PAPER No. 466

Socio-Economic and Financial Aspects of International Water Supply and Sanitation Decade for Pakistan

BY

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Paper No.466

SOCIO-ECONOMIC AND FINANCIAL ASPECTS OF INTERNATIONAL WATER SUPPLY AND SANITATION DECADE FOR PAKISTAN.

By

Masih Ullah Khan (*)

With the availability of potable water supply, considerable improvement in the environmental sanitation and advancement in the medical field, most of the diseases responsible for taking heavy toll of human life in the past, have become now virtually extinct in the developed countries. However, the position in the countries of the Third World is not quite encouraging, as the morbidity and mortality rate is still relatively high. According to WHO/IBRD Report on Water Supply and Sewerage Sector in Pakistan about 30% of the reported diseases and 40% deaths are believed due to water-borne diseases. Realising the implication of drinking water and sanitation on human health, the United Nations formally launched the decade 1981-90 as the "International Drinking Water Supply and Sanitation Decade". This action emphasized the global severity of the problem facing millions of people today because of lack of safe drinking water and sanitation facilities. In response to the U.N's call for "Safe Drinking Water and Adequate Sanitation for All" by 1990, many developing countries have established ambitious goals in the drinking water supply and sanitation at least with the minimum standards set forth by the WHO.

In developed countries, the implementation of the programme may not be difficult due to ample resources, but in the countries of the Third World the case is quite otherwise due to the meagre financial resources, social set-up and level of education of the masses. Due to poor

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financial resources the programme embarked upon by the U.N. seems to be too ambitious for countries of the Third World to achieve the set targets of the decade within the stipulated time.

It must be appreciated that the success of the programme is very much related and dependent upon the finances and education of the masses. It is not possible to achieve the desired object until and unless the common man through various methods and mass media is made aware of the importance of keeping the environments clean and necessity of operating and maintaining all water supply systems safe and free from contamination. The very purpose of providing expensive water supply and waste water disposal systems is defeated if these systems are not maintained properly by the people owing to the lack of education, civic sense or shear negligence in adopting adequate measures to ensure protection of these systems. This implies that there is need for changing social habits of people in the developing and under-developed countries. It is not very uncommon in under-developed countries that people ease themselves in open places, dump filth and garbage here and there and even throw night-soil and other household refuse in streets. They wash their clothes in flowing streams, near open wells and water tanks from where communitieis draw water for drinking needs. The sewers and open channels are used as dumping places of refuse and garbage, with the result that they get choked up and the streets are filled with sewage and sullage water, thus creating health hazard to the area.

In poor countries with inadequate financial resources even with all civic sense and awaking, people are some times helpless as no public toilets or other sanitary

facilities are provided for them. In rare cases where these facilities are provided, they are misused or are not maintained properly and become a source of nuisance as it pollutes the environments rather than keeping them clean and healthy. Cultivation of civic sense and health education among the masses is essentially required which is rather a pre-requisite to make this programme a success. They must be made conversant about different types of diseases, their effects on human health, their causes and the role of water in the transmission of diseases. They must also be educated to control these diseases through preventive measures. They must realise the importance of keeping the environments in a healthy and sanitary condition. In other words there is a need for revolutionary change in the socio-economic set-up in the Third World countries, which could be achieved by a well-planned and organised health programme. Water supply and sanitation developments are complementary and they should be jointly associated with other health development policies and programmes. In order to achieve the target, community participation is essentially required, which will be the best lever for this purpose.

UNICEF made a study on Water Supply and Sanitation for Pakistan which stated in review of August, 1981 that a major constraint on virtually all programmes in Pakistan was lack of community participation and lack of community commitment to:

a) Assist with installation.
b) Assume responsibility for maintenance.
c) Knowledge about disease causation and advantages of more hygiene for health.
d) Measurable indications that physical and behavioural targets are being met.
e) General surveillance, monitoring and evaluation.

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It may be added here that both water supply and sewerage/drainage schemes are very expensive ventures. One cannot enjoy the benefits of the facility fully until the whole system is completed. In case of water supply system, unless every component of the scheme right from development of the source upto the distribution network is completed, the consumers cannot benefit from the system. A continuous supply of water round the clock is also highly desirable. An interruption in the flow of water for very few days creates panic in the affected areas. Therefore, the whole system needa to be very efficient and very well maintained. This of course means huge expenditure on the maintenance and operation of water supply systems.

The objective of a clean and healthy environment cannot be achieved without provision of an adequate waste water disposal system. Water is a commodity, when supplied more, is demanded more. Therefore, water supply and sewerage/drainage schemes go hand in hand and cannot be separated. Otherwise in terms of sanitation and human health whatever we gain by providing adequate water supply system, we lose (if not more) by not providing an adequate and efficient waste water disposal system. Like water supply, waste water system can also be useful only when all of its components right from the house connections upto the sewage disposal works is completed and functions efficiently.

All this renders the provision of water supply and waste water disposal systems very expensive. They are expensive not only in the first instance due to high capital outlay but also due to the annual recurring charges for their efficient operation and maintenance.

At present potable water supply facilities are available

to about 38% of entire population of Pakistan out of which 77% belong to urban areas and 22% to rural areas. Similarly drainage and sanitary facilities of acceptable standard are available to only 16% population of Pakistan (48% of urban and 4% of rural). Access to piped water supply is limited to only large urban centres. Approximately 30% of urban population with access to piped water supply have house connections, the balance being served by stand-posts or public taps. According to Sixth Plan period starting from 1983, it is proposed to increase urban population coverage from 77% to 90% in piped water supply and 48% to 60% in case of sewerage and drainage facilities. In rural areas potable water supply coverage will be increased from 22% to 45%, while in case of drainage and sanitation the coverage will increase from 4% to 10%.

In view of resource limitations and to meet envisaged targets, modest design standards will be adopted. Water supply coverage will be both through house connections and stand-posts in urban areas and extensive use of hand-pumps in rural areas. From technical and hygiene view point it is better to have 24 hours water supply system, but the cost involved in a continuous system being higher than that of an intermittent system, does not permit to do so. The proportions of water which is wasted or remains un-accounted for in some urban distribution systems has been an additional handicap which is estimated to be as high as 40 to 45% as compared to internationally accepted permissible limits of 10 - 15%.

To accomplish the proposed sectoral targets for Pakistan, an allocation of Rs 6,400 millions has been provided during Sixth Plan, out of which Rs. 3,190 millions are for the rural areas. The capital cost as well as the maintenance and operational costs of water supply and

sewerage projects are too heavy to be met through public exchequer. The prevailing costs of construction and interest rates are also very high. Users charges, calculated even on no profit and no loss basis, work out much higher than those prevailing at present. In most cases revenue realised through user charges is not enough to cover even the operating cost of the system, with the result that huge recurring subsidies have to be provided. In order to meet both ends it is proposed that following measures be considered to implement and operate water supply and drainage systems efficiently:

a) Domestic loan for water supply and sewerage schemes be advanced at concessional rates. The loan be extended by the Federal Government to the Provinces or Autonomous Bodies at the same rate as charged by the foreign donor agency.

b) Machinery equipment and plants required for the projects be exempted from customs duty.

c) Electrical power for operating water supply and drainage system be charged at subsidised rates.

d) Attempt be made to complete metering of water supplies in all big cities in order to discourage and curtail wastage and unaccounted for water.

e) Tariff be so regulated as to provide progressively increasing rates for higher water consumption.

f) Operation and maintenance of rural water supply systems shall be financed entirely by the Government and expenditure so incurred be recovered through water charges.

The United Nation has declared the years 1981-90 as "International Drinking Water Supply and Sanitation Decade". This action

emphasizes the global severity of the problem facing millions of people today, because of the lack of safe drinking water and sanitation facilities. In response to the U.N's call for "Safe Water and Adequate Sanitation for All" by 1990, many developing countries have established ambitious goals in the drinking water supply and sanitation sector. The Government of Punjab has also prepared a rough cost estimate for providing adequate drinking water facilities to all the urban and rural population of Punjab by year 2000. Certain design criteria have been worked out and the same have been adopted, which are quite reasonable. The design criteria adopted and cost analysis is discussed below in detail.

DESIGN CRITERIA FOR WATER SUPPLY SCHEMES IN PUNJAB

The total population of Punjab according to 1981 census is 47 millions. The distribution in rural and urban areas is as follow:

a) Urban Population is 28% which works out to 13.2 millions.
b) Rural Population is 72% which works out to 33.8 millions.

Out of 13.2 millions urban population about 31.5% population i.e. 7.2 million persons are being provided with water supply facilities and remaining 6 million persons are to be provided with drinking water. Similarly drinking water is available to 6.5 million rural population (11.2% served with piped water and 8% served with hand pumps) and facilities to the rest 27.3 million persons are yet to be provided. The rural population of Punjab lives in 25,052 villages.

The entire population can be served with potable water with the following four systems:

1) Hand Pumps

Hand pumps can be provided only in the sweet water zone where depth of water bearing strata is within 100' depth and water table is at a depth of about 20' below ground level. One hand pump will be provided to cover 60 persons. The villages will also be provided with the surface drains and street pavements so that the waste water can be drained out in the adjacent pond or streams.

2) Modest Water Supply Schemes

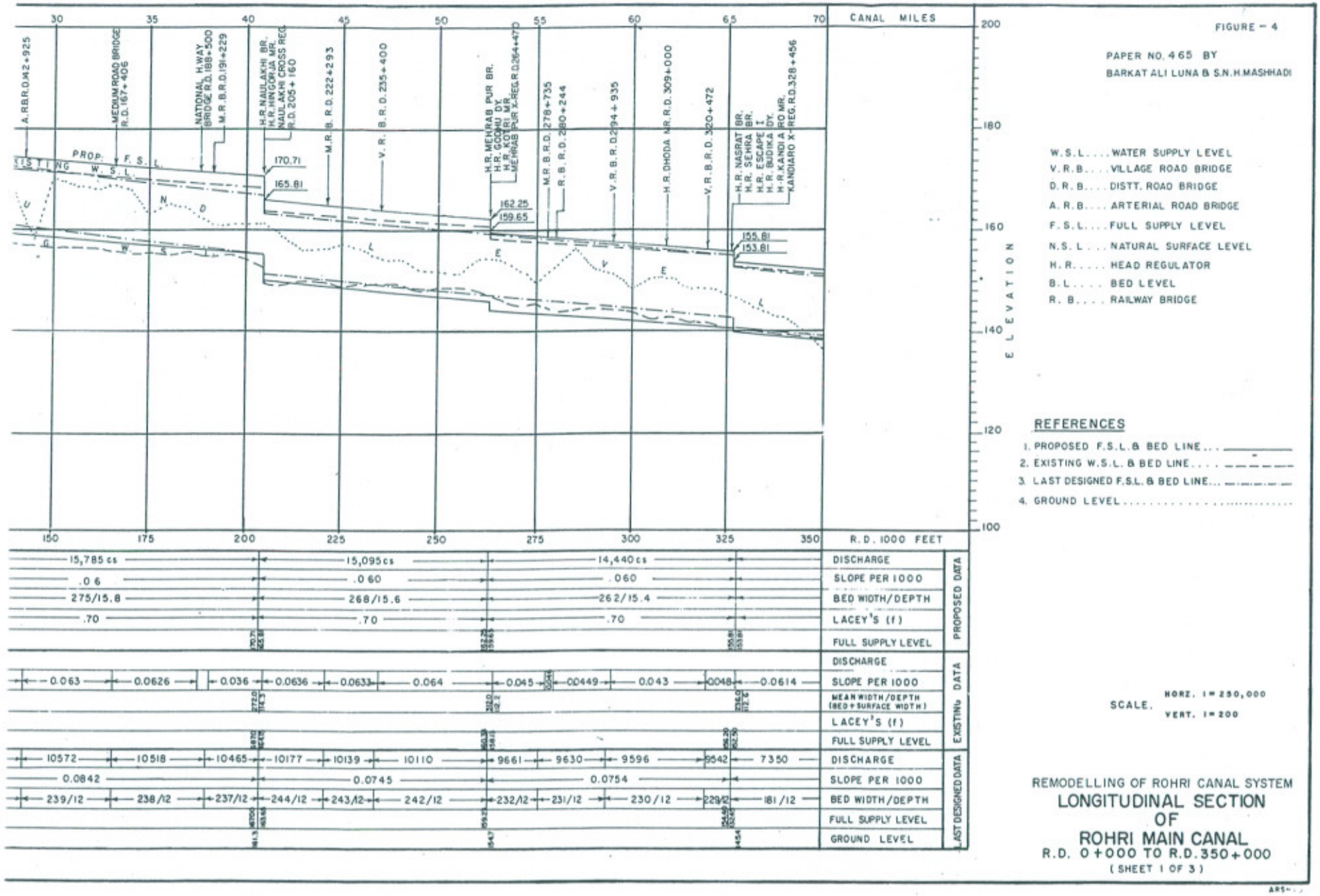
Modest water supply schemes would be provided in the villages where the population is upto 5,000 and the installation of hand pumps is not possible due to depth of sub-soil water table or if the facility of water-bearing strata is beyond 100' depth. The scheme will provide development of source of water, construction of few ground water tanks of 2,500 gallons capacity and laying of water supply main from the source upto ground tanks. This system has proved successful and economically feasible in rainfall areas (not commanded by canals), where there is a scarcity of water. The ground storage tanks would be provided with battery of taps around the tank for drawing water. The villages are also provided with surface drains and brick pavement in the streets in plain areas.

3) Rural Piped Public Water Supply Schemes

Public Water Supply Schemes to rural areas will be provided in the towns having population ranging

FIGURE – 4

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W.S.L. . . . WATER SUPPLY LEVEL
V.R.B. . . . VILLAGE ROAD BRIDGE
D.R.B. . . . DISTT. ROAD BRIDGE
A.R.B. . . . ARTERIAL ROAD BRIDGE
F.S.L. . . . FULL SUPPLY LEVEL
N.S.L. . . . NATURAL SURFACE LEVEL
H.R. . . . . HEAD REGULATOR
B.L. . . . . BED LEVEL
R.B. . . . . RAILWAY BRIDGE

REFERENCES

1. PROPOSED F.S.L.& BED LINE . . . ———
2. EXISTING W.S.L. & BED LINE . . . . – – – – –
3. LAST DESIGNED F.S.L. & BED LINE . . . —·—·—
4. GROUND LEVEL . . . . . .

SCALE. HORZ. 1 = 250,000
VERT. 1 = 200

REMODELLING OF ROHRI CANAL SYSTEM

LONGITUDINAL SECTION OF ROHRI MAIN CANAL

R.D. 0+000 TO R.D. 350+000

(SHEET 1 OF 3)

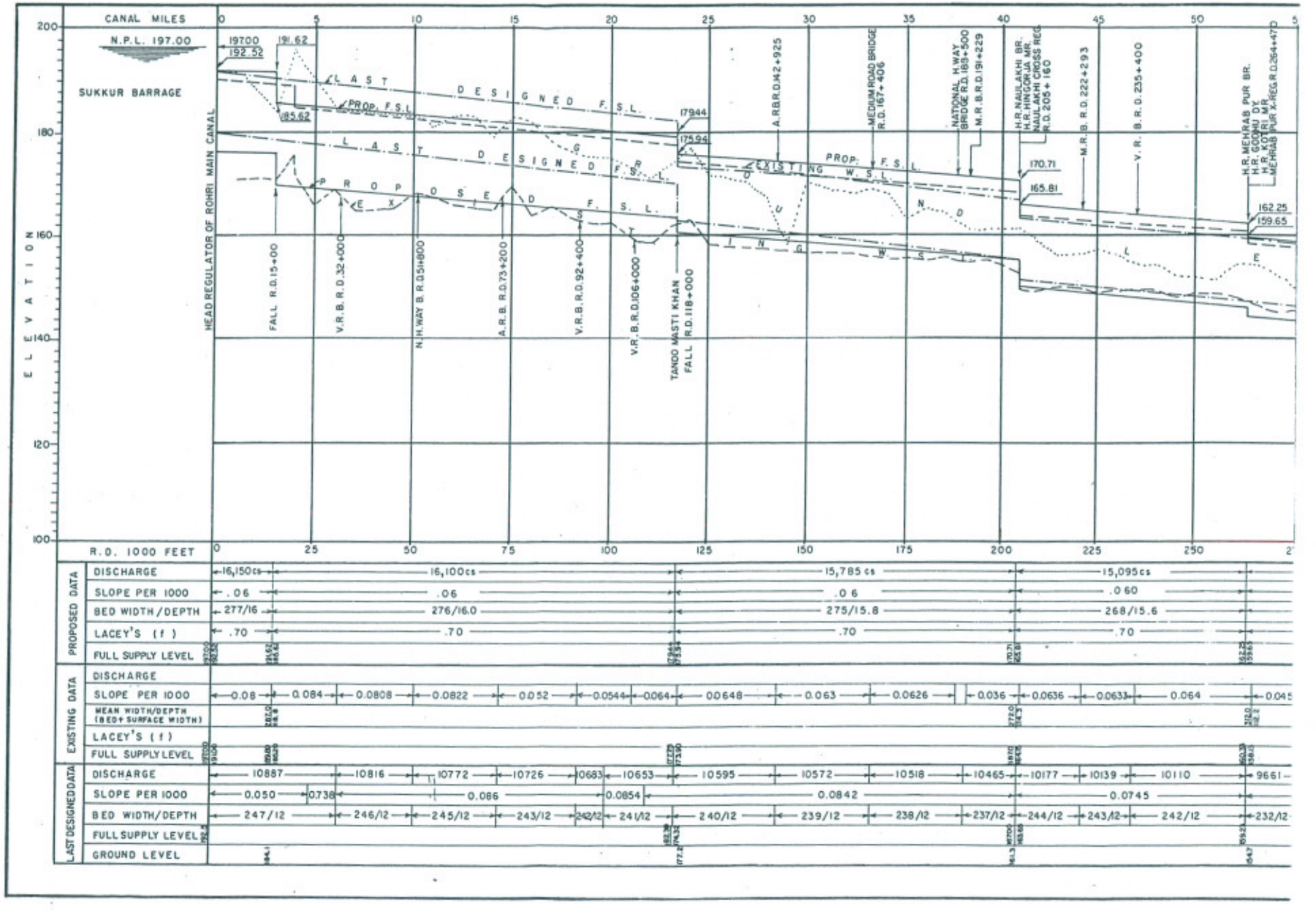
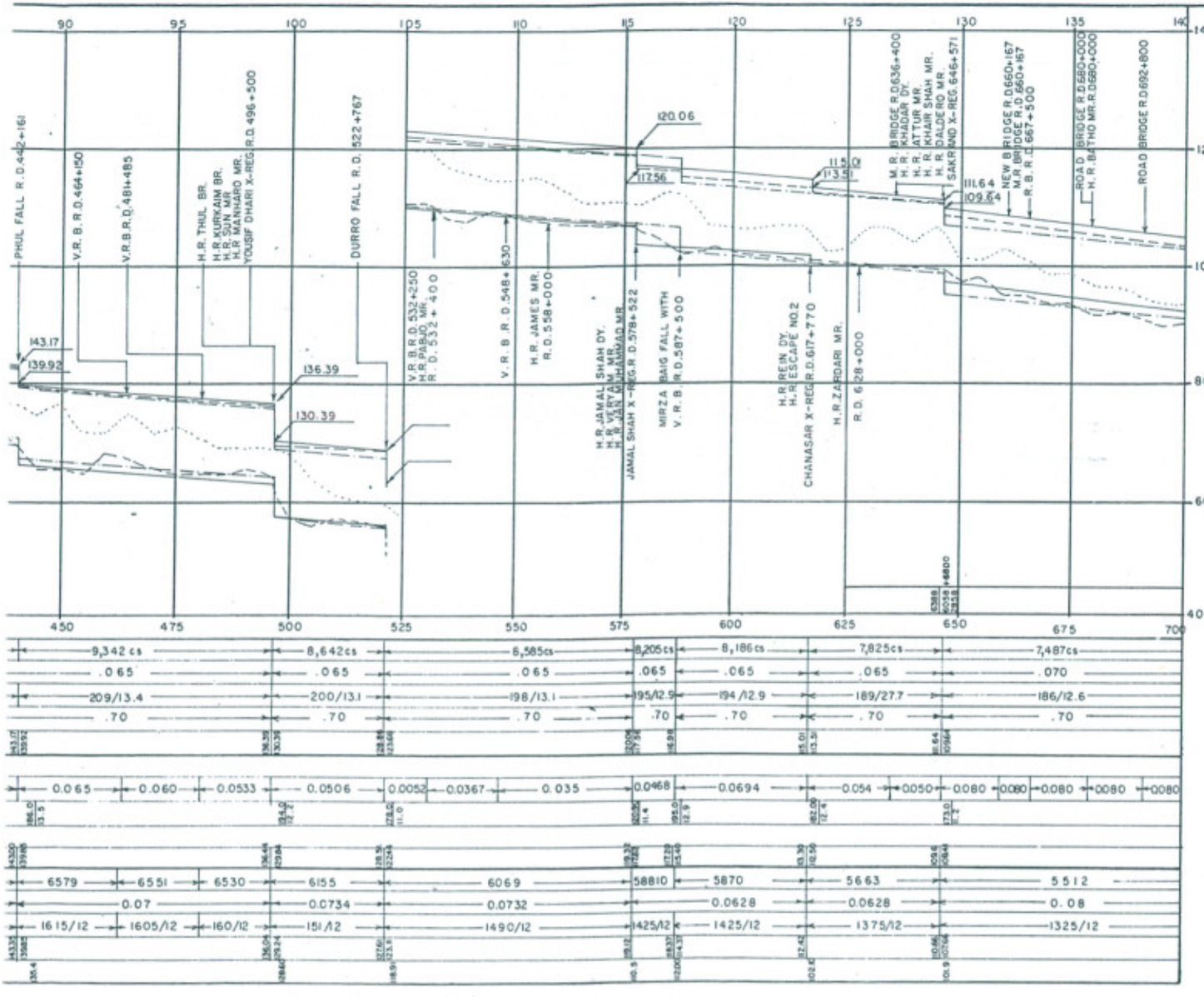

CANAL MILES
N.P.L. 197.00
SUKKUR BARRAGE
HEAD REGULATOR OF ROHRI MAIN CANAL
ELEVATION
LAST DESIGNED F.S.L.
PROP. F.S.L.
EXISTING W.S.L.
PROPOSED EXISTING DESIGNED F.S.L.
FALL R.D.15+00
V.R.B.R.D.32+000
N.H.WAY B.R.D.51+800
A.R.B. R.D.73+200
V.R.B.R.D.92+400
V.R.B.R.D.106+000
TANDO MASTI KHAN FALL R.D.118+000
A.R.B.R.D.142+925
MEDIUM ROAD BRIDGE R.D.167+406
NATIONAL H.WAY BRIDGE R.D.183+500
M.R.B.R.D.191+229
H.R.NAUSAKHI BR.
H.R.NAUSAKHI OFF TAKE
NAUSAKHI CROSS REG.
R.D.205+160
M.R.B. R.D.222+293
V.R. B.R.D.235+400
H.R.MEHRAB PUR BR.
H.R. GODHU DY.
H.R.KOTRI M.R.
MEHRAB PUR X-REG.R.D.264+470
R.D. 1000 FEET
PROPOSED DATA
DISCHARGE
SLOPE PER 1000
BED WIDTH/DEPTH
LACEY'S (f)
FULL SUPPLY LEVEL
EXISTING DATA
MEAN WIDTH/DEPTH (BED+SURFACE WIDTH)
LAST DESIGNED DATA
FULL SUPPLY LEVEL
GROUND LEVEL
16,150cs
16,100cs
15,785cs
15,095cs
.06
.060
277/16
276/16.0
275/15.8
268/15.6
.70
0.08
0.084
0.0808
0.0822
0.052
0.0544
0.064
0.0648
0.063
0.0626
0.036
0.0636
0.0633
0.064
0.045
10887
10816
10772
10726
10683
10653
10595
10572
10518
10465
10177
10139
10110
9661
0.050
0.738
0.086
0.0854
0.0842
0.0745
247/12
246/12
245/12
243/12
242/12
241/12
240/12
239/12
238/12
237/12
244/12
243/12
242/12
232/12

FIGURE – 5

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NOTE.

DATUM LINE CHANGED FROM
R.D. 525+000 TO R.D. 700+000

REFERENCES

1. PROPOSED F.S.L. & BED LINE
2. EXISTING W.S.L. & BED LINE
3. LAST DESIGNED F.S.L. & BED LINE
4. GROUND LEVEL

SCALE. HORZ. 1 = 250,000
VERT. 1 = 200

REMODELLING OF ROHRI CANAL SYSTEM

LONGITUDINAL SECTION OF ROHRI MAIN CANAL

R.D. 350+000 TO R.D. 700+000

(SHEET 2 OF 3)

ARSHAD

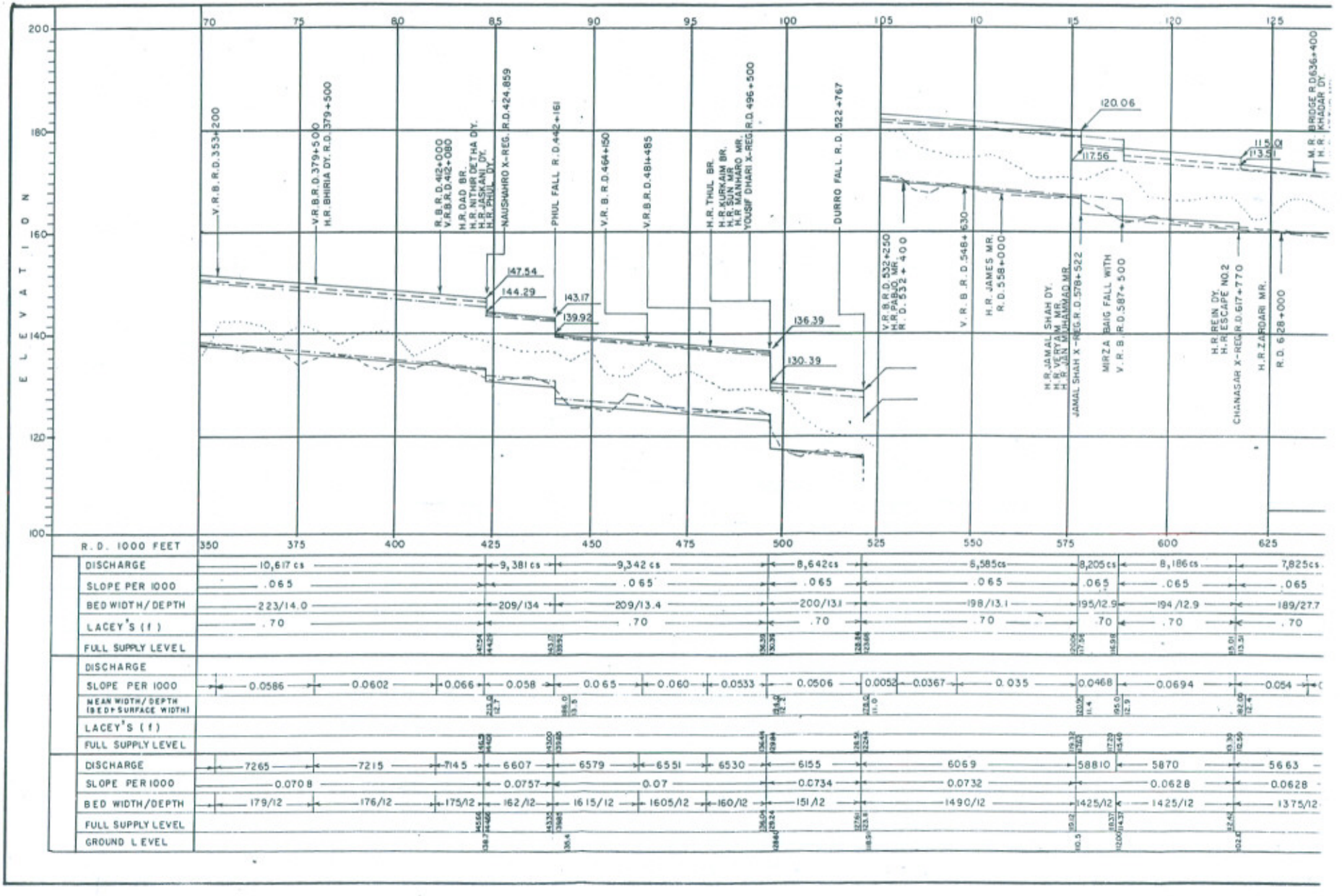
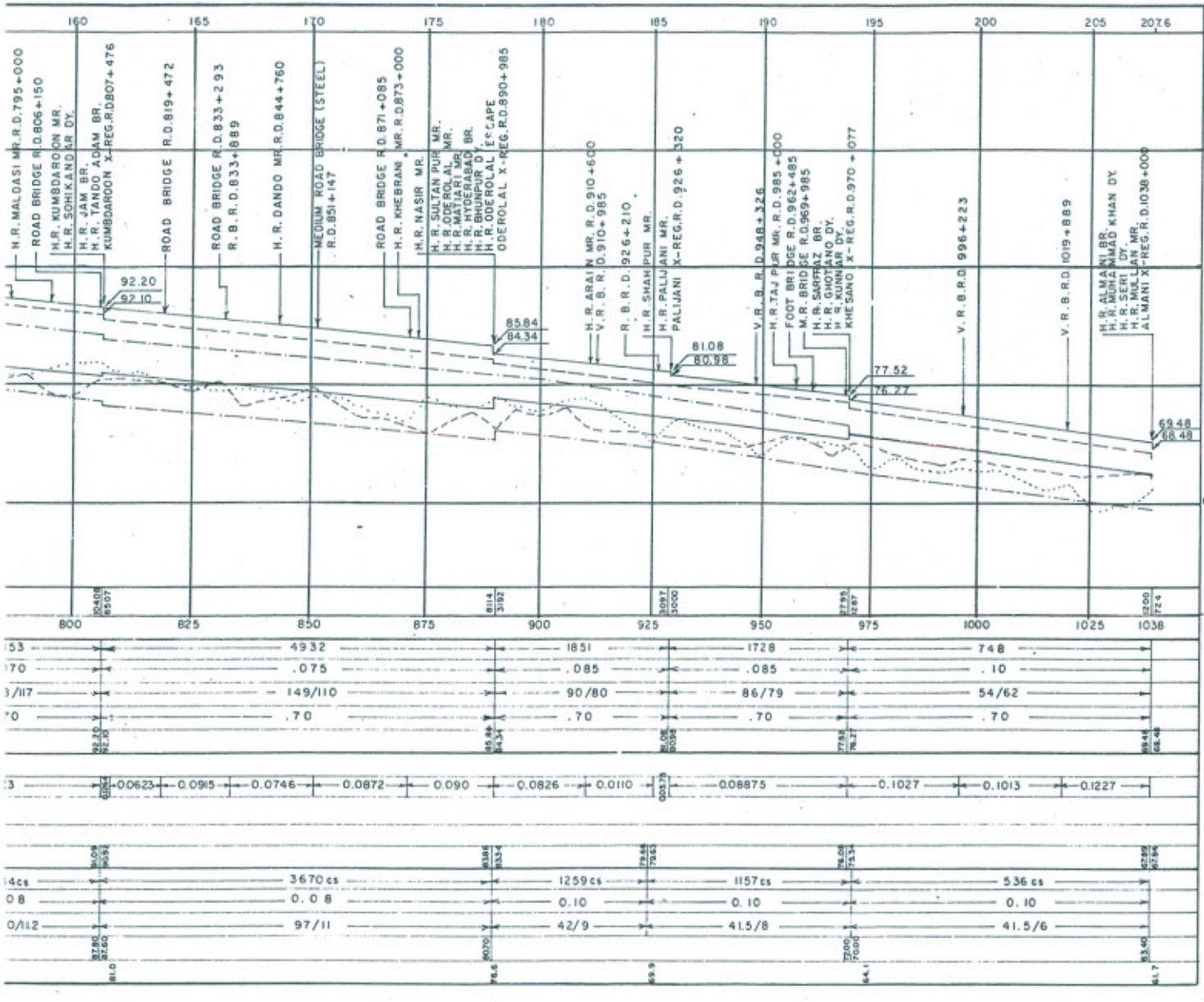

ELEVATION
200
180
160
140
120
100
70
75
80
85
90
95
100
105
110
115
120
125
V.R.B.R.D.353+200
V.R.B.R.D.379+500
H.R.BHIRIA DY.R.D.379+500
R.B.R.D.412+000
V.R.B.R.D.412+080
H.R.DAD BR.
H.R.NITHRI DETHA DY.
H.R.JASKANI DY.
H.R.PHUL DY.
NAUSHAHRO X-REG. R.D.424.859
PHUL FALL R.D.442+161
V.R.B.R.D.464+150
V.R.B.R.D.481+485
H.R.THUL BR.
H.R.KURKAIM BR.
H.R.SUN MR.
H.R MANHARO MR.
YOUSIF DHARI X-REG.R.D.496+500
DURRO FALL R.D. 522+767
V.R.B.R.D.532+250
H.R.PABO MR.
R.D.532+400
V.R.B.R.D.548+630
H.R.JAMES MR.
R.D.558+000
H.R.JAMAL SHAH DY.
H.R.VERYAM MR.
H.R.VALI MUHAMMAD MR.
JAMAL SHAH X-REG.R.D.578+522
MIRZA BAIG FALL WITH
V.R.B.R.D.587+500
H.R.REIN DY.
H.R.ESCAPE NO.2
CHANASAR X-REG.R.D.617+770
H.R.ZARDARI MR.
R.D. 628+000
M.R. BRIDGE R.D.636+400
H.R. KHADAR DY.
147.54
144.29
143.17
139.92
136.39
130.39
120.06
117.56
R. D. 1000 FEET
350
375
400
425
450
475
500
525
550
575
600
625
DISCHARGE
10,617 cs
9,381 cs
9,342 cs
8,642cs
8,585cs
8,205cs
8,186cs
7,825cs
SLOPE PER 1000
.065
BED WIDTH/DEPTH
223/14.0
209/134
209/13.4
200/13.1
198/13.1
195/12.9
194/12.9
189/27.7
LACEY'S (f)
.70
FULL SUPPLY LEVEL
DISCHARGE
SLOPE PER 1000
0.0586
0.0602
0.066
0.058
0.065
0.060
0.0533
0.0506
0.0052
0.0367
0.035
0.0468
0.0694
0.054
MEAN WIDTH/ DEPTH (BED+SURFACE WIDTH)
LACEY'S (f)
FULL SUPPLY LEVEL
DISCHARGE
7265
7215
7145
6607
6579
6551
6530
6155
6069
58810
5870
5663
SLOPE PER 1000
0.0708
0.0757
0.07
0.0734
0.0732
0.0628
0.0628
BED WIDTH/DEPTH
179/12
176/12
175/12
162/12
1615/12
1605/12
160/12
151/12
1490/12
1425/12
1425/12
1375/12
FULL SUPPLY LEVEL
GROUND LEVEL

FIGURE - 6

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REFERENCES

1. PROPOSED F.S.L. & BED LINE.....
2. EXISTING W.S.L. & BED LINE.....
3. LAST DESIGNED F.S.L. & BED LINE.....
4. GROUND LEVEL.....

SCALE. HORZ. 1" = 250,000
VERT. 1" = 200

REMODELLING OF ROHRI CANAL SYSTEM

LONGITUDINAL SECTION OF ROHRI MAIN CANAL

R.D. 700+000 TO R.D. 1038+000

(SHEET 3 OF 3)

ARSHAD

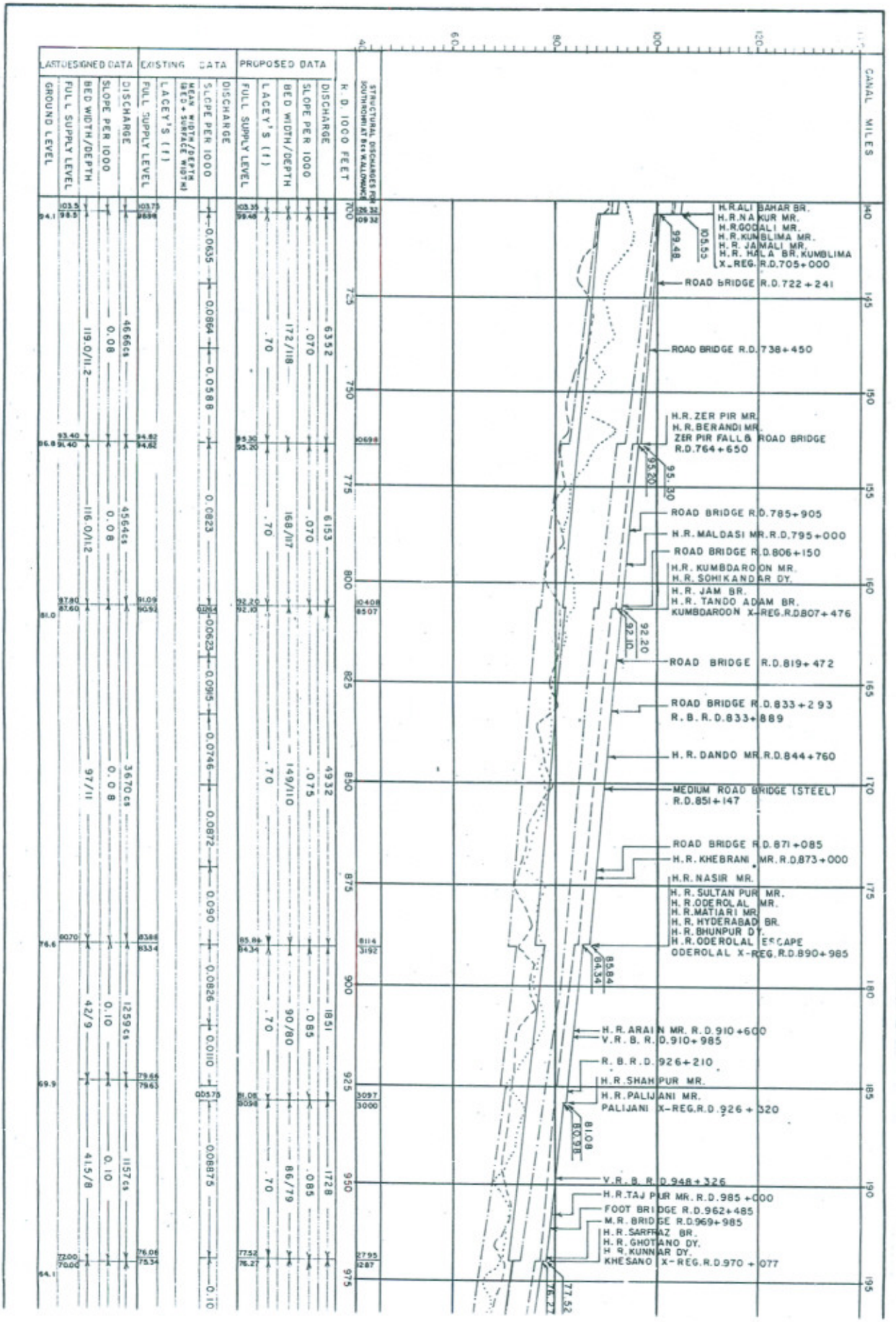
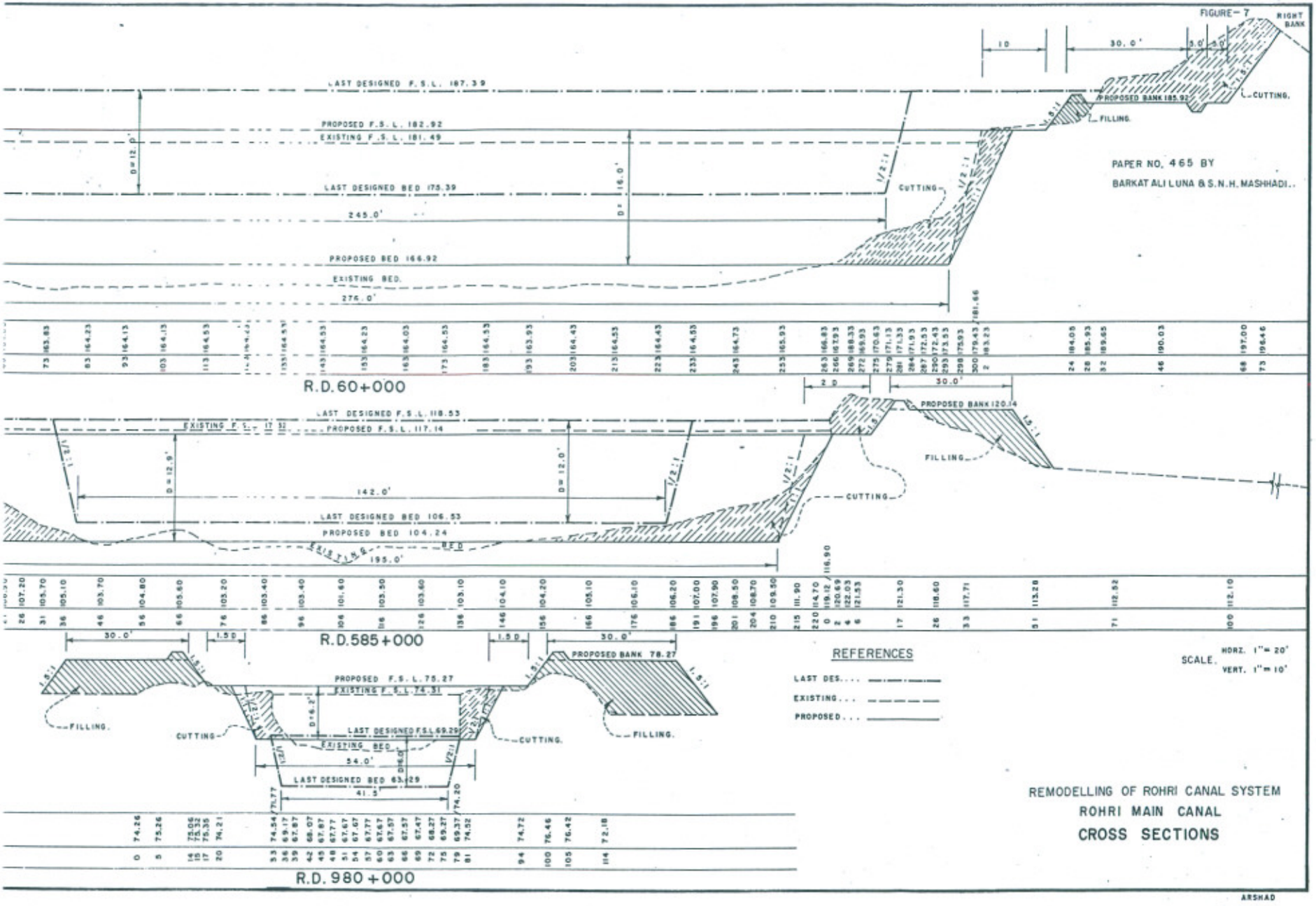

LAST DESIGNED DATA
EXISTING DATA
PROPOSED DATA
GROUND LEVEL
FULL SUPPLY LEVEL
DISCHARGE
SLOPE PER 1000
BED WIDTH/DEPTH
LACEY'S (f)
R. D. 1000 FEET
STRUCTURAL DISCHARGES FOR 30 DAYS SOUTHWARDS AT Rev KALDHANCH
CANAL MILES
H.R.ALI BAHAR BR.
H.R.NAKUR MR.
H.R.GODALI MR.
H.R.KUMBLIMA MR.
H.R. JAMALI MR.
H.R. HALA BR.KUMBLIMA
X-REG. R.D.705+000
ROAD BRIDGE R.D.722+241
ROAD BRIDGE R.D.738+450
H.R. ZER PIR MR.
H.R. BERANDI MR.
ZER PIR FALL & ROAD BRIDGE
R.D.764+650
ROAD BRIDGE R.D.785+905
H.R. MALDASI MR. R.D.795+000
ROAD BRIDGE R.D.806+150
H.R. KUMBDAROON MR.
H.R. SOHIKANDAR DY.
H.R. JAM BR.
H.R. TANDO ADAM BR.
KUMBDAROON X-REG.R.D807+476
ROAD BRIDGE R.D.819+472
ROAD BRIDGE R.D.833+293
R.B.R.D.833+889
H.R. DANDO MR. R.D.844+760
MEDIUM ROAD BRIDGE (STEEL)
R.D.851+147
ROAD BRIDGE R.D.871+085
H.R. KHEBRANI MR. R.D.873+000
H.R. NASIR MR.
H.R. SULTAN PUR MR.
H.R. ODEROLAL MR.
H.R. MATIARI MR.
H.R. HYDERABAD BR.
H.R. BHUNPUR DY.
H.R. ODEROLAL ESCAPE
ODEROLAL X-REG.R.D.890+985
H.R. ARAIN MR. R.D.910+600
V.R.B.R.D.910+985
R.B.R.D. 926+210
H.R. SHAHPUR MR.
H.R. PALIJANI MR.
PALIJANI X-REG.R.D.926+320
V.R.B.R.D.948+326
H.R. TAJ PUR MR. R.D.985+000
FOOT BRIDGE R.D.962+485
M.R. BRIDGE R.D.969+985
H.R. SARFRAZ BR.
H.R. GHOTANO DY.
H.R. KUNNAR DY.
KHESANO X-REG.R.D.970+077

FIGURE – 7


RIGHT BANK
10
30.0'
5.0'
5.0'
LAST DESIGNED F.S.L. 187.39
PROPOSED F.S.L. 182.92
EXISTING F.S.L. 181.49
D = 12.0'
LAST DESIGNED BED 175.39
D = 16.0'
245.0'
PROPOSED BED 166.92
EXISTING BED.
276.0'
PROPOSED BANK 185.92
CUTTING.
FILLING.
1/2:1
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R.D. 60+000
LAST DESIGNED F.S.L. 118.53
EXISTING F.S.L. 117.32
PROPOSED F.S.L. 117.14
D = 12.9'
D = 12.0'
142.0'
LAST DESIGNED BED 106.53
PROPOSED BED 104.24
EXISTING BED
195.0'
PROPOSED BANK 120.14
FILLING.
CUTTING.
1.5:1
R.D. 585+000
30.0'
1.5:1
PROPOSED F.S.L. 75.27
EXISTING F.S.L. 74.31
D = 16.3'
LAST DESIGNED F.S.L. 69.29
EXISTING BED
54.0'
D = 6.0'
LAST DESIGNED BED 63.29
41.5'
PROPOSED BANK 78.27
FILLING.
CUTTING.
R.D. 980+000
REFERENCES
LAST DES....
EXISTING...
PROPOSED...
SCALE.
HORZ. 1" = 20'
VERT. 1" = 10'
REMODELLING OF ROHRI CANAL SYSTEM
ROHRI MAIN CANAL
CROSS SECTIONS
ARSHAD

R.D. 980+000
R.D.585+000
R.D.60+000
LEFT BANK
CUTTING
FILLING
PROPOSED
EXISTING
LAST DESIGNED
DATUM LINE
ELEVATION
DISTANCE IN FEET
REDUCED LEVEL
EXIST.
30.0'
2.0
1.0
D = 12.0'
D = 12.9'
D = 6.2'
142.0'
195.0'
245.0'
274.0'
1:2/1
1.5:1
2:1

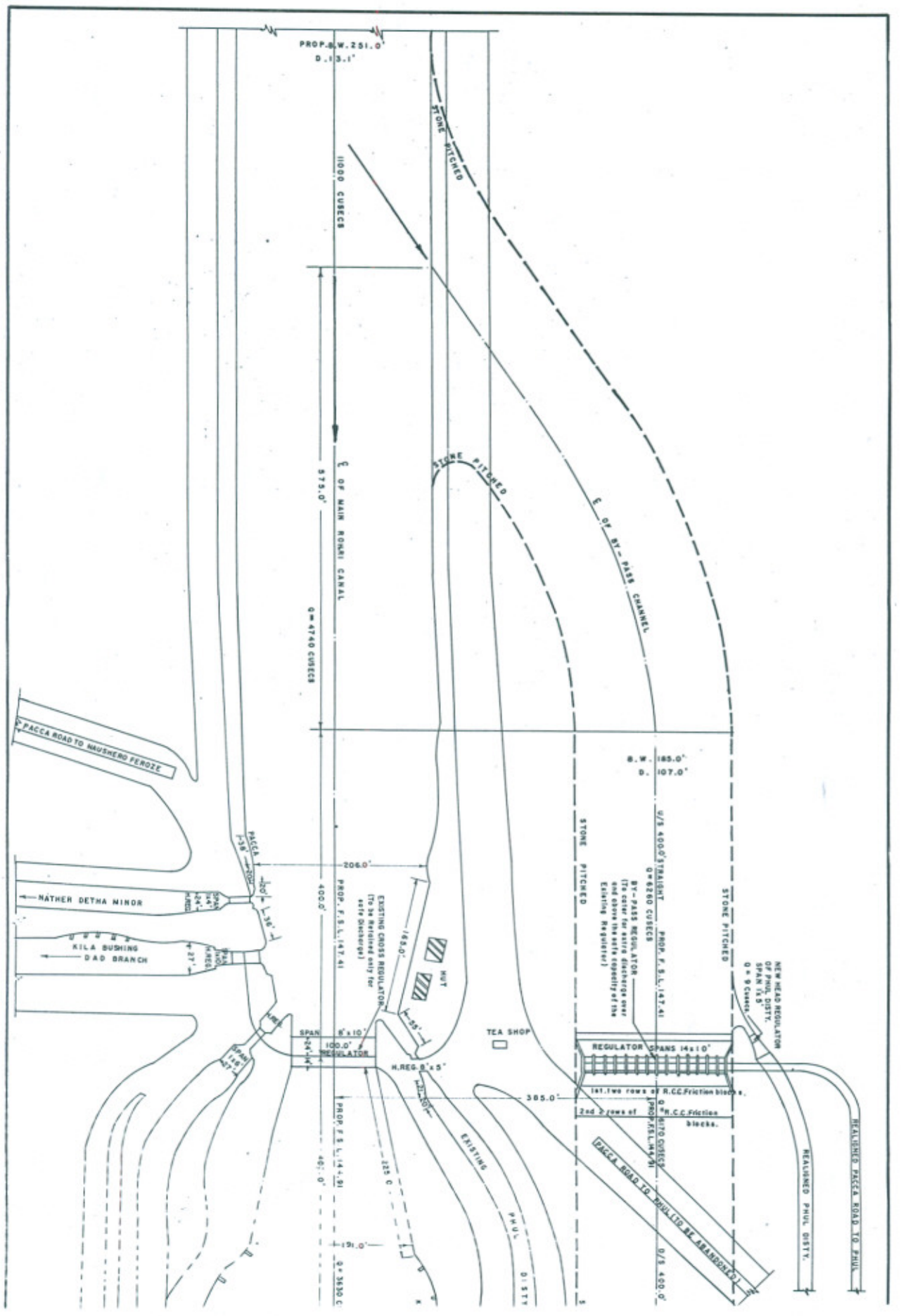
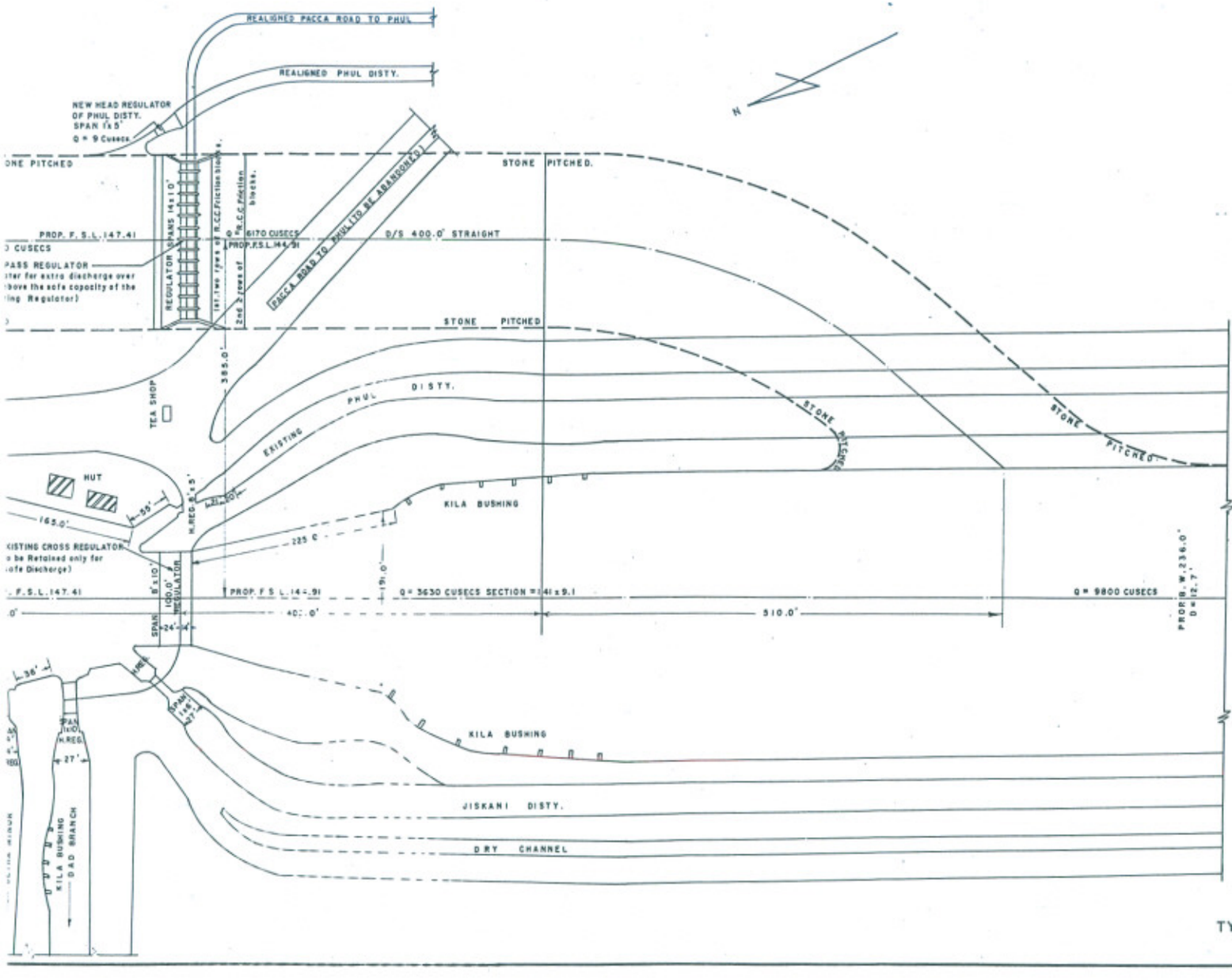

PROP. B.W. 251.0'
D. 13.1'
STONE PITCHED
11000 CUSECS
STONE PITCHED
E OF BY-PASS CHANNEL
E OF MAIN ROHRI CANAL
575.0'
Q = 4740 CUSECS
PACCA ROAD TO NAUSHERO FEROZE
B.W. 185.0'
D. 107.0'
U/S 400.0' STRAIGHT
Q = 6260 CUSECS
PROP. F.S.L. 147.41
BY-PASS REGULATOR
(To cater for extra discharge over and above the safe capacity of the Existing Regulator)
STONE PITCHED
STONE PITCHED
NEW HEAD REGULATOR OF PHUL DISTY. SPAN 15.5' Q = 9 Cusecs
206.0'
PACCA
NATHER DETHA MINOR
KILA BUSHING DAD BRANCH
PROP. F.S.L. 147.41
400.0'
EXISTING CROSS REGULATOR
(To be Retained only for safe Discharge)
HUT
TEA SHOP
SPAN 8'x10'
100.0'
REGULATOR
H.REG. 8'x5'
REGULATOR SPANS 14x10'
1st two rows of R.C.C. Friction blocks.
385.0'
2nd 2 rows of
Q = R.C.C. Friction blocks.
PROP. F.S.L. 144.91
6170 CUSECS
EXISTING
PHUL DISTY.
PACCA ROAD TO PHUL (TO BE ABANDONED)
U/S 450.0'
REALIGNED PHUL DISTY.
REALIGNED PACCA ROAD TO PHUL
PROP. F.S.L. 144.91
Q = 3630 C

FIGURE - 8

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NOTES.

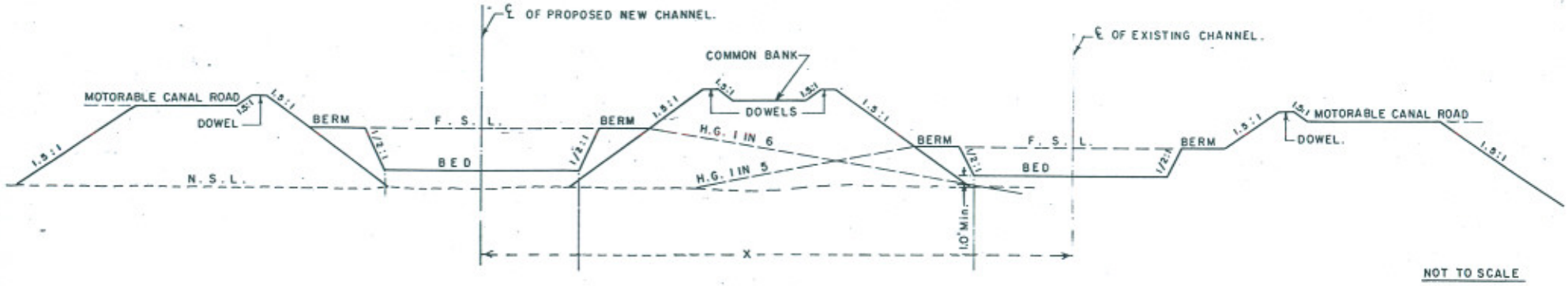
1. By-pass is proposed on the Left side, because there is only one Off-take on this side against 3 on the Right side.
2. The Geometry of the By-pass channel will be modified after model test.

REMODELLING OF ROHRI CANAL SYSTEM
ROHRI MAIN CANAL
R.D.424+859 (NAUSHERO)
TYPICAL BY-PASS CHANNEL & REGULATOR

ARSHAD

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NOTE

SEPARATION DISTANCE – X BETWEEN THE CENTER – LINES OF THE TWO CHANNELS SHALL BE FIXED IN SUCH A MANNER THAT THE PHREATIC LINE WITH A GRADIENTS OF I : 6 FROM THE NEW CHANNEL IN FULL CONDITION SHALL PASS AT A MINIMUM LEVEL OF ONE FOOT BELOW THE EMPTY BED OF THE EXISTING CHANNEL. SIMILARLY THE PHREATIC LINE WITH EXISTING CHANNEL FULL AND NEW CHANNEL EMPTY SHALL HAVE A GRADIENT I : 5 WHILE PASSING AT A LEVEL ON MINIMUM ONE FOOT BELOW BED LEVEL OF THE NEW CHANNEL.

REMODELLING OF ROHRI CANAL SYSTEM

A SKETCH SHOWING TYPICAL DUAL CHANNEL SYSTEM