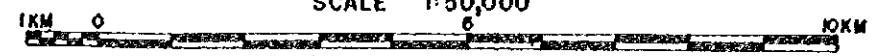
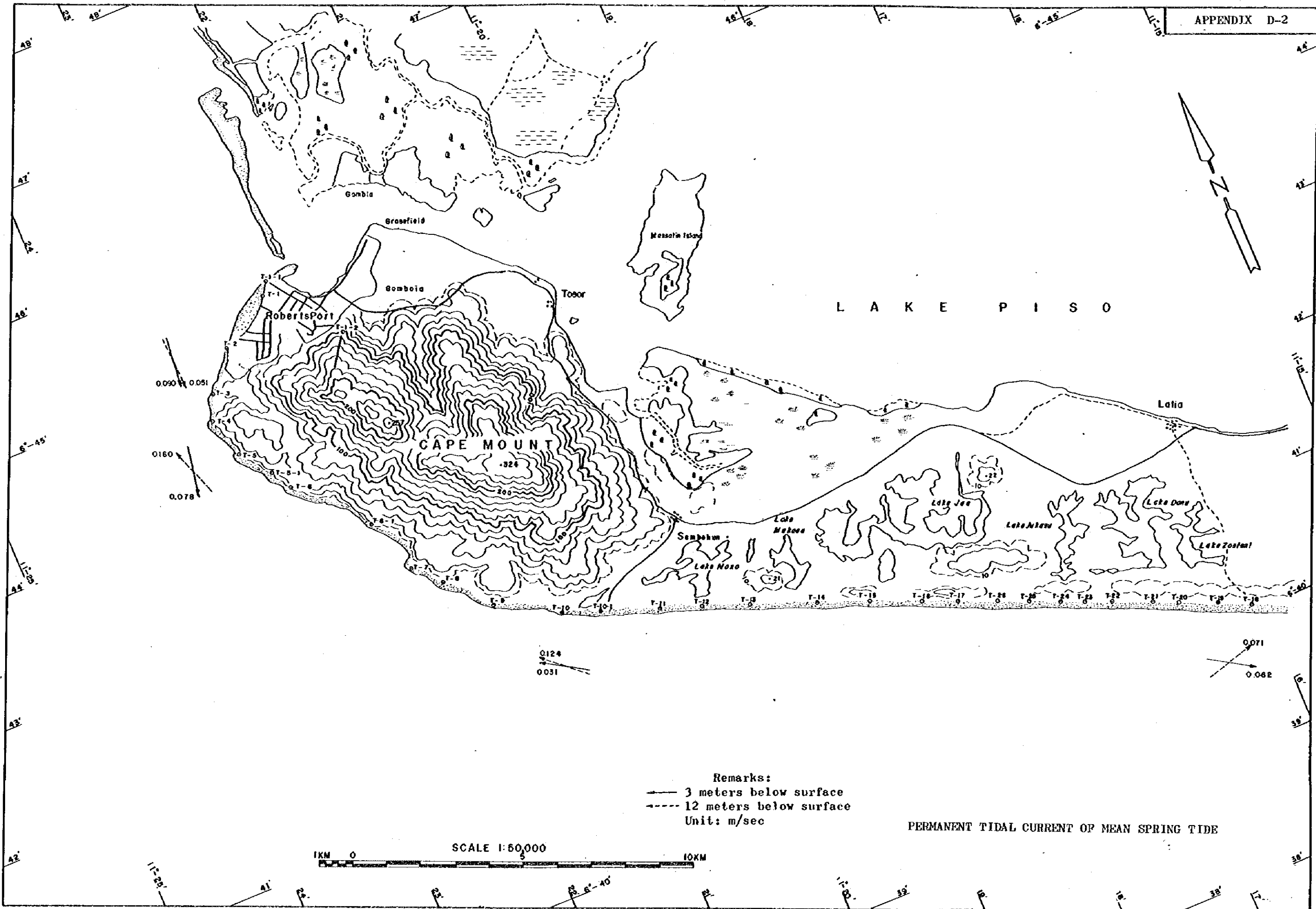


CURRENT MEASUREMENT POINTS

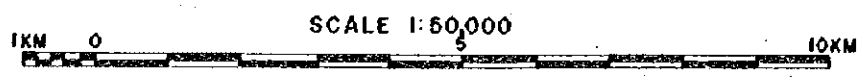
SCALE 1:50,000

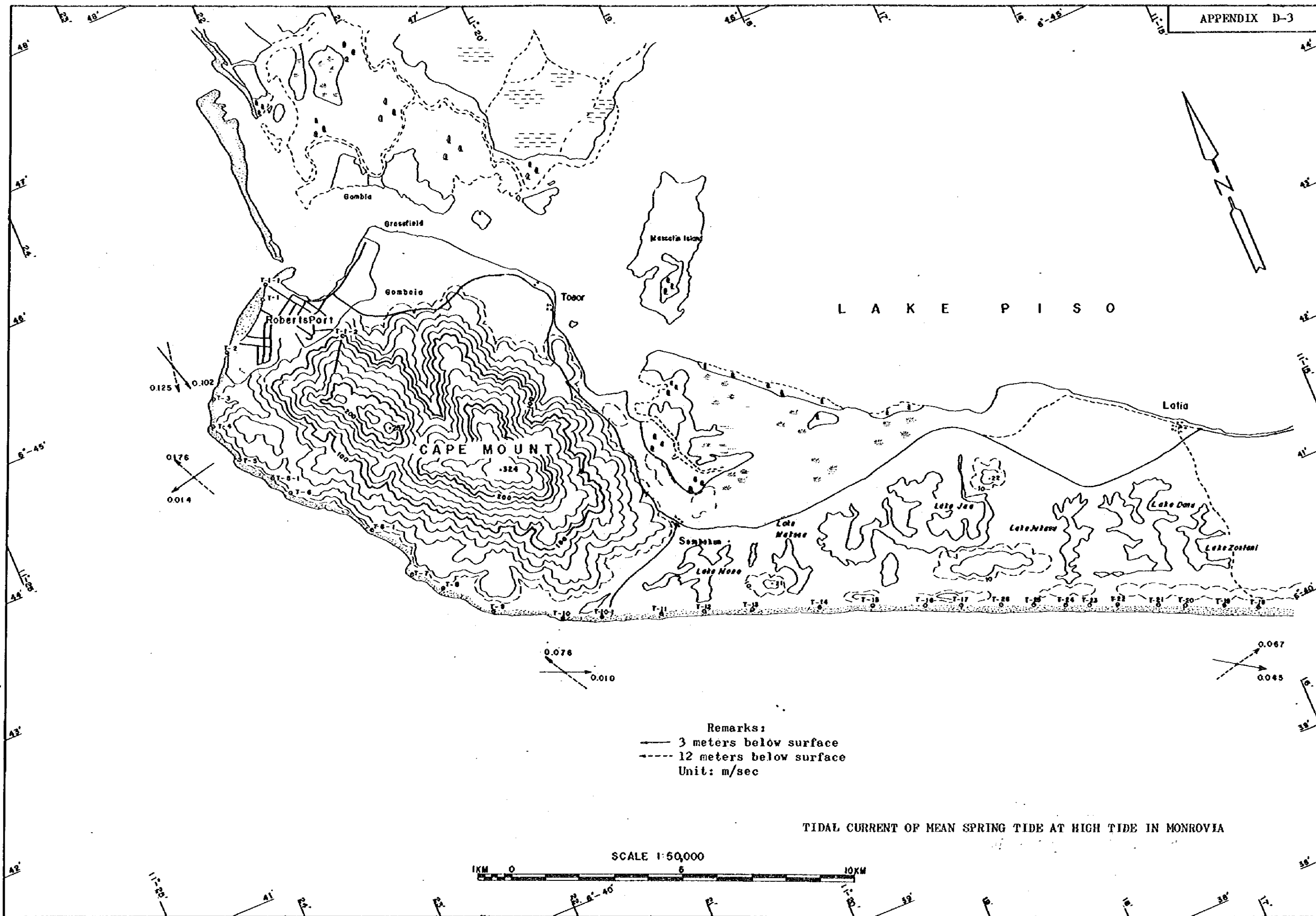




Remarks:  
 — 3 meters below surface  
 - - - 12 meters below surface  
 Unit: m/sec

PERMANENT TIDAL CURRENT OF MEAN SPRING TIDE



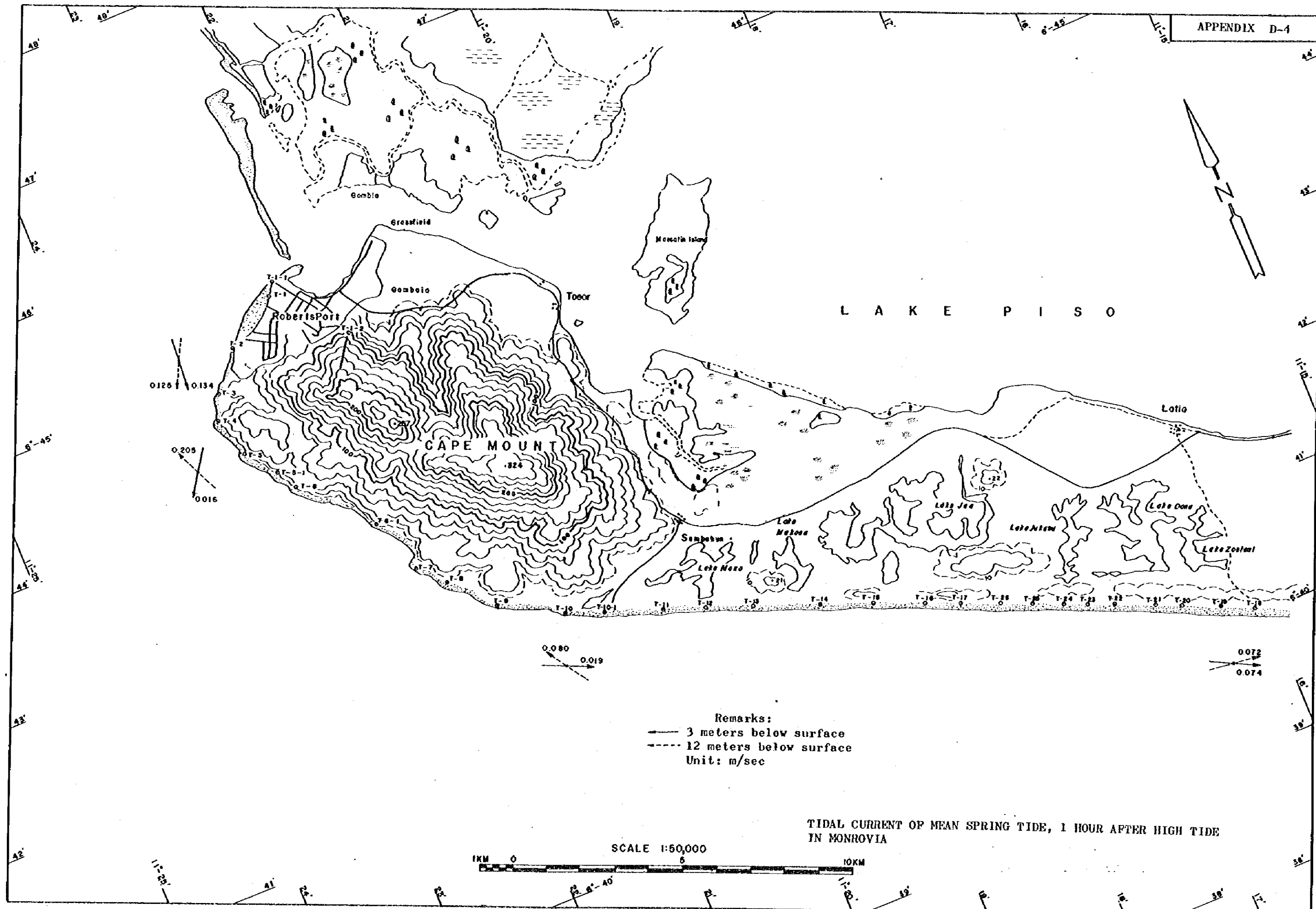


Remarks:  
 — 3 meters below surface  
 - - - 12 meters below surface  
 Unit: m/sec

TIDAL CURRENT OF MEAN SPRING TIDE AT HIGH TIDE IN MONROVIA

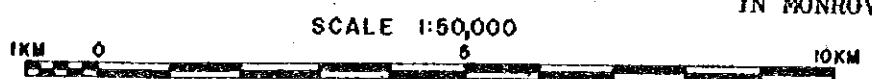
SCALE 1:50,000

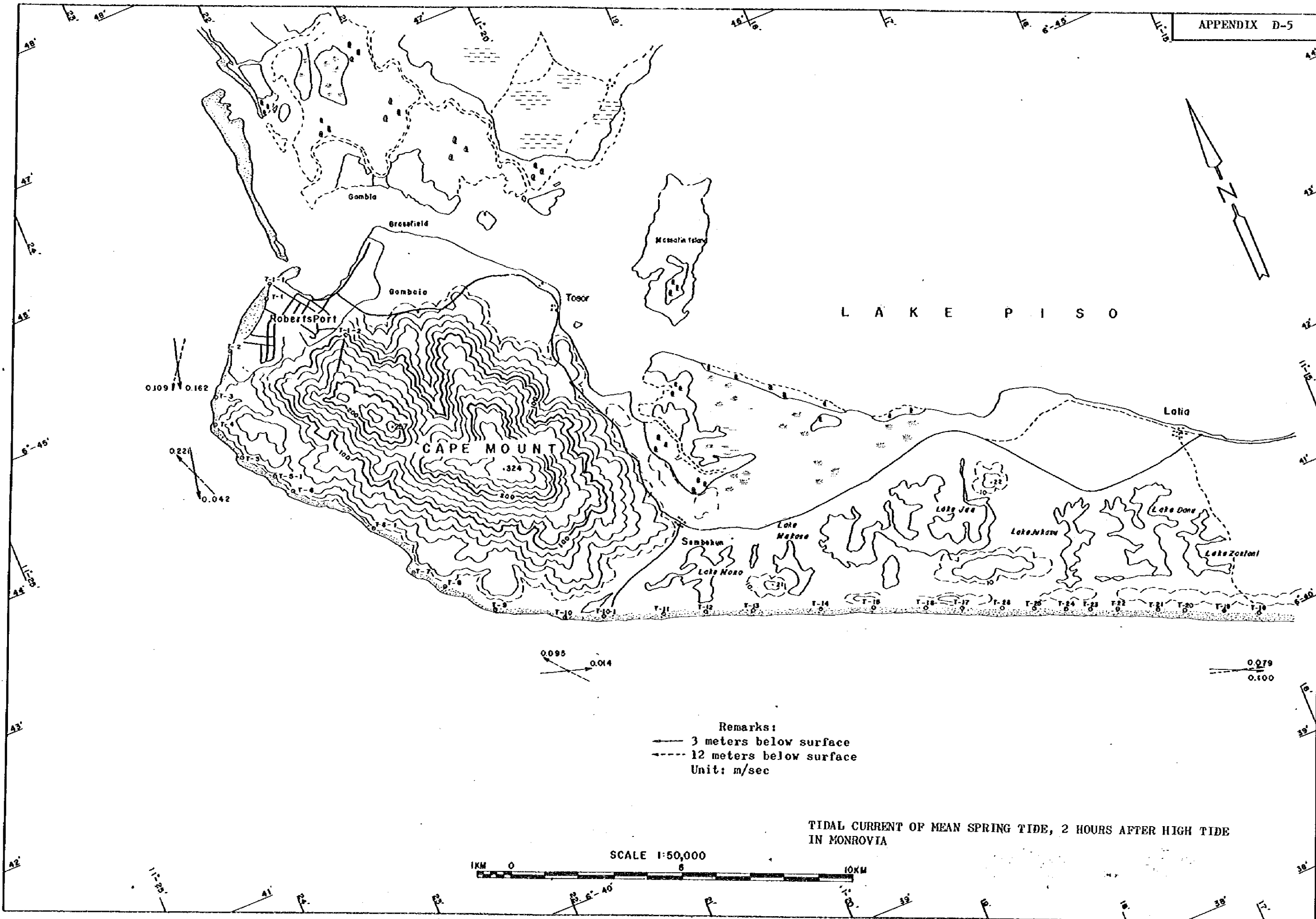


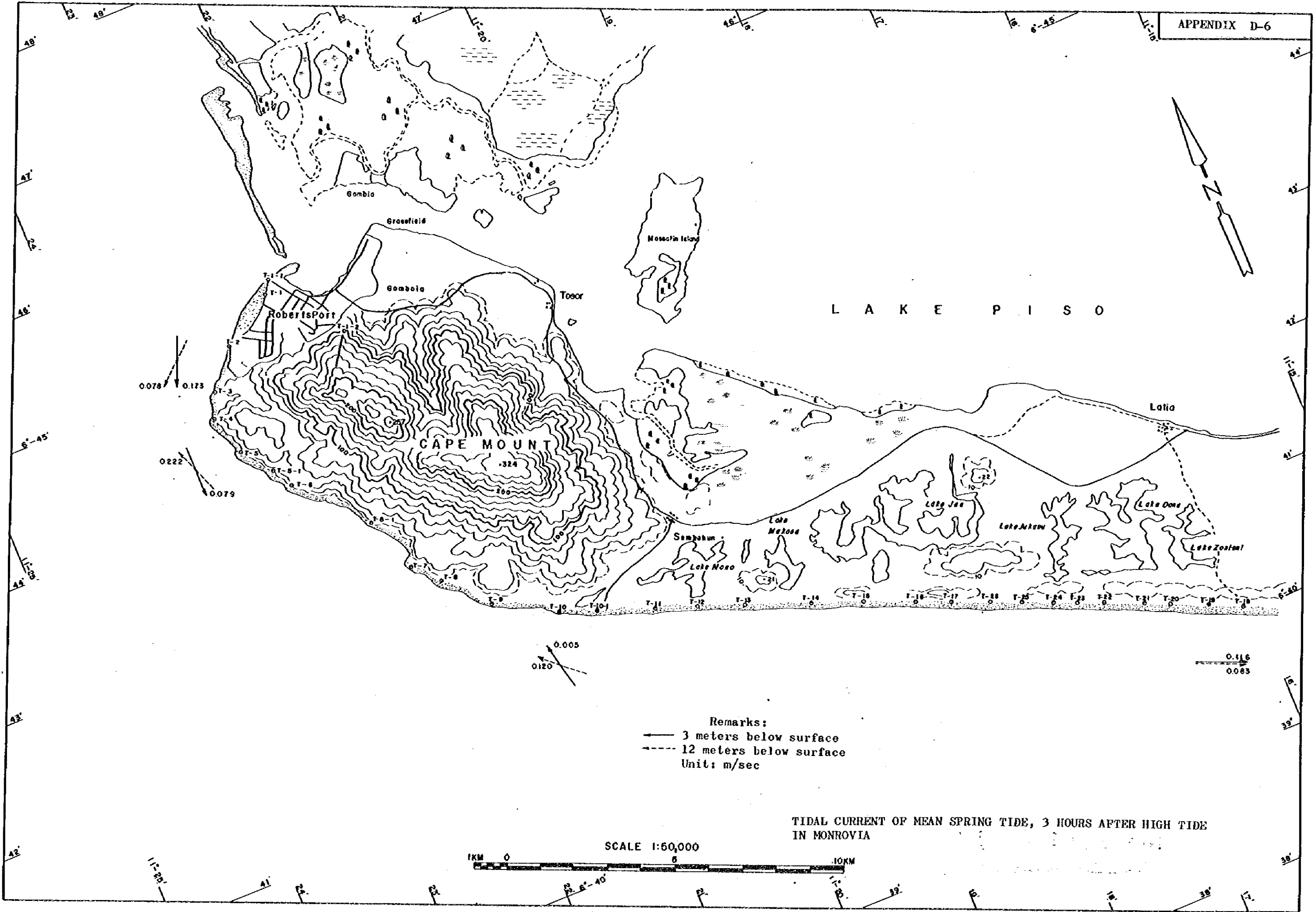


Remarks:  
 — 3 meters below surface  
 - - - 12 meters below surface  
 Unit: m/sec

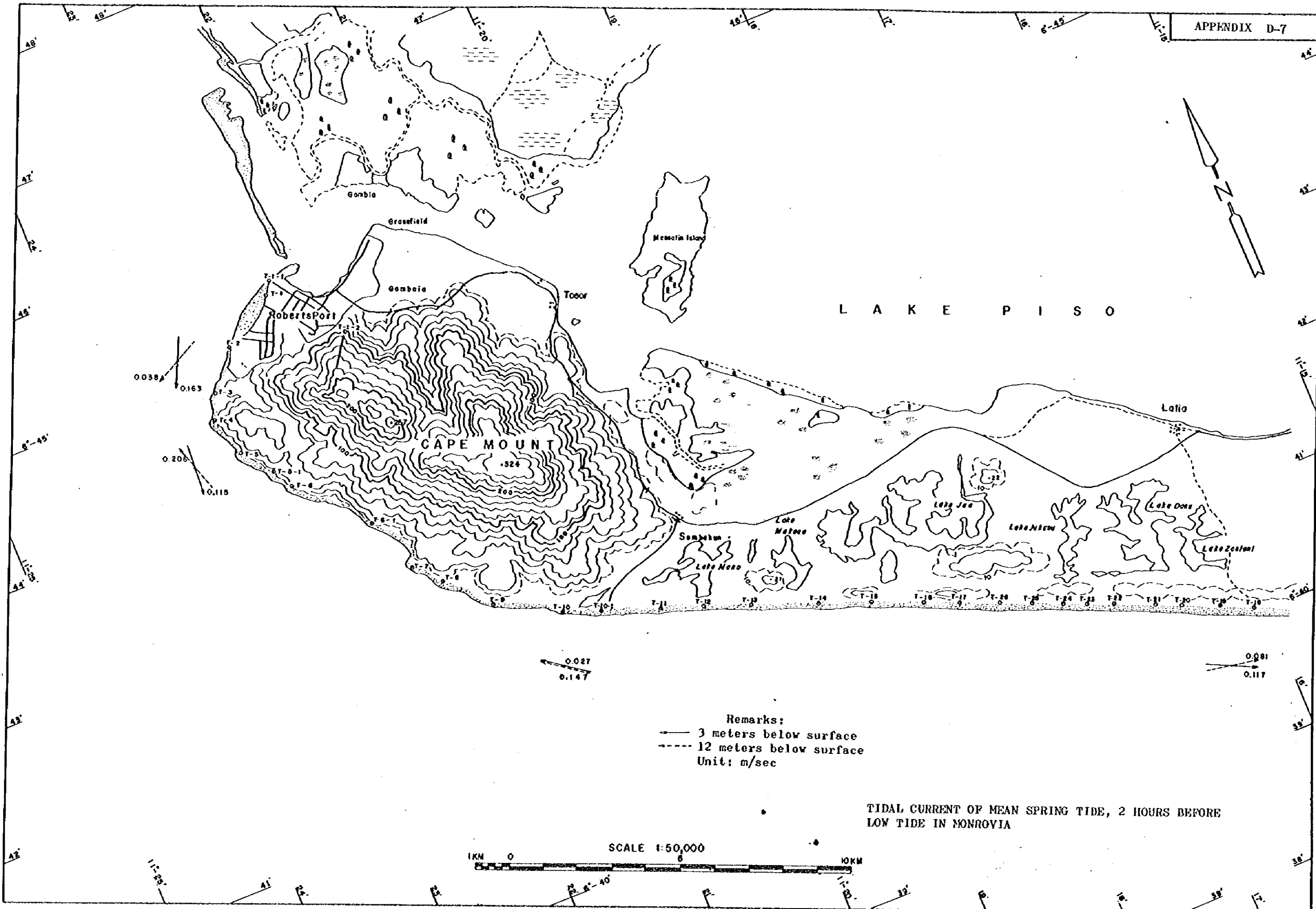
TIDAL CURRENT OF MEAN SPRING TIDE, 1 HOUR AFTER HIGH TIDE  
 IN MONROVIA







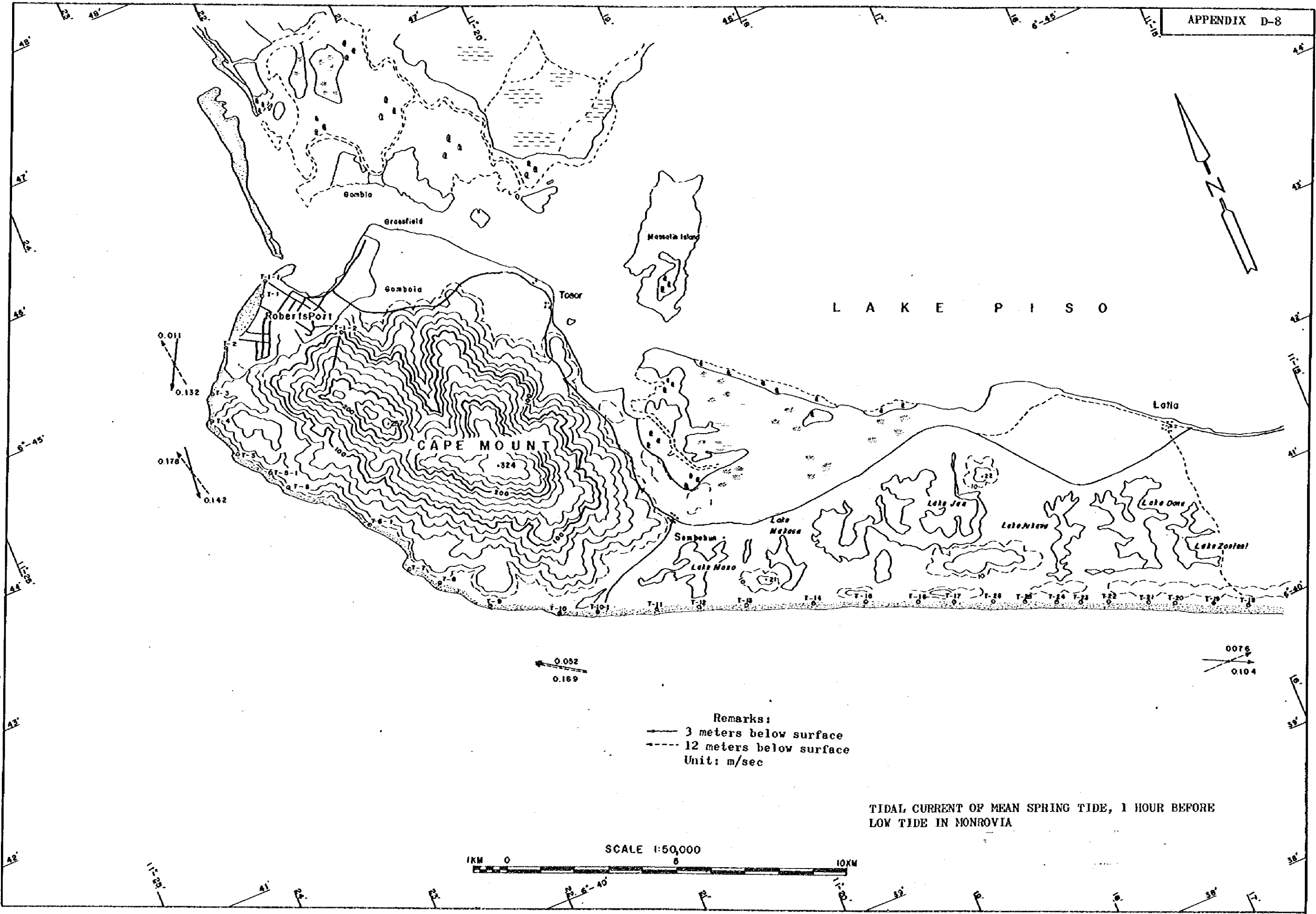
TIDAL CURRENT OF MEAN SPRING TIDE, 3 HOURS AFTER HIGH TIDE IN MONROVIA



Remarks:  
 — 3 meters below surface  
 - - - 12 meters below surface  
 Unit: m/sec

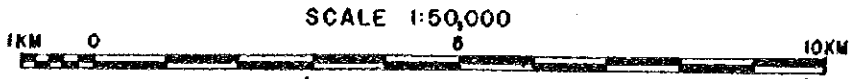
TIDAL CURRENT OF MEAN SPRING TIDE, 2 HOURS BEFORE  
 LOW TIDE IN MONROVIA



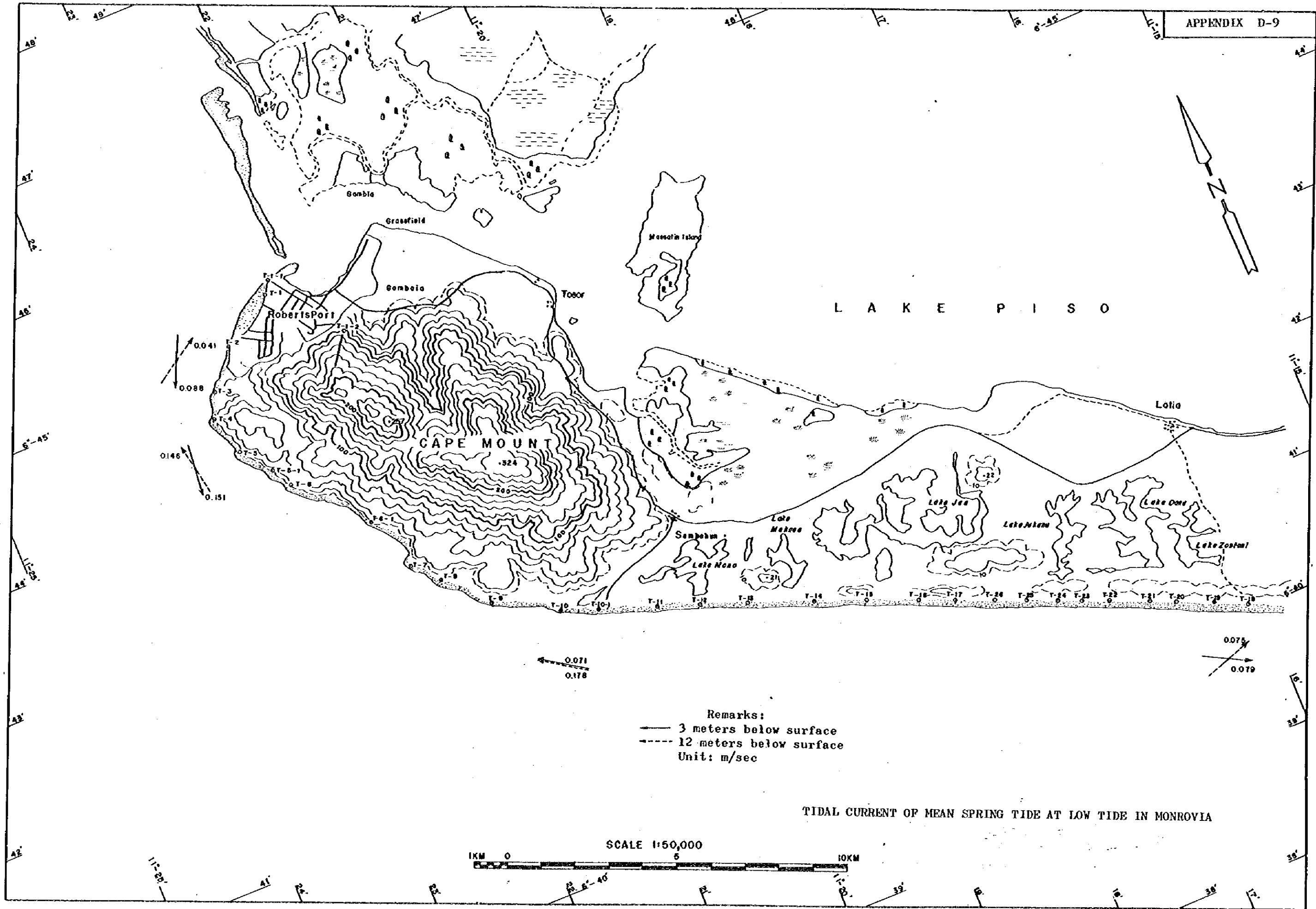


Remarks:  
 ——— 3 meters below surface  
 - - - 12 meters below surface  
 Unit: m/sec

TIDAL CURRENT OF MEAN SPRING TIDE, 1 HOUR BEFORE LOW TIDE IN MONROVIA

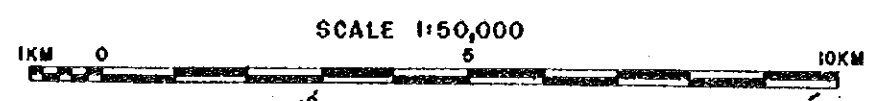


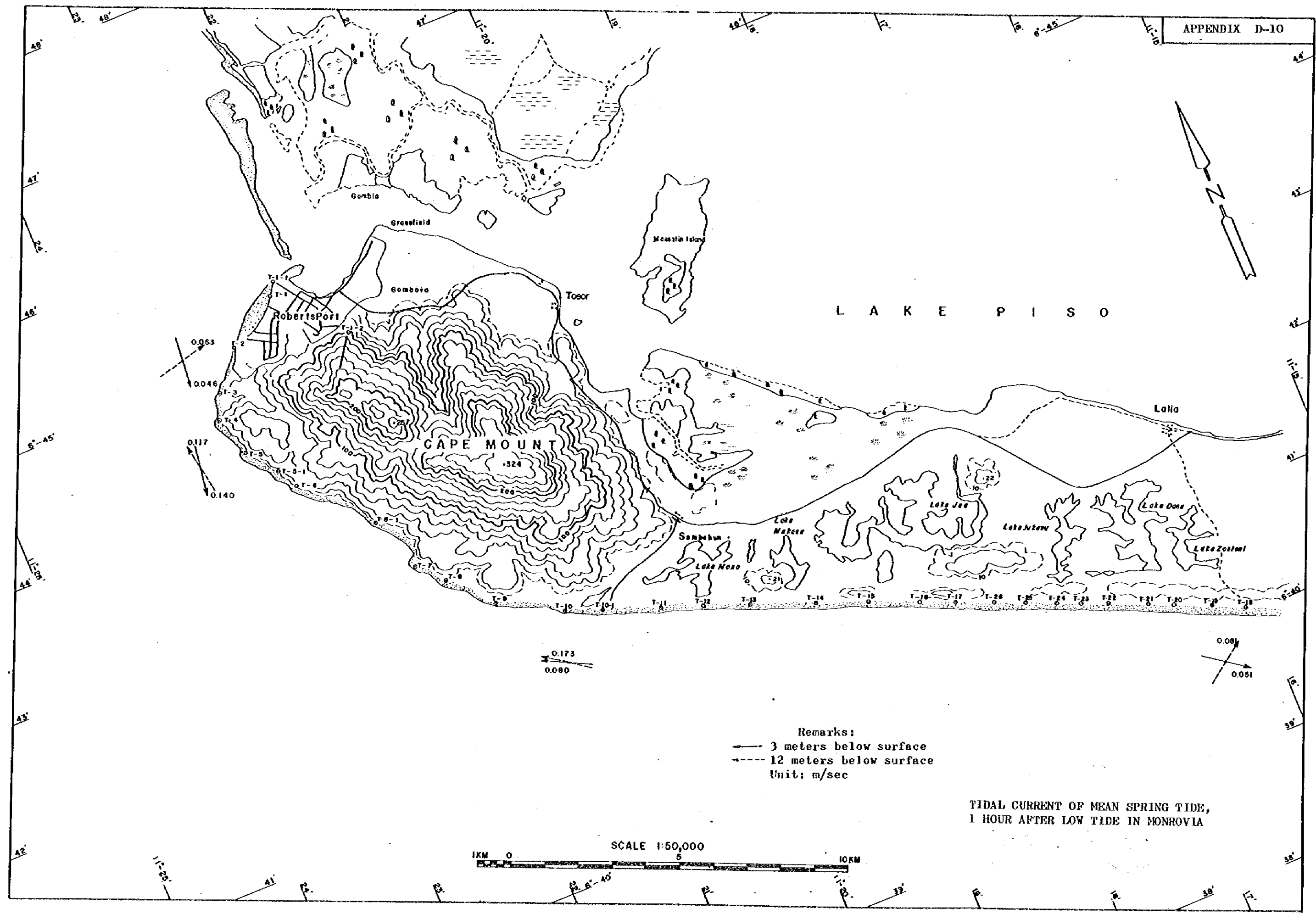




Remarks:  
 — 3 meters below surface  
 - - - 12 meters below surface  
 Unit: m/sec

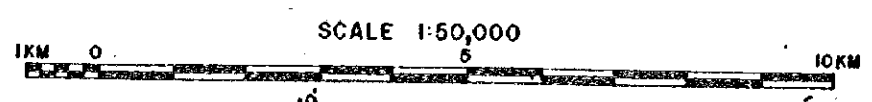
TIDAL CURRENT OF MEAN SPRING TIDE AT LOW TIDE IN MONROVIA

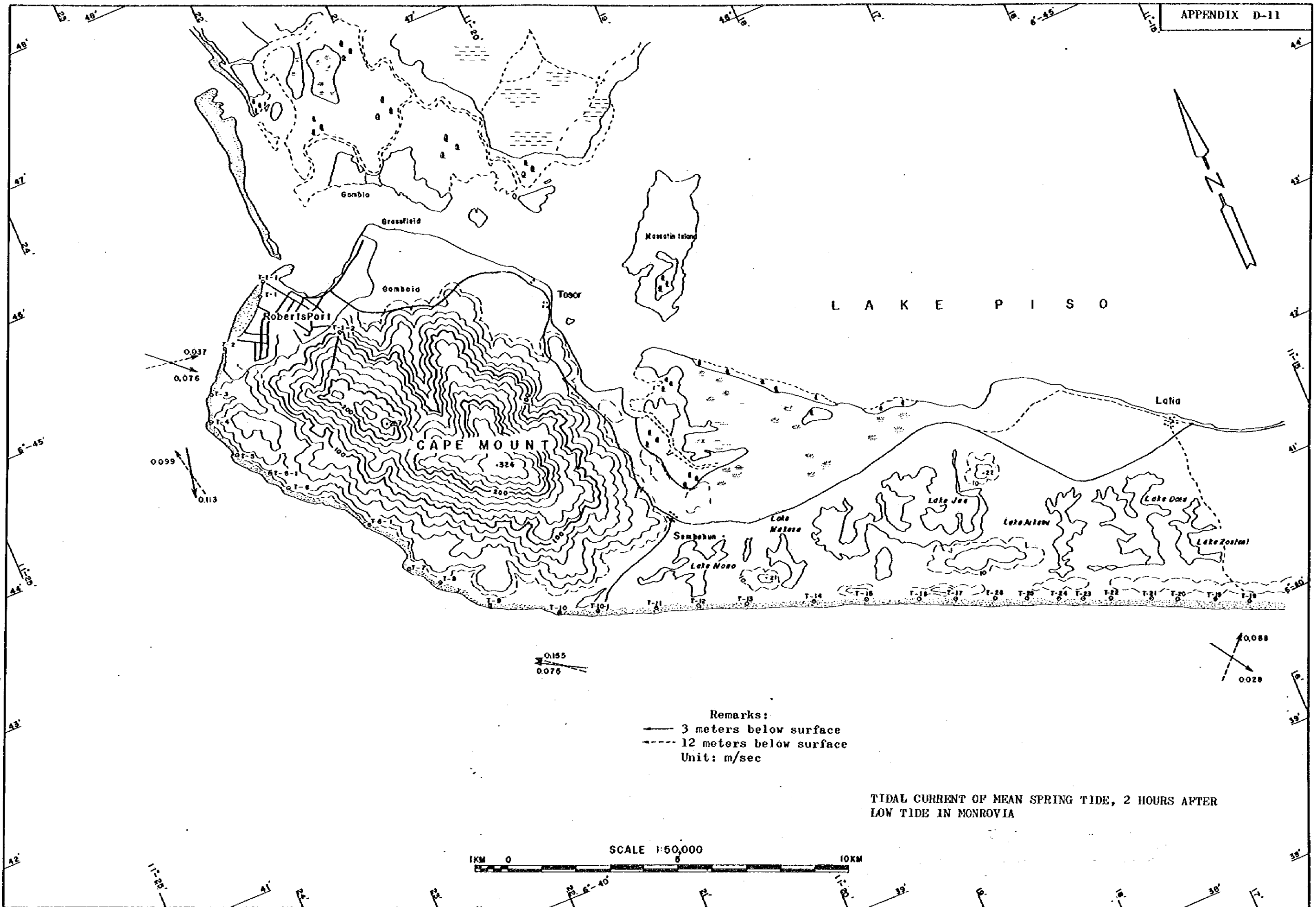




Remarks:  
 — 3 meters below surface  
 - - - 12 meters below surface  
 Unit: m/sec

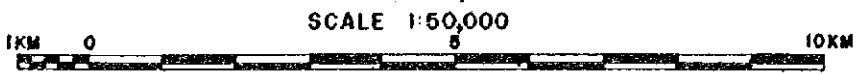
TIDAL CURRENT OF MEAN SPRING TIDE,  
 1 HOUR AFTER LOW TIDE IN MONROVIA

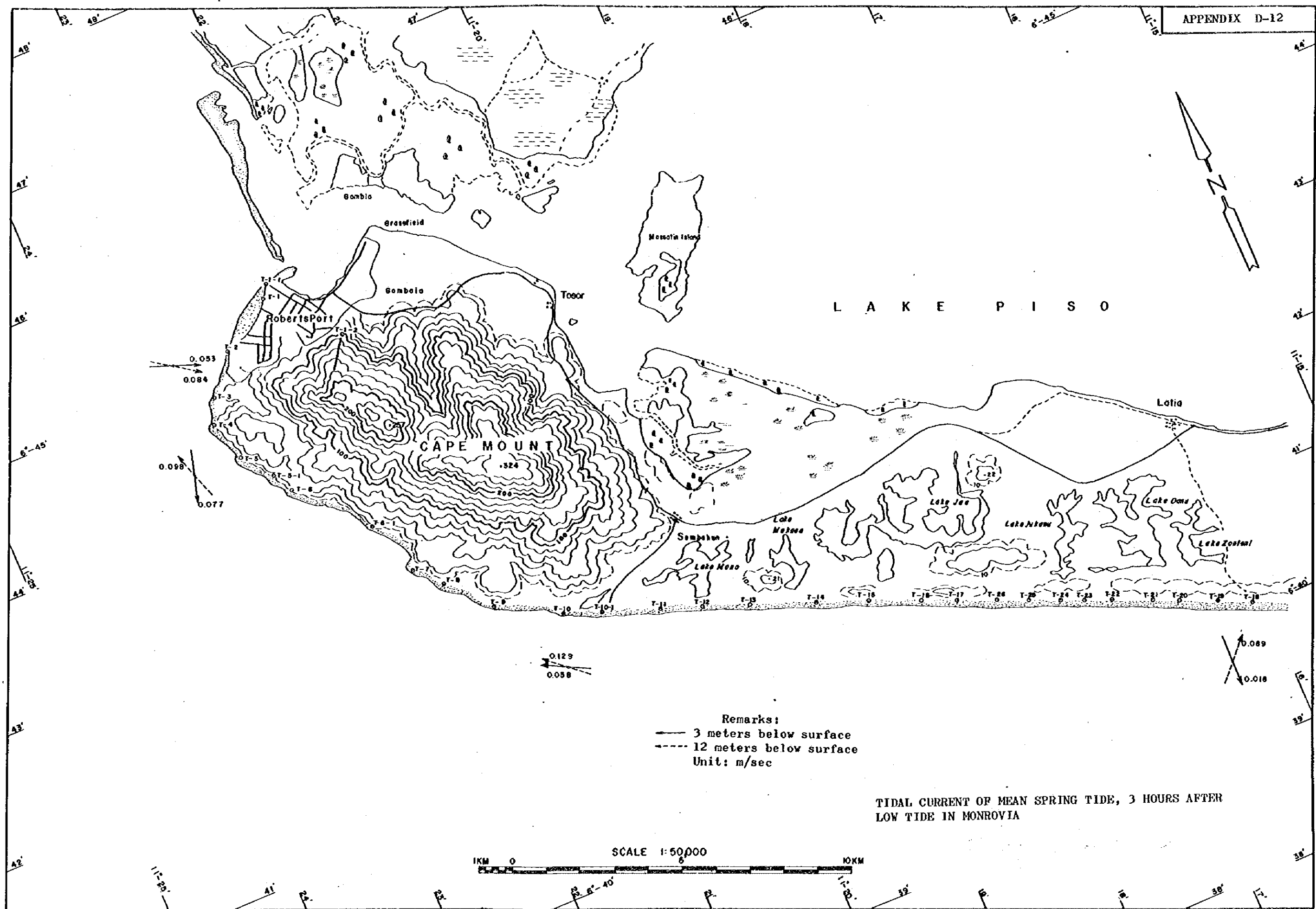




Remarks:  
 — 3 meters below surface  
 - - - 12 meters below surface  
 Unit: m/sec

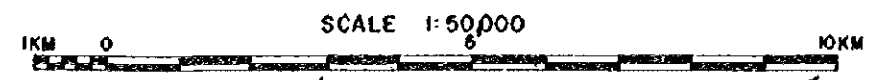
TIDAL CURRENT OF MEAN SPRING TIDE, 2 HOURS AFTER LOW TIDE IN MONROVIA

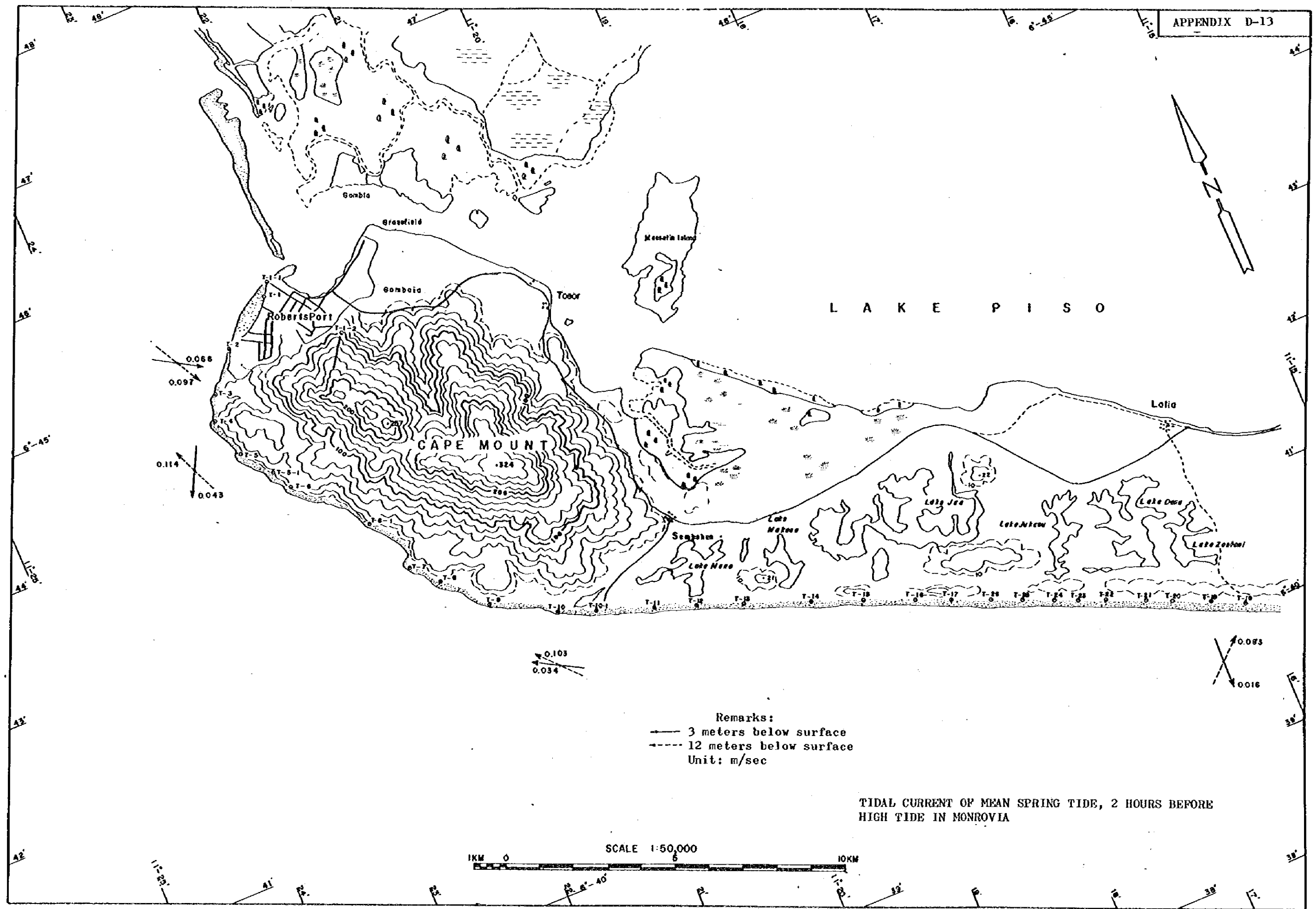




Remarks:  
 — 3 meters below surface  
 - - - 12 meters below surface  
 Unit: m/sec

TIDAL CURRENT OF MEAN SPRING TIDE, 3 HOURS AFTER  
 LOW TIDE IN MONROVIA

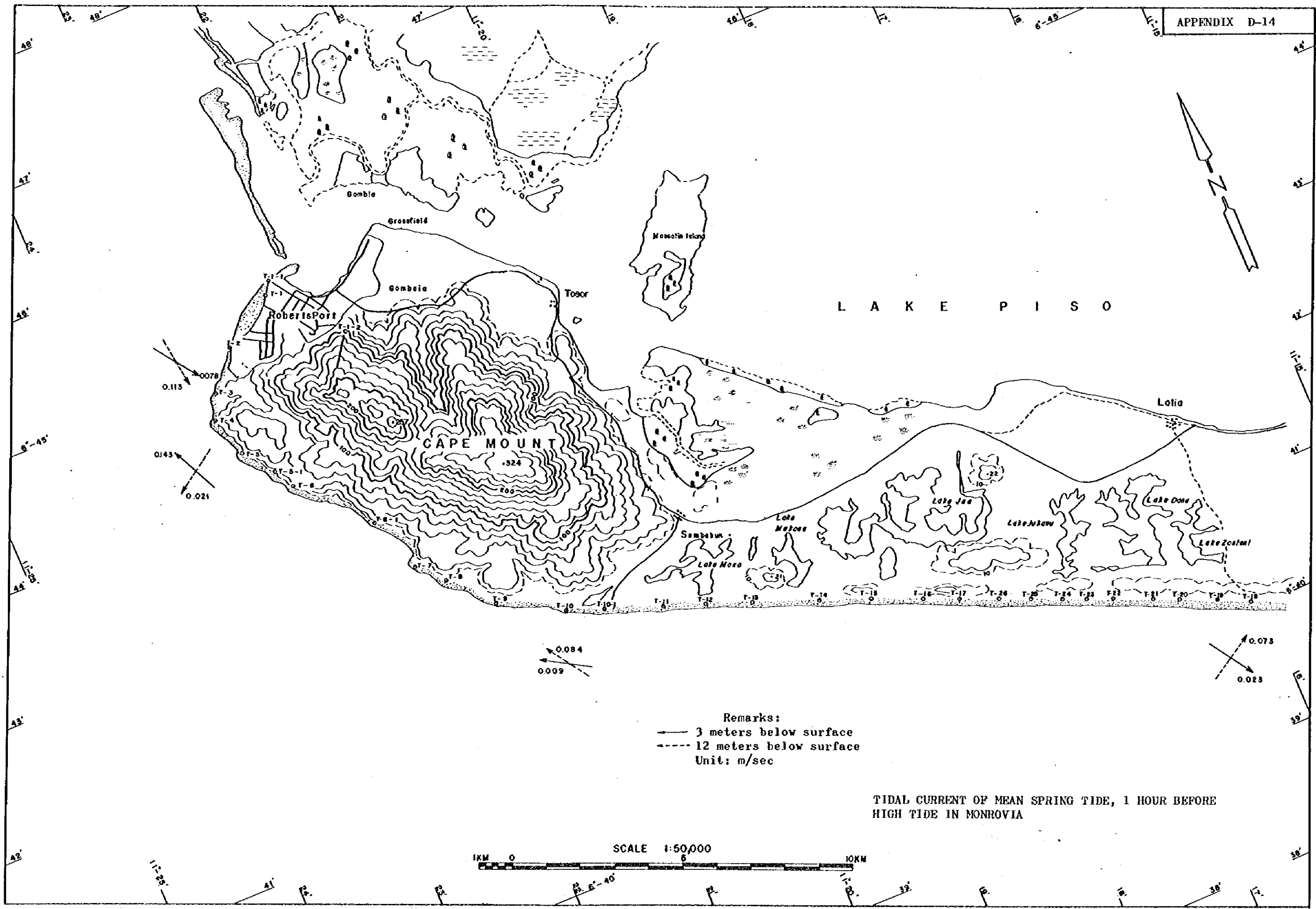




Remarks:  
 — 3 meters below surface  
 - - - 12 meters below surface  
 Unit: m/sec

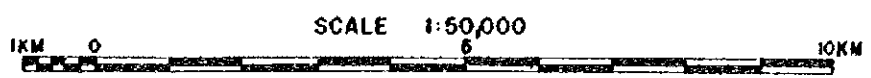
TIDAL CURRENT OF MEAN SPRING TIDE, 2 HOURS BEFORE HIGH TIDE IN MONROVIA



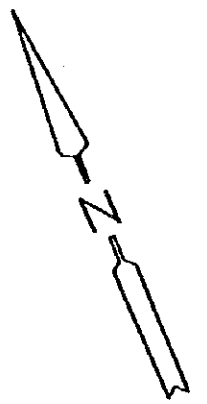
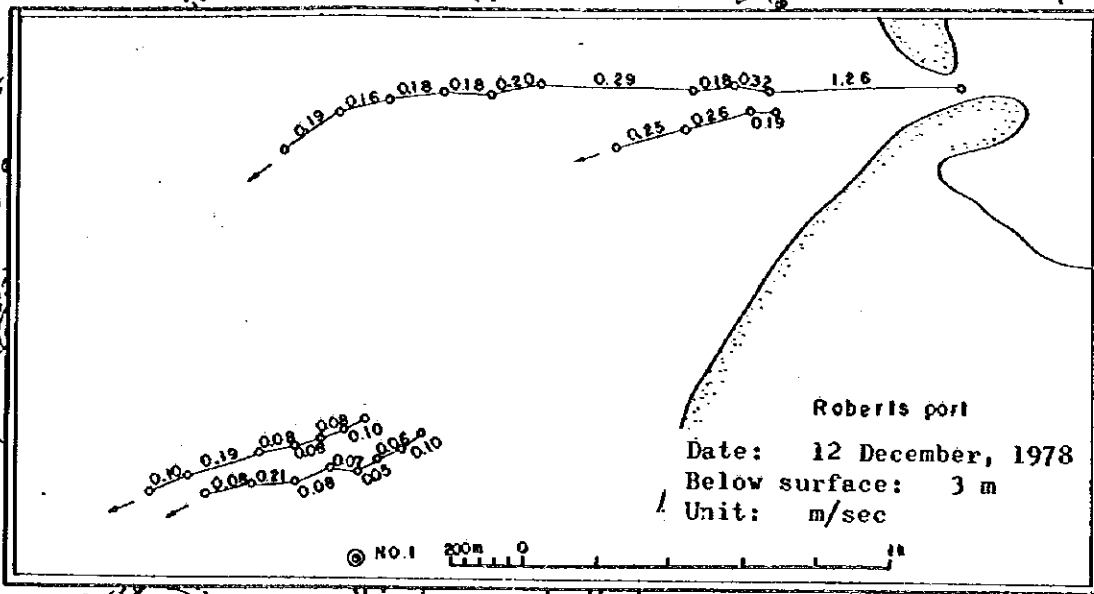


Remarks:  
 — 3 meters below surface  
 - - - 12 meters below surface  
 Unit: m/sec

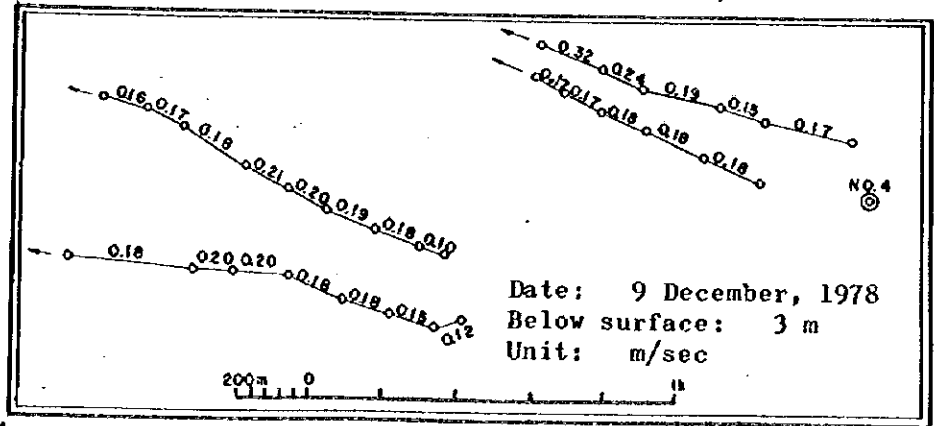
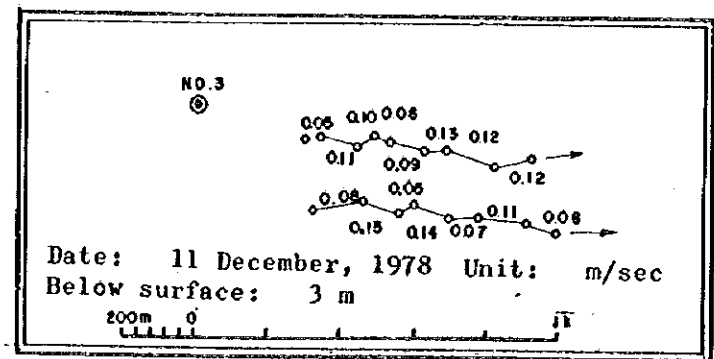
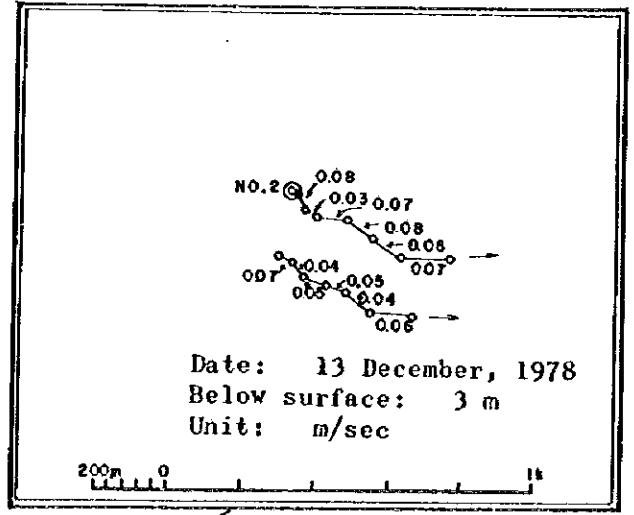
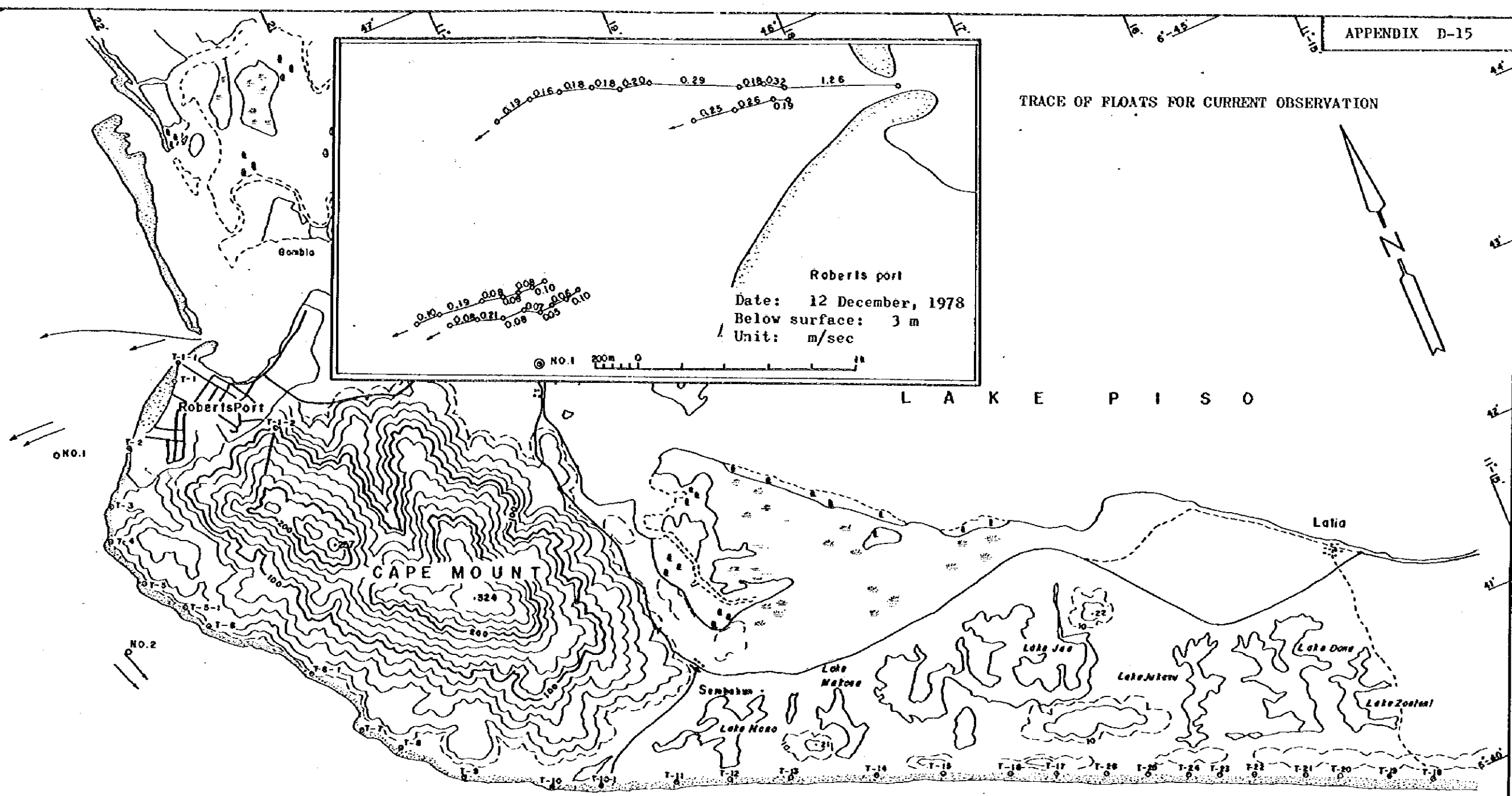
TIDAL CURRENT OF MEAN SPRING TIDE, 1 HOUR BEFORE HIGH TIDE IN MONROVIA



TRACE OF FLOATS FOR CURRENT OBSERVATION



L A K E P I S O



NO.1

NO.2

NO.3

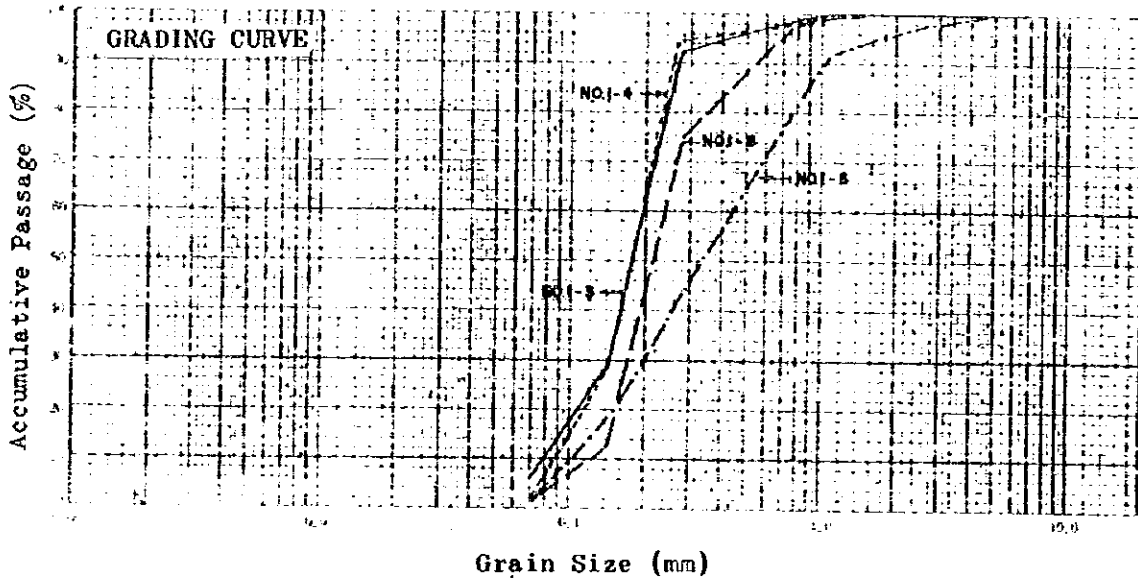
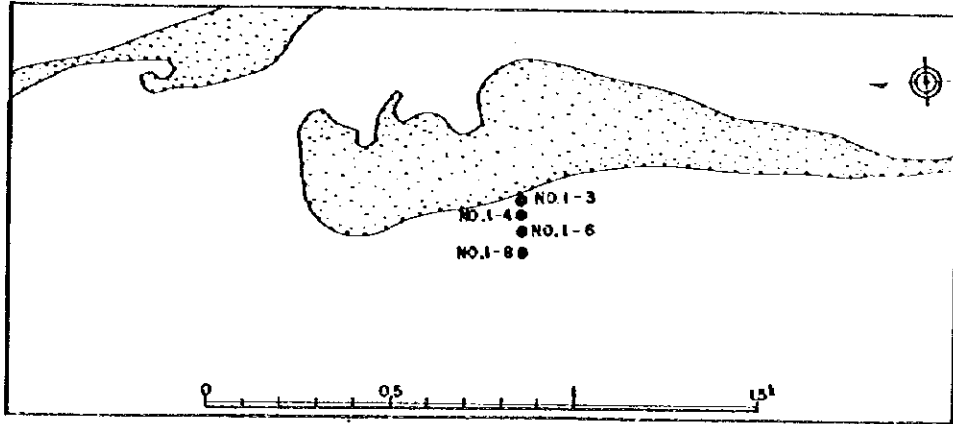
NO.4





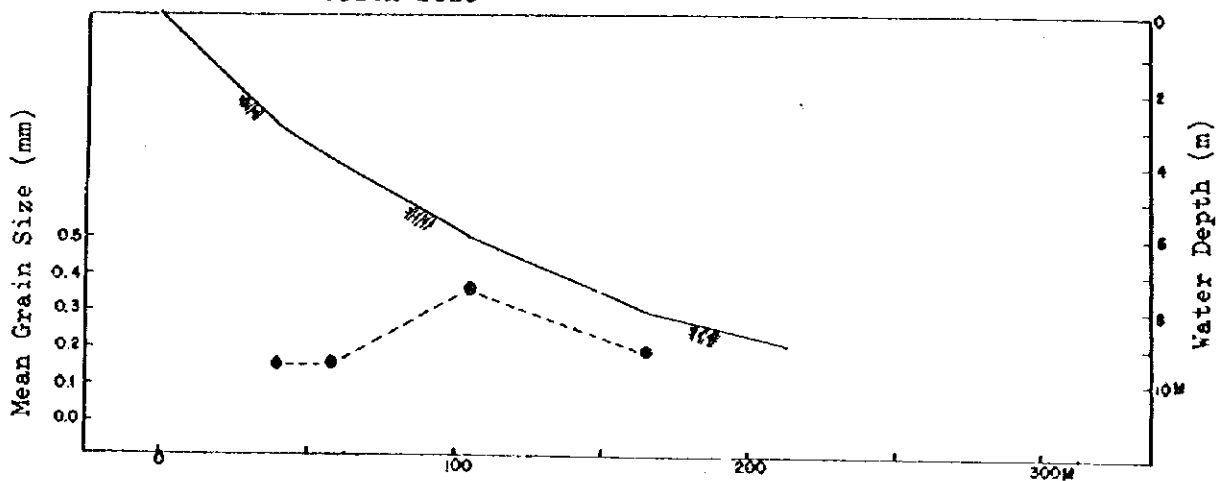
BOTTOM SAMPLING (NO. 1)

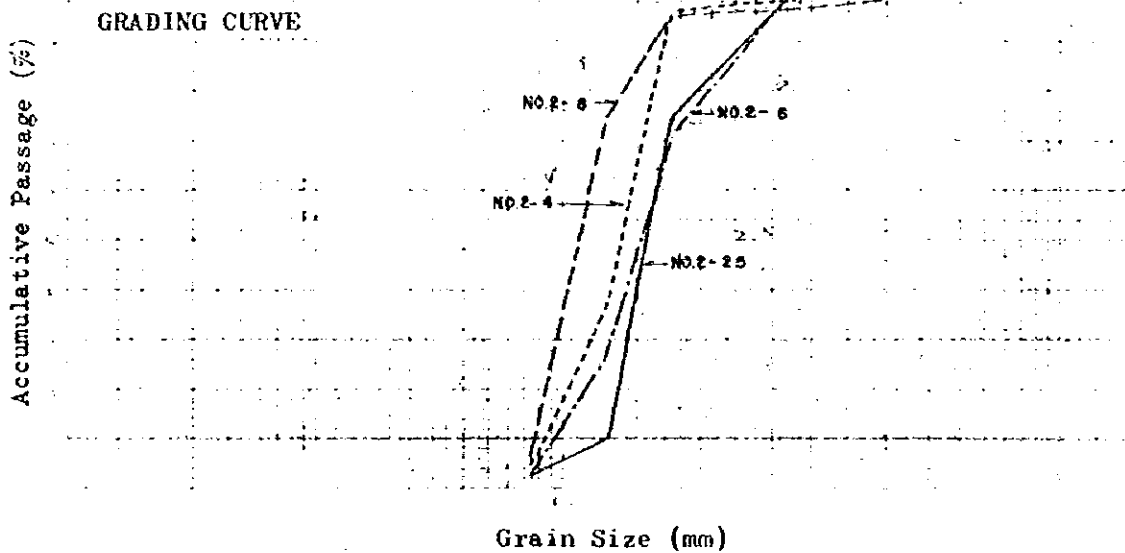
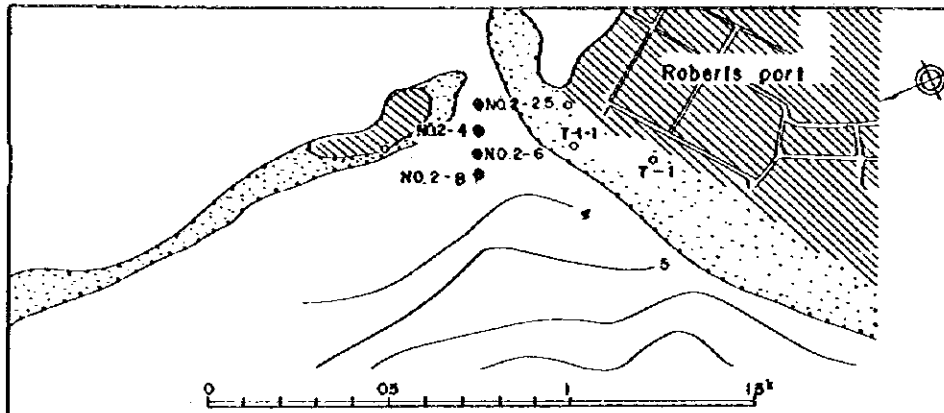
APPENDIX E-1



	D60	D30	D10	1	2	3	4
NO. 1 - 3	0.200 <sup>mm</sup>	0.149 <sup>mm</sup>	0.082 <sup>mm</sup>	2.439	1.354	0.147 <sup>mm</sup>	0.180 <sup>mm</sup>
1 - 4	0.200	0.149	0.090	2.222	1.233	0.143	0.180
1 - 6	0.441	0.200	0.108	4.083	0.908	0.355	0.339
1 - 8	0.240	0.171	0.137	1.846	0.937	0.181	0.215

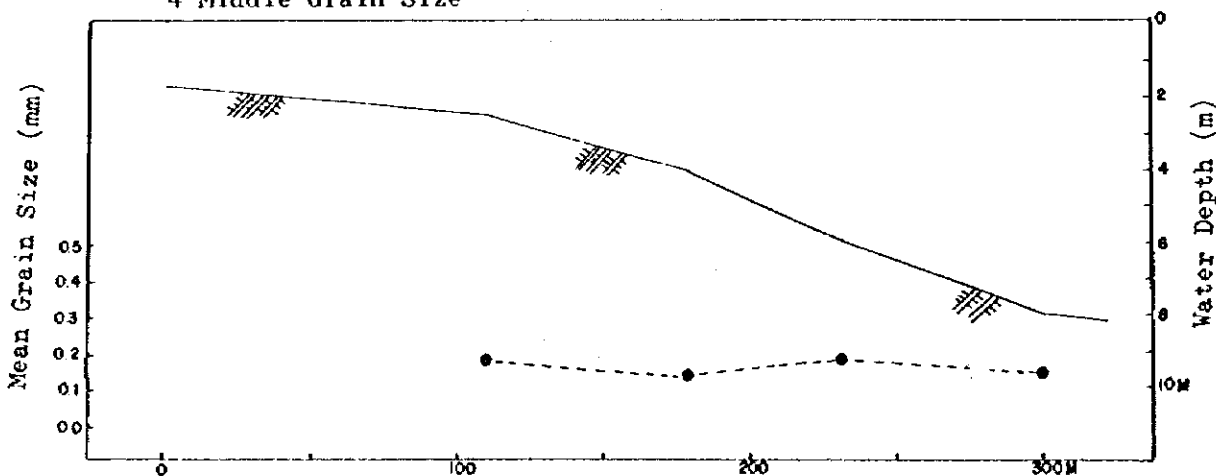
Notes: 1 Coef. of Uniformity, 2 Coef. of Curvature, 3 Mean Grain Size  
4 Middle Grain Size

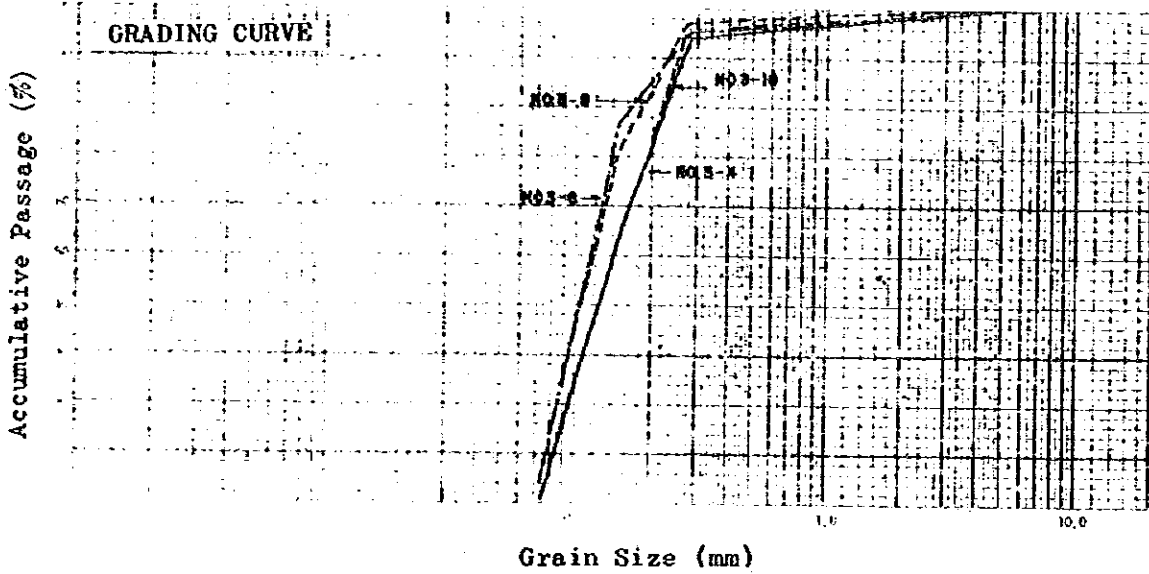
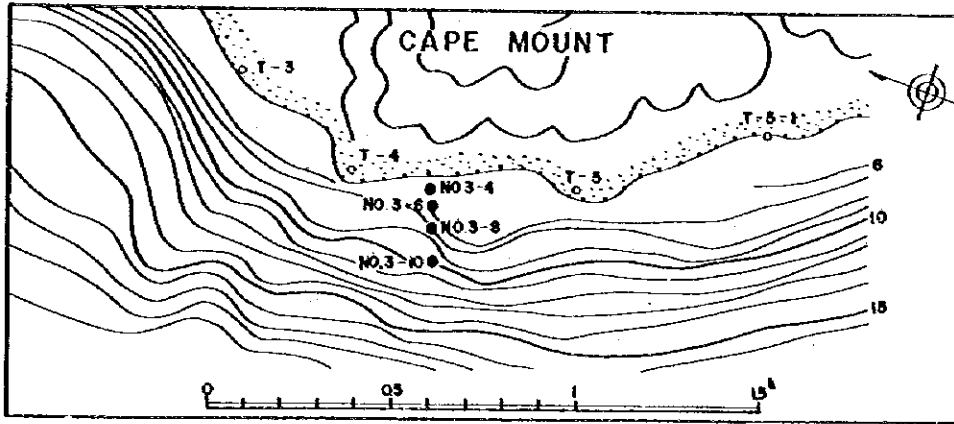




	D60	D30	D10	1	2	3	4
NO. 2-25	0.240 <sup>mm</sup>	0.181 <sup>mm</sup>	0.152 <sup>mm</sup>	1.579	0.898	0.184 <sup>mm</sup>	0.220 <sup>mm</sup>
2-4	0.190	0.130	0.085	2.235	1.046	0.139	0.171
2-6	0.240	0.159	0.095	2.526	1.109	0.173	0.209
2-8	0.129	0.095	0.078	1.654	0.897	0.140	0.117

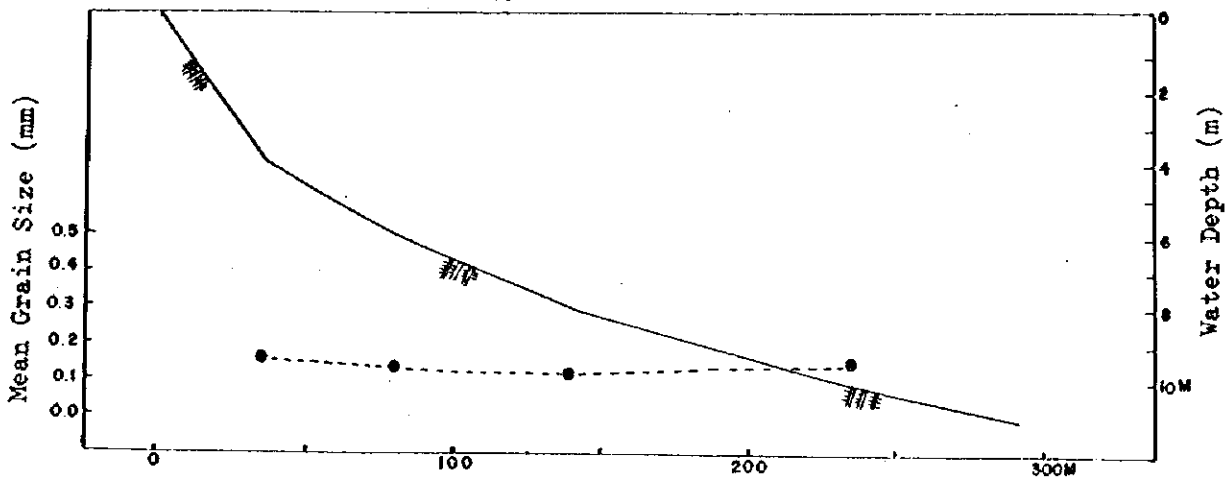
Notes: 1 Coef. of Uniformity, 2 Coef. of Curvature, 3 Mean Grain Size  
4 Middle Grain Size

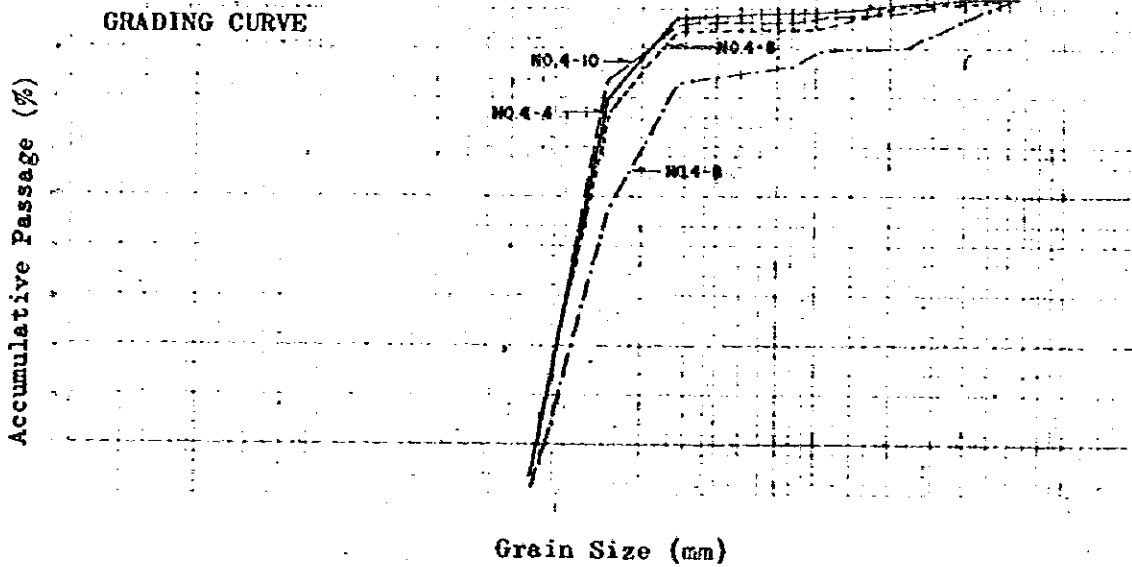
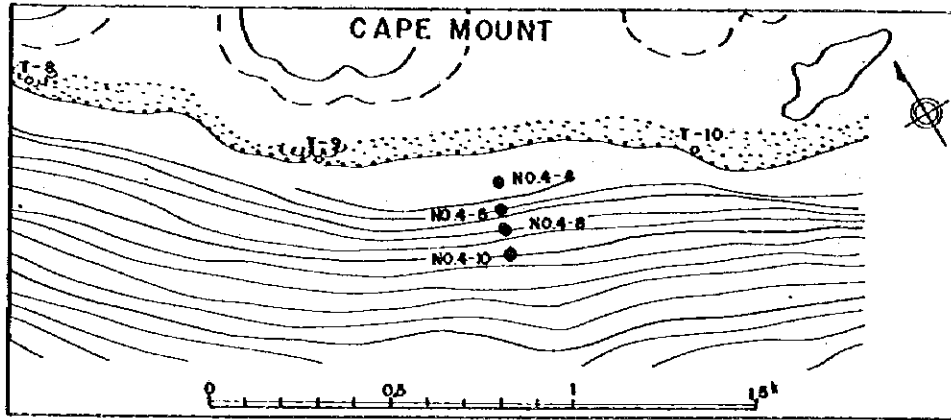




	D60	D30	D10	1	2	3	4
NO. 3 - 4	0.162 <sup>mm</sup>	0.107 <sup>mm</sup>	0.083 <sup>mm</sup>	1.952	0.851	0.159 <sup>mm</sup>	0.140 <sup>mm</sup>
3 - 6	0.125	0.095	0.077	1.623	0.938	0.140	0.113
3 - 8	0.131	0.095	0.077	1.701	0.895	0.115	0.119
3 - 10	0.167	0.109	0.082	2.037	0.868	0.148	0.145

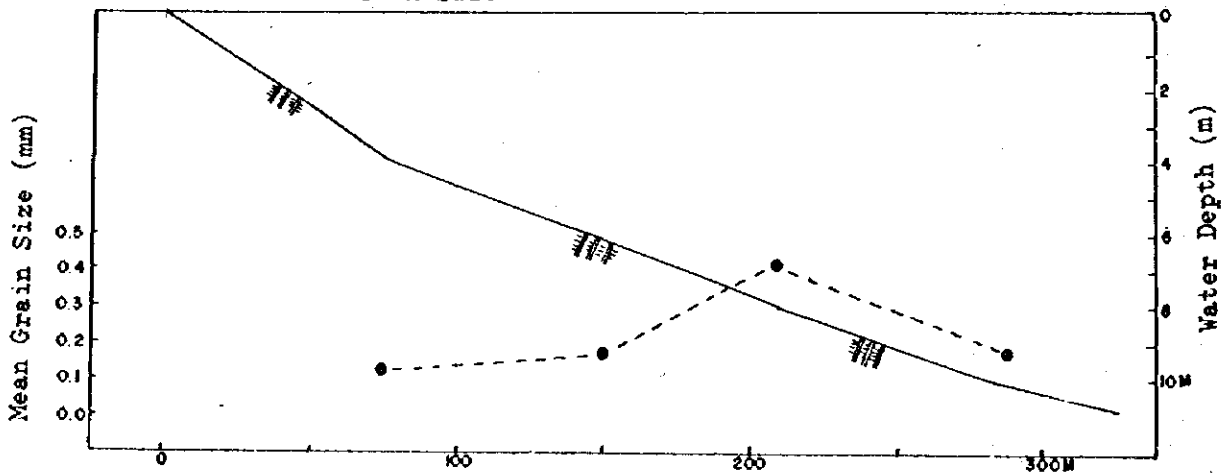
Notes: 1 Coef. of Uniformity, 2 Coef. of Curvature, 3 Mean Grain Size  
4 Middle Grain Size

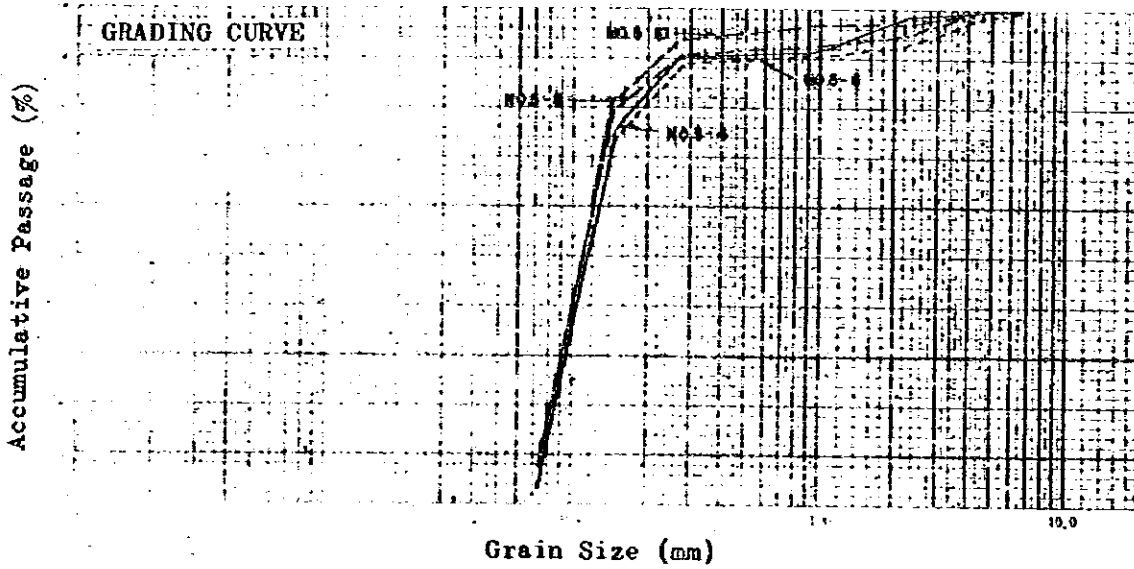
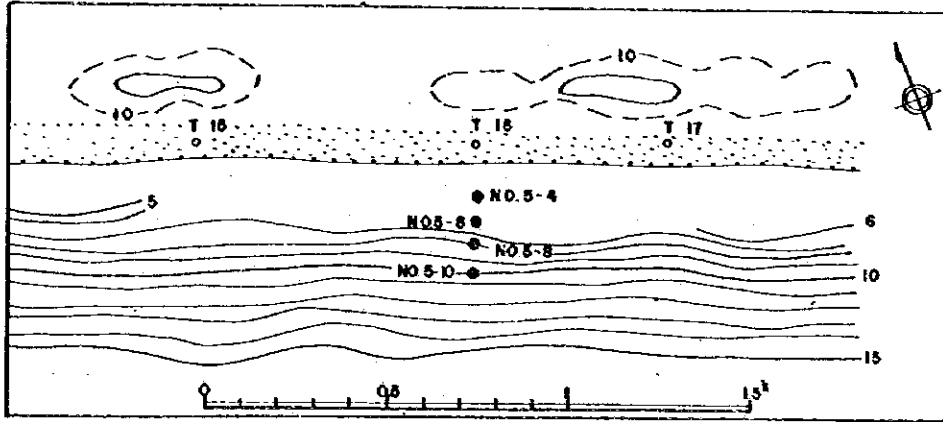




	D60	D30	D10	1	2	3	4
NO. 4 - 4	0.122 <sup>mm</sup>	0.093 <sup>mm</sup>	0.078 <sup>mm</sup>	1.564	0.909	0.129 <sup>mm</sup>	0.112 <sup>mm</sup>
4 - 6	0.126	0.094	0.078	1.615	0.899	0.177	0.114
4 - 8	0.158	0.106	0.082	1.927	0.867	0.416	0.134
4 - 10	0.120	0.105	0.077	1.558	1.193	0.179	0.110

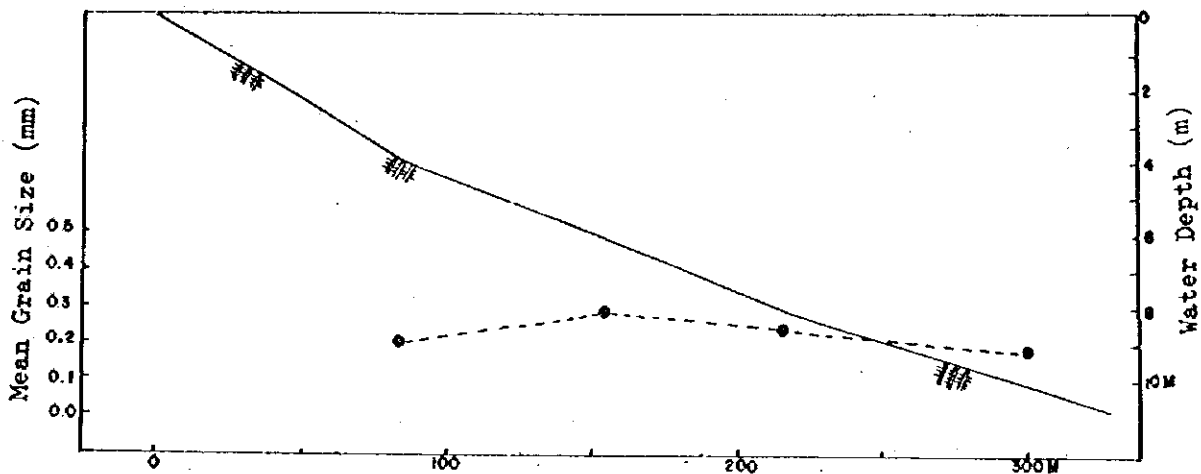
Notes: 1 Coef. of Uniformity, 2 Coef. of Curvature, 3 Mean Grain Size  
4 Middle Grain Size





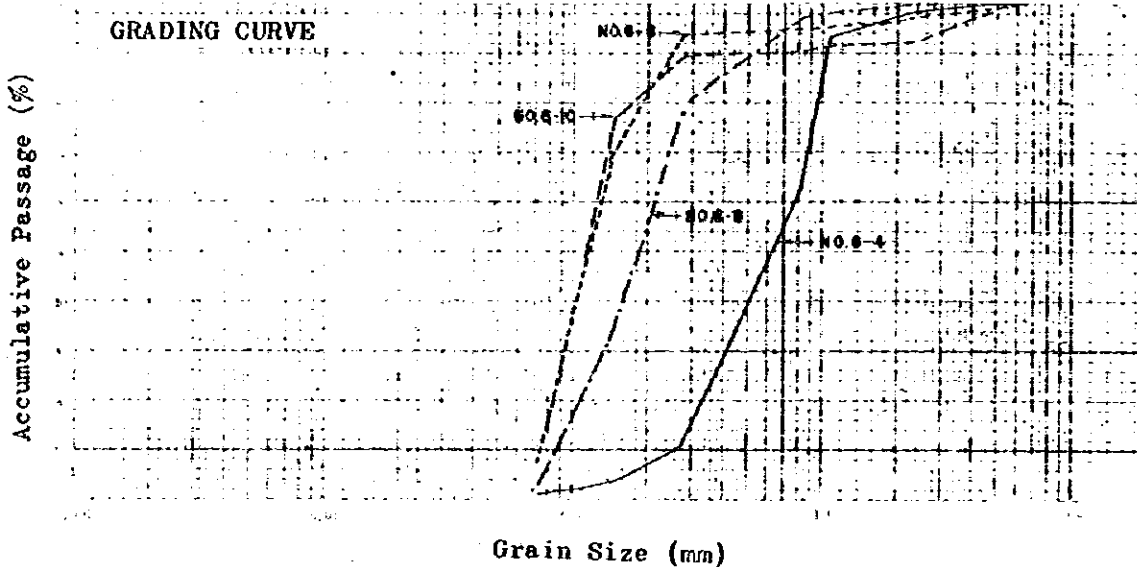
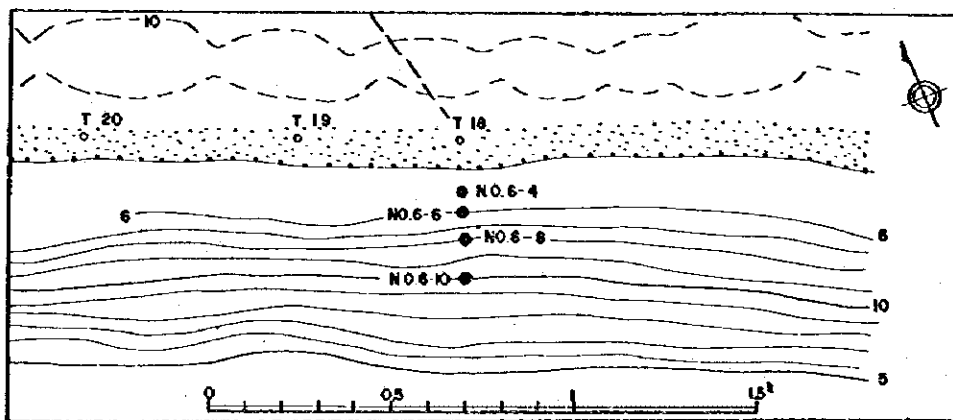
	D60	D30	D10	1	2	3	4
NO. 5 - 4	0.127 <sup>mm</sup>	0.095 <sup>mm</sup>	0.078 <sup>mm</sup>	1.628	0.911	0.200 <sup>mm</sup>	0.144 <sup>mm</sup>
5 - 6	0.127	0.095	0.078	1.628	0.911	0.293	0.114
5 - 8	0.120	0.092	0.076	1.579	0.928	0.242	0.117
5 - 10	0.120	0.093	0.078	1.538	0.924	0.187	0.111

Notes: 1 Coef. of Uniformity, 2 Coef. of Curvature, 3 Mean Grain Size  
4 Middle Grain Size



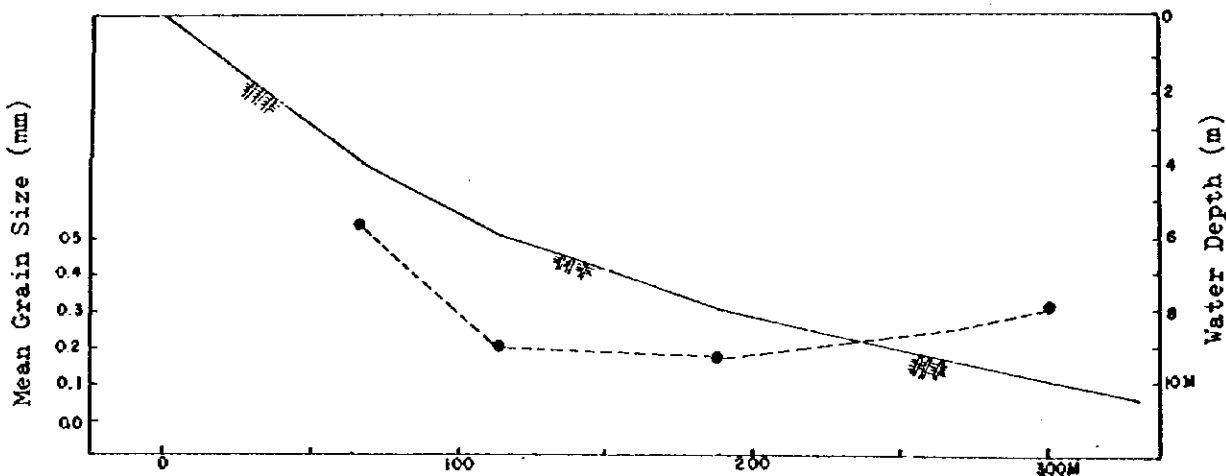
BOTTOM SAMPLING (NO. 6)

APPENDIX E-6

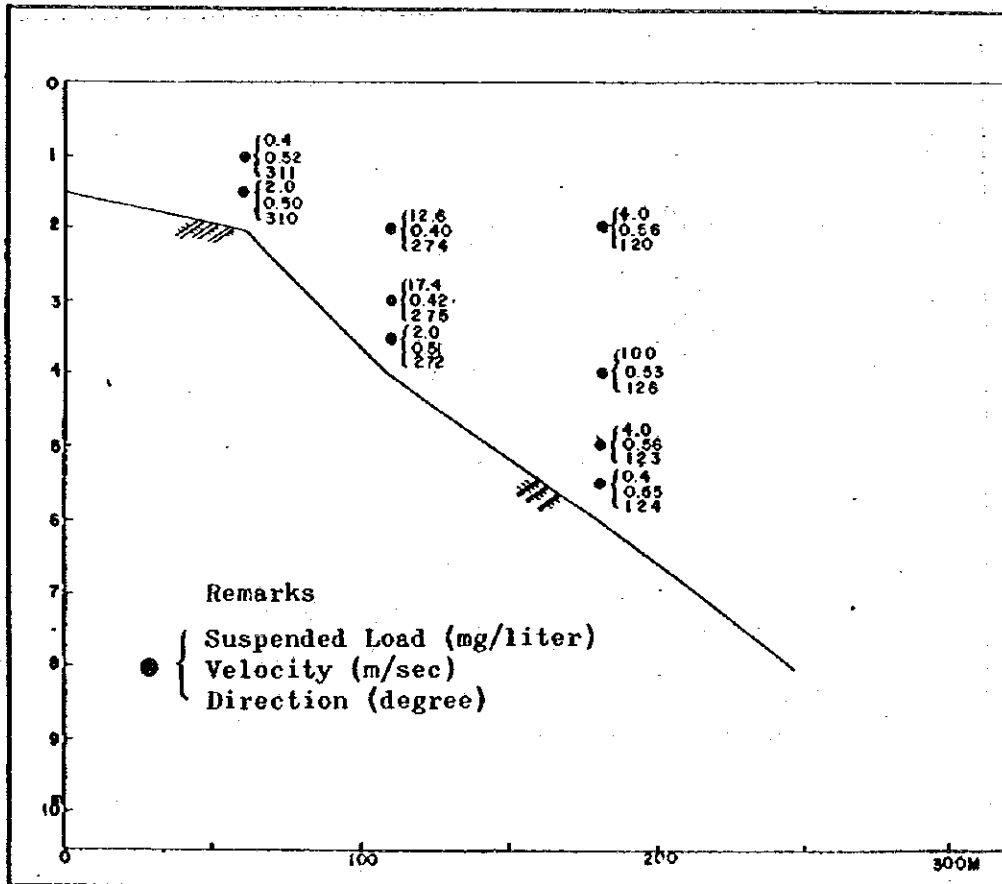
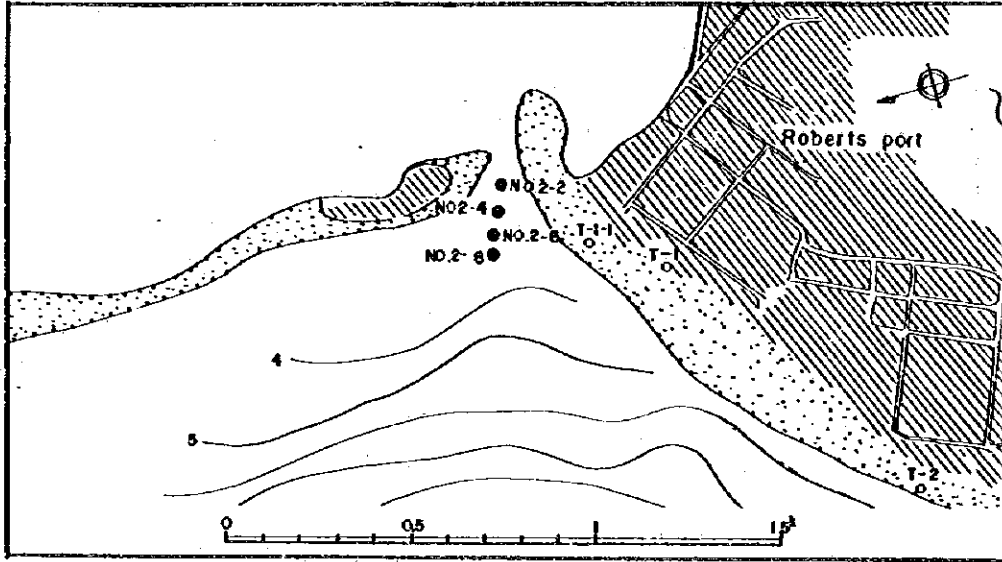


	(mm)						
	D60	D30	D10	1	2	3	4
NO. 6-4	0.780 <sup>mm</sup>	0.412 <sup>mm</sup>	0.250 <sup>mm</sup>	3.120	0.870	0.530 <sup>mm</sup>	0.630 <sup>mm</sup>
6-6	0.131	0.093	0.075	1.747	0.880	0.202	0.117
6-8	0.210	0.133	0.086	2.442	0.979	0.174	0.181
6-10	0.124	0.094	0.078	1.590	0.914	0.310	0.114

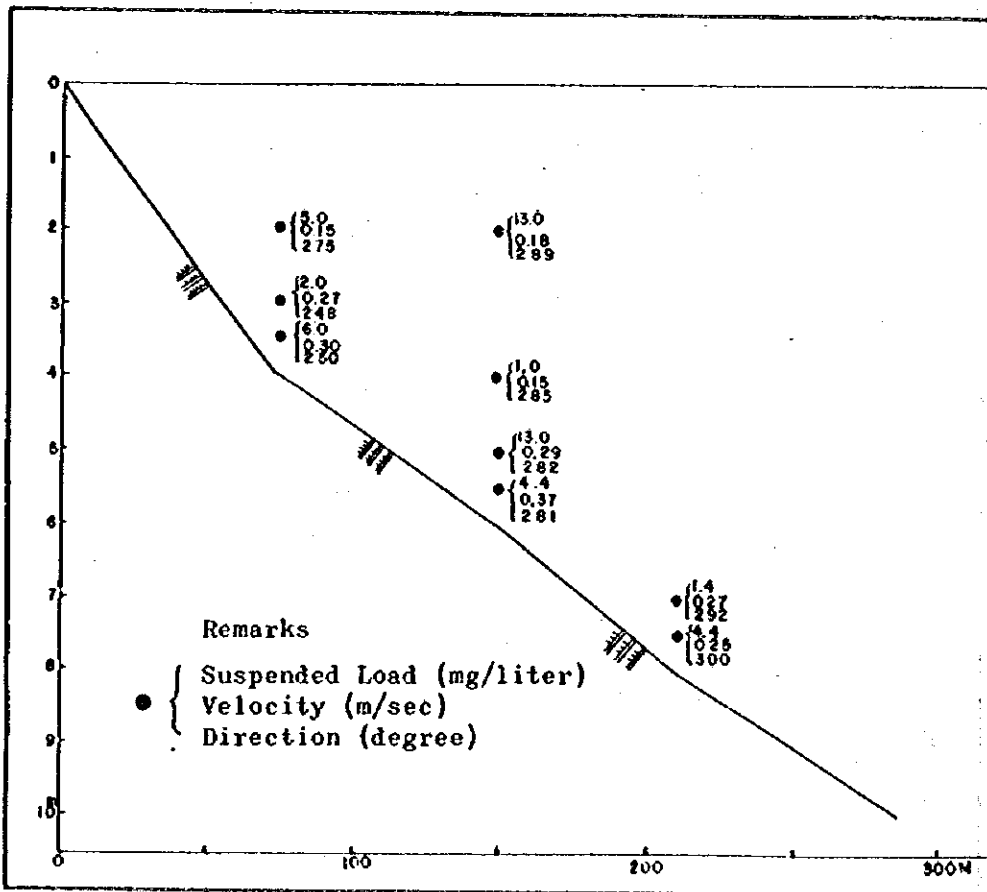
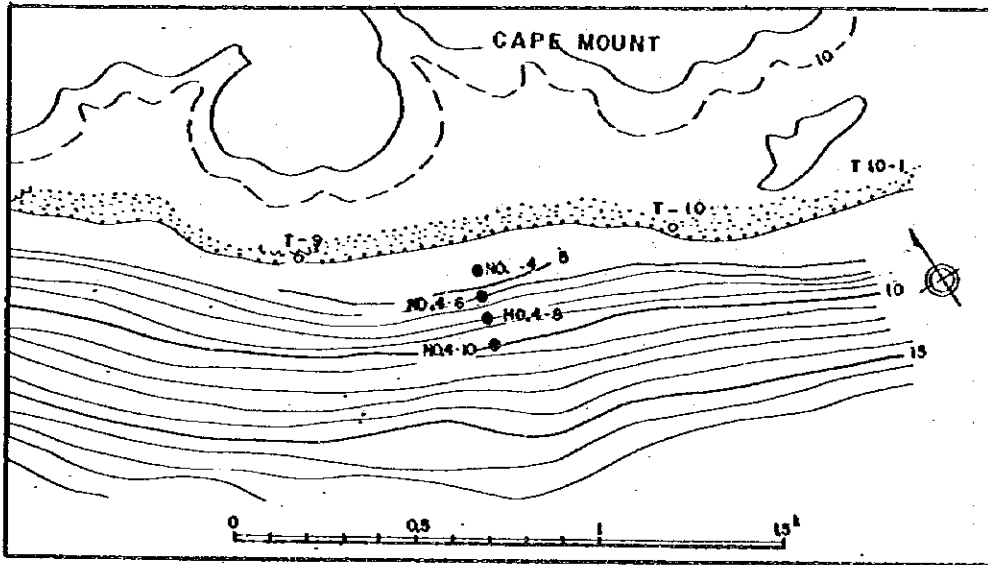
Notes: 1 Coef. of Uniformity, 2 Coef. of Curvature, 3 Mean Grain Size  
4 Middle Grain Size



SUSPENDED LOAD (NO. 2)

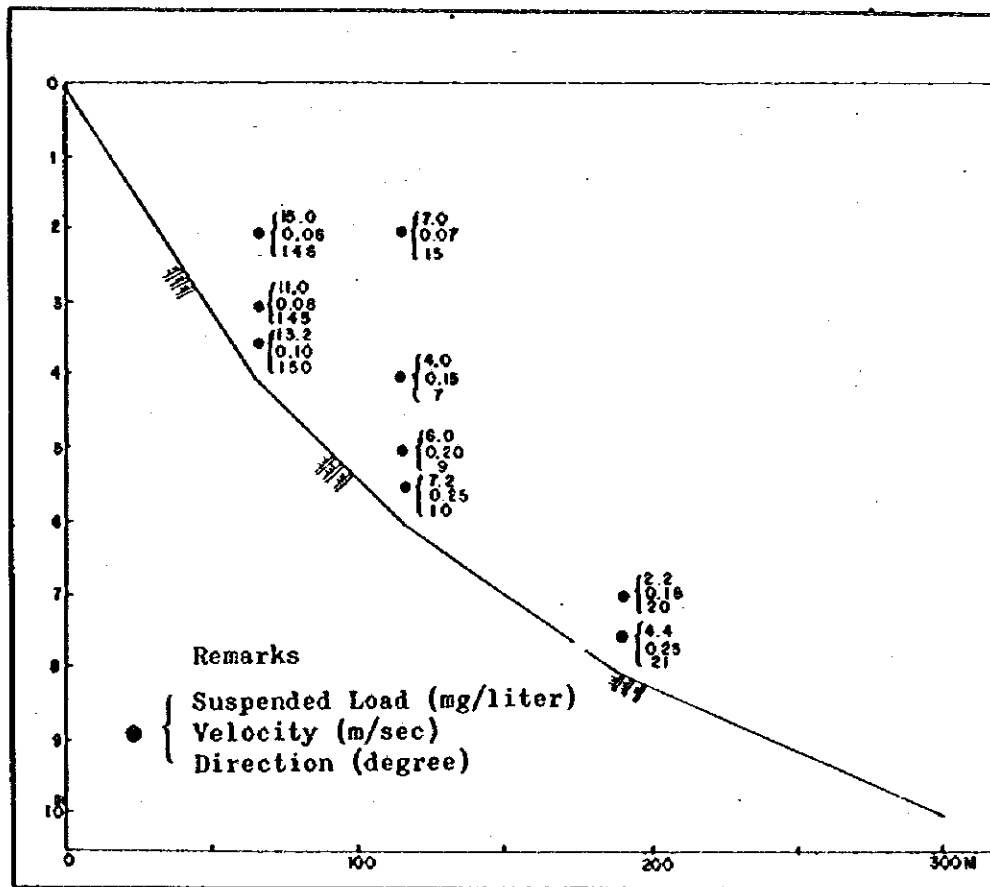
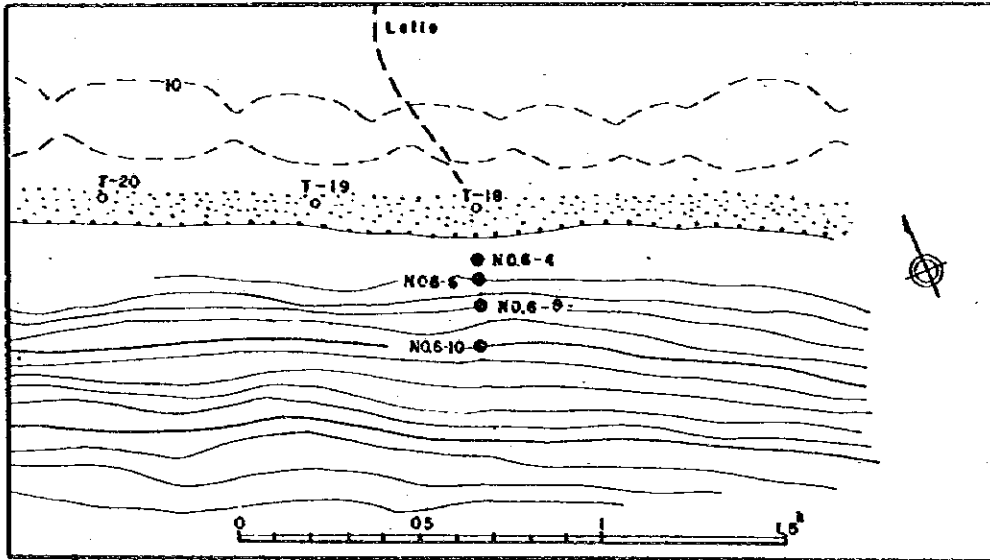


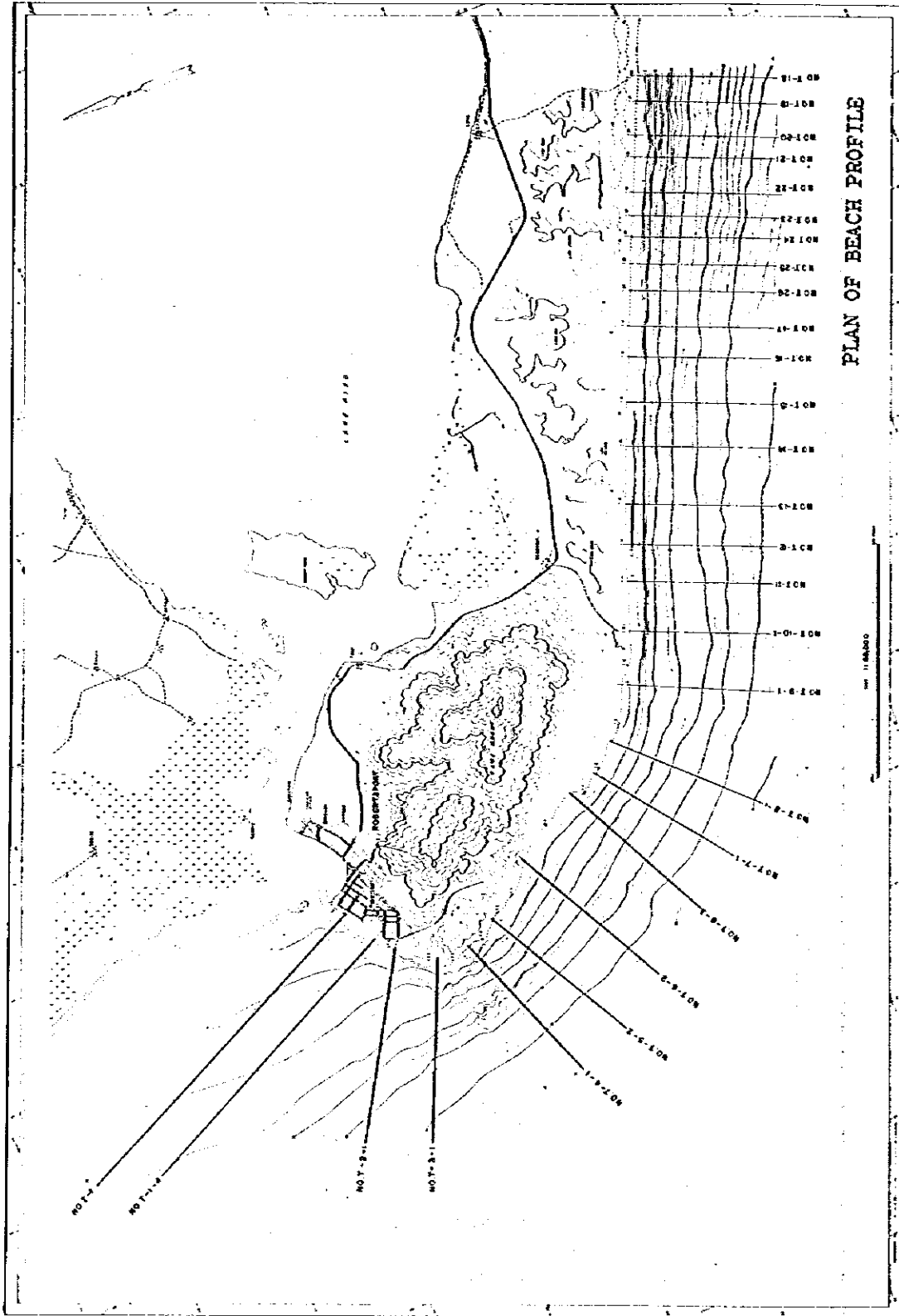
SUSPENDED LOAD (NO. 4)



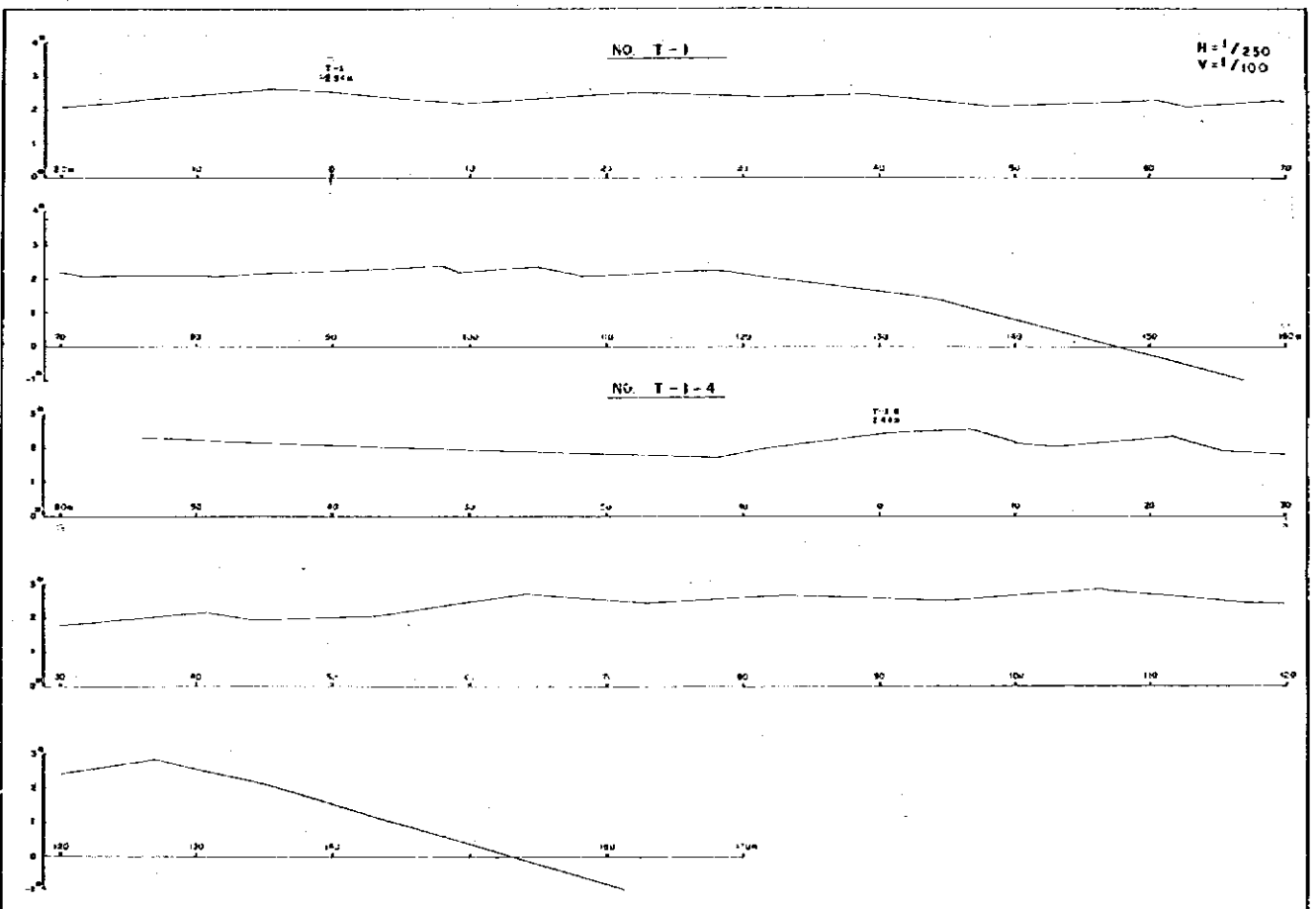
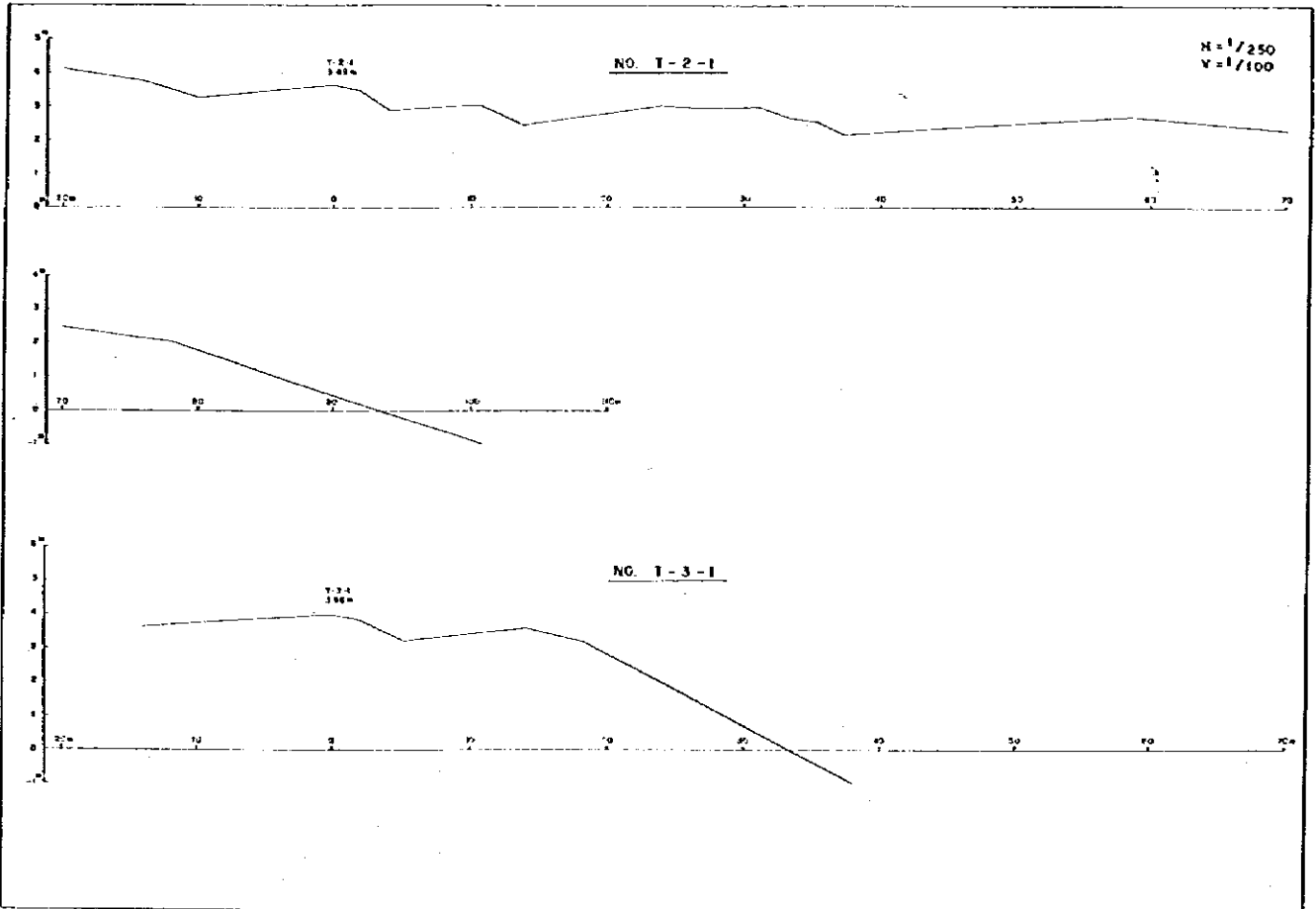


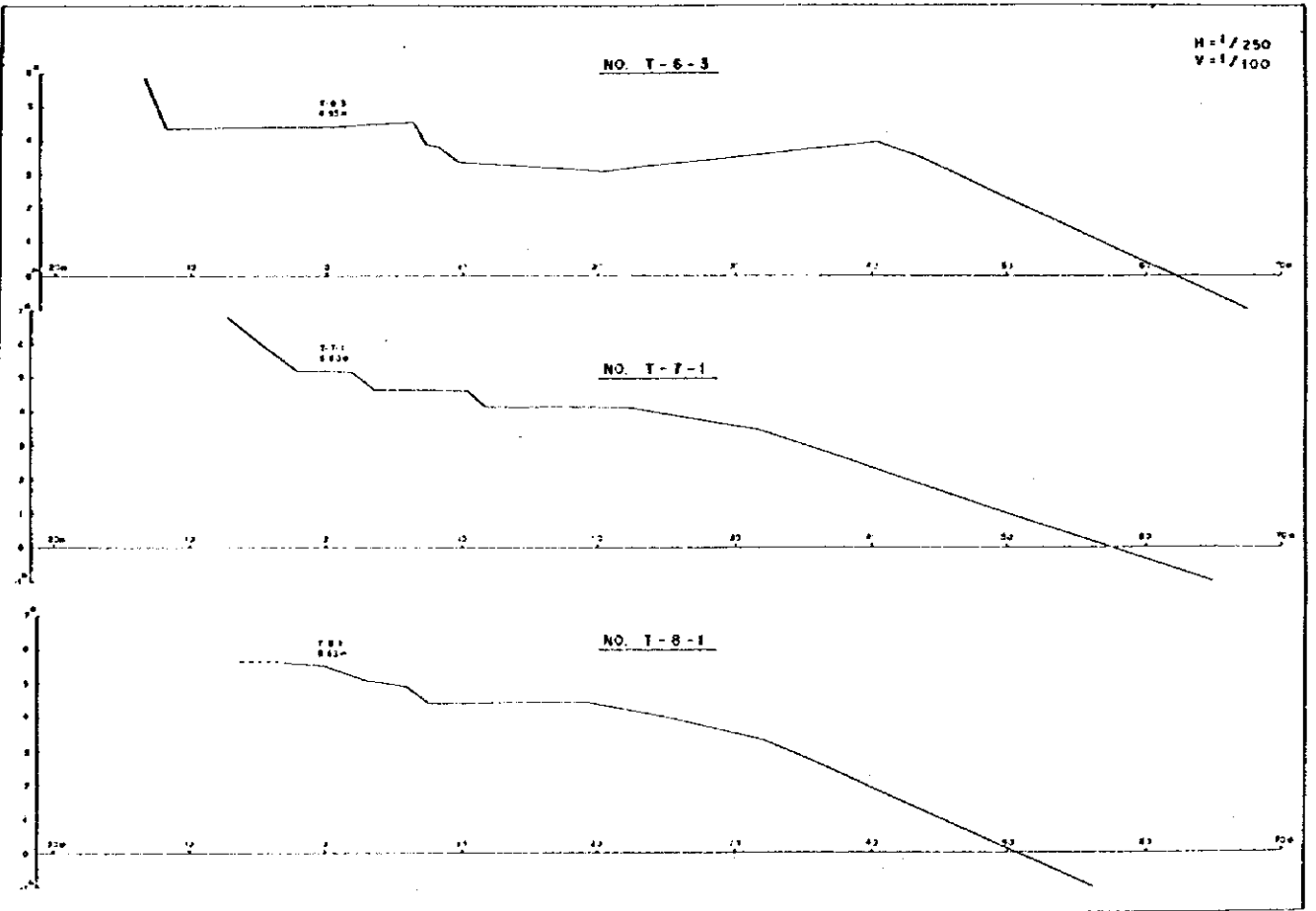
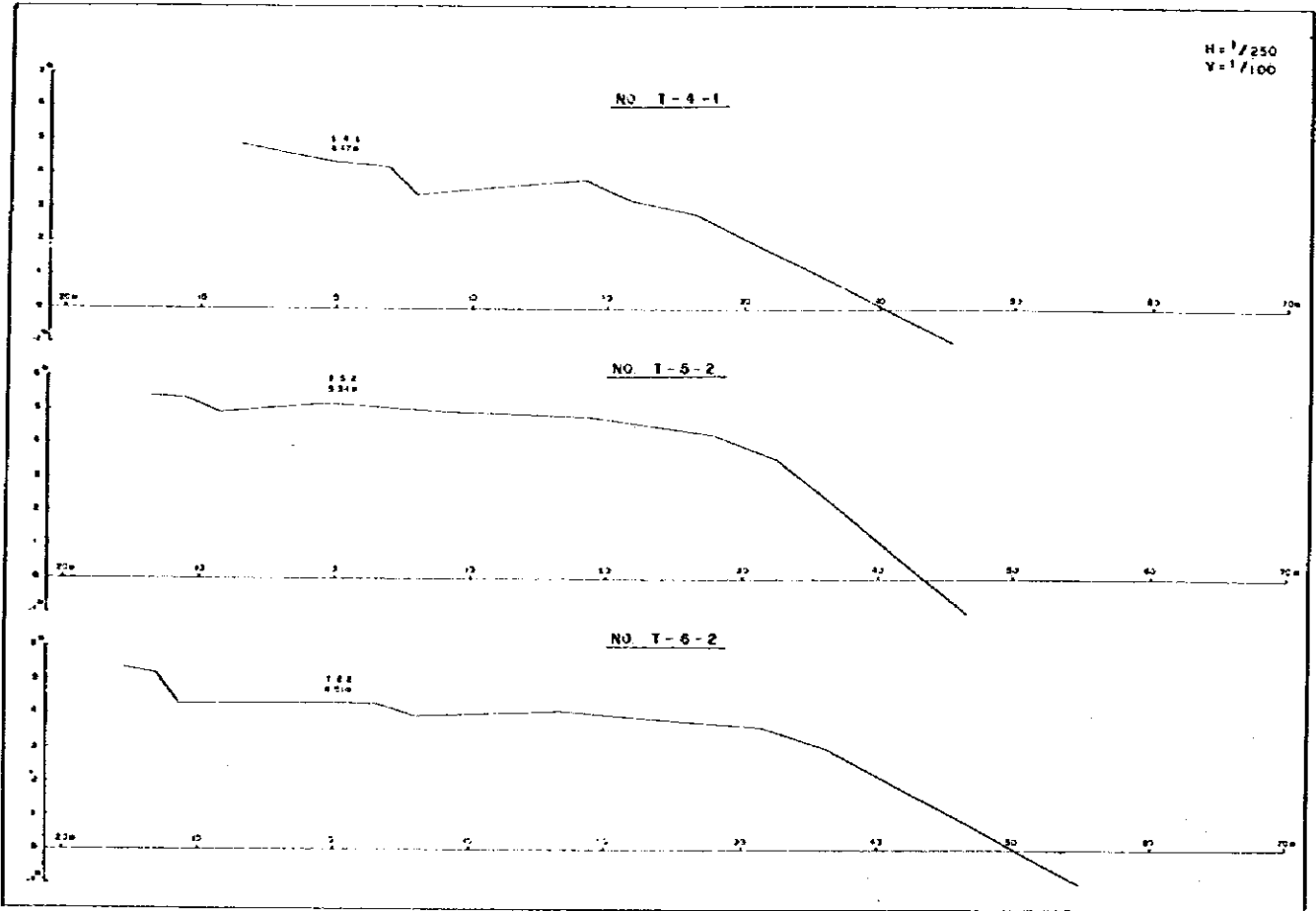
SUSPENDED LOAD (NO. 6)





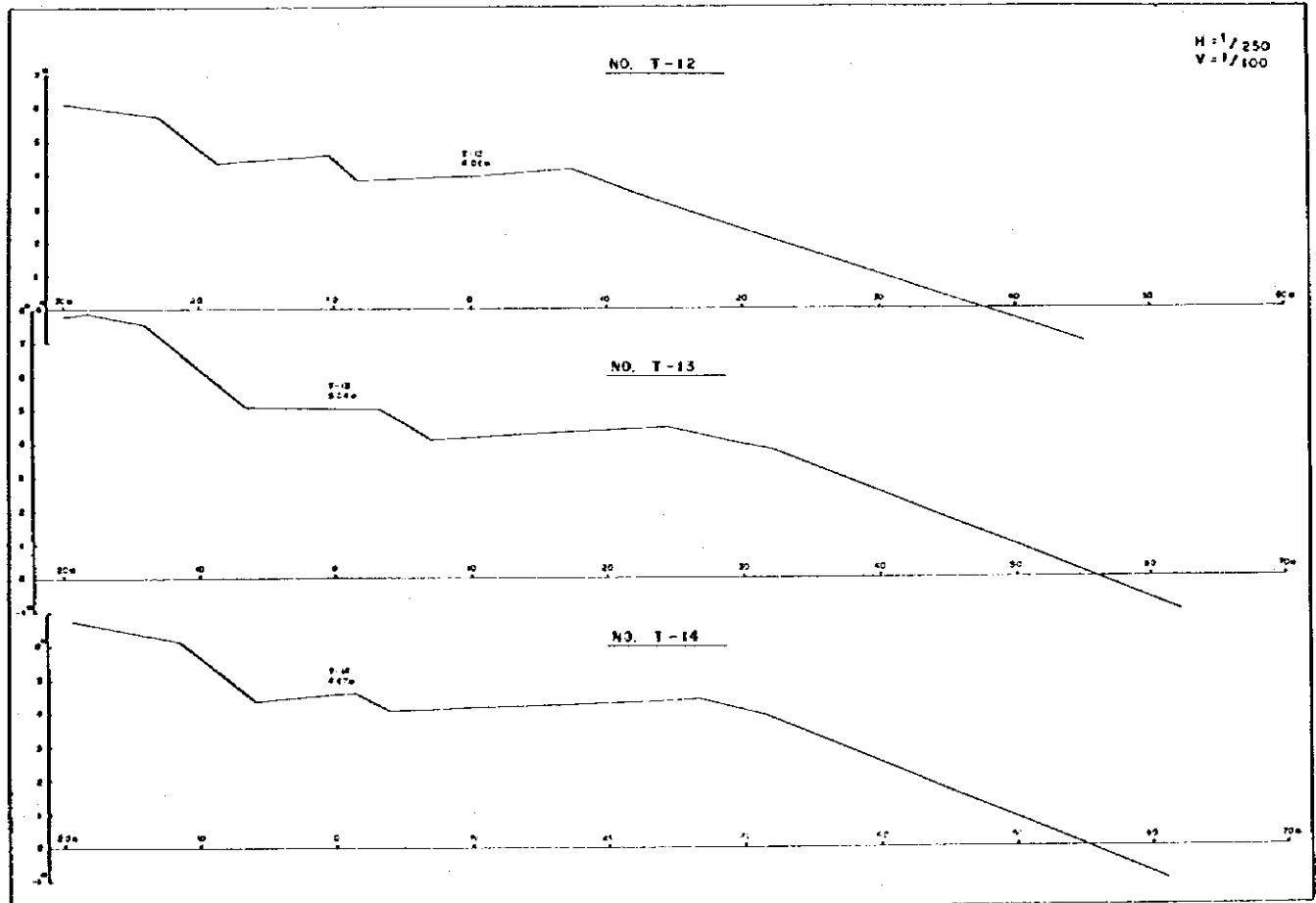
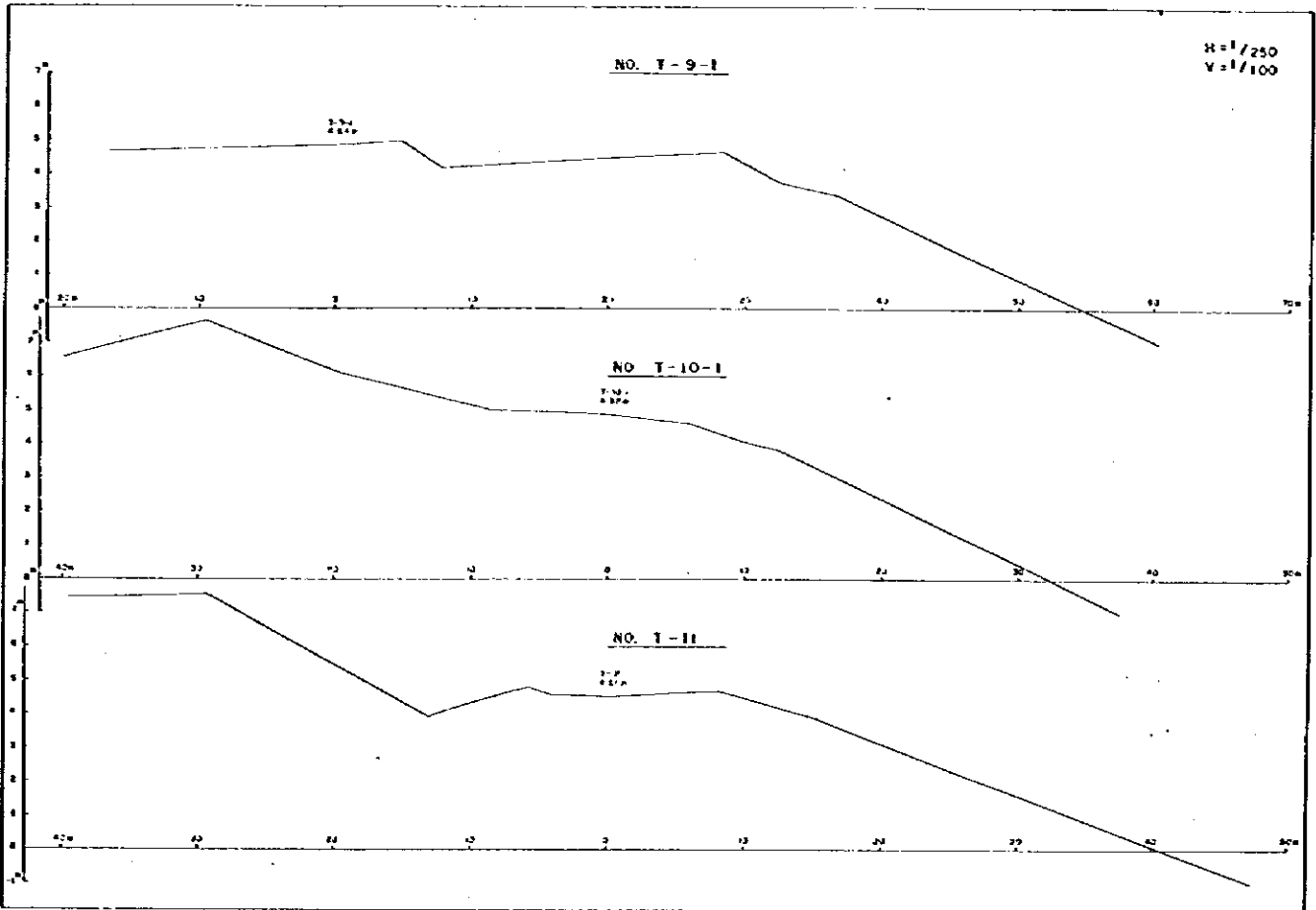
BEACH PROFILE

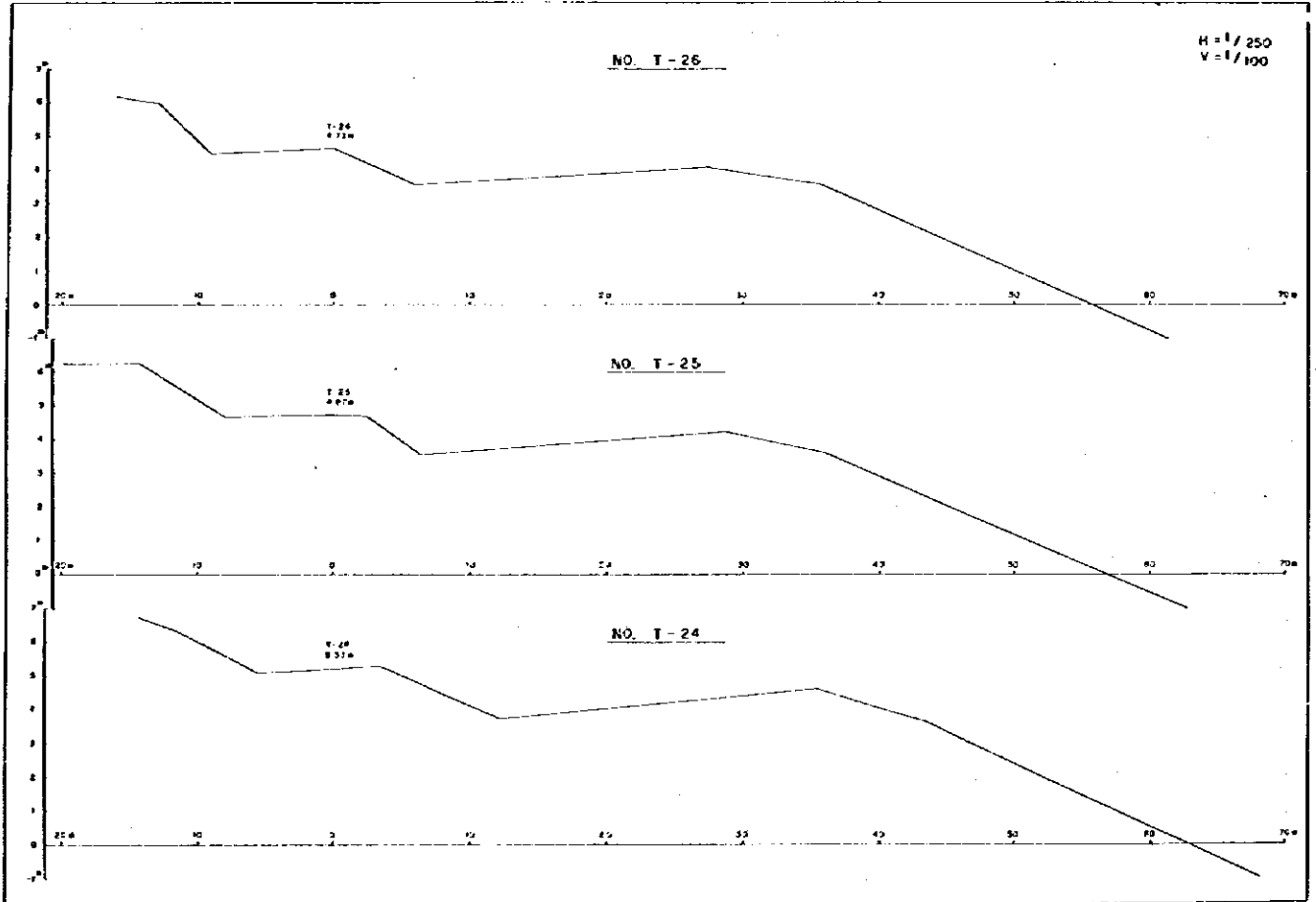
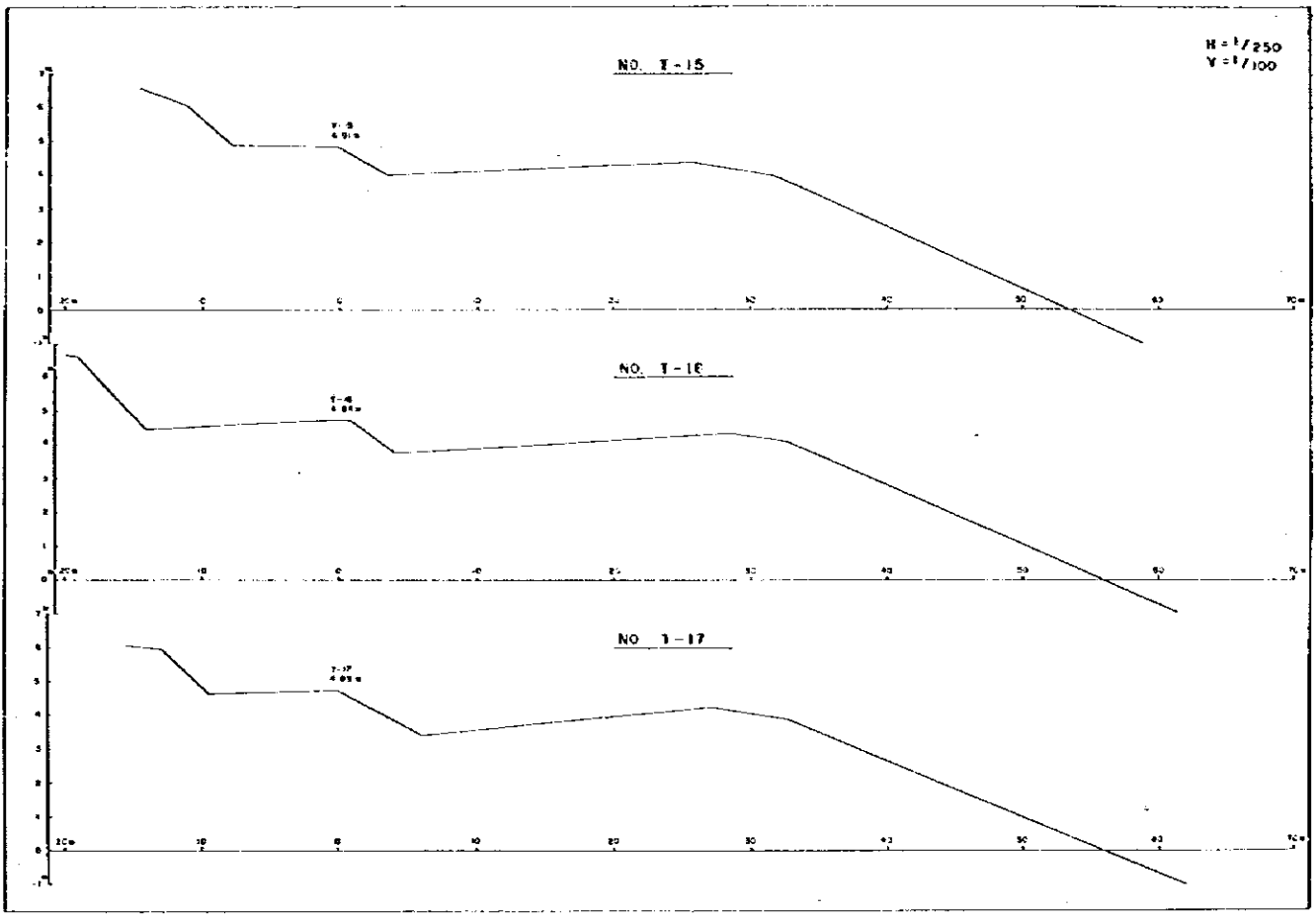


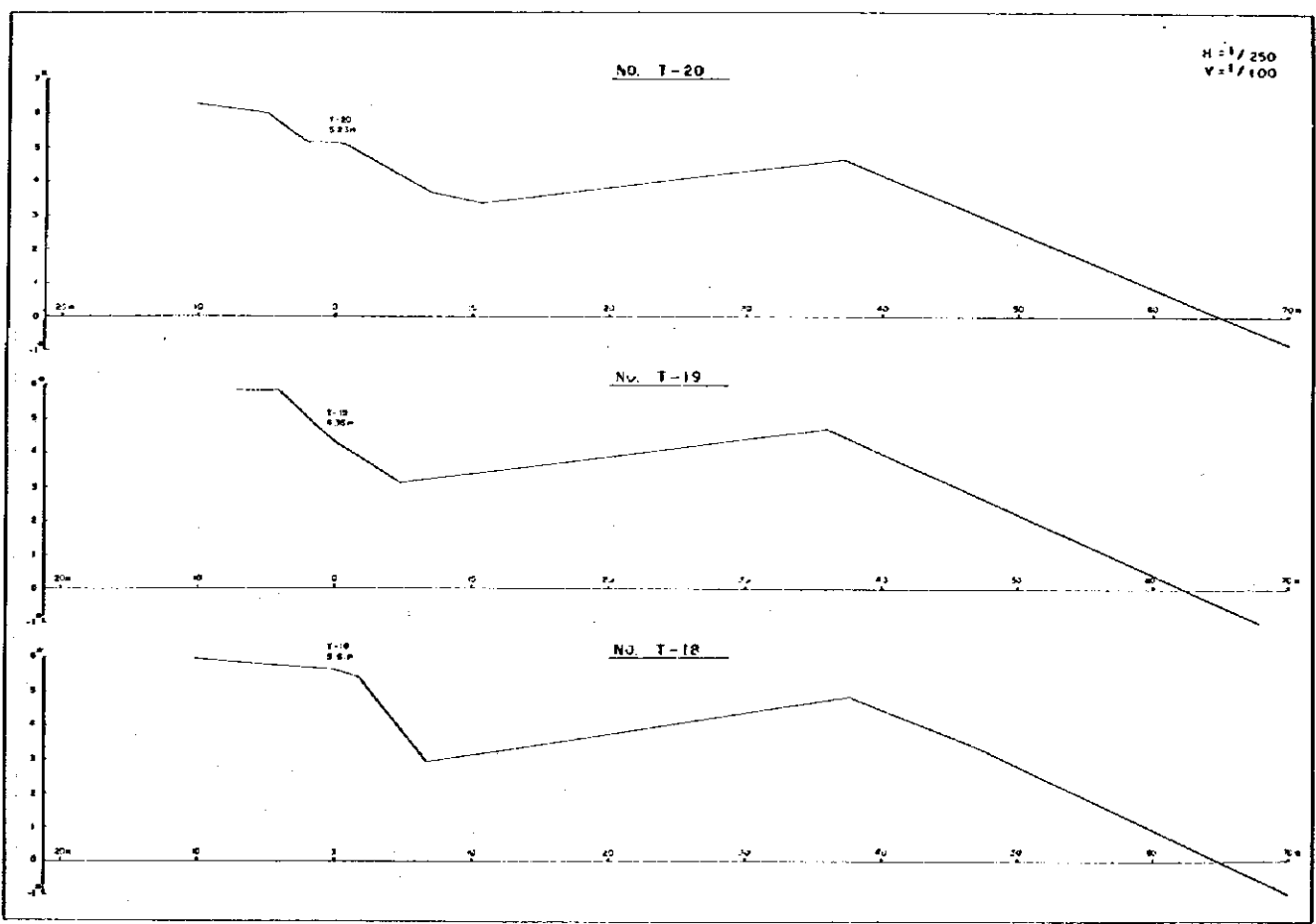
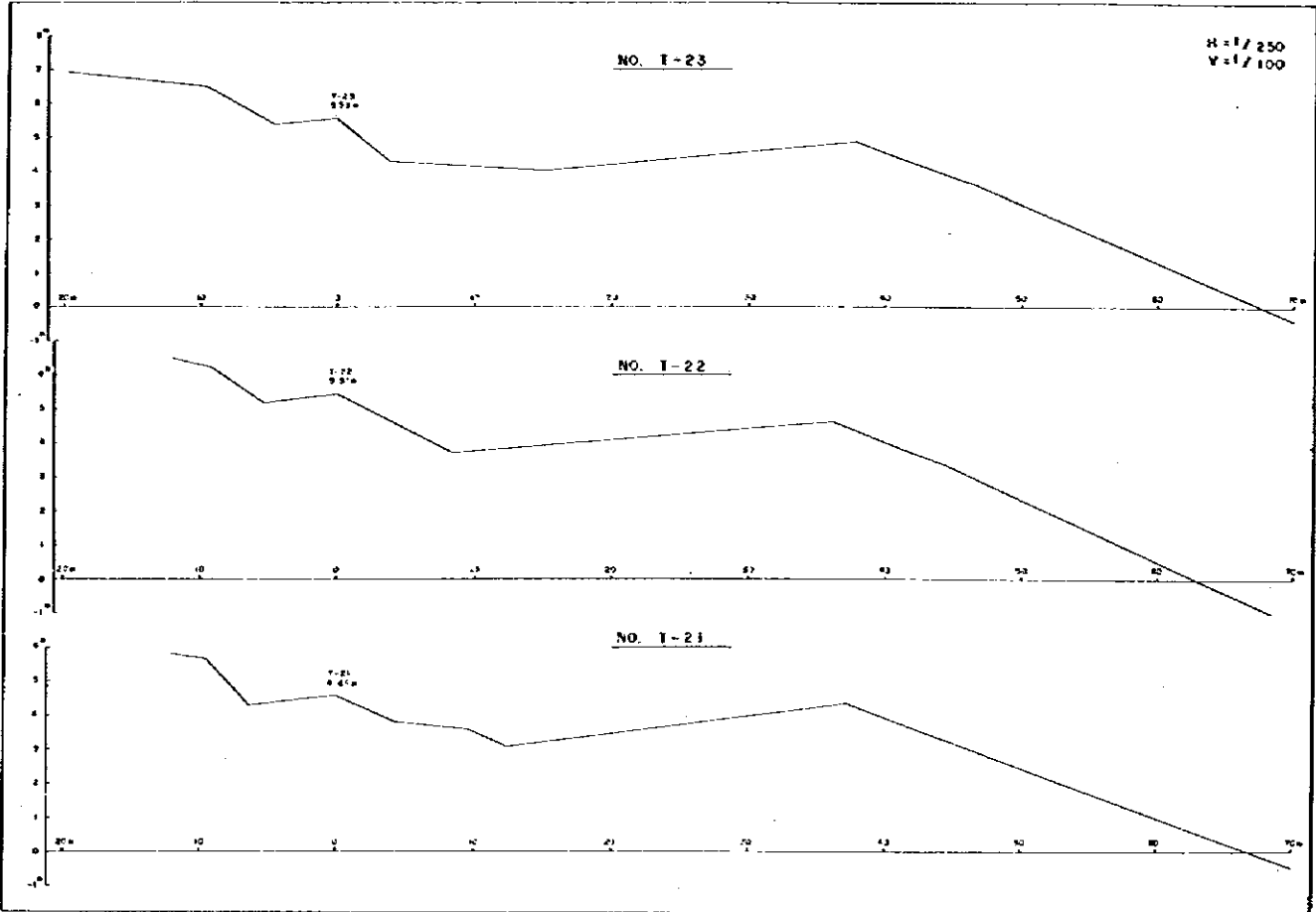


H=1/250  
V=1/100

H=1/250  
V=1/100

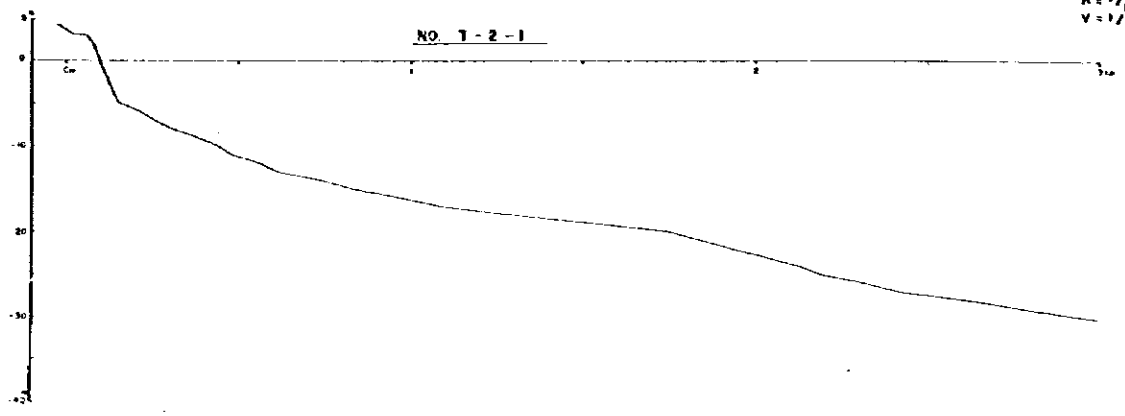




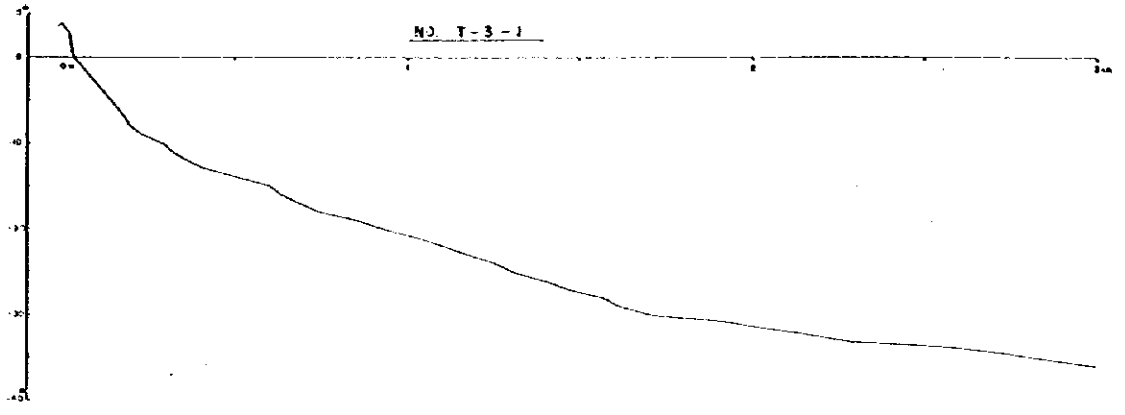


R = 1/10,000  
V = 1/400

NO. T-2-1

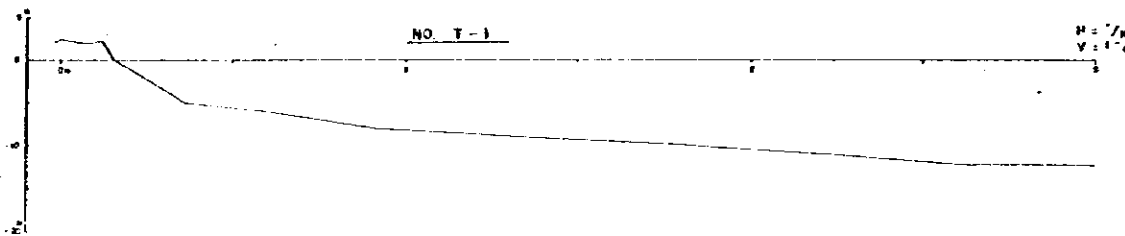


NO. T-3-1

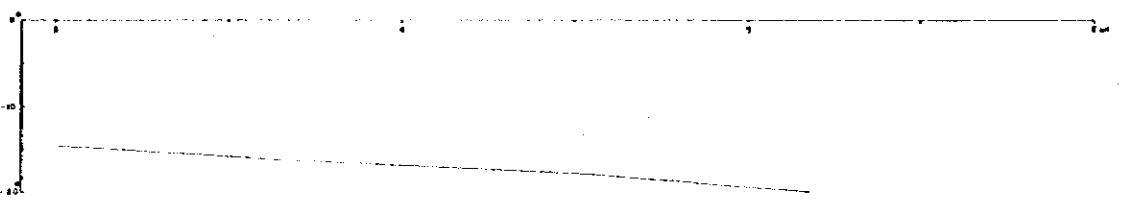
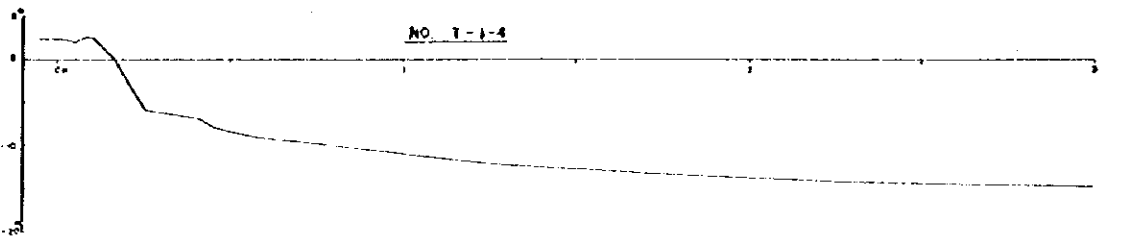


NO. T-1

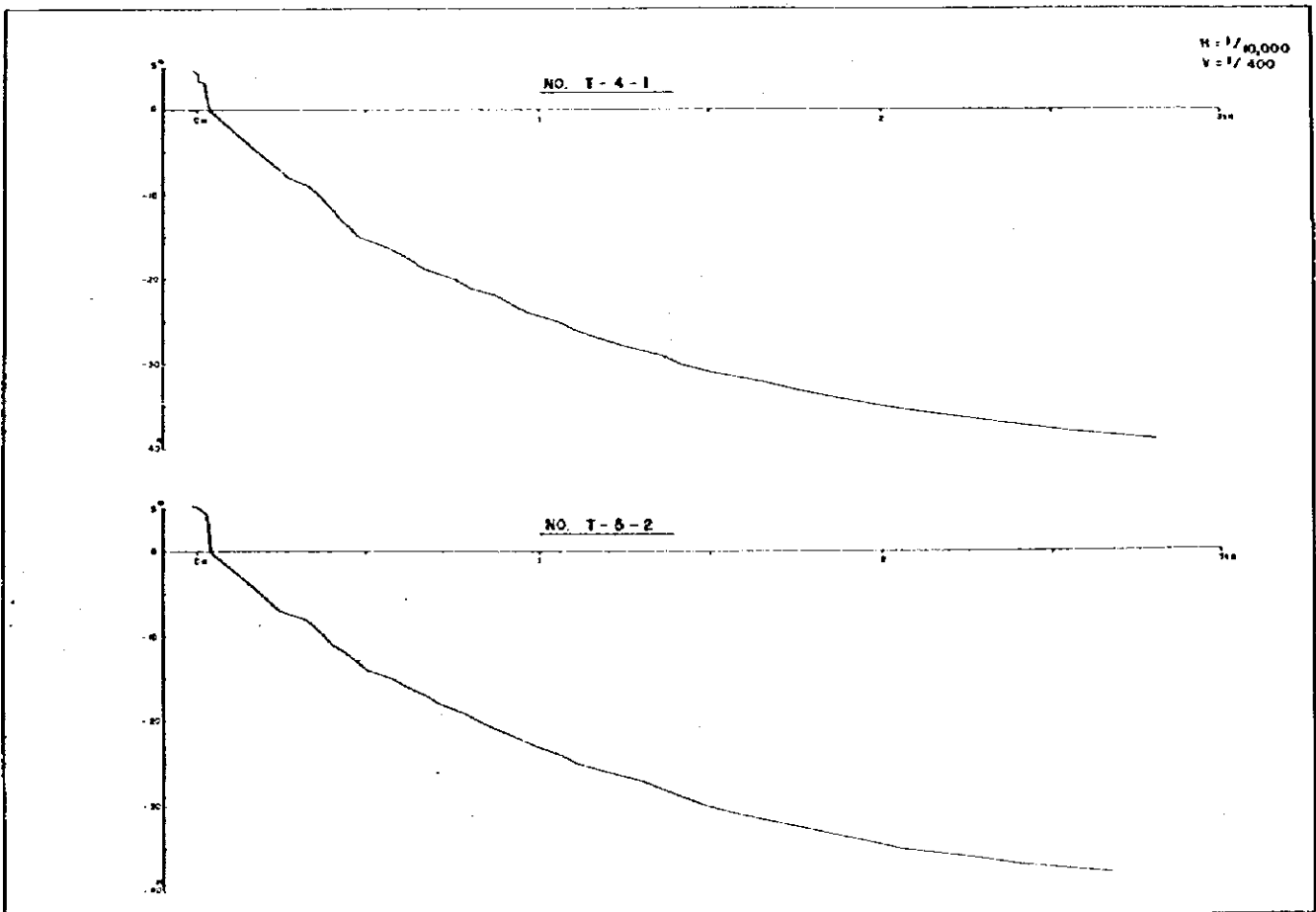
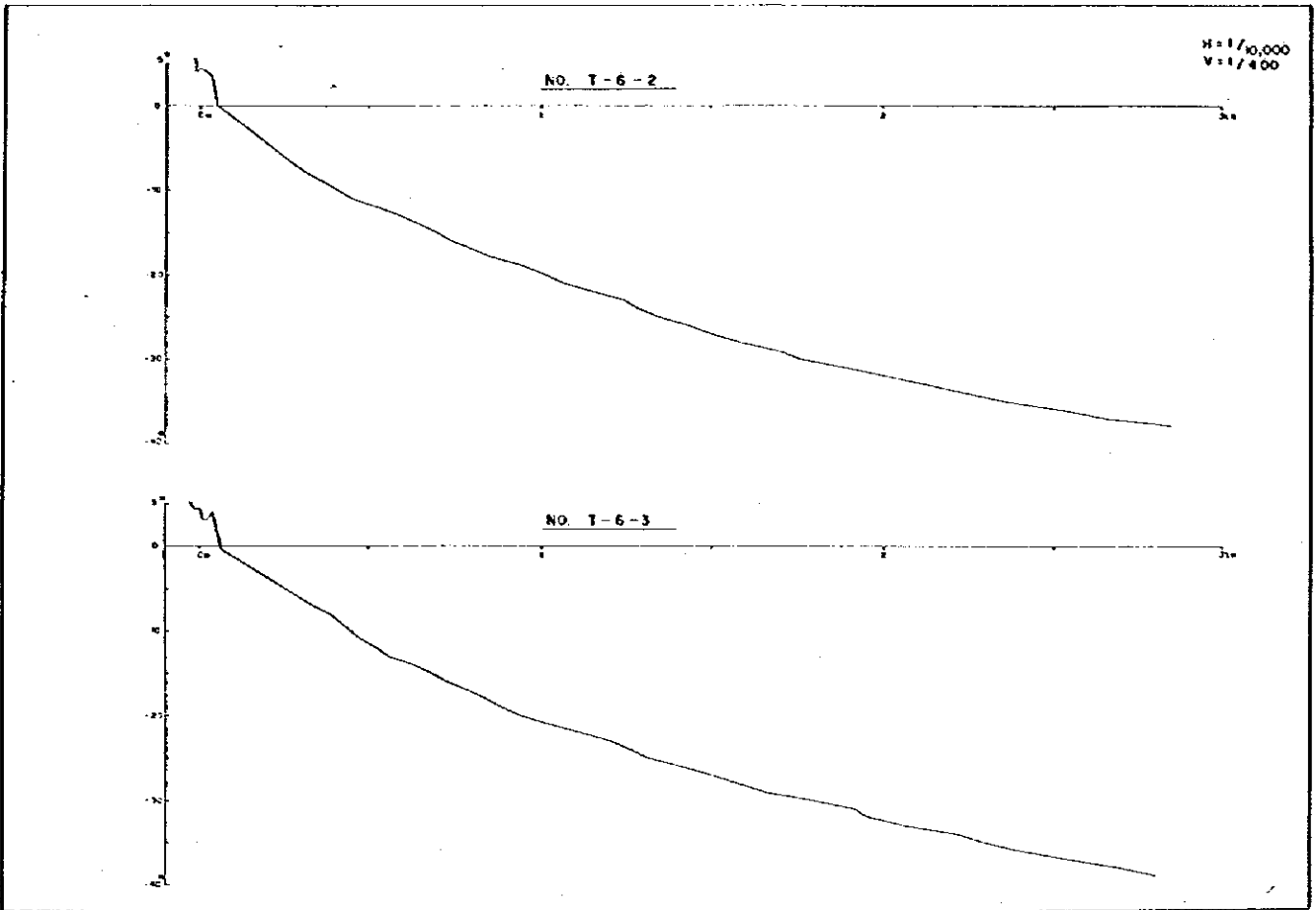
R = 1/10,000  
V = 1/400

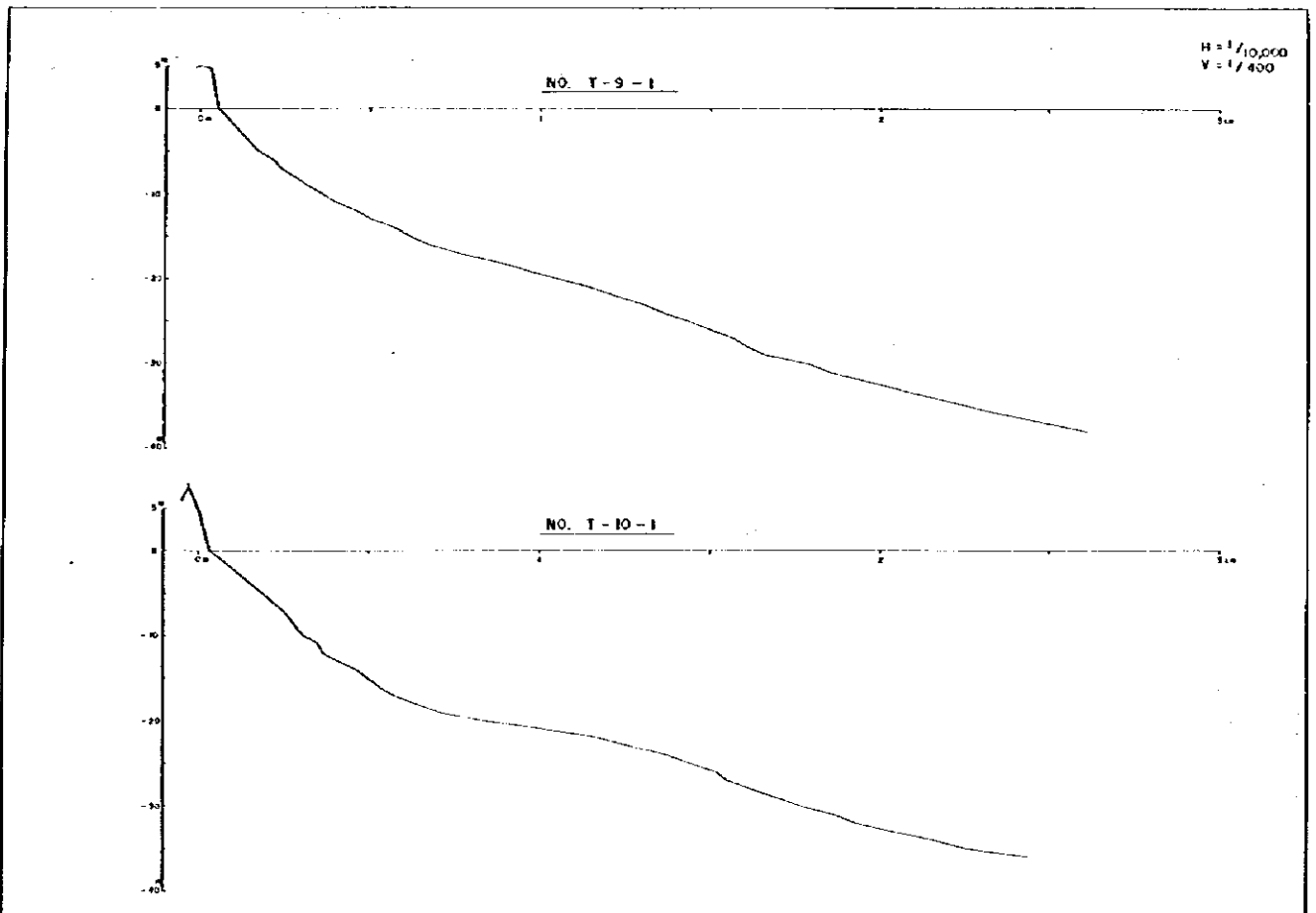
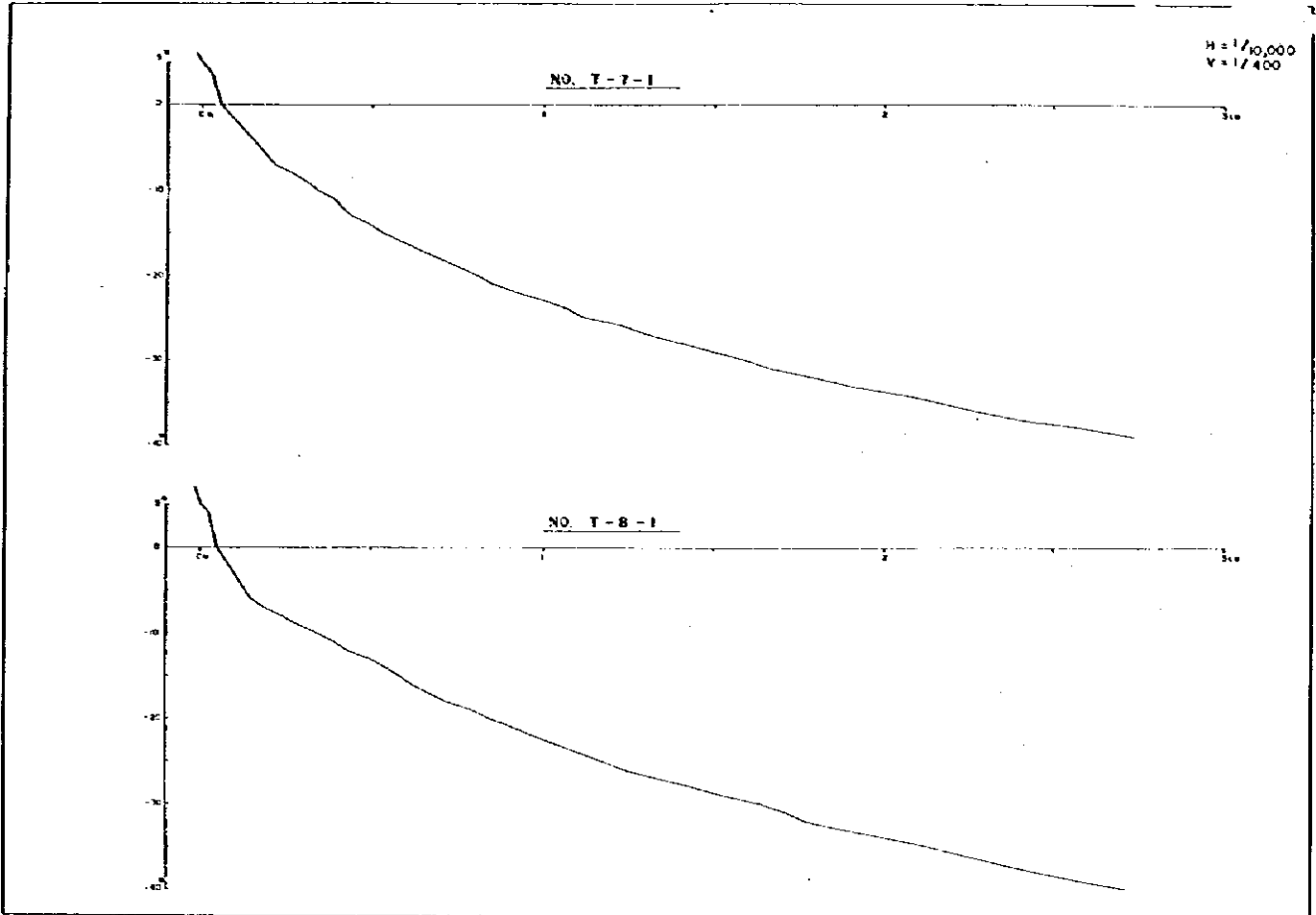


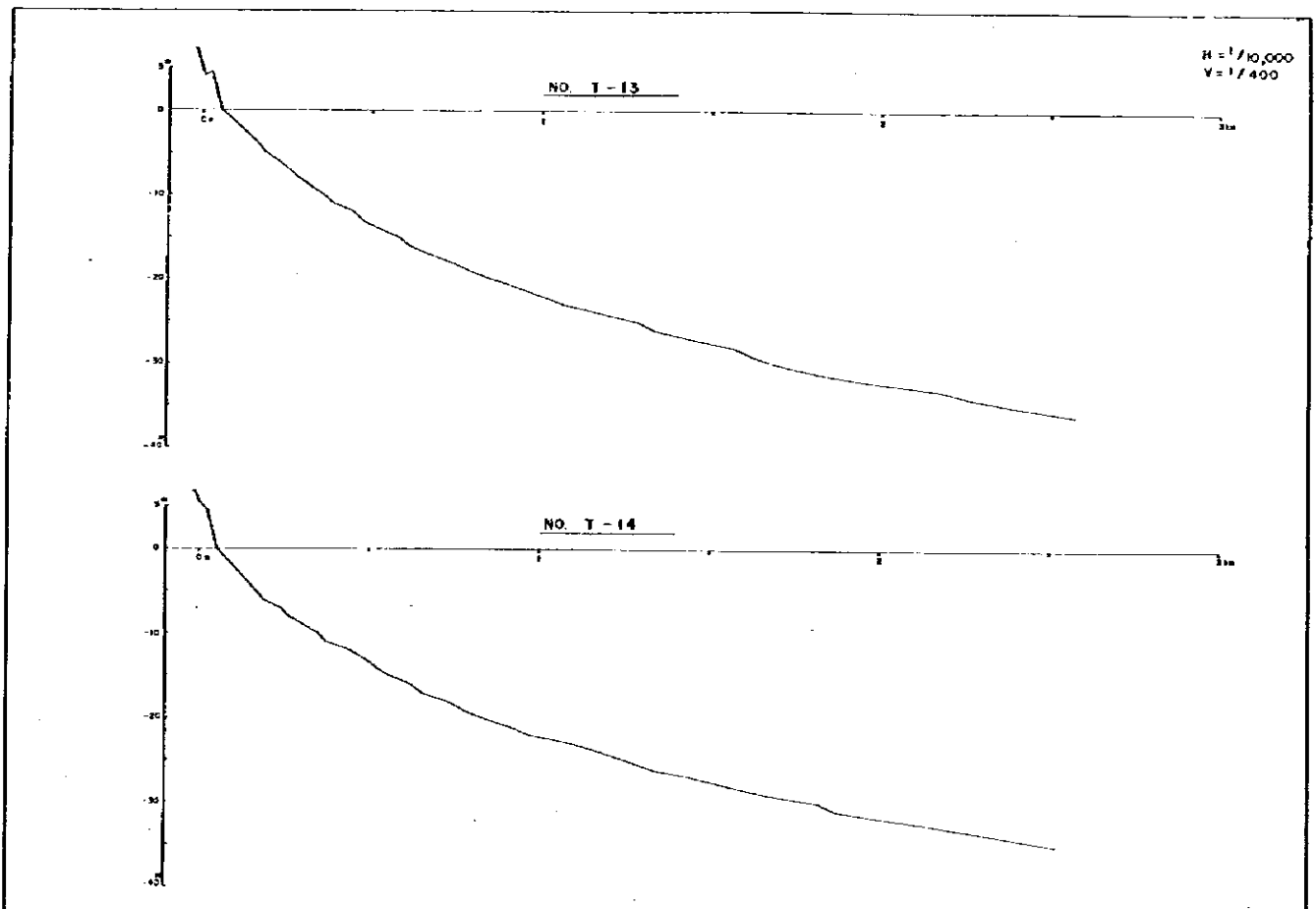
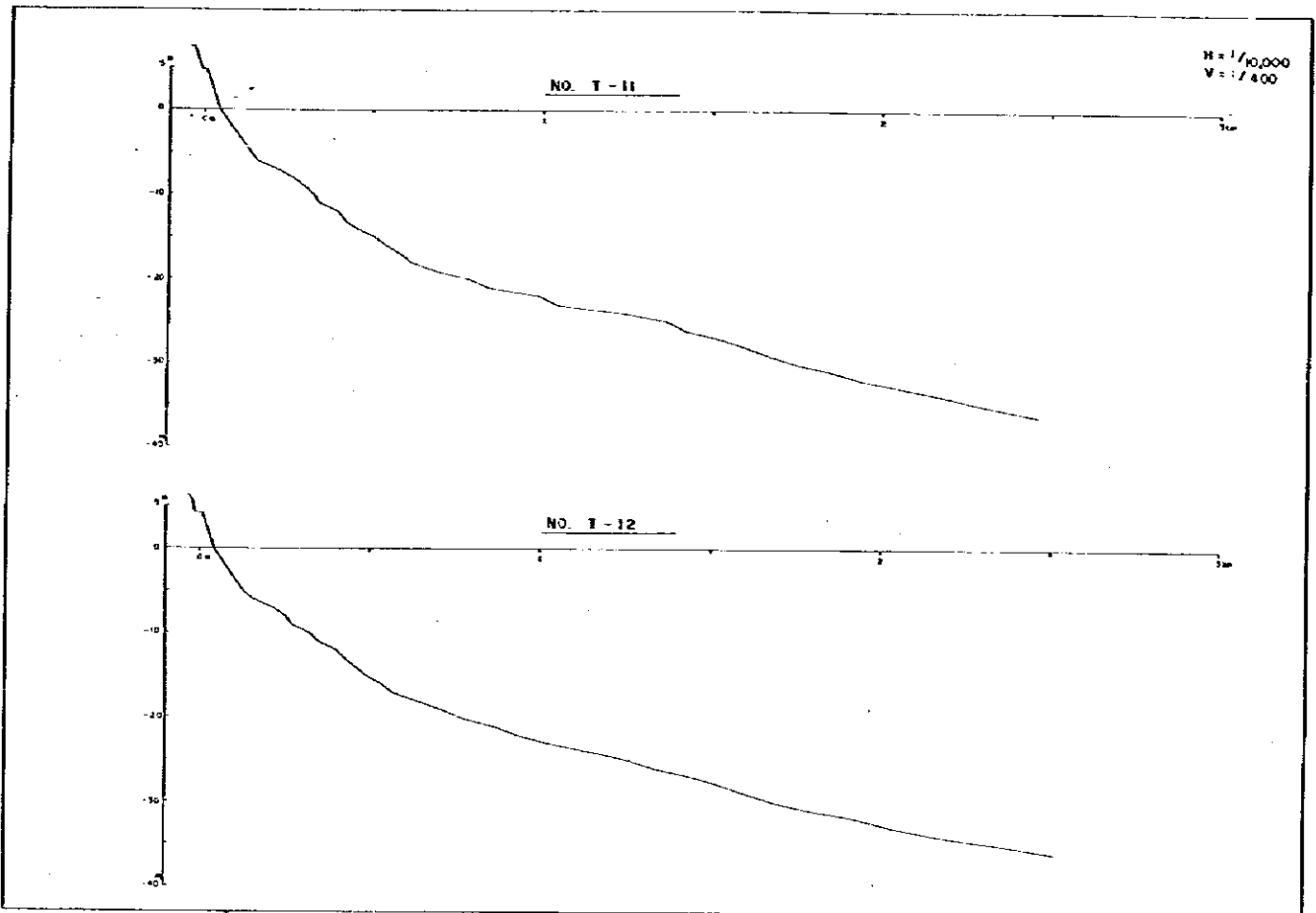
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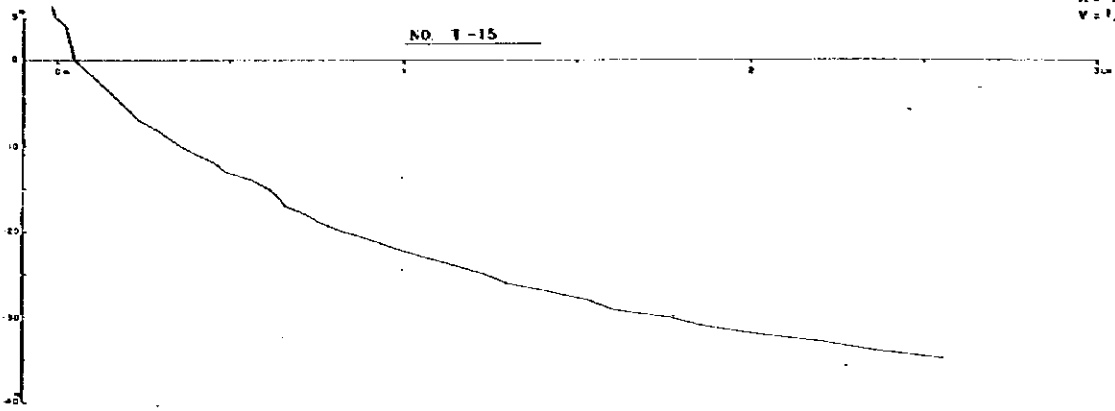




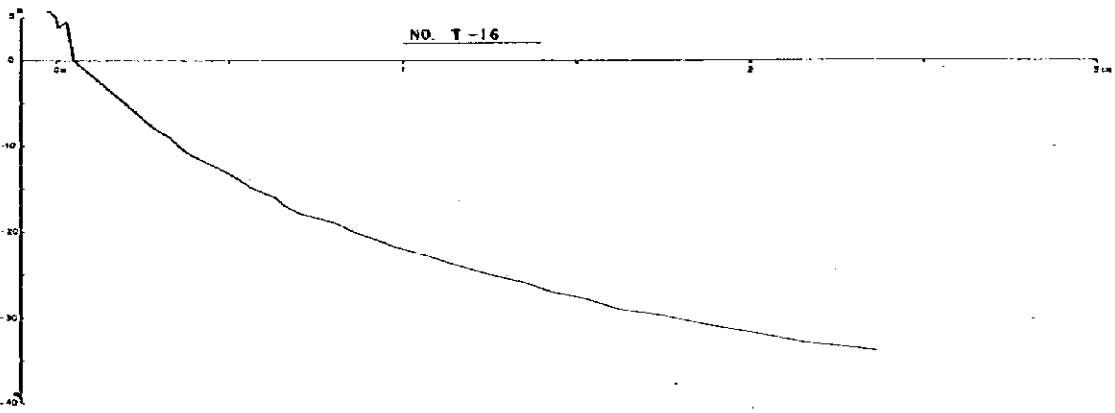


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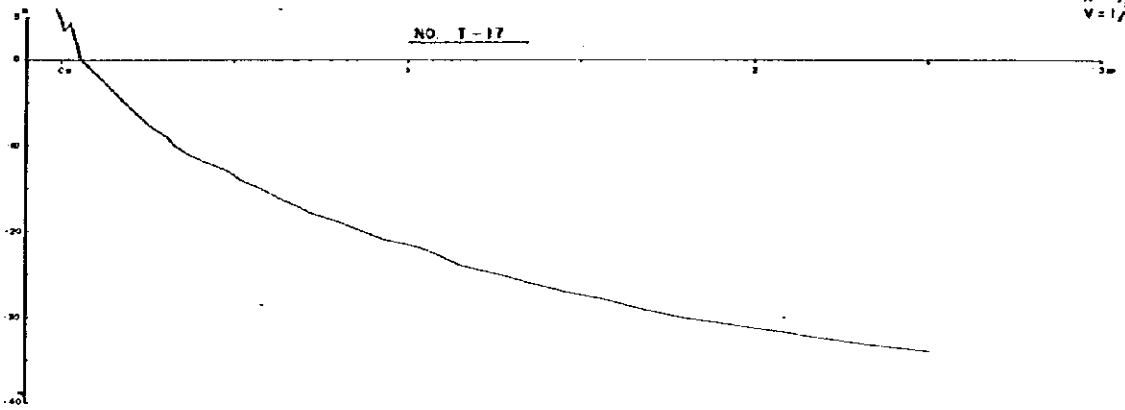


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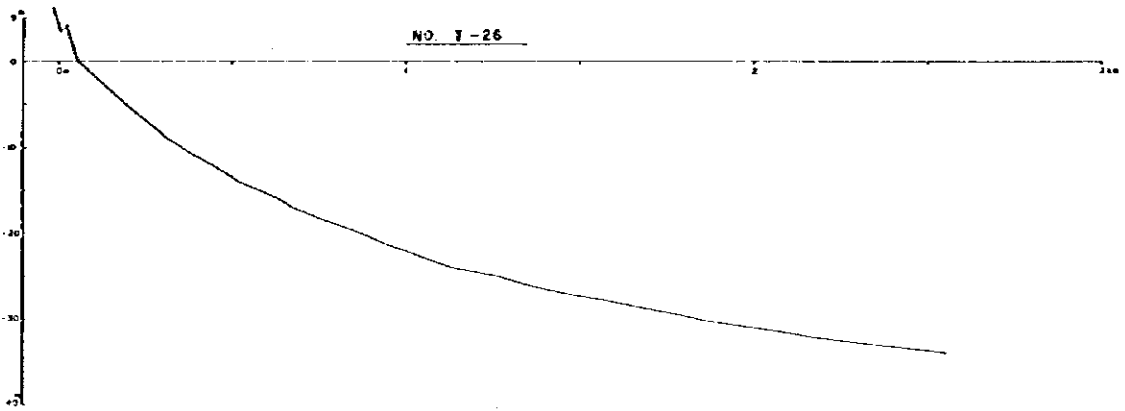


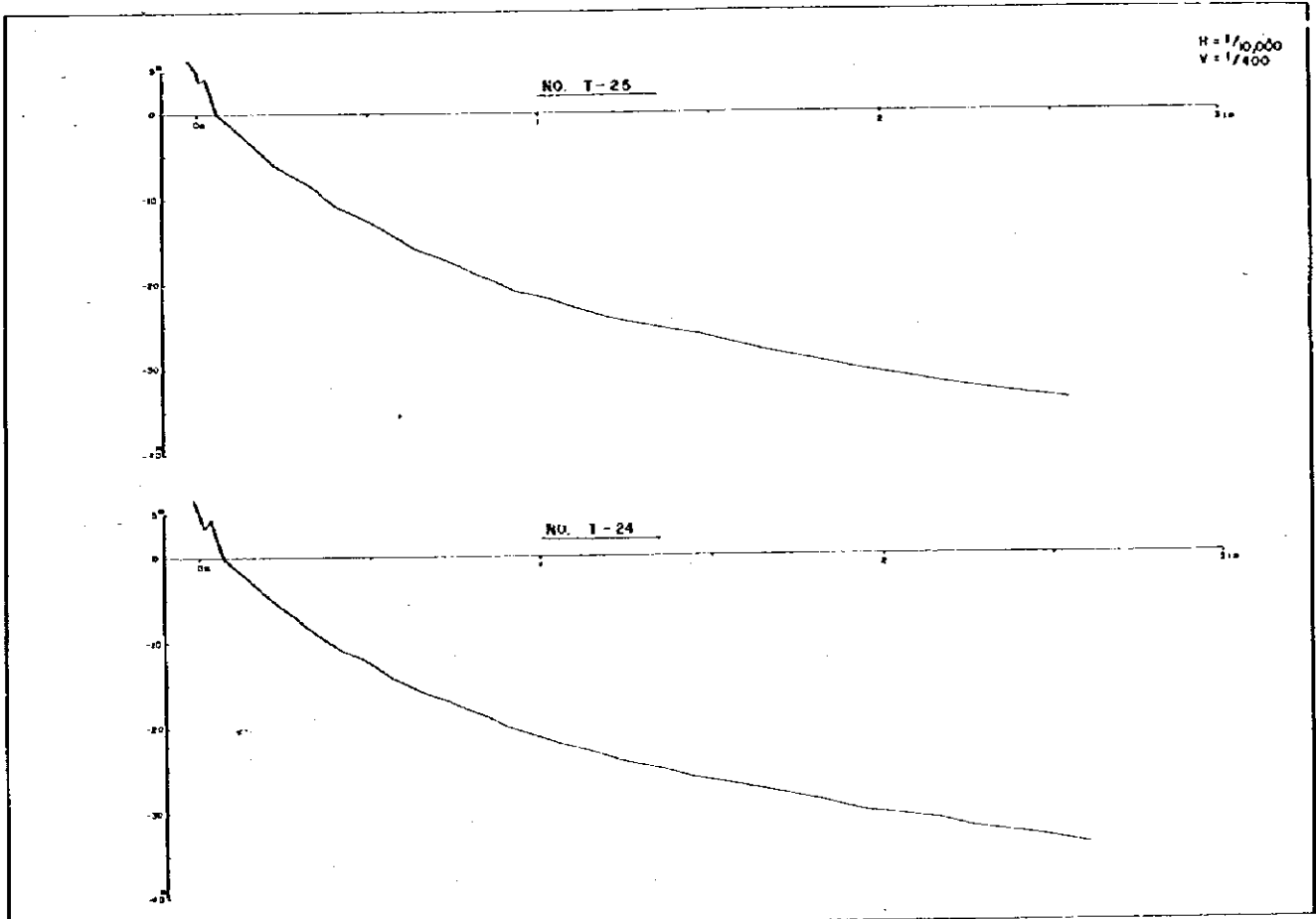
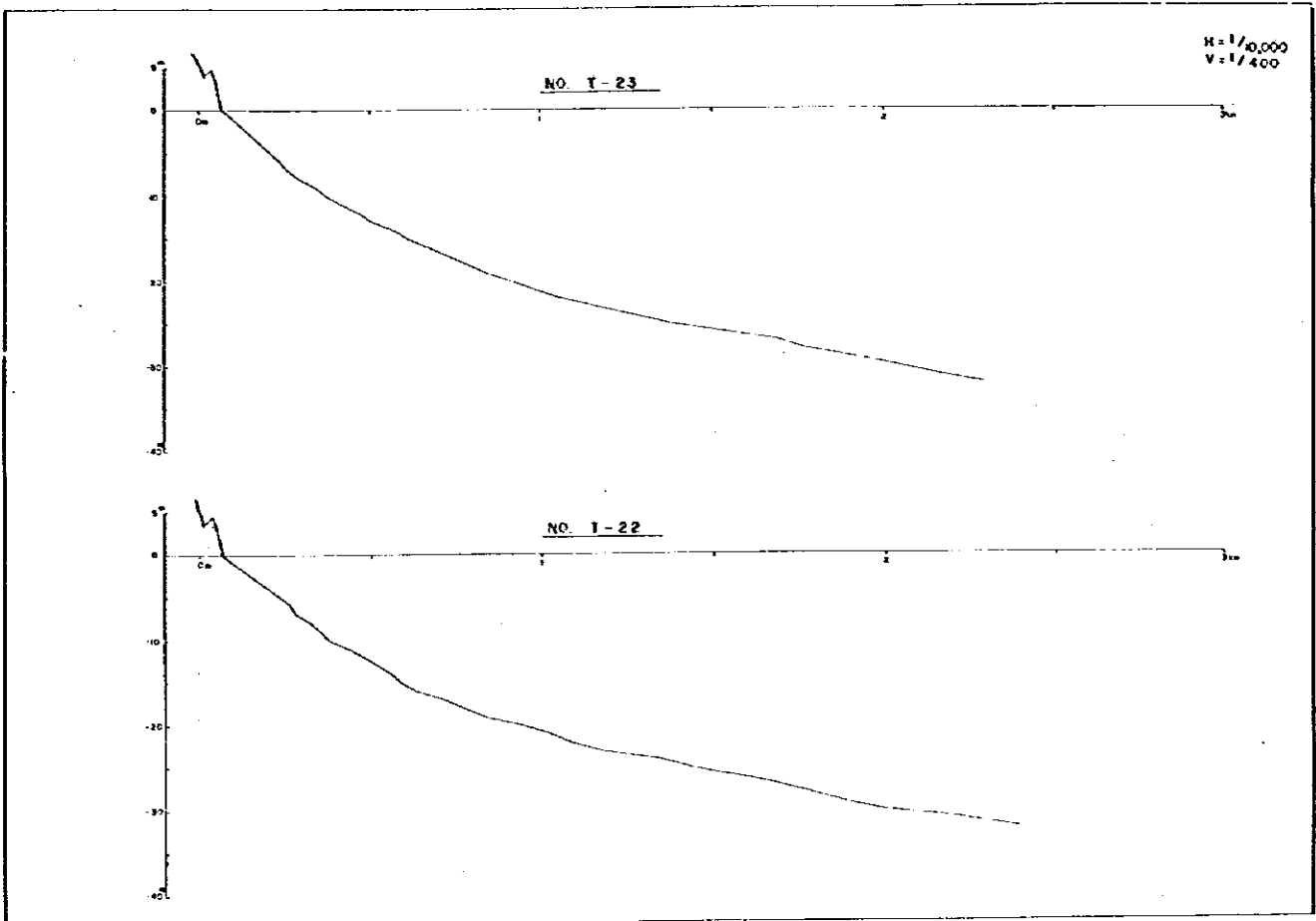
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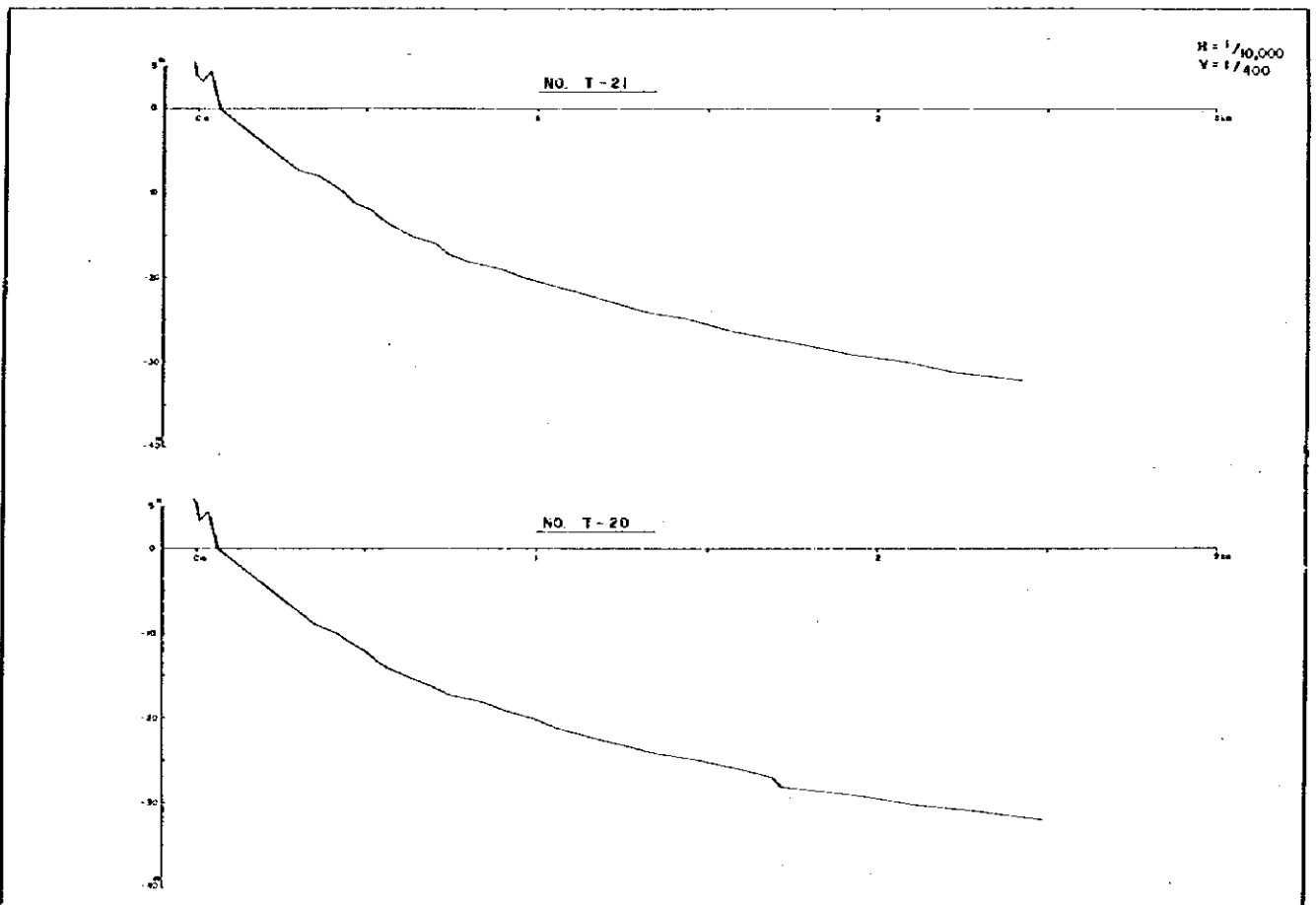
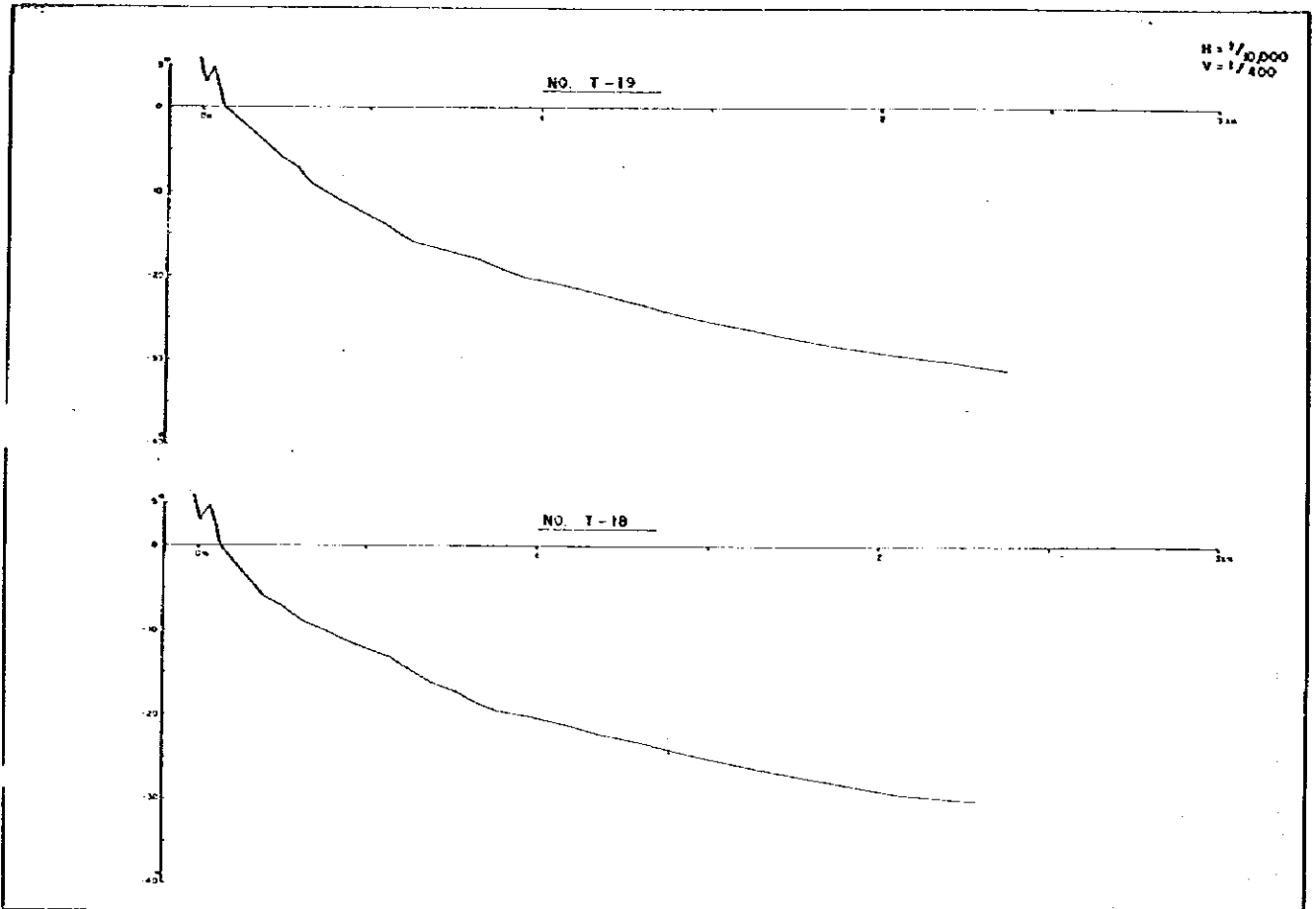
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NO. T-26







SCOPE OF THE STUDY FOR  
THE PORT DEVELOPMENT OF ROBERTSPORT

For the study on the development of Robertsport, it is contemplated to carry out the required survey and study in two stages:

- 1st stage : Master planning
- 2nd stage : Feasibility study

In Master planning, the possibility of establishing a new port at Robertsport will be assessed firstly from the viewpoint of a national transportation system in Liberia and, secondly, from the viewpoint of acceleration of regional development in related counties like Grand Cape Mount, Lofa and Montserrado.

I: 1ST STAGE

The Master planning will cover the works as follows:

1. Examine the existing port facilities, capacities and cargo volumes handled in Liberia and also in Freetown, Sierra Leone.
2. Examine the future expansion programme (short term/ long term) envisaged by the National Port Authority and review each programme.
3. Examine the existing inland cargo flows to and from the ports of different products and by different transportation means.

4. Examine the future aspect of the Mano River Union and its relation to the development of a new port at Robertsport.
5. Assess the future potential of import/export through the existing ports.
6. Assess the development potential of the hinterland of a new port at Robertsport giving due consideration to the port activities of neighbouring ports, Monrovia and Freetown, and expect the possibility of a share of port traffic through a new port at Robertsport.
7. Predict the future growth of major products like lumber/timber, rubber, coffee, and other agricultural and mineral products in the hinterland of a new port at Robertsport.
8. Examine existing fishery activities in Cape Mount County and assess the future aspect of fishing port development in connection with new port development at Robertsport.
9. Examine the possibility of tourism in Robertsport area in connection with new port development.
10. Assess the suitable port capacity of a new port to cater for the future port traffic and estimate the requirement of the fundamental port facilities such as berths, channels, etc. If staged development can be contemplated, clarify the procedure of each stage development.



11. List all the related infrastructure necessary to promote new port development and prepare preliminary layouts.
12. Prepare the Master Plan, giving due consideration to the Government policy in regional development and environmental.

II: 2ND STAGE

Field investigations required in the 2nd stage will cover the following:

1. To make more detailed sounding at intervals of less than 100m and clarify the relief of shoals and out-crops. This survey shall be performed during the dry season.
2. To install a wave rider during the rainy season for at least a year, if possible, so as to measure the wave heights, lengths and periods. This buoy shall be located offshore in the deep water zone.
3. To take aerial photographs at least once in each direction of prevailing wind so as to know the overall features of actual wave refractions.
4. To install a tide gauge in the sheltered area near Cape Mount Bay and to operate at least one month a year, if possible, including the sounding survey period.
5. To carry out more detailed current observations with floats as well as spot current meters during a consecutive 15 days on the strategic points. The readings of currents shall be executed at several depths.

6. To perform additional suspended sediment and bottom sampling during both rainy and dry seasons.
7. To perform a sonic prospecting survey (Sonostrator or Sparker) with 100 m interval square grid to cover the possible port area.
8. To carry out test borings at the points of intersections of the above grids and correlate with the data from sonic prospecting survey. These borings shall be performed during the dry season.
9. To carry out the siltation study by the following procedures:
  - aerial photographs of coast line at least once a year and if possible twice a year.
  - beach profile survey at three monthly intervals at least.
  - suspended sediment sampling/bottom sampling in the estuary and in the sea, in the rainy season/dry season. (This survey has been mentioned in other sections of this report.)
  - littoral drift trap shoreward of surf zone in rainy season/dry season.
  - collection of local historical records.
  - river flow study.
10. To make more detailed topographical survey so as to clarify the inundation area, drainage conditions and slope or relief for earth work study.

11. To perform onshore boring in line with the above topographical survey so as to clarify ground water, foundation and quarry work.
12. To make a basic survey for water/sewage study, e.g. river flow, rainfall catchment area, etc.
13. To record meteorological phenomena, temperature, wind, rainfall, humidity, etc.





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