

FINAL REPORT

**RESEARCH ON TURBULENCE AND
DIFFUSION OF PARTICULATE MATTER
IN THE LOWER LAYERS OF THE
ATMOSPHERE**

by

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FIELD STUDIES OF TURBULENCE AND DIFFUSION

1. Introduction

This paper summarizes the principal results obtained from a limited observational program on the behavior of a smoke plume emitted from a point source at ground level under various meteorological conditions. It includes, in addition, brief results of a statistical study to determine relationships between certain meteorological parameters and the standard deviation of the horizontal wind direction. Meteorological data were obtained from a 144-ft permanent tower, the instrumentation of which is described by Mr. Gill elsewhere in this publication. An Army M2 oil-fog smoke generator, modified to operate at about one third its usual output, was used as a point source in the smoke experiments. This generator ejects an oil vapor which yields, upon condensation, droplets about one half a micron in diameter. All smoke measurements were made from lapse-time photographs taken by 35-mm movie cameras at 1-sec intervals.

A knowledge of the surrounding surface and its roughness characteristics is necessary before experimental results of diffusion or turbulence measurements made near the earth's surface can be interpreted properly. The Round Hill Field Station (fig. 1) is located on a fairly flat point of land rising gently toward the north and exposed to Buzzards Bay to the east and south; the tower where the meteorological data were collected is about 100 ft from the shore.

2. Turbulence structure as shown by the growth of smoke "puffs"

Under conditions of marked solar heating it was observed that some portions of the plume grew more rapidly upward, forming turret shaped structures, than adjacent sections did. These upward surges will be referred to as "puffs". On 16 December 1949, a day with clear skies, northerly winds, and polar continental air, the gener-

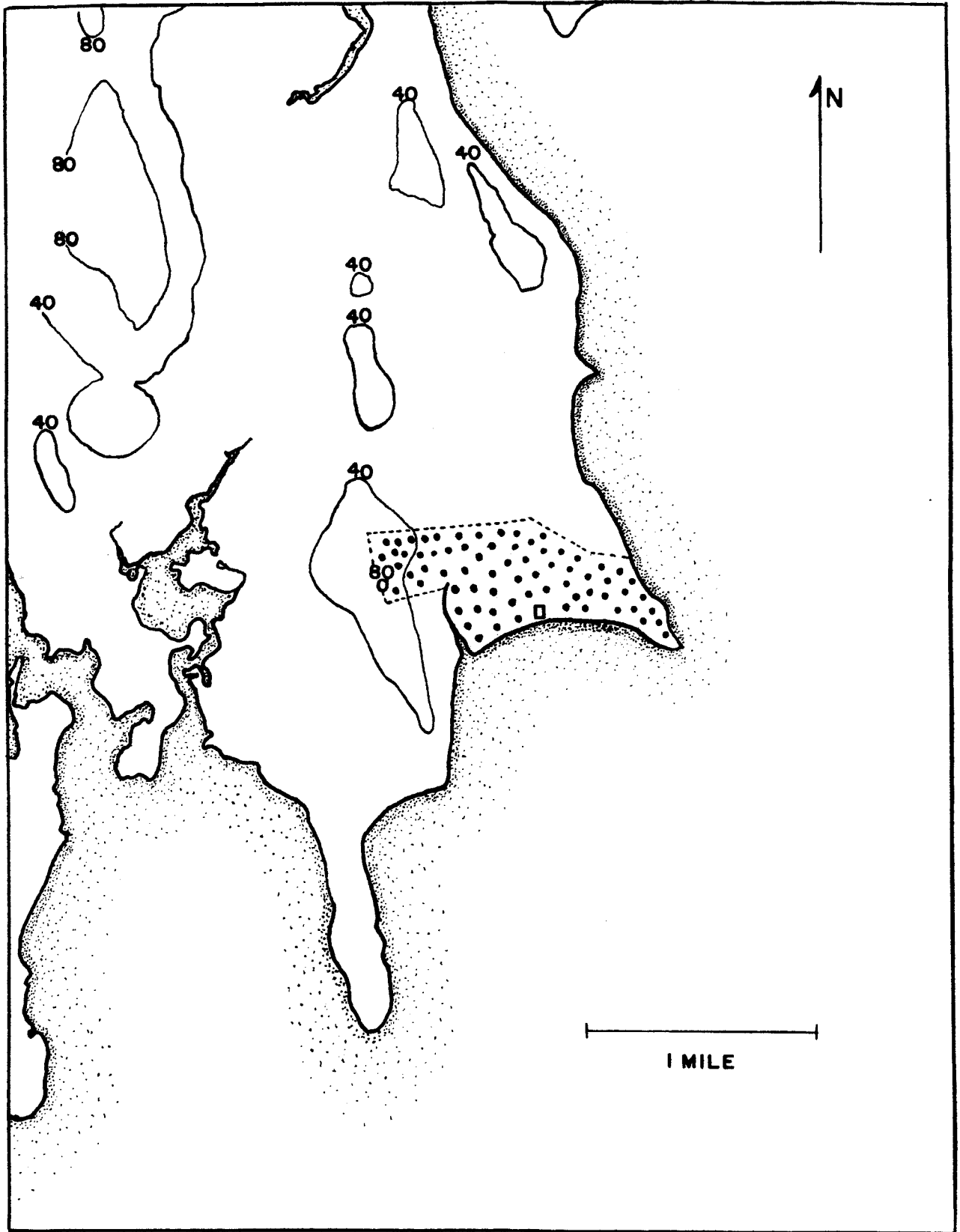


Fig. 1. Map showing location of the Round Hill Field Station. Stippled area marks the estate. The location of the permanent meteorological tower is shown by the □.