



# United States Department of the Interior



## FISH AND WILDLIFE SERVICE

Pacific Islands Fish and Wildlife Office  
300 Ala Moana Boulevard, Room 3-122, Box 50088  
Honolulu, Hawaii 96850

In Reply Refer To:  
12200-2008-FA-0012 / ER 07/0224

NOV 19 2007

Ms. Nora Macariola-See  
Environmental; Planning Division  
Naval Facilities Engineering Command, Pacific  
258 Makalapa Drive, Suite 100  
Pearl Harbor, Hawaii 96860-3134

Subject: Kilo Wharf Extension (MILCON P-502) Final Environmental Impact Statement (FEIS), Apra Harbor Naval Complex, Territory of Guam, Mariana Islands

Dear Ms. Macariola-See:

The U.S. Fish and Wildlife Service (Service) has reviewed the Final Environmental Impact Statement (FEIS) for the Proposed Kilo Wharf Extension, Apra Harbor Naval Complex, Guam, Mariana Islands. The proposed project is sponsored by the U.S. Department of the Navy. The following comments have been prepared pursuant to the National Environmental Policy Act of 1969 [42 U.S.C. 4321 *et seq.*; 83 Stat. 401], as amended (NEPA); the Endangered Species Act of 1973 (16 U.S.C. 1531 *et seq.*; 87 Stat. 884], as amended; and other authorities mandating Service concern for environmental values. Based on these authorities, we offer the following comments for your consideration.

The proposed project involves modifications to the existing Kilo Wharf to accommodate a new class of multi-purpose ammunition ship, known as T-AKE, which is about 689 feet (ft) long and scheduled to replace older ammunition vessels by 2010. Commander Navy Region Marianas is responsible for maintaining capacity to handle ammunitions delivery within Western Pacific geographic region. The existing wharf is about 400 ft long.

Two wharf extension alternatives have been considered in the FEIS that would support optimal conditions for cargo munitions handling operations. These include a West Extension Alternative and an East-West Extension Alternative. Both alternatives would result in an extended wharf that is 800 ft long. The West Extension Alternative, which is identified in FEIS as the preferred alternative is anticipated to result in less direct and indirect adverse impact to coral reef habitats than the East-West Alternative. A No-Action Alternative is also considered.

## GENERAL COMMENTS

The Service, along with the National Marine Fisheries Service (NMFS), the U.S Environmental Protection Agency (EPA), Guam Environmental Protection Agency (GEPA), and Guam Department of Agriculture (GDA) (collectively the Resource Agencies), have worked closely on the development of the proposed project with the Navy Facilities Engineering Command in Hawaii and Guam. Early coordination began in 2004, and we were pleased to experience incrementally increased collaboration over the next two and a half years. In particular, we are very appreciative of the Navy's willingness to support resource agency site investigations and analyses and share details related to project design features and anticipated construction methods.

The state of knowledge concerning the details of the scope and design of the project were uncertain at the beginning of project development and changed continuously into the FEIS stage. In 2005, we collectively agreed to take a "worst-case scenario" approach when evaluating anticipated project construction-related impacts to coral reef resources within the affected environment. We were asked by the Navy to take this approach when it became apparent that many project design details were not available to support a rigorous project impact assessment within the aggressive EIS timeline that was being pursued. This precautionary approach resulted in less detailed resource surveys and impact analyses, but allowed us to move forward with the Navy to develop acceptable mitigation recommendations while meeting the desired timeline.

Unfortunately, the FEIS contains many misleading criticisms directed at the Resource Agencies for taking this approach, and this could undermine the collaborative spirit necessary to see us through into the future. It is probably too late to revise the FEIS to more accurately reflect the lengths to which the Resource Agencies went to assist the Navy in this project and depth to which we tried to develop a more collaborative environmental review process for the future. Nevertheless, we request that the Navy work with the Resource Agencies to develop language in the Record of Decision (ROD) that will clarify this desire for a more collaborative approach and resolve these concerns.

Many technical inconsistencies persist in the FEIS that should be corrected and could have been avoided had the Navy more fully incorporated resource agency impact analyses into the document. The purpose and need for this action does not support either proposed alternative. According to the FEIS, the No Action Alternative would result in slower dock operations but still allow the Navy to meet its mission without necessarily degrading coral reef resources as would both the West and East/West Alternatives. The FEIS lacks a clear description of the existing environment, the resulting environmental consequences of the proposed action and a firm commitment to adequately offset lost ecological functions.

Much of our collaboration on this project was directed to assisting with development of sound mitigation recommendations. We are pleased that the FEIS identifies Cetti Bay Watershed restoration as the preferred compensatory mitigation action for the project. We believe this action is appropriate and has been objectively scaled through Habitat Equivalency Analysis (HEA) to replace the coral reef ecological functions that will be lost as a result of the project. In

addition, we believe it will best meet Army Corps of Engineers (Corps) guidance and requirements for compensatory mitigation.

The Navy has proposed a contingency mitigation plan in the event that it is not possible to complete the preferred mitigation. As proposed, this contingency plan does not contain adequate information to assess its ability to compensate for lost ecosystem function or to measure its performance. We are concerned that the contingency mitigation is not adequate to replace the losses incurred as a result of the proposed action. In addition, the contingency mitigation plan includes no measures for performance (success) evaluation or monitoring. The development of performance criteria and a monitoring plan will be a mitigation requirement of the Corps permit that will be issued to authorize the project dredge and fill activities.

The Navy has proposed four activities as part of their contingency mitigation: 1) reforestation of 150 acres in the Talofofu watershed, 2) deep water substrates, 3) expansion of the Orote Point Ecological Reserve Area (ERA), and 4) coral transplants. The Navy asserts that the deep water substrates will adequately compensate for all losses associated with this project. While all of these projects may have some beneficial affect on the coral reef ecosystem, we have reservations that successful implementation of this plan will provide sufficient replacement of ecosystem functions lost as a result of the proposed project.

Reforestation of savanna to *Acacia* forest in the Talofofu watershed will reduce sediment erosion from that land, but 150 acres constitutes approximately 1% of the watershed. Given such a small percent of the watershed is proposed for reforestation, it is unlikely that any reduction in erosion will have a positive effect on coral reefs, especially considering that the reforestation effort is not targeting problematic badland areas.

Artificial substrates have seldom produced communities with similar biodiversity to natural substrates (Baynes *et al.*, 1989, Perkol-Finkel *et al.*, 2005 and Wilhelmsson *et al.*, 1998). The HEA for this alternative uses total biomass as a measure of ecological function when equating losses of ecological function at Kilo Wharf to potential replacement of function derived from artificial substrates. This unit of comparison does not reflect ecological function, as replacement of coral with sponges or algae would result in different communities. Ecological function is related to species composition, and it is unclear how these have been equated in the HEA analysis. While some promising results for artificial reef have been recently published (Perkol-Finkel *et al.*, 2006), we feel that issues raised in that work, especially those related to artificial substrate placement and design, have not been adequately addressed and require more investigation before this technique can be used as a viable mitigation for loss of natural reef.

While we commend the proposal to expand the Orote Point ERA, we believe this will have minor positive effects on the reef in this area. The proposed expansion is in an area that receives few impacts that would be mitigated if this area is included within the reserve. The proposed expansion is not in an area that is heavily fished nor is it a location of frequent commercial diving activity (which would not be curtailed under the ERA).

Coral transplantation has had mixed success, particularly in the Pacific, often resulting in poor transplant survival and little ecological benefit (Bentivoglio 2003). Additionally, transplantation of coral to already impacted reefs will do little to improve reef health without concurrent reductions of relevant existing ecological stressors and, therefore, is expected to do little to offset losses. In a review of compensatory mitigation projects on Caribbean coral reefs, coral transplantation and mooring buoys were specifically identified as inappropriate and inadequate for mitigating permanent dredging impacts to coral reefs (USFWS 2004). We support National Research Council (NRC) guidelines that recommend a watershed approach be used when developing and implementing mitigation actions (NRC 2001).

Should a contingency mitigation plan be necessary, we believe it should be viable in terms of its appropriateness, scalability and consistency with current federal mitigation guidance. We recommend that the Navy coordinate with the Resource Agencies and the Corps to develop a viable contingency plan that will be acceptable to all parties. We recommend that the language describing this contingency plan in the ROD be collaboratively drafted with the Resource Agencies.

To help improve future coordination between the Navy and the Resource Agencies, we recommend the Navy provide the Resource Agencies with complete project design descriptions at the onset of coordination. Project construction alternatives should be fully vetted with descriptions of possible impacts that may include: dredging designs, filling designs, and construction barge anchoring systems, among others, prior to the commencement of site assessments and field work. Also, we recommend that future field site assessments and impact analyses are coordinated more closely among Navy and resource agency personnel. For example, methods and protocols for evaluating the environment and possible impacts should be developed in collaboration prior to field work. Collection of resource data to support impact assessments and mitigation recommendations should be collaborative by a team of resource agency and Navy biologists. We believe closer coordination of these activities with the Resource Agencies will result in a more accurate description of the environment, an improved analysis of potential project-related impacts, development of compensatory mitigation that will ensure losses of ecological functions are off-set, and the timely preparation of environmental documents that have wide support among the Resource Agencies.

## SUMMARY

As written, the FEIS does not adequately address our previous comments on the Draft EIS, nor does it incorporate the substantial scientific input that was provided to the Navy by the Resource Agencies on anticipated resource impacts at the Kilo project site. Moreover, the document is not reflective of the close project collaboration between the Navy and the Resource Agencies that transpired over the past two and a half years, and is critical of Resource Agency use of the “worst-case-scenario approach” that the Navy asked us to use to help them meet their aggressive project timeline.

The FEIS does not provide a clear description of the existing environment or environmental consequences, and it does not commit to replacing lost ecological functions through

implementation of the preferred mitigation plan. We recommend that the Navy work with the Resource Agencies to develop language pertaining to the preferred mitigation at Cetti Bay Watershed that maximizes the likelihood of its successful implementation. Moreover, we recommend that if a viable contingency mitigation plan is necessary, it be developed with the Resource Agencies and described in the ROD with the requirement that it is concurred with by the Corps, NMFS, EPA, and us. We hope the remainder of our comments, enclosed with this letter, will help you understand our concern for environmental values at the project site and our desire to assist the Navy with the ROD.

We appreciate the opportunity to comment on the FEIS. If you have any questions regarding this letter, please contact either Marine Ecologist Kevin Foster or Coastal Conservation Coordinator, Michael Molina, by telephone at (808) 792-9420 or (808) 792-9440, respectively.

Sincerely,

A handwritten signature in black ink, appearing to read 'Patrick Leonard', with a long horizontal line extending to the right.

*for* Patrick Leonard  
Field Supervisor

Enclosure (1) Specific Comments, References  
and Best Management Practices

cc: DOI-OEPC, Oakland  
ACOE-Honolulu District  
NMFS-PIRO-Honolulu  
USEPA-Region IX, San Francisco  
USEPA-Region IX, Honolulu  
DAWR, Guam  
EPA, Guam  
CRMP, Guam

## ENCLOSURE 1

## Kilo Wharf Extension (MILCON P-502) Final Environmental Impact Statement (FEIS), Apra Harbor Naval Complex, Territory of Guam, Mariana Islands

## SPECIFIC COMMENTS

Pg. 3-16. 3.3.1.1 Reef Structure: “A project-specific reconnaissance survey of the marine environment along southern Outer Apra Harbor was conducted by MRC in 2004 to characterize the geomorphology (structural composition) and dominant bottom composition (both biotic and abiotic)(MRC2005e).” The referenced report does not accurately portray existing conditions within the project construction area because the multi-spectral imagery used to describe the site was not field-verified with quantitative measurements (*e.g.*, coral densities), but with qualitative methods that produce results that are subject to significant variation. Therefore, the FEIS fails to provide an adequate description of the existing environment. We recommend that the Navy use the Revised-Draft Kilo Wharf Expansion Project Marine Assessment and Impact Analysis, Apra Harbor, Guam (February 2007) that was provided by the Resource Agencies to identify the existing environment at the project site.

Pg. 3-23. 3.3.1.2 Biotic Cover Southern Outer Apra Harbor: “Table 3-4 summarizes the approximate total area by bottom cover over the survey area depicted in Figure 3-4. Approximately 60 percent of the survey area consists of biotic cover, either in the form of live coral or macroalgae, and the remainder consists of abiotic cover.” This statement is incorrect and suggests the “remaining 40 percent” of cover is comprised of abiotic features. The FEIS fails to evaluate turf algae as a significant habitat feature within the project area. Turf algae habitat functions as a significant source of forage for a variety of mollusks and echinoderms, particularly in shallow marine reefs. The Service recognizes turf algae habitat as one that provides significant ecological functions, which contribute to a healthy coral reef community. Therefore, we recommend that the Navy recognize the extent of turf-covered marine habitat within the project area and treat that habitat as having ecological value.

Pg. 3-23. 3.3.1.2 Biotic Cover Southern Outer Apra Harbor – Back-Reef Flat: “Coral cover increases and algae cover decreases at the outer border of the reef flat.” This statement is qualitative in nature and does not provide the reader with an understanding of the biological community (*e.g.*, Genera/species densities) that exists within the project area. We recommend that the Navy refer to the Revised-Draft Kilo Wharf Expansion Project Marine Assessment and Impact Analysis, Apra Harbor, Guam (February 2007) for quantitative data and a more thorough description of the biological community within the project area.

Pg. 3-23. 3.3.1.2 Biotic Cover Southern Outer Apra Harbor – Back-Reef Flat: “While it provides a suitable substrate for marine organisms, the reef flat has relatively low biodiversity.” This is a qualitative statement and is unsubstantiated with quantitative data (*e.g.*, species densities) regularly used to calculate biodiversity (*i.e.*, Shannon’s index of diversity). We

recommend that the Navy refer to the Revised-Draft Kilo Wharf Expansion Project Marine Assessment and Impact Analysis, Apra Harbor, Guam (February 2007) for quantitative measurements of diversity.

Pg. 3-26. 3.3.1.2 Biotic Cover Southern Outer Apra Harbor – Fore-Reef Slope: “The fringing reef and fringing reef slope area adjacent to Kilo Wharf are not substantially different than the fringing reef slope along the other portions of the Orote Peninsula facing Apra Harbor.” This statement is currently unsubstantiated and speculative. Community level statements of comparison should be substantiated with appropriate analyses. We suggest this could be accomplished by referring to data from the Revised-Draft Kilo Wharf Expansion Project Marine Assessment and Impact Analysis, Apra Harbor, Guam (February 2007).

Pg. 3-24. 3.3.1.2 Biotic Cover Southern Outer Apra Harbor – Fore-Reef Slope: “Other corals occur on the reef slope sporadically, resulting in a zone of high (about 100 percent) coral cover, but low coral species diversity.” These qualitative statements do not provide the reader with sufficient information to understand components of coral reef community complexity, such as reproductive capacity or age structure. Age structure information is an integral metric used to perform Habitat Equivalency Analyses. Therefore, we recommend the Navy refer to quantitative data and biological descriptions compiled in the Revised-Draft Kilo Wharf Expansion Project Marine Assessment and Impact Analysis, Apra Harbor, Guam (February 2007) for a more accurate understanding of the affected coral reef community.

Pg. 3-32. 3.3.2 Coral Reef Biota ROI: Kilo Wharf vicinity: “In addition to recording quantitative and qualitative data on corals, the March 2004 NAVFAC PAC marine ecological assessment of the Kilo Wharf area included general observations of selected macroinvertebrates and fishes within the survey area.” There is no presentation of “quantitative coral data” in the “Coral Reef Biota” section of the FEIS. Therefore, we recommend that the Navy not indicate that the FEIS includes quantitative descriptions of coral species.

Pg. 3-33. 3.3.2 Coral Reef Biota ROI: Kilo Wharf vicinity: “During the marine ecological assessment survey, qualitative observations of the following five macroscopic benthic invertebrate phyla were as follows:” Lists of species do not amount to an assessment that would significantly contribute toward understanding the general ecology of the marine environment within the affected area. Therefore, we recommend the Navy refer to quantitative data and biological descriptions compiled within the Revised-Draft Kilo Wharf Expansion Project Marine Assessment and Impact Analysis, Apra Harbor, Guam (February 2007) to more accurately understand the affected coral reef community.

Pg. 3-45. 3.3.7 Resource Agency Survey: “In general, coral densities reported for each of the stations coincide with densities reported in the Navy surveys (see Table 3-9 for comparison).” Table 3-9 is completely inaccurate and will confuse the reader. Furthermore, ensuing interpretations associated with this table have been misrepresented because this table is not a comparison of “coral densities.” Rather, the table is a comparison of benthic substrate cover provided by coral. Only the Resource Agency surveys collected quantitative coral density data and these data have not been incorporated in the FEIS. These data provide an improved

understanding of community level complexity, as compared to simply reporting simplified estimates of cover, and we are concerned that these data have largely been ignored in the FEIS. Therefore, Table 3-9 should be titled “Comparison of Coral Cover by Resource Agency and Navy Zones.” Similarly, the word “density” within the table should be replaced with “cover.” Furthermore, we strongly suggest that the Navy refer to the coral density information reported in the Revised-Draft Kilo Wharf Expansion Project Marine Assessment and Impact Analysis, Apra Harbor, Guam (February 2007) to understand coral community level complexity.

Pg. 3-47. 3.3.7 Resource Agency Survey: “The stations in the vicinity of the wharf provide detailed information on about 0.15 ac (0.06 ha) of the substrate (15 transects at 430 ft<sup>2</sup> [40 m<sup>2</sup>] each). The limited number of stations and the absence of statistical method for their placement makes it problematic to extrapolate for impacts assessment purposes.” Prior to resource agency field work (January 06’), the Navy agreed to cooperate with FWS, NOAA, EPA and Territory of Guam agencies (GEPA and DAWR) to evaluate potential project construction-related impacts based on a “worst-case” scenario (Tim Sutterfield and Nora Macariolee-See, December 2005). The Navy instructed the Resource Agencies to take this approach because a clear understanding of the project construction alternatives was not available prior to the January 2006 survey. Survey stations were randomly located within the general footprint in which the Navy believed project construction activities might occur. Clearly, input from Navy personnel (NAVFAC PAC) played a significant role in determining where survey stations would be located during the January 2006 resource agency marine survey of coral reef resources adjacent to Kilo Wharf. Both Mr. Sutterfield and Ms. Macariola-See expressed overwhelming support for the Resource Agency assessment methods to estimate impacts to coral reef resources. Clearly, this statement has been made out of context in which the Resource Agencies had agreed to cooperate with the Navy, based upon the best available information provided to them by the Navy.

The FEIS has mischaracterized the intent of the resource agency surveys, which was not to characterize the general area, but to characterize the area of impact. It has portrayed the surveys as flawed, but the surveys were attempting to answer a different question than the MRC surveys. Additionally, the FEIS points out that the high standard deviations at stations are “coloring the utility of the reported mean station values.” (page 3-47) while overlooking the reason for high variability (high diversity of species) and obscuring the fact that low standard deviations were obtained in the MRC surveys by lumping species data into one species (*Porites rus*), one genera (non-*rus Porites*), and one family. The resource agency surveys indicate that the surveys were randomly selected within the defined area of the impact. Since the survey stations were randomly selected, it is unclear how it is “problematic to extrapolate” possible impacts. Furthermore, methods used for selecting survey stations during the Navy surveys (Smith 2004) is not identified.

Pg. 4-10. 4.2.6.1 West Extension Alternative: “Sketches of the 1986 silt curtain deployment included in the June 1986 monitoring report indicate they were open-ended and did not enclose the dredging areas. Furthermore, one monitoring report (*Sic* unreferenced) indicated that the silt curtains were torn, had holes or were otherwise missing large sections. These factors undoubtedly contributed to the observed silt plume. These observations of a visual plume traveling toward Orote Point in the original construction do not necessarily equate to significant

levels of sediment deposition or TSS.” In 1986, three monthly monitoring reports suggest large areas of coral reef, located down current of the original Kilo Wharf construction site were vulnerable to suspended sediments and sedimentation as a result of project dredging (Navy 1986a, Navy 1986b and Navy 1986c). Furthermore, the Navy reports characterize water quality and visibility conditions as “extremely poor” and that “marine life in the area is suffering as a result of continual sediment loading.” Another Navy account indicates: “Water quality was poor as was visibility (3-5 ft) and there was an appreciable amount of silt and mucous in the water. The entire area was permeated with silt suspended in the water column, settling out on the corals. Most all of the flat or encrusting corals (*Porties lutea*, *Astreopora* sp., *Goniastrea* sp.) are being covered with sediments and dying. Each of these species and other flat marine life forms show signs of stress from siltation. Marine plants are also showing signs of stress from reduced light penetration and smothering by sediments.” Clearly, the FEIS has not fully evaluated dredging induced sediment loading-related impacts to existing coral reef resources. Therefore, we recommend the Navy fully evaluate the potential for project-related sediment loading impacts to coral reef resources in areas adjacent to the project site, as well as areas of coral reef that extend west to Orote point and incorporate measures into the project that will minimize related impacts.

Pg. 4-23. 4.3.1.1 West Extension Alternative and Appendix C (page 67). We commend the Navy for investigating the potential sediment plume through the development of a mathematical model. Overall, the model appears to be sound, but we are concerned that the threshold value for sediment impacts, 0.2 mm/day (=40 mg/day/cm<sup>2</sup>) is too high for the size of sediments in the anticipated plume. Silts, which will form the majority of the plume, aggregate to into large sticky flocs of marine snow that are difficult for corals to remove (Fabricus and Wolanski 2000). As a result, silts and clays have a significantly larger impact on coral survival than coarser fractions and can have adverse impacts at concentrations as low as 4-5 mg/cm<sup>2</sup> in as short as 1 hour of exposure (Fabricus and Wolanski 2000). We recommend that the Navy examine threshold contours of lower concentrations when determining the extent of potential sediment-related impacts and incorporate measures into the project that will minimize such impacts.

Pg. 4-27. 4.2.6.1 West Extension Alternative – Coral Spawning: “Continually elevated sediment loads in the water column apparently do not prevent larval settlement and growth of *Porites rus* or these other Poritid species in these habitats.” There is no data contained within the FEIS to suggest this statement is true and accurate. It is not reasonable to assume that an unlimited amount of sediment in the water column will never adversely impact the survival of any coral.

Pg. 4-27. Section 4.3.1.1. West Extension Alternative. Equating high coral cover with successful recruitment is flawed; high coral cover does not necessarily indicate high levels of successful recruitment are presently occurring on the reef. Corals are long lived species; many large individuals can be over 100-years old and predate human-induced changes to the environment that can adversely impact successful coral recruit. Adult individuals have been shown to be more tolerant of ecological stressors than coral larvae or recruits, and adults may persist in environments in which new recruits cannot survive, creating a false impression of a “healthy” reef. Coral recruitment rates on reefs around Guam have declined precipitously over the past 30 years at numerous sites near Apra Harbor (Minton and Lundgren 2006). This has been coupled with a decline in coral cover. Without data on coral size structure it is not possible

to conclude that corals are successfully recruiting to areas in Apra Harbor based on the presence of high coral cover alone.

Pg. 4-51. 4.3.8 Mitigation: “Although the construction alternatives would have unavoidable adverse impacts to coral reefs, this loss is small when the abundance of similar habitat in the ROI is considered.” This statement is misleading because the FEIS does not provide an analysis of coral reef resources at Kilo Wharf in terms of contributions (*e.g.*, reproduction, genetic diversity, future survival) to other coral reef resources within Apra Harbor.

Pg. 4-97 4.5.4.2 Operational Period Impacts: “The UOG Marine Laboratory’s reef valuation study (Van Beukering et al., 2007) indicates that reefs in the vicinity of Kilo Wharf have a total economic value of between \$4,000 and \$8,100/acre/year.” The level of compensatory mitigation is not determined strictly by the economic values associated with the impacted resources. A memorandum of agreement between the two Federal agencies that administer the Clean Water Act Section 404 program (US Department of the Army and US Environmental Protection Agency, 1990) states that “The determination of what level of mitigation constitutes ‘appropriate’ mitigation is based solely on the values and functions of the aquatic resource that will be impacted” (section II B). That memorandum further states that “In determining compensatory mitigation, the functional values lost by the resource to be impacted must be considered” (section II C 3). The Fish and Wildlife Service considers that guidance to mean that the scale compensatory mitigation must be commensurate with the type, level, and duration of the lost ecological functions of impacted resources. The Habitat Equivalency Analysis methodology used in the analysis of compensatory mitigation scales compensatory mitigation to be commensurate with the type, level, and duration of the lost ecological functions of impacted resources.

To the extent that the economic values associated with the impacted resources at Apra Harbor are a relevant consideration, the van Beukering et al. (2007) study presents an incomplete valuation of such resources. Indeed, the authors state “We acknowledge that there are many conceptual and empirical problems inherent in producing the estimates of the [total economic value] of the coral reefs of Guam. For one, we were only able to assess part of the cultural, biodiversity, and non-use values” (pg. 54). For example, the study results were based on a household survey of only 400 local residents. Such a narrowly restricted survey excludes the potentially significant values of tourists and other world citizens that appreciate the coral resources of Guam. Therefore, the economic values cited in the FEIS represent an incomplete valuation of impacted resources, and are therefore misleading.

## REFERENCES

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US Fish and Wildlife Service  
Recommended Standard Best Management Practices

The Fish and Wildlife Service recommends that the following measures be incorporated into projects to minimize the degradation of water quality and impacts to fish and wildlife resources:

- a. Turbidity and siltation from project-related work shall be minimized and contained to within the vicinity of the site through the appropriate use of effective silt containment devices and the curtailment of work during adverse tidal and weather conditions;
- b. dredging/filling in the marine environment shall be scheduled to avoid coral spawning and recruitment periods;
- c. dredging and filling in the marine/aquatic environment shall be designed to avoid or minimize the loss special aquatic site habitat (coral reefs, wetlands etc.) and the unavoidable loss of such habitat shall be compensated for;
- d. all project-related materials and equipment (dredges, barges, backhoes etc) to be placed in the water shall be cleaned of pollutants prior to use;
- e. no project-related materials (fill, revetment rock, pipe etc.) should be stockpiled in the water (intertidal zones, reef flats, stream channels, wetlands etc.);
- f. all debris removed from the marine/aquatic environment shall be disposed of at an approved upland or ocean dumping site;
- g. no contamination (trash or debris disposal, alien species introductions etc.) of adjacent marine/aquatic environments (reef flats, channels, open ocean, stream channels, wetlands etc.) shall result from project-related activities;
- h. fueling of project-related vehicles and equipment should take place away from the water and a contingency plan to control petroleum products accidentally spilled during the project shall be developed. Absorbent pads and containment booms shall be stored on-site, if appropriate, to facilitate the clean-up of accidental petroleum releases;
- i. any under-layer fills used in the project shall be protected from erosion with stones (or core-loc units) as soon after placement as practicable; and
- j. any soil exposed near water as part of the project shall be protected from erosion (with plastic sheeting, filter fabric etc.) after exposure and stabilized as soon as practicable (with vegetation matting, hydroseeding etc.). The Fish and Wildlife Service believes that incorporation of these measures into projects will greatly minimize the potential for project-related adverse impacts to fish and wildlife resources.