

RAW  
H

## PRINCE WILLIAM SOUND RESTORATION PLAN

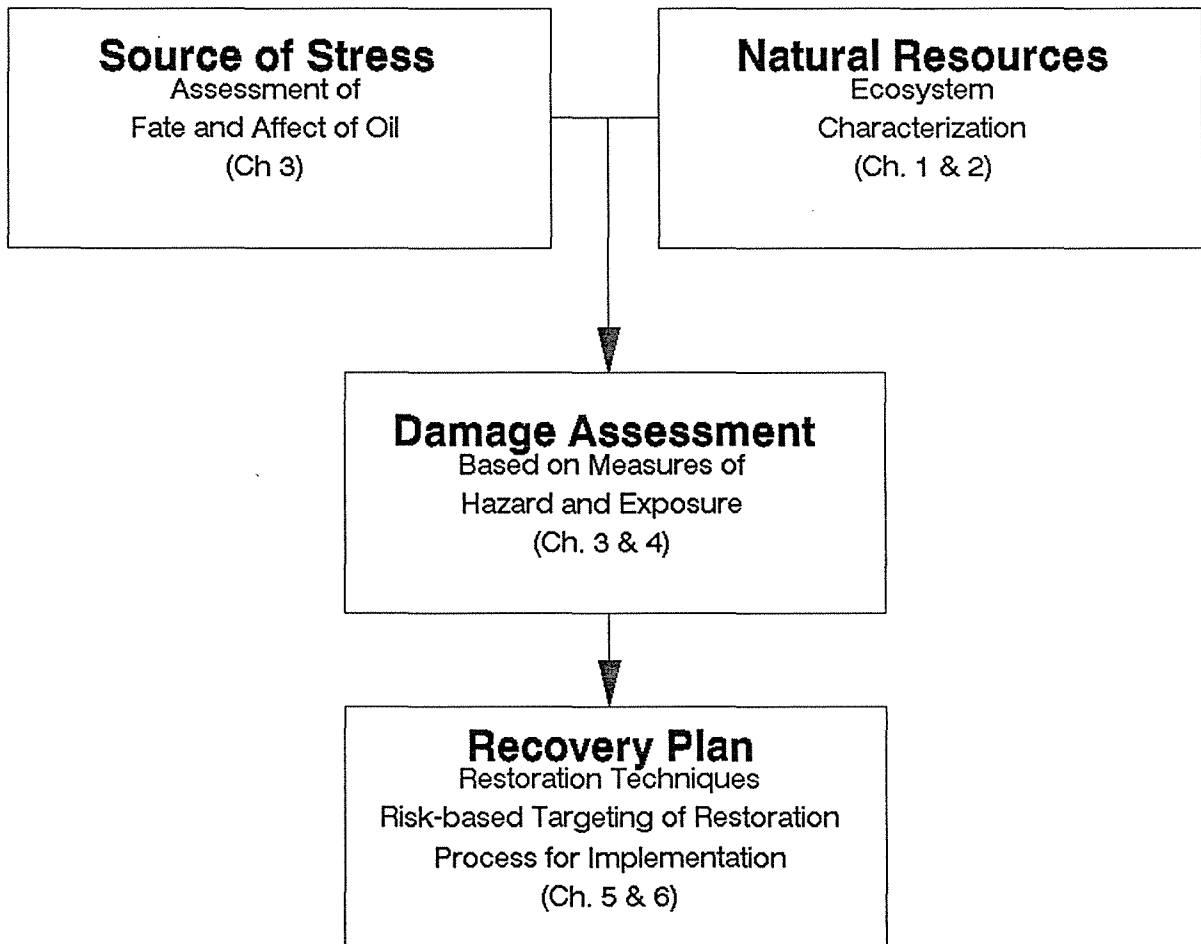
### Concept and Overall Approach

- \* The Restoration Plan will be a comprehensive, integrated, cost-effective approach toward restoring the affected physical environment to its pre-spill condition and re-establishing to the extent feasible the indigenous pre-spill ecosystems. The Plan will incorporate techniques and approaches to enhance and speed up natural restorative processes, correct adverse trends, and replace completely destroyed components of the environment.
- \* The conceptual approach toward Plan development will be similar to that used in hazard or risk assessment analyses of environmental impacts as used in many EPA regulatory processes.

Flow chart illustrating the concept is attached.

- \* This process begins with a characterization of the ecosystem, with particular regard to environmentally sensitive characteristics and areas. The hazards associated with the imposition of certain stresses (in this case spilled oil) are then assessed and the risks to various parts of the ecosystem are evaluated.
- \* From studies by the trustee Agencies the actual observed damages to each ecological compartment are determined and evaluated in terms of the initially established overall ecological significance, and the natural resiliency of each ecological compartment toward recovery is assessed.
- \* This assessment identifies what parts of the ecosystem need help in recovering from the effects of the spill, and the Restoration Plan is then built around what measures can be used to enhance the recovery of those parts of the ecosystem.
- \* A major part of the information necessary to complete this Plan can be obtained through the studies to be done by the trustee Agencies as part of their damage assessment efforts, if their presently planned studies are completed. EPA must coordinate with trustees to assure systematic measurement of the extent and duration of exposure.
- \* The remainder of the information necessary can be obtained from workshops conducted through the Scientific Advisory Panel.
- \* A proposed topic outline for the Restoration Plan report and a more detailed annotated outline for the report are attached. These are based on the implementation of the hazard or risk assessment approach outlined above.

# Environmental Protection Agency Prince William Sound Restoration Plan Risk/Hazard Assessment Approach



# Prince William Sound Restoration Plan

## Report Outline

### I. Introduction/Background

- A. Purpose, Scope, and Objectives of the Plan
- B. The Geographical Area of Concern.
- C. Ecological Risk Assessment Approach to Recovery/Restoration

### II. Ecosystem Characterization of the Area.

- A. Living Resources of the Affected Area
- B. The Habitats
- C. Relationship of habitat to use by biota before spill
- D. Essential food chain components in each subsystem

### III. Overall Environmental Effects of the Spill

- A. Immediate Environmental Effects
- B. Long-Range Environmental Effects
- C. Overall Consequences

### IV. Extent of Damage Actually Observed.

- A. Quantification of actual Population Loss
- B. Quantification of Amount of Each Type of Habitat lost
- C. Quantification of food chain disruption: Location and Extent
- D. Damage caused by short-term mitigation measures
- E. Effect of habitat loss and food chain disruption on long term survivability and reproductive capability of particular species

### V. Measures for Long-Term Restoration

- A. Possible Approaches that should be considered
- B. Selection of Feasible Means of Restoration
- C. Appropriate Agencies or Organizations for Implementing Restoration Measures
- D. Timing and Cost of Applying Restoration Measures

### VI. Recommended Program

- A. Living Resources targeted for assistance in Restoration
- B. Measures to be employed
- C. Budget and Schedule
- D. Recommended Responsible Agency or Organization

# PRINCE WILLIAM SOUND RESTORATION PLAN

## Annotated Outline

### I. Introduction/Background

#### A. Purpose, Scope, and Objectives of the Plan

#### B. The Geographical Area of Concern.

##### 1. General Physical Structure.

A description of what it looks like, and how it got that way: young mountain topography, fjord structure, glaciated coastline, active calving of glaciers, coastline primarily rocky and steep to, makeup of neighboring terrestrial environment (forested, grassland, wetlands, rocky terrain, etc.). Comparison of Prince William Sound area and adjacent coastal areas (e.g., Kodiak Island, Kenai Peninsula, Cook Inlet, Gulf of Alaska).

##### 2. Climate.

What the annual cycle of weather is like: temperatures, precipitation, fog, storms, amount of sunlight by seasons.

##### 3. Aquatic environment.

Characteristics of the water bodies in Prince William Sound and adjacent area, both upland and oceanic: fresh water inflow, salinity structure, stratification, seasonal variations in stratification and circulation, water chemistry (basic structure is fjord-like; this implies high sulfur/low oxygen in lower layers, which would have significant habitat implications) with particular attention to seasonal variations and differences in various parts of the system.

##### 4. Human Habitation and Economic Development.

Population of the area, towns and villages, economic base, commercial, recreational, and subsistence use of resources.

#### C. Ecological Risk Assessment Approach to Recovery/Restoration.

### II. Ecological Characterization of the Area.

NOTE: This discussion will include maps of Prince William Sound showing the seasonal distribution of ecologically sensitive areas.

#### A. The Living Resources of the Affected Area.

##### 1. Identification and quantitative inventory of indigenous living organisms (both plant and animal). This will not be exhaustive but will include all species of either direct or indirect significance in the categories listed below.

###### a. By environmental zone:

- Water column.

- Sediments or other benthic substrate.
  - Shoreline, beaches, or other littoral area.
  - Terrestrial.
  - Aerial.
- b. By use or other role:
- Commercially exploited (including recreation).
  - Endangered.
  - Unique.
  - Ecologically important.
  - Subsistence food source.
- c. By location in food chain:
- Primary producer.
  - Part of food chain base.
  - Predator.
2. Interrelationships among the biota in different parts of the environment (not especially food chain relationships, although these will be mentioned here but discussed in detail later).

#### B. The Habitats.

1. Assessment of type and amount of habitat present.
- a. Aquatic:
- Pelagic.
  - Coastal.
  - Embayments (shallow and fjord).
  - Littoral.
  - Vegetated (SAV).
- b. Benthic:
- Sandy.
  - Gravel.
  - Rocky.
  - Mud.
  - Vegetated.
- c. Inter-tidal and other littoral:
- Rocks and caves.
  - Gravel.
  - Sand.
  - Marshes and other vegetated areas.
- d. Embayments and fjords:
- all of a., b., and c.
- e. Terrestrial:
- Forest.
  - Grassland.
  - Marsh (Wetlands).
  - Rocks and caves.

#### 2. Interdependence of habitat types.

#### C. Relationship of habitat to use by biota before spill.

#### D. Essential food chain components in each subsystem.

1. For general ecosystem support.

2. To support specific indigenous species of concern.

### III. OVERALL ENVIRONMENTAL EFFECTS OF THE SPILL:

#### A. Immediate environmental impacts.

##### 1. Formation and movement of slick.

- a. Formation of a massive surface oil slick which drifted downwind and downcurrent of the vessel and soon began to develop streamers.
- b. Slick moved generally SSW over a period of several days, gradually becoming larger and breaking up as it hit shorelines and was mixed by wind and wave action.
- c. Parts of surface slick tended to collect in embayments and on shorelines and at that point to break up into smaller patches.

##### 2. Types of impacts

- a. Immediate impacts were primarily the result of the physical presence of the oil in the environment and its resulting interference with natural processes necessary to support life.
- b. These impacts appear to have been locally severe, but could have been minimized and longer-range effects avoided if the oil could have been contained within a few hours after its release.
- c. These types of immediate effects also occur along shorelines which are reached by large patches of oil.

#### B. Long-range environmental effects:

##### 1. Types of Effects

- a. Affect both land and water resources and are generally more severe and more subtle than the immediate effects.
- b. In the aquatic environment.
- c. Physical effects in the littoral zone.
- d. Biological effects in the littoral zone.

##### 2. Extent of Effects

- a. The immediate environmental effects mentioned above have been observed in Prince William Sound.
- b. Some of the longer-range and shoreline effects have already been observed, and the nature of the ecosystems along the Alaskan Coast that are likely to be affected by the future progress of the spilled oil are such that all of the long range effects mentioned are probable in some locations.
- c. Quantitative assessment of the extent of ecological damage will require observation of conditions over at least one breeding cycle.

C. Overall Consequences.

1. Ultimate endpoints appear as ecological stress on living resources and physical damage to non-living resources.
2. Extent of damage can range from extremely mild to catastrophic depending upon many factors.
3. Prince William Sound contains nursery, passage, and breeding areas for for commercially important fish, such as salmon and herring, rookeries for various pinniped (seal and walrus) species, and two significant otter habitats, as well as a large population of aquatic waterfowl.

IV. Extent of Damage Actually Observed.

A. Quantification of actual population loss.

1. Numbers of recovered animals and number of observed fatalities.
2. Estimated impact on total population.

B. Quantification of amount of each type of habitat lost.

1. Amount of physical destruction.
2. Relationship of physical destruction of habitat to disruption of food chain.

C. Quantification of food chain disruption: location and extent.

1. From physical destruction.
2. From toxic effects.

D. Damage caused by Short-Term mitigation measures.

1. Immediate containment.
2. Chemical dispersal.
3. Isolation of ecologically sensitive areas.
4. Establishment of barriers to migration by aquatic or littoral biota.
5. Capture and cleaning of oiled animals.
6. Removal of oil from water and shorelines.

E. Effect of habitat loss and food chain disruption on long term survivability and reproduction capability of particular species.

V. Measures for Long-Term Restoration

A. Possible approaches that should be considered.

1. Use artificially placed micro-organisms to destroy traces of oil so natural populations can re-establish themselves.
2. In the water column, re-establish natural populations from hatcheries as soon as oil levels are sufficiently low.
3. In the littoral zone, wait for natural

recolonization of the food chain base to occur, then artificially re-establish commercial or other important species.

4. In the littoral zone, artificially re-establish the food chain base with appropriate micro-organisms and epifaunal biota, then re-establish higher species from hatcheries or by transplantation from pristine areas.
5. Re-establish aquatic plants by transplantation, particularly in areas subject to erosion.
6. Re-create damaged or destroyed terrestrial and littoral habitats, and recolonize with transplanted species.

B. Selection of Feasible Means of Restoration.

1. Criteria for feasibility.
  - a. Practicality of implementation on the scale required.
  - b. Cost as compared to value, either ecological or economic, or both, of the resource to be restored.
  - c. Identification of a particular organization or entity to do the work.
2. Impact of short-term mitigative measures.
3. Research needs.

C. Appropriate Agencies or Organizations for Implementing Restoration Measures.

1. Responsibility as a trustee of specific resources.
2. Special expertise in the area or the resource.
3. Facilities available in the area.

D. Timing and Cost of Applying Restoration Measures.

1. Probable time frame for natural restoration to occur.
2. Extent to which natural processes can be speeded up or enhanced by employing certain additional measures.
3. Cost of employing additional measures as compared to the overall (not just economically quantifiable) value of the resource.

VI. Recommended Program.

- A. Living resources targeted for assistance in restoration.
- B. Measures to be employed.
- C. Budget and schedule.
- D. Recommended responsible Agency or organization.



RPWG  
H

## RESTORATION PLANNING PROJECT

### INTRODUCTION

Soon after the EVOS occurred, President Bush announced his goal and intent that the ecology and economies of PWS and the other affected areas be fully restored. The Trustees recognized from the beginning that restoration of the ecological health of areas affected by the oil spill is the fundamental purpose for conducting the NRDA. Initially, studies to determine the injury to natural resources were emphasized, since that information is basic to a determination of damages, and finally, restoration of resources.

Since late 1989, considerable effort has gone into specific restoration planning activities. An interagency Restoration Planning Work Group (RPWG) was formed to develop and coordinate what is envisioned to be a steadily growing level of activity throughout this year and next. A variety of activities have already been initiated by the RPWG and several more are proposed to occur during 1990, as described in the following pages. In addition, it is anticipated that restoration planning and project activities will be expanded further in 1991 and beyond.

### OBJECTIVES

The overall goal of the Restoration Planning Project is to identify appropriate measures that can be taken to restore the ecological health of natural resources affected by the EVOS. Among the objectives within this overall goal are:

- A. Encourage and provide for public participation and review during the restoration planning process.
- B. Identify and develop technically feasible restoration options for natural resources and services potentially affected by the oil spill.
- C. Incorporate an "ecosystem approach" to restoration (i.e., broadly focus on recovery of the ecosystems, as well as individual components).
- D. Identify when active restoration measures may be warranted, and when it may be appropriate to rely on natural recovery.
- E. Identify the costs associated with implementing feasible restoration measures, in support of the overall NRDA process.

## DEFINITION

Restoration is a broad term that can include direct restoration, replacement, or acquisition of resources or uses those resources provided that are equivalent in terms of ecological or human services.

Direct restoration refers to measures taken to restore an injured resource, and generally equates with on-site actions. An example would be to rehabilitate an oiled marsh ecosystem by supplementing natural plant and animal populations after removal of the oil.

Replacement refers to the substitution of one resource for an injured resource of the same type. An example is to use hatchery/aquaculture techniques to establish an entirely new fishery stock in place of one that has been severely damaged. Replacement activities may or may not be limited to the specific site or area where injury occurred.

Acquisition of equivalent resources means to obtain or otherwise protect resources that are similar or related to the injured resources in terms of ecological value, functions, or uses. An example is to obtain or protect undamaged wildlife habitats as alternatives to direct restoration of injured habitats. Equivalent resources could be acquired in locations removed from the immediate vicinity of the injured resource.

## 1990 RESTORATION PLANNING ACTIVITIES

Several major activities have been initiated or are proposed under the Restoration Planning Project in 1990. Each major activity area is described in this section.

### Public Participation

In part as a response to public comments on the 1989 NRDA Plan, several avenues have been developed for public involvement in the restoration planning process. The RPWG has conducted a public Restoration Symposium, and held public information and scoping meetings in several Alaskan communities directly affected by the oil spill. Additional public meetings may be held outside Alaska during 1990 as well. The RPWG has also begun to contact interest groups and other organizations that have expressed an interest in the restoration planning process, in order to gain a more direct and detailed understanding of their concerns and suggestions. An information flier and response form has been developed and distributed initially in Alaskan communities in order to encourage additional comments from residents of areas most directly affected by the spill. Reports generated through the Restoration Planning Project will generally be distributed publicly. The following paragraphs briefly describe the outcomes of the major public activities conducted to date.

## Restoration Symposium

A two-day public Restoration Symposium was held at the Egan Civic and Convention Center in Anchorage, Alaska on March 25 and 26, 1990. The symposium was the first opportunity for environmental, industry, and other interest groups and members of the general public to present their views about the content of a restoration plan. Formal presentations were made by more than 30 individuals. A report documenting the presentations and comments given at the Restoration Symposium is scheduled to be publicly distributed in July 1990.

## Community Scoping Meetings

An initial series of public information and scoping meetings was held beginning in April 1990. The RPWG travelled to eight Alaskan communities directly affected by the oil spill to provide an opportunity for residents to express their views about what a restoration plan should entail. Evening meetings were held in Cordova, Valdez, Whittier, Seward, Kenai, Homer, Kodiak and Anchorage. The community scoping meetings resulted in a variety of restoration ideas being identified. Public comments received as a result of the community scoping meetings will be documented in the progress report scheduled for public distribution in July 1990.

## Technical Workshops on Restoration

The RPWG conducted an initial three-day technical workshop on restoration in Anchorage in early April, 1990. The workshop provided a forum for the scientists most familiar with the effects of the oil spill, as well as other scientists with relevant knowledge, to focus their attention on potential restoration needs and opportunities. A second technical workshop is planned for the Fall 1990, and it is anticipated that more such opportunities will occur before the conclusion of the process. One purpose of the first technical workshop was to help identify and develop an initial set of potentially beneficial restoration techniques that could receive small-scale field testing during the Summer 1990. An array of potential feasibility study projects was identified, some of which are proposed to be initiated (see Restoration Feasibility Studies below). The results of the workshop will be documented in the progress report scheduled for public distribution in July 1990.

## Literature Review

The first phase of a comprehensive search of worldwide literature relevant to restoration of natural resources was initiated early in 1990. "Phase I," the initial search of key computerized literature data bases, identified several thousand potentially relevant references, which were narrowed to approximately one thousand of the most directly applicable citations. These references have been screened, and the most important ones have been flagged for

acquisition. These references will be reviewed in detail during the "Phase II" literature review, along with other references identified in an expanded search. Literature review activities are expected to continue throughout the restoration planning process. The results of "Phase I" will be summarized in the progress report scheduled for public distribution in July 1990. Updated results will be presented in subsequent reports.

### Feasibility Study Projects

There are relatively few existing technologies for restoration of natural resources that can be immediately applied under Alaskan conditions with certainty of success. For this reason, feasibility study projects are among the most important aspects of restoration planning. A feasibility study project may be appropriate when a restoration idea has been developed that appears to be potentially beneficial, but for which there is substantial uncertainty of its success or benefit with local species or under the sub-arctic conditions of the spill area.

The following pages present summaries for each of the initial feasibility study projects proposed for 1990. These projects were developed from ideas presented at the public symposium, the community scoping meetings, and the technical workshop. Factors considered in selecting 1990 studies included: the need to initiate the particular study as soon as possible, the ability to implement the project in a short time frame, reasonable likelihood of success, identified public concern, relationship to other NRDA studies, and budget priorities.

Five restoration Feasibility Studies having a total budget of \$326,400 are proposed for initial field testing in 1990. Two of these concern restoration of intertidal resources and communities, one addresses upland habitats used by wildlife affected by the spill, one involves stabilization and restoration in the supratidal zone, and one supports the potential acquisition of equivalent resources through review of land status, uses, and plans.

Three restoration technical support projects with a budget of \$236,500 are planned. The first will institute a formal peer review process for restoration project results and planning. The second will compile shoreline status information from both response and NRDA sources to support selection of sites and habitats for future feasibility studies and restoration projects. The third technical support project will fund development of detailed proposals for feasibility studies to be considered for implementation in 1991.

**BUDGET**

Restoration symposium	\$ 50.0
Community scoping meetings	40.0
Technical workshops	200.0
Literature collection/review	90.0
Feasibility study projects	562.9
Report preparation/publication	150.0
Salaries	600.0
Travel	<u>70.0</u>
TOTAL	\$1,762.9

Lead agencies: EPA, ADF&G

Cooperating Agencies: DNR, DEC, DOA, DOI, DOC