

National Marine Sanctuary Program
National Ocean Service
National Oceanic and Atmospheric Administration

**Funding Requirements
for the
National Marine Sanctuary System**

Supplemental Documentation
for
Report to Congress
As Required by the National Marine Sanctuaries Act Section 304 (f)

September 2004



The National Marine Sanctuary Program (NMSP) serves as the trustee for a system of marine protected areas, encompassing more than 18,000 square miles of marine and Great Lakes' waters from Washington State to the Florida Keys, and from Lake Huron to American Samoa. The National Oceanic and Atmospheric Administration (NOAA) manages marine sanctuaries through authority of the National Marine Sanctuaries Act (NMSA). Since passage of the act in 1972, the sanctuary program has worked cooperatively with the public and its partners to protect and manage sanctuaries, while allowing commercial and recreational uses compatible with the primary purpose of conservation. Currently, the National Marine Sanctuary System is comprised of 13 sites in the U.S. Exclusive Economic Zone and Great Lakes (Figure 1), designated by Congress. In addition, the Northwestern Hawaiian Islands (NWHI) Coral Reef Ecosystem Reserve (NWHI Reserve) is undergoing the sanctuary designation process to determine if it should be added to the National Marine Sanctuary System.

The designated and proposed sanctuaries range in size from less than a square mile to about 100,000 square miles and generally provide broadly defined ecosystem protection for the areas within their boundaries. Two sites, *Monitor* National Marine Sanctuary and *Thunder Bay* National Marine Sanctuary and Underwater Preserve, are focused on protecting submerged cultural resources, and another, *Hawaiian Islands Humpback Whale* National Marine Sanctuary, concentrates its activities around the protection of one species and its habitat.

Figure 1. The National Marine Sanctuary System



ABOUT THIS DOCUMENT

This document defines 10-year funding requirements for the existing National Marine Sanctuary System. It introduces and describes a “funding framework” and its components; establishes a generalized funding profile for individual sanctuaries; and forecasts the 10-year funding requirements for the evolution of existing sanctuaries in the system. It also compares funding framework results to an independent evaluation of full-funding requirements conducted for NOAA’s Planning, Programming, Budgeting, and Execution System (PPBES).

This analysis has two major components: (1) a life cycle framework describing the six phases of evolution for a sanctuary—from designation to mature operations to adaptive management—and (2) a funding estimation method that quantifies sanctuary labor and non-labor costs, headquarters and regional support, and administrative overhead during each life cycle phase. The overall analysis provides a range of cost estimates for the evolution of each sanctuary over time, and hence the entire system and program for a 10-year period. The analysis and cost estimates can also be used to forecast funding requirements associated with possible expansion of the sanctuary system.

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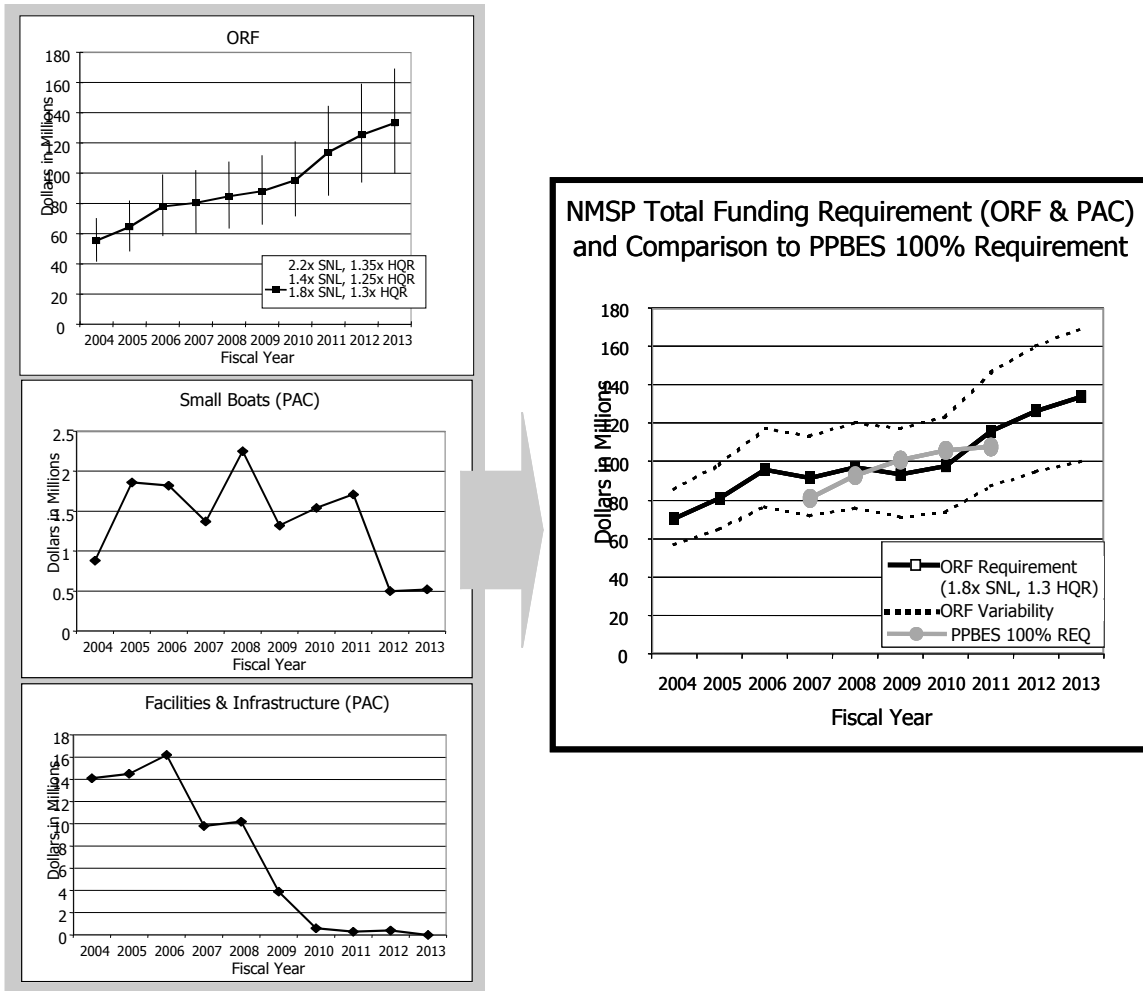
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EXECUTIVE SUMMARY

This document defines the 10-year funding requirements for the existing National Marine Sanctuary Program and estimates costs associated with possible system expansion. The analysis method, termed the “funding framework,” provides a range of cost estimates for the evolution of each sanctuary over time and hence the entire system and program for a 10-year period. Separate estimates are provided for Operations, Research, and Facilities (ORF) and for Procurement, Acquisition, and Construction (PAC) funds, consistent with historical appropriations. ORF funds include site labor and non-labor costs, headquarters and regional support, and administrative overhead. PAC funds provide for small boat acquisition as well as facilities, real property, signage, and exhibits.

Figure 2. Projected funding requirements (solid line) and estimate of variability (dashed lines) for the National Marine Sanctuary Program for FY2004-13 (ORF and PAC) using the “funding framework” method. For comparison, program funding projections for FY07-11 (ORF and PAC) are superimposed, based on NOAA’s Planning, Programming, Budgeting, and Execution System (PPBES) process (July 2004).



The funding framework has two major components: (1) a life cycle model that describes the six phases of evolution for each sanctuary (Table 1), from its designation to mature operations to adaptive management; and (2) a funding estimation method that quantifies the resource requirements needed at each sanctuary to perform the 16 major program functions (e.g., science, education, management) during each phase of its life cycle. These program functions

are explicitly tied to the authorizing mandates and have long-been the organizing units of the program's Annual Operating Plan (AOP) to track activities, staffing and costs. Program history documents that greater resources are needed for larger, more complex sites and for those in more mature phases of their life cycle.

For FY2004, the method projects a total of 231 site-based staff (416 program-wide) and a program budget approximating \$55M ORF and \$15M PAC are needed (Figure 2) to support the required program functions at all 13 existing sites as well as the ongoing designation of the Northwest Hawaiian Islands Coral Reef Ecosystem Reserve as the 14th sanctuary. By comparison, the FY2004 President's Budget appropriated \$36M, although the program ultimately received nearly \$47M (ORF and PAC) due to OMB adjustments for "salaries and expenses". By the end of the decade, FY2013, the method predicts significant increases as more sanctuaries reach more mature phases of their life cycles. Funding levels approximating \$134M are estimated to be needed by that date, assuming that no additional sanctuaries have been designated. These estimates are expected to have a range of approximately plus or minus 20% to allow for variance across sites with respect to site complexity and time required within each life cycle phase.

During FY2004, NOAA implemented the Planning, Programming, Budgeting and Execution System (PPBES) that provided a unique opportunity to evaluate the resource estimates predicted by the funding framework method. Figure 2 shows the program's total funding requirement developed in the PPBES process (FY2007-2011) superimposed on the estimates (FY2004-2013) developed using the funding framework. The graphs demonstrate general agreement at the program level of aggregation, suggesting a sound basis for the funding framework estimates.

Table 1. Life cycle phase description, typical duration, annual funding requirements and sanctuary status (FY2004).

The Sanctuary Life Cycle				Sanctuaries in Phase During FY 2004
Phase	Description	Duration (years)	Annual Funding Requirement (\$M)	
1	Pre-Designation and Designation	1 to 3	\$0.96-1.44M	NW Hawaiian Islands*
2	Start Up and Early Operations	2 to 5	\$1.44-5.51M	Thunder Bay
3	Transition and First Management Plan Review	1 to 2	\$2.16-7.19M	Cordell Bank Fagatelle Bay Flower Garden Banks Monitor Monterey Bay Olympic Coast Channel Islands Grays Reef Gulf of the Farallones Stellwagen Bank
4	Mature Operations	3 to 5	\$2.88-9.59M	HI Islands/Humpback Whale
5	Recalibration and Second Management Plan Review	1	\$3.12-10.79M	none
6	Adaptive Management	2 to 4	\$4.08-14.39M	Florida Keys

I. INTRODUCTION

I.1. The Program Need

A simple, requirements-based method is necessary to help define and quantify funding resources needed over time for the National Marine Sanctuary System. Historically, funding allocations reflected an emerging program, composed of a few small sites that focused largely on education and public awareness of biologically, culturally, or historically significant underwater resources. During these early years, sites had little need to apportion, track, or forecast funds across broad programmatic areas. However, early NMSP successes and growing public recognition of national marine sanctuaries throughout the 1980s and 90s helped to expand the scope and size of the sanctuary system (Table 2).

The inclusion of several large West Coast sites, the Florida Keys and portions of Hawaii substantially increased the underwater area requiring protection. At the same time, the diversity of the habitats and resources as well as competing compatible and non-compatible human uses greatly amplified the need for site characterization, science, and a deliberate and transparent public process to best manage these systems.

With each reauthorization, the NMSA reflected a maturing program and offered a moving target for program goals, from a clear focus on resource protection to a broader mandate for multiple use, making the mandate less explicit. In recent years, the program's AOP has been restructured to align with NMSA mandates and to better reflect the range and costs of functions performed at site, regional, and national levels. With the anticipated designation of the NWHI Reserve as the 14th sanctuary within the system, the program will be responsible for protecting more total area than the National Park Service (NPS), but is being asked to do so with considerably fewer staff and a fraction of the budget. The continued success of the program will be, in part, linked to its ability to rigorously define resource requirements that reflect and enable the maturing suite of operational capabilities evolving within the program.

Table 2. The national system of marine sanctuaries.

Sanctuary	Year Designated	Area (sq.mi)	Primary Resources
Channel Islands	1980	1658	Ecosystems and resources surrounding Channel Islands
Cordell Bank	1989	526	Productive upwelling area above and around Cordell Bank
Fagatele Bay	1986	0.25	Fringing coral reef ecosystem in eroded volcanic crater
Florida Keys	1990	3801	Shallow nearshore habitats including coral reefs and marine life they support
Flower Garden Banks	1992	56	Three underwater banks of coral reefs and other benthic habitats
Grays Reef	1981	23	Nearshore sandstone reef and benthic marine life it supports
Gulf of the Farallones	1981	1255	Habitats and marine life surrounding Farallone Islands
Hawaiian Islands Humpback Whale	1992	1370	Humpback whales and their habitat
Monitor	1975	1	Sunken Civil War-era ironclad ship
Monterey Bay	1992	5328	Coastal waters of central California including extensive habitats and marine life
Olympic Coast	1994	3310	Marine habitats and marine life along the coast of the Olympic Peninsula
Stellwagen Bank	1992	842	Waters surrounding the sand and gravel plateau of Stellwagen Bank
Thunder Bay	2000	448	Collection of 116 ships spanning over two centuries of Great Lakes shipping history
NW Hawaiian Islands (proposed)	2005 (anticipated)	131818	Marine waters surrounding chain of small islands, atolls and submerged banks

I.2. A Funding Framework Method to Define Program Resource Requirements

A funding framework method has been developed to allow realistic funding requirements for the sanctuary system to be estimated. The funding framework is designed to support internal program decision-making, NOAA budget processes, and other agency requirements. Its basis and components reflect three decades of experience within the program and more recent recognition that the costs to designate and then to operate a sanctuary over time can be described in terms of six "life cycle" phases that all sanctuary sites experience. These phases are pre-designation and designation, start-up and early operations, transition (first management plan review), mature operations, recalibration (second management plan review), and adaptive management. Following designation, each sanctuary is responsible for the characterization of site resources, research and monitoring, education and outreach, the development and implementation of management plans, enforcement, and the acquisition and maintenance of facilities and small boats. At present, many sanctuaries are completing their first management plan review, while some others are in early operation. Florida Keys National Marine Sanctuary reflects the program's only site conducting mature operations and adaptive management.

The funding framework method considers the evolution of each sanctuary through its life cycle phases, identifies the current development phase of each sanctuary, and quantifies a generalized unit of labor (and other associated costs) for each phase to define the needed investments. While the order of phases is consistent across all sanctuaries, the rate at which sites progress through each phase and the level of resources required will differ according to site complexity (e.g., site size, remoteness, ecosystem type), as well as the type and extent of human uses within the sanctuary. Predictably, the responsibilities and, therefore, the resource requirements for less complex sites in early phases of their life cycles is less than those for more complex sites in more mature phases. Despite the complexity and diversity of the sanctuary sites, the estimation method developed provides a common and simple approach for quantifying annual and long-term funding requirements.

I.3. Evaluating Method Projections and Adjusting for Uncertainty

Because uncertainty is inherent in any forecast, careful attention must be given to the factors affecting the range of the forecast. In this funding framework estimation method, uncertainty exists in two forms – errors in estimation and errors in schedules. However, decades of program experience provide a strong foundation for method design, data inputs, and validation. One measure of the reasonableness of the results generated is their relative agreement with the recent funding projections for FY2007-2011 required by NOAA's PPBES.

Compensating for Errors in Estimation

Two elements of the funding framework require estimates – labor units (staffing) and funding multipliers to account for site non-labor, headquarters, regional and administrative supports. In all cases, estimates benefit from a history of annual operating plans (AOPs) that have been structured to capture the costs and personnel requirements throughout all levels of the program.

Compensating for Errors in Schedule

The "life cycle" provides a generic sequencing of major activities and milestones expected to occur at each sanctuary over an approximate period of 10-20 years. This schedule is based on program history with the existing 13 sites, but recognizes that deviations that slow the evolution can occur due to administrative actions, budget constraints, and how a site was designated (i.e., Congressional vs. Administrative). In contrast, efficiencies gained through, for example, the "joint management plan" process for three sanctuaries in central California may expedite the schedule.

II. BUILDING A PREDICTIVE FUNDING FRAMEWORK ESTIMATION METHOD

The requirements for and application of any analytical or predictive tool depends on the questions to be answered as well as the ability to provide the quantitative information necessary. Questions concerning the program's funding requirements have evolved through the annual Congressional budget cycle and periodic reauthorization of the program. More recently, NOAA and the Office of Management and Budget (OMB) have established more rigorous processes for defining, tracking, and reporting of program requirements. For example, NOAA's PPBES and OMB's Program Assessment Review Tool (PART) evaluations have defined resource questions that derive from the program's major authorizations and require the program to develop the requisite data. As such, the program has restructured its Annual Operating Plan directly to better reflect, track progress towards, and measure costs associated with the mandated requirements of the NMSA. Additionally, the program has prepared several new planning and requirements documents, such as those for education, characterization, small boats, and facilities. Together, these actions position the program to ask the right questions and develop the appropriate analytical methods to answer them.

II. 1. What Questions Need to Be Answered?

The funding framework has been developed to address a range of questions that are derived from a single overarching inquiry – what is the cost to operate, over time, a system of marine sanctuaries and what are the costs associated with system expansion? The ability to respond accurately and thoroughly requires this question be separated into several component questions. The sequencing of these provides a practical approach to first understand the total program requirement, and then to evaluate those requirements in terms of present-day funding allocations and the capacity of the sanctuary system to continue to evolve.

- 1. What is the general funding profile for any given sanctuary?**
 - a. What are the annual operating costs for a sanctuary?
 - b. How do the funding requirements for site operations change over time?
 - c. Are the funding requirements the same for all sanctuaries?
- 2. What are the present-day (FY2004) funding requirements (ORF) for the National Marine Sanctuary system?**
- 3. What are the 10-year funding requirements (ORF) for the National Marine Sanctuary system?**
- 4. What are the funding requirements (ORF) for adding a new sanctuary to the existing national system?**
- 5. What are the Procurement, Acquisition and Construction (PAC) funding requirements for Facilities and Infrastructure for the National Marine Sanctuary system?**

Each of these questions can be answered using the funding framework estimation method. To do so, resource requirements are determined for the six operational components of the program (i.e., sanctuary sites, headquarters support, regional infrastructure, administrative overhead, facilities, and vessels). The estimation method is comprised of four major factors that consider sanctuary complexity, the phases of its life cycle, unit of labor estimates, and the funding estimation equations.

II.2. Defining the Key Program Elements that Require Funding

The true cost of operating a national system of marine sanctuaries goes beyond the site-based requirements and must account for a total of six key program elements. Four of these (site labor and non-labor, headquarters support, regional infrastructure, and administrative services) are reflected in the Operations, Research, and Facilities (ORF) portion of the program's annual allocation and can be quantified directly using the funding framework method. The remaining two elements, facilities and small boat acquisitions, are provided through a separate Congressional appropriation, called Procurement, Acquisition, and Construction (PAC) funding. They are estimated somewhat indirectly based on life cycle.

Site-based needs represent the cornerstone of the program's funding requirements. At each sanctuary, 16 discrete functions are performed to address the requirements of the NMSA and other enabling authorizations (Table 3). However, the sites also require support at the headquarters level and rely on administrative services as described below. The resource requirements for these support functions can be quantified using a multiplier of the site-based needs derived from historical data within the program. More recently, the program has moved towards a regional structure to better connect and coordinate with local and regional issues – the resource need for this support structure is also based on a multiplier of the site requirement. Facilities and small boat acquisitions are provided through a separate Congressional appropriation, called Procurement, Acquisition, and Construction (PAC) funding – these requirements were determined through separate studies (also based on the life cycle concept) and are also described.

Site Labor and Non-Labor Requirements (ORF)

The resources required to implement any or all of the 16 mandated functions required by the National Marine Sanctuaries Act throughout the life cycle of each sanctuary. This includes site labor costs that vary as a function of site complexity and life cycle phase. Additionally, an operations multiplier is used to account for all non-labor aspects, including facilities and small boat operations, vehicles, travel, and supplies.

Headquarters Support (ORF)

Professional, technical, and administrative personnel in Silver Spring, MD who serve a system-wide design and coordination role, working on issues of concern common to all sites, from directing and facilitating the conduct of management plan reviews to interagency coordination and the development of system-wide policies.

Regional Support (ORF)

Table 3. The National Marine Sanctuaries Act and other enabling authorizations prescribe 16 functional capabilities that define the Program's Annual Operating Plan (AOP).

1. Education
2. Outreach
3. Interpretive Facilities
4. Partnerships
5. Volunteers
6. Cultural Resources & Maritime Heritage
7. Characterization
8. Monitoring
9. Research
10. Damage Assessment & Restoration
11. Management Plan Review – Designations
12. Resource Management
 - Zoning
 - Permitting
 - GIS Applications
 - Enforcement
13. Sanctuary Advisory Councils
14. Resource Threat Reduction
 - Fishing Issues
 - Water Quality
 - Contingency Planning
 - Other
15. International Cooperation
16. Core Operations
 - Administration
 - Field Operations
 - National & Regional Program Support
 - Facilities Development

Personnel located within each region to oversee and facilitate collaboration among the sites in that region as well as focus attention on interagency coordination at the regional level.

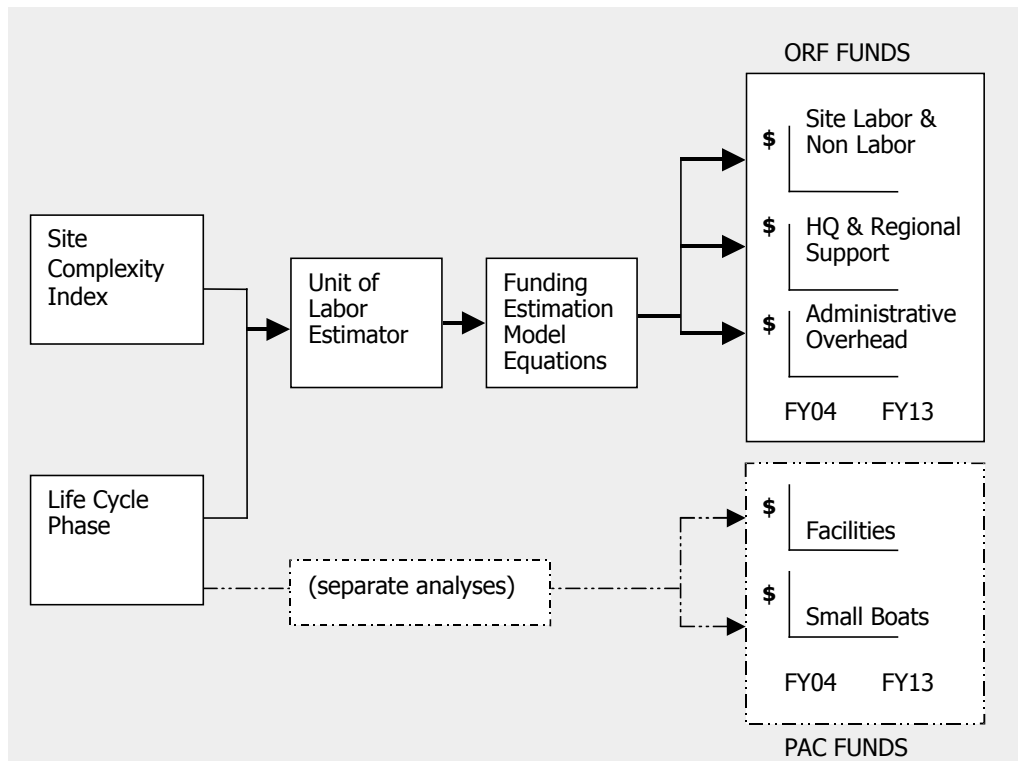
Administrative Overhead (ORF)

The program is part of a larger administrative structure within NOAA and is assessed annually to support organizational requirements of NOAA and the National Ocean Service (NOS).

Facilities Acquisition (PAC)

The program is authorized to acquire and develop physical facilities (land and buildings) to support administrative operations, education and visitor centers, vessel dockage and maintenance, and laboratories. While maintenance and operations of facilities are incorporated within the “site-specific requirements” component of the funding method, funding for facility acquisition is generally provided through a separate Congressional appropriation process. Because of this, facility acquisition is not included directly in the funding framework method, but is an additional component added to the overall funding requirement.

Figure 3. The funding framework method components.



Small Boat Acquisition (PAC)

Vessels are needed to support field operations in offshore locations. Unlike national parks, national marine sanctuaries are entirely underwater, hence a significant amount of program activities are on and in the water. While maintenance and operations of vessels are incorporated within the “site-specific requirements” component of the funding framework, the acquisition of vessels is subject to a separate appropriation process and is not included directly in the framework. Like facilities, vessel acquisition funding needs are considered as an additional component added to the overall funding requirement.

II.3. Defining Funding Framework Estimation Components

The estimation method is comprised of four primary components (Figure 3) – the site complexity index, the life cycle model, unit of labor estimator, and funding estimation equations – that together forecast ORF program requirements over time for site, headquarters, regional, and administrative functions as described above. Facility and small boat acquisition requirements (PAC) are determined through a separate but similar analysis and integrated later in this document to represent total program requirements.

Site Complexity Index (SCI)

This classification scheme represents the diversity of sanctuary sites (Table 4). The index considers site size (very small to very large), management type (ecosystem, cultural or single-species), human use impacts (low to very high), and geographic remoteness (not remote to remote). These four factors are used to assign a single site complexity index for each sanctuary that ranges from very low, low, medium, and high. The site complexity index is very low or low for seven sanctuaries, medium for four sanctuaries, and high for three sanctuaries.

Table 4. Site complexity index (SCI).

Sanctuary	Site Complexity Index	Site Complexity Index Factors			
		Size (Area)	Management Type	Human Uses	Remoteness
Channel Islands	M Medium	medium	ecosystem	high	not remote
Cordell Bank	VL Very Low	small	ecosystem	moderate	not remote
Fagatele Bay	VL Very Low	very small	ecosystem	low	remote
Florida Keys	H High	large	ecosystem	very high	not remote
Flower Garden Banks	L Low	very small	ecosystem	high	remote
Grays Reef	VL Very Low	very small	ecosystem	moderate	not remote
Gulf of the Farallones	M Medium	medium	ecosystem	high	not remote
HI Islands/Humpback Whale Monitor	L Low	medium	single species	low	remote
Monterey Bay	VL Very Low	very small	cultural/heritage	low	not remote
Olympic Coast	H High	large	ecosystem	very high	not remote
Stellwagen Bank	M Medium	large	ecosystem	moderate	not remote
Thunder Bay	M Medium	medium	ecosystem	high	not remote
NW Hawaiian Islands*	L Low	small	cultural/heritage	moderate	not remote
	H High	very large	ecosystem	high	remote

Life Cycle Framework

Six phases describe the evolution of a sanctuary from designation to maturation over a period of approximately 10-20 years. The phases are pre-designation and designation, start-up and early operations, transition (first management plan review), mature operations, recalibration (second management plan review), and adaptive management. Program experience suggests that each site will spend approximately one-to-three years in Phase 1, two-to-five years in Phase 2, one-to-two years in Phase 3, three-to-five years in Phase 4, one year in Phase 5, and two-to-four years in Phase 6. As the site functions and requirements evolve through the life cycle, so do the needed ORF and PAC resources. Table 5 illustrates the status (in 2004) of each sanctuary with respect to its life cycle phase. Descriptions of each life cycle phase are provided in the inset boxes, pages 18-19.

Unit of Labor Estimator

Table 5. Status of sanctuaries (FY04) with respect to life cycle phase.

This component defines the number of staff required to implement the activities associated with each life cycle phase effectively (Table 6). For example, a small, low complexity site at life cycle Phase 1 (pre-designation and designation) only requires four staff, whereas two additional positions are required as it moves into Phase 2 (early operations). Staff estimates are calibrated against historical data within the program.

Funding Estimation Equations

The estimation method uses two relatively simple equations to calculate funding requirements (ORF only) by sanctuary and life cycle phase (Figure 4). The equations estimates site labor costs, and then uses multipliers, based on historical program data, to account for other site support requirements:

The Sanctuary Life Cycle			Sanctuaries in Phase During FY 2004
Phase	Description	Duration (years)	
1	Pre-Designation and Designation	1 to 3	NW Hawaiian Islands*
2	Start Up and Early Operations	2 to 5	Thunder Bay
3	Transition and First Management Plan Review	1 to 2	Cordell Bank Fagatelle Bay Flower Garden Banks Monitor Monterey Bay Olympic Coast Channel Islands Grays Reef Gulf of the Farallones Stellwagen Bank
4	Mature Operations	3 to 5	HI Islands/Humpback Whale
5	Recalibration and Second Management Plan Review	1	none
6	Adaptive Management	2 to 4	Florida Keys

- **Site labor** – an average labor cost is used (based on FY2004 at \$84,000 including benefits and overhead) and adjusted at a 3% annual inflation rate. This rate is multiplied by the unit of labor requirement in Table 6.

Table 6. Unit of labor projections by life cycle phase and site complexity index.

Site Complexity	Index	Life Cycle Phase					
		1	2	3	4	5	6
1 Very Low		4	6	9	12	13	17
2 Low		4	8	10	17	20	25
3 Medium		6	14	16	23	25	32
4 High		6	23	30	40	45	60

- **Site non-labor operations** – approximately 1.4- 2.2 times (x) site labor costs. The lower value keeps the lights on and doors open, while the higher value represents full operational capacity to support site functions. Estimates reflect a midpoint value of 1.8x unless otherwise noted.
- **Headquarters support and regional infrastructure** – approximately 1.25x - 1.35x site labor costs and operations multiplier. The range reflects the extent of HQ and regional support required by the site, based on site complexity. Estimates reflect a midpoint value of 1.30x unless otherwise noted.
- **Administrative services** – a constant 1.22x the total for site operations and HQ/regional support.

- **Facilities and small boat acquisitions** – funding estimates for facility and small boat acquisitions were not derived directly from the funding framework, but instead were calculated through separate analyses that also used the life cycle approach (see references). However, operational maintenance costs have been accounted for through the “site non-labor” multiplier in the funding estimation method.

Figure 4. Funding estimation method formulas for site-based and national program budget requirements

Annual Site Budget =					
Site Labor Units	X	Avg. Labor Costs (\$K)	X	Site Non-Labor Costs (1.4-2.2x) X Inflation (1.03x)	
Annual Program Budget =					
\sum_{14}^1	Site Budgets	X	HQ & Regional Costs (1.3x)	X	Administrative Overhead (1.22x)
NOTE - ORF estimates only - need to add PAC funds for facility and small boat acquisition and construction for total program requirements					

II.4. Defining Data Inputs and Simplifying Assumptions

Nearly all assumptions and data inputs are derived from years of program experience, extensive planning and requirement documents based on the life cycle concept, and recent budget tracking through the realigned AOP. Critical data are summarized in Table 7.

Table 7. Funding framework method input parameter summary

Sanctuary	Site Complexity Index	FY 2004	
		Life Cycle Phase	Unit of Labor Estimate
Channel Islands	MED	3	16
Cordell Bank	VLOW	3	9
Fagatele Bay	VLOW	3	9
Florida Keys	HIGH	6	60
Flower Garden Banks	LOW	3	10
Grays Reef	VLOW	3	9
Gulf of the Farallones	MED	3	16
HI Islands/Humpback Whale	LOW	4	17
Monitor	VLOW	3	9
Monterey Bay	HIGH	3	30
Olympic Coast	MED	3	16
Stellwagen Bank	MED	3	16
Thunder Bay	LOW	2	8
NW Hawaiian Islands*	HIGH	1	6

In addition, a number of simplifying assumptions were made to ensure clarity and ease the presentation of the results to best answer the questions of concern. For example, for multipliers having a range of values (e.g., site non-labor is 1.4x–2.2x site labor costs), a midpoint value (i.e., 1.8x) was used. This means that method results have an inherent variability scaled to the range of the multipliers. Unless otherwise noted, these simplifying assumptions are carried through the remaining analyses:

- Uses an average labor cost (FY2004) at \$84,000
- Uses midpoints, rather than the range, of site non-labor (1.8x) and HQ/Regional (1.3x) multipliers as well as a constant 1.22x for administrative overhead
- Approximately 10-20 years are required for the entire life cycle, from Phase 1 (site pre-designation and designation) through the first iteration of adaptive management (Phase 6)
- Operations, Research and Facility (ORF) funds only

The Evolution of a Sanctuary Through Six Life Cycle Phases

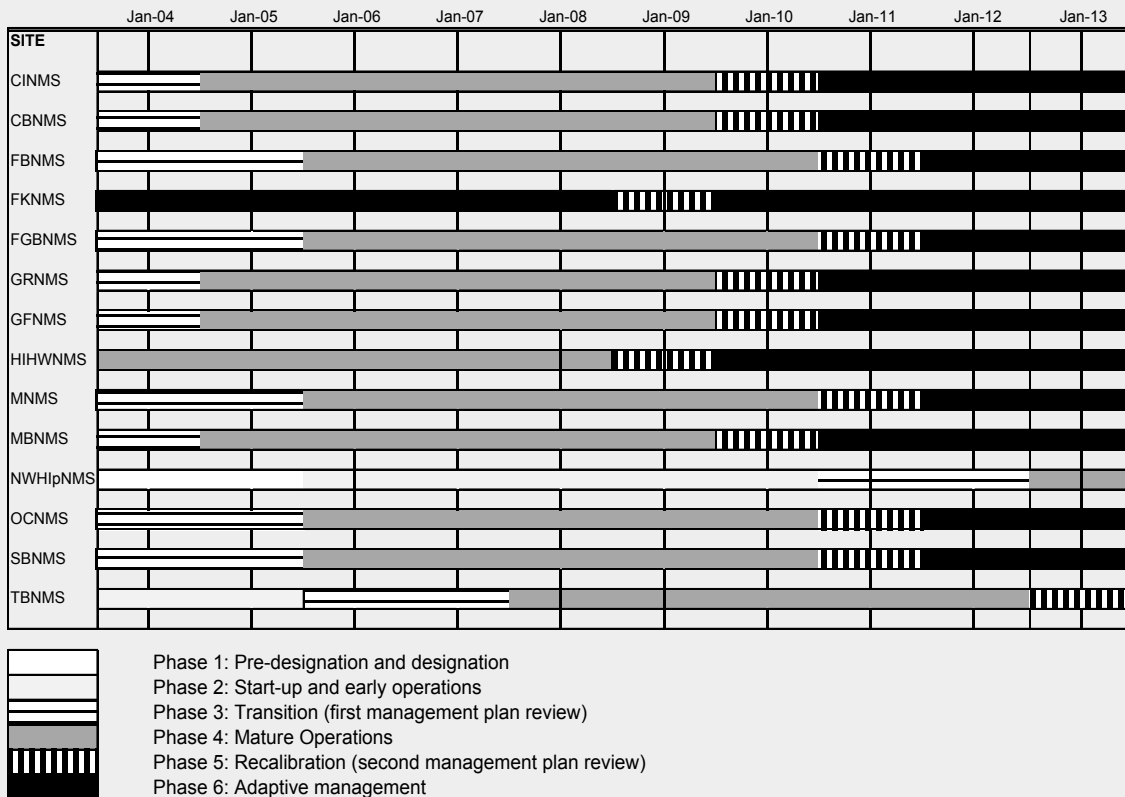
Phase 1: Pre-Designation and Designation (approx. 1-3 years)

During pre-designation, an area identified as a possible sanctuary undergoes a public scoping process to gather information on issues and problems of concern. Once the significant issues have been identified, existing data and information are assembled to describe the resources and qualities of the area under consideration and the threats to them. Additionally, a set of strategies to address these threats, including regulations, is proposed. This process requires considerable public involvement and, in nearly all cases, includes the appointment of a local or regional advisory body to help develop the management plan. Numerous forums, meetings, workshops, and hearings are conducted to maximize the opportunity for public involvement. Once complete, a management plan is developed and guided through the administrative process that ultimately authorizes sanctuary designation.

Phase 2: Start-Up and Early Operations (approx. 2-5 years)

The first few years after designation are focused on building staff and infrastructure and beginning to implement the management plan developed in the designation process. Consistent with that plan, the sites take on the tasks of acquiring and developing facilities, such as offices, visitors centers and laboratories, as well as acquiring vessels needed to support site-based research, education, outreach, and enforcement activities. Professional and administrative personnel are hired to staff the sanctuary. Volunteer programs are developed to supplement the management, monitoring, and education programs. Sanctuary Advisory Councils are established to ensure that effective links to the sanctuary community are established and nurtured.

Figure 5. Anticipated life cycle evolution for designated and proposed sanctuaries



Phase 3: Transition - First Management Plan Review (approx. 1-2 years)

During this phase, a site undergoes the first comprehensive review of the management plan developed during the designation process. At the beginning of this phase, sanctuaries usually have core staff in place, appropriate facilities for basic operations, and one or more vessels to support research and monitoring. Work in the start-up phase has identified the key issues and concerns that need further attention and analysis during the first management plan review. This review is conducted much like the original designation, though it benefits from more than five years of start-up activities, along with a well-developed and informed constituency, and some record of performance in meeting the goals set forth in the original management plan. "State of the Sanctuary" documents are developed to summarize the progress since the original designation. The details of what issues will be addressed in the review are identified in an extensive public input process. The ecological, social, economic, and cultural systems operating within the sanctuary are understood well enough to develop and prioritize action plans within the revised management plan and to identify the funding, personnel, and facilities necessary to effectively implement each element of the plan. This phase ends with the adoption of a revised management plan, including the publication of regulatory changes, if necessary.

Phase 4: Mature Operations (approx. 3-5 years)

After a site has gone through its first management review, it is expected to have reached a "mature" phase of operations and management. It generally will have the staff, facilities, and funding sufficient to support the implementation of primary management goals. New facilities may be constructed to support more sophisticated education and outreach activities that better connect the public as stewards of the sanctuary ecosystem. The ecological, social, economic, and cultural systems operating within the sanctuary are better understood, so that management actions can more effectively address finer-scale subtleties and make more informed decisions regarding use and preservation.

Phase 5: Recalibration - Second Management Plan Review (approx. 1 year)

The entire suite of sanctuary management tools is re-evaluated to determine if they are functioning properly. The second review process evaluates a site's management plan, ensuring that its overall direction and emphasis is focused appropriately. Recalibration broadly examines all sanctuary activities. At this point, managers should have a clear understanding of the ecological, social, economic, and cultural systems operating in the sanctuary and the ecosystem in which it is located. Successful research, monitoring, management, and education and outreach programs are likely to continue with only minor adjustments. This review is conducted more quickly than previous processes, the community having considerable experience in how to best participate, the issues being more clearly identified and the range of response options less expansive.

Phase 6: Adaptive Management (approx. 2-4 years)

The final phase is, in reality, an ongoing process of refining sanctuary management processes, generally on an issue-by-issue basis. The site is constantly evaluating these issues from a more holistic perspective of the sanctuary and surrounding ecosystem. The level of operations has been elevated and management actions have become more sophisticated and more finely tuned. Management strategies are being evaluated and adapted continuously to incorporate new information developed through research and monitoring, as well as to ensure that emerging conservation issues can be addressed effectively. As the ultimate phase of sanctuary evolution, adaptive management involves the greatest challenge, in that sufficient funding, expert and resourceful staff, appropriate facilities and vessels, and effective community involvement are all critical to ensure success.

III. WHAT ARE THE FUNDING REQUIREMENTS TO DESIGNATE AND OPERATE A NATIONAL MARINE SANCTUARY SYSTEM?

This section brings together the four elements of the funding framework method to address the questions concerning the NMSP funding requirements listed above. The sequencing of these questions provides a practical approach to first understand the total program requirement and then to evaluate those requirements in terms of present-day funding allocations and the capacity of the existing system to continue to evolve. Step-by-step application of the estimation method is not provided - only the program results and their interpretations. While the tendency might be to focus on results for those sanctuaries that define the extreme ends of the funding envelope (i.e., a small, less complex site versus a larger, more complex site), it is important to note that 10 of 14 sanctuaries have "site complexity indices" between very low (VL) and medium (M), meaning that resource estimates are generally at the lower end of the funding envelope.

III.1. Developing a Generalized Funding Profile for a Sanctuary

Annual Funding Requirements (ORF) and Variability Among Sanctuaries

Table 8 illustrates the annual funding requirements by life cycle phase and site complexity index. The totals include site labor as well as site non-labor, headquarters/regional and administrative multipliers. The annual funding requirements are not the same for all sanctuaries. Greater resources are needed for sanctuaries with higher site complexity and for those in more mature phases of their life cycle. For example, annual costs for a low complexity site (SCI 2) in Phase 2 of its life cycle (e.g., Thunder Bay) is approximately \$1.92M. In contrast, a medium complexity site (SCI 3) in Phase 3 of its life cycle (e.g., Olympic Coast) requires double the funding. During FY2004, 10 of 14 sites were in life-cycle Phase 3 and nearly all of these have site complexity indices of 1 (very low) to 3 (medium) – thus, the projected annual funding requirement for many sites within the program ranges from \$2.16M to \$3.84M.

Table 8. Annual funding requirements (ORF) and by site complexity index and life cycle phase. Assumes site labor at \$84K, site non-labor at 1.8x, HQ/regional at 1.3x and administrative overhead at 1.22x.

Site Complexity Index		Life Cycle Phase						Number of Sites
		1	2	3	4	5	6	
		1 Very Low	\$0.96	\$1.44	\$2.16	\$2.88	\$3.12	
2 Low	\$0.96	\$1.92	\$2.40	\$4.08	\$4.80	\$6.00	3	
3 Medium	\$1.44	\$3.36	\$3.84	\$4.80	\$6.00	\$7.67	4	
4 High	\$1.44	\$5.51	\$7.19	\$9.59	\$10.79	\$14.39	2	
dollars shown in millions								

III.2. Defining FY2004 Funding Requirements (ORF) for the National Marine Sanctuary System

For each of the 13 designated sanctuaries and the NWHI Reserve, a funding requirement is estimated based on the site complexity index, its life cycle phase during 2004, as described earlier. Table 9 assembles this information for each sanctuary and provides a program total. The method has estimated a total of 233 site-based staff (419 program-wide) and a program budget exceeding \$55.4M are required in FY2004 to fully implement the requirements of the NMSA. These estimates are greater than the actual FY2004 Congressional appropriation (\$47M) and total staff within the program (280).

Table 9. Program funding requirements (ORF) for FY2004. Assumes site labor at \$84K, site non-labor at 1.8x, HQ/regional at 1.3x, and administrative overhead at 1.22x.

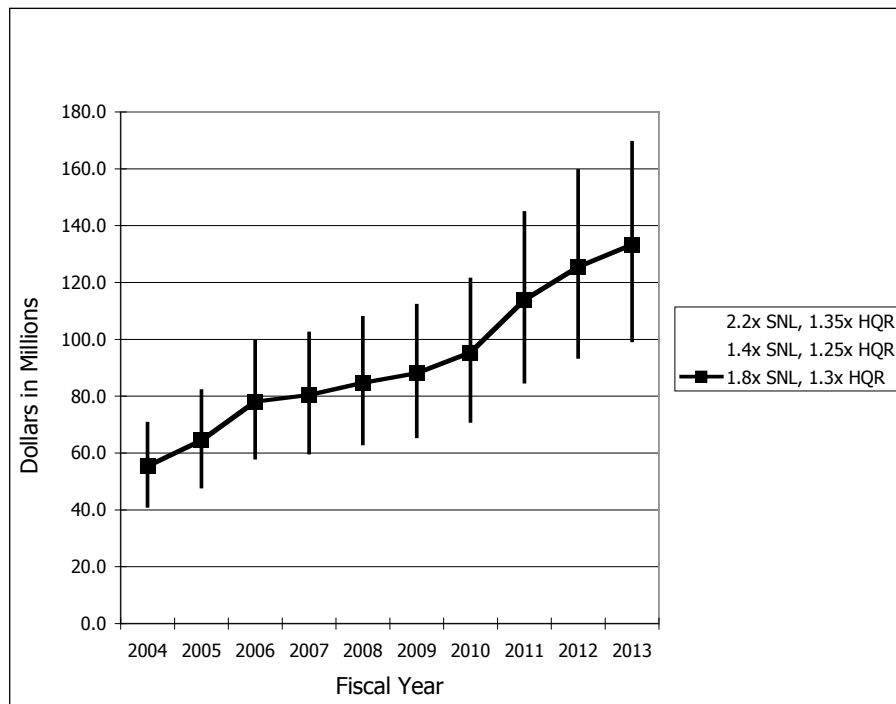
Sanctuary	Site Complexity Index	2004 Life Cycle Phase	2004 Unit of Labor Estimate	Site Funding Requirement (\$K)		
				Site Labor at \$84K	Site Non-Labor at 0.8x	Site Total Labor & Non-Labor
Channel Islands	MED	3	16	1344	1075	2419
Cordell Bank	VLOW	3	9	756	605	1361
Fagatele Bay	VLOW	3	9	756	605	1361
Florida Keys	HIGH	6	60	5040	4032	9072
Flower Garden Banks	LOW	3	10	840	672	1512
Grays Reef	VLOW	3	9	756	605	1361
Gulf of the Farallones	MED	3	16	1344	1075	2419
HI Islands/Humpback Whale	LOW	4	17	1428	1142	2570
Monitor	VLOW	3	9	756	605	1361
Monterey Bay	HIGH	3	30	2520	2016	4536
Olympic Coast	MED	3	16	1344	1075	2419
Stellwagen Bank	MED	3	16	1344	1075	2419
Thunder Bay	LOW	2	8	672	538	1210
NW Hawaiian Islands*	HIGH	1	6	504	403	907
SITE TOTALS	N/A	N/A	231	19404	15523	34927
HQ/Regional (\$34927 * 0.30) SUBTOTAL						10478 45405
Administration (\$45405 * 0.22)						9989
2004 SANCTUARY PROGRAM REQUIREMENT (ORF)						55395

III.3. Defining the 10-Year Funding Requirements (ORF) for the National Marine Sanctuary System

The program’s 10-year funding requirement is expected to increase as more sanctuaries reach mature and adaptive management phases of their life cycles. During any given fiscal year, the total program requirement will depend on the number of sites expected to be within each phase of the life cycle. In 2004, for example, 11 of 14 sites are within Phases 3 and 4. By 2009, 12 of 14 sites are expected to reach Phases 4 and 5, and by 2012, 12 of 14 sites are anticipated to be approaching Phase 6. This assumes that no new sites are added to the system.

Given this anticipated life cycle evolution, Figure 7 illustrates the projected 10-year funding requirement (ORF) for the national system of marine sanctuaries. The result (solid line) includes site labor, site non-labor (1.8x), HQ/regional (1.3x), administrative overhead (1.22x) and assumes an annual inflation rate at 3%. It suggests funding levels approximating \$134M are needed by FY2013 if the program is to be operating at full capacity and achieve its mandated responsibilities. By comparison, the error bars demonstrate the range of this funding estimate, which approaches plus or minus 20%. The lower estimate uses the lowest values in the site non-labor (1.4x) and HQ/regional (1.25x) multipliers, while the higher estimate uses the upper values in the site non-labor (2.2x) and HQ/regional (1.35x) range. At lower funding levels, the program must ensure basic operations occur at individual sites, while higher funding levels permit more comprehensive management of site-based sanctuary resources and the functional integration across sites to better operate as regional and national systems of sites.

Figure 7. Projected funding requirements (ORF) for the National Marine Sanctuary Program for FY2004-13. The solid line reflects the multipliers used in previous figures and tables in this report – i.e., site non-labor (1.8x), HQ/Regional (1.3x), and administration (1.22x). The error bars represent the extreme ends of the funding envelope, showing the minimum and maximum ranges of the site non-labor and HQ/regional multipliers.



III.4. Defining the Funding Requirements (ORF) to Add a New Sanctuary to the Existing System

The National Marine Sanctuary System can expand in two ways – either through Congressional authorization or through the traditional administrative process that uses the Site Evaluation List. Regardless of the expansion method, the costs associated with site designation (and subsequent life cycle phases) are the same and were defined in Table 8. The projected annual costs for site designation (i.e., phase 1) range from \$0.96M to \$1.92M, depending on site complexity. When compared to the Congressionally-appropriated FY2004 budget of \$36M, site designation represents 3-4% of the program funds. The projected annual costs for subsequent life cycle phases are provided in Table 10.

Table 10. Projected funding requirements associated with an additional site added to the national system.

The Sanctuary Life Cycle				Percent of FY2004 Congressional Appropriation (\$36M)
Phase	Phase Duration (years)	Description	Annual Funding Requirement (\$M)	
1	1 to 3	Pre-Designation and Designation	\$0.96-1.44M	3-4%
2	2 to 5	Start Up and Early Operations	\$1.44-5.51M	4-15%
3	1 to 2	Transition and First Management Plan Review	\$2.16-7.19M	6-20%
4	3 to 5	Mature Operations	\$2.88-9.59M	8-27%
5	1	Recalibration and Second Management Plan Review	\$3.12-10.79M	9-30%
6	2 to 4	Adaptive Management	\$4.08-14.39M	11-40%

III.5. Defining Funding Requirements (PAC) for Facilities and Small Boat Acquisitions

Two key elements of the program requirements that are not estimated directly through the funding framework are capital investments in facilities and small boats. Appropriated resources for these infrastructure requirements are through a separate funding mechanism, PAC. These funds are used for new construction, facility alterations, and other real property acquisitions. The program has recently completed two 10-year planning documents that quantify requirements for facilities and small boats, based on a life-cycle element of funding framework.

Estimating Funding Requirements for Facilities and Infrastructure

Facilities provide physical working space for office personnel, including HQ, regional and site-based staff, as well as the associated infrastructure for libraries and archives, conference and training spaces, and boat operations and storage. They also serve as critically important venues for public interaction and stewardship, thus requiring “interpretive” signage and exhibits. Table 11 summarizes a projected \$70M requirement over the next 10 years for facilities and infrastructure for the existing system, as defined by the report, Phase II: Long Range Master Plan for Facilities, Real Property, Signage and Exhibits (2004). This plan was developed by a facilities consulting company and includes a comprehensive inventory of future facility needs. Needs were based on site-specific program requirements, consistent with life cycle principles and site maturation.

Table 11. Program funding requirements (PAC) for facilities, real property, signage and exhibits.

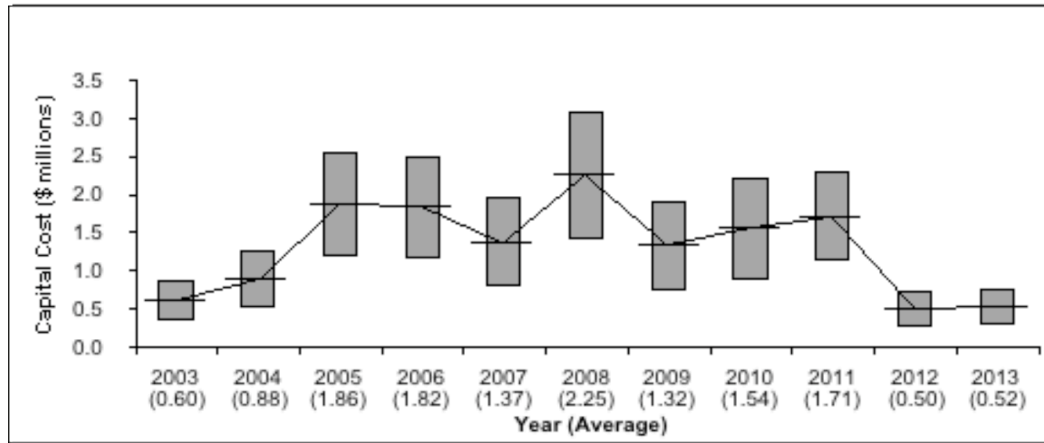
	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	TOTAL
PAC Construction	\$12.0	\$11.8	\$11.4	\$5.6	\$4.9	\$0.7	\$0.6	\$0.3	\$0.3	\$0.0	\$47.6
PAC Exhibits	\$2.1	\$2.7	\$4.8	\$4.2	\$5.3	\$3.2	<0.1	<0.1	\$0.1	<0.1	\$22.4
PAC TOTAL	\$14.1	\$14.5	\$16.2	\$9.8	\$10.2	\$3.9	\$0.6	\$0.3	\$0.4	\$0.0	\$70.0

Estimating Funding Requirements for Small Boats

Program experience has shown there is a critical need to have a presence on the water to ensure effective and efficient sanctuary management and protection of sanctuary resources. Small boats are essential for enforcing sanctuary regulations, monitoring natural and cultural heritage resources, educating the community, emergency response to spills and groundings, and maintenance of sanctuary infrastructure such as buoys and markers. Although core operations and maintenance for small boats, and even some acquisitions, are supported by ORF funds, the program’s requirement for small boats exceed by far the existing capacity. The 2002 report, Small Boat Requirements Study FY2003-2013, the program estimated a \$14.4M requirement for capital costs of new and replacement vessels (Figure 8).

The recommendations of the study were based on trip data collected from each site on the use of existing boats and marine equipment for monitoring, research, education, and enforcement. The program estimated future requirements by applying the six-phase sanctuary life cycle concept to future years (sites in advanced management phases have demonstrated an increased need for vessels). To ground-truth the recommendations, the report’s analyses were reviewed by internal experts and NOAA programs with small boat operations experience, including the NOAA Marine and Aircraft Operations office.

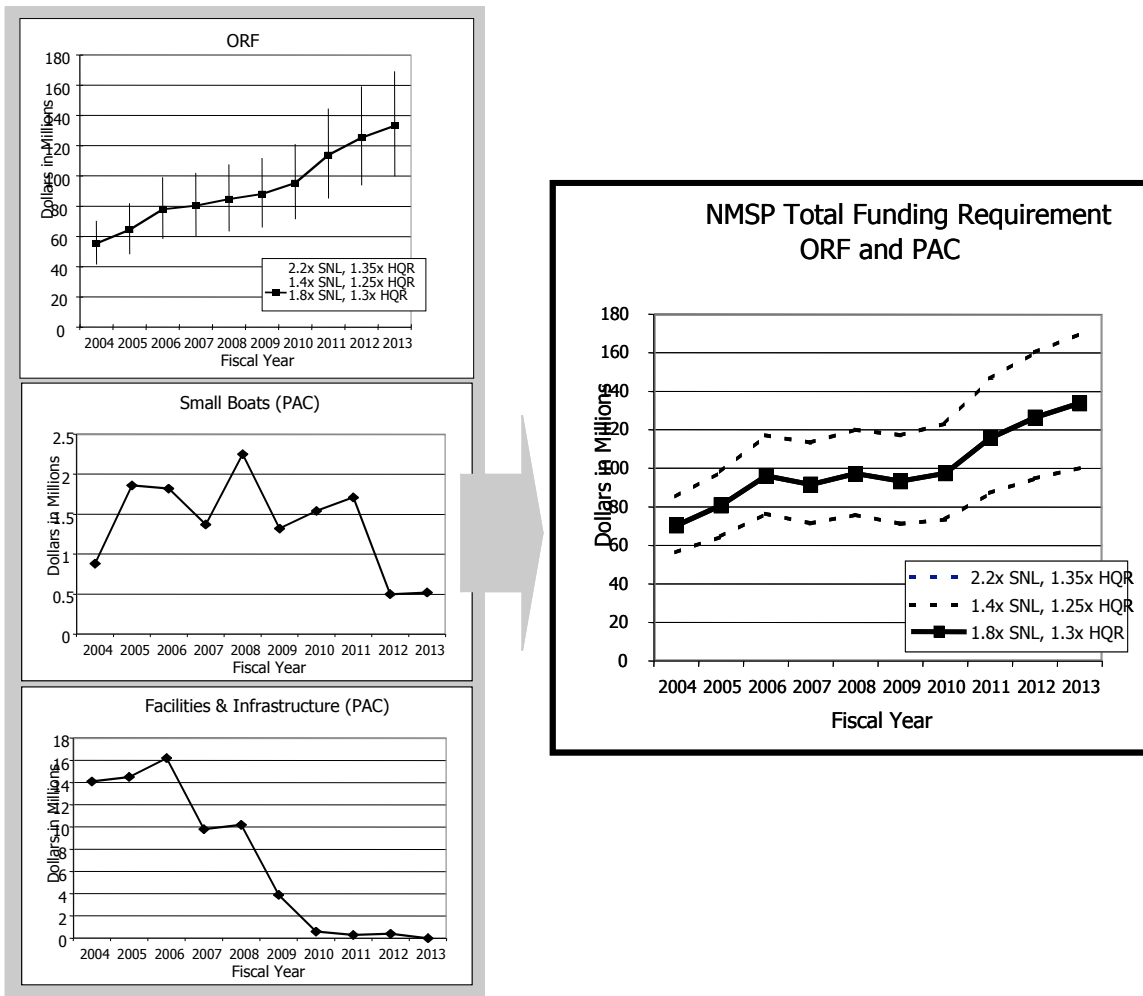
Figure 8. Projected funding requirements (PAC) for new and replacement vessels.



III.6. Defining the Total 10-Year Funding Requirement (ORF and PAC) for the National Marine Sanctuary System

Figure 9 summarizes the total funding requirement for FY2004-FY2013 for the National Marine Sanctuary Program. It brings together the ORF requirements presented previously in Figure 7 and PAC requirements presented in Figure 8 and Table 11. ORF estimates reflect the maturation of individual sites over time. In contrast to FY2004, when 12 of 14 sites are at life cycle stages 1-3, this same number of sites is expected to be operating at phase 6 by FY2013. Moreover, the program will continue to evolve and connect individual sites within regional and national systems of marine sanctuaries.

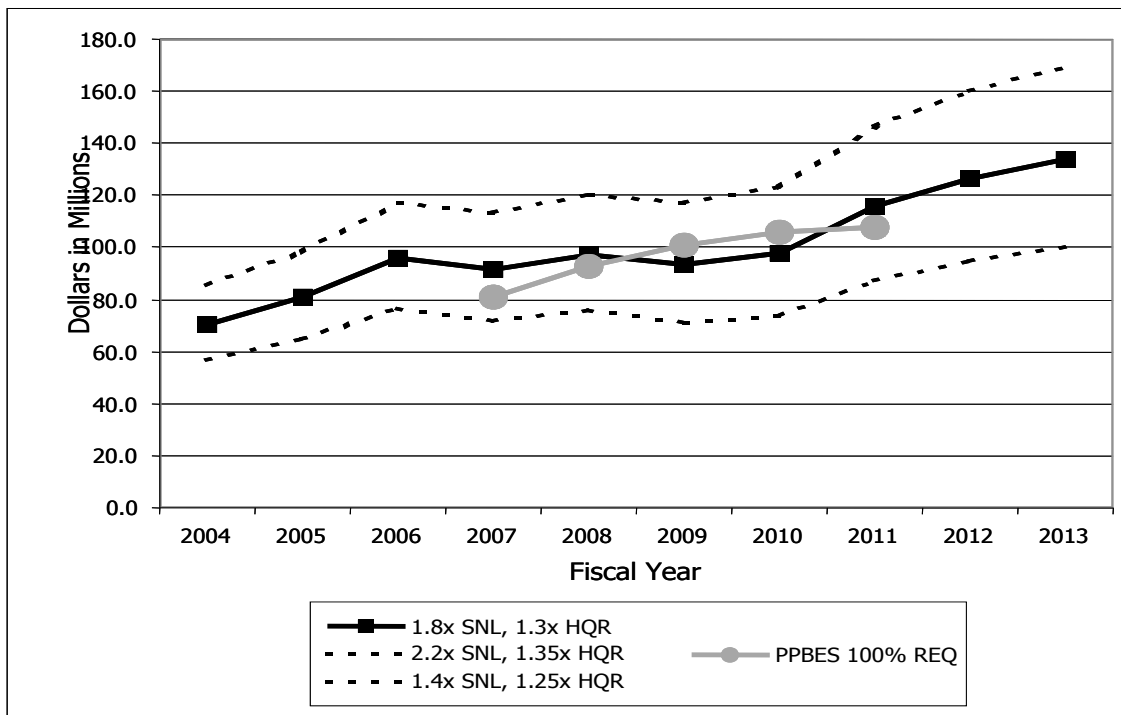
Figure 9. Projected funding requirements (solid line) and estimate of variability (dashed lines) for the National Marine Sanctuary Program for FY2004-2013 (ORF and PAC).



IV. COMPARING FUNDING FRAMEWORK PROJECTIONS TO THE PPBES 100% REQUIREMENT

The Planning, Programming, Budgeting, and Execution System (PPBES) is a new NOAA-wide budget allocation process that provides a unique opportunity to evaluate resource requirements projected by the funding framework method. Initiated in FY04, PPBES established a process for defining a program's "100% requirement" (i.e., staff and money) to achieve its mandated responsibilities. The process required programs to use their mandates as the sole basis for defining their "capabilities" – i.e., "what" the program is required to do and "how" the authorizations prescribe it be accomplished. From this, each NOAA staff and program office defined the "outputs" needed (i.e., products and outcomes) and the performance measures to be used in program evaluation. The final step quantified the "inputs" – in other words, the staff and funding required to develop the outputs, fully-enable the capabilities, and, therefore, fulfill the responsibilities of the mandates. These inputs were termed the program's "100% requirement".

Figure 10. Projected funding requirements (solid line) and estimate of variability (dashed lines) for the National Marine Sanctuary Program for FY2004-13 (ORF and PAC) based on funding framework methods. Superimposed (gray circles) are the program's "100% requirement" for FY07-11 (ORF and PAC), based on NOAA's Planning, Programming, Budgeting and Execution System (PPBES) process (July 2004).



While the PPBES process was more complex than described above, the major components and the logic-path parallel those used in the funding framework method. In the method, all functional capabilities (i.e., the 16 AOP functions) were derived directly from the NMSA and other authorizing legislation, similar to the PPBES method. Outputs defined through the PPBES process were comparable to (and in fact based upon) outcomes and endpoints associated with the "life cycle" phases used in the funding framework method. The method did use a somewhat different method to estimate funding and staffing requirements (i.e., the unit of labor and funding estimation method), but the approach was directly comparable to the "inputs" method of PPBES. Thus, the two approaches were similar in their beginning and end points, as well as their reliance

on the life cycle concept. However, they differed enough in their methodologies and level of detail to provide almost independent funding estimates for the same program.

Figure 10 overlays the PPBES 100% funding requirement (ORF and PAC) for FY07-11 alongside the funding framework estimates previously depicted in Figure 9. The 100% requirement closely tracks the centerline of the funding framework envelope, suggesting good agreement, at the program scale, and additional assurance concerning the validity of the model and its results.

V. CONCLUDING COMMENTS

In contrast to production-oriented programs, natural resource management programs often have endpoints and resource requirements that are difficult to define. However, the funding framework and sanctuary life cycle concept presented in this document are useful tools for understanding and quantifying for planning purposes resource requirements associated with complex NMSP functions. The overall approach taken here effectively estimates resource requirements for the major functions of the program, all of which are explicitly tied to authorizing mandates. Additionally, this analysis benefits from years of data, program experience, and recent tracking of activities, staffing and costs associated with performing the mandated AOP functions.

The valid question, however, remains: How good are the estimates and how can one tell? As stated above, the estimates were developed for "planning purposes," which means that only a certain range of precision and accuracy is necessary. NMSP expects that this range is within plus or minus 20%. What is most important is that the method is sound, repeatable, easy to understand, and can be validated. Fortunately, NOAA has just undergone a budgeting process known as PPBES, which uses a somewhat different method to estimate program funding requirements for FY06-FY10. The funding requirements generated in the PPBES process serve as one form of calibration for those estimated using the funding framework estimation method.

As the sanctuary program continues to gain more experience and data through the revised, mandate-driven AOP structure, and more sanctuaries progress through their life cycle phases, the method will become increasingly more able to identify resource requirements.

VI. GLOSSARY

AOP Annual Operating Plan

HQ Headquarters

NMSA National Marine Sanctuary Act

NMSP National Marine Sanctuary Program

NOAA National Oceanic and Atmospheric Administration

NPS National Park Service

NWHI Northwestern Hawaiian Islands

OMB Office of Management and Budget

ORF Operations, Research, and Facilities

PAC Procurement, Acquisition, and Construction

PART Program Assessment Review Tool

PBBES Programming, Budgeting, and Execution System

USFS United States Forest Service