas (15%)
TOTAL REDUCTION = 15,000 kg tbd/yr

C
Urban (20%)
Atmospheric (15%)
Stream Channels (30%)
Ground Water (25%)
Forested Area (15%)
TOTAL REDUCTION = 15,000 kg tbd/yr

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Select Distribution

- ATMOSPHERIC
- STREAM CHANNELS
- GROUND WATER
- FORESTED AREAS

- Decision Support System
- Adaptive Management Framework
- Agency/Legal Constraints
- Stakeholder Input

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PATHWAY 2007
A VISION FOR TAHOE'S FUTURE
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Indicators, Milestones and Objectives

Indicators
• Provide short-term measurable indicators of progress
• I.e. BMP performance, project load reductions

Milestones
• Sets measurable performance goals at predetermined time intervals
• Developed with linkage models
• I.e. Two/Five/Ten year load reduction goals, number of BMPs installed, funding goals

Objectives
• Long-term water quality goals
• Attainment of water quality goals and thresholds
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Monitoring Plan

1) Identify appropriate indicators and milestones

2) Track source load reductions, indicators and milestones over time

3) Account for variability

4) Account for resource availability

5) Integrative measures
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Implementation, Monitoring & Refinement
Implementation Plan

Indicators
- Source Load Reduction Indicators
- Management Indicators

Milestones
- Total Load Reduction Milestones
- Management Milestones

Water Body Indicators & Milestones

Performance Evaluation Protocol

Science
- Review Model Assumptions
- Update Model Based on New Science
- Modeling Adjustments
  - (e.g. expectations based on scientific predictions may be incomplete)

Implementation
- Insufficient Number of Projects
- Effectiveness Less than Needed
- Reduction Strategy Unrealistic
- Regulation Ineffective
  - (e.g. restoration efforts not meeting expectation)

Management
- Insufficient Funding
- Administrative/Management Support
- Agency Cooperation
  - (e.g. modify implementation plan)

Annual Secchi Objective

Has desired clarity been achieved?
- YES

Clarity measurement as predicted?
- YES

Are milestones and indicators being achieved?
- YES

- NO
Lake Tahoe TMDL Timeline

- **Initiate Research Plan**
  - September 2001 - March 2002

- **Research & Data Collection**
  - March 2002 - December 2004

- **Technical TMDL Development**
  - August 2002 - April 2005

- **Technical TMDL**
  - Summer 2005

- **Implementation Planning**
  - October 2003 - 2006

- **Policy Development**
  - 2005 & 2006

- **Final TMDL to Regional Board**
  - Summer 2007