CHAPTER 7

PATTERN OF INUNDATION

Previous information regarding the pattern of inundation is very meagre. Apart from the observations of the earlier workers like Oldham, MacMurdo etc., the only other source is that from the local people, mostly camelmen and fishermen, living in the vicinity of the Rann. Their reports were often found to be exaggerated and contradictory.

The author too found it very difficult to collect data on the pattern of inundation himself. A large portion of the Rann is rather inaccessible during the monsoon and some areas cannot be reached at all throughout the year. He has visited all possible areas during and beyond monsoon months and has attempted to collect 'on the spot' information. His trips to such areas which get inundated during monsoon months only, were quite informative. During dry periods, he could collect much data that revealed the manner and pattern of inundation. For certain inaccessible areas, he had to rely on inferred data based on geomorphic and air-photo studies, supported by the information of the accessible nearby areas.

With the active assistance of the personnel of the Border Security Force, the author conducted a systematic and somewhat detailed field study of the different parts of the Rann during various seasons throughout the year. His information has been supplemented by that provided by the personnels of the B.S.F.

As a result, the author has been able to reconstruct a fairly accurate and reliable picture of the inundation, involving the direction of movement of the various water bodies and the regions of stagnation during various seasons. The pattern of movement (stagnation and accumulation) is quite complex and includes more than one type of water movement within the various geomorphic facets. The author has succeeded in delineating the areas of inundation by sea and rain water and has also established the direction of movement of the various water bodies in individual Facets.

Each geomorphic Facet reflects a distinct pattern of water movement and has thus been treated separately. Often, inter-relationship of water movement from one Facet to the other is observed.

INUNDATION PATTERN IN FACET A (BET-ZONE)

In the Bet-zone north of Allah Band, the inundation pattern is very complex. In comparision, the movement pattern in the trench-zone (to be discussed later) is comparatively simpler, involving the movement of sea water, entering the Rann through the Kori Creek. The Bet-zone, a slightly elevated terrain (average R.L. 3.5) criss-crossed by a complex network of shallow channels, does not at any time receive sea-water. Its inundation is entirely due to surface movement of rain water and the author has been able to decipher the broad pattern and demarcate areas of excessive water-logging.

Based on his observations spread over a period of 3 years, the author has conclusively observed that in a broad way, the direction of water movement in the Bet zone is from north to south. This direction is seen to mark the direction of flow in the now abandoned channels that abound in this region (Fig. 3.3) coinciding with the original gradient of the channels. In Chapter 3, the geomorphology of this area has been discussed at length, and here the author has attempted to correlate the pattern of movement with the geomorphic features comprising abandoned and broken channels that control it.

Sub-Facet A_1 -

The Facet A especially its western half (Sub-Facet A_1) contains a network of channels. The air-photographs clearly indicate water movement from north to south and stagnates in some of the prominent depressions. The direction of water movement and the regions of water stagnation are shown in Fig. 7.1. The author has also observed that within this Facet, the pattern of inundation varies considerably in its different parts, the variation being essentially controlled by the geomorphology.

The Vigukot region, in the western part, is set on a distinct high (R.L. 4.6) such that the ground gently slopes away from it in all directions (Fig. 3.2). To the east and south of Vigukot, is situated the bets of Bet A and Karimshahi respectively, which are on a lesser height as compared to the Vigukot proper. As a result rainwater, during monsoon, flows down the Vigukot high, and through the various channels present here, gets collected in the depressions adjacent to it. Thus, in this region the Bet A, Karimshahi and the regions to its west are the first to be surrounded by rain water, debouching from the higher ground. With increasing inundation, these get completely submerged (depth upto 2 metres). The Vigukot 'high' and the higher bets are never completely under water (Plate 7.1). The main channel to the west of Vigukot, carries rain water from north to south direction, which ultimately collects, in the depression just north of Allah Band and in another major 'low' to its west (Fig. 7.2), where it stagnates till evaporation. Around 1.5 metres of water has been reported around these depressions during rains. During summer, they get dried.

To the east of the Vigukot high, the ground slopes and constitutes what appears to be a linear depression stretching almost east-west (Fig. 7.2) which forms a vast expanse of Rann, badly affected during rains. Just to the south of the depression are located the bets of Bada Sarbelo and Chota Sarbelo. These bets form a higher ground (R.L. 3) separated by almost N-S channels represented by the inter-bet region (Fig. 7.2) that appear to meet the linear depression to the north. Water accumulates in this depression (as much 1.5 metres) and also flows due south along the inter bet channels, finally inundating the low-lying areas around the bets (Fig. 7.2), where low gradient, lack of drainage and impervious sediments

PLATE 7.1

Partly submerged bets during inundation
Location: Chota Sarbela bet in the background.

collectively result in the accumulation of the water in the more prominent depressions first.

These bets are never submerged and quickly dry up. The channels are the next to dry up, while the depressions always retain water for quite sometime. During periods of heavy monsoons, the water is seen to remain in these depressions even for three to four months after the stoppage of rains.

The overall pattern of movement is evidently southwards, though the linear depression owing to its configuration does receive water from the south (Fig. 7.1). A striking feature of the inundation is that the northern perimeters of the bigger bets always have more collection of water (Fig. 7.2), implying that the predominantly south-flowing water gets trapped by the bet perimeter. The pattern of water movement in this region is shown in Fig. 7.1.

Sub-Facet A_2

The eastern part of the Facet A contains a large network of bets comprising Biar bet, Bawarla bet, Gainda bet, Bediya bet and Dharamshala bet.

To the north-east of Biar bet, runs a ENE-WSW linear depression, beyond which lies the higher ground of Chad bet (Fig. 7.2). To the south of Biar bet, the ground slopes gently to a trough like E-W channel along the same alignment as that of Allah Band which dies away in this part, being barely 30 to 40 cm in height (Fig. 7.2). Biar bet and Chad bet are in fact, the biggest elevated portions in the entire Facet, and the low ground that separates them is a very conspicuous inter-bet channel and is the main area of inundation in this part. A large number of small gullies are seen coming down the Chad bet and these provide channels for the rain water to debouch into the main depression to the south. A little water also debouches from the gullies cutting northwards from Biar bet.

In comparision to this channel, the part of Rann situated between Dharamshala and Bediya bets, has a different configuration. The latter forms a gently elevated ridge-like NE-SW trending ground, such that no water tends to collect here, and instead flows away in the depressions on all sides (Fig. 7.2).

Thus, it contributes to the water that stagnates in the depression between Biar and Chad bets (water depth here reaches 1.40 metres). South of Biar bet in the inter-bet zone, a fine network of channels, trending east-west is observed. These set of channels, reflect the position of broken drainage lines. This region gets water-logged during monsoons and is one of the first sectors in this Facet to be affected by rain. The depth of water accumulation here is around 60 to 75 cm. Furthermore, the water flowing along the channels and down the ridge-like elevation, accumulates in the depression east of Gainda bet (Fig. 7.2). The direction of water movement is shown in Fig. 7.1.

Along the southern flank of the Facet, between Gainda bet and Mori bet and between Mori bet and Kuar bet, the rain water from these inter-bet channels comes nearest to the sea-water that reaches the Facet B just south of it, and some part of it mixes with the sea water during heavy rains. Thus, this region can be regarded as a zone of mixing. The direction of water movement is definitely due south as is evident from the southerly slope of the ground. The channels between the above mentioned bets hold as much as 30 cm and 60 cm of water respectively during heavy rains. Under normal dry conditions it remains dry. Direction of water movement in this region is shown in Fig. 7.1.

INUNDATION PATTERN IN FACET B (TRENCH-LIKE DEPRESSION)

As already stated, this Facet comprising an E-W linear trench like feature, to the north of the mainland and Banni, is inundated by sea water.

For nearly six months of the year (March to August), this part of the Rann is subjected to flooding by sea water, which is forced eastward through the Kori Creek by tides and strong south-west winds. Basically, the overall pattern of movement of sea-water is from east to west. The author has worked out the details of this inundation pattern.

Based on (i) the distance from the Kori Creek mouth, and (ii) the depth and the extent of flooding during different parts of the year, this Facet has been sub-divided into following three Sub-Facets each characterising inundation somewhat different from the others:-

(1) Sub-Facet B_1 :

It comprises the western part of the Facet, the area to the north, north-east, east and west of the Kori Creek. It comes under the zone of regular tidal influence (Fig. 3.2). The sea-water emerges from Kori Creek (Plate 7.2).

(2) Sub-Facet B_2 :

It lies to the east of the above Sub-Facet and forms wide tract. This zone gets inundated during monsoon tides only (Fig. 3.2).

(3) Sub-Facet B_3 :

It forms the eastern most portion of the Facet and its flooding is restricted to stormy weather conditions when strong winds during high tides push the water, right upto Kuar bet (Plate 7.3), the eastern most limit of this Facet (Fig. 3.2).

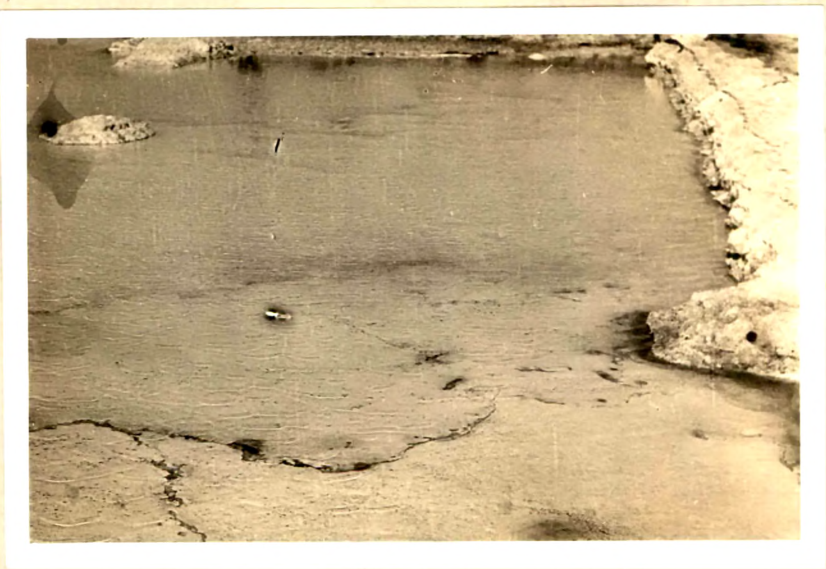
Sub-Facet B_1 :

This region falling within the range of regular tidal inundation, is almost always wet. During tidal

PLATE 7.2

Sea water emerging from Kori creek.
Location: Photograph taken at low tide from top of Lakhpat fort.

PLATE 7.3



Tidal ingress at Kuar bet. Depth of water around 1-2 cm.
Location: Kuar bet

invasion of sea-water, it gets so flooded that almost the entire surface gets under varying depths of water. The inundation is maximum during the highest tides on new-moon and full-moon nights. The extent and the level of inundation also depends on the direction and velocity of the prevalent wind. The highest level upto which the tidal water rises is a little less than 3 metres, near the mouth of the Kori Creek. The author was informed that the level of water in this Sub-Facet hardly exceeds the height of the small bets in this Sub-Facet, and as such these bets have never been submerged fully (Fig. 7.3). This fact is further supported by the nature of the sediment of the bets and the coarse grass that grows on them.

In the months of December, January and February, the overflow of tidal water is at its minimum, and the Kori Creek with its branches usually overflows its banks only a few times on the new and full moon nights. During these months, the wind velocity is also quite low, and blows from north to south. As a result, the east-ward flow of water is not much during this period. By the end of February the wind direction changes, and fairly strong south-west winds start blowing. This causes the sea water to travel further inwards, and during the last week of February, the entire region of this Sub-Facet is generally inundated, the water line stopping at the limit of the Sub-Facet. The extent of inundation of this Sub-Facet during these winter month is shown in Fig. 7.3. The depth of water during this period, varies between from few cm to as much as 30 cm. In general, the depth of inundating tidal water increases westward. Deep water is recorded near the mouth of the Kori Creek, while the shallowest level of 3 cm prevails at the eastern extremity of the Sub-Facet.

The depression NNE of the Kori Creek, south of Allah Band (Fig. 7.4) is the deepest part of the Facet, and holds water which during such period is around 30 cm deep. The mean R.L. of this depression if of the order of 2.0 metre. Even during the months of December and January when only the region around the Kori Creek is inundated, this depression holds appreciable water.

During March and April, winds become stronger and push the tidal water more inland such that inundation crosses the limit of this Sub-Facet and the sea water floods the terrain of the adjoining Sub-Facet B_2 as well. In the Sub-Facet B_1, not only the amount of inundating water goes up, but also the period of inundation also increases. The flooding which was confined to only four days between the new and full moon periods increases to seven days between the same period. During this period, the level of inundating water rises considerably. Almost the entire area of the Sub-Facet is under water. The water around Kori Creek mouth becomes as deep as 2 metres, while the minimum depth recorded farther from the creek is about 30 cm. The depression near Allah Band also receives additional water, its level going further up by about a metre. To, the west also, the Kori Creek overflows its banks and water depths increase considerably during this period. The depth of water around Kotri Dharamshala and Sayad Ali is around 2 metres and 1 metre respectively (Fig. 3.3).

The month of May is that of highest summer tide, and this period marks the period of maximum inundation, both in volume and extent. During this period, at times, the entire Facet B is inundated upto Kuar bet. The south-westerly winds blow very strongly during this month, occasionally becoming stormy. As a result, the Sub-Facet is submerged under deep waters. The depth of water at the mouth of the Kori Creek may exceed 2 metres. In the Allah Band depression, the water tends to show a similar depth. Even the eastern fringes of this Sub-Facet are found to be under at least 30 cm deep water.

During June and July almost similar conditions prevail and the depth of inundation remains the same. However, at the end of July, the wind velocity drops to a certain extent, and a decrease in the depth of inundation and the extent is recorded.

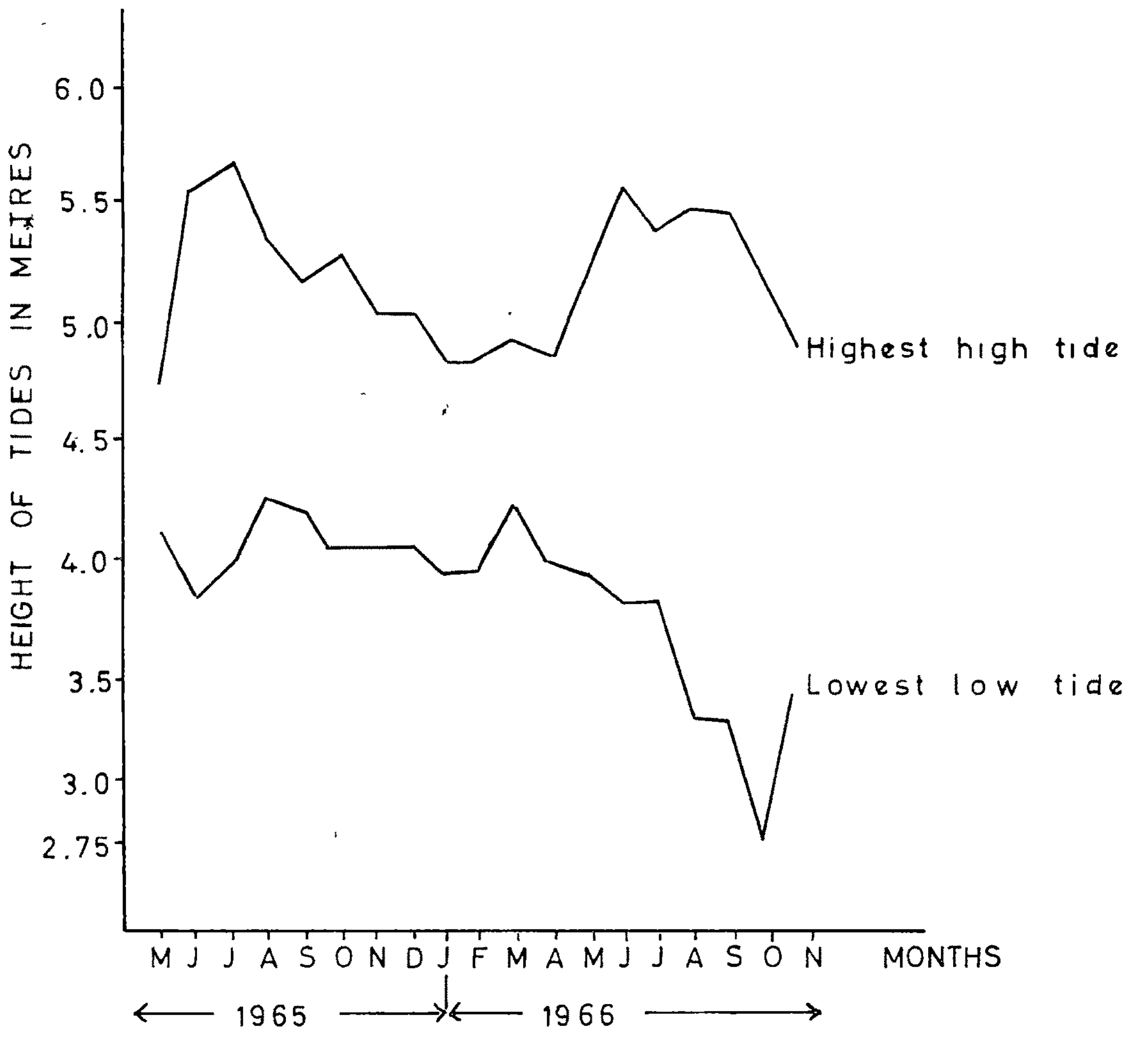
It has been observed that from the inundation point of view, the summer months are the worst. Not only the inundation is maximum, but its pattern is often unpredictable. Due to a combination of the factors of Kori Creek configuration and strong south-westerly winds, the tidal water has been recorded to inundate the area suddenly and with great velocity. Under abnormal weather conditions of cyclonic storms, water height as much as 2.5 metres is recorded around Lakhpat.

A remarkable feature of this inundation is that even after the recession of tides around Kori-Creek, the sea water pushed inland is kept in place by the strong south-westerly winds. Thus the Facet B_1, remains flooded to a considerable depth throughout the months of May, June and July.

With the onset of August, the inundating water starts receeding via Kori Creek and other minor creeks. The tides also decrease in height (Fig. 7.5) and the wind velocity drops down considerably. This process of recession of floods is gradual and continues during the months of September, October and November. By September end, the wind direction changes and blows from north and north-east. The progressive drop in the level of water is shown in Table 7.1. When most of the water has receeded from the outer fringes of this Sub-Facet in the month of August and September,

Fig. 7.5

MONTHLY HIGHEST HIGH AND LOWEST LOW TIDES NEAR LAKHPAT.



the Sindree depression (below Allah Band) retains water upto a maximum depth of 1.5 metres and resembles a vast inland lake. In other regions, the ground remains considerably wet and soggy.

Sub-Facet B_2 :

The terrain comprising this Sub-Facet forms the middle portion of the trench-like Facet. It is a little higher than Sub-Facet B_1, and gets inundated in the months of April, May, June, and July, during the periods of maximum tide and strong winds. When the monsoon season is over in August-September, most of the water in this part drains off; portions left in depression are left to get slowly evaporated resulting into thick layers of salt. By about November and December, the surface is fairly dry, and is hard enough to allow man and camels to walk over it. Jeep travel however is difficult, because the ground immediately below the salt crusted surface is still wet and soft. In the months of January and February, this area is absolutely dry on the surface and receives no ingress of sea water from the east. To the south, the streams of the mainland are also absolutely dry, and only pockets of highly saline water representing the remnants of the tidal water, are seen in patches. This tract, in fact has been a land route during winter months connecting Bhuj to Sindh via Luna and Vigukot (Fig. 3.2).

With the onset of summer, around the month of March, the wind direction changes and pushes the tidal water into some depressed portions of this Sub-Facet, viz south of Charakra dhoi and the depression south of Alah Band (Fig. 3.2). Depth of water in these depressions is as much as 15 to 20 cm, while the rest of surface is comparatively dry. Inundation in March and upto the middle of April, in this Sub-Facet is not of any appreciable extent, and the region is under tidal ingress for a period of 5 days between the full and new moon periods. Depth of water, on normal surface, during such periods, is around 10 cm. An interesting feature is that, during the initial period of inundation the salt encrusted surface retains its hardness even when under water which is seen to flow over it. The author made a careful observation of this phenomenon to finally disprove the belif that inundation was due to the rise of the sub-surface water.

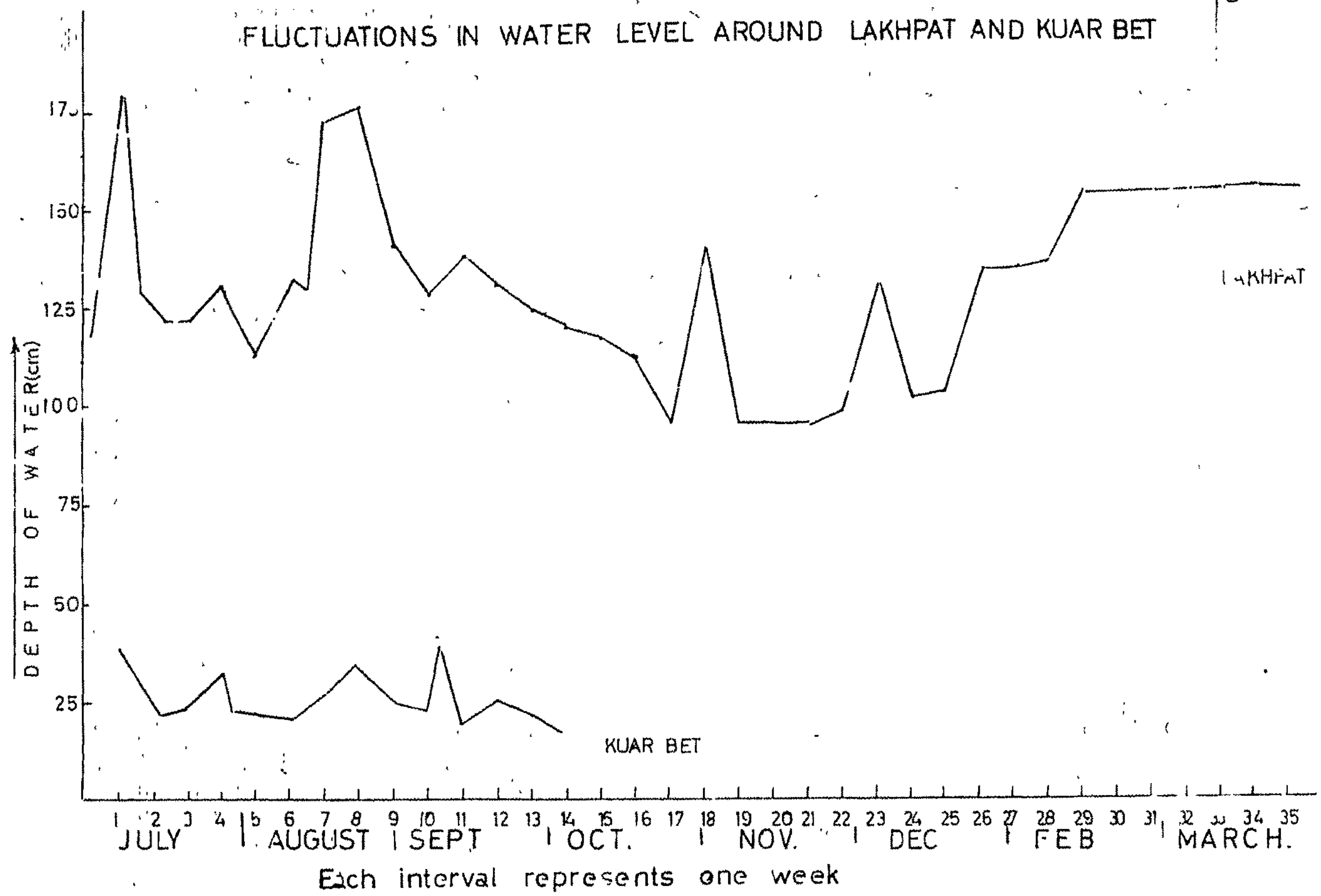
The flooding goes on increasing in subsequent months, and by May, the flooding is at its maximum, covering the entire surface under varying depths of water. Apart from the sea-water, a further augmentation is by direct precipitation. The depth of standing water, increases to as much 50 cm to 1½ metres and evenly more within the depressions mentioned before. Along the fringes of this water body, drainage of the streams coming from the mainland, to its south brings down some rain water as well. It was impossible to assess the discharge of these streams, which are flashy with an erratic flow along the whole width. Most of them swell instantaneously, run for a few hours during periods of rain and then die out.

In the months of June and July, the conditions are identical to that in May, Strong south-westerly winds keep back the water from retreating towards Kori Creek, and the whole tract is under water. The salt crusts also get dissolved by then, and render the area inaccessible and treacherous. The water starts receeding from the end of July. By August the wind dies down and most of this Sub-Facet progressively gets free from standing water, except in the depressions. The ground however remains moist, soft and dangerous. Movement by camel or on foot is rather impossible till the winter months of October and beyond.

Sub-Facet B_3 :

The inundating waters reach this Sub-Facet only during the monsoon period when aided by very strong winds. The flooding is rather erratic and unpredictable as it is mainly controlled by stormy conditions aided by high tides. Rise of tide level at Lakhpat aided by winds helps in pushing sea water upto this point (Fig. 7.6). This Sub-Facet makes a slight depression as compared to the Sub-Facet B_2 (R.L. at Kuar bet $\approx$ [illegible].[illegible]). As a result, once the tidal water is pushed within this depression it stays on forming a stagnant water body. The water depth here never exceeds 20 cm at the maximum. This water does not find an outlet and it neither can flow back to the sea due west, nor proceed inland eastward. On a careful scrutiny of the two channels one between

Fig. 7.7


FLUCTUATIONS IN WATER LEVEL AROUND LAKHPAT AND KUAR BET
DEPTH OF WATER(cm)
150
125
100
75
50
25
LAKHPAT
KUAR BET
1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26 27 28 29 30 31 32 34 35
JULY
AUGUST
SEPT
OCT.
NOV.
DEC
FEB
MARCH.
Each interval represents one week

Mori bet and Gainda bet and the other between Kuar bet and the mainland, it is obvious that the sea water cannot proceed beyond Kuar bet because the gradient is distinctly westwards. Thus, the question of the flow of sea water through these channels to regions north and east of it, has to be ruled out. Many of the previous workers erroneously believed that the sea water penetrated beyond the Dharamshala bet and Kuar bet through these two channels. Air photo studies and field observations during rainy seasons have very conclusively shown that the encroachment of sea water eastward is upto a certain point near Kuar bet (Fig. 7.7) where this salt crust tapers of indicating the eastern limit of sea water ingress (Stereo Plate 2).

INUNDATION PATTERN IN FACET C

The NE-SW trending ridge like elevation between Gainda bet and Dharamshala bet, comprises a very distinct high connecting Mori bet to Bediya bet. It slopes gradually to the east into a vast depression that stretches for several km eastwards. It comprises the Facet of the Great Barren Zone, in which a number of perennial wet patches exist - even during the driest period of the year. Its inundation is entirely due to the accumulation and stagnation of rain water derived mainly from direct precipitation or the rain water that converges within it from the higher ground on its sides. Some rain water may also flow down the stream channels of the rocky islands, but this is confined only to the depressions fringing the islands. As the surface of the facet is featureless, the water is always observed to collect in the depressions first and then overflow to the adjacent regions. To a limited extent, water movement may be controlled by the prevalent wind direction. The maximum depth of water recorded in this region is of the order of 4 metres in the more depressed regions flanking the islands. Here water movement is towards east during the times of heavy rains, when ultimately a vast sheet of water stretching from Pachham to the north of Bela island has been recorded. Owing to the topography and the prevalent wind direction, this water body never moves westwards. This region retains water for months in the shallow depressions to be evaporated subsequently giving rise to thick salt crusts. The ground here, especially after a prolonged rain, remains moist and sticky for a large part of the year.

The author has further observed that no connection exists between the inundation of this Facet and that of the Little Rann. In the past, some workers have suggested that the inundating waters, entering from the Kuar bet side flowed eastward and finally entered the Little Rann. Rowland (1898) wrote, "The natural configuration of the ground, together with the wide extent of the Rann depressions are sufficient to explain this, while at the same time there are evidences on record of an easterly flow of the Rann water and of their escape via the Little Rann." Recently Shrivastava (1971) and Glennie (1970) have also suggested a somewhat similar pattern of inundation. They have shown sea water ingress as far eastward as Bela Island (Fig. 7.8 and Fig. 7.9). They have further taken into account the waters of Luni that flows from NE in this facet. But the author found that the extent of inundation by the various agencies suggested to be exaggerated and untenable. Geomorphologically, there is no possibility at present, of sea water proceeding beyond Kuar bet even during

Fig 7 .8

INUNDATION MAP AFTER SHRIVASTAVA (1971)

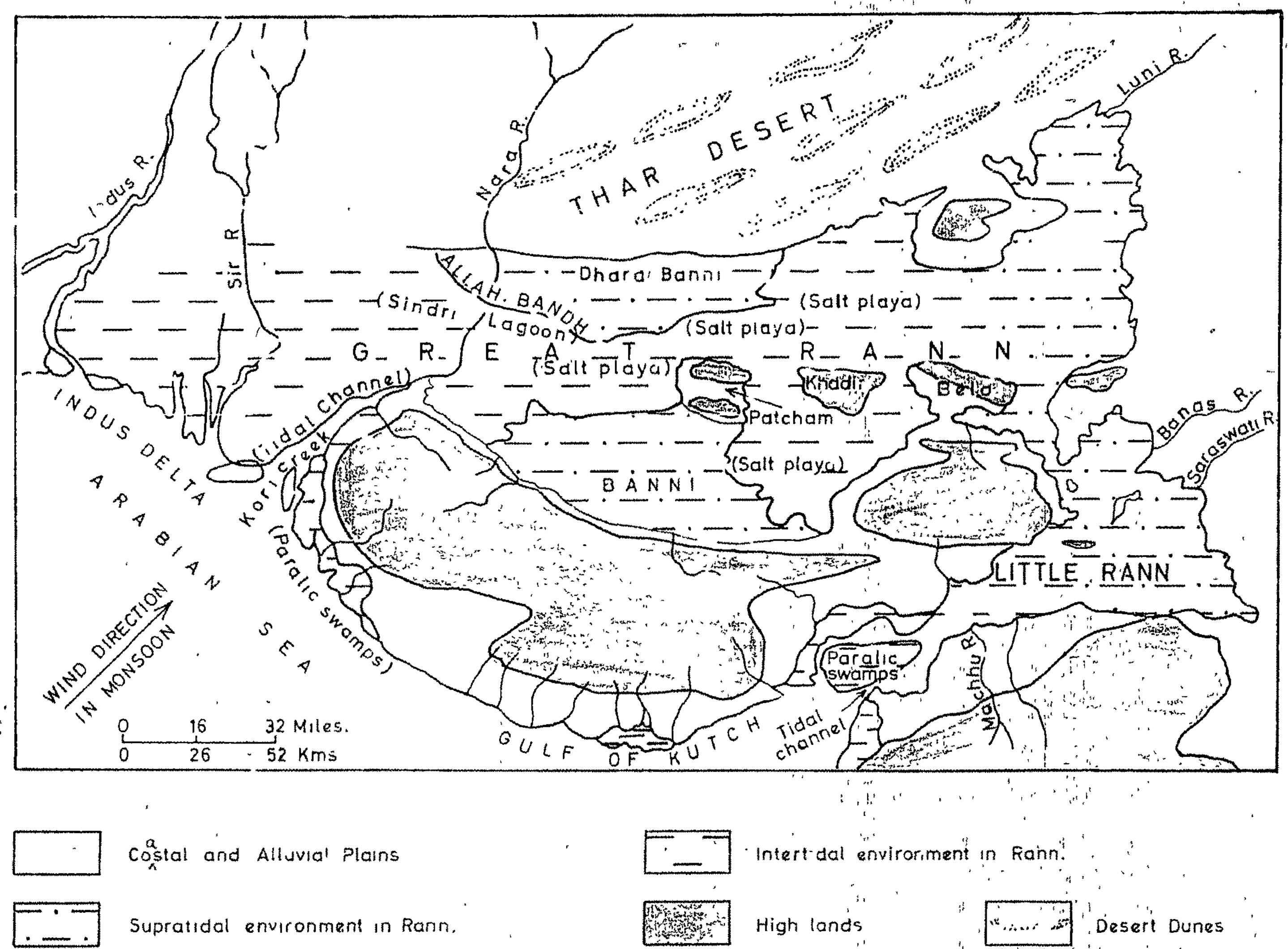
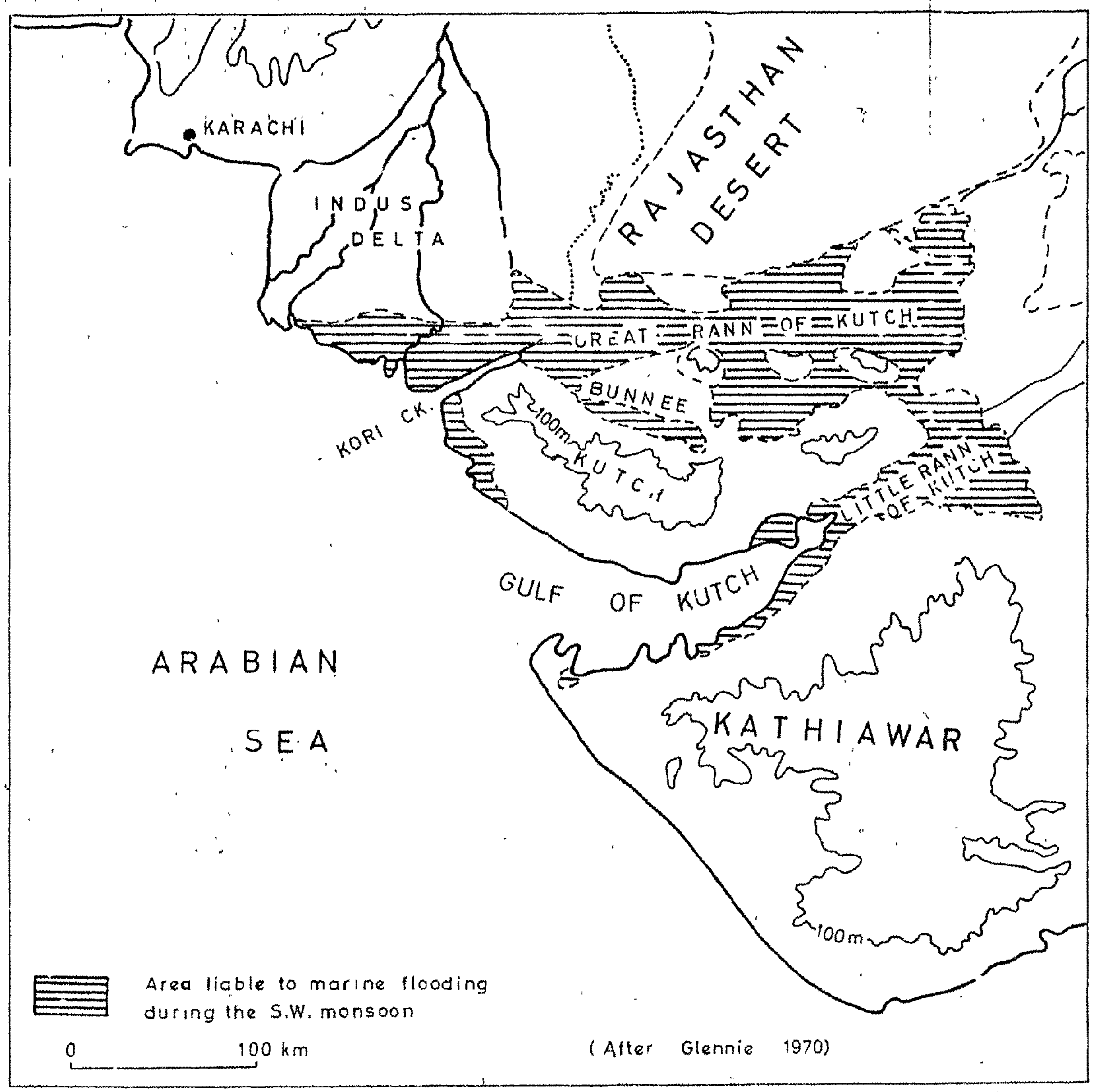


Fig. 7.9

INUNDATION MAP AFTER GLENNIE



(After Glennie 1970)

extreme storm condition. Air photos and ground water studies fully support this observation (Plate 7.4).

The inundation of the Great Rann via the Little Rann is not valid now, though the author feels that in the past, before the present railway embankment was constructed between the junction of the two Ranns, some water might have flowed into the Great Rann from the Little-Rann. At present, there is no flow from the Little to the Great Rann on account of this railway embankment. During his visit in June 1970, the author observed standing water on the Little Rann side to a depth of 2 metres whereas the Great Rann side (barely 50 metres away) was dry.

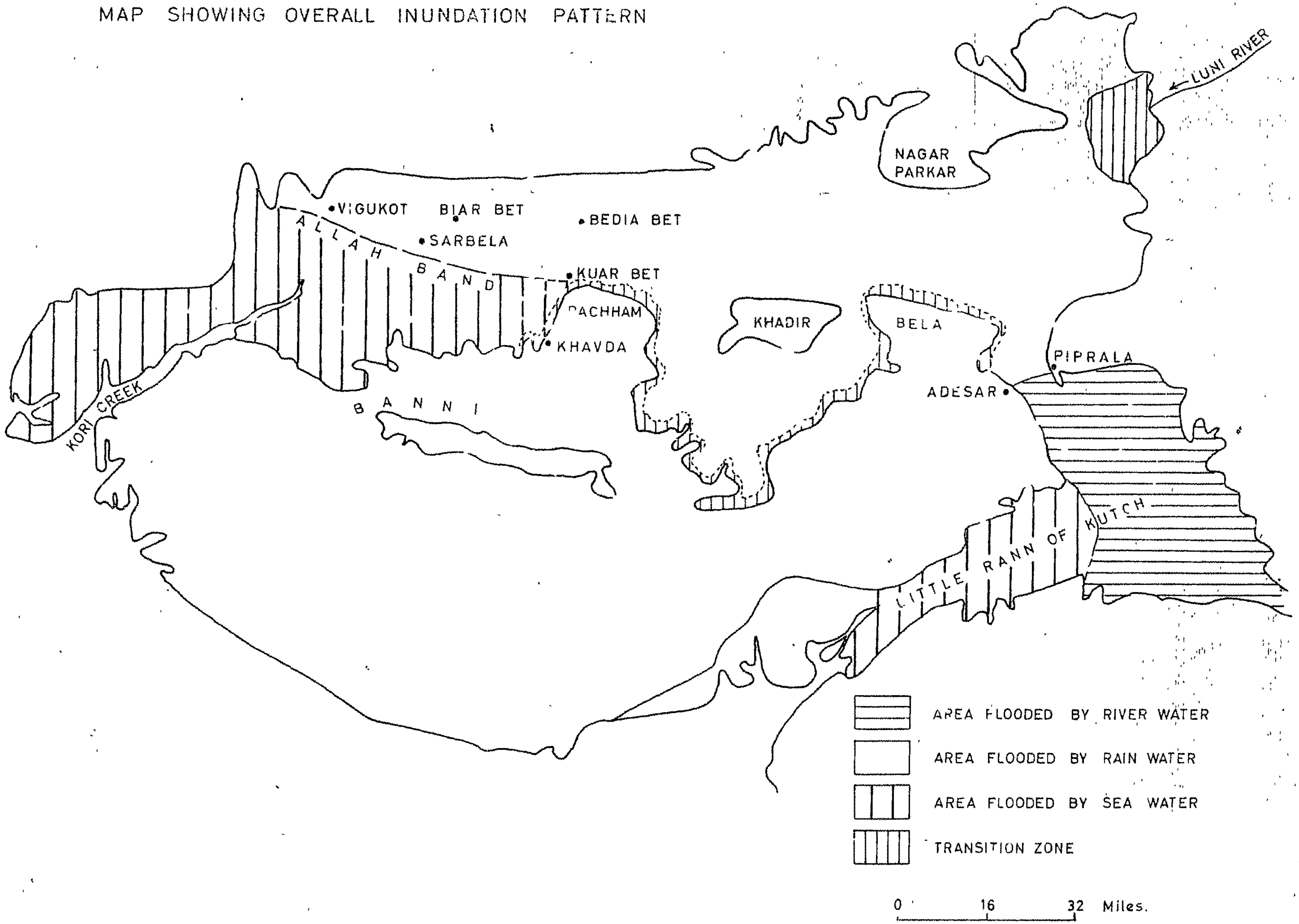
Obviously, the existing pattern of inundation is in no way connected either with sea water or rain water ingress from the west or the flow of rain and river water from the Little Rann. The overall pattern of inundation is shown in Fig. 7.10.

PLATE 7.4

Looking towards Kuar bet (in the background), photograph shows limit of tidal ingress indicated by the disappearance of salt crusts to the right of the bridge.
Location: Kuar bet.

Fig. 7. 10.

MAP SHOWING OVERALL INUNDATION PATTERN



SUMMARY

From the preceding discussion, it is so obvious that the pattern of inundation varies not only from Facet to Facet, but even within one single Facet, it shows considerable diversity.

While the inundation of Facets A and C is almost entirely due to transfer and accumulation of rain water, that of Facet B is exclusively a phenomenon related to tidal incursion. The sea water high tides aided by strong south-westerly winds, travels inwards as far as Kuar bet. The sea water does in no circumstances, travel beyond Kuar bet and the various hypotheses put forward by other workers that inundation of the Great Barren Zone (Facet C) was due to sea water ingress are not valid. In fact, the Facet C, though itself forming a vast shallow depression, is separated from the Facet B by a distinct high ground which prevents sea water from entering it. In the Facet B, the inundation pattern consists of three stages. During winter months, only the western part around the Kori Creek proper gets flooded during normal tides. With the onset of monsoon, the central portion also gets flooded and by the time monsoon is in full force, the entire Facet is under water to varying degrees.

In contrast, the flooding of the Bet-zone (Facet A) is entirely due to transfer of water through the channels and its accumulation in the depressions. The Facet marks a highly dissected surface consisting of numerous bets with a network of shallow depressed channels which are usually sites of water accumulation. The water due to direct precipitation is augmented by the water that flows down the various gullies from the bets. Also the channels show an overall gradient from north to south such that some rain water flows down from elevated areas in the north.

The inundation of Facet C is also a phenomena of rainwater accumulation in the vast depression. The flooding here takes place in two stages. First the smaller depressions are filled up and later on with the more rains, the water from these depressions spills over and gradually inundates the entire area. It is conclusively observed that no water from this depressed area could escape to the Little Rann and the suggestion of some earlier workers that the water flows down the Little Rann, is not correct.

TABLE 7.1

VARIATION OF WATER DEPTHS AROUND VARIOUS LOCATIONS DURING RAINS

Date	Meteorological conditions	Variation in depth (cm)	
LOCATION; KUAR BET			
June 1970			
29	Drizzle	15	
30	Drizzle	18	
July 1970			
1	Drizzle	13	
2	Drizzle	30.5	(tide)
3	Drizzle	30.5	(tide)
4	No Rain	30.5	(tide)
5	No Rain	30.5	(tide)
6	No Rain		
7	No Rain		
8	No Rain	20	
9	No Rain	13	
10	No Rain	15	
11	No Rain	18	
12	No Rain	11	
13	No Rain	8	
14	No Rain	5	

TABLE 7.1 (contd.)

Date	Meteorological conditions	Variation in depth (cm)
July 1970		
15	No Rain	18 (tide)
16	No Rain	18
17	Drizzle	15
18	Drizzle	20
19	Drizzle	23
20 to 26	No Rain	25
27 to 2-8-70	No Rain	20-25
August 1970		
3 to 9	No Rain	25-12
10 to 16	No Rain	12-15
17 to 23	Rain (All 7 days) Light	15-23
24 to 30	" (1st 3 days) Light to Heavy	23-30
31 to 6-9-70	" (1st 3 days) Light	30-23
September 1970		
7 to 13	" (4 days)	23-15
14 to 20	No Rain	30-15
21 to 27	2 Day Rain	20
28 to 4-10-70	No Rain	17
October 1970		
6 to 12	No Rain	12 (gradual decrease)

TABLE 7.1 (contd.)

Date	Meteorological conditions	Variation in depth (cm)
Subsequently, there was no further rain and the eastern edge of Kuar bet dried up by the end of November. The western edge however still retained pockets of sea water in depressions which evaporated to form salt crusts. The area was still soft and water oozed out from a depth, at times as low as 15.2 cm and this wet condition prevailed throughout the year.		
WIND DIRECTION : From SSW in the rains and changes direction around November when it starts blowing from North and North-east.		
LOCATION: LAKHPAT		
29-6-70 to 5-7-70	Rain (2 days) Light	89-142
July 1970		
6 to 12	No Rain	104-97
13 to 19	No Rain	steady around 97
20 to 26	No Rain	97-107
27 to 2-8-70	No Rain	decreases to 90
August 1970		
3 to 9	No Rain	steady around 104-109
10 to 16	Rain (3 days) Drizzle	104-137
17 to 23	" (6 days) "	steady around 137-142
24 to 30	" (2 days) "	decreases to 112
31 to 6-9-70	No Rain	decreases to 102

TABLE 7.1 (contd.)

Date	Meteorological conditions	Variation in depth (cm)
September 1970		
7 to 13	Rain (3 days) Drizzle	increases to 109
14 to 20	No Rain	decreases to 104
21 to 27	Rain (2 days) Drizzle	decreases to 99
28 to 4-10-70	No Rain	decreases to 96
October 1970		
5 to 11	No Rain	decreases to 94
19 to 25	No Rain	decreases to 89
26 to 1-11-70	No Rain	decreases to 76
November 1970		
2 to 8	No Rain	increases to 112
9 to 15	No Rain	decreases to 76
16 to 22	No Rain	increases to 76
23 to 28	No Rain	steady around 76
30 to 6-12-70	No Rain	steady around 78
December 1970		
7 to 13	No Rain	increases to 104
February 1971		
1 to 7	No Rain	decreases to 81
8 to 14	No Rain	steady around 82

TABLE 7.1 (contd.)

Date	Meteorological conditions	Variation in depth (cm)
February 1971		
15 to 21	No Rain	increases to 107
22 to 28	No Rain	steady around 107
March 1971		
1 to 4	Constant stiff wind from west to east holds back water	steady around 108
5 to 11		increases to 122
12 to 18		
19 to 25		
26 to 1-4-71		
April 1971		
2 to 8		

WIND DIRECTION: From SW to WSW in Monsoon
From N and NE in Winter

LOCATION: DHARAMSHALA

Date	Meteorological conditions	Variation in depth (cm)
29-6-70 to 5-7-70	Rain (All days) Drizzle	30-61
July 1970		
6 to 12	Rain (1 Day) Drizzle	61-45
13 to 19	No Rain (Clear)	45-25
20 to 26	No Rain (Clear)	25-10

TABLE 7.1 (contd.)

Date	Meteorological conditions	Variation in depth (cm)
27-7-70 to 2-8-70	No Rain (Cloudy)	10-7.5
August 1970		
3 to 9	No Rain (clear)	7.5-2.5
10 to 16	Rain (1 day) Drizzle	2.5-15
17 to 22	Rain (6 days) Heavy	15-45.7
23 to 30	No Rain (Cloudy)	around 45.7
31 to 6-9-70	Rain (1 day) Heavy	61-45
September 1970		
7 to 13	Rain (2 days) Drizzle	45-76
14 to 20	No Rain (Clear)	steady around 76.5
21 to 27	Rain (2 days) Heavy	76.5-122
28 to 4-10-70	No Rain	122-91
October 1970		
5 to 11	No Rain	91-75
12 to 18	No Rain	75-45
19 to 24	No Rain	45-21
25 to 30	No Rain	21-15

No further rain and standing water evaporated by middle of November and the area remained wet for further 1 week. Subsequent observations upto March indicated a dry condition. No sea water ingress.

WIND DIRECTION: As in other areas

TABLE 7.1 (contd.)

Date	Meteorological conditions	Variation in depth (cm)
LOCATION: BIAR BET		
30-6-70 to 5-7-70	No Rain (Cloudy)	steady around 61
July 1970		
6 to 12	Rain (1 day)	61-30.5
13 to 19	No Rain (Cloudy)	30.5-23
20 to 26	No Rain (Cloudy)	23-17.8
27 to 2-8-70	No Rain (Cloudy)	17.8-8.9
August 1970		
3 to 9	No Rain (Cloudy)	steady around 6.4
17 to 23	Rain (4 days) Heavy	increases to 30.5
24 to 30	Rain (1 day) Drizzle	30.5-45.5
31 to 6-9-70	No Rain (Cloudy)	45.5-86.5
September 1970		
7 to 13	Rain (1 day) Heavy	86.5-137
14 to 20	No Rain (Cloudy)	decreases to 91.5
21 to 27	Rain (1 day) Heavy	around 91.5
28 to 4-10-70	No Rain (Clear)	steady around 45.5
October 1970		
5 to 11	No Rain (Clear)	45.5-30.5

TABLE 7.1 (contd.)

Date	Meteorological conditions	Variation in depth (cm)
October 1970		
12 to 18	No Rain (Clear)	30.5-15
19 to 25	No Rain (Clear)	15-7.6

Further daily reports not send. Later enquiry revealed that the area was wet and inaccessible upto end of December, January and 1st week of February. Sudden increase in the depth of water, at times, was due to rain in regions north of Biar bet and brought down by the channels.

LOCATION: BEDIA BET

Date	Meteorological conditions	Variation in depth (cm)
July 1970		
5 to 11	Rain (2 days) Drizzle	15.2
13 to 19	No Rain (Cloudy)	moist ground
20 to 26	No Rain (Cloudy to clear)	moist
27 to 3-8-70	No Rain (Clear)	moist
August 1970		
4 to 10	No Rain (Clear)	moist
11 to 16	Rain (7 days) Heavy	122
17 to 23	Rain (7 days) 3 days heavy	steady around 135
24 to 30	No Rain (Cloudy)	decreases to 110
September 1970		
7 to 13	Rain (2days) Heavy(cloudy)	110-91.5
14 to 20	No Rain (Cloudy)	91.5-15
21 to 27	No Rain (Cloudy)	15-5

TABLE 7.1 (contd.)

Date	Meteorological conditions	Variation in depth (cm)
From 27-9-70 only occasional showers and the ground remained wet for about 15 days. However, compared to the Biar bet patch, Bedia bet on account of its conspicuously higher elevation drain of quicker.		
Rainfall in 1971 very scanty and no standing water was reported around this region as a result, accessibility was not hampered.		
WIND DIRECTION: As in other regions.		
LOCATION: KUDA		
August 1970		
10 to 16	Rain (All days) Light to Heavy	15.2
17 to 23	Rain (All days) Light to Heavy	15.2-30.5
24 to 30	Rain (All days) Light to Heavy	30.5-96.5
31 to 6-9-70	Rain (4 days) Light to Heavy	96.5-244
September 1970		
7 to 13	Rain (4 days) Light	244-366
14 to 20	No Rain (Clear)	steady around 366
21 to 27	Rain (3 days) heavy	366-457
28 to 4-10-70	No Rain (Cloudy)	steady around 410
October 1970		
5 to 11	No Rain (Clear)	405
12 to 18	No Rain (Clear)	390
19 to 25	No Rain (Clear)	380
Perennial wet patch and standing water was reported upto the end of February.		