

*Ludington Pumped Storage Project
Lake Front Model*

Part II - Appendix

E. F. BRATER
R. B. WALLACE

June 1970

Ebasco Services, Inc.
New York, New York

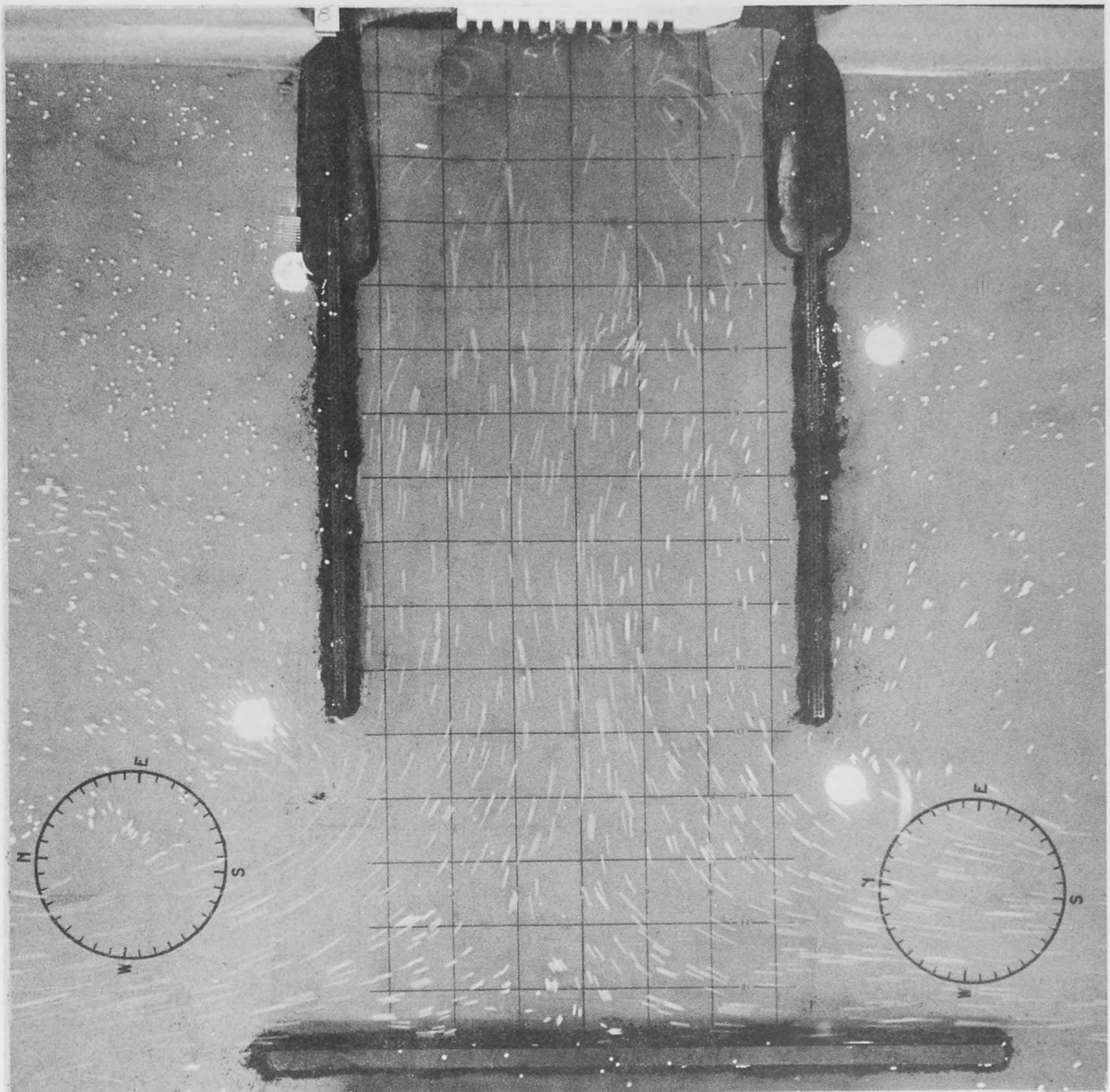


Department of Civil Engineering
Lake Hydraulics Laboratory
Technical Report No. 10

LIST OF PLATES

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- 20-77 Sub-surface Velocity Measurements
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LUDINGTON PUMPED STORAGE PROJECT
LAKE FRONT MODEL
PLATE No. 3

TEST No. 1-7

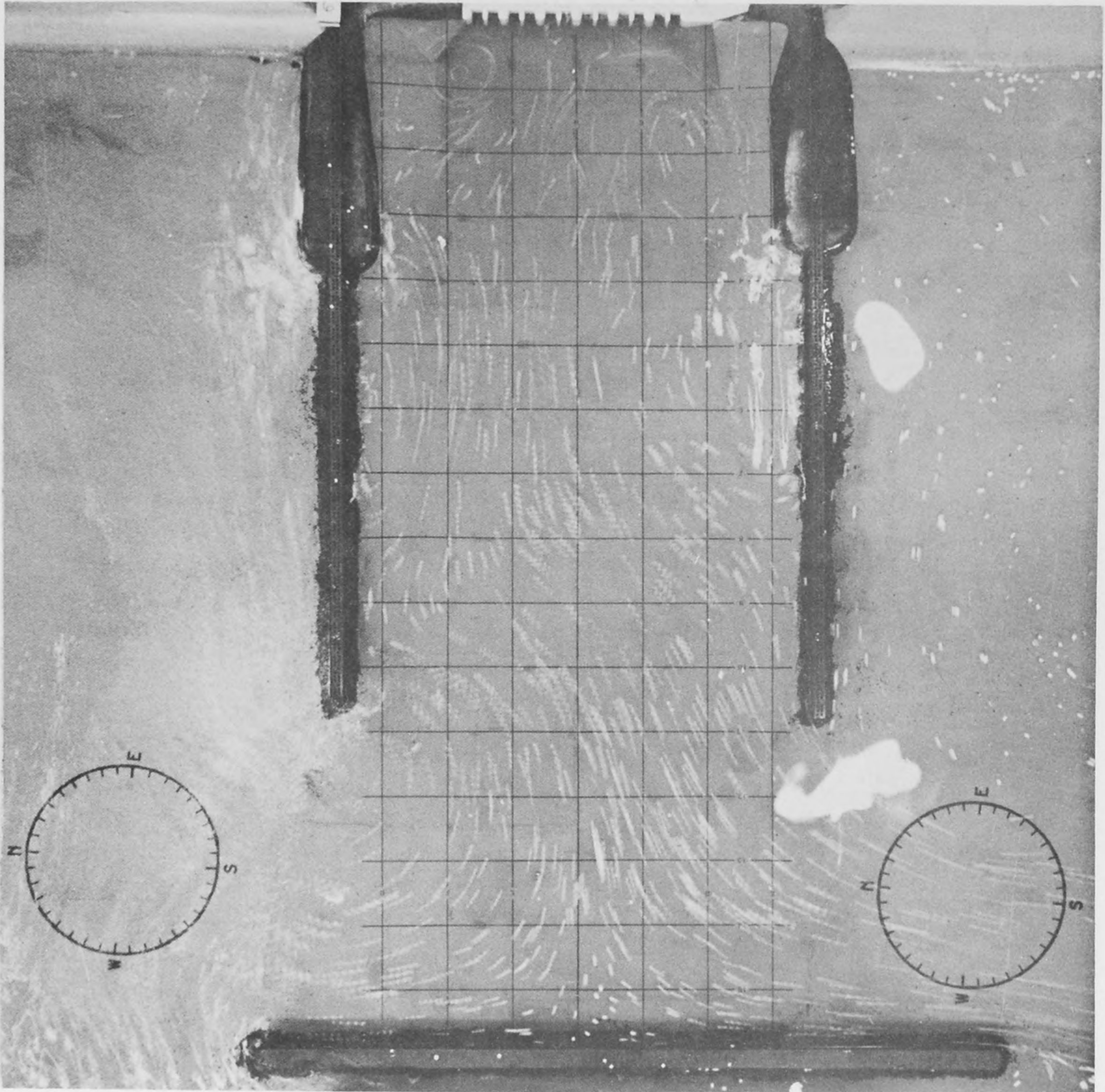
SURFACE VELOCITIES: Generating @ 76,000

WAVES: None

LITTORAL CURRENT: None

SCALE: Grid system is in 150' increments

NOV. 1969



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LUDINGTON PUMPED STORAGE PROJECT
LAKE FRONT MODEL
PLATE No. 4

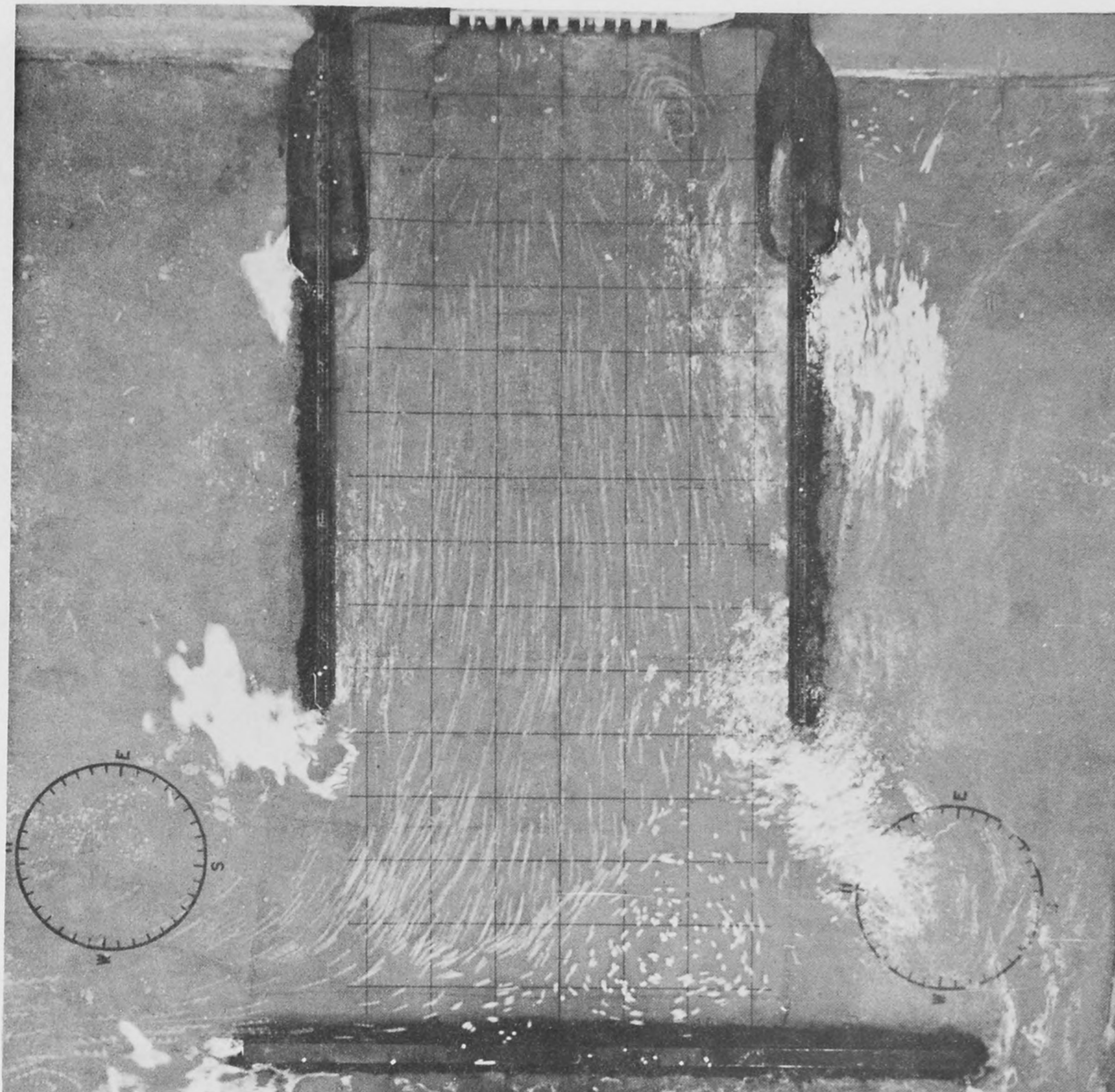
TEST No. 1-5

SURFACE VELOCITIES: Generating @ 76,000 c.f.s.

WAVES: North. West

LITTORAL CURRENT: South

SCALE: Grid system is in 150' increments NOV. 1969

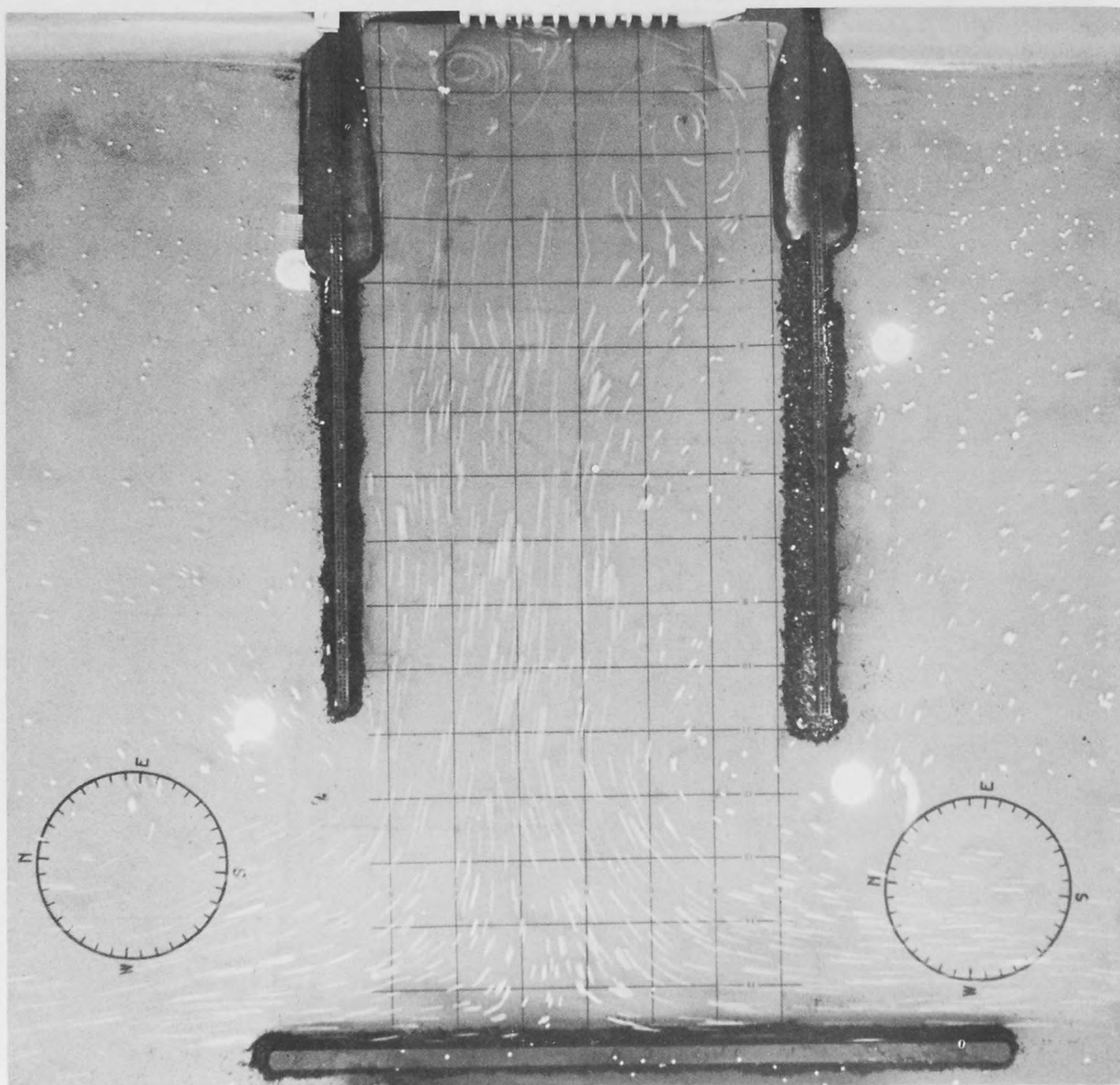


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LUDINGTON PUMPED STORAGE PROJECT
LAKE FRONT MODEL
PLATE No. 5

TEST No. 3-6
SURFACE VELOCITIES: Generating @ 76,000 c.f.s.
WAVES: South-West.
LITTORAL CURRENT: North
SCALE: Grid system is in 150' increments

NOV. 1969



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LUDINGTON PUMPED STORAGE PROJECT
LAKE FRONT MODEL
PLATE No. 6

TEST No. 1-10

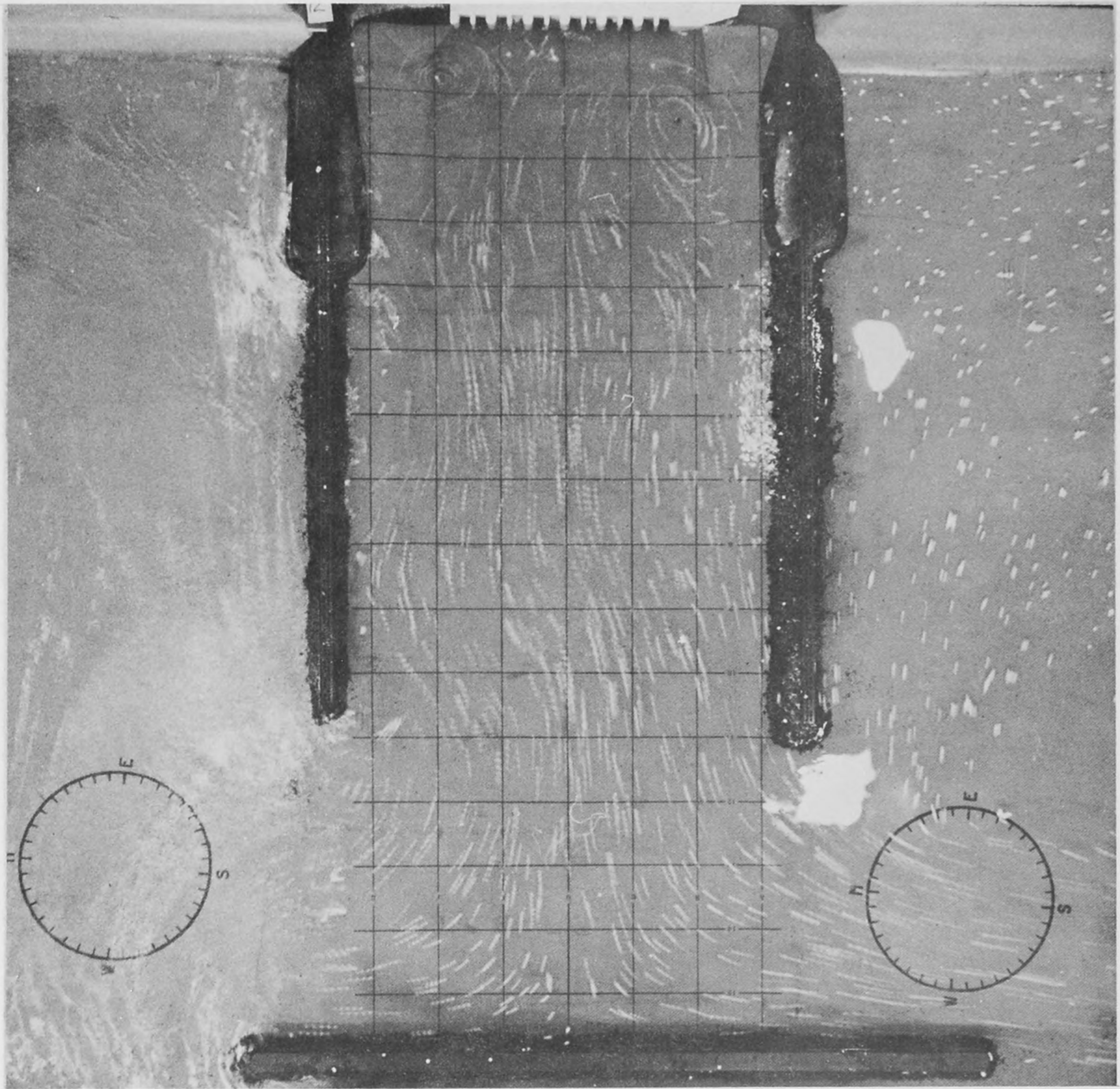
SURFACE VELOCITIES: Generating @ 76,000

WAVES: None

LITTORAL CURRENT: None

SCALE: Grid system is in 150' increments

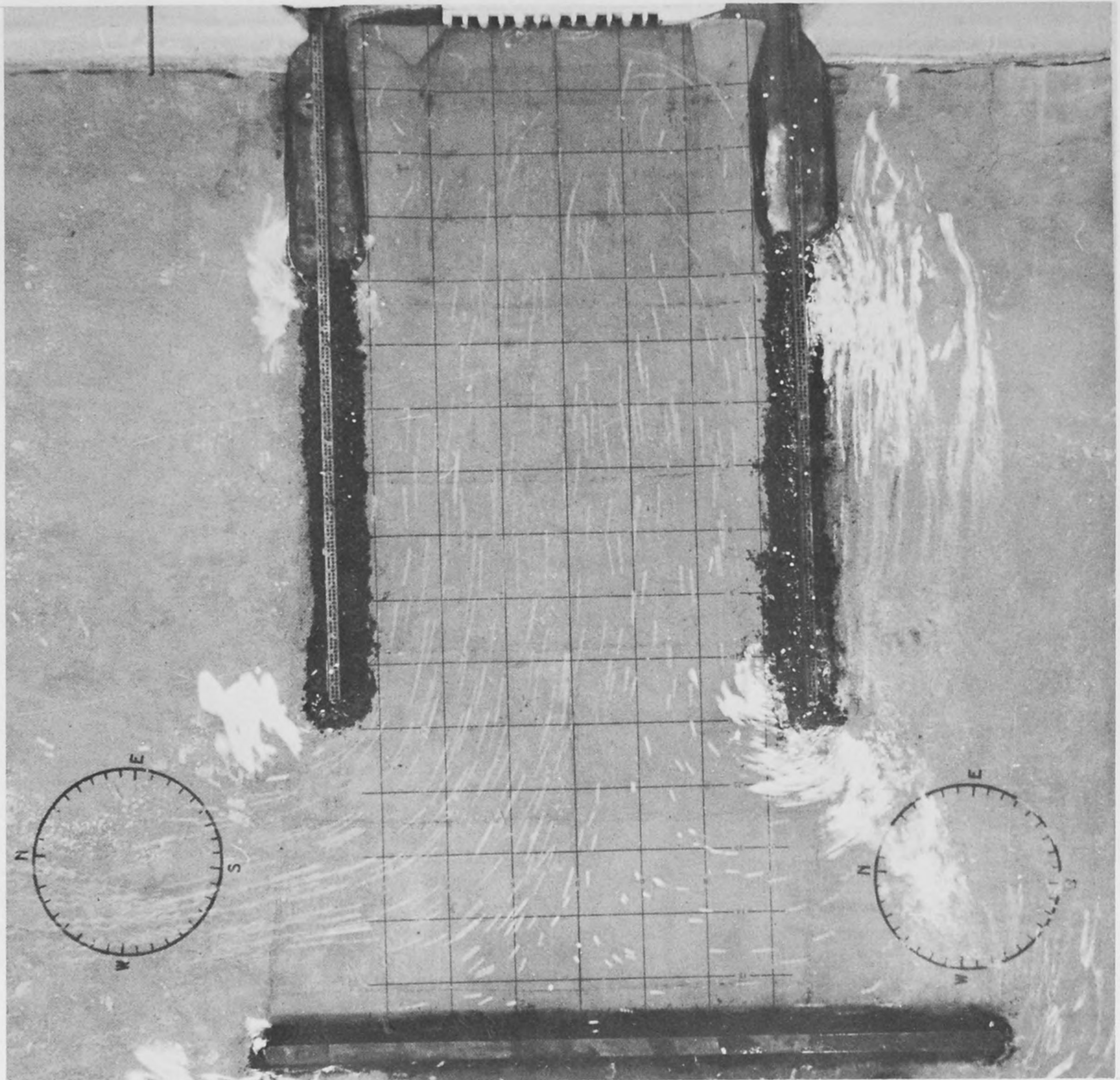
NOV. 1969



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LUDINGTON PUMPED STORAGE PROJECT
LAKE FRONT MODEL
PLATE No. 7

TEST No. 1-12
 SURFACE VELOCITIES: Generating @ 76,000 c.f.s.
 WAVES: North-West
 LITTORAL CURRENT: South
 SCALE: Grid system is in 150' increments NOV. 1969

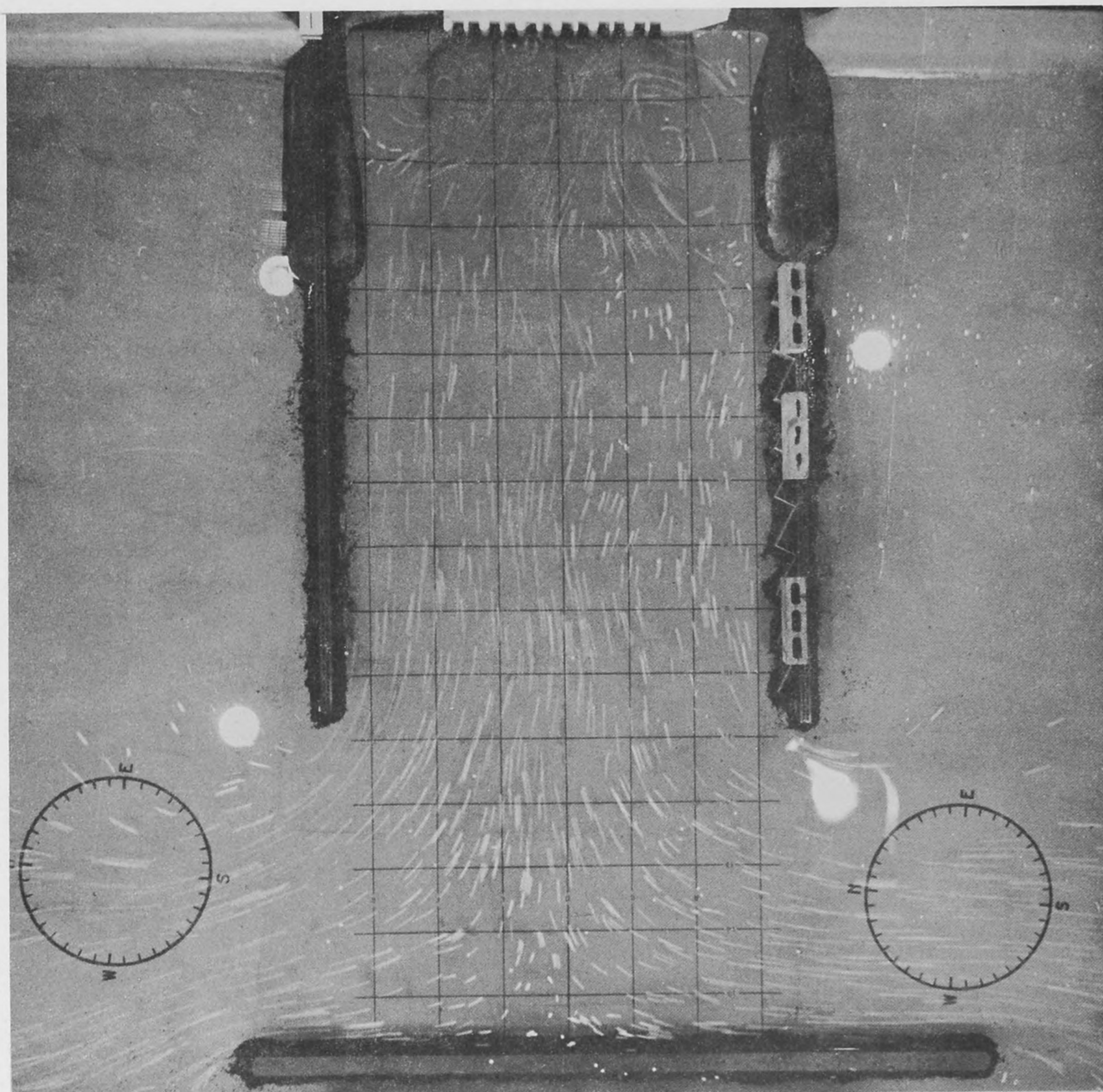


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LUDINGTON PUMPED STORAGE PROJECT
LAKE FRONT MODEL
PLATE No. 8

TEST No. 4-3
SURFACE VELOCITIES: Generating @ 76,000 c.f.s.
WAVES: South-West.
LITTORAL CURRENT: North
SCALE: Grid system is in 150' increments

NOV. 1969

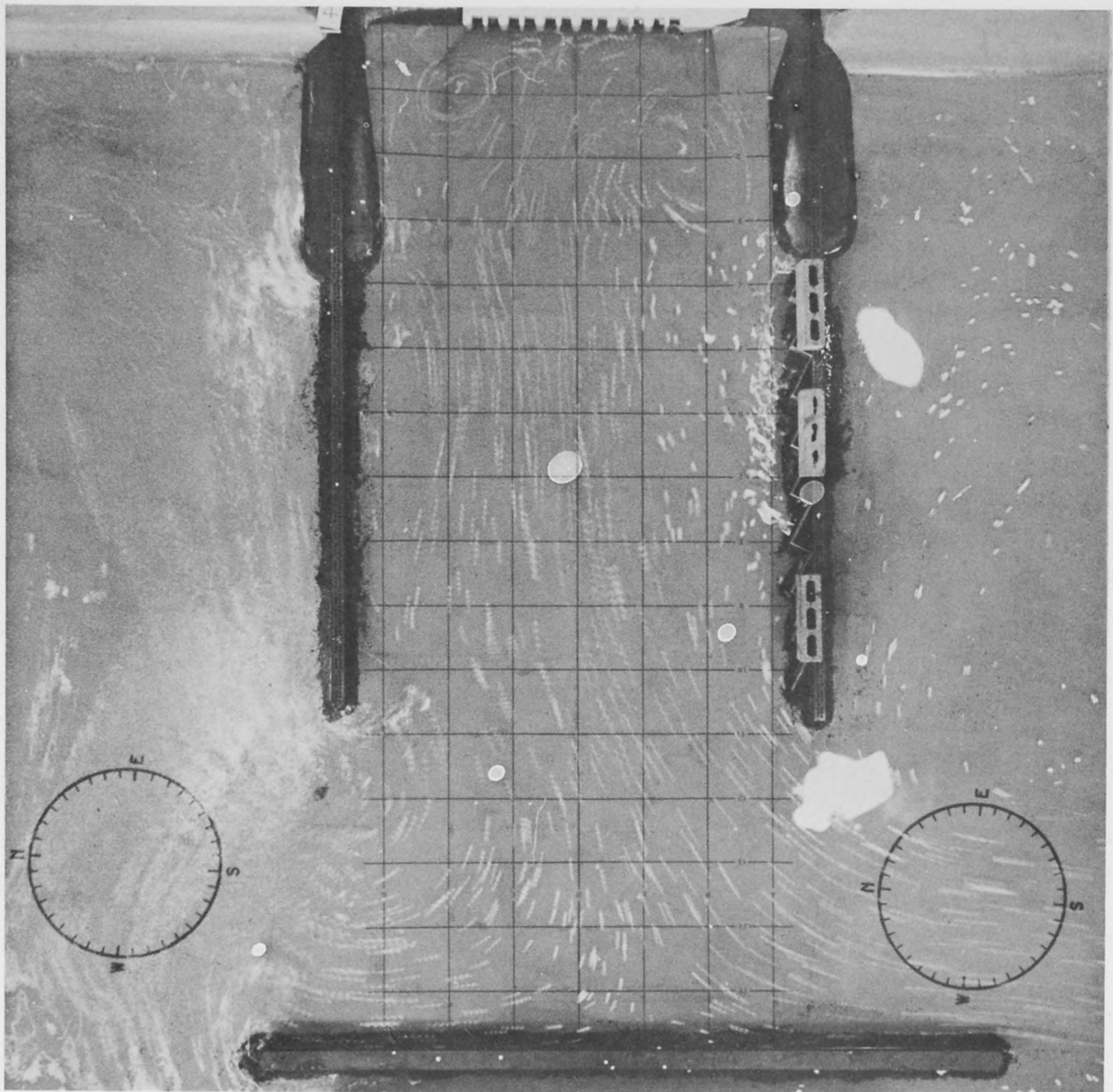


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LUDINGTON PUMPED STORAGE PROJECT
LAKE FRONT MODEL
PLATE No. 9

TEST No. 1-1
SURFACE VELOCITIES: Generating @ 76,000
WAVES: None
LITTORAL CURRENT: None
SCALE: Grid system is in 150' increments

NOV. 1969



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LUDINGTON PUMPED STORAGE PROJECT
LAKE FRONT MODEL
PLATE No. 10

TEST No. 1-3

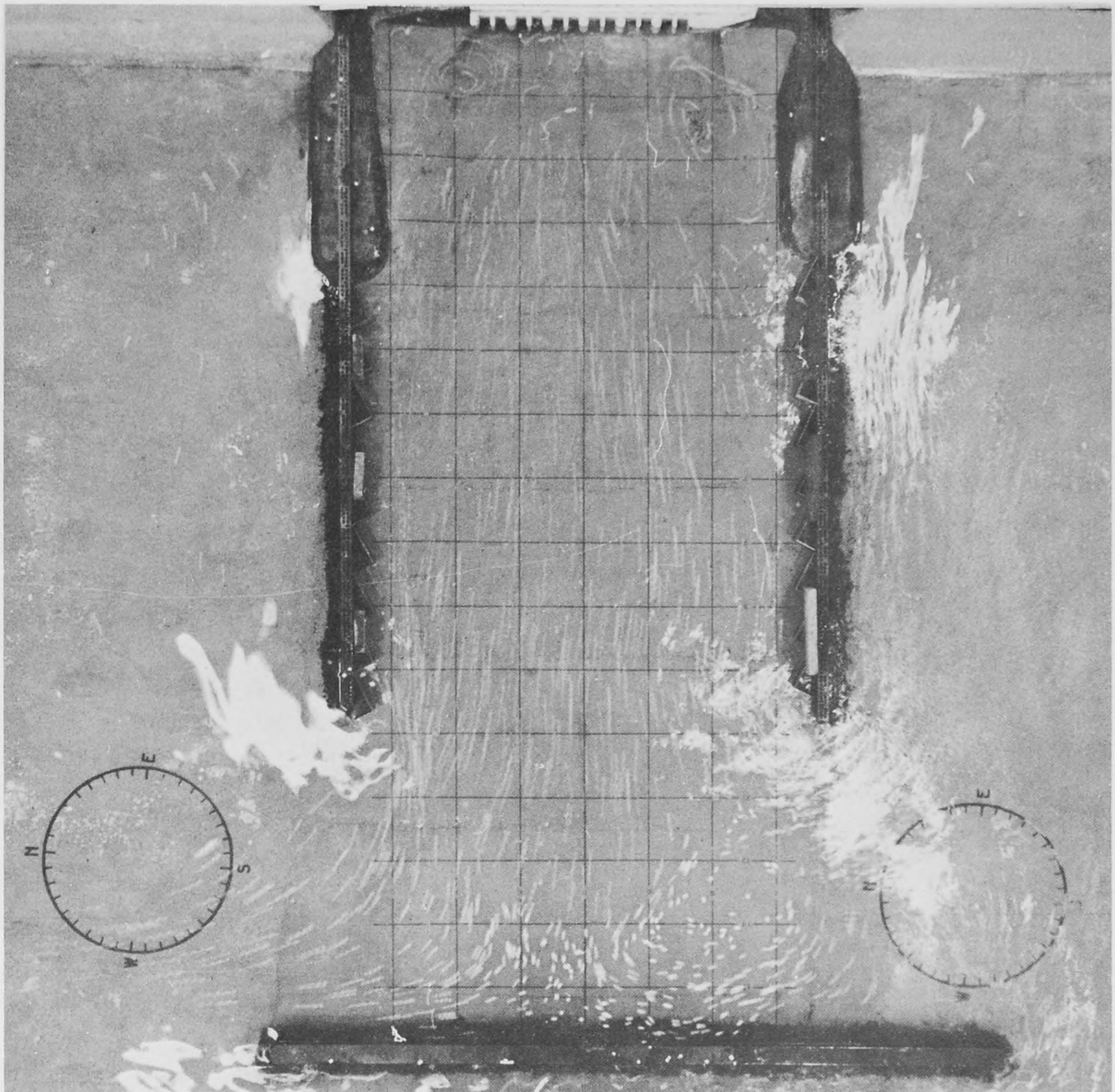
SURFACE VELOCITIES: Generating @ 76,000 c.f.s.

WAVES: North-West

LITTORAL CURRENT: South

SCALE: Grid system is in 150' increments

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LUDINGTON PUMPED STORAGE PROJECT
LAKE FRONT MODEL
PLATE No. II

TEST No. 3-5

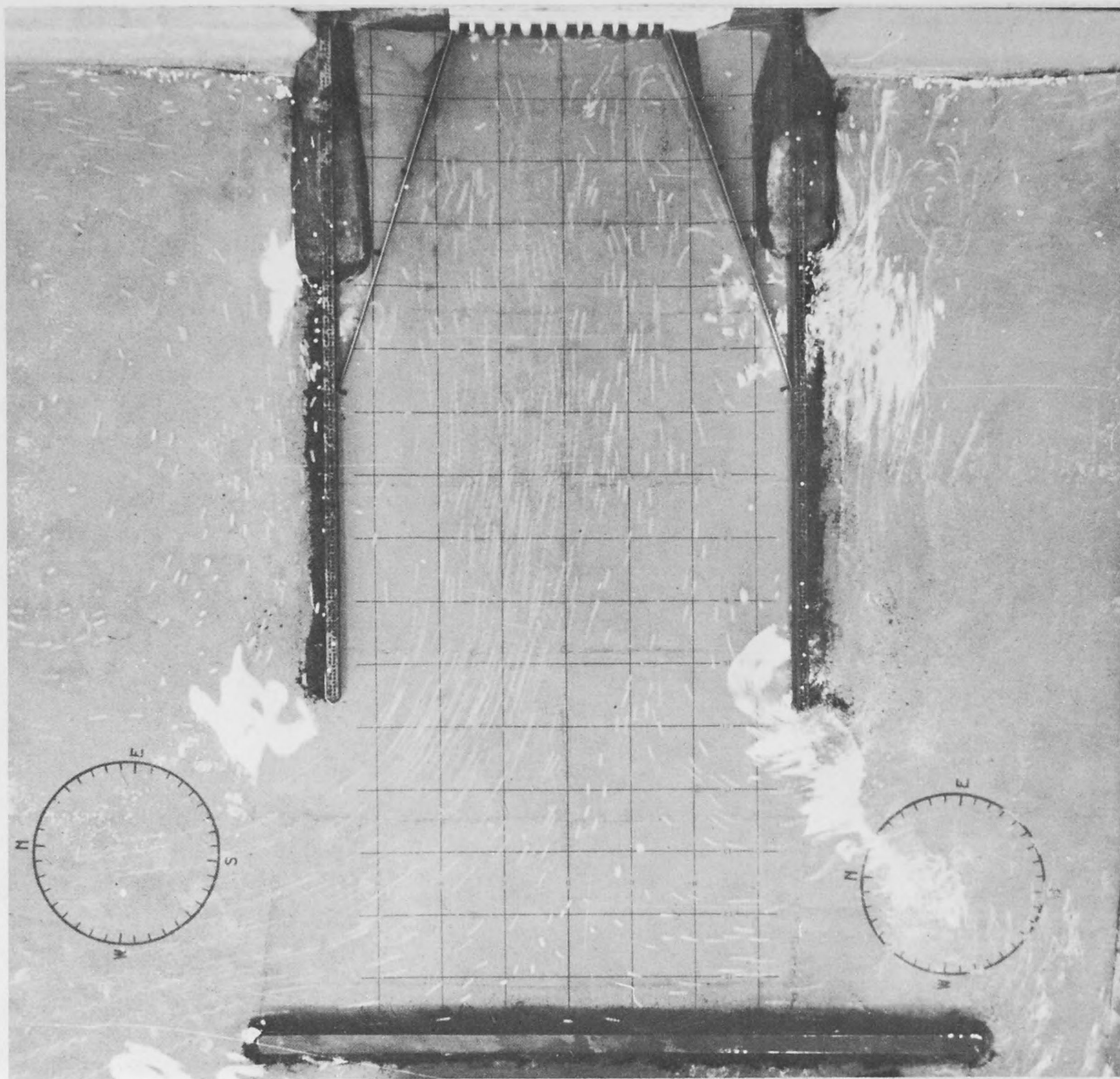
SURFACE VELOCITIES: Generating @ 76,000 c.f.s.

WAVES: South-West.

LITTORAL CURRENT: North

SCALE: Grid system is in 150' increments

NOV. 1969

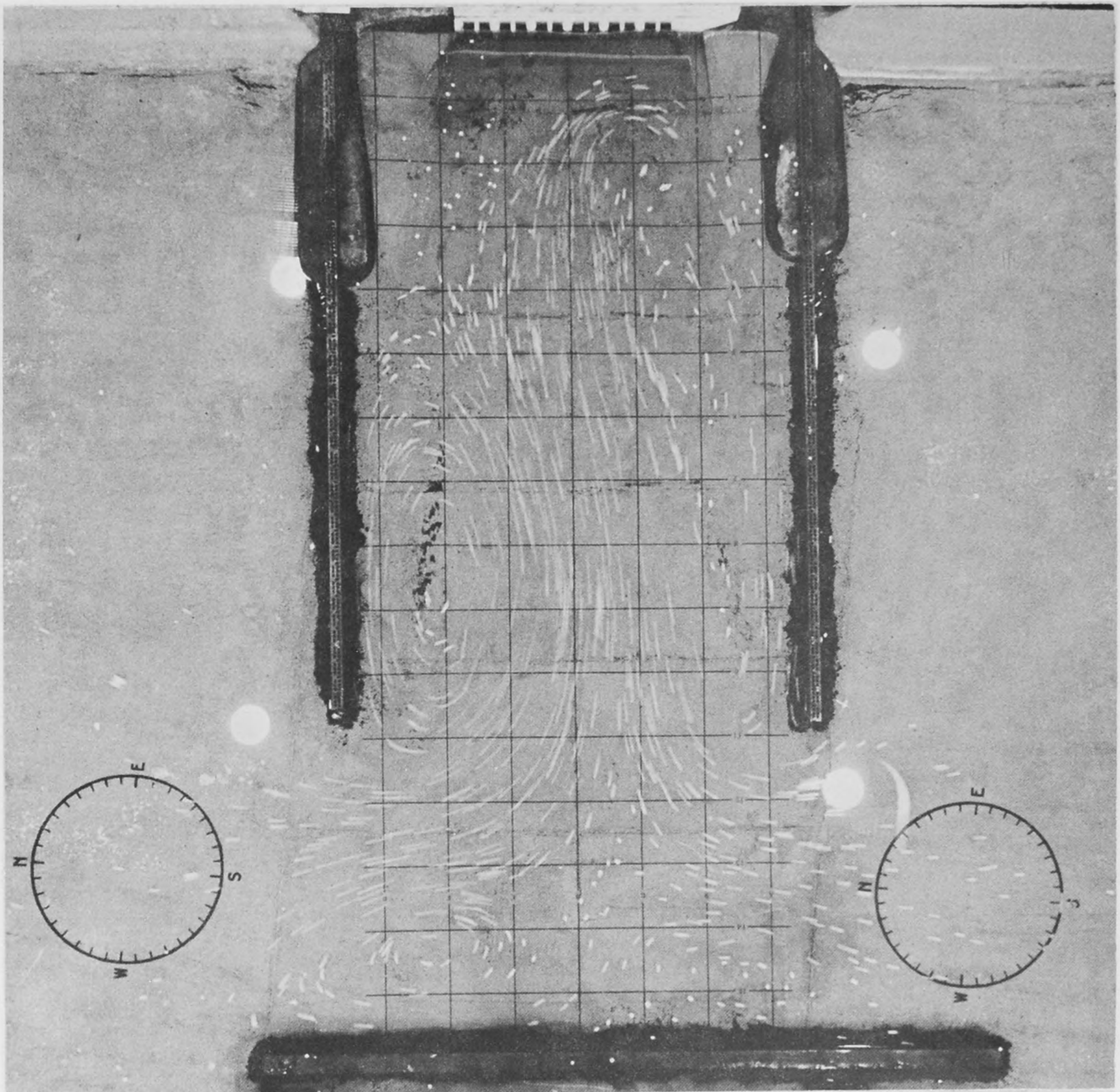


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LUDINGTON PUMPED STORAGE PROJECT
LAKE FRONT MODEL
PLATE No. 12

TEST No. 4-6
SURFACE VELOCITIES: Generating @ 76,000 c.f.s.
WAVES: South-West.
LITTORAL CURRENT: North
SCALE: Grid system is in 150' increments

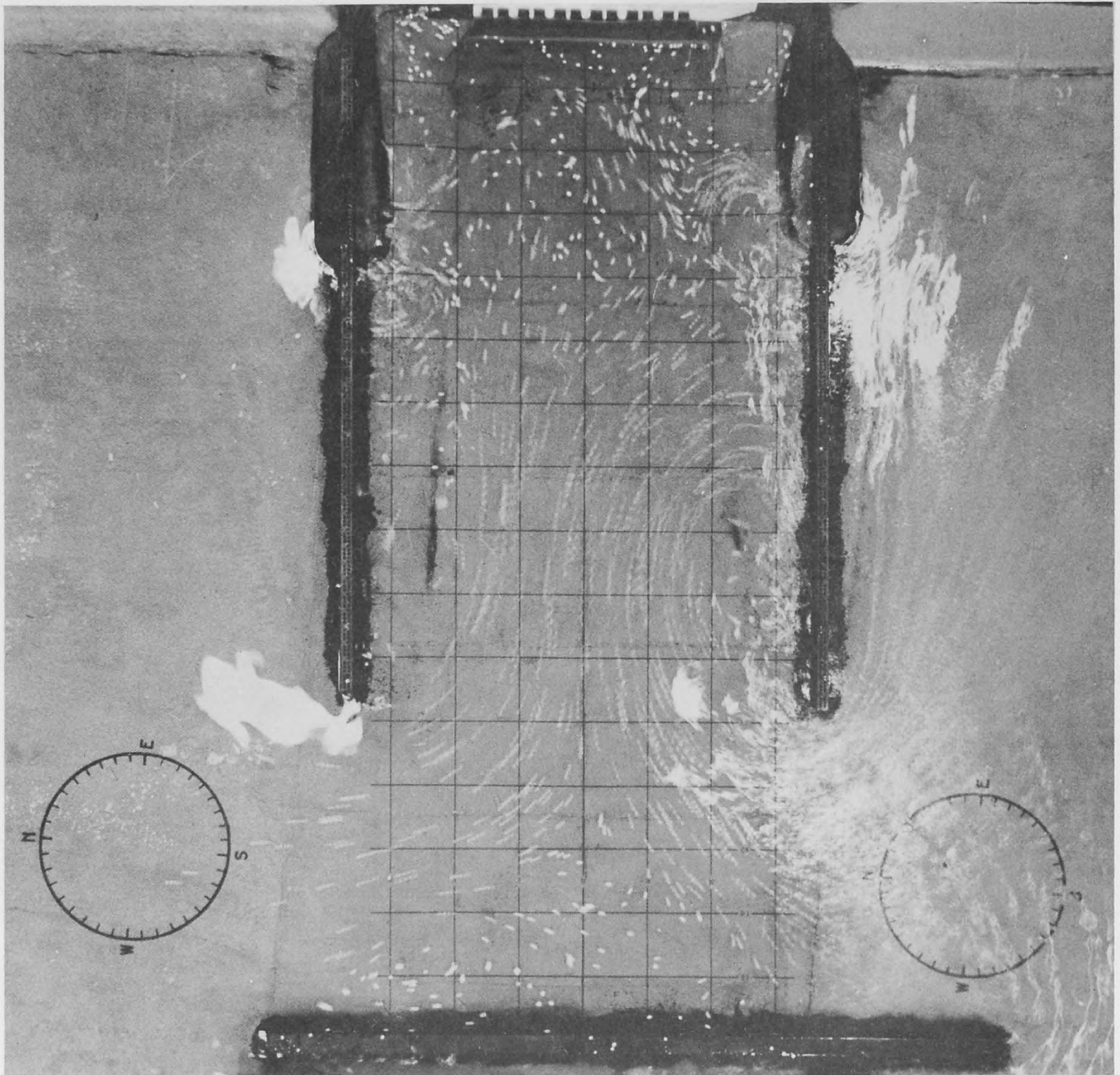
NOV. 1969



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LUDINGTON PUMPED STORAGE PROJECT
LAKE FRONT MODEL
PLATE No. 13

TEST No. 2-1
SURFACE VELOCITIES: Pumping @ 66,000 c.f.s.
WAVES: None
LITTORAL CURRENT: None
SCALE: Grid system is in 150' increments NOV. 1969



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LUDINGTON PUMPED STORAGE PROJECT
LAKE FRONT MODEL
PLATE No. 14

TEST No. 2-2

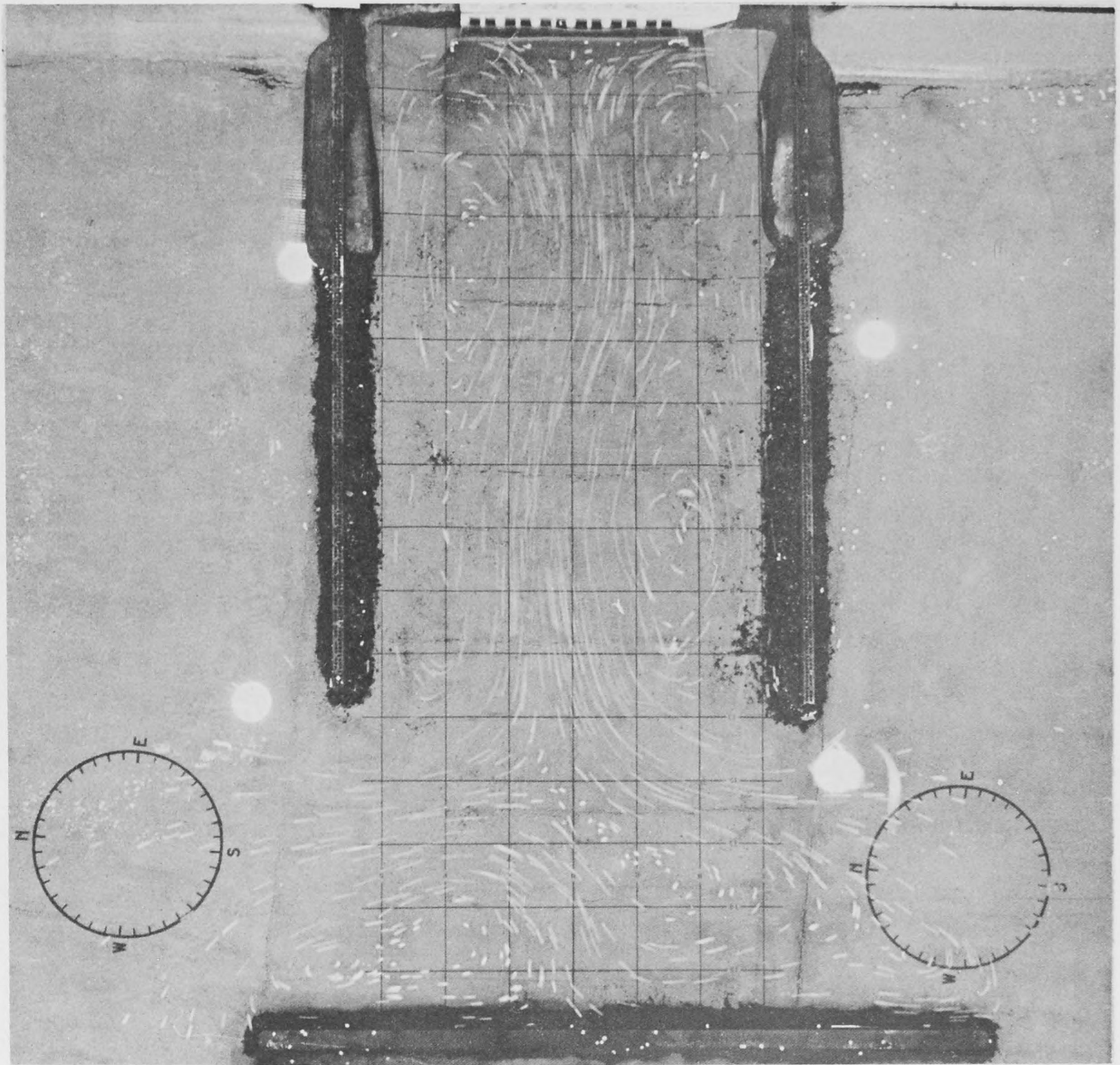
SURFACE VELOCITIES: Pumping @ 66,000 c.f.s.

WAVES: South - West

LITTORAL CURRENT: North

SCALE: Grid system is in 150' increments

NOV. 1969



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LUDINGTON PUMPED STORAGE PROJECT
LAKE FRONT MODEL
PLATE No. 15

TEST No. 2-3

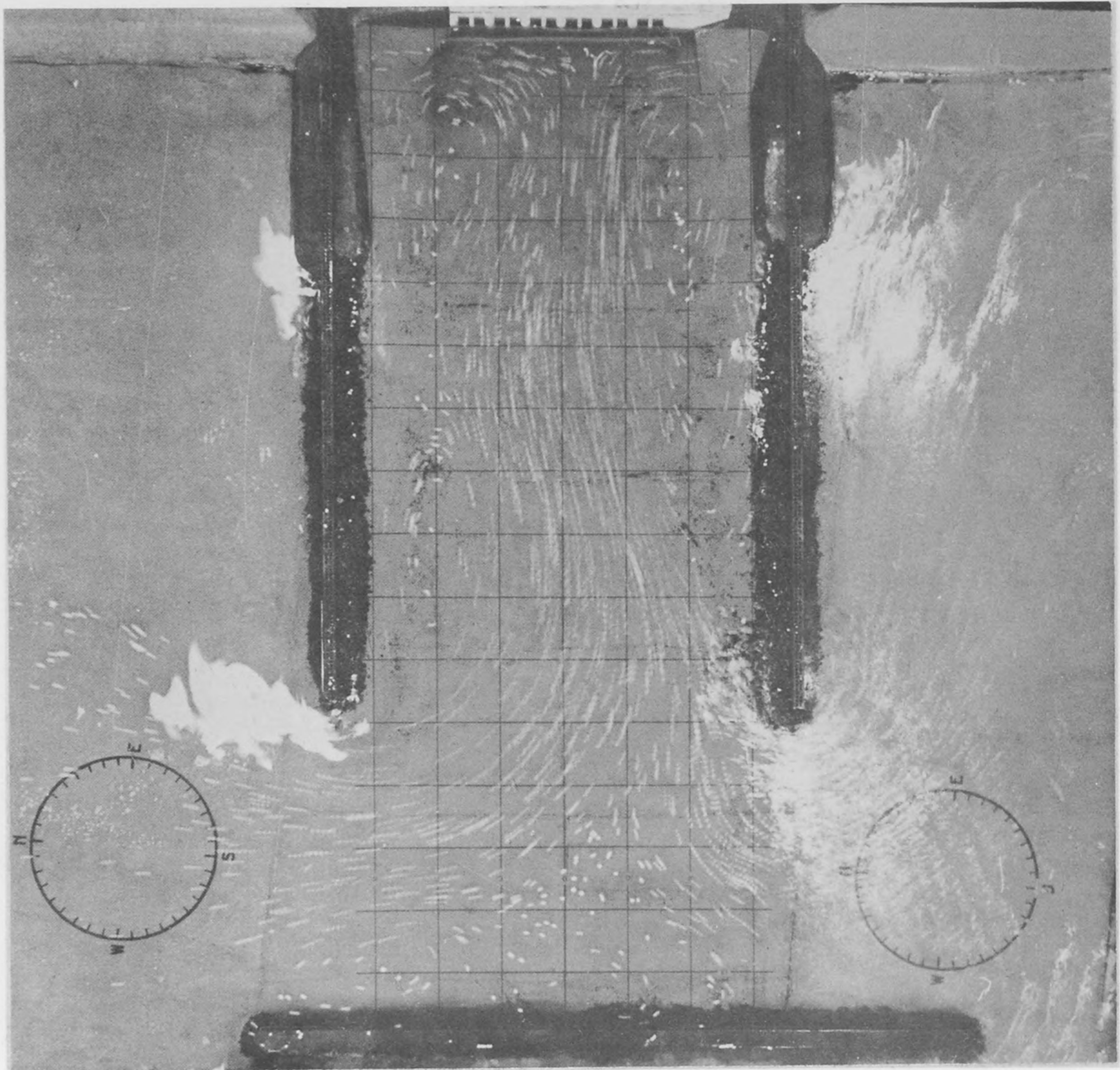
SURFACE VELOCITIES: Pumping @ 66,000 c.f.s.

WAVES: None

LITTORAL CURRENT: None

SCALE: Grid system is in 150' increments

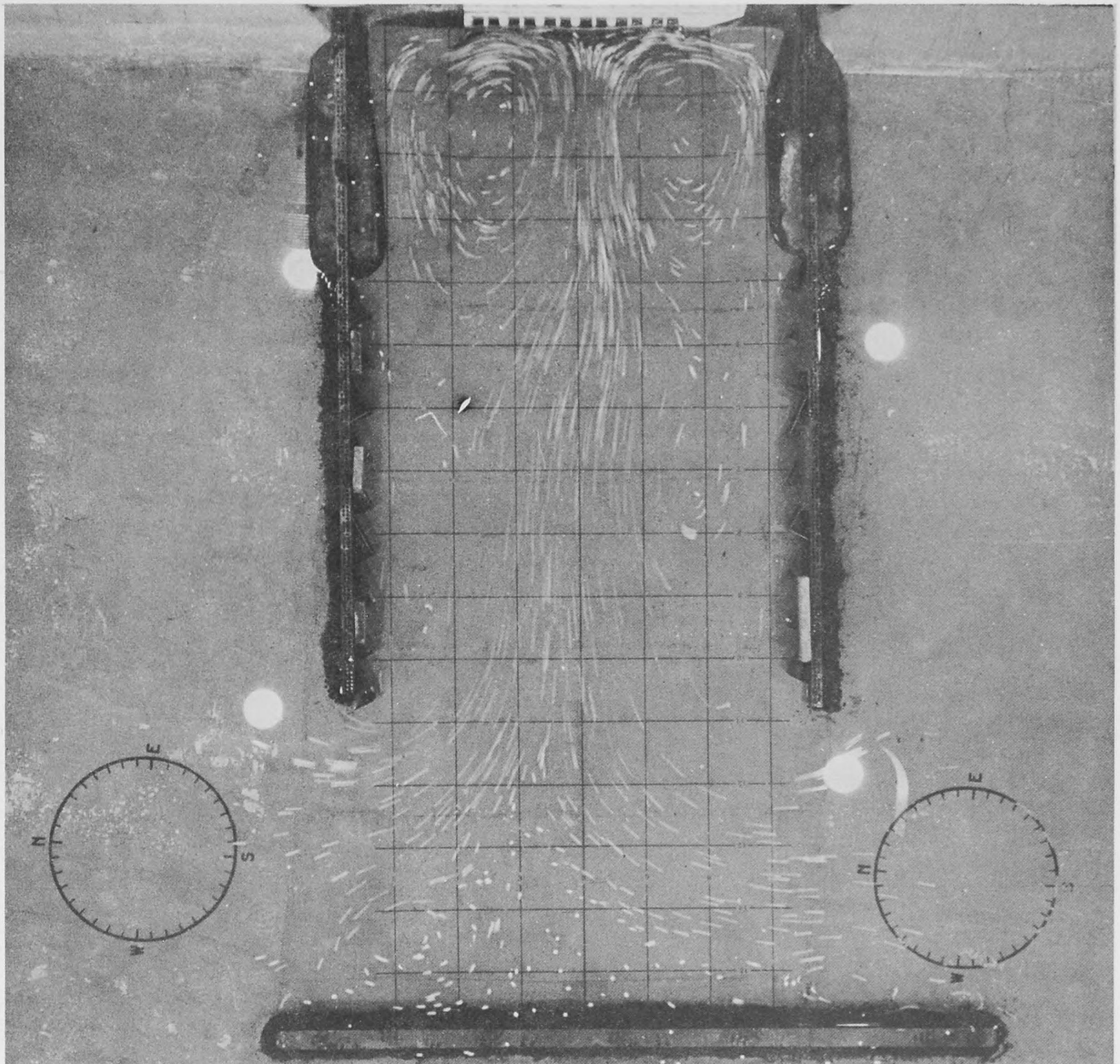
NOV. 1969



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LUDINGTON PUMPED STORAGE PROJECT
LAKE FRONT MODEL
PLATE No. 16

TEST No. 2-4
SURFACE VELOCITIES: Pumping @ 66,000 c.f.s.
WAVES: South - West
LITTORAL CURRENT: North
SCALE: Grid system is in 150' increments NOV. 1969

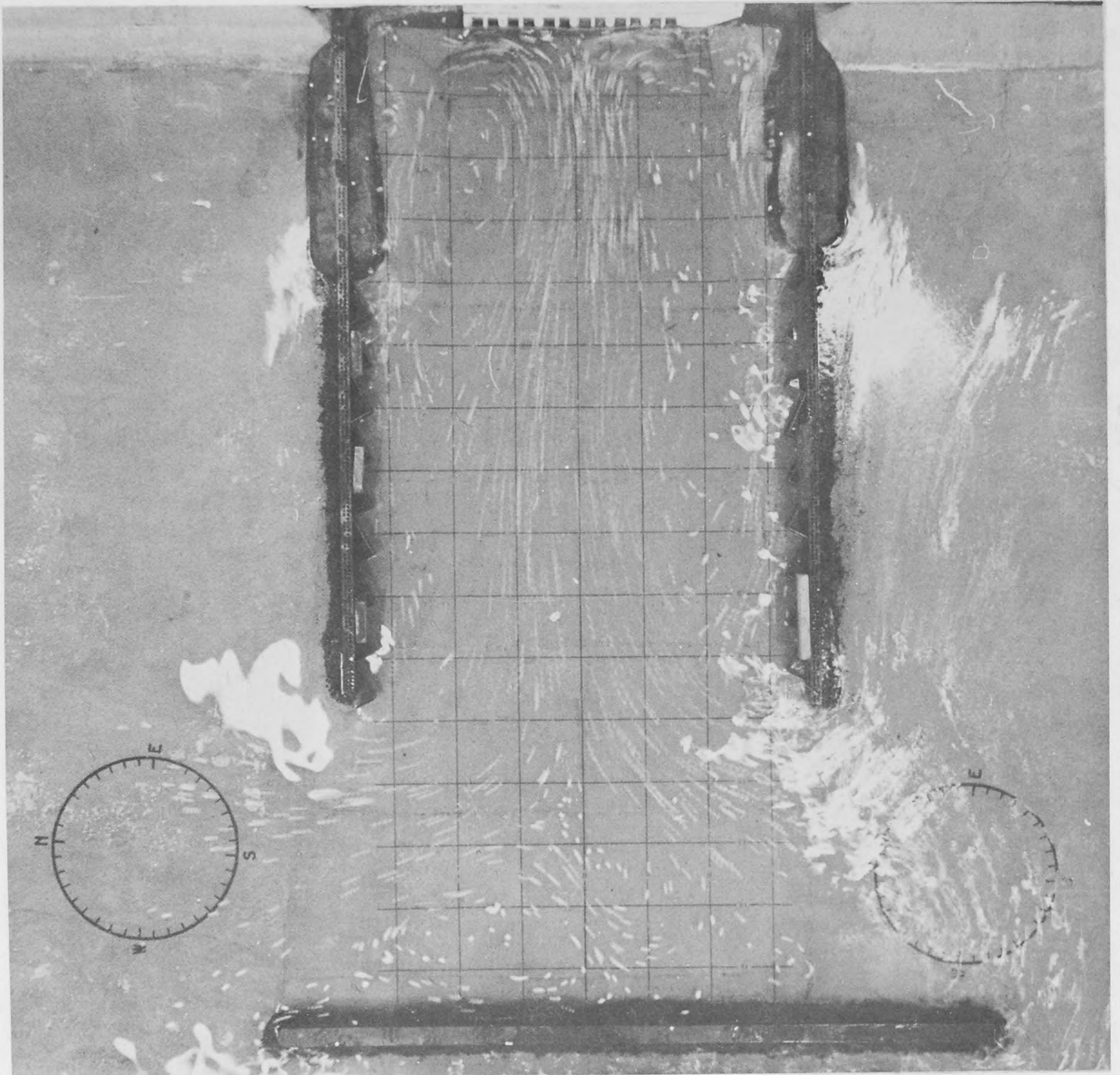


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LUDINGTON PUMPED STORAGE PROJECT
LAKE FRONT MODEL
PLATE No. 17

TEST No. 3-3
SURFACE VELOCITIES: Pumping @ 66,000 c.f.s.
WAVES: None
LITTORAL CURRENT: None
SCALE: Grid system is in 150' increments

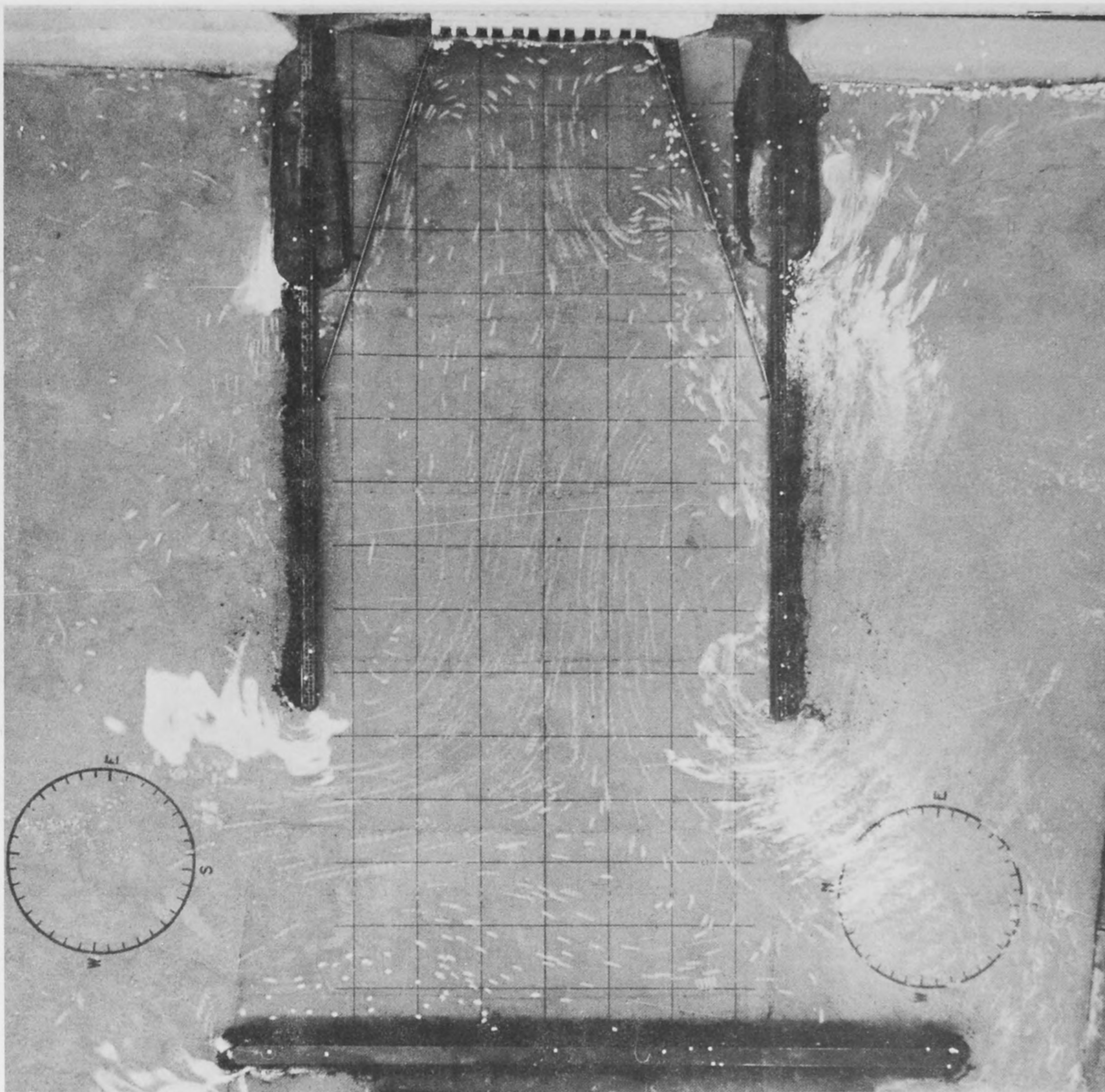
NOV. 1969



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LUDINGTON PUMPED STORAGE PROJECT
LAKE FRONT MODEL
PLATE No. 18

TEST No. 3-4
SURFACE VELOCITIES: Pumping @ 66,000 c.f.s.
WAVES: South - West
LITTORAL CURRENT: North
SCALE: Grid system is in 150' increments NOV. 1969



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LUDINGTON PUMPED STORAGE PROJECT
LAKE FRONT MODEL
PLATE No. 19

TEST No. 4-7

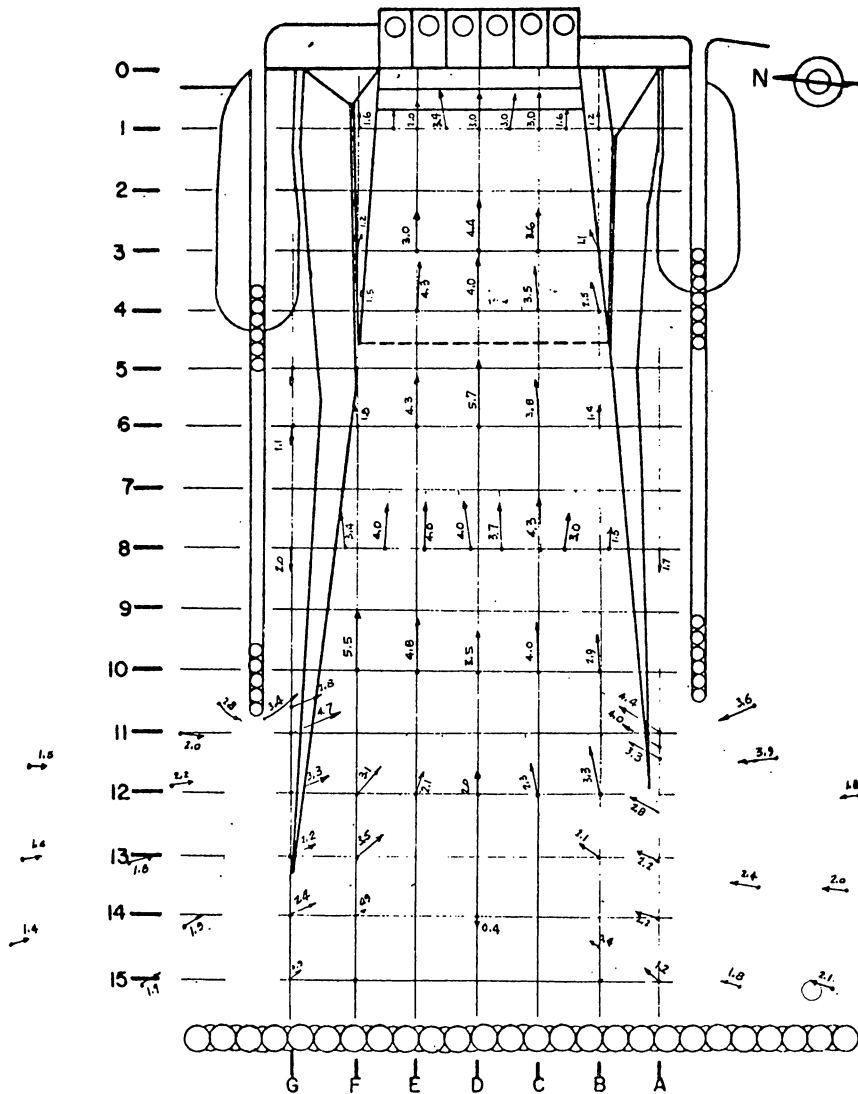
SURFACE VELOCITIES: Pumping @ 66,000 c.f.s.

WAVES: South - West

LITTORAL CURRENT: North

SCALE: Grid system is in 150' increments

NOV. 1969



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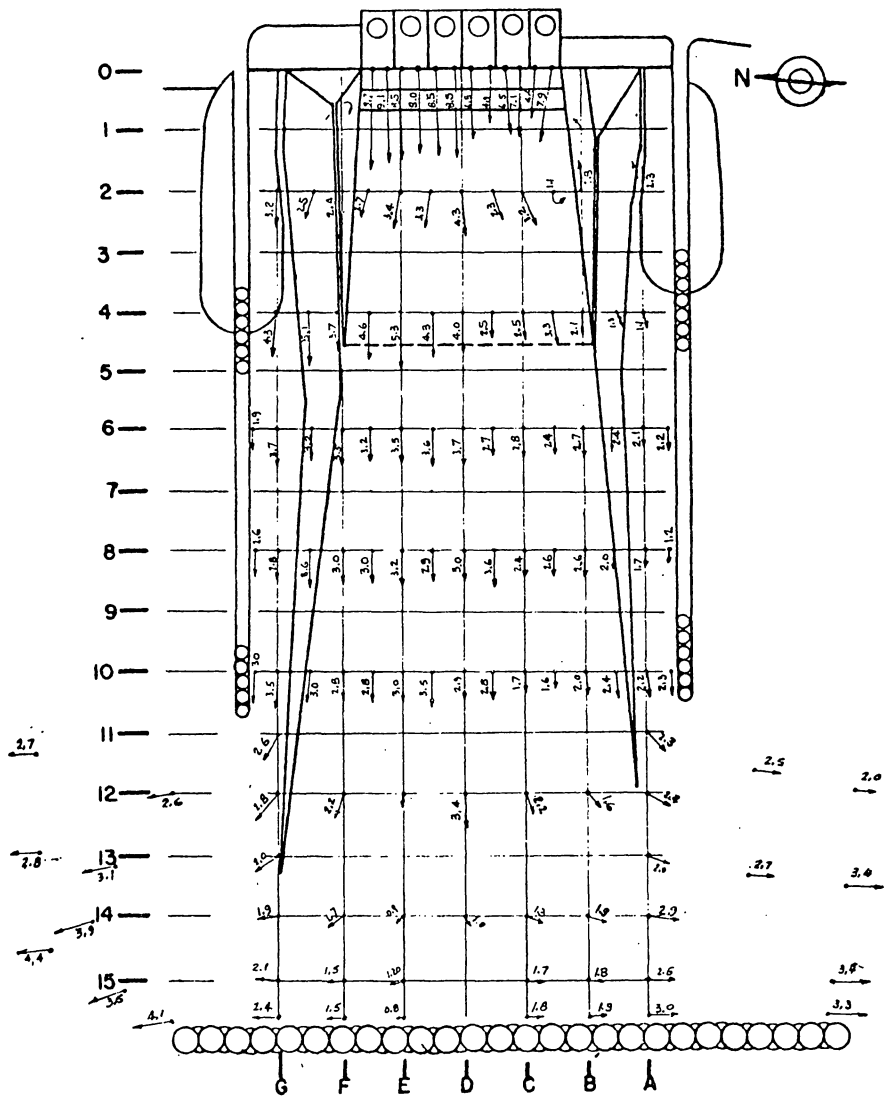
LUDINGTON PUMPED STORAGE PROJECT
LAKE FRONT MODEL

PLATE No. 20

TEST No. 1

BOTTOM VELOCITIES: Pumping @ 66,000 c.f.s.

SCALE: Grid system is in 150' increments NOV. 1969



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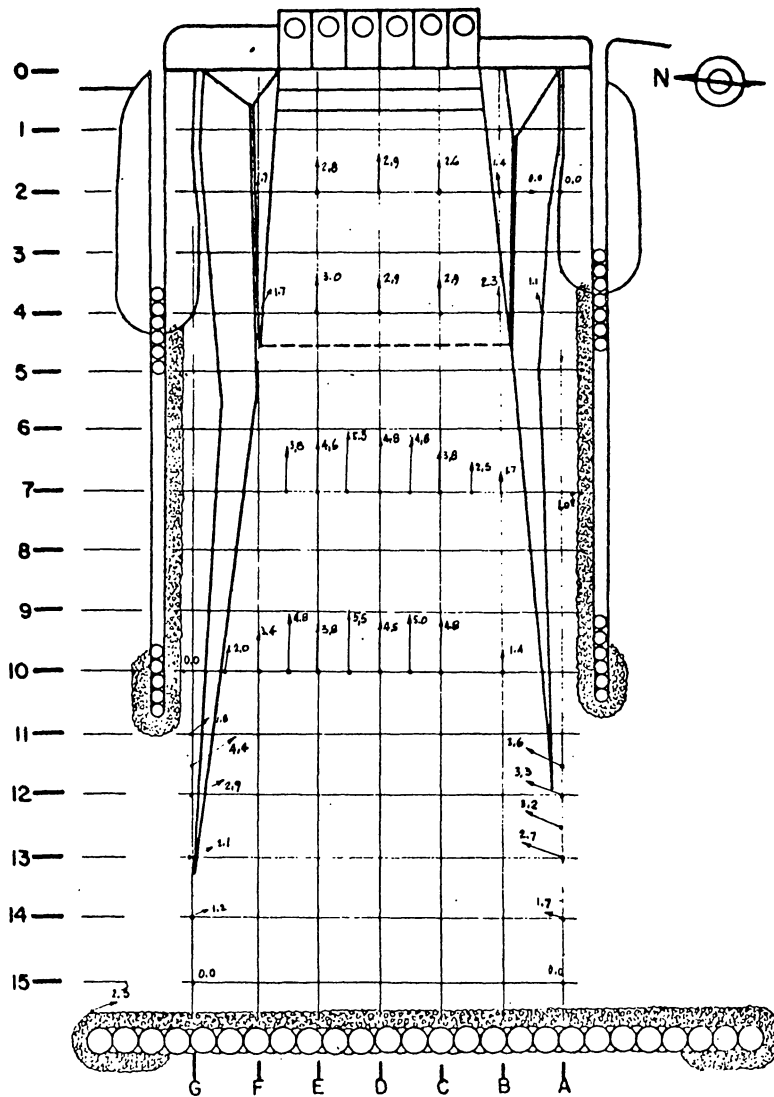
LUDINGTON PUMPED STORAGE PROJECT
LAKE FRONT MODEL

PLATE No. 21

TEST No. 2

BOTTOM VELOCITIES: Generating @ 76,000 cfs.

SCALE: Grid system is in 150' increments NOV. 1969



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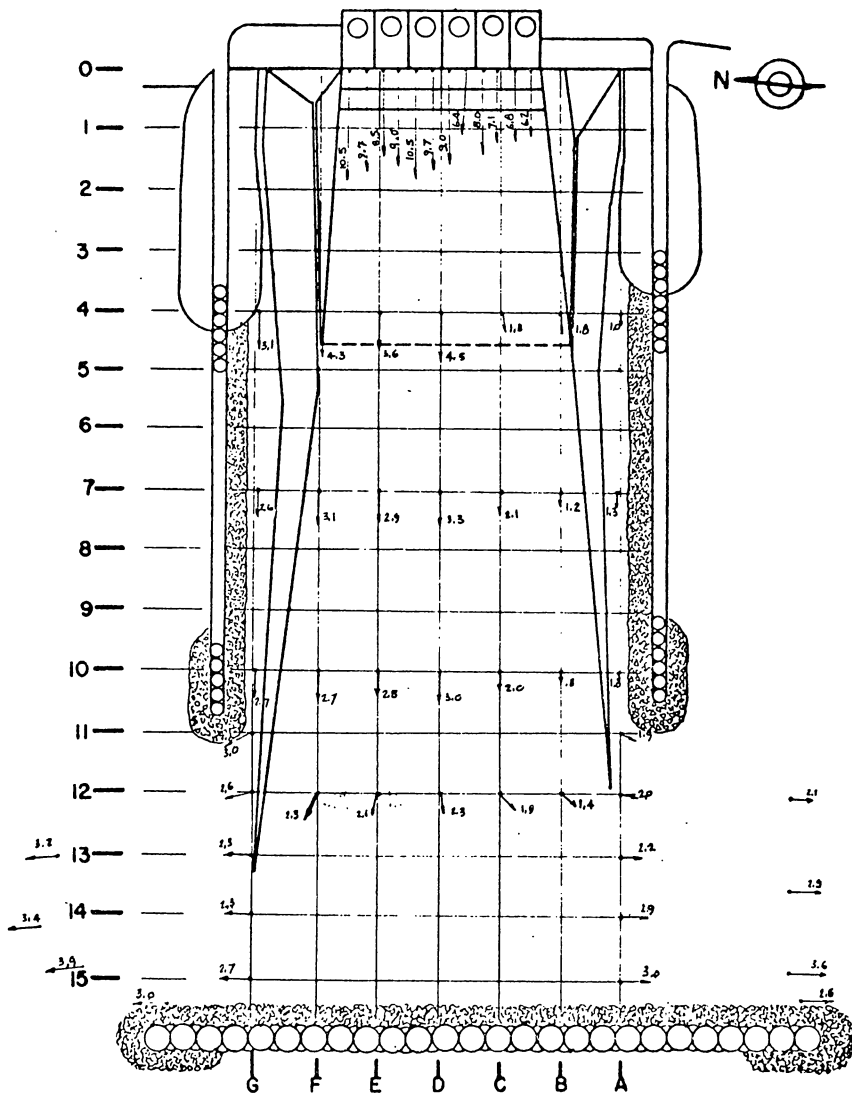
LUDINGTON PUMPED STORAGE PROJECT
LAKE FRONT MODEL

PLATE No. 22

TEST No. 3

BOTTOM VELOCITIES: Pumping @ 66,000 c.f.s.

SCALE: Grid system is in 150' increments NOV. 1969



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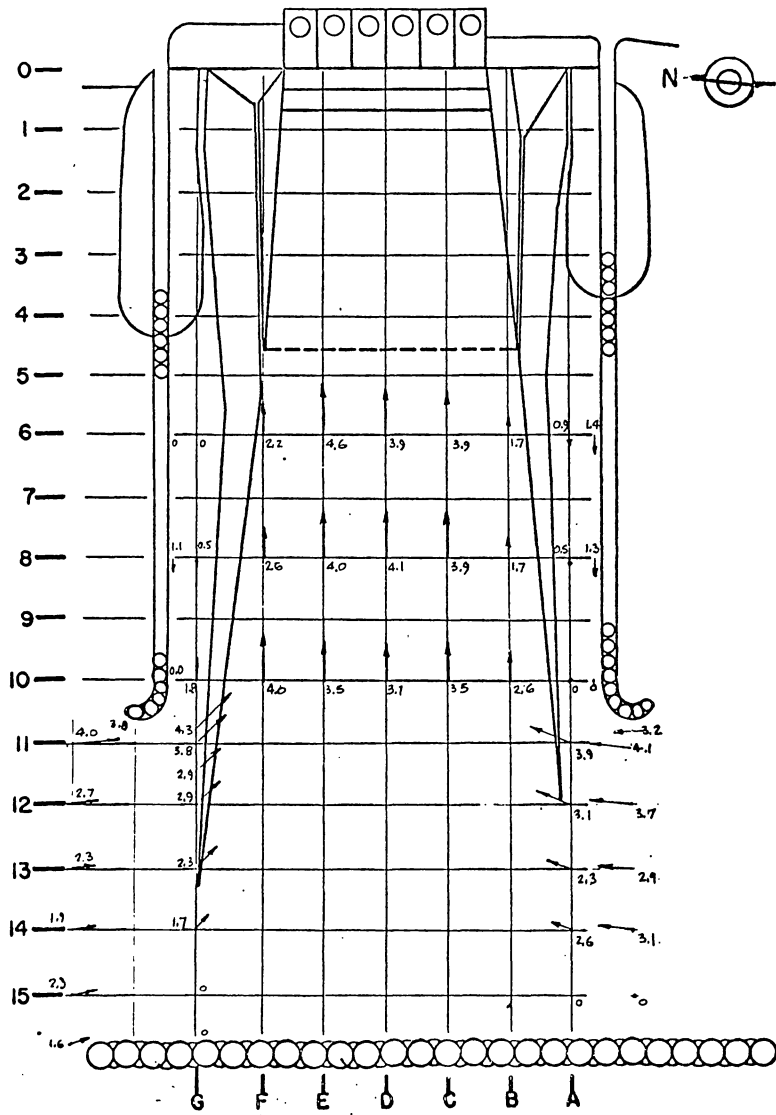
LUDINGTON PUMPED STORAGE PROJECT
LAKE FRONT MODEL

PLATE No. 23

TEST No. 4

BOTTOM VELOCITIES: Generating @ 76,000 cfs.

SCALE: Grid system is in 150' increments NOV. 1969



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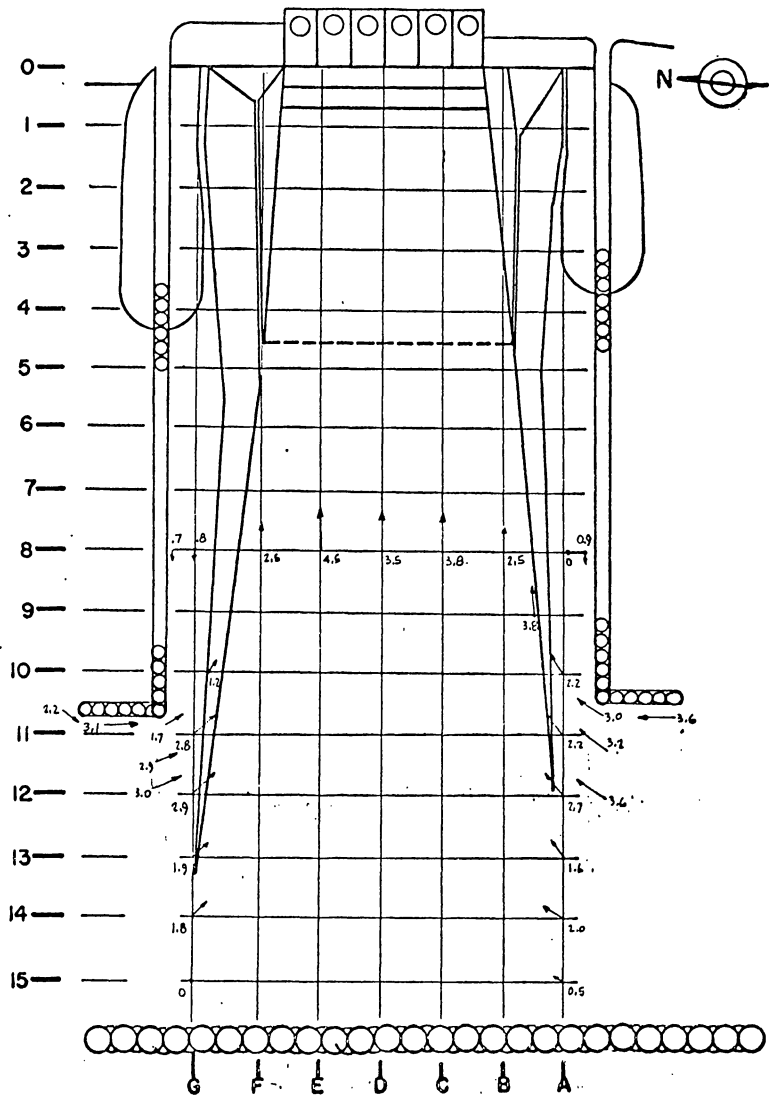
LUDINGTON PUMPED STORAGE PROJECT
LAKE FRONT MODEL

PLATE No. 24

TEST No. 16

BOTTOM VELOCITIES: Pumping @ 66,000 c.f.s.

SCALE: Grid system is in 150' increments NOV. 1969



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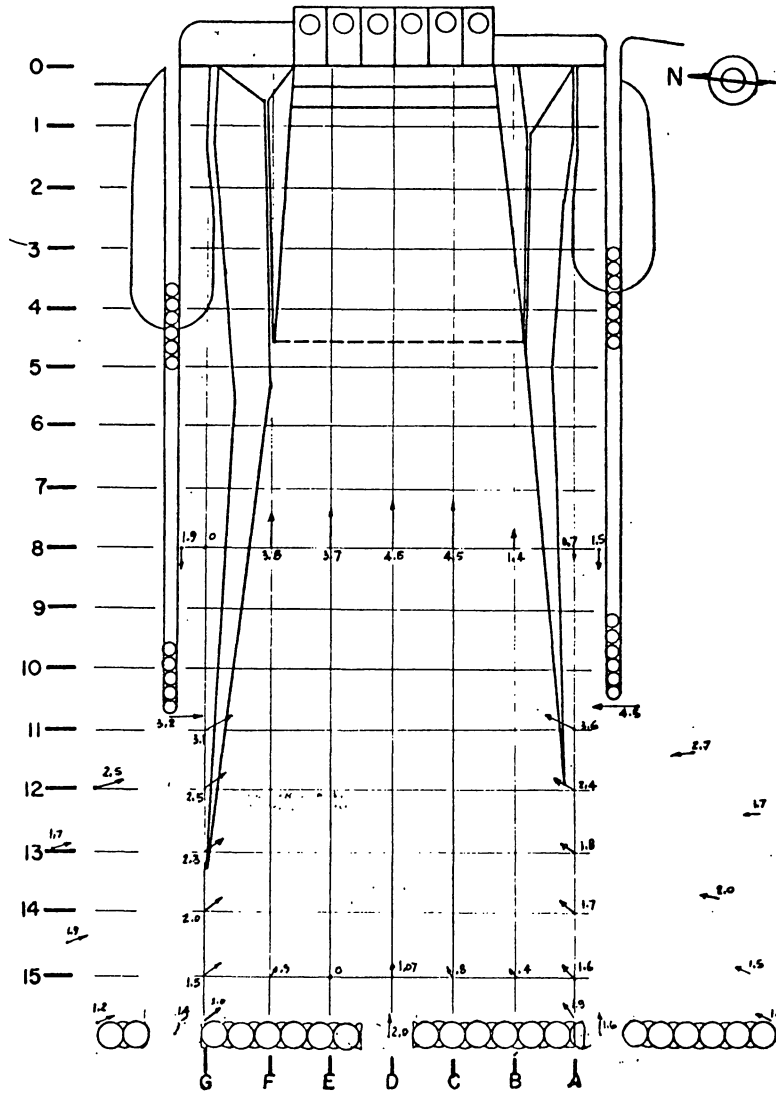
LUDINGTON PUMPED STORAGE PROJECT
LAKE FRONT MODEL

PLATE No. 25

TEST No. 6

BOTTOM VELOCITIES: Pumping @ 66,000 c.f.s.

SCALE: Grid system is in 150' increments NOV. 1969



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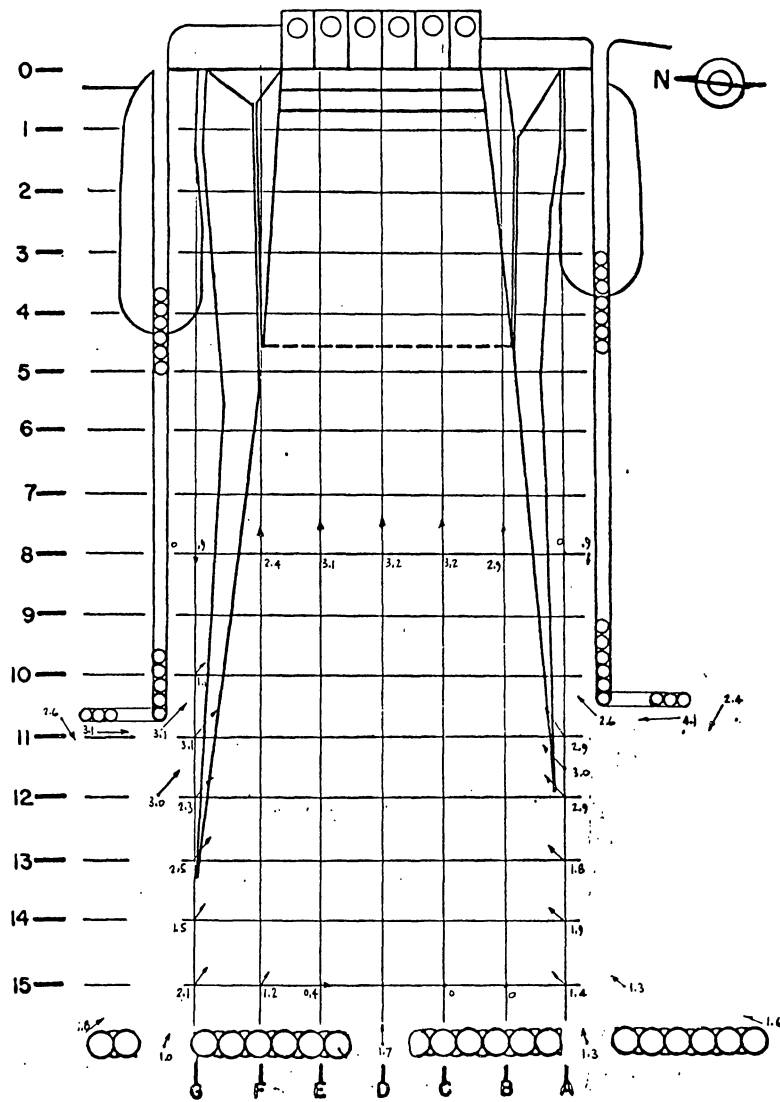
LUDINGTON PUMPED STORAGE PROJECT
LAKE FRONT MODEL

PLATE No. 26

TEST No. 15

BOTTOM VELOCITIES: Pumping @ 66,000 c.f.s.

SCALE: Grid system is in 150' increments NOV. 1969

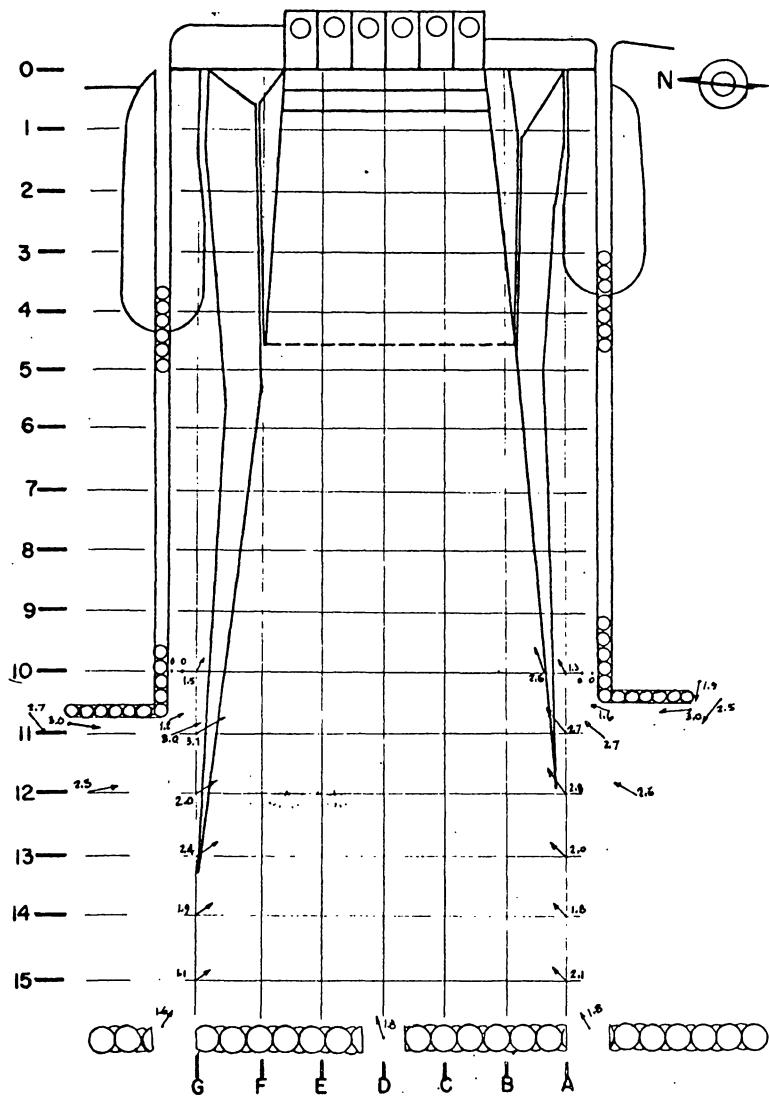


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LUDINGTON PUMPED STORAGE PROJECT
LAKE FRONT MODEL

PLATE No. 27

TEST No. 7
BOTTOM VELOCITIES: Pumping @ 66,000 c.f.s.
SCALE: Grid system is in 150' increments NOV. 1969



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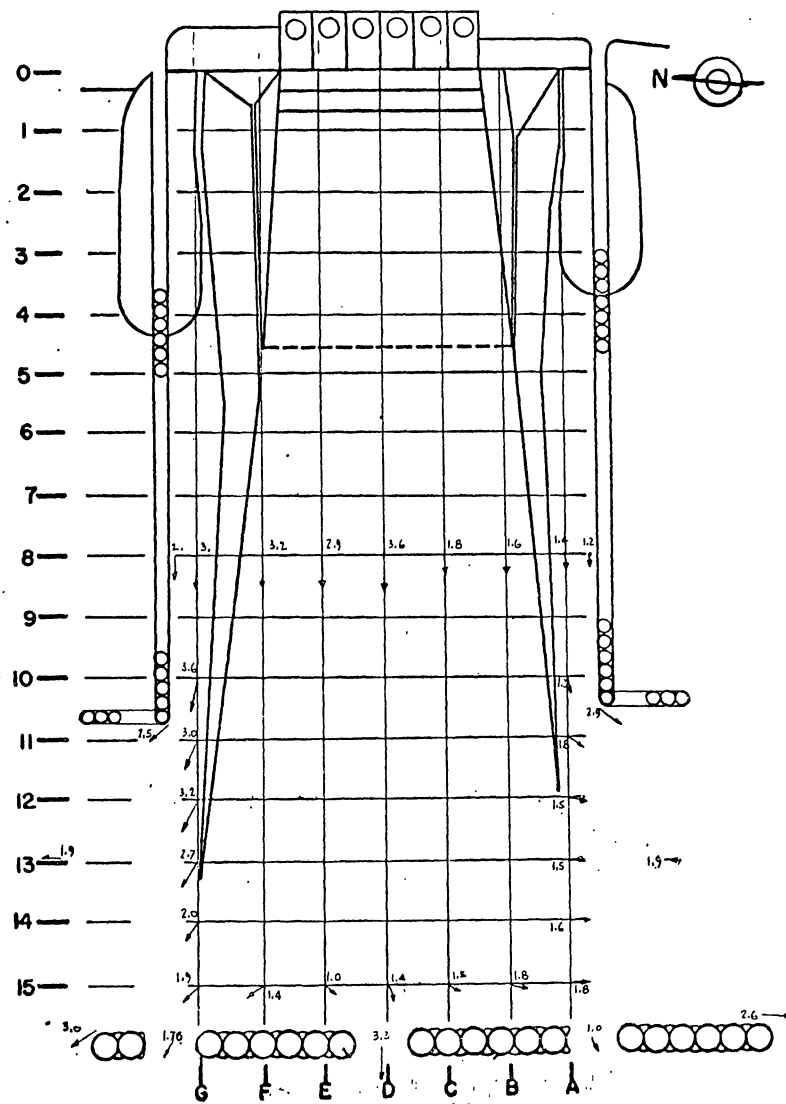
LUDINGTON PUMPED STORAGE PROJECT
LAKE FRONT MODEL

PLATE No. 28

TEST No. 7a

BOTTOM VELOCITIES: Pumping @ 66,000 c.f.s.

SCALE: Grid system is in 150' increments NOV. 1969



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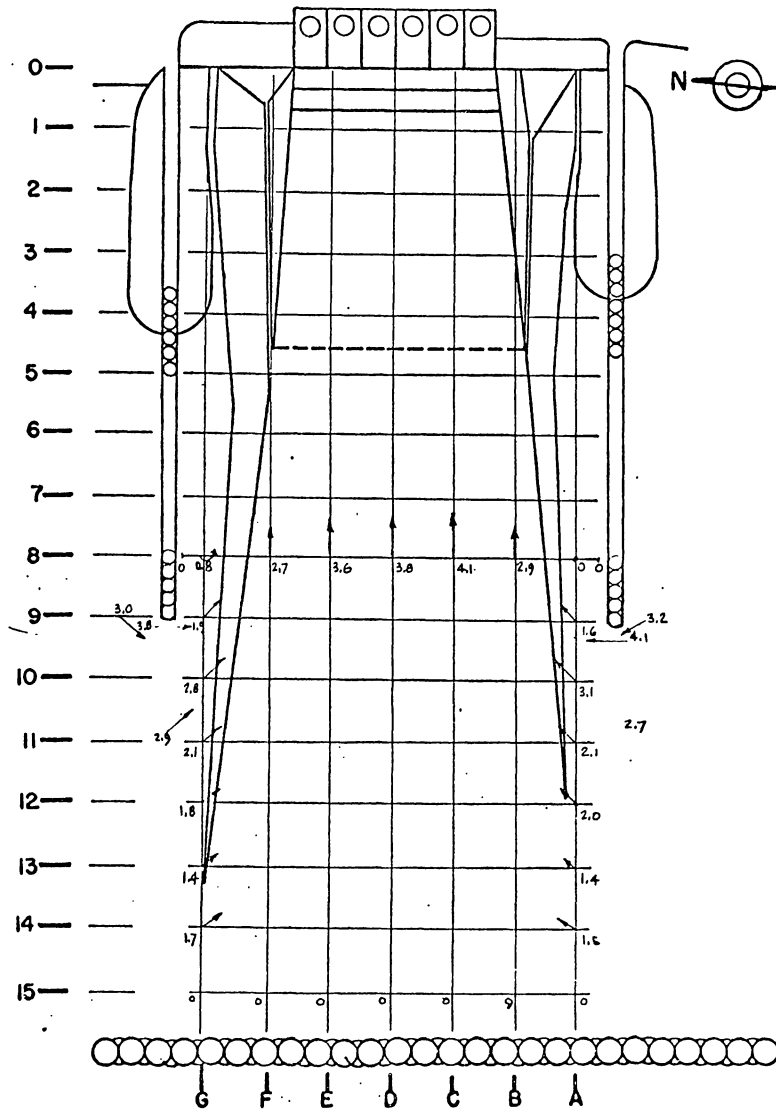
LUDINGTON PUMPED STORAGE PROJECT
LAKE FRONT MODEL

PLATE No. 29

TEST No. 5

BOTTOM VELOCITIES: Generating @ 76,000 cfs.

SCALE: Grid system is in 150' increments. NOV. 1969



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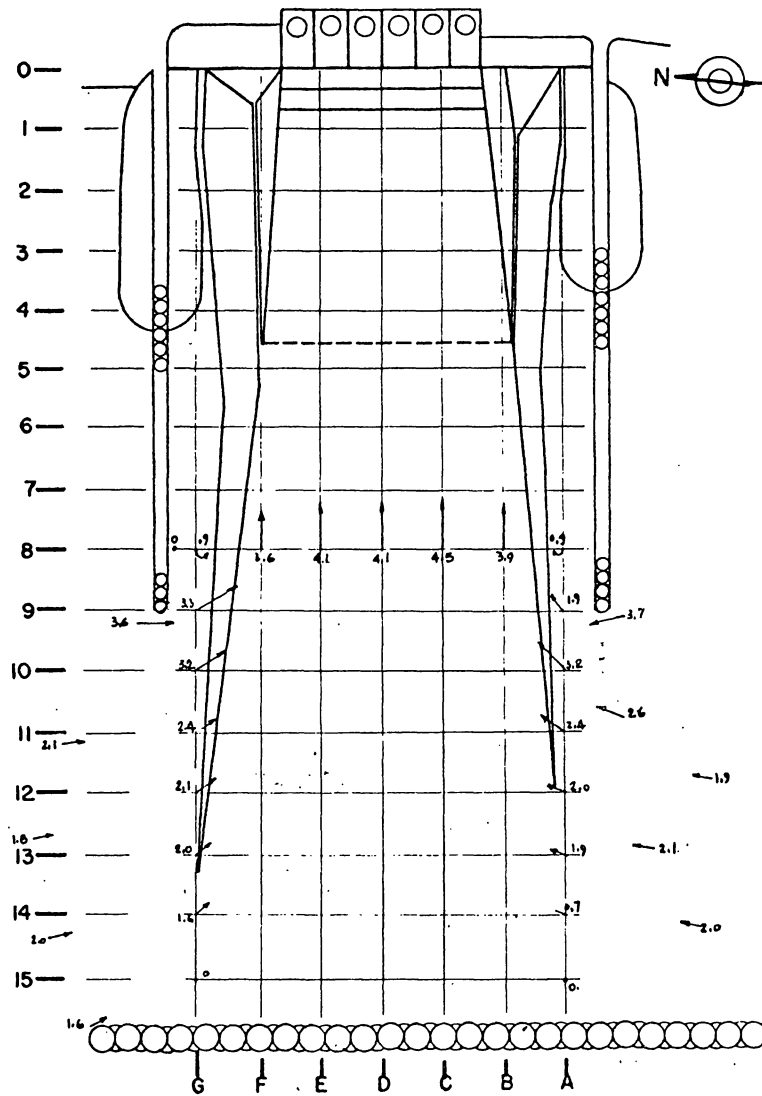
LUDINGTON PUMPED STORAGE PROJECT
LAKE FRONT MODEL

PLATE No. 31

TEST No. 9

BOTTOM VELOCITIES: Pumping @ 66,000 c.f.s.

SCALE: Grid system is in 150' increments NOV. 1969

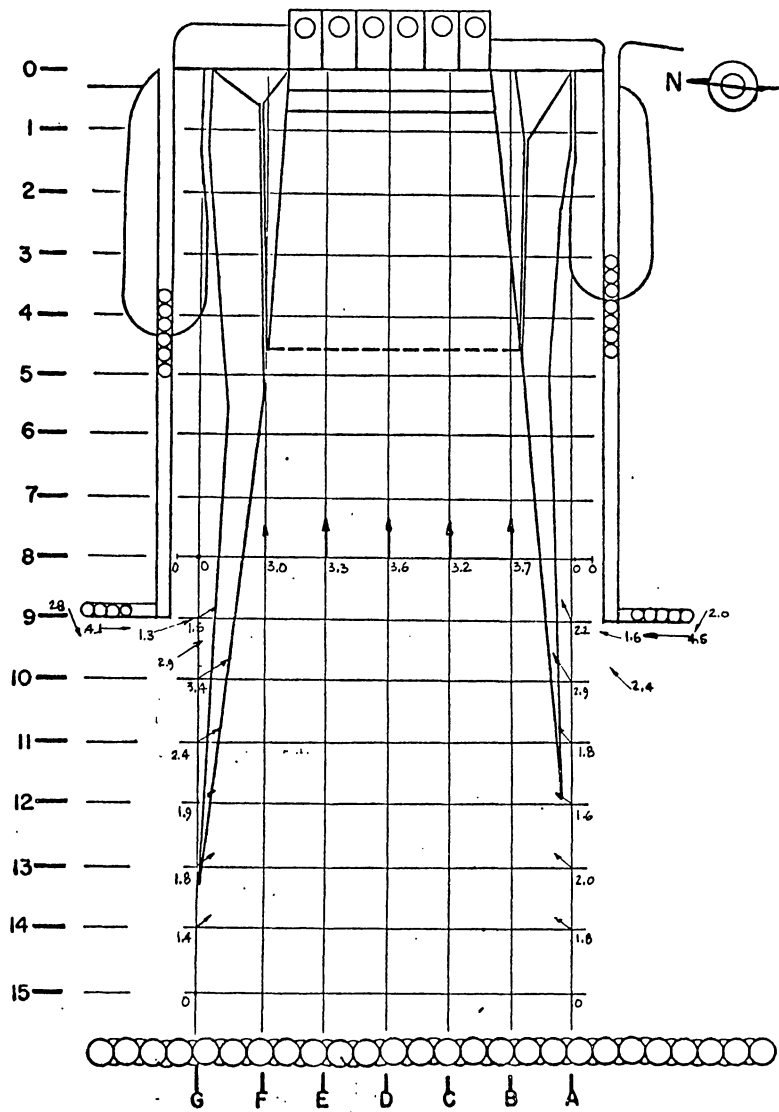


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LUDINGTON PUMPED STORAGE PROJECT
LAKE FRONT MODEL

PLATE No. 32

TEST No. 9a
BOTTOM VELOCITIES: Pumping @ 66,000 c.f.s.
SCALE: Grid system is in 150' increments NOV. 1969



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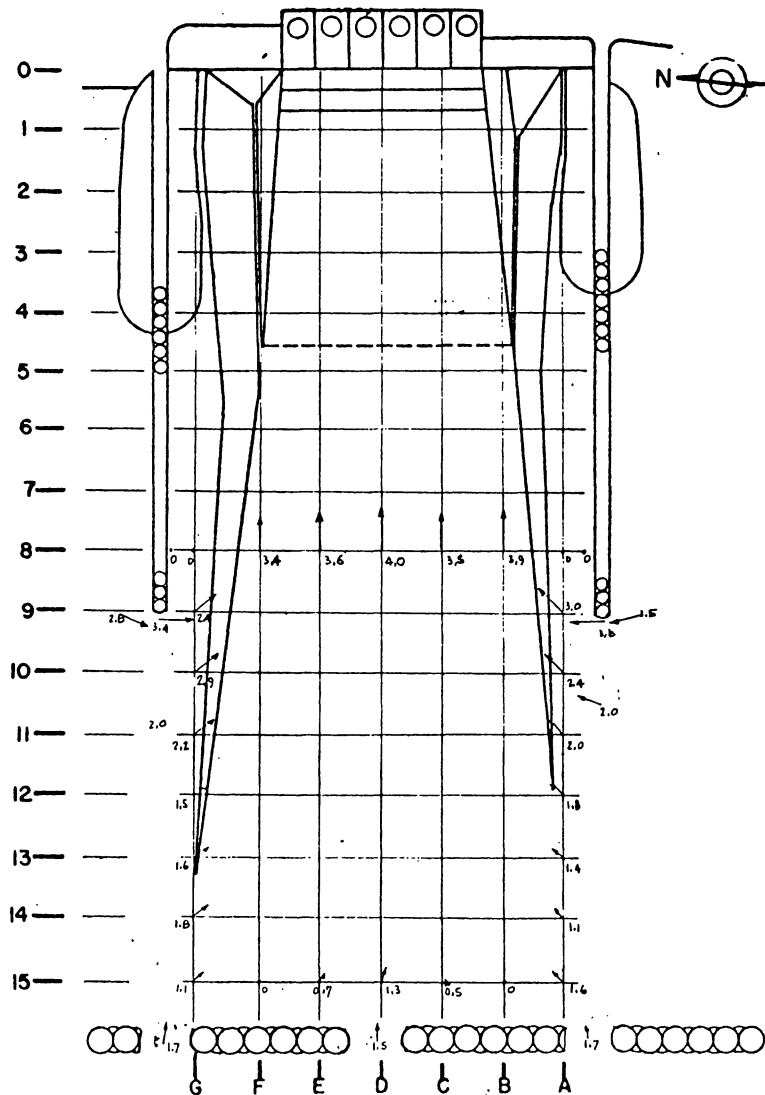
LUDINGTON PUMPED STORAGE PROJECT
LAKE FRONT MODEL

PLATE No. 33

TEST No. #8

BOTTOM VELOCITIES: Pumping @ 66,000 c.f.s.

SCALE: Grid system is in 150' increments NOV. 1969



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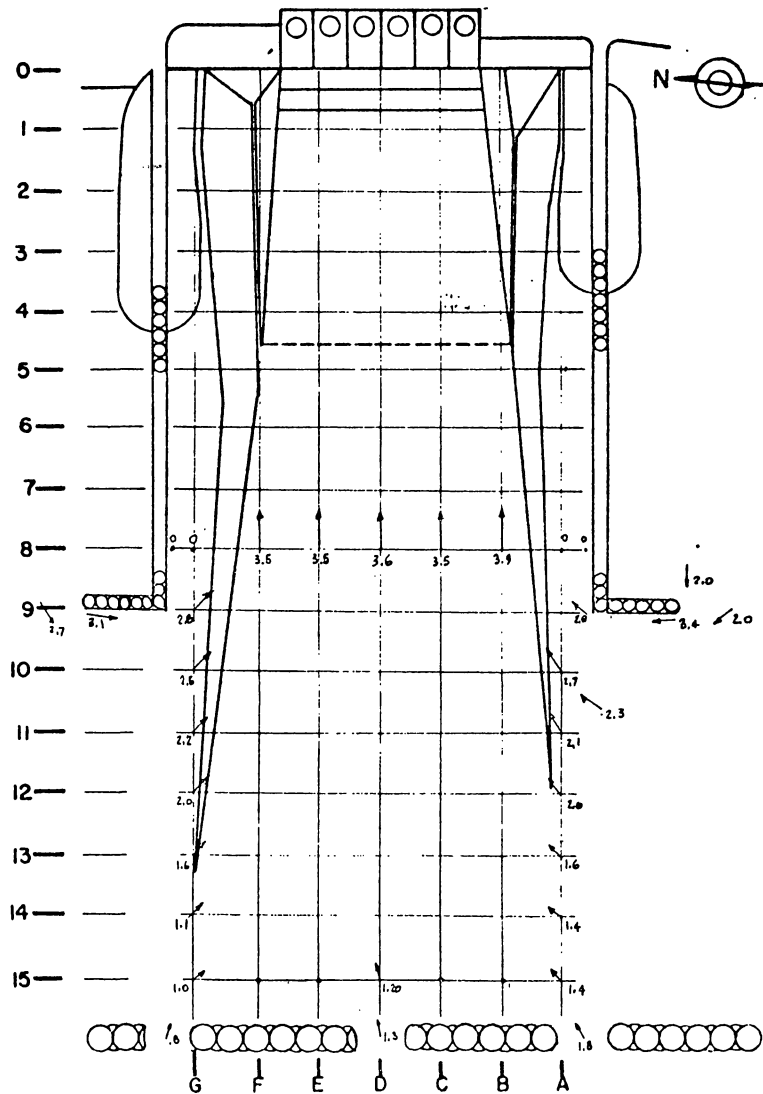
LUDINGTON PUMPED STORAGE PROJECT
LAKE FRONT MODEL

PLATE No. 34

TEST No. 10

BOTTOM VELOCITIES: Pumping @ 66,000 c.f.s.

SCALE: Grid system is in 150' increments NOV. 1969



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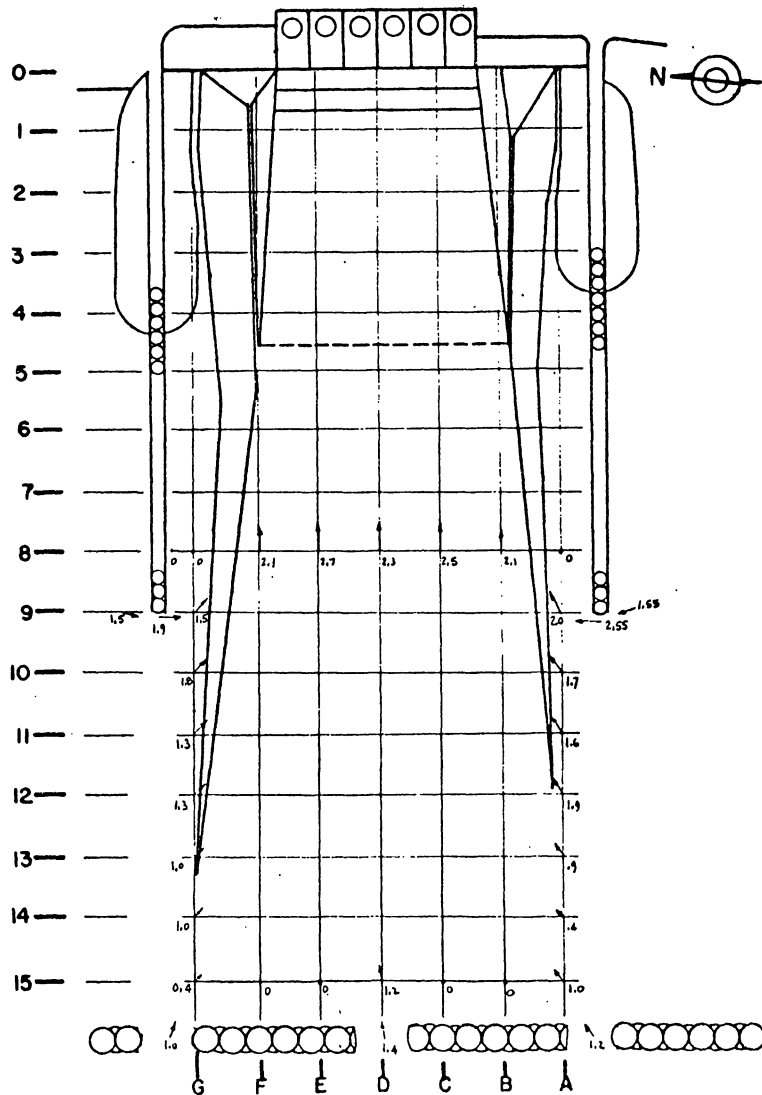
LUDINGTON PUMPED STORAGE PROJECT
LAKE FRONT MODEL

PLATE No. 35

TEST No. 12

BOTTOM VELOCITIES: Pumping @ 66,000 c.f.s.

SCALE: Grid system is in 150' increments NOV. 1969



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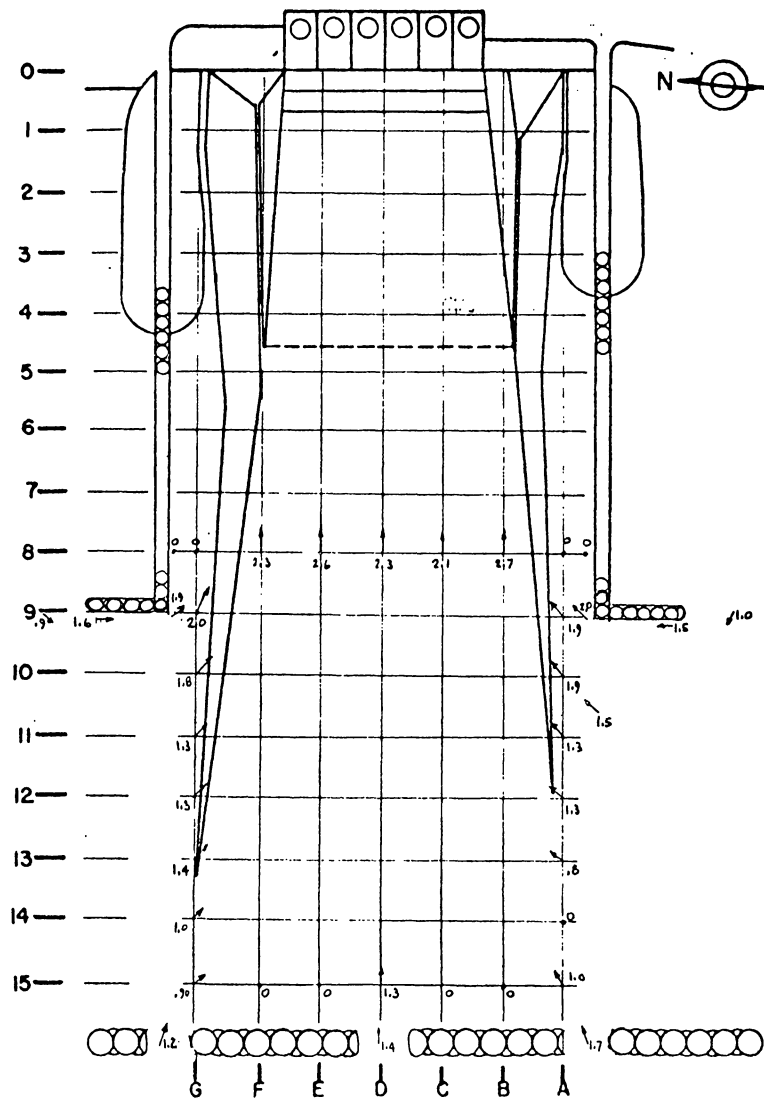
LUDINGTON PUMPED STORAGE PROJECT
LAKE FRONT MODEL

PLATE No. 36

TEST No. 11

BOTTOM VELOCITIES: Pumping @ 44,000 c.f.s.

SCALE: Grid system is in 150' increments NOV. 1969

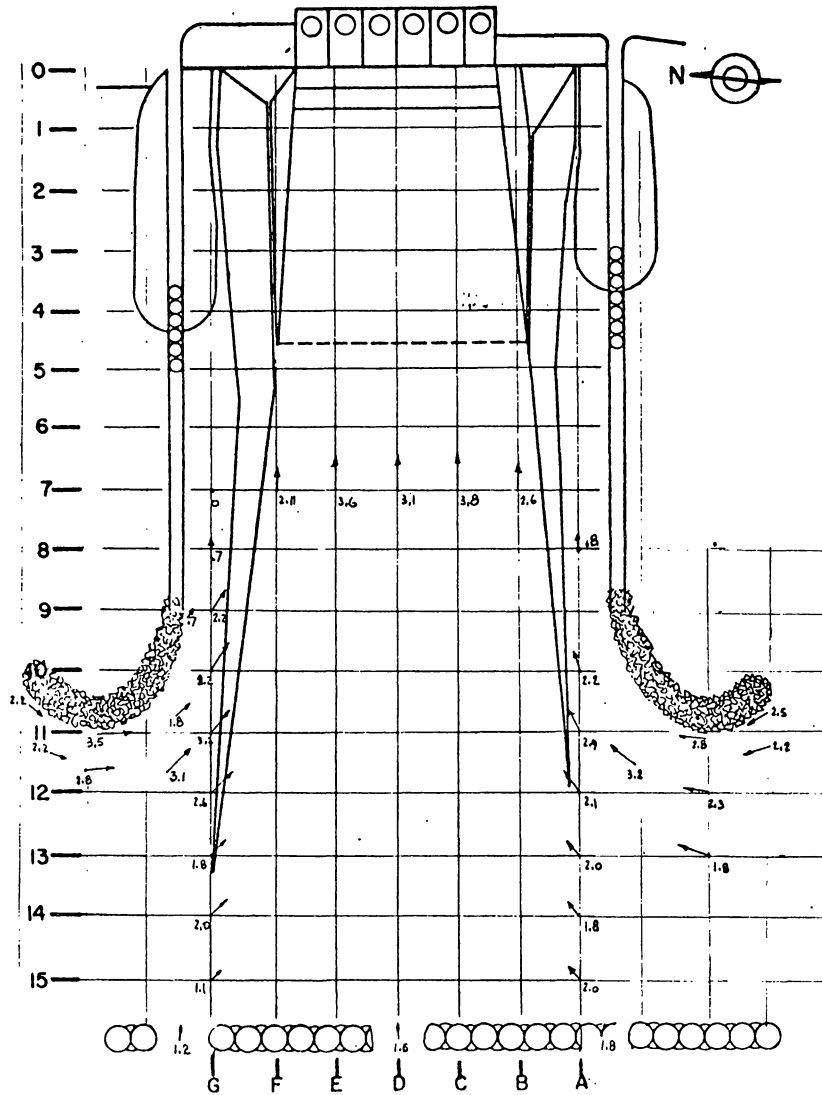


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LUDINGTON PUMPED STORAGE PROJECT
LAKE FRONT MODEL

PLATE No. 37

TEST No. 13
BOTTOM VELOCITIES: Pumping @ 44,000 c.f.s.
SCALE: Grid system is in 15' increments NOV. 1969



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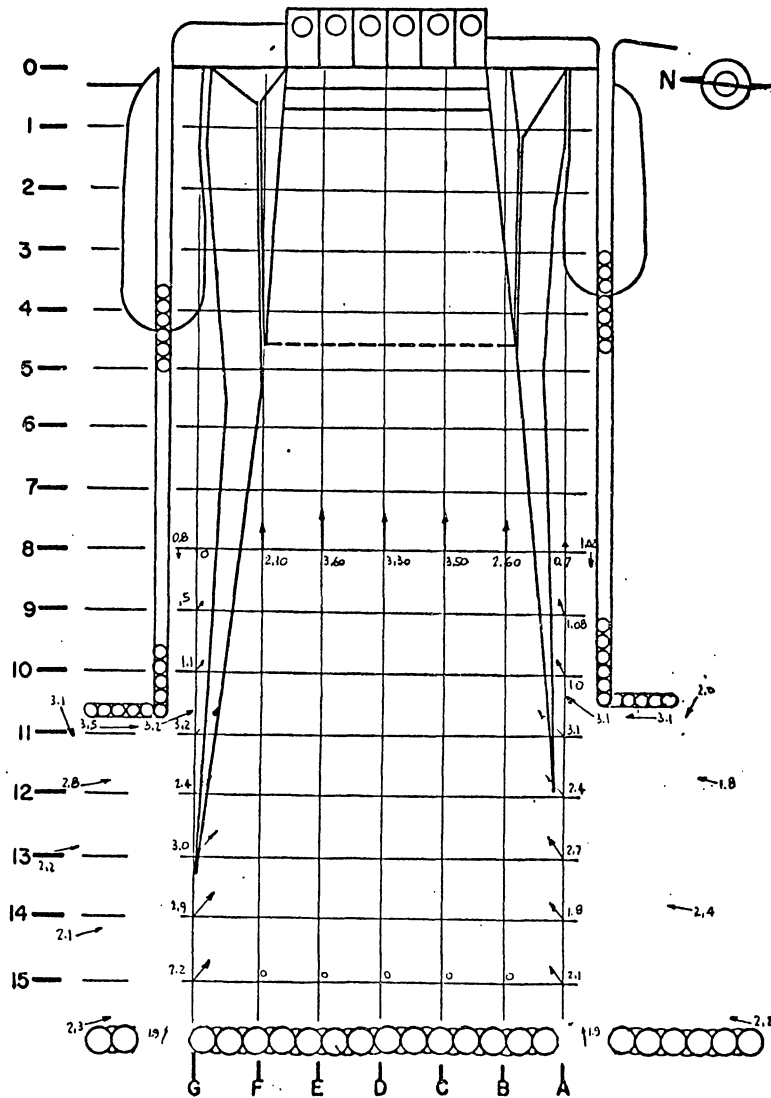
LUDINGTON PUMPED STORAGE PROJECT
LAKE FRONT MODEL

PLATE No. 38

TEST No. 17

BOTTOM VELOCITIES: Pumping @ 66,000 c.f.s.

SCALE: Grid system is in 150' increments NOV. 1969



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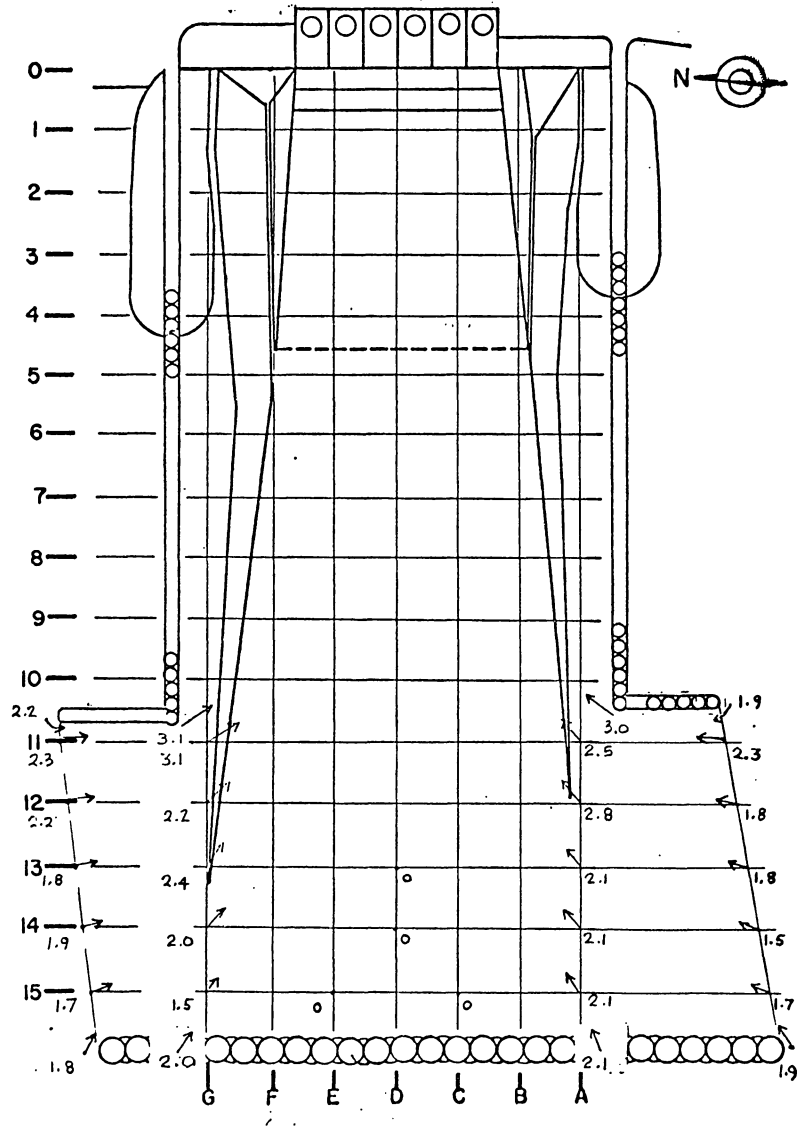
LUDINGTON PUMPED STORAGE PROJECT
LAKE FRONT MODEL

PLATE No. 39

TEST No. 18

BOTTOM VELOCITIES: Pumping @ 66,000 c.f.s.

SCALE: Grid system is in 150' increments NOV. 1969

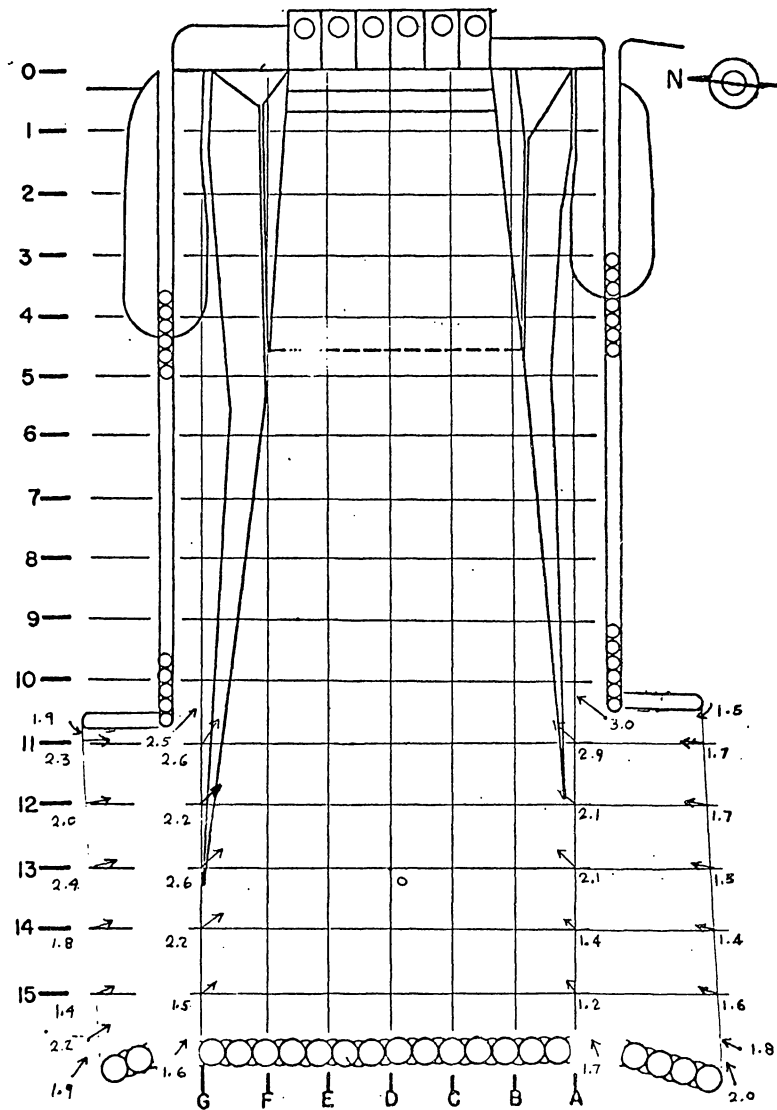


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LUDINGTON PUMPED STORAGE PROJECT
LAKE FRONT MODEL

PLATE No. 40

TEST No. 19
 BOTTOM VELOCITIES: Pumping @ 66,000 c.f.s.
 SCALE: Grid system is in 150' increments NOV. 1969



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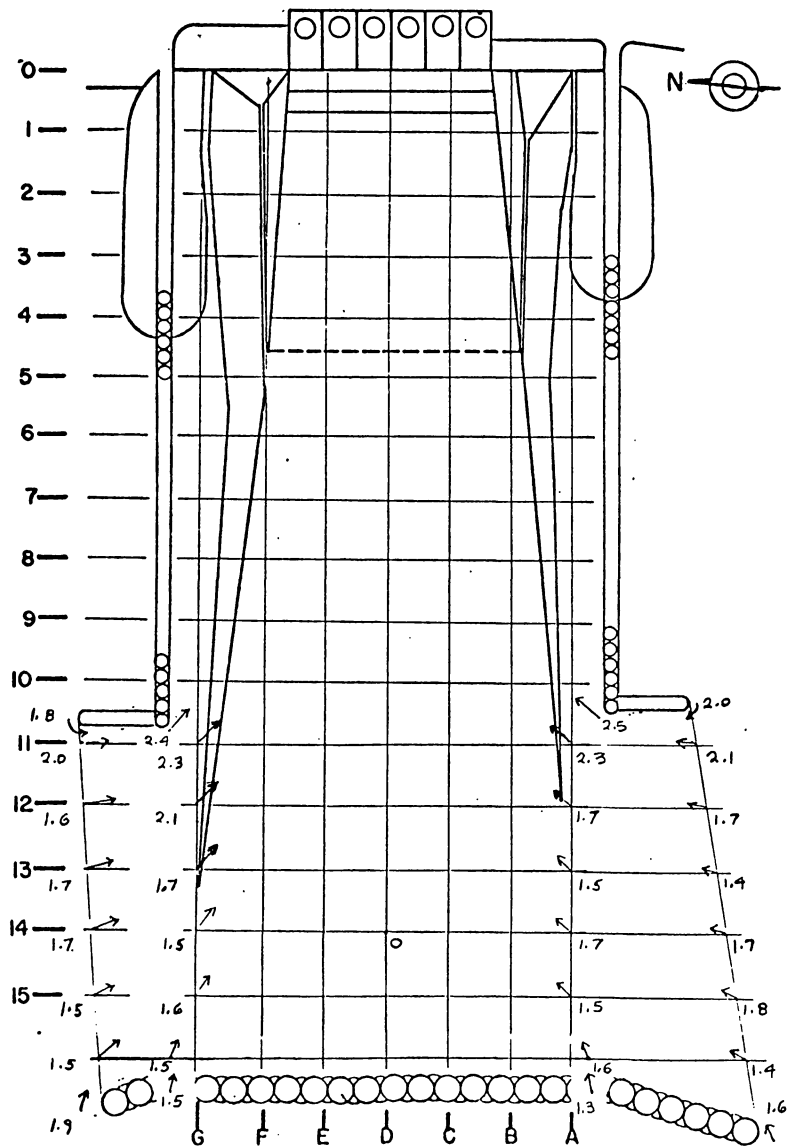
LUDINGTON PUMPED STORAGE PROJECT
LAKE FRONT MODEL

PLATE No. 41

TEST No. 20

BOTTOM VELOCITIES: Pumping @ 66,000 c.f.s.

SCALE: Grid system is in 150' increments NOV. 1969



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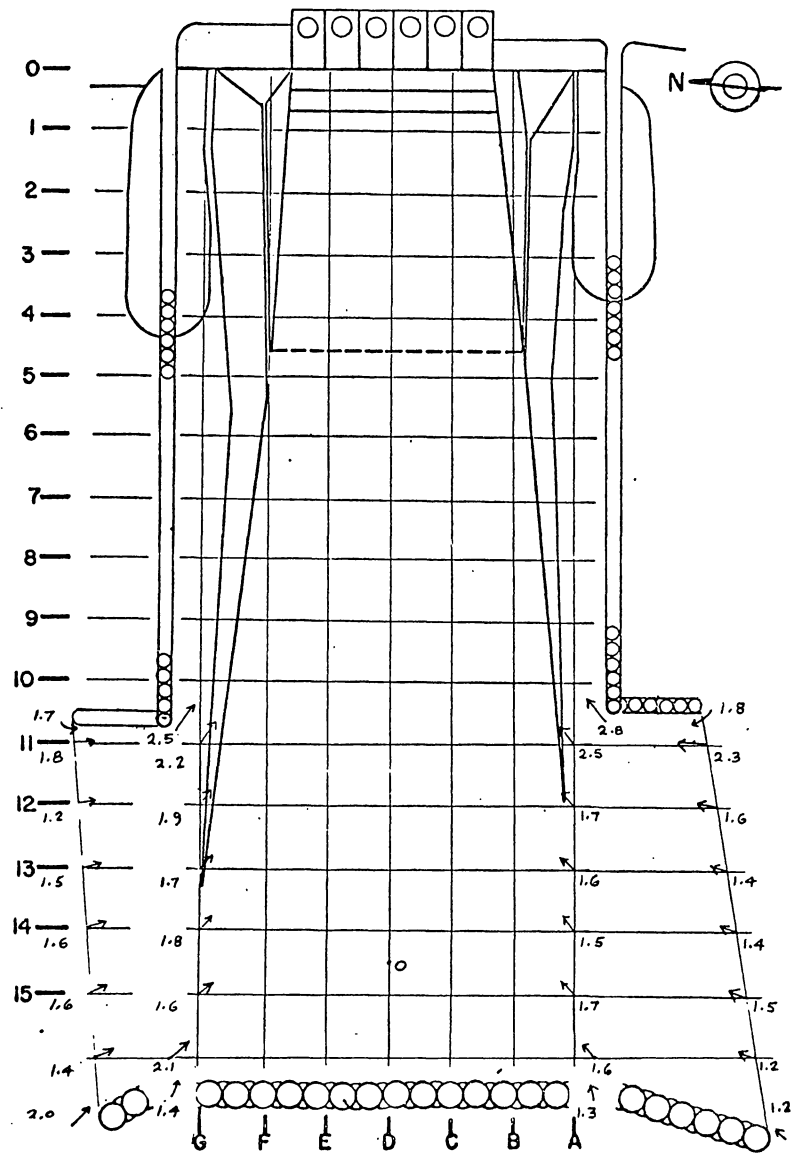
LUDINGTON PUMPED STORAGE PROJECT
LAKE FRONT MODEL

PLATE No. 42

TEST No. 23

BOTTOM VELOCITIES: Pumping @ 66,000 c.f.s.

SCALE: Grid system is in 150' increments NOV. 1969



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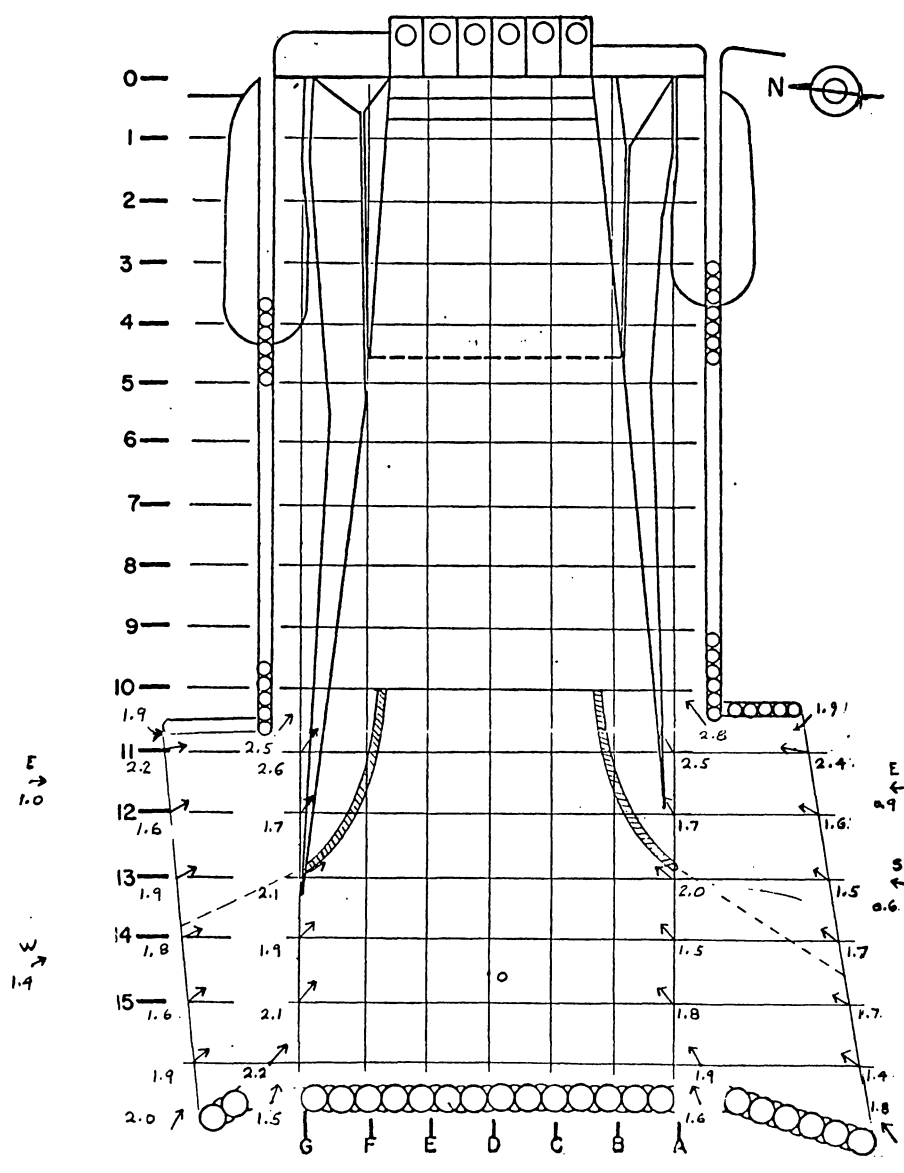
LUDINGTON PUMPED STORAGE PROJECT
LAKE FRONT MODEL

PLATE No. 43

TEST No. 24

BOTTOM VELOCITIES: Pumping @ 66,000 c.f.s.

SCALE: Grid system is in 150' increments NOV. 1969

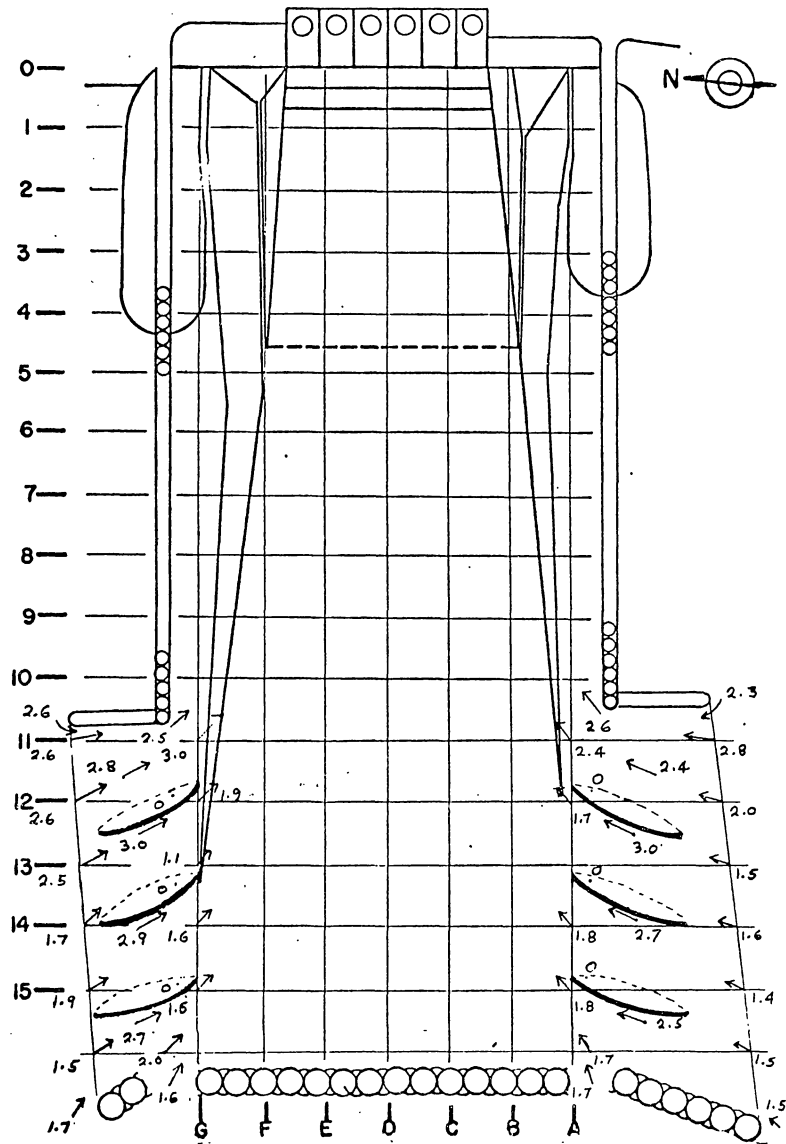


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LUDINGTON PUMPED STORAGE PROJECT
LAKE FRONT MODEL

PLATE No. 44

TEST No. 26
 BOTTOM VELOCITIES: Pumping @ 66,000 c.f.s.
 SCALE: Grid system is in 150' increments NOV. 1969



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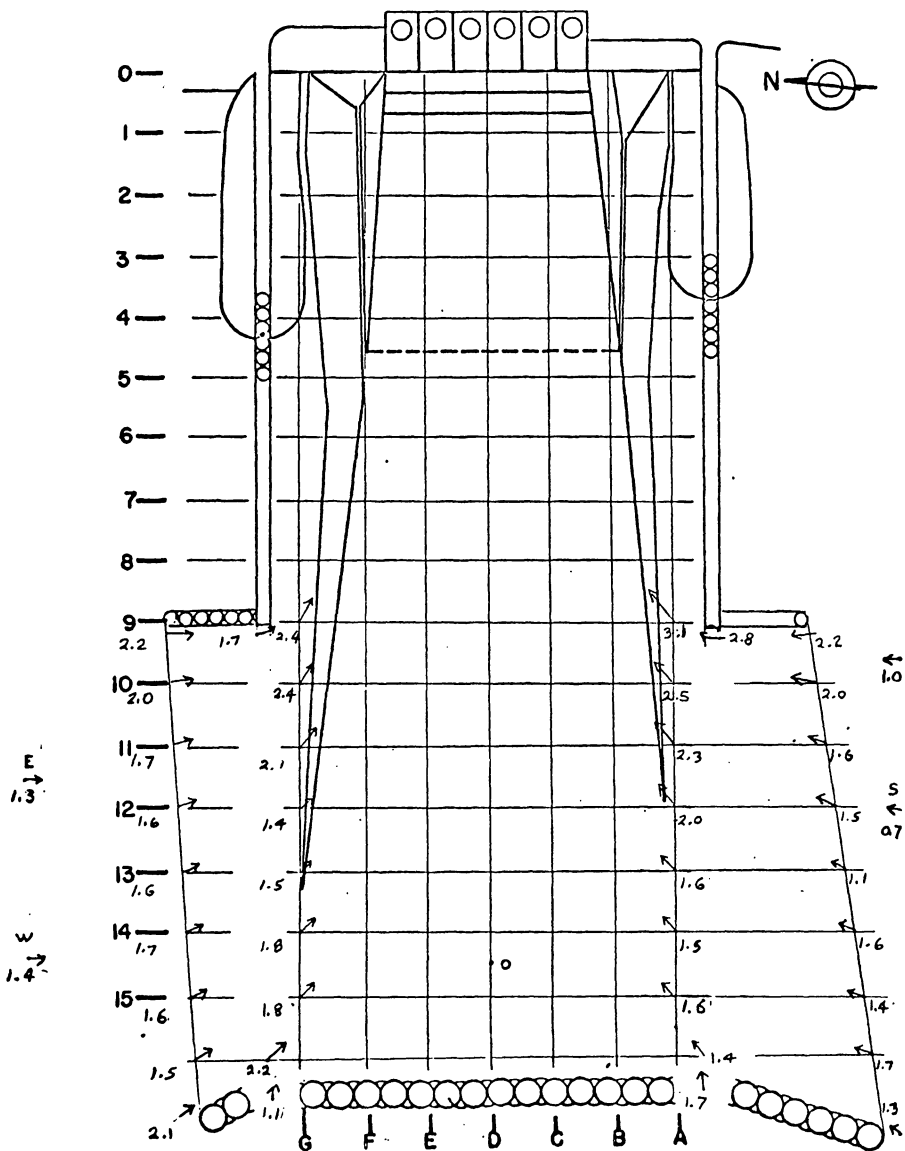
LUDINGTON PUMPED STORAGE PROJECT
LAKE FRONT MODEL

PLATE No. 45

TEST No. 27

BOTTOM VELOCITIES: Pumping @ 66,000 c.f.s.

SCALE: Grid system is in 150' increments NOV. 1969



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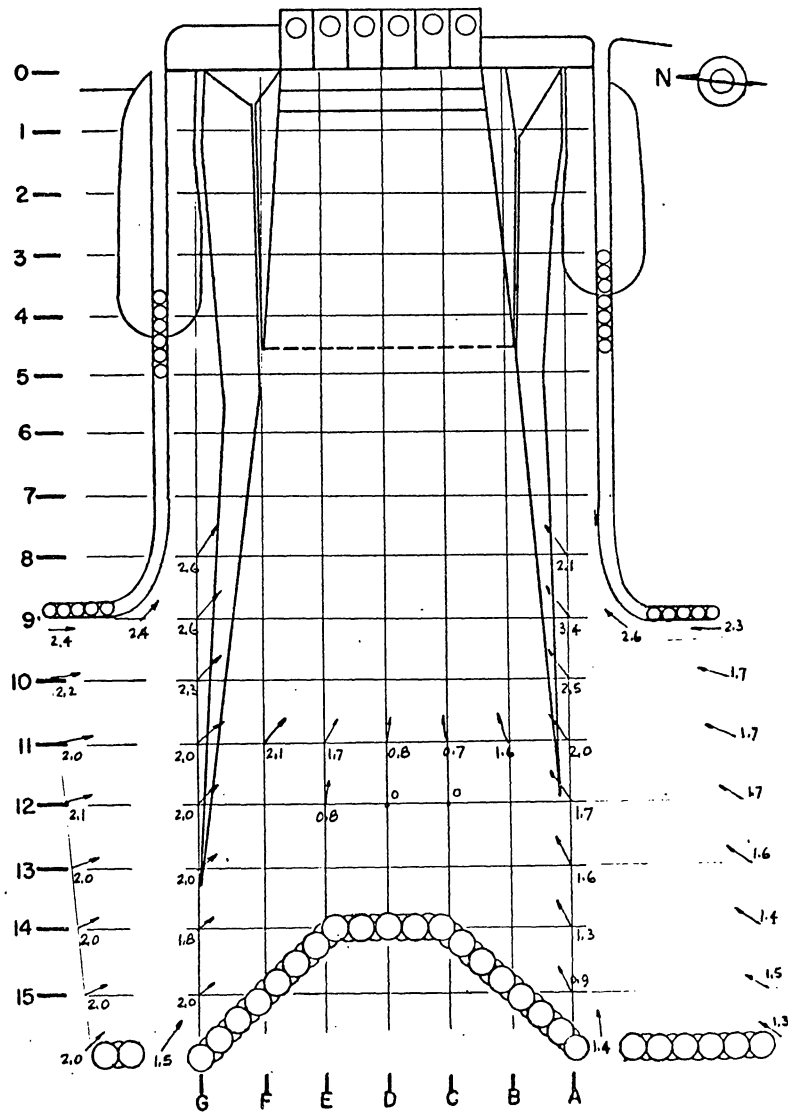
LUDINGTON PUMPED STORAGE PROJECT
LAKE FRONT MODEL

PLATE No. 46

TEST No. 25

BOTTOM VELOCITIES: Pumping @ 66,000 c.f.s.

SCALE: Grid system is in 150' increments NOV. 1969



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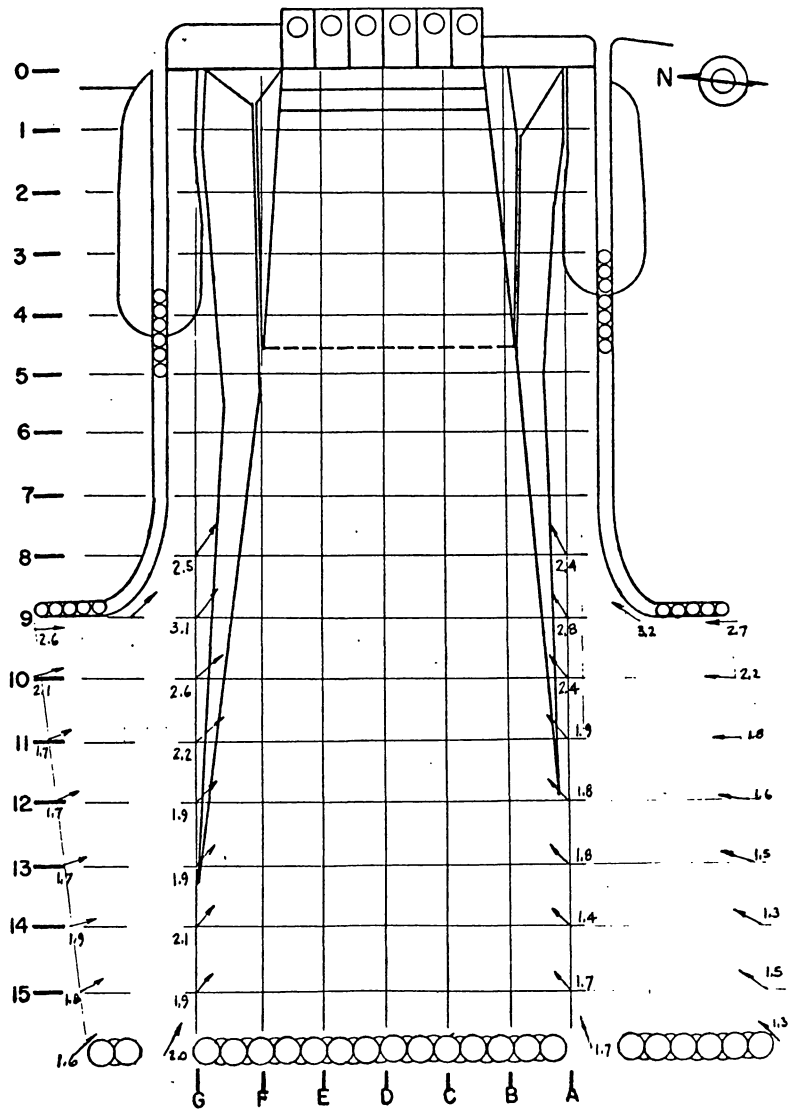
LUDINGTON PUMPED STORAGE PROJECT
LAKE FRONT MODEL

PLATE No. 47

TEST No. 31

BOTTOM VELOCITIES: Pumping @ 66,000 c.f.s

SCALE: Grid system is in 150' increments NOV. 1969



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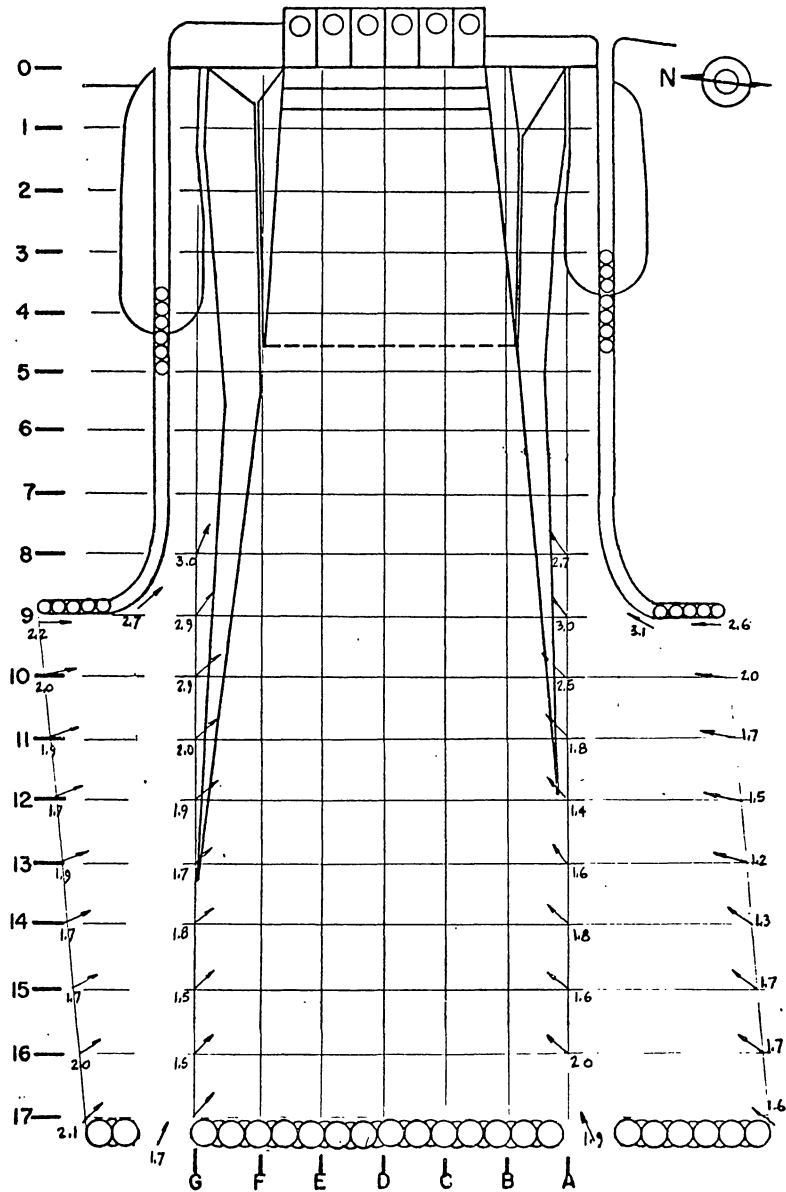
LUDINGTON PUMPED STORAGE PROJECT
LAKE FRONT MODEL

PLATE No. 48

TEST No. 30

BOTTOM VELOCITIES: Pumping @ 66,000 c.f.s.

SCALE: Grid system is in 150' increments NOV. 1969



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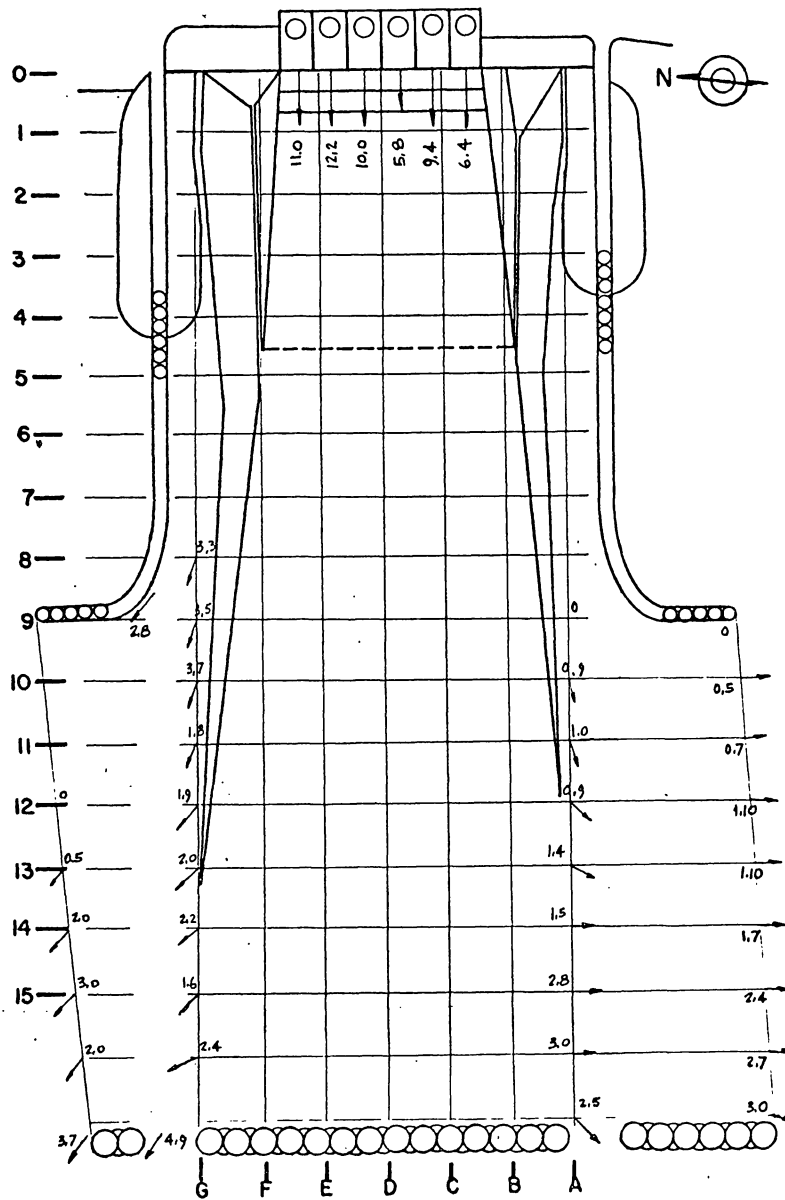
LUDINGTON PUMPED STORAGE PROJECT
LAKE FRONT MODEL

PLATE No. 49

TEST No. 29

BOTTOM VELOCITIES: Pumping @ 66,000 c.f.s.

SCALE: Grid system is in 150' increments NOV. 1969



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LUDINGTON PUMPED STORAGE PROJECT
LAKE FRONT MODEL

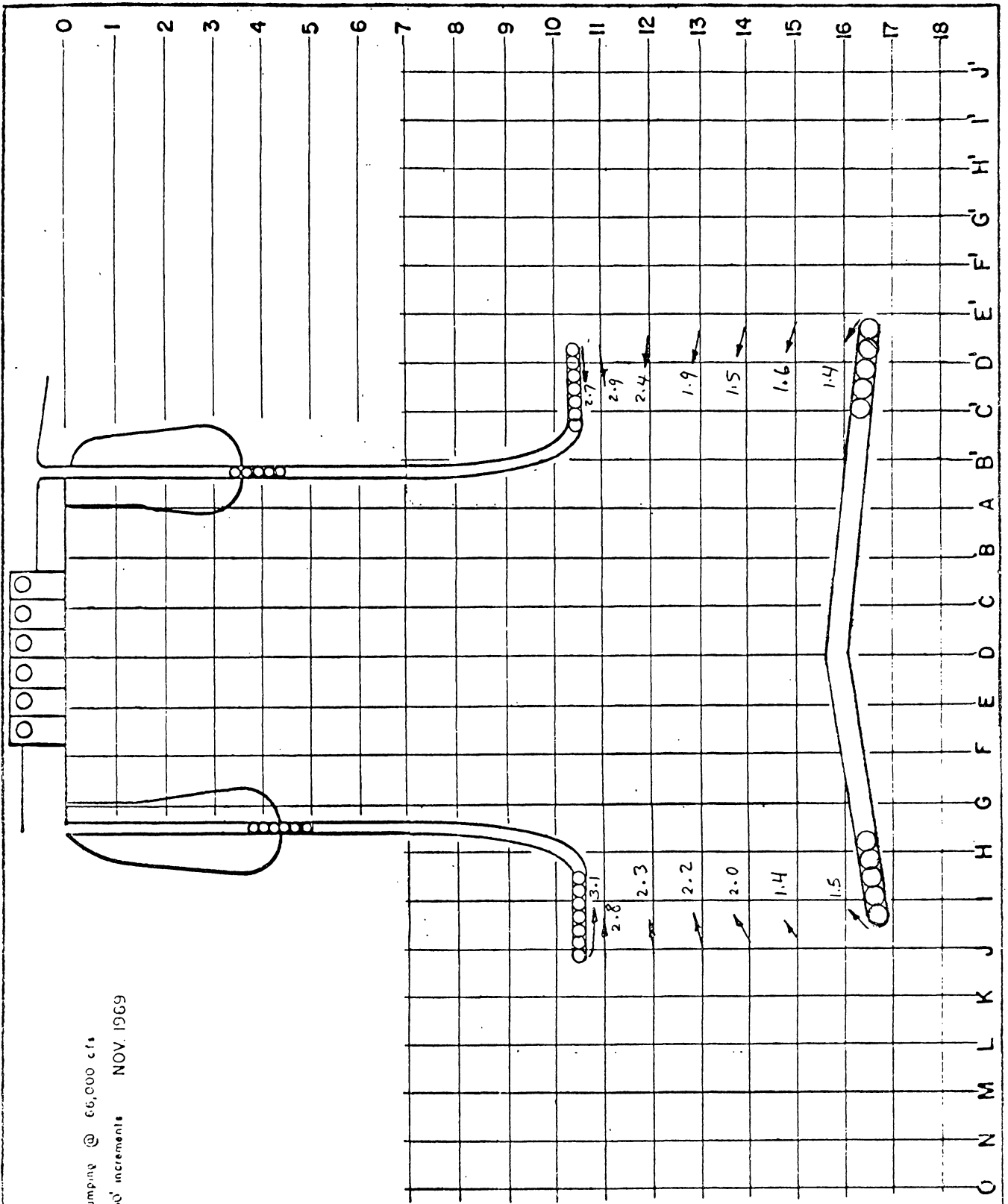
PLATE No. 50

TEST No. 32

BOTTOM VELOCITIES: Generating @ 76,000 cfs.

SCALE: Grid system is in 150' increments NOV. 1969

TEST No 38
 BOTTOM VELOCITIES Pumping @ 66,000 cfs
 SCALE: Grid system is in 150' increments NOV. 1969

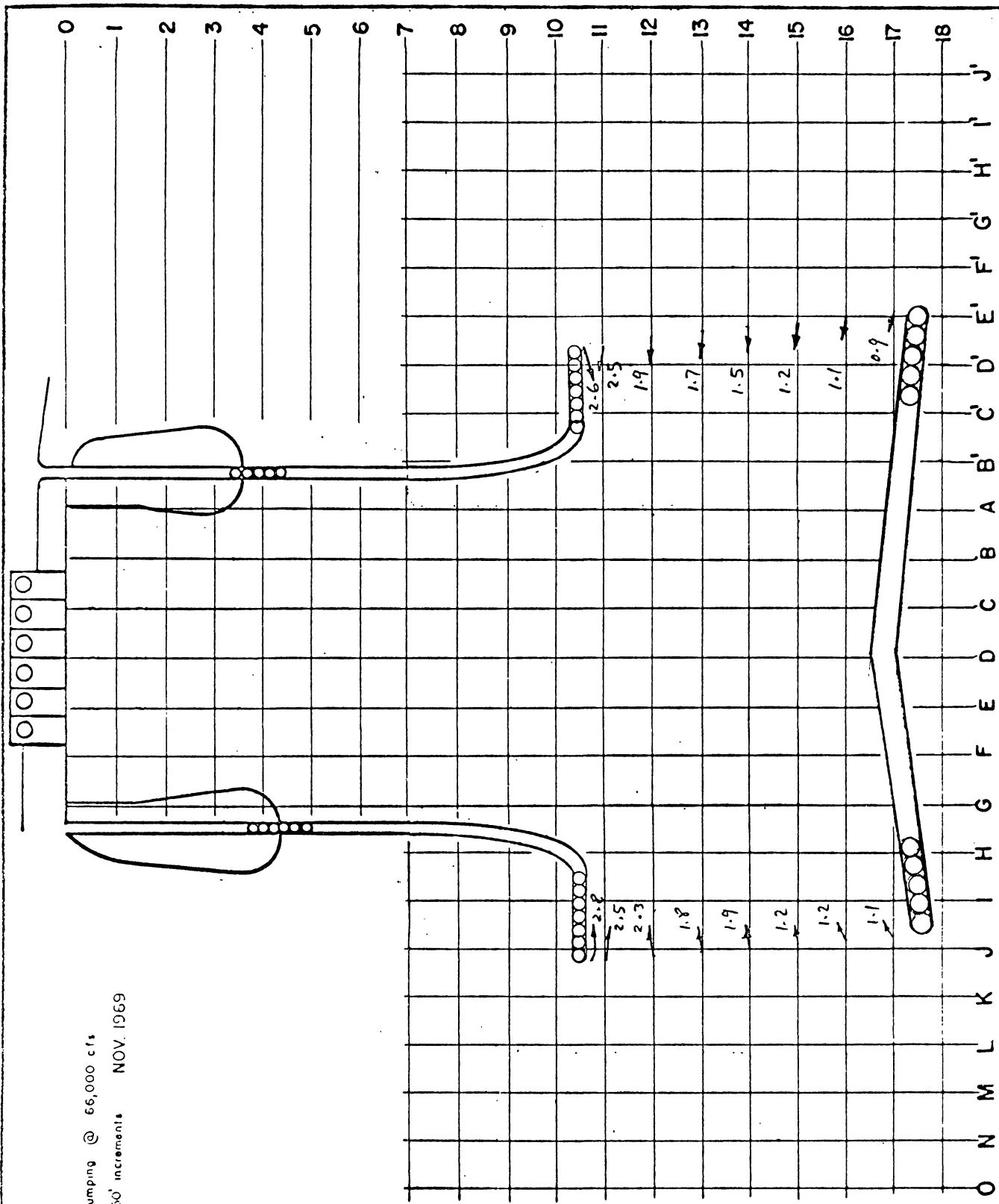


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LUDINGTON PUMPED STORAGE PROJECT
 LAKE FRONT MODEL

PLATE No. 51

TEST No 40
 BOTTOM VELOCITIES Pumping @ 66,000 cfs
 SCALE: Grid system is in 150' increments NOV. 1969

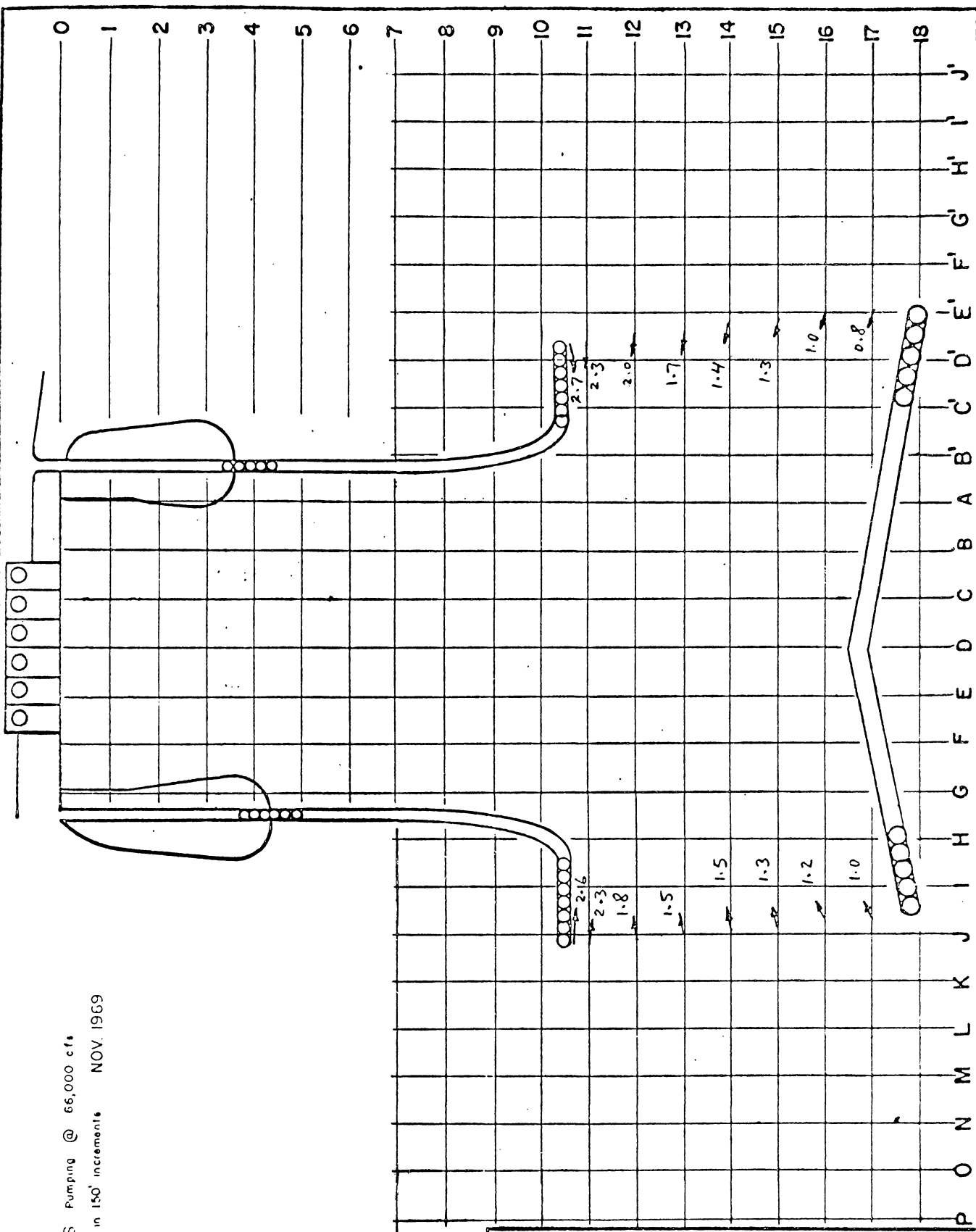


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 LAKE FRONT MODEL

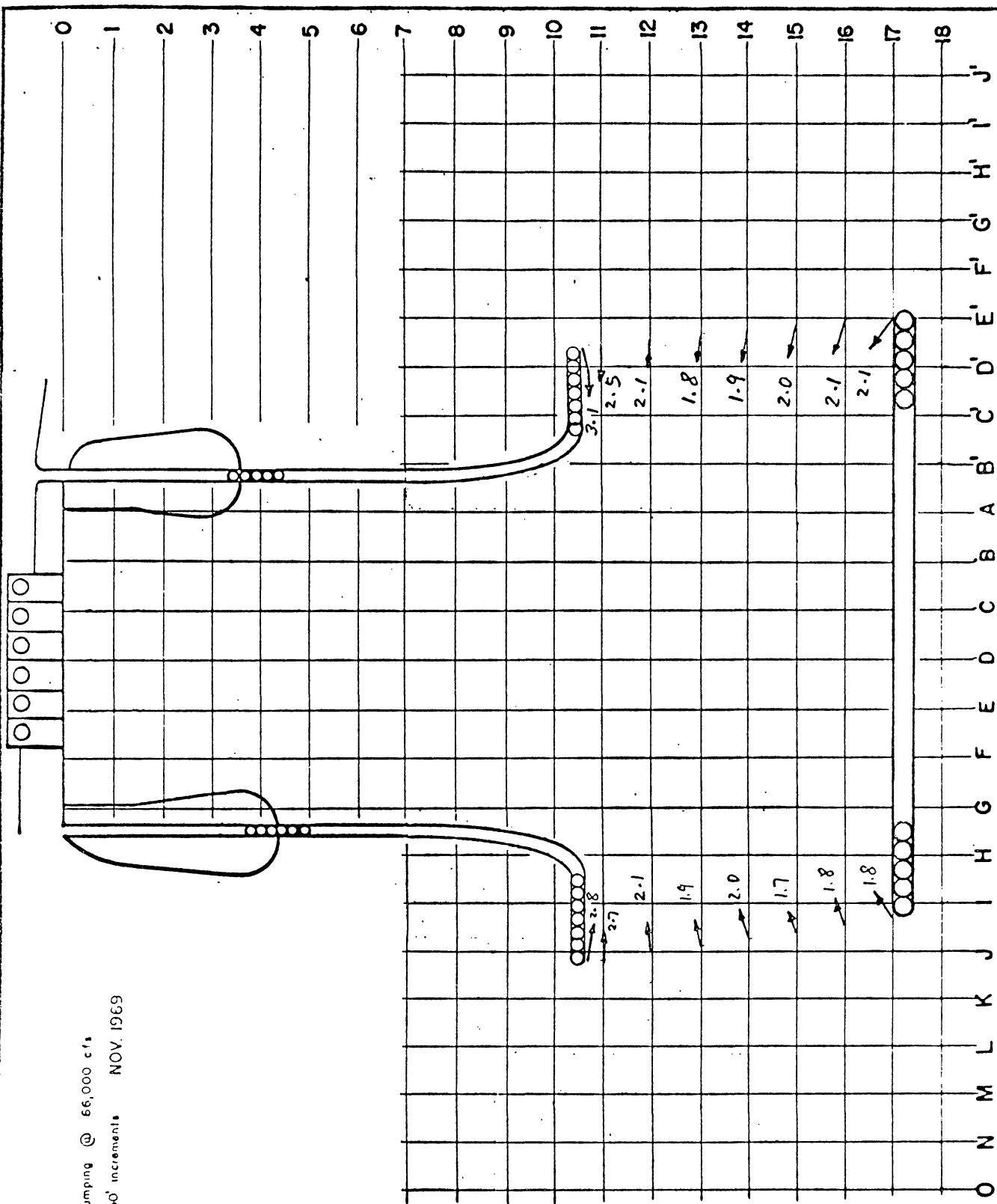
PLATE No. 52

TEST No 41
 BOTTOM VELOCITIES Pumping @ 66,000 cfs
 SCALE Grid system is in 150' increments NOV. 1969



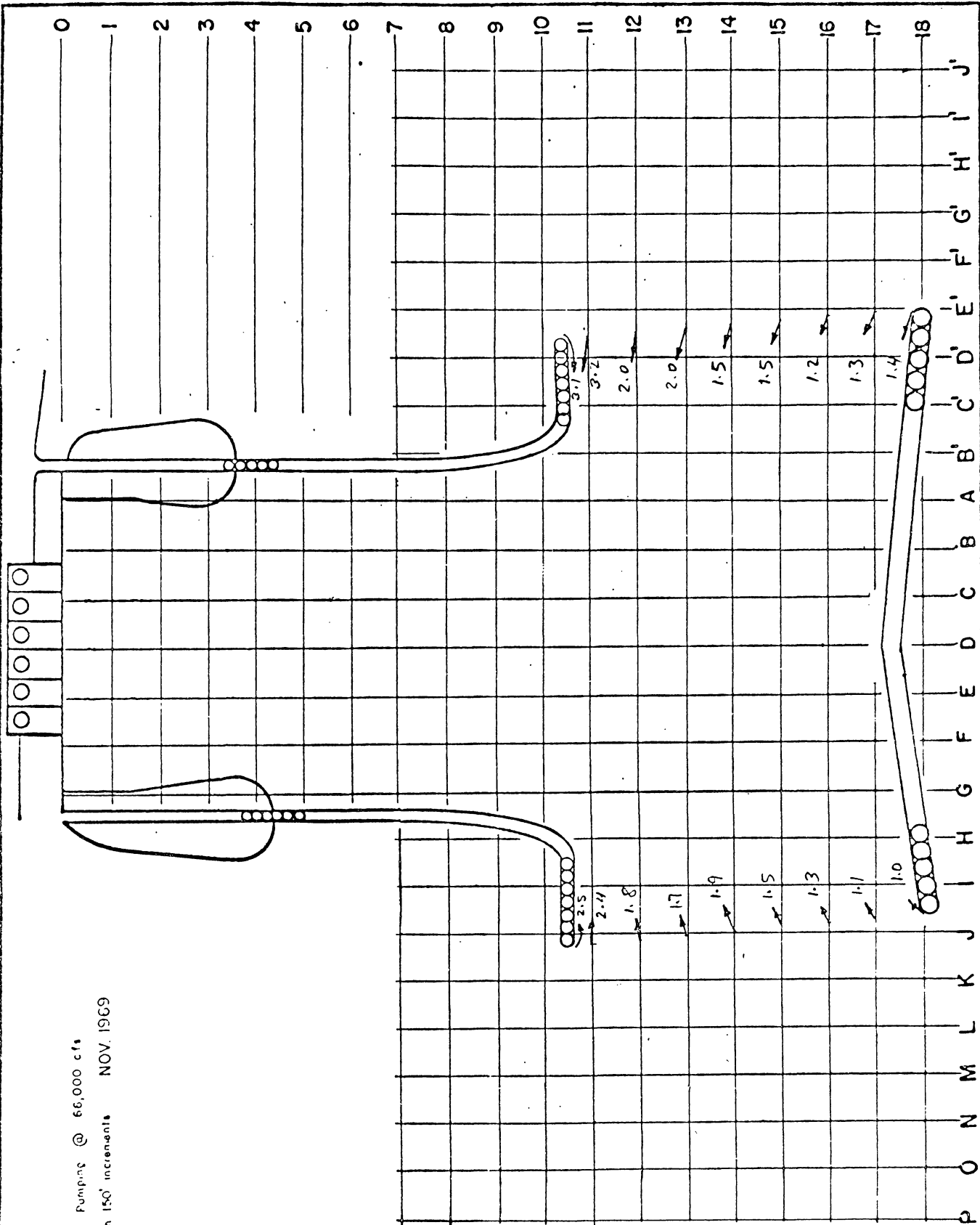
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 LUDINGTON PUMPED STORAGE PROJECT
 LAKE FRONT MODEL
 PLATE No. 53

TEST No 33
 BOTTOM VELOCITIES Pumping @ 66,000 cfs
 SCALE: Grid system is in 150' increments NOV. 1969



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 LAKE FRONT MODEL
 PLATE No. 54

TEST No 34
 BOTTOM VELOCITIES Pumping @ 66,000 cfs
 SCALE: Grid system is in 150' increments NOV. 1969

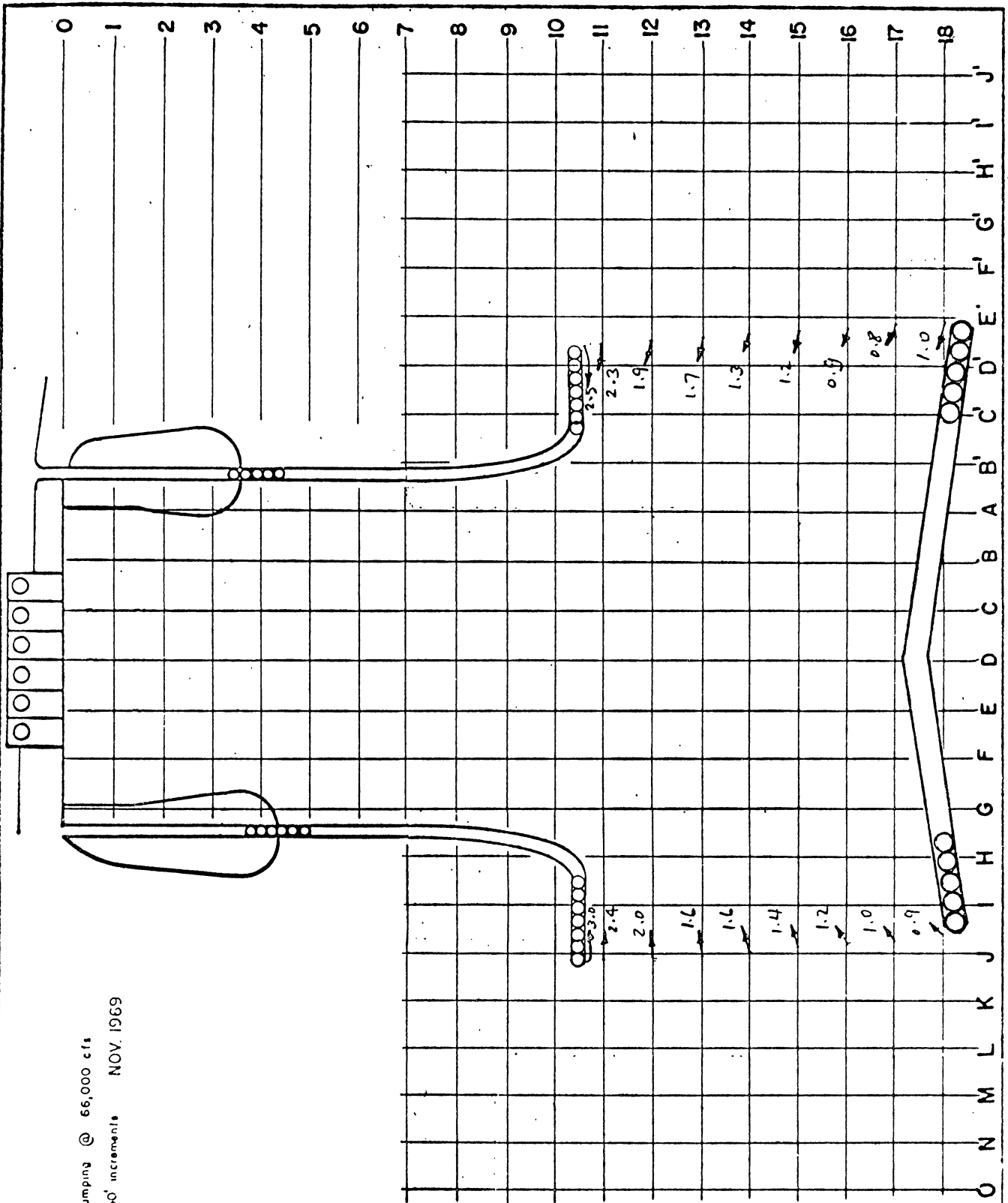


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LUDINGTON PUMPED STORAGE PROJECT
 LAKE FRONT MODEL

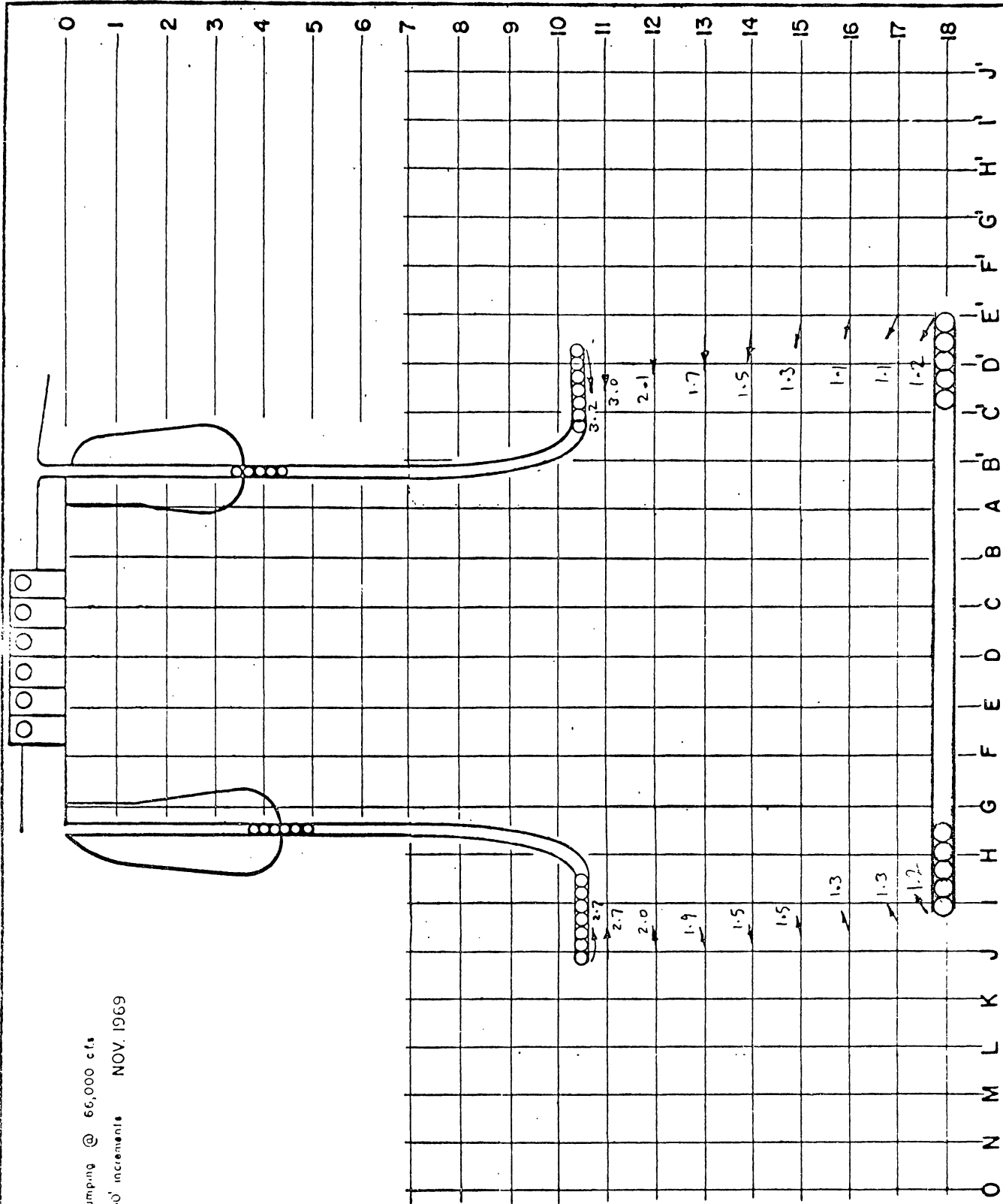
PLATE No. 55

TEST No 35
 BOTTOM VELOCITIES - Pumping @ 66,000 cfs
 SCALE: Grid system is in 150' increments NOV. 1969



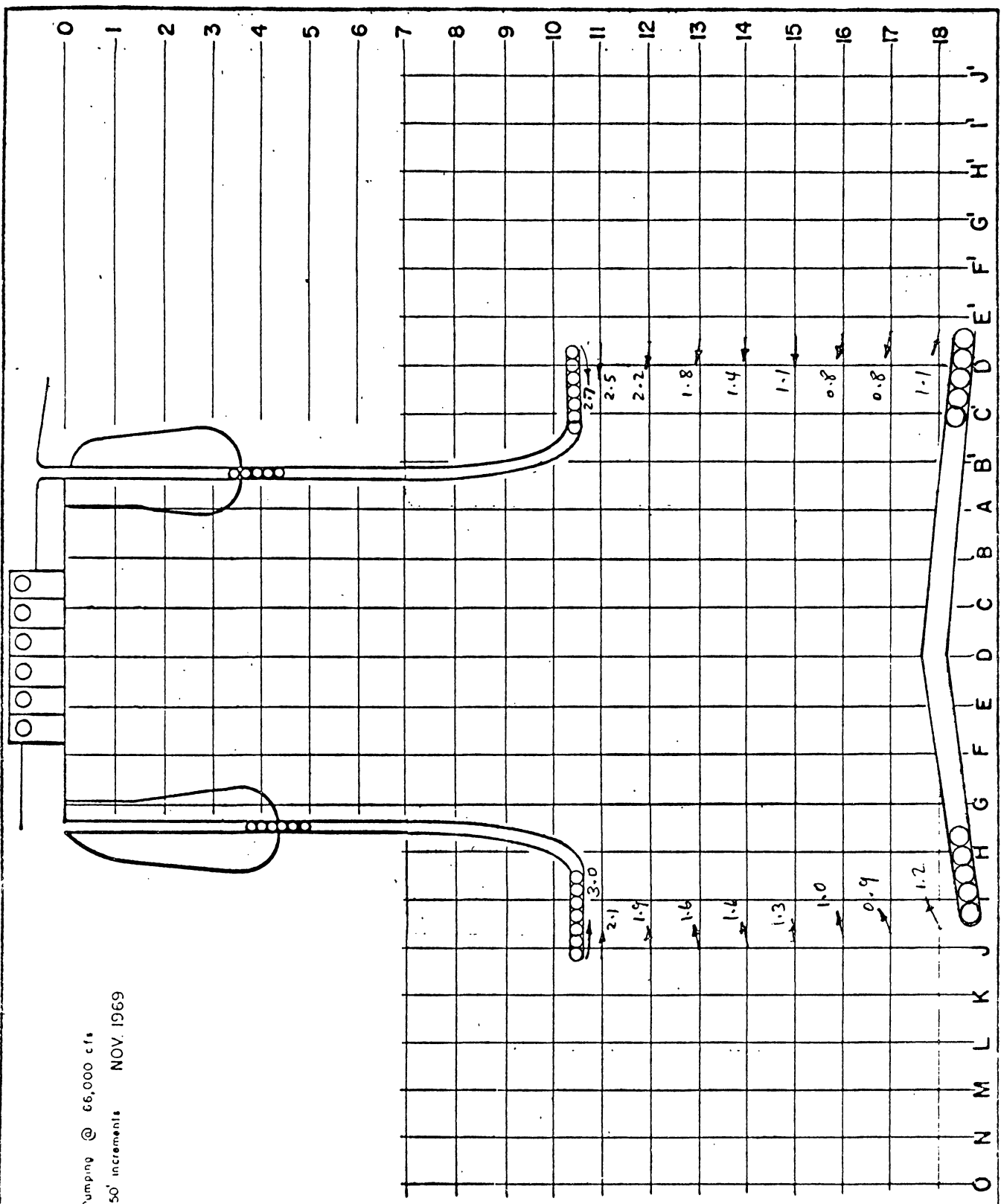
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 LUDINGTON PUMPED STORAGE PROJECT
 LAKE FRONT MODEL
 PLATE No. 56

TEST No 36
 BOTTOM VELOCITIES Pumping @ 66,000 cfs
 SCALE: Grid system is in 150' increments NOV. 1969



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 LUDINGTON PUMPED STORAGE PROJECT
 LAKE FRONT MODEL
 PLATE No. 57

TEST No 37
 BOTTOM VELOCITIES Pumping @ 66,000 cfs
 SCALE: Grid system is in 150' increments NOV. 1969

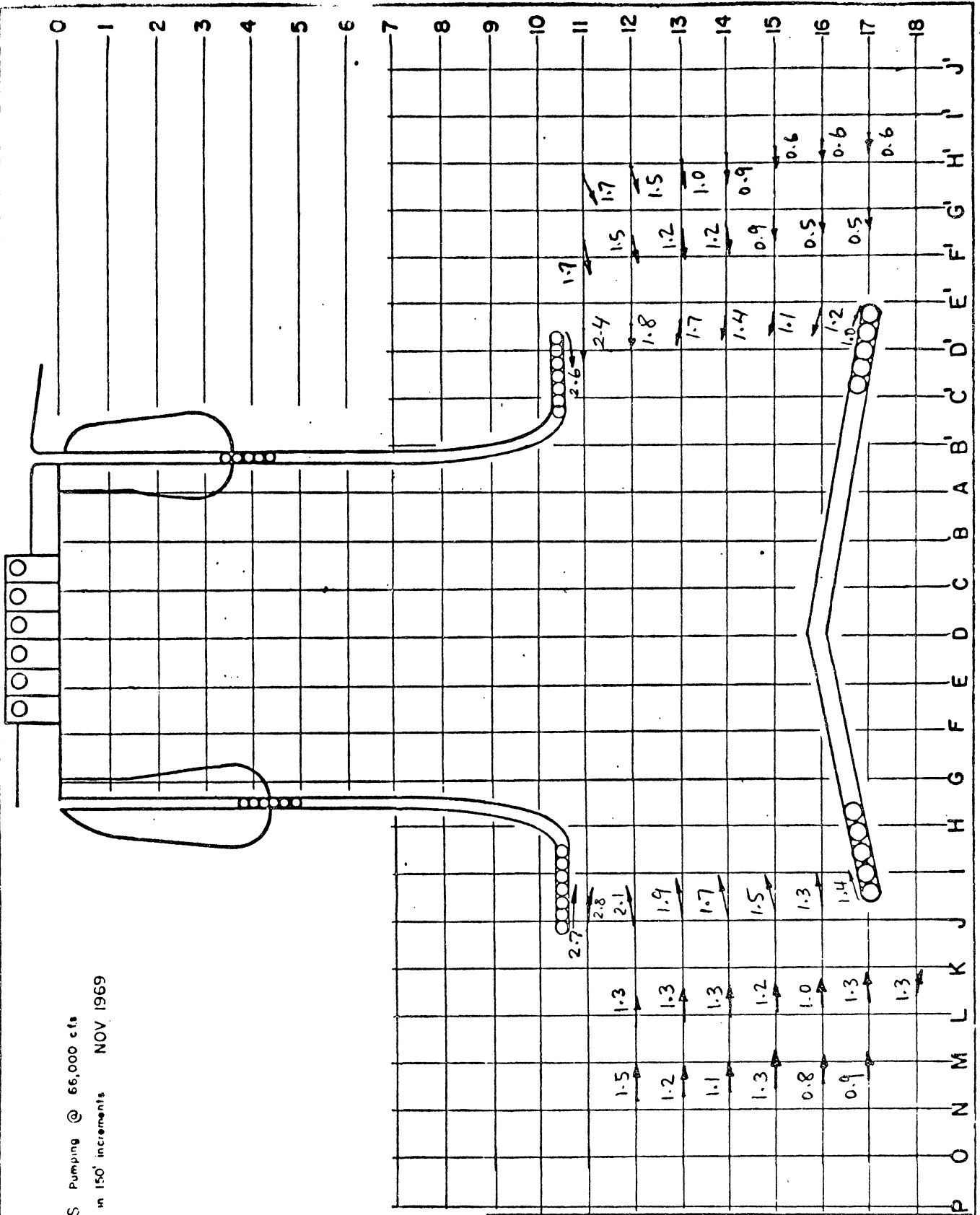


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LUDINGTON PUMPED STORAGE PROJECT
 LAKE FRONT MODEL

PLATE No. 58

TEST No 39
 BOTTOM VELOCITIES Pumping @ 66,000 cfs
 SCALE: Grid system is in 150' increments NOV 1969

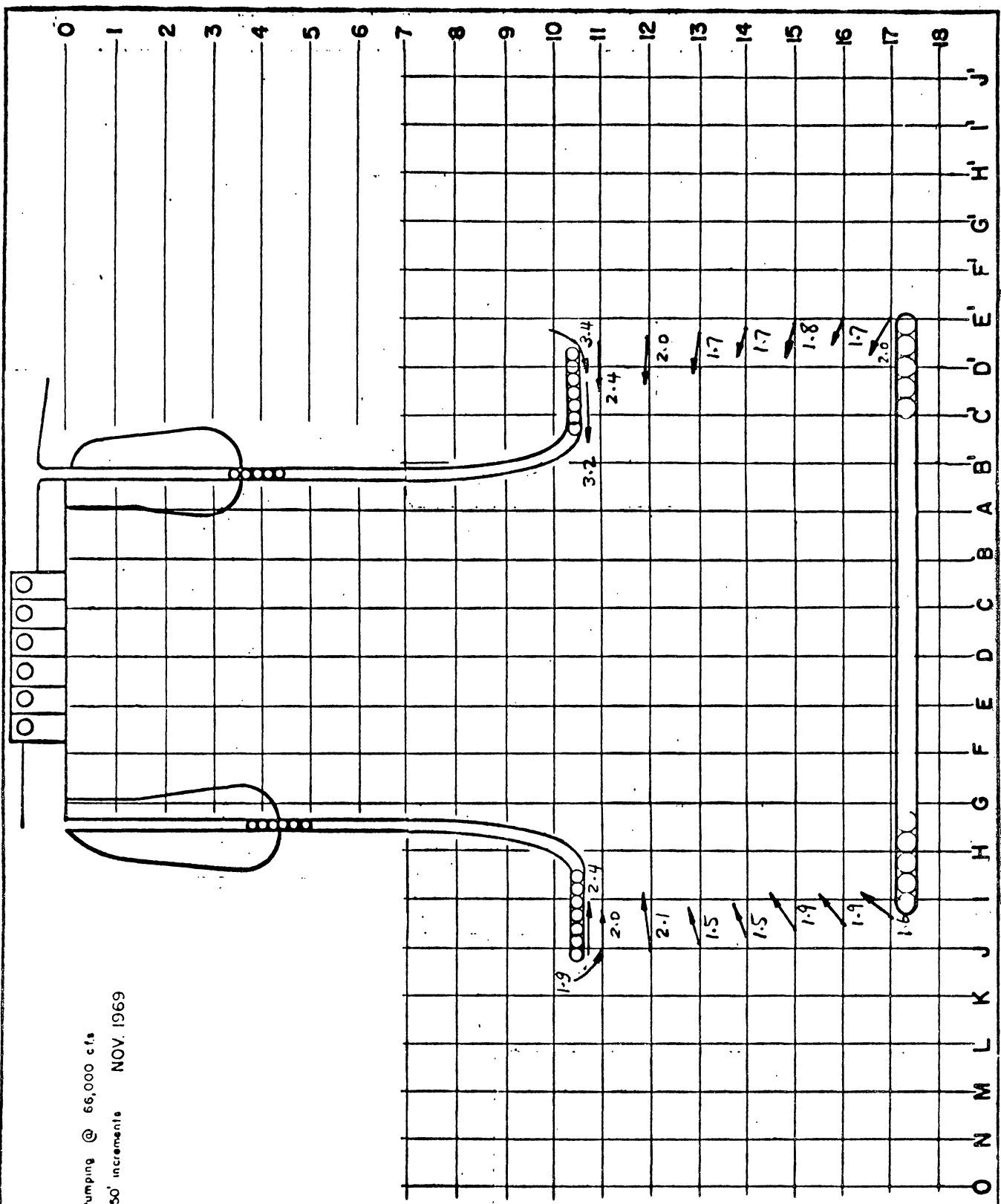


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LUDINGTON PUMPED STORAGE PROJECT
 LAKE FRONT MODEL

PLATE No. 59

TEST No 42
 BOTTOM VELOCITIES Pumping @ 66,000 cfs
 SCALE: Grid system is in 150' increments NOV. 1969

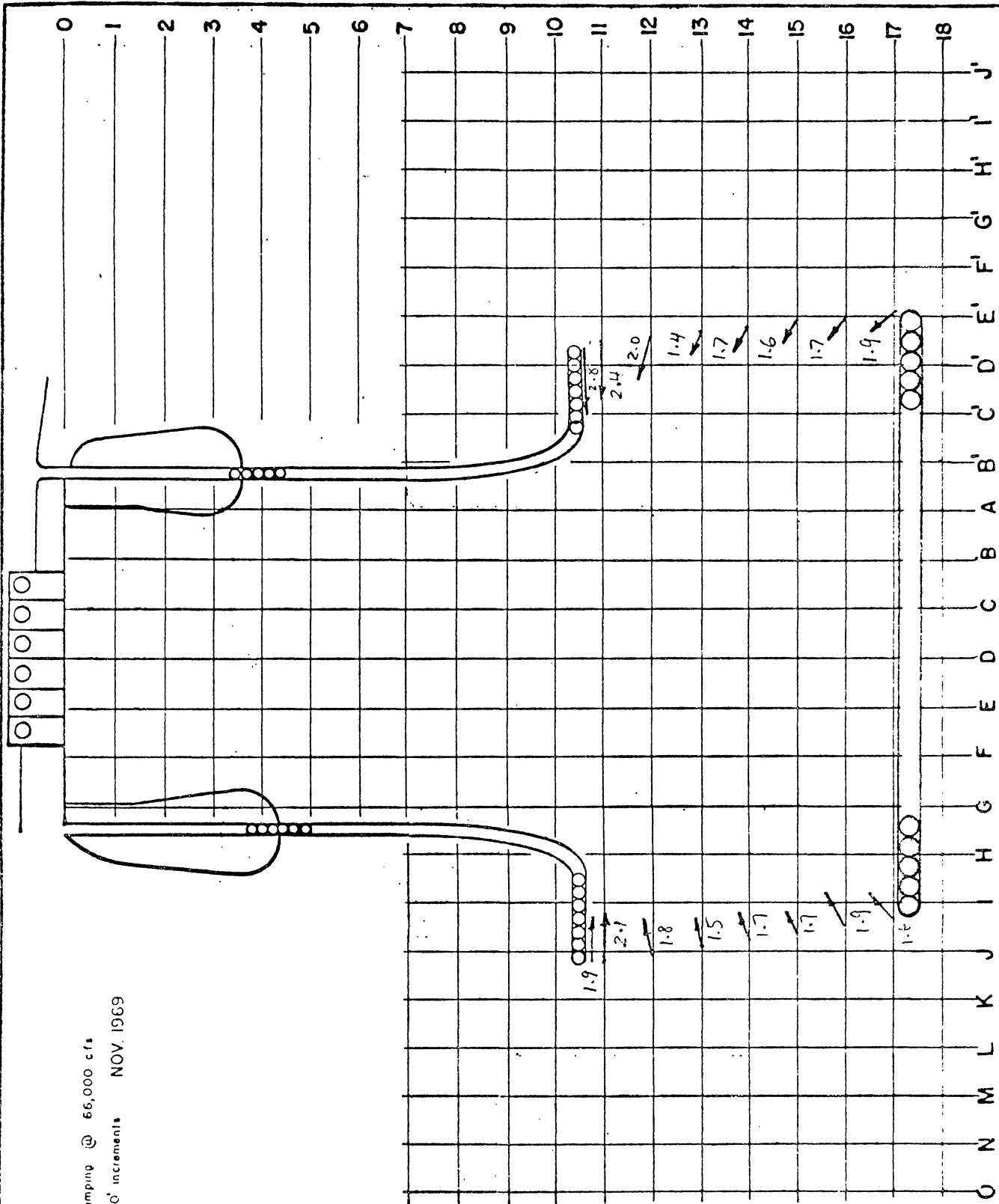


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LUDINGTON PUMPED STORAGE PROJECT
 LAKE FRONT MODEL

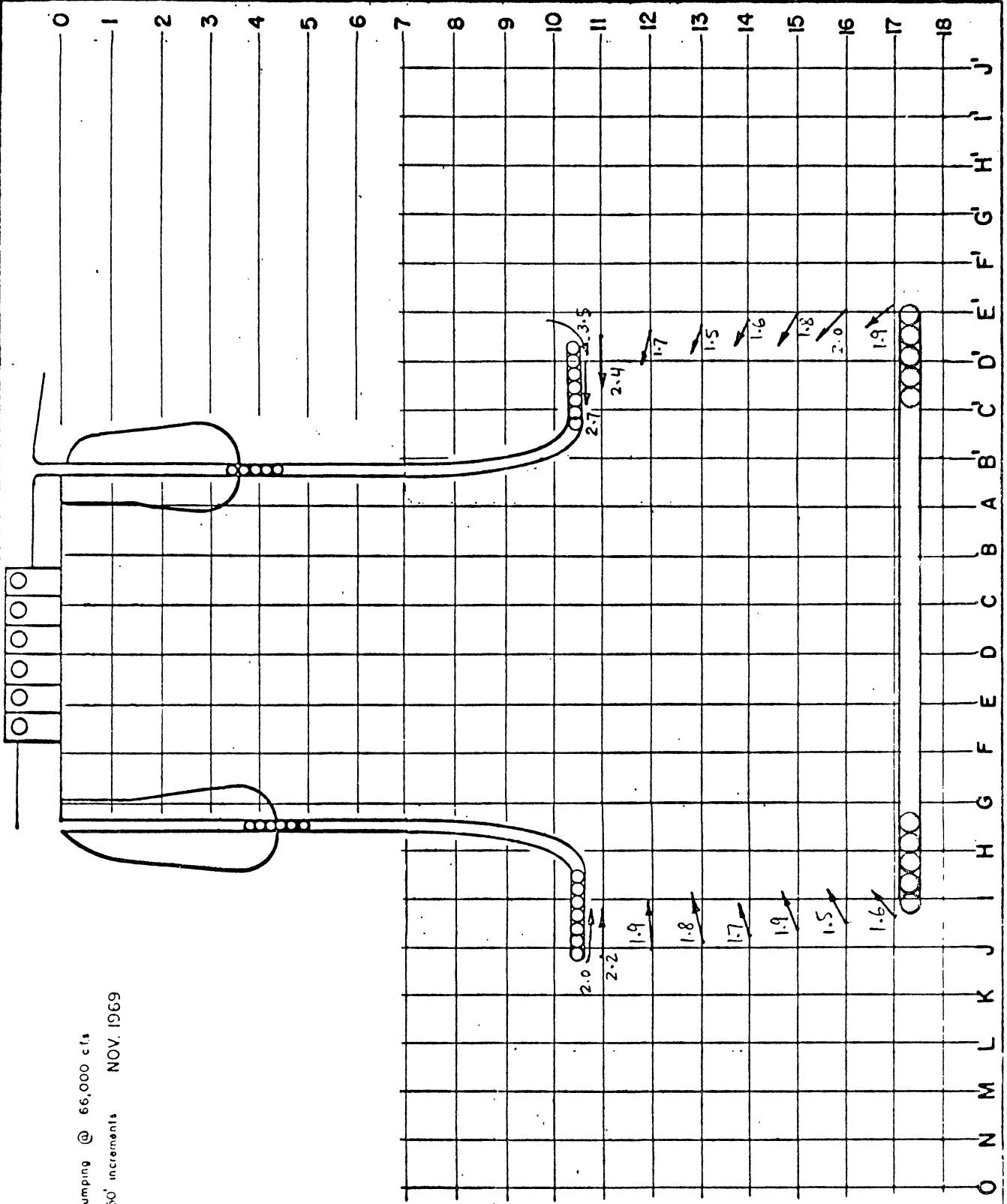
PLATE No. 60

TEST No 42-A
 BOTTOM VELOCITIES Pumping @ 66,000 cfs
 SCALE: Grid system is in 150' increments NOV. 1969



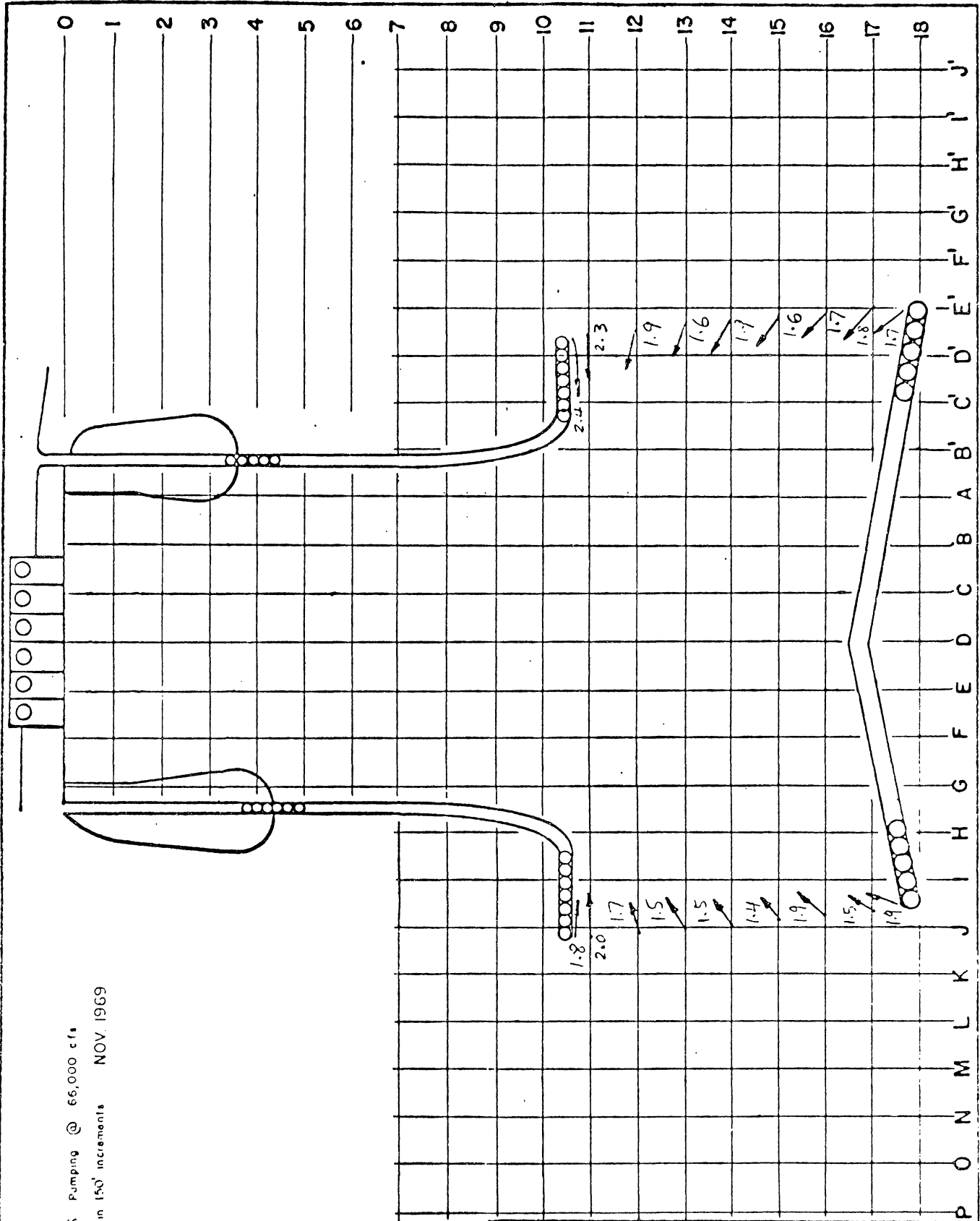
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 LUDINGTON PUMPED STORAGE PROJECT
 LAKE FRONT MODEL
 PLATE No. 61

1LST No 42-B
 BOTTOM VELOCITIES Pumping @ 66,000 cfs
 SCALE: Grid system is in 150' increments NOV. 1969



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 LAKE FRONT MODEL
 PLATE No. 62

TEST NO 43
 BOTTOM VELOCITIES Pumping @ 66,000 cfs
 SCALE Grid system is in 150' increments NOV. 1969

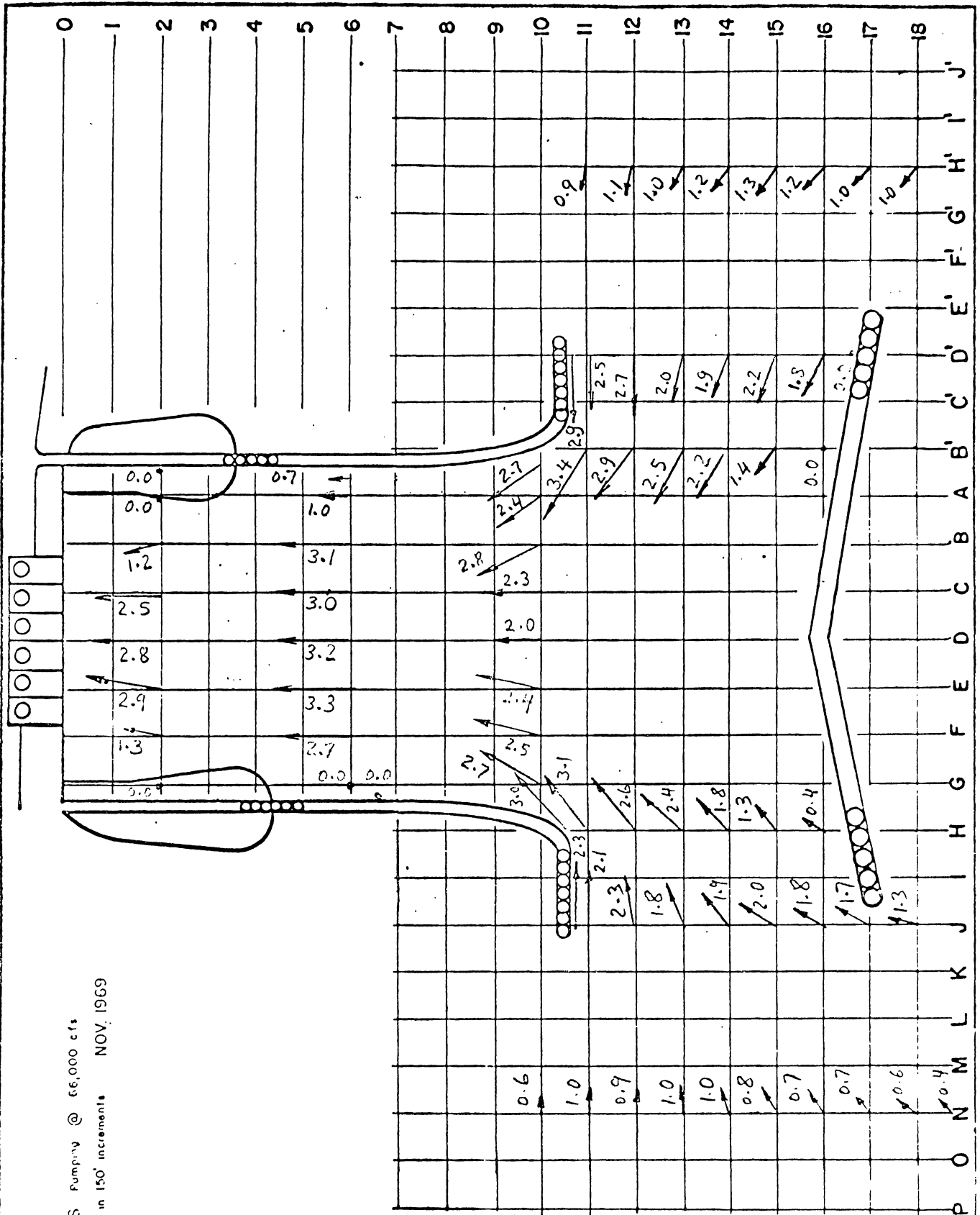


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 LAKE FRONT MODEL

PLATE No. 63

TEST No 46
 BOTTOM VELOCITIES Pumping @ 66,000 cfs
 SCALE: Grid system is in 150' increments NOV. 1969



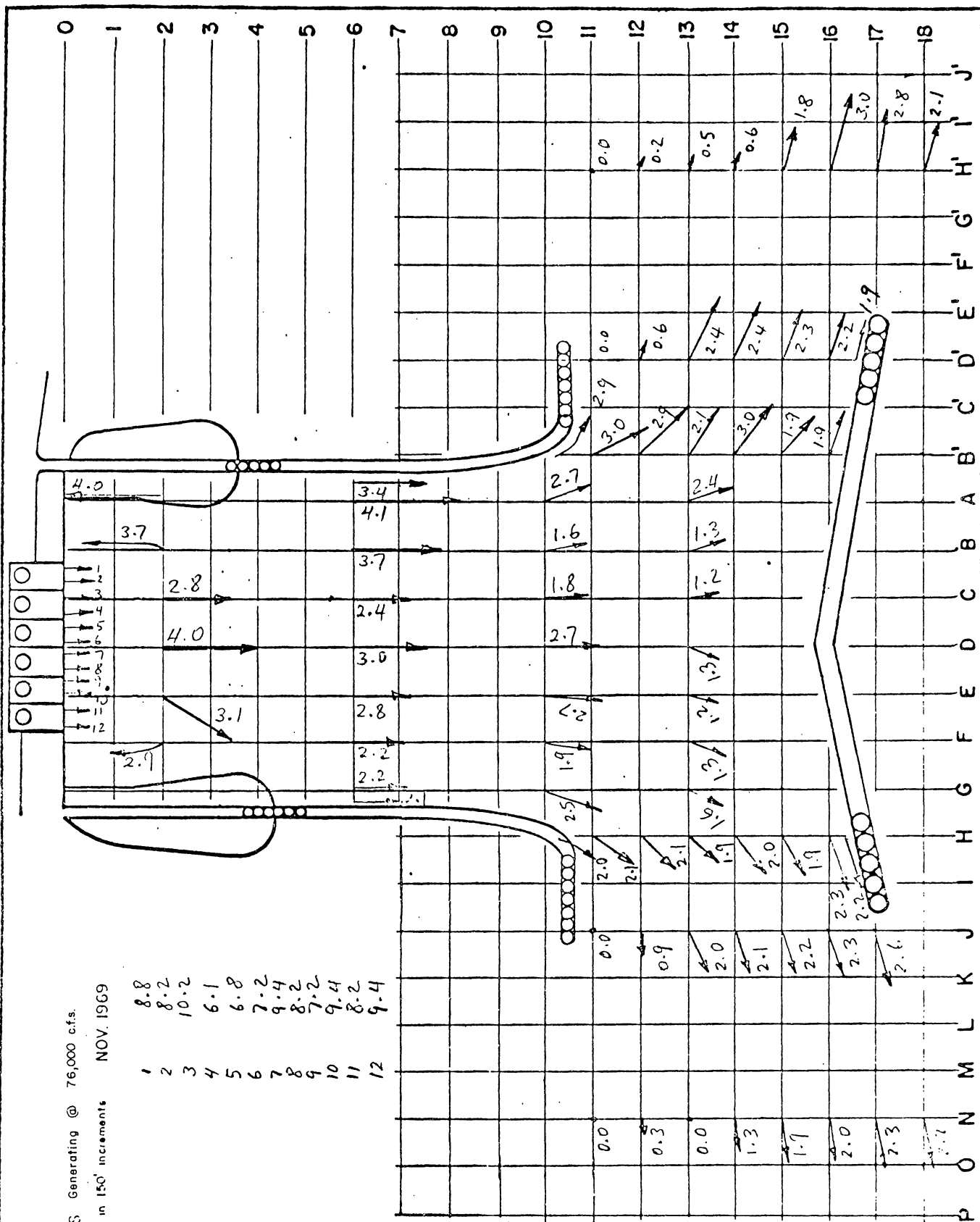
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 LAKE FRONT MODEL

PLATE No. 64

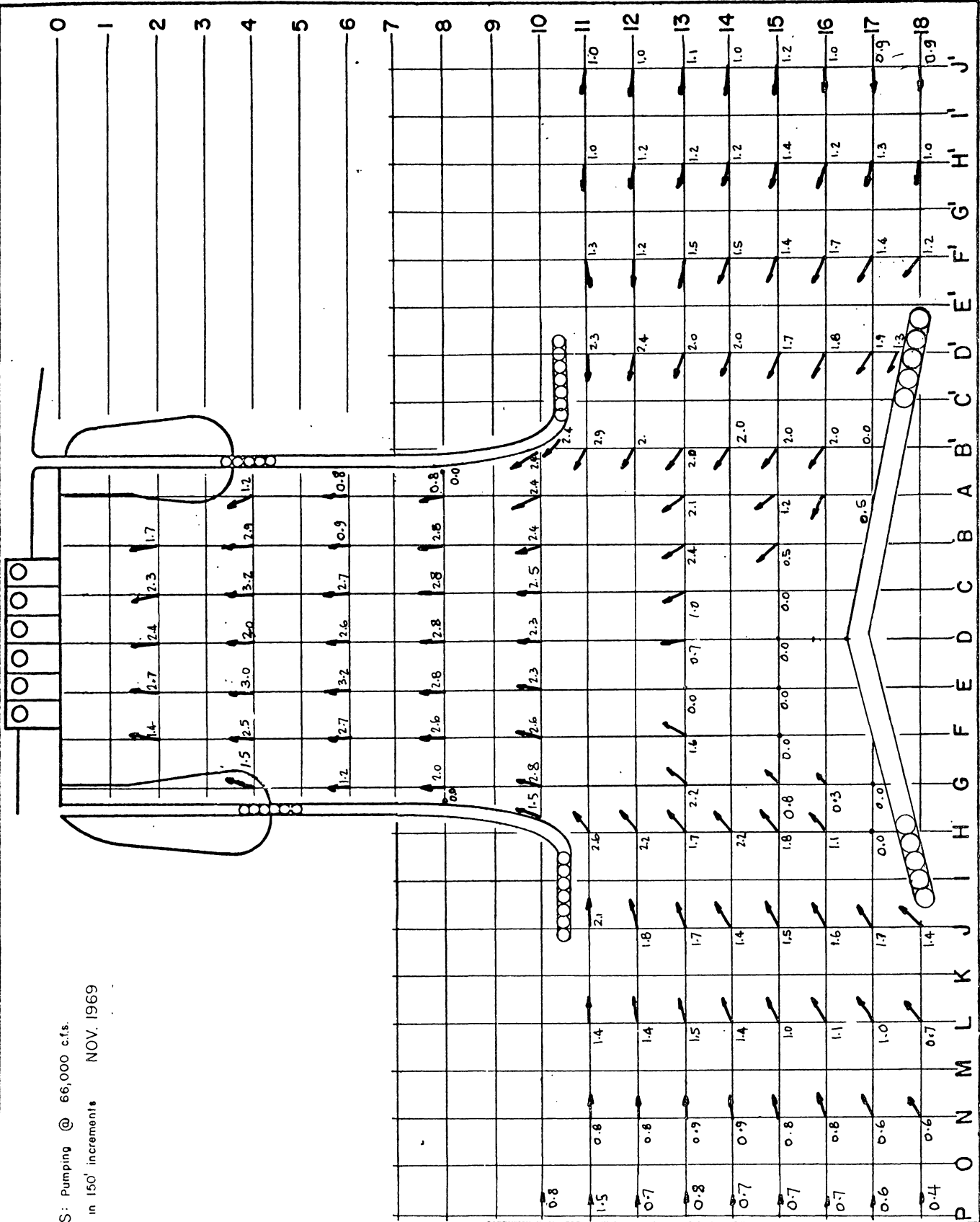
TEST No 47-A
 BOTTOM VELOCITIES Generating @ 76,000 cfs.
 SCALE: Grid system is in 150' increments NOV. 1969

- 1 8.8
- 2 8.2
- 3 10.2
- 4 6.1
- 5 6.8
- 6 7.2
- 7 9.4
- 8 8.2
- 9 7.2
- 10 9.4
- 11 8.2
- 12 9.4



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 PLATE No. 65

TEST No. 44
 BOTTOM VELOCITIES: Pumping @ 66,000 c.f.s.
 SCALE: Grid system is in 150' increments NOV. 1969



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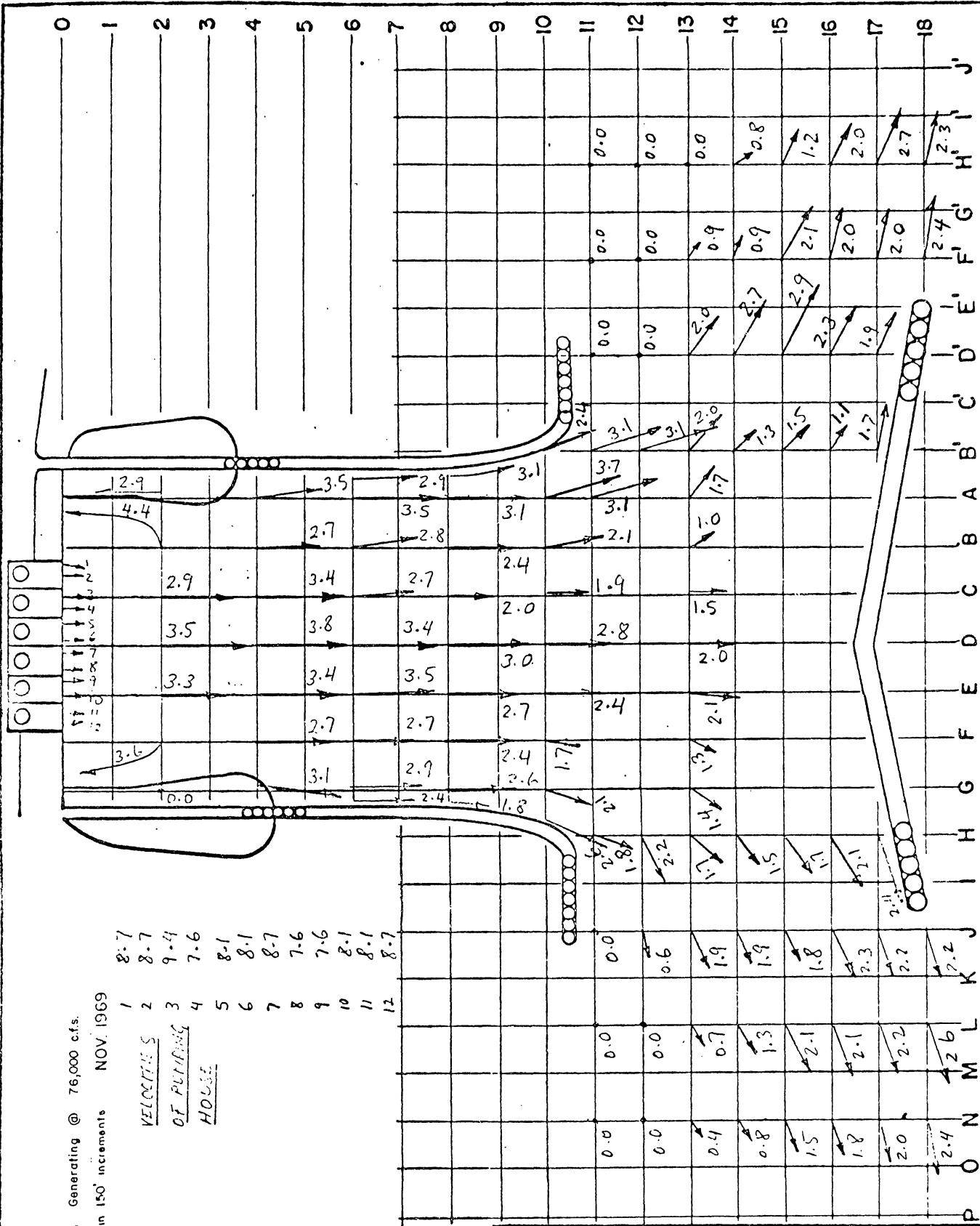
LUDINGTON PUMPED STORAGE PROJECT
 LAKE FRONT MODEL

PLATE No. 66

TEST No 4S-A
 BOTTOM VELOCITIES Generating @ 76,000 cfs.
 SCALE: Grid system is in 150' increments NOV. 1969

VELOCITIES
 OF PULPING
 HOUSE

| | |
|----|-----|
| 1 | 8.7 |
| 2 | 8.7 |
| 3 | 9.4 |
| 4 | 7.6 |
| 5 | 8.1 |
| 6 | 8.1 |
| 7 | 8.7 |
| 8 | 7.6 |
| 9 | 7.6 |
| 10 | 8.1 |
| 11 | 8.1 |
| 12 | 8.7 |



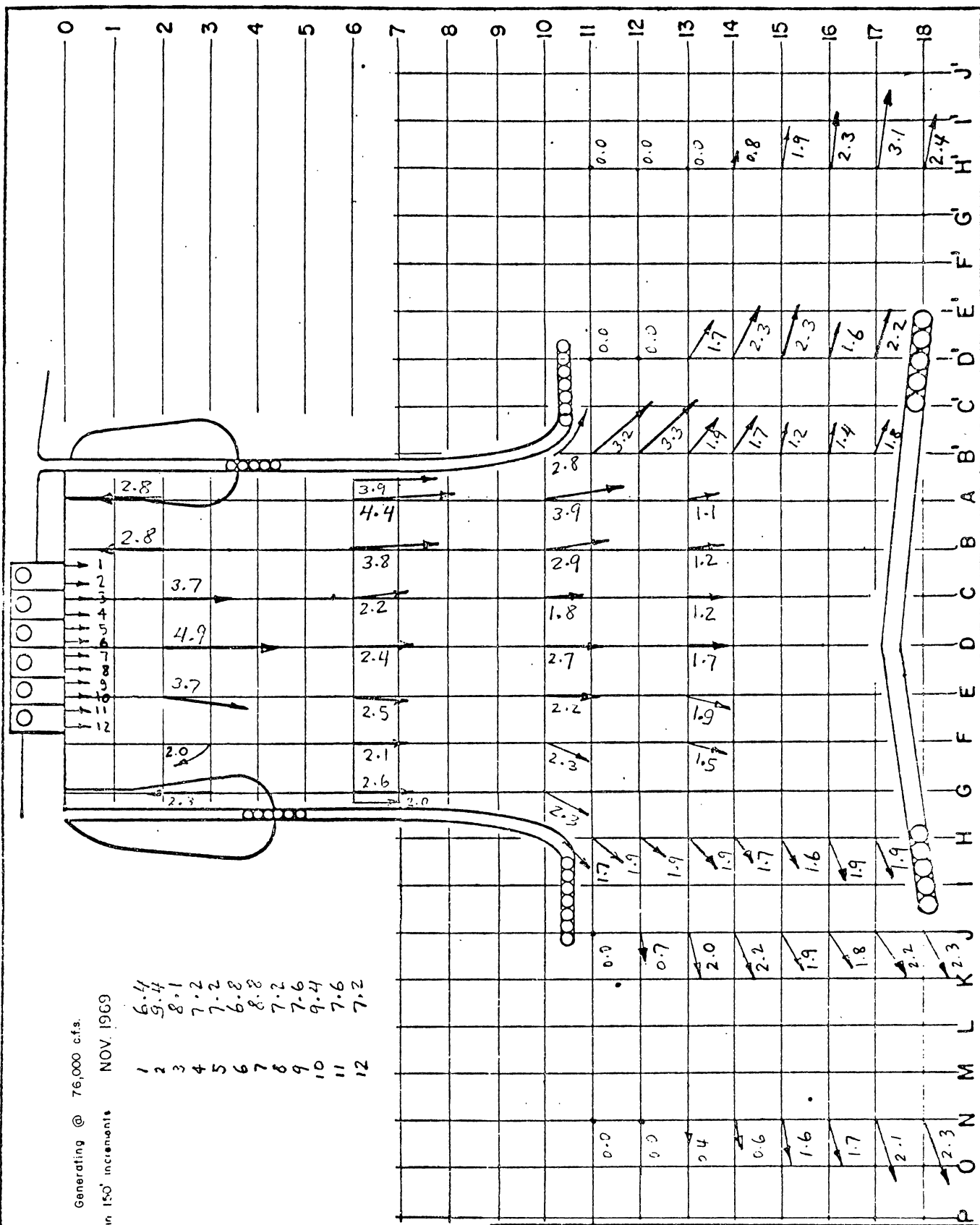
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 LAKE FRONT MODEL

PLATE No. 67

TEST No 49
 BOTTOM VELOCITIES Generating @ 76,000 cfs.
 SCALE: Grid system is in 150' increments NOV. 1969

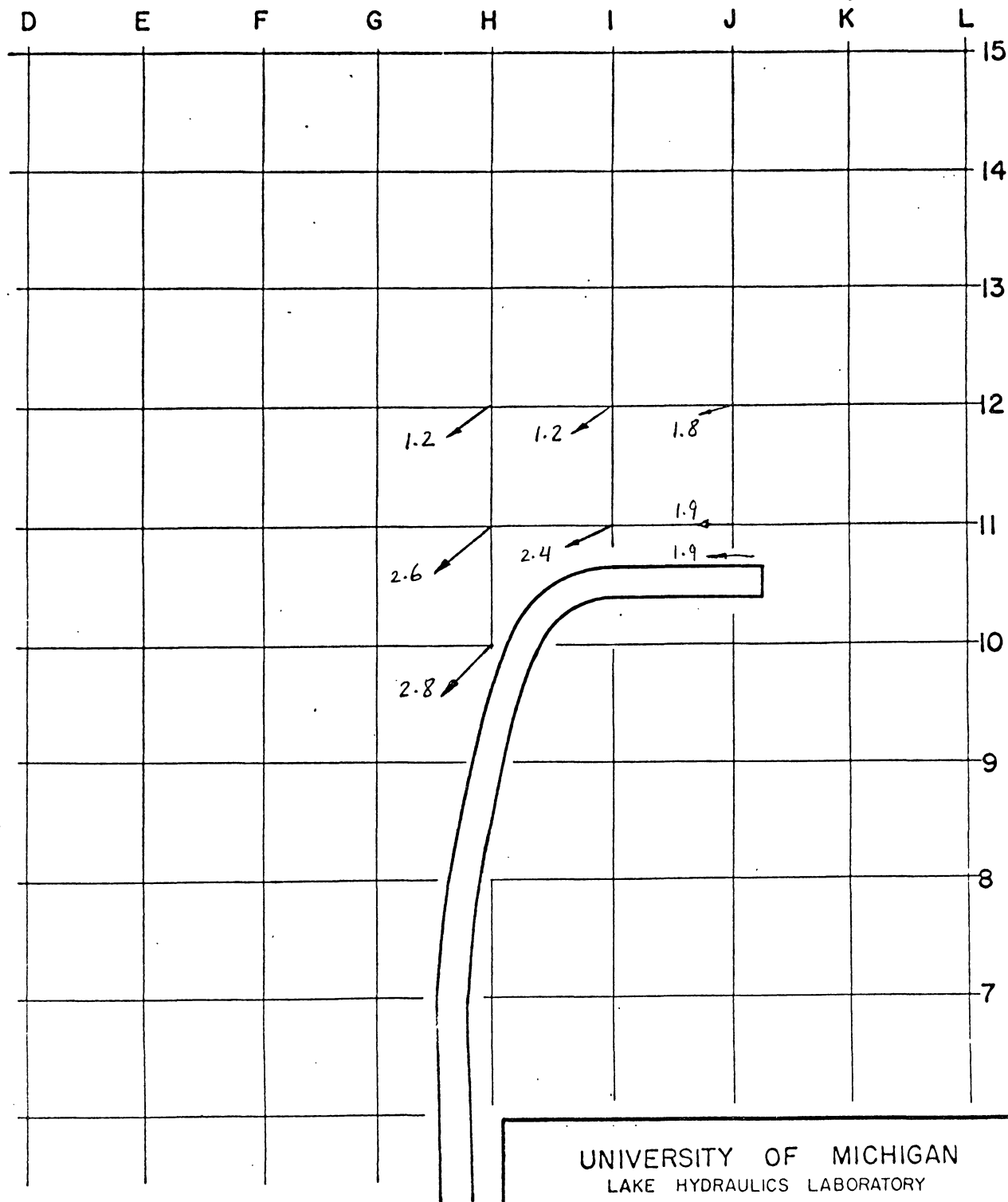
- 1 6.4
- 2 5.4
- 3 8.1
- 4 7.2
- 5 7.2
- 6 6.8
- 7 8.8
- 8 7.2
- 9 7.6
- 10 9.4
- 11 7.6
- 12 7.2



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PLATE No. 69



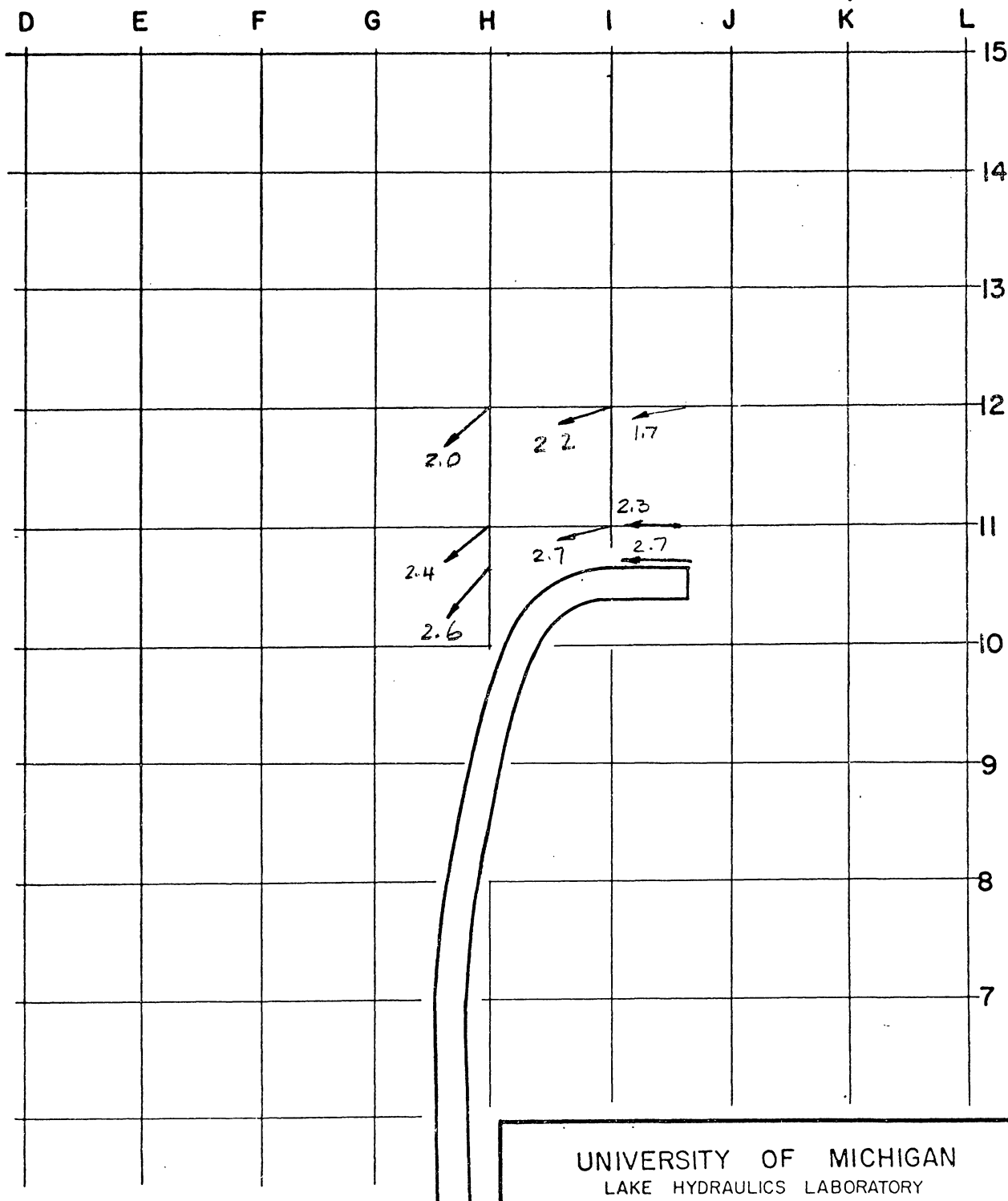
A

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LUDINGTON PUMPED STORAGE PROJECT
LAKE FRONT MODEL
PLATE No. 70

TEST No. 50
SURFACE VELOCITIES: Pumping @ 66,000 c.f.s.
WAVES: None
LITTORAL CURRENT: None
SCALE: Grid system is in 150' increments

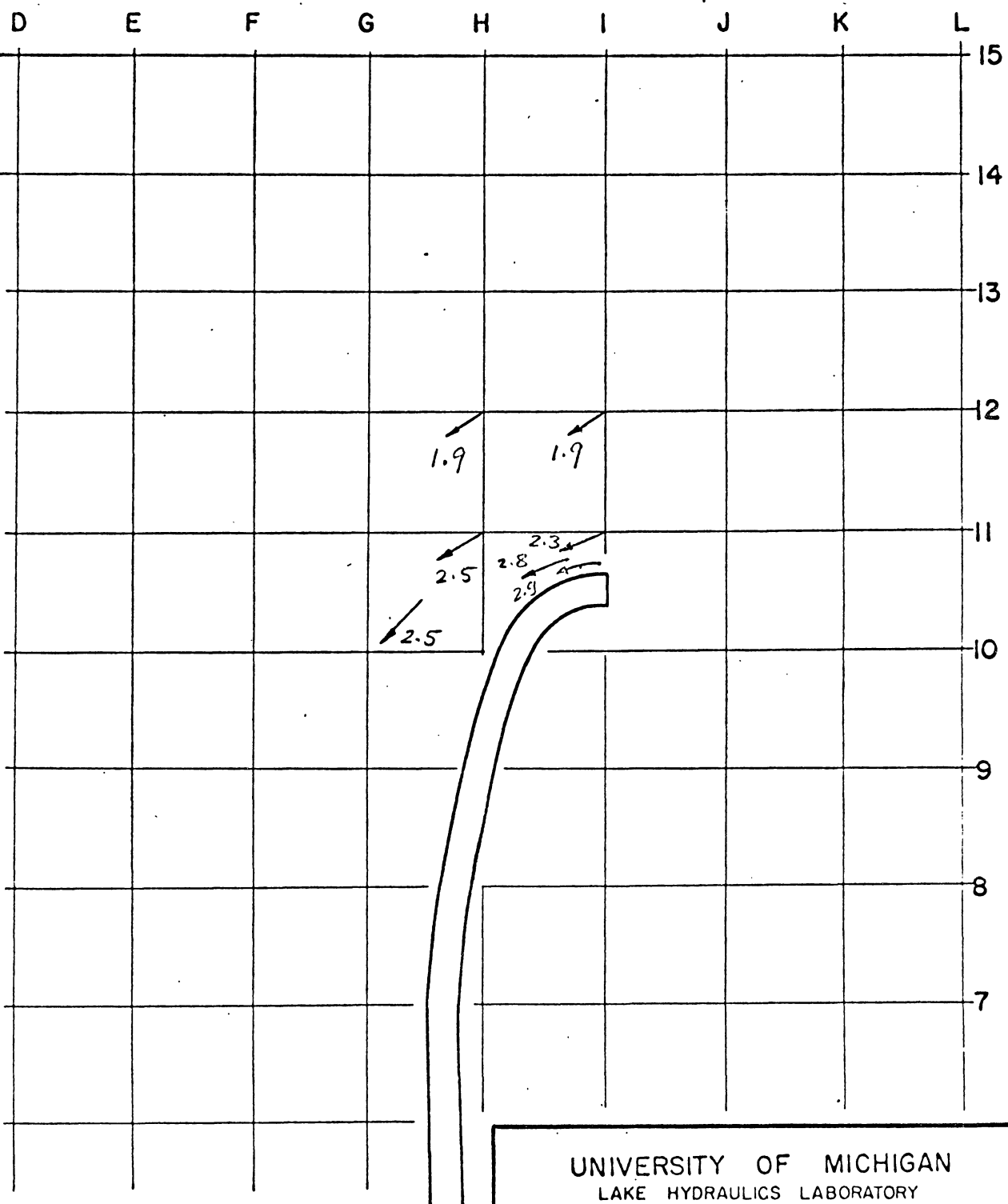
NOV. 1969



B

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 LUDINGTON PUMPED STORAGE PROJECT
 LAKE FRONT MODEL
 PLATE No. 71

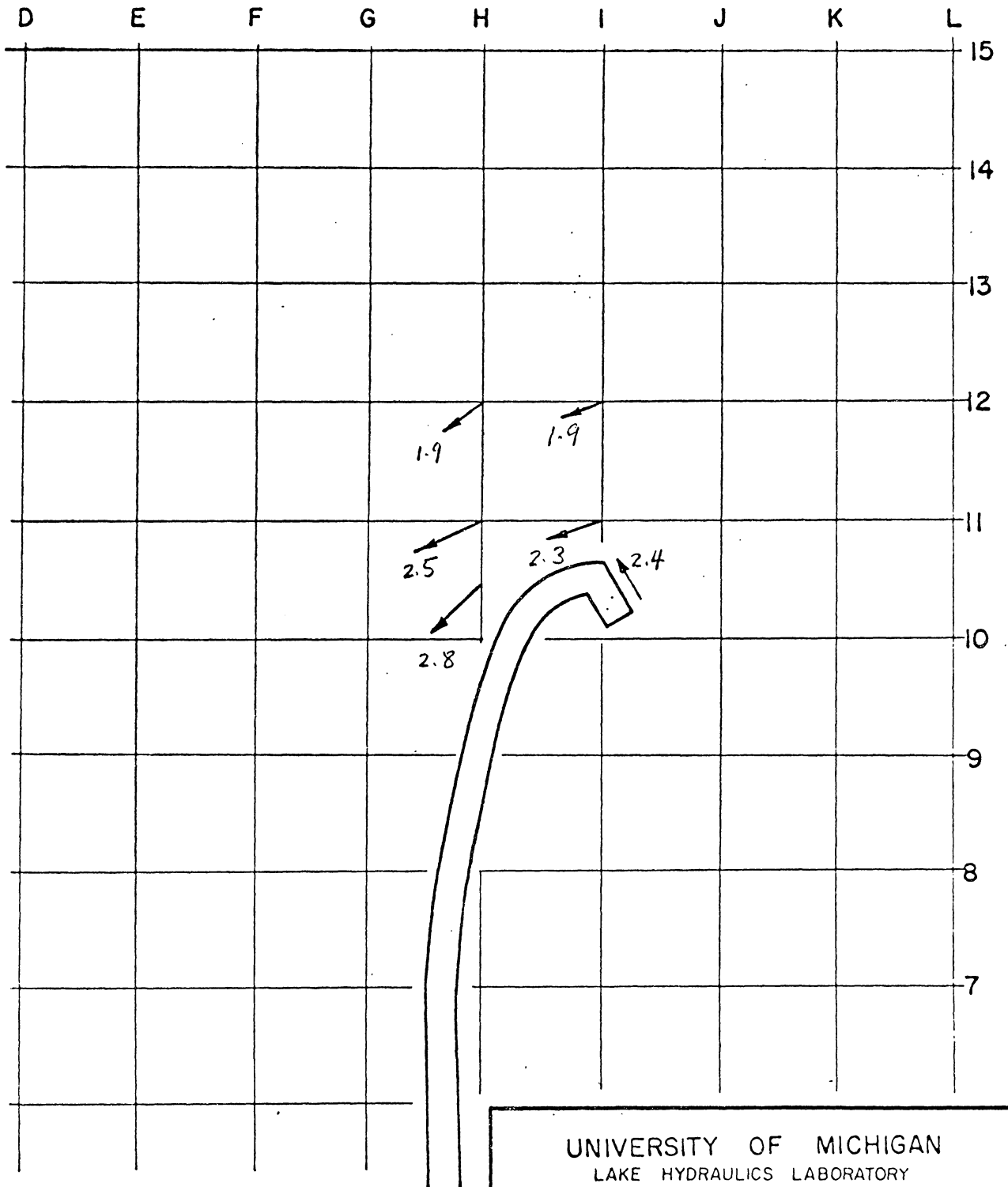
TEST No. 51
 SURFACE VELOCITIES: Pumping @ 66,000 c.f.s.
 WAVES: None
 LITTORAL CURRENT: None
 SCALE: Grid system is in 150' increments NOV. 1969



C

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 LUDINGTON PUMPED STORAGE PROJECT
 LAKE FRONT MODEL
 PLATE No. 72

TEST No. 52
 SURFACE VELOCITIES: Pumping @ 66,000 c.f.s.
 WAVES: None
 LITTORAL CURRENT: None
 SCALE: Grid system is in 150' increments NOV. 1969



D

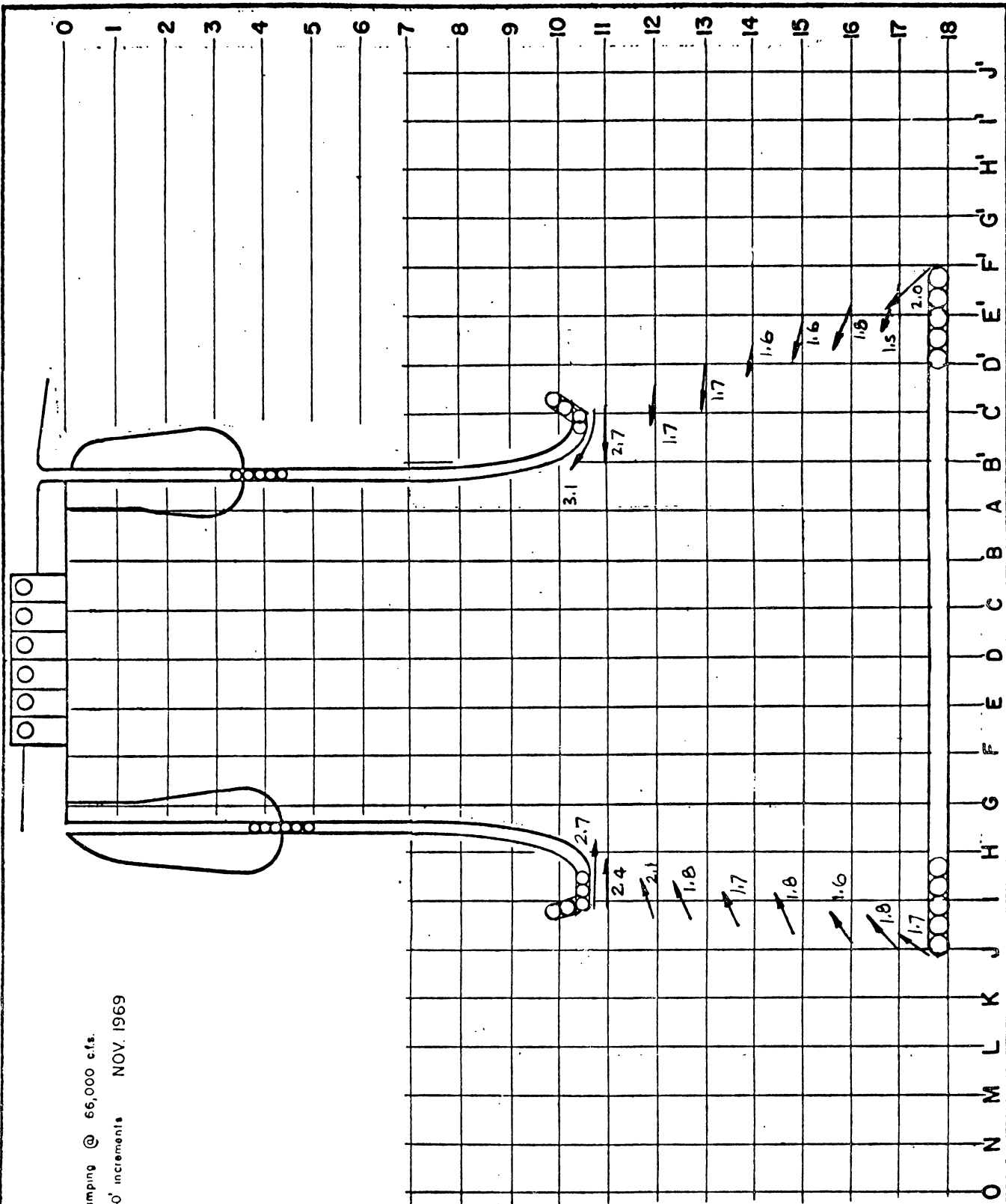
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LUDINGTON PUMPED STORAGE PROJECT
LAKE FRONT MODEL
PLATE No. 73

TEST No. 53
SURFACE VELOCITIES: Pumping @ 66,000 c.f.s.
WAVES: None
LITTORAL CURRENT: None
SCALE: Grid system is in 150' increments

NOV. 1969

TEST No. 54
 BOTTOM VELOCITIES: Pumping @ 66,000 cfs.
 SCALE: Grid system is in 150' increments NOV. 1969

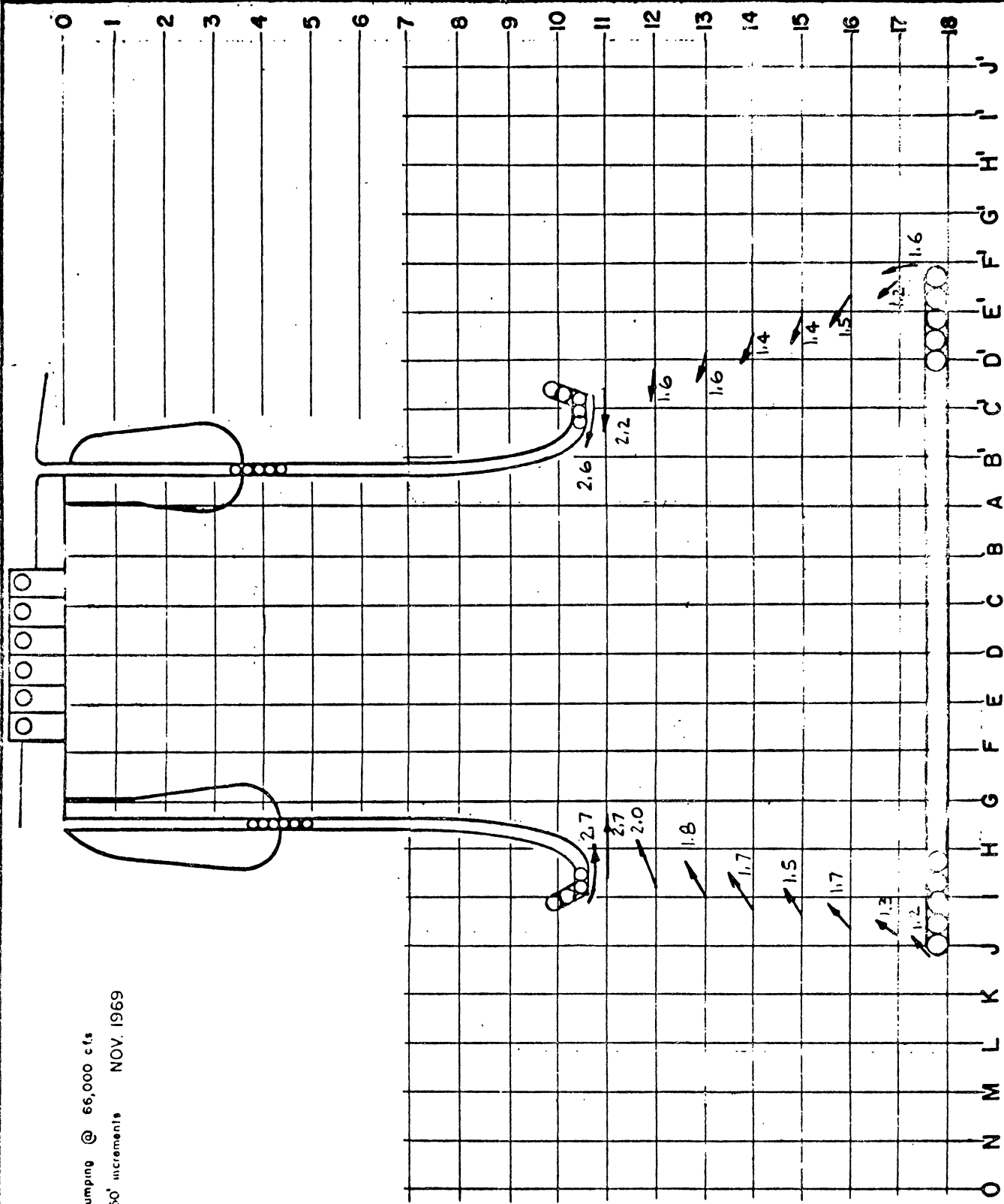


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 LAKE FRONT MODEL

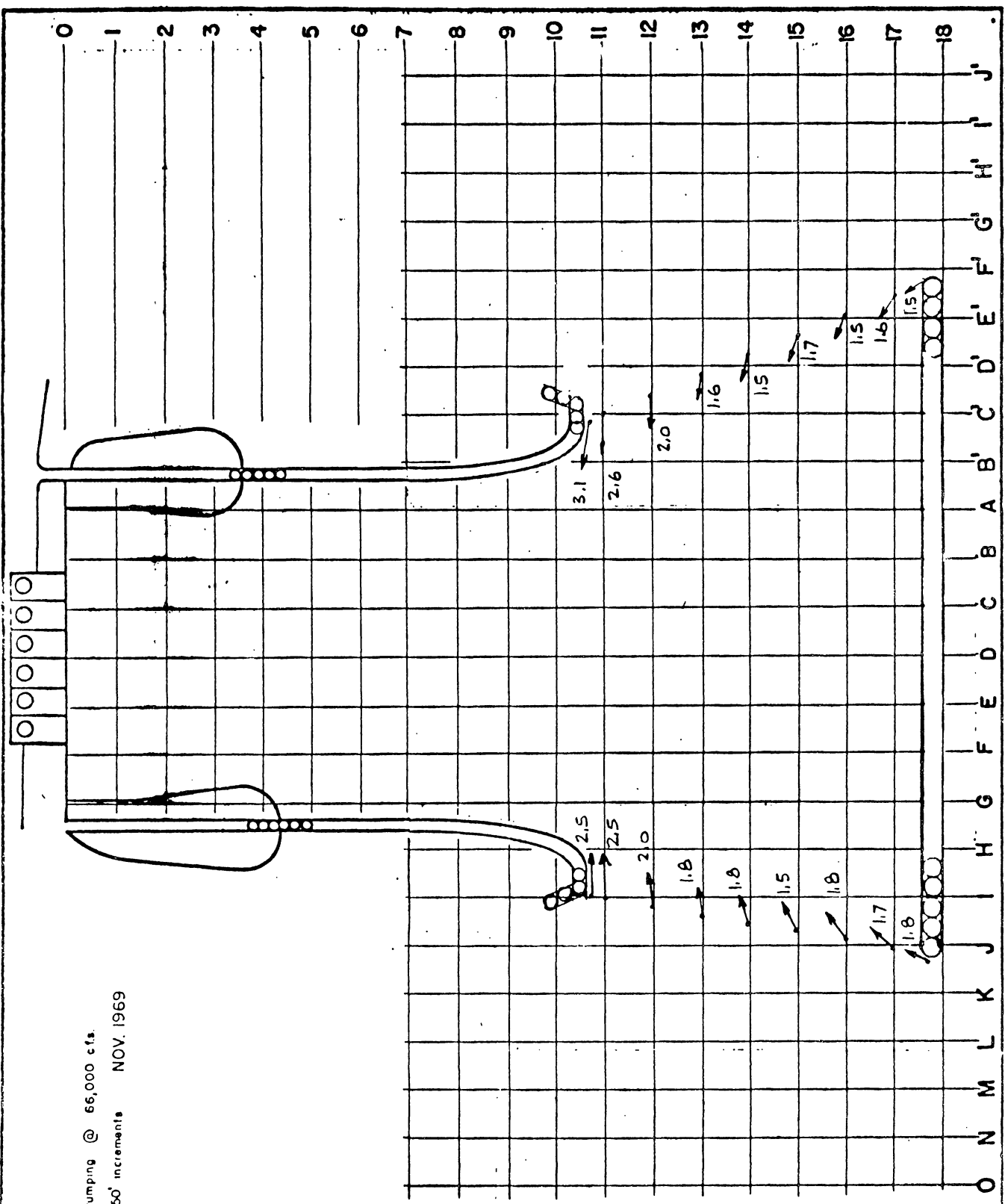
PLATE No. 74

TEST No 55
 BOTTOM VELOCITIES Pumping @ 66,000 cfs
 SCALE-Grid system is in 150' increments NOV. 1969



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 LAKE FRONT MODEL
 PLATE No. 75

TEST No. 56
 BOTTOM VELOCITIES: Pumping @ 66,000 cfs.
 SCALE: Grid system is in 150' increments NOV. 1969

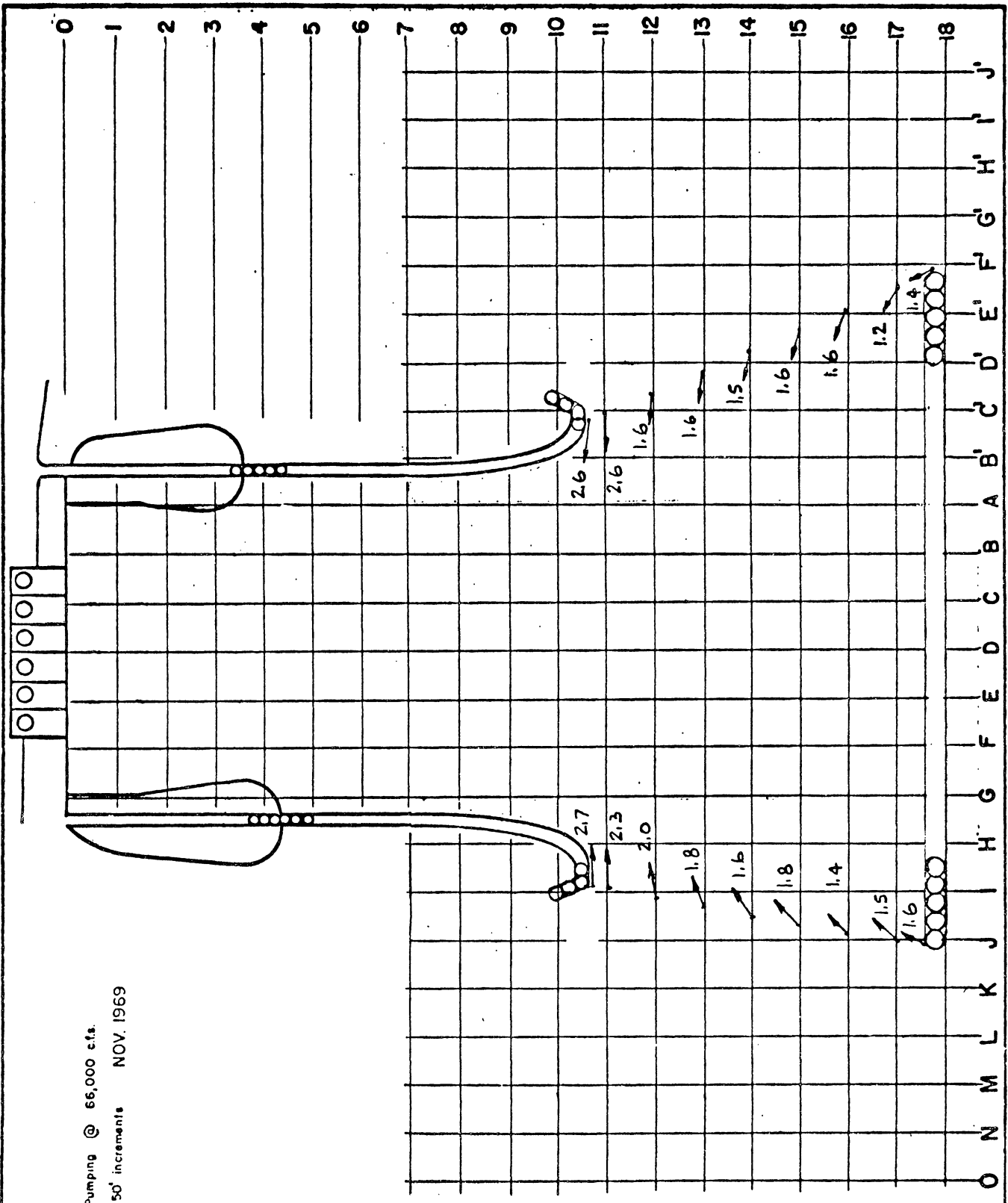


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 LAKE FRONT MODEL

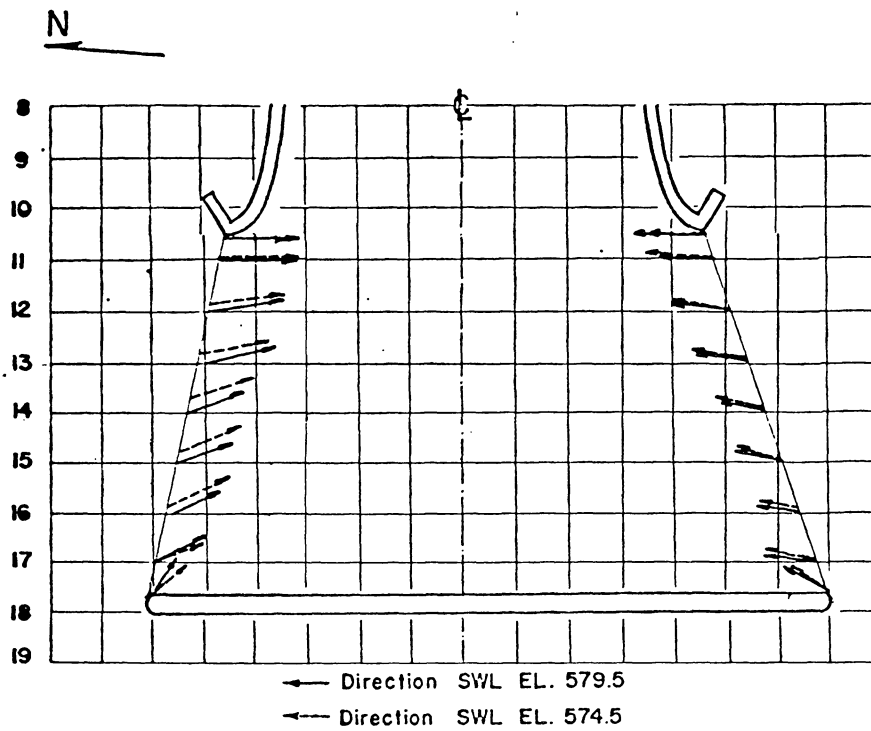
PLATE No. 76

TEST No. 57
 BOTTOM VELOCITIES: Pumping @ 66,000 cfs.
 SCALE: Grid system is in 150' increments NOV. 1969



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 LUDINGTON PUMPED STORAGE PROJECT
 LAKE FRONT MODEL
 PLATE No. 77

Comparison of Plate No. 74 and Plate No. 75



| Line No | North Opening | | | South Opening | | |
|---------|---------------|----------|----------------------|---------------|----------|----------------------|
| | Velocity | | Velocity Reduction % | Velocity | | Velocity Reduction % |
| | Plate 75 | Plate 74 | | Plate 75 | Plate 74 | |
| - | 2.66 | 2.60 | + 1.12 | 2.62 | 3.06 | +14.40 |
| 11 | 2.66 | 2.44 | - 9.00 | 2.24 | 2.60 | +16.70 |
| 12 | 1.27 | 2.12 | + 7.26 | 1.50 | 1.73 | + 7.50 |
| 13 | 1.81 | 1.78 | - 1.68 | 1.57 | 1.67 | + 6.00 |
| 14 | 1.70 | 1.73 | + 1.73 | 1.43 | 1.51 | + 5.30 |
| 15 | 1.48 | 1.81 | +18.20 | 1.43 | 1.56 | + 8.35 |
| 16 | 1.72 | 1.56 | -10.70 | 1.48 | 1.81 | +18.20 |
| 17 | 1.33 | 1.78 | +25.00 | 1.19 | 1.49 | +20.10 |
| - | 1.20 | 1.75 | +31.40 | 1.56 | 2.04 | +23.50 |
| Average | (1.81) | (1.89) | + 7.06 | (1.68) | (1.95) | +13.32 |

NOTE: + SIGN INDICATES REDUCTION
 - SIGN INDICATES INCREASE

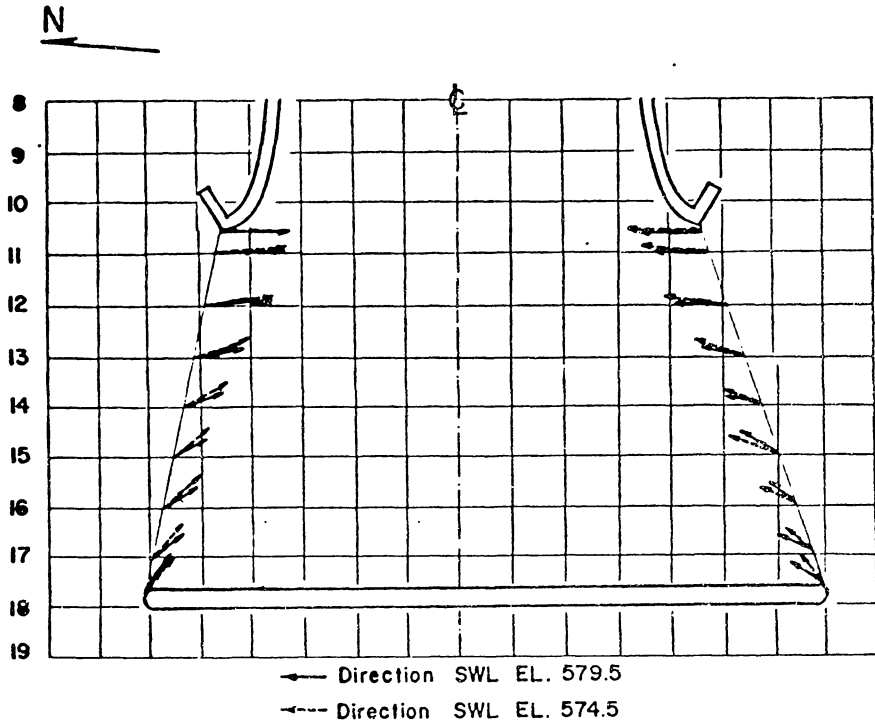
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LUDINGTON PUMPED STORAGE PROJECT
 LAKE FRONT MODEL

PLATE No. 78

TEST No.
 BOTTOM VELOCITIES: Pumping @ 66,000 c.f.s.
 SCALE: Grid system is in 150' increments NOV. 1969

Comparison of Plate No. 76 and Plate No. 77



| Line No | North Opening | | | South Opening | | |
|---------|---------------|----------|----------------------|---------------|----------|----------------------|
| | Velocity | | Velocity Reduction % | Velocity | | Velocity Reduction % |
| | Plate 77 | Plate 76 | | Plate 77 | Plate 76 | |
| - | 2.69 | 2.51 | -7.18 | 2.62 | 3.05 | +14.10 |
| 11 | 2.30 | 2.46 | +6.50 | 2.56 | 2.62 | + 2.29 |
| 12 | 1.97 | 2.01 | +2.00 | 1.55 | 2.00 | +22.50 |
| 13 | 1.83 | 1.75 | -4.38 | 1.57 | 1.62 | + 3.08 |
| 14 | 1.62 | 1.75 | +7.42 | 1.49 | 1.53 | + 2.61 |
| 15 | 1.81 | 1.53 | -15.4 | 1.60 | 1.67 | + 4.35 |
| 16 | 1.43 | 1.80 | +20.5 | 1.55 | 1.53 | - 1.31 |
| 17 | 1.47 | 1.70 | +13.5 | 1.16 | 1.57 | +27.3 |
| - | 1.57 | 1.82 | +13.7 | 1.39 | 1.51 | + 7.95 |
| Average | 1.85 | 1.92 | + 5.18 | 1.72 | 1.90 | + 9.20 |

NOTE: + SIGN INDICATES REDUCTION
 - SIGN INDICATES INCREASE

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LUDINGTON PUMPED STORAGE PROJECT
 LAKE FRONT MODEL

PLATE No. 79

TEST No.
 BOTTOM VELOCITIES: Pumping @ 66,000 c.f.s.
 SCALE: Grid system is in 150' increments NOV. 1969

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3 9015 09911 5100

AIIM SCANNER TEST CHART # 2

Spectra

4 PT ABCDEFGHIJKLMNOPQRSTUVWXYZabcdefghijklmnopqrstuvwxyz;"/?0123456789
 6 PT ABCDEFGHIJKLMNOPQRSTUVWXYZabcdefghijklmnopqrstuvwxyz;"/?0123456789
 8 PT ABCDEFGHIJKLMNOPQRSTUVWXYZabcdefghijklmnopqrstuvwxyz;"/?0123456789
 10 PT ABCDEFGHIJKLMNOPQRSTUVWXYZabcdefghijklmnopqrstuvwxyz;"/?0123456789

Times Roman

4 PT ABCDEFGHIJKLMNOPQRSTUVWXYZabcdefghijklmnopqrstuvwxyz;"/?0123456789
 6 PT ABCDEFGHIJKLMNOPQRSTUVWXYZabcdefghijklmnopqrstuvwxyz;"/?0123456789
 8 PT ABCDEFGHIJKLMNOPQRSTUVWXYZabcdefghijklmnopqrstuvwxyz;"/?0123456789
 10 PT ABCDEFGHIJKLMNOPQRSTUVWXYZabcdefghijklmnopqrstuvwxyz;"/?0123456789

Century Schoolbook Bold

4 PT ABCDEFGHIJKLMNOPQRSTUVWXYZabcdefghijklmnopqrstuvwxyz;"/?0123456789
 6 PT ABCDEFGHIJKLMNOPQRSTUVWXYZabcdefghijklmnopqrstuvwxyz;"/?0123456789
 8 PT ABCDEFGHIJKLMNOPQRSTUVWXYZabcdefghijklmnopqrstuvwxyz;"/?0123456789
 10 PT ABCDEFGHIJKLMNOPQRSTUVWXYZabcdefghijklmnopqrstuvwxyz;"/?0123456789

News Gothic Bold Reversed

4 PT ABCDEFGHIJKLMNOPQRSTUVWXYZabcdefghijklmnopqrstuvwxyz;"/?0123456789
 6 PT ABCDEFGHIJKLMNOPQRSTUVWXYZabcdefghijklmnopqrstuvwxyz;"/?0123456789
 8 PT ABCDEFGHIJKLMNOPQRSTUVWXYZabcdefghijklmnopqrstuvwxyz;"/?0123456789
 10 PT ABCDEFGHIJKLMNOPQRSTUVWXYZabcdefghijklmnopqrstuvwxyz;"/?0123456789

Bodoni Italic

4 PT ABCDEFGHIJKLMNOPQRSTUVWXYZabcdefghijklmnopqrstuvwxyz;"/?0123456789
 6 PT ABCDEFGHIJKLMNOPQRSTUVWXYZabcdefghijklmnopqrstuvwxyz;"/?0123456789
 8 PT ABCDEFGHIJKLMNOPQRSTUVWXYZabcdefghijklmnopqrstuvwxyz;"/?0123456789
 10 PT ABCDEFGHIJKLMNOPQRSTUVWXYZabcdefghijklmnopqrstuvwxyz;"/?0123456789

Greek and Math Symbols

4 PT ΑΒΓΔΕΕΘΗΙΚΑΜΝΟΠΦΡΣΤΥΩΧΨΖαβγδεξθηικλμνοπφρστνωχψζ≥≠",./≤±=≠' > < > < > < ≡
 6 PT ΑΒΓΔΕΕΘΗΙΚΑΜΝΟΠΦΡΣΤΥΩΧΨΖαβγδεξθηικλμνοπφρστνωχψζ≥≠",./≤±=≠' > < > < > < ≡
 8 PT ΑΒΓΔΕΕΘΗΙΚΑΜΝΟΠΦΡΣΤΥΩΧΨΖαβγδεξθηικλμνοπφρστνωχψζ≥≠",./≤±=≠' > < > < > < ≡
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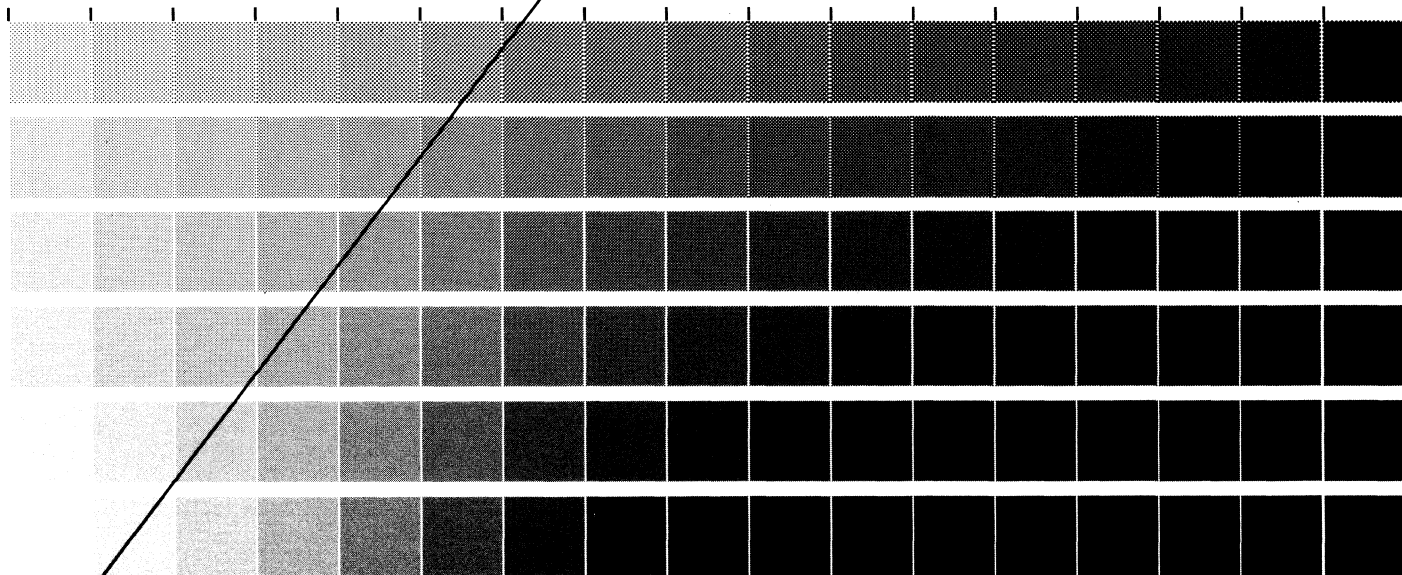
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MEMORIAL DRIVE, ROCHESTER, NEW YORK 14623

ROCHESTER INSTITUTE OF TECHNOLOGY, ONE LOMB

RIT ALPHANUMERIC RESOLUTION TEST OBJECT, RT-171

PRODUCED BY GRAPHIC ARTS RESEARCH CENTER



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