



## Golden Gate National Recreation Area General Management Plan Cost Estimating

Process, Methodology, Lessons Learned, Recommendations



**DRAFT: September 30, 2008**



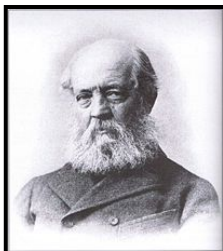
## Agenda

- Background on National Park Service General Management Plans (GMPs)
- The revised process developed for the Golden Gate NRA (GOGA) GMP
- Pilot cost estimating approaches for GOGA
- Issues, challenges, unexpected insights and lessons learned
- Recommendations
- Appendix: Cost Estimating Methodology

## History and context of the NPS General Management Plan

- General management planning is the broadest level of decision making for parks. It represents a shared understanding about the kinds of resource conditions and visitor experiences that will best fulfill the purpose of the park. General management planning is guided by the requirements of NEPA and NHPA, which direct that decisions must be based on adequate analysis, including consideration of a range of reasonable alternatives. GMP updates are generally needed every 15-20 years, or sooner if conditions warrant. Public involvement is strongly encouraged.
- The GMP has its roots in park landscape master plans, which were blueprints for determining the “face” of the park. The process was pioneered in the 1920s by the Park Service's first landscape engineers—Charles P. Punchard, Daniel R. Hull, and Thomas C. Vint—who created a distinctive style and standards of design for roads, trails, and buildings based on naturalistic principles and native materials. Frederick Law Olmstead had a strong influence on Vint.

Right: Frederick  
Law Olmstead



Second from  
right: Central  
Park bridge



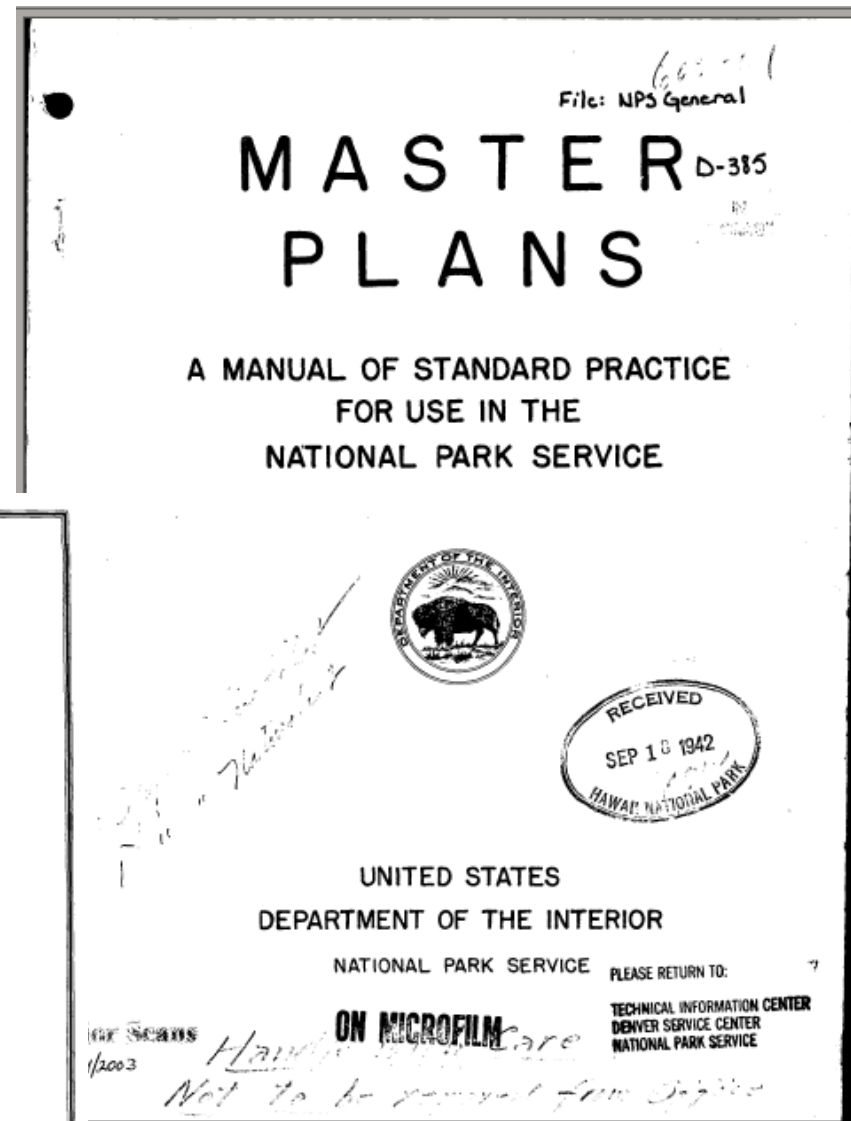
Left: Thomas C.  
Vint

Second from left:  
bridge in Mt.  
Ranier NP

- A 1926 cooperative agreement with the Bureau of Public Roads enabled NPS designers to build state-of-the-art roads while preserving park scenery and harmonizing built features with the natural setting of each park. By the 1930s major design trends were in place, including principles of rustic architecture that ensured harmonious design, construction, and landscape naturalization. At the park level these principles were articulated in master plans that guided park development.

## The Master Plan structure was formalized by NPS in 1941

- A formal, Servicewide structure for developing master plans was produced in 1942.
- The 100+ page Manual of Standard Practice provided extensive, detailed instructions to parks on preparing master plans.
- This is the first standardized template for GMPs known to exist.





**GENERAL DEVELOPMENT PLAN**

**ROCKY MOUNTAIN NATIONAL PARK**

SCALE: 1" = 1 MILE

DATE: 1934

BY: [illegible]

FOR: [illegible]

APPROVED BY: [illegible]

REVISION: [illegible]

LEGEND:

- ROADS: [illegible]
- TRAILS: [illegible]
- DEVELOPMENT AREA: [illegible]
- WORKING WILDERNESS: [illegible]
- RESEARCH AREA: [illegible]
- PARK BOUNDARY: [illegible]

Inset Diagrams:

- Forest Inn
- Horn Lake Lodge
- Fossil Creek Campground
- Bear Lake Lodge
- Meadow Lake Village and Park Entrance
- Wild-Born Campground
- Steeple and Mountain Area
- Hart House
- Horn Lake Lodge
- Fossil Creek Campground
- Bear Lake Lodge
- Meadow Lake Village and Park Entrance
- Wild-Born Campground
- Steeple and Mountain Area
- Hart House





## A major shaper of the modern GMP was the National Environmental Protection Act (NEPA) of 1969

- The passage of NEPA required the consideration of alternative actions by federal agencies, which had a profound impact on the shape of GMPs. The development and evaluation of alternatives is the cornerstone of the modern GMP.
- The development of cost estimates for the alternatives was a common aspect of GMPs by 1974, although the extent and precision of the estimates produced is unclear.

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To meet NEPA requirements federal agencies prepare a detailed statement known as an **Environmental Impact Statement (EIS)**. EPA reviews and comments on EISs prepared by other federal agencies, maintains a national filing system for all EISs, and assures that its own actions comply with NEPA.

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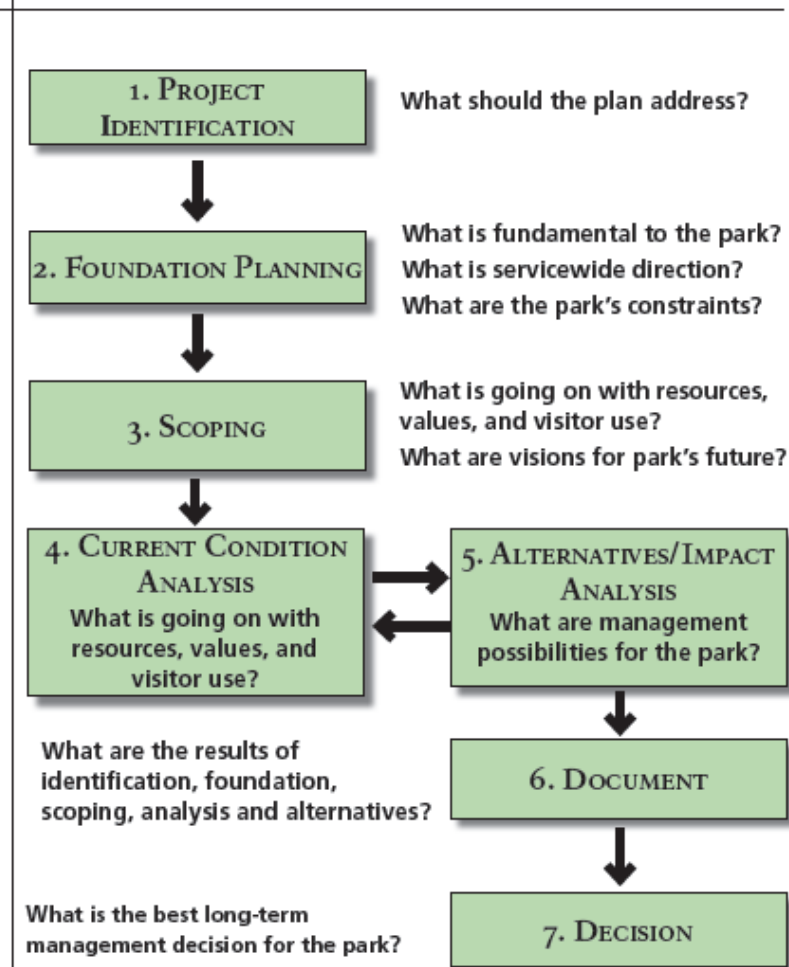




## The standard NPS planning process as it exists today

- The chart at right shows the standard phases of the contemporary NPS planning process, including GMPs, program plans and implementation plans.
- For the development of GMPs, consultants from NPS Community Planning (DSC) are typically engaged in Phase 2.
- Phase 3 focuses on the scoping of issues and preliminary alternatives, and NEPA/NHPA consultation and compliance.
- The focus of Phase 4 is data gathering and the analysis of natural and cultural conditions, socioeconomic conditions, and park operations.
- This review focuses on Phase 5, the analysis of alternatives and impacts.

### *PLANNING PROCESS CHART*





## Data gathering begins in Phase 1: Project Identification

PLANNING PROCESS STEPS CHART			
Steps	GMP	Program plans (RSS, CIP)	Implementation plans (FMP, etc.)
<b>1. PROJECT IDENTIFICATION</b>			
Internal scoping to identify issues	X	X	X
Identify need for action/plan	X	X	X
Identify project plan/goals and objectives	See program standards	See program standards	Project specific
Assemble interdisciplinary team	X	X	X
Enter project into Planning, Environment, and Public Comment (PEPC) system; check for related documents and initiate ESF	X	X	X
Begin project agreement and develop public involvement strategy	X	Maybe	Maybe
Identify information gaps and gather needed data	X	X	X
<b>2. FOUNDATION</b>			
Conduct Foundation Workshop	X	Maybe, if existing GMP, reaffirm	Maybe, if existing GMP, reaffirm
- purpose			
- significance			
- fundamental and important resources and values			
- interpretive themes, special mandates and servicewide laws and policies			
<b>3. SCOPING</b>			

*Need to explain here what kind of data is gathered and for what purpose. How is this data collected, managed, used and updated? -FR*

GMP PLANNING PROCESS STEPS CHART			
1. Project Identification			
Steps	GMP	Program Plans	Implementation Plans
1. Internal scoping to identify issues	X	X	X
2. Identify need for action/plan	X	X	Maybe
3. Identify project plan/plan goals and objectives	See program standards	See program standards	Project specific
4. Assemble interdisciplinary team	X	X	X
5. Enter project into Planning, Environment, and Public Comment (PEPC) system; check for related documents and initiate ESF	X	X	X
6. Begin project agreement and develop public involvement strategy	X	Maybe	Maybe
7. Identify information gaps and gather needed data	X	X	X
8. Prepare ROD to public	X		Maybe
9. No-action period to public	X		Maybe
10. Prepare ROD	X		Maybe
11. Review/approve ROD	X		Maybe
12. Federal Register NOA	X		Maybe
13. Release ROD/final plan to public	X		Maybe

## Data gathering continues in Phase 3: Alternatives/Impact Analysis

*Need to explain what's happening here. Does this data gathering build on data gathering from Phase 1? Same questions: what kind of data is gathered & for what purpose? How is this data collected, managed, used and modified? Are cost estimates even considered at this point? Is data collected primarily for NEPA/NHPA? - FR*

PLANNING PROCESS STEPS CHART

Steps	GMP	Program plans (RSS, CIP)	Implementation plans (FMP, etc.)
<b>1. PROJECT IDENTIFICATION</b>			
Internal scoping to identify issues	X	X	X
Identify need for action plan	X	X	X
Identify project plan goals and objectives	See program standards	See program standards	Project specific
Assemble interdisciplinary team	X	X	X
Enter project into Planning, Environment, and Public Comment (PEPC) system; check for related documents and initiate ESF	X	X	X
Begin project agreement and develop public involvement strategy	X	Maybe	Maybe
Identify information gaps and gather needed data	X	X	X
<b>2. FOUNDATION</b>			
Conduct Foundation Workshop	X	Maybe, if existing GMP, reaffirm	Maybe, if existing GMP, reaffirm
- purpose			
- significance			
- fundamental and important resources and values			
- interpretive themes, special mandates and servicewide laws and policies			
<b>3. SCOPING</b>			
Prepare NOI	X		Maybe
External scoping with public and partners on values, issues, and preliminary alternatives	Alts will be do a plan and no-action		X
Finalize project agreement? /upload to PEPC, update ESF	X		X

GMP PLANNING PROCESS STEPS CHART

3. Alternatives/Impact Analysis			
Steps	GMP	Program Plans	Implementation Plans
1. Prepare NOI	X		Maybe
2. External scoping with public and partners on values, issues, and preliminary alternatives.	Alts will be do a plan and no action		X
3. Preliminary consultation with other agencies (§106, §107)	X	X	X
4. Determine appropriate NEPA pathway	X		X
5. If EA, issue Federal Register NOI retraction (GMP)	X		
6. Continue data inventory	X		X
7. Finalize project agreement? /upload to PEPC, update ESF			Maybe
8. Analyze scoping comments to identify major questions to be answered by the plan and environmental issues/impact topics	X		X
9. Feedback to public	X		Maybe

## Phase 5 of the GMP process: Alternatives/Impact Analysis

PLANNING PROCESS STEPS CHART

Steps	GMP	Program plans (RSS, CIP)	Implementation plans (FMP, etc.)
<b>1. PROJECT IDENTIFICATION</b>			
Internal scoping to identify issues	X	X	X
Identify need for action/plan	X	X	X
Identify project/plan goals and objectives	See program standards	See program standards	Project specific
Assemble interdisciplinary team	X	X	X
Enter project into Planning, Environment, and Public Comment (PEPC) system; check for related documents and initiate ESF	X	X	X
Begin project agreement and develop public involvement strategy	X	Maybe	Maybe
Identify information gaps and gather needed data	X	X	X
<b>2. FOUNDATION</b>			
Conduct Foundation Workshop	X	Maybe, if existing GMP, reaffirm	Maybe, if existing GMP, reaffirm
- purpose			
- significance			
- fundamental and important resources and values			
- interpretive themes, special mandates and servicewide laws and policies			
<b>3. SCOPING</b>			
Prepare NOI	X		Maybe
External scoping with public and partners on values, issues, and preliminary alternatives	Alt. 1 and 2		X

GMP cost estimating begins once the process is well advanced

GMP PLANNING PROCESS STEPS CHART

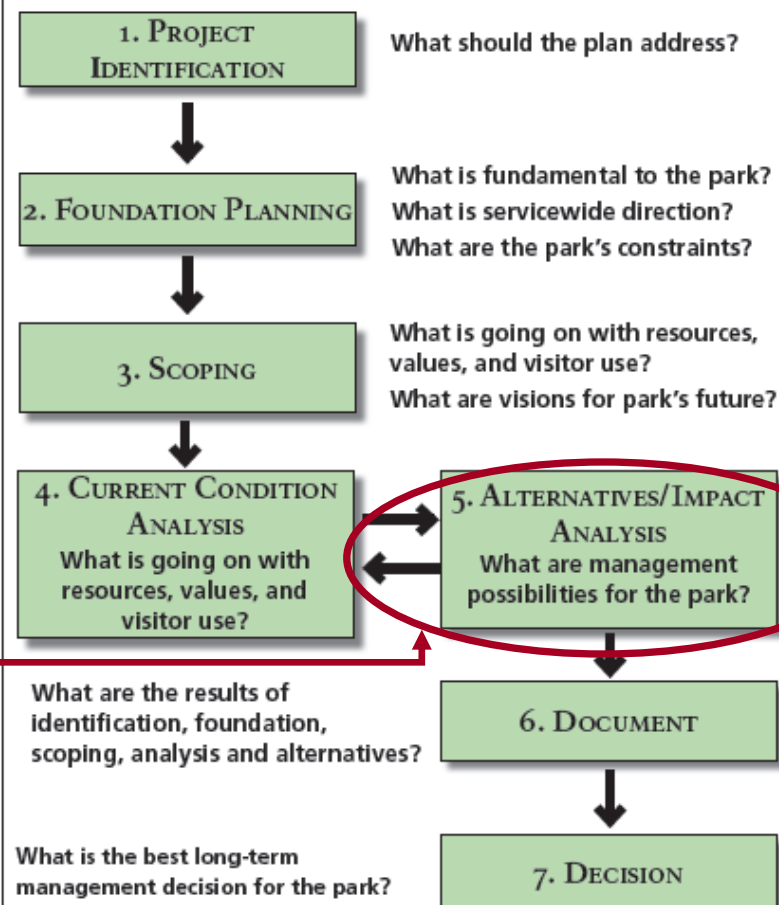
5. Alternatives/Impact Analysis			
Steps	GMP	Program Plans	Implementation Plans
1. Identify alternative concepts (GMP) or alternatives (implementation plan) to resolve issues	X		X
2. Define desired conditions by management	X		Maybe
3. Develop alternative zoning maps	X		
4. Define area-specific desired conditions for each alternative	X		
5. Finalize indicator and standards for user capacity	X		X
6. Region and/or WASO review of range of alternatives	X		Maybe
7. Public scoping on alternatives			X
8. Analyze scoping comments	X		Maybe
9. Analyze environmental impacts	X		X
10. Estimate costs of alternatives	X		X
11. Identify environmentally preferred alternative			X
12. Select preferred alternative (CBA, value analysis)	X		X
13. Region and/or WASO review of preferred	X		Maybe



## Cost estimating for GMPs occurs in Phase 5

- During Phase 5 the DSC Community Planning consultant reviews the alternatives matrix and creates a table of actions that would incur costs.
- Park managers are asked to provide estimates drawing from their historic / institutional knowledge and FMSS.
- If they can't, the DSC will fill in any blanks. Sources of information include interviews with construction experts, landscape architects, and parks with comparable projects. Web research is commonly done.
- The sole tool used by the DSC has been the CRV calculator. These efforts have produced Class D estimates. RS Means and CESS have not been previously used.

### *PLANNING PROCESS CHART*







## Choosing By Advantages: selecting the preferred alternative

- Phase 5 culminates in the Choosing By Advantages workshop, which brings park managers together to evaluate the advantages of each GMP alternative that has been identified.
- The purpose of the workshop is to identify the *preferred* alternative by assigning quantitative summary measures to each alternative. Cost estimates are used to help evaluate the advantages of each alternative.
- For example, one alternative might earn a higher point total than the others because it provides the greatest advantages, but ultimately be rejected because the cost is prohibitive.
- Alternatives can be improved, and receive higher point totals, by incorporating advantages from other alternatives. Cost can help decide the viability of new combinations.

Choosing By Advantages Summary Table

MUIR WOODS NATIONAL MONUMENT – CBA SUMMARY TABLE						
Factors	No Action	1. Connecting People	2. Coastal Ecosystems	3. National Treasures		
1. Strengthen the integrity and resiliency of coastal ecosystems.						
Advantage:		0	40	100	20	(50)
		More creek and floodplain restoration even though "natural" zone is larger, creek is not included in natural zone	Substantially more strengthening of the resiliency of the coastal redwood forest ecosystem, including a high degree of creek restoration. More forest restoration in Camino del Cañon and less risk of fire and other impacts as a result of overnight use.	Slightly more creek restoration		
2. Strengthen the integrity of the resources that contribute to the National Register of Historic Places and National Historic Landmarks.						
Advantage:		35	60	0	85	(60)
	Better retention and preservation of built historic features (Camp Hillwood maintained but not exhibited)	Much better retention, preservation and condition improvements to built historic features (rehab Camp Hillwood), removing non-historic structures to enhance cultural landscape			Substantially better retention, preservation and condition improvements to built historic features	
3. Support a diversity of recreational opportunities and national park experiences, appropriate to MUWO (Diverse ways to experience the primeval forest).						
Advantage:		40	75	0	70	(75)
	More diversity of national park experiences, settings, trails and visitor facilities	Very much more diversity of national park experiences, settings, trails, and visitor facilities and day-uses (adds Camino del Cañon)			Much more diversity of national park experiences, settings, trails and visitor facilities (balances recreation and preservation)	
4. Improves and promotes public understanding of park resources, NPS values and identity.						
Advantage:		40	60	0	70	
	Slightly better opportunities interpret NPS values but with more limited facilities and in less appropriate locations - currently a gateway to the park	Better opportunities to reach a range of visitors with education, interpretive and stewardship facilities and programs, such as a broader story, gateway to the park and NPS			Much better opportunities to provide focused and improved understanding of park values (preservation) to a broad audience. Intensive effort to engage people.	
5. Provide visitors with a safe and enjoyable access and circulation to and within the park.						
Advantage:		0	70	30	70	
		Much better at providing diverse options (car, transit, tour buses) to access the park, enhances visitor entry experience, while retaining broad access within the site	Better entry experience, but provides one primary option (transit) for visitor access and limits access within the site		Same as Alternative 1	
Total Score		115	305	130	315	(345)
Cost (capital and restoration costs)						



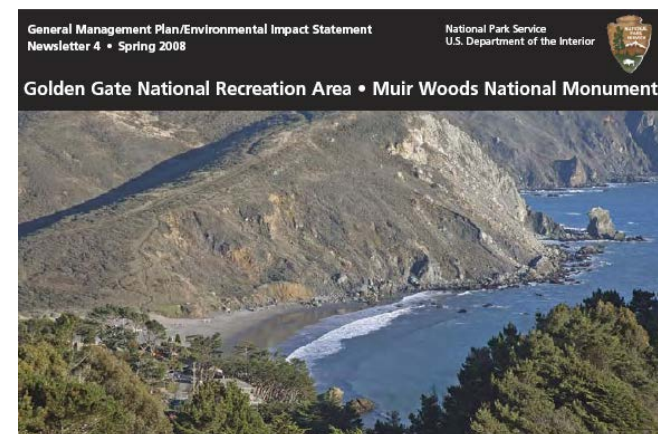
## Agenda

- Background on National Park Service General Management Plans
- The revised process developed for the GOGA GMP
- Pilot cost estimating approaches for GOGA
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- Appendix: Cost Estimating Methodology

## The GOGA General Management Plan (GMP) outlined potential park initiatives grouped under three distinct alternatives

### ■ Connecting people to parks

- The emphasis of this concept is to reach out and engage the community and other potential visitors in the enjoyment, understanding, and stewardship of the park's resources and values.
- Park management would focus on ways to attract and welcome people, connect people with the resources, and promote understanding, enjoyment, preservation, and health—all as ways to reinvigorate the human spirit. Visitor opportunities would be relevant to diverse populations now and in the future.



### ■ Preserving and Enjoying Coastal Ecosystems

- The emphasis of this concept is to preserve, enhance and promote dynamic and interconnected coastal ecosystems in which marine resources are valued and prominently featured.
- Recreational and educational opportunities would allow visitors to learn about and enjoy the coastal and marine environments, and gain a better understanding of the region's international significance and history.

### ■ Focusing on National Treasures

- The emphasis of this concept is to focus on the park's nationally important natural and cultural resources. The fundamental resources of each showcased site would be managed at the highest level of preservation to protect their value in perpetuity and to promote appreciation, understanding, and enjoyment.
- The National Park Service would prominently support resource preservation and educational goals. Visitors would have the opportunity to explore the wide variety of experiences that are associated with many different types of national parks – all in this park. All other resources would be managed to complement the nationally significant resources and visitor experiences.



## The modified process piloted at GOGA

- After establishing desired future conditions and park management zones, the park Core Planning Team looked at all park facilities within the context of those management zones and the desired future conditions. Park managers brainstormed facility projects that would help achieve desired future conditions.
- In addition to new construction, repair and rehabilitation, the GOGA Core Planning Team emphasized the disposal of underutilized and excess assets.
- The Core Planning Team identified a need for comprehensive, quality cost estimates to help inform the adoption of the preferred alternative for the GMP.

GMP PLANNING PROCESS STEPS CHART			
5. Alternatives/Impact Analysis			
Steps	GMP	Program Plans	Implementation Plans
1. Identify alternative concepts (GMP) or alternatives (implementation plan) to resolve issues	X		X
2. Define desired conditions by management	X		Maybe
3. Develop alternative zoning maps	X		
4. Define area-specific desired conditions for each alternative	X		
5. Finalize indicator and standards for user capacity	X		X
6. Region and/or WASO review of range of alternatives	X		Maybe
7. Public scoping on alternatives			X
8. Analyze scoping comments	X		Maybe
9. Analyze environmental impacts	X		X
10. Estimate costs of alternatives	X		X
11. Identify environmentally preferred alternative			X
12. Select preferred alternative (CBA, value analysis)	X		X
13. Region and/or WASO review of preferred	X		Maybe

Facilities were examined within the context of management zones and desired future conditions

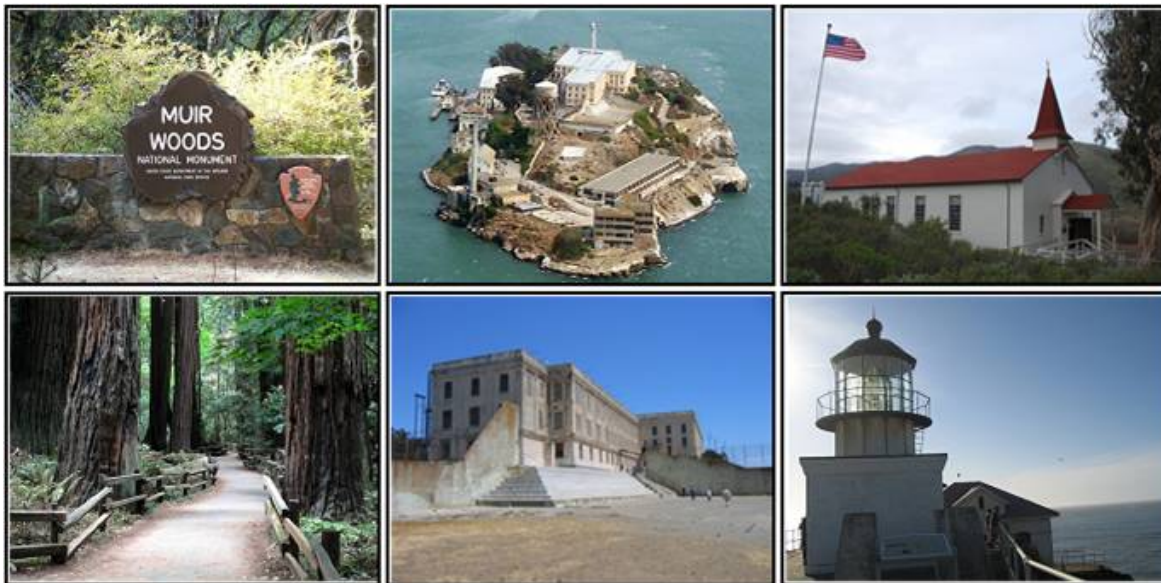
Disposal of excess & underutilized assets was emphasized

Cost estimates applied

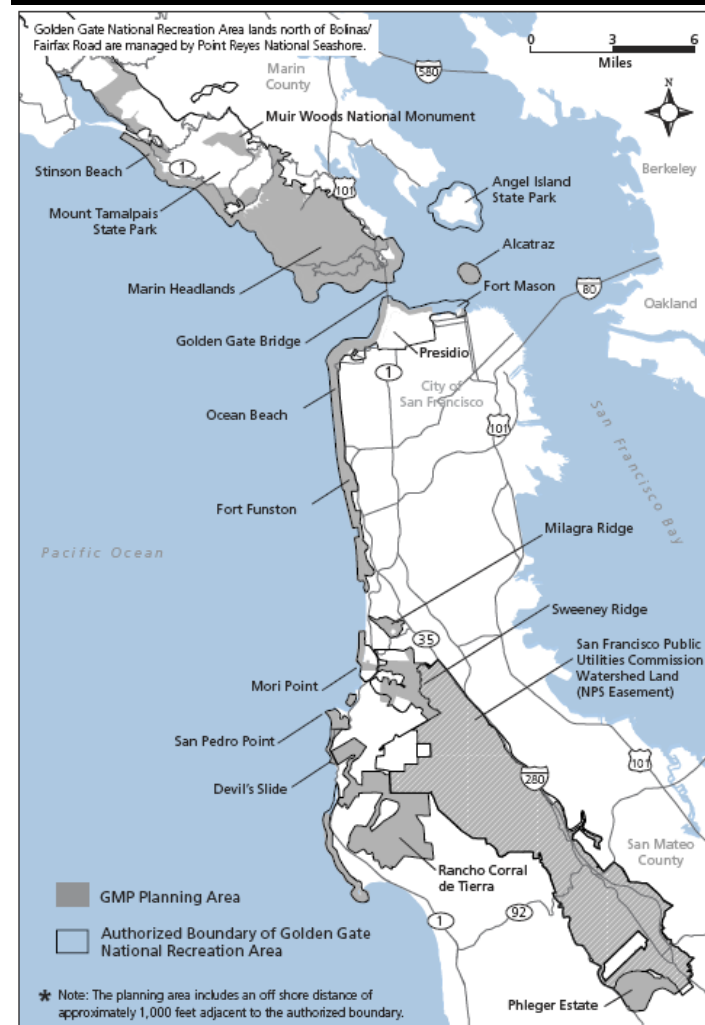


## The consideration of alternatives was applied to NPS facilities within the legislative boundaries of GOGA NRA and Muir Woods

- Desired conditions for facilities were analyzed within 14 geographic zones, which were bundled into three primary areas for the consideration of alternatives:
  - Muir Woods projects
  - Alcatraz Island projects
  - GOGA parkwide projects
- High-level project details were documented and aligned with the appropriate alternative, or theme



### Planning Area Map





## Agenda

- Background on National Park Service General Management Plans
- The revised process developed for the GOGA GMP
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- Issues, challenges, unexpected insights and lessons learned
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## The GOGA GMP projects assigned various project prescriptions across a range of asset types

- The objective of the GOGA GMP cost estimating effort was to provide the park with three cost components:

- The initial cost of the project
- The annual operations and maintenance (O&M) cost of the assets
- The amount of deferred maintenance avoided by implementing the project

- The initial cost of the project was categorized into three options:

- Construction of new assets
- Rehabilitation of existing assets
- Removal of low mission support assets

- Projects targeted different asset types:

- Buildings
- Housing units
- Roads/ Parking Areas
- Trails
- Maintained Landscapes
- Utilities (Water/ Waste Water systems)
- Non-industry standard (Fortifications, Amphitheaters, etc.)

GOGA GMP Project Prescriptions by Asset Type				
Asset Type	New Construction	Rehabilitation	Disposition	O&M
Buildings	✓	✓	✓	✓
Housing	✓	✓	✓	✓
Roads/ Parking Areas	✓	✓	✓	✓
Trails	✓	✓	✓	✓
Maintained Landscapes	✓	✓		✓
Utilities	✓	✓	✓	✓
Marinas		✓		✓
Monuments/Memorials		✓		✓
Fortifications		✓	✓	✓
Amphitheaters	✓			✓



## The GOGA GMP resulted in roughly 269 projects that required cost estimates

- Projects for existing assets included assets of historic and cultural significance and
  - **Military Fortifications:** The park includes one of the largest and most complete collections of military installations and fortifications in the country, dating from Spanish settlement in 1776 through the 20th century.
  - **Alcatraz Buildings:** Alcatraz Island, the site of pre-Civil War fortifications, was the nation's first military prison, later became the most notorious maximum security penitentiary in the United States, and subsequently was the site of the occupation that helped ignite the movement for American Indian self determination
- Projects also focused on natural restoration of park land
  - The coastal headlands of the Golden Gate are internationally recognized for their outstanding scenic quality. They serve as the panoramic backdrop to the metropolitan San Francisco Bay Area and contribute to the quality of life for area residents and visitors.
  - The remnant undeveloped coastal corridor of marine, estuarine, and terrestrial ecosystems supports exceptional native biodiversity and provides a refuge for one of the largest concentrations of rare, threatened and endangered species in the national park system.

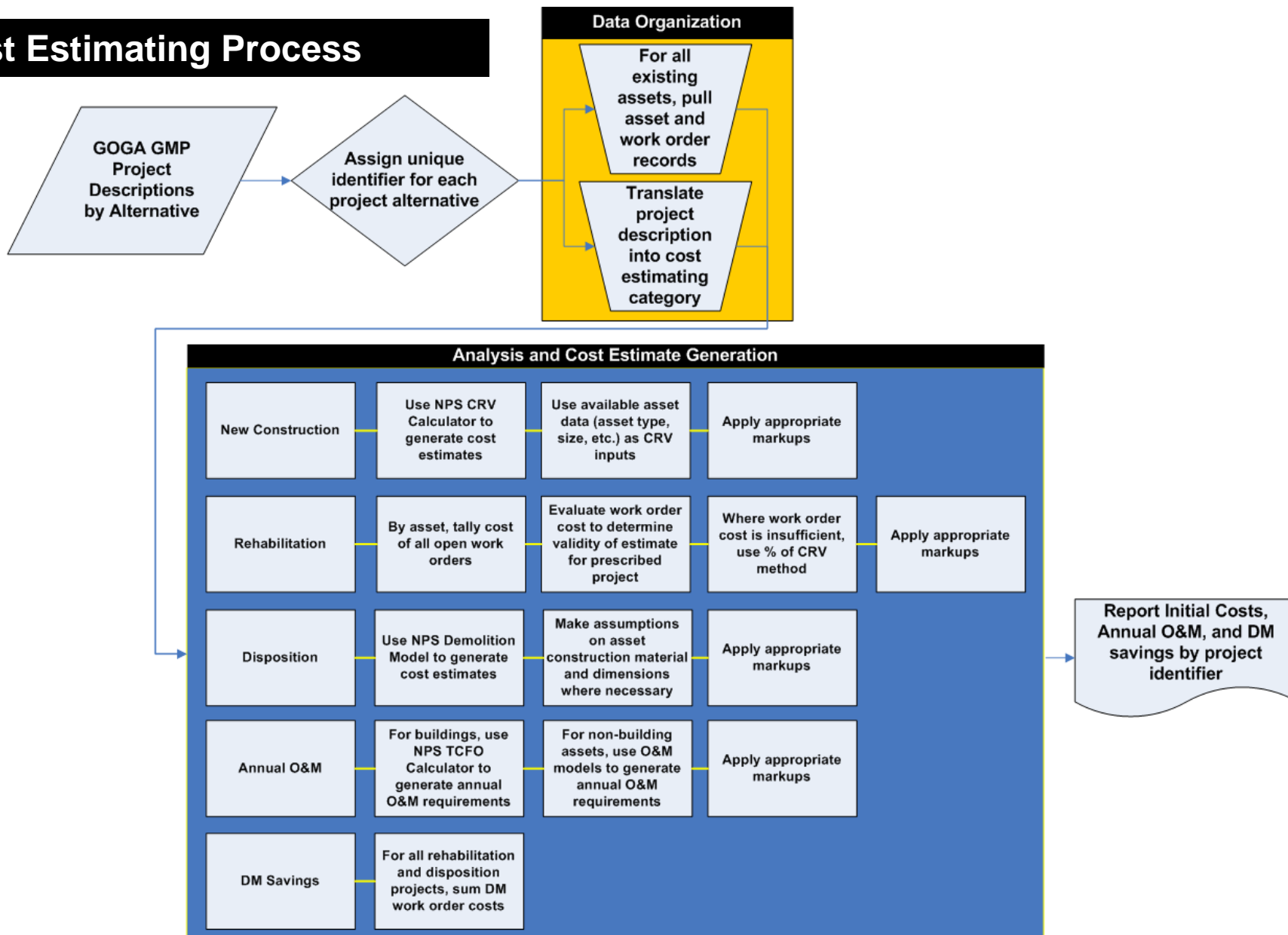
Number of Projects Requiring Cost Estimates				
Park Unit	Alt 1	Alt 2	Alt 3	Total
GOGA	82	48	64	194
MUWO	13	17	12	42
Alcatraz	11	11	11	33
Total	106	76	87	269

Number of Unique Cost Estimate Data Points				
Park Unit	Alt 1	Alt 2	Alt 3	Total
GOGA	414	318	524	1256
MUWO	100	63	17	180
Alcatraz	27	26	27	80
Total	541	407	568	1516





## GOGA Cost Estimating Process



## In order to generate the cost estimates, new and existing NPS tools were applied

- Existing Tools
  - Current Replacement Value (CRV) Calculator
  - Operations and Maintenance (O&M) Calculator
- Newly Deployed Tools
  - Total Cost of Facility Ownership (TCFO) Calculator
  - Demolition Cost Model
- NPS Asset Data
  - Facility Management Software System (FMSS) Work Orders
  - Project Management Information System (PMIS) data
- NPS tools incorporate industry standard data from various sources: RSMeans (2008), Whitestone Building Operations Cost Reference (2007-2008), International Facility Management Association (IFMA), American Water Works Association (AWWA), Federal Highways Administration standards
- NPS FMSS work orders were used to obtain work order cost estimates for existing asset deficiencies





## Total Cost of Facility Ownership (TCFO) Calculator

- Calculates the Total Cost of Ownership (TCO) for assets based on surface, equipment and operational selections from a pick list of asset components
- Provides a model for calculating the lifecycle costs for the asset, excluding disposition costs:
  - Utilizes historical data and best practices to pre populate components commonly used in the NPS portfolio
  - Generates room and equipment lists based on O&M Model data
  - Allows user the possibility of altering core data inputs through adjustment of layout, surface and equipment
  - Checks the selected components against total size for possible errors in scoping
  - Calculates both nominal and real costs across the assets lifecycle

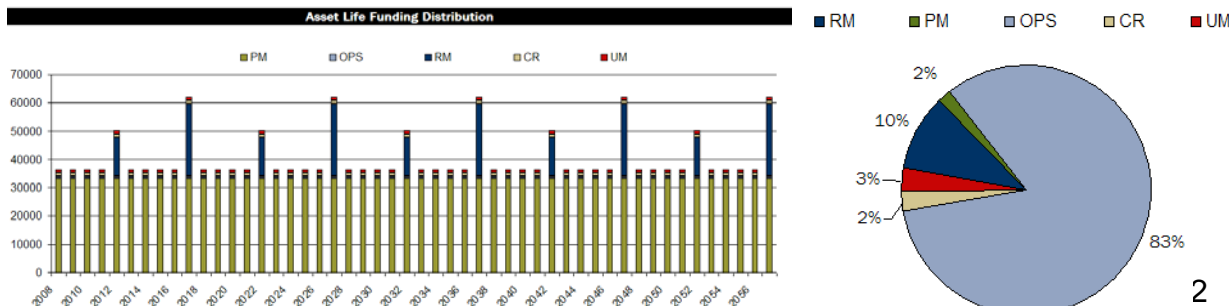
### TCFO Calculator Screenshots

Legend		Building Surfaces		Building Equipment																																																													
		Surface	Surface Type	Equipment	Type																																																												
Required user input																																																																	
Optional user input																																																																	
<p><b>Project Information</b></p> <p>Location of Asset by Park: GQG1</p> <p>Building Type: Administration Building</p> <p>Year Built: 2008</p> <p>Building Size (S.F.): 40000</p> <p>Design and construction cost: \$60,000</p> <p>Inflation factor: 2.00%</p> <p>Expected Life (in yrs): 50</p>																																																																	
<p><b>Building Specifications</b></p> <p>Exterior Walls: 6400 (S.F.)</p> <p>Roof: 51640 (S.F.)</p> <p>Exterior Doors: 6</p> <p>Exterior Windows: 24</p>																																																																	
<p><b>Rooms</b></p> <table border="1"> <thead> <tr> <th>Rooms</th> <th># Rooms</th> <th>Room Type</th> <th>Size (S.F.)</th> <th>Ceiling</th> <th>Height</th> </tr> </thead> <tbody> <tr> <td>Hallway</td> <td>2</td> <td></td> <td>6707</td> <td>8</td> <td></td> </tr> <tr> <td>Kitchen</td> <td>1</td> <td></td> <td>4039.23</td> <td>8</td> <td></td> </tr> <tr> <td>Multi-Purpose Room</td> <td>1</td> <td></td> <td>2280.13</td> <td>8</td> <td></td> </tr> <tr> <td>Office</td> <td>7</td> <td></td> <td>8355.68</td> <td>8</td> <td></td> </tr> <tr> <td>Restroom, staff</td> <td>2</td> <td></td> <td>2551.04</td> <td>8</td> <td></td> </tr> <tr> <td>Storage Room</td> <td>1</td> <td></td> <td>3635.40</td> <td>8</td> <td></td> </tr> <tr> <td>Training Room</td> <td>2</td> <td></td> <td>10051.52</td> <td>8</td> <td></td> </tr> <tr> <td>Work Room</td> <td>1</td> <td></td> <td>2280.13</td> <td>8</td> <td></td> </tr> <tr> <td colspan="5">Total (S.F.):</td> <td>40000</td> </tr> </tbody> </table>						Rooms	# Rooms	Room Type	Size (S.F.)	Ceiling	Height	Hallway	2		6707	8		Kitchen	1		4039.23	8		Multi-Purpose Room	1		2280.13	8		Office	7		8355.68	8		Restroom, staff	2		2551.04	8		Storage Room	1		3635.40	8		Training Room	2		10051.52	8		Work Room	1		2280.13	8		Total (S.F.):					40000
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<p><b>Building Surfaces</b></p> <p>Building Exterior: Exterior walls: WOOD SHEET SIDING</p> <p>Exterior doors: ALUMINUM</p> <p>Exterior windows: ALUMINUM</p> <p>Hallway: Roof: ASPHALT SHINGLE</p> <p>Interior walls: PAINTED DRYWALL</p> <p>Ceiling: PAINTED DRYWALL</p> <p>Floor: SHEET VINYL</p> <p>Kitchen: Interior walls: PAINTED DRYWALL</p> <p>Ceiling: ACOUSTIC TILE</p> <p>Floor: QUARRY TILE</p> <p>Multi-Purpose Room: Interior walls: PAINTED DRYWALL</p> <p>Ceiling: PAINTED DRYWALL</p> <p>Floor: CARPET</p> <p>Office: Interior walls: PAINTED DRYWALL</p> <p>Ceiling: PAINTED DRYWALL</p> <p>Floor: CARPET</p> <p>Restroom, staff: Interior walls: PAINTED DRYWALL</p> <p>Ceiling: PAINTED DRYWALL</p> <p>Floor: QUARRY TILE</p> <p>Storage Room: Interior walls: PAINTED DRYWALL</p> <p>Ceiling: PAINTED DRYWALL</p> <p>Floor: SHEET VINYL</p> <p>Training Room: Interior walls: PAINTED DRYWALL</p> <p>Ceiling: PAINTED DRYWALL</p> <p>Floor: CARPET</p> <p>Work Room: Interior walls: PAINTED DRYWALL</p> <p>Ceiling: PAINTED DRYWALL</p> <p>Floor: SHEET VINYL</p>																																																																	
<p><b>Building Equipment</b></p> <p>Electrical: Panelboard, 225 A and above</p> <p>Elevator:</p> <p>Fire Alarm System: Fire alarm control panel</p> <p>Fire Sprinkler System: Extinguishing system, wet pipe</p> <p>HVAC: Air conditioning, split system, DX; air cooled to 10 tons</p> <p>Plumbing System: Toilet (tank type)</p> <p>Lighting System: Fluorescent lighting fixture, 80 W</p> <p>Security System: Security, intrusion alarm system</p> <p>Water Heating System: Water Heater, Electric, 120 Gallon</p>																																																																	

Present Value (PV)						
50 Years						
Total TCFO	Build	RM	PM	OPS	CR	UM
\$2,070,786.19	\$60,000.00	\$200,792.25	\$32,875.57	\$1,665,141.00	\$49,596.89	\$62,380.48

Calculation includes location factor

### O&M Portfolio Cost by Work Type



## Demolition Cost Model

- Calculates the cost of asset demolition and the hauling and disposal of demolition debris for:
  - Buildings
  - Roads
  - Bridges
  - Fences
  - Well Closures
  - Septic Closures
- For buildings, demolition costs are calculated using the volume of the standing building. Disposal costs are calculated using assumption that SF of material to be disposed of equals 20% of building standing volume
- Roads demolition costs calculated by SF of pavement surface
- Capability to calculate cost of asbestos, lead paint abatement, and hazardous waste removal
- Costs derived from RSMeans Facilities Construction Cost Data (RSMeans reference: 02 41 Demolition)

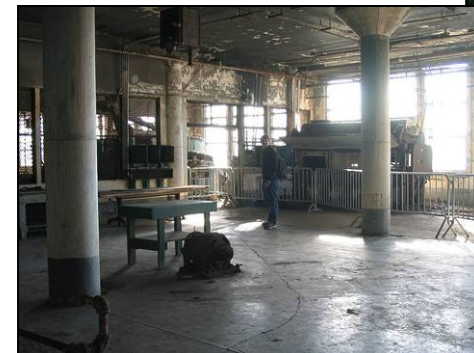
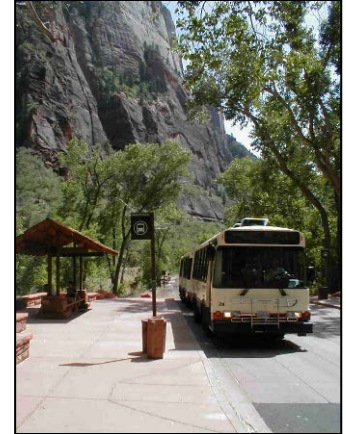
### Demolition Cost Model Screenshot

NPS Demolition Cost Model						
FMSS Location	Description					
Select Park ▶	Golden Gate NRA - All other Areas				Park Location Factor	1.470
	Disposal Cost Prior to Park Location Factor					\$0.00
	Disposal Cost (direct cost/pre-markup)				\$	-
Asset/Feature/Type Description	Quantity	Units	2008 Unit Price	Adjusted for 2008	Cost	
Hazmat Inspection		JOB	\$3,000.00	\$3,205.13	\$0.00	
Hazardous Waste Disposal	Hazardous Waste, Solid Bulk Pick-Up	TON	\$550.00	\$587.61	\$0.00	
	Hazardous Waste, Dumpsite Charge	TON	\$440.00	\$470.09	\$0.00	
	Hazardous Waste, Transportation to Dumpsite	MI	\$4.40	\$4.70	\$0.00	
	Disposal, Contaminated Soil	CF	\$12.22	\$13.06	\$0.00	
Asbestos Abatement	Asbestos Abatement for Demolition	SF	\$30.56	\$32.65	\$0.00	
Lead Paint Abatement	Lead Paint Abatement for Demolition	SF	\$15.30	\$16.35	\$0.00	
Building Removal	Demolition, Steel Building	CF	\$0.26	\$0.28	\$0.00	
	Disposal, Steel Building (Volume = 20%)	-	CF	\$0.35	\$0.00	
	Demolition, Concrete Building	CF	\$0.37	\$0.40	\$0.00	
	Disposal, Concrete Building (Volume = 20%)	-	CF	\$0.42	\$0.00	
	Demolition, Masonry Building	CF	\$0.28	\$0.30	\$0.00	
	Disposal, Masonry Building (Volume = 20%)	-	CF	\$0.34	\$0.00	
	Demolition, Wood/Other Building	CF	\$0.28	\$0.30	\$0.00	
	Disposal, Wood/Other Building (Volume = 20%)	-	CF	\$0.62	\$0.00	
Foundation Removal	Demolition, Concrete Slab	SF	\$3.78	\$4.04	\$0.00	
	Demolition, Concrete Walls	SF	\$11.80	\$12.61	\$0.00	
	Fence Demolition, Chain-linked	LF	\$3.05	\$3.26	\$0.00	



## The GOGA GMP presented projects which varied in complexity and uniqueness

- Muir Woods transit systems project proposed a seasonal and year-round shuttle service to service the park
  - Estimate based on comparable initiatives within the NPS
  - Project Management Information System (PMIS) data used to obtain cost of LPG fueled shuttle buses
  - Operations and maintenance costs derived from contract costs at Zion National Park
  
- Alcatraz projects proposed rehabilitating Laundry Building to accommodate visitor use and include restrooms, cafeteria, and exhibit space
  - CRV calculator used to derive base cost of a new visitor center of the size of the Laundry Building
  - Markups applied to direct costs to account for:
    - Historic nature of the building
    - Added transportation cost for shipping building materials
    - Planning and design





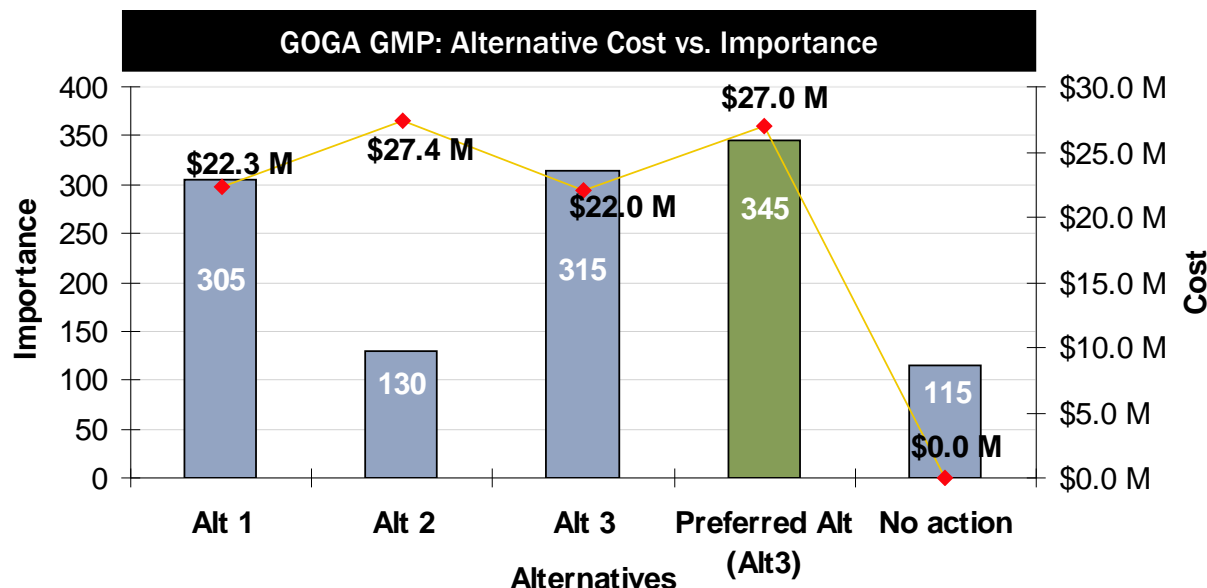
## Markups were applied to direct costs for all new construction, demolition, and large rehabilitation projects

Markup	Service Cost Markups	Gross Construction Markups	Planning and Design Costs	LEED Silver	Historical	Transportation
Markup %	77%	18%	23%	5%	100%	50%
<b>Markup Definition</b>	Add-ons applied to direct costs for <b>design contingencies (20%), G&amp;A (15%), profit (12%), and overhead (15%)</b> for more accurate representation of project costs	Gross Construction Costs include construction contingency and construction management costs. <b>Contingency</b> funds are used to pay for unforeseen or changed conditions associated with construction that result in a construction modification to the contract. Costs associated with construction contingency are 10% of net construction costs. <b>Construction Management</b> includes on-site inspection during construction, review of shop drawings, preparation of construction modifications, validation of monthly construction progress payments, preparation of as-built drawings, and other management or inspection services necessary to oversee and implement the construction contract. For NPS projects, average costs for construction management should not exceed 8% of net construction.	Planning & Design costs include compliance, pre-design, design, and supplemental services. <b>Compliance</b> includes preparation of necessary documents to complete a variety of processes for ensuring adherence with federal laws, and department and agency policies and guidelines for a particular project. Costs for compliance are 5% of net construction. <b>Pre-design</b> includes: initial scoping reporting, contracts prep, report on the existing conditions, description of functional needs, development of schematic alternative sketches, cost estimating, evaluating alternatives, and drawings and preliminary specifications. Costs associated with pre-design are 5% of net construction costs. <b>Design</b> is the development of detailed drawings, notes, and specifications of sufficient detail to allow for contractors to bid and construct the project, or day labor crews to purchase materials and construct the project. Costs associated with final design are 10% of net construction costs. <b>Supplemental services</b> include special architectural, engineering, or other services necessary to collect data to support pre-design or design development. Costs associated with supplemental services are 3% of net construction costs.	Markup for LEED Silver certification considers adjustments for both soft and hard costs. Soft costs include fees for registering and certifying a project through USGBC, related design and documentation costs, energy analysis costs, and commissioning. Hard costs relate to construction expenses incurred based on the selection of various different green components compared to a baseline building and necessary to achieve specific credits under the LEED guidance	Historical markup accounts for additional costs incurred in planning and rehabilitating a historic structure in order to make the building fit for visitor use, while maintaining the historical integrity of the building or structure.	Transportation markup accounts for the additional costs incurred in transporting construction personnel and construction materials to and from Alcatraz Island.
<b>Project Criteria</b>	- All new construction projects - All disposition projects	- All new construction projects - Rehabilitation projects exceeding \$50,000	- All new construction projects for buildings - Rehabilitation projects exceeding \$50,000 for buildings and housing	- All new constructions of visitor center exceeding \$2 million in direct costs	- All Alcatraz Island projects	- All Alcatraz Island projects



## The cost estimates were used in the CBA workshops in comparing the advantage of the alternative against the estimated cost of implementation

- Total scores tallied at the CBA workshop by alternative are weighed against the total cost of the alternatives
- Once a preferred alternative has been declared, the park can strengthen that alternative by incorporating positive aspects of the other alternatives
- In strengthening the preferred alternative, the estimated cost associated with the improvements are added to the preferred alternative cost





## Agenda

- Background on National Park Service General Management Plans (GMPs)
- The revised process developed for the GOGA GMP
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- Recommendations
- Appendix: Cost Estimating Methodology



## A substantial part of the cost estimating effort entailed organizing data into cost estimating requirements at the asset level

- Project descriptions presented a high-level explanation of the work to be done
  - “Improve existing facilities....”
  - “Rehab access and current facilities....”
  - “Building 64 would be rehabilitated as a multi-purpose facility to host an expanded variety of visitor services”
- The lack of detail in the project description made determining the basis of the estimate more difficult
- Assumptions became necessary when project description lacked sufficient detail regarding the targeted assets
  - For example, length and tread type of trail to be built or size of a parking lot, etc.

Project Description	Cost Estimating Requirements	Approach
New MUWO welcome center provide orientation, information, restrooms, snacks, picnicking facilities, and a book store; the centers would connect the shuttle to regional and local transportation systems	<b>New Construction of:</b> <ul style="list-style-type: none"> <li>* 7,000 SF Visitor Center</li> <li>* 5 MSF Turf</li> <li>* 10 Picnic Tables</li> <li>* 600SF concrete platform</li> <li>* 50 LF Flagpole</li> <li>* 1 Flagpole Foundation</li> <li>* 0.5 MSF Meadow (Group Planting)</li> <li>* 0.5 MSF Trees (Group Planting)</li> <li>* 500SF Mulch, wood chips</li> <li>* 4 6'x6' wood signs - 4 6'x3' bases</li> <li>* 1500 SF Comfort Station</li> </ul> <b>O&amp;M Requirements for:</b> <ul style="list-style-type: none"> <li>* 7000 SF Visitor Center</li> <li>* 5000 SF Visitor Center Grounds</li> <li>* 1500 SF Comfort Station</li> </ul>	Use NPS CRV Calculator, entering provided information as CRV inputs. Assumptions made where necessary  Use TCFO Calculator to generate O&M requirements for 7,000 SF Visitor Center and 1500 SF Comfort Station. Use NPS O&M Models to generate O&M requirements for 5,000 SF Visitor Center Grounds.
Existing main entrance area, including the entire upper parking area, restrooms, and visitor center, as well as a major portion of the lower parking lot, would be removed to restore natural conditions, including seasonal flooding	<b>Demolition of:</b> <ul style="list-style-type: none"> <li>* Parking lot, Muir Woods (80166)</li> <li>* Parking lot, NPS Admin (80169)</li> <li>* Restroom, Lower MW-17 (43467)</li> <li>* Restroom, Upper MW-15 (43468)</li> </ul> <b>DM Savings for:</b> <ul style="list-style-type: none"> <li>* Parking lot, Muir Woods (80166)</li> <li>* Parking lot, NPS Admin (80169)</li> <li>* Restroom, Lower MW-17 (43467)</li> <li>* Restroom, Upper MW-15 (43468)</li> </ul>	Use NPS Demolition Calculator. Use asset data for model inputs. Make assumptions where necessary on building dimensions and construction material.  Sum the cost of DM work orders to derive the total DM savings realized by removing the identified assets.



## Once the project data received from the park was organized, the cost estimating data gaps were identified

- In developing the project alternatives, key facility asset information was not documented by the park planning team
- For existing asset rehabilitations or disposals, location numbers were not provided for a number of projects
  - Obtaining missing location numbers required a coordinated effort between the cost estimating team and the Denver Service Center in investigating project and contacting park staff
  - Park staff were sometimes unaware of the origin of the project concept and determining a point of contact for the project proved difficult
- For new asset constructions, key asset specifications were not immediately available
  - Basic project details such as square footage of a building asset was not documented during the planning process
  - Determining needed data required meeting with park staff to re-visit project assumptions



## During the cost estimating process, a substantial amount of time and resources was devoted to gathering supplemental data to better define project requirements

- The DSC Community Planning team endeavored to establish parameters and baseline information for a vast set of project concepts drawing on information from GOGA GMP newsletters, but this was a daunting task.
- For many projects, the absence of asset location numbers and sufficient data on requirements was an impediment to expeditious generation of the cost estimates.

Data gathering & organization consumed 33% of project hours.

Staff Contribution (hours)	P.Hamilton	E.Kimsey	K.Watkins	C.Oskvig	M.Tetreault	F.Richardson	Totals	Percent
Task	Hours							
Reading & Reviewing information provided by NPS				1.00	4.00	2.00	7.00	4.52%
Re-organizing data / spreadsheet formatting					32.00	1.00	33.00	21.32%
Identifying duplicate asset entries			1.5				1.50	0.97%
Identifying / clarifying the approach to the tasks				2.00	18.00	2.00	22.00	14.22%
Seeking tools for use in generating the estimates	1.00				4.00	3.00	8.00	5.17%
Refining existing tools for use in the estimates	1.00				2.00		3.00	1.94%
Pursuing data requests with NPS and/or other sources					3.00	15.00	18.00	11.63%
Disposition estimates	4.00		5.25				9.25	5.98%
Rehabilitation estimates				2.00	4.00		6.00	3.88%
Construction estimates		12.00		1.00	1.00		14.00	9.05%
Lifecycle cost estimates				3.00	2.00		5.00	3.23%
Migrating cost estimates to client deliverable format		4.00			2.00		6.00	3.88%
General Project Management / Answering NPS questions				1.00	2.00	5.00	8.00	5.17%
Review and Quality Assurance					8.00	2.00	10.00	6.46%
Presentation of deliverables to NPS					1.00	3.00	4.00	2.58%
Totals	6.00	16.00	6.75	10.00	83.00	33.00	154.75	



## During the CBA workshop, there was a need for cost estimating input as project alternatives were refined

- When evaluating project alternatives during the CBA workshop, the park planning team altered certain project assumptions that have an impact on the project costs
- As the planning team reviewed the project requirements and associated cost estimates, discussions led to adjustments in the requirement
  - For example, the size of potential new structures were modified
- Decisions made to adjust the project requirements were documented, but the resulting change in cost was not analyzed at the CBA

## Gathering data for the estimates produced unexpected benefits

- Efforts to gather supplemental data for cost estimates prompted conversations between park managers that had not previously happened (or were inconclusive).
- For example, Alternative 1, Connecting People with the Park, included the establishment of a new comfort station and water fountain in a remote section of the Muir Woods scenic corridor.
- When the chief of maintenance was asked for more information about this project concept, he was surprised to see this project listed in the alternatives. Two years prior he had shut off the water line to existing facilities in that area due to high maintenance costs.

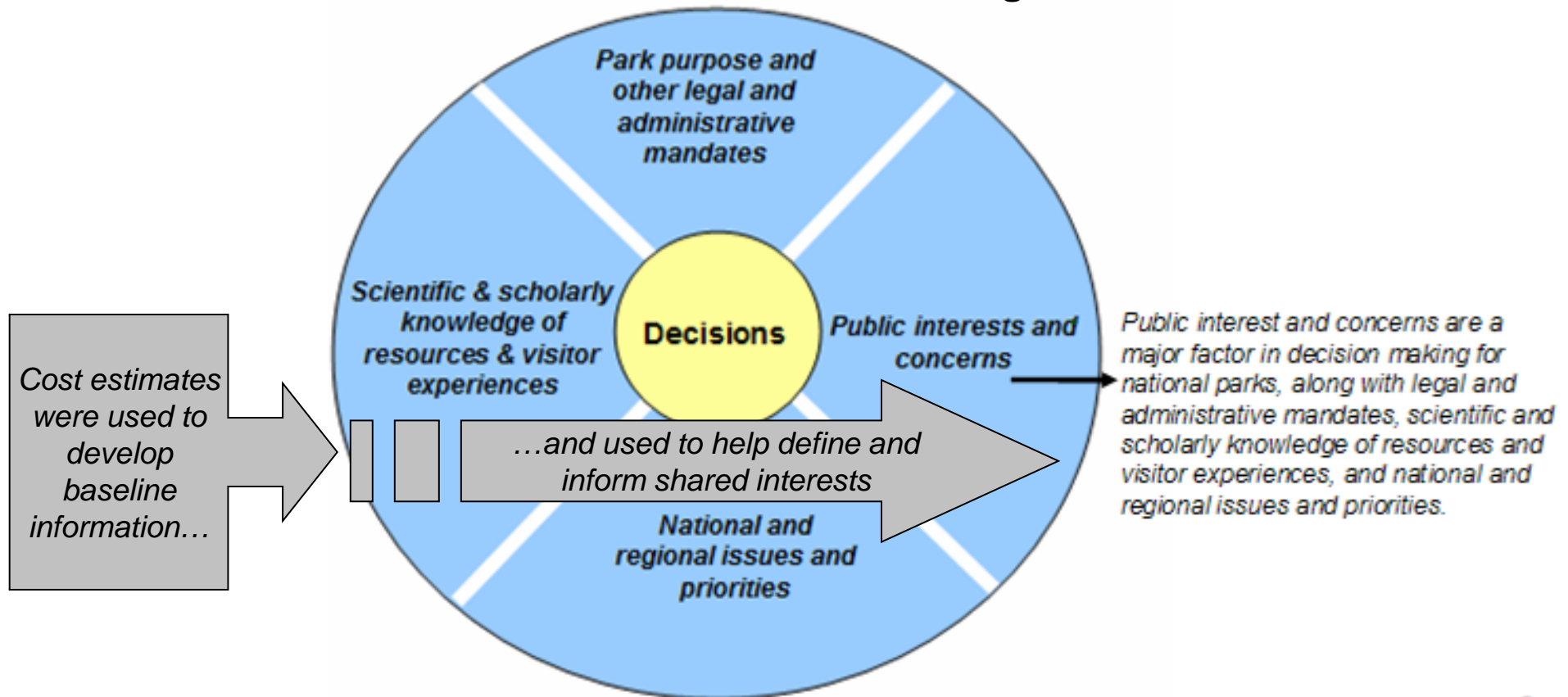






## Cost estimating not only provided better information for decision-making, it provided broader benefits for the planning process

### Influences on Decision Making







## Agenda

- Background on National Park Service General Management Plans
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## Recommendation 1: GMP cost estimating could benefit from a structured data gathering method introduced early in the project planning process

- *Create a standardized business process template for the organization of project data for park staff to complete before hand off, including asset location numbers for all assets, identification of park POC for all projects, and clearly defined approaches by estimate type. (1)*
- A cost estimating questionnaire could be used as a means of documenting project requirements during the planning process.



GMP Cost Estimating Questionnaire Mock-Up			
<b>Enter a Brief Project Description:</b>		Build a 7,000SF visitor center at the entrance of MUWO	
<b>New assets</b>			
Asset Type:	Building		
Building Type:	Visitor Center		
Square Footage:	7000 SF		
Is a parking lot required?	Yes		
If yes, how # of vehicles should the parking lot accommodate?	100		
Is the parking lot paved or unpaved?	Paved		
Will the building have a maintained landscape?	Yes		
If yes, what size will the building landscape be?	10000 SF		
What landscape features are required?	<b>Features</b>		<b>Quantity</b>
	Drinking Fountain	<input checked="" type="checkbox"/>	2
	Benches, Metal	<input checked="" type="checkbox"/>	12
	Benches, Wood		
	Picnic Tables	<input checked="" type="checkbox"/>	6
	Bike Rack		
	Flagpole	<input checked="" type="checkbox"/>	1
	Planting Area	<input checked="" type="checkbox"/>	2000SF
What are the additional requirements?	Visitor Center must have a bus shelter.		

## Recommendation 2: more quality assurance/control and enhanced data management would create efficiencies

- Park staff should check to see if projects are already in PMIS: utilize data from PMIS submissions
- Create a repository of project comparables for use in future GMP cost estimates. Useful project types would include visitor centers, interpretive exhibits, historic rehabilitations, transportation systems, archeological reports, natural resource restoration, and energy efficiency improvements.
- GMP Core team should include park Chief of Maintenance
- All projects should be vetted for consensus and review and rejection prior to the development of the GMP—are there some pet projects that don't have broad support but refuse to die? Example: MUWO comfort station.





## Recommendation 3:

- Once the cost estimates of the alternative have been completed by a consulting team, it would be useful to have those experts continue to participate in Phase 5 activities, including preparations for the CBA workshop, and post-workshop follow-up work.
- *Stephan and Sarah – could you help us develop a more detailed description of this expanded role for the cost estimating consultants? -FR*



## Recommendation 4: Capitalize on methodologies and tools used in the GOGA process to create efficiencies for future GMP cost estimating

- The DSC Community Planning team endeavored to establish parameters and baseline information for a vast set of project concepts drawing on information from GOGA GMP newsletters, but this was a daunting task.
- For many projects, the absence of asset location numbers and sufficient data on requirements was an impediment to expeditious generation of the cost estimates.

Roughly 20% of the effort expended at GOGA can be eliminated from future GMP cost estimating efforts

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## Recommendation 5: Earlier cost estimating could further improve the GMP process

PLANNING PROCESS STEPS CHART

Steps	GMP	Program plans (RSS, CIP)	Implementation plans (FMP, etc.)
<b>1. PROJECT IDENTIFICATION</b>			
Internal scoping to identify issues	X	X	X
Identify need for action/plan	X	X	X
Identify project plan goals and objectives	See program standards	See program standards	Project specific
Assemble interdisciplinary team	X	X	X
Enter project into Planning, Environment, and Public Comment (PEPC) system; check for related documents and initiate ESF	X	X	X
Begin project agreement and develop public involvement strategy	X	Maybe	Maybe

Preliminary data gathering for cost estimates could begin as early as Phase 1

GMP PLANNING PROCESS STEPS CHART

<b>1. Project Identification</b>			
Steps	GMP	Program Plans	Implementation Plans
1. Internal scoping to identify issues	X	X	X
2. Identify need for action/plan	X	X	Maybe
3. Identify project plan/plan goals and objectives	See program standards	See program standards	Project specific
4. Assemble interdisciplinary team	X		
5. Enter project into Planning, Environment, and Public Comment (PEPC) system; check for related documents and initiate ESF	X		
6. Begin project agreement and develop public involvement strategy	X		
7. Identify information gaps and gather needed data	X		

*Tentative recommendation - FR*

GMP PLANNING PROCESS STEPS CHART

<b>3. Alternatives/Impact Analysis</b>			
Steps	GMP	Program Plans	Implementation Plans
1. Prepare NOI	X		Maybe
2. External scoping with public and partners on values, issues, and preliminary alternatives.	Alts will be do a plan and no action		X
3. Preliminary consultation with other agencies (§106, §107)	X	X	X
4. Determine appropriate NEPA pathway	X		X
5. If EA, issue Federal Register NOI retraction (GMP)	X		
6. Continue data inventory	X		X
7. Finalize project agreement? /upload to PEPC, update ESF			Maybe
8. Analyze scoping comments to identify major questions to be answered by the plan and environmental issues/impact topics	X		X
9. Feedback to public	X		Maybe



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## For projects proposing the construction of new assets, the NPS CRV calculator was used to derive the direct construction costs

- Basis of estimate was derived from detail in the project description and data gained from interviews with park staff
  - For example, type of building, square footage, size of building landscape, length of trail, size of parking area
- Assumptions were made where necessary
  - For example, tread type for trails was required to develop trail construction estimate
- Markups on direct construction costs were added where applicable

### CRV Calculator Example: 1 mile of native trail

◀ Click to return to Summary
 **RECORD CRV**

## 2100 Trail

FMSS Location	Description	CRV
	CRV based on national average (base cost)	\$10,666
	Park Location Factor	1.470
	CRV with GOG2 Location Factor	\$15,678
	Service Costs (add 77.00%)	\$0
	<b>Total CRV (2008\$)</b>	<b>\$15,678</b>

Located at Golden Gate NRA - All other Areas

Asset/Feature/Type	Description	Quantity	Units	Unit Price	Cost
Tread	Asphalt		SF	\$10.60	\$0
	Concrete		SF	\$11.20	\$0
	Gravel (crushed stone aggregate)		SF	\$2.36	\$0
	Native	5,280	SF	\$2.02	\$10,666
	Paver block		SF	\$10.60	\$0
	Rip Rap		SF	\$55.90	\$0
	Wood chips		SF	\$1.38	\$0

Unit price derived from RSMeans cost assemblies



## For projects proposing the rehabilitations of existing assets, open FMSS work orders were used to derive the estimated project cost

- Alcatraz projects were an exception
  - Due to the unique nature of the Alcatraz projects and the assets current condition, the CRV calculator was used to derive the direct cost of rehabilitation
  - A series of construction markups were applied to obtain the total cost for these projects
- Sum of all FM work orders was used as rehabilitation cost estimate
  - Where work order cost did not sufficiently reflect the project description, projects were evaluated on individual basis and estimate was derived by applying a percentage of CRV (1%, 2%, 5%).
- Markups on direct construction costs where added where applicable
  - Large rehabilitation projects, over \$50,000, received construction and planning and design markups

### Example of GOGA rehabilitation project

Project Description	Assets	SF	Work Order Total
<b>Golden Gate Dairy Rehabilitation:</b> Adaptive use of historic structure for visitor opportunities and local community : 4 buildings, 5558 sq ft total	Golden Gate Dairy Hay Barn MB-102	2266.0	\$ 92,259
	Golden Gate Dairy House MB-101	2500.0	\$ 307,996
	Golden Gate Dairy Sanitary Barn MB-104	540.0	\$ 59,474
	Golden Gate Dairy Shed MB-105	252.0	\$ 25,050
<b>Total</b>		<b>5558.0</b>	<b>\$ 484,780</b>



## For projects proposing the removal of existing assets, the NPS Demolition Calculator was used to derive the direct costs

- Assets to be removed were identified by Denver Planning Team or through interviews with park staff
- Assumptions were made regarding building dimensions and construction material
- Service cost markups were applied to the direct cost estimate

### Demolition Calculator Example

Project Description	Assets	SF	Disposition Cost
<b>Golden Gate Dairy</b> <b>Disposition:</b> Remove nonhistoric residences	House, Winkelmanns	1289.0	\$ 18,817
	Quarters 2 (MB-1)	2428.0	\$ 35,199
	Quarters 11	714.0	\$ 10,351
<b>Total</b>		<b>4431.0</b>	<b>\$ 64,367</b>

Assumptions					
Length	Width	Height	CF	Foundation SF	Material
43.0	30.0	10.0	12890.0	1289.0	Wood
60.7	40.0	10.0	24280.0	2428.0	Masonry
59.5	12.0	10.0	7140.0	714.0	Wood

### NPS Demolition Cost Items

NPS Location		Description			
Select Park	Golden Gate NRA - All other Areas	Park Location Factor		1.470	
		Disposition Cost Prior to Park Location Factor		\$12,801	
		Disposition Cost (direct cost/pre-markup)		\$18,817	
Asset/Feature/Type Description	Quantity	Units	2008 Unit Price	Cost	
Building Removal	Demolition, Steel Building	CF	\$0.26	\$0.00	
	Disposal, Steel Building (Volume = 20%)	-	CF	\$0.35	\$0.00
	Demolition, Concrete Building	-	CF	\$0.37	\$0.00
	Disposal, Concrete Building (Volume = 20%)	-	CF	\$0.42	\$0.00
	Demolition, Masonry Building	-	CF	\$0.28	\$0.00
	Disposal, Masonry Building (Volume = 20%)	-	CF	\$0.34	\$0.00
Demolition, Wood/Other Building	12890	CF	\$0.31	\$3,944.54	
	2,578	CF	\$0.62	\$1,698.47	
Disposal, Wood/Other Building (Volume = 20%)	1289	SF	\$3.78	\$5,205.58	
		SF	\$11.80	\$0.00	
Foundation Removal	Demolition, Concrete Slab	SF	\$3.05	\$0.00	
Fence Removal	Fence Demolition, Chain-linked	LF	\$0.46	\$0.00	
	Demolition, Pavement	SF	\$17.35	\$0.00	
Road Removal	Demolition, Precast Bridge	SF	\$8.65	\$0.00	
	Demolition, Steel Bridge	SF	\$11.00	\$0.00	
Bridge Removal	Demolition, Laminated Wood Bridge	SF	\$5.25	\$1,952.09	
	Dump Charges, Building Construction Materials	348.03	CF	\$0.00	
Dump Charges	Dump Charges, Trees, Brush, Lumber	TON	\$50.00	\$0.00	
	Dump Charges, Rubbish	TON	\$60.00	\$0.00	

Unit price derived from RSMeans cost assemblies





## For both newly constructed and rehabilitated assets, annual O&M requirements were calculated

- For buildings, the recently created NPS TCFO Calculator was used to generate the annual O&M requirement
- For all other assets, the NPS O&M models were utilized in generating O&M requirements
- Both tools calculate industry standard costs for operations, preventative maintenance and recurring maintenance activities
  - The TCFO Calculator includes a component renewal cost, which is based on a default set of building equipment for each building type
- The current models used two broad approaches to modeling for industry standard asset types:
  - **Buildings/ Housing/ Maintained Landscapes:** use asset and equipment data from actual example assets from FMSS (that are representative of that asset type or size) and creates a cost build-up for the expected range of O&M activities
  - **Roads/ Trails/ Water & Wastewater:** Use an expected representative range of O&M activities for an asset type, based on typical equipment and expected O&M activities to create a generic model



## Deferred maintenance savings was determined for all rehabilitation and disposition projects

- DM Savings equaled the total estimated cost for all DM FMSS work orders associated with the asset location numbers identified in the project





**Questions?**