A PROPOSED WATERSHED PROTECTION PROGRAM EVALUATION APPROACH

An approach for funders, regulators, and permittees to design, evaluate and report watershed protection programs

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INTRODUCTION AND BACKGROUND

Tahoe Basin managers have an opportunity to enhance the Environmental Improvement Program (EIP) by refining existing metrics and clearly reporting on progress to funders by linking actions to desired outcomes valued by the public. This would 1) increase the clarity of reporting by curtailing redundant, countervailing information, and 2) help scale monitoring tasks appropriately to better meet the constraints of existing resources.

Purpose and Objectives of this Evaluation

This evaluation helps Tahoe Basin program managers understand how they can update the metrics used to report EIP progress such that programs maximize benefits produced for available funds and can win additional support when necessary. There are three identified objectives of this evaluation.

- Provide a foundation of metrics that can be used in a multi-benefit project prioritization tool
- Evaluate the existing metrics related to EIP water quality programs as they relate to stormwater
- Demonstrate a program evaluation and reporting approach that can be applied to all EIP programs

Scope and Process

EIP partners implement hundreds of projects each year across many different programs. However, this report is focused on water quality, so it evaluates specific EIP programs (Stormwater Management and Watershed Management). Each of these programs was selected because it provides direct water quality benefits, or improves water quality through co-benefits.

The process to evaluate each of these programs follows three steps. First, analyze Pre-2019 metrics to identify the subset of metrics relevant to water quality. Next, use Open Standards[1] tools and best practices to check whether there are gaps or redundancies in critical results chain linkages. Finally, propose program programs based on input from the Technical Advisory Committee.

Document Structure and Audience

The intended audiences for this document include Tahoe EIP program managers, as well as agency management personnel responsible for reporting progress and acquiring funding to accelerate environmental improvement. EIP program managers should use this document to refine program strategies and ensure there is clarity on program goals. Agency management should use this document to understand a streamlined structure of metrics for quantifying benefits of multi-benefit stormwater projects and communicating powerful success stories to policy makers and funders.

1. **Program Evaluation Approach –** This section is structured around two findings - 1) a manageable number of clearly defined metrics guides effective program implementation, and 2) results chains are an efficient tool for evaluating and communicating program success. Based on these findings, this section proposes a revised structure for metric terminology and proposes two results chain formats with distinct uses. Further, this section identifies potential changes in existing metrics based on the new metric categories. EIP program managers should read this section to understand the proposed approach for program evaluation, and how it differs from current practice.
2. **Program Analysis: Actions or Strategies, Intermediate Results, Desired Outcomes, and Metrics** – This section reviews, evaluates, and streamlines Pre-2019 results chains and metrics for three

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[1] The Open Standards for Conservation are an internationally recognized method for systematically planning, implementing, and monitoring progress toward local desired outcomes to understand what works, what does not, and how to ultimately adapt to improve efforts. Guidance document: https://cmp-openstandards.org/wp-content/uploads/2017/06/CMP-OS-V3.0-Final-minor-update-May-2107.pdf The Open Standards website: http://cmp-openstandards.org/

water quality programs. Based on these findings, this section provides an Example Potential results chain and metrics for each program. This section also summarizes the rationale for specific changes to each program. Both program managers and agency management should review this section to understand how the Example Potential programs differ from current programs.

3. **Appendices –** Key reference materials for understanding report findings are available in the appendices. These materials include documentation of quantitative (1-5) ratings to categorize each metric, and the metric categorization criteria. EIP program managers should read this section if they want to understand the details for recategorizing specific metrics, and the criteria to use for future program evaluation.

PROGRAM EVALUATION APPROACH

Tahoe Basin managers can deliver and report program success by explaining clearly how funding enables actions that logically lead to desired outcomes. Program evaluation theory, combined with previous discussions among TRPA program managers on how to structure EIP Performance Measures, have led to the current proposal of three distinct categories of metrics: input performance measures (input PMs), output performance measures (output PMs), and threshold standards. Programs that 1) communicate a limited number of metrics in each category, and 2) narratively explain the logical linkages between categories, have been successful in achieving desired outcomes, delivering good returns on investment, and enhancing their funding levels.

Metric Terminology and Use

Clear metric definitions enhance communication and increase consistency among programs. Categorizing metrics helps to show a progression from program efforts to valued outcomes. Consistency and categorization lead to clear reporting and improved decision making. Figure 1 (below) introduces a coherent set of terms that relates past language to well defined, proposed terms. *Metrics* is the general, *catch-all term* for any quantifiable value that is useful for management purposes. Metrics may be environmental measurements, indices derived from measurements, modeled values, or calculated from other sources. *Pre-2019 terminology* used in the Tahoe Basin leads to confusion because EIP Performance Measures and threshold standards each include multiple categories of metrics and overlap in their definitions. The *Proposed categories* tailor USDA terminology[2], which is commonly used in the field of program evaluation, to the familiar language of the Tahoe Basin.

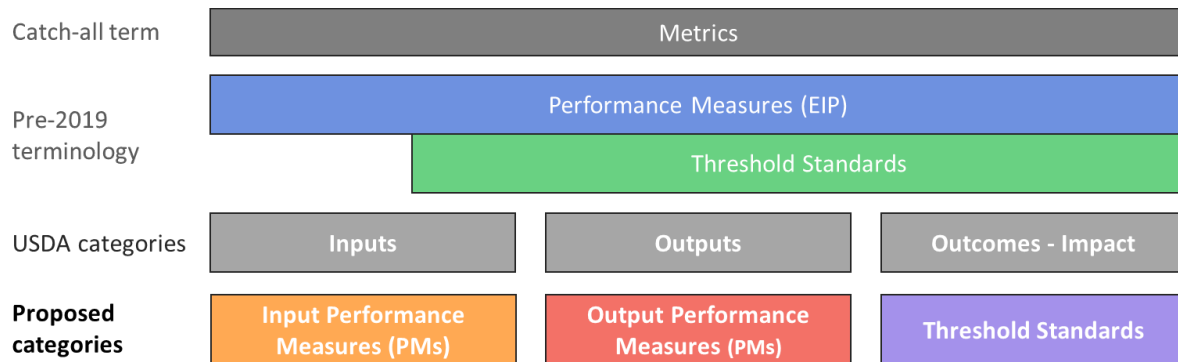| Catch-all term	Metrics		
Pre-2019 terminology	Performance Measures (EIP)		
		Threshold Standards	
USDA categories	Inputs	Outputs	Outcomes - Impact
Proposed categories	Input Performance Measures (PMs)	Output Performance Measures (PMs)	Threshold Standards

Figure 1. Comparison of metric categorization terminology. The orange, red, and purple bottom row depicts proposed categories of metrics that are well defined in this document and communicate a progression from program efforts to desired outcomes.

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[2] USDA logic model for program development and evaluation: https://bit.ly/2Usoupr

Using the proposed, three categories with recognizable terms and clear definitions, EIP program managers can select a manageable set of metrics for prioritizing projects and reporting progress (Figure 2). *Input PMs* inform the development of internal management reports, help ensure compliance with grant requirements to track funds, and enable data aggregation for annual summaries. *Output PMs* use quantitative modeling or monitoring results to update online platforms and represent the benefit or value of programs. Over time *threshold standards,* through long-term monitoring programs, communicate successful achievement of desired outcomes or signal areas for additional future investment.

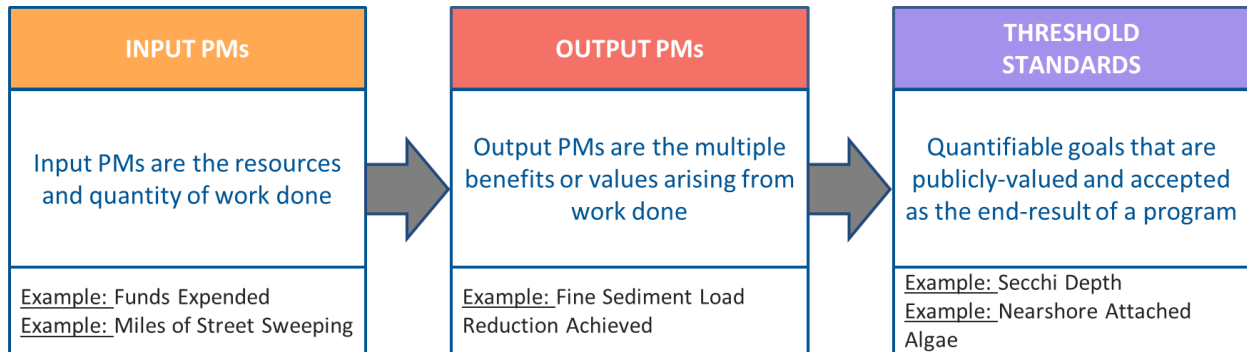| INPUT PMs	OUTPUT PMs	THRESHOLD STANDARDS
Input PMs are the resources and quantity of work done	Output PMs are the multiple benefits or values arising from work done	Quantifiable goals that are publicly-valued and accepted as the end-result of a program
Example: Funds Expended Example: Miles of Street Sweeping	Example: Fine Sediment Load Reduction Achieved	Example: Secchi Depth Example: Nearshore Attached Algae

Figure 2. Summary definitions of the three metric categories (input PMs, output PMs, and threshold standards) along with example metrics. Program managers can report clearly, enhance management decisions and win additional support by communicating 1-3 metrics in each category.

Metric Definitions

Input PMs are the resources and quantity of work done. They are the basic measures of resources used, actions taken, and funds expended. Input PMs are important because they enable managers to meet grant reporting requirements, and track funds expended and project activity. For example, the number of Projects Implemented, Dollars Spent, and Miles of Street Sweeping are input PMs.

Output PMs are the multiple benefits or value arising from work done. They are the core performance reporting metrics. They provide the right combination of implementer control, attribution to actions, and relevance to desired outcomes to justify their reporting effort and incentivize effective actions. These metrics represent the multi-benefit value produced through the actions/strategies of project implementers. For example, Fine Sediment Load Reduction and Volume of Urban Stormwater Reduced are output PMs.

Threshold standards are the quantifiable goals that are publicly valued and accepted as the end-result of a program. They are the long-term indicators of success. They provide a numeric perspective on quantifiable environmental and social values. They are often slow in responding to actions taken, challenging to attribute to management actions without research methods, and relatively expensive to measure. For example, (annual average) Secchi Depth is a threshold standard.

Comparing Uses of Pre-2019 Metric Categories: EIP Performance Measures and Threshold Standards
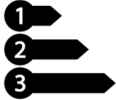
According to Pre-2019 terminology, metrics are categorized as either EIP PMs or threshold standards (Figure 3). Managers use *EIP PMs* to prioritize projects, report progress already underway, gain further support, maximize benefits achieved with current funds and demonstrate incremental progress. Comparatively, *Thresholds* that set environmental standards are used to describe progress toward long term goals and highlight future research needs.

Performance Measures (EIP)	Threshold Standards

Showing progress to regulators, funders, public and elected officials - Demonstrating progress toward outcomes is the essence of reporting. Clear tracking and reporting helps show that actions are on target to achieve goals and builds support from political and public stakeholders by demonstrating the value of investments.

Describe long-term goals - Threshold standards establish the EIP partners' shared goals for restoration and maintenance of the qualities of the Tahoe Region. Because Threshold Standards are outcome-based, they focus on the long-term or end-state goals for the system, rather than being prescriptive about the actions to achieve or maintain the goals.

Prioritizing by program-wide returns on investment (ROI) - Projects can be ranked by cost effectiveness and funded in a rational sequence based on the best to worst ROI. As a result, implementers can determine the marginal cost of alternatives and understand the benefit provided by each project.

Developing successful budget/funding requests – A performance-driven budget request quantifies expected benefits. These requests are a powerful way to articulate what will be accomplished with allocated funding. This evidence makes water quality funding requests more competitive for city, county and state grant funds.

Inform adjustment of ordinances and planning documents - Threshold Standard results are compiled and evaluated every four years to assess if the Regional Plan is working and to advise the TRPA Governing Board on making critical adjustments in the Code of Ordinances and other planning documents.

Enabling performance contracts, P3s and other strategies – Changing from traditional place-based, design-bid-build project delivery to a pay-for-performance model where contractors are paid by benefits achieved shifts risk to the private party. Public private partnerships (P3s) allow for various levels of additional risk and opportunity for private contractors.

Highlights future research needs - Reporting on Threshold Standards identifies future research needs and also lays out a framework to update Threshold Standards to make sure they are providing the information necessary to make programs, projects, and policies as effective as possible.

Figure 3. Comparison of the uses of EIP performance measures and threshold standards.

Results of Adopting Proposed Terminology for Tahoe

Pre-2019 terminology did not differentiate between different types of PMs. If Proposed terminology is adopted, Tahoe Basin managers can categorize metrics using the criteria described in Appendix A. When managers categorize metrics as either input PMs, output PMs, or Threshold Standards they can determine whether each category has a reasonable number of metrics to track and report with existing resources. Similarly, managers can easily determine when there are insufficient metrics in a category.

Using the categorization criteria, existing EIP PMs are categorized as either an input PM, or output PM. Additionally, PMs that are actually threshold standards will be moved to the threshold standard category. For example, "Miles of Street Sweeping" is recategorized as an input PM and "Fine Sediment Load Reduction Achieved" is recategorized as an output PM. Of the 35 EIP PMs, 86% become input PMs, 11% become output PMs, and 3% become threshold standards (Figure 4). Because EIP PMs are primarily input PMs but also include output PMs and threshold standards, this report proposes renaming "EIP PMs" as "EIP metrics".
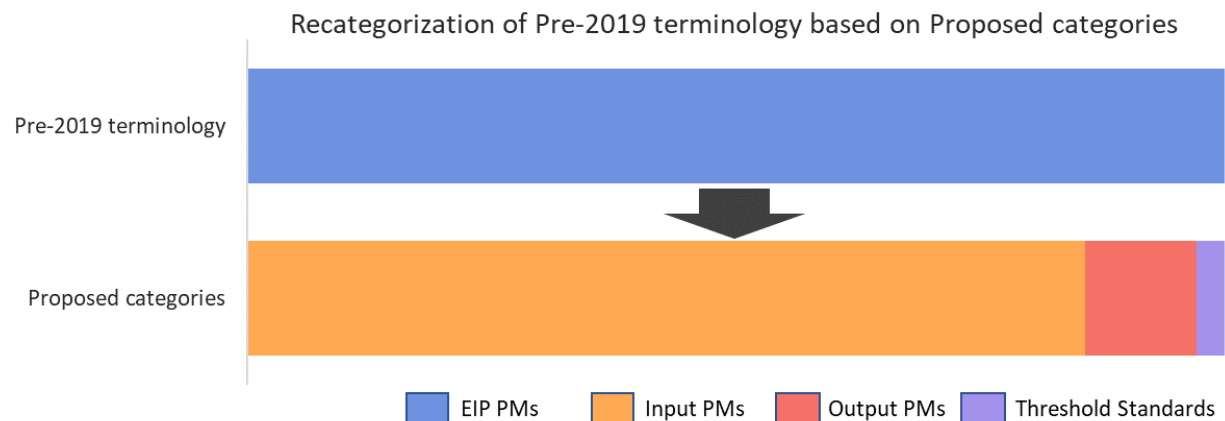

Figure 4. According to Pre-2019 terminology, all EIP PMs are performance measures (blue), but according to Proposed categories, EIP PMs are a combination of input PMs (orange), output PMs (red), and threshold standard metrics (purple).

Program Evaluation Process and Roles

An ongoing evaluation process enables programs to adapt over time as new desired outcomes emerge or the strategies to achieve them evolve. Figure 5 shows how desired outcomes can be communicated to policy makers, creating support for new input PMs such as funding or personnel. Scientists help develop new strategies and best practices that can increase the amount of output PMs for a given level of input PM. Output PMs and progress are tracked and reported by managers to the public and decisionmakers. Behind the scenes, conceptual models and research studies capture the relationship between input PMs, output PMs, and threshold standards. High functioning programs depend on the harmonious execution of these roles and regular feedback between relevant parties to focus on effective action and build relevance over time.

LEGEND

Metrics for program evaluation

Basis for understanding

Scientists conduct long-term monitoring to track threshold standards and report progress to managers. They develop research proposals based on insights from monitoring and conceptual models.

Managers communicate monitoring and research results to policy makers and the public. They adjust strategies based on monitoring and research findings.

Threshold Standards

Conceptual Models and Research

Managers track and report Output PMs from modeling and monitoring to understand progress toward goals.

Scientists perform monitoring and modeling for selected performance measures as contracted by managers.

Output PMs

Input PMs

Managers Develop program budgets & track actual input PMs for each strategy.

Scientists develop conceptual models and special studies to inform the relationship between Actions or Strategies, Intermediate Results and Desired Outcomes. Methods for monitoring metrics are based on expertise and research from scientists.
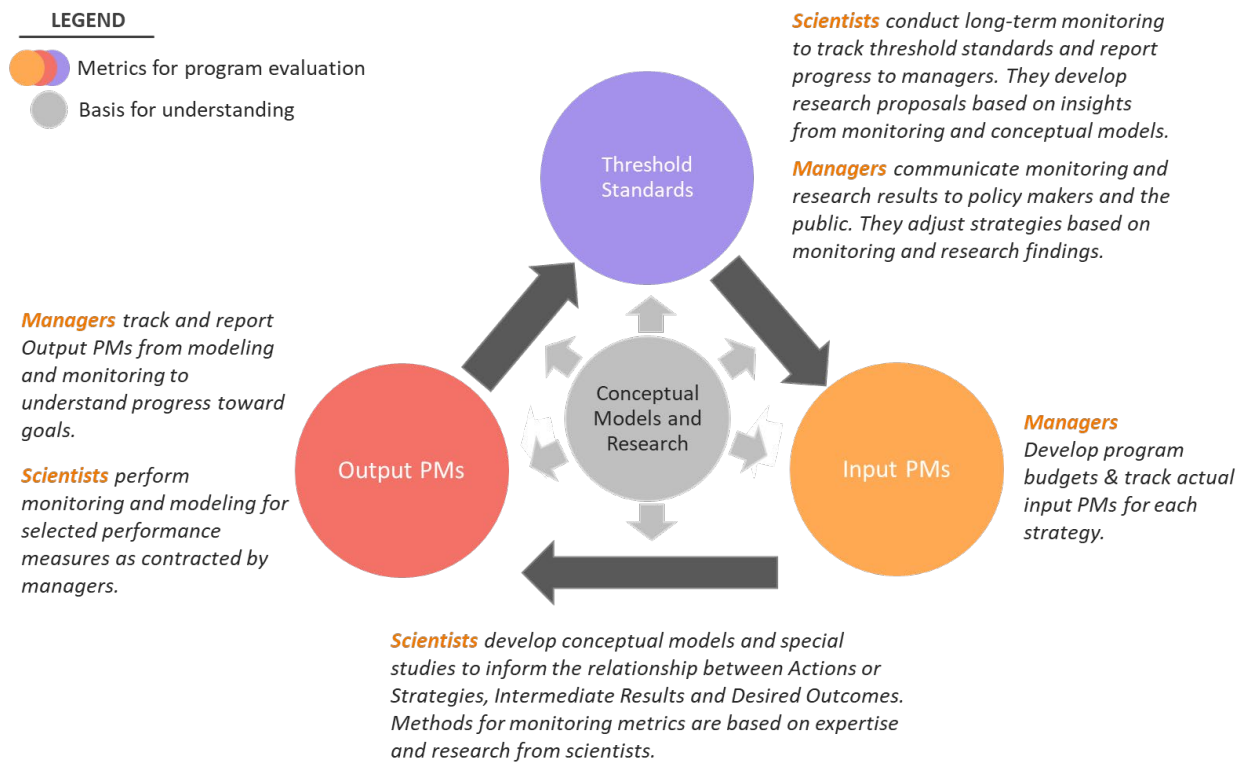
Figure 5. Managers and scientists have distinct roles in the ongoing program evaluation process that reports progress and updates metrics (output performance measures, input performance measures, and threshold standards) periodically as program actions or desired outcomes change.

Results Chains: A Tool for Program Evaluation

Results chains ground conversations among managers, scientists and the public about the most effective ways to achieve desired outcomes and cause-effect relationships in the scope of the program. There are two types of results chains for communication to two different audiences. First, a detailed results chain diagram shows linkages between program elements to enable comprehensive conversations among managers with technical audiences. Further, *detailed results chains* enable managers to communicate reasons that they believe a program will achieve its threshold standards. Second, a *streamlined results chain* diagram highlights key stories and evidence for decision-makers. This can improve the probability of additional funding and build stakeholder confidence

A detailed results chain serves as a common reference point for managers when prioritizing projects (Figure 6). A detailed results chain checks whether 1) the program has too many metrics to reasonably track with existing resources, 2) there are gaps in the metrics that leave critical results chain connections unmonitored, or 3) additional evidence is needed to create credible linkages between input PMs, output PMs, and threshold standards.. Further, a detailed results chain serves as a common reference point for scientists and managers to determine what to measure and where to invest.

- On the right side of the results chain, *desired outcomes* are shown as green ovals. These are long-term statements of success that are valued by external parties, like the public. They are measured by threshold standard metrics. Desired outcomes are composed of a title and a narrative. The narrative focuses on describing an end state, rather than trends or strategies to reach the desired outcome. When creating a results chain, use sources such as research studies, regulatory requirements and expert input

PM to identify 1-5 desired outcomes. Start results chain development with desired outcome agreement among stakeholders.

- On the left side of the results chain, yellow hexagons describe *actions or strategies* for achieving the desired outcomes. Actions or strategies are the components of projects that are expected to make change in the environment or society. They are measured by input PMs. When creating results chains, reference existing plans, strategy documents and manager insights to identify actions or strategies. Include actions or strategies based on the magnitude of resources directed to them, including only those actions/strategies that receive substantial resources. Avoid listing all possible strategies and activities as this can potentially cause the program to lose focus and become unproductive.

- Actions and strategies are expected to lead to a series of *intermediate results*, shown as blue rectangles. Intermediate results are the benefits that come from work done by project implementers and show a logical chain of cause and effect that is expected to result in desired outcome achievement. They are measured by output PMs. When using results chains, check the logical connections among intermediate results with technical experts, project managers and local stakeholders to ensure the best knowledge is represented.
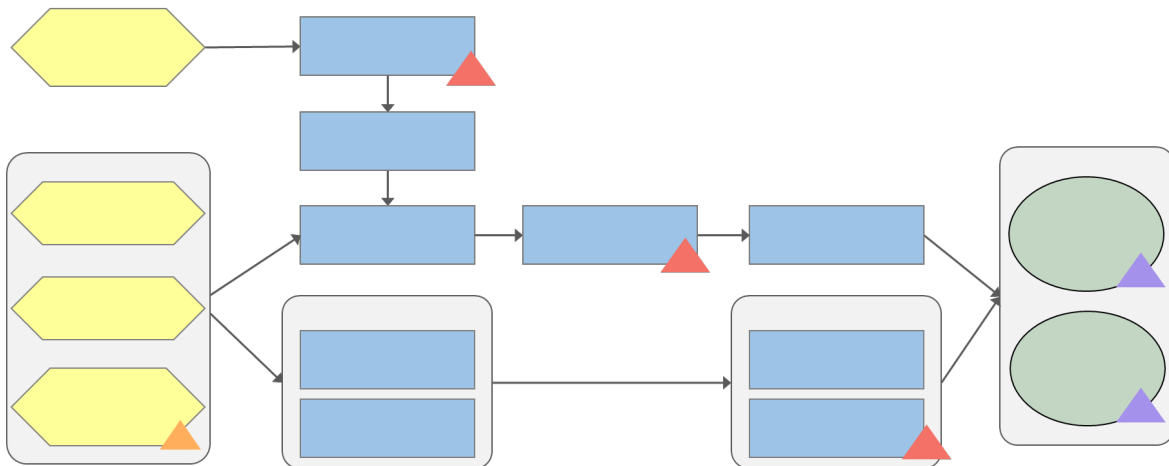
DETAILED RESULTS CHAIN FOR PROGRAM X

Figure 6. A detailed results chain defines the scope of the program by linking actions or strategies (yellow hexagons) and intermediate results (blue boxes) to desired outcomes (green ovals). Detailed results chains include several metrics in each category (orange input PMs, red output PMs, purple threshold standards) which managers can reasonably track with available resources. Metric (triangle) categories are defined in the metric definitions section of this document.

A streamlined results chain summary is useful for concisely reporting program accomplishments to policy makers and funders (Figure 7). Because this format includes only highly relevant information, streamlined results chains should be brief and easily digestible. That way, the audience can quickly understand the most essential information about the way an action or strategy leads to an intermediate result, and eventually, the desired outcome.

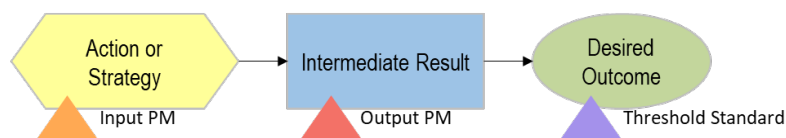## STREAMLINED RESULTS CHAIN FOR PROGRAM X

Figure 7. A streamlined results chain summarizes one action or strategy with relevant input PMs, one intermediate result with relevant output PMs, and one desired outcome with relevant threshold standard metrics.

PROGRAM EVALUATION: EIP WATER QUALITY PROGRAMS

The proposed program evaluation approach can help clarify and analyze EIP water quality programs to reveal redundant metrics, reporting gaps and areas where further research is needed to justify linkages. While EIP program components are currently documented in many separate sources[3], this report aggregates existing information on the EIP's water quality programs into detailed results chains referred to as a **Pre-2019 results chain**. This section provides the result of a program evaluation with **example potential programs** and a summary of proposed changes. The example potential programs are intended to serve as illustrations of how each program could be revised, rather than definitive recommendations to adopt. Program managers can review the summary of proposed changes to understand how to 1) evolve to a reasonable number of metrics for managers to track and report with existing resources, 2) clarify linkages relating actions/strategies to desired outcomes and 3) reflect current management practices and best available science.

The program evaluation approach is also useful for introducing new actions or strategies for the EIP. As of 2019, no program or strategy links road maintenance actions and water quality benefits. This section introduces a new **Example potential strategy** for improving water quality by repaving roads.

Because this report is focused on water quality benefits and co-benefits, the results chains presented here document only the program components relating to water quality. Other benefits of these programs are intentionally excluded.
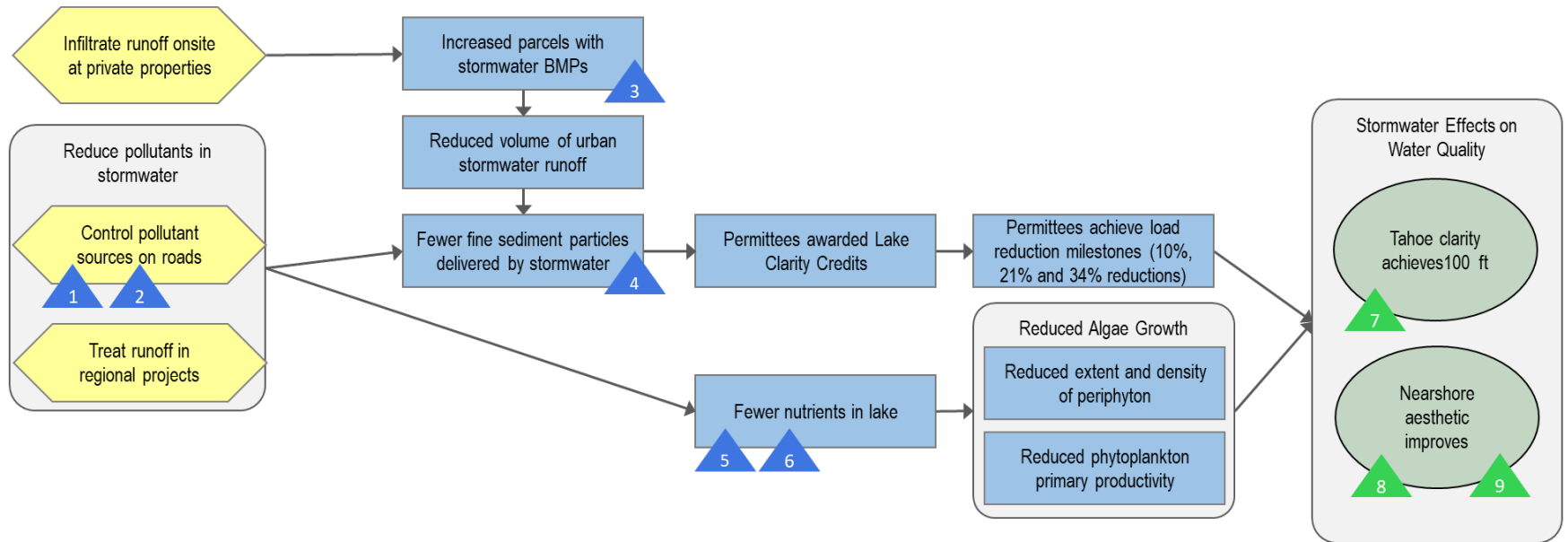
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[3] Referenced sources include: 2010 conceptual models, 2015 Threshold Evaluation chapters, LT Info performance measure info sheets, 2010 Conceptual Model and Indicator Framework Narrative documents, and 2010 Conceptual Model Briefing documents.

Stormwater Program

The Pre-2019 Stormwater Program aggregates existing information to document the current approach for tracking and reporting water quality benefits. The *Example Potential Stormwater Program* documents proposed changes to the program.

Pre-2019 Stormwater Program

Some strategies and intermediate results on the Pre-2019 results chain do not reflect current management practices and best available science. For example, there is not sufficient evidence linking nutrients, algae growth, and nearshore conditions to support intermediate results focused on reduced algae growth. Additionally, many metrics that are EIP PMs on the Pre-2019 results chain like "Parcels with Stormwater BMPs" would be recategorized as input PMs on the Example Potential results chain based on the Proposed terminology for Tahoe.

Example Potential Stormwater Program

This program focuses on reducing urban stormwater pollution to improve Tahoe clarity and nearshore conditions. It excludes strategies, desired outcomes, and metrics related to other potential benefits like flood management.
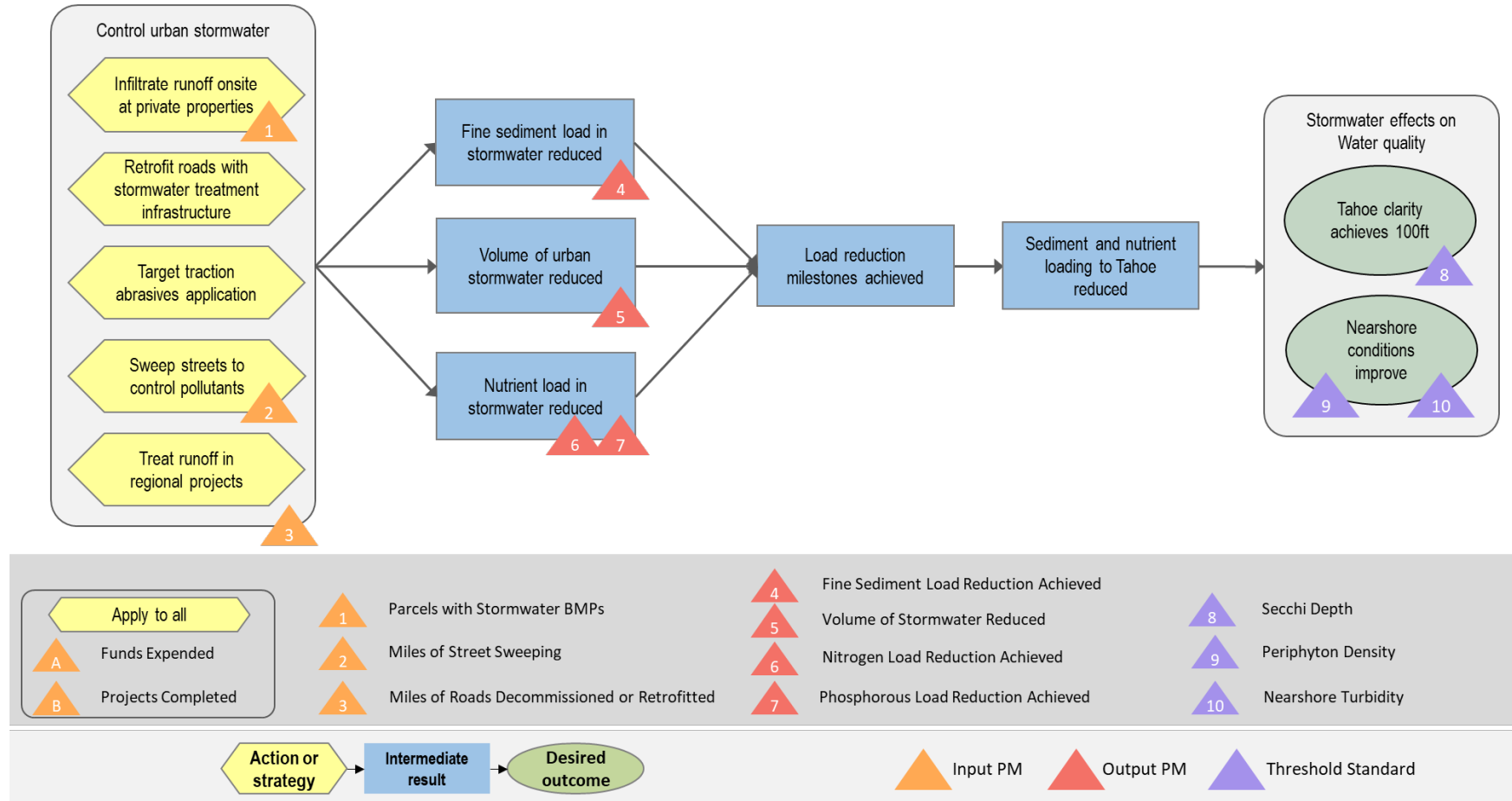
Desired Outcomes

The Stormwater Program focuses on attaining two desired outcomes that are highly valued by lake users: Tahoe clarity achieving 100ft and nearshore conditions improving. Both desired outcomes are both easily observable and directly experienced by lake users.

- Tahoe clarity achieves 100ft: Tahoe clarity supports an aesthetic beneficial use that drives the ecology and economy of the region. Secchi depth measurements for Tahoe return to 1970 levels; roughly 100ft.
- Nearshore conditions improve: The presence of algae and the clarity of shallow waters no longer detract from nearshore recreation or scenic value. Algae (periphyton biomass) attached to rocks, boats, buoys, piers in the nearshore (littoral) zone is reduced compared to 1967-1971 levels. Nearshore turbidity is less than one NTU for areas not directly influenced by stream discharge and less than three NTU for areas directly influenced by stream discharge.

Actions or Strategies & Intermediate Results

Clarity increases and nearshore conditions improve as a result of reducing fine sediment and nutrients entering Lake Tahoe. Controlling urban stormwater runoff is the primary method of reducing pollutant loading because urban runoff accounts for 72% of fine sediment loading.[4] The strategies Tahoe Basin managers are implementing to improve clarity and nearshore conditions are:

- Infiltrating runoff onsite at private properties: The Regional Plan for the Lake Tahoe Basin adopted by TRPA requires all public and private property owners to install erosion control measures (BMPs), to keep runoff from entering roadways and ultimately Lake Tahoe.[5]
- Retrofitting roads with stormwater treatment infrastructure: Local jurisdictions, both states, and federal partners have focused on installing curb and gutter, erosion control measures, and filtration devices on previously developed roads to better capture and treat stormwater runoff. Upland forest roads are decommissioned when feasible.
- Targeting traction abrasive application: Local governments utilize best available road operation technologies to reduce the amount of abrasives applied to roads to reduce generation of fine sediment.
- Sweeping streets to control pollutants: Street sweepers are used to remove pollutants, debris, and sediment from roads and parking lots. When routine street sweeping practices are employed, a portion of pollutants that accumulate on roads and parking lots may be removed before they are entrained in stormwater runoff and potentially transported to receiving waters.[6]
- Treating runoff in regional projects: Regional BMPs eliminate sediment discharge through infiltration, hydrologic source control, and pollutant source control of fine sediment.

Metrics

Input PMs track action taken on private properties and public roads to reduce pollutant generation and clean up existing pollutants.

1. **Parcels with Stormwater BMPs** – The number of developed parcels in the Tahoe Basin with best management practices (BMPs) installed each year (including appropriate operations and maintenance plans) to remove fine sediment particles and nutrients.

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[4] https://www.waterboards.ca.gov/lahontan/water_issues/programs/tmdl/lake_tahoe/docs/charting_course2clarity.pdf
[5] https://eip.laketahoeinfo.org/EIPActionPriority/Detail/4
[6] https://tahoebmp.org/Documents/BMPHandbook/Chapter%204/4.2/b_StrtSwp.pdf

2. **Miles of Street Sweeping** – The miles of city, county and state roads that are swept to reduce stormwater pollution during each EIP reporting year as part of regular operations and maintenance procedures.
3. **Miles of Roads Decommissioned or Retrofitted** - The amount of city, county, state and federal roads that are retrofitted or obliterated to reduce stormwater pollution.

Output PMs track reductions in key pollutants prevented from entering Lake Tahoe.

4. **Fine Sediment Load Reduction Achieved** - The estimated amount of fine sediment prevented from entering urban stormwater, based on the guidelines laid out in the Lake Clarity Crediting Program Handbook.
5. **Volume of Stormwater Reduced** – The estimated volume of urban stormwater reduced through BMP implementation based on PLRM model output.
6. **Nitrogen Load Reduction Achieved** - The estimated amount of nitrogen prevented from entering urban stormwater, based on the guidelines laid out in the LCCP Handbook.
7. **Phosphorous Load Reduction Achieved** - The estimated amount of phosphorus prevented from entering urban stormwater, based on the guidelines laid out in the LCCP Handbook.

Threshold standard metrics track long-term indicators of Lake Tahoe clarity in the pelagic lake and at the nearshore.

8. **Secchi Depth** - The annual average deep-water transparency as measured by Secchi disk.
9. **Nearshore Attached Algae** – The biomass of periphyton attached to submerged surfaces (e.g. rocks, boats, buoys, piers) in the nearshore (littoral) zone at routine monitoring sites and spring synoptic sites.
10. **Nearshore Turbidity** - Turbidity value, measured as nephelometric turbidity units (NTU) in shallow waters of the lake not directly influenced by stream discharges.

Summary of proposed changes

This report proposes the use of a *results chain dashboard* to highlight key stories and trends of the Stormwater Program for political and stakeholder audiences (Figure 8). The following example of a results chain dashboard uses metrics from each category to create an evidence-based story about management actions reducing fine sediment in stormwater and ultimately improving Tahoe Clarity.
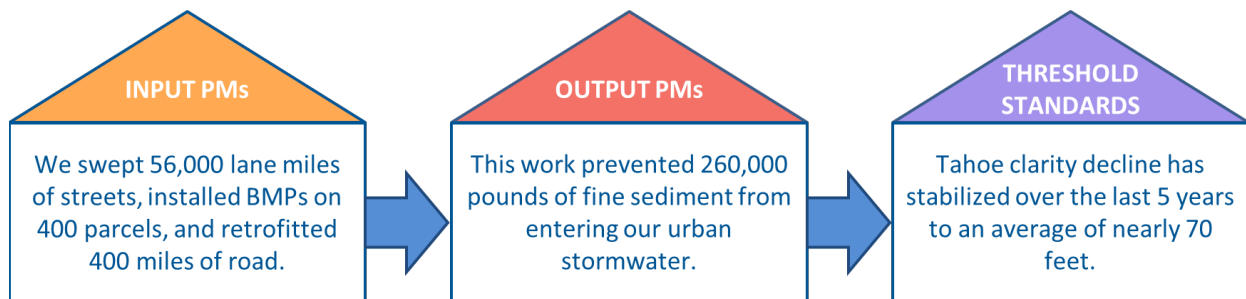

INPUT PMs

We swept 56,000 lane miles of streets, installed BMPs on 400 parcels, and retrofitted 400 miles of road.

OUTPUT PMs

This work prevented 260,000 pounds of fine sediment from entering our urban stormwater.

THRESHOLD STANDARDS

Tahoe clarity decline has stabilized over the last 5 years to an average of nearly 70 feet.

Figure 8. Example application of the dashboard results chain format to tell a story using Stormwater Program metrics.

Metrics to remove from the program in this example

Although Vertical Extinction Coefficient (VEC) measurement was included with the Pre-2019 results chain, this report proposes excluding this metrics from the Example Potential results chain to improve usefulness of the stormwater program (for water quality).

- Managers should track the desired outcome (Tahoe Clarity achieves 100ft) via Secchi depth measurements, not the VEC of the lake. Although VEC measurements beyond Secchi disk visibility provide useful research data on biological properties of the lake and have been adopted as a standard by Nevada, they do not provide information on the desired outcome valued most by policy makers, funders and the public. VEC measurements extend beyond Secchi Disc visibility, providing useful research data on biophysical properties of the lake, but not information on the desired outcome valued most by policy makers, funders, and the public.

Metrics to add to the program

This report proposes adding the following metrics to the Example Potential results chain to improve usefulness of the stormwater program (for water quality).

- Managers should begin tracking "Volume of Stormwater Reduced" as an output PM of the stormwater program. Reporting this metric will require minimal time and effort in addition to current practices because the PLRM already calculates this metric. Some strategies focus not on reducing specific pollutants, but on reducing runoff volume because it has the secondary benefit of reducing sediment and nutrient input to the Lake. Previously, there was no metric to track reductions in runoff volume. Adding this metric provides a clear metric for tracking volume reductions from management actions.

Recategorized metrics

When tracking and reporting the Stormwater Program, managers should be aware that many metrics are recategorized based on the Proposed terminology for Tahoe.

- Metrics recategorized from EIP PMs to input PMs include
    - Miles of Street Sweeping
    - Miles of Roads Decommissioned or Retrofitted
    - Parcels with Stormwater BMPs
- Metrics recategorized from EIP PMs to output PMs include
    - Fine Sediment Load Reduction Achieved
    - Volume of Stormwater Reduced
    - Nitrogen Load Reduction Achieved
   - Phosphorous Load Reduction Achieved

Road Strategy

As of 2019, there is no dedicated program or strategy for improving water quality through road maintenance. This report defines an Example Potential Roads Strategy that Tahoe Basin managers could use to link repaving roads to improving Lake Tahoe Clarity.

Example Potential Roads Strategy

This strategy focuses on repaving roads to improve Tahoe clarity. This strategy could be added to an existing EIP program or serve as the basis for a new program.
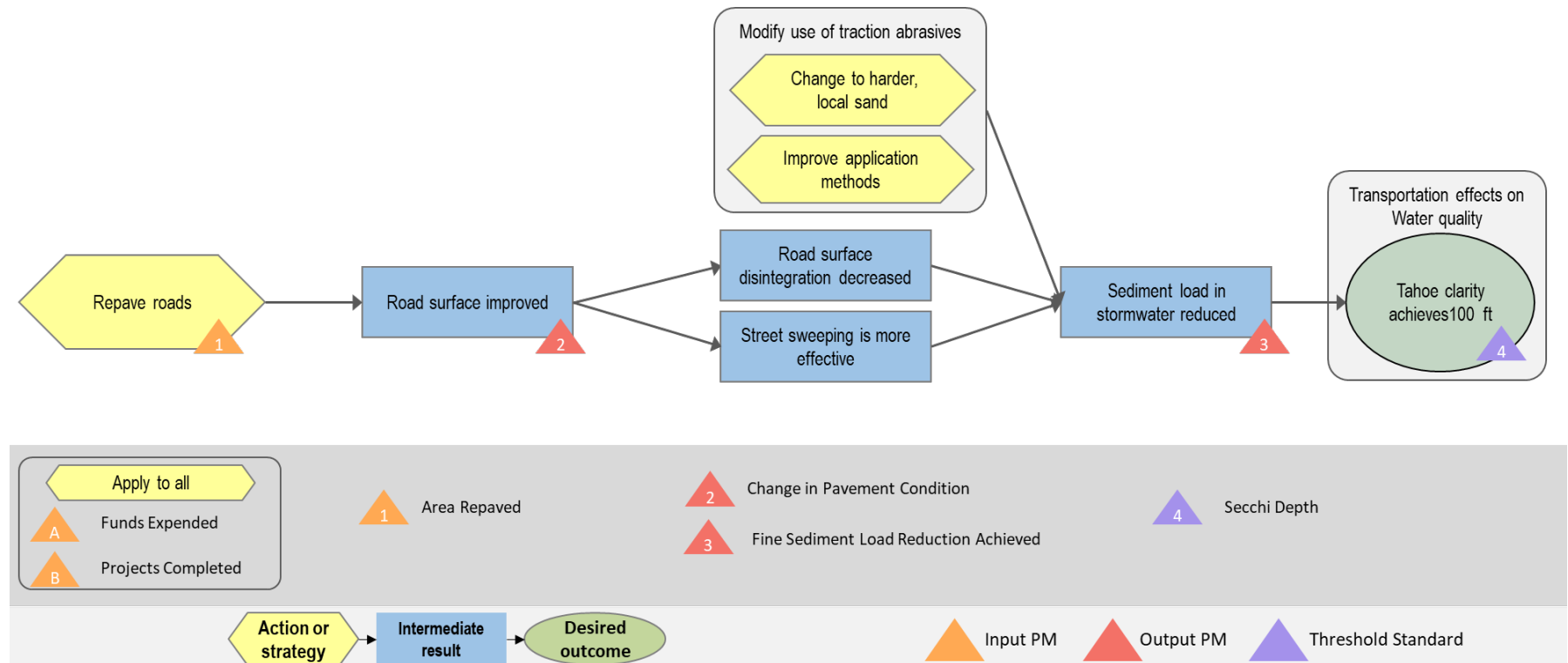
Desired Outcomes

The Roads strategy focuses on Tahoe clarity achieving 100ft, a threshold standard highly valued by the public because it is both easily observable and directly experienced by lake users.

- Tahoe clarity achieves 100ft: Tahoe clarity supports an aesthetic beneficial use that drives the ecology and economy of the region. Secchi depth measurements for Tahoe return to 1970 levels; roughly 100ft.

Actions or Strategies & Intermediate Results

Improving road conditions around Lake Tahoe leads to improved water clarity because road degradation is a significant source of fine sediment. The three strategies Tahoe Basin managers should implement to improve road conditions are

- Repave roads: When roadways are proactively managed with preventative maintenance, road rehabilitation, and road reconstruction activities less fine sediment is generated from degrading asphalt. Furthermore, fine sediment gets trapped in the cracks and potholes of a road in poor condition, making them more difficult to sweep effectively.
- Modify traction abrasives: When winter traction abrasives applied to the road are crushed by car tires, they are ground into fine sediment that enters Lake Tahoe. Managers can reduce fine sediment generated from road abrasives through several categories of action:
    - Changing road abrasives to harder, local sand: Switching road abrasives from volcanic cinders to Washoe sand reduces fine sediment generation.
    - Improving traction abrasive application methods: Relying on weather forecasts, installing sensors to measure road temperature, and treating roads with a de-icing brine solution that lowers the freezing point of the road, helps reduce the application of road abrasives.

Metrics

Input PMs track projects completed, and funds expended to repave roads.

1. **Roads Repaved** – The miles of permanent roads repaved within the Tahoe Basin.

Output PMs track changes in pavement condition and reductions in fine sediment load.

2. **Change in Pavement Condition** – The change in pavement condition of a given road surface using Pavement Condition Index (PCI), a numerical index between 0 and 100 [7]. PCI impacts the range of Road RAM scores achievable for a given road segment. Road RAM scores estimate the amount of fine sediment accumulation on a road and the resulting fine sediment concentrations in stormwater runoff from which loads are calculated. Higher PCI translates to higher average Road RAM scores and reduced fine sediment loads.
3. **Fine Sediment Load Reduction Achieved** - The estimated amount of fine sediment prevented from entering urban stormwater, based on the guidelines laid out in the LCCP Handbook.

Threshold standard metrics focus on secchi depth to understand long-term trends in pelagic clarity.

4. **Secchi Depth** - The annual average deep-water transparency as measured by a Secchi disk.

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[7] The PCI uses methods from ASTM D6433 - 11: Standard Practice for Roads and Parking Lots Pavement Condition Index Surveys. https://www.astm.org/Standards/D6433.htm.

Summary of proposed changes

This report proposes the use of a results chain dashboard to highlight key stories and trends of the Roads strategy for political and stakeholder audiences (Figure 9). The following example of a results chain dashboard uses metrics from each category to create an evidence-based story about management actions improving road conditions and ultimately improving Tahoe Clarity.
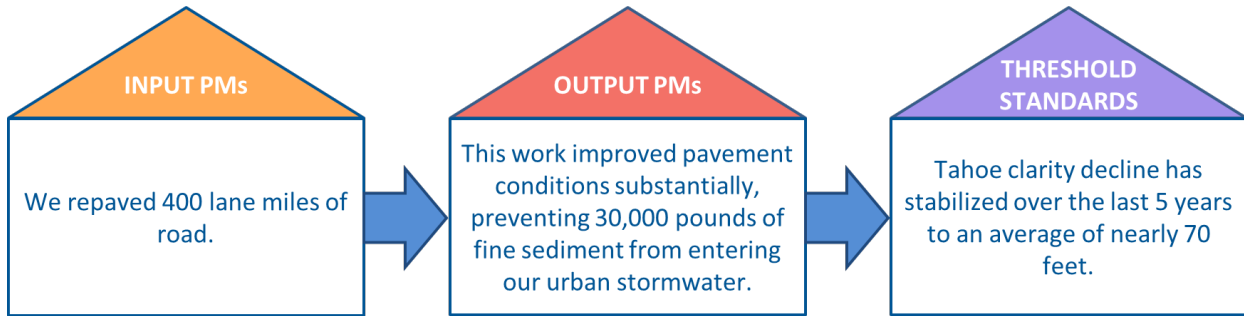
INPUT PMs

We repaved 400 lane miles of road.

OUTPUT PMs

This work improved pavement conditions substantially, preventing 30,000 pounds of fine sediment from entering our urban stormwater.

THRESHOLD STANDARDS

Tahoe clarity decline has stabilized over the last 5 years to an average of nearly 70 feet.

Figure 9. Example application of the dashboard results chain format to tell a story using Roads strategy metrics.

Watershed Program

The Pre-2019 Watershed Program aggregates existing information to document the current approach for tracking and reporting water quality benefits. The *Example Potential Watershed Program* documents proposed changes to the program.

Pre-2019 Watershed Program (Water Quality Focus)

Many metrics on the Pre-2019 results chain are redundant, not targeted to water quality, or in an inappropriate format (i.e. state standards and internal management metrics). Additionally, many metrics that are EIP PMs and threshold standards on the Pre-2019 results chain are recategorized on the Example Potential results chain based on the Example Potential terminology for Tahoe. For example, "Acres of SEZ Restored or Enhanced" would be categorized as an input PM instead of an EIP PM.
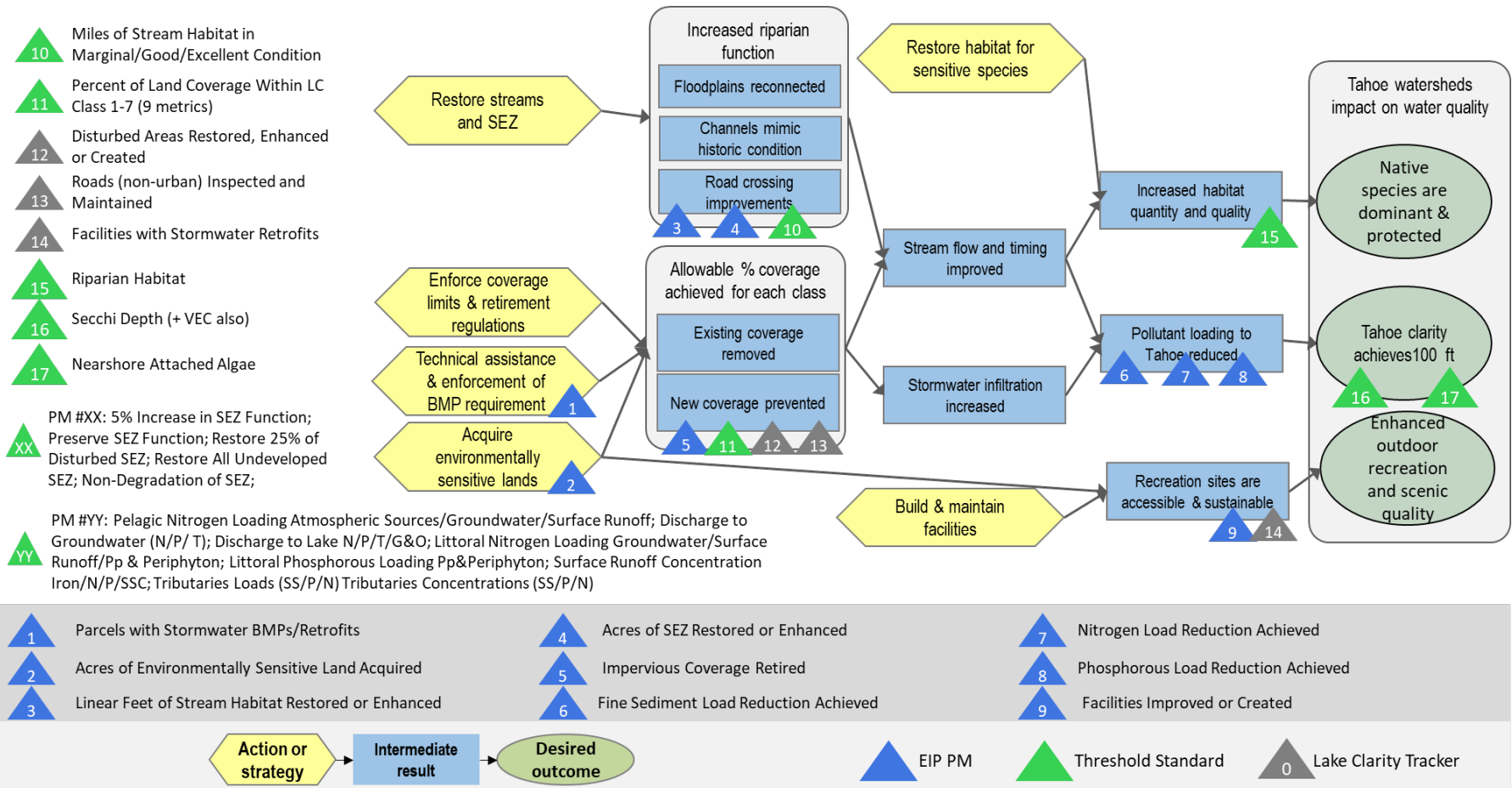
Example Potential Watershed Program

This program focuses on restoring priority watersheds to improve natural wildlife habitat and to improve Tahoe clarity and nearshore conditions. It excludes strategies, desired outcomes, and metrics related to other potential benefits like controlling invasive species.
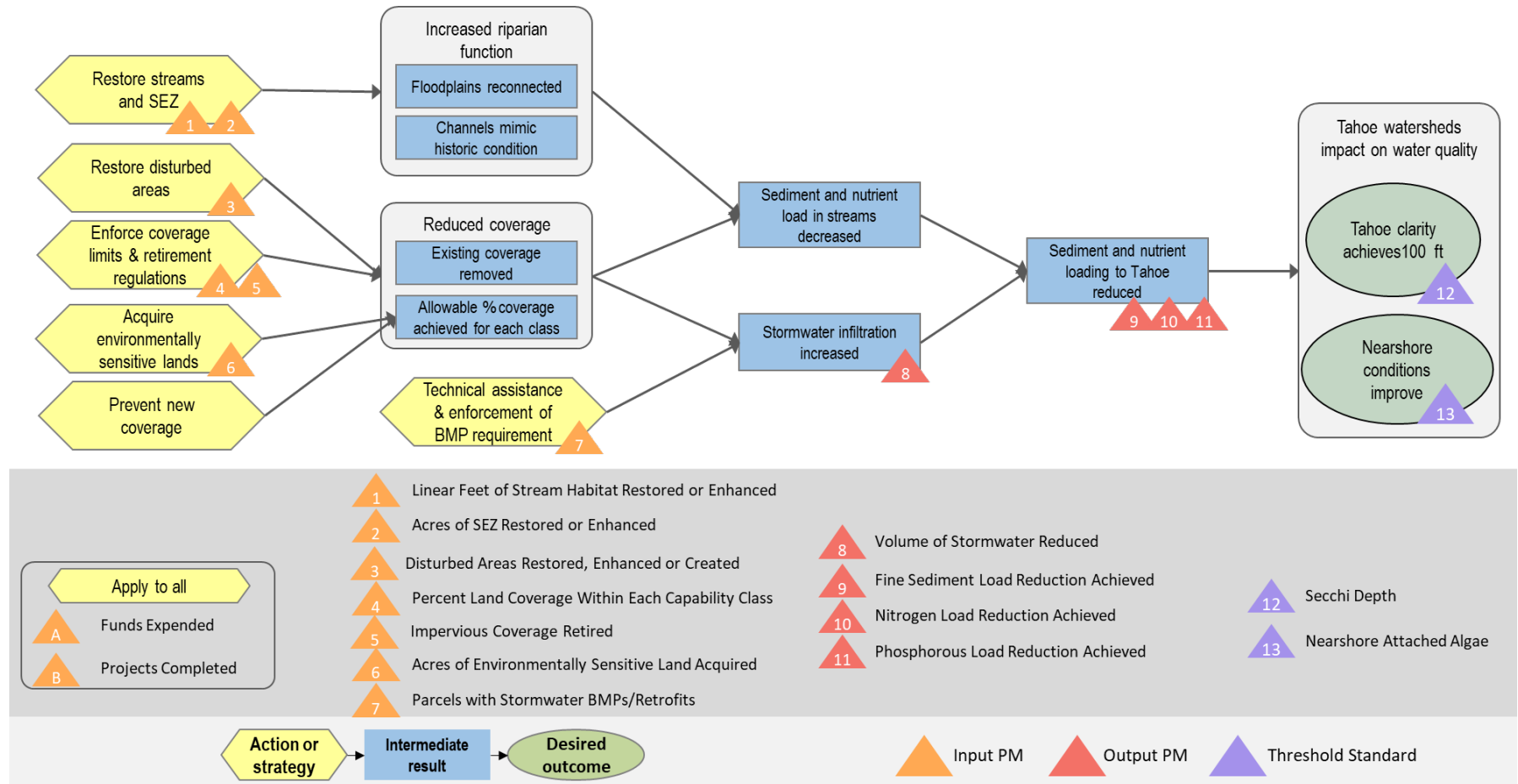
Desired Outcomes

The Watershed Program focuses on attaining two desired outcomes that are highly valued by lake users: Tahoe clarity achieving 100ft and nearshore conditions improving. Both desired outcomes are easily observable and directly experienced by lake users.

- Tahoe clarity achieves 100ft: Tahoe clarity supports an aesthetic beneficial use that drives the ecology and economy of the region. Secchi depth measurements for Tahoe return to 1970 levels; roughly 100ft.
- Nearshore conditions improve: The presence of algae and the clarity of shallow waters no longer detract from nearshore recreation or scenic value. Algae (periphyton biomass) attached to rocks, boats, buoys, piers in the nearshore (littoral) zone is reduced compared to 1967-1971 levels.

Actions or Strategies & Intermediate Results

Managing impervious coverage and improving ecological functions that retain sediment can prevent fine sediment from entering Lake Tahoe and increase water clarity. The strategies proposed to manage coverage and improve ecological function are

- Restore streams and Stream Environment Zone (SEZ): When SEZs function naturally they provide a variety of highly valued services, including water quality maintenance through nutrient cycling and sediment retention.[8] Restoring natural SEZ function, including removing fill, restoring natural, historical stream channels, stabilizing and revegetating stream channels, and reconnecting floodplains can reduce fine sediment and nutrient loading in streams that drain to Lake Tahoe.
- Restore disturbed areas: Restoring disturbed areas, including compacted soil, disturbed vegetation and/or impacted hydrology can reduce fine sediment and nutrient loading in streams that drain to Lake Tahoe.
- Increase landscape permeability: Increasing the permeability of land surrounding Lake Tahoe increases infiltration and reduces runoff that carries pollutants to the lake. Several categories of action can increase stormwater infiltration:
    - Enforce coverage limits and retirement regulations: When coverage limits and retirement policies within TRPA's coverage transfer and excess coverage mitigation programs are met, onsite infiltration increases and runoff to Lake Tahoe decreases.[9]
    - Acquire environmentally sensitive lands: Public acquisition, preservation and restoration of sensitive lands protects watersheds by mitigating development in the Tahoe Basin.[10]
    - Prevent new coverage: Limiting coverage and maintaining open space (by requiring a valid permit pursuant to TRPA Ordinance No. 4, or other TRPA approval) in a watershed is a recognized method for improving water quality since it maximizes the amount of land that can receive and infiltrate water and allows plants to filter nutrients and minimize runoff.[11]
- Technical assistance and enforcement of BMP requirements: Providing technical assistance to property owners and taking enforcement action (in coordination with local jurisdictions), as necessary, accelerates BMP implementation that increases stormwater infiltration on private property.[12]

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[8] http://www.trpa.org/stream-environment-zone/

[9] http://www.trpa.org/wp-content/uploads/TRPA-Land-Coverage-101_Final.pdf

[10] https://laketahoeinfo.org/Indicator/Detail/10/Overview

[11] http://www.trpa.org/wp-content/uploads/TRPA-Land-Coverage-101_Final.pdf

[12] http://www.trpa.org/wp-content/uploads/FINAL-TRPA-BMP-Action-Plan_02-25-2015-4.pdf

Metrics

Input PMs track public land improvement through restoration, enhancement, and acquisition as well as private land improvement through retirement and BMP installation.

1. **Linear Feet of Stream Habitat Restored or Enhanced** - The length of stream channel that is restored or enhanced to gain water quality functions and support species.
2. **Acres of SEZ Restored or Enhanced** - Acres of SEZ that are restored or enhanced in order to gain water quality function and values.
3. **Disturbed Areas Restored, Enhanced or Created** - The total acres of land in the forested uplands with compacted soil, disturbed vegetation and/or impacted hydrology that is restored, enhanced or created each year.
4. **Percent Land Coverage Within Each Capability Class** – The percent of land coverage within each defined capability class.
5. **Impervious Coverage Retired** - Square feet of existing and potential impervious coverage restored to a naturally functioning state and permanently retired.
6. **Acres of Environmentally Sensitive Land Acquired** - The acres of environmentally sensitive land acquired by public agencies for protection or restoration.
7. **Parcels with Stormwater BMPs/Retrofits** - The number of developed parcels in the Tahoe Region with best management practices (BMPs) installed each year that emphasize removal of fine sediment particles and nutrients. To qualify, all parcels and facilities must have appropriate operations and maintenance plans.

Output PMs track reductions in key pollutants prevented from entering Lake Tahoe.

8. **Volume of Stormwater Reduced** – The estimated volume of urban stormwater reduced through BMP implementation based on PLRM model output.
9. **Fine Sediment Load Reduction Achieved** - The estimated amount of fine sediment prevented from entering urban stormwater, based on the guidelines laid out in the LCCP Handbook.
10. **Nitrogen Load Reduction Achieved** - The estimated amount of nitrogen prevented from entering urban stormwater, based on the guidelines laid out in the LCCP Handbook.
11. **Phosphorous Load Reduction Achieved** - The estimated amount of phosphorus prevented from entering urban stormwater, based on the guidelines laid out in the LCCP Handbook.

Threshold standard metrics track long-term indicators of Lake Tahoe clarity in the pelagic lake and at the nearshore.

12. **Secchi Depth** - The annual average deep-water transparency as measured by Secchi disk.
13. **Nearshore Attached Algae** – The biomass of periphyton attached to submerged surfaces (e.g. rocks, boats, buoys, piers) in the nearshore (littoral) zone at routine monitoring sites and spring synoptic sites.

Summary of proposed changes

This report proposes the use of a results chain dashboard to highlight key stories and trends of the Watershed program for political and stakeholder audiences (Figure 10). The following example of a results chain dashboard uses metrics from each category to create an evidence-based story about restoration actions reducing fine sediment in stormwater and ultimately improving Tahoe Clarity.
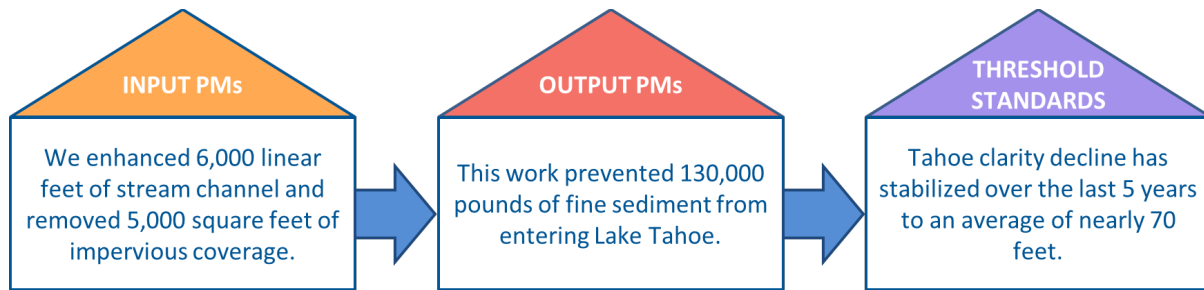
Figure 10. Example application of the dashboard results chain format to tell a story using Watershed program metrics.

Metrics to remove from the program

Although the following metrics were included with the Pre-2019 results chain, this report proposes excluding these metrics from the Example Potential results chain to improve usefulness of the Watershed Program (for water quality).

▪ Managers should track the desired outcome (Tahoe Clarity achieves 100ft) via Secchi depth measurements, not the VEC of the lake. Although VEC measurements beyond Secchi disk visibility provide useful research data on biological properties of the lake and have been adopted as a standard by Nevada, they do not provide information on the desired outcome valued most by policy makers, funders and the public. VEC measurements extend beyond Secchi Disc visibility, providing useful research data on biophysical properties of the lake, but not information on the desired outcome valued most by policy makers, funders, and the public. The following metrics are threshold standards in the fisheries category. Additionally, these metrics overlap with the metric "Linear Feet of Stream Habitat Restored or Enhanced" on the Example Potential results chain. The metric "Linear Feet of Stream Habitat Restored or Enhanced" is more relevant to the Watershed Program strategies than the metrics below because it is focused on improving habitat instead of maintaining habitat. To avoid overlap, the Example Potential results chain should only include the metric "Linear Feet of Stream Habitat Restored or Enhanced", rather than the metrics below.
  ▫ Miles of Stream Habitat in Marginal Condition
  ▫ Miles of Stream Habitat in Good Conditions
  ▫ Miles of Stream Habitat in Excellent Condition
▪ The metric "Roads (non-urban) Inspected and Maintained" is not attributed to specific intermediate results on the Pre-2019 results chain. Further, because this metric is about road maintenance it does not align with the focus of the Example Potential results chain. The Example Potential results chain is focused on restoring natural areas like stream habitat and SEZ. Restoration or mitigation of man-made features is covered through metrics 3-7 ("Disturbed Areas Restored", "Enhanced or Created", "Percent Land Coverage Within Each Capability Class", "Impervious Coverage Retired", "Acres of Environmentally Sensitive Land Acquired", and "Parcels with Stormwater BMPs/Retrofits") on the results chain. Including the metric "Roads (non-urban) Inspected and Maintained" in addition to metrics 3-7 would cause overlap that could lead to confusion and unnecessarily increase reporting costs.
▪ The following metrics are not attributed to specific intermediate results on the Pre-2019 results chain. Further, these metrics overlap with other input PMs tracking restoration and enhancement like the metric "Acres of SEZ Restored or Enhanced" on the Example Potential results chain. Overlapping metrics can cause confusion and increase reporting costs. The Example Potential results chain uses the

input PM "Acres of SEZ Restored or Enhanced" because it is more clearly written and better align with existing assessment methodologies[13] than the following metrics.

- 5% Increase in SEZ Function
- Restore 25% of Disturbed SEZ
- Restore All Undeveloped SEZ

▪ The following metrics are written as standards, not metrics. These metrics are threshold standards stating the need to preserve SEZ, not measures of action taken or products/services resulting from actions. For example, the definition of "Non-Degradation of SEZ" is "a non-degradation standard to preserve plant communities shall apply to trees.…to increase the acreage of such riparian associations…" These metrics are not measurable, attributable, or time bound.

- Preserve SEZ Function
- Non-Degradation of SEZ

▪ The following metrics are written as standards, not metrics. These metrics describe concentrations or loads to achieve, not measures of action taken or products/services resulting from actions. For example, the definition of "Iron Concentration (Surface Runoff)" is "achieve a 90-percentile concentration value for dissolved inorganic nitrogen of 0.5 mg/1…" Similarly, the definition of "Littoral Iron Loading - Pp & Periphyton" is "Reduce the loading… from all sources to meet the 1967-71 mean values…" Both these examples are written as standards to meet, not metrics that indicate performance.

- Pelagic metrics
  - Pelagic Nitrogen Loading
  - Pelagic Nitrogen Loading Atmospheric Sources
  - Pelagic Nitrogen Loading Groundwater
  - Pelagic Nitrogen Loading Surface Runoff
- Discharge to Groundwater metrics
  - Discharge to Groundwater Nitrogen
  - Discharge to Groundwater Phosphorous
  - Discharge to Groundwater Turbidity
- Discharge to Lake metrics
  - Discharge to Lake Nitrogen
  - Discharge to Lake Phosphorous
  - Discharge to Lake Turbidity
  - Discharge to Lake Grease and Oil
- Littoral metrics
  - Littoral Nitrogen Loading Groundwater
  - Littoral Nitrogen Loading Surface Runoff
  - Littoral Nitrogen Loading Pp & Periphyton
  - Littoral Phosphorous Loading Pp& Periphyton
- Surface water metrics
  - Iron Concentration (Surface Runoff)
  - Nitrogen Concentration (Surface Runoff)
  - Phosphorous Concentration (Surface Runoff)

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[13] Tahoe Regional Planning Agency's internal Threshold Assessment Methodology supports the agency's strategic initiative to review and update the threshold standards by providing a comprehensive picture of the strengths and weakness of the current system. The assessment is designed to catalog the attributes of the current system and support setting the strategic direction for the initiative. Threshold Assessment methods are applied to this report, as appropriate.

- ▪ Suspended Sediment (Surface Runoff)
- ▪ Metrics for tracking pollutants in the tributaries draining to Lake Tahoe were not attributed to specific intermediate results on the Pre-2019 results chain. Further, these metrics overlap with output PMs 8-10 ("Fine Sediment Load Reduction Achieved", "Nitrogen Load Reduction Achieved", and "Phosphorous Load Reduction Achieved") on the Example Potential results chain. Overlapping metrics can cause confusion and increase reporting costs. Therefore, the Example Potential results chain uses output PMs 8-10 instead of the metrics below because tributary measurements are too specific for this program.
  - ▫ Nitrogen Load (Tributaries)
  - ▫ Phosphorous Load (Tributaries)
  - ▫ Suspended Sediment Load (Tributaries)
  - ▫ Nitrogen Concentration (Tributaries)
  - ▫ Phosphorous Concentration (Tributaries)
  - ▫ Suspended Sediment (Tributaries)

Recategorized metrics

When tracking and reporting the Watershed Program, managers should be aware that many metrics that are recategorized based on the Example Potential terminology for Tahoe.

- ▪ Metrics recategorized from EIP PMs to input PMs include
  - ▫ Parcels with Stormwater BMPs
  - ▫ Acres of Environmentally Sensitive Land Acquired
  - ▫ Linear Feet of Stream Habitat Restored or Enhanced
  - ▫ Acres of SEZ Restored or Enhanced
  - ▫ Impervious Coverage Retired
- ▪ Metrics recategorized from EIP PMs to output PMs include
  - ▫ Fine Sediment Load Reduction Achieved
  - ▫ Nitrogen Load Reduction Achieved
  - ▫ Phosphorous Load Reduction Achieved

Improvements to Metric Descriptions on LT Info

General findings, relevant to all programs, provide Tahoe Basin managers information on data gaps in the existing set of metrics.

Some metrics on LT Info are difficult to understand because their definition is limited and spread across multiple web pages. Someone who is unfamiliar with the metric will need to review multiple pages to understand what the metric is tracking, how it is tracked, and why it is important (Figure 12). Instead of documenting all relevant information on one-page, different types of information are captured on the Overview and Threshold Dashboard pages. Further, it is difficult to interpret the information on the Overview page without first reading the Threshold page. To make this metric easier and quicker for the reader to understand, include all relevant information on one page, or provide a thorough definition link on the Overview page so the reader can understand the purpose and use of the metric without first referencing a different page.

Figure 11. The description of the metric "Critical Wildlife Habitat Areas" is spread across two web pages, the Overview page (shown on the left) and the Threshold Dashboard page (shown on the right). Further, the definition of the metric on the Overview page is difficult to understand without first reviewing the Threshold page.

Many of the Sustainability Dashboard metrics on LT Info are difficult to understand because they are missing definitions (Figure 13). Someone who is unfamiliar with the metric will have difficulty understanding what the metric is tracking, how it is tracked, and why it is important without a clear definition. To make this metric easier for the reader to understand, provide a definition on the Overview page.

Figure 12. The metrics Health Issues of Concern and Natural Gas Consumption are just two examples of Sustainability Dashboard metrics with no definition.

Some metrics on LT Info do not show any data (Status or Accomplishments) (Figure 14). It is difficult for a user to determine whether metrics reporting little to no data (no status, trends, or accomplishment information) are still worth the time and effort to track because it is unclear whether this information is collected but not reported online, or not tracked at all. Managers should reevaluate the importance of tracking metrics with no data to date. Further, the usefulness of metrics reporting "insufficient data to determine status" over long periods of time should be reevaluated.
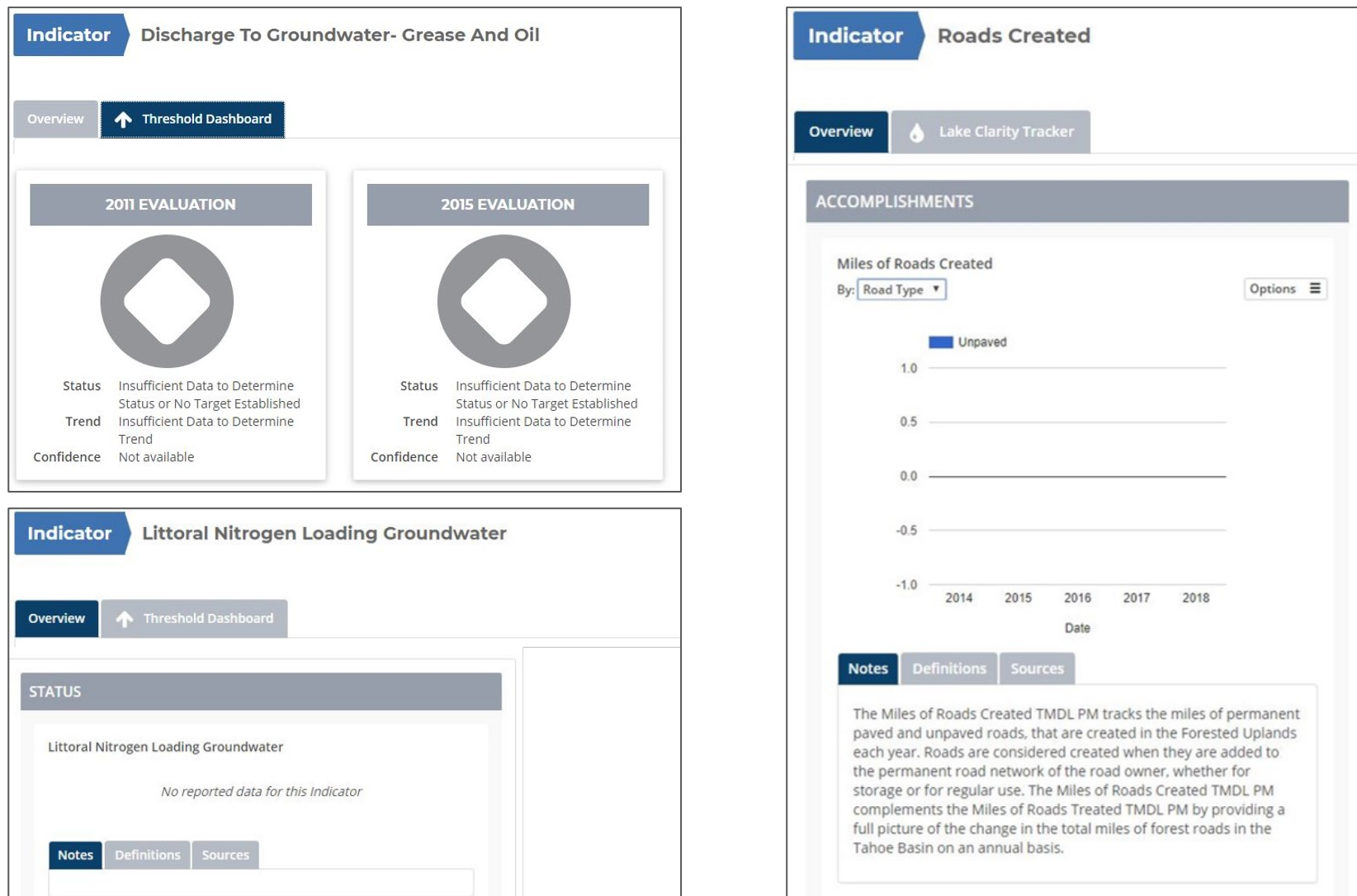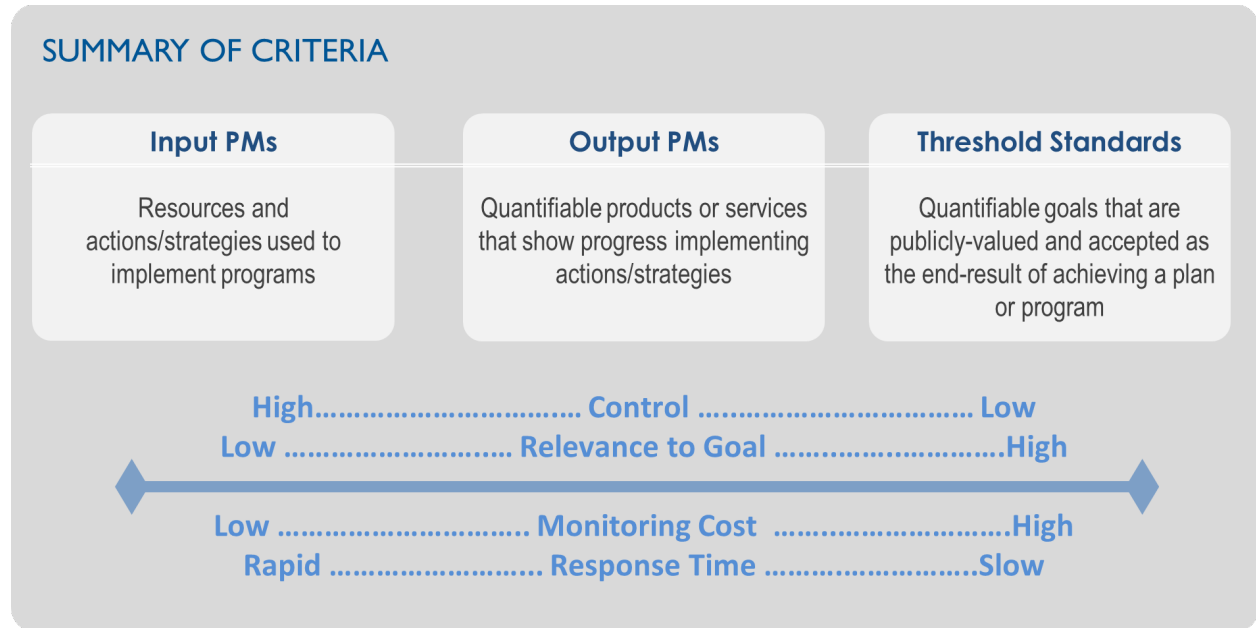

Figure 13. Discharge to Groundwater, Roads Created, and Littoral Nitrogen Loading Groundwater are all examples of metrics that include insufficient data to determine status (top left), no data in the Accomplishments section (top right), or no status (bottom).

APPENDIX A – METRIC CATEGORIZATION CRITERIA

This report used the following criteria to categorize metrics as input PMs, output PMs, or threshold standards. Each metric received a 1 through 5 rating for each of the three categories based on Proposed terminology. For example, a metric may have received a 1 rating as an input PM, a 1 as an output, and a 5 as a threshold standard based on the definitions below.

SUMMARY OF CRITERIA

Input PMs	Output PMs	Threshold Standards
Resources and actions/strategies used to implement programs	Quantifiable products or services that show progress implementing actions/strategies	Quantifiable goals that are publicly-valued and accepted as the end-result of achieving a plan or program

High…………………………… Control ……………………………… Low
Low ………………………… Relevance to Goal …………………………High

Low ………………………….. Monitoring Cost ………………………….High
Rapid ……………………….. Response Time ………………………..Slow

Input PMs

The resources and actions/strategies used to implement programs

Typical (not required) attributes: High control, low relevance to goal (threshold standard), low monitoring cost, rapid response time

Example metrics: Funds Expended, Full-time Equivalent (FTE) Staff, Acres ff Restoration, and Miles of Street Sweeping

5 This metric tracks dollars, projects completed, FTE staff time, or a quantifiable action or strategy like acres of restoration. There is a quantitative target.

3 The metric is part of normal project/program management or project design and is typically estimated before projects are implemented and can be reported for less than $1000 within 3 months of project construction completion. There is debate or lack of clarity about the metric definition. (Does not fit criteria for "0," below.)

0 This metric is a benefit of project completion* **OR** there is no information available beyond metric title.

This metric is NOT an environmental or social conditions status, environmental monitoring result, or a quality objective (i.e. reduce nitrogen concentration to 0.5 micrograms)

Output PMs

Quantifiable products or services that show progress made implementing actions/strategies

Typical (not required) attributes: Moderate control, relevance to goal (threshold standard), monitoring cost, and response time

Example metrics: Fine Sediment Load Reduction Achieved, Lake Clarity Credits, Pavement Condition Index

5 A numeric result of project implementation that can be summed across many types of projects that aim to achieve the same broad goal. There is a numeric target for this metric that signals successful completion of a strategy, but managers may compromise on the importance of achieving this target. This metric can be reported within 1 month of activity completion.

3 A numeric value that directly results from projects and can be reported within 2 months of activity completion and there is debate or lack of clarity about the metric definition.

0 This metric is not a benefit of project completion* **OR** there is no information available beyond metric title.

This metric IS an environmental or social conditions status, environmental monitoring result, a quality objective (i.e. reduce nitrogen concentration to 0.5 micrograms), $, project numbers complete, or staff time

Threshold Standards

Quantifiable goals that are publicly-valued and are accepted as the end-result of achieving a plan or program.

Typical (not required) attributes: Low control, high relevance to goal, higher monitoring cost, and longer response time than output pms

Example metrics: Receiving Water Pollutant Concentration, Recreation Trips and Quality, Riparian Area Functioning with Pre-development Hydrology

5 Managers are unwilling to compromise and accept partial attainment of the metric's target. Further, when the public and program mangers see that this metric's target is achieved, they feel comfortable that the purpose of the program has been met and resources should be focused elsewhere. {*This rating should not be used to define the successful completion of an action or strategy – rather to understand if the action or strategy achieved the environmental or societal results desired from the plan or program.*}

3 This metric is used to report the status and trends of the environment or society. It may require a stand-alone monitoring program that costs more than $5000/year. It may take years for human activities to affect the metric, however it is generally understood that humans can affect the metric's value. External drivers like climate variability or economic conditions may make it challenging to attribute status of this metric to results of the plan or program.

0 This metric may have received score of 3 or higher as an input pm or output pm **OR** there is no information available beyond metric title.

APPENDIX B – METRIC CATEGORIZATION RESULTS FOR EIP METRICS

This spreadsheet shows the metric categorization rating results for each EIP metric. As described in Appendix A, each EIP metric received a 1-5 rating for each of the three metric categories.

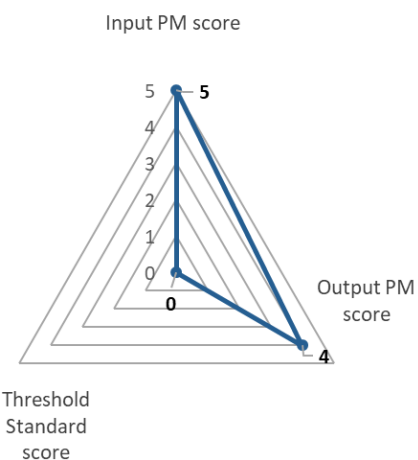|	NEW - Input PM		NEW - Output PM		NEW - Threshold Standard	
	Score1	Rationale1	Score2	Rationale2	Score3	Rationale3
Fine Sediment Load Reduction Achieved	0	Metric is a benefit of project completion	5	metric can be summed across projects and has a numeric target	0	scored a 3 or higher as an input
Nitrogen Load Reduction Achieved	0	Metric is a benefit of project completion	5	metric can be summed across projects and has a numeric target	0	scored a 3 or higher as an input
Phosphorous Load Reduction Achieved	0	Metric is a benefit of project completion	5	metric can be summed across projects and has a numeric target	0	scored a 3 or higher as an input
Parcels with Stormwater BMPs	5	tracks quantifiable action or strategy	0	not a benefit of project completion	0	scored a 3 or higher as an input
Miles of Roads Decommissioned or Retrofitted	4	tracks quantifiable action or strategy, but no numeric target	0	not a benefit of project completion	0	scored a 3 or higher as an input
Miles of Street Sweeping	4	tracks quantifiable action or strategy, but no numeric target	0	not a benefit of project completion	0	scored a 3 or higher as an input
Linear Feet of Stream Channel Restored or Enhanced	5	tracks quantifiable action or strategy	0	not a benefit of project completion	0	scored a 3 or higher as an input
Impervious Coverage Retired	4	tracks quantifiable action or strategy, but no numeric target	0	not a benefit of project completion	0	scored a 3 or higher as an input
Acres of SEZ Restored or Enhanced	5	tracks quantifiable action or strategy	0	not a benefit of project completion	0	scored a 3 or higher as an input
Acres of Environmentally Sensitive Land Acquired	4	tracks quantifiable action or strategy, but no numeric target	0	not a benefit of project completion	0	scored a 3 or higher as an input
Facilities Improved or Created	3	tracks quantifiable action or strategy, but there is debate over metric definition	0	not a benefit of project completion	0	scored a 3 or higher as an input
People Served	4	tracks quantifiable action or strategy, but no numeric target	0	not a benefit of project completion	1	this metric reports societal trends, external drivers like climate have little influence over this
Funds Expended	5	Tracks $	0	not a benefit of project completion	0	Metric is clearly an input, scored 5 on input
Number of Projects Completed	5	Tracks projects completed	0	not a benefit of project completion	0	Metric is clearly an input, scored 5 on input
Acres of Habitat Protected	5	tracks quantifiable action or strategy	0	not a benefit of project completion	0	scored a 3 or higher as an input
Acres of Habitat Restored or Enhanced	5	tracks quantifiable action or strategy	0	not a benefit of project completion	0	scored a 3 or higher as an input
Fish Planted	5	tracks quantifiable action or strategy	0	not a benefit of project completion	0	
Parcels Inspected for Defensible Space	5	tracks quantifiable action or strategy	0	not a benefit of project completion	0	
Special Status Species Sites Protected or Re-Established	5	tracks quantifiable action or strategy	0	not a benefit of project completion	0	
Watercraft Inspections for Invasive Species	5	tracks quantifiable action or strategy	0	not a benefit of project completion	0	
Acres Treated for Invasive Species	5	tracks quantifiable action or strategy	0	not a benefit of project completion	0	
New Invasive Species Locations Detected	0		0		3	metric is used to report status and trends and is an important program goal
Acres of Invasive Species Inventoried	5	tracks quantifiable action or strategy	0	not a benefit of project completion	0	
Acres of Forest Fuels Reduction Treatment	5	tracks quantifiable action or strategy	0	not a benefit of project completion	0	
Tons of Biomass Utilized	5	tracks quantifiable action or strategy	0	not a benefit of project completion	0	
Non-Compliant Wood Stoves Removed or Retrofitted	5	tracks quantifiable action or strategy	0	not a benefit of project completion	0	
Miles of Pedestrian and Bicycle Routes Improved or Constructed	5	tracks quantifiable action or strategy	0	not a benefit of project completion	0	
Pounds of Air Pollutants Removed or Avoided by Project	5	tracks quantifiable action or strategy	0	not a benefit of project completion	0	
Tons of Greenhouse Gases Reduced	5	tracks quantifiable action or strategy	0	not a benefit of project completion	0	
Miles of Trails Developed or Improved	5	tracks quantifiable action or strategy	0	not a benefit of project completion	0	
Length of Public Shoreline Added	5	tracks quantifiable action or strategy	0	not a benefit of project completion	0	
Educational and Interpretive Programs Produced	5	Tracks number of programs implemented	4	Value that directly results from projects, no numeric target	0	
Miles of Utility Lines Buried Underground	5	tracks quantifiable action or strategy	0	not a benefit of project completion	0	
Projects Meeting Scenic Quality Standards	5	tracks quantifiable action or strategy	0	not a benefit of project completion	0	
Watercraft Clean Launches	0	Benefit of project completion	3	A value that directly results from projects, but there is lack of clarity about the definition	2	scored a 3 or higher as an output and it doesn't take years for human activity to affect this metric, but it is important for environmental trends

APPENDIX C – ATTRIBUTE SHARING

As shown in Appendix B, some existing EIP PMs have attributes of multiple metric categories (input PM, output PM, and threshold standard). When a metric scores highly in two or more categories managers should examine its detailed description and measurement protocol to understand whether it needs refinement, or whether it actually provides value in multiple categories. If the metric does warrant high scores in multiple categories it is up to the manager to decide how to use the metric in practice. For example, of the 35 EIP PMs, only three received a score higher than 0 in multiple categories (Appendix B). "People Served" received an input PM score of 4, an output PM score of 0, and a threshold standard score of 1. Therefore, this metric is primarily an input PM, but has characteristics of a threshold standard. "Educational and Interpretive Programs Produced" received an input PM score of 5, an output PM score of 4, and a threshold standard score of 0. Therefore, this metric shares characteristics of both input PMs, and output PMs. "Watercraft Clean Launches" received an input PM score of 0, an output PM score of 3, and a threshold standard score of 2. Therefore, this metric can be used as both an output PM and a threshold standard and it is up to managers to determine which use is currently most appropriate.

People Served
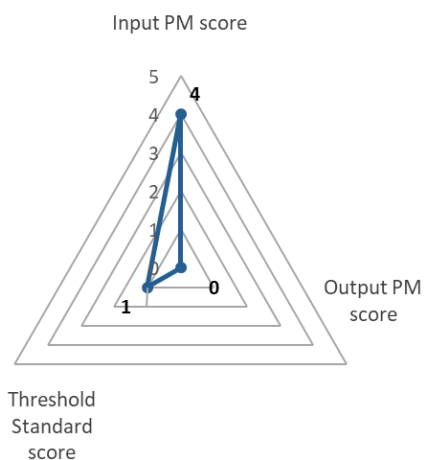
Educational and Interpretive Programs Produced

Watercraft Clean Launches