APPENDIX H
PLUME MODELS

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PLUME MODELS

Prior to the initiation of recovery activities, the National Oceanic and Atmospheric Administration ran a series of oil plume trajectory analyses (2001a) to model the behavior of an uncontained diesel fuel release at the shallow-water recovery sites. Several variables were factored into the models before they were run, including release location, wind direction, time period, and tide conditions (ebb or flood). Constants included the wind speed (10 knots [20 kilometers per hour]) and amount of diesel fuel released (20,000 gallons [76,000 liters]). A wind speed of 10 knots [20 kilometers per hour] was used since this is the average wind speed recorded at the Honolulu International Airport in August over the last 10 years (National Climatic Data Center, 2001). Twenty-thousand gallons (76,000 liters) was used because this was considered to be the most credible amount of diesel fuel that would be released. The models were run as if the release had occurred instantaneously as opposed to occurring over a period of time. This model has a 90% confidence limit, meaning there is a 90% probability the diesel fuel will be within the confidence limit shown on the plots of the diesel fuel plumes.

Analyses were run for every candidate shallow-water recovery site. At the Reef Runway site, the time period for every analysis was 24 hours. The plots show that winds from the east would result in diesel fuel being pushed toward the beach at Barbers Point during both ebb and flood tide conditions. Winds from the east/northeast could potentially result in diesel fuel being pushed toward the beach during both ebb and flood tidal conditions; however, it appeared to be much more likely during flood conditions. Winds from the north and northeast would result in the plume being pushed offshore after 24 hours in all conditions.

At Ewa Beach, the trajectory analyses show that when winds are from the east, diesel plumes would be pushed toward the beach during both tidal conditions after only 12 hours. After 18 hours the plume would be pushed toward the beach up the coast north of Barbers Point. Winds from the east/northeast would push the plume close to the beach along Barbers Point after only 12 and 18 hours during a flood and ebb tide, respectively. Winds from the northeast would push the plume offshore after 12 hours during both tidal conditions.

At Waianae Coast, winds from the east and east/northeast would push the plume away from the coast after only 12 hours during all tidal conditions. At southwest Molokai, winds from the east would push the plume away from the coast in all tidal conditions.

Light trade wind conditions (less than 10 knots [20 kilometers per hour]) during morning hours occur relatively infrequently, however, they can serve as an indicator for an afternoon seabreeze. A seabreeze occurs when the warm air over a land mass rises and

cooler air (from the ocean) moves in to replace it. During an uncontained diesel fuel or lubricating oil release, a seabreeze could potentially result in the plume being pushed directly towards shore (National Weather Service, 2001). Since this is a readily acknowledged condition, these wind conditions were not modeled.

To ensure recovery operations are conducted during optimal wind and current conditions, real-time surface and subsurface current monitoring would occur. This effort would be facilitated by placing data buoys at the edge of the coral fringe 2 to 3 nautical miles (4 to 6 kilometers) from the shallow-water recovery site, and at the shallow-water recovery site to monitor wind speed and direction, air temperature, current speed in the water column, and wave height and period. These buoys would be in place approximately 30 days prior to the start of recovery operations and would help ensure that recovery operations that could potentially result in a diesel fuel or lubricating oil release would only take place during the most favorable weather conditions for containing a release.

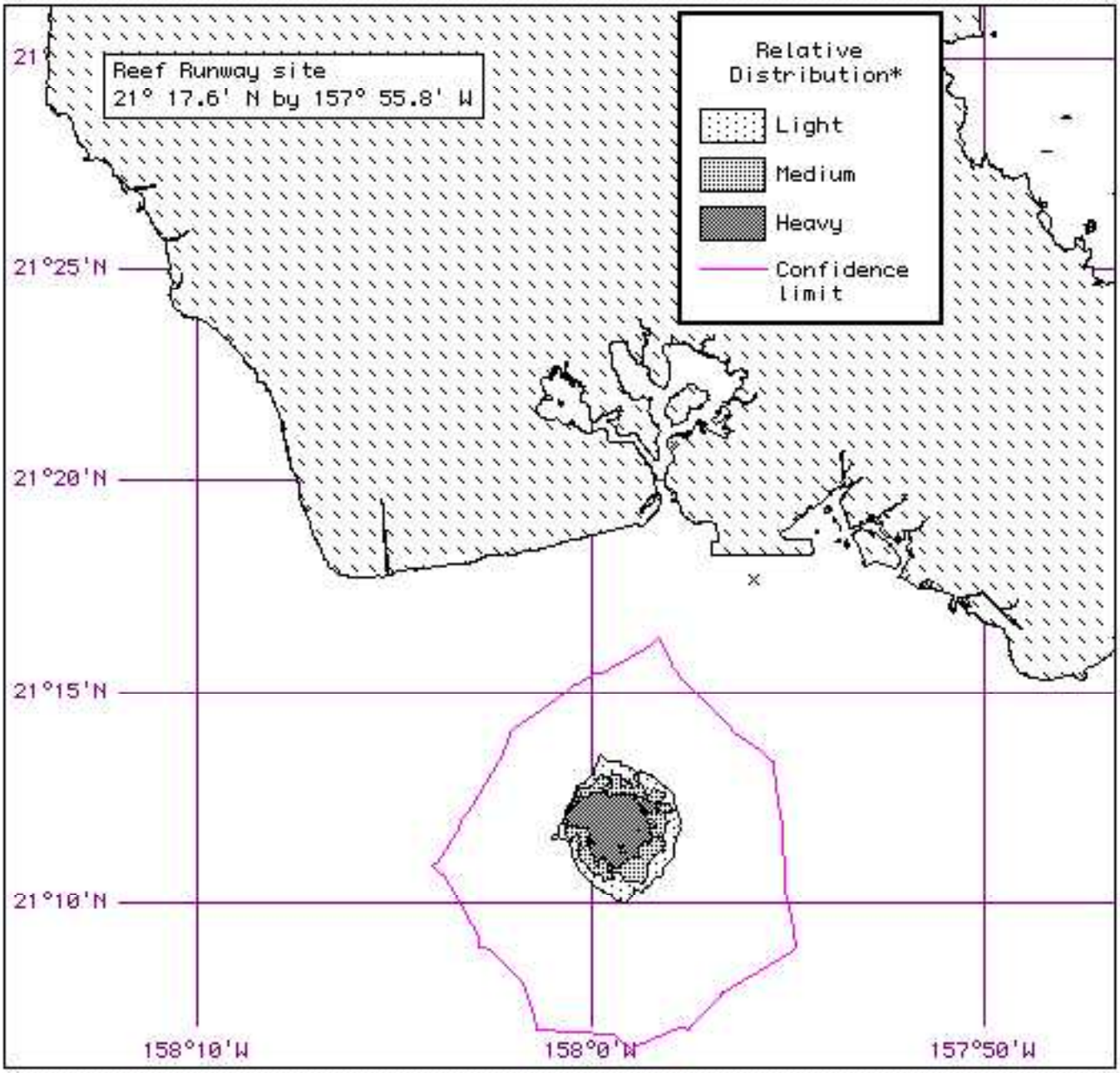
Reef Runway Site

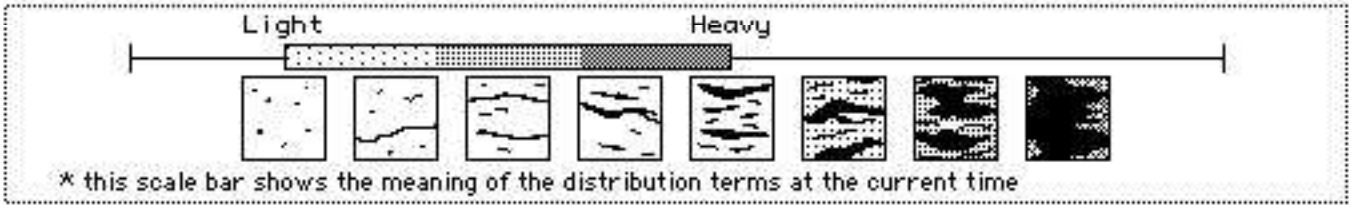
HAZMAT Trajectory Analysis

Estimate for: 24 hrs, 8/19/0
Prepared: 1516, 5/8/01

NOAA/HAZMAT (206) 526-6317

Operational window analysis model parameters:
Winds from N at 10 knots
Spill starts at beginning of ebb tide
20,000 gallons of diesel fuel spilled instantaneously





* this scale bar shows the meaning of the distribution terms at the current time

Reef Runway Site

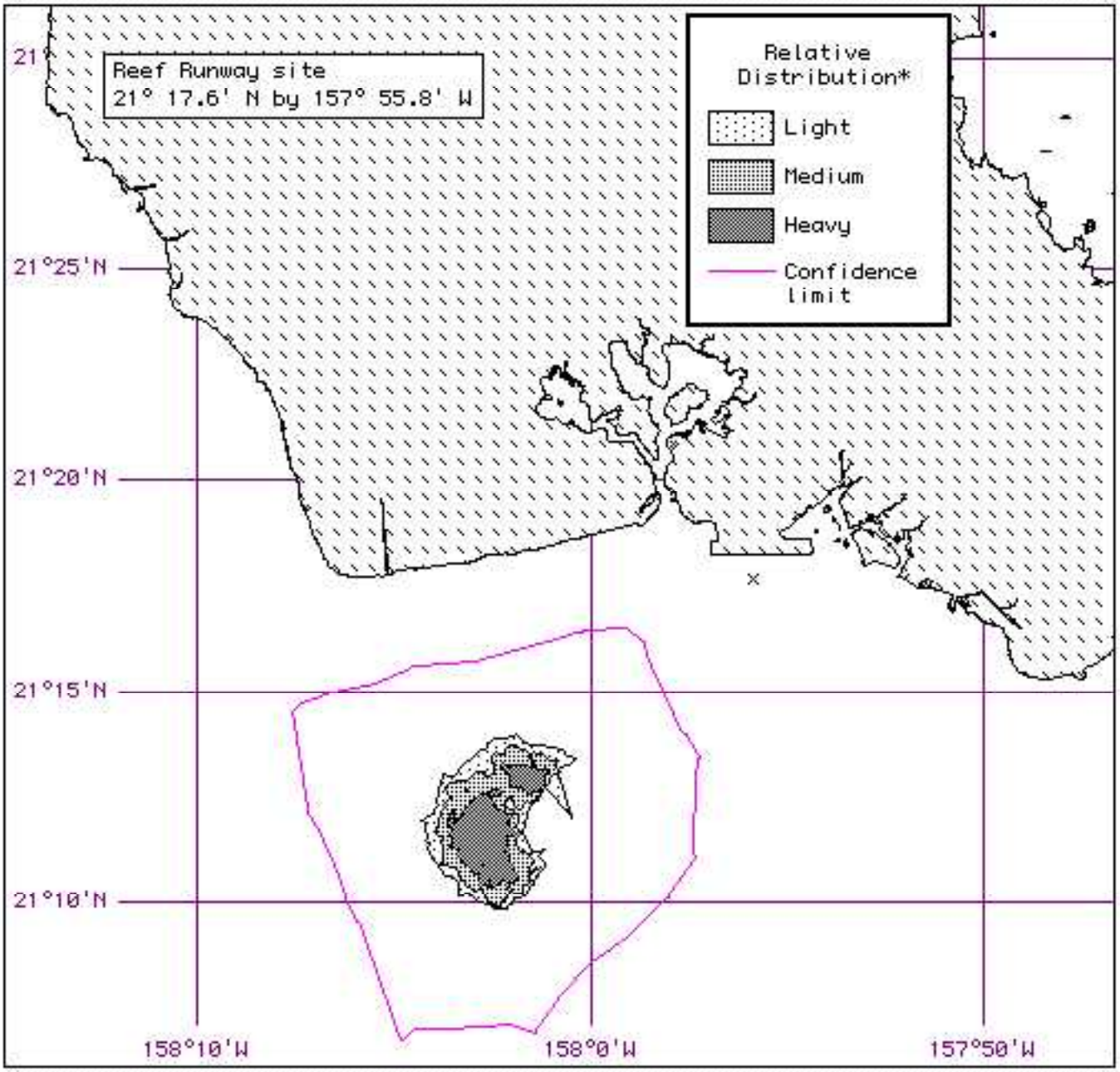
Estimate for: 24 hrs

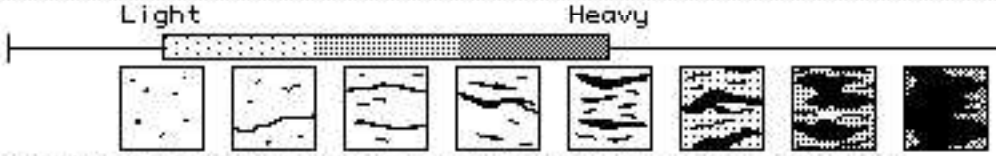
Prepared: 1516, 5/8/01

HAZMAT Trajectory Analysis

NOAA/HAZMAT (206) 526-6317

Operational window analysis model parameters:
Winds from N at 10 knots
Spill starts at beginning of flood tide
20,000 gallons of diesel fuel spilled instantaneously





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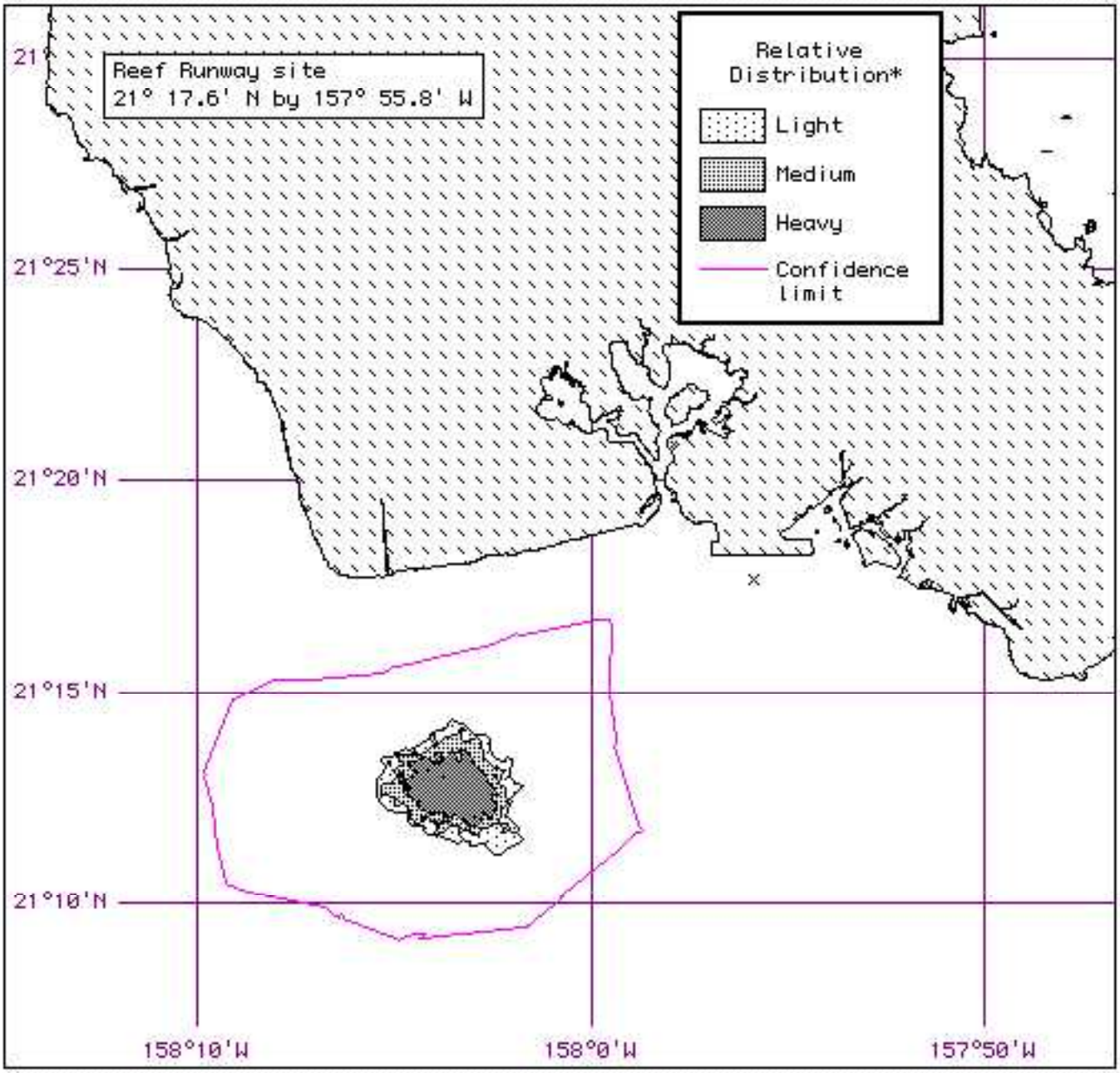
Reef Runway Site

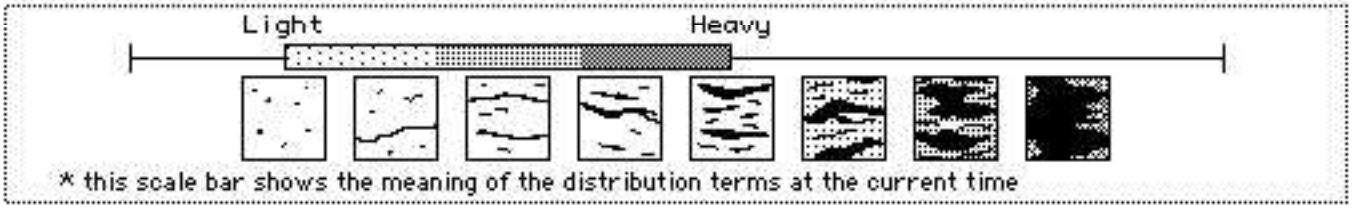
HAZMAT Trajectory Analysis

Estimate for: 24 hrs
Prepared: 1516, 5/8/01

NOAA/HAZMAT (206) 526-6317

Operational window analysis model parameters:
Winds from NE at 10 knots
Spill starts at beginning of ebb tide
20,000 gallons of diesel fuel spilled instantaneously





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Reef Runway Site

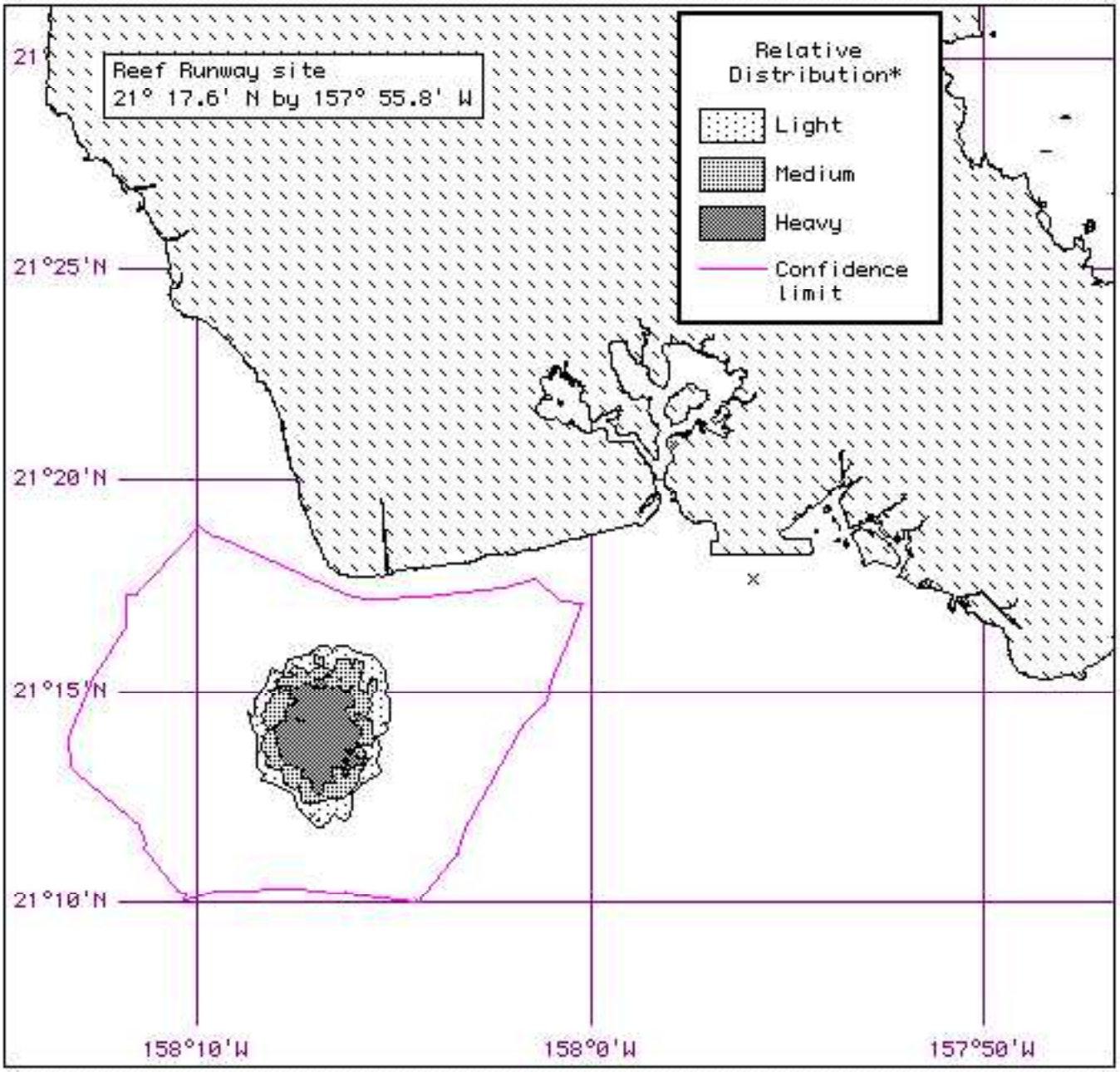
Estimate for: 24 hrs

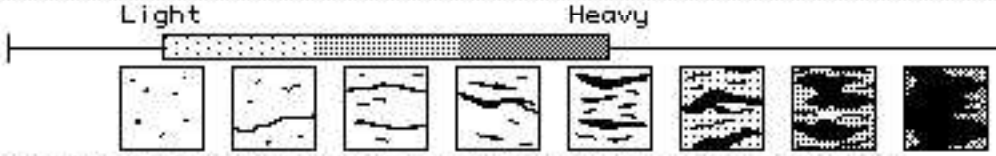
Prepared: 1516, 5/8/01

HAZMAT Trajectory Analysis

NOAA/HAZMAT (206) 526-6317

Operational window analysis model parameters:
Winds from NE at 10 knots
Spill starts at beginning of flood tide
20,000 gallons of diesel fuel spilled instantaneously





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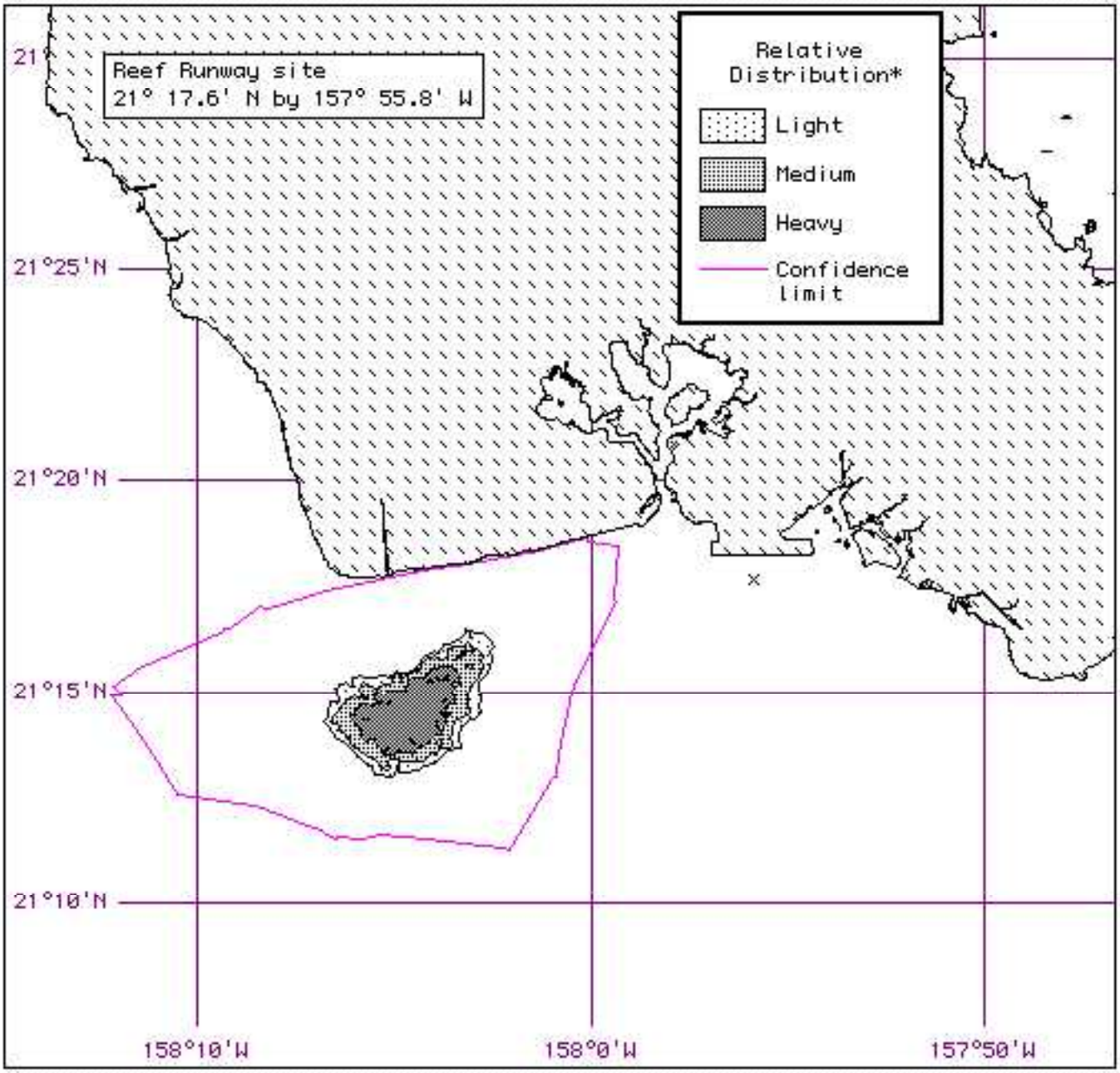
Reef Runway Site

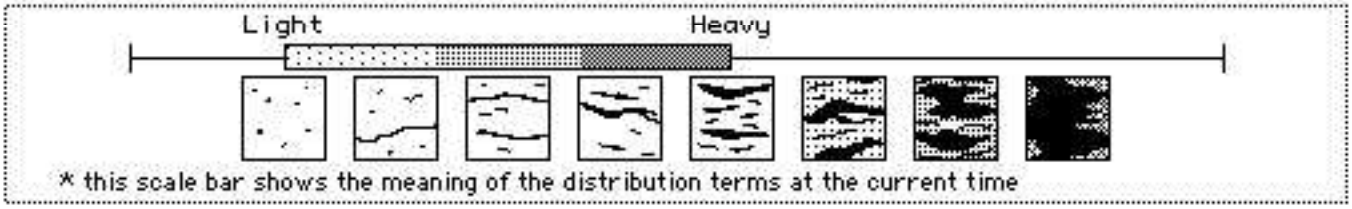
Estimate for: 24 hrs
Prepared: 1516, 5/8/01

HAZMAT Trajectory Analysis

NOAA/HAZMAT (206) 526-6317

Operational window analysis model parameters:
Winds from ENE at 10 knots
Spill starts at beginning of ebb tide
20,000 gallons of diesel fuel spilled instantaneously





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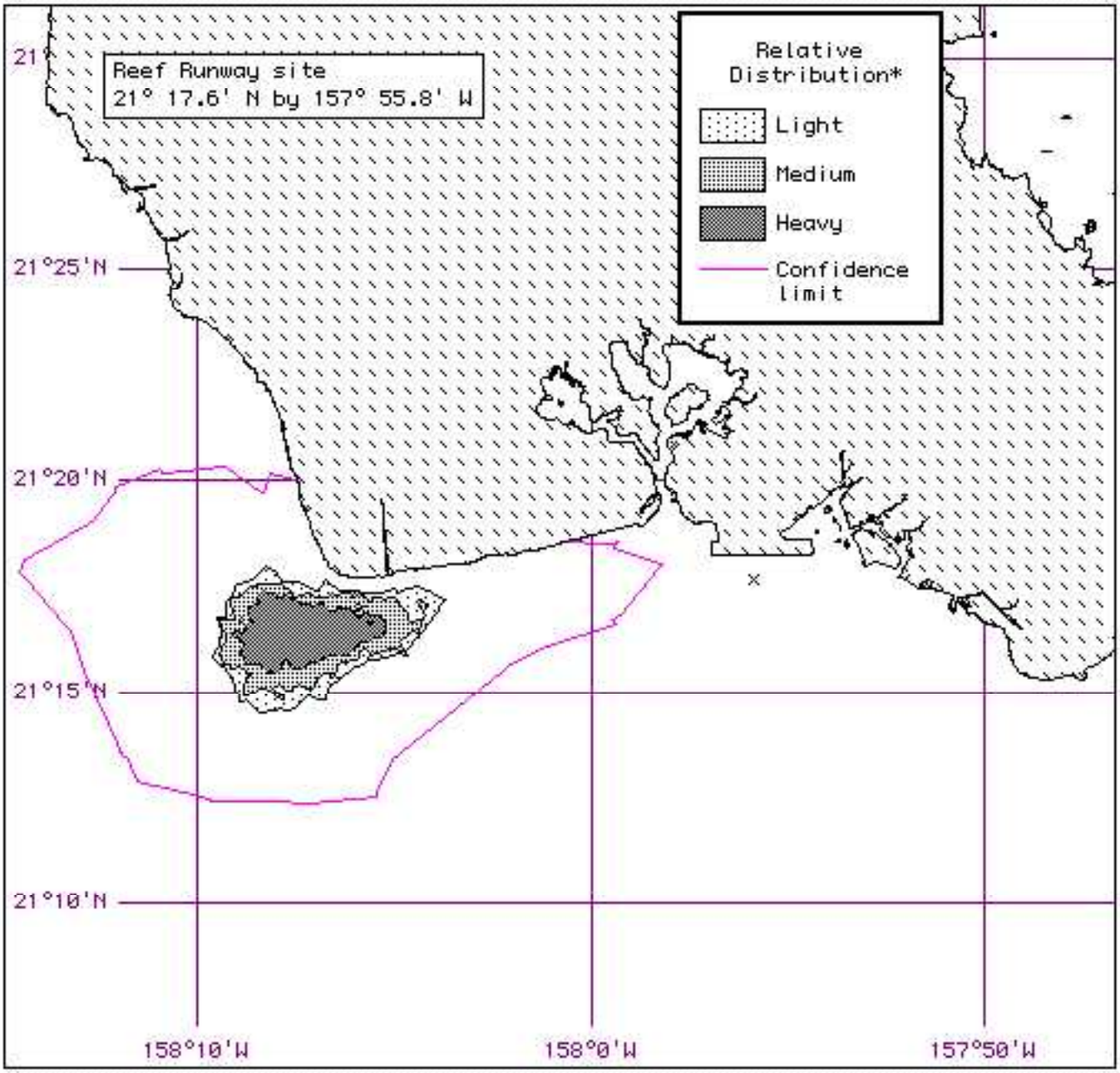
Reef Runway Site

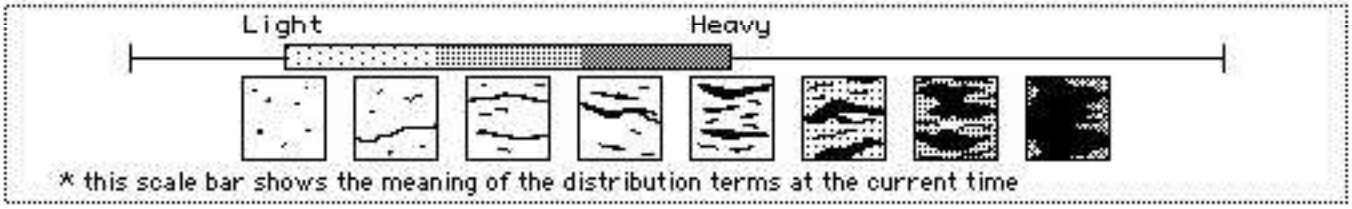
HAZMAT Trajectory Analysis

Estimate for: 24 hrs, 8/19/0
Prepared: 1516, 5/8/01

NOAA/HAZMAT (206) 526-6317

Operational window analysis model parameters:
Winds from ENE at 10 knots
Spill starts at beginning of flood tide
20,000 gallons of diesel fuel spilled instantaneously





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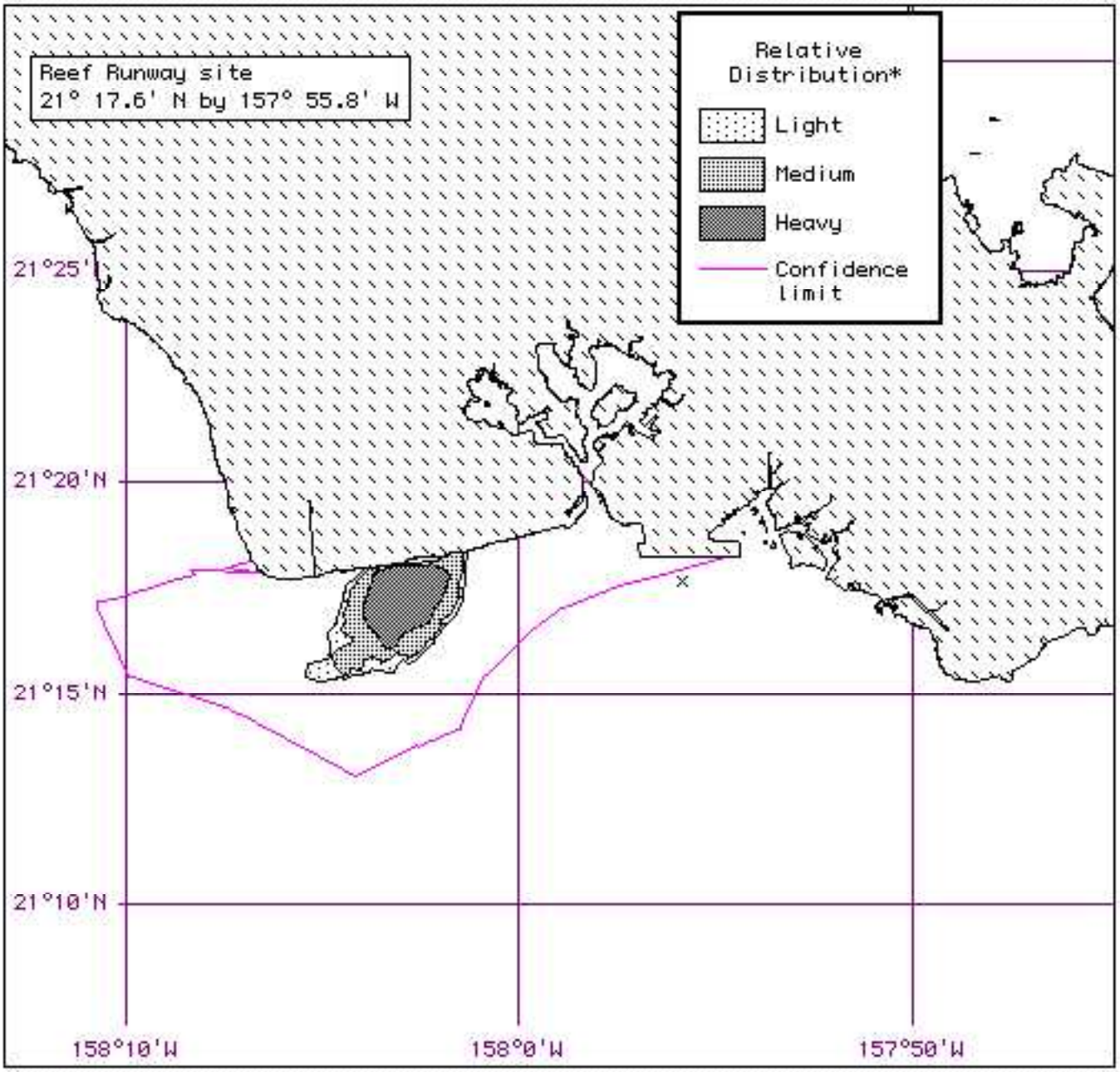
Reef Runway Site

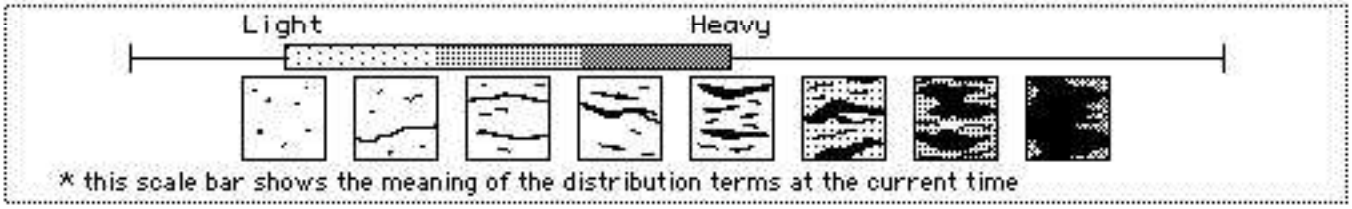
HAZMAT Trajectory Analysis

Estimate for: 24 hrs, 8/19/0
Prepared: 1516, 5/8/01

NOAA/HAZMAT (206) 526-6317

Operational window analysis model parameters:
Winds from E at 10 knots
Spill starts at beginning of ebb tide
20,000 gallons of diesel fuel spilled instantaneously





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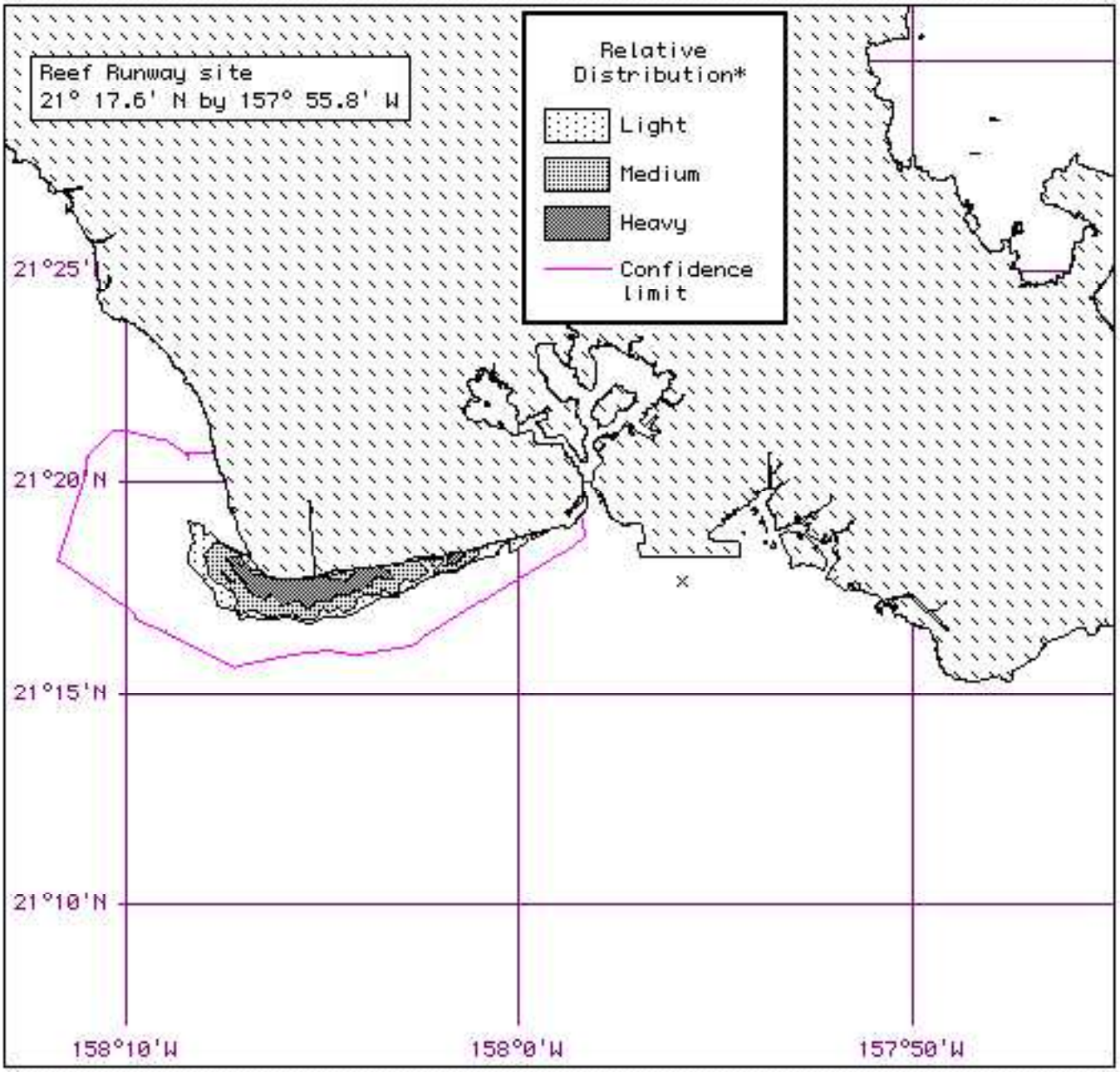
Reef Runway Site

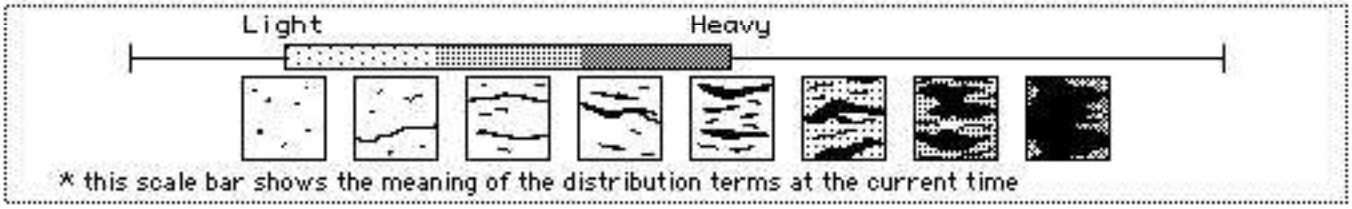
HAZMAT Trajectory Analysis

Estimate for: 24 hrs
Prepared: 1516, 5/8/01

NOAA/HAZMAT (206) 526-6317

Operational window analysis model parameters:
Winds from E at 10 knots
Spill starts at beginning of flood tide
20,000 gallons of diesel fuel spilled instantaneously





* this scale bar shows the meaning of the distribution terms at the current time

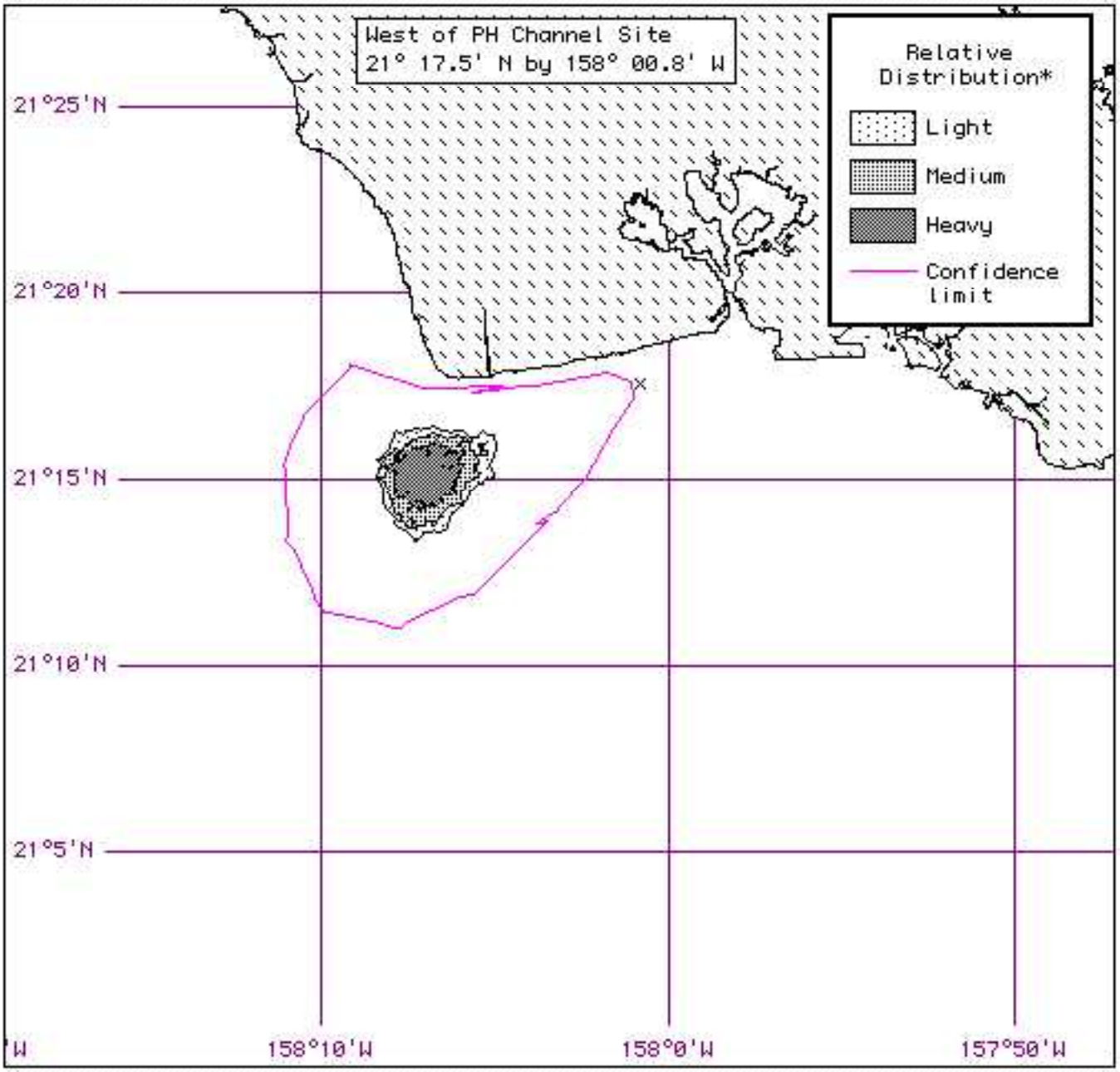
West of PH Channel

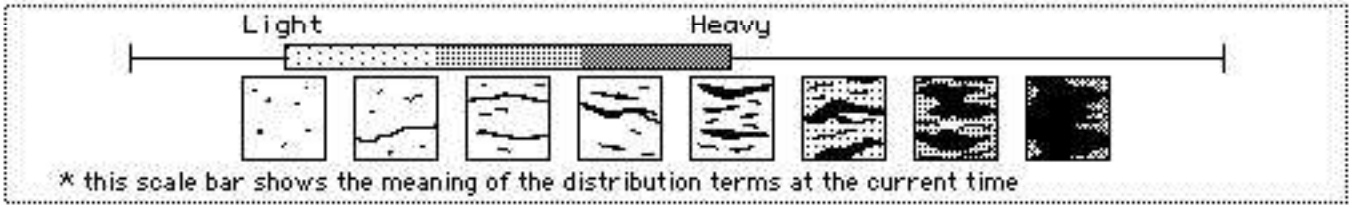
HAZMAT Trajectory Analysis

Estimate for: 18 hrs
Prepared: 1404, 5/8/01

NOAA/HAZMAT (206) 526-6317

Operational window analysis model parameters:
Winds from NE at 10 knots
Spill starts at beginning of ebb tide
20,000 gallons of diesel fuel spilled instantaneously





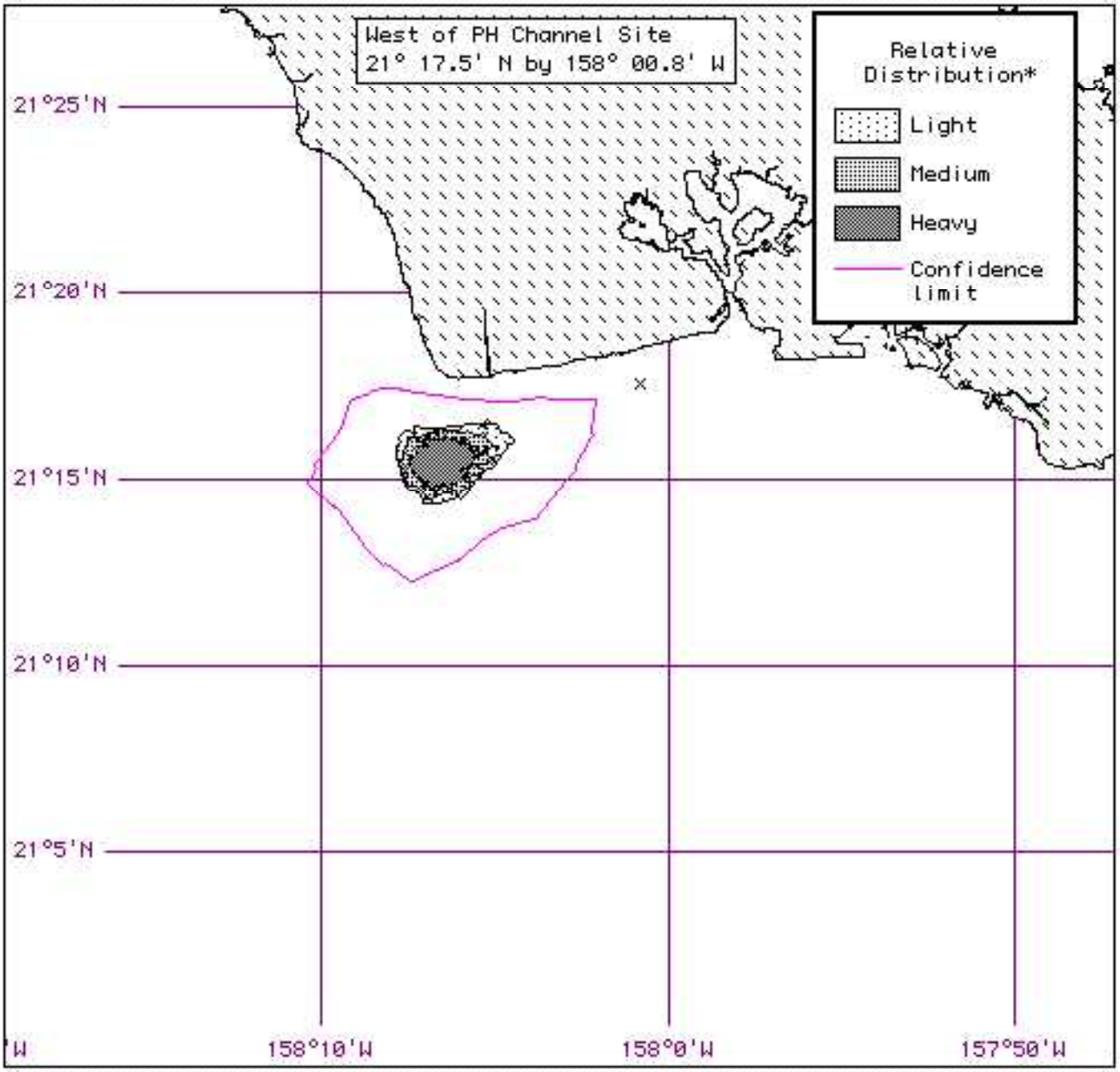
* this scale bar shows the meaning of the distribution terms at the current time

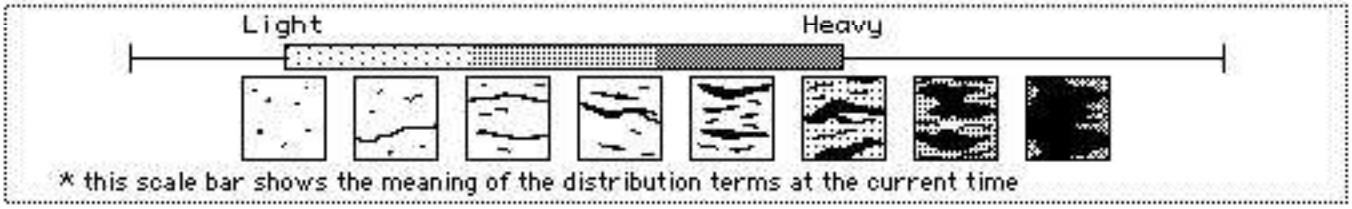
West of PH Channel **HAZMAT Trajectory Analysis**

Estimate for: 12 hrs, 8/19/0

Prepared: 1404, 5/8/01 NOAA/HAZMAT (206) 526-6317

Operational window analysis model parameters:
Winds from NE at 10 knots
Spill starts at beginning of flood tide
20,000 gallons of diesel fuel spilled instantaneously





* this scale bar shows the meaning of the distribution terms at the current time

West of PH Channel

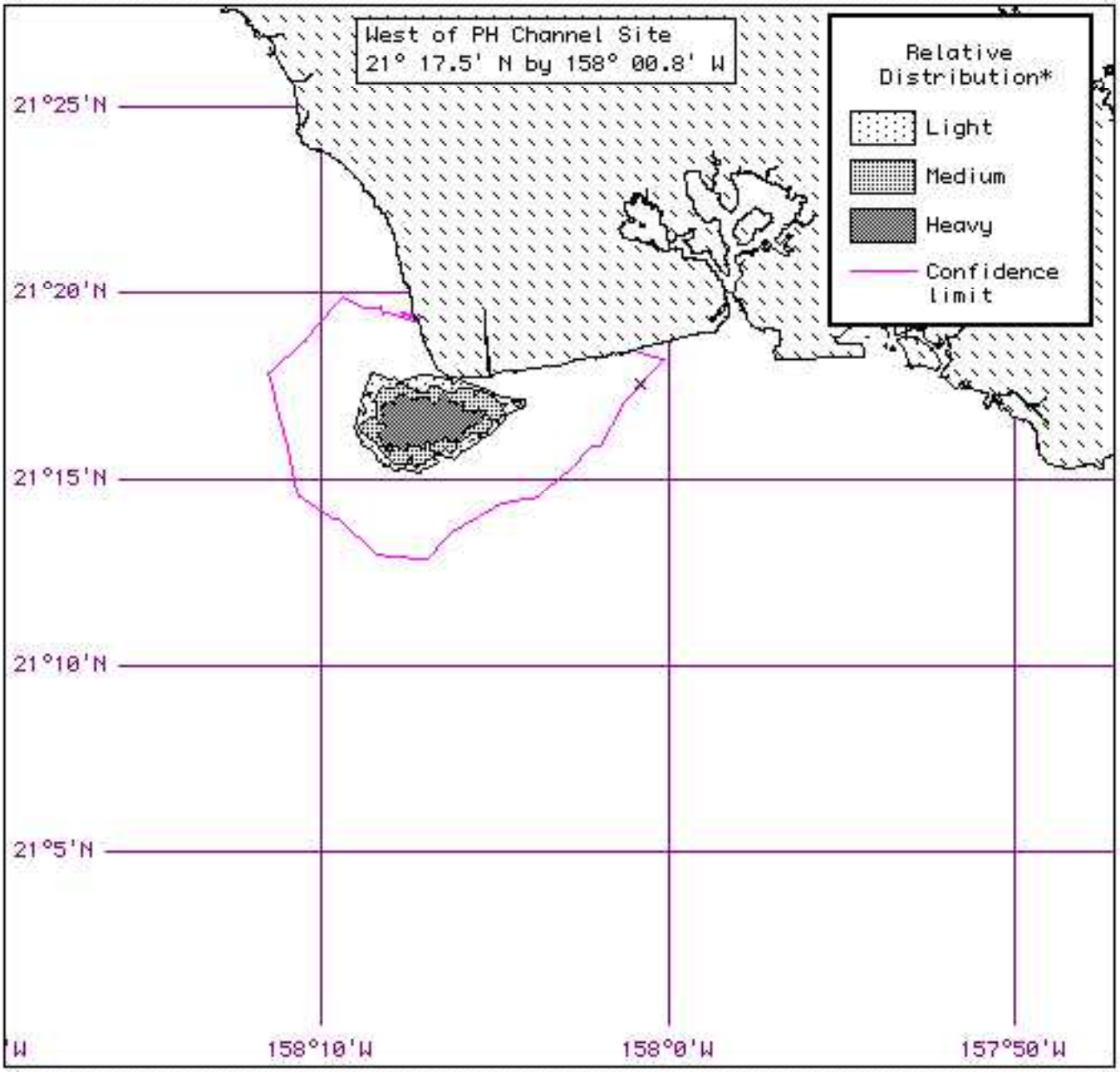
HAZMAT Trajectory Analysis

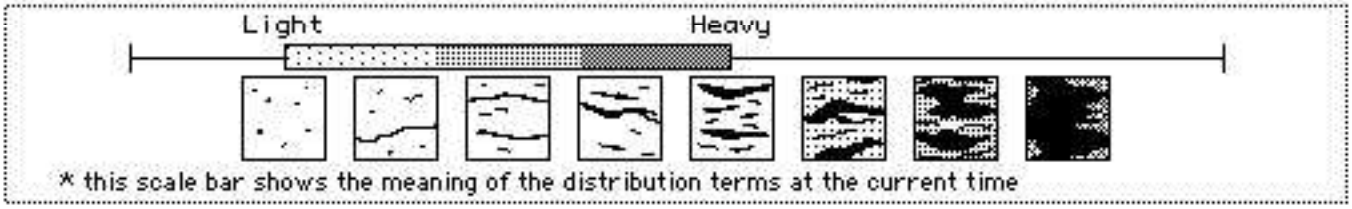
Estimate for: 1800

Prepared: 1404, 5/8/01

NOAA/HAZMAT (206) 526-6317

Operational window analysis model parameters:
Winds from ENE at 10 knots
Spill starts at beginning of ebb tide
20,000 gallons of diesel fuel spilled instantaneously





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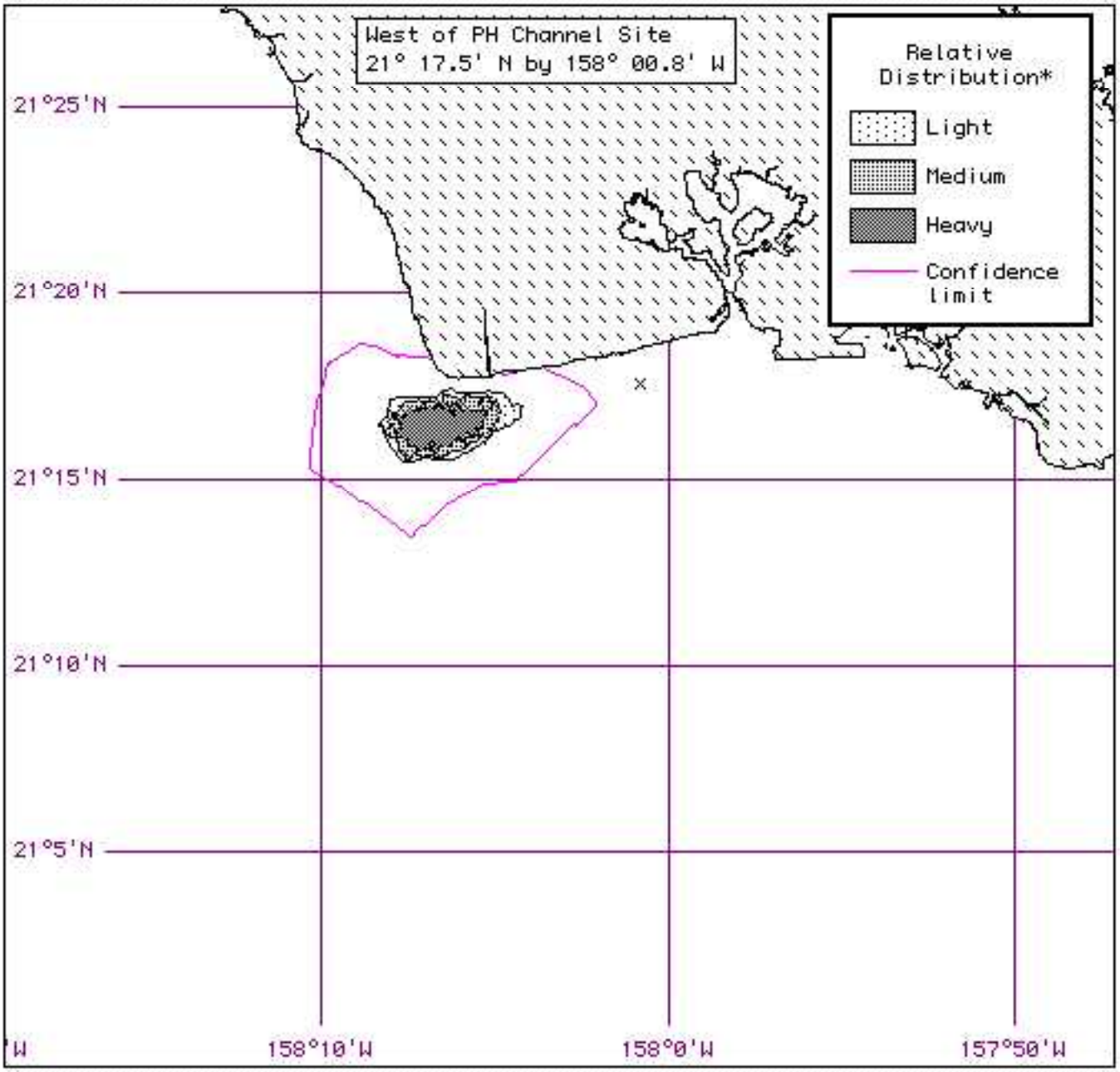
West of PH Channel

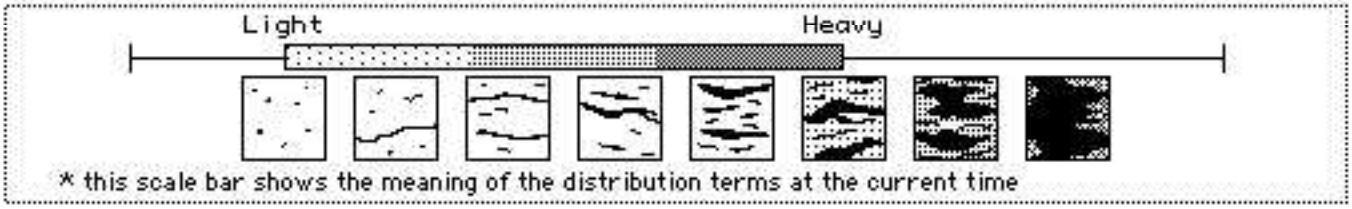
HAZMAT Trajectory Analysis

Estimate for: 12 hrs
Prepared: 1404, 5/8/01

NOAA/HAZMAT (206) 526-6317

Operational window analysis model parameters:
Winds from ENE at 10 knots
Spill starts at beginning of flood tide
20,000 gallons of diesel fuel spilled instantaneously





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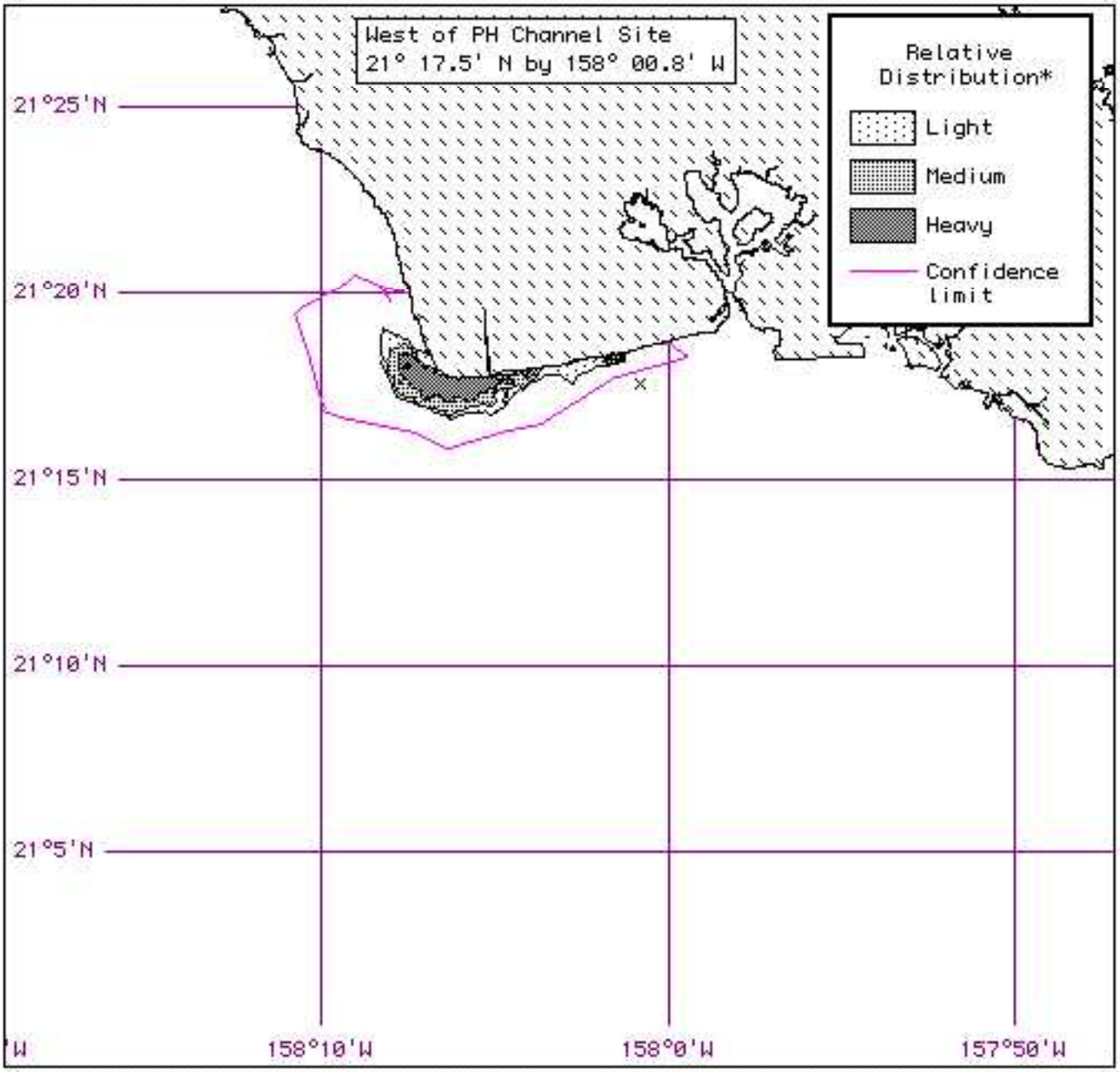
West of PH Channel

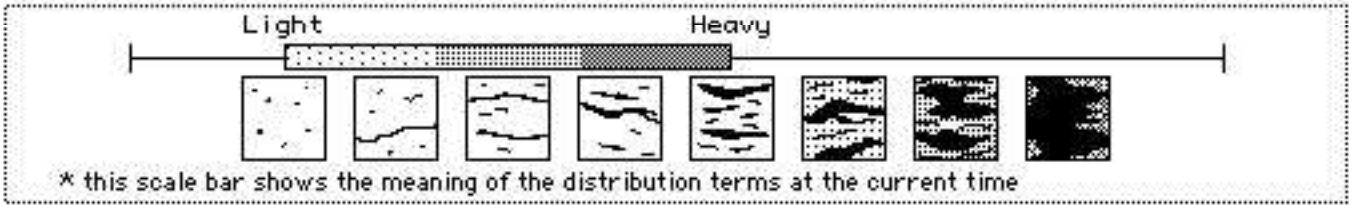
HAZMAT Trajectory Analysis

Estimate for: 18 hrs
Prepared: 1404, 5/8/01

NOAA/HAZMAT (206) 526-6317

Operational window analysis model parameters:
Winds from E at 10 knots
Spill starts at beginning of ebb tide
20,000 gallons of diesel fuel spilled instantaneously





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West of PH Channel

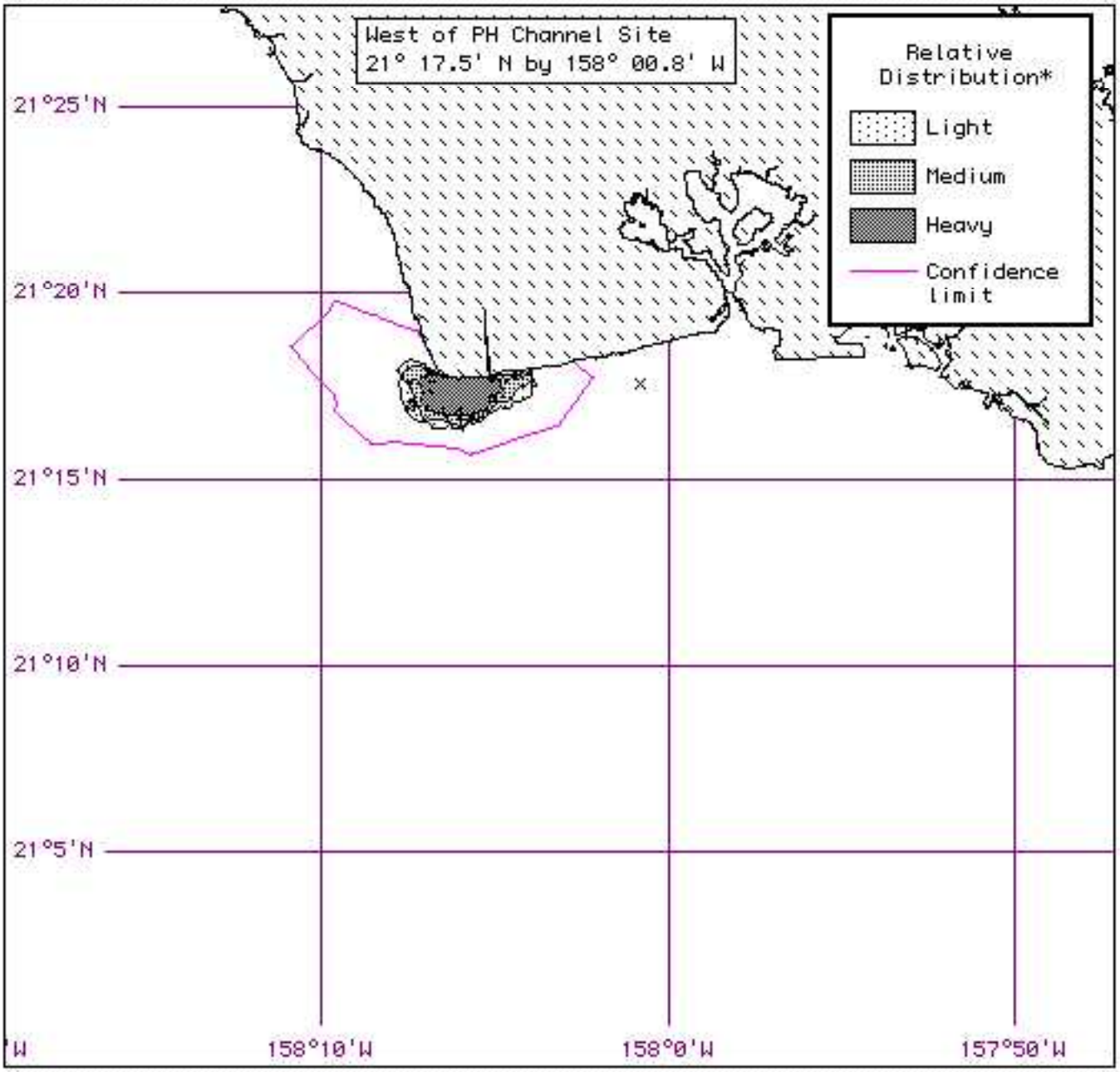
HAZMAT Trajectory Analysis

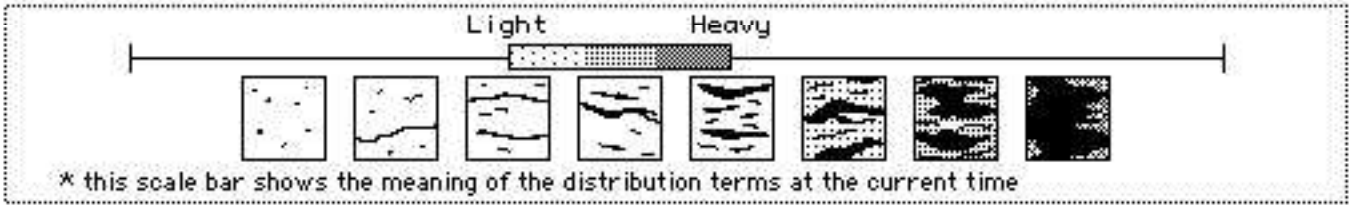
Estimate for: 12 hrs

Prepared: 1404, 5/8/01

NOAA/HAZMAT (206) 526-6317

Operational window analysis model parameters:
Winds from E at 10 knots
Spill starts at beginning of flood tide
20,000 gallons of diesel fuel spilled instantaneously





* this scale bar shows the meaning of the distribution terms at the current time

Waianae Coast

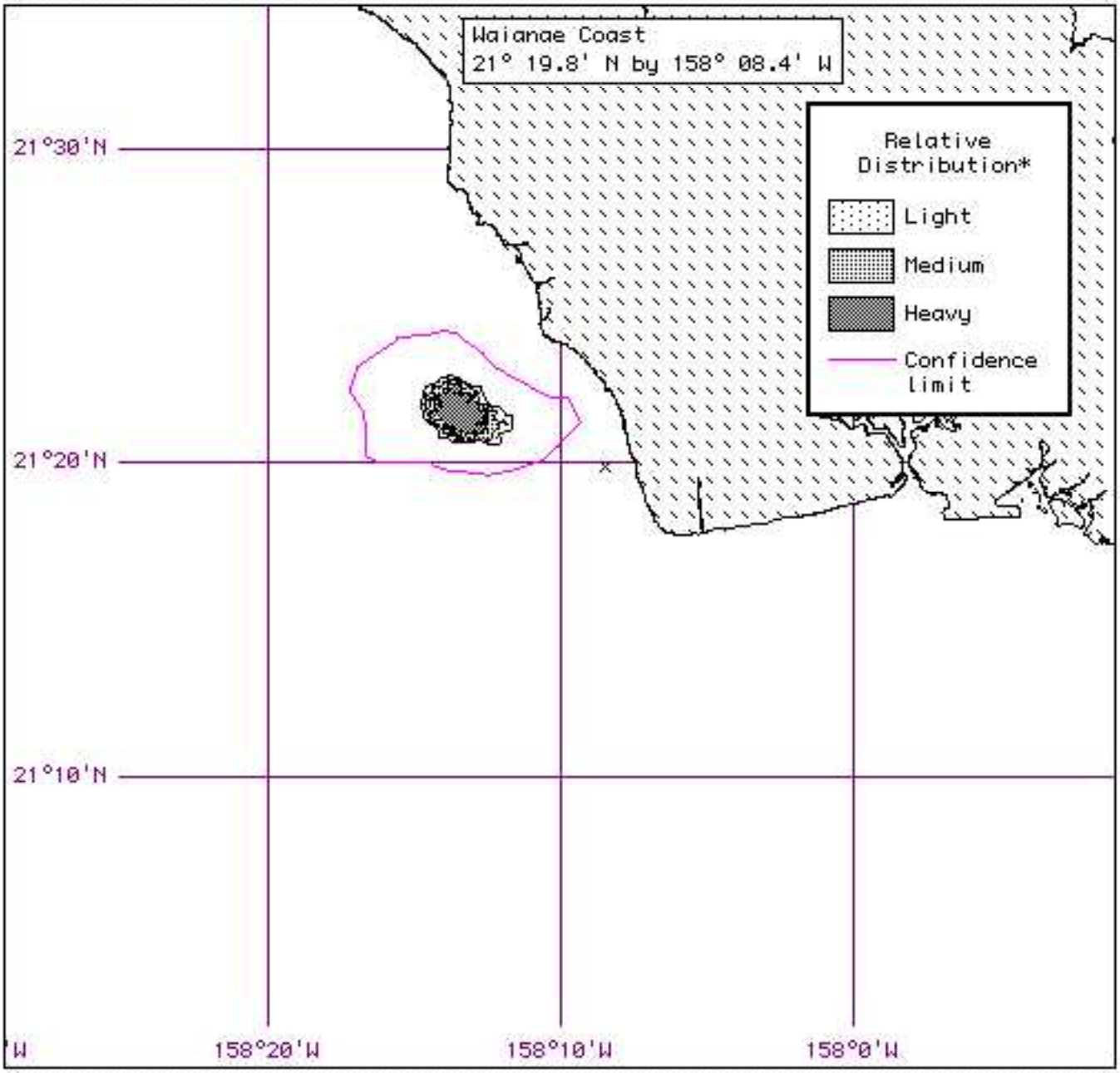
Estimate for: 12 hrs

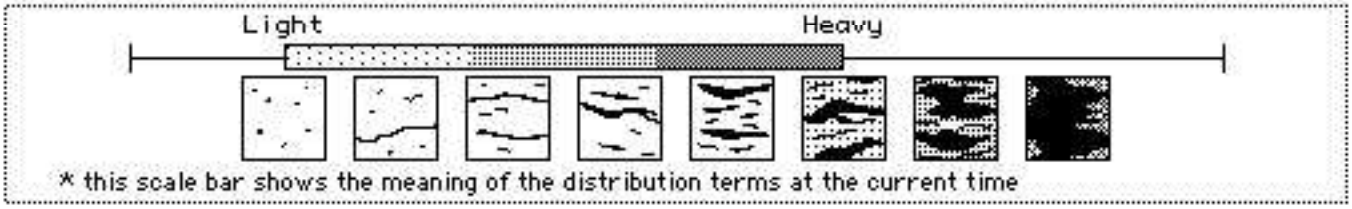
Prepared: 1015, 5/10/01

HAZMAT Trajectory Analysis

NOAA/HAZMAT (206) 526-6317

Operational window analysis model parameters:
Winds from ENE at 10 knots
Spill starts at beginning of ebb tide
20,000 gallons of diesel fuel spilled instantaneously





* this scale bar shows the meaning of the distribution terms at the current time

Waianae Coast

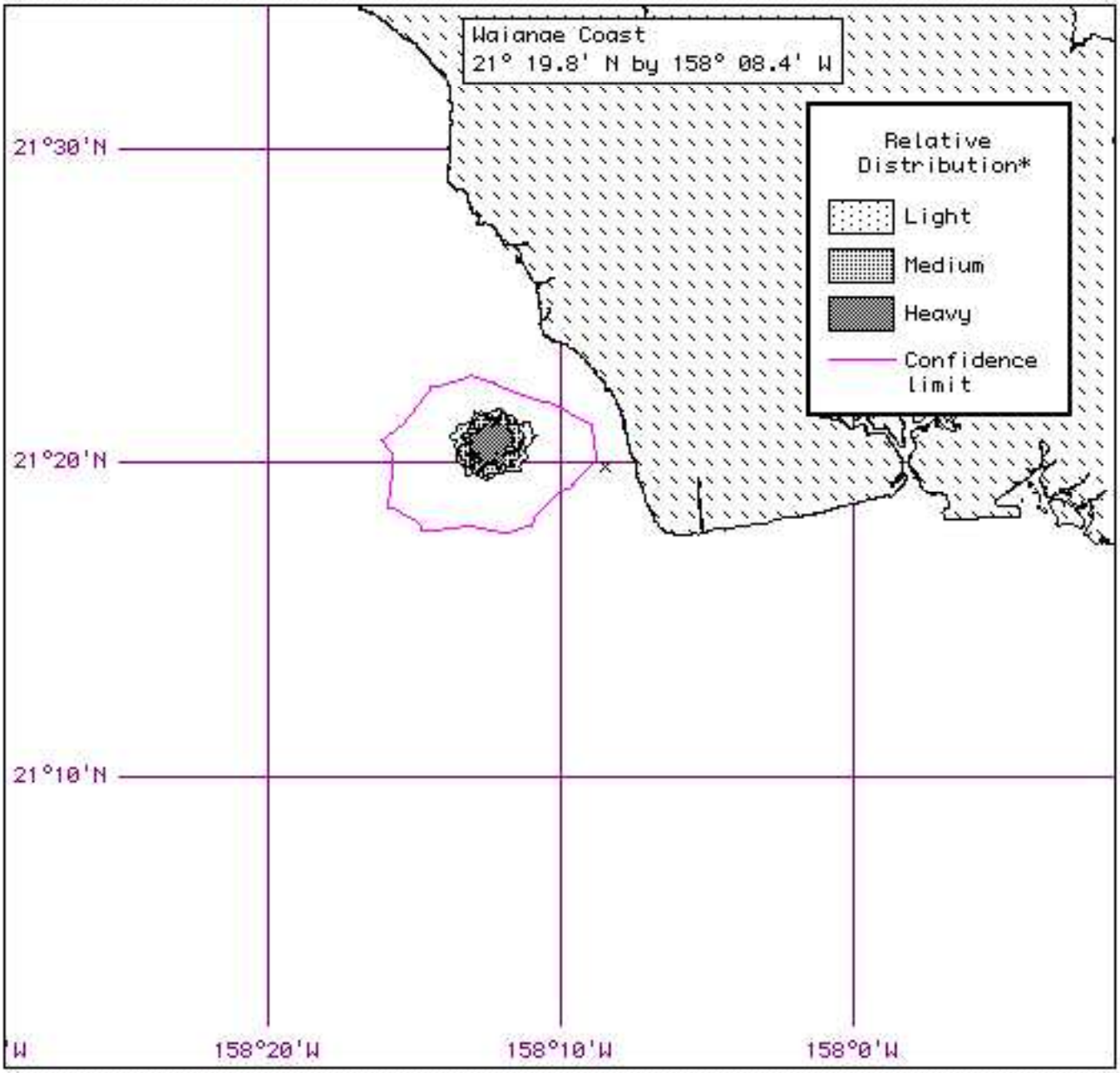
Estimate for: 0700, 8/19/01

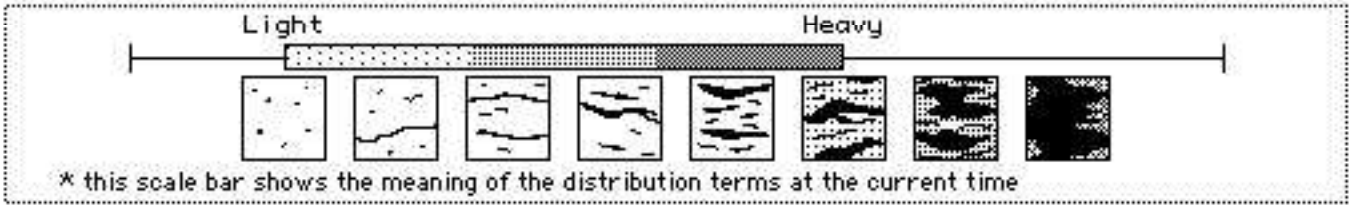
Prepared: 1015, 5/10/01

HAZMAT Trajectory Analysis

NOAA/HAZMAT (206) 526-6317

Operational window analysis model parameters:
Winds from ENE at 10 knots
Spill starts at beginning of flood tide
20,000 gallons of diesel fuel spilled instantaneously





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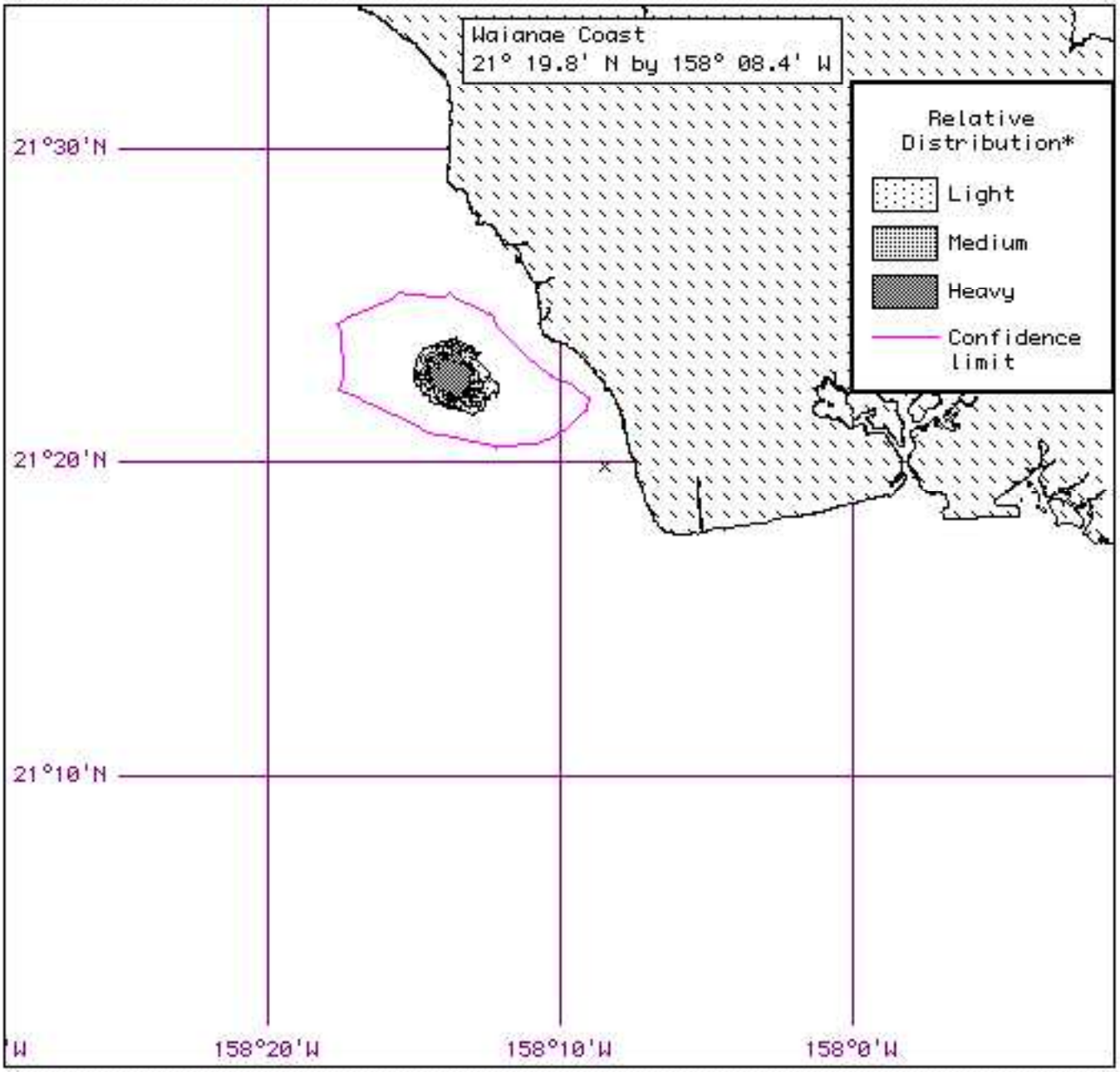
Waianae Coast

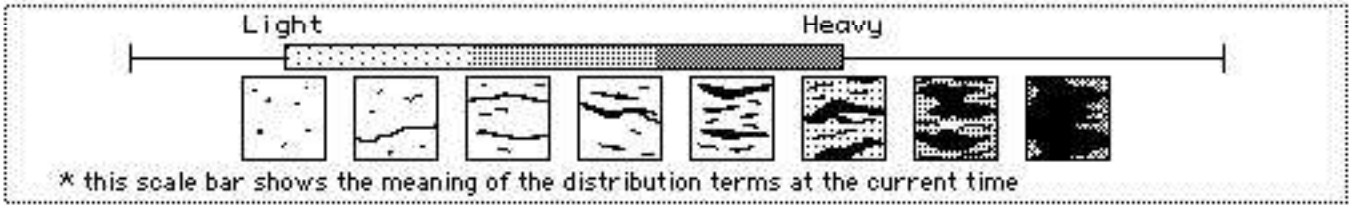
HAZMAT Trajectory Analysis

Estimate for: 12 hrs
Prepared: 1009, 5/9/01

NOAA/HAZMAT (206) 526-6317

Operational window analysis model parameters:
Winds from E at 10 knots
Spill starts at beginning of ebb tide
20,000 gallons of diesel fuel spilled instantaneously





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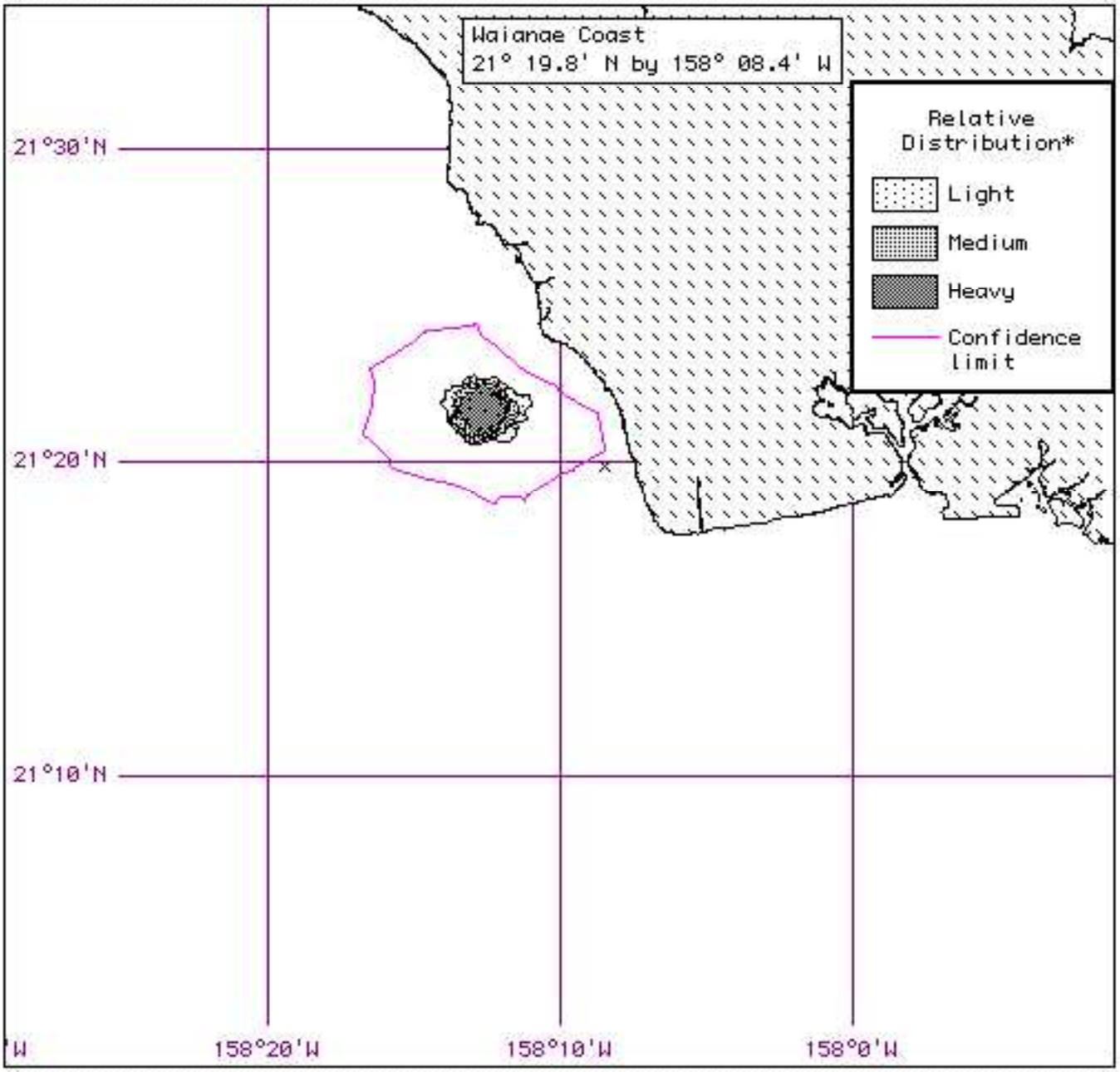
Waianae Coast

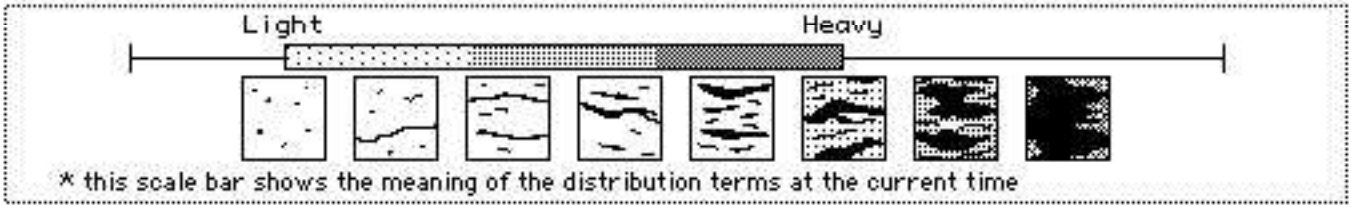
HAZMAT Trajectory Analysis

Estimate for: 12 hrs
Prepared: 1009, 5/9/01

NOAA/HAZMAT (206) 526-6317

Operational window analysis model parameters:
Winds from E at 10 knots
Spill starts at beginning of flood tide
20,000 gallons of diesel fuel spilled instantaneously





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