

TERRAIN STUDY

Maps. West Pakistan, 1:2,50,000, Sheets 39 O, P, 40 M, 44 B, C, D, E, F and G. West Pakistan, 1:50,000, Sheets 39 O/3, 4, 7, 8, 10, 11, 12, 14, 15 and 16, 39 P/1, 5, 6, 9, 10, 11, 13, 14, 15 and 16, 40 M/13, 44 B/10 to 16, 44 C/2 to 16, 44 D/1, 2, 3, 5, 6, 9 and 13, 44 /8, 12 and 16, 44 F/1 to 16, and 44 G/1 to 16.

Purpose and Other Limiting Considerations

1. **Purpose.** To carry out cisfrontier terrain study of AOR bounded by Line Okara Cantt – Depalpur – BP 251 in NE, IB in the East, line BP 486 – Salamsar (LQ 33) – Khan Garh Fort (WB 06) – Derawar Fort (RV 60) – Channi Goth (RV 34) – Punjnad HWs (RV 36) – along River Chenab (RQ 51) in the West and junc pt River Ravi (RN 23) – Chenab (RQ 51), River Ravi, Noor Shah, Okara Cantt in the North (Anx P).

2. **Limiting Conditions.** Info presented is based on data obtained from phy recce carried out by offrs detailed from subordinate fmns and data obtained from fol civ depts / agencies :-

- a. C&W Dept.
- b. Rural Dev Agencies.
- c. National and Provincial Highway Auths.
- d. Union Council / Town Committees /Zilla Councils.
- e. Pub Health Dept.
- f. Irrigation Dept.
- g. Spec projs such as Salinity Con and Reclamation Proj (SCARP) and 6R Hakra Comd and Water Mgmt Proj (CWMP).
- h. Rly Auths.
- i. Cholistan Dev Auth (CDA).
- j. Forest Dept.

k. Met Dept.

l. Pakistan Telecomm Corporation Ltd (PTCL).

3. **Pd of Report.** The report covers the pd up to Sep 2014.

4. **Div of Area.** Anx Q. 31 Corps constitutes nearly half of southern sec extending from canal irrigated areas in the north to desert in the south. The area under consideration extends from Sulemanki in the NE to Salamsar in the south. Depending upon the type of soil and rel of gr, 31 Corps AOR can be cat as under:-

a. **Northern Sec.** This sec is in Ravi – Sutlej Corridor (RSC) bounded by BP 251 – Depalpur – Okara and River Ravi in the east and junc pt of Punjnad HWs (RV 36) in the west.

b. **Southern Sec.** This sec comprises area bounded by River Sutlej in the north and NW, and the IB in the south and SE. This sec can be further divided in three secs, i.e, Green Belt, Semi Desert and Prime Desert. Peculiarities/div of these secs are as fol:-

(1) **Green Belt.** Area from Sulemanki till Fort Abbas.

(2) **Semi Desert.** Area extending from SW of Fort Abbas to Line Dittanwala Toba – Bojranwala Toba – Kawantiwala Toba.

(3) **Prime Desert.** Area confined b/w south of line Dittanwala Toba – Kawantiwala Toba to Line Derawar Fort – Nawan Kot – Bijnot – Salamsar.

c. **Green Belt.** This sec is flat, open, well cultivated and has well dev irrigation sys due to Eastern Sadiqia Canal (ESC), Fordwah Branch, Malik Branch and Hakra Branch. Numerous distys and water channels are intricately woven throughout its length and breadth. However, the pattern of canals and distys divide the area into distinct narrow sub corridors gen running from NE to SW. Comm infrastructure is well dev but compartmentation eff and, at places, high water table suggest slow and inf hy ops. However, southern part of the belt, which is open and flat, facilitates ltd mech mnvrs:-

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- (1) **Rel and Layout.** The area is gen plain with a soft crust. Apart from scattered sand dunes loc in the west and SW, area is gen flat and badly affected by water logging and salinity. Extensive cultivation has been done in areas where the problem of water logging is not very acute. In fact, certain crops which req excessive water, have been predominantly cultivated. An extensive sys of irrigation has been created in the area through numerous canals, distys and minors. Obsn upto 1000 – 1500 M is provided by the banks of canals / distys. All these run parallel to the IB and divide the area into small compartments. Smaller water channels, however, do not fol this pattern and criss cross the entire area. Due to encroachments made by water logging and salinity in the cultivable lands, sandy patches are being brought under cultivation. As a result, quite a no of the relative hts shown on maps, no longer exist on gr.
- (2) **Type of Soil.** Type of soil is predominantly sandy silt / sandy loam. Area confined b/w Sulemanki and Line Faqirwali-Dharanwala has mainly sandy loam with greater clay contents at places. This texture of soil poses tfc problems when area is saturated with water. Southern part of the green belt b/w Faqirwali / Fort Abbas and its extn upto Mansura has sandy silt.
- d. **Semi Desert.** Area north of Line Dittawala Toba - Bojhranwala Toba - Kawantiwala Toba is gen cl as semi desert and is part of the desert sec which extends SW of Fort Abbas. From SW of Fort Abbas upto Line Winjor – Dingarh (little NE of Winjor) is comparatively easier terrain that is more friendly to large scale mech mnvrs. The semi desert sec is barren and consists of gently rolling terrain from NE to SW. Dist upto green belt varies from 70 to 80 km. The area consists of

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Dhars varying in length and width from 1 to 2 km, and sand dunes varying in ht from 15 to 30 ft (4.5 to 9 M):-

- (1) **Type of Soil.** The semi desert area consists of various types of soil ranging from pure sand to sandy-silt loams. Dunes, which constitute greater part of this area, are predominantly sand, while Dhars have soil of finer texture having cohesive qualities, it is very firm and compact in nature. The composn and nature of soil in the dhars is such that it prevents seepage, thereby allowing retention of rain water for greater duration. In the northern sec, the sand is fine which makes mov of B vehs extremely difficult.
 - (2) **Rel of Gr.** The area in the entire desert sec gradually slopes down from NE to SW. Lay of the gr in this sec varies because of existence of sand dunes, Dhars and Gypsum beds. The Dhars vary in size and shape and extend upto a few km. Ht of sand dunes greatly varies ranging b/w 15 to over 70 ft. Area in the northern sec is ribbed with comparatively low sand dunes at greater dist b/w them.
- e. **Prime Desert.** Area hemmed b/w south of Line Dittawala Toba – Bojhranwala Toba – Kawantiwala Toba and NE of Line Derawar Fort – Nawankot – Bijnot – Salamsar, along IB upto Dittawala Toba is cl as Prime Desert. Dist from IB to the green belt in this sec varies from 80 to 100 km. Sand dunes vary from 30 to 70 ft (9 to 21 M) in ht, except in few areas in centre and east/ SE where the ht varies b/w 15 – 30 ft. The southern portion of this sec (areas b/w Rasulsar, Balwatewala Toba, Sanswala Toba and Bijnot) has a greater density of sand dunes which makes some parts of this sec impassible for any X cty mov.
- (1) **Type of Soil.** Southern sec has somewhat coarser sand. In NE portion, in areas of Winjor, Sheikh W/T, Bahu W/T, Tufane

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W/T, sand dunes are closely spaced and the sand is extremely soft thereby making mov of B vehs impossible. Gen the upper crust of few inches of sand over the sand dunes is a little hard due to weathering eff, which gets pulverized after a few passes. Below the upper crust, the stratum is soft sand. Due to the phenomenon of drifting, finer sand gets accumulated over the ridges thus making X cty mov extremely difficult.

Northern Sec

5. **Terrain.** RSC forms this sec which mainly represents typical plains of Punjab.

6. **Climatic Conditions.** Temp varies from 15 to 50°C. Rains are occasional. However, high water table and water logging make the weather almost unbearably hot and humid during Monsoons. About two third of the total annual rainfall occurs during Jul, Aug and Sep in the form of high intensity downpour. The remaining one third is received during months of Dec to Feb in mild showers. Main features of this climate are two distinct seasons: a hot summer with late Monsoon rains and fairly cold winter. The hottest month is Jun and the coldest month is Jan. Fog occurs for 10 to 15 days during Dec and Jan which reduces vis at dusk and dawn. The climatic data is as under :-

- a. **Temp.** Variation of temp during the pd is att as Anx B. Daily temp data is given at Anx C.
- b. **Winds.** Gentle winds blow during winters. However, due to the pressure gradients / atmospheric depressions in summers, the months from Jun to Aug are char by frequent dust storms that fol a humid and hot day. These storms are intensely dusty. No specific dir of the gale is fixed. It acquires, at times, a velocity of 80 to 96 kmph. Even after the storm is over, dust particles remain suspended in the atmosphere for 3 to 4 days thereby reducing vis. Dir of wind is as below (details at Anx C):-

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- (1) **Summer**. May to Oct is from SW to NE.
- (2) **Winter**. Nov to Apr is gen from NE to SW.
- c. **Vis**. Vis is ltd during summer due to dusty winds and during winters due to ltd fog in the morning. Vis is gen better at dawn. On an afternoon free of dust storm, the vis is good at dusk. There is no accumulation of dust at ni. Data on fol is att in tabular form:-
 - (1) **Sun Rise and Sun Set**. Anx D.
 - (2) **Moon Rise and Moon Set**. Anx E.
 - (3) **First Lt and Last Lt Timings**. Anx F.
 - (4) **Phs of Moon**. Anx G.
 - (5) **Weather Factors**. Fog is found only during winters gen along water channels. It persists for approx two to three hrs (sometime more then three hrs) after sunrise. In Dec and Jan after rains, fog covers almost the entire area and remains till late after sunrise. Winter factor data like mist, haze, rainfall and dust storms recorded during the pd is att at Anx H.
- d. **Rainfall**. Anx J.

7. **Topo**

- a. **Rel**. Entire area is composed of active, recent and sub recent flood plains of rivers Sutlej, Chenab, Ravi and old bed of Beas. Depressions of various dimensions do exist. However, almost all of them are so gentle that they cannot be noticed by a casual glance. The depressions are imp only from the inundation pt of view. However, the gen lay of gr is flat with its profile gently inclined from NE to SW. River Sutlej is the only imp natural feature of significance in this sec. The flow of the rivers, canals, distys and nullahs conform to the lay of gr. This sec is extensively cultivated with seasonal crops. Various rakhs and res forests exist in the area.

- b. **Drainage Sys.** A large tract of area along the current bed of River Sutlej was some time back the flood plain of the river. Slopes astride the course of the river in Fordwah Canal – Pakpattan Canal / Khadir Branch (RS 79) Corridor, are gen towards the river. All channels flow from NE to SW. Gradient of the drainage is form NE to SW.
- c. **Vegetation.** The area is extensively cultivated. 1–2 M high crops exist before harvesting season. Org plantation carried out at Khanewal (RR 38), Chichawatni (RM 90) and Arifwal (RS 39) by Forest Dept has significant mil value. All maj rds / trs and canals / distys have linear plantation on one or both sides which provides good cover. In the vicinity of River Sutlej, there is approx 1 – 1 ½ M high elephant grass in and around the river bed.
 - (1) **Crops Data.** Anx K.
 - (2) **Plantation Data.** Anx L.
 - (3) **Orchards/Forest Data.** Anx M.

8. **Soil Analysis**

- a. **Soil Conditions.** Soil in the area varies from silty clay / silty loam to patches of fine sand. Except in water logged areas and imed after rains during summer, going in this area varies from fair to good.
- b. **Water Table.** Water table in this sec ranges b/w 5-6 M below gr. There has been cont inc in water table depth from gr lvl due to shortage of rains during last few yrs except in some patches along canals/distys where it is 2 M or even less. The source of sub surface water in the area is seepage water from water channels and rainfall. However, from 15 Oct to 15 Feb, most of the canals / branches / distys / minors remain closed; during this pd, very little rains occur. Water table in the area reaches its lowest lvl in Jun. Conversely, it is at its peak during Oct. Water resources aval in the area are at Anx JJ.

- c. **Tfc.** The whole area is well served by rds and trs. X cty mov of all types of whs and trs is possible except where it is restd by canals / distys and water logged areas.

9. **Man Made Features**

- a. **Rds and Trs.** The entire area is criss crossed with rds which provide a very well dev comm infrastructure and no of laterals and penetrants (Ref Anx N, O).

(1) **Laterals**

- (a) Rd Bahawalnagar – Minchinabad – Mcleod Ganj – Sulemanki HWs is CI 70 A2 running parallel to Fordwah Canal.
- (b) Rd Sulaimanki - Bahawalnagar - Chishtian - Hasilpur - Khairpur - Bahawalpur.
- (c) Rd Bahawalnagar - Harunabad - Fort Abbas – Marot - Kudwala - Yazman - Ahmedpur East.
- (d) Rd Mcleod Gunj - Minchinabad - Bhawalnagar - Haroonabad/Chishtian Mandi which is CI 50A1 upto Bahawalnagar and CI 70A2 thereafter.
- (e) Tr along Eastern Sadqia Canal (ESC).
- (f) Rd Bahawalnagar– Chishtian (RS 02) – Hasilpur (RR 80) – Bahawalpur which is CI 70 A2.
- (g) Rd Bahawalnagar - Dunga Bunga (RS 52) – Haroonabad - Fort Abbas CI 70 A2 upto Haroonabad and CI 70 A1 between Haroonabad and Fort Abbas.

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- (a) Rd Sulaimanki - Okara.
- (b) Rd Mandi Sadiq Ganj - Pir Ghani / Pir Ghulam Qadir - Pakpattan – Sahiwal.
- (c) Rd Churiwala - Chhonawala - Hasilpur - Islam HWs - Vehari – Kacha Khu.
- (d) Rd Pakpattan - Pir Ghulam Qadir - Minchinabad.
- (e) Rd Khattan (RS 41)-Jundwala - Nursar –Madrassa which is CI 70 A1.
- (f) Rd Mianwala Toba, Rd Haroonabad – Qazi Wala – Chishtian, CI 70 A1 Idg to Xing sites at Sahuka, Lakha and Islam HWs.
- (g) Rd Mianwala Toba, Rd Haroonabad–Shaheed Chowk–Dharanwala, CI 70 A1.
- (h) Rd Faqir Wali–Shaheed Chowk – Dharanwala, CI 40 A1.
- (i) Rd Khichi Wala – Rafiqabad–Yatimwala, CI 70 A 1.
- (j) Rd Fort Abbas– Dharanwala–Chishtian, CI 70 A1 Idg to Xing sites at Sahuka, Lakha and Islam HWs, CI 70 A 1.

(3) **Trs.** There are numerous trs connecting the vills. Most of these trs become slushy and unfit for wh mov in wet weather. No permanent brs are provided over numerous small water channels which restrict mob whenever water runs in these channels. Tfc of these trs depends upon the condition of soil. These trs connect various locs with each other.

(4) **Dist.** Dist chart is att at Anx A.

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b. **Rlys.** Details are att at Anx AA.

(1) The sec is well served with broad gauge rly lines.

(a) Ahmedpur East – Bahawalpur – Khanewal - Okara. This is a broad gauge single rly line and forms part of main rly line Lahore – Karachi.

(b) Bahawalpur – Multan – Khanewal. This is a broad gauge single rly line loop which connects Multan with main rly line.

(c) Lodhran – Vehari – Arifwala – Haveli. It passes through the area connecting Arifwala – Pakpattan – Haveli - Basirpur and Kasur.

(2) **Rly Stas.** Anx AA.

(3) **Loading / Unloading Ramps.** Anx AA. Ramps exist on main rly stas only.

(4) **Sites for Placing Mob Ramps.** Anx AA.

c. **Tel.** PL Routes shown at Anx BB.

d. **Airfds.** Anx CC.

(1) **Multan Airport.** It is loc West of Multan Cantt and is jet capable. It consists of two parallel runways. Length of each runway is 3 km and width is 34 M. Presently, it is being used by PIA, Army Avn and PAF.

(2) **Okara Cantt Airfd.** Loc at Okara Cantt, it is an all weather, single runway, jet capable airfd which is 3 km long, 50 M wide and fit for med ac. There is no fence along the perimeter and radar facilities are not aval.

(3) **Vehari Airfd.** It is a PAF Fwd Op Base. The airfd is 3 km long. It remains deactivated during peace time but can be activated on short notice. It can be used by all types of jet ac.

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e. **Air Strips.** Anx DD.

f. **Canals / Branches / Distys / Minors / Drains.** Anx EE.

- (1) 31 Corps AOR is very well served with irrigation canals/ distys/ minors. Sulemanki HWs receives water from India through River Sutlej. Qty of water avail from Indian side is far less then req. To overcome this problem Balloki–Sulemanki Link Canal (BSLC) provides water from Balloki HWs to meet the req.
- (2) Three main canals, i.e, Pakpattan, **Fordwah** and **ESC** emanate from Sulemanki HWs. Pakpattan Canal flows towards northern side of River Sutlej and remaining two canals flow towards southern side of the river.
- (3) The salient features common to the canals / branches / distys are as under:-
 - (a) Canals / distys divide the area into narrow corridors.
 - (b) The canals and distys flow in fill.
 - (c) Any breach in these canals / distys will inundate the area rapidly.
 - (d) Distys of width upto 60 ft can be crossed by using AVLBs.
 - (e) Canals banks are made of hard surface. Mostly svc trs exist on one side of bank only. Only one hy veh at a time can mov on svc trs. Rec of vehs from these trs will pose problems as the banks are about 1.25 M higher than gr lvl.
 - (f) Home and far banks of all canals are of same ht except home banks of ESC and Hakra Main Branch which are higher than the far banks.
 - (g) Almost entire area along the banks of canals and distys is boggy. During their apch to the water line, AVLBs may get bogged down. Width of the canal bank is insufficient for

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launching of AVLB and therefore will req engr effort in terms of ramps.

- (h) Some of the distys and most of the minors can be crossed by tks after careful recce. However, if a bank of distys/minor is breached, the area will be inundated quickly and consequently become boggy.
- (4) Imp canals / branches / distys / minors / drains of the sec are as fols :-
 - (a) **Lower Bari Doab Canal (LBDC)**. This canal runs parallel to main rly line Lahore – Sama Satta and National Highway Lahore – Multan. This is one of the maj canals flowing from NE to SW. Width of this canal varies from 67-80 M with depth rg from 3.25-4.25 M. CI 9F1 svc tr exists on southern bank. Fol distys originate from this canal on the southern side :-
 - i. 1L Disty (RN 75).
 - ii. Kalasan 2L Disty (RN 84).
 - iii. Okara 4L Distys (RN 64).
 - iv. 5L Disty (RN 64).
 - v. 9L Disty (RN 32).
 - vi. Dad Fariana 11L Disty (RN 01).
 - vii. Chicha Watni 12L Disty (RN 01).
 - (b) **Khanwah Branch (RO 34)**. It originates from Dipalpur Canal. It is 17 M wide and 1.6 M deep. It flows south of Hujra and then bifurcates into two distys: Nahrawala Disty (RN 93) and Dipalpur Disty.
 - (c) **Upper Sohaq Branch (RO 12)**. Originates from BSLC and flows NE to SW. It is 26 M wide and 2 M deep. From Sq

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0520 onwards, it is known as Bunga Hayat Disty and its width reduces to 16 M. It terminates south of Bunga Hayat.

- (d) **Lower Sohaq (EO 12)**. Originates from BSLC Regulator (1221), flows parallel to BSLC upto Sq 1013 and then flows west upto Sq 6003 from where it divides into a no of distys. It is 32 M wide and 2 M deep. A cl 9F1 svc tr exists. Fol distys originate from this Branch:-

- i. Battak Disty (RO 11).
- ii. Mehtab Garh Disty (RO 01).
- iii. Shah Ahmed Disty (RO 01).
- iv. Haveli Disty (RN 90).
- v. Bohman Shah Disty (RN 80).
- vi. Musewal Disty (RN 70).
- vii. Sohaq Disty (RN 70).
- viii. Para Disty (RN 60).
- ix. Malka Hans Disty (RN 60).
- x. Nurpur Disty (RN 60).
- xi. Ludha Wanga Disty (RN 50).

- (e) **Pakpattan Canal (RT 09)**. Originates from Sulemanki HWs with max disch of 6,594 cusecs and flows towards West. A Cl 9F1 svc tr exists. Fol are its imp distys:-

- i. Bhatti Disty (RS 79).
- ii. Rehmuke Disty (RS 79).
- iii. Kabir 1R Disty (RN 60).
- iv. Salim Kot 1 – AR Disty (RS 49).
- v. Qabula 1L Disty (RS 48).
- vi. Arifwala 2L Disty (RS 38).
- vii. Fitna Disty (RS 28).
- viii. 2R (Balo Duba) Disty (RS 28).

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- ix. 4L (Trikhni) Disty (RS 28).
- x. Garwan Disty (RS 18).
- (f) **Khadir Branch (RS 79)**. It originates from Pakpattan Canal (Sq 7292) and flows SW. The disch at the head is 2,230 cusecs. Its length is 77.12 km. A CI 9F1 svc tr exists. Its distys are :-
 - i. Ferozepur Disty (RS 68).
 - ii. Pakpattan Disty (RS 68).
 - iii. Suchan Disty (RS 58).
 - iv. Hazara Disty (RS 47).
 - v. Machi Sing Disty (RS 36).
- (g) **Balloki – Sulemanki (BS) Link I**. It is a link canal b/w Balloki HWs and Sulemanki HWs to feed water into River Sutlej. It flows north to south. All other canals and distys cross this link canal through syphon at sqs 1826, 0940, 0934 and 1221. It is 80-100 M wide and 4-5 M deep.
- (h) **Balloki – Sulemanki (BS) Link II**. It is also a link b/w Balloki HWs and Sulemanki HWs. Primarily this canal is designed to take on the overflow of water from BS Link. It has common bank with BS Link I. A svc tr runs along the three banks of the twin canals and are almost at equal ht from the surrounding area. It is 50-67 M wide and 4-4.25 M deep.
- g. **Brs.** Anx FF. Brs on River Ravi at Balloki (RN 08), Mari Pattan (RS 45), Chichawatni and Sidhnai (RN 31) provide access to RCC from RSC and vice versa.
- h. **HWs**
 - (1) **Trimmu HWs**
 - (a) **Gen**

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- i. **Description.** Barrage.
- ii. **Loc.** Rd Jhang (RN 58) – Bhakar (RF 32).
- iii. **Water Source on Which Const.** River Chenab.
- (b) **No of Bays and Size.** 60 bays of 10 M width each.
- (c) **Ht of Gates**
 - i. **Weirs.** 5.2 M.
 - ii. **Under Sluices.** 7.3 M.
- (d) **Tech Data**
 - i. **Length.** 1,008 M.
 - ii. **Piers**
 - (aa) Thickness. 2.3 M.
 - (bb) Spans. 10 M under sluice; 20 M weirs.
 - iii. **Span Size.** As above.
 - iv. **Length.** 40 M.
 - v. **Above Water Lvl.** 2.5 M.
 - vi. **Railing.** Iron railing.
- (e) **Hydrology**
 - i. **Designed Disch.** 6,45,000 cusecs.
 - ii. **Designed High Flood Lvl.** 163.3 M.
 - iii. **Normal Pond Lvl.** 164 M.
- (f) **Head Regulator of Canals Off Shooting**
 - i. **Loc.** Rt bank.
 - ii. **No of Bays.** 3.
 - iii. **Canals.** Rangpur Canal.
 - iv. **Disch Capacity.** 2,709 cusecs.
- (g) **Br / Rd Over the Barrage with Cl.** Cl 70.
- (h) **Security / Protection Arngs**
 - i. **Loc.** On both ends of br.
 - ii. **Type.** Civ police.

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- iii. **Str.** 2 x men on each end.

(2) **Sidhnai HWs**

(a) **Gen**

- i. **Description.** Sidhnai HWs.
- ii. **Loc.** 3.5 km NE of Abdul Hakim.
- iii. **Water Source on Which Const.** River Ravi.

- (b) **No of Bays and Size.** 5 bays of 13 M width.

- (c) **Ht of Gates.** 4.0 x 4.3 M, 0.7 x 6.3 M and 0.7 x 7 M.

(d) **Tech Data**

- i. **Length.** 237 M incl abutments.
- ii. **Piers.** 14 nos.
 - (aa) Thickness - 2.7 M
 - (bb) Spans - 13.3 M
 - (cc) Spans size - 16.0 M
 - (dd) Length - 27.7 M
- iii. **Above Water Lvl.** 2.8 M
- iv. **Railing.** Concrete railing on both sides.

(e) **Hydrology**

- i. **Designed Disch.** 1,50,000 cusecs.
- ii. **Designed High Flood Lvl.** 158.8 M.
- iii. **Normal Pond Lvl.** 156 M.

(f) **Head Regulators of Canals Off Taking**

- i. **Loc.** Lt bank.
- ii. **No of Bays.** 10.
- iii. **Canals**
 - (aa) SMLC.
 - (bb) Sidhnai Feeder Canal.
- iv. **Disch Capacity**
 - (aa) SMLC - 11,650 cusecs

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(bb) Sidhnai Feeder - 4,058 cusecs

v. **Gates (Type and ht)**

(aa) Lt bank - West Gate 3.8 M

(bb) Rt bank - East Gate 3.8 M

(g) **Br / Rd Over the Barrage with Cl.** Cl 70 A2.(h) **Security / Protection Arngs.** A police CP manned by 2-3 policemen exists.10. **Natural Features**a. **Rivers**(1) **River Ravi.** Flows from NE to SW and forms the Northern bdry of 31 Corps AOR.(a) **Bed Condition.** Sandy and loamy soil.(b) **Width.** Avg 500 M.(c) **Wet Gap Dry / Wet Season.** 200 M.(d) **Current – Dry / Wet Season.** 0.17 m/s.(e) **Depth.** 5 M.(f) **Bank Type and Size.** Earthen.(g) **Flow of Water.** 5,000 to 10,000 cusecs.(2) **Old Bed of River Beas.** It flows NE to SW in the area. It remains almost dry in dry season except for some static seepage water of inconsequential imp. However, in wet season its obs value is considerably inc upto SMLC. There onward, it has been brought under cultivation and presently is only a depression. Its dimensions are :-**SECRET**

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	<u>Dry Season</u>	<u>Wet Season</u>
(a) Depth	0.3-0.5 M	2-3 M
(b) Current	Nil	1-2 m/s
(c) <u>Xing Feasibility.</u>	It can be crossed in dry season with minor engr effort. However, in wet weather it becomes an eff obs to be reckoned with confining all types of veh mov through brs.	

b. **Nullah/Drains**(1) **Maneka Nullah**

- (a) **Description.** It originates from area Thakerke Hasim (9803) and Dharange (0398) and flow from NE to SW. It remains dry during dry season. However, during wet season it drains out river water from the area and becomes an obs for all types of vehs.
- (b) **Depth.** 0.5 to 2 M.
- (c) **Width.** 2 to 5 M.
- (d) **Banks.** None.
- (e) **Current.** Nil.
- (f) **Xing Feasibility.** Can be crossed w/o engr effort in dry season.

(2) **Chura Nullah**

- (a) **Description.** It originates from area near Vill Chura Lakhwera Mankla (9800), runs from NE to SW and finally joins River Sutlej at sq 8991. It remains North of Rd Haveli – Fazilka in dry season. In the south, seepage water drains through this end and it turns out to be an obs for all types of vehs near Pakpattan Canal.
- (b) **Depth.** 0.3 to 1 M.
- (c) **Width.** 3 to 7 M.

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- (d) **Banks.** Nil.
- (e) **Current.** Nil.
- (f) **Xing Feasibility.** Can be crossed with minor engr effort. However, near Pakpattan Canal the area as a whole becomes boggy. Mov of all type of vehs will be impossible.

(3) **Naman Jundke Nullah.** This nullah originates from NW of Usmanpur (9497) and flows from NE to SW. It remains wet throughout the yr and is an obs for B vehs. However, near Pakpattan Canal (sq 8894), it becomes an obs for A vehs also. Data pertaining to this nullah is as fol:-

- (a) **Depth.** 1 to 2 M.
- (b) **Width.** 17 to 34 M.
- (c) **Banks.** Nil.
- (d) **Current.** Nil.
- (e) **Xing Feasibility.** Can be crossed from North with some engr effort in dry season. However, in wet season the entire length of its flow becomes difficult to cross.

11. **BUAs**

a. BUAs having significant bg on mil ops are as under:-

- (1) **Sahiwal.** It is a Dist HQ and maj city connected by GT Rd Lahore – Multan. It is also connected with all maj towns / vills around through metalled rds/ kutcha trs. Bypass to the city is aval. Civ facilities of hosp, grid sta, water reservoir, post and tg office, rly and police stas and air strip are aval.
- (2) **Chicha Watni.** This is a maj town in the area. It is a Teh HQ of Sahiwal Dist, connected by both GT Rd and rly line Lahore – Multan. All the vills around are connected through rds/ trs. Facilities of hosp, grid sta and post office, rly and police stas, tel exch and water reservoir are aval.

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- (3) **Okara**. It is another maj town. It is a Dist HQ connected with all maj cities/ towns/ vills both by rail and rd. Bypass rd is aval. Facilities of hosp, grid sta, post and tg office, rly and police stas, tel exch and water reservoir are aval.
- (4) **Pakpattan**. It is a large size city in the area. It is a Teh HQ and is linked with all cities/ towns with rds/ trs. Bypass aval in the West of the city is partially op due to lack of overhead br on rly line. There is Dist HQ Hosp with TB clinic, having facilities of op theatre, lab, dental surgeon and other specialists. Grid sta, post and tg office, rly and police stas, tel exch and water reservoir are aval.
- (5) **Dipalpur**. It is Sub Teh HQ of Okara. It is connected with Okara, Pakpattan, Sulemanki and Kasur with metalled rd. It is also connected with vills around through rd/ trs. Facilities like hosp, grid sta, post and tg office, police and rly stas, tel exch and water reservoir are aval.
- (6) **Renala Khurd**. Loc on Lahore – Multan National Highway and is also connected with Lahore - Multan rly line. Facilities like hosp, grid sta, power house, post and tg office, police and rly stas, tel exch and water reservoir are aval.
- (7) **Haveli**. It is a small town loc on Rd Bunga Hayat – Sulemanki. It is connected with towns/ vills around by means of rds/ trs. No bypass is aval. Facilities of hosp, grid sta, post and tg office, rly and police stas, tel exch and water reservoir are aval.
- (8) **Basirpur**. It is loc on Rd Okara – Dipalpur – Dullah (1010). It is a med size town. Facilities of hosp, post and tg office, police and rly stas and tel exch are aval.
- (9) **Malka Hans**. Loc on Rd Sahiwal – Pakpattan and connected with surrounding vills through rds/ trs. Facilities of a civ

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dispensary/ hosp, post and tg office, police sta and tel exch are aval.

(10) **Hujra**. It is a med town connected with surrounding towns/ vills by means of rds/ trs. Facilities of hosp, post and tg office, police sta, tel exch and water reservoir are aval.

(11) **Arifwala**. It is a Teh of Pakpattan District connected with cities/ towns both by rds as well as rly. No bypass is aval. Facilities like hosp, grid sta, post and tg office, rly and police stas, tel exch and water reservoir are aval.

b. **Population**. Att at Anx GG.

c. **Social Conditions**. Comparatively better social conditions exist than those living south of Sutlej because of productive/ fertile land. Land owners have tractors / trollies whereas peasants have bullock carts.

12. **Tfc**. The whole area is well served by rds and trs. X cty mov of all types of whs and trs is possible except where it is restd by canals / distys and water logged areas. In this sec, terrain does not favour large scale offn ops in the NE upto Pakpattan Canal because of lack of room for tac conc / mnvr in River Sutlej – Pakpattan Canal / Khadir Branch Corridor. However, terrain and comm infrastructure north of Pakpattan Canal and the remaining Northern Sec favour offn ops and offer multiple options. Ops in this sec are likely to be slow and inf hy.

Southern Sec

13. **Terrain**. The area towards NE is restd, providing ltd space for mnvr. However, towards South the area opens up, providing ample space for mnvr. This sec has a variety in the terrain, mainly influenced by the irrigation sys and nature of soil splitting it into Green, Semi-desert and Desert Secs. Imp commcens of this sec are Mcleod Ganj, Mandi Sadiq Ganj, Minchinabad, Bahawalnagar, Harunabad, Chishtian, Hasilpur, Yazman, Bahawalpur and Ahmedpur East. Dist in km b/w imp places have been shown in Dist Chart att as Anx A.

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- a. **Green Sec.** It is flat, open, well cultivated and has well dev irrigation system due to ESC (RS 64), Fordwah Branch, Malik Branch (RO 07), Hakra Branch (RS 40), Bahawal Canal, Desert Branch (RW 26) and Ahmedpur Branch (RW 97). Numerous distys and water channels are intricately woven through out its length and breadth. However, the pattern of canals and distys divide the area into distinct narrow sub – corridors gen running from NE to SW. Comm infrastructure is well dev. The area South of Harunabad was comparatively restd due to high water table, but had improved due to lowering of water table. Some scattered patches do exist which can be bypassed easily. In Bahawalnagar sec, water logged patches in area North and NW of Jalwala Reg exist which severly restrict the mov of trs vehs. Two land reclamation projs namely SCARP-VIII and 6R Hakra (CWMP) were exec in the area. Tfc has considerably improved after completion of these projs. River Sutlej is a complete tk obs b/w Sulemanki HWs and Punjnad HWs subj to aval of water. Similarly ESC, Hakra, Malik, Fordwah, Bahawal, Desert and Ahmedpur canals are also complete obs. In addn, there are three man-made A tk obs i.e. Fort Abbas – Marot A tk ditch, Mansura – Lal Patel A tk ditch, Murad A tk ditch (RS 10) which is astride RD Chishtian – Fort Abbas. Besides above, the drains of SCARP-VIII and 6R Hakra (CWMP) can also considerably enhance the terrain friction when charged. Green Sec can be further sub divided as follows :-

- (1) **Bahawalnagar Sec.** Area bounded by IB – Line Rampura (RS 34) – Qasimka (RS 35) – River Sutlej (RS 25) and Gaggo (RS 07).
- (2) **Harunabad Sec.** Area bounded by IB – Line Mianwala Toba (RX 49) – Harunabad (RS 40) – Chishtian (RS 12) – River Sutlej (RS 03) – Lakha (RR 94) and Burewala (RR 96).

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- (3) **Head Signai – Wallar Reg Sec.** Area bounded by IB – Line Wallar (RX – 36) Chak 130 (RX 18) – Chhonawala (RW 89) – Qaimpur (RR 81) – Islam HWs (RR 82) – Ludan (RR 83) and Chak 15 – 8L (RR 57).
- b. **Desert Sec.** This sec is further sub divided into Semi Desert and Prime Desert:-
- (1) **Semi Desert.** Area extending from SW of Fort Abbas to Line Dittanwala Toba – Bojranwala Toba – Kawantiwala Toba is cl as semi desert. It provides good going with comparatively flat, open and gently rolling cty. The area has ltd comm infrastructure. It has no water obs of mil significance except Hakra Rt Disty (RX 06) which originates from Wallar and peters out towards Marot. The artificial obs in the form of DCBs runs from Fort Abbas to Lal Patel and Murad Disty. These DCBs can be crossed by launching AVLB. The area is gradually being brought under cultivation by instl of tube wells in areas where sweat water is aval. In its present state, it has an appreciable terrain friction for wh vehs. X cty mov for B vehs is difficult and creates log sp problems.
- (2) **Prime Desert.** Part of vast and desolate sandy desert lies to Area confined b/w south of line Dittanwala Toba – Kawantiwala Toba to Line Derawar Fort – Nawan Kot – Bijnot – Salamsar. The desert consists of high sand dunes comb with large accumulation of soft sand whose configuration runs from NE to SW making the mov very difficult, especially from south and vice versa. The sand dunes are gen irregular in shape and structure because of varying wind vel and dir. These sand dunes are dominant features providing good obsns and F of Fs in the Dhars b/w them. The area is devoid of water, comm

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infrastructure and any maj habitation which may have obvious implications on mil ops.

14. **Climatic Conditions**

a. **Green Sec.** Summer season is considerably long from Apr to mid Oct. Pd b/w May to Jul is extremely hot and dry, mk by frequent dust storms creating refraction and mirage effs. Winters are short and moderately cold. The climatic data is as under:-

- (1) **Temp.** Max temp in summer varies from 35° to 50° C whereas along the border and desert, the temp can rise much higher. Variation of temp is given at Anx B.
- (2) **Wind.** Normal winds blow throughout the year with mild intensity rg from 5.5 to 9 kmph and gen from SW to NE or occasionally from south to north.
- (3) **Vis.** On acct of its proximity to the northern sec, vis conditions are similar.
- (4) **Rain.** Normally this area does not receive much rain. During Monsoon, rainfall of 35 to 80 mm can be expected and in winters intermittent rains occur.

b. **Semi Desert / Desert Sec.** Climate in this sec is extremely hot and dry. In summer the days are remarkably hot and nis are comparatively cool. Days are mk by normal winds blowing from NW to SE which often turn into sand storms sometimes ranging even beyond 60 kmph. Winter dawns are char by haze which clears off as the day wears. Refraction and mirage effs are very pronounced in this sec. Climatic data of this sec is as fols:-

- (1) **Temp.** In summer, the days are extremely hot with the temp rising upto 52°C whereas the nis are cool with temp dropping upto 15°C. During winters the days are warm and nis very cold (3 to 5°C).

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- (2) **Winds**. Normally wind blows from NW to SE with a speed of 8 to 16 kmph which often turns into sand storm blowing at 30 to 60 kmph or more.
- (3) **Vis**. Sep to Feb is best from the pt of vis. Owing to the reflection of the sand, vis is good during starry and moonlit nights. Vis of this sec is only affected due to str wind. During the summer, vis is ltd during day time and good during dusk and dawn pd. During winter, it is ltd due to fog during dawn and good during dusk. Vis is badly affected due to sand storms in both summer and winter season.
- (4) **Rain**. Rainfall is scanty and mostly in the form of local cloud bursts.

15. **Topo**a. **Green Sec**

- (1) **Rel**. The area is gen plain with a soft crust, apart from scattered sand dunes loc in the west and SW. It is flat area and is badly affected by water logging and salinity. Extensive cultivation has been carried out in the areas where the problem of water logging is not very acute. In fact, certain crops which req excessive water are predominantly cultivated here. An extensive sys of irrigation has been created in the area through numerous canals, distys and minors. Obsn upto 1000-1500 M is provided by the banks of canals / distys. All these run parallel to the border and divide the area into small corridors. Smaller water channels, however, do not fol this pattern and criss cross the entire area. Due to encroachments that water logging and salinity have made in the aval cultivatable area, sandy patches are being brought under cultivation. As a result, quite a few of the relative hts shown on maps, no longer exist on gr.

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- (2) **Drainage Sys.** Area is flat and therefore, there is no natural drainage of water. Water only flows locally to low lying areas and stagnant water which evaporates. These low lying areas cannot be negotiated by tks even when dry.

(3) **Vegetation**

- (a) There is only one res forest in the area loc 2 km east of Bahawalnagar. The plantation is fairly dense with undergrowth rg from 1 to 1.5 M. There are fire lanes in the forest which can take veh tfc in fair weather. The forest is spread over an area approx 2000 x 2000 M.
- (b) There are some scattered Mango and Orange orchards mainly towards south and SW of Bahawalnagar. A few scattered large size clumps of trees are aval at Bahawalnagar, west of Jalwala, north of Dunga Bunga (RS 52) in area Kat Wazir Khan (RS 42), Chak 80 (Harunabad RS 50) and Mianwala Toba (RX 49). The area also provides apch and exit for all types of vehs. Approx a bn size force can conc in these areas.
- (c) Trees are gen found around vills. All canals and distys have 'Shisham' and 'Kikar' trees on either side. The only exception being ESC and Hakra Branch which have trees mainly on the home bank. There are, however, some scattered trees on the far bank of these canals as well. Astride all metalled rds there are mostly scattered trees.
- (d) Area is extensively cultivated. In fact, land that has not been affected badly by water logging and salinity, is under cultivation. Sugarcane, Paddy, Cotton and Jantar are grown in summer. Wheat and Barley are the winter crops. Detailed data on crops of the area is att at Anx K.

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- (e) Obsn in the area is restd to 1000-1500 M due to crops and scattered clumps.
- (f) Data pertaining to crops, plantation, orchards and forests is given as under :-
 - i. **Crops Data**. Anx K.
 - ii. **Plantation Data**. Anx L.
 - iii. **Orchards/Forest Data**. Anx M.
- b. **Desert Sec.** It can be further sub divided into Semi Desert and Desert Sec:-
 - (1) **Semi Desert** . Area north of Line Winjor – Derawar Fort is semi desert.
 - (a) **Rel.** The terrain is gen rolling from NE to SW with large Dhars and small sand dunes mostly 10 to 15 ft high and in some cases upto 30 ft high. Dhars are predominantly clayey in texture providing excellent going. In wet weather however, the soil becomes slippery for wh vehs. Trs in the whole sec provide good riding surface and req very nominal treatment except some places where sand is extremely soft and req maj treatment. Area north of Panch Kot Wala Toba (WB 49) along Tr Pathani Wala Khu – Dingarh is comparatively open. In this sec, 5 to 6 km belt astride Bahawal Canal, Desert Branch and Hakra Rt Disty is extensively cultivated.
 - (b) **Drainage Sys.** Water sources are scarce and almost non existent in this sec, except around canals/distys. Old dried up river course of River Hakra fol the line of forts in the area. New water sup lines have been const in this area by CDA.

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- (c) **Vegetation.** Vegetation comprises few trees around tobas. There are no crops in this sec except those in near vicinity of Hakra Rt and Lt Distys. Vast patches of shrubs and bushes exist in this sec which are of some mil imp. A desert bush locally known as LAMA is quite common. The area is devoid of cover from aerial obsn. However, cover from gr obsn is provided by folds and undulations of the gr. Forests of mil significance are Dohdlan Res Forest (RX 24) south of Fort Abbas, Mojgarh Res Forest, Lal Sohanra Res Forest (RW 28) and plantations near Islam HWs and west of Bahawalpur (RV 97). Main crops in this sec are cotton, sugarcane, paddy, wheat and maize.
- (2) **Desert.** The area south of Line Winjor – Derawar Fort is prime desert sec.
- (a) **Rel.** The area is gen flat and open in the North and SW, while in the south and SE of Line Dhori (RV 10) – Derawar Fort the area is undulating and sandy, gradually slopping from NE to SW. Going is difficult due to high and drifting sand dunes and loose accumulation of soft sand especially in the area SE of Line Dhori – Nawan Kot (WA 75).
- (b) **Drainage Sys.** The entire area is devoid of sweet water. Old bed of River Hakra can be traced along Line Dingarh Fort – Derawar Fort. The area is gen uninhabited due to non avail of potable water and other essential civ amenities. However, after the Monsoon season when the tobas get filled with the rain water, a no of nomadic inhabitation of local Cholistan migrates to the area along with their animals and the area remains inhabited till drying

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up of these tobas. New water sup lines have been const by CDA in desert sec.

- (c) **Vegetation**. Except very few stunted trees, desert shrubs and bushes, no vegetation exists in the area.

16. **Soil Analysis**

a. **Green Sec**

- (1) **Soil Conditions**. The area NE of Line Dunga Bunga – Chandna (RS 32) – Chak Abdullah (RS 23) – Bahawalnagar consists of unconsolidated alluvium and consists predominantly of fine to med sand, silt and clay. Gravel is rare and coarse sand is uncommon. Area SW of Line Dunga Bunga – Chandna - Chak Abdullah – Bahawalnagar is predominantly sandy silt/sandy loam. Water table is gen high along river/canals. High water table and sandy loam soil pose problems during wet months. Area is boggy all along the rivers and the canals i.e Fordwah, ESC and Hakra, further strengthening the obs value of these canals.
- (2) **Water Table**. It is gen high and ranges b/w 0 to 2 M. It is high in the vicinity of canals but relatively lower in sandy patches. During wet weather, it rises further and makes the area boggy.
- (3) **Tfc**. Mov of vehs is not restd by the soft upper crust of the soil. The texture, however, restricts mov of hy/tr vehs.

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b. **Desert Sec**

- (1) **Soil Conditions.** Semi desert consists of various types of soil. They change from pure to sandy silt/ loams. Sand is found at the dunes while low lying areas known as Dhars have finer texture. In desert, the soil consists primarily of sand with patches of limestone in area Bijnot (WB 03), Salamsar, Ranhal (WB 34), Rukanpur (WB 36) and Pathani Wala Khu. Large scale mov of vehs (4x4) and trs is possible in Semi desert Sec. However, in Desert Sec, the going is difficult even for trs and reqs considerable engr effort for large scale mov. Dhars are good for wh vehs but will req some engr effort for sustained mov.
- (2) **Water Table.** In Desert Sec, the water table is fairly low. Rains are scarce. However, water gets accumulated in tobas, whenever rainfall occurs.

17. **Man Made Features**a. **Rds and Trs**

- (1) **Area NE of Line Jalwala – Bahawalnagar – Tibbi Lal Beg**
- (a) **Laterals.** Only lateral aval in this sec is Rd Bahawalnagar – Mandi Sadiq Gang – Sulemanki HWs. However, canals divide the area into three lateral corridors which are :-
- i. **Corridor 1.** Corridor formed by IB in the East and ESC in the West. It is devoid of rds; however, a few fair weather trs exist.
 - ii. **Corridor 2.** Corridor formed by ESC in the East and Fordwah Canal in the West is char by the only lateral of this sec: Rd Bahawalnagar – Minchinabad – Mcleod Ganj – Sulemanki HWs running parallel to Fordwah Canal.

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- iii. **Corridor 3.** Corridor formed by Fordwah Canal in the east and River Sutlej in the west consists of a few trs.
- (b) **Penetrants.** Beyond Mandi Sadiq Ganj, the sec provides two penetrants. The third penetrant starts rt from IB. These penetrants are :-
 - i. Rd Mcleod Ganj – Rehmuke (7880) Idg to Xing site Pir Ghani (RN 89).
 - ii. Rd Minchinabad – Mari Nihal (7075) Idg to Xing site Pir Ghulam Qadir (RN 68).
 - iii. Rd Jalwala – Bahawalnagar Idg to Xing site Tibbi Lal Beg (RN 36).
- (2) **Area SW of Line Bahawalnagar – Fort Abbas upto River Sutlej.** (Anx Q and R). No main rd exist b/w IB and Hakra Main.
 - (a) **Laterals**
 - i. Bahawalnagar – Chishtian (RS 02) – Hasilpur (RR 80) – Bahawalpur – Ahmed Pur East, CI 70A2.
 - ii. Bahawalnagar - Dunga Bunga (RS 52) – Harunabad – Fort Abbas: CI 70A2 upto Harunabad and 70A1 b/w Harunabad and Fort Abbas.
 - (b) **Penetrants**
 - i. Rd Khattan (RS 41) – Jundwala (RS 23) – Nursar (RS 33) – Madrassa (RS 23), CI 70 A1.
 - ii. Mianwala Toba, Rd Harunabad (4106) – Qazi Wala (3916) – Chishtian, CI 70 A1 Idg to Xing sites at Sahuka (RS 05), Lakha (RS 94) and Islam HWs.
 - iii. Mianwala Toba, Rd Harunabad – Shaheed Chowk (RS 20) – Dharanwala, CI 70 A1.

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- iv. Rd Faqir Wali – Shaheed Chowk – Dharanwala, CI 40 A1.
- v. Khichi Wala (RS 27) – Rafiqabad (RS 28) – Yatimwala (1782).
- vi. Wallar – Fort Abbas – Marot – Kudwala (RW 25) – Yazman (RW 04) – Ahmedpur East.
- vii. Modiwala, Rd Fort Abbas – Dharanwala – Chishtian, CI 70A1 Idg to Xing sites at Sahuka, Lakha and Islam HWS.
- viii. Rd Chhonawala – Hasilpur – Islam HWS.
- ix. Rana Bhana (RW 92) – Marot – KPT (RW 59) – Mailsi Syphon.
- x. Banawala (RW 71) – Mojgarh – Kudwala – Bahawalpur – Empress Br (RV 98).
- xi. Bijnot (WB 03) – Nawan Kot (WA 75) – Derawar Fort – Ahmedpur East – Uch (RV 45) – Punjnad HWS (RV 36).

(3) **Trs**. There are numerous trs connecting vills. Most of these trs become slushy and unfit for wh mov in wet weather. There are no permanent brs over the numerous small water channels which restricts mob whenever water runs in these channels.

(4) **Dist**. Dist chart is att at Anx A.

b. **Rlys**

- (1) There are two broad gauge rly lines in the area namely Sama Satta – Amruka (RT 18) Branch (Bahawalpur – Hasilpur – Bahawalnagar - Minchinabad – Mandi Sadiq Ganj – Chak Amruka) and Fort Abbas – Dunga Bunga – Bahawalnagar. Rly line Bahawalnagar – Amruka used to connect Fazilka (RT 29)

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and Muktsar (RO 60 India) with Bahawalnagar. The tr has been removed b/w Amruka and Fazilka (India).

- (2) **Rly Stas** Anx AA.
- (3) **Loading / Unloading Ramps**. Anx AA. Ramps exist on main rly stas only.
- (4) **Site for Placing Mob Ramps**. Anx AA.
- c. **Tel.** RL Routes are shown at Anx BB.
- d. **Air Fds - Bahawalpur Airport** (Anx CC). Presently Bahawalpur Airport is being used by PIA for landing of Fokker ac. It is also used by Army for landing of C130, Mashak and hels. The airport has been upgrd with the help of UAE Govt which now can be used by jet ac a/w ni take off/ landing facilities.
- e. **ALGs**. Anx DD. Imp ALGs are :-
 - (1) **Sulemanki ALG**. Loc on Rd Haveli – Sulemanki HWs (0395) where a portion of the rd has been widened to a size of 800 x 8 M for emergency landing of lt ac. Tfc has to be stopped for landing of ac.
 - (2) **Bahawalnagar ALG**. It is loc on Rd Bahawalnagar – Mari Mian Sahib (4256) about 5 km South of River Sutlej which has been widened to a size of 1000x15 M and is suitable for lt ac and hels. Tfc has to be stopped for landing of ac.
 - (3) **Fort Abbas ALG**. It is on Rd Fort Abbas – Dharanwala, 3 km North of Hakra Rt Disty. The rd has been widened to 600 x 8 M and is suitable for lt ac and hels. Tfc has to be stopped for landing of ac.
 - (4) **Madrasa ALG**. It is on Rd Chishtian – Bahawalnagar, 4 km West of Madrasa (Sq 2636). The rd has been widened to 700 x 10 M and is suitable for lt ac and hels. Tfc has to be stopped for landing of ac.

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- (5) **Khairpur Tamewali (KPT) ALG.** A landing strip has recently been dev near KPT.

f. **Canals / Branches / Distys / Minors / Drains.** Anx EE.

- (1) Salient features common to the canals/branches/distys are given as under :-
- (a) Canals / distys divide the area into narrow corridors.
 - (b) The canals and distys flow in the fill.
 - (c) Breach in canals/distys may inundate the area rapidly.
 - (d) Almost all distys of width upto 60 ft can be crossed by AVLBS.
 - (e) Canals banks are made of hard surface. Svc trs exist only on one side of bank. Only one hy veh at a time can mov on svc tr. Rec of veh from these trs will pose problem as the banks are about 1.25 M higher than gr lvl.
 - (f) Home and far banks of all canals are of same ht except home banks of ESC and Hakra Main Branch which are higher than the far banks.
 - (g) Area along the banks of canals and distys is boggy. AVLBS, during apch to water line, may get bogged down. Width of the canal bank is insufficient for launching of AVLB and will req engr effort.
 - (h) Some of the distys and most of the minors can be crossed by tks after careful recce. However, if the bank of a disty/minor is breached the area will be inundated quickly and consequently become boggy.
- (2) Details of imp canals/ branches/ distys/ minors/ drains are as fol :-
- (a) **Fordwah Canal.** Originates from Sulemanki HWs at sq 0694 and runs side by side parallel to ESC upto RD

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29+000 and then flows NE to SW. It tails off at sq 5213 near Bahawalnagar and is a seasonal irrigation canal. Rd Sulemanki – Bahawalnagar runs along this canal; as such a separate svc tr is not req. It has a width of 50 M and depth 2.6 M. Its disch at the head is 3,447 cusecs. Length of this canal is 118.928 km. Details are as fol:-

- i. Bahawal Disty (RS 98).
- ii. Darbariwala Disty (RS 87).
- iii. Dhuddi Disty (RS 76).
- iv. Zammurd Wah Disty (RS 66).
- v. Shah Farid Disty (RS 23).
- vi. Soda Disty (RS 13).
- vii. Daulat Disty (RS 44).

(b) **McLeod Ganj Branch (RT 08)**. Originates from Fordwah Canal at sq 0284, flows in the dir NE to SW and tails off at sq 9469. A cl 9F1 svc tr runs along the western bank. It has a width of 11.3 - 14 M and depth varies from 1.3 - 1.4 M. Disch of the canal is 374 cusecs. Fol distys/minors originate from this Branch:-

- i. Pirgarh Disty (RS 97).
- ii. Murid Pur Disty (RS 96).
- iii. Bair Disty (RS 96).
- iv. Chabiana Minor (RS 96).

(c) **ESC**. It originates from Sulemanki HWs and flows NE to SW. This canal runs along Fordwah Canal for a dist of approx 8.60 km upto Bareka (0687). From there it turns SW. A Cl 9F1 svc tr exists on the eastern bank upto RD 80+000. For the remaining length the tr runs along west

bank. Disch at the head is 6,080 cusecs. Length of the canal is 78.4 km. Its offshoots are:-

- i. Ghabiana Minor.
- ii. Malik Disty.
- iii. Bolewali Disty.
- iv. Jalwala Disty.
- v. Yarwah Disty.
- vi. Girdhary Disty.
- vii. Sirajwah Disty.
- viii. Malik Branch.
- ix. Hakra Branch.
- x. Awami Canal.

(d) **Sadiq Ford Feeder**. It originates from RD 189+000 of ESC and provides a link b/w Fordwah Canal and ESC. The svc tr CI 9F1 exists on the lt bank. Width is 7 to 10 M, depth 1 to 1.3 M and bank ht rg from 1.3 to 1.7 M.

(e) **Awami Canal (0891)**. The old Awami Canal originates from RD 13+000 of ESC and runs along the IB. It was designed in deep cut to work as A tk ditch. Since its commissioning, the scheme did not function as anticipated. The op of ditch feeding channel became problematic due to higher water table than the bed of the channel resulting in slushing and abnormal silting. Power connection provided to this scheme was from Mandi Sadiq Ganj grid sta 40 km away which resulted in considerable drop of voltage, non op of pumps and deposit of silt in the bed of feeding channel. Presently this canal has no obs value. In order to resolve the problem, a new irrigation scheme known as "New Awami Canal" was prep. It off takes from

RD 17+500 on the It bank of ESC, runs parallel to old Awami Canal and finally joins Lahura Minor. The canal has been const in fill with its banks 10 to 15 ft higher than gr lvl having a slope of 1:1.5. It has a length of 9.696 km. Entire length of the channel has been bricklined. Pumping sta at RD 17+500 with 17 pumps has been const. 2x Cl 9 brs have been const at RD 4+500 and 16+800. The proj was financed through ADP and exec by Provincial Irrigation and Power Dept. Disch at the head is 248 cusecs.

- (f) **Hakra Main Branch**. It offshoots from the tail end of ESC. It has a disch of 2,708 cusecs at the head and runs parallel to the border. Its width varies from 16 to 37 M and depth from 1.5 to 2.4 M. Length of Hakra Main Branch is 92.49 km. Fol distys originate from it :-

- i. Bakhrana Disty (RS 51).
- ii. 3R Disty or Qazi Wala Minor (RS 41).
- iii. 2R Disty (RS 52).
- iv. 3R Disty (RS 51).
- v. 1L Disty (RS 51).
- vi. 4R Disty (RS 51).
- vii. 5R Disty (RS 40).
- viii. 6R Disty (RX 49).
- ix. 2 L Disty (RX 49).
- x. 7R Disty (RX 48).
- xi. 3L Disty (RX 48).
- xii. 8R Disty (RX 37).
- xiii. 4L Disty (RX 48).
- xiv. 9R Disty (RX 37).

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- (g) **Hakra Rt Disty.** Originates at tail end of Hakra Branch. Flows in east – west dir. It has a disch of 376 cusecs at the head. Length of disty is 79.31 km, bed width varies from 3.3 to 14 M and depth varies from 0.5 to 1.5 M. Fol are the offshoots :-
- i. 1L Minor (RX 37).
 - ii. 2L Minor (RX 06).
 - iii. 3L Minor (RW 75).
 - iv. 1R. S Minor (RW 66).
 - v. 1R Minor (RW 76).
 - vi. 4L Minor (RW 65).
- (h) **Hakra Lt Disty.** Offshoots from tail of Hakra Branch and runs in southern dir. It has a disch of 22 cusecs at head. Length of the disty is 7.50 km, width varies from 2.3 to 2.7 M and depth from 0.6 to 0.65 M. No minor offshoots from Hakra Lt Disty.
- (i) **Malik Branch (RS 64).** Originates at tail of ESC. Flows in SW dir. Has a disch of 1,538 cusecs at the head. Length of this Branch is 37.40 km, width is 24-30 M and depth varies from 1.9 to 2.2 M. Murad and Fateh distys originate from its tail end. Fol distys are its offshoots:-
- i. Mahmuda Minor (RS 54).
 - ii. Bhakan Disty (RS 53).
 - iii. Gajjiani Disty (RS 53).
- (j) **Gajjiani Disty.** Originates from RD 38+900 of Malik Branch. Runs in SW dir. Has a disch of 319 cusecs at the head. Length of this disty is 44.76 km. Its width varies from 1 to 14 M and depth from 0.4 to 1.4 M. Fol minors flow out from this Disty :-

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- i. Dhaban 1R Minor (RS 43).
 - ii. Takhat Mahal Minor (RS 43).
 - iii. Chak Abdullah Minor (RS 33).
 - iv. Kokni Minor (RS 33).
 - v. Chaupalia Minor (RS 33).
 - vi. Chishtian Minor (RS 32).
- (k) **Murad Disty (RS 32)**. Originates from tail end of Malik Branch and runs in SW dir. Disch at the head is 595 cusecs, length is 74.88 km, width 1.5 to 15 M and depth 0.5 to 1.9 M. Fol are its offshoots :-
- i. Arain I Minor (RS 21).
 - ii. Arain II Minor (RS 00).
 - iii. Haran Minor (RS 00).
 - iv. Bair I Minor (RX 09).
 - v. Bair II Minor (RX 09).
 - vi. Zaman I Minor (RW 99).
 - vii. Zaman II Minor (RW 99).
 - viii. Shahu Minor (RW 99).
- (l) **Fateh Disty (RS 32)**. Starts from the tail end of Malik Branch and flows in SW dir. Disch at the head is 459 cusecs, length is 71.32 km, with a bed width varying from 1.5 to 15 M and depth from 0.5 to 1.5 M. Fol minors flow out from this Disty :-
- i. Khaiwa Minor (RS 21).
 - ii. Lakha Minor (RS 01).
 - iii. New Dhani Minor (RS 01).
 - iv. Old Dhani Minor (RS 01).
 - v. Bakhshan Khan Minor (RS 01).
 - vi. Polin Minor (RR 91).

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- vii. Hasilpur Minor (RR 91).
 - viii. Nathal Minor (RR 80).
- (m) **Qaimpur Canal (RR 82)**. Offshoots from Islam HWs and flows south/SW along Rd Qaimpur-Islam HWs. Disch at the head is 483 cusecs. Length of the canal is 11.84 km. Its width is 6-17 M and depth 1 to 1.7 M. Fol distys originate from this canal :-
- i. Chhon Wah Disty (RR 82).
 - ii. Ahmed Wah Disty (RR 82).
 - iii. Farrukh Wah Disty (RR 72).
 - iv. Katora Disty (RR 82).
 - v. Shahdad Disty (RR 72).
 - vi. Jhandari Disty (RR 72).
 - vii. Ballar Wah Minor (RR 71).
 - viii. Shallar Minor (RR 71).
 - ix. Tallar Minor (RR 71).
- (n) **Bahawal Canal (RR 82)**. Originates from Islam HWs and flows towards south, parallel to Rd Hasilpur – Bahawalpur. SMLC joins it at RD 140+00. Before confluence it is called Upper Bahawal Canal. It has a disch of 5,400 cusecs at the head. Length of the canal is 76.80 km with width varying from 46 to 50 M and depth is 4 M. Presently, due to hy silting in Upper Bahawal Canal (disused), full capacity of water (5400 cusecs) cannot be taken off from Islam HWs. It receives water from SMLC. Near Lal Suhanra, it bifurcates into Ahmedpur and Desert Branch. Fol distys offshoot from it :-
- i. Shaikhwan Disty (RR 71).
 - ii. Asrani Disty (RW 49).

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- (o) **Ahmedpur Branch (Bahawal Canal)**. Originates from tail end of Bahawal Canal. Flows along Rd Hasilpur – Bahawalpur, with a disch of 2,430 cusecs. Length of this Branch is 67.20 km. It has a width of 35 to 37 M and depth is 2.7 M. Fol distys off shoot from it :-
- i. Pakka Wah 1L Disty (RV 96).
 - ii. Shaikhan 2L Disty (RV 96).
 - iii. Khanwah 3L Disty (RV 96).
 - iv. Sardarwah 4L Disty (RV 96).
 - v. Nauranga 5L Disty (RV 86).
 - vi. Qutab Wah 6L Disty (RV 86).
 - vii. 7L Disty (RV 86).
- (p) **Desert Branch (RW 28)**. Originates from the tail end of Bahawal Canal and flows towards South/SE. At the head the disch is 2,516 cusecs. Length of this Branch is 64.80 km. Its width varies from 25 to 37 M and depth 1.9 to 2.5 M. At the tail end, Desert Branch is transformed into Dera Nawab Branch having 745 cusecs and Derawar Branch having 127 cusecs disch. Fol distys originate from it:-
- i. 1R Disty (RW 15).
 - ii. 1L Disty (RW 25).
 - iii. 2R Disty (RW 15).
 - iv. 2L Disty (RW 15).
 - v. 3L Dusty (RW 14).
 - vi. 2-AR Disty (RW 04).
 - vii. 3R Disty (RW 94).
 - viii. 1L/4L Disty RW (RW 04).
 - ix. 2L / 4L Disty (RW 04).

g. **Brs.** Anx FF.

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h. **HWs**(1) **Islam HWs**(a) **Gen**

- i. **Description.** Islam HWs.
- ii. **Loc.** Rd Vehari – Hasilpur – Chishtian.
- iii. **Source on Which Const.** River Sutlej.
- (b) **No of Bays and Size.** 29 bays of 20 M width each.
- (c) **Ht of Gates.** 5.3 M.

(d) **Tech Data**

- i. **Length.** 540 M.
- ii. **Piers**
 - (aa) Thickness - 2.3 M
 - (bb) Span - 20 M
 - (cc) Length - 20 M
- iii. **Above Water Lvl.** 2 M.
- iv. **Railing.** Iron railing.

(e) **Hydrology**

- i. **Designed Disch.** 3,00,000 cusecs
- ii. **Designed High Flood Lvl.** 152 M.
- iii. **Normal Pond Level.** 152 M.

(f) **Head Regulators of Canals Off Taking**

- i. **Loc.** On both lt and rt bank.
- ii. **No of Bays.** Seven on lt bank and two on rt bank.
- iii. **Canals.** Bahawal Canal and Qaimpur Canal on lt and Mailsi Canal (abandoned, does not exist on gr) on rt bank.
- iv. **Disch Capacity**
 - (aa) Lt bank - 5,400 cusecs
 - (bb) Rt bank - 558 cusecs

SECRETv. **Gates**

(aa) Lt bank - Walton gates 4 M high

(bb) Rt bank - Stoney gates 4 M high

(g) **Br/Rd Over the Barrage With Cl.** Cl 70.(h) **Security/Protection Arngs**i. **Loc.** On both ends of Barrage.ii. **Types.** Civ police.iii. **Str.** 2-4 men at each end.(2) **Sulemanki HWs**(a) **Gen**i. **Description.** Sulemanki HWs.ii. **Loc.** 16.4 km away from Haveli Lakha town on Rd Okara – Bahawalnagar with Cl 70 br over the HWs.iii. **Water Source on Which Const.** Water reaching from River Chenab/Ravi through BSLC in River Sutlej as well as flood over flow of River Sutlej rel by Indians.(b) **Size of Bays.** 8 x 20 M and 5.3 x 10.0 M.(c) **No of Gates and Ht**

i. No of Gates - 35

ii. Ht - 1.92 M

(d) **Tech Data**i. **Length.** 741 M.ii. **Piers**

(aa) Thickness - 2 M

(bb) Span - 7 x 20 M

(cc) Length - 25 M

iii. **Above Water lvl.** 1.92 M.iv. **Railing.** Railing is provided on rt side of the br only.**SECRET**

SECRET**(e) Hydrology**

- i. **Designed Disch.** 2,10,000 cusecs.
- ii. **Designed High Flood Disch.** 3,25,000 cusecs
- iii. **Normal Pond Lvl.** 187 M.

(f) Head Regulator of Canal Off Shootingi. **Loc**

- (aa) Rt offshoot is Pakpattan Canal.
- (bb) Lt offshoots are ESC and Fordwah Canal.

ii. **No of Bays**

- (aa) Pakpattan - 8 Bays
- (bb) ESC - 7 Bays
- (cc) Fordwah - 5 Bays

iii. **Canals**

- (aa) Pakpattan
- (bb) ESC
- (cc) Fordwah

iv. **Disch Capacity**

- (aa) Pakpattan - 6,594 Cusecs
- (bb) ESC - 6,080 Cusecs
- (cc) Fordwah - 3,447 Cusecs

(g) Security/Protection Arngs

- i. Loc - Desert Rangers Sulemanki
- ii. Type - Ranger
- iii. Str - Wing HQ

(h) Regulators

- i. BSLC, Gulsher Regulator, RD 226, width: 4.7 M, Masonry Arch type, CI 50
- ii. Pakpattan Branch, Khadir Regulator, RD 112, width 3.3 M, RCC type, CI 24

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- iii. ESC, Jalwala Regulator, RD 245, width 3.3 M, CI 12
 - iv. Dipalpur Canal, Lower Sohaq Branch Regulator, RD 202, width 2.8 M, RCC type, CI 9
- i. **Xing Sites.** Anx HH. (Summary of Xing sites over River Sutlej).
- (1) **Sulemanki Xing.** The site is downstream Sulemanki HWs. The apch to the Xing site is facilitated by Rd Haveli – Sulemanki (CI 70A2). About 4 km short of Sulemanki HWs, a cl 30 rd Maneke (RT 09) – Malleke (RT 09), 3.5 M wide and 2.1 km in length, takes the apch to the Xing site and exit is served by Tr Malleke(RT 09) - Hasil Saru(RT 08). During winter season, the water channel diminishes and 4 x 4 vehs and tractor trollies keep Xing.
 - (2) **Sulemanki HWs.** Its structure comprises a CI 70A2 br with carriageway of 18 ft.
 - (3) **Pir Ghani Xing.** A famous Xing site. Few years back a unifloat br was launched here by C&W Dept which has been removed. Provincial govt has not planed any other br on the xing site. A metalled rd is aval from Pakpattan to Pir Ghani Br. There onwards, a metalled rd goes to Rattake (RS 88) and to the Xing site. The exit from far bank is served by Rd Ismail Ratteke (RS 88) – Shah Karam (RS 88) – Mcleod Ganj. Length of exit is 12.5 km.
 - (4) **Pir Ghulam Qadir Xing.** Also known as Pakpattan Xing. A CI 70A2 br exists on this site providing a road link b/w Pakpattan and Bahawalnagr through Minchinabad.
 - (5) **Tibbi Lal Beg Xing.** There are two Xing sites, down stream and upstream of the RCC CI 70A2 br which can be dev with some engr effort in case of destruction of br. Downstream Xing is Qasimka (RS 25), which is approx 16 km away from the cl 70A2

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br whereas the upstream one is Musa Bohta (RS 45), approx 3 km away from the br.

- (6) **Qasimka Xing.** The apch originates from Qabula and passes through Khadir Branch and is char by a CI 70 A2 rd. After Xing over Khadir Branch, it passes through Tibbi Lal Beg and from there, a tr leads to Chak 25 KB (RS 25). A kutchra tr starts from Chak 25 KB and leads to vill Kaluke (RS 25) further going in the dir of the river line. The exit passes through 2 km of sandy patch to a tr which leads to metalled Rd Qasimke – Takhat Mahal (RS 34). At Takhat Mahal, Rd Bahawalnagar – Chishtian joins. During dry season the water channel diminishes and gap can be forded by 4 x 4 vehs.
- (7) **Musa Bohta Xing.** The apch originates from Qabula and after Mile stone 42 at Rd Arifwala – Qabula – Bahawalnagar (cl 70 A2), it turns towards vill Jogeke and vill Bhaini Niamat Ali (RS 46) and terminates at the river line. The exit from far bank passes through slippery area of 100 M and then through sandy portion of 1.5 km before it joins Chak Noor Muhammad Amin (RS 79). A kutchra tr leads from this vill to vill Kulachian (RS 45) for a dist of 1.6 km from where it joins Rd Qabula – Bahawalnagar.
- (8) **Sahuka Xing.** The apch originates from vill Sahuka (RS 05) and leads to the Xing site (RS 04) passing through vill Ghulam Farid Di Bhaini. On northern side, a metalled cl 40A1 rd terminates at Ghulam Farid Di Bhaini 5.25 km south of Sahuka, from where a Kutchra tr of 3.25 km leads to Xing site, passing through sandy area. On the southern side (exit), a cl 70A1 metalled rd terminates close to river at Dulla Akuka. Kutchra tr upto water line is only 1.25 km, most of it passes through river bed. B vehs

traveling time at 30 kmph is only 5 mins. A Hollow Plate CI 12 br of Highway Dept is launched during off Monsoon season.

- (9) **Lakha Xing.** The apch originates from vill Kachi Paki (RR 94) passes through vills Jatera Nau, Baramdda and terminates at River Sutlej (RR 93). On the Northern side, a CI 40A1 rd terminates at vill Jatera Nau Baramdda. Thereafter, a kutcha tr leads to Xing site. Length of tr is 5 km out of which 4 km passes through cultivated land remaining through sandy area and river bed/channels. B veh (jeep) takes 20 mins to reach the Xing site at 30 kmph. Ghulam Wah Disty is crossed over by a CI 70 RCC br. On the southern side, a cl 70A1 rd terminates at vill Bunga Baloch. Kutcha tr upto Xing site from Bunga Baloch is 2.5 km and B veh takes 10 mins at 30 kmph. Fresh proposal for rd Chn-Burewala – M5 (via Br Lakha Xing) has been fwd to Provincial Auth foe const in yr 2014/15. Detailed est / dev would commence on aval / rel of funds from provincial auth.
- (10) **Islam HWs.** Loc on River Sutlej. A cl 70A2 br forms part of the HWs. Total length of the br is 1400 ft and width of the carriageway is 20 ft. Br on the HWs connects Vehari and Hasilpur.
- (11) **Mailsi Syphon.** Loc on River Sutlej. A cl 70A2 br forms part of the structure. Total length of the br is 1536 ft and width of the carriageway is 24 ft. This br links Hasilpur/ KPT with Mailsi from where rds lead towards Multan, Vehari and Burewala.
- (12) **Empress Br.** CI 70A2 rd and cl 100 rly br links Bahawalpur with Multan.

- j. **SCARP VIII Drains**. The proj is loc in Bahawalnagar and Bahawalpur dists. The proj implementation initially proposed was to be carried out in six dev units. WAPDA initially implemented two units in SCARP VIII proj in NE of Southern sec - Minchinabad Pilot Unit I and Unit II projs. Details of the projs are as fol:-

- (1) **Unit I Proj**. For implementation purposes, this proj was given the name of Minchinabad Pilot Proj. It covers an area of 77,750 acres comprising mostly the northern part of Mcleod Ganj Irrigation Canal Sub Div and partly the eastern part of Bahawalnagar Irrigation Canal Sub Div and falls in the Canal Command of Fordwah Branch about 13 km west of Sulemanki HWs. The area is bounded by Sahiwal Disty in NE, Dhuddu Disty in SW and Fordwah Branch in the south. River Sutlej runs almost along the northern side of the proj area. 226 fresh water tube wells were instl along Fordwah Branch and its disty to lower the water table. Capacity of tube wells ranges from 1.0 to 1.5 cusecs. This unit was completed in 1978 and handed over to Irrigation Dept Punjab during 1979. Since then they are being op by Irrigation and Power Dept. Overall going of the area has been improved by the proj; however, drains and boggy beds have corres inc terrain friction. Details of the proj are att at Anx OO.
- (2) **Unit II Proj**. Implementation of Unit II Proj was taken in hand in Sep 1982. The proj is mainly loc in Tehsil Minchinabad and Bahawalnagar. Gross area of the proj is 111,000 acres out of which 100,400 acres are cultureable comd. It covers the command of Mcleod Ganj Branch, Bair Disty and ESC upto RD 219+500. Proj works incl remodelling of 172.8 km of open surface drains and instl of 30 test saline tube wells. Surface drains have two drainage systems. Drainage effluent of the area

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on the rt side of Fordwah Feeder is collected through the Upper Bahawalnagar Drain and its offshoots 1-L, 2-L, 3-L to Kali Budhi Drain and through an outfall drain into River Sutlej and lower Bahawalnagar Drain on lt side of Fordwah Feeder and its offshoot 1-R to new Sohail Outfall Drain through a syphon under the Fordwah Main Canal. The proj was completed in 1987 and handed over to Irrigation and Power Dept for op. Details of the proj showing surface drains and tube wells are att at Anx OO.

- (3) Currently, no of drains are choked and not been optimally utilized. Rehab schemes have been prep for clearance of these drains. The scheme has been approved by provincial auth. However funds are yet to be released.

k. **Unit III, IV, V and VI SCARP VIII and 6R Hakra (CWMP).** (Anx OO and T) WAPDA and Irrigation and Power Dept launched a ph prog to overcome the twin menace of water logging and salinity. There were two projs in 31 Corps area. The purpose of these projs was to con water logging and salinity for inc the agricultural production of the area by providing the safe disposal to drainage disch from the proj area. Drainage effluent from the Northern Z is disch in River Sutlej while that from the Southern Z is disposed off into the evaporation ponds in the Cholistan Desert.

- (1) **Unit III, IV, V and VI of SCARP VIII Proj.** Units III, IV, V and VI have been comb in a single proj namely "Fordwah Eastern Sadiqia Remaining Ph I" commonly known as SCARP-VIII. The proj is divided into Northern and Southern Z of SCARP-VIII and is covered by two civ adm units, ie, dists Bahawalpur and Bahawalnagar. SCARP-VIII is designed to drain off surface as well as sub surface water into River Sutlej and Cholistan Desert. The proj area is loc b/w longitude 72°34' and 73°27' East and

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latitude 29°29' and 29°47' North. The area is bounded by Rd Bahawalnagar–Hasilpur upto Chishtian Mandi and Azim Disty in the north and incls comds of Jalwala Disty in the NE, Hakra Branch of ESC in the SE, west and SW. It covers complete comd of 3R and 4R Disty and partial comd of Murad and Fateh distys.

(a) **Main Components****Northern Z**

<u>Drain</u>	<u>Length(Km)</u>	<u>Width(Ft)</u>	<u>Depth(Ft)</u>
i. Chishtian Main	83.18	30-40	4-10
ii. Kokni	17.5	15-18	3-4
iii. Madrasa	6.49	4-15	3-5
iv. Takhat Mahal	8.07	5-15	3-5
v. Noorsar	39.79	14-22	4-6

Southern Z

<u>Drain</u>	<u>Length(Km)</u>	<u>Width(Ft)</u>	<u>Depth(Ft)</u>
vi. Jandwala	61.3	6-38	3-8
vii. Khatran	30.98	18-20	3-6
viii. Dharanwala	10.40	30-50	3-5
ix. Shaheed	13.50	60-66	8-9
x. Haroonabad	98.57	61-85	4-9
xi. Qaziwala	10.52	6-12	3-5
xii. Baghsar	40.0	8-25	3-6
xiii. Outfall	24.26	90-103	9-10

(b) **Escapes**

- Baghsar Drain: RD 56+297 (30 Cusecs)
- Harunabad Drain: RD 151+900, 2 Cusecs, completed in 2002

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- iii. Shaheed Drain: RD 22+210, 40 Cusecs, Completed in 2002

(2) **6R Hakra (CWMP)**. Anx OO. It is a provincial govt proj sponsored by Irrigation and Power Dept, loc in gen area of 6R Disty (Mamun Disty) to minimize twin menace of water logging and salinity. Total cost of the proj was Rs 355.64 million with a foreign exch component of Rs 19.45 million. The proj consists of surface drains. About 36,000 acres in head reach of 6R Hakra Disty was badly water logged. To alleviate this problem, Comd Water Mgmt launched 6R Sub Proj in this area. The area lies in the south of Southern Z of SCARP-VIII, bounded by 5R Disty in the SW and 1R/1L Sub Minor in the south.

(a) **Proj Data**

- i. **Sponsors**. This proj was exec by Comd Water Mgmt of Provincial Irrigation Dept, Punjab.
- ii. **Cost**. RS 355.64 Million.
- iii. **Area UC this Proj**. 103,800 Acres
- iv. **Area with Very High Water Table**. 36,000 Acres

(b) **Drains**

i.	<u>Drain</u>	<u>Length (Kms)</u>	<u>Width (Ft)</u>	<u>Depth (Ft)</u>
	Drain A	29.25	28-47	4-7
	Drain B	9.10	23-24	3-5
	Drain C	12.2	17-18	3-5
	Drain D	35.51	30-35	5-7
	Outfall	24.30	47-52	7-8

(3) **Disposal of Effluent**

- (a) **Northern Z.** Through Chishtian Outfall Drain into River Sutlej near Islam HWs.
- (b) **Southern Z.** Through Outfall Drain into evaporation ponds having source at Chamruwala Toba (0282) in semi desert portion, south of Line KPT–Chhonawala and north of Line Marot–Quraish. A total of 29 evaporation ponds have been completed which cover an area of 430 sq km, length of about 48 km and width of 9.5 to 19.5 km. Proj Director SCARP-VIII was requested to change the alignment of evaporation ponds in the North–South dir to suit our op req, which has also been completed.

I. **Chamruwala Inundation Scheme.** The proj was started on 28 Jul 96 on its present alignment and it was completed in May 98 in fol phs:-

- (a) **Wide Channel.** An 8 km long channel, 70 ft wide and 5-15 ft deep, was const from Chamruwala to Sansianwala. This portion is composed of high sand dunes and inundation was not possible; therefore, dimension of the channel was so kept to convert it into a charged A tk ditch. A 10–15 ft high bund has also been const on western side.
- (b) **Narrow Channel.** From Sansianwala to Azamwala, a 10 km long channel having 16 ft width and 4-6 ft depth has been const. The channel was only to guide water in desired dir as gr slope permits flow of water under gravity. The channel also has kidney bunds on western side.
- (c) **Cross Dykes.** Cross dykes of about 100 M length have been const at Sansianwala and Namewala with gated walls inside the channel. These dykes were req to head up water and spread in these dhars. End dykes were const at

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Azamwala to stop water entering into green belt unchecked.

- (d) **Channel from 2 L Minor to DCB.** The green portion of area Quraish has been planned to be inundated by rel water from Hakra Rt through existing irrigation outlets and channels. Beyond green portion upto DCB, another channel was const having width of 15 to 20 ft and depth of 5-6 ft. An escape of 50 cusecs has also been const on 2 L Minor to disch water into the channel. The const channel can also be used for charging the DCB Rasafa – Quraish. An aqueduct has been planned over DCB to take the water across (inundation south of DCB) in case charging of DCB is not desired.

- m. **Forts.** There are a no of abandoned forts at Phulra, Mir Garh (9255), Jam Garh (8554), Marot, Dingarh (RW 12), Mojgarh (RW 43), Derawar, Bijnot (WB 03) and Nawan Kot (WA 75). These lines of forts are loc on the home bank of old bed of River Hakra. These are mainly of mud with sprinkle of pucca structures. They provide good obsn and can be used as static OPs.
- n. **Water Resources.** Details att at Anx JJ.
- o. **Med Facilities.** Details of hosps and dispensaries are att at Anx KK.

18. **Natural Features**

a. **Rivers**

- (1) **River Sutlej.** It flows from NE to SW and keeps meandering during summers and winters. Flow of water in the river is con by India at Bhakra Dam, Harike HWs and Hussainiwala HWs. Slightly upstream of Harike HWs, it is joined by River Beas. Since water is con by India so the river remains dry. However, to meet our agricultural/ irrigation needs, water of River Ravi is

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diverted into this river at Sulemanki HWs through BSLC. During dry spells, the river flows in two distinct channels of irregular pattern, except Tibbi Lal Beg Xing where it has one. At Lakha Xing, water flows in all the three channels whereas at other places water flows in southern channels only and remaining two channels receive water in rainy season.

(a) **Data**

- i. **Bed Condition.** Sandy/Silty.
- ii. **Width Dry Season.** Average 0.5 to 1 km.
- iii. **Width Wet Season.** Average 1 to 8 km.
- iv. **Wet Gap – Dry/Wet Season.** 1 km.
- v. **Current – Dry/Wet Season.** 0.7 to 1 m/sec.
- vi. **Depth.** 2-7 M.
- vii. **Flow of Water per Month.** 20,000 to 40,000 cusecs.

- (b) **Indian Capability.** India has const a no of dams/ barrages on the river namely ***Bhakra Dam*** (live storage: 5.72 MAF; max disch: 3,90,000 cusecs; ***stoppage cap: 572 days***), ***Nangal Dam*** (live storage: 0.012 MAF; max disch: 3,50,000 cusecs; ***stoppage cap: 1 day***), ***Ruper Barrage*** (max disch: 4,00,000 cusecs), ***Harrike*** (max disch: 6,50,000 cusecs) and ***Hussainiwala HW*** (max disch: 3,50,000 cusecs). It enjoys full con over the river and can manipulate the flow to its adv. However, we can still cont to put approx 18,500 cusecs of water in the river from the 63 km long BSLC. Thus an average wet gap of 300–500 ft will be created for which en will have to put in deliberate Xing effort.

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- b. **Nullah / Drains.** Data about other drains in the area is att at Anx HH.
- (1) **Muradwah Disused Canal (9886).** This is an old canal bed which used to be active prior to const of Sulemanki HWs. It originates from sq 9889, runs north to south upto 9281, then onward along Fordwah Canal and terminates near Mcleod Ganj. It connects River Sutlej with Fordwah Canal. Width of dry bed is 50 to 85 M and bank ht (both sides) varies from 5 to 8 M.
 - (2) **Fordwah Disused Nullah.** This is a dry nullah which originates from River Sutlej South of Sulemanki (0289) and runs parallel to Fordwah Canal Branch upto Minchinabad and then it divides into small nullahs/cuttings, which again joins River Sutlej. During high floods river water is likely to flow into it and remain active for the duration of the flood. Presently it is dry upto Mcleod Ganj. Down towards south, some seepage water of Fordwah Canal flows into it. It is 35-67 M wide and 0.7-1 M deep. The bed is gen marshy and boggy south of Mcleod Ganj.
 - (3) **Fazilka Drain**
 - (a) **Description.** It enters into Pakistan in sq 1196 and spreads out into River Sutlej. The flow of water in the drain is con by Indians through regulators. The area is flooded when water is rel by India. The water of this drain is not clean as sewerage system of Fazilka town joins up with this drain.
 - (b) **Wet Span.** 7 M.
 - (c) **Depth.** 2-3.5 M.
 - (d) **Ht of Banks.** Southern bank is 3.5-4 M high from gr lvl.
 - (e) **Xing Feasibility.** It cannot be crossed by A and B vehs without engr effort, if water is aval.

19. **Xing Sites.** Summary of Xing sites is as fol; misc details are att at Anx HH.

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- | | | | |
|----|------------------|---|----------------|
| a. | Sulemanki HWs | - | CI 70 A2 br. |
| b. | Pir Ghani | - | Ferry site. |
| c. | Pir Ghulam Qadir | - | CI 9 boat br. |
| d. | Tibbi Lal Beg | - | CI 70 A2 br. |
| e. | Sahuka | - | CI 12 boat br. |
| f. | Lakha | - | Ferry site. |
| g. | Islam HWs | - | CI 70 A2 br. |
| h. | Mailsi Syphon | - | CI 70 A2 br. |
| i. | Empress Rly Br | - | CI 100 br. |
| j. | Empress Rd Br | - | CI 70 A2 br. |

20. **BUAs**

- a. The area north of Sutlej is thickly populated whereas south of Sutlej, due to close proximity of border, lack of comm and desert tract of Cholistan, BUAs are few and have scanty population. BUAs having significant bg on mil ops are as under :-
- (1) **Sulemanki**. It has dev into a fairly large vill comprising a canal colony. It is connected with Haveli, Bahawalnagar and Fazilka through metalled rds. Facilities of a dispensary and tel exch are aval.
 - (2) **Bahawalnagar**. It is a large size city and Dist HQ. All metalled rds converge in Bahawalnagar. No bypass is aval. All facilities of large city are aval.
 - (3) **Minchinabad**. It is a med size city and Teh HQ. It is loc on lateral Bahawalnagar – Sulemanki and no bypass is aval. Hosp, post office, police sta and tel exch are aval in the city.
 - (4) **Mandi Sadiq Ganj**. It is a med size market town and is Teh HQ. Police sta and market place exist. No bypass is aval. A THQ hosp, post and tg office, police and rly sta and tel exch are aval in the town.

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- (5) **McLeod Ganj**. It is a med size city and is Tehsil HQ. Loc on lateral Bahawalnagar–Sulemanki and no bypass is aval. Qaimpur, Hasil Saru, Pir Ghani, Khole Mirzake, Rehmonke and Ahmedpur are the main trading centre of the city.
- (6) **Dunga Bunga**. It is a small town and a THQ. It has a through route and its diversion is possible. It possesses all facilities of a small town.
- (7) **Harunabad**. It is small city. It has a through route and its diversion is possible.
- (8) **Dharanwala**. It is small town with adequate civic amenities and water resources. Facilities like hosp, tel exch, post and tg office and police sta are aval. It is connected by a metalled rd with Fort Abbas which is an imp commcen.
- (9) **Faqirwali**. It is a small town. It has a hosp with partial surg/op facilities, a tel exch, post office, tg office and police sta. Water reservoirs are aval.
- (10) **Fort Abbas**. It is a med size town with civic amenities and adequate water resources. It is an imp commcen as it is connected with a good metalled rd with Chishtian, Bahawalnagar and Marot. It has a through route and diversion is possible.
- (11) **Marot**. It is a fair size town with complete civic amenities. It is an imp commcen as it is connected with Kudwala, Yazman, KPT and Fort Abbas. It can be bypassed. It has a through route and diversion is possible.
- (12) **Chishtian**. It is a med size city. It has a through route and its diversion is possible.
- (13) **Hasilpur**. It is a med size city. It has a through route and its diversion is possible.

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- (14) **Qaimpur**. It is a med size town. It has a through route and its diversion is possible.
- (15) **KPT**. It is a med size town. It has a through route and its diversion is possible.
- (16) **Bahawalpur**. It is a big city and Dist HQ. It has all the civic amenities aval. A no of routes pass through the city and diversions are possible.
- (17) **Quraish**. It is an imp comcen and lies on the western extent of green belt where it extends into the semi desert sec. It provides flk protection in the semi desert sec and cannot be bypassed.
- (18) **Mir Garh**. Mirgarh in itself has relatively minor tac significance. Its vicinity to Quraish and Fort Abbas add to its imp in the area.
- (19) **Rana Bhana**. Rana Bhana is a small toba lying on the imp apch towards Fort Abbas. Its significance is due to its loc.
- (20) **Banahwala**. Banahwala is a toba but carries imp because of its loc on junc of trs Idg to Fort Abbas and Marot.
- (21) **Mojgarh**. Mojgarh is a small fort/vill in the open desert. Its loc is imp because of its domination and presence of water source.
- (22) **Khirsar - Januwala Complex**. It is an imp complex both from its loc and defensibility pt of view. It assumes critical imp as critical area in the entire def.
- (23) **Dingarh**. Dingarh also carries significance by virtue of its loc, domination and adm value in the desert.
- (24) **Winjor**. Winjor is of tac imp because of its proximity to border and loc on the apch Idg to Lal Patel and Khirsar. It is also a Rangers post.
- (25) **Akkan Wala Toba**. This toba lies on junc of trs Idg to Lal Patel and Khirsar.

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(26) **Dhori**. Dhori also has minor tac imp because of its loc on one of the apch Idg to Channan Pir.

21. **Cantts incl New Projs Being Undertaken/ Planned**

- a. **Existing**. Bwp, DNS, SMHS (a bde size cantt; Bde/ units/ affiliated sub units have shifted b/w 2011 to 2013 except Med (SP) Arty Regt since accn has not been const).
- b. **New Const**. At Fort Abbas (1657), new const for CBG.

22. **Camping Grs**

- a. Chak 23 BC
- b. Rasafa
- c. Pakki Kothi
- d. Near Chaku Wala
- e. 2R & Mansoor
- f. KPT
- g. North of Marot/ Rasafa/ Quraish.
- h. Kandewala (SE of KPT).
- i. Rodewala.
- j. Nursar (west of KPT).
- k. Kala Pahar.
- l. Dhori/ Dingarh.

23. **Forts**. Forts Derawar, Dingarh and Mojgarh are the principal villis in the sec. These are not BUAs in the classic sense. Houses are mainly made of mud.

- a. **Population**. Att at Anx GG.
- b. **Social Conditions**
 - (1) **Green Sec**. Majority of people living south of Sutlej and close to the IB are poor and belong to rural society. They possess meagre land holdings. Only a few landlords are found. Considerable portion of the population are settlers from other

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dists of Punjab/East Punjab. Closer to the river social conditions improve.

- (2) **Semi Desert/Desert Sec.** The area is inhabited by nomadic sheep/cattle herders. They stick to desert as long as tobas can sustain them. Thereafter, they move close to the green belt for want of water. These people are physically tough and can serve as good trackers/ guides.

24. **Tfc**

- a. **Green Sec.** The area south of River Sutlej gen cannot afford large scale mvr/mov due to irrigation sys canal and water table problem. Completion of SCARP-VIII has improved the tfc.

- (1) Area in the IB and ESC Corridor, b/w Amruka and Dangorian, is suitable for the emp of a tk regt gp.
- (2) Area in the Fordwah Canal – River Sutlej corridor, b/w Bareke Br and Minchinabad, can also afford upto regt lvl armr mov/mnvr during low water table pd. However, during high water table pd this area cannot afford armr mnvr even at sqn lvl.
- (3) Area gen SW of line Bhagsar – Sadiq Ford Feeder – Khair Shah Utter sq 6468, provides ltd armr mnvr throughout the yr.
- (4) Area south of Line Jalwala – Bahawalnagar has a fairly well dev comm infrastructure. Area is suitable for large scale inf – armour ops except the triangle area of Dunga Bunga – Harunabad – Chishtian because of water logging, bog and restd spaces.
- (5) Completed drains of 6R Hakra (CWMP) and SCARP VIII have provided suitable lines of def for own tps.
- (6) 6R Hakra (CWMP) and SCARP VIII drains will affect emp of res.

- b. **Semi desert Sec.** Terrain in this sec favours adv of large scale forces particularly armr astride Tr Rana Bhana – Marot, Tr Banawala – Mojgarh, Rd/tr Fort Abbas – Marot – Kudwala/KPT and Rd Fort Abbas

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– Dharanwala – Chishtian. This avenue affords good going with large space for mnvr. Going is comparatively easy east of Line Pathani Wala Khu – Dingarh – Yazman because of the area being a comb of flat, open and gently rolling profile of dhars and dunes. However, the area will req some engr effort to make the going smooth for log sp.

- c. **Desert.** Going is difficult west of Line Pathani Wala Khu – Dingarh, where trs run over soft sand dunes req considerable engr effort for maint. The terrain in this sec is itself an obs which will cause high rate of mech attrition on both wh/tr vehs and phy attrition on men and material. The configuration of high sand dunes is from NE to SW, hence any mov from south to north will be difficult.

Mil Aspects

25. **Tac Aspects of Terrain.** Except for the canals / distys / nullah / rivers and boggy patches in some areas which restrict mov, the area is suitable for mob ops. A network of rds exists in the area which facilitates mov of large forces. Oct to May is suitable pd for mil ops. Mov from NE to SW dir is easier than other dirs because of lay of the gr and flow of nullah / distys / nullah / rivers.

a. **Apchs Aval to The En**

- (1) **A: Fazilka – Sulemanki.** This is the shortest apch ldg to Sulemanki with well served network of laterals, penetrants and well dev rly infrastructure on en side. Mov upto river line is restd due to a no of obs providing successive def lines. Armr hy ops are possible beyond River Sutlej because of a no of laterals, penetrants and adequate space of mnvr. Sulemanki HWs complex becomes a formidable obs once the pondage is activated / filled. After Xing the HWs, this apch provides ample room for mnvr and added adv of flk protection by BSLC. It can take an inf div.

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- (2) **B: Abohar – Hindu Malkot – Mandi Sadiq Ganj.** It originates from Abohar, passes through Hindu Malkot, Mandi Sadiq Ganj, Minchinabad and Pir Ghulam Qadir Xing over River Sutlej. Upto Mandi Sadiq Ganj its length is 45 km and upto Xing site 75 km. It extends in width from Sulemanki HWs to Bahawalnagar. From IB to River Sutlej this apch can take 2 to 3 inf divs and an armd bde. However, addl armr beyond the river is possible. Imp commcen are Mandi Sadiq Ganj, Mcleod Ganj, Minchinabad and Pakpattan. From Abohar to Hindu Malkot, a CI 70A1 rd exists for adm sp and from Mandi Sadiq Ganj to Minchinabad rd network exists which can asst the op. Obs enctr are Bikaner Canal, Ganga Canal, State Disty, ESC, Mcleod Ganj Branch, Fordwah Branch, Darbari Disty and River Sutlej. This apch can be comb with apchs A and C.
- (3) **C: Ganganagar (RT 04)/Srikanpur (RS 73) – Jalwala – Bahawalnagar – Tibbi Lal Beg – Arifwala – Sahiwal / Chichawatni.** It is short and dir apch ldg to strat objs. It is well served with a network of laterals and penetrants. It has well dev rd/rly comm infrastructure on both sides of IB but w/o any extn of strat comm from the en side to our area. Area b/w Jalwala and Tibbi Lal Beg has high water table due to extensive network of canals thereby restricting mov to rds only. ESC, Hakra Branch and Fordwah Branch, which are eff obs, run across the line of adv. This is the shortest apch to River Sutlej while bypassing Sulemanki defs. From IB to River Sutlej this apch can sustain 1 to 2 inf divs with some armr beyond which the terrain would facilitate emp of mech forces. However, considerable engr effort will be req for making a Xing over Sutlej. Imp commcen are Bahawalnagar, Arifwala and Pakpattan. Obs enroute are ESC,

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Hakra Branch, Malik Branch, Fordwah Branch, River Sutlej, Khadir Branch, Pakpattan Canal and old bed of River Beas. This apch can be comb with apchs B and D.

(4) **D: Surat Garh/Ganganagar – Padam Pur/Raisinghnagar – Dunga Bunga/Harunabad – Chishtian/Hasilpur – Islam HWs.**

Comm infrastructure (both rail and rd) is well dev on transfrontier side rt upto the border. On cisfrontier side, comm infrastructure is well dev upto Line Bahawalnagar – Dunga Bunga – Harunabad – Fort Abbas. It can take 2 x inf divs sp by an armr bde. Main obs are Gang Canal Feeder, Hakra Branch, Khatan, Murad, Fateh distys and Fordwah Canal. Imp commcen towards en side are Ganganagar, Surat Garh and Padampur whereas Harunabad, Dunga Bunga and Chishtian are imp commcen on our side. This apch can be comb with apchs C and E.

(5) **E: Surat Garh – Anup Garh – Fort Abbas – Chishtian Mandi / Hasilpur – Islam HWs.**

A comparatively longer apch. It is served with a well dev network of rds providing innumerable lateral and penetrants on both sides of IB. Purely from aval rd and rail infrastructure, this area is ideally suited for the assy and ops of large sized forces. Various distys lie along the line of adv creating compartmentation eff. Outfall drains of SCARP VIII in comb with Dharanwala Drain can become a viable line of def. Mov of B vehs will be restd to existing trs at most of the places. Imp commcen are Raisinghnagar, Suratgarh and Anupgarh on the en side and Fort Abbas, Chhonawala, Dharanwala, Khairpur, Hasilpur, Mailsi Syphon and Islam HWs on our side. Obs on this apch are Hakra Lt and Hakra Rt. This apch can take two to three inf divs and an armd div.

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- (6) **F: Bikaner – Pugal – Beriwala – Banawala/Churiwala – Mojgarh / Marot – Yazman/Khairpur – Ahmedpur East / Bahawalpur or Bahawalpur / Islam HWs.** It is relatively longer apch with rapidly dev rd infrastructure especially transfrontier. The semi desert terrain south of Hakra Rt is well served with desert trs. Three maj desert trs emanate from Churiwala to Rasafa/ Quraish, from Rana Bhana to Marot and from Banawala to Mojgarh and on to Yazman/Kudwala. These can be dev to take sustained tfc with engr effort. Beyond the green strip only two viable trs Marot – Khairpur and Mansura – Kudwala exist. These also can take sustained tfc with some engr effort. Imp commcens on en side are Rojhri, Gharsiana, Pugal and Beriwala while on our side these are Marot, Hasilpur, Qaimpur, Khairpur, Yazman, Bahawalpur and Ahmedpur East. The entire semi desert terrain on our side of the border is devoid of cover except the green strip astride Hakra Rt and Desert Branch. It can take an armd div alongwith a RAPID and one to two inf divs.
- (7) **G: Bikaner – Sachu – Derawar Fort – Ahmedpur East.** It is the longest apch, ldg through desert and semi desert terrain. On en side metalled rds are aval but on our side desert trs emanating from Salamsar, Rukanpur and Renhal req colossal engr effort for sustained tfc. The area poses burden on wh borne log for maint of mech and armd fmns. Imp commcens on en side are Ranjitpura, Gajjewala, Birsilpur and Sachu while on our side Derawar Fort, Ahmedpur East and Chhani Goth are the imp places. Due to fairly well dev transfrontier comm infrastructure, base of this apch permits assy of an armd div with a mech/ inf div. However, due to lack of adequate comm-infrastructure and enhanced terrain friction, capacity of this apch declines sharply

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in our area after Xing the IB and is reduced to emp of an armd bde gp only.

b. **Apchs Aval to Own Forces**

- (1) **Sulemanki – Fazilka – Hindu Malkot.** It is 50 km long. A no of penetrants are aval upto Fazilka. Series of obs created by the en would entail considerable engr effort. It can take an inf div.
- (2) **Minchinabad – Hindu Malkot / Abohar.** It is 58 km long and can take 2/3 inf divs with an armd bde. The series of existing obs will involve considerable engr effort.
- (3) **Bahawalnagar – Jalwala – Ganganagar.** It is 50 km long and can take 1 to 2 inf divs with some armr. Going conditions are comparatively better.
- (4) **Harunabad / Dunga Bunga – Padam Pur / Raisingnagar – Ganganagar / Surat Garh.** Another 1 to 2 inf divs with armd bde size apch which req maj engr effort. After Xing Gang Canal, diff options are open. It threatens maj commcens of en.
- (5) **Fort Abbas – Anup Garh – Surat Garh.** It is 105 km long and can take 2/3 inf divs sp by an armd div. Comparatively less engr effort is req.
- (6) **Bahawalpur – Mojgarh – Dingarh – Bikaner.** It can take an armd div a/w 1 to 2 inf divs.

c. **Imp Features / Critical Spaces**

- (1) **River Sutlej.** River Sutlej is a maj obs. However, its effectiveness is reduced during winters when only nominal water is aval in the river from BSLC / Sulemanki HWs. Its obs value can be enhanced by reg the flow of water from Sulemanki HWs, i.e, by rel water in BSLC to its full capacity and closing of Pakpattan Canal. In wet season, Xing will be impossible in the entire length of the river. Home bank of the river dominates far

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bank at most of the places. There are no fixed defs on home bank. River Sutlej splits the AOR into Cbt and Comm Zs. En's prime concern would be to seal off the Xing sites at the earliest whereas we would be interested in denying the same for the success of our op. The best option would be to def the Xing sites rt from the start and subsequently hold them strongly with inf while mech forces are emp to deny an opportunity Xing to the en. It forces the en to undertake deliberate Xing across water obs with at least corps size force especially if she fails to either hold the Xing sites with heliborne / AB forces or an opportunity Xing is affected. The design of en op will dictate his intention and the dirs for aslt across the river for undertaking sealing op. The maj challenge for en forces would be the wide choice of Xing sites aval to us which makes it extremely difficult for en to seal off all the Xing sites on the river.

- (2) **Sulemanki HWs Complex**. It has strat imp at Army and National lvl. Capture of this area could put the en across River Sutlej thereby dislocating the entire div/ corps defs. Besides, overall con of water in the canals/distys south of River Sutlej rests with this HWs. It is imp to note that en's offn mnvr south of Sulemanki HWs can be seriously upset/ jeopardized in timeframe if we retain con of Sulemanki HWs and fluctuate the flow of water for upsetting en's br effort. Present efforts to charge the ponds would make en's effort difficult to capture Sulemanki dir. It will req a bde to def. It can be tackled by the en from four dirs. First, from the north, apch the HWs from the lt. However, this apch cannot sustain the op of more than an inf bn. Secondly, from the east tackling the HWs frontally. This apch can sustain the op of a bde sp by a sqn of tks in fire sp role

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initially. Subsequently the battle of bund will be fought. Thirdly, from SE/ from the dir of Bareka Br (RT 08). This apch can sp the op of a bde sp by an Armr Regt minus. Fourthly, the AB/para apch enveloping Sulemanki HWs from the rear. However, the only possible way of capturing the HWs intact is through a surprise storming of the HWs frontally, sp by para / heliborne forces op from the rear. Own C atk on Sulemanki HWs will face same difficulties as faced by the en in atk it.

- (3) **Triple M Triangle Complex.** This area dominates the apchs to Pir Ghani and Pir Ghulam Qadir Xing sites. Rising water table in the area prevents conc/emp of large size forces. This Triangle will req a bde to def and an inf div to capture. The dir of atk to capture this Triangle has to be from North of Mandi Sadiq Ganj (area Chaupalia RT 07), tackling it from its lt flk. Suitable dirs to recapture this area are from NE and SW. Capture of Triangle facilitates adv towards Pir Ghani and Pir Ghulam Qadir Xings over River Sutlej.
- (4) **Awami Canal – Lahura Ditch.** Lahura Ditch has been const in cont of Awami Canal in Sulemanki sec and has a length of 31.45 km. Being too close to IB and keeping the sensitivity of the area in view it provides a good def line for holding fmn and a base for offn ops. It req a bde size force to hold it and div plus size force to capture it. Area opposite Amruka RS provides the best dir for turning the defs in this area. Its capture by the en would facilitate denying of suitable launch pad for own ctr offn.
- (5) **ESC.** It is a maj water obs running from NE to SW. It has vertical banks and draws its water from Sulemanki HWs. At places home bank is comparatively lower than the far bank. There are fixed defs on home bank at relatively imp and likely

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Xing places. Mandi Sadiq Ganj, Chaupalia and Bareka brs are imp tac features on this canal. Area b/w Lahura Ditch and ESC is enough for assy of a div plus force. Only an armd regt gp would be able to op from NW and SW dir due to the existence of boggy patches. ESC provides a sec line of def to Lahura Ditch and becomes a formidable def line when comb with the BUAs astride the canal. It would req a bde plus size force to def and div plus size force to capture it. However, en may emp heliborne/ AB forces to capture maj Xing sites thus facilitating his offn op. ESC's capture is related to dir of en ops in the Triple M sec. It could be for the capture of Sulemanki HWs from the south or Pir Ghulam Qadir, Pir Ghani Xings in the east – west dir. The third option is to draw our res from the main B fd by offn fixation.

- (6) **Fordwah Canal**. It takes off from Sulemanki HWs, runs parallel and close to ESC for about 8 km upto Bareka twin brs from where it pulls off North and away from ESC. Its home bank is higher than the far bank at places. It provides depth to ESC. Its imp feature is the only lateral, i.e, Sulemanki – Bahawalnagar which runs over its home bank upto Minchinabad and then south of it to Bahawalnagar. Home bank contains fixed defs at imp places. Free mov of tks and vehs is not possible in the corridor b/w ESC and Fordwah Canal. This is the last line of def before River Sutlej - its loss could open the flood gates across River Sutlej thus turning our def in the north and compelling us to take up def to the north and west of River Sutlej. It would req bde plus size force to def and div size force to capture. Best dir of attk is from north of Mcleod Ganj in the dir of Pir Ghani Xing and south of Minchinabad in the dir of Pir Ghulam Qadir Xing. The loss of this line would split the def of Northern Sec into two.

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- (7) **Hakra Main Canal.** It emanates from ESC at Jalwala. Hakra Branch is a complete obs upto Head Signai. Mamun Disty downwards, the obs value of Hakra Branch greatly diminishes. Finally it peters out into Hakra Rt and Hakra Lt distys with ltd or no obs value. Any rupture through the defs on Hakra Rt or en outflk mnvr will force a battle of reverse front or turn the defs on Hakra Branch.
- (8) **Murad Disty.** It emanates from Malik Branch and acts as sec line of def in Dunga Bunga Sec. It would req bde size force to def; however, large scale mov and op by the en would be slow and time consuming due to the boggy nature of terrain. Ops by the en would be either to bypass Bahawalnagar defs in the North or for provn of flk protection to forces mnvr in the south in the dir of Dharanwala – Chishtian.
- (9) **Outfall Drains and Pondage Area.** The outlay of drains and alignment of evaporation ponds provide depth to defs in Wullar Sec and on Murad Ditch. In isolation these drains have no maj tac significance. However, when comb with Murad Ditch Complex, it forces the en to undertake deliberate inf ops, splitting mech and inf fmns and asst the def to attrite the en and condition him for launching C attk across Murad Ditch. A bde size force is req to def it whereas a corps size force would be req to capture it because of the compulsion of undertaking ops in phs. Its loss does not have any significant eff on the defs.
- (10) **Murad A tk Ditch.** 41.58 km long, this is the most imp tac gr in corps area of op. Its retention ensures the def of the corps critical space, facilitates ops by the fmns being emp for ctr offn and threatens en's L of C and base of ops. Its loss would knock off the northern pivot of our defs denying all the advs. A div size

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force would be req to def it from Dharanwala incl to Chhonawala incl while connecting it Hasilpur in the North. The str achieved on this line is through creating successive lines of def by incorporating the Outfall Drain (SCARP VIII) into this complex.

- (11) **Hakra Rt.** Emenates from Hakra Branch at RD 28+000 and runs from east to west along Line Fort Abbas – Marot upto sq RQ 65. It is an obs for tks except near Marot and lies across all the penetrants east of Line Rana Bhana – Marot. It offers a good line of def. Any mov across it from the gen area Quraish eastwards would break the momentum of en's adv.
- (12) **Desert Branch.** Desert Branch is an eff obs when coupled with Res Forest of Lal Suhanra in the north and the BUA of Yazman in the south. This is the only eff water obs in the semi desert sec. Its loss would facilitate en mech ops in the dir of Bahawalpur – Ahmedpur East thus turning defs in the north and providing adequate flk protection in the area. 3x bde size def posn would be req to def area Lal Suhanra – Kudwala – Yazman – Tailwala. It would req inf div plus op to aslt across the canal in case en fails to achieve an opportunity Xing. Its retention facilitates launching of res from the dir of Kudwala – Yazman for cutting en's L of C and threatening the base of op. Its def would deny en progress in the dir of Bahawalpur – Ahmedpur East.
- (13) **Bahawalnagar – Jalwala Complex.** The imp of this area emerges on three accts. It is placed squarely on the shortest apch to the river line. Secondly, the imp of Jalwala Regulator and finally the close proximity of Tibbi Lal Beg Xing to the border. Cl 70 br at Tibbi Lal Beg inc the mil significance of Bahawalnagar Sec. Area is suited to slow inf ops and restricts the induction of large sized forces. An effort in this area would :-

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- (a) Spilt defs in AOR south of River Sutlej.
- (b) Protects the flk of any offn effort.
- (c) Deny Xing site of Tibbi Lal Beg for induction of res across River Sutlej.

- (14) **Mianwala Toba – Harunabad – Dharanwala Complex.** The complex is confined within the corridor formed by Hakra and Malik branches. The complex has well laid out network of rds and trs. It is served by two penetrants: Mianwala Toba – Harunabad – Chishtian and Mianwala Toba – Harunabad – Dharanwala – Chishtian; and a lateral: Fort Abbas – Harunabad – Bahawalnagar, all served by cl 70 A2 rds. The complex is loc approx 4.3 to 4.7 km from IB and provides a jump off pt for various op possibilities towards NE or West. Keeping in view the factors of strat dir and log, it can be assumed that it is well suited to a sizeable offn effort. Towns/vills of the complex can be dev into str pts. Hakra Branch and numerous distys in the complex lend str to def. The complex is suited for inf ops sp by ltd armr.
- (15) **Mubarakabad – Faqirwali – Khichiwala Complex.** This complex is based on a no of BUAs astride Rd Fort Abbas – Harunabad at a suitable dist from Hakra Main providing sufficient depth to the def. Dev of the BUAs into str pts, coupled with the numerous minors and drains in the area, would force the en to ph his ops thus gaining valuable time for the defender. It would req a bde size force to hold the str pts and div res mech / armd bde to be used for the C attk. Time gained by the defender on this line poses serious problems to the en for coord his effort to threaten Kudwala – Marot – Chhonawala simultaneously.
- (16) **Dharanwala – Chhonawala Complex.** This complex provides an imp depth posn in relation to Fort Abbas – Harunabad, and

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any br H gained by the en in b/w. It also con apchs to Hasilpur and Chishtian.

- (17) **Line Fort Abbas – Quraish - Rasafa – Marot – Mansura – Lal Patel A tk Ditch.** This line is 144.9 km long. There is high home bank at most of the places along this ditch. It is an eff obs against trs and whs and a partial obs against inf. Def based on the ditch coupled with the obs sys, would force the en to emp inf hy forces, facilitating our mech fmns to be emp in C attk from the dir of green belt towards the ditch. It would req an inf div suitably rft with CAF elms to def and would req a min of div plus to capture. Design of the ditch creates pivots on the flks, i.e., Fort Abbas and Marot. The best dir to reduce this pivot is by launching mnvr from the flks and linking up from the central loc of Rasafa – Quraish. In this complete sys, recapturing the ditch is very imp because its loss would force the defender to fall back to sec line of def.
- (18) **Line Marot – Mansura – Kudwala.** In semi desert sec, this is the narrowest pt connecting the imp pivots of Marot and Kudwala. This provides depth to the def of Mojgarh. It would req an armd bde size force with HAT elms to block the en and cause sufficient attrition to gain time for redepl of forces in this area. It could be held eff with a bde size force thus protecting MSR Bahawalpur – Yazman – Marot. For success of en forces in the semi desert sec, it is imperative to capture this sensitive space thus facilitating his ops for the encirclement of Marot and exploitation upto the Bahwal Canal and Desert Branch.
- (19) **Line Modiwala – Churiwala – Rana Bhana – Banawala.** This line is based on a series of sand dunes running parallel to the IB and eff covering the penetrants in the semi desert sec. This line

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can be eff used by mech forces emp as C tps in the area. Due to lack of natural obs, reliance has to be made on extensive use of M fds. The imp of this line is that it can be turned from the north if the en chooses to adv in the east–west dir from Churiwala towards Mojgarh. It is, therefore, imperative that the northern flk be gd eff.

- (20) **Fort Abbas Complex.** It is loc south of Hakra Rt Disty and approx 5 km from IB. It has an imp metalled rd link with Bahawalnagar and Chishtian providing high speed avenues, and a metalled rd also provides a link with Marot, offering various op possibilities. The town itself can be turned into a str pt. It will have to be cleared if the penetrants Bahawalnagar, Chishtian and Marot are to be used by the en. It serves as an imp and only base for any large size ops towards River Sutlej in the north or towards Bahawalpur in the NW. The area being devoid of any worthwhile obs or defensible terrain feature around it, and ft inf lacking requisite mob in the face of mech threat, will be highly vuln to encirclement. It reqs a bde to def and a div to capture it.
- (21) **Rasafa – Quraish Complex.** Loc b/w Fort Abbas and Marot complex. The area is devoid of any defensible terrain around it. It bifurcates the defs and turn the defs of Fort Abbas. It req a bde to def and a div plus to capture.
- (22) **Marot Complex.** It is loc south of Hakra Rt Disty and midway on penetrant Rana Bhana – Kudwala. Like Fort Abbas, it is also devoid of any terrain friction and is highly vuln to encirclement. It would req a bde plus size force to def and a corps size force to capture. To capture Marot en has two options: Hit Marot dir or encircle it by emp inf hy forces in the eastern prong in the dir of Rasafa – Quraish and mech forces in the western prong

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opposite Mojgarh – Januwali – Rodewala. En ops in the east – west and south – north dir can only progress on capture of Marot. It provides suitable base for launching C attk/Ctr offn.

- (23) **Mojgarh Complex**. It is loc SW of Mansura / Marot. It is an imp commcen with trs ldg to Kudwala, Dingarh and Marot. It is sit in the desert with reasonably good tfc for tr vehs and is suitable to serve as replenishment base for deep mech ops emanating from Pugal or Beriwala. A bde with mech forces op on its flk would be req to def it. En would req an armd div and a RAPID to capture it. Its loss turns the defs of Marot.
- (24) **Dingarh Complex**. It is loc further SW of Mojgarh and is an imp commcen with trs ldg towards Yazman and Mojgarh. It is loc in the desert sec with good tfc for tr vehs and is suitable for mob ops. A metalled rd links Dingarh with Yazman. It is imp for ops in the dir of Yazman and for flk protection of the main mnvr. It also facilitates en's op either in the dir of Derawar Fort or Channan Pir – Tailwala – Samasatta. The best option for the en is to bypass it. It should, therefore, be linked in the obs sys Dhorī – Dingarh – Yazman and Yazman – Derawar Fort. It would req a bn plus to def and a bde to capture.
- (25) **Yazman – Kudwala Complex**. This complex is loc astride the Desert Branch which is an eff obs. It protects Bahawalpur / Ahmedpur East from the south. The complex provides depth to any defs based on line Mojgarh – Dingarh. This complex gains str from the green belt south of the Desert Branch and the BUA of Yazman. It is also well served with black top rds from Bahawalpur and Ahmedpur East. Tps req to def the complex will be a bde size force or div size force from Tailwala to Lal


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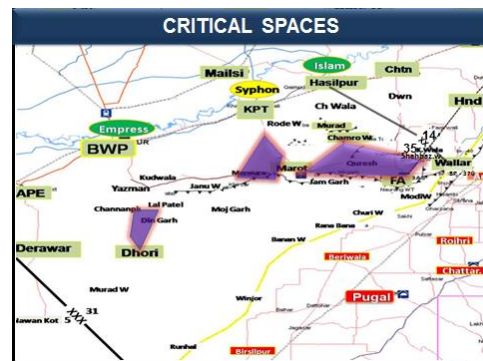
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Suhanra. The sec option is to emp the mech bde in the semi desert to the south and west of Yazman.

- (26) **Bahawalpur Complex**. A maj BUA with insufficient depth. The en would endeavour to capture and isolate the town and reduce it subsequently. For political reasons, it is imperative that Bahawalpur be def at all cost, which lies in the eff def of Desert Branch. However, if this line is ruptured then defs should be planned on Ahmedpur Branch. Empress brs (rd and rly) have significant imp since their capture would isolate Bahawalpur and also cut the cty's main comm artery. It would req an inf div sp by armd bde size force to def and a mech/inf corps to capture/invest it.
- (27) **Ahmedpur East Complex**. For dev of ops beyond Yazman – Bahawalpur, Ahmedpur East is the maj commcen and BUA. It would req an inf bde sp by mech forces to def it and a corps size force to capture it. Its loss would facilitate en ops towards Punjnad HWs and Rahim Yar Khan.
- (28) **Pir Ghani**. It dominates apch Mandi Sadiq Ganj – Mcleod Ganj – Pir Ghani – Haveli/Bunga Hayat – Balloki HWs. However, out of the three Xing sites over River Sutlej South of Sulemanki HWs, this Xing site is the most problematic from br ops pt of view. It will req a bde to def and an inf div to capture.
- (29) **Pir Ghulam Qadir**. It dominates the apch Mandi Sadiq Ganj – Minchinabad – Pakpattan. From tech aspects of br op, this Xing site is least problematic. However, imed after Xing the river it enctr the large BUA of Pakpattan hemmed in b/w Khadir Branch and Pakpattan Canal which can be converted into a formidable def complex. It will req a bde to def and a div to capture.

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- (30) **Tibbi Lal Beg**. It dominates the apch Jalwala – Bahawalnagar – Arifwala – Sahiwal – Chichawatni. From tech aspect of br op, this Xing site presents lesser problems. It will req a bde to def and a div to capture. This Xing site gets added significance due to presence of cl 70 br.
- (31) **Islam HWS**. Affords the shortest apch for own res to launch ctr offn / C attk south of Sutlej. En would endeavour to seal off this Xing either through air action or emp of air/heliborne forces and subsequently linking up by the gr forces. It must be def from the outset against air and gr action. It would req a bn size force to def initially and an AB bde to capture it. Presence of sizeable mech res in the area would deter any such bold venture by the en. Retention of sufficient space for assy of res south of the river is of paramount imp.
- (32) **Mailsi Syphon**. The chars and tac imp of Mailsi Syphon is similar to Islam HWS.
- (33) **Punjnad HWS**. Punjnad HWS gains imp when en ops proceed beyond Line Yazman – Bahawalpur in the dir of Reti – Rahim Yar Khan. Initially it would be obj for en heliborne and AB forces and subsequently to be captured by gr tps. It would req similar treatment as Islam HWS and would gain added imp due to the fact that this might be the only artery left to op south of River Sutlej. Hence it has to be denied at all costs with retention of sufficient space for build up of adequate res.
- (34) **Green Belt**. Area bounded by Fort Abbas, Marot, Chamrowala and Shahbazwala is critical for the def
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mnvr of 35 Div; hence must be def at all costs.

- (35) **Semi Desert Sec.** Line Marot - Mansura - Kali Dhar is imp to retain with Marot as pivot of mnvr for launching C attks and denying en link-ups.
- (36) **Desert Sec.** Lal Patel - Dhori - Channanpir is an imp space to retain for exploiting en's flk when it intends hdg in the strat dir of Ahmedpur East.

26. **Obsn, Fs of F, Cover and Clt**

a. **Climatic Conditions**

- (1) **Green Sec.** In addn to the dust storms, obsn in this sec is also eff by morning fog/haze which prevails over the water line during early hrs or morning during winter. In the imed vicinity of the water line during this pd of haze, obsn could be restd to a mere 20 to 35 m. This would, on one hand, allow concealed mov of own tps in the def locs while on the other, it could allow the en to mov close to own def locs. Rainfall is also likely to affect the obsn.
- (2) **Semi Desert / Desert Sec.** Weather permits good gr and air obsn but is adversely affected during summer months when dust and sandstorms may conceal the mov of large bodies of tps. However, at higher velocities of winds, these pose a restriction to own mov also.
- (3) **Vegetation**
 - (a) **Green Sec.** The area is thickly vegetated baring small patches of sandy areas. Vegetation exists in the form of crops, orchards, res forests and trees along rd/water channels which considerably restricts the Fs of F and obsn both from gr and air. Clt of a large body of tps is possible. The area facilities good cam.

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- (b) **Semi Desert Sec.** Fs of F and obsn are not restd in the area except astride narrow strip of vegetation along Hakra Rt Disty. Likewise, clt from air and gr obsn is also ltd in the area astride Hakra Branch and in certain portions north of Line Fort Abbas – Kudwala where the shrubs are dense and of considerable ht.
- (c) **Desert Sec.** Due to scarce vegetation, very ltd cover is aval in this sec.

(4) **Manmade Features**

- (a) **Green Sec.** Imp canals are ESC, Fordwah Branch, Hakra, Bahawal, Desert and Ahmedpur Branch. All these canals are above gr lvl thus facilitating obsn and Fs of F. However, to further enhance the obsn and Fs of F, banks of ESC and Hakra Branch have been raised at certain places. In addn, Malik Branch, Hakra Rt Disty and numerous other distys/minors etc lend some sp as mentioned above. Area is extensively cultivated due to presence of irrigation network thereby posing restriction on obsn and Fs of F other than canal/disty banks and rail / rd embankments. Obsn is especially restd during crop season and due to numerous towns/vills in the area.
- (5) **Desert Sec.** Abandoned forts of Derawar, Dingarh, Mojgarh, Marot, Nawakot provide good obsn. Hakra Rt Disty also facilitates obsn and Fs of F. In addn, Bahawal Canal and Desert Branch which skirt this sec in the north and SW also facilitate Fs of F and obsn to a considerable deg. A few double storeyed pacca houses in Fort Abbas, Marot, Mojgarh, Dingarh and Derawar dominate the area upto approx 1000 to 1500 m and thus serve as good OPs. Rd Fort Abbas – Marot – Kudwala cuts

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through the centre of the sec and dominates the area. At Kudwala, it crosses over the Desert Branch and is linked with Bahawalpur by a metalled rd.

b. **Mov**

(1) **Green Sec**

- (a) **Vegetation**. The area is extensively cultivated due to irrigation canal network which limits X cty mov of soft vehs. It also imposes restriction on mnvr.
- (b) **Surface Material**. Area is boggy and water logged along Malik Branch, gen area Dunga Bunga, Malikpura (RS 53) and along River Sutlej which impedes large scale X cty mov of whs and trs. In the vicinity of canals, mov of any type of veh is difficult. This sec is ideally suited for inf ops.
- (c) **Manmade Features**. Extensive artificial obs consisting of canal/distys hinder mov and limit use of apchs in this area. Hakra Main, Malik Branch, Fordwah and Bahawal canals in the east; and Desert and Ahmedpur branches in the west present consecutive lines of def in the area. The canals gen flow from NE to SW compartmenting the area into restd secs, lending str to the def and creating problems for the attacker.

c. **Obs**. Summary of imp obs is att at Anx LL.

- (1) **Lahura DCB**. It has been const in cont of Awami Canal in Sulemanki Sec and is 31.45 km long. Being too close to IB and keeping the sensitivity of the area in view, it provides a good def line for holding fmn and a base for offn ops. It req a bde size force to hold and div plus size force for being captured. Area opposite Amruka RS provides the best dir of turning the defs in

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this area. Its capture by the en would facilitate denial of suitable launch pad for own ctr offn.

- (2) **ESC**. It is a maj water obs, has vertical banks and draws water from Sulemanki HWs. Its capacity is 4,900 cusecs at a depth of 2-3 M and 5,400 cusecs of water at 3.3 M depth. At places, the home bank is comparatively lower than the far bank. There are fixed defs on home bank at relatively imp and likely Xing places. Mandi Sadiq Ganj, Chaupalia and Bareka brs are imp tac features on this canal. Area b/w Lahura Ditch and ESC is enough for assy of a div plus force. Only an armd regt gp would be able to op from NW and SW dir due to the existence of boggy patches.
- (3) **Fordwah Branch**. It emanates from Sulemanki HWs, runs parallel and close to ESC for about 8 km upto Bareka twin brs, from where it pulls off north and away from ESC. It is 30 M wide and 2.87 M deep. It reqs 3,200 cusecs of water to maint depth of 2-3 M. Its edges are sharp and rise directly from the water line. Its home bank is higher than the far bank at places. It provides depth to ESC. Its more imp feature is that the only lateral, ie, Sulemanki–Bahwalnagar runs over its home bank upto Minchinabad and then south of it to Bahawalnagar. Home bank contains fixed def at imp places. Rly line Amruka – Mandi Sadiq Ganj – Bahawalpur runs through the corridor running north to south and NE to SW. Free mov of tks and vehs is not possible in the corridor b/w ESC and Fordwah Canal.
- (4) **Old Bed of River Beas**. The river flows from NE to SW along the northern fringes of the area providing natural bdry. Area along its bed west of SMLC has been brought under cultivation and is no more an obs. In dry season, it can be negotiated

throughout its entire length by all types of vehs with some engr effort. During wet season, its span considerably inc and it becomes an eff obs restricting all types of vehs mov to rds and brs. Furthermore, it inundates the entire area north of 3R Disty making all types of veh mov in the area impossible.

- (5) **Canals in Depth.** LBDC, Pakpattan Canal, Upper and Lower Sohaq and Khadir branches are proper obs and would req engr effort to negotiate. The lateral lay of these canals, in conjunc with River Sutlej, will break momentum of any offn from the South.
- (6) **Hakra/Malik Branch.** Both canals emanate from Jalwala; Hakra Branch runs parallel and close to IB upto Wullar while Malik Branch runs at dist of 16-24 km from IB. Hakra Branch is 39.3 M wide and 2.7 M deep while Malik Branch is 43.3 M wide and 2.7 to 3.3 M deep. Both are complete tk obs.
- (7) **River Sutlej.** River Sutlej meandering along outer fringes of the Southern Sec is an all time maj obs. However, its eff is reduced during winter months when only nominal water is aval in the river from BSLC/ Sulemanki HWs. Obs value of River Sutlej can be enhanced by regulating the flow of water from Sulemanki HWs, i.e., by rel water in BSLC to its full capacity of approx 19,000 cusecs and closing of Pakpattan Canal which will give roughly 8,000 to 9,000 cusecs of water thus nec a maj br op to affect a Xing. Creeks in the river are partial obs for both A and B vehs mov during dry season. In wet season, Xing will be impossible in the entire length of River Sutlej in this area. Maj Xing places in this sec are Pir Ghani, Pir Ghulam Qadir ad Tibbi Lal Beg. On either side of the river, metalled rds exist upto a certain pt opposite these Xings. A cl 70A2 br has been const on Tibbi Lal

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Beg Xing. Making a cl 50 Xing over River Sutlej will entail careful recce and considerable engr effort. Home bank of the river dominates far bank at most of the places. However, there are no fixed def on home bank. Digging of trenches/wpns and gun pits would req large qty of def stores/local material. There is no cover aval along a strip of 1.6 km on either side of the river banks.

- (8) **Desert Sec.** Terrain favours adv of large scale forces, particularly armr, astride penetrants Fort Abbas – Marot – Kudwala, Fort Abbas – Dharanwala – Chishtian, Rana Bhana – Marot – Chhonawala, Rana Bhana – Marot – KPT and Pathani Wala Khu – Bahawal (RW 71) – Mojgarh – Dingarh – Yazman. This avenue affords good going with large spaces for mnvr by mech forces. Going is comparatively easy east of Pathani Wala Khu – Dingarh – Yazman although some engr effort will be req to make the going smooth for log sp. However, west of this penetrant the going is difficult since trs run over soft sand dunes req considerable engr effort for maint. This sec offers no obs till the line of Bahawal Canal and Desert Branch which are complete tk obs. However, Murad A tk Ditch is a formidable obs. Details of obs in this sec are as under (Anx P and S) :-

- (a) **Fort Abbas – Quraish - Rasafa – Marot – Mansura – Lal Patel A tk Ditch.** Initially the ditch was const from Fort Abbas upto Marot (92.8 kms) during 1989 - 1994. In 1997–98, the remaining portion, i.e., from Marot upto Lal Patel (52.9 km) was const. Now total length of this DCB is 144.9 km. It is 10 to 12 ft deep and 40 to 45 ft wide. There is high home bank at most of the places along this ditch. It is an eff obs against trs and whs and a partial obs against inf. Alignment is att at Anx P and Q.

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- (b) **Murad DCB.** Its length is 41.58 km and is the most important in corps area of op. Its retention ensures def of the corps critical space, facilitates ops by the fmns being emp for ctr offn and threatens en's L of C and base of ops. Its loss would knock off the northern pivot of our defs denying all the advs. A div size force would be req to def it from Dharanwala incl to Chhonawala incl while connecting it Hasilpur in the North. Str achieved on these lines is through creating successive line of def by incorporating the Outfall Drain (SCARP VIII) into this complex. Alignment is att at Anx P.
- (c) **Bahawal Canal.** It is sec line of def east of Line Qaimpur – Marot and the first line of def west of it. It is a complete obs. Marot – Khairpur penetrant runs across this canal which would compel the en to launch a deliberate br H op. A very eff def line which will be difficult to breach.
- (d) **Desert Branch.** It lies across the penetrant Idg to Kudwala or Yazman via Marot. It is the first obs b/w the IB and River Sutlej in the north. The comm infrastructure north of the canal is better than towards the south. The metalled rds are Rd Yazman – Bahawalpur and Kudwala – Chak 42 – Bahawalpur and tr/d Tailwala – Khangarh Sharif. Any adv on Bahawalpur would incl the estb of a sizeable br H across this Branch. Considerable engr resources will have to be depl to affect a Xing and sustain a breakout.
- (e) **Ahmedpur East Branch.** It is the sec obs after the Desert Branch which req considerable engr resources for Xing. There is no defensible terrain b/w Ahmepur East Branch

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and Bahawalpur except Bahawalpur City itself. The disadvantage of this line is that only Bahawalpur can be effective while Ahmedpur East is left open.

27. **Str Pts.** Marot, Fort Abbas and Quraish can be converted into strategic points.

28. **Op Towers**

a. **Green Belt / 53 Bde**

- (1) Chak 258 HL (3161)
- (2) Marot Fort (7555)
- (3) Phulara (1657)
- (4) Hamza Ranger Post
- (5) Modi Wala Ranger Post
- (6) Churi Wala Ranger Post

b. **Desert / Semi Desert / 74 Bde**

- (1) Pakki Kothe Post (228563)
- (2) Rangers Post (287561)
- (3) Musa Post (275524)
- (4) Gul Nazim Post (286534)
- (5) Modi W/ T (240441)

c. **Arty OPs**

Ser	OP Towers	Easting	Northing
OP Towers (Marot Sec)			
(1)	OP Tower Marot	74300	55300
(2)	OP Tower Kandl	55986	38073
(3)	OP Tower Rasafa	84200	59700
OP Towers (Dingarh Sec)			
(1)	OP Tower Dingarh	17531	26468
(2)	OP Tower Mojgarh	46804	36500

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29. **Engineering Aspects of the Terrain**

- a. **Const Sites**. Technically, soil factors of the Corridor IB – River Sutlej, especially SW of Minchinabad do not favour const of def complexes and air fds. Rds can be const but alignment must be kept away from water logged patches. Soil conditions are suitable for such const projs north of River Sutlej.
- b. **Const Material**. The area gen lacks const material with the exception of wood. Other materials are avail in local market imported from diff areas.
- c. **Water Sup**
 - (1) 31 Corps op area comprises three diff terrain configuration: Green, Semi Desert and Desert areas. 14 Div op area is completely green/agricultural with no dearth of water resources (well laid irrigation network and tube wells/wells). This area is also served with a very elaborate comm network. 35 Div and security Z area comprises all three configuration as under :-
 - (a) ***Main green belt***, extending some dist beyond Bahawal Canal, Ahmedpur Branch, Desert Branch and their distys.
 - (b) ***Sec green belt*** running along Hakra Rt, Fort Abbas to Mansura.
 - (c) ***Semi desert sec south of Sec Green Belt***, extending from Fort Abbas in the east to gen area Dhori in the west, traversing upto and beyond the IB.
 - (d) ***Desert*** extends from gen line Winjor – Dhori to Western Corps bdry and beyond upto IB / beyond in the south.
 - (2) Water sources in green belts of 35 Div area are avail in the form of irrigation network, tube wells and wells. In semi desert and desert sec, most of the water sources are saline / brackish. In

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desert area there is scarcity of water sources. Usually the depth of water table is b/w 350-500 ft. The available water is mostly saline / brackish. Some areas have sweet water but water becomes brackish after excessive withdrawal. Diff water sources in AOR are mentioned at Anx JJ.

- d. **Water Sup Lines**. Details at Anx MM .
- e. **Elec Sup**. Grid sta details at Anx NN.
- f. **Industrial Instls**. Due to social conditions and lack of raw material, area lying in the corridor IB – River Sutlej lacks worthwhile industrial instls. However, an industrial area is under dev in Bahawalnagar. In the area north of River Sutlej small size industrial instls incl rice husking mills, cotton ginning factories have come up. Poultry farms exist in Pakpattan, Arifwala, Sahiwal, Okara, Bahawalpur and Khanewal. A small industrial sec also exists in Bahawalpur, south of Empress brs in the low lying area/old bed of River Sutlej.

30. **Transfrontier Terrain Data - Vol IV**

Concl

31. 31 Corps AOR presents itself for a variety of options for en / own ops. Owing to poor tfc, several manmade features and avail of imp structures close to IB, the area North of Fort Abbas is suitable for ltd armr / inf hy ops and thus presents offn options to en aimed at shallow objs. Area south of Fort Abbas is vast and open with imp objs in substantial depth from IB thus presenting large scale mech / armd warfare. Massive engr effort would be req in this area to inc the terrain friction for denying space for mnvr to the en forces.

32. Area south of Sutlej is ideally suitable for large scale mech and armd warfare. With the dev of several obs sys in the area, the texture of terrain friction has changed considerably.

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