STANDARD FORM OF BIDDING DOCUMENTS

FOR

PROCUREMENT OF WORKS

Construction of Satti Kali Dam, District Bannu
ADP NO. 2010 (2023-24)

Package-II: CONSTRUCTION OF IRRIGATION SYSTEM, & ITS AFFILIATED STRUCTURES I/C ELECTRIFICATON OF DAM EMBANKMENT OF SATTI KALI DAM DISTRICT BANNU (BALANCE WORKS)

DIRECTORATE GENERAL SMALL DAMS,
IRRIGATION DEPARTMENT KHYBER PAKHTUNKHWA

NOVEMBER – 2024

TABLE OF CONTENTS

Description		Page
No. INVITATION FOR BIDS		**5**
	Form	**6**
INSTRUCTIONS TO BIDDERS		**8**
A.	**General**	
IB.1	Scope of Bid	**9**
IB.2	Source of Funds	**9**
IB.3	Eligible Bidders	**9**
IB.4	One Bid Per Bidder	**10**
IB.5	Cost of Bidding	**10**
IB.6	Site Visit	**10**
B.	**Bidding Documents**	
IB.7	Contents of Bidding Documents	**11**
IB.8	Clarification of Bidding Documents	**11**
IB.9	Amendment of Bidding Documents	**11**
C.	**Preparation of Bids**	
IB.10.	Language of Bid	**12**
IB.11	Documents Accompanying the Bid	**12**
IB.12	Bid Prices	**13**
IB.13	Currencies of Bid and Payment	**14**
IB.14	Bid Validity	**14**
IB.15	Bid Security	**14**
IB.16	Alternate Proposals by Bidder	**15**
IB.17	Pre-Bid Meeting	**15**
IB.18	Format and Signing of Bid	**17**
D.	**Submission of Bids**	
IB.19	Sealing and Marking of Bids	**17**
IB.20	Deadline for Submission of Bids	**18**
IB.21	Late Bids	**18**
IB.22	Modification, Substitution and Withdrawal of Bids	**19**

E. Bid Opening and Evaluation

IB.23 Bid Opening **19**
IB.24 Process to be Confidential **20**
IB.25 Clarification of Bids **20**
IB.26 Examination of Bids and Determination of Responsiveness **20**
IB.27 Correction of Errors **21**
IB.28 Evaluation and Comparison of Bids **21**

F. Award of Contract

IB.29 Award **22**
IB.30 Procuring Entity's Right to Accept any Bid and to Reject any or all Bids **22**
IB.31 Notification of Award **23**
IB.32 Performance Security **23**
IB.33 Signing of Contract Agreement **23**
IB.34 General Performance of the Bidders **24**
IB.35 Integrity Pact **24**
IB.36 Instructions Not Part of Contract **24**

BIDDING DATA **25**

FORM OF BID AND APPENDICES TO BID **30**

FORM OF BID **31**
Appendix-A to Bid : Special Stipulations **33**
Appendix-B to Bid : Foreign Currency Requirements **34**
Appendix-C to Bid : Price Adjustment (Under Clause 70) **35**
Appendix-D to Bid : Bill of Quantities **36**
Appendix-E to Bid : Proposed Construction Schedule **58**
Appendix-F to Bid : Method of Performing the Work **59**
Appendix-G to Bid : List of Major Equipment – Related Items **62**
Appendix-H to Bid : Construction Camp and Housing Facilities **62**
Appendix-I to Bid : List of Subcontractors **63**
Appendix-J to Bid : Estimated Progress Payments **64**
Appendix-K to Bid : Organization Chart of the Supervisory Staff and Labour **65**
Appendix-L to Bid : Integrity Pact **66**

FORMS

BID SECURITY **68**
PERFORMANCE SECURITY **70**
CONTRACT AGREEMENT **72**
MOBILIZATION ADVANCE GUARANTEE/BOND **74**

PART-I: GENERAL CONDITIONS OF CONTRACT **76**

PART-II: PARTICULAR CONDITIONS OF CONTRACT

SPECIFICATIONS - SPECIAL PROVISIONS

SPECIFICATIONS - TECHNICAL PROVISIONS

DRAWINGS

INVITATION
FOR BIDS

INVITATION FOR BIDS

Date: 22 November 2024
Loan/Credit No: Annual Development Programme
Bid Reference No.: Construction of Satti Kali Dam, District Bannu ADP No. 2010 (2023-24)

1. The Directorate General Small Dams, Irrigation Department Khyber Pakhtunkhwa has received funds from the Provincial Govt: towards the cost of "Construction of Satti Kali Dam, District Bannu ADP No. 2010 (2023-24)" and it is intended that part of the proceeds of these funds will be applied to eligible payments under the contract for the Construction of Satti Kali Dam, District Bannu. Bidding is open to all qualified firms.

2. The Procuring Entity invites sealed bids from eligible firms or persons licensed by the Pakistan Engineering Council, registered / enrolled with the Procuring Entity's Department / Authority or prequalified for the respective work(s) registered/enrolled with the Procuring *Entity* Department / Authority or prequalified for the respective in the appropriate category for the Works. A foreign bidder is also entitled to bid only in a joint venture with a Pakistani constructor in accordance with the relevant provisions of PEC/KP-PPRA Bye-laws.

3. Bidders may obtain further information from, inspect at and acquire the Bidding Documents from the office of the Procuring Entity, at Plot No. 27, Street No.12, Sector E-8, Phase-VII, Hayatabad Peshawar.

4. A complete set of Bidding Documents may be purchased by an interested bidder on submission of a written application to the above office and upon payment of a non- refundable fee of Rs. *Nil.*

5. All bids must be accompanied by a Bid Security in the shape of Deposit at Call from a Scheduled Bank of Pakistan, in the amount of Rs. (2% of the estimated cost) or an equivalent amount in a freely convertible currency, and must be delivered to at or before 12:00 hours, on (12.12.2024). Bids will be opened at 12:30 PM (12.12.2024) on the same day, in the presence of bidders' representatives who choose to attend at the same address.

The NIT as published is reproduced here for ready reference.

DIRECTORATE GENERAL SMALL DAMS IRRIGATION DEPARTMENT
GOVERNMENT OF KHYBER PAKHTUNKHWA PESHAWAR
Plot # 27, Street No. 12, Sector E-8, Phase-VII, Hayatabad Peshawar
Phone No: 091-9219555, Fax No: 091-9219534, Email: smalldams1234@gmail.com

NOTICE INVITING E-BIDDING
(SINGLE STGE SINGLE ENVELOPE PROCEDURE)

Director General Small Dams Peshawar invites electronic bids in accordance with KPPRA Procurement Rules 2014 on single stage single envelope procedure for the following work, from eligible Firms/Contractors registered with PEC and Government of Khyber Pakhtunkhwa in required category.

S.No	Name of Work	E/Cost (Rs. Million)	Required Category	PEC Code	Earnest Money	Date & Time of opening
1	**ADP No. 1739/140534 (2024-25)** Construction of Sitti Kalli Dam District Bannu.					
A	**Package-1** Construction of Sitti Kalli Dam District Bannu **Sub Work:** Construction Of Spillway Stilling Basin,Retaining Wall, Road Culverts, Shoulder & Drain Of Satti Kali Dam District Bannu (Additional Works	248.195	C-03 & Above	CE-04	2% of Estimated cost	12/12/2024 (12:30 PM)
B	**Package-2** Construction of Sitti Kalli Dam District Bannu **Sub Work:** Construction of Irrigation System & its affiliated Structures i/c Electrification of Dam Embankment	168.869	C-04 & Above	CE-04	2% of Estimated cost	12/12/2024 (12:30 PM)

Last date and time for submission of Bids is **12th December 2024** at **1200 Hour**. In case Bids are not opened on the above mentioned date due to unforeseen reasons, these shall be opened on the next working day at the same place & time.

TERMS AND CONDITIONS:

1. Bid Soliciting Documents containing instructions to Bidders, Terms and conditions, packages wise work details and required forms to be filled and shall be submitted along with Bid by the bidders can be download from the official websites of Irrigation Department Khyber Pakhtunkhwa (**www.irrigation.gkp.pk**) and KPPRA (**www.kppra@gov.pk**).
2. **Eligibility Criteria For Bidders to Qualify For Bidding**: Firms which has completed minimum one Small Dam including its Irrigation Network for a Cultivable Command Area (CCA) of 600 Acres in last 10 Years shall only be eligible to apply for the above Projects. Relevant attested documents be provided with confirmation certificate from concerned department / executing agency for confirmation of eligibility.
3. Non eligible firms shall be considers as non-responsive.
4. It is very important for the bidders to note and comply that Separate set of Bid Solicitation Documents, complete in all respect shall be submitted for each package including bidding documents complete in hard copy form via courier and also scan copy of each and every bidding document and supporting material submitted in hard copy form via email: **kohatsmalldams@gmail.com** , acceptable till the closing date. The hard copy envelop will have

DIRECTORATE GENERAL SMALL DAMS IRRIGATION DEPARTMENT
GOVERNMENT OF KHYBER PAKHTUNKHWA PESHAWAR
Plot # 27, Street No. 12, Sector E-8, Phase-VII, Hayatabad Peshawar
Phone No: 091-9219555, Fax No: 091-9219534, Email: smalldams1234@gmail.com

to be neatly marked of package number on separate envelops, for which the bidders intends to apply.

5. The project is to be completed within a period of 18 months (June 2026) after issuance of Work Order and the contractor will be proceeded for punitive action and liquidated damages @ Rs. 0.05% for each day of delay in completion of the works subject to a maximum of 10% of Contract Price stated in the Letter of Acceptance.
6. All Bidders must be registered relevant taxation department and Khyber Pakhtunkhwa Revenue Authority with active status.
7. All bidders are required to submit 2% Bid Security / Earnest Money of their total quoted Bid from scheduled Bank in the name of Director General, Small Dams Peshawar along with their Bids. The Bids will be rejected by the employer as **non-responsive**, in case a bidder fails to submit **"Bid Security" CDR along with** their bids of required limits.
8. Pre-bid meeting will be held on **Dated 6-12-2024 @ 1100 Hrs.** in the Office of Director General Small Dams Peshawar. Moreover, interested bidders are also advised to visit the site.
9. Electronic Bidding shall be done on "Above / Below System" on BOQ / Engineer's estimate.
10. Any disfiguring/overwriting, manipulation in the tender shall be liable to rejection.
11. The bidder shall submit their bids on the following address mentioned below O/o The Director General Small Dam Irrigation Department Peshawar only through reliable courier Service on or before the deadline along with required documents as per details mentioned in Bid Solicitation Documents. The affixed labels of the Courier Service Provider may be authenticated for tracking before opening. Fake courier delivery shall be processed as per the law and would not be considered.
12. Venue of Bids Opening is Director General Small Dams Irrigation Department Peshawar office, Plot # 27, Street No. 12, Sector E-8, Phase-VII, Hayatabad Peshawar.

Director General Small Dams
Irrigation Department Khyber Pakhtunkhwa Peshawar.
Plot # 27, Street No. 12, Sector E-8, Phase-VII, Hayatabad Peshawar

INSTRUCTIONS TO BIDDERS

INSTRUCTIONS TO BIDDERS

(Note: These Instructions to Bidders along with Bidding Data will not be part of the Contract and will cease to have effect once the contract is signed.)

A. GENERAL

IB.1 Scope of Bid

1.1 The Procuring Entity as defined in the Bidding Data hereinafter called "the Procuring Entity" invites bids for the construction and completion of works as described in these Bidding Documents, and summarized in the Bidding Data hereinafter referred to as the "Works".

1.2 The successful bidder will be expected to complete the Works within the time specified in Appendix-A to Bid.

1.3 Throughout these bidding documents, the terms 'bid' and 'tender' and their derivatives (bidder / tenderer, bid / tender, bidding / tendering etc.) are synonymous.

IB.2 Source of Funds

2.1 The expenditure on this project will be met from the Public Funds of the Provincial Government of Khyber Pakhtunkhwa (GoKP), as defined in Rule-2(l) of KPPRA Procurement Rules or through a loan/credit from the source (s) as indicated in the Bidding Data in various currencies towards the cost of the Project specified in the Bidding Data and it is intended that part of these Public Funds or proceeds of this loan/credit will be applied to eligible payments under the Contract for which these Bidding Documents are issued.

IB.3 Eligible Bidders (All conditions for eligibility mentioned in NIT is mandatory and will be applicable)

3.1 This Invitation for Bids is open to all bidders meeting the following requirements:

a. Duly licensed by the Pakistan Engineering Council (PEC) in the category relevant to the value of the Works or as mentioned in the NIT.

b. Duly prequalified / enlisted with the Procuring Entity in the category relevant to the value of the Works or as mentioned in the NIT.

c. Is neither associated, nor has been associated, directly or indirectly, with the Consultants or any other entity that has prepared the design, specifications and other documents for the Project or being proposed for any position in the Project Management.

3.2 A bidder having a conflict of interest will be declared as non-responsive if the bidder has a close business relationship with the Procuring Entity's professional personnel, who directly or indirectly involved in any part of: (i) the preparation of the bidding documents for the Works, (ii) the Bid evaluation or (iii) the supervision of such Works.

IB.4 One Bid per Bidder

4.1 Each bidder shall submit only one bid either by himself, or as a partner in a joint venture. A bidder who submits or participates in more than one bid (other than alternatives pursuant to Clause IB.16) will be disqualified.

IB.5 Cost of Bidding

5.1 The bidders shall bear all costs associated with the preparation and submission of their respective bids and the Procuring Entity will in no case be responsible or liable for those costs, regardless of the conduct or outcome of the bidding process.

IB.6 Site Visit

6.1 The bidders are advised to visit and examine the site of Works and its surroundings and obtain for themselves on their own responsibility all information that may be necessary for preparing the bid and entering into a contract for construction of the Works. All cost in this respect shall be at the bidder's own expense.

6.2 The bidders and any of their personnel or agents will be granted permission by the Procuring Entity to enter upon his premises and lands for the purpose of such inspection, but only upon the express condition that the bidders, their personnel and agents, will release and indemnify the Procuring Entity, his personnel and agents from and against all liability in respect thereof and will be responsible for death or personal injury, loss of or damage to property and any other loss, damage, costs and expenses incurred as a result of such inspection.

B. BIDDING DOCUMENTS

IB.7 Contents of Bidding Documents

7.1 The Bidding Documents, in addition to invitation for bids, are those stated below and should be read in conjunction with any Addenda issued in accordance with Clause IB.9.

1. Instructions to Bidders.
2. Bidding Data.
3. General Conditions of Contract, Part-I (GCC).
4. Particular Conditions of Contract, Part-II (PCC).
5. Specifications – Special Provisions.
6. Specifications - Technical Provisions.
7. Form of Bid & Appendices to Bid.
8. Bill of Quantities (Appendix-D to Bid).
9. Form of Bid Security.
10. Form of Contract Agreement.
11. Forms of Performance Security and Mobilization Advance Guarantee/Bond.
12. Drawings.

7.2 The bidders are expected to examine carefully the contents of all the above documents. Failure to comply with the requirements of bid submission will be at the Bidders own risk. Pursuant to Clause IB.26, bids which are not substantially responsive to the requirements of the Bidding Documents will be rejected.

IB.8 Clarification of Bidding Documents

8.1 Any prospective bidder requiring any clarification (s) in respect of the Bidding Documents may notify the Procuring Entity in writing at the Procuring Entity's address indicated in the Invitation for Bids. The Procuring Entity will respond to any request for clarification which he receives earlier than 28 days prior to the deadline for submission of bids.

Copies of the Procuring Entities response will be forwarded to all purchasers of the Bidding Documents, including a description of the enquiry but without identifying it's source.

IB.9 Amendment of Bidding Documents

9.1 At any time prior to the deadline for submission of bids, the Procuring Entity may, for any reason, whether at his own initiative or in response to a clarification requested by a prospective bidder, modify the Bidding Documents by issuing addendum.

9.2 Any addendum thus issued shall be part of the Bidding Documents pursuant to Sub- Clause 7.1 hereof and shall be communicated in writing to all purchasers of the Bidding Documents. Prospective bidders shall acknowledge receipt of each addendum in writing to the Procuring Entity.

9.3 To afford prospective bidders reasonable time in which to take an addendum into account in preparing their bids, the Procuring Entity may extend the deadline for submission of bids in accordance with Clause

C. PREPARATION OF

BIDS IB.10 Language of Bid

10.1 The bid and all correspondence and documents related to the bid exchanged by a bidder and the Procuring Entity shall be in the bid language stipulated in the Bidding Data and Particular Conditions of Contract. Supporting documents and printed literature furnished by the bidders may be in any other language provided the same are accompanied by an accurate translation of the relevant parts in the bid language, in which case, for purposes of evaluation of the bid, the translation in bid language shall prevail.

IB.11 Documents Accompanying the Bid

11.1 Each bidder shall:

(a) submit a written power of attorney authorizing the signatory of the bid to act for and on behalf of the bidder;

(b) update the information indicated and listed in the Bidding Data and previously submitted with the application for prequalification, and continue to meet the minimum criteria set out in the prequalification documents which as a minimum, would include the following:

(i) Evidence of access to financial resources along with average annual construction turnover;
(ii) Financial predictions for the current year and the two following years including the effect of known commitments;
(iii) Work commitments since prequalification;
(iv) Current litigation information; and
(v) Availability of critical equipment. and

(c) furnish a technical proposal taking into account the various Appendices to Bid specially the following:

Appendix-E to Bid Proposed Construction Schedule Appendix-F to Bid Method of Performing the Work Appendix-G to Bid List of Major Equipment Appendix-K to Bid Organization Chart for Supervisory Staff
and other pertinent information such as mobilization program etc;

11.2 Bids submitted by a joint venture of two (2) or more firms shall comply with the following requirements:

(a) the bid and in case of a successful bid, the Form of Contract Agreement shall be signed so as to be legally binding on all partners;
(b) one of the joint venture partners shall be nominated as being in charge; and this authorization shall be evidenced by submitting a power of attorney signed by legally authorized signatories of all the joint venture partners;
(c) the partner-in-charge shall always be duly authorized to deal with the Procuring Entity regarding all matters related with and/or incidental to the

execution of Works as per the terms and Conditions of Contract and in this regard to incur any and all liabilities, receive instructions, give binding undertakings and receive payments on behalf of the joint venture;

(d) all partners of the joint venture shall at all times and under all circumstances be liable jointly and severally for the execution of the Contract in accordance with the Contract terms and a statement to this effect shall be included in the authorization mentioned under Sub-Para(b) above as well as in the Form of Bid and in the Form of Contract Agreement (in case of a successful bid); and

(e) a copy of the agreement entered into by the joint venture partners shall be submitted with the bid stating the conditions under which it will function, its period of duration, the persons authorized to represent and obligate it and which persons will be directly responsible for due performance of the Contract and can give valid receipts on behalf of the joint venture, the proportionate participation of the several firms forming the joint venture, and any other information necessary to permit a full appraisal of its functioning. No amendments / modifications whatsoever in the joint venture agreement shall be agreed to between the joint venture partner without prior written consent of the Procuring Entity.

11.3 Bidders shall also submit proposals of work methods and schedule, in sufficient detail to demonstrate the adequacy of the Bidders' proposals to meet the technical specifications and the completion time referred to in Sub-Clause 1.2 hereof.

IB.12 Bid Prices

12.1 Unless stated otherwise in the Bidding Documents, the Contract shall be for the whole of the Works as described in Sub-Clause 1.1 hereof, based on the unit rates and / or prices submitted by the bidder.

12.2 The bidders shall fill in rates and prices for all items of the Works described in the Bill of Quantities. Unit rate offered for an item shall be considered upto two significant decimals places for evaluation purposes. Items against which no rate or price is entered by a bidder will not be paid for by the Procuring Entity when executed and shall be deemed covered by rates and prices for other items in the Bill of Quantities. Corrections in rates and prices, if any, shall be made by crossing out, initialing, dating and re-writing.

12.3 All duties, taxes and other levies payable by the Contractor under the Contract, or for any other cause, as on the date 28 days prior to the deadline for submission of bids shall be included in the rates and prices and the total Bid Price submitted by a bidder.

Additional / reduced duties, taxes and levies due to subsequent additions or changes in legislation shall be reimbursed / deducted as per Sub-Clause 70.2 of the General Conditions of Contract Part-I.

12.4 The rates and prices quoted by the bidders are subject to adjustment during the performance of the Contract in accordance with the provisions of Clause 70 of the Conditions of Contract. The Procuring Entity shall furnish the prescribed information for the price adjustment formulae in Appendix-C to Bid, and shall submit with their bids such other supporting information as required under the said Clause.

IB.13 Currencies of Bid and Payment

13.1 The unit rates and the prices shall be quoted by the bidder entirely in Pak rupees. A bidder expecting to incur expenditures in other currencies for inputs to the Works supplied from outside the Procuring Entity's country (referred to as the "Foreign Currency Requirements") shall indicate the same in Appendix-B to Bid. The proportion of the Bid Price (excluding Provisional Sums) needed by him for the payment of such Foreign Currency Requirements either (i) entirely in the currency of the Bidder's home country or, (ii) at the bidder's option, entirely in Pak rupees provided always that a bidder expecting to incur expenditures in a currency or currencies other than those stated in (i) and (ii) above for a portion of the foreign currency requirements, and wishing to be paid accordingly, shall indicate the respective portions in his bid.

13.2 The rates of exchange to be used by the bidder for currency conversion shall be the TT&OD Selling Rates published or authorized by the State Bank of Pakistan prevailing on the date 28 days prior to the deadline for submission of bids.

For the purpose of payments, the exchange rates used in bid preparation shall apply for the duration of the Contract.

IB.14 Bid Validity

14.1 Bids shall remain valid for the period stipulated in the Bidding Data after the Date of Bid Opening specified in Clause IB.23.

14.2 In exceptional circumstances, prior to expiry of the original bid validity period, the Procuring Entity may request that the bidders extend the period of validity for a specified additional period which shall in no case be more than the original bid validity period. The request and the responses thereto shall be made in writing. A bidder may refuse the request without forfeiting his Bid Security. A bidder agreeing to the request will not be required or permitted to modify his bid, but will be required to extend the validity of his Bid Security for the period of the extension, and in compliance with Clause IB.15 in all respects. The bidder shall bear all costs to be incurred on such extensions.

IB.15 Bid Security

15.1 Each bidder shall furnish, as part of his bid, a Bid Security in the amount stipulated in the Bidding Data in Pak Rupees or an equivalent amount in a freely convertible currency. [The bid security shall be submitted from the account of the firm/bidder/contractor who submits the bid][2]

15.2 The Bid Security shall be, at the option of the bidder, in the form of Deposit at Call or a Bank Guarantee issued by a Scheduled Bank in Pakistan or from a foreign bank duly counter guaranteed by a Scheduled Bank in Pakistan in favour of the Procuring Entity valid for a period 28 days beyond the Bid Validity date.

15.3 Any bid not accompanied by an acceptable Bid Security shall be rejected by the Procuring Entity as non-responsive.

15.4 The bid securities of unsuccessful bidders will be returned as promptly as possible, but not later than 28 days after the expiration of the period of Bid Validity.

15.5 ["The bid security of the successful bidder be retained with the Procuring Entity till completion of the defect liability period and the amount of guarantee will be reduced by an equivalent amount".][3]

15.6 The Bid Security may be forfeited:

(a) if the bidder withdraws his bid except as provided in Sub-Clause 22.1;

(b) if the bidder does not accept the correction of his Bid Price pursuant to Sub-Clause 27.2 hereof; or

(c) In the case of successful bidder, if he fails within the specified time limit to:

(i) furnish the required Performance Security; or
(ii) sign the Contract Agreement.

IB.16 Alternate Proposals by Bidder

16.1 Should any bidder consider that he can offer any advantages to the Procuring Entity by a modification to the designs, specifications or other conditions, he may, in addition to his bid to be submitted in strict compliance with the Bidding Documents, submit any Alternate Proposal(s) containing (a) relevant design calculations; (b)technical specifications; (c)proposed construction methodology; and (d) any other relevant details / conditions, provided always that the total sum entered on the Form of Bid shall be that which represents complete compliance with the Bidding Documents.

16.2 Alternate Proposal(s), if any, of the lowest evaluated responsive bidder only may be considered by the Procuring Entity as the basis for the award of Contract to such bidder.

IB.17 Pre-Bid Meeting (As per NIT)

17.1 The Procuring Entity may, on his own motion or at the request of any prospective bidder(s), hold a pre-bid meeting to clarify issues and to

answer any questions on matters related to the Bidding Documents or any other matter that may be raised at that stage. The date, time and venue of pre- bid meeting, if convened, is as stipulated in the Bidding Data. All prospective bidders or their authorized representatives shall be invited to attend such a pre- bid meeting.

17.2 The bidders are requested to submit questions, if any, in writing so as to reach the Procuring Entity not later than seven (7) days before the proposed pre-bid meeting.

17.3 Minutes of the pre-bid meeting, including the text of the questions raised and the replies given, will be transmitted without delay to all purchasers of the Bidding Documents. Any modification of the Bidding Documents listed in Sub-Clause 7.1 hereof which may become necessary as a result of the pre-bid meeting shall be made by the Procuring Entity exclusively through the issue of an Addendum pursuant to Clause IB.9 and not through the minutes of the pre- bid meeting.

17.4 Absence at the pre-bid meeting will not be a cause for disqualification of a bidder.

IB.18 Format and Signing of Bid

18.1 Bidders are particularly directed that the amount entered on the Form of Bid shall be for performing the Contract strictly in accordance with the Bidding Documents.

18.2 All appendices to Bid are to be properly completed and signed.

18.3 No alteration is to be made in the Form of Bid nor in the Appendices thereto except in filling up the blanks as directed. If any such alterations be made or if these instructions be not fully complied with, the bid may be rejected.

18.4 Each bidder shall prepare by filling out the forms completely and without alterations one (1) original and number of copies, specified in the Bidding Data, of the documents comprising the bid as described in Clause IB.7 and clearly mark them “ORIGINAL” and “COPY” as appropriate. In the event of discrepancy between them, the original shall prevail.

18.5 The original and all copies of the bid shall be typed or written in indelible ink (in the case of copies, photostats are also acceptable) and shall be signed by a person or persons duly authorized to sign on behalf of the bidder pursuant to Sub- Clause 11.1(a) hereof. All pages of the bid shall be initialed and stamped by the person or persons signing the bid.

18.6 The bid shall contain no alterations, omissions or additions, except to comply with instructions issued by the Procuring Entity, or as are necessary to correct errors made by the bidder, in which case such corrections shall be initialed by the person or persons signing the bid.

18.7 Bidders shall indicate in the space provided in the Form of Bid their full and proper addresses at which notices may be legally served on them and to which all correspondence in connection with their bids and the Contract is to be sent.

18.8 Bidders should retain a copy of the Bidding Documents as their file copy.

18.9 All the bidding data submitted in hard copy will also have to be submitted in soft scan copy on email mentioned in the NIT kohatsmalldams@gmail.com

D. SUBMISSION OF BIDS

IB.19 Sealing and Marking of Bids

19.1 Each bidder shall submit his bid as under:

(a) ORIGINAL and each copy of the Bid shall be separately sealed and put in separate envelopes and marked as such.

(b) The envelopes containing the ORIGINAL and copies will be put in one sealed envelope and addressed / identified as given in Sub-Clause 19.2 hereof.

19.2 The inner and outer envelopes shall:

(a) be addressed to the Procuring Entity at the address provided in the Bidding data;

(b) bear the name and identification number of the contract as defined in the Bidding Data; and

(c) provide a warning not to open before the time and date for bid opening, as specified in the Bidding Data.

19.3 In addition to the identification required in Sub- Clause 19.2 hereof, the inner envelope shall indicate the name and address of the bidder to enable the bid to be returned unopened in case it is declared "late" pursuant to Clause IB.21

19.4 If the outer envelope is not sealed and marked as above, the Procuring Entity will assume no responsibility for the misplacement or premature opening of the Bid.

IB.20 Deadline for Submission of Bids (As per NIT)

20.1 (a) Complete Bids must be received by the Procuring Entity at the address specified no later than the time and date stipulated in the Bidding Data. In the event of the specified date for the submission of bids declared a holiday for the Procuring Entity, the Bids will be received up to the appointed time on the next working day.

(b) Bids with charges payable will not be accepted, nor will arrangements be undertaken to collect the bids from any delivery point other than that specified above. Bidders shall bear all expenses incurred in the preparation and delivery of bids. No claims will be entertained for refund of such expenses.

(c) Where delivery of a bid is by mail and the bidder wishes to receive an acknowledgment of receipt of such bid, he shall make a request for such acknowledgment in a separate letter attached to but not included in the sealed bid package.

(d) Upon request, acknowledgment of receipt of bids will be provided to those making delivery in person or by messenger.

20.2 The Procuring Entity may, at his discretion, extend the deadline for submission of bids by issuing an amendment in accordance with Clause IB.9, in which case all rights and obligations of the Procuring Entity and the bidders previously subject to the original deadline will thereafter be subject to the deadline as extended.

IB.21 Late Bids

21.1 (a) Any bid received by the Procuring Entity after the deadline for submission of bids prescribed in Clause IB.20 will be returned (17 unopened to such bidder.

(b) Delays in the mail, delays of person in transit, or delivery of a bid to the wrong office or due to any other reason, shall not be accepted as an excuse for failure to deliver a bid at the proper place and time. It shall be the bidder's responsibility to determine the manner in which timely delivery of his bid will be accomplished either in person, by messenger or by mail.

IB.22 Modification, Substitution and Withdrawal of Bids

22.1 Any bidder may modify**,** substitute or withdraw his bid after bid submission provided that the modification, substitution or written notice of withdrawal is received by the Procuring Entity prior to the deadline or the extended deadline pursuant to clause IB.20.2, for submission of bids.

22.2 The modification, substitution or notice for withdrawal of any bid shall be prepared, sealed, marked and delivered in accordance with the provisions of Clause IB.19 with the outer and inner envelopes additionally marked "MODIFICATION", "SUBSTITUTION" or "WITHDRAWAL" as appropriate.

22.3 No bid may be modified by a bidder after the deadline for submission of bids except in accordance with Sub-Clauses 22.1 and 27.2.

22.4 Withdrawal of a bid during the interval between the deadline for submission of bids and the expiration of the period of bid validity specified in the Form of Bid may result in forfeiture of the Bid Security in pursuance to Clause IB.15.

E. BID OPENING AND EVALUATION

IB.23 Bid Opening

23.1 The Procuring Entity will open all the bids received (except those received late), including withdrawals, substitution and modifications made pursuant to Clause IB.22, in the presence of bidders' or their representatives who choose to attend, at the time, date and location stipulated in the Bidding Data. In the event of the specified date for the opening of bids being declared a holiday for the Procuring Entity, the Bids will be opened at the appointed time and location on the next working day. The bidders' representatives who are present shall sign a register evidencing their attendance.

23.2 Envelopes marked "MODIFICATION", "SUBSTITUTION" or "WITHDRAWAL" shall be opened and read out first. Bids for which an acceptable notice of withdrawal has been submitted pursuant to Clause IB.22 shall not be opened.

23.3 The bidder's name, total Bid Price and price of any Alternate Proposal(s), any discounts, bid modifications, substitution and withdrawals, the presence or absence of Bid Security and such other details as the Procuring Entity may consider appropriate, will be announced by the Procuring Entity at the opening of bids.

23.4 Procuring Entity shall prepare minutes of the bid opening including the information disclosed to those present in accordance with the Sub-Clause 23.3.

IB.24 Process to be Confidential

24.1 Information relating to the examination, clarification, evaluation and comparison of bid and recommendations for the award of a contract shall not be disclosed to bidders or any other person not officially concerned with such process before the announcement of the final result of the bid evaluation which shall be done at least ten (10) days prior to issue of Letter of Acceptance and place the same on its and Authority's Website (KP-PPRA Rule-45). The announcement to all Bidders will include table(s) comprising read out prices, discounted prices, price adjustments made, final evaluated prices and recommendations against all the bids evaluated. Any effort by a bidder to influence the Procuring Entity's processing of bids or award decisions may result in the rejection of such bidder's bid. Whereas any bidder feeling aggrieved may lodge a written complaint not later than ten (10) days after the announcement of the bid evaluation report; however mere fact of lodging a complaint shall not warrant suspension of the procurement process.

IB.25 Clarification of Bids

25.1 To assist in the examination, evaluation and comparison of bids, the Procuring Entity may, at his discretion, ask any bidder for clarification of his bid, including breakdowns of unit rates. The request for clarification and the response shall be in writing but no change in the price or substance of the bid shall be sought, offered or permitted except as required to confirm the correction of arithmetic errors discovered by the Procuring Entity in the evaluation of the bids in accordance with Clause IB.28.

IB.26 Examination of Bids and Determination of Responsiveness

26.1 Prior to the detailed evaluation of bids, the Procuring Entity will determine whether each bid is substantially responsive to the requirements of the Bidding Documents.

26.2 A substantially responsive bid is one which (i) meets the eligibility criteria; (ii) has been properly signed; (iii) is accompanied by the required Bid Security and (iv) conforms to all the terms, conditions and specifications of the Bidding Documents, without material deviation or reservation. A material deviation or reservation is one (i) which affect in any substantial way the
scope, quality or performance of the Works; (ii) which limits in any substantial way, inconsistent with the Bidding Documents, the Procuring Entity's rights or the bidder's obligations under the Contract; or (iii) adoption/rectification whereof would affect unfairly the competitive position f other bidders presenting substantially responsive bids.

26.3 If a bid is not substantially responsive, it will be rejected by the Procuring Entity and may not subsequently be made responsive by correction or withdrawal of the non-conforming deviation or reservation.

IB.27 Correction of Errors

27.1 Bids determined to be substantially responsive will be checked by the Procuring Entity for any arithmetic errors. Errors will be corrected by the Procuring Entity as follows:

(a) where there is a discrepancy between the amounts in figures and in words, the amount in words will govern and

(b) where there is a discrepancy between the unit rate and the line item total resulting from multiplying the unit rate by the quantity, the unit rate as quoted will govern, unless in the opinion of the Procuring Entity there is an obviously gross misplacement of the decimal point in the unit rate, in which case the line item total as quoted will govern and the unit rate will be corrected.

27.2 The amount stated in the Form of Bid will be adjusted by the Procuring Entity in accordance with the above procedure for the correction of errors and with the concurrence of the bidder, shall be considered as binding upon the bidder. If the bidder does not accept the corrected bid price, his bid will be rejected and the Bid Security shall be forfeited in accordance with Sub-Clause 15.6(b) hereof.

IB.28 Evaluation and Comparison of Bids

28.1 The Procuring Entity will evaluate and compare only the bids determined to be substantially responsive in accordance with Clause IB.26.

28.2 In evaluating the bids, the Procuring Entity will determine for each bid the evaluated Bid Price by adjusting the Bid Price as follows:

(a) making any correction for errors pursuant to Clause IB.27;
(b) excluding Provisional Sums and the provision, if any, for contingencies in the Summary Bill of Quantities, but including competitively priced Day work; and
(c) making an appropriate adjustment for any other acceptable variation or deviation, including discounts or other price modification in the bids.

28.3 The estimated effect of the price adjustment provisions of the Conditions of Contract, applied over the period of execution of the Contract, shall not be taken into account in Bid evaluation.

28.4 If the Bid of the successful bidder is seriously unbalanced in relation to the Procuring Entity's estimate of the cost of work to be performed under the Contract, the Procuring Entity may require the bidder to produce detailed price analyses for any or all items of the Bill of Quantities to demonstrate the internal consistency of those prices with the construction methods and schedule proposed. After evaluation of the price analyses, the Procuring Entity may require that the amount of the Performance Security set forth in Clause IB.32 be increased at the expense of the successful bidder to a level sufficient to protect the Procuring Entity against financial loss in the event of default of the successful bidder under the Contract.

F. AWARD OF CONTRACT

IB.29 Award

29.1 Subject to Clauses IB.30 and IB.34, the Procuring Entity will award the Contract to the bidder whose bid has been determined to be substantially responsive to the Bidding Documents and who has offered the lowest evaluated Bid Price**,** provided that such bidder has been determined to be eligible in accordance with the provisions of Clause IB.3 and qualify pursuant to Sub-Clause IB 29.2.

29.2 The Procuring Entity, at any stage of the bid evaluation, having credible reasons for or *prima facie* evidence of any defect in supplier's or contractor's capacities, may require the suppliers or contractors to provide information concerning their professional, technical, financial, legal or managerial competence whether already pre-qualified or not:

Provided that such qualification shall only be laid down after recording reasons therefore in writing. They shall form part of the records of that bid evaluation report.

IB.30 Procuring Entity's Right to Accept any Bid and to Reject any or all Bids

30.1 Notwithstanding Clause IB.29, the Procuring Entity reserves the right to accept or reject any Bid, and to annul the bidding process and reject all bids, at any time prior to award of Contract, without thereby incurring any liability to the affected bidders or any obligation except that the grounds for rejection of all bids shall upon request be communicated to any bidder who submitted a bid, without justification of grounds. Rejection of all bids shall be notified to all bidders promptly.

IB.31 Notification of Award

31.1 Prior to expiration of the period of bid validity prescribed by the Procuring Entity, the Procuring Entity will notify the successful bidder in writing ("Letter of Acceptance") that his Bid has been accepted. This letter shall name the sum which the Procuring Entity will pay the Contractor in consideration of the execution and completion of the Works by the Contractor as prescribed by the Contract (hereinafter and in the Conditions of Contract called the "Contract Price").

31.2 No Negotiation with the bidder having evaluated as lowest responsive or any other bidder shall be permitted, however, Procuring Entity may have clarification meetings to get clarify any item in the bid evaluation report.

31.3 The notification of award and its acceptance by the bidder will constitute the formation of the Contract, binding the Procuring Entity and the bidder till signing of the formal Contract Agreement.

31.3 Upon furnishing by the successful bidder of a Performance Security, the Procuring Entity will promptly notify the other bidders that their Bids have been unsuccessful and return their bid securities.

IB.32 Performance Security (As per KPPRA Act / Rules modified from time to time)

32.1 The successful bidder will furnish to the Procuring Entity a Performance Security in the form and the amount stipulated in the Bidding Data and the Conditions of Contract plus additional security for unbalanced bids in accordance with Clause IB.28.4 within a period of 28 days after the receipt of Letter of Acceptance.

32.2 Failure of the successful bidder to comply with the requirements of Sub-Clause IB.32.1 or Clauses IB.33 or IB.35 shall constitute sufficient grounds for the annulment of the award and forfeiture of the Bid Security.

IB.33 Signing of Contract Agreement

33.1 Within 14 days from the date of furnishing of acceptable Performance Security under the Conditions of Contract, the Procuring Entity will send the successful bidder the Contract Agreement in the form provided in the Bidding Documents, incorporating all agreements between the parties.

33.2 The formal Agreement between the Procuring Entity and the successful bidder shall be executed within 14 days of the receipt of the Contract Agreement by the successful bidder from the Procuring Entity.

IB.34 General Performance of the Bidders

The Procuring Entity reserves the right to obtain information regarding performance of the bidders on their previously awarded contracts/works. The Procuring Entity may in case of consistent poor performance of any Bidder as reported by the Procuring Entity's of the previously awarded contracts, inter alia, reject his bid and/or refer the case to the Pakistan Engineering Council (PEC) and KPPRA. Upon such reference, PEC / K P P R A in accordance with its rules, procedures and relevant laws of the land take such action as may be deemed appropriate under the circumstances of the case including black listing of such Bidder and debarring him from participation in future bidding for similar works.

IB.35 Integrity Pact

The Bidder shall sign and stamp the Integrity Pact provided at Appendix-L to Bid in the Bidding Documents for all procurement contracts exceeding Rupees ten million. Failure to provide such Integrity Pact shall make the bidder non-responsive.

IB.36 Instructions not Part of Contract

Bids shall be prepared and submitted in accordance with these Instructions which are provided to assist bidders in preparing their bids, and do not constitute part of the Bid or the Contract Documents.

BIDDING DATA

BD-1
[NOTES ON BIDDING DATA

This Section is intended to assist the Procuring Entity in providing the specific information in relation to corresponding clauses in Instructions to Bidders (IB) and should be prepared to suit each individual contract.

The Procuring Entity should provide in the Bidding Data information and requirements specific to the circumstances of the Procuring Entity, the processing of the Bid, the applicable rules regarding Bid Price and currency, and the Bid evaluation criteria that will apply to the Bids. In preparing this section, the following aspects should be checked:

(a) Information that specifies and complements the provisions of section; Instruction to Bidders must be incorporated.

(b) Amendments and/or supplements, if any, to the provisions of Instructions to Bidders, necessitated by the circumstances of each individual contract, can be introduced only in this section since Instructions to Bidders will remain unchanged.

Bidding Data

The following specific data for the Works to be bid shall complement, amend, or supplement the provisions in the Instructions to Bidders. Wherever there is a conflict, the provisions herein shall prevail over those in the Instructions to Bidders.

[Instructions are provided, as needed, in italics.]

Instructions to Bidders Clause Reference	
1.1	**Name and address of the Procuring Entity:** Directorate General Small Dams, Irrigation Department Khyber Pakhtunkhwa Plot No. 27, Street No.12, Sector E-8, Phase-VII, Hayatabad Peshawar
1.1	Name of the Project & Summary of the Works: Construction of Satti Kali Dam, District Bannu ADP No. 2010 (2023-24) Package-II: **CONSTRUCTION OF IRRIGATION SYSTEM, & ITS AFFILIATED STRUCTURES I/C ELECTRIFICATON OF DAM EMBANKMENT OF SATTI KALI DAM DISTRICT BANNU (BALANCE WORKS)**
2.1	Name of the Borrower/Source of Financing/Funding Agency: *Annual Development Programme – ADP (2023-24), Khyber Pakhtunkhwa*
8.1	Time limit for clarification: *[Till Bids closing date as per NIT]*
10.1	Bid language: *[English]*
11.1	(b) Prequalification Information to be updated: (N/A) *[As per NIT]*
11.1(c)	Furnish Technical Proposal: (Requirements as mentioned in NIT be fulfilled) The bidder to submit a technical proposal in sufficient detail to demonstrate the adequacy of the bid in meeting requirements for timely completion of the Works.

13.1 Bidders to quote entirely in Pak. rupees but specify the percentages of foreign currency they require.

14.1 Period of Bid Validity:

[90 days]

15.1 Amount of Bid Security:
2% of the estimated cost.

17.1 Venue, time, and date of the pre-Bid meeting:

Time: 11:00 AM Dated: 06.12.2024
Address: Directorate General Small Dams, Irrigation Department Khyber Pakhtunkhwa
Plot No. 27, Street No.12, Sector E-8, Phase-VII, Hayatabad Peshawar

18.4 Number of copies of the Bid to be completed and returned: (One original and scan copy emailed) *[As per NIT]*

19.2(a) Procuring Entity's address for the purpose of Bid submission:

[As per NIT]

19.2(b) Name and Number of the Contract:

Construction of Satti Kali Dam, District Bannu ADP No. 2010 (2023-24)

Package-II: **CONSTRUCTION OF IRRIGATION SYSTEM, & ITS AFFILIATED STRUCTURES I/C ELECTRIFICATON OF DAM EMBANKMENT OF SATTI KALI DAM DISTRICT BANNU (BALANCE WORKS)**

20.1(a) Deadline for submission of bids: As per NIT

[12:00 Hours Dated: 12.12.2024]

23.1 Venue, time, and date of Bid opening:

Time: 12:30 PM Dated: 12.12.2024
Address: Directorate General Small Dams, Irrigation Department Khyber Pakhtunkhwa
Plot No. 27, Street No.12, Sector E-8, Phase-VII, Hayatabad Peshawar*] .*

32.1 Standard form and amount of Performance Security acceptable to the Procuring Entity:

The contractor shall provide performance security to the Procuring Entity on the prescribed Form. The said security shall be furnished or caused to be furnished by the contractor within 28 days after the receipt of the letter of Acceptance. The performance security shall be of an amount equal to 10 percent of the Contract Price stated in the letter of Acceptance. Such Security shall be in the Form of Bank Guarantee from any schedule Bank of Pakistan.

FORM OF BID
AND
APPENDICES TO BID

FB-1

FORM OF BID

Bid Reference No. _____

(Name of Contract/Works)

To:

_____

_____

_____

Gentleman,

1. Having examined the Bidding Documents including Instructions to Bidders, Bidding Data, Conditions of Contract. Specifications, Drawings and Bill of Quantities and Addenda Nos.---------- for the execution of the above-named Works, we, the undersigned, offer to execute and complete such Works and remedy any defects therein in conformity with the Conditions of Contract. Specifications, Drawings, Bill of Quantities and Addenda for the sum of Rs. _____ (Rupees _____) or such other sum as may be ascertained in accordance with the said conditions.

2. We understand that all the Appendices attached hereto form part of this Bid.

3. As security for due performance of the undertakings and obligations of this Bid, we submit herewith a Bid Security in the amount of Rupees ---------- ---------- Rs.----------drawn in your favour or made payable to you and valid for a period of ------days beginning from the date Bids are opened.

4. We undertake, if our Bid is accepted, to commence the Works and to complete the whole of the Works comprised in the Contract within the time stated in Appendix-A to Bid.

5. We agree to abide by this Bid for the period of --------days from the date fixed for receiving the same and it shall remain binding upon us and may be accepted at any time before the expiration of that period.

6. Unless and until a formal Agreement is prepared and executed, this Bid, together with your written acceptance thereof, shall constitute a binding contract between us.

7. We do hereby declare that the Bid is made without any collusion, comparison of figures or arrangement with any other bidder for the Works.

8. We understand that you are not bound to accept the lowest or any Bid you may receive.

Dated this _____day of_____20_____

Signature: _____

in the capacity of _____duly authorized to sign Bids for and on behalf of

_____
(Name of Bidder in Block Capitals)
(Seal)

Address:_____
_____
_____

Witness:

Signature: _____
Name: _____
Address. _____
_____
Occupation_____

SPECIAL STIPULATIONS

Clause	Conditions of Contract		
1.	Engineer's Authority to issue Variation in emergency	2.1	2% of the Contract Price as stated in the Letter of Acceptance.
2.	Amount of Performance Security	10.1	10% of Contract Price as stated in the Letter of Acceptance or prevailing as KPPRA notification.
3.	Time for Furnishing Programme	14.1	Within 30 days from the date of receipt of Letter of Acceptance.
4.	Minimum amount of Third-Party Insurance	23.2	Rs. 1.0 million per occurrence with number of occurrences unlimited.
5.	Time for Commencement	41.1	Within 14 days from the date of receipt of Engineer's Notice to Commence which shall be issued within fourteen (14) days after signing of Contract Agreement.
6.	Time for Completion	43.1, 48.2	18 months extendable
7.	Amount of Liquidated Damages	47.1	Rs. 0.05 % of the Contract price for each day of delay in completion of the Works subject to a maximum of 10% of Contract Price stated in the Letter of Acceptance.
8.	Defects Liability Period	49.1	365 days from the effective date of Taking Over Certificate.
9.	Percentage of Retention Money	60.2	10% of the amount of Interim Payment Certificate.
10.	Limit of Retention Money	60.2	5% of the Contract Price as stated in the Letter of Acceptance.
11.	Minimum amount of Interim Payment Certificates (Running Bills)	60.2	Rs. 5,000,000. (Five Million)
12	Time of Payment from delivery of Engineer's Interim Payment Certificate to the Procuring Entity / Employer.	60.10	30 days, subject to availability of funds, work done or any other unavoidable hindrance.
13	Mobilization Advance (Interest Free)	60.12	10% of Contract Price as stated in the Letter of Acceptance in two instalments.

FOREIGN CURRENCY REQUIREMENTS

NOT APPLICABLE

BC-1
Appendix-C To Bid

PRICE ADJUSTMENT UNDER CLAUSE 70 OF CONDITIONS OF CONTRACT

The source of indices and the weightages or coefficients for use in the adjustment formula under Clause 70 shall be as follows:

(To be filled by the Procuring Entity)

Cost Element	Description	Weightages	Applicable index
1	**2**	**3**	**4**
(i)	Fixed Portion	0.25	
(ii)	Local Labour (Skilled & Unskilled*) With unskilled as representative items.*	0.15	Government of Pakistan (GoP) Federal Bureau of Statistics (FBS) Monthly Statistical Bulletin.
(iii)	Cement – in bags.	0.25	" " "
(iv)	Reinforcing Steel - in tons.	0.15	" " "
(v)	High Speed Diesel (HSD) – in Liter	0.20	Fixed by OGRA
	Total	**1.00**	

Notes:

1) Indices for "(ii)" to "(vii)" are taken from the Government of Pakistan Federal Bureau of Statistics, Monthly Statistical Bulletin. The base cost indices or prices shall be those applying 28 days prior to the latest day for submission of bids. Current indices or prices shall be those applying 28 days prior to the last day of the billing period.

2) Any fluctuation in the indices or prices of materials other than those given above shall not be subject to adjustment of the Contract Price.

3) Fixed portion shown here is for typical road project, Procuring Entity to determine the weightage of Fixed Portion considering only those cost elements having cost impact of seven (7) percent or more on his specific project.

BD-1

Appendix-D to Bid

BILL OF QUANTITIES

A. Preamble

1. The Bill of Quantities shall be read in conjunction with the Conditions of Contract, Specifications and Drawings.

2. The quantities given in the Bill of Quantities are estimated and provisional, and are given to provide a common basis for bidding. The basis of payment will be the actual quantities of work executed and measured by the Contractor and verified by the Engineer and valued at the rates and prices entered in the priced Bill of Quantities, where applicable, and otherwise at such rates and prices as the Engineer may fix as per the Contract.

3. The rates and prices entered in the priced Bill of Quantities shall, except insofar as it is otherwise provided under the Contract include all costs of Contractor's plant, labour, supervision, materials, execution, insurance, profit, taxes and duties, together
with
all general risks, liabilities and obligations set out or implied in the Contract. Furthermore all duties, taxes and other levies payable by the Contractor under the Contract, or for any other cause, as on the date 28 days prior to deadline for submission of Bids, shall be included in the rates and prices and the total Bid Price submitted by the Bidder.

4. A rate or price shall be entered against each item in the priced Bill of Quantities, whether quantities are stated or not. Unit rates must be offered in two decimal places for an item. In case the bidder quotes rates for an item in more than two decimal places, the same shall be considered upto two significant decimal places for evaluation purposes. The cost of items against which the Contractor will have failed to enter a rate or price shall be deemed to be covered by other rates and prices entered in the Bill of Quantities.

5. The whole cost of complying with the provisions of the Contract shall be included in the items provided in the priced Bill of Quantities, and where no items are provided, the cost shall be deemed to be distributed among the rates and prices entered for the related items of the Works.

6. General directions and description of work and materials are not necessarily repeated nor summarized in the Bill of Quantities. References to the relevant sections of the Bidding Documents shall be made before entering prices against each item in the priced Bill of Quantities.

7. Provisional sums included and so designated in the Bill of Quantities shall be expended in whole or in part at the direction and discretion of the Engineer in accordance with Sub-Clause 58.2 of Part I, General Conditions of Contract.

BD-2

Appendix-D to Bid

BILL OF QUANTITIES

B. Work Items (specimen)

NAME OF WORK: CONSTRUCTION OF SATTI KALI DAM DISTRICT BANNU
ADP NO. 2010 (2023-24)

SUB WORK: CONSTRUCTION OF IRRIGATION SYSTEM, & ITS AFFILIATED STRUCTURES I/C ELECTRIFICATON OF DAM EMBANKMENT OF SATTI KALI DAM DISTRICT BANNU (BALANCE WORKS)

PACKAGE-II
SUMMARY OFCOST

S No.	Description		(Amount Rs)
A	**CIVIL WORKS**		
	i	Irrigation System & Its Affiliated Structures	164,309,013
	ii	Electrification of Dam Embankment	4,559,565
		Sub-Total: A	**168,868,579**
		Add -------% above/Below Contractor Premium	
		Tender Price (To be carried forward to Summary)	
		Tender Price in words:----------	

Stamp & Signature of Contractor:

BD-3

Appendix-D to Bid

BILL OF QUANTITIES

NAME OF WORK: **CONSTRUCTION OF SATTI KALLI DAM DISTRICT BANNU ADP NO. 2010 (2023-24). (BALANCE WORKS)**

SUB WORK: **CONSTRUCTION OF IRRIGATION SYSTEM, & ITS AFFILIATED STRUCTURES I/C ELECTRIFICATON OF DAM EMBANKMENT OF SATTI KALI DAM DISTRICT BANNU (BALANCE WORKS)**

PACKAGE-II

BILL OF QUANTITY

1: IRRIGATION SYSTEM, & ITS AFFILIATED STRUCTURES

S.No	Item Code	Description	Unit	Balance Work On MRS 2024 1st Bi Annual		
				Quantity	Rate (Rs)	Amount (Rs)
1		Earth Excavation in Irrigation Channels including clearing grubbing and disposal of Excavated Material				
i	03-10-d	in Shingle/Gravel	M^3	2,375.38	589.24	1,399,672
ii	03-10-a	in Ordinary Soil	M^3	2,430.97	391.28	951,189
iii	03-78-b	Excavation for core trench of Dam Embankment/Spillway/Intake & Outlet Structure and Irrigation System upto design depth in Soft Rock/Shale requiring 20% blasting i/c removing of material from outside of the structure area.	M^3	6,513.22	915.78	5,964,672
iv	03-78-c	Excavation for core trench of Dam Embankment/ Spillway/Intake & Outlet Structure and Irrigation System upto design depth in Medium Hard Rock requiring 50% blasting i/c removing of material from outside of the structure are.	M^3	6,010.02	1,372.08	8,246,229
2	03-67-a	Structural Excavation in Common Material	M^3	11,068.50	657.80	7,280,857
3	03-25-d	Excavation in Foundation of Building, bridges etc complete in shingle/gravel	M^3	73.45	449.67	33,027
4	03-12-d	Earth excavation in irrigation channels/drains & disposal upto 25m. & dressing : in Shingle/Gravel	M^3	327.73	923.30	302,593
5	06-05-i	Plain Cement Concrete including placing, compacting, finishing & curing (Ratio 1:4:8)	M^3	387.31	11,471.96	4,443,194

6	06-05-h	Plain Cement Concrete including placing, compacting, finishing & curing (Ratio 1:3:6)	M^3	590.55	12,859.69	7,594,276
7	03-06-a	Embankment formation in ordinary soil & compaction bymechanical means at optimum moistures content to 90% max. modified AASHTO dry density (borrow area)	M^3	897.80	678.51	609,166
8	17-01-a	Formation, dressing and preparing sub-grade in bed	M^2	4,767.60	117.89	562,052
9	17-01-b	Formation, dressing and preparing sub-grade On slope	M^2	9,057.16	160.75	1,455,938
10	17-02	Stabilized layer of cement, sand mortar 1:30 2" thick on slope	M^2	644.71	496.83	320,311
11	17-04-a	1" thick plaster of cement, sand motar 1:10 in bed	M^2	4,767.60	610.91	2,912,573
12	17-04-b	1" thick plaster of cement, sand motar 1:10 On slope	M^2	8,987.17	683.25	6,140,481
13	17-10-a-02	4" thick PCC lining, using washed screened & graded/cursched stone aggregate : in bed : Ratio 1:3:6	M^3	466.14	12,525.20	5,838,504
14	17-10-b-02	4" thick PCC lining, using washed screened & graded/cursched stone aggregate : On slope : Ratio 1:3:6	M^3	1,133.91	13,151.73	14,912,848
15	06-23	Fill expansion joints with bitumen, sand & saw dust in Ratio 1:2:2	M	2,543.38	165.22	420,217
16	03-67-c	Structural backfill using Common Material available at site	M^3	7,762.79	519.57	4,033,314
17	06-46-b	Erecting & removing formwork to concrete in any shape / position (Vertical)	M^2	10,665.89	750.75	8,007,418
18	06-05-f	Plain Cement Concrete including placing, compacting, finishing & curing (Ratio 1:2:4)	M^3	130.00	15,436.87	2,006,795
19	06-07-a-03	RCC in roof slab, beam, column & other structural members, insitu or precast. Type C (1:2:4)	M^3	1,086.64	17,793.23	19,334,783
20	06-07-b-03	RCC in raft foundation slab, base slab of column & ret. wall etc, not including in 06-06. Type C(1:2:4)	M^3	309.31	17,793.23	5,503,656
21	06-08-c	Supply & fabricate M.S. reinforcement for cement concrete (Hot rolled deformed bars Grade 40)	Tonne	22.18	324,224.31	7,192,425

22	06-08-b	Supply & fabricate M.S reinforcement for cement concrete (hot rolled deformed bars Grade 60)	Tonne	129.53	327,869.3	42,468,995
23	24-40	Supplying and Fixing PVC Water Stopper 8" wide 3/8" thick	M	2,458.35	578.01	1,420,949
24	10-Sep	Brick on edge flooring, laid in 1:6 c/s mortar, over a bed of 3/4" thick cement mortar 1:6	M^2	0.40	2,007.77	799
25	19-27	Providing and Laying stone pitching with hammer dressed stones on surface, laid in courses	M^3	0.34	4,795.91	1,629
26	23-01-a	Providing and Laying RCC pipe, moulded with cement concrete 1:1.5:3, including cost of reinforcement, testing etc : 4" dia:	M	21.94	927.28	20,349
27	23-01-b	Providing and Laying RCC pipe, moulded with cement concrete 1:1.5:3, including cost of reinforcement, testing etc : 6" dia:	M	10.97	1,261.56	13,842
28	23-01-c	Providing and Laying RCC pipe, moulded with cement concrete 1:1.5:3, including cost of reinforcement, testing etc : 9" dia:	M	5.49	1,754.13	9,623
29	16-29-b-i	Reinforced Concrete Pipe Culvert (AASHTO M-170) Dia: 610mm	M	24.38	4,959.90	120,936
	Sub-Total					**159,523,314**
	Add Location factor for District Bannu @ Rs 3%					**4,785,699**
	Total					**164,309,013**

NAME OF WORK: **CONSTRUCTION OF SATTI KALLI DAM DISTRICT BANNU ADP NO. 2010 (2023-24). (BALANCE WORKS)**

SUB WORK: **CONSTRUCTION OF IRRIGATION SYSTEM, & ITS AFFILIATED STRUCTURES I/C ELECTRIFICATON OF DAM EMBANKMENT OF SATTI KALI DAM DISTRICT BANNU (BALANCE WORKS)**

PACKAGE-II

BILL OF QUANTITY

Bill No. 2 : Electrification of Dam Embankment

S.No	Item Code	Description	Unit	Balance Work On MRS 2024 1st Bi Annual		
				Quantity	Rate (Rs)	Amount (Rs)
2.1	15-40-a-01	S/FG. I. Tubular st. light pole 8' of 5" dia 7' 4",5' of 3" dia single arm of 5' of 1.5" dia.	Nos	8.00	21,576.38	172,611
2.2	15-40-a-02	Supply and Fixing GI tubular street light pole, 8' of 5" dia,7' 4" dia, 5' of 3" dia, Double arm of 5' of 1.5" dia	Each	2.00	31,296.38	62,593
2.3	NSI	Construction of foundation for pole including cost of pit excavation, 1:2:4 RCC 450mm x 450mm x 1830 mm along with (4 No Electro-plated galvanized J-bolts dia=25mm, lenght=1m with L-Bend=150mm) having atleast 150mm threads with double Nuts/double Washers) complete in all respects as shown in the drawings and as per instructions of Engineer incharge.	Job	10.00	16,038.00	160,380
2.4	NSI	Solar panel mount (Top-of-Pole) made of galvanized angle Iron to sustain 200 km/h wind pressure suitable for mounting 250 watts 01 No panels	Job	2.00	13,687.50	27,375
2.5	26-01-c-02	Supply and Erection of pole mounted SMD type light road light fixture in Aluminium dia cast body with corrosion resisted powder coated finish (60-70 watts) with 12/24V DC LED	Watt	2.00	15,985.67	31,971
2.6	26-01-e-01	Supply and Erection of MPPT Solar Light Charge Controller (10 Amps,12/24 V) with all sort of electronic protections	Job	2.00	9,837.65	19,675
2.7	15-02-a-05	Supply and Erection PVC pipe for wiring purpose complete On surface including clamps etc: 1.5" i/d	m	10.00	200.15	2,002
2.8	26-01-g-09	Supply and Erection 2x4 sq.mm flexible copper cable	m	10.00	736.56	7,366

2.9	15-36-g	P/I of Road light fixture SMD type white LED minimum 60 watt AC type, IP 65, Led efficacy min 100 lumens/ watt	No	8.00	15,270.75	122,166
2.1	15-47-a	Wiring of main & sub-main in 2 single core PVC insulated& sheathed cable : 3/0.029	M	200.00	519.11	103,822
2.11	15-47-b	Wiring of main and sub main in 2 single core pvc insulated and sheathed cable 7-29	M	200.00	736.04	147,208
2.12	15-47-d	Wiring of main and sub main in 2 single core pvc insulated and sheathed cable 7-64	M	300.00	3,076.87	923,061
2.13	15-47-c	Wiring of main and sub main in 2 single core pvc insulated and sheathed cable 7-44	M	600.00	1,122.02	673,212
2.14	26-01-d-01	P/I of solar panel (PV module) mono crystalline, A Grade minimum 250 watt, IEC 61215 and 61730 certified	watts	6,000.00	49.72	298,320
2.15	Market Rate	Provision of 200 AH Gel Battery along with Stand Ritar, Narrada Or Vision Battery	No	8.00	99,000	792,000
2.16	Market Rate	P/I of MPPT inverter 48 volt 5KW infini	No	1.00	200,000	200,000
2.17	Market Rate	Mounting structure for panels	Job	1.00	180,000	180,000
2.18	Market Rate	light sensors and conductors of appropriate size	No	2.00	5,000	10,000
2.19	Market Rate	DC/ AC breakers and accessories etc.	Job	1.00	18,000	18,000
2.20	Market Rate	Installation & Transportation	Job	1.00	250,000	250,000
2.21	15-02-a-07	Supply and Erection PVC pipe for wiring purpose complete On surface including clamps etc: 3" i/d	M	450.00	235.15	105,818
2.22	15-75-a	S&E cubical type factory fabricated floor/wall mounting steel main boar complete.	Each	1.00	31,601.80	31,602
2.23	15-42-a	S& E 2'x2'x1/8" copper plate I/c revitting to copper tape & placing in mixture of salt etc.	Each	10.00	10,070.55	100,706
2.24	Market	Provide & install Hand Siren (MANUAL)	Nos	1.00	50000	50,000
Sub Total						**4,489,886**
Add Location factor for District Bannu @ Rs 3% (except market rate items)						**69,679**
Total						**4,559,565**

BILL OF QUANTITIES

C. Daywork

Schedule General

1. Reference is made to Sub-Clause 52.4 of the General Conditions of Contract Part-I Work shall not be executed on a day work basis except by written order of the Engineer. Bidders shall enter basic rates for Daywork items in the Schedules, which rates shall apply to any quantity of Daywork ordered by the Engineer. Nominal quantities have been indicated against each item of Daywork, and the extended total for Daywork shall be carried forward to the Bid Price.

Daywork Labour

2. In calculating payments due to the Contractor for the execution of Daywork, the actual time of classes of labour directly doing the Daywork ordered by the Engineer and for which they are competent to perform will be measured excluding meal breaks and rest periods. The time of gangers (charge hands) actually doing work with the gang will also be measured but not the time of foreman or other supervisory personnel.

3. The Contractor shall be entitled to payment in respect of the total time that labour is employed on Daywork, calculated at the basic rates entered by him in the Schedule of Daywork Rates for labour together with an additional percentage, payment on basic rates representing the Contractor's profit, overheads, etc., as described below:

   a. the basic rates for labour shall cover all direct costs to the Contractor, including (but not limited to) the amount of wages paid to such labour, transportation time, overtime, subsistence allowances and any sums paid to or on behalf of such labour for social benefits in accordance with Pakistan law.

      The basic rates will be payable in local currency only; and

   b. the additional percentage payment to be quoted by the Bidder and applied to costs incurred under (a) above shall be deemed to cover the Contractor's profit, overheads, superintendence, liabilities and insurances and allowances to labour timekeeping and clerical and office work; the use of consumable stores, water, lighting and power; the use and repair of stagings, scaffolding, workshops and stores, portable power tools, manual plant and tools; supervision by the Contractor's staff, foremen and other supervisory personnel; and charges incidental to the foregoing.

BD-9

Appendix-D to Bid

SCHEDULE OF DAYWORK RATES

I. Labour

Item No.	Description	Unit	Nominal Quantity	Rate (Rs) in Figure	Rate (Rs) in Words	Extended Amount (Rs.)
1	2	3	4	5	6	7
D101	Ganger	Hr	75			
D102	Labourer	Hr	250			
D103	Brick layer	Hr	100			
D104	Mason	Hr	150			
D105	Carpenter	Hr	100			
D106	Steel work Erector	Hr	100			
D107	Steel work Binders	Hr	100			
D108	Driver for vehicle up to 10 tons	Hr	100			
D109	Operator for excavator, dragline, shovel or crane	Hr	100			
D110	Operator for tractor, (tracked) with dozer blade or ripper	Hr	300			
D111	Operator for compressor machine	Hr	100			
D112	Other skilled operators	Hr	100			
	Sub Total Allow ------- percent of subtotal for Contractor's overhead, profit, etc. In accordance with Paragraph 3(b) of Daywork Schedule					
	Total for Daywork: Labour : (Carried forward to Daywork Summary)					

Daywork Material

4. The Contractor shall be entitled to payment in respect of materials used for Daywork (except for materials for which the cost is included in the percentage addition to labour costs as detailed heretofore), at the basic rates entered by him in the Schedule of Daywork Rates for materials together with an additional percentage payment on the basic rates to cover overhead charges and profit, as follows:

   a. the basic rates for materials shall be calculated on the basis of the invoiced price, freight, insurance, handling expenses, damage, losses, etc., and shall provide for delivery to store for stockpiling at the site. The basic rates shall be stated in local currency but payment will be made in the currency or currencies expended upon presentation of supporting documentation;

   b. the additional percentage payment shall be quoted by the Bidder and applied to the equivalent local currency payments made under Sub-Para(a) above; and

   c. the cost of hauling materials used on work ordered to be carried out as Daywork from the store or stockpile on the site to the place where it is to be used will be paid in accordance with the terms for Labour and Constructional Plant in this Schedule.

Appendix-D to Bid

SCHEDULE OF DAYWORK RATES

II. Materials

Item No.	Description	Unit	Nominal Quantity	Rate (Rs) in Figure	Rate (Rs) in Words)	Extended Amount (Rs.)
1	2	3	4	5	6	7
D201	Cement, ordinary Portland or equivalent in bags	Bags	500			
D202	Cement, sulphate resistant in bags	Bags	100			
D203	Mild Steel reinforcing bar up to 16mm diameter to BS 4449 or equivalent	M.Ton	5			
D204	Coarse aggregate for concrete as Specified in Clause	Cu.M	200			
D205	Fine aggregate for concrete as Specified in Clause	Cu.M	100			
	Sub Total					
	Allow ---------- percent of subtotal for Contractor's overhead, profit, etc; in accordance with Paragraph 4(b) of Daywork Schedule					
	Total for Daywork: Materials (Carried forward to Daywork Summary)					

Daywork Constructional Plant

5. The Contractor shall be entitled to payments in respect of constructional plant already on Site and employed on Daywork at the basic rental rates entered by him in the Schedule of Daywork Rates for constructional plant. The said rates shall be deemed to include complete allowance for depreciation, interest, indemnity and insurance, repairs, maintenance, supplies, fuel, lubricants, and other consumables, and all overhead, profit and administrative costs related to the use of such equipment. The cost of drivers, operators and assistants will be paid for separately as described under the section on Daywork Labour.

6. In calculating the payment due to the Contractor for constructional plant employed on Daywork, only the actual number of working hours will be eligible for payment, except that where applicable and agreed with the Engineer, the travelling time from the part of the Site where the constructional plant was located when ordered by the Engineer to be employed on Daywork and the time for return journey thereto shall be included for payment.

7. The basic rental rates for constructional plant employed on Daywork shall be stated in Pakistani Rupees.

SCHEDULE OF DAYWORK RATES

III. Constructional Plant

Item No.	Description	Unit	Nominal Quantity	Rate (Rs.) in Figure	Rate Rs.) in Words	Extended Amount (Rs.)
1	2	3	4		5	6
D301	Excavator, face shovel or dragline:					
	1. Up-to and including 1 CuM	Hr	60			
	2. Over 1 Cu.M to 2 Cu. M.	Hr	70			
	3. Over 2 Cu. M	Hr	50			
D302	Tractor (tracked) including bull or angle dozer:					
	1. Up-to and including 150 HP	Hr	50			
	2. Over 150 to 200 HP	Hr	60			
	3. Over 200 to 250 HP	Hr	40			
D303	Tractor with ripper:					
	1. Up-to and including 200 HP	Hr	60			
	2. Over 200 to 250 HP	Hr	60			
D304	Wheel Loader up to 4 CuM capacity	Hr	60			
D305	Rear Dump Trucks					
	1. 10 ton capacity	Hr	60			
	2. 20 ton capacity	Hr	65			
D306	Concrete Mixer up to 1 CuM	Hr	60			
	Total for Daywork: Constructional Plant (Carried forward to Daywork Summary) including contractor overhead, profit etc; in accordance with paragraph of day work schedule					

BD-14

Appendix-D to Bid

DAYWORK

Summary (Daywork)

Sr No	Description	Amount (Rs)
1	Total for Daywork: Labour	
2	Total for Daywork: Materials	
3	Total for Daywork: Constructional Plant	
	Total for Daywork (Carried forward to Summary Page of Bill of Quantities)	

BD-15

Appendix-D to Bid

BILL OF QUANTITIES

SUMMARY

Sr No	Description	Amount (Rs)
1	Civil Works with contractor premium	
	Sub-Total of Civil Works	
2	Total Day work	
	Bid Price	

Note 1: All Provisional Sums are to be expended in whole or, in part at the direction and discretion of the Engineer in accordance with Sub-Clauses 52.4 and 58.2 of the General Conditions of Contract Part- I.

Note 2: Any item cropped up during execution of the project, will be paid per rate of MRS 2024 (Bi-annual) along with application of approved contractor premium.

BE-1

Appendix-E to Bid

PROPOSED CONSTRUCTION SCHEDULE

Pursuant to Sub-Clause 43.1 of the General Conditions of Contract, the Works shall be completed on or before the date stated in Appendix-A to Bid. The Bidder shall provide as Appendix-E to Bid, the Construction Schedule in the bar chart (CPM, PERT or any other to be specified herein) showing the sequence of work items and the period of time during which he proposes to complete each work item in such a manner that his proposed program for
completion of the whole of the Works and parts of the Works may meet Procuring Entity's completion targets in days noted below and counted from the date of receipt of Engineer's Notice to Commence (Attach sheets as required for the specified form of Construction Schedule):

	Description	**Time for Completion**
a)	Whole Works	_____days
b)	Part-A	_____days
c)	Part-B	_____days
d)	_____	_____days
e)	_____	_____days

BF-1

Appendix-F to Bid

METHOD OF PERFORMING THE WORK

[The Bidder is required to submit a narrative outlining the method of performing the Work. The narrative should indicate in detail and include but not be limited to:

1. Organization Chart indicating head office and field office personnel involved in management and supervision, engineering, equipment maintenance and purchasing.

2. Mobilization in Pakistan, the type of facilities including personnel accommodation, office accommodation, provision for maintenance and for storage, communications, security and other services to be used.

3. The method of executing the Works, the procedures for installation of equipment and machinery and transportation of equipment and materials to the site.]

BG-1

Appendix-G to Bid

LIST OF MAJOR EQUIPMENT – RELATED ITEMS

[The Bidder will provide on Sheet 2 of this Appendix a list of all major equipment and related items, under separate heading for items owned, to be purchased or to be arranged on lease by him to carry out the Works. The information shall include make, type, capacity, and anticipated period of utilization for all equipment which shall be in sufficient detail to demonstrate fully that the equipment will meet all requirements of the Specifications.]

BG-2

Appendix-G to Bid

LIST OF MAJOR EQUIPMENT

Owned Purchased or Leased	Description of Unit (Make, Model, Year)	Capacity HP Rating	Condition	Present Location or Source	Date of Delivery at Site	Period of Work on Project
1	2	3	4	5	6	7
a. Owned						
b. To be purchased						
c. To be arranged on Lease						

BH-1

Appendix-H to Bid

CONSTRUCTION CAMP AND HOUSING FACILITIES

The Contractor in accordance with Clause 34 of the Conditions of Contract shall provide description of his construction camp's facilities and staff housing requirements.

The Contractor shall be responsible for pumps, electrical power, water and electrical distribution systems, and sewerage system including all fittings, pipes and other items necessary for servicing the Contractor's construction camp.

The Bidder shall list or explain his plans for providing these facilities for the service of the Contract as follows:

1. Site Preparation (clearing, land preparation, etc.).

2. Provision of Services.

    a) Power (expected power load, etc.).
    b) Water (required amount and system proposed).
    c) Sanitation (sewage disposal system, etc.).

3. Construction of Facilities

    a) Contractor's Office. Workshop and Work Areas (areas required and proposed layout, type of construction of buildings, etc.).
    b) Warehouses and Storage Areas (area required, type of construction and layout).
    c) Housing and Staff Facilities (Plans for housing for proposed staff, layout, type of construction, etc.).

4. Construction Equipment Assembly and Preparation (detailed plans for carrying out this activity).

5. Other Items Proposed (Security services, etc.).

BI-1

Appendix-I to Bid

LIST OF SUBCONTRACTORS

I/We intend to subcontract the following parts of the Work to subcontractors. In my/our opinion, the subcontractors named hereunder are reliable and competent to perform that part of the work for which each is listed.

Enclosed are documentation outlining experience of subcontractors, the curriculum vitae and experience of their key personnel who will be assigned to the Contract, equipment to be supplied by them, size, location and type of contracts carried out in the past.

Part of Works (Give Details)	Subcontractor (With Complete Address)
1	2

BJ-1

Appendix-J to Bid

ESTIMATED PROGRESS PAYMENTS

Bidder' estimate of the value of work which would be executed by him during each of the periods stated below, based on his Program of the Works and the Rates in the Bill of Quantities, expressed in thousands of Pakistani Rupees:

Quarter/ Year/ Period	**Amounts (1,000 Rs.)**
1	**2**
Ist Quarter	
2nd Quarter	
3rd Quarter	
4rth Quarter	
Bid Price	

BK-1

Appendix-K to Bid

ORGANIZATION CHART
FOR THE
SUPERVISORY STAFF AND LABOUR

BL-1
Appendix-L to Bid

(INTEGRITY PACT)

DECLARATION OF FEES, COMMISSION AND BROKERAGE ETC. PAID BY THE SUPPLIERS OF GOODS, SERVICES & WORKS IN CONTRACTS WORTH RS. 10.00 MILLION OR MORE

Contract No: **Dated:**
Contract Value:
Contract Title: Construction of Satti Kali Dam, District Bannu **Package-II**

….....[name of Contractor] hereby declares that it has not obtained or induced the procurement of any contract, right, interest, privilege or other obligation or benefit from Government of Pakistan (GoP) or any administrative subdivision or agency thereof or any other entity owned or controlled by GoP through any corrupt business practice.

Without limiting the generality of the foregoing, [name of Contractor] represents and warrants that it has fully declared the brokerage, commission, fees etc. paid or payable to anyone and not given or agreed to give and shall not give or agree to give to anyone within or outside Pakistan either directly or indirectly through any natural or juridical person, including its affiliate, agent, associate, broker, consultant, director, promoter, shareholder, sponsor or subsidiary, any commission, gratification, bribe, finder's fee or kickback, whether described as consultation fee or otherwise, with the object of obtaining or inducing the procurement of a contract, right, interest, privilege or other obligation or benefit in whatsoever form from GoP, except that which has been expressly declared pursuant hereto.

[name of Contractor] certifies that it has made and will make full disclosure of all agreements and arrangements with all persons in respect of or related to the transaction with GoP and has not taken any action or will not take any action to circumvent the above declaration, representation or warranty.

[name of Contractor] accept full responsibility and strict liability for making any false declaration, not making full disclosure, misrepresenting facts or taking any action likely to defeat the purpose of this declaration, representation and warranty. It agrees that any contract, right, interest, privilege or other obligation or benefit obtained or procured as aforesaid shall, without prejudice to any other rights and remedies available to GoP under any law, contract or other instrument, be voidable at the option of GoP.

Notwithstanding any rights and remedies exercised by GoP in this regard, [name of Contractor] agrees to indemnify GoP for any loss or damage incurred by it on account of its corrupt business practices and further pay compensation to GoP in an amount equivalent to ten time the sum of any commission, gratification, bribe, finder's fee or kickback given by [name of Supplier] as aforesaid for the purpose of obtaining or inducing the procurement of any contract, right, interest, privilege or other obligation or benefit in whatsoever form from GoP.

Name of PE/Department: …… Signature: …… [Seal]

Name of Contractor: …… Signature: …… [Seal]

FORMS

BID SECURITY
PERFORMANCE SECURITY
CONTRACT AGREEMENT
MOBILIZATION ADVANCE GUARANTEE/BOND

BS-1

BID SECURITY
(**Bank Guarantee)**

Security Executed on _____
(Date)

Name of Surety (Bank) with Address: _____
(Scheduled Bank in Pakistan)

Name of Principal (Bidder) with Address

_____

Penal Sum of Security Rupees . _____ (Rs. _____)

Bid Reference No. _____

KNOW ALL MEN BY THESE PRESENTS, that in pursuance of the terms of the Bid and at the request of the said Principal (Bidder) we, the Surety above named, are held and firmly bound unto _____
(hereinafter called the 'Procuring Entity') in the sum stated above for the payment of which sum well and truly to be made, we bind ourselves, our heirs, executors, administrators and successors, jointly and severally, firmly by these presents.

THE CONDITION OF THIS OBLIGATION IS SUCH, that whereas the Bidder has submitted the accompanying Bid dated _____for Bid No. _____for_____(Particulars of Bid) to the said Procuring Entity;

and

WHEREAS, the Procuring Entity has required as a condition for considering said Bid that the Bidder furnishes a Bid Security in the above said sum from a Scheduled Bank in Pakistan or from a foreign bank duly counter-guaranteed by a Scheduled Bank in Pakistan, to the Procuring Entity, conditioned as under:

(1) that the Bid Security shall remain in force up to and including the date 28 days after the deadline for validity of bids as stated in the Instructions to Bidders or as it may be extended by the Procuring Entity, notice of which extension(s) to the Surety is hereby waived;

(2) that the Bid Security of unsuccessful Bidders will be returned by the Procuring Entity after expiry of its validity or upon signing of the Contract Agreement; and

(3) that in the event of failure of the successful Bidder to execute the proposed Contract Agreement for such work and furnish the required Performance Security, the entire said sum be paid immediately to the said Procuring Entity pursuant to Clause 15.6 of the Instruction to Bidders for the successful Bidder's failure to perform.

NOW THEREFORE, if the successful Bidder shall, within the period specified therefor, on the prescribed form presented to him for signature enter into a formal Contract with the said Procuring Entity in accordance with his Bid as accepted and furnish within twenty eight (28) days of his being requested to do so, a Performance Security with good and sufficient surety, as may be required, upon the form prescribed by the said Procuring Entity for the faithful performance and proper fulfillment of the said Contract or in the event of non-withdrawal of the said Bid within the time specified for its validity then this obligation shall be void and of no effect, but otherwise to remain in full force and effect.

PROVIDED THAT the Surety shall forthwith pay the Procuring Entity the said sum upon first written demand of the Procuring Entity (without cavil or argument) and without requiring the Procuring Entity to prove or to show grounds or reasons for such demand, notice of which shall be sent by the Procuring Entity by registered post duly addressed to the Surety at its address given above.

PROVIDED ALSO THAT the Procuring Entity shall be the sole and final judge for deciding whether the Principal (Bidder) has duly performed his obligations to sign the Contract Agreement and to furnish the requisite Performance Security within the time stated above, or has defaulted in fulfilling said requirements and the Surety shall pay without objection the said sum upon demand from the Procuring Entity forthwith and without any reference to the Principal (Bidder) or any other person.

IN WITNESS WHEREOF, the above bounden Surety has executed the instrument under its seal on the date indicated above, the name and seal of the Surety being hereto affixed and these presents duly signed by its undersigned representative pursuant to authority of its governing body.

SURETY (Bank)

WITNESS: Signature _____

1. _____ Name _____

_____ Title _____

Corporate Secretary (Seal) Corporate Guarantor (Seal)

2. _____

_____

Name, Title & Address

PS-1

FORM OF PERFORMANCE SECURITY
(Bank Guarantee)

Guarantee No._____
Executed on _____
Expiry date _____

[Letter by the Guarantor to the Procuring Entity]

Name of Guarantor (Bank) with address:_____
(Scheduled Bank in Pakistan)

Name of Principal (Contractor) with address:_____

Penal Sum of Security (express in words and figures)_____

Letter of Acceptance No. _____Dated _____

KNOW ALL MEN BY THESE PRESENTS, that in pursuance of the terms of the Bidding Documents and above said Letter of Acceptance (hereinafter called the Documents) and at the request of the said Principal we, the Guarantor above named, are held and firmly bound unto the (hereinafter called the Procuring Entity) in the penal sum of the amount stated above for the payment of which sum well and truly to be made to the said Procuring Entity, we bind ourselves, our heirs, executors, administrators and successors, jointly and severally, firmly by these presents.

THE CONDITION OF THIS OBLIGATION IS SUCH, that whereas the Principal has the Procuring Entity's above said Letter of Acceptance for (Name of Contract) for the _____

_____(Name of Project).

NOW THEREFORE, if the Principal (Contractor) shall well and truly perform and fulfill all the undertakings, covenants, terms and conditions of the said Documents during the original terms of the said Documents and any extensions thereof that may be granted by the Procuring Entity, with or without notice to the Guarantor, which notice is, hereby, waived and shall also well and truly perform and fulfill all the undertakings, covenants terms and conditions of the Contract and of any and all modifications of said Documents that may hereafter be made, notice of which modifications to the Guarantor being hereby waived, then, this obligation to be void; otherwise to remain in full force and virtue till all requirements of Clause 49, Defects Liability, of Conditions of Contract are fulfilled.

Our total liability under this Guarantee is limited to the sum stated above and it is a condition of any liability attaching to us under this Guarantee that the claim for payment in writing shall be received by us within the validity period of this Guarantee, failing which we shall be discharged of our liability, if any, under this Guarantee.

PS-2

We, _____ (the Guarantor), waiving all objections and defences under the Contract, do hereby irrevocably and independently guarantee to pay to the Procuring Entity without delay upon the Procuring Entity's first written demand without cavil or arguments and without requiring the Procuring Entity to prove or to show grounds or reasons for such demand any sum or sums up to the amount stated above, against the Procuring Entity's written declaration that the Principal has refused or failed to perform the obligations under the Contract which payment will be effected by the Guarantor to Procuring Entity's designated Bank & Account Number.

PROVIDED ALSO THAT the Procuring Entity shall be the sole and final judge for deciding whether the Principal (Contractor) has duly performed his obligations under the Contract or has defaulted in fulfilling said obligations and the Guarantor shall pay without objection any sum or sums up to the amount stated above upon first written demand from the Procuring Entity forthwith and without any reference to the Principal or any other person.

IN WITNESS WHEREOF, the above-bounden Guarantor has executed this Instrument under its seal on the date indicated above, the name and corporate seal of the Guarantor being hereto affixed and these presents duly signed by its undersigned representative, pursuant to authority of its governing body.

_____
Guarantor (Bank)

Witness:

1. Signature

_____
Corporate Secretary (Seal)

Name _____

Title _____

2. _____

_____
Name, Title & Address

_____
Corporate Guarantor
(Seal)

CA-1

FORM OF CONTRACT AGREEMENT

THIS CONTRACT AGREEMENT (hereinafter called the "Agreement") made on the ----------day of---------- (month) 2024 between ----------(hereinafter called the "Procuring Entity" and ----------(hereafter called the "Contractor") of the other part.

WHEREAS the Procuring Entity is desirous that certain Works, viz ----------should be executed by the Contractor and has accepted a Bid by the Contractor for the execution and completion of such Works and the remedying of any defects therein.

NOW this Agreement witnesseth as follows:

1. In this Agreement words and expressions shall have the same meanings as are respectively assigned to them in the Conditions of Contract hereinafter referred to.

2. The following documents after incorporating addenda, if any, except those parts relating to Instructions to Bidders shall be deemed to form and be read and construed as part of this Agreement, viz:

   (a) The Contract Agreement;
   (b) The Letter of Acceptance;
   (c) The completed Form of Bid;
   (d) Special Stipulations (Appendix-A to Bid);
   (e) The Particular Conditions of Contract – Part II;
   (f) The General Conditions – Part I;
   (g) The priced Bill of Quantities (Appendix-D to Bid);
   (h) The completed Appendices to Bid (B, C, E to L);
   (i) The Drawings;
   (j) The Specifications.
   (k) _____(any other)

3. In consideration of the payments to be made by the Procuring Entity to the Contractor as hereinafter mentioned, the Contractor hereby covenants with the Procuring Entity to execute and complete the Works and remedy defects therein in conformity and in all respects with the provisions of the Contract.

4. The Procuring Entity hereby covenants to pay the Contractor, in consideration of the execution and completion of the Works as per provisions of the Contract, the Contract Price or such other sum as may become payable under the provisions of the Contract at the times and in the manner prescribed by the Contract.

IN WITNESS WHEREOF the parties hereto have caused this Agreement to be executed on the day, month and year first before written in accordance with their respective laws.

Signature of the Contactor	Signature of Procuring Entity
(Seal)	(Seal)

Signed, Sealed and Delivered in the presence of:

Witness:	Witness:
(Name, Title and Address)	(Name, Title and Address)

MG-1

MOBILIZATION ADVANCE GUARANTEE

Guarantee No: ---------- Dated: ----------

WHEREAS ----------(hereinafter called the 'Procuring Entity') has entered into a Contract for ----------(Particulars of Contract) with ---------- (hereinafter called the "Contractor').
AND WHEREAS, the Procuring Entity has agreed to advance to the Contractor, at the Contractor's request, an amount of Rupees (Rs)----------which amount shall be advanced to the Contractor as per provisions of the Contract.

AND WHEREAS, the Procuring Entity has asked the Contractor to furnish Guarantee to secure the mobilization advance for the performance of his obligations under the said Contract.

AND WHEREAS, _____
(Scheduled Bank in Pakistan acceptable to the Procuring Entity) (hereinafter called the "Guarantor") at the request of the Contractor and in consideration of the Procuring Entity agreeing to make the above advance to the Contractor, has agreed to furnish the said Guarantee.

NOW, THEREFORE, the Guarantor hereby guarantees that the Contractor shall use the advance for the purpose of above-mentioned Contract and if he fails and commits default in fulfillment of any of his obligations for which the advance payment is made, the Guarantor shall be liable to the Procuring Entity for payment not exceeding the aforementioned amount.

Notice in writing of any default, of which the Procuring Entity shall be the sole and final judge, on the part of the Contractor, shall be given by the Procuring Entity to the Guarantor, and on such first written demand, payment shall be made by the Guarantor of all sums then due under this Guarantee without any reference to the Contractor and without any objection.

This Guarantee shall remain in force until the advance is fully adjusted against payments from Interim Payment Certificates of the Contractor or until whichever is earlier.

_____
(Date)

The Guarantor's liability under this Guarantee shall not in any case exceed the sum of Rupees _____(Rs _____).

This Guarantee shall remain valid up to the aforesaid date and shall be null and void after the aforesaid date or earlier if the advance made to the Contractor is fully adjusted against payments from Interim Payment Certificates of the Contractor provided that the Guarantor agrees that the aforesaid period of validity shall be deemed to be extended if on the above mentioned date the advance payment is not fully adjusted.

GUARANTOR (BANK)

1. Signature _____
2. Name _____
3. Title _____

WITNESS

1. _____

_____
Corporate Secretary (Seal)

2. _____ _____
(Name Title & Address) Corporate Guarantor (Seal)

[Notes on the Conditions of Contract

The Conditions of Contract comprise two parts:

(a) Part I - General Conditions of Contract
(b) Part II - Particular Conditions of Contract

Over the years, a number of "model" General Conditions of Contract have evolved. The one used in these Standard Bidding Documents was prepared by the International Federation of Consulting Engineers (Federation Internationale des Ingenieurs-Conseils, or FIDIC), and is commonly known as the FIDIC Conditions of Contract. (The used version is the fourth edition, 1987, reprinted in 1992 with further amendments).

The FIDIC Conditions of Contract have been prepared for an ad measurement (unit price or unit rate) type of contract, and cannot be used without major modifications for other types of contract, such as lump sum, turnkey, or target cost contracts.

The standard text of the General Conditions of Contract chosen must be retained intact to facilitate its reading and interpretation by bidders and its review by the Client. Any amendments and additions to the General Conditions, specific to the contract in hand, should be introduced in the Particular Conditions of Contract.

The use of standard conditions of contract for all civil Works will ensure comprehensiveness of coverage, better balance of rights or obligations between Procuring Entity and Contractor, general acceptability of its provisions, and savings in time and cost for bid preparation and review, leading to more economic prices.

The FIDIC Conditions of Contract are copyrighted and may not be copied, faxed, or reproduced. Without taking any responsibility of its being accurate, Pakistan Engineering Council with prior consent of FIDIC Secretariat, has reproduced herein the FIDIC General Conditions of Contract for reference purpose only which cannot be used by the users for preparing their bidding documents. The bidding document may include a purchased copy, the cost of which can be retrieved as part of the selling price of the bidding document. Alternatively, the FIDIC Conditions of Contract can be referred to in the bidding documents, and the bidders are advised to obtain copies directly from FIDIC.*

---

* Add the following text if the bidding documents, as issued, do not include a copy: "Copies of the FIDIC Conditions of Contract can be obtained from: FIDIC Secretariat
P.O. Box 86
1000 Lausanne 12
Switzerland
e-mail: fidic.pub@fidic.org – FIDIC.org/bookshop]

FEDERATION INTERNATIONAL DES
INGENIEURS-CONSEILS

CONDITIONS OF CONTRACT FOR WORKS OF CIVIL ENGINEERING CONSTRUCTION

PART I GENERAL CONDITIONS
WITH FORMS OF TENDER AND AGREEMENT

FOURTH EDITION 1987
Reprinted 1988 with editorial amendments
Reprinted in 1992 with further amendments

Copies of the FIDIC Conditions of Contract 4th Edition, 1987 reprinted in 1992 with further amendments can be obtained from:

FIDIC SECRETARIAT

P.O BOX NO. 86

1000 Lausanne 12

Switzerland

e-mail fidic.pub@fidic.org-FIDIC org/bookshop

TABLE OF CONTENTS

PART II - PARTICULAR CONDITIONS OF CONTRACT

Clause	Title	Page
1.1	Definitions	80
2.1	Engineer's Duties and Authority	80
2.2	Engineer's Representative	82
2.7	Engineer Not Liable	82
2.8	Replacement of the Engineer	82
5.1	Language(s) and Law	82
5.2	Priority of Contract Documents	82
6.6	Shop Drawings	83
6.7	As-Built Drawings	83
10.1	Performance Security	83
10.4	Performance Security Binding on Variations and Changes	84
14.1	Program to be Submitted	84
14.3	Cash Flow Estimate to be Submitted	84
14.5	Detailed Program and Monthly Progress Report	84
15.2	Language Ability of Contractor's Representative	85
15.3	Contractor's Representative	85
16.3	Language Ability of Superintending Staff of Contractor	85
16.4	Employment of Local Personnel	85
19.3	Safety Precautions	85
19.4	Lighting Works at Night	86
20.4	Procuring Entity's Risks	86
21.1	Insurance of Works and Contractor's Equipment	86
21.4	Exclusions	87
25.5	Insurance Company	87
31.3	Co-operation with Other Contractors	87
34.2	Rates of Wages and Conditions of Labour	87
34.3	Employment of Persons in the Service of Others	87
34.4	Housing for Labour	87
34.5	Health and Safety	88
34.6	Epidemics	88
34.7	Supply of Water	88
34.8	Alcoholic Liquor or Drugs	88
34.9	Arms and Ammunition	88
34.10	Festivals and Religious Customs	88
34.11	Disorderly Conduct	89
34.12	Compliance by Subcontractors	89
35.2	Records of Safety and Health	89
35.3	Reporting of Accidents	89
36.6	Use of Pakistani Materials and Services	89
41.1	Commencement of Works	89
47.3	Bonus for Early Completion of Works	90
48.2	Taking Over of Sections or Parts	90
51.2	Instructions for Variations	90

TABLE OF CONTENTS

PART II - PARTICULAR CONDITIONS OF CONTRACT

Clause	Title	Page
52.1	Valuation of Variations	90
53.4	Failure to Comply	90
54.3	Customs Clearance	90
54.5	Conditions of Hire of Contractor's Equipment	90
59.4	Payments to Nominated Sub-contractors	90
59.5	Evidence of Payments	90
60.1	Monthly Statements	91
60.2	Monthly Payments	91
60.10	Time for Payment	91
60.11	Secured Advance on Materials	92
60.11	Financial Assistance to Contractor	92
63.1	Default of Contractor	93
65.2	Special Risks	93
67.3	Arbitration	93
68.1	Notice to Contractor	93
68.2	Notice to Procuring Entity and Engineer	93
70.1	Increase or Decrease of Cost	94
73.1	Payment of Income Tax	95
73.2	Customs Duty & Taxes	95
74.1	Integrity Pact	96
75.1	Termination of Contract for Procuring Entity's Convenience	96
76.1	Liability of Contractor	96
77.1	Joint and Several Liability	97
78.1	Details to be Confidential	97

PART II - PARTICULAR CONDITIONS OF CONTRACT
(Mandatory Provisions not to be Amended / Substituted except as instructed by KPPRA)

1.1 Definitions

(a) (i) The Procuring Entity/Employer is Director General of Small Dams to Govt: of Khyber Pakhtunkhwa Irrigation Department Peshawar and with his representative who is Director (South), Directorate General of Small Dams, Irrigation Department Peshawar

(a) (iv) The Engineer is Director (South), Directorate General of Small Dams, Irrigation Department Peshawar or any other competent person appointed by the Procuring Entity/Employer, and notified to the Contractor, to act in replacement of the Engineer. Provided always that except in cases of professional misconduct, the outgoing Engineers is to formulate his certifications/ recommendations in relation to all outstanding matters, disputes and claims relating to the execution of the Works during his tenure.

(a) (v) Engineer Representative (Project Manager Supervisory Consultant)

(b)(v) "Bidder or Tenderer" means any person or persons, company, corporation, firm or joint venture submitting a Bid or Tender.

(b)(v) The following is added at the end of the paragraph:
The word "Tender" is synonymous with "Bid" and the word "Tender Documents" with "Bidding Documents".

The following paragraph is added:
(b)(ix) "Program" means the program to be submitted by the Contractor in accordance with Sub-Clause 14.1 and any approved revisions thereto.

(e)(i) The text is deleted and substituted with the following:

"Contract Price" means the sum stated in the Letter of Acceptance as payable to the Contractor for the execution and completion of the Works subject to such additions thereto or deductions therefrom as may be made and remedying of any defects therein in accordance with the provisions of the Contract.

2.1 Engineer's Duties and Authority
With reference to Sub-Clause 2.1(b), the following provisions shall also apply; The Engineer shall obtain the specific approval of the Procuring Entity before carrying out his duties in accordance with the following Clauses:

(i) Consenting to the sub-letting of any part of the Works under Sub-Clause 4.1 "Subcontracting".

(ii) Certifying additional cost determined under Sub-Clause 12.2 “Not Foreseeable Physical Obstructions or Conditions”.

(iii) Any action under Clause 10 “Performance Security” and Clauses 21,23,24 & 25 “Insurance” of sorts.

(iv) Any action under Clause 40 “Suspension”.

(v) Any action under Clause 44 “Extension of Time for Completion”.

(vi) Any action under Clause 47 “Liquidated Damages for Delay” or Payment of Bonus for Early Completion of Works (PCC Sub-Clause 47.3).

(vii) Issuance of “Taking Over Certificate” under Clause 48.

(viii) Issuing a Variation Order under Clause 51,except:

a) in an emergency* situation, as stated here below, or

b) if such variation would increase the Contract Price by less than the amount stated in the Appendix-A to Bid.

(ix) Fixing rates or prices under Clause 52.

(x) Extra payment as a result of Contractor’s claims under Clause 53.

(xi) Release of Retention Money to the Contractor under Sub-Clause 60.3 “Payment of Retention Money”.

(xii) Issuance of “Final Payment Certificate” under Sub-Clause 60.8.

(xiii) Issuance of “Defect Liability Certificate” under Sub-Clause 62.1.

(xiv) Any change in the ratios of Contract currency proportions and payments thereof under Clause 72 “Currency and Rate of Exchange”.

(Note: Procuring Entity may further vary according to need of the project)

* (If in the opinion of the Engineer an emergency occurs affecting the safety of life or of the Works or of adjoining property, the Engineer may, without relieving the Contractor of any of his duties and responsibilities under the Contract, instruct the Contractor to execute all such work or to do all such things as may, in the opinion of the Engineer, be necessary to abate or reduce the risk. The Contractor shall forthwith comply with any such instruction of the Engineer. The Engineer shall determine an addition to the Contract Price, in respect of such instruction, in accordance with Clause 52 and shall notify the Contractor accordingly, with a copy to the Procuring Entity.)

2.2 Engineer's Representative

The following paragraph is added:

The Procuring Entity shall ensure that the Engineer's Representative is a professional engineer as defined in the Pakistan Engineering Council Act 1975 (V of 1976)

The following Sub-Clauses 2.7 and 2.8 are added:

2.7 Engineer Not Liable

Approval, reviews and inspection by the Engineer of any part of the Works does not relieve the Contractor from his sole responsibility and liability for the supply of materials, plant and equipment for construction of the Works and their parts in accordance with the Contract and neither the Engineer's authority to act nor any decision made by him in good faith as provided for under the Contract whether to exercise or not to exercise such authority shall give rise to any duty or responsibility of the Engineer to the Contractor, any Subcontractor, any of their representatives or employees or any other person performing any portion of the Works.

2.8 Replacement of the Engineer

"If the Procuring Entity intends to replace the Engineer, the Procuring Entity shall, not less than 14 days before the intended date of replacement, give notice to the Contractor, of the name, address and relevant experience of the intended replacement Engineer. The Procuring Entity shall not replace the Engineer with a person against whom the Contractor raises reasonable objection by notice to the Procuring Entity, with supporting particulars."

5.2 Language(s) and Law

(a) The Contract Documents, shall be drawn up in the English language.
(b) The Contract shall be subject to the Laws of Islamic Republic of Pakistan.

5.3 Priority of Contract Documents

The documents listed at (1) to (6) of the Sub-Clause are deleted and substituted with the following:

(1) The Contract Agreement (if completed);
(2) The Letter of Acceptance;
(3) The completed Form of Bid;
(4) Special Stipulations (Appendix-A to Bid);
(5) The Particular Conditions of Contract – Part II;
(6) The General Conditions – Part I;
(7) The priced Bill of Quantities (Appendix-D to Bid);
(8) The completed Appendices to Bid (B, C, E to L);
(9) The Drawings;

(10) The Specifications; and
(11) _____(any other).

In case of discrepancies between drawings, those of larger scale shall govern unless they are superseded by a drawing of later date regardless of scale. All Drawings and Specifications shall be interpreted in conformity with the Contract and these Conditions. Addendum, if any, shall be deemed to have been incorporated at the appropriate places in the documents forming the Contract.

The following Sub-Clauses 6.6 and 6.7 are added:

6.6 Shop Drawings

The Contractor shall submit to the Engineer for review 3 copies of all shop and erection drawings applicable to this Contract as per provision of relevant Sub-Clause of the Contract.

Review and approval by the Engineer shall not be construed as a complete check but will indicate only that the general method of construction and detailing is satisfactory and that the Engineer's review or approval shall not relieve the Contractor of any of his responsibilities under the Contract.

6.7 As-Built Drawings

At the completion of the Works under the Contract, the Contractor shall furnish to the Engineer 6 copies and one reproducible of all drawings amended to conform with the Works as built. The price of such Drawings shall be deemed to be included in the Contract Price.

10.1 Performance Security

The Contractor shall provide Performance Security to the Procuring Entity in the prescribed form. The said Security shall be furnished or caused to be furnished by the Contractor within 28 days after the receipt of the Letter of Acceptance. The Performance Security shall be of an amount equal to 10% of the Contract Price stated in the Letter of Acceptance. Such Security shall, at the option of the bidder, be in the form of either (a) bank guarantee from any Scheduled Bank in Pakistan or
(b) bank guarantee from a bank located outside Pakistan duly counter-guaranteed by a Scheduled Bank in Pakistan [deleted][6].

The cost of complying with requirements of this Sub-Clause shall be borne by the Contractor.

The following Sub-Clause10.4 is added:

[6] Words "(c) an insurance company having at least AA rating from PACRA/JCR" deleted by KPPRA Notification No. KPPRA/M&E/Estt:/1-4/2016 dated May 24, 2016.

10.4 Performance Security Binding on Variations and Changes

The Performance Security shall be binding irrespective of changes in the quantities or variations in the Works or extensions in Time for Completion of the Works which are granted or agreed upon under the provisions of the Contract.

14.1 Program to be Submitted

The program shall be submitted within 42 days from the date of receipt of Letter of Acceptance, which shall be in the form of:

i) a Bar Chart identifying the critical activities.
ii) a CPM identifying the critical path/activities.
(Procuring Entity to select appropriate one)

14.3 Cash Flow Estimate to be Submitted

The detailed Cash Flow Estimate shall be submitted within 21 days from the date of receipt of Letter of Acceptance

The following Sub-Clause 14.5 is added:

14.5 Detailed Program and Monthly Progress Report

a) For purposes of Sub-Clause 14.1, the Contractor shall submit to the Engineer detailed program for the following:

(1) Execution of Works;
(2) Labour Employment;
(3) Local Material Procurement;
(4) Material Imports, if any; and
(5) Other details as required by the Engineer.

(b) During the period of the Contract, the Contractor shall submit to the Engineer not later than the 8th day of the following month, 5 copies each of Monthly Progress Reports covering:

(1) A Construction Schedule indicating the monthly progress in percentage;
(2) Description of all work carried out since the last report;
(3) Description of the work planned for the next 56 days sufficiently detailed to enable the Engineer to determine his program of inspection and testing;
(4) Monthly summary of daily job record;
(5) Photographs to illustrate progress ;and
(6) Information about problems and difficulties encountered, if any, and proposals to overcome the same.

(c) During the period of the Contract, the Contractor shall keep a daily record of the work progress, which shall be made available to the Engineer as and when requested. The

daily record shall include particulars of weather conditions, number of men working, deliveries of materials, quantity, location and assignment of Contractor's equipment.

The following Sub-Clauses 15.2 and 15.3 are added:

15.2 Language Ability of Contractor's Representative

The Contractor's authorized representative shall be fluent in the English language. Alternately an interpreter with ability of English language shall be provided by the Contractor on full time basis. The Engineer / Procuring Entity, however, may relax conditions of the language from English to other local languages if deemed appropriate,

15.3 Contractor's Representative

The Contractor's authorized representative and his other professional engineers working at Site shall register themselves with the Pakistan Engineering Council.

The Contractor's authorized representative at Site shall be authorized to exercise adequate administrative and financial powers on behalf of the Contractor so as to achieve completion of the Works as per the Contract.

The following Sub-Clauses 16.3 and 16.4 are added:

16.3 Language Ability of Superintending Staff of Contractor

A reasonable proportion of the Contractor's superintending staff shall have a working knowledge of the English language. If the Contractor's superintending staff are not fluent in English language, the Contractor shall make competent interpreters available during all working hours in a number deemed sufficient by the Engineer. The Engineer

/ Procuring Entity, however, may relax conditions of the language from English to other local languages if deemed appropriate,

16.4 Employment of Local Personnel

The Contractor is encouraged, to the extent practicable and reasonable, to employ staff and labour from sources within KPK.

The following Sub-Clauses 19.3 and 19.4 are added:

19.3 Safety Precautions

In order to provide for the safety, health and welfare of' persons, and for prevention of damage of any kind, all operations for the purposes of or in connection with the Contract shall be carried out in compliance with the Safety Requirements of the Government of Pakistan and KPK with such modifications thereto as the Engineer may authorize or direct and the Contractor shall take or cause to be taken such further measures and comply with such further requirements as the Engineer may determine to be reasonably necessary for such purpose.

The Contractor shall make, maintain and submit reports to the Engineer concerning safety, health and welfare of persons and damage to property, as the Engineer may from time to time prescribe.

19.4 Lighting Work at Night

In the event of work being carried out at night, the Contractor shall at his own cost, provide and maintain such good and sufficient light as will enable the work to proceed satisfactorily and without danger. The approaches to the Site and the Works where the night-work is being carried out shall be sufficiently lighted. All arrangement adopted for such lighting shall be to the satisfaction of the Engineer's Representative.

20.4 Procuring Entity's Risks

The Procuring Entity's risks are:

Delete the text and substitute with the following:

(a) insofar as they directly affect the execution of the Works in KPK

- (i) war and hostilities (whether war be declared or not), invasion, act of foreign enemies,
- (ii) rebellion, revolution, insurrection, or military or usurped power, or civil war,
- (iii) ionizing radiations, or contamination by radioactivity from any nuclear fuel, or from any nuclear waste from the combustion of nuclear fuel, radioactive toxic explosive or other hazardous properties of any explosive nuclear assembly or nuclear component thereof,
- (iv) pressure waves caused by aircraft or other aerial devices travelling at sonic or supersonic speeds,
- (v) riot, commotion or disorder, unless solely restricted to the employees of the Contractor or of his Subcontractors and arising from the conduct of the Works;

(b) loss or damage due to the use or occupation by the Procuring Entity of any Section or part of the Permanent Works, except as may be provided for in the Contract;

(c) loss or damage to the extent that it is due to the design of the Works, other than any part of the design provided by the Contractor or for which the Contractor is responsible; and

(d) any operation of the forces of nature (insofar as it occurs on the Site) which an experienced contractor:

- (i) could not have reasonably foreseen, or
- (ii) could reasonably have foreseen, but against which he could not reasonably have taken at least one of the following measures:
  - (a) prevent loss or damage to physical property from occurring by taking appropriate measures, or
  - (b) insure against.

21.1 Insurance of Works and Contractor's Equipment

(Procuring Entity may vary this Sub-clause 1.1 (b))

21.4 Exclusions

The text is deleted and substituted with the following:

There shall be no obligation for the insurances in Sub-Clause 21.1 to include loss or damage caused by the risks listed under Sub-Clause 20.4 para (a) (i) to (iv).

The following Sub-Clause 25.5 is added:

25.5 Insurance Company

The Contractor shall be obliged to place all insurances relating to the Contract (including, but not limited to, the insurances referred to in Clauses 21, 23 and 24) with either National Insurance Company of Pakistan or any other insurance company operating in Pakistan and acceptable to the Procuring Entity.

Costs of such insurances shall be borne by the

Contractor. The following Sub-Clause 31.3 is added:

31.3 Co-operation with other Contractors

During the execution of the Works, the Contractor shall co-operate fully with other contractors working for the Procuring Entity at and in the vicinity of the Site and also shall provide adequate precautionary facilities not to make himself a nuisance to local residents and other contractors.

The following Sub-Clauses 34.2 to 34.12 are added:

34.2 Rates of Wages and Conditions of Labour

The Contractor shall pay rates of' wages and observe conditions of labour not less favourable than those established for the trade or industry where the work is carried out. In the absence of any rates of wages or conditions of labour so established, the Contractor shall pay rates of wages and observe conditions of labour which are not less favourable than the general level of wages and conditions observed by other Procuring Entities whose general circumstances in the trade or in industry in which the Contractor is engaged are similar.

34.3 Employment of Persons in the Service of Others

The Contractor shall not recruit his staff and labour from amongst the persons in the services of the Procuring Entity or the Engineer; except with the prior written consent of the Procuring Entity or the Engineer, as the case may be.

34.4 Housing for Labour

Save insofar as the Contract otherwise provides, the Contractor shall provide and

maintain such housing accommodation and amenities as he may consider necessary for all his supervisory staff and labour, employed for the purposes of or in connection with the Contract including all fencing, electricity supply, sanitation, cookhouses, fire prevention, water supply and other requirements in connection with such housing accommodation or amenities. On completion of the Contract the temporary camps or housing provided by the Contractor shall be removed and the Site reinstated to its original condition, all to the approval of the Engineer.

34.5 Health and Safety

Due precautions shall be taken by the Contractor, and at his own cost, to ensure the safety of his staff and labour at all times throughout the period of the Contract. The Contractor shall further ensure that suitable arrangements are made for the prevention of epidemics and for all necessary welfare and hygiene requirements.

34.6 Epidemics

In the event of any outbreak of illness of an epidemic nature, the Contractor shall comply with and carry out such regulations, orders and requirements as may be made by the Government, or the local medical or sanitary authorities, for purpose of dealing with and overcoming the same.

34.7 Supply of Water

The Contractor shall, so far as is reasonably practicable, having regard to local conditions**,** provide on the Site, to the satisfaction of the Engineer or his representative, adequate supply of drinking and other water for the use of his staff and labour.

34.8 Alcoholic Liquor or Drugs

The Contractor shall not, otherwise than in accordance with the Statutes, Ordinances and Government Regulations or Orders for the time being in force, import, sell, give, barter or otherwise dispose of any alcoholic liquor or drugs, or permit or suffer any such importation, sale, gift, barter or disposal by his Subcontractors, agents, staff or labour.

34.9 Arms and Ammunition

The Contractor shall not give, or otherwise dispose of to any person or persons, any arms or ammunition of any kind or permit or suffer the same as aforesaid.

34.10 Festivals and Religious Customs

The Contractor shall in all dealings with his staff and labour have due regard to all recognized festivals, days of rest and religious and other customs.

34.11 Disorderly Conduct

The Contractor shall at all times take all reasonable precautions to prevent any unlawful, riotous or disorderly conduct by or amongst staff and labour and for the preservation of peace and protection of persons and property in the neighborhood of the Works against the same.

34.12 Compliance by Subcontractors

The Contractor shall be responsible for compliance by his Subcontractors of the provisions of this Clause.

The following Sub-Clauses 35.2 and 35.3 are added:

35.2 Records of Safety and Health

The Contractor shall maintain such records and make such reports concerning safety, health and welfare of persons and damage to property as the Engineer may from time to time prescribe.

35.3 Reporting of Accidents

The Contractor shall report to the Engineer details of any accident as soon as possible after its occurrence. In the case of any fatality or serious accident, the Contractor shall, in addition, notify the Engineer immediately by the quickest available means.

The following Sub-Clause 36.6 is added:

36.6 Use of Pakistani Materials and Services

The Contractor shall , so far as may be consistent with the Contract, make the maximum use of materials, supplies, plant and equipment indigenous to or produced or fabricated in Pakistan and services, available in Pakistan preferably in KPK provided such materials, supplies, plant, equipment and services shall be of required standard.

41.1 Commencement of Works

The text is deleted and substituted with the following:

The Contractor shall commence the Works on Site within the period named in Appendix-A to Bid from the date of receipt by him from the Engineer of a written Notice to Commence. Thereafter, the Contractor shall proceed with the Works with due expedition and without delay.

The following Sub-Clause 47.3 is added:

47.3 Bonus for Early Completion of Works

The Contractor shall in case of earlier completion for either whole or part(s) of the Works pursuant to Sub-Clauses 48.1 and 48.2(a) respectively of the General Conditions of Contract, be paid bonus up-to a limit and at a rate equivalent to 50% of the relevant limit and rate of liquidated damages prescribed in Appendix-A to Bid

"Special Stipulations".

48.2 Taking Over of Sections or Parts

For the purposes of para (a) of this Sub-Clause, separate Times for Completion shall be provided in the Appendix-A to Bid "Special Stipulations".

51.2 Instructions for Variations

At the end of the first sentence, after the word "Engineer", the words "in writing" are added.

52.1 Valuation of Variations

In the tenth line, after the words "Engineer shall" the following is added: within a period not exceeding one-eighth of the completion time subject to a minimum of 28 days from the date of disagreement whichever is later.

53.4 Failure to Comply

This Sub-Clause is deleted in its entirety.

54.3 Customs Clearance

(Procuring Entity may vary this Sub-Clause)

54.5 Conditions of Hire of Contractor's Equipment

The following paragraph is added:

The Contractor shall, upon request by the Engineer at any time in relation to any item of hired Contractor's Equipment, forthwith notify the Engineer in writing the name and address of the Owner of the equipment and shall certify that the agreement for the hire thereof contains a provision in accordance with the requirements set forth above.

The following Sub-Clauses 59.4 & 59.5 are added:

59.4 Payments to Nominated Subcontractors

The Contractor shall pay to the nominated Subcontractor the amounts which the Engineer certifies to be due in accordance with the subcontract. These amounts plus other charges shall be included in the Contract Price in accordance with Clause 58 [Provisional Sums], except as stated in Sub-Clause 59.5 [Certification of Payments].

59.5 Certification of Payments & Nominated Subcontractors

Before issuing a Payment Certificate which includes an amount payable to a nominated Subcontractor, the Engineer may request the Contractor to supply reasonable evidence that the nominated Subcontractor has received all amounts due in accordance with previous Payment Certificates, less applicable deductions for retention or otherwise. Unless the Contractor:

a) submits reasonable evidence to the Engineer, or

b) i)satisfies the Engineer in writing that the Contractor is reasonably entitled to withhold or refuse to pay these amounts, and

ii) submits to the Engineer reasonable evidence that the nominated Subcontractor has been notified of the Contractor's entitlement,

then the Procuring Entity may (at his sole discretion) pay direct to the nominated Subcontractor, part or all of such amounts previously certified (less applicable deductions) as are due to the nominated Subcontractor and for which the Contractor has failed to submit the evidence described in sub-paragraphs (a) or (b) above. The Contractor shall then repay, to the Procuring Entity, the amount which the nominated Subcontractor was directly paid by the Procuring Entity.

60.1 Monthly Statements

In the first line after the word "shall", the following is added:

"on the basis of the joint measurement of work done under Clause 56.1,"

In Para (c) the words "the Appendix to Tender" are deleted and substituted with the words " Sub-Cause 60.11 (a)(6) hereof". (in case Clause 60.11 is applicable)

60.2 Monthly Payments

In the first line, "28" is substituted by "14".

60.10 Time for Payment

The text is deleted and substituted with the following:

The amount due to the Contractor under any Interim Payment Certificate issued by the Engineer pursuant to this Clause, or to any other terms of the Contract, shall , subject to Clause 47, be paid by the Procuring Entity to the Contractor within 30 days after such Interim Payment Certificate has been jointly verified by Procuring Entity and Contractor, or, in the case of the Final Certificate referred to in Sub Clause 60.8, within 60 days after such Final Payment Certificate has been jointly verified by Procuring Entity and Contractor; Provided that the Interim Payment shall be caused in 42 days and Final Payment in 60 days in case of foreign funded project. In the event of the failure of the Procuring Entity to make payment within the times stated, the Procuring Entity shall pay to the Contractor compensation at the 28 days rate of KIBOR+2% per annum for local currency and LIBOR+1% for foreign currency, upon all sums unpaid from the date by which the same should have been paid. The provisions of this Sub-Clause are without prejudice to the Contractor's entitlement under Clause 69.

The following Sub-Clause 60.11 is added:

60.11 Secured Advance on Materials

a) The Contractor shall be entitled to receive from the Procuring Entity Secured Advance against an indemnity bond acceptable to the Procuring Entity of such sum as the Engineer may consider proper in respect of non-perishable materials brought at the Site but not yet incorporated in the Permanent Works provided that:

(1) The materials are in accordance with the Specifications for the Permanent Works;

(2) Such materials have been delivered to the Site and are properly stored and protected against loss or damage or deterioration to the satisfaction of the Engineer but at the risk and cost of the Contractor;

(3) The Contractor's records of the requirements, orders, receipts and use of materials are kept in a form approved by the Engineer, and such records shall be available for inspection by the Engineer;

(4) The Contractor shall submit with his monthly statement the estimated value of the materials on Site together with such documents as may be required by the Engineer for the purpose of valuation of materials and providing evidence of ownership and payment therefor;

(5) Ownership of such materials shall be deemed to vest in the Procuring Entity and these materials shall not be removed from the Site or otherwise disposed of without written permission of the Procuring Entity; and

(6) The sum payable for such materials on Site shall not exceed 75 % of the (i) landed cost of imported materials, or (ii) ex-factory / ex-warehouse price of locally manufactured or produced materials, or (iii) market price of other materials.

(b) The recovery of Secured Advance paid to the Contractor under the above provisions shall be effected from the monthly payments on actual consumption basis.

60.11 Financial Assistance to Contractor

Financial assistance shall be made available to the Contractor by the Procuring Entity by adopting any one of the following three Alternatives**:**

Alternative One: Mobilization Advance

(a) An interest-free Mobilization Advance 10% of the Contract Price stated in the Letter of Acceptance shall be paid by the Procuring Entity to the Contractor in two equal parts

(b) upon submission by the Contractor of a Mobilization Advance Guarantee*/* for the full amount of the Advance in the specified form from a Scheduled Bank in Pakistan :

(1) First part within 14 days after signing of the Contract Agreement or date of receipt of Engineer's Notice to Commence, whichever is earlier; and

(2) Second part within 42 days from the date of payment of the first part, subject to the satisfaction of the Engineer as to the state of mobilization of the Contractor.

(b) This Advance shall be recovered in equal three installments or the PE as deemed fit.

63.1 Default of Contractor

The following para is added at the end of the Sub-Clause:

Provided further that in addition to the action taken by the Procuring Entity against the Contractor under this Clause, the Procuring Entity may also refer the case of default of the Contractor to Pakistan Engineering Council for punitive action under the Construction and Operation of Engineering Works Bye-Laws 1987, as amended from time to time as well as under the prevailing rules of KPPRA.

65.2 Special Risks

The text is deleted and substituted with the following:

The Special Risks are the risks defined under Sub-Clause 20.4 sub paragraphs (a) (i) to (a) (v).

67. 3 Arbitration

In the sixth to eight lines, the words "shall be finally settled....appointed under such Rules" are deleted and substituted with the following:

Shall be finally settled under the provisions of the Arbitration Act, 1940 as amended or any statutory modification or re-enactment thereof for the time being in force.

The following paragraph is added:

The place of arbitration shall be..... , Pakistan.

68.1 Notice to Contractor

The following paragraph is added:

For the purposes of this Sub-Clause, the Contractor shall, immediately after receipt of Letter of Acceptance, intimate in writing to the Procuring Entity and the Engineer by registered post, the address of his principal place of business or any change in such address during the period of the Contract.

68.2 Notice to Procuring Entity and Engineer

For the purposes of this Sub-Clause, the respective address are:

a) The Procuring Entity:

(to be filled in by the Procuring Entity as appropriate)

b) The Engineer:
(to be filled in by the Procuring Entity as appropriate)

70.1 Increase or Decrease of Cost

Sub-Clause 70.1 is deleted in its entirety, and substituted with the following:

The amounts payable to the Contractor, pursuant to Sub-Clause 60.1, shall be adjusted in respect of the rise or fall in the cost of labor, materials, and other inputs to the Works, by applying to such amount the formula prescribed in this Sub-Clause.

(a) Other Changes in Cost

To the extent that full compensation for any rise or fall in costs to the Contractor is not covered by the provisions of this or other Clauses in the Contract, the unit rates and prices included in the Contract shall be deemed to include amounts to cover the contingency of such other rise or fall of costs.

(b) Adjustment Formula

The adjustment to the monthly statements in respect of changes in cost shall be determined from the following formula:-

$$Pn = A + b\frac{Ln}{Lo} + c\frac{Mn}{Mo} + d\frac{En}{Eo} + \ldots\ldots\ldots\ldots$$

Where:

Pn is a price adjustment factor to be applied to the amount for the payment of the work carried out in the subject month, determined in accordance with Paragraph
60.1 (a), and with Paragraphs 60.1 (b) and (e), where any variations and daywork are not otherwise subject to adjustment;

A is a constant, specified in Appendix-C to Bid, representing the nonadjustable portion in contractual payments;

b, c, d, etc., are weightages or coefficients representing the estimated proportion of each cost element (labour, cement and reinforcing steel etc.) in the Works or Sections thereof, net of Provisional Sums and Prime Cost; the sum of A, b, c, d,

etc., shall be one;

Ln, Mn, En, etc., are the current cost indices or reference prices of the cost elements for month “n” , determined pursuant to Sub-Clause 70.1(d), applicable to each cost element; and

Lo, Mo, Eo, etc., are the base cost indices or reference prices corresponding to the above cost elements at the date specified in Sub-Clause 70.1(d).

(c) Sources of Indices and Weightages

The sources of indices and weightages shall be those listed in Appendix-C to Bid, duly filled in by the Procuring Entity /Engineer.

(d) Base, Current, and Provisional Indices

The base cost indices or prices shall be those prevailing on the day 28 days prior to the latest date for submission of bids. Current indices or prices shall be those prevailing on the day 28 days prior to the last day of the period to which a particular monthly statement is related. If at any time the current indices are not available, provisional indices as determined by the Engineer will be used, subject to subsequent correction of the amounts paid to the Contractor when the current indices become available.

(e) Adjustment after Completion

If the Contractor fails to complete the Works within the Time for Completion prescribed under Clause 43, adjustment of prices thereafter until the date of completion of the Works shall be made using either the indices or prices relating to the prescribed time for completion, or the current indices or prices, whichever is more favorable to the Procuring Entity, provided that if an extension of time is granted pursuant to Clause 44, the above provision shall apply only to adjustments made after the expiry of such extension of time.

(f) Weightages

The weightages for each of the factors of cost given in Appendix-C to Bid shall be adjusted if, in the opinion of the Engineer, they have been rendered unreasonable, unbalanced, or inapplicable as a result of varied or additional work executed or instructed under Clause 51. Such adjustment(s) shall have to be agreed in the variation order.

The following Sub-Clauses 73.1, 73.2, 74.1, 75.1, 76.1, 77.1and 78.1 are added:

73.1 Payment of Income Tax

The Contractor, Subcontractors and their employees shall be responsible for payment of all their income tax, super tax and other taxes on income arising out of the Contract and the rates and prices stated in the Contract shall be deemed to cover all such taxes.

73.2 Customs Duty & Taxes

(Procuring Entity may incorporate provisions where applicable)

74.1 Integrity Pact

If the Contractor or any of his Subcontractors, agents or servants is found to have violated or involved in violation of the Integrity Pact signed by the Contractor as Appendix-L to his Bid, then the Procuring Entity shall be entitled to:

(a) recover from the Contractor an amount equivalent to ten times the sum of any commission, gratification, bribe, finder's fee or kickback given by the Contractor or any of his Subcontractors, agents or servants;

(b) terminate the Contract; and

(c) recover from the Contractor any loss or damage to the Procuring Entity as a result of such termination or of any other corrupt business practices of the Contractor or any of his Subcontractors, agents or servants.

The termination under Sub-Para (b) of this Sub-Clause shall proceed in the manner prescribed under Sub-Clauses 63.1 to 63.4 and the payment under Sub-Clause 63.3 shall be made after having deducted the amounts due to the Procuring Entity under Sub-Para (a) and (c) of this Sub-Clause.

75.1 Termination of Contract for Procuring Entity's Convenience

The Procuring Entity shall be entitled to terminate the Contract at any time for the Procuring Entity's convenience after giving 56 days prior notice to the Contractor, with a copy to the Engineer. In the event of such termination, the Contractor :

(a) shall proceed as provided in Sub-Clause 65.7 hereof; and

(b) shall be paid by the Procuring Entity as provided in Sub-Clause 65.8 hereof.

76.1 Liability of Contractor

The Contractor or his Subcontractors or assigns shall follow strictly, all relevant

labour laws including the Workmen's Compensation Act and the Procuring Entity shall be fully indemnified for all claims, damages etc. arising out of any dispute between the Contractor, his Subcontractors or assigns and the labour employed by them.

77.1 Joint and Several Liability

If the Contractor is a joint venture of two or more persons, all such persons shall be jointly and severally bound to the Procuring Entity for the fulfillment of the terms of the Contract and shall designate one of such persons to act as leader with authority to bind the joint venture. The composition or the constitution of the joint venture shall not be altered without the prior consent of the Procuring Entity.

78.1 Details to be Confidential

The Contractor shall treat the details of the Contract as private and confidential, save in so far as may be necessary for the purposes thereof, and shall not publish or disclose the same or any particulars thereof in any trade or technical paper or elsewhere without the prior consent in writing of the Procuring Entity or the Engineer. If any dispute arises as to the necessity of any publication or disclosure for the purpose of the Contract, the same shall be referred to the decision of the Engineer whose award shall be final.

PART II –PARTICULAR CONDITIONS OF CONTRACT

Index	Clause
Alcoholic Liquor or Drugs	34.8
Arbitration	67.3
Arms and Ammunition	34.9
As-Built Drawings	6.7
Bonus for Early Completion of Works	47.3
Cash Flow Estimate to be Submitted	14.3
Commencement of Works	41.1
Compliance by Sub-Contractors	34.12
Conditions of Hire of Contractor's Equipment	54.5
Contractor's Representative	15.3
Co-operation with Other Contractors	31.3
Customs Clearance	54.3
Customs Duty and Taxes	73.2
Default of Contractor	63.1
Definitions	1.1
Detailed Program and Monthly Progress Report	14.5
Details to be Confidential	78.1
Disorderly Conduct	34.11
Procuring Entity's Risks	20.4
Local Personnel	16.4
Employment of Persons in the Service of Others	34.3
Engineer Not Liable	2.7
Employment of Engineer's Duties and Authority	2.1
Engineer's Representative	2.2
Epidemics	34.6
Exclusions	21.4
Failure to Comply	53.4
Festivals and Religious Customs	34.10
Financial Assistance to Contractor	60.11
Health and Safety	34.5
Housing for Labour	34.4
Increase or Decrease of Cost	70.1
Instructions for Variations	51.2
Insurance of Works and Contractor's Equipment	21.1
Insurance Company	25.5
Integrity Pact	74.1
Joint and Several Liability	77.1
Language Ability of Contractor's Representative	15.2
Language Ability of Superintending Staff of Contractor	16.3
Language(s) and Law	5.1
Liability of Contractor	76.1

Index	Clause
Lighting Work at Night	19.4
Monthly Payments	60.2
Monthly Statements	60.1
Notice to Contractor	68.1
Notice to Procuring Entity and Engineer	68.2
Payment of Income Tax	73.1
Payments of Nominated Subcontractors	59.4
Performance Security	10.1
Performance Security Binding on Variation and Changes	10.4
Priority of Contract Documents	5.2
Program to be Submitted	14.1
Rates of Wages and Conditions of Labour	34.2
Records of Safety and Health	35.2
Replacement of the Engineer	2.8
Reporting of Accidents	35.3
Safety Precautions	19.3
Secured Advance on Materials	60.11
Shop Drawings	6.6
Special Risks	65.2
Supply of Water	34.7
Taking Over of Sections or Parts	48.2
Termination of Contract for Procuring Entity’s Convenience	75.1
Time for Payment	60.10
Use of Pakistani Materials and Services	36.6
Valuation of Variations	52.1

SPECIFICATIONS- SPECIAL PROVISIONS

TABLE OF CONTENTS

SPECIAL STIPULATIONSCLAUSE OF SPECIFICATION SPECIAL PROVISION

SP-01 DESCRIPTION OF PROJECT.....

SP-02 PROJECT FEATURES.....

SP-03 DRAWINGS.....

SP-04 LAYOUT OF WORK AND SURVEYS.....

SP-05 ABBREVIATIONS OF STANDARDS.....

SP-06 STANDARDS OTHER THAN THOSE SPECIFIED.....

SP-07 APPROVAL OF MATERIALS, EQUIPMENT AND WORKMANSHIP .....

SP-08 INSPECTION.....

SP-09 CONSTRUCTION SCHEDULE.....

SP-10 CONTRACTOR'S CAMP AND SITE FACILITIES TO BE PROVIDED BY THE CONTRACTOR – CONSTRUCTION AND MAINTENANCE. .....

SP-11 WATER FOR CONSTRUCTION AND OTHER USES .....

SP-12 WEATHER CONDITIONS .....

SP-13 ASSISTANCE FOR ENGINEER.....

SP–14 STORAGE AND USE OF EXPLOSIVES.....

SP–15 VENTILATION AND DUST CONTROL .....

SP–16 PHOTOGRAPHS.....

SP–17 SECURITY.....

SP–18 DIRECTED AND REQUIRED .....

SP–19 CONTRACTOR TO COOPERATE WITH OTHERS.....

SP-20 PROGRESS REPORTS AND PHOTOGRAPHS .....

SP-21 SAFETY AND HEALTH.....

SP-22 RESTRICTION OF WORKMEN TO SITE .....

SP-23 PROTECTION CHARGES AND TRIBAL ROYALTIES.....

SP-24 MOBILIZATION OF ADVANCE.....

SP-25 COMMUNICATION TO THE ENGINEERS .....

SP-26 WORD DONE AFTER COMPLETION DATE.....

SP-27 MEASUREMENT AND PAYMENT.....

SP-28 DECISION OF EMPLOYER.....

SP-29 ADDITIONS TO AND DELETIONS FROM CLAUSES .....

SP-30 CONSTRUCTION ITEMS .....

SPECIFICATIONS

SPECIAL PROVISIONS

SP-01 DESCRIPTION OF PROJECT

The Project dam site is situated inn District Bannu on Tangai Alged. It is about 8.0 km North-East of Bannu and 2.5 km North-West of Satti village. Coordinates of the dam are; 33^{o} 03' 32"N and 70^{o} 37' 34"E (G.T Sheet No. 38 K/12).

Tangai Algad generally carries run-off produced by rainfall only. Reservoir will store flood water for irrigation purposes. The dam site is accessible through a black top road, locally called as Gombatti road. The catchment area of the Tangai Algad upto the dam is 29.8 sq. miles. The mean annual inflow at dam site is estimated as 3,560 acre-ft. Outflow for 500-year return period is 29,502 cusecs. Spillway width at ogee is 80 m while reduced to 50m at chute area. Life of reservoir was estimated through Brune curves. After 48 years of operation it is expected that 60% of gross storage will be filled.

The gross area (GCA) is 3000 acres having 2600 acres as culturable area (CCA). There is major constraint of irrigation water for cultivation of the whole CCA.

The main dam embankments have blocked the existing gap in the reservoir periphery of Tangai Algad. The main dam is 37 m (121 feet) high Clay core Earth fill Dam about 197 m (646.3 feet) long extending across the Tangai algad. The dam will create a reservoir which at its normal conservation level of 381.0 m (1250.06 ft).

The embankment zoning comprises; a central Clay core, Gravel fill in the shoulders, downstream filters, downstream drainage blanket, toe drain, upstream slope protection through riprap (rock pieces) to cater for the wave run up. The upstream and downstream slopes are 2. 5 H: 1V and 2. H: 1V respectively.

Stability of the embankment dam has been ascertained through adopting the standard procedures recommended by ICOLD and USBR for embankment design. Numerical models were developed to analyze slope stability, seepage through core and elastic settlement of the dam body. Whereas, earthquake induced deformations have been computed using Newmark's Method. The earthquake coefficient of 0.2 g has been used for analysis and design of the project.

The Satti Kalli Dam Spillway has been proposed at left abutment adjacent to the dam axis. The width of the ungated ogee overflow spillway at approach channel and at ogee is 262.48 ft (80 m), width of stilling basin is about 164.04 ft (50 m) to pass the flood of 29,502 cusec. Spillway has been proposed fully lined including ogee, chute, stilling basin and side walls. Anchor bars and drainages pipes also been included.

For Satti Kalli dam a tower type intake is provided with intake level at El. 1210.6 ft (369.0 m) a.m.s.l which will release the inflows as per crop water requirement and low flow discharges during construction. Access bridge has been added, to control the flow from upstream as well to

inspect the intake tower.

After the sedimentation up to the dead storage level lower inlet would be blocked with stop logs and the upper level which is above inlet level, will operate for irrigation releases at downstream.

Irrigation system off-taken from outlet structure at downstream right side of dam embankment. The system consists of main canal (8km) and minor (2km) having a total length of 10km.

Revision of the PC-I warranted mainly due to increase in scope of work of spillway (complete lining with stilling basin/energy dissipator), Irrigation system (concrete lining), realignment of road (paved road with concrete shoulders), Electrification of dam (solar based). The General items have also significantly increased, both of (i) supervisory consultancy due to increase in input and escalation upon remuneration, (ii) secondly due to abnormal market price hike, the rate of specified materials enhanced many folds, resulting in increase in cost of price adjustment/escalation of the civil works.

The Additional/ balance works are further sub-divided into three (02) packages:

a. Package-I: Construction of Spillway Stilling Basin, Retaining Wall, Road Culverts, Shoulder and Drain of Satti Kali Dam, District Bannu (Additional works)

b. Package-II: Construction of Irrigation System and Its Affiliated Structures I/C Electrification of Dam Embankment of Satti Kali Dam District Bannu (Balance works)

Construction time frame for these packages is 18 months, all the packages are proposed to be executed simultaneously.

SP-02 PROJECT FEATURES

Salient features of the project are given below:

Main Dam	
Type	Clay core Earth Fill Dam)
Crest width	9.15 m (30 ft.)
Length of Dam	197 m (646.3 ft)
Max Height of Dam	37m (121 ft)
Slope upstream face	2.5 H: 1.0 V
Slope downstream face	2.0 H : 1.0 V
Dead Storage Level	369 m (AMSL)
Maximum Conversation Level	381 m (AMSL)
Reservoir	
Catchment Area	29.80 (Sq. miles)
Gross Storage of Reservoir	4334 (Acre-ft)
Live Storage of Reservoir	3355 (Acre-ft)
Dead Storage of Reservoir	978 (Acre-ft)
Estimated Average Annual Runoff	3560 (Acre-ft)
Reservoir Area	157 (Acres)
Ogee Crest Spillway	
Width of spillway	80 m (262.48 ft.)
Width of Stilling Basin	50m (164.05 ft)
Max. Inflow against 500yr Return Period	34,033 Cusecs
Out flow at 500 Years return	29,502 Cusecs
Irrigation	
Gross Command Area (GCA)	3000 (Acres)
Culturable Command Area (CCA)	2600 (Acres)
Length of Main Canal	8.0 Km
Length of Minor Canal	2.0 Km
Design Discharge	10.66 cusecs
Intake Structure	
Conduit Length	88 m
Cost, Economic and Financial Evaluation	
Project Cost Estimate (Revised)	Rs. 1,348.606 million
EIRR	13.3%
Benefit cost ratio	1.52:1

SP-03 DRAWINGS

i) Drawings in Contract

The Drawings entitled Satti Kali Dam Project listed in List of Drawings (Vol.-II) and herein-after referred to as Bid Drawings, show the scope of work to be performed by the Contractor. The Bid Drawings shall not be used as a basis for fabrication or construction but may be used for planning, scheduling and placing preliminary orders for materials, subject to corrections based on the future issue of Drawings as provided under sub-clause SP-03 (ii), Construction Drawings. Any other drawings which are issued as Addenda before opening of Bids shall become part of this list.

ii. Construction Drawings

After award of Contract, the Bid Drawings will be replaced by drawings issued by the Engineer for construction, with such supplementary specifications as may be necessary. The Drawings issued for construction will include Bid Drawings reissued, Bid Drawings as may be modified, and additional drawings as required to develop in greater detail the construction required and shall be referred to hereinafter as Construction Drawings. The Construction Drawings will be drawings from which shop erection, concrete placing, formwork or other detailed drawings shall be prepared by the Contractor. The work shall be executed in conformity with the Construction Drawings.

iii. Definition of Term Drawings

The terms Drawings as used throughout the Specifications applies to both the Bid Drawings defined in sub-clause SP-03 (i), Drawings in Contract and to the drawings issued for construction as described in sub-clause SP-03 (ii), Construction Drawings.

iv. Checking of Drawings

The Contractor shall check all Construction Drawings carefully as soon as practicable after receipt thereof and shall promptly advise the Engineer of any errors or omissions.

v. Copies of Drawings and Specifications

Drawings and Specifications will be issued to the Contractor as follows:

1. Bid Drawings

Sets of Bid Drawings will be provided at cost of reproduction upon written request of the contractor.

2. New Construction Drawings.

Two copies of each drawing (free of charge) will be provided to the Contractor.

3. Specifications

Sets of Specifications will be provided at cost fixed by Engineer upon written request of the Contractor.

vi. Drawings to be furnished by the Contractor

1. Shop Drawings

All shop drawings required for the work (except reinforcing steel bending and cutting drawings and such drawings as are specified to be furnished by others under separate contracts) including field erection layout and construction detail drawings shall be furnished by the Contractor for approval of the Engineer. If more detailed drawings are necessary to complete any part of the work, such detailed drawing shall be prepared by the Contractor and submitted to the Engineer for approval. All drawings shall be completed and shall be submitted in due time and in logical order to facilitate proper coordination. All drawings submitted and approved will form part of the Contract.

2. Lift Drawings

Not less than fifteen calendar days prior to starting construction of any lift or other placement of concrete the Contractor shall submit to the Engineer for approval, detailed drawings hereinafter called lift drawings to such scale as to show clearly all recesses openings and embedded work, including embedded structural, mechanical and electrical items, in each lift or placement in sufficient detail for proper prosecution of the work. Lift drawings shall be submitted for every lift or other placement of concrete.

3. Camp Layout Drawings

Three prints of drawings showing the layout of the Contractor's camps with locations of his offices, labour camps, workshops, stores, sheds, yards and the constructional plant which the Contractor proposes to use on the works shall be submitted by the Contractor to Engineer for review. The drawings shall be submitted sufficiently in time to permit adequate review by the Engineer. Two sets of the drawings will be retained by the Engineer and one set will be returned to the Contractor with comments.

4. Other Drawings

Drawings showing proposed methods of construction for Temporary Works and other drawings additional to those referred to hereinabove, required by the Specifications, and shall also be submitted to the Engineer for approval.

5. Ownership of Drawings

All the drawings, bill of materials and any other information or documents furnished by the Contractor shall become the property of the Employer and shall be non-returnable.

vii. Submission and Approval

1. Drawings for Approval

The Contractor shall send drawings requiring approval of the Engineer by mail as follows:

Project Manager Satti Kali Dam – District Bannu	1 Reproducible and 2 prints

With copy to

Resident Engineer Satti Kali Dam – District Bannu	One print

Within fifteen calendar days after receipt, the Engineer will send one copy to the Contractor marked “Approved”. “Approved Except as Noted” or “Returned for Correction”. The notations “Approved” and “Approved Except as Noted” will authorize the Contractor to proceed with the fabrication of the materials and equipment or construction work covered by such drawings subject to the corrections, if any indicated thereon.

When prints of drawings have been “Returned for Correction” the Contractor shall make the necessary revisions on the drawings and shall resubmit prints for approval in the same manner as for new drawing. Every revision made during the life of the Contract shall be shown by number, date and subject in a revision block.

2. Work Prior to Approval

Any work done prior to the approval of drawings shall be at the Contractor’s risk. The Engineer shall have the right to request any additional details and to require the Contractor to make any changes in the design which are necessary to conform to the provisions and intent of these Specifications without additional cost to the Employer. The approval of the drawings by the Engineer shall not be construed as a complete check but will indicate only that the general method of construction and detailing is satisfactory. Approval by the Engineer of the Contractor’s drawings shall not be held to relieve the Contractor of the obligation to meet all the requirements of these specifications or of the responsibility for the correctness of the Contractor’s drawings or of the responsibility for

correct fit of assembled parts in final position or of the responsibility for the adequacy of method of construction.

3. Sequence of Submission

The sequence of submission of all drawings shall be such that all information is available for checking each drawing when it is received. All drawings submitted for approval shall be provided with a blank white space approximately 100 mm in height by 200 mm in width near the lower right-hand corner to be used for notations by the Engineer.

4. Approved Drawings

All Approved Drawings and data shall form part of the Contract. If revisions are made after a drawing has been approved, the Contractor shall furnish for approval additional copies as specified for the initial submission, subsequent to each revision. The Contractor shall distribute approved drawings by air mail to the addresses as follows:

Project Manager Satti Kali Dam – District Bannu	1 reproducible and 2 prints
_____	
_____	
Resident Engineer Satti Kali Dam – District Bannu	Two prints
_____	
_____	
Director (South) Small Dams, Directorate General Small Dams Irrigation Department Govt. of Khyber PakhtunKhwa, Plot # 27, Street # 12, Sector E – 8, Phase – 7, Hayatabad, Peshawar.	1 reproducible and 2 prints

The distribution may be varied in the course of the Contract.

viii. Mechanical, Electrical Drawings Diagrammatic

Certain mechanical and electrical Drawings are diagrammatic and indicate the general arrangement of the work. The Contractor shall refer to the Structural and other appropriate

detailed drawings for information as to the location of all fixtures and equipment. Where additional information is required, the Contractor shall request this information from the Engineer in writing.

ix. Record Drawings

The Contractor shall during the progress of the work, keep a record of all changes in and corrections to the designs and layouts shown on the Drawings. The Contractor shall prepare the record drawings under the supervision of the Engineer. The Contractor shall furnish to the Engineer three copies of all the record drawings after approval by the Engineer.

x. Drawings, Data, Correspondence – Language

Unless otherwise approved by the Engineer all drawings, data correspondence and other submissions made by the Contractor shall be in the English language.

SP-04 LAYOUT OF WORK AND SURVEYS

i. Reference Points, Lines and Levels

The Engineer will layout a reference line or lines in the field with accompanying points and bench marks with the assistance of surveyors/equipment, labour and materials provided by the Contractor. The Contractor shall establish all permanent reference points for construction control as a consequence of this work.

ii. Verification

The Engineer may make checks as the work progresses to verify lines and grades established by the Contractor and to determine the conformance of the work as it progresses with the requirements of Specifications and Drawings. Such checking by the Engineer shall not relieve the Contractor of his responsibility to perform all work in accordance with the Drawings and Specifications and the lines and grades given therein.

SP-05 ABBREVIATIONS OF STANDARDS

Standard specifications and codes of the following listed authorities wherever cited herein are referred to by use of the acronyms shown below. All materials and workmanship shall comply with requirements of latest revisions of applicable codes.

1.	American National Standards Institute, Inc.	ANSI
2.	American Society for Testing and Materials	ASTM
3.	American Association of State Highway & Transport Officials	AASHTO
4.	British Standards Institution	BS
5.	American Standards Association	ASA

6.	American Concrete Institute	ACI
7.	United States Bureau of Reclamation	USBR
8.	Steel Structures Painting Council	SSPC
9.	National Electrical Manufacturers Association	NEMA
10.	Insulated Power Cable Engineers Association	IPCEA
11.	American Society of Mechanical Engineers	ASME
12.	American Welding Society	AWS
13.	American Water Works Association	AWWA
14.	American Institute of Steel Construction	AISC
15.	U.S. Federal Highway Administration	FHWA
16.	American Institute of Architects	AIA
17.	American Society of Civil Engineers	ASCE
18.	American Wood Preservers Association	AWPA
19.	American Wire Gauge	AWG

SP-06 STANDARDS OTHER THAN THOSE SPECIFIED

Where requirements for materials or equipment are specified by reference to a standard which has its origin in one country, it is not the intention to restrict the requirements solely to that standard and that country. Other standards including standards of other countries will be accepted provided the requirements thereof in the sole opinion of the Engineer are at least equal to the requirements of the standard specified. The Contractor may propose to the Engineer an equivalent standard other than that specified in which case he shall submit the proposed standard and all other information required by Clause SP-07. Approval of Materials Equipment and Workmanship and shall submit written proof that his proposed standard is equivalent in all significant respects to the standard specified.

SP-07 APPROVAL OF MATERIALS, EQUIPMENT AND WORKMANSHIP

i. Manufacturer's Certificate of Compliance

In the case of standard labeled stock products of standard manufacture which have a record of satisfactory performance in similar work over a period of not less than two years, the Engineer may accept a notarized statement from the manufacturer certifying that the product conforms to the applicable specifications.

ii. Mill Certificates

In the case of materials for which such practice is usual, the Engineer may accept the manufacturer's certified mill and laboratory certificate.

iii. Testing Laboratory Certificates

The Engineer may accept a certificate from a commercial testing laboratory, satisfactory to him, certifying that the product has been tested within a period acceptable to the Engineer and that it conforms to the requirements of the Specifications.

iv. Service Record

If a demonstrable satisfactory service record is available for a material, certain specified tests may be waived by the Engineer.

v. Cost

The cost of any additional laboratory field and shop tests required through the resubmission of samples because of failure to comply with the Specifications shall be borne by the Contractor and will be deducted from any money due to him.

SP-08 INSPECTION

All material and equipment furnished and all work performed by the Contractor shall be subject to inspection by the Engineer at all times and in all states of completion both off-site and on-site. The Contractor shall furnish promptly, without additional charge, all facilities, labour and material reasonably needed by the Engineer to perform such inspection and tests. Selected materials and equipment may be inspected at the source e.g. borrow area, manufacturer's plant etc. as well as at the Site. Acceptance of materials and equipment or the waiving of inspection thereof shall in no way relieve the Contractor of the responsibility for furnishing materials and equipment meeting the requirements of the Contract.

SP-09 CONSTRUCTION SCHEDULE

i. Schedule to be provided

The Contractor shall carry out the Works in accordance with the dates specified in the Bid. Pursuant to Clause 14.1 of the Conditions of Contract, programe to be furnished, the Contractor shall within 15 days of the Order to Proceed submit to the Engineer for approval his proposed Schedule for construction and completion of the works.

ii. Form of Schedule

The schedule shall be in a form acceptable to the Engineer Activities shown on the schedule shall consist not only of the actual construction operations but shall also include the submittal and approval of drawings and samples, procurement of materials and equipment, and installation and testing of major and critical items.

iii. Shipping of Materials and Equipment to the Site

In preparing the Schedule, the Contractor shall fully take into account the requirements, limitations and possibilities of ocean or air freight, inland road and rail transportation etc. Progress of all shipments to the site shall be continuously monitored and the Contractor shall provide staff or agents to expedite all shipments and ensure compliance with the approved schedule.

iv. Approved Schedule

After initial approval by the Engineer the Contractor shall monitor the Schedule

and regularly but at intervals not exceeding 90 days submit revised copies for the information of the Engineer. All revisions shall be accompanied by an explanation of the reasons for the change(s). Any revisions required as a result of the Engineer's review or of changes in the overall project schedule shall be executed by the Contractor within 15 days of receipt of the Engineer's notice that such a revision is required. The approved schedule shall govern for such purposes as determination of extension of time, as the Engineer may require.

SP-10 CONTRACTOR'S CAMP AND SITE FACILITIES TO BE PROVIDED BY THE CONTRACTOR – CONSTRUCTION AND MAINTENANCE.

i. The Contractor's camps shall comply with the rules of the Pakistan Labour Camp Rules, (latest edition), issued by the Pakistan Health, Welfare and Local Government Department and the requirements therein set forth.

ii. The Contractor shall establish his own material testing laboratory near the dam site. He shall provide all equipment required to perform tests attached as Annex-1.

iii. The Contractor with the approval of the Engineer shall provide and maintain such haul and access roads as are necessary for construction of the works. It shall also include access road from right abutment of dam to the spillway site. Construction and maintenance of haul and access roads will not be measured for payment.

iv. No separate payment will be made for any of the construction for Contractor's camps and utilities and their maintenance, and other facilities for use of the Engineer and Employer under these specifications, and all costs therefore shall be included in the unit rates Bided for the items of the Bill of Quantities under this Contract.

i. The contractor shall provide the food free of cost to consultant team who are working on site.

ii. The contractor will provide 4x4 Toyota Pickup to client staff during execution period of the project, including POL, Driver and maintenance etc; No separate payment will be made for this facility.

SP-11 WATER FOR CONSTRUCTION AND OTHER USES

It is expressly expounded that the Contractor shall make his own investigations and arrangements for procurement and supply of water for construction and other uses. The Employer shall not accept any responsibility or entertain any claims by the Contractor due to non-availability of sufficient quantity or required quality of water.

SP-12 WEATHER CONDITIONS

The Contractor shall be deemed to have taken all possible weather and river flow conditions into account when preparing his Bid and shall not be entitled to extra payment by reason of the occurrence or effect of excessive rainfall, drought, temperature or

humidity, high winds, floods or any other meteorological phenomenon.

SP-13 ASSISTANCE FOR ENGINEER

The Contractor shall provide for the use of the Engineer whenever required during the Contract, all chainmen, staff men, laborers, tradesmen, technicians, instruments, apparatus, protective head gear and other equipment as the Engineer deems necessary for the execution of his duties in connection with the Contract.

The Contractor shall be solely responsible for all such instruments and apparatus and shall ensure that they are at all times in good repair and adjustment.

All equipment other than expendable items shall revert to the Contractor on completion of the Works.

No separate payment will be made for the work done pursuant to this Clause.

SP–14 STORAGE AND USE OF EXPLOSIVES

i. Explosives shall be stored, transported, handled and used in accordance with the law. The Contractor shall comply with all special rules and regulations that may be made by the authorities having jurisdiction, and by the Engineer, regarding construction of, and storage in magazines, precautions on blasting work, and the like. The Contractor will be held responsible to the Employer for all claims for damage caused.

ii. Explosives and detonators shall not be transported in the same vehicle. Explosives shall be stored in suitable magazines in an approved location. Detonators shall be kept in separate magazines. The magazine shall be plainly marked with large letters EXPLOSIVES – DANGEROUS in English and Urdu and shall be locked and guarded at all times. Keys to unlock the magazines shall be kept only by magazine keepers. Each magazine shall have around it a clear area suitably barricaded with a security fence.

iii. Before starting any drilling and blasting of rock the Contractor shall submit his proposed plan in writing for such operations to the Engineer for approval, shall not deviate there from without the written permission of the Engineer. The Contractor's plan shall include statement of maximum safe distance; means of protection of concrete and other work and structures, all of which shall be compatible with good practice as indicated in the approved safety manuals and other approved publications. Approval by the Engineer of the Contractor's plan of operation shall in no case relieve the Contractor of full responsibility for the entire drilling and blasting operation, including the safety of persons and the work.

iv. The Contractor shall satisfactorily cover chutes in open cut excavation as may be required to prevent damage to the works and injury to persons, and shall take extra precautions on all blasting work when required by the Engineer. Flagmen shall be employed by the Contractor to warn of pending blasts, and no radios shall

be operated in the proximity of blasting operation.

The Contractor shall blast to the extent approved in a manner which will not open seams nor crack or otherwise damage the rock outside of the prescribed limits of excavation, nor unduly shake up the ground and make it unstable, nor injure concrete already placed or existing structures at the site or in the vicinity thereof, nor in any way affect foundation and other rock and soil that is grouted. Whenever, in the Engineer's opinion, the Contractor's blasting operations may cause damage to rock against which concrete is to be placed, or rock that has been grouted, or otherwise cause damage, the Contractor shall drill shorter holes and use lighter charges or use mechanical rock removal or other suitable methods to complete the excavation.

SP–15 VENTILATION AND DUST CONTROL

The Contractor shall keep the air of the excavations and other spaces in a condition suitable for the health of men and clear enough for surveying operations.

SP–16 PHOTOGRAPHS

No photographs of the Site of the Works or any part thereof shall be published or otherwise circulated with the permission of the Engineer.

No such permission shall exempt the Contractor from complying with any statutory provisions in regard to the taking and publication of photographs.

SP–17 SECURITY

i. The Contractor shall always be deemed to have acquired himself with the provision of the Official Secret Act 1923 as adopted in Pakistan and other security provisions prevailing in the area in which he is working and shall abide by and conform to these. He will further ensure that his employees (supervising staff and labour etc) are acquainted with and abide by the rules, regulations and orders. Breach of the said provisions on the part of the Contractor or his employees, in addition to any other liability under law may also result in the immediate cancellation of the Contract by the Employer and completion of remainder of the work at the Contractors risk and cost by any other agency which the Employer may consider suitable to the needs of the case.

ii. The Engineer at his discretion shall have the right to issue the passes and control admission of the Contractor, his servants, work people and agents to the site of the Works or of any part thereof and the lists of work people etc. employed on the Works and shall satisfy the Engineer as to the genuineness of such personnel. Passes shall remain the property of the Employer and shall be returned at any time on demand by the Engineer and in all cases on completion of the work.

SP–18 DIRECTED AND REQUIRED

Unless otherwise stated, wherever in the Specifications or upon the Drawings, the words 'directed', 'required', 'permitted',' ordered' 'designated', 'prescribed' or words of like import

are used it shall be understood that the 'direction', 'requirement', 'permission', 'order', 'designation' or 'prescription' of the Engineer is intended and similarly the words approved acceptable satisfactory or words of like import shall mean approved by or acceptable or satisfactory to the Engineer.

SP–19 CONTRACTOR TO COOPERATE WITH OTHERS

Pursuant to Clause 31.2 of the Conditions of Contract, the Contractor shall coordinate his work with that of other Contractors/Sub-Contractors at the Site to whatever extent may be necessary to complete the Project in accordance with the Schedule, the Drawings and Specifications and the requirements of the Engineer. Should a disagreement or dispute arise between the Contractor, and any of the other Contractor/Sub-Contractors, the same shall be submitted without delay to the Engineer for his decision. Upon such decision, the Contractor, and other Contractor/Sub Contractors, shall proceed with the work in accordance therewith, immediately.

SP-20 PROGRESS REPORTS AND PHOTOGRAPHS

On the Tenth day of each month the Contractor shall submit four copies of a detailed written report in a form acceptable to the Engineer of the progress of the work during the preceding month. The report shall show, among such other data as the Engineer may request, the percentage of each type of work completed during the month and the total percentages of completion as of the date of the report. The Contractor shall also supply to the Engineer 8"x10" colour photographs of the work in progress throughout the Contract period. The photographs shall be taken at the start and completion of each major component of the work and at other times as directed by the Engineer to show the progress of the Project and each feature thereof. The Contractor shall provide one negative and four glossy prints of each photograph monthly. Only clear, sharply defined photographs will be accepted. No separate payment will be made for work done pursuant to this Clause.

SP-21 SAFETY AND HEALTH

i. General

In prosecuting the work, the Contractor shall provide working conditions on each operation that shall be safe and healthful as the nature of that operation permits. The crushing of rock, the dumping of stone, the mixing of concrete and handling of cement, steel and other materials shall be so conducted that these operations will not be injurious to life, limb or health. All work shall be performed in accordance with applicable local and national law, codes requirements and regulations including safety, health, welfare of persons and others.

ii. Accident and Fire Prevention

The Contractor shall enforce rules and regulations for the safe prosecution of the work in order to avoid preventable accidents and to minimize injuries to his

employees and those of the Employer, the Engineer and other third Parties work areas shall be adequately posted with safety signs and posters. Machinery and equipment shall be guarded and all hazards eliminated. All reasonable precautions shall be taken against fire, and provisions shall be made for the expeditious extinguishing thereof.

In addition to the reports which the Contractor may be required to file under the law he shall file with the Engineer on or before the tenth day of each month, a report giving the total force employed on this Contract in man-days during the previous calendar month, the number and character of all accidents resulting in loss of time, and any other information on classification of employees, injuries received on the work and disabilities arising there from that may be required by the Engineer.

During the entire period of his operations at the site, the Contractor shall be required to make arrangements for providing emergency medical treatment including first aid treatment and approved qualified personnel to administer such treatment to all injured persons including the Employer's and Engineer's personnel. The Contractor shall designate one or more approved competent licensed physicians who shall at all times be ready to supply medical and surgical services. The Contractor shall submit for the approval of the Engineer and upon such approval install a means of rapidly summoning the physicians to the site of an accident or fire.

SP-22 RESTRICTION OF WORKMEN TO SITE

The Contractor shall restrict his workmen to the Site and prevent trespass into adjoining property and completed parts of the works and shall take all necessary precautions to prevent and indemnify the Employer against any damages arising from nuisance of any kind.

SP-23 PROTECTION CHARGES AND TRIBAL ROYALTIES

The Contractor or any of his sub-contractors shall be responsible for the payment of protection charges and tribal royalties, if so required to be paid in accordance with any locally established tradition custom or practice and the rates and prices stated in the priced Bill of Quantities shall be deemed to cover all such protection charges, tribal royalties and other such payments.

SP-24 MOBILIZATION OF ADVANCE

An interest free mobilization advance is to be paid under Clause 60.12 of the conditions of Contract Part-II, to compensate the Contractor for operation including, but not limited to, any necessary mobilization expenses for all equipment, related components and supplies and delivery to the Site; those necessary for the interim salaries and the movement or personnel, household effects, supplies and incidentals to the project site,

for site preparation, the establishment of workshops, storage, offices, accommodation, services and other facilities deemed to be required under the Contract; and for any other work and operation which must be performed or costs which must be incurred prior to the initiation of works under the Contract. The advance payment shall be repaid by the Contractor in accordance with Clause 60.12 of condition of Contract Part-II.

SP-25 COMMUNICATION TO THE ENGINEERS

The Contractor shall address all communications as follows:

Project Director

Satti Kali Dam Project

_____

_____

With copy to

Resident Engineer

Satti Kali Dam Project

_____

_____

SP-26 WORD DONE AFTER COMPLETION DATE

The contractor obligation to provide facilities and services to the personnel and officers of the employer, the engineer and other contractors will terminate upon date of the final certificate of completion. However, if directed by the engineer, the contractor shall continue such work to the extent directed by the Engineer for an additional period of up to twelve months. Payment for such additional work will be made under the provisional sum for item, continuation of the contractor-provided services. No payment under this clause will be made for those parts of the contractor's camp and other facilities which he requires for his own use during the defects liability period.

The aforementioned schedule of time and instructions will require handing over of certain portions of the facilities on the date of final certificate of completion. The contractor will be permitted to retain possession of and use such portion to the employer when no longer needed during the defects liability period

SP-27 MEASUREMENT AND PAYMENT

General

Unless specifically provided, all works/services required to be provided under Special Provisions, shall be deemed to be included in the unit rates of Bill of Quantities and no separate measurement or payment shall be made.

SP-28 DECISION OF EMPLOYER

In these Clauses, if there is anything repugnant to the conditions of Contract then decision of the Employer shall be final.

SP-29 ADDITIONS TO AND DELETIONS FROM CLAUSES

Employer has the right of making any additions to and/or deletions from any conditions of contract special provisions, Technical Specifications and any other document forming a part of Bid/Contract Documents.

SP-30 CONSTRUCTION ITEMS

Employer has the right to add or delete any item of Construction.

SPECIFICATIONS-
TECHNICAL PROVISIONS

TECHNICAL SPECIFICATIONS

Table of Contents

SECTION - 1	**CARE AND HANDLING OF WATER**
SECTION - 2	**EXCAVATION**
SECTION - 3	**CONSTRUCTION OF EARTH FILL**
SECTION - 4	**PLAIN AND REINFORCED CONCRETE**
SECTION - 5	**EMBANKMENT INSTRUMENTATION**
SECTION - 6	**BRICK WORK**
SECTION - 7	**REINFORCED CEMENT CONCRETE PIPE**
SECTION - 8	**CONCRETE LINING FOR CHANNELS**
SECTION - 9	**ELECTRIFICATION**
SECTION - 10	**ROAD**

SECTION – 1
CARE AND HANDLING OF WATER

1.1 GENERAL

This section covers the construction, maintenance, and required removal of structures and other facilities, and the performance of all work necessary to Care and Handling of spring water, river water, ground water, rain water, flood water, water from any other source, and local drainage in connection with entire contract i.e. during construction and maintenance periods so that such water does not interfere with the progress or affect the quality of construction. The work includes but is not limited to the following.

i. Dewatering of Foundations and Trenches,

ii. Care and Handling of river work/water

The contractor shall be required to complete all works in stipulated time frame.

1.2 COFFERDAMS/CONSTRUCTION OF WEIR/DIVERSION ARRANGEMENT

Cofferdam/Weir shall be constructed in accordance with the requirements shown on the Drawings and as specified herein or as directed by the Engineer. Locations of the cofferdam/Weir and proposed typical cross-section are shown on the Drawings. The proposed cofferdam/Weir section may be modified by the Contractor with the approval of the Engineer. The contractor may also increase the height of the cofferdam/Weir, if necessary, with the prior approval of the Engineer. All such construction if carried out shall be at the Contractor's expense. Embankment slopes facing river shall be protected by providing temporary stone protection Reno mattress parallel to river flows upto the elevation shown on the Drawings. construction of the dam in the river channel shall be started at the advent of dry season. Slope protection Reno-mattress will be removed before undertaking construction of dam in this stage. Embankment Dam construction must be completed in all respects prior to the any flood season. Engineer’s approval shall be necessary for selection and demarcation of the borrow areas. The cofferdam/Weir shall be constructed by compacting river bed material (or specified in drawings). Each layer shall have a compacted thickness of 60 cm and shall be subjected to not less than two passes of a 10 ton tamping or other approved roller. Trapped water, if any, between the main dam and the cofferdams/Weir shall be drained off by any method proposed by the Contractor and approved by the Engineer. A constant watch shall be maintained by Contractor to check and close any leaks through the body or foundation of cofferdams/weir. Dewatering arrangements including pumps, if required, shall be provided on the downstream of the cofferdams/weir to keep the area dry while placing the embankment fill. Cofferdams/weir shall be maintained till such time that the embankment has been completed in all respects.

The proposed method of Care and handling of Water is tentative, only for guidance

and in no way limits the responsibility of the Contractor to provide risk - free care of water. The Contractor shall obtain the prior approval of the Engineer for any alternative method of care and handling of water. The Contractor shall also obtain the prior approval of the Engineer in respect of the date on which he proposes to start the Cofferdam filling or weir construction, which date shall be as soon as practicable after the commencement of the dry season and in accordance with the Construction Schedule to be provided by the Contractor.

1.3 MEASUREMENT AND PAYMENT

Care and Handling of Water Measurement will be made as lump sum of all work acceptably performed under Section SP 1.1 (i), (ii), (iii) and (iv) and which is not included for payment under any other item.

Payment will be made for the unit measured as provided above at the Contract lump sum price for Care and Handling of Water during construction and maintenance and shall constitute full compensation for all costs related to care and handling of water during construction and maintenance and other works for which payment is not made under other items including review of scheme shown on the Drawing, submission for approval, accepted adjustments of scheme, construction including excavation and fill, their maintenance, dewatering including pumping, repair or replacement of damaged work due to flood and other waters, expense incidental to overtopping of cofferdams/weir; dewatering, re-excavation, refill and all other work related to the item. Payment for this item shall be made accordingly to the schedule of payment approved by the Engineer.

SECTION - 2
EXCAVATION

2.1 GENERAL

This section covers the excavation for Embankment Dam, Spillway. Outlet Structure, Irrigation System, borrow areas; dental excavation; other excavation not specified in other Sections; and disposal of all excavated materials except as the placement of the material is covered in other Sections.

2.2 DRAWING PRESENTATION

In addition to the required excavation lines for permanent structures, the Drawings show the borrow areas which may be used as sources of construction materials; results of field explorations at the required excavation and borrow areas including selected sources and estimated quantities of materials for use in various zones of the Dam. The information regarding sources and estimated quantities of materials for use in Embankments as presented on the Drawings is not intended as a representation or a warranty and is presented only for the information of the Contractor. The Employer assumes no responsibility for any deductions, interpretations or conclusions drawn there-from. The Contractor will be required to review all data in Contract Documents, make his own investigations and studies necessary for a proposed plan of sources and distribution of excavated materials, and shall perform the work using sources and distribution that will result in the optimum project economy to the Employer and optimum progress consistent with requirements of the Drawings and Specifications. The Contractor shall propose his plan of excavated material's utilization for approval of the Engineer. After the plan proposed by the Contractor is approved, the Contractor may propose alterations in his plan for further approval of the Engineer as may be found necessary during the course of the work.

2.3 CLASSIFICATION OF EXCAVATED MATERIALS

a) General

The terms Rock and Earth are hereby defined when used for the purpose of classifying excavated materials for payment under the various Items of BOQ.

b) Rock

Rock is defined as all materials which, in the opinion of the Engineer, require blasting, or the use of metal wedges and sledgehammers, or the use of compressed air drilling for its removal, and which cannot be extracted by ripping with a tractor of at least 150 brake hp with a single rear mounted heavy duty ripper. In case of doubt the Engineer's decision will be considered final.

c) Earth

Earth shall mean all material except hard rock as defined above in sub-section (b). earth shall include, but not necessarily be limited to soft rock, river deposited material, all geologically recent materials such as alluvium and talus;

all layers of earth which are cemented so that the soil becomes conglomerate. Soft rock such as mudstone, siltstone, clay stone, etc. shall be treated as soil, if not covered under sub-section (b) above.

2.4 EXCAVATION OPEN CUT– GENERAL EXCAVATION METHODS

2.4.1 Excavation Methods

The Contractor shall perform all open cut excavation and grading to the final elevation lines and grades shown on the Drawings or approved by the Engineer. Excavation shall be performed by approved methods. The Contractor shall make such trial excavations as are necessary to indicate the adequacy of the excavation methods. The rock excavation in the foundation area of structures shall be done by excavation equipment and or such careful methods as Line Drilling, Pre Splitting or Cushion Blasting. The responsibility for the success of the excavation method shall rest with the Contractor regardless of approval by the Engineer.

The area from which the excavated material is expected to be used in construction of embankments and fills has been designated on the Drawings. In general for the earth and rock materials the Engineer will use his best endeavors to advise the Contractor at the loading areas regarding the suitability of excavated materials for use in the embankment based on the Engineer's examination prior to transportation to points of placement. Stock-piling will not be paid for. The quality requirements of the materials are specified in Section 3.4-Materials.

2.4.2 Excavation Extent

Excess excavation performed by the Contractor for any purpose or reason, other than that ordered in writing by the Engineer, shall be at the expense of Contractor. All excavation for structures shall be carried to foundation material satisfactory to the Engineer regardless of whether the elevation thereof is higher or lower than the elevation shown on the drawings. All necessary precautions shall be taken to preserve the material below and beyond the lines of all excavation in sound undisturbed condition. All over-excavation required by the Engineer to be backfilled shall be backfilled by the Contractor in accordance with instructions of the Engineer; over-excavation in rock shall be backfilled with concrete or as directed by the Engineer; if over-excavation is unauthorized, it shall be backfilled at the Contractor's expense. Except where the use of other materials is specifically approved by the Engineer, unauthorized excessive excavation in rock and in earth where side forms are not used shall be backfilled with concrete at the Contractor's expense.

Materials for use in the work shall be carefully excavated to produce the material in form suitable for the work; additional measures such as secondary blasting, mixing, blending and sieving shall be used, if necessary, to make the excavated material suitable for the required use. Excavations through overburden into rock shall be performed in a manner to result in separation of the rock from the overburden so that the maximum practicable amount of suitable embankment and fill material will be produced.

2.4.3 Excavation Tolerances

Excavation shall be performed within the tolerances for excavation limits indicated on the Drawings. Where no tolerances are indicated, excavation shall be performed to tolerance established by the Engineer as acceptable for the design and type of work involved. In cases where the governing criteria permit, the Engineer may relax the tolerance to facilitate construction.

2.4.4 Excavation Line to Suit Field Condition

The character and desired dimensions of the proposed excavations are in general indicated on the Drawings. The Engineer, however, shall have the right to:

(i) Vary the depth, width, and length of the excavations and to increase or decrease the slopes including berms of the excavations; and

(ii) Require the use of berms of dimension as instructed in permanent slopes where none are shown on the Drawings, if conditions require or permit such modifications for the purpose of obtaining more stable or economical slopes and/or foundations. The Engineer shall have the right to vary the excavation lines after excavation has been commenced.

2.4.5 Support of Excavations

During the excavation work, the Contractor shall be responsible for providing stable interim excavation slopes and for the proper support of excavations (regardless of the method of support specified by the Engineer) as necessary to accomplish the final construction shown on the Drawings.

2.4.6 Dewatering of Foundations

The Contractor shall maintain all foundation and other permanent work areas free of water as shown on the Drawings, or as approved by the Engineer. The Contractor shall provide, install, operate and maintain approved Dewatering systems (including sufficient standby equipment) to dewater and keep dry all areas of construction during construction operations and as required to keep

excavated foundation and side slopes stable. All fill material shall be placed in the dry. The Contractor shall employ pumping methods in such a way as to prevent loss of fines from or other damage to foundations, maintain the stability of the excavated slopes and to permit construction operations, as required to be performed in the dry. The Contractor shall also install measurement and recording devices approved by the Engineer, for accurately measuring the quantities and rates of water pumped.

No separate payment will be made for dewatering of foundations. The cost thereof shall be included in the Contract lumpsum price for the care of water during construction (Section 1).

2.5 FOUNDATION PREPARATION

2.5.1 Clearing and Stripping for Embankment Foundations

All areas against which fill has to be placed directly shall be cleared of all trees and vegetation as described in this Section. Clearing within the fill areas shall consist of the complete removal above ground of trees and stumps, all bush, shrubs, weeds and vegetation and all debris and objectionable material. Cleared material shall be disposed of by the Contractor by burning in open area the combustible materials and removal of the incombustible materials from the site of work in a waste area designated by the Engineer. In addition, the areas to receive embankments shall be stripped of all organic soils, loose rocks and loose talus as directed by the Engineer. The haulage involved in the operation is included in the BOQ.

2.5.2 Preparation of Foundations

(a) Some of the foundation materials may deteriorate on exposure and get disturbed and remolded by construction traffic. The Contractor shall carry out his operations in such a manner that the risk of disturbance, deterioration and remolding is reduced to a minimum.

(b) Rock outcrops and knobs shall be reduced to required slopes and the excavation for embankment base done accordingly to bring it to proper level and grade, as directed by the Engineer. The haulage for stockpile and disposal of un-usable material downstream of dam body is included in the B.O.Q.

2.5.3 Excavation for Core Trench

Beneath the foundation of the dam within limits as shown on the Drawings necessary earth materials shall be excavated, bed rock surfaces prepared and impervious fill material placed as required for the control of under-seepage. Excavation shall be carried to the specified depth in the river bed and to

reasonably sound strata at the abutments. Contractor shall be responsible for the maintenance of stable slopes during the excavation and backfill of the core trench. The slopes shown on the Drawing are indicative and may be varied or supplemented with berms, if required, subject to the approval of the Engineer. The suitable material excavated from the core trench will be allowed to be placed in the main embankment as directed by the Engineer and the Contractor may stockpile such suitable materials for further use. The payment for placement of suitable material will be made separately according to other materials in the dam. The unsuitable material will be disposed of in the designated spoil area, and no additional payment will be made for the stockpiling and disposal work. The portion of the excavation for the core trench below water table shall be dewatered subject to the requirements of Section 2.4.6. During the placing and compacting of the fill material in the core trench the water level at every point in the core trench shall be maintained below the bottom of trench. The haulage for stockpile and un-usable material is included in the BOQ.

2.5.4 Surface Dental Treatment

Exposed rock surface within the rock-cutoff contact areas shall be cleaned by brooming and compressed air injection. Surface treatment shall be performed if necessary, to ensure that no open or loosely filled fissures, joints or bedding planes are present which might permit seepage concentrations along the rock-cutoff contact areas. Surface treatment shall consist of coating with asphalt emulsion or slush grouting, or as directed by the Engineer. Slush grouting shall consist of treatment of cracks and fissures with a 1:6 cement water mixture under light pressure, as and where directed by the Engineer.

Unsatisfactory material in pockets, seams and fissures shall be removed, if so ordered by the Engineer. Fissures, seams and shear zones exposed in the cleaning process shall be immediately filled with dental concrete, as directed by the Engineer. Exposed surface of final grade excavation in rock cutoff contact area which cannot be immediately covered with impervious fill shall be coated with asphalt emulsion in order to prevent to atmosphere.

2.5.5 Excavation for Trenches

Unless otherwise directed or permitted by the Engineer not more than 10 m of any trench in advance of the end of the pipeline already laid shall be opened at any time. Trenches shall be excavated to the dimensions and depths shown on the Drawings or ordered by the Engineer or in such a position or to such dimensions and depths as shall allow for the proper construction of the relevant

structure and proper execution of the relevant operation. Pipe trenches shall be excavated to give a clear width of ½ diameter of pipe with a minimum of 150 mm, on either side of the pipe. Additional excavation shall be carried out to give ample space for making joints and, where necessary, for concrete bedding or surround.

The banks of the pipe trench shall be as nearly vertical as practicable. Bell holes and depressions for joints shall be dug after the trench bottom has been prepared. The pipe, except for joints, shall rest on the prepared bottom for its full length. Bell holes and depressions shall be only of such length, depth, and width as required for properly making the particular type of joints. Stones above 15 cm size shall be removed to avoid point bearing. Whenever wet or otherwise unstable material that is incapable of properly supporting the pipe as determined by the Engineer is encountered in the bottom of the trench, such material shall be removed to the depth required and the trench backfilled to the proper grade with coarse sand, or other suitable approved granular material. Such replacement of unsuitable material will be paid for at the contract unit price for that item of work.

Where the Contractor has excavated to depths in excess of the requirements, due to his negligence or from causes within his control, he shall refill and compact at his own expense the excess excavation with suitable material upto corrected level, as approved by the Engineer.

Excavation of appurtenances shall be sufficient to leave at least 300 mm but not more than 600 mm between the outer surface and the embankment or timber that may be used to hold and protect the banks. Any over-depth excavation below such appurtenances that has not been directed by the Engineer, will be considered un-authorized and shall be refilled with compacted sand, gravel or concrete, as directed by the Engineer and at no additional cost to the Employer.

2.5.6 Excavation for Canals / Channels

The work to be done under Excavation for Channels consists of the construction of canals as shown on the Drawings or as designated by the Engineer. All excavations and embankments shall be made to lines and grades shown on the Drawings or established by the Engineer. Where practicable, the finishing operations of the channel sections shall be performed by the Contractor simultaneously with the channel excavation. During the progress of the work, it may be found necessary or desirable by the Engineer to vary the slopes or the dimensions of the excavations for channels and embankments

from those shown on the Drawings or specified herein, and the Contractor shall perform the work to the revised and changed slopes and dimensions. All necessary precautions shall be taken to preserve the material below and beyond lines of all excavation in the soundest possible condition. Runways for equipment shall not be cut into channels banks.

Excavated materials shall be disposed of in required embankments, backfill or in spoil banks as shown on the Drawings, or shall be placed in approved waste areas or in other locations as directed by the Engineer. Where shown on the Drawings or directed by the Engineer, approved excavated materials shall be placed in compacted embankments along the channel. The approved materials shall be placed in approximately horizontal layers not more than 6 inch thick after being well compacted. Prior to and during placement operations, the material shall have the proper moisture content for compaction as determined by the Engineer. If the moisture content is less than that required for compaction, it shall be supplemented by sprinkling and reworking the material during placement. If the moisture content is greater than that required for compaction, the material shall be dried by reworking, mixing with dry materials or other approved means. Each layer of the embankment shall be compacted by properly routing the travel of the mechanical excavation, hauling and placing equipment over the fill during construction of the compacted embankment.

The Contractor shall not interrupt nor interfere with the natural flows in irrigation and drainage channels for any reason or purpose without the written approval of the Engineer. Should temporary works such as diversion channels and structures be required, the Contractor shall construct, maintain and remove when no longer required all such temporary works. Any damage to temporary and permanent works or the property of others due to improper operation or failure of the works constructed for maintaining flow in irrigation and drainage channels shall be corrected by the Contractor at his own expense.

Measurement for payment for Excavation for Channels will include all excavation within the channel prism. The channel prism is defined as the volume bonded by the designated bed level of channel, the specified side slopes of the channel projected to the natural surface level, and the natural surface level, all as shown on the Drawings for any particular reach of the channel.

2.5.7 Excavation for Structures

All earth excavation under this contract, which is not included under the classification “Earth excavation in Trenches and cut off trench” shall be

classified and paid for as earth excavation for structures.

The Contractor shall provide adequate timbering or shoring for excavations. Should the sides and ends of any excavations give way the contractor shall, at no extra cost, remove all disturbed ground. Any excavation carried outside the limits shown on Drawings and specified herein as the payment limits, shall not be treated as excavated and shall not be paid for.

When foundation level is reached, the Engineer's representative will inspect the exposed ground and give directions as to what further excavation, if any, he considers necessary. The excavation should be done in such a manner as to ensure that the work rests on a solid and perfectly clean foundation. If the Contractor allows any portion of such foundations to deteriorate due to exposure, he shall make good the foundation to the satisfaction of the Engineer without extra cost.

Except where otherwise specified in the Special Provision, excavation and backfill for culvert and drainage pipes, except granular backfill to under drains, will not be paid for separately but shall be considered as a subsidiary obligation of the Contractor covered under the contract price for the various classes of culvert pipe as provided.

2.6 PRECAUTIONARY AND REMEDIAL MEASURES

2.6.1 Protection of existing Facilities and Structures

Contractor shall take every necessary precaution not to endanger the safety, occupation or operation of any property, structures, installations or services in the vicinity of his operations and shall observe any restrictions imposed by authority concerned /Engineer to this end. Should any such property, structures, installations or services be endangered or damaged as a result of the Contractor's operations, he shall immediately report any such damage to the Engineer's Representative and the authority concerned and shall forthwith undertake remedial measures to the satisfaction of the Engineer or the appropriate authority.

2.6.2 Planking and Strutting

The Contractor shall provide at his own expense, to the satisfaction of the Engineer, all timbering, poling, shoring, strutting and other approved supports to the sides of all excavations, trenches and all other works in such a way as will be sufficient to secure them from falling and to prevent any movement. All responsibilities connected with this part of the work shall rest with the Contractor.

In removing timbering, shoring and strutting and all other supports from

excavation and trenches, special care shall be taken to avoid pressure on fresh concrete or any other work until it is sufficiently safe to resist such pressure.

2.6.3 Removal of Water

The Contractor shall build all drains and do ditching, pumping, well pointing, bailing, and all other work necessary to keep the excavation clear of ground water, sewage and storm water during the progress of the work and until the finished work is safe from injury. All water pumped or drained from the work shall be disposed of in a manner satisfactory to the Engineer and necessary precautions against flooding shall be taken. The procedure for dewatering of subsoil water from excavation for the purpose of construction of Water Supply lines and other structures shall be in accordance with the method given below: Dewatering of subsoil water from excavations of trenches and excavations for other structures shall be arranged by an adequate process of well pointing, bailing and /or pumping.

Well pointing shall consist of bore holes, provided with necessary strainers, blind pipes and pumping machinery and these shall be of suitable size and depth and shall be located on both sides of the trench and along the periphery of water level to a sufficient depth to keep the excavations clear of subsoil water during the process of construction.

As a part of the work and at no extra cost, the Contractor shall provide all strainer pipes and other requisite material, and boring tools and plant, etc. for the well pointing and shall also provide pumping equipment as well as operating personnel, power, etc. Dewatering of subsoil water by well pointing, bailing and/ or pumping shall be continuous process round the clock during the progress of the work and until the finished work is safe, from injury to the complete satisfaction of the Engineer's representative and any interruption in continuous pumping and causing injury to the works done or under construction shall require the Contractor to repair or rebuild the works to the entire satisfaction of the Engineer's representative at no extra cost.

2.6.4 Maintenance of Excavation

All excavation shall be properly maintained while open and exposed. Sufficient suitable barricades, warning lights, flood lights, signs, and similar Items shall be provided by the Contractor. The Contractor shall be responsible for any damage due to his negligence.

No separate payment will be made for the removal of water. The cost thereof shall be included in the contract lump sum price for the care and handling of

water during construction (Section 1).

2.6.5 Surplus and Unsuitable Materials

All surplus and unsuitable materials shall be removed and disposed of at locations approved by the Engineer. The disposal of aforesaid materials shall not interfere with other works and shall not damage or spoil other material. When it is necessary to haul earth or rock material over street or pavement, the Contractor shall prevent such material from falling on the street or pavement. No separate payment shall be made for removal and disposal of unsuitable or surplus materials.

2.6.6 Cutting Pavement

In cutting or breaking road surfacing, the Contractor shall not use equipment which will damage the adjacent pavement. Existing paved surfaces shall be cut back beyond the edge of trenches to form neat square cuts. The road ballast, brick pavement, and other materials shall be placed on one side and shall be preserved for re-installment when the trench is filled. Wherever necessary or required for the convenience of the public, the contractor shall provide suitable temporary bridges which shall be maintained in service until backfilling has been completed. The contractor shall keep the road crossings manned 24 hours per day. During night time, enough red lights shall be provided to warn the traffic. If detour is necessary, the Contractor shall make proper for the traffic and shall install signs 1 m x 1.2 m in size indicating the detour.

2.7 ROCK EXCAVATION

2.7.1 Rock Excavation for Foundations of Structures

(a) General

Hard Rock shall be excavated by systematic and such approved methods of drilling and blasting which will prevent damage to foundation, barring and wedging, by ripping or directly by excavating equipment. Precautions shall be taken to preserve the material outside the lines of excavation in an undisturbed condition. Refilling of over excavation beyond lines and grades shown on Drawings shall be done with concrete or other materials approved by the Engineer at the Contractor's expense. The Contractor shall clean rock slope benches and shall maintain an inspection system in regard to hard rock slopes as necessary to provide safe working conditions. Requirements regarding the use of explosives are specified in sub-clause SP-14 Storage and Use of Explosives.

(b) Drilling and Blasting

Wherever blasting is approved by the Engineer, it will be carried out in the foundation area by methods like Line Drilling, Pre Splitting or Cushion Blasting. The depth and spacing of holes for blasting with such methods during the work shall be determined by the Contractor and will be modified at the direction of the Engineer, based on observation of the manner in which the rock breaks as blasting operations progress, and additional testing as shown to be necessary. Blasting patterns shall be varied as required to produce the gradations required for the material to be placed in the permanent work. Whenever further blasting may injure the rock upon or against which concrete or fill is to be placed, the use of explosives shall be discontinued and excavation shall be completed by wedging, barring and channeling, or other suitable methods. Approval by the Engineer of the method of blasting shall not relieve the Contractor of his sole responsibility for the adequacy and safety of the blasting.

2.7.2 Dental and Other below Grade Excavation

Zones of unsatisfactory material below the foundation levels shown on the Drawing which will require excavation may be encountered. All such material, regardless of character, shall be removed and disposed of as directed by the Engineer. Dental excavation, to be paid for as Day work, shall consist of the removal of earth such as talus or alluvium or unsound rock such as soft, friable or highly weathered rock (and sound rock incidental to such removals) from below the foundation or other base excavation lines indicated on the Drawings or directed by the Engineer for structures and for impervious earth-rock contacts, and from locations such as joints and pockets and between rock beds where the use of power excavation equipment is not practicable. Dental excavation to be paid for as Day work shall not include removal of materials below the aforementioned excavation lines where in the opinion of the Engineer, a removal operation similar to that used for any portion of the excavation above such lines could be used. Dental excavation to be paid for as Day work shall not include removal of materials by pressure washing and shall not include excavation which is classified by the Engineer or paid for under another as classified by the Engineer or paid for under another Contract Item. Excavated areas covered in this Sub-section shall be cleaned as specified and provided with dental treatment as provided in sub-section 2.5.4.

2.7.3 Preparation of Contact Surface between Rock and Concrete

Exposed rock surface within the foundation against which concrete is to be placed shall be cleaned and broomed and the surface and undulations shall be covered and filled with a layer of blinding concrete as directed by the Engineer. The blinding concrete shall be provided according to Specifications in Section 5 for Concrete.

2.8 ROCK QUARRIES

2.8.1 General

The sandstone rock for riprap material and stone pitching shall be obtained from the rock borrow area as indicated on the Drawings or from other rock quarries near the dam site as directed by the Engineer. The Contractor shall exploit, develop and maintain the approved rock quarries and pits in a suitable condition for the extraction and removal of the required materials in a manner satisfactory to the Engineer, and so as to obtain at all times the greatest practicable yield of suitable material in the deposit. The fact that the Employer has approved the Site and location from which material for riprap and stone pitching may be obtained shall not be considered as constituting the approval for use of all material extracted from the quarries and the Contractor shall be responsible for the specified quality and grading of such produced material. For quality and gradation of riprap material the Section 3.4 for Materials shall be applicable.

The quantity of rock from rock borrow area as shown on the Drawings is gross estimated quantity and there is no guarantee that this quarry will yield such quantities of suitable material. If the Contractor proposes to use any additional rock quarry, he shall do so with the written approval of the Engineer.

2.8.2 Blasting and Excavations

The methods of excavating, quarrying and size separation shall be subject to the approval of the Engineer. Selected areas in the rock source will be designated for the riprap material. The gradation of riprap is specified in Section 3.4.2 and Contractor shall plan his blasting and quarrying work in a manner to produce material according to the required gradation.

2.8.3 Measurement and Payment for Quarried Material

The processed material from the rock quarries shall be placed in the dam or spillway or in other areas as directed by the Engineer as per Section 3.7 to 3.10 which Items shall include the entire cost of processing, separating, grading, handling, transportation, stockpiling and placement of this material. No

separate payment shall be made for the excavation of the material under this Section.

2.9 BORROW AREAS

2.9.1 General

Borrow areas for earth material in the permanent works shall be the borrow areas shown on the Drawings. Other borrow areas designated by the Engineer and additional borrow areas selected by the Contractor shall be approved by the Engineer. Investigations in the borrow areas shown on the Drawings have indicated that material is suitable for use in the permanent works. If the Contractor proposes to use borrow areas other than those shown on the Drawings, he shall investigate the areas investigations at his expense and furnish the test results for approval of the Engineer. He will be allowed to use the material subject to approval of the Engineer.

2.9.2 Operation of Borrow Areas

The Contractor shall perform all necessary clearing, stripping, selective excavation to necessary depth and extent, in the dry or below groundwater, draining of borrow areas, pre-wetting of material in the borrow areas, dressing of borrow area during and after completion and disposition of materials to obtain and make the material suitable for use in the work. Excavation and transportation may be performed by any approved method and by the use of excavating and transporting equipment suited to accomplish the intended purpose in the work. The Contractor shall determine the conditions of the materials in each borrow area and provide proper means of handling the materials. Excavation in the borrow areas shall be accomplished to provide proper drainage at all times and to result in the efficient recovery of the maximum amount of suitable materials from the area. Upon completion of the borrow operations the borrow areas outside the limits of the reservoir shall be left reasonably smooth, evenly dressed, and shaped to drain. The contractor may use borrow material in the temporary works, such as cofferdam haul and access roads. However, no measurement for payment will be made of such materials unless such materials are reused, as approved, under an Item in the Bill of Quantities for which measurement and payment of such materials is provided.

2.10 DISPOSITION OF MATERIALS

2.10.1 General

The disposition of all excavated materials including top soil in borrow areas and excess and over break excavation, shall be in accordance with the requirements of the Drawings and Specifications and as approved by the Engineer. Such approval shall supersede the indicated usage of any particular excavation source shown on the Drawings. The Contractor shall be permitted to use all suitable materials from required excavation in the work shown on the Drawings. Materials from borrow areas and quarries that are designated by the Engineer as unsuitable shall be neatly disposed of in approved locations at no expense to the Employer.

The Contractor shall be responsible for making and maintaining all haul roads required for transport of the materials from the Borrow Areas and Quarries to their required destinations. No separate payment will be due to the Contractor for the haul roads and all costs related to this Item shall be included in the unit prices of the materials as provided in the Bill of Quantities.

2.10.2 Disposition of Suitable Material from Foundation Spillway.

All suitable material excavated from foundations of Dam, Spillway and other excavations, consisting of Rock, Earth as determined by the Engineer may be stockpiled by the Contractor in the designated stockpile areas in an approved manner. The Contractor will be permitted to re-handle and use the suitable material from the stockpiles for the construction of fill. No extra payment will be made to the Contractor for stockpiling and all payments related to this Item will be covered by the Item related to Excavation.

2.10.3 Disposal at Spoil

Unsuitable materials from required excavations shall be disposed of in the spoil areas selected by the Contractor subject to approval of the Engineer. Spoil areas shall be left in satisfactory conditions, smoothly dressed and shaped to drain. No additional payment will be made to the Contractor for this work; all payments will be covered by the related Item for Excavation.

2.10.4 Boulders

Boulders shall be disposed of as follows or as otherwise approved by the Engineer. Boulders encountered in the borrow areas shall be disposed of in the borrow excavation. Boulders encountered in other open cut excavations shall be hauled to the directed areas; breaking if necessary shall be performed to make the material suitable for use in the works.

2.11 MEASUREMENT AND PAYMENT

2.11.1 General

The measurement for excavations in borrow areas shall be made for the final acceptably placed fill without any allowance for bulking or otherwise. The Contractor shall be deemed to have made all such allowances in the unit rates quoted by him.

No separate measuring shall be made for supports, shoring, and planking, strutting and dewatering which the Contractor may require to complete the job.

2.11.2 Clearing, Stripping and Grading of Foundations for Embankment Dam and its Abutments.

Measurement for clearing, stripping and grading of foundations of dam will be made in square meters projected vertically to a horizontal plane of the foundation area acceptably cleared, stripped and graded as per Section 2.5. No separate payment will be made for bushes and trees and their removal will be deemed to be included in the measurement for overburden and other unsuitable materials.

Payment will be made for the number of square meters as measured above for clearing, stripping and grading of foundations for dam and shall constitute full compensation for clearing, stripping and grading of all material related to this Item including disposal of the stripped material in the spoil areas as directed by the Engineer.

2.11.3 Excavation for Core Trench in Earth

Measurement will be made of the number of cubic meters of Earth as defined in Section 2.3 Classification, in original position acceptably removed from within the lines and grades shown on the Drawing or directed by the Engineer for providing cutoff below the dam in core trench, abutments and toe drain.

Payment will be made for the number of cubic meters measured as provided above at the contract unit price of Excavation for core trench and shall constitute full compensation for excavating the Earth from foundations including disposal in the stockpiles or spoil area as directed by the Engineer.

2.11.4 Excavation for Core Trench in Rock

Measurement will be made for the number of cubic meters of Rock as defined in Section 2.3 Classification in original position acceptably excavated from core trench, abutments and toe drain within the lines and grades shown on the drawing or as directed by the Engineer.

Payment will be made for number of cubic meters measured as provided above at the Contract unit price for Excavation of Rock in the core trench and shall constitute full compensation for excavating the rock including breaking up, re-handling, its disposal in the stockpiles or spoil area or as otherwise directed by the Engineer.

2.11.5 Excavation for Trenches

Measurement will be made of the number of cubic meters of Earth acceptably removed from within the lines and grades shown on the Drawings or as directed by the Engineer.

Payment will be made for the number of cubic meters measured as provided above at the contract unit price of Excavation for trenches and shall constitute full compensation for excavating the Earth from trenches including disposal in the stockpiles or spoil area as directed by the Engineer.

2.11.6 Excavation for Canals/Channels

Measurement for payment for Excavation for Channels will include all excavation within channel prism regardless of the method of excavation or type of material excavated at the direction of the Engineer. No measurement for payment will be made of over-excavation of the Channel prism, except where done at the direction of the Engineer.

Payment for Excavation for Channels will be made at the contract unit price per cubic meter for Excavation for Channels. The amount shall be full payment for the work specified herein as Excavation for Channels, including stripping and removal of debris from areas not designated to be paid for separately under Clearing.

2.11.7 Surface-Dental Treatment of Foundation-Dental Concrete

The measurement and payment for Dental Concrete shall be made under Section 5, “Plain and Reinforced Concrete”.

2.11.8 Surface-Dental Treatment of Foundation for Core-Trench in Rock – Asphalt Emulsion Spray Coat.

Measurement will be made for the number of liters of Asphalt emulsion sprayed in the acceptable manner to cover the prepared foundation as specified in Section 2.5.4

Payment will be made for the number of liters of Asphalt emulsion measured above for the Contract unit Item for Asphalt Emulsion Spray Coat and shall constitute full compensation for all the material and labor supplied for coating the foundation by spraying the asphalt emulsion over it and all other work related to the Item.

2.11.9 Surface-Dental Treatment of Foundation for Core-Trench in Rock-Slush Grouting.

Measurement will be made of the number of square meters of area treated with slush grouting to cover the prepared foundation in an acceptable manner as specified in Section 2.5.4.

Payment will be made for the number of square meters of foundation area treated with slush grouting as measured above at contract unit rate for slush grouting and shall constitute full compensation for all the material and labor supplied for slush grouting of the foundation area and all other work related to the Item.

2.11.10 Dental Treatment and other below Grade Excavation and Backfilling

Dental treatment and other below grade excavation and backfilling ordered by the Engineer to be carried out as Day work shall be paid for at Day work rates entered against the appropriate Items in Day work Schedule, Appendix-D to Bid, Day work Rates for Labor, Plant and Materials.

2.11.11 Excavation of Earth and Rock in the Foundation of Structures

Measurement will be made for the number of cubic meters of Earth and Rock respectively as defined in Section 2.3 Classification, in original position acceptably excavated from the foundation of structures, within the lines and grades shown on the drawing or as directed by the Engineer.

Payment shall be made for number of cubic meter measured as provided above at the Contract unit price for Excavation of Earth and Rock respectively from the foundation of Structures and shall constitute full compensation for excavating the soil or rock including breaking up rehandling its disposal in the stockpiles or spoil area as directed by the Engineer.

2.11.12 Excavation for Disposal Drain in Earth

Measurement will be made of the number of cubic meter of Earth, in original position acceptably removed from within the lines and grades shown on the Drawings or as directed by the Engineer for the disposal drain.

Payment will be made for the number of cubic meter measured as provided above at the contract unit price of Excavation for Disposal Drain and shall

constitute full compensation for excavating the Earth from foundations including disposal in the stockpiles or spoil area as directed by the Engineer.

2.11.13 Provide and install PVC Pipe in Water Measuring Structures

Measurement will be made for the number of linear meters of specified diameter of PVC Pipe acceptably installed in the Water measuring structures of best quality as approved by the Engineer.

Payment will be made for the number of linear meter acceptably measured at the contract unit price for providing and installing the PVC and shall constitute full compensation for all the related works in accordance with the drawings or as directed by the Engineer.

SECTION – 3

CONSTRUCTION OF EARTHFILL

3.1 SCOPE

The work covered by this Section consists of the construction of the Embankment Dam, earth fill and stone pitching for Spillway, earth fill for irrigation system, backfill for irrigation conduit and structures and other miscellaneous fills including the preparation of the foundation.

3.2 DEFINITIONS

The term fill as used in section 3 of these Specifications is defined as the earth fill portion of the dam including all other fill, riprap, filters and drain materials for the dam and as used in the connection with other works. The terms dam embankment used to devote all earthworks.

"Zone": that part of an embankment or fill, the material for which has specified characteristics such as particle size, moisture content, density and method of placing. Only that zone will be applicable which is mentioned in the drawings and BOQ of the Project.

3.3 GENERAL PROVISIONS.

3.3.1 Reference Standards

The numbers and subjects of reference standards are listed below:

STANDARD	SUBJECT
USBR	Earth Manual, Second Edition
BS 1377:1967	Methods of testing soils for civil engineering purposes.
ASTM C535	Test for resistance to abrasion for large size coarse aggregate by use of the Los Angeles machine.
ASTM C88	Test for soundness of aggregates by use of Sodium Sulphate or Magnesium Sulphate.

3.3.2 Submissions by the Contractor

Submission which the Contractor is required to make in relation to embankment other fills include the following:

(a) Drawings:

Contractor's record drawings of the agreed foundation level survey prior to the placement of fill in those areas.

Contractor's record drawings of all agreed level surveys taken for the measurement purpose of quantities in fill.

Survey records as specified above shall be submitted to the engineer within 7-days completion of the survey work recorded on them.

(b) Test Results:

Laboratory and field tests results on agreed format.

(c) Samples:

Materials proposed use as fill, where specifically required by the Engineer.

3.3.3 Equipment and Methods

Before proceeding with any of the work specified in this section, the Contractor shall furnish the construction sequence and material utilization scheme he proposes to use in fill construction, integrated with requirements of the approved construction schedule, to the Engineer as further information for approval under Clause 14 of the Conditions of the Contract. The Contractor's submission will include the following details:

Proposed method of placing and compacting fill including a schedule of plant and equipment to be used.

Programme for quality control of earthworks.

Proposed sources of all embankment and fill materials including riprap and method of selective excavation and processing.

Proposed programme of embankment construction.

3.3.4 Test Fills for Embankment

Test fill of 30.5 m (100ft) minimum length will be constructed for embankment zones as directed by Engineer. The minimum compacted width shall be at least three rollers widths and for two specified fill thicknesses. No separate payment will be made for these test fills , and if approved, will form part of the permanent works.

3.3.5 Lines and Grades

Fills shall be constructed to the lines, grades, and cross-sections indicated on the Drawings unless otherwise directed by the Engineer. Materials conforming to the requirements specified in Section 3.4 Materials, shall be placed and compacted within the indicated zone limits. The Engineer reserves the right to increase or decrease the foundation widths, the embankment slopes or the zone limits or to make such other changes in the embankment sections as may be deemed necessary to produce safe structures, or for efficient utilization of materials from required excavations. Settlement of foundation and dam for the post construction period will be provided for by increasing the height of the sections. Required height increases will be determined and specified by the Engineer from settlement observations made as the work progresses.

3.3.6 Backfilling of Excess Excavation

Unless indicated otherwise on the Drawings or allowed in accordance with the written permission issued by the Engineer, Excess Excavation shall be backfilled.

The backfill shall comprise the material comprising the structure on fill material to be placed within the measured excavation, to the same standard as specified for that structure or fill or as specified on construction drawings.

Any additional excavation required to enable the backfill to be placed as specified shall also count as Excess Excavation. No additional payment will be made for backfill of Excess Excavation.

3.3.7 Placing of Fill on a Formation

Before the placing of any fill on a Formation all shattered loose and weathered material shall be removed from the excavation so as to ensure that the work rests on a sound and clean foundation or, where appropriate, abuts against undisturbed ground. The methods of cleaning the foundation for the impervious core of embankment shall include the use of compressed air jets where necessary, and the Engineer will inspect and record the geology of these parts of the formation before approving them.

No additional payment will be made for cleaning of the foundation or undisturbed ground as specified above.

3.3.8 Conduct of Work

a) Maintenance, Protection and Tests

The contractor shall maintain and protect the Dam in a satisfactory condition at all times until final completion of all work under the Contract including period of maintenance in accordance with the Clause 9 of the Conditions of Contract. Any approved fill material which is diverted from its use in construction of the dam, or rendered unsuitable after being placed in the dam before final acceptance of the work, shall be replaced by the Contractor in a satisfactory manner and no additional payment will be made thereof. The Engineer will establish a programme of testing of in-place fill to ensure that the work is being performed in conformity with the requirements of these Specifications. The Engineer will also perform tests on materials at their source and during their processing and handling as necessary for quality control and the Contractor shall adjust his methods as Specification requirements. Tests of material and embankment construction will be made at regular intervals and Engineer will notify Contractor of any deficiencies in materials and/or construction when results of tests are known. Deficiencies shall be remedied by such measures as the Engineer may direct. Remedies shall include the complete removal of portions of the fill if so directed by the Engineer. The contractor shall dispose of any unsuitable materials

and refill the excavated area with suitable material as directed, at no cost to the Employer. The Contractor may be required to remove, at his own expense, any fill placed outside of the prescribed slope lines where such placement is not authorized by the Engineer.

(b) Haul Road

Haul roads shall be located and constructed as approved by the Engineer. They shall be designed to maintain the intended traffic safely, without endangering dam stability during the construction period and shall be constructed in a manner to preclude contamination or alteration of materials forming the dam section. All haul roads located on dam slopes shall be removed at the completion of dam construction. Roads on abutments, which would be unstable during reservoir operations shall be removed at the completion of the dam construction or stabilized to the satisfaction of the Engineer. Haul or construction roads shall not be measured for payments.

(c) Stockpiles

Whenever the Contractor for his own convenience excavates and stockpiles fill material for subsequent usage in the fill, no additional payment shall be made for such stockpiling nor for the reloading and hauling of this material to its final position in the embankment except where specifically provided in the Specifications and Bill of Quantities.

Any stockpile shall contain material suitable for use in one fill Zone only, unless otherwise authorized in writing by the Engineer, and the Contractor shall advise the Engineer of the intended use of the material contained in all such stockpiles.

3.4 MATERIALS

3.4.1 General

Fill materials shall be obtained primarily from the designated borrow areas indicated on the Drawings and specified in Section 2. The Contractor may use the suitable materials for the fill from additional sources on any borrow areas investigated by him, with the approval of Engineer who will satisfy himself that the material conform to the specifications. Providing the material of the zoned embankment is mentioned in the drawings and the material with haulage is however, included in the B.O.Q. Material containing bush, roots, sod, organic material or other material not considered suitable shall be cleaned of such materials or shall be wasted in areas away from the work site, as approved by the Engineer. All materials shall not contain any clods and lumps which cannot

be broken up during compaction and shall conform to the requirements of the Specifications, their dispositions in the dam shall be as directed by the Engineer.

3.4.2 Riprap

Limestone/Sand Stone materials for riprap slop protection of embankment, flexible riprap apron and stone pitching at other designated areas, shall be hard, angular, sound, durable, free from cracks, seams or other defects which would tend to increase unduly its deterioration from natural causes. Material for riprap shall be obtained from the designated areas and shall conform to the following grading limits.

MATERIAL SIZE	PERCENT FINER THAN BY WEIGHT
700 mm	100
300 mm	30-51
150 mm	11-51
75 mm Not greater than	11

Abrasion after 1000 revolution in a Los Angeles machine in accordance with ASTM C535 shall not exceed a loss in weight of more than 40 %. The soundness shall be measured in Sodium Sulphate solution in accordance with ASTM C88. The loss in weight after 5 cycles shall not exceed 5%.

3.4.3 Filter under upstream Riprap and Downstream slope protection.

Material (Cobbles and gravel) for the filter under upstream riprap and downstream slope (if any) protection shall comprise hard, durable non-cohesive particles conforming to the following gradation limits.

MATERIAL SIZE	PERCENT FINER THAN BY WEIGHT
300 mm	95
150 mm	64-95
75 mm	40-82
38 mm	19-64
19 mm Not greater than	44
10 mm Not greater than	23

The material can be obtained from the overburden or quarried rock of the same quality as riprap but conforming to the above gradation limits.

3.4.4 Impervious Core

Material for compacted impervious core shall be the clayey or other suitable material available in approved borrow areas or other sites and shall conform to the grading limits shown on the drawing.

3.4.5 Silty Sandy Gravel Fill

Material for compacted silty-sandy gravel fill, in upstream and d/s shells, shall be obtained from the nullah bed and other approved borrow areas. The material shall be well graded within the following limits.

Excavated Sandy material from the spillway will also be used as downstream shell fill. No screening or processing of the sandstone for grading control shall be desired except for the exclusion of lumps, bigger than the thickness of the compacted layers which cannot be broken down by the compaction equipment.

3.4.6 Gravel Drainage Blanket

Material for compacted drainage blanket shall be angular, sound and durable gravels. This material shall be cohesionless and well graded within the limits shown on the drawings.

3.4.7 Sand Filter

Material for compacted sand filter and chimney drain shall be obtained from the nullah bed D/S at the dam site or from other approved sources. The material shall be well graded sand within the shown on the drawings:

3.4.8 Downstream Sandy Gravel Toe Protection

Material for the downstream toe cobbles and gravel shall conform to the design gradation and quality requirement for material 3.4.6 above.

3.4.9 Slush Grout

Slush grout for sealing the rock surface of the core foundation after cleaning shall be made with clean well-ground sand conforming to ASTM concrete sand with ordinary Portland cement.

The slush grout shall contain between 2 parts and 3 parts of sand to one part of cement as part of cement as approved by the Engineer. Its water content shall be sufficient to produce a mixture, which can be poured to penetrate and fill open joints, fissures and fractures in the rock surface and can be broomed over and into the rock surface to fill minor surface discontinuities and irregularities.

3.5 CONTACT BETWEEN ROCK AND IMPERVIOUS CUTOFF

3.5.1 Rock Cutoff Contact

Requirement for contact between rock and impervious cutoff area are specified in Subsection 2.5.3. Excavation for Dam Core trench and Subsection 3.4.9 Slush grout.

3.6 PREPARATION OF DAM FOUNDATION FOR FILL GENERAL

Requirement for preparation of dam foundation are specified in Section 2.5. Foundation preparation and Subsection 3.3.7. Placing of Fill on a Formation.

Where fill is to be placed on an excavated and trimmed overburden surface, the area designated in writing by the Engineer, the Contractor shall roll the trimmed foundation surface as though it were part of fill, as each layer of fill is compacted.

Where fill is to be placed on a rock, the hollows shall be filled with fill concrete or compacted fill material as directed by the Engineer. Where ordered by the Engineer, the Contractor shall carry out Incidental Excavation and refill with compacted fill material or fill concrete.

After excavation and surface preparation has been completed in a particular area, the Contractor shall take all necessary steps to prevent deterioration of the surface before it is covered by fill. If, notwithstanding these requirements, any deterioration does take place, the Contractor shall carry out such remedial works as the Engineer considers being reasonably necessary. Where required by the Engineer, the foundation shall be sprayed with water before fill material is placed, and standing or running water will not be allowed.

Where grouting has been carried out prior to fill, all excess grout and debris shall be cleared by the methods such the slush grout cap and underlying grout curtain shall not be damaged.

3.7 PLACEMENT

3.7.1 General

No fill material shall be placed on any part of the foundation until that part has been inspected and approved by the Engineer and agreed levels recorded. Any fill material placed before the foundation has been inspected and approved by the Engineer, shall be removed and the foundation prepared again at no additional cost to the Employer.

Material of the several type and qualities required shall be deposited and distributed within the zone limits shown on the Drawings and to the slopes indicated within the tolerance specified below. The gradation and distribution of materials in the Zones of dam shall be such as to produce in each Zone a

reasonably well-graded mass. Fill material shall be handled and placed by such methods as will minimize segregation, in lifts of depths as specified, and in general so that the smaller sizes of the material within the dam are placed towards the middle and the larger sizes towards the outer surfaces. Where Riprap slope protection is placed on permanently exposed embankment slopes, the placing of fill shall be supplemented by required methods to obtain surfaces within a tolerance of plus 4-inch (10 cm) and minus 2-inch (5 cm) except that the extreme minus or plus tolerance shall not be continuous over an area greater than 20 square meter. For all other Zones not specified above, or elsewhere, material shall be placed as close as practicable to the lines shown on the Drawings or as approved by the Engineer. Bridging in the fill, and all slabs and slabby rock shall be broken down.

If in the opinion of the Engineer the rolled surface on any layer of fill is too dry or smooth to bond properly with the material to be placed thereon, it shall be moistened and worked with a harrow or scarifier in an approved manner to sufficient depth to provide a satisfactory bonding surface before the succeeding layer of fill material is placed. If in the opinion of the Engineer the rolled surface of any layer of in-place fill material is too wet for proper placement of the layer to be placed thereon, it shall be removed or scarified or harrowed to reduce the water content to the required amount before the succeeding layer is placed thereon.

The Contractor shall complete each layer of fill fully up to the abutment contacts and against sloping foundations and ensure that the fill is compacted as specified throughout.

3.7.2 Deterioration of Fill Material

Should the material selected as fill, while acceptable at the time of selection, becomes unacceptable to the Engineer, for any reason, including exposure to weather conditions, flooding, contamination by other materials or segregation during progress of works, the Contractor shall remove such damaged, softened or segregated material to a spoil tip and replace it with fresh approved material, at no additional cost to the Employer.

3.7.3 Protection of Completed Fill Surface

The Contractor shall be responsible for protecting completed fill surface against erosion. If it starts to rain, the surface of the fill shall be made smooth with a drainage slope to induce runoff from the filled areas and leave no areas that can retain water. Run off from heavy rain shall be controlled to prevent gully erosion of the placed fill. Any gully erosion shall be repaired with material

compacted in accordance with these Specifications, and eroded surface shall be restored and graded to ensure a proper bond with new fill placed on them.

3.7.4 Unrestrained Edges of Fill

The unrestrained edges of fill for permanent slopes shall be overbuilt as necessary to allow full compaction to be achieved within the defined limits of the fill. The excess material shall be trimmed and removed to leave a regular compacted surface.

3.7.5 Rate of Placement

Unless otherwise indicated or directed by the Engineer the top of each embankment Zone, including the riprap and blanket shall be maintained at the approximately the same level throughout each embankment construction stage regardless of the number and types of materials being placed, except, as may be required to prevent mixture of embankment materials. Materials shall be delivered in proper sequence and distributed over the surfaces of the fills at such a rate as will ensure the completion of each embankment Zone and stage thereof within the specified time.

3.7.6 Watering of Fill

During dry weather, whether fill is being placed or not, the surface of the fill shall be sprayed with water to prevent cracking of the surface. Should cracking of the surface of fill occur, the Contractor shall remove such cracking material and replace it with fresh fill within the specified range of moisture content.

3.7.7 Riprap Protection - Placement

Stone for riprap shall be hand placed on the Dam and elsewhere within the limits indicated for Zone R material in such manner as to produce a well graded mass of rock with the minimum practicable percentage of voids and shall be constructed within the specified tolerance to the lines and grades shown on the Drawings or Stacked in the field. A tolerance of plus 4-inch (10 cm) or minus 2-inch (5 cm) from the slope lines and grades shown on the Drawings will be allowed in the finished surface of the riprap, except that either extreme of such tolerance shall not be continuous over an area greater than 20 Sq meters. The larger stones shall be well distributed and the entire mass of stones in their final position shall be roughly graded to conform to the gradation specified in Section 3.4 Materials. The finished riprap shall be free from objectionable pockets of small stones and clusters of larger stones. Unless otherwise authorized by the Engineer, riprap protection shall be placed in conjunction with the construction of the riprap as may be necessary to prevent mixture of embankment and stone protection materials.

3.7.8 Filter Under Upstream Riprap and Downstream Slope Protection - Placement

Cobbles and gravel for filter layer and protective layer shall be hand placed within the limits shown on the Drawings. The placement shall conform to the Specifications Section 3.7.7. Riprap Protection –placement and as further directed by the Engineer. Care shall be taken that materials do not get mixed with other Zone material.

3.7.9 Gravel Drainage Blanket - Placement

The gravel in drainage blanket shall be placed in the Dam within the limits shown on the Drawings. Care shall be taken that one Zone material does not get mixed with other Zone material. The loading from the stockpiles shall be done in such a manner that segregation is minimized. If considered necessary by the Engineer, some mixing or wetting of material before hauling shall be done.

3.7.10 Impervious Core – Placement

Impervious core fill shall be placed in the embankment including cut off trench within the limits indicated for fill material. If in the opinion of the Engineer the rolled surface on any layer of fill is too dry or smooth to bond properly with the layer of material to be placed thereon it shall be moistened and worked with a harrow or scarifier in an approved manner to sufficient depth to provide a satisfactory bonding surface before the succeeding layer of fill material is placed. If in the opinion of the Engineer the rolled surface of any layer of in-place fill is too wet for proper placement of the layer to be placed thereon, it shall be removed or scarified or harrowed to reduce the water content to the required amount before the succeeding layer is placed thereon. No fill shall be placed below water. During placement and Compacting of cutoff trench material, the water level at every point in the cut off trench shall be maintained below the foundation of trench till entire cutoff trench has been completely filled and duly compacted.

3.7.11 Sand Filter – Placement

The compacted sand filter shall be placed in the dam within the limits shown on the Drawings. The loading from stockpiles shall be done in such a manner that segregation will be minimized. The material shall be made wet at the source and in any stockpiles, and during transportation and placing, to prevent segregation. Care shall be taken that one Zone material does not get mixed with another Zone material.

3.7.12 Riprap Protection - Placement

Stone in downstream slope protection shall be placed at the random in the dam within the limits shown on Drawings. The finished surface shall be free from objectionable pockets of small stones and clusters of larger stones.

3.7.13 Silty Sandy Gravel - Placement

The compacted silty sandy gravel fill in upstream and downstream shells respectively, shall be placed in the dam within the limits shown on the Drawings.

Individual lumps of sandstone rock Subsection 3.4.5 which cannot be broken down by compaction equipment will be acceptable within the fill Zones, provided that their largest dimensions is smaller than the layer thickness, that such lumps are completely surrounded by compacted fill conforming to the specified requirement and that such lumps do not comprise more than 10 % of the fill in any layer.

3.7.14 Slush Grout - Placement

Rock surface cracks and fractures beneath the core shall be filled with slush grout, poured and broomed over the surface of the rock; as shown on the Drawings or directed by the Engineer, but not more than 72 hours after the final foundation surface is exposed by excavation.

Grouted surface shall be covered with a layer of compacted fill within an hour of completion of grouting. Traffic shall not be allowed over areas of surface grouting until they have been covered with a layer of compacted fill.

3.7.15 Grout Curtain – Placement

High pressure grouting shall be used to form the cutoff curtain to reduce seepage beneath the Dam. Pressure from 10 to 20 psi shall be used to suit conditions and as directed by the Engineer.

Single-stage grouting shall be applied by drilling the hole to full depth, installing the nipple, washing the hole, and grouting the hole, all in one operation.

The optimum rate of grouting injection will be that which permits the greatest quantity of cement to be forced into the foundation rock without causing displacement of the surface. Either grout mix or pressure shall be controlled to achieve this purpose.

The grouting of any hole shall be continued until the hole or grout connection takes grout at the rate of less than one cubic meter of the grout mixture in 10 minutes for pressure between 10 to 20 psi.

The grouting shall start from the lowest elevation of the foundation and proceeding towards the abutments. Grouting on all holes shall start with clear

water injected at the maximum grouting pressure to wash any clay or other erodible material present in some seams from the hole.

Prior to commencing any grouting work, the Contractor will submit the grouting procedure, type of grouting equipment he intends to use and name of the specialist grouting supervisor for the approval of the Engineer.

3.7.16 Stone Pitching – Placement

The areas designated for placement of stone pitching shall be excavated to the lines and grades shown on the Drawings or as directed by the Engineer.

Stone and rock spalls used in the stone pitching shall be placed and bedded in such a manner that the completed stone pitching is stable and without tendency to slide. Large open spaces between the stone shall be avoided. Care shall be taken to ensure that all stone is well bedded on its flattest surface. The stone shall be placed so as not to project above the neat lines shown on the Drawings or directed by the Engineer. All interstices in the stone pitching shall be well-filled with rock spalls. The amount of rock spalls used shall not be in excess of that required to fill the voids in the revetment stone.

3.8 SPREADING

After depositing, the materials shall be spread by approved means in approximately horizontal and uniform layers, to ensure proper and uniform compaction. Except as otherwise directed by the Engineer as a result of the tests conducted during construction, the maximum thickness of each compacted fill layer for different Zones shall be as follows:

Riprap and Shell Material	12-inch (30 cm)
Core Material	6-inch (15 cm)
Protective layer Material	12-inch (30 cm)
Sand Filter Material	8-inch (20 cm)
Gravel drainage Material	8-inch (20 cm)

The riprap (Zone A1) and protective layer Zone A3 materials shall be placed in accordance with Section 3.7.3 Riprap Protection.

The Contractor shall determine by making test sections, the loose lift thickness required in order to attain the compacted thickness specified herein. Where reduction or increase in lift thickness is ordered by the Engineer, the maximum particle size permitted shall not exceed the compacted lift thickness. As soon as practicable after commencement of construction of fill, the fill surface shall be sloped with a transverse slope of not less than 3 percent throughout construction. During dumping and spreading the Contractor shall provide at all times adequate facilities for removal of all unsuitable and/or oversize material.

Unsuitable materials shall be removed from the embankment and disposed of in an approved manner. The entire surface or any section of the embankment under construction shall be maintained in such a condition that construction equipment can travel on any part of the section. Ruts in the surface of any layer shall be filled satisfactorily before compacting.

3.9 MOISTURE CONTROL

3.9.1 General

Where necessary, the Contractor shall adjust the moisture content of fill, either by drying out or adding water, so that it is within the range of moisture content for the fill after the compaction as set out in the Compaction Table included hereto. The water and fill shall be thoroughly mixed to a uniform moisture content.

The Contractor shall ensure that water being applied to adjust the moisture content of material in one Zone does not drain off the surface on to another Zone.

3.9.2 Fill Material

All processing of fill material, to produce rolled fill including the adjustment of moisture content and breaking of lumps, shall be done before the material is hauled to the area where it is to be placed and compacted. So far as practicable, the material shall be delivered and spread in moisture range of 2 % above Standard Proctor optimum to optimum by irrigation or drying within the borrow areas. On the basis of tests conducted during construction, the Engineer reserves the right to make modifications in the required range of moisture for this material. Only such moisture variation as is needed for minor adjustment of moisture changes caused by evaporation during handling and placement or rainfall shall be allowed on the fill. The moisture shall be distributed uniformly throughout each layer prior to compaction. Optimum moisture content shall be determined in the laboratory by the Engineer by making Standard Proctor compaction test. The optimum moisture contents for the materials in borrow area will be furnished by the Contractor to the Engineer at daily intervals or at significant changes of material being placed.

3.9.3 Other Zones

As determined by the Engineer, some addition of water will be required for compaction of materials in other Zones of the dam and to reduce segregation tendencies. The addition of water for this purpose shall be accomplished prior to handling, unless otherwise directed by the Engineer.

3.10 COMPACTION

3.10.1 General

The compaction of fill material placed in the various zones shall be carried out to the requirement set out in the Compaction Table included here to The requirements of the Compaction. Table apply to each layer of fill after it has been compacted and before it is covered by a subsequent layer of fill. The following definitions shall apply with respect to Compaction Table:

- Moisture content shall be the moisture content immediately after compaction.
- Layer thickness, shall be the thickness after compaction.
- Relative compaction (r.c.), shall be measured as a percentage of the maximum dry density measured by BS 1377:1967, Test 12.
- Relative Density (r.d.), of cohesionless soils shall be measured as described in USBR Earth Manual, Second Edition, Appendix E 12.

3.10.2 Equipment

Compaction equipment shall generally consist of sheep-foot and vibratory rollers, temping rollers and other approved rollers and shall be used as prescribed in subsequent Sections and as determined and ordered by the Engineer as a result of the tests conducted during construction.

(a) Special Compactors

Compaction of materials in areas where it is impracticable to use a roller or tractor, as provided above, shall be performed by the use of compactors of the heavy-duty power driven type. They shall be capable of producing densities at least equal to those produced by the equipment specified in Sub-Clause (a) hereof. All such equipment will be subject to approval by the Engineer. Compactors, which do not obtain the required density with a reasonable amount of coverage of each layer and at a production rate consistent with the adjacent embankment, shall not be used in the work.

(a) Sprinkling Equipment

Sprinkling Equipment shall consist of tank trucks, pressure – distributors, or other equipment designed to apply water uniformly and in controlled quantities to variable widths of surface. Tanks trucks shall be equipped with positive shutoff valve so that no leakage will result from the nozzles when equipment is not operating. Leaks shall be repaired immediately and any material rendered too wet because of faulty equipment shall be removed and reconditioned and no additional payment will be made therefore.

COMPACTION TABLE

MATERIAL	COMPACTED LAYER THICKNESS (cms)	RELATIVE COMPACTION (r.c.) * OR RELATIVE DENSITY (r.d.)**		MOISTURE CONTENT (%)*** (Related to optimum for relative compaction test as specified)	
		2/3 rds of Test Results to Exceed	All Test Results to Exceed	2/3 rds of Test Results to be	All Test Results to be
Impervious Core	15 cm(6")	r.c = 98% (Standard Proctor)	r.c. = 98%	Between +1 and +3	Greater than 0
Upstream Shell	30 cm (12")	r.c = 98% (Standard Proctor)	r.c. = 95%	Between -2 and +1	Between -3 and +2
Downstream shell	30 cm (12")	r.c = 95% (Standard Proctor)	r.c. = 92%	Between -2 and +1	Between -3 and +2
Filter Under Upstream Slope Riprap Layer (if needed)	30 cm (12")	r.d. = 75%	r.d. = 65%	-	-
Downstream Slope Protection	30 cm (12")	r.d. = 75%	r.d. = 65%	-	-
Fine Filter	20 cm (8")	r.d. = 75%	r.d. = 65%	-	-
Coarse Filter	20 cm (8")	r.d. = 75%	r.d. = 65%	-	-

Note:- The embankment zones are applicable which are mentioned in drawings and BOQ of the Project.

* The relative compaction (r.c.):refer to BS 1377:1967, Test 12.

** The relative density (r.d.) : refer to USBR Earth Manual, Second Edition, Appendix-E 12.

*** A moisture content given in the Table as minus a number (x) is x% below the optimum moisture content (y%) : i.e. the moisture content "-x" is (y-x)%. Similarly the moisture content "+x" is (y+x)%.

3.10.3 Compaction General

After a layer of fill material has been deposited, it shall be scarified, bladed or otherwise treated as necessary to produce a uniform material with respect to moisture content and grain size distribution, in accordance with Section 3.9 Moisture Control, mixing shall be performed to the full depth of the layer if so required. When the moisture content and conditions of the layer is satisfactory the lift shall be compacted. Portions of the fill which are not accessible to the

roller shall be placed in lifts consistent with the material size and compaction with power tempers to a degree equal to that obtained on the other portions of the compacted fill by rolling as specified. Dumping, spreading, sprinkling and compacting may be performed at the same time at different points along a section of Embankment when there is sufficient area to permit these operations to proceed simultaneously.

Unless otherwise approved by the Engineer, the direction of compaction rolling in the embankment shall be parallel to the axis of the embankment.

3.10.4 Sub grade Compaction

The Sub grade below the dam shall be scarified by harrows to a depth of (10 inch) 25cm, the material shall then be moistened as per clause 3.9.3 and compacted with not less than ten passes of the specified vibratory roller.

3.10.5 Compaction of Fill Material

Except as otherwise determined and ordered by the Engineer fill materials shall be deposited in successive layers of thickness as specified and compacted as follows:

(a) Each layer of fill material in the impervious Zone C and Zone E_1 and E_2, shall be compacted to a dry density not less than 95% Standard Proctor laboratory density.

(b) In other zones, each layer of material except riprap slope protection shall be compacted to a dry density not less than 75% relative density.

(c) Compaction of riprap layer will not be required.

3.11 SLIDES

(a) In the event of slides in any part of the embankment prior to final acceptance of the work, the Contractor shall remove material from the slide area, as directed, and shall rebuild such portion of the embankment. In case it is determined that the slide was caused through the fault of the Contractor, the removal and disposal of material and the rebuilding of the embankment shall be performed without cost to the Employer; otherwise this work will be paid for the applicable Contract unit prices for the compacted fill or backfill.

(b) Lightly Compacted Fills

Fills and backfills designated on the Drawings or directed by the Engineer to be lightly compacted shall be such as to produce a dry density not less than 90% Standard Proctor laboratory density for cohesive materials and a dry density of not less than 65% relative density for granular materials. Compaction equipment shall conform to the general requirements of Section 3.10 Compaction.

3.12 MISCELLANEOUS FILLS AND BACKFILLS

3.12.1 General

In addition to the embankment fill for the dam certain miscellaneous fills and backfills will be required for Spillway, irrigation system, irrigation conduit and other structures and near the abutment areas. Material requirements for these backfills shall be specified on the Drawings and the type of material for these fills will be as specified in Section 3.4 Materials or as directed by the Engineer.

3.12.2 Operations Adjacent to Existing Structures

In general, no fill or backfill or other load shall be placed on or against the surface of any concrete structure earlier than is permissible with regard to the protection of the structure. At locations where the safety of structure might be endangered, such operations shall not proceed until the construction has attained sufficient strength to withstand any stresses that might develop incidental to the operations required; provided that no fill or backfill will be placed without the prior approval of the Engineer. If so required the Contractor shall submit details of the methods of placement, spreading and compaction he proposes to use for the protection of structures at such locations for the approval of the Engineer. Within areas where rollers cannot be used, the material shall be compacted by means of power tempers. Drainage openings through walls shall be kept open at all times.

3.12.3 Compaction

Subject to the limitations on compaction of fill and backfill material adjacent o structures and/or drainage features specified in the Subsection 3.12.2. Operations Adjacent to Existing Structures above, compaction of fills and backfills shall conform to the following except if specified as dump fill.

(a) Well Compacted Fill

Fills and backfills designated on the Drawings or directed by the Engineer to be well compacted shall be as such as to produce a dry density of not less than 98% Standard Proctor laboratory density for cohesive materials and a dry density of not less than 75% relative density for granular materials. Compaction equipment and procedures shall conform to the general requirements of Section 3.10 Compaction.

3.13 BACKFILLING OF TRENCHES

3.13.1 General

The trenches shall not be completely backfilled until all required pressure tests are performed and until the irrigation conduit as placed conforms to the

requirements of Specification. Where in the opinion of the Engineer, damage is likely to result from withdrawing sheeting and shoring; the same shall be left in place and cut off at a place level 1 meter (3 ft) below ground surface. Sheeting left in place shall be paid for at the approved rate for that item of work. Trenches shall be backfilled to the ground surface with selected excavated material or other for proper compaction. Trenches improperly backfilled shall be reopened to the depth required for proper compaction, then refilled and compacted to the required density as given in Subsections 3.13.2 and 3.13.3. The surface shall be restored to its original or better condition. Any road shall be replaced and restored.

3.13.2 Lower Portion of Trench

Backfill material shall be deposited in 15 cm (6 inch) maximum thickness layers and compacted with suitable hand tempers to produce a dry density of not less than 95% Standard Proctor laboratory density for cohesive materials or as directed by the Engineer until there is a cover of not less than 30 cm (12 inch) over the pipe. The backfill material in this portion of trench shall consist of approved materials free from stones and lumps.

3.13.3 Remainder of Trench

The remainder of the trench shall be backfilled with material that is free from stones larger than 15 cm (6 inch) in any dimension. Backfill material shall be compacted to 90% Standard Proctor laboratory density for cohesive or equivalent for other materials or as directed by the Engineer.

3.13.4 Borrow Area for Trenches

In case of insufficiency of excavated material and unsuitability of earth for backfilling, conforming to the above Specifications, such material shall be brought from the approved source, by the Contractor.

3.14 EMBANKMENT FOR CANALS/ CHANNELS

Embankment for canals / channels shall be constructed as specified in clause 2.5.6 as shown on the Drawings. Maintenance berms and inspection road along the canals shall also be constructed of well compacted approved material in accordance with clause 2.5.6.

3.15 TESTING

3.15.1 Testing by the Contractor

The Contractor shall be responsible for carrying out all field and laboratory tests required to ensure that all fill material placed complies with the Specifications, and that the material is compacted so as to conform to the requirements stated in the Compaction Table over the full depth of each layer. Testing shall be to

BS 1377: 1967 or USBR Earth Manual, Second Edition unless otherwise specified or approved by the Engineer.

Laboratory tests of maximum and minimum dry densities and optimum moisture contents shall be on samples taken adjacent to and including in-situ density test samples.

Maximum dry densities and optimum moisture contents for compaction control by relative compaction shall be derived using Test 12 of BS 1377: 1967 as specified in the Compaction Table and maximum and minimum dry densities for compaction control by relative density shall be derived using the test described in Appendix E12 of USBR Earth Manual, second Edition.

Particle size distribution (grading) shall be determined by the appropriate variation of Test 7 of BS 1377: 1967. Tests 7 (A) or 7 (D) shall be used unless otherwise agreed by the Engineer.

Fill density in the field will be determined as follows:

(a) In fine and medium grained soils, the Contractor shall propose a suitable method which will consist of a large-scale replacement method and it must give consistent and correct results, to the satisfaction of the Engineer.

(b) In rock fill, filter and drainage layers, water replacement method shall be employed using a plastic lining film in a test hole. The hole shall be not less than 10 cubic meter in volume for rock-fill and not less than 1.0 cubic meter in volume for filter and drainage layer.

The location of each field test or sampling point shall be to the approval of the Engineer.

The minimum frequency of testing for Control Tests shall be as approved by the Engineer.

The Contractor shall inform the Engineer at least one hour before he proposes to carry out any field test or take a sample so that the Engineer may supervise the test or the taking of the sample. Tests shall be carried out in groups of two or more all in the same layer. The Contractor shall carry out an additional group of tests, designated “Repeat Test”, in any fresh layer as designated by the Engineer, after any group of tests, including a group of tests carried out by or on behalf of the Engineer, designated “Engineer’s Test”, has failed to meet the specified requirements. The acceptability of that layer shall then be determined by the results of the new group of tests.

The numbering system to be used for recording tests and test results shall be subject to the Engineer's approval and shall clearly differentiate between Control, Repeat, Engineer's and Extra Tests.

Test results and copies of calculations shall be submitted to the Engineer promptly upon completion of the tests.

3.15.2 Engineer's Tests

The carrying out of any tests by or on behalf of the Engineer shall not relieve the Contractor of any of his responsibilities for testing in accordance with the Specifications. The Contractor shall inform the Engineer of his programme for placement and compaction of fill in sufficient time to allow the Engineer to make arrangements for Engineer's tests to be carried out without delaying the Construction progrramme.

3.16 MEASUREMENT AND PAYMENT

3.16.1 General: Equipment Fill, trench backfill and stone apron/ pitching

Measurement under these items will be computed by actual measurements methods and will be made of the number of cubic meter of each material Zone in place and accepted in the embankment fill to the lines, grades and cross-sections shown on the Drawings or established by the Engineer.

Payment shall constitute full compensation for constructing the embankment from required borrow areas, quarries and stockpiles including excavating, loading, unloading, rehandling, hauling, processing, moistening, placing and compacting the materials and all other work related to the Item.

3.16.2 Riprap Stone Protection for Embankments

Payment will be made for the number of cubic meter measured as provided above at the Contract unit price per cubic meter for Riprap smaller and larger stone protection respectively for Embankments.

3.16.3 Impervious Core Fill

Payment will be made for the number of cubic meter measured as provided above at the Contract unit price per cubic meter for Impervious Core Fill.

3.16.4 Sand Filter

Payment will be made for the number of cubic meter measured as provided above at the Contract unit price per cubic meter for Sand Filter.

3.16.5 Cobble and Gravel Toe

Payment will be made for the number of cubic meter measured as provided

above at the Contract unit price per cubic meter for Sandy Gravel Toe.

3.16.6 Slush Grout

Payment will be made for the number of cubic meter measured as provided above at the Contract unit price per cubic meter for Slush Grout.

3.16.7 Grout Curtain

Payment will be made for the number of cubic meter measured as provided above at the Contract unit price per cubic meter for Grout Curtain.

3.16.8 Stone Apron

Measurement for payment of Stone Apron at the locations specified will be made to the outlines of the stone in place and accepted according to the thickness of the stone apron shown on the Drawings or establish by the Engineer.

Payment will be made for the number of cubic meter as provided above at the Contract unit price per cubic meter for the Stone Apron at specified locations and shall constitute full compensation for materials and placement of the stone apron including preparation of foundation and all other works related to the item.

3.16.9 Miscellaneous Fills and Backfills around Structures

Measurement will be made of the number of cubic meter of well compacted or lightly compacted fills and backfills in accordance with Subsection 3.12.3 as specified on the Drawings or directed by the Engineer, in place and accepted around the Structures according to the lines and grades as shown on the Drawings.

Payment will be made for the number of cubic meter measured as provided above at the Contract unit price per cubic meter for the respective items as indicated in BOQ and shall constitute full compensation for constructing the fill with the materials obtained from the specified stockpiles or borrow areas including hauling, placing, moistening and compacting the material and all other work related to the item.

3.16.10 Compaction and Backfilling of Trenches

Measurement shall be made of the number of cubic meter of earth acceptably backfilled with well-compacted earth for trenches within the lines and grades shown on the Drawings or as directed by the Engineer.

Payment for compaction and backfilling of trenches shall be made at unit price per cubic meter as stated in the BOQ and shall constitute full compensation for backfilling with the materials obtained from the specified stockpiles or borrow areas including hauling, placing, moistening and compacting the material and

all other works related to the item.

3.16.11 Stone Pitching

Measurement for payment for stone pitching at specified locations will be made to the outlines of the stone pitching on the basis of the accepted thickness of the stone pitching as shown on the Drawing and as directed by the Engineer. No extra payment will be made for increased thickness of stone pitching.

Payment for furnishing, transporting and placing stone pitching will be made at the unit price bid per cubic meter in the Bill of Quantities for Stone Pitching. The amount bid shall be full payment for the work specified herein as stone pitching, including preparation of the foundation, placing of the stone pitching and all other works related to the item.

The payment shall be deemed to include the costs of cement grouting at Toe Drain for providing, cement, performing grouting and all the related activities in connection to complete the work as per specifications and drawings to the satisfaction of the Engineer.

3.16.12 Construction of Embankment for Canals/ Channels

Measurement will be made of the number of cubic meter of canal embankment constructed as per Specification and Drawings, and as directed by the Engineer.

Payment will be made of the number of cubic meter of canal embankment as measured above and shall constitute full compensation for the materials from required borrow areas, quarries and stockpiles including loading, unloading, re-handling, hauling, processing, moistening, placing, well compacting the materials and all the works stated in the above BOQ items including preparation of maintenance berms and inspection roads.

SECTION – 4
PLAIN AND REINFORCED CONCRETE

4.1 SCOPE

This section covers the manufacturing, forming, transporting, placing, stripping of forms, finishing and curing of plain and reinforced normal concrete in the structures included herein and as shown in the drawings. The relevant reference standards are listed in sub-sections 4.31 at the end of this section.

4.2 SPECIFICATIONS

The following codes shall be used.

4.2.1 Reinforced Concrete

Reinforced Concrete will be designed in accordance with the applicable provisions of “Building Code Requirements for Reinforced Concrete (ACI 318-89) and commentary ACI 318-89” of American Concrete Institute.

4.2.2 Plain Concrete

Design of Structural Plain Concrete will be based upon the relevant provisions of “Building Code Requirements for Structural Plain Concrete (ACI 318.1 – 89) and commentary – ACI 318.1 R – 89”, of American Concrete Institute.

4.3 COMPOSITION AND QUALITY

Concrete shall be composed of Portland cement, water, fine and coarse aggregates and any admixtures as and when specified. The concrete mixes will be designed by the Contractor under the supervision of the Engineer who will determine the required quality of the concrete for the structures covered by these Specifications. The design strengths of concrete for various parts of the structures shall be as shown on the Drawings.

4.4 CEMENT

4.4.1 General

Generally Portland cement shall be used for the construction of this Contract. Cement shall be furnished in sacks or in bulk form as approved by the Engineer. Unless otherwise permitted, cement from not more than two plants shall be used and in general, the product from only one plant shall be used in any particular section of the work. No cement recovered through cleaning sacks shall be used.

4.4.2 Portland Cement

Portland cement shall be Pakistani manufactured, unless otherwise approved

by the Engineer. Portland cement shall conform to Pakistan Standard 232 or British Standard BS 12: 1978 or later “Specifications for Ordinary and Rapid Hardening Portland Cement” or to ASTM Designation C150-86. “Standard Specifications for Portland Cement”.

4.4.3 Tests

Cement shall be sampled at storage site and tested from time to time at the discretion of the Engineer in accordance with the ASTM Designation C150-86 or its equivalent latest British Standards. Expenses for such tests shall be borne by the Contractor. If the tests prove that the cement has become unsatisfactory, it shall be removed from the site immediately. Cement which has been in storage at the project site longer than four months shall not be used until retesting proves it to be satisfactory.

4.4.4 Transportation of Cement

Transportation of the cement from the factory to the site stores and to the point of use shall be accomplished in such a manner that the cement is completely protected from exposure to moisture. Cement which has been adversely affected by moisture, as determined by the Engineer, shall be rejected. Cement shall be delivered in strong and well made paper and cloth sacks, each plainly marked with the manufacturer’s name, brand, type of cement and the weight of cement contained therein. Packages varying more than 3 percent cement from the weight marked thereon may be rejected and if the average weight of packages in any consignment as shown by weighing fifty packages taken at random is less than that marked on the packages, the entire consignment may be rejected. Packages received in broken or damaged condition shall be rejected or may be accepted only as fractional packages as determined by the Engineer.

4.4.5 Storage

Cement shall be stored in dry, weather tight and properly ventilated structure. All storage facilities shall be subject to approval and shall be such as to permit easy access for inspection and identification of each consignment. Sufficient cement from a single source shall be in storage at the work site to complete any lift of concrete started. Adequate storage capacity shall be furnished to provide sufficient cement to meet the peak needs of the project. Cement in sacks shall be stored on a damp-proof floor and shall not be piled to a height exceeding 2m (6.5 ft.).

The Contractor shall use cement in the approximate chronological order in which it is received at the site. All empty sacks shall be promptly disposed of as approved by the Engineer.

Cement storage facilities shall be emptied and cleaned by the Contractor when so directed, however, the interval between required cleanings will normally not be less than four months.

Suitable accurate scale shall be provided by the Contractor for weighing the cement in stores and elsewhere on the work if required, and he shall also furnish all necessary test weights.

4.4.6 Delivery and Usage Record

Accurate records of deliveries of cement and its use in the work shall be kept by the Contractor. Copies of these records shall be supplied to the Engineer in such a form as he may require.

4.5 AGGREGATES

Materials used as aggregates shall conform to ASTM C33-86 “Specifications for Concrete Aggregates” and shall be obtained from sources known to produce satisfactory results for the different specified grades of concrete. The use of aggregates from sources which have not been approved by the Engineer shall not be permitted. The following tests shall be carried out by the Contractor at his own expense to determine the suitability of the material for the intended use:

- Mechanical properties
- Porosity
- Organic impurities
- Clay and Silt contents
- Abrasion and Soundness
- Alkali Reactivity Potential
- Water Soluble Chloride Content

4.5.1 Fine Aggregate for Concrete

Fine aggregate shall conform to provisions of ASTM C33-86 to ensure water tightness and chemical resistance where required.

Fine aggregate for grade A . B and C of concrete shall be well graded natural sand, stone screenings or other inert material of similar characteristics or a combination of these. The whole of it shall be perfectly clean, free from coagulated lumps, soft and flaky particles, shale alkali, organic matter, loam mica and injurious amount of other deleterious substances. Maximum allowable content of silt and other deleterious inert substances is 5 percent. Material derived from stone unsuitable for coarse aggregate shall not be used as fine aggregate. Fine aggregate derived from stone screenings shall be well shaped, cubical, hard, dense and durable and shall be stacked on a platform so as to adequately protect it from dust and other admixtures.

Grading for the above specified fine aggregate shall be within the following

limits, when tested in accordance with ASTM C136 – 84a.

Sieve Size	Percentage Passing (Dry Weight)
9.5 mm (3/8 in)	100
4.75 mm (No. 4)	95 to 100
2.36 mm (No. 8)	80 to 100
1.18 mm (No. 16)	50 to 85
0.60 mm (No. 30)	25 to 60
0.30 mm (No. 50)	10 to 30
0.15 mm (No. 100)	2 to 10

Fineness Modulus shall range between 2.3 and 2.60.

4.5.2 Coarse Aggregate for Concrete

Coarse aggregate for grades A, B and C of concrete shall consist of quarried or crushed stone/river run gravel or inert material or a combination of these, durable, sound, cubical and well shaped, free from soft or friable matter or thin elongated pieces, alkali, organic matter or injurious amounts of other deleterious substances. Deleterious inert matter shall not exceed 3 percent.

4.5.3 Storage of Aggregate

Each class of aggregate is to be stored separately and the Contractor is to provide means of ensuring that aggregates are stored on a suitable hard clean surface or platform to prevent contamination from the ground or any other source.

4.5.4 Proportions of Coarse and Fine Aggregates

The nominal ratio of the volume of coarse aggregate to the volume of fine aggregate shall be decided by compression test of concrete cylinders to be furnished by the Contractor. The Engineer may order these ratios to be varied slightly according to the grading of the aggregates by weight, if necessary, so as to produce required grading for the mixtures of coarse and fine aggregate. The Engineer shall get the tests carried out at the Contractor's cost.

At the beginning of the Works and where there is any change in the course or fine aggregates or in their source of supply, the Contractor is to have a series of tests on cylinders made representative of and marked as to the aggregates and their grading and mix of concrete. Such cylinders are to be tested in the laboratory under identical conditions, except for small variations in the relative proportions of the coarse and fine aggregates up and down from the best proportions derived from the sieve analysis. The cylinders are to be tested at 3, 7 and 28 days.

4.5.5 Water

Water for washing aggregates, mixing concrete and curing shall be clean and free from harmful matter and shall satisfy the recommendations contained in

the Appendix of BS 3148-80 or ASTM D596-83 or equivalent. The concentration of sulphates and chlorides shall be such that the concrete mix as a whole complies with the limits of salts content recommended in the Appendix of BS 3148-80 or ASTM D596-83 or equivalent. The Contractor shall make arrangements to protect water from direct Sun and contamination by wind-blown materials. The Engineer shall order re-testing of water whenever deemed necessary. Water shall meet the following requirements:

Chlorides such as Sodium chloride	Max.	500	ppm
Sulphate such as Sodium Sulphate	Max.	1000	ppm
Impurities	Max.	2000	ppm
Alkali Carbonate and Bicarbonates	Max.	1000	ppm

Water for curing concrete shall have a pH value not lower than 6 or greater than 9 and shall not contain impurities which cause discoloration of concrete.

4.6 CONCRETE MIX STRENGTH

4.6.1 Strength

In addition to the mix design parameters pursuant to structural characteristics, chemical resistance and durability requirements, the concrete mixes shall also conform to the placing systems employed.

The concrete shall be one of the following three different grades to be paid for at their respective unit prices designated.

Grade of Concrete	Type of Concrete	Minimum Compressive Strength Tested at 28 days	Max. size of Aggregate (in)
A	Normal Structural	3000 –psi	3/4 -1.5
B	Massive	3000 – psi	3
C	Plain	2000 – psi	3

However, the actual concrete mix requirement shall consist of proportioning and mixing for the following strengths when tested in the form of cylinders; test shall be made for each grade of concrete. The cylinders are to made, cured, stored, transported and tested in accordance with ASTM C 39 – 86. The tests are to be carried out at a testing laboratory approved by the Engineer. All such tests shall be carried out at the expense of the Contractor.

4.6.2 WATER CEMENT RATIO

In general, the Engineer ‘s design will provide for water cement ratios by weight (exclusive of water absorbed by the aggregates), which will be determined on the basis of producing concrete having suitable workability, density, impermeability, durability and the required strength without the use of excessive amounts of cement.

4.7 Consistency

Proportions of ingredients shall vary to achieve the desired concrete consistencies when tested conforming to the following slump requirements or as desired by the Engineer. The slump shall be determined in accordance with ASTM C143-78

Use of Concrete	Minimum & Maximum Slump (mm)
Columns, Beams, Slabs and Slabs on ground	25 (1”) to 75 (3”)
Plain or reinforced Foundations, Footings	25 (1”) to 100 (4”)

In all cases, the proportions of aggregates for concrete shall be such as to produce mixtures which will work readily into the corners and angles of the forms and around the reinforcement without permitting the segregation of materials or laitance formation. Uniformity in concrete consistency from batch to batch shall be ensured.

4.8 MEASUREMENT OF MATERIALS

The coarse and fine aggregate are to be weighed or accurately measured to the Engineer’s satisfaction. In no event they are to be measured by the shovel or barrow.

4.9 MIXING METHODS

The concrete shall be mixed in an approved mechanically operated batch mixer. The mixer, its hopper and working platforms shall be protected from sun, rain and wind.

The aggregates and cement shall be mixed together before adding water until the concrete is of even colour and consistency throughout. Dirt and other undesirable substances shall be excluded. Water shall not be added indiscriminately from a hose or can. All concrete shall be thoroughly mixed by a modern reliable batch mixer to produce maximum output of concrete necessary to complete the Works within the specified time without reducing the required mixing time. Concrete shall be mixed in the concrete mixers for the duration required for uniform distribution of the ingredients to produce a homogenous mass of consistent colour but for not less than 1.5 minutes. The mixer shall be operated by trained operators, who have previous experience of running and operation of concrete mixers.

At the conclusion of mixing, the mixer and all handling plants shall be thoroughly cleaned out before the concrete remaining in them has had time to set.

No concrete shall be mixed by hand without the Engineer's written consent, and such consent shall be given only for small quantities in special circumstances.

4.10 TEST OF CONCRETE

4.10.1 Strength Test During the Work

Strength tests of the concrete placed during the course of the work will be made by the Engineer in an approved laboratory at the Contractor's expense. The Contractor shall assist the Engineer in obtaining, for control purposes, such number of cylinders and/or beams as the Engineer may direct, but in general, three cylinders and/or beams, taken from each 10 to 50 cu.m or fraction thereof, or from each days pour, whichever is less, of each grade of concrete placed, and shall govern. Test specimen will be made and cured in accordance with the applicable requirements of ASTM Designation C31-87, "Practices for Making and Curing Concrete Compressive and Flexural Test Specimens in the Field". Cylinders and beams will be tested in accordance with the applicable requirements of ASTM Designation C39-86, "Standard Method of Test for Compressive Strength of Cylindrical Concrete Specimens" and ASTM Designation C78-84, "Standard Method of Test for Flexural Strength of Concrete (Using Simple Beam with Third Point Loading)". The test result will be based on the average of the strength of the test specimens except that if one specimen in a set of three shows manifests evidence of improper sampling, molding, or testing, the test result will be based on the average of the remaining two specimens. If two specimens out of a set of three show such defects, the results of the set will be discarded and average strength determined from test results of the other two sets. The standard age of test will be 28 days. If the average of the strength test of the specimen cured under laboratory controls, for any portion of the work, falls below the minimum allowable compressive or flexural strength at 28 days required for the grade of concrete used in that portion, the Engineer may change the proportions of the constituents of the concrete, as necessary to secure the required strength for the remaining portions of the work. If the average strength of the specimens cured under actual field conditions as specified herein before falls below the minimum allowable strength, the Engineer will make such changes in the conditions for temperature and moisture under which the concrete work is being placed and cured as may be necessary to secure the required strength.

4.10.2 Tests of Hardened Concrete In, or Removed from the Structure

Where the results of the strength tests of the control specimens indicate the concrete as placed does not meet Specification requirements or where there is

other evidence that the quality of the concrete is below specification requirements, core-boring tests will be made by the Engineer in accordance with ASTM Designation C42-84a Standard Method of Obtaining and Testing Drilled Cores and Sawed Beams of Concrete. In the event that the core-boring test indicates that the concrete placed does not conform to the Drawings and Specifications, the Contractors shall take measures as prescribed by the Engineer to correct the deficiency. If a strength deficiency is found and is due to the Contractor's fault or negligence, the entire cost of replacing faulty concrete shall be borne by the Contractor who shall also reimburse the Employer for the cost of making tests. Otherwise, payment for removing and replacing faulty concrete will be made under applicable Items of the Bill of Quantities insofar as they are applicable and as Day Work where not classifiable under the Items of the Bill of Quantities.

4.11 TRANSPORTATION OF CONCRETE

Concrete shall be conveyed from mixer to the place of final deposit as rapidly as practicable , by methods which will prevent segregation or loss of ingredients and in accordance with the latest edition of ACI 304," Recommended Practice for Measuring, Mixing, Transporting and Placing Concrete".

Any wet batch hopper through which the concrete passes shall be conical in shape. There shall be no vertical drop greater than 1.50 m expect where suitable equipment is provided to prevent segregation and where specifically authorized. Belt conveyers, chutes, or other similar equipment shall not be permitted for conveying concrete except where the use of this equipment is approved in writing by the Engineer, in advance of any use. Each type or grade of concrete shall be visually identified by placing a coloured tag or marker on the bucket may be positively identified and placed in the structure forms in the desired position.

4.12 PLACING

4.12.1 General

Concrete placing shall follow the Recommended Practice for Measuring, Mixing, Transporting and Placing Concrete, latest ACI 304 requirement. No concrete shall be placed until all formwork, reinforcement, installation of parts to be embedded , bracing of forms and preparation of surface involved in the placing and the method of placement have been approved by the Engineer. Approval of the method of placement proposed will not relieve the Contractor of his responsibility for its adequacy and he shall remain solely responsible for the satisfactory construction of all work under the Contract.

Before concrete is placed, all surfaces upon or against which concrete is to be placed, shall be free from standing water, mud, debris or loose material. All surfaces of form and embedded material that have become encrusted with dried mortar or grout from concrete previously placed shall be cleaned of all such mortar or grout before the surrounding or adjacent concrete is placed. The surfaces of absorptive material against or upon which concrete is placed shall be moistened thoroughly so that moisture will not be drawn from the freshly placed concrete. The depositing of concrete shall be regulated so that the concrete may be effectively compacted with a minimum of lateral movement in to horizontal layers approximately0.40 m in thickness. No concrete that has partially been hardened or contaminated by foreign materials shall be deposited in the structure, nor shall re-tampered concrete be used unless approved by the Engineer. The surfaces of construction joints shall be kept continuously wet for at least eighteen hours during the twenty four hours period prior to placing concrete except as otherwise directed by the Engineer. All free water shall be removed and the construction joint shall be completely surface dry prior to placement of concrete. All concrete placing equipment and methods shall be subject to approval. Concrete placement will not be permitted; when in the opinion of the Engineer weather conditions prevent proper placement and consolidation.

5.12.2 Placing Concrete Under Water

Concrete shall not be placed under water except where inevitable in which case approval must be sought from the Engineer and the work carried out under his immediate supervision. In this case the method of placing shall be as hereinafter specified.

Concrete deposited under water shall be of the strength as specified on drawings with a minimum cement content of 400 kg per cubic meter of concrete.

The slump of the concrete shall be maintained between 10 and 20 cm. To prevent segregation, it shall be carefully placed in a compact mass, in its final position, by means of a tremie, a bottom-dump bucket, or other approved means, and it shall not be disturbed after being placed. Water must not be allowed to flow past the fresh concrete surface.

A tremie shall consist of a tube having a diameter of not less than 25 cm constructed in sections having flanged couplings fitted with gaskets with a hopper at the top. The tremie shall be supported so as to permit free movement

of the discharge end over the entire top surface of the work and so as to permit rapid lowering when necessary to retard or stop the flow of concrete. The discharge end shall be closed at the start of work so as to prevent water entering the tube and shall be completely submerged in concrete at all times; the tremie tube shall be kept full to the bottom of the hopper. When a batch is dumped into the hopper, the flow of concrete shall be induced by slightly raising the discharge end, but always keeping it in the placed concrete. The flow shall be continuous until the work is completed.

When the concrete is placed with a bottom-dump bucket, the top of the bucket shall be open. The bottom doors shall open freely downward and outward when tripped. The bucket shall be completely filled and slowly lowered to avoid backwash. It shall not be dumped until it rests on the surface upon which the concrete is to be deposited and when discharged shall be withdrawn slowly until well above the concrete.

Dewatering may proceed when the concrete seal is sufficiently hard and strong. All laitance or other unsatisfactory material shall be removed from the exposed surface by scraping, chipping or other means which will not injure the surface of the concrete.

4.13 COMPACTING CONCRETE

All concrete, except that in blinding layers and in-situ-concrete in very small sections, shall be compacted by vibration. After any necessary hand spading, working and ramming into place, each layer of concrete shall be compacted with mechanical immersion vibrators of types approved by the Engineer.

The immersion vibrators shall produce vibration of a frequency not less than 6000 impulses per minute. Under no circumstances shall be immersion vibrators be allowed to come into contact with reinforcement or shuttering. Immersion vibrators shall penetrate vertically for a few inches into any previous unset layer in order to establish a satisfactory bond, but no concrete shall be vibrated in such a manner as to cause injury to concrete (already set or otherwise) in other parts of works. Care shall be taken to keep the vibrators vertical, to insert them at regular intervals and withdraw them slowly to prevent the formation of voids, so that the entire mass of the concrete is properly compacted. Haphazard or random penetration of the vibrators without sufficient depth of insertion shall be avoided. A sufficient number of vibrators shall be used to ensure compaction of each batch of concrete before the next batch is delivered. At least one extra vibrator shall be in hand for emergency use.

Vibration shall be supplemented by hand punning with approved small diameter

smooth steel rods with rounded ends in order to achieve complete compaction around reinforcement and other embedded fittings and a completely dense mortar finish against the shuttering.

Excessive vibration shall be avoided and on no account shall vibration be continued after a good surface finish, without free water, has been achieved. Vibration and punning shall be just sufficient to produce a dense, homogenous concrete properly filling the moulds and free from air voids, segregation, bleeding, honeycombing and other imperfections. Only highly skilled operators and workmen, subject to constant supervision, shall be employed in vibrating and punning concrete.

4.13.1 Time Interval between Mixing and Placing

Concrete mixed in stationary mixers and transported by non-agitating equipment shall be placed within thirty minutes after it has been mixed, unless otherwise authorized. When a truck mixer or agitator is used for transporting concrete, the concrete shall be delivered to the site of the work and discharge shall be completed within 1.5 hours after introduction of the cement to the aggregates. The concrete shall be placed within 20 minutes after it has been discharged. In all cases, concrete shall be placed and compacted well within the initial setting time.

4.14 CONCRETE FINISHES

Concrete finishes shall be made in accordance with the provision of ACI 301-84 or as directed by the Engineer. Workmanship in shuttering and concreting shall be such that concrete work shall normally require retouching and the surfaces being dense, watertight and, where steel shuttering has been used, it should be perfect and smooth. Should there be faults in these respects, the Contractor shall cut out and replace the whole of the lift concerned or such volume as the Engineer decides, or make good if permitted by the Engineer and to his approval. Concrete which is honey-combed or otherwise shows voids shall invariably be cut out and replaced in an approved manner as directed by the Engineer.

Any good making shall be carried out immediately after striking the shuttering and shall be restricted to light rubbing down with wet carborundum or the approved correction of minor blemishes. In no circumstances shall surfaces be made good with cement or washes or rendering.

Exposed concrete surfacing not requiring shuttering and not subsequently to be given extra finishes shall be given perfectly dense smooth finish with a wooden float.

Where concrete slabs, ducts, bases or machine plinths will themselves from the finished floor surface the concrete shall be trowel led immediately after the first laying process only just sufficiently to give a level surface. Thereafter, when the concrete has

stiffened to a condition such that a hard compacted surface can be obtained without bringing up laitance, a final surface toweling shall be given with a steel float to produce a smooth finish.

4.14 PLACING TEMPERATURE

The temperature of concrete when it is being placed shall conform to the requirements herein specified for thin, moderate and heavy concrete sections and mass concrete. The Engineer's determination as to the type of section and applicable placing temperatures shall govern. Concrete shall be placed at temperature as follows:

Concrete for delivery to the forms at the coolest temperature which is practicable to produce under current conditions, but in no case in excess of 32 degree C. Except as otherwise determined by the Engineer, Section to which this provision will apply, shall be considered to be sections ten feet and less in thickness when screened and/or formed on both faces, and five feet and less in thickness when one face in placed against earth, rock or previously placed concrete.

If concrete is placed when the weather is such that the temperature of the concrete would exceed the limits herein specified, as determined by the Engineer, the Contractor shall employ effective means, such as precooking of aggregates and mixing water and placing at night, as necessary, to maintain the temperature of the concrete, as it is placed, below the maximum limits specified herein.

4.15 CURING OF CONCRETE

4.15.1 General

Curing of all concrete including repair work shall conform to the recommendation given in ACI 308 "Standard Practice for Curing Concrete". Unless otherwise specified or ordered by the Engineer all concrete shall be cured by water. It shall be kept wet continuously for at least fourteen (14) days after placement. It shall be covered with water saturated material like gunny bags, canvas, clean sand, matting, etc. or any other improved method duly approved by the Engineer.

Shuttering and exposed faces of concrete and mortar shall be covered by at least 3 thicknesses of approved stout hessian kept continuously cool and wet by an efficient and comprehensive system of sprinklers and diffused jets of water, with appropriate temporary drainage arrangements, for at least 14 days after placing.

As an alternative to continuous curing with water after stripping of shuttering a proprietary membrane method of curing may be used provided that it is used strictly in accordance with the manufacturer's instructions, is coloured to show its presence, contains no bituminous substance, does not prejudice the appearance of permanently

exposed concrete surfaces and is in all other respects to the approval of the Engineer. Wherever practicable, both faces of concrete structures shall be appropriately treated in order to prevent tensile stresses due to differential shrinkage or temperature across the section. Furthermore, the Contractor shall continue to provide facilities for covering and/or keeping wet such exposed surfaces of the Work as are, in the opinion of the Engineer liable at any time to be damaged by weather.

At no time shall any further work involving concrete proceed until the Contractor has satisfied the Engineer that all such work previously carried out is being protected and cured in accordance with this clause.

4.15.2 Curing Precast Concrete Members

Pre-cast concrete members shall be cured for not less than 7 days by the water method or by steam curing, at the option of the Contractor. Steam curing for pre-cast members shall conform to the following provisions:

- After placement of the concrete, members shall be held for a minimum 4 hours pre-casting period.
- To prevent moisture loss on exposed surfaces during the pre-steaming period, members shall be covered immediately after casting or the exposed surfaces shall be kept wet by fog spray or wet blankets.
- Enclosures for steam curing shall allow free circulation of steam about the member and shall be constructed to contain the live steam with a minimum moisture loss. The use of tarpaulins or similar flexible covers will be permitted, provided they are kept in good repair and secured in such a manner to prevent the loss of steam and moisture.
- Steam at jets shall be low pressure and in a saturated condition. Steam at jets shall not impinge directly on the concrete, test cylinders, or forms. During application of the steam, the temperature rise within the enclosure shall not exceed 20 degrees C per hour. The curing temperature throughout the enclosure shall not exceed 65 degree C and shall be maintained at a constant level for a sufficient time necessary to develop the required compressive strength. Control cylinders shall be covered to prevent moisture loss and shall be placed in a location where temperature is representative of the average temperature of the enclosure.
- Temperature recording devices that will provide an accurate continuous permanent record of the curing temperature shall be provided. A minimum of one temperature recording device per 60 meters of continuous bed length will be required for checking temperature.

- Curing of pre-cast concrete will be considered completed after a termination of the steam curing cycle.

4.16 PREPARATION OF EARTH SURFACES

Before concrete is placed in or against any excavation or filling, the surface of such earthwork shall have been compacted and shall be free from running and standing water, oil and other deleterious matter. Loose earth and other material shall be removed. The excavation or filling shall be damp but not wet and special precautions shall be taken to prevent groundwater from damaging green concrete or causing movement of the concrete.

Immediately after the excavation or filling has been trimmed and prepared as above, the exposed foundation shall be protected by a blinding layer or “No-fines” concrete or of cement mortar or other protection as show on the Drawings or ordered by the Engineer. Such blinding layers and coatings shall be thoroughly cleaned and moistened before further concrete work is placed thereon.

Reinforced concrete shall not be cast against an unprotected face of earth or any other material liable to become loose or to slip; the greatest possible care shall be taken to avoid falls of material on to the concrete, by leaving the timbering in place (if permitted) or by recovering the timbering in small depths and lengths at a time and by any other approved means. If any such falls occur, all soiled concrete shall be removed and replaced at Contractor’s own cost.

4.17 CASTING SECTIONS AND CONSTRUCTION JOINTS

(a) General

The concrete in each integral part of a structure shall be placed continuously, and the Contractor will not be allowed to commence work on any such part unless sufficiently inspected and approved material for the concrete is at hand, and his forces and equipment are sufficient to complete the part without interruption in the placing of the concrete.

Construction joints shall be made only where located on the plans or shown in the pouring schedule, unless otherwise approved.

If not detailed on the plans, or in the case of emergency, construction joints shall be placed as directed. Shear keys or inclined reinforcement shall be used where necessary to transmit shear or bond the two sections together. When shear keys or inclined reinforcement are not provided, the concrete shall be roughened as directed. Joints in the concrete due to stopping work shall be avoided as far as possible. Such joints, when necessary, shall be constructed to meet the approval

of the Engineer.

When the placing of concrete is temporarily discontinued the concrete, after becoming firm enough to retain its shape, shall be cleaned of laitance and other objectionable material to a sufficient depth to expose sound concrete. Where a "feathered edge" might be produced at a construction joint, as in the sloped top surfaces of a wing wall, an inset formwork shall be used to produce an edge thickness of not less than 15 centimeters in the succeeding layer. Work shall not be discontinued with 50 centimeters of the top of any face, unless provision has been made for a coping less than 50 centimeters thick, in which case, if permitted by the Engineer, the construction joint may be made at the underside of coping.

Immediately following the discontinuance of placing concrete all accumulations of mortar splashed upon the reinforcing steel and the surfaces of forms shall be removed. Dried mortar chips and dust shall not be puddle into the unset concrete. Care shall be exercised, during the cleaning of the reinforcing steel, not to injure or break the concrete steel bond at and near the surface of the concrete.

(b) Box Culverts

In general, the base slab or footings of box culverts shall be placed and allowed to set before the remainder of the culvert is constructed. In this case, suitable provision shall be made for bonding the sidewalls to the culvert base, preferably by means of raised longitudinal keys so constructed as to prevent, as far as possible, the percolation of water through the construction joint.

In the construction of box culverts 1.25 meters or less in height, the sidewalls and top slab may be constructed as a monolith. When this method of construction is used, necessary construction joints shall be vertical and at right angles to the axis of the culvert.

In the construction of box culverts more than 1.25 meters in height the concrete in the walls shall be placed and allowed to set before the top slab is placed. In this case, appropriate keys shall be left in the sidewalls for anchoring the cover slab.

If possible, each wing-wall shall be constructed as a monolith. Construction joints, where unavoidable, shall be horizontal and so located that no joint will be visible in the exposed face of the wing wall above the ground line.

(c) Construction Joints

Construction joints shall be made only where shown on the Drawings or called for

in the pouring schedule, unless otherwise approved by the Engineer. If not detailed on the Drawings, construction joints, also in case of emergency shall be placed to meet the approval of the Engineer. Shear keys or reinforcement shall be used, unless otherwise specified, to transmit shear or to bond the two sections together. Before depositing new concrete on or against concrete which has hardened, the forms shall be retightened. The surface of the hardened concrete shall be roughened as required by the Engineer, in a manner that will not leave loose particles of aggregate or damage concrete at the surface. It shall be thoroughly cleaned of foreign matter and laitance. When directed by the Engineer the surface of the hardened concrete which will be in contact with new concrete shall be washed with water to his satisfaction, and to ensure an excess of mortar at the juncture of the hardened and the newly deposited concrete, the cleaned and watered surfaces, including vertical and inclined surface, shall first be thoroughly covered with a coating of mortar of the same proportion of sand and cement as the class of concrete used against which the new concrete shall be placed before the grout or mortar has attained its final set.

The placing of concrete shall be carried continuously from joint to joint. The face edges of all joints which are exposed to view shall be carefully finished true to line and elevation.

4.18 FORM WORK

The Contractor shall submit, for the approval of the Engineer full proposals and design calculations for all form work and proposals for the period of time to elapse before each item of the shuttering is struck. Notwithstanding the approval of the Engineer to any actual shuttering or proposals for its striking, the Contractor shall retain complete responsibility for its adequacy as to the provisions of this clause and for any consequences of the striking being premature or harmful. In general the minimum time for the removal of form work shall be as under:

	Form Work	Normal Period
a)	Form work of vertical surfaces such as Walls and columns faces.	3 * days
b)	Beams and slabs	14 * days
c)	Sides of Beams Caps and other parts	5* days
d)	Mass concrete	3* days

*Normal values of time span to the point of striking forms are subject to change depending on the results of concrete age versus strength tests.

Form work shall be designed with easily sealed access hatches for inspection purposes and for removal of water and deleterious materials, and with connections to facilitate striking without damaging the concrete. Form work for soffits of slabs shall be erected with an upward camber of 6 mm for each 3 m. of span. When props are to be left in position under slabs the shuttering shall be made and removed in such a way that the props are not disturbed in any way.

A tolerance of plus or minus 3 mm inline or level will normally be permitted after erection of the shuttering which shall nevertheless be sufficiently strong, stiff and rigidly braced against loads due to the wet concrete and vibration and against constructional loads, to remain true to the line and level accepted before concreting. It shall be sufficiently watertight to ensure that there shall occur no “fine” or escape of mortar at joints or of liquid from the concrete.

All exterior angles for concrete work no permanently buried in the ground shall be given 19mm x 19mm chamfers unless otherwise indicated on the Drawings.

Timber for shuttering shall be well seasoned, free from loose knots, splits, projecting nails and the like and from any adhering foreign matter.

Steel shuttering shall be used to produce a fair face concrete with only a faint but consistent pattern of plate marks on exposed concrete surfaces. The shuttering shall be assembled from wrought tongued and grooved boarding, true and tightly fitted with joints as necessary, the whole surface and all edges being rendered smooth before and after oiling. Bearing in mind the quality of the finish required, wrought, plain-edged and butt-joint boarding may replace the tongued and grooved boarding or purpose-made steel – faced shutters of first-class quality solely at the discretion of the Engineer.

Rough shuttering shall be used for surfaces to be buried in the ground and shall be assembled from sawn boards with smooth and true edges or from approved steel shutters. In either case all joints shall be suitably filled.

The inside faces of all shuttering shall be treated with an approved material to prevent adhesion of the concrete, all such materials being kept clear of the reinforcement and other items to be embedded.

Shuttering shall be struck by static force alone without shock, vibration or damage to the concrete. Shuttering being reused shall be thoroughly repaired and cleaned before re-assembly.

4.19 TOLERANCES

The Contractor is to complete all works including formwork, placement, curing, etc, so as to ensure the concrete surfaces will conform to the specified tolerance limits given in ACI 316 and 347. Where tolerances are not stated in the specifications or the drawings, maximum permissible deviations from established lines, grades and

dimensions shall conform to the tolerances given hereinafter:

These tolerances are not cumulative.

Concrete work not meeting the tolerance requirements will be rejected unless an acceptable repair work is allowed by the Engineer.

4.19.1 Cast in Place Concrete

(a) Variation from plumb (or the specified better for inclined walls).

i) In the lines and surfaces of piers, walls and in arises

- In any 3m length or height 6 mm
- In any 6m height 10 mm
- Maximum for the entire length or height 25 mm

ii) For exposed corner piers, control – joint grooves and other conspicuous lines

- In any bay or 6 m length or height 6 mm
- Maximum for the entire length or height 12 mm

(b) Variation from the level or from the grades specified on the drawings.

i) In slab soffits, beam soffits and in arises measured before Removal of supporting shores.

- In any 3m height 6 mm
- In any bay or 6 m length 10 mm
- Maximum for the entire length 19 mm

ii) In exposed lintels, sills, parapets, horizontals grooves and other conspicuous lines.

- In any bay or 7 m length 6 mm
- Maximum for the entire length 12 mm

(c) Variation of the linear structure lines from established position in plan and related position of piers and walls.

- In any bay or 6 m length 12 mm
- Maximum for the entire length 25 mm

(d) Variation in the sizes and locations of sleeves, floor openings, and wall openings 6 mm

(e) Variation in cross-sectional dimensions of columns and beams and in the thickness of slabs and walls.

Minus 6 mm

Plus 12mm

(f) Footings

(Tolerances apply to concrete dimensions only, not to positioning of vertical reinforcing steel, dowels, or embedded items).

(i)	Variation in dimension in plan	
	Minus	12 mm
	Plus	50 mm
(ii)	Misplacement or eccentricity 2% of the footing width in the direction of mis-placement but no more than	50 mm
(iii)	Thickness	
	Decrease in specified thickness	5%
	Increase in specified thickness	No limit

4.20 CONCRETE FOR SECOND STAGE AND BLOCKOUTS

Blockouts for equipment and fittings and for such other works as indicated or directed shall be provided as indicated on the Drawings. After the said equipment and fittings have been installed and adjusted in their final location, the block out recesses shall be filled with concrete. Before installing the components to be embedded in block out concrete, and before depositing any block out concrete, the concrete surfaces of the block out shall be cleaned in the manner specified for cleaning construction joints.

Second stage concrete for filling the openings left for the installation of equipment and fittings shall be anchored to the first stage concrete. The size and spacing of the concrete fixing sockets, if any, to be embedded in the first stage concrete shall be subject to the approval of the Engineer. Different components of structures to be built from second stage concrete indicated on Drawing as second stage shall be connected to the first stage concrete through dowels. Dowels not shown in first stage concrete drawings shall be placed and fixed in position by drilling hole in concrete as approved by the Engineer.

4.21 REPAIR OF CONCRETE GENERAL

4.21.1 General

Concrete that is damaged from any cause; concrete that is honeycombed, fractured, or otherwise defective; because of excessive surface depressions, must be excavated and built up to bring the surface to the prescribed lines; shall be removed and replaced with drypack mortar, or concrete, as hereinafter specified. Repair of concrete shall be performed only by skilled workmen and within 24 hours of removal of forms. The Contractor shall keep the Engineer advised as to when repair of concrete will be performed. Unless an inspection is waived in each specific case, repair of concrete shall be performed only in the presence of the Engineer. Repairs shall be made in accordance with the procedures approved by the Engineer.

4.21.2 Materials

All materials used in the repair of concrete shall conform to the applicable requirements of the Specifications.

4.22.3 Protrusions

Where bulges and abrupt irregularities protrude outside the specified limits on formed surfaces not to be concealed permanently, the protrusions shall be reduced by bush-hammering and grinding so that the surfaces are within the specified limits.

4.22.4 Depressions

a) General

All fillings for depressions shall be bonded tightly to the surfaces of holes and shall be sound and free from shrinkage cracks and dummy areas after the fillings have been cured and have dried. All fillings in surfaces of structures prominently exposed to public view shall contain sufficient white Portland cement to produce the same colour as that of the adjoining concrete. Repairs shall be made with concrete filling, mortar filling or dry-pack filling except where repairs with epoxy concrete and/or epoxy mortar are directed to be made by the Engineer. Concrete, mortar or dry pack mortar filling shall each be mixed in proportions approved by the Engineer to produce a repair at least equivalent in strength, density and durability to the concrete in which the repair is required.

b) Concrete Filling

Concrete filling shall be used for holes extending entirely through concrete sections; for holes in which no reinforcement is encountered and which are greater in area than 0.1 square metre and deeper than 10 cm; and for holes in reinforced concrete which are greater in areas than 0.05 square metre in area and which extend beyond the reinforcement.

c) Mortar Filling

Mortar filling, placed under impact by use of a mortar gun, may be used for repairing defects on surfaces, not exposed to public view where the defects are too wide for dry-pack filling and too shallow for concrete filling and no deeper than the far side of the reinforcement that is nearest to the surface.

d) Dry pack Mortar Filling

Dry pack mortar fillings shall be used for filling holes having a depth nearly equal to, or greater than, the least surface dimension; for narrow slots cut for repair of cracks; for grout pipe recesses; and for tie rod fastener recesses as specified. Dry pack mortar shall not be used for filling behind reinforcement or for filling holes that extend completely through a concrete section. If removal of the ends of form ties results in recesses, the recesses

shall be filled with dry pack mortar provided that filling of recesses in surfaces upon or against which fill material or concrete is to be placed will be required only where the recesses are deeper than 25 mm in walls less than 305 mm thick.

e) Surface Finishes of Repaired Areas

The Contractor shall correct all imperfections on the concrete surfaces as necessary to produce surfaces that conform to the requirements specified for the adjacent area Sub-section “Finishes and Finishing”. Fins and encrustations shall be neatly removed from the surfaces.

4.22 EPOXY CONCRETE AND MORTAR

4.22.1 Mixing and Batching

a) Epoxy Binder

Prior to mixing, the two components of the epoxy resin binder shall be conditioned to 15^{o}C to 21^{o}C. The two components shall be combined with constant stirring, and the stirring shall be continued until a uniform mixture is obtained. The rate of mixing should be such that entrained air is held to a minimum. A power-driven (air or spark proof) mixer with propeller-type blade operating at a maximum of 500 rpm shall be used for mixing the two components of the epoxy resin binder and a hemispherical bottomed polyethylene or metal container shall be used for the mixing.

b) Epoxy Concrete

Epoxy binder shall be prepared as specified above, and after the two components have been thoroughly mixed, shall be transferred to large metal pans and the aggregates added in recommended and approved proportion as directed by the Engineer.

General: The fine aggregate shall be added to the epoxy resin binder and the material shall be mixed until a rich mortar consistency is attained. The coarse aggregate shall then be added and the epoxy concrete thoroughly mixed.

c) Epoxy Mortar

Epoxy binder shall be prepared as specified above in para (a) above Epoxy Binder, and after the two components have been thoroughly mixed, shall be transferred to large metal pans and the fine aggregate added in recommended and approved proportions as directed by the Engineer. The fine aggregate shall be added to the binder gradually and mixing continued until all particles are coated.

4.22.2 Temperature, Moisture Protection for Epoxy Mortars and Concrete

Epoxy concrete and mortar shall be placed and repairs shall be made when the atmospheric and concrete temperature are above 38^{o}C and less than 5^{o}C and remain in this range for a period of at least 24 hours. If the work is required to be done at temperatures lower or higher than those specified; approved means as recommended by the manufacturer of the epoxy binder and approved by Engineer shall be provided to raise or lower the ambient and concrete temperatures as required for satisfactory work. Such means will include heating or cooling equipment and necessary shelters. If temperatures below 5^{o}C are anticipated during the cure-out or hardening period of the epoxy concrete or mortar, heated enclosures shall be maintained over the repair area with care taken to avoid localized heating or hot-spots. Circulating air shall be used to ensure the surface temperatures do not exceed 35^{o}C, during curing. Epoxy resin concrete and mortar shall be placed only on sound, clean dry surfaces. Suitable methods shall be used to dry and to maintain dry the contact surfaces of the concrete to which the epoxy concrete or mortar is to be applied. All repairs shall be protected from rain or seepage water for at least 24 hours and from all types of traffic for a period of 72 hours.

4.22.3 Preparation and Placing

a) Epoxy Concrete

All fines, dust, and other loose material on the contact surface shall be removed by scrubbing with a stiff bristle brush followed by washing. The dry, cleaned surfaces shall receive a prime coat of epoxy resin. The prime coat shall be applied in a thin coat and briskly scrubbed into the dry concrete surface with a stiff bristle brush. Placement of the epoxy resin, concrete shall be delayed until the prime coat becomes tacky. The epoxy resin concrete shall be placed in layers not over 100 mm in thickness. The thickness of courses and time interval between courses, shall be such that the temperature of the epoxy concrete does not exceed at any time during hardening. Mechanical plate, screed, or float vibrators or hand tampers shall be used to consolidate the epoxy concrete. Excess epoxy concrete which becomes spread on the adjacent surfaces of hardened concrete shall be removed before it hardens.

b) Epoxy Mortar

Defective concrete in areas as determined by the Engineer shall be repaired with the aid of a saw cut at least 25 mm outside the faulty area.

The concrete between the saw cut and the edge of the faulty area and the concrete throughout the area shall be chipped out to solid concrete. The cavity thus formed shall be thoroughly cleaned with compressed air, sand blasting or other method to remove all loose material. The dry, cleaned surfaces of the cavity shall receive a prime coat of epoxy resin binder of composition as recommended by the manufacturer of the epoxy. The prime coat shall be applied in a thin coating and scrubbed into the surface with a stiff bristle brush. Placement of epoxy resin mortar shall be delayed until the prime coat becomes tacky. The epoxy mortar shall then be placed in the cavity in layers not exceeding 25 mm in thickness. The time interval between placements of additional layers shall be such that the temperature of the epoxy resin mortar does not exceed 60^{o}C at any time during hardening. Mechanical plate, screed or float vibrators or hand tampers shall be used to consolidate the epoxy resin mortar. Excess epoxy resin mortar, which becomes spread on the adjacent surfaces of the hardened concrete, shall be removed before it hardens.

4.22.4 Health and Safety Precautions

- Full face shields shall be used during all mixing and blending operations and for placing operations as required.
- Protective skin creams of a suitable nature for the operations shall be used.
- Portable eye washing facilities shall be maintained at mixing, batching and placing operations.
- Adequate fire protection shall be maintained at all mixing and placing operations.
- Smoking or the use of spark or flame producing devices is prohibited within 15 meters of mixing and placing operations.
- The mixing, placing, or storage of solvent is prohibited within 15 meters of any vehicle, equipment, or machinery which could be damaged from fire or could ignite vapors from the material.
- Facilities shall be provided for decontamination of clothing and equipment at the job site.
- Contaminated clothing which cannot be decontaminated shall be burned at an approved burning area at the end of each working day.
- Care should be taken in handling solvent for cleaning equipment to avoid problems of toxicity, fires, and possible explosions.
- Adequate ventilation shall be provided.

4.23 FINISHES AND FINISHING

4.23.1 General

Allowable deviations from plumb or level and from the alignment, profile grades, and dimensions shown on the Drawings or specified by the Engineer. Tolerances are defined as tolerances and are to be distinguished from irregularities in finish as described herein. The classes of finish and the requirements for finishing of concrete surfaces shall be generally specified in this sub-sections and as indicated on the Drawings. Finishing of concrete surfaces shall be performed only by workmen who are skilled concrete finishers.

The Contractor shall keep the Engineer informed as to when finishing of concrete will be performed. Unless inspection is waived in each specific case, finishing of concrete shall be performed only in the presence of the Engineer. Concrete surfaces will be tested by the Engineer where necessary to determine whether surface irregularities are within the limits hereinafter specified. Surface irregularities are classified as abrupt or gradual. Off-sets caused by displaced or misplaced form sheathing or lining or form sections, or otherwise defective form lumber will be considered as abrupt irregularities, and will be tested by direct measurements. All other irregularities will be considered as gradual irregularities, and will be tested by the use of a template, consisting of a straight edge or the equivalent thereof for curved surfaces. The length of the template will be 1.5 meters.

The classes of finish for concrete surfaces shall be as shown on the Drawings or as directed by the Engineer. Interior surfaces shall be sloped for drainage where shown on the Drawings or directed. Surfaces which will be exposed to the weather, shall be sloped for drainage. Unless the use of other slopes or level surfaces is indicated on the Drawings or directed. Surfaces which will be exposed to the weather, shall be sloped for drainage. Unless the use of other slopes or level surfaces is indicated on the Drawings or directed, narrow surfaces, such as tops of walls shall be sloped approximately 10 mm per 30 cm. No grinding will be required on such formed surfaces other than that necessary for repair of surface imperfections as specified herein.

4.24 POLYVINYLCHLORIDE WATER STOP

4.24.1 Scope

The work to be done under this item, consists of providing and installing PVC water stops as shown on the Drawings or as directed by the Engineer.

4.24.2 General

Polyvinylchloride water stops shall be extruded from an elastomeric plastic compound, the basic resin of which shall be polyvinylchloride (PVC). The compound shall contain such additional resins, plasticizers, stabilizers or other materials needed to ensure that when the material is compounded and extruded to the shapes and dimensions shown, it will have physical characteristics when tested by the U.S. Corps of Engineers Test Method specified below:

Physical Characteristics	No. of Specimens Tested	Requirement	USCE Test Method
Tensile strength using die III, not less than	5	12 N/Sq.mm (1750 psi)	568
Ultimate elongation using die III, not less than	5	350%	573
Low temperature brittleness, no sign of failure such as cracking or chipping at	5	-37^{o}C	570
Stiffness in flexure, 13 mm span, not less than	3	2.75 N/sq.mm (400 psi)	571

4.24.3 Installation

Installation of water stops shall be in accordance with the provision of ACI 504 R. The PVC Water stops shall be laid in continuous lengths. Splices in the continuity or at the intersections of runs of PVC water stops shall be performed by heat sealing the adjacent surfaces in accordance with the manufacturer's recommendations or as directed by the Engineer. A thermostatically controlled electric source of heat shall be used to make all splices. The correct temperature at which splices should be made will differ with the material used but should be sufficient to melt but not char the plastic. After splicing, a remoulding iron with ribs and corrugations to match the pattern of the water stop shall be used to reform the ribs at the splice. The continuity of the characteristics components of the cross-section of the water shop design (ribs, tubular center axis, protrusions, and the like) shall be maintained across the splice.

4.25 ADMIXTURES

4.25.1 General

Admixtures, including air-entraining admixtures, foaming chemicals and water-reducing admixtures, shall not be used except with the prior approval of the Engineer. All tests for the evaluation and approval of an admixture shall be made by the Contractor at his cost.

4.25.2 Air-Entraining Admixtures

The source and brand of air-entraining admixture, required shall be proposed by the Contractor and approved by the Engineer. The air entraining admixture will be an approved substance or compound conforming to the requirements of ASTM C260-77, “Standard Specifications for Air-Entraining Admixtures for Concrete,” which will produce entrained air in the concrete as hereinafter specified. The air-entraining admixture shall be added to the batch in solution in a portion of the mixing water. This solution shall be matched by means or a mechanical batcher capable of accurate measurement and in such a manner as to ensure uniform distribution of the admixture throughout the batch during the specified mixing period.

4.25.3 Water-Reducing Admixtures

The source, brand, types, of suitable water reducing cement dispersing admixtures, if required, shall be proposed by the Contractor and approved by the Engineer. The water entraining admixture will be compatible with the air entraining admixture specified above and shall be batched and added to the concrete in the manner specified for the adding of air-entraining admixture but separate from the portion of the mixing water containing the air-entraining admixture. The quantities of water-reducing, cement dispersing admixture to be used shall be in accordance with the instructions of the Manufacturers as approved by the Engineer. Water reducing admixture shall conform to the requirements of ASTM C494-81 “Standard Specification for Chemical Admixtures for Concrete”.

4.25.4 Foaming Chemicals

The source, brand and types of suitable foaming chemicals, if required, shall be as approved by the Engineer. The foaming agent shall conform to ASTM C869 “Standard Specifications for Foaming Agents used in Making Preformed Foam for Cellular Concrete.”

4.26 EXPANSION JOINTS

4.26.1 Material

Expansion joint material shall be pre-moulded asphalt impregnated fiber board, to be applied over the full joint width, except otherwise indicated on the drawings and shall conform to ASTM D1751-83.

4.26.2 Filler

Expansion joint filler shall consist of sponge rubber, self-expanding cork or any other material and type as designated by ASTM D1752-84.

4.27 STEEL REINFORCEMENT

4.27.1 Scope

The work to be done under these items shall include furnishing, cutting, bending, and placing all steel reinforcement as indicated on the Drawings or otherwise required. All reinforcement when surrounding concrete is placed, shall be free from loose, flaky rust, and scale, and free from oil, grease or other coating which might destroy or reduce its bond with the concrete. All placing shall be in accordance with Drawings furnished or approved. The use of reinforcement for the transmission of current for welding will not be permitted. All reinforcement, including dowels, remaining exposed in the work shall be suitably protected until embedded in concrete.

4.27.2 Cutting and Bending

Steel reinforcement may be mill or field cut and bent. All bending shall be in accordance with standard approved practice and by approved machine methods. When bending is required, it shall be performed prior to embedding the bars in the concrete. In all such cases, the bars shall be cold bent. Bending or straightening of bars partially embedded in set concrete shall not be permitted except in isolated cases where corrective action or a field change is required and is specifically approved by the Engineer.

4.27.3 Quality

Concrete reinforcement bars shall be of following quality:

Intermediate grade Steel: It shall be deformed bar conforming to ASTM 615-86 grade 40 and 60 or equivalent having minimum yield strengths of 40 ksi and 60 ksi respectively. The Contractor shall provide labour, materials; arrange measuring and testing facilities to ascertain quality, weight or quantity of steel at his own expense. No steel shall be incorporated in the Works without prior approval of the Engineer.

4.27.4 Spacing of Bars

The spacing of bars shall be as shown on the Drawings or as directed by the Engineer. The variation from indicated spacing, provided that the total area of reinforcement is in accordance with the Drawings, shall not be more than 25 mm (1 inch).

4.27.5 Relation of Bars to Concrete Surface

The cover of all main reinforcement shall conform to the dimensions shown on the Drawings. The protective covering shall not be less than, and shall not exceed more than 6 mm from the values specified on the Drawings to indicate the clear distance from the edge of the main reinforcement to the concrete surface. The concrete covering of stirrups spacer bars and similar secondary reinforcement may be

reduced by the diameter of such bars.

4.27.6 Splicing

Except as otherwise shown on the Drawings or specified herein, all splices, lengths of laps, splice locations, placement and embedment of latest reinforcement shall conform to the applicable requirements of American Concrete Institute 318-83, Building Code Requirements for Reinforcement Concrete. All splices and locations of laps in reinforcement shall be as shown on the Drawings or as directed by the Engineer. Additional bar splices shall be provided as required, subject to approval of the Engineer. Lapped ends of bars may be placed in contact and securely wired or may be separated sufficiently to permit the embedment of the entire surface of each bars by butt-welding or by approved mechanical methods such as the Cad weld splice or other type splice using positive connectors where indicated or directed by the Engineer. Butt welding of reinforcing bars, where indicated or directed shall conform to the requirements of American Welding Society's Recommended Practice for Welding Reinforcing Steel Metal Inserts and Connections, D. 12.1. Concrete shall be protected from heat during welding operations.

4.28.7 Supports

All reinforcement shall be secured in place by use of metal or concrete supports, spacers, or ties, as approved by the Engineer. Such supports shall be of sufficient strength as to maintain the reinforcement in place throughout the concreting operation. The supports shall be used in such a manner that they will prevent discoloration or deterioration of the concrete. Concrete supports shall be manufactured of the same concrete mix as used in the structure to be concreted.

4.28 MEASUREMENT AND PAYMENT

Measurement and payment for concrete, reinforcement, steel and precast concrete will be made in accordance with the provisions of this clause specified hereinafter.

4.28.1 Method of Measurement

Concrete will be measured for the number of unit cubic meter of different grades acceptably placed complete in all respects as per Drawings and in strict accordance with this section of Specification.

Pre-cast members will be measured for the number of unit cubic meter acceptably cast, placed complete in all respects as per Drawings and as directed by the Engineer.

Measurement will be made for the tons (2240 lbs) of reinforcing steel acceptably placed on the basis of the lengths of bars installed in accordance with the approved Drawings or bar schedules or as directed, converted to weight for the size of bars

listed by the use of unit weights per linear metre as follows:

Bar Size	Unit Weight Kg/m	Unit Weight lbs/ft
6 mm	0.249	0.167
9 mm	0.560	0.376
13 mm	0.994	0.668
15 mm	1.552	1.043
18 mm	2.235	1.502
21 mm	3.042	2.044
25 mm	3.973	2.670
28 mm	5.059	3.775
31 mm	6.403	4.172
34 mm	7.906	5.049

Steel in laps and embedment indicated on the Drawings or as required by the Engineer will be paid for at the steel unit price. No measurement for payment will be made for the steel consumed in providing supports and for the additional steel in laps which are authorized for the convenience of the Contractor.

Measurement will be made of the number of linear meter of 6 inch – 2 bulb and 9 inch – 3 bulb size polyvinylchloride water stops acceptably placed in the work. In computing the quantities, no allowance will be made for laps.

Measurement for holes and grout for dowel – anchors will be based on the number of linear meter of hole drilled to the lengths shown on the drawings or as approved or directed by the Engineer. No measurement will be made for dowel or anchor holes drilled solely to accommodate the Contractor's construction procedure. The dowels will be measured as reinforcing steel.

Measurement will be made of the number of unit square meter of trash rack and weir blades of 12 gauge steel plate provided and acceptably fixed at the specified locations as shown on the drawings.

Measurement will be made of the number of mild steel plates with standard markings, steel flumes and M.S. shutter plates provided and acceptably fixed as specified on the Drawings and as directed by the Engineer.

Measurement will be made on lump sum basis for providing and installing vertical slide gates of sizes specified in the Bill of Quantities and details shown on the Drawings, and as directed by the Engineer.

4.28.2 Basis of Payment

Payment will be made in accordance with the unit prices in the Bill of Quantities for the various items in accordance with the Specifications and shall constitute full compensation for furnishing all materials, casting, fixing, installing, splicing, shuttering, drilling, grouting, equipment and labour and for performing all operations necessary to complete the work.

4.29 CODES AND STANDARDS

The work shall conform to the requirements of the following codes and Standards, unless otherwise specified.

* PS	419	Properties and Specifications of Blocks
ASTM	C31-87	Practices for Making and Curing Concrete Test Specimens in the Field.
ASTM	C33-86	Standard Specification for Concrete Aggregates
ASTM	C39-86	Standard Test Methods for Compressive Strength of Cylindrical Concrete Specimens.
ASTM	C42-84a	Standard Methods of Obtaining and Testing Drilling Cores and Sawed Beams of Concrete.
ASTM	C78-84	Standard Test Methods of Test for Flexural Strength of Concrete (using Simple Beam with Third Point Loading).
ASTM	C136-84a	Standard Method of Test for Sieve or Screen Analysis of Fine and Coarse Aggregates.
ASTM	C143-78	Standard Method of Test for Slump of Portland Cement Concrete.
ASTM	C150-86	Standard Specifications for Portland Cement.
ASTM	C404-85	Standard Specifications for Aggregate for Masonry Grout.
ASTM	C566-84	Standard Test Method for Total Moisture Content of Aggregate by Drying.
ASTM	D596-83	Methods of Reporting Results of Water Analysis.
ASTM	A615-86	Standard Specifications for Deformed and Plain Billet – Steel Bars for Concrete Reinforcement
ASTM	D1190-80	Standard Specifications for Concrete Joint Sealer, Hot-Poured Elastic Type.
ASTM	D1751-83	Standard Specifications for Preformed Joint Fillers for Concrete Paving and Structural Construction (No extruding and Resilient Bituminous Types).
ASTM	D1752-84	Standard Specifications for Preformed Sponge Rubber and Cork Expansion Joint Fillers for Concrete Paving and Structural

		Construction.
ASTM	D185-79	Standard Specifications for Concrete Joint sealer, Cold-Application Type.
BS	12-78	Specifications for Ordinary and Rapid Hardening Portland Cement.
BS	146-58	Specifications for Portland-blast furnace Cement.
BS	3148-80	Methods of Tests for Water for Making Concrete.
BS	4027-80	Specifications for Sulphate Resisting Cement.
ACI	301-84	Specifications for Structural Concrete for (Revised Buildings1985)
ACI	304R-85	Guide for Measuring, Mixing, Transporting and Placing Concrete.
ACI	308-81	Standard Practice for Curing Concrete (Revised 1986)
ACI	309-72	Standard Practice for Consolidation of Concrete (Revised 1982)
ACI	316R-82	Recommendation for Construction of Concrete Pavements and Concrete Bases.
ACI	318-89 &	Building Code Requirements for Reinforced
ACI	318R-89	Concrete and Commentary by ACI
ACI	318.1-89	Building Code Requirements for Structural Plain Concrete.
ACI	318.1R-89	Commentary by ACI
ACI	347-78 (Re-approved 1984)	Recommended Practice for Concrete Formwork

*PS PAKISTAN STANDARDS BS BRITISH STANDARDS

SECTION – 5
EMBANKMENT INSTRUMENTATION

5.1 GENERAL

Embankment instrumentation shall be provided according to the provisions herein specified or as directed by the Engineer.

Instrumentation will be required for measurement of hydrostatic pressure, settlements and seismicity in the embankment. In general three types of instruments will be installed.

The porous tube standpipe piezometers (Casagrande type) will be installed for pore pressure measurements, surface settlement points for measurement of settlements at the surface. The Contractor shall furnish and install all apparatus in accordance with the detailed specifications outlined herein or shown on the Drawing and as directed by the Engineer.

5.2 EQUIPMENT AND MATERIALS

The Contractor shall furnish all materials, equipment, special tools and other items which are required to complete the installation of instrumentation. These materials to be furnished by the Contractor shall include, but are not necessarily limited to the following.

(a) Riser pipes of Polyethylene tubing, 12.5 mm internal diameter and 14 mm external diameter, in lengths corresponding to the depths at which the porous points shall be installed.

(b) A porous tube piezometer tip (Casagrande Type) assembly.

(c) Thoroughly washed sand between No. 20 and No. 40 mesh.

(d) Protective casing split pipe of 100 mm nominal diameter with fittings for riser tubing's within the embankment.

(e) Oakum, burlap and cement grout.

(f) A water level indicator for measurement of water level in the piezometers mounted in a spool type reel, having corrosion resistant stainless steel tip, high strength durable plastic coated copper cable 30m long, marked at every one meter interval, and a transistorized battery operated water level indicator such as designation DR 760 A manufactured by M/S soil test incorporated Evanston 60202 USA or equivalent.

(g) 20 mm dia, mild steel bar provided with stainless steel cap for embankment settlement monitoring.

(h) USBR crossbar settlement gauge.

(i) Relief Wells.

(j) Seepage measuring arrangement and V notch

5.3 INSTALLATION OF INSTRUMENTATION

(a) General

Instrumentation shall be installed by the Contractor as construction progresses to the lines and elevations shown on the Drawings, under the supervision of the Engineer. Apparatus and associated tubes and other transmitting media shall be installed during the daylight hours or at night only if adequate lighting is provided as approved by the Engineer. No portion of any instrumentation shall be covered

Until tested and approved by the Engineer. Open ends of all incomplete lines of tubing shall be sealed to exclude foreign matter. It shall be the Contractor's responsibility to protect the apparatus from damage or displacement during the execution of the Works. Any damage or displacement of the apparatus or facilities by the Contractor's operations shall be repaired and / or replace by the Contractor at his own cost. Foundation and embankment piezometers shall be installed at the locations and elevations shown on the Drawings, or as established by the Engineer, as the work progresses. The terms piezometer as used herein shall mean the piezometer tip assembly and connecting tubing, and/or other media required for measuring pore pressure.

(b) Foundation

The Contractor shall drill holes as approved by the Engineer, of size as specified to accommodate equipment of the size to be used for foundation piezometers to depths as indicated on the Drawings. The boreholes shall be thoroughly cleaned before placing instrument. In each hole the Contractor shall install piezometers, complete with tip assembly and connecting tubing as shown on the Drawings or as directed by the Engineer, Clean, saturated well graded sand shall be placed in the hole around each piezometers tip, extending at least 30 cm below and 60 cm above the tip. The hole shall then be backfilled to the bottom of embankment fill with an impervious plug of cement grout as shown on the Drawings.

c) Embankment Piezometers

The embankment piezometers shall be installed in the open pits or trenches at locations shown on the Drawings. Excavation of pits or trenches shall be done by manual methods so as to disturb the adjacent embankment as little as possible. Prior to installation of piezometers and tubing, selected sand shall be placed upon the selected material in accordance with the details shown on the drawings or as directed by the Engineer. No pockets of loose material will be permitted adjacent to the piezometer tips or tubing. Tubing shall be kept in

proper orientation; spacing and each riser tube shall be properly tagged. The backfill, compaction of soil in the pits shall be performed by manual methods as directed by the Engineer. Soil tests shall be made by the Contractor to ensure that compaction obtained is at least equal to that of adjacent embankment. The sand shall be firmly placed to preclude any movement of piezometer within the bedding. Piezometer tubing shall be extended to successively higher elevation as embankment construction proceeds by means of vertical split casing pipe. Splicing of riser pipes will not be permitted and any joint shall have to be authorized by the Engineer in writing only.

d) Surface Settlement Points

The Contractor shall construct surface settlement points as close as practicable to the locations shown on the Drawings, as soon as practicable after embankment has been constructed to the elevation of each such point. Surface settlement points shall be constructed by installing lengths of reinforcement bar vertically into the dam as shown on the Drawings or as directed by the Engineer.

e) USBR Crossbar Settlement Gauges

The Contractor shall install USBR crossbar settlement gauges as close as practicable to the locations shown on the Drawings.

The settlement gauges shall be kept centered and plumb as piping for each unit is extended upward as the construction of the dam embankment progresses. The Contractor will be required to take all necessary precautions to prevent damage to the units and extensions and changes in vertical alignment. Protective measures shall include the construction and removal of suitable barricades or burial of the unit with suitable measures for recovery to permit measurements to be made and extensions added. Installation and bedding shall conform to the manufacturer's approved instructions. The Contractor shall keep the inside of the pipes free from foreign matter during installation. Pipe extensions shall be carried above the completed embankment surface and concrete caps placed thereon.

(f) Strong Motion Seismograph

The Contractor shall provide and install strong motion seismographs as close as practicable to the locations shown on the Drawings.

g) Relief Wells

The Contractor shall install relief wells after the construction as and where they are required and decided by the Engineer.

h) Seepage Measuring Arrangement with V Notch

The Contractor shall provide and install a seepage measuring chamber with V notch as directed by the Engineer. Without any cost claim for it. It reading should daily be noted at a diary.

5.4 MEASUREMENT AND PAYMENT

(a) Measurement and Payment

All work under this Section, Instrumentation of Embankments and their Foundations, will be paid for under the following Provisional and Prime Cost Items in accordance with Clause 58 of the Conditions of Contract. No increase in Contract price of any kind will be made due to interference of the work under this Section with the embankment construction or any other work under this Contract.

(b) Install, Operate and Maintain Embankment and other Miscellaneous Instrumentation, Equipment and Appurtenances

The provisional sum for this item will cover installing the approved instrumentation including supplementary instrumentation placed by boring, instrumentation houses and observation stations including earthwork incidental thereto, and such operations incidental to the instrumentation that the Engineer may require, except that construction of buildings and furnishing and installing of electrical work will be covered under the applicable items of the Bill of Quantities.

(c) Furnish Embankment and other Miscellaneous Instrumentation Equipment

The Prime Cost sum will cover furnishing and delivering the approved embankment and other miscellaneous instrumentation to the site of the work.

(d) Provide install and maintain Relief Wells

Measurement and Payment will be made for the number of relief wells provided, installed and maintained by the Contractor according to the details given on drawings, specifications and as directed by the Engineer.

Payment will be made for the number of relief wells measured at the contract unit price and shall constitute full compensation for providing, installing maintaining and all the related works in accordance with the drawings and as directed by the Engineer.

SECTION – 6
BRICK WORK

6.1 SCOPE

This section consists of construction of brick-walls of any thickness with first class hand-mould and/or machine pressed bricks with the specified ratio of cement mortar in foundation, plinth, and superstructure or for any other structure as directed by the Engineer, or shown in the Bid Schedule. The Contractor shall furnish all materials and all other requirements to produce finished brick work. Brick work and materials for brick work shall be in strict accordance with this section of the specifications and applicable drawings and subject to the terms and conditions of the Contract.

6.2 MATERIALS

6.2.1 Bricks

The bricks used shall be of standard size (9”x4.5”x3”) first class well burnt, uniform in shape, size, texture, color and should produce a ringing sound when struck. The bricks shall be free from flaws, cracks, chips, stone nodules of lime or kan-kar or any other blemishes. The brick shall not absorb more than one sixth of its weight when soaked in water for one hour. Compressive strength shall not be less than 2000 lbs per square inch. Bricks over burnt, under burnt vitrified and irregular shall not be used. Bricks of uniform size shall be used throughout the work and source of supply shall not be diversified.

6.2.2 Portland Cement

Portland cement shall conform to the stipulations and requirements set forth in Section for “Plan and Reinforced Concrete”.

6.2.3 Mortar Sand

Sand for mortar used in construction of brickwork required under these Specifications shall be furnished by the Contractor in accordance with the provisions and in conformity with the stipulations and requirements of ASTM Designation C144-70 or latest revision and shall have a fineness modulus between 1.6 and 2.5.

6.2.4 Water

The water used in the preparation of mortar shall be free from objectionable quantities of silt, organic matter, alkali salts and other impurities and it will be tested and approved by the Engineer at the Contractor’s cost.

6.3 MORTAR COMPOSITION

Mortar for all brickwork requiring mortar shell, except when otherwise specified by these Specifications or as directed by the Engineer, consist of one part of Portland cement to 3 parts of damp loose mortar sand by volume and sufficient water to produce the proper consistence for the intended use. Mortar shall not be retained for more than 30 minutes and shall be constantly worked over with

hoe or shovel until used.

6.4 MORTAR BATCHING

Methods or equipment used for mixing mortar shall be such as will accurately determine and control the amount of each separate ingredient entering into the mortar and shall be subject to the approval of the Engineer. If a mixer is used it shall be of approved design and the mixing time after the ingredients are in the mixer, except for the full amount of water, shall not be less than two minutes.

Mortar shall be mixed only in sufficient quantities for immediate use and all mortar not used within 30 minutes after addition of water to the mix shall be wasted. Retempering of mortar shall not be allowed. Mixing pans and troughs shall be thoroughly cleaned and washed at the end of each day's work.

6.5 SOAKING

Before use all bricks shall be soaked in clean water in tanks or pits for at-least two hours.

6.6 LAYING OF BRICKS

All brickwork shall be skillfully laid with level courses, uniform joints, square corners, plumb verticals and true surfaces except when otherwise shown on the Drawings or directed by the Engineer. Brickwork will be of best standard of workmanship obtainable and objectionable offsets in the brickwork shall be avoided. Smoothest practicable finished surface of the brickwork shall be ensured. Unless otherwise specified bricks shall be laid in English Bond with frogs (Manufacturer's marks) upward.

All horizontal joints shall be parallel and truly level. Vertical joints in alternate coarses shall come directly over one another. Thickness of joints unless otherwise specified shall not be less than ¼ of an inch and not more than 3/8 of an inch. The height of 4 coarses and 3 joints as laid shall not exceed by more than 1 inch the height of 4 bricks as piled one upon the other.

6.7 CURING

All brickwork involving use of cement shall be cured by water curing or other acceptable methods. The Engineer shall approve all methods and operations of the Contractor in curing different portions of work.

When curing by water, brickwork shall be kept wet for at least ten days by covering with water saturated materials or by a system of perforated pipes, mechanical sprinklers, porous hose, ponding or by any other approved method which will keep all surfaces to be cured continuously wet. Water used for curing shall meet the requirements Clause 6.2.4 of these specifications.

6.8 MEASUREMENT AND PAYMENT

6.8.1 Method of Measurement

Measurement for brickwork shall be in unit cubic meter of brick work provided within the limits as shown on the Drawings or as directed by the Engineer.

6.8.2 Basis of Payment

Payment for brickwork shall be made at the contract unit price for unit cubic meter. Payment shall constitute full compensation for furnishing all materials, equipment and labour including all incidentals necessary to complete the work.

SECTION – 7
REINFORCED CEMENT CONCRETE PIPE

7.1 SCOPE OF WORK

The work to be done under this section consists of furnishing, laying, jointing and testing pre-cast RCC Pipe Line in the excavated trenches on the bedding material for conveyance of water complete in all respects as shown on the Drawings and elsewhere and as directed by the Engineer.

7.2 GENERAL

1) All RCC Pipe shall be furnished and installed in complete conformity with the stipulations and requirements specified herein and elsewhere in these specifications and on the Drawings.
2) All excavation required in placing RCC Pipe under these specifications shall be performed by the Contractor in accordance with the provisions of, and in complete conformity with the stipulations and requirements specified in Section-2, “Excavation”.

7.3 CLASSIFICATIONS

1) The RCC Pipe shall be manufactured in accordance with the Specifications of ASTM C-361 of internal dia as shown on the Drawings.

7.4 MATERIALS

1) All materials, methods of manufacture and strength requirements for the RCC Pipe shall conform to the requirements of ASTM Designation: C-361 and shall be subject to inspection and approval of the Engineer.
2) Cement – Portland cement shall conform to the requirements of specifications set forth in Section for “Plain and Reinforced Concrete”.
3) Sand – All sand shall conform to the Specifications for sand set forth in Section for “Plain and Reinforced Concrete”.
4) Aggregates – Aggregates shall conform to ASTM Specification C-33 except that the requirements for gradation shall not apply.
5) Steel reinforcement – Reinforcement shall consist of wire conforming to ASTM Specification A-82 or A-496 or wire fabric conforming to Specifications A-185 or Specifications A-497 or bars of Grade 40 steel conforming to Specifications A-615 or bars of Grade 80 steel conforming to Specification A-306.

7.5 MIXTURE

The aggregate shall be so sized, graded, proportioned and thoroughly mixed in a batch mixer with such proportions of cement and water as will produce a homogeneous concrete mixture of such quality that pipe will conform to the classification specified above. In no case shall the proportion of Portland Cement in the mixture be less than six U.S. Standard bags (94 lbs) per cubic yard (56 kg/cu.m) of the concrete.

7.6 JOINTS

1) The ends of reinforced concrete pipe sections shall be so formed that when the pipes are laid together they will make a continuous and uniform line of pipe. The joints shall be such as will permit effective jointing and to permit placement without irregularities in the flow line. The joint shall be bell and spigot joint with rubber gasket of ½ inch thickness of inside diameter equal to the inside diameter of the concrete pipe and approved by the Engineer.

7.7 MANUFACTURE

1) Placement of Concrete – The transporting and placement of concrete shall be by methods that will prevent the segregation of the concrete materials and the displacement of the reinforcement steel from its proper position in the form.
2) Curing – Pipes shall be cured by any one of the following methods.
   i) Steam Curing
   ii) Water Curing

   The pipe shall be cured for a sufficient length of time so that the concrete will develop the specified strength at 28 days or less.
3) Pipes shall be substantially free of fractures, large or deep cracks, and surface roughness. The ends of the pipe shall be normal to the walls and center of the pipe.

7.8 TESTING AND INSPECTION

1) Pipe shall be tested by the method covered in the standard specifications ASTM Designations: C-76 and each manufacturer furnishing pipe under these specifications shall be fully equipped to carry out the test herein designated. Upon the demand of the Engineer and under his supervision, the manufacturer shall perform such number of tests as the Engineer may deem necessary to establish the quality of the pipe manufactured. Failure of any pipe to meet the test requirements shall be sufficient cause for rejection of all pipe which the test specimen represents. All pipe shall be subjected to inspection by the Engineer at the factory and point of delivery. The purpose of the inspection shall be to cull and reject pipes which independent of the physical tests herein specified,

fail to meet the requirements of these specifications.

7.9 REJECTION

(1) Rejection may be made on account of any of the following:

a) Fracture or cracks passing through the shell, except for a single end crack that does not exceed the depth of the joint.

b) Defects that indicate imperfect proportioning, mixing and moulding.

c) Surface defects indicating honeycombed or open texture.

d) Damaged ends, where such damage would prevent the making of a satisfactory joint.

e) Failure to give a clear ringing sound when tapped with a light hammer.

f) Exposure of the reinforcement where such exposure indicates that the reinforcement was misplaced.

g) Pipe damaged during shipment or handling may be rejected even if previously approved.

7.10 REPAIR

Pipe may be repaired if necessary because of occasional imperfections in manufacture or accidental injury during handling and will be acceptable if in the opinion of the Engineer, the repairs are sound, properly finished, cured and the repaired pipe conforms to the requirements of these specifications.

7.11 INSTALLATION

(1) All concrete pipe shall be set to the alignment and grades shown on the Drawings or established by the Engineer. Concrete pipe installed in the ground shall be laid on a compact and properly shaped bedding material of natural gravel or crushed rock as per specifications in Section for “Construction of Earth fill” and approved by the Engineer, and compacted in such a manner as will not disturb the alignment or grade of the pipe. Payment for natural gravel or crushed rock shall be made under “Bedding Material”. Concrete pipe installed in concrete or masonry structures shall be secured, in a manner satisfactory to the Engineer, against any misalignment during concrete or masonry placement.

(2) The Contractor shall furnish all materials required and shall construct approved water-tight joints between concrete pipe sections. Ends of pipe sections shall be thoroughly cleaned and the section being placed drawn up tightly to correct line and grade. Mortar for finishing joints in concrete pipe shall consist of one part Portland cement to three parts sand by volume with sufficient water to obtain a suitable consistency. All operations of the Contractor in jointing the pipe sections shall be approved by the Engineer.

7.12 MEASUREMENT AND PAYMENT

7.12.1 Reinforced Cement Concrete Pipe:

Measurement for payment for reinforced cement concrete pipe will be made of the number of linear meters of pre-cast concrete pipe of each size actually furnished and installed as shown on the Drawings or directed by the Engineer, measured along the center line of the pipe from end to end of the pipe in place without allowance for laps at joints or for excess material which may be trimmed off to fit the required installation.

No direct payment will be made for cement and reinforcement used in manufacturing of RCC Pipe and the cost of furnishing all materials required for manufacturing RCC Pipe shall be included in the unit rate tendered in the Bill of Quantities for the item of reinforced cement concrete pipe in which the materials are used.

Payment for furnishing and installing reinforced cement concrete pipe will be made for the number of linear meter of pipe acceptably installed at the contract unit price in the Bill of Quantities. The amount of bid for the item shall be full payment for the work specified herein and on the Drawings for Reinforced Cement Concrete Pipe, including spigots, socket ends, rubber ring and cement mortar for jointing concrete pipe installed complete in all respects and approved by the Engineer.

7.12.2 T-Joints and Control Valves for R.C.C. Pipes:-

Measurement for payment will be made for the number of T-Joints and Control Valves of specified sizes provided and fixed according to the details given on Drawings and as directed by the Engineer.

Payment will be made for the number of T-Joints and Control Valves measured at the contract unit price and shall constitute full compensation for providing, fixing and all the related works in accordance with the Drawings and as directed by the Engineer.

SECTION – 8
CONCRETE LINING FOR CHANNELS

8.1 SCOPE OF WORK

The work to be done under this section consists of constructing un-reinforced lining complete in all respects including trimming the earth formation, preparation of sub-grade, local filling and compaction where required, supplying, placing and compaction of 3000 Psi (28 days Cylinder strength) concrete and surface finishing; and necessary formwork, curing, forming construction, expansion and contraction joints as shown on the Drawings or as directed by the Engineer.

8.2 EARTHWORK

a) Embankments for un-reinforced concrete lined channels shall be formed as shown on the drawings or directed by the Engineer and in accordance with the specifications in Section for “Construction of Earth-fill”.

b) The formation to the concrete lining shall be scarified and sprayed with water, if necessary and compacted to bring the material to a dry density not less than 95% of the maximum Proctor density as specified in Embankment Compaction Specifications. Unsuitable material shall be cut out and replaced with selected material and compacted as specified.

c) Immediately prior to placing the un-reinforced concrete channel lining the formation to the concrete lining shall be formed to the required profile by careful excavation, trimming, cement and bedding and compaction.

8.3 PREPARATION OF SUB-GRADE IN PREDOMINANTLY SANDY REACHES

When channel is in cutting in predominantly sandy reaches compaction of sub-grade shall be done as follows:

i) Compaction of the bed shall be done by over-saturating the bed by flooding it with water before lining is laid.

ii) Compaction of sides shall be done by ramming.

8.4 PREPARATION OF SUB-GRADE IN REACHES REQUIRING DISMANTLING

Existing lining shall be completely dismantled and disposed of as directed by the Engineer.

8.5 CONCRETE LINING GENERAL

a) The Contractor shall use properly designed form, templates and other equipment as may be necessary for placing and finishing concrete to the required profiles and dimensions for concrete lining of channels as shown on Drawings or as directed by the Engineer.

b) It shall also be ensured that all the operators and mechanics are trained and experience in handling of such equipment.

c) Sample lengths of channel lining shall be constructed in advance so that the

Engineer may consider and approve the method of working which the Contractor proposes to employ and the quality of lining to be achieved.

8.6 TRIMMING

a) The previously compacted ground and embankments shall be trimmed within the following tolerances from the given alignment:
   ± 20 mm straight sections
   ± 50 mm on tangent and partial curves
   ± 100 mm on 90 degree curves
   ± 20 mm from established grade

b) After trimming, the sub grade shall be kept moist by intermittent fine spraying with water, prior to the lining operation. The period between trimming and lining shall not exceed 72 hours.

8.7 CONCRETE

Concrete to be used for concrete lining shall conform to the specifications of 3000 Psi (28-days Cylinder strength) concrete in the Section for "Plain and Reinforced Concrete"

8.8 CURING

Curing of concrete lining shall be carried out by the Contractor as specified in the Section for "Plain and Reinforced Concrete".

8.9 MEASUREMENT AND PAYMENT

8.8.1 Concrete Lining in Channels

Measurement for payment for all work of concrete lining in channels will be made for one cubic meter furnished and placed to the lines and grades as shown on the drawings or as approved by the Engineer.

Payment for the concrete lining will be made at the unit price bid for unit cubic meter in the Bill of Quantities for concrete lining. The amount of bid shall be full payment for all work specified in the scope of work. The cost of filling or excavating earthwork to the required grade including construction of compacted embankments shall be separately paid under the relevant item. No separate payment will be made for water stops used in the lining, between lining and structure interfaces and entire cost shall be deemed to have been included in the unit rates of lining.

8.8.2 Cement Sand Bedding under Concrete lining

Measurement for payment for all work of cement sand bedding will be made of the number of unit square meter placed under concrete lining to the lines and grades as shown on the drawings or as approved by the Engineer.

Payment for this item will be made at the unit price bid per unit square meter in the Bill of Quantities for placing cement sand bedding under the concrete lining. The amount of bid shall be full payment for all work specified in the scope of work.

SECTION -9

ELECTRIFICATION

9.1 ELECTRIC WORKS GENERAL

9.1.1 Scope of Work

The electrical work to be completed under this section consists of road lighting. The work shall consist of supplying, installing, testing and commissioning of lighting poles, light fittings, and bulbs, overhead conductors, cables and wiring accessories and Earthing etc. required as shown on the drawings, given in B.O.Q. and as described in these specifications, complete in all respects. This also includes responsibility of all related works necessary and appurtenant thereto for its proper functioning.

9.1.2 Standards and Regulations

The work in general shall be completed in accordance with the code of practice CP-1004 of 1974 by British Standards Institution with up to–date amendments and taking into account the temperature and other conditions prevailing at site. Water and Power Development Authority regulations and requirements shall be adhered wherever applicable.

9.1.3 System Rating

	Medium Voltage	**Low Voltage**
Rated service voltage	11 KV	400/230 V
Highest system voltage	12.5 KV	-
Number of Phases	3	3 +N
Frequency	50 C/S	50 C/S

9.1.4 Climate and Site Conditions

Climate Conditions at Site are as below:-

- Maximum peak ambient shade Temperature 50 deg. C
- Minimum ambient temperature 0 deg. C
- Maximum temperature of metal surface in direct sun light 80 deg. C

9.1.5 Materials

All materials used shall be of approved make wherever given in these specifications and best of their respective kinds complying with latest International Standards. All equipment's and materials installed shall be suitable in every respect for operation of WAPDA main supply system. All equipment's and materials supplied by the Contractor shall be approved by the Engineer even if these are in accordance with the Specifications, B.O.Q and the Drawings.

9.1.6 General Instructions

a) The electrical work shall be carried out by licensed workmen authorized to undertake such work under the provisions of the Rules adopted and modified by the Government of Pakistan from time to time.

b) The installation in general shall be carried out in conformity with Electricity Rules and Regulations for the Electrical Equipment adopted and updated Govt. of Pakistan.

c) The Contractor shall set out the work himself and if any discrepancy is found, he shall report to the Engineer and shall act as directed. If any defective electrification work is carried out by the Contractor on his own, he shall rectify or make it good at his own cost.

d) The Contractor shall keep pace with the work of the Civil Contractor and any other specialist contractor. The Engineer shall be kept informed about the program and the progress of work so that there is no hindrance in the progress of work at site.

e) In case of any ambiguity or error /omission in the nomenclature of BOQS', specifications and drawings, the decision of Engineer shall be final.

f) The Contractor shall submit a work schedule in a week's time from the date of award of work. Any improvement sought by the Engineer in the work schedule shall have to be complied with.

g) The Contractor shall be responsible for submitting the test certificates and getting the installation passed by the Electric Inspector appointed by the Government of the K.P.K.

The Contractor shall be responsible for making all payments for the Testing Laboratories and inspection of electrical installations etc.

9.2 LIGHT FITTINGS

9.2.1 General

The light fitting types are given in the drawings and each is specified with type number in the items of Bill of Quantities, where a definite manufacturer's type is specified. If the particular type of fitting specified is not available, approved equivalent fitting may be accepted with the consent of the Engineer.

The determination of quality will be based on certified photo-electric data covering the co-efficient of utilization. Average brightness data, as well as equivalence of construction, material, shape, finishes operation, etc. For any substitution the Engineers' approval is necessary. The contractor shall submit samples of each light fitting specified and obtain approval from the Engineer before commencing the installation. The erection of light fitting shall include one twin core or two single core 2.5 mm. sq PVC insulated and PVC sheathed wires from porcelain/thermoplastic connectors in the junction box up to lamp holder through the hollow of pole in case

where the supply is fed from an underground lighting feeders.

9.2.2 Material Requirement

The lanterns for use on poles shall be suitable for fluorescent lamps. The lanterns shall be suitable for side entry mounting at a height above ground level as shown on drawings.

The lanterns shall be of pleasing aesthetic appearance with quality finish, and shall in general comply with BSS 1988 or equivalent specifications.

The lanterns shall be designed to accommodate and be completed with 240 volts, two 40 Watts fluorescent lamps, and shall provide a cut-off light distribution in accordance with C.I.E. Specifications. The control gear shall be mounted inside the lantern body.

The light flux to be provided by the lantern in the lower hemi-sphere shall not be less than 72% of the lumens output of the lamp.

The lanterns shall be totally enclosed with refractor bowls of glass or equivalent material which shall be suitable in all respects for site service conditions, and whish shall stand up to the heat from the lamp in the temperature conditions prevailing at site.

The lanterns shall have body of corrosion resistant die-cast aluminum or similar light alloy material suitable in all respects for site service conditions.

The lamp holders shall be smooth and free from irregularities. The side entry mounting shall allow for 210 mm of horizontal unthreaded 42 mm outside diameter spigot which shall be securely gripped by robust clamps.

The optical system shall be so attached to the lantern as to allow easy access without danger of the refractor falling to the ground. The lamps shall operate in the horizontal position and the light directing equipment shall be such that it can be fitted in the correct orientation to the light source.

All nuts, bolts, hinges and other fitting material shall be of stainless steel or galvanized steel.

The reflectors of high purity anodized aluminum inside the fitting shall be used to give cut-off light distribution as required.

Gaskets shall be capable of withstanding the temperature variation, moisture, rain and other conditions to which they will be exposed. Gaskets when fitted to exclude dust, water etc. shall be attached to the lanterns or lantern part such that they will be retained in position when lantern is opened for maintenance.

Terminals shall be of tinned brass or other non-corrodible material and each terminal shall have at least two pinching screws for the incoming cable which shall be suitably anchored to the lantern so that the terminal connections are not in any way strained

by the weight of the cable. All terminals shall be clearly identified.

All internal wiring of the light fittings shall be carried out with cable having a non-hydroscopic heat resistant, cross-linked polyethylene or similar primary insulation which shall withstand without deterioration the temperature to which it may be subjected during service, and shall have sufficient flexibility for the required purpose. Lamp control gear shall be provided with the lantern and shall be fitted inside the body. A wiring diagram with wattage, operating voltage and current figures shall be clearly printed on the body of the ballast. All control ballasts shall be of low power loss and fully tropical zed and in particular the power factor correction capacitors shall be contained in leak-proof metal containers. The values of the capacitor shall be such that the power factor of their associated lamps and ballast units is raised to 0.9 or better. Capacitors shall be fitted with internal discharge resistances. Terminals of the capacitors shall be covered by PVC shrouds.

The wiring connections, ballast and capacitors etc. and associated tails for lamp connections shall be copper wire of size 2.5 sq. mm in high temperature resistance insulation such as cross-linked polyethylene. A terminal block of porcelain or high quality thermoplastic material (for phase, neutral and earth) with necessary pinching screws shall be provided; also a clamp for anchoring the supply leads (or three core cable) from the terminal box at the bottom of the pole.

9.2.3 Data to be submitted with Bid

a. Total light output of lantern.
b. Light output ratio.
c. Total lumens in lower hemisphere.
d. Scale drawings of lanterns showing construction details.
e. Type of reflector and details of material used.
f. Catalogue and/or any other illustrations.
g. Total electrical consumption of lamp and ballast.
h. Total wind area of lantern.
i. Dimensions of control gear.

9.2.4. Light Fitting Installation

- The light fitting shall be installed in the correct alignment.
- The fitting shall be thoroughly cleaned and all dust on the fitting shall be removed.
- The Contractor shall insure that all electrical connections are tight and proper.
- The light fitting shall be installed after the poles are erected to avoid damage to the fitting during installation.

9.3 ROAD LIGHTING POLES

9.3.1 Material Specifications

The poles shall be of steel round section welded tubes assembled as shown in the drawings. The steel used in the manufactures of poles shall be made by open hearth or electric furnace process. The steel for poles shall have the following specifications.

Tensile Strength			
Minimum	:	39.7	Kg/sq. mm
Maximum	:	56.3	Kg/sq. mm
Yield Point			
Minimum	:	24.7	Kg/sq. mm
Elongation			
In 200mm sample 20% min.			

The straight portion of the pole shall be truly vertical and no deviation more than 1/700 of its length shall be accepted. Other tolerances shall be as below:

i)	Outside diameter	: + 1.0%
ii)	Wall thickness	: + 10.0%
iii)	Overall length of poles	: + 0.5%
iv)	Weight	: - 3.0%
		+ not limited

The pole shall be so designed that when subjected to wind at a velocity of 125 Km/Hr on the full projection area of poles a factor of safety of three (3) on the minimum tensile, strength of the material shall be obtained. In addition, the temporary horizontal deflection at the lantern position shall not exceed 1/40 of the length of the pole above ground at a wind speed of 100 Km/Hr.

A 12 mm diameter stainless steel stud complete with nut and washers shall be provided in the base compartment of the pole for Earthing purpose.

9.3.2 Paint

Entire surface of the pole above ground shall be given two coats of red lead primer and length below ground, two coats of bitumen. After completing the erection of the lighting poles, the poles shall be painted for entire length above ground along-with hardware with two coats of good quality readymade aluminum paint. The primer coat shall not be removed but only uneven surface wherever present may be smoothed off by use of emery paper.

9.3.3 Pole Installation

The poles shall be installed in holes excavated to proper size and depth as shown on the Drawings. The foundation shall be of cement concrete class-C having a 28 days crushing strength of not less than 210 Kg/sq. cm. The curing period of concrete shall be at least 7 days without any load being imposed on the concrete. Alternately RCC muffs having nominal wall thickness of 25 mm and length of 1650 mm will be used for installation of poles. The concrete of RCC muff shall have 28 days crushing

strength of 315 Kg/sq. cm.

The poles shall be installed in correct alignment and shall be vertical.

9.3.4 Tests

The poles shall be tested and the results recorded for each test by the Manufacturer in the presence of authorized representative of the Owner. The testing cost will be borne by the Contractor. The following test will be carried out on lots of complete pole.

i) Visual inspection
ii) Verification of dimensions and weights
iii) Transverse load test.

9.3.5 Data to be submitted with Bid

- Dimensional drawings showing height, in and outside diameter of various sections of the pole.
- Specifications of the materials which will be used in manufacturing of poles.
- Details of all joints giving welding process.
- Weight of pole.
- Design calculation sheet for the poles and joints.
- Test results of similar types of poles already supplied by the manufacturer.
- Any other document the bidder deems necessary.

9.4 ALL ALUMINUMSTRANDED CONDUCTORS

9.4.1 Resistivity

The resistivity of aluminum wire depends upon its purity and its physical condition. For the purposes of this specification the maximum value permitted is 0.028264 ohm. Sq. mm/m at 20 degrees C and this value shall also be used as standard resistivity for the purpose of calculations.

9.4.2 Density

At a temperature of 20 degree C, the density of hard-drawn aluminum wire is to be taken as 2.703 Kg/cu. dm.

9.4.3 Coefficient of Linear Expansion

The coefficient of linear expansion of hard drawn aluminum wire is to be taken as 23x10-6 per centigrade degree.

9.4.4 Material

The conductor shall be constructed of hard-drawn aluminum wires having the

mechanical and electrical properties specified herein. The material shall contain not less than 99.5 percent aluminum by weight. The aluminum wires shall be clean, smooth and free from harmful defects prior to being stranded.

9.4.5 Joints

There shall be no joints in any wire of a stranded conductor containing seven wires, except those made in the base rod or wire before final drawing.

In stranded conductors containing more than seven wires, joints in individual wires are permitted, in addition to those made in the base rod or wires before final drawing, but no two such joints shall be less than 15 m apart in the complete stranded conductor. Such joints shall be made by resistance or cold pressure butt welding. They are not required to fulfill the mechanical or electrical requirements for un-jointed wires. Joints made by resistance butt welding shall, subsequent to welding, be annealed over a distance of at least 200 mm on each side of the joint.

9.4.6 Stranding

The wires used in the construction of stranded conductor shall before stranding, satisfy all the relevant requirements of this specification.

In all constructions the successive layers shall have opposite directions of lay, the outermost layer being right handed. The wires in each layer shall be evenly and closely stranded.

In aluminum stranded conductors having multiple layers of wires, the lay ratio of any layer shall not be greater than the lay ratio of layer immediately beneath it.

9.4.7 Standard Sizes

The dimensions and characteristics of the conductors standardized are given in table below:

Code word	Nominal size	Strands & wire dia	Calculated area of complete conductor	Ultimate strength	D.C resistance at 20 degree C conductor
	Sq.mm	No. /mm	Sq. mm	Kg	Ohms /km
Gant	26	7/2.21	26.85	469	1.0661
Ant	52	7/3.10	52.83	847	0.5419
Wasp	106	7/4.39	105.95	1633	0.2702

9.5 LOW TENSION CABLE

9.5.1 Description

The work under this section consists of supply, installation, testing and commissioning of all material and services of low tension (LT) cables and the accessories as specified herein or as given in the Bid Drawings and in the Bill of Quantities.

The conductor shall discuss the electrical layout with the Engineer and coordinates at site with other services for exact route, location and position of the wires.

The LT cables with accessories shall also comply with the General Specifications, and with other relevant provisions of the Bid Documents.

9.5.2 General

All LT cables for power and road light fittings shall be PVC insulated of specification voltage grade complying with BS-6346 and/or BS-6004.

The polyvinyl chloride PVC insulation shall comply with BS 6746.

Conductor shall be stranded or solid of high conductivity soft annealed electrolytic copper complying with BS-6360.

All single core cables to be run in the pole from terminal box to lamps and circuits operating up to 250-volts shall be of 300/500 volts grade.

All power cables for main feeders, main to sub-main feeders, power equipment, etc., armored or unarmored shall be of 600/1000 volt grade.

The limitations of cable sizes given in the referred standards shall be given due consideration.

Cable manufactured by the following firms shall be used provided they fulfill the requirements as given in specification of this Section:-

1. M/S. Pakistan Cables (a subsidiary of BICC London).
2. M/S. Pioneer Cables (Karachi)
3. M/S Newage Cables (Lahore)
4. M/S AGE Cables (Peshawar)

9.5.3 Power and Lighting Cables

The cables shall be furnished and installed in accordance with the details shown on the drawings. The guide lines and criteria for reference is given below:

9.5.3.1 Underground Cables

Cable for laying directly underground shall be PVC insulated, PVC sheathed and armored with galvanized steel wire. Cable fully installed

in underground ducts or pipes shall be PVC insulated.

9.5.3.2 Surface Cables

Cable for distribution system of surface shall be single or multicore, as shown on drawings.

9.5.3.3 Cables in Conduits

All cables/ wiring in conduits shall be PVC insulated, single core or multi core as given in the bill of quantities.

9.5.4 Phase Identification

All cables shall have phase identification colored insulation of each core. The color code shall be red, yellow and blue for phase conductors and black for neutral conductor. The manufacture's standard color scheme will also be acceptable, provided it is consistent for all types and sizes of cables. Where insulated earth conductor is installed, it shall have green and yellow color.

Single phase circuits shall have red for phase and black for neutral conductor.

For all cables to be supplied and installed, the Contractor shall submit complete technical data, including conductor material type, insulation material type, current carrying capacity, voltage grade, weight for 100 meters etc. and all such data shall be supported by test certificates, current and temperature rise curves, etc.

9.6 ROAD LIGHTING CONTROL BOX

9.6.1 Description

The work under this section consists of supplying, installing, testing, connecting, and commissioning of all material and services of the complete Road Lighting control Box as specified herein or stated on the Bid Drawing and in the Bill of Quantities.

The Contractor shall discuss the electrical layout with the Engineer and coordinate at site with other services for exact route, location and position of the electrical lines and equipment.

The Road Lighting Control Box shall also comply with General Specifications, Section 9 and with other relevant provisions of the Bid Documents.

9.6.2 General

The Road Lighting Control shall be 14-SWG steel sheet fabricated, pole mounted outdoor cubicle type, totally enclosed, water tight and vermin proof. It shall be complete in all respects with material and accessories, factory assembled, tested and finished all according to the specifications and to the normal requirements as per Bid drawings.

The control box with all components and accessories shall be suitable for front

operation and shall:-

- Have a rupturing capacity of 7.5 KA at 400-V unless other stated on the drawings.
- Be provided with adequate clearance from live parts so that flashovers cannot be caused by switching, vermins, pests, etc.
- All components rated for insulation class of 600 Volts minimum
- All components mounted so as to facilitates ease of maintenance form the front.
- Have the components mounted so as to facilitate ease of maintenance from the front.
- Have door to open through 180 degree to give maximum access for cabling and maintenance.
- Be fitted with internal light with wiring and switch.
- Be painted inside and outside conforming to requirements of such type of material.
- Have locking arrangements and will be provided with three sets of keys.

9.6.3 Components

The road lighting control box comprise of the following components:-

1-No. Miniature circuit breaker, single pole and neutral, 45 Amps, 240-V, 50-Hz, flush type with operating handle and knob on the front side.

1-No. Magnetic contactor, 3 phases, 400-volts, 200-volts solenoid. Main contacts of the contactor should be suitable for 45 Amps continuous rating. The contactor shall have one auxiliary contact.

1-No. Photo electric cell switch to operate 1-phase 45-Amps circuit. The photo cell switch shall also have override and switch-off facilitates. Light censoring unit will be installed on nearby transformer or lighting pole. All the necessary hardware and cables will be provided by the Contractor. The contact of photo electric switch shall be continuous rating (5A) type.

1-No. ON/OFF/AUTO switch, 5-Amp rating, 200-V, shall have 3 position marked “AUTO”, “ON”, and “OFF”. It shall be suitable for flush mounting and will have square front.

1-No. Miniature circuit breaker, single pole, 45-A rating, 220-volts. (outgoing)

1-Set. Internal light point complete with holder.Bulb and ON/OFF switch.

1-Set. Earthing terminal strip, neutral link, inter-connecting wires to the components, terminal block, brass glands, lugs for incoming and

outgoing 25mm sq. cables.

9.6.4 Data to be submitted with Bid

a- General arrangement of the road lighting control box and proposed foundation details.

b- Catalogues and illustrations of photo cell electric switch and other components.

c- Details of materials used for weather and dust proofing. All cable glands to be supplied in this Bid shall be brass outdoor type complete with locking rings and earth tag and PVC shrouds.

9.6.5 Road Lighting Control Box Installation

The Road lighting Control Box shall be installed at location shown on the drawing. All installation materials for mounting the control box on pole such as bolts, nuts washers, supporting steel clamps, shall be provided by the Contractor.

Loose parts dispatched by the manufacturer shall be installed and connected as per assembly drawing provided by the manufacturer. Any safety locking of meter, relays, etc., provided by the manufacturer for safe transport shall be released only after the control box is erected in position.

The incoming and outgoing cables shall be connected as recommended by manufacturer.

The control box body shall be connected to earth as per instructions given in section “Earthing” of these specifications. The control box shall be tested and commissioned in the presence of the Engineer.

9.7 EARTHING SYSTEM

9.7.1 General Description

The work under this section consists of supplying, installing, Testing and commissioning of all material and services of the complete earthing system as specified herein or stated on the Bid Drawing and in the Bill of Quantities.

The Contractor shall discuss the electrical layout with the Engineer and co-ordinate at site with other services for exact route, location and position of the electrical lines and equipment.

The earthing system shall also comply with the General Specifications, and with other relevant provisions of the Bid Documents.

The earthing system consists of earth electrodes, earth connecting points, earthing leads, earth continuity conductors and all accessories, necessary for the satisfactory operation of the associated electrical system. The earthing system shall comply with the relevant WAPDA Specifications.

9.7.2 Earth Continuity Conductor.

Earth continuity conductor (ECC) shall be stranded galvanized steel wire of sizes as indicated on the drawings. The earth continuity conductor shall comply with the same specifications as given for single core in the relevant section of specifications. For bonding of miscellaneous metal work, the size of ECC will be 8 SWG. All sockets, lugs, thimbles etc. , shall be provided for a complete earthing installation.

9.7.3 Earth Electrodes

The earth electrode shall comprise of copper deposited mild steel rod 16 mm diameter and 3000 mm long including 25 mm tapered portion, thoroughly hammered into the ground. The rod shall be connected to the earth terminal of the pole through 7/3.2 mm i.e. 10 mm diameter galvanized steel stranded wire. The rod shall be connected to the ground conductor by means of a connector which shall be tightened properly. After tightening , the connector shall be covered with bitumen to prevent ingress of moisture and soil. The distance of rod from the foundation and the rod depth shall be as per WAPDA specifications on the subject.

9.7.4 Earthing Installations

Complete earthing system as shown on the drawing shall be installed by the Contractor. The earthing system shall give earth resistance including the resistance of soil, earth electrode and earth conductors equal to or less than one ohm. If earthing resistance exceeds one ohm, more earth electrodes shall be installed. The earth wire and the rod shall be securely clamped.

9.8 GALVANISED IRON PILE BRACKETS

9.8.1 Material Description

Galvanized iron pipe bracket shall be of heavy gauge, wall thickness 2.9mm outer diameter 42 mm galvanized both inside and outside by hot dip galvanizing process. The size and shape of bracket will be as shown on drawing. The mounting material such as nuts, bolts, and clamp will be provided.

9.8.2 Paint

After installation, the lighting bracket shall be painted for entire length with good quantity aluminum paint as already mentioned in item 9.3.2.

9.9 SPOOL INSULATORS AND D-SHACKLE

9.9.1 Spool - Insulator

This item shall consist of providing and installing of spool- insulators, galvanized iron D-shackles and clamps including nuts, bolts etc, on lighting

poles in accordance with WAPDA specifications for installing overhead all aluminum 7/.122". Conductor.

9.9.1.1 Specifications

i)	Dry flashover voltage	25 KV
ii)	Wet flashover Voltage	15 KV
iii)	Puncture Voltage	33 KV
iv)	Mechanical breaking load	1364 Kg (3000 lbs)

9.9.1.2 Dimensions

i)	Height of insulator	76 mm
ii)	Width of insulator	76 mm

9.9.2 D- Shackle Assembly

D-Shackle assembly is used for keeping spool insulator in position and for running of LT overhead lines.

9.9.2.1 Requirements

D-Shackle assembly shall consist of D-shape, MS pin and split cotter pin. D-shackle strap and the pin shall be manufactured from mild steel having the following properties:

.	Yield point minimum	25 Kg/mm sq (35.56 KSI)
.	Elongation minimum	22% on 8 in gauge length

9.10 INSTALLATION

9.10.1 Workmanship

All work both in the erection and preparatory thereto shall be performed in a careful, neat, competent, and thoroughly satisfactory and workman like manner according to the plans, specifications and construction drawings will be carried out to accordance with approved practices.

9.10.2 Safety of Public

The Contractor shall provide, erect and maintain all necessary barricades, suitable and sufficient red light, danger signals and signs and take all necessary precautions for the protection of the work and safety of public.

9.10.3 Protection of Real crossed by Right-of-Way

The Contractor shall limit the movement of his crews and equipment on right-of-way including approved access routes, so as to minimize damage to property and shall endeavor to avoid marring the lands.

Damage to ditches, terraces, roads and other features of the land shall be corrected, and the land shall be restored as nearly as practicable to its original condition before final acceptance of the work.

The Contractor shall be responsible directly to the concerned authority for any excessive or unnecessary damage to lands resulting from his operations, whether on right-of-way, on lands adjacent thereto, or on approved access roads, and deductions will be made from payments due to the Contractor to cover the amount of such excess of unnecessary damage as determined.

9.10.4 Stringing and Sagging

While stringing, the conductor shall not be allowed to touch the ground. Care shall be taken to prevent damage to the aluminum strands. Damaged length of conductor is not to be used on line. The Conductor shall provide temporary protection or guards when stringing the conductor over Railway, highways, Telecommunication or Power Lines.

In these spans no joint shall be permitted. All joints and tap connections shall be of compression type. The strands of the conductor shall be perfectly cleaned and the joints shall be made in accordance with the manufacturer's instructions.

Sagging shall be done in neither sections consisting of nor more than 12 spans or between dead-end structures when less than 12 spans apart. For section consisting of more than 7 spans, sags shall be measured at least at 2 spans, where the ground is relatively level, sags shall be measured in spans, near the Ist and 3rd quarter points in the section when measured at 2 locations and in the half section further from the pulling equipment when measured at one location.

Sags shall be done by the direct line of sight using sighting boards located at pre-determined distances below the points of attachment of cables at two adjacent supports. These distances shall be calculated for the average temperature of the conductor during the period of measurement. Conductor temperature shall be accurately measured with thermometers of a type and make to be approved by the Engineer.

Span lengths and allowable sag shall be chosen keeping in view the required ground clearances and strength of structure. However the Contractor shall ensure that spans between sections are neither too small nor too large.

Conductors shall not be pre-stressed before sagging expects that during the stringing and sagging operation these shall rest in the stringing pulleys for a period of not more than 6 hours at a tension not greater than required for sagging before being brought to the correct sag. When sagging the conductors these shall be pulled 10 to 15 percent above the required sag and then slackened off to correct sag. After all

adjustments have been made, the resulting sag shall not exceed the specified sag. A tolerance of 5% shall be allowed for sag for less than the specified sag.

Sagging operations shall not be carried on when, in the opinion of the Engineer's representative, wind extremely low temperature, or other adverse conditions prevent satisfactory sagging.

9.10.5 Conductor Joints or Splices, Repair Sleeves and Dead Ends.

Unless otherwise directed, all joints or splices, repair sleeves and dead ends shall be applied to the conductor in accordance with the recommendations of the conductor manufacturer.

The Contractor shall furnish all necessary tools including compressors, required for applying compression joints or splices, repair, sleeves and compression type dead ends.

All joints or splices and repair sleeves shall be located at least 70mm away from the structures. No joints or splices or repair sleeves shall be used in spans crossing over the adjoining important roads or public utility lines of voltage greater than 3 kilo-volts. The minimum distance between two joints or splices shall not be less than 7 percent of the minimum random length of conductor. No more than one joint or splice will be permitted in any one conductor in any one span.

Where strain clamps are used, the conductor may be strung through the dead-end position without cutting or, if the conductor is cut, the jumper connections shall be made with parallel-groove clamps, pressure connectors, or T-connectors where required. The U bolts on strain clamps shall be retightened after line tension is applied.

Compression-type repair sleeves may be used to repair minor damage to the conductor provided that:

i) At the location of the damage on the conductor to be repaired not more than 1/3 of the outer strands are damaged over a length of not more than 10 cm.

ii) Not more than 2 strands in the outer layer are broken, no strands in the inner layer of strands are broken, and the cross-sectional area of any other of the damage strands is not reduced by more than 25 percent.

iii) In a maximum of 10 percent of the total length of conductor, the minimum distance between 2 repair sleeves or between a repair sleeves and splicing sleeve, is not less than the minimum random length of conductor.

iv) In a maximum of an additional 10 percent of the total length of conductor, one repair sleeve may be used on each length of conductor equal to or greater than the standard length of conductor provided, that the distance from the repair sleeve to the nearest splicing sleeve is not less than one quarter of the standard length specified. The compression repair sleeves shall be suitable for the size and type of conductor with which they are to be used.

9.11 MEASUREMENTS AND PAYMENT

9.11.1 Electrical Work BOQ.

Measurement and payment for Electrical work shall be made in accordance with the provision specified hereinafter.

9.11.1.1 Method of Measurement

Measurement shall be made for the complete electrical work including all accessories acceptably installed complete in all respect as per drawings and specifications.

9.11.1.2 Basis of Payment

Payment shall be made at the contract lump sum price and shall constitute full compensation for the cost providing, installing, commissioning and testing of external lighting system, including steel poles, lighting fixture, overhead conductor, insulators, clamps, D-shackles, ties, guy wires, brackets and cables including earthling and all other items related to work and all accessories complete in all respect as described in specifications including all labor and incidental to complete the works.

SECTION – 10

ROAD WORKS

SUB-SECTION – 10.1: ROAD WORKS – PREPARATION OF SUB-GRADE

10.1.1 GENERAL

The sub-grade is that part of the work on which sub-base is placed or if there is no sub-base, the base of pavement structure. Preparation of sub-grade shall consist of excavating from higher area and filling of lower area to the required level and grades and compaction as shown in the drawing or as directed by the Engineer/Engineer's Representative.

10.1.2 ACCESS ROAD

The expense for construction of Access Road for transport of machinery and other equipment to the site shall be borne by the Contractor as it is his responsibility to provide a safe passage for construction equipment and machinery. A tentative alignment has been marked and shown in drawings; however, the Contractor may plan and improvise an alternate, if necessary.

10.1.3 MATERIALS

All suitable material from excavation shall be used.

10.1.4 EXECUTION

10.1.4.1 Prior Works

Culverts, drain pipes and any other minor structures below the sub grade level, including the fully compacted backfill over them, if necessary to within 12 inches below the sub grade level; ditches, drains, outlets for drainage and headwalls and wing walls for culverts, shall be in such operative condition as to insure prompt and effective drainage and to avoid damage to the sub grade by surface water. No work shall be started on the preparation of the sub grade before the prior works herein described have been approved by the Engineer/Engineer's Representative.

10.1.4.2.Sub GRADE IN CUT

Unless otherwise directed by the Engineer/Engineer's Representative, the soil below sub- grade elevation shall be excavated to a minimum depth of 6 inches if required, and material removed from the road way portion to the areas within the site as directed by the Engineer/Engineer's Representative. Moisture content shall be adjusted within the designated moisture range and compacted to > 95% of maximum dry density as determined by AASHTO method T-180. If soil encountered at the sub-grade elevation as shown in the plans is found unsuitable in the opinion of the Engineer/Engineer's Representative then this unsuitable soil shall be removed and replaced by the approved select embankment material to the depth as directed by the Engineer/Engineer's Representative.

10.1.4.3. Protection of Completed Work

Any part of the sub grade that has been completed shall be protected and well drained and any damage resulting from default of the Contractor shall be repaired as directed by the Engineer/Engineer's Representative without additional payment. The Contractor shall be responsible for all the consequences of traffic being admitted to the sub grade. He shall repair any ruts or ridges occasioned by his own traffic or that of others by reshaping and compacting with rollers of the size and type necessary for such repair. He shall limit the amount of sub grade preparation to an area that can be maintained with the equipment available. He shall arrange for sub grade preparation and sub-base or base placing to follow each other closely. The sub grade, when prepared too soon in relation to the laying of the sub-base, is liable to deteriorate, and in such case the Contractor shall, without additional payment, repair, reroll, or re-compact the sub grade as may be necessary to restore it to the state specified herein.

10.1.4.4. Compaction

The compaction of sub grade for roads and paved areas in embankments and cuttings shall be in accordance with the specification described in Earthwork Section.

10.1.4.5. Finishes and Tolerances

The finished sub-grade surface shall be smooth and even and when measured with 10 ft. straight edge the tolerance from the designed grades shall be no more than 1 inch. No tolerance above the designed grade is allowed. Sub-grade that does not conform to this shall be reshaped at the expense of the Contractor and no material for the subsequent work shall be placed until the sub-grade is in perfect condition and approved by the Engineer/Engineer's Representative.

10.1.5 MEASUREMENT AND PAYMENT

The quantity to be paid for shall be the number of square meter of sub grade prepared as hereinbefore prescribed and accepted. Sub grade on embankments shall not be measured for direct payment. The quantities, determined as provided above, shall be paid for at the contract unit price respectively, for each of the particular pay items shown in the Bill of Quantities. These prices and payments shall be full compensation for all costs necessary for the proper completion of the work prescribed in this item.

SUB-SECTION – 10.2: ROAD WORKS – SUB-BASE AND BASE COURSES

10.2.1 GENERAL

10.2.1.1 Granular Sub-Base Course

This work shall consist of furnishing and placing one (1) or more courses of aggregate, on a prepared sub grade in accordance with the Specifications, in conformity with the lines, grades, thickness and typical cross-sections shown on the plans or established by the Engineer/ Engineer's Representative.

10.2.1.2 Aggregate Base Course

This work shall consist of furnishing and placing one (1) or more layers of aggregate, on a prepared surface in accordance with the Specifications, and in conformity with the lines, grades, thickness and typical cross-sections shown on the plans or established by the Engineer/Engineer's Representative.

10.2.1.3 Water Bound Macadam Base Course (WBM)

This work shall consist of furnishing and placing one or more courses of clean crushed stone base mechanically interlocked by rolling, and voids thereof filled with screening and binding material with the assistance of water, laid on a prepared sub- grade, sub base, or existing pavement in conformity with the lines, grades and cross-section shown on the drawings.

10.2.2. MATERIALS

10.2.2.1 Aggregates

A. Source of Materials

All aggregates for use in the construction of the sub-base and base courses shall be obtained only from sources approved by the Engineer/Engineer's Representative. The actual quarry pits or gravel deposits shall be in all cases approved by the Engineer/Engineer's Representative.

The Bidder shall determine the location, suitability and quantity of material available before tendering as well as the cost and the amount of work required to crush, screen and the length of haulage to the job site. The Bidder shall also satisfy himself and make a determination of the amount of overburden that must be removed from any quarry site and the cost of handling such overburden. He shall include all costs in his bid price.

The Contractor shall provide the Engineer/Engineer's Representative, within thirty (30) days prior to the scheduled beginning of construction with a complete statement of the origin and composition of all stone and/or gravel aggregates to be used in the work, including those for sub-base and base course. All material shall comply with the specified requirements for the various aggregates. The locating and the manufacture of aggregates which must meet the requirements of the Specifications is the sole responsibility of the Contractor to manufacture such aggregates at the rates and in the quantities required to complete the work within the specified Contract Time.

The approval of the Contractor's crushing and screening plant equipment by the

Engineer/Engineer's Representative shall in no way relieve the Contractor of the responsibility of producing aggregates which meet the specifications and in the quantities required for the completion of the work within the specified Contract Time.

No aggregate producing equipment shall be put into operation prior to the approval of the equipment by the Engineer/Engineer's Representative. If after the equipment is put into operation it fails to perform as proposed, the Contractor shall provide additional approved equipment or replace the original equipment with more suitable equipment, as may be directed by the Engineer/Engineer's Representative.

The Contractor shall commence crushing and screening of aggregates for sub-base, base, concrete, or as otherwise may be required immediately after the occupancy of the Project Laboratory by the Engineer/Engineer's Representative and/or immediately after the Contractor receives approval of his aggregate sources.

B. Testing

Work Item	Material	Test Method	Sampling And Aashto Testing Frequency Acceptance Limit
Aggregate Base Course	Aggregate	Gradation T2	3/Source plus 1/20000 cft.
		Plasticity T89,T90	3/Source plus as Index required based on visual observations
		CBR T180,T193	3/Source plus as required based on variation in gradation
		Abrasion T96	3/Source plus 1/100000 cft.
		Sodium T104 Sulphate Soundness	3 source plus 1/10000 cft.
		Fractured Visual Faces	3/source plus as required based on visual observation.
		Flat and Visual elongated particles	- do -
		Moisture T180 Density	1/35000 cft.
		Field T191 Density T238 & T239	4/layer/1500 ft. 3 min./layer if less than 1500 ft.laid Note

In order to ascertain the properties of all aggregate materials, the Contractor shall submit for approval by the Engineer/Engineer's Representative,

test certificates from an approved testing laboratory for all materials intended for incorporation in the work prior to commencement of work.

Representative samples for such testing shall be taken by the Contractor, at his expense, in the presence of the Engineer/Engineer's Representative, and duplicate samples shall be submitted to the Engineer/Engineer's Representative for future reference.

The Contractor may, if approved by the Engineer/Engineer's Representative, conduct the necessary tests in the Project Laboratory. The tests shall be conducted in the presence of the Engineer/Engineer's Representative by the Contractor's Material-Engineer. The qualifications of the Contractor's Materials-Engineer must be submitted to and approved by the Engineer/Engineer's Representative prior to any testing operations.

This testing, whether performed at an approved testing laboratory, or in the Project Laboratory, shall be solely the Contractor's responsibility and will be at the Contractor's expense. The testing frequency, acceptance limits and other pertinent information for proper control of each work item shall conform to the following tables No. 2320-A and 2320-B. The tables provide the minimum under normal conditions.

Table 2-A Schedule Of Sampling And Testing Aggregate Base Course

(a) * Acceptance limits, unless otherwise noted, shall be as specified under section 2320. Note (a) For number of tests 3 or more, average value must be equal to or greater than 100% as specified compaction requirements in section 2320 and no individual test shall yield less than 98%. Test locations shall be selected by random method.

TABLE 2-B
SCHEDULE OF SAMPLING AND TESTING FOR GRANULAR SUB-BASE

Work Item	Material	Test Method	Sampling And Aashto Testing Frequency Acceptance Limit	
Granular Sub-base	Aggregate	Gradation	T2	3/Source plus 1/20000 cft.
		Plasticity	T89,T90	3/Source plus as required based on visual observations
		CBR	T180,T193	3/Source plus as required based on variation in gradation
		Abrasion	T96	3/Source plus 1/20000 cft.
		Moisture Density Field Density	T180 T191 T238 & T239	4/layer/1500 ft. 3 min./layer if less than 1500 ft. laid Note (a)

* Acceptance limits, unless otherwise noted, shall be as specified under section 2320. Note (a) For number of tests 3 or more, average value must be equal to or greater

than 100% as specified compaction requirements in section 2320 and no individual test shall yield less than 98%. Test locations shall be selected by random method.

C. Approval and Inspection

All sources of material shall be approved by the Engineer/Engineer's Representative prior to procuring or processing material from such sources. Test certificates obtained or performed by the Contractor at his expense are intended to assist the Contractor in his estimate of the location, extent and quantities which will comply with the Specifications when properly processed, and will in no way obviate the need for further testing by the Engineer/Engineer's Representative. Only materials from approved sources shall be processed for incorporation into the work. Approval of specific sources of materials shall not be construed as final approval and acceptance of materials from such sources.

All processed material shall be tested and approved before being stored on the site or incorporated in the work and may be inspected and tested at any time during the progress of their preparation and use. Questionable materials, pending laboratory testing and subsequent approval, shall not be unloaded and incorporated with materials previously approved and accepted. If however, the grading and quality of the material delivered to the site do not conform to the grading and quality as previously inspected and tested, or do not comply with the Specifications, the Engineer/Engineer's Representative reserves the right to reject such materials at the site of the work. Only materials conforming to the requirements of the Specifications shall be used in the work.

Samples must meet all test requirements as specified under the Specifications. The Contractor shall permit the Engineer/Engineer's Representative or his designated representative to inspect any and all materials used or to be used, at any time during or after its preparation, or while being used during the process of the work or after the work has been completed. All such materials not complying with the required Specifications, whether in place or not, shall be rejected and shall be removed promptly from the work. The Contractor shall supply, or arrange with any producers or manufacturers to supply all necessary material, labour, tools and equipment for such inspection.

D. Storage

Materials shall be stored so as to insure preservation of their specified quality and fitness for the work. They shall be placed on hard, clean surfaces and, when required by the Engineer/Engineer's Representative, they shall be placed under cover. Stored materials shall be located so as to facilitate prompt inspection and control. Private property shall not be used for storage purposes without written consent of the owner.

The centre of the storage area shall be elevated and sloped to the sides so as to provide proper drainage of excess moisture. The material shall be stored in such a way as to prevent segregation and coning to insure proper control of gradations and moisture. Coarse aggregate storage piles shall be built-up in layers not exceeding 3 ft.

The height of a stockpile shall be limited to a maximum of 15 ft. The equipment and methods used for stockpiling aggregates and for removing from the stockpiles must be approved by the Engineer/Engineer's Representative and shall be such that no detrimental degradation of the aggregate will result and no appreciable amount of foreign material will be incorporated into the aggregate.

The stockpile site shall be prepared by clearing and smoothing and must be approved by the Engineer/Engineer's Representative. Prior to any stockpiling of aggregates, cross sections of the stockpile site shall be taken and control points established for use in determining the quantity of subsequently stockpiled material.

10.2.2.2 Granular Sub-Base Course

The subbase material shall be clean and free from organic matter and other deleterious substances, and shall be of such nature that it can be compacted readily under watering and rolling to form a firm stable base.

The material shall comply to the following grading and quality requirements:-

a) Material for sub-base shall consist of well-graded gravel with sand and silt, conforming to the following requirements:

AASHTO Sieve	Percent Passing
2-1/2 in.	100
2 in.	90 – 100
No.4	35 – 70
No. 200	0 – 50

The grading is based on aggregates of uniform specific gravity, and the percent passing the various sieves are subject to correction by the Engineer/Engineer's Representative when aggregates of varying specific gravities are used.

- Liquid Limit (AASHTO 89) 25 maximum
- Plasticity Index (AASHTO 90) 6 maximum
- Sand Equivalent (AASHTO 176) 25 maximum
- Loss by Abrasion (AASHTO 96) 50 maximum

b) The material shall have a CBR value of at least 30%, determined according to AASHTO T193. The CBR value shall be obtained at a density corresponding to 98% of the maximum dry density determined according to AASHTO T180 method D.

10.2.2.3 Aggregate Base Course

Materials shall conform to the requirements for the "Aggregate Base Course" specified. All aggregates for base course shall consist of clean, tough, durable, sharp angle fragments free of any excess of thin or elongated pieces, and reasonably free of soft, disintegrated or decomposed stone, dirt or other

deleterious matter.

Crushed gravel or stone fragments for base courses shall consist of the product obtained by crushing gravel or rock that, if directed by the Engineer/Engineer's Representative, has first been screened in such a manner that not less than ninety (90) percent of the material to be crushed is retained on a one-quarter (1/4) inch sieve. The amount of crushing shall be regulated so that at least ninety (90) percent by weight, of the pieces retained on the No.4 sieve have at least two (2) mechanically fractured faces.

Co-efficient of uniformity	D60 D10	4 Minimum
Co-efficient of curvature	D30xD30 D10xD60	Between 1 & 3

- Physical Requirements: All base course aggregates shall conform to the following physical requirements:

Loss of Sodium Sulfate Soundness Test (AASHTO T 104)	10 percent maximum
Loss of Sodium Sulfate Soundness Test (AASHTO T 104)	12 percent maximum
Loss by Abrasion Test (AASHTO T 96)	40 percent maximum
Sand Equivalent (AASHTO T 176)	45 Minimum
Laminated material shall not exceed 15% percent of total volume of aggregate base course.	
Friable Particles (AASHTO T 112)	0.25 percent maximum
CBR of material passing ¾ inch sieve	80% minimum

- Gradation: Coarse materials for base course shall be crushed rock or crushed gravel conforming to the following grading requirements:

AASHTO Sieve	**Percent Passing**
2 1/2 in.	100
2 in.	90 - 100
1 1/2 in.	35 - 70
1 in.	0 - 15
1/2 in.	0 - 5

Fine materials for base course shall be quarry screenings or natural material and of suitable binding quality as approved by the Engineer/Engineer's Representative. The material shall be free from foreign or organic matter, dirt, shale, clay and clay lumps, or other deleterious matter and shall conform to the following requirements:-

AASHTO Sieve	**Percent Passing**
3/8 in.	100
No. 4	85 - 100
No. 100	10 - 30
Plasticity Index (AASHO T 90)	6 maximum

Sand Equivalent (AASHO T 176) 30 minimum

The combined material shall consist of a mixture of all aggregate uniformly graded from coarse to fine to conform to the following gradation requirements:

AASHTO Sieve	**Percent Passing**
2 1/2 in.	100
2 in.	90 - 100
1 1/2 in.	60 - 90
1 in.	42 - 77
3/4 in.	35 - 70
1/2 in.	25 - 60
No. 4	15 - 40
No. 10	10 - 1
No. 40	5 - 15
No. 200	2 - 9

When the aggregate is a total aggregate, it may be accepted at the crusher. Acceptance of the material by the Engineer/Engineer's Representative does not constitute acceptance of the base course, only that the material is approved for use in the base course.

10.2.3. EXECUTION

10.2.3.1 Granular Sub-Base

A. Method of Construction

a) Preparation of Sub grade: Unless other sub grade preparation is called for on the plans or sub grade preparation appears as a separate item for compensation in the Bills of Quantities, the Contractor shall, as part of the work of sub-base, prepare the sub grade. The formation of the sub grade shall be excavating sufficient material from the roadway area and placing the "Granular Sub-base" on the sub grade obtained thereby. The sub grade shall, as hereinafter described, be brought to the lines, grades, and typical section shown on the plans for the bottom of the "Granular Sub-base".

b) Spreading: Sub-base aggregates shall be spread on sub grade which has been approved by the Engineer/Engineer's Representative. Sub-base which has been placed on a sub grade not approved by the Engineer/Engineer's Representative, shall be removed at the Contractor's expense. Sub-base aggregate shall be spread on the sub grade in layers not exceeding six (6) inches in compacted depth. Spreading shall be done by means of approved mechanical spreaders, distributing the material to the required width and loose thickness. Where the required sub-base thickness is greater than six (6) inches, the material shall be placed in layers of equal thickness, in no case shall a layer be less than three (3) inches thick

The material shall be handled so as to avoid segregation. Segregated materials shall be remixed until uniform. Suitable precautions shall be taken to prevent rutting of the sub grade during the spreading of the sub-base material. No hauling or placement of material will be permitted when, in the judgment of the Engineer/Engineer's Representative, the weather or road conditions are such that the hauling operations will cause cutting or rutting of the sub grade or cause contamination of the sub-base material.

c) Compaction: The moisture content of the sub-base material shall be adjusted prior to compaction, by watering with approved sprinkler trucks or by drying out, as directed by the Engineer/Engineer's Representative, to that extent required to obtain the specified density for sub-base. Sub-base shall be compacted to one-hundred (100) percent of the maximum dry density as determined according to AASHO T 180 Method D, or to seventy-eight (78) percent of the relative density in accordance with ASTM D 2049, as deemed appropriate by the Engineer/Engineer's Representative. The moisture content directed by the Engineer/Engineer's Representative shall be the optimum moisture content determined from the moisture-density test performed in the laboratory on the sub-base material, or as otherwise directed by the Engineer/Engineer's Representative after compaction trials as specified in sub- paragraph (d) of this section.

The sub-base aggregate shall be compacted by means of approved compaction equipment progressing gradually from the outside towards the center with each succeeding pass uniformly overlapping the previous pass. Rolling shall continue until the entire thickness of each layer is thoroughly and uniformly compacted to the specified density. Rolling shall be accompanied by sufficient blading, in a manner approved by the Engineer/Engineer's Representative, to insure a smooth surface free from ruts or ridges and having the proper section and crown.

Any areas inaccessible to normal compaction equipment shall be compacted by means of mechanical tampers until satisfactory compaction is obtained.

Each layer of sub-base course must be completely compacted and approved by the Engineer/Engineer's Representative prior to the delivery of materials for a succeeding layer of sub-base.

d) Compaction Trials: If directed by the Engineer/Engineer's Representative, prior to the commencement of his sub-base operations, the Contractor shall construct trial lengths, not to exceed two hundred (200) ft. The materials used in the trials shall be that approved for use as sub-base and the equipment used shall be that according to the Contractor's approved detailed program of work.

The object of these trials is to determine the adequacy of the Contractor's equipment, the loose depth measurements necessary to result in the specified compacted layer depths, the field moisture content, and the relationship between the number of compaction passes and the resulting density of the material.

The Contractor may proceed with sub-base and work only after the methods and procedures established in the compaction trial have been approved by the Engineer/Engineer's Representative.

e) Finishing: The Contractor shall program his operations to avoid the drying out of the sub-base during construction. If any layer of sub-base material, or part thereof, is permitted to dry out after compaction, or does not conform to the required density or finish, the Contractor shall, at his own expense, rework, water or re-compact the material, as directed by the Engineer, to the density specified, before the next layer of subbase is superimposed thereon.

Immediately prior to the placing of the first layer of base course on the sub-base the final layer of sub-base shall be at the specified density and to the required grade and section. In order to maintain these requirements while placing the next course, it may be necessary to water and reshape the surface of the sub-base, which work shall be at the Contractor's expense.

The surface of the finished sub-base will be tested with a ten (10) ft. long straight edge by the Engineer/Engineer's Representative at selected locations. The variation of the surface from the testing edge of the straightedge between any two (2) contacts with the surface shall at no point exceed one half (1/2) inches when placed on or parallel to the centerline or when placed perpendicular to the center line of the roadway. The sub-base shall be compacted to the thickness and cross section as shown on the plans and shall not vary by more than one half (1/2) inch from the required elevation. All humps and thickness deficiencies exceeding the specified tolerances shall be corrected by removing the defective work or by adding new material as directed by the Engineer/Engineer's Representative. No material for base course shall be placed until the sub- base has been approved by the Engineer/Engineer's Representative.

10.2.3.2 Aggregate Base Course

A. Method of Construction

a) Combining Aggregate and Water: Aggregate for base course shall be combined into a uniform mixture and water added by watering and mixing in a manner approved by the Engineer/Engineer's Representative, before final placement of the material.

The moisture added to the aggregates shall be that required, as designated by the Engineer/Engineer's Representative, to obtain the specified density thereby preparing an aggregate completely ready for compaction after spreading on the sub-base. In no case will the wetting of aggregates in stockpiles or trucks be permitted.

b) **Spreading:** Unless otherwise specified, aggregate for base courses shall be delivered to the roadbed as a uniform mixture and shall be placed on the existing prepared sub base, in a uniform layer or layers not exceeding six (6) inches in compacted depth, including any binder that is to be blended on the

base. Spreading shall be done by means of approved self-propelled spreader box distributing the material to the required width and loose thickness. When the required base thickness is greater than six (6) inches the material shall be spread in layers of equal thickness.

The material shall be so handled, as to avoid segregation. If an aggregate spreader causes segregation in the material, or leaves ridges or other objectionable marks on the surface which cannot be eliminated easily or prevented by adjustment of the spreader operation, the use of such spreader shall be discontinued and the spreader replaced. All segregated material shall be removed and replaced with well-graded material. No "skin" patching shall be permitted.

No hauling or placement of material will be permitted when, in the judgment of the Engineer/Engineer's Representative, the weather or road conditions are such that hauling operations will cause cutting or rutting of the sub-base surface or cause contamination of the base course material.

c) **Compaction:** If directed by the Engineer/Engineer's Representative, prior to starting the aggregate base operation, the Contractor shall construct trial lengths in accordance with sub-paragraph d) "Compaction Trials" in section 2323 "granular Subbase".

Immediately after placing, the base course material shall be compacted. The material shall be compacted to a density of not less than one-hundred (100) percent of Maximum Density as determined according to AASHO T 180 Method C, or to seventy-eight (78) percent of the Relative Density in accordance with ASTM D 2049, as deemed appropriate by the Engineer/Engineer's Representative. The field determination of density shall be made in accordance with AASHO T 181. The percent of density shall be adjusted to compensate for the weight and volume of aggregate larger than the aggregate used in the compaction control test where applicable.

Rolling shall be continued until the entire thickness of each layer is thoroughly and uniformly compacted to the density specified. The final rolling of the completed base course shall be done with a self-propelled roller. Rolling shall be accompanied by sufficient blading in a manner approved by the Engineer/Engineer's Representative, to insure a smooth surface, free from ruts or ridges and having the proper section and crown. When additional water is required it shall be added in the amount and manner approved by the Engineer/Engineer's Representative. Each layer of base course must be completely compacted by the Contractor and approved by the Engineer/Engineer's Representative prior to the delivery of materials for a succeeding layer.

Surface finishing shall meet the requirements in accordance with sub-paragraph

e) "Finishing" in section 2323 "Granular Sub-Base" except that the variation of the surface from testing edge of 10 ft long straight edge between any two contacts shall at no point exceed one quarter (1/4) inch when placed perpendicular or

parallel to the center of the roadway. The base course shall be compacted to thickness and cross-section as shown on the plans and shall not vary by more than minus one quarter (1/4) inch from the required elevation. No tolerance above the designed grade or level of base course shall be allowed. All lumps and depressions and thickness deficiencies exceeding the above specified tolerances shall be connected by removing and replacing the defective work or as directed by the Engineer/Engineer's Representative.

If the material for the base course is laid and compacted in more than one (1) layer, the Contractor shall plan and coordinate the work in such a manner that the previously placed and compacted layers be allowed ample time for drying and development of sufficient stability before vehicles hauling materials for the succeeding layers, or other heavy equipment are permitted on the base. Prior to placing the succeeding layers of material, the top of the layer shall be made sufficiently moist to insure bond between the layers. The edges and edge slopes of the base course shall be bladed or otherwise dressed to conform to the lines dimensions shown on the plans and present straight, neat and workmanlike lines and slopes as free of loose material as practicable.

The Contractor shall also plan the work and handle the various operations so that the least amount of water will be lost by evaporation from uncompleted surfaces. If the Contractor delays placing of succeeding layers of base course material to the extent that additional water must be applied to prevent raveling or excessive dripping, the application of such water shall be at the Contractor's expense and will not be considered as the basis for a claim for additional compensation. Water shall be applied at such times and in such quantities as directed by the Engineer/Engineer's Representative and the Engineer/Engineer's Representative shall have full authority to require the suspension of all other work on the project to insure the proper maintenance of previously compacted material. If after the base is compacted, any areas are above or below proper grade and true elevations, such area shall be loosened and after having had additional materials added or excess material removed, as the case may require, shall be reconstructed as described herein. If after the base is compacted, any areas fail to meet the specified density and gradation requirements, they shall be loosened or removed as directed by the Engineer/Engineer's Representative and reconstructed as described before.

d) Maintenance of Base Course: Following the construction of the aggregate base, the compacted base course shall be maintained by the Contractor at his expense. The Contractor shall blade, broom and otherwise maintain the base, keeping it free from raveling, and other defects until such time as the bituminous prime or other surface is applied. Water shall be applied at such time and in such quantities as directed by the Engineer/Engineer's Representative.

The Engineer/Engineer's Representative shall determine when the surface of the base course is in the proper condition to permit the bituminous prime and/or

surfacing to be applied. If the Contractor chooses not to apply the bituminous prime and/or surfacing at that time, he must continue to maintain the surface of the base course, including the application of necessary water, at his expense until such time as the bituminous prime and/or surfacing is applied. Any additional expense incurred by the Contractor because of his failure to apply the bituminous prime and/or surfacing when so permitted by the Engineer/Engineer's Representative will not be considered as the basis for a claim for additional compensation.

10.2.4. MEASUREMENT AND PAYMENT

The quantity of sub-base and base courses to be paid for shall be measured by the theoretical volume in place as shown on the drawings or as directed and approved for construction by the Engineer/Engineer's Representative, placed and accepted in the completed granular sub-base course and aggregate base course. No allowance will be given for materials placed outside the theoretical limits shown on the cross sections. Trial sections shall not be measured separately but shall be included in the quantities above.

The accepted quantities measured as provided above shall be paid for at the contract unit price per cubic foot of Granular Sub- base course, Aggregate Base Course and water bound macadam base course for the pay item shown in the Bill of Quantities, which price and payment shall constitute full compensation for furnishing all materials, hauling, placing, watering, rolling, labour, equipment, tools and incidentals necessary to complete the item.

SUB-SECTION – 3: ROAD WORKS - BITUMINOUS SURFACE COURSES

10.3.1. GENERAL

10.3.1.1 Bituminous Prime Coat

This work shall consist of applying a liquid asphalt prime coat on previously constructed base courses, toe of roadway shoulders, and concrete surfaces (and when otherwise shown on the plans) in accordance with the specifications, and in conformity with the lines shown on the plans or established by the Engineer/Engineer's Representative.

10.3.1.2 Bituminous Wearing Course

"Bituminous Wearing Course" work shall consist of the construction of one course of hot-mixed, hot-laid, bituminous mixture conforming to the requirements of this section, spread and compacted on a new or existing base course, concrete pavement, or bridge /culvert top in accordance with the specifications and in conformity with the lines, grades and typical cross sections shown in the plans.

10.3.1.3 Bituminous Surface Treatment

This work shall consist of a wearing surface composed of a bituminous prime coat following by two (2) or three (3) applications of bituminous seal coats with each seal coat receiving an application of aggregates cover material in accordance with the specification and in conformity with the lines shown on the plans or established by the Engineer/Engineer's Representative.

10.3.2. PRODUCTS

10.3.2.1 Bituminous Prime Coat

The prime coat shall be medium-curing cutback asphalt consisting of an asphaltic base or an appropriate type of penetration grade asphalt fluxed with suitable petroleum distillates. The product shall be free of water, show no separation prior to use and shall conform to all requirements of Grade MC-1 as per AASHTO M-82 or appropriate penetration grade asphalt.

10.3.2.2 Bituminous Wearing Course

A. Mineral Aggregates

Mineral aggregates for "Bituminous Wearing Course" shall consist of coarse aggregates fine aggregates, and filler material, if required all complying with the following requirements.

a) Coarse aggregates which is the material retained on an AASHTO No.4 sieve, shall consist of crushed rock or crushed gravel as directed by the Engineer/Engineer's Representative. It shall be clean, hard, tough, durable and sound, and shall be of uniform quality and free from decomposed stone, organic matter, shale, clay, lumps and other deleterious substances.

The coarse aggregate shall be free from an excess of flat elongated pieces (in no case more than ten (10) percent) and shall be of such character that when coated with asphalt shall pass a stripping test performed in

accordance with AASHTO T 182.

Crushed gravel for use as coarse aggregate shall consist of the product obtained by crushing material that has first been screened in such a manner that not less than ninety (90) percent of the material to be crushed is retained on an AASHTO No. 3/8-inch sieve. The amount of crushing of gravel shall be regulated so that at least ninety (90) percent by weight of the material retained on an AASHTO No.4 sieve shall consist of pieces with at least one (1) mechanically fractured face, and when tested for stability of bituminous mix shows satisfactory stability.

b) Fine aggregates shall consist of that portion of the total aggregate that passes an AASHTO No.4 sieve. Fine aggregate obtained by crushing gravel shall be produced that after crushing, at least eight-five(85) percent by weight of the material passing the AASHTO No.4 sieve and retained on the AASHTO No. 8 sieve shall consist of pieces having at least one (1) mechanical fractured face. Should natural material passing the AASHTO No. 4 sieve be included in the mixture, this material shall be fed to the dryer as a separate aggregate and the amount used shall be so limited that the mixture of fine aggregates will contain not less than twenty-five (25) percent by weight of the crushed aggregates.

c) When the combined grading of the coarse and fine aggregates is deficient in material passing the AASHTO No. 200 sieve, mineral filler shall consist of finely divided mineral matter such as rock dust including limestone dust, slag dust, hydrated lime, hydraulic cement, or other suitable mineral matter. At the time of use it shall be sufficiently dry to flow freely and essentially free from agglomerations. Filler material shall be free from lumps, balls or other deleterious material, and shall conform to the requirements of AASHTO M17. Gradation requirements as follows:

Sieve Percentage	**Passing (By Weight)**
No. 30	100
No. 50	95 - 100
No. 200	70 - 100

The combined mineral aggregate shall meet the quality requirements specified in Section 2320, Part 2322, Clause 03. "Aggregate Base Course" and in addition shall conform to the following physical requirements.

Sand Equivalent (AASHTO T 176) determined after all processing except for addition of asphalt binder.	45 minimum
Plasticity index (AASHTO T 90)	3 maximum
Loss of Marshall Stability by submerging specimens in water at 60 degrees C for twenty-four (24) hours as compared to stability measured after submersion in water at 60 degrees C for twenty (20) minutes.	25 percent maximum

When tested according to AASHTO T11 and AASHTO T2 the combined mineral aggregate shall conform to the following grading:

AASHTO Sieve Size	Percent Passing
3/4 in.	100
1/2 in.	80 - 100
3/8 in.	70 - 90
No. 4	50 - 70
No. 8	35 - 50
No. 30	18 - 29
No. 80	13 - 23
No. 100	8 - 16
No. 200	4 - 10

The grading limits specified are based on materials of uniform specific gravity and shall be adjusted by the Engineer/Engineer's Representative to compensate for any variations in specific gravity of the individual sizes. The grading may be varied by the Engineer/Engineer's Representative on the basis of Marshall Tests to obtain optimum stability and life of the completed "Bituminous Wearing Course".

B) Asphalt

Asphalt for "Bituminous Wearing Course" shall be petroleum asphalt cement, grade 60-70 penetration conforming to the requirements in the following table:

Specifications for Asphalt Cements (AASHTO M20)

General Requirements	The asphalt shall be prepared by the refining of petroleum. It shall be uniform in character and shall not foam when heated to 176.7 degree C	
	Method (ASTM)	**Penetration grade min. max**
- Penetration 25°C 100 grams, 5 seconds	D – 5	60 - 70
- Specific Gravity at 25°C	D – 70	1.01-1.06
Softening Paint R+B, °C	D – 36	49-57
Flash point(Cleveland) Open Cup°C	D – 92	218
Loss on heating (a) 163°C 5 hours, percent wt. Max	D – 6	0.2
Penetration after loss on heating 25°C, 100 grams, 5 second, % of original	D – 6/D – 5	78
Ductility: At 25°C 5 cm. per min., cm	D – 113	100
Solubility in organic solvents percent	D – 165	99

C) Job Mix

At least thirty (30) days prior to the date he intends to begin production of plant-mix. "Bituminous Wearing Course" mixtures, and after receiving approval of the aggregates from the Engineer/Engineer's Representative and after the delivery, on site of the asphalt specified for "Bituminous Wearing Course", the contractor shall make written request for the approved job-mix formula from the Engineer/Engineer's Representative.

The job-mix formula will be prepared by the Contractor, under the supervision of the Engineer/Engineer's Representative, in the Project laboratory.

The job-mix. formula shall combine the mineral aggregates and asphalt in such proportion as to produce a mixture conforming to the following composition limits by weight.

	Percent by Weight
Total Mineral Aggregates	96 – 93
Asphaltic Binder (percent of total mix)	4 - 7

When tested according to the Marshall Method, the bituminous mixture shall conform to the following requirements:

Stability	800 (min.)
Flow	2.4 - 4.0
Voids in total mix(percent)	3.0 - 5.0
Voids filled with asphalt (percent)	75 - 82

All trial mixes shall be prepared by the Contractor in the presence of the Engineer/Engineer's Representative and will be tested by the Engineer/ Engineer's Representative.

The Marshall test procedure will be used to determine the percentage of liquid asphalt that is to be incorporated into the mixture. Open bituminous mixes deteriorate rapidly due to the drying and oxidizing effect of the sun, therefore, the mix will be densely graded and relatively on the high-side in fines. For the same reasons, a low asphalt content in the mix is detrimental. The job-mix formula will therefore provide for as high an asphalt content as possible for a mix designed by the Marshall test procedure to provide the specified stability. The mix formula will also take into consideration the absorption of asphalt into the aggregates. Thus for calculations for voids the adjusted bulk specific gravity of the Marshall specimens adjusted for the portion of asphalt lost by absorption, shall be used.

The gradation for the combined aggregate, including the mineral filler shall be within the limits specified in the specifications. The Engineer/Engineer's

Representative may vary the specified limits where he deems it necessary, on the basis of the Marshall tests, to obtain optimum stability and life of the completed mix.

Upon receiving the job-mix formula approved by the Engineer/Engineer's Representative the Contractor shall adjust his plant to proportion the individual aggregates, mineral filler and asphalt to produce a final mix that, when compared to the job-mix formula shall be within the following limits:

Maximum Variations of Percentage of Materials Passing

	Percent
AASHTO No. 4 and larger	± 5
AASHTO No. 10 and retained on the 200	± 4
AASHTO No. 200 + 1.5 Asphalt Content	± 0.3

The Engineer/Engineer's Representative will test the mix periodically and, if necessary, direct the Contractor to readjust the plant to maintain conformity to the job-mix formula. If, during production, the grading of the aggregates alters, the mix shall be redesigned and the plant readjusted as outlined above.

The assistance of the Engineer/Engineer's Representative in the preparation of the job- mix formula in no way relieves the Contractor of the responsibility of producing a bituminous mixture meeting the requirements of the specifications.

D) Equipment

Equipment shall conform to the standards outlined in Section 2390 "Equipment", and shall be according to the type and number outlined in the Contractor's detailed Program of Work as approved by the Engineer/Engineer's Representative.

In addition to the above requirements trucks used for hauling bituminous mixtures shall have tight, clean, smooth metal beds which have been thinly coated with a minimum amount of paraffin oil, line solution, or other approved material to prevent the mixture from adhering to the beds. When required by the Engineer/Engineer's Representative, each vehicle shall be equipped with a canvas cover or other suitable material of such size as to protect the mixture from the weather.

10.3.2.3 Bituminous Surface Treatment

A) Bituminous Materials

Prime Coat: The prime coat shall be medium-curing cutback asphalt consisting of an asphaltic base or an appropriate type of penetration grade asphalt fluxed with suitable petroleum distillates as directed by the Engineer/Engineer's Representative. The product shall be free of water,

show no separation prior to use, and shall conform to all the requirements of asphalt institute USA, for the specified or approved type of penetration grade asphalt.

Seal Coat: The seal coat shall be rapid-curing cutback asphalt consisting of an asphaltic base or an appropriate type penetration grade asphalt fluxed with suitable petroleum distillates as directed by the Engineer/Engineer's Representative. The product shall be free of water, show no separation prior to use and shall conform to all the requirements asphalt institute, USA, for the specified or approved type.

B) Cover Material

Aggregate for cover material shall be screenings of crushed stone which are clean, tough, durable and free from dirt and other objectionable matter. The percentage of wear shall not be more than forty (40) as determined by AASHTO T96. When subjected to five (5) cycles of sodium-sulfate soundness testing, as determined by AASHTO T104, it shall have a weight loss not greater than (10) percent. The moisture content in the aggregate applied directly to the surface of the bituminous material shall not exceed three (3) percent by weight plus one-half (1/2) the water absorption of the aggregate at the time of delivery to the Project. In no case shall free moisture be drawing from the truck bed. Aggregate shall conform to the following gradations and shall be approved by the Engineer/Engineer's Representative.

C) Aggregate Gradation

The percentage composition by weight of aggregate shall conform to the following gradations:

US Standard Sieve	**Percentage Passing by Weight**		
	Size No. 1	**Size No. 2**	**Size No. 3**
1"	100	-	-
3/4"	90-100	-	-
1/2"	20- 55	100	-
3/8"	0- 15	85-100	100
1/4"	-	-	90-100
No. 4	0- 5	10-30	60- 85
No. 8	-	0-10	0- 25
No. 16	-	0- 5	0- 5
No. 200	-	0- 2	0- 2

The size of aggregate for seal coat shall be 3/8 inches.

The portion of aggregate retained on the 9.5 mm (3/8 inch) sieve shall not contain more than fifteen (15) percent of particles by weight so flat or

elongated, or both, that the ratio between the maximum and the minimum dimensions exceeds 5:1.

The nominal sizes of aggregates used for surface treatment shown against table as under :-

Size No. 1: Nominal size 18 mm

Size No. 2: Nominal size 12 mm

Size No. 3: Nominal size 9 mm

Size No. 4: Nominal size 6 mm

D) Equipment

Equipment shall conform to the requirements specified in Section 2390 "Equipment" and shall be of the type and number outlined in the Contractor's Programme of Work, as approved by the Engineer/ Engineer's Representative.

10.3.3. EXECUTION

3.3.1 Bituminous Prime Coat

A. Construction Requirements

a) Preparation of Road Surfaces: It shall be the Contractor's sole responsibility to maintain the surface in an approved condition, conforming to the required grades and sections.

Any defects which may develop shall be immediately corrected at the Contractor's expense.

Prior to the application of the bituminous material, all loose materials shall be removed from the surface and the surface shall be cleaned by means of approved mechanical sweepers or blowers and/or hand brooms, until it is as free from dust as is deemed practicable. If deemed necessary by the Engineer/Engineer's Representative, and if the surface is an earth surface or a water-bound base course or subbase, the cleaned surface shall be given a light application of water and allowed to dry to a surface-dry condition before the bituminous material is applied. No traffic shall be permitted on the surface after it has been prepared to receive the bituminous material.

b) Preparation of Concrete surfaces: Prior to the application of the prime coat, the or concrete surface or pavement shall be cleaned of all loose material by means of approved mechanical sweepers and/or hand brooms, followed by approved blowers. All expansion joints shall be cleaned and filled with bituminous material as directed by the Engineer/Engineer's Representative.

c) Heating of Bituminous Materials: Heating shall be with equipment as specified in Section 2390 "Equipment for Heating Bituminous Materials". The use of any method of agitation or heating that introduces free steam or moisture into

the bituminous material is prohibited. Materials heated to temperatures above twenty-eight (3) degrees C higher than the maximum application temperature specified shall be considered as overheated and shall be rejected until the material can be resampled and retested. The reacceptance or final rejection will be made by the Engineer/Engineer's Representative on the same requirements under which the material was originally tested.

d) Temperature of Bituminous Materials at Time of Application Bituminous: materials shall be applied temperatures within the ranges specified by the asphalt institute, USA for the respective type & grade.

e) Prime Coat: The prime coat shall be applied to approved earth surfaces, water-bound base courses, top of roadway shoulders, and concrete surface and pavements as soon as practicable as determined by the Engineer/Engineer's Representative, after they have been prepared and are sufficiently dry.

Areas To Be Primed: The top of earth surfaces or base courses from a point six (6) inches outside the edge of the pavement line to the like point on the opposite side of the roadway.

The top of the shoulders from the intersection of embankment slope and top of sub grade to the edge of the pavement line.

The concrete surfaces.

Other surfaces as shown on the plans or ordered by the Engineer/Engineer's Representative.

Application of the Prime: specified bituminous material shall be applied at the rate as directed by the Engineer/Engineer's Representative, by approved pressure distributors operated by skilled workmen. The spray nozzles and spray bar shall be adjusted and frequently checked so that uniform distribution is insured. Spraying shall cease immediately upon any clogging or interference of any nozzle, and corrective measures taken before spraying is resumed.

Hand sprays will be approved only for priming small patches or inaccessible areas that cannot be primed by normal operation of the distributor.

Care shall be taken that application of bituminous material at the junction of spreads is not in excess of the specified amount. Any excess shall be squeezed from the surface when ordered by the Engineer/Engineer's Representative. Any skipped areas or recognized deficiencies shall be corrected by means of approved hand sprays.

Test Section and Rates of Application: The rate of application for prime material shall be specified by the Engineer/Engineer's Representative within the limits shown below as determined from field trials conducted on a test section or sections. The Contractor shall prior to the time he intends to begin his priming operation, prepare a test section of an approved length for the determination of the rate of application for the prime coat. On projects where surfaces to be primed are constructed of different materials, a test section for each type of material shall

be prepared by the Contractor.

The test methods shall be determined by the Engineer/Engineer's Representative and performed by the Contractor in the presence of the Engineer/Engineer's Representative.

The Engineer/Engineer's Representative may order subsequent test sections and/or alter the previously established rate or rates of application when he deems it necessary.

Application Rates for bituminous material for prime coat shall range from 0.12 gal/sq.yd to 0.32 gal./sq.yd.

In the event that it would be necessary to apply the asphalt in two applications instead of one in order to attain the required quantity or specified results the contractor shall accomplish the same without additional payment.

Protection of Adjacent Structures: When bituminous materials are being applied, the surfaces of all structures, wheel guards, guard rail, kerbs and gutters, and other roadway appurtenances shall be protected in a manner approved by the Engineer/Engineer's Representative to prevent them from being splattered with bituminous material or marred by equipment operation. In the event that any appurtenances becomes splattered or marred, the Contractor shall at his own expense, remove all traces of bituminous materials, and repair all damage and leave the appurtenances in an approved condition.

Blotting: If deemed necessary by the Engineer/Engineer's Representative after the bituminous material has been applied for forty-eight (48) hours under favorable conditions and the prime coat has not dried sufficiently that it will not be damaged by traffic, a light application of aggregate shall be applied. The blotter material shall be a clean fine sand, other material as approved by the Engineer/Engineer's Representative. Blotting material shall be applied sparingly on only the areas that have not dried. Blotting of the prime coat shall be done only when directed by the Engineer/Engineer's Representative. Normally, additional time shall be allowed for drying of the prime coat when in the opinion of the Engineer/Engineer's Representative this procedure does not seriously delay subsequent operations.

Maintenance of Prime Coat: The Contractor shall maintain the prime coat treatment and the surface of the sub grade or base course intact until it shall have been covered by the surface course. Any area where the prime coat has been damaged by traffic or by the Contractor's operations, shall be cleaned of all loose material, the defective base course or sub grade repaired to the satisfaction of the Engineer/Engineer's Representative and the prime coat reapplied. The maintenance and repair of the prime coat and the underlying sub grade or base course shall be done at the Contractor's expense.

Traffic Control: The Contractor shall provide detours for the traveling public and for operational use in areas where priming is being done. Where no convenient detour can be made available, the priming operation shall be confined to one-half (1/2) of the roadway at a time and the Contractor shall provide traffic control

to the satisfaction of the Engineer/Engineer's Representative.

B. Weather and Temperature Limitations

Application of prime coat shall be performed only when the surface is dry, when the atmospheric temperature is above fifteen (15) degrees C, and when the weather is not foggy or rainy.

10.3.3.2 Bituminous Wearing Course

A. Construction Requirements

Rolling equipment shall be self-propelled. The wheels on the rollers shall be equipped with adjustable scrapers and the rollers shall have water tanks and sprinkling apparatus which shall be used to keep the wheels wet and prevent the surface material from sticking.

Weights of two-axle tandem steel rollers, three axle tandem steel rollers, three-wheel steel rollers, and self-propelled pneumatic-tired rollers shall be as specified in Section 2390 Part 2392 Clause 01, sub-clause C, D, E, G and H. The total weight of the pneumatic-tired roller shall be varied as directed by the Engineer/Engineer's Representative.

a) Preparation of Asphalt Cement: Asphalt cement shall be heated within a range of 135 degrees C to 163 degrees C at the time of mixing. All material reheated more than 42 degrees C above the maximum shown shall be considered overheated and shall be rejected until the material can be re-sampled and tested. The re-acceptance or rejection will be made on the same requirements as established for the original material. Asphalt cement received from the refinery at temperatures in excess of 163 degrees C but not exceeding 191 degrees C may be used.

b) Preparation of Mineral Aggregates: Each aggregate ingredient shall be heated and dried at such temperatures that the temperature as recorded in the hot fines bin after screening shall not exceed 163 degrees C. If the aggregates contain sufficient moisture to cause foaming in the mixture or their temperature is in excess of 163 degrees C, they shall be removed from the bins and returned to their respective stockpiles.

Immediately after heating, the aggregate or aggregates shall be screened into at least three (3) sizes and conveyed into separate bins ready for batching and mixing with bituminous material. When the aggregates furnished are of such size and grading that separating into three (3) bins is impractical, the number of required separations may be reduced to two (2) with the approval of the Engineer/Engineer's Representative. The efficiency of the screening operations shall be sufficient to produce, at plant operating capacity, gradations in each of the sizes of heated and dried aggregates which are reasonably uniform and result in the production of a mixture complying with the limits specified for the aggregate.

c) Preparation of Bituminous Mixture: Dried aggregate as specified for bituminous construction and prepared as prescribed above shall be combined in the plant in the proportionate amounts as approved. Asphalt cement shall be introduced into the mixture in the proportionate amount determined by the Engineer/Engineer's Representative. All according to the job-mix formula.

The initial mixing time will be designated by the Engineer/Engineer's Representative. Mixing time may be increased by the Engineer/Engineer's Representative if additional time is necessary to obtain a homogeneous mixture and satisfactory coating.

On batch plants, timing shall being at the start of the asphalt introduction into the pug mill.

The length of mixing time for continuous plants will be determined by the following formula or other approved methods.

$$\text{Mixing time in second} = \frac{\text{Pug mill dead capacity in Kilos}}{\text{Pug mill output in Kilos/second}}$$

The temperature of the asphalt, except for temporary fluctuations, shall not be lower than fourteen (14) degrees C below the temperature of the aggregate at the time the two (2) materials enter the mixer or pug mill.

d) Preparation of Existing Surface: When the bituminous mixture is placed on a prepared surface, and whether or not a prime coat is designated on the plans, the surface shall be prepared to meet the requirements provided in sub-clause A (a) of Section 2, Part 2.2.3.

"Aggregate Base Course" The surface shall be maintained in accordance with sub- clause A (b) of this Section.

Prime Coat: Prior to the placing of the mixture, a prime coat shall be applied to the sub grade or surface in accordance with the standards specified in Part 2332, Clause 01 and as directed by the Engineer/Engineer's Representative.

e) Placing of the Mixture: The bituminous mixture shall be spread and finished true to crown and grade by the automatically controlled bituminous paver. Bituminous mixtures may be spread and finished by hand methods only where machine methods are impractical as determined by the Engineer/ Engineer's Representative.

- The automatically controlled paver shall spread the bituminous mixtures without tearing the surface and shall strike a finish that is smooth, true to cross section, uniform in density and texture and free from hollows, transverse corrugations and other irregularities.

- The paver shall be operated at a speed which will give the best results for the type of paver being used and which coordinates satisfactorily with the rate of delivery of the mixture to the paver so as to provide a uniform rate of placement without intermittent operation of the paver.

All bituminous mixtures shall be delivered to the paver at a temperature between 139 degrees C and 163 degrees C. Mixtures delivered to the paver at lower

temperatures shall be discarded.

The maximum thickness for layers may be increased slightly when such increase is more adaptable to total pavement thickness and when in the opinion of the Engineer/Engineer's Representative it is not detrimental to placement and rolling conditions.

- Preliminary Survey and Reference String Line: The Contractor shall make the survey required for the reference grade. When the survey is approved by the Engineer/Engineer's Representative, the Contractor shall erect and maintain an approved reference string line and operate the paver to conform to the string line for the initial layer and/or any other layers as directed. Elevation control point stakes for the sub grade and first layer of base course shall be set at a maximum spacing of seventy five (75) feet.

The use of the automatically controlled bituminous paver to provide both longitudinal and transverse control shall include the furnishing and maintaining of a string line, whether it be erected or mobile, by the Contractor. The longitudinal and transverse controls shall operate independent of each other to the extent that the surface of the bituminous mixture will conform to the string line and will be uniform in cross section or crown.

The Contractor shall establish the center line points and shall maintain the location of the points until the completion of the surfacing or as directed.

When directed by the Engineer/Engineer's Representative, the Contractor shall erect a string line to be used as a guide for the finishing machine in order to maintain a uniform edge alignment. If any other method is proposed by the Contractor it shall be approved by the Engineer/Engineer's Representative.

- Machine Spreading: The Contractor shall make a survey study of the center line profile and crown of the existing surface or base and determine or calculate a Reference Grade Line and shall furnish to the Engineer/Engineer's Representative for reference and approval the fill values at each profile point necessary to erect the Reference String line.

- On the initial traffic lane paving operation the asphaltic mixture shall be spread with the bituminous paver to a grade line constant to the Reference String Line.

- On erection and maintenance of the Reference String Line shall be so coordinated that the string will be taut and free from sags at the time it is in use as a guide for the paver.

- The Mobile String Line or equivalent shall be used as the reference guide on all paving operations except when the Reference String Line is used or other provisions are made and approved by the Engineer/Engineer's Representative.

- The use of the automatically controlled paver may be waived on irregular sections or other sections when approved by the Engineer/Engineer's Representative.

- If the Contractor uses an approved manually-controlled bituminous paver, the same general placement procedures shall be followed. Thirty (30) days prior to the time the Contractor intends to begin paving, he shall present to the Engineer/Engineer's Representative, for approval, a placement procedure, incorporating the intent of the procedures outlined above, adapted to the Contractor's approved manually- operated bituminous paver. No mixture shall be placed prior to the Engineer/Engineer's Representative's approval of the Contractor's proposed methods and procedures for placing the mixture.

f) Thickness Cores: Thickness determination shall be made at a minimum of six (6) locations per lane per kilometer, or at locations designated by the Engineer/Engineer's Representative. The Contractor shall furnish and operate an approved saw or core drill for cutting samples from the compacted mixtures on the road. The equipment shall be capable of cutting the mixture without shattering the edges of the specimen or otherwise disturbing the density of the specimen. Sawed samples shall be four (4) inches square (nominal) and cored samples shall be four (4) inches in diameter (nominal).

Unless otherwise permitted, cores extracted for thickness measurement shall not be used for density determination and density samples shall not be used for thickness measurements.

g) Compaction of Mixtures: After spreading and strike-off and as soon as the mix conditions permit the rolling to be performed without excessive shoving or tearing, the mixture shall be thoroughly and uniformly compacted.

Rolling shall not be prolonged till cracks appear. Rollers shall be of the steel wheel and/or pneumatic-tire type and shall be in perfect condition, capable of reversing without backlash, and shall be operated at speeds slow enough to avoid displacement of the bituminous mixture. The number and weight of rollers shall be sufficient to compact the mixture to the required density while it is still in a workable condition. The use of equipment which results in excessive crushing of the aggregate will not be permitted. A minimum of three (3) rollers, two (2) steel wheels and one (1) pneumatic-tire type, shall be used with each spreading operation.

Initial or breakdown rolling shall be done by means of either a tandem power steel roller or a three (3) wheel power steel roller. Rolling shall begin as soon as the mixture will bear the roller without undue displacement. Rolling shall be longitudinally, beginning at the low side of the spread of material and proceeding toward the high side, overlapping on successive trips by at least one-half (1/2) the width of the rear wheels. Alternate trips of the roller shall be of slightly different lengths.

The motion of the roller shall at all times be slow enough to avoid displacement of the mixture and the speed of the roller shall be as approved by the Engineer/Engineer's Representative. To prevent adhesion of the mixture to the rollers, the wheels of the rollers shall be kept properly moistened with water, but

an excess of water will not be permitted.

The initial or breakdown rolling shall be followed by rolling with a pneumatic-tired roller. Final compaction and finish rolling shall be done by means of a tandem power steel roller unless otherwise designated. When the specified density is not obtained, changes in size and/or number of rollers shall be made as corrective measures to satisfy the density requirement.

Rollers shall be operated by competent and experienced roller men and shall be kept in operation continuously, if necessary, so that all parts of the pavement will receive substantially equal compaction at the time desired. The Engineer/Engineer's Representative will order the mixing plant to cease operation at any time proper rolling is not being performed.

The road density requirements shall be equal to or greater than ninety-six (96) percent of the Marshall Density of each day's production.

Any mixture that becomes loose, broken, mixed with foreign material, or which is in any way defective in finish or density, or which does not comply in all other respects with the requirements of the specifications shall be removed, replaced with suitable material, and finished in accordance with the specifications.

h) Contact Surfaces: Contact surfaces of kerb, gutters, man holes, and similar structures shall be painted with a thin uniform coating of asphaltic material approved by the Engineer/Engineer's Representative. The bituminous mixture shall be placed uniformly high near the contact surfaces so that after compaction it will be one half (1/2) inch above the edge of such structures.

j) Joints: Joints between old and new pavements or between successive days' work shall be made using proper heaters so as to insure thorough and continuous bond between the old and new mixtures. Transverse construction joints in previously laid material shall be constructed by cutting the material back vertically for its full depth so as to expose a fresh surface.

Before placing the fresh mixture against a cut joint or against old pavement, the contact surface shall be sprayed or painted with a thin uniform coat of appropriate type of bitumen. Where a finishing machine is used, the longitudinal joint shall be made by overlapping the screed on the previously laid material for a width of at least one (1) inch and depositing a sufficient amount of mixture so that the joint formed will be smooth and tight.

k) Protection of Fresh Mixture: The Contractor shall protect all sections of newly compacted mixture from traffic until they have hardened properly.

l) Maintenance of Traffic: Traffic be maintained through the project, detouring of traffic will be permitted.

B. Surface Tolerances

The surface will be tested with a five (5) feet straightedge by the Engineer/Engineer's Representative at selected locations. The variation of the

surface from the testing edge of the straightedge between any two (2) contacts with the surface shall at no point exceed point one (.10) inch when placed on or parallel to the center line or when placed perpendicular to the center line of the roadway. All humps and depressions exceeding the specified tolerance shall be corrected by removing the defective Work and replacing it with new material as directed by the Engineer/Engineer's Representative.

C. Compaction, Sampling and Testing

Densities herein called "Field Mold Densities" will be determined as the Work progresses. The Field Mold Density shall be determined in accordance with AASHTO T166. The briquettes used in this ascertainment shall be made of the same material used in construction, taken from samples of freshly-mixed bituminous mixture at the plant. Reheating of the mixture will not be permitted.

The density of the mixture as placed and compacted on the road shall be determined from samples cut from the compacted courses on the road at locations specified by the Engineer/Engineer's Representative. Samples shall be obtained in sets of two (2) cut from the same location on the road. The frequency of testing shall be one (1) set of samples per traffic lane per two thousand (2000) linear feet or a minimum of one (1) set per day for shorter runs, and such additional tests to determine limits of areas deficient in density, or for recheck. The density of these samples will be referred to as "Road Density".

The Contractor shall cut the samples with an approved saw or core drill in the presence of the Engineer/Engineer's Representative. The equipment shall be capable of cutting the mixture without shattering the edges of the specimen or otherwise disturbing the density of the specimen. Samples shall be four (4) inches square (nominal) or four (4) inches in diameter (nominal).

Unless otherwise permitted, samples extracted for thickness measurement shall not be used for density determination and density samples shall not be used for thickness measurements.

The Contractor shall when necessary furnish and apply cold water, ice or other cooling substance to the surface of the pavement to prevent the samples from shattering or disintegrating. The Contractor shall cut all samples and fill and compact all test holes at his own expense.

D. Weather Limitations

Hot asphaltic mixtures shall be placed only when the air temperature is four (4) degrees C or above, and when the weather is not foggy or rainy and when the existing surface is free from moisture.

10.3.3.3 Bituminous Surface Treatment

A. Construction Requirements

a) Preparation of Surfaces: Surfaces shall be prepared in accordance with the requirements specified in Part 2333, Clause 01. "Bituminous Prime Coat". At the

time of the application, the weather shall be warm and dry and the road surface shall be clean and dry. Spraying shall not be done unless the road temperature is above twenty (20) degree C for at least one hour prior to the commencement of spraying operations, and the temperature shall not be less than twenty (20) degree C during the spraying. Prior to applying the asphaltic material, dirt and other objectionable materials shall be removed from the surface and surface shall be primed. If so directed by the Engineer/Engineer's Representative the surface shall be cleaned by power brooming or wire brush until all loose and foreign materials are removed.

b) Traffic Control: Traffic shall be detoured during execution of this work. No separate payment shall be made for conformance to this paragraph, all items being considered subsidiary to all of the items in the Bill of Quantities.

c) Heating of Bituminous Materials: Heating shall be with equipment as specified in section 2390 subparagraph D(6) "Equipment for Heating Bituminous Materials". The use of any method of agitation or heating that introduces free steam or moisture into the bituminous material is prohibited. Materials heated to temperatures above twenty-eight (3) degrees C higher than the maximum application temperature specified shall be considered as overheated and shall be rejected until the material can be resampled and retested. The reacceptance or final rejection will be made by the Engineer/Engineer's Representative on the same requirements under which the material was originally tested.

d) Temperature of Bituminous Materials: The temperature of bituminous materials at the time of application shall be within the ranges specified in Part 2332, Clause 03. " Bituminous Wearing Course".

e) Prime Coat:

- General: The bituminous prime coat shall be applied to the base course as shown on the plans or as established by the Engineer/Engineer's Representative. The prime coat shall be applied in accordance with the requirements specified in Part 2332, Clause 01. "Bituminous Prime Coat".

- Rate of Application: The rate of application shall be in accordance with the requirements specified in subpara graph D.5 of Clause 2333, Part 01. "Bituminous Prime Coat".

f) First Seal Coat: After the prime coat has been applied and has thoroughly penetrated the surface and cured as specified in subparagraph A (e) of Clause 2331, Part 01. "Bituminous Prime Coat", the Contractor shall apply the bituminous Seal Coat and shall apply the cover material and roll and manipulate the surface all in accordance with the requirements specified hereinafter:

- Application of Bituminous Material: Bituminous material shall be applied by means of a pressure distributor in a uniform, continuous spread over the section to be treated and within the temperature range specified. The quantity of bituminous material to be used per square meter shall be within the limits

hereinafter specified and as directed by the Engineer/Engineer's Representative.

A strip of building paper, at least three (3) feet wide and with a length equal to that of the spray bar of the distributor plus twelve (12) inches shall be used at the beginning of each spread. If the cut-off is not positive, the use of paper may be required by the Engineer/Engineer's Representative at the end of each spread. The paper shall be removed and disposed of in an approved manner. The distributor shall be moving forward at proper application speed at the time the spray bar is opened. Any skipped areas or deficiencies shall be corrected in an approved manner. Junctions of spreads shall be carefully made to assure a smooth riding surface.

The length of spread of bituminous material shall not be in excess of the which trucks loaded with cover coat material can immediately cover.

The spread of bituminous material shall not be more than six (6) inches wider than the width covered by the cover coat material from the spreading device. Under no circumstances shall operations proceed in such manner that bituminous material will be allowed to chill, set up, dry, or otherwise impair retention of the cover coat.

The distributor, when not spreading, shall be so designed that the spray bar or mechanism will not drip bituminous materials on the surface of the traveled way.

Distribution of the bituminous material shall be so regulated and sufficient bituminous material left in the distributor at the end of each application so that there will be a uniform distribution of bituminous material. In no case shall the distributor be allowed to expel air with the bituminous material thereby causing uneven coverage.

- Application of Aggregate: Immediately following the application of the bituminous material, cover material shall be spread with an approved aggregate spreader in quantities as specified by the Engineer/Engineer's Representative and within the limits specified herein. Spreading shall be accomplished in such a manner that the tires of the trucks or aggregate spreader at no time contact the uncovered and newly applied bituminous material. No portion of the binder shall remain uncovered for a period in excess of 20 (twenty) minutes after spraying.

- Procedures of starting, stopping or turning of any piece of equipment which results in displacement of the cover material or damage to the seal courses shall be prohibited.

- The spreading equipment shall be of such width and arrangement that as the aggregate is placed complete coverage will be obtained. No brooming dragging, or blading of the cover material shall be permitted prior to initial rolling. Any arrangement of the cover material shall be done with hand methods. Overlapping the applications of cover material shall be avoided and all spillage shall be removed from the surface. Before rolling, the bituminous material shall be uniformly covered.

- When directed by the Engineer/Engineer's Representative, the Contractor will be required to add bituminous material or aggregate or both bituminous material and aggregate to portions of the project. Furnishing additional bituminous material and furnishing spreading dragging and rolling of additional aggregate will not be paid for separately but will be considered as subsidiary Work pertaining to the item of "Triple Bituminous Surface Treatment".

- **Manipulation:** Immediately after the application of bituminous material and aggregate to the road surface and after the aggregate has been rearranged as may be necessary to provide uniform and complete coverage, the surface shall be sufficiently rolled with an approved pneumatic-tired roller to embed the aggregate thoroughly into the bituminous material. Sufficient rollers shall be provided that the initial rolling consisting of two (2) complete coverages with the pneumatic-tired roller shall be completed within thirty (30) minutes after the cover material is applied. The rollers shall be operated on each coverage so that each succeeding trip of the roller will overlap at least fifty (50) percent of the width of the preceding trip. No blading or dragging of the aggregate will be permitted for the first seal coat. Any rearrangement of the cover material before or during the initial rolling shall be done by approved hand methods. Rolling shall be continued after the rolling specified above is completed until a maximum amount of the aggregate is satisfactorily embedded in the bituminous material. Pneumatic-tired rollers shall be operated at a maximum speed of eight (8) kilometers per hour.

g) Second and third Seal Coat: Immediately prior to the second application of bituminous material for sealing the surface shall be cleaned in an approved manner of all dust and excess cover material which is not embedded in the first application of bituminous material for sealing. Care shall be exercised not to dislodge any cover material which is embedded in the bituminous material. The second seal coat shall be applied as specified hereinbefore, except that immediately following completion of the initial pneumatic rolling the surface shall be rolled with an approved steel roller. Brooms or drag brooms shall not be used to shift the cover material until the initial rolling with the pneumatic-tired and steel rollers is completed and until the bituminous material has cooled and set up sufficiently to hold the cover material, preferably not earlier than the day following the application of the second seal coat. Any rearrangement of the cover material during the initial rolling shall be done by approved hand methods. The rolling shall be longitudinal and shall commence at the outer edges of the road, overlapping the shoulders, and progress toward the center. Rolling shall continue until the entire surface has been completely covered at least two (2) times with a pneumatic-tired roller and one (1) time with a steel wheel roller. Maximum speed of rollers shall be as hereinbefore specified.

- Additional Manipulation of Completed Surface: The Contractor shall manipulate the surface for a period of five (5) days after the second seal coat has been applied. The manipulation shall consist of the application of additional bituminous material or aggregate or additional dragging and rolling or all of these

operations to portions of the surface that, as determined by the Engineer/Engineer's Representative, require such additional treatment. The manipulation shall also include the dragging and one (1) complete rolling with the steel roller over the entire surface each day from the time the surface is completed until and including the fifth (5th) day after. A light blade equipped with broom drag shall be operated immediately ahead of the roller throughout all rolling during the manipulation period. The daily dragging and rolling under manipulation may be omitted, if in the opinion of the Engineer/Engineer's Representative, the weather and roadbed conditions are such that the dragging and rolling would not be beneficial to the surface.

The third seal coat shall also be applied in a similar way, if required.

Bituminous material, aggregate and additional manipulation ordered by the Engineer/Engineer's Representative, in this Work, will not be paid for separately but will be considered subsidiary to the item of "Triple Bituminous Surface Treatment" included in the "Bill of Quantities".

h) Rates of Application: The rates of application for bituminous material and aggregate for "Bituminous Surface Treatment" shall be within the following limits:

Aggregate Coverage Bituminous Material

Application	Size	Lbs./sq.ft min.	Lbs./sq.ft max.	Lbs./sq.ft min.	Lbs./sq.ft max.
First Course 1	4.5	5.5	0.37	0.46	
Second Course 2	2.5	3.0	0.18	0.32	
Third Course 3	1.4	2.5	0.14	0.10	
Seal Coat with Aggregate		0.75	0.85		

- The specific rates of application of the bituminous material and aggregates will be established by the Engineer/Engineer's Representative from a test section performed in general conformance to the requirements specified in Part 2333, Clause 01. "Bituminous Prime Coat" and as directed by the Engineer/Engineer's Representative.

i) Final Inspection: After all other Work has been completed, and prior to final inspection and acceptance the excess loose cover material along the edges of the surface shall be broomed and bladed off the shoulder to provide a definite and distinct line along the edge of the sealed surface. The tolerance limits or finishing requirements shall be same as given for bituminous wearing course.

- Working Period: All Work shall be so conducted that the Work of applying asphalt and aggregate and of all rolling shall be completed during the time from sunrise to sunset and under favorable weather conditions as determined by the Engineer/Engineer's Representative.

10.3.4. MEASUREMENT AND PAYMENT

The quantities of bituminous wearing course and bituminous surface treatment shall be measured by number of square meter of the surface of compacted material placed in accordance with the plans, specifications and direction of the Engineer/Engineer's

Representative.

The quantity of bituminous or Asphaltic material used is also included in the asphalt concrete mixture and will not be measured separately.

No separate or direct payment shall be made for prime coat, furnishing all labour, materials tools, equipment and incidentals and for performing all the work involved in applying prime coat complete in place as per specifications or direction of the Engineer/Engineer's Representative. The cost thereof shall be deemed to be included in other items of bituminous concrete wearing course or bituminous surface treatment. Quantities of bituminous material, wasted or remaining on hand after completion of the work, shall not be measured or paid for.

The quantities determined as provided above shall be paid for at the contract unit price respectively for each of the particular pay items as shown in the Bill of Quantities, which prices and payment shall constitute full compensation for all the costs necessary for the proper completion of the work prescribed in this item:

[Refer for General Specifications to]

General Specifications
(Technical Specifications for Workmanship)
MRS – 2020/2022
Communication and Works Department, KPK

DRAWING

SATTI KALI DAM

PACKAGE = 02

1 MAIN CANAL

2 HYDRAULIC STRUCTURE

MAIN CANAL

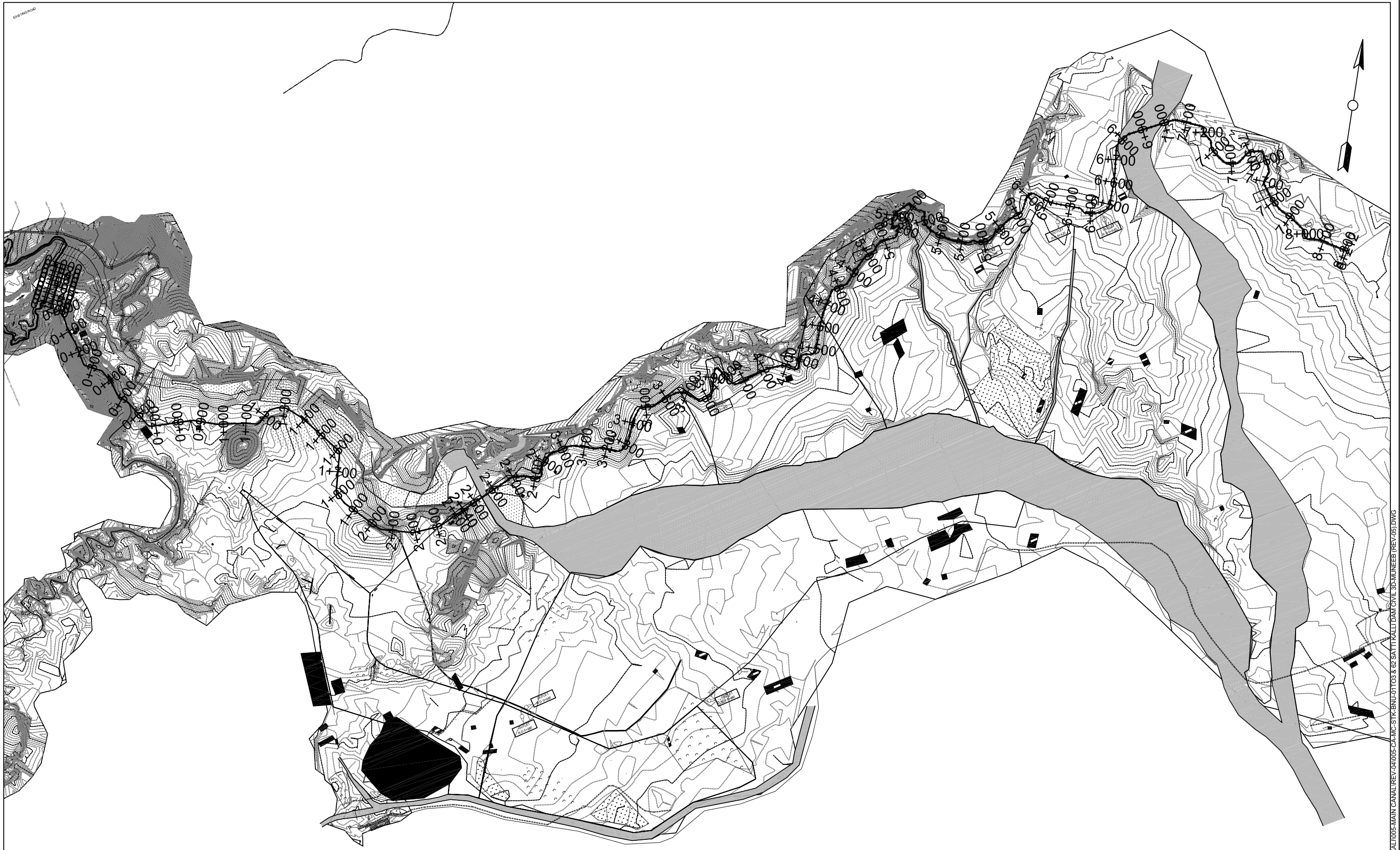
INDEX SHEET

DETAIL DESIGN & CONSTRUCTION SUPERVISION OF SATTI KALLI DAM DISTRICT BANNU

PACKAGE-02

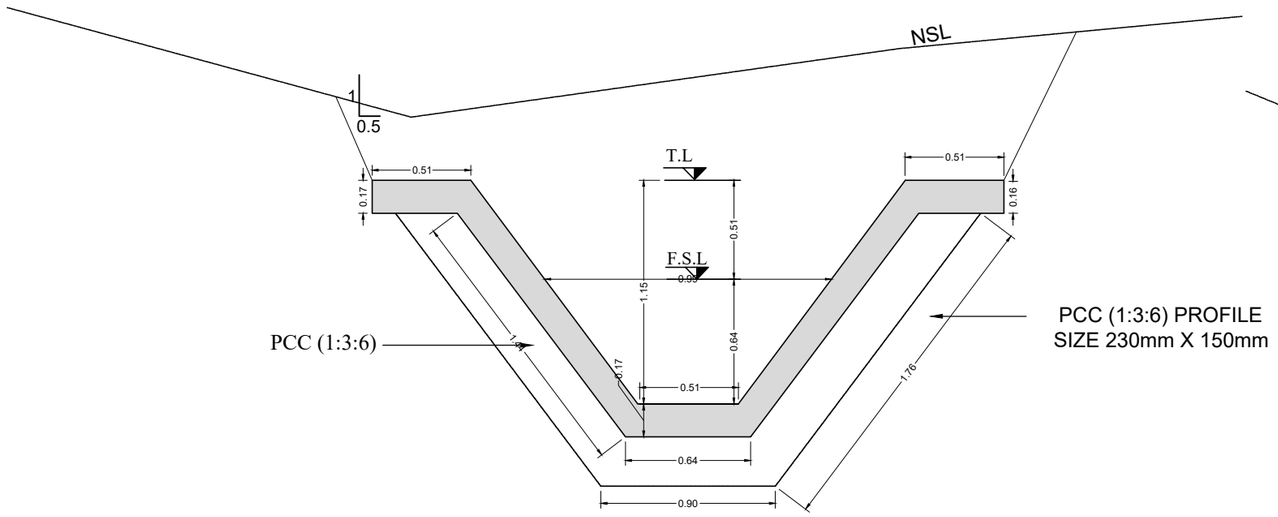
LIST OF DRAWINGS

SR. NO	DRAWING NO.	DESCRIPTION	SHEET
	01. MAIN CHANNEL		
01	005-CA-MC-KP-STK-BNU-01	KEY PLAN OF IRRIGATION	01
02	005-CA-MC-TS-STK-BNU-02	TYPICAL SECTIONS-01	02
03	005-CA-MC-TS-STK-BNU-03	TYPICAL SECTIONS-02	03
04	005-CA-MC-TS-STK-BNU-04 TO 14	PLAN & PROFILE	04-14
	02. MAIN CHANNEL HYDRAULIC STRUCTURES		
01	007-CA-HYS-STK-BNU-01	FLOOD ESCAPE	15
02	007-CA-HYS-STK-BNU-02	FALL CHUTE-01	16
03	007-CA-HYS-STK-BNU-03	FALL CHUTE-02	17
04	007-CA-HYS-STK-BNU-04	PIPE OUTLET	18
05	007-CA-HYS-STK-BNU-05	PIPE CULVERT PLAN	19
06	007-CA-HYS-STK-BNU-06	PIPE CULVERT ELEVATION	20
07	007-CA-HYS-STK-BNU-07	SUPER PASSAGE PLAN	21
08	007-CA-HYS-STK-BNU-08	SUPER PASSAGE SECTIONS	22
09	007-CA-HYS-STK-BNU-09	TAIL CLUSTER	23
10	007-CA-HYS-STK-BNU-10	AQUEDUCT PLAN	24
11	007-CA-HYS-STK-BNU-11	AQUEDUCT SECTIONS	25
12	007-CA-HYS-STK-BNU-12	PIPE CULVERT-01 PLAN	26
13	007-CA-HYS-STK-BNU-13	PIPE CULVERT-02 PLAN	27
14	007-CA-HYS-STK-BNU-15	BOX CULVERT	28
15	007-CA-HYS-STK-BNU-16	ESCAPE CHANNEL	29
16	007-CA-HYS-STK-BNU-17	PIPE CULVERT PLAN	30
17	007-CA-HYS-STK-BNU-18	PIPE CULVERT SECTION	31
18	007-CA-HYS-STK-BNU-19	SUPER PASSAGE	32
19	007-CA-HYS-STK-BNU-20	BOX CULVERT	33
20	007-CA-HYS-STK-BNU-21	ROAD CROSSING CULVERT	34
21	007-CA-HYS-STK-BNU-22	TYPICAL PIPE OUTLET	35
22	007-CA-HYS-STK-BNU-23	TAIL CLUSTER	36
23	007-CA-HYS-STK-BNU-24	AQUEDUCT PLAN (0+629 TO 0+651)	37
24	007-CA-HYS-STK-BNU-25	AQUEDUCT PLAN REINFORCEMENT	38
25	007-CA-HYS-STK-BNU-26	AQUEDUCT PLAN	39
26	007-CA-HYS-STK-BNU-27 TO 36	AQUEDUCT PROFILE	40-50
27	007-CA-HYS-STK-BNU-37 TO 45	AQUEDUCT PLAN	50-59
28	007-CA-HYS-STK-BNU-46 TO 49	RETAINING WALL	59-63
29	007-CA-HYS-STK-BNU-50 TO 53	RETAINING WALL & BOX CULVERT	63-67



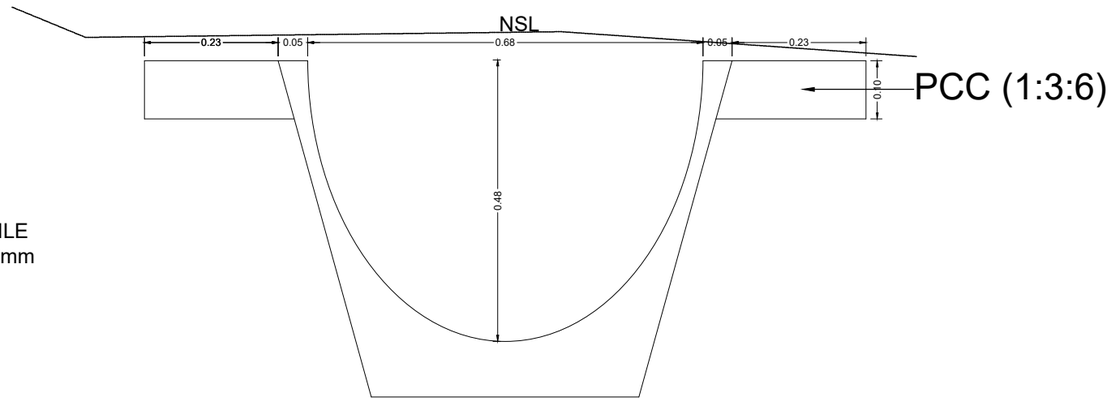
CLIENT:	CONSULTANT:	REV	DESCRIPTION	DATE	PROJECT:				SIGNATURE + SEAL
GOVERNMENT OF KHYBER PAKHTUNKHWA DIRECTORATE GENERAL SMALL DAMS, IRRIGATION DEPARTMENT, PESHAWAR	CONSULTING ASSOCIATES NS TOWER, HAYATABAD COMMERCIAL COMPLEX, NEAR (WFP) WAREHOUSE, MAIN ACHINI BALA ROAD, PESHAWAR, PAKISTAN PH: +92 91 5701774 EMAIL: Consultingassociates127@gmail.com				SATI KALLI DAM PROJECT DISTRICT, BANNU	DRAWN BY: MUNEEB KHAN DESIGNED BY: DAWOOD KHAN CHECKED BY: SHAKIL AHMAD	ISSUED FOR CONSTRUCTION SCALE: NTS		
		R-01	ISSUED FOR CONSTRUCTION	APR-2019	TITLE: KEY PLAN OF IRRIGATION CHANNELS	DRAWING NUMBER : 005-CA-MC-KP-STK-BNU-01 SHEET NO:		REV NO 05	
		C-00	ISSUED FOR CONSTRUCTION	21-FEB-23					

F:\33 SATTI KALLI\REV-05\F-WAHID SATTI KALLI\005-MAIN CANAL\REV-04\005-CA-MC-STK-BNU-01\TO3 & 62 SATTI KALLI DAM CIVIL 3D-MUNEEB (REV-05).DWG



7

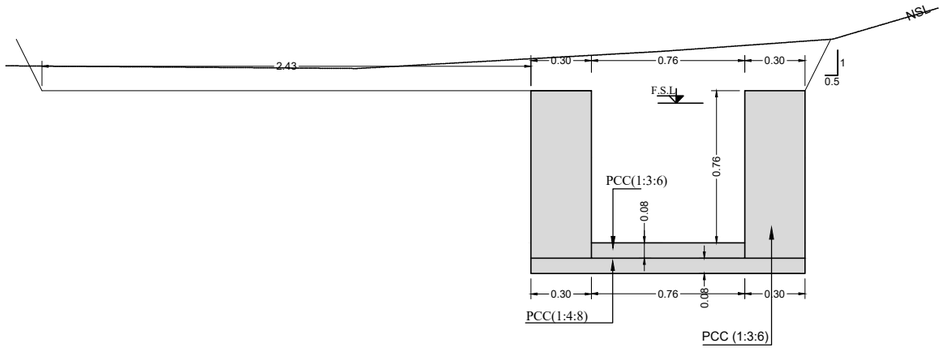
MAIN CHANNEL TYPICAL SECTION
RD 7+000 ~ TAIL



TYPICAL SECTION OF P ARABOLIC
SEGMENT TYPE SPL-D SUB MINOR
RD 0+2000M

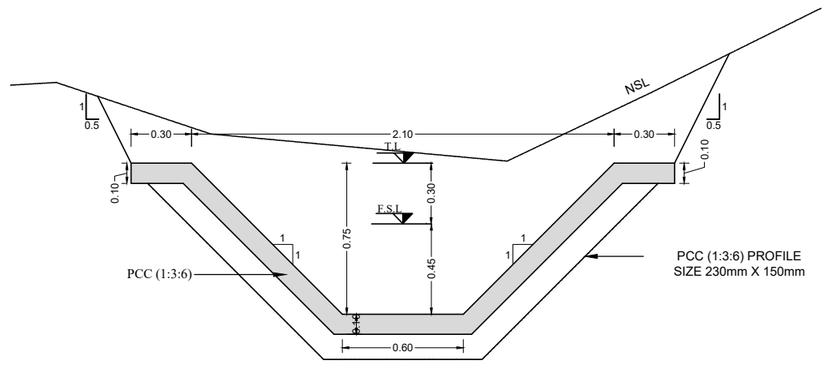
CLIENT:	CONSULTANT:	REV	DESCRIPTION	DATE	PROJECT:	DRAWN BY: MUNEEB KHAN	ISSUED FOR CONSTRUCTION	SIGNATURE + SEAL
GOVERNMENT OF KHYBER PAKHTUNKHWA DIRECTORATE GENERAL SMALL DAMS, IRRIGATION DEPARTMENT, PESHAWAR	CONSULTING ASSOCIATES NS TOWER, HAYATABAD COMMERCIAL COMPLEX, NEAR (WFP) WAREHOUSE, MAIN ACHINI BALA ROAD, PESHAWAR, PAKISTAN PH: +92 91 5701774 EMAIL: Consultingassociates127@gmail.com				SATI KALLI DAM PROJECT DISTRICT, BANNU	DESIGNED BY: DAWOOD KHAN CHECKED BY: SHAKIL AHMAD	SCALE:	
					TITLE: IRRIGATION CHANNEL TYPICAL SECTION-01	DRAWING NUMBER : 005-CA-MC-TS-STK-BNU-02 SHEET NO:	REV NO 05	
		R-01	ISSUED FOR CONSTRUCTION	APR-2019				
		C-00	ISSUED FOR CONSTRUCTION	21-FEB-23				

F:\33 SATTI KALLI\REV-06 PACKAGES\PACKAGE-02\005-MAIN CHANNEL\005-CA-MC-STK-BNU-01 TO 3 & 62 SATTI KALLI DAM CIVIL 3D-MUNEEB (REV-05).DWG



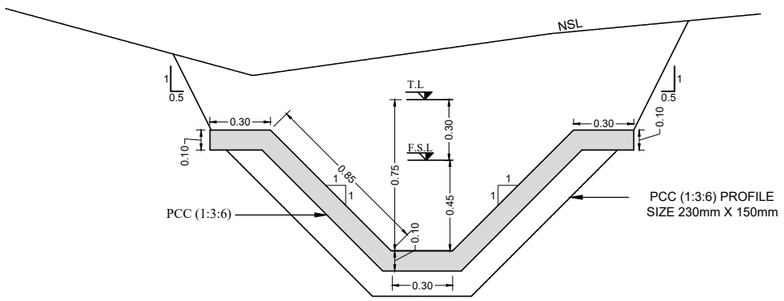
1

MAIN CHANNEL TYPICAL SECTION
RD 0+000 ~ 0+740



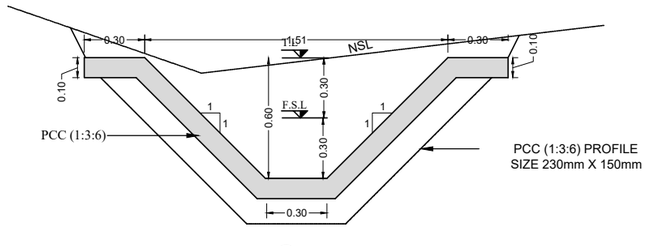
2

MAIN CHANNELTYPICAL SECTION
RD 0+740 ~ 2+070



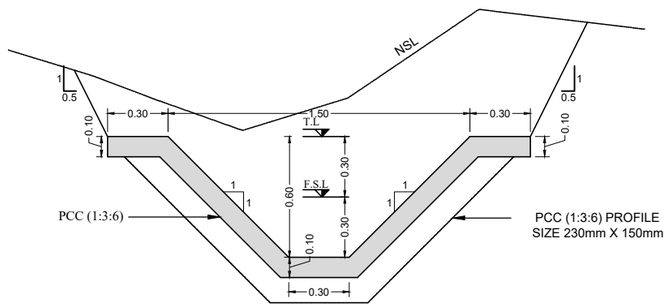
3

MAIN CHANNEL TYPICAL SECTION
RD 2+070 ~ 6+640



4

MAIN CHANNEL TYPICAL SECTION
RD 6+640 ~ 8+000

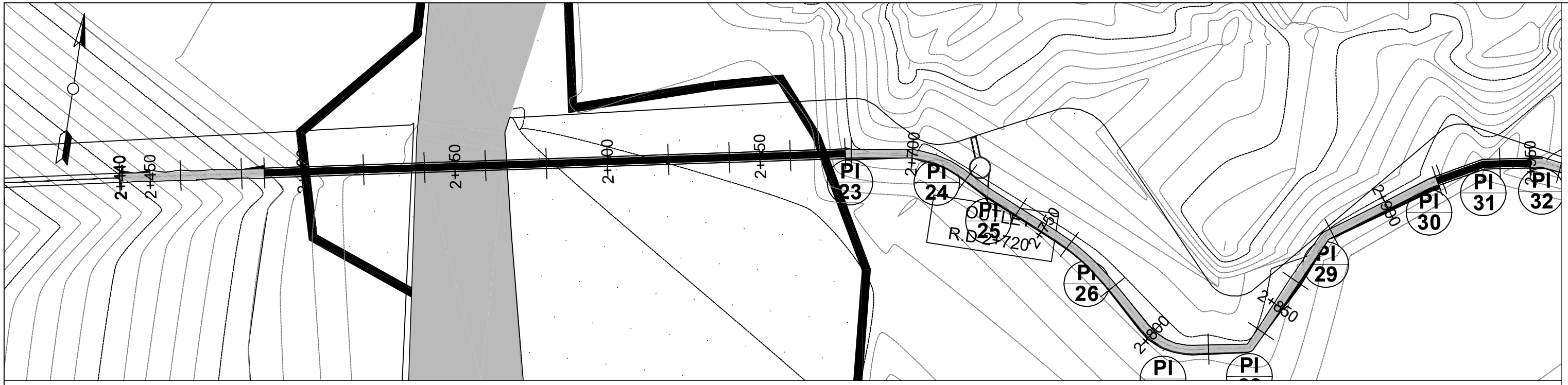


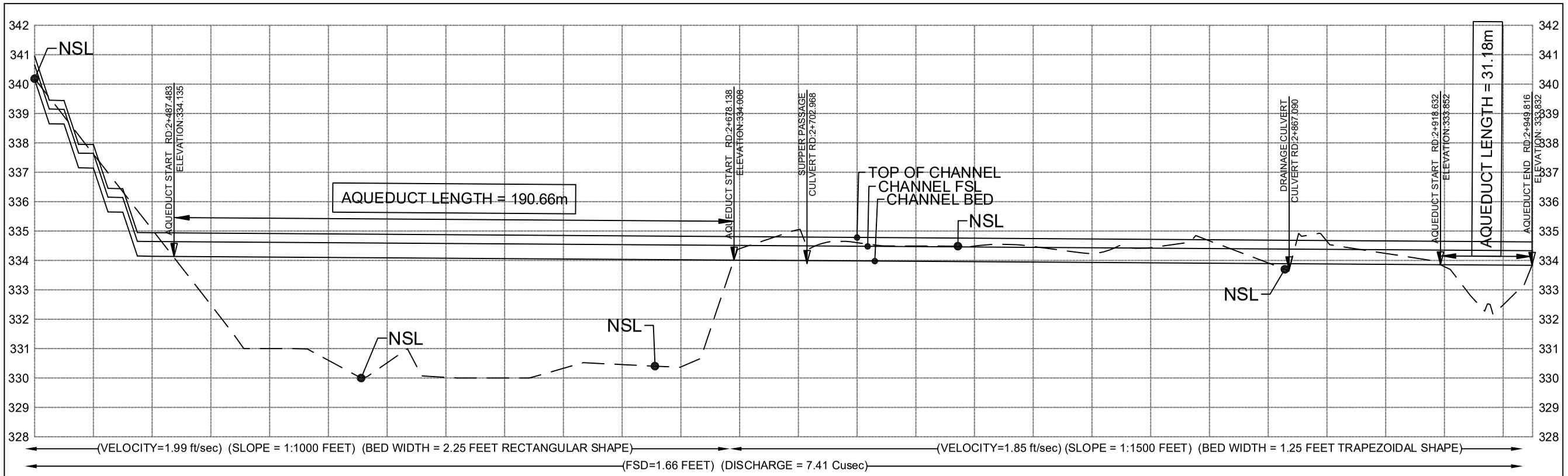
1

MINOR CHANNEL TYPICAL SECTION
RD 0+000 ~ 2+000

CLIENT:	CONSULTANT:	REV	DESCRIPTION	DATE	PROJECT:	DRAWN BY: MUNEEB KHAN	ISSUED FOR CONSTRUCTION	SIGNATURE + SEAL
GOVERNMENT OF KHYBER PAKHTUNKHWA DIRECTORATE GENERAL SMALL DAMS, IRRIGATION DEPARTMENT, PESHAWAR	CONSULTING ASSOCIATES NS TOWER, HAYATABAD COMMERCIAL COMPLEX, NEAR (WFP) WAREHOUSE, MAIN ACHINI BALA ROAD, PESHAWAR, PAKISTAN PH: +92 91 5701774 EMAIL: Consultingassociates127@gmail.com				SATI KALLI DAM PROJECT DISTRICT, BANNU	DESIGNED BY: DAWOOD KHAN CHECKED BY: SHAKIL AHMAD	SCALE:	
		R-01	ISSUED FOR CONSTRUCTION	APR-2019	TITLE: IRRIGATION CHANNEL TYPICAL SECTION-02	DRAWING NUMBER : 005-CA-MC-TS-STK-BNU-03 SHEET NO:	REV NO 05	
		C-00	ISSUED FOR CONSTRUCTION	21-FEB-23				

P:\33 SATTI KALLI\REV-06 PACKAGES\PACKAGE-02\005-MAIN CHANNEL\005-CA-MC-STK-BNU-01 TO 3 & 62 SATTI KALLI DAM CIVIL 3D-MUNEEB (REV-05).DWG





RD	DBL NSL	FSL TOC
2+440	340.150 340.183	340.950 340.650
2+460	337.140 337.619	337.940 337.640
2+480	334.140 335.054	334.940 334.640
2+500	334.127 332.490	334.927 334.627
2+520	334.114 331.000	334.914 334.614
2+540	334.101 330.602	334.901 334.601
2+560	334.088 330.519	334.888 334.588
2+580	334.074 330.023	334.874 334.574
2+600	334.061 330.000	334.861 334.561
2+620	334.048 330.329	334.848 334.548
2+640	334.035 330.458	334.835 334.535
2+660	334.022 330.376	334.822 334.522
2+680	334.009 334.396	334.809 334.509
2+700	333.996 335.047	334.796 334.496
2+720	333.983 334.604	334.783 334.483
2+740	333.969 334.490	334.769 334.469
2+760	333.956 334.487	334.756 334.456
2+780	333.943 334.472	334.743 334.443
2+800	333.930 334.238	334.730 334.430
2+820	333.917 334.434	334.717 334.417
2+840	333.904 334.667	334.704 334.404
2+860	333.891 333.912	334.691 334.391
2+880	333.878 334.649	334.678 334.378
2+900	333.865 334.237	334.665 334.365
2+920	333.851 333.787	334.651 334.351
2+940	333.838 332.490	334.638 334.338
2+950	333.832 333.877	334.632 334.332

MAIN-CANAL-2+440-TO-END - PROFILE
VERTICAL EXAGGERATION = 10.000

CLIENT:

GOVERNMENT OF KHYBER PAKHTUNKHWA
DIRECTORATE GENERAL SMALL DAMS,
IRRIGATION DEPARTMENT, PESHAWAR

CONSULTANT:

CONSULTING ASSOCIATES
NS TOWER, HAYATABAD COMMERCIAL COMPLEX,
NEAR (WFP) WAREHOUSE, MAIN ACHINI BALA ROAD,
PESHAWAR, PAKISTAN
PH: +92 91 5701774
EMAIL: Consultingassociates127@gmail.com

REV	DESCRIPTION	DATE
R-01	ISSUED FOR CONSTRUCTION	APR-2019
C-00	ISSUED FOR CONSTRUCTION	21-FEB-23

PROJECT:
SATI KALLI DAM PROJECT
DISTRICT, BANNU

TITLE:
MAIN CHANNEL
PLAN & PROFILE

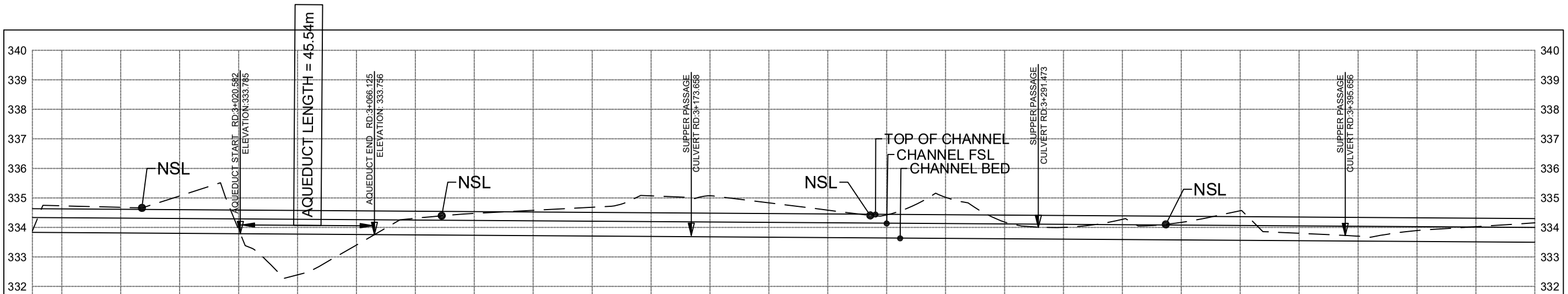
DRAWN BY:	MUNEEB KHAN
DESIGNED BY:	DAWOOD KHAN
CHECKED BY:	SHAKIL AHMAD

ISSUED FOR CONSTRUCTION
SCALE: NTS

DRAWING NUMBER : 005-CA-MC-P&P-STK-BNU-04
REV NO 05
SHEET NO:

SIGNATURE + SEAL

F:\33 SATTI KALLI\REV-06 PACKAGES\PACKAGE-02\005-MAIN CHANNEL\005-CA-MC-STK-BNU-01 TO 3 & 62 SATTI KALLI DAM CIVIL 3D-MUNEEB (REV-05).DWG



(VELOCITY=1.85 ft/sec) (SLOPE=1:1500 FEET) (DISCHARGE=7.41 Cusec) (BED WIDTH=1.25 FEET (TRAPEZOIDAL SHAPE))

RD	DBL NSL	FSL TOC
2+950	333.832	334.632
2+960	333.877	334.332
	333.825	334.625
	334.732	334.325
2+980	333.812	334.612
	334.679	334.312
3+000	333.799	334.599
	335.068	334.299
3+020	333.786	334.586
	333.928	334.286
3+040	333.773	334.573
	332.392	334.273
3+060	333.760	334.560
	333.402	334.260
3+080	333.747	334.547
	334.308	334.247
3+100	333.733	334.533
	334.473	334.233
3+120	333.720	334.520
	334.576	334.220
3+140	333.707	334.507
	334.680	334.207
3+160	333.694	334.494
	335.070	334.194
3+180	333.681	334.481
	335.070	334.181
3+200	333.668	334.468
	334.831	334.168
3+220	333.655	334.455
	334.584	334.155
3+240	333.642	334.442
	334.423	334.142
3+260	333.628	334.428
	335.019	334.128
3+280	333.615	334.415
	334.183	334.115
3+300	333.602	334.402
	334.000	334.102
3+320	333.589	334.389
	334.271	334.089
3+340	333.576	334.376
	334.168	334.076
3+360	333.563	334.363
	334.562	334.063
3+380	333.550	334.350
	333.799	334.050
3+400	333.537	334.337
	333.702	334.037
3+420	333.524	334.324
	333.893	334.024
3+440	333.510	334.310
	334.026	334.010
3+460	333.497	334.297
	334.152	333.997

MAIN-CANAL-2+440-TO-END - PROFILE
VERTICAL EXAGGERATION = 10.000

CLIENT:

GOVERNMENT OF KHYBER PAKHTUNKHWA
DIRECTORATE GENERAL SMALL DAMS,
IRRIGATION DEPARTMENT, PESHAWAR

CONSULTANT:

CONSULTING ASSOCIATES
NS TOWER, HAYATABAD COMMERCIAL COMPLEX,
NEAR (WFP) WAREHOUSE, MAIN ACHINI BALA ROAD,
PESHAWAR, PAKISTAN
PH: +92 91 5701774
EMAIL: Consultingassociates127@gmail.com

REV	DESCRIPTION	DATE
R-01	ISSUED FOR CONSTRUCTION	APR-2019
C-00	ISSUED FOR CONSTRUCTION	21-FEB-23

PROJECT:
SATI KALLI DAM PROJECT
DISTRICT, BANNU

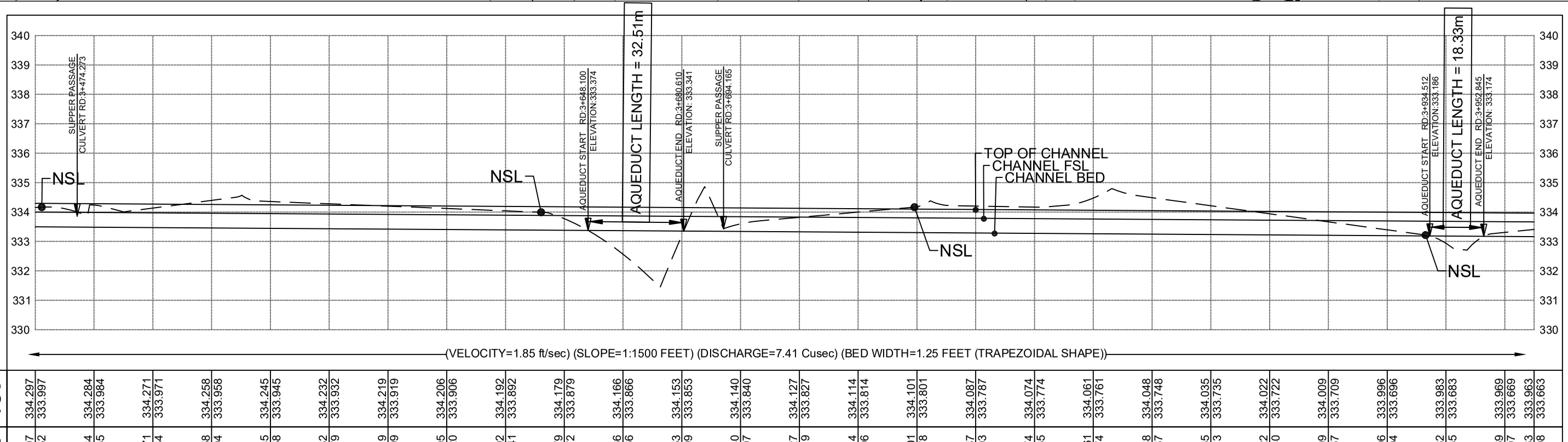
TITLE:
MAIN CHANNEL
PLAN & PROFILE

DRAWN BY:	MUNEEB KHAN
DESIGNED BY:	DAWOOD KHAN
CHECKED BY:	SHAKIL AHMAD

ISSUED FOR CONSTRUCTION
SCALE: 1:1250
DRAWING NUMBER : 005-CA-MC-P&P-STK-BNU-05
REV NO 05
SHEET NO:

SIGNATURE + SEAL

F:\33 SATTI KALLI\REV-06 PACKAGES\PACKAGE-02\005-MAIN CHANNEL\005-CA-MC-STK-BNU-01 TO 3 & 62 SATTI KALLI DAM CIVIL 3D-MUNEEB (REV-05).DWG



(VELOCITY=1.85 ft/sec) (SLOPE=1:1500 FEET) (DISCHARGE=7.41 Cusec) (BED WIDTH=1.25 FEET (TRAPEZOIDAL SHAPE))

RD	DBL NSL	FSL TOC
3+460	333.497 / 334.152	334.297 / 333.997
3+480	333.484 / 334.235	334.284 / 333.984
3+500	333.471 / 334.134	334.271 / 333.971
3+520	333.458 / 334.394	334.258 / 333.958
3+540	333.445 / 334.358	334.245 / 333.945
3+560	333.432 / 334.279	334.232 / 333.932
3+580	333.419 / 334.199	334.219 / 333.919
3+600	333.405 / 334.120	334.206 / 333.906
3+620	333.392 / 334.041	334.192 / 333.892
3+640	333.379 / 333.772	334.179 / 333.879
3+660	333.366 / 332.566	334.166 / 333.866
3+680	333.353 / 333.199	334.153 / 333.853
3+700	333.340 / 333.597	334.140 / 333.840
3+720	333.327 / 333.819	334.127 / 333.827
3+740	333.314 / 333.996	334.114 / 333.814
3+760	333.301 / 334.178	334.101 / 333.801
3+780	333.287 / 334.203	334.087 / 333.787
3+800	333.274 / 334.165	334.074 / 333.774
3+820	333.261 / 334.474	334.061 / 333.761
3+840	333.248 / 334.487	334.048 / 333.748
3+860	333.235 / 334.213	334.035 / 333.735
3+880	333.222 / 333.940	334.022 / 333.722
3+900	333.209 / 333.667	334.009 / 333.709
3+920	333.196 / 333.394	333.996 / 333.696
3+940	333.182 / 332.935	333.983 / 333.683
3+960	333.169 / 333.307	333.969 / 333.669
3+970	333.163 / 333.408	333.963 / 333.663

MAIN-CANAL-2+440-TO-END - PROFILE
VERTICAL EXAGGERATION = 10.000

CLIENT:

GOVERNMENT OF KHYBER PAKHTUNKHWA
DIRECTORATE GENERAL SMALL DAMS,
IRRIGATION DEPARTMENT, PESHAWAR

CONSULTANT:

CONSULTING ASSOCIATES
NS TOWER, HAYATABAD COMMERCIAL COMPLEX,
NEAR (WFP) WAREHOUSE, MAIN ACHINI BALA ROAD,
PESHAWAR, PAKISTAN
PH: +92 91 5701774
EMAIL: Consultingassociates127@gmail.com

REV	DESCRIPTION	DATE
R-01	ISSUED FOR CONSTRUCTION	APR-2019
C-00	ISSUED FOR CONSTRUCTION	21-FEB-23

PROJECT:
SATI KALLI DAM PROJECT
DISTRICT, BANNU

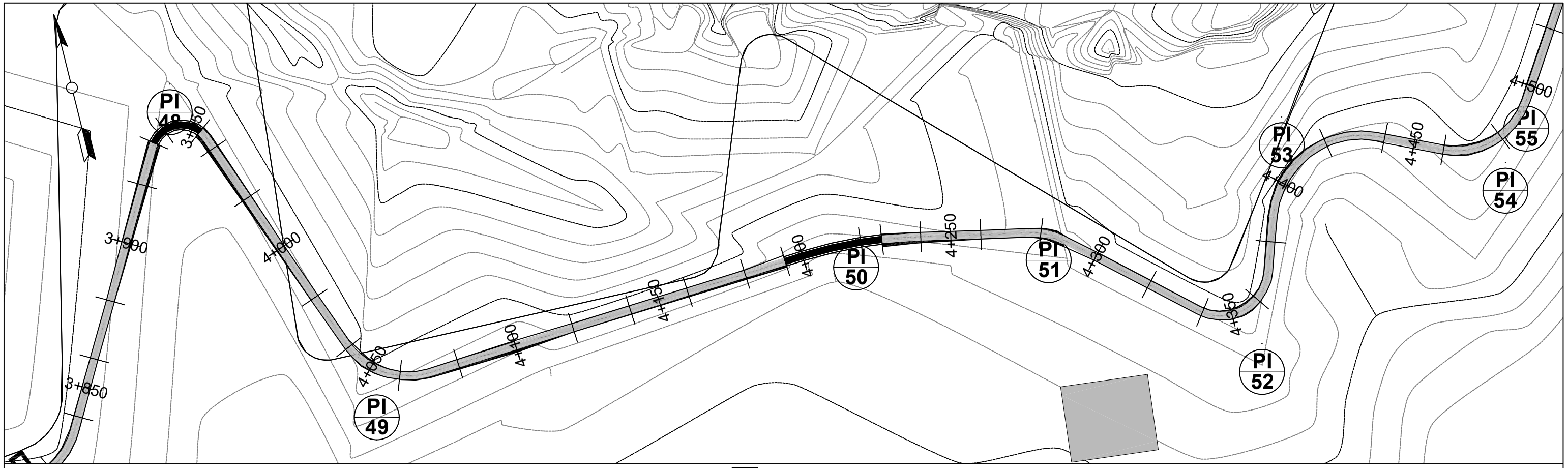
TITLE:
MAIN CHANNEL
PLAN & PROFILE

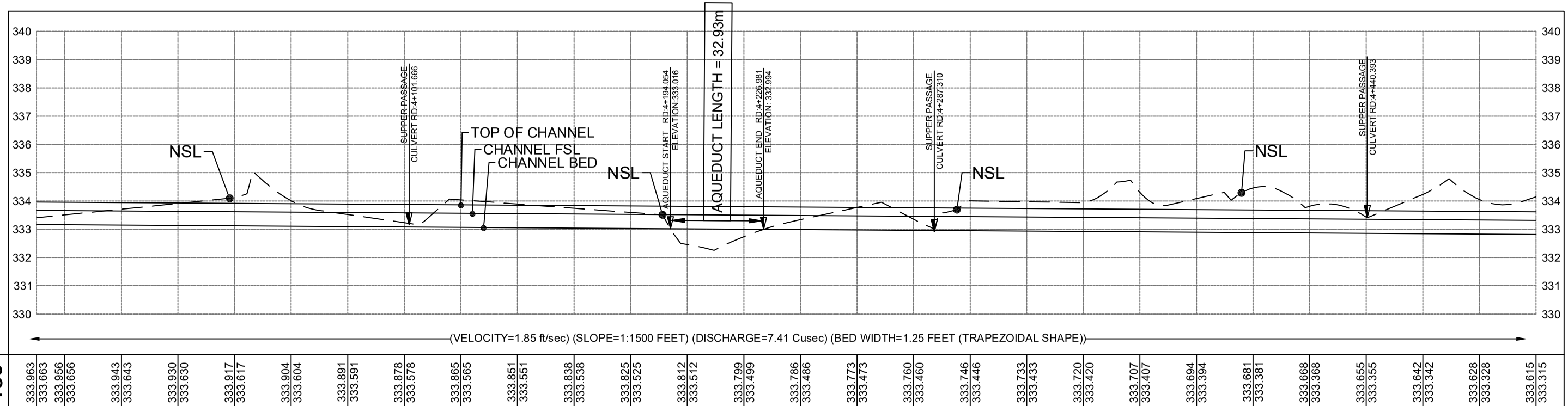
DRAWN BY:	MUNEEB KHAN
DESIGNED BY:	DAWOOD KHAN
CHECKED BY:	SHAKIL AHMAD

ISSUED FOR CONSTRUCTION
SCALE: 1:1250
DRAWING NUMBER : 005-CA-MC-P&P-STK-BNU-06
REV NO 05
SHEET NO:

SIGNATURE + SEAL

F:\33 SATTI KALLI\REV-06 PACKAGES\PACKAGE-02\005-MAIN CHANNEL\005-CA-MC-STK-BNU-01 TO 3 & 62 SATTI KALLI DAM CIVIL 3D-MUNEEB (REV-05).DWG





RD	DBL NSL	FSL TOC
3+970	333.163	333.963
3+980	333.408	333.663
4+000	333.156	333.956
4+020	333.508	333.656
4+040	333.143	333.943
4+060	333.709	333.643
4+080	333.130	333.930
4+100	333.911	333.630
4+120	333.117	333.917
4+140	334.121	333.617
4+160	333.104	333.904
4+180	334.007	333.604
4+200	333.091	333.891
4+220	333.521	333.591
4+240	333.078	333.878
4+260	333.230	333.578
4+280	333.064	333.865
4+300	334.038	333.565
4+320	333.051	333.851
4+340	333.890	333.551
4+360	333.038	333.838
4+380	333.742	333.538
4+400	333.025	333.825
4+420	333.594	333.525
4+440	333.012	333.812
4+460	332.459	333.512
4+480	332.999	333.799
4+500	332.738	333.499
	332.986	333.786
	333.339	333.486
	332.973	333.773
	333.769	333.473
	332.960	333.760
	333.356	333.460
	332.946	333.746
	334.003	333.446
	332.933	333.733
	333.971	333.433
	332.920	333.720
	333.950	333.420
	332.907	333.707
	334.302	333.407
	332.894	333.694
	334.082	333.394
	332.881	333.681
	334.459	333.381
	332.868	333.668
	333.814	333.368
	332.855	333.655
	333.432	333.355
	332.841	333.642
	334.231	333.342
	332.828	333.628
	334.051	333.328
	332.815	333.615
	334.146	333.315

MAIN-CANAL-2+440-TO-END - PROFILE
VERTICAL EXAGGERATION = 10.000

CLIENT:

GOVERNMENT OF KHYBER PAKHTUNKHWA
DIRECTORATE GENERAL SMALL DAMS,
IRRIGATION DEPARTMENT, PESHAWAR

CONSULTANT:

CONSULTING ASSOCIATES
NS TOWER, HAYATABAD COMMERCIAL COMPLEX,
NEAR (WFP) WAREHOUSE, MAIN ACHINI BALA ROAD,
PESHAWAR, PAKISTAN
PH: +92 91 5701774
EMAIL: Consultingassociates127@gmail.com

REV	DESCRIPTION	DATE
R-01	ISSUED FOR CONSTRUCTION	APR-2019
C-00	ISSUED FOR CONSTRUCTION	21-FEB-23

PROJECT:
SATI KALLI DAM PROJECT
DISTRICT, BANNU

TITLE:
MAIN CHANNEL
PLAN & PROFILE

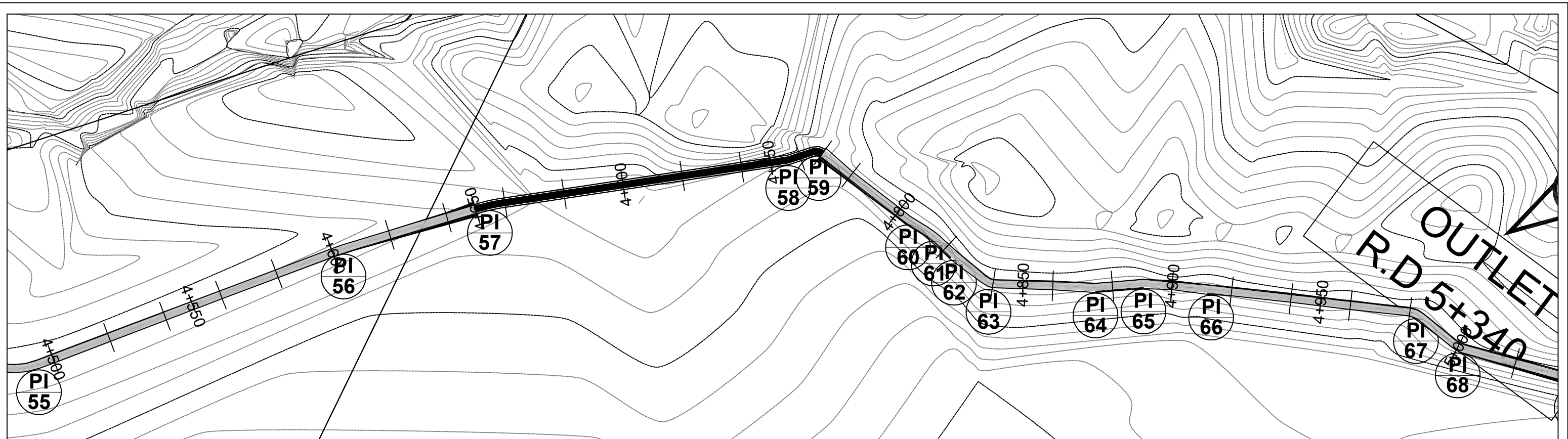
DRAWN BY:	MUNEEB KHAN
DESIGNED BY:	DAWOOD KHAN
CHECKED BY:	SHAKIL AHMAD

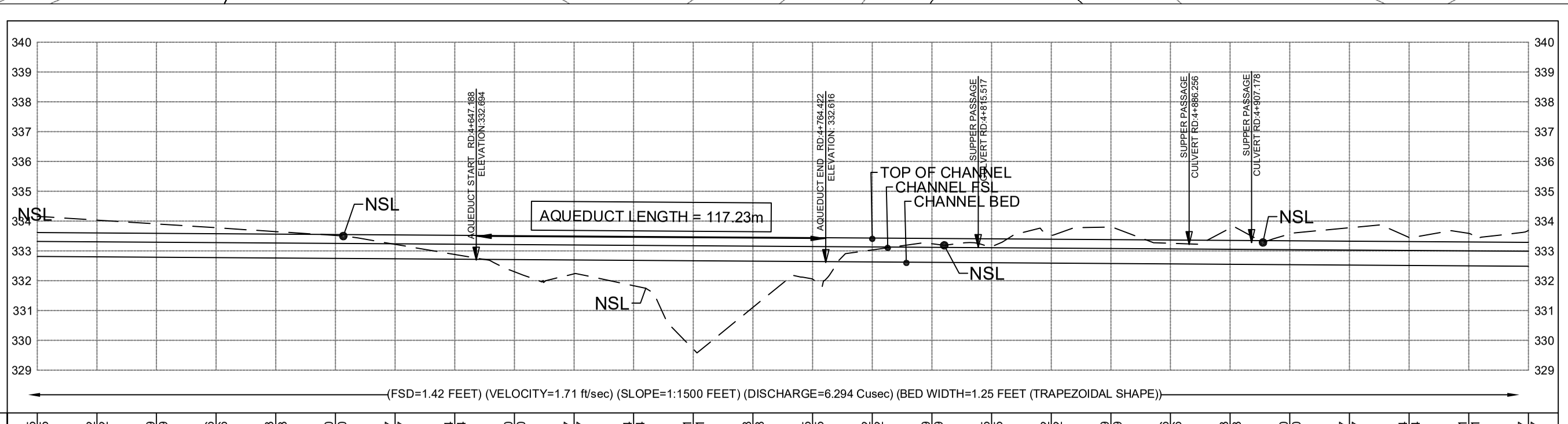
ISSUED FOR CONSTRUCTION
SCALE: 1:1250

DRAWING NUMBER: 005-CA-MC-P&P-STK-BNU-07
SHEET NO:
REV NO 05

SIGNATURE + SEAL

F:\33 SATTI KALLI\REV-06 PACKAGES\PACKAGE-02\005-MAIN CHANNEL\005-CA-MC-STK-BNU-01 TO 3 & 62 SATTI KALLI DAM CIVIL 3D-MUNEEB (REV-05).DWG





RD	DBL NSL	FSL TOC
4+500	332.815	333.615
	334.146	333.315
4+520	332.802	333.602
	334.032	333.302
4+540	332.789	333.589
	333.904	333.289
4+560	332.776	333.576
	333.776	333.276
4+580	332.763	333.563
	333.649	333.263
4+600	332.750	333.550
	333.521	333.250
4+620	332.737	333.537
	333.222	333.237
4+640	332.723	333.524
	332.882	333.224
4+660	332.710	333.510
	332.300	333.210
4+680	332.697	333.497
	332.233	333.197
4+700	332.684	333.484
	331.831	333.184
4+720	332.671	333.471
	329.706	333.171
4+740	332.658	333.458
	331.107	333.158
4+760	332.645	333.445
	332.055	333.145
4+780	332.632	333.432
	333.033	333.132
4+800	332.618	333.419
	333.241	333.119
4+820	332.605	333.405
	333.144	333.105
4+840	332.592	333.392
	333.522	333.092
4+860	332.579	333.379
	333.796	333.079
4+880	332.566	333.366
	333.254	333.066
4+900	332.553	333.353
	333.766	333.053
4+920	332.540	333.340
	333.568	333.040
4+940	332.527	333.327
	333.777	333.027
4+960	332.514	333.314
	333.453	333.014
4+980	332.500	333.301
	333.589	333.001
5+000	332.487	333.287
	333.689	332.987

MAIN-CANAL-2+440-TO-END - PROFILE
VERTICAL EXAGGERATION = 10.000

CLIENT:

GOVERNMENT OF KHYBER PAKHTUNKHWA
DIRECTORATE GENERAL SMALL DAMS,
IRRIGATION DEPARTMENT, PESHAWAR

CONSULTANT:

CONSULTING ASSOCIATES
NS TOWER, HAYATABAD COMMERCIAL COMPLEX,
NEAR (WFP) WAREHOUSE, MAIN ACHINI BALA ROAD,
PESHAWAR, PAKISTAN
PH: +92 91 5701774
EMAIL: Consultingassociates127@gmail.com

REV	DESCRIPTION	DATE
R-01	ISSUED FOR CONSTRUCTION	APR-2019
C-00	ISSUED FOR CONSTRUCTION	21-FEB-23

PROJECT:
SATI KALLI DAM PROJECT
DISTRICT, BANNU

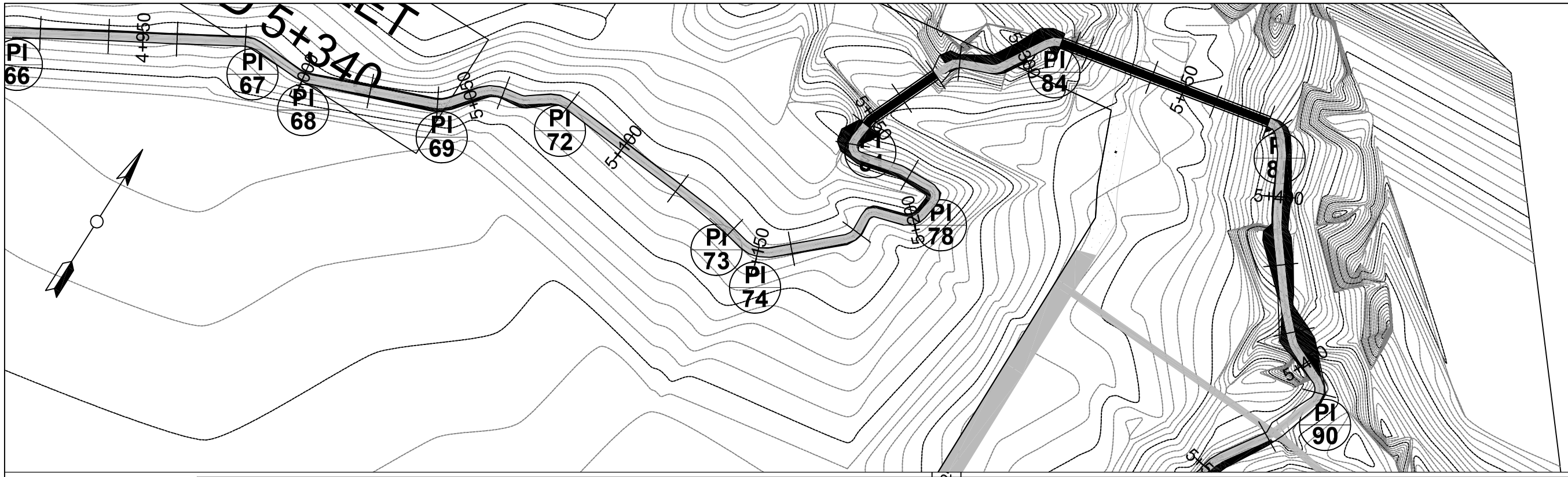
TITLE:
MAIN CHANNEL
PLAN & PROFILE

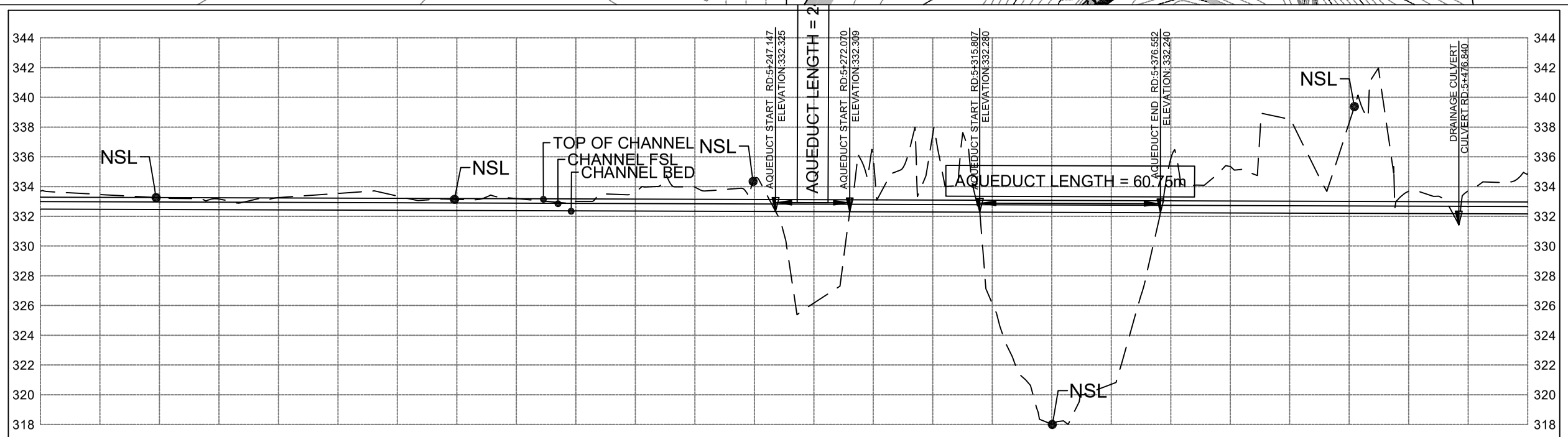
DRAWN BY:	MUNEEB KHAN	ISSUED FOR CONSTRUCTION
DESIGNED BY:	DAWOOD KHAN	
CHECKED BY:	SHAKIL AHMAD	SCALE: 1:1250

DRAWING NUMBER : 005-CA-MC-P&P-STK-BNU-08
SHEET NO:
REV NO 05

SIGNATURE + SEAL

F:\33 SATTI KALLI\REV-06 PACKAGES\PACKAGE-02\005-MAIN CHANNEL\005-CA-MC-STK-BNU-01 TO 3 & 62 SATTI KALLI DAM CIVIL 3D-MUNEEB (REV-05).DWG





(FSD=1.42 FEET) (VELOCITY=1.71 ft/sec) (SLOPE=1:1500 FEET) (DISCHARGE=6.294 Cusec) (BED WIDTH=1.25 FEET (TRAPEZOIDAL SHAPE)

RD	DBL NSL	FSL TOC
5+000	332.487 333.689	333.287 332.987
5+020	332.474 333.468	333.274 332.974
5+040	332.461 333.285	333.261 332.961
5+060	332.448 333.157	333.248 332.948
5+080	332.435 333.251	333.235 332.935
5+100	332.422 333.536	333.222 332.922
5+120	332.409 333.359	333.209 332.909
5+140	332.395 333.136	333.196 332.896
5+160	332.382 333.190	333.182 332.882
5+180	332.369 333.000	333.169 332.869
5+200	332.356 333.725	333.156 332.856
5+220	332.343 333.962	333.143 332.843
5+240	332.330 334.502	333.130 332.830
5+260	332.317 326.165	333.117 332.817
5+280	332.304 335.774	333.104 332.804
5+300	332.291 337.538	333.091 332.791
5+320	332.277 326.145	333.078 332.778
5+340	332.264 318.014	333.064 332.764
5+360	332.251 320.704	333.051 332.751
5+380	332.238 335.874	333.038 332.738
5+400	332.225 335.336	333.025 332.725
5+420	332.212 338.519	333.012 332.712
5+440	332.199 338.292	332.999 332.699
5+460	332.186 333.683	332.986 332.686
5+480	332.173 333.713	332.973 332.673
5+500	332.159 334.838	332.960 332.660

MAIN-CANAL-2+440-TO-END - PROFILE
VERTICAL EXAGGERATION = 5.000

CLIENT:

GOVERNMENT OF KHYBER PAKHTUNKHWA
DIRECTORATE GENERAL SMALL DAMS,
IRRIGATION DEPARTMENT, PESHAWAR

CONSULTANT:

CONSULTING ASSOCIATES
NS TOWER, HAYATABAD COMMERCIAL COMPLEX,
NEAR (WFP) WAREHOUSE, MAIN ACHINI BALA ROAD,
PESHAWAR, PAKISTAN
PH: +92 91 5701774
EMAIL: Consultingassociates127@gmail.com

REV	DESCRIPTION	DATE
R-01	ISSUED FOR CONSTRUCTION	APR-2019
C-00	ISSUED FOR CONSTRUCTION	21-FEB-23

PROJECT:
SATI KALLI DAM PROJECT
DISTRICT, BANNU

TITLE:
MAIN CHANNEL
PLAN & PROFILE

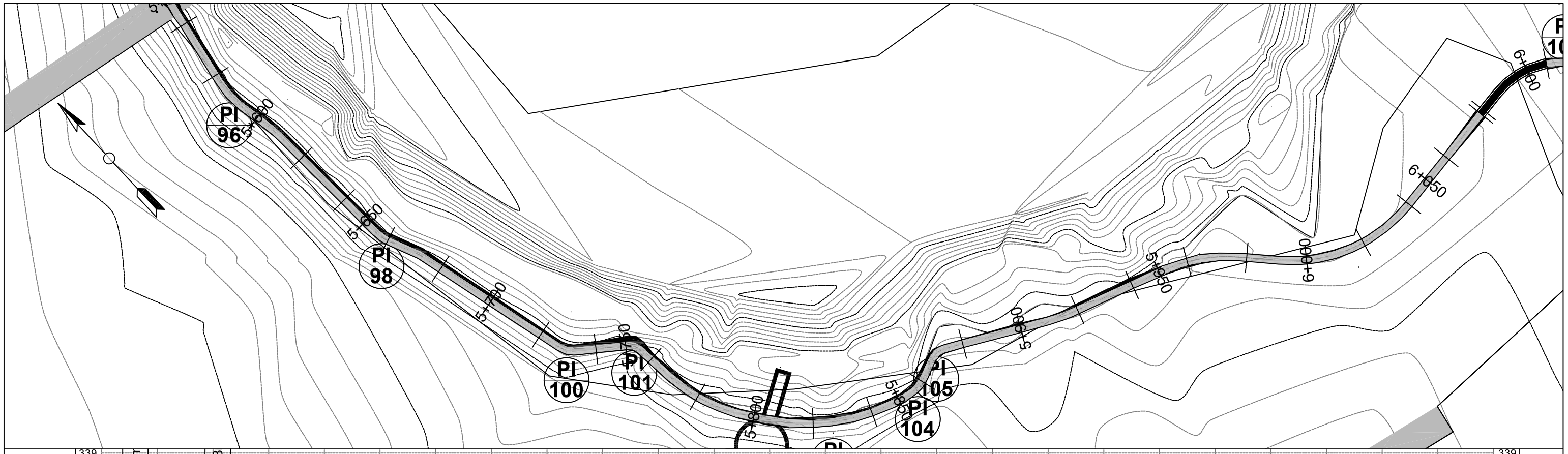
DRAWN BY:	MUNEEB KHAN
DESIGNED BY:	DAWOOD KHAN
CHECKED BY:	SHAKIL AHMAD

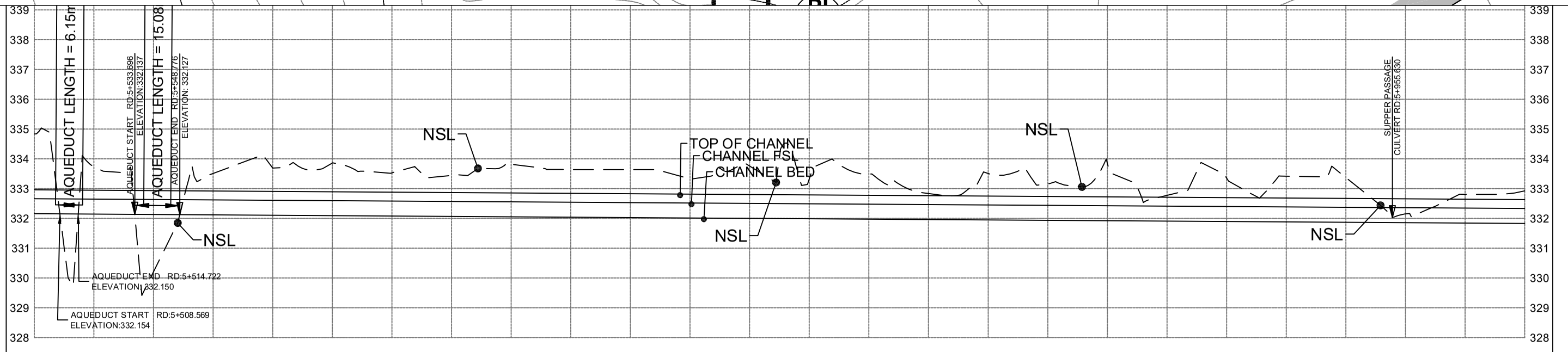
ISSUED FOR CONSTRUCTION
SCALE: 1:1.25

DRAWING NUMBER : 005-CA-MC-P&P-STK-BNU-09
SHEET NO:
REV NO 05

SIGNATURE + SEAL

F:\33 SATTI KALLI\REV-06 PACKAGES\PACKAGE-02\005-MAIN CHANNEL\005-CA-MC-STK-BNU-01 TO 3 & 62 SATTI KALLI DAM CIVIL 3D-MUNEEB (REV-05).DWG





(FSD=1.42 FEET) (VELOCITY=1.71 ft/sec) (SLOPE=1:1500 FEET) (DISCHARGE=6.294 Cusec) (BED WIDTH=1.25 FEET (TRAPEZOIDAL SHAPE))

RD	DBL NSL	FSL TOC
5+500	332.159 / 334.838	332.960 / 332.660
5+520	332.146 / 333.733	332.946 / 332.646
5+540	332.133 / 330.212	332.933 / 332.633
5+560	332.120 / 333.512	332.920 / 332.620
5+580	332.107 / 333.692	332.907 / 332.607
5+600	332.094 / 333.858	332.894 / 332.594
5+620	332.081 / 333.531	332.881 / 332.581
5+640	332.068 / 333.445	332.868 / 332.568
5+660	332.054 / 333.834	332.855 / 332.555
5+680	332.041 / 333.641	332.841 / 332.541
5+700	332.028 / 333.638	332.828 / 332.528
5+720	332.015 / 333.325	332.815 / 332.515
5+740	332.002 / 333.756	332.802 / 332.502
5+760	331.989 / 333.327	332.789 / 332.489
5+780	331.976 / 333.489	332.776 / 332.476
5+800	331.963 / 332.836	332.763 / 332.463
5+820	331.950 / 333.511	332.750 / 332.450
5+840	331.936 / 333.159	332.737 / 332.437
5+860	331.923 / 333.843	332.723 / 332.423
5+880	331.910 / 332.773	332.710 / 332.410
5+900	331.897 / 333.355	332.697 / 332.397
5+920	331.884 / 333.418	332.684 / 332.384
5+940	331.871 / 333.377	332.671 / 332.371
5+960	331.858 / 332.152	332.658 / 332.358
5+980	331.845 / 332.811	332.645 / 332.345
6+000	331.831 / 332.927	332.632 / 332.332

MAIN-CANAL-2+440-TO-END - PROFILE
VERTICAL EXAGGERATION = 10.000

CLIENT:

GOVERNMENT OF KHYBER PAKHTUNKHWA
DIRECTORATE GENERAL SMALL DAMS,
IRRIGATION DEPARTMENT, PESHAWAR

CONSULTANT:

CONSULTING ASSOCIATES
NS TOWER, HAYATABAD COMMERCIAL COMPLEX,
NEAR (WFP) WAREHOUSE, MAIN ACHINI BALA ROAD,
PESHAWAR, PAKISTAN
PH: +92 91 5701774
EMAIL: Consultingassociates127@gmail.com

REV	DESCRIPTION	DATE
R-01	ISSUED FOR CONSTRUCTION	APR-2019
C-00	ISSUED FOR CONSTRUCTION	21-FEB-23

PROJECT:
SATI KALLI DAM PROJECT
DISTRICT, BANNU

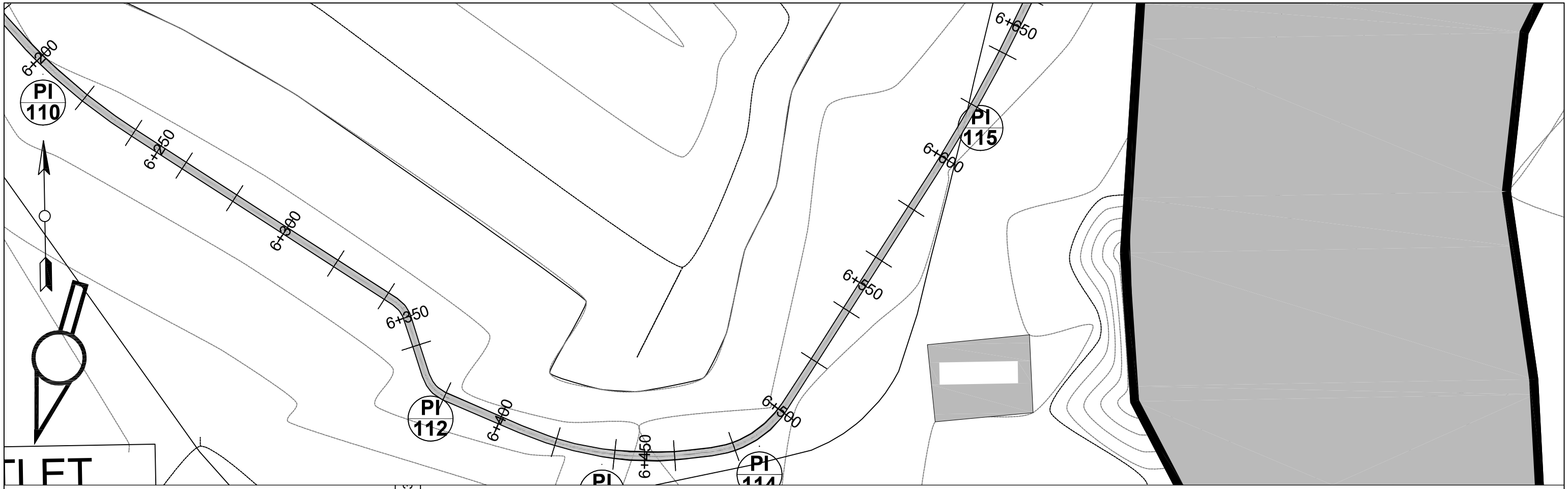
TITLE:
MAIN CHANNEL
PLAN & PROFILE

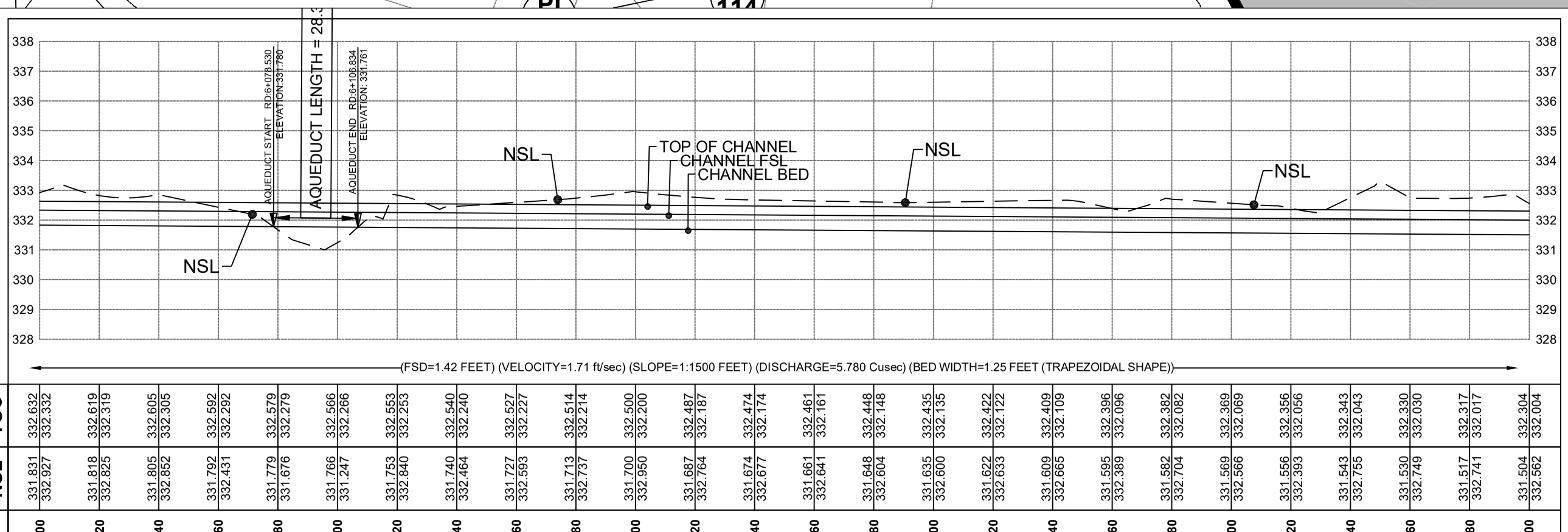
DRAWN BY:	MUNEEB KHAN	ISSUED FOR CONSTRUCTION
DESIGNED BY:	DAWOOD KHAN	
CHECKED BY:	SHAKIL AHMAD	SCALE: 1:1.253

DRAWING NUMBER: 005-CA-MC-P&P-STK-BNU-10
REV NO: 05
SHEET NO:

SIGNATURE + SEAL

F:\33 SATTI KALLI\REV-06 PACKAGE\SI\PACKAGE-02\005-MAIN CHANNEL\005-CA-MC-STK-BNU-01 TO 3 & 62 SATTI KALLI DAM CIVIL 3D-MUNEEB (REV-05).DWG



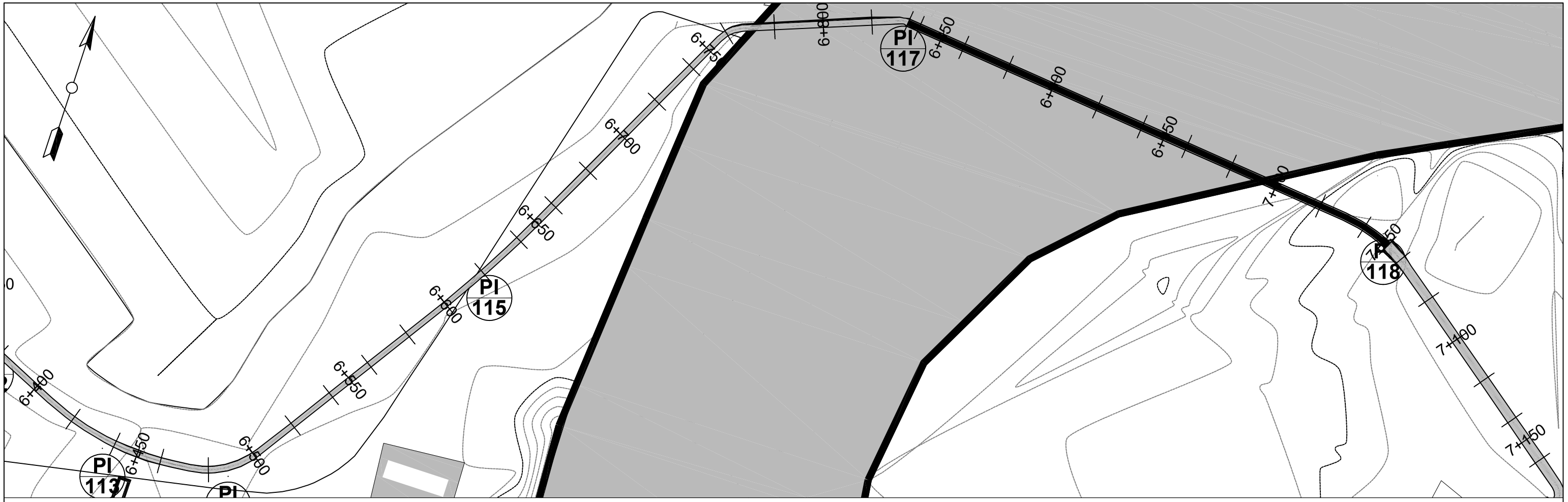


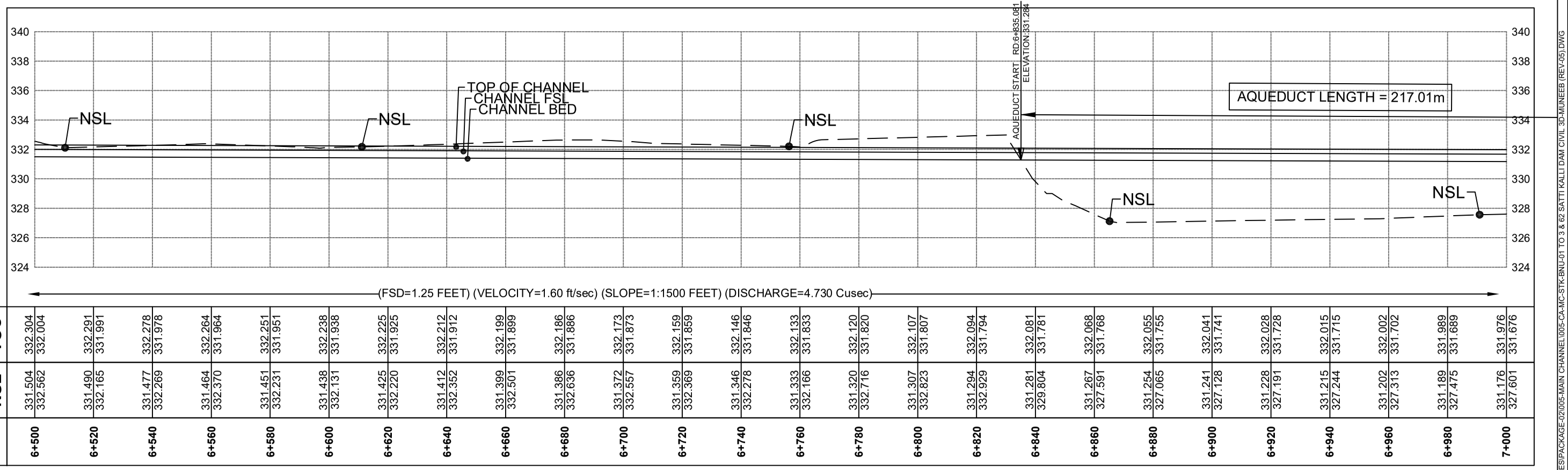
	RD	6+000	6+020	6+040	6+060	6+080	6+100	6+120	6+140	6+160	6+180	6+200	6+220	6+240	6+260	6+280	6+300	6+320	6+340	6+360	6+380	6+400	6+420	6+440	6+460	6+480	6+500
DBL	FSL	332.632	332.619	332.605	332.592	332.579	332.566	332.553	332.540	332.527	332.514	332.500	332.487	332.474	332.461	332.448	332.435	332.422	332.409	332.396	332.382	332.369	332.356	332.343	332.330	332.317	332.304
	TOC	332.332	332.319	332.305	332.292	332.279	332.266	332.253	332.240	332.227	332.214	332.200	332.187	332.174	332.161	332.148	332.135	332.122	332.109	332.096	332.082	332.069	332.056	332.043	332.030	332.017	332.004
	NSL	331.831	331.818	331.805	331.792	331.779	331.766	331.753	331.740	331.727	331.713	331.700	331.687	331.674	331.661	331.648	331.635	331.622	331.609	331.595	331.582	331.569	331.556	331.543	331.530	331.517	331.504
		332.927	332.825	332.852	332.431	331.676	331.247	332.840	332.464	332.593	332.737	332.950	332.764	332.677	332.641	332.604	332.600	332.633	332.665	332.389	332.704	332.566	332.393	332.755	332.749	332.741	332.562

MAIN-CANAL-2+440-TO-END - PROFILE
VERTICAL EXAGGERATION = 10.000

CLIENT:	CONSULTANT:	REV	DESCRIPTION	DATE	PROJECT:			ISSUED FOR CONSTRUCTION	SIGNATURE + SEAL
GOVERNMENT OF KHYBER PAKHTUNKHWA DIRECTORATE GENERAL SMALL DAMS, IRRIGATION DEPARTMENT, PESHAWAR	CONSULTING ASSOCIATES NS TOWER, HAYATABAD COMMERCIAL COMPLEX, NEAR (WFP) WAREHOUSE, MAIN ACHINI BALA ROAD, PESHAWAR, PAKISTAN PH: +92 91 5701774 EMAIL: Consultingassociates127@gmail.com				SATI KALLI DAM PROJECT DISTRICT, BANNU	DRAWN BY: MUNEEB KHAN DESIGNED BY: DAWOOD KHAN CHECKED BY: SHAKIL AHMAD		
		R-01	ISSUED FOR CONSTRUCTION	APR-2019	TITLE: MAIN CHANNEL PLAN & PROFILE	DRAWING NUMBER: 005-CA-MC-P&P-STK-BNU-11 SHEET NO:	SCALE: 1:1250	REV NO 05	
		C-00	ISSUED FOR CONSTRUCTION	21-FEB-23					

F:\33 SATTI KALLI\REV-06 PACKAGES\PACKAGE-02\005-MAIN CHANNEL\005-CA-MC-STK-BNU-01 TO 3 & 62 SATTI KALLI DAM CIVIL 3D-MUNEEB (REV-05).DWG





RD	DBL NSL	FSL TOC
6+500	331.504 / 332.562	332.304 / 332.004
6+520	331.490 / 332.165	332.291 / 331.991
6+540	331.477 / 332.269	332.278 / 331.978
6+560	331.464 / 332.370	332.264 / 331.964
6+580	331.451 / 332.231	332.251 / 331.951
6+600	331.438 / 332.131	332.238 / 331.938
6+620	331.425 / 332.220	332.225 / 331.925
6+640	331.412 / 332.352	332.212 / 331.912
6+660	331.399 / 332.501	332.199 / 331.899
6+680	331.386 / 332.636	332.186 / 331.886
6+700	331.372 / 332.557	332.173 / 331.873
6+720	331.359 / 332.369	332.159 / 331.859
6+740	331.346 / 332.278	332.146 / 331.846
6+760	331.333 / 332.166	332.133 / 331.833
6+780	331.320 / 332.716	332.120 / 331.820
6+800	331.307 / 332.823	332.107 / 331.807
6+820	331.294 / 332.929	332.094 / 331.794
6+840	331.281 / 329.804	332.081 / 331.781
6+860	331.267 / 327.591	332.068 / 331.768
6+880	331.254 / 327.065	332.055 / 331.755
6+900	331.241 / 327.128	332.041 / 331.741
6+920	331.228 / 327.191	332.028 / 331.728
6+940	331.215 / 327.244	332.015 / 331.715
6+960	331.202 / 327.313	332.002 / 331.702
6+980	331.189 / 327.475	331.989 / 331.689
7+000	331.176 / 327.601	331.976 / 331.676

MAIN-CANAL-2+440-TO-END - PROFILE
VERTICAL EXAGGERATION = 5.000

CLIENT:

GOVERNMENT OF KHYBER PAKHTUNKHWA
DIRECTORATE GENERAL SMALL DAMS,
IRRIGATION DEPARTMENT, PESHAWAR

CONSULTANT:

CONSULTING ASSOCIATES
NS TOWER, HAYATABAD COMMERCIAL COMPLEX,
NEAR (WFP) WAREHOUSE, MAIN ACHINI BALA ROAD,
PESHAWAR, PAKISTAN
PH: +92 91 5701774
EMAIL: Consultingassociates127@gmail.com

REV	DESCRIPTION	DATE
R-01	ISSUED FOR CONSTRUCTION	APR-2019
C-00	ISSUED FOR CONSTRUCTION	21-FEB-23

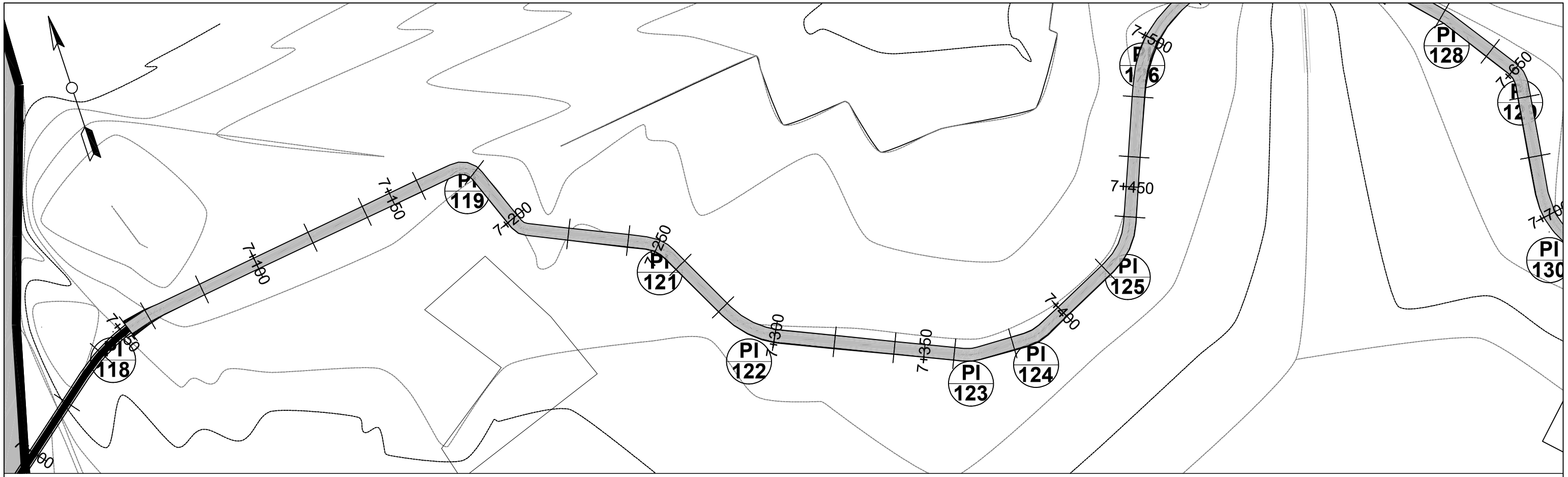
PROJECT:
SATI KALLI DAM PROJECT
DISTRICT, BANNU

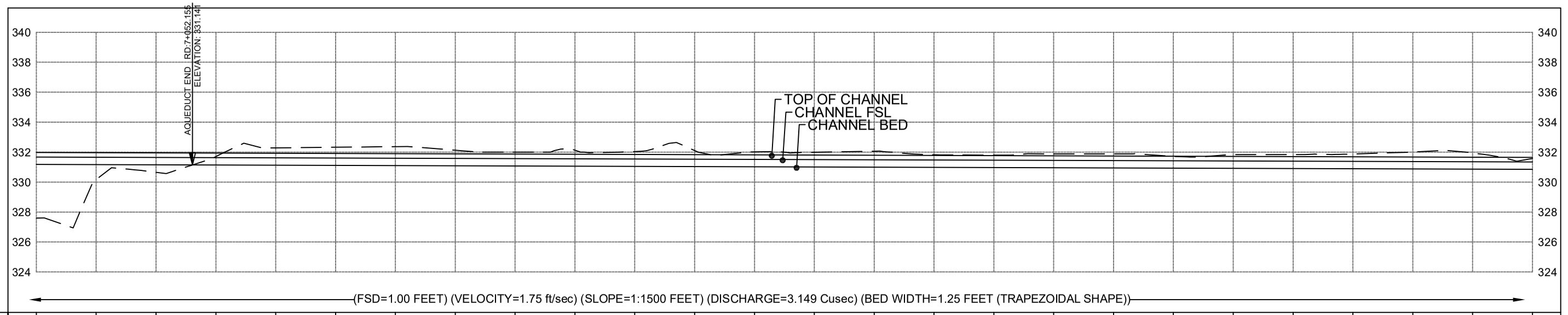
TITLE:
MAIN CHANNEL
PLAN & PROFILE

DRAWN BY: MUNEEB KHAN
DESIGNED BY: DAWOOD KHAN
CHECKED BY: SHAKIL AHMAD
ISSUED FOR CONSTRUCTION
SCALE: 1:1.54
DRAWING NUMBER: 005-CA-MC-P&P-STK-BNU-12
SHEET NO:
REV NO 05

SIGNATURE + SEAL

F:\33 SATTI KALLI\REV-06 PACKAGES\PACKAGE-02\005-MAIN CHANNEL\005-CA-MC-STK-BNU-01 TO 3 & 62 SATTI KALLI DAM CIVIL 3D-MUNEEB (REV-05).DWG





RD	DBL NSL	FSL TOC
7+000	331.176 / 327.601	331.976 / 331.676
7+020	331.163 / 330.177	331.963 / 331.663
7+040	331.149 / 330.658	331.950 / 331.650
7+060	331.136 / 331.704	331.937 / 331.637
7+080	331.123 / 332.285	331.923 / 331.623
7+100	331.110 / 332.326	331.910 / 331.610
7+120	331.097 / 332.367	331.897 / 331.597
7+140	331.084 / 332.129	331.884 / 331.584
7+160	331.071 / 332.000	331.871 / 331.571
7+180	331.058 / 332.129	331.858 / 331.558
7+200	331.044 / 332.039	331.845 / 331.545
7+220	331.031 / 332.106	331.832 / 331.532
7+240	331.018 / 332.016	331.818 / 331.518
7+260	331.005 / 331.988	331.805 / 331.505
7+280	330.992 / 332.064	331.792 / 331.492
7+300	330.979 / 331.822	331.779 / 331.479
7+320	330.966 / 331.801	331.766 / 331.466
7+340	330.953 / 331.887	331.753 / 331.453
7+360	330.940 / 331.880	331.740 / 331.440
7+380	330.926 / 331.716	331.727 / 331.427
7+400	330.913 / 331.833	331.714 / 331.414
7+420	330.900 / 331.831	331.700 / 331.400
7+440	330.887 / 331.876	331.687 / 331.387
7+460	330.874 / 332.006	331.674 / 331.374
7+480	330.861 / 331.943	331.661 / 331.361
7+500	330.848 / 331.567	331.648 / 331.348

MAIN-CANAL-2+440-TO-END - PROFILE
VERTICAL EXAGGERATION = 5.000

CLIENT:

GOVERNMENT OF KHYBER PAKHTUNKHWA
DIRECTORATE GENERAL SMALL DAMS,
IRRIGATION DEPARTMENT, PESHAWAR

CONSULTANT:

CONSULTING ASSOCIATES
NS TOWER, HAYATABAD COMMERCIAL COMPLEX,
NEAR (WFP) WAREHOUSE, MAIN ACHINI BALA ROAD,
PESHAWAR, PAKISTAN
PH: +92 91 5701774
EMAIL: Consultingassociates127@gmail.com

REV	DESCRIPTION	DATE
R-01	ISSUED FOR CONSTRUCTION	APR-2019
C-00	ISSUED FOR CONSTRUCTION	21-FEB-23

PROJECT:
SATI KALLI DAM PROJECT
DISTRICT, BANNU

TITLE:
MAIN CHANNEL
PLAN & PROFILE

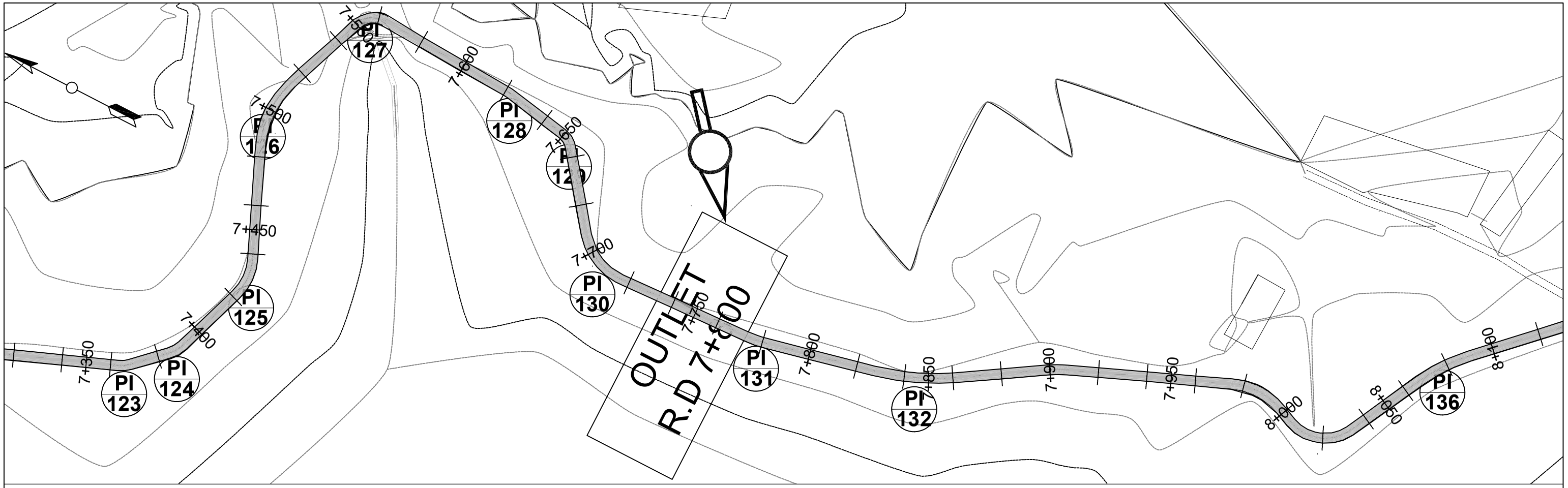
DRAWN BY:	MUNEEB KHAN
DESIGNED BY:	DAWOOD KHAN
CHECKED BY:	SHAKIL AHMAD

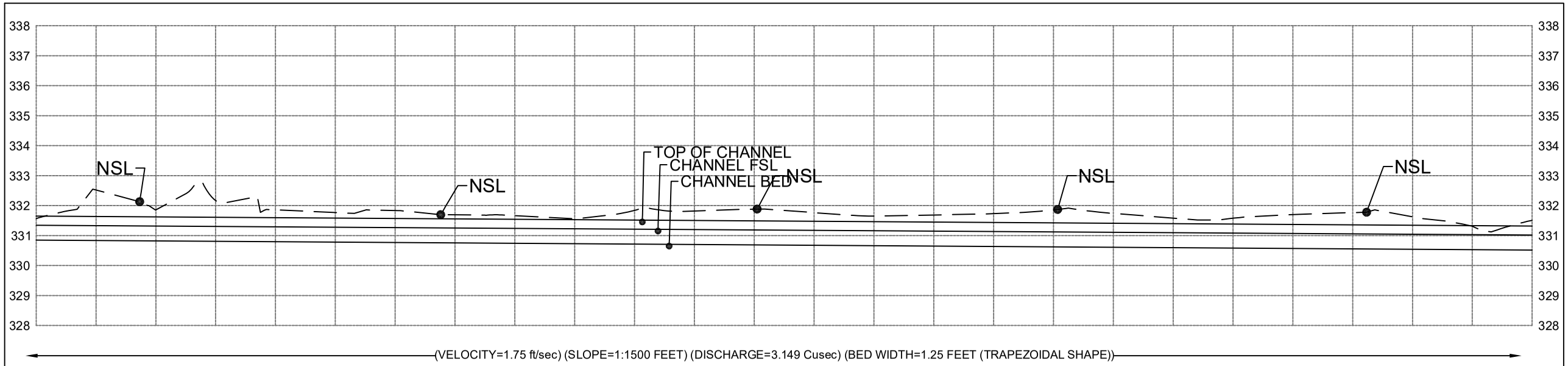
ISSUED FOR CONSTRUCTION
SCALE: 1:1250

DRAWING NUMBER : 005-CA-MC-P&P-STK-BNU-13
REV NO 05
SHEET NO:

SIGNATURE + SEAL

F:\33 SATTI KALLI\REV-06 PACKAGES\PACKAGE-02\005-MAIN CHANNEL\005-CA-MC-STK-BNU-01 TO 3 & 62 SATTI KALLI DAM CIVIL 3D-MUNEEB (REV-05).DWG





RD	FSL TOC	DBL NSL
7+500	331.648	330.848
	331.348	331.567
7+520	331.635	330.835
	331.335	332.520
7+540	331.622	330.822
	331.322	331.857
7+560	331.609	330.808
	331.309	332.167
7+580	331.595	330.795
	331.295	331.859
7+600	331.582	330.782
	331.282	331.769
7+620	331.569	330.769
	331.269	331.836
7+640	331.556	330.756
	331.256	331.694
7+660	331.543	330.743
	331.243	331.666
7+680	331.530	330.730
	331.230	331.559
7+700	331.517	330.717
	331.217	331.842
7+720	331.504	330.703
	331.204	331.822
7+740	331.491	330.690
	331.191	331.884
7+760	331.477	330.677
	331.177	331.766
7+780	331.464	330.664
	331.164	331.651
7+800	331.451	330.651
	331.151	331.688
7+820	331.438	330.638
	331.138	331.734
7+840	331.425	330.625
	331.125	331.857
7+860	331.412	330.612
	331.112	331.739
7+880	331.399	330.599
	331.099	331.585
7+900	331.386	330.585
	331.086	331.580
7+920	331.373	330.572
	331.073	331.701
7+940	331.359	330.559
	331.059	331.767
7+960	331.346	330.546
	331.046	331.625
7+980	331.333	330.533
	331.033	331.309
8+000	331.320	330.520
	331.020	331.509

MAIN-CANAL-2+440-TO-END - PROFILE
VERTICAL EXAGGERATION = 10.000

CLIENT:

GOVERNMENT OF KHYBER PAKHTUNKHWA
DIRECTORATE GENERAL SMALL DAMS,
IRRIGATION DEPARTMENT, PESHAWAR

CONSULTANT:

CONSULTING ASSOCIATES
NS TOWER, HAYATABAD COMMERCIAL COMPLEX,
NEAR (WFP) WAREHOUSE, MAIN ACHINI BALA ROAD,
PESHAWAR, PAKISTAN
PH: +92 91 5701774
EMAIL: Consultingassociates127@gmail.com

REV	DESCRIPTION	DATE
R-01	ISSUED FOR CONSTRUCTION	APR-2019
C-00	ISSUED FOR CONSTRUCTION	21-FEB-23

PROJECT:
SATI KALLI DAM PROJECT
DISTRICT, BANNU

TITLE:
MAIN CHANNEL
PLAN & PROFILE

DRAWN BY:	MUNEEB KHAN
DESIGNED BY:	DAWOOD KHAN
CHECKED BY:	SHAKIL AHMAD

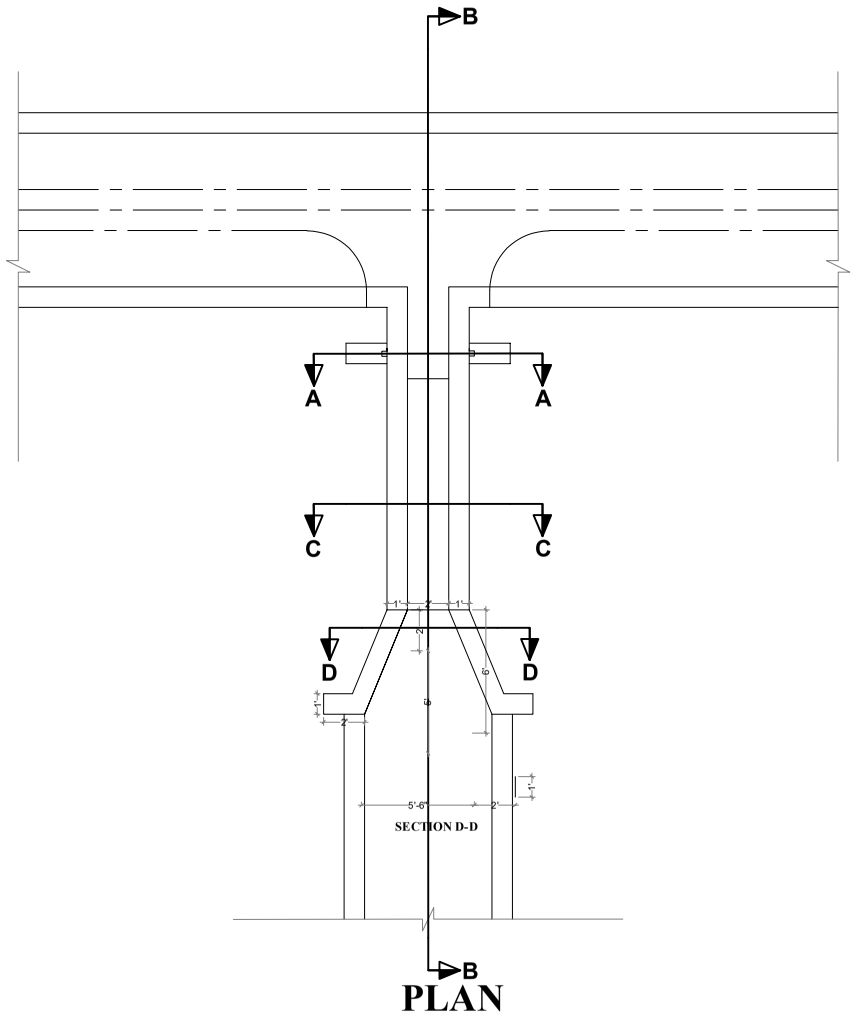
ISSUED FOR CONSTRUCTION
SCALE: 1:1.543

DRAWING NUMBER : 005-CA-MC-P&P-STK-BNU-14
SHEET NO:
REV NO 05

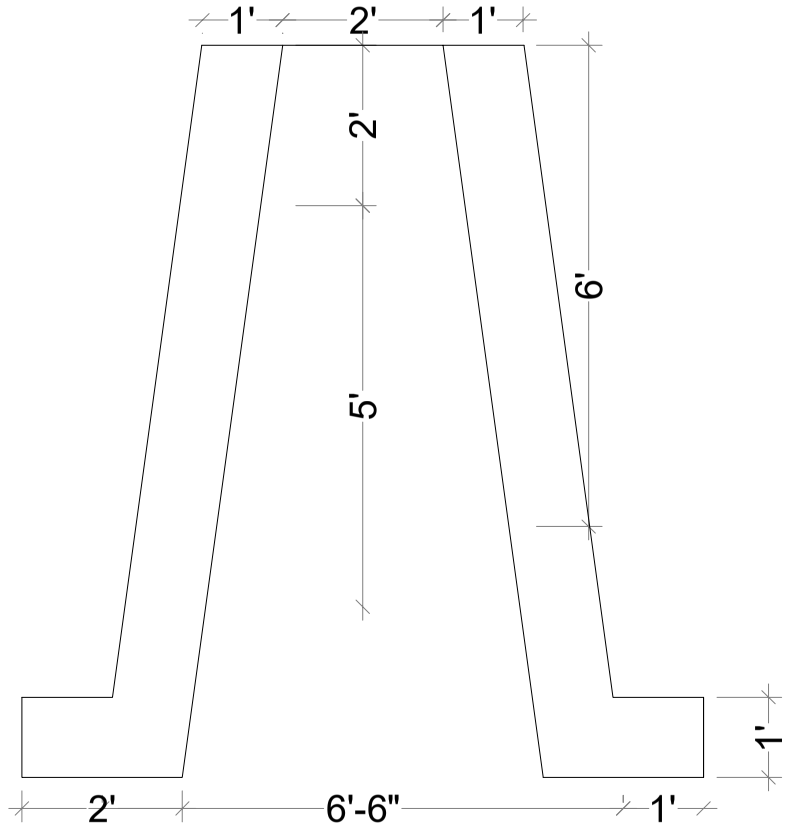
SIGNATURE + SEAL

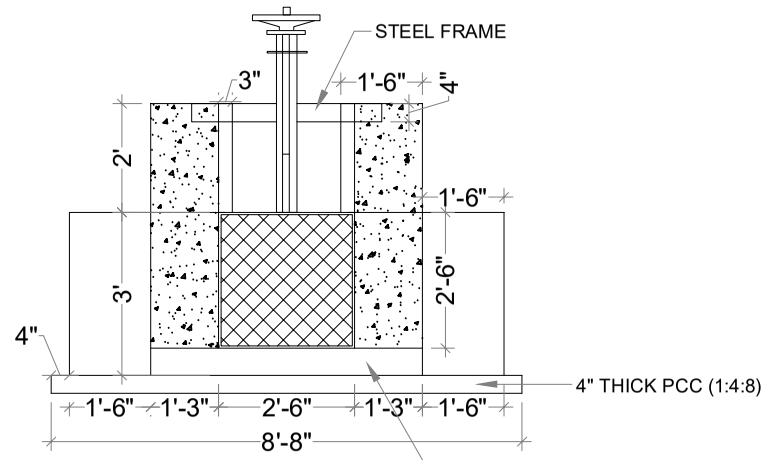
F:\33 SATTI KALLI\REV-06 PACKAGES\PACKAGE-02\005-MAIN CHANNEL\005-CA-MC-STK-BNU-01 TO 3 & 62 SATTI KALLI DAM CIVIL 3D-MUNEEB (REV-05).DWG

HYDRAULIC STRUCTURES

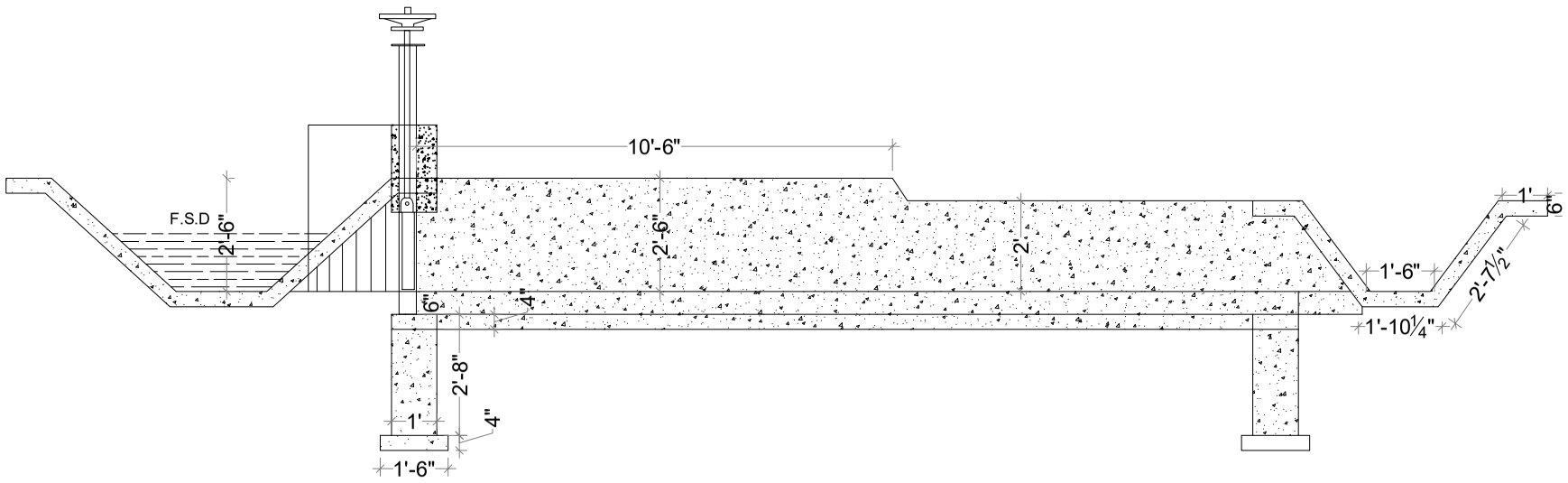


PLAN

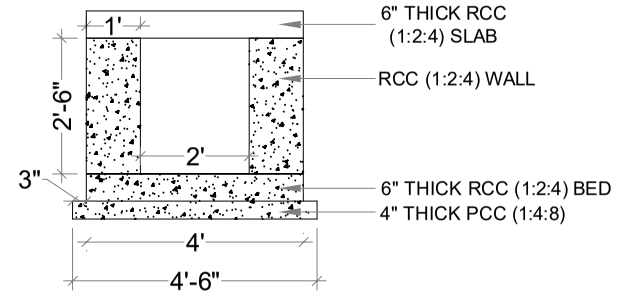




SECTION A-A

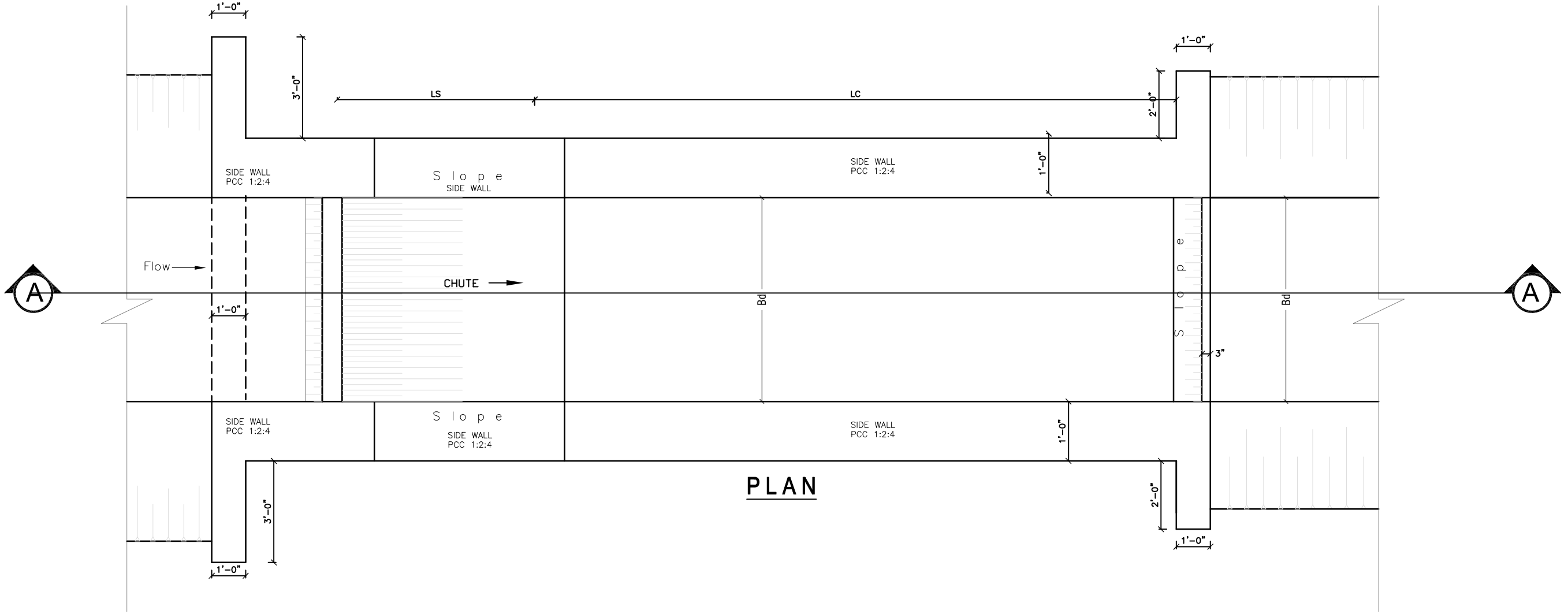


SECTION B-B

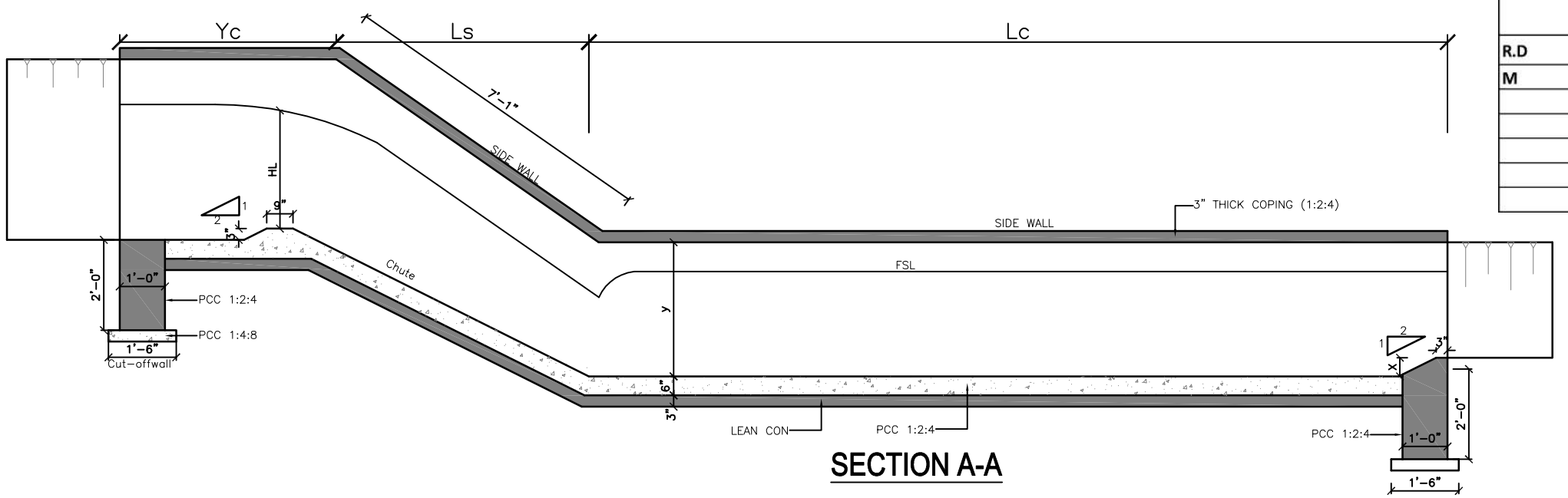


SECTION C-C

GOVERNMENT OF KHYBER PAKHTUNKHWA DIRECTORATE GENERAL SMALL DAMS, IRRIGATION DEPARTMENT, PESHAWAR	**CONSULTING ASSOCIATES** HOUSE #59A, SYED JAMAL UDDIN ROAD, UNIVERSITY TOWN PEHSAWAR, PAKISTAN PH: +92 91 5701774 EMAIL: Consultingassociates127@gmail.com	TITLE:- SATI KALLI DAM PROJECT BANNU	DRAWING TITLE:- **HYDRAULIC STRUCTURES** **FLOOD ESCAPE**	DRAWING:- PLAN, SECTION A-A & SECTION B-B, CUT OFF WALL NO = 02 & LENGTH = 20'	DRAWN BY: MUNEEB KHAN DESIGN BY: DAWOOD KHAN CHECKED & SUBMITTED BY: SHAKIL AHMAD 007-CA-HYS-STK-BNU-01 SHEET NO



PLAN



SECTION A-A

Hydraulic Design of Chute Drop (ft)

FALL ON MINOR CHANNEL

R.D	Width (Bd)	Discharge	H_L	Ls	L_C	L_d	X	YC	Y
M	ft	Cusec	ft	ft	ft	ft	ft	ft	ft
	3	**10.66**	**1.10**	**12.17**	**10.95**	**5.37**	**1**	**1.52**	**5**
	3	**10.66**	**1.10**	7.42	**8.55**	4.89	1	1.52	5
	3	**10.66**	**1.10**	6.56	**8.04**	4.77	1	1.52	5
	3	**10.66**	**1.10**	3.28	**5.69**	4.19	1	1.52	5
	3	**10.66**	**1.10**	1.64	**4.02**	3.67	1	1.52	5

GOVERNMENT OF KHYBER PAKHTUNKHWA
DIRECTORATE GENERAL SMALL DAMS,
IRRIGATION DEPARTMENT, PESHAWAR

CONSULTING ASSOCIATES
NEAR DEANS COMPLEX APARTMENTS,BEHIND GUL CNG,BOARD BAZAAR,JAMRUD ROAD,PESHAWAR
PH #: 091-5701774-45 Fax - 091-5701775
E-MAIL: consultingassociates127@gmail.com

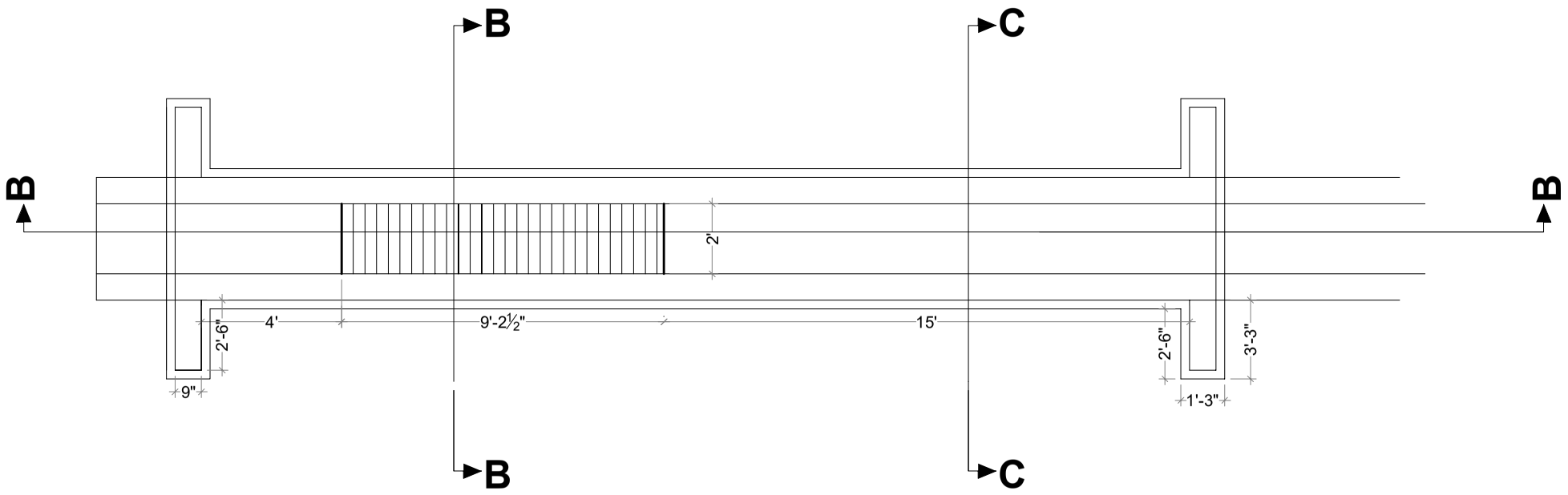
SATI KALLI DAM PROJECT
BANNU

STAMP & SIGNATURES:

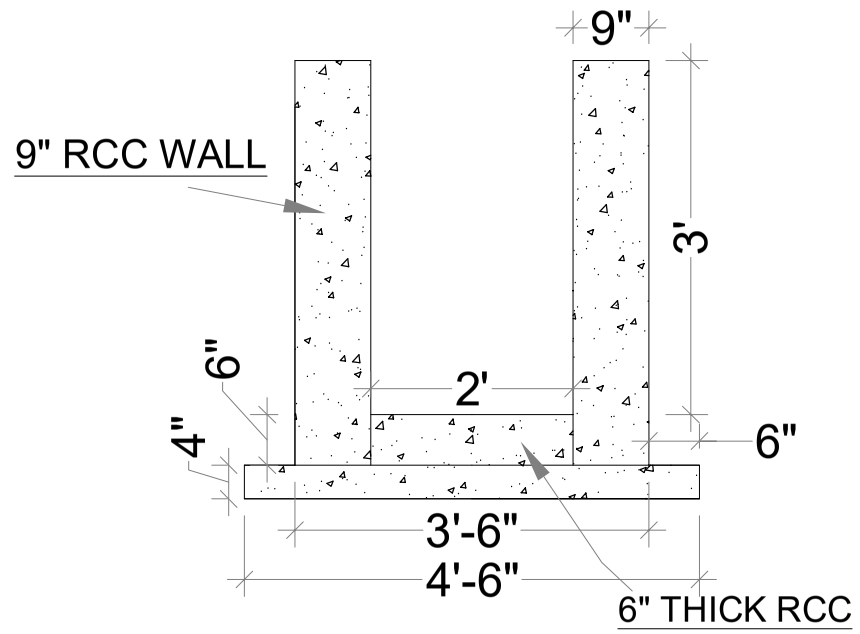
REV.	DATE	

FALL STRUCTURE DETAILS

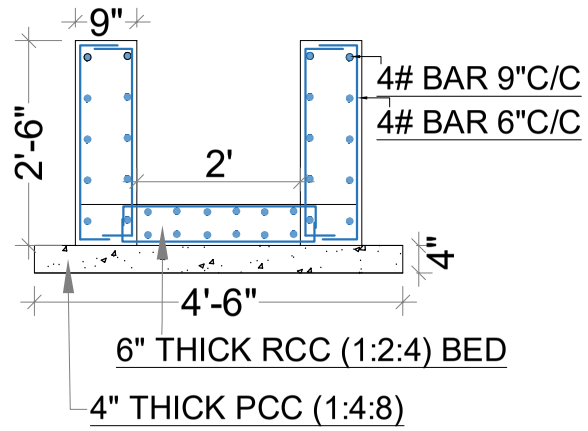
DWG NO : 007-CA-MC-HYS-STK-BNU-02 SHEET NO:-



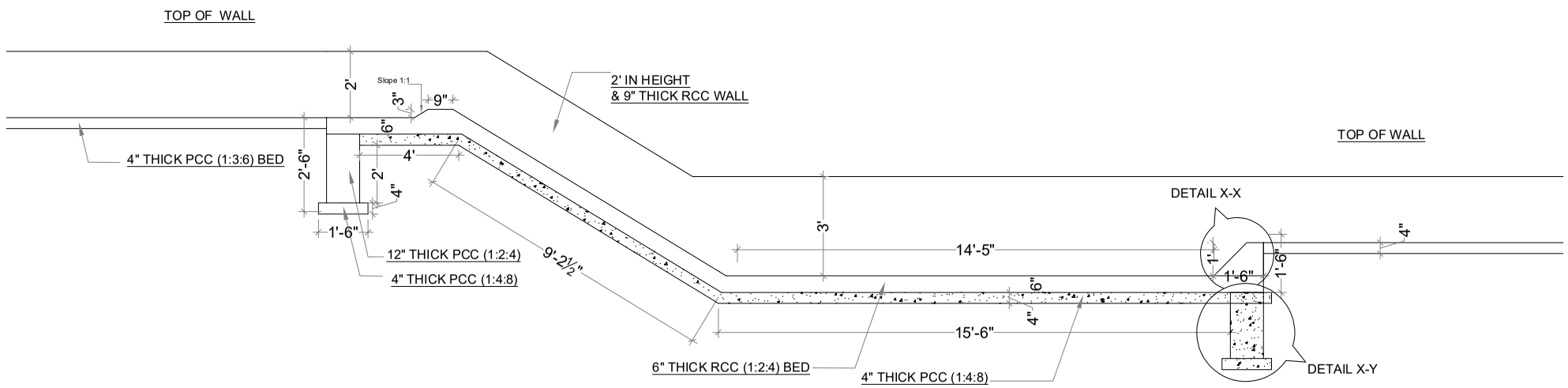
Plan



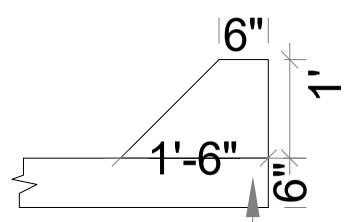
Section C-C



Section B-B

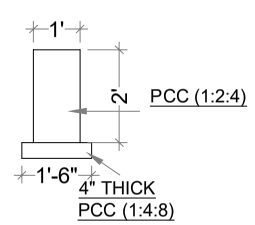


Section A-A



6" THICK RCC
(1:2:4) BED

DETAIL OF D/S TOE WALL



DETAIL X-Y

GOVERNMENT OF KHYBER PAKHTUNKHWA
DIRECTORATE GENERAL SMALL DAMS,
IRRIGATION DEPARTMENT, PESHAWAR

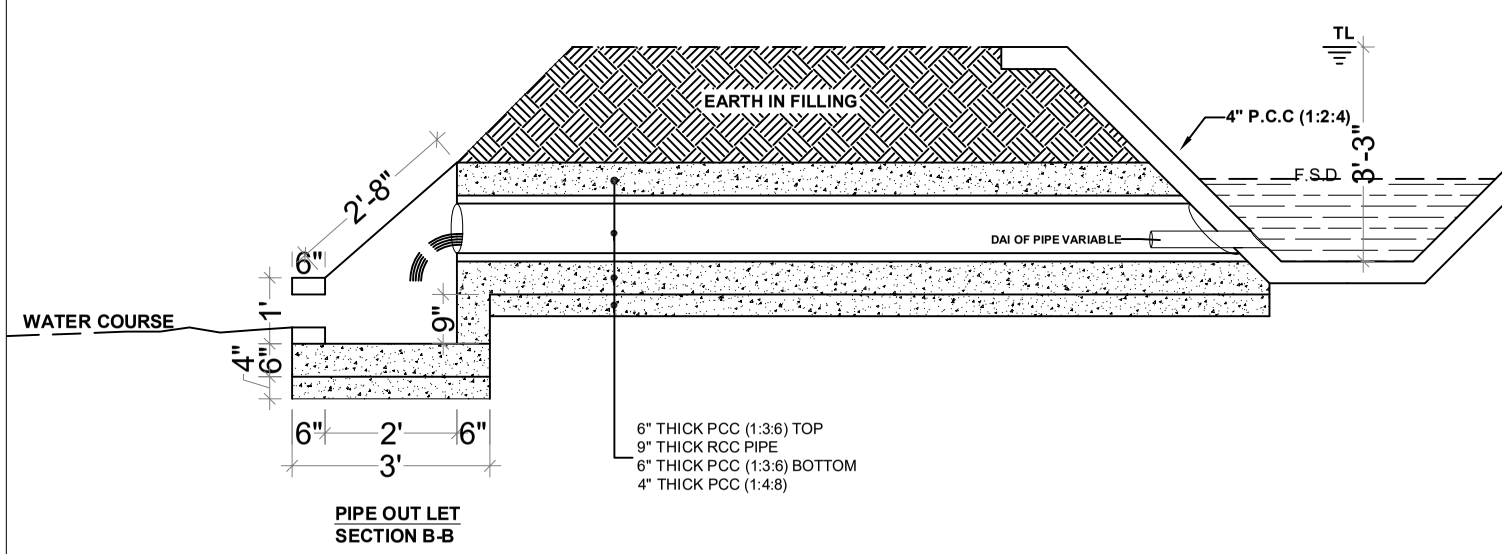
CONSULTING ASSOCIATES
HOUSE #59A, SYED JAMAL UDDIN ROAD, UNIVERSITY TOWN
PEHSAWAR, PAKISTAN
PH: +92 91 5701774
EMAIL: Consultingassociates127@gmail.com

TITLE:-
SATI KALLI DAM PROJECT
BANNU

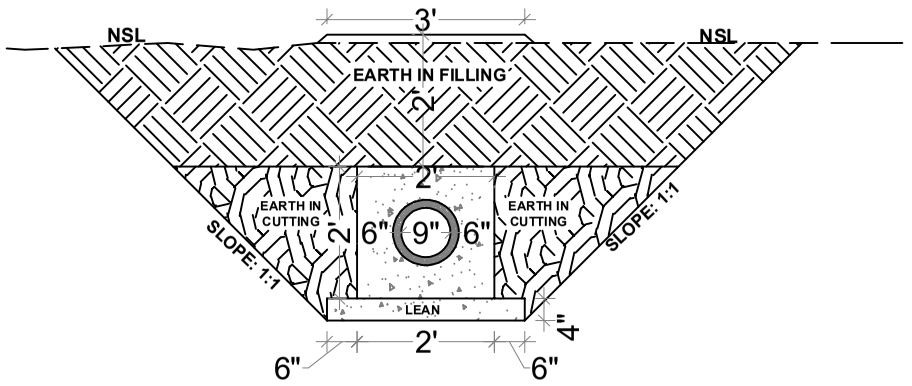
DRAWING TITLE:-
HYDRAULIC STRUCTURES
LEFT BANK CANAL
DROP FALL-02

DRAWING:-
PLAN, SECTION A-A, SECTION B-B &
DETAILS M

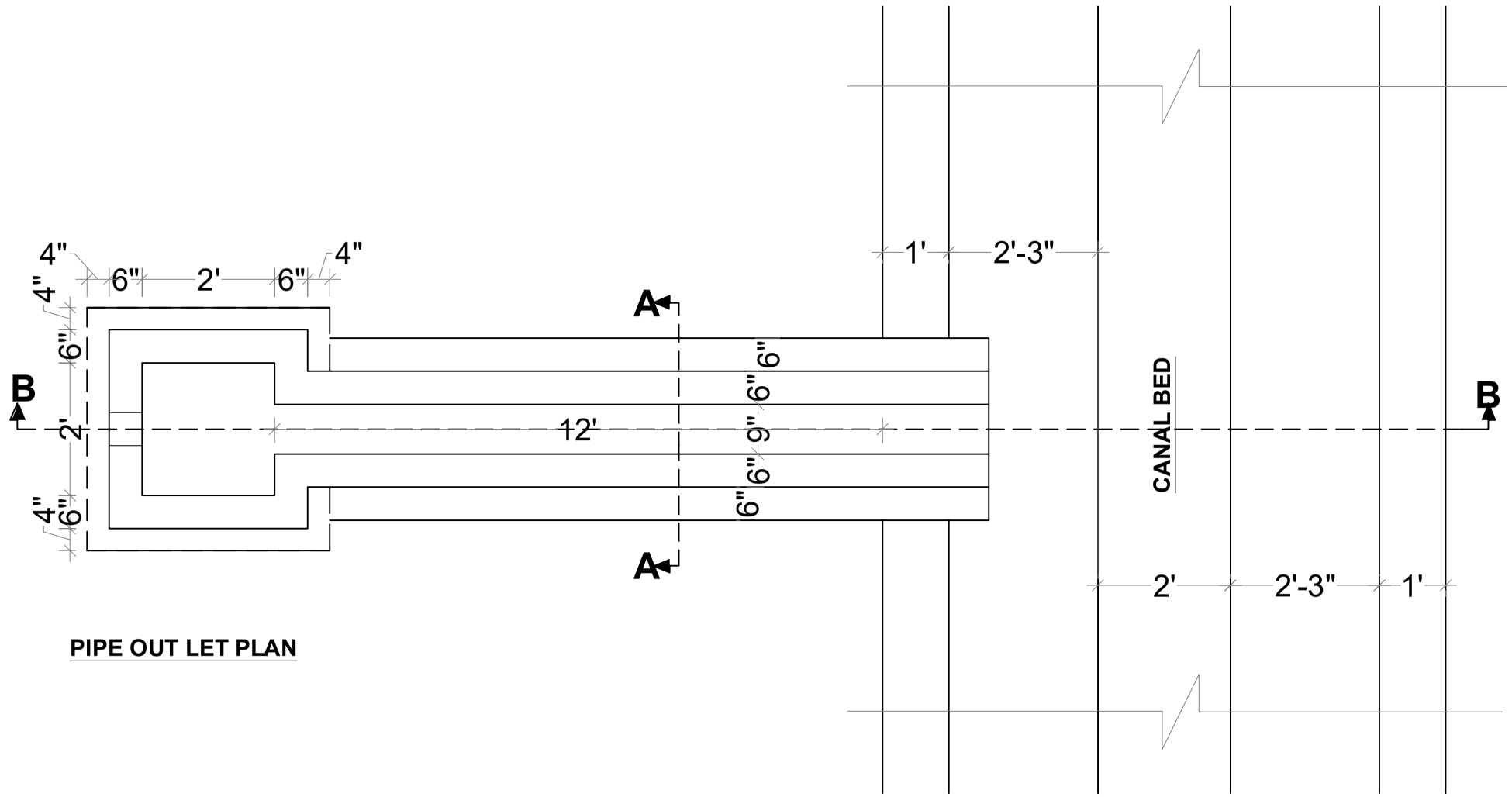
DRAWN BY	MUNEEB KHAN
DESIGN BY	DAWOOD KHAN
CHECKED & SUBMITTED BY	SHAKIL AHMAD
007-CA-M1-HYS-STK-BNU-03	SHEET NO.



PIPE OUT LET
SECTION B-B

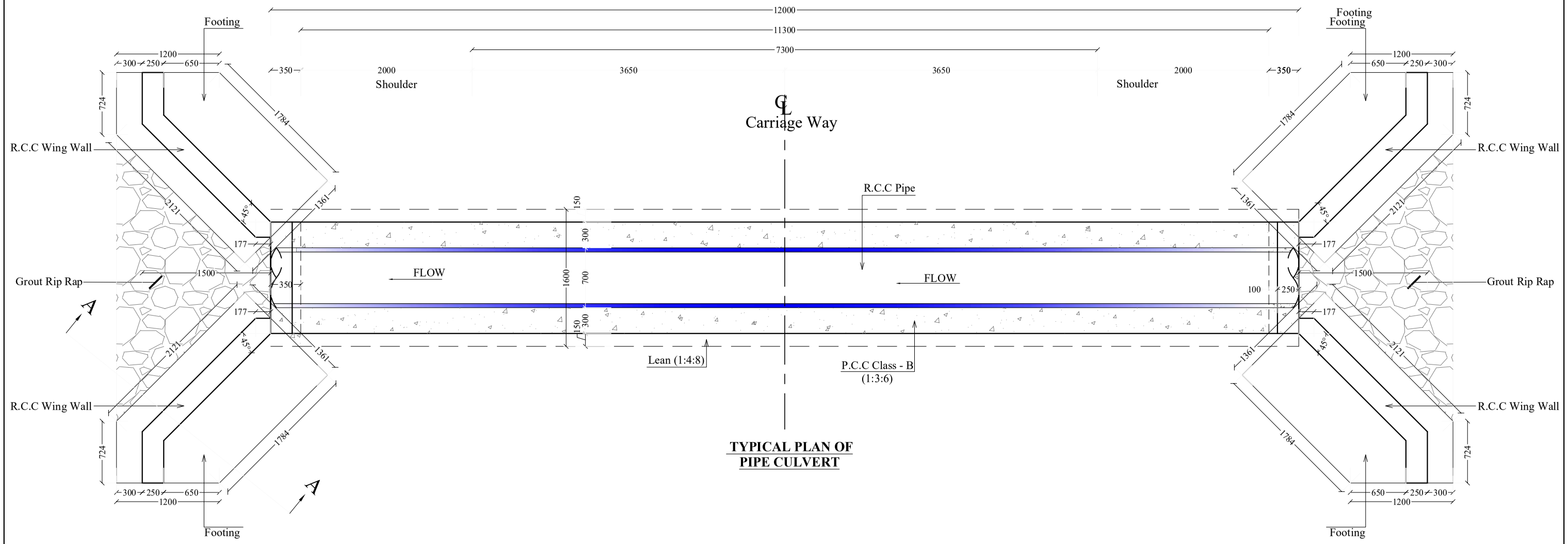


PIPE OUT LET
SECTION A-A

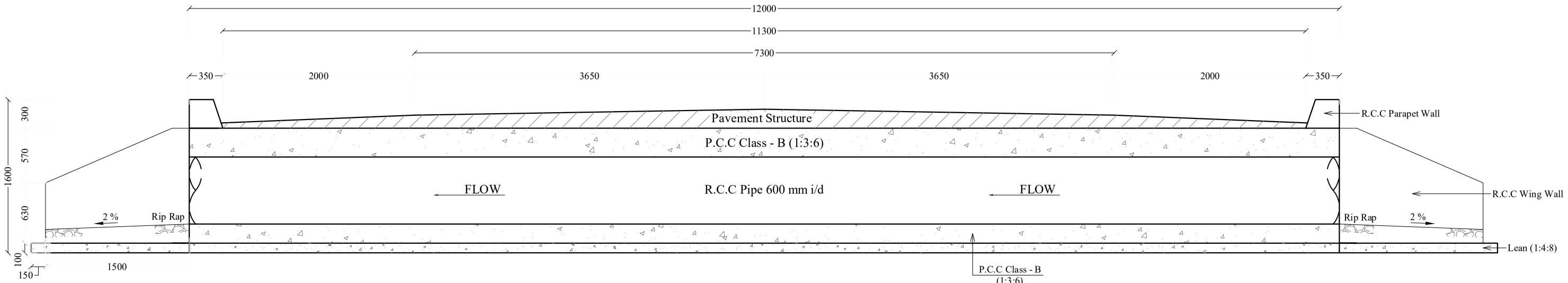


PIPE OUT LET PLAN

GOVERNMENT OF KHYBER PAKHTUNKHWA DIRECTORATE GENERAL SMALL DAMS, IRRIGATION DEPARTMENT, PESHAWAR	**CONSULTING ASSOCIATES** HOUSE #59A, SYED JAMAL UDDIN ROAD, UNIVERSITY TOWN PEHSAWAR, PAKISTAN PH: +92 91 5701774 EMAIL: Consultingassociates127@gmail.com	TITLE:- SATI KALLI DAM PROJECT BANNU	DRAWING TITLE:- **HYDRAULIC STRUCTURES** **PIPE OUT LET**	DRAWING:- PLAN, SECTION A-A, SECTION B-B & DETAILS "M"	DRAWN BY: MUNEEB KHAN DESIGN BY: DAWOOD KHAN CHECKED & SUBMITTED BY: SHAKIL AHMAD 007-CA-M1-HYS-STK-BNU-04 SHEET NO.



TYPICAL PLAN OF PIPE CULVERT



TYPICAL LONG SECTION OF PIPE CULVERT

GOVERNMENT OF KHYBER PAKHTUNKHWA
DIRECTORATE GENERAL SMALL DAMS,
IRRIGATION DEPARTMENT, PESHAWAR

CONSULTING ASSOCIATES
NEAR DEANS COMPLEX APARTMENTS,BEHIND GUL CNG,BOARD BAZAAR,JAMRUD ROAD,PESHAWAR
PH #: 091-5701774-45 Fax - 091-5701775
E-MAIL: consultingassociates127@gmail.com

SATI KALLI DAM PROJECT
BANNU

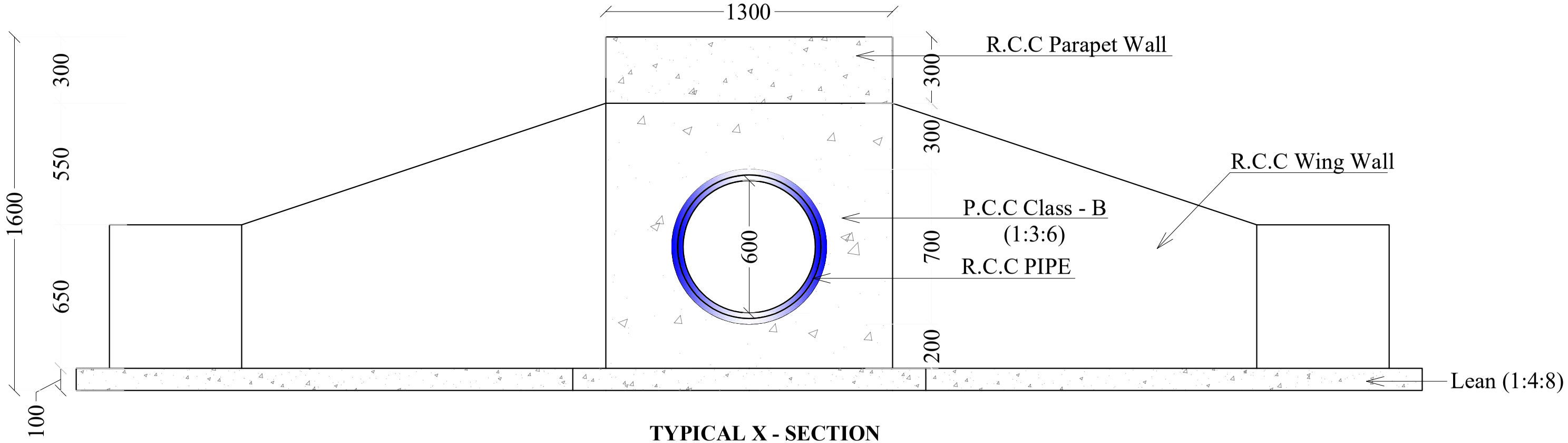
STAMP & SIGNATUREs:

REV.	DATE	

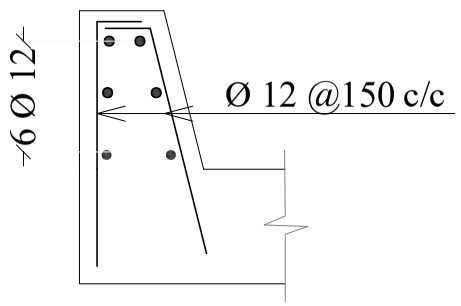
600 MM DIA PIPE CULVERT

DWG NO:- **007-CA-HYS-KP-STK-BNU-05**

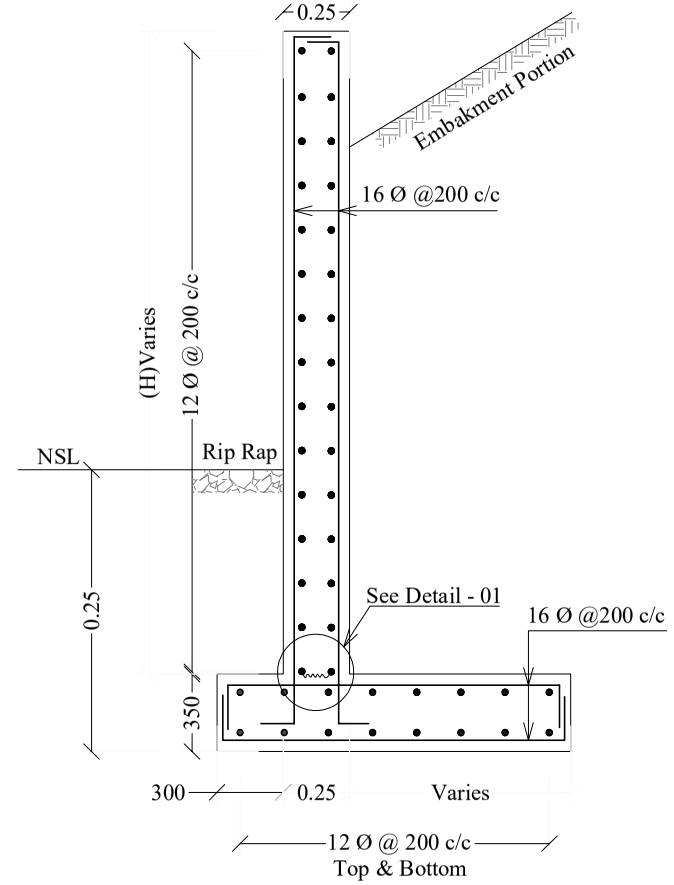
SHEET NO:-



TYPICAL X - SECTION OF PIPE CULVERT



REINFORCEMENT DETAIL OF PARAPET



REINFORCEMENT DETAIL OF SECTION A-A

GOVERNMENT OF KHYBER PAKHTUNKHWA
DIRECTORATE GENERAL SMALL DAMS,
IRRIGATION DEPARTMENT, PESHAWAR

CONSULTING ASSOCIATES
NEAR DEANS COMPLEX APARTMENTS,BEHIND GUL CNG,BOARD BAZAAR,JAMRUD ROAD,PESHAWAR
PH #: 091-5701774-45 Fax - 091-5701775
E-MAIL: consultingassociates127@gmail.com

SATI KALLI DAM PROJECT
BANNU

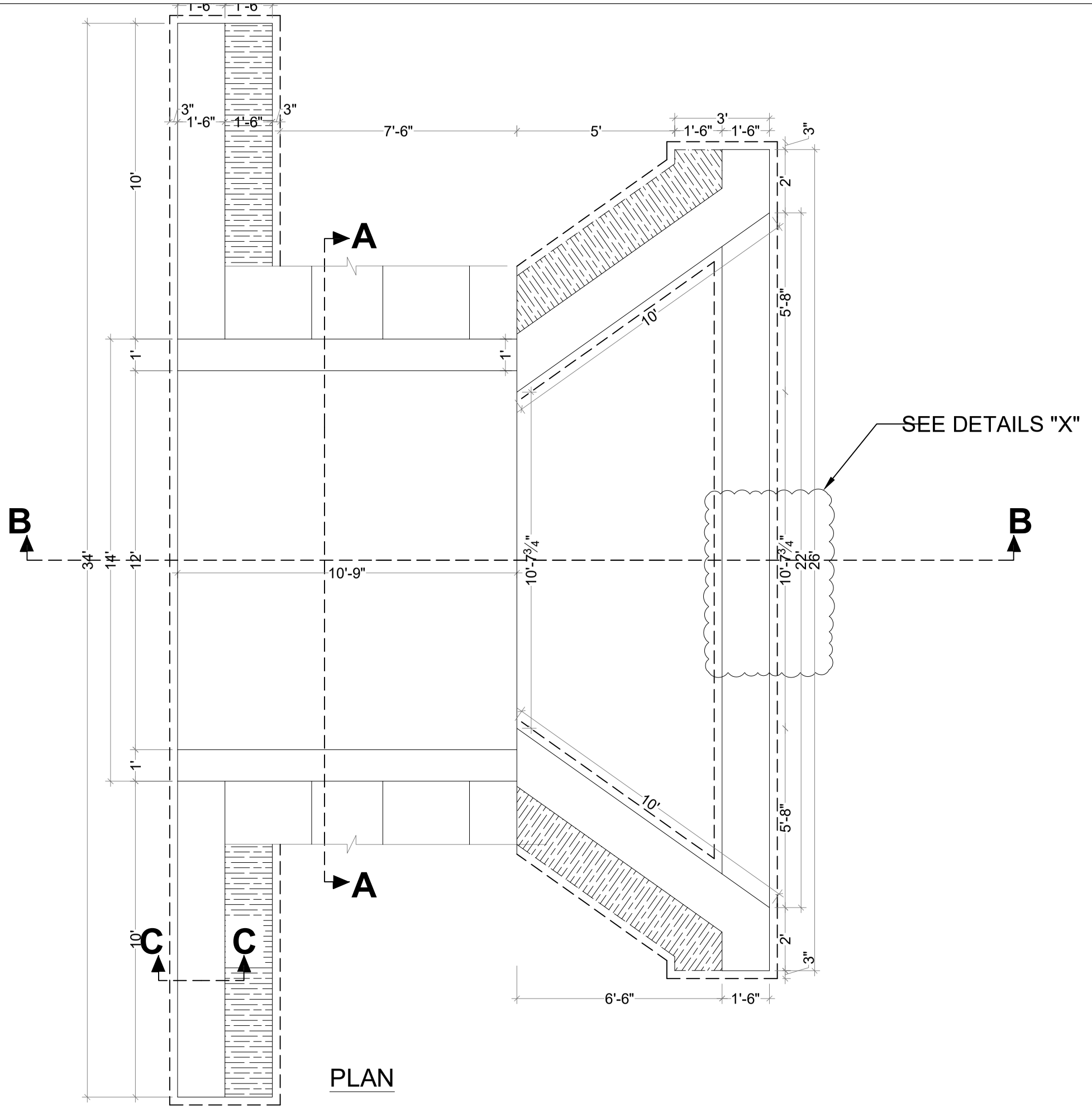
STAMP & SIGNATURES:

REV.	DATE	

600 MM DIA PIPE CULVERT

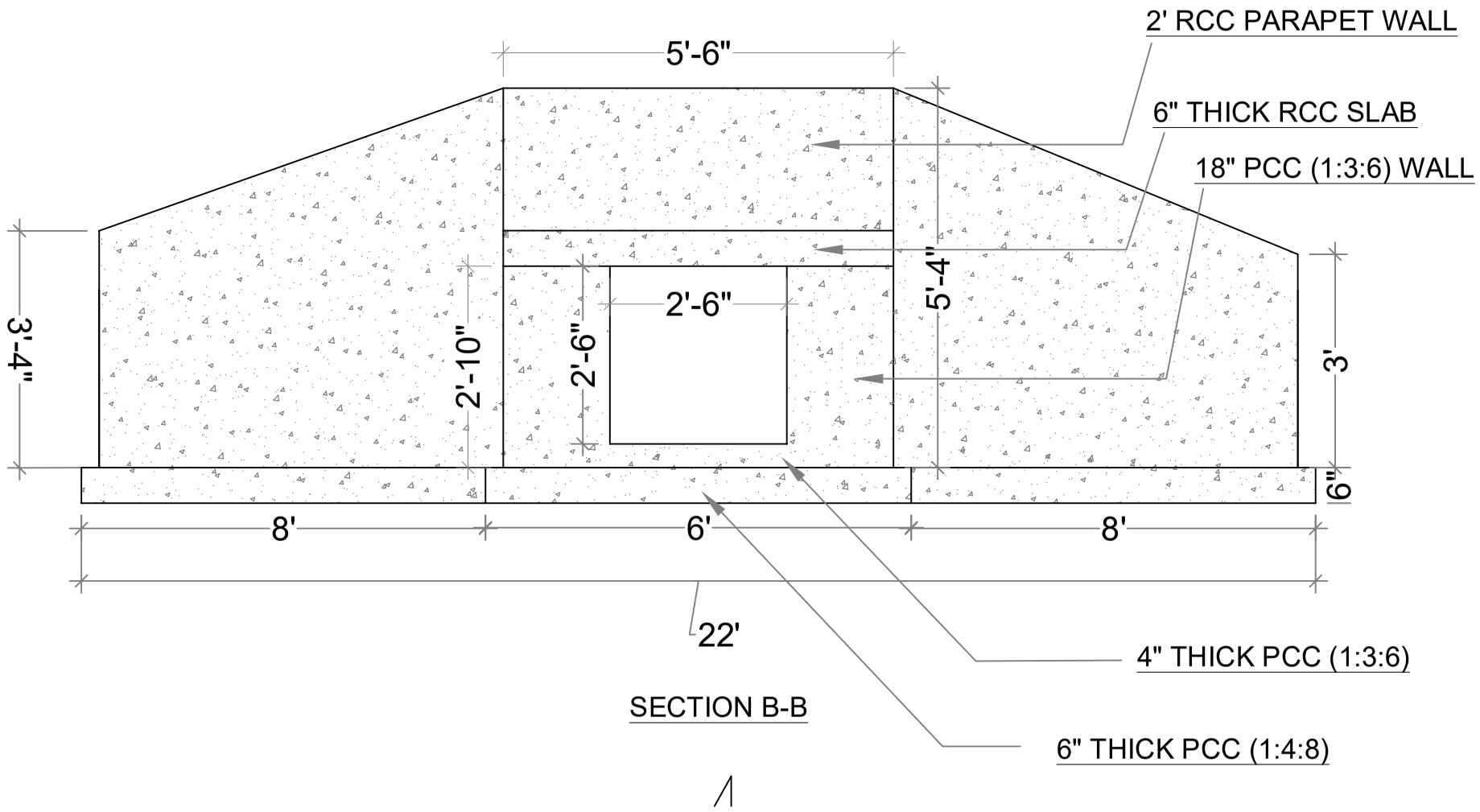
DWG NO:- **007-CA-HYS-KP-STK-BNU-06**

SHEET NO:-

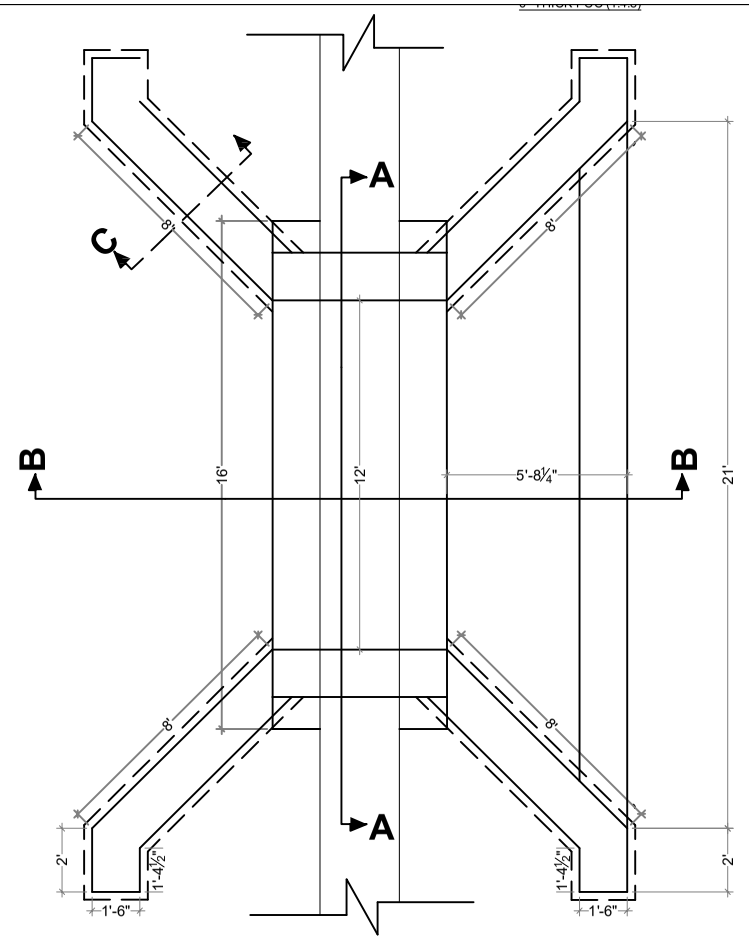


PLAN

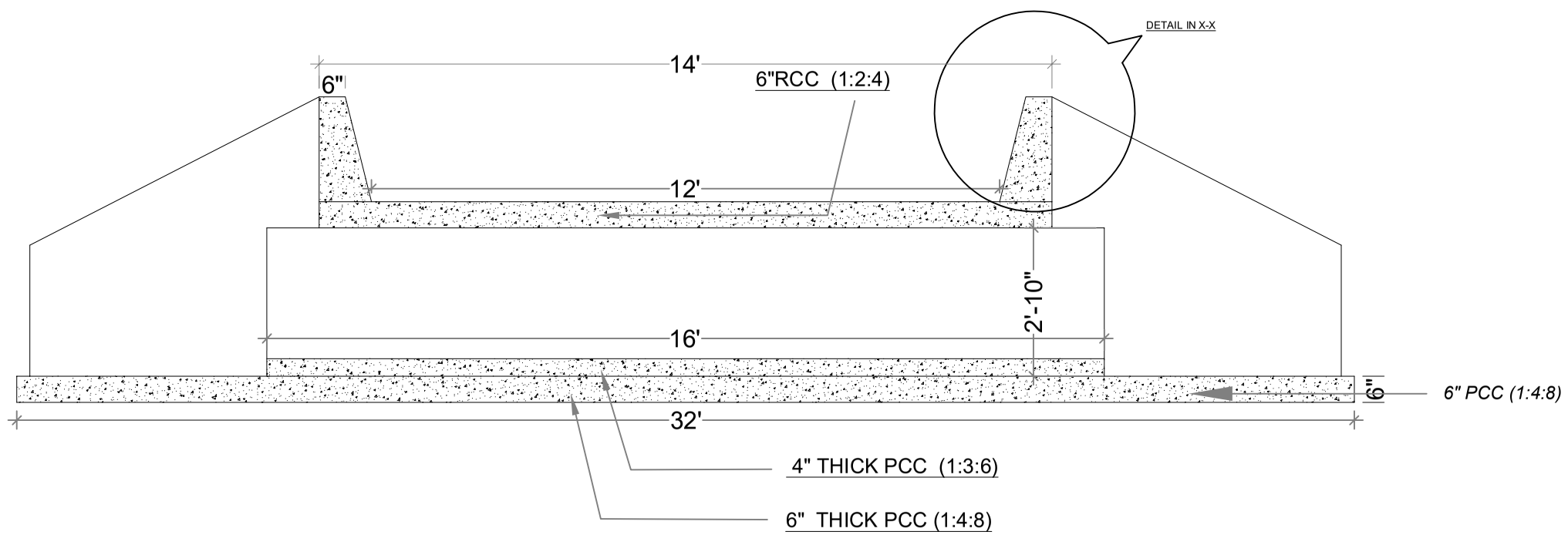
GOVERNMENT OF KHYBER PAKHTUNKHWA DIRECTORATE GENERAL SMALL DAMS, IRRIGATION DEPARTMENT, PESHAWAR	**CONSULTING ASSOCIATES** HOUSE #59A, SYED JAMAL UDDIN ROAD, UNIVERSITY TOWN PEHSAWAR, PAKISTAN PH: +92 91 5701774 EMAIL: Consultingassociates127@gmail.com	TITLE:- SATI KALLI DAM PROJECT BANNU	DRAWING TITLE:- **HYDRAULIC STRUCTURES** **SUPER PASSAGE**	DRAWING:- **PLAN** **RD = 6+200 9+875**	DRAWN BY: MUNEEB KHAN DESIGN BY: DAWOOD KHAN CHECKED & SUBMITTED BY: SHAKIL AHMAD 007-CA-HYS-STK-BNU-07 SHEET NO.



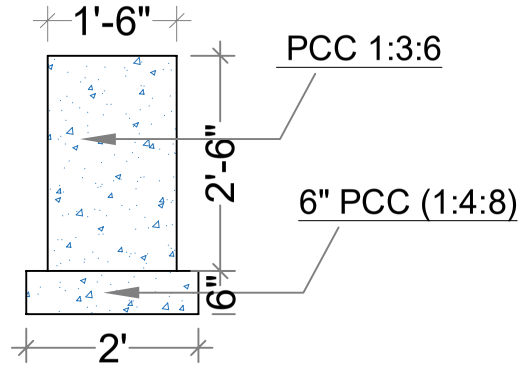
SECTION B-B



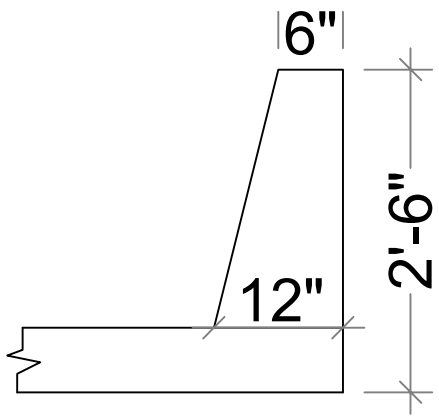
PLAN



SECTION A-A



SEC AT C-C



DETAIL X-X

GOVERNMENT OF KHYBER PAKHTUNKHWA
DIRECTORATE GENERAL SMALL DAMS,
IRRIGATION DEPARTMENT, PESHAWAR

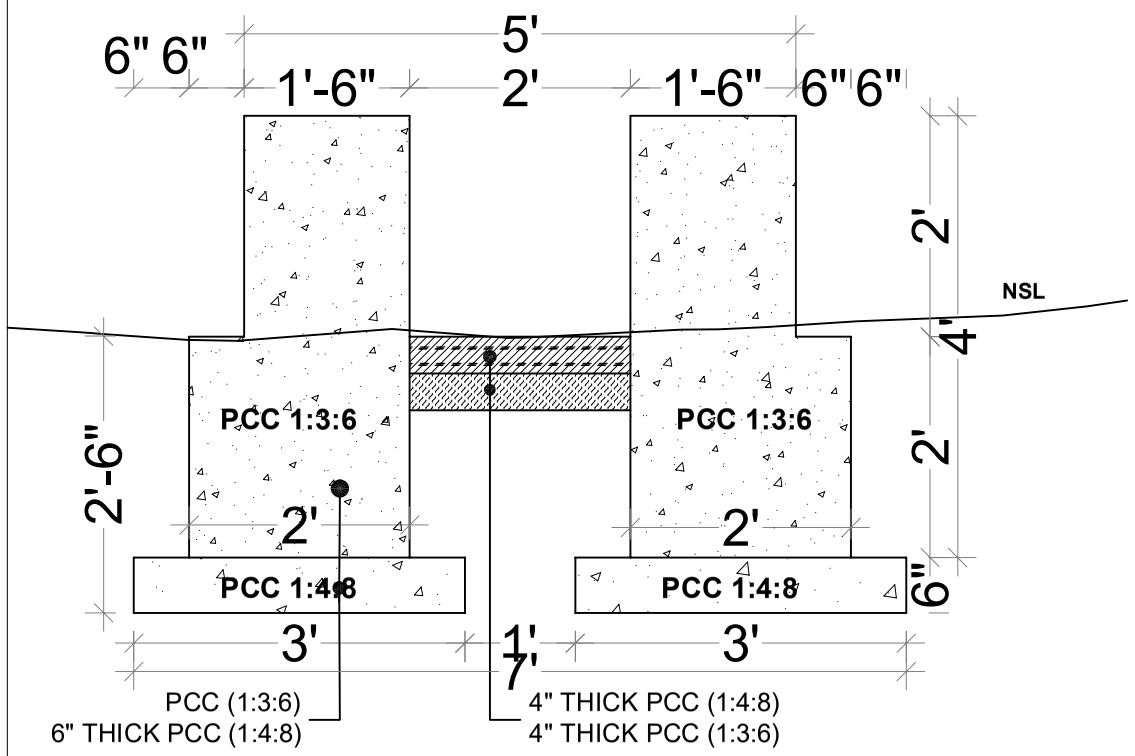
CONSULTING ASSOCIATES
HOUSE #59A, SYED JAMAL UDDIN ROAD, UNIVERSITY TOWN
PEHSAWAR, PAKISTAN
PH: +92 91 5701774
EMAIL: Consultingassociates127@gmail.com

TITLE:-
SATI KALLI DAM PROJECT
BANNU

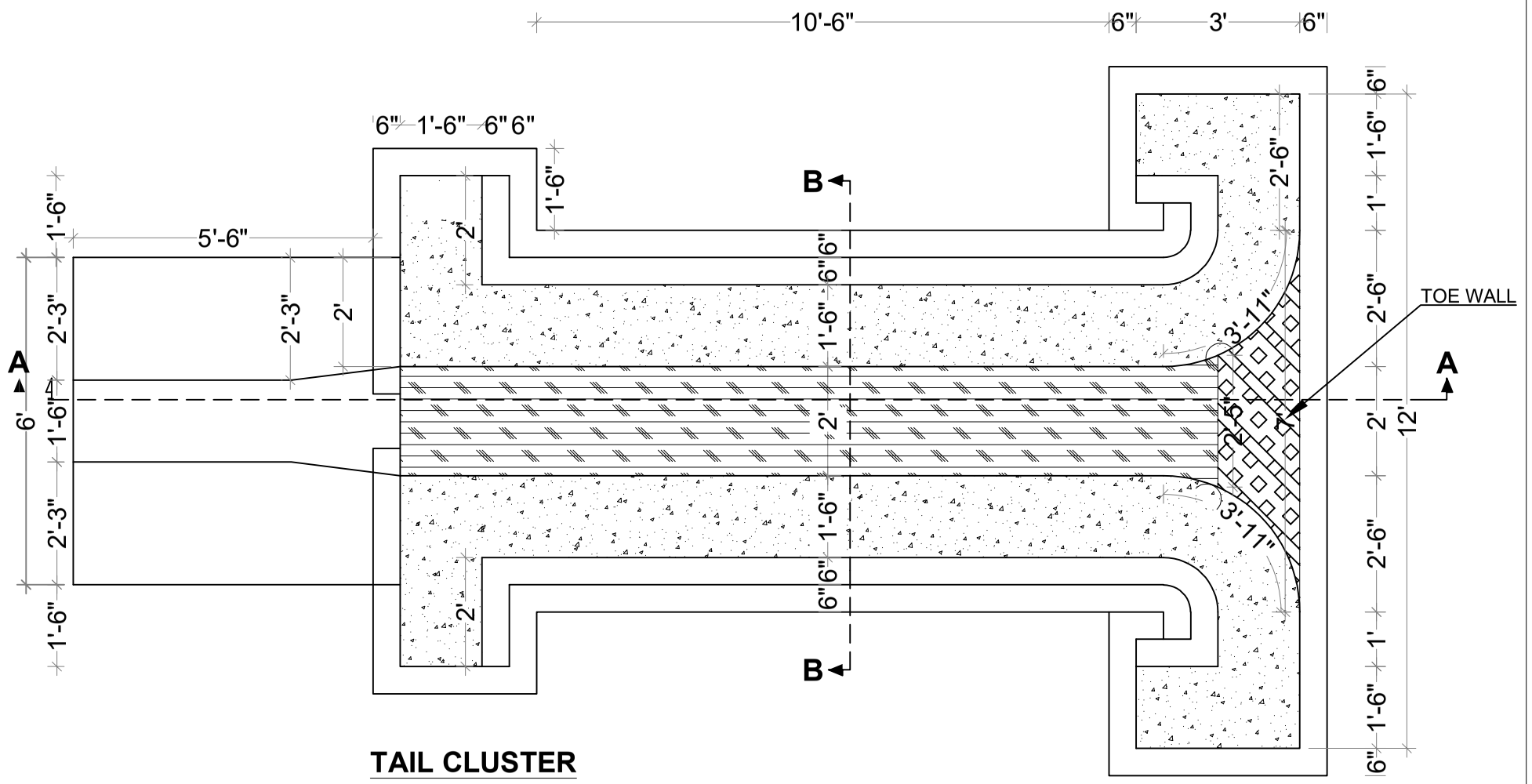
DRAWING TITLE:-
HYDRAULIC STRUCTURES
SUPER PASSAGE

DRAWING:-
TYPICAL SECTION, LONG SECTION,
RD = 6+200 9+875

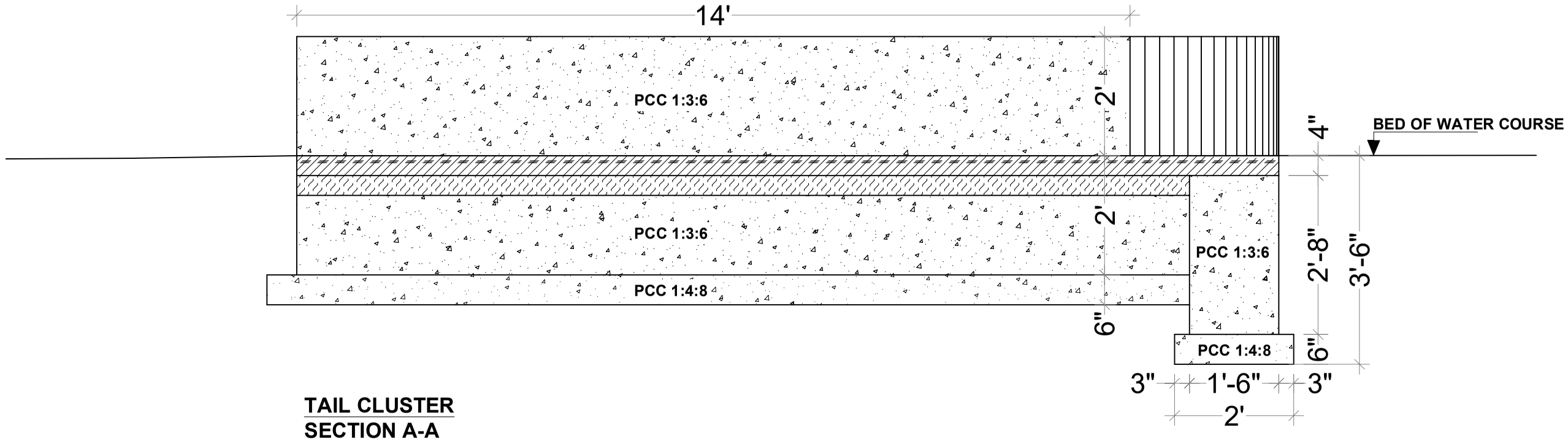
DRAWN BY	MUNEEB KHAN
DESIGN BY	DAWOOD KHAN
CHECKED & SUBMITTED BY	SHAKIL AHMAD
007-CA-HYS-STK-BNU-08	SHEET NO.



TAIL CLUSTER
SECTION B-B



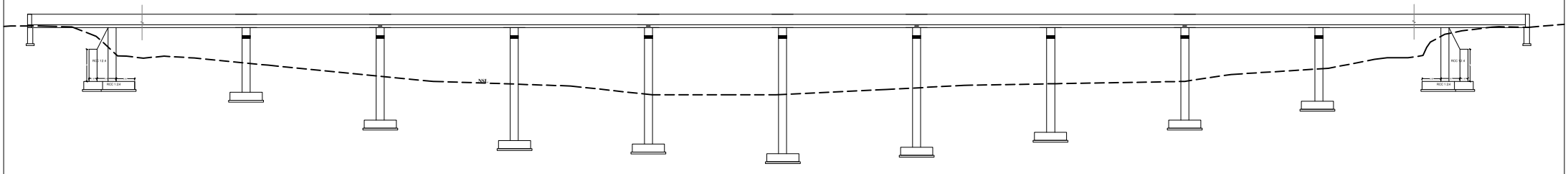
TAIL CLUSTER
PLAN

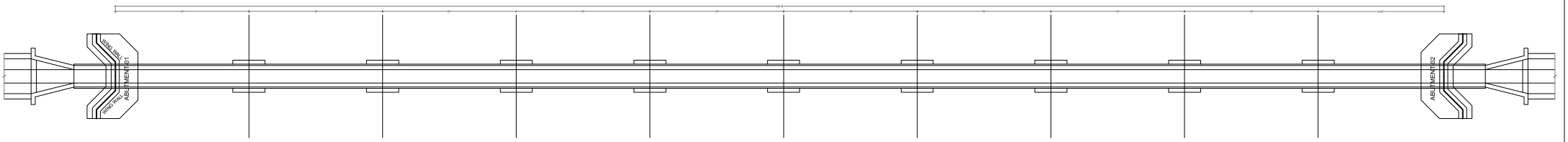


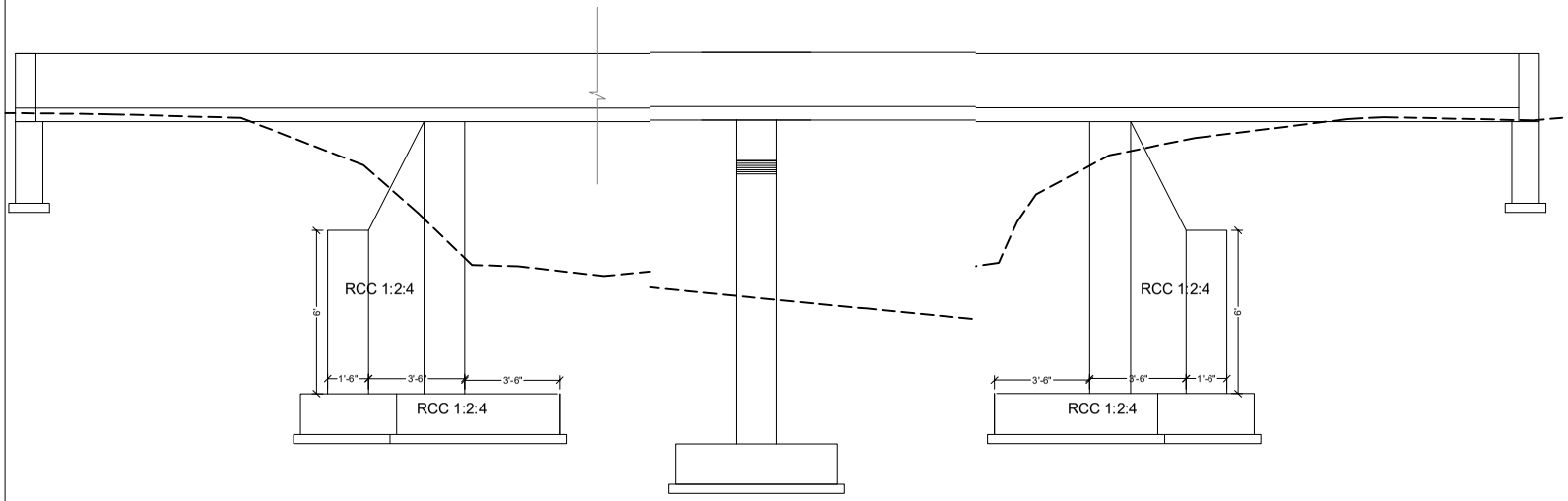
TAIL CLUSTER
SECTION A-A

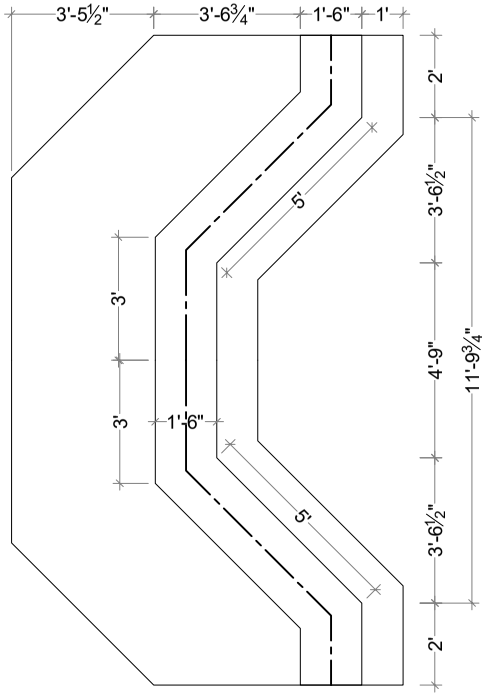
TOE WALL

GOVERNMENT OF KHYBER PAKHTUNKHWA DIRECTORATE GENERAL SMALL DAMS, IRRIGATION DEPARTMENT, PESHAWAR	**CONSULTING ASSOCIATES** HOUSE #59A, SYED JAMAL UDDIN ROAD, UNIVERSITY TOWN PEHSAWAR, PAKISTAN PH: +92 91 5701774 EMAIL: Consultingassociates127@gmail.com	TITLE:- SATTI KALLI DAM PROJECT BANNU	DRAWING TITLE:- **HYDRAULIC STRUCTURES** **TAIL CLUSTER**	DRAWING:- PLAN, SECTION A-A, SECTION B-B	DRAWN BY: MUNEEB KHAN DESIGN BY: DAWOOD KHAN CHECKED & SUBMITTED BY: SHAKIL AHMAD 007-CA-HYS-STK-BNU-09 SHEET NO.









GOVERNMENT OF KHYBER PAKHTUNKHWA
DIRECTORATE GENERAL SMALL DAMS,
IRRIGATION DEPARTMENT, PESHAWAR

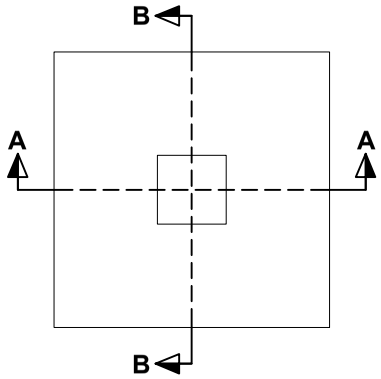
CONSULTING ASSOCIATES
HOUSE #59A, SYED JAMAL UDDIN ROAD, UNIVERSITY TOWN
PEHSAWAR, PAKISTAN
PH: +92 91 5701774
EMAIL: Consultingassociates127@gmail.com

TITLE:-
SATI KALLI DAM PROJECT
BANNU

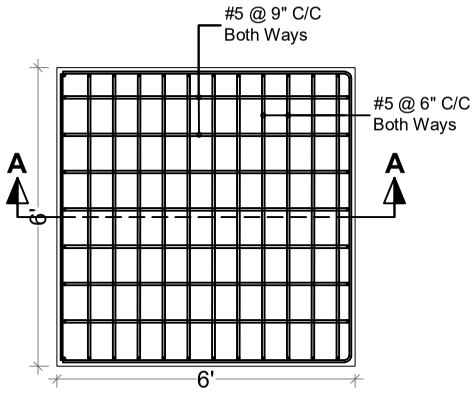
DRAWING TITLE:-
HYDRAULIC STRUCTURES
AQUEDUCT-02

DRAWING:-
PLAN
ABUTMENT ,WING WALLS AND CUTOFF WALL

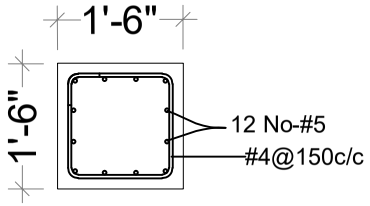
DRAWN BY	MUNEEB KHAN
DESIGN BY	DAWOOD KHAN
CHECKED & SUBMITTED BY	SHAKIL AHMAD
007-CA-HYS-STK-BNU-10	SHEET NO



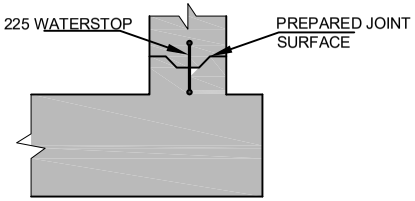
PIER PLAN



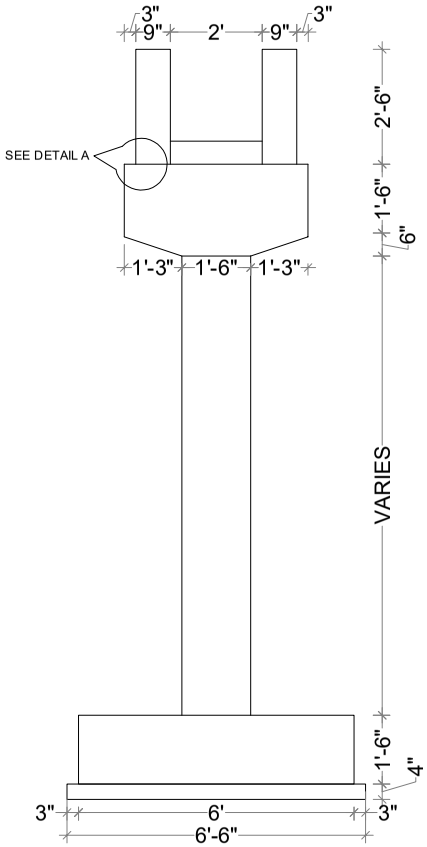
PIER PLAN



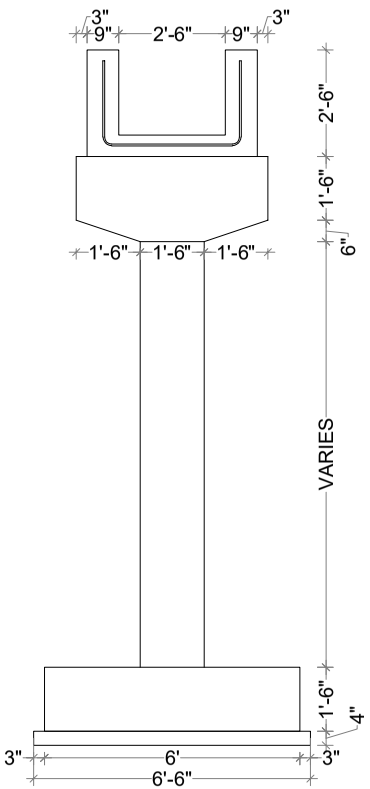
PIER SECTION C-C



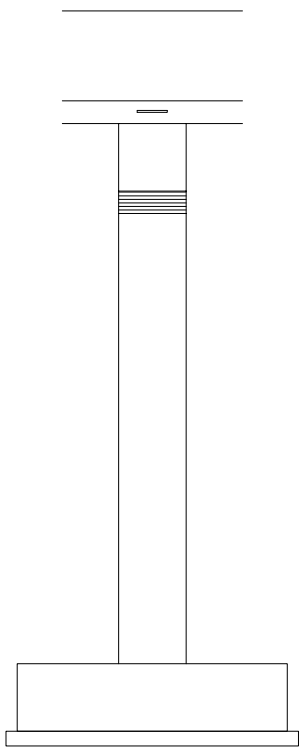
SEE DETAIL-A



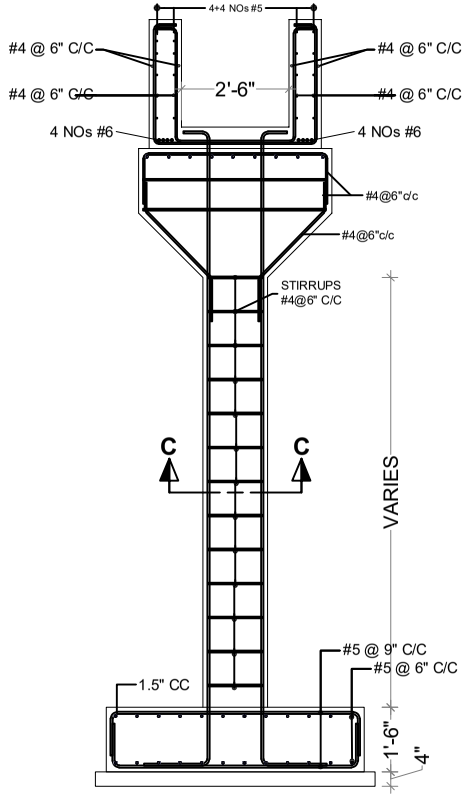
SECTION A-A



SECTION A-A
AT 50' INTERVALS

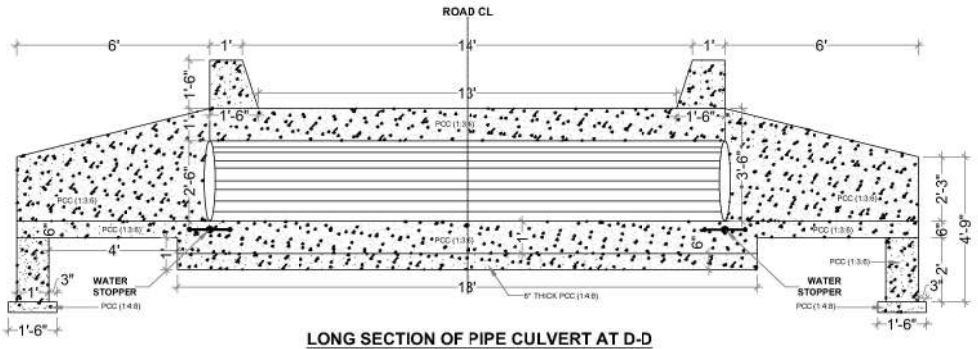


SECTION B-B
AT 50' INTERVALS

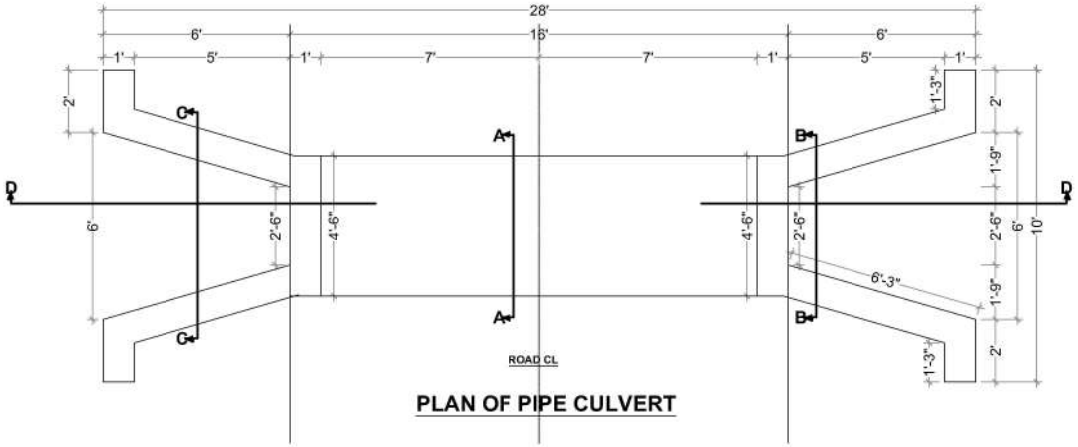


SECTION A-A
REINFORCEMENT DETAILS

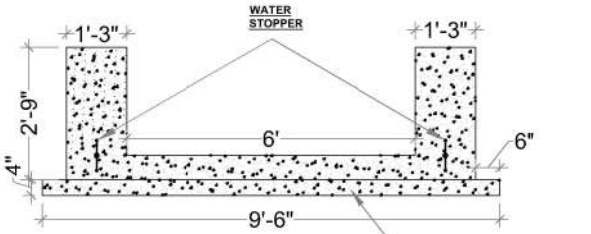
GOVERNMENT OF KHYBER PAKHTUNKHWA DIRECTORATE GENERAL SMALL DAMS, IRRIGATION DEPARTMENT, PESHAWAR	**CONSULTING ASSOCIATES** HOUSE #59A, SYED JAMAL UDDIN ROAD, UNIVERSITY TOWN PEHSAWAR, PAKISTAN PH: +92 91 5701774 EMAIL: Consultingassociates127@gmail.com	TITLE:- SATI KALLI DAM PROJECT BANNU	DRAWING TITLE:- **HYDRAULIC STRUCTURES** **AQUEDUCT**	DRAWING:- **PLAN, WING WALLS SECTION AND CUTOFF WALL SECTIONS**	DRAWN BY: MUNEEB KHAN DESIGN BY: DAWOOD KHAN CHECKED & SUBMITTED BY: SHAKIL AHMAD 007-CA-HYS-STK-BNU-11 SHEET NO



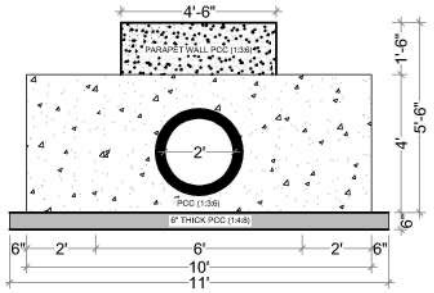
LONG SECTION OF PIPE CULVERT AT D-D



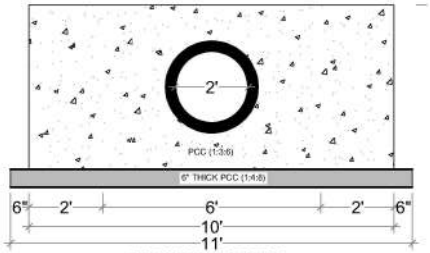
PLAN OF PIPE CULVERT



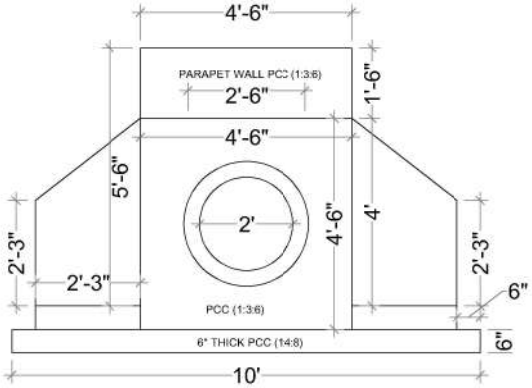
SECTION AT C-C



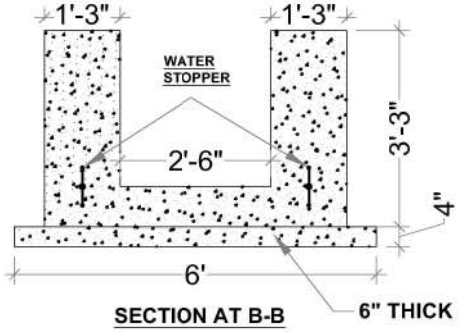
PIPE CULVERT SECTION
FRONT VIEW



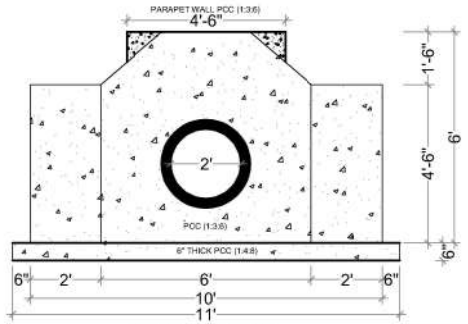
PIPE CULVERT SECTION
FRONT VIEW



PIPE CULVERT X-SECTION AT A-A

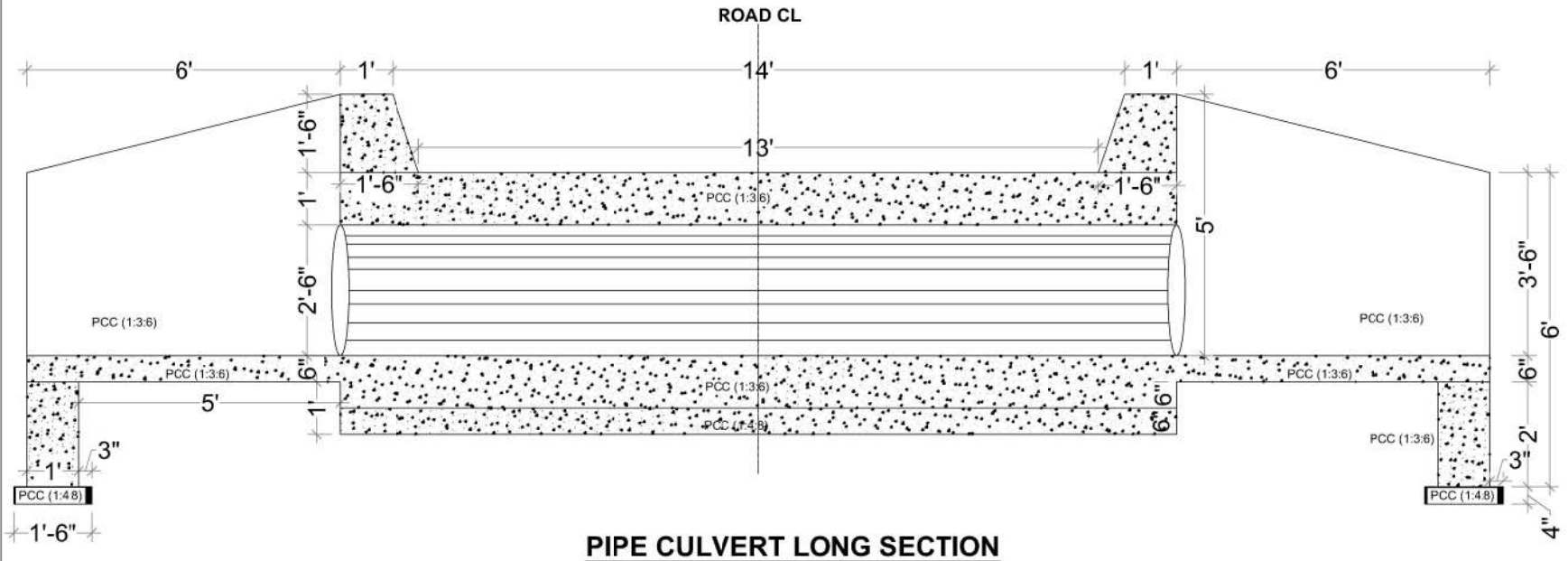


SECTION AT B-B

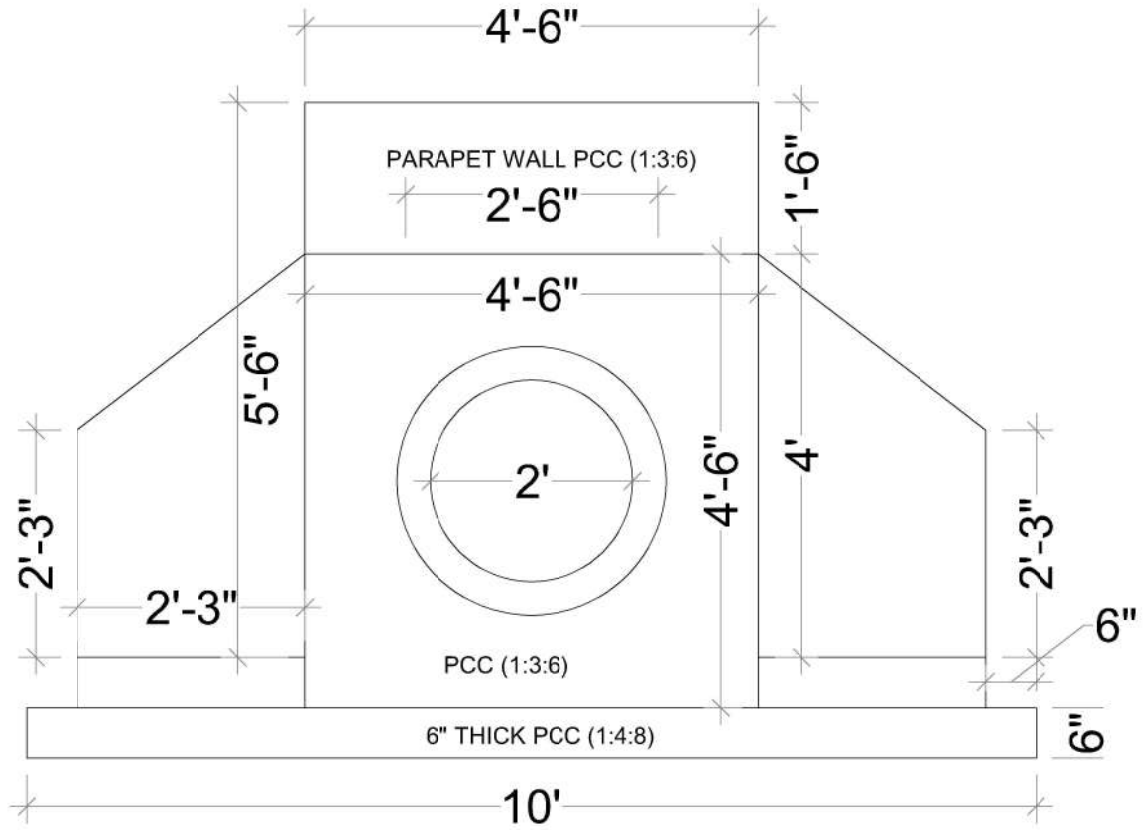


PIPE CULVERT SECTION
FRONT VIEW

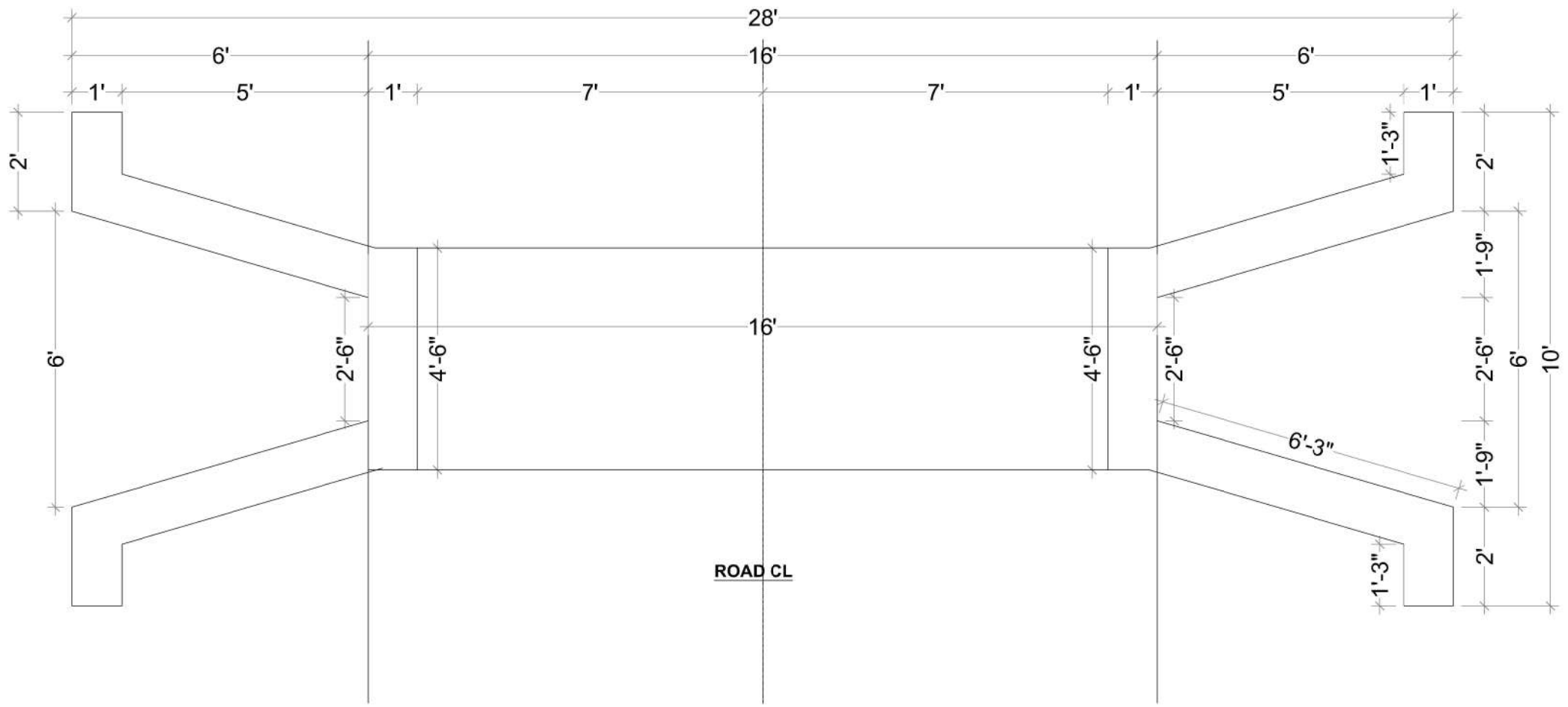
GOVERNMENT OF KHYBER PAKHTUNKHWA DIRECTORATE GENERAL SMALL DAMS, IRRIGATION DEPARTMENT, PESHAWAR	**CONSULTING ASSOCIATES** HOUSE #59A, SYED JAMAL JODIN ROAD, UNIVERSITY TOWN PEHSAWAR, PAKISTAN PH: +92 91 5701774 EMAIL: Consultingassociates127@gmail.com	TITLE:- SATI KALLI DAM PROJECT BANNU	DRAWING TITLE:- **HYDRAULIC STRUCTURES** **PIPE CULVERT**	DRAWING:- TYPICAL SECTION	DRAWN BY: MUNEEB KHAN DESIGN BY: DAWOOD KHAN CHECKED & SUBMITTED BY: SHAKIL AHMAD 007-CA-HYS-STK-BNU-12 SHEET NO.



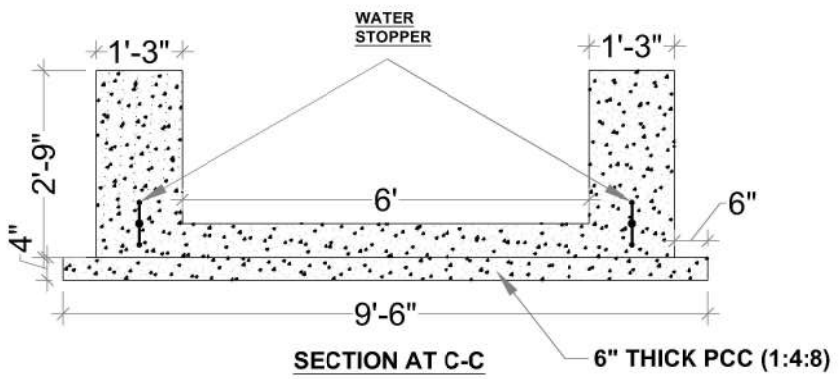
PIPE CULVERT LONG SECTION



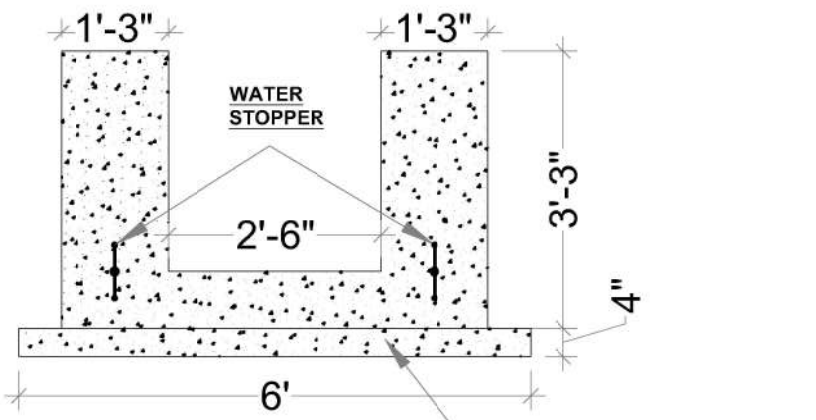
PIPE CULVERT X-SECTION AT A-A



PLAN



SECTION AT C-C



SECTION AT B-B

GOVERNMENT OF KHYBER PAKHTUNKHWA
DIRECTORATE GENERAL SMALL DAMS,
IRRIGATION DEPARTMENT, PESHAWAR

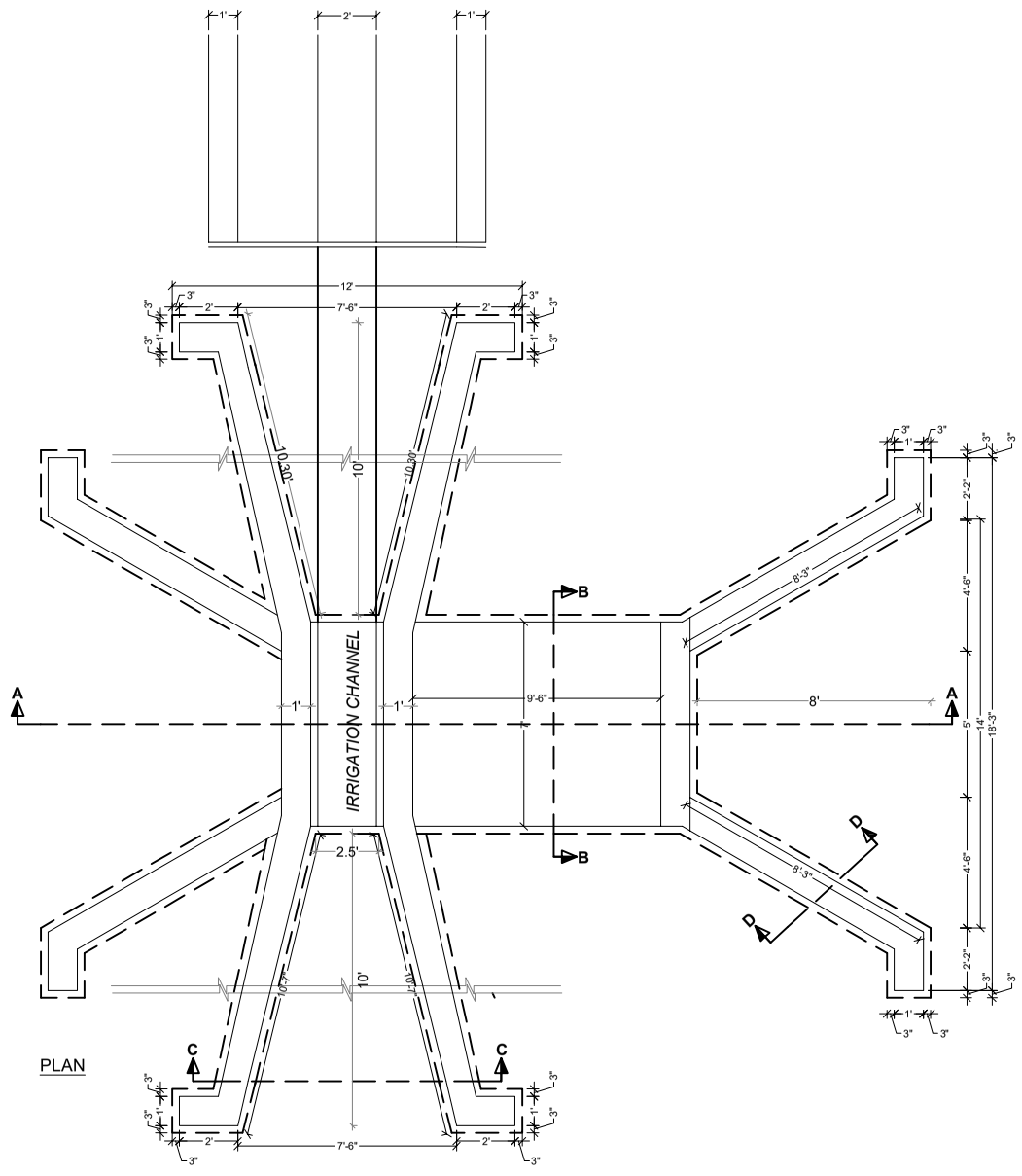
CONSULTING ASSOCIATES
HOUSE #59A, SYED JAMAL UDDIN ROAD, UNIVERSITY TOWN
PEHSAWAR, PAKISTAN
PH: +92 91 5701774
EMAIL: Consultingassociates127@gmail.com

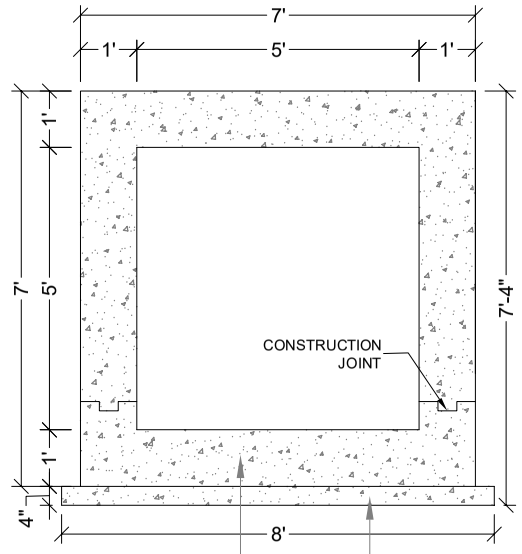
TITLE:-
SATI KALLI DAM PROJECT
BANNU

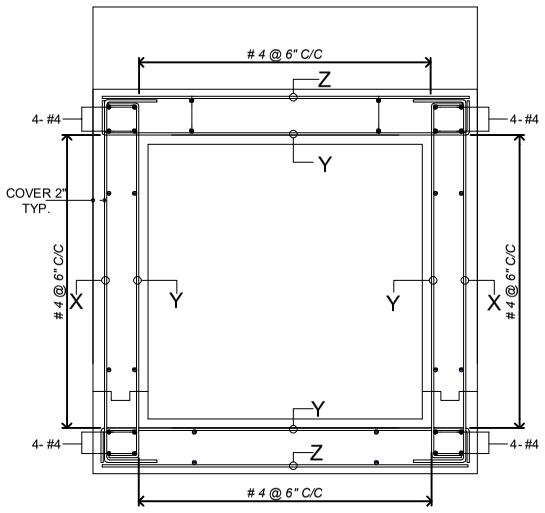
DRAWING TITLE:-
HYDRAULIC STRUCTURES
PIPE CULVERT

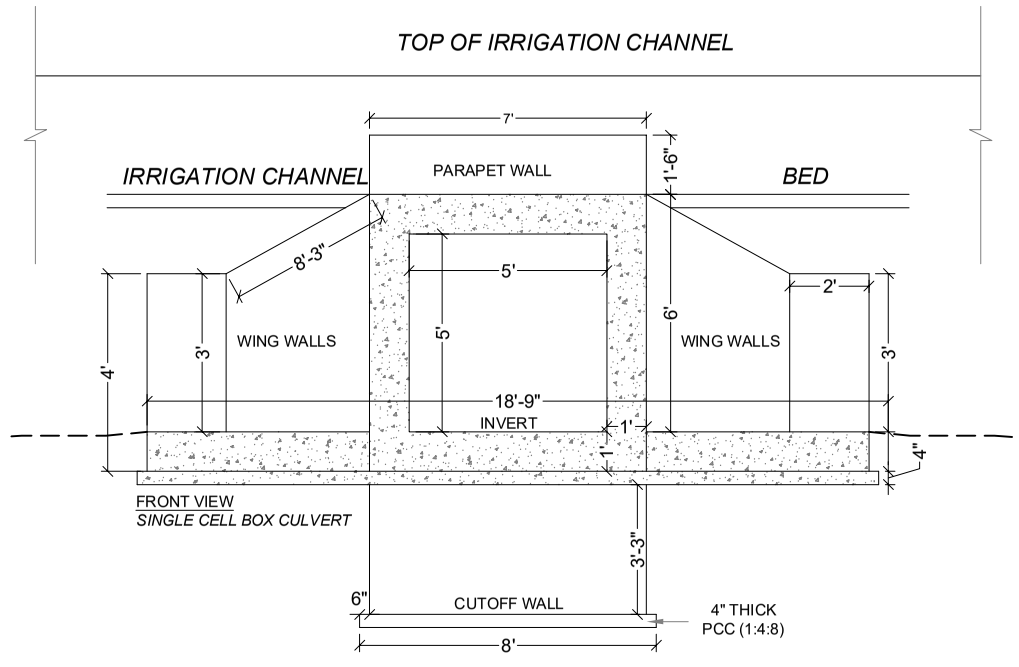
DRAWING:-
TYPICAL SECTION

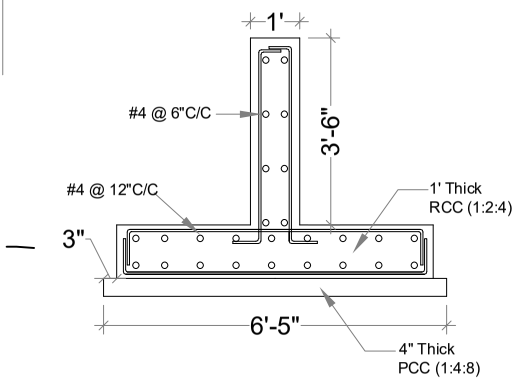
DRAWN BY	MUNEEB KHAN
DESIGN BY	DAWOOD KHAN
CHECKED & SUBMITTED BY	SHAKIL AHMAD
007-CA-HYS-STK-BNU-13	SHEET NO.

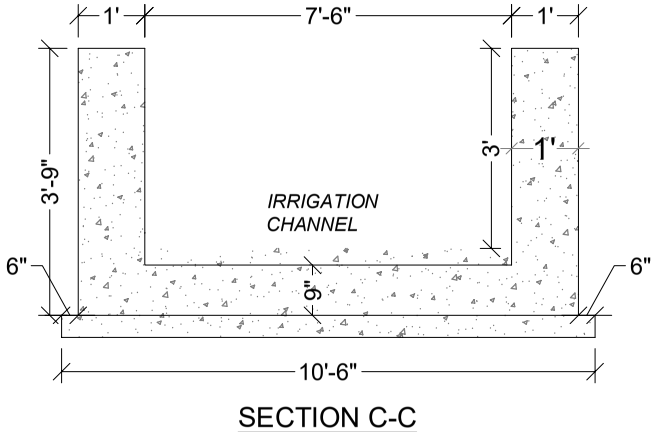


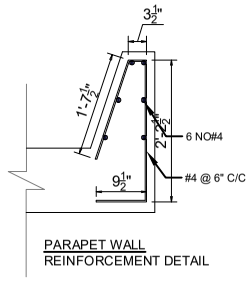


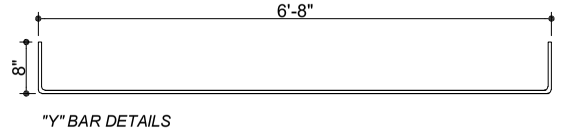


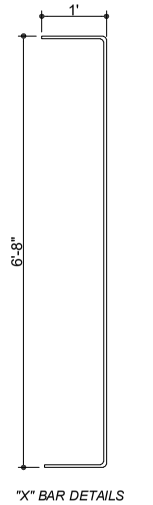












GOVERNMENT OF KHYBER PAKHTUNKHWA
DIRECTORATE GENERAL SMALL DAMS,
IRRIGATION DEPARTMENT, PESHAWAR

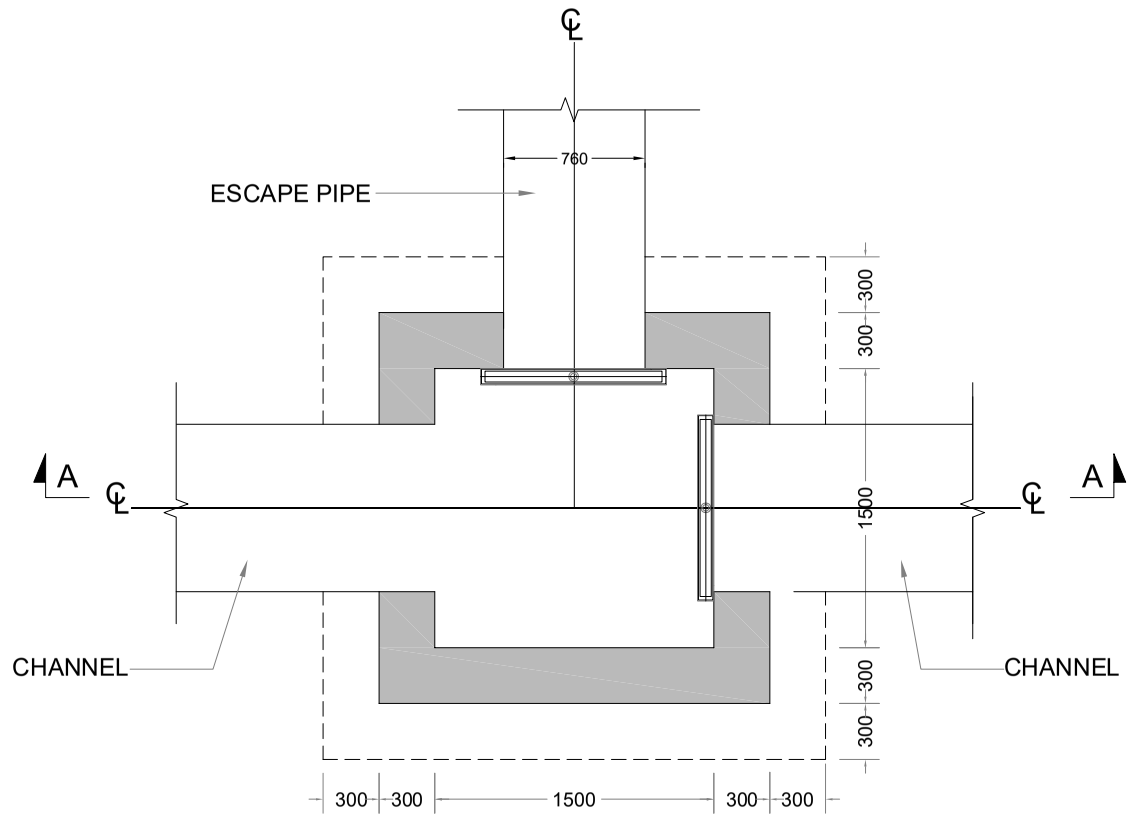
CONSULTING ASSOCIATES
HOUSE #59A, SYED JAMAL UDDIN ROAD, UNIVERSITY TOWN
PEHSAWAR, PAKISTAN
PH: +92 91 5701774
EMAIL: Consultingassociates127@gmail.com

TITLE:-
SATI KALLI DAM PROJECT
BANNU

DRAWING TITLE:-
HYDRAULIC STRUCTURES
BOX CULVERT

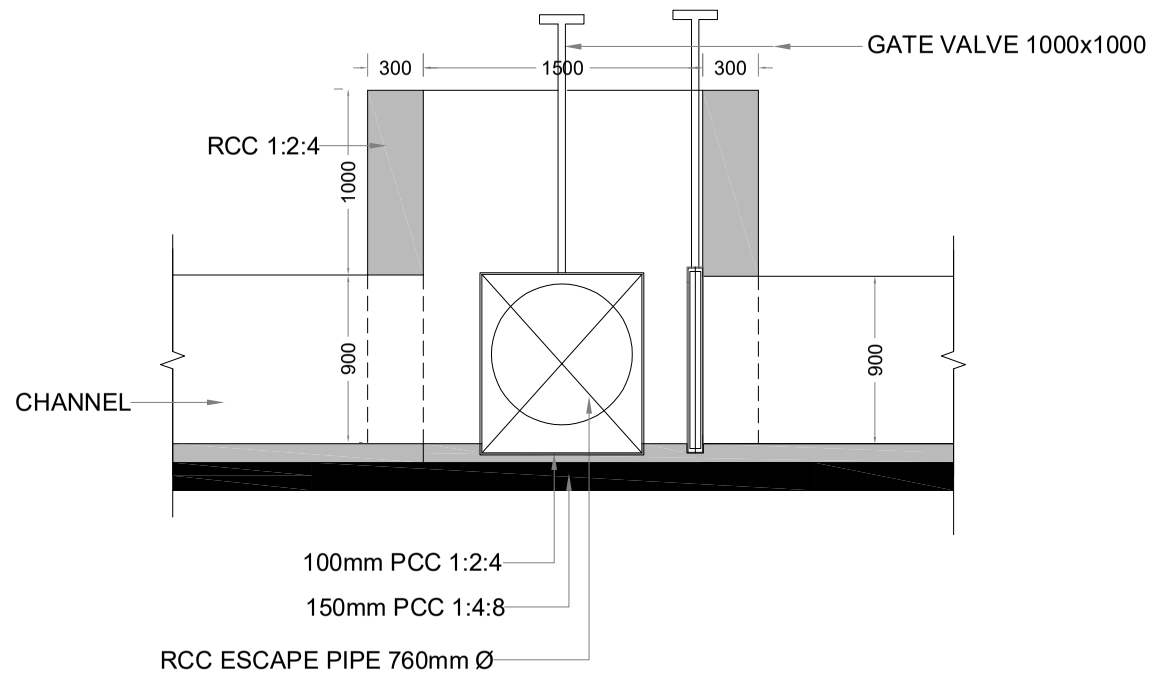
DRAWING:-
PLAN, SECTION A-A, SECTION B-B

DRAWN BY	MUNEEB KHAN
DESIGN BY	DAWOOD KHAN
CHECKED & SUBMITTED BY	SHAKIL AHMAD
007-CA-HYS-STK-BNU-15	SHEET NO.



ESCAPE CHANNEL PLAN

SCALE = 1:75



ESCAPE CHANNEL SEC A-A

SCALE = 1:75

GOVERNMENT OF KHYBER PAKHTUNKHWA
DIRECTORATE GENERAL SMALL DAMS,
IRRIGATION DEPARTMENT, PESHAWAR

CONSULTING ASSOCIATES
NEAR DEANS COMPLEX APARTMENTS,BEHIND GUL
CNG,BOARD BAZAAR,JAMRUD ROAD,PESHAWAR
PH #: 091-5701774-45 Fax - 091-5701775
E-MAIL: consultingassociates127@gmail.com

SATI KALLI DAM PROJECT
BANNU

STAMP & SIGNATURES:

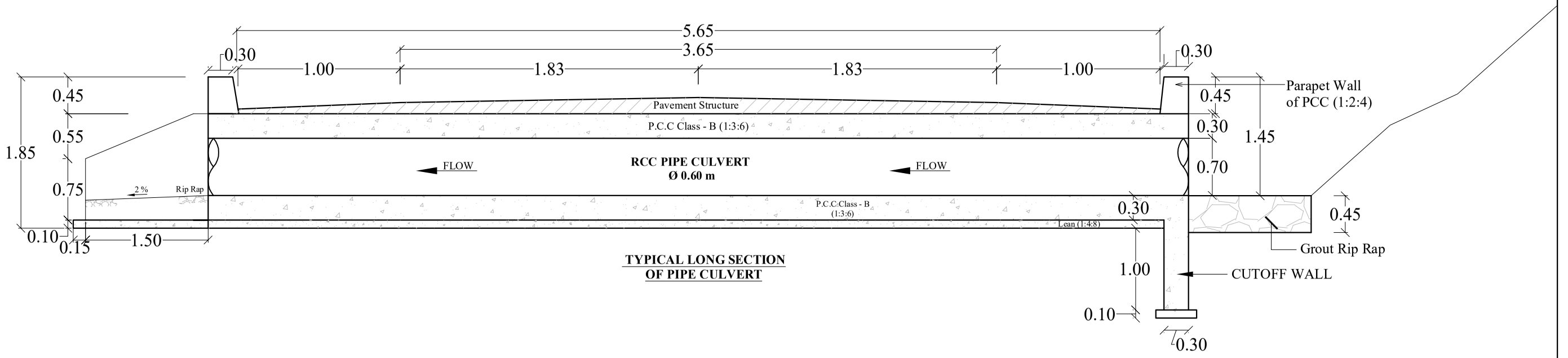
REV.	DATE	
01	APRIL 2019	REVISED INTAKE

ESCAPE CHANNEL PLAN & SECTION
AT IRRIGATION CHANNEL RD 0+035

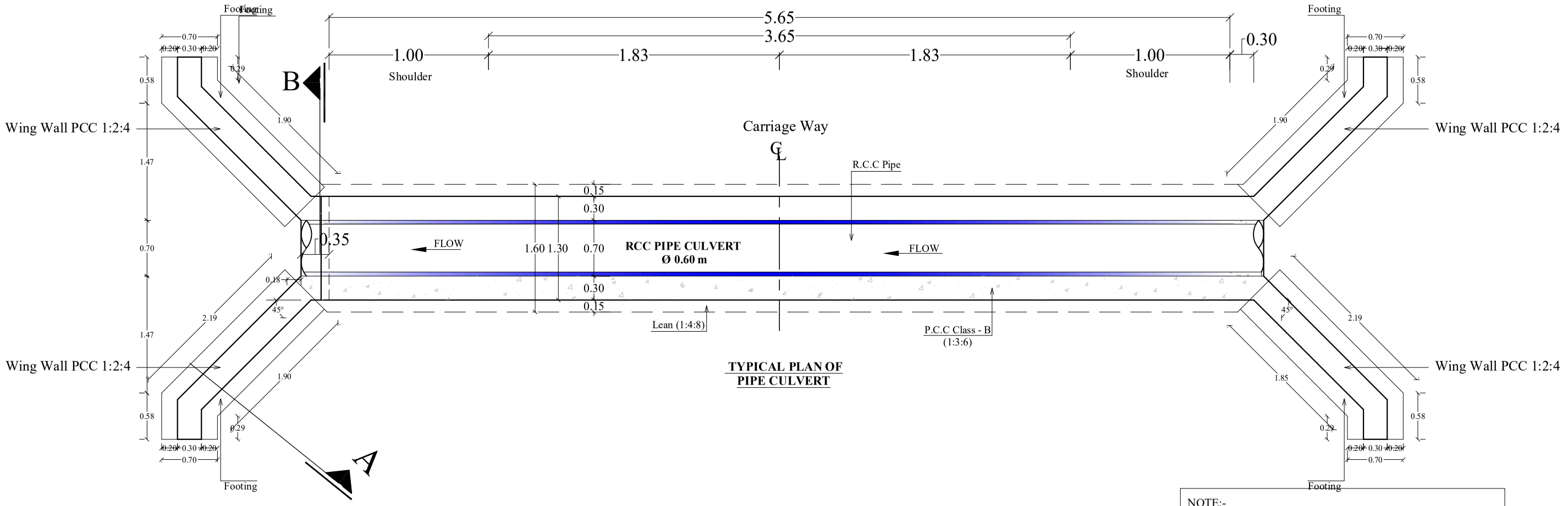
DWG NO: **007-CA-MC-HYS-STK-BNU-16**

SHEET NO:

CAD-File No.: F:\33 SATTI KALLI\REV-06 PACKAGES\PACKAGE-02\007-IRRIGATION CHANNEL HYDRALIC STRUCTUE\007-CA-HYS-STK-BNU-16 ESCAPE CHANNEL.DWG



TYPICAL LONG SECTION OF PIPE CULVERT



TYPICAL PLAN OF PIPE CULVERT

NOTE:-
ADJUST DRAIN HEIGHT AROUND PIPE CULVERT OR AS PER ENGRNEER DIRECTION

Client:-

GOVERNMENT OF KHYBER PAKHTUNKHWA
DIRECTORATE GENERAL SMALL DAMS,
IRRIGATION DEPARTMENT, PESHAWAR

Consultant:-

CONSULTING ASSOCIATES
NEAR DEANS COMPLEX APARTMENTS,BEHIND GUL
CNG BOARD BAZAAR, JAMRUD ROAD,PESHAWAR
PH#: 091-5701774-45 Fax - 091-5701775
E-MAIL: consultingasso@yahoo.com

Title:-

PALAN OF
PIPE CULVERT Ø 600 mm

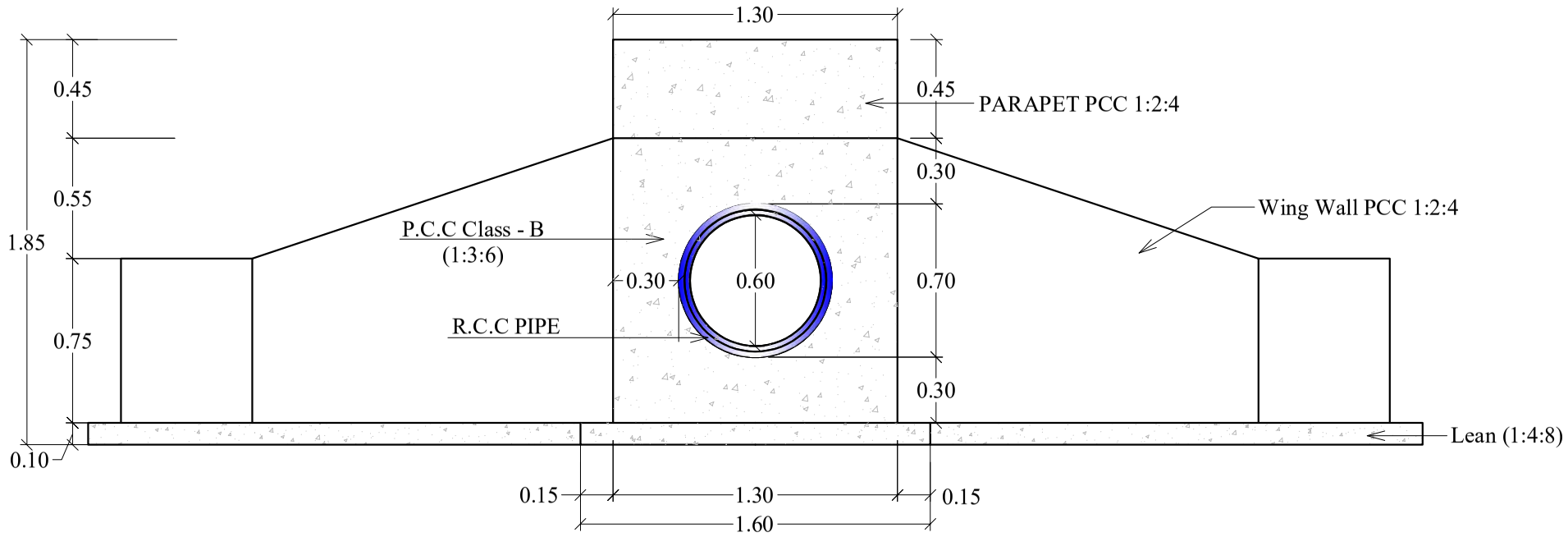
REV.NO.	DATE	DESCRIPTION	BY	CKD	APPRO

Project:- SATI KALLI DAM PROJECT BANNU

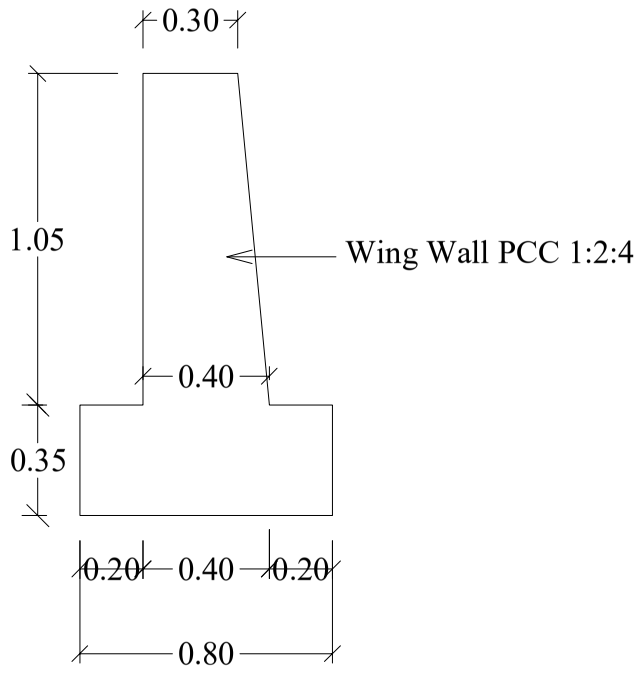
DRAWN BY
CHECK BY
APPROVED BY
DATE:
SHEET NO:

DWG NO : 007-CA-MC-HYS-STK-BNU-17

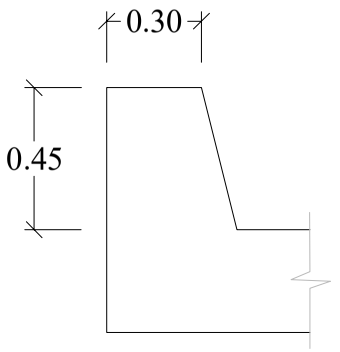
CAD-File No.: F:\33 SATTI KAILLI\REV-06 PACKAGES\PACKAGE-02\007-IRRIGATION CHANNEL HYDRALIC STRUCTUE\007-CA-HYS-STK-BNU-17 & 18 PIPE CULVERT.DWG



CROSS SECTION AT BB
OF PIPE CULVERT



WING WALL SECTION A-A

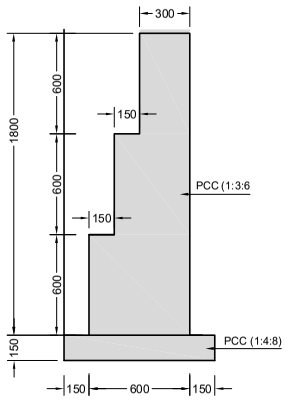


PARAPET

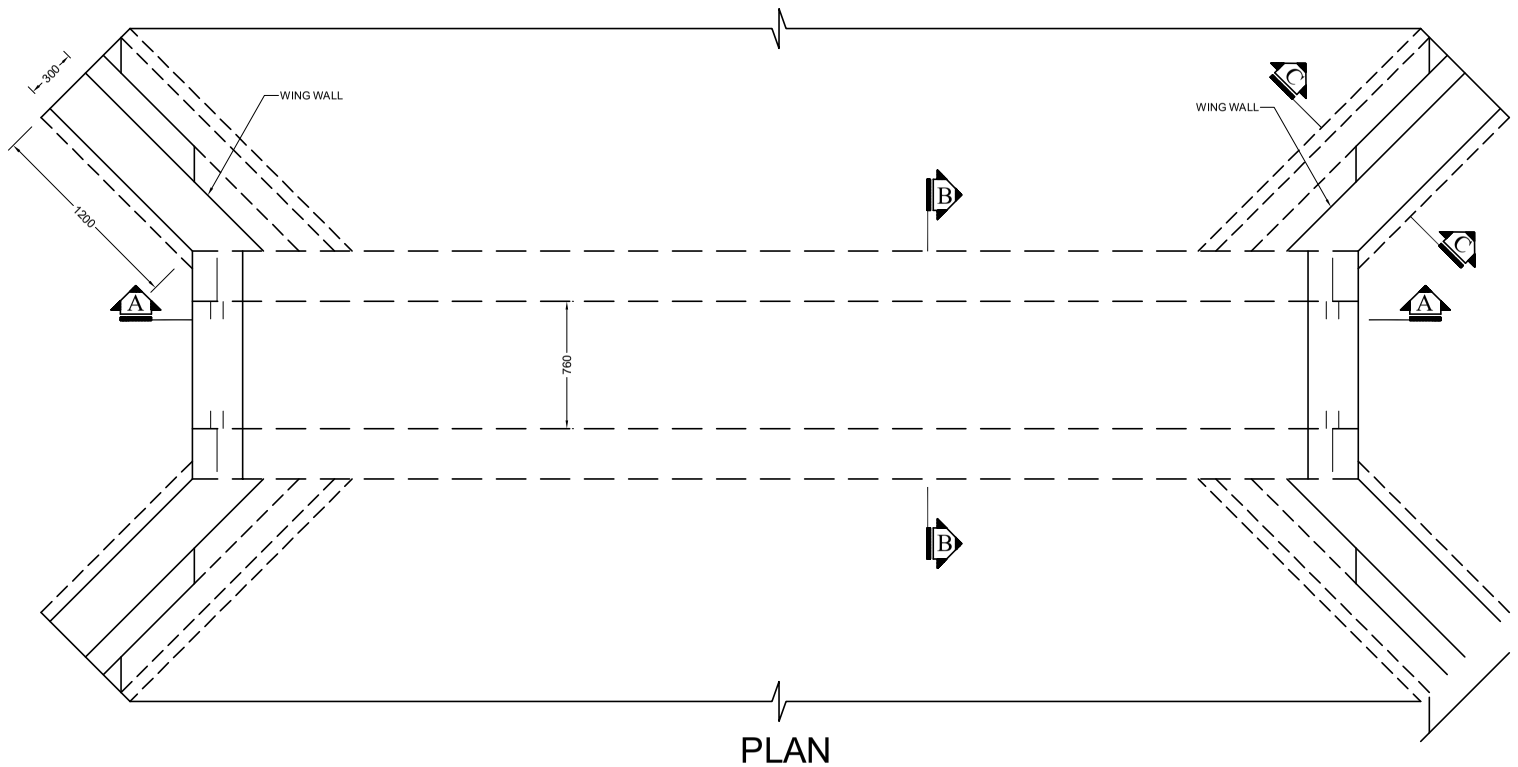
Client:- **GOVERNMENT OF KHYBER PAKHTUNKHWA DIRECTORATE GENERAL SMALL DAMS, IRRIGATION DEPARTMENT, PESHAWAR**	Consultant:- **CONSULTING ASSOCIATES** NEAR DEANS COMPLEX APARTMENTS,BEHIND GUL CNG BOARD BAZAAR, JAMRUD ROAD,PESHAWAR PH#: 091-5701774-45 Fax - 091-5701775 E-MAIL: consultingasso@yahoo.com	Title:- **SECTIONS OF PIPE CULVERT Ø 600 mm**	Project:- SATI KALLI DAM PROJECT BANNU
			DRAWN BY / CHECK BY / APPROVED BY — DATE: — SHEET NO:
			DWG NO : 007-CA-MC-HYS-STK-BNU-18

REV.NO.	DATE	DESCRIPTION	BY	CKD	APPRO

CAD-File No.: F:\33 SATTI KAILLI\REV-06 PACKAGES\PACKAGE-02\007-IRRIGATION CHANNEL HYDRALIC STRUCTUE\007-CA-HYS-STK-BNU-17 & 18 PIPE CULVERT.DWG



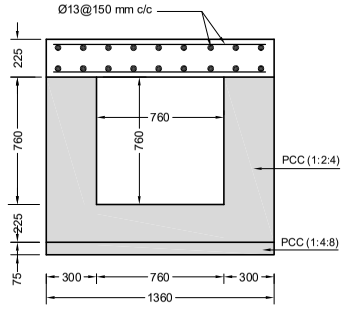
SECTION C-C
SCALE A



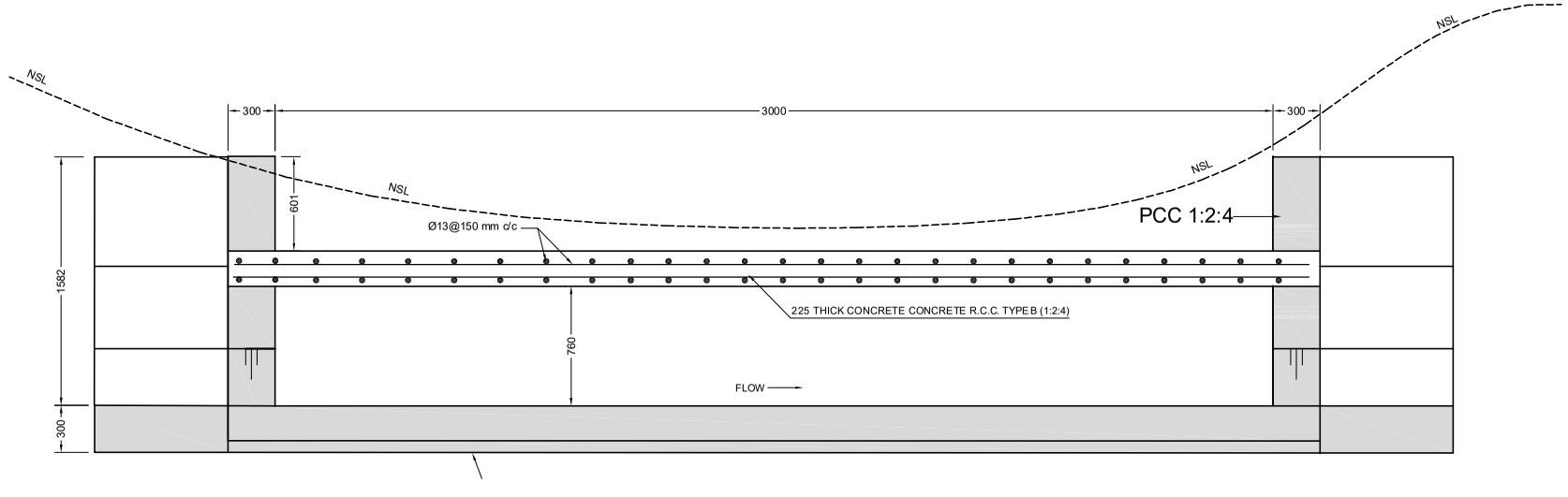
PLAN
SCALE A

NOTES:

1. ALL DIMENISION ARE IN MILLIMETERS.
2. FINAL LOCATON OF STRUCTURE TO BE DECIDE ON SITE.



SECTION B-B
SCALE A



GOVERNMENT OF KHYBER PAKHTUNKHWA
DIRECTORATE GENERAL SMALL DAMS,
IRRIGATION DEPARTMENT, PESHAWAR

CONSULTING ASSOCIATES
NEAR DEANS COMPLEX APARTMENTS,BEHIND GUL CNG,BOARD BAZAAR,JAMRUD ROAD,PESHAWAR
PH #: 091-5701774-45 Fax - 091-5701775
E-MAIL: consultingassociates127@gmail.com

SATI KALLI DAM PROJECT
BANNU

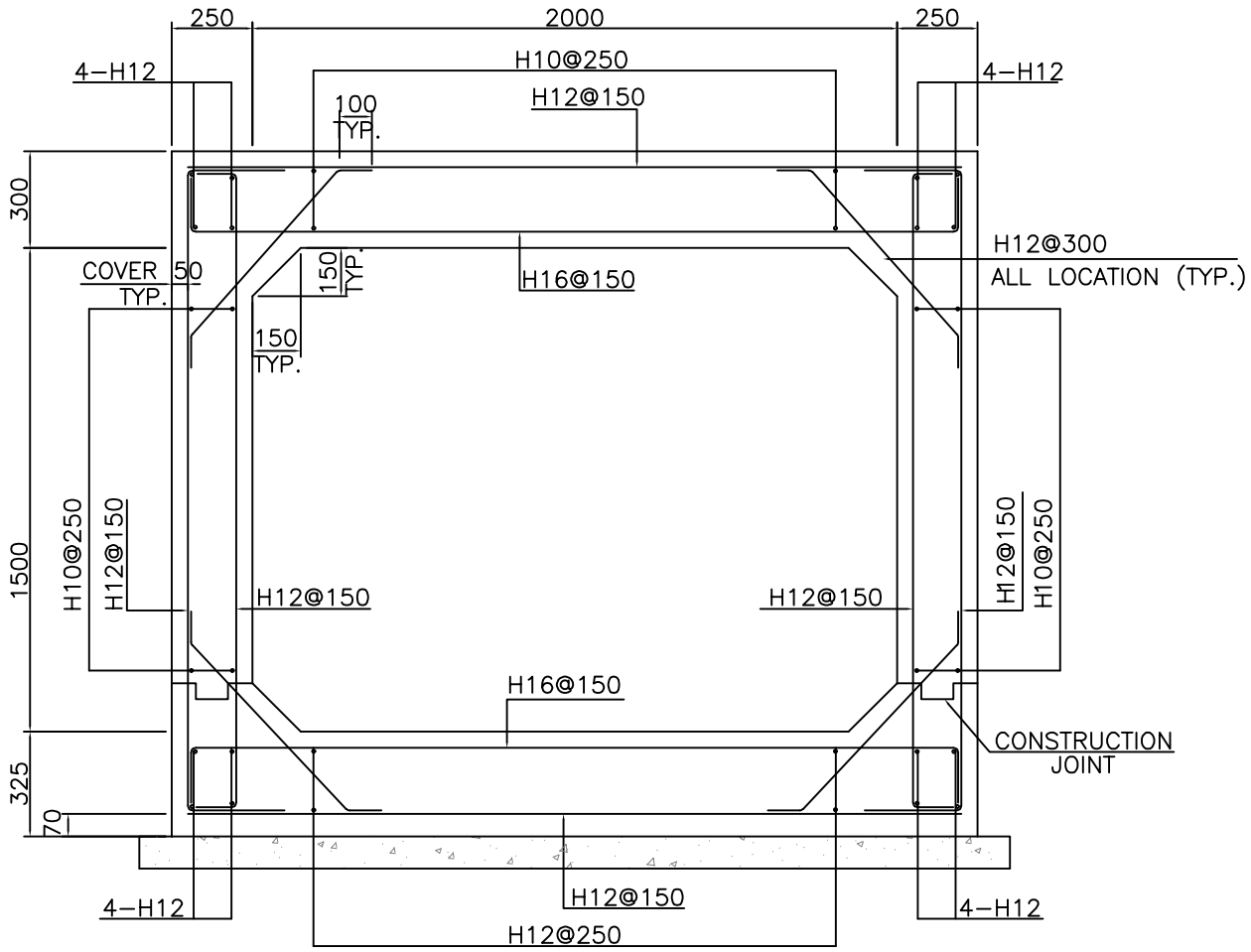
STAMP & SIGNATURES:

REV.	DATE	

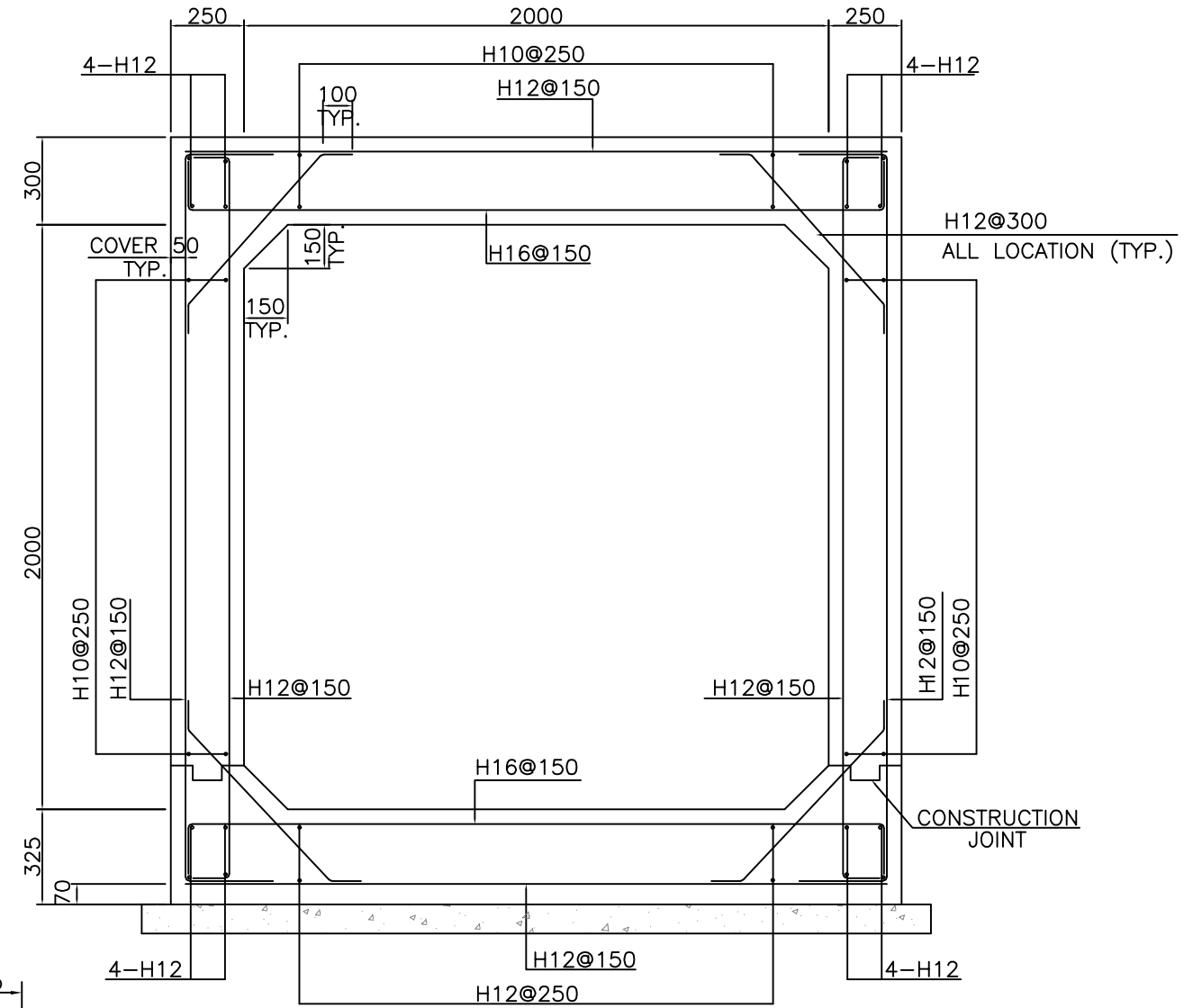
SUPER PASSAGE AT RD 0+200 , 0+280 , 0+360 , 0+400 , 3+160 , 3+320 & 7+000

DWG NO : 007-CA-MC-HYS-STK-BNU-19

SHEET NO



SINGLE CELL (1 x 2M x 1.5M)

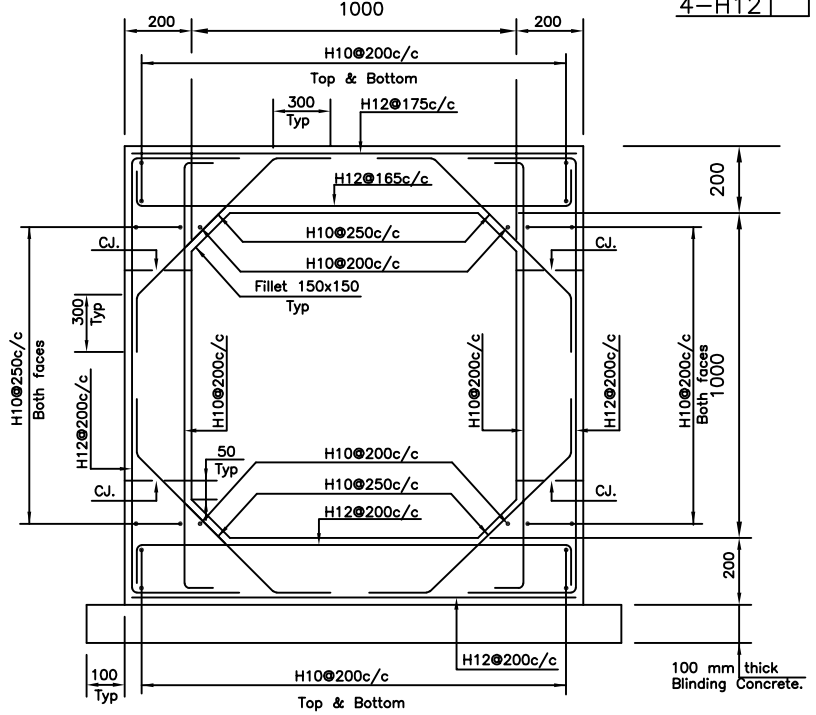


SINGLE CELL (1 x 2M x 2M)

NOTES:–

- ** BAR CUT LENGTH SHALL BE IN ACCORDANCE WITH LENGTH OF CULVERT.
- ALL STURCTURAL CONCRETE SHALL BE CLASS "A' CONCRETE.
- ALL STURCTURAL REINFORCEMENT SHALL BE GRADE 60 STEEL.
- MINIMUM COVER TO THE REINFORCEMENT SHALL BE 50mm.
- OVERLAP LENGTH OF REBAR SHALL BE 48XDIA OF BARS.
- FOR CULVERTS WITH SPAN LESS THAN ANY OF THOUS SHOWN IN TABLE, USE REINFORCEMENT AND SPACING FOR NEXT GREATER SIZE SPAN.MARK NECESSARY CHANGES IN BAR LENGTH AND QUANTITIES.
- EXPENSION JOINTS SHALL BE PROVIDED AT MAX.15m LENGTH IF NECESSARY.
- n= NUMBER OF CELLS
- LAP= 48 TIMES DIA OF BAR
- FOR BARS MARKED D,E,F, & G IN MULTIPLE CELLS CULVERTS, THE LAP SHALL BE PROVIDED AT LOCATIONS AS FOLLOWS:
  (i) FOR BARS C & F AT MID OF CULVERT CELL.
  (ii) FOR BARS D & E AT C.L OF INTERNAL WALL.
- THE EXTRA LENGTH OF BARS C, D, E & F DUE TO SKEW EFFECT SHALL BE BENT IN THE WALLS MAINTAINING THE CONCRETE COVER
- C.J MEANS CONSTRUCTION JOINT
- THIS DRAWING SHOULD BE READ IN CONJUNCTION WITH DRAWING NO. BHN–KHN–43210–306

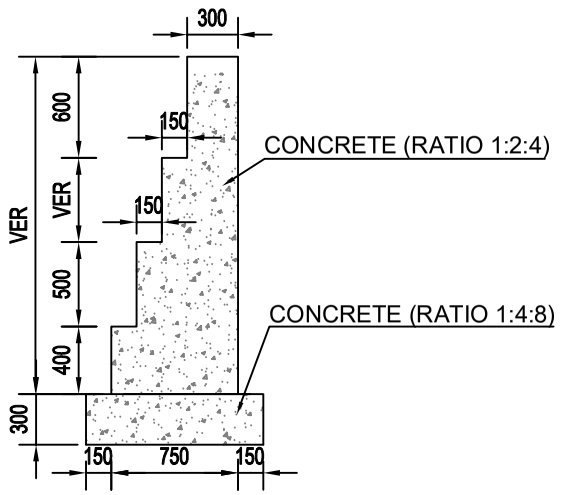
NOTE:-
ADJUST LENGTH BOX CULVERT AS PER SITE OR AS DIRECTED BY ENGRNEER



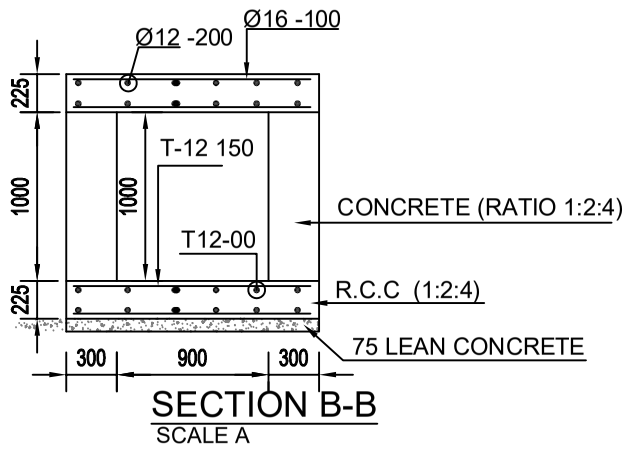
(SINGLE CELL 1 x 1M x 1M)

Client:- GOVERNMENT OF KHYBER PAKHTUNKHWA DIRECTORATE GENERAL SMALL DAMS, IRRIGATION DEPARTMENT, PESHAWAR	Consultant:- CONSULTING ASSOCIATES, NEAR DEANS COMPLEX APARTMENTS,BEHIND GUL CNG BOARD BAZAAR, JAMRUD ROAD,PESHAWAR, PH#: 091-5701774-45 Fax - 091-5701775, E-MAIL: consultingasso@yahoo.com	Title:- BOX CULVERT SECTIONS						Project:- SATI KALLI DAM PROJECT BANNU
								DRAWN BY / CHECK BY / APPROVED BY
								DATE: / SHEET NO:
			REV.NO.	DATE	DESCRIPTION	BY	CKD	APPRO
								DWG NO : 007-CA-MC-HYS-STK-BNU-20

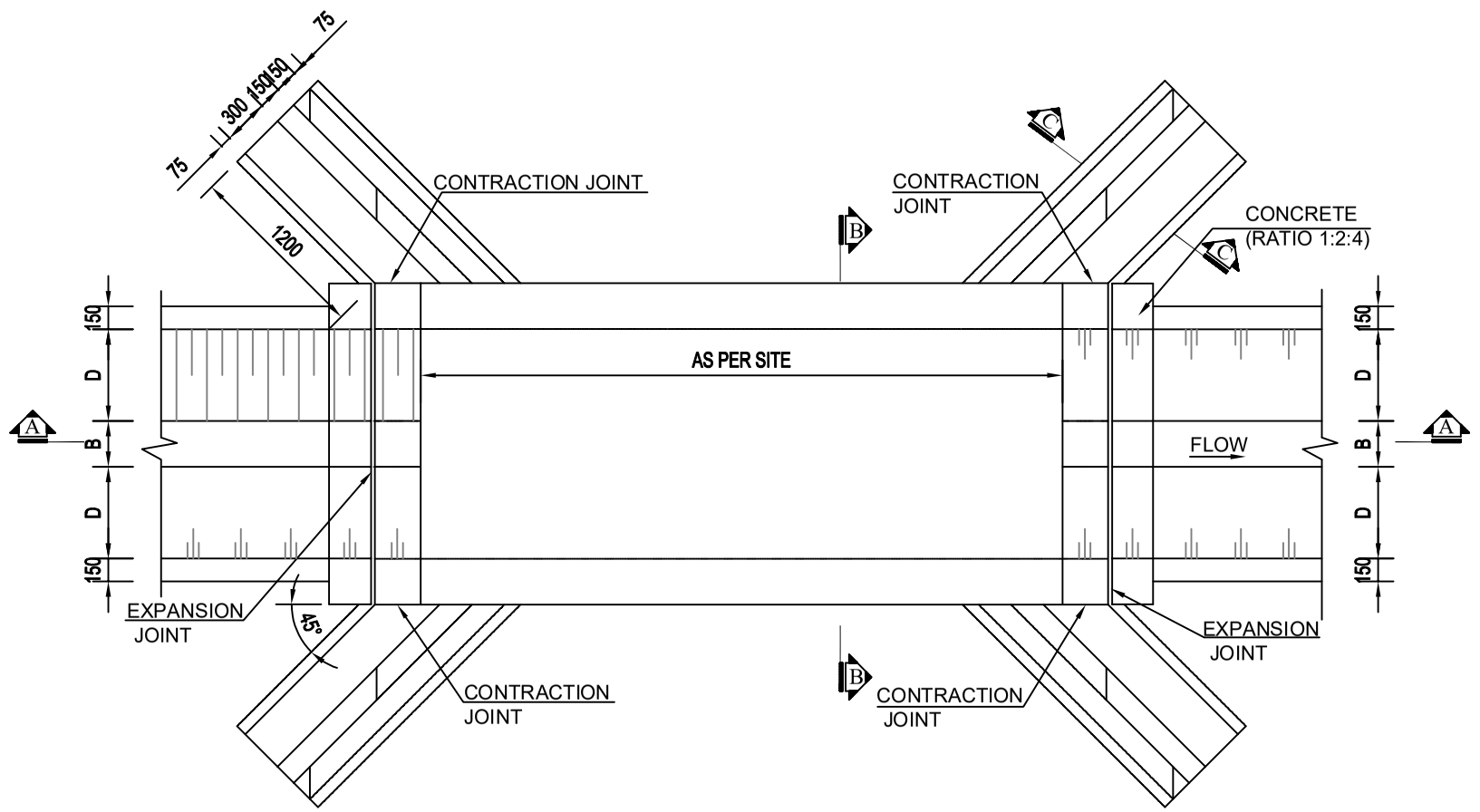
CAD-File No.: F:\33 SATTI KAILLI\REV-06 PACKAGES\PACKAGE-02\007-IRRIGATION CHANNEL HYDRALIC STRUCTUE\007-CA-HYS-STK-BNU-20 BOX CULVERT.DWG



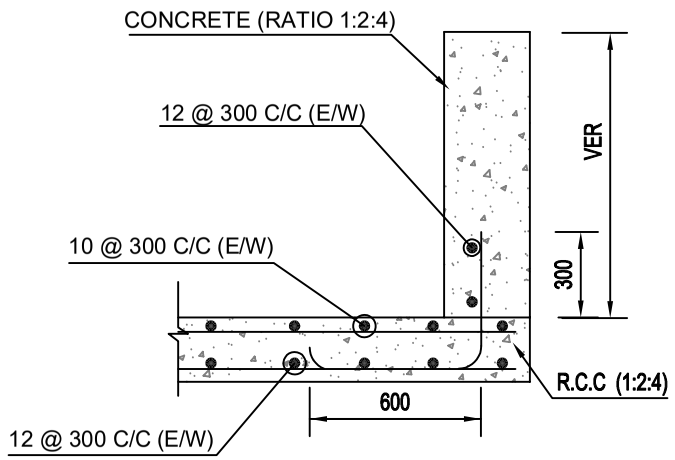
SECTION C-C
SCALE A



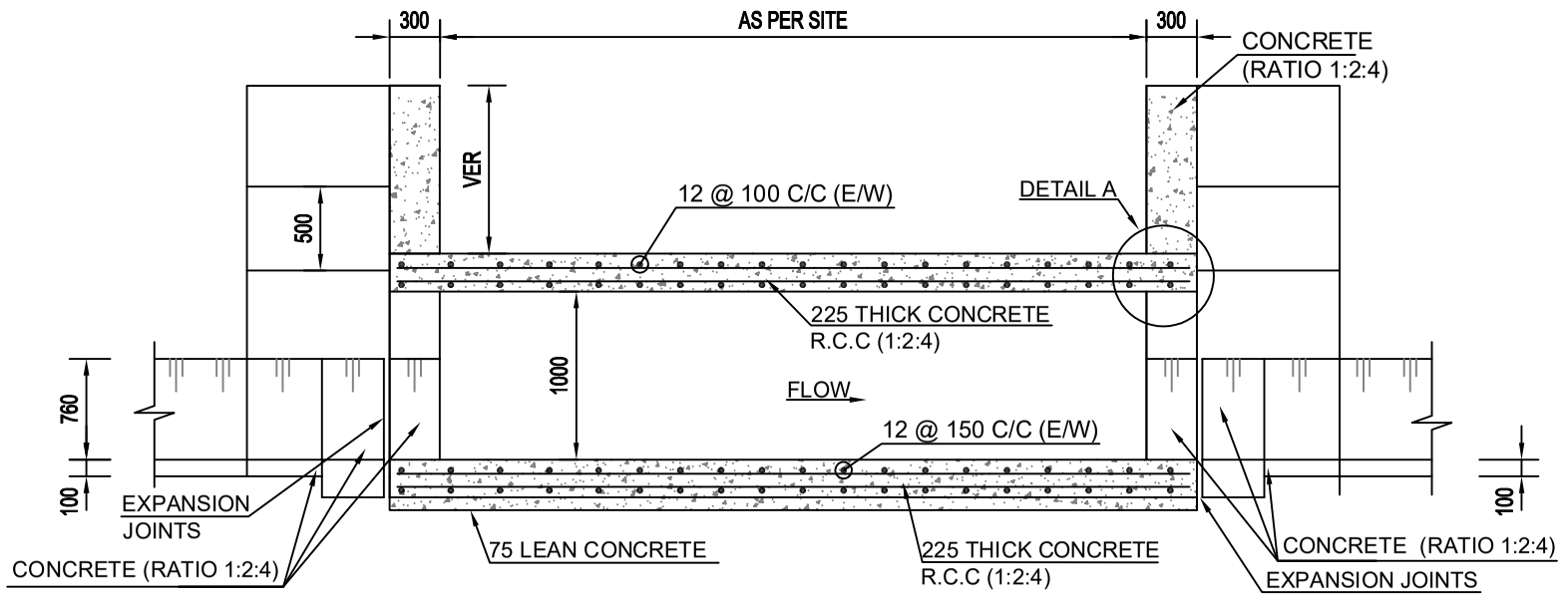
SECTION B-B
SCALE A



PLAN
SCALE A



DETAIL A
SCALE B



SECTION A-A
ROAD CROSSING CULVERT
SCALE A

NOTES:

1. ALL DIMENISION ARE IN MILLIMETERS.
2. FINAL LOCATON OF STRUCTURE TO BE DECIDE ON SITE.

GOVERNMENT OF KHYBER PAKHTUNKHWA
DIRECTORATE GENERAL SMALL DAMS,
IRRIGATION DEPARTMENT, PESHAWAR

CONSULTING ASSOCIATES
NEAR DEANS COMPLEX APARTMENTS,BEHIND GUL CNG,BOARD BAZAAR,JAMRUD ROAD,PESHAWAR
PH #: 091-5701774-45 Fax - 091-5701775
E-MAIL: consultingassociates127@gmail.com

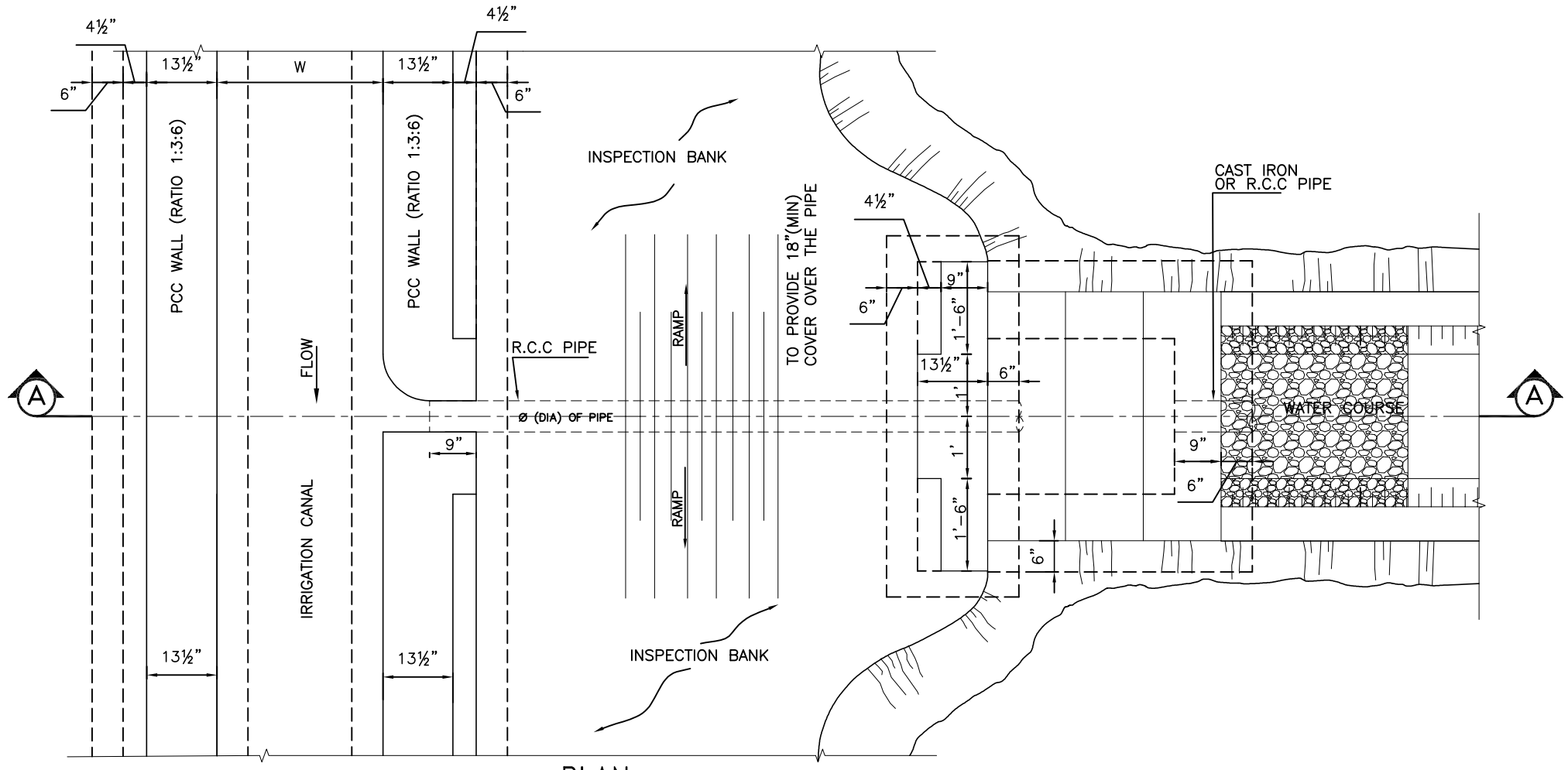
SATI KALLI DAM PROJECT
BANNU

STAMP & SIGNATURES:

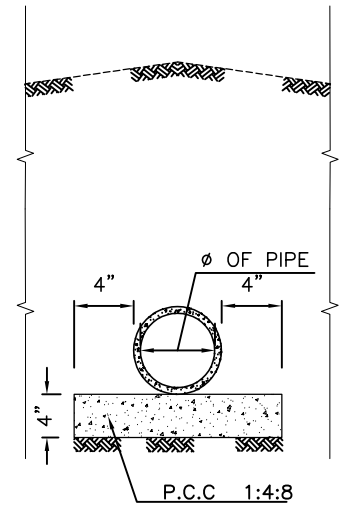
REV.	DATE	

CULVERT AT RD 0+930 , 1+140 , 1+220 , 1+740 , 3+160 & 3+320 ,

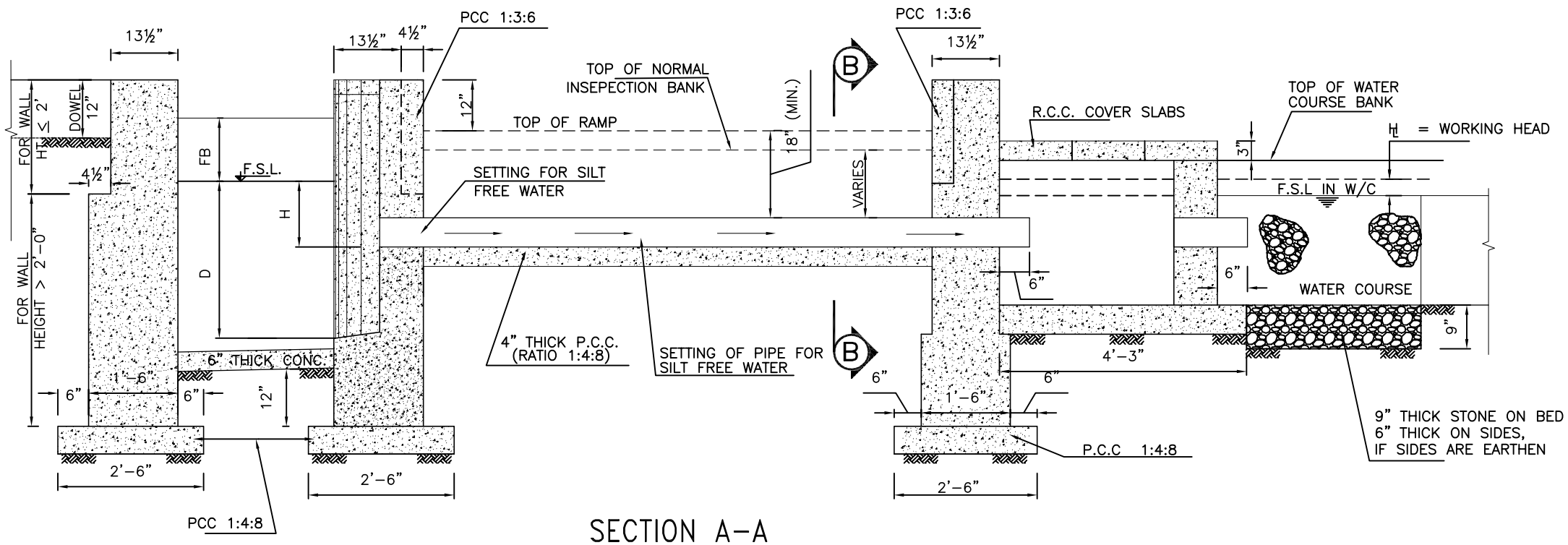
DWG NO : 007-CA-MC-HYS-STK-BNU-21 | SHEET NO:



PLAN
N.T.S.



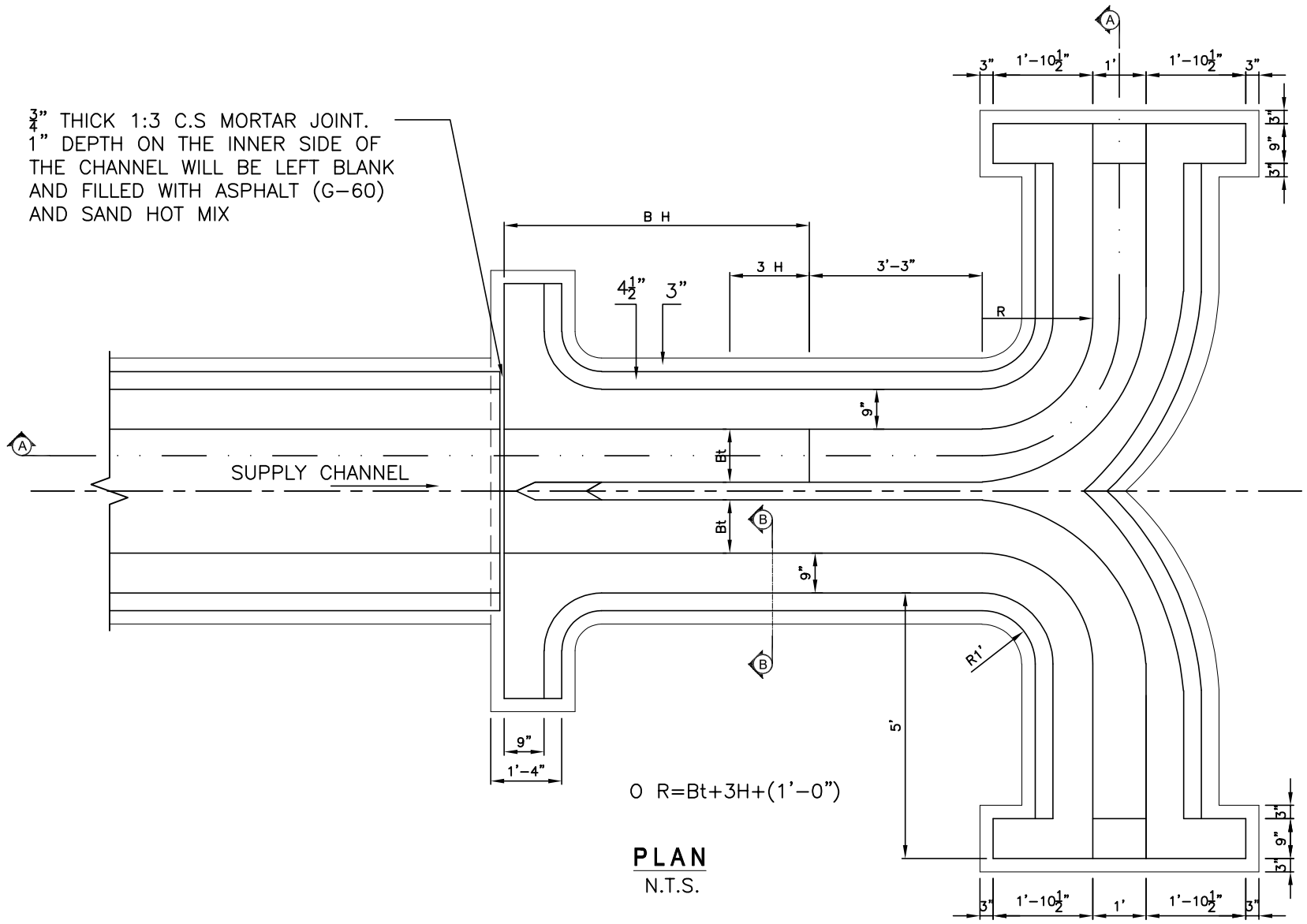
SECTION B-B



SECTION A-A
N.T.S.

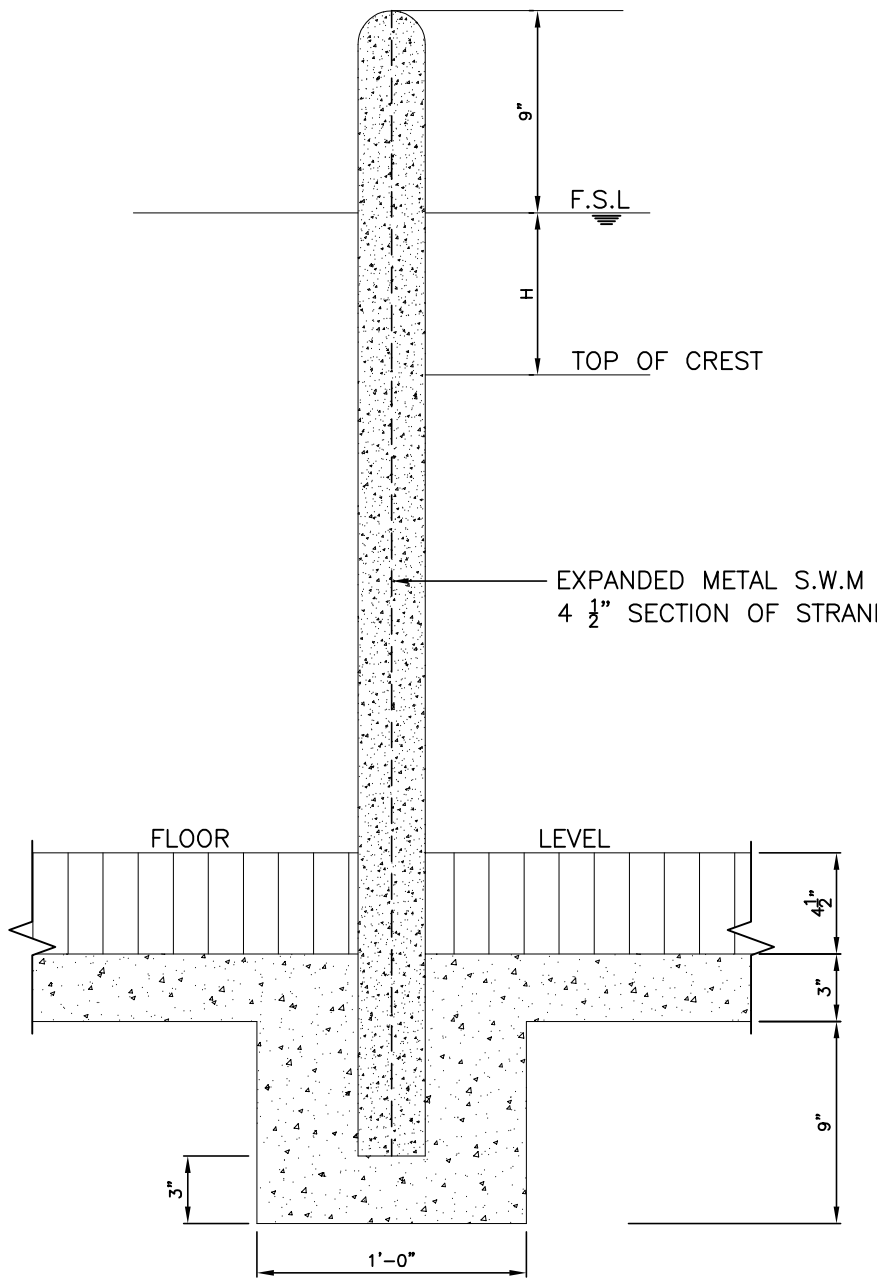
GOVERNMENT OF KHYBER PAKHTUNKHWA DIRECTORATE GENERAL SMALL DAMS, IRRIGATION DEPARTMENT, PESHAWAR	CONSULTING ASSOCIATES NEAR DEANS COMPLEX APARTMENTS,BEHIND GUL CNG,BOARD BAZAAR,JAMRUD ROAD,PESHAWAR PH #: 091-5701774-45 Fax - 091-5701775 E-MAIL: consultingassociates127@gmail.com	SATI KALLI DAM PROJECT BANNU	STAMP & SIGNATUREs: REV. DATE	TYIPICAL PIPE OUTLET DWG NO : 007-CA-MC-HYS-STK-BNU-22 SHEET NO:-

¾" THICK 1:3 C.S MORTAR JOINT.
1" DEPTH ON THE INNER SIDE OF THE CHANNEL WILL BE LEFT BLANK AND FILLED WITH ASPHALT (G–60) AND SAND HOT MIX

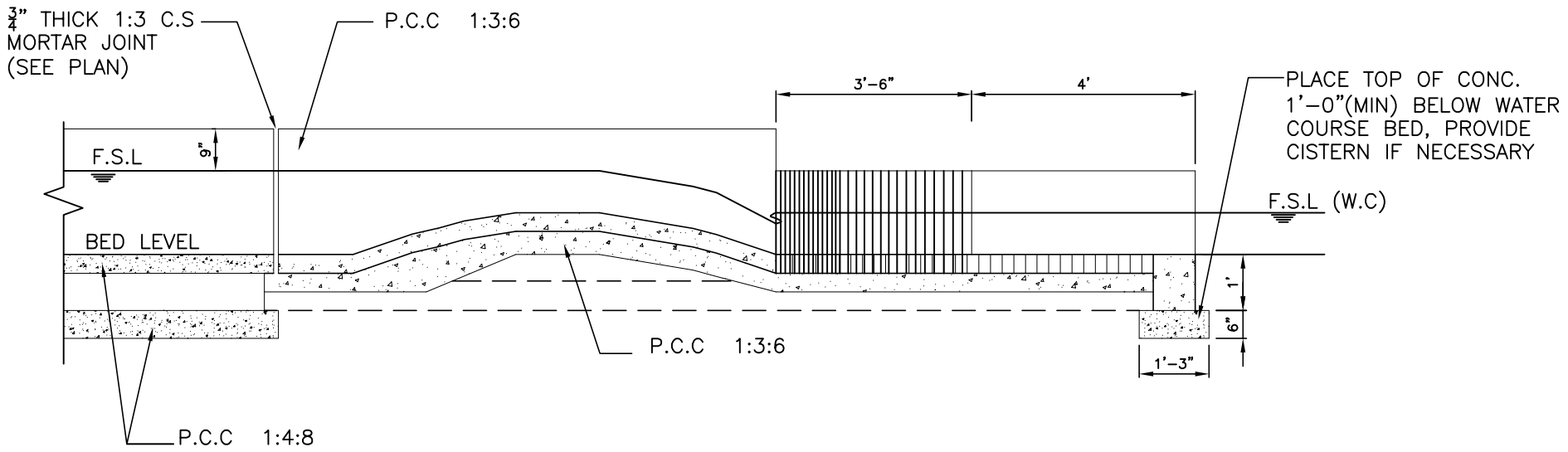


O R=Bt+3H+(1'–0")

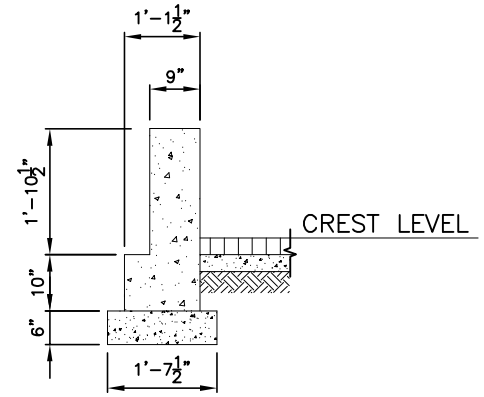
PLAN
N.T.S.



DETAIL OF DIVIDE WALL
N.T.S.

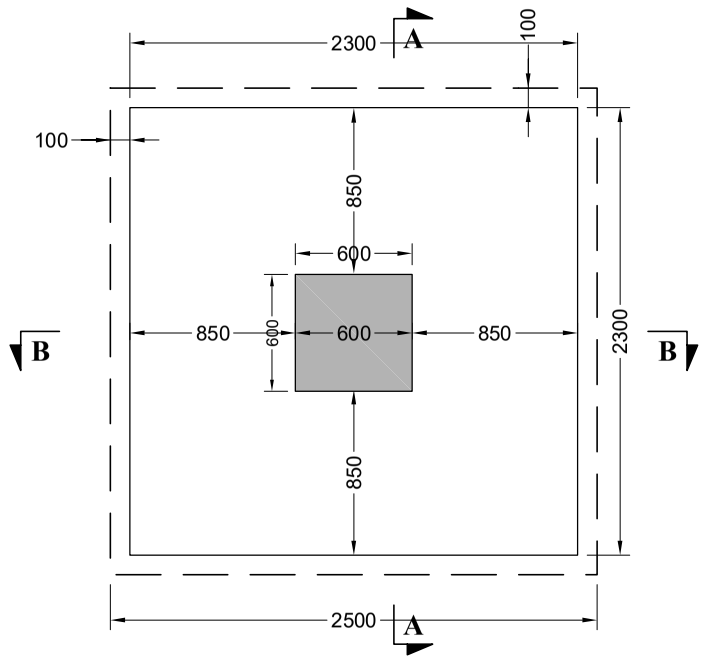


SECTION A-A
N.T.S.

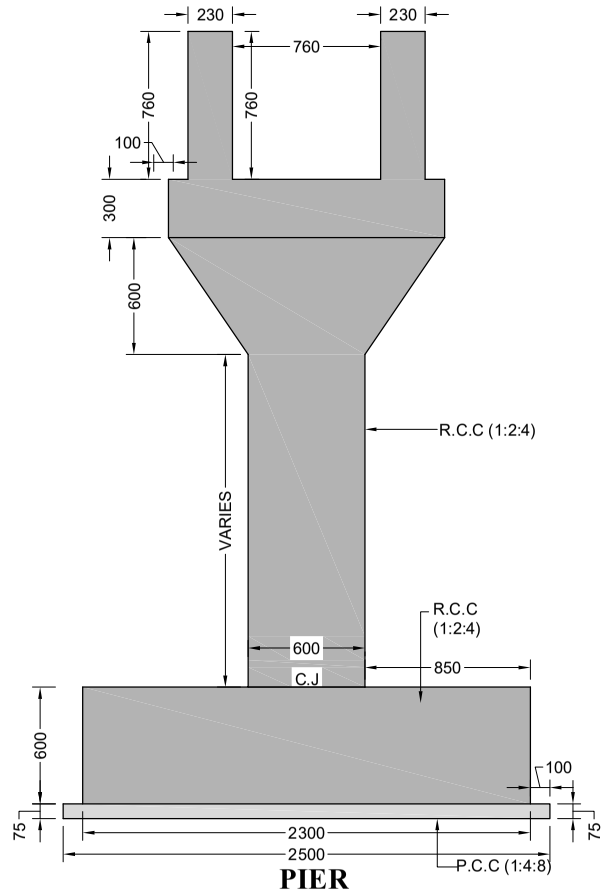


SECTION B-B

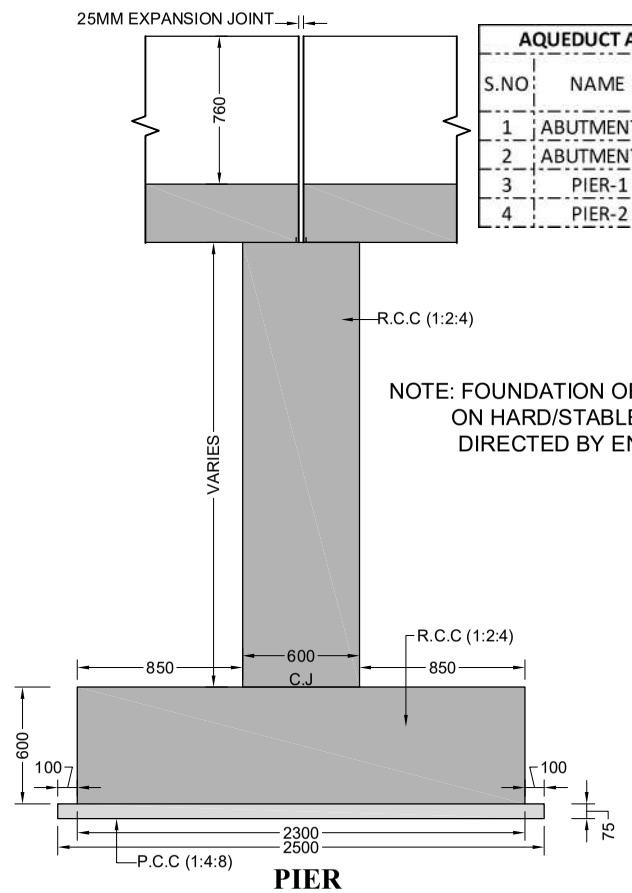
GOVERNMENT OF KHYBER PAKHTUNKHWA DIRECTORATE GENERAL SMALL DAMS, IRRIGATION DEPARTMENT, PESHAWAR	CONSULTING ASSOCIATES NEAR DEANS COMPLEX APARTMENTS,BEHIND GUL CNG,BOARD BAZAAR,JAMRUD ROAD,PESHAWAR PH #: 091-5701774-45 Fax - 091-5701775 E-MAIL: consultingasso@yahoo.com	SATI KALLI DAM PROJECT BANNU	STAMP & SIGNATURES:	REV. / DATE	TAIL CLUSTER DWG NO : 007-CA-MC-HYS-STK-BNU-23 SHEET NO:-



PIER FOOTING PLAN

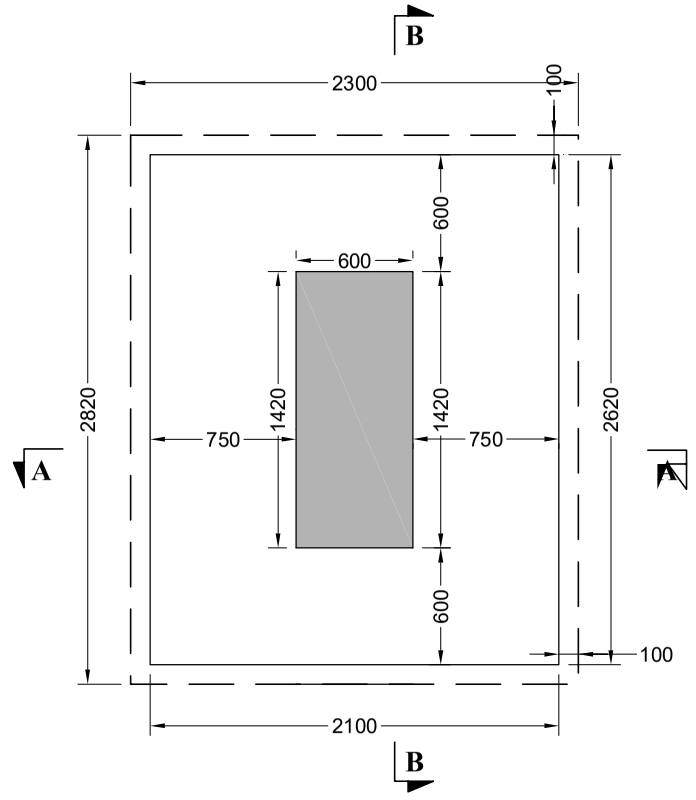


PIER SECTION A-A

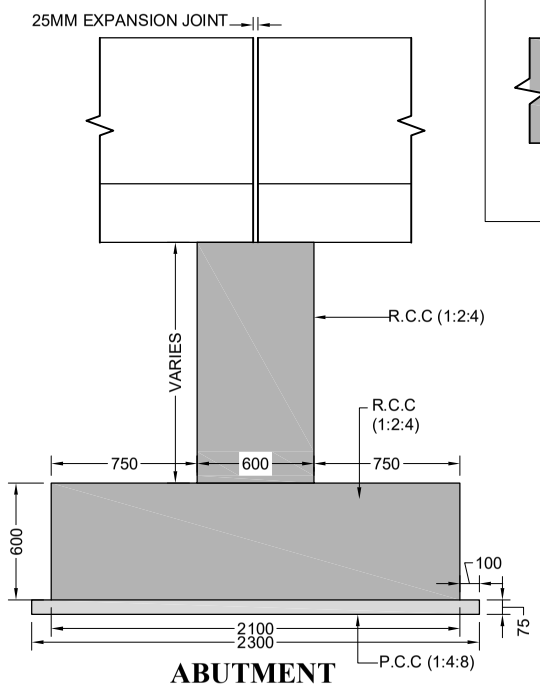


AQUEDUCT AT RD 0+629 ~ 0+651		
S.NO	NAME	HIEGHT WITH FOOTING (m)
1	ABUTMENT-1	2.46
2	ABUTMENT-2	2.46
3	PIER-1	3.37
4	PIER-2	3.37

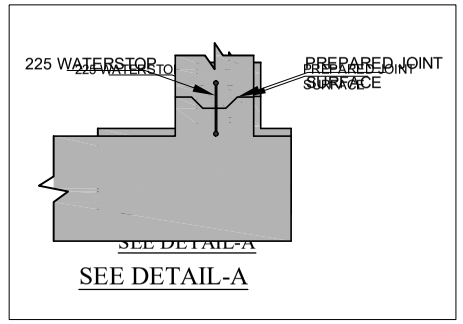
PIER SECTION B-B



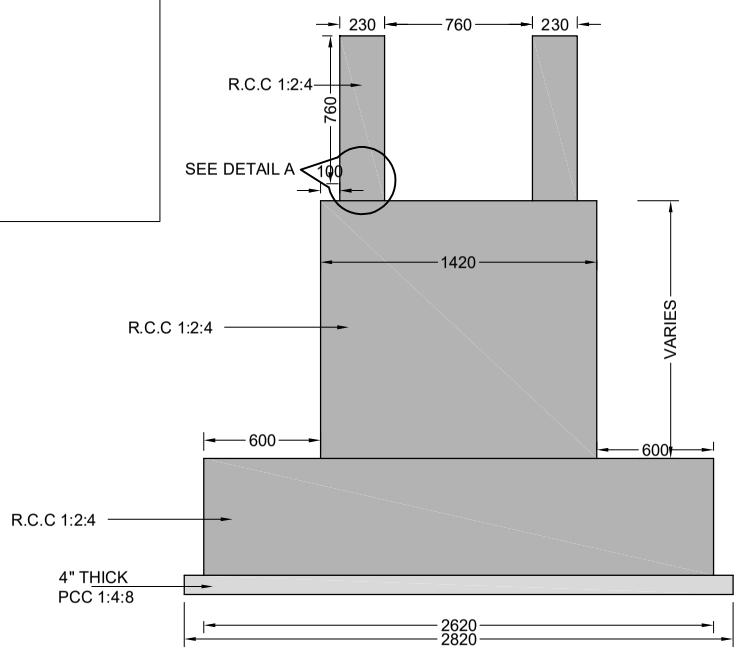
ABUTMENTS FOOTING PLAN



ABUTMENT SECTION A-A



SEE DETAIL-A



SECTION B-B AQUEDUCT U/S & D/S SECTION (TYPICAL)

GOVERNMENT OF KHYBER PAKHTUNKHWA
DIRECTORATE GENERAL SMALL DAMS,
IRRIGATION DEPARTMENT, PESHAWAR

CONSULTING ASSOCIATES
NEAR DEANS COMPLEX APARTMENTS,BEHIND GUL CNG,BOARD BAZAAR,JAMRUD ROAD,PESHAWAR
PH #: 091-5701774-45 Fax - 091-5701775
E-MAIL: consultingassociates127@gmail.com

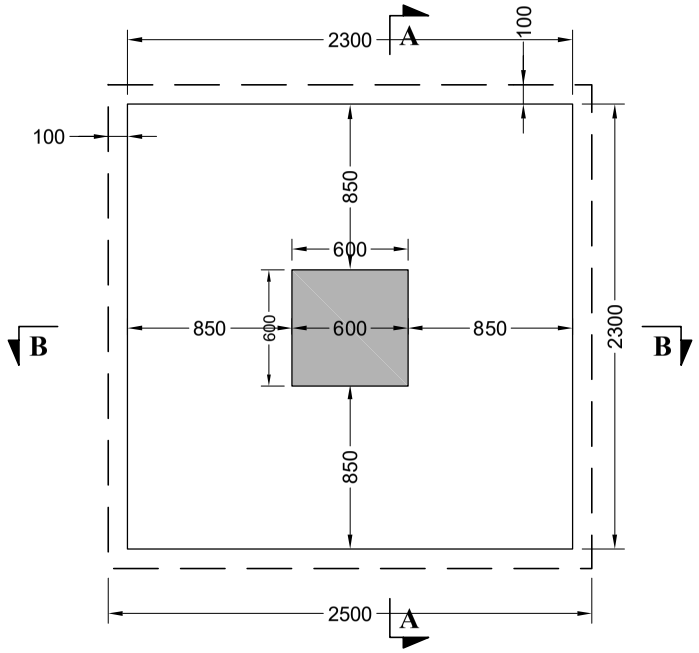
SATI KALLI DAM PROJECT
BANNU

STAMP & SIGNATUREs:

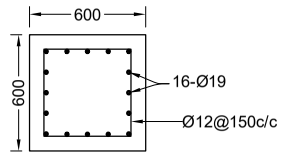
REV.	DATE	

AQUEDUCT STRUCTURE DETAILS AT RD 0+629 ~ 0+651

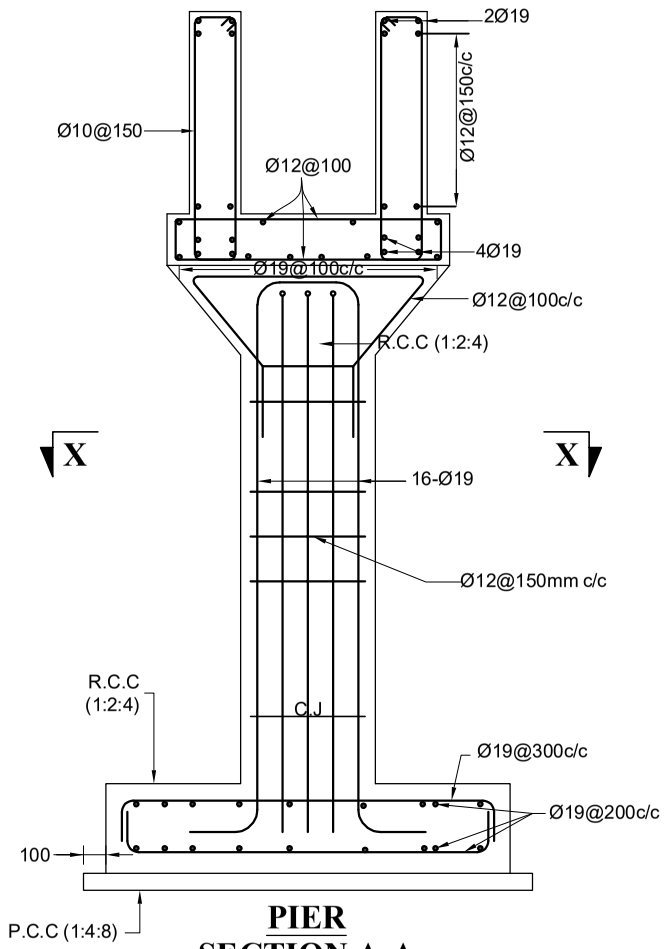
DWG NO : 007-CA-MC-HYS-STK-BNU-24 | SHEET NO:



PIER FOOTING PLAN



PIER SECTION X-X
SCALE: 1:40

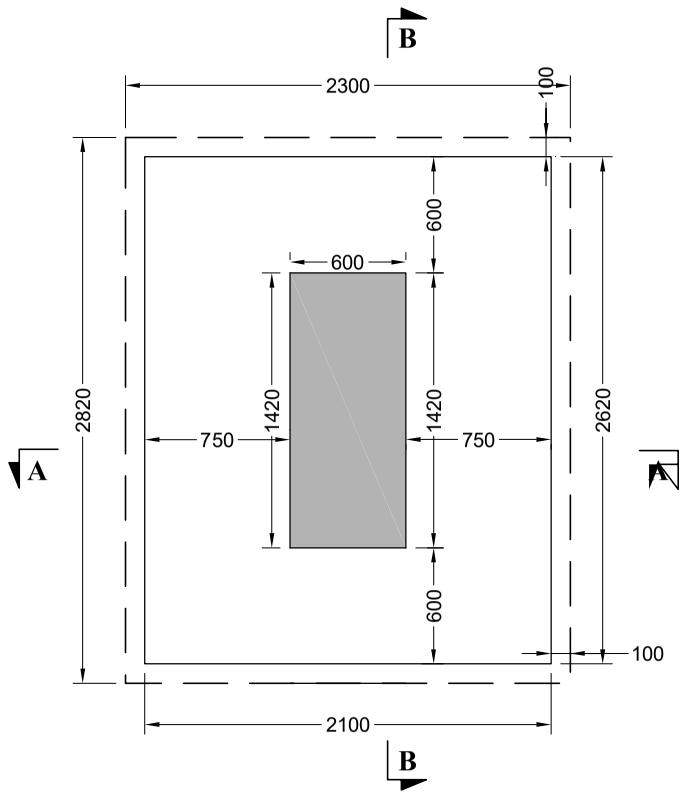


PIER SECTION A-A

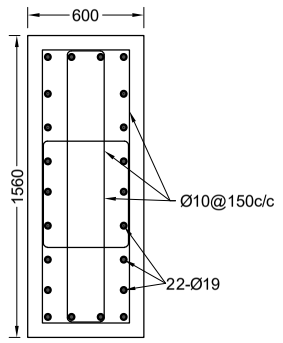
NOTES

1:- ALL DIMENSIONS AND LEVELS ARE IN METER.
2:- LAP LENGTH = 48 X DIA OF BAR.
3:- R.C.C 4000 PSI , 28 DAYS.
4:- P.C.C 2000 PSI , 28 DAYS.
5:- REINFORCEMENT SHALL BE DEFORMED BARS HAVING YIELD STRENGTH OF 60000 PSI.
6:- SHUTTERING OF BASE SLAB OF AQUEDUCT CHANNEL & ITS SIDE WALLS SHOULD BE REMOVED AT THE SAME TIME

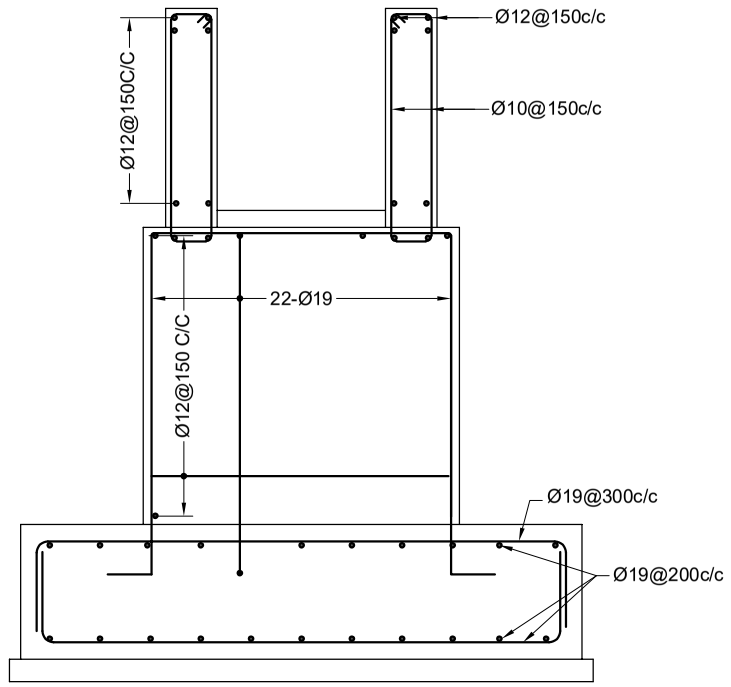
NOTE: FOUNDATION OF PIER SHOULD BE ON HARD/STABLE STRATA OR AS DIRECTED BY ENGINEER



ABUTMENTS FOOTING PLAN



ABUTMENT SECTION X-X



AQUEDUCT U/S & D/S SECTION

GOVERNMENT OF KHYBER PAKHTUNKHWA
DIRECTORATE GENERAL SMALL DAMS,
IRRIGATION DEPARTMENT, PESHAWAR

CONSULTING ASSOCIATES
NEAR DEANS COMPLEX APARTMENTS,BEHIND GUL CNG,BOARD BAZAAR,JAMRUD ROAD,PESHAWAR
PH #: 091-5701774-45 Fax - 091-5701775
E-MAIL: consultingassociates127@gmail.com

SATI KALLI DAM PROJECT
BANNU

STAMP & SIGNATURES:

REV.	DATE	

AQUEDUCT STRUCTURE DETAILS
AT RD 0+629 ~ 0+651

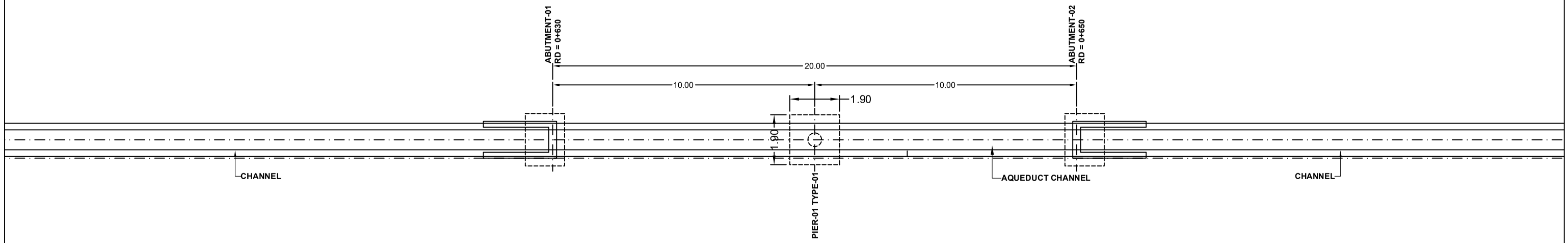
DWG NO : 007-CA-MC-HYS-STK-BNU-25 | SHEET NO:

NOTE:-

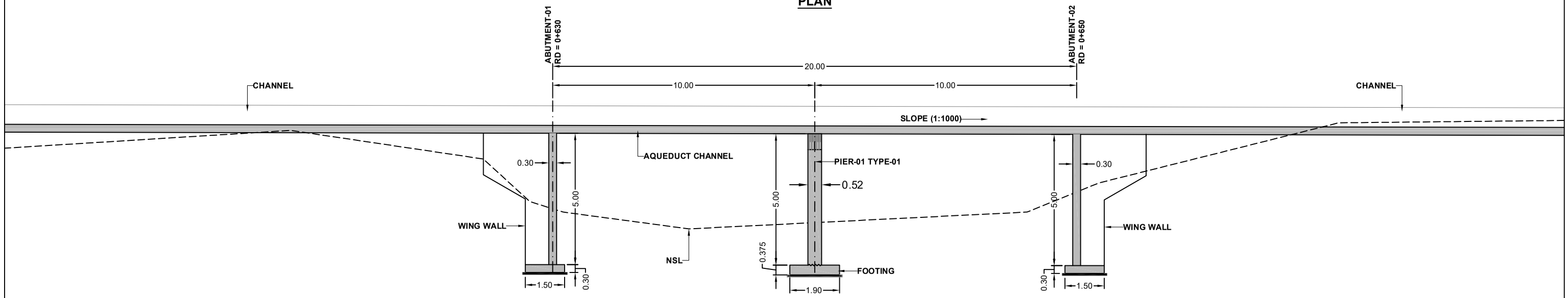
1. THE HIEHT OF PIER VARIES & INCLUDES THREE TYPE OF PIERS (TYPE-01, TYPE-02 & TYPE-03).

a. TYPE-01 RANGE IS UPTO 10m.
b. TYPE-02 RANGE IS FROM 10m-15m.
c. TYPE-03 RANGE IS FROM 15m-25m.

2. THE TROUGH SIZE FOR AQUEDUCT No.3 & No.9 SHALL BE 600mm x 600mm AND FOR REMAINING AQUEDUCTS THE TROUGH SIZE SHALL BE 760mm x 760mm.



PLAN



LONG SECTION

CLIENT: GOVERNMENT OF KHYBER PAKHTUNKHWA DIRECTORATE GENERAL SMALL DAMS, IRRIGATION DEPARTMENT, PESHAWAR	**CONSULTANT:** **CONSULTING ASSOCIATES** NEAR DEANS COMPLEX APARTMENTS, BOARD BAZAR, BEHID GUL CNG, JAMRUD ROAD PEHSAWAR, PAKISTAN PH: +92 91 5701774 EMAIL: Consultingassociates127@gmail.com	**PROJECT:** SATI KALLI DAM PROJECT DISTRICT BANNU

REV	DESCRIPTION	DATE
P01	DRAWINGS	11-03-22

DRAWN BY:	AZMAT ALI
DESIGNED BY:	YASIR IQBAL
CHECKED BY:	FARID KHAN

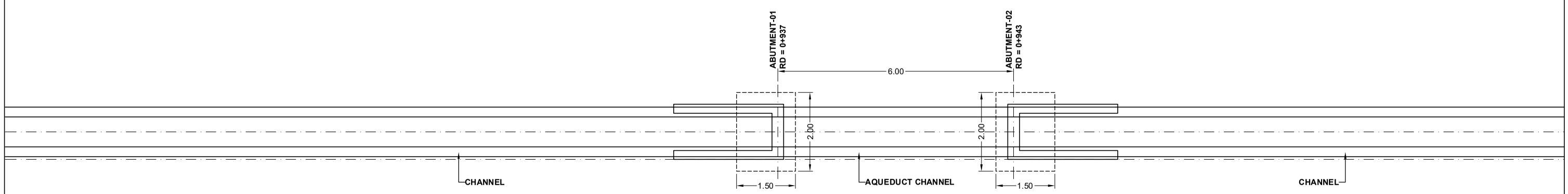
SCALE 1:100

TITLE:
SATTI KALLI DAM
AQUEDUCT-01 AT RD (0+630 TO 0+650)

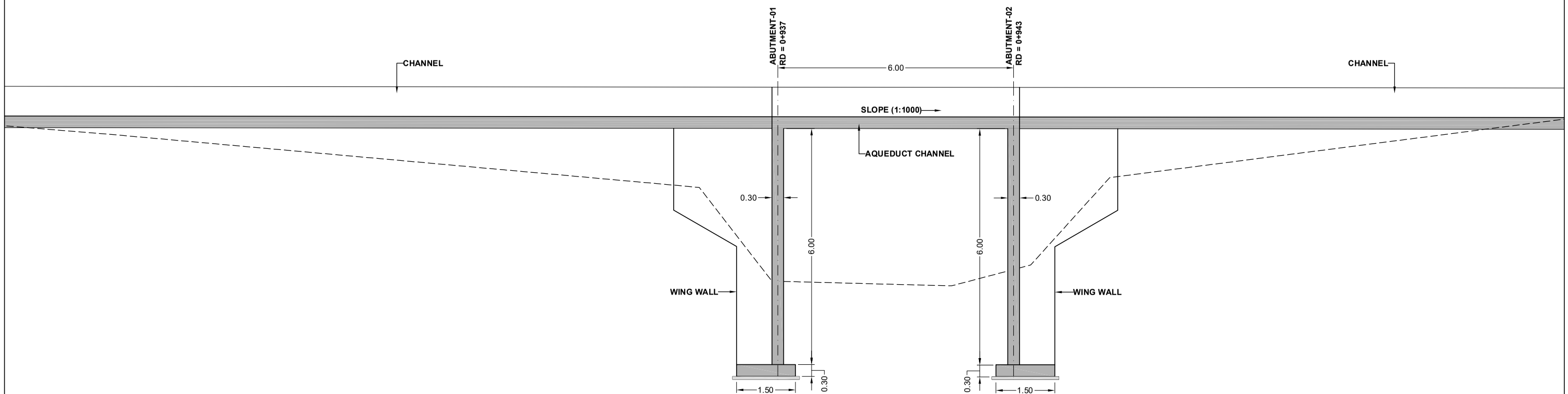
DRAWING NO.
007-CA-MC-HYS-STK-BNU-26

SHEET NO:

CAD-File No:- F:\33 SATTI KALLI\REV-06 PACKAGES\PACKAGE-2\2007-IRRIGATION CHANNEL HYDRAULIC STRUCTUE\007-CA-HYS-STK-BNU-26 TO 36 AQUEDUCT PROFILE.DWG



PLAN



LONG SECTION

CAD-File No.: F:\33.SATTI KALLI\REV-06 PACKAGES\PACKAGE-02\007-IRRIGATION CHANNEL HYDRAULIC STRUCTUE\007-CA-HYS-STK-BNU-26 TO 36 AQUEDUCT PROFILE.DWG

CLIENT:

GOVERNMENT OF KHYBER PAKHTUNKHWA
DIRECTORATE GENERAL SMALL DAMS,
IRRIGATION DEPARTMENT, PESHAWAR

CONSULTANT:

CONSULTING ASSOCIATES
NEAR DEANS COMPLEX APARTMENTS, BOARD BAZAR,
BEHID GUL CNG, JAMRUD ROAD PEHSAWAR, PAKISTAN
PH: +92 91 5701774
EMAIL: Consultingassociates127@gmail.com

REV	DESCRIPTION	DATE
P01	DRAWINGS	11-03-22

PROJECT:

SATI KALLI DAM PROJECT
DISTRICT BANNU

TITLE:

SATTI KALLI DAM
AQUEDUCT-02 AT RD (0+937 TO 0+943)

CONSTRUCTION DRAWINGS

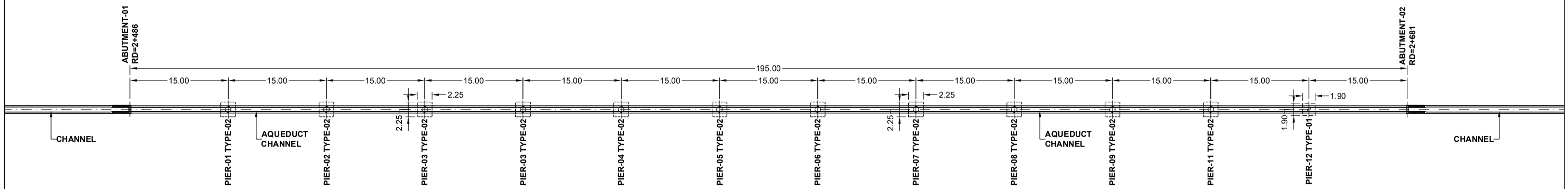
DRAWN BY:	AZMAT ALI
DESIGNED BY:	YASIR IQBAL
CHECKED BY:	FARID KHAN

SCALE
1:100

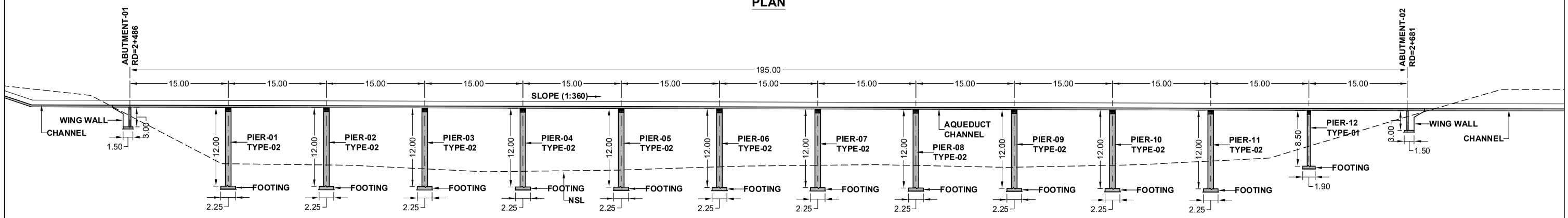
DRAWING NO.

007-CA-MC-HYS-STK-BNU-27

SHEET NO:



PLAN



LONG SECTION

CAD-File No:- F:\33 SATTI KALLI\REV-08\ PACKAGES\PACKAGE-02\007-IRRIGATION CHANNEL HYDRAULIC STRUCTUE\007-CA-HYS-STK-BNU-28 TO 36 AQUEDUCT PROFILE.DWG

CLIENT:

GOVERNMENT OF KHYBER PAKHTUNKHWA
DIRECTORATE GENERAL SMALL DAMS,
IRRIGATION DEPARTMENT, PESHAWAR

CONSULTANT:

CONSULTING ASSOCIATES
NEAR DEANS COMPLEX APARTMENTS, BOARD BAZAR,
BEHID GUL CNG, JAMRUD ROAD PEHSAWAR, PAKISTAN
PH: +92 91 5701774
EMAIL: Consultingassociates127@gmail.com

REV	DESCRIPTION	DATE
P01	DRAWINGS	11-03-22

PROJECT:
SATI KALLI DAM PROJECT
DISTRICT BANNU

TITLE:
SATTI KALLI DAM
AQUEDUCT-03 AT RD (2+486 TO 2+681)

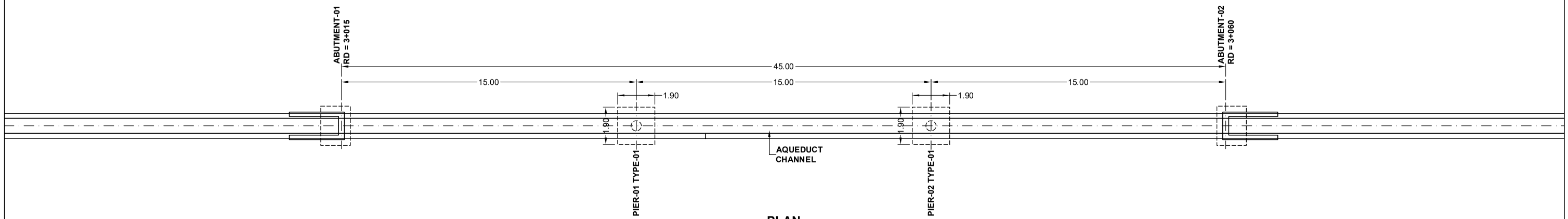
CONSTRUCTION DRAWINGS

DRAWN BY:	AZMAT ALI
DESIGNED BY:	YASIR IQBAL
CHECKED BY:	FARID KHAN

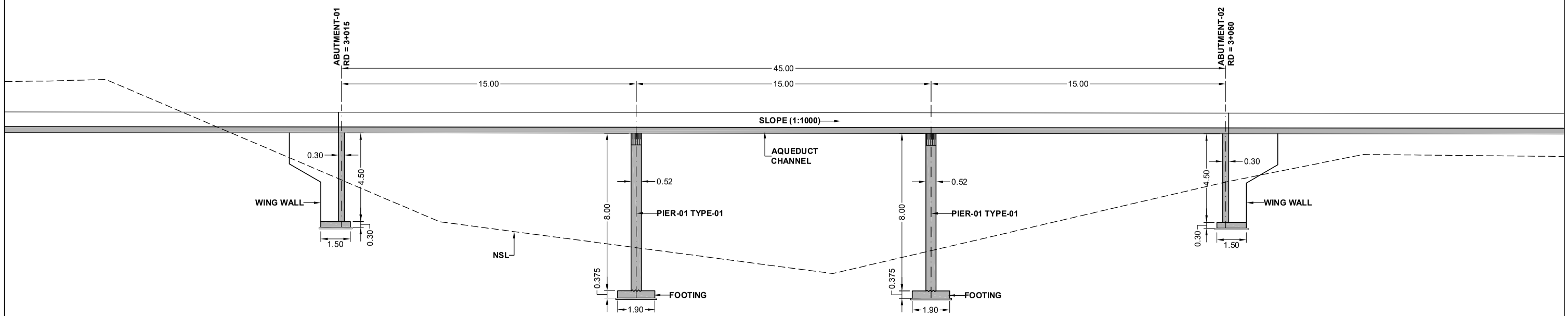
SCALE
1:600

DRAWING NO.
007-CA-MC-HYS-STK-BNU-28

SHEET NO:



PLAN



LONG SECTION

CAD-File No:- F:\33 SATTI KALLI\REV-06 PACKAGES\PACKAGE-02\007-IRRIGATION CHANNEL HYDRAULIC STRUCTUE\007-CA-HYS-STK-BNU-28 TO 36 AQUEDUCT PROFILE.DWG

CLIENT:

GOVERNMENT OF KHYBER PAKHTUNKHWA
DIRECTORATE GENERAL SMALL DAMS,
IRRIGATION DEPARTMENT, PESHAWAR

CONSULTANT:

CONSULTING ASSOCIATES
NEAR DEANS COMPLEX APARTMENTS, BOARD BAZAR,
BEHID GUL CNG, JAMRUD ROAD PEHSAWAR, PAKISTAN
PH: +92 91 5701774
EMAIL: Consultingassociates127@gmail.com

REV	DESCRIPTION	DATE
P01	DRAWINGS	11-03-22

PROJECT:

SATI KALLI DAM PROJECT
DISTRICT BANNU

TITLE:

SATTI KALLI DAM
AQUEDUCT-04 AT RD (3+015 TO 3+060)

CONSTRUCTION DRAWINGS

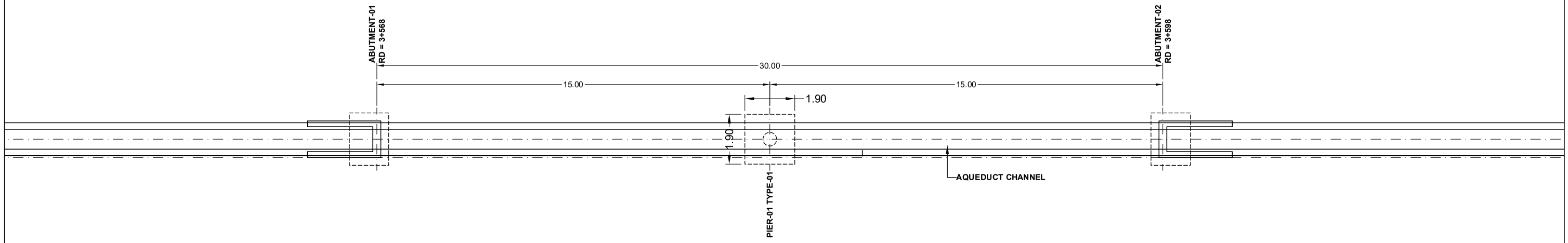
DRAWN BY:	AZMAT ALI
DESIGNED BY:	YASIR IQBAL
CHECKED BY:	FARID KHAN

SCALE
1:200

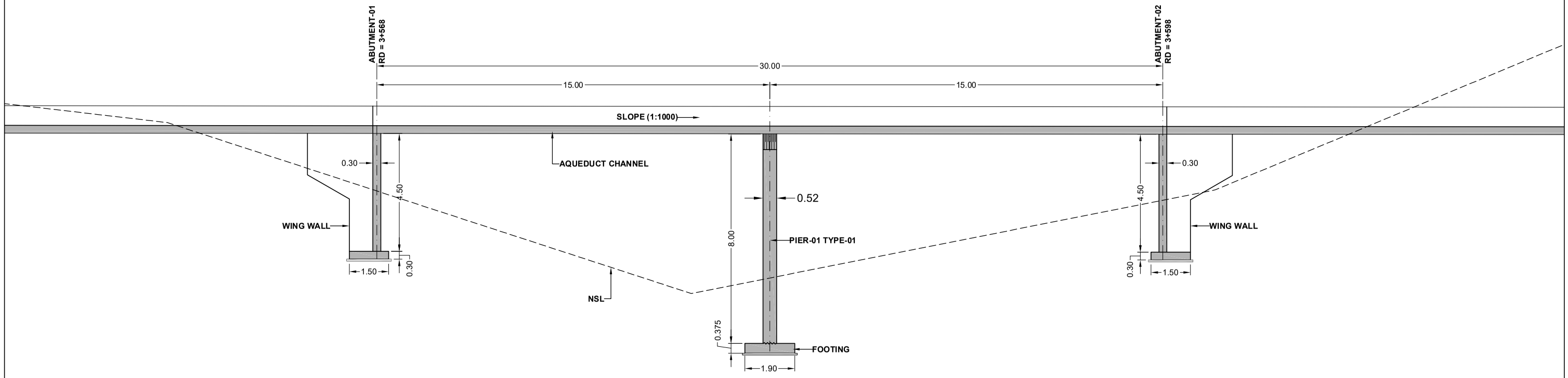
DRAWING NO.

007-CA-MC-HYS-STK-BNU-29

SHEET NO:



PLAN



LONG SECTION

CAD-File No.: F:\33 SATTI KALLI\REV-06 PACKAGES\PACKAGE-02\007-IRRIGATION CHANNEL HYDRALIC STRUCTUE\007-CA-HYS-STK-BNU-26 TO 36 AQUEDUCT PROFILE.DWG

CLIENT:

GOVERNMENT OF KHYBER PAKHTUNKHWA
DIRECTORATE GENERAL SMALL DAMS,
IRRIGATION DEPARTMENT, PESHAWAR

CONSULTANT:

CONSULTING ASSOCIATES
NEAR DEANS COMPLEX APARTMENTS, BOARD BAZAR,
BEHID GUL CNG, JAMRUD ROAD PEHSAWAR, PAKISTAN
PH: +92 91 5701774
EMAIL: Consultingassociates127@gmail.com

REV	DESCRIPTION	DATE
P01	DRAWINGS	11-03-22

PROJECT:
SATI KALLI DAM PROJECT
DISTRICT BANNU

TITLE:
SATTI KALLI DAM
AQUEDUCT-05 AT RD (3+568 TO 3+598)

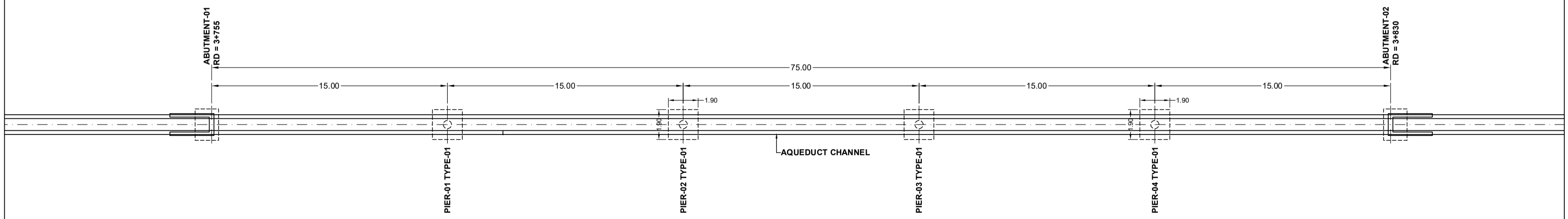
CONSTRUCTION DRAWINGS

DRAWN BY:	AZMAT ALI
DESIGNED BY:	YASIR IQBAL
CHECKED BY:	FARID KHAN

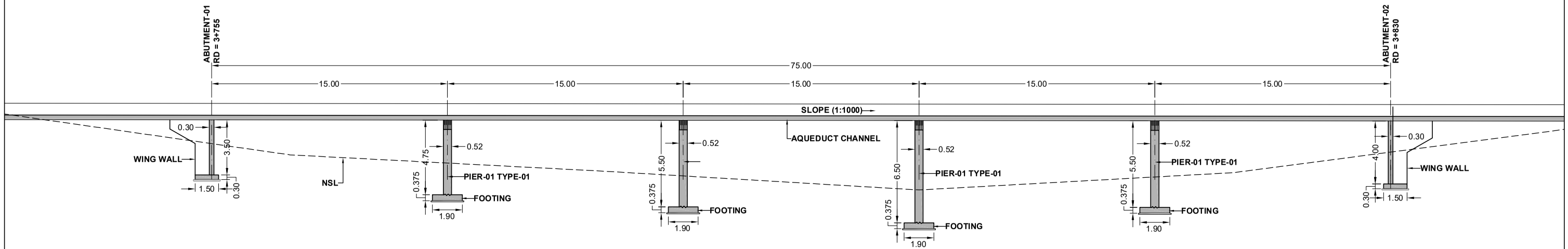
SCALE
1:150

DRAWING NO.
007-CA-MC-HYS-STK-BNU-30

SHEET NO:



PLAN



LONG SECTION

CAD-File No.: F:\33 SATTI KALLI\PREV-06 PACKAGES\PACKAGE-02\007-IRRIGATION CHANNEL HYDRALIC STRUCTUE\007-CA-HYS-STK-BNU-26 TO 36 AQUEDUCT PROFILE.DWG

CLIENT:

GOVERNMENT OF KHYBER PAKHTUNKHWA
DIRECTORATE GENERAL SMALL DAMS,
IRRIGATION DEPARTMENT, PESHAWAR

CONSULTANT:

CONSULTING ASSOCIATES
NEAR DEANS COMPLEX APARTMENTS, BOARD BAZAR,
BEHID GUL CNG, JAMRUD ROAD PEHSAWAR, PAKISTAN
PH: +92 91 5701774
EMAIL: Consultingassociates127@gmail.com

REV	DESCRIPTION	DATE
P01	DRAWINGS	11-03-22

PROJECT:

SATI KALLI DAM PROJECT
DISTRICT BANNU

TITLE:

SATTI KALLI DAM
AQUEDUCT-06 AT RD (3+755 TO 3+830)

CONSTRUCTION DRAWINGS

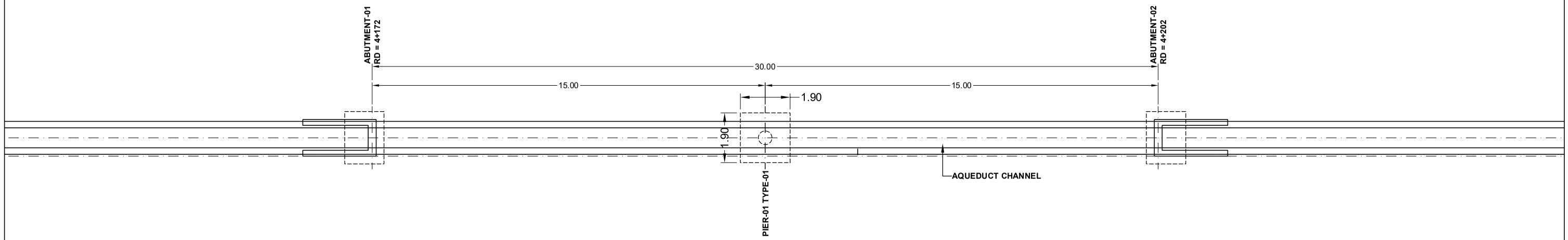
DRAWN BY:	AZMAT ALI
DESIGNED BY:	YASIR IQBAL
CHECKED BY:	FARID KHAN

SCALE
1:250

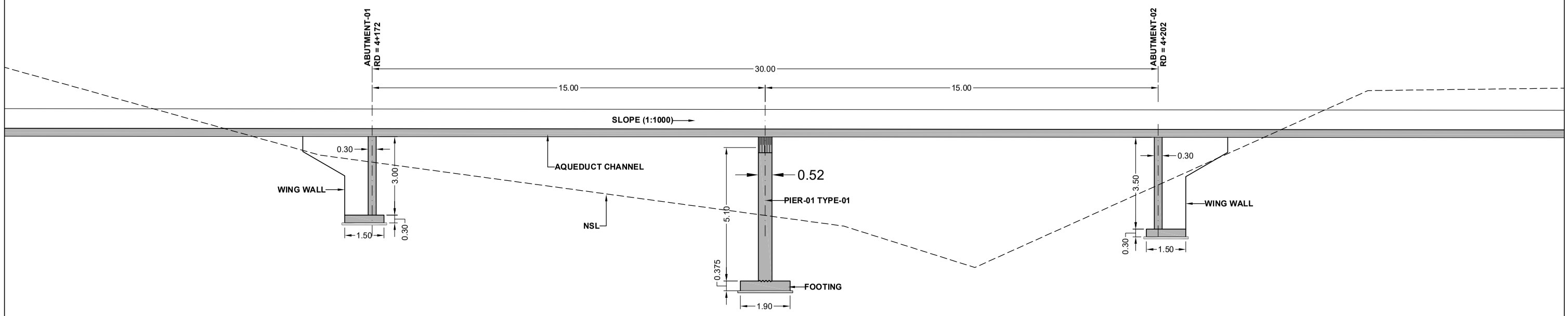
DRAWING NO.

007-CA-MC-HYS-STK-BNU-31

SHEET NO:



PLAN



LONG SECTION

CAD File No: F:\33 SATTI KALLI\REV-06 PACKAGES\PACKAGE-02\007-IRRIGATION CHANNEL HYDRAULIC STRUCTUE\007-CA-HYS-STK-BNU-28 TO 36 AQUEDUCT PROFILE.DWG

CLIENT:

GOVERNMENT OF KHYBER PAKHTUNKHWA
DIRECTORATE GENERAL SMALL DAMS,
IRRIGATION DEPARTMENT, PESHAWAR

CONSULTANT:

CONSULTING ASSOCIATES
NEAR DEANS COMPLEX APARTMENTS, BOARD BAZAR,
BEHID GUL CNG, JAMRUD ROAD PEHSAWAR, PAKISTAN
PH: +92 91 5701774
EMAIL: Consultingassociates127@gmail.com

REV	DESCRIPTION	DATE
P01	DRAWINGS	11-03-22

PROJECT:
SATI KALLI DAM PROJECT
DISTRICT BANNU

TITLE:
SATTI KALLI DAM
AQUEDUCT-07 AT RD (4+172 TO 4+202)

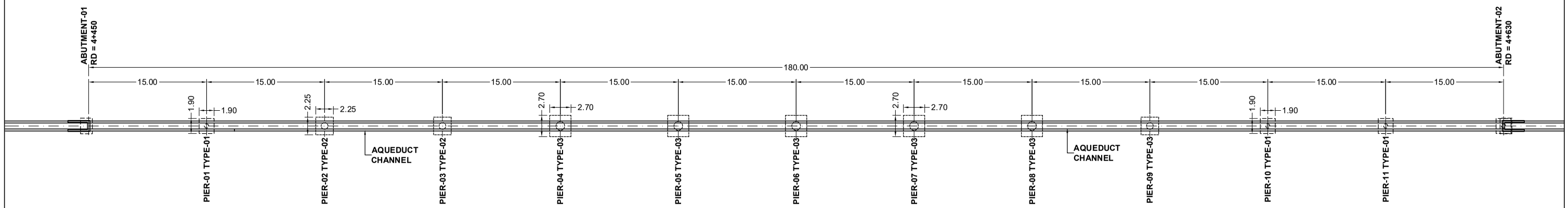
CONSTRUCTION DRAWINGS

DRAWN BY:	AZMAT ALI
DESIGNED BY:	YASIR IQBAL
CHECKED BY:	FARID KHAN

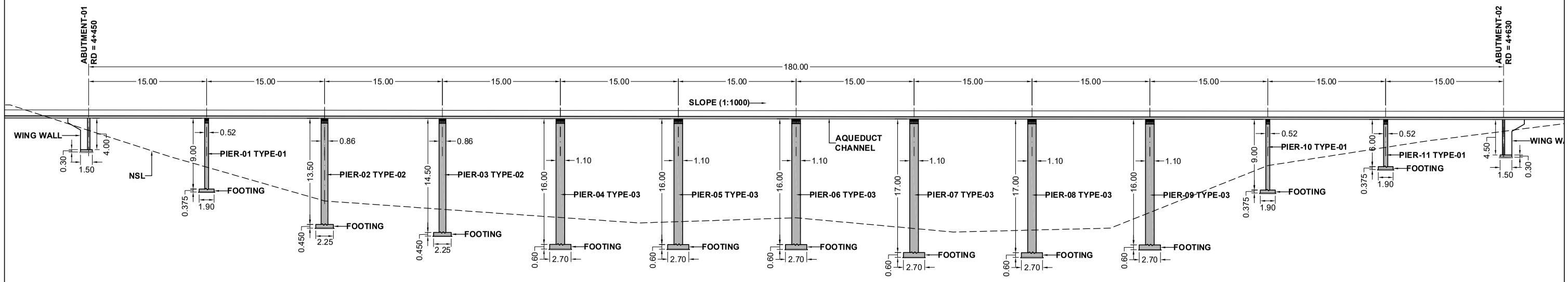
SCALE
1:150

DRAWING NO.
007-CA-MC-HYS-STK-BNU-32

SHEET NO:



PLAN



LONG SECTION

CAD File No: F:\33 SATTI KALLI\REV-06 PACKAGES\PACKAGE-02\007-IRRIGATION CHANNEL HYDRAULIC STRUCTUE\007-CA-HYS-STK-BNU-28 TO 39 AQUEDUCT PROFILE.DWG

CLIENT:

GOVERNMENT OF KHYBER PAKHTUNKHWA
DIRECTORATE GENERAL SMALL DAMS,
IRRIGATION DEPARTMENT, PESHAWAR

CONSULTANT:

CONSULTING ASSOCIATES
NEAR DEANS COMPLEX APARTMENTS, BOARD BAZAR,
BEHID GUL CNG, JAMRUD ROAD PEHSAWAR, PAKISTAN
PH: +92 91 5701774
EMAIL: Consultingassociates127@gmail.com

REV	DESCRIPTION	DATE
P01	DRAWINGS	11-03-22

PROJECT:
SATI KALLI DAM PROJECT
DISTRICT BANNU

TITLE:
SATTI KALLI DAM
AQUEDUCT-08 AT RD (4+450 TO 4+630)

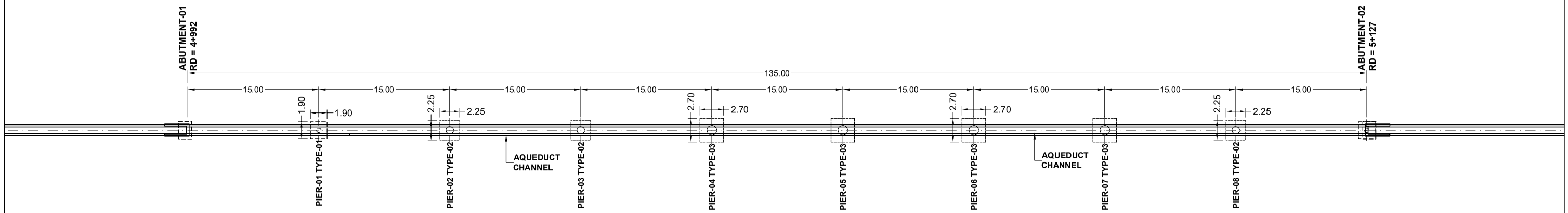
CONSTRUCTION DRAWINGS

DRAWN BY:	AZMAT ALI
DESIGNED BY:	YASIR IQBAL
CHECKED BY:	FARID KHAN

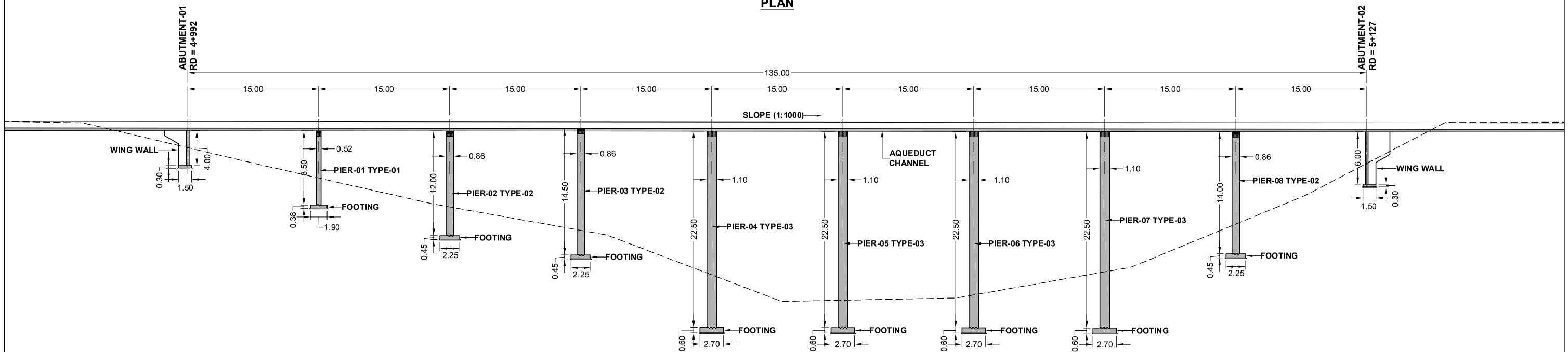
SCALE
1:500

DRAWING NO.
007-CA-MC-HYS-STK-BNU-33

SHEET NO:



PLAN



LONG SECTION

CAD-File No.: F:\33 SATTI KALLI\REV-06 PACKAGES\PACKAGE-02\007-IRRIGATION CHANNEL HYDRALIC STRUCTUE\007-CA-HYS-STK-BNU-26 TO 36 AQUEDUCT PROFILE.DWG

CLIENT:

GOVERNMENT OF KHYBER PAKHTUNKHWA
DIRECTORATE GENERAL SMALL DAMS,
IRRIGATION DEPARTMENT, PESHAWAR

CONSULTANT:

CONSULTING ASSOCIATES
NEAR DEANS COMPLEX APARTMENTS, BOARD BAZAR,
BEHID GUL CNG, JAMRUD ROAD PEHSAWAR, PAKISTAN
PH: +92 91 5701774
EMAIL: Consultingassociates127@gmail.com

REV	DESCRIPTION	DATE
P01	DRAWINGS	11-03-22

PROJECT:
SATI KALLI DAM PROJECT
DISTRICT BANNU

TITLE:
SATTI KALLI DAM
AQUEDUCT-09 AT RD (4+992 TO 5+127)

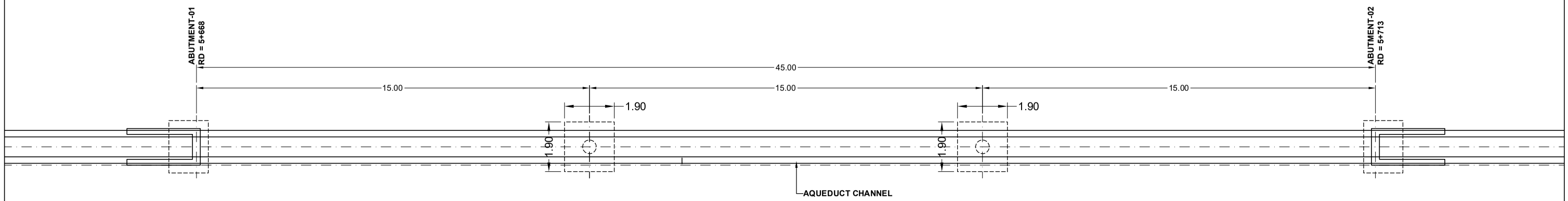
CONSTRUCTION DRAWINGS

DRAWN BY:	AZMAT ALI
DESIGNED BY:	YASIR IQBAL
CHECKED BY:	FARID KHAN

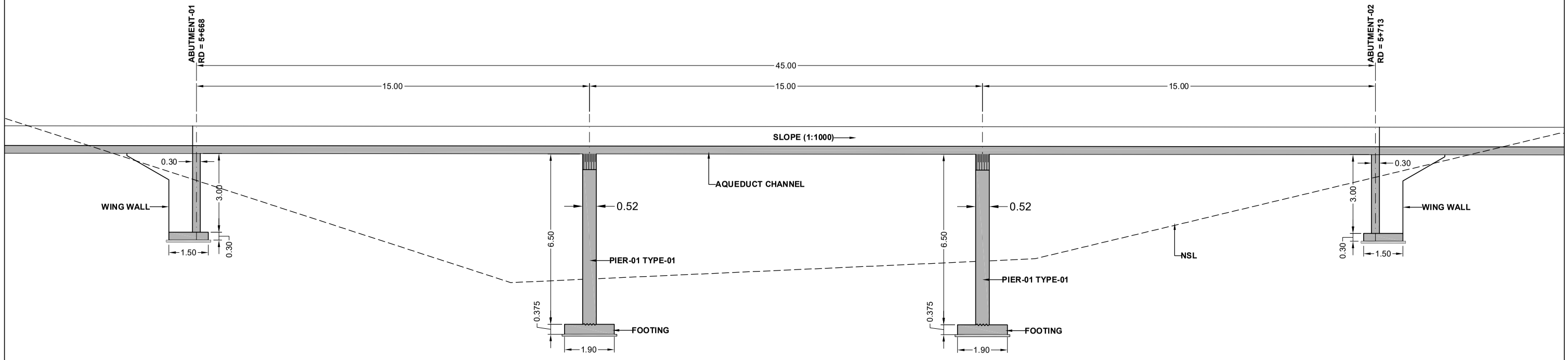
SCALE
1:450

DRAWING NO.
007-CA-MC-HYS-STK-BNU-34

SHEET NO:



PLAN



LONG SECTION

CLIENT:

GOVERNMENT OF KHYBER PAKHTUNKHWA
DIRECTORATE GENERAL SMALL DAMS,
IRRIGATION DEPARTMENT, PESHAWAR

CONSULTANT:

CONSULTING ASSOCIATES
NEAR DEANS COMPLEX APARTMENTS, BOARD BAZAR,
BEHID GUL CNG, JAMRUD ROAD PEHSAWAR, PAKISTAN
PH: +92 91 5701774
EMAIL: Consultingassociates127@gmail.com

REV	DESCRIPTION	DATE
P01	DRAWINGS	11-03-22

PROJECT:
SATI KALLI DAM PROJECT
DISTRICT BANNU

TITLE:
SATTI KALLI DAM
AQUEDUCT-10 AT RD (5+668 TO 5+713)

CONSTRUCTION DRAWINGS

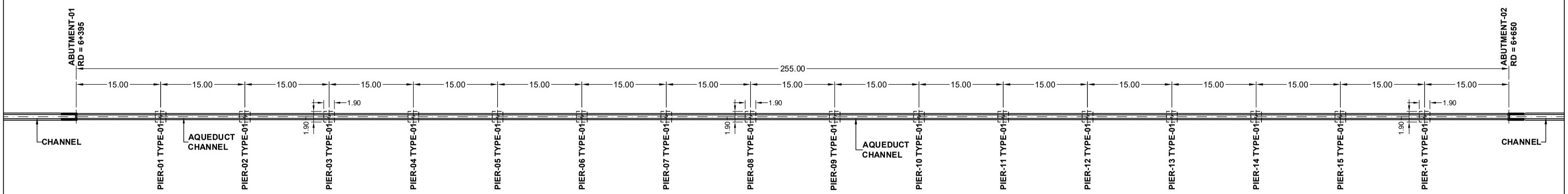
DRAWN BY:	AZMAT ALI
DESIGNED BY:	YASIR IQBAL
CHECKED BY:	FARID KHAN

SCALE
1:450

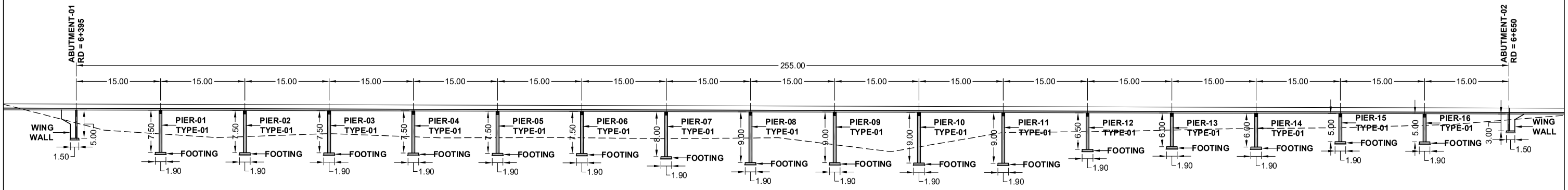
DRAWING NO.
007-CA-MC-HYS-STK-BNU-35

SHEET NO:

CAD-File No:- F:\33 SATTI KALLI\REV-08\ PACKAGES\PACKAGE-02\007-IRRIGATION CHANNEL HYDRAULIC STRUCTUE\007-CA-HYS-STK-BNU-36 TO 36 AQUEDUCT PROFILE.DWG



PLAN



LONG SECTION

CAD File No. : F:\03 SATTI KALLI\REV-06 PACKAGES\PACKAGE-02\007-IRRIGATION CHANNEL HYDRAULIC STRUCTUE\007-CA-HYS-STK-BNU-26 TO 36 AQUEDUCT PROFILE.DWG

CLIENT:

GOVERNMENT OF KHYBER PAKHTUNKHWA
DIRECTORATE GENERAL SMALL DAMS,
IRRIGATION DEPARTMENT, PESHAWAR

CONSULTANT:

CONSULTING ASSOCIATES
NEAR DEANS COMPLEX APARTMENTS, BOARD BAZAR,
BEHID GUL CNG, JAMRUD ROAD PEHSAWAR, PAKISTAN
PH: +92 91 5701774
EMAIL: Consultingassociates127@gmail.com

REV	DESCRIPTION	DATE
P01	DRAWINGS	11-03-22

PROJECT:
SATI KALLI DAM PROJECT
DISTRICT BANNU

TITLE:
SATTI KALLI DAM
AQUEDUCT-11 AT RD (6+395 TO 6+650)

CONSTRUCTION DRAWINGS

DRAWN BY:	AZMAT ALI
DESIGNED BY:	YASIR IQBAL
CHECKED BY:	FARID KHAN

SCALE
1:450

DRAWING NO.
007-CA-MC-HYS-STK-BNU-36

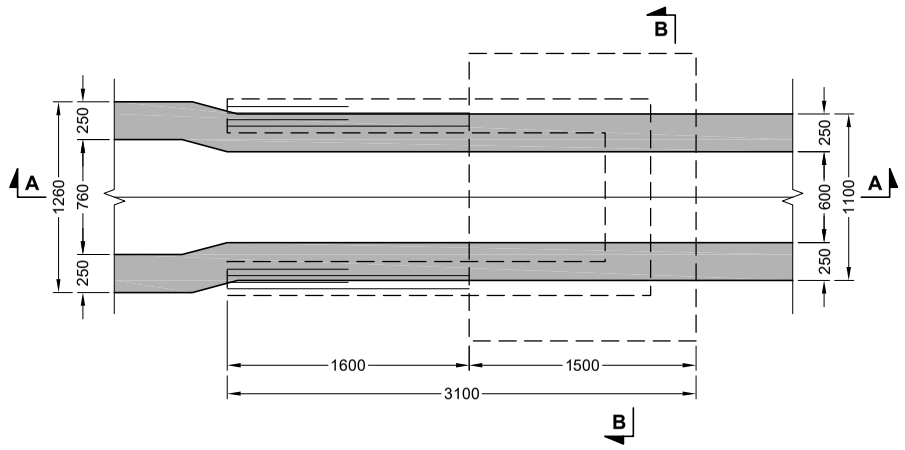
SHEET NO:

NOTE:-

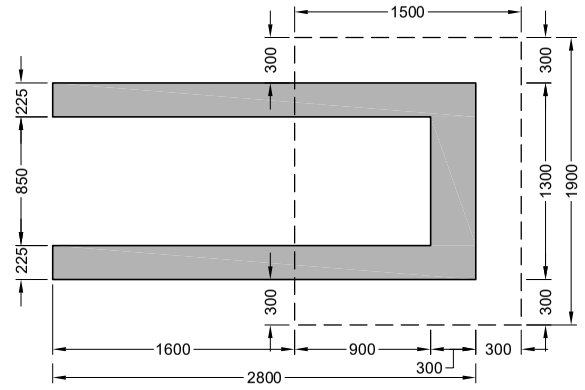
1. THE HIEHT OF PIER VARIES & INCLUDES THREE TYPE OF PIERS (TYPE-01, TYPE-02 & TYPE-03).

a. TYPE-01 RANGE IS UPTO 10m.
b. TYPE-02 RANGE IS FROM 10m-15m.
c. TYPE-03 RANGE IS FROM 15m-25m.

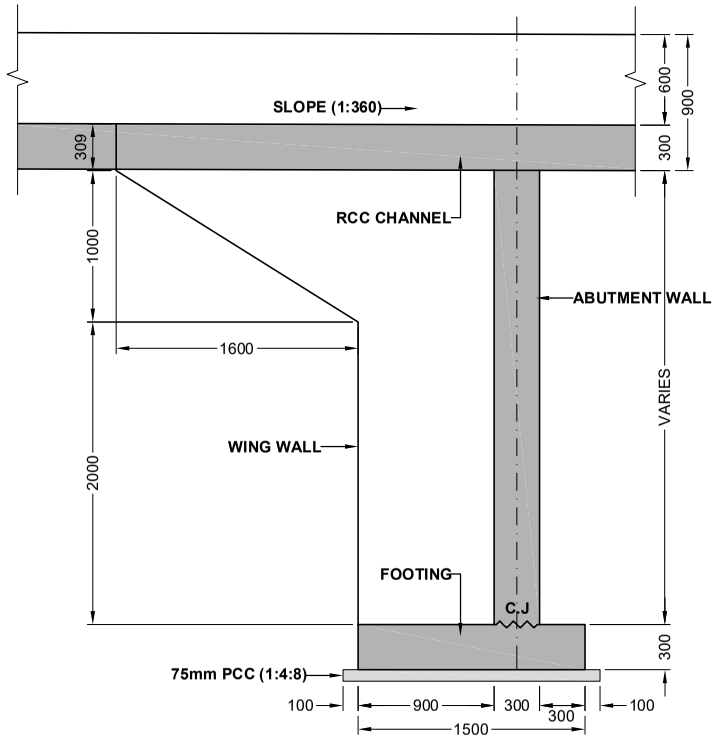
2. THE TROUGH SIZE FOR AQUEDUCT No.3 & No.9 SHALL BE 600mm x 600mm AND FOR REMAINING AQUEDUCTS THE TROUGH SIZE SHALL BE 760mm x 760mm.



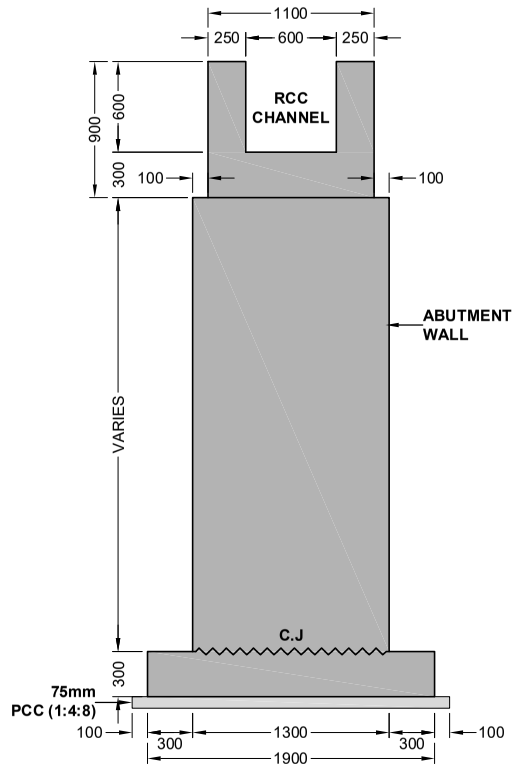
ABUTMENT TYPICAL PLAN



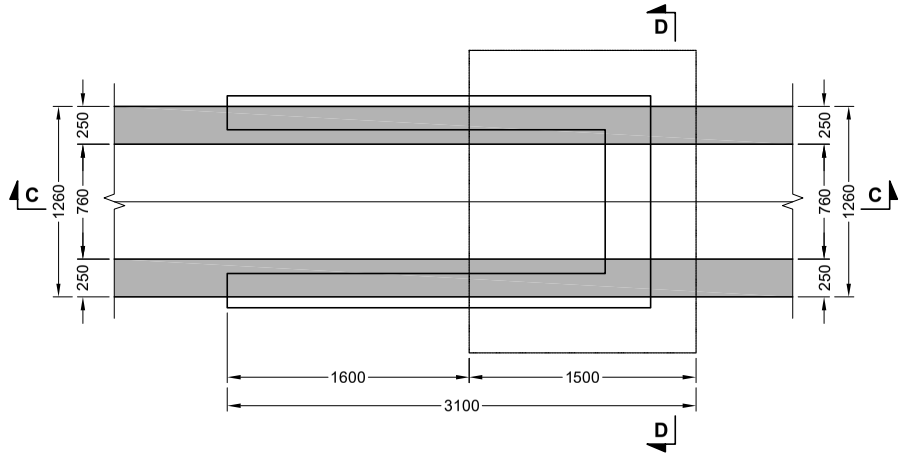
ABUTMENT WALL & FOOTING TYPICAL PLAN



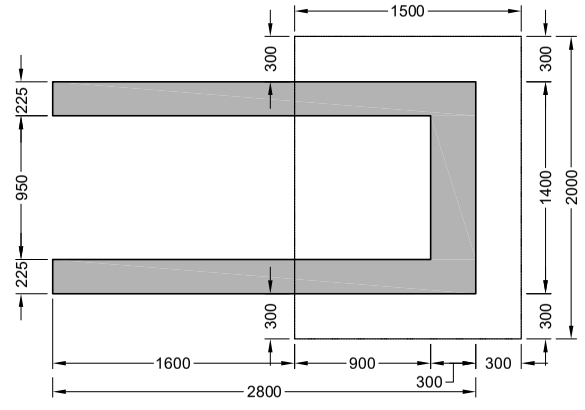
SECTION (A-A)



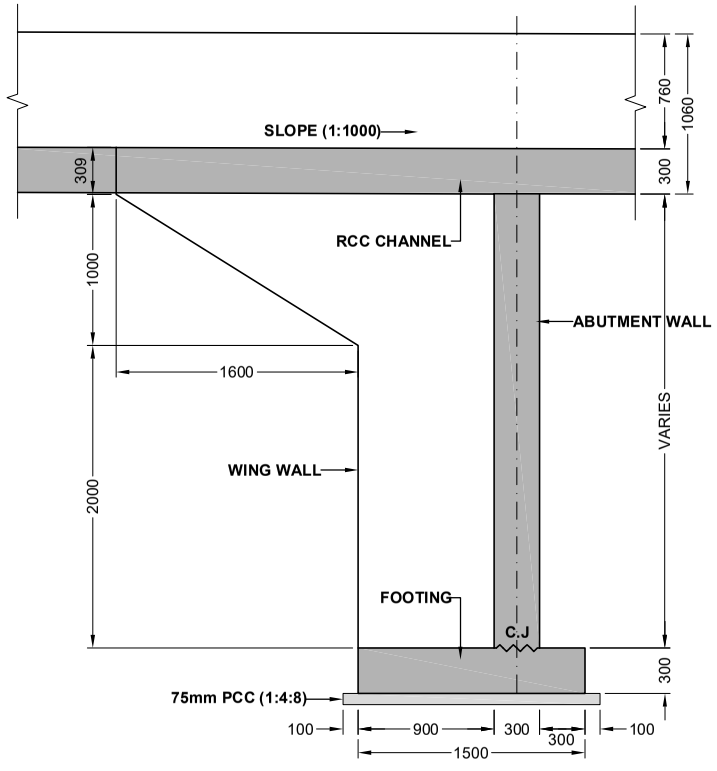
SECTION (B-B)



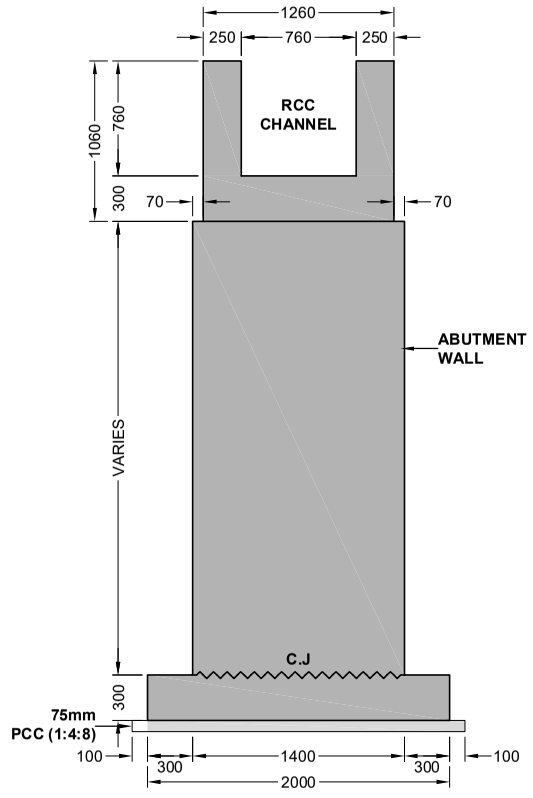
ABUTMENT TYPICAL PLAN



ABUTMENT WALL & FOOTING TYPICAL PLAN



SECTION (C-C)



SECTION (D-D)

		CONSTRUCTION DRAWINGS
CLIENT: GOVERNMENT OF KHYBER PAKHTUNKHWA DIRECTORATE GENERAL SMALL DAMS, IRRIGATION DEPARTMENT, PESHAWAR	**CONSULTANT:** **CONSULTING ASSOCIATES** NEAR DEANS COMPLEX APARTMENTS, BOARD BAZAR, BEHID GUL CNG, JAMRUD ROAD PEHSAWAR, PAKISTAN PH: +92 91 5701774 EMAIL: Consultingassociates127@gmail.com	DRAWN BY: AZMAT ALI DESIGNED BY: YASIR IQBAL CHECKED BY: FARID KHAN SCALE 1:50

REV	DESCRIPTION	DATE
P01	DRAWINGS	11-03-22

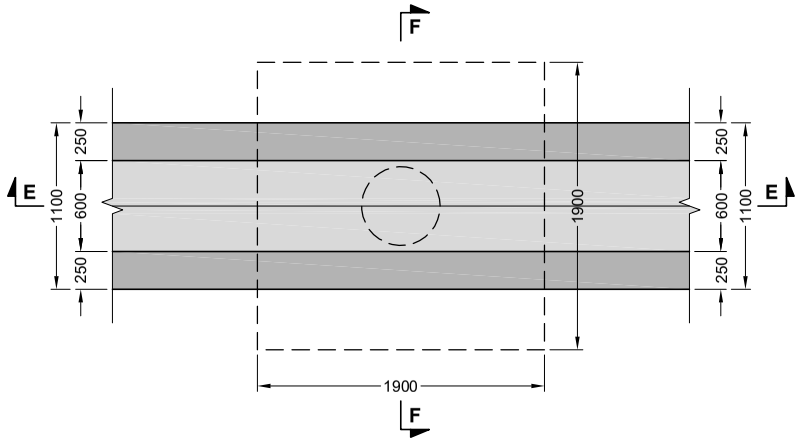
PROJECT: SATI KALLI DAM PROJECT
DISTRICT BANNU

TITLE: **SATTI KALLI DAM**
AQUEDUCT DETAIL CROSS SECTIONS

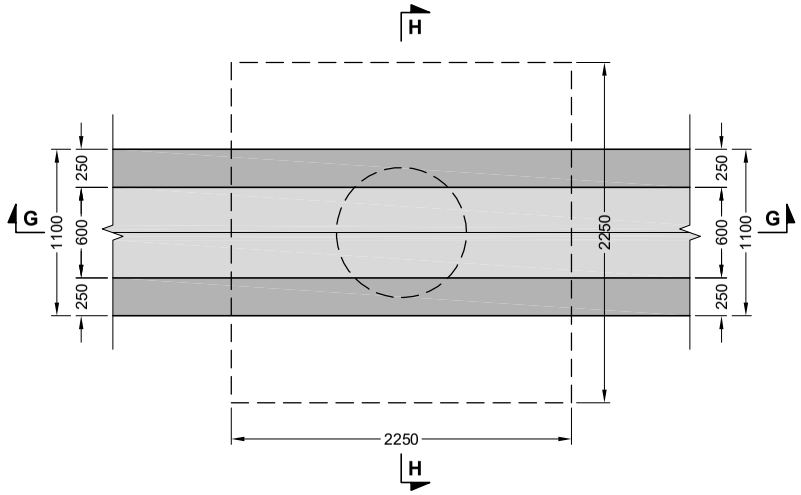
DRAWING NO. 007-CA-MC-HYS-STK-BNU- 37

SHEET NO:

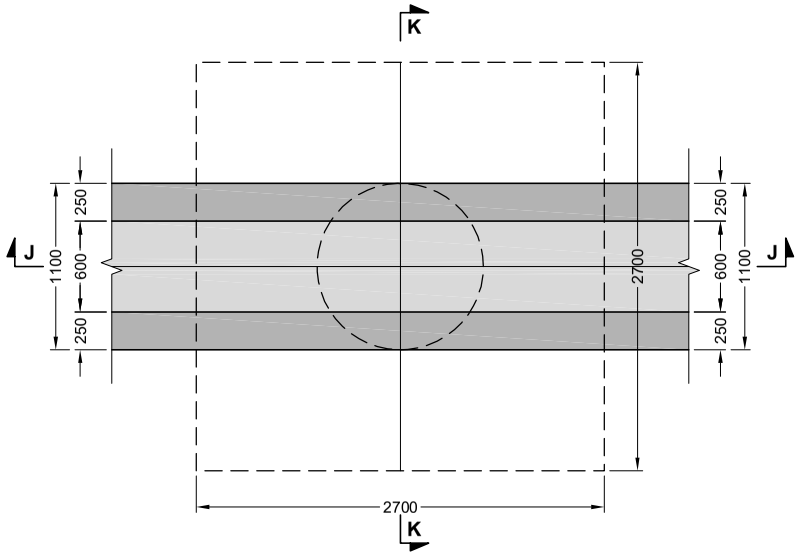
CAD-File No.: F:\33 SATTI KALLI\REV-06\ PACKAGES\PACKAGE-02\007-IRRIGATION CHANNEL HYDRALIC STRUCTUE\007-CA-HYS-STK-BNU-37 & 43 AQUEDUCT.DWG



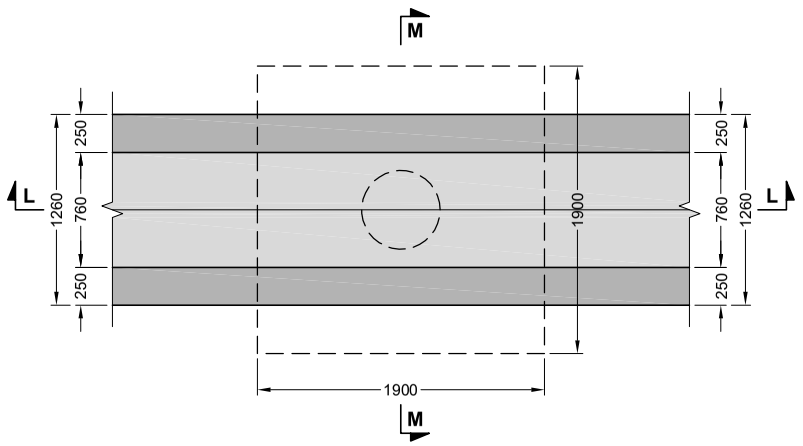
PIER & FOOTING PLAN OF TYPE-01



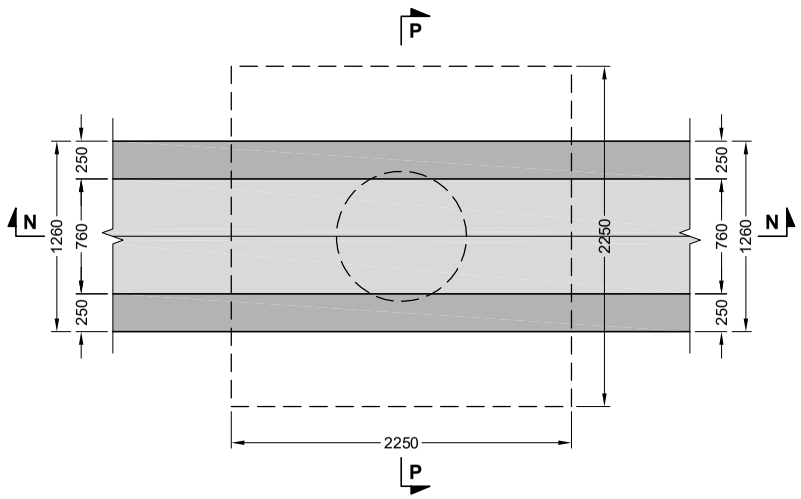
PIER & FOOTING PLAN OF TYPE-02



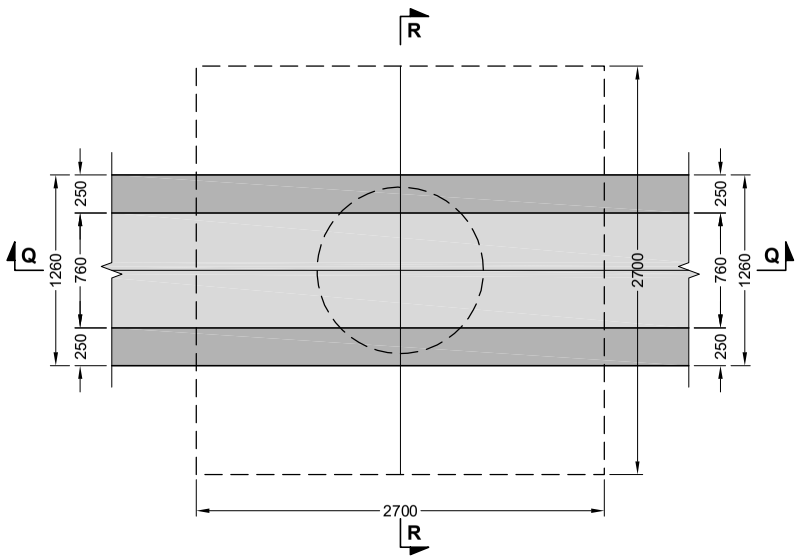
PIER & FOOTING PLAN OF TYPE-03



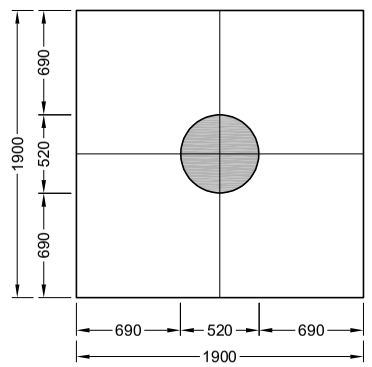
PIER & FOOTING PLAN OF TYPE-01



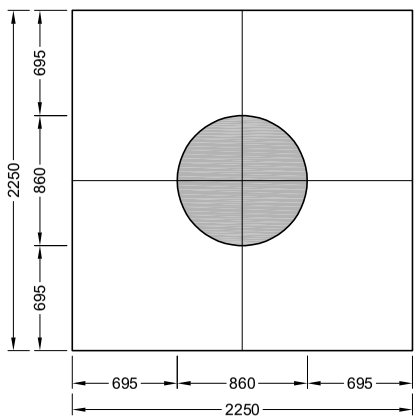
PIER & FOOTING PLAN OF TYPE-02



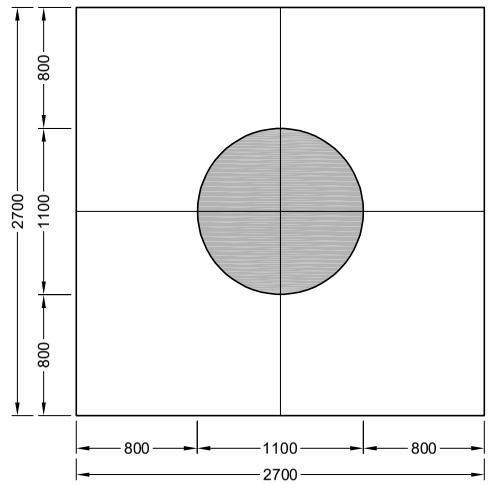
PIER & FOOTING PLAN OF TYPE-03



PIER & FOOTING PLAN OF TYPE-01



PIER & FOOTING PLAN OF TYPE-02



PIER & FOOTING PLAN OF TYPE-03

CAD File No:- F:\33 SATTI KALLI\REV-06 PACKAGES\PACKAGE-02\007-IRRIGATION CHANNEL HYDRAULIC STRUCTUE\007-CA-HYS-STK-BNU-37 & 43 AQUEDUCT.DWG

CLIENT:

GOVERNMENT OF KHYBER PAKHTUNKHWA
DIRECTORATE GENERAL SMALL DAMS,
IRRIGATION DEPARTMENT, PESHAWAR

CONSULTANT:

CONSULTING ASSOCIATES
NEAR DEANS COMPLEX APARTMENTS, BOARD BAZAR,
BEHID GUL CNG, JAMRUD ROAD PEHSAWAR, PAKISTAN
PH: +92 91 5701774
EMAIL: Consultingassociates127@gmail.com

REV	DESCRIPTION	DATE
P01	DRAWINGS	11-03-22

PROJECT:
SATI KALLI DAM PROJECT
DISTRICT BANNU

TITLE:
SATTI KALLI DAM
AQUEDUCT DETAIL CROSS SECTIONS

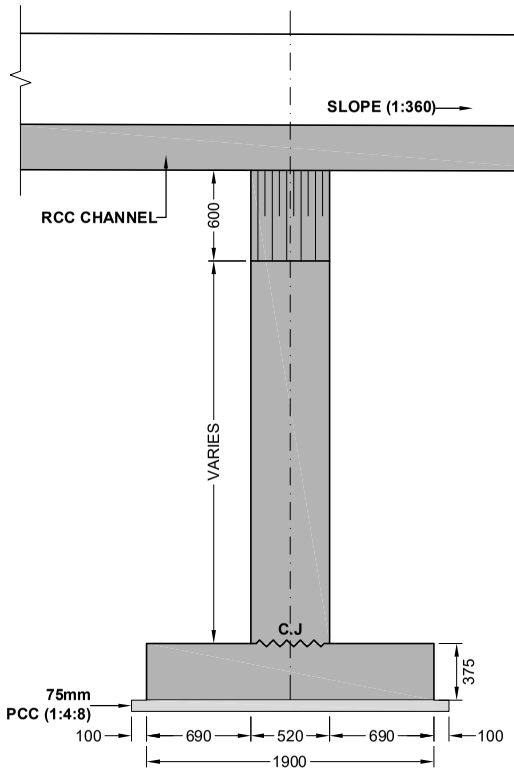
CONSTRUCTION DRAWINGS

DRAWN BY:	AZMAT ALI
DESIGNED BY:	YASIR IQBAL
CHECKED BY:	FARID KHAN

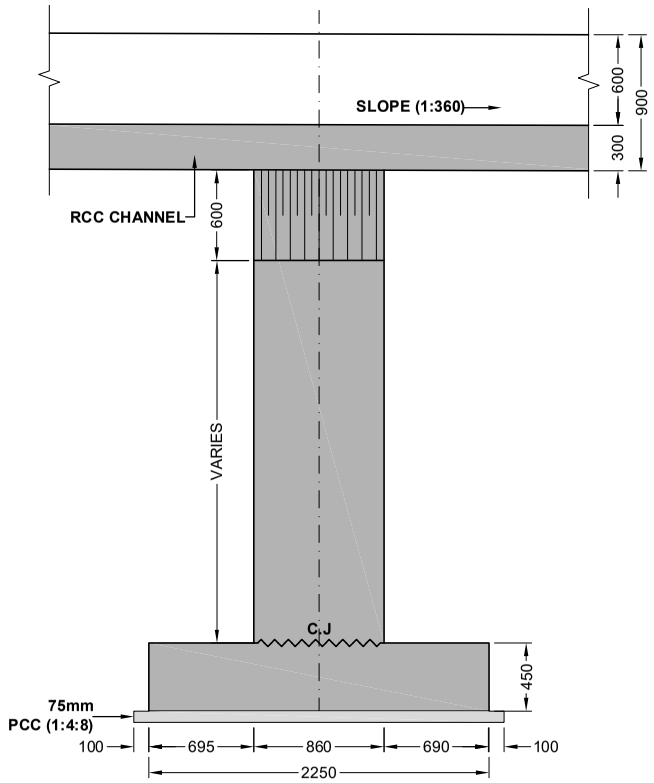
SCALE
1:50

DRAWING NO.
007-CA-MC-HYS-STK-BNU- 38

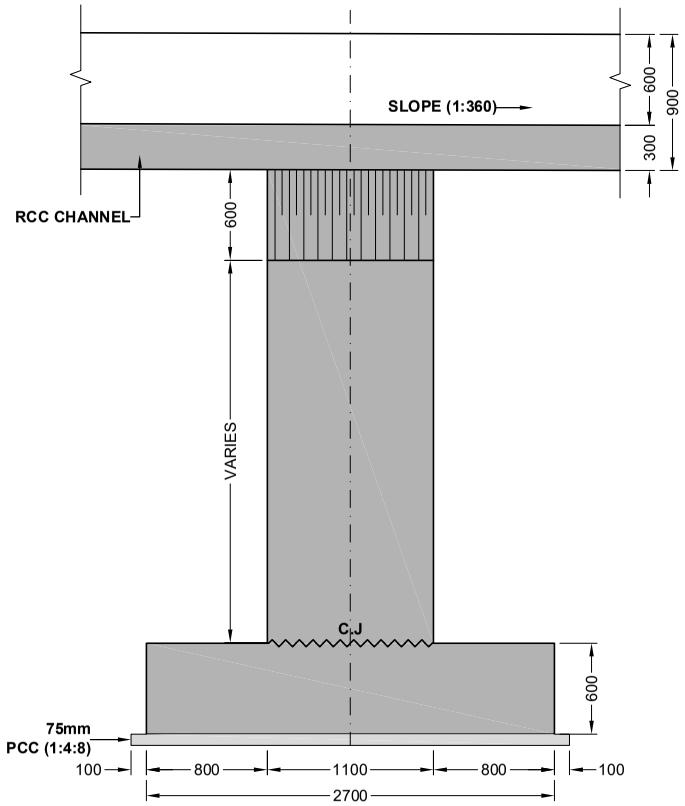
SHEET NO:



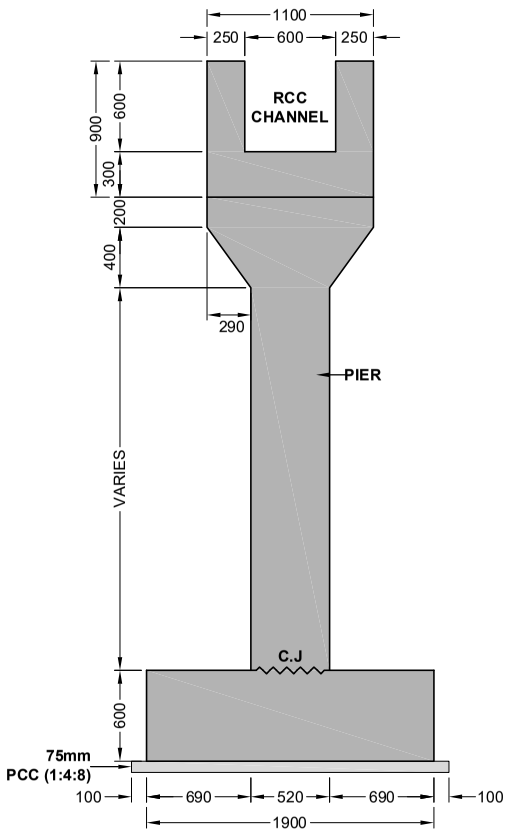
SECTION (E-E) - TYPE-01



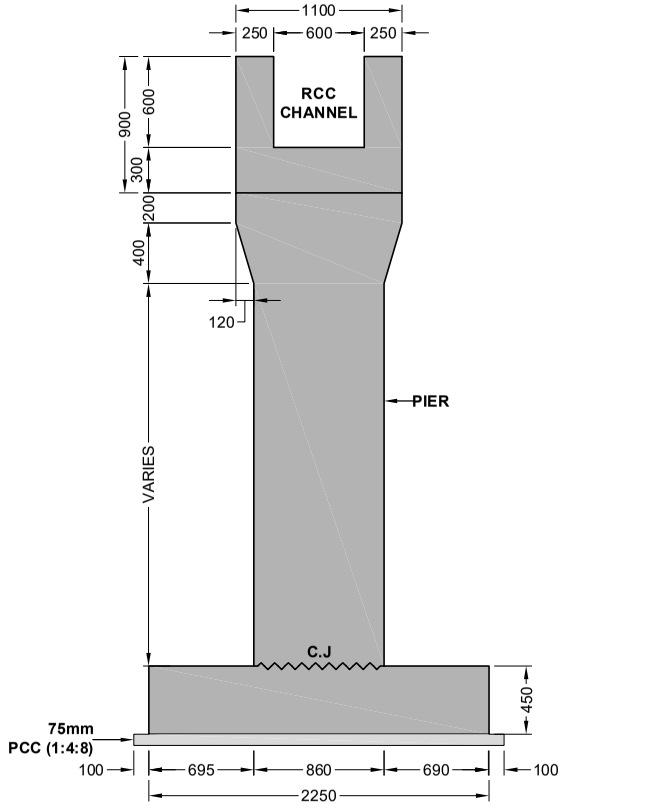
SECTION (G-G) - TYPE-02



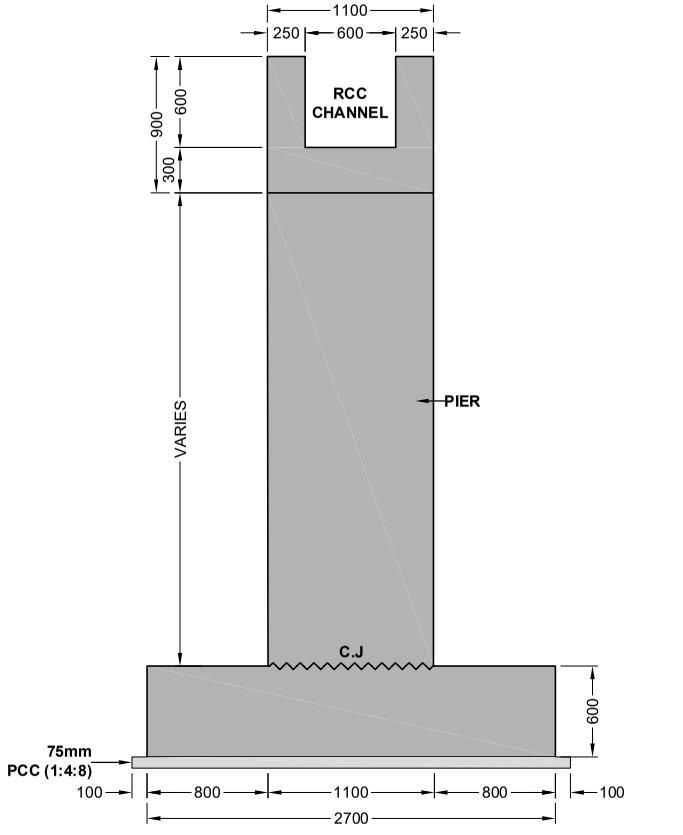
SECTION (J-J) - TYPE-03



SECTION (F-F) - TYPE-01



SECTION (H-H) - TYPE-02



SECTION (K-K) - TYPE-03

CAD File No: F:\33 SATTI KALLI\REV-06 PACKAGES\PACKAGE-02\007-IRRIGATION CHANNEL HYDRALIC STRUCTUE\007-CA-HYS-STK-BNU-37 & 43 AQUEDUCT.DWG

CLIENT:

GOVERNMENT OF KHYBER PAKHTUNKHWA
DIRECTORATE GENERAL SMALL DAMS,
IRRIGATION DEPARTMENT, PESHAWAR

CONSULTANT:

CONSULTING ASSOCIATES
NEAR DEANS COMPLEX APARTMENTS, BOARD BAZAR,
BEHID GUL CNG, JAMRUD ROAD PEHSAWAR, PAKISTAN
PH: +92 91 5701774
EMAIL: Consultingassociates127@gmail.com

REV	DESCRIPTION	DATE
P01	DRAWINGS	11-03-22

PROJECT:

SATI KALLI DAM PROJECT
DISTRICT BANNU

TITLE:

SATTI KALLI DAM
AQUEDUCT DETAIL CROSS SECTIONS

CONSTRUCTION DRAWINGS

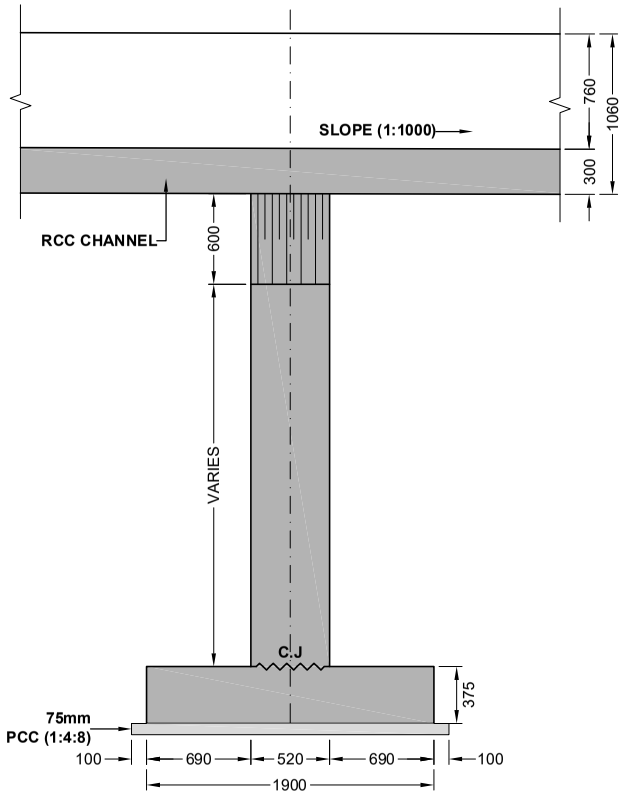
DRAWN BY:	AZMAT ALI
DESIGNED BY:	YASIR IQBAL
CHECKED BY:	FARID KHAN

SCALE
1:50

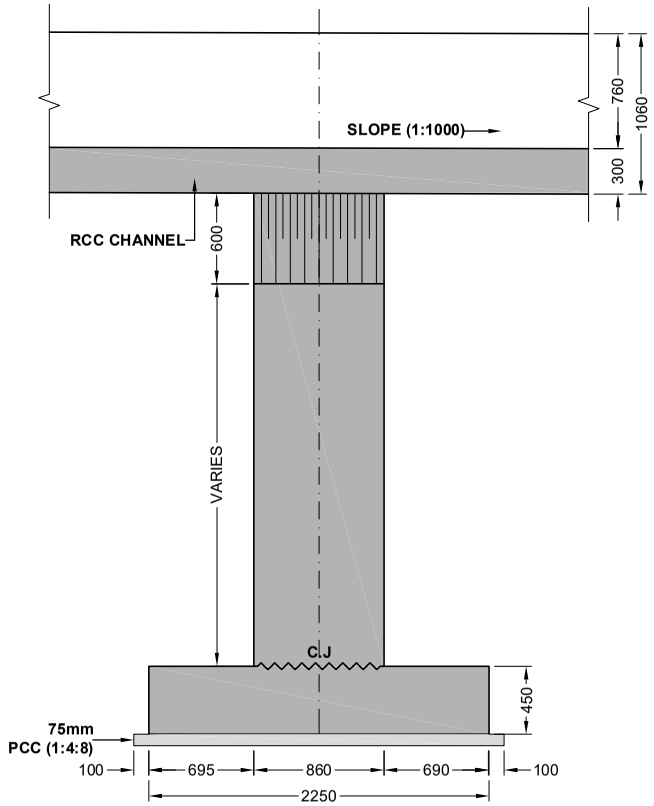
DRAWING NO.

007-CA-MC-HYS-STK-BNU-39

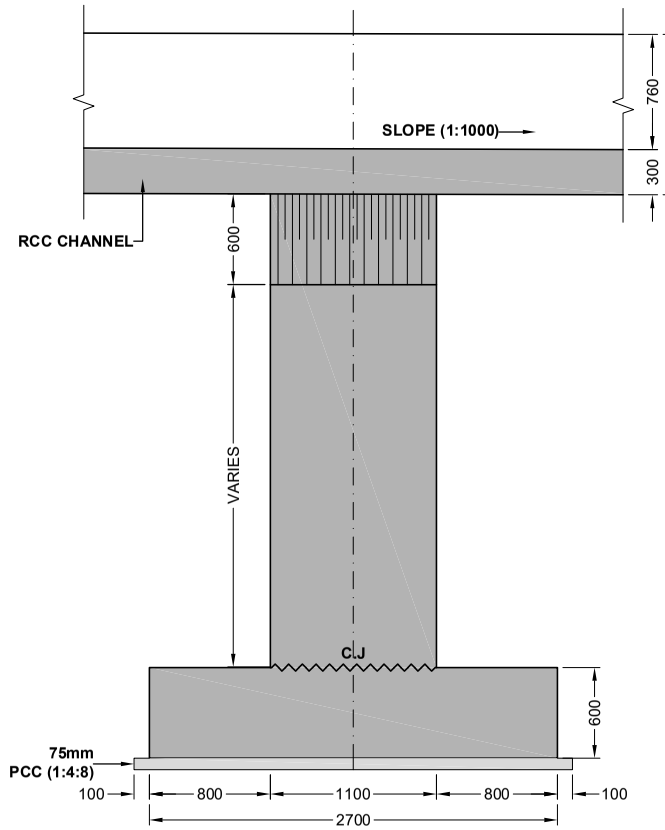
SHEET NO:



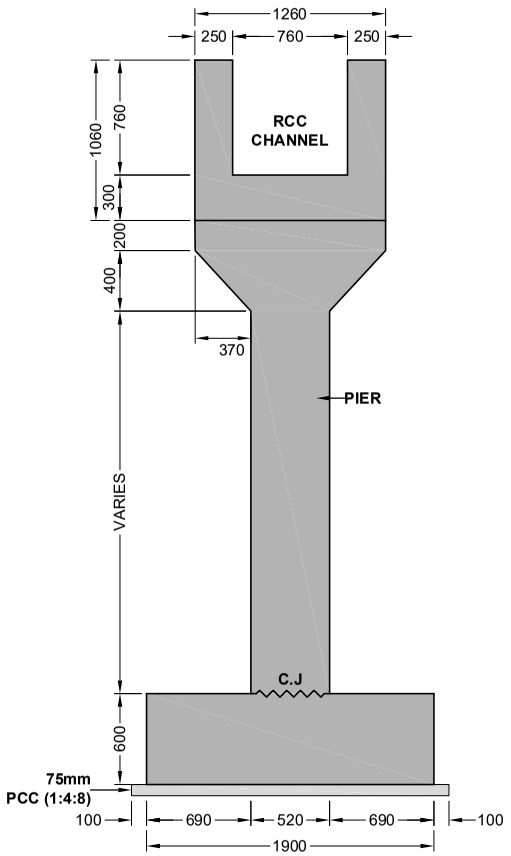
SECTION (L-L) - TYPE-01



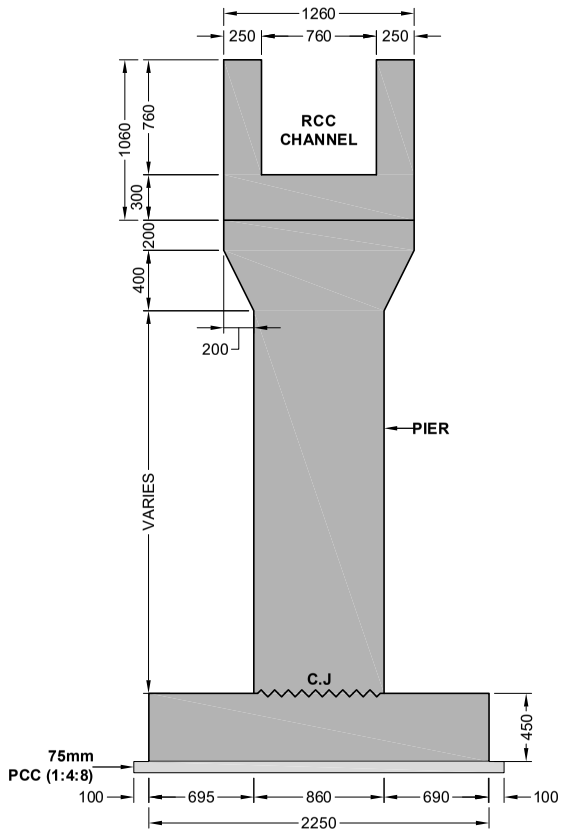
SECTION (N-N) - TYPE-02



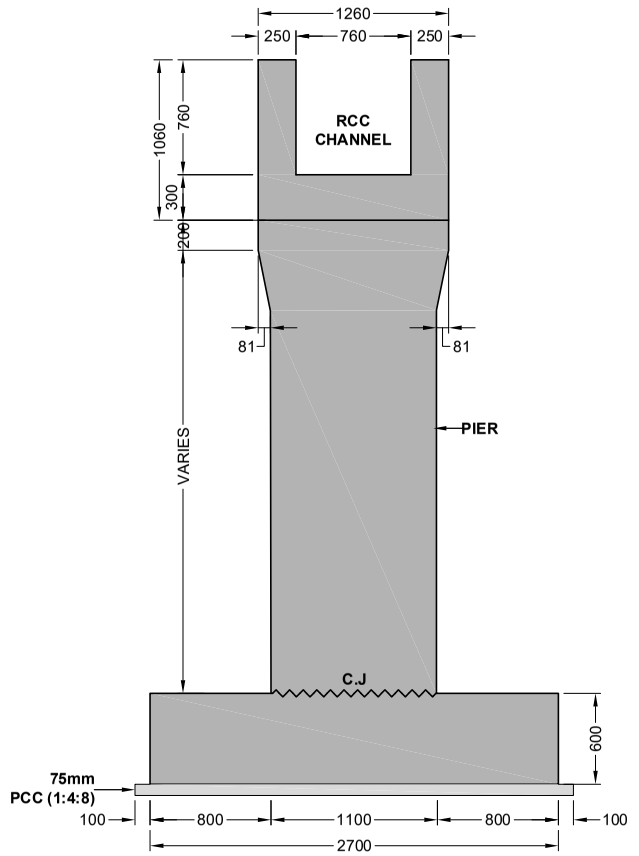
SECTION (Q-Q) - TYPE-03



SECTION (M-M) - TYPE-01



SECTION (P-P) - TYPE-02



SECTION (R-R) - TYPE-03

CAD-File No.: F:\33 SATTI KALLI\REV-06 PACKAGES\PACKAGE-02\007-IRRIGATION CHANNEL HYDRALIC STRUCTUE\007-CA-HYS-STK-BNU-37 & 43 AQUEDUCT.DWG

CONSTRUCTION DRAWINGS

CLIENT:

GOVERNMENT OF KHYBER PAKHTUNKHWA
DIRECTORATE GENERAL SMALL DAMS,
IRRIGATION DEPARTMENT, PESHAWAR

CONSULTANT:

CONSULTING ASSOCIATES
NEAR DEANS COMPLEX APARTMENTS, BOARD BAZAR,
BEHID GUL CNG, JAMRUD ROAD PEHSAWAR, PAKISTAN
PH: +92 91 5701774
EMAIL: Consultingassociates127@gmail.com

REV	DESCRIPTION	DATE
P01	DRAWINGS	11-03-22

PROJECT:

SATI KALLI DAM PROJECT
DISTRICT BANNU

DRAWN BY:	AZMAT ALI
DESIGNED BY:	YASIR IQBAL
CHECKED BY:	FARID KHAN

SCALE
1:50

TITLE:

SATTI KALLI DAM
AQUEDUCT DETAIL CROSS SECTIONS

DRAWING NO.

007-CA-MC-HYS-STK-BNU- 40

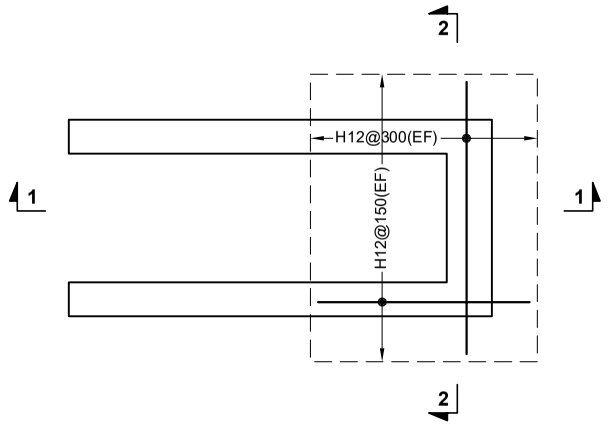
SHEET NO:

NOTE:-

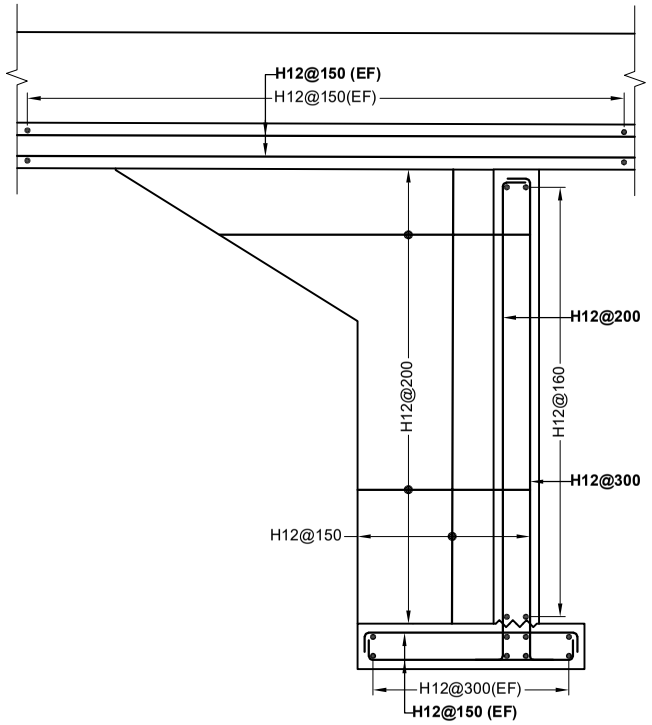
1. **THE HIEHT OF PIER VARIES & INCLUDES THREE TYPE OF PIERS (TYPE-01, TYPE-02 & TYPE-03).**

a. **TYPE-01 RANGE IS UPTO 10m.**
b. **TYPE-02 RANGE IS FROM 10m-15m.**
c. **TYPE-03 RANGE IS FROM 15m-25m.**

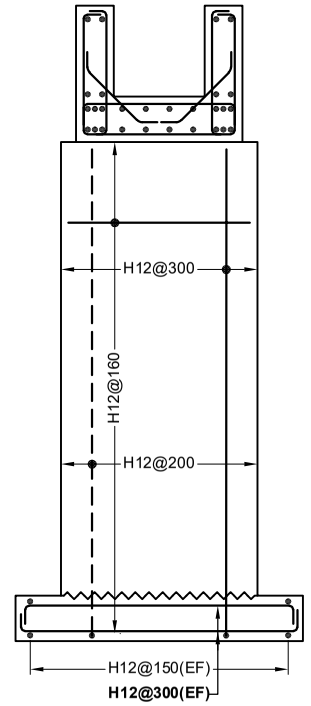
2. **THE TROUGH SIZE FOR AQUEDUCT No.3 & No.9 SHALL BE 600mm x 600mm AND FOR REMAINING AQUEDUCTS THE TROUGH SIZE SHALL BE 760mm x 760mm.**



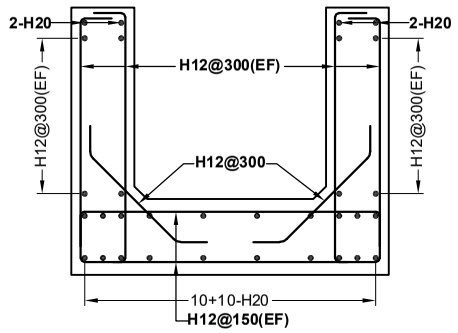
ABUTMENT REINFORCEMENT PLAN
SCALE 1:50



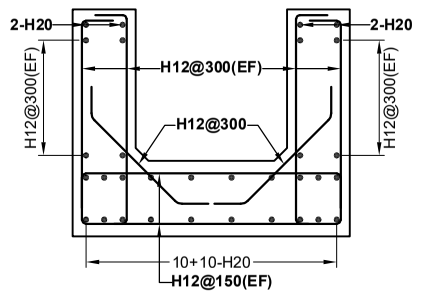
SECTION (1-1)
SCALE 1:50



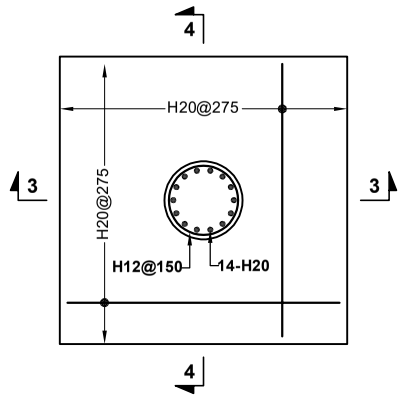
SECTION (2-2)
SCALE 1:50



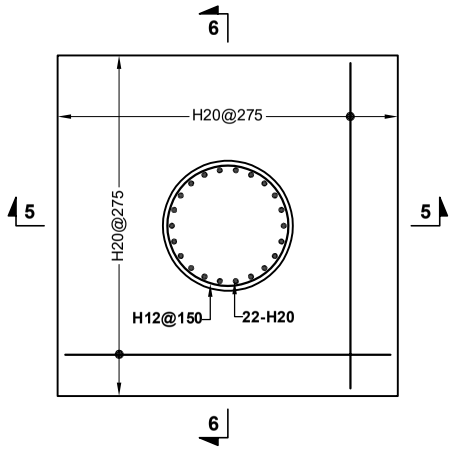
CHANNEL (760x760) REINFORCEMENT DETAIL
SCALE 1:30



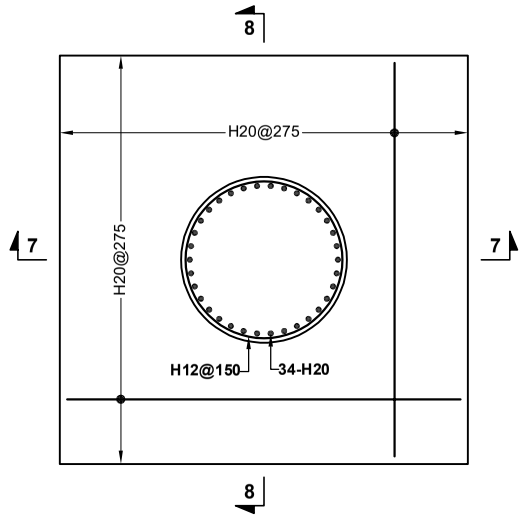
CHANNEL (600x600) REINFORCEMENT DETAIL
SCALE 1:30



PIER & FOOTING REINFORCEMENT PLAN OF TYPE-01
SCALE 1:50



PIER & FOOTING REINFORCEMENT PLAN OF TYPE-02
SCALE 1:50



PIER & FOOTING REINFORCEMENT PLAN OF TYPE-03
SCALE 1:50

CAD-File No:- F:\33 SATTI KALLI\REV-08\ PACKAGES\PACKAGE-02\007-IRRIGATION CHANNEL HYDRALIC STRUCTUE\007-CA-HYS-STK-BNU-37 & 43 AQUEDUCT.DWG

CLIENT:

GOVERNMENT OF KHYBER PAKHTUNKHWA
DIRECTORATE GENERAL SMALL DAMS,
IRRIGATION DEPARTMENT, PESHAWAR

CONSULTANT:

CONSULTING ASSOCIATES
NEAR DEANS COMPLEX APARTMENTS, BOARD BAZAR,
BEHID GUL CNG, JAMRUD ROAD PEHSAWAR, PAKISTAN
PH: +92 91 5701774
EMAIL: Consultingassociates127@gmail.com

REV	DESCRIPTION	DATE
P01	DRAWINGS	11-03-22

PROJECT:
SATI KALLI DAM PROJECT
DISTRICT BANNU

TITLE:
SATTI KALLI DAM
AQUEDUCT REINFORCEMENT DETAIL CROSS SECTIONS

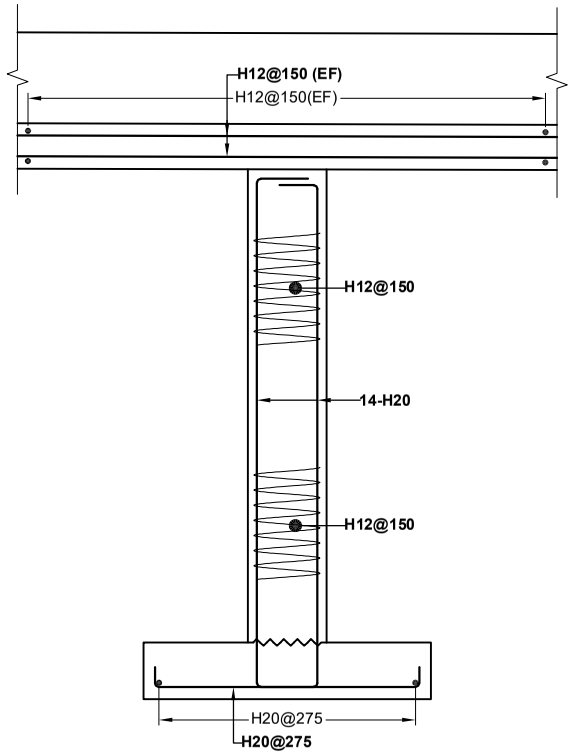
CONSTRUCTION DRAWINGS

DRAWN BY:	AZMAT ALI
DESIGNED BY:	YASIR IQBAL
CHECKED BY:	FARID KHAN

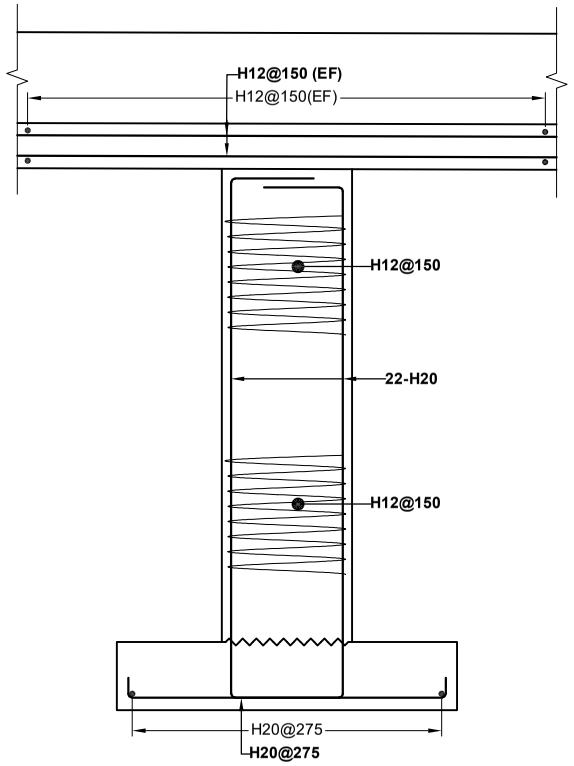
SCALE AS SHOWN

DRAWING NO.
007-CA-MC-HYS-STK-BNU- 41

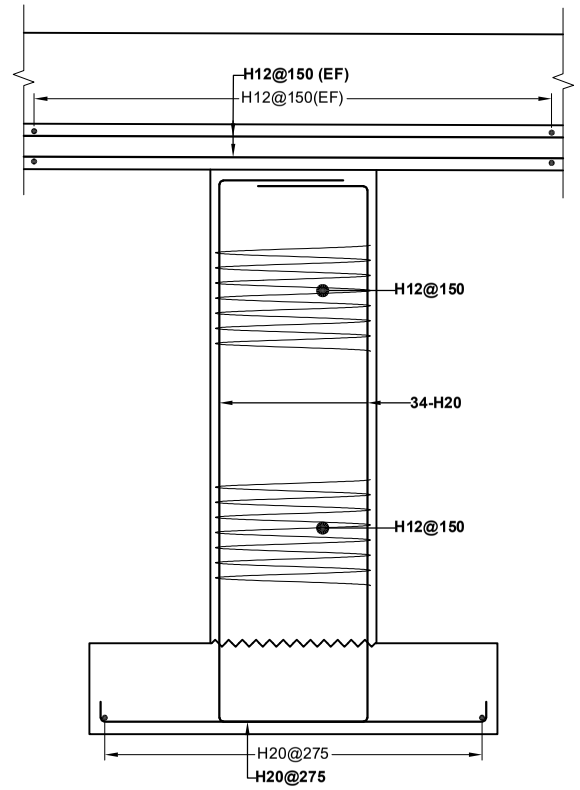
SHEET NO:



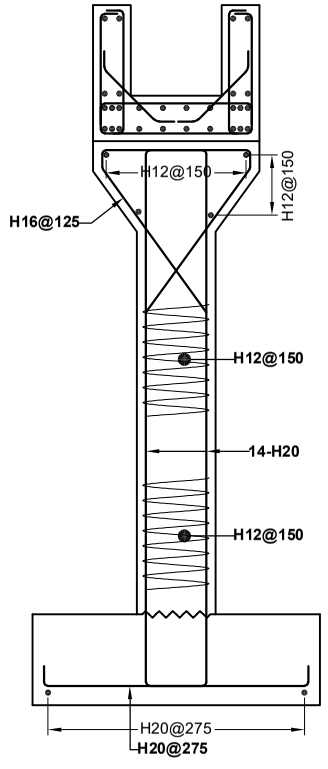
SECTION (3-3) TYPE-01
(600x600)



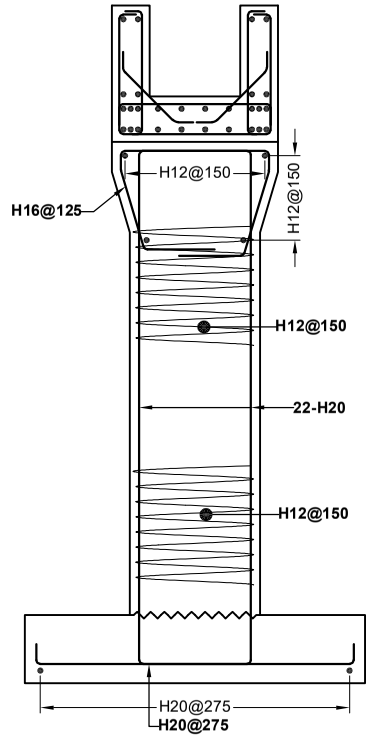
SECTION (5-5) TYPE-02
(600x600)



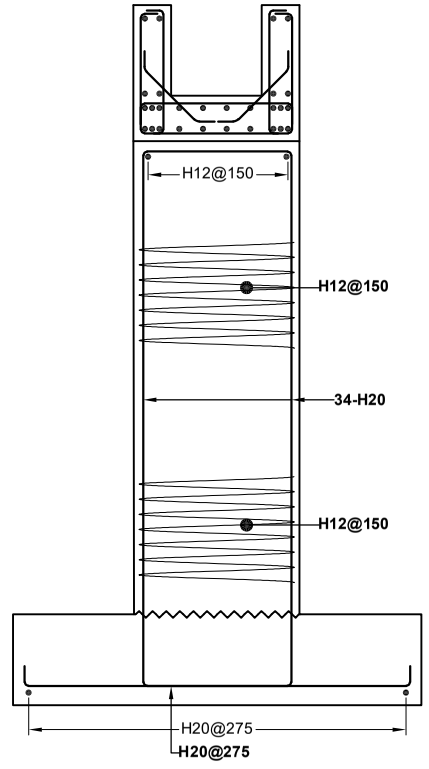
SECTION (7-7) TYPE-03
(600x600)



SECTION (4-4) TYPE-01
(600x600)



SECTION (6-6) TYPE-02
(600x600)



SECTION (8-8) TYPE-03
(600x600)

CAD-File No.: F:\33 SATTI KALLI\REV-06 PACKAGES\PACKAGE-02\007-IRRIGATION CHANNEL HYDRALIC STRUCTUE\007-CA-HYS-STK-BNU-37 & 43 AQUEDUCT.DWG

CLIENT:

GOVERNMENT OF KHYBER PAKHTUNKHWA
DIRECTORATE GENERAL SMALL DAMS,
IRRIGATION DEPARTMENT, PESHAWAR

CONSULTANT:

CONSULTING ASSOCIATES
NEAR DEANS COMPLEX APARTMENTS, BOARD BAZAR,
BEHID GUL CNG, JAMRUD ROAD PEHSAWAR, PAKISTAN
PH: +92 91 5701774
EMAIL: Consultingassociates127@gmail.com

REV	DESCRIPTION	DATE
P01	DRAWINGS	11-03-22

PROJECT:
SATI KALLI DAM PROJECT
DISTRICT BANNU

TITLE:
SATTI KALLI DAM
AQUEDUCT REINFORCEMENT DETAIL CROSS SECTIONS

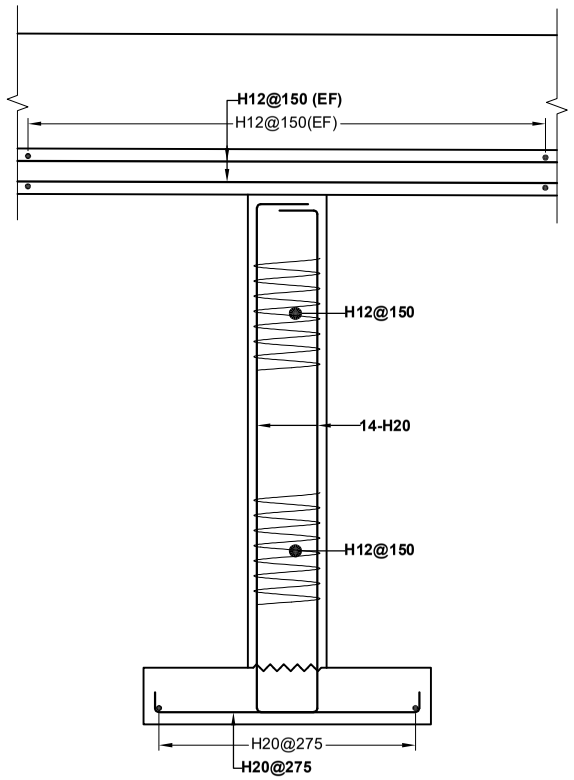
CONSTRUCTION DRAWINGS

DRAWN BY:	AZMAT ALI
DESIGNED BY:	YASIR IQBAL
CHECKED BY:	FARID KHAN

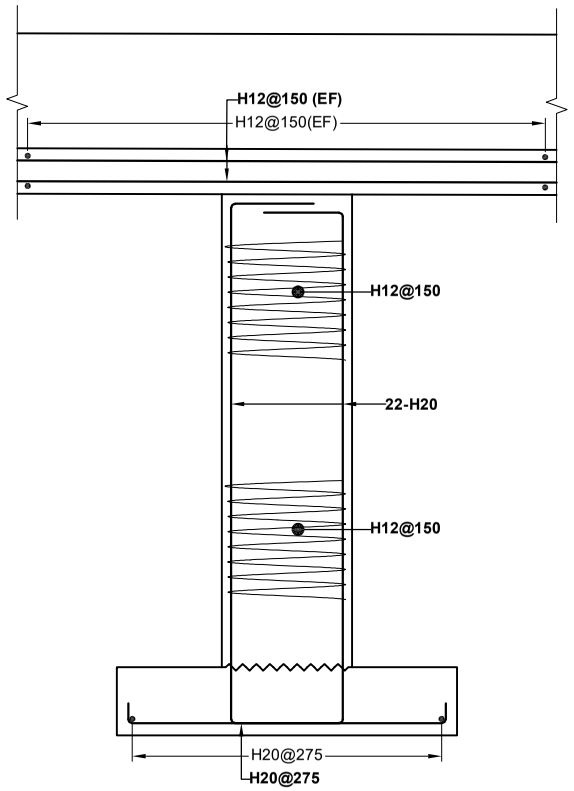
SCALE
1:50

DRAWING NO.
007-CA-MC-HYS-STK-BNU-42

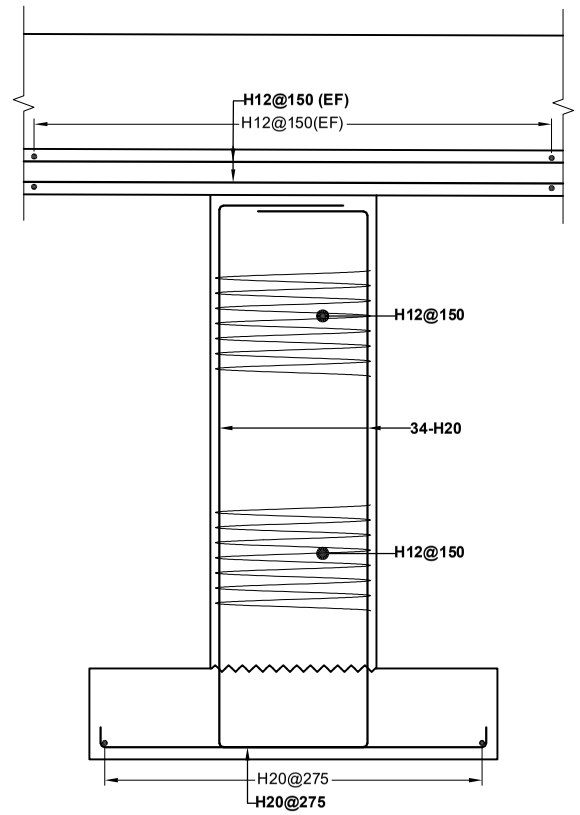
SHEET NO:



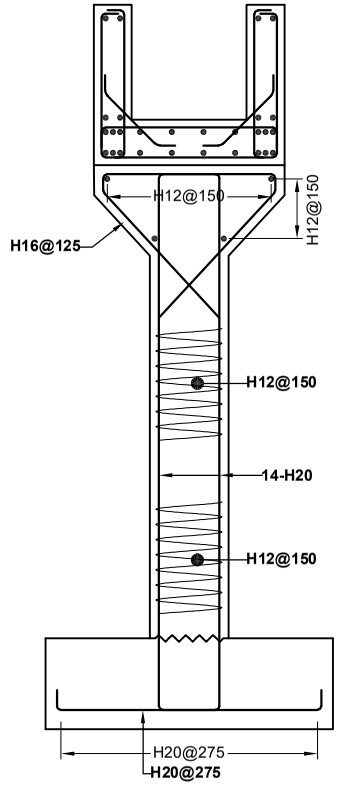
SECTION (3-3) TYPE-01
(760x760)



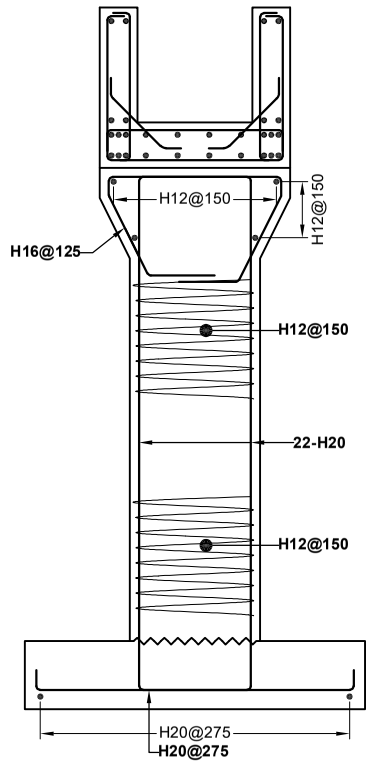
SECTION (5-5) TYPE-02
(760x760)



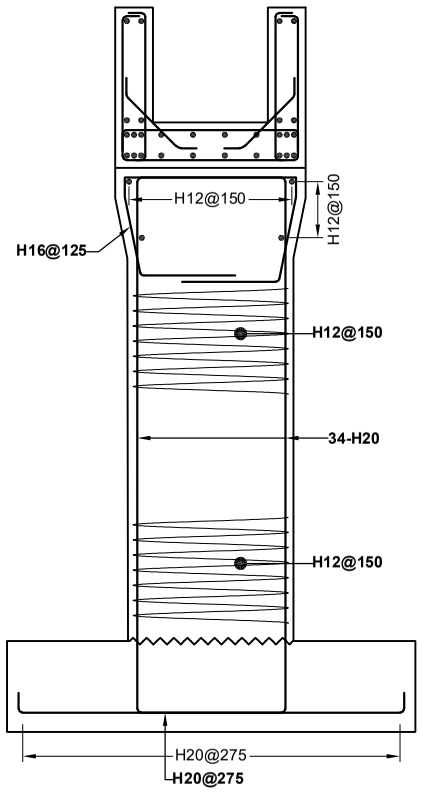
SECTION (7-7) TYPE-03
(760x760)



SECTION (4-4) TYPE-01
(760x760)



SECTION (6-6) TYPE-02
(760x760)



SECTION (8-8) TYPE-03
(760x760)

CAD File No. : F:\33 SATTI KALLI\REV-06 PACKAGES\PACKAGE-02\007-IRRIGATION CHANNEL HYDRALIC STRUCTUE\007-CA-HYS-STK-BNU-37 & 43 AQUEDUCT.DWG

CLIENT:

GOVERNMENT OF KHYBER PAKHTUNKHWA
DIRECTORATE GENERAL SMALL DAMS,
IRRIGATION DEPARTMENT, PESHAWAR

CONSULTANT:

CONSULTING ASSOCIATES
NEAR DEANS COMPLEX APARTMENTS, BOARD BAZAR,
BEHID GUL CNG, JAMRUD ROAD PEHSAWAR, PAKISTAN
PH: +92 91 5701774
EMAIL: Consultingassociates127@gmail.com

REV	DESCRIPTION	DATE
P01	DRAWINGS	11-03-22

PROJECT:
SATI KALLI DAM PROJECT
DISTRICT BANNU

TITLE:
SATTI KALLI DAM
AQUEDUCT REINFORCEMENT DETAIL CROSS SECTIONS

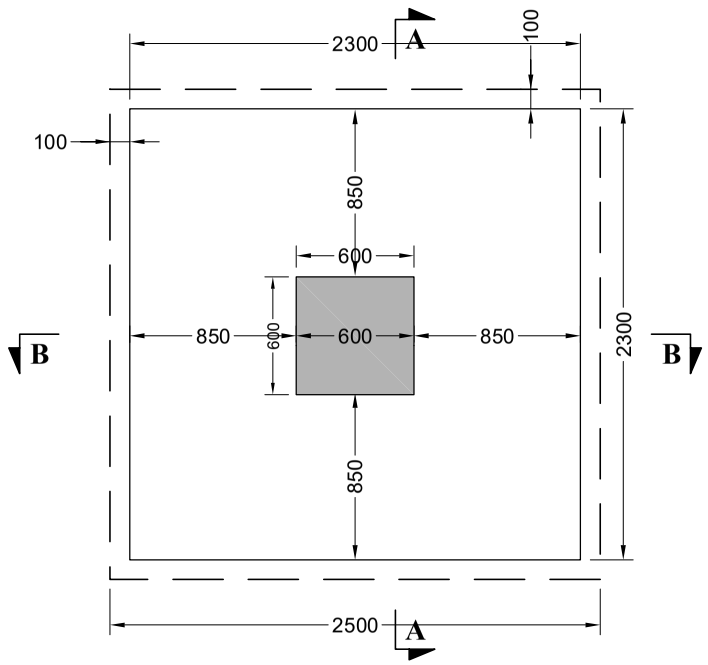
CONSTRUCTION DRAWINGS

DRAWN BY:	AZMAT ALI
DESIGNED BY:	YASIR IQBAL
CHECKED BY:	FARID KHAN

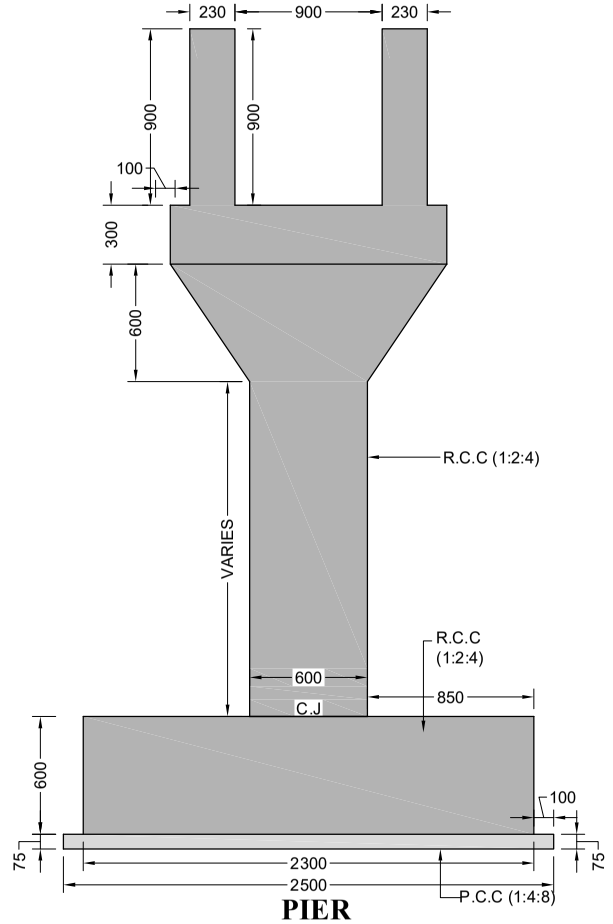
SCALE
1:50

DRAWING NO.
007-CA-MC-HYS-STK-BNU-43

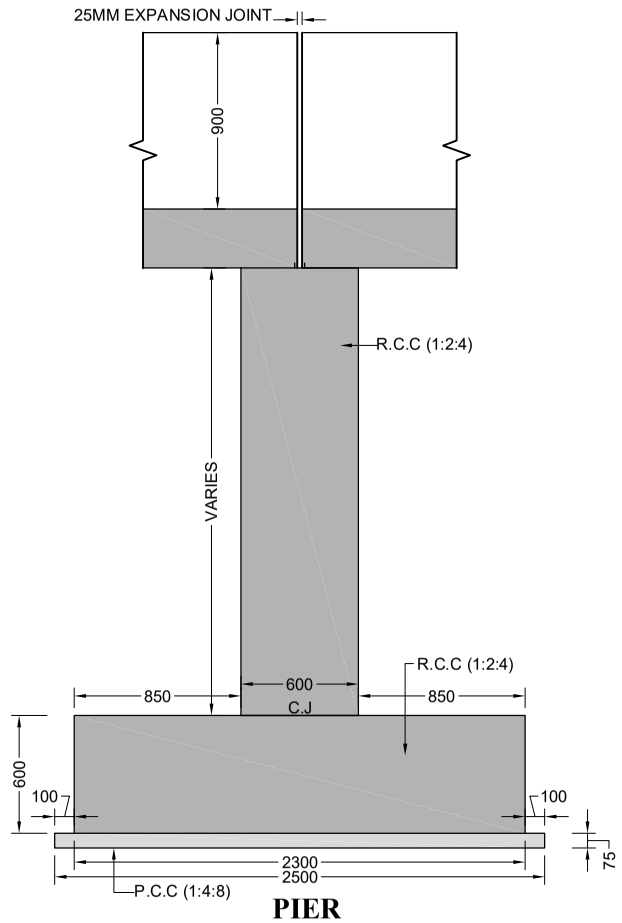
SHEET NO:



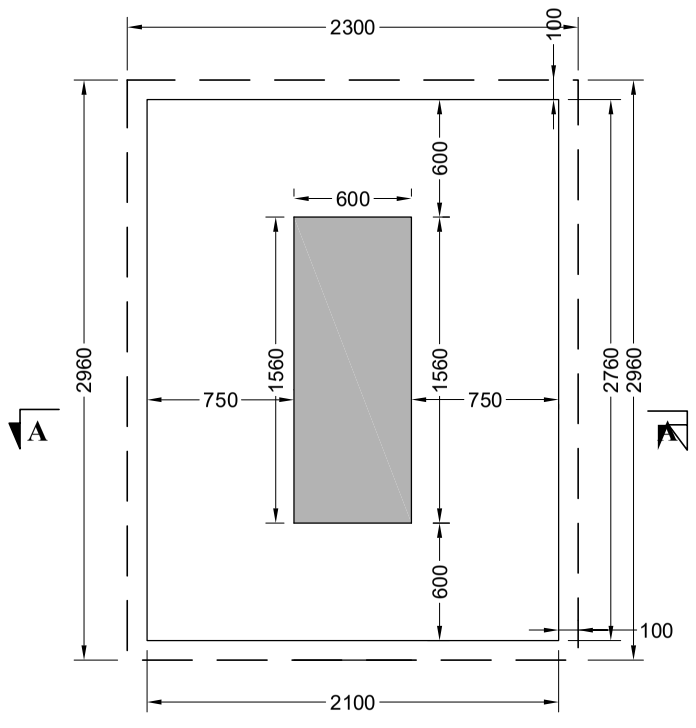
PIER FOOTING PLAN



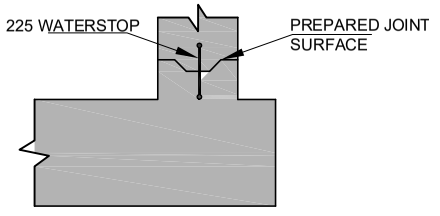
PIER SECTION A-A



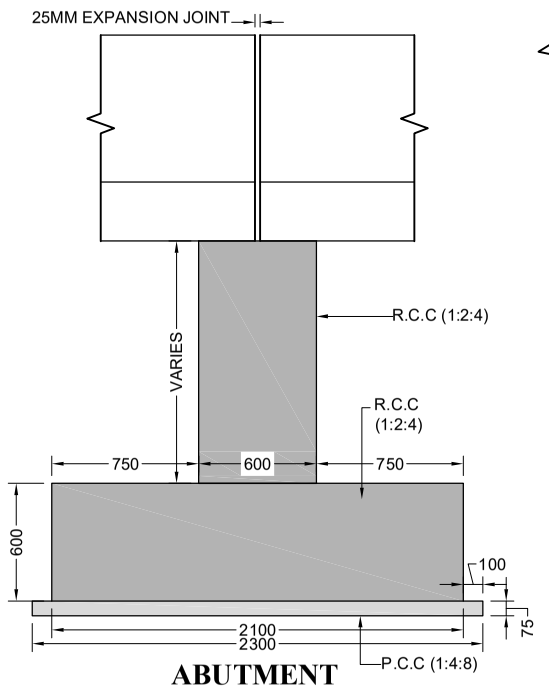
PIER SECTION B-B



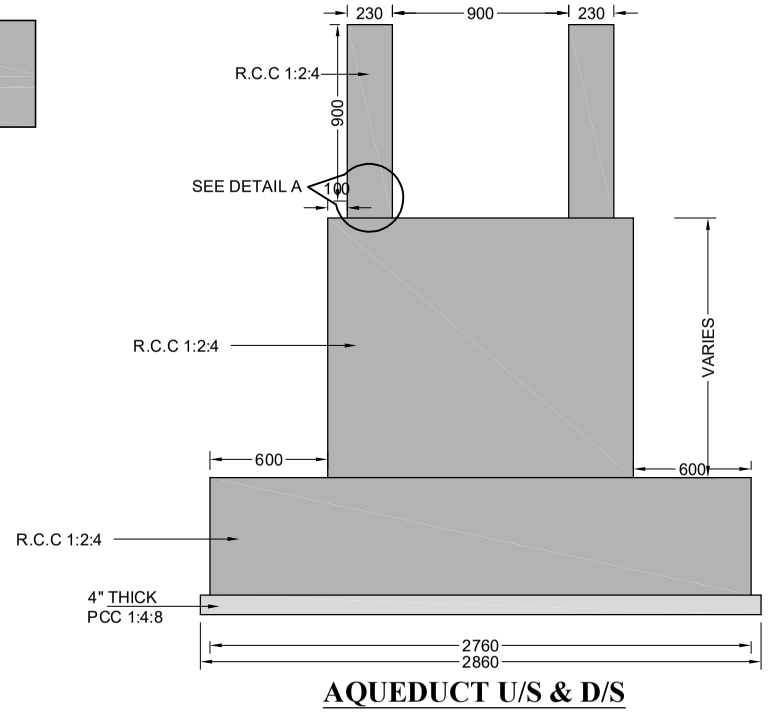
ABUTMENTS FOOTING PLAN



SEE DETAIL-A



ABUTMENT SECTION A-A



AQUEDUCT U/S & D/S SECTION (TYPICAL)

GOVERNMENT OF KHYBER PAKHTUNKHWA
DIRECTORATE GENERAL SMALL DAMS,
IRRIGATION DEPARTMENT, PESHAWAR

CONSULTING ASSOCIATES
NEAR DEANS COMPLEX APARTMENTS,BEHIND GUL
CNG,BOARD BAZAAR,JAMRUD ROAD,PESHAWAR
PH #: 091-5701774-45 Fax - 091-5701775
E-MAIL: consultingassociates127@gmail.com

SATI KALLI DAM PROJECT
BANNU

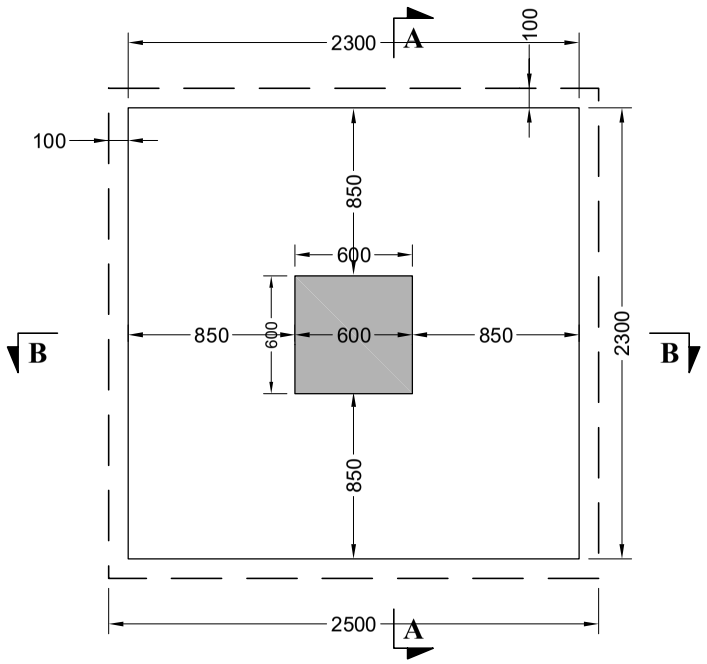
STAMP & SIGNATUREs:

REV.	DATE	

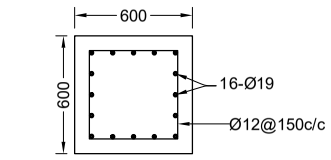
AQUEDUCT STRUCTURE DETAILS

DWG NO: 007-CA-MC-HYS-STK-BNU-44

SHEET NO:

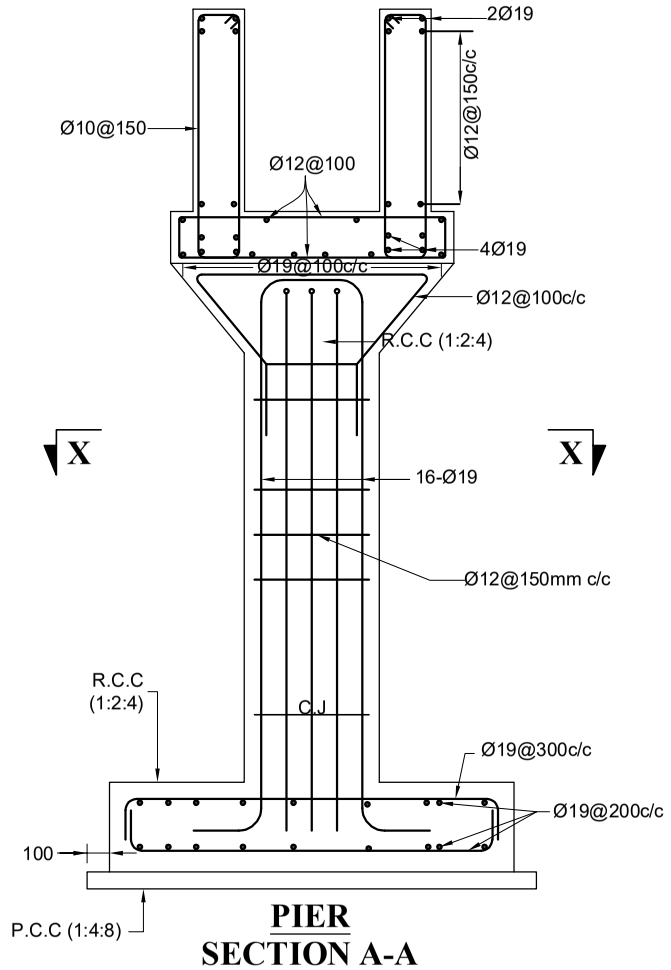


PIER FOOTING PLAN



PIER SECTION X-X

SCALE: 1:40



PIER SECTION A-A

NOTES

1:- ALL DIMENSIONS AND LEVELS ARE IN METER.

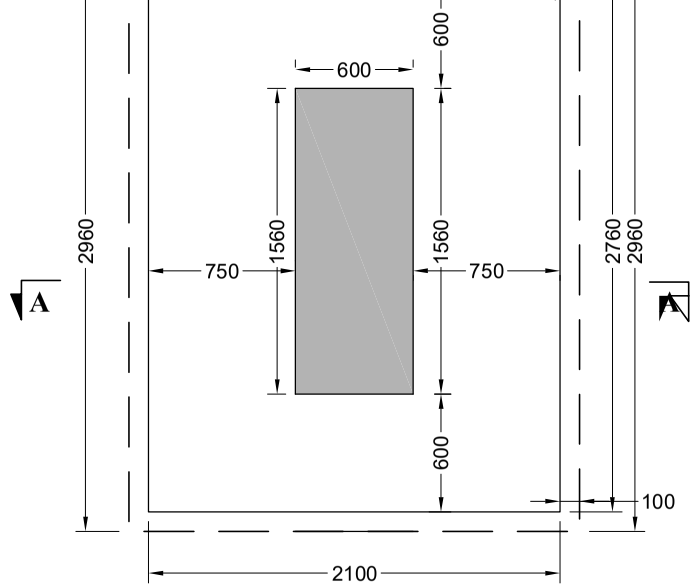
2:- LAP LENGTH = 48 X DIA OF BAR.

3:- R.C.C 4000 PSI , 28 DAYS.

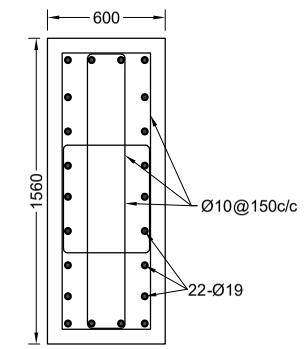
4:- P.C.C 2000 PSI , 28 DAYS.

5:- REINFORCEMENT SHALL BE DEFORMED BARS HAVING YIELD STRENGTH OF 60000 PSI.

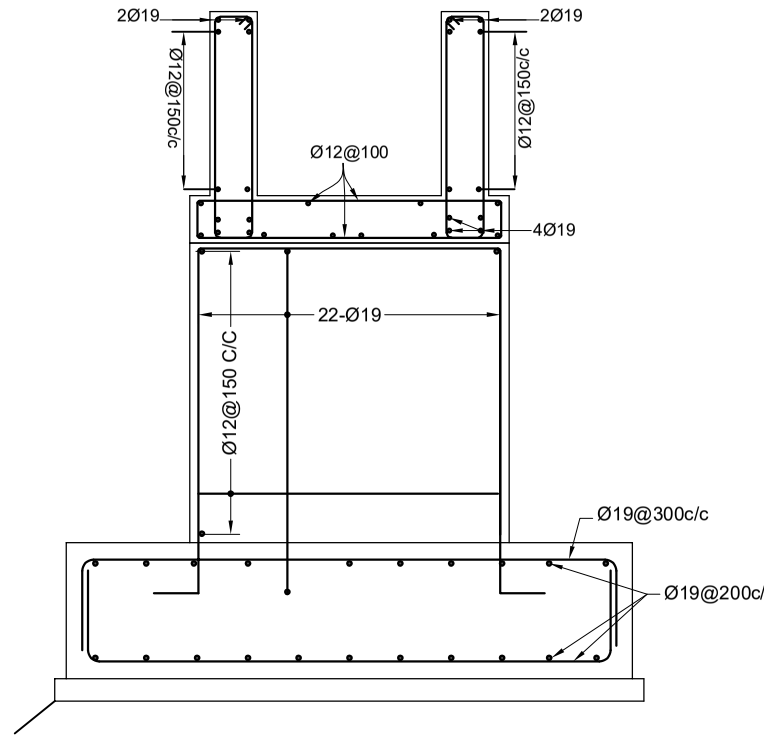
6:- SHUTTERING OF BASE SLAB OF AQUEDUCT CHANNEL & ITS SIDE WALLS SHOULD BE REMOVED AT THE SAME TIME



ABUTMENTS FOOTING PLAN

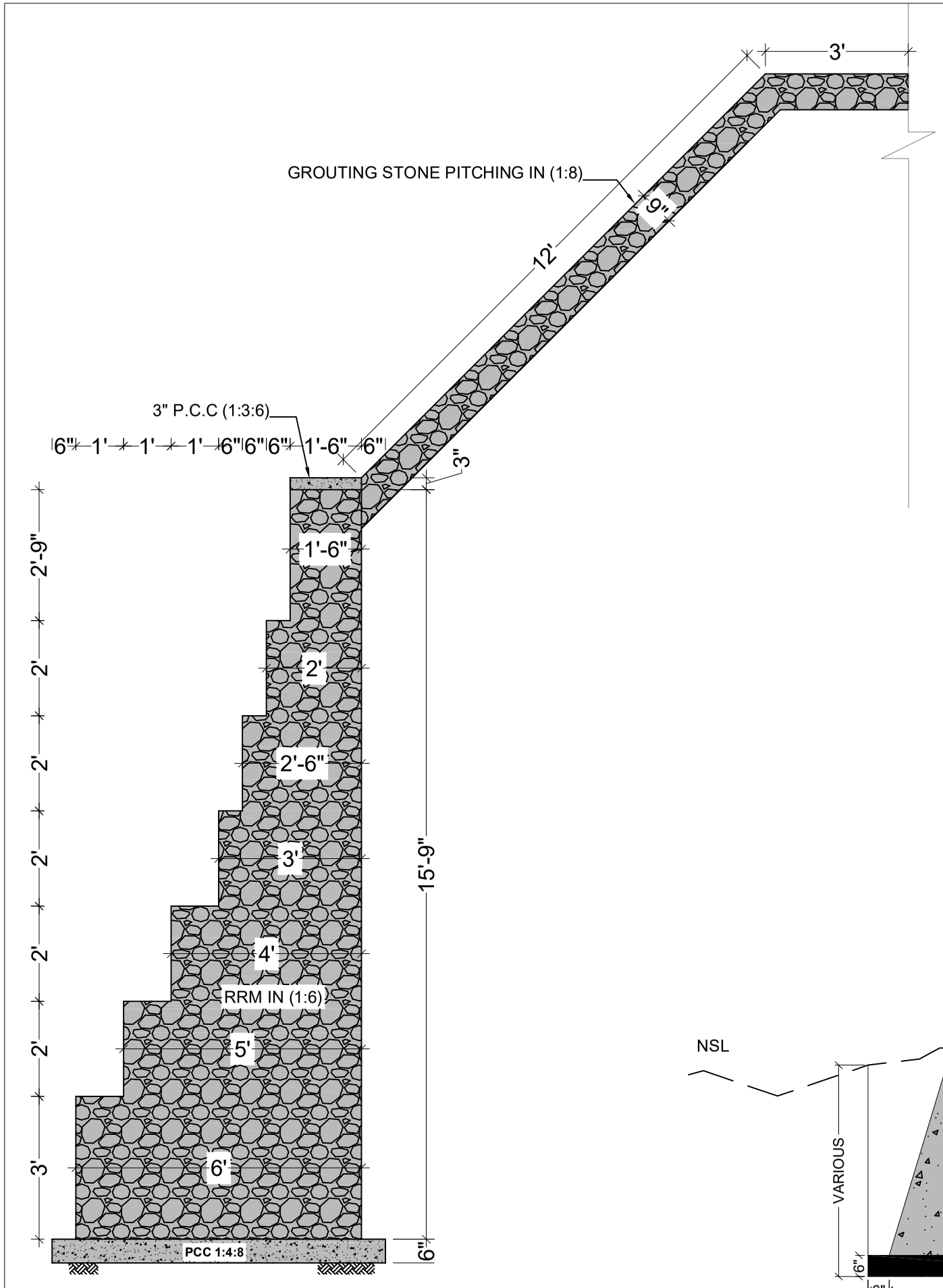


ABUTMENT SECTION X-X

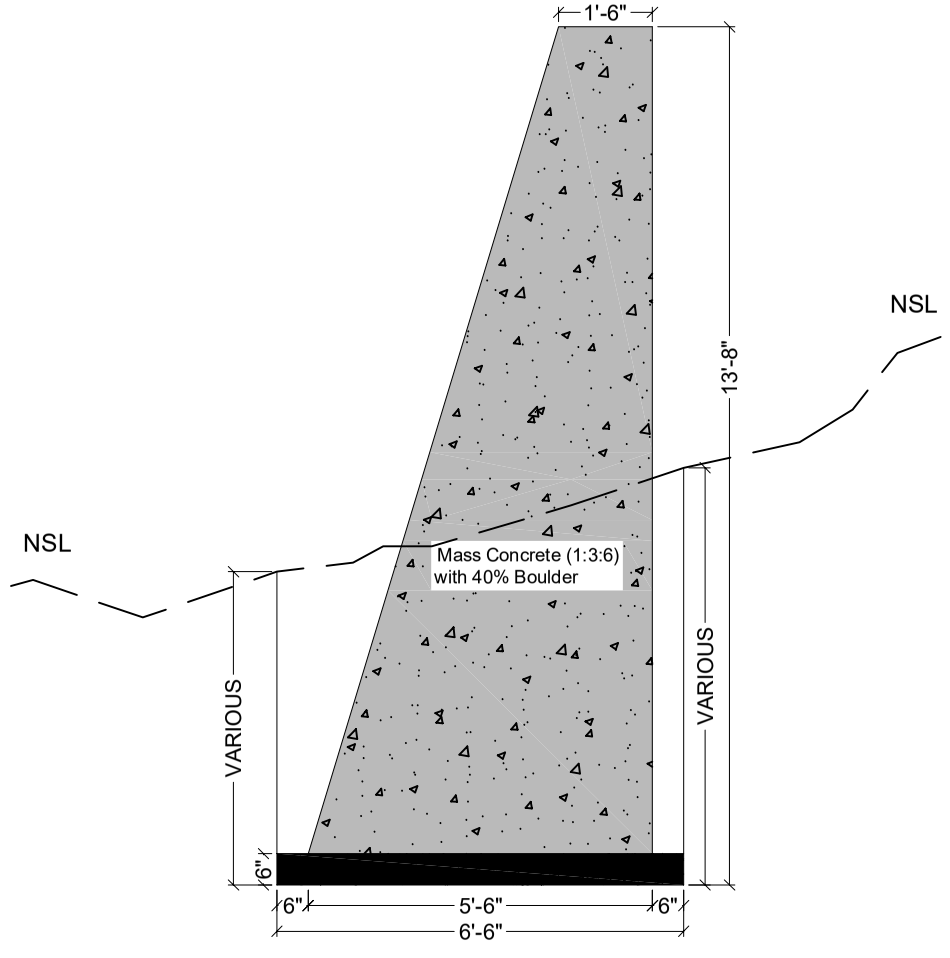


AQUEDUCT U/S & D/S SECTION

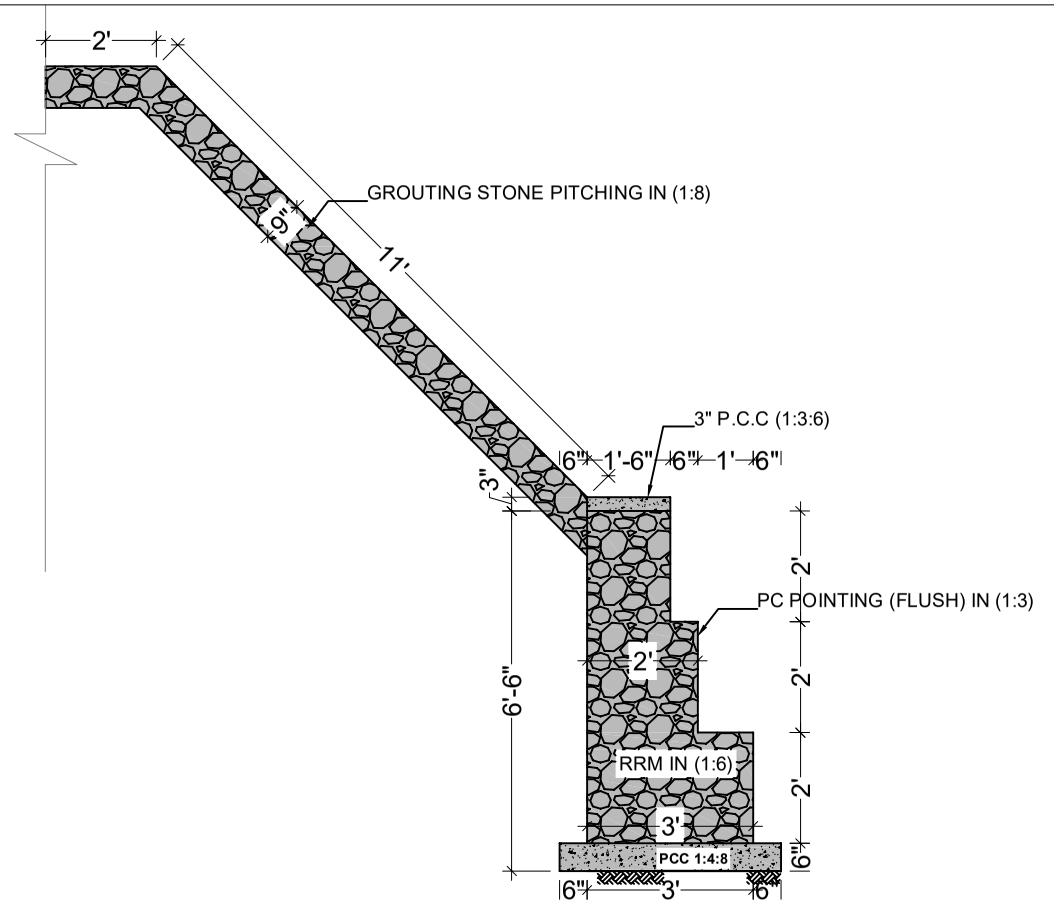
GOVERNMENT OF KHYBER PAKHTUNKHWA DIRECTORATE GENERAL SMALL DAMS, IRRIGATION DEPARTMENT, PESHAWAR	CONSULTING ASSOCIATES NEAR DEANS COMPLEX APARTMENTS,BEHIND GUL CNG,BOARD BAZAAR,JAMRUD ROAD,PESHAWAR PH #: 091-5701774-45 Fax - 091-5701775 E-MAIL: consultingassociates127@gmail.com	SATI KALLI DAM PROJECT BANNU	STAMP & SIGNATURES:	REV. / DATE	AQUEDUCT STRUCTURE DETAILS DWG NO: 007-CA-MC-HYS-STK-BNU- 45 / SHEET NO:



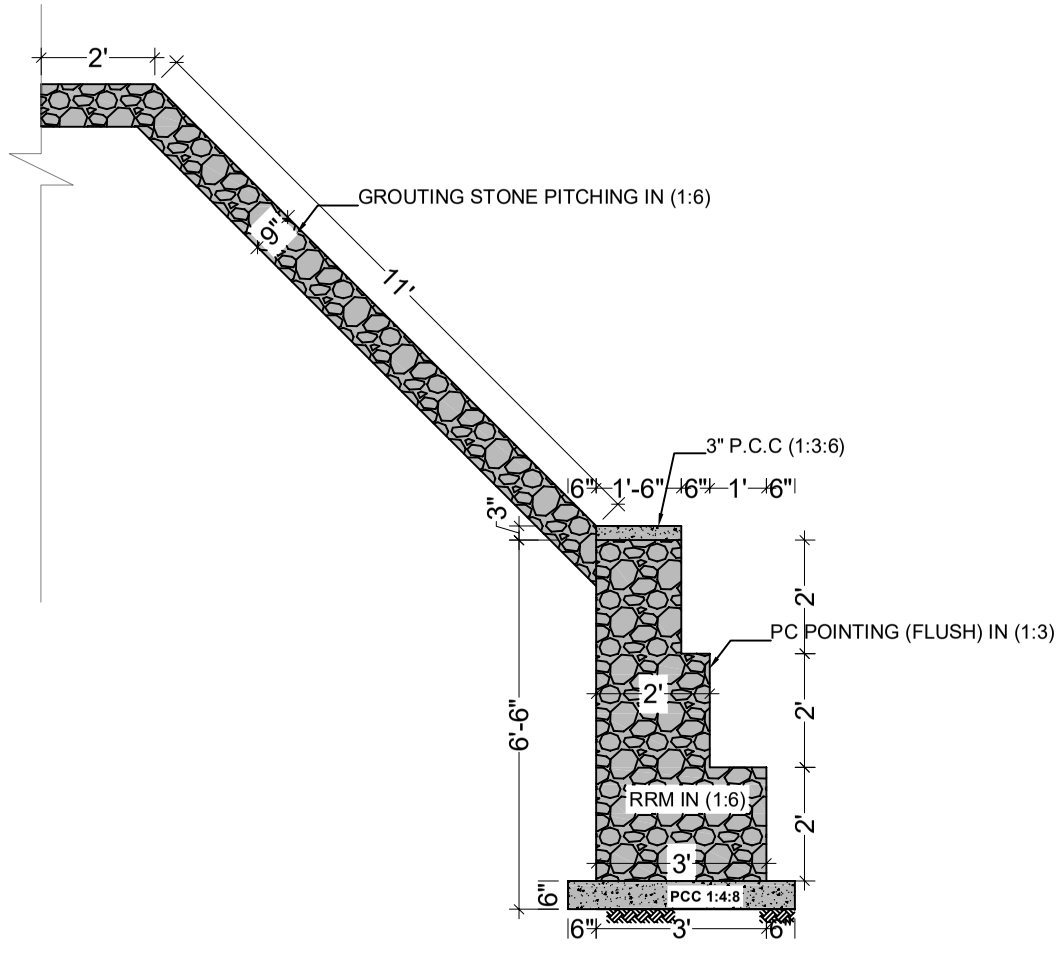
TYPICAL SECTION OF 5 CELL CULVERT WALL
UP STREAM
LENGTH = 52.50'



CROSS-SECTION

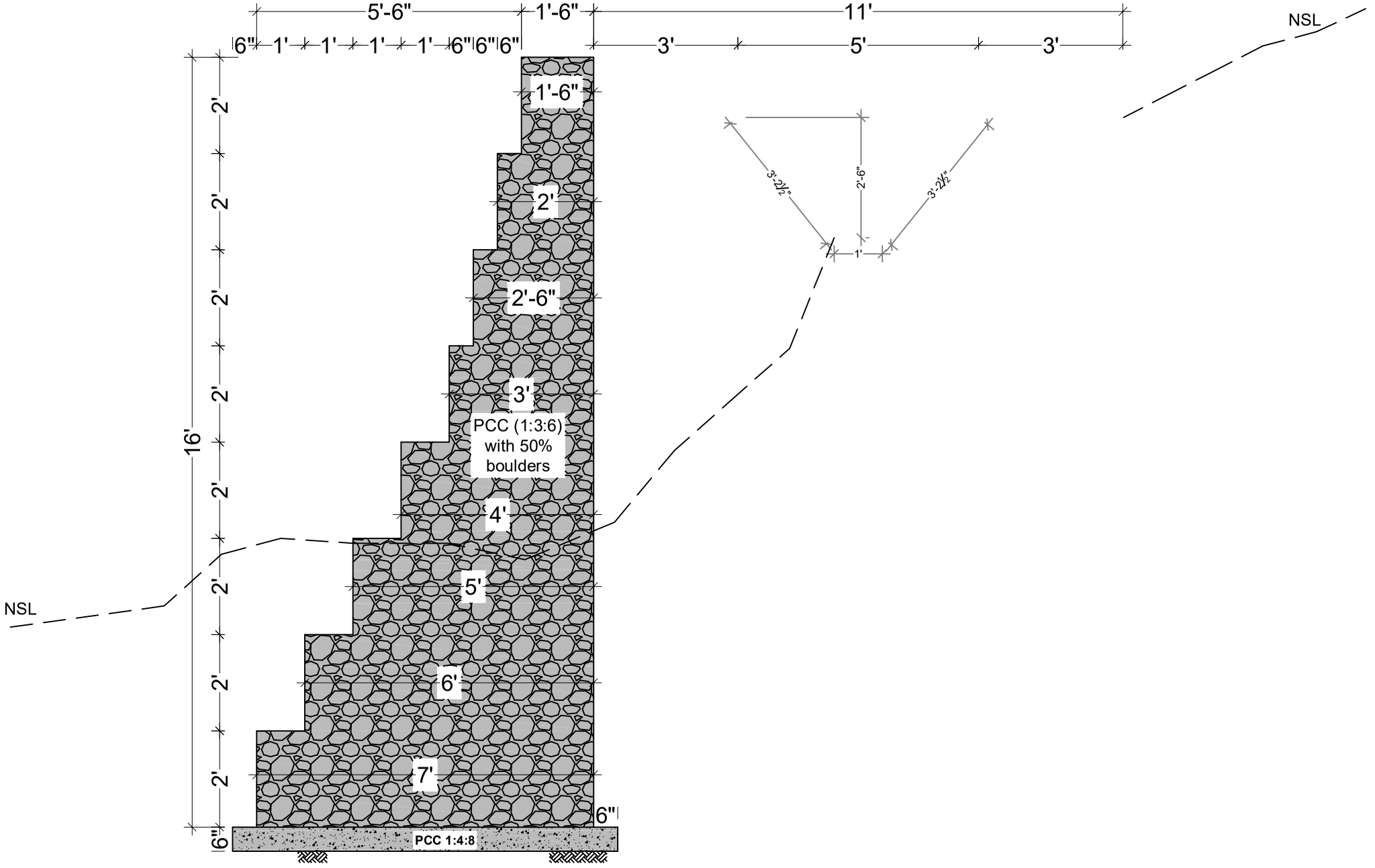


TYPICAL SECTION OF TWO CELL CULVERT
UP STREAM & DOWN STREAM
LENGTH = 55.75'



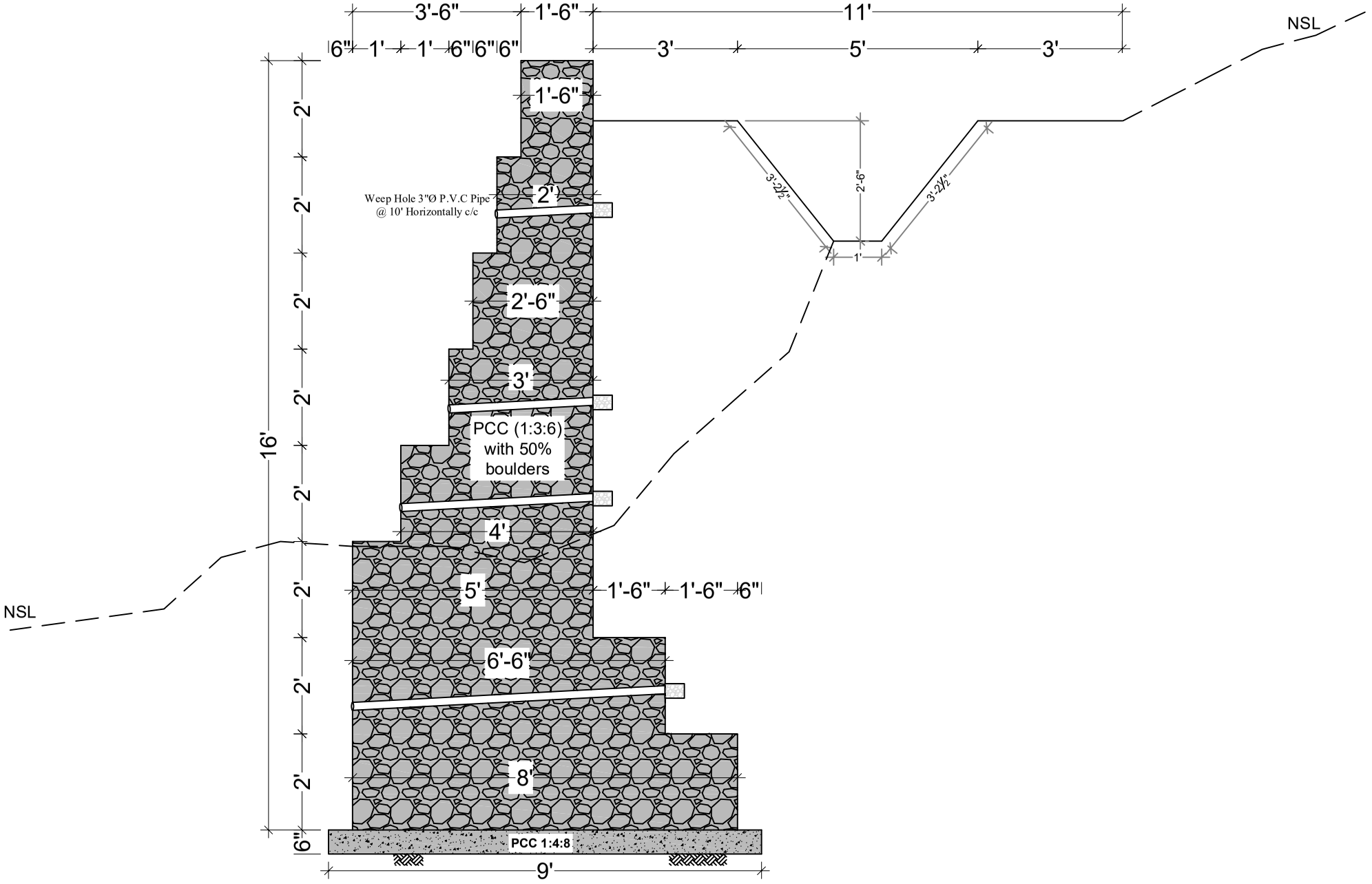
TYPICAL SECTION OF 5 CELL CULVERT
DOWN STREAM
LENGTH = 39.375'

CLIENT: GOVERNMENT OF KHYBER PAKHTUNKHWA, DIRECTORATE GENERAL SMALL DAMS, IRRIGATION DEPARTMENT, PESHAWAR	CONSULTANTS: CONSULTING ASSOCIATES, NS TOWER,HAYATABAD COMMERCIAL COMPLEX, NEAR WFP WAREHOUSE, MAIN ACHINI BALA ROAD,PESHAWAR, PH #: 091-5701774-45 Fax - 091-5701775, E-MAIL: consultingassociate127@gmail.com	PROJECT: SATTI KALI DAM DISTRICT, BANNU	TITLE: RETAINING WALL SUB TITLE: HYDRAULIC STRUCTURES	DRAWN BY: MUNEEB KHAN DESIGN BY: DAWOOD KHAN CHECKED & SUBMITTED BY: FARID KHAN	DRAWING NO.: 007-CA-MC-HYS-RW-STK-BNU-01-46 REVISION NO.: 00 SHEET NO.: DATE: August 24



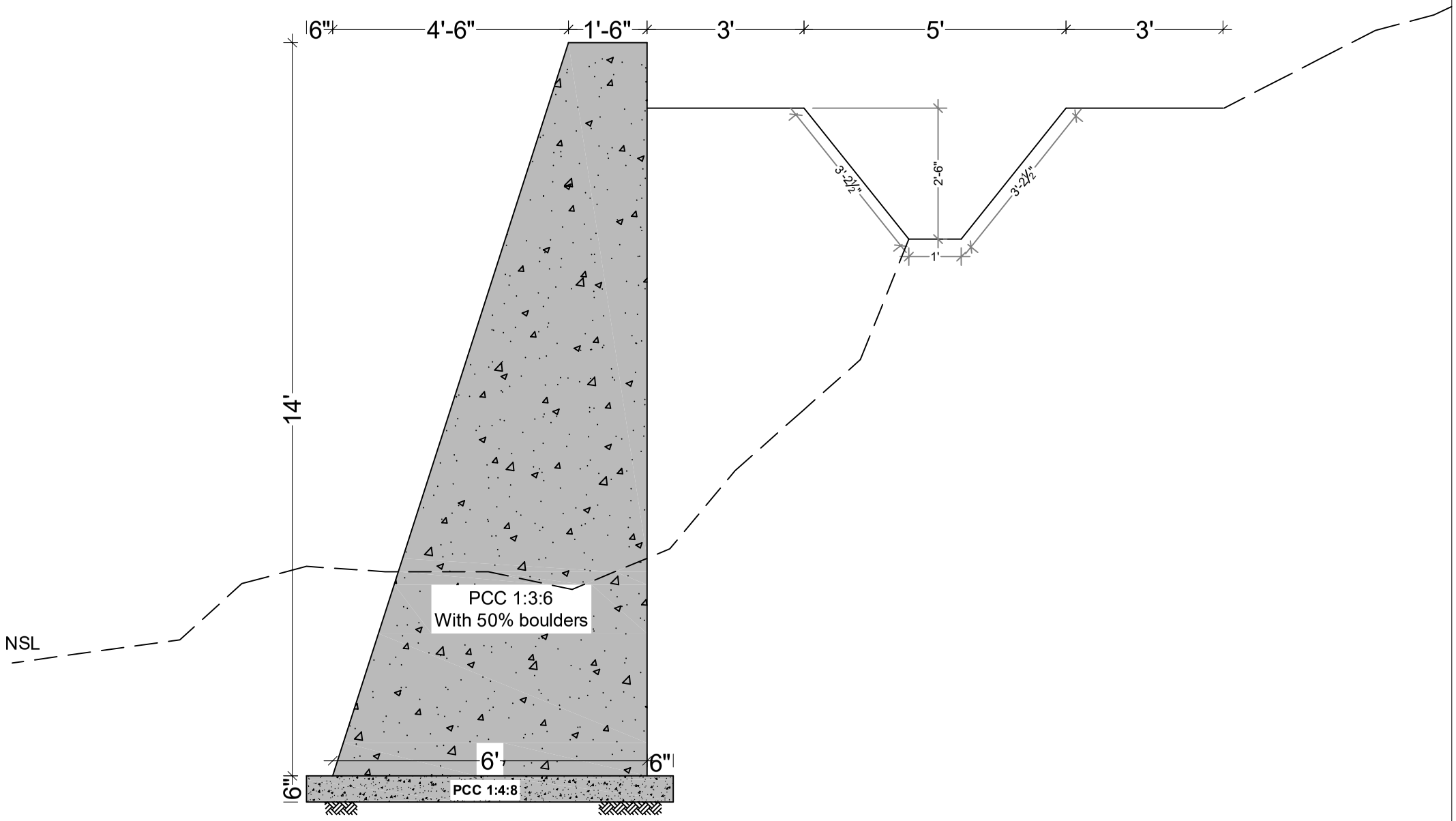
TYPICAL SECTION OF RETAINING WALL

CLIENT: GOVERNMENT OF KHYBER PAKHTUNKHWA, DIRECTORATE GENERAL SMALL DAMS, IRRIGATION DEPARTMENT, PESHAWAR	CONSULTANTS: CONSULTING ASSOCIATES, NS TOWER,HAYATABAD COMMERCIAL COMPLEX, NEAR WFP WAREHOUSE, MAIN ACHINI BALA ROAD,PESHAWAR, PH #: 091-5701774-45 Fax - 091-5701775, E-MAIL: consultingassociate127@gmail.com	PROJECT: SATTI KALI DAM DISTRICT, BANNU	TITLE: RETAINING WALL SUB TITLE: TYPICAL SECTION	DRAWN BY: MUNEEB KHAN DESIGN BY: DAWOOD KHAN CHECKED & SUBMITTED BY: FARID KHAN	DRAWING NO.: 007-CA-MC-HYS-RW-STK-BNU-02-47 REVISION NO.: 00 SHEET NO. DATE: MAY, 2013



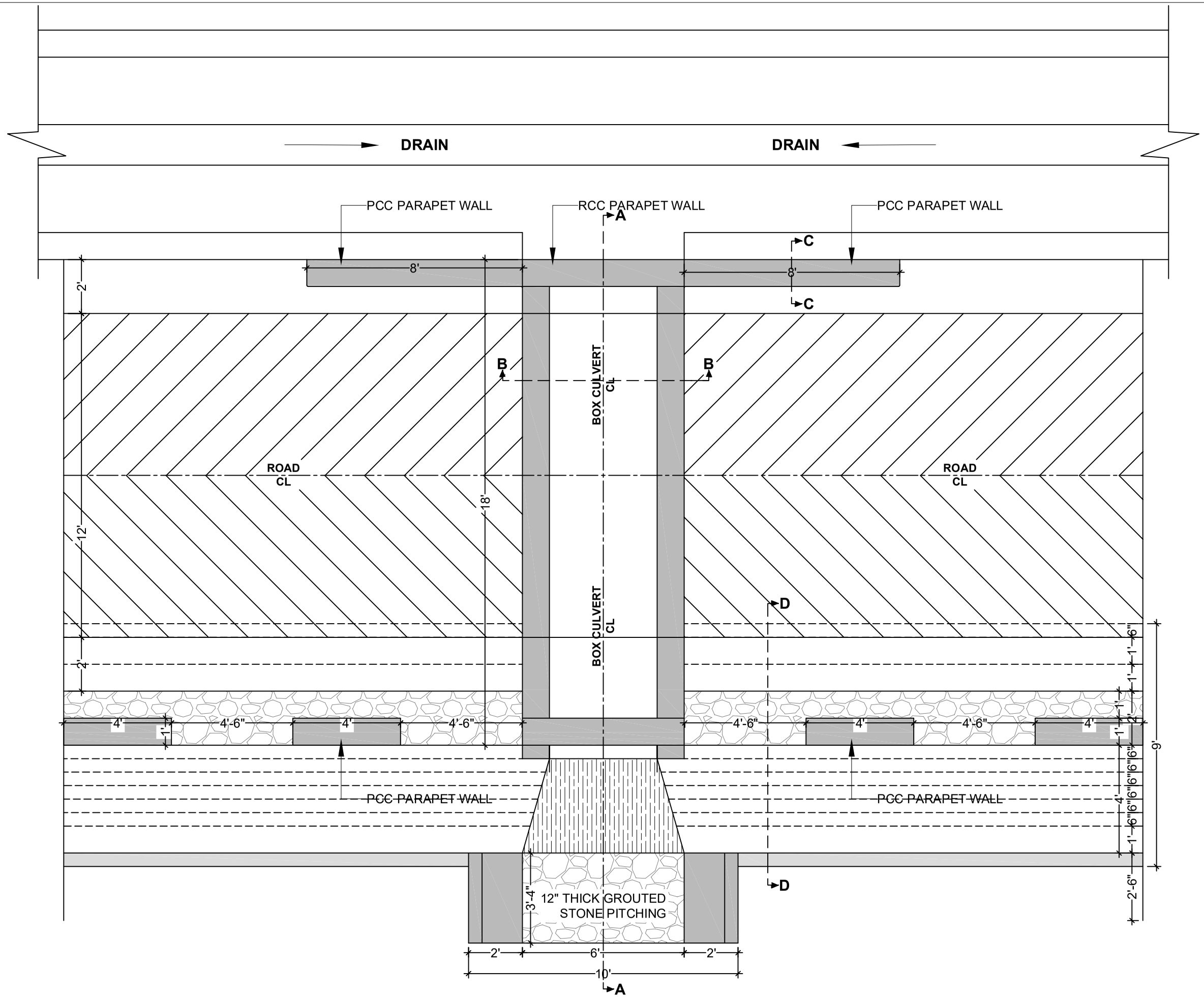
TYPICAL SECTION OF RETAINING WALL

CLIENT: GOVERNMENT OF KHYBER PAKHTUNKHWA, DIRECTORATE GENERAL SMALL DAMS, IRRIGATION DEPARTMENT, PESHAWAR	CONSULTANTS: CONSULTING ASSOCIATES, NS TOWER,HAYATABAD COMMERCIAL COMPLEX NEAR WFP WAREHOUSE, MAIN ACHINI BALA ROAD,PESHAWAR PH #: 091-5701774-45 Fax - 091-5701775 E-MAIL: consultingassociate127@gmail.com	PROJECT: SATTI KALI DAM DISTRICT, BANNU	TITLE: RETAINING WALL SUB TITLE: TYPICAL SECTION	DRAWN BY: MUNEEB KHAN DESIGN BY: DAWOOD KHAN CHECKED & SUBMITTED BY: FARID KHAN	DRAWING NO.: 007-CA-MC-HYS-RW-STK-BNU-03-48 REVISION NO.: 00 SHEET NO. DATE: MAY, 2013

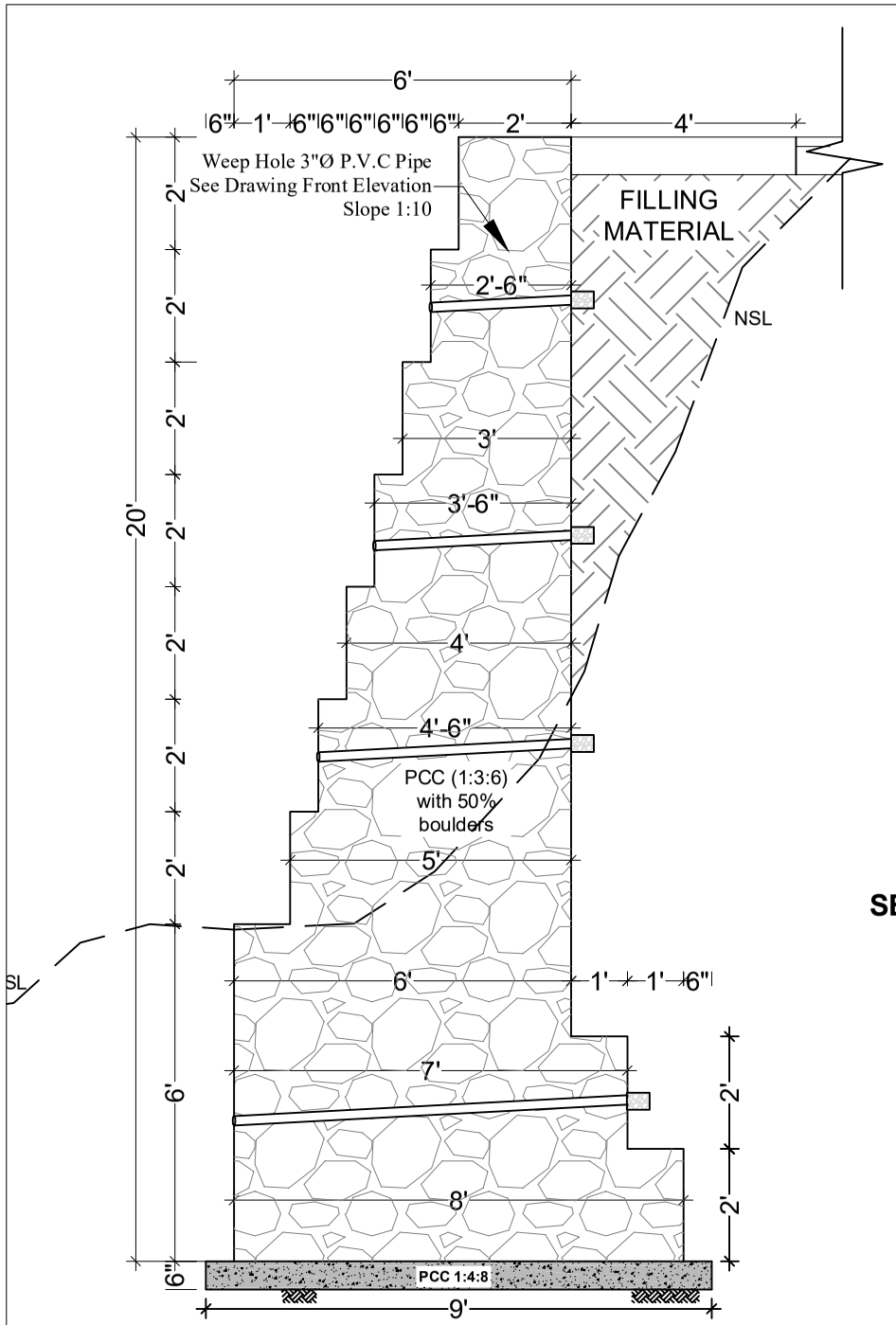


TYPICAL SECTION OF RETAINING WALL

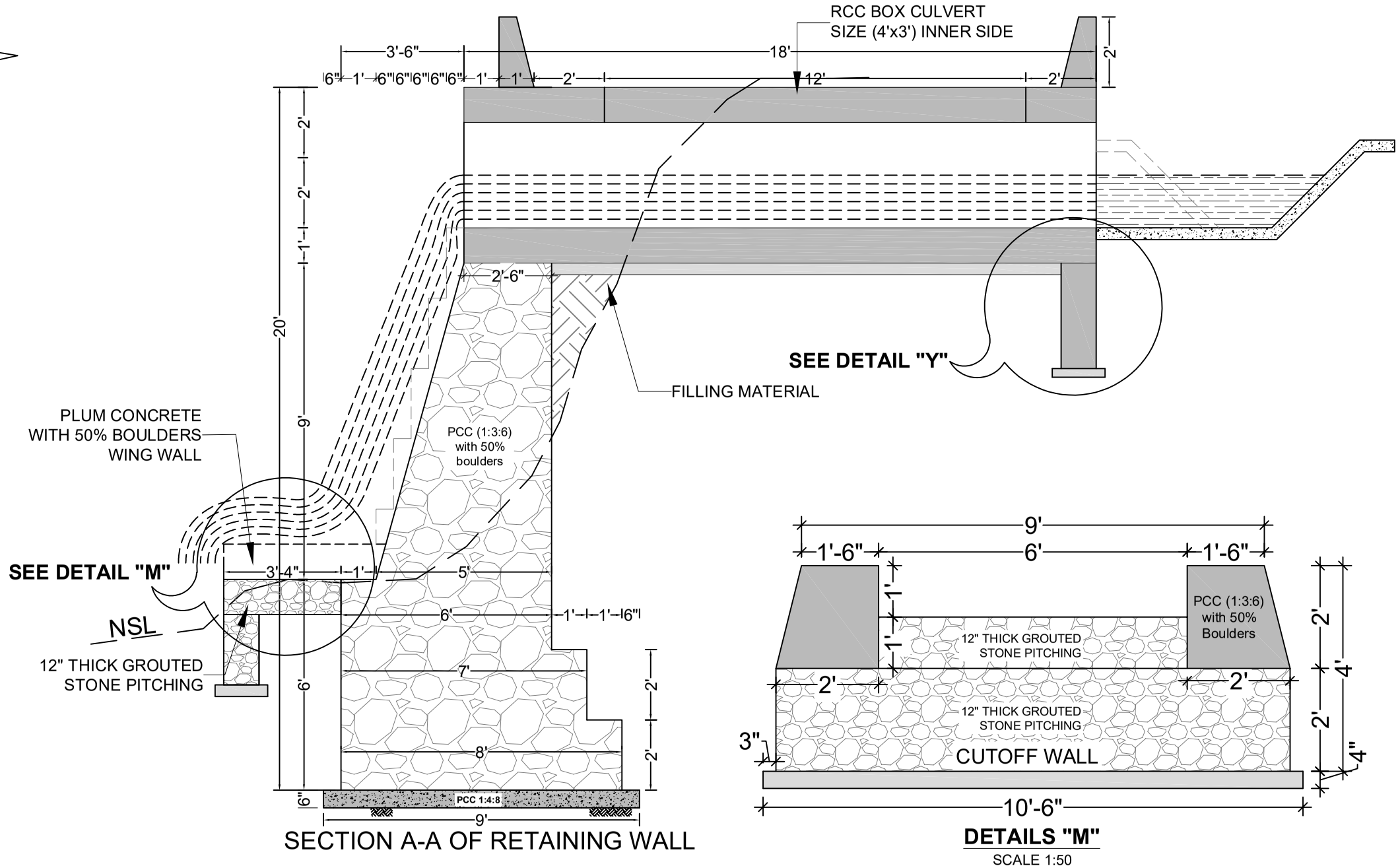
CLIENT: GOVERNMENT OF KHYBER PAKHTUNKHWA, DIRECTORATE GENERAL SMALL DAMS, IRRIGATION DEPARTMENT, PESHAWAR	CONSULTANTS: CONSULTING ASSOCIATES, NS TOWER,HAYATABAD COMMERCIAL COMPLEX, NEAR WFP WAREHOUSE, MAIN ACHINI BALA ROAD,PESHAWAR, PH #: 091-5701774-45 Fax - 091-5701775, E-MAIL: consultingassociate127@gmail.com	PROJECT: SATTI KALI DAM DISTRICT, BANNU	TITLE: RETAINING WALL SUB TITLE: TYPICAL SECTION	DRAWN BY: MUNEEB KHAN DESIGN BY: DAWOOD KHAN CHECKED & SUBMITTED BY: FARID KHAN	DRAWING NO.: 007-CA-MC-HYS-RW-STK-BNU-04-49 REVISION NO.: 00 SHEET NO. DATE: MAY, 2013



CLIENT: GOVERNMENT OF KHYBER PAKHTUNKHWA, DIRECTORATE GENERAL SMALL DAMS, IRRIGATION DEPARTMENT, PESHAWAR	CONSULTANTS: CONSULTING ASSOCIATES, NS TOWER,HAYATABAD COMMERCIAL COMPLEX, NEAR WFP WAREHOUSE, MAIN ACHINI BALA ROAD,PESHAWAR, PH #: 091-5701774-45 Fax - 091-5701775, E-MAIL: consultingassociate127@gmail.com	PROJECT: SATTI KALI DAM DISTRICT, BANNU	TITLE: RETAINING WALL & BOX CULVERT SUB TITLE: PLAN (NEAR SPILLWAY)	DRAWN BY: MUNEEB KHAN DESIGN BY: DAWOOD KHAN CHECKED & SUBMITTED BY: FARID KHAN	DRAWING NO.: 007-CA-MC-HYS-RW-STK-BNU-05-50 REVISION NO.: 00 SHEET NO.: DATE: August 24



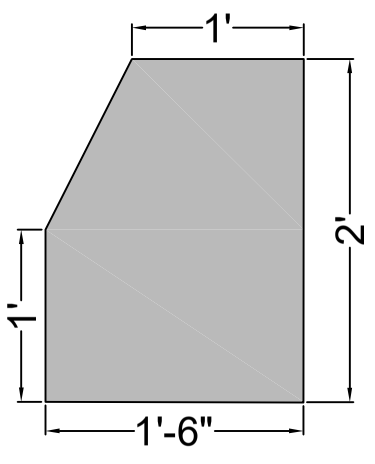
SECTION D-D OF RETAINING WALL



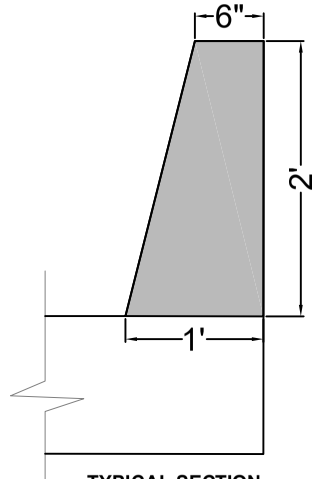
SECTION A-A OF RETAINING WALL

DETAILS "M"

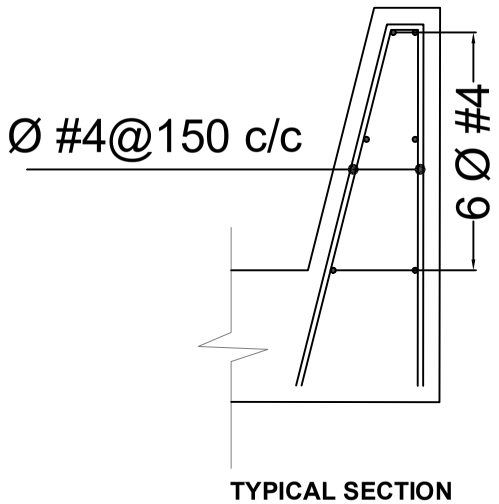
SCALE 1:50



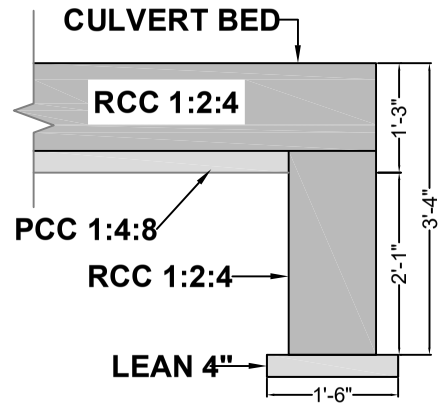
TYPICAL SECTION
PCC PARAPET WALL



TYPICAL SECTION
RCC PARAPET WALL

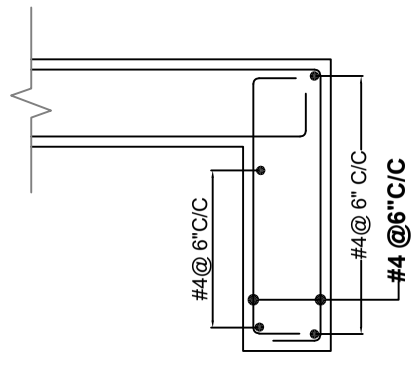


TYPICAL SECTION
PCC PARAPET WALL



CUTOFF WALL DETAIL "Y"

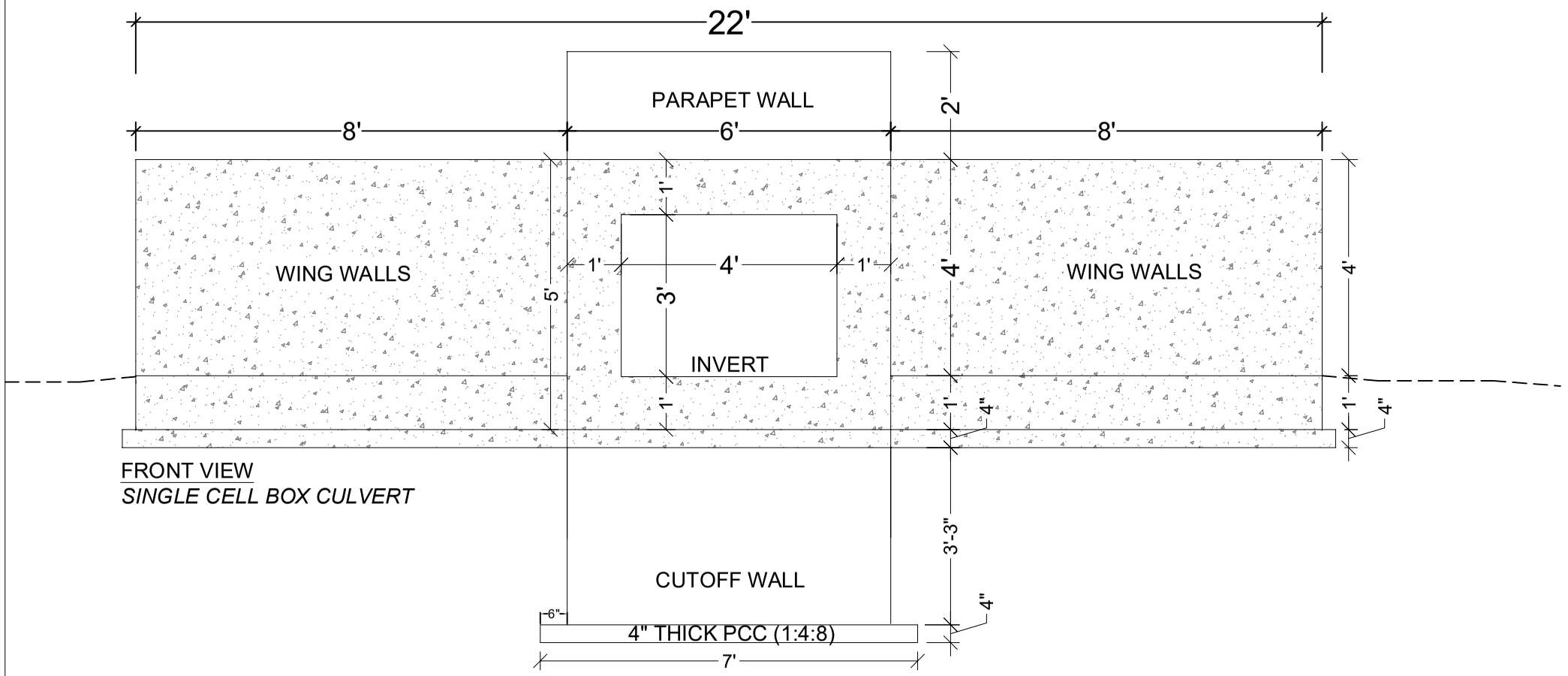
SCALE 1:50



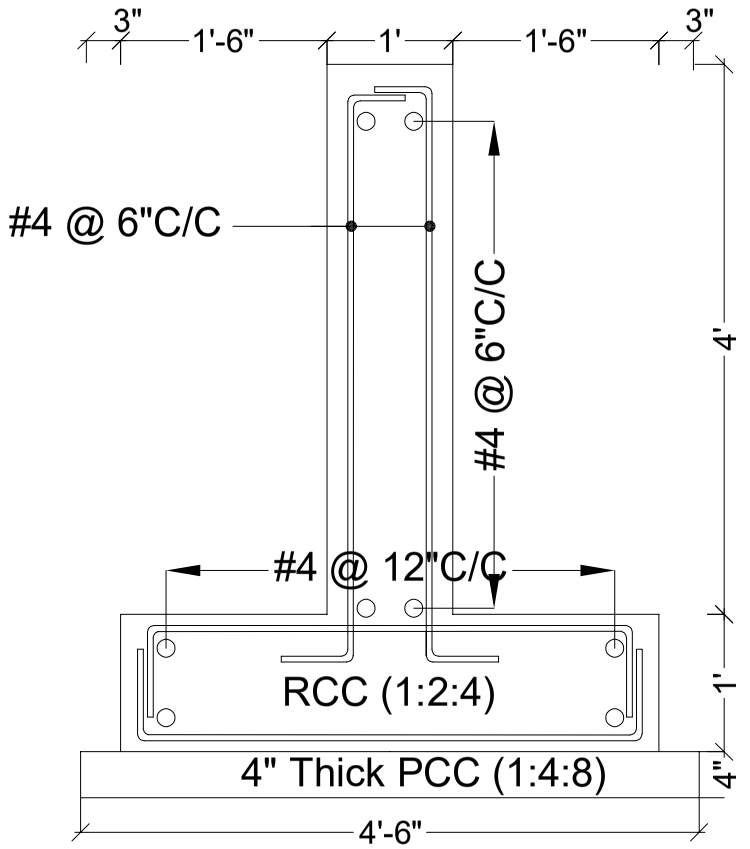
REINFORCEMENT OF DETAIL "Y"

CLIENT: **GOVERNMENT OF KHYBER PAKHTUNKHWA** DIRECTORATE GENERAL SMALL DAMS, IRRIGATION DEPARTMENT, PESHAWAR	CONSULTANTS: CONSULTING ASSOCIATES NS TOWER,HAYATABAD COMMERCIAL COMPLEX NEAR WFP WAREHOUSE, MAIN ACHINI BALA ROAD,PESHAWAR PH #: 091-5701774-45 Fax - 091-5701775 E-MAIL: consultingassociate127@gmail.com	PROJECT: SATTI KALI DAM DISTRICT, BANNU	TITLE: RETAINING WALL & BOX CULVERT SUB TITLE: SECTIONS A-A (DOWN STREAM)

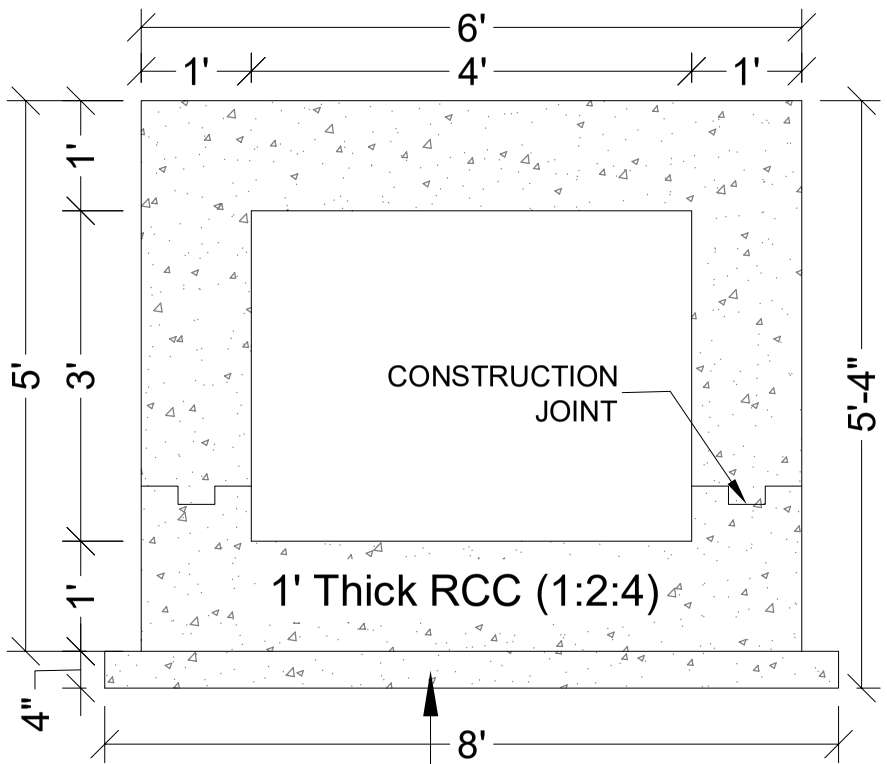
DRAWN BY	MUNEEB KHAN	DRAWING NO.	007-CA-MC-HYS-RW-STK-BNU-05-51
DESIGN BY	DAWOOD KHAN	REVISION NO.	00
CHECKED & SUBMITTED BY	FARID KHAN	SHEET NO.	DATE: August 24



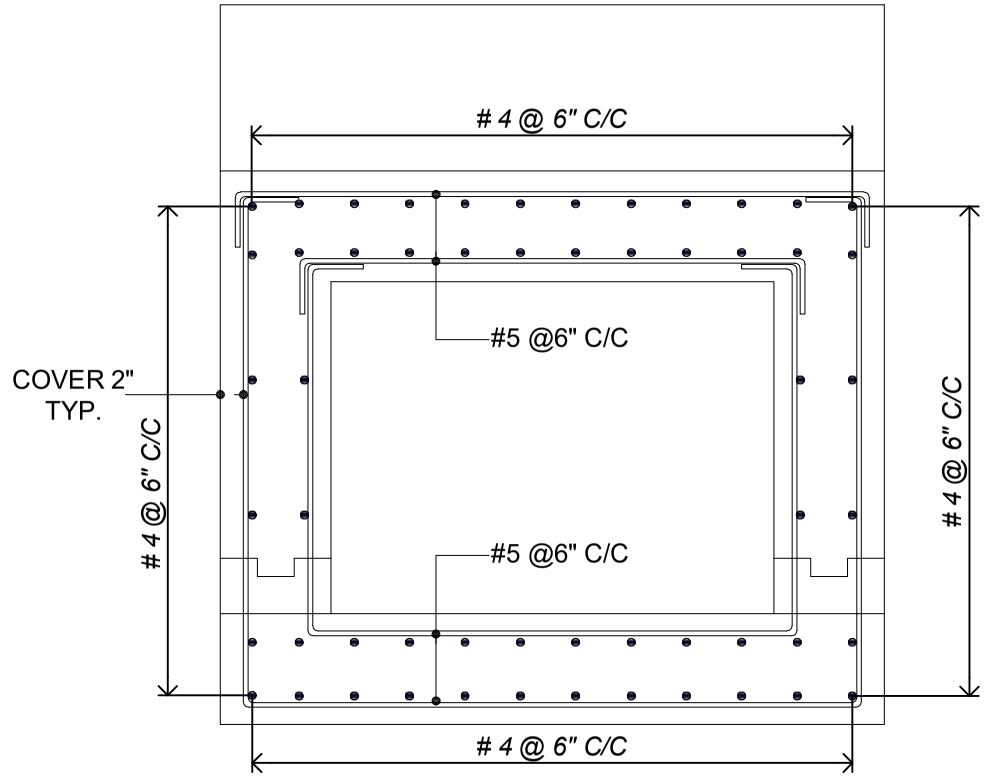
FRONT VIEW
SINGLE CELL BOX CULVERT



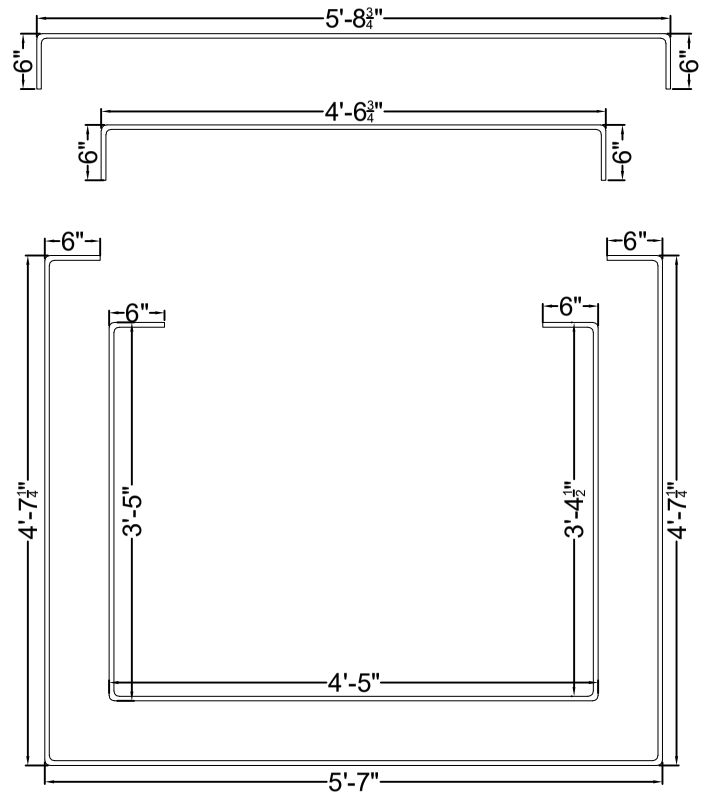
RCC WING WALL X-SEC AT C-C



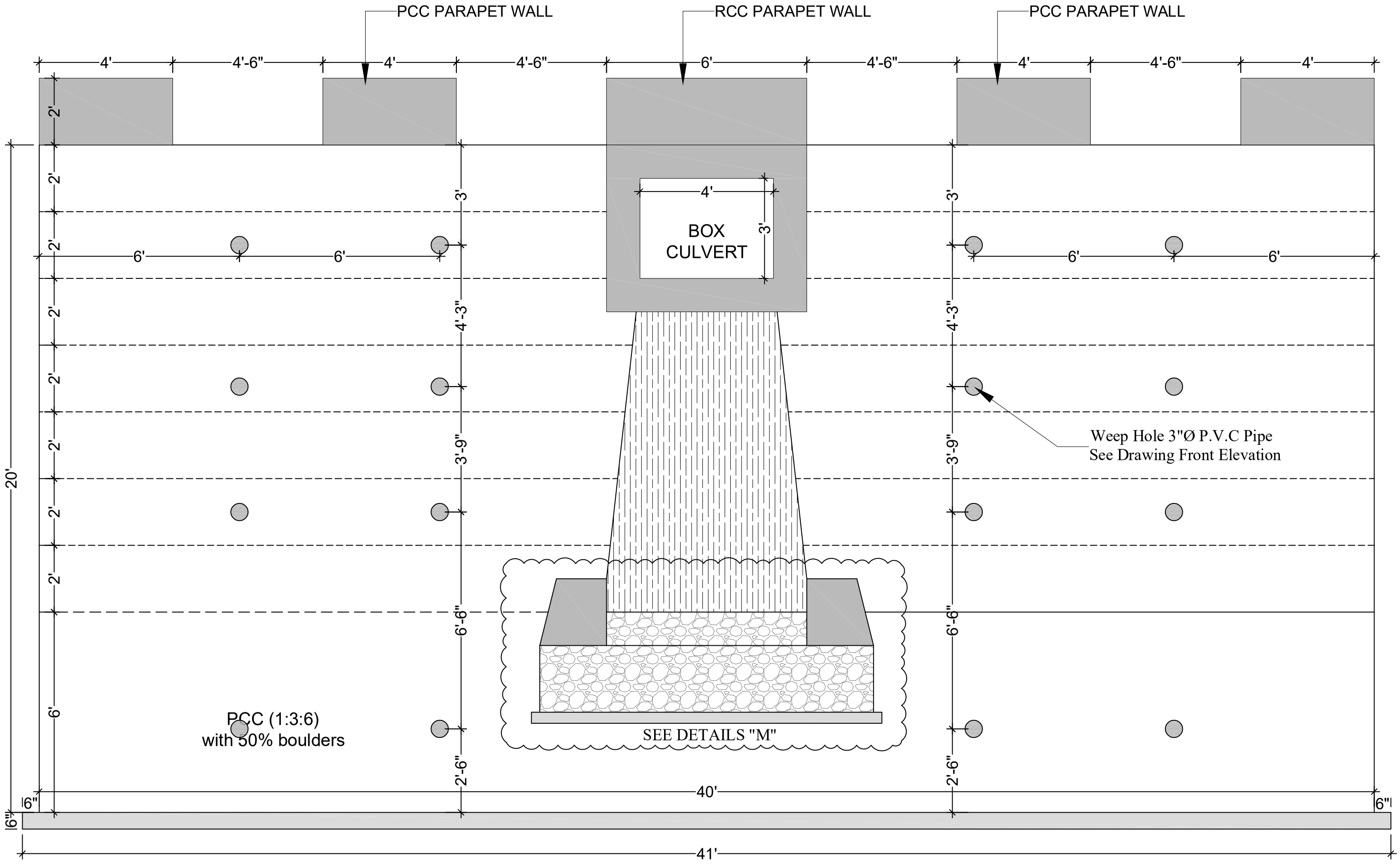
SECTION B-B



REINFORCEMENT DETAIL
SINGLE CELL BOX CULVERT (4' x 3')



CLIENT: **GOVERNMENT OF KHYBER PAKHTUNKHWA** DIRECTORATE GENERAL SMALL DAMS, IRRIGATION DEPARTMENT, PESHAWAR	CONSULTANTS: CONSULTING ASSOCIATES NS TOWER,HAYATABAD COMMERCIAL COMPLEX NEAR WFP WAREHOUSE, MAIN ACHINI BALA ROAD,PESHAWAR PH #: 091-5701774-45 Fax - 091-5701775 E-MAIL: consultingassociate127@gmail.com	PROJECT: SATTI KALI DAM DISTRICT, BANNU	TITLE: RETAINING WALL & BOX CULVERT SUB TITLE: SECTIONS B-B (UP STREAM)	DRAWN BY: MUNEEB KHAN DESIGN BY: DAWOOD KHAN CHECKED & SUBMITTED BY: FARID KHAN	DRAWING NO.: 007-CA-MC-HYS-RW-STK-BNU-05-52 REVISION NO.: 00 SHEET NO.: DATE: August 24



CLIENT: GOVERNMENT OF KHYBER PAKHTUNKHWA, DIRECTORATE GENERAL SMALL DAMS, IRRIGATION DEPARTMENT, PESHAWAR	CONSULTANTS: CONSULTING ASSOCIATES, NS TOWER,HAYATABAD COMMERCIAL COMPLEX, NEAR WFP WAREHOUSE, MAIN ACHINI BALA ROAD,PESHAWAR, PH #: 091-5701774-45 Fax - 091-5701775, E-MAIL: consultingassociate127@gmail.com	PROJECT: SATTI KALI DAM DISTRICT, BANNU	TITLE: RETAINING WALL & BOX CULVERT SUB TITLE: FRONT ELEVATION	DRAWN BY: MUNEEB KHAN DESIGN BY: DAWOOD KHAN CHECKED & SUBMITTED BY: FARID KHAN	DRAWING NO.: 007-CA-MC-HYS-RW-STK-BNU-05-53 REVISION NO.: 00 SHEET NO.: DATE: August 24