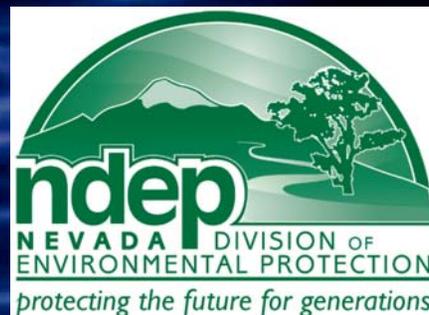


What are the options for reducing pollutant inputs to Lake Tahoe?

Pollutant Reduction Opportunities



Questions Addressed

What are the options for reducing pollutant inputs to Lake Tahoe?

Review Pollutant Reduction Opportunity analysis approach

Highlight PRO project findings

Discuss planning level implementation recommendations and overall recommended strategy

Pollution Reduction Opportunity Project

**Primary Objective:
Quantify potential pollutant
load reduction opportunities**



What are the options for reducing pollutant inputs to Lake Tahoe?

Analysis Opportunities

Quantify potential basin wide solutions

Assess cumulative benefits and relative costs

Establish basin wide assessment methods

Provide foundation for implementation planning



What are the options for reducing pollutant inputs to Lake Tahoe?

Analysis Limitations

Analysis not applicable to project scale

Limited to quantifiable actions

Emphasis on water quality

Limited time, resources, and effectiveness data



What are the options for reducing pollutant inputs to Lake Tahoe?

Project Team

Source Category Groups

Atmospheric Deposition

Urban Runoff and Groundwater

Forest Runoff

Stream Channel Erosion

Source Category Integration Committee

Technical Reviewers

Focus Team

What are the options for reducing pollutant inputs to Lake Tahoe?

Pollutant Reduction Opportunity Development Process

Step 1: Pollutant control option selection and screening

Step 2: Site scale analysis

Treatment Tiers

Step 3: Basin-wide extrapolation

Pollutant reduction estimates

Cost

What are the options for reducing pollutant inputs to Lake Tahoe?

Atmospheric Deposition Primary Pollutant Sources

Mobile Emissions (Nitrogen)

Dust (Fine Sediment)



What are the options for reducing pollutant inputs to Lake Tahoe?

Atmospheric Deposition Pollutant Control Opportunities

Emissions – control Nitrogen
Reduce VMT: incentives
and transit

Dust control – reduce Fine Sediment
Efficient roadway sweeping
Switch to deicers
Pave or gravel unpaved surfaces



What are the options for reducing pollutant inputs to Lake Tahoe?

Forest Upland Primary Pollutant Sources

Unpaved roads

Disturbed areas

Forest management



What are the options for reducing pollutant inputs to Lake Tahoe?

Forest Upland Pollutant Control Opportunities

Unpaved roadway BMPs

Mulch/till recreation areas

Restore legacy roads and trails

Advance BMPs for forest management work



What are the options for reducing pollutant inputs to Lake Tahoe?

Urban & Groundwater Primary Pollutant Sources

Impervious surface runoff

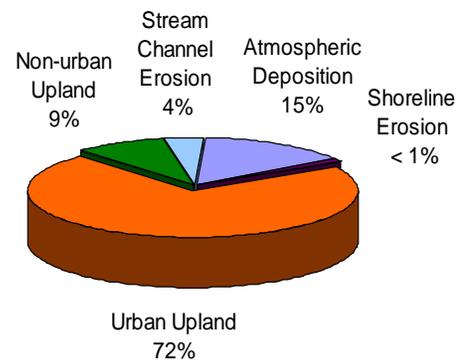
Erosion

Traction abrasives

Fertilizers



**Fine Sediment Particle Number Estimates
(particles less than 20 micrometers):
Percent Contribution per Source Category**



What are the options for reducing pollutant inputs to Lake Tahoe?

Urban & Groundwater Pollutant Control Opportunities

Source control methods

Remove impervious cover

Runoff infiltration

Storm water treatment

Fertilizer management



What are the options for reducing pollutant inputs to Lake Tahoe?

Stream Channel Erosion Primary Sources

Emphasis on bank erosion only

Upper Truckee River

Ward Creek

Blackwood Creek



What are the options for reducing pollutant inputs to Lake Tahoe?

Stream Channel Erosion Pollutant Control Opportunities

Full unconstrained restoration

Targeted bank and bed protection

A mix to restoration and bank protection



What are the options for reducing pollutant inputs to Lake Tahoe?

Pollutant Reduction Opportunity Project Summary

Analysis represents average load reductions and costs

Basin wide estimates offer relative benefit comparisons

Urban Uplands and Atmospheric controls appear to be largest opportunity

Forest practices and stream restoration efforts remain important treatments

What are the options for reducing pollutant inputs to Lake Tahoe?

Implementation Scenarios

Source Category Group load and cost estimates are the foundation of basin-wide implementation options

Three different implementation “scenarios” were developed and presented to Focus Teams and the Pathway Forum

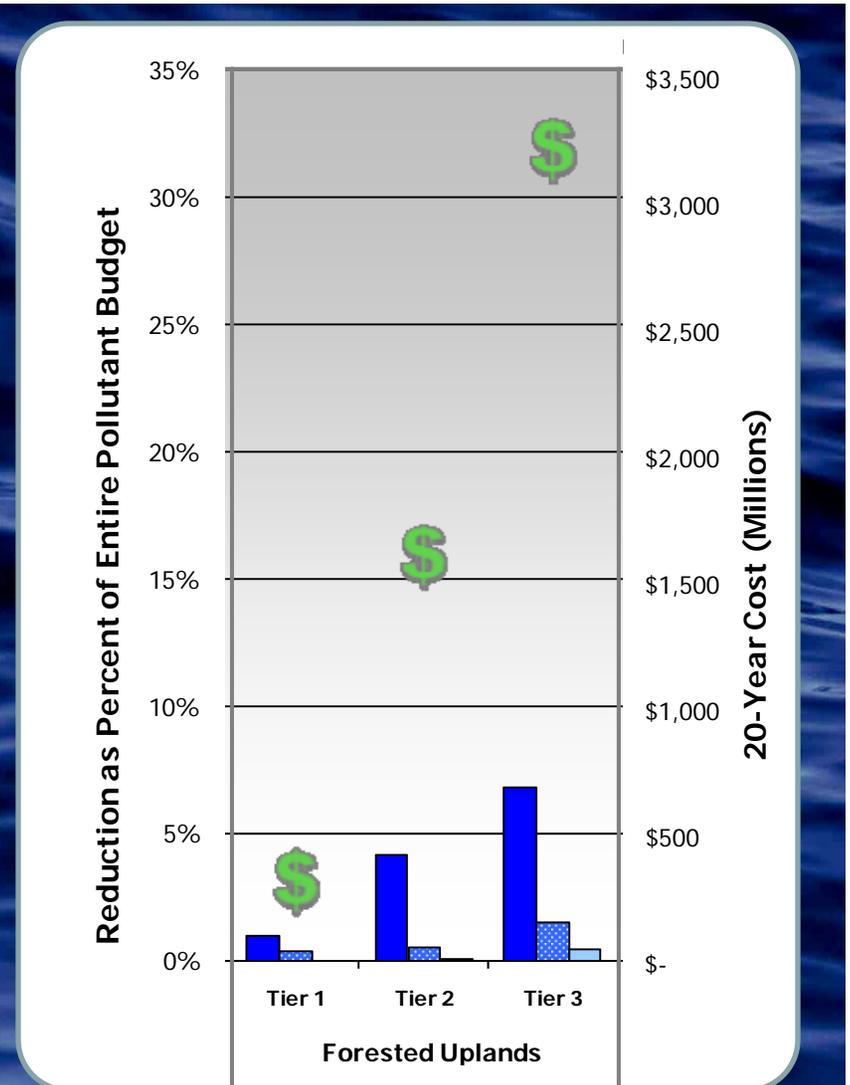
Focus Team and Forum feedback helped narrow the options to a single basin-wide recommended strategy

Forest Upland Implementation

Load reduction opportunities are relatively limited

Additional reduction efforts do not appear cost effective

Current practices effectively reduce loads



What strategy should we implement to reduce pollutant inputs to Lake Tahoe?

Forest Upland Implementation Recommendation

Restore/maintain roads as planned

Revegetate/treat disturbed lands

Treat forest soils

Achieve ~1% reduction in total fine particle budget

**Estimated Cost: \$120M Capital,
\$4.5M Annual O&M**



What strategy should we implement to reduce pollutant inputs to Lake Tahoe?

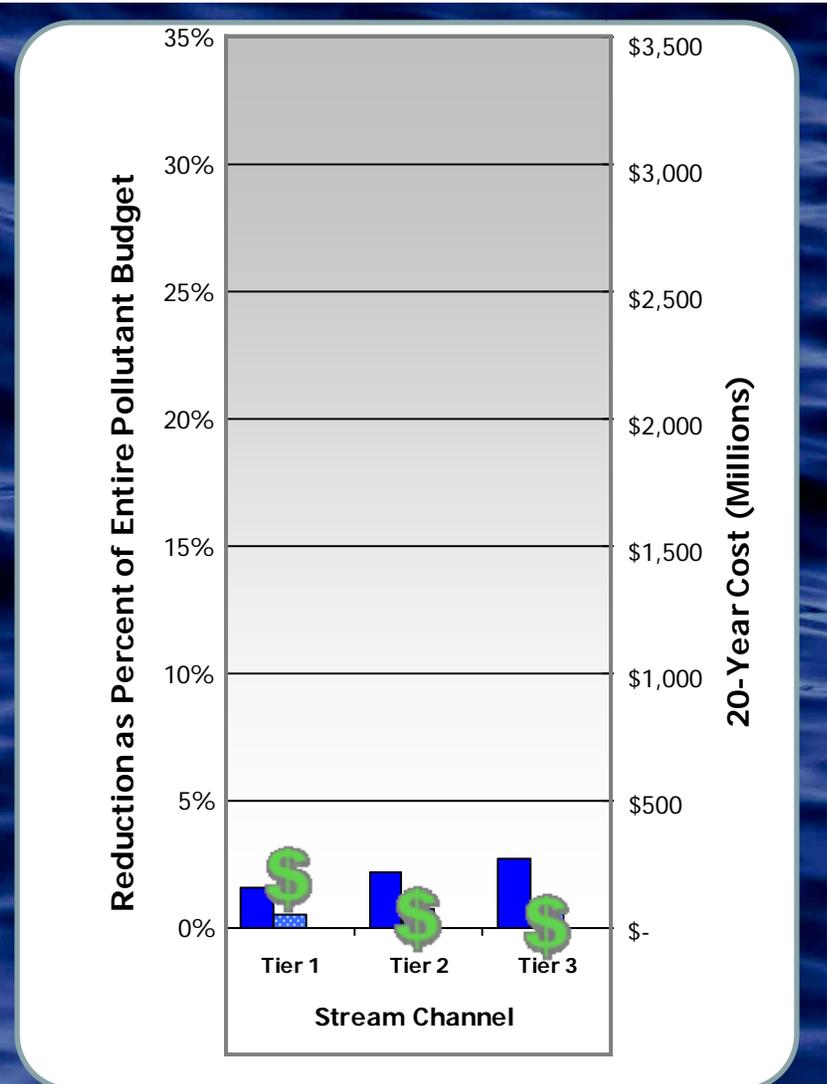
Stream Channel Restoration

In-channel sources are small

Restoration is cost effective

Restoration offers multiple benefits

Restoration likely provides additional water quality benefits



What strategy should we implement to reduce pollutant inputs to Lake Tahoe?

Stream Channel Restoration Recommendation



Continue current restoration activities

Support monitoring and research

Achieve ~2% reduction in total fine particle budget

Estimated Cost: \$40M Capital

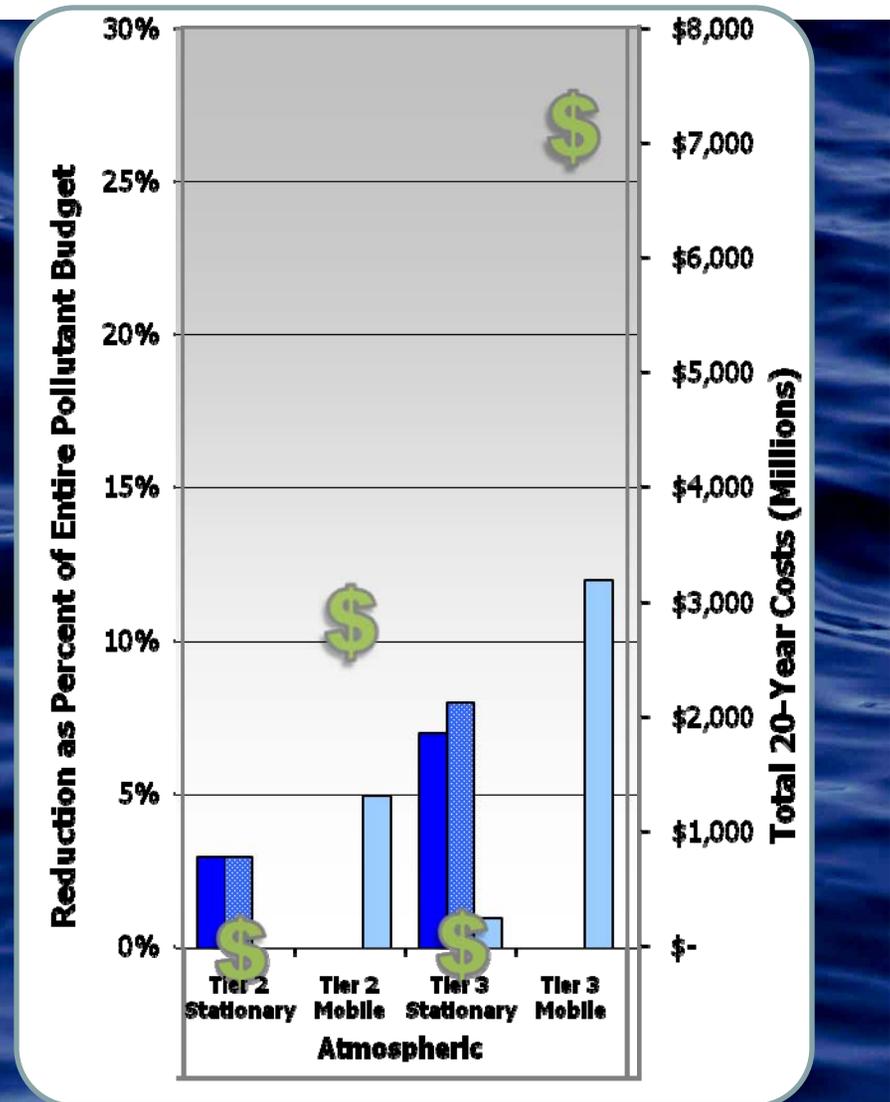
What strategy should we implement to reduce pollutant inputs to Lake Tahoe?

Atmospheric Deposition Implementation

Addressing mobile sources does not significantly reduce particle loads

Mobile source controls are expensive

Good opportunity to reduce particle loads by targeting dust sources



What are the options for reducing pollutant inputs to Lake Tahoe?

Atmospheric Deposition Recommendation

Focus on dust control measures

Continue VMT reduction efforts

**Achieve ~5% reduction in total
fine particle budget**

**Estimated Cost: \$45M Capital,
\$0.4M Annual O&M**



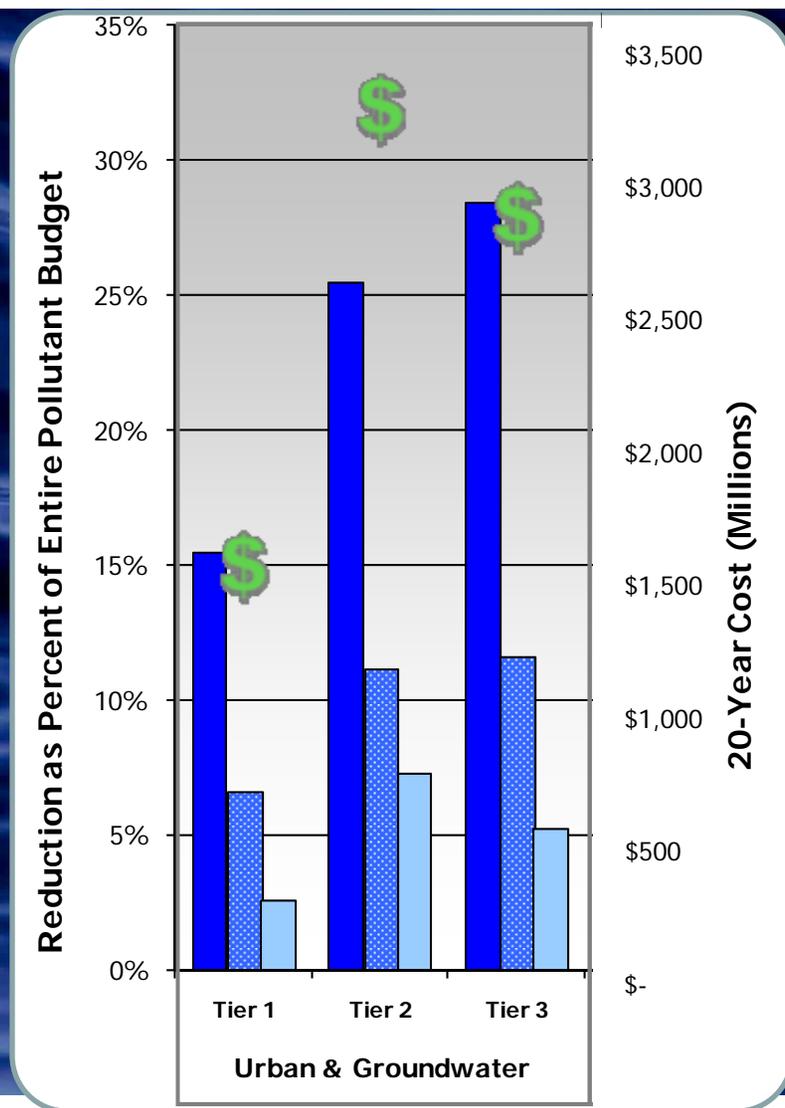
What strategy should we implement to reduce pollutant inputs to Lake Tahoe?

Urban Runoff and Groundwater Implementation

**Significant particle reductions
can be achieved through
innovative practices**

**Pump and treat technologies
hold promise**

**Finer scale planning is needed
to refine implementation
approach**



What are the options for reducing pollutant inputs to Lake Tahoe?

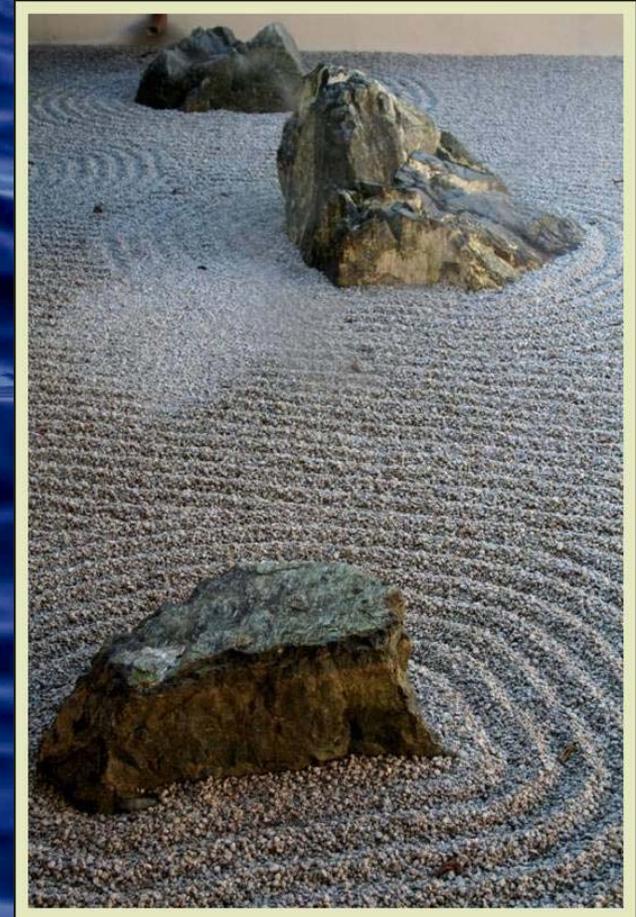
Urban Runoff and Groundwater Recommendation

Continue to implement known technologies

Move toward more innovative practices and intensive operations and maintenance

Achieve ~25% reduction in total fine particle budget

**Estimated Cost: \$1.3B Capital,
\$6M Annual O&M**



What strategy should we implement to reduce pollutant inputs to Lake Tahoe?

Recommended Strategy Summary

Options to meet clarity challenge are few

Implementation approach emphasizes cost effective measures to reduce atmospheric dust sources

Innovative measures will be needed to achieve necessary particle load reductions from urban areas

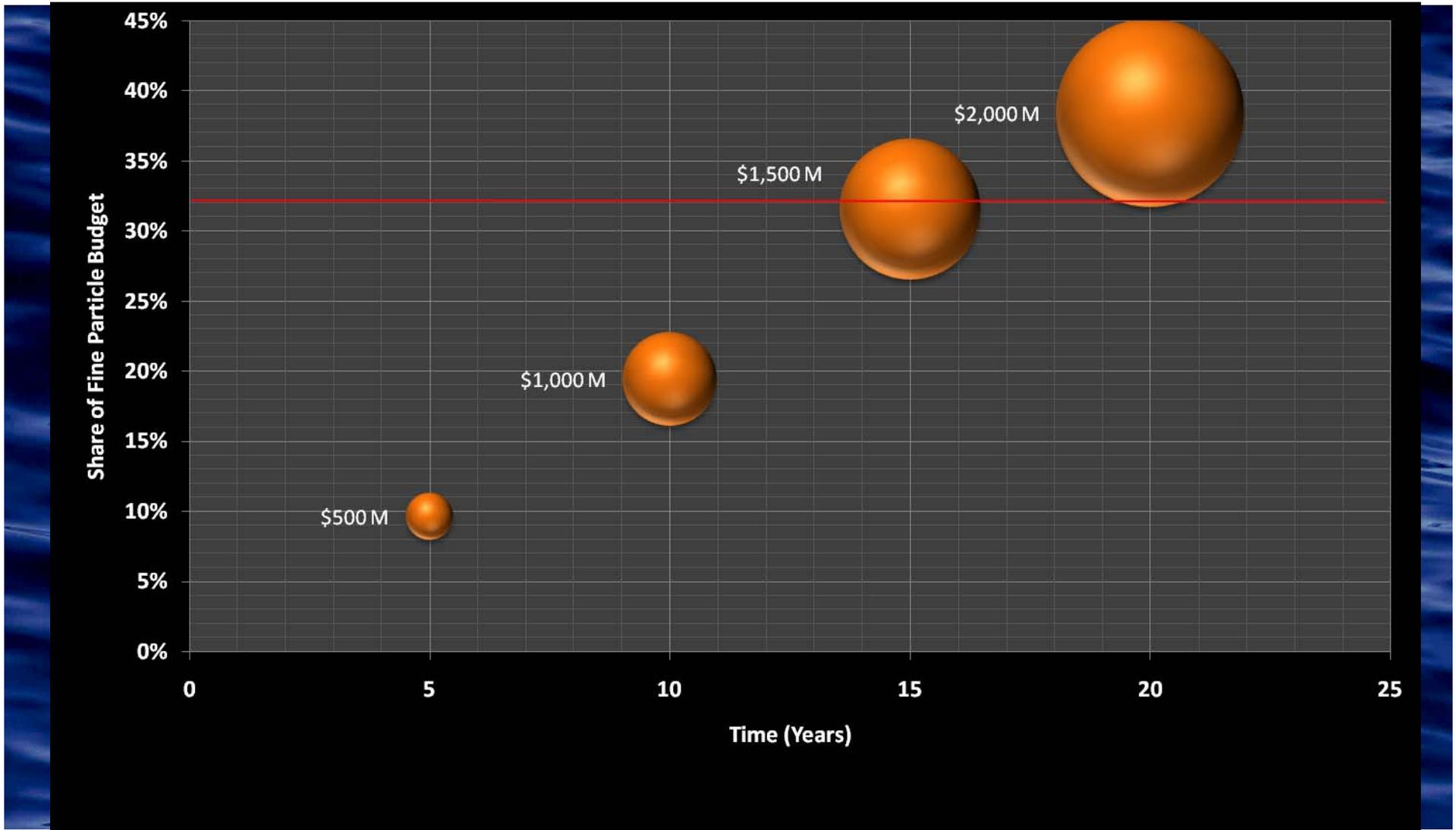
Finer scale jurisdiction and/or subwatershed planning is needed to refine actual implementation options and expected load reductions

Charting a course to _____



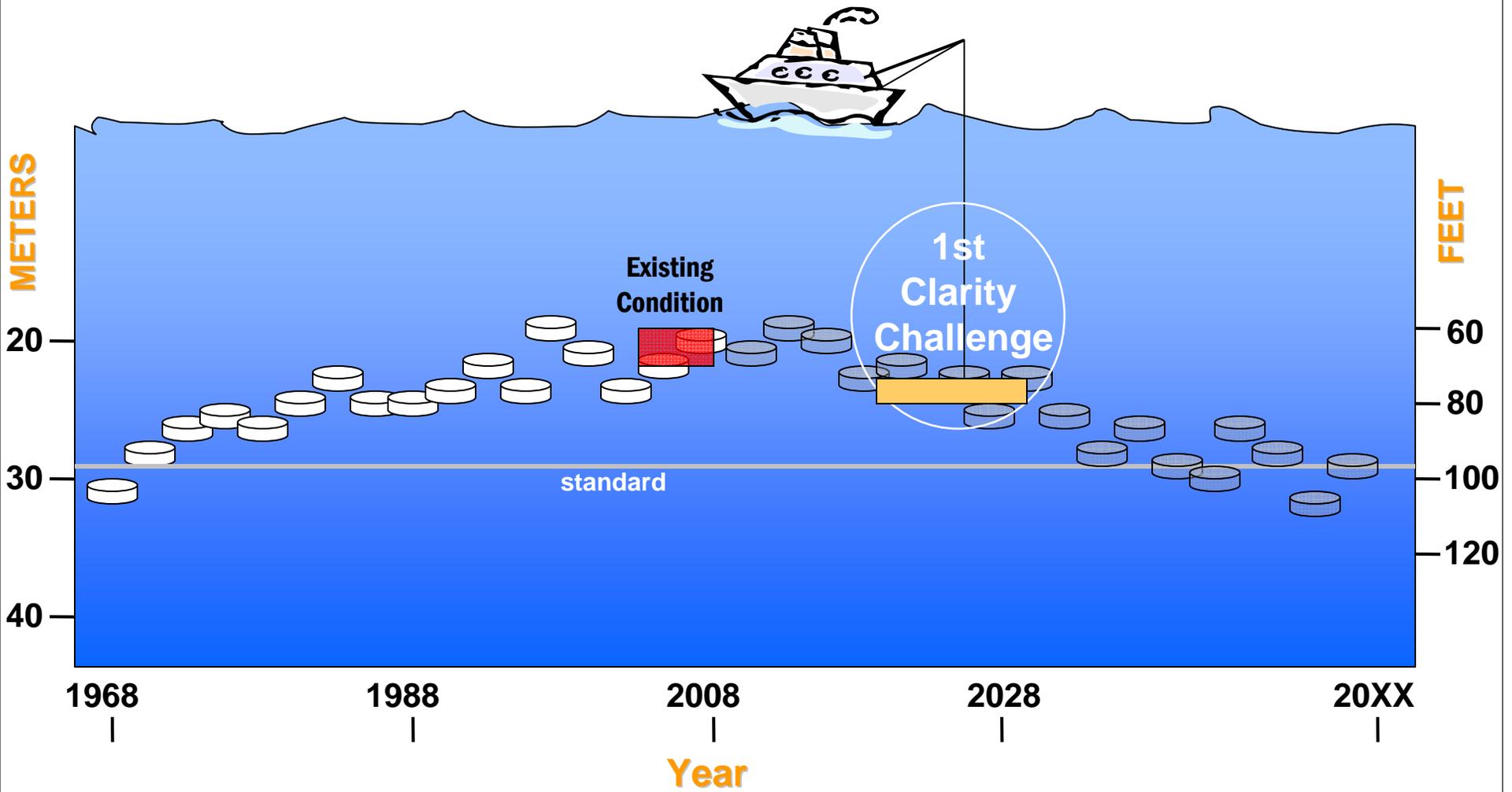
_____ **Clarity** ²⁷

Time Sequence - Move Forward & Innovate



What strategy should we implement to reduce pollutant inputs to Lake Tahoe?

The Clarity Challenge: Reverse clarity decline and measurably improve clarity



Treatment Tiers

Represent different levels of effort and cost

3 tiers for each source category

Each tier is unique

Several exceptions

What strategy should we implement to reduce pollutant inputs to Lake Tahoe?

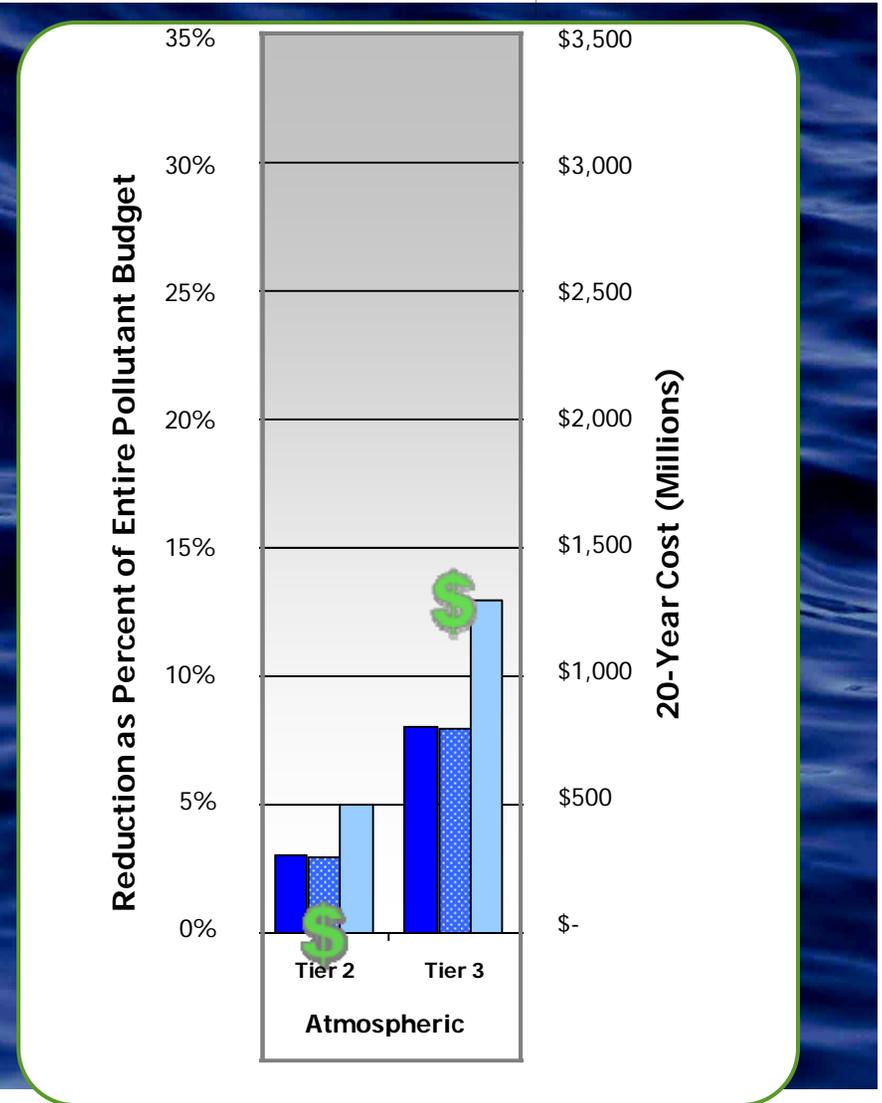
Tiers : Atmospheric Deposition

Tier 1: baseline – no reduction calculated

Tier 2: reduce Vehicle Miles Traveled (VMT) by 10%

Tier 3: reduce VMT by 25% and increase stationary source controls

Cost offsets



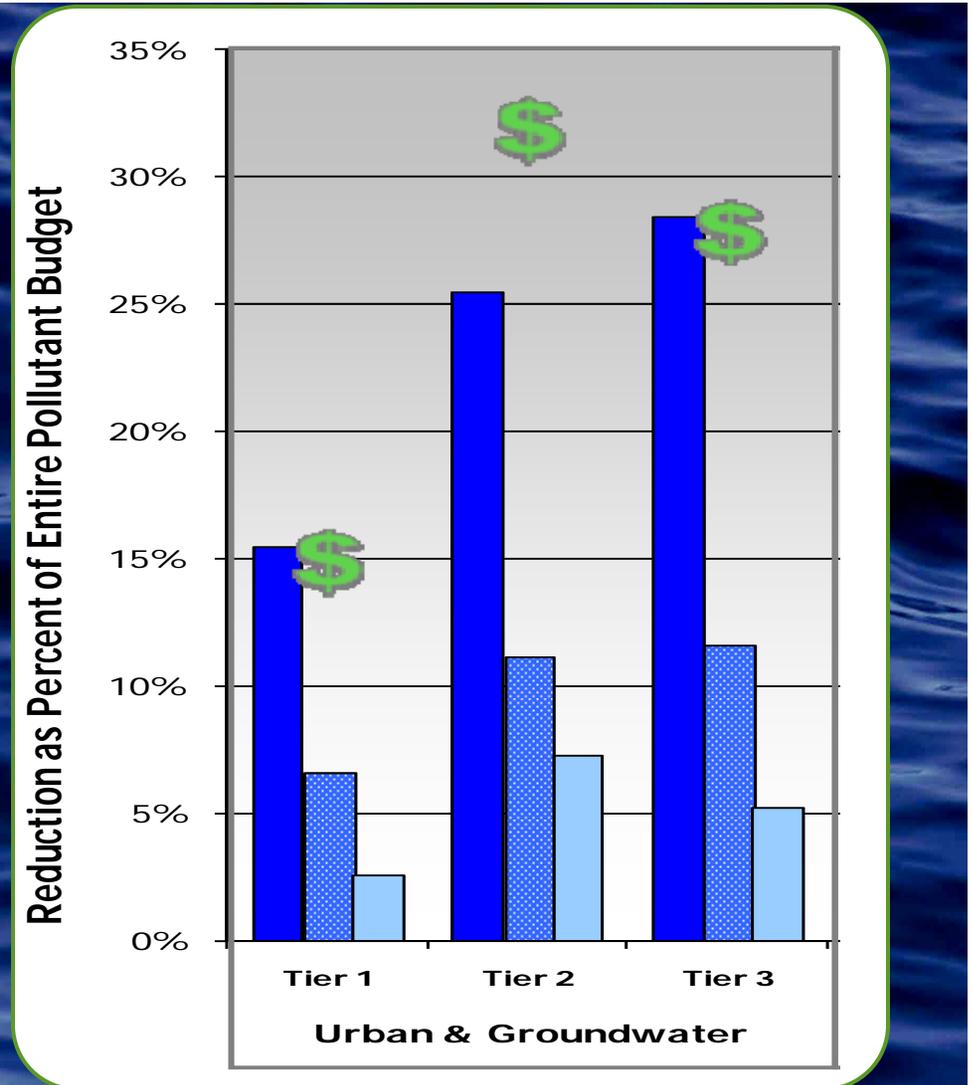
What strategy should we implement to reduce pollutant inputs to Lake Tahoe?

Tiers : Urban runoff and groundwater

Tier 1: enhanced version of the EIP

Tier 2: advanced practices, applied more aggressively in a project area

Tier 3: Pump and treat system complemented by advanced practices



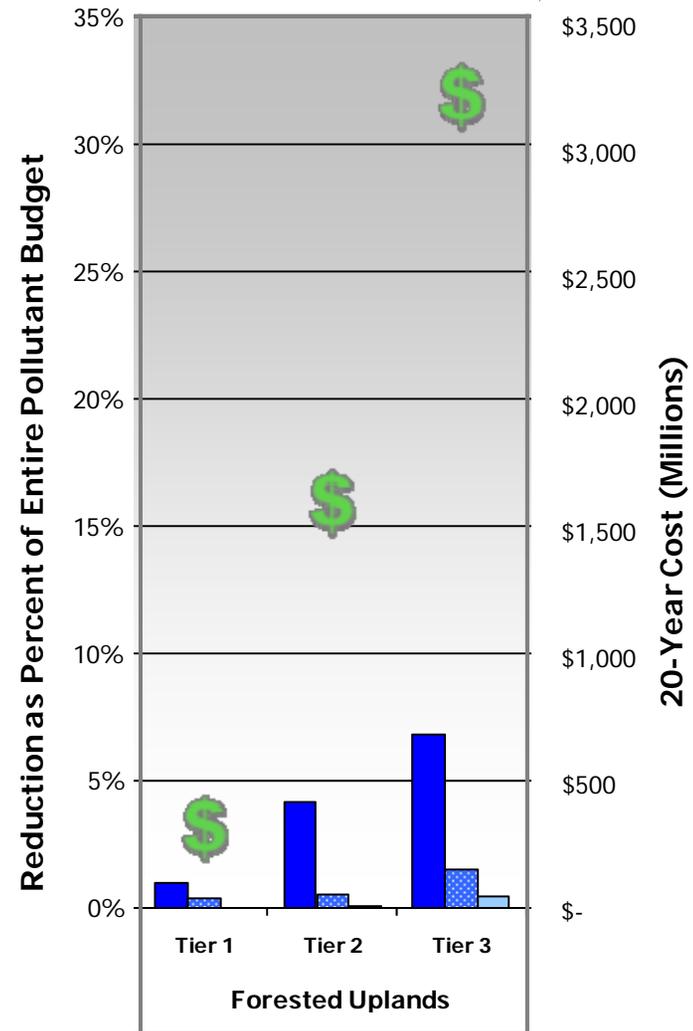
What strategy should we implement to reduce pollutant inputs to Lake Tahoe?

Tiers : Forest runoff

Tier 1: surface treatments and (currently) required management practices

Tier 2: mulch treatments and full management practices

Tier 3: tilling and full restoration to “native” conditions



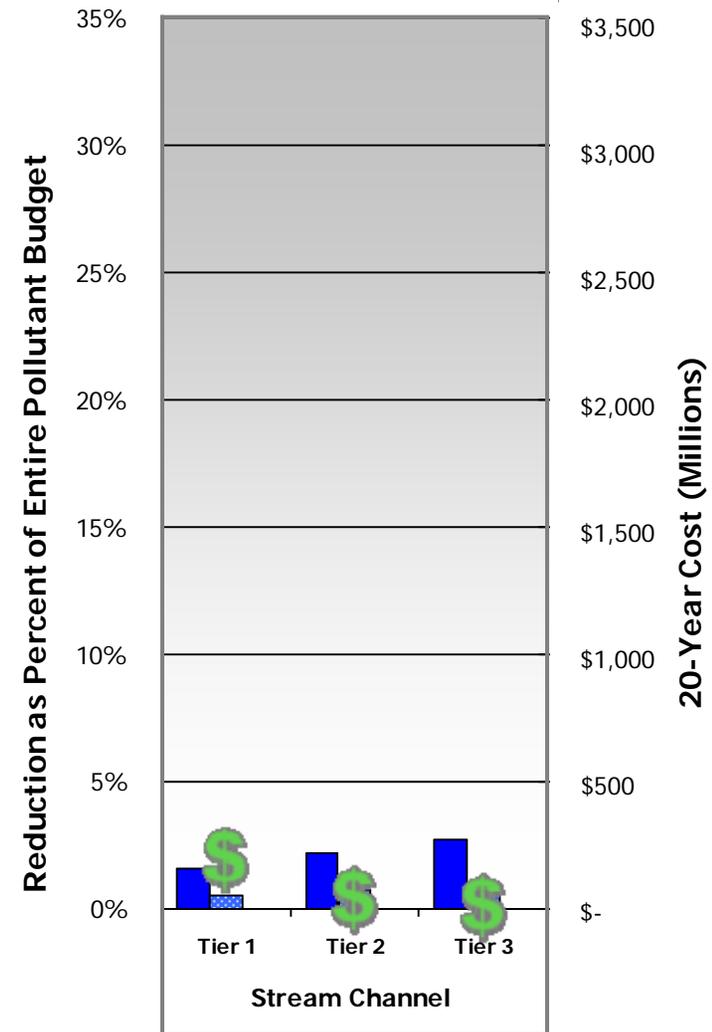
What strategy should we implement to reduce pollutant inputs to Lake Tahoe?

Tiers : Stream channel erosion

**Tier 1: full restoration
unconstrained**

**Tier 2: mix of restoration
and stabilization,
constraints considered**

**Tier 3: bank stabilization,
no floodplain reconnection**

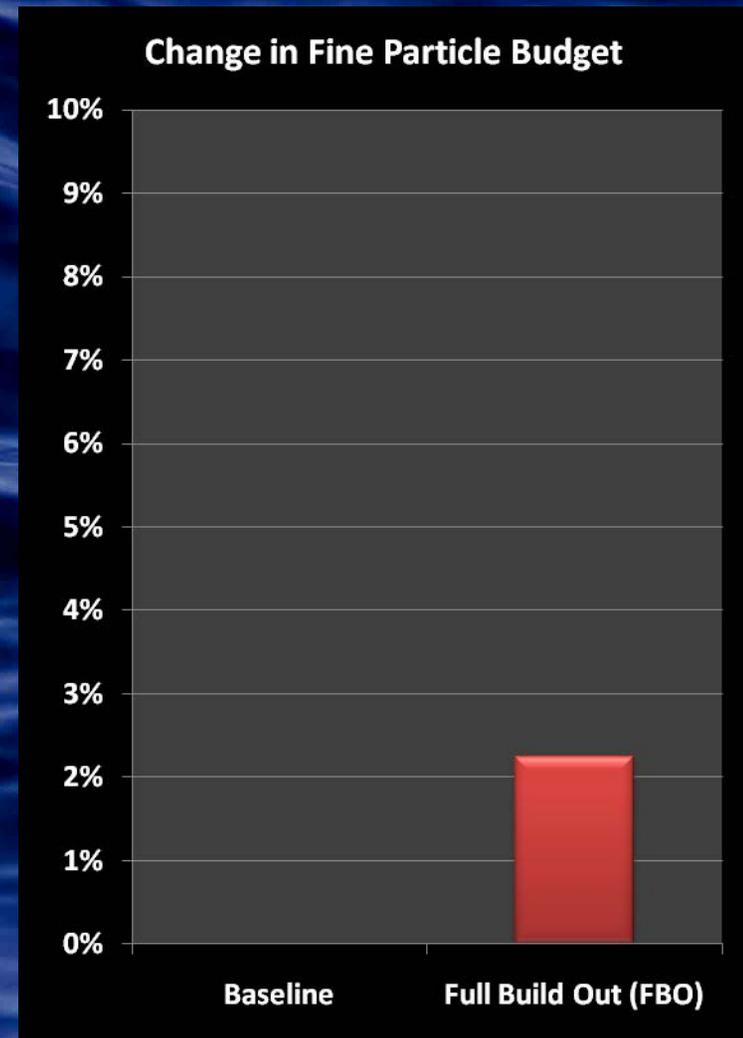


What strategy should we implement to reduce pollutant inputs to Lake Tahoe?

What about impervious coverage?

Approx. 2% increase in particle loading at full build out under current rules

Development under current regulations helps control pollutants

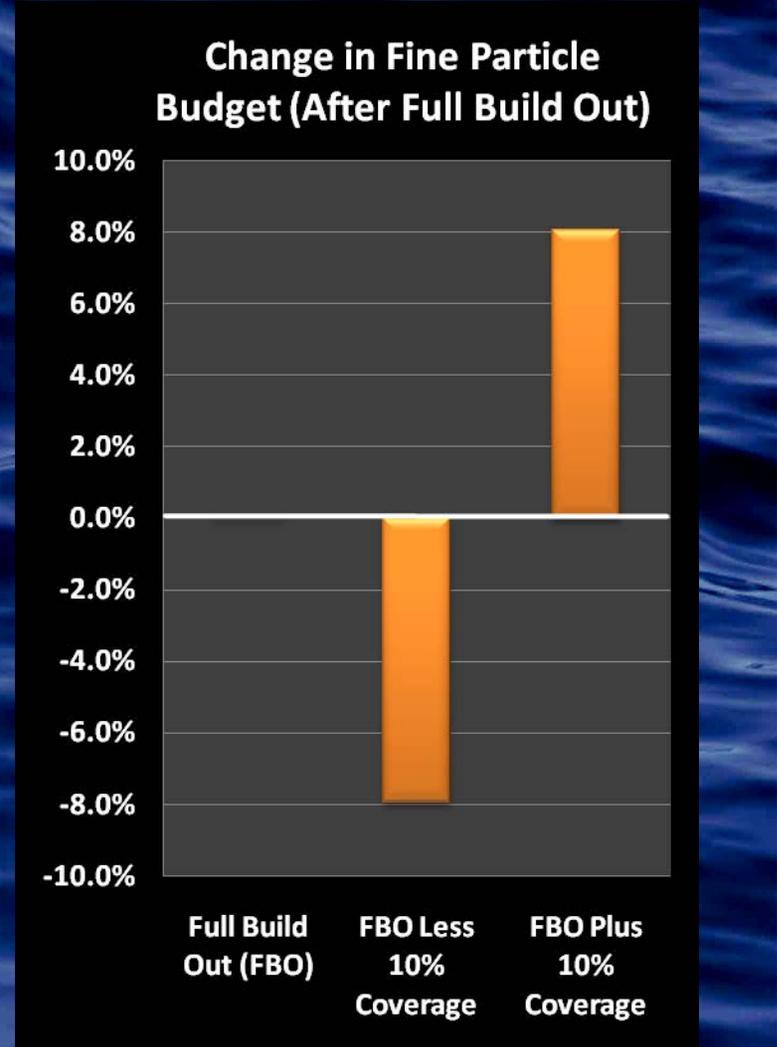


What about impervious coverage?

An increase or decrease in allowable coverage

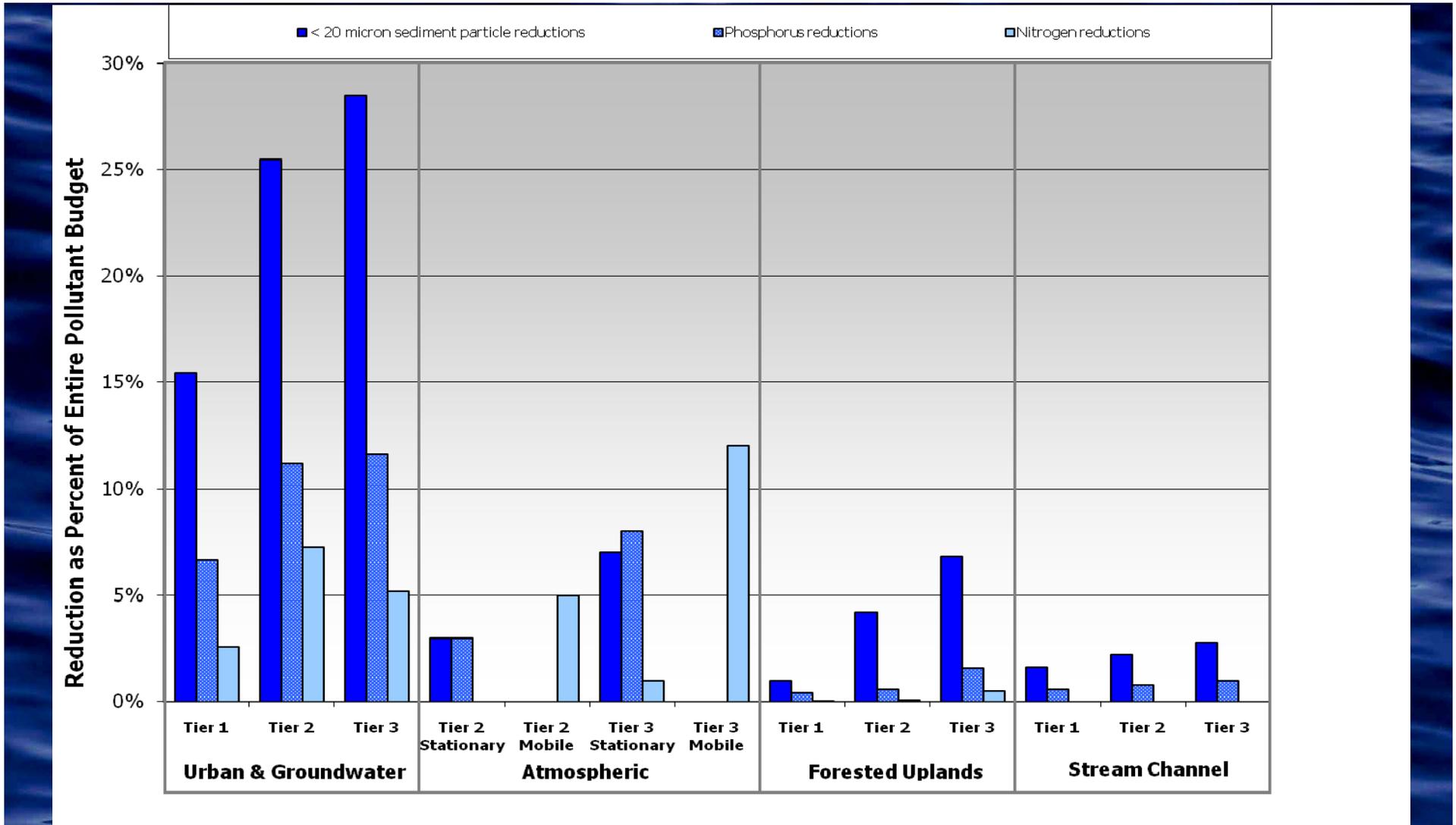
Changing impervious cover significantly affects fine particle loading

Reducing coverage presents load reduction opportunity

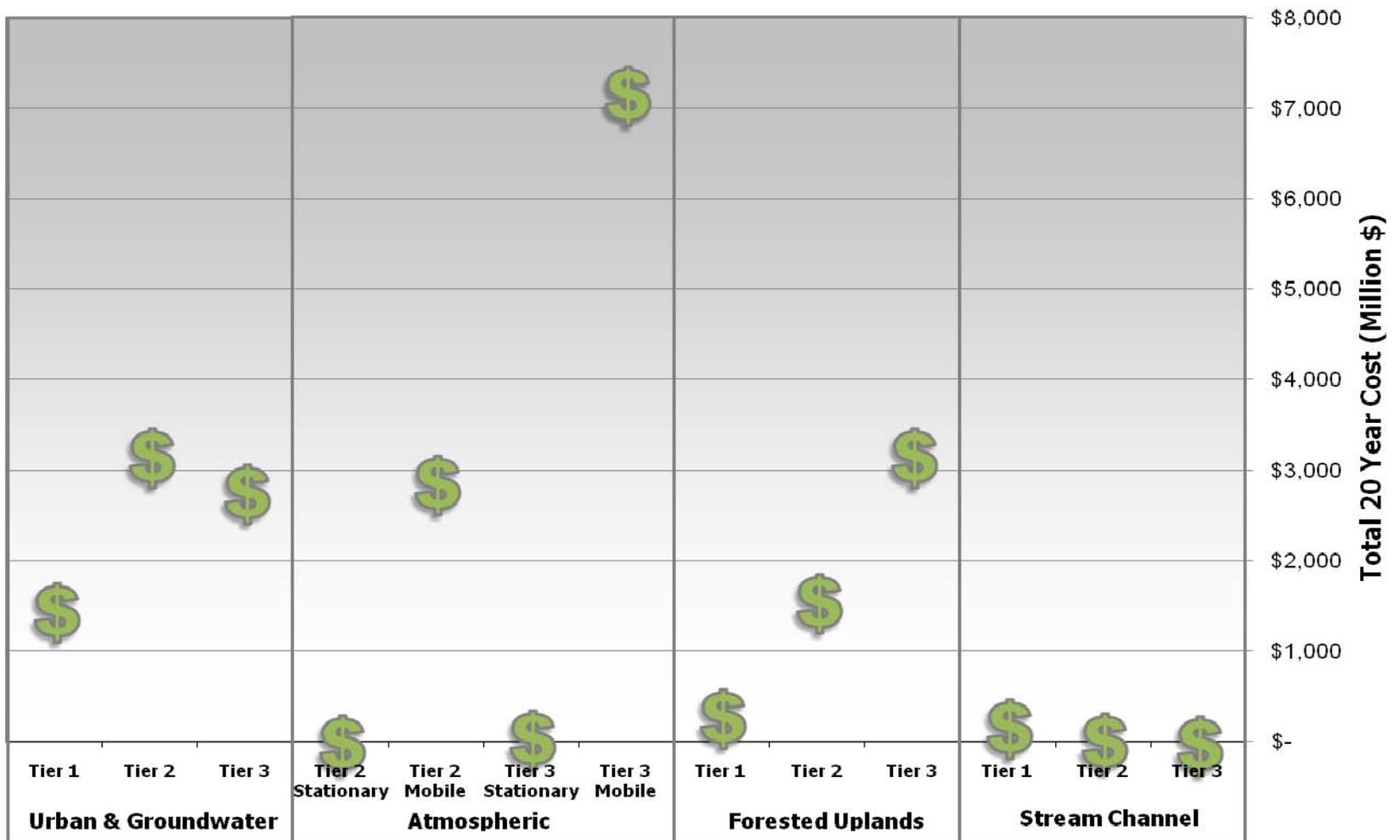


What strategy should we implement to reduce pollutant inputs to Lake Tahoe?

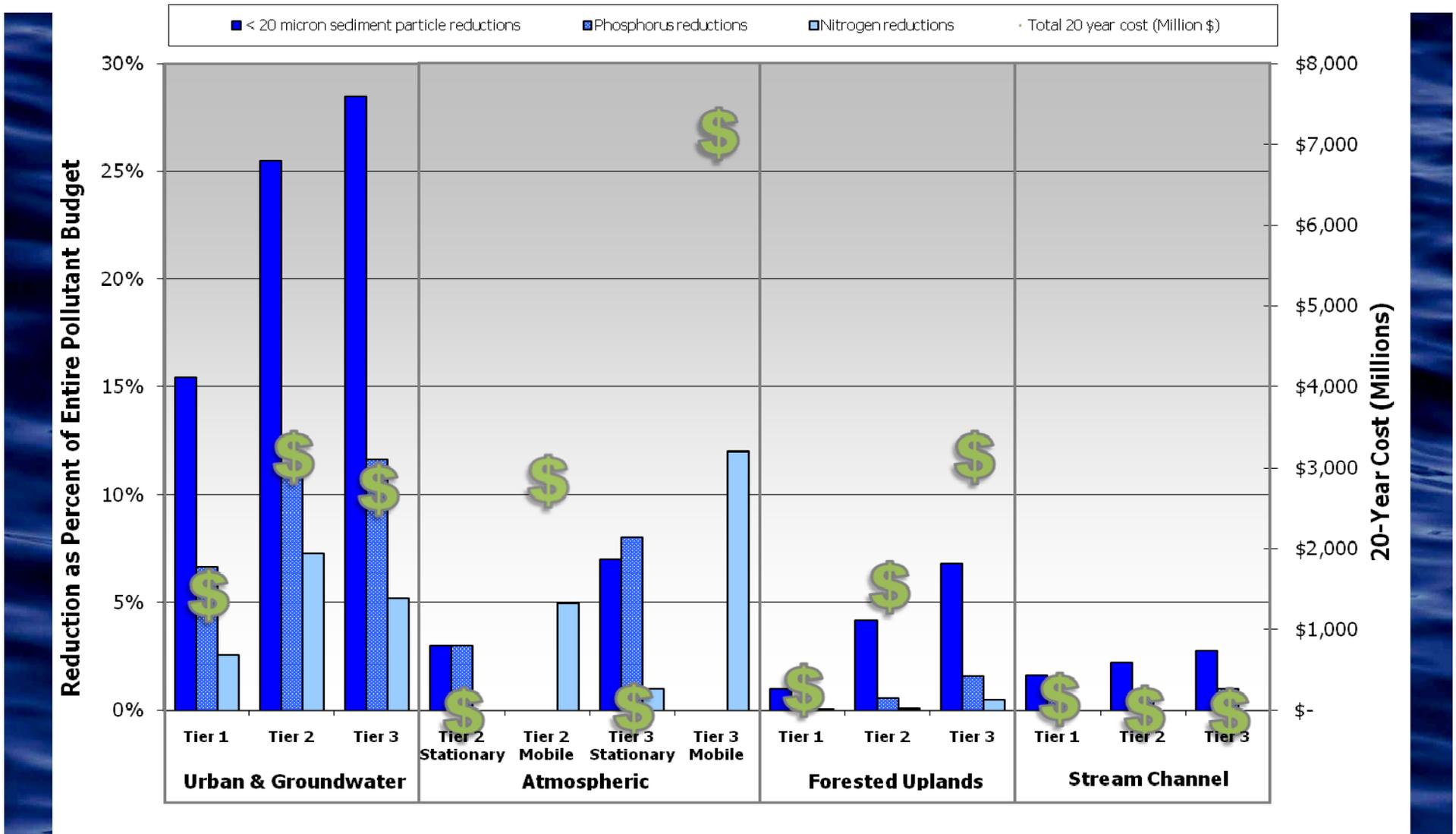
Estimated Potential Load Reductions



Estimated Potential Costs

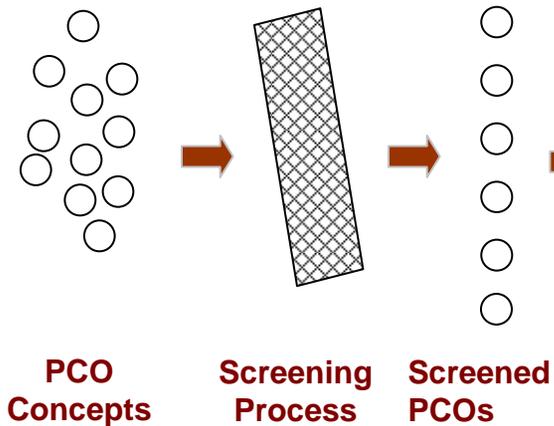


Combined Load Reductions and Costs

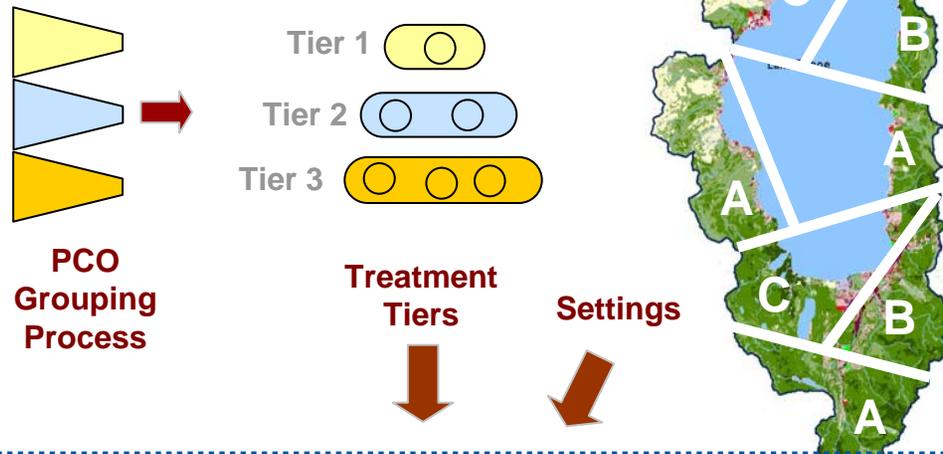


Pollutant Reduction Opportunity Development Process

Step 1: PCO Evaluation



Step 2: Site-Scale Analysis



Step 3: Basin-Wide Analysis

Extrapolation Process

- GIS
- Models

Combined Results Tables

Load Tables

Sediment Reduction Table

Phosphorus Reduction Table

Nitrogen Reduction Table

Cost Tables

Total 20 Year Cost Table

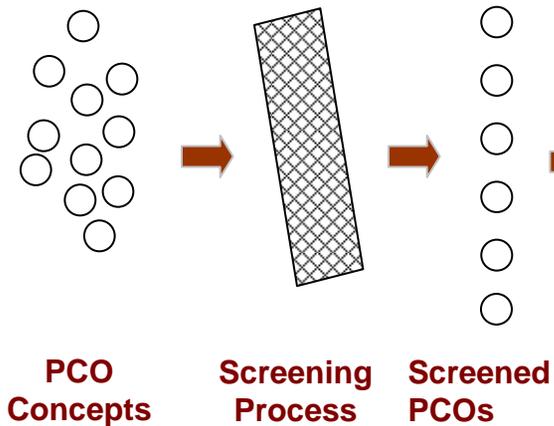
Capital Cost Table

O & M Cost Table

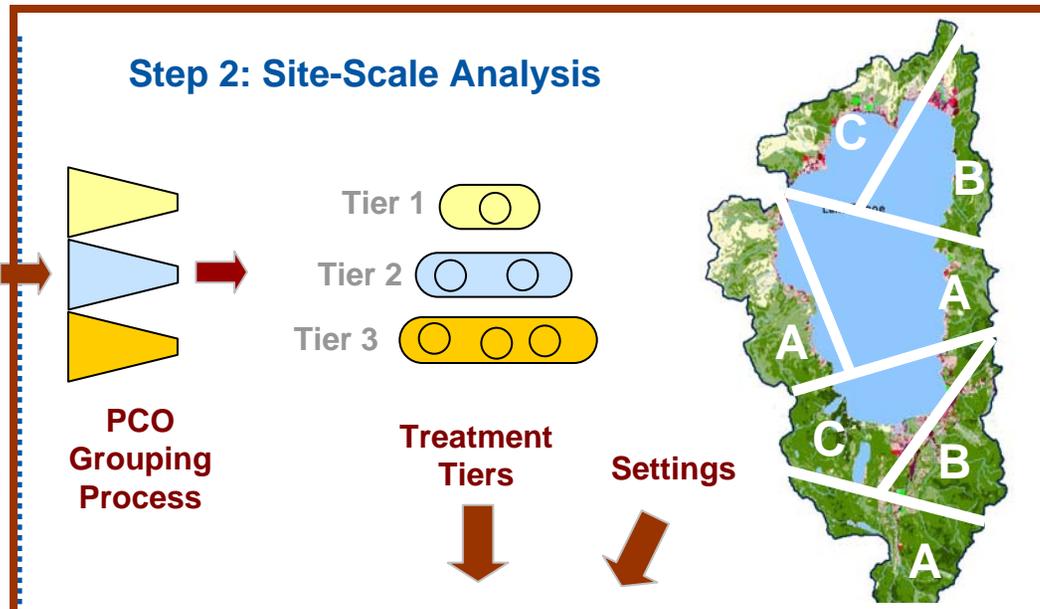
Cost-Effectiveness Table

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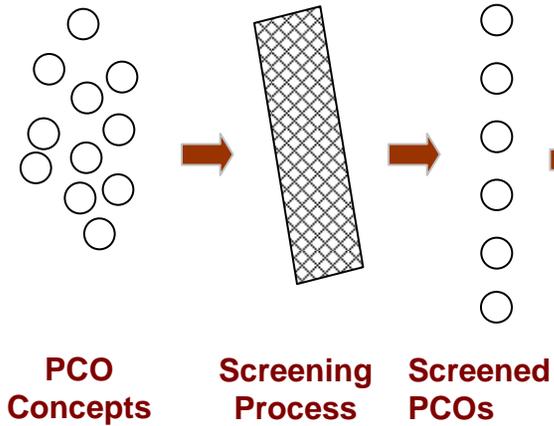
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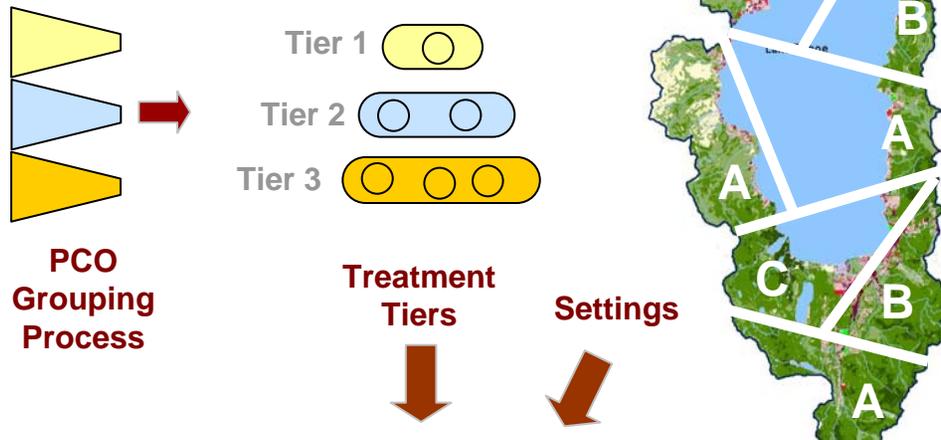
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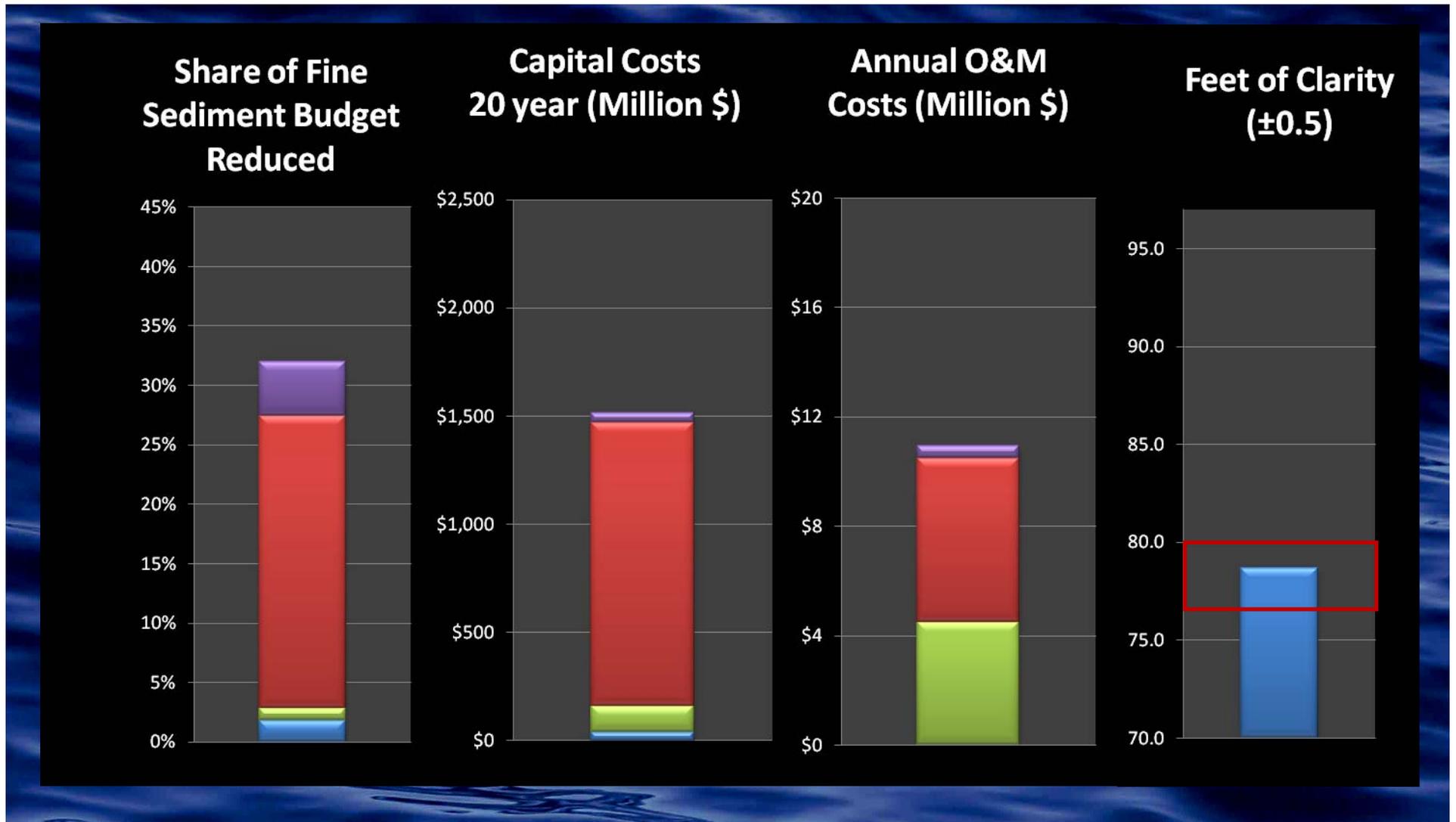
Total 20 Year Cost Table

Capital Cost Table

O & M Cost Table

Cost-Effectiveness Table

Implementation Scenario Summary



What strategy should we implement to reduce pollutant inputs to Lake Tahoe?