Draft 2-1-93

CHAPTER V. RESTORATION PLAN ALTERNATIVES

The chapter presents different ways the to use funds from the civil settlement to restore the injuries to resources and services caused by the spill. Each approach, called an alternative, is a scenario that demonstrates the effect of different policy decisions on restoration. If there were no disagreement on how to restore oil spill injuries, or if there was enough money available to complete everything people wanted to do, there would be no need to illustrate different approaches. However, there are differences of opinion on the best methods of using settlement funds, and alternatives show the implications of different policy decisions on restoration.

INTRODUCTION TO RESTORATION ALTERNATIVES

Each restoration alternative is composed of four components: a theme, policy decisions, restoration options, and approximate budget allocations. Table V-1 on the next page summarizes the themes and policies of the alternatives.

5 authors wrote, not reviewed yet
substantive comments coming from RT 2-4-93
organization needs work

TABLE V-1. Summary of Restoration Alternatives

	Alternative 1 Natural Recovery	Alternative 2 Protection	Alternative 3 Limited Restoration	Alternative 4 Moderate Restoration	Alternative 5 Comprehensive Restoration
THEME	No action other than monitoring and normal agency management.	Protect injured resources and services from further degradation or disturbance.	Take the most effective actions to protect and restore injured services and resources whose population has declined. Maintain the existing character of the affected area.	Take the most effective actions to protect and restore all injured resources and services. Increase, to a limited extent, opportunities for human use in the affected area.	Take all reasonable actions to protect, restore, and enhance all injured resources and services. Increase opportunities for human use in the affected area.
VARIABLES					
Injury	N/A	All injured resources.	Injured resources whose populations declined.	All injured resources.	All injured resources.
Status of Recovery	N/A	All stages of recovery.	Resources not yet recovered.	Resources not yet recovered.	All stages of recovery.
Effectiveness of Restoration Actions	N/A	All beneficial actions.	Most effective actions.	Most effective actions.	All beneficial actions.
Opportunities for Human Use	N/A	N/A	Protect existing uses.	Protect or increase existing uses.	Protect, or increase existing uses; encourage appropriate new uses.

Monitoring and information programs are included in all alternatives.
Restoration actions may be undertaken for injured resources, services, or their equivalents.

ALTERNATIVE THEMES. The alternative theme is a description of what the alternative attempts to achieve. It is a general statement of the objectives of the alternative -- a reflection of different answers to four policy questions facing the Trustees.

The theme of Alternative 1, Natural Recovery, is to let the spill-affected area recover on its own, but to monitor recovery and continue normal agency management. In this alternative, the Trustees spend no funds on restoration; they would spend only to monitor recovery. Alternative #1 is a "no-action" alternative required by the U.S. National Environmental Policy Act, Environmental Impact Statement that accompanies the restoration plan. This alternative provides a useful baseline to judge the effects of the other alternatives.

The theme of Alternative 2, Protection, is to protect injured resources and services so they can recover on their own without further disruption. In this alternative, the objective is to fund restoration measures such as land purchases that protect injured resources and services from further stresses, and to let natural processes effect recovery.

Alternatives 3 through 5 represent a progression of restoration actions. These three alternatives progress from a limited to a more expansive view of restoration. The options in Alternative 3, Limited Restoration, address only the most serious resources injuries: those that caused a detectable decline in the population of a resource. The alternative addresses these injuries using only the most effective restoration methods. In addition, in this alternative the Trustees would cease restoration once a population recovered. The alternative also addresses services, but only to the extent of protecting existing uses.

Alternative 4, Moderate Restoration, takes a more expansive approach to injury. It address all injury: population-level, and chronic injuries. It address services by both protecting and enhancing existing use.

Alternative 5, Comprehensive Restoration, takes a further step In this alternative, the Trustees would fund restoration and protective measures aimed at all resources, and would be willing to aid a species even after it recovered. In this alternative, the Trustees would be willing to fund techniques with a lower level of effectiveness. They would be willing to fund restoration for services that goes past protecting or enhancing existing human use, and encourages appropriate new ones.

POLICY DECISIONS. In deciding what restoration actions to fund, the Trustees are faced with a variety of policy decisions. The alternatives illustrate the implications of different answers to these decisions. They do this through the use of four policy questions, or policy variables, summarized in Table V-2. The first two variables apply to resources only; the last variable applies to services only; the third variable applies to both resources and services. Each variable raises a significant policy issue.

Table V-2. Variables Used to Construct Alternatives

VARIABLE	POLICY ISSUE
Injury	Should restoration actions address ALL injured resources or only those whose populations declined because of the oil spill?
Status of Recovery	Should restoration actions cease when a resource has recovered?
Effectiveness of Restoration Actions	Should the plan include only the most effective restoration actions or all beneficial actions, even those less certain of success or likely to produce only slight improvement in recovery?
Opportunities for Human Use	To what extent should restoration actions be used to increase opportunities for human use?

Policy Variable: Injury. Some people believe that restoration efforts should be focused only on those resources that experienced a population decline after the oil spill. They believe that unless the injury was sufficiently serious to detect a difference in population, the trustees should not fund restoration efforts. Others believe that restoration should focus on all resources, including those that experienced a chronic or sublethal injury that did not result in a detectably lower population.

There are a number of reasons why a sublethal or chronic injury may not result in a lower population. These include: the chronic or sublethal injury may not affect the productivity of the species, or the species may have some natural compensating mechanism for the injury. There also may be enough variability in the natural abundance of the species to mask any effect of the injury, or scientific measurement techniques may not be sensitive enough to measure the effect on the spill-area population.

Table V-3 shows which resources showed a population decline, and which showed chronic or sublethal injury without a detectable change in population. The table shows the injuries that occurred as of 1989, the spill year and does not take into account recovery.

Table V-3. Degree of Injury

Resources whose populations declined because of the spill.	Sublethal or Chronic Effects. No Detectable spill-related population decline
Harbor seals	River otters
Sea otters	Bald eagles
Killer Whales	Pink salmon
Common murres	Pacific herring
Marbled murrelet	Rockfish
Pigeon Guillemots	Dolly Varden
Harlequin ducks	Cutthroat Trout
Black oystercatchers	
Sockeye salmon smolts	
Intertidal organisms	
Subtidal organisms	

Policy variable: Status of Recovery. Some people believe that once a resource is recovered, the Trustees should cease their restoration efforts. Others believe that the Trustees should continue restoration, especially protective measures such as land purchases, even after resources recover to where it would have been in the absence of the spill.

Currently, no resources have recovered from population decline. However, some chronic injuries have recovered. As resources recover, this issue will become more important.

Table V-4 shows current expectations about when resources will recover. The information in the table is based on the best available information to agency and peer review scientists. For some species, there is substantial disagreement on the exact mechanism of the injury and how long it will take to recover. For many species, much is unknown about when and how recovery will take places. However, the table below represents the current best estimate of natural recovery, unaided by society's restoration techniques. These estimates will certainly change as recovery continues, monitoring uncovers more information, and scientists learn more about each species.

Table V-3. Status of Natural Recovery

Population-level Injuries	Expected Recovery	Comments
Harbor seals	Unknown	In decline before the spill. Population may have stabilized.
Sea otters	< 50 years	Population stable, but not recovering
Killer Whales	< 20 years	Recovering
Common murres	< 120 years	Recovery varies by colony.
Marbled murrelet	Maybe stabilize in < 50 years.	In decline before spill. Maybe still declining; maybe stable.
Pigeon Guillemots	Maybe stabilize in < 50 years.	In decline before spill. Probably still declining.
Harlequin ducks	Maybe < 50 years	Still no reproduction within spill area.
Black oystercatchers	< 30 years	Recovering
Sockeye salmon smolts	< 50 years	In Kenai, not yet recovering.
Intertidal organisms	< 25 years	Recovering in most places.
Subtidal organisms	< 10 years in most places.	Recovering in most places.

Sublethal or Chronic Injuries	Expected Recovery of Chronic Injury	Comments
River otters	Unknown	
Bald eagles	Recovered	Back to pre-spill population by 1993-1995
Pink salmon	Unknown	
Pacific herring	Recovered	May know if population declined after 1993 spawning season.
Rockfish	Unknown	
Dolly Varden	< 20 years	
Cutthroat Trout	< 20 years	

Policy variable: Effectiveness of Restoration Actions. Most people would agree that all things being equal, the Trustee should fund the most effective techniques available for restoring oil-spill injuries. However, people may disagree at what level of effectiveness a technique is not worth funding. The Effectiveness of Restoration Actions variable gets at this issue.

The effectiveness of an option is classified into two categories, based on how much change they cause in some aspect of the rate or degree of natural recovery.

- **Most Effective options.** These are the options that have a significant effect on recovery, or make it significantly more likely that the population will achieve its predicted natural recovery. "Most effective" options includes those that agency and peer review scientists

estimate could decrease the time to recovery by at least 25%. Options which significantly changed the expected degree of recovery, relative to its prespill condition or its rate of decline were also included in this category.

Many times scientists estimate the time to recovery in a range of years; for example, they might estimate that a population will recovery in, say, 20 to 80 years. Twenty to 80 years forms the confidence interval surrounding recovery. We included options in the "most effective" category, if they decreased the confidence interval by 25%. In this example, that decrease would change the confidence interval to 20-60 years. This is a quantitative way of a scientist saying that the option makes it significantly more likely that an species will achieve its predicted natural recovery.

- **Other Beneficial options.** This category includes options that agency and peer review scientists estimate will have a measurable effect on recovery. It includes those options estimated to cause a 10-24% change in recovery times, including those that change the confidence interval by 10-24%.

Changes less than 10% are unlikely to be measurable. Scientists can rarely measure less than a 10% change in population levels. Options estimated to cause less than a 10% change in recovery (or the confidence interval surrounding recovery) were eliminated from consideration.

In most cases, natural recovery is the most effective mechanism for recovery. Frequently, there is little society can do to help an injured resource or service except wait and protect the injured resources or services from further stress.

The table below shows whether effective options are available to actively aid an injured resource or service recovery, and whether there are options available to protect it from further stress.

Table V-X. Availability of Effective Options

Resources whose populations	Active Restoration		Protection	
declined because of the spill.	Most Eff.	Beneficial	Most Eff.	Beneficial
Harbor seals	No	No	Yes	No
Sea otters	Study*	No	Yes	No
Killer Whales	No	No	Study*	No
Common murres	Yes	Study*	Yes	No
Marbled murrelet	No	No	Yes	No
Pigeon Guillemots	Yes	No	Yes	No
Harlequin ducks	Study*	No	Yes	Yes
Black oystercatchers	No	Study*	No	Yes
Sockeye salmon smolts	Yes	Yes	Yes	Yes
Intertidal organisms	Study*	No	No	No

Subtidal organisms	No	No	No	No
Sublethal or Chronic Effects.	No			
Detectable spill-related population decline				
River otters	No	No	No	No
Bald eagles	No	No	No	Yes
Pink salmon	Yes	Yes	No	Yes
Pacific herring	No	No	Yes	No
Rockfish	No	No	Yes	No
Dolly Varden	Yes	No	Yes	No
Cutthroat Trout	Yes	No	Yes	No

* Study refers to options that require feasibility studies to fully evaluate them. They include experimental techniques and further analysis to determine whether they can live up to their potential. They are listed under the column in which they would fall if feasibility or further study finds that they are as effective as they promise.

Policy variable: Opportunities for Human Use. Many of the service options, most notably those for recreation or fishing have the objective of improving or increasing opportunities for human use of the spill area as a way to restore or enhance the spill damages. In interviews with spill-area users, many have expressed concern that too much additional use, especially if located inappropriately, might adversely change the character of the area. This variable addresses that this issue. This variable applies only to restoration options for services.

For this criteria, these options are grouped into four categories.

- *Protect existing uses.* Certain options protect existing opportunities for human use of the spill area. They are not designed to increase use levels or change use patterns, but only to protect what existed before the spill. Examples might be funding to state or federal agencies to construct recreation facilities that protect the environment such as outhouses in over-used areas, or improved trails where hiking is damaging wetlands. Other examples include programs to provide information about the safety of subsistence foods to subsistence users.

- *Protect existing or increase existing uses.* Options in this category provide additional opportunity for human use of the spill area. Examples are funding to increase existing sport- or commercial fishing runs, or funding to construct recreation facilities such as public-use cabins that would also increase opportunities for human use.

- *Protect or increase existing uses; or encourage appropriate new uses.* Options in this category take a further step in increasing opportunities for human use of the spill area. They include funding agencies to add new uses in appropriate locations such as visitor centers, new fishing runs, or commercial facilities.

In all of these categories, options would be funded through existing state and federal agencies. Those agencies are required to comply with existing land-use plans, and agency procedures such as those requiring public notice.

OTHER INFORMATION: COST. Cost for each option is shown in 1993 dollars. Payments from Exxon will deposited each year through the year 2001. The 1993-value of the remaining settlement (existing balance plus future deposits) is approximate $522 million. That is an inflation-adjusted amount. The actual amount in current dollars will be ____. Costs are approximate and will change as more is learned about injuries and the options.

Alternative 1 - Natural Recovery

THEME	No action other than monitoring and normal agency management.
VARIABLES	
Injury	N/A
Status of Recovery	N/A
Effectiveness of Restoration Actions	N/A
Opportunities for Human Use	N/A

Monitoring and information programs are included in all alternatives.
Functional equivalents of injured resources and services are included in all alternatives.

What would happen to resources and services within the Exxon Valdez oil spill area if no restoration options were implemented? Normal agency management continues, current trends in human use of the affected area continue, and planned development of private lands continue. These trends influence the environment that injured resources face in order to recover. Ideally, the exact injury would be known, and enough would be known about each resource to develop a population model. Unfortunately, such detailed information is not available for most resources; therefore, estimates are based on discussions with agency experts and peer reviewers, and from experience with similar species in different areas (Note: the literature synthesis information is not yet incorporated into this DRAFT!). Similarly, there is limited information on the injury to services.

The objectives of this alternative are to describe the potential rate and degree of recovery for the injured resources with only normal agency management; identify the missing information that make the recovery estimates uncertain; describe the recovery of services; and to describe the monitoring and public information program that would be funded through the Trustee Council.

I. Monitoring

Monitoring under this alternative is designed to follow the progress of natural (unassisted) recovery of resources and services injured by the oil spill, and to determine when natural recovery has restored injured resources and service to their pre-spill conditions. Implicit in this design is the need to rely as much as possible on normal agency management and monitoring. For example, monitoring the distribution and abundance of harbor seals in Prince William Sound and the Gulf of Alaska, per se, would not be included in the Trustees' monitoring program because the abundance of harbor seals in these waters is already monitored by the National Marine Fisheries Service and the Alaska Department of Fish & Game under provisions of the Marine Mammal Protection Act. However, where designs (goals and objectives) of existing (pre-spill) agency monitoring programs, as in

the case of harbor seal, do not adequately address the impacts and recovery dynamics of harbor seals injured by the oil spill, monitoring harbor seal distribution and abundance on or near oiled segments of their range would be included in the Trustees' Natural Recovery Monitoring Program.

Monitoring under this alternative will be conducted on the in surface waters, on tidelands, and on adjacent uplands including their watersheds in Prince William Sound the Gulf of Alaska. Monitoring will continue dependent upon the severity and duration of injuries resulting from the oil spill and the time necessary to establish a trend for recovery.

Resources to be monitored include but are not limited to affected floral (sea grasses and seaweeds) and faunal assemblages (marine mammals, marine birds including sea ducks, fish and shellfish) as well as impacted intertidal and subtidal substrates upon which they depend. Services arising from injured natural resources also will be monitored inclusive of, but not limited to: recreation, subsistence, commercial fishing, wilderness and intrinsic values. Finally, archaeological resources will be monitored.

Costs for monitoring included in this alternative should be modest and should not exceed $2.5 million per year, or $2.0-$3.0 million per year.

II. Information and Education:

Information and education provide the link between restoration activities and knowledge about the effects of those activities. As restoration, or the lack of direct application of restoration tech niques, proceeds and is monitored, the gathering, systematizing, documentation and distribution of information about restoration provides interested persons and communities, scientists, educators, public officials and agencies facts about the effectiveness of techniques and status of recovery for injured resources and services.

Reporting results provides support to education curricula, scientific communities, media, and governmental or private brochures and displays. An Annual Report to the Public (the name only used as an example) would provide in word, graphics and picture information about how much and where money was spent, and what environmental progress, if any, was being made. The information medium would reflect the needs of the various interests. Radio and video shorts, newspaper inserts, books and brochures could all be used. More active methods of information dissemination are meetings and workshops. These media are most effective in rural areas when the information is carried to the people, i.e. town meetings and school workshops.

All methods of information exchange have a means for receiving comment from any interested party. Generally these are clip-out sections of a newspaper, mailers in books and brochures, phone or FAX numbers, and return addresses. For some interested or affected groups such as the Native communities and other subsistence users, visits to their communities, schools and homes for one on one exchanges enhances the credibility of the information and the informer. These intimate interchanges provide both parties a better understanding of interests, needs and reactions to restoration activities.

III. Resources

Natural recovery estimates vary widely for the injured species. For many of the injured species there is not enough information to develop accurate population models that can be used to make predictions. In addition, the recovery of a particular resource is closely dependent on the quality of its habitat and it is difficult to make predictions when future changes to the environment are unknown. Agency scientists and peer reviewers used the best information available to them to predict the potential recovery time. Most gave a range in years that represent possible "best-case" scenarios and "worse-case" scenarios. The wider the span in years, the more uncertainty exists in the expected recovery. For species that were declining prior to the spill even a range in years was impossible. Sometimes it was possible to imagine how long it would take for a population to stabilize, but for most of these species the reason for the decline is unknown and estimates are speculative at best.

A. Marine Mammals

Harbor seals: The harbor seal population in the Gulf of Alaska and Prince William Sound has suffered a severe population decline since the 1970's. The reasons for this decline are unknown, which makes predicting a recovery rate from the effects of the oil spill impossible. The population is expected to continue to decline.

Killer whales - AB pod: As long as there is no additional mortality due to human interactions, the AB pod is expected to fully recover to its pre-spill population level between 10 to 20 years from 1989. The overall whale population is not believed to be injured.

Sea otters: Sea otters are expected to recover 80 - 100% of their pre-spill population. The rate of recovery is dependant on the growth rate of the injured population. Under ideal habitat conditions (abundant high quality food and little competition) sea otters can expand their population at more than 10% per year. Sea otter populations already established in an area probably have a growth rate closer to 2 - 3 % per year. Future habitat conditions and corresponding population growth rates are difficult to predict in the injured area. If the habitat remains degraded the sea otter population may not recover for 35 to 40 years (variation reflects that the population currently may not have a positive growth rate and it may be another 5 years before it begins to grow). If the habitat recovers rapidly to a 'high quality condition', and there are no chronic sublethal effects on the sea otter population, recovery may occur within 7 - 15 years from 1993. (In order to attain this early recovery, the population would have to sustain a

B. Terrestrial Mammals

River otters: River otters are expected to fully recover within 20 years. The injury to river otters is not well understood, therefore it is difficult to make recovery estimates or estimate the effectiveness of different restoration options.

C. Birds

Bald eagles: Bald eagles are expected to be fully recovered to the pre-spill population level between 4 to 6 years after the oil spill (1993 - 1995).

BLACK OYSTERCATCHERS: Natural recovery is expected to occur within the next 30 years. There is a lot of uncertainty regarding the rate of recovery because the actual impact of the injury will not be known until the 1993 breeding season when chicks hatched during 1989 will become sexually mature. It is also unknown how much movement there is between areas so the effect of immigration into the oiled area may greatly accelerate the recovery. The population growth rate for black oystercatchers is unknown; if the growth rate is equal to Eurasian oystercatchers (6.25%) and there are no lingering sublethal effects, the population may recover in 15 years from 1989.

Common murre: The injured common murre populations are expected to return to between 80 to 100% of their pre-spill level. The degree of recovery may vary from pre-spill levels because of natural population fluctuations. The recovery rate for this species is very slow with the predicted recovery time between 50 and 120 years from 1989. These recovery estimates are dependant upon the assumption that commercial fishing doesn't increase near the colonies and that there are no other catastrophic disturbances.

Harlequin ducks are expected to recover to within 80 - 100% (natural variation) of their pre-spill population level. Experts disagreed on the expected recovery time with recovery estimates ranging between 10 and 50 years from 1989.

Marbled murrelets: The marbled murrelet population is not expected to return to pre-spill population levels. The population has been on a long-term decline which is expected to continue. Estimates on when the population may stabilize vary widely between experts. Estimates of further declines range from an additional 20 to 50 % loss with the population stabilizing at that reduced level between 11 and 50 years from now. Because the cause of the pre-spill decline is unknown, it is difficult to estimate stabilization or recovery times.

Pigeon Guillemots: Pigeon guillemots are not expected to return to their pre-spill population levels. The population was declining prior to the spill and the decline is expected to continue. The reasons for the long-term decline are unknown which makes predictions of future population trends extremely difficult. The population is expected to stabilize sometime in the next 50 years, but estimating the population size when it stabilizes is even more uncertain.

D. Fish

Cutthroat trout The injured cutthroat trout population is expected to fully recover to its pre-spill levels in about 13 years (9-19 year range). This is largely due to existing Alaska Department of Fish and Game management which has closed sport-fishing for cutthroat trout in the impacted area.

Dolly Varden trout: The injured dolly varden population is expected to fully recover to its pre-spill levels in about 13 years (9-19 year range). This is largely due to existing Alaska Department of Fish and Game management which has closed sport-fishing in the Prince William Sound impacted area.

Pacific Herring: The complex population dynamics of Pacific herring make it impossible to predict the extent of injury and estimate the natural recovery rate until fish spawned during the oil spill, and subsequent years, return. The effects of the most likely injury scenarios are expected to be recovered within 50 years of 1989, but until the extent of injury is known the uncertainty is extremely wide.

Wild stock Pink salmon: The overall injured population of wild stock pink salmon is expected to recover within 20 years of 1989. While peer reviewers and agency experts expect the population to recover to 100 % of its pre-spill population, it is possible that the wild stocks may be unable to recovery fully. The degree of recovery estimates ranges between 50 and 100%. The lower range estimates represents concern for those streams which are experiencing chronic effects from the oil spill and from the impact of hatchery fish "straying" into wild streams.

Rockfish: There are too many unknowns regarding the injury to rockfish to make predictions around natural recovery.
growth rate higher than 5%/year.)

Sockeye salmon - Kenai river system: Natural recovery of the Kenai river sockeye salmon run is complicated by changes that occurred in the rearing habitat as a result of overescapement. While peer reviewers and agency experts agreed that the population will eventually recover to its pre-spill average, the rate of recovery is more difficult to predict. Recovery rate estimates varied between experts and ranged between 10 to 50 years from 1989 to achieve the 10 year average population size with similar yearly variation. The worst case scenario would occur if two problems developed: the plankton population in the rearing lakes did not recover to the same species composition as before the overescapements; and the salmon population developed a "cyclic abundance" pattern with huge returns some years followed by extremely low runs in other years. The best case scenario could occur if the habitat is recovered by 1993 and there is adequate escapement of spawning adults into the system.

Sockeye Salmon - Kodiak: Natural Recovery of the Kodiak, Red Lake system is expected to be rapid because the overescapement just occurred one year (rather than 1987-1989 for the Kenai system). The injury is expected to produce a one generation effect which means that recovery should occur in 1996, possibly 1997.

E. Coastal Habitat

Coastal Habitat - Upper Intertidal: Natural Recovery of the upper intertidal zone will occur in stages as different species in the community respond to improved environmental conditions. *Fucus* provides food and shelter for many of the invertebrate species that

occupy the upper intertidal zone. These species will return after the *Fucus* has recovered. Full recovery of the upper intertidal zone is expected to occur in 8 - 25 years. The wide range is partially due to the ability of *Fucus* to recolonize injured areas. Recovery estimates for the *Fucus* population range from 6 to 15 years. Once *Fucus* begins to recolonize an area it is expected to take a few more years before other to begin to resemble their pre-spill populations.

IV. Services

Much of what is stated for resources is also applicable to injured services. If no restoration options were implemented for these injured services, what would their fate be? Current levels of use or management would continue. Injuries which occurred as a result of direct oiling, cleanup response, and looting or vandalism, as well as to perceptions of despoiled wilderness character would have to be managed by affected agencies. User groups such as commercial and sport fishers and subsistence users would continue to rely upon information produced from monitoring and presented through information and education options. Management and regulation of subsistence uses would continue under current agency jurisdiction.

Archaeologic Sites and Artifacts: Sites and artifacts will not recover from oil damage and depredation. Managers of lands where these sites occur must prevent further site degradation and loss of artifacts and scientific information under current authority and management priority.

Subsistence: Under the Natural Recovery Alternative, no action (restoration) other than normal agency management and monitoring will be conducted. In the case of native communities, normal agency management of the Alaska Department of Fish and Game Subsistence Division includes regulation of bag limits, seasons and other scientifically routine methods to protect wild and renewable resources. These activities are dependent upon monitoring to determine harvest quantities; levels of participation in subsistence activities; where subsistence hunting, fishing, and gathering occurs; the distribution and exchange of subsistence products; methods and means of harvest; and other demographic and economic data.

This alternative will also adress additional monitoring not considered as a normal agency activity prior to the spill. Because of both real and perceived contamination of subsistence foods, there is a need to continue monitoring and chemical analyses of mussels, clams, rockfish, harbor seals and other resources. This monitoring approach is designed to identify traditional subsistence areas still contaminated, measure residual hydrocarbon levels in subsistence foods, as well as restore the confidence of subsistence hunters and fishers in the safety of subsistence resources in the oil spill area.

Recreation and Tourism: Injury to recreation uses occurred throughout the oilspill area. As a result experiences and perceptions changed. Recreation users report less visible oil and a slow, but discernable increase in wildlife sightings. There is also a yearly increase in the number of people using the spill area for recreation activities, although in

1991 activities were still below pre-spill levels. A steady increase in recreation use of the spill area is expected to continue. Annual rates and eventual levels of use by 2001 are unpredictable, as is a date when use will equal or surpass that of 1989.

Wilderness and Intrinsic Values: The uplands of the oil spill area are generally perceived to be of wilderness character. The designated and undesignated Wildernesses have formally recognized this character. Oil found above the mean high tide impacted these areas and perceptably injured the wilderness character of the land. Cleanup and time have removed most visible oil, but the perception of a degraded wilderness resource remains. But visible oil, evidence of damage assessment, and restoration studies are physical reminders of mans' presence and remains a deterent to wilderness experiences by visitors. Oil will disappear in time and managers will provide guidance to field workers to be sensitive to the wilderness character thereby reducing evidence of their presence. The perception that the undeveloped portions of the oil spill area offers visitors an "unspoiled" wilderness experience may never return.

Sport and Commercial Fishing: Closure of commercial fisheries during the spill caused injury to those who relied on this resource for a livelyhood. Current sport fishing closures for cutthroat trout in Western Prince William Sound has resulted from a decline in that species. The current closure will continue until the species recovers. Perceptions of contaminated fish persist. Sport fishing trips to the spill area remain below the pre spill levels. Overescapement of at least two consecutive years' runs of sockeye into the Kenai River system has reduced the food available for fry. Since the adult return from the low years of outmigration will be low, the adults may not be able to produce enough eggs to rebuild the runs within a single generation. If this is the case, adult runs in 1999 and 2000 may also be low. Fluctuations in the number of spawning adults and outmigrating smolts will continue to be monitored by management agencies and regulatory adjustments made to attempt compensatory takes by commercial and sport fishers.

V. COST

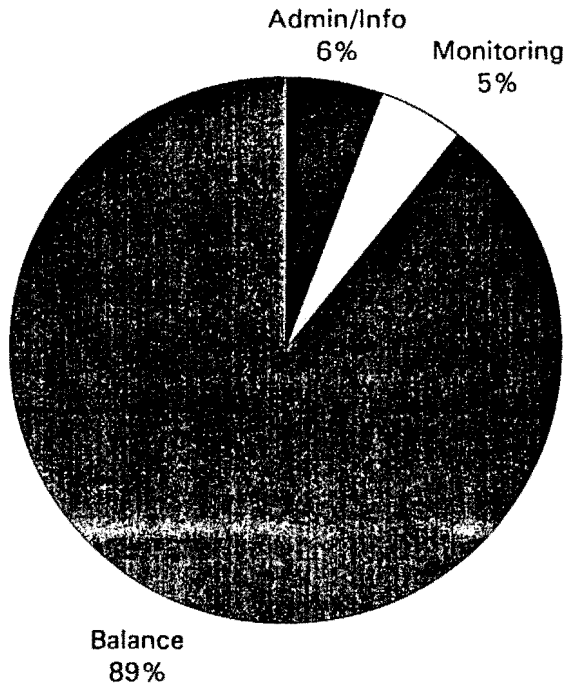
Detailed cost estimates for Alternative 1 are contained in Table ___; the allocation of these costs is shown in Figure ___. Estimates of cost are approximate.

The inflation-adjusted value of the remainder of the settlement fund is about $522 million. * Monitoring would require about 6% of this amount; and Aministration/Information 5%.

This scenario would leave 89% of the remaining settlement uncommitted. Uncommitted funds could be held for unantipated expenses or an endowment. If the entire balance were invested in an endowment, it would yield about $13 million annually.

* use 1990 data, don't inflate for IMPLAN (K. Rice 2-1-93)

Allocation of Remainder of Settlement Funds	Total $	%
Admin/Info	30190.0	6%
Monitoring	25250.0	5%
Balance	466560.0	89%



NB: All costs are expressed in units of $1,000 (1993 $). The inflation-adjusted value of the remainder of the settlement is about $522 million.

Alternative 1 - Natural Recovery														
				ANNUAL COST			DURATION					TOTAL COST		
								Years				10-Year Maximum		
Opt	DESCRIPTION	ResSvc	UNIT	Exp	Low	High	Type	E	L	H		Expected	Lower	Higher
P1.00	Administration	Multiple resources										30190.0	30180.0	50200.0
P2.00	Monitoring	Multiple resources										25250.0	20250.0	70250.0

NB: All costs are expressed in units of $1,000 (1993 $). The inflation-adjusted value of the remainder of the settlement is about $522 million.

Alternative 2 - Protection

THEME	Protect injured resources and services from further degradation or disturbance.
VARIABLES	
Injury	All injured resources.
Status of Recovery	All stages of recovery.
Effectiveness of Restoration Actions	All beneficial actions.
Opportunities for Human Use	N/A

Monitoring and information programs are included in all alternatives.
Functional equivalents of injured resources and services are included in all alternatives.

The goal of this alternative is for the spill-affected area to return to prespill conditions on its own without further disturbance. This alternative addresses all injured resources and services whether or not they have recovered. Table _____ lists the resources and services addressed in this alternative. As these resources and services recover, protective actions would continue so that they are not subject to additional stress.

RESOURCES		SERVICES
Population Decline	**Sublethal/Chronic**	
Black oystercatcher Common murre Harbor seal Harlequin duck Intertidal organism Killer whale Marbled murrelet Pigeon guillemot Sea otter Sockeye salmon Subtidal organisms	Bald eagle Cutthroat trout Dolly varden Pacific herring Pink salmon River otter Rockfish	Archaeology Commercial fishing Recreation Sport fishing Subsistence Wilderness

Table _____. Resources and Services Addressed in Alternative 2

Restoration Options. Among the many restoration ideas suggested by scientist, agencies, and the public, only eight meet the criteria for this alternative. There is at least one effective restoration action for each injured resource or service except intertidal organisms, killer whale, pigeon guillemot, sea otter, subtidal orgnisms, Pacific herring,

river otter, rockfish, commercial and sport fishing, and subsistence. Many of these restoration options apply to several species. Table ___ lists restoration options by resource or service. These options are presented as potential projects which have already been evaluated; they are not proposals. Over time, other options are likely to be proposed which may be superior to those listed here.

The primary protective measure is Habitat protection and acquisition. In this alternative Habitat protection and acquisition applies to the following resources and services:

Harlequin duck	Bald eagle	Recreation
Marbled murrelet	Cutthroat trout	Wilderness
Sockeye salmon	Dolly varden	
	Pink salmon	

MONITORING

Monitoring under this alternative will focus on the need to evaluate the effectiveness of specific protection measures used in restoring injured resources and services. For example, monitoring of injured resources and services would be conducted in conjunction with establishing special designations such as refuges, sanctuaries, parks and critical areas, purchase and protection of private lands, protection to reduce disturbance around marine bird colonies and marine mammal haulouts, and protection of archaeological sites to deter further degradation of sites and artifacts.

This alternative also includes the provision to determine when natural recovery will restore injured resources and services to their pre-spill conditions. It assumes that normal agency management and monitoring will not be duplicated.

Monitoring under this alternative will be conducted on uplands including their watersheds adjacent to coastal habitat and on tidelands and associated waters impacted by the oil spill. Monitoring will continue dependent upon the severity and duration of injuries resulting form the oil spill and the time necessary to establish a trend for recovery.

Resources to be monitored will include those afforded opportunity to recover on protected uplands, tidal habitats and associated waters inclusive of but not limited to affected floral (sea grasses and seaweeds) and faunal assemblages (marine mammals, marine birds including sea ducks, fish and shellfish) as well as impacted intertidal and subtidal substrate upon which they depend. In the case of services, monitoring would focus on documenting recovery of human-use activities (recreation, subsistence, wilderness perception) associated with protected habitats. Archaeological resources present on protected uplands and tidelands also will be monitored.

Costs associated with monitoring are again modest and should not exceed $2.5 million per year with a range of $2.0-$3.0 million per year. Of the $2.5 million per year figure, $1.5 million per year is allotted to monitoring effectiveness of restoration, and $1.0 million is allotted to monitoring natural recovery.

RESOURCE/SERVICE	RESTORATION OPTION
Black oystercatcher	40.0 Special designations
Common murre	4.1 Reduce disturbance at marine bird colonies
Harbor seal	4.2 Reduce disturbance at marine mammal haulouts
Harlequin duck	37.0 Habitat protection and acquisition
Intertidal organisms	None
Killer whale	None
Marbled murrelet	37.0 Habitat protection and acquisition 40.0 Special designations
Pigeon guillemot	None
Sea otter	None
	37.0 Habitat protection and acquisition
Subtidal organisms	None
Bald eagle	37.0 Habitat protection and acquisition
Cutthroat trout	19.0 Anadromous Streams Catalogue 37.0 Habitat protection and acquisition
Dolly varden	19.0 Anadromous Streams Catalogue 37.0 Habitat protection and acquisition
Pacific herring	None
Pink salmon	37.0 Habitat protection and acquisition 40.0 Special designations
River otter	None
Rockfish	None
Archaeology	1.1 Site stewardship program 1.2 Site patrol and monitoring 10.0 Preserve archaeological sites and artifacts
Commercial fishing	None
	37.0 Habitat protection and acquisition 40.0 Special designations
Sport fishing	None
Subsistence	None
Wilderness	37.0 Habitat protection and acquisition 40.0 Special designations
Multiple resources	44.0 Spill prevention and contingency planning

Table ____. Restoration Options for Alternative 2.

EVALUATION

I. EFFECT ON THE RECOVERY OF RESOURCES

A. MARINE MAMMALS

Harbor seals: Reduce disturbance at marine mammal haulouts (#4) through interagency coordination would help to ensure that harbor seal haulout sites are considered and protected when permitting coastal and marine activities (especially set-net sites) could improve the amount of recovery (if any). Existing disturbance levels within the EVOS area are thought to be minimal but applying this option would provide benefits by preventing additional pup mortality at haulout sites.

Killer whales - AB pod: There are no habitat protection options currently identified that would have notable effects on the AB pod. Although broadly applied protection options such as Special Designations would certainly provide some added protection to the pod.

Sea otters Reduce disturbance at marine mammal haulout and concentration areas (#4.0): There is little information available on how sea otters react to disturbance (such as logging at the head of a highly used bay) so it is difficult to evaluate the ability of this option to prevent habitat degradation. A special study that addresses this problem would provide information on how to implement this option and a land acquisition option to benefit sea otters.

B. TERRESTRIAL MAMMALS

River otters: Habitat protection and acquisition (37.0) provides some protection to the river otter population. No estimates on the amount of habitat that could be protected, or on the tolerance of otters to disturbance are available. Special designations (#40.0): Because we don't know the tolerance of river otters to human activities it is difficult to evaluate this option. Intuitively, we would imagine this option would provide less benefit than acquiring protection on private lands, because there are fewer threats to lands already publicly managed.

C. BIRDS

Bald Eagles: Habitat protection and acquisition (#37) would ensure that the degree of recovery is equal to the pre-spill population level. The bald eagle population in PWS is believed to be at or near the habitat's carrying capacity. Any loss of nesting habitat would likely constitute a corresponding decrease in the population.

BLACK OYSTERCATCHERS: Special designations (#40) that protect areas where black oystercatchers concentrate (usually subadults and failed breeders) or restrict access to injured beaches with several breeding pairs may improve the rate of recovery between 10 to 24 %. Because black oystercatcher habitat is concentrated along the intertidal zone for feeding and breeding little benefit would be added by purchasing

upland habitats. There may be a slight (<10%) improvement in the rate of recovery from habitat protection and acquisition in some site specific situations where shoreline activities disturb the nesting birds.

Common murre: Reduce disturbance at marine bird colonies (#4): This option could have a beneficial effect (10 - 24%) on reducing the amount of time to recovery at colonies where human activities disturb the birds during nesting. This option is most likely to have the greatest benefit at the Barrens Islands or Puale Bay. It is thought that the Chiswell Islands colonies have habituated to the tour boats so there would be limited effectiveness at those colonies. Special designations (#40) would provide the same types of protection but cover a larger area.

Harlequin ducks: Habitat protection and acquisition is the single most effective option for ensuring the population can recover to its pre-spill population at the fastest rate. Studies in the Lower 48 have shown that harlequins are easily disturbed by logging, and other human development, and therefore a proportional loss in breeding birds can be expected.

Marbled murrelets: Habitat protection and Acquisition provides the greatest benefit in ensuring that the population can recover and could prevent an even more rapid decline if current prime habitat were developed. It is conceivable that a large portion of the marbled murrelet population could nest in the prime harvestable timber owned privately, but until more is known about nesting habitat it is impossible to estimate the potential impact from logging or other development.

Special designations that include both upland and marine habitats could provide substantial protection to marbled murrelet habitat. A large designation area that would limit development activities and pollution sources may have a positive effect on the prey base. This added protection would also increase the confidence in a more rapid stabilization period. There is wide disagreement between experts on the benefit these designations may provide.

Pigeon Guillemots: Pigeon guillemots are one of the few alcids that appear to be tolerant of human activity near nesting areas, but it is important to protect the nesting sites from erosion and other degradation. Protecting upland habitat immediately adjacent to the coast would prevent the population decline from accelerating due to lost nesting habitat.

D. FISH

Cutthroat trout Update and expand Alaska anadromous stream catalog (#19) will improve the confidence in the population reaching 100% of its pre-spill levels is increased by 10% because there would be a better understanding of the actual population distribution.

Habitat protection and acquisition (37) could prevent substantial losses to the population and therefore affect the degree of recovery. Because PWS cutthroat trout are at the northern extent of their range it is believed that they are more vulnerable to habitat alterations. Large scale development on private lands which would increase the traffic and fishing pressure on nearby populations could cause local (stream-specific) populations to collapse.

Dolly Varden trout Habitat protection and acquisition (37) could prevent a 10 - 20% loss to the population from reduced quality habitat.

Wild stock Pink salmon Habitat protection and acquisition (#37.0) could provide protection to 10 - 30% of the population. This is especially true for areas outside of Prince William Sound where there are more streams with pinks that spawn above the intertidal zone. The added protection may also allow for the population to increase approximately 10% above pre-spill levels.

Special Designations (#40.0): The effectiveness of this option is similar to acquiring private lands. No changes would be seen in the rate or degree of recovery. Special designations which protect the large intertidal spawning areas, and prevent degradation from mining activities, could benefit 10 - 30% of the population.

Sockeye salmon: Habitat protection and acquisition (37.0): The Kenai river system is already protected from most habitat degrading development. This option could be considered to protect the Quartz Creek area from negative impacts caused by widening the Sterling Highway, but would probably have less than a 10% effect on the overall population. For the Red Lake stock, if this option could be applied to protect the watershed that supports the lake.

E. Coastal Habitat

All options that protect coastal areas would benefit the intertidal zones, however, at this time there are no specific protection options targeted at coastal habitat alone.

EFFECT ON THE RECOVERY OF SERVICES

Archaeology. Restoration of archaeological resources cannot regenerate what has been destroyed, but it can successfully address the prevention of further degradation and loss of both sites and the scientific information they contain. Site stewardship program, Site patrol and monitoring, and Preservation of archaeological sites and artifacts are highly effective techniques to protect archaeological resources in the spill-affected area. The last option entails some physical repair and data recovery.

Recreation. Both of the restoration actions included for recreation serve primarily to

protect existing uses and their resource base. Habitat protection and Special designations are the primary means of protecting recreation.

Wilderness. Habitat protection amd acquisition is a highly effective means of preventing additional injury to wilderness; Special designations would provide an increased level of resource protection compatible with preservation of wilderness values.

II. MULTI-SPECIES IMPACTS OF PROPOSED OPTIONS

RESOURCE RESTORATION OPTIONS:

The primary focus of this alternative is to implement options which provide protection for the resources and services while they recover. Implementing these protection options for most injured resources helps improve our confidence that the species will be able to recover to their pre-spill levels at the rate described under Natural Recovery. There are a few exceptions where added protection will prevent a disturbance that is known to affect the reproductive productivity of a species. These are described below.

For black oystercatchers Special designations may be used to protect breeding pairs and improve the rate of recovery by 10 to 24% over natural recovery. There may be some slight, but probably less than 10 % improvement from acquiring adjacent uplands.

For common murres reducing disturbance from abrupt loud noises (such as gun shots fired by fishermen to kill large halibut) during breeding could increase the productivity of the nesting colony somewhere between 10 to 24% depending on the current level of disturbance.

For marbled murrelets, experts disagree on the effectiveness of Special designations that cover both upland and marine habitats it is possible that they may have a positive effect on the prey species. This added protection and benefit increases the likelihood that the population could stabilize more rapidly.

Because protective measures would be taken for almost all of the injured resources, this alternative has secondary benefits to a wide variety of other non-injured species.

For services, habitat protection and special designations help to maintain the remote, pristine quality of the oil spill area. As described earlier, these options benefit a wide variety of species and therefore benefit the services which depend upon them.

III. GEOGRAPHIC DISTRIBUTION

Table 3 indicates the part of the spill area where the options will most likely be applied. The areas may change as detailed project planning is completed and as more is learned

about injury or recovery.

Options in Alternative #2 focus on protection. Protection is applicable in all parts of the spill area and with some exceptions the options will be applied throughout the spill area. Reducing disturbance at murre colonies will be applied only at the three large colonies in the spill area: Chiswell, Barren Islands, and Paule Bay Colonies. Dolly Varden char and cutthroat trout do not exist in the spill area outside of Prince William Sound. The option locating anadromous streams for those species will be applied only in the Sound.

IV. COST

Detailed cost estimates for Alternative 2 are contained in Table ___; the allocation of these costs is shown in Figure ___. Estimates of cost are approximate. No cost estimates are included for Special designations and Spill prevention and contingency planning because no particular designation is under consideration and spill prevention and contingency planning appears to be well funded at present. However, these situations could change over time. Actual costs will vary as new information about injury becomes available through the monitoring program, new ideas are developed for appropriate restoration options, and project planning proceeds.

The inflation-adjusted value of the remainder of the settlement fund is about $522 million. Two-thirds (67%) of this amount could be set aside for Habitat Protection. Administration/ Information would require 7%; Monitoring 5%; and other restoration projects 2%.

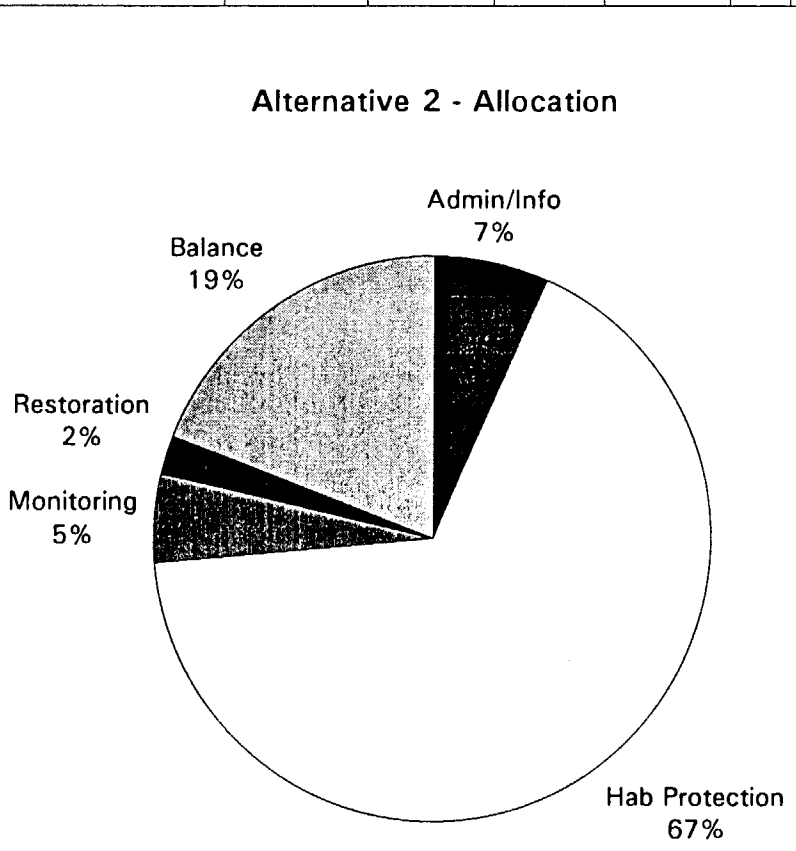
This scenario would leave 19% of the remaining settlement uncommitted. Uncommitted funds could be held for unanticipated expenses, such as injuries identified through the monitoring program, new options, or higher-than-projected costs for those already considered. Another use of the balance could be to fund an endowment for ongoing projects or for a research foundation. If the entire balance were invested in an endowment, it would yield about $2.8 million annually.

RESOURCE OR SERVICE	Opt. No.	OPTION NAME	Options without an alternative	Prince William Sound			Kenai/Cook Inlet			Alaska	Kodiak/Afog		Outside
				North	East	West	Kenai Ck In	Lower Ck In	Central Ck In	Penin.	Afg. Shuyak	Kodiak	EVOS
Archaeology	1	Archeological site stewardship program	0	X	X	X	X	X	X	X	X	X	
Common murre	4.1	Reduce disturbance at marine bird colonies	0				X	X	X	X			
Harbor seal	4.2	Reduce disturbance at marine mammal haulout	0	X	X	X	X	X	X				
Archaeology	10	Preserve archaeological sites and artifacts	0	X	X	X	X	X	X	X	X	X	
Cutthroat/Dolly Varden Trout	19	Update anadromous fish stream catalogue	0		X	X							
MULTI-SPECIES	37	Habitat protection and acquisition	0		X	X	X	X	X	X	X	X	
MULTI-SPECIES	40	Special designations	0	X	X	X	X	X	X	X	X	X	
Prevention	44	Spill prevention and contingency plannin	0	X	X	X	X	X	X			X	

~~ALTERNATIVE #2~~

Table X. Expected Geographic Distribution of Options in Alternative #2.

Allocation of Remainder of Settlement Funds	Total $	%
Admin/Info	35190.0	7%
Hab Protection	350000.0	67%
Monitoring	25250.0	5%
Restoration	12622.0	2%
Balance	98938.0	19%



NB: All costs are expressed in units of $1,000 (1993 $). The inflation-adjusted value of the remainder of the settlement is about $522 million.

Alternative 2 - Protection														
				ANNUAL COST			DURATION				TOTAL COST		
								Years			10-Year Maximum		
Opt	DESCRIPTION	ResSvc	UNIT	Exp	Low	High	Type	E	L	H	Expected	Lower	Higher
1.10	Site stewardship program	Archaeology	Per 3 areas	195.0	195.0	195.0	Ltd	10	10	10	1950.0	1950.0	1950.0
1.20	Site patrol and monitoring	Archaeology		300.0	300.0	300.0	Ltd	4	3	5	1200.0	900.0	1500.0
4.10	Reduce disturbance	Common murre									330.0	185.0	640.0
4.20	Reduce disturbance	Harbor seal									330.0	185.0	640.0
4.30	Study: Reduce disturbance	Sea otter					Ltd				120.0	80.0	640.0
4.40	Reduce disturb public info	Multiple resources		40.0	30.0	50.0	Ltd	1	1	1	40.0	30.0	50.0
4.50	Reduce disturb field presence	Multiple resources		438.0	390.0	486.0	Ltd	10	10	10	4380.0	3900.0	4860.0
10.00	Archaeol Res Protection	Archaeology									4072.0	3250.0	7000.0
19.10	Anad Stream Catalogue	Cutthroat trout		100.0	100.0	100.0	Ltd	1	1	1	100.0	100.0	100.0
19.30	Anad Stream Catalogue	Pink salmon		100.0	100.0	100.0	Ltd	1	1	1	100.0	100.0	100.0
37.00	Habitat protection/acquisition	Multiple resources									350000.0	225000.0	350000.0
40.00	Special designation	Multiple resources											
44.00	Spill prevention/conting plng	Multiple resources					Ltd						
P1.00	Administration	Multiple resources									35190.0	30180.0	50200.0
P2.00	Monitoring	Multiple resources									25250.0	20250.0	70250.0

NB: All costs are expressed in units of $1,000 (1993 $). The inflation-adjusted value of the remainder of the settlement is about $522 million.

Alternative 3 - Limited Restoration

THEME	Take the most effective actions to protect and restore injured services and resources whose population has declined. Maintain the existing character of the affected area.
VARIABLES	
Injury	Injured resources whose populations declined.
Status of Recovery	Resources not yet recovered.
Effectiveness of Restoration Actions	Most effective actions.
Opportunities for Human Use	Protect existing uses.

Monitoring and information programs are included in all alternatives.
Functional equivalents of injured resources and services are included in all alternatives.

The goal of this alternative is for the worst-injured resources and services to return to prespill conditions as efficiently as possible. This is the only alternative that limits its scope to resources whose populations declined after the spill. Table _____ lists the resources and services addressed in this alternative. None of the resources whose populations declined after the spill has yet recovered. However, as resources recover, settlement funds would no longer be allocated to protecting or restoring them. This alternative includes only the most effective actions for protecting injured resources and restoring them to prespill conditions. It also includes only those actions that protect existing human uses that were injured and the resource base on which they depend. For example, a boat ramp in an area already used to launch boats would protect the beach that supports this type of recreational use.

RESOURCES	SERVICES
Black oystercatchers Common murres Harbor seals Harlequin ducks Intertidal organisms Killer whales Marbled murrelet Pigeon guillemots Sea otters Sockeye salmon Subtidal organisms	Archaeology Commercial fishing Recreation Sport fishing Subsistence Wilderness

Table _____. Resources and Services Addressed in Alternative 3

Restoration Options. Among the many restoration ideas suggested by scientist, agencies, and the public, twenty one meet the criteria for this alternative. There is at least one effective restoration action for each injured resource or service except black oystercatchers and subtidal organisms. Table ___ lists restoration options by resource or service. These options are presented as potential projects which have already been evaluated; they are not proposals. Over time, other options are likely to be proposed which may be superior to those listed here.

In this alternative, Transplanting hatchery runs for commercial and sport fishing would continue only until the wild stocks of salmon recover to prespill levels. Testing subsistence foods for hydrocarbon contaimination and providing Access to traditional foods in areas outside the spill-affected area would be continued only until subsistence resources and use return to prespill levels. New backcountry public recreation facilities would be provided only if they protect existing recreational uses and the resource base on which they depend. Facilities that increase use or create a new use would not be supported with settlement funds. Habitat Protection and Acquisition would apply to only the following resources and services:

Harlequin duck	Recreation
Marbled murrelet	Wilderness

MONITORING

Monitoring under this alternative will focus on the need to evaluate the effectiveness of restoration options used in combination including those designed to manage human use, to directly manipulate injured resources and services, to protect or acquire critical habitat, and to replace or acquire the equivalent of injured resources and services. Monitoring of this type is designed to identify where additional restoration activities may be appropriate, and determine when injury is delayed.

For those resources where little can be done to accelerate recovery, e.g., sea otter, Alternative 3 includes provision to monitor natural recovery. Also, Alternative 3 assumes that normal agency management and monitoring will not be duplicated.

However, monitoring will only be conducted for those resources injured at the population level, and only in conjunction with those restoration measures that are likely to be the most effective when implemented. Monitoring for services will apply only to those options designed to protect and restore existing services injured by the oil spill.

Monitoring will be conducted on and in surface waters, tidelands, and on adjacent uplands including their watersheds in Prince William Sound and the Gulf of alaska. Monitoring also will be conducted outside the spill affected area to measure the effectiveness of replacement and acquisition of equivalent resources and services options, e.g., eliminate predators from marine bird colonies in the Aleutian Islands, included in this

RESOURCE/SERVICE	RESTORATION OPTION
Archaeology	1.1 Site stewardship program 1.2 Site patrol and monitoring 10.0 Preserve archaeological sites and artifacts
Black oystercatchers	None
Common murres	16.1 Study: Social stimuli 17.2 Reduce predator access
Harbor seals	46.0 Cooperative program - fishers 47.0 Cooperative program - subsistence users
Harlequin duck	13.0 Eliminate oil from mussel beds 37.0 Habitat protection and acquisition
Intertidal organisms	14.0 Accelerate recovery - upper intertidal
Killer whales	45.0 Study: Changes in black cod fishery gear
Marbled murrelet	9.0 Minimize incidental take 37.0 Habitat protection and acquisition 40.0 Special designations
Pigeon guillemots	17.2 Reduce predator access
Sea otters	4.2 Study: Reduce disturbance 13.0 Eliminate oil from mussel beds 47.0 Cooperative program - subsistence users
Sockeye salmon	2.5 Intensify management 48.2 Improve survival rates
Subtidal organisms	None
Commercial fishing	18.0 Replace salmon harvest opportunities
Recreation	12.1 New backcountry public recreation facilities 37.0 Habitat protection and acquisition 40.0 Special designations
Sport fishing	18.0 Replace salmon harvest opportunities
Subsistence	30.0 Test subsistence foods 49.0 Access to traditional foods
Wilderness	37.0 Habitat protection and acquisition 40.0 Special designations
Multiple resources	44.0 Spill prevention and contingency planning

Table ____. Restoration Options for Alternative 3.

alternative. Monitoring will continue dependent on the severity and duration of effects resulting form the spill and the time necessary to establish a trend for recovery.

Resources to be monitored include but are not restricted to affected floral (sea grasses and seaweeds) and faunal assemblages (marine mammals, marine birds including sea ducks, etc.

Costs of Alternative 3 will be $4.0 million per year with a range of $3.5 to $4.5 million per year. Of the $4.0 million per year figure, $3.0 million per year is allotted to monitoring effectiveness of restoration, and $1.0 million per year is allotted for monitoring natural recovery.

EVALUATION

I. EFFECT ON RECOVERY

most effectiur methods

All of the restoration actions in this alternative are expected to improve the rate or degree of recovery by 25% to over 50% over natural recovery. However, the objective of this alternative is to protect as well as to restore. Consequently, some restoration actions were included not because they accelerate recovery but because they protect injured resources or services from further degradation or decline.

doubt

Restoration actions whose primary purpose is to protect injured resources and services are:

1.1 Archaeological site stewardship program
1.2 Archaeological site patrol and monitoring
10.0 Preserve archaeological sites and artifacts
12.1 New backcountry public recreation facilities to protect existing uses or their resource base
37.0 Habitat protection/acquisition
40.0 Special designations
44.0 Spill prevention and contingency planning

The effect these options have on recovery is to prevent further stress to resources and services, thereby allowing natural recovery processes to work more efficiently.

The effect of other restoration actions on recovery are described below by resource or service.

EFFECT ON THE RECOVERY OF RESOURCES

A. MARINE MAMMALS

Harbor seals: The two options which have the greatest potential to benefit harbor seals

are both cooperative programs which will help provide greater management by coordinating the groups that have the most interaction with the harbor seal population. These groups include managers, researchers, subsistence users and commercial fishermen. The two options are: Develop a cooperative program with subsistence users, and Develop a cooperative program with commercial fishermen.

Killer whales - AB pod: The AB pod feeds in the area where the Prince William Sound black cod fishery occurs. In the past there have been conflicts with the killer whales marauding the fishermens' catch. An option to coordinate, and compensate, fishermen to Facilitate gear changes in the black cod fishery from long-lines to pots, would prevent the whales from marauding the catch and eliminate the need for fishermen to defend their harvest.

Sea otters: The option believed to have the greatest ability to effect the overall sea otter population is to Develop a cooperative program with subsistence users. This option would help ensure that the sea other population fully recovers to its pre-spill level and sustain any changes in harvest levels.

The special study of Eliminating oil from oiled mussel beds could be highly effective (25% to over 50%) in improving the weanling pups survival and recruitment rates. This option has to be considered as a special study because there are too many unknown factors that influence the potential effectiveness of this option. The current level of exposure of young otters to oil from oiled mussel beds is not known, nor is there information on how much oiled food can be eaten before the toxin levels cause an adverse effect. Without this information this option cannot be adequately evaluated.

B. BIRDS

BLACK OYSTERCATCHERS: None of the current options proposed for black oystercatchers are expected to reach the effectiveness level required for this alternative.

Common murres: At this time, there are no proposed options which are certain to reach the effectiveness level required for this alternative. There are two options which have the potential to greatly influence the rate of recovery for common murres; however, preliminary work would need to be completed before the effectiveness can be adequately evaluated. These options are: (#16.1) Enhancing the social stimuli, and (#17.2) Predator control to benefit marine birds.

Enhancing social stimuli may accelerate the rate of recovery by reducing the number of years for the population to return to synchronized and successful breeding. Using social stimuli to encourage synchronization is an experimental technique.

The level of predation, and its impact, on the injured colonies has not been documented. If it is shown to be a significant problem (At some colonies predation has been shown to

destroy 50% of the eggs.), then this option could greatly affect the breeding success of the colonies.

Harlequin ducks: Protecting nesting habitat (#37 Habitat protection and acquisition) for harlequin ducks is the most effective technique currently proposed. While it will not improve the rate or degree of recovery, it can prevent habitat loss which could prevent the population from fully recovering to its prespill level.

Eliminating oil from oiled mussel beds (#13) has the potential to improve the rate of recovery of a localized area by 25 - 50%; however, at this time there are too many unknowns to be certain of its effectiveness, therefore this would be considered as a Special study.

Marbled murrelets: Protecting habitat (options #37 Habitat protection and acquisition and #40 Special designations) would ensure that the marbled murrelet population could recover to is prespill levels once the population decline is reversed. Protecting the coastal waters could also benefit their prey which may help stabilize the population more quickly. In localized areas, option #9 Minimizing incidental take of marine birds could provide additional help to stabilize the population.

Pigeon guillemots: The only option currently proposed that has the potential to produce a substantial impact on stabilizing the population needs to have preliminary work completed before the option can be adequately evaluated. Option #17.2 Predator control to benefit marine birds has the potential to increase productivity by 25-50 % at very site specific locations; however, predation levels at colonies within the injured area have not been documented and this option may not be needed should predation levels be low.

C. FISH

Sockeye salmon (Kenai River): Option 2 Intensify fisheries management to protect injured stocks is the single most effective option for aiding and protecting the Kenai river systems. Its primary benefit is in the ability to prevent future overescapement problems which could greatly exacerbate the current injury level. With this option the risk of overescapements could be reduced from 25% to 10%.

In combination with the above option, and under the right environmental conditions, option #48 (Improve the survival of salmon eggs to fry) could be very effective for the Kenai river system. Improving survival of salmon eggs to fry could stimulate recovery so the injury is confined to one generation and recovery is complete around the year 2000. In order to implement this option monitoring of the plankton population and salmon escapement must occur in 1994/95 in order to supplement fry production in 1995.

D. COASTAL HABITAT

Coastal habitat - subtidal: At this time, no effective options have been identified that could help the recovery of subtidal organisms.

Coastal habitat - upper intertidal: Option 14 - Accelerate the recovery of the upper intertidal zone may prove to greatly increase the recovery time on a very localized basis. Experts have estimated that the option could increase the rate of recovery by 25 to 50%; however, the techniques are experimental and are not likely to be applied on a broad scale.

EFFECT ON THE RECOVERY OF SERVICES

Archaeology. Restoration of archaeological resources cannot regenerate what has been destroyed, but it can successfully address the prevention of further degradation and loss of both sites and the scientific information they contain. Site stewardship program, Site patrol and monitoring, and Preservation of archaeological sites and artifacts are highly effective techniques to protect archaeological resources in the spill-affected area. The last option entails some physical repair and data recovery.

Commercial Fishing. Replacing harvest opportunities by creating new hatchery runs is a highly effective method of replacing commercial fishing opportunities lost due to fishing closures or reduced harvest of species injured by the spill. In this alternative, the newly created runs would continue only until wild stocks recover.

Recreation. All three of the restoration actions included for recreation serve primarily to protect existing uses and their resource base. Habitat protection and Special designations are the primary means of protecting recreation. However, in limited situations New backcountry public recreation facilities could protect both recreation and the resources on which it depends by, for example, providing an outhouse in a heavily used area.

Sport fishing. Replacing harvest opportunities by creating new hatchery runs is a highly effective method of replacing sport fishing opportunities lost due to fishing closures or reduced harvest of species injured by the spill. In this alternative, the newly created runs would continue only until wild stocks recover.

Subsistence. Testing subsistence foods is expected to be an effective way of restoring confidence in the safety of subsistence resources withing the spill area. Concern over the safety of subsistence resources is believed to be one of the reasons subsistence harvests have not yet returned to pre-spill levels. Providing Access to traditional foods in areas outside the spill-affected area would be a highly effective way of restoring lost

use. Both projects would be continued until subsistence resources and use have recovered to pre-spill levels.

Wilderness. Habitat protection amd acquisition is a highly effective means of preventing additional injury to wilderness; Special designations would provide an increased level of resource protection compatible with preservation of wilderness values.

II. MULTI-SPECIES IMPACTS OF PROPOSED OPTIONS

Ecosystem Effects. Of the twenty-three restoration options included in this alternative, six benefit multiple resources. They are:

13.0 Eliminate oil from mussel beds
14.0 Accelerate recovery of upper intertidal zone
37.0 Habitat protection and acquisition
40.0 Special designations
44.0 Spill prevention and contingency planning
48.2 Improve survival rates of sockeye salmon

The resources these restoration options benefit may include resources injured at a sublethal or chronic level and therefore not directly addressed in this alternative.

The remaining seventeen restoration options focus on individual species. However, even these actions are expected to benefit services such as subsistence and recreation.

RESOURCE RESTORATION OPTIONS:

Of the 14 resource restoration options identified in Alternative 3, 6 of them could potentially have significant multiple-species and habitat benefits.

Habitat protection and acquisition targeted at harlequin ducks would protect the riparian zone and nearby uplands adjacent to anadromous streams. Protection of these areas will have far reaching effects on other resources that depend on the riparian zone and on the anadromous fish. Protection for marbled murrelets would include more upland, non-riparian, habitat and would provide even greater protection for wildlife species that have large home ranges. Some of the other species that would benefit from implementing these options are: Sitka black-tailed deer; brown bears, black bears, river otters, bald eagles, and anadromous fish. Special designations for marbled murrelets would benefit terrestrial species utilizing old growth forests.

For pigeon guillemots and common murres it is possible that reducing predators near nesting colonies would be very effective in helping the colonies recover. If it is determined that predation is a serious problem at injured colonies then implementation

if predation is a limiting factor

of this option could be considered. This option would also benefit other species that are preyed upon by the gulls and weasels. Even though implementing this option for either murres or guillemots would not have a long-term effect on the predator population there is obviously a negative ecological cost to the predators. Therefore, the ecological costs and benefits will be carefully weighed to determine if the option should be implemented.

There were no options identified that would have the effectiveness level required in this alternative that would benefit black oystercatchers; however, if habitat protection were extended to the coastline, black oystercatcher and pigeon guillemot habitat would be protected. In addition, two of the special studies could benefit black oystercatchers if implemented in areas which are have, or had, high use.

These special study options include eliminating oil from oiled mussel beds and accelerating the upper intertidal. Both of these options affect lower levels of the food chain which can benefit many species. For instance, accelerating the growth rate of the seaweed *Fucus* would accelerate the colonization of invertebrates such as limpets. Limpets are one of the main prey species for black oystercatchers whose eggs and chicks are preyed upon by gulls, ravens, and some mammalian predators. Limpets and other small invertebrates are consumed by other species which are then taken by birds, river otters, etc. Although both of these special study options have effects on many species, they are not likely to be applied on a broad scale to benefit more than a localized area.

Improving survival rates of juvenile sockeye salmon could benefit marine and terrestrial predators which feed on salmon eggs, juvenile and adults. This includes bald eagles, brown bears, cutthroat trout and Dolly Varden, harlequin ducks, killer whale, harbor seals and river otters. However, the option needs to be carefully implemented so as not to exceed the carrying capacity of the ecosystem by producing large numbers of new fish.

SERVICE RESTORATION OPTIONS

Of the 9 service restoration options proposed for Alternative 3, 5 of them have potential impacts on multiple species and habitats.
Building new backcountry, public recreation facilities has potential negative impacts on all species if facilities are sited so as to increase human use of damaged habitats or other areas supporting recovering species. Alternatively, properly sited facilities could 'harden' use areas and direct uses away from injured areas and promote undisturbed natural recovery of injured resources.

Habitat acquisition and special designations for recreational purposes could benefit injured resources by protecting them from development and disturbances incompatible with recreation. On the other hand, these options could, if not carefully implemented, increase human use of damaged areas and slow natural recovery rates.

Spill prevention and contingency planning could benefit all species by preventing additional spills which would further compound existing injuries.

Replacing harvest opportunities by creating new salmon runs would benefit commercial and sport fishermen. Positive multi-species impacts would result from benefits to the many species which prey on salmon adults, eggs and juveniles. Benefits would be higher in the case of stream stocking programs, since eggs, juveniles and adult would be available to marine and terrestrial predators. This includes bald eagles, brown bears, cutthroat trout and Dolly Varden, harlequin ducks, killer whale, harbor seals and river otters. Terminal hatchery runs would provide fewer species with prey, since only adults and juveniles would be available to marine predators.

Negative impacts include the possibility of increasing mortality of seabirds and marine mammals due to interactions
with new commercial fisheries. Also, wild-stock pink salmon could possibly be impacted by fish from new runs straying into wild streams. Lastly, new runs stocked into streams which did not previously support salmon might harm resident fish through competition for food and spawning habitat.

Archaeology. Restoration of archaeological resources cannot regenerate what has been destroyed, but it can successfully address the prevention of further degradation and loss of both sites and the scientific information they contain. Site stewardship program, Site patrol and monitoring, and Preservation of archaeological sites and artifacts are highly effective techniques to protect archaeological resources in the spill-affected area. The last option entails some physical repair and data recovery.

Commercial Fishing. Creating new Terminal hatchery runs is a highly effective method of replacing commercial fishing opportunities lost due to fishing closures or reduced harvest of species injured by the spill. In this alternative, the newly created runs would continue only until wild stocks recover.

Recreation. All three of the restoration actions included for recreation serve primarily to protect existing uses and their resource base. Habitat protection and Special designations are the primary means of protecting recreation. However, in limited situations New backcountry public recreation facilities could protect both recreation and the resources on which it depends by, for example, providing an outhouse in a heavily used area.

Sport fishing. Transplanting hatchery runs is a highly effective method of replacing sport fishing opportunities lost due to fishing closures or reduced harvest of species injured by the spill. In this alternative, the newly created runs would continue only until wild stocks recover.

Subsistence. Testing subsistence foods is expected to be an effective way of restoring

confidence in the safety of subsistence resources withing the spill area. Concern over the safety of subsistence resources is believed to be one of the reasons subsistence harvests have not yet returned to pre-spill levels. Providing Access to traditional foods in areas outside the spill-affected area would be a highly effective way of restoring lost use. Both projects would be continued until subsistence resources and use have recovered to pre-spill levels.

Wilderness. Habitat protection amd acquisition is a highly effective means of preventing additional injury to wilderness; Special designations would provide an increased level of resource protection compatible with preservation of wilderness values.

III. GEOGRAPHIC DISTRIBUTION

Table 3 indicates the part of the spill area where the options will most likely be applied. The areas may change as detailed project planning is completed and as more is learned about injury or recovery.

Most protective options are applied throughout the spill area. But some research and restoration options are not applicable in all regions. With two exceptions, subsistence options and most commercial fishing options are applied in Prince William Sound and Kodiak. The exceptions are: feasibility study of Black Cod fishing interactions with Killer whales (Prince William Sound, where the interactions are expected to occur); Intensify pink salmon management to protect injured stocks (PWS), and Improve survival rates of salmon and eggs (Red Lake on Kodiak.)

IV. COST

Detailed cost estimates for Alternative 3 are contained in Table ___; the allocation of these costs is shown in Figure ___. Estimates of cost are approximate. No cost estimates are included for Special designations and Spill prevention and contingency planning because no particular designation is under consideration and spill prevention and contingency planning appears to be well funded at present. However, these situations may change over time. Actual costs will vary as new information about injury becomes available through the monitoring program, new ideas are developed for appropriate restoration options, and project planning proceeds.

The inflation-adjusted value of the remainder of the settlement fund is about $522 million. Sixty-two percent (62%) of this amount could be set aside for Habitat Protection. Monitoring and Administration/Information would require about 8% each. Other Restoration actions would require slightly less than 5%.

This scenario would leave 19% of the remaining settlement uncommitted. Uncommitted funds could be held for unanticipated expenses, such as injuries identified through the monitoring program, new options, or higher-than-projected costs for those already

~~[illegible].xls~~

RESOURCE OR SERVICE	Opt. No.	OPTION NAME	Prince William Sound			Kenai/Cook Inlet			Alaska	Kodiak/Afog		Outside
			North	East	West	Kenai Ck In	Lower Ck In	Central Ck In	Penin.	Afg. Shuyak	Kodiak	EVOS
Archaeology	1	Archeological site stewardship program	X	X	X	X	X	X	X	X	X	
Pink salmon	2.3	Intensify pink salmon mgmt to protect inj stocks	X	X	X							
Sockeye salmon	2.5	Intensify sockeye mgmt to protect inj stocks										
Marbled murrelet	9	Minimize incidental take by comm fish	X	X	X	X	X	X	X	X	X	
Archaeology	10	Preserve archaeological sites and artifacts	X	X	X	X	X	X	X	X	X	
Harlequin duck	13	Eliminate oil from mussel beds			X	X	X	X	X	X	X	
Upper intertidal	14	Accelerate recovery of upper intertidal zone			X	X	X	X	X	X	X	
Pigeon guillemot	17.2	Reduce predator access (Pigeon Guillemot)	X	X	X	X	X	X	X	X	X	
Comm'l & Sport Fishing	18	Replace salmon harvest opportunities	X	X	X						X	
Subsistence	30	Test subsistence foods for oil contamination		X	X						X	
MULTI-SPECIES	37	Habitat protection and acquisition		X	X	X	X	X	X	X	X	
MULTI-SPECIES	40	Special designations	X	X	X	X	X	X	X	X	X	
Prevention	44	Spill prevention and contingency plannin	X	X	X	X	X	X			X	
Killer Whale - AB pod	45	Black cod fishery, feas stdy	X	X	X							
Harbor seal	46	Cooperative program with fishermen	X	X	X							
Harbor Seal & Sea otter	47	Cooperative program with subsistence users		X	X						X	
Sockeye salmon	48	Improve survaval rates of salmon eggs & juv.								X	X	
Subsistence	49	Provide subsistence users access		X	X						X	

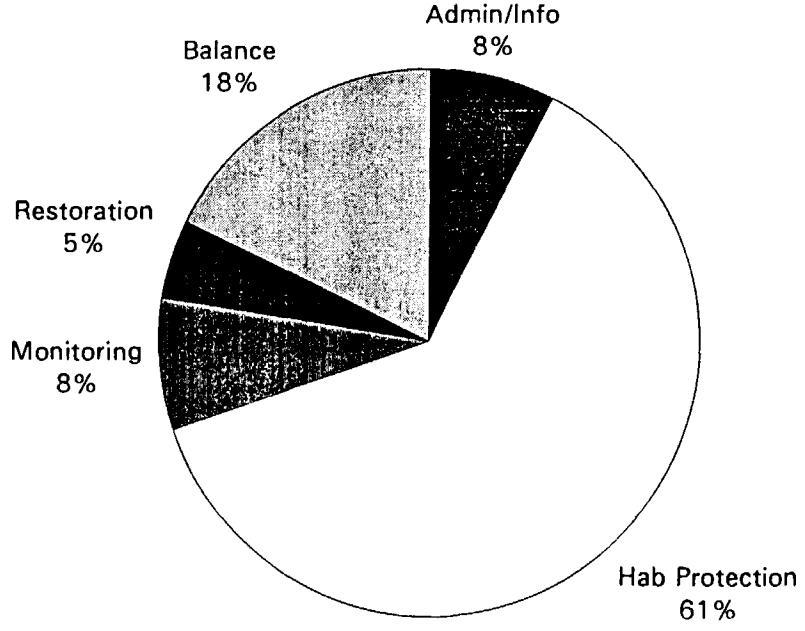
Table X. Expected Geographic ~~Alternative #3~~ Distribution of Options in Alternative #3

considered. Another use of the balance could be to fund an endowment for ongoing projects or for a research foundation. If the entire balance were invested in an endowment it would yield about $2.6 million annually.

V. PRIORITY

Because Alternative 3 addresses more severely injured resources, includes the most effective restoration actions, and few restoration options were identified for each resource or service, there is no proposal for setting priorities. However, if environmental conditions on the Kenai river system are adequate to support a supplemental fry program then Option 2.0 and 48.0 must be in place in 1994.

Allocation of Remainder of Settlement Funds		Total $	%
Admin/Info		40190.0	8%
Hab Protection		325000.0	62%
Monitoring		40250.0	8%
Restoration		24742.0	5%
Balance		91818.0	18%



NB: All costs are expressed in units of $1,000 (1993 $). The inflation-adjusted value of the remainder of the settlement is about $522 million.

Alternative 3 - Limited Restoration

Opt	DESCRIPTION	ResSvc	UNIT	ANNUAL COST			DURATION				TOTAL COST 10-Year Maximum		
				Exp	Low	High	Type	Years E	L	H	Expected	Lower	Higher
1.10	Site stewardship program	Archaeology	Per 3 areas	195.0	195.0	195.0	Ltd	10	10	10	1950.0	1950.0	1950.0
1.20	Site patrol and monitoring	Archaeology		300.0	300.0	300.0	Ltd	4	3	5	1200.0	900.0	1500.0
2.50	Intensify management	Sockeye salmon		750.0	700.0	800.0	Ltd	5	2	5	3750.0	1400.0	4000.0
4.30	Study: Reduce disturbance	Sea otter					Ltd				120.0	80.0	640.0
9.00	Minimize incidental take	Marbled murrelet									1625.0	1100.0	2000.0
10.00	Archaeol Res Protection	Archaeology									4072.0	3250.0	7000.0
12.10	New backcountry rec facilities	Recreation									1620.0	480.0	3256.0
13.10	Eliminate oil from mussel beds	Harlequin duck		491.0	340.0	641.0	Ltd	5	4	7	2455.0	1360.0	4487.0
13.20	Study: Elim oil fr mussel beds	Sea otter											
14.10	Accelerate recovery of UIT	Intertidal organisms		150.0	100.0	200.0	UR	5	4	7	750.0	400.0	1400.0
16.10	Study: Social stimuli	Common murre					Ltd				850.0	800.0	5500.0
17.21	Reduce predator access	Common murres		350.0	300.0	400.0	Ltd	5	5	10	1750.0	1500.0	4000.0
17.22	Reduce predator access	Pigeon guillemot		200.0	150.0	250.0	Ltd	4	4	6	800.0	600.0	1500.0
18.10	Replace harvest opportunities	Comm fishing	Per run	150.0	100.0	200.0	Ltd	2	1	5	300.0	100.0	1000.0
18.20	Replace harvest opportunities	Sport fishing	Per run	150.0	50.0	200.0	Ltd	2	1	5	300.0	50.0	1000.0
30.00	Test subsistence foods	Subsistence		330.0	300.0	350.0	Ltd	3	2	5	990.0	600.0	1750.0
37.00	Habitat protection/acquisition	Multiple resources									325000.0	225000.0	350000.0
40.00	Special designation	Multiple resources											
44.00	Spill prevention/conting plng	Multiple resources					Ltd						
45.00	Study: Changes in black cod	Killer whale		30.0	30.0	30.0	Ltd	1	1	1	30.0	30.0	30.0
46.00	Coop prgm-fishermen	Harbor seal		50.0	30.0	100.0	Ltd	3	1	5	150.0	30.0	500.0
47.10	Coop prgm-subsistence users	Harbor seal		30.0	30.0	30.0	UR	10	10	10	300.0	300.0	300.0
47.10	Coop prgm-subsistence users	Sea otter					UR						
48.20	Improve survival rates	Sockeye salmon	Per run	400.0	200.0	600.0	Ltd	3	1	5	1200.0	200.0	3000.0
49.00	Access to traditional foods	Subsistence		53.0	50.0	60.0	UR	10	10	10	530.0	500.0	600.0
P1.00	Administration	Multiple resources									40190.0	30180.0	50200.0
P2.00	Monitoring	Multiple resources									40250.0	20250.0	70250.0

NB: All costs are expressed in units of $1,000 (1993 $). The inflation-adjusted value of the remainder of the settlement is about $522 million.

Alternative 4 - Moderate Restoration

THEME	Take the most effective actions to protect and restore all injured resources and services. Increase, to a limited extent, opportunities for human use in the affected area.
VARIABLES	
Injury	All injured resources.
Status of Recovery	Resources not yet recovered.
Effectiveness of Restoration Actions	Most effective actions.
Opportunities for Human Use	Protect or increase existing uses.

Monitoring and information programs are included in all alternatives.
Functional equivalents of injured resources and services are included in all alternatives.

The goal of this alternative is for all injured resources and services to return to prespill conditions as efficiently as possible. Table _____ lists the resources and services addressed in this alternative. None of the resources whose populations declined after the spill has yet recovered. However, as resources recover, settlement funds would no longer be allocated to protecting or restoring them. This alternative includes actions that protect existing human uses that were injured and the resource base on which they depend and also those actions that would increase existing use. An example of the latter is a new hatchery run that may increase fishing opportunities but is compatible with existing use.

RESOURCES		SERVICES
Population Decline	Sublethal/Chronic	
Black oystercatcher Common murre Harbor seal Harlequin duck Intertidal organism Killer whale Marbled murrelet Pigeon guillemot Sea otter Sockeye salmon Subtidal organisms	Bald eagle Cutthroat trout Dolly varden Pacific herring Pink salmon River otter Rockfish	Archaeology Commercial fishing Recreation Sport fishing Subsistence Wilderness

Table _____. Resources and Services Addressed in Alternative 4.

Restoration Options. Among the many restoration ideas suggested by scientist, agencies, and the public, 28 meet the criteria for this alternative. Of these, 21 are identical to those in Alternative 3. There is at least one effective restoration action for each injured resource or service except black oystercatchers, subtidal organisms and river otter. Table ___ lists restoration options by resource or service. These options are presented as potential projects which have already been evaluated; they are not proposals. Over time, other options are likely to be proposed which may be superior to those listed here.

In this alternative, as for Alternative 3, Transplanting hatchery runs for commercial and sport fishing would continue only until the wild stocks of salmon recover to prespill levels. Testing subsistence foods for hydrocarbon contaimination and providing Access to traditional foods in areas outside the spill-affected area would be continued only until subsistence resources and use return to prespill levels. However, in contrast to Alternative 3 New backcountry public recreation facilities would be provided either to protect or increase existing recreational uses. Habitat Protection and Acquisition would apply to only the following resources and services:

Harlequin duck	Bald eagle	Recreation
Marbled murrelet	Cutthroat trout	Wilderness
	Dolly varden	

MONITORING

Monitoring under this alternative will be conducted to evaluate the effectiveness of restoration options used in combination inclusive of managing human use, directly manipulating resources and services, protecting or acquiring critical habitat, and replacing

or acquiring the equivalent of injured resources and services. Monitoring of this type is designed to identify where additional restoration activities may be appropriate, and determine when injury is delayed.

This alternative also includes the provision to monitor the dynamics of other ecological components, e.g., those important in the food chain (web) of injured species. This type of monitoring is useful in detecting residual effects of the oil spill many years removed from the event, and it provides a baseline from which to assess impacts of future spills and other disturbance. It also generates a database that facilitates greater understanding of how our changing environment affects the species that we manage and protect.

For those resources or services where little can be done to accelerate their recovery, e.g., sea otter, Alternative 4 includes provision to determine when natural recovery will restore injured resources and services to their pre-spill conditions. It also is assumed that normal agency management and monitoring will not be duplicated.

Under this alternative, monitoring will be conducted for all injured resources and services, but particularly in conjunction with restoration options that are likely to be the most effective when implemented. Monitoring recovery of injured services will be undertaken in association with restoration measures designed to protect, restore and to increase (enhance) existing human-use activities

Monitoring will be conducted on and in surface waters, on tidelands, and on adjacent uplands including their watersheds in Prince William Sound and the Gulf of Alaska. Monitoring also will be conducted outside the spill affected area to measure the effectiveness of replacement or acquisition of equivalent resources and services options, e.g., eliminate predators of marine birds on Aleutian Islands, included in this alternative. Monitoring will continue dependent upon the severity and duration of effects resulting from the spill and the time necessary to establish a trend for recovery. Some monitoring components, e.g. those designed to document long-term trends in the health of the ecosystem, could continue in perpetuity if supported by an endowment.

Resources to be monitored include but are not restricted to affected floral (sea grasses and sea weeds) and faunal assemblages (marine mammals, marine birds including sea ducks, etc. See Alternative 1 for complete list of injured resources and services to be monitored.

Costs for Alternative 4 are $5.0 million per year with a range of $4.0-$5.0 million per year. Of the $5.0 million per year figure, $3.0 million per year is allotted to monitoring effectiveness of restoration; $1.0 million per year is allotted to monitoring natural recovery; and $1.0 million per year is allotted for monitoring long-term trends in the health of the ecosystem.

RESOURCE/SERVICE	RESTORATION OPTION
Black oystercatcher	None
Common murre	16.1 Study: Social stimuli 17.2 Reduce predator access
Harbor seal	46.0 Cooperative program - fishers 47.0 Cooperative program - subsistence users
Harlequin duck	13.0 Eliminate oil from mussel beds 37.0 Habitat protection and acquisition
Intertidal organisms	14.0 Accelerate recovery - upper intertidal
Killer whale	45.0 Study: Changes in black cod fishery gear
Marbled murrelet	9.0 Minimize incidental take 37.0 Habitat protection and acquisition 40.0 Special designations
Pigeon guillemot	17.2 Reduce predator access
Sea otter	4.2 Study: Reduce disturbance 13.0 Eliminate oil from mussel beds 47.0 Cooperative program - subsistence users
Sockeye salmon	2.5 Intensify management 48.2 Improve survival rates
Subtidal organisms	None
Bald eagle	37.0 Habitat protection and acquisition
Cutthroat trout	2.1 Intensify management 37.0 Habitat protection and acquisition
Dolly varden	2.1 Intensify management 37.0 Habitat protection and acquisition
Pacific herring	2.2 Intensify management
Pink salmon	2.3 Intensify management 51.0 Relocate existing hatchery runs
River otter	None
Rockfish	2.4 Intensify management
Archaeology	1.1 Site stewardship program 1.2 Site patrol and monitoring 10.0 Preserve archaeological sites and artifacts 35.0 Acquire replacements for artifacts from the spill area
Commercial fishing	11.2 Fertilize lakes to improve sockeye salmon rearing success 18.0 Replace salmon harvest opportunities

Recreation	12.1 New backcountry public recreation facilities 37.0 Habitat protection and acquisition 40.0 Special designations
Sport fishing	11.2 Fertilize lakes to improve sockeye salmon rearing success 18.0 Replace salmon harvest opportunities
Subsistence	30.0 Test subsistence foods 49.0 Access to traditional foods
Wilderness	37.0 Habitat protection and acquisition 40.0 Special designations
Multiple resources	44.0 Spill prevention and contingency planning

Table ____. Restoration Options for Alternative 4.

EVALUATION

I. EFFECT ON THE RECOVERY OF RESOURCES

A. Marine mammals

Harbor seals: The two options which have the greatest potential to benefit harbor seals are: Develop a cooperative program with subsistence users, and Develop a cooperative program with commercial fishermen. These programs which will help provide greater management by coordinating managers, researchers, subsistence users and commercial fishermen.

Killer whales - AB pod: An option to determine the feasibility of facilitating gear changes in the black cod fishery from long-lines to pots, would prevent the whales from marauding the catch and eliminate the need for fishermen to defend their harvest.

Sea otters: The option believed to have the greatest ability to effect the overall sea otter population is to Develop a cooperative program with subsistence users. This option would help ensure that the sea other population fully recovers to its pre-spill level and sustain any changes in harvest levels. In addition, the special study of Eliminating oil from oiled mussel beds could be highly effective (25% to over 50%) in improving the weanling pups survival and recruitment rates if oiled mussel beds are determined to be a major reason for the poor weanling survival.

B. Terrestrial mammals

River otters: There are no proposed options that meet the effectiveness level described for this option.

C. Birds

Bald eagles: None of the current options proposed for bald eagles are expected to reach the effectiveness level required for this alternative.

Black oystercatchers: None of the current options proposed for black oystercatchers are expected to reach the effectiveness level required for this alternative.

Common murres: At this time, there are no proposed options which are certain to reach the effectiveness level required for this alternative. There are two options which have the potential to greatly influence the rate of recovery for common murres; however, preliminary work would need to be completed before the effectiveness can be adequately evaluated. These options are: (#16.1) Enhancing the social stimuli, and (#17.2) Predator control to benefit marine birds. (note: greater detail provided in Alternative 3.)

Harlequin ducks: Protecting nesting habitat (#37 Habitat protection and acquisition) for harlequin ducks can prevent habitat loss which could prevent the population from fully recovering to its prespill level. In addition, in localized areas the special study Eliminating oil from oiled mussel beds (#13) has the potential to improve the rate of recovery of a localized area by 25 - 50%; however, at this time there are too many unknowns to be certain of its effectiveness.

Marbled murrelets: Protecting habitat (options #37 Habitat protection and acquisition and #40 Special designations) would ensure that the marbled murrelet population could recover to is prespill levels once the population decline is reversed. Protecting the coastal waters could also benefit their prey which may help stabilize the population more quickly. In localized areas, option #9 Minimizing incidental take of marine birds could provide additional help to stabilize the population.

Pigeon guillemots: The only option currently proposed that has the potential to produce a substantial impact on stabilizing the population needs to have preliminary work completed before the option can be adequately evaluated. Option #17.2 Predator control to benefit marine birds has the potential to increase productivity by 25-50 % at very site specific locations; however, predation levels at colonies within the injured area have not been documented and this option may not be needed should predation levels be low.

D. Fish

Cutthroat trout: Option 2 Intensify fisheries management to protect injured stocks would benefit both cutthroat trout and its dependent sport fishery. By determining the maximum sustained yield and documenting fishable areas the sport fishery could be opened, or partially opened as early as 1998. It can also be used to enhance the injured stocks an additional 5-10% above the pre-spill population level.

Habitat protection and acquisition is believed to be especially important for cutthroat trout in Prince William Sound because they are at the northern extent of their geographic range and are believed to be more vulnerable to habitat alterations.

Dolly Varden trout: Option 2 Intensify fisheries management to protect injured stocks would benefit the Dolly Varden trout population by determining the maximum sustained yield and documenting the sport fishery the fishery could be managed to protect injured stocks. It can also be used to enhance the injured stocks an additional 5-10% above the pre-spill population level.

Herring: The extent of injury to herring is still unknown. Option 2 Intensify fisheries management to protect injured stocks could improve the rate and degree of recovery by more than 50% if it is necessary. The option would allow for increased precision in stock assessment which would allow for manipulation of the harvest levels to counter all but the most extreme levels of injury.

Pink salmon: The coded-wire tagging and stock separation information that would be gained from an intensified fisheries management program (option 2) would help ensure that the wild stock population fully recover and could accelerate the recovery rate as much as 50% over natural recovery. Relocating existing hatchery runs (option 51) could substantially improve the recovery of wild stocks by reducing interception rates by 25 - 50%. The benefits of this option would be fairly localized.

Sockeye salmon: Option 2 Intensify fisheries management to protect injured stocks is the single most effective option for aiding and protecting the Keani River sockeye. With this option the risk of overescapements on the Kenai River could be reduced from 25% to 10%. In combination with management, and under the right environmental conditions, option #48 (Improve the survival of salmon eggs to fry) could be very effective for the Kenai river system. Improving survival of salmon eggs to fry could stimulate recovery so is complete around the year 2000. Monitoring of the plankton population and salmon escapement must occur in 1994/95 in order to supplement fry production in 1995. Option #11.2, Fertilization of lakes to improve sockeye rearing success could be applied to Coghill Lake to enhance sockeye production.
(effectiveness rating?***)

Rockfish: The only option that would have notable benefits to the rockfish population regardless of the injury level is to intensify the fisheries management. The added information will help direct the harvest to compensate for injury from the oil spill.

E. Coastal habitat

Coastal habitat - subtidal: At this time, no effective options have been identified that could help the recovery of subtidal organisms.

Coastal habitat - upper intertidal: Option 14 - Accelerate the recovery of the upper intertidal zone may prove to greatly increase the recovery time on a very localized basis. Experts have estimated that the option could increase the rate of recovery by 25 to 50%; however, the techniques are experimental and are not likely to be applied on a broad scale.

EFFECT ON THE RECOVERY OF SERVICES

Archaeology. Restoration of archaeological resources cannot regenerate what has been destroyed, but it can successfully address the prevention of further degradation and loss of both sites and the scientific information they contain. Site stewardship program, Site patrol and monitoring, and Preservation of archaeological sites and artifacts are highly effective techniques to protect archaeological resources in the spill-affected area. The last option entails some physical repair and data recovery. Acquiring replacements for artifacts from the spill area would be a moderately effective means of preserving and studying artifacts which were taken from the oil spill area prior to the spill and are currently in the possession of museums and agencies.

Commercial Fishing. Replacing harvest opportunities by creating new salmon runs is a highly effective method of replacing commercial fishing opportunities lost due to fishing closures or reduced harvest of species injured by the spill. In this alternative, the newly created runs would continue only until wild stocks recover.

Recreation. Three of the restoration actions included for recreation serve primarily to protect existing uses and their resource base. Habitat protection and Special designations are the primary means of protecting recreation. However, in limited situations New backcountry public recreation facilities could protect both recreation and the resources on which it depends by, for example, providing an outhouse in a heavily used area. Expanding existing visitor centers is a moderately effective way to disseminate information about spill injuries, recovery, and how the public can modify their uses of the area to maximize recovery.

Sport fishing. Replacing harvest opportunities by creating new salmon runs is a highly effective method of replacing sport fishing opportunities lost due to fishing closures or reduced harvest of species injured by the spill. In this alternative, the newly created runs would continue only until wild stocks recover.

Subsistence. Testing subsistence foods is expected to be an effective way of restoring confidence in the safety of subsistence resources withing the spill area. Concern over the safety of subsistence resources is believed to be one of the reasons subsistence harvests have not yet returned to pre-spill levels. Providing Access to traditional foods in areas outside the spill-affected area would be a highly effective way of restoring lost use. Both projects would be continued until subsistence resources and use have recovered to pre-spill levels.

Wilderness. Habitat protection amd acquisition is a highly effective means of preventing additional injury to wilderness; Special designations would provide an increased level of resource protection compatible with preservation of wilderness values.

II. MULTI-SPECIES IMPACTS OF PROPOSED OPTIONS

RESOURCE RESTORATION OPTIONS:

Of the 17 resource restoration options identified in Alternative 4, 8 of them could potentially have significant multiple-species and habitat impacts.

Habitat protection and acquisition targeting harlequin ducks, marbled murrelets, bald eagles and cutthroat trout would protect the coastal fringe areas, riparian zones, watersheds and other uplands. Protection of these areas will have far reaching effects on other resources that depend on these habitats and the species which utilize them. Some of the other species that would benefit from implementing these options are: Sitka black-tailed deer; brown bears, black bears, river otters, salmon, and a variety of other fish and birds. Special designations targeting marbled murrelets would benefit terrestrial species using uplands and old growth forests.

For pigeon guillemots and common murres it is possible that reducing predators near nesting colonies would be very effective in helping the colonies recover. If it is determined that predation is a serious problem at injured colonies then implementation of this option could be considered. This option would also benefit other species that are preyed upon by the gulls and weasels. Even though implementing this option for either murres or guillemots would not have a long-term effect on the predator population there is obviously a negative ecological cost to the predators. Therefore, the ecological costs and benefits will be carefully weighed to determine if the option should be implemented.

There were no options identified that would have the effectiveness level required in this alternative that would benefit black oystercatchers; however, if habitat protection were extended to the coastline, black oystercatcher and pigeon guillemot habitat would be protected. In addition, two of the special studies could benefit black oystercatchers if implemented in areas which are have, or had, high use.

These special study options include eliminating oil from oiled mussel beds and accelerating the upper intertidal. Both of these options affect lower levels of the food chain which can benefit many species. For instance, accelerating the growth rate of the seaweed *Fucus* would accelerate the colonization of invertebrates such as limpets. Limpets are one of the main prey species for black oystercatchers whose eggs and chicks are preyed upon by gulls, ravens, and some mammalian predators. Limpets and other small invertebrates are consumed by other species which are then taken by birds, river otters, etc. Although both of these special study options have effects on many species, they are not likely to be applied on a broad scale to benefit more than a localized area.

Improving survival rates of juvenile sockeye salmon and Fertilizing lakes to improve sockeye rearing success could benefit marine and terrestrial predators which feed on salmon eggs, juvenile and adults. This includes bald eagles, brown bears, cutthroat trout

and Dolly Varden, harlequin ducks, killer whale, harbor seals and river otters. However, the option needs to be carefully implemented so as not to exceed the carrying capacity of the ecosystem by producing large numbers of new fish.

Relocating existing hatchery runs to benefit wild pink salmon could have negative impacts on seabirds and marine mammals if fishing pressures are shifted into areas used heavily by these species. These impacts could be avoided by carefully choosing the location and timing of the relocation.

SERVICE RESTORATION OPTIONS

Of the 11 service restoration options proposed for Alternative 4, 5 of them have potential impacts on multiple species and habitats.
Building new backcountry, public recreation facilities has potential negative impacts on all species if facilities are sited so as to increase human use of damaged habitats or other areas supporting recovering species. Alternatively, properly sited facilities could 'harden' use areas and direct uses away from injured areas and promote undisturbed natural recovery of injured resources.

Habitat acquisition and Special designations for recreational purposes could benefit injured resources by protecting them from development and disturbances incompatible with recreation. On the other hand, these options could, if not carefully implemented, increase human use of damaged areas and slow natural recovery rates.

Spill prevention and contingency planning could benefit all species by preventing additional spills which would further compound existing injuries. ***where does this option really go?

Replacing harvest opportunities by creating new salmon runs would benefit commercial and sport fishermen. Positive multi-species impacts would result from benefits to the many species which prey on salmon adults, eggs and juveniles. Benefits would be higher in the case of stream stocking programs, since eggs, juveniles and adult would be available to marine and terrestrial predators. This includes bald eagles, brown bears, cutthroat trout and Dolly Varden, harlequin ducks, killer whale, harbor seals and river otters. Terminal hatchery runs would provide fewer species with prey, since only adults and juveniles would be available to marine predators.

Negative impacts include the possibility of increasing mortality of seabirds and marine mammals due to interactions
with new commercial fisheries. Also, wild-stock pink salmon could possibly be impacted by fish from new runs straying into wild streams. Lastly, new runs stocked into streams which did not previously support salmon might harm resident fish through competition for food and spawning habitat.

III. GEOGRAPHIC DISTRIBUTION

Table 3 indicates the part of the spill area where the options will most likely be applied. The areas may change as detailed project planning is completed and as more is learned about injury or recovery.

Most options are applied throughout the spill area. Many of the options involving fish are applicable only in Prince William Sound including management plans for: cutthroat trout and Dolly Varden char, herring, pink salmon, rockfish (also applied to Kenai), and Coghill Lake fertilization. Projects involving sockeye are applied when applicable to Kenai and Red Lake (on Kodiak).

IV. COST

Detailed cost estimates for Alternative 4 are contained in Table ___; the allocation of these costs is shown in Figure ___. Estimates of cost are approximate. No cost estimates are included for Special designations and Spill prevention and contingency planning because no particular designation is under consideration and spill prevention and contingency planning appears to be well funded at present. However, these situations could change over time. Actual costs will vary as new information about injury becomes available through the monitoring program, new ideas are developed for appropriate restoration options, and project planning proceeds.

The inflation-adjusted value of the remainder of the settlement fund is about $522 million. Over half (57%) of this amount could be set aside for Habitat Protection. Monitoring would require about 10%; Aministration/Information 9%; and Other Restoration actions 5%.

This scenario would leave 18% of the remaining settlement uncommitted. Uncommitted funds could be held for unanticipated expenses, such as injuries identified through the monitoring program, new options, or higher-than-projected costs for those already considered. Another use of the balance could be to fund an endowment for ongoing projects or for a research foundation. If the entire balance were invested in an endowment it would yield about $2.6 million annually.

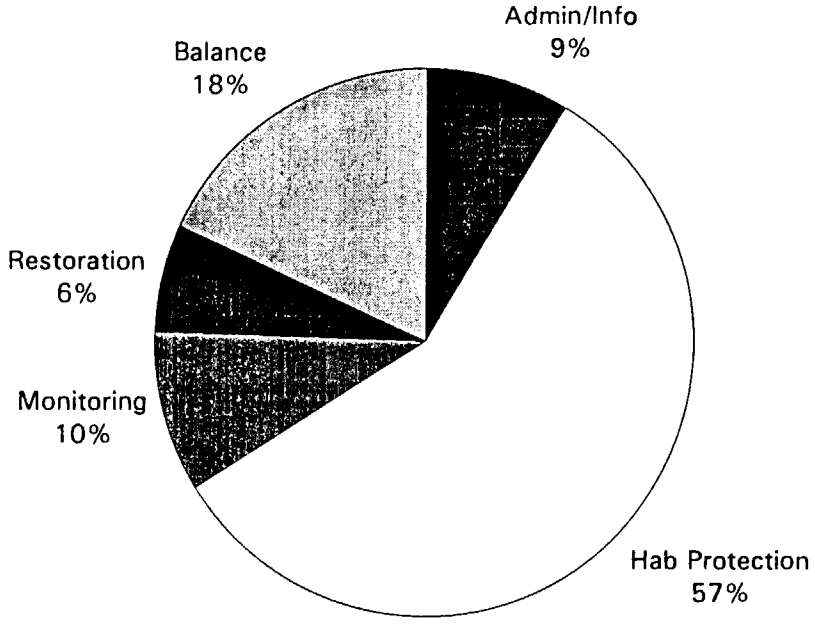
~~GEOALT4.XLS~~

RESOURCE OR SERVICE	Opt. No.	OPTION NAME	Prince William Sound			Kenai/Cook Inlet			Alaska	Kodiak/Afog		Outside
			North	East	West	Kenai Ck In	Lower Ck In	Central Ck In	Penin.	Afg. Shuyak	Kodiak	EVOS
Archaeology	1	Archeological site stewardship program	X	X	X	X	X	X	X	X	X	
Cutthroat/Dolly Varden Trout	2.1	Intensify Cuttroat/Dolly mgmt to protect injured		X	X							
Herring	2.2	Intensify herring mgmt to protect inj stocks	X	X	X							
Pink salmon	2.3	Intensify pink salmon mgmt to protect inj stocks	X	X	X							
Rockfish	2.4	Intensify rockfish mgmt to protect injured stocks	X	X	X	X	X	X				
Sockeye salmon	2.5	Intensify sockeye mgmt to protect inj stocks										
Marbled murrelet	9	Minimize incidental take by comm fish	X	X	X	X	X	X	X	X	X	
Archaeology	10	Preserve archaeological sites and artifacts	X	X	X	X	X	X	X	X	X	
Coghill Lake Fertilization	11.2	Fertilize lakes to improve sockeye rearing succe	X									
Recreation	12.1	Construct New backcountry public facilities	X	X	X	X	X	X	X	X	X	
Harlequin duck	13	Eliminate oil from mussel beds			X	X	X	X	X	X	X	
Upper Intertidal	14	Accelerate recovery of upper intertidal zone			X	X	X	X	X	X	X	
Pigeon guillemot	17.2	Reduce predator access (Pigeon Guillemot)	X	X	X	X	X	X	X	X	X	
Comm'l & Sport Fishing	18	Replace salmon harvest opportunities	X	X	X						X	
Subsistence	30	Test subsistence foods for oil contamination		X	X						X	
Research & Education	33.1	Expand existing visitor center(s)										
Research & Education	34.2	Fund a marine research prog or foundation										
Archaeology	35	Acquire replacements for artifacts from the spill	X	X	X	X	X	X	X	X	X	X
MULTI-SPECIES	37	Habitat Protection and Acquisition		X	X	X	X	X	X	X	X	
MULTI-SPECIES	40	Special designations	X	X	X	X	X	X	X	X	X	
Prevention	44	Spill prevention and contingency plannin	X	X	X	~~X~~	~~X~~	~~X~~			X	
Harbor seal	46	Cooperative program with fishermen	X	X	X							
Harbor seal & Sea Otter	47	Cooperative program with subsistence users		X	X						X	
Sockeye salmon	48	Improve survaval rates of salmon eggs & juv.								X	X	
Subsistence	49	Provide subsistence users access		X	X						X	
Pink salmon	51	Relocate existing hatchery runs	X	X	X							

~~ALTERNATIVE #4~~

Table X. Expected Geographic Distribution of Options in Alternative #4

Allocation of Remainder of Settlement Funds	Total $	%
Admin/Info	45190.0	9%
Hab Protection	300000.0	57%
Monitoring	50250.0	10%
Restoration	33247.0	6%
Balance	93313.0	18%



NB: All costs are expressed in units of $1,000 (1993 $). The inflation-adjusted value of the remainder of the settlement is about $522 million.

Alternative 4 - Moderate Restoration

Opt	DESCRIPTION	ResSvc	UNIT	ANNUAL COST			DURATION				TOTAL COST 10-Year Maximum		
								Years					
				Exp	Low	High	Type	E	L	H	Expected	Lower	Higher
1.10	Site stewardship program	Archaeology	Per 3 areas	195.0	195.0	195.0	Ltd	10	10	10	1950.0	1950.0	1950.0
1.20	Site patrol and monitoring	Archaeology		300.0	300.0	300.0	Ltd	4	3	5	1200.0	900.0	1500.0
2.10	Intensify management	Cutthroat/Dolly		145.0	130.0	160.0	Ltd	2	2	2	290.0	260.0	320.0
2.20	Intensify management	Pacific herring		457.0	457.0	457.0	Ltd	2	2	4	914.0	914.0	1828.0
2.30	Intensify management	Pink salmon		1200.0	900.0	1500.0	Ltd	2	2	4	2400.0	1800.0	6000.0
2.40	Intensify management	Rockfish		593.0	593.0	593.0	Ltd	2	1	4	1186.0	593.0	2372.0
2.50	Intensify management	Sockeye salmon		750.0	700.0	800.0	Ltd	5	2	5	3750.0	1400.0	4000.0
4.30	Study: Reduce disturbance	Sea otter					Ltd				120.0	80.0	640.0
9.00	Minimize incidental take	Marbled murrelet									1625.0	1100.0	2000.0
10.00	Archaeol Res Protection	Archaeology									4072.0	3250.0	7000.0
11.20	Fertilize lakes	Sockeye salmon	Per lake	190.0	150.0	220.0	Ltd	3	1	5	570.0	150.0	1100.0
12.10	New backcountry rec facilities	Recreation									1620.0	480.0	3256.0
13.10	Eliminate oil from mussel beds	Harlequin duck		491.0	340.0	641.0	Ltd	5	4	7	2455.0	1360.0	4487.0
13.20	Study: Elim oil fr mussel beds	Sea otter											
14.10	Accelerate recovery of UIT	Intertidal organisms		150.0	100.0	200.0	UR	5	4	7	750.0	400.0	1400.0
16.10	Study: Social stimuli	Common murre					Ltd				850.0	800.0	5500.0
17.10	Eliminate introduced foxes	Seabird repl					UR				2500.0	1500.0	3500.0
17.21	Reduce predator access	Common murres		350.0	300.0	400.0	Ltd	5	5	10	1750.0	1500.0	4000.0
17.22	Reduce predator access	Pigeon guillemot		200.0	150.0	250.0	Ltd	4	4	6	800.0	600.0	1500.0
18.10	Replace harvest opportunities	Comm fishing	Per run	150.0	100.0	200.0	Ltd	2	1	5	300.0	100.0	1000.0
18.20	Replace harvest opportunities	Sport fishing	Per run	150.0	50.0	200.0	Ltd	2	1	5	300.0	50.0	1000.0
30.00	Test subsistence foods	Subsistence		330.0	300.0	350.0	Ltd	3	2	5	990.0	600.0	1750.0
35.00	Aquire archaeol. artifacts	Archaeology		225.0	150.0	300.0	Ltd	3	3	3	675.0	450.0	900.0
37.00	Habitat protection/acquisition	Multiple resources									300000.0	225000.0	350000.0
40.00	Special designation	Multiple resources											
44.00	Spill prevention/conting plng	Multiple resources					Ltd						
46.00	Coop prgm-fishermen	Harbor seal		50.0	30.0	100.0	Ltd	3	1	5	150.0	30.0	500.0
47.10	Coop prgm-subsistence users	Harbor seal		30.0	30.0	30.0	UR	10	10	10	300.0	300.0	300.0
47.10	Coop prgm-subsistence users	Sea otter					UR						
48.20	Improve survival rates	Sockeye salmon	Per run	400.0	200.0	600.0	Ltd	3	1	5	1200.0	200.0	3000.0
49.00	Access to traditional foods	Subsistence		53.0	50.0	60.0	UR	10	10	10	530.0	500.0	600.0
51.00	Relocate existing hatchery runs	Pink salmon	Per run				Ltd	22	2	3			
P1.00	Administration	Multiple resources									45190.0	30180.0	50200.0
P2.00	Monitoring	Multiple resources									50250.0	20250.0	70250.0

85

NB: All costs are expressed in units of $1,000 (1993 $). The inflation-adjusted value of the remainder of the settlement is about $522 million.

Alternative 5 - Comprehensive Restoration

THEME	Take all beneficial actions to protect and restore all injured resources and services. Increase opportunities for human use in the affected area.
VARIABLES	
Injury	All injured resources.
Status of Recovery	All stages of recovery
Effectiveness of Restoration Actions	All beneficial actions.
Opportunities for Human Use	Protect or increase existing uses; or encourage appropriate new uses.

Monitoring and information programs are included in all alternatives.
Functional equivalents of injured resources and services are included in all alternatives.

The goal of this alternative is for all injured resources and services to return or exceed prespill levels. Table _____ lists the resources and services addressed in this alternative; they are identical to those addressed in Alternatives 2 and 4. This alternative includes actions that protect existing human uses that were injured and the resource base on which they depend and also those actions that would increase existing use or create new uses. An example of the last item is a new commercial facility on public land that attracts different types of uses than had previously existed there.

RESOURCES		SERVICES
Population Decline	**Sublethal/Chronic**	
Black oystercatcher Common murre Harbor seal Harlequin duck Intertidal organism Killer whale Marbled murrelet Pigeon guillemot Sea otter Sockeye salmon Subtidal organisms	Bald eagle Cutthroat trout Dolly varden Pacific herring Pink salmon River otter Rockfish	Archaeology Commercial fishing Recreation Sport fishing Subsistence Wilderness

Table _____. Resources and Services Addressed in Alternative 5.

Restoration Options. Among the many restoration ideas suggested by scientist, agencies, and the public, 38 meet the criteria for this alternative. Of these, 21 are identical to those in Alternative 3; and 7 are identical to those in Alternative 4. There is at least one effective restoration action for each injured resource or service except subtidal organisms. Table ___ lists restoration options by resource or service. These options are presented as potential projects which have already been evaluated; they are not proposals. Over time, other options are likely to be proposed which may be superior to those listed here.

In this alternative, Restoring salmon harvest opportunities for commercial and sport fishing could continue after wild stocks of salmon recover to prespill levels. Testing subsistence foods for hydrocarbon contaimination and providing Access to traditional foods in areas outside the spill-affected area could be continued only after subsistence resources and use return to prespill levels. In addition, funding for New backcountry public recreation facilities and Planning and marketing of public land for commercial recreation facilities, Visitor centers, and Marine environmental institute would be considered to protect or increase existing recreational uses or encourage new ones. Habitat Protection and Acquisition would apply to only the following resources and services:

Black oystercatcher	Bald eagle	Recreation
Harlequin duck	Cutthroat trout	Wilderness
Marbled murrelet	Dolly varden	
Sockeye salmon	Pink salmon	

Monitoring

Monitoring under this alternative is designed to assess the effectiveness of restoration options used in combination
inclusive of managing human uses, directly manipulating resources and services, protecting and acquiring critical habitat, and replacing or acquiring the equivalent of injured resources and services. Monitoring of this type is designed to identify where additional restoration activities may be appropriate, and determine when injury is delayed.

This alternative also includes the provision to monitor the dynamics of other ecological components, e.g., those important in the food chain (web) of injured species. This type of monitoring is useful in detecting residual effects of the oil spill many years removed form the event, and it provides a baseline from which to assess the impacts of future oils spills and other disturbance. It also generates a database that facilitates greater understanding of how our changing environment affects the species that we manage and protect.

For those resources and services where little can be done to accelerate recovery, e.g., sea otters, Alternative 5 also includes provision to determine when natural recovery will restore injured resources and services to their pre-spill conditions. It also is assumed that normal agency management and monitoring will not be duplicated.

Under this alternative, monitoring will be conducted for all injured resources and services, irregardless of the severity of injury or our understanding of the status of recovery. Monitoring will be conducted in conjunction with all restoration measures implemented, even those that we are less certain will
produce a beneficial effect. Monitoring recovery of injured services also will be undertaken in association with restoration measures designed to protect, restore, and to increase (enhance) existing (pre-spill) human-use activities.

Monitoring will be conducted on and in surface waters, on tidelands, and on adjacent uplands including their watersheds in Prince William Sound and the Gulf of Alaska. Monitoring also will be conducted outside the spill affected area to measure the effectiveness of replacement and acquisition of equivalent resources and services options, e.g. eliminate predators from marine bird colonies on Aleutian Islands, included in this alternative.

Monitoring will continue dependent upon the severity and duration of injuries resulting from the oil spill and the time necessary to establish a trend for recovery. Some monitoring components, e.g., those designed to document long-term trends in the health of the affected ecosystem, would continue in perpetuity if supported by an endowment.

Resources to be monitored include but are not restricted to affected floral (sea grasses and seaweeds) and faunal (Marine mammals, marine birds including sea ducks), etc. See complete list of resources and services to be monitored in Alternative 1.

Costs of monitoring for this alternative is $6.0 million per year with a range of $5.0-$7.0 million per year. Of the $6.0 million per year figure, $4.0 million is allotted to monitoring the effectiveness of restoration; $1.0 million per year is allotted to monitoring natural recovery; and $1.0 million per year is allotted to monitoring long-term trends in the health of the ecosystem.

RESOURCE/SERVICE	RESTORATION OPTION
Black oystercatcher	14.0 Accelerate recovery - upper intertidal 37.0 Habitat protection and acquisition 40.0 Special designations
Common murre	4.1 Reduce disturbance at marine bird colonies 16.1 Study: Social stimuli 17.2 Reduce predator access
Harbor seal	4.2 Reduce disturbance at marine mammal haul-out areas 46.0 Cooperative program - fishers 47.0 Cooperative program - subsistence users
Harlequin duck	8.0 Develop sport harvest guidelines 13.0 Eliminate oil from mussel beds 37.0 Habitat protection and acquisition
Intertidal organisms	14.0 Accelerate recovery - upper intertidal
Killer whale	45.0 Study: Changes in black cod fishery gear
Marbled murrelet	9.0 Minimize incidental take 37.0 Habitat protection and acquisition 40.0 Special designations
Pigeon guillemot	17.2 Reduce predator access
Sea otter	4.2 Study: Reduce disturbance 13.0 Eliminate oil from mussel beds 47.0 Cooperative program - subsistence users
Sockeye salmon	2.5 Intensify management 11.3 Improve access: salmon fish passes 37.0 Habitat protection and acquisition 48.2 Improve survival rates
Subtidal organisms	None
Bald eagle	37.0 Habitat protection and acquisition
Cutthroat trout	2.1 Intensify management 19.0 Anadromous Streams Catalogue 37.0 Habitat protection and acquisition
Dolly varden	2.1 Intensify management 19.0 Anadromous Streams Catalogue 37.0 Habitat protection and acquisition
Pacific herring	2.2 Intensify management

Pink salmon	2.3 Intensify management 11.1 Construct salmon spawning channels 11.3 Improve access: salmon fish passes 19.0 Anadromous Streams Catalogue 37.0 Habitat protection and acquisition 40.0 Special designations 48.0 Improve survival rates of salmon eggs and juveniles 51.0 Relocate existing hatchery runs
River otter	8.0 Develop sport and trapping harvest guidelines
Rockfish	2.4 Intensify management
Archaeology	1.1 Site stewardship program 1.2 Site patrol and monitoring 10.0 Preserve archaeological sites and artifacts 35.0 Acquire replacements for artifacts from the spill area
Commercial fishing	11.2 Fertilize lakes to improve sockeye salmon rearing success 18.0 Replace salmon harvest opportunities
Recreation	12.1 New backcountry public recreation facilities 12.2 Plan and market public land for commercial rec facilities 33.1 Visitor centers 34.0 Marine environmental institute 37.0 Habitat protection and acquisition 40.0 Special designations
Sport fishing	11.2 Fertilize lakes to improve sockeye salmon rearing success 18.0 Replace salmon harvest opportunities
Subsistence	18.0 Replace salmon harvest opportunities 30.0 Test subsistence foods 49.0 Access to traditional foods 50.1 Develop subsistence mariculture sites 50.2 Develop bivalve shellfish hatchery and rescue center
Wilderness	37.0 Habitat protection and acquisition 40.0 Special designations
Multiple resources	44.0 Spill prevention and contingency planning

Table ____. Restoration Options for Alternative 5.

EVALUATION

I. EFFECT ON THE RECOVERY OF RESOURCES:

A. MARINE MAMMALS

Harbor seals (first priority): At present, disturbance of harbor seals at their haulout sites is not believed to be a significant problem, therefore reducing disturbance at marine

mammal haulout sites (option 4.0) has less effectiveness than the other two options proposed. However, this option would ensure that disturbance remains minimal and protects harbor seals from additional pup mortality that could be caused if disturbance patterns change.

The two options which have the greatest potential to benefit harbor seals are: Develop a cooperative program with subsistence users, and Develop a cooperative program with commercial fishermen. These programs which will help provide greater management by coordinating managers, researchers, subsistence users and commercial fishermen. These options are in the first priority level for Alternative 6.

Killer whales - AB pod (first priority): The most effective option to provide protection for the AB pod is an option to determine the feasibility of facilitating gear changes in the black cod fishery from long-lines to pots. If this option is feasible it would prevent the whales from marauding the catch and eliminate the need for fishermen to defend their harvest.

Sea otters (first priority): The option believed to have the greatest ability to effect the overall sea otter population is to Develop a cooperative program with subsistence users. This option would help ensure that the sea other population fully recovers to its pre-spill level and sustain any changes in harvest levels. In addition, the special study of Eliminating oil from oiled mussel beds could be highly effective (25% to over 50%) in improving the weanling pups survival and recruitment rates if oiled mussel beds are determined to be a major reason for the poor weanling survival.

Very little is known about the effects of disturbance from boat traffic or from harvest and development of coastal lands. A special study which investigates the impact of such activities would determine if Option 4, reducing disturbance at marine mammal haulout sites and concentration areas or Option 37, habitat protection and acquisition should be implement to protect the injured sea otter population.

B. TERRESTRIAL MAMMALS

River otters: If the injury to the river otter population is not chronic from reduced habitat quality, then an option to develop sport and trapping harvest guidelines could be beneficial in restoring the population.

C. BIRDS

Bald eagles: Habitat protection and acquisition is the only option that is likely to provide direct benefit to the bald eagle population. Because there are already mandatory protection for bald eagles, the benefits from this option will be limited.

Black oystercatchers (first priority): Special designations that protect areas where black oystercatchers concentrate (usually subadults and failed breeders), or restrict access to injured beaches with serveral breeding pairs may improve the rate of recovery

by about 10%. In localized, site-specific areas the rate of recovery may be improved by 10 - 24% by implementing the special study option to accelerate recovery of the upper intertidal zone (#14).

Common murres (first priority): There are two options which have the potential to greatly influence the rate of recovery for common murres; however, preliminary work would need to be completed before the effectiveness can be adequately evaluated. These options are: (#16.1) Enhancing the social stimuli, and (#17.2) Predator control to benefit marine birds. (note: greater detail provided in Alternative 3.) In addition, a feasibility to examine the effectiveness of modifying the characteristics of the nesting ledges may provide another option to improve the recovery rate.

Other options which would provide less direct benefits, but would effect a larger portion of the colonies include reducing disturbance at marine bird colonies, which could reduce the recovery time by 10 -24%; and special designations which would have the same effect but cover an even broader geographic area.

Harlequin ducks (first priority): Protecting nesting habitat (#37 Habitat protection and acquisition) for harlequin ducks can prevent habitat loss which could prevent the population from fully recovering to its prespill level. In addition, in localized areas the special study Eliminating oil from oiled mussel beds (#13) has the potential to improve the rate of recovery of a localized area by 25 - 50%; however, at this time there are too many unknowns to be certain of its effectiveness.

The current early season closure for hunting harlequin ducks is believed to be benefiting the rate of recovery by 10 - 24%. Additional late season closures are expected to provide only minor added benefits.

Marbled murrelets (first priority): Protecting habitat (options #37 Habitat protection and acquisition and #40 Special designations) would ensure that the marbled murrelet population could recover to is prespill levels once the population decline is reversed. Protecting the coastal waters could also benefit their prey which may help stabilize the population more quickly. In localized areas, option #9 Minimizing incidental take of marine birds could provide additional help to stabilize the population.

Pigeon guillemots (first priority): Option #17.2 Predator control to benefit marine birds has the potential to increase productivity by 25-50 % at very site specific locations; however, predation levels at colonies within the injured area have not been documented and this option may not be needed should predation levels be low. Preliminary work must be completed before this option can be adequately evaluated.

Pigeon guillemots are fairly tolerant of human activities, however, it is important to protect nesting habitat from erosion and other degradation. Habitat protection and acquisition of lands immediately adjacent to the coast would prevent the population decline from accelerating due to lost nesting habitat.

D. FISH

Cutthroat trout: Option 2 Intensify fisheries management to protect injured stocks would benefit both cutthroat trout and allow the sport fishery to be opened as early as 1998. It can also be used to enhance the injured stocks an additional 5-10% above the pre-spill population level.

Habitat protection and acquisition is believed to be especially important for cutthroat trout in Prince William Sound because they are at the northern extent of their geographic range and are believed to be more vulnerable to habitat alterations. Likewise, updating the Alaska anadromous stream catalog would help ensure that all injured stocks are identified and protected.

Dolly Varden trout: Option 2 Intensify fisheries management to protect injured stocks would benefit the Dolly Varden trout population by determining the maximum sustained yield and documenting the sport fishery the fishery could be managed to protect injured stocks. It can also be used to enhance the injured stocks an additional 5-10% above the pre-spill population level.

Herring: The extent of injury to herring is still unknown. Option 2 Intensify fisheries management to protect injured stocks could improve the rate and degree of recovery by more than 50% if it is necessary. The option would allow for increased precision in stock assessment which would allow for manipulation of the harvest levels to counter all but the most extreme levels of injury.

Pink salmon: The coded-wire tagging and stock separation information that would be gained from an intensified fisheries management program (option 2) would help ensure that the wild stock population fully recover and could accelerate the recovery rate as much as 50% over natural recovery. Relocating existing hatchery runs (option 51) could substantially improve the recovery of wild stocks by reducing interception rates by 25 - 50%. The benefits of this option would be fairly localized.

Other options that could provide additional benefit to specific streams if implemented in conjunction with option 2 included: Improve survival of salmon eggs to fry, which could also provide short-term enhancement (10 - 24%); improve access to salmon spawning areas by building fish passes or removing barriers, could improve recovery and provide long-term enhancement; construct salmon spawning channels and other instream improvements could increase spawning production by 10 -20 %. Unfortunately there are very few locations that these options can be implemented so the overall effectiveness on the population is limited.

Habitat protection and acquisition could provide protection to habitat for 10 - 30% of the population, especially for stocks found outside of Prince William Sound where more pinks spawn above the intertidal zone. The added protection from this option and from updating the anadromous stream catalog could increase the overall population by 10%.

Rockfish: The only option that would have notable benefits to the rockfish population regardless of the injury level is to intensify the fisheries management. The added information will help direct the harvest to compensate for injury from the oil spill.

Sockeye salmon - Kenai river and Red Lake (first priority): Option 2 Intensify fisheries management to protect injured stocks is the single most effective option for aiding and protecting the two injured systems. With this option the risk of overescapements on the Kenai River could be reduced from 25% to 10%. In combination with management, and under the right environmental conditions, option #48 (Improve the survival of salmon eggs to fry) could be very effective for the Kenai river system. Improving survival of salmon eggs to fry could stimulate recovery so is complete around the year 2000. Monitoring of the plankton population and salmon escapement must occur in 1994/95 in order to supplement fry production in 1995.

Improving access to salmon spawning areas by building fish passes or removing barriers (11.3) can be used to enhance the Red Lake population by 10 - 24%. In addition Habitat protection and acquisition may be used to protect specific areas of the Kenai River drainage or to protect the watershed that feeds into Red Lake.

E. COASTAL HABITAT

Coastal habitat - subtidal: At this time, no effective options have been identified that could help the recovery of subtidal organisms.

Coastal habitat - upper intertidal (first priority): Option 14 - Accelerate the recovery of the upper intertidal zone may prove to greatly increase the recovery time on a very localized basis. Experts have estimated that the option could increase the rate of recovery by 25 to 50%; however, the techniques are experimental and are not likely to be applied on a broad scale.

EFFECT ON THE RECOVERY OF SERVICES

Archaeology. Restoration of archaeological resources cannot regenerate what has been destroyed, but it can successfully address the prevention of further degradation and loss of both sites and the scientific information they contain. Site stewardship program, Site patrol and monitoring, and Preservation of archaeological sites and artifacts are highly effective techniques to protect archaeological resources in the spill-affected area. The last option entails some physical repair and data recovery. Acquiring replacements for artifacts from the spill area would be a moderately effective means of preserving and studying artifacts which were taken from the oil spill area prior to the spill and are currently in the possession of museums and agencies.

Commercial Fishing. Replacing harvest opportunities by creating new salmon runs is a highly effective method of replacing commercial fishing opportunities lost due to fishing closures or reduced harvest of species injured by the spill. In this alternative, the newly

created runs could continue after wild stocks recover.

Recreation. Three of the restoration actions included for recreation serve primarily to protect existing uses and their resource base. Habitat protection and Special designations are the primary means of protecting recreation. However, in limited situations New backcountry public recreation facilities could protect both recreation and the resources on which it depends by, for example, providing an outhouse in a heavily used area.

Planning an marketing new commercial facilities on public land would be an effective way of encouraging new recreational uses of the spill area. Creating new visitor centers or building a Marine environmental institute would encourage new uses of the spill area. These options are also effective ways to disseminate information about spill injuries, recovery, and how the public can modify their uses of the area to maximize recovery.

Sport fishing. Replacing harvest opportunities by creating new salmon runs is a highly effective method of replacing sport fishing opportunities lost due to fishing closures or reduced harvest of species injured by the spill. In this alternative, the newly created runs could continue after wild stocks recover.

Subsistence. Testing subsistence foods is expected to be an effective way of restoring confidence in the safety of subsistence resources withing the spill area. Concern over the safety of subsistence resources is believed to be one of the reasons subsistence harvests have not yet returned to pre-spill levels. Providing Access to traditional foods in areas outside the spill-affected area would be a highly effective way of restoring lost use. Both projects would be continued until subsistence resources and use have recovered to pre-spill levels.

Developing subsistence mariculture sites and Funding a shellfish hatchery and technical research center would benefit subsistence users by providing a source of uncontaminated shellfish for their diets. Given that traditional shellfish beaches may remain contaminated for several years, or be perceived to be contaminated, these options create moderate improvements in the rate and degree of recovery.

Replacing harvest opportunities by creating new salmon runs is an effective method of replacing subsistence harvest opportunities lost due to fishing closures or reduced harvest of species injured by the spill. New runs of salmon could replace other sources of food which are perceived as unsafe to eat, such as some shellfish and marine mammals. The option would result in moderate increases in the rate and recovery of subsistence. In this alternative, the newly created runs could continue after wild stocks recover.

Wilderness. Habitat protection amd acquisition is a highly effective means of preventing additional injury to wilderness; Special designations would provide an increased level of resource protection compatible with preservation of wilderness values.

II. MULTI-SPECIES IMPACTS OF PROPOSED OPTIONS

RESOURCE RESTORATION OPTIONS:

11 of the resource restoration options identified in Alternative 5 could potentially have significant multiple-species and habitat impacts.

Habitat protection and acquisition targetting harlequin ducks, bald eagles, marbled murrelets, pink and sockeye salmon, cutthroat trout and Dolly Varden would protect coastal fringe areas, riparian zones, watersheds and other uplands. Protection of these areas will have far reaching effects on other resources that depend on these areas and the species which utilize them. Some of the other species that would benefit from implementing these options are: Sitka black-tailed deer; brown bears, black bears, river otters, and several species of fish and birds. Special designations targetting pink salmon, black oystercatchers and marbled murrelets would benefit all other species utilizing anadromous streams, intertidal areas and old growth forests.

For pigeon guillemots and common murres it is possible that reducing predators near nesting colonies would be very effective in helping the colonies recover. If it is determined that predation is a serious problem at injured colonies then implementation of this option could be considered. This option would also benefit other species that are preyed upon by the gulls and weasels. Even though implementing this option for either murres or guillemots would not have a long-term effect on the predator population there is obviously a negative ecological cost to the predators. Therefore, the ecological costs and benefits will be carefully weighed to determine if the option should be implemented.

There were no options identified that would have the effectiveness level required in this alternative that would benefit black oystercatchers; however, if habitat protection were extended to the coastline, black oystercatcher and pigeon guillemot habitat would be protected. In addition, two of the special studies could benefit black oystercatchers if implemented in areas which are have, or had, high use.

These special study options include eliminating oil from oiled mussel beds and accelerating the upper intertidal. Both of these options affect lower levels of the food chain which can benefit many species. For instance, accelerating the growth rate of the seaweed *Fucus* would accelerate the colonization of invertebrates such as limpets. Limpets are one of the main prey species for black oystercatchers whose eggs and chicks are preyed upon by gulls, ravens, and some mammalian predators. Limpets and other small invertebrates are consumed by other species which are then taken by birds, river otters, etc. Although both of these special study options have effects on many species, they are not likely to be applied on a broad scale to benefit more than a localized area.

Constructing spawning channels, Fertilizing lakes to improve sockeye rearing success, Improving access to spawning areas and Increasing survival of juvenile salmon are all options which could benefit marine and terrestrial predators which feed on salmon eggs,

juvenile and adults. This includes bald eagles, brown bears, cutthroat trout and Dolly Varden, harlequin ducks, killer whale, harbor seals and river otters. However, the options need to be carefully implemented so as not to exceed the carrying capacity of the ecosystem by producing large numbers of new fish. In addition, when these options result in new harvest patterns, care should be taken to minimize impacts on existing fisheries as well as interactions with seabirds and marine mammals.

Updating the anadromous stream catalogue for any one species has the benefit of providing increased regulatory protection for all anadromous species, as well as resident fish. This includes all salmon species, trout and Dolly Varden.

Relocating existing hatchery runs to benefit wild pink salmon could have negative impacts on seabirds and marine mammals if fishing pressures are shifted into areas used heavily by these species. These impacts could be avoided by carefully choosing the location and timing of the relocation.

SERVICE RESTORATION OPTIONS

8 of the service restoration options proposed for Alternative 5 have potential impacts on multiple species and habitats.

Building new backcountry, public recreation facilities has potential negative impacts on all species if facilities are sited so as to increase human use of damaged habitats or other areas supporting recovering species. Alternatively, properly sited facilities could 'harden' use areas and direct uses away from injured areas and promote undisturbed natural recovery of injured resources.

Planning and marketing new commercial facilities on public land could potentially have negative impacts on all injured species. Human use of the area would be substantially increased and would result in disturbance of recovering species. Impacts could be reduced by siting new facilities near population centers or along heavily travelled routes.

Habitat acquisition and Special designations for recreational purposes could benefit injured resources by protecting them from development and disturbances incompatible with recreation. On the other hand, these options could, if not carefully implemented, increase human use of damaged areas and slow natural recovery rates.

Creating new visitor centers or building a Marine environmental institute could benefit all injured resource by increasing public awareness of the nature of injury and recovery, and why it is important not to create additional human disturbances in damaged areas. However, if new visitor centers were sited in areas which would increase human use of recovering habitats, natural recovery would be slowed. This could be avoided by siting centers near existing population centers.

Spill prevention and contingency planning could benefit all species by preventing additional spills which would further compound existing injuries. ***where does this option

really go?

Replacing harvest opportunities by creating new salmon runs would benefit commercial and sport fishermen. Positive multi-species impacts would result from benefits to the many species which prey on salmon adults, eggs and juveniles. Benefits would be higher in the case of stream stocking programs, since eggs, juveniles and adult would be available to marine and terrestrial predators. This includes bald eagles, brown bears, cutthroat trout and Dolly Varden, harlequin ducks, killer whale, harbor seals and river otters. Terminal hatchery runs would provide fewer species with prey, since only adults and juveniles would be available to marine predators.

Negative impacts include the possibility of increasing mortality of seabirds and marine mammals due to interactions
with new commercial fisheries. Also, wild-stock pink salmon could possibly be impacted by fish from new runs straying into wild streams. Lastly, new runs stocked into streams which did not previously support salmon might harm resident fish through competition for food and spawning habitat.

III. GEOGRAPHIC DISTRIBUTION

Table 3 indicates the part of the spill area where the options will most likely be applied. The areas may change as detailed project planning is completed and as more is learned about injury or recovery.

Most options are applied throughout the spill area. Protective options are for the most part applied throughout the spill area. Active restoration projects targeting specific biologic conditions apply where the injury occurred. Others involving more wide-spread injuries such as those targeting recreation and education apply over more regions.

IV. COST

Detailed cost estimates for Alternative 5 are contained in Table ___; the allocation of these costs is shown in Figure ___. Estimates of cost are approximate. No cost estimates are included for Special designations and Spill prevention and contingency planning because no particular designation is under consideration and spill prevention and contingency planning appears to be well funded at present. However, these situations could change over time. Actual costs will vary as new information about injury becomes available through the monitoring program, new ideas are developed for appropriate restoration options, and project planning proceeds.

The inflation-adjusted value of the remainder of the settlement fund is about $522 million. Less than half (42%) of this amount could be set aside for Habitat Protection. Monitoring would require about 12%; Aministration/Information 10%; and Other Restoration actions 18%.

This scenario would leave 18% of the remaining settlement uncommitted. The balance

RESOURCE OR SERVICE	Opt. No.	OPTION NAME	Prince William Sound			Kenai/Cook Inlet			Alaska	Kodiak/Afog		Outside
			North	East	West	Kenai Ck In	Lower Ck In	Central Ck In	Penin.	Afg. Shuyak	Kodiak	EVOS
Archaeology	1	Archeological site stewardship program	X	X	X	X	X	X	X	X	X	
Cutthroat/Dolly Varden Trout	2.1	Intensify Cuttroat/Dolly mgmt to protect injured		X	X							
Herring	2.2	Intensify herring mgmt to protect inj stocks	X	X	X							
Pink salmon	2.3	Intensify pink salmon mgmt to protect inj stocks	X	X	X							
Rockfish	2.4	Intensify rockfish mgmt to protect injured stocks	X	X	X	X	X	X				
Sockeye salmon	2.5	Intensify sockeye mgmt to protect inj stocks										
Common murre	4.1	Reduce disturbance at marine bird colonies				X	X	X	X			
Harbor seal	4.2	Reduce disturbance at marine mammal haulout	X	X	X	X	X	X				
Harlequin Duck	8	Develop sport harvest guidelines for injured spe	X	X	X	X	X	X				
River otter	8	Develop sport and trapping harvest guidelines	X	X	X							
Marbled murrelet	9	Minimize incidental take by comm fish	X	X	X	X	X	X	X	X	X	
Archaeology	10	Preserve archaeological sites and artifacts	X	X	X	X	X	X	X	X	X	
Pink salmon	11.1	Construct salmon spawning channels	X	X	X							
Coghill Lake Fertilization	11.2	Fertilize lakes to improve sockeye rearing succe	X									
Pink salmon	11.3	Improve access: salmon fish passes	X	X	X					X		
Sockeye salmon	11.3	Improve access: salmon fish passes									X	
Recreation	12.1	Construct New backcountry public facilities	X	X	X	X	X	X	X	X	X	
Recreation	12.2	Plan & Mkt new comm'l facilities on pub land	X	X	X	X	X	X	X	X	X	
Harlequin duck	13	Eliminate oil from mussel beds			X	X	X	X	X	X	X	
MULTI-SPECIES	14	Accelerate recovery of upper intertidal zone			X	X	X	X	X	X	X	
Common murre	17.2	Reduce predator access to colonies (murres)				X	X	X	X	X	X	
Pigeon guillemot	17.2	Reduce predator access (Pigeon Guillemot)	X	X	X	X	X	X	X	X	X	
Commercial Fishing	18	Replace salmon harvest opportunities	X	X	X						X	
Sport Fishing	18	Replace salmon harvest opportunities	X	X	X						X	
Subsistence	18	Replace salmon harvest opportunities		X	X						X	
Cutthroat/Dolly Varden Trout	19	Update anadromous fish stream catalogue		X	X							
Pink salmon	19	Update anadromous fish stream catalogue	X	X	X	X	X	X		X	X	
Subsistence	30	Test subsistence foods for oil contamination		X	X						X	
Research & Education	33.2	Design and construct a new visitor center	X	X	X	X	X	X	X		X	
Research & Education	34.1	Marine environmental insitute	X	X	X	X	X	X	X		X	
Research & Education	34.2	Fund a marine research prog or foundation										
Archaeology	35	Acquire replacements for artifacts from the spill	X	X	X	X	X	X	X	X	X	X
MULTI-SPECIES	37	Habitat protection and acquisition		X	X	X	X	X	X	X	X	
MULTI-SPECIES	40	Special designations	X	X	X	X	X	X	X	X	X	
Prevention	44	Spill prevention and contingency plannin	X	X	X	X	X	X			X	
Killer Whale - AB pod	45	Black cod fishery, feas stdy	X	X	X							
Harbor seal	46	Cooperative program with fishermen	X	X	X							
Harbor Seal &Sea otter	47	Cooperative program with subsistence users		X	X						X	
Pink salmon	48	Improve survaval rates of salmon eggs & juv.	X	X	X							
Sockeye salmon	48	Improve survaval rates of salmon eggs & juv.								X	X	
Subsistence	49	Provide subsistence users access		X	X						X	
Subsistence	50.1	Develop subsistence mariculture sites		X	X						X	
Subsistence	50.2	Develop bivalve shellfish hatchery and resc ctr				X	X	X				

For Table Title - See Next Page -

RESOURCE OR SERVICE	Opt. No.	OPTION NAME	Prince William Sound			Kenai/Cook Inlet			Alaska	Kodiak/Afog		Outside
			North	East	West	Kenai Ck In	Lower Ck In	Central Ck In	Penin.	Afg. Shuyak	Kodiak	EVOS
Pink salmon	51	Relocate existing hatchery runs	X	X	X							

Expected

~~ALTERNATIVE #5~~

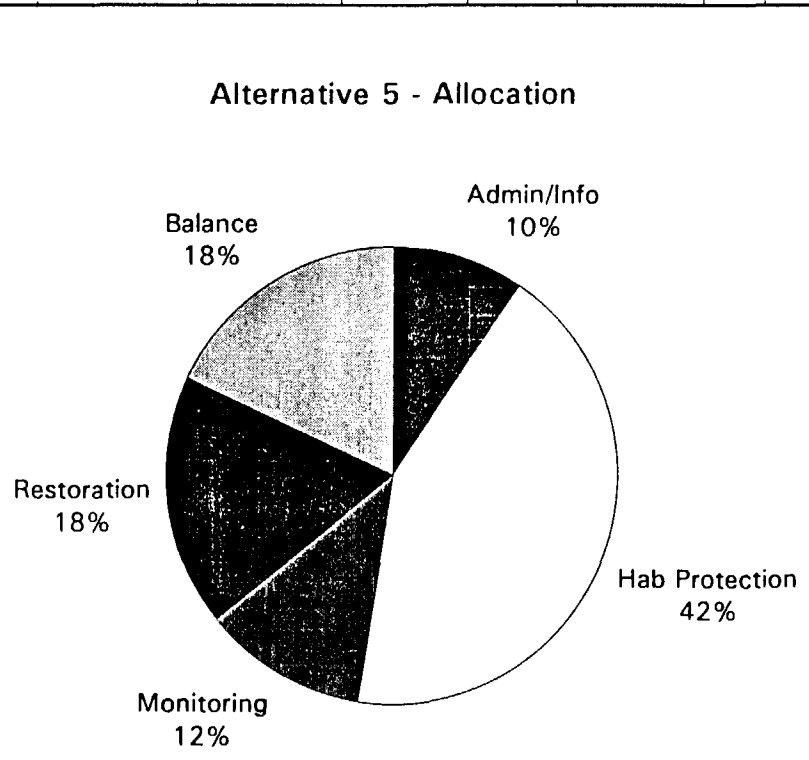
Table X. Geographic Distribution of Options in Alternative #5

could be held for unanticipated expenses, such as injuries identified through the monitoring program, new options, or higher-than-projected costs for those already considered. Another use of the balance could be to fund an endowment for ongoing projects or for a research foundation. The estimated amount of the balance could yield about $2.6 million annually through an endowment.

V. PRIORITY

The theme of this alternative includes all beneficial restoration options for all levels of injury from the Exxon-Valdez oil spill. When addresses implementation, first priority is to be placed on restoration options that address species with population level injuries. We have identified these species and the proposed options by highlighting **first priority** after the resource name under the effectiveness in this Evaluation section.

Allocation of Remainder of Settlement Funds	Total $	%
Admin/Info	50190.0	10%
Hab Protection	225000.0	43%
Monitoring	60250.0	12%
Restoration	92606.0	18%
Balance	93954.0	18%



NB: All costs are expressed in units of $1,000 (1993 $). The inflation-adjusted value of the remainder of the settlement is about $522 million.

Alternative 5 - Comprehensive Restoration														
				ANNUAL COST			DURATION				TOTAL COST		
								Years			10-Year Maximum		
Opt	DESCRIPTION	ResSvc	UNIT	Exp	Low	High	Type	E	L	H	Expected	Lower	Higher
1.10	Site stewardship program	Archaeology	Per 3 areas	195.0	195.0	195.0	Ltd	10	10	10	1950.0	1950.0	1950.0
1.20	Site patrol and monitoring	Archaeology		300.0	300.0	300.0	Ltd	4	3	5	1200.0	900.0	1500.0
2.10	Intensify management	Cutthroat/Dolly		145.0	130.0	160.0	Ltd	2	2	2	290.0	260.0	320.0
2.20	Intensify management	Pacific herring		457.0	457.0	457.0	Ltd	2	2	4	914.0	914.0	1828.0
2.30	Intensify management	Pink salmon		1200.0	900.0	1500.0	Ltd	2	2	4	2400.0	1800.0	6000.0
2.40	Intensify management	Rockfish		593.0	593.0	593.0	Ltd	2	1	4	1186.0	593.0	2372.0
2.50	Intensify management	Sockeye salmon		750.0	700.0	800.0	Ltd	5	2	5	3750.0	1400.0	4000.0
4.10	Reduce disturbance	Common murre									330.0	185.0	640.0
4.20	Reduce disturbance	Harbor seal									330.0	185.0	640.0
4.30	Study: Reduce disturbance	Sea otter					Ltd				120.0	80.0	640.0
4.40	Reduce disturb public info	Multiple resources		40.0	30.0	50.0	Ltd	1	1	1	40.0	30.0	50.0
4.50	Reduce disturb field presence	Multiple resources		438.0	390.0	486.0	Ltd	10	10	10	4380.0	3900.0	4860.0
8.10	Sport/trap harvest guidelines	Harlequin duck		15.0	10.0	30.0	UR	5	2	10	75.0	20.0	300.0
8.20	Sport/trap harvest guidelines	River otter		15.0	10.0	30.0	UR	5	2	10	75.0	20.0	300.0
9.00	Minimize incidental take	Marbled murrelet									1625.0	1100.0	2000.0
10.00	Archaeol Res Protection	Archaeology									4072.0	3250.0	7000.0
11.10	Salmon spawning channels	Pink salmon	9 total	579.0	579.0	579.0	Ltd	6	6	6	3474.0	3474.0	3474.0
11.20	Fertilize lakes	Sockeye salmon	Per lake	190.0	150.0	220.0	Ltd	3	1	5	570.0	150.0	1100.0
11.30	Fish passes	Pink salmon	5 passes	250.0	64.0	1900.0	Ltd	6	6	10	1500.0	384.0	19000.0
11.30	Fish passes	Sockeye salmon	2 passes	100.0	25.0	800.0	Ltd	6	6	10	600.0	150.0	8000.0
12.10	New backcountry rec facilities	Recreation									1620.0	480.0	3256.0
12.20	Pln/mkt comm rec facilities	Recreation		275.0	200.0	350.0	Ltd	1	1	1	275.0	200.0	350.0
13.10	Eliminate oil from mussel beds	Harlequin duck		491.0	340.0	641.0	Ltd	5	4	7	2455.0	1360.0	4487.0
13.20	Study: Elim oil fr mussel beds	Sea otter											
14.10	Accelerate recovery of UIT	Intertidal organisms		150.0	100.0	200.0	UR	5	4	7	750.0	400.0	1400.0
14.20	Accelerate recovery of UIT	Black oystercatchers											
16.10	Study: Social stimuli	Common murre					Ltd				850.0	800.0	5500.0
16.20	Study: Improve nest sites	Common murre					Ltd				850.0	800.0	5500.0
17.10	Eliminate introduced foxes	Seabird repl					UR				2500.0	1500.0	3500.0
17.21	Reduce predator access	Common murres		350.0	300.0	400.0	Ltd	5	5	10	1750.0	1500.0	4000.0
17.22	Reduce predator access	Pigeon guillemot		200.0	150.0	250.0	Ltd	4	4	6	800.0	600.0	1500.0
18.10	Replace harvest opportunities	Comm fishing	Per run	150.0	100.0	200.0	Ltd	2	1	5	300.0	100.0	1000.0
18.20	Replace harvest opportunities	Sport fishing	Per run	150.0	50.0	200.0	Ltd	2	1	5	300.0	50.0	1000.0
18.30	Replace harvest opportunities	Subsistence	Per run	150.0	50.0	200.0	Ltd	4	1	10	600.0	50.0	2000.0

NB: All costs are expressed in units of $1,000 (1993 $). The inflation-adjusted value of the remainder of the settlement is about $522 million.

Opt	DESCRIPTION	ResSvc	UNIT	ANNUAL COST			DURATION				TOTAL COST 10-Year Maximum		
								Years					
				Exp	Low	High	Type	E	L	H	Expected	Lower	Higher
19.10	Anad Stream Catalogue	Cutthroat trout		100.0	100.0	100.0	Ltd	1	1	1	100.0	100.0	100.0
19.30	Anad Stream Catalogue	Pink salmon		100.0	100.0	100.0	Ltd	1	1	1	100.0	100.0	100.0
30.00	Test subsistence foods	Subsistence		330.0	300.0	350.0	Ltd	3	2	5	990.0	600.0	1750.0
33.00	Visitor center	Recreation	Per 5000 sf				Ltd				1000.0	750.0	1750.0
34.00	Marine environmental institute	Recreation									42000.0	42000.0	42000.0
35.00	Aquire archaeol. artifacts	Archaeology		225.0	150.0	300.0	Ltd	3	3	3	675.0	450.0	900.0
37.00	Habitat protection/acquisition	Multiple resources									225000.0	225000.0	350000.0
40.00	Special designation	Multiple resources											
44.00	Spill prevention/conting plng	Multiple resources					Ltd						
45.00	Study: Changes in black cod	Killer whale		30.0	30.0	30.0	Ltd	1	1	1	30.0	30.0	30.0
46.00	Coop prgm-fishermen	Harbor seal		50.0	30.0	100.0	Ltd	3	1	5	150.0	30.0	500.0
47.10	Coop prgm-subsistence users	Harbor seal		30.0	30.0	30.0	UR	10	10	10	300.0	300.0	300.0
47.10	Coop prgm-subsistence users	Sea otter.					UR						
48.10	Improve survival rates	Pink salmon	Per run	400.0	200.0	600.0	Ltd	3	1	5			,
48.20	Improve survival rates	Sockeye salmon	Per run	400.0	200.0	600.0	Ltd	3	1	5	1200.0	200.0	3000.0
49.00	Access to traditional foods	Subsistence		53.0	50.0	60.0	UR	10	10	10	530.0	500.0	600.0
50.10	Subsistence mariculture sites	Subsistence		200	180	220	Ltd	3	2	4	600.0	360.0	880.0
50.20	Bivalve shellfish hatchery etc	Subsistence		1000.0	1300.0	2500.0	Ltd	3	2	4	3000.0	2600.0	10000.0
51.00	Relocate existing hatchery runs	Pink salmon	Per run				Ltd	22	2	3			
P1.00	Administration	Multiple resources									50190.0	30180.0	50200.0
P2.00	Monitoring	Multiple resources									60250.0	20250.0	70250.0

NB: All costs are expressed in units of $1,000 (1993 $). The inflation-adjusted value of the remainder of the settlement is about $522 million.