

NATIONAL EXAM May 2003

98-Nav-A1 Fundamentals of Naval Architecture

Duration 3 hours

NOTES:

- 1- If doubt exists as to the interpretation of any question , the candidate is urged to submit with the answer paper, a clear statement of any assumptions made.
- 2- The format of the examination is "OPEN BOOK" exam any calculator is permitted. .
- 3-- Any five questions constitute a complete paper. Only the first five questions as they appear in your answer book will be marked.
- 4- All questions are of equal value.

EXAM QUESTIONS FOR
98-Nav-A1, Fundamentals of Naval Architecture

PLEASE ANSWER 5 OF THE 6 QUESTIONS BELOW

1- Figure 1 shows the ship geometry and the curves of form for a destroyer. T-the draft marks read 11 ft forward and 12 ft at aft. If the draft marks are located on the perpendiculars calculate:

- 1- The displacement of the ship in salt and fresh water.
- 2- The location of the center of buoyancy from the keel and the transverse and longitudinal meta centric radii.
- 3-Tonnes per inch immersion.
- 4- Location of the center of floatation.
- 5- Moment to change trim by 1inch.

2- The cross curves of stability for a ship are shown in Figure 2. Obtain the general stability curve for this ship at a displacement of 3200 tons.

If the value of KG is reduced to 12 ft 6 inches, plot the resulting general stability curve for this condition and obtain the value of GM.

If the center of gravity is not on the line of symmetry but off centered by 6 inches to the port side, plot the general stability curve for this condition. What is the resulting GM now?

Show your work on the general stability diagram.

3- For the ship in problem 1 with the same initial forward and aft drafts, We now add 12000 pounds of meat , 15000 gals of fresh water to be stored at station 14. In addition 10 tons of ammunition is added at the station 4. All weight additions are on the center line. Calculate the resulting

- Displacement
- Forward and aft draft mark readings.
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4- By an inclining experiment the ship in question 1 is observed to have a metacentric height of 3.5 feet in salt water. While sailing the ship is damaged below waterline and floods a compartment 25 feet forward and 14 feet athwart ship and with 80 tons of salt water in free communication with sea. The center of gravity of water is 8 feet above the keel and 6 feet starboard of the center line. Calculate :

- KM, and KG, as a result of weight alone of water.
- Free surface effect
- Free communication effect.
- Final metacentric height after flooding
- List due to flooding.

5- The destroyer in Figure 1 is inclined to determine the actual position of the center of gravity above the keel. The

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draft readings with the inclining weights aboard give a mean draft of 11 ft 6 inches with no trim. The inclining moment and resulting tangent of the angles of inclination are listed below..

Moment (ft .tons)	Tangent of the angle of inclination
150 to stbd.	0.0220
300 to stbd	0.0460
0	0.0020
150 to port	0.0180
300 to port	0.0420

The specific gravity of water by hydrometer and corrected for temperature is 1.020.
Calculate the vertical height of the center of gravity above the keel KG.

6- A destroyer of the class represented by Figure 1 is dry docked with a draft of 12 ft forward and aft. The center of gravity above the keel before docking is 15 ft. At what draft reading will the effective metacentric height become zero. What needs to be done before this time at the dry dock.

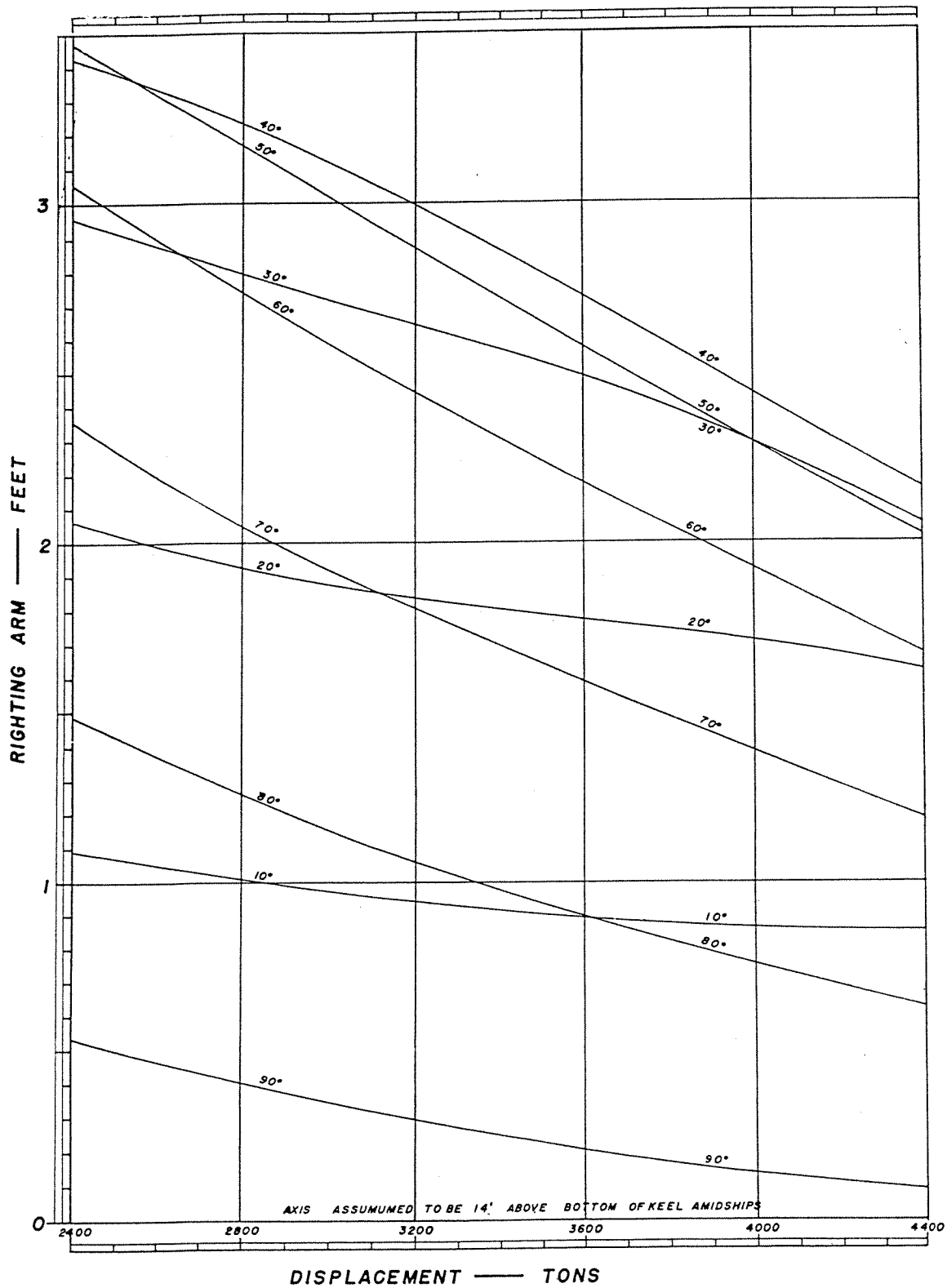
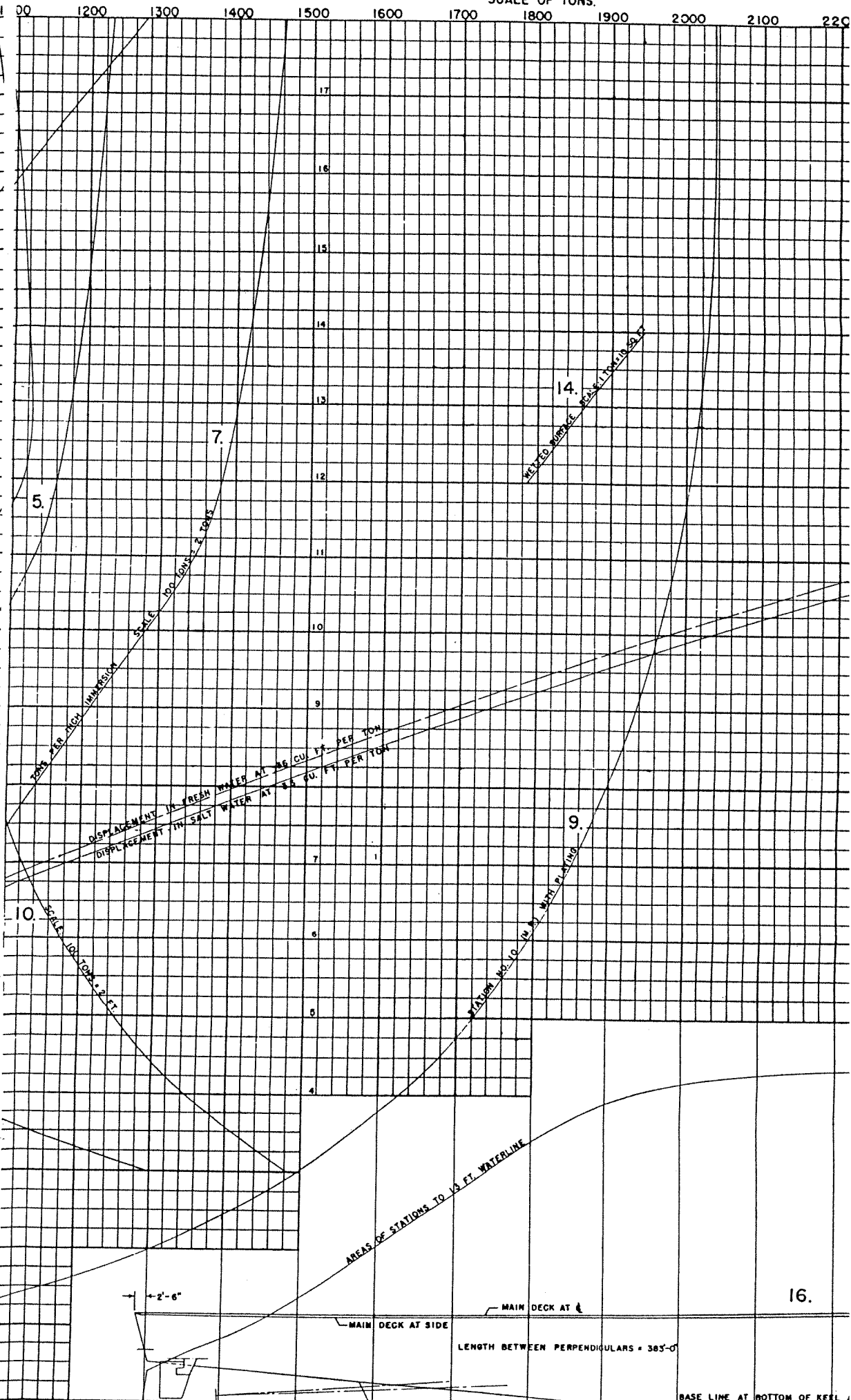
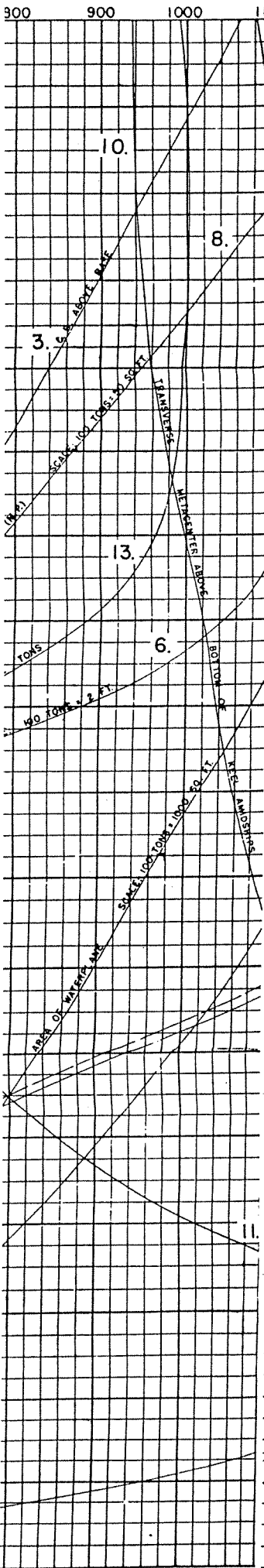
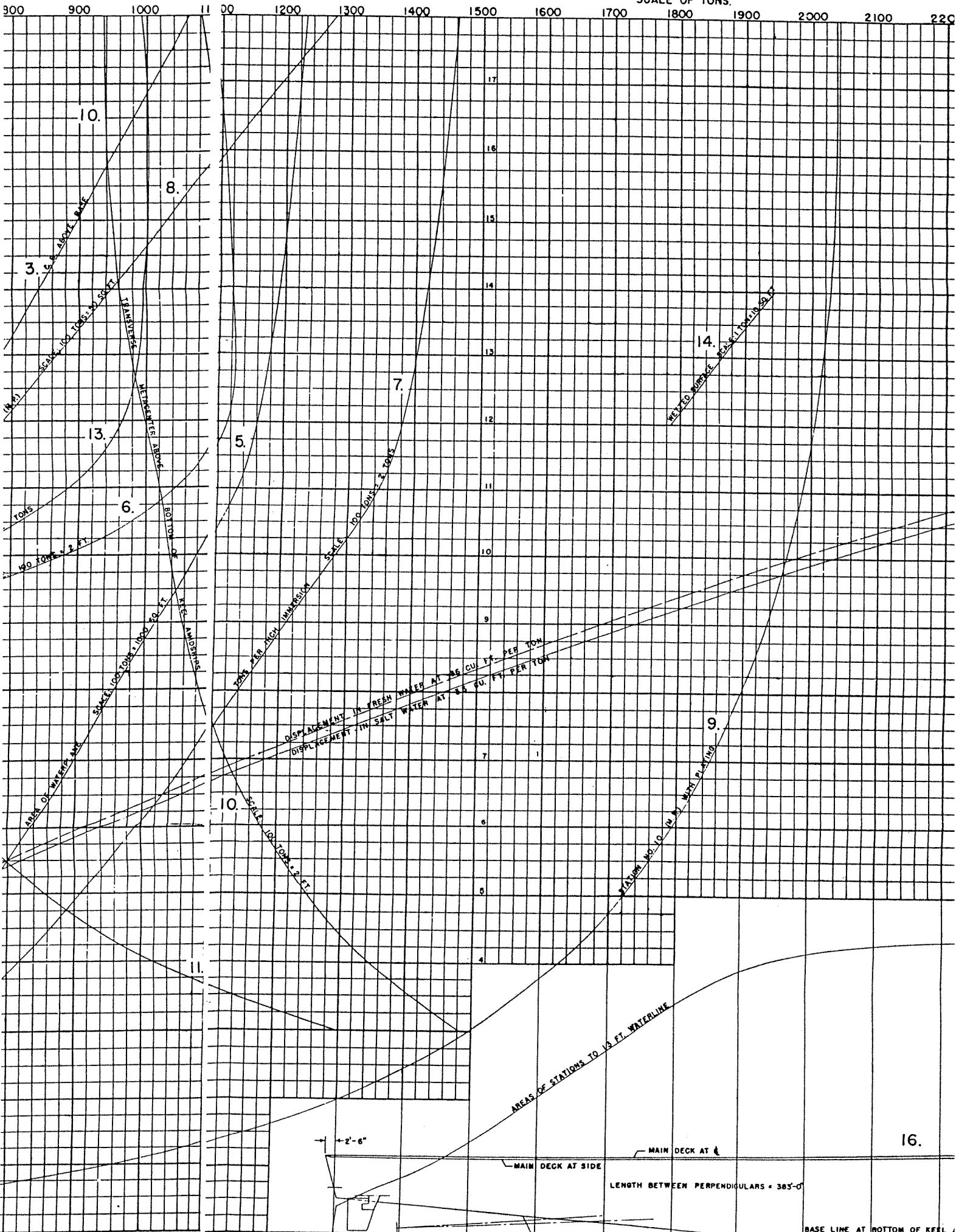
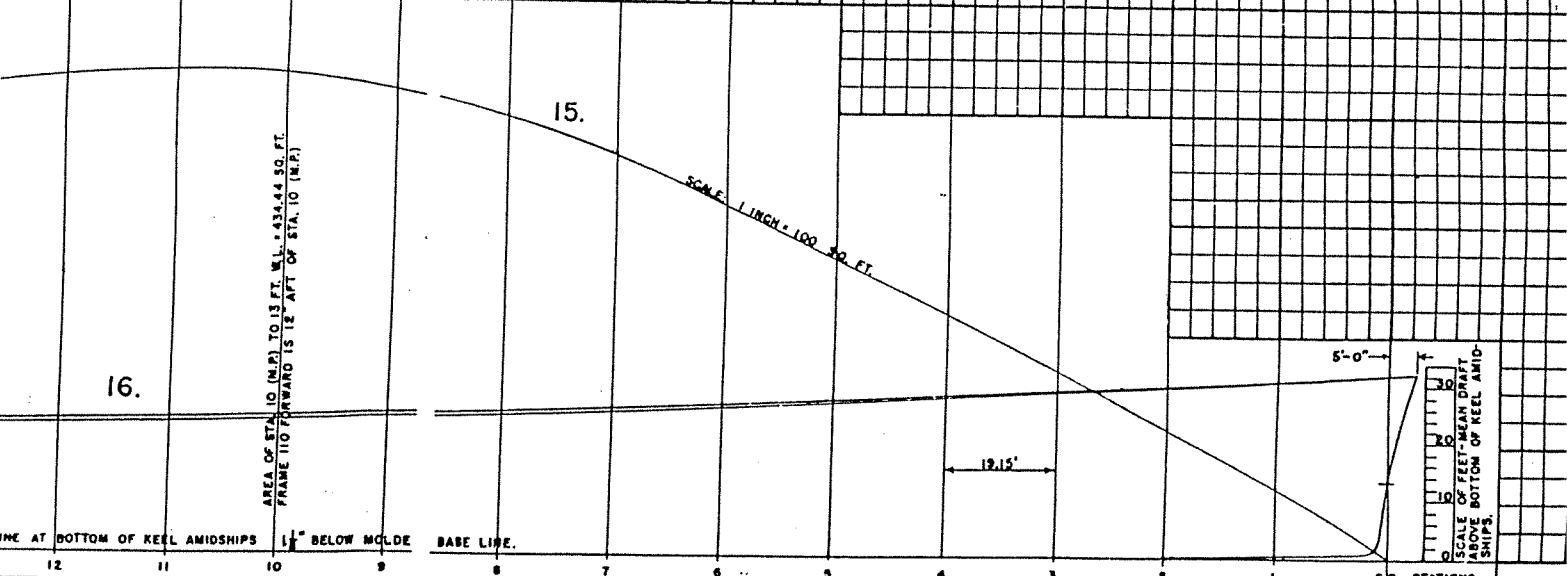
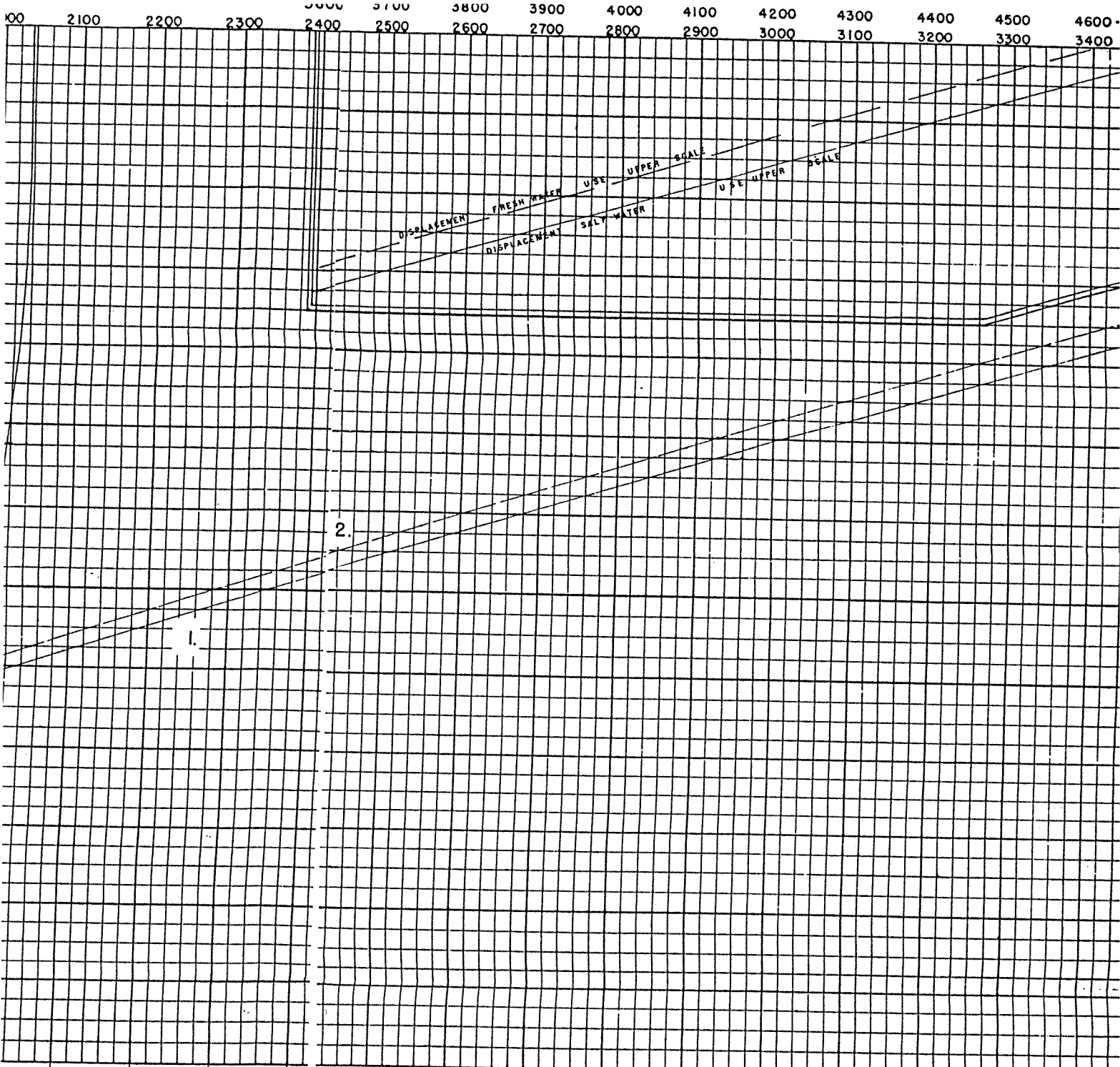


Figure 3-9. Cross Curves of Stability for a typical United States Destroyer-type Ship.



STATIONS A.P. 19 18 17 16 15 14 13 12 11 10 9 8 7 6 5 4

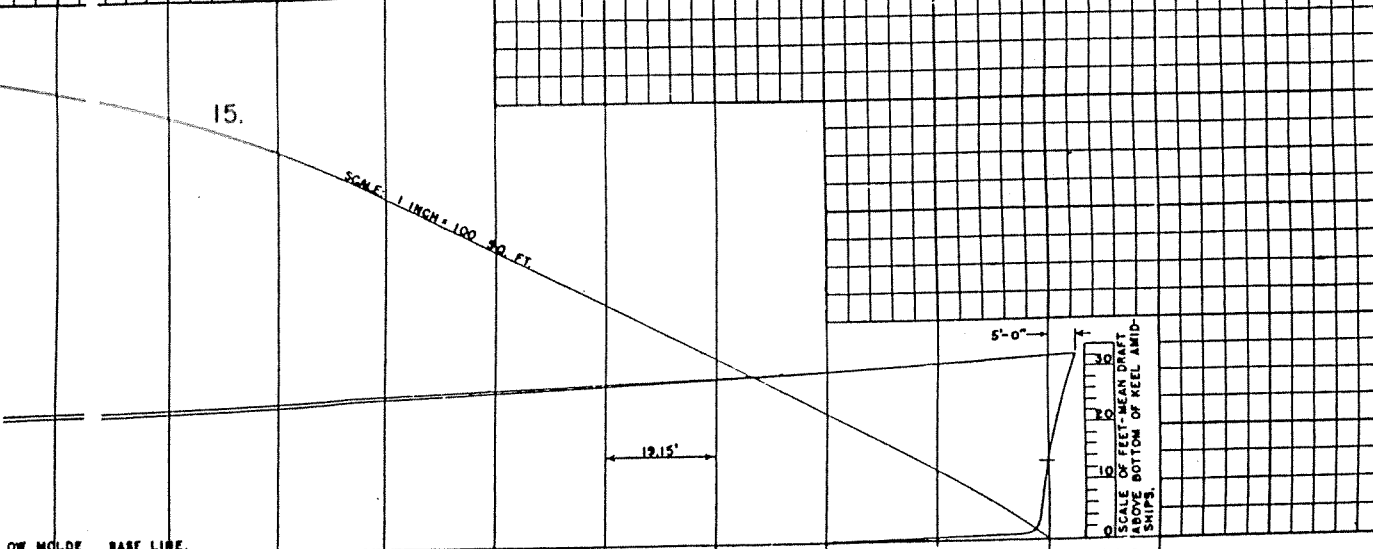
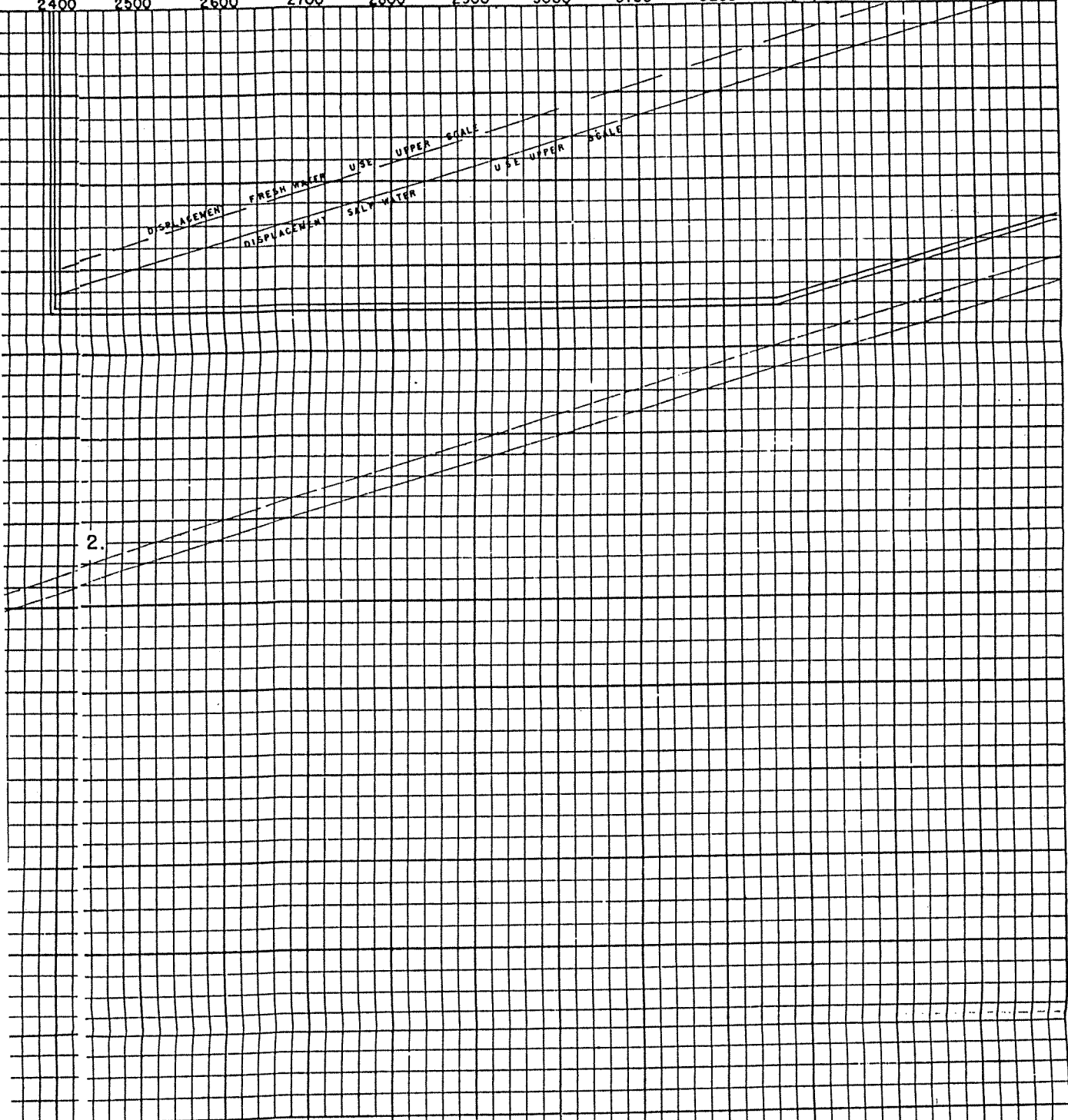


AREA OF STA. 10 (M.P.) TO 13 FT. W.L. = 434.43 SQ. FT.
 FRAME 110 FORWARD IS 12" AFT OF STA. 10 (M.P.)

LINE AT BOTTOM OF KEEL AMIDSHIPS 1" BELOW MCLDE BASE LINE.

SCALE OF FEET-MEAN DRAFT FROM BOTTOM OF KEEL AMIDSHIPS

3600 3700 3800 3900 4000 4100 4200 4300 4400 4500 4600 4700 4800
 2400 2500 2600 2700 2800 2900 3000 3100 3200 3300 3400 3500 3600



OW MCLDE BASE LINE.

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