GOAL 8:
REDUCE POLLUTION

KEY THREATS ADDRESSED:

Reducing pollution from sources on land and at sea is critical to conserving and restoring coral reef ecosystems. The figure below is a general summary of the relative importance (H = high, M = medium, L = low) of this goal in addressing specific threats to coral reefs. A higher ranking suggests that activities to reduce pollution are considered more important to addressing the threat. Lower rankings suggest that although activities under this goal may make significant contributions, they may currently be less important to addressing the threat. The rankings are a summary of input shown in Table 2. The actual importance of this goal in addressing threats to reefs will depend on location and other factors (see Tables 3 and 4 for regional comparisons).

THREATS	Global warming/ Climate change	Diseases	Hurricanes/ Typhoons	Extreme biologic events	Overfishing	Destructive Fishing Practices	Habitat Destruction	Invasive Species	Coastal Development	Coastal Pollution	Sedimentation & Runoff	Marine Debris	Overuse From Tourism	Vessel Groundings	Vessel Discharges
Reduce Pollution	**H**	**M**	**L**	**L**	**L**	**L**	**L**	**H**	**M**	**H**	**H**	**H**	**L**	**L**	**H**

RATIONALE FOR ACTION:

Land-based pollution is the major cause of coral reef loss and degradation in many coral reef ecosystems world-wide (Bryant et al., 1998). Coral reef ecosystems need clean, clear water and healthy habitats, both of which can be imperiled by pollution.

Many coral reef ecosystems are currently impacted by a variety of pollutants, including sedimentation, nutrients, chemical contaminants, marine debris, and invasive, non-native species (biological pollutants). Pollution enters reef ecosystems in many ways, ranging from specific point sources such as sewage pipes and vessel discharges, to more diffuse runoff from land-based sources such as agriculture, coastal development, road construction, and on-site waste water management systems, to airborne sources such as emissions from automobiles and power

plants. Reef degradation is even greater in areas where the loss of wetlands or other habitats has reduced nature's ability to filter nutrients and other pollutants before they reach the reefs.

Conserving the Nation's coral reef ecosystems requires reductions in the concentrations and cumulative impacts of pollution from a variety of sources. Land use practices such as deforestation, coastal infrastructure and road construction, logging, and agriculture in coastal watersheds can produce large amounts of sediment being carried in runoff, streams and rivers to coral reefs. Sediments smother corals and decrease water clarity, leading to a variety of impacts on the reef ecosystem including reduced coral cover, diversity, and recruitment. Excess nutrient loading from inadequate treatment and disposal of human and animal waste, and surface runoff from urban and agricultural lands, can also lead to significant changes and damage to the reef community. Discharges of oil, garbage, and ballast water from vessels can also impact coral reef species. Marine debris from fishing or other sources also has impacts on some reef ecosystems. Introductions of invasive species are also of serious concern in some areas, particularly through the discharge of ballast water from visiting vessels that can transport alien species from one region to another.

POLLUTION REDUCTION STRATEGY

The goal is to reduce the quantity and impacts of sediment, nutrient, marine debris, and biological pollutants (e.g., invasive species) on coral reef ecosystems. The U.S. National Action Plan to Conserve Coral Reefs and related documents of the Water and Air Quality Working Group of the U.S. Coral Reef Task Force outline the strategy to achieve this goal. For more detailed information see http://coralreef.gov/. The strategy has two main parts divided into seven objectives: (1) developing tools to assess the biological, chemical, and physical conditions of coral reef ecosystems, and (2) reducing the major types of pollution impacting coral reef ecosystems. The first part (development of tools to assess and reduce the impacts of pollution) is also discussed in the Assessing and Monitoring Reef Health, and Conducting Strategic Research sections of the strategy.

Objective 1: Reduce sedimentation and other land-based sources of pollution by improving land-use and management practices in coastal watersheds through public-private partnerships, incentive-based measures, technical and financial assistance, habitat restoration and other activities.

Objective 2: Reduce nutrient pollution by establishing comprehensive waste management systems to reduce discharges of harmful pollutants from wastewater treatment facilities, vessels, industrial sources, agricultural sources and air deposition.

Objective 3: Reduce chemical pollution (e.g., oil, toxics, hazardous materials) from land-based sources and vessel discharges.

Objective 4: Reduce the flow of marine debris pollution from land-based sources and vessels, and remove existing marine debris from reef ecosystems.

Objective 5: Prevent and control the spread of invasive (e.g., non-native) species in coral reef ecosystems from ballast water and other mechanisms.

Objective 6: Develop tools to assess and address the impacts of pollutants on coral reefs.

Objective 7: Increase awareness and understanding of the ecological, health and socioeconomic impacts of land-based and marine pollution on reef ecosystems.

SUMMARY OF ACCOMPLISHMENTS (2001)

The following is a partial summary of recent accomplishments by federal and non-federal members of the U.S. Coral Reef Task Force to achieve the goal and objectives. For more detailed information see http://coralreef.gov/.

Objective 1 Accomplishments:

- Provided technical and limited financial assistance to private landowners and land users to implement the conservation practices that reduce sediment and nutrient runoff from crop and pastureland, thereby providing secondary benefits to nearshore coral reef ecosystems. (USDA)
- Provided technical and limited financial assistance to state, territory and commonwealth agencies to reduce flow of sediments and other pollutants to reefs from coastal watersheds. (NOAA, EPA and partners)
- Published Storm water Phase II regulations to help reduce the impacts of storm water discharges on reefs and other sensitive coastal resources. (EPA)

Objective 2 Accomplishments:

- Implemented the Water Quality Protection Program Action Plan for the FKNMS focusing on sea grasses and water quality, upgrading inadequate wastewater and storm water infrastructure, and conducting public education and outreach activities to improve local stewardship. (EPA, NOAA, Florida)

- Published a brochure on the impacts of untreated sewage discharged from boats on coral reefs and other sensitive aquatic resources and drafted guidelines on voluntary management measures for on-site waste water treatment systems. (EPA)
- Established a no-discharge zone in coastal waters of Monroe County, Florida, to help reduce pollution and reef impacts. (Florida and partners)
- Monitored for air deposition of nitrogen in the Florida Keys. (EPA)
- Began developing a phosphorus risk assessment tool for field use in the Hawaiian Islands. (USDA)

Objective 3 Accomplishments:

- Provided technical assistance to government and non-governmental entities to reduce the flow of chemical pollutants to reefs from land and vessel sources. (NOAA and partners)
- Produced resource guide on "Coral Reefs and Oil Spills: Planning and Response Considerations" to help prevent and respond to oil spill events. (NOAA)
- Updated Environmental Sensitivity Indices for key coral reef ecosystems for use in identifying sensitive recourses before hazardous material spills, and establishing protection priorities and cleanup strategies. (NOAA and partners)
- Conducted biological assessment to evaluate potential effects of ship construction/repair activities on coral reefs near Diego Garcia. (DOD)
- Implemented biomonitoring program using reef fish to detect impacts of human activities on coral reefs of Johnston Atoll. (DOD)

Objective 4 Accomplishments:

- Established monitoring sites in Hawaii as part of the National Marine Debris Monitoring Program. (EPA and partners)
- Expanded interagency debris removal efforts in a major effort to clean up existing concentrations of marine debris in the (NWHI) within 3 years. Three charter vessels and the R/V TOWNSEND CROMWELL collected nearly 70 tons of debris, primarily at Pearl and Hermes and Kure Atolls - more than had been collected in all previous years combined. Reefs at Kure Atoll were essentially cleared of all major debris. (NOAA, DOI, USCG, Hawaii and other partners)
- Coordinated the first large-scale reef cleanup in the main Hawaiian Islands, on the shoreline around Kauai. The work is being done by Tesoro Oil Company as compensation for an oil spill from their offshore moorings off the east coast of Kauai. (Hawaii, NOAA and other partners).

- Working with State of Hawaii and community volunteers since 1998, removed over 5,000 pounds of net debris each year in Kane'ohe Bay as part of the reef cleanup at Marine Corps Base Hawaii (MCBH). (DOD and partners)

Objective 5 Accomplishments:

- Worked with the Aquatic Nuisance Species Task Force, National Invasive Species Council and other partners to investigate ballast water management and pathways of introduction of alien species. (USCG, NOAA, DOI and partners)
- Produced a Guidebook of Introduced Marine Species in Hawaii and hosted two workshops to explore pathways of introduction and impacts of invasive species on coral reefs. (FWS, Hawaii and partners)
- Supported research on factors related to observed phase shifts in coral reef system from spread of alien macroalgae (Hawaii and partners).
- Sponsored workshop on "Reef Aliens: Marine Invasive Species in Hawaii" to increase awareness among educators and help promote integration of this topic into education efforts. (DOI and partners).
- Supported survey of marine alien species in portions of the (NWHI) coral reef ecosystem (DOI and partners).

Objective 6 Accomplishments:

- Continued review of coral ecosystem indicators, developed a research strategy for creating coral reef indexes of biological integrity and started developing bio-assessment tools for coral reef ecosystems. (EPA).
- Published *Nutrient Criteria Technical Guidance Manual for Estuarine and Coastal Marine Waters* to help states, tribes and others establish scientifically sound nutrient criteria for coastal and estuarine waters (including coral reef areas). (EPA).
- Completed an assessment and "Ecosystem Report Card" of the coral reef ecosystem of the (FKNMS). (NOAA, EPA, DOI, Florida, academic and other partners).

Objective 7 Accomplishments:

- Implemented the Water Quality Protection Program Action Plan for the FKNMS focusing on sea grasses and water quality, upgrading inadequate wastewater and storm water infrastructure, and conducting public education and outreach activities to improve local stewardship. (EPA, NOAA, Florida)

IMPLEMENTATION PLAN 2002-2003

Successful implementation of the strategy is contingent on funding and other factors, including effort by a variety of federal and non-federal organizations. The Water and Air Quality working group of the U.S. Coral Reef Task Force, working with many partners, provided the following partial summary of key actions needed from government and non-governmental entities in 2002-2003 to help fulfill the objectives. More detailed information is available from the working group or member organizations of the U.S. Coral Reef Task Force (http://coralreef.gov/).

To Address Objective 1:

- Reduce on-site erosion and nutrient runoff in surface waters through incentive-based measures and by increasing technical and financial assistance to private landowners and land users.
- Increase efforts to evaluate the success of land use and best management practices to reduce sediment and nutrient runoff from agriculture and other land use practices.
- Conduct assessment of sediment and other pollution issues in reef-associated coastal watersheds to help identify priorities and strategy of action in each region.
- Increase technical and financial assistance to state, territory and commonwealth agencies to reduce flow of sediments and other pollutants to reefs from coastal watersheds.
- Evaluate the performance of existing storm water discharge practices on reefs and other sensitive coastal resources.

To Address Objective 2:

- Increase technical and financial assistance to private landowners and land users to reduce on-site erosion and nutrient runoff in surface waters.
- Increase efforts to evaluate the success of land use and best management practices to reduce nutrient runoff from agriculture and other land use practices.
- Conduct assessment of nutrient pollution issues in reef-associated coastal watersheds to help identify priorities and strategy of action in each region.
- Increase technical and financial assistance to state, territory and commonwealth agencies to reduce flow of nutrient pollutants to reefs from coastal watersheds.
- Evaluate the impacts of existing vessel discharge practices on reefs and other sensitive coastal resources in six high-use regions.
- Identify, increase monitoring, and develop action strategies for three reef regions at high risk from air deposition of nutrients.
- Support implementation of the Water Quality Protection Program Action Plan for the Florida Keys coral reefs.

- Support implementation of the South Florida Comprehensive Ecosystem Restoration Program to help restore South Florida's coral reef ecosystem.
- Work with the shipping industry to identify and reduce impacts from vessel discharges.

To Address Objective 3:

- Increase technical and financial assistance to government and non-governmental entities to reduce the flow of chemical pollutants to reefs from land and vessel sources.
- Produce technical information and resource guides for U.S. and international use to help prevent and respond to hazardous material spills in coral reef ecosystems.
- Continue to update Environmental Sensitivity Indices for key coral reef ecosystems for use in identifying sensitive resources before hazardous material spills, and establishing protection priorities and cleanup strategies.
- Identify priority areas for additional action to reduce impacts to coral reefs from vessel discharges.
- Support pre-event response planning with federal, state and local partners.

To Address Objective 4:

- Establish additional monitoring sites on the Main Hawaiian Islands of Hawaii, Molokai and Lanai as part of the National Marine Debris Monitoring Program.
- Continue 2nd and 3rd years of major effort to remove marine debris from the coral reef ecosystem of the (NWHI).
- Identify sources and paths of marine debris to coral reef ecosystems of the Hawaiian islands.
- Design and implement measures to stop the flow of marine debris to the coral reef ecosystem of the Hawaiian Islands.

To Address Objective 5:

- Support development of methods to reduce introduction of invasive species in vessel ballast water.
- Research primary pathways of introduction and impacts of invasive species on coral reefs.
- Develop and implement an early warning and response system for invasive species in Hawaii and other coral reef ecosystems.

To Address Objective 6:

- Continue development of indexes of coral reef biological integrity and bio-assessment tools for coral reef ecosystems.

- Support development of local to regional coral reef monitoring systems to allow regular assessments and tracking of coral reef conditions and effects of management actions.

To Address Objective 7:

- Design Manual for Onsite Sewage Treatment Systems and the Voluntary Guidelines for Onsite Sewage System Management, and develop a guidance manual on implementing the voluntary guidelines.