

Stabilization and Repair to a Historic Wharf Kalaupapa National Historical Park Molokai, Hawaii

Association of Conservation Engineers
52nd Annual Conference

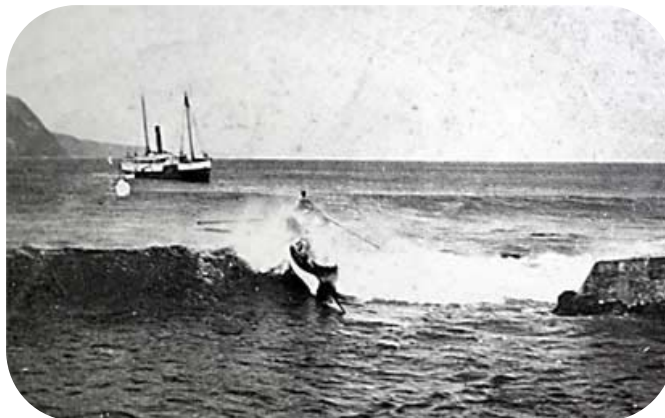
September 15-19, 2013
Breckenridge, Colorado

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Introduction

- Owner – National Park Service
 - Denver Service Center
 - Pacific West Region
 - Kalaupapa National Historic Park
- Other stakeholders
 - State of Hawaii, Kalaupapa State Park
 - USACE – Honolulu District / Pacific Ocean Division



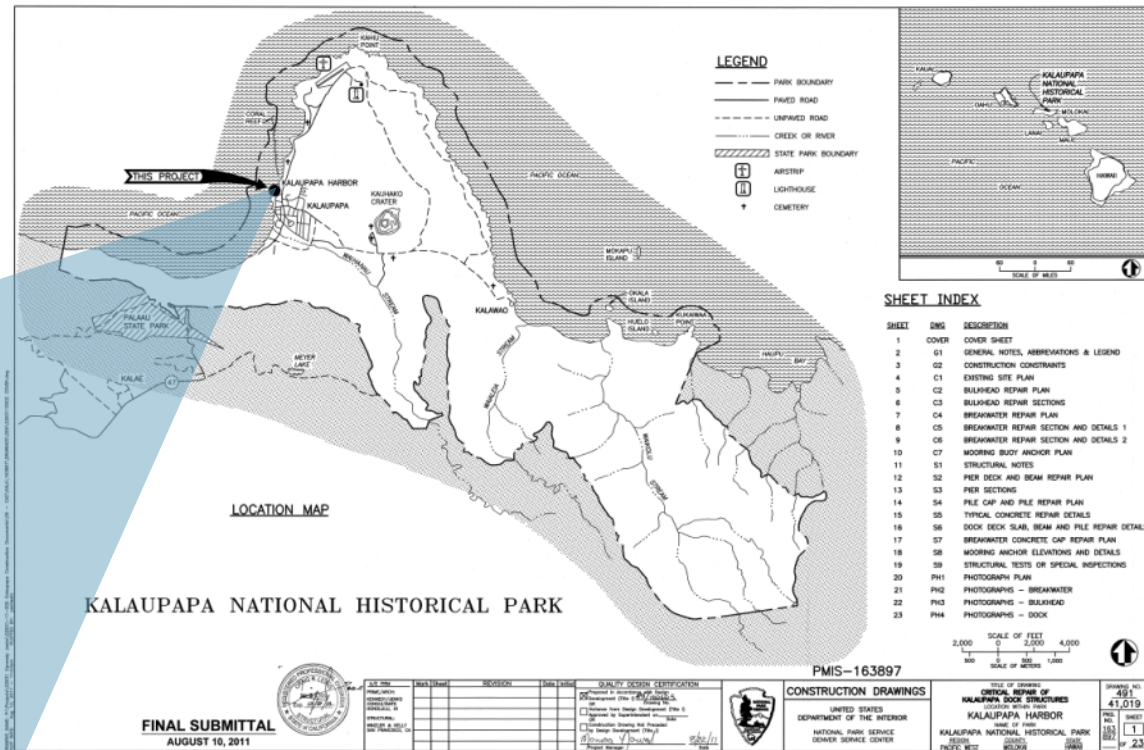
Row boat carrying new patients and cargo
Photo credit: www.nps.gov



Site Location



- Kalaupapa National Historical Park
 - Island of Molokai, HI
 - Kalawao County



Site Information

- Kalaupapa means “flat leaf”
- Known as the Makaanalua Peninsula; 13.21 square miles
- Average elevation: 66 feet (sea level to 450 feet)
- Formed by lava eruption from ocean floor thru now dormant volcano (Kauhako Crater) on peninsula
 - Lake within >800 feet deep
- Adjacent cliffs of main island rise to 2,000 foot elevation



Most of the village of Kalaupapa as seen from an airplane
Photo credit: www.wikipedia.org



Kalaupapa Peninsula as seen from a descent down the sea cliffs
Photo credit: www.wikipedia.org

Historical Background

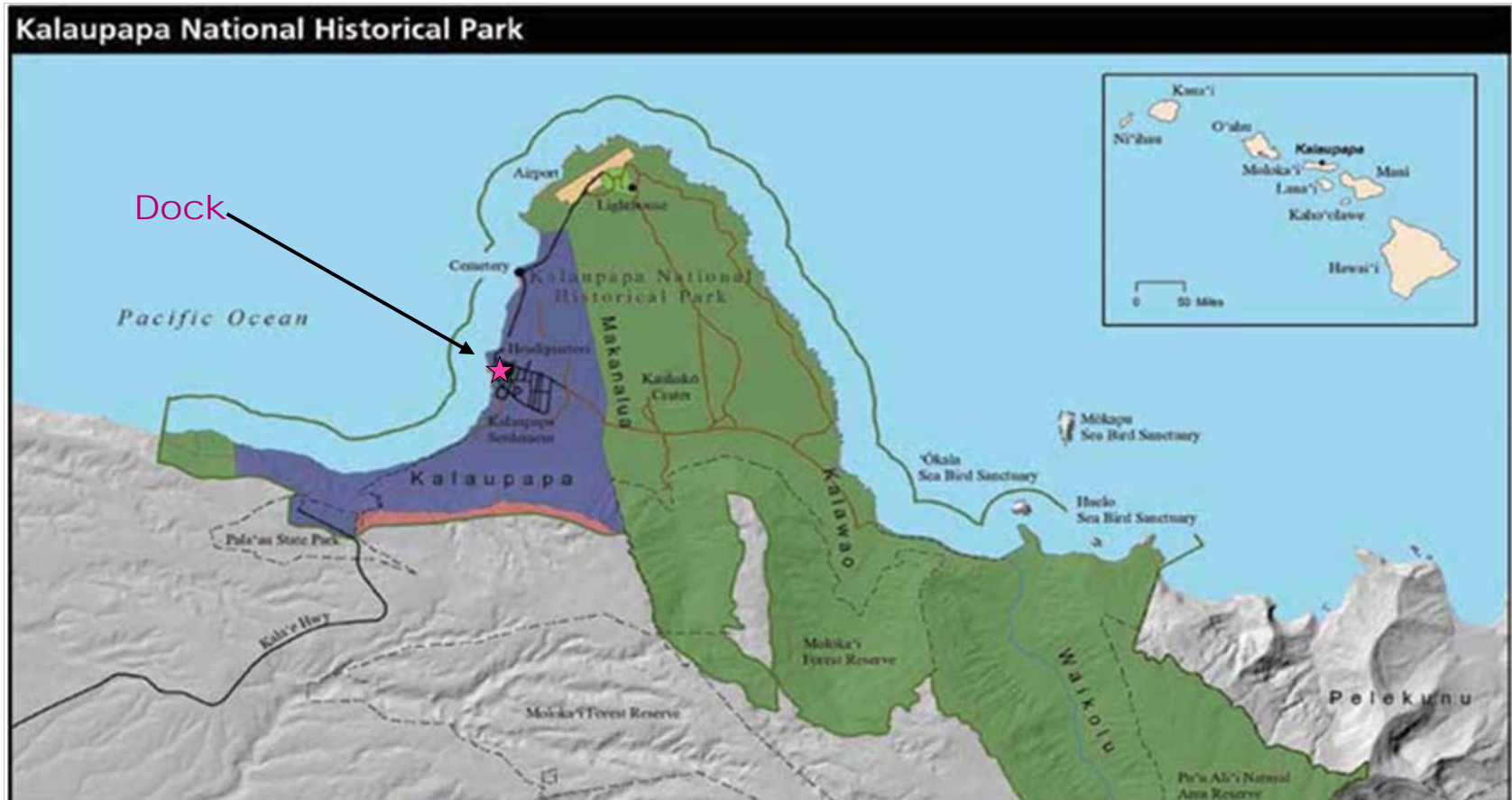


Photo credit: www.nps.gov

Historical Background (cont'd)

900/1000 AD to about 1880s	Native Hawaiian occupation – peak of about 2,700 people (before European arrival)
1853	Construction of Christian Church (oldest intact structure still in use as NPS Ranger Station)
1865	Isolation Law enacted by King Kamehameha V
1865	Establishment of Leper Colony at Kalawao on east side of peninsula
1873	Father Damien arrived (canonized as a Catholic Saint in 2009)
1890s to 1900	Establishment of Leper Colony at Kalaupapa on west side of peninsula and abandonment of Kalawao
1900	Population of patients peak at 1,200



Hawaiian family photo



Stone ruins



Children with Hansen's Disease (leprosy)

Historical Background (cont'd)

1909-1913	US Government Research Facility built and operated at Kalawao site
1910	Lighthouse built on north end of peninsula
1930s	Major infrastructure improvements and facilities construction
1940s	WW II – part of peninsula used as a military aircraft practice firing / bombing range
1946	Treatment and cure for Hansen's Disease



Group of helpers and patients with Brother Joseph Dutton



Church



1870s stone water cistern

Historical Background (cont'd)

1969	Isolation Law repealed
1980	Designated as National Historic Site by NPS
1999	Movie “Molokai” starring Peter O’Toole and Kris Kristofferson about Father Damien and the Leper Colony
2010	Population: 90 (approx. 6 patients)
2012	Historic wharf structure area repaired and restored by AMEC



Father Damien

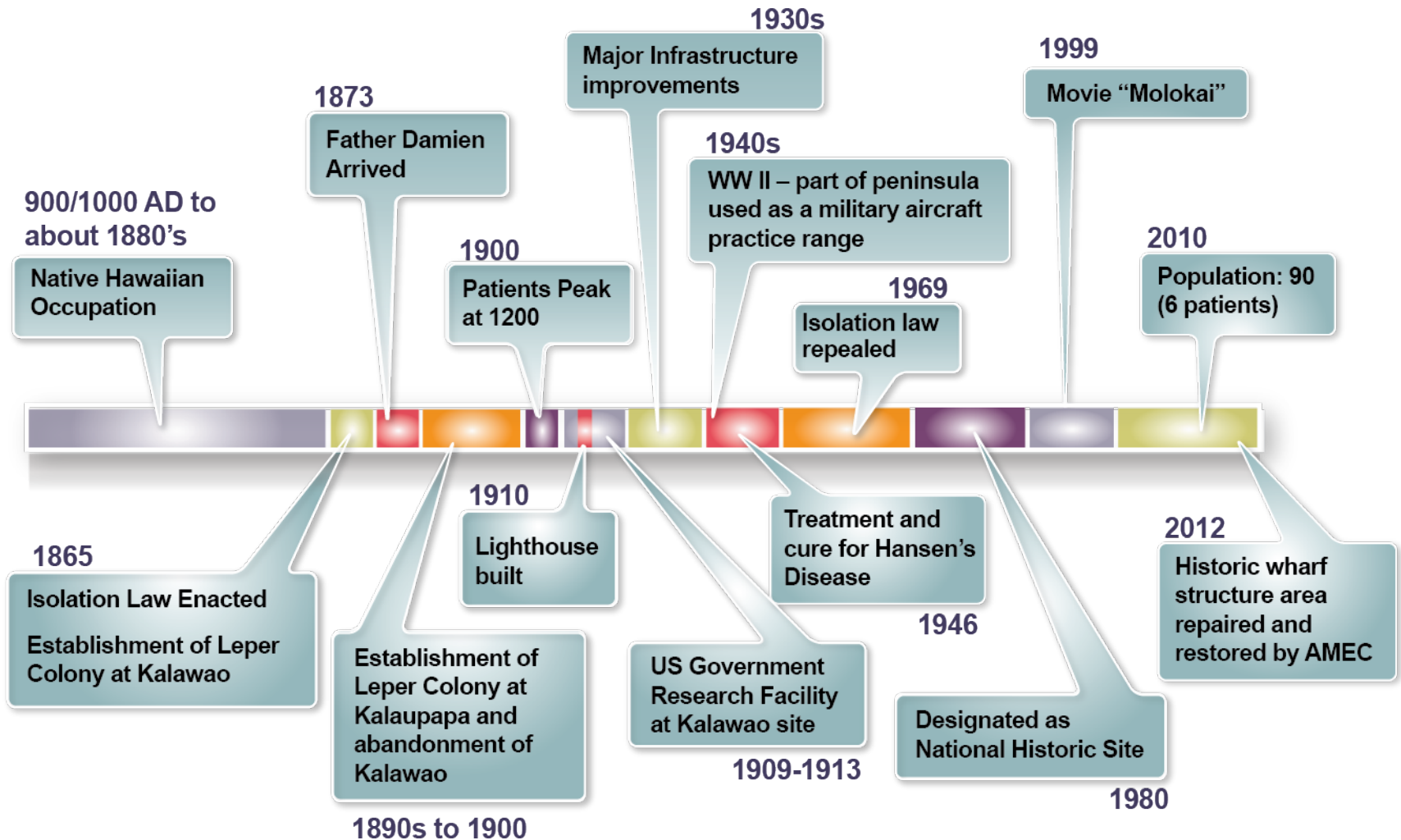


Museum

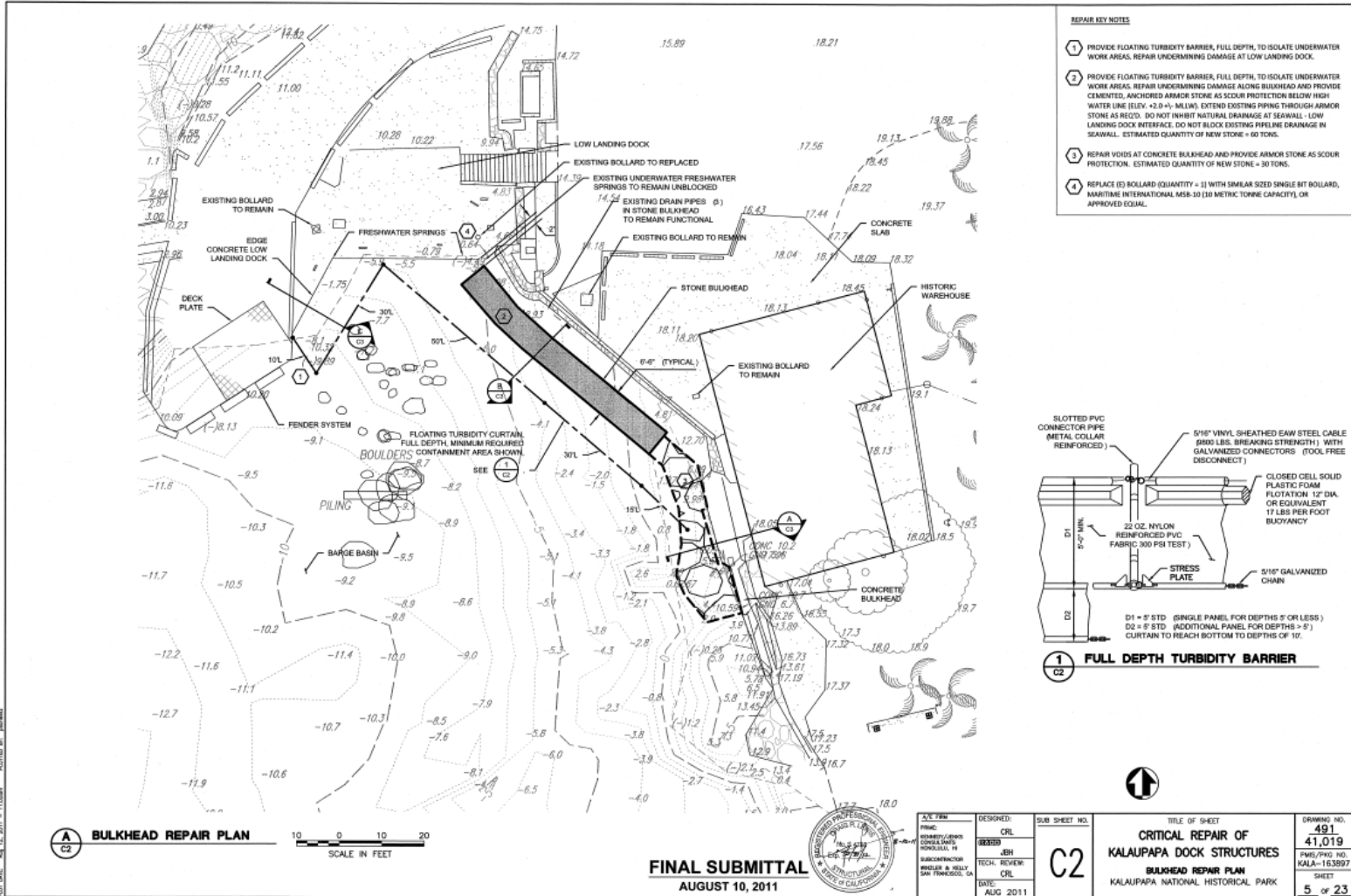


Paschoal Hall

Historical Background (cont'd)



Pre-construction Site Conditions



Logistical Issues and Work Element Challenges

- Worker housing
- Food and supplies
- Construction materials
- Concrete batching / handling
- Weather
- Patient and visitor safety, sensitivity and control
- Construction equipment
- Worker safety and control
- Waste management
- Environmental and cultural resource protection
- Armor stone source / handling



Concrete delivery



Armor stone arrival

Natural and Cultural Resource Issues

- Water quality
- Hawaiian monk seals
- Coral beds
- Historical artifacts and protection



Water quality testing



Monk seal during pre-condition survey



Monk seal

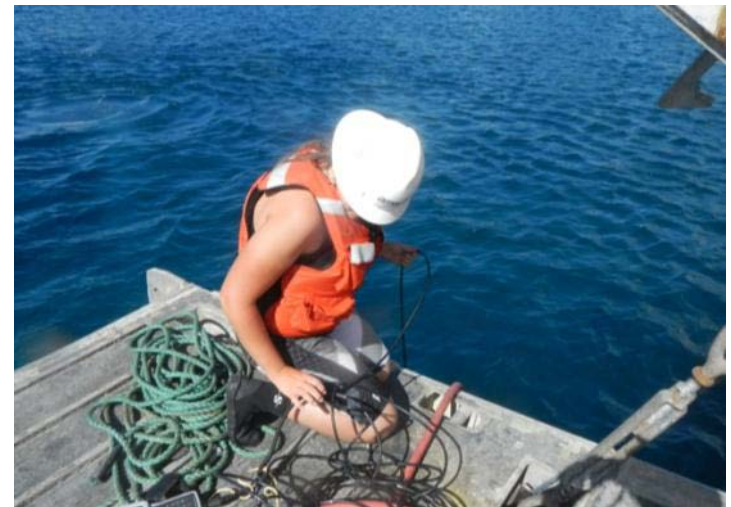
Photo Credit: www.nps.gov

Pre-construction Submittals

- Accident Prevention Plan
- Waste Management Plan
- Quality Control Plan
- Environmental Management Plan
- Storm Water Pollution Control Plan

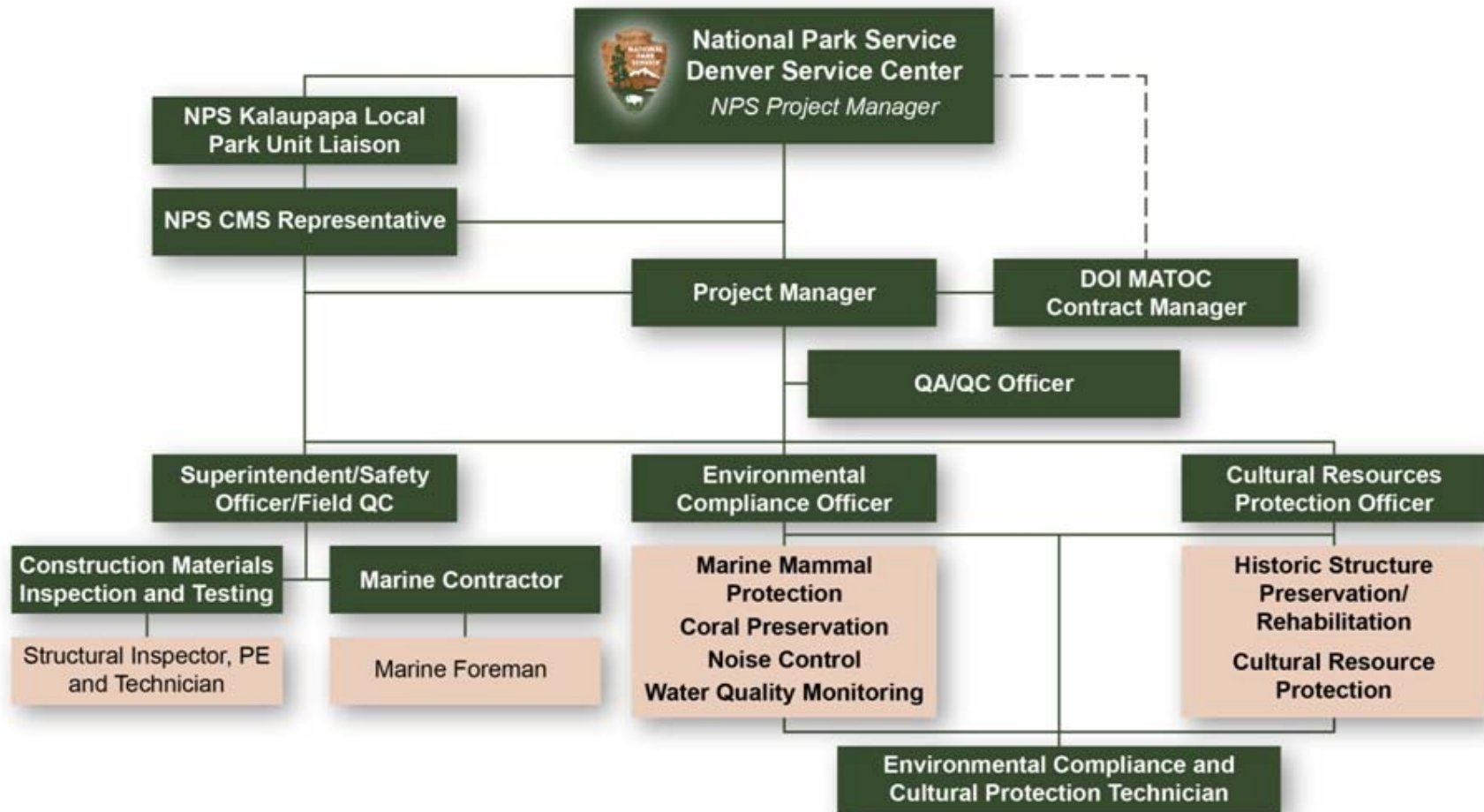


Daily safety meeting



Water quality testing

Project Organization



Stabilization and Repairs to Wharf Area

Work elements

1. Concrete bulkhead, dock, and low landing dock repairs

- Concrete spall repairs



Demolition of slab



Demolition of top deck

- Concrete crack repairs



Crack sealing



Crack sealing

Work elements

1. Concrete bulkhead, dock, and low landing dock repairs (cont'd)

- Lean concrete void filling (including void size investigation)



Precondition survey



Concrete coring



Concrete delivery



Concrete delivery

Work elements

1. Concrete bulkhead, dock, and low landing dock repairs (cont'd)

- Concrete dock pile repairs



Concrete dock pile repairs



Concrete dock pile repairs

- Place and cement armor stone



Armor stone arrival



Armor stone placement

Work elements

2. Stone bulkhead rehabilitation

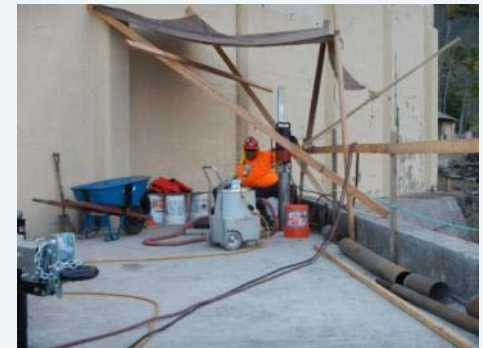
- Lean concrete void filling (including void size investigation)



Headwall void



Headwall void



Coring holes in headwall



Void forms



Void forms



Stone bulkhead void filling

Work elements

2. Stone bulkhead rehabilitation (cont'd)

- Place and cement armor stone



Armor stone placement



Armor stone placement

Work elements

3. Removal of displaced armor stones and debris in boat / barge basin



Armor stone relocation



Armor stone relocation

Work elements (cont'd)

4. Breakwater rehabilitation

- Removing / reconfiguring existing armor stone



Work elements (cont'd)

4. Breakwater rehabilitation (cont'd)

- Replacing missing armor stone



Armor stone at breakwater

- Installing concrete filled bags



Concrete stayform

Work elements (cont'd)

4. Breakwater rehabilitation (cont'd)

- Repair of concrete spalls and cracks of cap



Breakwater spall demolition



Breakwater repairs



Placement of concrete at breakwater



Finishing repairs



Breakwater repairs

Stabilization and Repairs to Wharf Area

Work elements (cont'd)

5. Installation of mooring anchorages



Mooring buoy installation



Drilling anchors



Installation of mooring bollard

Work elements (cont'd)

6. Underwater inspection



Displaced armor stone



Pile inspection

7. Environmental compliance and mitigation



Water quality testing



Silt curtain



Silt curtain

Budget and Schedule



Budget

Proposed	\$2,902,328
Modifications due to unforeseen conditions and additional work	\$138,155
Actual	\$3,040,483

Schedule (2012)

	Award	NTP	Substantial Completion	Fixed Completion	Final Mods Completion	End Date	Finish Ahead
Proposed	Apr. 1	May 1	Sep. 12	Sep. 25	--	Oct. 31	1 month
Actual	May 1	Jun. 19	Aug. 26	Aug. 29	Sep. 8	Dec. 12	3 months

Acknowledgements

- National Park Service – Denver Service Center
- National Park Service – Kalaupapa National Historical Park
- Kennedy / Jenks Consultants – Honolulu, HI



Questions

