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Register No. 7

ANNEXES TO HARBOR DEFENSE PROJECT
HARBOR DEFENSES OF BOSTON

The short title of this document is OCA-AN-B

Under the provisions of A.R. 330-5 (paragraph 17c), each recipient of this document should make return therefor on June 30 and December 31 of each year to the Chief of Coast Artillery, Washington, D.C.

DECLASSIFIED
DOD Dir. 5200.9/Sept. 27, 1988
NMW by 14 data 10/24/11
Per Sec Army by TAGO 7063,
17 July 1967.

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ANNEX A

SEACOAST GUNS

AUTHORITIES

1. This Annex was prepared January 25, 1934, by a Board of Officers appointed under the provisions of paragraph 1 d, AR 100-20.

2. Approved by the Secretary of War in the 14th Indorsement, AG 660.2 (1-25-34)(Misc.) E, dated August 13, 1934.

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ANNEX A.

SEACOAST GUNS.

1. Tactical Organization. The organization of the harbor defense into six groups and one groupment is shown in Exhibit 1-A.

a. The underwater defense with its rapid fire batteries is organized into a groupment, since the number of mine groups, nine, is large and is divided between Broad Sound and Nantasket Roads; and also since the mine planters will serve all parts of the underwater defense and should not be assigned to either group. X

b. The major calibre guns and mortars are organized into a long-range group, a southern group, and a northern group. The field of fire of the first group is mainly in the outer bay; of the second group in the direction of Nantasket Roads (see Exhibit 2-A) with CP at Point Allerton; and of the third group, in Broad Sound (see Exhibit 3-A) with CP at Fort Heath. The 155 mm. battery to be provided at Nahant is included in the long-range group for convenience, it being located on a flank of the harbor defense and near the long-range 12-inch battery at Fort Ruckman.

c. It is necessary to designate a fort commander in the case of four of the nine forts in order to provide for the eventuality of landing attack or the severance of communications. In the case of these four forts, the senior battery commander has been designated in Exhibit 1-A as the fort commander, except in the case of Fort Ruckman (to which the 155-mm. battery is attached) where the battery commander of Battery Gardner has been designated. At Fort Duvall, there is but one organization, the 16-inch battery. Each of the other forts has a group or groupment commander present who becomes fort commander when the need for such a commander arises. X

d. The five antiaircraft batteries are organized into one group with command post at Fort Standish, where there is a capacious fire control station, otherwise surplus, with adequate space for the antiaircraft intelligence center. X

- (1). Each of the five antiaircraft batteries is organized into a gun, a machine gun and a searchlight detachment.

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2. a. Under the provisions of the Harbor Defense Project approved by the Secretary of War in 1st indorsement, December 27, 1932, (AG 660.2; 5-17-32; Misc. E), there are four 10-inch disappearing guns in the harbor defense which are to be retained on a reduced maintenance status, with no provision for personnel, as a reserve of material. These guns are Battery Morris at Fort Standish and Nos. 3 and 4 guns of Battery Bartlett at Fort Warren. One of these batteries has been assigned to each of the two groups into which the major-calibre, medium-range guns are organized.

b. Guns Nos. 3 and 4 of Battery Bartlett should hereafter be designated Battery Bartlett as the other guns are no longer required and are to be scrapped.

3. a. The field of fire of each of the batteries of the harbor defense is shown in an exhibit appended to Annex B, this exhibit showing also the fire-control installations of the battery.

b. An airplane photograph of each of the nine forts of the harbor defense is attached; the photographs are marked Exhibits 6-A to 14-A. X

LONG-RANGE GROUP.

4. Battery Long, two 16-inch barbette guns at Fort Duvall. The field of fire is shown in Exhibit 2-B of Annex B. The dead space resulting from the high traverse lies either on the land or close to shore and is unimportant. There is a small dead area formed by Point Allerton but this area extends no farther than 3,000 yards from the shore and is not a serious handicap. The dead spaces are shown in Exhibit 4-A.

5. Battery Gardner, two 12-inch LR guns at Fort Ruckman. The field of fire of this battery is shown in Exhibit 2-B. The dead space caused by the high bomb-proof traverse lies mostly on the land or within the harbor and is of no serious consequence. There is a rocky knoll, Bayley Hill, 300 yards to the southeast of the battery which forms a mask that prevents fire at less than about 4,500 yards range; the high point of this knoll should be removed. Both dead areas are shown in Exhibit 5-A. X

6. Batteries Gardner and Long are of such value in the defense against naval operations that they are likely to be the objects of air attack and they are at present very conspicuous, as shown in airplane photographs marked Exhibits 6-A and 7-A. The exposed concrete surfaces, since the photographs were taken, have been painted with asphalt emulsion, which has been found by experiment to greatly reduce visibility; and trees and shrubs have been so planted as eventually to assist in concealing the batteries. X

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7. 155-mm. Battery, four guns, at Nahant. a.

This battery, authorized by the Harbor Defense Project approved by the Secretary of War in last indorsement, December 27, 1932, (AG 660.2; 5-17-32; Misc. E), is to be provided for the purpose of covering the water area north and northeast of Nahant. When an emergency arises the Harbor Defense Commander will select a site for the battery that will enable it to carry out the proscribed mission, which is to prevent destroyers from lying north of Nahant, where they could fire into the left rear of Battery Gardner and seriously interfere with the operation of these guns.

b. The site selected should be such that the position can be occupied expeditiously and permit the battery to open fire without any unusual amount of preparation. The mission of this battery involves covering a field of fire of such limited extent that it can be accomplished without the use of concrete platforms.

c. (1). One position which may be considered by the Harbor Defense Commander is on a knoll on the shore at a point shown as "Spouting Horn" on U. S. Coast and Geodetic Survey chart No. 240; the site is 1,050 yards northwest of East Point. Located on this knoll, with the axis of the field of fire 5° north of east, all four guns will be able to fire from a line tangent to East Point on the right to a line tangent to Marblehead Neck on the left; and one gun will be able to fire to the north and northwest in Nahant Bay. This site is shown in Exhibit 15-A.

(2). A second suitable location, also shown in the exhibit, is near the middle of Lynn Beach, north of Little Nahant and south of Lynn. This strip of open beach is the property of the Metropolitan Park Commission, a Commonwealth of Massachusetts public corporation, and probably will be maintained free of buildings. A field of fire can be obtained from a line tangent to Spouting Horn, on the right, to a line passing just south of Marblehead Neck on the left, as shown in Exhibit 15-A.

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SOUTHERN GROUP.

8. This group is intended primarily to cover the water area to the southeast and east of the harbor. The group commander's station is favorably located on high ground at Point Allerton, overlooking the field of fire. There are four 12-inch guns and ten 12-inch mortars in this group, and two 10-inch guns in reserve. The field of fire of the group as a whole is shown in Exhibit 2-A; and in Annex B, the field of fire of each battery is shown in a separate exhibit with its fire-control installations.

9. Battery Stevenson, two 12-inch disappearing guns, at Fort Warren. The field of fire of this battery is shown in Exhibit 4-B of Annex B. Due to construction of the emplacements, the guns can be fired 10° farther to the left than they can be loaded. On the right the firing arc similarly can be increased for firing, though not for loading; but this additional arc would be on land. The director is correctly located, and there is no interference with one gun of the battery by the other in any part of the field of fire.

10. Battery Ripley, two 12-inch barbette guns at Fort Revere. a. The field of fire of Battery Ripley is shown in Exhibit 5-B. By removing the ladder leading to the loading platform from the left side of the carriage, the field of fire has been increased to the right by approximately 9° . A similar increase could be made on the left of the field of fire but this is unnecessary.

b. As the line of gun centers is 99° , No. 2 gun could not fire in the increased arc while No. 1 gun is manned. Nevertheless the modification has been made in the case of both guns since No. 1 gun may be disabled.

11. Battery Cushing-Whitman, ten 12-inch mortars at Fort Andrews. a. There has been formed one battery of the two adjacent batteries, Cushing, four 12-inch mortars, and Whitman, six 12-inch mortars. Requirements for fire-control stations and communications were reduced by the consolidation. While fire of the ten mortars will be confined to one target, this is not a material disadvantage because other major-calibre, medium-range batteries bear on the same water area.

b. While the mortars are capable of all-around fire, the important part of the field of Battery Cushing-Whitman lies from azimuth 170° on the left to azimuth 282° on the right. See Exhibit 6-B.

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c. The war reserve of ammunition heretofore approved for Battery Whitman is 648 rounds, all of which should be stored in the harbor defense. The war reserve of Battery Cushing is 432 rounds, all of which likewise should be stored in the harbor defense. As these mortars may be expected to fire chiefly in the outer zones because of restricted channels or shallow water within 8,000 yards range, most of the ammunition should be for the longer ranges; the distribution should be three 700-lb. projectiles to one 1046-lb. projectile.

	: Battle	: Central	: War
	: Allowance	: Reserve	: Reserve
<u>Battery Cushing-Whitman</u>	:	:	:
1046-lb.	: 270	: 0	: 270
700-lb.	: 810	: 0	: 810
Total	: 1080	: 0	: 1080

12. Nos. 3 and 4 Guns, Battery Bartlett, 10-inch D.C. at Fort Warren. a. These two guns constitute a reserve of material. No manning party is provided for them. Should other guns be disabled, these guns may be used, personnel being shifted from the disabled armament. No fire control system is provided, data for this battery being furnished by the baseline of the disabled battery.

b. The field of fire is shown in Exhibit 7-B. The field of each gun can be increased five degrees on the right by removing the controller box from its present position and placing it elsewhere; the expense would be nominal; but as the increased field of fire would be on the land, the alteration is not considered necessary.

NORTHERN GROUP.

13. This group is planned to cover the water area to the northeast and east of the harbor. The group commander's station is well located on the high bluff at Fort Heath, overlooking Broad Sound and the approach to the main ship channel. The group comprises three 12-inch guns and twelve 12-inch mortars, with two 10-inch guns in reserve. The field of fire of the group as a whole is shown in Exhibit 3-A; and in Annex B each battery is shown in a separate exhibit with its fire control installations.

14. Battery Kellogg, six 12-inch mortars, and Battery Lincoln, six 12-inch mortars, at Fort Banks. a. The fields of fire of these two mortar batteries are shown in Exhibit 8-B; as the two batteries are close together, their fields of fire are plotted as one. While they are capable of all-around fire, the important part of the field lies from azimuth 220° clockwise to azimuth 345°.

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b. The war reserve of ammunition for Battery Kellogg is 648 rounds and for Battery Lincoln it is the same. All should be stored in the harbor defense. These batteries may be expected to fire chiefly in the outer zones but there is also a considerable area of deep water within range of the heavier projectile. The distribution should be two 700-lb. projectiles to one 1046-lb. projectile.

15. Battery Winthrop, three 12-inch disappearing guns at Fort Hoath. The field of fire is shown in Exhibit 9-B. The battery is well located.

16. Battery Morris, two 10-inch disappearing guns at Fort Standish. The battery constitutes a reserve of material. No manning party nor fire control system is provided but they are to be taken from the disabled armament which this battery replaces. The field of fire is shown in Exhibit 10-B.

RAPID-FIRE BATTERIES.

17. MINE GROUP 1. Two 6-inch and three 3-inch batteries are assigned to this southern group. The mine field lies across Nantasket Roads between the Brewster islands and Point Allerton and in rear of it is an antisubmarine net with no gate.

a. Battery McCook, two 6-inch barbette guns at Fort Andrews. The field of fire is shown in Exhibit 11-B. The high ground at Hull prevents covering the south half of the mine field.

b. Battery Whipple, two 6-inch barbette guns at Fort Standish. Both guns bear on the mine field, at ranges under 4,000 yards, as shown in Exhibit 12-B.

c. Battery Bumpus, two 3-inch pedestal mounts at Fort Andrews. The field of fire is shown in Exhibit 13-B. The high ground at Hull prevents fire on the south half of the mine field. The battery is approximately 4,300 yards from the mine field.

d. Battery Stevens, two 3-inch pedestal mounts at Fort Strong. This battery is masked from the mine field by Fort Warren and Gallups Island, as shown in Exhibit 14-B. Between these islands there is an angle of about 7°, from azimuth 272° to azimuth 279° approximately, in which the battery can fire on the mine field. The range is over 6,000 yards.

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e. Battery Williams, three 3-inch pedestal mounts at Fort Standish. This rapid-fire battery which could be valuable, has the field of fire shown in Exhibit 15-B; it covers the mine field at a range of less than 4,000 yards. No. 1 gun, however, cannot fire on the northernmost group of the mine field and No. 2 gun cannot fire on the northern half of the field; only one of the three guns can fire on the whole mine field. This is due to the azimuth of the directrix which is 29° east of south instead of being more to the east. The traverses formerly prevented firing Nos. 1 and 2 guns farther to the left than azimuth 272° and 278° respectively. The traverses have been cut back to allow these guns to fire as far to the left as Boston Light and so to cover the mine field.

18. MINE GROUP 2. Two 6-inch and two 3-inch batteries are assigned to this northern mine group. The mine field lies in Broad Sound, about 1,000 yards outside the entrance of North Channel (the main ship channel). On the south of the controlled mines is a barrage of Navy contact mines extending to Calf Island; and on the northwest is a similar barrage extending to Grovers Cliff. All of these mines should be defended by rapid-fire guns. There is an antisubmarine net across the junction of the North and South channels with a gate in the North Channel. Of the four batteries, one three-gun 6-inch battery is fully effective. The others are of little value for the defense of the mine field.

a. Battery Terrill, three 6-inch disappearing guns at Fort Standish. The field of fire is shown in Exhibit 16-B. All three guns bear on the mine field, at a range of approximately 6,000 yards.

b. Battery Sanders, three 6-inch disappearing guns at Fort Revere. The field of fire is shown in Exhibit 17-B. This battery is approximately 8,300 yards from the mine field.

c. Battery Basinger, two 3-inch pedestal mounts at Fort Strong. The field of fire is shown in Exhibit 18-B. The battery is prevented by high ground and buildings at Fort Strong from firing as far to the east as the controlled mines; it can assist with one gun in the defense of the contact mines extending northwest from the controlled mines toward Grovers Cliff, though the range to these mines is approximately 6,000 yards.

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d. Battery Taylor, two 3-inch pedestal mounts at Fort Strong. The field of fire is shown in Exhibit 19-B. The battery faces northwest and but one gun at a time can be fired to the eastward of Door Island. The range to the mine field is approximately 6,000 yards. This battery is of little value.

19. Ammunition. The war reserve and battle allowances of ammunition for the batteries of the harbor defense are shown in Exhibit 16-A. ✓

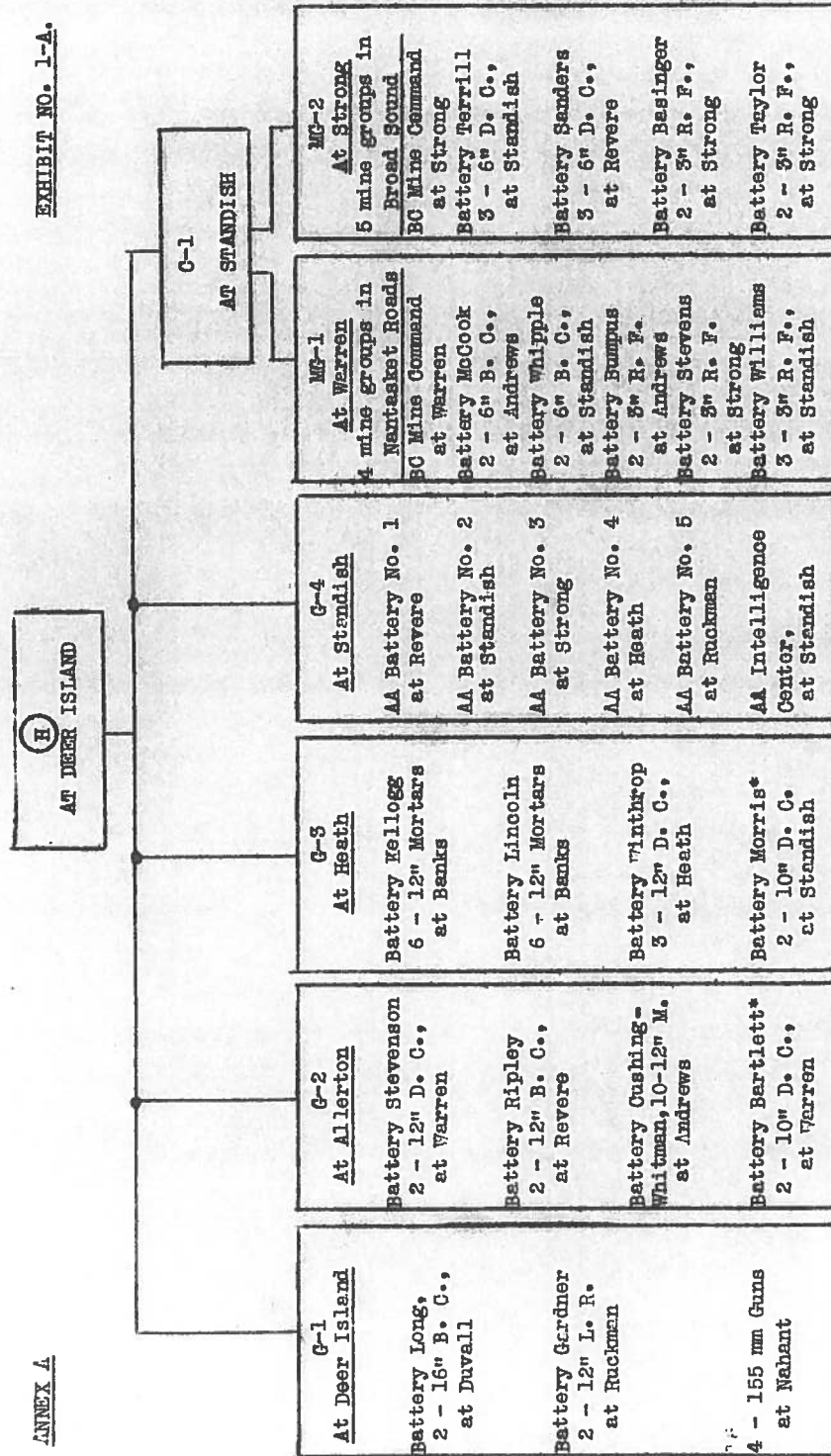
20. Cost Estimate. An estimate of cost and priority guide is appended as Exhibit 17-A. Those items which should be procured and installed in peace time are marked with an A. Those which should be procured in peace but whose installation may be deferred until an emergency arises are marked B. Those items to be procured and installed when an emergency arises are marked C. ✓

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EXHIBIT NO. 1-A.

ANNEX A



Each AA Battery includes a gun, a machine gun, and a searchlight detachment. Fort Commanders, where designation is needed; Fort Ruckman: BC Gardner; Ft. Banks, Senior BC; Ft. Revere, Senior BC; Ft. Andrews, Senior BC.

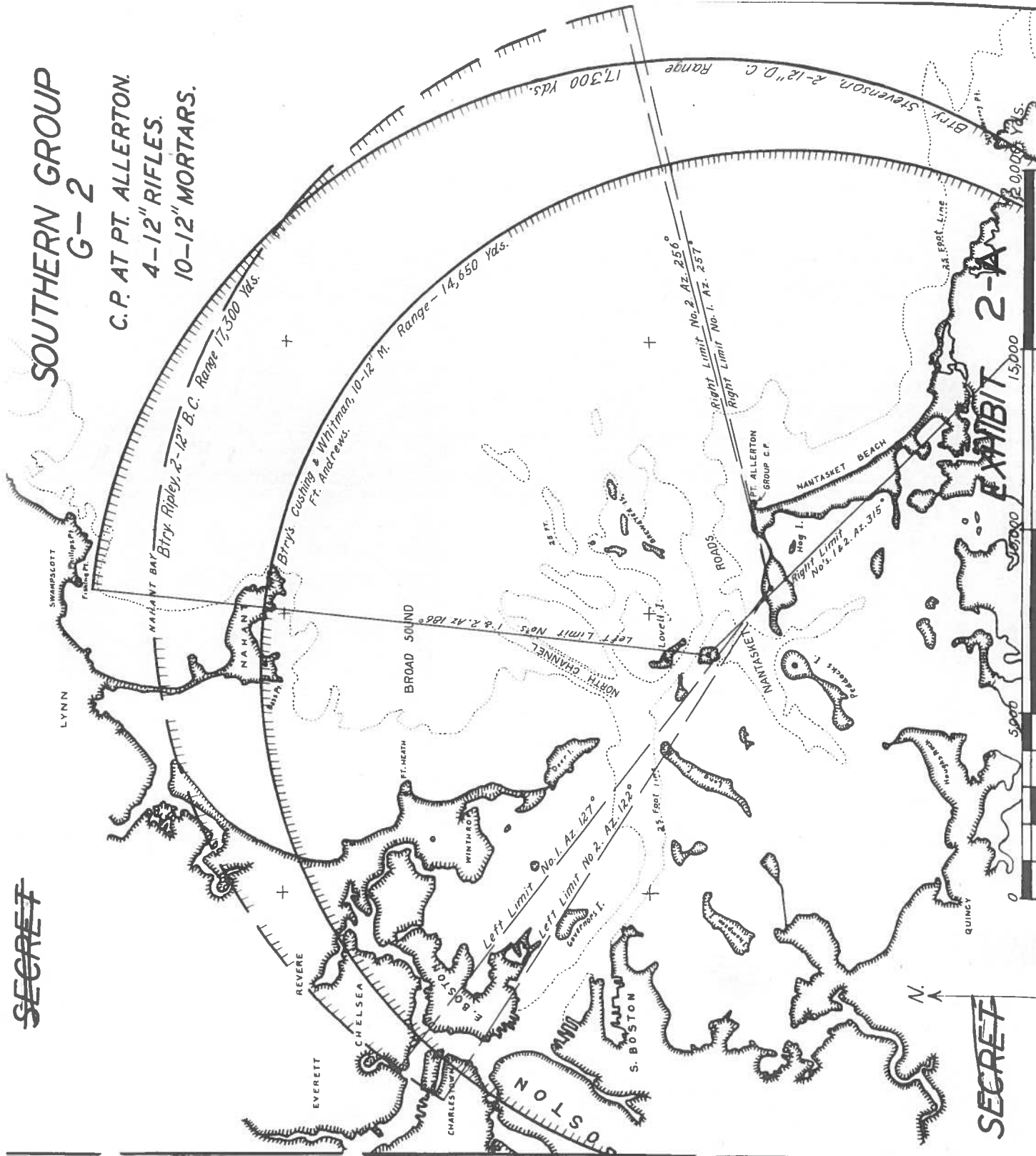
*Reduced maintenance status.

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SOUTHERN GROUP G-2

C.P. AT PT. ALLERTON.
4-12" RIFLES.
10-12" MORTARS.

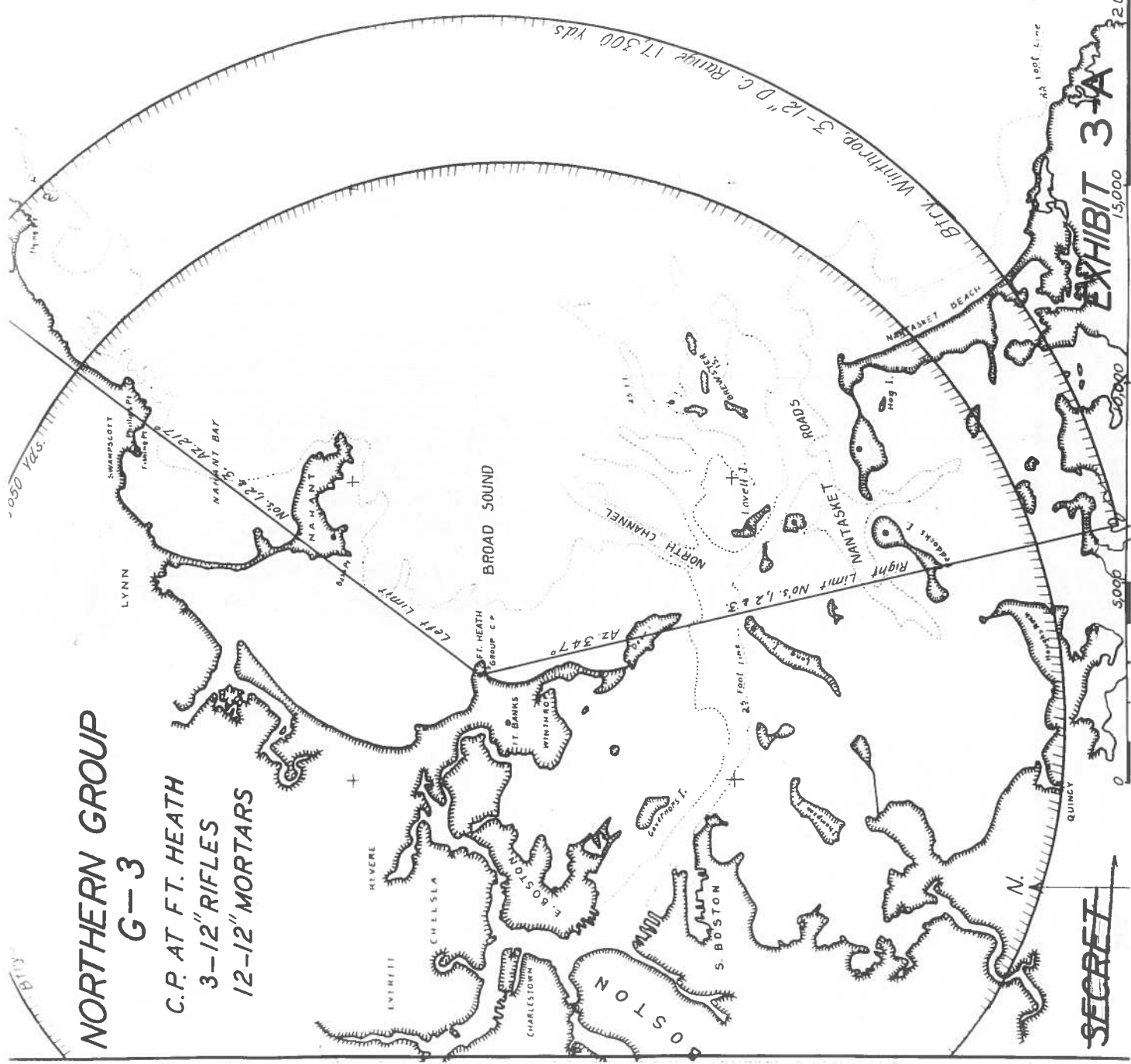


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EXHIBIT 2-A

NORTHERN GROUP G-3

C.P. AT FT. HEATH
3-12" RIFLES
12-12" MORTARS



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EXHIBIT 3-A

15,000

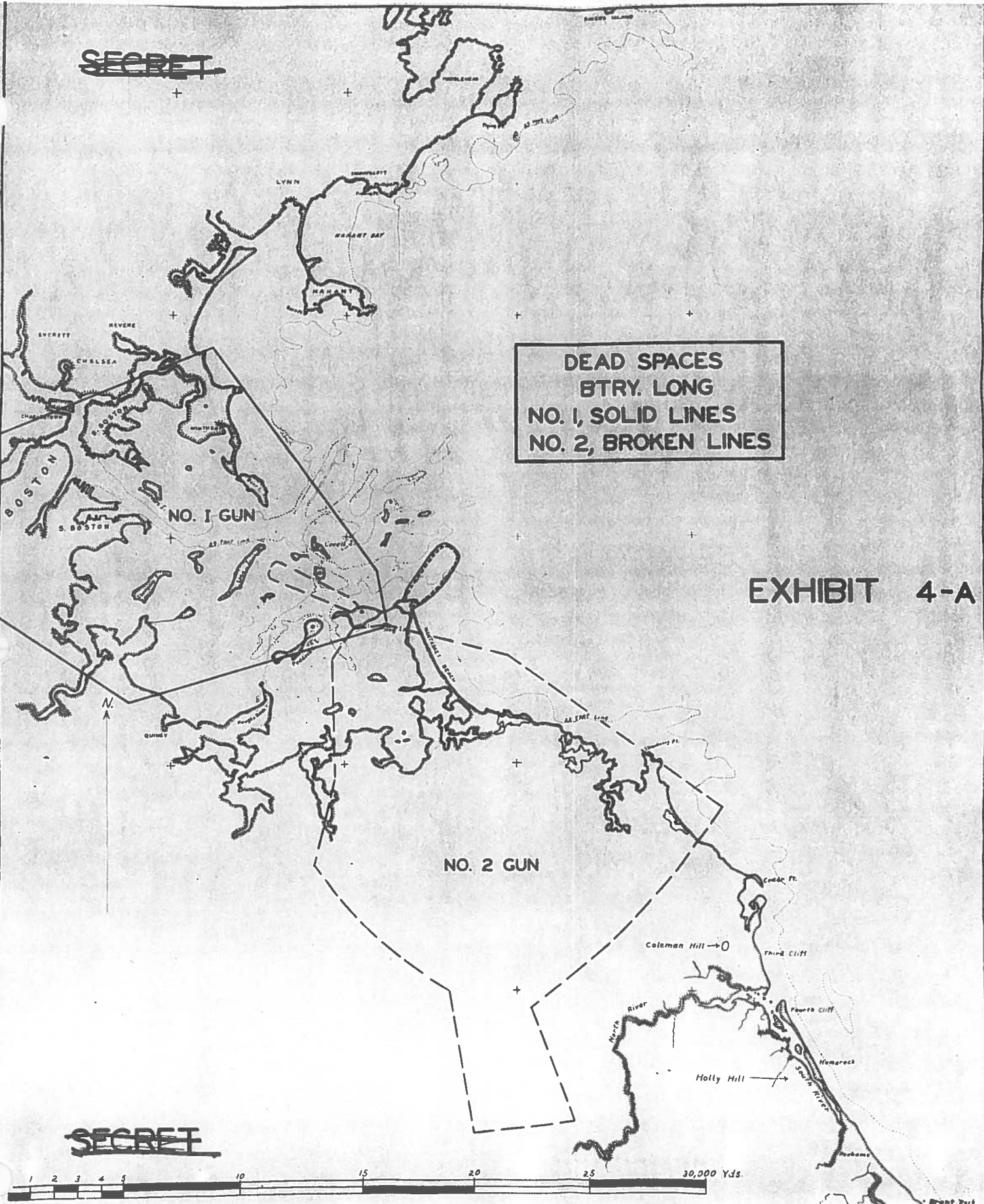
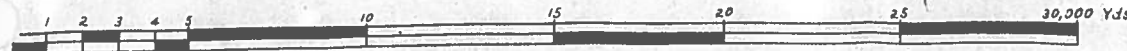
20,000 Yds.

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DEAD SPACES
BTRY. LONG
NO. 1, SOLID LINES
NO. 2, BROKEN LINES

EXHIBIT 4-A

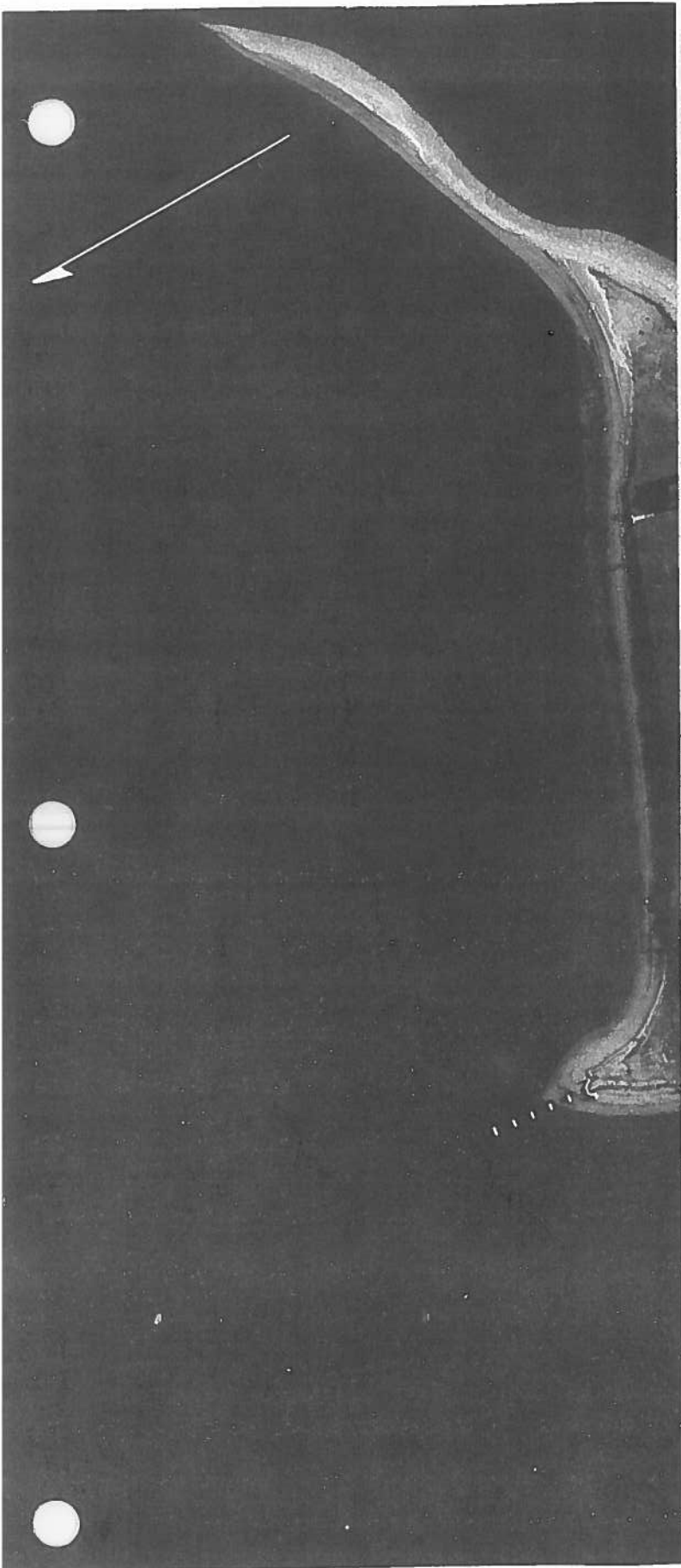
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[illegible]

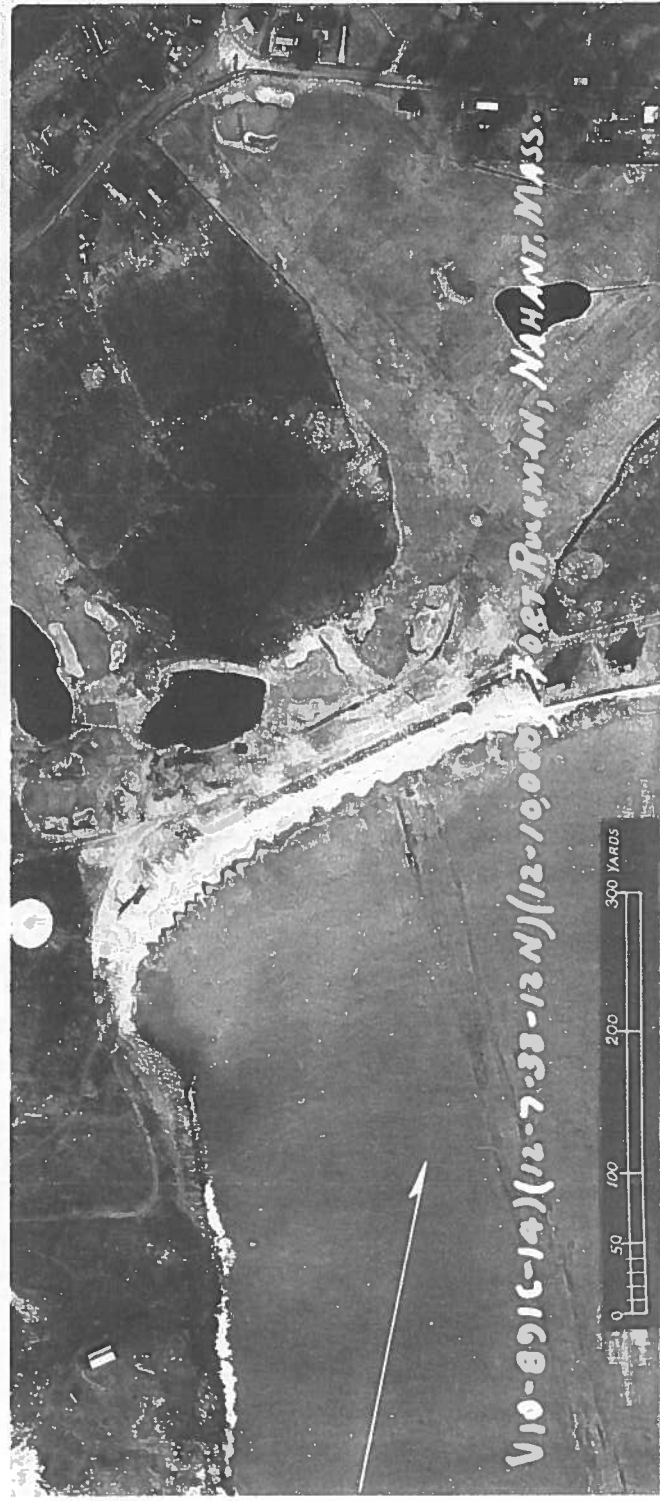
DEAD SPACES
BTRY. GARDNER
NO. 1 SOLID LINES
NO. 2 BROKEN LINES

EXHIBIT 5-A



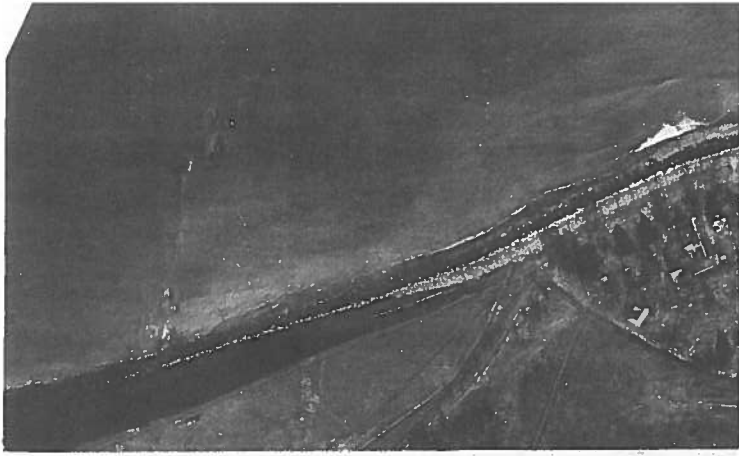
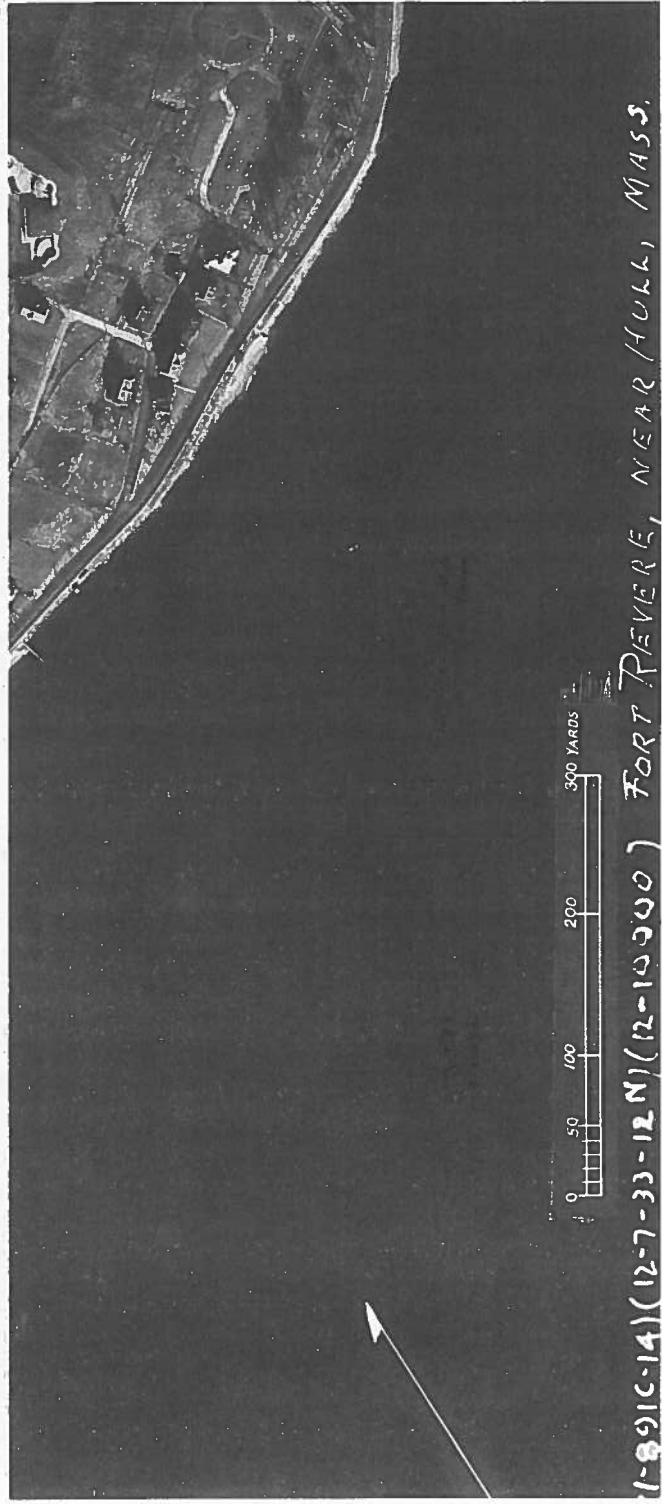
0 50 100 200 300 YARDS

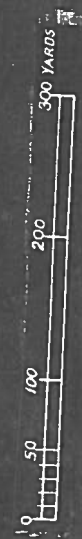
V2-5916-14)(12-7-33-12N)(12-10000) Fort Duvall, H



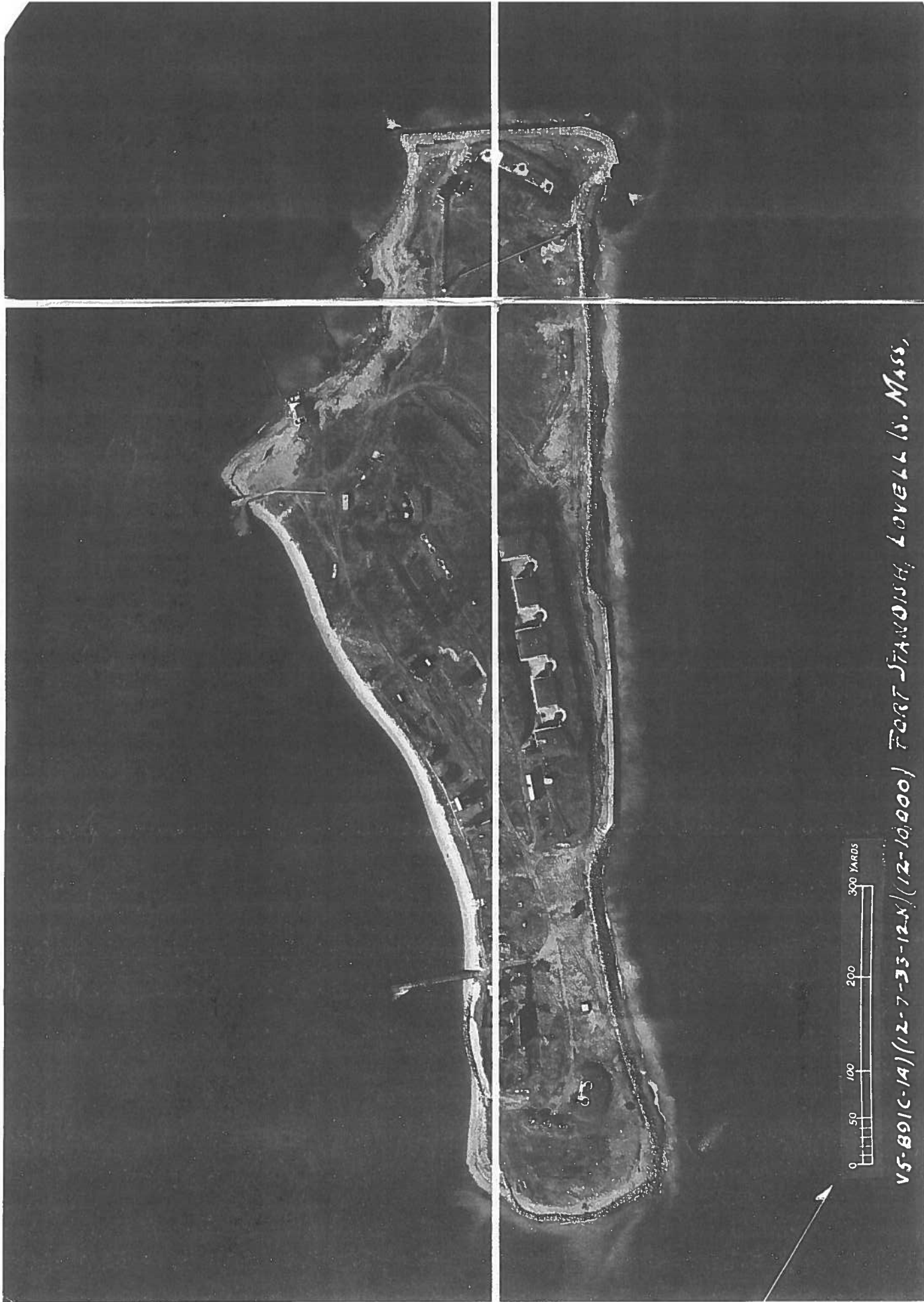
V10-8916-14)(12-7-33-12N)(12-10-00) Feet Runway, Nahant, Mass.





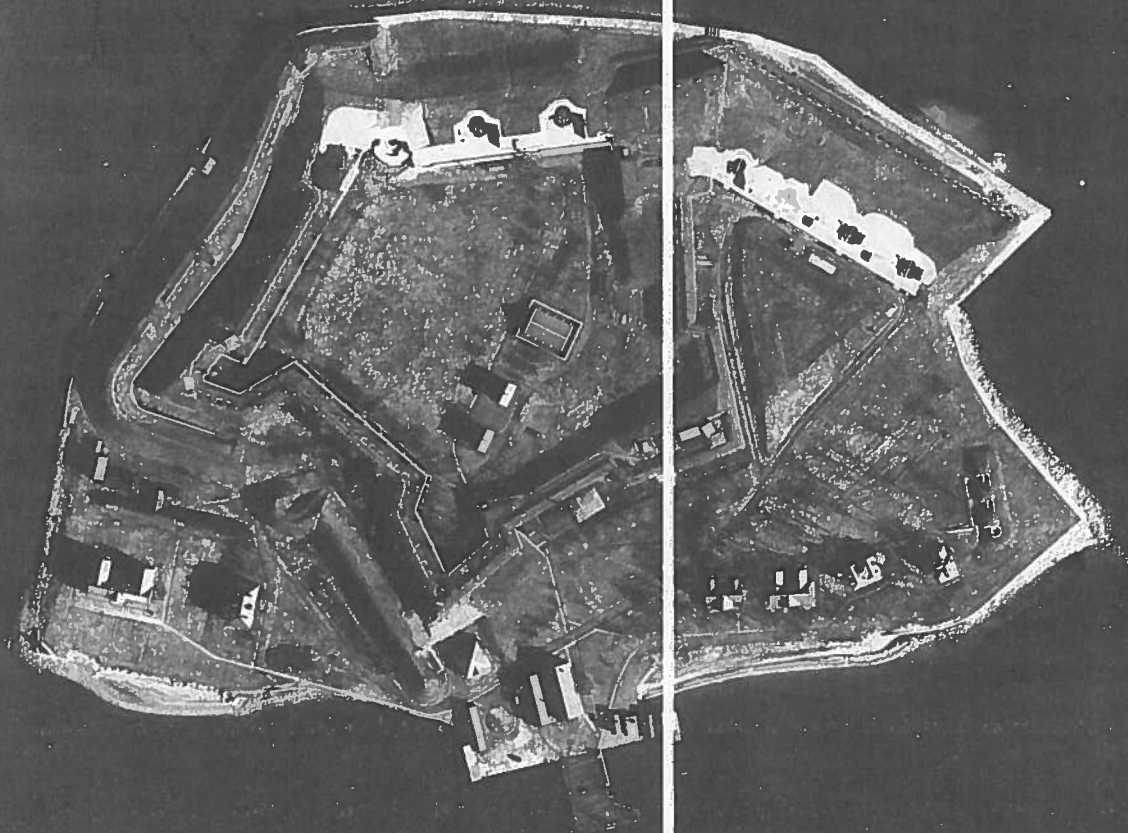


V3-5915-14) (12-7-33-12N) (12-10000) FORT ANDREWS, PEABODY'S IS. MASS.

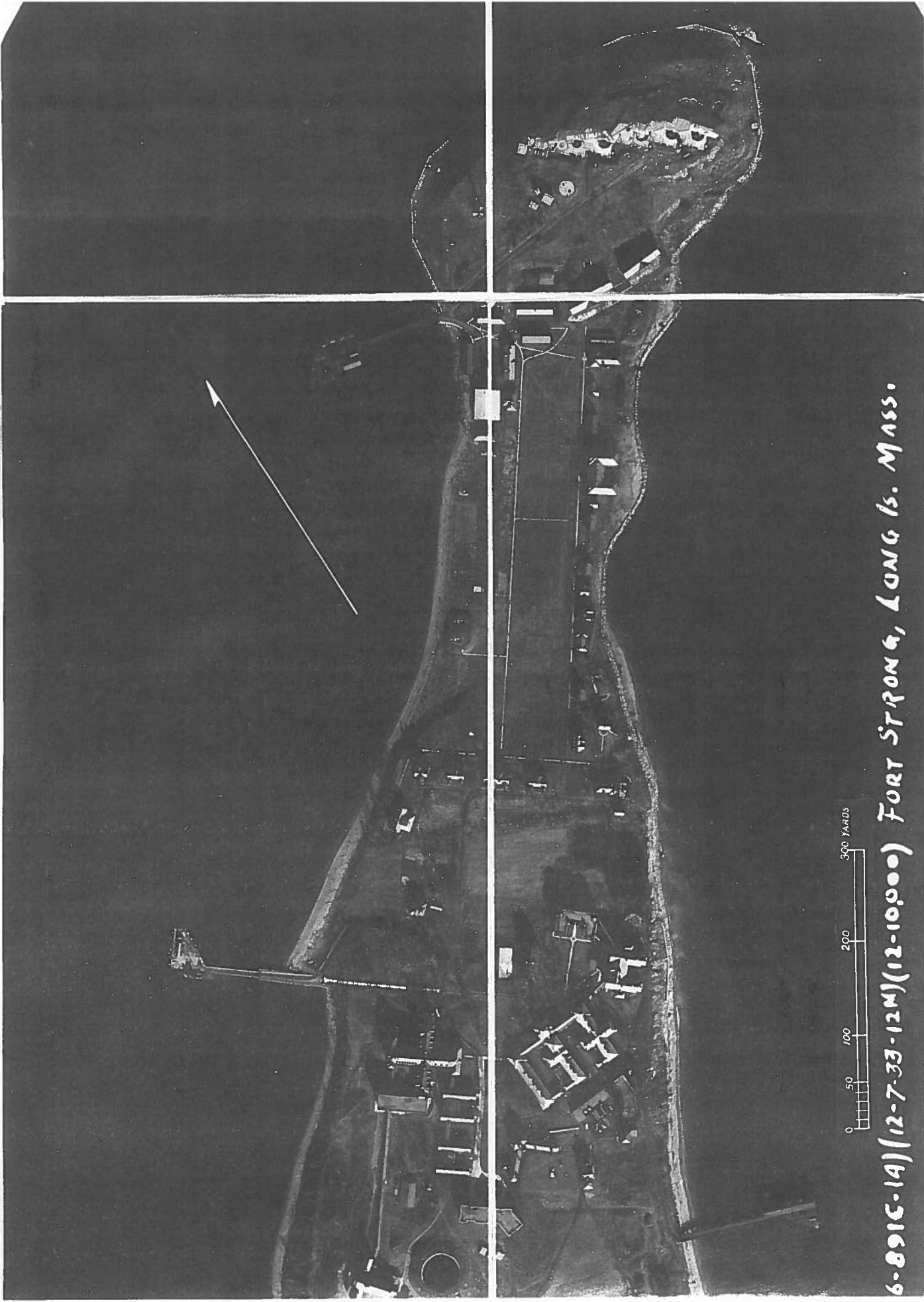


0 50 100 200 300 YARDS

V5-891C-141/12-7-33-12X/12-10,000/ FORT STANWISH, LOVELL IS. MASS.



V4-891C-14 (12-7-33-12 N) (12-10-00) FORT WARREN GEOR



6-8915-14) (12-7-33-12M) (12-10,000) FORT STRONG, LONG IS. MASS.



ATLANTA

Y-7-8916-14 (12-7-53-12-14) (13-10000) FORT BANKS, WILMINGTON

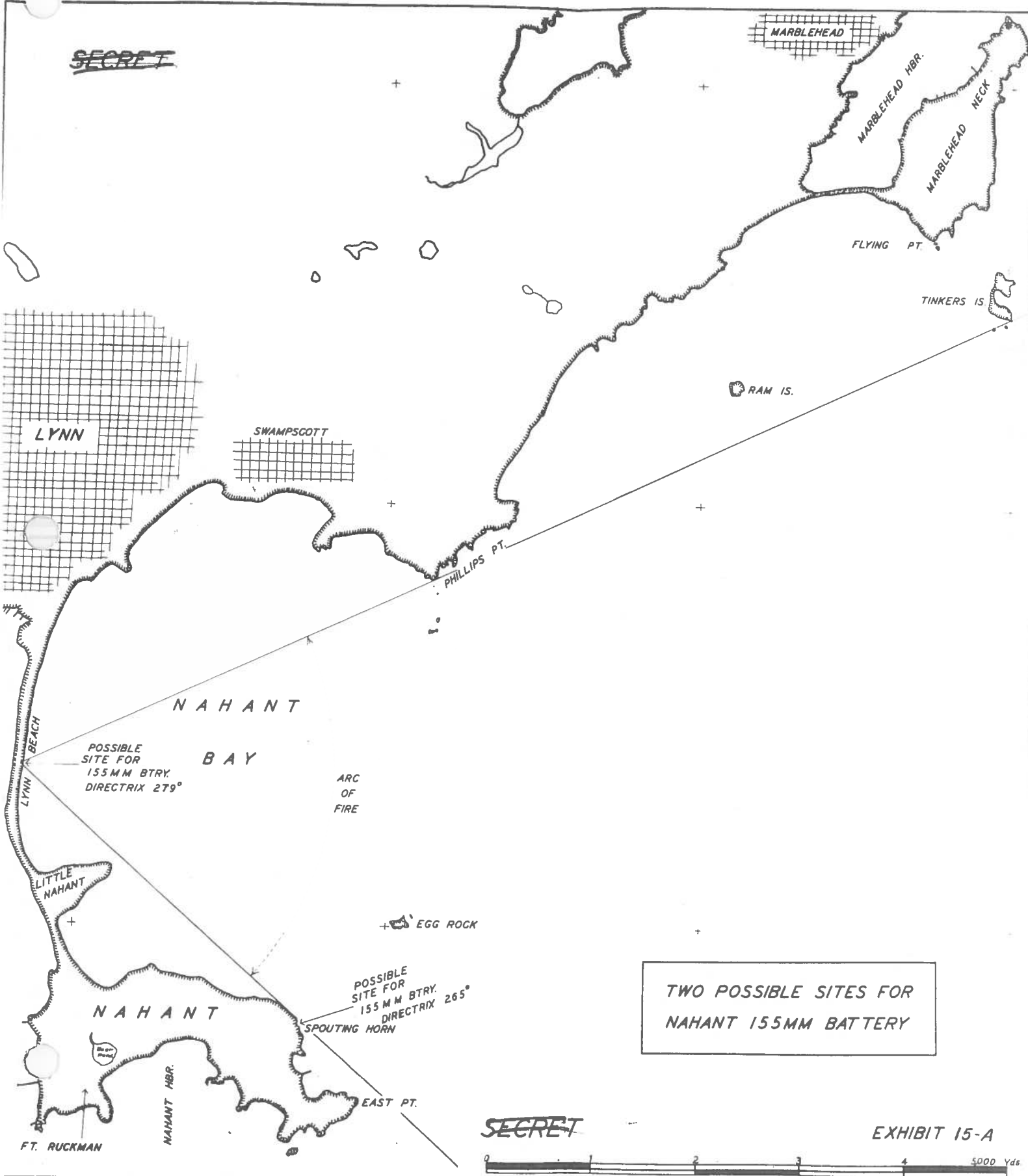
300 YARDS
200
100
0



0 50 100 200 300 YARDS

V8-891C-14 (12-7-33-12 N) (12-10000)
FORT HEATH, GROVE'S CLIFF, WINTHROP, MASS.

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TWO POSSIBLE SITES FOR
NAHANT 155MM BATTERY

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EXHIBIT 15-A

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ANNEX A. EXHIBIT NO. 16-A. WAR RESERVE AND BATTLE ALLOWANCE OF AMMUNITION H. D. OF BOSTON
 Approved by the Secretary of War in 6th Indorsement, AGO, May 5, 1933. (AG 381.4; 3-31-33; Misc. E).

Batteries	Guns	Cal. and Type	Projec- tile	Rounds			Remarks
				W.	R.	B. A.	
Long	2	16-inch		360	180		
Cushing - Whitman	10	12-inch M.		1080	1080		1046 lb. projectiles, 270; 700 lb. Projectiles, 810.
Lincoln	6	12-inch M.		648	648		1046 lb. projectiles, 216; 700 lb. projectiles, 432.
Kellogg	6	12-inch M.		648	648		1046 lb. projectiles, 216; 700 lb. projectiles, 432.
Gardner	2	12-inch LR		540	400		1070 lb. projectiles, 300; 975 lb. projectiles, 100.
Winthrop	3	12-inch		540	330		870 lb. projectiles.
Ripley	2	12-inch		180	180		870 lb. projectiles.
Stevenson	2	12-inch		360	360		870 lb. projectiles.
Morris	2	10-inch		162	132		
Bartlett	2	10-inch		162	162		
155 m. m.	4	155 mm		1440	1000		Store at Battery Gardner.
McCook	2	6-inch	(A.P.	1080	480		
			(H.E.	360	160		
Sanders	3	6-inch	(A.P.	1620	855		
			(H.E.	540	285		
Terrill	3	6-inch	(A.P.	1620	589		450 rounds to be stored at Battery Burbeck.
			(H.E.	540	196		
Whipple	2	6-inch	(A.P.	1080	640		450 rounds to be stored at Battery Morris.
			(H.E.	360	210		
Bumpus	2	3-inch		720	540		
Williams	3	3-inch		1080	800		
Stevens	2	3-inch		360	270		
Basinger	2	3-inch		720	540		
Taylor	2	3-inch		360	270		

The Battle Allowance can be stored at the battery in each case except as noted.
 The full Battle Allowance cannot be accommodated until certain surplus ammunition now on hand
 is removed from the Harbor Defense.

EXHIBIT NO. 16-A.

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ANNEX A. EXHIBIT NO. 17-A. COST ESTIMATE AND PRIORITY GUIDE H. D. OF BOSTON

Priorities subject to change based on availability of funds

Prior-	ity	Items	Class	Description of Project	Ordinance	Material	Engineer	Labor	Total
7	1	B	14	Sight Mounts for 155 mm guns	\$ 8,000				\$ 8,000
8	1	A		Reduce top of knoll on Bayley Hill			\$ 45	\$ 105	\$ 150
				Total	\$ 8,000	\$ 45	\$ 105		\$ 8,150

Class A - To be procured and installed in peacetime.
 Class B - To be procured in peacetime and installed when an emergency arises.
 Class C - To be procured and installed when an emergency arises.
 Note: No expenditure of funds by the Signal Corps, Chemical Warfare Service, Coast Artillery Corps, or for land, is contemplated in this Annex.
 * To be accomplished with maintenance funds when they become available.

EXHIBIT NO. 17-A.

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ANNEX B

FIRE CONTROL INSTALLATIONS

AUTHORITIES

1. This Annex was prepared January 25, 1934, by a Board of Officers appointed under the provisions of paragraph 1 d, AR 100-20.

2. Approved by the Secretary of War in the 14th Indorsement, AG 660.2 (1-25-34) (Misc.) E, dated August 13, 1934.

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A N N E X B.

FIRE CONTROL INSTALLATIONS.

1. The tactical organization of the harbor defense is shown in Exhibit 1-A of Annex A, Seacoast Guns. The system of communication between the elements of the command is shown in the Fire Control Diagram for the Eventual Status of the harbor defense, which accompanies this annex as Exhibit 1-B. The location on the ground of the major elements of the fire control system, as provided for in this plan, is shown in the several annexes attached.

2. In determining the fire control system needed by a battery, cognizance is taken of the following:

a. The angle of intersection at the target must be 15° or greater; and the area within 15° of the baseline (as measured from both base-ends) is to be excluded because the construction of the plotting board arms does not permit utilizing this area.

b. The DPF may be depended upon to furnish reasonably accurate ranges to a distance of 800 yards for each 10 feet of its height above sea level, but is more dependent on clear weather than either the horizontal base or the CRF since accurate waterlining is essential. The M-1 DPF has a longer accuracy-range. For the horizontal base or the CRF, sighting on the mast is sufficient and haze or low islands may not interfere with accurate range finding.

c. Atmospheric conditions in New England are such that visibility extends beyond 20,000 yards on exceptionally clear days only; it may be depended on up to 12,000 yards; and is ordinarily in the vicinity of 15,000 yards.

d. The extreme ranges of which the 16-inch and 12-inch LR batteries are capable require the use of a number of baselines in order that the full range and field may be utilized. Some of these baselines will be at such distance from the battery that unless a simplified and small-scale plotting board is used, relocating will be necessary; this may be accomplished directly by use of the seacoast director, or by the use of an intermediate plotting board.

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e. On Exhibit 2-B there has been plotted a curve of 35,000 yards range from the Navy Yard on the north and from the Fore River Plant of the Bethlehem Shipbuilding Corporation on the south, which are representative of the harbor facilities to be defended. It is presumed that hostile fire at ranges greater than 35,000 yards will not be undertaken because of the expenditure of ammunition involved. The curve, in connection with the 20,000 yard limit of visibility and the effective areas of the proposed baselines shows that:

- (1). During daylight, in clear weather, observation from the shore substantially covers the area within which vessels must lie to bombard the water terminals of Boston.
- (2). At night or in hazy weather or beyond the 20,000 yard limit of visibility, position finding is dependent on airplanes, subaqueous sound ranging or such other means as may be developed.

3. Orientation Data. a. The orientation data of any harbor defense are now based on rectangular coordinates whose origin is some convenient point on a meridian passing through the harbor defense. The data in use originate with the Coast and Geodetic Survey. The Survey is now engaged in redetermining its basic data, on the New 1927 North American Datum.

b. As the origin of some of the harbor defense orientation data is in doubt and may not have been carried out with the needed accuracy; as the triangulation of the Coast and Geodetic Survey is itself being revised; and as some new batteries and fire control stations must in any case be surveyed, it appears to be an advantageous time to redetermine the entire orientation net of the harbor defense.

4. a. Fire Control Diagram. The Fire Control Diagram of the Eventual Status of the harbor defense is appended as Exhibit 1-B. This diagram shows the fire control system as it will be when all changes contemplated by the Project approved by the Secretary of War on December 27, 1932, and these annexes thereto, shall have been effected.

b. Whenever changes in the fire control system are made (such, for example as installing new switchboards or the laying of new cables), this diagram shall constitute a guide and shall be consulted in order that the trend of new work shall be to provide for the eventual needs of the command.

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c. Whenever alterations are made in the Project approved December 27, 1932, or its annexes, affecting the fire control diagram, the diagram should be modified to accord with the alterations. This fire control diagram of the eventual status and the fire control diagram of the existing status of the harbor defense will both be maintained and kept up to date at all times.

5. Post Telephone Lines. a. The rear echelon of the harbor defense command post is at Fort Banks where supply, including administration, is centered. One post telephone line has been provided herein to the Fort Banks switchboard from each of the other forts, and two such trunk lines from the H station at Deer Island. Within a fort, one post telephone is provided to the local switchboard from each battery, group or higher command post, and where the plotting room is at a distance from the BC station, a post telephone is provided from the plotting room.

b. Thus one pair each is provided from Forts Duvall, Revere and Andrews to the Fort Warren switchboard and thence to Fort Standish and Deer Island to Fort Banks. One pair is provided from Fort Warren and one from Fort Strong to Fort Standish. Hence from Fort Standish to Deer Island and thence to Fort Banks, there are provided six pairs for supply purposes. From Deer Island to Fort Banks a total of eight pairs is provided.

c. These trunk lines between forts are sufficient and should not be exceeded since attention, labor and funds must be concentrated on the fire control system, and since otherwise the required number of pairs in cables will be excessive.

6. Steel Fire Control Tower. a. The long range of the 16-inch and 12-inch LR batteries results in the necessity of providing very wide fields of view for the observing instruments of some base-end stations. To avoid interference by one station with the view from an adjacent station, it is essential where the need for a wide view exists to provide that one observing room shall be above another. This is accomplished economically by using a steel tower. These wide angles can be obtained equally well with a concrete building; the advantage of a steel tower (in addition to lower cost) is in its quick erection if an emergency arises before funds have become available to purchase the site and build the station.

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b. The required wide angle of view is usually best obtainable from some one location. If that site is not occupied it may become necessary to build several stations instead of one. It not infrequently happens that the desired site is on an estate which the owner will not sell at any reasonable cost but the wartime use of which would present no difficulties. A quickly erected steel tower best meets this case.

c. The design of a steel fire control tower is now the subject of correspondence with the War Department.

7. Harbor Defense Commander's Station. a. The existing "H" station on Deer Island is suitably located but lacks space for carrying on the work of the harbor defense commander and his staff; it consists of an observing room only. It is proposed to provide a building containing six rooms, each 15 by 20 feet, and one story high, adjoining the present station. The commander of the inshore patrol, under the one special war plan so far drawn up, is (with the concurrence of the Navy Department) to be located with the harbor defense commander and this desirable arrangement calls for space. If the station has not been built when an emergency occurs, it should immediately be constructed.

- (1). The building should be of steel and concrete or comparable construction, with low roof, and almost wholly below ground level to avoid visibility from the sea. Excavation for the building has been completed.

8. Brewster Islands. a. This group of islands consisting of the Brewsters and adjacent islands, lies off the entrance of Boston Harbor and masks the view to some extent from all fire control stations in the harbor defense. The islands are of different elevations and it is possible to see the water over some of them, from some of the fire-control stations. It is possible to see the superstructure or masts of vessels, over most of the Brewsters, from most fire control stations. A panoramic sketch, marked Exhibit 3-B, shows the view from a fire control station of average height; this view is representative of the masking effect of these islands on the harbor defense fire control system. It will be observed that:

- (1). The horizontal baselines can track targets passing beyond the Brewsters by observing on the masts, except that small vessels cannot be observed and that no vessels can be seen across the high portion of Great Brewster.

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(2). DPF's as such cannot operate.

(3). Searchlights are blocked by the islands.

9. Employment of Commercial Telephone Lines. a.

The somewhat dense population of the shores of Massachusetts Bay with its summer colonies results in there being available at most points on the shore ample commercial telephone installations which may be utilized to connect the more distant base-end stations with the harbor defense fire control system. Near each of the proposed observing stations there are permanently installed commercial telephone cables. By leasing the requisite number of pairs at time of emergency with provision for cutting out switchboards and for energizing the lines, it will be possible to dispense with many miles of Government-owned cables. It is proposed, however, to provide Government-owned communications for the nearer base-end stations.

(1). Where circuits extend through telephone exchanges, they should be cross-connected straight through frames and not run into switchboards, to ensure continuous line with no possibility of interruption.

b. On War Department approval of this provision, a contract in the usual form should be made by the Corps Area Signal Officer with the New England Telephone Company, effective on the occurrence of an emergency.

10. The next succeeding paragraphs are concerned with description of places required for new fire control installations. Following these are paragraphs dealing with the requirements of each battery. The numbers used refer to the fire control stations shown in Exhibit 2-B.

LONG RANGE FIRE CONTROL PROJECT.

11. a. No baselines had in 1933 been provided for the 16-inch and 12-inch LR batteries. On the south, there is an observing room for Battery Long (two 16-inch) and one for Battery Gardner (two 12-inch) in a newly constructed station at Point Allerton. On the north, at Marblehead Neck there is available a site on the lighthouse reservation. These two locations are points of departure in determining the baselines on the south and on the north shores of Massachusetts Bay.

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b. The new positions selected as base-end stations have been surveyed and their latitude and longitude determined. A concrete monument has been set in the ground to mark the exact location over which the instrument center should be placed. These monuments are marked with a brass disk bearing the inscription "Corps of Engineers, U. S. Army. Map Control Point."

12. Baseline 1 - 2. This baseline extends from Brant Rock to Fourth Cliff and is 9,700 yards long. It is shown in Exhibit 2-B as Baseline 1 - 2 and affords observation over and beyond the area included in the 25° intersection curve shown in the exhibit, up to the 20,000 yard limit of visibility which is an approximation.

a. Brant Rock. The site of the fire control station marked 1, is on a rise about 300 yards from the beach and about 27 feet above mean sea level, and overlooks most of the cottages which line the water front. The location is marked "Tower" on the Coast and Geodetic Survey Chart; there is a high steel water tower at the site, belonging to the town of Marshfield in which the village of Brant Rock is located. An instrument height of 35 feet above the ground is required because of the possibility of construction of buildings in the foreground; and an additional 10 feet should be provided to increase the horizon. The total height of about 72 feet above sea level will afford a DPF range of 5,760 yards, which will cover the area along the shore on the south to within approximately 4,500 yards of the extreme range of the 16-inch guns. If the M-1 DPF is provided, the entire area along the shore to the maximum range will be covered. The property, being publicly owned, possibly cannot be purchased without court proceedings but plans may be made for its occupancy in an emergency. A steel fire control station with one observing room should be provided, the material being purchased and stored in the harbor defense. The required arc of view is from azimuth 157° to azimuth 333°. The station should be equipped with spotter's azimuth instrument, and an antiaircraft observer should be provided for.

- (1). The New England Telephone Company has overhead cables comprising 130 pairs, of which 42 pairs are not in use. The distance from the proposed station to the point of connection with the telephone cable at pole No. 159 is 1,288 feet. The connection from Brant Rock village is through the Marshfield exchange. Connection with the fire control system is proposed at Point Allerton. The charge for the required five circuits is \$82.90 each per month, or \$414.50 per month.

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b. Fourth Cliff. This site is on a Navy Radio Direction-Finding Station reservation. It is 9,700 yards from Brant Rock on the south and 12,100 yards from Strawberry Point on the north. The reservation comprises 2.56 acres and is now occupied by two small frame buildings. The elevation is approximately 35 feet and the arc of visibility extends from First Cliff on the north to Brant Rock on the south, or from azimuth 171° to azimuth 325°.

- (1). Permission to erect a steel fire control tower was granted by the Secretary of the Navy in letter to the Secretary of War dated May 2, 1934 (Navy Department file A2-14;340406; WD file AG 665.41 H.D. of Boston; 5-2-34; Misc. D).
- (2). A steel tower with one observing room should be erected. The instrument height should be approximately 75 feet above mean sea level or 40 feet above ground. A DPF and spotter's azimuth instrument should be provided. An antiaircraft observer should be located here.
- (3). If an emergency arises before this station has been constructed, it will be possible to use azimuth instruments on tripods as a temporary measure pending construction of the station.
- (4). The village of Humarock is 3,000 yards distant. The New England Telephone Company has a cable of 51 pairs from Humarock, 21 pairs of which are spares. The cable route from Humarock is to the Marshfield telephone exchange. Connection with the fire control system at Point Allerton is proposed. The charge for the required five circuits is \$85 each per month or a total of \$425 per month. The telephone company has but one circuit from Humarock to Fourth Cliff. It will be necessary to provide 9,000 feet of 10-pair type 340 cable, costing \$2,538.
- (5). If the site at Fourth Cliff should for any reason become unavailable, there is a suitable location at Third Cliff approximately 2,000 yards to the north of Fourth Cliff, and about 1¼ miles southeast of Scituate village. This site is on a site about 70 feet above sea level.

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Cottages line this bluff. Commercial telephone service is available at the site. A suitable location for the observing station is on a lot owned by Professor Joseph C. Riley, Massachusetts Institute of Technology. This lot is 50 by 175 feet and last sold for \$2,000, since which time Professor Riley has built a small frame cottage estimated by a neighboring householder to be worth \$1,000. The view from Third Cliff (at an instrument height of 7 feet above ground level) is across Second Cliff and First Cliff to an azimuth of approximately 171° on the north and to Brant Rock on the south. If this site should be used, a one-room steel fire control station should be erected with the angle of view just stated. A concrete marker such as that described in paragraph 11 b has been set and surveyed.

13. Baseline 2 - 3. This proposed baseline extends from Fourth Cliff to Strawberry Point and is 12,100 yards in length. It is shown in Exhibit 2-B as Baseline 2 - 3 and affords observation over the sea area included in the 25° intersection curve shown in the exhibit, as limited by the 20,000 yard limit of visibility.

a. Strawberry Point. The site of the fire control station marked 3, is on a brush-covered knoll approximately 57 feet above mean sea level, on a point known as The Glades near Cohasset, the end of which is called Strawberry Point. Coast Chart No. 242 shows the locality in detail on a scale of 1:5000. The entire point is owned by The Glades Club of which Mr. Charles Francis Adams of 15 State Street, Boston, is now treasurer. The arc of view, 201°, is from Strawberry Hill at Nantasket clockwise to Cedar Point, or from azimuth 116° to azimuth 317°. Strawberry Point is a salient in the coastline which changes direction, making it important to locate a base-end station here.

b. The knoll, on which it is proposed to erect a steel fire control tower, is 600 yards southeast of the clubhouse and 100 yards west of the road. Provision should be made for two observing rooms, for the 16-inch and the 12-inch LR batteries. Each observing room should be equipped with DFF and spotter's azimuth instrument, and an antiaircraft observer should be provided for. The upper DFF should have an instrument height of 80 feet above mean sea level or approximately 23 feet above ground level, and this upper observing room should be assigned to the 16-inch battery.

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c. The station at Strawberry Point should be constructed as soon as funds are available. One-fourth acre of land with right of way thereto, is sufficient and will cost, it is estimated, approximately \$1,000.

d. Government-owned communications should be provided in order that a part of the baselines required for the long-range batteries may be ready at all times.

- (1). Should it be decided to substitute commercial leased lines, there is a telephone cable as far as The Glades village about 1,000 yards distant along the road. The cable is partly buried and partly aerial and has 30 pairs, 9 of which are now spare; it connects with the Cohasset telephone exchange.

14. Baseline 3 - 4. This baseline extends from Strawberry Point to Point Allerton where there is an existing station, and is 12,700 yards long. It is shown in Exhibit 2-B as Baseline 3 - 4; observation is afforded over the sea area included in the 25° intersection line shown in the exhibit, as limited by the 20,000 yard assumed limit of visibility.

15. Baseline 4 - 5. Extending across the entrance of Boston Harbor, this baseline from Point Allerton to East Point, Nahant, is 13,350 yards long. It is shown in Exhibit 2-B as Baseline 4 - 5; the area which it covers is shown in the exhibit.

a. Point Allerton. There is a three-story fire control station at this point, completed in 1932. Observing rooms are hereby assigned as follows:

- (1). The smaller room at the top of the building as B" Battery Gardner, equipped with DFF.
- (2). The middle floor, right hand room as the group commander's station of Group 2, equipped with DPF and BC telescope.
- (3). The middle floor, left hand room as BC and B", Battery Cushing-Whitman, equipped with DPF and BC telescope.
- (4). The lower floor, right hand room as B⁴, Battery Long, equipped with DPF.
- (5). The lower floor, left hand room as BC, Battery Long, equipped with BC telescope and spotter's azimuth instrument.

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b. On the outbreak of an emergency, a small station should be constructed on the Point Allerton reservation, in front of the present station, to house a spotter for Battery Gardner and one for Battery Cushing-Whitman, for whom there is no room in the present station.

c. East Point, Nahant. A three-story fire control station is to be located southwest of an existing wooden observation tower about 450 yards southwest of East Point. The ground is approximately 50 feet above mean sea level. There are high trees in the background. An instrument height of about 12 feet above ground should be provided for the lowest station, giving a height of tower of approximately 30 feet above ground. Each station should be equipped with DPF and an azimuth instrument for spotting; and an anti-aircraft observer should be provided for. The observing room for Battery Gardner should accommodate the battery commander.

(1). This station is provided as B³ Gardner, B⁵ Long and an Emergency station for either Winthrop, Lincoln or Kellogg as may be decided at the time by the group commander. These three medium range batteries have their secondary stations at Fort Ruckman; this "E" station will provide for observation (either by DPF, or by horizontal base in connection with the B' of each battery at Fort Heath) over a water area north of an east-and-west line through East Point which is masked from the secondaries. The upper observing room should be assigned as the Emergency Winthrop - Lincoln - Kellogg.

(2). It is believed that sufficient ground can be purchased at a reasonable price in the required location, which is the property of Harmon Elliott, 272 School Street, Watertown, Mass. If the station has not been completed when an emergency arises, azimuth instruments on tripods can be used in the vicinity of East Point or on the wooden observation tower.

d. An arc of view from Marblehead Neck on the left to Fort Heath on the right should be obtained for each observing instrument.

e. A 20-pair trenched telephone cable will be required to Fort Ruckman, a distance by road of approximately 2,950 yards.

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16. Baseline 5 - 6. This baseline extending from East Point to Marblehead Neck is 12,400 yards long; the areas covered by the baseline and by the DPF's at its ends are shown in Exhibit 2-B.

a. Marblehead Neck. The Secretary of Commerce in letter of July 16, 1931, granted use of the lighthouse reservation (excepting the lighthouse, etc.) to the War Department pending its transfer when Congressional authority is obtained (AG 601.4 Marblehead, Mass; 6-2-31; Misc.). It is proposed to construct a stool fire control station of two rooms, one above the other, for use of the 16-inch and 12-inch LR batteries. The required arc of view is from azimuth 233° clockwise to azimuth 19°.

b. Government-owned communications should be provided in order that the baseline East Point - Marblehead Neck may be ready for use at any time. A 20-pair cable to Fort Ruckman should be laid, eleven pairs being required for the base ends and for two searchlights planned for this location.

c. The ground level at Marblehead Neck Light is approximately 30 feet above mean sea level. An instrument height of approximately 70 feet above ground, or 100 feet above sea level, should be provided for the upper of the two DPF instruments with which the stations should be equipped, in order to overlook the buildings on the Neck, to the south. This upper station should be assigned to Battery Gardner. The stations should also be equipped with azimuth instruments for spotters; and an antiaircraft observer should be provided for. This station, because of the retired position of the lighthouse reservation and high ground to the northwest, will not be conspicuous.

17. Baseline 6 - 7. This baseline extends from Marblehead Neck to Coolidge Point (1,000 yards west of Magnolia; on maps called Goldsmith Point), and is 13,000 yards long. It is shown in Exhibit 2-B as Baseline 6 - 7, on which the 25° intersection curve is plotted.

a. Coolidge Point. The proposed site is on a knoll covered with stunted trees from eighteen to twenty feet high. The knoll is approximately 125 yards in rear (north) of the summer home of Robert Treat Payne 2d, 10 Postoffice Square, Boston; it is across the local road from Mr. Payne's residence and is owned by him. Close by on the east is a cottage belonging to Bishop Henry K. Sherrill. The principal real estate agent dealing in property here is John Coughlin of Manchester. The ground level is approximately 80 feet.

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b. One-fourth acre should be purchased in order to hold the site. The price is estimated as \$1,500. A steel fire control tower two stories high should be erected when an emergency arises. An instrument height of 25 feet for the lower of the two required DPF's should be obtained in order to amply clear trees and houses. As the ground slopes away from the proposed site, this height will insure against future interruption of view.

(1). A buried cable, belonging to the New England Telephone Company, with ample capacity, extends along highway 127; it connects with the telephone exchange at Manchester. The distance from the proposed site to the highway is 850 yards. A 10-pair cable will be required. The charge for the required nine circuits with connection to the fire control station at Fort Ruckman is \$434.00 per month.

(2). The height is sufficient to overlook the southern part of the village of Magnolia. The arc of view extends from Eastern Point, Gloucester, clockwise through the south and southwest to the direction of Marblehead Lighthouse. Kottlo Island in the foreground does not obstruct the view, being about 30 feet above mean sea level at its highest point.

REQUIREMENTS OF EACH BATTERY.

18. Long Range Group. a. There is available for the group commander a suitable station (heretofore the C-2 station and now surplus) on Deer Island. A spotter for the group should be located on Outer Brewster.

b. The M-1 DPF should be provided for each observing station of Battery Long and Battery Gardner.

c. It is proposed to provide Battery Long, two 16-inch guns at Fort Duvall, with the six baselines shown in Exhibit 2-B:

Brant Rock to Fourth Cliff (1 - 2);
Fourth Cliff to Strawberry Point (2 - 3);
Strawberry Point to Point Allerton (3 - 4);
Point Allerton to East Point (4 - 5);
East Point to Marblehead Neck (5 - 6);
Marblehead Neck to Coolidge Point (6 - 7).

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- (1). Spotters are proposed in each of the stations above, and also at Eastern Point Light, Gloucester. The Eastern Point spotting station should be connected by commercial telephone entering the fire control system at Fort Ruckman.
- (2). This battery should be equipped with a seacoast director.
- (3). Plotting room equipment remains to be completed.

c. It is proposed to provide Battery Gardner, two 12-inch LR guns at Fort Ruckman, with the four baselines shown in Exhibit 2-B; viz,

Strawberry Point to Point Allerton (3 - 4);
Point Allerton to East Point (4 - 5);
East Point to Marblehead Neck (5 - 6)
Marblehead Neck to Coolidge Point (6 - 7).

- (1). Spotters are proposed in each of the five stations above except Point Allerton, and also at Eastern Point Light, Gloucester; this last to be connected by commercial telephone.
- (2). Battery Gardner should be equipped with a seacoast director.
- (3). Plotting room equipment is yet to be completed.

d. It is proposed to provide the Nahant 155 mm. battery with a 15-foot CRF to be located at the battery. The CRF should be stored in the harbor defense, and on the occurrence of an emergency, a frame station with concrete instrument base should be constructed.

- (1). A spotter equipped with azimuth instrument should be located at the battery. Telephone communication should be provided with the group commander, by field wire to the Fort Ruckman switchboard.

19. Southern Group. a. The group commander now has an excellent location in the fire control station at Point Allerton, overlooking his field of fire as shown in Exhibit 2-A. A spotter for the group should be located on Outer Browster.

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b. Battery Stevenson, two 12-inch D. C. at Fort Warren. The field of fire is shown in Exhibit 4-B. B' at Fort Warren has a DPF with range of 6,000 yards but it is masked over a considerable arc as shown. B" at Fort Revere is also equipped with a DPF which has a range of 6,650 yards, masked as shown. The baseline will operate up to the 15° intersection line, except for the masked areas; but the area covered by baseline and DPF's is only a small fraction of the area covered by the guns and an additional baseline is needed. It is proposed to provide Battery Stevenson with the left one of the two baseline stations at Strawberry Hill on Nantasket peninsula where there is a small reservation now containing two tertiary stations of Batteries Whitman and Cushing, one of which becomes surplus by combining these two batteries.

- (1). The present frame structure has deteriorated. When a new station is built, it should have two observing rooms, one above another, equipped with a DPF for Battery Stevenson and a DPF for Battery Cushing-Whitman. The DPF's will cover the area north of Strawberry Point, not covered by the proposed baseline Fort Warren - Strawberry Hill.

c. Battery Ripley, two 12-inch B.C. at Fort Revere. The field of fire is shown in Exhibit 5-B. B' with DPF is at Fort Revere. B" also equipped with DPF is at Fort Standish. The two instruments are masked by the Brewsters and adjacent islands; but masts and occasionally some of the superstructure of vessels can be seen over those islands. Baseline intersections of 15° or greater are obtained up to the curve plotted on the exhibit. The fire control system of Battery Ripley is satisfactory.

d. Battery Cushing-Whitman, ten 12-inch mortars at Fort Andrews. It is proposed to form one battery by combining Battery Cushing, four 12-inch mortars, and Battery Whitman, six 12-inch mortars, as stated in paragraph 11 of Annex A; these two batteries are located adjacent to each other at Fort Andrews. Each battery has three baselines, the stations being located next each other; B' is at Point Allerton, B" at Fort Andrews, and B³ at Strawberry Hill. Combining the two batteries will permit of utilizing three of these stations elsewhere. The field covered by each of the three baselines, and by the DPF's with which each baseline station is equipped, is shown in Exhibit 6-B. B' at Fort Andrews is almost completely masked but has a small field in the direction of Boston Light in connection with B" at Point Allerton. B" has a wide view and its DPF will reach approximately to the range limit of the mortars except on the north. B³ at Strawberry Hill, in connection with B" covers the field of fire to the east and southeast adequately. To avoid overcrowding the diagram, the masked areas from B³ are not shown; B³ is almost completely masked to the west of a line tangent on the east to Point Allerton, but is not masked to the east or southeast.

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- (1). At Strawberry Hill, the right hand station of the two located at that place is hereby assigned to Battery Cushing-Whitman, the left hand station being assigned to Battery Stevenson.

e. Battery Bartlett (Guns Nos. 3 and 4), 10-inch D.C. at Fort Warren. This is a battery in reserve. It is to have no fire control system, the equipment now on hand being available for use elsewhere. If brought into service, Battery Bartlett will utilize the fire control installations of the disabled battery which it replaces. Its field of fire is shown in Exhibit 7-B.

20. Northern Group. a. The group commander is to be located in an existing station (heretofore designated F'-6) well placed at Fort Heath, overlooking the field of fire of the group as shown in Exhibit 3-A of Annex A. The three batteries of this group are at present prevented from firing east or northeast of Nahant by the restricted view from the base-end stations at Fort Ruckman. See paragraph 15 c. A spotter for the group should be located on Outer Brewster.

h. Battery Kollogg, six 12-inch mortars at Fort Banks. The battery is capable of all-around fire and has three baselines as shown in Exhibit 8-B. B' at Fort Heath is equipped with a DPF having the effective radius shown in the exhibit. B'' at Fort Ruckman also has a DPF; view from this instrument is restricted by East Point, as shown, and in consequence this baseline cannot be used north of an east-and-west line through Nahant. B³ at Deer Island is not yet provided with an observing instrument; a DPF should be furnished; it would have the effective radius indicated in the exhibit. The baseline B'-B³ provides for fire south of an east-and-west line through East Point. A rise near B³ on Deer Island masks a narrow sector to the northeast where this station is needed, and the ground here should be levelled; the cost is estimated as \$75.00. All three stations are masked by the Brewsters as shown, but masts and occasionally the superstructure of vessels can be seen over these islands.

c. Battery Lincoln, six 12-inch mortars at Fort Banks. This battery, adjacent to Battery Kollogg, has the same field of fire and its three base-end stations are alongside those of Kollogg; see Exhibit 8-B. B' at Fort Heath has a DPF with the arc of view and effective range shown in the diagram. B'' at Nahant, similarly equipped, is limited on the left of its field by East Point. The baseline B' - B'' covers a large portion of the field of fire of the battery adequately but is masked to the north of an east-and-west line through Nahant. B³ at Deer Island has a DPF with the view and range plotted on the exhibit. The partial mask from all stations caused by the Brewsters and adjacent islands is shown; glimpses of targets can be obtained over these masks but the DPF's, as such, cannot operate.

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d. Battery Winthrop, three 12-inch D.C. at Fort Heath. The three stations are located adjacent to those of Batteries Kellogg and Lincoln and all are equipped with DPF. The limitations of the three baselines and of the DPF's are shown in Exhibit 9-B. The field of fire as a whole is adequately covered by the fire control system except that fire cannot be directed on targets in the area east or northeast of Nahant.

e. An emergency station at East Point, described in paragraph 15 c will afford observation for either Battery Lincoln, Kellogg or Winthrop (as decided by the group commander) over the area east and northeast of Nahant, otherwise masked.

f. Battery Morris, two 10-inch D.C. at Fort Standish. This battery is in a status of a reserve of materiel, with no fire control system, it being intended to use the fire control equipment of the battery which it replaces whenever Battery Morris is placed in service. Its field of fire is shown in Exhibit 10-B. The fire control stations and equipment now on hand are available for assignment elsewhere. The present baseline Fort Standish - Deer Island has the advantage that it covers a part of the water area northeast of Nahant, masked from other baselines; for this reason, there is shown on the exhibit the area covered by the baseline, in order to record the information.

21. a. Secondary stations at Fort Ruckman. The base-end stations at Fort Ruckman (B' Kellogg, Lincoln and Winthrop) are located 220 yards in front of Battery Gardner, which has not been fired. One or both guns will fire over the stations if firing between azimuths 314° and 338° . This is a vital portion of the field of fire, across the harbor entrance. The stations are higher than the guns. Blast-effect would probably render these important stations untenable. Therefore these stations are to be abandoned and new stations of the manhole type are to be constructed for Batteries Kellogg, Lincoln and Winthrop on the Fort Ruckman reservation approximately 200 feet to the front of the present stations and close to the water. Blast will be sufficiently reduced by this increase of distance, and by the location beyond the crest of Bayley Hill. See map of Nahant, marked Exhibit 20-B. The instrument height will be approximately 55 feet, as compared with 74 feet at the old location.

b. In order to provide for fire to the northeast and north of East Point by one of the three batteries, Kellogg, Lincoln or Winthrop, one observing room is to be added to the East Point base-end station to be constructed for Batteries Long and Gardner, described in paragraph 15 c ante. This observing room will be designated Emergency Kellogg-Lincoln-Winthrop and will serve whichever battery the group commander decides at the time. In conjunction with B' at Fort Heath, a baseline is formed which will cover an area to the east of Nahant, masked from the secondary stations at Fort Ruckman.

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- (1). The upper observing room of the station is assigned as the "T" station in order to obtain the additional DPF range, which is especially important for Battery Winthrop. The observing arc should extend from Phillips Point on the north clockwise to Fort Heath on the southwest.

22. Rapid Fire Batteries. Because of their distance from the mine fields which they are intended to protect, and the fact that some of the batteries are wrongly faced or are masked in part from the mine field, more guns are needed than would normally be necessary. There are nine rapid fire batteries; two 6-inch and three 3-inch batteries assigned to the southern mine field and two 6-inch and two 3-inch batteries assigned to the northern mine field.

23. Southern Mine Group. a. Battery McCook, two 6-inch B. C. at Fort Andrews. See Exhibit 11-B. This battery has no fire control system. A manhole-type station for DPF was built in 1925 for the battery, to replace a conspicuous brick tower, but no instrument has been installed. One is needed. The view from this station is limited on the right by the high ground at Hull, and masked on the left by the Brewsters. The mine field is covered.

- (1). Should it become practicable at some time to provide a new station for Battery McCook, a CRF station should be built. The CRF station should be near the battery to avoid the necessity of relocating. As the present DPF station is now and is fairly satisfactory, the construction of the CRF station at this time is not proposed.

b. Battery Whipple, two 6-inch B.C. at Fort Standish. See Exhibit 12-B. The battery has a 15-foot CRF. Both guns and the CRF station bear on the southern mine field at a range of 3,500 yards and also on a portion of the northern mine field (one gun on the entire field) at a range of about 6,000 yards.

c. Battery Bumpus, two 3-inch P. M. at Fort Andrews. This battery has a 9-foot CRF, mounted in a station at abandoned Battery Rico; it has the field of view shown in Exhibit 13-B.

d. Battery Stevens, two 3-inch P. M. at Fort Strong. This battery, as shown in Exhibit 14-B, is approximately 6,000 yards in rear of the mine field and is masked from it except through an arc of 70°. It has no fire control station or instrument, and in view of the small value of the battery the expenditure to provide fire control equipment seems inexpedient.

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e. Battery Williams, three 3-inch P.M. at Fort Standish. See Exhibit 15-B. A 9-foot CRF is on hand but no station has been constructed. Since the traverses have been shortened as described in paragraph 17 c, Annex A, any one of the three guns can fire on the mine field, at a range of approximately 3,600 yards. A suitable provision for mounting the CRF is to construct a wooden platform 15 feet high in rear of the battery; from the instrument height of about 20 feet so provided, an all-around view is obtainable. The design of a suitable tower is attached as Exhibit 21-B.

24. Northern Mine Group. a. Battery Terrill, three 6-inch D. C. at Fort Standish. See Exhibit 16-B. The battery is provided with a horizontal base and plotting room. B' at Fort Standish has a DPF as has B" at Deer Island. The baseline has a good presentation and adequate length. The masked areas are shown in the exhibit, as are the areas covered by the baseline and by each of the DPF's. The mine field is adequately covered, though at a range of approximately 6,000 yards.

- (1). A portion of the duct line between the Fort Standish switchboard room and Battery Terrill was washed out by the sea in 1921 and has not been restored; it should be rebuilt. In 23d indorsement, February 11, 1930, to The Adjutant General, the Chief of Engineers stated that an estimate of \$3,200 would be included in estimates for the fiscal year 1932 (665; Boston; 96). Using labor provided by emergency funds, a start was made in 1934 toward rebuilding the duct line. The shore protection referred to in the correspondence was completed December 28, 1932.

b. Battery Sanders, three 6-inch D.C. at Fort Revere. See Exhibit 17-B. The baseline provided, with B' (equipped with DPF) at Fort Revere and B" (similarly equipped) at Fort Standish, does not entirely cover the controlled mines and does not cover the west contact mines of the northern mine field at all. The low site of the DPF at B" limits its range to about 2,500 yards. The DPF at B' is effective to about 10,600 yards, and covers both the controlled and the contact mines. The average range to the mine field is 8,300 yards. Because of the range, the battery is of value principally in defending the southern portion of the mine field. A two-gun 6-inch battery with CRF at Fort Heath would be more valuable.

c. Battery Basinger, two 3-inch P. M. at Fort Strong. The battery is approximately 6,500 yards from the mine field as shown in Exhibit 18-B. It is equipped with CRF having the field indicated.

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d. Battery Taylor, two 3-inch P.M. at Fort Strong. No fire-control stations or apparatus have been assigned to the battery. The field of fire is shown in Exhibit 19-B. As the battery faces northwest, but one gun at a time can be fired to the east of Deer Island. The range is approximately 7,000 yards. The battery has little value. It seems inadvisable to provide a fire-control system.

25. Fire Control Cables. a. Some of the fire control cables in the harbor defense are of considerable age. The elimination of batteries no longer required, and the addition of the extensive demands of the long range fire control project, and of the antiaircraft artillery with its intelligence service, has made advisable a change in the routing of the main axis of communication. That axis should lie from Fort Ruckman on the north to Fort Heath, thence to Fort Banks, to Deer Island via the west side of Winthrop peninsula, to Fort Standish, to Fort Warren, and thence to the Hull terminal.

- (1). Lateral lines will extend from Fort Standish to Fort Strong; from Fort Standish to Outer Browster; from Fort Warren to Fort Andrews; and from the Hull terminal to Fort Duvall.

b. The existing and projected cables are shown in Exhibit 23-B. In Exhibit 22-B are shown the detailed requirements of the fire control system, from which the required capacity of the cables were determined.

c. The following statement shows the cable requirements of the harbor defense:

- (1). A 20-pair cable should be provided from Marblehead Neck to Fort Ruckman; 11 pairs are needed.
- (2). A 30-pair cable should be provided from Fort Ruckman to Fort Heath in addition to the 30-pair cable existing; 48 pairs are needed.
- (3). There is an existing 75-pair subterranean cable from Fort Heath to Fort Banks; 65 pairs are needed.
- (4). A 75-pair cable should be provided from Fort Banks to Deer Island via the west side of the Winthrop peninsula; the necessary right of way from Fort Banks to the water is assured. The existing cables from Fort Heath to Deer Island then should be abandoned or recovered, as they lie over rocky shoals. 56 pairs are needed.

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- (5). A 50-pair cable should be laid from Deer Island to Fort Standish in addition to the existing 50-pair cable laid in 1913; this provides an alternative route for the most essential lines should one of the cables fail. 62 pairs are needed. X
- (6). A 75-pair cable should be provided from Fort Standish to Fort Warren, on account of the age of the existing cables. When the present cables become unserviceable they may then be abandoned in place. 41 pairs are needed. X
- (7). By a re-routing of cables in 1934, the needs of that portion of the fire control system between Fort Warren and Strawberry Hill were met. Old cable No. 274 from Fort Andrews to Fort Warren was recovered and part of it relaid to the east cable terminal at Fort Andrews. The remainder was used to lay a new cable (numbered 564) from Fort Warren to the Hull cable terminal, thus providing 33 pairs direct from Fort Warren to the Hull terminal and 35 pairs to Fort Andrews, 25 pairs of which may be connected through to the Hull terminal via one of the two 25-pair cables existing between the east terminal at Fort Andrews and the Hull terminal. Old cable No. 275 from Fort Warren to Fort Andrews was recovered and part of it relaid as now No. 564 from Fort Warren to the Hull terminal. Another part of this cable has been laid as now No. 562 from the Hull terminal to the Point Allerton terminal. This results in now giving a capacity of 55 pairs direct from Fort Warren to the Hull terminal and 25 pairs from Fort Warren to the Hull terminal via Andrews, or a total of 80 pairs, of which 64 pairs are needed. It also allows a margin over the 5 pairs needed direct from Fort Warren to stop at Fort Andrews, and for the 16 pairs required from the Hull terminal to stop at Fort Andrews. X
- (8). Laying the new cable No. 562 from the Hull terminal to Point Allerton provides a capacity of 70 pairs over this section of which 58 pairs are needed. Old cable No. 429 from Fort Andrews to the Hull terminal was recovered and the cable relaid as now No. 565 from Point Allerton to Strawberry Hill. This provided a total of 22 pairs between these two points, of which 13 pairs are needed. X

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- (9). An unused portion of old cable No. 275 is presently to be laid between Fort Warren and Fort Standish; it will be designated No. 563. When this cable is laid, the requirements of the harbor defense project between Strawberry Hill and Fort Standish will have been met.
- (10). No new cable is required between Fort Standish and Fort Strong, where there are now 42 pairs; 17 pairs are required.
- (11). A 10-pair cable should be provided from Fort Standish to Outer Brewster; 9 pairs are needed.
- (12). A 20-pair cable should be provided from Point Allerton to Strawberry Point; 11 pairs are needed.

d. The commercial lines from the south (see paragraph 9, ante) should enter the fire control system at Point Allerton.

26. Switchboards. a. Switchboards are required as follows:

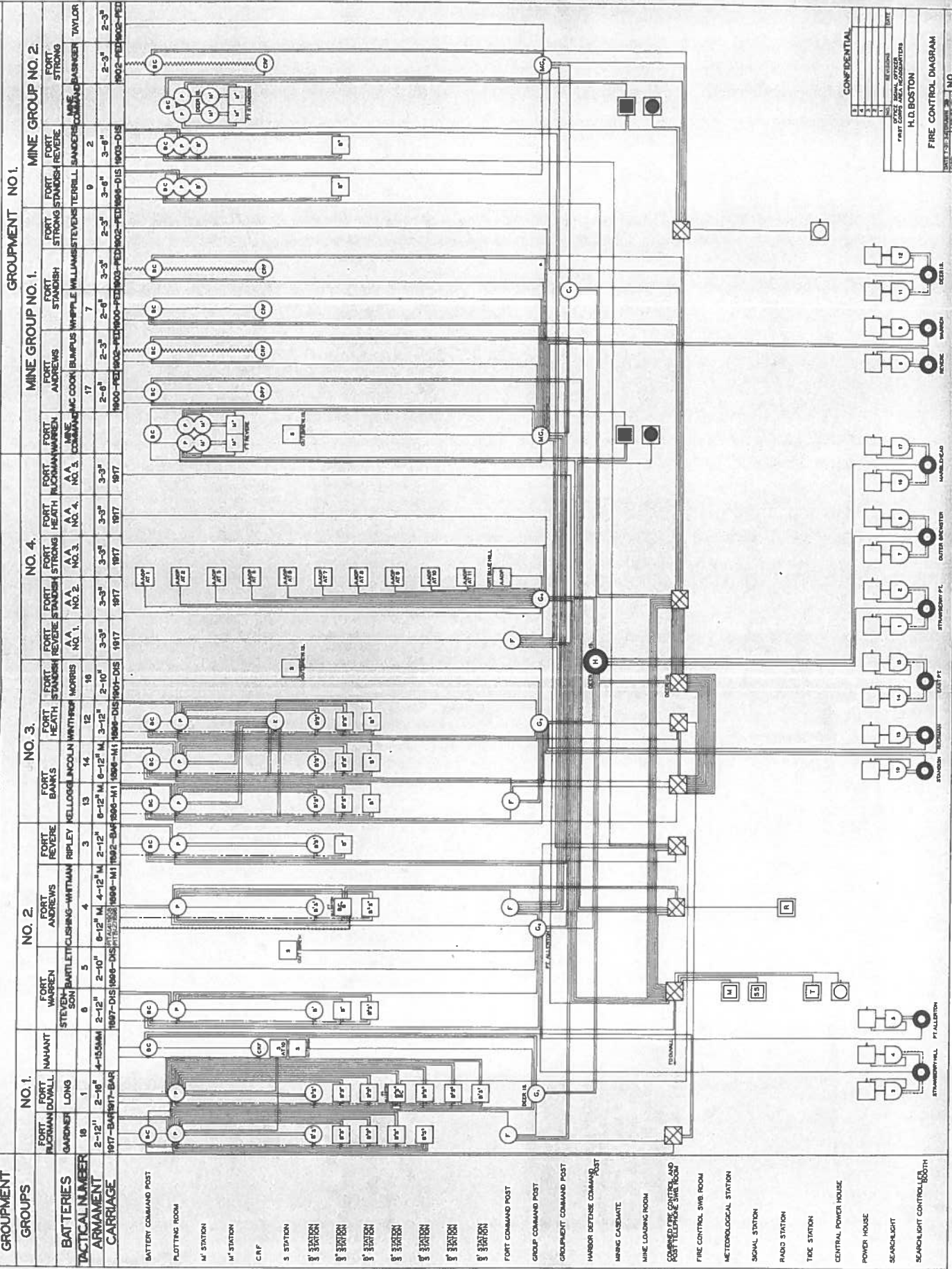
Fort Ruckman -- to be provided;
Fort Heath -- existing;
Fort Banks -- to be provided;
Deer Island -- to be provided; X
Fort Standish -- existing;
Fort Warron -- existing;
Fort Rovero -- existing.

b. Batteries Long and Gardner should be equipped with a switching panel under control of the battery commander, enabling him promptly to change from one baseline to another.

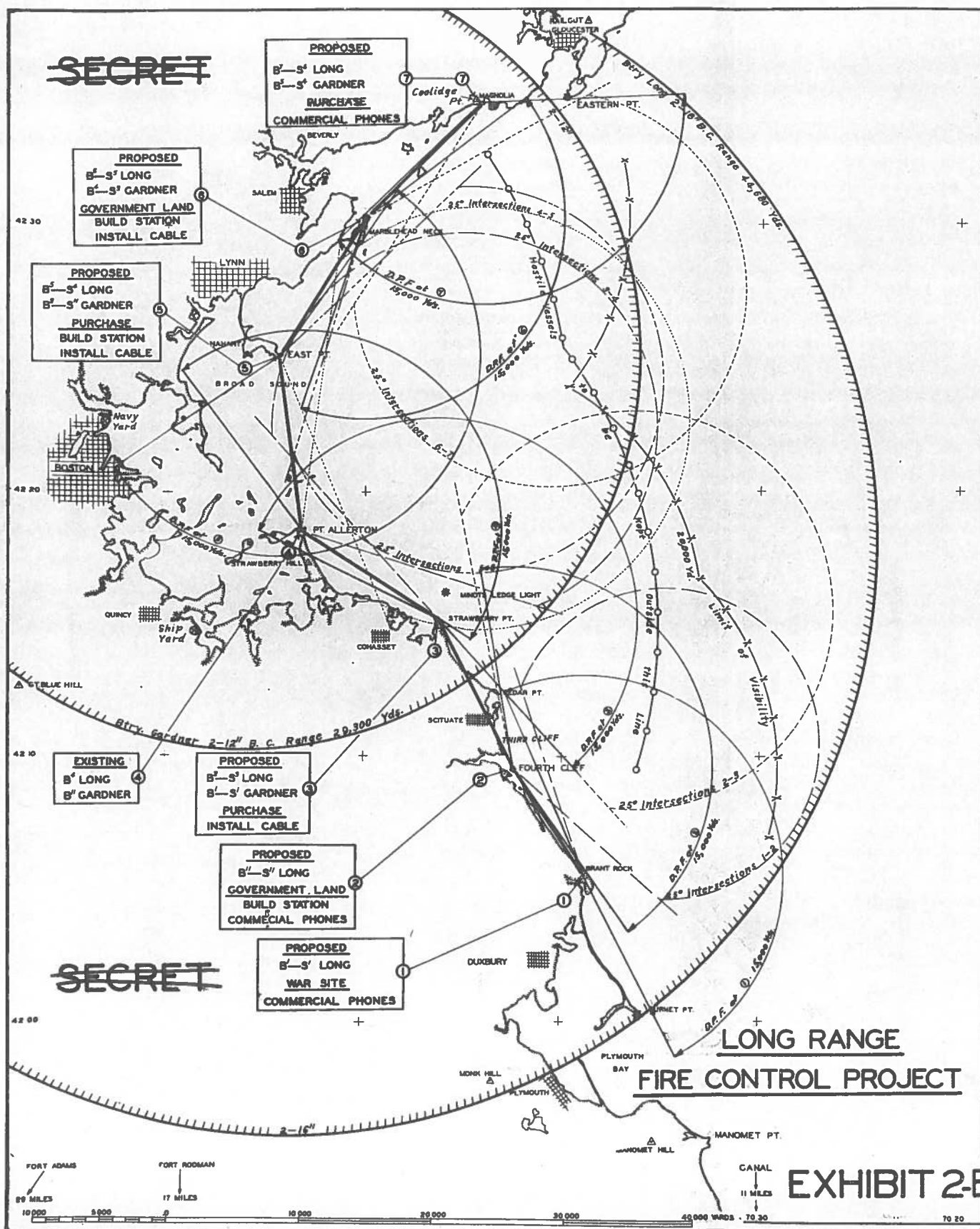
27. Cost Estimate. An estimate of cost and priority guide is appended as Exhibit 24-B. Those items which should be procured and installed in peace time are marked with an A. Those which should be procured in peace but whose installation may be deferred until an emergency arises are marked B. Those items to be procured and installed when an emergency arises are marked C.

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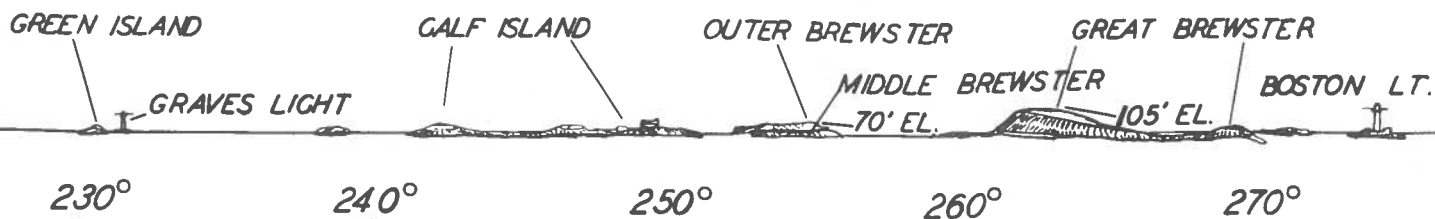
FIRE CONTROL DIAGRAM-EVENTUAL STATUS-HARBOR DEFENSES OF BOSTON



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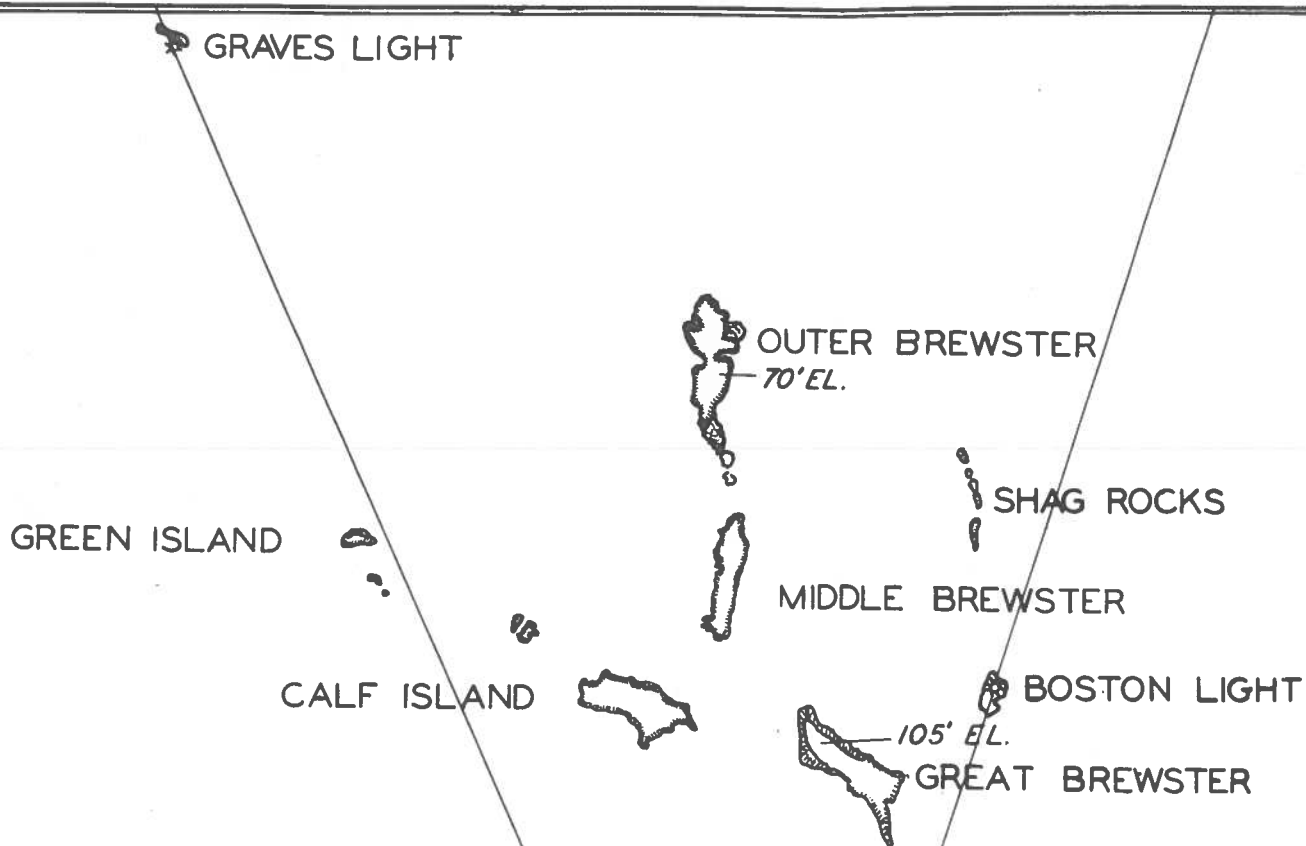


VIEW FROM AN AVERAGE FIRE CONTROL STATION, FORT STANDISH



A CRF OR HOR. BASE CAN OBSERVE ON MASTS OVER ALL ISLANDS EXCEPT HIGH PORTION OF GREAT BREWSTER.

A D.P.F. CANNOT OPERATE OVER ANY ISLAND.



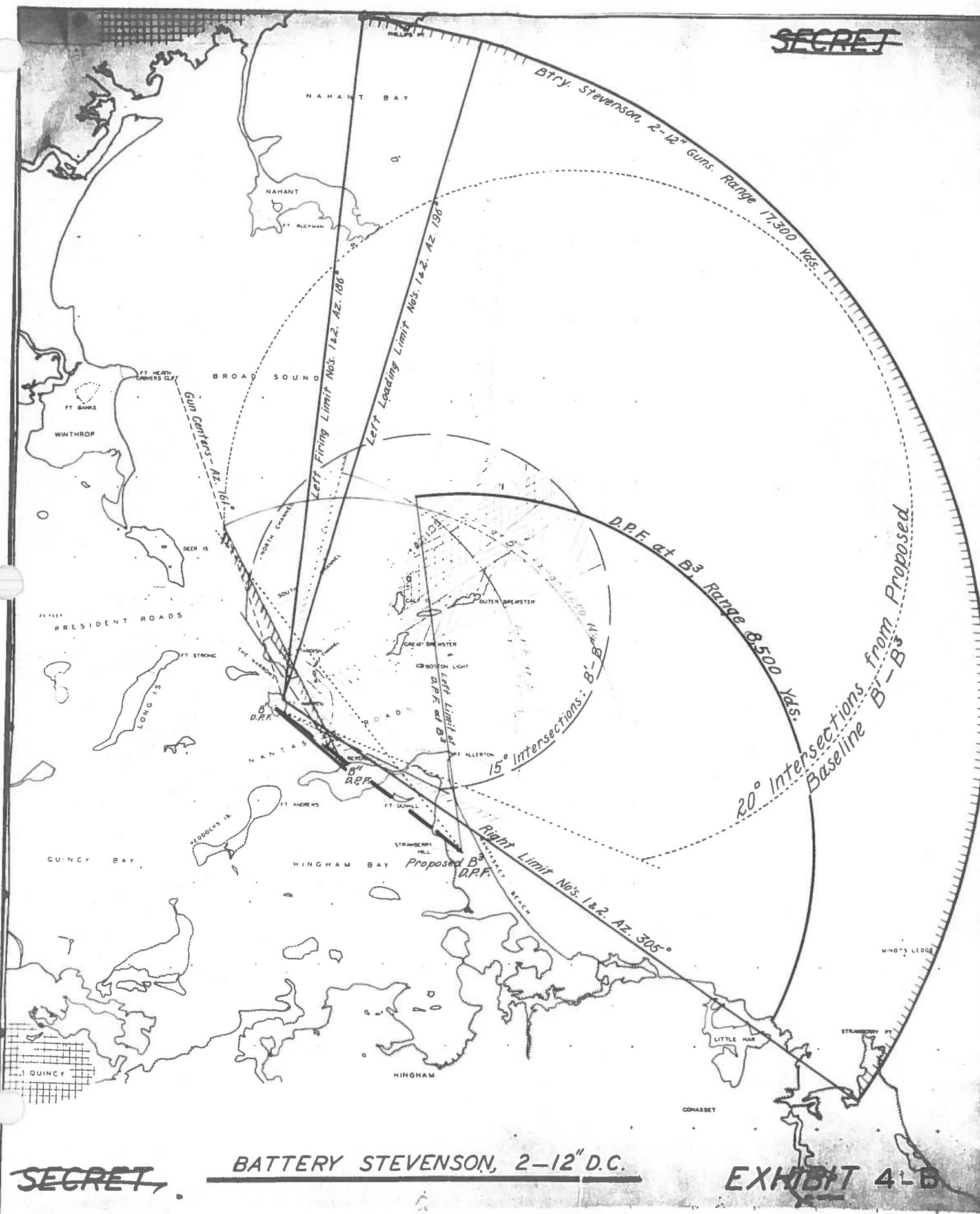
Scale 1/80000

FORT STANDISH



EXHIBIT 3-B

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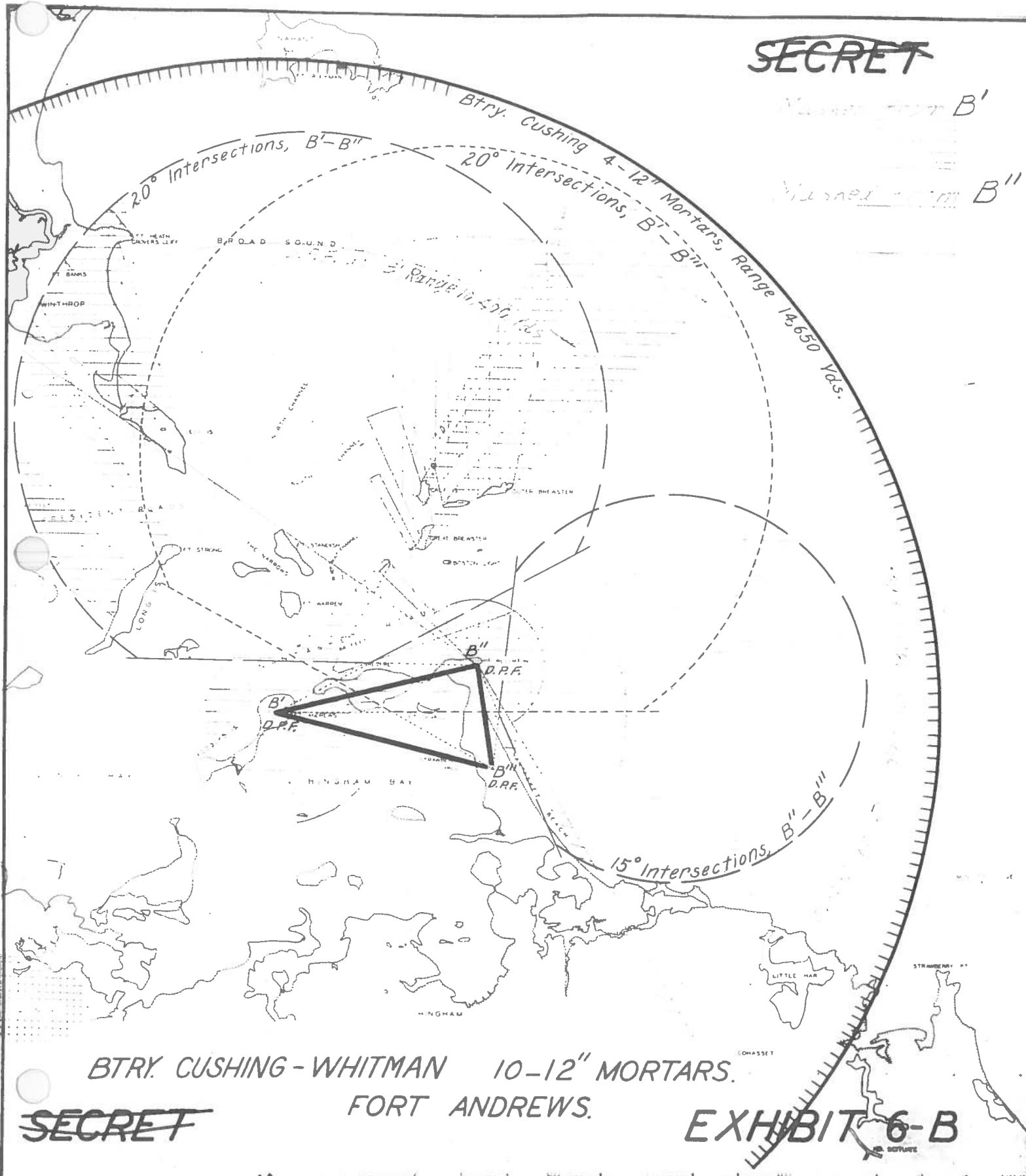


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BATTERY STEVENSON, 2-12" D.C.

EXHIBIT 4-B

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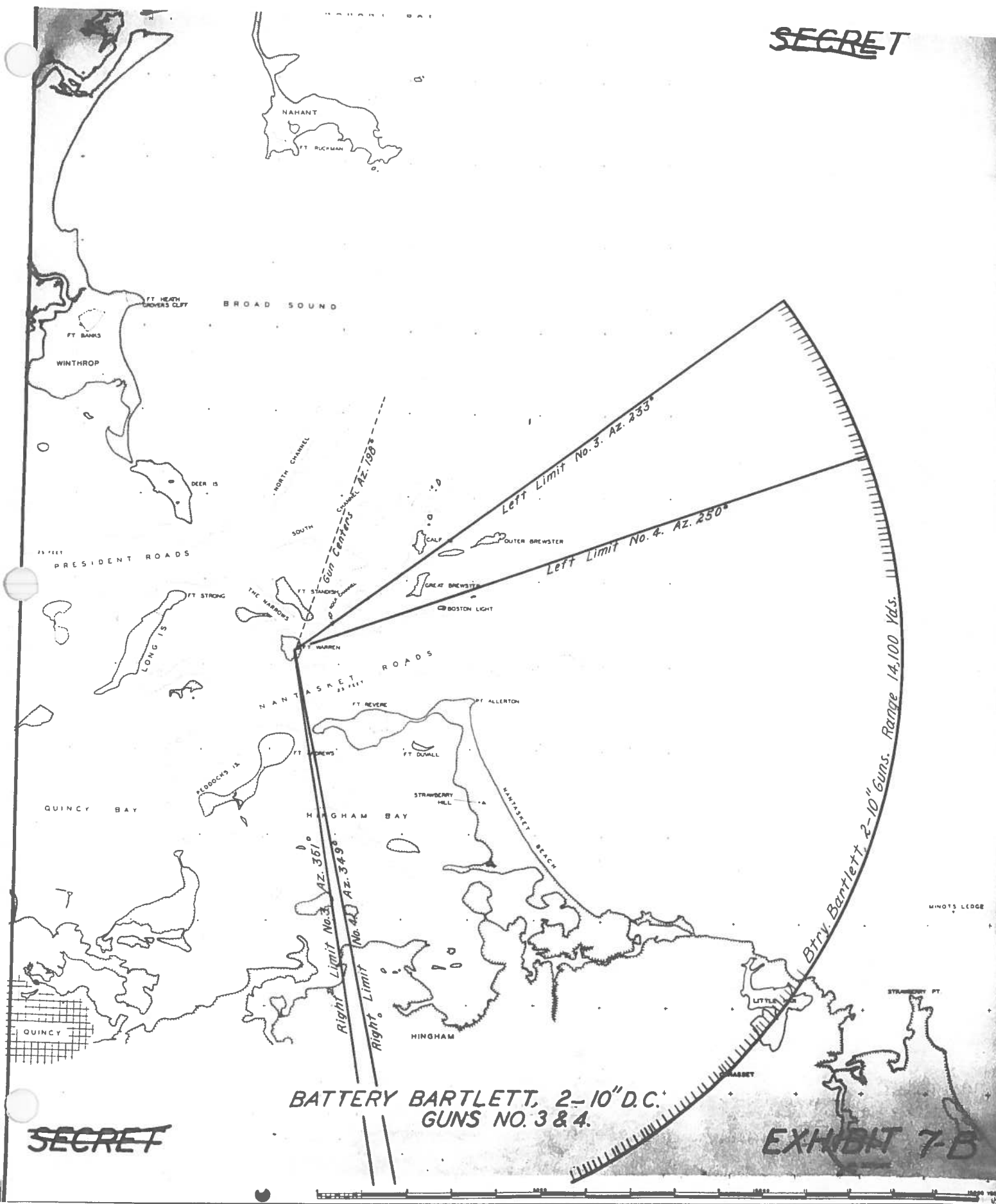


BTRY. CUSHING - WHITMAN 10-12" MORTARS.
FORT ANDREWS.

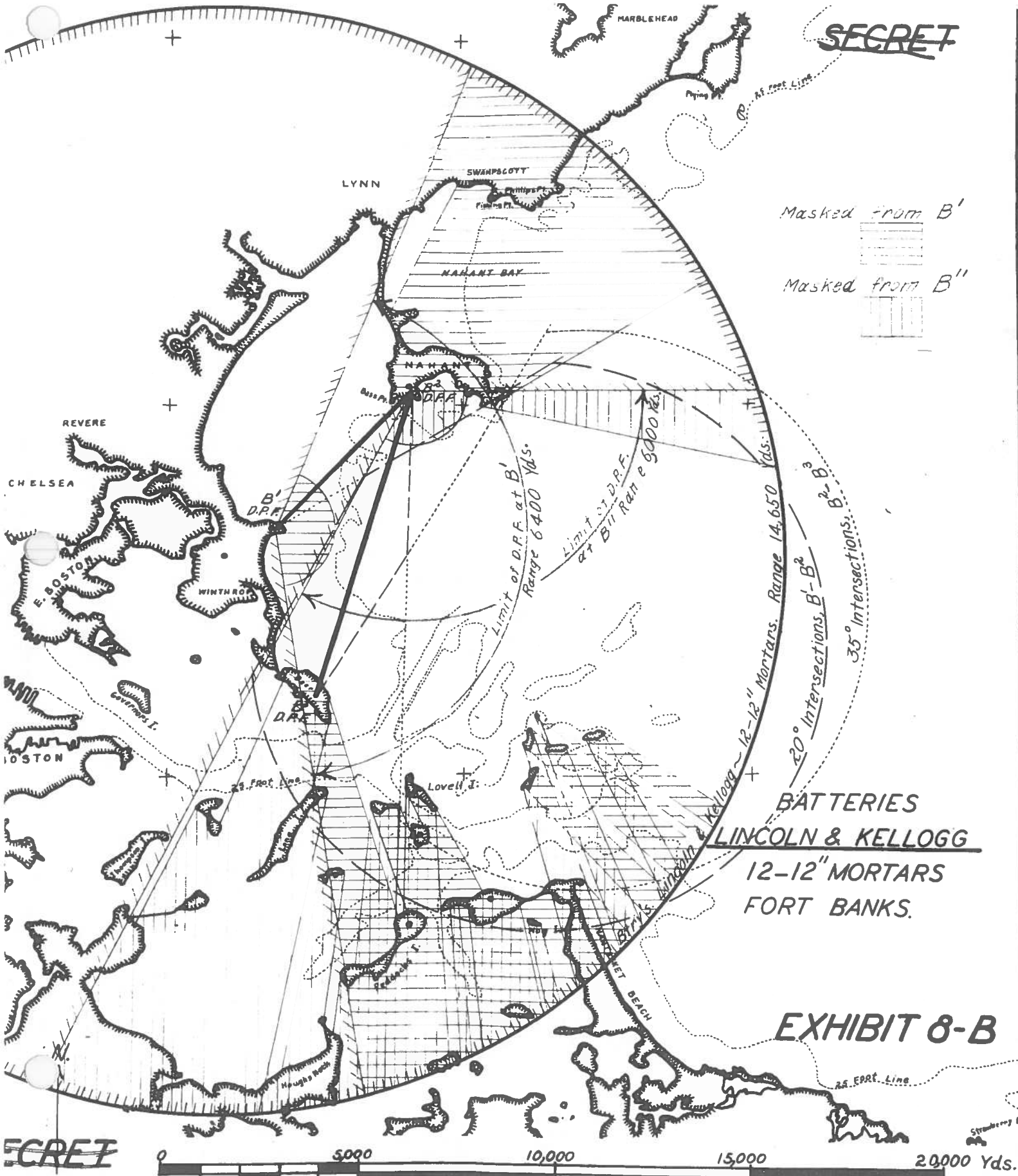
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EXHIBIT 6-B

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Masked from B'

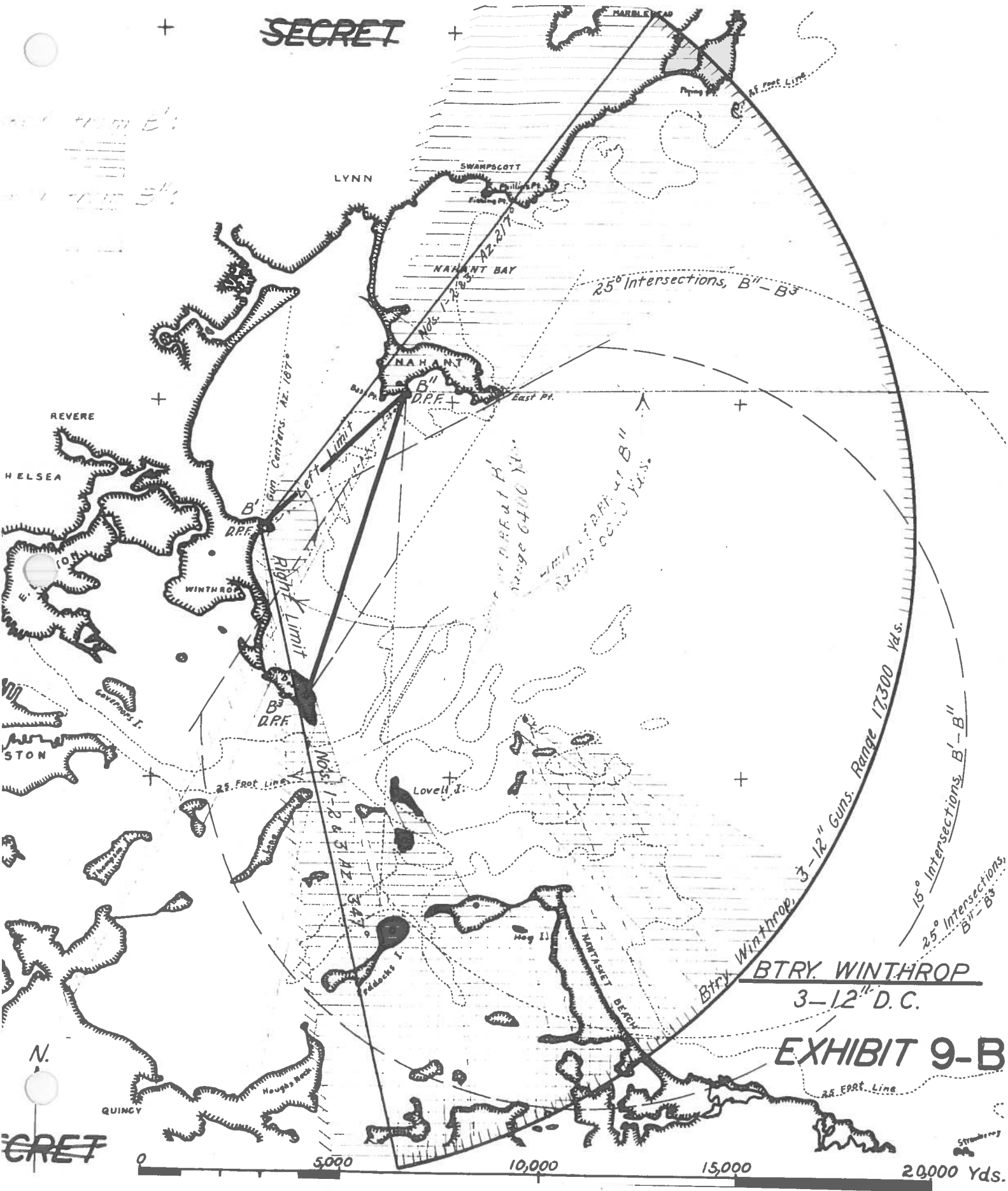
Masked from B''

**BATTERIES
LINCOLN & KELLOGG**
12-12" MORTARS
FORT BANKS.

EXHIBIT 8-B

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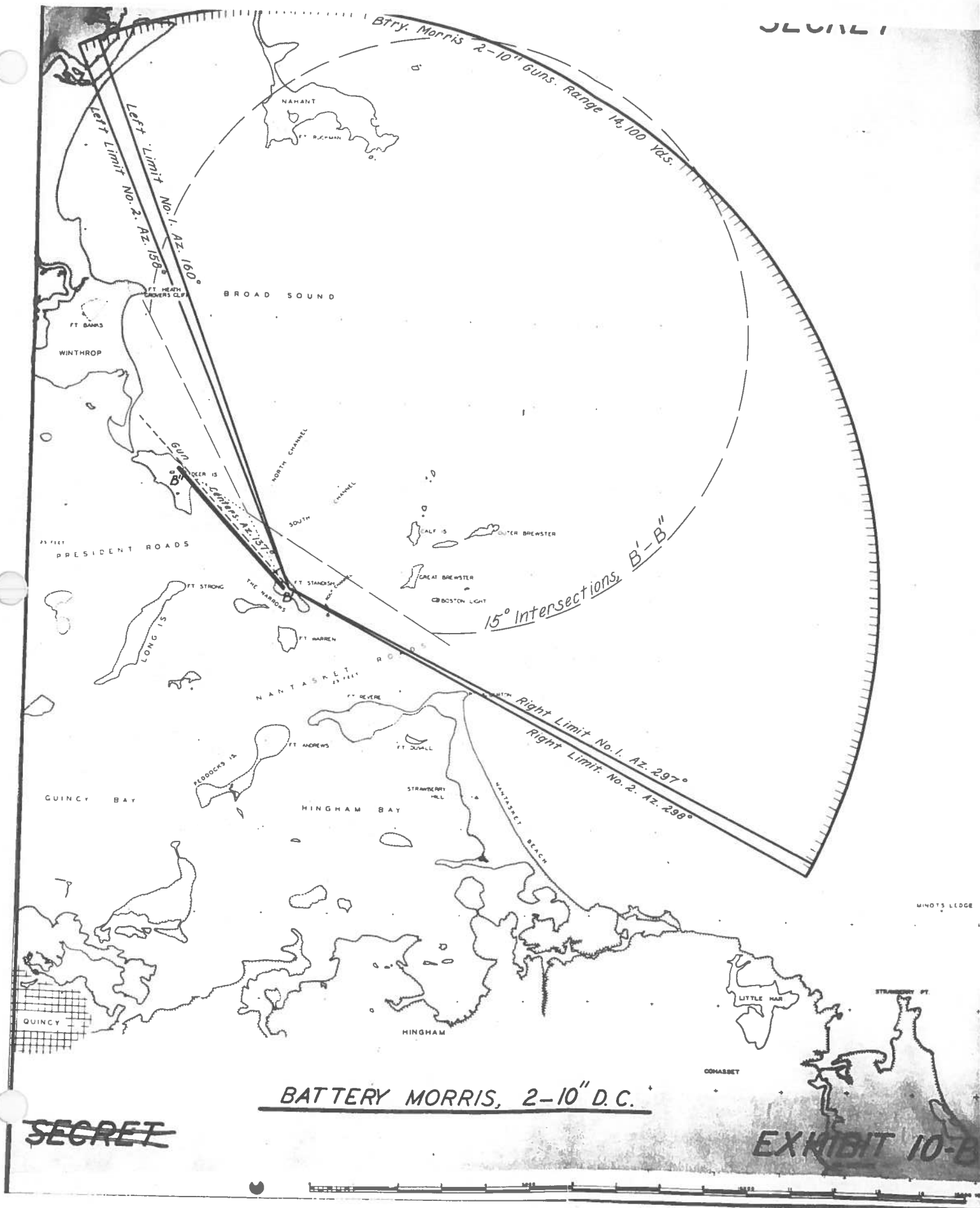


BTRY WINTHROP
3-12" D.C.

EXHIBIT 9-B

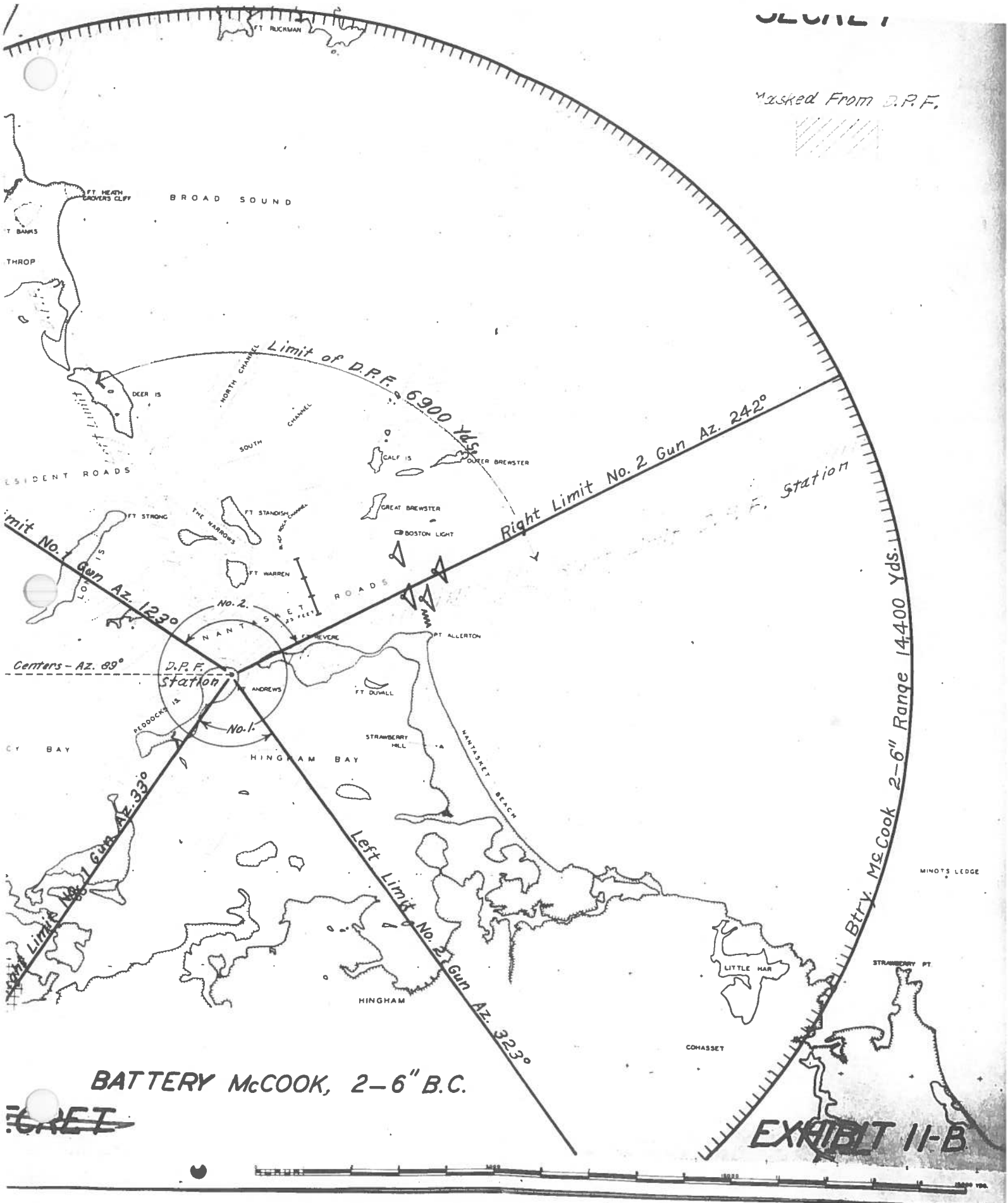
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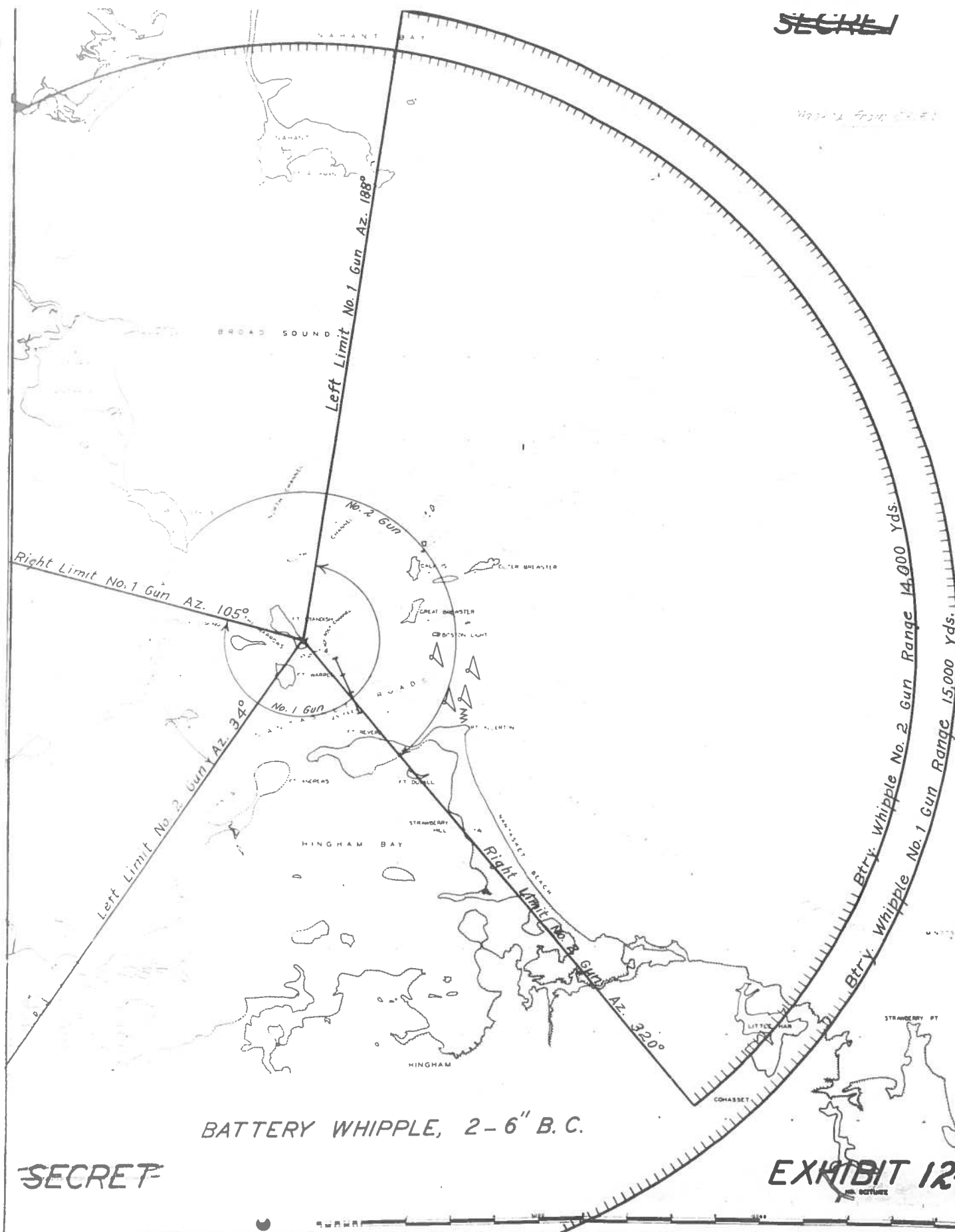
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Masked From D.P.F.



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WIND FROM S.W.



BATTERY WHIPPLE, 2-6" B.C.

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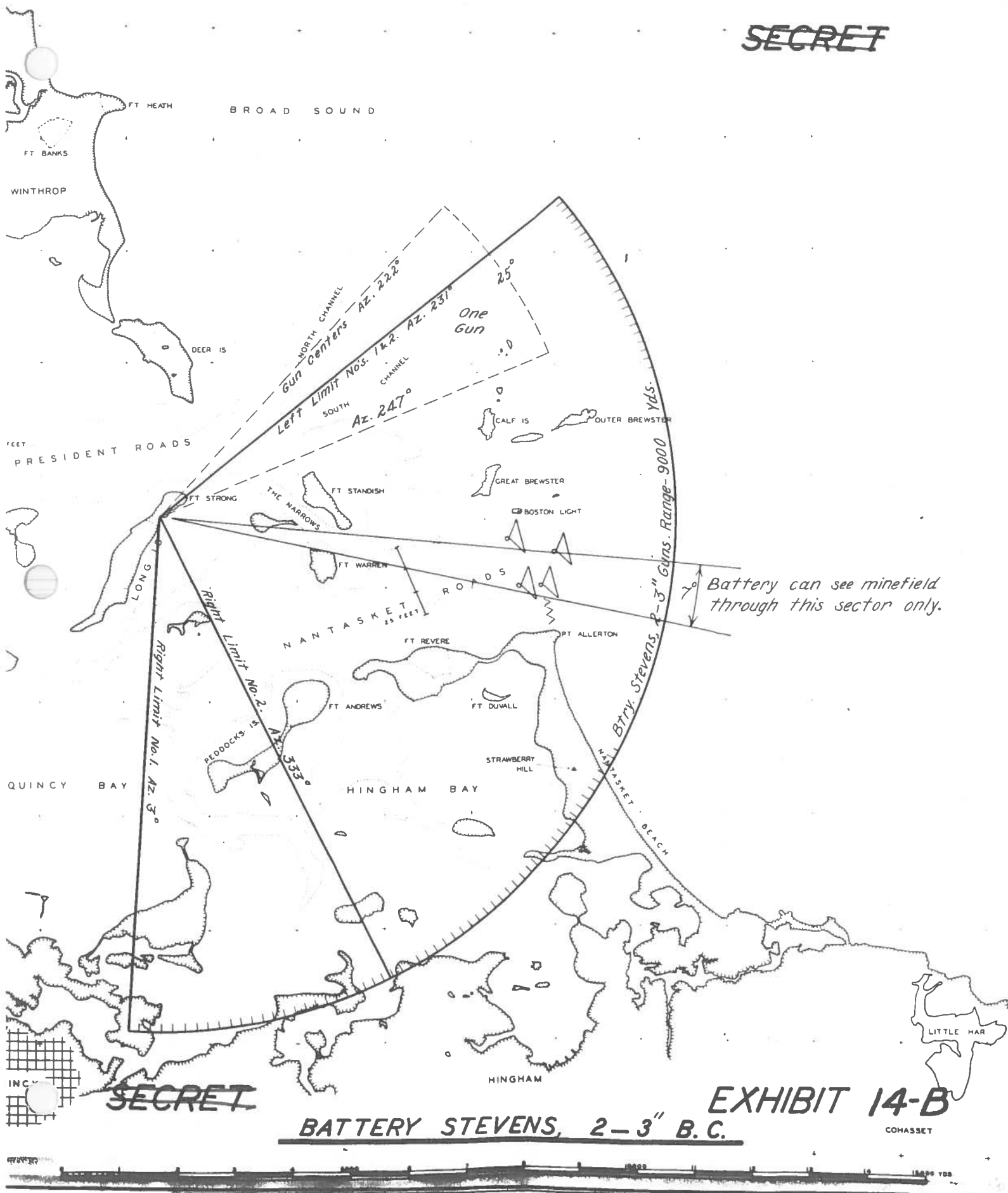
EXHIBIT 12-B

[illegible][illegible]

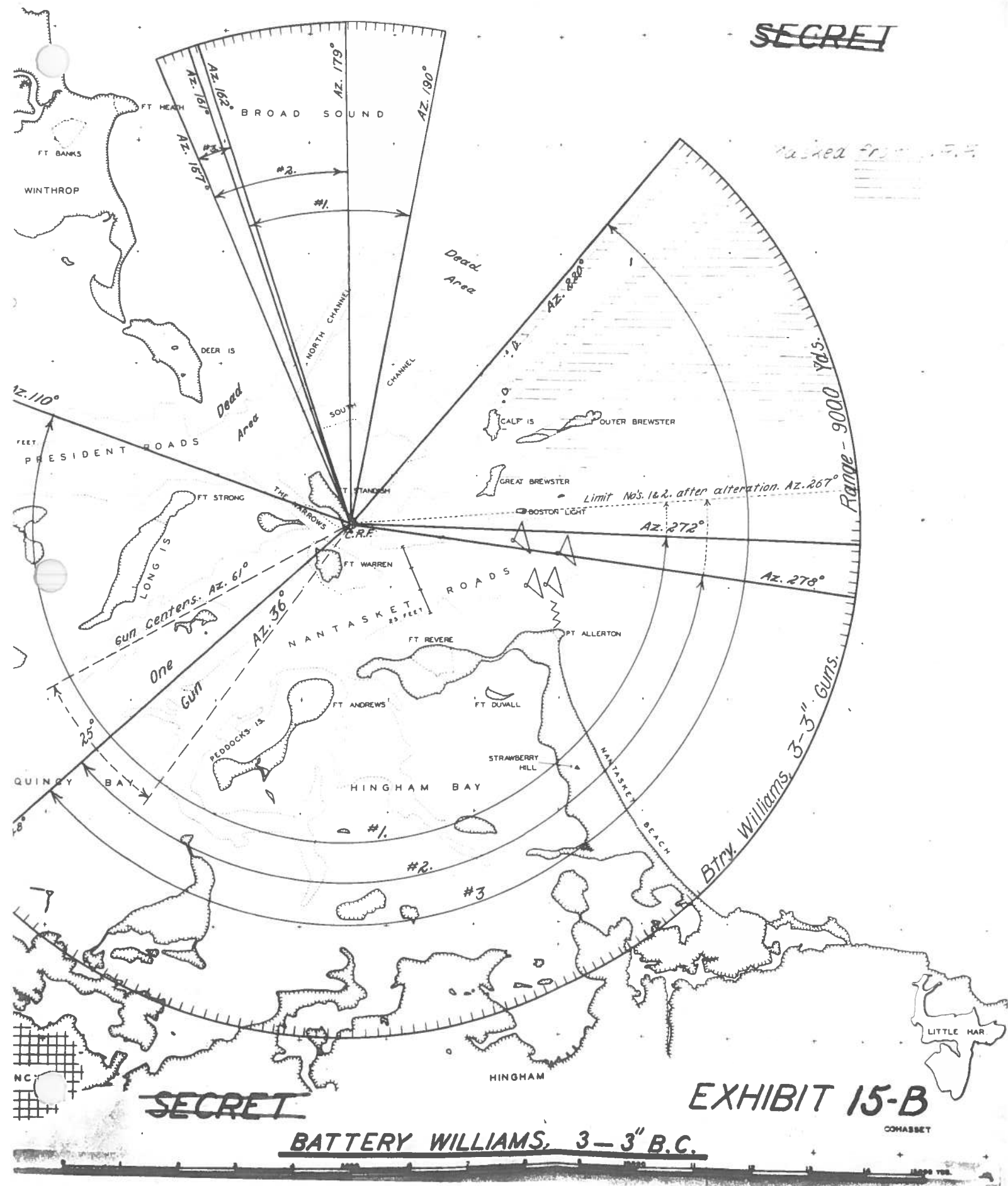
EXHIBIT 13-B

BATTERY BUMPUS, 2-3" B.C.

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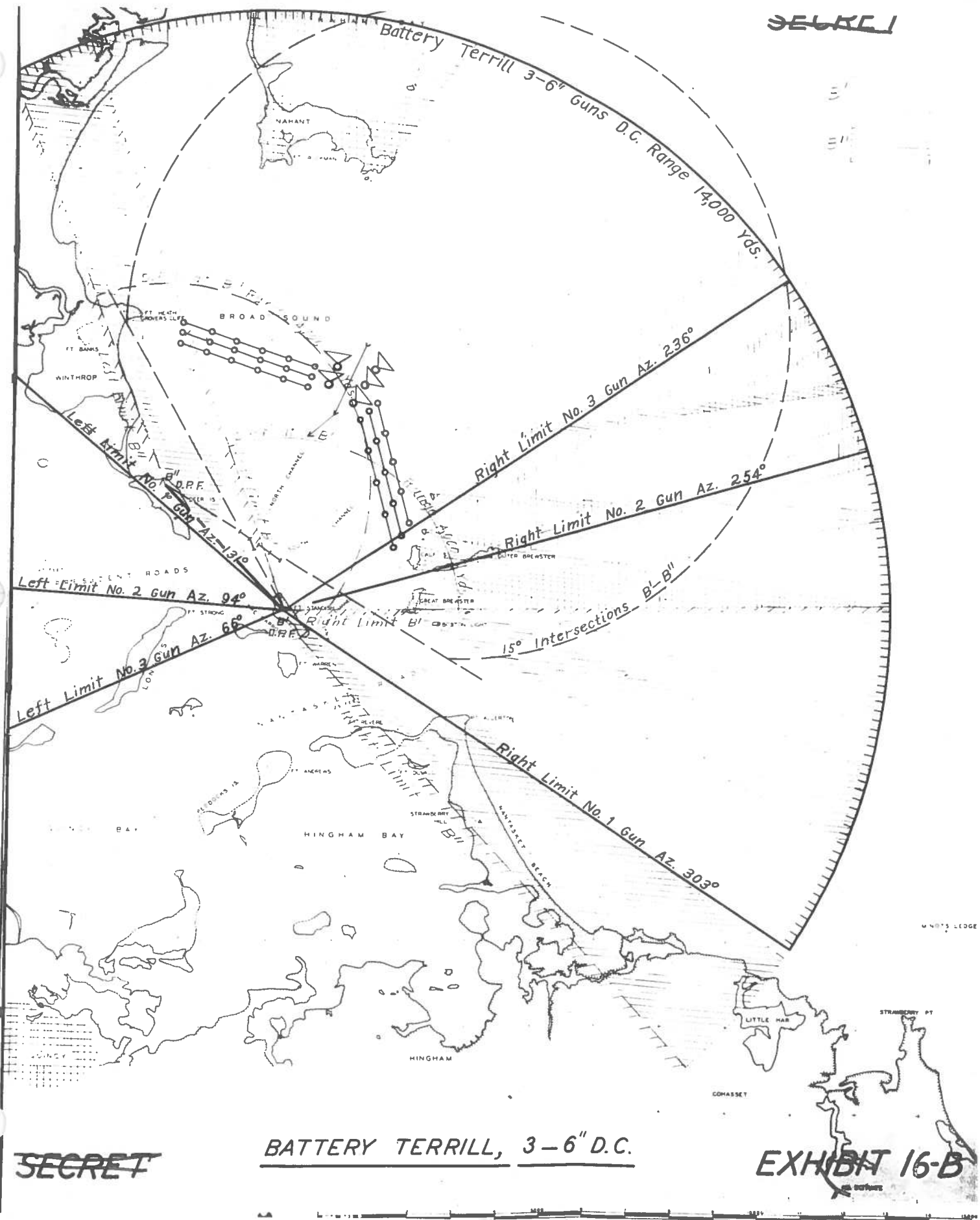
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EXHIBIT 15-B

BATTERY WILLIAMS, 3-3" B.C.

COMASSET

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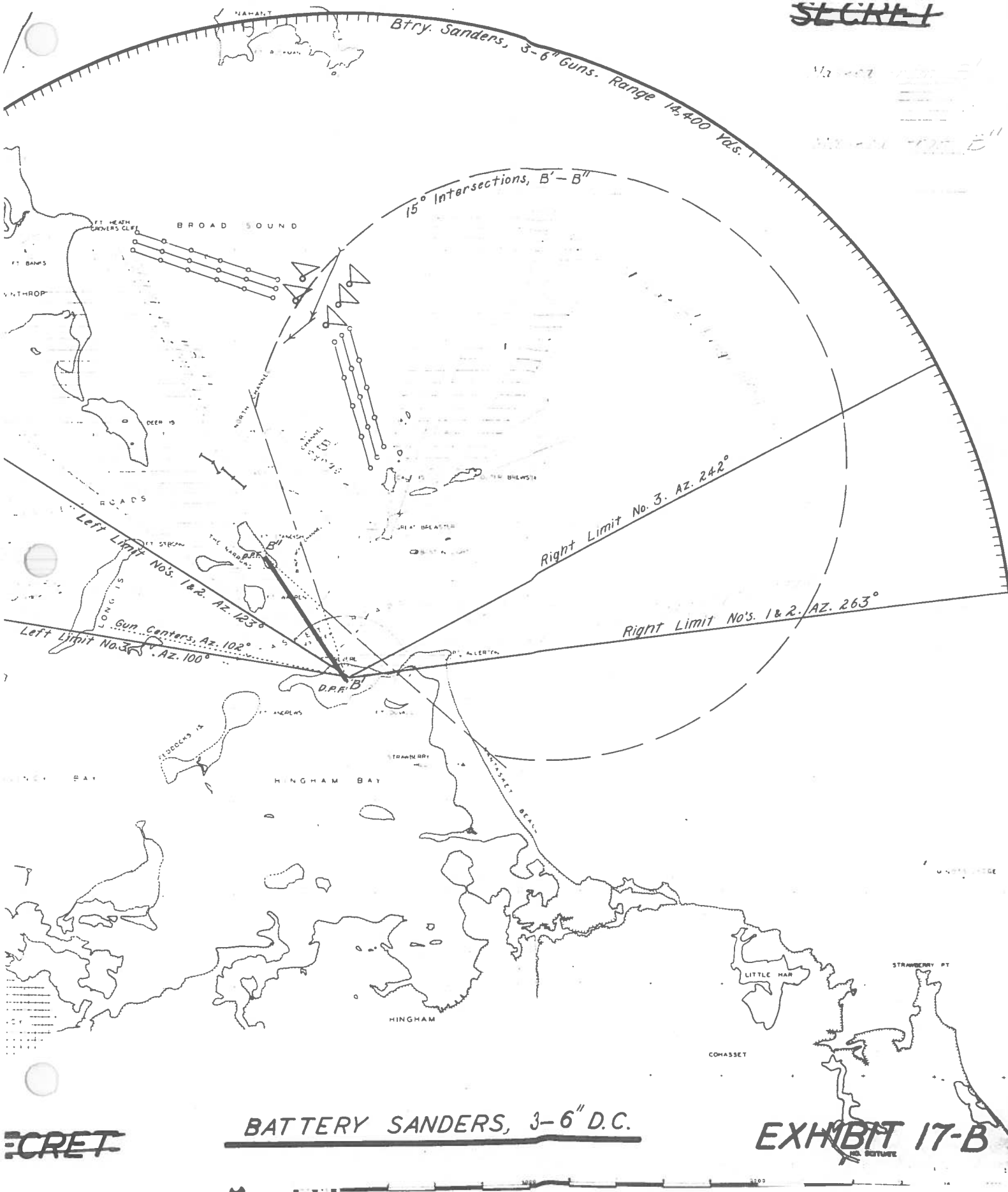


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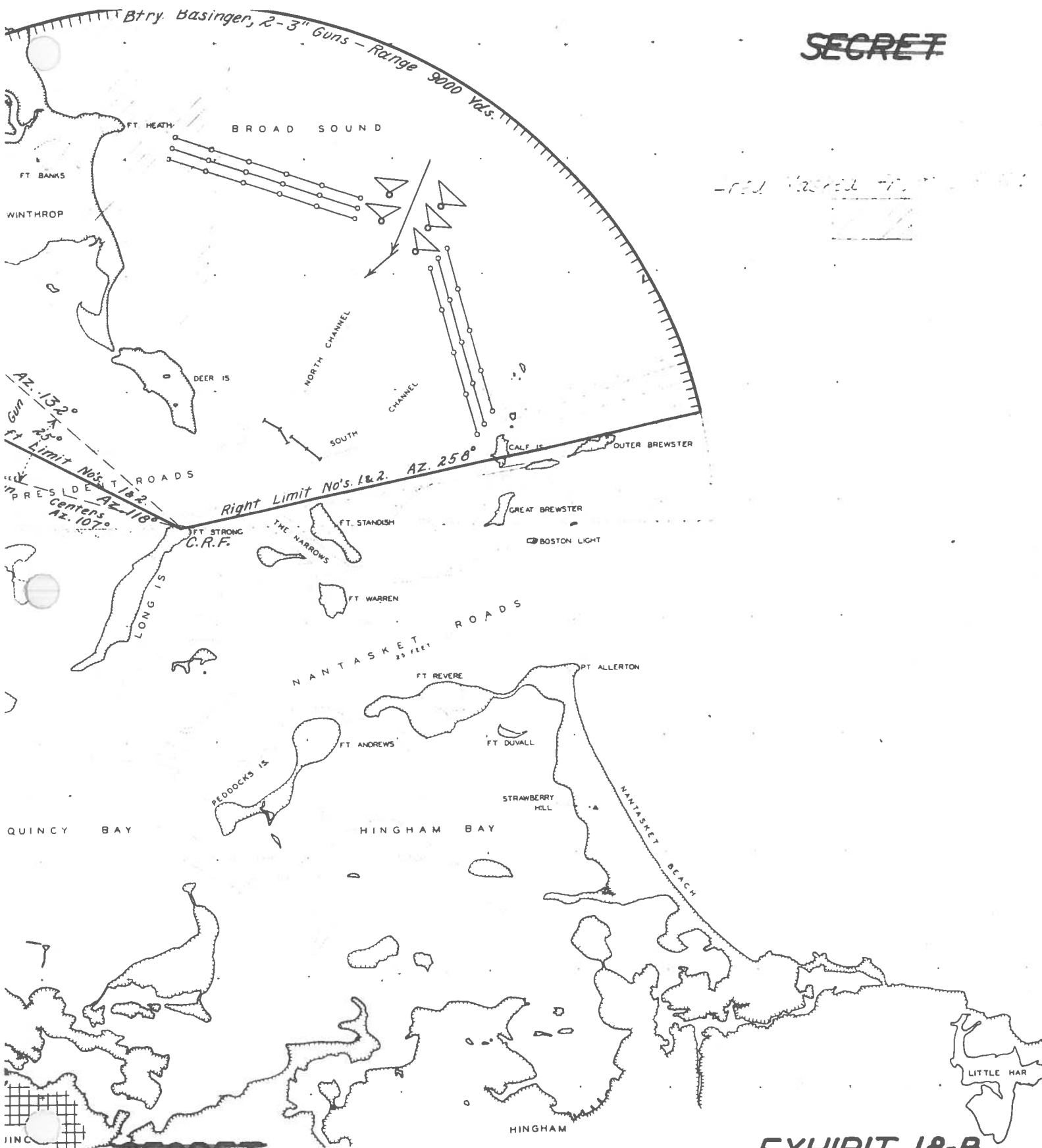
BATTERY TERRILL, 3-6" D.C.

EXHIBIT 16-B

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EXHIBIT 18-B

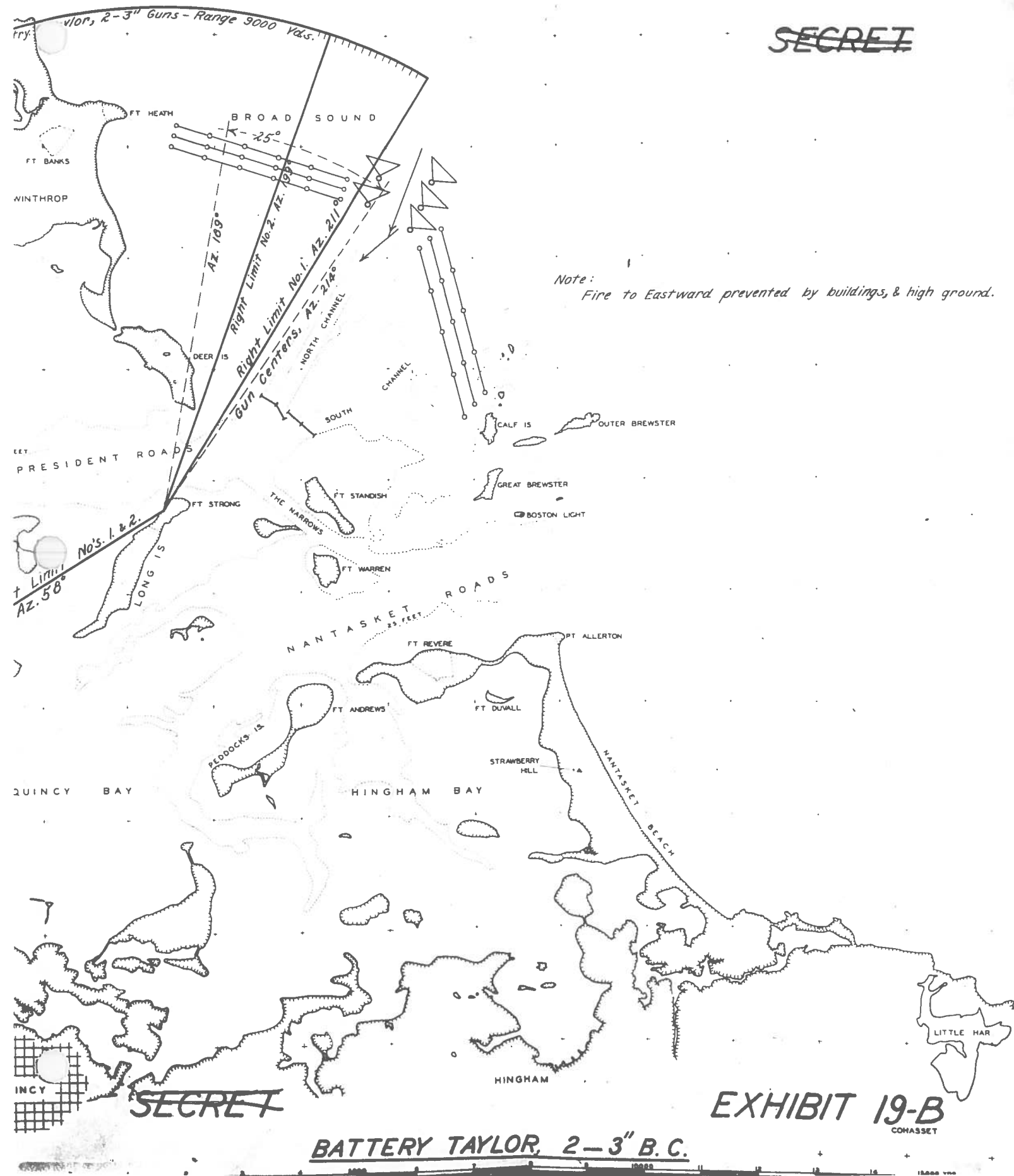
COHASSET

BATTERY BASINGER, 2-3" B.C



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BATTERY TAYLOR, 2-3" B. C.



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PRESENT F. C. STATIONS AT
FORT RUCKMAN AND
PROPOSED F. C. STATIONS AND
SEARCHLIGHTS AT EAST POINT.

EXHIBIT No. 20-B



NAHANT BAY

Spouting Horn.

Sanders Ledge.

East Point

Proposed
F.C. Station

Pea Island

Shag Rocks

Battery Gardner

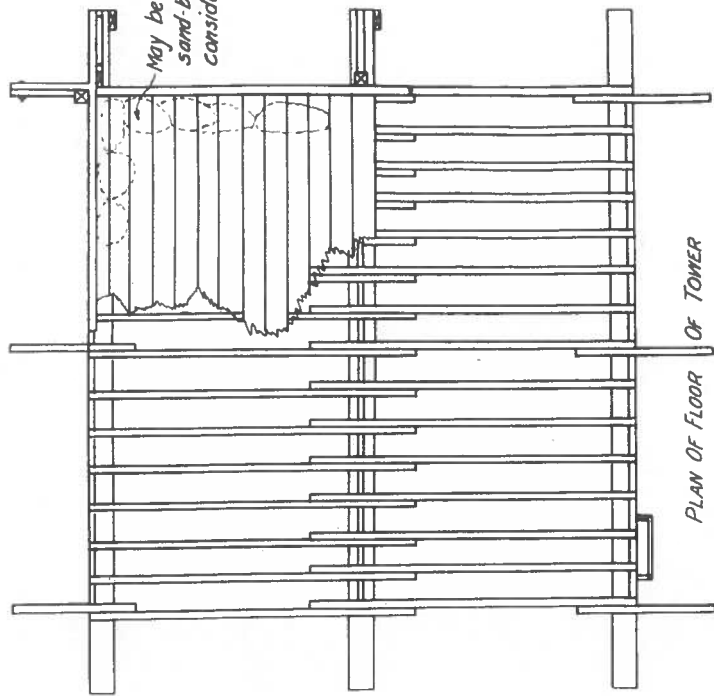
Bayley Hill

F.C. Stations
Future Location

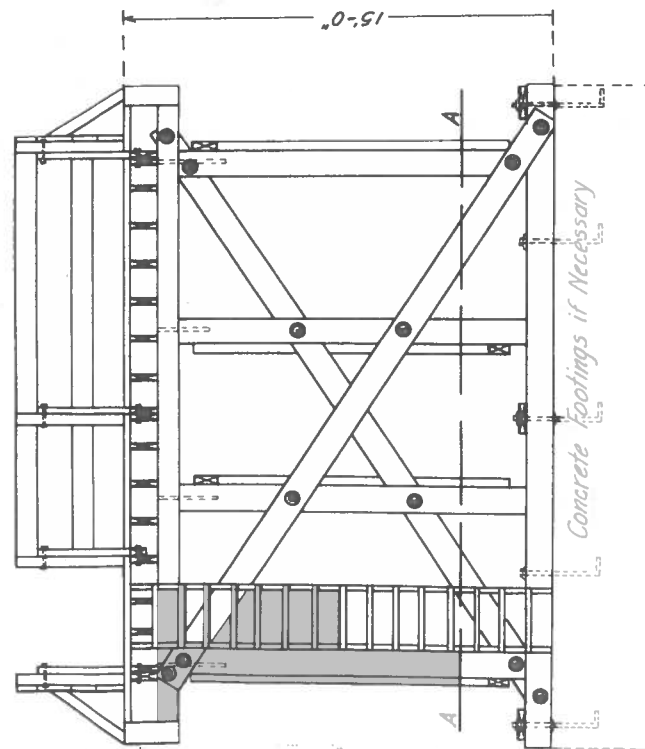
F.C. Stations
Present Location.

Compiled from Photostats of Sections of
Sheets 2177 & 3767, U.S.C. & G.S. and Sketch Map
of Fort Ruckman.

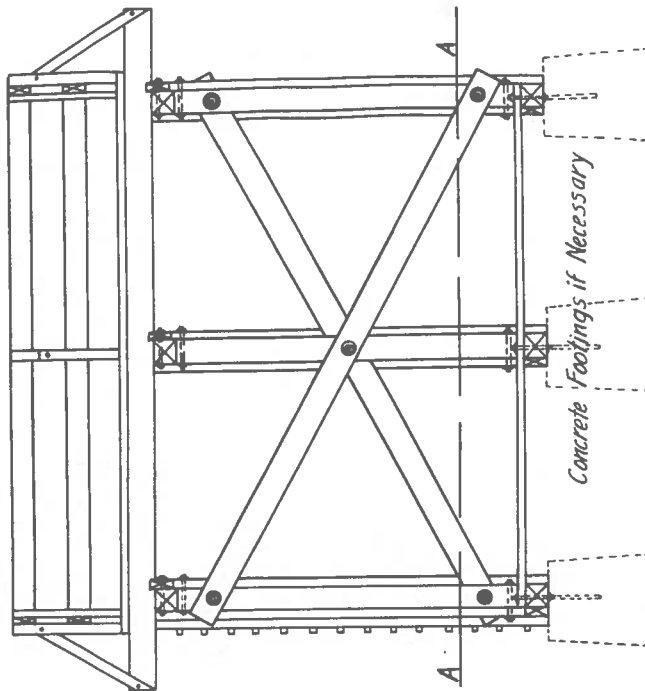
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SECTIONAL PLAN THROUGH LINE A-A



ELEVATION NORMAL TO BENT



ELEVATION PARALLEL TO BENT

DESIGN OF C.R.F. STATION TOWER

ENGINEER OFFICE

DECEMBER 22, 1933

Stem

EXHIBIT 21-B

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MARBLEHEAD NECK

LYNN

NAHANT

FT. RUCKMAN

EAST PT.

Needed 11 Pr.
Proposed 20 Pr.

Needed 48 Pr.
Now 31 Pr.

BROAD SOUND

FT. HEATH

FT. BANKS

Needed 56 Pr.
Now 32 Pr. (TO BE ABANDONED)

Needed 62 Pr.
Now 51 Pr.

DEER IS.

Needed 17 Pr.
Now 4.2 Pr.

FT. STRONG

FT. STANDISH

Needed 41 Pr.
Now 37 Pr. (TO BE ABANDONED)

FT. WARREN

Needed 5 Pr.
Now 30 Pr.
To Andrews.

Needed 54 Pr.
Now 50 Pr.

FT. ANDREWS

Additional pairs required
are furnished via
Ft. Andrews.

FT. REVERE

FT. DUVAL

STRAWBERRY HILL

Needed 16 Pr.
Now 50 Pr.
To Andrews.

PT. ALLERTON

Needed 58 Pr.
Now 70 Pr.

Needed 32 Pr.
Now 5.2 Pr.

Needed 13 Pr.
Now 2.2 Pr.

20 Pr.

MINOTS

STRAWBER

F. C. CABLES

— Existing
— x — x — x Proposed

Existing cables are shown as
having number of pairs which
are serviceable.

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EXHIBIT 23-B

COST ESTIMATE AND PRIORITY GUIDE

Priorities subject to change based on availability of funds.

H. L. OF BOSTON

Prior- ity	Class	Description of Project	Contractors Material	Engineers Labor	Signal Corps Land	Total
1	A	Recomputation orientation data, including necessary surveys		\$500		\$500
2	A	Equipment for plotting room, battery house				
3	A	1 Seasonal Director, \$55,000; 1 A.M. unit, \$25; 1 Board, fire adjustment, \$210; 1 Board, deflection, \$1900; 1 Board, spotting, \$1500; 1 Board, range correction, \$800; 1 Battery range corrector, \$120; 1 Indicator, wind component, \$150	\$55,785			56,785
4	A	1 Switching panel, \$375; 4 headsets with plug attachment, \$100	1,070			1,070
5	A	Equipment for Plotting Room, Battery Gardner			475	475
6	A	1 Seasonal Director, \$55,000; 1 A.M. unit, \$25; 1 Board, fire adjustment, \$210; 1 Board, deflection, \$1900; 1 Board, spotting, \$1500; 1 Board, range correction, \$800; 1 Percentage corrector, \$120; 1 Indicator, wind component, \$150	56,785			56,785
7	A	1 Switching panel, \$375; 4 headsets with plug attachment, \$100	1,070			1,070
8	A	Construction and equipment of PU Station at East Point.			475	475
9	A	Cost of 1/2 acre of land				
10	A	Installation 30-pr. submarine cable from Ft. Henth to Ft. Ruckman (16% for overhead inspection and transportation included)			13,250	1,250
11	A	Installation 20-pr. submarine cable from Ft. Ruckman to East Point, approximately 10,000 feet.			8,280	8,280
12	A	Construction 3-story PU station, proposed steel type, to give lowest H.L. of 10 ft. above ground level			3,200	5,280
13	A	Equipment for B-55, Battery Gardner		4,200		6,500
14	A	1 Finder, depression position, \$4,290; 1 Instrument, azimuth, M 1918, \$975	5,265			5,265
15	A	3 Telephone, wall, with headsets, \$231; 1 Bell, T. I., \$9			240	240
16	A	Equipment for B-55, Battery Gardner				
17	A	1 Finder, depression position, \$4,290; 1 Instrument, azimuth, M 1918, \$975	5,265			5,265
18	A	3 Telephone, wall, with headsets, \$231; 1 Bell, T. I., \$9			240	240
19	A	Interior station wiring				
20	A	Equipment for B-55, Battery Gardner				
21	A	2 Telephones, PU				
22	A	2 Telephones, wall, with headsets	572		154	572
23	A	Equipment for B-55, Battery Gardner				
24	A	Construction 3-story PU station, proposed steel type, to give H.L. of 10 ft. above ground level				
25	A	Installation 20-pr. submarine cable from Marblehead Hook to Ft. Ruckman (16% for overhead inspection and transportation included)				
26	A	Construction and equipment of cable terminal				
27	A	Installation approximately 100 feet 10-pr. cable from cable terminal to station				
28	A	Interior station wiring				
29	A	Equipment for B-55, Battery Gardner				
30	A	1 Finder, depression position, \$4,290; 1 Instrument, azimuth, \$975	5,265			5,265
31	A	3 Telephone, wall, with headsets, \$231; 1 Bell, T. I., \$9			240	240
32	A	Equipment for B-55, Battery Gardner				
33	A	1 Finder, depression position, \$4,290; 1 Instrument, azimuth, \$975	5,265			5,265
34	A	3 Telephone, wall, with headsets, \$231; 1 Bell, T. I., \$9			240	240
35	A	Equipment for B-55, Battery Gardner				
36	A	Construction 3-story PU station, proposed steel type, to give H.L. of 10 ft. above ground level				
37	A	Installation 20-pr. submarine cable from Marblehead Hook to Ft. Ruckman (16% for overhead inspection and transportation included)				
38	A	Construction and equipment of cable terminal				
39	A	Installation approximately 100 feet 10-pr. cable from cable terminal to station				
40	A	Interior station wiring				
41	A	Equipment for B-55, Battery Gardner				
42	A	1 Finder, depression position, \$4,290; 1 Instrument, azimuth, \$975	5,265			5,265
43	A	3 Telephone, wall, with headsets, \$231; 1 Bell, T. I., \$9			240	240
44	A	Equipment for B-55, Battery Gardner				
45	A	1 Finder, depression position, \$4,290; 1 Instrument, azimuth, \$975	5,265			5,265
46	A	3 Telephone, wall, with headsets, \$231; 1 Bell, T. I., \$9			240	240
47	A	Equipment for B-55, Battery Gardner				
48	A	Construction 3-story PU station, proposed steel type, to give H.L. of 10 ft. above ground level				
49	A	Installation 20-pr. submarine cable from Marblehead Hook to Ft. Ruckman (16% for overhead inspection and transportation included)				
50	A	Construction and equipment of cable terminal				
51	A	Installation approximately 100 feet 10-pr. cable from cable terminal to station				
52	A	Interior station wiring				
53	A	Equipment for B-55, Battery Gardner				
54	A	1 Finder, depression position, \$4,290; 1 Instrument, azimuth, \$975	5,265			5,265
55	A	3 Telephone, wall, with headsets, \$231; 1 Bell, T. I., \$9			240	240
56	A	Equipment for B-55, Battery Gardner				
57	A	1 Finder, depression position, \$4,290; 1 Instrument, azimuth, \$975	5,265			5,265
58	A	3 Telephone, wall, with headsets, \$231; 1 Bell, T. I., \$9			240	240
59	A	Equipment for B-55, Battery Gardner				
60	A	Construction 3-story PU station, proposed steel type, to give H.L. of 10 ft. above ground level				
61	A	Installation 20-pr. submarine cable from Marblehead Hook to Ft. Ruckman (16% for overhead inspection and transportation included)				
62	A	Construction and equipment of cable terminal				
63	A	Installation approximately 100 feet 10-pr. cable from cable terminal to station				
64	A	Interior station wiring				
65	A	Equipment for B-55, Battery Gardner				
66	A	1 Finder, depression position, \$4,290; 1 Instrument, azimuth, \$975	5,265			5,265
67	A	3 Telephone, wall, with headsets, \$231; 1 Bell, T. I., \$9			240	240
68	A	Equipment for B-55, Battery Gardner				
69	A	1 Finder, depression position, \$4,290; 1 Instrument, azimuth, \$975	5,265			5,265
70	A	3 Telephone, wall, with headsets, \$231; 1 Bell, T. I., \$9			240	240
71	A	Equipment for B-55, Battery Gardner				
72	A	Construction 3-story PU station, proposed steel type, to give H.L. of 10 ft. above ground level				
73	A	Installation 20-pr. submarine cable from Marblehead Hook to Ft. Ruckman (16% for overhead inspection and transportation included)				
74	A	Construction and equipment of cable terminal				
75	A	Installation approximately 100 feet 10-pr. cable from cable terminal to station				
76	A	Interior station wiring				
77	A	Equipment for B-55, Battery Gardner				
78	A	1 Finder, depression position, \$4,290; 1 Instrument, azimuth, \$975	5,265			5,265
79	A	3 Telephone, wall, with headsets, \$231; 1 Bell, T. I., \$9			240	240
80	A	Equipment for B-55, Battery Gardner				
81	A	1 Finder, depression position, \$4,290; 1 Instrument, azimuth, \$975	5,265			5,265
82	A	3 Telephone, wall, with headsets, \$231; 1 Bell, T. I., \$9			240	240
83	A	Equipment for B-55, Battery Gardner				
84	A	Construction 3-story PU station, proposed steel type, to give H.L. of 10 ft. above ground level				
85	A	Installation 20-pr. submarine cable from Marblehead Hook to Ft. Ruckman (16% for overhead inspection and transportation included)				
86	A	Construction and equipment of cable terminal				
87	A	Installation approximately 100 feet 10-pr. cable from cable terminal to station				
88	A	Interior station wiring				
89	A	Equipment for B-55, Battery Gardner				
90	A	1 Finder, depression position, \$4,290; 1 Instrument, azimuth, \$975	5,265			5,265
91	A	3 Telephone, wall, with headsets, \$231; 1 Bell, T. I., \$9			240	240
92	A	Equipment for B-55, Battery Gardner				
93	A	1 Finder, depression position, \$4,290; 1 Instrument, azimuth, \$975	5,265			5,265
94	A	3 Telephone, wall, with headsets, \$231; 1 Bell, T. I., \$9			240	240
95	A	Equipment for B-55, Battery Gardner				
96	A	Construction 3-story PU station, proposed steel type, to give H.L. of 10 ft. above ground level				
97	A	Installation 20-pr. submarine cable from Marblehead Hook to Ft. Ruckman (16% for overhead inspection and transportation included)				
98	A	Construction and equipment of cable terminal				
99	A	Installation approximately 100 feet 10-pr. cable from cable terminal to station				
100	A	Interior station wiring				
101	A	Equipment for B-55, Battery Gardner				
102	A	1 Finder, depression position, \$4,290; 1 Instrument, azimuth, \$975	5,265			5,265
103	A	3 Telephone, wall, with headsets, \$231; 1 Bell, T. I., \$9			240	240
104	A	Equipment for B-55, Battery Gardner				
105	A	1 Finder, depression position, \$4,290; 1 Instrument, azimuth, \$975	5,265			5,265
106	A	3 Telephone, wall, with headsets, \$231; 1 Bell, T. I., \$9			240	240
107	A	Equipment for B-55, Battery Gardner				
108	A	Construction 3-story PU station, proposed steel type, to give H.L. of 10 ft. above ground level				
109	A	Installation 20-pr. submarine cable from Marblehead Hook to Ft. Ruckman (16% for overhead inspection and transportation included)				
110	A	Construction and equipment of cable terminal				
111	A	Installation approximately 100 feet 10-pr. cable from cable terminal to station				
112	A	Interior station wiring				
113	A	Equipment for B-55, Battery Gardner				
114	A	1 Finder, depression position, \$4,290; 1 Instrument, azimuth, \$975	5,265			5,265
115	A	3 Telephone, wall, with headsets, \$231; 1 Bell, T. I., \$9			240	240
116	A	Equipment for B-55, Battery Gardner				
117	A	1 Finder, depression position, \$4,290; 1 Instrument, azimuth, \$975	5,265			5,265
118	A	3 Telephone, wall, with headsets, \$231; 1 Bell, T. I., \$9			240	240
119	A	Equipment for B-55, Battery Gardner				
120	A	Construction 3-story PU station, proposed steel type, to give H.L. of 10 ft. above ground level				
121	A	Installation 20-pr. submarine cable from Marblehead Hook to Ft. Ruckman (16% for overhead inspection and transportation included)				
122	A	Construction and equipment of cable terminal				
123	A	Installation approximately 100 feet 10-pr. cable from cable terminal to station				
124	A	Interior station wiring				
125	A	Equipment for B-55, Battery Gardner				
126	A	1 Finder, depression position, \$4,290; 1 Instrument, azimuth, \$975	5,265			5,265
127	A	3 Telephone, wall, with headsets, \$231; 1 Bell, T. I., \$9			240	240
128	A	Equipment for B-55, Battery Gardner				
129	A	1 Finder, depression position, \$4,290; 1 Instrument, azimuth, \$975	5,265			5,265
130	A	3 Telephone, wall, with headsets, \$231; 1 Bell, T. I., \$9			240	240
131	A	Equipment for B-55, Battery Gardner				
132	A	Construction 3-story PU station, proposed steel type, to give H.L. of 10 ft. above ground level				
133	A	Installation 20-pr. submarine cable from Marblehead Hook to Ft. Ruckman (16% for overhead inspection and transportation included)				
134	A	Construction and equipment of cable terminal				
135	A	Installation approximately 100 feet 10-pr. cable from cable terminal to station				
136	A	Interior station wiring				
137	A	Equipment for B-55, Battery Gardner				
138	A	1 Finder, depression position, \$4,290; 1 Instrument, azimuth, \$975	5,265			5,265
139	A	3 Telephone, wall, with headsets, \$231; 1 Bell, T. I., \$9			240	240
140	A	Equipment for B-55, Battery Gardner				
141	A	1 Finder, depression position, \$4,290; 1 Instrument, azimuth, \$975	5,265			5,265
142	A	3 Telephone, wall, with headsets, \$231; 1 Bell, T. I., \$9			240	240
143	A	Equipment for B-55, Battery Gardner				
144	A	Construction 3-story PU station, proposed steel type, to give H.L. of 10 ft. above ground level				
145	A	Installation 20-pr. submarine cable from Marblehead Hook to Ft. Ruckman (16% for overhead inspection and transportation included)				
146	A	Construction and equipment of cable terminal				
147	A	Installation approximately 100 feet 10-pr. cable from cable terminal to station				
148	A	Interior station wiring				
149	A	Equipment for B-55, Battery Gardner				
150	A	1 Finder, depression position, \$4,290; 1 Instrument, azimuth, \$975	5,265			5,265
151	A	3 Telephone, wall, with headsets, \$231; 1 Bell, T. I., \$9			240	240
152	A	Equipment for B-55, Battery Gardner				
153	A	1 Finder, depression position, \$4,290; 1 Instrument, azimuth, \$975	5,265			5,265
154	A	3 Telephone, wall, with headsets, \$231; 1 Bell, T. I., \$9			240	240
155	A	Equipment for B-55, Battery Gardner				
156	A	Construction 3-story PU station, proposed steel type, to give H.L. of 10 ft. above ground level				
157	A	Installation 20-pr. submarine cable from Marblehead Hook to Ft. Ruckman (16% for overhead inspection and transportation included)				
158	A	Construction and equipment of cable terminal				
159	A	Installation approximately 100 feet 10-pr. cable from cable terminal to station				
160	A	Interior station wiring				
161	A	Equipment for B-55, Battery Gardner				
162	A	1 Finder, depression position, \$4,290; 1 Instrument, azimuth, \$975	5,265			5,265
163	A	3 Telephone, wall, with headsets, \$231; 1 Bell, T. I., \$9			240	240
164	A	Equipment for B-55, Battery Gardner				
165	A	1 Finder, depression position, \$4,290; 1 Instrument, azimuth, \$975	5,265			5,265
166	A	3 Telephone, wall, with headsets, \$231; 1 Bell, T. I., \$9			240	240
167	A	Equipment for B-55, Battery Gardner				
168	A	Construction 3-story PU station, proposed steel type, to give H.L. of 10 ft. above ground level				
169	A	Installation 20-pr. submarine cable from Marblehead Hook to Ft. Ruckman (16% for overhead inspection and transportation included)				
170	A	Construction and equipment of cable terminal				
171	A	Installation approximately 100 feet 10-pr. cable from cable terminal to station				
172	A	Interior station wiring				
173	A	Equipment for B-55, Battery Gardner				
174	A	1 Finder, depression position, \$4,290; 1 Instrument, azimuth, \$975	5,265			5,265
175	A	3 Telephone, wall, with headsets, \$231; 1 Bell, T. I., \$9			240	240
176	A	Equipment for B-55, Battery Gardner				
177	A	1 Finder, depression position, \$4,290; 1 Instrument, azimuth, \$975	5,265			5,265
178	A	3 Telephone, wall, with headsets, \$231; 1 Bell, T. I., \$9			240	240
179	A	Equipment for B-55, Battery Gardner				
180	A	Construction 3-story PU station, proposed steel type, to give H.L. of 10 ft. above ground level				
181	A	Installation 20-pr. submarine cable from Marblehead Hook to Ft. Ruckman (16% for overhead inspection and transportation included)				
182	A	Construction and equipment of cable terminal				
183	A	Installation approximately 100 feet 10-pr. cable from cable terminal to station				
184	A	Interior station wiring				
185	A	Equipment for B-55, Battery Gardner				
186	A	1 Finder, depression position, \$4,290; 1 Instrument, azimuth, \$975	5,265			5,265
187	A	3 Telephone, wall, with headsets, \$231; 1 Bell, T. I., \$9			240	240
188	A	Equipment for B-55, Battery Gardner				
189	A	1 Finder, depression position, \$4,290; 1 Instrument, azimuth, \$975	5,265			5,265
190	A	3 Telephone, wall, with headsets, \$231; 1 Bell, T. I., \$9			240	240
191	A	Equipment for B-55, Battery Gardner				
192	A	Construction 3-story PU station, proposed steel type, to give H.L. of 10 ft. above ground level				
193	A	Installation 20-pr. submarine cable from Marblehead Hook to Ft. Ruckman (16% for overhead inspection and transportation included)				
194	A	Construction and equipment of cable terminal				
195	A	Installation approximately 100 feet 10-pr. cable from cable terminal to station				
196	A	Interior station wiring				
197	A	Equipment for B-55, Battery Gardner				
198	A	1 Finder, depression position, \$4,290; 1 Instrument, azimuth, \$975	5,265			5,265
199	A	3 Telephone, wall, with headsets, \$231; 1 Bell, T. I., \$9			240	240
200	A					

H. D. OF BOSTON

COST ESTIMATE AND PRIORITY GUIDE

Priorities subject to change based on availability of funds.

EXHIBIT NO. 24-B.

ANNEX B.

Priority	Item Class	Description of Work	Quantity	Unit	Estimated Cost	Actual Cost	Remarks
1	A	Construction and equipment of PO Station at Strawberry Hill.	1	Station	\$10,542	\$10,500	
2	A	Construction of 20-yr. embankment cable from Strawberry Hill.	1	Emb.	\$1,000	\$1,000	
3	A	Installation of 20-yr. embankment cable from Strawberry Hill to Point Allerton (15% for overhead, inspection and transportation included)	1	Emb.	\$1,100	\$1,100	
4	A	Erection cable terminal at Strawberry Point	1	Term.	\$50	\$50	
5	A	Installation 420 feet 10-yr. cable from terminal to station	1	Cable	\$250	\$250	
6	A	Interior station wiring	1	Wiring	\$150	\$150	
7	A	Erection 2-story PO Station, proposed steel type, to give upper HI of 25 feet above ground level	1	Station	\$4,000	\$4,000	
8	A	Equipment for B-191, Battery Long.	1	Equip.	\$2,000	\$2,000	
9	A	1 Finder, depression position, \$4,250; 1 Instrument, azimuth, M 1918, \$975	1	Finder	\$4,250	\$4,250	
10	A	5 Telephones, wall, with headsets, \$231; 1 Bell, T. I., \$9	1	Phone	\$240	\$240	
11	A	Equipment for B-191, Battery Gardner.	1	Equip.	\$2,000	\$2,000	
12	A	1 Finder, depression position, \$4,250; 1 Instrument, azimuth, M 1918, \$975	1	Finder	\$4,250	\$4,250	
13	A	5 Telephones, wall, with headsets, \$231; 1 Bell, T. I., \$9	1	Phone	\$240	\$240	
14	A	2 PO Installations at Outer Brewster. Bottling stations for G-1, G-2, G-3, G-4, and W-1.	2	Inst.	\$3,900	\$3,900	
15	A	4 Instruments, azimuth, M 1918	4	Inst.	\$3,900	\$3,900	
16	A	4 Telephones, wall, with headsets	4	Phone	\$308	\$308	
17	A	Construction 6-room, 1-story PO Station at Deer Island	1	Station	\$6,500	\$6,500	
18	A	Construction and equipment of PO Station at Fourth Cliff.	1	Station	\$3,500	\$3,500	
19	A	2-story PO Station, proposed steel type, to give HI of 25 feet above ground level	1	Station	\$5,400	\$5,400	
20	A	Installation of 900 feet 10-yr cable from station to commercial contact	1	Cable	\$1,800	\$1,800	
21	A	Interior station wiring	1	Wiring	\$1,550	\$1,550	
22	A	Mobile metal 6 string	1	String	\$230	\$230	
23	A	Equipment for B-191, Battery Long.	1	Equip.	\$425	\$425	
24	A	1 Finder, depression position, \$4,250; 1 Instrument, azimuth, M 1918, \$975	1	Finder	\$4,250	\$4,250	
25	A	5 Telephones, wall, with headsets, \$231; 1 Bell, T. I., \$9	1	Phone	\$240	\$240	
26	A	Construction and equipment of PO Station at Brant Rock.	1	Station	\$2,800	\$2,800	
27	A	1-story PO Station, proposed steel type, to give HI of 45 feet above ground level (steel only)	1	Station	\$2,800	\$2,800	
28	A	Installation 1288 feet 10-yr. cable from station to commercial contact	1	Cable	\$640	\$640	
29	A	Interior station wiring	1	Wiring	\$160	\$160	
30	A	Monthly rental 5 circuits from Brant Rock to Point Allerton	1	Rental	\$415	\$415	
31	A	Equipment for B-191, Battery Long.	1	Equip.	\$2,000	\$2,000	
32	A	1 Finder, depression position, \$4,250; 1 Instrument, azimuth, \$975	1	Finder	\$4,250	\$4,250	
33	A	5 Telephones, wall, with headsets, \$231; 1 Bell, T. I., \$9	1	Phone	\$240	\$240	
34	A	Construction and equipment of PO Station at Point Allerton.	1	Station	\$4,250	\$4,250	
35	A	Equipment for B-191, Battery Long.	1	Equip.	\$4,250	\$4,250	
36	A	1 Finder, depression position, \$4,250;	1	Finder	\$4,250	\$4,250	
37	A	Equipment B-5, Battery Gardner	1	Equip.	\$4,250	\$4,250	
38	A	1 Finder, depression position, \$4,250; 1 Instrument, azimuth, M 1918, \$975	1	Finder	\$4,250	\$4,250	
39	A	2 PO Installations at Outer Brewster. Bottling stations for G-1, G-2, G-3, G-4, and W-1.	2	Inst.	\$3,900	\$3,900	
40	A	1 Instrument, azimuth, M 1918.	1	Inst.	\$975	\$975	

(continued)

• Not carried into totals.

Class A - To be procured and installed in peacetime.
Class B - To be procured in peacetime and installed when an emergency arises.
Class C - To be procured and installed when an emergency arises.

* Not carried into totals.

ANNEX C

SEARCHLIGHTS

AUTHORITIES

1. This Annex was prepared January 25, 1934, by a Board of Officers appointed under the provisions of paragraph 1 g, AR 100-20.

2. Approved by the Secretary of War in the 14th Inorsement, AG 660.2 (1-25-34)(Misc.) E, dated August 13, 1934.

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A N N E X C.

SEARCHLIGHTS.

1. The maximum dependable range of the 60-inch searchlight in clear weather on the northern New England coast is assumed to be 8,500 yards or less. In Exhibits 1-C to 4-C are shown the areas illuminated by the proposed lights.

2. a. The Brewsters and adjacent islands, squarely in front of the harbor entrance, seriously restrict lights located at Forts Revere, Warren and Standish (the three more advanced forts) as shown in panoramic drawing marked Exhibit 3-B; and thus more lights are needed in this harbor defense than would be required if those forts were not present. Lights on the Brewsters cannot alone be relied on because of their exposed position.

b. It is considered advisable that each gun and mine group should be provided with sufficient lights under control of the group commander to ensure a minimum effective illumination of at least the inner vital part of the field of that group. Lights not essential to the groups should be provided to cover a reasonable portion of the outer fields of fire; and these outer lights should operate under the harbor defense commander through his searchlight officer, rather than under the long-range group commander, because more than one of the gun groups may require them.

3. The present numbering of lights dates from the time of the Davis Board in 1908 and many changes have taken place; some of the positions recommended by that board were subsequently disapproved; the 36-inch light has become obsolete; the locations of the main ship channel and of the mine fields have been changed; and the long-range batteries have been constructed. The numbers so long in use should be discontinued to avoid confusion which already tends to exist. Both numbers are used in this annex in order to facilitate the transition.

4. There are eight searchlights now installed in the harbor defense. It is proposed to provide nine additional lights for the locations stated below. One light should be provided as a reserve on the south shore and one on the north shore; if needed, they may be taken from positions 1 and 17 and replaced from depot.

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5. a. The following searchlights are proposed:

Two at Strawberry Point (Nos. 1 and 2; new);
Two SE of Strawberry Hill (Nos. 3 and 4; old
positions of Nos. 1 and 2; installed for the
period of the World War);
One at Point Allerton (No. 5; old position
No. 3);
One at Fort Revore (No. 6, old No. 4);
Two on Outer Brewster (Nos. 7 and 8; old
positions Nos. 8 and 9);
One at Fort Warren near Bastion B (No. 9; old
position No. 7);
One at Fort Standish (No. 10; old No. 10);
Two on Deer Island (Nos. 11 and 12; old Nos.
13 and 14);
One at Fort Ruckman (No. 13; old No. 16);
Two at East Point (Nos. 14 and 15; old No. 17,
installed for the period of the World War);
Two at Marblehead Neck (Nos. 16 and 17; new).

b. This project calls for a total of 17 searchlights.

	:	Fixed	:	Semimobile	:	Total
Called for	:	8	:	9	:	17
On hand	:	8	:		:	8
In designated position	:	(6)	:		:	(6)
Not in designated position:	:	(2) *	:		:	(2) *
To be furnished	:	0	:	9	:	9

* 1 at Fort Andrews; 1 at Fort Strong; to be moved to Outer Brewster.

6. a. It is proposed to discontinue the lights not included in paragraph 5, as follows:

Old No. 5 at Fort Andrews, now installed.
Old No. 6 at Fort Warren (near sea wall)
never installed; dropped from project
before 1915.
Old No. 11 at Fort Strong, now installed.
Old No. 12 at Fort Strong, 36-inch, removed
some time prior to 1922.
Old No. 15 at Fort Heath; never installed;
dropped from project before 1915.

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b. Searchlight No. 5 at Fort Andrews is a 60-inch fixed light located on the north end of the island on an elevator mount with 25-KW set located in Battery Cushing-Whitman. Its field of illumination is from a line tangent to the high ground at Hull (azimuth 256°) on the right, through the north and west to a line toward Quincy (azimuth 55°) on the left. It can cover a portion only of the southern mine field, at a distance of 4,500 yards. It does not assist effectively in the gun defense. The mine field is better illuminated by other lights located more to the front as stated below.

- (1). This light and power plant are hereby designated for position No. 7 on Outer Brewster.

c. Searchlight No. 11 at Fort Strong is a 60-inch fixed light located on the northeast tip of the island on a railroad car, with 25-KW set located in abandoned Battery Ward. Its field is from Quincy Bay (azimuth 23°) on the right counterclockwise to a line toward Nahant (azimuth 194°) on the left. It is masked by nearby islands through more than 90° from the south to the east. It is 6,000 yards in rear of the northern mine field, and is cut off from the southern mine field by Gallups Island and Fort Standish except through a sector of less than two degrees. It does not assist the gun defense, being situated too far inside the harbor.

- (1). This light and power plant are hereby designated for position No. 8 on Outer Brewster.

7. Telephones. A telephone line should be provided to the searchlight controller from the station of the group or higher commander who controls that searchlight. From the controller to the light and, separately, from the light to the power plant, a sound-powered or local battery telephone system should be provided.

PROPOSED SEARCHLIGHTS IN DETAIL.

8. a. Two lights at Strawberry Point, Nos. 1 and 2. These lights should be located about 100 yards apart on the rocky point 515 yards north of Strawberry Point fire control station. See Coast Chart No. 242, scale 1:5000. The property belongs to The Glades Club. It need not be purchased but authority to occupy it in an emergency may reasonably be presumed.

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b. The site is approximately 25 feet above mean sea level. The lights should be mounted on the standard 32-foot steel towers designed for fixed installations. The semimobile (modified standard seacoast type) searchlights with portable AA type power plants should be employed.

c. The lights should be approximately 100 yards apart and should not be closer to the fire control station than the point indicated. They should both have an illuminating arc from the direction of Cedar Point on the south to the direction of Point Allerton on the north.

d. These lights should operate directly under the harbor defense commander.

9. Two lights southeast of Strawberry Hill; Nos. 3 and 4. a. These lights should be about 800 yards southeast of the reservation on Strawberry Hill, being sited to the right (south) in order to avoid interference with the fire control station there. They should be near the beach. The water front is built up with an inexpensive type of summer house and beach resort buildings; a site need not be purchased but an available open space occupied by lease or permission at time of an emergency.

b. The site is low. The lights should be mounted on the standard 32-foot steel towers designed for fixed installations. The semimobile (modified standard seacoast type) searchlights with portable AA type power plants should be employed.

c. Lights 3 and 4 should operate under the southern gun group, G-2.

10. One light at Point Allerton; No. 5. a. The light should be near the extreme eastern end of the point, for use to the northeast, east and southeast over the approaches to Nantasket Roads. There is a level, Government-owned strip of land running around Point Allerton, extending back from the seawall. The searchlight should be mounted on a push car with track running back from the operating position to a location approximately 200 yards to the west, where it may be sheltered in daylight behind the high knoll in which Point Allerton terminates; the power plant should be placed in this sheltered location.

b. Interference with the fire control station at Point Allerton, which is on a hill 300 yards southwest of the tip of the point, is adequately provided against by locating the searchlight near the water, below the hill, at a distance of more than 200 yards from the station; the difference in level will be approximately 90 feet.

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c. The semimobile (modified standard seacoast type) searchlight with portable AA type power plant should be employed.

d. This light should be assigned to the southern gun group, G-2.

11. One fixed light at Fort Revere; No. 6 (old No. 4).
a. This light is in place. Its operating arc is from a line tangent to Point Allerton (azimuth 258°) counterclockwise to a line tangent to the north end of Poddocks Island (azimuth 80°). It is masked on the north by the Brewsters and adjacent islands; by Forts Warren and Standish; and by Long Island; but it bears directly on the southern mine field.

b. It is proposed to assign the light to the southern mine group, MG-1. It covers the mine field at a distance of approximately 2,500 yards, and the approaches thereto except from the south.

12. Two fixed lights on Outer Brewster; Nos. 7 and 8, (old Nos. 8 and 9). a. This island, comprising 17½ acres, is the property of the War Department. It is the most important searchlight and spotting position in the harbor defense. See Exhibit 5-C. These two lights should be located on knolls 73 and 52 which are 150 yards apart. Located on these knolls, both lights will have an operating arc from the direction of Nantasket Beach on the south counterclockwise to the direction of Great Head, Winthrop, on the northwest; and in addition the light on knoll 73 will cover the southern mine field. The lights should be so installed as to ensure these operating arcs.

b. One splinter-proof power plant should be constructed, utilizing the existing excavation of a basement of a burned house (near which there is a well affording a small but adequate water supply). Approximately 200 yards of conduit will be required from power plant to the two lights. In this location, both power plant and conduits will be masked from view.

c. Each light should have a splinter-proof shelter located west of the knoll with approximately 20 yards of railroad track to the operating position. No mechanical power beyond a hand windlass will be needed.

d. Lights and 25-KW sets can be landed by barge; the construction of a landing is not necessary. Telephonic connection should be provided by 10-pair cable to Fort Standish with two circuits for the searchlights, four for spot-ers for the three gun groups and the southern mine group, and one for an antiaircraft searchlight.

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e. The installation should be completed as soon as funds are available; the lights and engines should be installed and the submarine cable should be stored in the harbor defense. A frame barrack for the detachment may be built when the emergency arises. The lights should operate under the harbor defense commander.

13. One fixed light at Fort Warren; No. 9, (old No. 7). a. A 36-inch light was removed from this position some time prior to 1922. The direction of the railroad track from the shelter to the operating position is 219° which is the approximate axis of the arc over which the light can be traversed; this arc is from azimuth 129° on the left to azimuth 309° on the right. The actual useful limits are from the direction of the south end of Fort Standish (or just north of there, as the end of the island is low), to the direction of Point Allerton.

b. A 60-inch fixed light was installed in 1934. It will illuminate the southern mine field at a range of approximately 3,500 yards, and the approaches thereto. The light should be assigned to Mine Group 1.

14. One fixed light at Fort Standish, No. 10 (old number same). a. This light, now installed, has an operating arc from azimuth 163° on the left to azimuth 42° on the right, a width of 239 degrees. Like other lights in this vicinity, it is masked by the Brewsters and adjacent islands, in this case through an arc of approximately 43 degrees.

b. It is too distant from the northern mine field (approximately 5,500 yards) to be of great value, and should be assigned to the northern gun group, G-3.

15. Two fixed lights on Deer Island, Nos. 11 and 12; (old Nos. 13 and 14). a. These two lights are now installed. No. 11 has an operating arc from a line toward Fort Rickman (azimuth 185°) on the left to a line toward Fort Andrews (azimuth 340°) on the right, and also has an arc west of Fort Strong, inside the harbor. It is masked by Forts Standish and Warren and by Gallups Island, as well as by the Brewster group. No. 12 has an operating arc from a line tangent to Fort Hoath on the left (azimuth 171°) to a line toward Fort Warren, (azimuth 329°) on the right. It is masked by the same islands as No. 11.

b. Both of these lights should be assigned to the northern mine group, MG-2. They cover the mine field at a distance of approximately 5,000 yards. This group has a double primary station on Deer Island.

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16. One fixed light at Fort Ruckman, No. 13, (old No. 16. a. This light is installed. It has an operating arc from a line tangent to East Point on the left to a line toward Fort Standish on the right or from azimuth 278° to azimuth 358°. It is limited on the right by the location of the operating position in the face of Bayley Hill; the field cannot be increased to the right without excessive cost. The light fails to bear on the deep water area off Winthrop. It is of slight value.

b. Light No. 13 should be assigned to the northern gun group, G-3.

17. Two lights at East Point, Nos. 14 and 15; (old No. 17). a. There was a light installed on private property here during the war. A distance of 300 yards or more should be ensured between the location of the nearer of the two proposed lights and the fire control station proposed for East Point; this distance is obtainable. The lights should be approximately 100 yards apart. Both should have an operating arc of about 195° from the direction of the east end of Deer Island to the direction of Phillips Point.

b. These searchlights can be sited on the high rocky ground of the northeast tip of East Point, without interfering with the East Point fire control station, approximately 400 yards distant.

c. The property, owned by the family of Henry Cabot Lodge, need not be purchased, but plans may be made to occupy it in war. It was so occupied in the Spanish-American and World wars.

d. The semimobile (modified standard seacoast type) searchlights with portable A type power plants should be employed. The lights should be mounted on push cars for movement from shelter to operating position, using a light rail track and flange wheels.

e. Searchlights Nos. 14 and 15 should be assigned to the northern gun group, Group 3.

18. Two lights at Marblehead Neck, Nos. 16 and 17. a. In view of the deep water closer to Boston on the north than on the south side of the Bay, these two lights are requisite if bombardment is to be prevented, at something less than extreme range. Marblehead harbor with 25 feet of water is too close to Boston to be left open for use by large landing parties.

b. The lights should be located 100 yards or more apart, on the southeast part of Marblehead Neck. They will be sufficiently distant from the base-end station near the lighthouse to avoid interference. Both lights should have an illuminating arc from the direction of Nahant to a line toward Baker's Island.

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c. There are two sites, free from buildings at this time, which are suitable. One is on a 60-foot knoll, 1,460 yards south of the lighthouse, 830 yards northeast of Flying Point and 150 yards west of the shore. The other location is close to the shore on a rocky point 770 yards northeast of Flying Point. U.S. Coast and Geodetic Survey chart No. 240, scale 1:20,000 shows the locality in detail. The site need not be purchased but may be obtained by lease at time of an emergency.

d. The semimobile (modified standard seacoast type) searchlights with portable AA type power plants should be employed. The lights should be mounted on the standard 32-foot steel tower designed for fixed installation.

19. Priority. a. Searchlight material should be provided in the following order of priority:

- (1). Nos. 7 and 8 on Outer Brewster: position to be prepared; the two lights and engines rendered surplus at Forts Andrews and Strong should be designated for use on Outer Brewster, and should be moved there as soon as the positions can be prepared.
- (2). Nos. 14 and 15 at East Point: to be furnished and stored.
- (3). No. 5 at Point Allerton: to be furnished and stored.
- (4). Nos. 3 and 4, southeast of Strawberry Hill: to be furnished and stored.
- (5). Nos. 16 and 17, at Marblehead Neck: to be furnished and stored.
- (6). Nos. 1 and 2, at Strawberry Point: to be furnished and stored.

20. Storage. Space can be made available for storing and operating these nine lights at the Army Base, Boston, under jurisdiction of the harbor defense commander.

21. Cost Estimate. An estimate of cost and priority guide is appended as Exhibit 6-C. Those items which should be procured and installed in peace time are marked with an A. Those which should be procured in peace but whose installation may be deferred until an emergency arises are marked B. Those items to be procured and installed when an emergency arises are marked C.

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EXHIBIT I-C

HARBOR DEFENSE
COMMANDER'S LIGHTS
NOS. 1, 2, 7, 8, 16 & 17.

SECRET

SEARCHLIGHT PROJECT

LIGHTS NOS. 3-4&5 TO GROUP 2.
IN SOLID LINES

LIGHTS NOS. 10-13-14&15 TO GR. 3.
IN BROKEN LINES

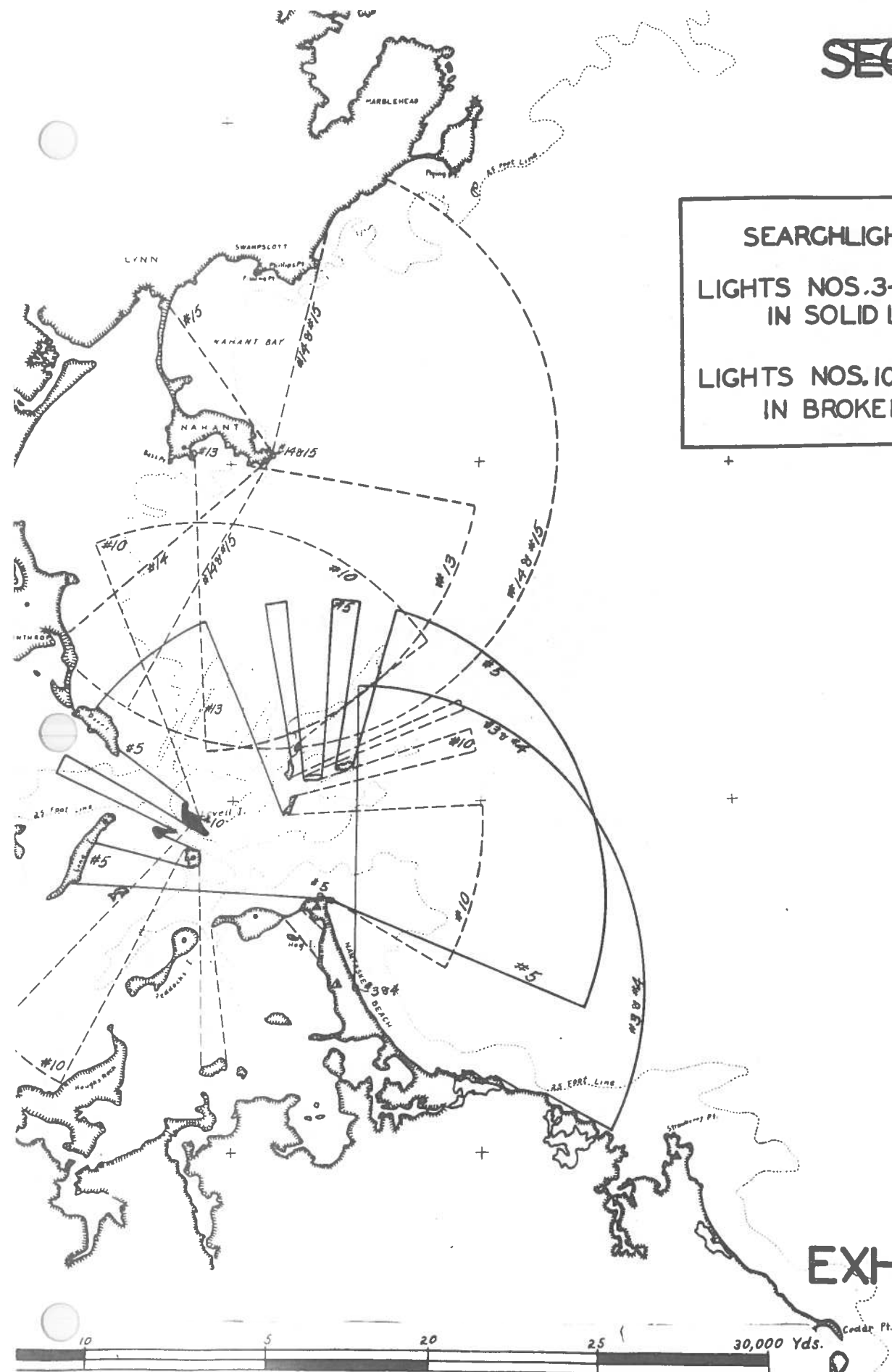


EXHIBIT 2-C

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SEARCHLIGHT PROJECT

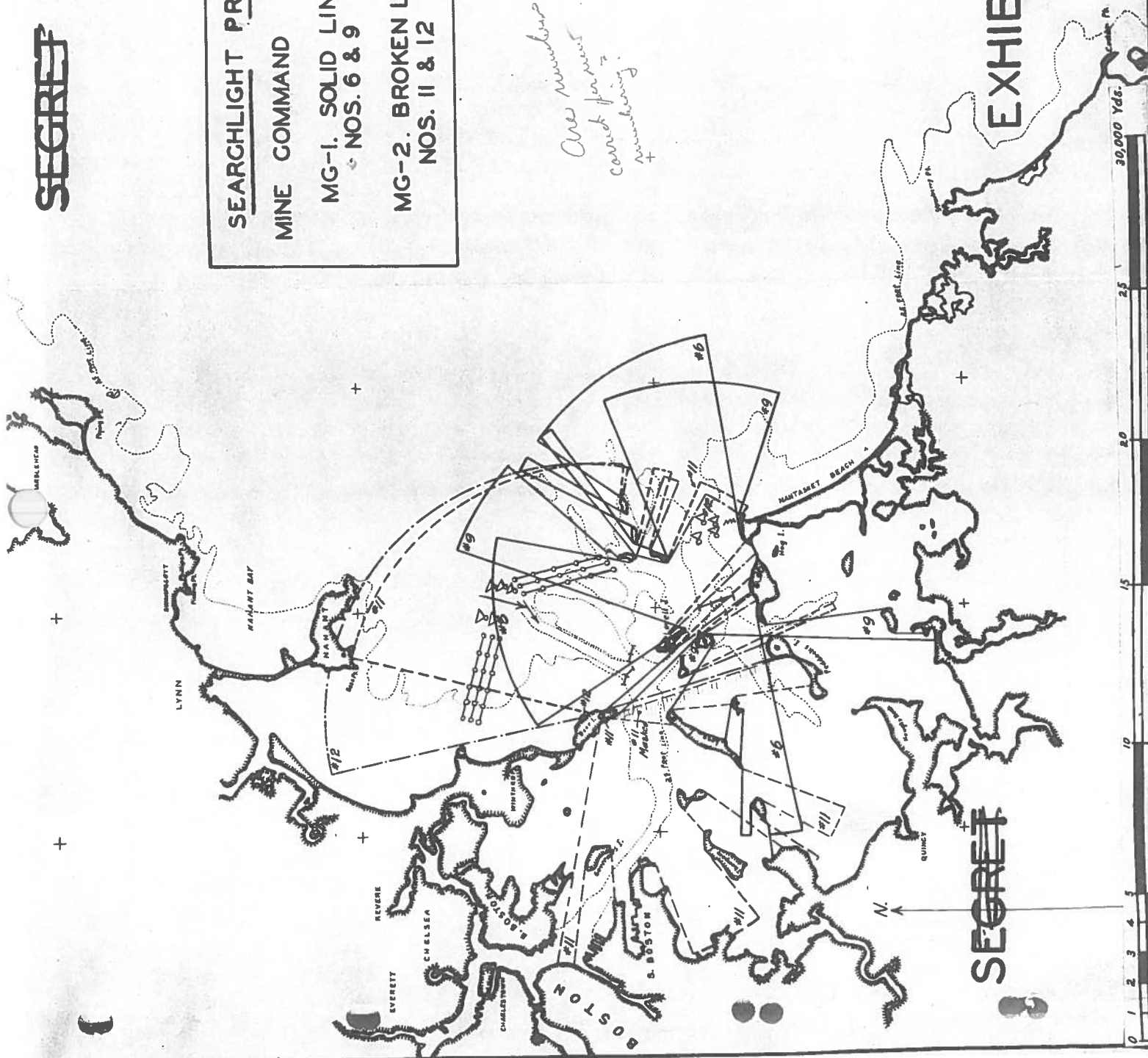
MINE COMMAND LIGHTS

MG-1. SOLID LINES
NOS. 6 & 9

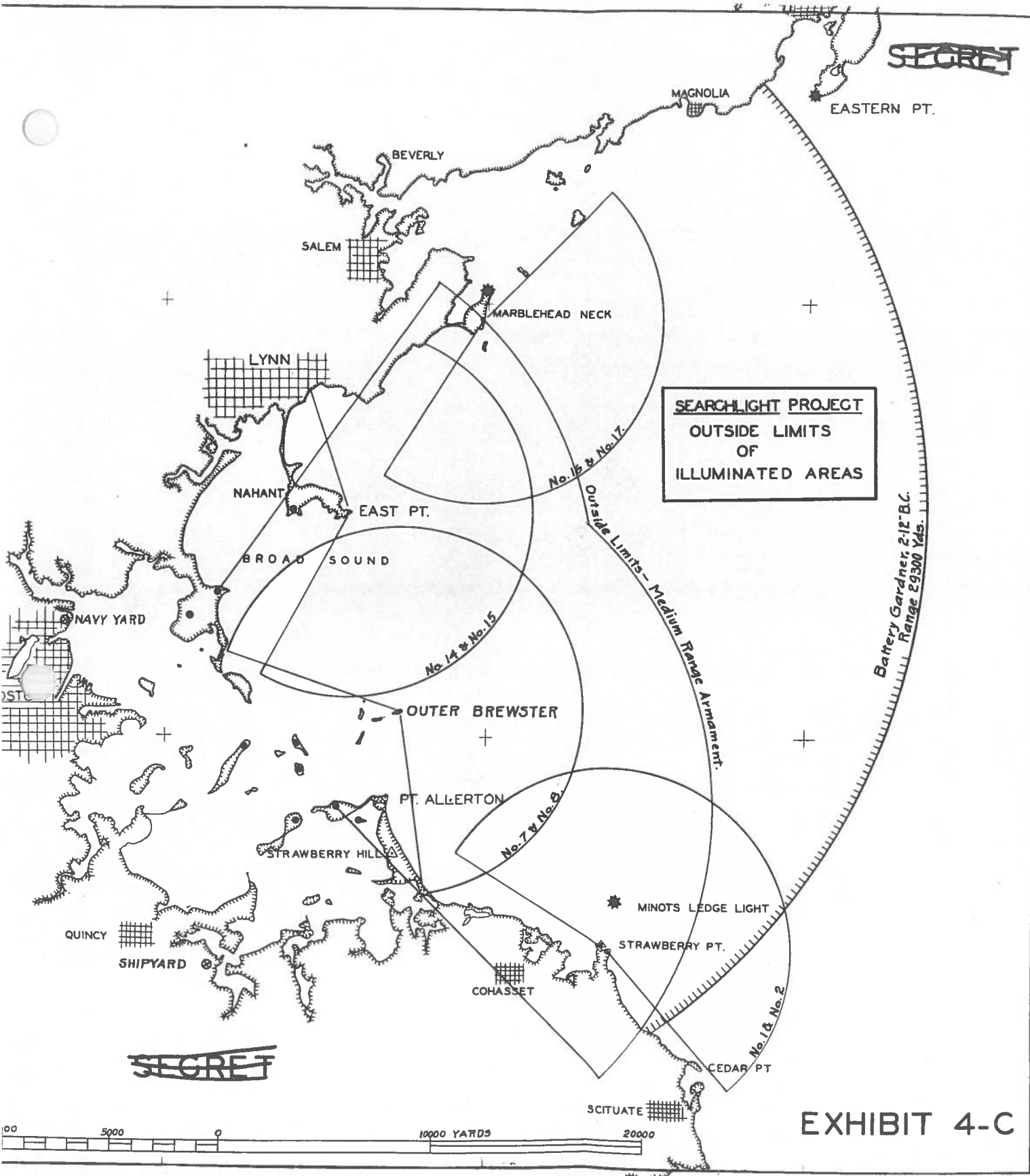
MG-2. BROKEN LINES
NOS. 11 & 12

*Area numbers
cannot form
+ numbering*

EXHIBIT 3-C



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Battery Gardner, 2-12" B.C.
Range 29300 Yds.

EXHIBIT 4-C

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SURVEY 1914 BY ERNEST A. PORTER
OFFICE DISTRICT ENGINEER
BOSTON
ORIGINAL SCALE 1"=50 FEET
V.I., 5 FEET. REF. M.L.W. +

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SEARCHLIGHT PROJECT
2 SEACOAST
SEARCHLIGHTS
1 AA. SEARCHLIGHT

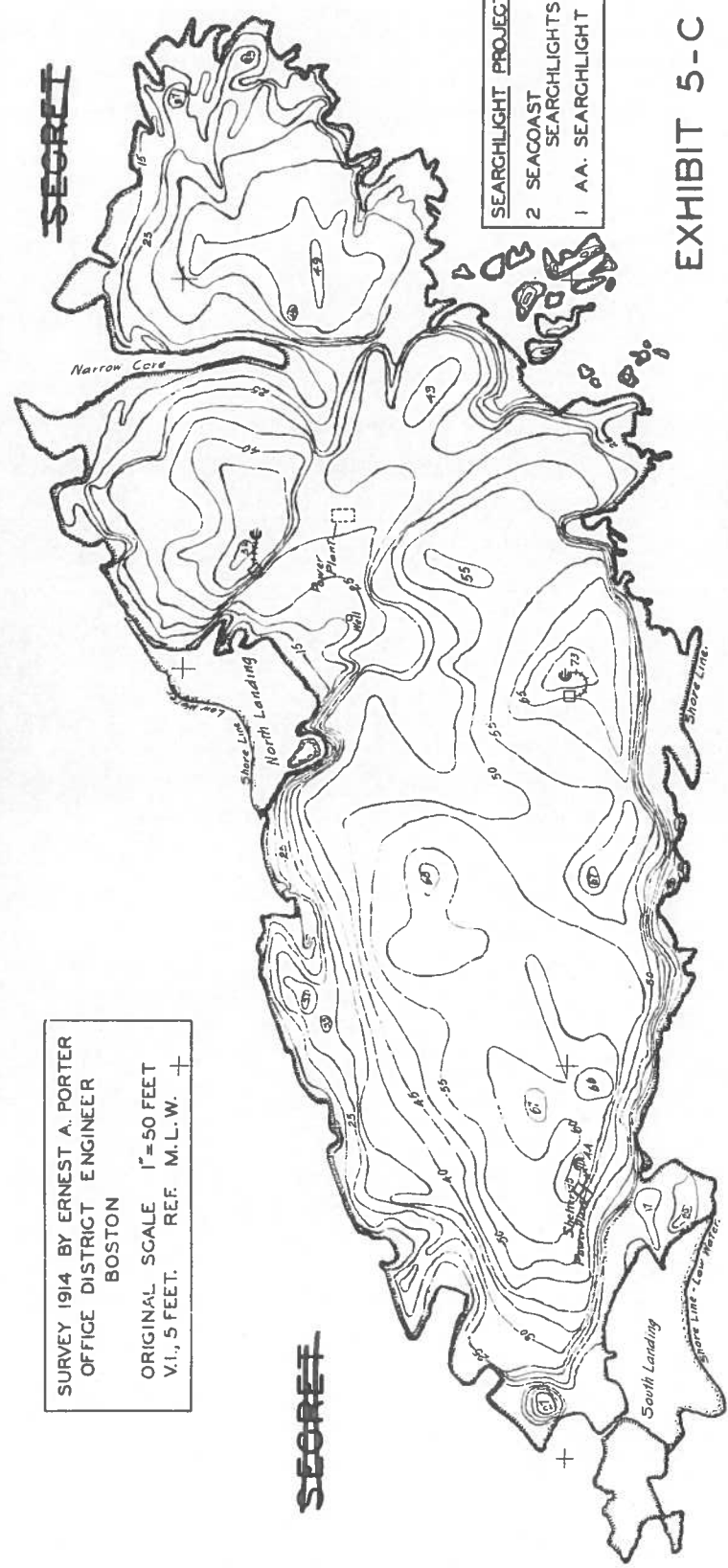


EXHIBIT 5-C

OUTER BREWSTER



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ANNEX C. EXHIBIT NO. 6-C

COST ESTIMATE AND PRIORITY GUIDE

H. D. OF BOSTON

Priorities subject to change based on availability of funds.

Priority	Item	Class	Description of Project	Engineers			Signal		
				Material	Labor	Mat'l	Material	Labor	Mat'l
3	1	A	Searchlights Nos. 7 and 8.						
			: Move searchlights and power plants from Fort Strong and Fort						
			: Andrews to Outer Brewster; construct shelters for lights and						
			: power plant and install lights.	\$ 8,200	\$ 5,000		\$ 616		\$ 13,200
			: 8 telephones, wall, with headsets						616
	2	B	Searchlights Nos. 14 and 15.						
			: 2 Seacoast 60-inch searchlights, modified standard (lights on hand)		1,300				1,300
			: 2 Portable AA type power plants	12,000					12,000
			: 2 Push cars and 300 yards of track	850	600				1,450
			: 2 shelters for lights	600	600				1,200
	3	B	Searchlights Nos. 3 and 4						
			: 2 Seacoast 60-inch searchlights, modified standard (lights on hand)		1,300				1,300
			: 2 Standard 32 ft. steel towers	4,000	4,000				8,000
			: 2 Portable AA type power plants	12,000					12,000
			: 8 Telephones, wall, with headsets				616		616
	4	B	Searchlight No. 5						
			: 1 Seacoast 60-inch searchlight, modified standard (light on hand)		650				650
			: 1 Portable AA type power plant	6,000					6,000
			: 1 Push car with 200 yards of track	1,100	800				1,900
			: 1 Shelter for light and power plant	300	300				600
			(Continued)						
			Total	\$ 45,050	\$ 14,550	\$ 1,232			\$ 60,832

EXHIBIT NO. 6-C

H. D. OF BOSTON

ANNEX C. EXHIBIT NO. 6-C COST ESTIMATE AND PRIORITY GUIDE

Priorities subject to change based on availability of funds.

Priority	Item	Class	Description of Project	Engineer			Signal		
				Material	Labor	Mat'l	Material	Labor	Mat'l
3	5	B	Searchlights Nos. 1 and 2.	Brought forward	\$45,050	\$14,550	\$1,232	\$	60,832
			2 Seacoast 60-inch searchlights, modified standard (lights on hand)		1,300				1,300
			2 Standard 32 ft. steel towers		4,000	4,000			8,000
			2 Portable AA type power plants		12,000				12,000
			8 Telephones, wall, with headsets					616	616
6	B		Searchlights Nos. 16 and 17.						
			2 Seacoast 60-inch searchlights, modified standard (lights on hand)		1,300				1,300
			2 Standard 32 ft. steel towers		4,000	4,000			8,000
			2 Portable AA type power plants		12,000				12,000
			8 Telephones, wall, with headsets					616	616
			Total		\$77,050	\$25,150	\$2,464		\$104,664

Class A - To be procured and installed in peacetime.

Class B - To be procured in peacetime and installed when an emergency arises.

Class C - To be procured and installed when an emergency arises.

Note: No expenditure of funds by the Ordnance Department, Chemical Warfare Service, Coast Artillery Corps, or for land, is contemplated in this annex.

ANNEX D

UNDERWATER DEFENSE

AUTHORITIES

1. This Annex was prepared January 25, 1934, by a Board of Officers appointed under the provisions of paragraph 1 d, AR 100-20.
2. Approved by the Secretary of War in the 14th Indorsement, AG 660.2 (1-25-34)(Misc.) E, dated August 13, 1934.

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A N N E X D.

UNDERWATER DEFENSE.

1. The present underwater defense project, approved by the Secretary of War on January 16, 1929, provides for four groups of mines in the southern (Nantasket Roads) entrance to the harbor controlled from Fort Warren, and five groups in the northern entrance (the main ship channel), controlled from Fort Strong.

2. a. The mine cases, anchors, cable, tools and other material required, as well as the panels, generators and other electrical equipment (all of which material of both classes is enumerated in Tables of Allowances - Submarine Mine Equipment) should be stored at Fort Warren for the southern mine field and at Fort Strong for the northern mine field.

b. This material should be kept on hand, complete and in serviceable condition.

3. In addition to the material comprised in the Tables of Allowances, the mine project requires adequate shore installations including position finding systems, and boats and wharves.

SHORE INSTALLATIONS.

4. Fort Warren. a. The present shore facilities at Fort Warren are sufficient to house and operate the mine material assigned to that station. One of the two cable tanks leaks and requires extensive work to make it serviceable. The condition (effort to correct which has repeatedly been made) may be due either to

(1). Faulty design, the heavy structure resting on the tank floor; or

(2). Washing away of the soil beneath the tank.

It is proposed to rebuild the floor, supporting it with numerous heavy concrete pillars sunk deep into the ground.

b. The wharf has had only small annual repairs for many years and before long will require extensive rehabilitation.

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5. Fort Strong. a. The present shore installations are sufficient to store and operate the mine materiel assigned to the northern mine field.

b. The wharf is serviceable at present but will soon require extensive rehabilitation.

6. Position Finding Service. a. Groupment Commander's Station. The old mine groupment commander's station at Fort Warren having been destroyed by fire in 1931, there is hereby assigned to C-1 a station at Fort Standish, built as F'-4 and now designated as B' of Battery Burbock, a battery which is no longer required. This is a stucco building, on the backbone of Lovell Island, is capacious, and overlooks both mine fields and the approaches thereto. There is no suitable station available at Fort Warren for C-1.

b. Southern Mine Group, MG-1. The mine group commander is assigned the station at Fort Warren now designated F'-3; it overlooks the mine field.

(1). Baselines. The base-end stations are double stations; in each pair, the stations are referred to as right or left. Duplicating the baselines enables tracking more than one target. M' is at Fort Warren and both right and left stations are equipped with DPF's. M", similarly equipped, is at Fort Revere. Exhibit 1-D shows the area covered by the baseline and by each DPF. The mine field is satisfactorily covered. Where the approaches from the north or south are masked from one base-end, they are visible from the DPF at the other end of the baseline. A spotter for the batteries of this mine group should be located on Outer Brewster.

c. Northern Mine Group, MG-2. The mine group commander is hereby assigned the station at Fort Strong now designated F'-5. It overlooks the mine field.

(1). Baselines. The base-end stations are double stations. This group has three pairs of base-end stations. The M' stations at Fort Strong are not needed and should be abandoned, leaving the baseline Deer Island - Fort Standish. M³ at Deer Island is hereby designated M', and M" at Fort Standish should continue to be so designated. Exhibit 2-D shows the area covered by the baseline Deer Island - Fort Standish.

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At Deer Island there is a DPF in the left station but none installed in the right station; a DPF should be provided. At Fort Standish there is a DPF in the right station but none in the left; one should be installed. There are two Lewis DPF's in the double station proposed for abandonment at Fort Strong.

BOATS.

7. It is considered that two mine planters, four DB boats and twelve motor mine yawls are required to plant and maintain the submarine mines included in the project. In addition, for use during the period of planting, there should be provided a third mine planter as substitute.

a. Mine Planters.

- (1). Lighthouse tenders should be designated by name for service as emergency mine planters. Those two vessels should be provided in peace with the necessary dock fittings as specified in the Tables of Allowances, and the specified planting equipment should be kept on hand in the harbor defense.
- (2). A tug with barge equipped with power boom may be employed as the third (substitute) mine planter.

b. DB Boats.

- (1). There are two L boats in the harbor defense.
- (2). In Massachusetts Bay there is a common type of power boat from 45 to 60 feet in length, with hoisting boom; these boats are used by fishermen. Two of these power boats can be employed as DB boats.

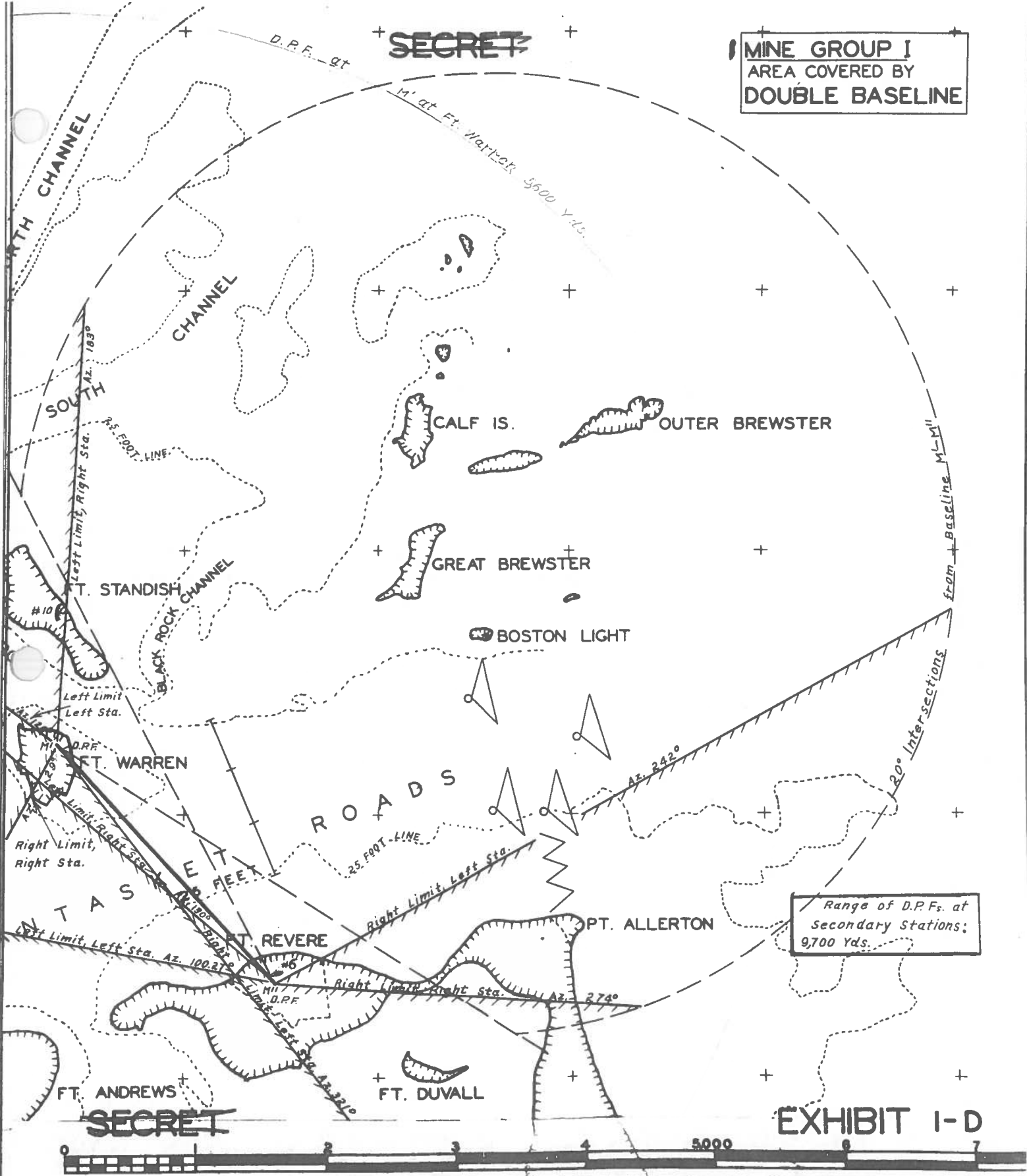
c. In addition to the four yawls now on hand in the harbor defense, the necessary additional launches can be obtained locally.

8. Cost Estimate. An estimate of cost and priority guide is appended as Exhibit 3-D. Those items which should be procured and installed in peace time are marked with an A. Those which should be procured in peace but whose installation may be deferred until an emergency arises are marked B. Those items to be procured and installed when an emergency arises are marked C.

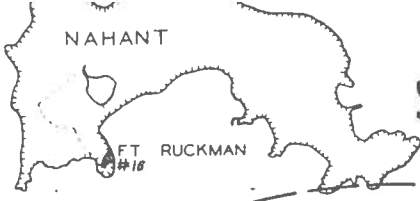
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**MINE GROUP I
AREA COVERED BY
DOUBLE BASELINE**



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MINE GROUP 2
AREA COVERED BY
DOUBLE BASELINE

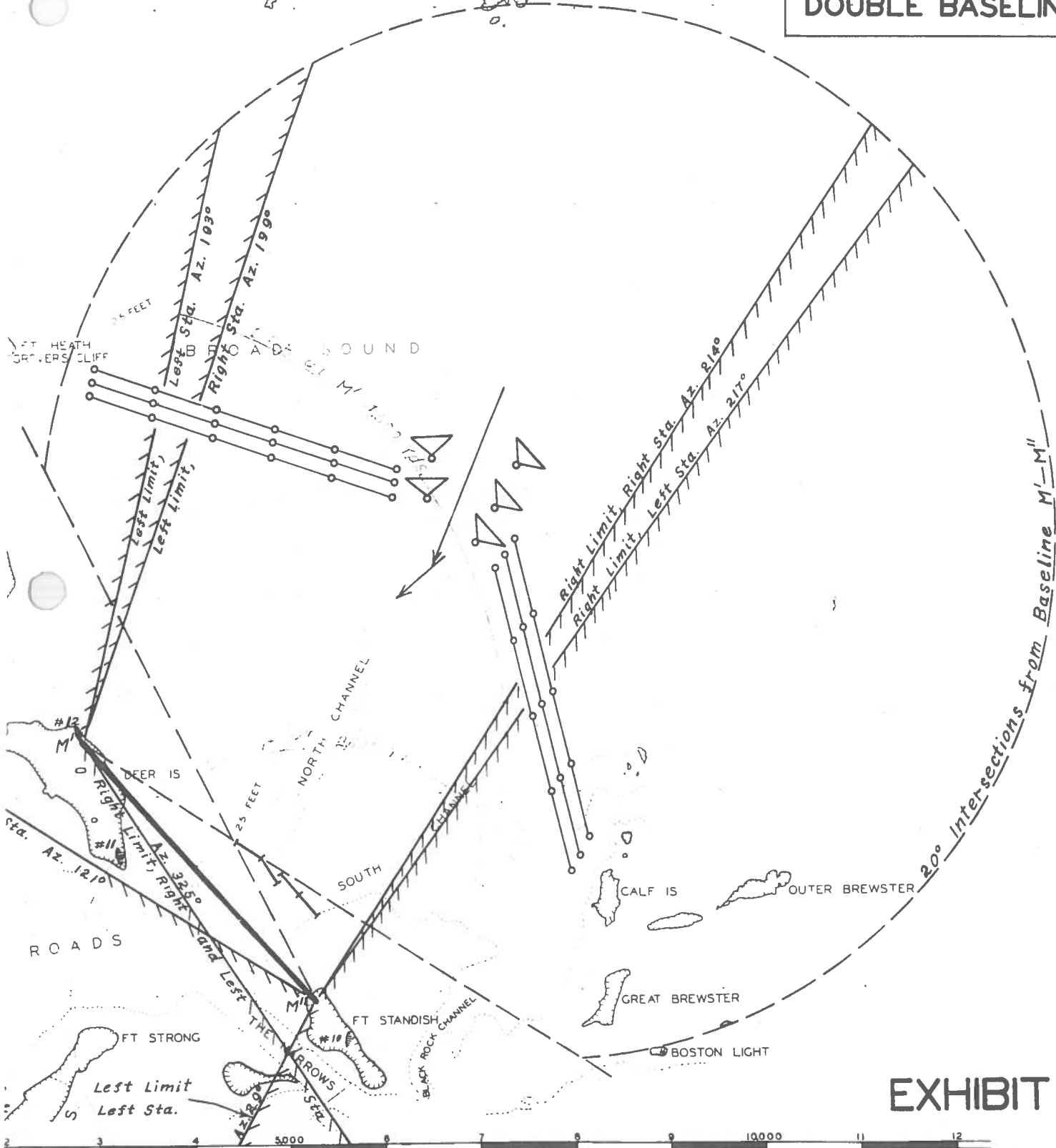


EXHIBIT 2-D

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ANNEX D. EXHIBIT NO. 3-D.

COST ESTIMATE AND PRIORITY GUIDE.

H. D. OF BOSTON

Priorities subject to change based on availability of funds.

Prior-ity	Item	Class	Description of project	C.A.C. : : Mat'l	Ord- : nance	Engineers : Mat'l	Signal : Labor	Signal : Mat'l	Total
2	1	A	Submarine mine material to complete approved mine project	\$51,200		\$1,250	\$1,250		\$51,200
	2	A	Repair of cable tank at Fort Warren						2,500
	3	B	Equipment for C-1.						
			: 1 Telescope, BC, \$575; 1 Field glasses, \$59						614
			: 3 Telephones, wall, with headsets						231
	4	B	Equipment for MG-1 spotter at Outer Brewster.						
			: 1 Instrument, azimuth, M 1918						975
			: 1 Telephone, wall, with headset						77
			Total	\$51,200	\$1,589	\$1,250	\$1,250	\$308	\$55,597

Class A - To be procured and installed in peacetime.
Class B - To be procured in peacetime and installed when an emergency arises.
Class C - To be procured and installed when an emergency arises.
Note: No expenditure of funds by the Chemical Warfare Service or for land is contemplated in this Annex.

EXHIBIT NO. 3-D.

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ANNEX E

ANTIAIRCRAFT GUN DEFENSE

AUTHORITIES

1. This Annex was prepared January 25, 1934, by a Board of Officers appointed under the provisions of paragraph 1 d, AR 100-20.
2. Approved by the Secretary of War in the 14th Indorsement, AG 660.2 (1-25-34)(Misc.) E, dated August 13, 1934.

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A N N E X E.

ANTI-AIRCRAFT GUN DEFENSE.

1. a. Guns. The antiaircraft gun defense of the Harbor Defenses of Boston is shown in Exhibit 1-E. In that diagram the assumptions are made that the target is traveling at 120 miles per hour, at an altitude of 15,000 feet and that the effective horizontal range of the guns at that altitude is 6,000 yards.

b. Machine Guns. The number of machine guns which reasonably may be required, and provided, is conditioned on the expectation of simultaneous attack by more than one flight; and as a general guide, the proportion of machine guns to gun batteries in the antiaircraft regiment may be taken. For the five gun batteries in this harbor defense this proportion would provide twenty machine gun platoons. This project calls for eighteen machine gun platoons.

- (1). The exact location of the machine guns is to be determined by the harbor defense commander, considering the availability, at the time when an emergency arises, of sites which will give all-around fire, as nearly down to the horizon as is practicable.

c. Searchlights. The disposition of the antiaircraft searchlights is shown in Exhibit 1-E. To the extent permitted by the coast line, the lights have been pushed out from the batteries to such distance that targets may be illuminated before they come within range of the guns. While the searchlights are regarded as an accessory of the particular gun battery which they are provided to serve, their locations have been modified to secure the best illumination of the area covered by the five batteries as a whole. Unless so located, the 15 lights would be insufficient. It may become desirable in this location to control all fifteen searchlights from the group commander's station. Sufficient pairs have been provided in the cables to permit this arrangement.

- (1). All searchlights in this project are to be of the portable type.

d. Organization. The antiaircraft batteries are each composed of a gun detachment, a machine gun detachment and a searchlight detachment. The five batteries form the antiaircraft group (Group 4) with command post at Fort Standish. This is also the center of the antiaircraft intelligence service which is a part of the group. Information is to be telephoned to the intelligence center by all antiaircraft batteries and by outlying observers.

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2. Antiaircraft Intelligence Service. a. Antiaircraft observers have been provided for at six of the outlying fire control stations and at five other points, each observer being provided with telephone direct to the antiaircraft intelligence center. Those places are: Manomet Hill, Monk Hill, Brant Rock FC Station, Fourth Cliff FC Station, Strawberry Point FC Station, Great Blue Hill, East Point FC Station, Marblehead Neck FC Station, Coelidge Point FC Station, Eastern Point (Gloucester), and Railcut Hill. The antiaircraft intelligence net is shown in Exhibit 2-2.

(1). In addition to the antiaircraft observers above who are specially designated as such, antiaircraft intelligence will originate with each antiaircraft gun battery, machine gun platoon and searchlight. An observer should be placed aboard a vessel of the Inshore Patrol. Information may be received from the Harbor Defenses of Narragansett Bay (64 miles), New Bedford (51 miles), and Portsmouth (52 miles).

(2). Provision for intelligence from other sources such as the Offshore Patrol, the Coast Guard and lighthouses is the function of the sub-sector commander and does not form a part of this Project.

3. AA Gun Battery No. 1, at Fort Revere. a. Gun Detachment. The three guns of this battery are located on the high ground near the water tower. Three carriages are on hand. The gun blocks were constructed in 1934. The director may be placed 120 yards from the center of the battery.

b. Machine Gun Detachment. Four platoons, or 16 machine guns, are proposed, two platoons to be located at Fort Duvall, one at Fort Andrews and one at Fort Revere. A total of 2100 feet of field wire for connection with the fire control system will be required.

c. Searchlight Detachment. Four lights with sound locators are to be provided, each with power plant. These lights should be located as follows:

- (1). One at Fort Duvall.
- (2). One at Strawberry Hill.
- (3). One near base of Nantasket peninsula.
- (4). One near Crow Point.

A total of 9,250 feet of field wire will be required. The two lights last named should be connected by commercial telephone to Strawberry Hill.

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4. AA Gun Battery No. 2 at Fort Standish. a. Gun Detachment. The third gun of this battery is to be located 40 yards from the two existing guns, toward the north. The ground slopes downward from old Battery Vincent (where the two existing guns are emplaced) toward the north, and the third gun is to be raised about four feet above the surrounding terrain. The director may be located 80 yards from the center of the battery on the left flank of Battery Morris.

b. Machine Gun Detachment. Three platoons, or 12 machine guns are proposed, to be located at Outer Brewster, Fort Standish and Fort Warren, respectively. A total of 3,600 feet of field wire will be required.

c. Searchlight Detachment. Two lights with sound locators and power plants are to be provided. They should be located as follows:

- (1). One on Outer Brewster at the point shown on Exhibit 5-C of Annex C.
- (2). One at Fort Standish.

A total of 2,400 feet of field wire will be required.

5. AA Gun Battery No. 3, at Fort Strong. a. Gun Detachment. The third gun of this battery is to be located 40 yards from the two existing guns on the side toward the beach.

- (1). It may become necessary to put in one or two groins of rip-raps to prevent the washing away of the shore-line of the reservation. If an encroachment of the water occurs, this protective work will have to be undertaken in any case, to prevent loss of the submarine mine storeroom at Fort Strong.

- (2). The director may be located on Battery Taylor, 125 yards from the center of the AA battery.

b. Machine Gun Detachment. Three platoons or 12 machine guns are proposed; one at Fort Strong, one at Fort Andrews and one on Gallups Island; this last to utilize commercial cable supplemented by field wire, a total of 4,050 feet of which will be required.

c. Searchlight Detachment. Four searchlights with sound locators and power plants are to be provided. They should be located as follows:

- (1). One near the south end of Long Island.
- (2). One at Squantum.
- (3). One on Governors Island.
- (4). One near southwest tip of Peddocks Island.

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Lights (1) and (4) may be connected by field wire to the fire control system. Light (2) may utilize commercial telephone to the fire control system at Point Allerton. Light (3) will require a single-conductor cable to the Army Base, one mile distant, thence commercial telephone connection to the fire control system at Fort Banks. A total of 8,000 feet of field wire will be required.

6. AA Gun Battery No. 4 at Fort Heath. a. Gun Detachment. The third gun of this battery is to be located 45 yards from the other two guns on the side toward Battery Winthrop. The mask formed by Battery Winthrop is 90° in height from the proposed location of this gun and less than that from the other two guns. The director should be located on the parapet of Battery Winthrop, 80 yards from the center of the antiaircraft battery.

b. Machine Gun Detachment. Four platoons or 16 machine guns are proposed, one to be disposed so as to protect Battery Winthrop, two to be placed so as to protect Batteries Lincoln and Kollogg at Fort Banks, and one on Deer Island.

c. Searchlight Detachment. Three searchlights with sound locators and power plants are to be provided. They should be located as follows:

- (1). One at Revere Beach.
- (2). One on Deer Island.
- (3). One at Winthrop Head, mounted on the standpipe there. The water tower has sufficient strength to carry the light; and the present local authorities are willing to have it there.

A total of 16,800 feet of field wire will be required.

7. AA Gun Battery No. 5, at Fort Ruckman. a. Gun Detachment. This three-gun battery, constructed in 1934, is located 400 yards northwest of Battery Gardner, on the Fort Ruckman reservation, on open ground now in use as a golf course. The director should be located on the knoll to the rear of Battery Gardner, 400 yards from the center of the AA battery.

b. Machine Gun Detachment. Four platoons or 16 machine guns are proposed; two to be disposed so as to protect Battery Gardner and the other two to protect the fire control station and searchlights proposed for East Point. A total of 4,800 feet of field wire will be required.

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c. Searchlight Detachment. Two searchlights with sound locators and power plants are to be provided. They should be located as follows:

- (1). One between Spouting Horn and East Point, Nahant.
- (2). One at Phillips Point.

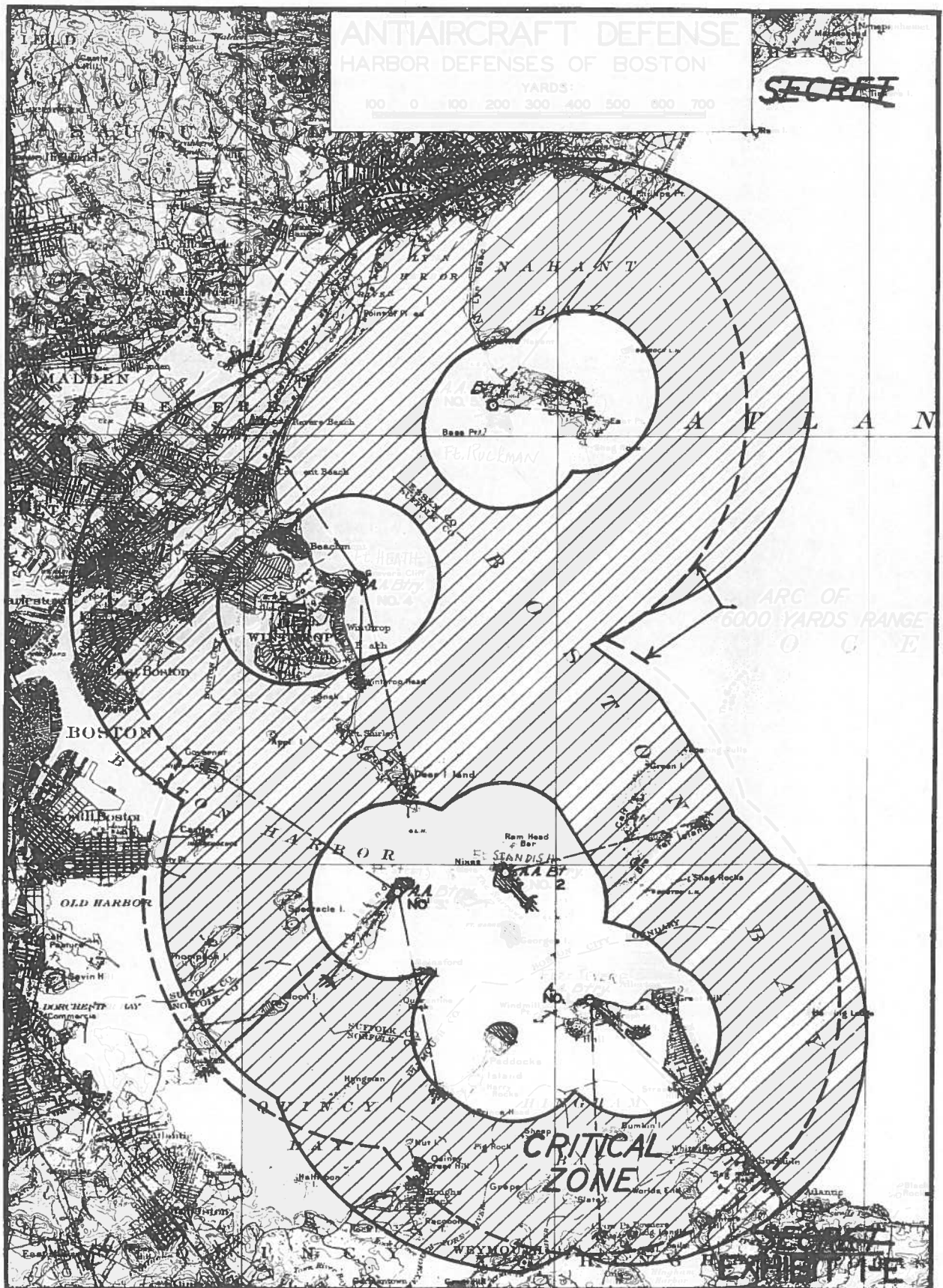
A total of 2,100 feet of field wire will be required. Light (2) should employ commercial telephone to the fire control system at Fort Ruckman.

8. The locations proscribed in this Annex for individual antiaircraft guns and for antiaircraft gun batteries were approved by the War Department in 12th indorsement, WD AGO, October 14, 1933 (AG 660.2; 7-13-33; Misc. E).

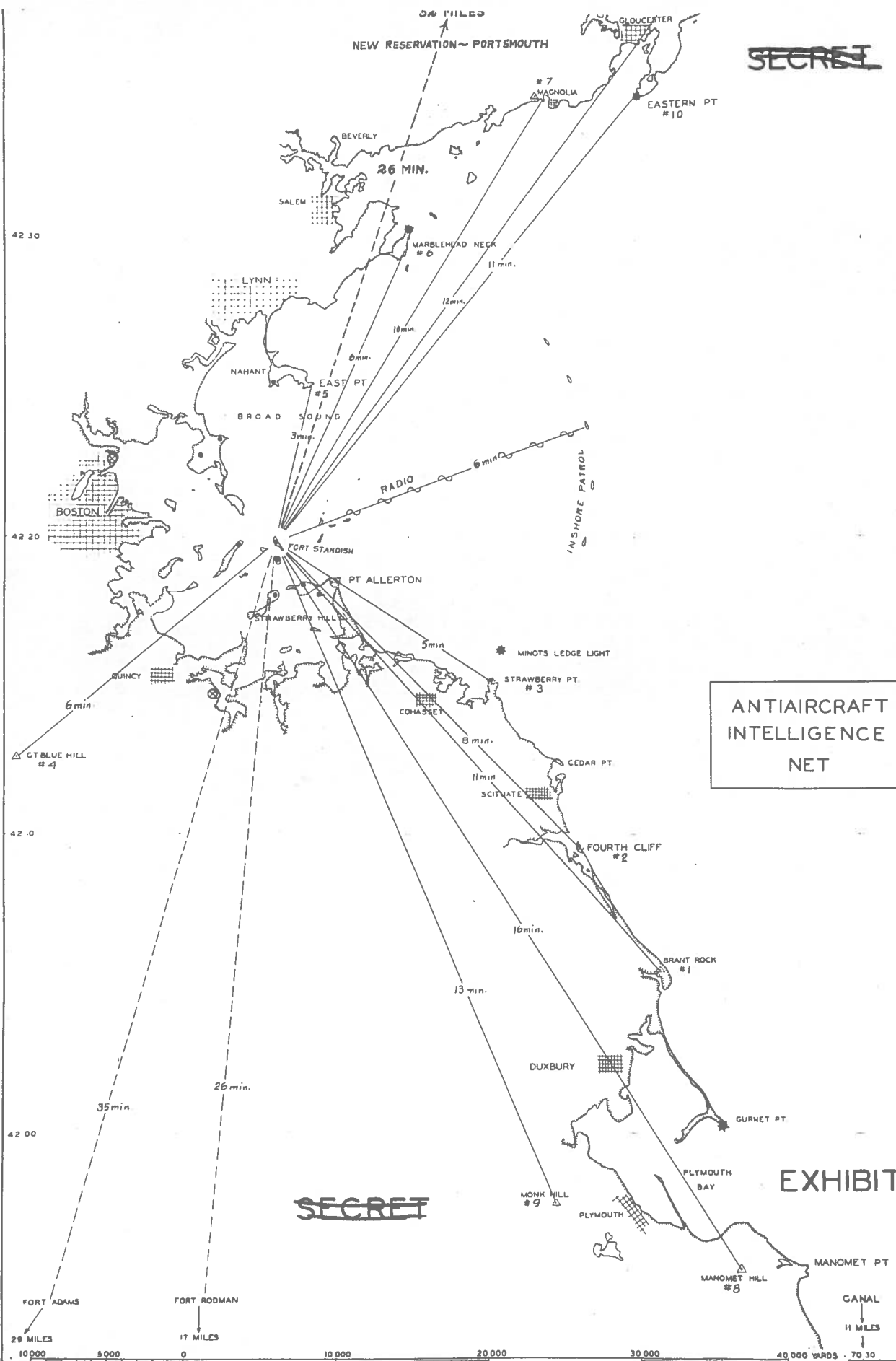
9. The war reserve and battle allowance of ammunition is shown in Exhibit 3-E. The battle allowance of machine gun ammunition, when determined, should be stored at Fort Warren.

10. Cost Estimate. An estimate of cost and priority guide is appended as Exhibit 4-E. Those items which should be procured and installed in peace time are marked with an A. Those which should be procured in peace but whose installation may be deferred until an emergency arises are marked B. Those items to be procured and installed when an emergency arises are marked C.

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ANNEX E.

EXHIBIT NO. 3-E.

WAR RESERVE AND BATTLE ALLOWANCE
OF
ANTIAIRCRAFT AMMUNITION

HARBOR DEFENSES OF BOSTON

Approved in 6th Indorsement, W. D., AGO,
May 5, 1933, (AG 381.4; 3-31-33; Misc. E).

AA (5 batteries) W.R. 16200; B.A. 8100.

Batteries	: Battle : Allowance	: Central : Reserve	: War : Reserve	: :	Remarks
No. 1, Ft. Revere	: 3240	: 1620	: 1620	:)	
	:	:	:	:)	
No. 2, Ft. Standish	: 3240	: 1620	: 1620	:)	
	:	:	:	:)	
No. 3, Ft. Strong	: 3240	: 1620	: 1620	:)	Store in
	:	:	:	:)	Ft. Warren
No. 4, Ft. Heath	: 3240	: 1620	: 1620	:)	
	:	:	:	:)	
No. 5, Ft. Ruckman	: 3240	: 1620	: 1620	:)	

The Battle Allowance of antiaircraft machine gun
ammunition, when determined, should be stored in Fort Warren.

EXHIBIT NO. 3-E.

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Priorities subject to change based on availability of funds

Prior- ity	Item:Class	Description of project	Ord- nance	Engineers Mat'l	Signal: Labor:Mat'l	Total
5	1	AA Battery No. 1 at Fort Revere, Mass.	\$ 17,337			\$ 17,337
		3 Fixed 3-inch AA Guns				\$ 19,000
		3 Fuze setters, \$3000; 1 Height Finder, \$16,000				\$ 38,000
		1 Director with transmission system (360 ft. of cable)				1,500
		1 AA BC Observation Instrument				24,800
		16 .50 caliber AA machine guns with FC equipment				80,000
		4 AA portable searchlight units, complete				24,080
		4 Sound locators				83
		11,350 feet W 110 field wire				
2	A	AA Battery No. 2 at Fort Standish, Mass.				
		1 Gun block for 3-inch AA gun				400
		1 Fixed 3-inch AA gun and carriage				200
		Raise gun position of third gun				
		3 Fuze setters, \$3000; 1 Height Finder, \$16,000				19,000
		1 Director with transmission system (240 ft. of cable)				38,000
		1 AA BC Observation Instrument				1,500
		12 .50 caliber AA machine guns with FC equipment				18,600
		2 AA portable searchlight units, complete				40,000
		2 Sound Locators				12,040
		6,000 feet W 110 field wire				44
		(Continued)				
		Total	\$232,024	\$120,600	\$1000	\$ 127,353,751

H. D. OF BOSTON

ANNEX E. EXHIBIT NO. 4-E COST ESTIMATE AND PRIORITY GUIDE

Priorities subject to change based on availability of funds.

Prior-	ity	Item:	Class:	Description of Project	Ord-	Engineers	Signal	Total
5	3	A	AA Battery No. 3 at Fort Strong, Mass.	Brought forward:	\$232,024:	\$120,600:	\$1000:	\$127,353,751
			1 Gun block for 3-inch AA gun		29,725:	400:	200:	600
			3 Fixed 3-inch AA guns and one carriage		19,000:			29,725
			3 Fuze setters, \$3000; 1 Height finder, \$16,000		38,000:			19,000
			1 Director with transmission system (375 ft. of cable)		1,500:			38,000
			1 AA BC Observation instrument		18,600:			1,500
			12 .50 caliber AA machine guns with FC equipment		80,000:			18,600
			4 AA portable searchlight units, complete		24,080:			80,000
			4 Sound locators					24,080
			12,050 feet W 110 field wire					88
			AA Battery No. 4 at Fort Heath, Mass.					
			1 Gun block for 3-inch AA gun		18,167:	400:	200:	600
			1 Fixed 3-inch AA gun and carriage		19,000:			18,167
			3 Fuze setters, \$3000; 1 Height finder, \$16,000		38,000:			19,000
			1 Director with transmission system (240 feet of cable)		1,500:			38,000
			1 AA BC Observation instrument		24,800:			1,500
			16 .50 caliber AA machine guns with FC equipment		60,000:			24,800
			3 AA portable searchlight units, complete		18,060:			60,000
			3 Sound locators					18,060
			16,800 feet W 110 field wire					122
			(Continued)					
			Total		\$462,456:	\$261,400:	\$1400:	\$337,5745.593

EXHIBIT NO. 4-E

ANNEX E.

EXHIBIT NO. 4-E

COST ESTIMATE AND PRIORITY GUIDE

H. D. OF BOSTON

Priorities subject to change based on availability of funds

Prior- ity	Item:Class	Description of Project	Ord- nance	Engineers Mat'l	Signal Labor:Mat'l	Total
5	A	1 AA Battery No. 5 at Fort Ruckman, Mass.	\$482,456	\$261,400	\$1400	\$337,856
		2 Fixed 3-inch AA guns and one carriage	23,946			23,946
		3 Fuze setters, \$3000; 1 Height finder, \$16,000	19,000			19,000
		1 Director with transmission system (1200 feet of cable)	38,000			38,000
		1 AA BC Observation instrument	1,500			1,500
		16 .50 caliber AA machine guns with FG equipment	24,800			24,800
		2 AA portable searchlight units, complete		40,000		40,000
		2 Sound locators	12,040			12,040
		6,900 feet W 110 field wire				50
6		Equipment for 11 observation posts				
	B	11 Field glasses				
	B	5 Telephones, wall, with headsets	429			429
	C	Monthly rental 1 circuit from Manomet Hill to Pt. Allerton				385
	C	Monthly rental 1 circuit from Monk Hill to Pt. Allerton				148
	C	Monthly rental 1 circuit from Great Blue Hill to Pt. Allerton				112
	C	Monthly rental 1 circuit from Railroad Hill to Pt. Ruckman				57
	C	Monthly rental 1 circuit from Eastern Pt. to Pt. Ruckman				97
						98
		Total	\$602,171	\$301,400	\$1400	\$772,905,743

* Not included in totals.

Class A - To be procured and installed in peacetime.

Class B - To be procured in peacetime and installed when an emergency arises.

Class C - To be procured and installed when an emergency arises.

Note: No expenditure of funds by the Chemical Warfare Service, Coast Artillery Corps, or for land, is contemplated in this Annex.

EXHIBIT NO. 4-E.

ANNEX F

SUPPORTING AIRCRAFT

AUTHORITIES

1. This Annex was prepared January 25, 1934, by a Board of Officers appointed under the provisions of paragraph 1 d, AR 100-20.

2. Approved by the Secretary of War in the 14th Indorsement, AG 660.2 (1-25-34)(Misc.) E, dated August 13, 1934.

~~SECRET~~

A N N E X F.

SUPPORTING AIRCRAFT.

1. Mission: To furnish observation and surveillance missions for gun defenses of Fort Andrews, Fort Banks, Fort Duvall, Fort Heath, Fort Revere, Fort Ruckman, Fort Standish, Fort Strong and Fort Warren.

2. Equipment required: One (1) Observation Flight; three planes equipped with radio.

3. Landing Fields:

a. Operating:

(1) Boston Airport, Boston, Mass.

b. Emergency:

- (1). Naval Reserve Station, Squantum, Mass.
- (2). Dennison Airport, North Quincy, Mass.
- (3). Muller Field, Revere, Mass.
- (4). Brockton Airport, Brockton, Mass.
- (5). Boston Metropolitan Airport, Norwood, Mass.
- (6). Natick - Wellesley Airport, Natick, Mass.
- (7). Beverly Airport, Beverly, Mass.
- (8). Clark Airport, Hanover, Mass.

4. Gas and Oil: To be requisitioned for and maintained on hand at Air Corps Detachment, Boston Airport, Boston, Mass.

5. Communications:

a. Local telephone system. Air Corps Detachment, Boston Airport.

b. Radio between planes on missions and the Harbor Defense Command Post.

~~SECRET~~

ANNEX G

GAS DEFENSE

AUTHORITIES

1. This Annex was prepared January 25, 1934, by a Board of Officers appointed under the provisions of paragraph 1 d, AR 100-20.

2. Approved by the Secretary of War in the 14th Indorsement, AG 660.2 (1-25-34)(Misc.) E, dated August 13, 1934.

SECRET

A N N E X G.

GAS DEFENSE.

1. a. This project contemplates the use of the collective protector unit M1 or later model, having a rated capacity of 200 cubic feet per minute. Three cubic feet per minute per person not physically active, and ten cubic feet for personnel of plotting rooms is required. Therefore one unit will supply a maximum of 20 persons actively engaged or 67 persons not active. There are the further conditions that each person should be allowed 150 cubic feet of space; and that one unit will supply the necessary slight positive air pressure to a room of no more than 10,000 cubic feet capacity.

b. The basis for providing reserve canisters is that the life of the canister is 40 hours; and the assumption that there may be two gas attacks of eight hours each, each week for three months. This is a very ample allowance.

c. Only permanent and bombproof structures should, in general, be gas proofed. Power plants do not require protection, nor do isolated fire control stations. Short range batteries of the secondary armament are not protected. Provision for gas defense is to be made whenever new emplacements are constructed.

d. For personnel outside of gas-proofed rooms, reliance is placed on gas masks, protective clothing and the employment of trained squads of men using chlorido of lime to neutralize mustard gas. All of this personal and organizational equipment is outside the scope of this project.

2. a. Attack by gas must ordinarily be carried out by airplane since otherwise the expenditure of naval ammunition would be excessive. The fire of antiaircraft guns and machine guns will be a deterrent to effective gas attack.

b. Attack with persistent gas is the chief concern.

3. Provision is made in this project for complete gas-proofing of the plotting rooms, and a rest room at each battery where a room is available without undertaking new construction. Aid stations may be established in the rest rooms. Evacuations should be first to military and then to civil hospitals.

4. Cost Estimate. An estimate of cost and priority guide is appended as Exhibit 1-G. Those items which should be procured and installed in peace time are marked with an A. Those which should be procured in peace but whose installation may be deferred until an emergency arises are marked B. Those items to be procured and installed when an emergency arises are marked C.

SECRET

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H. D. OF BOSTON

COST ESTIMATE AND PRIORITY GUIDE

ANNEX G. EXHIBIT NO. 1-G.

Priorities subject to change based on availability of funds.

Prior-Item:	Class:	Description of project	Cu.Ft.:	No. of persons:	No. of Collec- tive:	No. of: tions:	Cost Estimate	Engineer	Total
9	1	Fort Duvall. Battery Long.							
	A	Plotting Room	2745:	16	1	4	1,860:	300:	75: 2,235
	B	Rest Room	2650:	18	1	4	1,860:	300:	75: 2,235
2		Fort Ruckman. Battery Gardner.							
	A	Plotting Room	2448:	16	1	4	1,860:	300:	75: 2,235
	B	Rest Room	2800:	19	1	4	1,860:	300:	75: 2,235
3		Fort Warren.							
	A	Battery Stevenson plotting room	7200:	16	1	4	1,860:	300:	75: 2,235
	B	Battery Stevenson rest room	13600:	90	2	8	3,720:	600:	150: 4,470
	A	1st Mine Command plotting room	2058:	14	1	4	1,860:	300:	75: 2,235
	B	1st Mine Command casemate	2688:	4	1	4	1,860:	300:	75: 2,235
	B	1st Mine Command rest room	1584:	10	1	4	1,860:	300:	75: 2,235
4		Fort Heath. Battery Winthrop.							
	A	Plotting Room	3456:	16	1	4	1,860:	300:	75: 2,235
	B	Rest Room (Not Bombproof)	1512:	10	1	4	1,860:	300:	75: 2,235
5		Fort Revere. Battery Senders.							
	A	Plotting Room	2160:	14	1	4	1,860:	300:	75: 2,235
	B	Rest Room	1000:	7	1	4	1,860:	300:	75: 2,235
Total							\$26,040:	\$4,200:	\$31,290

EXHIBIT NO. 1-G.

SECRET

SECRET

H. D. OF BOSTON

ANNEX G. EXHIBIT NO. 1-G. COST ESTIMATE AND PRIORITY GUIDE

Priorities subject to change based on availability of funds.

Prior-Item:	Class:	Description of Project	Gu. Ft.	No. of Persons:	No. of Collectives:	No. of Reserve:	No. of Engineers:	Cost Estimate	Total
9	6	Fort Standish.							
	A	Battery Terrill plotting room	1920:	13	1	4	1,860:	300:	75: 2,235
	B	Battery Terrill rest room(not bombproof)	1386:	9	1	4	1,860:	300:	75: 2,235
	B	Battery Whipple rest room	2100:	14	1	4	1,860:	300:	75: 2,235
7		Battery Andrews. Battery McCook.							
	A	Plotting Room	1568:	10	1	4	1,860:	300:	75: 2,235
	B	Rest Room	2430:	16	1	4	1,860:	300:	75: 2,235
8		Fort Strong. 2d Mine Command.							
	A	Plotting Room	1547:	10	1	4	1,860:	300:	75: 2,235
	B	Casemate	4030:	4	1	4	1,860:	300:	75: 2,235
	B	Rest Room	2016:	13	1	4	1,860:	300:	75: 2,235
9		Fort Banks.							
	A	Battery Kellogg plotting room	3500:	16	1	4	1,860:	300:	75: 2,235
	B	Battery Kellogg rest room	5000:	23	1	4	1,860:	300:	75: 2,235
	A	Battery Lincoln plotting room	3500:	16	1	4	1,860:	300:	75: 2,235
	B	Battery Lincoln rest room	5000:	33	1	4	1,860:	300:	75: 2,235
Total									\$48,350:\$7,800:\$1,950:\$58,110

Class A - To be procured and installed in peacetime.

Class B - To be procured in peacetime and installed when an emergency arises.

Class C - To be procured and installed when an emergency arises.

Note : No expenditure of funds by the Ordnance Department, Signal Corps, Coast Artillery Corps, or for land, is contemplated in this annex.

SECRET

ANNEXES H - M

ESTIMATES - CHIEFS OF ARMS AND SERVICES

ANNEX H

ESTIMATES, CHIEF OF COAST ARTILLERY

Annex	Priority	Item	Class A	Total
D	2	1	\$ 51,200	\$51,200

The following is a recapitulation of the total cost of all Annexes:-

Annex	Procuring Service	Class A	Class B	Class C	Total
A	:Engineers	:\$ 150	:\$:\$	150
	:Ordnance	:	8,000	:	8,000
	Total	150	8,000	:	8,150
B	:Engineers	38,950	14,700	:	53,650
	:Ordnance	123,585	31,719	:	155,304
	:Signal Corps	121,256	*1,226	*7,352	*139,834
	Total	283,791	*47,645	*7,352	*338,788
C	:Engineers	13,200	89,000	:	102,200
	:Signal Corps	616	1,848	:	2,464
	Total	13,816	90,848	:	104,664
D	:Engineers	2,500	:	:	2,500
	:Ordnance	:	1,539	:	1,589
	:Signal Corps	:	308	:	308
	:Coast Artillery	51,200	:	:	51,200
	Total	53,700	1,897	:	55,597
E	:Engineers	302,800	:	:	302,800
	:Ordnance	601,742	429	:	602,171
	:Signal Corps	387	385	*512	*1,284
	Total	904,929	814	*512	*906,255
G	:Engineers	4,125	5,625	:	9,750
	:Chemical Warfare	20,460	27,900	:	48,360
	: Service	:	:	:	:
	Total	24,585	33,525	:	58,110
	GRAND TOTAL	:\$1,280,971	*\$182,739	*\$7,864	*\$1,471,564

*Includes future rentals (See Annex M)

Approved by Chief of Coast Artillery,
October 8, 1934.

ANNEX J

ESTIMATES, CHIEF OF ENGINEERS

Annex:	Priority:	Item :	Class A :	Class B :	Total
A :	8 :	1 :	\$ 150 :	:	\$ 150
B :	1 :	1 :	3,500 :	\$:	3,500
:	:	4 :	7,550 :	:	7,550
:	:	5 :	3,300 :	:	3,300
:	:	6 :	7,000 :	:	7,000
:	:	8 :	10,000 :	:	10,000
:	:	9 :	:	\$ 5,400 :	5,400
:	:	10 :	:	2,300 :	2,300
:	:	12 :	1,500 :	6,000 :	7,500
:	:	14 :	:	500 :	500
:	:	16 :	1,100 :	:	1,100
Total			38,950 :	14,700 :	53,650
C :	3 :	1 :	13,200 :	:	13,200
:	:	2 :	:	15,950 :	15,950
:	:	3 :	:	21,300 :	21,300
:	:	4 :	:	9,150 :	9,150
:	:	5 :	:	21,300 :	21,300
:	:	6 :	:	21,300 :	21,300
Total			13,200 :	59,000 :	102,200
D :	2 :	2 :	2,500 :	:	2,500
E :	5 :	1 :	80,000 :	:	80,000
:	:	2 :	41,600 :	:	41,600
:	:	3 :	80,600 :	:	80,600
:	:	4 :	60,600 :	:	60,600
:	:	5 :	40,000 :	:	40,000
Total			302,800 :	:	302,800
G :	9 :	1 :	375 :	375 :	750
:	:	2 :	375 :	375 :	750
:	:	3 :	750 :	1,500 :	2,250
:	:	4 :	375 :	375 :	750
:	:	5 :	375 :	375 :	750
:	:	6 :	375 :	750 :	1,125
:	:	7 :	375 :	375 :	750
:	:	8 :	375 :	750 :	1,125
:	:	9 :	750 :	750 :	1,500
Total			4,125 :	5,625 :	9,750
GRAND TOTAL			\$ 361,725 :	\$ 109,325 :	\$ 471,050

Approved by Chief of Engineers,
September 6, 1934.

ANNEX K

ESTIMATES, CHIEF OF ORDNANCE

Annex:	Priority:	Item :	Class A :	Class B :	Total
A :	7 :	1 :	\$:	\$ 8,000 :	\$ 8,000
B :	1 :	2 :	39,855 :	:	39,855
:	:	3 :	39,855 :	:	39,855
:	:	4 :	11,102 :	:	11,102
:	:	5 :	10,530 :	:	10,530
:	:	6 :	10,530 :	:	10,530
:	:	7 :	:	3,900 :	3,900
:	:	9 :	:	5,265 :	5,265
:	:	10 :	:	5,265 :	5,265
:	:	11 :	11,713 :	975 :	12,688
:	:	12 :	:	10,530 :	10,530
:	:	13 :	:	1,950 :	1,950
:	:	15 :	:	3,834 :	3,834
Total			123,585 :	31,719 :	155,304
D :	2 :	3 :	:	614 :	614
:	:	4 :	:	975 :	975
Total			:	1,589 :	1,589
E :	5 :	1 :	124,717 :	:	124,717
:	:	2 :	107,307 :	:	107,307
:	:	3 :	130,905 :	:	130,905
:	:	4 :	119,527 :	:	119,527
:	:	5 :	119,286 :	:	119,286
:	:	6 :	:	429 :	429
Total			601,742 :	429 :	602,171
GRAND TOTAL			\$ 725,327 :	41,737 :	767,064
			:	:	:

Approved by Chief of Ordnance,
October 1, 1934.

ANNEX L

ESTIMATES, CHIEF OF CHEMICAL WARFARE SERVICE

Annex	Priority	Item	Class A	Class B	Total
G	9	1	\$ 1,860	\$ 1,860	\$ 3,720
		2	1,860	1,860	3,720
		3	3,720	7,440	11,160
		4	1,860	1,860	3,720
		5	1,860	1,860	3,720
		6	1,860	3,720	5,580
		7	1,860	1,860	3,720
		8	1,860	3,720	5,580
		9	3,720	3,720	7,440
GRAND TOTAL			\$ 20,460	\$ 27,900	\$48,360

Approved by Chief, Chemical Warfare Service,
August 31, 1934.

ANNEX M

ESTIMATES, CHIEF SIGNAL OFFICER

Annex:	Priority:	Item :	Class A :	Class B :	Class C :	Total
B	1	\$ 2 : \$	475 :	\$:	\$:	475
		3 :	475 :	:	:	475
		4 :	14,684 :	:	:	14,684
		5 :	20,412 :	:	:	20,412
		6 :	32,915 :	:	:	32,915
		7 :	:	308 :	:	308
		9 :	:	240 :	2,738 :	2,978
		10 :	:	240 :	* 425 :	*
		12 :	:	240 :	1,050 :	1,290
		13 :	:	:	* 415 :	*
		17 :	52,295 :	* 198 :	* 434 :	2,530
						*
Sub-total			121,256 :	1,028 :	6,078 :	128,362
*Totals not included			0 :	198 :	1,274 :	1,472
above						
TOTAL			121,256 :	1,226 :	7,352 :	129,834
C	3	1 :	616 :	:	:	616
		3 :	:	616 :	:	616
		5 :	:	616 :	:	616
		6 :	:	616 :	:	616
Total			616 :	1,848 :	:	2,464
D	2	3 :	:	231 :	:	231
			:	77 :	:	77
Total			:	308 :	:	308
E	5	1 :	83 :	:	:	83
		2 :	44 :	:	:	44
		3 :	88 :	:	:	88
		4 :	122 :	:	:	122
		5 :	50 :	:	:	50
		6 :	:	385 :	:	385
			:	:	* 148 :	*
			:	:	* 112 :	*
			:	:	* 57 :	*
			:	:	* 97 :	*
			:	:	* 98 :	*
Sub-total			387 :	385 :	0 :	772
*Totals not included			0 :	0 :	512 :	512
above						
TOTAL			387 :	385 :	512 :	1,284
GRAND SUB-TOTALS			\$ 122,259 :	\$ 3,569 :	\$ 6,078 :	\$131,906
*TOTALS NOT INCLUDED			0 :	198 :	1,786 :	1,984
ABOVE						
GRAND TOTALS			\$ 122,259 :	\$ 3,767 :	\$ 7,864 :	**133,890

*Covers future rentals for use of commercial telephone lines.

**Includes future rentals.

Approved by Acting Chief Signal Officer;
September 17, 1934.