APPENDIX D

Executive Summary of the 2011 Draft Threshold Evaluation Peer Review, including individual panel member review reports.

Maureen McCarthy, Peer Review Coordinator, Tahoe Science Consortium
James Mahoney, Peer Review Panel Chair

Biographical Summary of the Peer-Review Panel

James R. Mahoney, Ph.D. (Chair)
Eagle, Idaho

Dr. Mahoney is currently an Environmental Management Consultant serving US and international clients. Previously he was Assistant Secretary of Commerce for Oceans and Atmosphere and Deputy Administrator of NOAA. He has also served as Director of the US Climate Change Science Program and in a variety of other positions in the public and private sectors. He holds a B.S. in Physics from LeMoyne College and a Ph.D. in Meteorology from MIT.

Carol A. Wessman, Ph.D.
Boulder, Colorado

Dr. Wessman is a Professor in the Ecology and Evolutionary Biology Department at the University of Colorado at Boulder. Her research interests include ecosystem and landscape ecology, regional and global biogeochemical cycling, and ecological applications of remote sensing and geographic information systems. She holds a Ph.D. from the University of Wisconsin.

Richard Axler, Ph.D.
Duluth, Minnesota

Dr. Axler is a Senior Research Associate with the Natural Resources Research Institute at the University of Minnesota Duluth. His research focuses on lake and water quality management and restoration, aquatic ecosystem responses to pollutants, nutrient cycling and food web dynamics, web-based environmental education and constructed treatment wetlands. He holds a B.A. in Physics from Temple University and a Ph.D. in Ecology/Limnology from the University of California, Davis.

Daniel E. Canfield, Jr., Ph.D.
Gainesville, Florida

Dr. Canfield is a Professor of Limnology at the School of Forest Resources & Conservation at the University of Florida. His specialty is applied research that directly relates to the management of aquatic ecosystems, and he is the founder of Florida LAKEWATCH, a statewide citizen-volunteer water quality monitoring program. He has served as president of the North American Lake Management Society and received their Secchi Disk Award for his contributions to the management of America's lakes. He holds a B.S. in Biology from Bates College, and an M.S. and Ph.D in Zoology (Limnology) from Iowa State University.

Robert J. Lilieholm, Ph.D.

Orono, Maine

Dr. Lilieholm is an Associate Professor of forest economics and policy in the School of Forest Resources at the University of Maine. His research examines ways in which wildlands can be sustainably managed to promote a wide range of ecological and social goals, looking into land use issues, including the modeling of alternative future growth scenarios to determine the long-term impact of development on natural systems at the landscape level. He holds a B.S. in Forest Management from Utah State University, an M.S. in silviculture from Louisiana State University, and a Ph.D. in Forest Economics and Policy from the University of California, Berkeley.

Gary T Hunt, QEP
Lowell, Massachusetts

Mr. Hunt, a Principal Scientist and Vice President with TRC Environmental Corporation, is an air quality expert with over 22 years of air quality and emission experience. He specializes in the characterization, quantification and control of toxic air pollutant emissions. He is also a member of the Air Quality Impacts Committee for the Water Environment Federation (WEF), a Fellow of the Air and Waste Management Association (AWMA), and a member of the American Chemical Society (ACS), Division of Environmental Chemistry. Mr. Hunt is a Qualified Environmental Professional (QEP) who holds a B.S. in Chemistry from Villanova University and an M.S. in Environmental Sciences from Rutgers University.

Edwin E. Krumpe, Ph.D.
Moscow, Idaho

Dr. Krumpe is a Professor of Resource Recreation and Tourism at the University of Idaho College of Natural Resources. He is also Principal Scientist of Wilderness Management for the University of Idaho Wilderness Research Center, where he was Director for six years. He has over thirty years' experience in conducting research on recreation and tourism management, wilderness and wild and scenic river planning, natural resource communication, and public involvement and conflict resolution. He holds a B.S. in Forest Recreation from West Virginia University, a M.S. in Recreation and Park Administration, and a Ph.D. in Recreation Resources from Colorado State University.

Review of the Tahoe Regional Planning Agency Draft 2011 Threshold Evaluation Report
Executive Summary of the Scientific Peer Reviews

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OUTLINE:

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2. **Importance of Independent Scientific Peer Review**
3. **Peer Reviewers: Selection, Assignment of Review Responsibilities, and Designated Review Procedures**
4. **Examples of the Reviewers' Descriptive Comments About the Draft 2011 Plan**
5. **Reviewers' Recommendations for Improving the Final Version of the 2011 Threshold Plan - Summary**
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Appendix A. Tabulation of Notable Reviewers' Comments

(Note to readers: use this executive summary document as a guide to the detailed scientific peer reviewers' comments, but frequently refer to the detailed comment record as the principal action tool.)

1. Introduction.

This document summarizes the scientific peer reviews prepared as key elements in the development of the TRPA 2011 Threshold Evaluation Report. The document also conveys two sets of recommendations based on the peer review reports: (1) suggested improvements for TRPA to consider during its preparation of the final version of the 2011 Threshold Evaluation Report, and (2) suggested improvements in the data collection and analysis methodologies for TRPA to consider during its development of the next cycle (2016) Threshold Evaluation Plan.

Consistent with the mandate for the Tahoe Regional Planning Compact codified by the 1980 federal legislation (Public Law 96-551) which incorporated and extended previous state (Nevada and California) planning initiatives, TRPA has published a periodic series of Threshold Evaluation Reports since the mid-1980s at 5-year intervals. The draft 2011 TRPA Threshold Evaluation

[1] **Professional resume available. Relevant recent experience includes: Director, U.S. National Acid Precipitation Assessment Program (NAPAP), 1988 – 1991; Director, U.S. Climate Change Science Program (USCCSP), 2002 – 2006; Chairman, National Academy of Sciences Round Table on Climate Change Education *(focused on improving decision making), 2009 – present.***

Report, now being readied for public review and comment, is the latest in this series of important periodic environmental planning reports.

The uniquely clear water Lake Tahoe, its surrounding basin and its interlinked ecosystems are broadly regarded as signature treasures in the North American roster of "special environmental zones". The Lake Tahoe Basin deserves the highest standards of practice directed to protecting its sensitive natural features, while seeking the optimal balance between the region's environmental assets and its contributions to human and economic wellbeing, and enhancing its role in public education and enjoyment. Long time-horizon environmental and economic planning for the region, including the preparation of periodic updates that describe trends, risks and benefits is a core activity needed to sustain the role of the Lake Tahoe Basin as a regional laboratory for learning by measurement, analysis and feedback. The regional planning cycle embracing the sequential elements of *plan-observe-verify-adjust* is essential to maintaining the unique features of the Lake Tahoe Basin for future generations. The draft 2011 TRPA Threshold Evaluation Report, to be completed after consideration of the Peer Review summarized here and subsequent public and stakeholder comments, builds on the multiple previous planning experiences and the continuing interpretations of "lessons learned" throughout the past three decades.

2. Importance of Independent Scientific Peer Review

The current draft 2011 TRPA Threshold Evaluation Report is the first in the 25-year-long series to include the significant step of independent scientific peer review in the evaluation of the evidence considered during the development and preparation of the plan, including (1) independent consideration of the field measurements and other scientific information used to interpret the projected future conditions considered in the planning process; (2) evaluation of the scientific methods used to describe the status, trends, future projections and confidence limits attributed to each of the many environmental quality parameters discussed throughout the document; (3) comments on the conclusions reported by the primary authors of the regional plan, based on the measured and projected environmental indicator data; (4) comments on the unavoidable limitations in the available data, and the resulting limitations to be assigned to the conclusions reported in the 2011 Report; and (5) suggestions about possible improvements in the various interpretations and projections, including thoughts about embracing improvements in the methodologies adopted for future threshold evaluations. **The incorporation of a broad independent scientific peer review in the documentation of this draft report, and the full sharing of the reviewer comments with all interested persons reviewing this report, represents a substantial improvement in the quality of this and future environmental/economic evaluations of the Lake Tahoe region.**

The role of independent scientific peer review: For more than a century, the adoption of independent review by qualified specialists with experience in the scientific disciplines and/or applications described in a draft document has been considered the *sine qua non* requirement to promote quality and objectivity in scientific analyses (including interpretive data analyses, process evaluations and future projections) reported in the open scientific literature. While far from universal (usually because of resource limitations), the adoption of scientific peer review is an essential measure of presumed quality in published scientific reports (note the use of the concept of "publication in a peer reviewed scientific journal" to identify the high quality standard expected of the most significant scientific analyses).

Resource limitations, together with a reliance on the "usual practice" concept (*i.e.,* "this is the way we have usually made these projections …") has resulted in infrequent use of peer review to promote high quality scientific analyses in the majority of policy oriented applied scientific studies such as those reported in the previous versions of the Threshold Evaluation Reports published since 1987. The peer review panel members view that this first adoption of a robust practice of peer review in the 2011 TRPA Report **is to be highly commended** – and hopefully will serve as a useful example for future evaluations of Lake Tahoe Basin environmental baselines and trends. In particular, future Tahoe Basin regional planning investigations that undertake to define acceptable environmental and economic balance threshold indicators should rely upon independent scientific peer reviews as essential elements in their evaluations.

3. Peer Reviewers: Selection, Assignment of Review Responsibilities, and Designated Review Procedures

The Tahoe Science Consortium (TSC), under the leadership of Executive Director Dr. Maureen McCarthy, has been responsible for identifying, recruiting and administering the work of the TRPA Threshold Review scientific peer review panel. This responsibility arises from the charter of TSC, which was created in 2005 to foster increased collaboration between research organizations and resource management agencies serving the Lake Tahoe Basin. The primary objective of the TSC is to promote science in support of the preservation, restoration, and enhancement of the unique environmental values in the Basin.

TSC has recruited and administered the work of the seven scientific specialists who have been asked to review the entire draft 2011 Threshold Review Report, with focused areas of coverage also assigned to each reviewer. Each reviewer was asked to provide comments on the report as a whole - as well as in-depth comments on his/her assigned sections appropriate for their individual specialties. The chairman of the review panel, working with Dr. McCarthy and each of the individual reviewers, was responsible for developing this Executive Summary for the peer review. All members of the peer review panel reviewed the working draft version of this executive summary. The final products of the peer review panel's work are (1) this executive summary which has been approved by all seven reviewers, and (2) the full text of the peer review comments prepared by the individual reviewers. Individuals with an interest in, or responsibility for, the issues raised in the scientific peer reviews are urged to consult the full texts of the reviews, in addition to this summary. A large number of individual issues have been raised throughout the individual peer review documents - including many that will be of interest the audience for this summary. The members of the review panel are listed alphabetically in the following table:

ASSIGNED REVIEWERS	**AREAS OF SPECIAL FOCUS**
Richard P. Axler, Ph.D. Natural Resources Research Institute University of Minnesota – Duluth	Water quality and fisheries
Daniel E. Canfield, Jr., Ph.D. Fisheries and Aquatic Sciences . University of Florida – Gainesville	Water quality, soil conservation and fisheries
Gary T. Hunt, QEP	Air quality (including visibility & odor) and

Principal Scientist and Vice President TRC Environmental Corporation – Lowell, MA	noise
Edwin E. Krumpe, Ph.D. Head, Department of Conservation Social Sciences University of Idaho – Moscow	Wildlife, scenic, noise & recreation
Robert J. Lilieholm, Ph.D Associate Professor of Forest Policy University of Maine – Orono	Vegetation, scenic & recreation
James R. Mahoney, Ph.D. Environmental Adviser Former Harvard University faculty, federal and international appointee & private sector environmental specialist	Chair of the peer review panel, focus on the entire report, the executive summary and air quality.[2]
Carol Wessman, Ph.D. Professor of Ecology & Evolutionary Biology Assoc. Director, CIRES University of Colorado – Boulder	Soil conservation, vegetation and wildlife

The overall commentary prepared by each reviewer responded to six (6) topic questions posed by TEC. These included **five common questions** to be addressed by each reviewer, **and one "specialized technical question list"** that incorporated the nine discipline-specific topics addressed by the TRPA Draft Threshold Assessment. The written comments prepared by all reviewers are reflected in this executive summary. The full texts of all reviewer comments will be part of the public record memorializing the combined preparation and scientific peer reviews adopted for the 2011 Threshold Review Report.

The five "common questions" addressed by TRC to each reviewer are:

- **Introduction -** Does the **Introduction Section** provide sufficient background information necessary to understand the purpose and scope of the Threshold Evaluation? Are statements of fact presented in the Introduction Section sufficiently supported with appropriate references or original data and analysis?

- **Methodology** – Are prescribed approaches for determining the status and trends of the indicators relative to adopted standards clearly presented and appropriate? Is the prescribed approach for determining the level of confidence in status and trend determinations clearly presented and appropriate? Are the approaches prescribed to

[2] Mahoney verbally collaborated with Hunt on air quality, but the written review document was entirely prepared by Hunt (and Mahoney reviewed and concurred.)

determine an interim target and attainment date for each indicator reasonable, given data and funding limitations?

- **Indicator and Indicator Reporting Category Evaluations –** Is the write-up associated with each indicator evaluation clear and complete? Are the analytical methods appropriately applied in the determination of an indicator's status, trend, and confidence? Are there other or different analyses you would recommend to evaluate indicator status or trend? Are the aggregation methods appropriately applied in the evaluation of each indicator-reporting category? Are statements of fact or conclusions supported by appropriate references or original data and analysis?

- **Regional Plan Implementation and Effectiveness –** Does the information presented in the draft threshold report reasonably describe the implementation of Regional Plan actions (known as compliance measures) designed to benefit environmental and socioeconomic conditions consistent with adopted threshold standards? Are the findings and conclusions related to compliance measure implementation and their effectiveness on the attainment of threshold standards reasonable and justified, given the available information and constraints? Are there other or different analyses you would recommend to evaluate the implementation and effectiveness of TRPA's Regional Plan?

- **Conclusions –** Are conclusions presented appropriately supported by report analyses and findings? Does the best available science generally support the conclusion, or does it suggest a substantially different conclusion?

- **Recommendations –** Are recommendations (in the draft TRPA Threshold Evaluation Report) appropriately supported by the report findings and conclusions? Are the proposed recommendations related to policy and on-the-ground project implementation supported by best available science?

The questions addressed to guide each reviewer's individual "indicator – specific discussions" were:

- **Indicator and Indicator Reporting Category Evaluations –** Is the write-up associated with each indicator evaluation clear and complete? Are the analytical methods appropriately applied in the determination of an indicator's status, trend and confidence? Are there other or different analyses that you would recommend to evaluate indicator status or trend? Are the aggregation methods appropriately applied in the evaluation of each indicator-reporting category? Are statements of fact or conclusions supported by appropriate references or original data and analysis?

4. Examples of the Reviewers' Descriptive Comments

All reviewers reported positive commendations about the draft 2011 Threshold Report. Not surprisingly, each reviewer also reported specific concerns, along with suggestions for improvements – benefitting both the current draft plan and future Lake Tahoe regional planning exercises. This suggests that significant benefits will likely result if TRPA's future threshold assessment procedures incorporate provisions for independent scientific peer review from their earliest planning phases.

This Section 4 provides a small number of illustrative examples of the key comments, concerns and recommendations drawn from the hundreds reported by the scientific peer reviewers. The following Section 5 presents further analysis of reviewer comments that relate to recommended improvements in the final draft of the current 2011 Threshold Assessment. Section 6 similarly suggests improvements (and potential cost savings) related to the preparation of future versions of the Lake Tahoe Threshold Assessments.

A cautionary note about these illustrative quotations from the peer reviews: The immediately following brief list of sample comments provides a window into the thinking and writing of the peer reviewers. However, this brief list should not be used to characterize the overall theme of the review comments, nor of the priority ranking to be assigned to any specific comment. An analysis of the nearly 100 typed pages containing the reviewers' comments indicates that in total there are **many hundreds of individual comment themes** developed from the reviewers' careful readings of the draft threshold plan, and **many dozens of individual suggestions for improvements** based on these comments. Therefore, any individual who is preparing final (public record) copy of the TRPA 2011 Threshold Assessment, and/or who is developing enhanced field measurement plans or new analytical methods for application to future assessments, **should refer to the files of original reviewer comments – and not simply to this summary overview.** This executive summary document will hopefully provide context and some "roadmaps" to guide future users of the peer review comments, but this summary alone cannot provide sufficient information to guide future assessment planning.

Illustrative examples of the overview comments reported by each of the reviewers. The following quotations were selected to briefly illustrate a sample of the peer reviewers' comments. These were selected by the peer review chairman, subject to review by all panel members, to characterize the range of comments reported, while avoiding an excessively positive or negative bias. The authors of the individual comments are not identified in this text (so as not to personalize this summary) but the full text of the reviewer comments - with the individual authors identified - will be available in the public record when the comprehensive files for the 2011 Threshold Assessment are made public.

- "… TRPA did an overall very good job of compiling and summarizing an enormous amount of environmental, socioeconomic and management data and information."

- "Socioeconomic data were very valuable in giving the reader appreciation for the size of the Lake Tahoe region and the trends relevant to the Threshold Evaluation."

- "Frankly, I found this chapter [# 1: Introduction] to be the weakest of the whole Threshold Report for several reasons, each of which could be easily improved."

- "The 2011 Threshold Evaluation Report does a good job of describing monitoring and evaluation activities and trends in the Lake Tahoe Basin. While I note some areas for improvement … I found the report and its analysis comprehensive and well reasoned."

- "The introduction is well written for a technical report, but as written TRPA is missing an opportunity to place its mission in the context of helping the environment and the economy."

- "I think the Chapter 12 summary of the implementation and effectiveness of the 1987 TRPA Regional Plan is basically sound and reasonable … I also see no fundamental (aka 'fatal') flaws in the basic science being applied or in the Conclusions and Recommendations in Chapter 13 and found this chapter to be extremely well conceived and written."

- "The TRPA Threshold Evaluation Methodology in its entirety is a relatively complex process and difficult to understand without several in depth readings of this chapter."

- "The final chapter on conclusions and recommendations is right on target"

- "This evaluation plan is a powerful assemblage of data from multiple sources that addresses the Basin ecosystem in a comprehensive way. That point should be at the forefront of this document."

- "As a social scientist I believe the report and analyses could go further in exploring the human dimensions of land uses in the Tahoe Basin."

The above examples briefly illustrate the range of the reviewers' comments – they are diverse, generally more positive than negative, and frequently coupled with suggestions for improvement. As a reminder, serious readers of the overall TRPA 2011 report and its recommendations are encouraged to consult the details in the full set of peer reviewer comments, which provide extensive guidance about the uses and limitations of the technical information in the Threshold Report, along with many suggestions about potential long term improvements in the development of the entire range of environmental and socioeconomic information that best supports future regional planning analyses for the Lake Tahoe region.

5. **Reviewers' Recommendations for Improving the Final Version of the 2011 Threshold Plan - Summary**

This section provides a brief overview of the peer reviewers' comments and recommendations for improving the final version of the 2011 TRPA Threshold Plan. Overall, the full set of peer reviewer comments fills nearly 100 pages of text, and this full record is commended for study by all

individuals interested in, and/or responsible for, a comprehensive analysis of the record of peer review comments. A six-page condensed synopsis, extracted and highlighted from the full review record, was also developed during the preparation of this Executive Summary. This synopsis appears as Appendix A, attached to this summary document. In total, the reader is referred to three sets of recommendations relevant for consideration during the preparation of the final version of the TRPA 2011 Threshold Plan:

- The brief overview summary comments immediately following in this Executive Summary. These identify the broad themes in the reviewers' comments and recommendations, for the benefit of the Executive Summary reader. For verification and elaboration of these overview comments, readers are referred to Appendix A, and/or to the full set of the reviewers' comments.

- Appendix A, attached to this Executive Summary. The tabulation in Appendix A identifies the majority of the themes and recommendations reported by the peer review team, and the listed comments are highlighted to aid the reader in finding topics of special interest. For ease of reference to the full texts of the reviewers' comments, most of the text in Appendix A is a verbatim copy of the relevant extracts from the detailed reviewers' comments.

- The full record versions of the comments and recommendations prepared by the six individual peer reviewers. These documents are being submitted for the record, along with this Executive Summary. In total, the three document files (Executive Summary, Appendix A, and the six sets of individual reviewer comments) constitute the full documentation of the peer reviewer comments and recommendations requested by TRPA, and prepared under the direction of TSC.

Overview of reviewer comments on the draft 2011 Threshold Report[3]

- Each of the reviewers reported positive commendations about the draft 2011 Threshold Report. The 2011 report was seen as a major improvement as compared to earlier planning documents[4].
- The review panel believes that the 2011 draft Threshold Report is technically sound and provides a credible basis to support ongoing TRPA policy-making.

[3] Use in this section of some text extracted from the April 11, 2012 statement of Dr. Maureen McCarthy, TRC Executive Director, presented to the California Senate Budget and Fiscal Review panel is gratefully acknowledged.

[4] The view of the chair of the review panel (the author of this summary) is: "I have presented environmental assessments and plans to more than thirty public hearing boards during the past four decades, and the current draft TRPA 2011 Assessment document stands among the most comprehensive and high quality examples that I have experienced. There is always room for improvement (especially among broad scope analyses), but the TRPA 2011 draft is a high quality example of this important practice as applied to comprehensive ecosystem analyses."

- The panel did not find any "fatal flaws" (*i.e.*, deficiencies that would create potentially significant misunderstandings) in the TRPA document.
- Review panel members broadly endorsed the recommendation that independent scientific peer review be established as the appropriate standard of practice to be embraced during the preparation of future technically based TRPA documents.

Reviewer recommendations for modifications to the final version of the 2011 Threshold Report. Key points made by the reviewers are presented below. The reviewers recognize that some of these recommendations may need to be deferred to future reports given time constraints.

- Introduction: The Introduction should set the context for the Threshold Evaluation Report and clearly explain the relationship between the 2011 Threshold Evaluation and the 2012 Regional Plan Update.

- Air Quality: Air quality monitoring in the basin is crucial and should be maintained despite most indicators being in attainment. Complacency with the current situation is not a prudent course of action. Given that Federal and State standards for ozone will likely undergo further reductions, it is critical to maintain these monitoring programs. Historic data of atmospheric deposition to the nitrogen (and phosphorus) budgets for the lake should be included to emphasize the strong link between the airshed and watershed.

- Water Quality: The effects of meteorological conditions on Secchi disk measurements need to be explained and summer (as well as winter and annual) Secchi disk measurements, along with other data in the UCD-TERC State of the Lake Reports and relevant scientific publications, should be included in the analysis of water clarity trends. A great case is made for the importance of suspended sediments as a major contributor to the decline in lake clarity. An alternative hypothesis should be discussed examining the impact of soil erosion (as a major source of suspended sediments) on lake clarity. The reviewers concur that more focused monitoring and analysis efforts are warranted to understand nearshore conditions and the connection between nearshore and deepwater indicators.

- Soil Conservation: This could be one of the most important chapters in the 2011 Threshold Evaluation Report. A clear link between soil erosion and water clarity needs to be explained. The key tables from Bailey's 1974 soil classification document and other key reference material should be included in the Appendices. Better explanation is needed on the importance of SEZs to soil conservation and a plan needs to be included for developing indicators that evaluate the health of naturally functioning, as well as restored, SEZs.

- Vegetation Preservation: Justification for this Threshold Category is strong; however, more emphasis should be given to the spatial distribution of vegetation communities throughout the Basin including sugar pine and aspen. TRPA monitoring plans should more directly address growing concerns over the creation and maintenance of early successional forests and/or shade intolerant species. Threshold indicators should be included that that support fire reduction treatments in landscape areas away from communities (as well as in populated areas).

- Fisheries: A more complete discussion is needed about the types and habitats of the fish found in Tahoe lakes and streams and what constitutes "prime fish habitat." Factors such as weather, climate patterns, elevation, topography may significantly alter stream flow characteristics, therefore, the establishment of a minimum "in-stream flow," while very costly, may not benefit stream fish populations. The approaches for protecting fish habitats could benefit from applying best practices used in other lake ecosystems.

- Wildlife: The relevance of the eight wildlife species chosen for monitoring needs to be explained and the connection between wildlife health and other threshold assessments such as riparian and wetland restoration needs to be clearly described. Spatial distribution of the wildlife habitats and linkages between wildlife habitat and other threshold categories (e.g., vegetation, soil) should be included in the indicator categories.

- Scenic: This chapter would benefit from visual illustrations of the different levels of scenic value. A better explanation is needed to explain how the community design standards work and how the threshold is implemented.

- Noise: The noise program is too complex and resource intensive. There are too many indicators, land use categories, and numerical thresholds that need to be monitored to evaluate attainment. Non-attainment should not be based upon a single exceedance of a standard, but rather on a percentage of events that exceed the threshold over a fixed time periods.

- Recreation: The Recreation chapter is very sparse and lacks the detail presented in other chapters. In particular, a network approach that examines the interconnectivity of recreation venues is needed to capture the diverse aspects of recreation in the basin.

6. Reviewers' Recommendations to Improve Future TRPA Threshold Plans - Highlights

This section summarizes several of the recommendations for improvements in the development of future threshold plans that emerged from the peer review commentaries. The issues included in this summary should be interpreted as "characteristic of the reviewer comments, but not priority ranked" because: (1) the peer reviewers were not asked to priority rank the significance of their individual recommendations; (2) the topic assignments for the individual reviewers were not prioritized and no overall designation of importance levels was requested as part of the peer review process; (3) the importance of the various recommended improvements in measurement configurations and data analysis methodologies will necessarily be partly "in the eye of the beholder" without an agreed statement of strategic goals for future threshold plans, and (4) this list of emerging themes reflects the individual judgments of the peer review group members. Most of the cited recommendations for improvements in future TRPA planning activities emerged (in some variation) in the comments from two or more members of the peer review team.

A note to the TRPA 2011 Threshold Report author team: in addition to the recommendations summarized in the list below, please note that a large number (*i.e.*, many dozens) of specific recommendations for improvements in the 2011 Report appear throughout

the individual peer review statements that will become part of the public record. The individual report section authors should carefully consider these recommendations during the final revision process for the 2011 Threshold Report.

Notable recommendations about the planning for **future *(i.e., post – 2011 Threshold Evaluations)*** information collection protocols and data management methodologies reported by the TRPA 2011 Threshold Summary peer reviewers include:

Recommendation A. Consider adopting enhanced relational data base management[5] methodologies to support ongoing environmental measurement programs, and to improve the analytical tools available for use in future threshold assessment reports. Lake Tahoe regional measurement and planning activities have been undertaken for more than a half-century - and each successive program has expanded upon the scope, coverage and interrelationships of its predecessors. As a result, the quantity and complexity of the overall Lake Tahoe Basin data archive have continued their growth throughout each new five-year planning cycle. Fortunately, the growth in the use of state-of-the-art relational data base management techniques (*i.e.* GIS map-based) combined with the explosive increase in data management hardware and software tools capable of keeping ahead of the "regional planning data explosion", provide the opportunity to transform the massive expansion of relevant Lake Tahoe regional data from an ever-increasing challenge into newfound capability to better detect and evaluate relationships and trend information embedded in the observations. Advances in the information processing capabilities lodged within many current data base management software applications provide investigators with opportunities for significant improvements in multiple parameter data base analysis, thereby improving the understanding of interrelated trends in the Lake Tahoe regional planning profiles.

In order to embrace the benefits of these new information management capabilities, initial investments may be needed to address the requirements for new software, technical staff training and familiarization activities, and possibly new ambient measurement technology to upgrade the regional data inputs. In most situations similar to the data growth demands characteristic of the Lake Tahoe regional planning applications, the expected benefit - cost ratios will likely prove to be highly favorable. One comment about the timing of upgrades to the regional information management applications: the current time frame (*i.e.,* at the end of one TRPA five-year planning period and the beginning of the next cycle) may be **the optimal era** for deciding on, and implementing, an upgraded regional data base management system that would be ready to support the preparation of the TRPA 2016 Threshold Assessment. Therefore a key corollary to Recommendation A is:

Corollary to Recommendation A. After completion of the 2011 TRPA Threshold Review and its review by the several TRPA constituencies, TRPA should promptly explore possible partnerships to pursue upgraded environmental measurement and information

[5] For quick background information, consult Google, Wikipedia, *etc.*

processing systems that could provide significantly better insight into the patterns of data used to support the 2016 and subsequent Threshold Assessments.

Recommendation B. Expand the use of a landscape perspective for analysis of Tahoe region ecosystem measurements and data analyses – closely related to the consideration of relational data base uses (above) is the prospect of better integration of ecosystem information by the adoption of a landscape perspective for regional assessment. A landscape perspective considers the variability within and between ecosystem types, and recognizes that all ecological processes and management actions take place in particular spatial contexts that define interactions and influence outcomes. Ecosystemsfunction at a range of scales: changed conditions at one level arise from processes occurring at lower levels, and are constrained, in turn, by even higher levels. The peer reviewers who addressed the ecosystem elements of the 2011 Threshold Report discussed the need to expand the use of an ecosystem perspective as an element in their reviews.

Combined consideration of recommendations **A** and **B** (adoption of a relational data base information management system, enhanced with the use of an ecosystem perspective to interpret the field measurements collected within the Lake Tahoe basin region) would suggest the possibility of significantly more integrated data interpretation capabilities to evaluate future regional ecosystem and socioeconomic parameters.

Recommendation C. Increase the consideration of the impacts of climate change[6] upon observed Tahoe basin ecosystem behavior, and its related corollary:
Corollary to Recommendation C: Increase the consideration of possible climate change influences on socioeconomic parameters and trends in the Lake Tahoe Basin During the past decade (or longer) the influences of climate change phenomena (including changes in typical seasonal weather profiles, measureable variability in the migration profiles for many mobile species, modifications to annual flora life cycles, and changes in regional agricultural productivity, among others) have become more evident in several temperate and extreme climate regions. Examples of these modifications related to climate change have been detected within the Lake Tahoe region. Future TRPA assessments will most likely address further emerging influences of climate change throughout the Lake Tahoe planning region. Given the lengthy and extensive ambient observations already available for the Tahoe Basin, this region is becoming a highly interesting natural laboratory for the study of the interaction of both ecosystem and socioeconomic consequences of climate change, For example:

- Natural ecosystem effects versus human effects can be evaluated with reference to actual *in situ* observations – with the added benefit of several long period-of-record data sets developed as part of the multi-decade analyses by TRPA and its partner organizations, while:

[6] In this planning document "climate change" may be considered to result from both anthropogenic (*i.e.* natural) and human-caused influences.

- At the same time, the profiles of human responses to climate change stresses can be examined by reference to available regional socioeconomic information. For both the ecosystem and socioeconomic data records, observations of responses to several types of climate variability (*e.g.*, changes in averages and extreme events, and secular trends in ecosystem data) can be examined at many locations throughout the Lake Tahoe region for several ecosystem parameters.

Recommendation D. Increase the focus on achieving balance between environmental and socioeconomic parameters in the Tahoe basin region From its earliest days, and from its charter, TRPA has been charged with helping define the productive balance between the environmental and economic measures that reflect the desired values in the Lake Tahoe region. All of the measurement programs and the scientific analysis methodologies adopted to serve the region have been developed to better understand the productive balance and recognize trade-offs between the socioeconomic and ecosystem values that define the Lake Tahoe region.

There should be no "winners and losers" between the environmental and economic perspectives: TRPA's mission includes the search for appropriate balance between these two sets of goals. TRPA already has collected, and will continue to amass, the information needed to assist stakeholders, (*i.e.*, interested members of the public, relevant government agencies at all levels, permanent and seasonal homeowners, recreational visitors, and local business leaders) who seek to understand the issues involved in establishing a long-term state of "approximate balance" between the environmental and the socioeconomic assets maintained in the Lake Tahoe region.

Recommendation E. Maintain (and increase as needed) the attention on sustaining the unique water clarity in the lake

Uniquely clear lake water is justifiably regarded to be a "signature asset" of the Lake Tahoe experience. This is a key feature, well known and appreciated by the broad public - and well addressed in the 2011 TRPA Threshold Report and earlier studies.

Regular observations of Secchi disc depths (the maximum depth that the standard Secchi disc can be detected from the surface level) have been conducted at the lake since 1968, and the average observed depths have declined from 1960 – 1970s levels in the range of 100 feet to the range of 60 to 70 feet in the past decade. The most significant factors that have contributed to the reduction in water clarity are (1) enhanced growth of algae suspended in the water column due to nutrient enrichment from both atmospheric deposition of nitrogen coupled with enhanced discharge of phosphorus (and perhaps other micronutrients such as iron) derived from watershed erosion and largely associated with suspended sediment; and (2) extremely fine particulate material also derived from watershed erosion and discharged to the lake via its many streams. These mechanisms appear to be reasonably well understood by the general public.

Other mechanisms that can compromise near-surface water clarity include increases in persistent (*i.e.*, non-episodic, like fire events) particle deposition into the lake, and increases in near-surface

turbidity related soil erosion in the watershed, and runoff from construction sites, residential developments, and parking areas.

Water clarity measurements (by Secchi disc) are generally well recognized by the interested public, and these data often serve as useful (albeit imperfect) surrogates for informing overall public judgment about sustainability conditions at the lake. Because of the significant role of Secchi disc information in "reminding" the public about the sustainability status of the lake, this measurement program should be well maintained and reported. At the same time, the limitations of these measurements as status indicators of the lake ecosystem viability should also be communicated to the public, and other relevant ecosystem indicators should continue to be broadly communicated.

Recommendation F. Increase the analyses of the influences of air quality and local human activity on water quality, vegetation and soils

As a "semi-closed" system, the Lake Tahoe basin region is an excellent laboratory for the evaluation and teaching of the environmental principal that "everything is connected to everything else". It is notable that the mutual preservation of ecosystem and socioeconomic goals would not be seen as a "balance and trade-off" analysis by most residents and vacation visitors in the lake region. Instead, it is likely that most permanent and periodic residents would regard ecosystem and socioeconomic goals as "two halves of the same coin". For example, most local residents and visitors understand that the crystal clear lake water, the absence of noise and odor pollution, the perception of (reasonably) pristine local ecosystems, and the expectation that these values would be preserved over time, all contribute to maintenance of increased property values for local owners, and to a willingness to pay higher costs among visitors who rent lodging during their stays.

Despite the frequent goal sharing mentioned above, TRPA is well aware that occasional local disputes that can often be characterized as environmental *vs.* economy disagreements – indeed elements of TRPA may be called upon to mediate these issues. One key asset that can help facilitate resolution of local community "environmental *vs.* economic" disputes is a clear understanding of the scientific basis for land use and activity restrictions that maintain the environmentally sustainable local culture desired by nearly all local residents and visitors.

One of the best methods to enhance the understanding of the ecosystem values in a residential community is the development of a community understanding of the activities that sustain local ecosystem values – or threaten to degrade these values. This level of "community understanding" of significant local cause-effect relationships usually emerges from a combination of believable science-based process descriptions supplemented by a record of credible local ecosystem observations available to the community and its local planners.

TRPA can seek "win – win" outcomes by continuing its development of understanding about important processes that influence local ecosystem indicators (*e.g.,* deposition of air contaminants into the lake surface waters, used water runoff into the soils and the lake, effects of airborne pollutants carried into the lake region from distant air pollution sources, *etc.*) Maintenance of high quality environmental observations by the TRPA partners and contractors is an essential element of

developing and maintaining the essential "status and trend" information for long term support of this regional planning capability.

Recommendation G. Increase attention to the future uses and costs of ambient measurements.

The records of environmental observations often constitute the key evidence regarding local compliance with established ambient standards. Moreover, the trends in the ambient data record often provide the most important evidence about the expected continued compliance status for these parameters; observed unfavorable trends can be the "canary in the mine" early warning information about the need for additional information on known (and perhaps unknown) air emission and water effluent sources impacting the lake basin area.

Ambient environmental measurements are principally used retrospectively, to evaluate historical compliance with standards, and to examine local conditions during highly unusual events (*e.g.*, local forest fire occurrences, resulting in very high loadings of fire combustion products and ash in the atmosphere, or deposited onto the lake surface.) Contemporaneous or near-contemporaneous availability of ambient monitoring information may be highly useful in the Lake Tahoe region, The Lake Tahoe Basin is a "unique protected region" that would benefit from routine access to ambient environmental monitoring information when available. (This does not suggest that TRPA assume the role of a front-line regulatory and enforcement agency. Rather, the suggestion is that TRPA examine the practicality and costs involved in near-real-time sharing of environmental measurements, to support the missions of the local, state and federal agencies responsible for continuous environmental monitoring and operational environmental compliance assurance in the region. The review team is not aware of the degree of mission and information sharing currently in place between TRPA and partnering organizations.

Enhanced information sharing between TRPA and other organizations reflects the mantra of environmental monitoring programs: more information is better. This does not suggest a move to major information overload, but the specific suggestion could be stated as follows:

- More monitoring information is better, but the practicalities of cost must be considered.
- Quality and integrity of ambient measurement records must meet requirements for their applications.
- TRPA should examine its ambient observation requirements, and evaluate whether enhanced information sharing with partnering organizations, possibly allowing cost savings resulting from mission sharing, would yield overall benefits in both quality and information coverage.

Recommendation H. Consider more comprehensive use of economic planning information in the development of environmental status and (future and retrospective) trend analyses.

TRPA, together with other government agencies serving portions of the Lake Tahoe region, maintains substantial information records related to its environmental stewardship and economic planning responsibilities. During the current peer review process the question of TRPA's expanded use of the socioeconomic information in its records was discussed. The reviewers understand the need for confidentiality of land and business owner information, and other similar records that must be maintained as required by law or regulation. At the same time, and in conformity with its obligation to keep personal information confidential, some reviewers have suggested that TRPA may enhance its analytical abilities (to fill gaps not being addressed by sister organizations), and provide more useful information to its constituents, if it explores the appropriate use of regional socioeconomic information to improve current profiles of environmental analyses and projections. For example, TRPA might explore its resources of commercial records and permits, to explore for analytical and predictive relationships that would enhance its ability to characterize current environmental conditions in the lake region. Also, the decades long planning data available for the region could support retrospective and current regional pattern analyses that enhance evaluations of environmental parameters in the region. Moreover, the capability to estimate future ambient environmental patterns as related to expected future economic activity in the lake region could become a major planning asset supporting the work of TRPA as well as its NV and CA sister agencies.

The prospects for developing future environmental status estimates based on aggregated socioeconomic information have received attention in the context of research inquiries during recent years. The Lake Tahoe region represents a possibly good "test bed" for further analysis and possible future application. The lake region is moderately isolated and much of its ambient environmental profile arises from local sources. If interested, TRPA could undertake an interesting - and possibly valuable – inquiry in its home region, based on the types of planning information already for the region.

Recommendation I. Consider the use of state-of-the-art trend evaluation methods, especially to evaluate low frequency, high consequence events.

Some reviewers have cited examples of recent research about novel environmental data projection and interpretation methods (*e.g.*, nonlinear and multi-parameter projections) – and have queried whether are there may be benefits for TRPA to explore their use. Extensive ambient data records collected at many locations throughout the United States and elsewhere suggest that some of the most notable ambient environmental conditions are best characterized as "rare and high consequence events."

TRPA might review some of the information available in its records, and address the question of whether unusual exposure events may be responsible for an out-of-proportion fraction of "damaging levels of environmental impacts" felt by sensitive elements in the lake region

ecosystems - and whether these impacts may merit special attention as part of the TRPA's program of ecosystem safeguarding.

Two recent and notable Tahoe region forest fires have resulted in great damage in the region, as well as substantial local ecosystem exposures to both gaseous combustion products and ash residue (airborne dust loadings transported over long distances, combined with major dust deposition loads in the immediate Tahoe region.) These fire events were the August, 2005 Gondola fire (under the ski gondola line at the Heavenly Ski Resort) which consumed 973 acres of forest land, and the larger Angora fire in the South Lake Tahoe region in June 2007, which destroyed over 3100 acres of forest land. Other smaller but still consequential fires have also occurred in the Tahoe region during the past decade. The 2005 and 2007 major fire events were so significant that their environmental impacts fell well outside the range of typical long term ambient environmental conditions in the lake region; they illustrate the potentially severe impacts that can result from even larger scale fire events, for example those in the tens of thousands of acres category.

TRPA may benefit from exploration of extrapolation methods that can help establish typical daily and annual distributions of regional environmental exposures – thereby isolating for special study the impact profiles of the two most devastating Tahoe region fires of the past decade.

7. Concluding Comment

Returning to earlier statements in this executive summary, the independent peer review process has provided important insights about the Draft TRPA 2011 Threshold Evaluation Report. The peer reviews confirm the generally high quality of the TRPA work product, and careful analysis of the TRPA draft document by the peer reviewers has led to the development of many constructive recommendations addressing two upcoming goals: (1) completion of a high quality final version of the 2011 TRPA Threshold Evaluation Report, and (2) identification of process changes (*e.g.*, advanced ambient measurement protocols, enhanced data analysis methods, more focused systems analyses directed at interpreting the tradeoffs between environmental and socioeconomic considerations, *etc.*) that can yield improvements to be implemented throughout the next five-year planning cycle for TRPA. These recommendations are provided herein, with best regards from the peer review team.

Appendix A. Tabulation of Notable Reviewers' Comments

Table A-1 highlights the scope and focus of notable findings and recommendations reported by the peer reviewers. For efficiency in referencing the large number of reviewer comments in the table, no distinction is made between the concepts of "finding" and "recommendation". In most cases, the "finding" in the reviewer comment list implies one or more related "recommendations", and *vice versa.*

Table A-1 provides a useful catalog of comments, and key words have been highlighted in bold text to assist readers searching for specific issues. The left column in the table indicates the initial letter of the reviewer's family name and the page number in the file of comments prepared by each reviewer. While the tabulated information may be useful for many investigators, readers are urged to refer to the original files of the reviewers' comments to better understand the context and details of each comment. No references to minor editorial changes recommended by the peer reviewers are included in Table A-1.

Table A-1 is intended to serve three purposes:

1. To provide a quick reference to possible topics of interest for readers of the peer reviewer comments, especially by visual reference to the bolded key words.
2. To characterize the approximate frequency of citations of various issues emerging in the reviews.
3. To locate the referenced comments efficiently, especially in the context of "neighboring comments" that may also interest readers of the overall set of reviewer comments..

For a more focused understanding of the comments of the multiple reviewers, readers are urged to refer to the full texts of the review comments, and to examine those detailed comments for examples of commonality and differences among the reviewers.

Table A-1. Summary of key elements of the reviewers' comments

	AXLER COMMENT SUMMARY FOLLOWS:
A 2	More comprehensive **scientific review** of many **data sets.**
A 3	Strongest recommendation: maintain core program of Lake Tahoe **pelagic, near shore and tributary data collection.**
A 3	Add a succinct **history of the procession of deterioration** in the lake, tributaries and air quality.
A 3	Questions the use of the word **"Threshold"** in this context.
A 4	No mention of the **Washoe** Tribe in the information presentations.
A 4	Strong need for **quantitative trend data**, even when subjective.
A 4	**Statistical framework needed for confidence analysis** – recurring issue in many chapters.
A 5	**Methodology chapter** is good, but still **needs improvements.**
A 5	**Improved statistical methodology** needed overall.
A 6	**Impact of weather** on air quality, water quality and socioeconomic parameters needed.
A 6	Need **rules for confidence** in status determinations.
A 6	Explore links between **atmospheric deposition data and lake nitrogen and phosphorus concentrations**.
A 6	Note times of **severe forest fires in the air quality data**.
A 7	Methodology chapter should address **quality of statistical data** (P Value, etc.)

A 7	**Water quality chapter data does not mirror other published records (TERC, etc.)**
A 8	**Statistical uncertainties** need to be presented and addressed, along with **confidence limits, for secchi depth.**
A 9	Questions **polynomial fit to water quality data trends** (other similar references elsewhere also).
A 9	Other **statistical methods for trend evaluation** needed.
A 10	Is this a **climate change signal**?
A 11	Questions lack of **flow weighted means analyses for stream data.**.
A 11	**Linear regression analysis for water quality trends is not statistically significant**.
A 12.	**Suspended sediment and fine particle** analysis is excellent
A 12	Important to examine **relationship between Secchi depth and phytoplankton community composition changes**.
A 12	Soil conservation: **perform Lidar analysis [remote sensing] prior to leaf out**.
A 13	**"No net increases**" in **impervious surface** and in **runoff** are useful guidelines.
A 14	Why are **CA Fish & Game, and NV Dept. of Wildlife**, and others not contributors to the **Fisheries Section analyses**?
A 15	**Lake habitat: no discussion of uncertainty and trend**s in the analysis.
A 17	Describe how **stormwater management, planning and zoning in urban areas,** and **forest management** actions affect **vegetation profiles.**
A 18	The **Recreation Chapter is very sparse.**
A 18	**Good discussion** of the **overall progress in the Tahoe Basin**.
A 19	**Conclusions and Recommendations Chapter is excellent**.
	END OF AXLER COMMENT SUMMARY
	CANFIELD COMMENT SUMMARY FOLLOWS:
C 1	Worldwide debate regarding the **effects of untreated or treated municipal wastewater intensified** from 1960s onward. Strong consensus developed to **remove point sources of nutrients from lakes** developed in 1970s and 1980s.
C 2	Focus shifted to **nonpoint sources of nutrient enrichment** in 1980s.
C 2	Best management practices **(BMPs)** and total maximum daily loads **(TMDLs)** became more important in 1990s.
C 2	**Numerical nutrient criteria** stressed by EPA in 2000s.
C 3	TRPA charged with **balancing economic and environmental concerns**.
C 3	TRPA's 2012 challenge: **make sense of 40+ years of research** and set a **management direction** for Lake Tahoe.
C 3	Introduction is well written, but TRPA is missing the opportunity to promote its **mission to balance economic and environmental values.**
C 5	**Simple linear regression** is used to estimate indicator trends, but the document reports **weak trends when there is no time dependent relationship.**
C 5	Overall, challenges **regression-based attainment findings as not statistically meaningful.**
C 6	"This review **advances different ideas to promote further discussions**."
C 6	**Water transparency** is the key issue; **Secchi depth** needs extensive discussion, along with **other influencing environmental factors.**

C 7	A **nutrient budget** is needed to evaluate **eutrophication and its effects**.
C 7	Importance of **mixing events on the long term buildup of nutrients** in the lake.
C 8	Questions of **suspended sediments *vs.* nutrients** as primary influence on **lake water clarity changes.**
C 9	**Light conditions** can lead to **inhibition of phytoplankton production**, influencing **water clarity**.
C 9	Question: would **investments in nutrient control** be better spent for **soil sediment erosion control?**
C 10	**Soil control issues** may be the **most important factors for preserving** Lake Tahoe quality.
C 10	**Many policy and management actions can reduce pollutant loading to Lake Tahoe**. These include (1) restoration of stream environment zones (SEZs), (2) urban growth control limits, (3) BMPs to reduce nutrient and sediment discharge from disturbed soils, (4) Reduced motor vehicle use and increased public transport, and (5) ongoing allocation of water quality mitigation funds to support erosion control.
C 11`	Experience of the Soil Conservation Service demonstrates that the **focus should be** on the **points where the water enters the flow channel** and **points of in-stream instability.**
C 12	Chapter 7 **(fisheries)** would benefit from a **complete listing of all species**.
C 12	Questions **whether more extensive mapping** will advance **fish management issues**.
C 13	TRPA **should not rush to judgment** on **invasive species challenges**.
C 14	**Chapter 12** (Regional Plan Implementation and Effectiveness) is **well written with a great deal of information …**
C 14	Chapter 12 reads as a **strong environmental regulation document**, and not as a balanced (economy and environment) document.
C 15	Because Lake Tahoe exists in an erosion basin, prioritizing work on the streams is crucial.
	END OF CANFIELD COMMENT SUMMARY
	HUNT COMMENT SUMMARY FOLLOWS:
H 1	**Data on the types and number of businesses** by **industrial sector** were especially valuable.
H 2	With reference to TRPA Assessment **Chapter 11 (Recreation)**, reviewer **disagrees with** the practice of **not using a status score** in calculating **overall indicator status** because of (1) **insufficient data** or (2) **lack of an established standard.**
H 2	For those **indicators trending away** from the standard it is **unclear why literature reviews** were the **preferred** approach.
H 2	With reference to TRPA Assessment **Chapter 13 (Conclusions and Recommendations),** a process including **the use of an Odor Hotline to monitor odor complaints** should be considered. Odor events could be used to **evaluate attainment of an actual numerical standard.**
H 3	**The current noise program is too complex and resource intensive**. There are **too many indicators, land use categories and numerical thresholds** that need to be monitored to evaluate attainment.
H 4	**Noise** standard attainment **should not be based** upon **a single exceedance** of a

	standard **but rather make use of all data collected.**
H 4	**Recommendations for additional actions, findings and conclusions** found in individual data evaluation and interpretation reports **should be referenced in** TRPA Assessment **Chapter 13.**
H 4	**Noise pollution is unlikely to be remedied** through continued use of **low noise pavement,** *i.e.*, this would be a **poor use of resources**.
H 4	A **severe lack of data prevents adequate evaluation** of many of the **single noise event indicators.**
H 5	**Cumulative Noise Event Levels (CNEL)** prioritized by **land use category** and/or consolidation of existing land use categories **should be considered**.
H 6	TRPA should **maintain an aggressive campaign to further reduce emissions** attributable to **human activities (vehicles, wood stoves,** etc.)
H 6	There are **no data that address** the impacts of **wildfires** and, more importantly, **prescribed burning** have on air quality.
H 7	**Maintenance of air quality** in the Lake Tahoe region requires that contributions from **all emission sources**, **both natural and anthropogenic**, be considered.
H 7	**CO indicator data** are **well below the strictest** applicable ambient **standards.**
H 8	The **traffic volume standard** associated with the **CO indicator category should be retained.**
H 8	TRPA has **no authority** to regulate **transport of pollutants from outside the region**.
H 9	The review **team does not agree with** the plan for no **further action to be taken relative to the ozone standards.**
H 10	The **NOx indicator status** contains **incorrect values for both State and Federal NO2** ambient air quality 1-hour standards.
H 10	**Both** the **air quality monitoring and emissions estimating** approach for the NOx indicator status and trend analyses **should continue until the next TRPA review (5 years)** takes place.
H 10	The reviewer **does not agree** that the **confidence level in visibility status and trends** is **adequate**.
H 12	How can you reliably report status and trends for the **PM10 indicator as 24-hour averages** and not have sufficient data to report **an annual average** at the same location?
H 12	TRPA should specify how the **DRI – Chen 2011 report** will be used to revise the **visibility indicator monitoring program**.
H 13	**Odor policies** should be **retained** and a **numerical Threshold Standard adopted.**
	END OF HUNT COMMENT SUMMARY
	KRUMPE COMMENT SUMMARY FOLLOWS:
K 1	The Introduction should present a **compelling overview for all of intended readers**.
K 2	I like the use of the **visual symbols or icons**. These are a **good idea, so use them consistently.**
K 2	The methodology is well written, but note that it **does not take into account nonlinear trajectories (*e.g.*, polynomial models) or complex interactions**.
K 3	Monitoring **wildlife is inherently complicated** and this chapter does a good job of presenting the information in a … **manner that a lay person can understand**.

K 3	How were the **eight special wildlife species** selected?
K 4	The **scenic resources chapter** needs a better explanation of how the **community design standards work and how the threshold is implemented.**
K 4	The **multiple noise standards** (9 for single events, 11 for cumulative events) all seem to have some critical limitations. I suggest they be prioritized, and then a reasonable number be selected…
K 5	Large problem: "There is currently **no established peer reviewed monitoring plan to … evaluate the indicator."**
K 5	The **recreation chapter is so brief** that it s **difficult to evaluate** whether it is clear and complete.
K 5	Reviewer concurs that **TRPA should coordinate with more entities** to implement a **more comprehensive recreational user survey**.
K 6	The information presented in this **(recreation) chapter was neither compelling nor adequate** to support the finding that the thresholds are currently in attainment.
K 6	Chapter 12 (Implementation and Effectiveness) is **well written and does a very good job of synthesizing and summarizing the discussions**.
K 7	It is **difficult to distil**l such a comprehensive accumulation of findings and recommendations into the final recommendations. **The authors have done well**.
	END OF KRUMPE COMMENT SUMMARY
	LILIEHOLM COMMENT SUMMARY FOLLOWS:
L 1	I found the report and its analysis **comprehensive and well reasoned**. The final chapter on conclusions and recommendations **is right on target**.
L 3	The text notes the aging of the baby boom generation, but is the trend in the Basin area even more pronounced than that reflected in national statistics (*i.e.,* more retirees)?
L 4	This chapter **(Methodology) clearly presents and supports the overall prescribed approach …**
L 5	TRPA monitoring should more directly address growing concerns over the creation and maintenance of **early successional forests and/or shade intolerant species.**
L 6	Recognize and reduce the **risk of stand-replacing catastrophic wildfires**.
L 7	The suggestion of developing **health indicators is crucial, especially for aspen**.
L 9	Chapter 9 would benefit from a **clearer distinction between "travel route ratings" and "scenic quality ratings".**
L 10	Has TRPA considered **landowner outreach/education and cost-sharing programs** to create **incentives for scenic quality improvements on private lands**?
L 11	**The recreation chapter is very sparse in detail** – especially when compared to the other resource chapters,
L 12	Except for limitations noted above, the I**mplementation and Effectiveness chapter reasonably describes the information** presented in the report.
L 15	The **conclusions are reasonably supported** by the best available science summarized in the report.
L 15	As a social scientist, I believe the **report and analyses could go further in exploring the human dimensions of land use issues in the Tahoe Basin**.
	END OF LILIEHOLM COMMENT SUMMARY
	WESSMAN COMMENT SUMMARY FOLLOWS:

W 1	The **introduction chapter needs a compelling narrative at the start** to introduce the rationale for TRPA's integrated assessment and evaluation plan in the Basin.
W 1	The document drops into "Background" by **repeating the original Statement of Mission**. **This gives such a strong bureaucratic and regulatory teno**r to the document that **it may be off-putting** for its intended readers.
W 1	**TRPA sits at the perfect scale** to evaluate the big picture of land use practices and their implications.
W 2	There is a general need for **TRPA to take a landscape perspective** in order to **relate the Threshold Categories to one another.**
W 2	I suggest … a **Threshold Category of "Landscape Ecology"** be incorporated into TRPA as an **integrating theme** …
W 3	The intentions and methods (of the threshold indicators) were described, but the **language was slightly to very dense.**
W 3	Under Section 2, the discussion of "Determine Indicator Status" is not clear and, in fact, confusing.
W 5	At the very least, a **Basin wide inventory and remote monitoring of SEZ** would be instrumental in the event of new upland disturbances, **such as wildfire**.
W 5	Difficult to critique the **remote sensing methods when the land capability classes are not described.**
W 6	As currently framed, the only SEZ indicator is area (acres) – while this is straightforward, **acreage itself is not adequate to describe impacts on soil conservation.**
W 7	The **vegetation** section is well written and clear.
W 9	Given the **recent fires** (Angora and Gondola), **wouldn't the eventual regeneration satisfy targets for small diameter trees?**
W 10	The **introduction to the Wildlife section confuses terminology** and is **not consistent with the threshold category hierarchy established for TRPA**.
W 10	**TRPA's achievements, limitations and recommendations are well integrated in the Implementation and Effectiveness chapter**.
	END OF THE WESSMAN COMMENT REVIEW

Review of the Tahoe Regional Planning Agency (TRPA) 2011 Threshold Evaluation Report

Draft report received by Tahoe Science Council, February 16, 2012

March 18, 2012

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Background statement:

I am a broadly trained aquatic ecologist with 37 years of experience in water resources science conducting basic and applied research, partnering with local, state, federal, and tribal agencies, environmental organizations, and decision-makers, and collaborating with formal and non-formal education and outreach professionals to use these kinds of data to improve the environmental literacy and decision-making of the general public. In the past 10 years, I have devoted much of my time as the lead of a web-based project entitled www.LakeSuperiorStreams.org designed to inform and educate multiple audiences at the head of the Great Lakes about how ultra-oligotrophic Lake Superior's streams and nearshore zone "work" and respond to both natural events, and to human activities in the watershed, and to provide a resource for further understanding and remediation and restoration actions.

I contributed in a modest way to the relatively early stages of the Lake Tahoe Interagency Monitoring Program (LTIMP) via technical and administrative coordination of the Tahoe Research Group at UC-Davis, helping synthesize lake and stream water quality, and atmospheric nutrient deposition data from WY 1981-1984, developing lake and watershed conceptual models, and providing critical review of the original 1982 Threshold Carrying Capacity Report. I find it extremely gratifying to be able to examine the 15 to 45 year long data sets that resulted from this effort and the dozens of state- of-the-art BMPs and management policies that have been installed, enacted, and institutionalized to address the many sources of environmental degradation occurring in the Tahoe Basin. I was an 11 year member of Dr. Charles Goldman's "other", less heralded long-term limnology research program at Castle Lake, a small (20 hectare) meso-oligotrophic sub-alpine lake in a small undeveloped Klamath mountain watershed. Castle now has a 52 year

intensive and comprehensive limnological data set which complements Tahoe monitoring program information data to provide novel opportunities for better understanding and managing the combined effects of weather and climate, the natural watershed and airshed, and human activities. The prior federal and state investments in research and monitoring in the Tahoe Basin should be applauded along with the past and current leadership of the Tahoe Research Group, and its principle agency collaborators, including the TRPA. These efforts continue to provide a scientifically solid foundation of information that TRPA can use for evaluating mitigation, remediation and restoration actions designed to restore historic water and air quality in the Basin.

I. Overall Assessment of the TRPA 2011 Threshold Evaluation Report

The 2011 Threshold Evaluation Report by the Tahoe Regional Planning Agency (TRPA) did an overall very good job of compiling and summarizing an enormous amount of environmental, socioeconomic, and management data and information. TRPA also significantly improved their format from previous reports in order to facilitate presenting the information to different audiences, i.e. technical versus non-technical. Some of the figures are already more conducive to presentation via a website that I briefly examined than in a hard copy report because of the ability to enlarge maps and ancillary panels.

The TRPA Compact that began in 1982 with various additions and amendments over the next 15 years provided a landmark framework for redressing more than a century and a half of natural resource degradation to a lake basin that is a global jewel. The current 5 year Threshold Evaluation provides an opportunity for progress to be reviewed, and mid course improvements to be made to both the science and management policy aspects of the Compact. I think the Chapter 12 summary of the implementation and effectiveness of the 1987 TRPA Regional Plan is basically sound and reasonable. There are many other aspects of the Report's analyses and conclusions that may be criticized in good faith in order to improve scientific interpretations, implementation of cutting edge BMPs and management policies, and reduce costs. However, I see no fundamental (aka "fatal") flaws in the basic science being applied or in the Conclusions & Recommendations in Chapter 13 which I found to be extremely well conceived and written.

A more comprehensive scientific review of the data sets remains a critical need, although this task appears to be already in progress based on various statements that appear in various appendices, and in TERC (UC-Davis) reports - especially their 2011 State of the Lake report for Water Year 2010. My major concern with the Draft Thresholds Report was in regard to its lack of statistical rigor in the status and trends analyses, and not doing a better job of linking the large effects of annual weather differences to lake and stream water quality and the natural variability of the data in the context of available measurement methods. I was also disappointed that the Report did not do a good job of presenting information in a landscape perspective highlighting how certain key indicators cut across major areas (i.e. Chapters) – such as how the Air Quality NOx data is linked to lake N-loading; how N and P source loading is from fundamentally different processes (N from the atmosphere and P from watersheds), and how the land-water interface meets in the littoral zone with consequences to periphyton and phytoplankton, food webs, fisheries, recreation, and both scenic and property value. I think that it is important for the Report's audiences to understand that the cost of a particular management action in one policy area may have important positive effects in other areas; and conversely that there may be difficult trade-offs between well intended policies.

I also cannot overstate the importance and cost-effectiveness of a strong, well funded outreach, education, and training program for the general public, students and teachers, agencies, decision-makers, and targeted business audiences. This cannot be just a "tacked on" item, and in my experience, effective outreach is rarely carried out well by agencies or in an objective manner by business and industry. There are extremely experienced outreach and extension educators in all land grant universities, particularly those in states with marine or Great Lakes coastal zones via their Sea Grant programs. University Extension programs benefit from not being perceived as advocacy groups, their ability to work at all scales from local to international, and their expertise in translating basic and applied science and engineering results to the general public, to teachers, to businesses, and to decision-makers.

My strongest recommendation is to maintain the core program of Lake Tahoe pelagic and nearshore data collection and tributary monitoring that has been led by the Tahoe Research Group, now TERC, at the University of California- Davis (UCD) since the 1960's. I also believe it is crucial for TERC at UC-Davis, in collaboration with the other Tahoe Science Consortium member institutions, to be the organization that directs and conducts these programs, and takes the lead role in interpreting the aquatic data, presenting it to target audiences, recommending program improvements, prioritizing Tahoe Basin focused applied research, and reviewing the science of the assessment process for TRPA's evaluations of management actions (e.g. structural BMPs, SEZ restoration, planning and zoning ordinances, etc). This academically and research focused group has the scientific (ecological, physical/chemical/geological, social, and behavioral), engineering, and socioeconomic expertise, stature, and reputation for objectivity that I believe is needed to overcome the economic and political realities of today and maintain the Lake Tahoe restoration mission. My understanding is that TERC now has strong ties to UNR and DRI and it could be that scientists from these institutions are more appropriate to lead some analyses.

The remainder and bulk of my review includes editorial comments and suggestions for improving the Report and the overall Tahoe Basin restoration program.

Chapter 1: Introduction

This section would be considerably more useful if it began with a succinct history of the progression of the deterioration of Lake Tahoe, its tributaries, and its air quality. This should include a few key trend figures. This could be followed by an equally succinct description of the key planning and regulatory events leading to the current Tahoe Compact. The Draft Introduction assumes that the reader is familiar with the past 50 years of science, management, and politics and I doubt that this is an accurate assumption.

I also never have agreed with the use of the word "Threshold" in the context used in the Compact. To the average person I think it sounds like a cliff is looming and if an environmental regulatory or guidance "threshold" is exceeded, there will be a catastrophic consequence – like the whole lake turning green. This word derives from at least the late 1970's –early 80's and I think it would be wise for TRPA to phase it out. In the Great Lakes, the term "Tipping Points" is used, and I'm not a fan of this usage either.

I also see that the Washoe Tribe is part of the compact yet I don't recall seeing evidence of their input. Since I did not focus on the socioeconomic indicators, I may have overlooked this. Several

bands of the Ojibwe Tribe are deeply involved in watershed and airshed sustainability issues in the western arm of Lake Superior, and sometimes offer different, unique, and valuable perspectives. Impacts on their cultural resources are particularly critical to address.

Editorial comments:

1-2. P2 final sentence - ….interchangeably

Last P – What exactly is the "amendment process?" Do both State legislatures need to ratify it? Do the Governors need to sign off as well?

1-3. P4 – Sentence reads "Over the next decade …." And then gives a statistic for 2035 which is 23 years from now.

1-4. Figure 1-1. Carson City is in the water. Maps in general could have larger fonts, more information and be interpretable in Black & White.

1-5. Figure 1-2 should start in 1950 or 1960. The data exist and have been previously published. Further, this figure and others like it use the wrong x-axis in their graphing software. The scale must be linear in time for trend data, and data gaps left as gaps. Using a date scale that simply plots histograms for all years at even intervals distorts the visual analysis of trends.

Figure 1-3. It would be interesting to also contrast this to older data.

1-6. Table 1-1 – Annual changes all need to be divided by 10 since the % changes are decadal.

1-7. Figure 1-4. Should go back as far as possible (at least to 1970).

Fig 1-5 – I would like to have seen the plot include 1980 and 1970 data.

1-8. Same comment as above for these Figures. I think the reader needs to see how socioeconomic factors changed over the same time frame as the air and water quality changed. Then, they can be associated statistically as the first step in trying to identify cuae-effect relationships.

1-14. Fig 1-9.

STATUS- Difficult to distinguish in black && white. Also the right circle for insufficient data might have a big "X" inside to make it stand out.
TREND – There's a strong need to be quantitative and on a sound statistical foundation. Even if it's subjective basis, develop a process for quantifying Best Professional Judgment to assess the confidence for these metrics.

CONFIDENCE – a statistical framework for determining confidence in status and trends indicators need to be based on measures of uncertainty which need to be clearly shown in all figures and tables, and clearly discussed. This is a recurring flaw in most chapters, especially those involving water quality.

1-15. Indicator (Unit of Measure). An indicator has units, and this confuses that notion. Perhaps go to the EPA- funded Great Lakes Environmental Indicators study led by my home institution (http://glei.nrri.umn.edu/) and also the Pacific Estuarine Ecosystem Indicator Research (PEEIR) project for the California coastal zone led by UC-Davis (http://www.bml.ucdavis.edu/peeir/index.htm) to bring the Compact language into better agreement with the rest of the country.

Chapter 2. Methodology (and all of its appendices)

This chapter does a good job of presenting TRPA's approach to determining status and trends for their prescribed set of indicators. Their new metrics for evaluating progress in relation to targets may be an improvement over previous 5-year evaluations. However, there are still some important methodology questions that need to be addressed. The major one relates to the lack of adequate statistical analysis and the potential use of incorrect techniques based on the characteristics of the data set (i.e. how much data, missing data, levels of detection, confidence limits, normality or non-normality assumptions, etc.). These analyses are not trivial to carry out and are usually the result of extensive discussions between the scientists who designed the monitoring and research programs and statisticians who have had prior experience evaluating these kinds of long-term environmental data sets. A linear regression analysis has assumptions built into it, such as normally distributed data – which is not the case for many environmental variables. There are other non-parametric models and tests for trends that are well vetted by the U.S. Geological Survey (USGS) for use in streams in particular, but also for lakes. It does not appear to me that the scientists from TRPA's Partners had much to do with the statistical methodology used for the Report or the presentation of their own data; and I think they are the folks that should be doing the analysis, and then working with TRPA and Extension Educators to best communicate results in words and graphics.

Editorial comments:

Careful re-reading of this section's wording is also needed.

2-4. Throughout the report, it's time to use meters as the primary unit and put "feet" in parentheses throughout (except in some pre-packaged figures from TERC, DRI or USGS.).

I also think it's inappropriate to use a ratio of current annual secchi (or any other indicator) and the target value as a measure of "attainment" for a couple of reasons. The first is that the parameter may not be linear – such as light attenuation as estimated by secchi depth. One meter of loss of secchi depth from 25-24 m is due to a tiny fraction of particles in the water needed to decrease it from 15 to 14 meters or 5 to 4 meters. Such data may be "linearized" by using a Ln transformation or by using 1/[secchi depth]. Also, we have no reason to expect progress to be linear over time and I would argue that this creates false expectations. Most ecological processes that I know of are distinctly non-linear. And the installation of stormwater BMPs and the repair of SEZs, for example, can require several years for construction impacts to wash away and re-vegetation to occur. Sediment discharge may be worse after a project than before if heavy rainstorms occur before the project area is fully remediated.

Definitions of what constitutes a change as in Table 2-2 are useful only to the extent that you can accurately assess the values of the indicators and their uncertainty. It may be better to simply

report an Indicator Trend Category as Improving, Declining, Essentially No Change, and Insufficient Data to Evaluate. Where a rate of change can be calculated, it should be reported along with the confidence intervals. The detail in some of the indicator descriptions seems unwarranted given the uncertainties in the values of some of these indicators.

There is also an important need to have some index of the weather in most of the water quality, and perhaps also some of the air quality, and even socioeconomic indicators. For more than 30 years it has been clear to the TRG (now TERC) that annual secchi, and in particular winter secchi, increased (more transparent) in low precipitation Water Years. Weather has direct control of the water budget in the basin such as stream flows, but also is important to lake productivity in terms of how early summer stratification breaks down, how long the lake remains isothermal, how strong and frequent wind storms are, how early or late does spring arrive, and how dry and how hot is summer? I think TRPA has also spent too much attention comparing one year to other. There's ample data presumably to do a good job of addressing the influence of the weather – which would then need to summarized for the 5 year evaluation period and used when discussing changes between evaluation periods and in discussing the individual "bumps and grinds" of the data – particularly the secchi and 14C-PPr data.

2-8 **Confidence**. I rather like the way TRPA tried to establish "rules" for consistency in their confidence in status estimation. However, the Trend Confidence procedure, in my opinion, has the flawed premise that trends are always described by a linear regression and associated t-test (determined by the combination of r2 and degrees of freedom n-1). It's a step in the right direction, in that the confidence of the trend description should be stated clearly. However, the methodology will likely vary depending on the nature of the data set.

Chapter 3. Air Quality

As noted previously, I would like to have seen clear links to the atmospheric deposition data collected by TRG/TERC since the mid-late 1970s and to the nitrogen (and phosphorus) budgets for the lake. The public and legislators need to know that that there are extremely important linkages between the Tahoe Basin Watershed and Airshed – with some things more readily controllable than others.

I didn't see mention of dry deposition and wet deposition measurements or computations. They are important data. I also didn't see a tabulation of NH4-N versus NO3/2 N deposition, both wet and dry) or how this has changed over time. There are many western NADP network sites in addition to those operated by TERC and perhaps other agencies or DRI.

Since skiing is such a big winter usage driver, couldn't TRPA develop an index for the "quality" of winter in terms of the ski resorts? This metric could then be related to air quality and perhaps even water quality variables over the long term. This could help establish better cause-effect relationships.

It would be helpful if significant forest fire years were so noted in the relevant air pollutant figures. I believe one graph noted 1997 in that regard; and the recent South Lake Tahoe fire is another.

If some parameters were measured prior to 1985, and I know there were, they should perhaps be included in an Appendix and used in the discussion of results as needed. It's alright to use such data even if not determined at all the other stations now in use. I always want to see the entire data set.

<u>Editorial comments</u>:

The Air Quality parameter presentations were pretty clear to me and well written. The lake map schematics in the figures were too small to read.
Figure on 3-10 needs stats for linear trend lines
All stats have a problem with using too many significant figures. 3-15 has a regression slope that should be at least 2, possibly 3 significant figures while the y-intercept and r2 have 3 or 4 when the intercept should be the same as the slope and r2 could be just 0.072.
The report would benefit from a consistent approach to stating the level of significance to be used and then not drawing the regression line when this level is not achieved.
3-30. Stats missing from figure. Map too small to see. I don't think a t-test comparing the data from 2000-2005 would be significantly different from the period 2006-2009.
I was not familiar with the stats testing methodology that the agency(s) used for these air quality (Thiel ?) regressions. The METHODLOGY chapter should describe it in some detail. Their "P" value appears to be analogous to the normal distribution's p-value. However TRPA is converting this value to a percent confidence estimate – where a P=0.12 becomes a Confidence = 88%. [the same as 100* (1-alpha)]. Note that 88% in this context may not be a very "high" confidence result. TRPA and CARB and Cal Dept of Health (?) can presumably state something in regard to the relative risk to the public of higher values of air pollutants in S. lake Tahoe as opposed to other less populated regions where exposure is much lower.
3-34. Upper figure should not have a trend line since it is not statistically significant.
3-35 USE OF RUNNING AVERAGES: Adopted Standards refers to using a running 3 year average. This can provide a nice way to visually smooth data. It might also be used for water quality data to help qualitatively filter out interannual weather differences.

Chapter 4. Water Quality (and all of its appendices)

I have two major criticisms of this section – the first is that the presentation and analysis of the long-term water quality data from the lake and its tributaries do not appear to mirror the data and analyses presented by TERC-UC-Davis via its 2011 (WY 2010) State of the lake report or its many other publications found on its website; the second is indirectly related to the first and involves the inadequate statistical analysis of the long-term data sets. There are also many omitted, but important data sets: such as nitrate/nitrite-N (+ammonium-N) accumulation in the lake over time; atmospheric deposition of TN and DIN over time; depth (and perhaps duration) of winter mixing over time; chlorophyll-a in surface water and per square meter (integrated water column) over time; fine suspended sediment over time; temperature, etc. These trends, or lack of trend, are important ancillary data for determining cause and effect. They also provide important linkages for telling the complex "story" to the general public and to decision makers about the changing water quality in the lake and the most plausible hypotheses that have been tested using all available data. Lake Tahoe's phytoplankton PPr and secchi transparency data stories do a good job of integrating a bunch of different fluxes (e.g. nutrient inputs from land and atmosphere driven by weather and landscape cover, use, and current management actions). These same factors also affect the nearshore (littoral zone) although it is much more difficult to effectively characterize this especially variable zone than it is the pelagic offshore water. The TRG and TERC have addressed synoptic variation in these water quality parameters via season long comparisons between the Index, Mid-lake North, and Mid-lake South stations. Similarly the spatial differences in atmospheric deposition of nutrients and precipitation were assessed in the 1980's and perhaps also more recently. Periphyton have been monitored using state of the art methods since the late 1970s and should also be a part of the story because of the ability of this indicator to identify more localized conditions (site-specificity).

Specific and editorial comments:

Lake Water Quality

Table 4-1. Statistical uncertainties need to be presented and addressed. The mean values for secchi depth and 14C-PPr that are used as standards (i.e. 1967-1971 annual means) need to always be reported as a mean ± standard deviation (n) or with 90 or 95% confidence intervals.
The same comment applies to the 1973-1981 stream loading standards. Some analogous measure of uncertainty is usually available for non-parametric statistical tests.

Applicable State and Federal WQ standards listed in this table are sometimes not specific enough – such as what do the concentrations of N and P correspond to? Surface water, euphotic zone, integrated vertical water column? In the nearshore zone this is messier and therefore, it is perhaps even more important to be specific.

4-6. Top row of Table 1. Why is there a TSS standard for groundwater infiltration? Or Fe or TP, or turbidity? Is Fe measured as total Fe or dissolved Fe? What are the minimum data requirements for evaluating a water body, especially streams where flows are flashy and concentrations are affected strongly by hydrologic regime – base flow, versus snow melt runoff, versus significant rainstorm events? TERC has guidelines and protocols that they and USGS have followed for many years.

4-7. P3. After the last line "….Chapter 12. Consider adding "...This will also reduce urban and rural runoff pollutant loads to the lake."

4-9. Map illegible; Relevance statement should be reviewed by TERC. Phytoplankton affect transparency by scattering light which is presumed to have a much larger effect on transparency than is the amount of light they absorb for photosynthesis. The plot should depict the standard as a line with a fuzzy band denoting the 90 or 95% confidence interval. It is also important to include this graph and the secchi graphs showing the error bars for variation within a year – it may be necessary to refer the reader to a blown up full page chart, but the fact that the long-term trends far exceed the magnitude of intra-annual variation is extremely important.

4-10. Top. I do not see any basis presented here for the statement that the trend is declining. The effect of interannual weather differences on annual and seasonal PPr and secchi needs to be described clearly to show how low precip years tend to be associated with improved water quality – presumably because of reduced tributary nutrient and sediment loading, reduced winter mixing of aphotic zone nitrate-N, and perhaps other related phenomena – such as food web changes (i.e. grazing by zooplankton). I think it's a mistake for TRPA to be evaluating one year in relation to another, or to the long-term average except for the purpose of illustrating correlations with meteorological or some other tangible factor. Perhaps a running 3 year average would be helpful.

4-12. The polynomial fit provides a reasonable description of the data but there is no supporting "model" for why this equation should be used. In fact there are other alternative models that could be used, including a linear increase from 1968 through about 1992 or 1993, and then a flat (i.e. no slope) line with high variability since then. I suggest presenting several scenarios.

Middle of page: precipitation is a part of meteorology.

Target Attainment Date = 2076. It's probably time for TERC to try to obtain funding for a thorough re-analysis of these long-term data sets with a goal of helping define more realistic or at least better grounded targets (I suspect this is already in progress). It is encouraging to see some of the pelagic indicators suggesting improvement, or at least a decreased rate of decline. After removing the effect of interannual weather (or other) factors, this is a story worth trumpeting since it is plausible that management actions carried out over the last 20 years or so are at least in part, the cause for this recovery.

4-15. Once again, it is possible and in my opinion desirable to present several alternative statistical scenarios besides the polynomial fit which is simply a curve fitting exercise. The reasoning behind the statements about the 2010 data in relation to targets seems unwarranted to me. However, they might have compared the 5 year averages from the current and previous evaluation period, but again after normalizing to interannual precipitation (at the least).

4-16. Needs TERC review. A vertical extinction coefficient is not a "Sensor". It's a measure of the rate of attenuation of light (usually photosynthetically available radiation [PAR]) with depth measured using an electronic sensor that is lowered down the water column.

Not sure what the Interim target achieves.

It would also be interesting to see data from the "summer" window, in addition to the winter window and the full annual averages. They each may tell different stories.

<u>Tributary Water Quality</u>

- Maps are illegible

4-20. Label left column of creeks = CA and right column NV

I think it's important to show flow-weighted (i.e. normalized) concentrations in addition to mean annual concentration (e.g. for TP ion page 4-24).

4-21. top panel – how is the number of sufficient samples defined? How are years with few samples handled in the plots? It seems to me that there should be a minimum number of samples, perhaps with a caveat regarding how they are distributed across hydrologic regimes. For example, if 4 samples are collected during baseflow for the year, one would expect low TSS and relatively high DIN and TN because the water is typically much clearer during baseflow with a lower concentration of suspended particles. TRG/TERC/USGS have traditionally conducted event based sampling with a balance between high and low flow sample collections over the course of the year.

Years might be characterized as to the frequency of larger events, say perhaps 24 hr rain storms > 0.5" (this is a criterion used in MN for construction contractors to check their BMPS poor runoff and erosion).

Is General Creek still considered to be a reasonable reference stream based on very low development? If so, it could be used as such – at least for the western basin watersheds.

4-22. Top table – Additional columns with % development and % Impervious Surface would be informative. If general Creek has virtually no development in the watershed and still violates a WQ standard, isn't this a problem in terms of the values of the standards or criteria?

4-22. P2. Or is this due to a climate change signal?

4-22. P3. The Rosewood Creek diversion from the Third Creek watershed needs to be highlighted in all its graphs and tables. This needs to be dealt with in terms of qualifying how the diversion might affect the Third Creek long-term data set.

4-22. **Confidence.** I don't agree that qualitative graphical inspection is the only way to assess potential trends here. As for the lake data, I would have TERC, USGS, and DRI stream ecologists and hydrologists analyze these data. Mann- Kendall non parametric trend analysis is a method long used by USGS and many state agencies for assessing temporal, and more recently, spatial trends in stream data.

4-23. Interim target – refers to next major evaluation. *When and by whom*. Perhaps this whole section needs to wait for further analyses.

Target Attainment Date – if only qualitative graphical inspections were performed, how was the year 2031 arrived at?

Human and Environmental Drivers – The rain shadow comment needs to be stated up front. In fact much of this section would be appropriate at the beginning of the stream WQ section. It is well written and reasonably complete.

Monitoring Approach – needs to specify details of the Event Based Sampling approach and protocols used.

4-24. Map illegibility. General Creek 1981 data for TP seems very strange – the highest average TP. I recall that this was a low water year but cannot recall if because of this there were problems getting a wide enough distribution of samples.

4-25. Adopted Standard – switches from using dissolved-P to using total –P.

4-25 to 4-26. I got lost in the reasoning for not using flow-weighted means. If concentrations are simply averaged, there is a lot of weight given to outliers and this can be really important for smaller data sets for particular streams and years. A median value is perhaps more appropriate for such low data (low "n") years but a set of rules for how to deal with this are needed.

P2. A better way to state this is that 13 out 18 years had TP <0.070 mgP/L. It is wrong to define a difference of 0.02 mg/L as being "near" the standard of 0.05 mg/L – this is an entirely arbitrary statement. It depends on the method limit of detection and the field variance.

Bottom of 4-26 – The rain shadow statement lends itself to justifying the use of flow weighted means. Or perhaps by hydrologic regimes (snow melt runoff, base flow, and storm events where each provides a somewhat different bit of information). Especially when contrasting TSS, TP, TN, and DIN.

TN section suffers from the same problems as TP.

4-32 – TSS Loads as per the trend graph shown. This type of plot could be done for different sets of streams to look for patterns back through 1980.

Trend line is inappropriate because the linear regression is nowhere near statistically significant. Since the largest flow streams have data back to ~ 1980, I would use these data and show their summation all the way back. Then a second panel right below the original can be shown that includes the additional NV streams added in 1992. Don't truncate that long-term data set – it is almost always helpful to see the entire data set; you can always include an inset of a more recent time period if that is helpful in the presentation.

The 2010 loads were not only similar to 2003, but also 2009. And 1999 and 2000 had similar loads but much higher flows illustrating the fact that there are other factors affecting nutrient and sediment loads and concentrations. Besides precip patterns across the basin, there might be soils differences that were not discussed (are there good soils maps and erodibility indices throughout the Basin?). The rain on snow comment was a good one and these years might be flagged in their plots.

4-33. Bottom paragraph needs much more careful analysis.

4-34. The discussion of sediment particles < 16 microns in diameter is important but should not be buried in an Appendix. It is included in the TERC reports.

4-36 through 4-38. TP trend not significant and so there should <u>not</u> be a regression line drawn.

Stacked time course plots for individual streams and their loads could be visually helpful, especially if water yield was also plotted. Annual loads for each stream and for the totals should have some estimate of the uncertainty associated with the value used as an indicator. However this done must be well vetted by the partner organizations who designed the sampling program, and collect and analyze the data.

4-40 to 4-43. Same general comments pertain to the Nitrate+Nitrite story. Ammonium-N is also still analyzed, I think, and so is important to consider by itself and also added to NO3/2 as DIN.

The statistically significant decline of Nitrate+Nitrite –N load over time is certainly an interesting result and worthy of further analysis by Partner stream ecologists and hydrologists. It would be helpful to see companion plots going back to 1980 (and including 1974 and '75 data for Ward Creek and Blackwood Creek) plus precip and atmospheric N-deposition and NOx concentrations.

Appendix WQ-2. Suspended Sediment and Fine Particles

This is a very useful section that might be included in the main WQ chapter instead of "buried" as an appendix. It could be helpful to begin the data discussion with a set of long-term data showing how annual water yield (per acre of watershed) relates to annual precipitation.

WQ2-1. P4. I understand that is convenient to have graphs for all 10 streams starting at the same year, in this case 1993, but I would have preferred to see an extra column in the summary tables that would show all years of data summarized for each stream. It would also be helpful to see these data normalized to watershed area, and to annual water yield (flow-weighted) in order to highlight the differences between the streams.

Figure 1. Legend typo "yearly"

Figures 1-4 scales: Although nice to see all streams on the same Y-axis, this makes the graphs difficult to read in some cases.

For Fig 1 – I suggest a 0-12,000 TSS load scale for Third Creek and 0-2400 for the other 4 streams. Perhaps the second Y-scale could be 0-1000 (Q) for Third and Incline and 0-100 for the other three. A note should appear in the higher scaled figures to alert the reader that there is a scale difference between streams.

Remainder of the Appendix that repeats the TSS section but for all the N and P fractions measured: Same comments as for TSS regarding flow-weighting and areal normalizing, and scale s.

General Comment – There is a section in the TERC's 2011 State of the Lake Report regarding fine particle data for the lake (Index station presumably) and its relationship to secchi depth. It also discusses the potential for changes in phytoplankton community composition to alter secchi depth relationships to 14C-PPr, chlor-a etc. <u>This seems extremely important to me and should be featured in Chapter 4.</u>

Chapter 5. Soil Conservation

Overall, I thought this chapter was well written and I was impressed by the amount of work that has been done in the Basin. However, as with Water Quality, it suffers from some problems with the presentation and analysis of the data. The fact that the Lidar analysis was performed in Aug 2010 might warrant a statement regarding an ideal time for using it with contemporaneous aerial photography would be prior to leaf-out. I see also that further analysis of the Impervious Surface (IS) data are due in Dec 20-12. TRPA's interim approach of using new land coverage based on permitted projects seems like a good idea.

<u>Comments</u>:

p. 5-6. I disagree with the way the TOTALS are presented in Table 5-2. Their analysis in essence has set a somewhat arbitrary allowance for IS within classes and then allowed ISD to increase to this maximum. Since the lake and tributaries are, and have been, stated to be Impaired in sense of the Clean Water Act, it seems imprudent and flawed to have an IS policy that continues to allow further conversion to IS as a "Target." Rather, a reasonable policy would be not increase IS within a class unless a very strong case can be made for a variance. This would also require a public

hearing in my view. No net increase in Impervious Surface is a policy gaining traction in regions with water resources that are still in good shape, but threatened. Duluth, MN has such development ordnance. Various Low Impact Design features on development sites can then be promoted along with proper training for architects, landscapers, and contractors.

5-7. Map illegible

5-8. I disagree with the statement under OVERALL that states that interim targets are not needed for land classes where IS was below the target for the reasons described above. The science of how IS relates to water quality in flashy streams like those at Tahoe and in my own North Shore of Lake Superior is very young and guidelines are general at best. IS leads to excess flow, high peak flows, lower base flows, increased channel and bank erosion, increased sediment and nutrient discharge. A no net increase in runoff guideline or ordinance at least in many areas of the basin seems warranted.
I agreed with the rest of this section including its Recommendations.
5-12. Table 5-1. It would be helpful to include a final row with the total 21,944 acres listed that also showed that 4400 of these were already disturbed of which 25%, or 1100 acres, is to be remediated and restored. Therefore, by my calculation 546 to 629 acres have been restored/remediated to date, or 50-57% of the target.
5-14. Map illegible. The Bar graphs should be plotted on a true time scale, with the 3 bars centered at 1990, 1992 and 1995 – they overlap. I calculate the rate for interval 1 as 21.6 acres/yr, for 2 as 19.8 acres per year and for the 3rd (1980-2011) as 17.6 acres/year. This indicates that the rate of SEZ restoration is slowing down over time.
I would also move Table 5-1 back a page or two to allow the reader to digest the importance of IS and SEZs.

Chapter 6. Vegetation
I did not review this chapter in detail but agreed with discussions led by other reviewers in our March 16, 2012 conference call with the TSC.

Chapter 7. Fisheries
Overall, I thought this was a well written section. It seems to me that fisheries expertise is plentiful from within CAL Fish and Game and NEV Dept of Wildlife, plus the 2 major universities and probably also in the US Forest Service. It's not clear to me why these other Partners are not included in the authorship for this chapter.
This would also be a good chapter to have an introduction that placed the conservation of trout and the other aquatic organisms in the streams into the stormwater/IS/development/hydrologic alteration framework. It should be especially well integrated with the SEZ, Vegetation, and soil conservation sections. Coldwater fish and macroinvertebrate communities have provided very good indicators of watershed/stream "health" or "condition" in other regions of the country with abundant small, flashy, streams located in nutrient poor soils (MN, ID, WI, MI, etc). Similarly, the nearshore zone connects watershed runoff, groundwater, and surface runoff to substrate composition during spawning, to substrate coverage by periphyton, to scenic and recreational condition.
Focusing on the Lahontan Cutthroat Trout (LCT) seems like a sensible, basin-wide interest which could be piloted by TRPA as an indicator of "something." The problem is that it is not always known why a re-introduction fails and there may be important factors (such as a series of particular

weather-years, or a parasite that varies from year to year) that are not well understood or accounted for. Still, if the re-introduction is successful, this could be an excellent integrator of overall watershed or subwatershed health if sustained over time.
This would also be a good place to lay out the chronology of fish management actions and the purported effects on the lake's food webs.
I thought the 9 Policies were well conceived and clearly described.

Editorial comments:

7-1, P3, L4: …'includes programs THAT either….' Also, seems like the EIP includes programs that are designed to enhance / restore habitats (whether they are successful is a different issue).

7-1, P4, L1: ….'there ARE one goal and…'

7-2, P2, L10: …'may be required for development….'. Does this mean required for development projects or that protective measures etc. may be required TO BE developed?

7-3, Table 7-1, row 2. Shouldn't this talk about non-degradation from 1997 status, as opposed to maintain that status? What if some of the marginal streams are improved? In this case, the 38 miles of this stream class would not be maintained.

7-4, P1, L5: insert new word…. 'are composed OF larger diameter…'

7-4, P2, L3: physical disturbance can occur across a spectrum of very minor change (to substrate type and/or areal extent) to gross change. Where is the extent of change (within an area) considered? I am guessing that this is incorporated into the remotely sensed measurement of fish habitat, but this is not clear from this text. Perhaps the last part of this paragraph addresses this issue.

7-4, P3: Lake Habitat status does appear to be numerically worse and that confidence is low. But it would be more accurate to state this difference (7% decrease) is, or may be, insignificant – especially since measurement accuracy is stated to be 86%. I'm not sure what 'accuracy' means in this context, and there is no discussion of overall uncertainty (precision) but there should be some clear description of what a realistic change-detection magnitude is. The footnotes to the map (under TREND) mention the 'differences in mapping approach'. Since lake habitat quality is clearly an important metric, there needs to be more discussion of these differences and the possible implications of these for future trend detection ability.

Also, it is not clear how important the remotely sensed habitat data are, in reality. The map footnotes (STATUS) mention that it is likely that any changes in habitat quality since 2002 have not been anthropogenic because of strict permitting and mandatory mitigation actions. Changes are hypothesized to be associated with natural littoral drift and fluctuating lake levels, if there have even been significant habitat quality changes. Therefore, there is the question of whether the habitat standards exclude naturally-derived changes? Perhaps a more detailed monitoring of substrate quality in the vicinity of construction projects (upstream-downstream and before after) would be more valuable than lake-wide remotely-sensed monitoring. This would be valuable assessment and cost-effectiveness data for BMPs.

7-5 (figure): color-coding scheme in bar chart and map should match. Also, top section of first bar in the graph looks to be closer to black than dark blue. Red appears as brown. Label the bars with their Year (2002 vs 1997). Map should state that the Benchmark Year for this habitat survey was 1997 (?).

7-6, **Trend**, L5: first half of this line doesn't make sense. Needs to be re-written. Missing clause.

7-6, **Trend** paragraph: it would be helpful to preface the relatively detailed description of fish assemblage changes by an introductory statement to the effect that recent changes in relative abundance of some species may be related to habitat changes – for example…….

7-6 **Confidence** – What is the basis for this "86% accurate" statement. Did they ground truth it – at least at a clause saying a bit about the basis for this statistic.

7-6, **Interim Target** section: I see no substantive reason to reduce the interim target to 5,601 acres, in view of the accuracy issues noted above.

7-6, **Target Attainment Date**: a justification for the stated attainment date of 2025 is not at all clear to me - especially since the first sentence in this paragraph mentions that attainment date cannot be accurately estimated. What does 'stand' mean in the second sentence of this paragraph?

7-6 **Human and Environmental drivers.** "...global climate change typo…"

7-7, **Effectiveness of Programs and Actions**: the recommendation for measuring 'other dimensions' of fish habitat needs more discussion for justification. How important would these additional metrics be in terms of describing status & trends of fish habitat quality in a way that would be useful for assessment purposes? Shouldn't this discussion be placed in the subsequent paragraph ('Recommendation for Additional Actions')?

7-8, P3. While the stream rating methodology may not have been included in the referenced report, there presumably must have been a methodology to be able to come up with number of miles in different classes. Surely this key information gap merits some more investigation – someone, somewhere, must know how these data were derived. Without this information, doesn't the standard become essentially useless? I suppose that the section under 'Recommendation for Additional Actions' is essentially saying that existing data and, by implication, the standards are of little use and that this effort is being started afresh. But it's hard to believe that there are no previous data that might be used to characterize these streams in the past.

7-9. Define residential versus migratory streams

7-10 .L1 – Aren't woody debris and periphyton on rocks part of the standard stream habitat assessment protocol?

7-11. **Effectiveness of Programs and Actions** – Consider adding "…and implement standardized assessment methodology appropriate to Sierra Nevada streams.

7-11. **Recommendations for Additional Actions**- The Karr and Chu paper (1999) is now rather dated. There are perhaps more appropriate reviews by EPA and USGS, by the National Park Service, and by numerous states, including Minnesota (see Surface Water Assessment Program, Minnesota Pollution Control Agency), as well as the scientific literature.
7-12. Instream flow relevance- This section does not stress the importance of how temperature and oxygen stress that can occur naturally can be trumped by the warming climate and exacerbated by societal development activities and the inability of our storm water and land management policies to increase groundwater storage and base flows. Trout are in a difficult squeeze and water quality is an important component of their habitat.

7-13. Criteria 2 – it would be helpful to have a small map inset showing the 4 dammed streams.

7-14, P1, L7: 'potential' = potentially

7-14, P1, last sentence. Isn't it during these periods of very low flow conditions that anthropogenic flow modifications are likely to be especially important for fish? Places like this provide good nodes for linking stormwater increased flashiness + low base flows linking to potential DO and thermal "Squeezes" during hot dry summers. And the effect of multi-year droughts and of course predicted effects of climate change on the Northern Sierra region.

7-14, P3 ('Based on Tracy and Rost's…'): First sentence seems to say that it is not worth establishing minimum flows. However, previous paragraph, 3rd bullet, states that one recommendation of the Tracy and Rost evaluation is that 'instream flow requirements for all….fish species should be determined'. These two statements appear to be contradictory.

7-14. **Human and Environmental Drivers**: It would be helpful to include a discussion of how stormwater management, planning and zoning in urban and urbanizing areas, and effects and forest management interact with these other "natural" factors.

7-15. **Effectiveness of Programs**: Consider adding "…since 1987. However, neither fish species-specific nor stream-specific instream flow standards have (apparently) yet been developed, or at least implemented. "

7-17, P1, L1: incorporated not incorporating.

7-17, P1, L2: Why propose removing a policy statement if the threshold standard has been met? Isn't this a success story (at least with regard to existing policies)? However, developing a more quantitative standard would certainly be useful. Map unreadable

Chapter 8. Wildlife
Editorial comments:
8-5. Plotting precip along with the Goshawk data is interesting. However, the value for cumulative precipitation would need to be discussed in terms of what period, be it multi-month, or an annual cycle is relevant to nesting date. Could use July to June, or Oct – June…. The lowest active territories appear to be associated with low Water Years but this needs more analysis.
8-7. Trend line needs its equation and stats, consistent with earlier chapter formats.

General: I suggest taking a look at Dr. Jerry Niemi's long-term northern Minnesota and Wisconsin forest bird website and reports in terms of statistical analyses and data presentation http://www.nrri.umn.edu/mnbirds/ . Jerry is an excellent biostatistician, and Great Lakes ecologist, with a specialty in avian ecology.
8-9. Last sentence - Data from 1979-1997 should be presented and discussed perhaps. It might have use for filling in a nearly 2 decade hole without data.
8-13, 8-15, - Bar graphs are again using an incorrect x-axis for discussing trends. The scale should be linear in time to clearly show the gaps in data.
8-19. This is an informative way of showing data when there is a plausible hypothesis for the change in slope after 1998. However they could also have plotted a horizontal line to describe a flattening out of the deer decline after 1998, as opposed to a sharply increasing line. In any case the stats for the regressions should be shown.

Chapter 11. Recreation
I was surprised at how sparse this chapter was. I would think that it would be helpful to present more socioeconomic metrics in this section to potentially associate with the ecological indicators. Ultimately, we would all benefit as citizens if there were really reliable and comprehensive indicators of the value of our natural resources (essentially eco-services in EPA parlance).
Chapter 12. Implementation and Effectiveness of the 1987 TRP Regional Plan
This Chapter did a nice job of summarizing the progress that has been made in the Basin, and the overall success of the Threshold Compact and the coordination and leadership of TRPA. Nevertheless, I disagree with the statement on 12-2 (bottom paragraph) that uses the decline in the previous 3 low water years as evidence for overall lake improvement. Once again, I think the strong influence of interannual water budget differences needs to first be taken into account.

I particularly liked the discussion regarding the need to take a closer look at the status of wetlands in the basin.

Figure 12-1 is an inappropriate graph. A linear time scale should be used, and each interval plotted at its time-mid-point and as a Bar, not a dot. The width of the bars will correspond to the time interval for the estimate, and there is no need or reason to connect the dots (or the bars). Each of the 3 intervals could have a set of 4 different colored bars corresponding to the land cover classes in the legend.

Figure- 2. Same comments as above.

12-6. Fisheries. Perhaps request an interim report by 2013 to be further examined in 2016 at the next 5 year Evaluation.

It would also be helpful to see an analysis of zooplankton trends over the long period of TRG/TERC monitoring.

12-14. Air Quality & Transportation – consider adding "…habitat quality indicators and reduce atmospheric deposition of nitrogen and to a lesser extent phosphorus to basin soils and to Lake Tahoe and its tributaries.

12-15 – Highlights of implemented projects. Is this during the 24 year period 1987-2011 or the 14 year period 1997-2011?

"Acres of weeds…" should note that these are invasive or exotic species. 12-16 also needs to add invasive aquatic weeds in the Fig 12-4 legend to make it clear that macrophytes are not being targeted except for invasive species. Also might be further stressed that no pesticides were being used.

12-16. Forest Management. "Treated 45,413 acres WITH WHAT?

12-17. Note that street sweepers are also a BMP for reducing stormwater pollutant loadings to tributaries and to the nearshore zone of the lake.

12-29. Bottom table – a Figure might be helpful but x-axis must be linear in time.

Question – Does the Plan target a net reduction in Impervious Surface? There is presumably too much already considering the continuing WQ issues.

12-30. P1 L4 – Should be Table 12-8 in the reference.

12-32 – I'm not seeing how the reference to 3000 square miles to a foot of water depth is meaningful. Comparing it to a state like Rhode Island makes more sense to me.

P4 – water savings might be expressed as a % of actual water use to give a better indication of trends.

12-34. Table 12-10 Note 3. How is it possible that a peak flow estimate was not available from NTPUD given their NPDES reporting requirement? At least an estimate should be available.

Chapter 13. Conclusions and Recommendations

This section did an excellent job of summarizing the analyses described in the individual chapters. Even though I had issues with the presentation of data and some of the analyses, I think this chapter did an excellent job overall of summarizing a large amount of scientific data, and in general qualifying the conclusions that could be drawn from the data. The Recommendations were on target. This was also an extremely well conceived and well written section and I have no editorial comments to add.

Appendix IE-4. Tahoe Monitoring & Evaluation Program

This was a well written Appendix. I have a few comments to add:

- Road de-icing agents. Our regional Stormwater Protection Team for western Lake Superior has conducted contractor training workshops for winter parking lot maintenance for a number of years with excellent results. Fortin Consulting Co. in Minneapolis has developed the workshops and extensive handouts via EPA 319 funding and collaboration with the MN Dept of Transportation and the Minnesota Pollution Control Agency. Information may be found at:

- http://www.pca.state.mn.us/index.php/about-mpca/mpca-events-and-training/road-salt-education-program.html
- http://www.fortinconsulting.com/winter_training.html
- http://www.lakesuperiorstreams.org/understanding/impact_salt.html

- Are all culverts, road crossings, stormwater outfalls GIS mapped?

- Is there a Citizen Science Monitoring program in place for schools and the general public. Stream transparency and stage height are fairly easily measured. Minnesota and Wisconsin have superb Citizen Stream Monitoring Program s – (see http://www.lakesuperiorstreams.org/citizen/volunteermonitor.html for links.

- Remote sensing offers a method for trying to get at littoral zone water quality. I assume it's been tried. This is another area where volunteer local boaters could be helpful in ground truthing satellite data, by arming them with secchi disks.

Appendix IE-4. Summary of Lake Tahoe Aquatic Invasive Species Program

This section might well be included as a separate Chapter. Perhaps a Terrestrial Invasives section could also be included. The spread of invasive species has implications in terms of both additional management costs, and impacts to aquatic and terrestrial resources – which may be linked in the case of terrestrial invasive plants on SEZs and wetlands; and by invasive aquatic organism effects on littoral and nearshore food webs and primary producers (phytoplankton and periphyton community structure and productivity).

Appendix CR-1 P-Fertilizer Phase out White Paper

This is an excellent addition to the program since it saves people money up front for unnecessary fertilizer use, and is almost guaranteed to reduce P-loading.

In the section on the P-fertilizer experiment in Minnesota (middle paragraph of second page) it could add:

" to document phosphorus reductions, although at least one paired neighborhood scale study showed a reduction in stormwater P discharge (see http://www.lakeaccess.org/fertilizer.html and also http://www.pca.state.mn.us/index.php/view-document.html?gid=7750 . There are other useful references from Roger Bannerman via USGS in Middleton, WI research lab.

This is a good place to question the need for turf lawns along riparian zone and the lakeshore. Minnesota has done a very good job of educating home owners and businesses about this issue and offering incentives and options for restoring these areas to native vegetation. See Carrol Henderson *Lakescaping for Wildlife and Water Quality* (http://www.dnr.state.mn.us/eco/pubs_restoration.html) and MN Shoreland Management

information (http://www.shorelandmanagement.org/; http://www.dnr.state.mn.us/waters/watermgmt_section/shoreland/index.html)
I'm not sure if geese and gull poop is a serious issue in the Tahoe Basin, but it is in many Minnesota lakes where they are attracted to turf lawns along the lakeshore and stream shore. Buffer strips of native vegetation have proven to be very effective at discouraging large groups of birds as well as stabilizing the shoreline, reducing fertilizer and pesticide use associated with lawn maintenance, and possibly reducing susceptibility to shoreline establishment of certain invasive aquatic plants.

Review of 2011 Tahoe Regional Planning Agency Threshold Evaluation

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March 15, 2012

GENERAL COMMENTS

The purpose of this peer review is to determine whether the data evaluation, presentation, and interpretation associated with the Threshhold Evaluation is consistent with the best available science. Determining the best available science is somewhat subjective. It is probably better to determine if the multiple working hypotheses that are advanced in the scientific literature are adequately addressed (Chamberlain 1890). This will prevent "parental affection" for any specific hypothesis!

Since the 1950s, scientists working on Lake Tahoe have done incredible work that has advanced not only knowledge about the lake itself, but also the scientific discipline of limnology. Of particular note are the bodyworks by Dr. Charles Goldman, his colleagues, and students at the University of California-Davis. Even to this day, UC-Davis is a major player at Lake Tahoe and in the science of limnology. UC-Davis gets a special acknowledgement in this review because the findings of this group are strongly linked to many of the programs implemented under the TRPA regional plan.

By the 1960s, the worldwide debate regarding the effects of untreated or treated municipal wastewater (point-sources) on lakes intensified. The seminal work of Dr. Goldman demonstrated that the addition of elements like phosphorus, nitrogen, iron and molybdenum to lakes stimulated algal production. About the same time, European scientists, especially Richard Vollenweider, demonstrated the concentration of an element like phosphorus in a water body could be determined by the total load of that element entering the water body. Although these findings generated controversy between environmental protection groups and development forces, efforts to remove point-source discharges from lakes advanced.

A strong scientific and political consensus regarding the need to remove point sources of nutrients from lakes developed in the 1970s and 1980s and action was taken. The consensus emerged in part because of the establishment of relationships between open-water algal biomass as measured by chlorophyll and total phosphorus and algal biomass and water clarity as measured by a Secchi disc. Studies elucidated in greater detail the relationship of total nutrient load to lake mean depth and how flushing rate and sedimentation rate influence nutrient loss rates. Whole-lake experiments in Canada also demonstrated the importance of phosphorus as the primary limiting nutrient in most lakes, particularly oligotrophic lakes like Lake Tahoe. Frank Rigler convinced most lake managers to measure total phosphorus because the cycling time between forms was so fast. And finally, because one of the world's premier limnologists, G. E. Hutchinson made the important point in 1969 "that we should think not of oligotrophic or eutrophic water types, but of lakes and their drainage basins and sediments as forming oligotrophic or eutrophic systems," treated point-sources

were exported from drainage basins when possible. By doing so, the lakes responded very positively such as was the case at Lake Tahoe and Lake Washington.

As point sources of nutrient enrichment were brought under control, the focus of the scientific and regulatory community in the 1980s shifted to nonpoint source nutrient enrichment. Those believing non-point sources of nutrients posed a bigger threat to lakes than point sources took the thoughts of Hutchinson to mean the addition of nutrients by humans to an ecosystem constituted eutrophication and that economic growth was tantamount to encouraging pollution. As the 1980s and 1990s, progressed, warning were advanced in the scientific community that natural factors such as geology and changes in precipitation could overwhelm any human impact. By the late 1990s, questions were being raised as to where was the evidence that population growth was adversely affecting water quality as assessed by nutrient concentrations, algal biomass as measured by chlorophyll, and water clarity as measured by use of a Secchi disc. It was also warned that while phosphorus and nitrogen may be the limiting nutrients to algal biomass, the nutrients might not be the limiting environmental factors.

In the 1990s, best management practices, BMPs, were being implemented and total maximum daily loads of nutrients, TMDL's, were being established for lakes. As the decade progressed studies in states like Florida began to show the BMPs worked well in the short term, but could be overwhelmed by a stochastic event like a hurricane. Studies also showed the TMDLs did not adequately reflect hydraulic loading and unrealistic loading were being established at place like Lake Okeechobee, Florida. It was also in the 1990s that the plant nutrients were renamed "pollutants" to imply the nutrients would destroy the biotic integrity of a lake. More and more lakes across the nation were classified as impaired.

As the United States, entered the 21st century, the USEPA pushed for the establishment of numeric nutrient criteria rather than narrative statements. As the process evolved, USEPA essentially classified any eutrophic lake as impaired, regardless of whether the lake was naturally eutrophic or eutrophic due to human activities. Due to a court ruling, USEPA established numeric nutrient criteria for Florida's waters. The State of Florida objected and scientific evidence was presented by Dr. Roger Bachmann that geology determined the trophic status of many Florida lakes, in the warm-waters of Florida nutrients enhanced biological abundance, and that population growth since the coming of Europeans did not adversely affect water quality in Florida lakes if those waters receiving point source discharges were not considered. It became clear for effective lake management that while the elements phosphorus and nitrogen were the limiting nutrients for algal biomass the real limiting elements for lake management were silver and gold. Because the economic resources of many states were greatly diminished after 2008, unnecessary and unjustified regulation by the USEPA was opposed by the State of Florida.

So what does all of the above have to do with the Tahoe Regional Planning Agency (TRPA)? TRPA was approved in 1969 by California and Nevada and charged with developing a regional plan to balance economic and environmental concerns through zoning designed to protect more fragile areas of the Tahoe basin. Specific attention was directed towards restoring and preserving Lake Tahoe's famous water clarity. Reviewing the history of TRPA, it is clear that TRPA has always attempted to use the best available science in its decision making process. Unfortunately for TRPA and other similar organizations across the United States, Science does not work on the same time-scale as the political decision process. Political leaders want certainty so scientists coming before an organization like TRPA typically fail to present all the multiple working hypotheses and only present the hypothesis they have developed "parental affection" for as the scientific community's absolute theory. In many cases, "Schools of Thought" are presented as absolute fact so groups like TRPA with mostly non-scientists on the governing body have a difficult time raising serious challenges to the information presented. As a result the debate is often viewed as an argument between environmental protection and development forces.

TRPA's challenge in 2012 is to try to make sense of 40 plus years of research and set a direction for the management of a national resource, Lake Tahoe. Lake Tahoe is a complicated ecosystem as is often explained in great detail by the scientific community, but TRPA would be well served to remember "Occam's Razor" or the "KISS" principle.
Occam's razor, also called law of economy, or law of parsimony gives precedence to simplicity; of two competing theories, the simplest explanation of an entity is to be preferred. In everyday English, the principle "Keep It Simple Stupid" applies. But, applying these principles requires that TRPA be able to challenge the "Status Quo," typically a most difficult task. However, there is a 2012 television advertisement that asks – If someone did not challenge the status quo what would the earth be today; answer Flat!

INTRODUCTION

INTRODUCTION – Does the Introduction Section provide sufficient background information necessary to understand the purpose and scope of the Threshold Evaluation? Are statements of fact presented in the Introduction Section sufficiently supported with appropriate references or original data and analysis?

Comments – The introduction is well written for a technical report, but as written TRPA is missing an opportunity to place its mission in the context of helping the environment and the economy. In these tough economic times, political leaders facing massive budget deficits are looking for ways to cut budgets so eliminating an organization that is perceived to be anti-business is eliminated or cut substantially. In Florida, the people established water management districts in the state constitution to protect and manage the state's waters. Over the years, the districts in the eyes of many legislators became perceived as arrogant, non-responsive to local governments and the people, an certainly anti-business through their policies, The Florida Legislature, with the budget crisis, severely cut state allocations to the districts, limited their taxing authority, and mandated their annual budgets be approved by the Secretary of the Florida Department on Environmental Protection. All of these changes led to massive layoffs and the ending of district programs.

Dr. Charles Goldman wrote that the polarization between environmental protection and development forces was rapid at Lake Tahoe during the time TRPA was created. He wrote in 1988 that the debate focused on water quality and transparency in Lake Tahoe and because of the economic pressures of a large gambling, recreation, and real estate industry, the conflict continued. So, there is no reason to believe that the roots of the debate have disappeared with the tough economic times beginning in 2008.

It would seem important to remind readers that the United States Congress declared Lake Tahoe and its basin a national resource. California and Nevada recognized the great importance of Tahoe to the states. The Tahoe Regional Planning Agency was created because it was recognized that the conservation of Lake Tahoe and its basin required a watershed approach in order to maintain the lake's fantastic water transparency. While some individuals saw TRPA's mission as a way to impose new restrictions on both the location and extent of future development, TRPA's mission was to find a balance between the region's ecological and economical health. Readers need to understand this Threshold Evaluation provides TRPA and other interested parties to evaluate the success of past actions and institute change to truly balance the needs of the region's ecology and the region's sagging economy. If the potential opponents recognize TRPA has an open mind and is having a fair and open review, they will more likely accept the true importance of TRPA to the Lake Tahoe basin and stop calling for the end of TRPA.

METHODOLOGY – Are prescribed approaches for determining the status and trend of indicators relative to adopted standards clearly presented and appropriate? Is the prescribed approach for determining the level of confidence in status and trend determinations clearly presented and appropriate? Are the approaches prescribed to determine interim target and attainment date for an indicator reasonable given data and funding limitations?

Comments – The methodology section is clearly written and easy to understand. The approaches being used are generally appropriate, but there are some concerns about statistical interpretations.

In this document, simple linear regression was used to estimate indicator trends from available data unless otherwise specified in the Data Evaluation and Interpretation narrative. When evaluating trends with data collected over multiple years, it is possible because of the N to obtain a statistically significant relationship, but it is not meaningful. Dr. Yves Prairie of Canada and Bryhn and Dimberg of Sweden (Prairie, Y.T. 1996. Evaluating the predictive power of regression models. Canadian Journal of Fish and Aquatic Sciences 53:490-492.; Bryhn, A.C. and P.H. Dimberg. 2011. An operational definition of a statistically meaningful trend. PLos ONE 6(4):1-9.) have shown that when the R^2 value is less than 0.64 the relationship is not statistically meaningful. This is important as weak trends are reported in the document when there is no time relationship.

Estimating the time it will take an indicator to reach attainment using regression analysis is a standard scientific approach. However, the predicted value from a regression equation is only an estimate and is subject to error. It is clearly necessary to provide confidence intervals around the estimated value because as the x values gets farther from the mean value the confidence intervals become so large the prediction is essentially meaningless. For this reason, extrapolating outside the range of data used to establish a regression has proven over time to often lead to erroneous predictions. Many scientists do this, but the confidence in the prediction should be classified as very, very, very low or to put it bluntly useless.

Another major concern are the apparent limitations placed by the preparers of this Threshold Evaluation, on themselves, as to what data would be considered for analysis. There is a wealth of important information in the scientific literature and agency reports that could prove most useful in trying to solve the Lake Tahoe puzzle. For example, Dr. Goldman's publications of 1965 and 1988 (and the references cited) are particularly helpful as is the UC-Davis Tahoe: State of the Lake Report 2011 (see Chapter 4, Water Quality).

Throughout the historical published literature, there are numerous single point estimates, such as historical Secchi readings, that when aggregated they can be compared using standard statistical techniques like frequency analysis to provide evidence for or against change. Such an analysis permits the time window to be expanded prior to 1968 and to look at the multiple working hypotheses examined by early scientists. Data continuity and quality assurance results typically do not contribute significantly to a variance component analysis as most of the variance is attributed to date and spatial variance in a single lake. The appropriate sampling protocol also changes with the researcher and the objectives of their study, but the information obtained during the study can be most useful. Therefore, it is highly recommended that the preparers of this evaluation consider all available information.

INDICATOR AND INDICATOR REPORTING CATEGORIES EVALUATIONS – Is the write-up associated with each indicator evaluation clear and complete? Are the analytical methods appropriately in the

determination of an indicator's status, trend, and confidence? Are there other or different analyses you would recommend to evaluate indicator status or trend? Are the aggregation methods appropriately applied in the evaluation of each indicator reporting category? Are statement of facts or conclusions supported by appropriate references or original data and analysis?

Comments – The purpose of this peer review is to determine whether the data evaluation, presentation and interpretation associated with the Threshold Evaluation is consistent with best available science. Each scientist has his or her own view as to what constitutes "the best available science." The write-up for most of the indicators is clear and mostly complete, but the order of presentation can be improved for those people not familiar with the specific issue at Lake Tahoe. Where appropriate different analytical methods will be suggested that could refute the conclusions drawn or support them. Regardless, different ideas are advanced in this review to promote further discussions.

Chapter 4 – Water Quality: Lake Tahoe is recognized by nearly everyone as a "Water of Extraordinary Ecological or Aesthetic Value," but the single most important issue is the perceived change in water transparency. When discussions take place regarding issues such as algal production or the prevention of water quality degradation to preserve Lake Tahoe for future generations, somewhere buried in the issue is the change in water transparency.

So first, there needs to be a complete discussion of changes in Secchi depth and the factors responsible for the changes. The discussion should begin with the annual average changes in Secchi depth followed by winter changes and summer changes as reported in the 2011 UC-Davis State of the Lake Report. The preparers of this Threshold Evaluation document need to explain to the reader the reason for winter Secchi readings (period of complete lake mixing). It is also very important to report the summer Secchi changes as most users of the lake see the clarity during the summer.

Once the changes in water clarity between 1968 and present day are fully discussed, the next section put the finding in historical context. The focus should not be on the Secchi measurement (33 m) made by LeConte in 1876, but the range of Secchi depth measurements reported by Goldman in 1965 (see Figure 10). Goldman reported variations in transparency ranging from a little over 40 m to maybe 12 m. Goldman concluded these observations indicate that the transparency varies considerably during the year and that the pelagic zone of Tahoe probably had not suffered any marked decline in transparency during the last 90 years. This is an important conclusion to check out because the frequency of present-day values occurring outside of the range reported in the early 1960s may not be that great, suggesting human activities may not have resulted in great changes in Lake Tahoe's water clarity.

The data summarized by Goldman contains many single measurements rather than just annual averages. Examination of Figure 10, however, shows that there are numerous measurements for the month of July. The distribution of measured July values can be statistically compared to the 1968 to present-day July values to determine how many years from 1968 to now differ from years when Goldman thought transparency had not declined. This would provide further evidence of whether Lake Tahoe's transparency has changed due to human activities or just natural factors.

Once these analyses are complete, it is extremely important to discuss the eutrophication hypothesis advanced by Goldman in 1965 because the issue of nutrient enrichment due to human activities has held as much importance to the people living in the Tahoe basin as changes in water clarity!

When Goldman initiated his eutrophication work, the focus was on point source discharges of municipal waste, which was having a demonstrable effect on the lake's littoral zone. Due to Goldman's efforts, nutrient-rich wastewaters are exported out of the Tahoe basin. With the elimination of the major point

sources, nonpoint source nutrient enrichment became the concern in the 21st century.

In assessing the potential impact of nutrients on a lake, a nutrient budget is often constructed. The Lake Tahoe Interagency Monitoring Program provided total phosphorus load estimates for 10 streams, which represent about 50% of the flow from all 63 input streams at Lake Tahoe. From 1993 to 2010, phosphorus loads have varied from less than 5,000 kg/yr to about 45,000 kg/yr. A potential total phosphorus concentration can be calculated by first dividing the estimated total load by the lake's surface area (495 km^2) and then dividing by the lake's mean depth (305 m). If we assume the total phosphorus load to Lake Tahoe is double the maximum measured between 1993 and 2010(say 100,000 kg/yr), the potential total phosphorus concentration for a well mixed Lake Tahoe would be approximately 0.7 µg/L.

This potential concentration raises some interesting questions. The potential concentration is less than the in-lake total phosphorus values reported in some of the available scientific literature. Based on the Vollenweider nutrient-loading concept, the in-lake nutrient concentration should be less than the potential concentration due to losses from the lake's hydraulic flushing rate and sedimentation rate. When the measured in-lake concentration is higher than the potential concentration, an internal source of nutrients needs to be investigated.

UC-Davis scientists have identified the importance of mixing events, particularly during the winter when the lake mixes completely. With this information, it could be concluded that external inputs of nutrients, especially phosphorus (the limiting nutrient today), are not a major driving factor in the lake. UC-Davis scientists estimate Lake Tahoe's water to have an average residence of 600 years, thus it is reasonable to question whether there is a concern for the long-term build up of nutrients in the lake. The loss of phosphorus from the lake through its outlet is basically not important. The important loss factor is sedimentation because phosphorus concentrations in the lake remain low.

UC-Davis in its 2011 State of the Lake report presented evidence through its calculation of Carlson's trophic state index (TSI) that phosphorus concentrations in Lake Tahoe are declining. TRPA would be well served by providing trends in nutrients in this Threshold Evaluation report, as this is an issue that needs to be addressed relative to future actions in regard to soil conservation.

UC-Davis in its 2011 State of the Lake report presented evidence that the chlorophyll TSI was staying the same of slightly decreasing. The total phosphorus TSI was decreasing, but the Secchi TSI rather than increasing was decreasing. When such a situation occurs, there is clear evidence that eutrophication is not affecting water clarity, but the water clarity is diminishing because of another environmental factor.

This Threshold Evaluation report made a great case for suspended sediments. Focusing on suspended sediments rather than nutrients for the factor controlling water clarity in Lake Tahoe also raises questions regarding the role of suspended sediments in other issues such as habitat for aquatic macrophytes and fish and it raises questions again if TRPA is focusing on the right management strategy. Perhaps TRPA needs to focus on soil erosion control.

Shifting TRPA's focus to soil erosion control efforts probably would be met with resistance because it would permit a new balance to evolve between economic and environmental concerns. However, the authors of the 2011 Threshold Evaluation report would be well served to reference the visit of one of America's foremost limnologists, Chauncey Juday, in 1904 (referenced in Goldman 1965). Juday obtained a Secchi reading of 19.5 m during his visit, which was substantially less than LeConte's reading of over 30 m. Based on his observations, Juday noted the reduced visibility was due to the inflow of suspended sediments from the streams. He observed plumes of sediments moving miles into the Lake Tahoe. Juday also recorded

the species of aquatic macrophytes present and noted their abundance was sparse because of the lack of suitable substrate (rocks versus fine sediments). Based on Juday's observations an alternative hypothesis to nutrient enrichment as the cause of the lake's water clarity decline was established early on and provides additional support to this report's finding of the importance of fine suspended sediments.

Of great importance to this report is the large increase in primary production since 1968. This finding could still be the key finding for support of the nutrient enrichment hypothesis, but the finding needs to be placed in context of the importance of fine suspended sediments to water clarity. Primary production is a rate function. The values currently being reported are not going to produce massive algal blooms or fish kills. Current levels would only increase overall biological production and probably lead to more fish.

The near linear increase in primary production ($R^2 = 0.96$) requires one to ask the question "why" a straight line increase. In this report increasing nitrogen and phosphorus inputs are considered to be the main driver of primary production increases. Yet, UC-Davis' 2011 State of the Lake Report suggests loads are decreasing or at least they are being controlled by meteorological events Given the finding that water clarity is being influenced by suspended sediments, a relationship between in-lake nutrient concentrations and primary production should be established, a graph of the relationship would be most informative.

An alternative hypothesis should also be discussed. In exceptionally clear lakes like Lake Tahoe, light conditions can lead to inhibition of phytoplankton production. UC-Davis scientists have shown that the chlorophyll maximum lies deeper in the water column and that the depth of the maximum is decreasing as clarity decreases. So, is it possible that the reduction in Lake Tahoe's water clarity is establishing a better light climate for phytoplankton and there is less inhibition of photosynthesis? If this is the case, it may then be possible to explain the linear increase in primary production. It would also lead to the conclusion that TRPA's primary production standard of 52 $gC/m^2/yr$ cannot be obtained unless the right meteorological events occur. Certainly, the finding of this Threshold Evaluation Report that attainment of the target may not occur in the next 50 years should raise serious questions.

Recommendations - Obviously, Lake Tahoe is a complicated ecosystem and there is uncertainty regarding the role of nutrients in the lake, which either directly or indirectly affects TRPA's regulatory actions. Here is where Occam's Razor could be of great benefit.

Nutrient-rich wastewater is exported from the Lake Tahoe watershed. The program should be continued and where possible expanded if development intensity becomes sufficient to warrant connection to the wastewater treatment plants. The plants should not be allowed to exceed their treatment capacity.

Phosphorus and nitrogen are naturally occurring elements in the soils of the Lake Tahoe basin. These elements cycle amongst their various forms rapidly so lake managers recognize the focus should be on the total component of the nutrients. Control of soil erosion in Lake Tahoe's watershed would reduce the nutrients entering the lake and suspended sediments. On a whole lake basin consideration, the role of urban development becomes less significant when examining sediment erosion and sediment transport to the lake. TRPA should prioritize the basins and institute with their partners major soil stabilization programs. Monitoring pelagic water clarity and sediment/nutrient loads can assess the effectiveness of the program.

Many of the recommendations provided in the 2011 Threshold report need to be evaluated in terms of cost and would the money be more effectively used to control sediment erosion. For example using satellites to assess spatial variance in water quality would be valuable to some, but the dollars could be used to control more sediment. Likewise street sweepers can remove fine sediments from roads, but given the cost of the machines, maintenance costs, disposal costs, and personnel cost far more sediments could be controlled more effectively by investing in soil erosion control.

Chapter 5 – Soil Conservation: This could be on of the most important chapters in the 2011 Threshold Evaluation report. For the authors, they see the primary purpose of this section is to provide an evaluation of the status of indicators relative to the 10 adopted soil conservation targets related to the impervious cover and SEZ indicator reporting categories. For a reader who had just read Chapter 4 and the discussion on the effect of fine suspended sediments on lake water clarity, there was an expectation there would be a major discussion on soil erosion control projects.

From a traditional background, Soil Conservation essentially means erosion control and the SEZs are stream riparian zones that slow the flow of water and trap sediments. Hard surfaces are of concern only if the runoff water has sufficient volume and speed to pick up sediments and induce stream channel instability.

Policy and management actions to attain standards for Tahoe Basin tributary waters are implemented through the TRPA Regional Plan, and generally aim to reduce pollutant loading to Lake Tahoe. These actions include:

• Restoration and enhancement of stream environment zones (SEZ).

• Urban growth control limits.

• Best management practices (BMPs) to reduce nutrient and sediment discharge from disturbed soils, and retrofit regulations for private and commercial property BMPs.

• Reducing private automobile use through improvements to public transit and alternative transportation modes with the goal of reducing air pollution and the subsequent deposition of nitrogen and fine sediment.

• Ongoing allocation of water quality mitigation funds to support erosion control and storm water pollution control projects.

Reducing private automobile use has many benefits, but it will not have any major impact on fine sediments and their associated nutrients. New urban growth limits sound very reasonable, but will contribute little to the overall deposition of sediments into Lake Tahoe because the unstable stream channels already exists and some streams with little anthropogenic disturbance contribute the greatest amount of sediments. BMPs are to be encouraged with the hope of reducing the amount and rate of flow to the streams, but during exceptionally wet years, the BMPs seem to be overwhelmed more often than not.

The key to soil conservation in the Tahoe basin is getting the funds together to support erosion control. Erosion control must be on the entire Lake Tahoe watershed so that the inflowing streams are prioritized as to where the work is done first so as to get the "biggest bang for the buck." Spending money to get better satellite models will not be as effective as putting "boots on the ground" to eyeball the major areas of soil disturbance.

Practical experience with erosion control in the days of the Soil Conservation Service demonstrated a focus should be on the point where water enters the flow channel and points of in-stream instability. In the Lake Tahoe region, this report has shown that landscape disturbances including but not exclusive to impervious road and parking lot surfaces, residential and commercial development, wildfire, and the degradation of stream channel stability, can contribute to sediment and nutrient inputs to Lake Tahoe or its tributaries. But

more importantly, weather variations and long-term climate change (wet/dry periods) are considered among the most important environmental drivers of tributary runoff and thus sediments and nutrients.

Given all this information, TRPA probably would be well served to considering instituting soil conservation practices utilized in Maine and the mountainous regions of Europe. In Maine, disturbed soils along roadways are line with large rock cobble. This rock slows the flow of water preventing the development of erosion channels. Where water from hard surfaces enters a channel, large crushed rocks are used to line the channel. This prevents erosion of the head of the channel and facilitates the deposition of fine sediments by slowing the water. In high gradient streams such as those found in Europe and at Lake Tahoe, in-channel erosion is the predominant source of sediments. The Swiss and Germans have developed machinery (the Menzi and the Spider) that can move up steep streams and their embankments to the point of erosion and them move large in-stream boulders to either divert the flow of water from the unstable bank or stabilize the point of erosion. These approaches have been shown to be cost-effective at mitigating the impact of suburban or urban development as well as helping when stochastic natural events cause change.

If the above is not the direction TRPA is considering, the chapter as written is understood, but it is difficult to assess the scientific validity because this reviewer was not able to obtain a copy of Bailey's work where each soil map unit was assigned to a land capability class. Without this information it is difficult to assess the impact of using the updated soil survey. However, if everything is accepted at face value it is questionable why the authors suggest a 6-acre change in imperious cover will occur by 2016 and Class 1b will not obtain the standard in 563 years. When an outside reader sees numbers like these, they will conclude these are SWAG (Scientific Wild Ass Guesses) estimates and credibility is diminished. For Class 1b why not just say standard will not be obtained in the foreseeable future or it is never expected to reach attainment!

Also recognize that when SWAG estimates appear in a report, political leaders ask why we are funding expensive remote sensing projects to get numbers like this rather than fixing the problem.

Chapter 7 – Fisheries: Lake Tahoe supports a number of fish species and important sport fisheries. It is clear that the authors of this report have classified the fish into desirable and undesirable categories. It would greatly help an evaluation of the Chapter a complete listing of all species was given along with their desirability classification as desirability is in the eye of the beholder.

The discussion of the fish species composition prior to the arrival of Euro-Americans leaves the impression that some people want to return to seven species. I suspect this will never occur given the great size and depth of Lake Tahoe and no one will allow the fisheries biologists enough money to purchase sufficient rotenone (a fish toxicant) to kill all the fish in the basin. So it is clearly a decision as to what species shall be restored and managed (i.e., Lahontan cutthroat trout (Oncorhynchus clarki henshawi)).

The goal of TRPA adopted standards for the Tahoe Region fisheries resources is to improve aquatic habitat important for the growth, reproduction, and perpetuation of existing and threatened fish resources in the Lake Tahoe basin. For the lake, a numeric target was established to achieve the equivalent of 5,948 acres of "prime" fish habitat. This raises the question of what truly constitutes prime habitat and for what fish species.

Many of TRPA's restriction on lake or stream usage seem to be related to the "public" perception of the day as to what hurts fish habitat. For example, TRPA (1982a) considered moderate to heavy

boat traffic as disturbance that significantly contributed to the decline of lake fish habitat quality, while TRPA (1996) further considered the rearrangement or clearing of near shore substrate to accommodate beach use during low lake levels as disturbance to fish habitat and thus a degradation to fish habitat conditions. In the 2011 Threshold Evaluation report, the authors noted studies since the initial adoption of the threshold standard have revealed that boat activity is not sufficiently frequent in the littoral zone to degrade conditions in "prime" fish habitat (Allen and Reuter 1996). Findings such as this are typical in fisheries and regulations passed with the best of intentions often have no significant effect on the fish. This suggests other TRPA standards need to be questioned to determine if the regulation has a positive impact on the fish or is it just managing people?.

In the report, it is written that spawning habitats are composed of relatively small diameter rocky substrates used by native minnows for spawning and rearing fry and it is stated prime lake habitat is defined by substrate size which essentially means rocky substrate, A numeric target was established to achieve the equivalent of 5,948 acres of "prime" fish habitat. Studies available to the authors suggest there are only about 5,600 acres of prime habitat and they see a need for new mapping studies. However. Lake Tahoe is over 122,000 acres in size and based on significant figures prime habitat, given the uncertainty of the estimates, probably should report only one significant figure so both estimates would be 6,000 acres.

While recommendations are being advanced to do more expensive mapping, it is questionable how that will advance fish management issues. Besides if rocky substrate is the goal, then the issue comes back to suspended sediments. Juday in his survey of the aquatic macrophyte community at Lake Tahoe in 1904 found fine bottom sediments were sparse and the prime factor limiting the establishment of submersed aquatic plants. Since that study fish like the largemouth bass and bluegill that prefer a sandy/silty substrate for spawning have become established, as have non-native aquatic plants like milfoil. The common theme with all these environmental concerns is fine suspended sediments. So once again working on soil erosion in the streams might be the best expenditure of taxpayer dollars.

The emphasis on recommendations made still focus on presumed detrimental effects of shoreline alterations. Some of the concerns are based on speculation with little evidence to back them up. For example, the building of docks are always presumed to be bad for fish habitat, but studies across the United states show this is typically not the case and the real issue is shoreline aesthetics. When a new species is found, statements are made regarding how the invader will destroy the biotic integrity of the system. Such is often not the case and there can be positive effects as seen with one of the most notorious plant invaders in Florida, the submersed aquatic macrophyte hydrilla. TRPA should not rush to judgment on these issues and fund management projects that have been shown to work as it has been virtually impossible to eliminate invasive species.

Assessment of stream habitat relative to what is good or bad for fish is difficult. It seems there is a movement in the Tahoe basin to initiate stream bioassessments. While many states do this or develop biotic integrity indices the approaches typically fail. Failure occurs because the approaches often fail to account for the natural relationships first. For example, USEPA uses diatoms to assess the nutrient status of lakes. However, plotting the data shows no relationship between their indices and nutrient concentrations. Many bioassessments often fail to take into account more nutrients lead to greater productivity that leads to greater biological abundance of plants, fish, and aquatic birds.

It is clear that due to insufficient documentation of methods and definitions originally used to assess stream conditions, the authors of the 2011 Threshold Evaluation report feel it is not possible to assess current status relative to adopted standards. There is information available from the U.S. Forest Service that the streams are supporting a variety of non-game and game species that are native to and not native to Tahoe streams. This suggests stream conditions are fine for fish, but the management objective for each stream need to be established. For example, the streams have been classified into migratory and residential streams. The Forest Service identified a number of road crossings that did not meet the criteria for fish passage and represented barriers for at least one life stage of salmonid or sculpin. These streams should be prioritized with the streams selected for erosion control and retrofitted simultaneously. By combing efforts, the stream evaluations in the future can provide a better assessment of any truly impaired streams.

The discussion regarding human and environmental drivers provided a laundry list of every possible human impact that could be thought of. The basis for the concerns is questionable as the evidence suggests the streams are in good shape. After accounting for the natural factors a few streams should be targeted for improvement to demonstrate management actions work. More importantly, if there was a stream that was severely impacted TRPA should have public input on the problem and the stream could be prioritized for fixing.

When discussing streams, the potential human impact of concern, especially during droughts is minimum flows. It is clear that the regional scientist recognize weather and climate patterns and geological context such as elevation and topography significantly affect stream flow characteristics. Therefore, TRPA's original recommendation to establish minimum in-stream flow conditions would be extremely costly with little benefit to the stream fish populations.

Restoring Lahontan cutthroat trout populations is an excellent example of where TRPA should cooperate with other groups in establishing priority streams. Combining soil conservation efforts, SEZ efforts with fish restoration could identify the few streams where success can be achieved and the agencies could get credit for doing something positive.

REGIONAL PLAN IMPLEMENTATION AND EFFECTIVENESS – Does the information presented in the report reasonably describe the implementation of Regional Plan actions (known as compliance measures) designed to benefit environmental and socioeconomic conditions consistent with adopted threshold standards? Are the findings and conclusions related to compliance measure implementation and their effectiveness on the attainment of threshold standards reasonable and justified, given that available information and constraints? Are there other or different analyses you would recommend to evaluate the implementation and effectiveness of TRPA's Regional Plan? Does the information presented in the report reasonably describe the implementation?

Comments – Chapter 12 is well written with a great deal of information on how the implementation of various actions has taken place. Coming from the State of Florida where the Legislature must provide a balanced budget, I am most sensitive to how agency budgets have been cut and how agencies have been reorganized. When such situations exist it is important to remember some legislative aide will review written documents for talking points!

In reading Chapter 12, the balance between environmental and socioeconomic conditions that TRPA is to achieve is not there. This section reads as a strong environmental regulation document. Given the discussions about the effects of natural factors like wet and dry periods, it is highly likely that a legislator predisposed to being anti-regulation will decide many of the actions by TRPA are capricious and arbitrary. The justification will be after spending over a billion dollars, the transparency of Lake Tahoe has not improved!

Like most agencies trying to justify their existence, their reports contain positive results that are based in part on truth. For example in Chapter 12 it is written that overall, status and trend monitoring data indicate that although all standards are not being fully achieved, environmental conditions in the basin are improving and the 1987 Regional Plan and associated programs, controls and implemented actions have contributed to improved conditions. But, the central issue is lake transparency and it has not improved so when it is written that improving trends in some cases are subtle, suggesting that additional or *more aggressive policy and management actions* are needed legislators against regulation take careful note.

It would be far better to trumpet the positive effect of removing treated domestic waste from the watershed and discuss what has been learned about the influence of natural environmental factors. Saying the declining trend in sediment and nutrient load from streams and the slowing rate of lake transparency decline coincides with the implementation dates of the 1987 Regional Plan and 1997 EIP (see Water Quality Chapter of this evaluation) may be true as a coincident, but a cause/effect relationship is difficult to establish. It might be better if TRPA was to state it was reviewing its ordinances to determine how to achieve a better balance for the regions environment and economy.

Again, with the information presented in the 2011 Threshold Evaluation report it is difficult to support the statement: "The results of TMDL research and the subtly declining (i.e., improving) trends associated with pollutant loads indicated that adopted policies and programs have been effective but more aggressive management and land use policy actions are needed and should be focused on the urbanized landscape." If fine suspended sediments are a cause for Lake Tahoe's declining transparency, there are streams with little development delivering more suspended sediments than urban areas that only make up about 10% of the entire area of Lake Tahoe's watershed. Because Lake Tahoe exists in an erosion basin, prioritizing work on the streams is crucial.

The authors also candidly admitted that the research and modeling needed to understand how compliance measures are related to Lake Tahoe transparency (the Lake Tahoe TMDL), proposed by regional scientists, will cost more than $10 million. This is obviously well beyond TRPA's funding ability, but the recommendation is modeling. From the data presented, models have a great deal of uncertainty and seem to be used more to promote schools of thought. For example, the impacts of climate change are listed as a major threat to the environment and economy of the Tahoe Basin. So does this mean that we should stop snow and rain because more water brings in more nutrients and sediments?

Reading Chapter 12 also provides insight into philosophical beliefs. For example, it is stated that Tahoe is transitioning from a gaming-based economy to an economy based on ecotourism, green environmental innovation, and health and wellness services, as identified in the Lake Tahoe Basin Prosperity Plan. Is this what all the people want during tough economic times? Projects are proposed and funded that can be nothing more than "feel good" projects. For example, mechanical removal of non-native fishes was conducted at 14 sites in 2011. Largemouth bass were targeted, but it is very difficult to affect overall abundance of this species. Removal shifts the size structure by removing large fish and encouraging more small fish.

CONCLUSIONS – Are conclusions presented appropriately supported by report analyses and findings? Does the best available science generally support the conclusion, or does it suggest a substantially different conclusion?

Comments – Conclusions are supported and not supported as detailed above. TRPA needs to decide who is the audience for this report. As written in Chapter 12, "Like everything else in today's reality of shrinking resources, hewing to the past system which is neither fully affordable nor fully implementable simply invites failure and ignores the "new normal" of today's budgets and resources." Nothing could be truer!

RECOMMENDATIONS – Are recommendations appropriately supported by report findings and conclusions? Are proposed recommendations related to policy and on-the-ground project implementation supported by best available science?

Comments – Proposed recommendations should clearly indicate how actions by TRPA would better help balance the needs of the environment and the economy. Special attention needs to be given to improving Lake Tahoe's transparency. Establishing an invasive species may be needed, but at what cost and how will success is evaluated? Banning phosphorus fertilizer is a hot topic in the 2000s all across the United States, but the best available science can show that the ban will have little effect on Lake Tahoe and effort would be better spent trying to control sediment/nutrient inputs from the streams.

An issue like banning phosphorus fertilizer has hidden potential problems for an organization like TRPA. A phosphorus fertilizer ban could be justified because phosphorus currently is identified as the limiting nutrient in Lake Tahoe. If Goldman is right that with sufficient phosphorus reductions nitrogen will become the limiting nutrient, does TRPA then come back and ban all fertilizers. Also, how will TRPA justify a fertilizer ban when phosphorus and nitrogen occur naturally in the soils? Following such a recommendation opens TRPA up to the charge they are over regulating without doing anything measurable for Lake Tahoe's transparency.

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Independent Peer Review

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Tahoe Regional Planning Agency (TRPA)-Threshold Evaluation Report

March 26, 2011

Introduction-Chapter 1

Sufficient information is presented to allow for the reader to understand the purpose and objectives of the Threshold Evaluation. Socioeconomic data were very valuable in giving the reader appreciation for the size of the Lake Tahoe Region and trends relevant to the Threshold Evaluation. These features and trends were in almost all cases supported by actual data with associated references as appropriate. Data on the types and numbers of businesses by industrial sector (Table 1-2) were especially valuable as related to the air quality portion of the peer review. It would have been helpful also knowing which of these industries (and how many) had permits related to discharges into the Lake Tahoe environment, For example, water discharge permits, air emissions permits etc. If not provided in this section then it is recommended that this information be provided in the media specific sections of the report as appropriate. Figure 1-2 summarizes the proportions (by %) of primary and secondary residences in each of the counties that comprise the Lake Tahoe Region. It would be helpful if the total number of primary and secondary residences located in each of these counties was also listed. As related to the air quality portion of the Threshold Evaluation it is also recommended that the numbers of wood stoves in place in residential and commercial properties and the numbers of vehicles owned and operated by these residents be also provided. Again this data can be provided in the Introduction section or the Air Quality section (Section 3) of the report.

Methodology-Chapter 2

Methodology employed was well described and clearly presented. Often times example calculations were provided. This was true for the Determination of Indicator Status and Evaluation of Indicator Trend sections. The TRPA Threshold Evaluation Methodology in its entirety is a relatively complex process and difficult to comprehend without several in depth readings of this chapter. This was particularly the case for confidence in status and trends determinations as these were harder to follow as overall confidence determinations resulted from a combination of a number of separate status and trend confidence ratings. The confidence status and trend determinations would benefit greatly if an actual example calculation was provided preferably for one of the actual threshold categories presented later in the report. The TRPA

adopted a simple system for this report cycle *"to improve the consistency and transparency of status, trend and confidence characterizations at the Indicator Reporting Category level"*. Methodologies applied in prior TRPA Threshold Evaluations were not well documented and overall trends for an Indicator Reporting Category appeared to be based upon *"staff's best professional judgment"*. The methodology applied in the current Threshold Evaluation represents a significant improvement over these prior approaches, as a result.

This reviewer disagrees with the practice of not using a status score in calculation of overall indicator status when the following conditions exist: 1] due to insufficient data or 2] because a standard had not been established. The overall score should reflect the unavailability of these data regardless of these circumstances. I have the same criticism for this practice used in calculation of indicator trend scores. The ultimate outcome is that confidence scores are affected in those instances where status and trends scores were artificially biased high due to insufficient data or lack of standards (page 2-12).

The approach for estimating interim targets and attainment dates appears reasonable for indicators trending towards the standard and for those standards found to be in attainment. For those indicators trending away from the standard it is not clear why literature reviews were the preferred approach. It was not clear why actual TRPA data (if available) could not be used? Further, if nothing was yielded from the literature review no interim target or attainment date was identified.

The attainment status of many indicators is evaluated using a numerical value. In some instances (eg odors) management standards and/or policy statements and practices are employed solely in determining attainment status. All three (3) of these practices in practice should work in unison on a parallel path towards evaluating indicator performance and ultimately Threshold Standard attainment. To this end policy statements and management standards (if without numerical endpoints) should not be viewed as having the same stature in the overall process as those with actual numerical standards. Forward progress towards attainment, as well as, decline is difficult to evaluate for threshold categories where numerical standards are not in place (Page 2-13). For example, in the case of odors the TRPA should consider installation of a process to monitor and record odor complaints including use of an Odor Hotline. Odor events could be monitored and used to evaluate attainment with an actual numerical standard (eg goal = reduction of complaints year to year). This could be accomplished through development of a complaint data base. Goals for attainment could be set moving forward consisting of net reductions in complaints (actual number or %) from the prior reporting period. Complaint trends could be monitored and used to evaluate the effectiveness of existing regulations and policy statements.

Note: Readers should view only color versions of the report (hard copy or electronic on screen) to fully appreciate report contents. The methodology used and the actual results for each threshold category are hard to follow when viewed in black and white.

Noise-Chapter 10

The TRPA Threshold Evaluation Report indicates that noise standards had been exceeded during the observation period for the following categories: highways, South Lake Tahoe Airport and motorized watercraft. Confidence in each of these was classified as low and in the case of both the airport and motorized aircraft outcomes were influenced significantly by insufficient data sets. Cumulative Noise Event Level (CNEL) indicators and standards, as well, were often characterized by low confidence and trends with little or no change. This was often attributed to the lack of adequate data. In 2011 TRPA adopted an improved monitoring program for CNEL indicators that included randomization of land use sampling and multiple 24 hour sampling events. Historical monitoring typically consisted of a single 24 hour sampling event per each land use plan area. As a result, adequate historical data do not exist to properly evaluate trends. The TRPA Report recommends that the noise standards program be evaluated and standards adjusted as needed to reflect levels that are protective but realistically achievable. Further, this evaluation exercise should reconsider the method for defining threshold attainment for noise indicators. The current practice of declaring non-attainment on the basis of a single exceedance of a noise standard (single event type indicator only) should be vacated in favor of a statistical based or per cent (%) attainment standard (page 13-4). This reviewer supports these recommendations.

The TRPA report also recommends that noise standards be eliminated in instances where TRPA lacks the authority to enforce compliance (page 13-12). The TRPA claims it does not have the *"authority and capacity"* to enforce some standards as they lack the necessary *"police powers or criminal authority to temporarily arrest an individual"*. This reviewer does not agree with this recommendation as the TRPA may have other alternatives to consider in lieu of elimination of standards. TRPA should consider delegating enforcement for selected noise standards to local law enforcement officers and/or health agents provided TRPA numerical standards are recognized by and/or incorporated into the local statutes for each of the affected towns and counties in the Lake Tahoe Region. Violations as confirmed my noise measurements could result in warnings and fines levied against the offender.

General Comments and Recommendations

1] The noise program is too complex and resource intensive at present. There are too many indicators, land use categories and numerical thresholds that need to be monitored to evaluate attainment. Attainment may not be possible given the current approach and the TRPA claim of limited resources. These circumstances likely contributed to the TRPA recommendation to eliminate some standards and "*only retain standards and associated indicators which it has the authority and capacity to affect and measure"* (page 13-12).

2] Review and evaluation of existing noise standards is warranted. If new numerical standards are adopted the means of demonstrating compliance must be included.

3] Numerical values only should be used for evaluating attainment with each noise standard. Non-attainment should not be based upon a single exceedance of a standard but rather make use of all data collected. The data set should include all compliant measurements, as well as, all exceedance data. In this manner attainment can be defined as a % value (total compliance values/total # measurements). Statistical analyses of data for each category should also be applied. This approach is especially important to those noise standards characterized as single noise events (eg motorized water craft).

4] Standardized methodology is needed for all measurements (page 10-17) .This consists of peer reviewed noise monitoring protocols/plans to be used by all staff taking noise measurements in the Lake Tahoe Region. Monitoring plans should include the following at a minimum: a] use of standard instrumentation including performance specifications b] standard operating procedures (SOPs) c] instrument calibration procedures d] quality assurance/quality control measures e] monitoring frequency and duration for each single-event and CNEL category event f] statistical analyses of data needed for evaluating attainment status with each standard g] distance from source for each single-event category.

5] Recommendations for additional actions, findings and conclusions are frequently contained within the individual data evaluation and interpretation reports for each indicator category. These need to be consolidated to remove redundancy and placed more prominently in Section 13 of the report where they are most relevant. A number of these recommendations, findings and conclusions may not have been considered in preparation of the Conclusions and Recommendations Section that is in the report currently.

6] The report states that noise standard exceedances associated with highways and transportation corridors "*were more directly tied to certain types of motorcycle exhaust systems and large truck "jake braking" than to overall tire-on-pavement noise (page 13-4)"*. This suggests that noise pollution in this indicator category will not be remedied through continued use of low noise pavement. If this is indeed true future expenditures to install low noise pavement should be examined (eg cost versus benefit analyses) and an alternative approach for reduction of on road noise may be warranted such as enhanced enforcement of the standards.

Comments and Recommendations- Single Noise Event Categories

1] There appear to be too many numerical threshold standards for single noise events (Table 10-1). Evaluation of the noise program should include examination of these standards to verify that all are necessary for protection of the public health and environment.

2] A severe lack of data does not permit adequate evaluation of many of the single noise event indicators. As a result, the effectiveness of existing regulations and programs cannot be characterized with certainty. This is particularly the case for all of the non-watercraft noise indicators. Out of the three watercraft associated single noise event indicators data are available for only the shoreline test. No data are available for the Pass By and Stationary watercraft

indicators. Based upon the limited data for a single indicator TRPA has concluded the following: "*current conditions to be considerably worse than the established standards, the trend is rapidly declining, and confidence in the determination of status and trend is low (Figure 10-2)"*. This reviewer agrees with this assessment.

3] Mitigation measures for watercraft associated noise should include a combination of more rigorous data collection, enforcement and prohibition of certain boat types on the lake. The TRPA recommends consideration of a number of noise reduction measures as follows: "*restricting the types of motorized watercraft ….. to those that can meet minimum allowable noise standards, adjusting maximum allowable noise levels… and/or multi-jurisdiction enforcement within the no-wake zone (page 13-4)."* This reviewer supports these recommendations.

Comments and Recommendations- Cumulative Noise Event Level (CNEL) Categories

1] Noise levels prioritized by land use category should be considered. The current approach is too resource intensive and unwieldy. TRPA, as part of the proposed re-evaluation process, should decide which are the most important land use categories. Factors to consider may include where are the most people, wildlife that may be affected by "unwanted sound"? Where have the most complaints been received historically? What have been the most common sources of these noise complaints??

2] There are too many indicator categories for CNEL noise given the current approach and TRPA's claim regarding lack of resources. Consolidation/combination of existing land use categories should be considered if this can be justified. There are currently five (5) separate numerical values used as noise standards (See Table page C-15). Can this number be reduced to three (3)?? (For example 45, 55 and 65 dBA).

3] In 2011 TRPA adopted an improved monitoring program for CNEL indicators that included randomization of land use sampling and multiple 24 hour sampling events. This monitoring design should be adopted moving forward and expanded if resources allow. It is appropriate that this be examined as part of the overall evaluation of the noise program recommended by TRPA.

4] The TRPA report concludes that CNEL attainment "*status is considerably worse than the established target, the trend has no significant change and confidence in the determination of status and trend is low to moderate (Figure 10-3)"*. Further, the following is offered as part of all of the CNEL indicator categories data evaluation and interpretation reports*: "based upon available trend information and the lack of program-specific effectiveness monitoring, it is not possible to characterize the effectiveness of existing regulations and programs with certainty."* This reviewer agrees with this assessment.

Air Quality-Chapter 3

General Comments

1] Data on the types and numbers of businesses by industrial sector were provided in Table 1-2 of the report Introduction. It would be helpful also knowing which of these industries (and how many) have air quality permits in place. Regulated pollutants should be identified and emission rate data for each would also be helpful if these data are readily available.

2] Figure 1-2 summarizes the proportions (by %) of primary and secondary residences in each of the counties that comprise the Lake Tahoe Region. It would be helpful if the total number of primary and secondary residences located in each of these counties was also listed. It is also recommended that the numbers of wood stoves in place in residential and commercial properties and the number of vehicles owned and operated by these residents be also provided.

3] Recommendations for additional actions, findings and conclusions are frequently contained within the individual data evaluation and interpretation reports for each indicator category. These need to be consolidated to remove redundancy and placed more prominently in Section 13 of the report where they are most relevant. A number of these recommendations, findings and conclusions may not have been considered in preparation of the Conclusions and Recommendations Section that is in the report currently.

4] Current economic conditions in the Lake Tahoe Region as well as the country as a whole are impacting population growth and development. For example data provided in the Introduction of the report document notes a decline in population in the region as evidenced by comparison of 2000 and 2010 census figures (Figure 1-2), a downward trend in school enrollment (Figure 1-4), high unemployment rates (Table 1-3) and a steady decline in employment in the gaming industry (Figure 1-6). These factors are likely influencing air quality indicators in a positive manner. The majority of the air quality threshold indicators are in attainment with respective standards and a number are trending downward. The TRPA, however, should maintain an aggressive campaign to further reduce emissions attributable to human activities (vehicles, wood stoves etc) such that an attainment "cushion" can be maintained in the event that the economy within the region begins to rebound once again. Complacency with the current situation should not be the recommended course of action.

5] A number of references are made in this section to natural sources of air pollution most notably biomass burning. This includes both wildfires and controlled or prescribed burns. These references are typically found within the data evaluation and interpretation reports for each of the indicators or pollutant categories. The PM10 and PM2.5 indicators within the visibility category, for example, actually identify *prescribed burning controls* as an action item to improve current air quality conditions. This same language appears in a number of places within the visibility indicator reports (pages 27, 29, 31, 33, and 38). Aside from these repeated references there is no data within the report that addresses the impacts that wildfires and more importantly prescribed burning have on air quality within the Lake Tahoe air shed with the exception of impacts

observed in the Regional Visibility category (See page 35 Status and Trend). Further, these recommendations for prescribed burning controls do not appear in the Conclusions and Recommendations section of the report (Note: this serves to illustrate comment #3 above). Wood stove emissions are addressed in the air quality recommendations and conclusions while prescribed burn emissions and associated controls are absent. Maintenance of air quality in the Lake Tahoe region warrants that contributions from all emissions sources both anthropogenic and natural be considered.

6] Only emissions from California vehicles are accounted for in the air quality indicator categories. CARB emissions estimates are used, for example, to develop daily and annual emissions for NOx. These data, in turn, have been used historically to monitor attainment with the NOx threshold standard. It appears that emissions from vehicles registered in the state of Nevada that operate within the Lake Tahoe region are not accounted for in any of these emissions estimates. Further, if Nevada vehicle emissions standards are not equivalent to California vehicle emission standards then continuous improvement in air quality may not be achievable. It is recommended that the revised TRPA report address the impacts associated with tailpipe emissions from vehicles registered in Nevada. For example, should Nevada consider adopting California vehicle emissions standards?

Carbon Monoxide (CO)

1] CO data representing the most recent five (5) year period (2006-2010) indicates that concentrations for this indicator are well below the strictest applicable standards. This is true for both the 1-hour and 8-hour CO standards. TRPA has concluded that the overall status is considerably better than the target, that the trend shows rapid improvement with a high degree of confidence. This reviewer agrees with this assessment.

2] No interim target or target attainment date is offered as the Lake Tahoe Region is currently in attainment with the strictest standard. TRPA has also concluded that current regulatory programs, policies and actions directed at reductions in carbon monoxide emissions especially from motor vehicles have been effective. Existing programs and actions will remain in place for continued control of carbon monoxide emissions. This reviewer agrees with these findings and the recommended course of action.

3] The report recommends (Section 13) that additional attention be placed on measures to effect reductions in private automobile use, promote use of bicycle travel including both new and improved bike trails , invest in public transit operations including use of low emission vehicles and incentive programs to eliminate non-EPA complaint wood stoves. This reviewer agrees with this recommended course of action.

4] A recommendation is made to reduce the existing standard for 8-hour carbon monoxide from the current concentration of 9 ppm (v/v) to a value of 6 ppm (v/v) so as to be consistent with

standards currently in place in the states of California and Nevada. This is a reasonable recommendation that is supported by the monitoring data provided in the report.

5] It is proposed in Appendix CR-2 that the traffic volume standard associated with the carbon monoxide indicator category be deleted from Resolution 82-11. If this action is intended to eliminate the monitoring program that is currently in place for average daily winter volume this reviewer is not in agreement. There is no mention of this action in either, the Conclusions and Recommendations (Section 13) or the Recommendations for Additional Actions contained in the VMT Data Evaluation and Interpretation report. This apparent discrepancy needs to be addressed and the proposed action in Appendix CR-2 clarified as needed.

Ozone- Specific Comments

1] TRPA maintains a 1-hour standard for ozone of 0.08 ppm (v/v). This standard is more stringent than the corresponding standards for both California (0.09 ppm) and Nevada (0.10 ppm). TRPA recommends that the current standard of 0.08 ppm remain in place. This reviewer agrees with this recommendation.

2] Data for the most recent calendar year (2009) demonstrates compliance with the stricter TRPA standard but historical data indicates both exceedances of the TRPA standard as well as the California standard. TRPA classifies the trend as "little or change" with a moderate level of confidence. The monitoring data supports these findings.

3] TRPA has characterized compliance with the 8-hour ozone standard as "somewhat worse than target" with a trend that reflects "little or no change". The monitoring data for the period 1984-2009 when compared to the only available regulatory standard of 0.070 ppm (State of California) supports the TRPA findings.

4] Ozone data presented as the highest 3-year average of the 4th highest 8-hour concentration indicates that the Lake Tahoe Region has never violated the historical Federal Standard of 0.080 ppm or the revised standard of 0.075 ppm adopted in 2008. Despite conditions that TRPA defines as "at or somewhat better than target" the long term trend shows no significant change over the calendar period 1986-2009. The monitoring data, again, supports these findings.

5] Ozone levels reflect contributions from NOx and hydrocarbon precursor compounds originating both within the Lake Tahoe air shed, as well as, these same precursors transported to the air shed from outside the region. Admittedly, as stated in Section 13 (page 13-12) of the report *"TRPA has no regulatory authority to enforce mitigating measures for an adopted air quality standard that relates to the transport of pollutants from outside of the Region"*. This position is well founded and appropriate especially as it applies to ozone formation. This reviewer agrees with the TRPA position relative to pollutant transport from outside the Region. As a result, TRPA programs and actions must continue to aggressively emphasize reductions in

emissions of ozone precursor compounds from sources within the Lake Tahoe Region where TRPA has jurisdiction.

6] TRPA is uncertain regarding the effectiveness of existing programs in controlling ozone levels measured within the Lake Tahoe Region. Further, the high inter-annual variability in ozone concentrations (both 1-hour and 8-hour values) suggests that programs currently in place may not be effective at improving conditions moving forward. This is particularly important when you consider that both Federal and state standards for ambient ozone will likely undergo further reductions in the future (Federal reduced last in 2008). In the event that reductions are adopted current trends in the Lake Tahoe Region suggest that attainment may not be achievable.

7] Data Evaluation and Interpretation Reports for both the 1-hour and Year average (4^{th} highest 8-hour) ozone indicators recommend that no additional actions are warranted at this time due to the current attainment status for these two (2) targets. This reviewer does not agree with this course of action.

8] The Data Evaluation and Interpretation Report for the 8-hour average (indicator status *"slightly worse than target")* recommends a different course of action as follows: "*current programs and activities may need to be more aggressively implemented or redesigned. Continued failure to meet this ozone standard may indicate the need to reduce the dependency on the private automobile through land use policy that incentivizes more densely-populated and walk able town centers"* This more aggressive posture is appropriate for addressing ozone attainment moving forward. It is this reviewer's recommendation that this language be placed in Section 13 of the report and adopted for all ozone and NOx standard attainment in a revised version of this report.

Nitrogen Oxides-Specific Comments

1] This indicator currently relies on modeled emissions estimates of NOx from automobiles. Data are based solely on the California portion of the Basin on what appears to be traffic count data collected in the Lake Tahoe Region (Contributions from Nevada vehicles are not included). Results are reported in units of tons per day of NOx (average summer day) and are compared against a 9.4 ton/day threshold standard. These data have been trending downward since 1990 and are characterized in the report with "moderate improvement". Indicator status has been classified as "at or somewhat better than target". Confidence is classified as low attributable to the following: 1) results are considered as estimates owning to modeling approach and 2) only California contributions are considered. The latter applies to both indicator status as well as trends. This reviewer agrees with this assessment.

2] TRPA recommends that the current NOx indicator be replaced moving forward through collection of actual ambient measurements for NO2. Data collection began in August 2011 at a monitoring station located at the Stateline NV office of TRPA. Data are available for the

calendar period of August-November 2011. These data will be compared moving forward to state (Nevada and California) and Federal standards expressed as an annual average concentration for NO2. TRPA recommends that the indicator for NOx currently in place be replaced with existing state and federal ambient air quality standards for NO2. The applicable Federal and California standards are summarized in Table 1. This reviewer endorses this recommendation for evaluating NOx indicator status and trends in the future.

Table 1 Ambient Air Quality Standards for Nitrogen Dioxide

Averaging Time	California Standard	Federal Standard **
Annual*	0.030 ppm	0.053 ppm
1 hour	0.18 ppm	0.100 ppm

* Annual Arithmetic Mean ** Nevada Standard

3] The preliminary data set for NO2 collected in 2011 (August-November 2011) was found to be in compliance with all state and federal standards for NO2 when expressed as a 1-hour average concentration. Sufficient data were not collected for appropriate comparison to the annual arithmetic mean standards. This reviewer agrees with these observations.

4] The discussion regarding status of the NOx indicators (see page 3-22 first paragraph) contains incorrect values for both State and Federal NO2 ambient air quality standards. The discussion reports that the highest 1-hour concentration for NO2 measured in 2011 at the TRPA monitoring station met both the California and Federal 1-hour standards. While this statement is true the values listed for the California and Federal 1-hour NO2 standards are actually the annual arithmetic mean concentrations. This section and the % below standards values need to be revised, as a result.

5] TRPA further recommends that the NOX estimating methodology for evaluating indicator status and trends be discontinued in 2012. This reviewer does not agree with this recommendation as the proposed replacement indicator has only been in place for a portion of 2011. It is this reviewer's recommendation that both the air quality monitoring and emissions estimating approach for the NOx indicator status and trend analyses continue until the next TRPA review cycle (5 years) takes place. This will allow for collection of greater than 5 years of ambient NO2 measurements resulting in a more representative data base than is currently available. Historical trends for modeled NOx emissions should continue for comparison to trends in measured ambient concentrations of NO2. It should be noted that the historical approach represents only contributions from vehicle emissions (California only). Hence the confidence in

indicator status and trend has been characterized by TRPA as low. Ambient NO2 concentrations should more accurately represent contributions of all sources of NO2 and not be limited to vehicular emissions.

Visibility

1] TRPA recommends adoption of the Federal Clean Air Visibility Rule as part of the visibility threshold standard moving forward**.** This reviewer endorses adoption of this existing rule as it is offered to supplement other indicators currently used and proposed for future use in evaluating status and trends in the overall visibility indicator category.

2] The visibility threshold standard or indicator reporting category is comprised of nine (9) individual indicators (See Figure 3-3). The report characterizes the current status as "considerably better than target" with an associated trend that shows "moderate improvement". Confidence in both visibility status and trend is reported as "moderate". This reviewer does not agree with this assessment. Data are not available for three (3) indicators and confidence as a result could not be reported. Confidence in two (2) other indicator categories is characterized as low. Yet a moderate confidence determination has been reported. This assessment represents an example of what was described by this reviewer as a fundamental problem with the methodology employed by TRPA for indicator status and trend determinations. More specifically if insufficient data are available for any indicator category then that category is not considered in the final determination (See Methodology Chapter 2).

Wood Smoke and Suspended Soil Sediment

1] TRPA recommends that both the wood smoke and suspended soil sediment standards be vacated and replaced with applicable state standards for particulate (page 13-8, Appendix CR-2 and Table 3-1). It is not clear regarding what applicable state standards will be used. Will both the PM10 and PM2.5 California standards apply as Nevada does not currently have state only standards? Please clarify in revised report. This reviewer endorses this recommendation provided both PM10 and PM2.5 serve as indicators for status and trend analyses moving forward.

PM10 Specific Comments

1] A "moderate confidence" determination is reported for the Highest 24 hour Average PM10 Concentration indicator based upon a status "somewhat below target" and a "moderately improving" trend. This determination is based upon PM10 data collected previously at the Stateline monitoring site and more recently at the South Lake Tahoe site. Recent trends at the latter site for the calendar period 2005-2009 indicate increases in the highest 24-hour PM10 concentrations. Yet PM10 data for the period 2007-2010 at the same South Lake Tahoe site needed to derive an annual average PM10 were reported as "not collected". As a result indicator status and trends were characterized as "unknown". It is not clear to this reviewer how you can reliably report status and trend for the PM10 indicator as a 24-hour average and not have

sufficient data to report an annual average at the same location. This further compromises the confidence reported for the PM10 data as well as the overall status and trend for the entire visibility threshold standard. These observed discrepancies should be addressed such that they are clear in the revised report.

PM2.5 Specific Comments

1] Status for both PM2.5 indicators is characterized as considerably better than target. These determinations are based upon measured concentrations at two (2) locations in the Lake Tahoe region: South Lake Tahoe and Bliss State Park. The trend reported for annual average PM2.5 (based primarily on the most recent Bliss State Park data) is characterized as "little or no change". The trend determination for PM2.5 as a 3-year average of the 98th percentile 24-hour average concentration is characterized as "moderate decline". This determination is directly attributable to increasing concentrations of PM2.5 measured at the Bliss Park site during the calendar period 2005-2009. This reviewer agrees with this assessment.

2] It should be noted that PM2.5 measurements at both sites have historically been collected using the IMPROVE sampler. This sampler is widely accepted for compliance demonstrations with regional haze regulations as is the application here. Since these samplers do not qualify as Federal Reference Method (FRM) samplers the data cannot be used to demonstrate compliance with National Ambient Air Quality Standards (NAAQS) for PM2.5.

Regional and Sub Regional Visibility Specific Comments

1] TRPA recommends that the extinction coefficient indicators adopted as part of the Visibility Threshold Standard (Resolution 82-11, as amended) and used historically for status and trend analyses be vacated and replaced with recommendations contained in a 2011 report prepared by Desert Research Institute. This report entitled *Visibility Monitoring and Standards for Lake Tahoe Basin: Assessment of Current and Alternative Approaches* (Final Report July 20.2011) was prepared by Chen et al. This reviewer agrees with this recommendation.

2] TRPA needs to fully understand and embrace the proposed program for visibility monitoring prescribed in the 2011 DRI report. This includes paying particular attention to the priorities identified in Section 4, monitoring cost estimates in Table 13, manpower estimates and associated costs in Table 14, and report Summary and Conclusions contained in Section 6. For example, the DRI report (page 6-1) expresses concerns about recent trends observed in visibility degradation. More specifically, the 90th percentile b ext at the Bliss Park Site appears to have increased in the period 2001-2009. High b ext values were attributable to *"large wildfires, of which the frequency and intensity are expected to increase over time owing to climate change"*. (TRPA report makes no mention of this trend). The TRPA report simply offers that the current approach to collect data for status and trend analysis of the regional and sub-regional visibility category be revised to reflect the DRI Chen 2011 report. No specifics are offered, however, regarding how the visibility monitoring program will actually be restructured. This proposed course of action appears only in

Appendix CR-2 and is not addressed in the Air Section 3 or the Summary and Conclusions Section 13 of the TRPA report. Section 13 contains only the following recommendation: *"that the agency amends the regional visibility threshold standard to improve consistency with the federal Clean Air Visibility Rule"*. While this reviewer agrees with this recommendation additional language is needed regarding how the DRI Chen 2011 report will be used in revisions to the TRPA visibility indicator monitoring program. It is important that this be addressed in revisions to the TRPA report such that the resources and cost impacts associated with the restructured visibility monitoring program are recognized and accounted for by TRPA and their funding sources moving forward.

3] Status and trend determinations for both the 50^{th} and 90^{th} percentile indicators that comprise the sub-regional visibility indicator category are reported as unknown due to insufficient data. Annual conditions were monitored regularly during the period 1991-2003 using a reconstructed light extinction indicator. Adequate data were last collected during calendar year 2004. Since that time (2004-2010) insufficient data have been collected to allow for a status and trend determination. No explanation is offered to account for the lack of monitoring data for such a long period of time. TRPA recommends that monitoring of this indicator be reestablished at the South Lake Tahoe site in the future. Further this course of action has been identified as the *"top priority of a future visibility monitoring program"*.

Odor Specific Comments

1] Odor indicator attainment status has relied historically on CARB and Federal policy statements and regulations. In addition, TRPA adopted a policy statement in Resolution 82-11 that addressed diesel exhaust and has identified controls within the Regional Plan that address diesel engine idling specifically. TRPA recommends that these policy statements be removed from the list of Threshold Standards they are required to address. This recommendation has likely been influenced by the fact that attainment is difficult to evaluate for threshold categories where numerical standards are not in place (Page 2-13). This reviewer does not endorse the removal of these TRPA policies regarding odors, however. Rather these policies should be retained and a numerical Threshold Standard put in place to directly monitor the attainment status of the odor indicator as well as trends moving forward. Odor monitoring and controls directed at diesel exhaust/emissions will also benefit reductions in emissions of other pollutants/indicator categories such as PM10, PM2.5, CO, ozone, NOx and overall visibility.

2] The TRPA should consider a process to monitor and record odor complaints including use of an Odor Hotline. Odor events could be monitored and used to evaluate attainment with an actual numerical standard (eg goal equals a reduction in the number of complaints and/or violations from year to year). This could be accomplished through development of a complaint data base. Goals for attainment could be established moving forward consisting of net reductions in complaints and/or violations (actual number or %) from the prior reporting period. Complaint and violation trends could be monitored and used to evaluate the effectiveness of all existing odor regulations and policy statements. Enforcement responsibilities could be delegated to local

law enforcement agencies such that additional TRPA resources would be limited. In a similar manner to the proposed approach for noise odor violations could result in warnings and fines levied against the offender.

Review of the Tahoe Regional Planning Agency's (TRPA) 2011 Threshold Evaluation Report

(Draft report dated February 2012)

by
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Chapter 1: Introduction

Introduction --- Does the Introduction Section provide sufficient background information necessary to understand the purpose and scope of the Threshold Evaluation? Are statements of fact presented in the Introduction Section sufficiently supported with appropriate references or original data and analysis?

Frankly, I found this chapter to be the weakest of the whole Threshold Report for several reasons, each of which could be easily improved. First, we were told that this report should be of interest to, and readable by, lay people, stakeholders, scientists and managers. To that end I believe the introduction should present a compelling overview of why the Lake Tahoe region is so important geographically, environmentally, socially, and economically. An historical overview of the threats and concerns that led to the Tahoe Regional Planning Compact to preserve, restore, and enhance the unique natural and human environment of the spectacular Lake Tahoe Region should explain why the TRPA was formed and the need for periodic assessment and evaluation. I had to read a number of other documents, visit the website and pour through material in the appendices and executive summary to gain this appreciation.

Second, I think that the statements of mission and purpose and principles are important and could be included in a sidebar. Third, the "Environmental and Socioeconomic Setting of the Lake Tahoe Region" lacks substance and purpose. I don't know why the particular tables of socioeconomic data are presented—what do the declining rates for school enrollment, gaming employment, transient occupancy tax, and so forth have to do with the environmental quality of the basin. It looks like almost everything is in decline, so does that mean politicians and administrators don't need to be concerned? Or will they question how the conditions monitored in the basin could really be worsening if pressures from population and development are in decline?

Finally, the "Description of Indicator Summaries" is well written. I like the use of the visual symbols or icons. One suggestion is that the use of circles that are color coded to indicate three things at once, (status, confidence and implementation status), might lead to some confusion later on when the reader is immersed in this lengthy report. For example, I could remember the meaning of the directional arrows but I had to go back and look up the meaning of the "confidence" icon's dotted line versus solid line. Perhaps more important is the criticism that some chapters used these icons very well to summarize and display information (eg. Wildlife,

Noise,) while others completely omitted them altogether. They are a good idea, so use them consistently!

Chapter 2: Methodology

> **Methodology** --- Are prescribed approaches for determining the status and trend of indicators relative to adopted standards clearly presented and appropriate? Is the prescribed approach for determining the level of confidence in status and trend determinations clearly presented and appropriate? Are the approaches prescribed to determine an interim target and attainment date for an indicator reasonable given data and funding limitations?

Overall, this chapter is well written and adequately describes the prescribed approaches for determining the status and trend of indicators relative to the adopted standards. Likewise, the approach for determining the level of confidence in status and trend was adequately explained. The reader should be reminded that this is the overall approach to methodology and that in individual chapters on indicators there will be some further explanation where slight modifications to this methodology are required. I think that the explanation about the appropriateness (or not) of applying simple linear regression should be highlighted, and perhaps repeated in the Wildlife Chapter 8.

> *It is important to note that this method does not take into account nonlinear trajectories (e.g., polynomial models) or complex interactions that can lead to trajectories exhibited by step-functions or changing cyclical patterns common in for example wildlife populations. (p 2-7)*

Chapter 8: Wildlife

> **Indicator and Indicator Reporting Category Evaluations** – Is the write-up associated with each indicator evaluation clear and complete? Are the analytical methods appropriately applied in the determination of an indicator's status, trend, and confidence? Are there other or different analyses you would recommend to evaluate indicator status or trend? Are the aggregation methods appropriately applied in the evaluation of each indicator reporting category? Are statements of fact or conclusions supported by appropriate references or original data and analysis?

Monitoring wildlife is inherently complicated and this chapter does a good job of presenting the information in a consistent and graphical manner that the lay person can understand. The complexity of explaining eight very different indicators is addressed very well by displaying the information for each special interest species first graphically, and then in written text with common headings (e.g., "Relevance," … "Attainment Status," … "Trend," … "Confidence," etc.). The analyses are appropriately described and interpreted and limitations are explained.

I would like to point out some omissions or things that could be included to improve this chapter. Of primary concern is that the reader is never offered an explanation of the relevance of the eight special interest species. Why or how were these species selected? How is their presence related

to the health of the Lake Tahoe ecosystem? The narrative says there are 217 species of birds, 59 mammals, 5 amphibians, and 8 reptiles, but only 8 charismatic mega-fauna were monitored. Were there reasons like historic precedence, keystone status, degraded habitat, or some other compelling reasons? Perhaps their selection was explained in prior plans, and some of this information is buried in reporting tables, but their significance is not readily apparent to the reader of this chapter.

Another concern is that it is not clear whether or not monitoring these species addresses the problems that increasing population and development commonly introduce, such as habitat fragmentation, loss of connectivity and travel corridors, adequate size of habitat compartments, harassment by humans, and displacement by disturbance tolerant species. Finally, I have concerns that the monitoring of wildlife seems only weakly linked to the other assessments, such as vegetation, recreation, soil or noise. This appears to be a general weakness that could be improved by approaching the monitoring program from a landscape perspective that takes a comprehensive ecosystem approach that would be appropriate for the TRPA.

Chapter 9: Scenic Resources

In this chapter the write-up associated with each indicator evaluation is clear and complete. The page of text explaining the background and purpose of each indicator is useful. The presentation of the information for each indicator in both graphical and text in tables (similar to Chapter 8: Wildlife) facilitates the reader's understanding of this set of indicators that are not commonly understood. I would suggest that this chapter would benefit greatly by presenting more information about how the information is collected along with some pictures to illustrate different levels of presence/absence. For example, most readers would have no conception of how objective measures of relative scenic value are collected nor would they understand how "unity," vividness," "variety," and "intactness" are assessed from absent to high. The same could be said for "coherence," "condition," "compatibility," and "design quality." Personally, from my work with the US Forest Service I am aware that these are well documented in professional and academic literature, but I think that most readers would not be familiar with these and some visual examples and explanation would be an improvement.

Finally, I think there needs to be a better explanation of how the community design standards work and how the threshold is implemented. Perhaps a table could present examples of these design standards from different communities. Also it is unclear how these would be judged or assessed to be adequate or not. Is the number of standards adopted relevant? Or is the number of communities that have adopted them the important metric?

Chapter 10: Noise

This is a difficult chapter for someone who is not well-versed in the acoustical sciences. The purpose and justification for monitoring noise is well explained and the concept of single noise events and cumulative noise events seem to be appropriate for monitoring in the Lake Tahoe Basin. But several limitations in the chapter seem to point to the need for further refinement of the noise monitoring protocols and data collection.

The multiple standards (eg., 9 standards for single noise events and 11 standards for cumulative noise events) all seem to have some critical limitations. Some, like single noise events for aircraft away from the airport, apparently were severely under-sampled. Furthermore, for 11 of the 12 "other single event noise standards" it is reported that there are insufficient data to determine either status or trend. I believe this is very problematic and suggest that the TRPA Threshold Report specifically make recommendations on how to address this problem. I would suggest that they first prioritize or rank the importance of monitoring the 12, and then select a reasonable number of the top priority ones and concentrate on adequately sampling them. Alternatively, they could redouble their efforts on all 12 if the resources were adequate to do so.
Perhaps the problem that looms larger is the statement that appeared time after time-- "There is currently no established peer-reviewed monitoring plan or protocol for monitoring and evaluating the Community Noise Equivalent Level (CNEL) indicator." The TRPA is to be commended for seeking and following professional advice from a noise expert (Brown-Buntin Associated, Inc.) to randomize land use units and sampling periods to improve the characterization of variation in CNEL. Nevertheless, the noise data and the level of compliance will always be in question until some peer-reviewed monitoring protocols and sampling plans are developed.

Chapter 11: Recreation

The major criticism of the chapter on recreation is that it is so brief that it is difficult to make an assessment of the write-up associated with each indicator or to evaluate whether it is clear and complete. Likewise, it is difficult to judge whether the analytical methods are appropriately applied in the determination of an indicator's status, trend, and confidence. The chapter begins by saying that the Lake Tahoe area, "offers an abundance of recreational opportunities that are highly valued by visitors and residents. These recreational resources are one of the major drivers of the regional economy, and contribute to the quality of life in the Basin (TRPA p. 11-1)" and then presents just slightly over five pages of descriptive narrative. It is surprising that the chapter totally abandons the format displayed in the other chapters that includes a graphical portrayal and narrative in table format for each indicator. Such a display of the indicators and their assessment data would make it much easier to assess how well each was in attainment of the threshold targets.
The problem with this chapter is not so much with the indicators chosen, but rather it is the lack of explanation of the data that should be remedied. For example, it makes sense to use the US Forest Service National Visitor Use Monitoring protocols because this allows comparison to a large baseline of assessments elsewhere. However, we have no idea whether the sampling was adequate (50 surveys? 100? 1,000?) in the Lake Tahoe Basin. The chapter only mentions that some of the survey factors were relevant to the threshold and only reports the overall percent of people who were satisfied or very satisfied. Although the scores were generally high, some were fairly low. No interpretations of the relevance of these findings are presented. Likewise, we don't know if earlier data are available that could help determine whether any trends exist. I would concur with the authors' recommendation that TRPA should coordinate with public agencies and

private entities to implement a more comprehensive recreational user survey that assesses recreational experiences at a wide range of Forest Service and non-Forest Service sites. From this chapter it appears that there is no adequate existing recreation resource inventory which could be used to identify the current geographic distribution of recreation facilities or access infrastructure, such as parking facilities, trailheads, connecting corridors. Finally, it would be helpful if maps that display the distribution or density of recreation assets were provided. Such mapping data would also be useful in the section that addresses public land acquisition and development of access amenities.

The section on Fair Share of Recreation Capacity employs a somewhat novel approach of using "persons at one time" (PAOT) allocations for the evaluation criteria for the indicator. I found the description of how this concept was applied to be somewhat lacking. The meaning of the term "fair share" was explained better in Chapter 12, "Implementation ." The recreation chapter should explain how TRPA came up with the PAOT allocations and how they would be used to insure a balanced and fair share of total Basin capacity for outdoor recreation. Once again, Chapter 12 does a better job explaining this. It is also unclear how PAOTs can serve both as a cap on recreation development and as a desirable target to show attainment of basin goals. Is rapid development of remaining PAOTs a desirable thing, or is slow incremental development more desirable—and why? The data presented are not much help. For example, the table with no title (page 11-5) displays Regional Plan Allocations for summer day use, winter day use and summer overnight, and subsequent assignments for 2006 and 2011, but there is no way for the reader to interpret whether the total percent of all PAOTs is an improving or declining trend. In conclusion, the information presented in this chapter was neither compelling nor adequate to support the finding that the thresholds are currently in attainment.

Chapter 12: Implementation and Effectiveness of the 1987 Regional Plan

> Regional Plan Implementation and Effectiveness– Does the information presented in the report reasonably describe the implementation of Regional Plan actions (known as compliance measures) designed to benefit environmental and socioeconomic conditions consistent with adopted threshold standards? Are the findings and conclusions related to compliance measure implementation and their effectiveness on the attainment of threshold standards reasonable and justified, given that available information and constraints? Are there other or different analyses you would recommend to evaluate the implementation and effectiveness of TRPA's Regional Plan?

Chapter 12 is well written and does a very good job of synthesizing and summarizing the previous chapters' discussion of the achievement of TRPA thresholds and standards. It successfully integrates additional information from the prior plans (1987), goals and policies (1986) and various codes and policies. As noted above, some of the discussion and explanations are better than what was presented in the individual chapters. Overall, the recommendations are sound and follow from the analyses presented in prior chapters. My only concern is that the TRPA Threshold Evaluation suffers from compartmentalization of chapters 3 through 11. The report would benefit from some recognition or discussion of how the various indicators, standards, and recommendations are related or interact with each other. The spectacular qualities of the Lake Tahoe Region are all interrelated and function as a dynamic biophysical and socio-economic system. Perhaps some additional thought should be given to

expressing how the recommendations for air quality, water quality, soil conservation, vegetation preservation, fisheries, wildlife, scenic resources, noise, and recreation will function as an integrated system. The document does address this concern in various chapters, but it should be highlighted in this chapter.

Chapter 13: Conclusions and Recommendations

> Are recommendations appropriately supported by report findings and conclusions? Are proposed recommendations related to policy and on- the-ground project implementation supported by best available science?

It is a difficult task to distill such a comprehensive accumulation of findings and recommendations into the final recommendations chapter. The authors have done well in distilling the findings and recommendations in Chapter 13. Overall, the conclusions and recommendations of this chapter are supported by the findings and analyses as they were presented in the preceding chapters. The recommendations appear to be effectively aligned with the goals and policy statements presented throughout the various chapters in the document. I expect that after the recommendations from the reviewers of this document are digested and incorporated, where appropriate, there will need to be some modifications to the conclusions and recommendations chapter. Nevertheless, the recommendations appear to be reasonable and supported by the findings.

Review of the Tahoe Regional Planning Agency's (TRPA) 2011 Threshold Evaluation Report

(Draft report dated February 2012)

by

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University of Maine, Orono, Maine
March 15, 2012

Overall Assessment of the 2011 Threshold Report

The 2011 Threshold Evaluation Report does a good job of describing monitoring and evaluation activities and trends in the Lake Tahoe Basin. While I note some areas for improvement (e.g., better recognition of wildfire risk and the need to sustain early successional forest systems), I found the report and its analysis comprehensive and well-reasoned. The final chapter on conclusions and recommendations is right on target. In future efforts, TRPA could benefit from more human dimensions research that focuses on stakeholder needs and motivations, as well as research on how to better translate science into meaningful and sustained action in the Lake Tahoe Basin.

Chapter 1: Introduction

Overall Chapter 1 Comments:

This introductory chapter provides sufficient background information to understand the purpose and scope of the Threshold Evaluation. Overall and except as noted below, statements of fact presented in the Chapter appear to be sufficiently supported with appropriate references and/or data and analysis. The discussion on socio-economics could be expanded, and the ambiguity over data in Table 1-1 (see my comments below) raises some concerns that need to be addressed.

Specific Chapter 1 Comments:

Page 1-1: Move the text on Mission and Statement of Principles to a one-page sidebox to highlight the material and segregate it from the body of the document. This is very important information, but I feel that it gets lost by having it incorporated into the general text.

Page 1-3: Reference to Squaw Valley should give approximate location to towns or sites in Figure 1-1... at present, the site is not marked so it is assumed to be out of the location shown in Figure 1-1.

Page 1-3, third full paragraph: Include approximate annual ppt.

Page 1-3, fourth full paragraph: Cite source of forecasted population increase from 55,000 to 58,000 by 2030. How does this compare with CA, NV, and US?

Page 1-3, fourth full paragraph: In the last sentence, specify that Placer County has the highest level of second-home ownership "in the region." Also, how has the composition of year-round vs. second-home residences varied over time (i.e., more or less of a trend toward the latter). Does the higher number of second homes in CA reflect different socio-economic trends in that state?

Page 1-3, last paragraph: Is this median income level for year-round residents only, or does it include second-home owners?

Page 1-4: Figure 1-1 needs a scale to show distance.

Page 1-6, Table 1-1: Reword title to read "Median income for (specify all residents or just year-round residents) and estimated annual change in median income..." Also, is this household income or some other measure (once again, include in title)? Note that the Table gives the total percent change between 1990 and 2000, or decadal change – not an annual change as indicated in the table heading. Annual change for the City of South Lake would be 0.65%/year, not 5.16%. Also, is CY 2000 the most recent data available? How does this rate of change compare with other areas (i.e., CA, NV, US). I suggest that the Table include CA, NV and US medians at the bottom for comparison. Finally, while the table suggests modest gains in income, the data presented are probably in nominal dollars (the table should clearly indicate this too). Assuming these are nominal dollars, if they were converted to constant, inflation-adjusted dollars, the "increase" of 0.65% per year indicated above would change to a significant decrease in median income (i.e., in constant, inflation-adjusted dollars, the 1990 median income of $53,649 actually fell to $42,823 in 2000 – a decadal decline of 20% or an annual decline of 0.89%/year; note that I used the BLS CPI inflation calculator at http://www.bls.gov/data/inflation_calculator.htm). In short, if these are constant dollars, clearly state so in the title and headings. If not, convert all data to constant, inflation-adjusted (i.e., "real") dollars so that comparisons across time can be made.

Page 1-6: The first paragraph reads "similar to the recent population trends..." and mentions a decline in school enrollment. But population trends are upward – although modest. Perhaps year-round resident trends are down – which would account for the statement. But year-round population cannot be discerned from Figure 1-2. Also, when describing school closures, give an indication of what percentage of capacity has been affected (e.g., percent of seats or some other measure). Finally, the report cites the increase in the percentage of

students receiving subsidized school lunches... how does this differ as compared to CA, NV, US, and are these trends related to the data presented in Table 1-1?

If Table 1-1 is in constant dollars, then the 20% decline in inflation-adjusted income would explain the increase in subsidized lunches.

Page 1-6, last paragraph: The text notes the aging of the "Baby Boom" generation, but is the trend in the Basin even more pronounced than that reflected in national statistics? In other words, is the Tahoe region attracting relatively more retirees (i.e., older residents)? If so, this could have important implications on the future of schools, health care, and other important socio-economic sectors. Also, why has the 25-39 age group declined in number? This is a key household-forming demographic group. Is it due to high housing costs (perhaps related to TRPA regulations), or diminished employment opportunities, perhaps tied to seasonal recreational jobs and falling employment in resource extraction and processing sectors? Once again, this is important background information that should be included.

Page 1-7, Figure 1-4: Specify K-12 education in Figure title.

Page 1-7, Figure 1-5: Are 2010 data available?

Page 1-8, Table 1-2: The "Industry" sector looks incomplete (i.e., there is no public sector, or natural resources, manufacturing, etc.). Be sure this listing is complete.

Page 1-8, first paragraph: These unemployment rates are "very" high – not just "relatively" high. Are there historic trend data that could be incorporated here to see if this is persistent, something new given the current recession, or unique to the region?

Page 1-8, Table 1-3: Include CA, NV and US unemployment rates at the bottom of the Table.

Page 1-9, first paragraph: Include another sentence or two about the Heavenly Gondola and the Marriot projects – were these important projects? Did they meet intended needs/goals? As written, the last sentence of the paragraph referring to redevelopment is unclear to uninformed readers.

Page 1-9, Figure 1-7: Note typo in righthand vertical axis label (i.e., "transiet").

Page 1-9, last paragraph: Give the reader a sentence or footnote on the emerging trend towards developing economic "clusters" – this is important to the region. Also, what stakeholder interests are represented in the Prosperity Plan? Are there opponents?

Page 1-10: Second bullet under "The Current Report" has a typo at the end. Also, in the bullet before that, I think it would be more accurate to state " Report on the degree and rate of

change in relation to adopted Environmental Thresholds..." This allows for the possibility that some indicators deviate from goals.

Page 1-10, second full paragraph: I like this new approach of distinguishing between numerical standards, management standards, and policy statements.

Page 1-10, last paragraph: Figure 1-1 in the text should be Figure 1-8. This same error is repeated in the first paragraph on page 1-11.

Page 1-15: In the text describing "Trend," what is the "EIP" – spell-out and briefly define.

Page 1-16, fifth paragraph from the bottom: Fix typos in first sentence (delete "to" and ";").

Page 1-16: At the end of the chapter, you could inform the reader that Chapter 2 on methodology can be skipped by the casual reader given the basic description of the rating system provided in Chapter 1. This could be repeated at the beginning of Chapter 2.

Chapter 2: Methodology

Overall Chapter 2 Comments:

This Chapter clearly presents and supports the overall prescribed approaches for determining: (1) the status and trend of indicators relative to adopted standards; (2) the level of confidence in status and trend determinations; and (3) interim target and attainment dates for indicators given existing data and funding/staff resources. In addition, the Chapter includes some important improvements regarding the procedures used to aggregate attainment status metrics at the Indicator Reporting Category level.

Specific Chapter 2 Comments:

Page 2-2, last paragraph: Add a final sentence, e.g., "These four steps are described in detail below."

Page 2-4, paragraph directly below bullets: Change "... and is understandable by most." to "... and is readily understandable."

Page 2-4, first equation near the bottom of the page: Change "% to target" to "Percent to Target" for consistency.

Page 2-6, first paragraph under the section entitled "Evaluation of Indicator Trend:" Give the reader some idea of what the term "evaluation period" means. I assume that this could be a year in the case of annual measures, or 5 to 10 years (or more) for some periodic forest measurements.

Page 2-7, Figure 2-2: Rather than combine all possible trend symbols into a single graphic, use five different trend indicators to avoid possible confusion (e.g., use an approach similar to that expressed in Figure 2-3).

Page 2-8, Table 2-2: For the last row of the Table, change "... insufficient data or due to..." to "... insufficient data, highly variable data, or due to..."

Page 2-12: Correct the reference to "Figure X4."

Page 2-13, paragraph above the middle set of bullets: Change "...but are principles..." to "..but are instead principles..."

Page 2-13: Correct grammar in sentence before section entitled "Estimating Interim Targets."

Page 2-14, second bullet: Correct typo (i.e., "estamate").

Page 2-14: Correct typo under "Air Quality" description (i.e., "intenties").

Page 2-14: Correct typo under "Wildlife" description (i.e., change "provide" to "provided," change "Depart ment" to "Department").

Page 2-14: Correct typo under "Recreation" description (i.e., correct "Consevancy").

Chapter 6: Vegetation

Overall Chapter 6 Comments:

The chapter description associated with each indicator evaluation is clear and complete. Except as noted below, the analytical methods applied in the determination of an indicator's status, trend, and confidence appear appropriate. The overall approach of recognizing common vegetation, sensitive sites, and sensitive species seems appropriate. Further recommendations for the installation of permanent plots makes sense. So do proposed measures of monitoring vigor and health. Two areas where the report and monitoring effort could be improved in future years are described below:

(1) Sustaining Early Successional/Shade Intolerant Forest Species – TRPA monitoring should more directly address growing concerns over the creation and maintenance of early successional forests and/or shade intolerant species. The report and indicators make no mention of sugar pine – the regeneration of this species is of growing concern given the lack of open, regenerating areas in Sierra forests favored by the species. Smilarly, aspen is referenced only as it pertains to the deciduous riparian standard. The widespread decline of aspen across the West is likely a concern in the Tahoe Basin – are there non- riparian corridors where aspen exists? And if so, how are these important forests being managed and monitored? The long-term viability of sugar pine and aspen is restricted by the lack of

larger forest openings that is increasingly commonplace across the Sierra. Currently TRPA allows for openings less than 8 acres – perhaps this should be revisited and larger-sized clearings allowed. The report mentions overstory removal as one way to enhance the small-diameter forest indicator (see page 6-13) – this should be explored as an option, especially in concert with fuel reduction treatments (see below). In addition, it should be recognized that silvicultural practices like thinning can be used to increase stand diameter by: (1) removing smaller trees; and (2) stimulating the growth of remaining trees. Additional benefits are control of species composition (i.e., management could favor sugar pine or other species of concern), and reduced ladders fuels and fire risk.

(2) Recognizing and Reducing the Risk of Stand-replacing Catastrophic Wildfire – Stand-replacing wildfire is perhaps the greatest threat to vegetation in the Tahoe Basin. The USFS is actively mapping wildfire risk at the stand-level. Such metrics should be considered as an indicator, with associated quantitative goals to reduce these ratings. The Report notes of fire risk reduction treatments, but these are described as being focused near communities to protect life and property. While this is a recognized priority, additional treatments should be strategically located across the landscape in areas removed from communities to limit the risk of large, stand-replacing fire. Ultimately, the re-introduction of natural or "historic" fire regimes should be pursued as a goal. When fire does occur, shrub control in concert with reforestation will be needed to avoid prolonged shrub cover. If properly reforested, these sites could assist in meeting early successional forest/species goals.

Specific Chapter 6 Comments:

Page 6-1, last paragraph: The text refers to little active forest management until the 1970s, but does not specify what's happened since then (i.e, some active management is implied, but not described).

Page 6-2, first paragraph: In the first sentence, change "fire resistant species" to "fire susceptible species." Also, in the last sentence, specify the type of treatments being conducted in conifer forests.

Page 6-8: Be consistent in use of vegetation "communities" and "associations." As currently written, this varies across text and figures, making the text less readable. Also, "Incense cedar" is not a true cedar and should be written as "Incense-cedar."

Page 6-9, top sentence: Change "cotton wood" to "cottonwood." Under "Status," some statement of wildfire risk should be included.

Page 6-10, one-third down the page: Change "...through permitting..." to "...through the permitting..."

Page 6-11, bar graph: Some explanation is needed for the very high yellow pine value reported in 2006.

Page 6-12, subsection under "Trend:" References that the Gondola and Angola Fires will contribute young forested acres need to be tempered by recognition of the need to quickly control brush and re-forest these areas after a fire to avoid sites being occupied for extended periods (many decades) by brush and shrubs. Are these sites in fact regenerated and returning to forest? I suspect not. For example, a summer 2011 newstory indicated that the USFS was just beginning site restoration work on the 2007 Angora Fire – while this is a long delay, it is typical of the Agency's ability to respond after fire.

Page 6-12, subsection under "Interim Target:" In the last sentence, why does TRPA expect a stable or slight increase in the area of small diameter red fir and Jeffrey pine by 2016? If anything, I would expect a stable to declining trend due to: (1) natural stand growth (i.e., movement into larger size classes); and (2) the risk of loss to wildfire.

Page 6-13, subsection under "Monitoring Approach:" The text refers to "...stands dominated by trees <10.9" were enumerated..." How is dominance defined? Basal area, trees per acre, volume, crown coverage, or some other metric?

Page 6-15, last two sentences: Is more work really needed to refine these trend data? Also, are there concrete estimates of how many more acres of meadow could be restored through conifer removal? This seems important, along with vigor and health indicators as suggested by TRPA.

Page 6-17, subsection under "Recommendations for Additional Actions:" I agree that the current shrubland threshold standard of "not more than 25%" is problematic and should be changed. However, the more likely risk is to exceed the 25% benchmark as wildfire threatens to convert forestlands to shrublands for extended periods of time.

Page 6-19, subsection under "Effectiveness of Programs and Actions:" This section notes limited potential for further removal of conifers in deciduous riparian zones. Restoring these areas, however, is critical due to their limited extent and ecological importance. A century of fire exclusion has undermined aspen health and allowed for the invasion of conifers such as white fir. Aggressive restoration is warranted, and "existing regulations" limiting restoration should be re-examined. In other words, rather than revise downward the threshold (as recommended under the "Recommendations" section), revise the regulations so that these areas can be restored.

Page 6-19, subsection under "Recommendations for Additional Actions:" The suggestion of developing health indicators is crucial, especially for aspen. Indeed, across the Western U.S., hundreds of thousands (or more) of acres of aspen are in decline, so while they may meet a simple numerical "acres" threshold, their declining condition suggests decreased representation across the landscape in the future.

Page 6-20: Under “Relevance,” change “(i.e., Jeffrey Pine)” to “(e.g., Jeffrey and Sugar Pine).”

Page 6-21, middle of page: Change “50 years of fire suppression” to “100 years of fire suppression.”

Page 6-24, first paragraph: I strongly agree with TRPA’s recognition of the need for forest management given past fire suppression, current overstocking, and changes in species composition.

Page 6-25: In three places, “...determine that TRPA...” should read “...determined that TRPA...”

Page 6-26, third paragraph: How was average DBH calculated? Arithmetic or quadratic mean?

Page 6-29, subsection under “Indicator (Unit of Measure):” Need to better define “dominated by large diameter” trees... once again, is this percent of basal area, trees per acre, volume, or some other measure?

Page 6-29, subsection under “Effectiveness of programs and Actions:” Reference to acres treated for fire risk reduction should be reported by type – i.e., Wildland Urban Interface (WUI) projects vs. projects located away from developed regions and intended to protect large, forested landscapes.

Page 6-30, end of section: Relaxing the subalpine late seral threshold is probably warranted, although careful thinning could be used to accelerate stand growth and increase stand diameter in some situations.

Page 6-31, second paragraph, last sentence: Change “...due insufficient...” to “... due to insufficient...”

Page 6-34: Photo needs to be included in top left.

Page 6-35, last paragraph: Remove parentheses around CTC.

Page 6-37: Photo needs to be included in top left.

Pages 6-38, 40, 42, 45 and 49, subsection under “Monitoring Approach:” In describing the USFS Region 5 Range Monitoring Program, each of these pages, while addressing swamps, marshes, and fens respectively, refers instead to “meadows” (e.g., on page 6-38, “The protocol is designed to enable the user to classify a meadow according to...”). “Meadow” should be changed to “wetland” or more specific wording.

Page 6-39: Photo is needed in top left.

Page 6-41: Note extra line above "TRPA Threshold Category." Page also needs a photo in top left.

Page 6-43, end of first section: Are two monitoring plots sufficient to form the basis of future threshold evaluations? Same comment for page 6-45.

Page 6-43, last section: Given the destructive nature of beaver activity, why isn't their removal proposed as an option?

Page 6-44: Main map needs an inset locator map. Also, a photo is needed at left.

Page 6-47: Photo is needed in top left.

Page 6-48, second paragraph: Revise "...and quality fens..." to "...and quality of fens..." Add "and" after "(Sikes et al. 2011)." In the last sentence, note that "data" is plural (i.e., change "Since this data is..." to "Since these data are...")

Page 6-50: Photo is needed in top left.

Page 6-51: Eleven lines from the top: Change "...the 2011 survey is not yet..." to "...the 2011 survey are not yet..."

Page 6-55: The font size of information in the locator map is too small to be legible.

Pages 6-59 and 6-60: Reference is made to an MOU that expired in 2011... should its renewal be recommended on page 6-60, or was the MOU unsuccessful? Or no longer needed?

Page 6-64, top sentence: Change "litter" to "trash" to avoid confusion with downed naturally occurring biomass.

Chapter 9: Scenic Resources

Overall Chapter 9 Comments:

This Chapter deals with information tangential to my area of expertise. Some general comments to improve the Chapter include the following:

- The Chapter would benefit from a clearer distinction between "travel route ratings" and "scenic quality ratings." I found myself flipping back and forth in the text trying to figure out the difference. Perhaps a table with some photos at the very beginning could help create in the reader's mind the difference between the two.

- The SR-1 through SR-4 designations are used haphazardly (e.g., see heading on page 9-10 vs. headings on other pages). Either use the SR designations consistently, or drop them from the text.

- The Chapter references the 1982 and 2010 reports that set forth the methodology for assigning scenic ratings. Referring to these alone, however, leaves the reader wondering exactly how these ratings are assigned. I suggest adding a number of photos that depict how the metrics described in the text appear in real life (e.g., unity, vividness, variety, and intactness). The same could be done for "scenic resources" (e.g., page 9-7 refers to 209 scenic resources without giving the reader any idea as to what these are – are they large trees, cliffs, views of waterways, etc.).

- The Chapter cites many examples of improvement in visual quality, as well as some declines (see, e.g., last sentence on page 9-10). When citing these changes, an example or representative photograph would help immensely. For example, on page 9-22 the report cites improvement in urban and commercial centers... several before/after photos would help the reader in understanding these changes. Also, in the "Implementation" chapter there was mention of community visioning sessions. These should be mentioned here, along with a comparison of how community and TRPA visions compare and contrast.

- Has TRPA considered landowner outreach/education and cost-sharing programs to create incentives for scenic quality improvements on private lands? If not, this should be considered.

<u>Specific Chapter 9 Comments:</u>

Page 9-3, first paragraph: Reference to the Pioneer Trail – I assume this is a highway, not a hiking trail?

Page 9-8, last sentence under subheading "Relevance:" "...shoreland scenic resources..." should read "...roadway scenic resources..."

Page 9-10, second to the last paragraph: Change "...33 roadway travel units..." to "...shoreline travel units..." Later in that paragraph, change "1952" to "1982."

Page 9-12, subheading "Relevance:" The last two sentences describe a decline and then rebound in scenic quality... briefly explain why.

Page 9-21: The report describes design standards and guidelines, and how communities can develop their own substitute guidelines. I think it would help the reader better understand the level of local "buy-in" if this chapter included a figure or table showing the number of

communities with substitute standards. Also useful would be a figure showing, by year: (1) new development units; and (2) permits for remodeling. These data are important

because they would give the reader an idea of how quickly the overall built environment (through both avenues – new construction and remodeling) is likely to move toward scenic quality thresholds.

Chapter 11: Recreation

Overall Chapter 11 Comments:

This chapter is very sparse in detail – especially when compared to the other resource chapters I reviewed. More detail could be presented to demonstrate: (1) existing types/acres of recreational opportunities/facilities available; (2) trends in these opportunities and facilities; and (3) geographic location. For example, in the last paragraph on page 11-2, the text notes that 93 recreational facilities have been constructed or rehabilitated under EIP's recreation program. More detail would give the reader a better understanding of the types, extent and location of these projects. Also, trail/access connectivity is not addressed here, but is discussed later in Chapter 13. I suggesting adding more discussion of connectivity and networks to this chapter.

Specific Chapter 11 Comments:

Page 11-3, section under "Recreation User Surveys:" How many surveys were conducted? How many respondents? Where were these surveys conducted (i.e., where on USFS lands and what types of sites and facilities)? Does earlier data exist, and if so, can a trend be discerned? Also, the overall survey results, while favorable, do indicate areas for improvement (e.g., parking availability – which affects access), recreation information, and signage. Are these shortfalls later addressed in the report's recommendations for future work? Also, is there any information about visitors' demographics and activities (e.g., place of residence, age, activities, etc.).

Page 11-3, section under "Public Land Acquisition and Development of Access Amenities:" First, the title for this section needs to be capitalized to be consistent. The text should show land acquisition over time and describe why acquisition has slowed over the last 5 years (less need or fewer funds?). Where are the 2,579 feet of acquired lake shore, and how does this compare with existing public lakeshore and total lakeshore? References to trails and trailheads needs more detail as to location and type of use (e.g., bike, hiking, equestrian, etc.).

Page 11-3, section under "Recommendations for Additional Actions:" There likely is a need for surveying visitors using non-USFS sites, as well as better resource inventories. Along with the suggested identification of geographic locations, include types of use. Also, consider placing this information on an easily available web-based platform like GoogleEarth. Perhaps local individuals and organizations could perform some of this inventory work.

Page 11-4 (and earlier): Clearly define "fair share" as a concept. I was uncertain of its definition and intent until I read Chapter 12 on "Implementation" (it's explained more clearly there). Also, the text should make it clear that TRPA arrived at PAOT allocations to ensure balanced use and set limits by types of use. Here too, the rationale is unclear until one reads Chapter 12. How were PAOT allocations determined?

Page 11-4, section under "Attainment Status:" Describe why there has been a slowdown in PAOT projects. Then, when describing projects under the EIP, give the reader an idea of the types of information requested by the IEC. Finally, the EIP lists three types of projects (e.g., lake access, etc.) – what is the distribution of approved projects across these three areas, and how have these data changed over time? Where are areas of current and expected need?

Page 11-5, middle of the page: The Table should have a numeric designator. The "Regional Plan Allocations" heading should note that these are maximum levels – correct? Also, what does the "PA" acronym stand for in footnote "***"?

Page 11-5, bottom paragraph: The text described what sounds like some major improvements in recreational facilities. I suggest including a photo or two to illustrate for the reader these additions to the area's recreational assets.

Page 11-6, section "4:" Include a map showing areas of recent land acquisitions. Also, describe the types of resources and human uses these lands include/accommodate.

Chapter 12: Implementation and Effectiveness of the 1987 Regional Plan

Overall Chapter 12 Comments:

Except as noted above, the information presented in the report is reasonably described in the Implementation chapter. Compliance measures appear well-designed to benefit environmental and socioeconomic conditions consistent with adopted threshold standards. The findings and conclusions, as well as their effectiveness on the attainment of threshold standards, is reasonable and justified. Pertinent limitations stemming from data, information and constraints are identified.

Specific Chapter 12 Comments:

Page 12-4, Figure 12-1: These data would be more accurately depicted in a bar chart – as it is, it implies annual trends (despite the "time period" categories on the horizontal axis). On a related note, is there any indication of land cover conversion in developed/lakeside regions outside of the area studied by Raumann and Cablk (2008)? Even an anecdotal assessment in the text would be beneficial and informative.

Page 12-4, last paragraph: This first sentence needs to clearly state that these improvements in forest condition are based only on the 2008 study by Raumann and Cablk that examined

the southern portion of the Basin. It would be important to know if these trends are consistent with changes across the Basin. I am pleased with TRPA's recognition of the role that vegetation treatments can play in reducing fire risk and restoring riparian systems. These activities need to begin moving beyond developed areas in order to reduce fire risk across the Basin's landscape. Finally, the recognition of the need to create open stand conditions for conifer regeneration is very appropriate. Current forest-clearing size limits may, however, be too restrictive. In addition, while aspen is oftentimes a riparian species, this is not always the case. Non-riparian aspen stands, if they exist in the Basin, should be studied to determine if they are in decline (my guess is yes), and if treatment through overstory removal or prescribed fire is feasible.

Page 12-5, Figure 12-2: These data would be more accurately depicted in a bar chart – as it is, it implies annual trends (despite the "period" categories on the horizontal axis). Also, the vertical axis should read as indicated in Figure 12-1 (i.e., add "average annual...").

Page 12-8, section on Recreation: The summary discussion here is in some respects better than that found in the chapter on recreation (e.g., clear explanation of the "fair share" and PAOT concepts, reference to efforts to develop a comprehensive trail system, etc.).

Page 12-8, second paragraph, last sentence: The reference to "maintaining high quality recreation..." suggests that trend data are available, but trends were not reported in Chapter 11.

Page 12-9, first paragraph: This is the first reference to SQIP. The program appears to be very important given the Basin's development legacy; it should be described in the chapter on Scenic Resources (i.e., Chapter 9). Finally, the topics discussed in Chapter 12 should follow the order and format of the overall report (e.g., reverse the order of the discussion of "Recreation" and "Scenic Quality" on pages 12-8 and 12-9 to match the order of the chapters upon which they draw their information; also, change "Scenic Quality" to "Scenic Resources" – or whichever is the accepted term – so that the discussion in Chapter 12 uses the same terminology as the title of Chapter 9).

Page 12-10, last paragraph: The fourth sentence needs editing. Add comma after "Regional Plan" in the second-to-the-last sentence.

Page 12-12, footnote 4: How is the amount of this monetary deposit determined?

Page 12-14: The top sentence on this page refers to EIP estimates of primary and secondary job creation – are these data included in the socioeconomic section of the report (i.e., Chapter 1)? I do not think so. Also, it would be instructive to give some idea of the amount of funding being allocated across these different threshold categories (e.g., use a graphic

similar to Figure 12-3). The recognition on the top of page 12-15 regarding wildfire risk is very pertinent.

Page 12-16, Figure 12-4 and section above "Forest Management:" The Report needs to define AIS in the second bullet. In Figure 12-4, progress appears impressive until one reads the units on the vertical axis... how many acres are suited for treatment? Also, the Figure's title should read "diver-assisted."

Page 12-16, section on "Forest Management:" Indicate the location of these 45,413 acres. Based on earlier text, these are likely to be near developed areas – a necessary first-step for protecting life and property. Also important, however, are treatment areas across the forested landscape that can serve to limit the spread of large-scale catastrophic wildfires (defensible fuel profile zones or DFPZs). Finally, in the "Forest Management Goal" graphic, indicate the time-period covered by the 10-year target. The same comment applies to similar graphics on pages 12-17 and 12-18.

Page 12-18, second bullet: Add "$" before 18.7 million.

Page 12-19 under "Other Program Elements:" Were these EIP-supported "visioning efforts" mentioned under the scenic resources chapter? I do not think so, but such efforts would appear to be very important.

Page 12-19, section entitled "Implementation...:" The first sentence should let the reader know that the efforts described are already being implemented – this is not explained until later (i.e., see text before first bullet on page 12-22). I suggest beginning this section with verbiage such as: "As described in this document, over the last 4 years..." Also, either delete commas after bulleted items or use consistently.

Page 12-20, top bullet: Edit text as needed.

Page 12-20, paragraph in middle of page, last sentence: Add "the" before "monitoring program..."

Page 12-20, second to the last paragraph, first sentence: Add "staff and financial" before "resources."

Page 12-20, second to last paragraph, third sentence: Add "with" before "threshold."

Page 12-20, last paragraph: Describe "Pathway Planning Process" and "Basin Executives." Also, in the second sentence, "costs" should be singular.

Page 12-21, top paragraph: Change "$4M" to "$4 million."

Page 12-21, second paragraph: Add “unintentionally” before “designed.”

Page 12-23, top paragraph, last sentence: Fix typo.

Page 12-24, third full paragraph: Explain why no new allocations were issued in 2009 and 2010 (this is also referenced in footnote "c" on page 12-25).

Page 12-25, Table 12-1b, footnote 5: Define IPES and change "remains" to "remain."

Page 12-28: The paragraph above Table 12-6 refers to "declining local population..." This was not explicitly stated/demonstrated in Chapter 1.

Page 12-28, Table 12-6: The data in the Table would be more informative if they were expressed as percent changes rather than an absolute change in number.

Page 12-29, text above Table 12-7: Change "(only 52 percent)" to "(a decline of 49%)."

Page 12-30, first paragraph, last sentence: This is highly significant and should be noted elsewhere.

Page 12-30, Table 12-8: This Table is confusing as presented. Is there any relationship between the left and right columns, or are these just a continuation of a listing of water purveyors?

Page 12-32, middle of page: Change "year to year" to "year-to-year."

Page 12-35, Table 12-11: Is "546" intentionally in bold font?

Page 12-35, Table 12-11: Add dollar signs before the values in the Table.

Page 12-37, middle paragraph: Add a footnote explaining the "land bank" concept.

Page 12-38, first paragraph: Describe the types of projects that these funds can support.

Chapter 13: Conclusions and Recommendations

Overall Chapter 13 Comments:

The conclusions presented are supported by the analyses and findings I reviewed. Overall and except as noted above, the report uses the best available science to support its conclusions. The recommendations are sound and follow logically from the earlier analyses. The proposed policy recommendations and projects to be implemented are supported by the best available science and consider realistic estimates of Agency resources. I think the synthesis presented is clearly "on target." As a social scientist, I believe that the report and analyses could go further in exploring the human dimensions of land use issues in the Tahoe Basin. Specific examples include more (or better described) stakeholder engagement, and the use of social science to better study human perceptions, needs, and motivations in the Tahoe Basin. Also important would be research that

explicitly studies how scientific knowledge can lead to improved outcomes on-the-ground, through both public and private actions.

Specific Chapter 13 Comments:

Page 13-3, second bullet: Include reference to increased ladder fuels and the loss of shade intolerant species. Also consider including a goal of fire re-introduction. Finally, in the last sentence, note that fuel treatments offer employment opportunities for local residents
– this seems important given the high level of unemployment.

Page 13-5, second-level bullet near the middle of the page: Change "...efficiently that the past..." to "...efficiently than the past..."

Page 13-8, last bullet: Is there a better term than "language clean up"?

Review of the Tahoe Regional Planning Agency's (TRPA)
2001 Threshold Evaluation Report

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15 March 2012

Chapter 1 Introduction

This chapter needs compelling narrative at the start to introduce the rationale for TRPA's integrated assessment and evaluation plan in the Basin. Lake Tahoe is a national treasure, with significant human presence. As such, the Basin is a complex human-natural system that requires a comprehensive approach to address the social, economic and environmental issues and their interactions which are important to its long-term sustainability. Instead of setting this context, the document drops right into "Background" by repeating the original Statement of Mission and Statement of Principles of the TRPA. This gives such a strong bureaucratic and regulatory tenor to the document that it may likely be off-putting to its intended readers. Undoubtedly, this language helps define the TRPA, and is important to explain its purpose and guiding policies. However, the Introduction's initial focus on regulations and ordinances does not establish the important motivation for such a plan, and becomes so "top-down"/regulatory, it convinces only the most supportive (and therefore persistent) readers of its value.

This evaluation plan is a powerful assemblage of data from multiple sources that addresses the Basin ecosystem in a comprehensive way. That point should be at the forefront of this document. The TRPA is in a unique position and, presumably was set up to, synthesize data across a range of scales and concerns to develop a regional perspective and assist a long view of environmental and social dynamics in the Lake Tahoe Basin. It's a hard task. But the vision of TRPA should be to recognize and assist the management of resources and the demand for those resources in a meaningful and balanced way. The relatively new dialogue around ecosystems goods and services is a realistic perspective of social demands on the environment, while

keeping ecosystem sustainability at the center of the conversation. An important advance, in my mind, is the recognition of *trade-offs* we as a society must evaluate in our decision-making processes. TRPA is positioned to evaluate trade-offs as few agencies, governing or social bodies can. It sits at the perfect scale – the region – to evaluate the big picture of land use practices and their implications. Too small a scale can lose the context and introduce an isolated perspective, and too big a scale moves on to other issues (national connections, markets, and larger scale processes.) TRPA has in its hands valuable data on status and trends of Basin components. Its job is to recognize and evaluate the connections among those components, weigh the trade-offs given sustainability objectives and resource constraints, and diagnose the best practices that will facilitate wise and sustainable management. By setting this context, this valuable role of the TRPA, there may be more agreement and balanced appreciation among the interested stakeholders of the immediate and long-term goals of the Plan.

On a related note, here is a general need in TRPA to take a landscape perspective in order to relate the Threshold Categories to one another. There is not nearly the focus that I had expected on the interactions among the Categories. Here there is a huge dataset describing air and water quality, vegetation and wildlife, soil and fisheries, and the more direct social demands of recreation and aesthetics; and yet, there are relatively few points that discuss their interactions. For example, how does landscape structure (a result of prior and current land cover/use) influence sediment flow through the basin, affecting water quality and fisheries? How does urban development interface with upland landscapes to amplify or attenuate sediment flow, wildlife distribution, and air quality? The Basin is highly vulnerable to wildfire after years of fire suppression. Can that vulnerability be reduced by re-establishing the past disturbance regime (e.g. relatively frequent fire) in the Basin as it operates today without excessive disruption to recreation demands, water quality, unique habitat, and natural regeneration processes? There is evidence that these integrative questions are being considered by the TRPA, but they are buried in Appendices in Chapter 12. For example, Appendix IE-2 is an excellent overarching examination of the biological integrity of streams, and Appendix IE-5 summarizes several projects that align with the TRPA's integration goals and polices.

I would suggest either a Threshold Category of "Landscape Ecology" be incorporated into the TRPA as an integrating theme, or a concerted effort to discuss the existing Threshold and Indicator Categories in the context of the landscapes of the Basin; for example, having Landscape Ecology as an Indicator Reporting Category within each Threshold.

Editorial Comments

- Pg 1-2, 3rd paragraph: "Threshold standards *are* set forth in Exhibit A of Resolution 82-11 address…" → delete "are"

- Figure 1-2. Shouldn't 1980 have an asterisk (*) in the graph since US Census data exist? Or were they not used that year and only in 2000 and 2010?

- Pg 1-9, 1st paragraph, last sentence: "The significance of this phenomenon has *both* positive environmental and economic implications …." → delete "both"

- Figure 1-8. The text in this figure is hard to read. Could the figure be redesigned with larger font, at least for the headings?

- Pg 1-12, 2nd paragraph: capitalize "Numerical Standard" throughout to be consistent with capitalized "Management Standard".

- Pg 1-12, last paragraph, 6th line: "…the status of each numerical *indicator* relative to …" Spelling of indicator.

- Pg 1-12, last paragraph, 3rd line from bottom: Tense of sentence: "…Standard or Policy Statement exists, it *was is* included or otherwise referenced in the Management …" → replace "was" with "is"

- Pg 1-14: Description for TRPA Threshold Category – The first sentence is unclear. Should it read something like "*Identifies the topic area and the standard and associated indicator with which the indicator category is affiliated*."?

- Pg 1-14, last line: "….Resolution 82-11 where a standard is labeled as *a* management, but also identifies numeric …"

- Pg 1-15, under Indicator: "For example, *a* parts per million or ppm is a standardized measurement …." → delete "a"

Chapter 2 Methodology

Prescribed approaches for determining the status and trend of indicators relative to adopted standards was fairly clear and appropriate, with several exceptions. The intentions and methods were described completely, but language was slightly to very "dense". Editing, with a focus on simplifying and shortening sentences, would significantly increase clarity. I found a number of typographical errors and tried to point out a few below under "Editorial Comments". This chapter needs significant editorial attention.

Under Section 2, the discussion of "Determine Indictor Status" is not clear and, in fact, confusing. Figure 2-1 appears to define percent divergence differently than the example given for winter lake transparency and differently than the detailed discriptions of the categories of discrimination. The best I can tell, the figure should be labeled such that the ≤25% and ≥25% of the target are going to be relative to the type of standard. For example, for "achieve the minimum" standard, the "somewhat worse than target" is ≤75% and "considerably better than target" is ≥125%. (I understand the figure is implying the target plus/minus 25% or greater/less than, but that's confusing.) The example of winter lake transparency is confusing because it is categorized as "considerably worse than target" because it is great than the target. In sum, this section needs to be made consistent in its message.

Editorial Comments:

- Pg 2-1, Interim Target: "is an intermediate numeric objective identified in Threshold Evaluations ***and*** related to a standard that is expected …."

- Pg 2-2, central question to evaluation: *"What is the status of the indicator …. and how has it changed over time (trend)?"* → space between "over" & "time"

- Pg 2-4: *"Maintain with Range"* Standards → "e.g. percent forest vegetation type cover" is awkward. Use "e.g. percent cover of forest vegetation type".

- Pg 2-4, 2nd to last paragraph: "This method is commonly used because it *is* based on straightforward calculations …."

- Pg 2-5: "For the "*maintain within range*" ….. "However, if the value was above or below the *prescribed* range, one needed to …."

- Pg 2-6, 1st paragraph under 3): "In other cases, (comma) a trend determination was not made due *to* insufficient data …."

- Pg 2-6, 2nd paragraph under 3): "…method that fits a straight line through the set of points plotted on x (time) and y (indicator value) *axes* …"

- Pg 2-7, third line: "The coefficient of determination or R2 values was also evaluated …" The coefficient of determination is defined in the next sentence.

- Pg 2-7: "….functions or changing cyclical patterns common in, (comma) for example, (comma) wildlife populations."

- Pg 2-8, Under 4): The term "Aging" in "Data Continuity, Aging, and Quality Assurance" is not quite right. "Age" of sampling isn't commonly used. More applicable would be "Sampling" or "Record" or "Duration" or …?

- Pg 2-8, "Spatial and Temporal Representation": "… analysis or a *scientifically-supportable* qualitative rationale. *and* Either approach *infers that* the spatial and temporal representativeness of the monitoring effort adequately characterizes regional conditions for the resource or condition considered."

- An example of a very complex and unclear sentence on page 2-10 under "Aggregation of Status, Trend, and Confidence": *"In general it appeared that previous evaluations took a very restrictive approach for characterizing the attainment status at the Indicator Reporting Category level where the Indicator Reporting Category was deemed to be in "non-attainment" if any of the standards within the Indicator Reporting Category were out of attainment in any of the years covered by the evaluation."* Wow.

- Pg 2-13: "In these instances, the numerical elements of the management standards were evaluated *in a manner similar to* a numerical standard if …"

Chapter 5 Soil Conservation

General: The two indicator categories, impervious cover and stream environment zones (SEZs), are important to soil conservation concerns. They represent important points of integration of soil movement for the whole basin; the urban environments (impervious) are largely located at the land-lake interface and the SEZs are distributed throughout the smaller watersheds within the basin. A focus on impervious surfaces is defensible, but should be presented in a way that also emphasizes its contribution to the amplification and/or attenuation (depending on urban design) of the water flow coming from the surrounding Basin uplands. (A perfect point for integration in the Plan) The SEZ Indicatory Category has a restrictive focus on restoration of disturbed SEZs. While these are important contributors to soil conservation (hot spots, in fact), a more comprehensive evaluation of Basin-wide SEZs is needed; this has been recognized and recommended in this document. While resources prohibit the monitoring of all SEZs, a spatial assessment (remote sensing and GIS) of their size distribution would be very useful to look at SEZ quality and erosion presence or potential. At the very least, a Basin-wide inventory and remote monitoring of SEZ distribution would be instrumental to in the event of new upland disturbances, such as wildfire.

Impervious Cover

The Impervious Cover indicator evaluation is clearly written, with some exceptions. The rationale for choosing this indicator is fairly well described and certainly relevant to soil conservation. However, there are no references cited for statements or conclusions throughout this section. There is a substantial current literature on the impacts of impervious surfaces on water flow and water quality that can support the statements made in this evaluation. Further, references supporting the discussion of soft coverage and, in particular soil compaction, are needed to back up statements regarding the ecological impacts of compaction. A slightly more enhanced discussion with supporting citations would strengthen this section.

Threshold Standard

The Impervious Cover Category must comply with the Land-Capability Classification of the Lake Tahoe Basin, California-Nevada (Bailey 1974). The general nature of the range of Bailey's land capability classes (#1-7) is described, but is inadequate for critique. Bailey's actual 1974 document for this classification scheme is difficult to access; it is an old US Forest Service publication that is not readily available. I couldn't find it at my university nor in an internet search (other than work that cites it). It would be very useful for this reviewer, and the public as well, to have access to at least a short description of each of the classes. I suggest a table be inserted into the document that characterizes each of the classes by the important physical criteria, including the specific variables mentioned in the text as well as any other pertinent information such as vegetation cover. For example, it is not obvious what is meant by "disturbance hazards" and what is the gradient of hazards that help define these categories?

Not knowing the constitution of the land capability classes makes it difficult to critique whether the remote sensing methods used for the 2011 threshold evaluations are adequate for distinguishing fractional cover of impervious surfaces across these classes. The LIDAR and high resolution multispectral imagery are probably very useful and I understand that only preliminary analyses have been conducted, but more information on the capability classes and the characteristics of the remote sensing data is needed. Description of the data properties (resolution, time of acquisition (mos/yr) should be included in the introduction, apart from what

is included in the panel on Data Evaluation and Interpretation, in order to fully discuss analysis challenges and future plans. More detail on the intended use of the object-based analysis is necessary for this indicator evaluation. Understandably, this is all preliminary. But a better description of the application of this approach (the approach/algorithm and advantages) is important in this section. Some information is provided in the "Data Evaluation and Interpretation" section, but a better description should also be included upfront in the text.

New Land Coverage
The first paragraph is unclear. How is land coverage calculated on water quality mitigation fees? I assume acreage is mentioned in documentation for permitted projects. Please clarify.

Data Evaluation and Interpretation
Trend: The report states that a comparison of the current assessment of impervious cover thresholds (based on LIDAR/multispectral high resolution imagery and the 2007 NRCS soil survey) and the 2006 assessment (IKONOS and 1972 soil survey) are inappropriate. Certainly the scales are different (although that detail is not in the text), but I am not convinced that a comparison cannot be made at some level of aggregation. Historical analyses of land cover change often rely on very different sources of information, but nonetheless some information on trends can be derived. The comparison is made between the *map* products, with stated caveats on data sources, etc. A carefully designed comparison could be made, tracking uncertainty along the way. If the team insists this is impossible, a much better justification as to why this *cannot* be done is needed.

Recommendations for Additional Actions: I support the recommendation to update or replace the language of the Bailey report. The original ecosystem-based conception of Bailey can and should be upheld, but with the updated 2007 soil survey driving the land capability systems, the threshold standard language will need to be updated.

Stream Environment Zone
The Stream Environment indicator evaluation is relatively clear, with some significant exceptions. Like the section on Impervious Surfaces, this text is poorly supported by scientific literature. Research on the importance of riparian zones, wetlands, etc. is abundant and can be cited to support the rationale for this category. Significantly more text is needed on the importance of SEZ to *soil conservation*, given this is a reporting category for such. Other important ecosystem services provided by these zones are listed in the text, but there is relatively little discussion of soil conservation per se.

Threshold Standard
As currently framed, the only SEZ indicator is area (acres) in the Urban and Rural regions. While this is a relatively straightforward assessment to make (certainly with its challenges), acreage is not, in and of itself, adequate to describe impacts on soil conservation. It is an integrative parameter, in that it represents the presence of the zones which are critical to soil conservation, but it is an indirect indicator of erosion and sediment transport. Moreover, with only area as a threshold standard, transitional states (when disturbance hasn't cleared the structure/vegetation of the zone, e.g. stressed, or low level disturbance) or legacy impacts are likely not to be captured. Other, more direct measurements (perhaps only one or two, but

especially erosion) would help define the character of the SEZs, i.e. their quality or state. Soil loss initiated through disturbance of various kinds is certainly of concern in the Lake Tahoe Basin. Erosion of stream channels through disturbed soils and excess runoff can contribute substantial nutrients and sediments to the Lake and consequently reduce soil clarity. Potential threshold standards such as identification of runoff and erosion sources and amounts would lead to an explicit statement on management and erosion control practices.

Data Evaluation and Interpretation
The Indicator Unit of Measure is described as "acres of restored SEZs in urban and rural areas". Is there no monitoring of change in SEZs throughout the Lake Tahoe Basin? The indicator should not be confined to *restoration* projects if it is meant as an assessment tool of overall Basin condition. The standard is set in terms of preservation of existing Basin soils as well as restoration of disturbed SEZs, and therefore the assessment goals are not being met. It is stated that no indicator has been developed to verify the preservation of naturally functioning SEZs. This should be pointed out in the text up-front in the introductory paragraphs (outside of the Data Evaluation and Interpretation panel), and a distinction made between the definition of the TRPA Indicator Category and what is being assessed; namely only restoration projects are being monitored for state and trends, but not the area of naturally functioning SEZs in the Basin. It is evident from discussion under "Status" that such baseline monitoring is not being done, but no (or little) rationale is given. This is an important goal for the Soil Conservation Indicator and plans to complete the evaluation of this component should be included in the plan.

Editorial Comments

- Pg 5-2, 3 lines from bottom: "This, this evaluation provides a preliminary characterization of the proportion of each land capability class *that is covered* with impervious surfaces.
- Pg 5-3, 2nd paragraph under "Updated Soil Survey":
    - "This updated soil survey replaces the old soil survey (Rogers 1974) used by *Bailey (1974)* to assign …."
    - "One significant change in the updated soil survey was that mapping resolution nearly doubled, *from WHAT to WHAT?"*
- Pg 5-10, 2nd paragraph: "…. Defined by hydrology, hydric soils and water-loving or *water-tolerant* vegetation.
- Pg 5-10, 3rd paragraph under "Threshold Standard": "*Restored SEZs* for this category for 2003-2011 *total 83.5 acres."*
- Pf 5-10, last paragraph: need commas → "….the 25% restoration threshold standard includes SEZ restoration adjacent to, but outside of, the urban boundary."
    - Similar problem on next page, top: "Several of these projects are located adjacent to, but outside, TRPA "urban areas".

Chapter 6 Vegetation Preservation

General: This is a well written chapter. The evaluation is generally clear and, aside from a few important exceptions, complete. Justification for this Threshold Category is strong, and the authors have done a fine job incorporating standard-relevant justification to the Data Evaluation and Interpretation panels. The beginning of the chapter would benefit from a paragraph

introducing the scope of the category, the effort and the justification for looking at Vegetation Preservation as a Threshold Category of the Basin's condition. Statements of fact or conclusions are generally well supported throughout the chapter by appropriate references.

That being said, this effort runs the danger of diminishing its importance to Basin-wide concerns by its sole focus on the detail of the vegetation communities and ecosystems and not their spatial distribution throughout the Basin. Their composition *and* their configuration are fundamental to many concerns – wildlife, water quality, soil conservation, recreation & scenic resources. In other words, the introduction should contain some discussion of landscape structure, configuration and fragmentation processes resulting from development and disturbance within the Lake Tahoe Basin. I would add that a recommendation is warranted for a landscape analysis in future work. The landscape is an important scale of assessment to integrate several Threshold Indicators, but in this case, very important to the assessment of the status and trends of the vegetation associations and ecosystems of interest. Current and past human activities and natural disturbances are important drivers of landscape structure, defined as composition and configuration of cover types. These drivers are described well in the text, but the discussion could go a little further and connect the drivers and their legacies directly to patterns of vegetation cover. This, then, could support a useful standard indicator. Fragmentation is important to biodiversity and landscape diversity, of particular concern to this Threshold Category. Indicator standards could be selected landscape metrics such as patch size, patch age distribution, juxtaposition, and connectivity.

Common Vegetation

The standard indicator Species Richness (a numeric Management Standard) might be titled Landscape Richness or Land Cover Richness or Vegetation Richness because it at the level of an association of species rather than individual species. Rather than the count of vegetation associations as the unit of measure, the Shannon Diversity Index could be used with cover types to have more sensitivity to proportion of the landscape occupied by each cover type.

In Table 6.1, why is the Common Vegetation Category non-degradation standard to preserve plant communities a Management Standard (indicator: the natural qualities of the community) and the Uncommon Plant Communities Category non-degradation standard a Numerical Standard (without numeric targets; indicator: the natural qualities of the community)? I would think these would be considered the same standard type since the indicator descriptions are the same.

Data Evaluation and Interpretation: Vegetation Community Richness

Recommendations for Additional Actions - landscape structure analysis may be useful to inform managers on the fragmentation -- juxtaposition of vegetation associations, their patch area, connectivity. These metrics are sensitive to disturbance, human activities and, potentially, long-term climate change impacts, and will change with time.

Data Evaluation and Interpretation: Proportion of Small Diameter Tree Dominated Stands

Given the recent fires (Angora and Gondola), wouldn't the eventual regeneration satisfy targets for small diameter trees? More appropriately phrased, recent fires have cleared mature forest and, while there will be earlier seral phases, a significant component of the landscape will be in

young forest relatively soon. This possibility is suggested in the last sentence of the Trend section, but should be developed more. I would think these recent fires, and the likelihood of more to come, are sufficient to initiate regeneration and make this Standard less important. Is there discussion of removing "ongoing fire suppression"? Understandably, fuel management in wildland-urban interfaces will be a big issue and fuel management is desirable. But what about the rest of the Basin? An explanation of why natural disturbance dynamics are not considered as a useful driver of forest age diversity is needed here.

Data Evaluation and Interpretation: Relative Abundance of Late Seral and Old Growth Ecosystems for Montane, Upper Mondane and Subalpine Elevation Zones
Recommendations are clearly stated and logical. The reflection on threshold standards is important, and the consideration of the subalpine forest not meeting targets is a logical one. Given that the area of the subalpine has not been affected by logging or fire suppression and is therefore likely to have changed very little since Euro-American settlement, a revisit of threshold standard is warranted. Trying to meet the same coverage as montane and upper-montane forests is setting the assessment up for failure, and defining subalpine old-growth on the same size standard (>24" dbh) does not recognize the ecology of that high elevation zone.

Editorial Comments
I have found a number of typographical errors that minimal editorial effort will correct. Further:

- Pg 6-6, last paragraph: Correct grammar: "…. adopted management targets, the overall trend shows that 5 of the 6 indicator *is are* unknown, with little or no change in vegetation community richness." The last sentence of the paragraph is also not very clear: "An evaluation of 2 management standards … consistent with the adopted threshold standards for common vegetation." Is that saying that there are already policies, etc. in existence that are used for other threshold standards as well as the common vegetation standard? Please be more specific with the meaning of this sentence.

- Figure 6-1. Bottom right box: The Status, Trend, and Confidence evaluations for Relative Abundance of the Deciduous Riparian Vegetation Type" have not been completed.

<u>Chapter 8 Wildlife</u>
This Indicator Evaluation is weaker in detail than other chapters. The introduction is clear and informative, but only lightly touches on the Basin's human and natural disturbances which may have a significant influence on wildlife persistence and movement. The spatial configuration of habitat has important implications for health and persistence of species. Addressing wildlife from a landscape perspective will create linkages to other assessments (e.g. vegetation, soil) and demonstrate that the TRPA is taking a comprehensive, ecosystem approach. Overview text is missing for Habitats of Special Signifcance, 1 of the 2 Indicator Reporting Categories.

Special Interest Species
The introduction to this section confuses terminology and is not consisted with the Threshold Category hierarchy established for the TRPA. The first paragraph addresses the management standard associated with the disturbance zones; this is the second standard in Table 8-1. The second paragraph speaks to the "special interest species threshold" (referring to the Indicator Reporting Category of Special Interest Species which contains both population sizes and disturbance zones) and describes the entire "threshold" as numerical, apparently referring to the population site standard. The third paragraph describes the 2nd management stand (disturbance zones) of the "special interest species threshold". The 4th paragraph then correctly mentions the "special interest species indicator reporting category".

Special Interest Species: Peregrine Falcon. The reporting icon describes the Status as "at or somewhat better than target. The text states "The threshold standard of two population sites is in attainment."

Indicator Reporting Category *Habitats of Special Interest* has a nondegradation standard for significant wildlife habitat consisting of deciduous trees, wetlands, and meadows. The Indicator Summary specifies Riparian Habitats and the text therein only speaks to riparian and wetland areas. I assume that "riparian" includes deciduous species as described in the Vegetation Indicator Reporting Category (aspen, alder, cottonwood, willow) but this should be directly addressed. Meadows can be wet or dry, so will not fall within the wetland category. This Indicator Summary should be consistent with the Table 8-1 Standard description.

Chapter 12 Implementation and Effectiveness
TRPA's achievements, limitations, and recommendations are well integrated in this chapter. It successfully synthesizes the compliance measures and implications of the previous chapters, and the contributions of the 1987 Regional Plan, associated plans, controls and implemented actions to improvements in environmental conditions in the Lake Tahoe Basin.

Soil Conservation: While a concern to assess the preservation of stream environment zones is expressed in Chapter 5, it is not addressed in this synthesis. An effort to monitor SEZs across the Basin is ultimately needed to conclusively demonstrate the improvement of SEZ conditions and monitor disturbance impacts such as wildfire on landscape structure.

Vegetation Preservation: The caption under Figure 12-2 is somewhat deceptive. While Non-forested wetland to Forested (wetland?) did decline after 1987, the declines for Grassland/shrub to Forest and forest thickening were a continuation from pre-1987 trends for the former and a slowed decline after a period of rapid decline pre-1987 in the latter. While the 1987 Regional Plan probably had a role in these trends, it is inaccurate to imply that it was solely responsible.

"More management actions are needed to restore conifer forest structure and composition" is a challenging stance in the context of disturbance regimes and landscape dynamics. The concern is that the densification of forests and fuel loads make the Basin vulnerable to extreme fire events. This is a real concern, however describing management as "restoration" implies a static

condition of the goal, pre-European landscapes. While this may be nuanced, the management discussion would be serviced by defining the real goal of building a resilient landscape. What is ultimately desired is a landscape that is sustainable through a disturbance regime that is not catastrophic to certain elements of the Basin; in other words, the region is managed to be adaptable to human and natural disturbance, and the interannual variation that climate and biology bring. This current landscape of the Lake Tahoe Basin is different than pre-settlement in that there is a component of urban development at the interface between wildlands and the lake; there are high-pressure recreation and social expectations; air quality is changing due to human activities; and the baseline climate under which the Basin evolved may be in flux. Restoration (as "best practices" as it can be) assumes a control of natural processes that may be inappropriate. "Restoration" of pre-European landscapes from historical, cumulative impact of land use, fire suppression and natural disturbances implies a family of management choices which may or may not be necessary depending on location in the watershed and proximity to wildland-urban interfaces. Restoration and thinning programs near urban development should be prioritized. However, I would suggest that, any activities outside of those areas be considered in terms of landscape/soil stabilization (in "restoration" projects or logging enterprises) and regeneration processes that promote a resilient landscape structure; but that this is not referred to as "restoration of forest structure and composition".

Chapter 13 Conclusions & Recommendations

This section is representative of the analyses described in the reports. It positively summarizes the science and recommendations, and the conclusions follow logically.