

Resilience & Adaptation Strategies

Tijuana River National Estuarine Research Reserve



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Purpose of Document

This document outlines specific actions that the Tijuana River National Estuarine Research Reserve (TRNERR) is considering for implementation to ensure that the Tijuana River Valley is resilient to future climatic and environmental changes.

The following is recommended for integration into the **2017 Comprehensive Management Plan (CMP) update**:

- A new Reserve-wide goal that specifically addresses climate change adaptation.
- Long-term adaptation and resilience outcomes for the Reserve.
- Climate adaptation and resilience objectives and strategies for the Reserve as a whole, and the specific departmental focus areas:
 - Cultural & Historical Resources
 - Education & Community Outreach
 - Research
 - Stewardship
 - Resource Protection, Management, and Restoration
 - Public Access & Recreation
 - Training

In addition to what will be integrated into the CMP, each department has outlined a proposed **Implementation Plan**, which includes:

- Timeline;
- Performance metrics; and
- Identification of opportunities for interdepartmental collaboration.

The adaptation strategies are a result of the Climate Understanding & Resilience in the River Valley (CURRV) project that developed four future planning scenarios that outline local vulnerabilities to a changing climate in the context of on-the-ground science, monitoring, and expertise. The scenarios were used to inform the development of the Reserve's adaptation strategies. **For more information visit:** <http://www.trnerr.com/currv/>

Climate Change Adaptation Goal

The resilience & adaptation strategies outlined in this document, support and align with the Reserve's Vision, Mission, & Goals as outlined in the current Comprehensive Management Plan (2010):

Vision: The Reserve and its partner organizations will inspire among diverse audiences more effective estuarine and marine management, compatible use, and proper resource protection using innovative and coordinated research, education and conservation approaches, throughout the biogeographic region between Point Conception and San Quintín.

Mission: To preserve, protect, and manage the natural and cultural resources within the Research Reserve, enhance scientific understanding and education, ensuring compatible recreation and resource use for the benefit of present and future generations. This will be accomplished through partnerships with the community, educational institutions, and government entities working in the estuary, its binational watershed, and biogeographic region.

Goals

1. To protect, restore and enhance the viability of key coastal habitats and species and preserve the region's cultural heritage while encouraging compatible public use, education and research.
2. To fully integrate the Reserve's research, stewardship and education programs and provide a model of excellence in all three areas.
3. To engage coastal decision-makers and the general public in the Reserve's stewardship mission by promoting awareness, a sense of pride in the resource and an enhanced capacity to improve Tijuana River coastal and watershed ecosystems in general.
4. To assume regional leadership role for science-based natural resource enhancement and urban ecosystem management.

In order to advance the Reserve's coordinated climate change and resilience programming, it is recommended that a new goal directly addressing climate change is added into the 2017 update of the CMP:

To develop and implement innovative climate change programming that advances the ability of habitats, wildlife, and communities to successfully adapt to and prepare for future environmental and climatic change.

The addition will allow the Reserve to advance innovative and cutting-edge climate change education, research, stewardship, and training strategies.

Long-Term Adaptation & Resilience Outcomes

The Reserve will work towards multiple long-term outcomes through the implementation of the resilience and adaptation strategies outlined in this document.

Comprehensive

- Habitats and wildlife in the river valley are resilient to changes in our environment and climate, and are able to naturally maintain ecosystem health and function in a dynamic socio-ecological context.
- The Southern California- Baja region is a leader in implementing innovative climate adaptation strategies that consider the social and ecological context of local communities.

Cultural & Historical Resources

- The Reserve is a leader in implementing innovative adaptation strategies that document, preserve, and protect the river valley's cultural and historical resources.
- The River Valley's Holocene environmental setting is documented, outlining the cultural resources from the Pleistocene-Holocene interface to present. Specifically focusing on environmental change and Native American adaptation to environmental change to determine if there are historical lessons learned that can help inform modern day adaptation.
- The Reserve provides a platform to collaborate with local universities to advance interdisciplinary research into environmental change, and human occupation and adaptation during the Holocene.

Education & Community Outreach

- An engaged, inspired, and passionate constituency supports estuary protection and enhancement in the face of a changing climate.
- Local youth and the broader community have advanced climate literacy, and value restored coastal wetlands as nature-based climate adaptation strategies.
- The community is directly linked to on-the-ground, place-based research and restoration efforts that advance local understanding of climate change science and impacts.

Research

- Widespread scientific understanding of how to effectively manage and restore Reserve habitats and coastal ecosystems in the Southern California Bight within the context of future climatic and environmental changes.
- The Reserve is a hub where cutting-edge climate change research and monitoring is conducted, and directly linked to on-the-ground management.

Stewardship: Resource Protection, Management, and Restoration

- The Reserve is a regional leader in preserving, protecting, and restoring habitats that enhance the resources available for wildlife in the context of long-term future climate and environmental changes.
- The Reserve is able to rapidly respond to unexpected, fast-moving changes in our climate and environment, mitigating impacts before habitats and wildlife are drastically impacted.

Stewardship: Public Access & Recreation

- There is consistent, safe access to the Reserve through a connected trails and road system that supports multiple visitor uses, while simultaneously allowing existing habitats and wildlife the ability to adapt to future environmental and climate changes.

Training

- Coastal decision-makers have increased capacity to design, implement, and measure climate adaptation strategies.
- TRNERR's Coastal Training Program is considered a premier training and technical assistance provider in the areas of climate change adaptation and resilience.
- Training and technical assistance offerings support climate adaptation at the Reserve and within the bioregion.

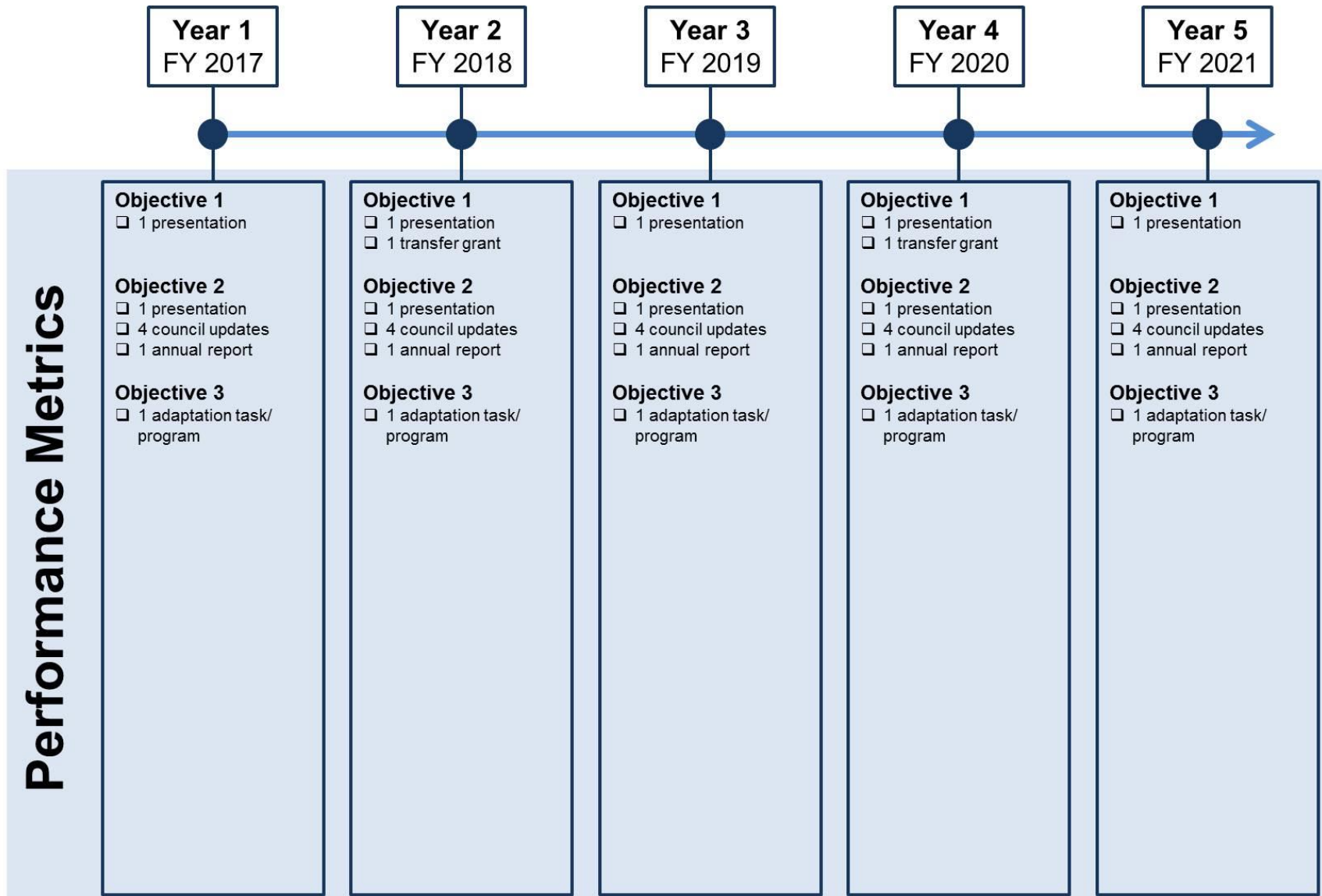
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Comprehensive Adaptation Strategies

These strategies are to be implemented by Reserve management and all Departments.

#	Objectives	Strategies	Performance Indicators (Outputs)	Interdepartmental Effort
1	Enhance collaboration within the National Estuarine Research Reserve System around climate change, adaptation, and resilience.	<ul style="list-style-type: none"> Transfer lessons learned as part of Resilience projects to other NERRs 	<ul style="list-style-type: none"> 4-5 presentations at annual meetings (~1/yr) 2 transfer grants with other Reserves 	Education, Research, Stewardship, Training
2	Strengthen engagement with the Reserve's Advisory Council and member agencies around climate change and resilience.	<ul style="list-style-type: none"> Compile an annual report highlighting the implementation of the Reserve's adaptation strategies and resilience efforts Regularly update the Advisory Council on Resilience and adaptation projects 	<ul style="list-style-type: none"> 5 presentations that highlight climate change(1/yr) Updates on Reserve Resilience projects to the Advisory council at every meeting (4/ year) Share the annual report tracking implementation of the Reserve's adaptation strategies 	Education, Research, Stewardship, Training
3	Coordinate interdepartmental implementation of the climate adaptation strategies identified in this document	<ul style="list-style-type: none"> Apply for grant funds to support adaptation strategy implementation Work with OCM to develop Ops grant task outcomes that supports programmatic adaptation focus and evaluation 	<ul style="list-style-type: none"> 1 task/award period that addresses adaptation and evaluation for each program (1/yr) 	Education, Research, Stewardship, Training

Implementation Plan



This plan is adaptive, as the completion and timing of tasks are dependent on available funding, alignment with other project timelines, and emerging collaborations.

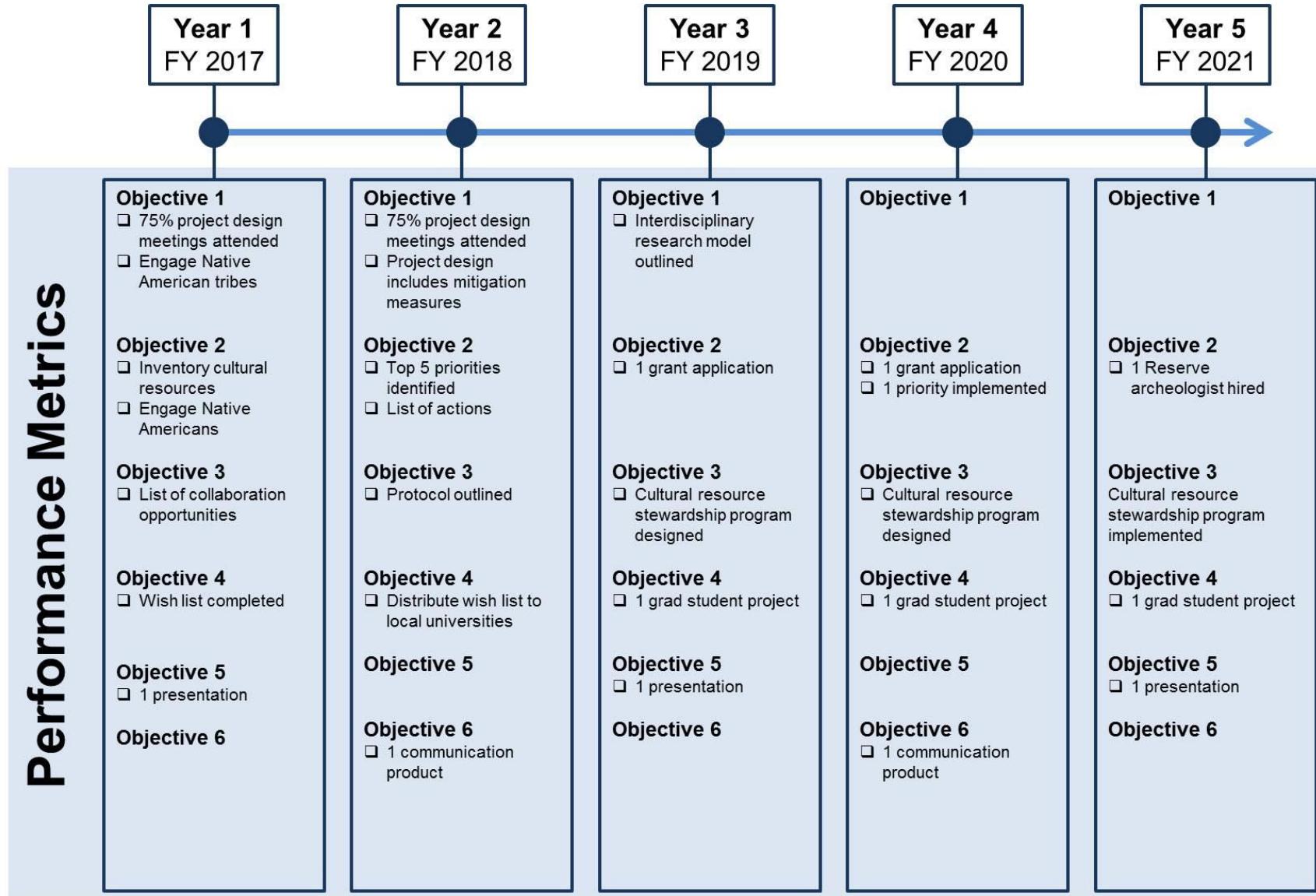
Cultural & Historical Resources

Adaptation Strategies

#	Objectives	Strategies	Performance Indicators	Interdepartmental Collaboration
1	Ensure TETRP is completed with full consideration of cultural and historical resources.	<ul style="list-style-type: none"> Cultural resources specialist provides input throughout the project design phase. Train the project team about protocols for the discovery of cultural and historical resources. Appropriate avoidance and mitigation measures are in place and implemented. Archaeological investigations include studies aimed at understanding human adaptation to previous climate change. Engage Native American tribes in the process. 	<ul style="list-style-type: none"> Cultural Resources specialist to attend 75% of project design meetings. Project design includes avoidance and mitigation measures. Outline an interdisciplinary model for scientific research that includes a cultural component. Engage directly with tribal nations. 	Research, Stewardship, Training
2	Enhance the resilience of cultural & historical sites that may be compromised as a result of climate change.	<ul style="list-style-type: none"> Full inventory of Reserve's cultural and historical resources. Identify the specific sites that are at risk due to climate change Prioritize the top 5 river valley resources where action needs to be taken with ongoing Native American consultation. Identify what actions need to be taken for the top 5 priorities (monitor, capping, testing, data recovery, documentation and/or relocation of structures). Develop a Cultural Resources Management Plan for the Reserve featuring climate change Hire reserve archaeologist to implement objectives and strategies and manage cultural resources. 	<ul style="list-style-type: none"> Inventory of cultural resources Top 5 priorities identified List of actions to address top 5 priorities Engage directly with tribal nations and incorporate their ideas/priorities 2 grant applications submitted to address priority areas and increase capacity 1 priority area addressed/ implemented 1 Reserve archaeologist hired 	Research, Stewardship
3	Leverage existing Reserve monitoring to determine when cultural and historical resources may become compromised as a result of climate change.	<ul style="list-style-type: none"> Determine if there are specific indicators of change that are currently monitored at the Reserve that may help to determine when cultural and historical resources are being compromised. Develop a protocol with the Research program for ensuring that Reserve cultural staff, including State Parks Archaeologists, are made aware of concerning shifts in environmental or climatic conditions. 	<ul style="list-style-type: none"> Identify potential areas of collaboration with the Research program Outline a protocol for reporting when a change that may impact cultural & historical resources occurs. Develop cultural resource stewardship program. 	Research, Stewardship, Training

#	Objectives	Strategies	Performance Indicators	Interdepartmental Collaboration
4	Advance interdisciplinary research that addresses environmental change in the Holocene.	<ul style="list-style-type: none"> Outline research priorities, including monitoring and research projects (i.e., lagoon coring, C-14, pollen analysis) that identify setting over the past 12,000 years and human adaptation to previous climate change (e.g., Holocene). 	<ul style="list-style-type: none"> Outline research “wish list” Share “wish list” with local universities Complete 2-3 graduate student research projects with local universities 	Research
5	Train Reserve staff about local cultural & historical resources in the context of climate change adaptation.	<ul style="list-style-type: none"> Provide a presentation to staff on the cultural & historical resources present in the river valley, addressing climate change science, risk, and adaptation. 	<ul style="list-style-type: none"> 1-3 presentations 	Education, Training
6	Develop cultural & historical educational materials that incorporate the concept of climate change.	<ul style="list-style-type: none"> Identify opportunities to develop educational and communications materials that highlight local cultural & historical resources and climate change Develop communications materials. Engage Native American Tribes. 	<ul style="list-style-type: none"> 2 communication products produced 	Education, Training

Implementation Plan



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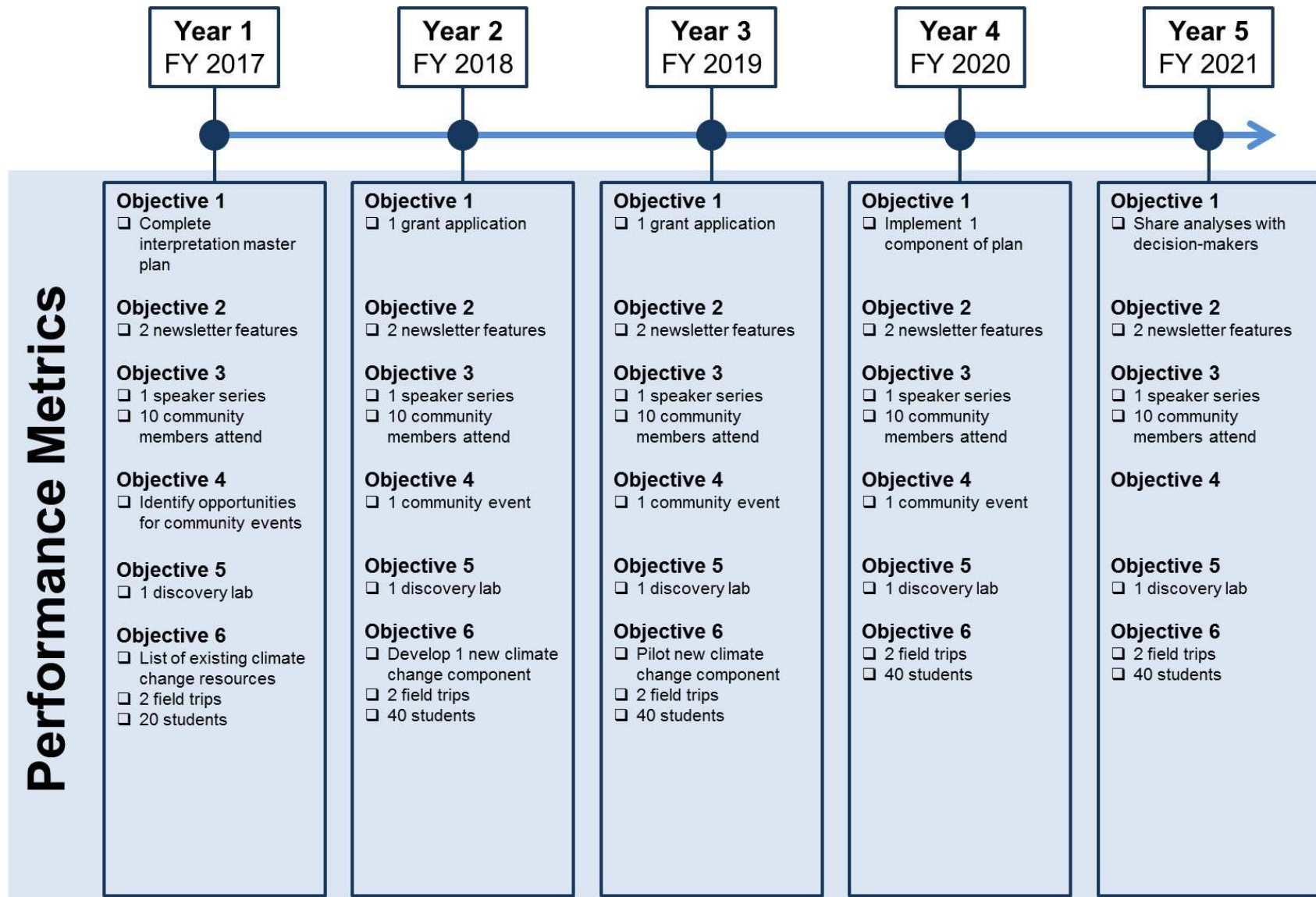
Education & Community Outreach

Adaptation Strategies

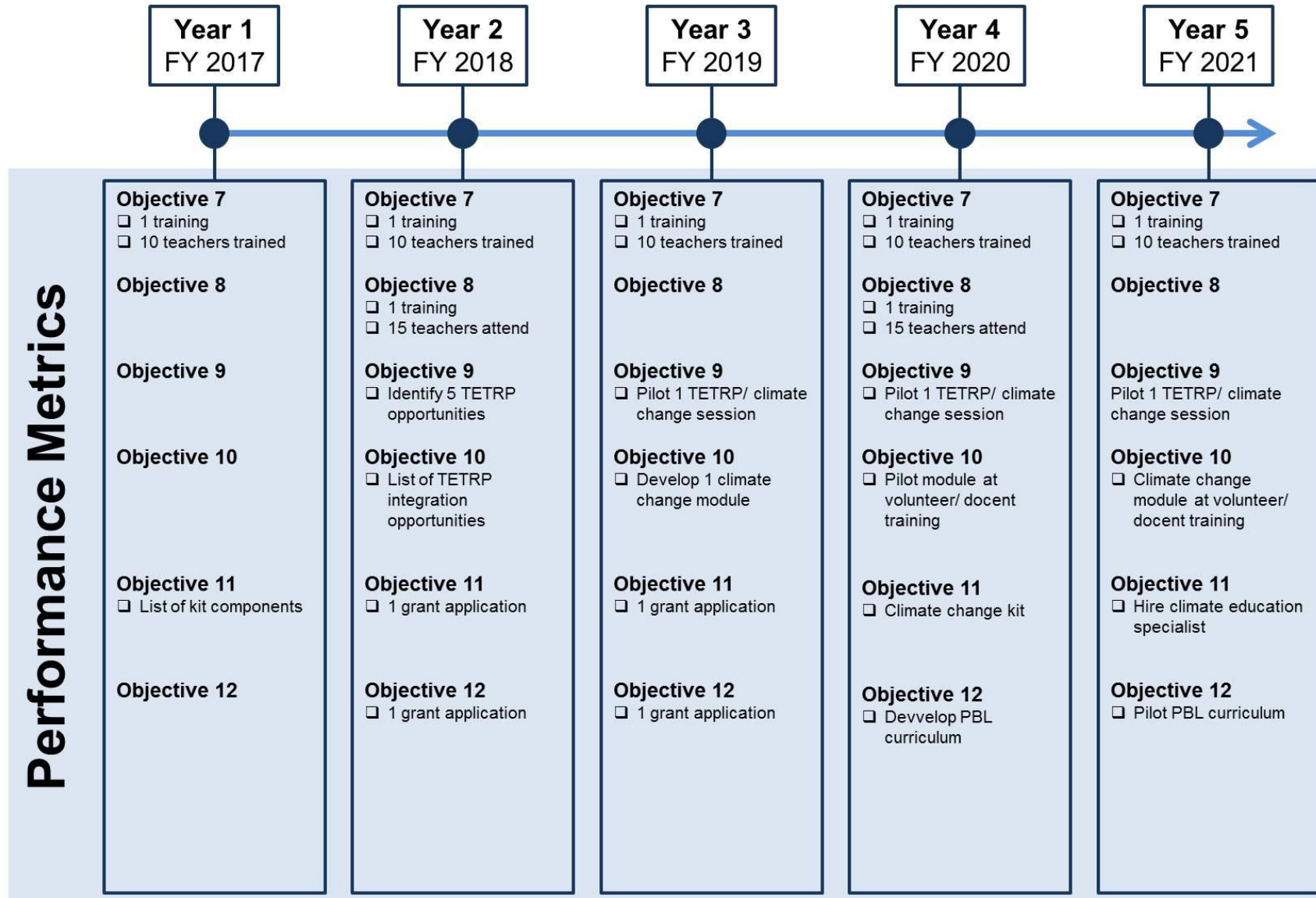
#	Objectives	Strategies	Performance Indicators	Interdepartmental Effort
1	Integrate climate change into Interpretation Master Plan.	<ul style="list-style-type: none"> Review Interpretation Master Plan and identify opportunities to integrate climate change Apply for funding to begin implementing climate change components of plan. 	<ul style="list-style-type: none"> Completed Interpretation Master Plan with climate change components 1-2 grant applications Implement 1 climate change component of master plan 	
2	Provide climate change research and monitoring in the monthly newsletter.	<ul style="list-style-type: none"> Collaborate with the Research team to identify new and interesting climate change research and monitoring topics. 	<ul style="list-style-type: none"> At least 10 climate change spotlights in monthly newsletter. (2/ yr) 	Research
3	Organize engaging Saturday Speaker Series that feature climate change.	<ul style="list-style-type: none"> Identify potential speakers and invite them to partake in the Saturday Speaker Series. 	<ul style="list-style-type: none"> Hosted 5 Saturday Speaker Series focusing on climate change. At least 50 community members educated on local climate science and adaptation. 	Training
4	Host or collaborate to organize family-centered community events where climate change is a featured topic.	<ul style="list-style-type: none"> Integrate climate change into community event opportunities 	<ul style="list-style-type: none"> 3 community events completed 	Research, Stewardship
5	Integrate climate change into at Discovery Labs.	<ul style="list-style-type: none"> Review existing discovery lab curriculums Identify opportunities within the curriculum to integrate climate change Pilot the climate change components during discovery lab sessions 	<ul style="list-style-type: none"> Host 5 discovery labs with climate change components 	Research
6	Host middle school and high school field trips where climate change is a core component.	<ul style="list-style-type: none"> Review existing field trip curriculums and identify existing resources for climate change integration. Develop 1 new climate change resource to be integrated into curriculum. In collaboration with teachers, pilot climate change field trip components. 	<ul style="list-style-type: none"> List of existing climate change resources. 1 newly Reserve developed climate change component to field trips 10 field trips with climate change component hosted. At least 200 students partake in a field trip with a climate change component. 	

#	Objectives	Strategies	Performance Indicators	Interdepartmental Effort
7	Update climate change component of TOTE teacher training to reflect current climate change science and adaptation.	<ul style="list-style-type: none"> Identify new research, monitoring, and management advances regarding climate change science. Integrate updates into presentations of training exercises. 	<ul style="list-style-type: none"> 5 TOTE teacher trainings hosted with an updated climate change session. (1/yr) At least 50 teachers trained. 	Research
8	Provide NNOCCI trainings for informal educators.	<ul style="list-style-type: none"> Maintain, enhance, and leverage strong partnerships with regional NNOCCI study circle and other regional climate change collaboratives to identify training needs and opportunities. 	<ul style="list-style-type: none"> 2 NNOCCI trainings completed. At least 30 informal educators trained in strategic framing of climate change. 	Training
9	Integrate TETRP restoration initiative into educational programs, highlighting climate adaptation and carbon sequestration.	<ul style="list-style-type: none"> Collaborate with Research program in identifying opportunities to integrate TETRP into educational programming. Identify funding from TETRP to fund education and community outreach. 	<ul style="list-style-type: none"> Identify 5 new opportunities for integration of TETRP into educational programs (e.g., docent training, discovery labs, interpretation, citizen science...). Coordinate and pilot at least 3 new educational sessions on TETRP and climate change. 	Research, Stewardship
10	Integrate climate change into docent and volunteer trainings, using TETRP as a case study.	<ul style="list-style-type: none"> Review current docent and volunteer trainings and identify opportunities to integrate climate change. Develop a climate change module to be integrated into trainings. Pilot the climate change components during docent and volunteer trainings. 	<ul style="list-style-type: none"> Identification of opportunities for integration of climate change into docent and volunteer trainings 1 climate change module integrated into trainings Incorporation of climate change component into all future docent and volunteer trainings. 	Research
11	Develop a prepackaged climate change “kit” for local middle schools, leveraging the San Diego Children and Nature curriculum.	<ul style="list-style-type: none"> Identify and apply for funding to hire a climate education specialist and curriculum writer Using the Reserve’s climate education needs assessment, brainstorm ideas for what to be included in the “kit” 	<ul style="list-style-type: none"> List of components of what the “kit” would include. 1-2 grant applications submitted to secure funding for project. If funding secured, develop a middle school climate change “kit” If funding secured, hire climate education specialist 	
12	Develop project-based learning (PBL) curriculum that includes the resiliency of the student using eco-literacy methods.	<ul style="list-style-type: none"> (Refer to obj. 11: Identify and apply for funding to hire a climate education specialist and curriculum writer) 	<ul style="list-style-type: none"> 1-2 grant applications submitted to secure funding for project. If funding secured, Pilot PBL program at an afterschool setting or with a High Tech High Chula Vista class. 	Research, Training

Implementation Plan



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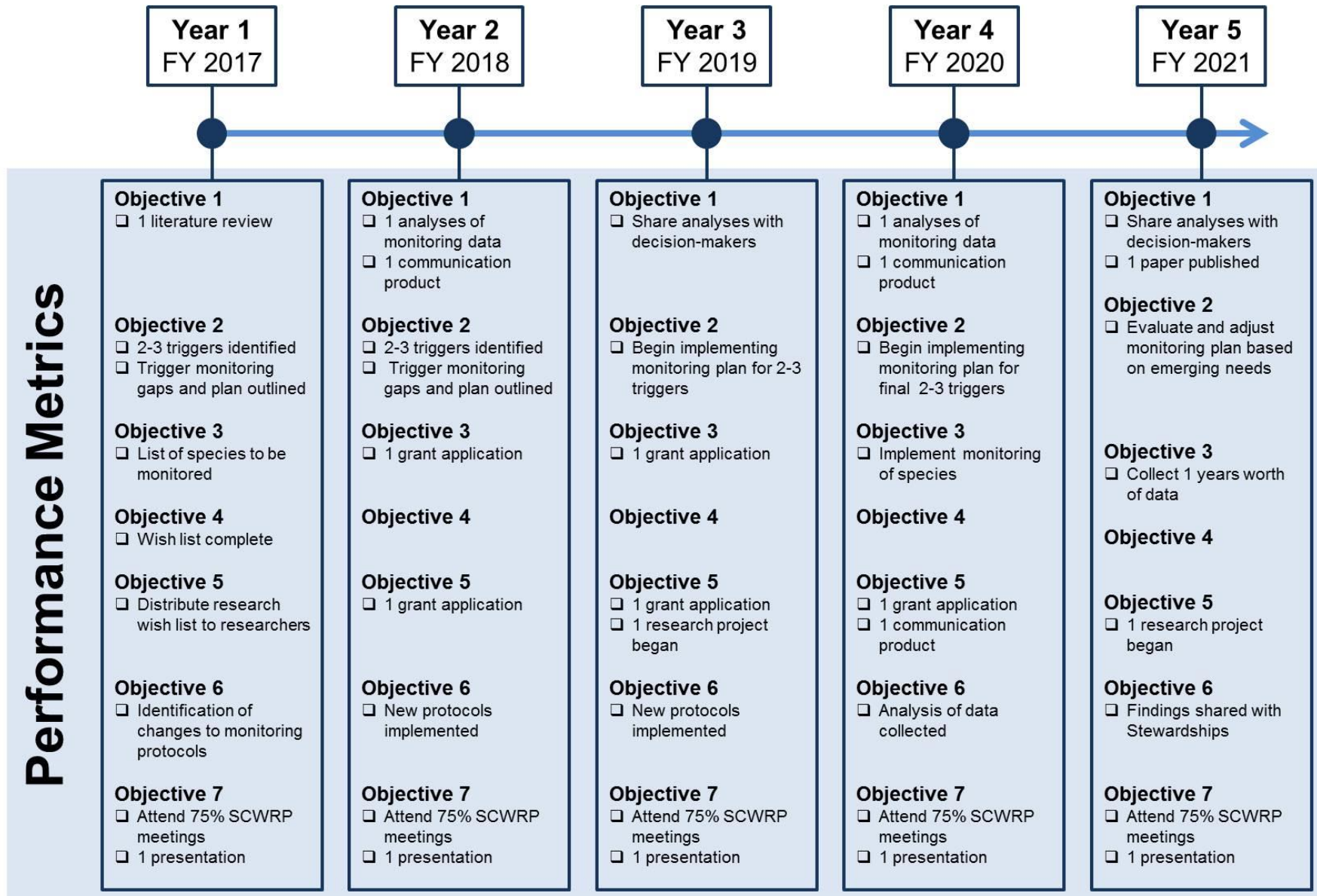
Research

Adaptation Strategies

#	Objectives	Specific Actions	Performance Indicators	Interdepartmental Collaboration
1	Identify any significant changes or trends in temperature, Ph, DO, salinity and/ or vegetation based on collected monitoring data in the Tijuana Estuary and other San Diego County Estuaries.	<ul style="list-style-type: none"> Literature review of best available local climate science. Analysis of historical and current monitoring data (i.e., SWMP) in relation to best available climate science. Maintain & expand existing monitoring program 	<ul style="list-style-type: none"> Documentation of at least one literature review Documentation of at least 2 analyses of existing monitoring data 2 communication products communicating findings Distribution of findings to Reserve staff, local decision-makers, and natural resource managers 1 paper published 	Training
2	Finalize management “triggers” and determine if existing physical and biological monitoring efforts need to be modified to know when a trigger occurs.	<ul style="list-style-type: none"> List triggers that will initiate adaptive management procedures Develop monitoring plan for triggers Identification of monitoring gaps, and how to fill them 	<ul style="list-style-type: none"> 3-5 triggers identified Monitoring plan for triggers established Documentation of monitoring gaps. Outlined strategy for addressing identified needs Implement monitoring strategy and adjust as needed 	Stewardship
3	Enhance monitoring of at least three species, specifically distributions, abundance, and/or assemblages, that will provide indications of change.	<ul style="list-style-type: none"> Identify species of scientific and management interest Pursue funding to establish a regular monitoring program Continue monitoring of vegetation, minnows, total suspended solids (TSS), and mole crabs. 	<ul style="list-style-type: none"> List of species to be monitored 1- 2 grant applications to secure funding Establish a monitoring program for identified species Data on species distribution and assemblage (at least 1 years worth) 	Stewardship
4	Develop and maintain a research “wish list” that identifies management needs and potential research projects that may address these needs.	<ul style="list-style-type: none"> Identify Research needs Identify Researchers conducting research of interest Identify instrumentation and technology that would advance localized data collection 	<ul style="list-style-type: none"> List of potential research projects, researchers, and technology/ instrumentation 	Stewardship, Training

#	Objectives	Specific Actions	Performance Indicators	Interdepartmental Collaboration
5	Facilitate at least three new Reserve-based projects by researchers from other institutions that address climate change impacts and resilience.	<ul style="list-style-type: none"> • Distribute research “wish list” to researchers • Pursue funding opportunities that encourage researchers to conduct research on topics identified in wish list • Establish new and maintain current relationships with researchers at local institutions (i.e., Scripps, SDSU) • Facilitate sharing of Reserve monitoring data 	<ul style="list-style-type: none"> • 2- 3 grant applications seeking funding for research on “wish list” • 2 research projects that are directly linked to management needs (i.e., on wish list) • 1 communication product communicating results 	Stewardship, Training
6	Enhance current monitoring of invasive species to better understand the connection between invasive species and climate change.	<ul style="list-style-type: none"> • Identify areas where current monitoring protocols can be enhanced • Enhance ongoing monitoring by implementing newly identified protocols • Analyze collected data in the context of climate change • Coordinate with the Stewardship program to ensure that research is directly informing management approaches 	<ul style="list-style-type: none"> • Documentation of how monitoring protocols should be adapted • New protocols implemented • Analysis of data collected • Provide Stewardship key research findings 	Stewardship
7	Continue to be actively engaged with the State Coastal Conservancy’s Southern California Wetland Recovery Project (SCWRP), and support the integration of climate change science into the regional strategy update.	<ul style="list-style-type: none"> • Continue engagement with the Wetland Managers Group (WMG), Science Advisory Panel (SAP), and the Wetlands Advisory Group (WAG). • Continue to conduct cutting edge climate change research and planning, and transferring findings and processes to SCWRP. 	<ul style="list-style-type: none"> • Attend 75% of SCWRP meetings • 3-5 presentations on Reserve-led resilience efforts 	Stewardship, Training

Implementation Plan



Stewardship

Adaptation Strategies

Resource Protection, Management, and Restoration

#	Objectives	Strategies	Performance Indicators	Interdepartmental Effort
1	<p>Ensure the Tijuana Estuary Tidal Restoration Program (TETRP) integrates the best-available climate science into its phased design and implementation.</p> <p>Climate Mitigation Co-benefit: Carbon sequestration/ Blue Carbon</p>	<ul style="list-style-type: none"> Ensure the design and implementation of the restoration project considers all potential impacts of climate change. 	<ul style="list-style-type: none"> Checklist outlining what climate considerations should be considered in TETRP design Outline of how TETRP design addresses climate change and the CURRV scenarios 1 communication product discussing TETRP and climate change 	Research, Training
2	<p>Identify natural strategies to manage sediment, considering not only how climate change may alter sediment dynamics but how sediment can be used to naturally increase shoreline resiliency.</p>	<ul style="list-style-type: none"> As part of TETRP, explore opportunities for beneficial reuse of sediment (e.g., beach and dune restoration). Explore other opportunities for beneficial reuse in the river valley (e.g., Nelson Sloan Quarry) 	<ul style="list-style-type: none"> Outline how sediment can be beneficially reused as part of the TETRP design phase Implement identified beneficial reuse strategies during the implementation of TETRP 1 communication product discussing TETRP and climate change 	Research, Training
3	<p>Identify key partner organizations and researchers that can increase capacity to respond to immediate, unexpected, fast-moving extreme climate change events or impacts.</p>	<ul style="list-style-type: none"> List of potential areas of expertise needed List of local experts that can help with immediate assessment of fast moving climatic and environmental changes. 	<ul style="list-style-type: none"> Documentation of multiple Response Teams categorized by specific impact areas 	Research

#	Objectives	Strategies	Performance Indicators	Interdepartmental Effort
4	Enhance collaboration with the Advisory Council to facilitate the acquisition of upstream lands of ecological importance.	<ul style="list-style-type: none"> • Discuss opportunities at Advisory Council meetings • Strengthen partnerships with both land managers and organizations that specialize in land acquisition • If an opportunity arises, collaborate with the Advisory Council to acquire the prioritized property 	<ul style="list-style-type: none"> • 5 discussions/ presentations about land acquisition (1/yr) • If opportunity presents itself, successful acquisition of addition land by an Advisory Council member 	
5	Outline species specific operational conservation strategies to manage priority species, considering climate change.	<ul style="list-style-type: none"> • Review local research into how priority species may be impacted by climate change • Identify specific operational actions that staff can take to mitigate climate impacts to priority species 	<ul style="list-style-type: none"> • Outline operational strategies for 3-5 priority species 	Research

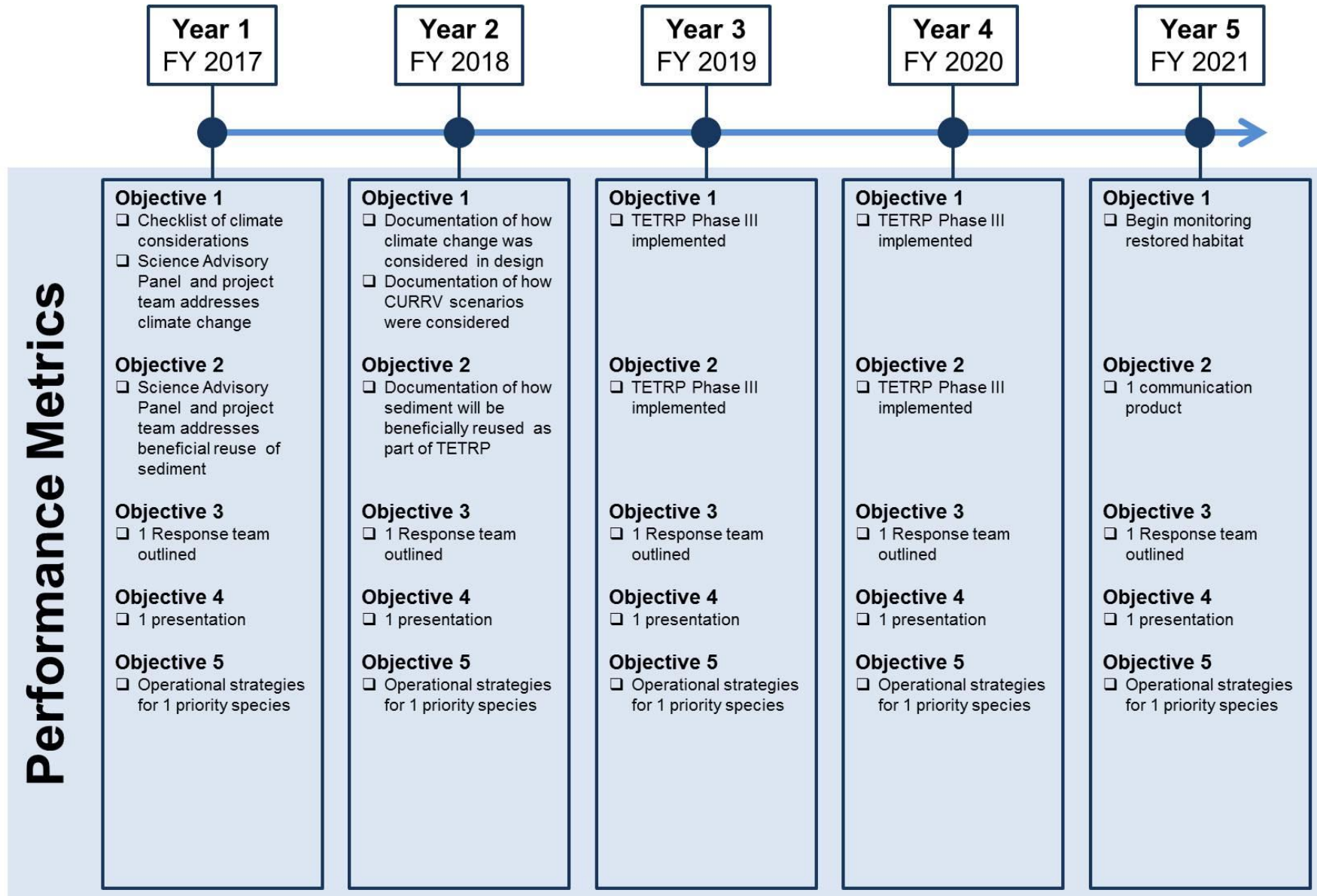
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Public Access & Recreation

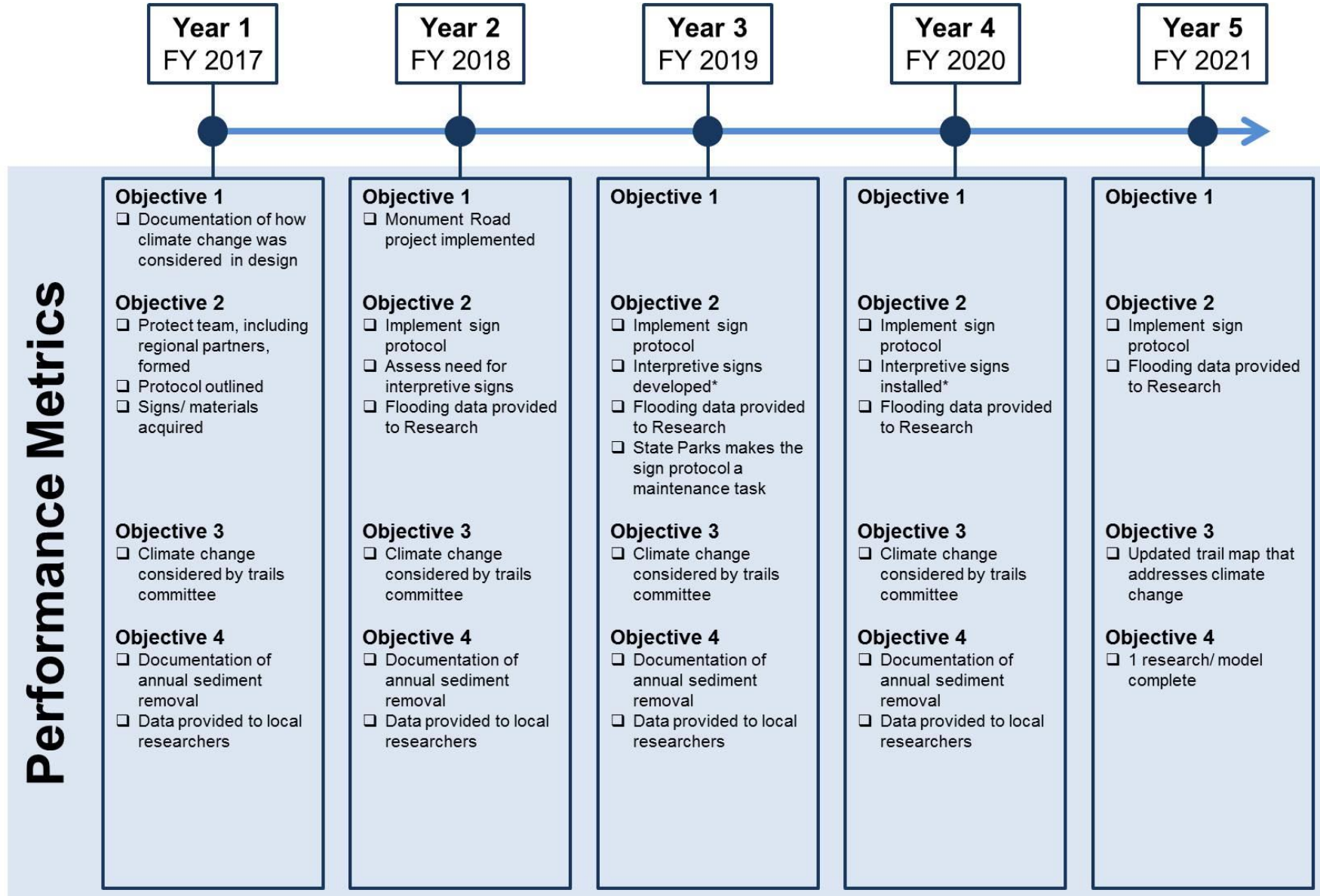
#	Objectives	Strategies	Performance Indicators	Interdepartmental Effort
1	Upgrade Monument Road and associated facilities, including the associated staging area, in the context of existing flooding and how climate change may exacerbate current conditions.	<ul style="list-style-type: none"> Incorporate climate change into the design and implementation of the Monument Rd project Coordinate project with design of TETRP 	<ul style="list-style-type: none"> Documentation of how climate change was considered and addressed in the design of the road 	
2	Outline a protocol for signage when trail and/ or park access is compromised during extreme flooding events or when areas are closed to protect wildlife.	<ul style="list-style-type: none"> Outline a protocol for distributing signs indicating trail closure, collaborating with the multiple agencies that maintain and manage trails and beach closures (e.g., County DEH) Meet with education staff about how to use trail closures as an opportunity to simultaneously educate the public about climate change (e.g., temporary interpretive signs erected during extreme events) 	<ul style="list-style-type: none"> Signs and appropriate materials are acquired and/ or developed Protocol for sign distribution outlined Protocol successfully enacted during extreme events State Parks prioritizes signs as a maintenance task Documentation of flooding events given to the Research team to determine if baseline patterns are shifting 	Education, Research
3	Throughout the maintenance of existing trails and design of new trails, consider how climate change may alter access to existing routes and distribution of habitats and wildlife.	<ul style="list-style-type: none"> Identify alternative options for rerouting trails system when permanent changes must be made. 	<ul style="list-style-type: none"> List of trails that face permanent closure, and correlating strategies for how to address the vulnerabilities 	Research
4	Monitor the ongoing effectiveness of the sediment basin to determine if changing climatic and environmental conditions are impacting sediment loads.	<ul style="list-style-type: none"> Track when the sediment basins are full (e.g., time of year). Track how much sediment is removed from the basins annually. Provide sediment data to local researchers (e.g., Trent Biggs) to analyze and model 	<ul style="list-style-type: none"> Documentation of annual sediment removal 1 research project and /or model addressing sediment dynamics completed using sediment data 	

Implementation Plan

Resource Protection, Management, and Restoration



Public Access & Recreation

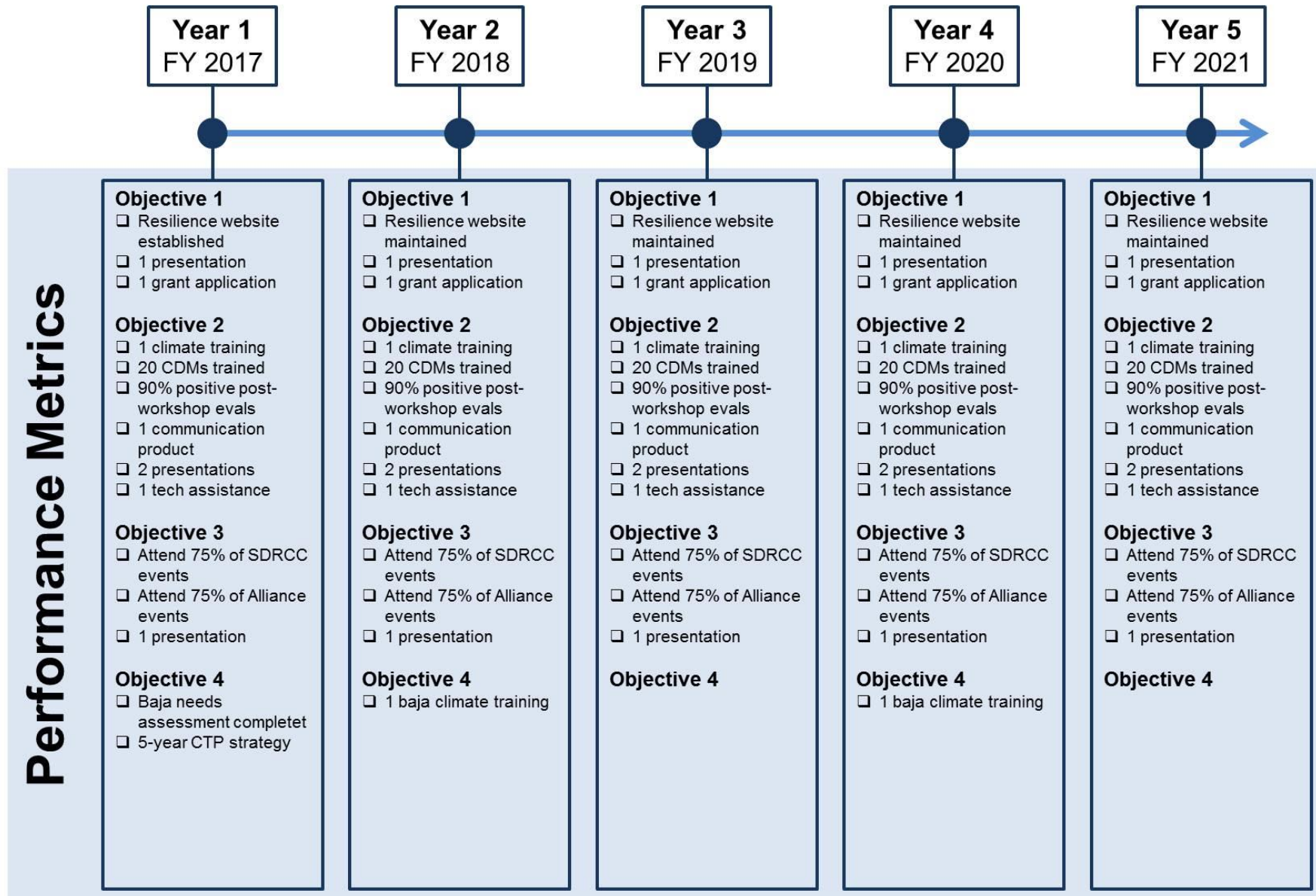


Coastal Training

Adaptation Strategies

#	Objectives	Strategies	Performance Indicators	Interdepartmental Collaboration
1	Coordinate and leverage Reserve-led Resilience projects	<ul style="list-style-type: none"> CTP serves as the programmatic point of contact for the Reserve's Resilience efforts Ensure consistent messaging by establishing and promoting a webpage that highlights Reserve-led Resilience projects Transfer lessons learned throughout project implementation within Reserve Expand resilience efforts by securing additional funding 	<ul style="list-style-type: none"> A website featuring Reserve lead Resilience projects, ensuring Reserve project results and lessons learned are publically accessible 5 staff oriented-presentations (i.e., brown bag lunches) (1/yr) 3-5 grant applications submitted 	Research, Education, & Stewardship
2	Support coastal decision-makers as they assess climate vulnerabilities, undertake adaptation planning, and begin to implement specific strategies	<ul style="list-style-type: none"> Offer trainings for coastal decision-makers on topics related to climate adaptation Provide technical assistance (e.g. facilitation, grant proposal development, evaluation) to coastal decision-makers on topics related to climate adaptation Develop and distribute communications materials that advance local understanding of climate adaptation, with a particular focus on nature-based strategies Share lessons learned throughout the CURRV project and other Reserve-led Resilience efforts Distribute funding announcements, and where appropriate, provide technical assistance for proposal development 	<ul style="list-style-type: none"> 5 climate-oriented trainings hosted 100 coastal decision-makers participate in trainings Positive post-workshop evaluation responses (90% or greater) 5 climate communication products completed 10 presentations that transfer lessons learned (2/yr) 3 technical assistance offerings 	Research, Stewardship
3	Maintain and enhance engagement with regional networks that are focused on advancing regional climate adaptation	<ul style="list-style-type: none"> Attend and, when appropriate, support the San Diego Regional Climate Collaborative (SDRCC) through providing training and technical assistance Attend and, when appropriate, support the Climate Science Alliance- South Coast (Alliance) through providing training and technical assistance Develop relationships with other local networks that are working to integrate climate change science into coastal resource management 	<ul style="list-style-type: none"> Attend 75% of SDRCC network meetings and events Attend 75% of Alliance meetings and events 5 presentations at Collaborative or Alliance events (1/yr) 	Research, Education, & Stewardship
4	Amplify areas where CTP can increase its capacity and expand its program within the bioregion, particularly in Baja-California to address climate change and support adaptation	<ul style="list-style-type: none"> Design and implement a needs assessment to determine training and technical assistance needs among Baja-California decision-makers Apply findings from needs assessment to identify training priorities Ensure that CTP 5-year strategy reflects this objective 	<ul style="list-style-type: none"> Report of results from Baja Needs assessment with recommendations 5-year strategy with a binational component 2 trainings 	Research, Education

Implementation Plan



Scenarios

Understanding Vulnerabilities and Uncertainty

Climate change poses new management challenges for resource managers working to conserve and enhance resilient coastal habitats. Typical vulnerability assessment frameworks are challenging to consistently implement in the complex and uncertain socio-ecological context that resource managers make decisions in.

An alternative approach, scenario planning, is emerging as a framework that allows current and future vulnerabilities to be assessed, while overcoming the challenges associated with having to make informed decisions in the short-term while planning for long-term resilience.

Scenarios are not predictions. Each individual scenario is an alternative description of how the future may unfold, outlining a different plausible future state of a system.

TRNERR used the relationship between two primary variables to frame the development of four separate scenarios (Refer to figure 1):

- Tidal prism, and
- Extreme river flow events.

Each scenario was developed in three stages, through discussions at workshops and in one-on-one interviews with researchers, resource managers, and local agencies:

- **Physical Landscape:** Experts outlined how changes in tidal prism and extreme river flow events may alter how important physical characteristics shape the landscape.
- **Natural Habitats:** Considering the physical scenario characteristics identified in the previous step, the key factors that affect the health of each habitat-type were identified.
- **Built Environment:** The results from the previous two steps were used as a platform to discuss how changes in the physical landscape and natural habitats may impact critical infrastructure and management approaches.

For more information about the scenario planning process visit:

<http://www.trnerr.com/currv>

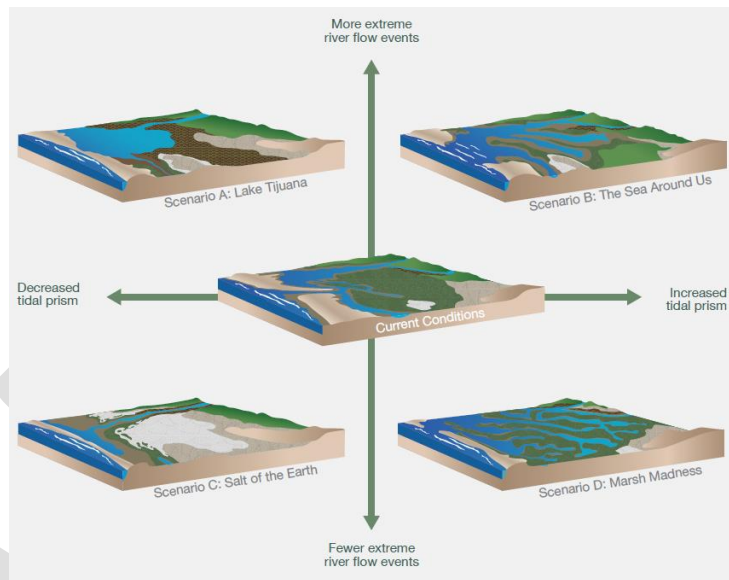


Figure 1: The Tijuana River NERR's four future planning scenarios.

Linking the Scenarios to Management

The Reserve's current management philosophy is built on a foundation that supports and enhances rare habitats and wildlife that are currently present. These habitats need to be managed using strategies that are currently effective in maintaining ecosystem health and function. However, in the future strategies may need to be adjusted as habitats change in response to climatic and environmental conditions. Most of the adaptation strategies in this document will be effective in all four scenarios; however, there are some strategies that will need to be adapted significantly given new science and observations.

In order to ensure current management strategies are not altered too soon (i.e., forsaking existing, healthy habitats and wildlife) or too late (i.e., climate change impacts lead to mass die-offs), it's important to build in adaptive pathways that can help ensure we are able to successfully manage the river valley. Effective management approaches will need to adapt in the event of any of the following occurring:

- Transitions between scenarios;
- Any component of the four scenarios becoming a reality; or
- A scenario that was not considered or outlined.

The concept of triggers provides us this opportunity.

Triggers: Managing for Change

Triggers are events or observations that indicate a critical long-term shift in habitat and wildlife health, potentially meaning the system is shifting into one of our outlined scenarios. The triggers help to ensure management strategies are proactively updated in response to an indicator that a threshold is approaching, and if crossed may lead to a long-term, permanent shift in how the ecosystem functions. Proposed triggers for TRNERR are outlined below:

Category	Trigger
Flooding	Data loggers are indicating an increase in water levels that correlate with flooding at the end of Seacoast Dr.
River mouth	River mouth closes in a non-El Niño year
Sea level rise & Sediment	Water level data and the Surface Elevation Tables (SETs) are on a path that indicates sea level rise will soon outpace sedimentation.
Wildlife	Annual bird surveys are indicating a trend of decreasing populations for species of concern.

If one of the events above is observed, a re-evaluation of current adaptation strategies is triggered (Refer to Figure 2). For example, if the river mouth closes in a non-El Niño year, all departments commit to re-evaluating their resilience and adaptation strategies to ensure that management strategies are still effective. This will help us to ensure we can manage for current habitats, transitions between scenarios (i.e., moving from scenario A to B), in a new scenario, or even in a world we have yet to visualize (e.g., some components of scenario A, mixed with scenario D, and mixed with a new scenario E).

In order to ensure the triggers chosen are appropriate and effectively monitored, the Research program will lead the refinement and implementation of the above proposed triggers over the next several years (Refer to Research Adaptation Strategies).

Adapting Adaptation Strategies in Response to Triggers

If a trigger is observed, Reserve staff are committed to re-visiting the adaptation strategies outlined in this document to ensure that as new science emerges and observations are catalogued the strategies maintain their effectiveness. Refer below for the types of questions that each department will discuss to ensure adaptation strategies are working in light of changes within the system.

Comprehensive (Reserve-wide)	<ul style="list-style-type: none"> • What are we required to do from a regulatory perspective? • What is the most economically viable option? • Are there lessons from other NERRs that we can use to inform our decisions?
Education	<ul style="list-style-type: none"> • Does our educational programming need to be adjusted to reflect the observed shifts in the system? • Are there specific changes that our visitors should be made aware of at the front desk or through interpretive signage? • Are there changes that the community needs to be made aware of through ongoing community outreach events?
Research	<ul style="list-style-type: none"> • Does our monitoring plan need to be changed? • Is there data that needs to be analyzed to better understand changes in the system? • Is there new science out there that needs to be directly linked to management?
Restoration	<ul style="list-style-type: none"> • Do we manage the river mouth as open or allow it to transition to a closed system? What are the ecological, societal and economic implications of managing the system in an open state vs. a closed state? • How do we manage for current habitats and wildlife while managing for observed change?
Public Access & Recreation	<ul style="list-style-type: none"> • Are there trails or visitor facilities compromised? • Can we improve design of the trails and visitor facilities to maintain them open? • Are there access points that face permanent closure?
Training	<ul style="list-style-type: none"> • Is there new science that needs to be communicated to decision-makers? Specifically, considering monitoring data from the Reserve. • Is there a specific group of decision-makers we need to engage with through training or technical assistance? • Do we need to alter training content to reflect observed changes?



For more information visit: <http://www.trnerr.com/currv>

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