left guide bank has taken place. This is a marked alteration in the river approach, considering that the maximum river discharge up to the time the observations were taken, was not greater than 12,000 cusecs. One important result which these observations have brought forth, is that even when the bed is not 'alive' at other places, it is active in the vicinity of the island.

No marked erosion of the central bela occurred and the apron of the island remained intact.

July 1944

The observations in the month of July were made on two dates, *i.e.*, the 6th and 22nd.

6th July, 1944. A plot of the observations of this date is made in Fig. 35-A*. A perusal of this figure shows scouring action at Sections A, B, A1, B1 and C1 near the island, while on the left side of the main channel, there is silting up. Sections C, E and G do not indicate any change. Section D indicates scouring action in the central portion of the channel. Section F shows a scour on the right side of the central line and silting at the nose of the left guide bank. Up to this date, the river discharge was very low.

The observations of 6th July also indicated the same tendency to scour near the pitched island and to silt along the left bank as shown by the observations made in June.

22nd July, 1944. Between the 6th and the 22nd July, the river was rising. On the 19th, a low flood of 1,06,579 cusecs discharge occurred. On the 21st, left undersluices were opened in order to wash out the silt in the left pocket. The observations were taken after the sluicing-closure of the left pocket. A plot of the observations taken on the 22nd July is shown in 35-B*. From an examination of this figure it will be seen that :—

1. In the main river at all the six sections above the nose of the guide banks silting occurred in the left half and scour took place in the right half of the channel. The point of intersection of the sections, *i.e.*, the original and of 22nd July was situated in the middle of the main channel.

2. In the right channel scour occurred at the three sections above the pitched island. At the three sections downstream of the island a slight amount of silt deposited.

3. Downstream of the pitched island the deepest point of the river bed was situated at the centre line of the weir.

4. At the nose of the divide wall, silting occurred in the whole of the bed.

5. **Settlement of the apron on the right side of the pitched island.** In the low flood discharge, a small portion of the stone apron, on the right side of the pitched island, settled down.

Fig. 36 illustrates the river approach to the pitched island. It will be seen that the main flow takes a curve towards the pitched island.

Conclusions. From a perusal of the above results it will be seen that the island started working and attracted the main river towards it, resulting in silting up of the original main channel.

August 1944

Conditions in August 1944. Observations during August were taken on the 9th, 10th and 11th. In the last week of July and up to 11th of August the river remained higher than that in July. There were about three low floods and a medium flood of 2,00,000 cusecs. This was the maximum discharge experienced in the monsoon of 1944. On the 9th August both the undersluices were opened and the canals were closed. River conditions at the pitched island are illustrated in Fig. 37. It will be seen that all the floats dropped into the river upstream of the island for tracing directions of flow are attracted by the pitched island. A plot of the observations taken on 11th August is illustrated in Fig. 35-C*. From an examination of this figure the following indications are obtained :—

1. In the main river 2/3rd of the channel from the left bank above the tail end of the pitched island became silted. At some places the silt deposit was of the order of 8 to 10 feet.

2. The remaining 1/3rd of the main channel scoured out. The deepest scour occurred near the edge of the central bela and along the left edge of the pitched island. The depth of scour below the original bed level near the island was at certain points over 12 feet.

3. Downstream of the pitched island the bed scour was still greater. The deepest channel downstream of the island occurred along the centre-line of the weir.

4. In the right channel, scour occurred near the right edge of the pitched island.

The left edge of the central bela was eroded at several places as given below :—

R. D.	*Depth of erosion.*
4650	25 feet.
4900	30 feet.
5100	40 feet.
5500	40 feet.
6000	60 feet.
6500	120 feet.
7000	80 feet.
7500	100 feet.
8000	100 feet.
8500	70 feet.

Fig. 38* illustrates the erosion of the left edge of the central bela at R. D. 62,000. The erosion of the bela is fairly heavy as shown by the photograph.

Conclusions. From the observations made in August it may be shown that the river approach was considerably altered upstream of the pitched island. The main river flowed along the left edge of the central bela. At the pitched island and downstream of it, up to the guide banks the deepest channel was situated along the centre-line of the weir. Similarly, the deepest river bed in the right channel was also situated close to the right edge of the pitched island.

It may, therefore, be concluded that the pitched island functioned satisfactorily and the object, for which it was constructed, was achieved.

September 1944

Conditions in September, 1944. The river discharge during the second half of August was fairly high. There were two low floods one from 13th to 17th and the other on the 28th. In the latter flood the right under-sluices were opened since the Pakpattan canal was closed for repairs.

The observations were made on the 2nd, 3rd 4th and 12th of September.

2nd September 1944. A plot of the observations taken on the 2nd September, 1944, is given in Fig. 35-D. From an examination of this figure it will be seen that :—

1. The main river is concentrated along the left edge of the central bela upstream of the pitched island. At the pitched island the channel is deepest. Its maximum width here is about 250 to 300 feet. The remaining bed of the river on the left is highly silted up.

2. In the right channel also the deepest point of the bed is close to the right edge of the pitched island.

3. Downstream of the pitched island a considerable scour has taken place at the centre-line of the weir and the deepest channel is situated in the centre right up to the divide wall.

Conclusions. Due to the presence of the island the river approach in monsoon 1944 has altered considerably. The deep river instead of flowing along the left bank has shifted towards the central bela upstream of the pitched island. The approach of the river at some distance upstream of the pitched island is oblique from the left bank towards the pitched island; and a few hundred feet upstream of the pitched island the deepest channel is situated along the edge of the bela and is concentrated in a narrow section of 250 to 300 feet width. In the remaining channel, silting has occurred along the left bank upstream of the nose of the left guide bank.

In the right channel also the deepest bed is close to the right edge of the pitched island. Downstream of the pitched island the deepest channel is situated along the centre-line of the weir.

In Fig. 35-E river sections at R. D. 3650, 3900, 4150, 4400, 4650 and 4900 observed for different months are compared. From a persual of this diagram it will be clear that at R. D. 4900, *i.e.*, 400 ft. upstream of the pitched island the central bela has been eroded along the left

edge and the main river moved towards the bela. At R. D. 4650, *i.e.*, 150 ft. upstream of the island heavy erosion occurred at the left edge of the bela and the deepest river was situated there. Similarly, the deep channel moved to the pitched island as illustrated by sections at R.D. 4400. Downstream of the pitched island the deepest river bed was situated along the centre-line.

The pitched island has, thus, done its job.

3rd September, 1944. A flood of 100,000 cusecs occurred on the 3rd of September and observations were made in the rising flood. Soundings taken close to the pitched island gave a depth of over 22 feet. Since the motor launch could not be used, observations were not made further in the channel except close to the island. A velocity of about 9 feet was observed close to it. The detailed observations made on this date are given below :—

Pond level ... R. L. 567·9

Discharge ... 1,00,000 cusecs.

Observations in the main channel :

(*i*) Average sounding at 100 feet from the centre of the pitched island ... 22 feet.

(*ii*) Velocity close to the left edge of the pitched island 8·74 feet per second.

Observations at the upstream nose of the pitched island :

(*i*) Sounding ... 4·8 feet.

(*ii*) Velocity ... 3·13 feet per second.

Water from the main river or the left channel was flowing into the right channel along the upstream nose of pitched island.

Observations in the right channel :

(*i*) Average sounding at 100 feet from the centre of the pitched island ... 13 feet.

(*ii*) Velocity close to the right edge of the pitched island ... 7·35 feet per second.

4th September, 1944. On the 4th September, the discharge in the river further increased to 1,54,271 cusecs. In this discharge a heavy action occurred at the pitched island. The main river flow was concentrated along the left edge of the central bela upstream of the pitched island and at the pitched island. Downstream of the pitched island the main flow occurred along the centre-line to the weir. Detailed observations could not be made in this discharge. The conditions showed that the whole river was attracted by the pitched island and downstream of the island the flow occurred centrally to the weir. Current directions are illustrated in Fig. 39.

An examination of the apron on the left side of the pitched island showed that a slight settlement of this apron at certain points occurred during this discharge.

12th September, 1944. The river discharge remained above 1,20,000 cusecs on the 5th and the 6th of September. On the 8th the river fell to 55,000 cusecs. On the 11th the river discharge fell to 30,000 cusecs and below.

On the 6th and 7th September, the left undersluices were opened to flush the left pocket of the silt deposit for about three days between the 6th and the 8th. The left and the central groups of the weir were opened to pass the flood discharge. The right undersluices were closed. Observations made on the 12th September and plotted in Fig. 35-E indicated silting at the pitched island and certain amount of scour along the left guide bank and at the nose of guide bank due to the prolonged opening of the undersluices and the left portion of the weir. After the 12th September the river fell very low and no observations were made.

CONCLUSIONS

Different methods of river training have been discussed in this Paper. From the experiments carried out by means of models and on the full scale, it has been shown that the use of the pitched island is a satisfactory method of river training and control. The pitched island pulls the main river towards itself and a deep channel forms at the island as well as downstream of it. The method works very satisfactorily in the vicinity of control points, such as, weirs and railway bridges.

Observations on the prototype will be continued during the next year. Arrangements are being made to take observations during medium and high floods.

REFERENCES

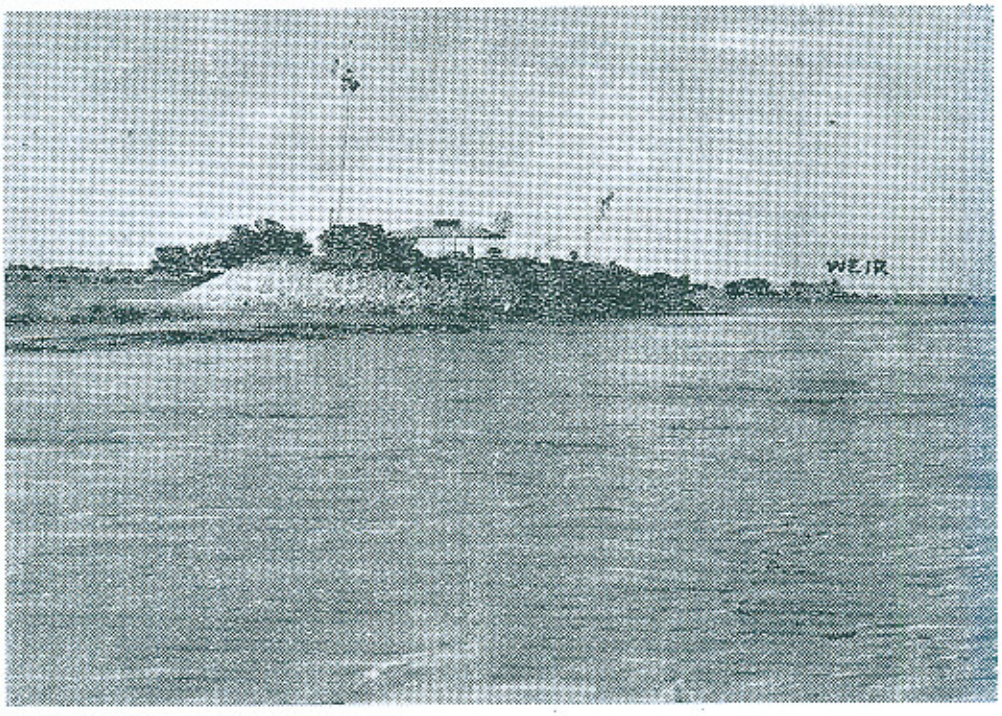
1. Dubuat, P. L. G. Comte (1786).—Principles d'Hydraulique, etc., Nov, Ed. Paris, Imper. de Monsieur.
2. Exner, F. M., (1919)., 2-A,—Sitz. Ber. Akad. Wiss. Wein, Abt. 128, 1453-73.
3. Qureshi, M. S. (1943).—Curr. Sci., 12, 278.
4. Stanley, W. F., (1881).—Experimental Researches, etc., (London, E. and F. N. Spon, Ltd.)
5. Thomson, J., (1877).—Proc. Roy. Soc., Lond., (A), 25, 5-8 Also, Scientific Papers in Physics and Engineering (Lond., Camb. Univ. Press) pp. 96-99.

6. Uppal, H. L. and Mushtaq Ahmad (1936).—Studies in River Training – Investigation of a model of River Sutlej for straightening the course of the river above Pallah Headworks (Typewritten paper of Irrig. Res. Inst., Lahore).

7. Vogel, D. Herbert, (1934).—Model Studies for Channel Stabilization Mississippi River, Paper 15, of the U. S. Waterways Experi. Sta. Vicksburg, Mississippi.

RIVER TRAINING AND CONTROL BY PITCHED ISLANDS

RIVER SUTLEJ ABOVE SULEIMANKI WEIR



Pitched island constructed at R. D. 4,500 upstream of the Weir.

RIVER TRAINING AND CONTROL BY PITCHED ISLANDS.

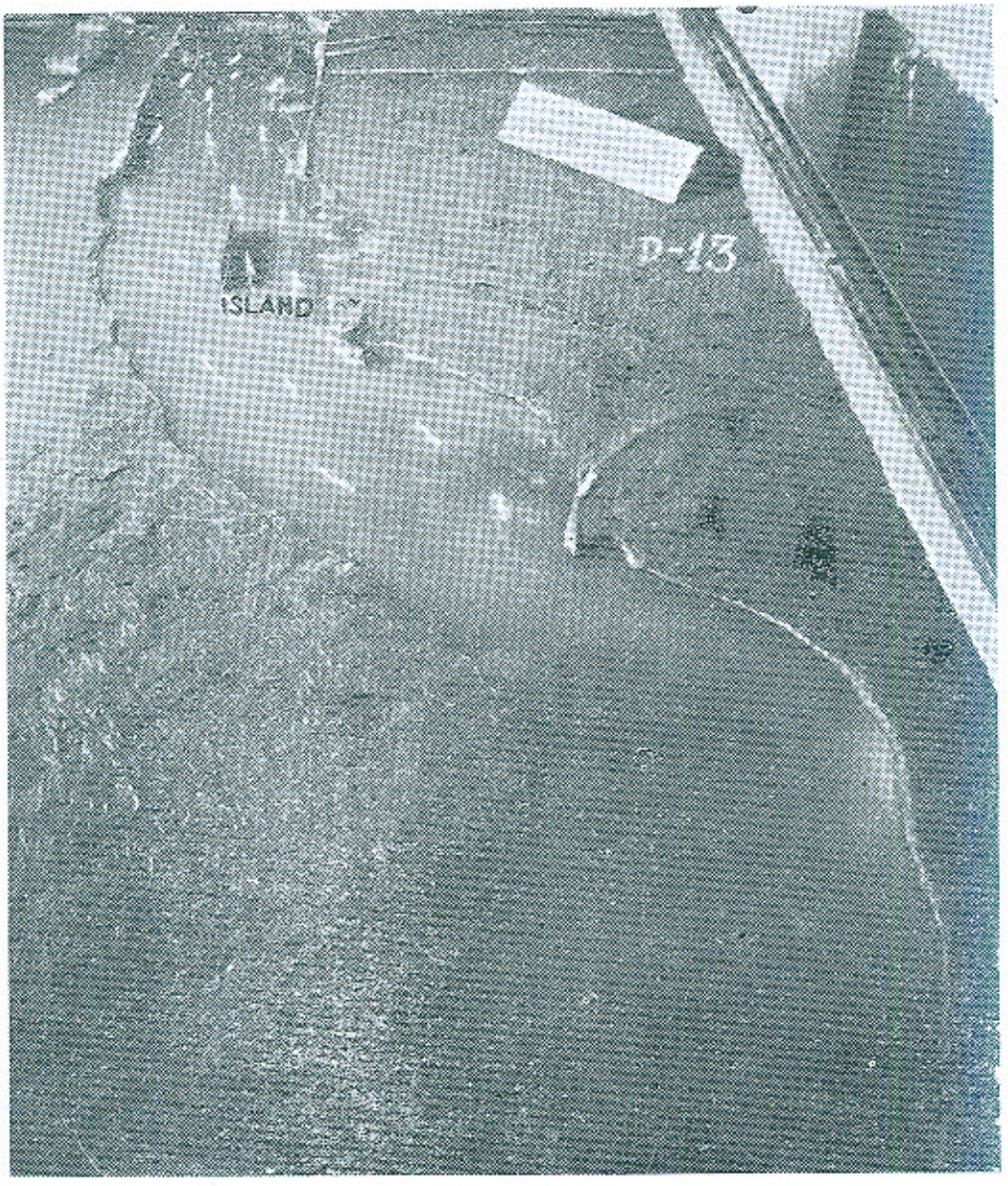
A study of the pitched island by means of models.

1936-37 Studies.

River Sutlej above Islam Headworks.

Triangular pitched island at 5,000 ft. above Weir.

Fig. 3



The flow is distributed uniformly between the guide banks.

RIVER TRAINING AND CONTROL BY PITCHED ISLANDS.

1936-37 Studies.

River Sutlej above Islam Headworks.

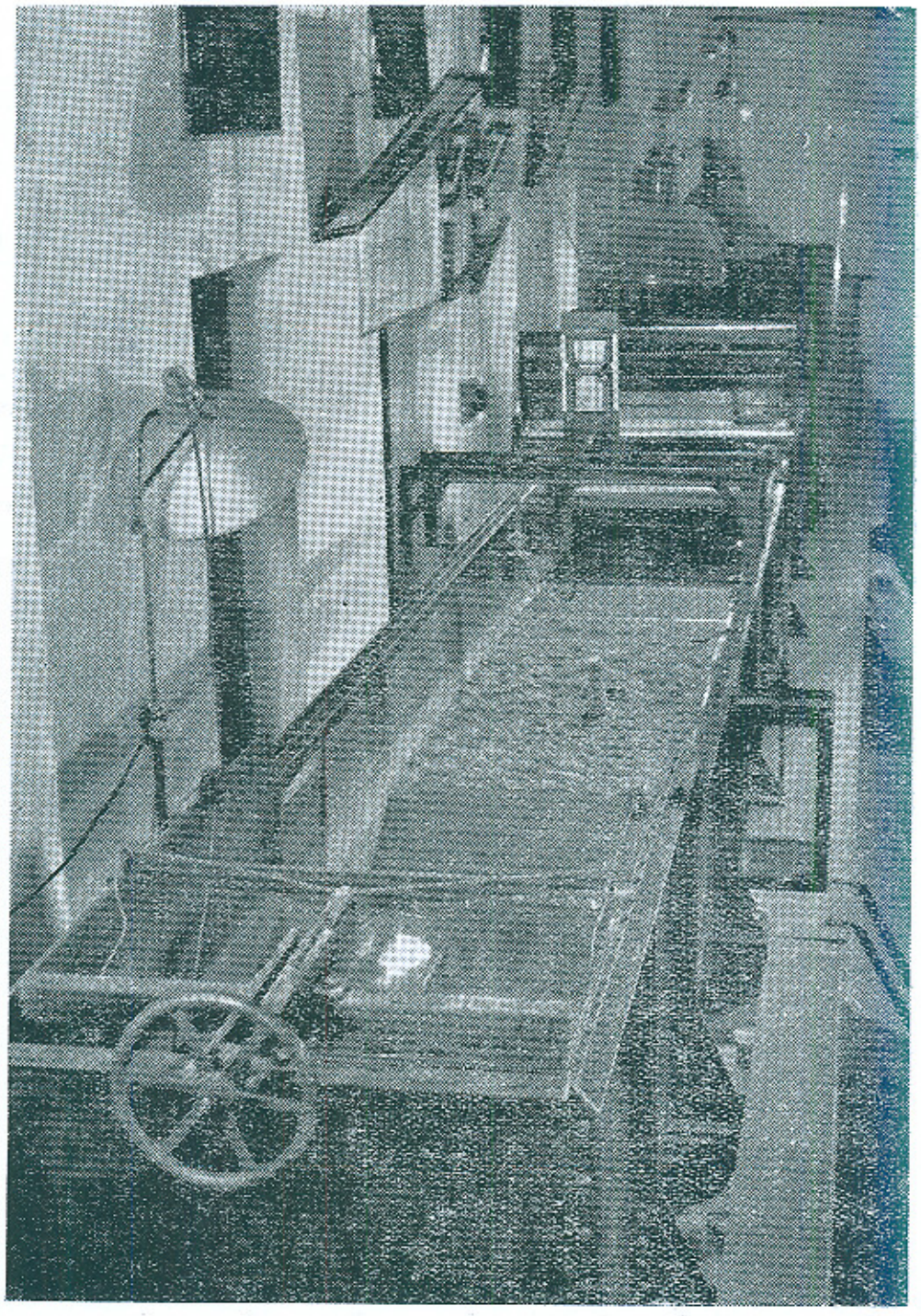
Triangular Pitched island at 50,000 ft. above weir.

Fig. 3A



Conditions of river bed in dry.

RIVER TRAINING AND CONTROL BY PITCHED ISLANDS
FLUME EXPERIMENTS
1943-44 Studies. Fig. 7



This photograph illustrates the island constructed on a sandy bed in the glass flume and its effect. It will be seen that in the vicinity of the pitched island action takes place; while the bed on the upstream of the pitched island is not alive.

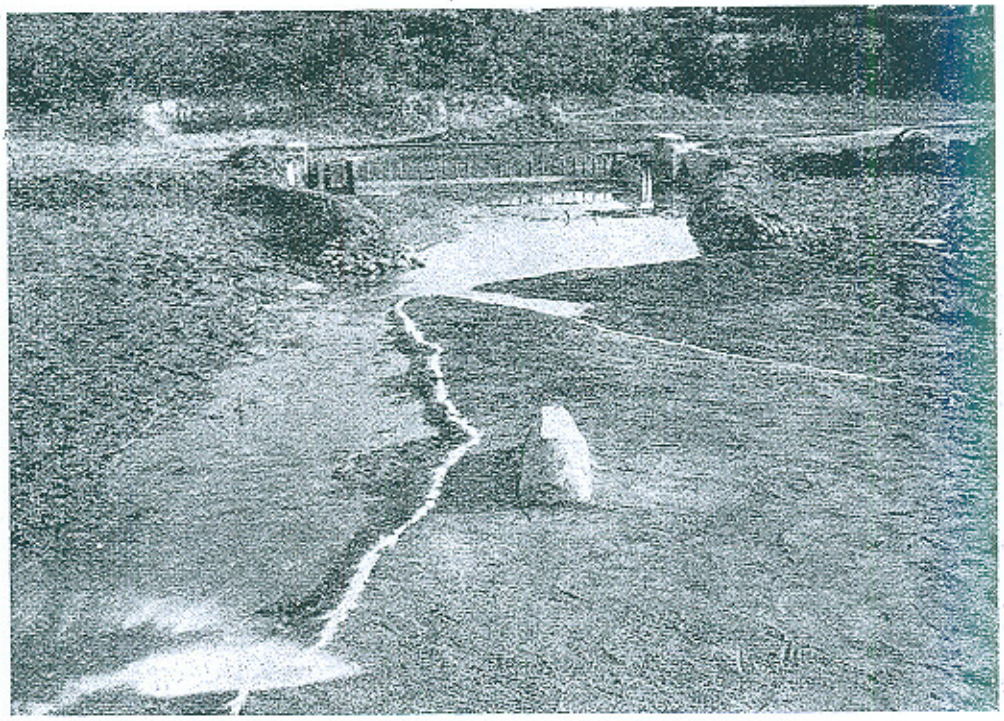
A study of the pitched island by means of models.

Experiments on Large-Scale Models.

1943-44 Studies.

River Sutlej above Suleimanki Headworks.

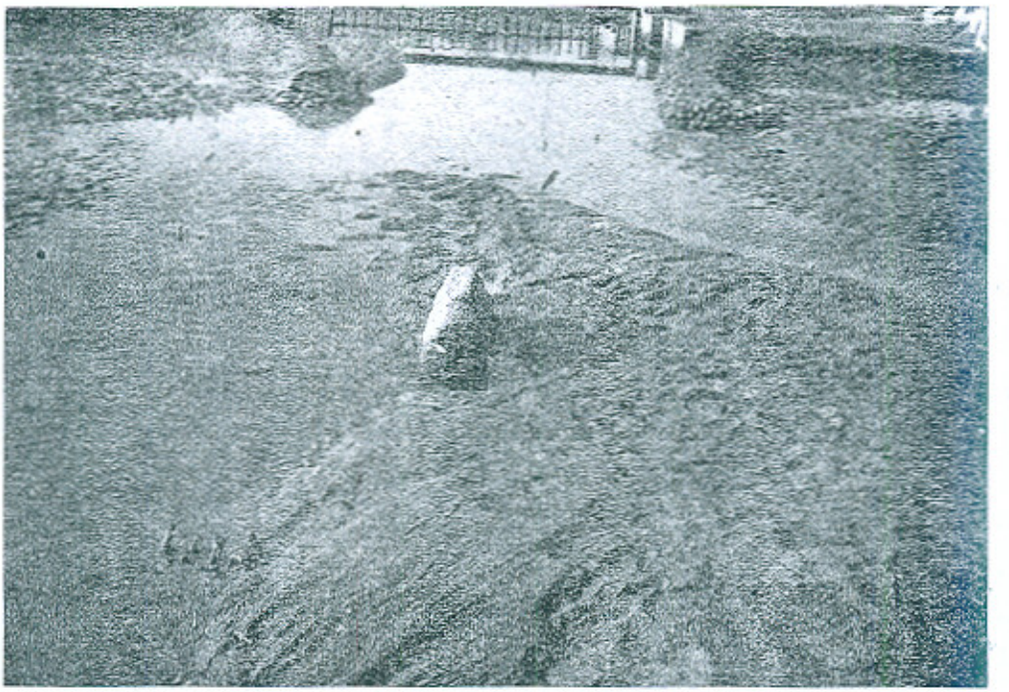
Fig. 13



River bed just after the construction of the island in the first position.

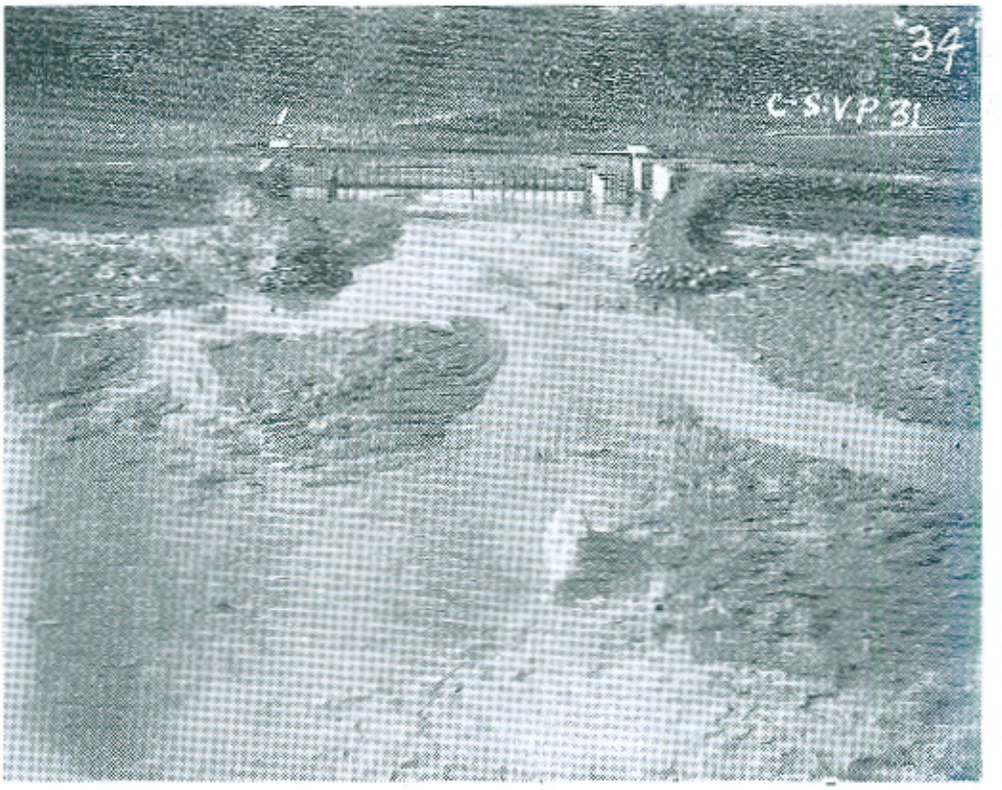
RIVER TRAINING AND CONTROL BY PITCHED ISLANDS.

Fig. 13A



River bed after running the model in the presence of the island in the first position.

Fig. 13B



River bed after running the model in the presence of the island constructed on the centre-line (2nd position).

RIVER TRAINING AND CONTROL BY PITCHED ISLAND.

A study of the pitched island by means of models.

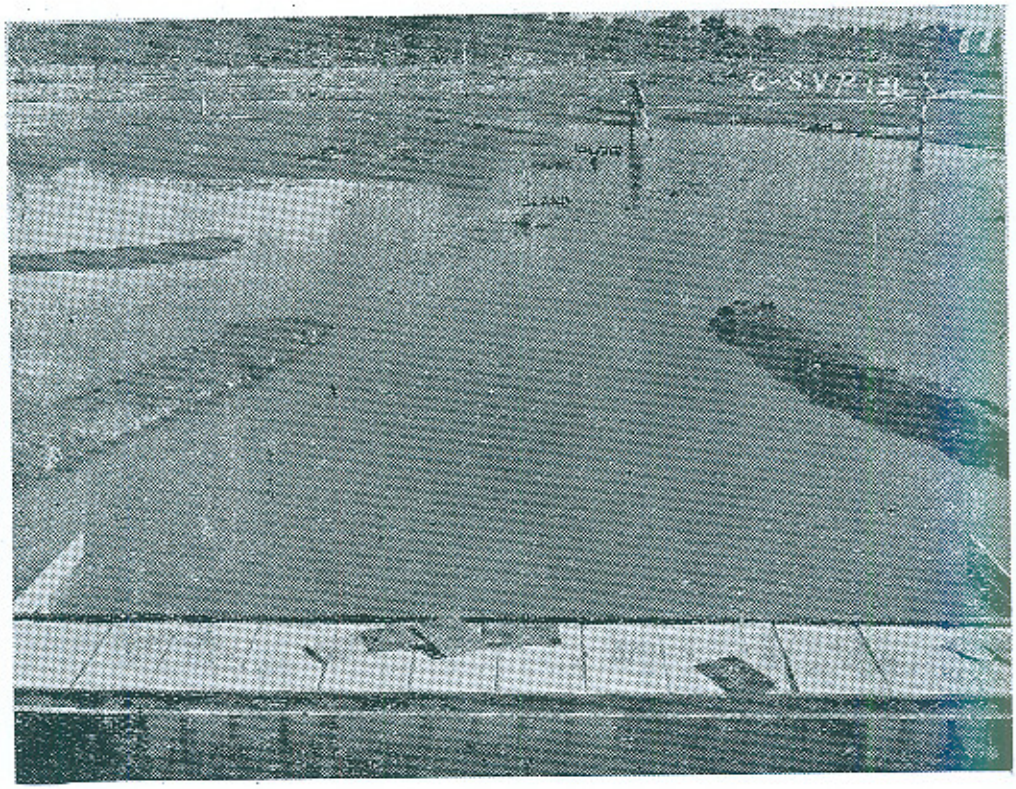
Experiments on Large Scale Models.

1943-44 Studies.

River Sutlej above Sulcimanki Headworks.

Two pitched islands constructed at 7,000 and 1,300 ft. above Weir.

Fig. 14



Looking Upstream.

This photograph illustrates the conditions of flow in a discharge of 1,00,000 cusecs after running the flood discharges. Very little action appears to be taking place at Island No. 2. The main current, strikes the Island No. 1.

RIVER TRAINING AND CONTROL BY PITCHED ISLANDS.

A study of the pitched island by means of models.

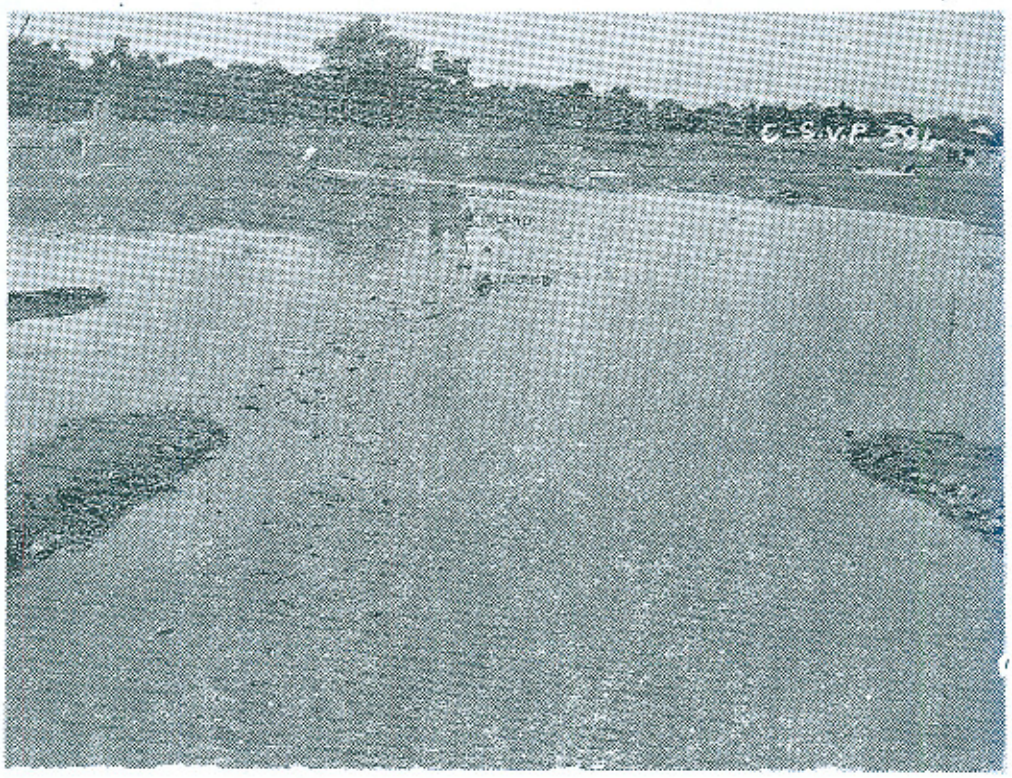
Experiments on Large Scale Models.

1943-44 Studies.

River Sutlej above Suleimanki Headworks.

Three pitched islands constructed at 7,000 ; 13,000 and 19,000 ft. above Weir.

Fig. 16



Looking Upstream.

This photograph shows the course of the river in a discharge of 80,000 cusecs.

RIVER TRAINING AND CONTROL BY PITCHED ISLANDS.

A study of the pitched island by means of models.

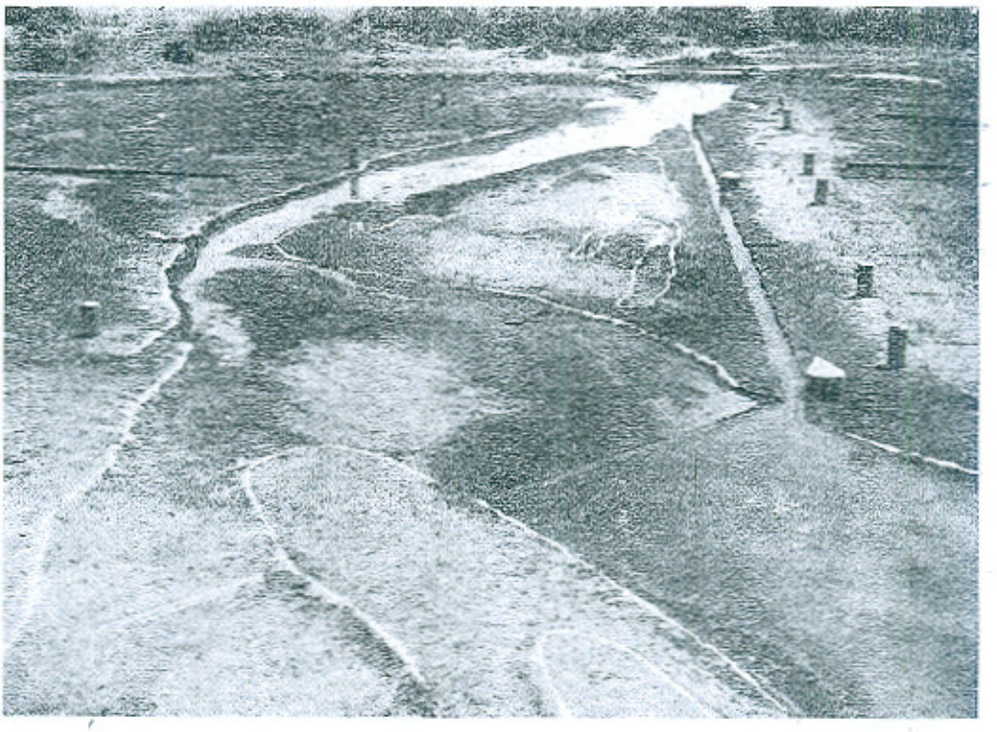
Experiments on Large Scale Models.

1943-44 Studies.

River Sutlej above Suleimanki Headworks.

Three islands joined to the main river by a leading cut. The main river closed by an earthen bund.

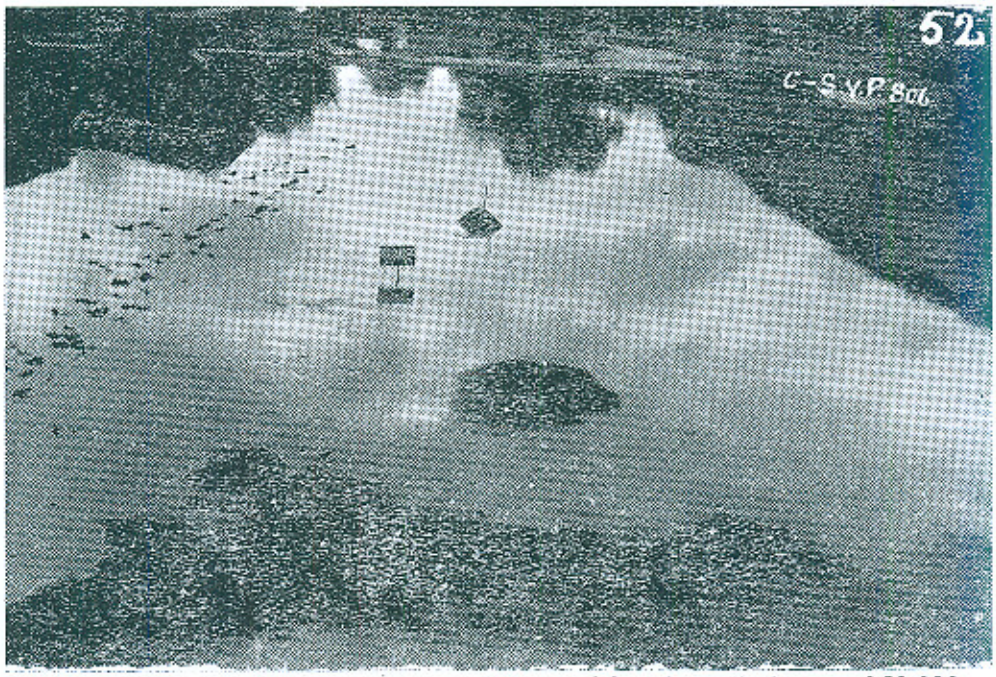
Fig. 20



This photograph shows the bund breached near the island.

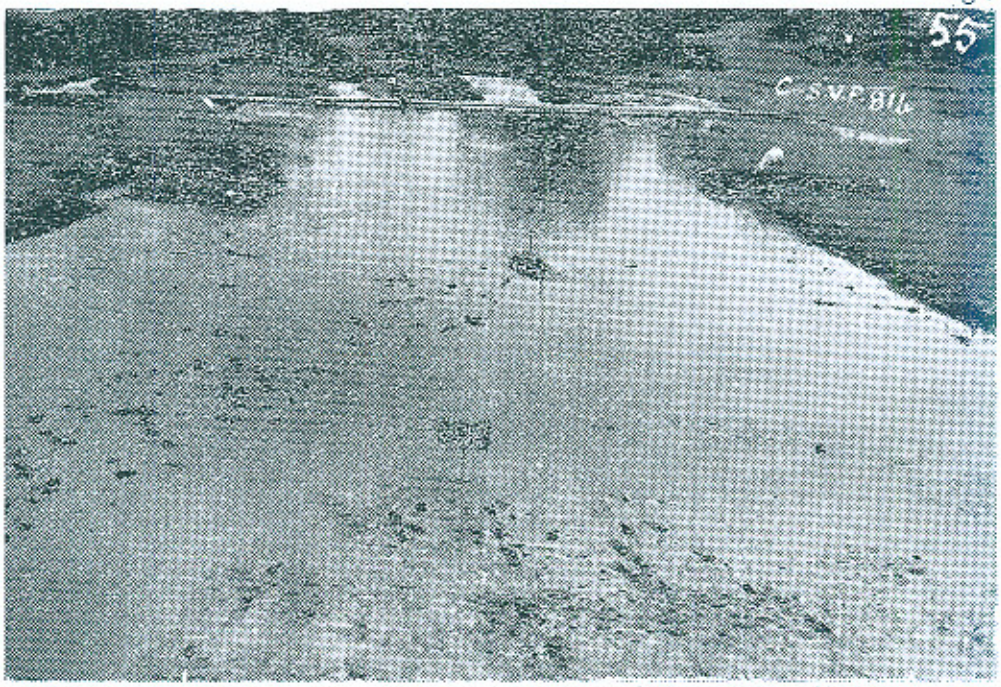
A study of the pitched island by means of models,
Experiments on Large Scale Models
1943-44 Studies.
River Sutlej above Suleimanki Headworks.
Large Scale model with pond level maintained at R. L. 569.

Fig. 23



This photograph illustrates the conditions of flow in a discharge of 60,000 cusecs. The floats on the model indicate the directions of flow. It will be seen that the main flow is at the nose of the left guide bank.

Fig. 23A



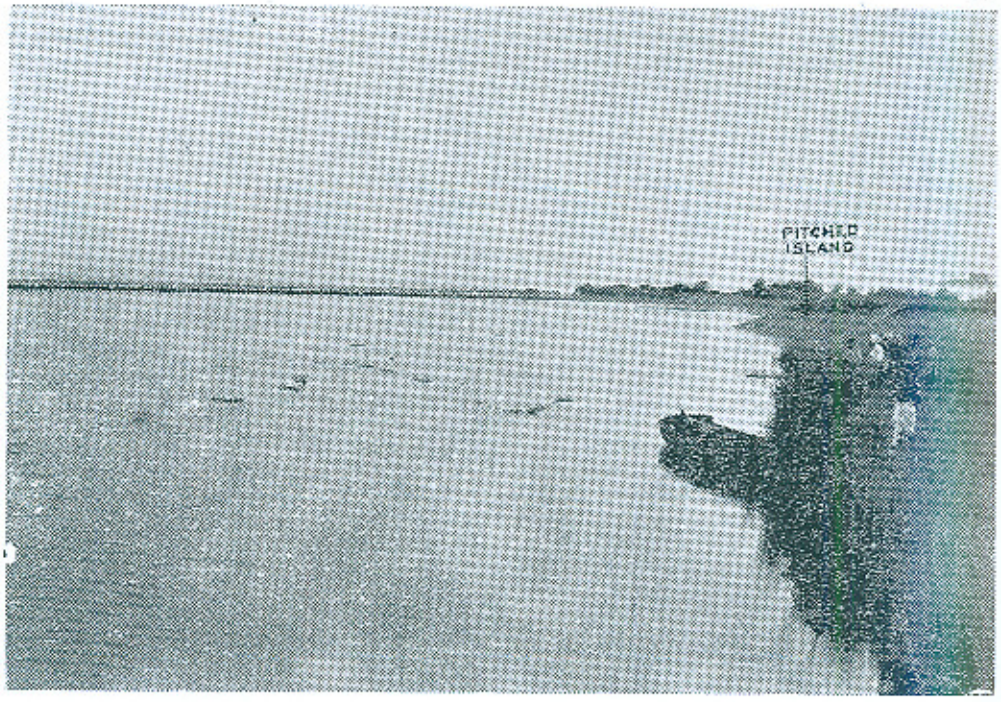
This photograph illustrates the conditions of flow in a discharge of 1,00,000 cusecs after running 1,50,000 cusecs. The main river approaches the island along the left edge of the central bela. The main river in this discharge is concentrated at the pitched island.

RIVER TRAINING AND CONTROL BY PITCHED ISLANDS.

A study of the pitched island by means of full scale experiments.

Effect of a pitched island constructed on the River Sutlej above Suleimanki Headworks.

Fig. 36



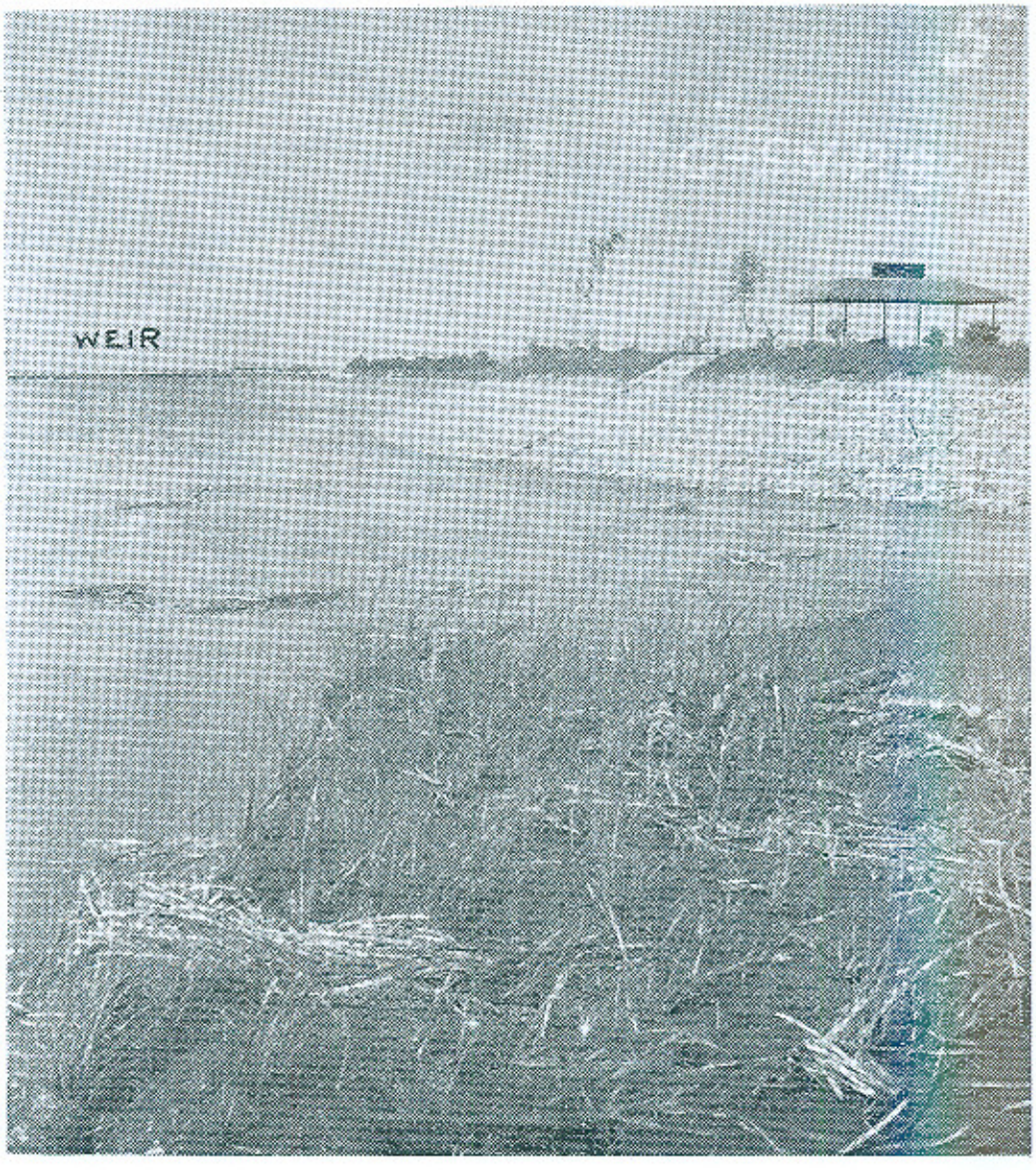
The current directions in the presence of the pitched island. Photograph was taken on 31st July, 1944, in a discharge of 1,00,000 cusecs. It will be seen from this photograph that the island attracts the main current towards itself.

RIVER TRAINING AND CONTROL BY PITCHED ISLANDS.

A study of the pitched island by means of full scale experiments.

Effect of a pitched island constructed on the River Sutlej above Suleimanki Headworks.

Fig 37



Photograph taken on 9th August.

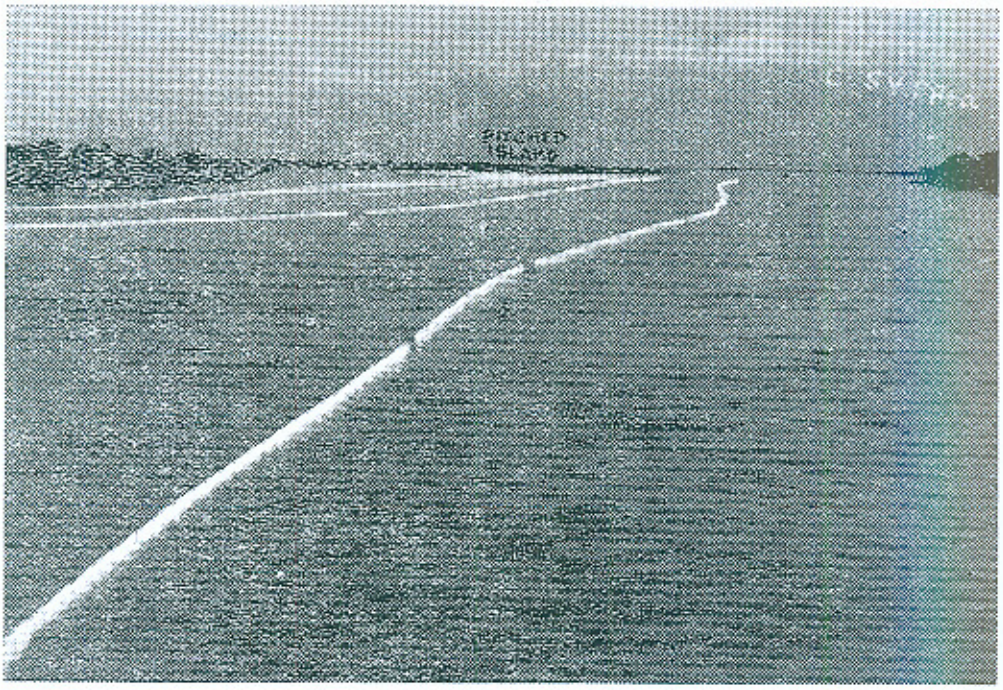
Sarkanda floats were thrown into the main stream upstream of the pitched island. Almost all the floats collected near the pitched island. The floats are seen in the photograph.

RIVER TRAINING AND CONTROL BY PITCHED ISLANDS.

A study of the pitched island by means of full scale experiments.

Effect of a pitched island constructed on the River Sutlej above Suleimanki Headworks.

Fig. 39



Looking upstream from the Weir.

This photograph shows the current directions in a discharge of 1,00,000 cusecs.

TABLE I.

Statement showing velocities observed on a large-scale model of the river Sutlej at Suleimanki.

Pond R. L. 569·0.

Discharge.	Velocities in the river left side from the pitched island.														Velocities in the river right side.								Remarks.
	0	50	100	150	200	300	400	450	600	750	900	1050	1200	1350	50	100	150	200	300	450	600	900	
Cusecs.																							
30,000	...	...	...	...	...	...	...	1·3	1·34	1·37	1·3	...	...	...	...	...	...	...	...	...	...	...	Still water at pitched island.
50,000	...	..	...	...	...	1·3	1·67	1·67	2·03	1·37	...	...	...	...	...	...	...	...	...	...	...	...	No flow ,,
60,000	...	...	...	...	..	1·67	1·8	2·51	2·9	2·34	1·34	1·3	...	..	...	...	...	...	...	...	...	...	,, ,, ,,
80,000	...	...	...	...	1·3	1·67	2·72	3·1	3·1	3·1	2·03	1·73	1·30	...	...	...	1·34	1·37	1·37	1·3	1·3	...	,, ,, ,,
100,000	...	...	...	...	2·34	3·4	4·7	4·7	4·93	4·7	2·92	1·80	1·34	...	...	1·67	1·73	1·80	1·73	1·67	...	...	,, ,, ,,
125,000	.	...	1·34	2·34	2·51	3·1	4·14	4·42	4·14	3·40	2·18	1·73	1·37	...	...	1·3	1·37	1·67	3·1	2·93	2·72	...	,, ,, ,,
150,000	1·34	1·34	1·73	2·93	4·14	3·77	4·77	5·44	5·44	4·14	3·1	2·93	2·34	1·52	1·34	1·37	1·73	2·34	3·77	3·40	3·1	2·34	
175,000	1·52	3·1	3·40	4·70	5·60	5·8	5·8	5·8	4·7	4·7	3·77	4·7	4·7	1·73	1·67	2·34	3·77	4·93	5·94	5·94	5·6	4·70	
200,000	1·8	4·42	4·7	5·6	5·94	6·72	6·94	6·94	7·17	7·17	4·93	5·8	5·6	3·4	2·72	2·93	2·93	3·1	4·42	7·17	5·82	4·14	
225,000	3·4	3·77	4·14	4·42	5·94	6·94	6·94	6·94	6·72	5·82	5·8	5·6	5·4	2·9	2·93	3·1	3·1	3·4	4·42	6·33	6·72	5·94	
250,000	2·03	2·18	3·1	4·14	4·42	5·8	5·8	5·8	4·9	4·9	3·8	3·8	3·4	4·93	2·18	2·5	2·5	2·3	4·4	5·8	4·9	4·7	
275,000	2·03	1·52	2·18	3·4	4·93	5·8	6·7	6·9	7·6	7·1	7·1	6·7	5·6	4·4	1·8	1·37	1·67	1·52	1·34	2·34	4·42	1·73	
250,000	2·34	2·2	3·1	4·9	5·4	5·6	5·8	6·7	6·7	5·9	6·9	5·8	4·1	XXX	2·5	1·7	1·7	1·7	1·7	1·8	3·1	2·3	
225,000	1·4	1·5	2·0	2·2	3·1	4·1	5·9	5·9	6·9	7·2	7·4	4·9	4·9	1·73	1·7	1·3	1·4	1·4	1·3	2·0	1·5	1·3	
200,000	1·7	1·3	1·7	1·7	1·8	2·3	4·7	5·4	5·8	6·1	5·8	4·4	5·4	1·8	1·4	1·3	1·3	1·3	1·3	1·7	1·7	XXX	
175,000	1·7	1·3	1·7	2·2	2·9	4·1	4·4	4·9	5·9	5·9	6·9	6·7	5·9	3·4	1·7	1·5	1·3	1·3	1·3	1·5	1·5	1·3	
150,000	2·2	1·7	1·8	2·3	2·3	3·1	4·9	5·9	6·7	6·9	5·8	6·9	5·4	4·4	1·7	1·3	1·3	1·3	1·3	1·3	1·3	...	
125,000	2·0	1·7	1·7	2·3	2·9	4·1	6·3	6·7	7·2	6·1	7·8	7·6	6·1	4·4	1·5	1·3	1·3	Not observed (XXX)				...	
100,000	2·2	1·7	2·1	2·5	2·5	2·5	2·9	3·1	4·1	5·6	5·6	5·4	4·9	4·1	2·2	1·8	1·3	...	...	...	...	...	
80,000	2·3	1·8	2·2	2·0	2·7	2·2	2·0	2·5	2·3	3·1	3·8	4·4	3·1	...	1·7	1·7	1·7	1·7	...	...	...	...	

XXX denotes not observed.

TABLE II.

PAPER No. 275.

Statement showing scour and gauges obtained on a large-scale model of the river Sutlej at Suleimanki.

Pond R. L. 569·0.

Discharge.	Gauges in River.				Scour Depth below W. S. at the pitched island.				Remarks.
	Weir.	2000.	U./S. edge 4617.	D./S. edge 4265.	U./S. edge 4617	Left.	Right.	D./S. edge 4265.	
Cusecs.									
30,000	569·0	569·0	69·1	69·0	4·4	10·2	10·2	10·2	No action.
50,000	569·0	569·0	69·1	69·1	5·0	10·3	10·2	10·4	No action.
60,000	569·0	69·05	69·1	69·2	5·2	11·8	12·0	11·0	No action.
80,000	569·0	69·1	69·25	69·1	5·0	11·8	15·0	11·4	Slight action at right side.
100,000	569·0	69·2	69·6	69·4	5·4	11·0	12·0	11·0	No action.
125,000	569·0	69·6	70·0	69·8	6·6	11·0	13·2	12·0	Slight action at right side.
150,000	569 0	70·0	70·4	70·2	6·2	12·6	14·4	13·6	
175,000	569·0	70·2	70·8	70·4	6·4	11·0	17·6	11·4	
200,000	69·5	71·0	72·0	71·8	8·0	16·0	20·0	11·8	
225,000	69·8	71·6	73·2	72·6	10·0	16·4	21·2	11·2	
220,000	70·2	72·6	74·0	73·6	11·0	18·0	22·2	11·0	
275,000	70·8 70·5	72·4	74·8	74·2	11·0	20·1	22·4	14·4	
250,000	70·4	71·6	74·0	73·2	10·0	20·8	22·0	9·0	
225,000	70·0	71·0	72·0	71·6	9·8	19·0	18·2	9·2	
200,000	69·8	70·8	71·8	71·4	8·0	17·8	20·0	8·2	
175,000	69·8	70·2	70·8	70·6	7·8	16·0	18·0	7·4	
150,000	69·4	70·2	70·5	70·4	6·4	16·4	18·0	6·6	
125,000	69·0	69·6	70·0	69·8	6·6	15·0	15·8	5·2	
100,000	69·0	69·4	69·8	69·5	6·6	15·0	16·0	10·4	
80,000	69·0	69·4	69·8	69·7	8·2	15·0	16·6	7·0 16·6	Right side. Left side.

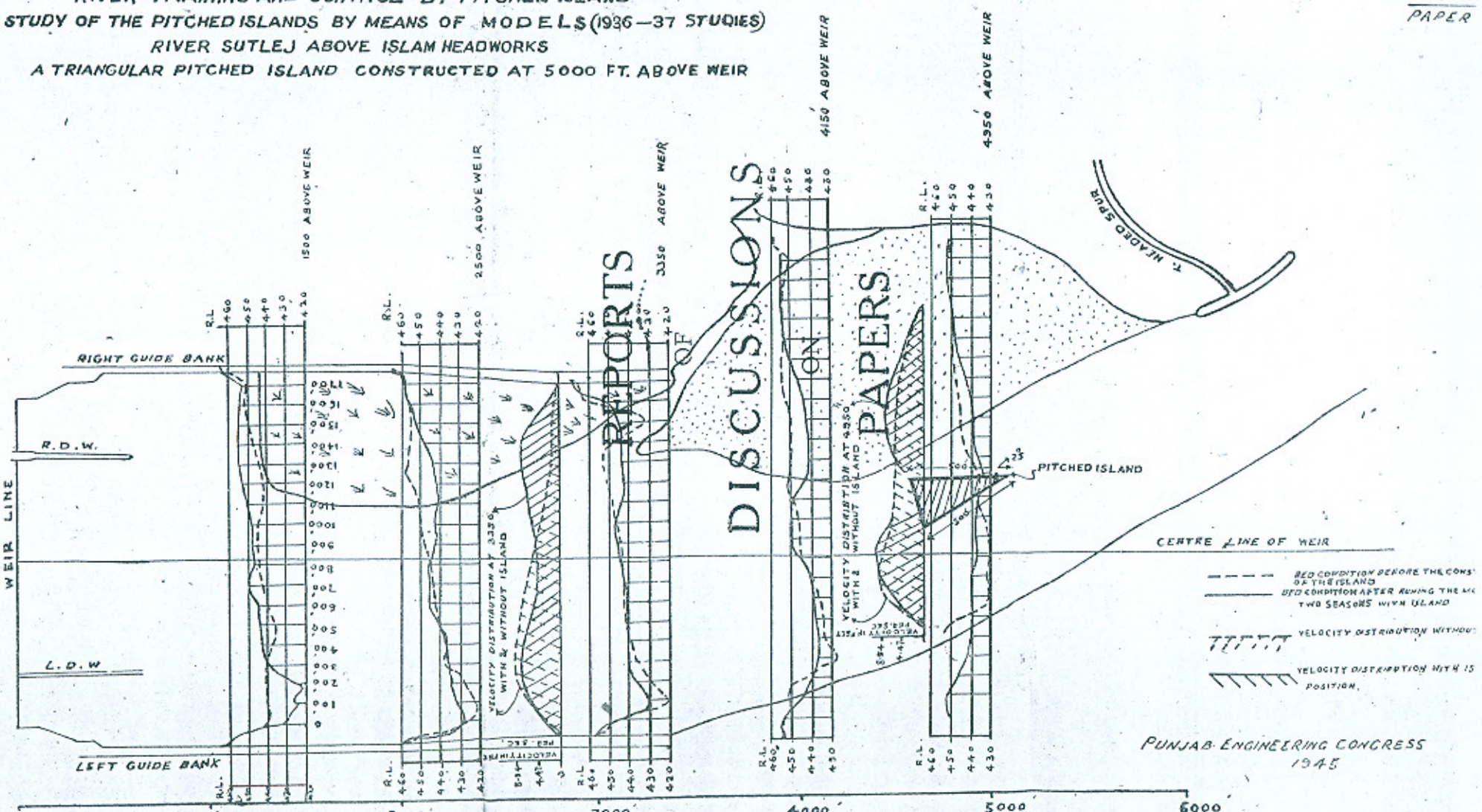
RIVER TRAINING AND CONTROL BY PITCHED ISLAND

A STUDY OF THE PITCHED ISLANDS BY MEANS OF MODELS (1936—37 STUDIES)

RIVER SUTLEJ ABOVE ISLAM HEADWORKS

A TRIANGULAR PITCHED ISLAND CONSTRUCTED AT 5000 FT. ABOVE WEIR

Fig
PAPER



REPORTS OF DISCUSSIONS ON PAPERS

PUNJAB ENGINEERING CONGRESS
1945

FIG. 10

TRACTIVE FORCE DIAGRAM
RECTANGULAR ISLAND IN THE CENTRE OF THE FLUME

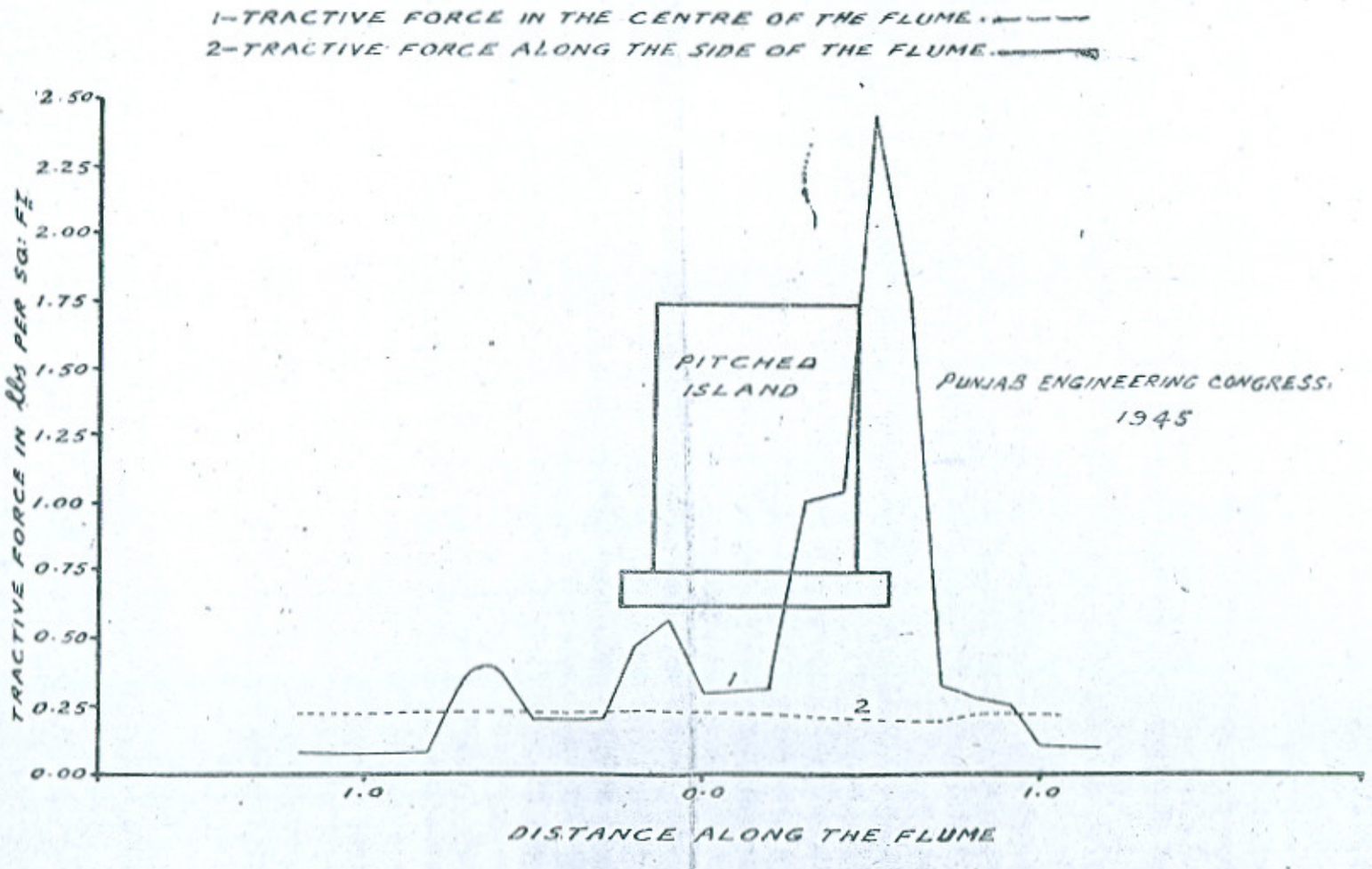
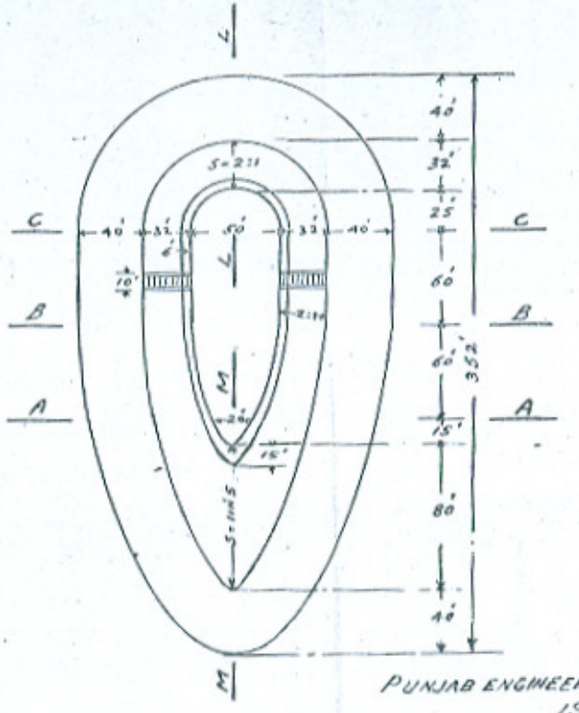


FIG. 22

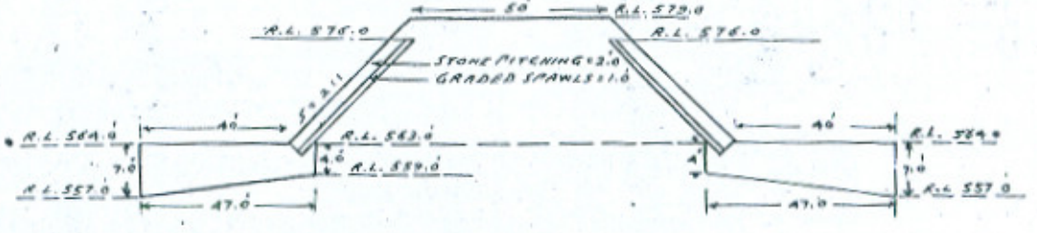
PLAN OF PITCHED ISLAND
CONSTRUCTED AT R.D. 4500 U/S SULEIMANKI WEIR
SCALE = 1/1000

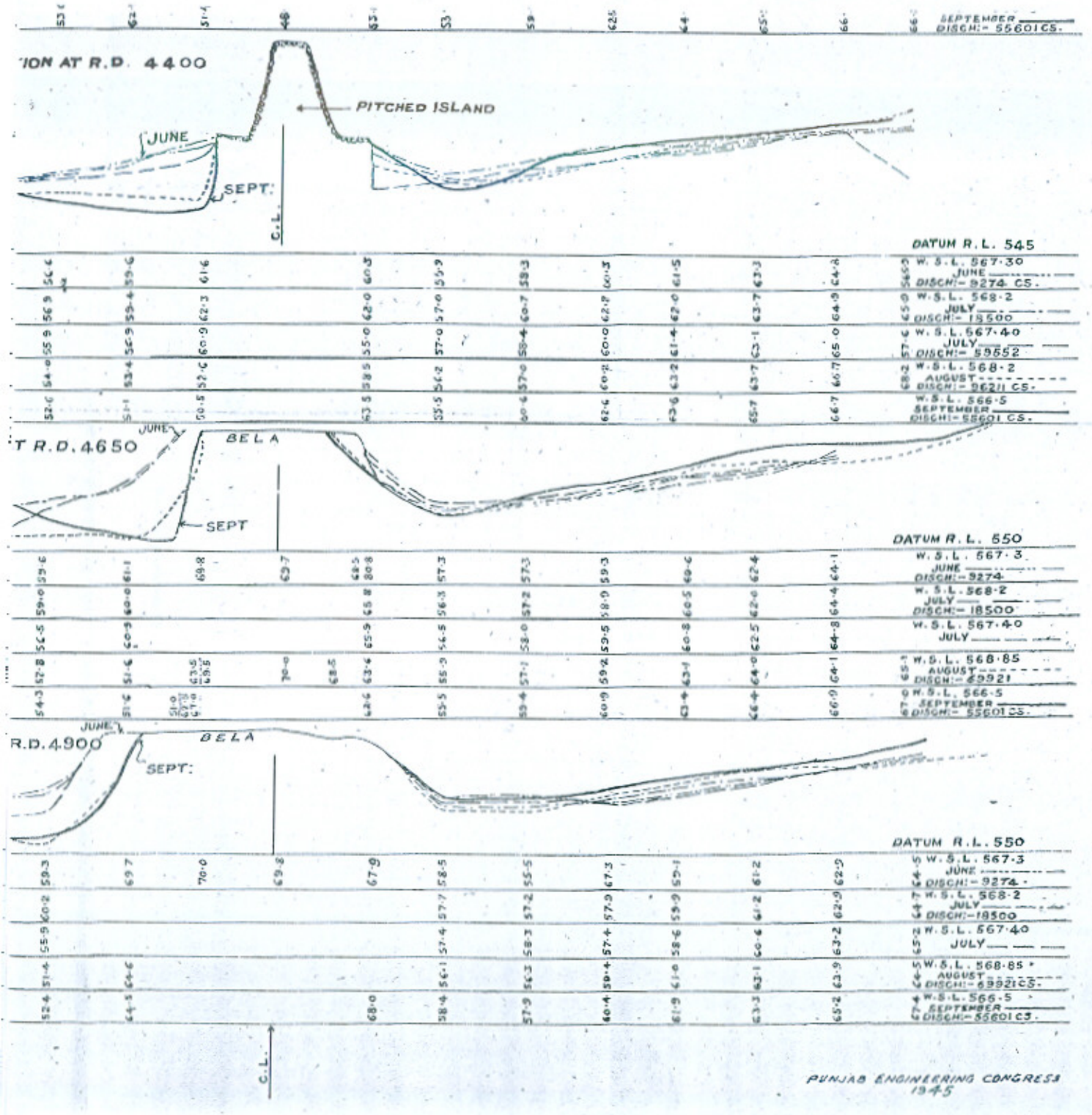


PUNJAB ENGINEERING CONGRESS
1945

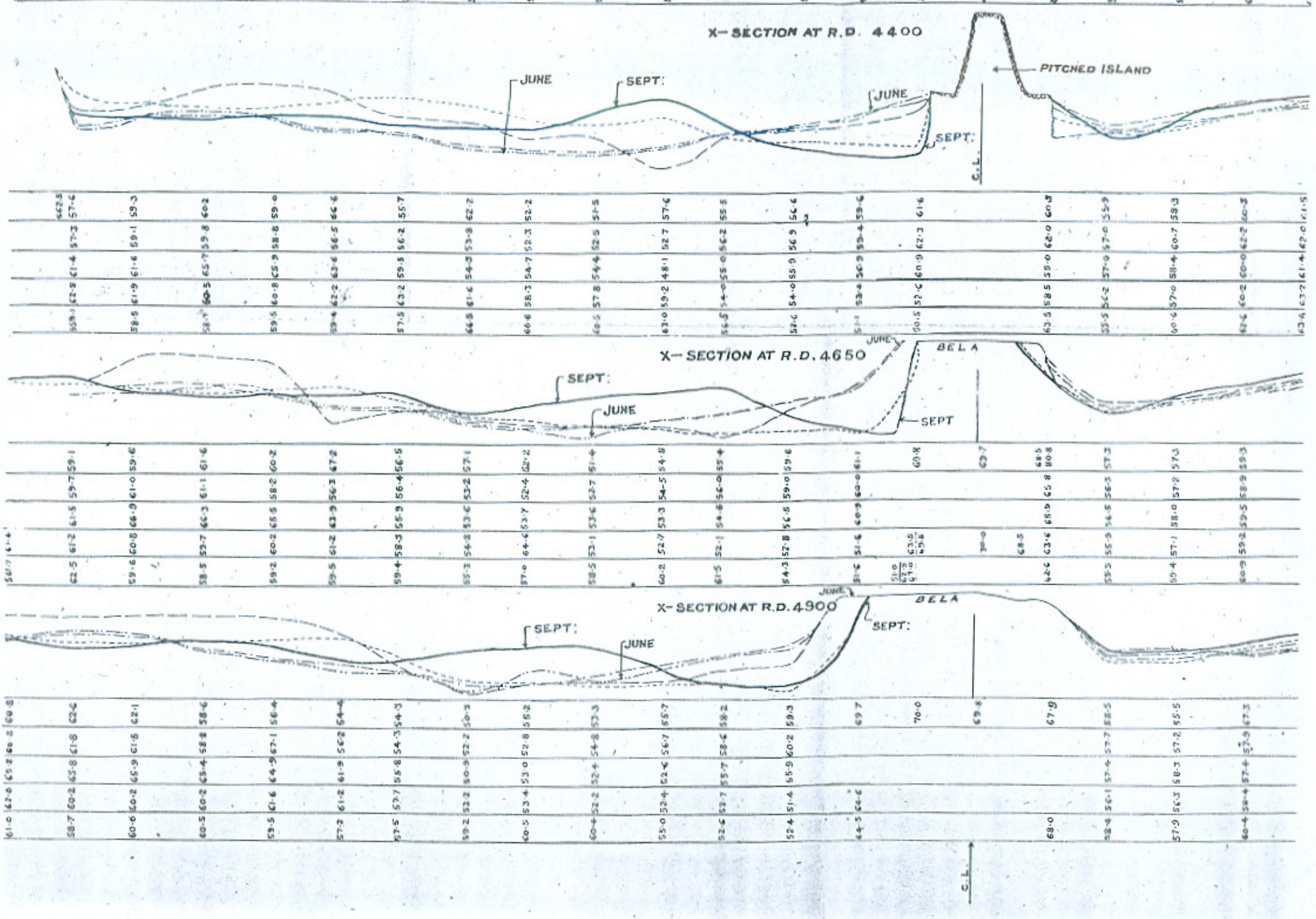
SECTION ON C.C.

SCALE { HOR: 1/400
VER: 1/200





PUNJAB ENGINEERING CONGRESS
1945


X- SECTION AT R.D. 4400
JUNE
SEPT:
JUNE
SEPT:
PITCHED ISLAND
C.L.
X- SECTION AT R.D. 4650
JUNE
BELA
SEPT:
JUNE
SEPT
X- SECTION AT R.D. 4900
JUNE
BELA
SEPT:
SEPT:
JUNE
C.L.

RIVER SUTLEJ ABOVE SU

X-SECTIONS CLOSE TO THE PITCHED

DURING MONSOO

X — SECTION AT R.

53·6	52·4	55·5	56·6	57·5	-200	
55·6	55·4	55·0	56·4	56·4	-300	
53·6	66·1	54·0	55·7	56·2	-400	
41·0	43·9	53·7	52·7	53·0	-500	
40·8	44·1	47·5	51·9	51·0	-600	
47·1	54·5	38·5	51·6	49·5	-700	
46·0	52·6	40·5	40·6	41·0	-800	
40·8	54·1	45·0	41·4	43·0	-900	
46·2	48·7	51·7	50·6	50·9	-1000	
42·2	50·1			57·0	-1100	

X — SECTION AT R.D

52·4	50·5	56·2	57·8	54·0	
62·4	55·9	54·9	86·3	56·4	
64·4	56·3	64·7	55·2	53·9	
62·4	57·1	55·2	53·6	54·3	
59·4	58·3	56·8	57·6	51·1	
55·5	60·5	57·5	53·4	52·1	
57·2	61·9	60·8	52·5	52·0	
60·2	60·7	62·5	53·2	52·3	
60·6	63·0	61·9	55·2	53·4	
54·7	43·1	61·0	57·3	48·2	
61·4	57·3	49·8	53·3	49·0	
60·4	64·1	60·5	64·3	64·1	
67·9	68·0	55·2	55·3	54·9	
				69·7	

X — SECTION AT R.D

JUNE

SEPT.

2·5	52·3	55·2	57·1	58·3	
3·6	54·3	54·7	55·4	55·3	
6·2	55·3	54·1	53·9	54·3	
4·9	56·0	55·2	52·8	53·4	
9·7	58·0	58·8	51·9	51·2	
8·3	58·1	57·1	52·5	51·3	
7·4	61·5	62·8	53·6	53·3	
3·5	62·0	65·1	56·2	56·5	
1·4	61·2	64·4	57·3	57·2	
1·4	62·2	61·3	59·2	59·4	
1·5	61·1	60·0	57·6	58·1	
2·0	61·0	61·1	55·6	55·6	
	59·9				
	70·0			57·0·0	

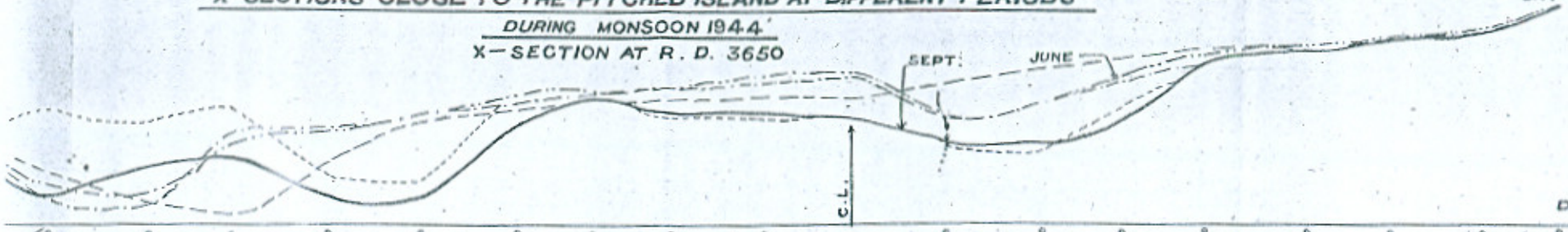
RIVER SUTLEJ ABOVE SULEIMANKI HEADWORKS

X-SECTIONS CLOSE TO THE PITCHED ISLAND AT DIFFERENT PERIODS

DURING MONSOON 1944

FIG 35 e
PAPER 275

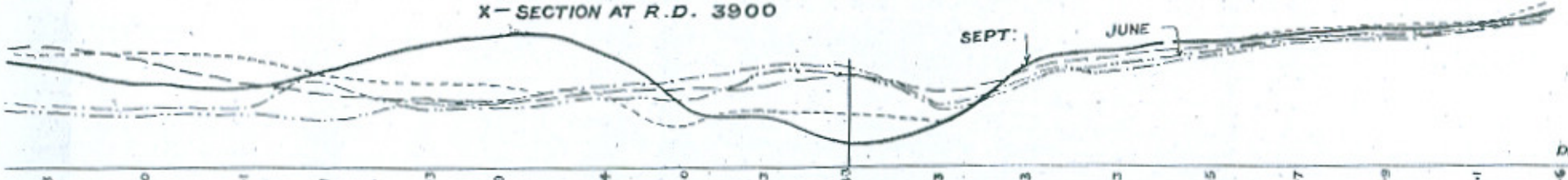
X-SECTION AT R. D. 3650



DATUM R.L. 530

R.D.	-900	-800	-700	-600	-500	-400	-300	-200	-100	0	+100	+200	+300	+400	+500	+600	+700	+800
W.S.L. 566·1 JUNE DISCHARGE 5787	43·0	41·0	49·5	51·0	53·0	56·2	56·4	57·5	58·0	58·9	52·3	54·1	59·5	62·2	63·2	64·5	65·5	63·0
W.S.L. 568·40 JULY DISCH: 18500	41·4	40·4	49·6	51·8	53·7	58·7	56·4	57·5	57·9	58·7	52·4	54·6	59·2	61·8	62·9	63·9	65·2	64·2
W.S.L. 567·40 JULY	45·0	40·5	38·5	47·5	53·7	54·0	55·6	55·5	56·6	55·7	56·2	55·9	61·5	62·7	63·6	64·2	65·0	64·2
W.S.L. 567·85 AUGUST DISCH: 69921 CS.	54·1	52·6	54·5	44·1	43·9	66·1	55·4	55·6	52·4	51·2	46·5	48·6	55·8	61·9	63·7	64·2	65·7	64·9
W.S.L. 568·7 SEPTEMBER DISCH:-	40·8	46·0	47·1	48·4	41·0	53·6	55·6	53·6	53·5	51·6	48·6	48·6	53·0	61·6	63·6	65·4	65·8	63·6

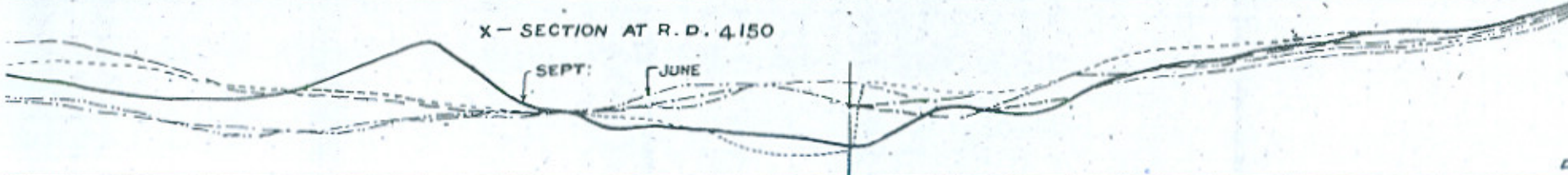
X-SECTION AT R.D. 3900



DATUM R.L. 545

R.D.	-900	-800	-700	-600	-500	-400	-300	-200	-100	0	+100	+200	+300	+400	+500	+600	+700	+800
W.S.L. 566·1 JUNE DISCH: 5787	52·3	52·0	52·1	51·1	54·3	53·9	56·4	54·0	59·3	58·3	52·3	56·4	59·3	61·5	62·7	62·9	64·1	56·6
W.S.L. 568·40 JULY DISCH: 18500	53·2	52·5	53·4	57·6	53·6	55·2	56·3	57·8	59·6	58·9	52·8	56·4	58·2	61·1	62·4	63·3	64·2	63·3
W. S.L. 567·40 JULY	62·5	60·8	57·5	56·8	57·1	55·2	64·7	56·2	57·0	58·0	55·3	58·2	60·5	61·9	62·6	63·6	64·2	64·8
W. S.L. 568·85 AUGUST DISCH: 69921 CS.	62·7	61·9	60·5	58·3	57·1	55·9	54·9	56·2	57·0	58·0	55·3	58·2	60·5	62·7	62·1	63·1	65·1	63·8
W.S.L. 567·4 SEPTEMBER DISCH: 37845 CS.	60·2	57·2	53·5	59·4	62·4	64·4	61·4	52·4	52·4	47·4	56·4	58·9	61·4	62·4	65·3	65·5	66·1	64·4

X-SECTION AT R.D. 4150



DATUM R.L. 545

R.D.	-900	-800	-700	-600	-500	-400	-300	-200	-100	0	+100	+200	+300	+400	+500	+600	+700	+800
W. S.L. 566·1 JUNE DISCH:- 5787	56·5	53·3	53·3	51·2	53·4	54·3	55·3	58·3	59·1	59·0	53·4	56·73	60·3	61·3	62·6	63·6	64·6	66·8
W.S.L. 568·40 JULY DISCH:- 18500	56·2	53·6	52·5	51·9	52·8	53·9	55·4	57·1	59·4	59·3	55·2	55·5	58·5	60·3	61·8	63·5	64·5	66·4
W.S.L. 567·40 JULY	65·1	62·8	57·1	58·8	55·2	54·1	54·7	55·2	58·2	55·0	56·6	59·3	60·0	61·5	62·9	64·4	64·8	65·7
W.S.L. 568·85 AUGUST DISCH:- 69921 CS.	63·0	61·5	58·0	54·3	54·7	55·2	57·1	55·4	59·1	55	56·8	59·1	62·5	63·5	64·7	65·1	66·6	65·7
W.S.L. 566·5 SEPTEMBER DISCH:- 55601CS.	63·0	61·5	58·1	56·0	55·2	54·1	54·9	55·2	58·2	59·0	53·1	57·1	59·5	62·5	64·4	65·9	66·1	66·8

FIG. 35.d

FIG 35 d
PAPER 275

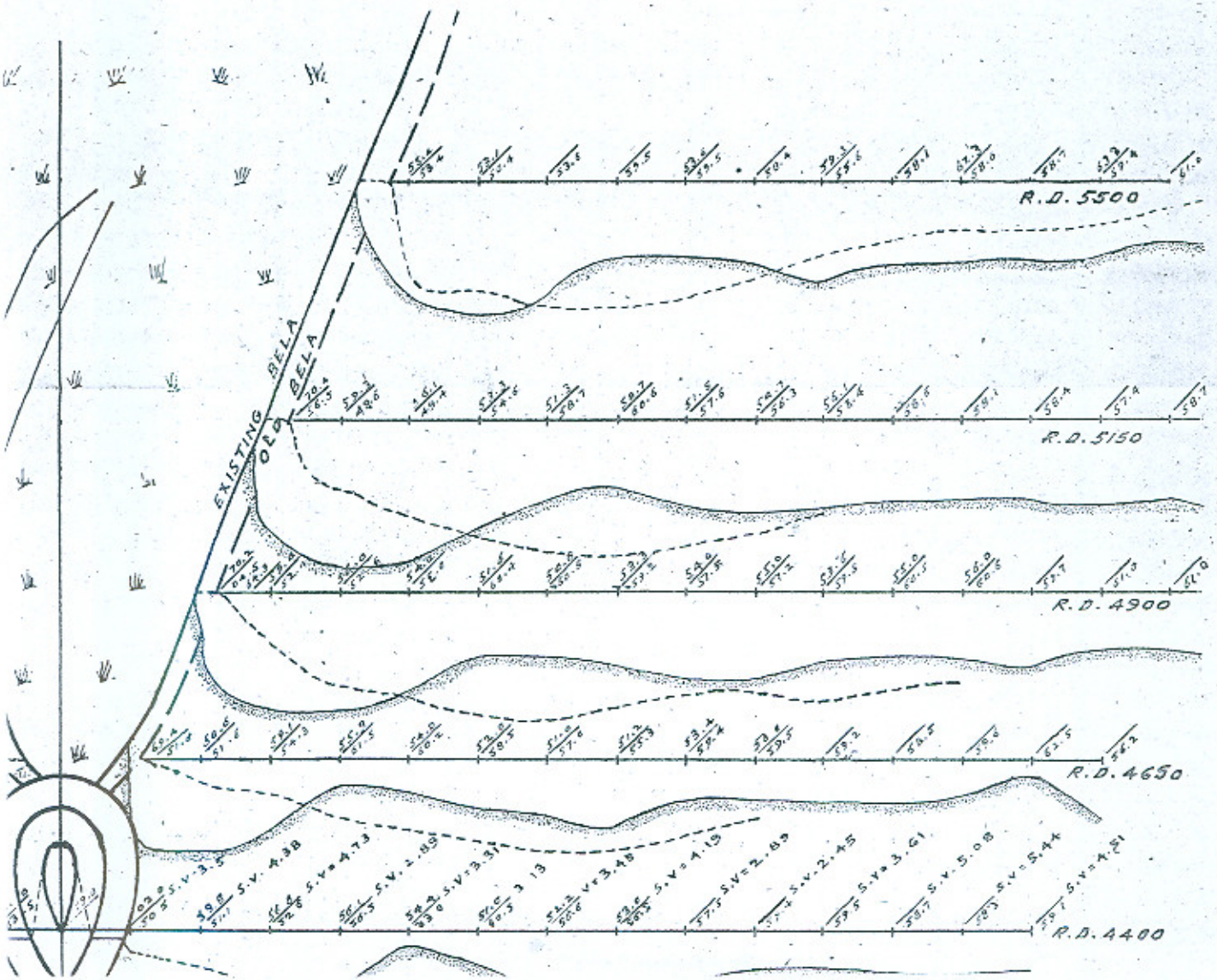
VD CONTROL BY PITCHED ISLANDS.

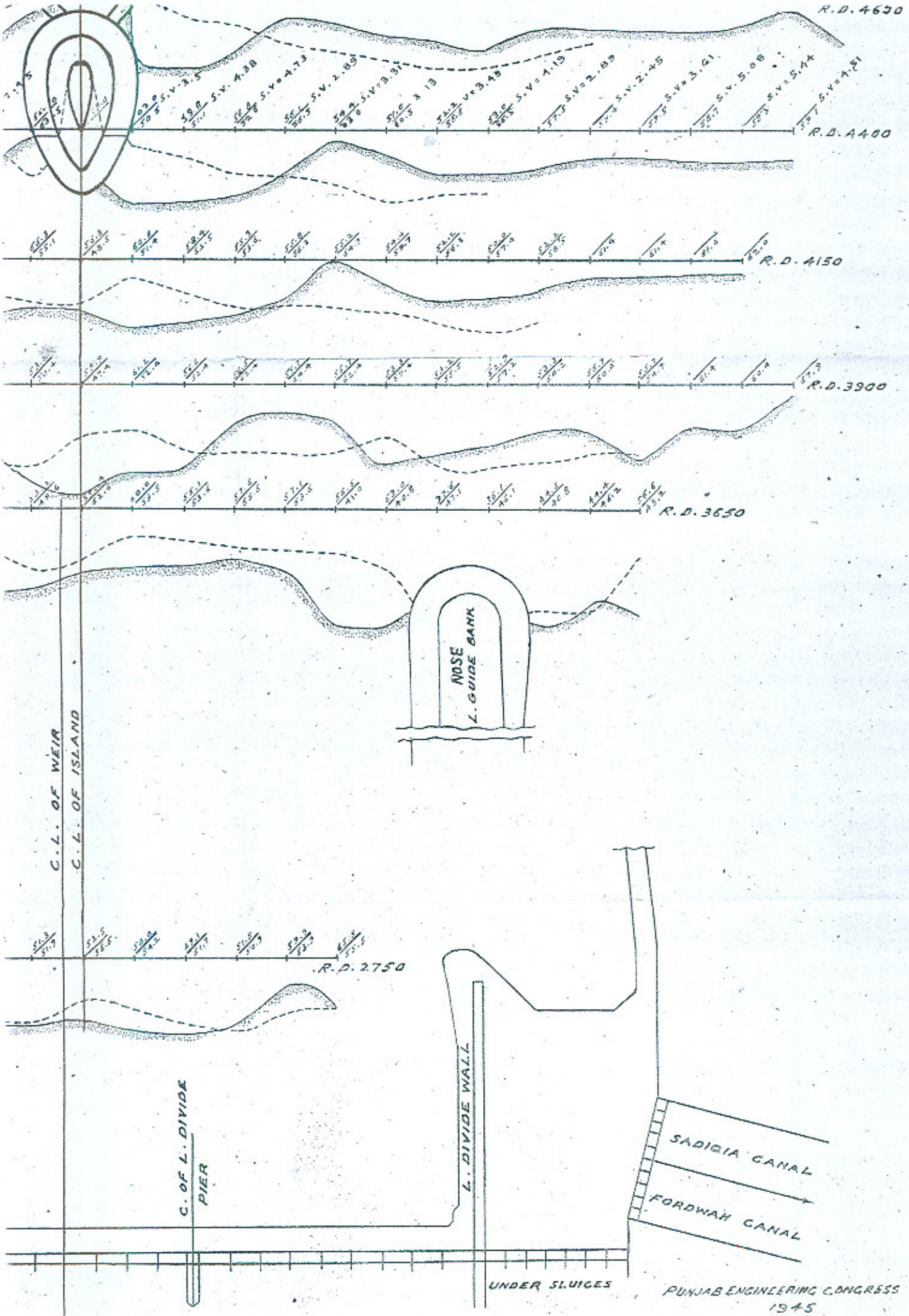
SLAND BY MEANS OF FULL SCALE EXPERIMENTS

ITLEJ ABOVE SULEIMANKI HEADWORKS

PTEMBER 2, 1944

SCALE = { 1/2000 HORIZ
1/200 VERT




R.D. 4600
R.D. 4400
R.D. 4150
R.D. 3900
R.D. 3650
R.D. 2750
NOSE
L. GUIDE BANK
C.L. OF WEIR
C.L. OF ISLAND
C. OF L. DIVIDE PIER
L. DIVIDE WALL
SADIQIA CANAL
FORDWAH CANAL
UNDER SLUICES
PUNJAB ENGINEERING CONGRESS
1945

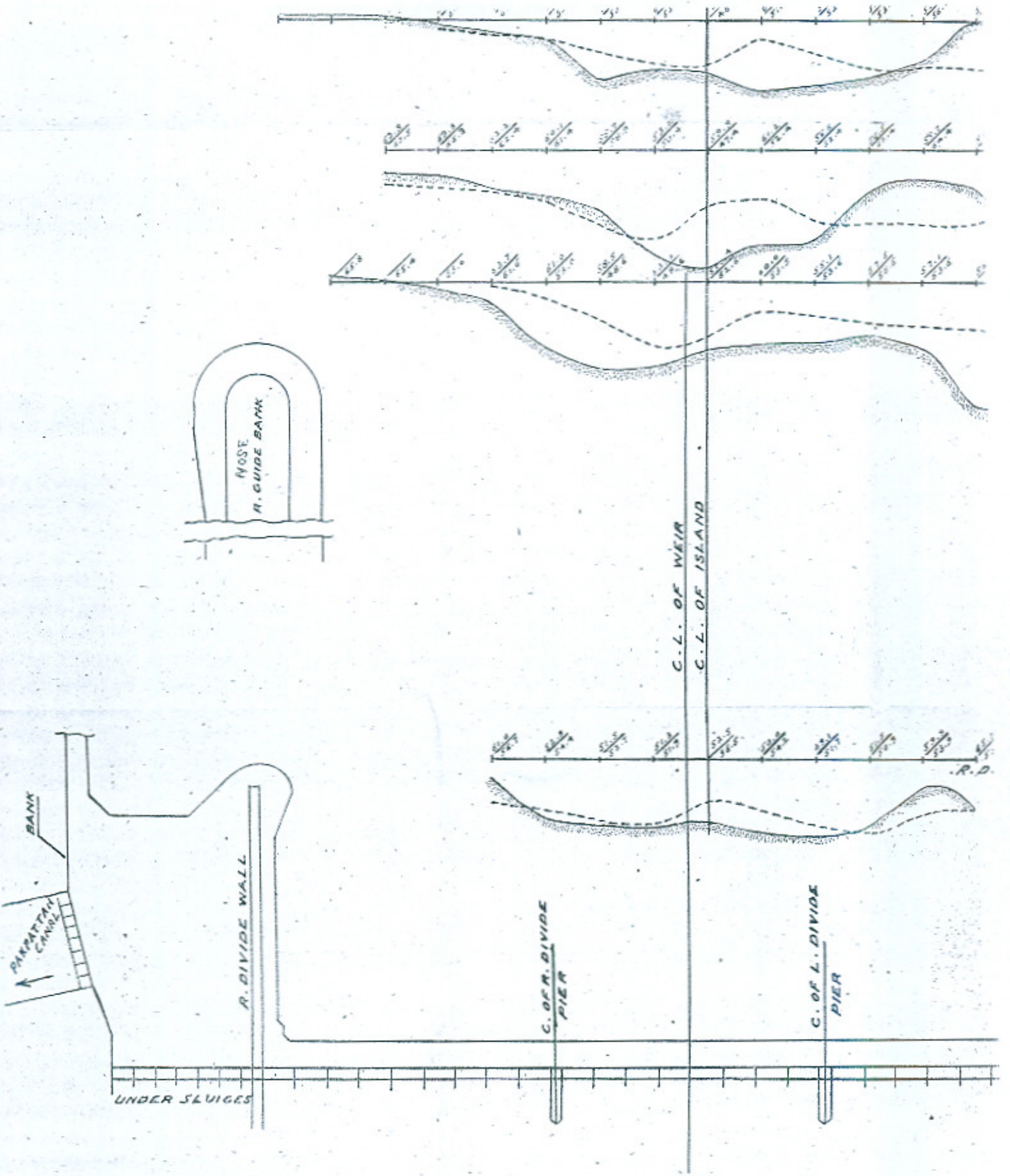

NOSE
R. GUIDE BANK
C. L. OF WEIR
C. L. OF ISLAND
R.D.
BANK
PANJHARA CANAL
R. DIVIDE WALL
C. OF R. DIVIDE PIER
C. OF L. DIVIDE PIER
UNDER SLUICES

FIG. 35.d

RIVER TRAINING AND CONTROL

A STUDY OF THE PITCHED ISLAND BY MEA

OBSERVATIONS ON RIVER SUTLEJ ABOVE SL

SEPTEMBER 2, 1944

SCALE = { 1/2000 HORIZ
1/200 VERT

ORIGNAL DATA - - - - - - - - FEB: 1944

OBSERVED DATA ——— SEPT 1944

DISCHARGE = 55601 CUSECS

POND LEVEL = 687.00 R

CANALS — OPEN (ONLY PKP).

RIVER REGULATIONS = LEFT UNDER-SLUICES OPEN

