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Preliminary Report

A CURSORY RADIATION SURVEY OF SELECTED ISLANDS OF ENIWETOK ATOLL

I. Introduction

Selected islands of Eniwetok Atoll were surveyed for radiological conditions from July 14, 1971 to July 21, 1971, by Mr. Charles F. Costa, EPA, and Mr. O. D. T. Lynch, Jr., USAEC, in partial support of the DNA/AFWL PACE Program (Project MICRO-ATOLL). Particular attention was focused on the islands of Engibe (JANET) and Runit (YVONNE), the islands of immediate interest to the PACE Program. The survey of all islands visited, however, was necessarily brief due to the allotted survey time (six days) and the number of personnel (two monitors).

2. Islands Surveyed

The following is a listing of islands surveyed during the above-mentioned period:

From NMP-K

Geographical Name	Code Name
Engibe	JANET
Runit	YVONNE
Rojoa	URSULA
Biijiri	TILDA
Aranit (or Aomon)	SALLY
Bogon	IRENE
Bogairik	HELEN

3. Island Cover

All of the islands surveyed contained considerable vegetation, enough so that movement through the interior of the islands was, in general, difficult. A summary of the island cover follows:

D/C - Marg. Ra. Settlement (Eniwetok)

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MESSERSCHMEDIA ARGENTA (BEACH HELIOTROPE)

Found on all islands, generally dense, and up to 20 plus feet in height.

SCAVEOLA TACCADA (SCAVEOLA)

Found on all islands, generally dense, and up to 20 plus feet in height.

IPOMOEA PES-CARPE (MORNING GLORY)

Found on all islands, forming a dense ground cover.

BUNCH GRASS

Found on all islands, forming spotty ground cover.

CASSYTHA FILIFORMIS (LAUREL DODDER, KAANIN)

Found on most islands, forming ground and tree cover.

PANDANAS

Single specimen found on the northeast tip of Aranit (SALLY).

MORINDA CETRIFOLIA

Single specimen found in the middle of Aranit (SALLY).

HIBISCUS

Observed on the northwest tip of Bogon (IRENE).

COCOS NUCIFERA (COCONUT PALM)

Few trees observed on Engibe (JANET) and Runit (YVONNE).

4. Survey Instruments

The following types of instruments were used to perform this survey.

Name	Detector	Radiation Detected	Range
Eberline E-500B	G.M.	$\beta+\gamma,\gamma$	Background - 2R/hr.
Ludlum	Scint.	γ	Background - 3000 μR/hr.
PAC-1S	Scint.	α	0 - 2 x 10^6 cpm

Exposure rate measurements were taken three feet above the ground. Since contact readings were generally similar to exposure rate measurements, only exposure rates are reported unless the difference was significant. Where the difference was significant it is noted on the attached survey sheets.

5. Survey Results

A. Engibe (JANET)

General Description

Engibe, a triangular shaped island situated on the north end of the atoll, possessed considerable vegetative growth. Movement through the island was limited to existing test roads, the shoreline, and a large runway on the north end of the island. The island is the home of a large tern rookery situated on the northern end of the island. A survey of the island resulted in measured exposure rates ranging from 10-100 μR/hour inland and 2-4 μR/hour along the beaches. Scrap metal with contact gamma readings up to 12 mR/hour was observed.

Exposure Rate Readings

Engibe can be divided into three distinct measurement areas: the area north of the airstrip, the area south of the airstrip, and the areas around the EASY, X-RAY, and ITEM surface ground zeroes (SGZ). In the inland area north of the airstrip, the exposure rates ranged from 20-60 μR/hour, while measurements ranging from 10 to 20 μR/hour were observed in the inland areas south of the airstrip.

Measurements were made along selected radials from the SGZ's as ground cover would allow. At the site of the EASY Event, the maximum exposure rate observed was 70 μR/hour on a radial of 135° true, 200 feet from the SGZ, in an area of dense vegetation. In general, 20 μR/hour was observed throughout most of this area with the exception of the area east of the SGZ which was indicating 40-50 μR/hour. At the site of the X-RAY Event, the maximum exposure rate observed was 100 μR/hour (120 μR/hour ground contact) on a radial of 030° true, approximately 400 feet from the SGZ (also densely vegetated). General exposure rates around the SGZ ranged from 50-70 μR/hour. At the site of the ITEM Event (the only readily apparent SGZ on Engibe), the crater of which appears as a large burned out area on the northern tip of the island, the maximum exposure rate observed was about 5 μR/hour. This rather low level is probably due to the lack of vegetation,

the lack of any top soil or other loose ground cover, and the sweeping effect of the tide - the crater was open to the ocean side of the reef.

Scrap metal (contact readings)

Large quantities of activated scrap metal were found near the SGZ's, probably constituting the major radiological hazard on Engibe. The maximum reading observed on scrap metal was 12 mR/hour. This reading was obtained from a large twisted I-beam wrapped around a metal collimator located on the northwest end of the island, just north of the large bunker.

Alpha contamination

No surface alpha activity was detected on Engibe.

B. Runit (YVONNE)

General Description

Runit is a long slender island situated on the eastern side of the atoll. Runit possessed somewhat less vegetative cover than Engibe, thus making location and identification of SGZ's easier. Travel on the island was done mostly on the main road running the length of the island. A survey of Runit resulted in measured exposure rates ranging from a few μR/hour to 1 mR/hour. Scrap metal with contact gamma readings up to 35 mR/hour was observed. Alpha contamination in soil and in vegetation was detected near the FIG Event site. Count rates up to 3000 cpm (measured with a PAC-1S) in wet soil were observed.

Exposure Rate Readings

One day was allotted to the radiation survey of Runit, thus allowing only enough time to survey the northern half of the island. Measured exposure rates observed in the middle portion of the island averaged 15 μR/hour. These readings persisted to within about 300 feet of the CACTUS crater lip. A survey along a transect across the island through the ZEBRA Event site indicated exposure rates ranging from 4 to 8 μR/hour. Readings along a transect across the island through the FIG Event site ranged from 1 to 6 μR/hour. The highest measured exposure rates on the entire atoll (1 mR/hr) occurred on top of the crater lip located at the southern end of the CACTUS

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crater. At the crater's immediate edge (crater filled with water) readings ranged from 40 to 100 μR/hour.

Scrap Metal (contact readings)

Large quantities of activated scrap metal were observed near the CACTUS and LACROSSE Event sites. Trenches excavated for the purpose of collecting soil and ground water samples exposed considerable metal debris. The maximum reading observed on scrap metal was 32 mR/hour closed shield, 35 mR/hour open shield. This piece of scrap metal, a partially buried I-beam, was observed on the island road near bunker Hartack Station 182-01 (Greenhouse Station 57). General scrap metal contact readings ranged from 100 μR/hour to about 8 mR/hour.

Alpha Contamination

Alpha contamination was detected along a 65 foot length of the berm on the ocean side of the beach near the FIG Event. The contamination was confined to a vein of relatively dark sand, from 3 to 8 inches thick, found exposed on the berm near Redwing Station 1311.05 (bunker). The wet soil yielded up to 3000 cpm (measured with a PAC-1S) on the vertical face of the vein. Some black plastic sheeting and cables were observed in this layer. To determine the extent of the alpha contamination, a trench was dug between the FIG SGZ and the beach. Alpha contamination was detected at a depth of 8 inches. Two additional trenches, one 300 feet north and another 200 feet south of the FIG SGZ, just off the ocean side of the road, yielded no detectable alpha activity to a depth of two feet. However, alpha activity was detected on bunch grass located adjacent to the north trench.

Rojoa (URSULA), Biijiri (TILDA) and Aranit (SALLY)

General Description

Rojoa, Biijiri, and Aranit islands are three larger islands on the northeast portion of the atoll. They are connected by a bridge (Rojoa and Biijiri) and a causeway (Biijiri and Aranit). All of the islands are generally densely vegetated with the exception of the northeast end of

Aranit which was found to be free of dense ground cover.

Exposure Rate Reading

Measured exposure rates on Rojoa and Biijiri were relatively low, 5-10 μR/hour and 1-4 μR/hour respectively. On Aranit, the maximum exposure rate observed was 150 μR/hour near the western end of the island. Exposure rates throughout the island averaged between 60 and 100 μR/hour.

Scrap Metal

Very little scrap metal was evident on any of the above islands. On Biijiri, a piece of scrap metal on the northeast end of the island had a contact reading of 1 mR/hour while scrap metal evident on Aranit ranged from 250 to 800 μR/hour on contact.

Alpha Contamination

No surface alpha activity was detected on Rojoa, Biijiri, or Aranit.

Bogairikk (HELEN) and Bogon (IRENE)

General Description

Bogairikk island now consists of nothing more than a small, sparsely vegetated "islet", which is almost an extension of the sandbar originating from the southwest corner of Bogon. Bogon is much larger, with considerable vegetation and several large bushes. Movement in the interior of Bogon was very difficult due to the extensive growth of CASSYTHA FILIFORMIS, which not only covered the ground, but also formed a formidable barrier on trees and on bunkers.

Exposure Rate Readings

Measured exposure rates on Bogairikk averaged 10 μR/hour. On Bogon, exposure rates were considerably higher. On the southeast side of the SEMINOLE crater on what appears to be darkened coral, exposure and ground contact rates up to 300 μR/hour were measured. The average exposure rate was about 100 μR/hour. Along the northern half of Bogon, exposure rates

up to 400 μR/hour were observed with an average reading of 100 μR/hour. Readings along the southern portion of Bogon ranged from 10-50 μR/hour.

Scrap Metal

Some scrap metal was observed on both islands, most of it concentrated around the SEMINOLE crater. Contact readings ranged from 0.3 to 0.5 mR/hour.

Alpha Contamination

No surface alpha activity was detected on Bogairikk or Bogon.

Environmental Samples

The collection of environmental samples was limited to the islands of Engibe and Runit. On Engibe, surface (1-2.5 cm) and profile (20 cm) soil samples were collected from the EASY, X-RAY, and ITEM Event sites. Also, several surface soil samples were collected at the site of the beryllium contaminated area on the northwest tip of the island. Two ground water samples were collected on the island from the fresh water lens at approximately 6 to 8 feet in depth. A surface water sample was obtained from the water in the ITEM Event crater.

On Runit, surface and depth soil samples were collected from the CACTUS, LACROSSE, and FIG Event sites. One ground water sample (from the island's fresh water lens) was collected and one vegetation (bunch grass) sample was collected near the FIG site. All samples are presently being analyzed by EPA/WERL and the results will be available at a later date.

Conclusions

As a preliminary evaluation, it seems apparent from the cursory radiological survey performed that Runit (YVONNE) presents the greatest radiological hazard of any of the islands surveyed. Large quantities of scrap metal are evident along the reef near the LACROSSE site and to a lesser extent inland. The maximum contact reading on scrap metal (35 mR/hour) was observed on

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this island. If this is indicative of what low level activated surface scrap metal reads, then it is realistic to expect to find buried scrap metal of significantly higher activity.

Alpha contamination was found on the ocean side of Runit (a review of several earlier reports on decontamination attempts on Runit suggests alpha contamination to be buried on the lagoon side) near the site of the FIG Event. Contamination appears to be confined to a vein of darkened sand which in some places along the beach is exposed to the wear and tear of the elements. The maximum reading observed on this contaminated wet sand was 3000 cpm measured with a PAC-1S. Alpha activity was also observed on bunch grass located approximately 300 ~~yards~~ feet north of the FIG site. The boundaries of the contaminated area were not delineated because of the lack of time. Also, predictions of the levels of contamination one can expect buried near the FIG site cannot be made based on results of this survey.

The highest measured exposure rate levels on the atoll were also found on Runit, at the lip of the CACTUS crater. A maximum exposure rate of 1 mR/hour was measured at that location. Runit has been used by both Kentron and Coast Guard personnel stationed on Eniwetok as a recreation island.

The radiological conditions of the other islands are significantly better than that on Runit. The only problem area appears to be surface - and thus the possibility of subsurface-activated scrap metal, especially on Engibe and Aranit. On Engibe, a portion of the northwest tip of the island near the large concrete bunker has been contaminated with beryllium from past rocket tests.

Recommendations

The following are our recommendations based on the radiation survey. These recommendations may be modified somewhat when the sample results are completed.

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A. A comprehensive radiation survey of the entire atoll should be made to document the radiological situation as it exists to date, preferably prior to any possible alteration of the atoll eco-system as a result of PACE program activities.

B. The boundaries of the alpha contaminated area on Runit should be defined and posted as an off-limit no digging area as soon as possible. In conjunction with this, modifications to the berm possessing the layer of alpha contaminated sand should be made in order to stop further erosion of contaminated soil onto the beach.

C. Radiation warning signs should be placed on the lip of the CACTUS crater.

D. Agencies working on the atoll should be advised that removal of scrap metal is prohibited without rad-safe approval.

E. In light of the objectives of the PACE program, continuous rad-safe support of the program is recommended to evaluate the radiological conditions and hazards of any metal debris and contaminated soil uncovered or resuspended by excavation and other test activities.

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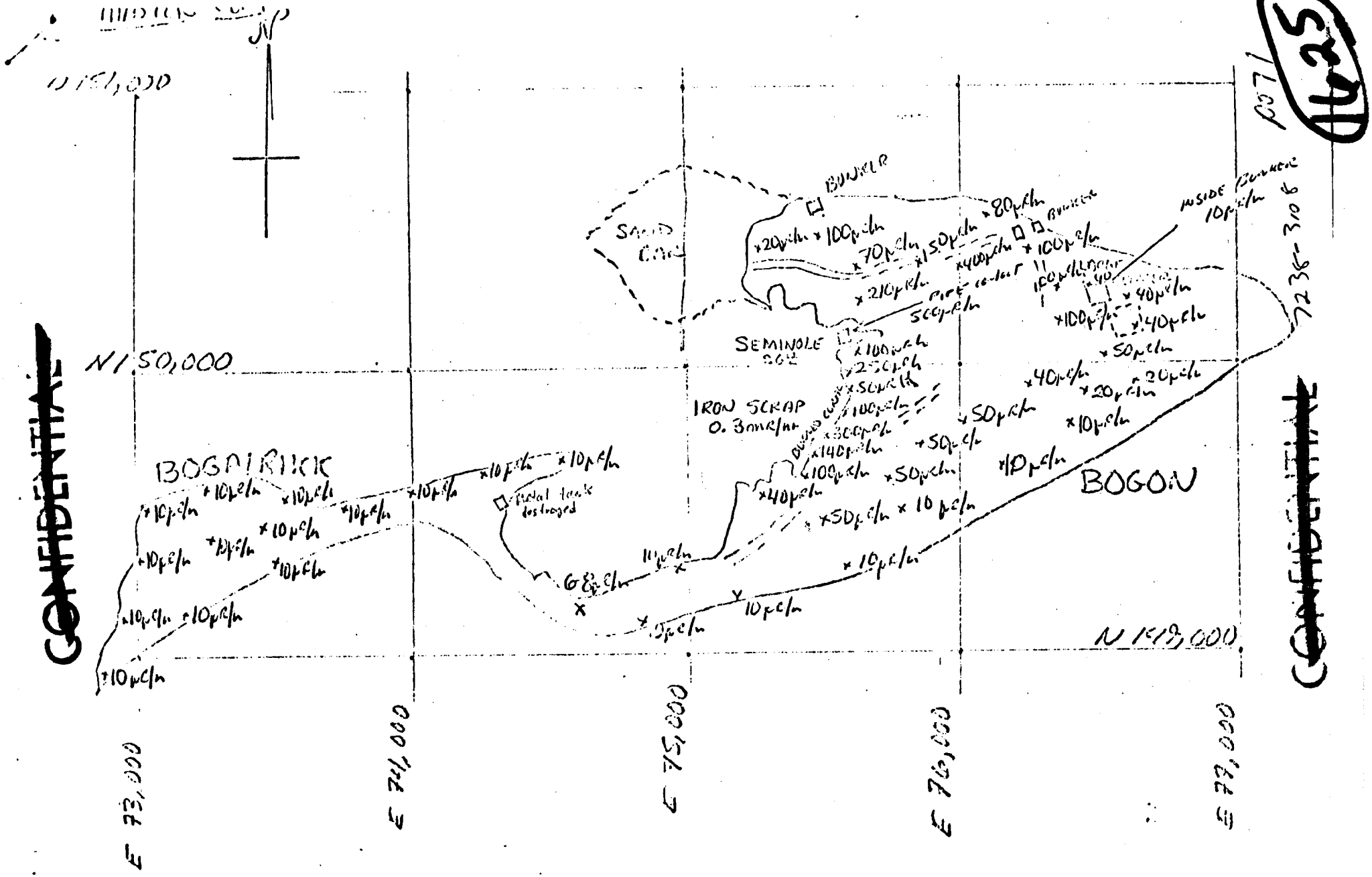

RADIOLOGICAL SURVEY OF ENIWETOK ATOLL

BOGAIRIKIK (ISLAND) AND BOGON (ISLAND)

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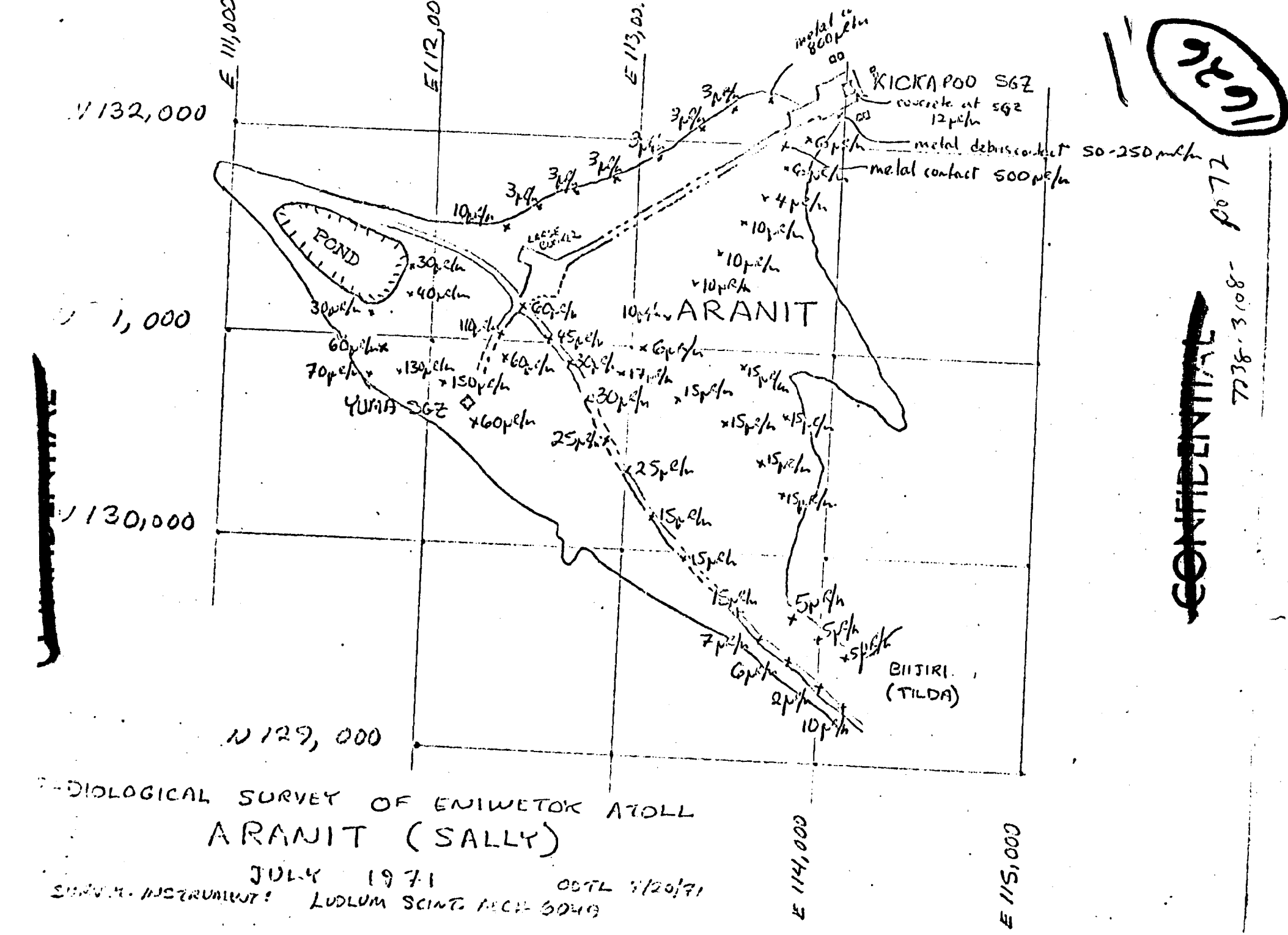

BIOLOGICAL SURVEY OF ENIWETOK ATOLL

ARANIT (SALLY)

JULY 1971

SURV. INSTRUMENT: LUDLUM SCINT. MICRO 3000

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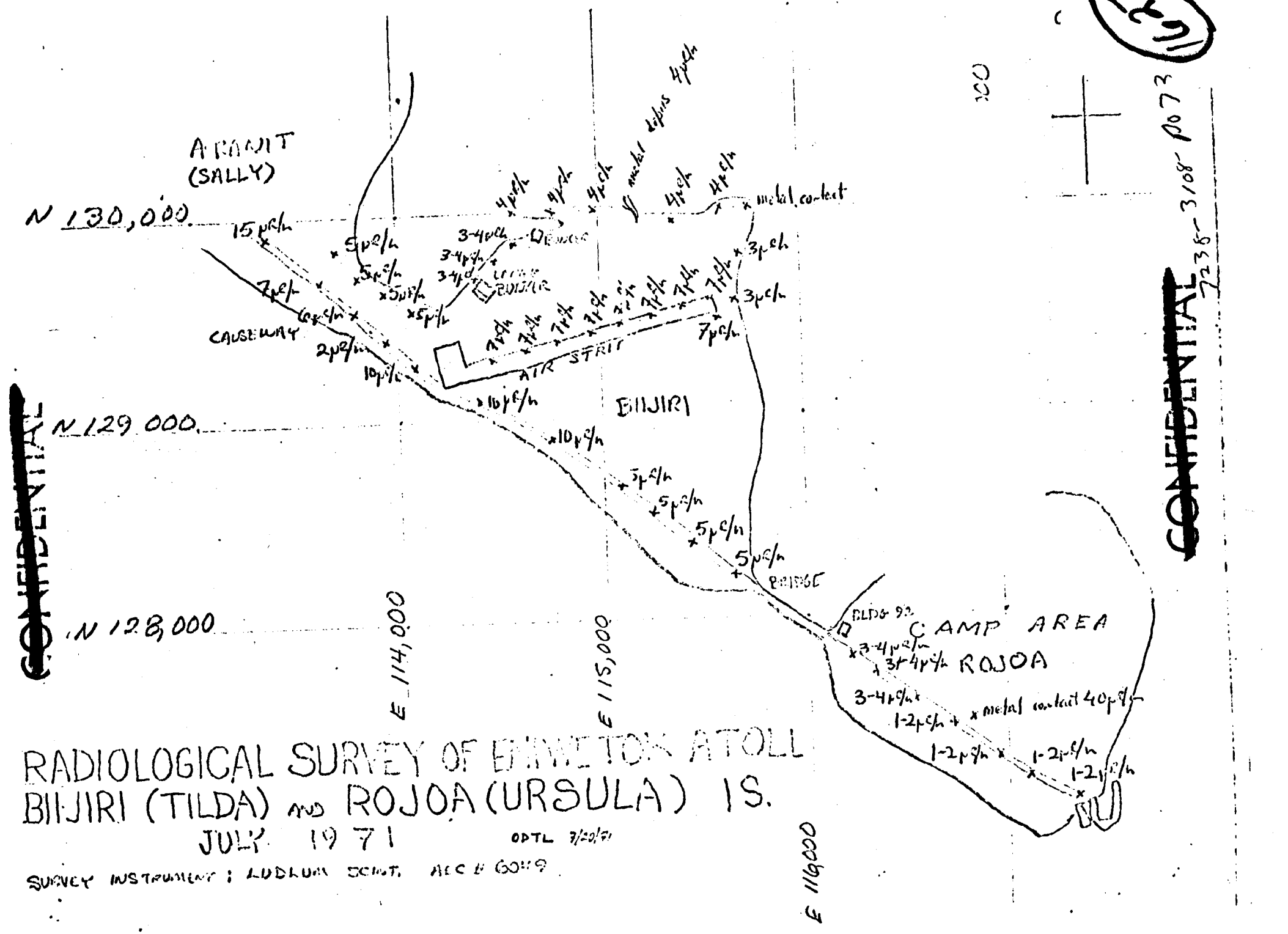

RADIOLOGICAL SURVEY OF ENIWETOK ATOLL
BIIJIRI (TILDA) AND ROJOA (URSULA) IS.

JULY 1971

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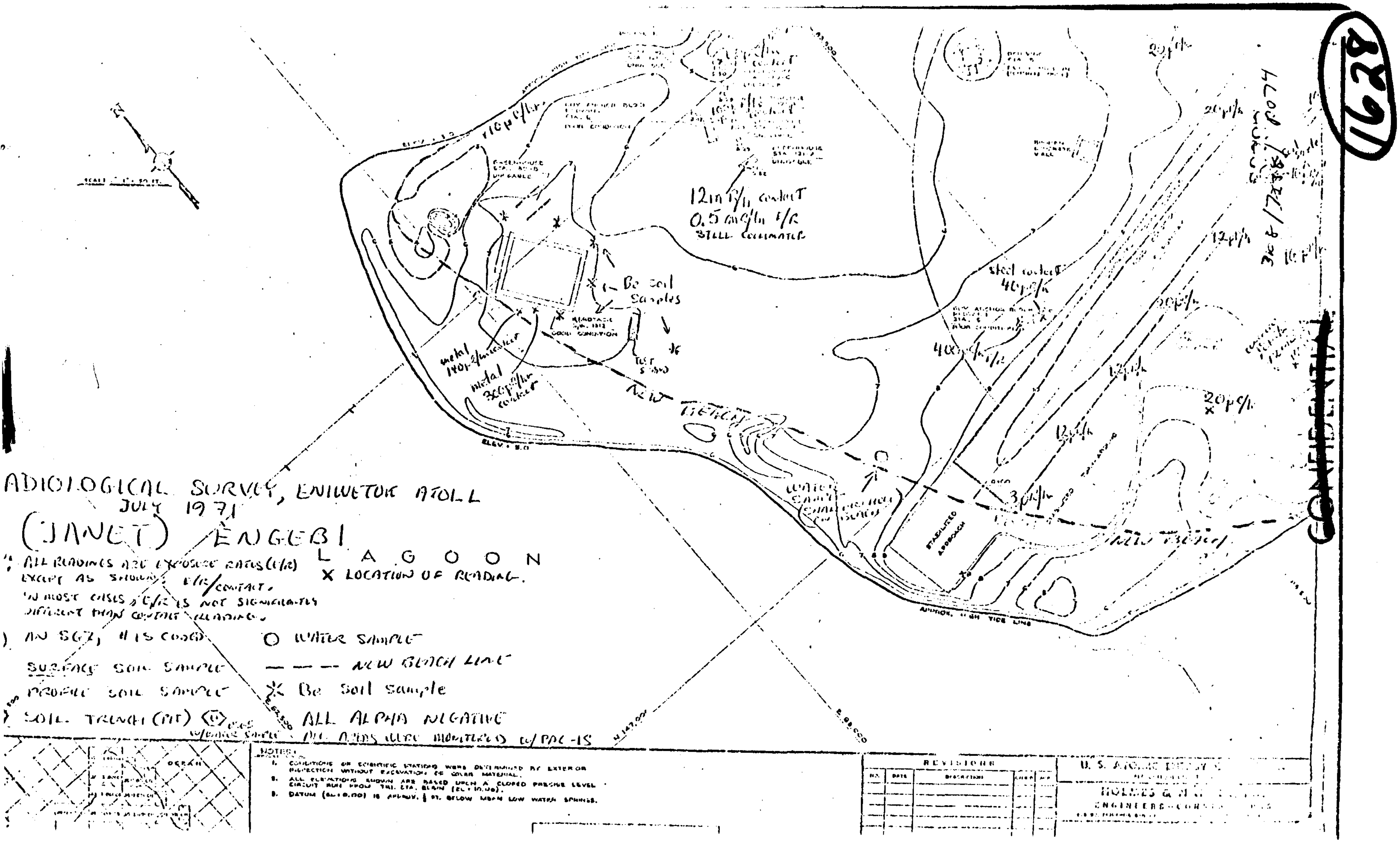
SURVEY INSTRUMENT: LUDLUM SCINT. AEC # 6049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ADIOLOGICAL SURVEY, ENIWETOK ATOLL
JULY 1971
(JANET) ENGEBI
LAGOON
ALL READINGS ARE EXPOSURE RATES
EXCEPT AS SHOWN: E/R/CONTACT.
X LOCATION OF READING.
AN SGZ, # IS GOOD
O WATER SAMPLE
SURFACE SOIL SAMPLE
- - - NEW BEACH LINE
PROFILE SOIL SAMPLE
Be Soil sample
SOIL TRENCH (PIT)
ALL ALPHA NEGATIVE
12 mr/h contact
0.5 mr/h E/R
STEEL COLLIMATOR
Be soil Samples
NEW TRENCH
NEW TRENCH
steel contact 40 μr/h
40 μr/h
metal 360 μr/hr contact
20 μr/h
12 μr/h
16 μr/h
30 μr/h
STABILIZED APPROACH
ELEV. 8.0
NOTES:
1. CONDITIONS OF SCIENTIFIC STATIONS WERE DETERMINED BY EXTERIOR INSPECTION WITHOUT EXCAVATION OF COVER MATERIAL.
2. ALL ELEVATIONS SHOWN ARE BASED UPON A CLOSED PRECISE LEVEL CIRCUIT RUN FROM TRI. STA. ELAIN (EL. 10.00).
3. DATUM (EL. 0.00) IS APPROX. ½ FT. BELOW MEAN LOW WATER SPRINGS.
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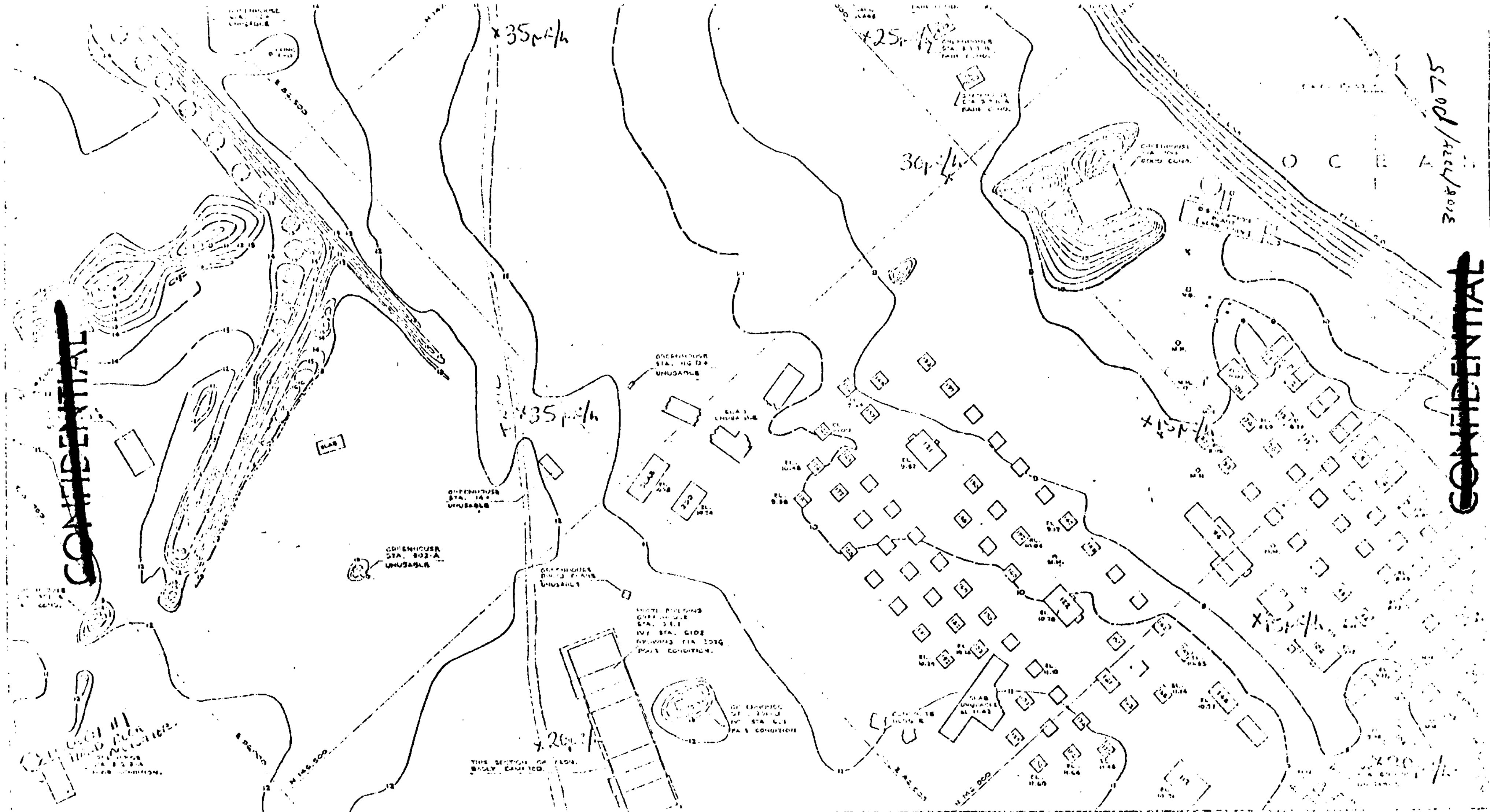

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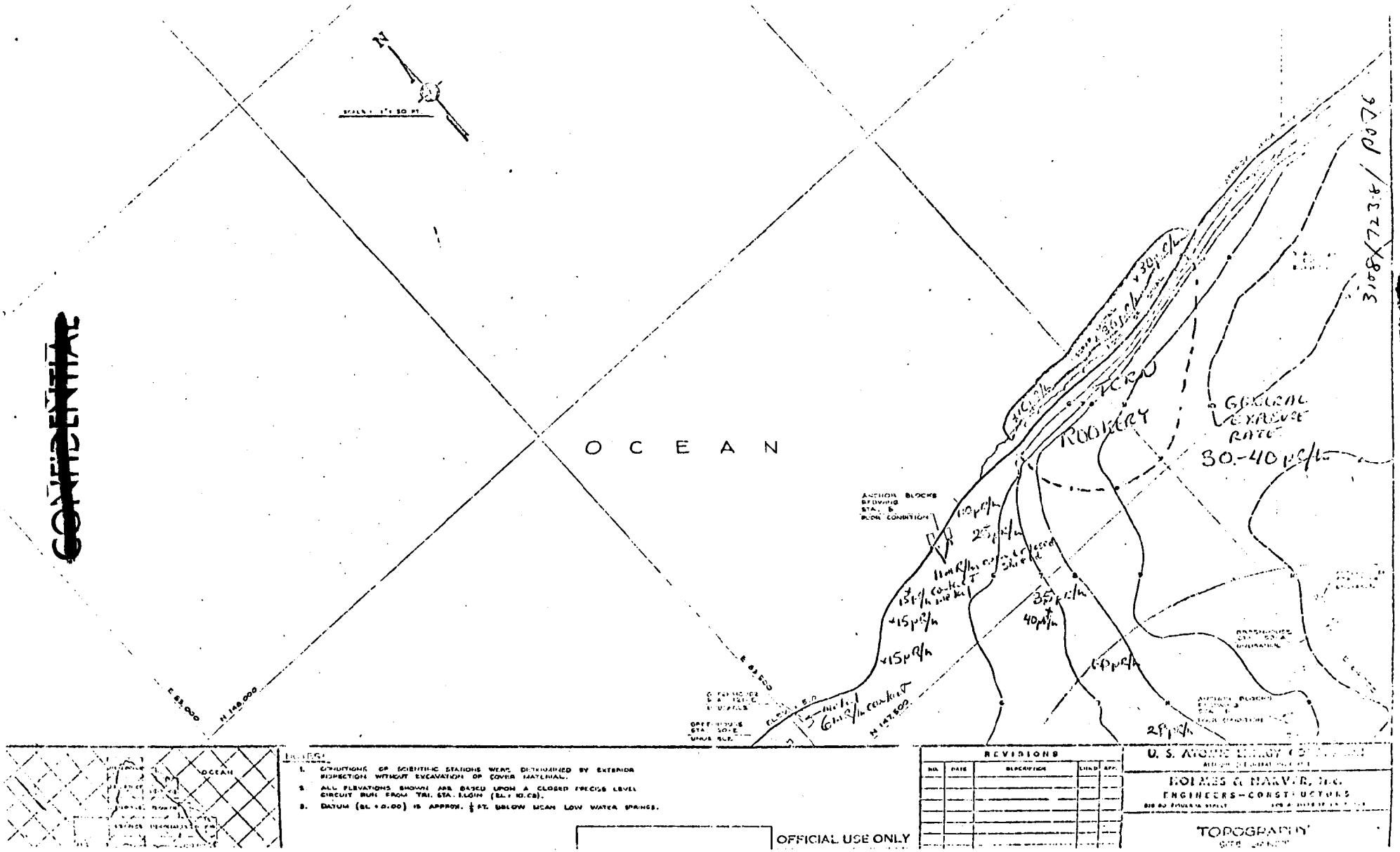

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3. DATUM (EL. = 0.00) IS APPROX. 1 FT. BELOW MEAN LOW WATER SPRINGS.

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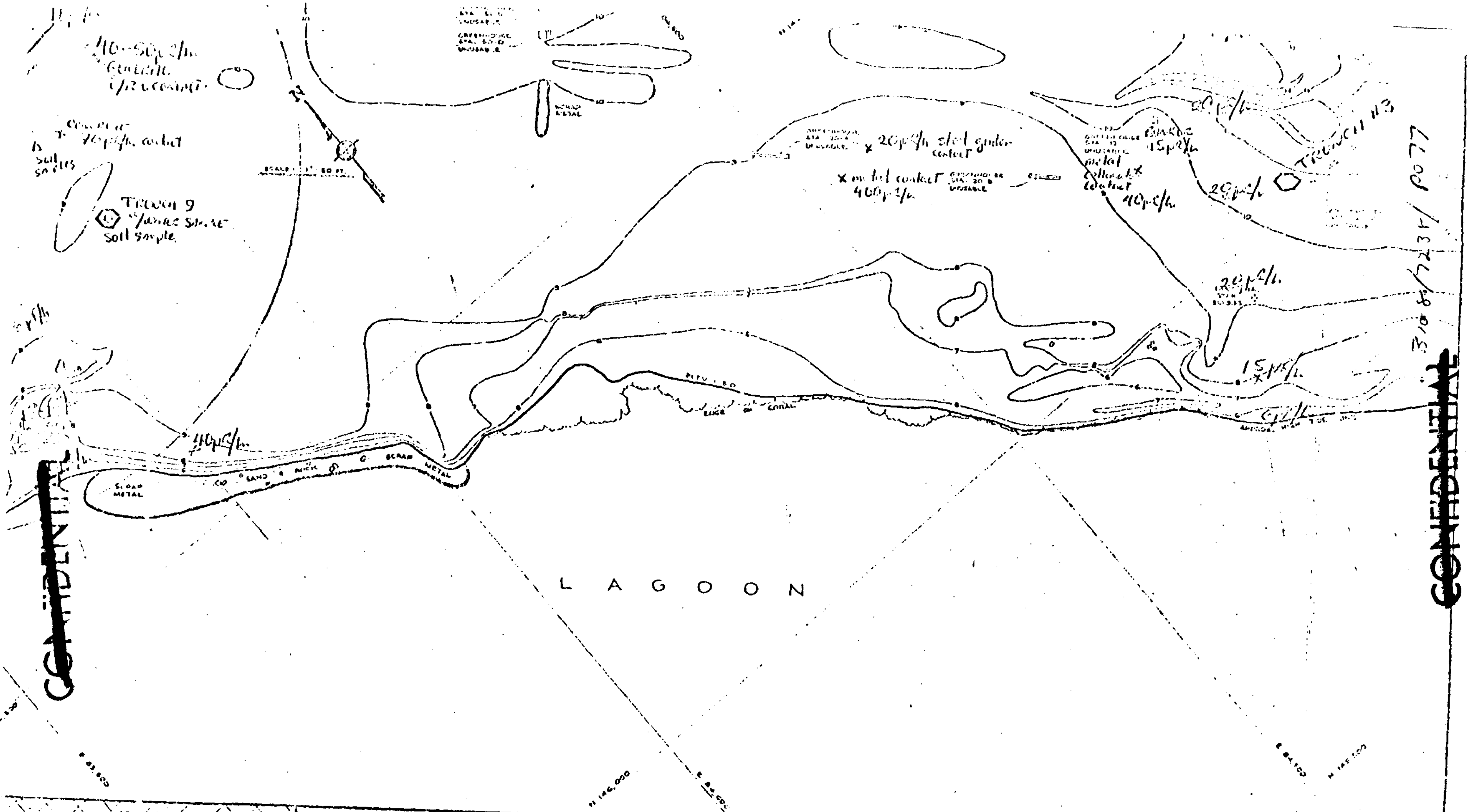

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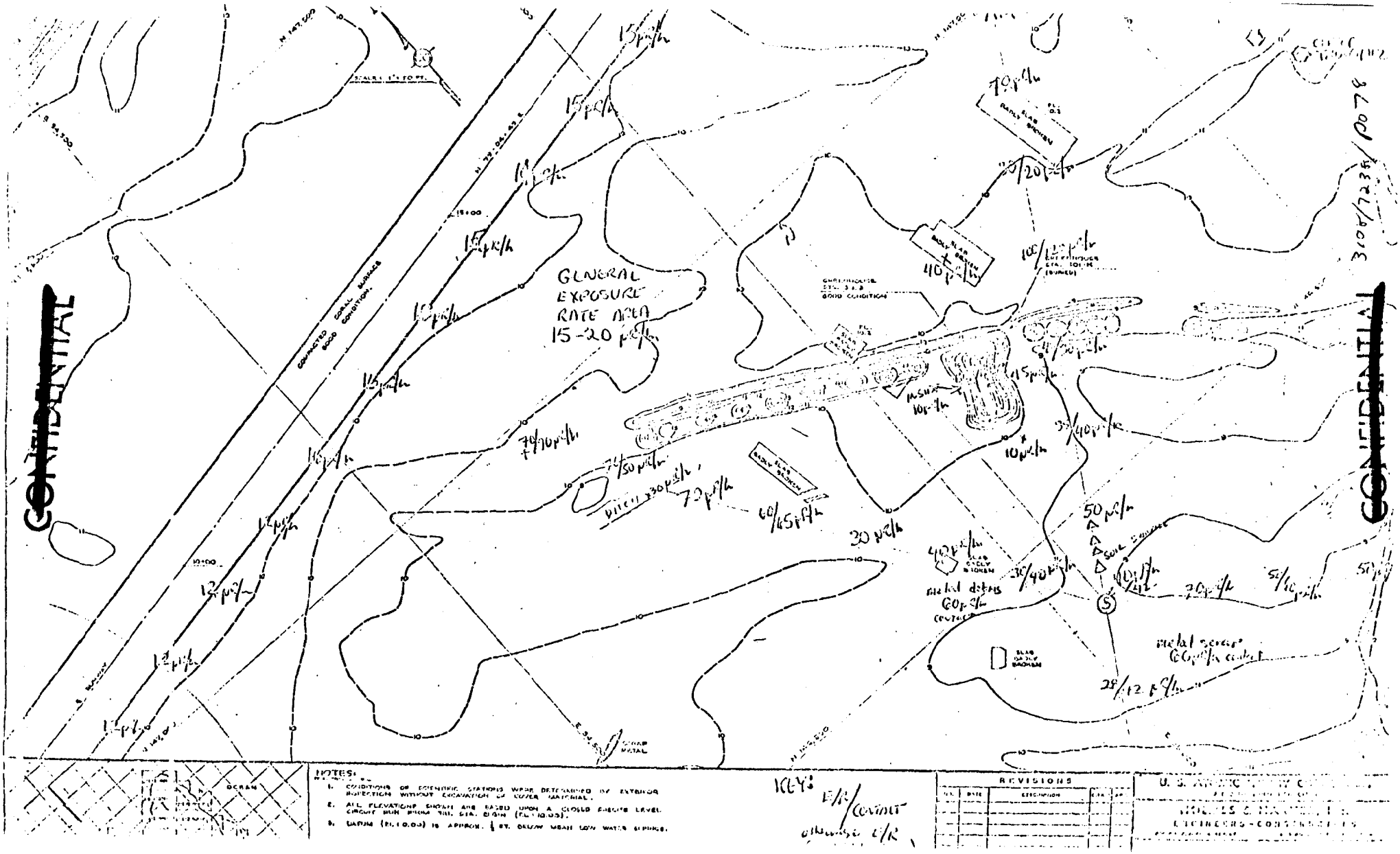
CONFIDENTIAL
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GENERAL EXPOSURE RATE AREA 15-20 p/h
15 p/h
10 p/h
20 p/h
30 p/h
40 p/h
50 p/h
NOTES:
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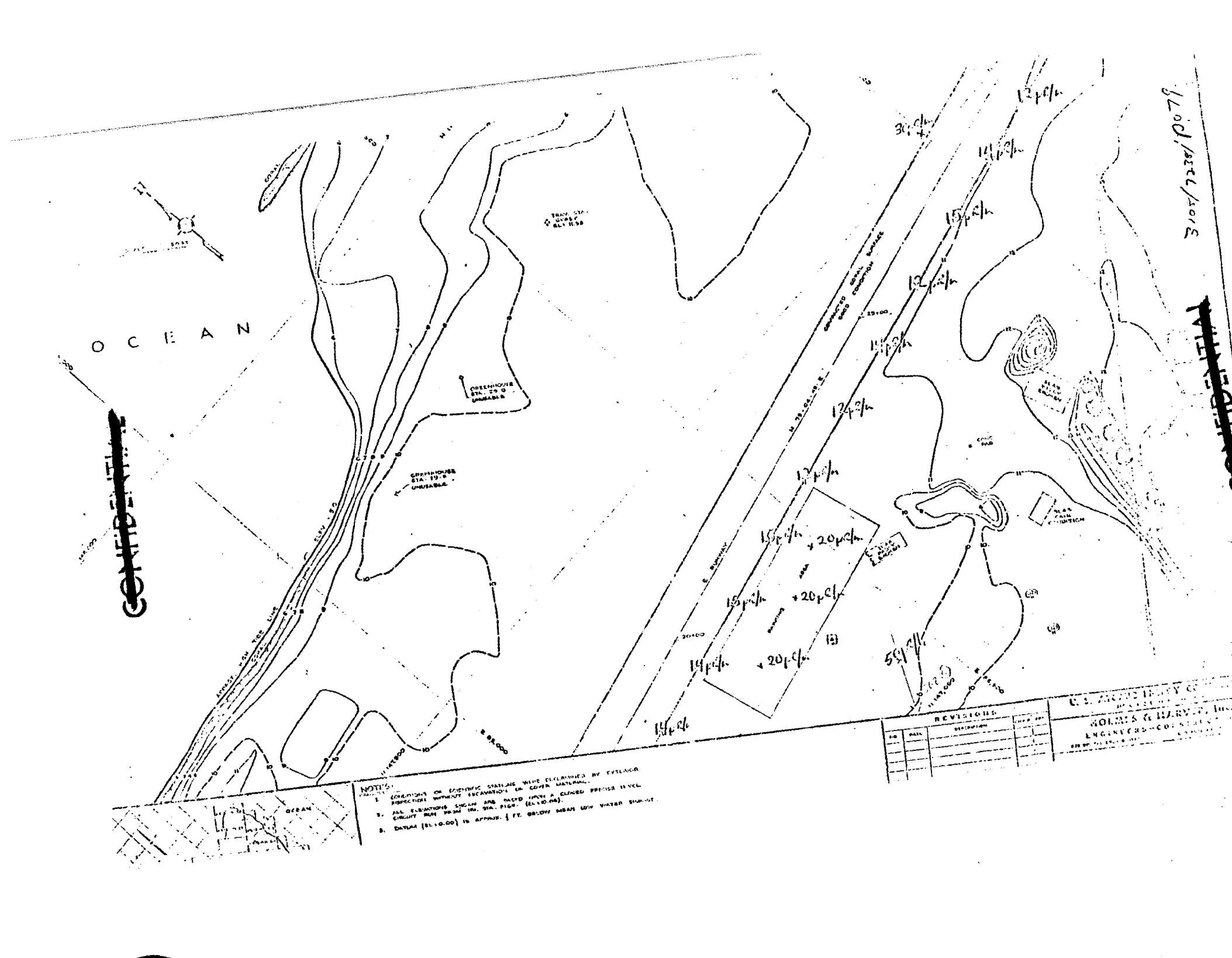
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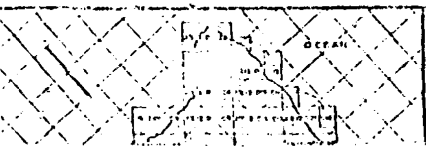

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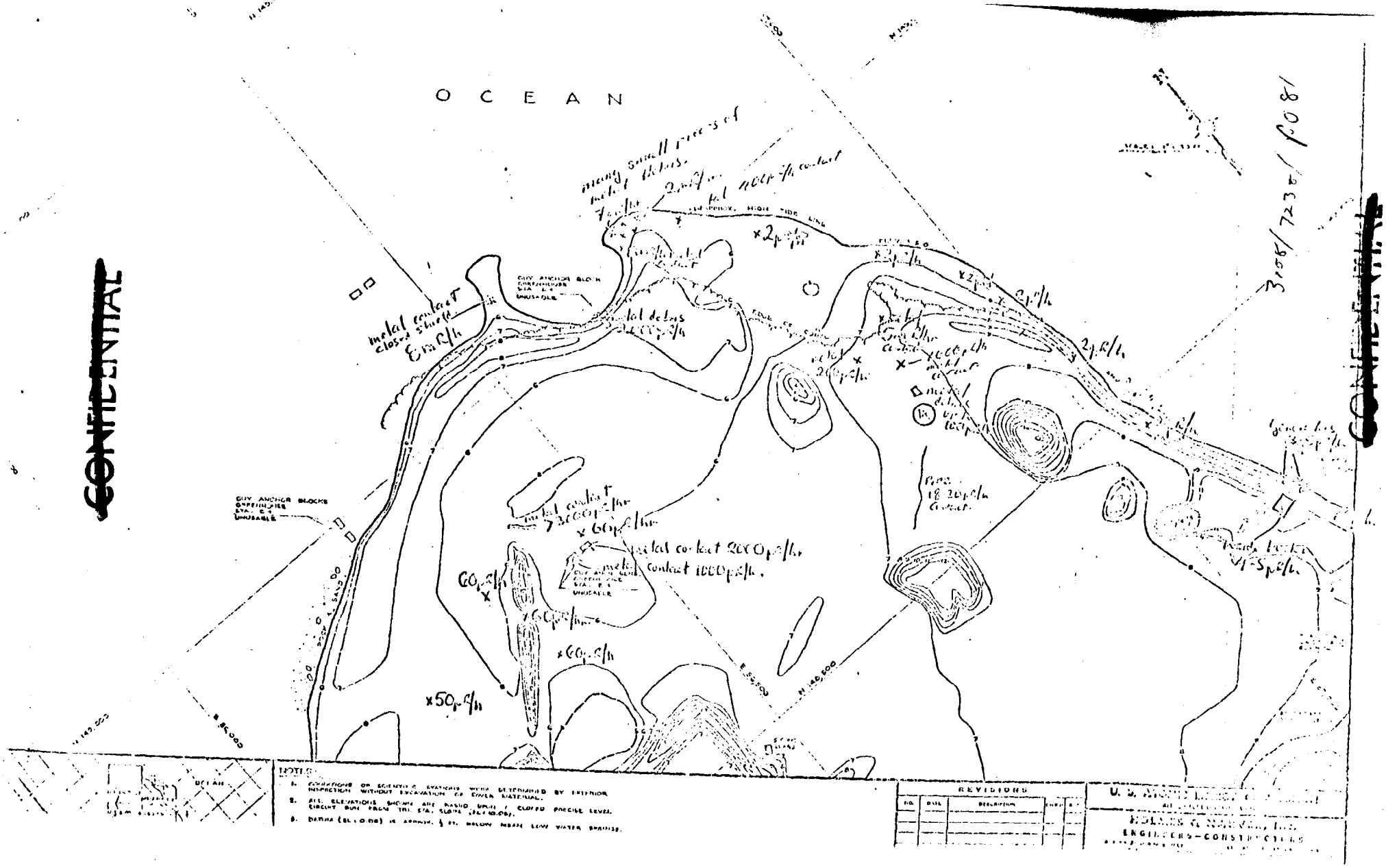

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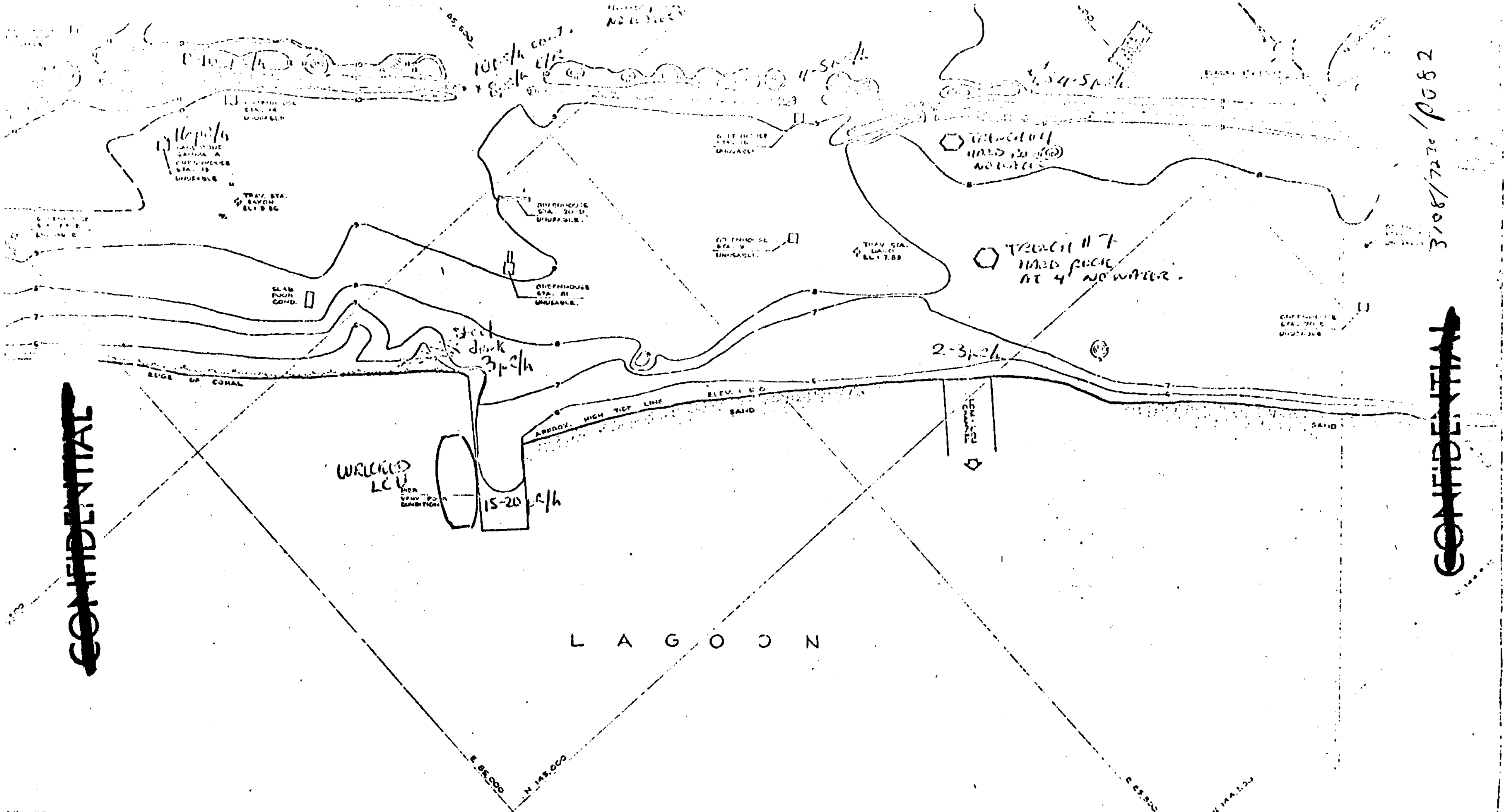

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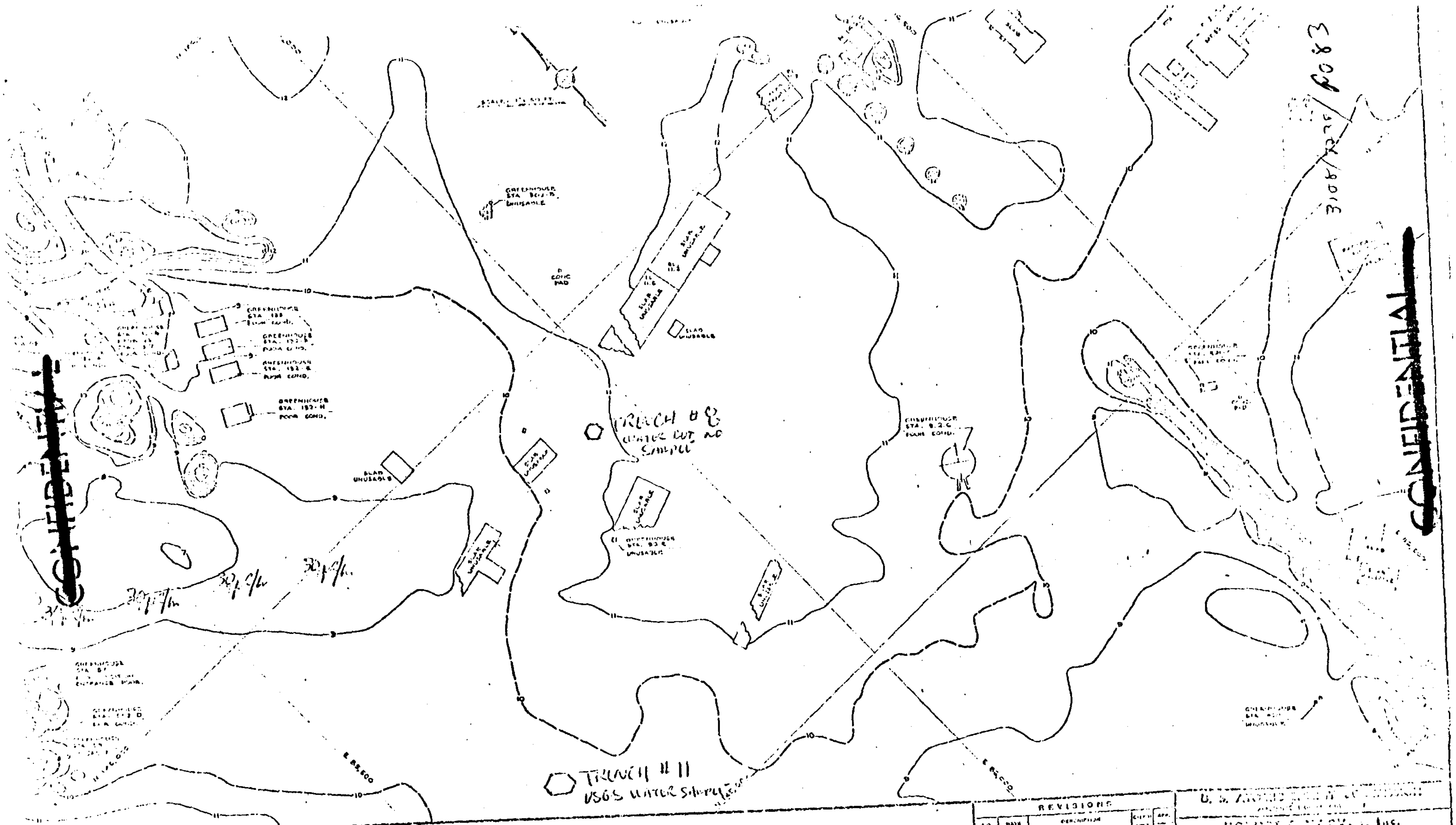

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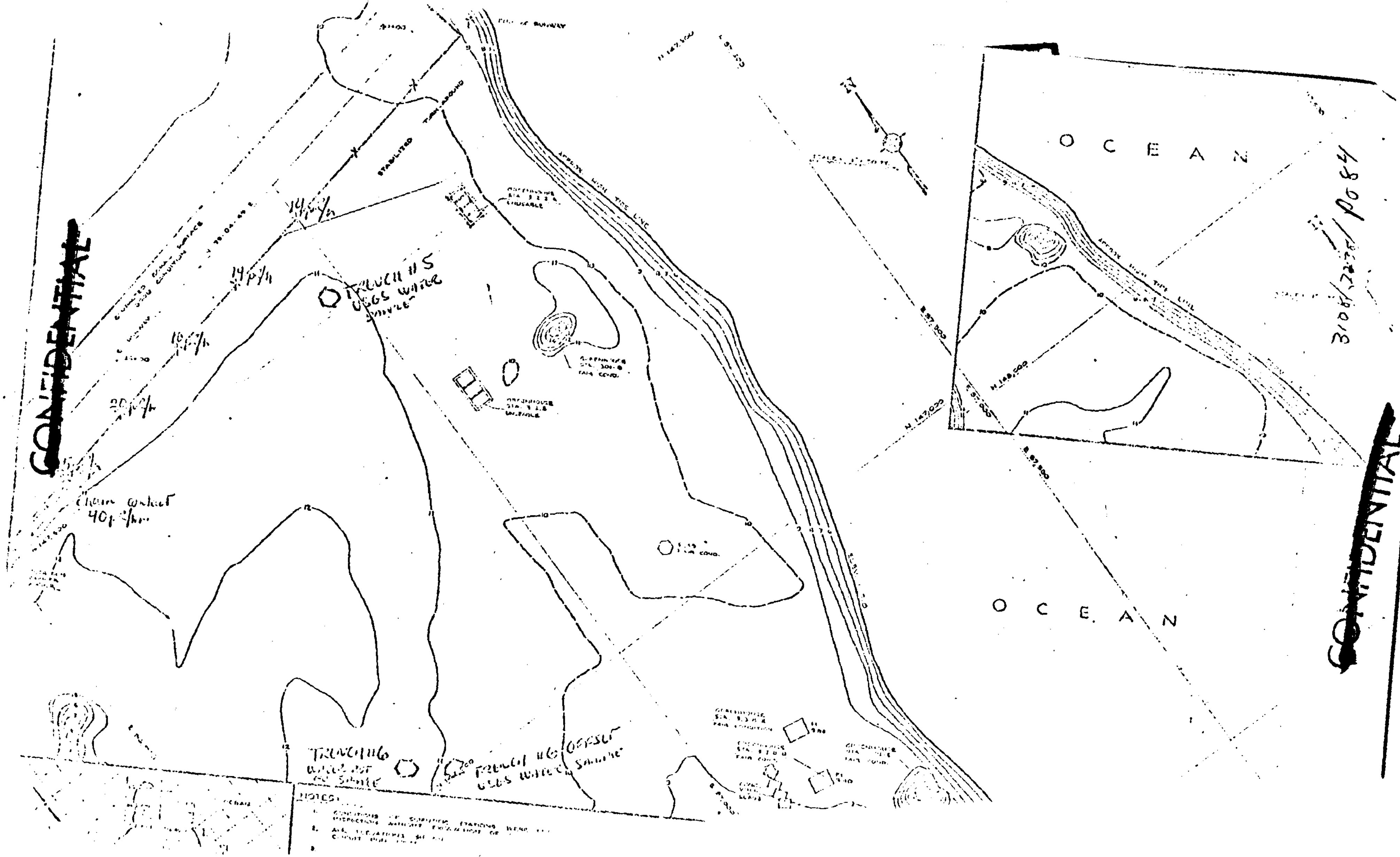
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TRENCH #5 USGS WATER SAMPLE
STABILIZED TURNAROUND
APPROX. HIGH TIDE LINE
OCEAN
OCEAN
TRENCH #6 OFFSET USGS WATER SAMPLE
NOTES:
CONFIDENTIAL

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OCEAN
LAGOON
x15 µR/h
x15 µR/h
x15 µR/h
x15 µR/h
x15 µR/h
NOTE:
GREENHOUSE SERIES 70 & 71 STATIONS. ALL UNUSABLE.
IVY SERIES 623 STATIONS. ALL UNUSABLE.
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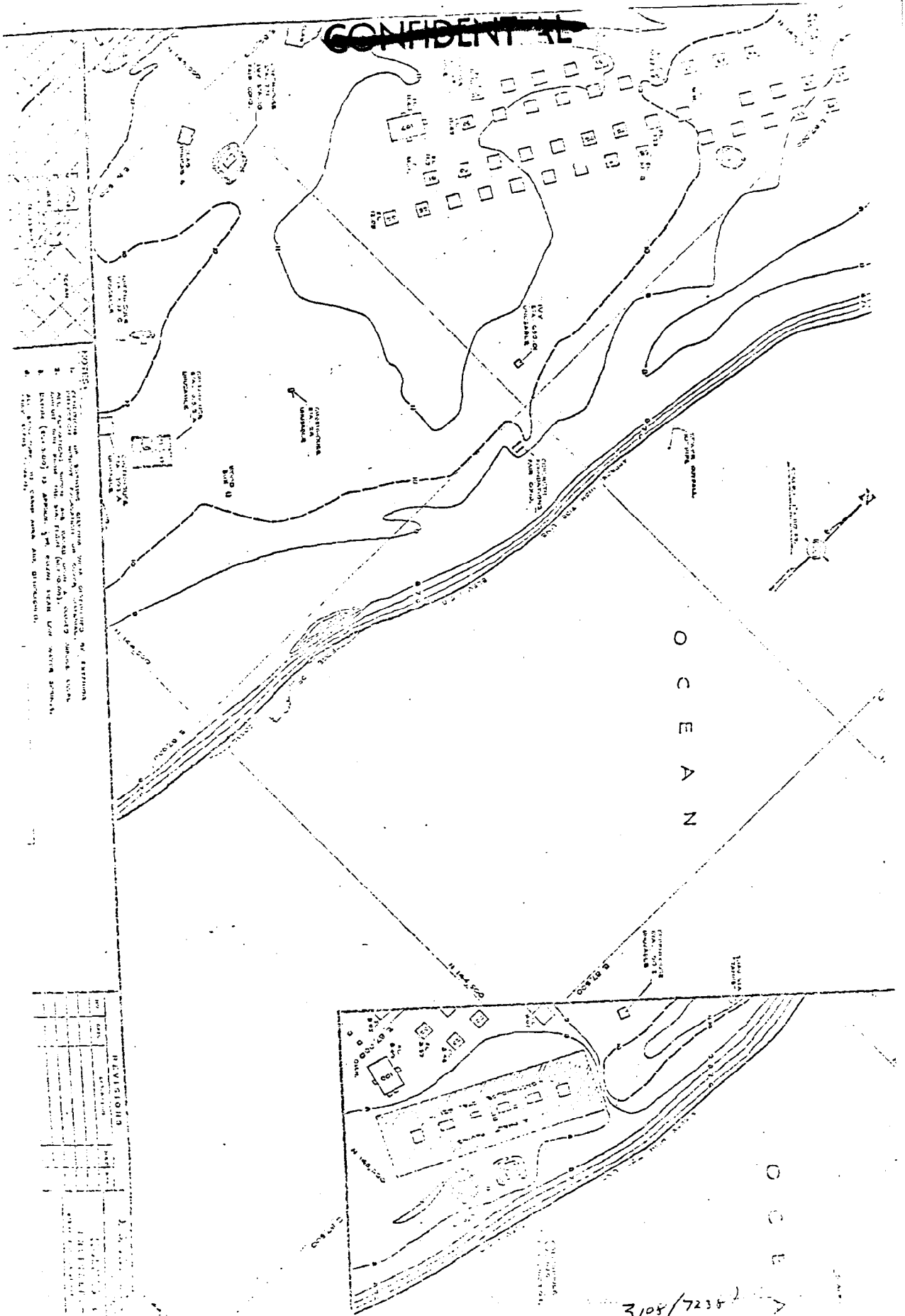

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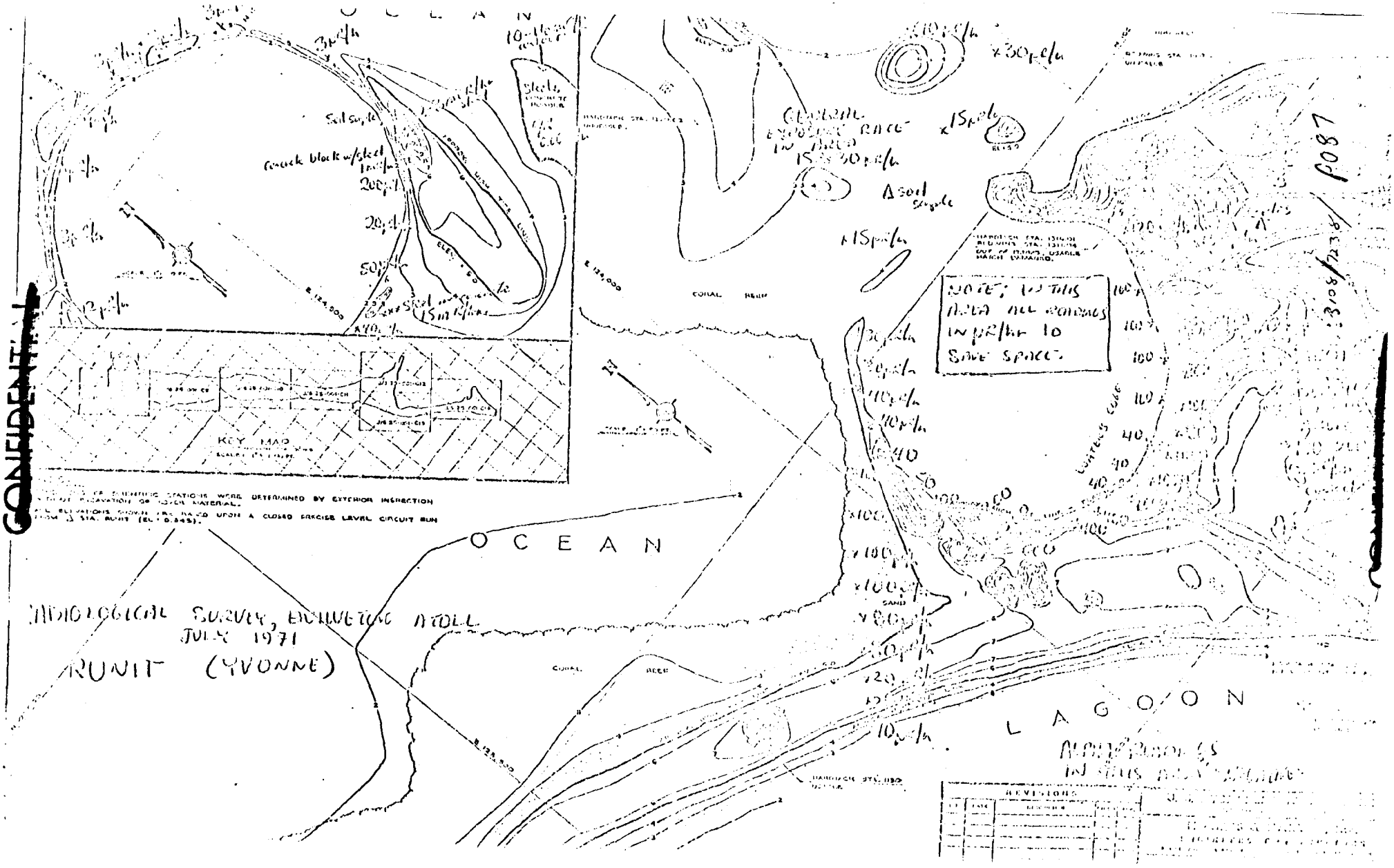
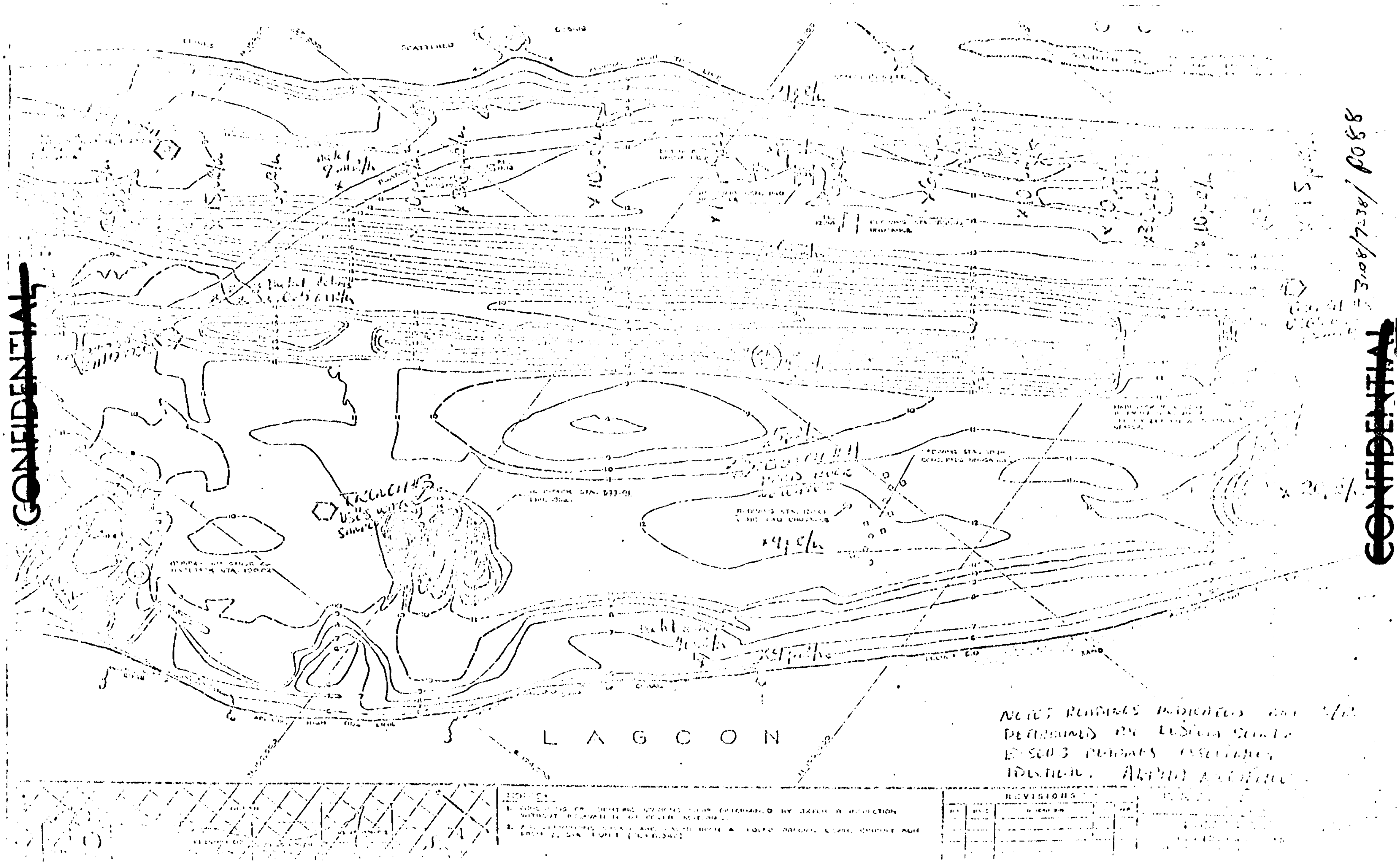

CONFIDENTIAL
OCEAN
KEY MAP
OCEAN
LAGOON
NOTE: TO THIS AREA ALL SOUNDS IN FT/HR TO SAVE SPACE.
BIOLOGICAL SURVEY, ENIWETOK ATOLL
JULY 1971
RUNIT (YVONNE)
1971
F087



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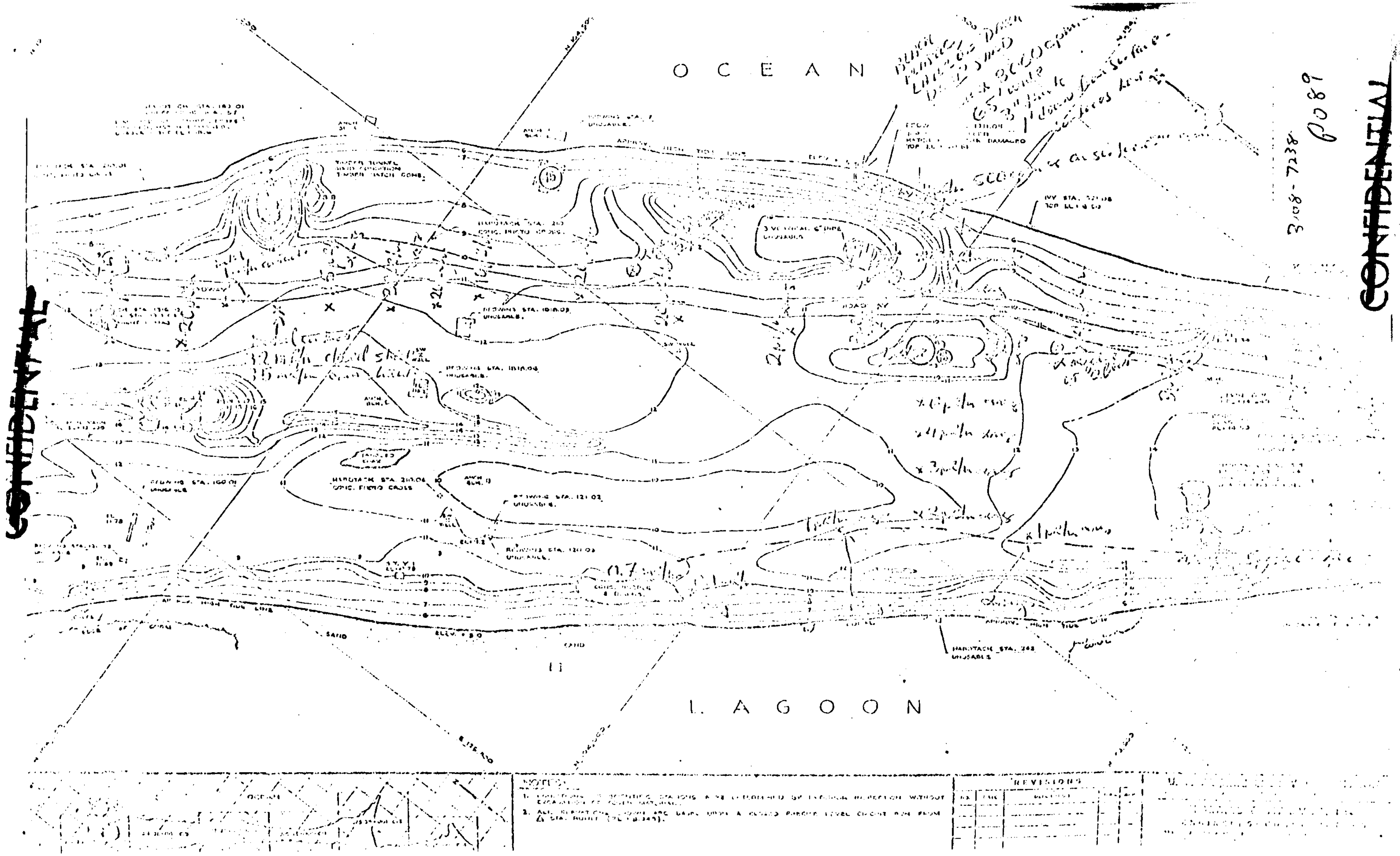

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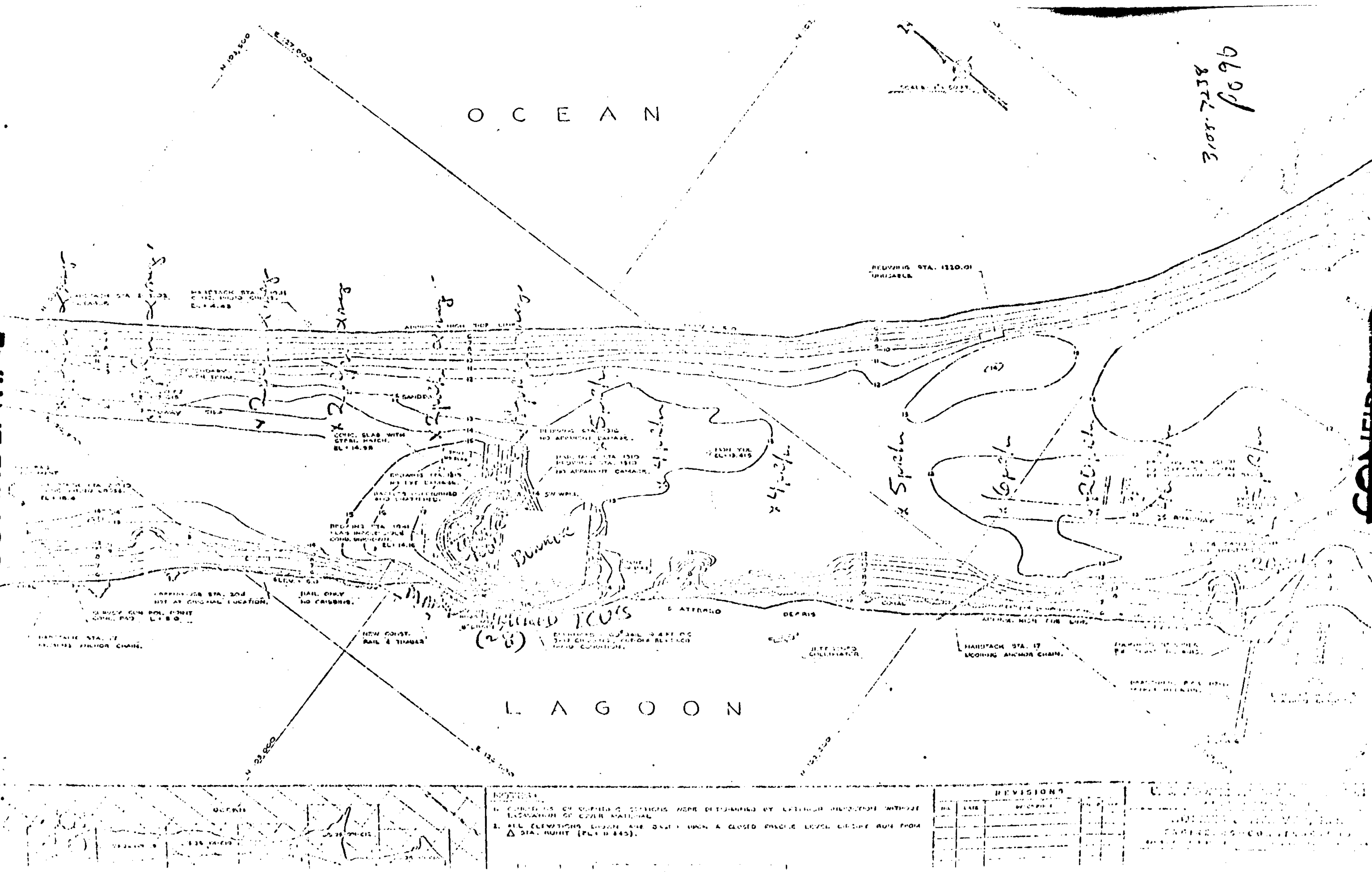

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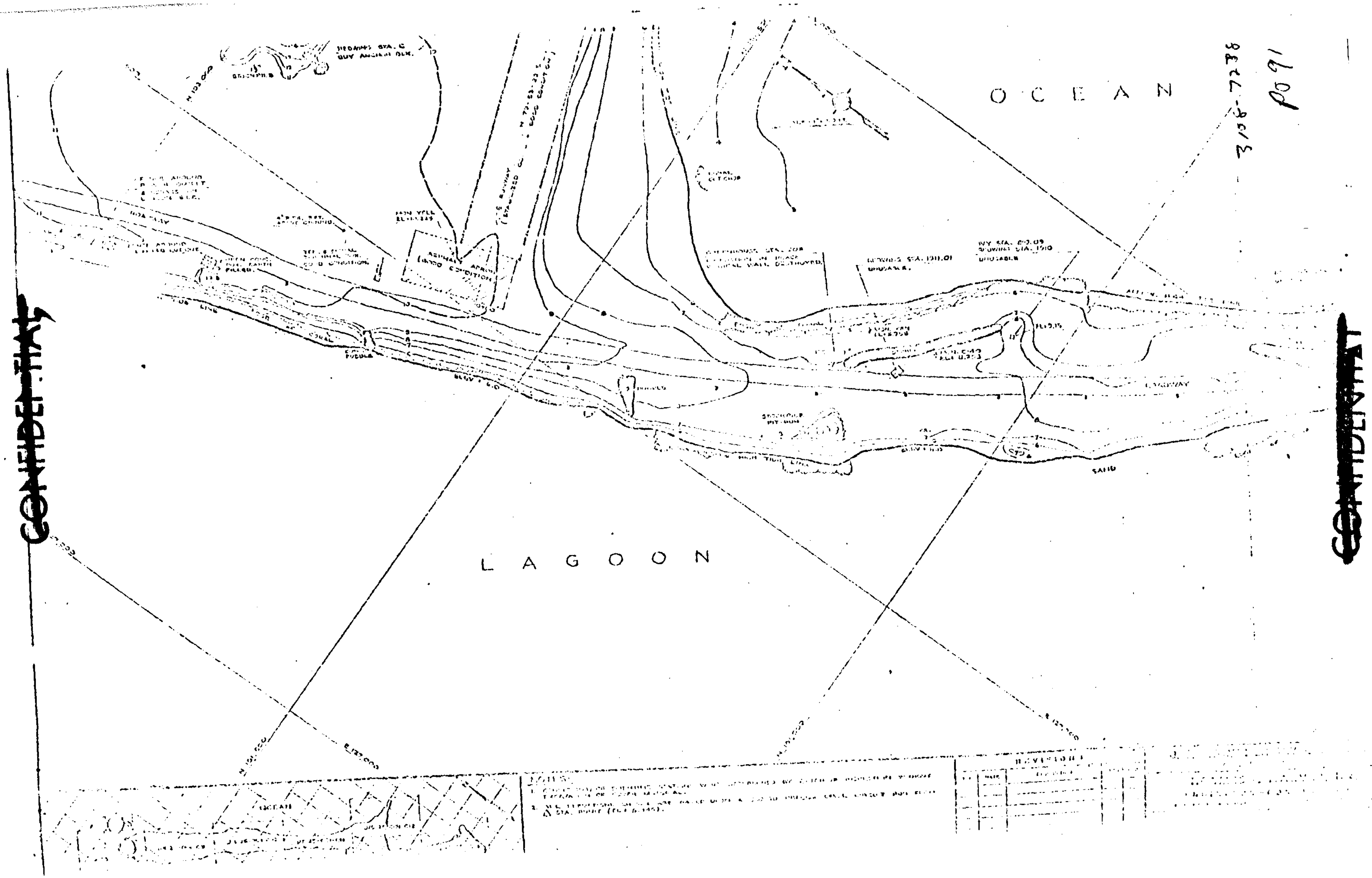

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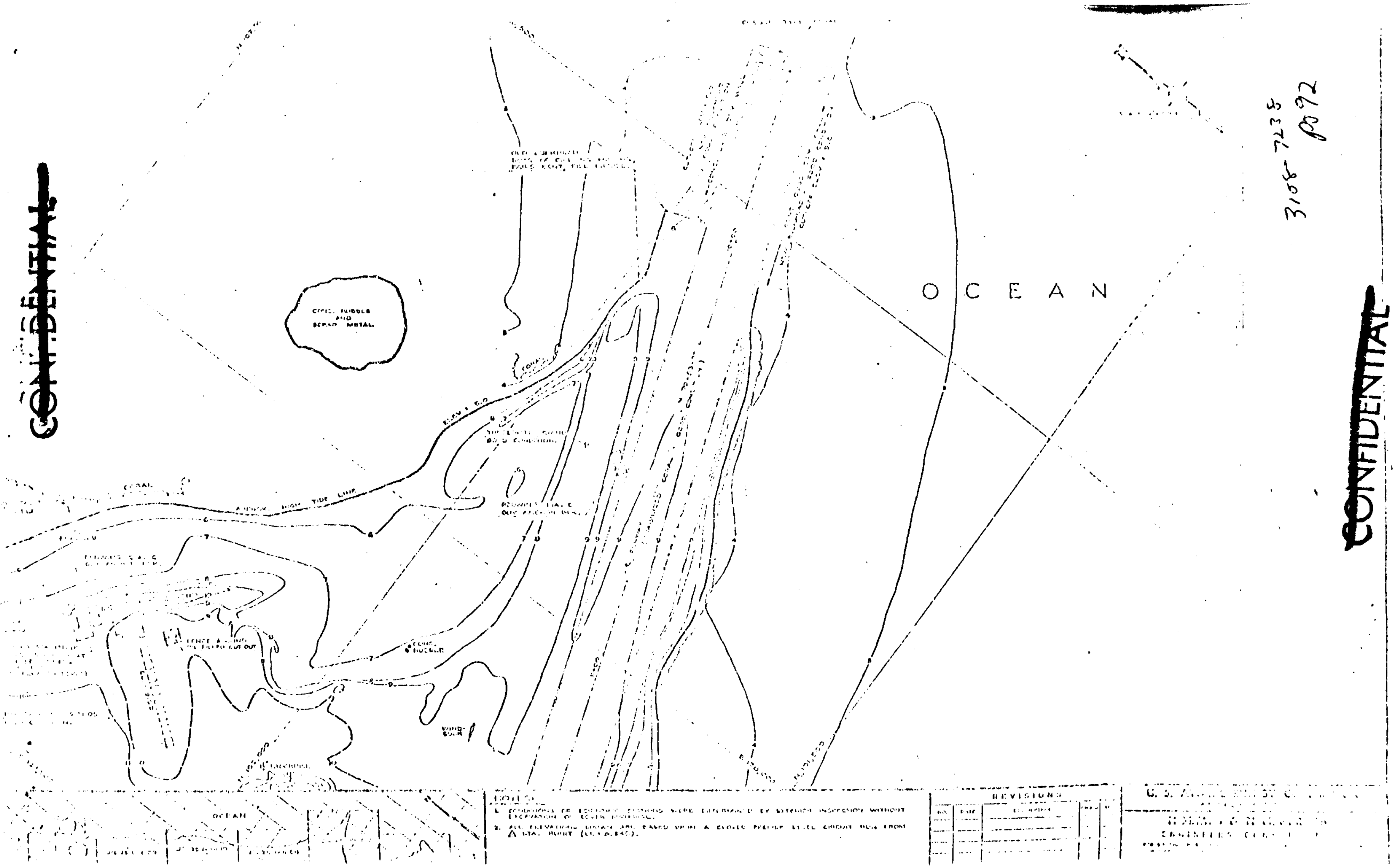

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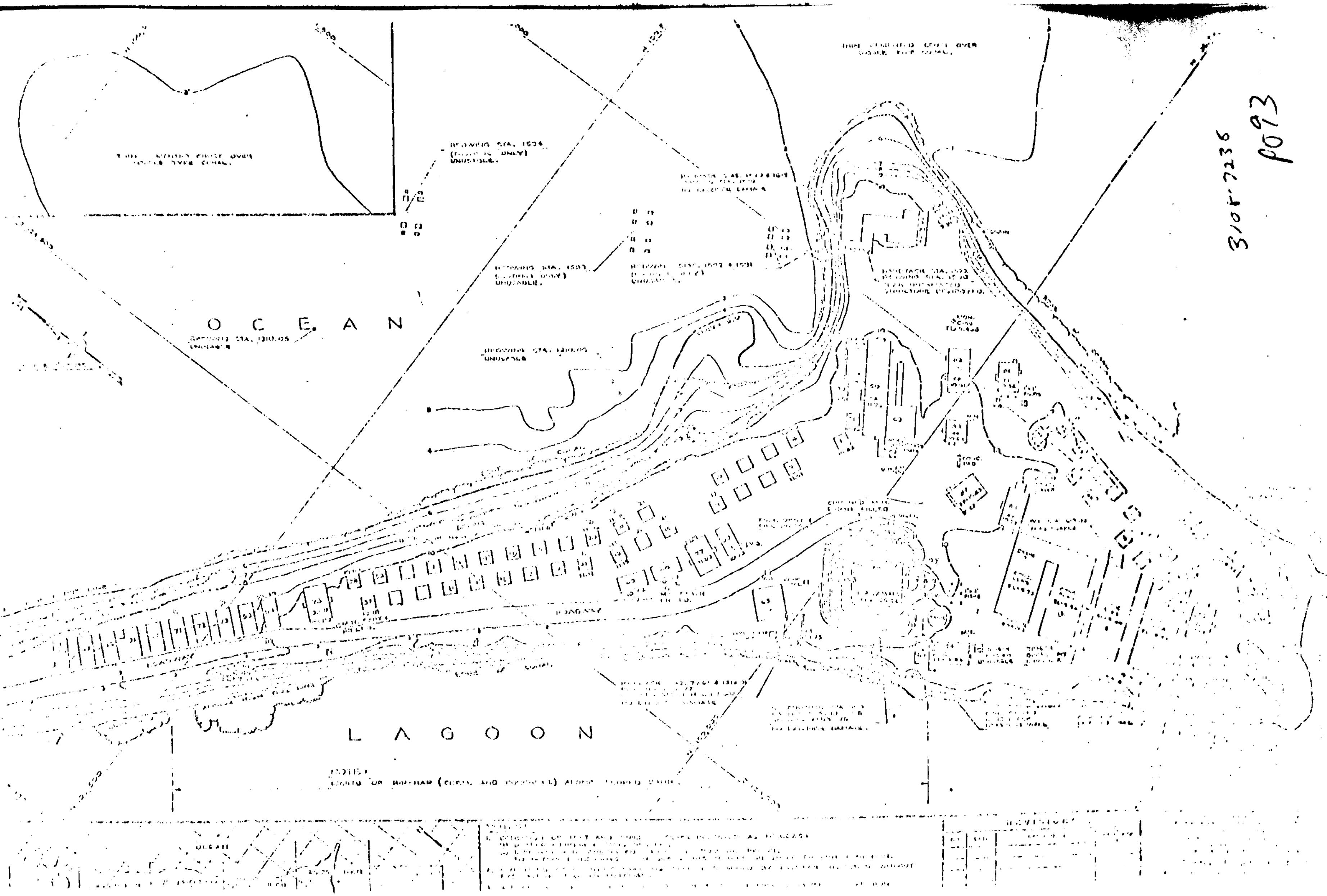

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