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### Habitat Equivalency Analysis

The natural resource trustees for the San Francisco Drydock oil spill incident provided representatives of San Francisco Drydock and MARAD with estimates of shoreline oiling at the technical presentation in Oakland on June 18, 1997. We indicated that we used these values in preliminary work on the debit or loss side of Habitat Equivalency Analysis (HEA), but emphasized that we had not completed the equivalency analysis and therefore were not scaling the restoration project concepts on the basis of HEA.

Following the presentation, the Trustees continued to analyze the oiling data and habitats impacted by spilled petroleum. We have attached four (4) graphics from our Geographic Information Systems (GIS) database that illustrate the extent, location, and degree of oiling in artificial, mudflat, rocky intertidal, and sandy beach habitats. The graphic for oiling of artificial structures such as piers, breakwaters, and seawalls does not include the extensive surface area of the San Francisco waterfront, which was calculated separately and included in the documentation for impacts to Pacific herring and their spawning habitat.

Based on re-examination of habitats within the oil-affected areas, and re-examination of response documentation for the presence and extent of oiling, the Trustees have revised their estimates of linear mileage of oiled shoreline, which affects the acreage totals of oiled habitat. The overall mileage of oil-impacted shoreline that was presented on June 18, 1997, was 138 miles. The new total is 133 miles, representing less than four (4) percent difference in affected shoreline. A notable change, however, occurred in the allocation of oiled shoreline between the different habitat types. The new values are presented in Table 1.

Table 1.

HABITAT	TOTAL MILES	ACRES	DEGREE OF OILING
ARTIFICIAL SHORELINE	19.6	5	LIGHT
		19	VERY LIGHT
MUDFLATS	5.0	99	VERY LIGHT
ROCKY INTERTIDAL	43.21	0.12	HEAVY
		16	MEDIUM
		144	LIGHT
		356	VERY LIGHT
SANDY BEACHES	65.1	94	HEAVY
		280	MEDIUM
		278	LIGHT
		642	VERY LIGHT

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General Assumptions for the Purposes of Settlement:

The following assumptions were made when developing preliminary estimates for percentages of service losses from specific habitats that were oiled as a result of the San Francisco Drydock Oil Spill Incident.

- 1) Injuries caused by the toxicity of IFO 180, or any associated physical fouling of habitat and other natural resources, are (in part) directly related to the physical persistence of visible oil.
- 2) Losses in resource services as a result of the oil spill are based on anticipated longer-term exposure to persistent and visible oil as well as shorter-term exposure to oil that was not visible but coated on suspended sediments that washed across the exposed biota and habitats.
- 3) A simplified scheme to describe the diversity of habitat types was used by the Trustees, with four categories designated to cover the full range of intertidal habitat types exposed to oiling. These include: Artificial Structures, Mudflats, Sandy Beaches, and Rocky Intertidal.
- 4) Exposure to oil in each habitat was based on the total area of the intertidal band that is wetted during a diurnal tidal cycle. Average band widths were assigned to each category, and these averages were based on the Trustees' knowledge of beach profiles and rocky intertidal slopes, as well as the tidal amplitude, within the spill-affected zone. . The average band widths are: Artificial Structures = 3m; Mudflats = 50 m; Sandy Beaches = 50 m; and Rocky Intertidal = 30 m.
- 5) The percentage of oiling is simplified in four categories as follows: VERY LIGHT = <1 - 10%; LIGHT = 11 - 25%; MEDIUM = 26 - 50%; HEAVY = 51%.
- 6) The percentage of oiling is directly related to the percentage of resource service loss, with VERY LIGHT = 10% loss; LIGHT = 20% loss; MEDIUM = 50% loss; HEAVY = 100% loss.
- 7) Each habitat is treated as initially providing 100% ecological services prior to oiling.
- 8) The Trustees assigned individual time periods for persistence of oil in each habitat types. This is based on the integration of many factors, including the substrate type, the stickiness of the oil, and the degree of wave energy in the habitat.
- 9) Time paths for recovery are assumed to be linear, and injuries do not extend into perpetuity.

Recovery Paths:

For purposes of settlement, the recovery paths proposed below are all assumed to be linear. None of the injuries to habitat are assumed to extend to perpetuity; each affected habitat types has a finite duration of assumed injury and loss of services. Accelerated recovery rates during the first year are assumed only in medium to heavily oiled areas that received cleanup as part of response efforts. Areas with very low and low levels of oiling, in

most instances, were not cleaned to any significant degree and therefore are not assumed to have accelerated recovery rates during the first year.

1) **Artificial Surfaces & Rocky Intertidal:** For purposes of settlement, the Trustees have used a linear recovery rate over a total of five years to approximate the recovery of services in these types of impacted habitats, with no residual service losses assumed beyond the five year period. In uncleaned areas, for example, the rate of service return would be 20% per year. In cleaned areas that were either medium to heavily oiled, the rate during the first year would be 25%, with a subsequent linear recovery path over the remainder of the five year period.

3) **Mudflat:** For purposes of settlement, the Trustees have used a flat linear recovery path that extends over one year to approximate the recovery of services in these types of impacted habitats, with no residual service losses assumed beyond the one year period. At the end of the one year period, it is assumed that full recovery is instantaneous, with no residual service losses assumed beyond the one year period.

3) **Sandy Beaches:** For purposes of settlement, the Trustees have used a flat linear recovery path that extends over three (3) months to approximate the recovery of services in these types of impacted habitats, with no residual service losses assumed beyond the three month period. At the end of the three month period, it is assumed that full recovery is instantaneous, with no residual service losses assumed beyond the three month period.

SUMMARY TABLE OF ASSUMPTIONS:

Degree of Oiling	Habitat Type & % Service Loss		
	artificial or rocky	beaches	mudflats
Very light oiling of habitat (0-10%)	10% for first year, 5 yrs overall loss time.	10% for 3 months	10% for 1 year
Light oiling of habitat (10-25%)	20% for first year, 5 yrs overall loss time.	20% for 3 months	20% for 1 year
Medium oiling of habitat (25-50%)	50% for first year, 5 yrs overall loss time.	50% for 3 months	50% for 1 year
Heavy oiling of habitat (>50%)	100% for first year, 5 yrs overall loss time.	100% for 3 months	100% for 1 year