

**ISLAMIC REPUBLIC OF PAKISTAN
GOVERNMENT OF PUNJAB
LOCAL GOVERNMENT & COMMUNITY
DEVELOPMENT DEPARTMENT**



**LOAN 3562-PAK:
PUNJAB INTERMEDIATE CITIES IMPROVEMENT
INVESTMENT PROGRAM (PICIIP)**



BIDDING DOCUMENT

ICB-Works/PICIIP-08A:

**Construction of Wastewater Treatment Plant
(WWTP) in North Zone, Sahiwal**

-Single-Stage: Two-Envelope Bidding Procedure-

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STANDARD BIDDING DOCUMENT

Procurement of Works

- Single-Stage: Two-Envelope Bidding Procedure -

Asian Development Bank
December 2016

Procurement of Works

BIDDING DOCUMENT for ICB-Works/PICIIP-08A:

Construction of Wastewater Treatment Plant (WWTP) in North Zone, Sahiwal

Issued on:	20 September 2023
Invitation for Bids No:	ICB-Works/PICIIP-08A
ICB No:	PICIIP-08A-Sahiwal-WWTP
Employer:	Program Management Unit (PMU) Punjab Intermediate Cities Improvement Investment Program (PICIIP) Local Government & Community Department Punjab, Lahore
Country:	Pakistan

Preface

This Bidding Document for the Procurement of Works has been prepared by **Program Management Unit (PMU), Punjab Intermediate Cities Improvement Investment Project (PICIP), Local Government & Community Development Department, Punjab Pakistan** and is based on the Standard Bidding Document for the Procurement of Works (*SBD Works*) issued by the Asian Development Bank dated **December 2016**.

ADB's *SBD Works* has the structure and the provisions of the Master Procurement Document entitled "Bidding Documents for the Procurement of Works", prepared by multilateral development banks and other public international financial institutions, except where ADB-specific considerations have required a change.

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Section 1 - Instructions to Bidders

This Section specifies the procedures to be followed by Bidders in the preparation and submission of their Bids. Information is also provided on the submission, opening, evaluation of bids, and on the award of contract.

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Section 1 - Instructions to Bidders

A. General

- 1. Scope of Bid**
 - 1.1 In connection with the Invitation for Bids (IFB) indicated in the Bid Data Sheet (BDS), the Employer, as indicated in the BDS, issues this Bidding Document for the procurement of Works as specified in Section 6 (Employer's Requirements). The name, identification, and number of contracts of the international competitive bidding (ICB) are provided in the BDS.
 - 1.2 Throughout this Bidding Document,
 - (a) the term "in writing" means communicated in written form and delivered against receipt;
 - (b) except where the context requires otherwise, words indicating the singular also include the plural and words indicating the plural also include the singular; and
 - (c) "day" means calendar day.
- 2. Source of Funds**
 - 2.1 The Borrower or Recipient (hereinafter called "Borrower") indicated in the BDS has applied for or received financing (hereinafter called "funds") from the Asian Development Bank (hereinafter called "ADB") toward the cost of the project named in the BDS. The Borrower intends to apply a portion of the funds to eligible payments under the contract(s) for which this Bidding Document is issued.
 - 2.2 Payments by the ADB will be made only at the request of the Borrower and upon approval by ADB in accordance with the terms and conditions of the Financing Agreement between the Borrower and ADB (hereinafter called "Financing Agreement"), and will be subject in all respects to the terms and conditions of that Financing Agreement. No party other than the Borrower shall derive any rights from the Financing Agreement or have any claim to the funds.
- 3. Fraud and Corruption**
 - 3.1 ADB's Anticorruption Policy requires Borrowers (including beneficiaries of ADB-financed activity), as well as Bidders, Suppliers, and Contractors under ADB-financed contracts, observe the highest standard of ethics during the procurement and execution of such contracts. In pursuance of this policy, ADB
 - (a) defines, for the purposes of this provision, the terms set forth below as follows:
 - (i) "corrupt practice" means the offering, giving, receiving, or soliciting, directly or indirectly, anything of value to influence improperly the actions of another party;
 - (ii) "fraudulent practice" means any act or omission, including a misrepresentation, that knowingly or recklessly misleads, or attempts to mislead, a party to obtain a financial or other benefit or to avoid an obligation;

- (iii) “coercive practice” means impairing or harming, or threatening to impair or harm, directly or indirectly, any party or the property of the party to influence improperly the actions of a party;
 - (iv) “collusive practice” means an arrangement between two or more parties designed to achieve an improper purpose, including influencing improperly the actions of another party;
 - (v) “obstructive practice” means (a) deliberately destroying, falsifying, altering, or concealing of evidence material to an ADB investigation; (b) making false statements to investigators in order to materially impede an ADB investigation; (c) failing to comply with requests to provide information, documents, or records in connection with an Office of Anticorruption and Integrity (OAI) investigation; (d) threatening, harassing, or intimidating any party to prevent it from disclosing its knowledge of matters relevant to the investigation or from pursuing the investigation; or (e) materially impeding ADB’s contractual rights of audit or access to information; and
 - (vi) “integrity violation” is any act which violates ADB’s Anticorruption Policy, including (i) to (v) above and the following: abuse, conflict of interest, violations of ADB sanctions, retaliation against whistleblowers or witnesses, and other violations of ADB’s Anticorruption Policy, including failure to adhere to the highest ethical standard.
- (b) will reject a proposal for award if it determines that the Bidder recommended for award has, directly or through an agent, engaged in corrupt, fraudulent, collusive, coercive, or obstructive practices or other integrity violations in competing for the Contract;
 - (c) will cancel the portion of the financing allocated to a contract if it determines at any time that representatives of the Borrower or of a beneficiary of ADB-financing engaged in corrupt, fraudulent, collusive, coercive, or obstructive practices or other integrity violations during the procurement or the execution of that contract, without the Borrower having taken timely and appropriate action satisfactory to ADB to remedy the situation;
 - (d) will impose remedial actions on a firm or an individual, at any time, in accordance with ADB’s Anticorruption Policy and Integrity Principles and Guidelines (both as amended from time to time), including declaring ineligible, either indefinitely or for a stated period of time, to participate¹ in ADB-financed, -administered, or -supported activities or to benefit from an ADB-financed, -administered, or -supported contract, financially or otherwise, if it at any time determines that the firm or individual has, directly or through an agent, engaged in corrupt, fraudulent, collusive, coercive, or obstructive practices or other integrity violations; and

¹ Whether as a Contractor, Nominated Subcontractor, Consultant, Manufacturer or Supplier, or Service Provider; or in any other capacity (different names are used depending on the particular Bidding Document). A Nominated Subcontractor is one that either has been (i) included by the Bidder in its prequalification application or bid because it brings specific and critical experience and know-how that are accounted for in the evaluation of the bidder’s prequalification application or the bid; or (ii) appointed by the Employer.

(e) will have the right to require that a provision be included in bidding documents and in contracts financed by ADB, requiring Bidders, suppliers and contractors to permit ADB or its representative to inspect their accounts and records and other documents relating to the bid submission and contract performance and to have them audited by auditors appointed by ADB.

3.2 Furthermore, Bidders shall be aware of the provision stated in Subclause 1.15 and 15.6 of the Conditions of Contract.

4. Eligible Bidders

4.1 A Bidder may be a natural person, private entity, or government-owned enterprise subject to ITB 4.5—or any combination of them with a formal intent to enter into an agreement or under an existing agreement in the form of a Joint Venture. In the case of a Joint Venture,

(a) all partners shall be jointly and severally liable; and

(b) the Joint Venture shall nominate a Representative who shall have the authority to conduct all business for and on behalf of any and all the parties of the Joint Venture during the bidding process and, in the event the Joint Venture is awarded the Contract, during contract execution.

4.2 A Bidder, and all parties constituting the Bidder, shall have the nationality of an eligible country, in accordance with Section 5 (Eligible Countries). A Bidder shall be deemed to have the nationality of a country if the Bidder is a citizen or is constituted, incorporated, or registered, and operates in conformity with the provisions of the laws of that country. This criterion shall also apply to the determination of the nationality of proposed subcontractors or suppliers for any part of the Contract including related services.

4.3 A Bidder shall not have a conflict of interest. All Bidders found to have a conflict of interest shall be disqualified. A Bidder may be considered to be in a conflict of interest with one or more parties in the bidding process if any of, including but not limited to, the following apply:

(a) they have controlling shareholders in common; or

(b) they receive or have received any direct or indirect subsidy from any of them; or

(c) they have the same legal representative for purposes of this bid; or

(d) they have a relationship with each other, directly or through common third parties, that puts them in a position to have access to material information about or improperly influence the bid of another Bidder, or influence the decisions of the Employer regarding this bidding process; or

(e) a Bidder participates in more than one bid in this bidding process, either individually or as a partner in a joint venture, except for alternative offers permitted under ITB 13 of the Bidding Document. This will result in the disqualification of all Bids in which it is

involved. However, subject to any finding of a conflict of interest in terms of ITB 4.3(a)-(d) above, this does not limit the participation of a Bidder as a Subcontractor in another Bid or of a firm as a Subcontractor in more than one Bid; or

- (f) a Bidder or any affiliated entity, participated as a Consultant in the preparation of the design or technical specifications of the works that are the subject of the Bid; or
- (g) a Bidder was affiliated with a firm or entity that has been hired (or is proposed to be hired) by the Employer or Borrower as Engineer for the contract.

4.4 A firm shall not be eligible to participate in any procurement activities under an ADB-financed, -administered, or -supported project while under temporary suspension or debarment by ADB pursuant to its Anticorruption Policy (see ITB 3), whether such debarment was directly imposed by ADB, or enforced by ADB pursuant to the Agreement for Mutual Enforcement of Debarment Decisions. A bid from a temporary suspended or debarred firm will be rejected.

4.5 Government-owned enterprises in the Employer's country shall be eligible only if they can establish that they (i) are legally and financially autonomous, (ii) operate under commercial law, and (iii) are not a dependent agency of the Employer.

4.6 Bidders shall provide such evidence of their continued eligibility satisfactory to the Employer, as the Employer shall reasonably request.

4.7 Firms shall be excluded if by an act of compliance with a decision of the United Nations Security Council taken under Chapter VII of the Charter of the United Nations, the Borrower's country prohibits any import of goods or contracting of works or services from that country or any payments to persons or entities in that country.

4.8 In case a prequalification process has been conducted prior to the bidding process, this bidding is open only to prequalified Bidders.

5. Eligible Materials, Equipment and Services

5.1 The materials, equipment, and services to be supplied under the Contract shall have their origin in eligible source countries as defined in ITB 4.2 above and all expenditures under the Contract will be limited to such materials, equipment, and services. At the Employer's request, Bidders may be required to provide evidence of the origin of materials, equipment, and services.

5.2 For purposes of ITB 5.1 above, "origin" means the place where the materials and equipment are mined, grown, produced, or manufactured, and from which the services are provided. Materials and equipment are produced when, through manufacturing, processing, or substantial or major assembling of components, a commercially recognized product results that differs substantially in its basic characteristics or in purpose or utility from its components.

B. Contents of Bidding Document

6. Sections of Bidding Document

6.1 The Bidding Document consist of Parts I, II, and III, which include all the sections indicated below, and should be read in conjunction with any addenda issued in accordance with ITB 8.

PART I Bidding Procedures

Section 1 - Instructions to Bidders (ITB)

Section 2 - Bid Data Sheet (BDS)

Section 3 - Evaluation and Qualification Criteria (EQC)

Section 4 - Bidding Forms (BDF)

Section 5 - Eligible Countries (ELC)

PART II Requirements

Section 6 - Employer's Requirements (ERQ)

PART III Conditions of Contract and Contract Forms

Section 7 - General Conditions of Contract (GCC)

Section 8 - Particular Conditions of Contract (PCC)

Section 9 - Contract Forms (COF)

6.2 The IFB issued by the Employer is not part of the Bidding Document.

6.3 The Employer is not responsible for the completeness of the Bidding Document and their addenda, if they were not obtained directly from the source stated by the Employer in the IFB.

6.4 The Bidder is expected to examine all instructions, forms, terms, and specifications in the Bidding Document. Failure to furnish all information or documentation required by the Bidding Document may result in the rejection of the bid.

7. Clarification of Bidding Document, Site Visit, Pre-Bid Meeting

7.1 A prospective Bidder requiring any clarification on the Bidding Document shall contact the Employer in writing at the Employer's address indicated in the BDS or raise his inquiries during the pre-bid meeting if provided for in accordance with ITB 7.4. The Employer will respond in writing to any request for clarification, provided that such request is received no later than 21 days prior to the deadline for submission of bids. The Employer shall forward copies of its response to all Bidders who have acquired the Bidding Document in accordance with ITB 6.3, including a description of the inquiry but without identifying its source. Should the Employer deem it necessary to amend the Bidding Document as a result of a request for clarification, it shall do so following the procedure under ITB 8 and ITB 22.2.

7.2 The Bidder is advised to visit and examine the Site of Works and its surroundings and obtain for itself on its own responsibility all information that may be necessary for preparing the Bid and entering into a contract for construction of the Works. The costs of visiting the Site shall be at the Bidder's own expense.

7.3 The Bidder and any of its personnel or agents will be granted permission by the Employer to enter its premises and lands for the purpose of such visit, but only upon the express condition that the Bidder, its personnel, and agents will release and indemnify the

Employer and its 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 the inspection.

- 7.4 The Bidder's designated representative is invited to attend a pre-bid meeting, if provided for in the BDS. The purpose of the meeting will be to clarify issues and to answer questions on any matter that may be raised at that stage.
- 7.5 The Bidder is requested to submit any questions in writing, to reach the Employer not later than 1 week before the meeting.
- 7.6 Minutes of the pre-bid meeting, including the text of the questions raised, without identifying the source, and the responses given, together with any responses prepared after the meeting, will be transmitted promptly to all Bidders who have acquired the Bidding Document in accordance with ITB 6.3. Any modification to the Bidding Document that may become necessary as a result of the pre-bid meeting shall be made by the Employer exclusively through the issue of an addendum pursuant to ITB 8 and not through the minutes of the pre-bid meeting.
- 7.7 Nonattendance at the pre-bid meeting will not be a cause for disqualification of a Bidder.

8. Amendment of Bidding Document

- 8.1 At any time prior to the deadline for submission of Bids, the Employer may amend the Bidding Document by issuing addenda.
- 8.2 Any addendum issued shall be part of the Bidding Document and shall be communicated in writing to all who have obtained the Bidding Document from the Employer in accordance with ITB 6.3.
- 8.3 To give prospective Bidders reasonable time in which to take an addendum into account in preparing their Bids, the Employer may, at its discretion, extend the deadline for the submission of Bids, pursuant to ITB 22.2

C. Preparation of Bids

9. Cost of Bidding

- 9.1 The Bidder shall bear all costs associated with the preparation and submission of its Bid, and the Employer shall in no case be responsible or liable for those costs, regardless of the conduct or outcome of the bidding process.

10. Language of Bid

- 10.1 The Bid, as well as all correspondence and documents relating to the bid exchanged by the Bidder and the Employer, shall be written in the language specified in the BDS. Supporting documents and printed literature that are part of the Bid may be in another language provided they are accompanied by an accurate translation of the relevant passages in the language specified in the BDS, in which case, for purposes of interpretation of the Bid, such translation shall govern.

**11. Documents
Comprising the
Bid**

11.1 The Bid shall comprise two envelopes submitted simultaneously, one called the Technical Bid containing the documents listed in ITB 11.2 and the other the Price Bid containing the documents listed in ITB 11.3, both envelopes enclosed together in an outer single envelope.

11.2 The Technical Bid shall comprise the following:

- (a) Letter of Technical Bid;
- (b) Bid Security or Bid-Securing Declaration, in accordance with ITB 19;
- (c) alternative Bids, if permissible, in accordance with ITB 13;
- (d) written confirmation authorizing the signatory of the Bid to commit the Bidder, in accordance with ITB 20.2;
- (e) documentary evidence in accordance with ITB 17, establishing the Bidder's qualifications to perform the contract;
- (f) Technical Proposal in accordance with ITB 16;
- (g) Any other document required in the BDS.

11.3 The Price Bid shall comprise the following:

- (a) Letter of Price Bid;
- (b) completed Price Schedules, in accordance with ITB 12 and ITB 14;
- (c) alternative price Bids, at Bidder's option and if permissible, in accordance with ITB 13;
- (d) Any other document required in the BDS.

11.4 In addition to the requirements under ITB 11.2, Bids submitted by a Joint Venture shall include a copy of the Joint Venture Agreement entered into by all partners. Alternatively, a Letter of Intent to execute a Joint Venture Agreement in the event of a successful Bid shall be signed by all partners and submitted with the Bid, together with a copy of the proposed agreement.

**12. Letters of Bid and
Schedules**

12.1 The Letters of Technical Bid and Price Bid, and the Schedules, including the Bill of Quantities, shall be prepared using the relevant forms furnished in Section 4 (Bidding Forms). The forms must be completed without any alterations to the text, and no substitutes shall be accepted. All blank spaces shall be filled in with the information requested and as required in the BDS.

13. Alternative Bids

13.1 Unless otherwise indicated in the BDS, alternative Bids shall not be considered.

13.2 When alternative times for completion are explicitly invited, a statement to that effect will be included in the BDS, as will the method of evaluating different times for completion.

13.3 Except as provided under ITB 13.4 below, Bidders wishing to offer technical alternatives to the requirements of the Bidding Document must first price the Employer's design as described in the Bidding Document and shall further provide all information necessary for a

complete evaluation of the alternative by the Employer, including drawings, design calculations, technical specifications, breakdown of prices, and proposed construction methodology and other relevant details. Only the technical alternatives, if any, of the lowest evaluated Bidder conforming to the basic technical requirements shall be considered by the Employer.

13.4 When specified in the BDS, Bidders are permitted to submit alternative technical solutions for specified parts of the Works. Such parts will be identified in the BDS and described in Section 6 (Employer's Requirements). The method for their evaluation will be stipulated in Section 3 (Evaluation and Qualification Criteria).

14. Bid Prices and Discounts

14.1 The prices and discounts quoted by the Bidder in the Letter of Price Bid and in the Bill of Quantities shall conform to the requirements specified below.

14.2 The Bidder shall fill in rates and prices for all items of the Works described in the Bill of Quantities. Items against which no rate or price is entered by the Bidder will not be paid for by the Employer when executed and shall be deemed covered by the rates for other items and prices in the Bill of Quantities.

14.3 The price to be quoted in the Letter of Price Bid, in accordance with ITB 12.1, shall be the total price of the Bid, excluding any discounts offered. . Absence of the total bid price in the Letter of Price Bid may result in the rejection of the Bid.

14.4 The Bidder shall quote any discounts and the methodology for their application in the Letter of Price Bid, in accordance with ITB 12.1.

14.5 Unless otherwise provided in the BDS and the Contract, the rates and prices quoted by the Bidder are subject to adjustment during the performance of the Contract in accordance with the provisions of the Conditions of Contract. In such a case, the Bidder shall furnish the indexes and weightings for the price adjustment formulas in the Tables of Adjustment Data included in Section 4 (Bidding Forms) and the Employer may require the Bidder to justify its proposed indexes and weightings.

14.6 If so indicated in ITB 1.1, bids are being invited for individual contracts or for any combination of contracts (packages). Bidders wishing to offer any price reduction for the award of more than one Contract shall specify in their bid the price reductions applicable to each package, or alternatively, to individual Contracts within the package. Price reductions or discounts shall be submitted in accordance with ITB 14.4, provided the Bids for all contracts are submitted and opened at the same time.

14.7 All duties, taxes, and other levies payable by the Contractor under the Contract, or for any other cause, as of 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 the Bidder.

15. Currencies of Bid and Payment

- 15.1 The unit rates and the prices shall be quoted by the Bidder entirely in the currency specified in the BDS.
- 15.2 Bidders shall indicate the portion of the bid price that corresponds to expenditures incurred in the currency of the Employer's country in the Schedule of Payment Currencies included in Section 4 (Bidding Forms).
- 15.3 Bidders expecting to incur expenditures in other currencies for inputs to the Works supplied from outside the Employer's country and wishing to be paid accordingly may indicate up to three foreign currencies in the Schedule of Payment Currencies included in Section 4 (Bidding Forms).
- 15.4 The rates of exchange to be used by the Bidder for currency conversion during bid preparation shall be the selling rates for similar transactions prevailing on the date 28 days prior to the deadline for submission of bids published by the source specified in the BDS. If exchange rates are not so published for certain currencies, the Bidder shall state the rates used and the source. Bidders should note that for the purpose of payments, the exchange rates confirmed by the source specified in the BDS as the selling rates prevailing 28 days prior to the deadline for submission of Bids shall apply for the duration of the Contract so that no currency exchange risk is borne by the Bidder.
- 15.5 Foreign currency requirements indicated by the Bidders in the Schedule of Payment Currencies shall include but not limited to the specific requirements for
- (a) expatriate staff and labor employed directly on the Works;
 - (b) social, insurance, medical and other charges relating to such expatriate staff and labor, and foreign travel expenses;
 - (c) imported materials, both temporary and permanent, including fuels, oil and lubricants required for the Works;
 - (d) depreciation and usage of imported Plant and Contractor's Equipment, including spare parts, required for the Works;
 - (e) foreign insurance and freight charges for imported materials, Plant and Contractor's Equipment, including spare parts; and
 - (f) overhead expenses, fees, profit, and financial charges arising outside the Employer's country in connection with the Works.
- 15.6 Bidders may be required by the Employer to clarify their foreign currency requirements, and to substantiate that the amounts included in the unit rates and prices and shown in the Schedule of Payment Currencies are reasonable and responsive to ITB 15.3 above, in which case a detailed breakdown of its foreign currency requirements shall be provided by the Bidder.
- 15.7 Bidders should note that during the progress of the Works, the foreign currency requirements of the outstanding balance of the Contract Price may be adjusted by agreement between the Employer and the Contractor in order to reflect any changes in foreign currency requirements for the Contract, in accordance with Subclause 14.15 of

the Conditions of Contract. Any such adjustment shall be effected by comparing the percentages quoted in the bid with the amounts already used in the Works and the Contractor's future needs for imported items.

- 16. Documents Comprising the Technical Proposal**
- 16.1 The Bidder shall furnish a Technical Proposal including a statement of work methods, equipment, personnel, schedule, and any other information as stipulated in Section 4 (Bidding Forms), in sufficient detail to demonstrate the adequacy of the Bidders' proposal to meet the work requirements and the completion time.
- 17. Documents Establishing the Qualifications of the Bidder**
- 17.1 To establish its qualifications to perform the Contract in accordance with Section 3 (Evaluation and Qualification Criteria) the Bidder shall provide the information requested in the corresponding information sheets included in Section 4 (Bidding Forms).
- 17.2 Domestic Bidders, individually or in joint ventures, applying for eligibility for domestic preference shall supply all information required to satisfy the criteria for eligibility as described in ITB 35.
- 18. Period of Validity of Bids**
- 18.1 Bids shall remain valid for the period specified in the BDS after the bid submission deadline date prescribed by the Employer. A bid valid for a shorter period shall be rejected by the Employer as nonresponsive.
- 18.2 In exceptional circumstances, prior to the expiration of the bid validity period, the Employer may request Bidders to extend the period of validity of their Bids. The request and the responses shall be made in writing. If a bid security is requested in accordance with ITB 19, it shall also be extended 28 days beyond the deadline of the extended validity period. A Bidder may refuse the request without forfeiting its bid security. A Bidder granting the request shall not be required or permitted to modify its Bid.
- 19. Bid Security/Bid-Securing Declaration**
- 19.1 Unless otherwise specified in the BDS, the Bidder shall furnish as part of its Bid, in original form, either a Bid-Securing Declaration or a bid security as specified in the BDS. In the case of a bid security, the amount and currency shall be as specified in the BDS.
- 19.2 If a Bid-Securing Declaration is required pursuant to ITB 19.1, it shall use the form included in Section 4 (Bidding Forms). The Employer will declare a Bidder ineligible to be awarded a Contract for a specified period of time, as indicated in the BDS, if the Bid-Securing Declaration is executed.
- 19.3 If a bid security is specified pursuant to ITB 19.1, the bid security shall be, at the Bidder's option, in any of the following forms:
- (a) an unconditional bank guarantee,
 - (b) an irrevocable letter of credit, or
 - (c) a cashier's or certified check,
- all from a reputable source from an eligible country as described in Section 5 (Eligible Countries). In the case of a bank guarantee, the bid security shall be submitted either using the Bid Security Form included

in Section 4 (Bidding Forms) or another form acceptable to the Employer. The form must include the complete name of the Bidder. The bid security shall be valid for 28 days beyond the original validity period of the bid, or beyond any period of extension if requested under ITB 18.2.

19.4 Unless otherwise specified in the BDS, any Bid not accompanied by a substantially compliant bid security or Bid-Securing Declaration, if one is required in accordance with ITB 19.1, shall be rejected by the Employer as nonresponsive.

19.5 If a bid security is specified pursuant to ITB 19.1, the bid security of unsuccessful Bidders shall be returned as promptly as possible upon the successful Bidder's furnishing of the performance security pursuant to ITB 42.

19.6 If a bid security is specified pursuant to ITB 19.1, the bid security of the successful Bidder shall be returned as promptly as possible once the successful Bidder has signed the Contract and furnished the required performance security.

19.7 The bid security may be forfeited or the Bid Securing Declaration executed,

(a) if a Bidder withdraws its bid during the period of bid validity specified by the Bidder on the Letters of Technical Bid and Price Bid, except as provided in ITB 18.2; or

(b) if the successful Bidder fails to

(i) sign the Contract in accordance with ITB 41;

(ii) furnish a performance security in accordance with ITB 42;

(iii) accept the arithmetical correction of its Bid in accordance with ITB 33; or

(iv) furnish a domestic preference security, if so required.

19.8 The Bid Security or Bid Securing Declaration of a Joint Venture shall be in the name of the Joint Venture that submits the Bid. If the Joint Venture has not been legally constituted at the time of bidding, the bid security or Bid-Securing Declaration shall be in the names of all future partners as named in the letter of intent mentioned in ITB 4.1.

20. Format and Signing of Bid

20.1 The Bidder shall prepare one original set of the Technical Bid and one original set of the Price Bid comprising the Bid as described in ITB 11 and clearly mark it "ORIGINAL - TECHNICAL BID" and "ORIGINAL - PRICE BID." Alternative Bids, if permitted in accordance with ITB 13, shall be clearly marked "ALTERNATIVE." In addition, the Bidder shall submit copies of the Technical and Price Bids, in the number specified in the BDS, and clearly mark each of them "COPY." In the event of any discrepancy between the original and the copies, the original shall prevail.

20.2 The original and all copies of the Bid shall be typed or written in indelible ink and shall be signed by a person duly authorized to sign on behalf of the Bidder. This authorization shall consist of a written

confirmation as specified in the BDS and shall be attached to the bid. The name and position held by each person signing the authorization must be typed or printed below the signature. All pages of the Bid, except for unamended printed literature, shall be signed or initialed by the person signing the Bid. If a Bidder submits a deficient authorization, the Bid shall not be rejected in the first instance. The Employer shall request the Bidder to submit an acceptable authorization within the number of days as specified in the BDS. Failure to provide an acceptable authorization within the prescribed period of receiving such a request shall cause the rejection of the Bid.

- 20.3 Any amendments such as interlineations, erasures, or overwriting shall be valid only if they are signed or initialed by the person signing the Bid.

D. Submission and Opening of Bids

21. Sealing and Marking of Bids

- 21.1 Bidders may always submit their Bids by mail or by hand. When so specified in the BDS, Bidders shall have the option of submitting their Bids electronically. Procedures for submission, sealing, and marking are as follows:
- (a) Bidders submitting Bids by mail or by hand shall enclose the original of the Technical Bid, the original of the Price Bid, and each copy of the Technical Bid and each copy of the Price Bid, in separate sealed envelopes, duly marking the envelopes as "ORIGINAL - TECHNICAL BID," "ORIGINAL - PRICE BID," and "COPY NO... - TECHNICAL BID" and "COPY NO.... - PRICE BID." These envelopes, the first containing the originals and the others containing copies, shall then be enclosed in one single envelope per set. If permitted in accordance with ITB 13, alternative Bids shall be similarly sealed, marked and included in the sets. The rest of the procedure shall be in accordance with ITB 21.2 and ITB 21.5.
 - (b) Bidders submitting Bids electronically shall follow the electronic bid submission procedures specified in the BDS.
- 21.2 The inner and outer envelopes shall
- (a) bear the name and address of the Bidder;
 - (b) be addressed to the Employer in accordance with BDS 22.1; and
 - (c) bear the specific identification of this bidding process indicated in the BDS 1.1.
- 21.3 The outer envelopes and the inner envelopes containing the Technical Bid shall bear a warning not to open before the time and date for the opening of Technical Bid, in accordance with ITB 25.1.
- 21.4 The inner envelopes containing the Price Bid shall bear a warning not to open until advised by the Employer in accordance with ITB 25.7.
- 21.5 If all envelopes are not sealed and marked as required, the Employer will assume no responsibility for the misplacement or premature opening of the Bid.

- 22. Deadline for Submission of Bids**
- 22.1 Bids must be received by the Employer at the address and no later than the date and time indicated in the BDS.
- 22.2 The Employer may, at its discretion, extend the deadline for the submission of Bids by amending the Bidding Document in accordance with ITB 8, in which case all rights and obligations of the Employer and Bidders previously subject to the deadline shall thereafter be subject to the deadline as extended.
- 23. Late Bids**
- 23.1 The Employer shall not consider any Bid that arrives after the deadline for submission of bids, in accordance with ITB 22. Any bid received by the Employer after the deadline for submission of Bids shall be declared late, rejected, and returned unopened to the Bidder.
- 24. Withdrawal, Substitution, and Modification of Bids**
- 24.1 A Bidder may withdraw, substitute, or modify its Bid – Technical or Price – after it has been submitted by sending a written notice, duly signed by an authorized representative, and shall include a copy of the authorization in accordance with ITB 20.2, (except that withdrawal notices do not require copies). The corresponding substitution or modification of the Bid must accompany the respective written notice. All notices must be
- (a) prepared and submitted in accordance with ITB 20 and ITB 21 (except that withdrawal notices do not require copies), and in addition, the respective envelopes shall be clearly marked “WITHDRAWAL,” “SUBSTITUTION,” “MODIFICATION”; and
- (b) received by the Employer no later than the deadline prescribed for submission of Bids, in accordance with ITB 22.
- 24.2 Bids requested to be withdrawn in accordance with ITB 24.1 shall be returned unopened to the Bidders.
- 24.3 No Bid may be withdrawn, substituted, or modified in the interval between the deadline for submission of Bids and the expiration of the period of bid validity specified by the Bidder on the Letters of Technical Bid and Price Bid or any extension thereof.
- 25. Bid Opening**
- 25.1 The Employer shall open the Technical Bids in public at the address, on the date and time specified in the BDS in the presence of Bidders` designated representatives and anyone who chooses to attend. Any specific electronic bid opening procedures required if electronic bidding is permitted in accordance with ITB 21.1, shall be as specified in the BDS. The Price Bids will remain unopened and will be held in custody of the Employer until the specified time of their opening. If the Technical Bid and the Price Bid are submitted together in one envelope, the Employer may reject the entire Bid. Alternatively, the Price Bid may be immediately resealed for later evaluation.
- 25.2 First, envelopes marked “WITHDRAWAL” shall be opened and read out and the envelope with the corresponding Bid shall not be opened, but returned to the Bidder. No bid withdrawal shall be permitted unless the corresponding withdrawal notice contains a valid authorization to request the withdrawal and is read out at bid opening.

- 25.3 Second, outer envelopes marked "SUBSTITUTION" shall be opened. The inner envelopes containing the Substitution Technical Bid and/or Substitution Price Bid shall be exchanged for the corresponding envelopes being substituted, which are to be returned to the Bidder unopened. Only the Substitution Technical Bid, if any, shall be opened, read out, and recorded. Substitution Price Bid will remain unopened in accordance with ITB 25.1. No envelope shall be substituted unless the corresponding substitution notice contains a valid authorization to request the substitution and is read out and recorded at bid opening.
- 25.4 Next, outer envelopes marked "MODIFICATION" shall be opened. No Technical Bid and/or Price Bid shall be modified unless the corresponding modification notice contains a valid authorization to request the modification and is read out and recorded at the opening of Technical Bids. Only the Technical Bids, both Original as well as Modification, are to be opened, read out, and recorded at the opening. Price Bids, both Original as well as Modification, will remain unopened in accordance with ITB 25.1.
- 25.5 All other envelopes holding the Technical Bids shall be opened one at a time, and the following read out and recorded:
- (a) the name of the Bidder;
 - (b) whether there is a modification or substitution;
 - (c) the presence of a bid security or Bid-Securing Declaration, if required; and
 - (d) any other details as the Employer may consider appropriate.
- Only Technical Bids and alternative Technical Bids read out and recorded at bid opening shall be considered for evaluation. Unless otherwise specified in the BDS, all pages of the Letter of Technical Bid are to be initialed by at least three representatives of the Employer attending bid opening. No Bid shall be rejected at the opening of Technical Bids except for late bids, in accordance with ITB 23.1.
- 25.6 The Employer shall prepare a record of the opening of Technical Bids that shall include, as a minimum, the name of the Bidder and whether there is a withdrawal, substitution, or modification; alternative proposals; and the presence or absence of a bid security or Bid-Securing Declaration, if one was required. The Bidders' representatives who are present shall be requested to sign the record. The omission of a Bidder's signature on the record shall not invalidate the contents and effect of the record. A copy of the record shall be distributed to all Bidders who submitted Bids on time, and posted online when electronic bidding is permitted.
- 25.7 At the end of the evaluation of the Technical Bids, the Employer will invite bidders who have submitted substantially responsive Technical Bids and who have been determined as being qualified for award to attend the opening of the Price Bids. The date, time, and location of the opening of Price Bids will be advised in writing by the Employer. Bidders shall be given reasonable notice of the opening of Price Bids.

- 25.8 The Employer will notify Bidders in writing who have been rejected on the grounds of their Technical Bids being substantially nonresponsive to the requirements of the Bidding Document and return their Price Bids unopened.
- 25.9 The Employer shall conduct the opening of Price Bids of all Bidders who submitted substantially responsive Technical Bids, in the presence of Bidders' representatives who choose to attend at the address, on the date, and time specified by the Employer. The Bidder's representatives who are present shall be requested to sign a register evidencing their attendance.
- 25.10 All envelopes containing Price Bids shall be opened one at a time and the following read out and recorded:
- (a) the name of the Bidder;
 - (b) whether there is a modification or substitution;
 - (c) the Bid Prices, including any discounts and alternative offers; and
 - (d) any other details as the Employer may consider appropriate.

Only Price Bids discounts, and alternative offers read out and recorded during the opening of Price Bids shall be considered for evaluation. Unless otherwise specified in the BDS, all pages of the Letter of Price Bid and Bill of Quantities are to be initialed by at least three representatives of the Employer attending bid opening. No Bid shall be rejected at the opening of Price Bids.

- 25.11 The Employer shall prepare a record of the opening of Price Bids that shall include, as a minimum, the name of the Bidder, the Bid Price (per lot if applicable), any discounts, and alternative offers. The Bidders' representatives who are present shall be requested to sign the record. The omission of a Bidder's signature on the record shall not invalidate the contents and effect of the record. A copy of the record shall be distributed to all Bidders who submitted Bids on time, and posted online when electronic bidding is permitted.

E. Evaluation and Comparison of Bids

26. Confidentiality

- 26.1 Information relating to the examination, evaluation, comparison, and post qualification of Bids and recommendation of contract award, shall not be disclosed to Bidders or any other persons not officially concerned with such process until information on the Contract award is communicated to all Bidders.
- 26.2 Any attempt by a Bidder to influence the Employer in the evaluation of the Bids or Contract award decisions may result in the rejection of its Bid.
- 26.3 Notwithstanding ITB 26.2, from the time of bid opening to the time of Contract award, if any Bidder wishes to contact the Employer on any matter related to the bidding process, it may do so in writing.

- 27. Clarification of Bids**
- 27.1 To assist in the examination, evaluation, and comparison of the Technical and Price Bids, the Employer may, at its discretion, ask any Bidder for a clarification of its Bid. Any clarification submitted by a Bidder that is not in response to a request by the Employer shall not be considered. The Employer's request for clarification and the response shall be in writing. No change in the substance of the Technical Bid or prices in the Price Bid shall be sought, offered, or permitted, except to confirm the correction of arithmetic errors discovered by the Employer in the evaluation of the Price Bids, in accordance with ITB 33.
- 27.2 If a Bidder does not provide clarifications of its Bid by the date and time set in the Employer's request for clarification, its Bid may be rejected.
- 28. Deviations, Reservations, and Omissions**
- 28.1 During the evaluation of Bids, the following definitions apply:
- (a) "Deviation" is a departure from the requirements specified in the Bidding Document;
 - (b) "Reservation" is the setting of limiting conditions or withholding from complete acceptance of the requirements specified in the Bidding Document; and
 - (c) "Omission" is the failure to submit part or all of the information or documentation required in the Bidding Document.
- 29. Examination of Technical Bids**
- 29.1 The Employer shall examine the Technical Bid to confirm that all documents and technical documentation requested in ITB 11.2 have been provided, and to determine the completeness of each document submitted.
- 29.2 The Employer shall confirm that the following documents and information have been provided in the Technical Bid. If any of these documents or information is missing, the offer shall be rejected.
- (a) Letter of Technical Bid;
 - (b) written confirmation of authorization to commit the Bidder;
 - (c) Bid Security or Bid-Securing Declaration, if applicable; and
 - (d) Technical Proposal in accordance with ITB 16.
- 30. Responsiveness of Technical Bid**
- 30.1 The Employer's determination of a Bid's responsiveness is to be based on the contents of the bid itself, as defined in ITB11.
- 30.2 A substantially responsive Technical Bid is one that meets the requirements of the Bidding Document without material deviation, reservation, or omission. A material deviation, reservation, or omission is one that,
- (a) if accepted, would:
 - (i) affect in any substantial way the scope, quality, or performance of the Works specified in the Contract; or
 - (ii) limit in any substantial way, inconsistent with the Bidding Document, the Employer's rights or the Bidder's obligations under the proposed Contract; or

(b) if rectified, would unfairly affect the competitive position of other Bidders presenting substantially responsive Bids.

30.3 The Employer shall examine the technical aspects of the Bid submitted in accordance with ITB 16, Technical Proposal, in particular, to confirm that all requirements of Section 6 (Employer's Requirements) have been met without any material deviation, reservation, or reservation.

30.4 If a Bid is not substantially responsive to the requirements of the Bidding Document, it shall be rejected by the Employer and may not subsequently be made responsive by correction of the material deviation, reservation, or omission.

31. Nonmaterial Nonconformities

31.1 Provided that a Bid is substantially responsive, the Employer may waive any nonconformities in the Bid that do not constitute a material deviation, reservation, or omission.

31.2 Provided that a Technical Bid is substantially responsive, the Employer may request that the Bidder submit the necessary information or documentation, within a reasonable period of time, to rectify nonmaterial nonconformities in the Technical Bid related to documentation requirements. Requesting information or documentation on such nonconformities shall not be related to any aspect of the Price Bid. Failure of the Bidder to comply with the request may result in the rejection of its Bid.

31.3 Provided that a Technical Bid is substantially responsive, the Employer shall rectify quantifiable nonmaterial nonconformities related to the Bid Price. To this effect, the Bid Price shall be adjusted, for comparison purposes only, to reflect the price of a missing or non-conforming item or component. The adjustment shall be made using the method indicated in Section 3 (Evaluation and Qualification Criteria).

32. Qualification of the Bidder

32.1 The Employer shall determine to its satisfaction during the evaluation of Technical Bids whether Bidders meet the qualifying criteria specified in Section 3 (Evaluation and Qualification Criteria).

32.2 The determination shall be based upon an examination of the documentary evidence of the Bidder's qualifications submitted by the Bidder, pursuant to ITB 17.1.

32.3 An affirmative determination shall be a prerequisite for the opening and evaluation of a Bidder's Price Bid. A negative determination shall result into the disqualification of the Bid, in which event the Employer shall return the unopened Price Bid to the Bidder.

33. Correction of Arithmetical Errors

33.1 During the evaluation of Price Bids, the Employer shall correct arithmetical errors on the following basis:

(a) If there is a discrepancy between the unit price and the total price that is obtained by multiplying the unit price and quantity, the unit price shall prevail and the total price shall be corrected, unless in the opinion of the Employer there is an obvious misplacement of the decimal point in the unit price, in which case the total price as quoted shall govern and the unit price shall be corrected.

- (b) If there is an error in a total corresponding to the addition or subtraction of subtotals, the subtotals shall prevail and the total shall be corrected.
 - (c) If there is a discrepancy between the bid price in the Summary of Bill of Quantities and the bid amount in item (c) of the Letter of Price Bid, the bid price in the Summary of Bill of Quantities will prevail and the bid amount in item (c) of the Letter of Price Bid will be corrected.
 - (d) If there is a discrepancy between words and figures, the amount in words shall prevail, unless the amount expressed in words is related to an arithmetic error, in which case the amount in figures shall prevail subject to (a), (b) and (c) above.
- 33.2 If the Bidder that submitted the lowest evaluated bid does not accept the correction of errors, its Bid shall be disqualified and its bid security may be forfeited or its Bid-Securing Declaration executed.
- 34. Conversion to Single Currency**
- 34.1 For evaluation and comparison purposes, the currency(ies) of the Bid shall be converted into a single currency as specified in the BDS.
- 35. Margin of Preference**
- 35.1 Unless otherwise specified in the BDS, a margin of preference shall not apply.
- 36. Evaluation of Price Bids**
- 36.1 The Employer shall use the criteria and methodologies listed in this Clause. No other evaluation criteria or methodologies shall be permitted.
- 36.2 To evaluate the Price Bid, the Employer shall consider the following:
- (a) the bid price, excluding Provisional Sums and the provision, if any, for contingencies in the Summary Bill of Quantities, but including Daywork items, where priced competitively;
 - (b) price adjustment for correction of arithmetic errors in accordance with ITB 33.1;
 - (c) price adjustment due to discounts offered in accordance with ITB 14.4;
 - (d) converting the amount resulting from applying (a) to (c) above, if relevant, to a single currency in accordance with ITB 34;
 - (e) adjustment for nonconformities in accordance with ITB 31.3; and
 - (f) application of all the evaluation factors indicated in Section 3 (Evaluation and Qualification Criteria).
- 36.3 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.
- 36.4 If this Bidding Document allows Bidders to quote separate prices for different contracts, and the award to a single Bidder of multiple contracts, the methodology to determine the lowest evaluated price of the contract combinations, including any discounts offered in the Letter of Price Bid, is specified in Section 3 (Evaluation and Qualification Criteria).

36.5 If the Bid, which results in the lowest Evaluated Bid Price, is seriously unbalanced or front loaded in the opinion of the Employer, the Employer 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, taking into consideration the schedule of estimated Contract payments, the Employer may require that the amount of the performance security be increased at the expense of the Bidder to a level sufficient to protect the Employer against financial loss in the event of default of the successful Bidder under the Contract.

- 37. Comparison of Bids** 37.1 The Employer shall compare all substantially responsive Bids to determine the lowest evaluated Bid, in accordance with ITB 36.2.
- 38. Employer's Right to Accept Any Bid, and to Reject Any or All Bids** 38.1 The Employer reserves the right to accept or reject any Bid, and to annul the bidding process and reject all Bids at any time prior to contract award, without thereby incurring any liability to Bidders. In case of annulment, all Bids submitted and specifically, bid securities, shall be promptly returned to the Bidders.

F. Award of Contract

- 39. Award Criteria** 39.1 The Employer shall award the Contract to the Bidder whose offer has been determined to be the lowest evaluated Bid and is substantially responsive to the Bidding Document, provided further that the Bidder is determined to be qualified to perform the Contract satisfactorily.
- 40. Notification of Award** 40.1 Prior to the expiration of the period of bid validity, the Employer shall notify the successful Bidder, in writing, that its Bid has been accepted.
- 40.2 At the same time, the Employer shall also notify all other Bidders of the results of the bidding. The Employer will publish in an English language newspaper or well-known freely accessible website the results identifying the bid and lot numbers and the following information: (i) name of each Bidder who submitted a Bid; (ii) bid prices as read out at bid opening; (iii) name and evaluated prices of each Bid that was evaluated; (iv) name of bidders whose bids were rejected and the reasons for their rejection; and (v) name of the winning Bidder, and the price it offered, as well as the duration and summary scope of the contract awarded. After publication of the award, unsuccessful Bidders may request in writing to the Employer for a debriefing seeking explanations on the grounds on which their Bids were not selected. The Employer shall promptly respond in writing to any unsuccessful Bidder who, after publication of contract award, requests a debriefing.
- 40.3 Until a formal contract is prepared and executed, the notification of award shall constitute a binding Contract.
- 41. Signing of Contract** 41.1 Promptly after notification, the Employer shall send the successful Bidder the Contract Agreement.
- 41.2 Within 28 days of receipt of the Contract Agreement, the successful Bidder shall sign, date, and return it to the Employer.

42. Performance Security

- 42.1 Within 28 days of the receipt of notification of award from the Employer, the successful Bidder shall furnish the performance security in accordance with the conditions of contract, subject to ITB 36.5, using for that purpose the Performance Security Form included in Section 9 (Contract Forms), or another form acceptable to the Employer.
- 42.2 Failure of the successful Bidder to submit the above-mentioned Performance Security or to sign the Contract Agreement shall constitute sufficient grounds for the annulment of the award and forfeiture of the bid security or execution of the Bid-Securing Declaration. In that event, the Employer may award the Contract to the next lowest evaluated Bidder whose offer is substantially responsive and is determined by the Employer to be qualified to perform the Contract satisfactorily.
- 42.3 The above provision shall also apply to the furnishing of a domestic preference security if so required.

Section 2 - Bid Data Sheet

This Section consists of provisions that are specific to this procurement and supplement the information or requirements included in Section 1 - Instructions to Bidders.

A. General

ITB 1.1	The number of the Invitation for Bids is: ICB-Works/PICIIP-08A
ITB 1.1	The Employer is: Program Management Unit (PMU), Punjab Intermediate Cities Improvement Investment Program (PICIIP), Local Government & Community Development Department, Punjab, Pakistan
ITB 1.1	The name of the international competitive bidding process (ICB) is: Construction of Wastewater Treatment Plant (WWTP) in North Zone, Sahiwal The identification number of the ICB is: ICB-Works/PICIIP-08A
ITB 2.1	The Borrower is: Islamic Republic of Pakistan
ITB 2.1	The name of the Project is: Punjab Intermediate Cities Improvement Investment Program (PICIIP)

B. Contents of Bidding Documents

ITB 7.1	<p>For clarification purposes only, the Employer's address is:</p> <table border="1"> <tr> <td>Attention:</td> <td>Program Director Program Management Unit Punjab Intermediate Cities Improvement Investment Program (PICIIP) Local Government & Community Development Department, Punjab, Pakistan</td> </tr> <tr> <td>Street address:</td> <td>40 B-1, Gulberg 3, MM Alam Road</td> </tr> <tr> <td>City:</td> <td>Lahore</td> </tr> <tr> <td>ZIP code:</td> <td>54000</td> </tr> <tr> <td>Country:</td> <td>Islamic Republic of Pakistan</td> </tr> <tr> <td>Telephone:</td> <td>+92 42 99268484</td> </tr> <tr> <td>Fax:</td> <td>+92 42 99268483</td> </tr> <tr> <td>E-mail address:</td> <td>pmu.piciip@punjab.gov.pk</td> </tr> </table> <p>The Employer will respond in writing to any request for clarification, provided that such request is received no later than 14 days prior to the deadline for submission of bids.</p>	Attention:	Program Director Program Management Unit Punjab Intermediate Cities Improvement Investment Program (PICIIP) Local Government & Community Development Department, Punjab, Pakistan	Street address:	40 B-1, Gulberg 3, MM Alam Road	City:	Lahore	ZIP code:	54000	Country:	Islamic Republic of Pakistan	Telephone:	+92 42 99268484	Fax:	+92 42 99268483	E-mail address:	pmu.piciip@punjab.gov.pk
Attention:	Program Director Program Management Unit Punjab Intermediate Cities Improvement Investment Program (PICIIP) Local Government & Community Development Department, Punjab, Pakistan																
Street address:	40 B-1, Gulberg 3, MM Alam Road																
City:	Lahore																
ZIP code:	54000																
Country:	Islamic Republic of Pakistan																
Telephone:	+92 42 99268484																
Fax:	+92 42 99268483																
E-mail address:	pmu.piciip@punjab.gov.pk																

ITB 7.4	A Pre-Bid meeting shall take place.	
	Date:	Monday, 02 October 2023
	Time:	1100 Hours
	Place:	Office of the Program Director Program Management Unit (PMU) Punjab Intermediate Cities Improvement Investment Program (PICIP) Address: 40 B-1, Gulberg 3, MM Alam Road, Lahore, Pakistan
	City:	Lahore
	Country:	Islamic Republic of Pakistan
	Telephone:	+92 42 99268484
<p>Keeping in mind the convenience of the bidder(s), the bidder(s) can also attend the said meeting through Skype using the ID mentioned below:</p> <p>Zoom link ID: https://us06web.zoom.us/j/88029329934?pwd=0qbHZUYc9yuaTnAtmq7bNiXydgdxMY.1</p> <p>All bidders are encouraged to physically attend the Pre-Bid Meeting, however, the online platform is also available to facilitate participation.</p> <p>A site visit conducted by the Employer will not be organized.</p>		

C. Preparation of Bids

ITB 10.1	<p>The language of the Bid is: English</p> <p>Bidders are required to submit documentary evidence of below documents in English language. If the documentary evidences are other than in the English language, then the bidder shall submit accurate translation of the relevant passages in the English language duly attested by the notary public of the Bidder's Country/similar legal instrument of authorization as applicable under the laws of the bidder's home country, (specifying the authority for such attestation as per law of the country). Certification by the Foreign Office of the country(ies) of origin of the Bidder(s) is acceptable.</p> <p>All the documentation to be submitted by the Bidder in order to substantiate the information requested in the corresponding Information Sheets, mentioned hereinbelow:</p> <ol style="list-style-type: none"> a) Form EQU: Equipment b) Form ELI – 1: Bidder's Information Sheet c) Form ELI – 2: Joint Venture Information Sheet d) Form FIN – 1: Historical Financial Performance e) Form FIN – 2: Average Annual Construction Turnover f) Form FIN – 3: Availability of Financial Resources g) Form FIN – 4: Financial Requirements for Current Contract Commitments h) Form EXP – 1: Contracts of Similar Size and Nature; as mentioned under Para 2.4.1, Section 3 of the Bidding Documents.
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	i) Form EXP – 2: Construction Experience in Key Activities; as mentioned under Para 2.4.1, Section 3 of the Bidding Documents
ITB 11.2 (g)	Refer to “Technical Proposal” in Section 4 and “Documents (Submission Requirements)” in Section-3.
ITB 11.3 (d)	The Bidder shall submit with its Price Bid the following additional documents: Not Applicable
ITB 12.1	The units and rates in figures entered into the Bill of Quantities and Daywork Schedule should be typewritten or if written by hand, must be in print form. Bill of Quantities and Daywork Schedule not presented accordingly may be considered nonresponsive.
ITB 13.1	Alternative bids <u>shall not</u> be permitted.
ITB 13.2	Alternative times for completion <u>shall not</u> be permitted.
ITB 13.4	<u>Not Applicable</u>
ITB 14.5	The prices quoted by the Bidder <u>shall be</u> adjustable.
ITB 15.1	The unit rates and the prices shall be quoted by the Bidder entirely in: “ Pakistan Rupees ”.
ITB 15.4	The rates of exchange shall be the selling rates 28 days prior to the deadline for submission of bids published by: State Bank of Pakistan.
ITB 16.1	The Technical Proposal shall also include a Health and Safety COVID-19 Plan, in accordance with the relevant government regulations and guidelines on COVID-19 prevention and control issued by the Government of Pakistan (http://covid.gov.pk/guideline), or in the absence thereof, to international good practice guidelines, such as World Health Organization 2020, Considerations for public health and social measures in the workplace in the context of COVID-19, Geneva available here: https://www.who.int/publications-detail/considerations-for-public-health-and-social-measures-in-the-workplace-in-the-context-of-covid-19 . Absence of or incomplete submission may result in rejection of bid.”
ITB 18.1	The bid validity period shall be one hundred and fifty (150) days.
ITB 19.1	A bid-securing declaration shall <u>not</u> be required. The Bidder shall furnish a bid security of amount of: <u>PKR 40,000,000 or USD 134,000/-</u> The bid security shall be in Pak Rupees or U.S. Dollars in favor of the Program Director (PD), Program Management Unit (PMU), Punjab Intermediate Cities Improvement Investment Program (PICIIIP), 40 B-1, M M Alam Road, Gulberg 3, Lahore, Pakistan.
ITB 19.2	Not Applicable
ITB 19.4	Subject to the succeeding sentences, any bid not accompanied by an irrevocable and callable bid security shall be rejected by the Employer as nonresponsive. If a Bidder submits a bid security that (i) deviates in form, amount, and/or period of

	<p>validity, or (ii) does not provide sufficient identification of the Bidder (including, without limitation, failure to indicate the name of the Joint Venture or, where the Joint Venture has not yet been constituted, the names of all future Joint Venture Partners), the Employer shall request the Bidder to submit a compliant bid security within Ten (10) days of receiving such a request. Failure to provide a compliant bid security within the prescribed period of receiving such a request shall cause the rejection of the Bid.</p>
ITB 20.1	<p>In addition to the original of the bid (<i>technical and financial bids</i>), the number of hard copies of the bid is: Three (03).</p> <p><i>To facilitate evaluation, bidders are encouraged to submit soft copies [two CDs (Compact Disc) or DVD (Digital Versatile Disc) or USB] one each in PDF format with its Technical Bid and Price Bid (Price Bid & BOQs to be provided in excel format also). The soft copy (CD or DVD or USB) of the Technical Bid shall be enclosed in the envelope containing the hard copy of the Bidder's Original Technical Bid, and the soft copy (CD or DVD or USB) of the Price Bid shall be enclosed in the envelope containing the hard copy of the Bidder's Original Price Bid.</i></p> <p><i>If there is any discrepancy between the data/information in the soft copy (CD or DVD or USB) of the Bidder's Technical Bid and the hard copy of the Bidder's Original Technical Bid and between the price indicated in the hard copy of the Bidder's Original Price Bid, and in the soft copy (CD or DVD or USB) of the Bidder's Price Bid, the data and information indicated in the hard copy of the Original Technical Bid and the Original Price Bid shall prevail.</i></p> <p>Note: Submission of the CD is only for reference and shall not constitute electronic bid submission as stipulated in ITB 21.1(b) and is provision in the Data Sheet.</p>
ITB 20.2	<p>The written confirmation of authorization to sign on behalf of the Bidder shall consist of a <i>board resolution or its equivalent, or power of attorney, which should either be:</i></p> <ol style="list-style-type: none"> a) <i>notarized, or</i> b) <i>attested to by an appropriate authority in the Bidder's home country, specifying the representative's authority to sign the bid on behalf of the bidder.</i> <p><i>If the bidder is an intended or existing joint venture, such authorization should be signed by all parties and specify the representative's authority to sign the bid on behalf of the intended or existing joint venture.</i></p> <p><i>If the joint venture has not yet been formed, also include written evidence from all proposed members of joint venture of their intent to enter into a joint venture in the event of a contract award in accordance with 11.2(d).</i></p>
ITB 20.2	The Bidder shall submit an acceptable authorization within Ten (10) days.

D. Submission and Opening of Bids

ITB 21.1	Bidders do not have the option of submitting their Bids electronically.
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ITB 21.1 (b)	If Bidders shall have the option of submitting their Bids electronically, the electronic bidding submission procedures shall be: Not Applicable.														
ITB 22.1	<p>For bid submission purposes only, the Employer's address is:</p> <table border="1"> <tr> <td>Attention:</td> <td>Program Director Program Management Unit (PMU) Punjab Intermediate Cities Improvement Investment Program (PICIIP) Local Government & Community Development Department, Punjab</td> </tr> <tr> <td>Street address:</td> <td>40 / B-1 Gulberg 3, MM Alam Road, Lahore, Pakistan</td> </tr> <tr> <td>City:</td> <td>Lahore</td> </tr> <tr> <td>ZIP code:</td> <td>54000</td> </tr> <tr> <td>Country:</td> <td>Islamic Republic of Pakistan</td> </tr> </table> <p>The deadline for bid submission is:</p> <table border="1"> <tr> <td>Date:</td> <td>Monday, 06 November 2023</td> </tr> <tr> <td>Time:</td> <td>1500 Hours</td> </tr> </table>	Attention:	Program Director Program Management Unit (PMU) Punjab Intermediate Cities Improvement Investment Program (PICIIP) Local Government & Community Development Department, Punjab	Street address:	40 / B-1 Gulberg 3, MM Alam Road, Lahore, Pakistan	City:	Lahore	ZIP code:	54000	Country:	Islamic Republic of Pakistan	Date:	Monday, 06 November 2023	Time:	1500 Hours
Attention:	Program Director Program Management Unit (PMU) Punjab Intermediate Cities Improvement Investment Program (PICIIP) Local Government & Community Development Department, Punjab														
Street address:	40 / B-1 Gulberg 3, MM Alam Road, Lahore, Pakistan														
City:	Lahore														
ZIP code:	54000														
Country:	Islamic Republic of Pakistan														
Date:	Monday, 06 November 2023														
Time:	1500 Hours														
ITB 25.1	<p>The opening of the Technical Bid shall take place at:</p> <table border="1"> <tr> <td colspan="2">Office of the Program Director Program Management Unit (PMU) Punjab Intermediate Cities Improvement Investment Program (PICIIP) Local Government & Community Development Department, Punjab</td> </tr> <tr> <td>Street address:</td> <td>40 / B-1 Gulberg 3, MM Alam Road, Lahore, Pakistan</td> </tr> <tr> <td>City:</td> <td>Lahore</td> </tr> <tr> <td>ZIP code:</td> <td>54000</td> </tr> <tr> <td>Country:</td> <td>Islamic Republic of Pakistan</td> </tr> <tr> <td>Date:</td> <td>Monday, 06 November 2023</td> </tr> <tr> <td>Time:</td> <td>The technical bids shall be opened immediately after the bid submission deadline.</td> </tr> </table>	Office of the Program Director Program Management Unit (PMU) Punjab Intermediate Cities Improvement Investment Program (PICIIP) Local Government & Community Development Department, Punjab		Street address:	40 / B-1 Gulberg 3, MM Alam Road, Lahore, Pakistan	City:	Lahore	ZIP code:	54000	Country:	Islamic Republic of Pakistan	Date:	Monday, 06 November 2023	Time:	The technical bids shall be opened immediately after the bid submission deadline.
Office of the Program Director Program Management Unit (PMU) Punjab Intermediate Cities Improvement Investment Program (PICIIP) Local Government & Community Development Department, Punjab															
Street address:	40 / B-1 Gulberg 3, MM Alam Road, Lahore, Pakistan														
City:	Lahore														
ZIP code:	54000														
Country:	Islamic Republic of Pakistan														
Date:	Monday, 06 November 2023														
Time:	The technical bids shall be opened immediately after the bid submission deadline.														
ITB 25.1	Electronic bid opening procedure shall be as follows: Not Applicable.														
ITB 25.5	The Letter of Technical Bid shall be initialed by at least three (03) representatives of the Employer attending Bid opening.														
ITB 25.10	The Letter of Price Bid and Bill of Quantities shall be initialed by at least three (03) representatives of the Employer attending Bid opening.														

E. Evaluation and Comparison of Bids

ITB 34.1	The currency that shall be used for bid evaluation and comparison purposes to convert all bid prices expressed in various currencies into a single currency is: Not applicable
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ITB 35.1A margin of preference **shall not** apply.

Section 3 - Evaluation and Qualification Criteria

- Without Prequalification -

This Section contains all the criteria that the Employer shall use to evaluate bids and qualify Bidders. In accordance with ITB 32 and ITB 36, no other methods, criteria and factors shall be used. The Bidder shall provide all the information requested in the forms included in Section 4 (Bidding Forms).

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1. Evaluation

In addition to the criteria listed in ITB 36.2 (a)–(e), other relevant factors are as follows:

1.1 Adequacy of Technical Proposal

Evaluation of the Bidder's Technical Proposal will include an assessment of the Bidder's technical capacity to mobilize key equipment and personnel for the contract consistent with its proposal regarding work methods, scheduling, and material sourcing in sufficient detail and fully in accordance with the requirements stipulated in Section 6 (Employer's Requirements).

Non-compliance with equipment and personnel requirements described in Section 6 (Employer's Requirements) shall not normally be a ground for bid rejection and such non-compliance will be subject to clarification during bid evaluation and rectification prior to contract award.

1.2 Completion Time

An alternative Completion Time, if permitted under ITB 13.2, will be evaluated as follows:

Not Applicable.

1.3 Technical Alternatives

Technical alternatives, if permitted under ITB 13.4, will be evaluated as follows:

Not Applicable.

1.4 Quantifiable Nonconformities and Omissions

Subject to ITB 14.2 and ITB 36.2, the evaluated cost of quantifiable nonconformities including omissions, is determined as follows:

“Pursuant to ITB 31.3, the cost of all quantifiable nonmaterial nonconformities shall be evaluated, including omissions in Daywork where competitively priced but excluding omission of prices in the Bill of Quantities. The Employer will make its own assessment of the cost of any nonmaterial nonconformities and omissions for the purpose of ensuring fair comparison of Bids.”

1.5 Domestic Preference

If a margin of preference is provided for under ITB 35.1, the following procedure shall apply:

Not Applicable.

1.6 Multiple Contracts

Not Applicable.

1.7 Other Criteria

The Employer will take into account the quality of the Health and Safety COVID -19 Plan ('the Plan') attached to the Technical Proposal in its evaluation of the Adequacy of the Technical Proposal.

The bidder should demonstrate in the Plan the health and safety measures they will put in place on site in relation to COVID-19 prevention and controls, including but not limited to, PPE requirements, site set up, training, induction and mobilization of new personnel, equipment and plants cleaning and other hazard management measures while undertaking site work activities, site visitors health and safety protocols, as well as the approach to the monitoring and reporting of the Plan. The Plan should be fit for purpose for the particular construction works of this contract and be aligned with any relevant government regulations and guidelines on COVID-19 prevention and controls, as well as workplace safety requirements, or in the absence thereof, to international good practice guidelines such as World Health Organization 2020. Considerations for public health and social measures in the workplace in the context of COVID- 19 Geneva available here: <https://www.who.int/publicationsdetail/considerations-for-public-health-and-social-measures-in-the-workplacein-the-context-of-covid-19>.

2. Qualification

It is the legal entity or entities comprising the Bidder, and not the Bidder's parent companies, subsidiaries, or affiliates, that must satisfy the qualification criteria described below.

2.1 Eligibility

Criteria	Compliance Requirements			Documents	
Requirement	Single Entity	Joint Venture			Submission Requirements
		All Partners Combined	Each Partner	One Partner	

2.1.1 Nationality

Nationality in accordance with ITB Subclause 4.2.	must meet requirement	must meet requirement	must meet requirement	not applicable	Forms ELI - 1; ELI - 2 with attachments
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2.1.2 Conflict of Interest

No conflicts of interest in accordance with ITB Subclause 4.3.	must meet requirement	must meet requirement	must meet requirement	not applicable	Letter of Technical Bid
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2.1.3 ADB Eligibility

Not having been declared ineligible by ADB, as described in ITB Subclause 4.4.	must meet requirement	must meet requirement	must meet requirement	not applicable	Letter of Technical Bid
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2.1.4 Government-Owned Entity

Bidder required to meet conditions of ITB Subclause 4.5.	must meet requirement	must meet requirement	must meet requirement	not applicable	Forms ELI - 1; ELI - 2 with attachments
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2.1.5 United Nations Eligibility

Not having been excluded by an act of compliance with a United Nations Security Council resolution in accordance with ITB Subclause 4.7.	must meet requirement	must meet requirement	must meet requirement	not applicable	Letter of Technical Bid
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2.1.6 Registration with Pakistan Engineering Council (PEC)

<p>National Bidder must be registered with Pakistan Engineering Council (PEC) and shall submit proof of registration Certificate with a validity of 2023 in category C-1 or above with Specialization in CE01, CE-09 and CE 10 at the time of bid submission.</p> <p>The bidder whose registration expires for the year at the time of bid submission, the bidder shall be required to submit a valid registration before contract signing.</p>	must meet requirement	not applicable	JV partner must meet requirement as per their respective JV share	must meet requirement	Forms ELI - 1; ELI - 2 with attachments
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2.2 Pending Litigation and Arbitration

Pending litigation and arbitration criterion shall apply.

2.2.1 Pending Litigation and Arbitration

Criteria	Compliance Requirements			Documents	
Requirement	Single Entity	Joint Venture			Submission Requirements
		All Partners Combined	Each Partner	One Partner	
All pending litigation and arbitration, if any, shall be treated as resolved against the Bidder and so shall in total not represent more than fifty percent (50%) percent of the Bidder's net worth calculated as the difference between total assets and total liabilities.	must meet requirement by itself or as partner to past or existing Joint Venture	not applicable	must meet requirement by itself or as partner to past or existing Joint Venture	not applicable	Form LIT - 1

2.3 Financial Situation

2.3.1 Historical Financial Performance

Criteria	Compliance Requirements			Documents	
Requirement	Single Entity	Joint Venture			Submission Requirements
		All Partners Combined	Each Partner	One Partner	
Submission of audited financial statements or, if not required by the law of the Bidder's country, other financial statements acceptable to the Employer, for the years 2021, 2022 & 2023 or the latest three years to demonstrate the current soundness of the Bidder's financial position. As a minimum, the Bidder's net worth for the last year calculated as the difference between total assets and total liabilities should be positive.	must meet requirement	not applicable	must meet requirement	not applicable	Form FIN - 1 with attachments

2.3.2 Average Annual Construction Turnover

Criteria	Compliance Requirements			Documents	
Requirement	Single Entity	Joint Venture			Submission Requirements
		All Partners Combined	Each Partner	One Partner	
Minimum average annual construction turnover of USD 6.7 Million calculated as total certified payments received for contracts in progress or completed, within the last three (03) years .	must meet requirement	must meet requirement	must meet 25% of the requirement	must meet 40% of the requirement	Form FIN - 2

2.3.3 Financial Resources

Criteria	Compliance Requirements			Documents	
Requirement	Single Entity	Joint Venture			Submission Requirements
		All Partners Combined	Each Partner	One Partner	
<p>For Single Entities:</p> <p>The Bidder must demonstrate that its financial resources defined in FIN - 3, less its financial obligations for its current contract commitments defined in FIN - 4, meet or exceed the total requirement for the Contracts of USD 840,000/-.</p>	must meet requirement	not applicable	not applicable	not applicable	<p>Form FIN – 3 and Form FIN – 4.</p> <p>If the Bidder want to make use of line of credit to meet financial resource requirement, the bidder shall provide dedicated line of credit from the issuing bank by clearly indicating the name of this project.</p>
<p>For Joint Ventures:</p> <p>(1) One partner must demonstrate that its financial resources defined in FIN - 3, less its financial obligations for its own current contract commitments defined in FIN - 4, meet or exceed its required share of the amount of USD 336,000/- from the total requirement for the Contract(s).</p> <p>AND</p>	not applicable	not applicable	not applicable	must meet requirement	<p>Form FIN – 3 and Form FIN – 4.</p> <p>If the Bidder want to make use of line of credit to meet financial resource requirement, the bidder shall provide dedicated line of credit from the issuing bank by clearly indicating the name of this project.</p>
<p>(2) Each partner must demonstrate that its financial resources defined in FIN - 3, less its financial obligations for its own current contract commitments defined in FIN - 4, meet or exceed its required share of amount of USD 210,000/- from the total requirement for the Subject Contract.</p> <p>AND</p>	not applicable	not applicable	must meet requirement	not applicable	<p>Form FIN – 3 and Form FIN – 4.</p> <p>If the Bidder want to make use of line of credit to meet financial resource requirement, the bidder shall provide dedicated line of credit from the issuing bank by clearly indicating the name of this project.</p>
<p>(3) The joint venture must demonstrate that the combined financial resources of all partners defined in FIN - 3, less all the partners' total financial</p>	not applicable	must meet requirement	not applicable	not applicable	<p>Form FIN – 3 and Form FIN – 4.</p> <p>If the Bidder want to make use of line of credit to meet financial resource</p>

obligations for the current contract commitments defined in FIN - 4, meet or exceed the total requirement for the contracts of USD 840,000/- .					requirement, the bidder shall provide dedicated line of credit from the issuing bank by clearly indicating the name of this project.
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2.4 Construction Experience

2.4.1 Contracts of Similar Size and Nature

Criteria	Compliance Requirements			Documents	
Requirement	Single Entity	Joint Venture			Submission Requirements
		All Partners Combined	Each Partner	One Partner	
Participation as a contractor, Joint Venture partner, or Subcontractor, in at least one contract that has been successfully or substantially completed within the last ten (10) years and that is similar to the proposed works, where the value of the Bidder's participation in the contract exceeds USD 3.3 Million . The similarity of the Bidder's participation shall be based on details/characteristics as described in Section 6 "Employer's Requirements" which require experience in execution of Waste Water Treatment Plant Projects .	must meet requirement	not applicable	not applicable	must meet requirement	Form EXP – 1. Completion, or Taking Over or substantial completion certificate from the Employer or by the Engineer indicating Employer's name, contract name, value and completion time to demonstrate compliance with the requirements. If the participation was through a JV or as subcontractor, only the respective share will be considered. Also, Using Form EXP-1, the Bidders must specify percent and amount of participation of total contract amount. The Bidders may also provide pertinent information such as JV/subcontract agreement and payment receipts.

2.4.2 Construction Experience in Key Activities

(May be complied with by the Bidder or by Specialist Subcontractor. If Specialist Subcontractors are proposed by the Bidder for key activities, each Specialist Subcontract must have experience in related key activity as a single entity.

If the key activity is to be undertaken by a Specialist Subcontractor, the Employer shall require evidence of the subcontracting agreement from the Bidder.)

Criteria	Compliance Requirements				Documents
	Single Entity	Joint Venture			
Requirement			All Partners Combined	Each Partner	One Partner
For the above or other contracts executed during the period stipulated in 2.4.1 above, a minimum construction experience in the following key activities:	must meet requirement	must meet requirement ^a	not applicable	not applicable	Form EXP – 2. IPCs or Completion/Substantial completion / taking over certificate or certificate of execution of activities from the Employer of completed / substantially completed projects to substantiate experience in Key Activities.
1. Mechanically compacted earthwork (17 Million CFT minimum)					
2. Reinforced Concrete Works (0.3 Million CFT minimum)					

^a In the case of a joint venture bidder, at least one of the partners must have the experience in the key activity if the bidder itself (not its subcontractor) will carry out the relevant activity.

Section 4 - Bidding Forms

- Without Prequalification -

This Section contains the forms to be completed by the Bidder and submitted as part of its Bid.

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Letter of Technical Bid

The bidder must accomplish the Letter of Technical Bid on its letterhead clearly showing the bidder's complete name and address.

Date:

ICB No.: **PICIIP-08A-Sahawal-WWTP**
 Invitation for Bid No.: **ICB-Works/PICIIP-08A**

To:

Program Director (PD)
Program Management Unit (PMU)
Punjab Intermediate City Improvement Investment Program (PICIIP)
Local Government & Community Development Department, Punjab, Pakistan

We, the undersigned, declare that:

- (a) We have examined and have no reservations to the Bidding Documents, including Addenda issued in accordance with Instructions to Bidders (ITB) 8.
- (b) We offer to execute in conformity with the Bidding Documents the following Works:
Construction of Wastewater Treatment Plant (WWTP) in North Zone, Sahiwal.
- (c) Our Bid consisting of the Technical Bid and the Price Bid shall be valid for a period **150 days** from the date fixed for the bid submission deadline in accordance with the Bidding Documents, and it shall remain binding upon us and may be accepted at any time before the expiration of that period.
- (d) Our firm, including any Subcontractors or Suppliers for any part of the Contract, have nationalities from eligible countries in accordance with ITB 4.2.
- (e) We, including any Subcontractors or Suppliers for any part of the contract, do not have any conflict of interest in accordance with ITB 4.3.
- (f) We are not participating, as a Bidder in more than one Bid in this bidding process in accordance with ITB 4.3(e), other than alternative offers submitted in accordance with ITB 13.
- (g) Our firm, its affiliates or subsidiaries, including any Subcontractors or Suppliers for any part of the contract, has not been declared ineligible by ADB, under the Employer's country laws or official regulations or by an act of compliance with a decision of the United Nations Security Council.

- (h) [We are not a government-owned enterprise] / [We are a government-owned enterprise but meet the requirements of ITB 4.5].¹
- (i) We agree to permit ADB or its representative to inspect our accounts and records and other documents relating to the bid submission and to have them audited by auditors appointed by ADB.
- (j) If our Bid is accepted, we commit to mobilizing key equipment and personnel in accordance with the requirements set forth in Section 6 (Employer's Requirements) and our technical proposal, or as otherwise agreed with the Employer.

Name

In the capacity of

Signed

Duly authorized to sign the Bid for and on behalf of

Date

¹ Use one of the two options as appropriate.

Letter of Price Bid

The bidder must accomplish the Letter of Price Bid on its letterhead clearly showing the bidder's complete name and address.

Date:

ICB No.: **PICIIP-08A-Sahawal-WWTP**
 Invitation for Bid No.: **ICB-Works/PICIIP-08A**

To:

Program Director (PD)
Program Management Unit (PMU)
Punjab Intermediate City Improvement Investment Program (PICIIP)
Local Government & Community Development Department, Punjab, Pakistan

We, the undersigned, declare that:

- (a) We have examined and have no reservations to the Bidding Documents, including Addenda issued in accordance with Instructions to Bidders (ITB) 8.
- (b) We offer to execute in conformity with the Bidding Documents and the Technical Bid submitted for the following Works:

Construction of Wastewater Treatment Plant (WWTP) in North Zone, Sahiwal.

- (c) The total price of our Bid, excluding any discounts offered in item (d) below is:

[amount of foreign currency in words], [amount in figures], and [amount of local currency in words], [amount in figures]

The total bid price from the Summary of Bill of Quantities should be entered by the bidder inside this box. Absence of the total bid price in the Letter of Price Bid may result in the rejection of the bid.

- (d) The discounts offered and the methodology for their application are: _____
- (e) Our Bid shall be valid for a period of **150 days** from the date fixed for the bid submission deadline in accordance with the Bidding Documents, and it shall remain binding upon us and may be accepted at any time before the expiration of that period.
- (f) If our Bid is accepted, we commit to obtain a performance security in accordance with the Bidding Documents.

- (g) We have paid, or will pay the following commissions, gratuities, or fees with respect to the bidding process or execution of the Contract.¹

Name of Recipient	Address	Reason	Amount
.....
.....

- (h) We understand that this bid, together with your written acceptance thereof included in your notification of award, shall constitute a binding contract between us, until a formal contract is prepared and executed.
- (i) We understand that you are not bound to accept the lowest evaluated bid or any other bid that you may receive.
- (j) We agree to permit ADB or its representative to inspect our accounts and records and other documents relating to the bid submission and to have them audited by auditors appointed by ADB.

Name

In the capacity of

Signed

Duly authorized to sign the Bid for and on behalf of

Date

¹ If none has been paid or is to be paid, indicate "None".

Bid Security Bank Guarantee

.....*Bank's name, and address of issuing branch or office*¹

Beneficiary: *Name and address of the employer*

Date:

Bid Security No.:

We have been informed that *name of the bidder*. (hereinafter called "the Bidder") has submitted to you its bid dated (hereinafter called "the Bid") for the execution of *name of contract* under Invitation for Bids No. ("the IFB").

Furthermore, we understand that, according to your conditions, bids must be supported by a bid guarantee.

At the request of the Bidder, we *name of bank*. hereby irrevocably undertake to pay you any sum or sums not exceeding in total an amount of *amount in words* (. *amount in figures*) upon receipt by us of your first demand in writing accompanied by a written statement stating that the Bidder is in breach of its obligation(s) under the bid conditions, because the Bidder

- (a) has withdrawn its Bid during the period of bid validity specified by the Bidder in the Letters of Technical and Price Bid; or
- (b) does not accept the correction of errors in accordance with the Instructions to Bidders (hereinafter "the ITB"); or
- (c) having been notified of the acceptance of its Bid by the Employer during the period of bid validity, (i) fails or refuses to execute the Contract Agreement, or (ii) fails or refuses to furnish the performance security, in accordance with the ITB, or (iii) fails or refuses to furnish a domestic preference security, if required.

This guarantee will expire (a) if the Bidder is the successful Bidder, upon our receipt of copies of the Contract Agreement signed by the Bidder and the Performance Security issued to you upon the instruction of the Bidder; or (b) if the Bidder is not the successful Bidder, upon the earlier of (i) our receipt of a copy of your notification to the Bidder of the name of the successful Bidder, or (ii) 28 days after the expiration of the Bidder's bid.

Consequently, any demand for payment under this guarantee must be received by us at the office on or before that date.

This guarantee is subject to the Uniform Rules for Demand Guarantees, ICC Publication No. 458.²

..... *Authorized signature(s) and bank's seal (where appropriate)*

-- Note --

In case of a joint venture, the bid security must be in the name of all partners to the joint venture that submits the bid.

¹ All italicized text is for use in preparing this form and shall be deleted from the final document.
² Or 758 as applicable.

Bid-Securing Declaration

Date: *[insert date (as day, month and year)]*

Bid No.: *[insert number of bidding process]*

Alternative No.: *[insert identification No if this is a bid for an alternative]*

To: *[insert complete name of the employer]*

We, the undersigned, declare that:

We understand that, according to your conditions, Bids must be supported by a Bid-Securing Declaration.

We accept that we will automatically be suspended from being eligible for bidding in any contract with the Borrower for the period of time of . . . *[insert number of days as indicated in ITB 19.2 of the BDS]* . . . starting on the date that we receive a notification from the Employer if we are in breach of our obligation(s) under the bid conditions, because we

- (a) have withdrawn our Bid during the period of bid validity specified in the Letters of Technical and Price Bid; or
- (b) do not accept the correction of errors in accordance with the Instructions to Bidders (hereinafter "the ITB"); or
- (c) having been notified of acceptance of our Bid by the Employer during the period of bid validity, (i) fail or refuse to execute the contract, if required; or (ii) fail or refuse to furnish the Performance Security, in accordance with the ITB; or (iii) fail or refuse to furnish a domestic preference security, if required.

We understand this Bid-Securing Declaration shall expire if we are not the successful Bidder, upon the earlier of (i) our receipt of your notification to us of the name of the successful Bidder; or (ii) 28 days after the expiration of our Bid.

Signed: *[insert signature of person whose name and capacity are shown]*

In the capacity of *[insert legal capacity of person signing the Bid-Securing Declaration]*

Name: *[insert complete name of person signing the Bid-Securing Declaration]*

Duly authorized to sign the bid for and on behalf of *[insert complete name of the bidder]*

Dated on _____ day of _____, _____ *[insert date of signing]*

Corporate Seal *[where appropriate]*

-- Note --

In case of a joint venture, the Bid-Securing Declaration must be in the name of all partners to the joint venture that submits the bid.

Technical Proposal

Personnel

Equipment

Site Organization

Method Statement

Traffic Diversion Plan

Mobilization Schedule

Construction Schedule

COVID-19 Specific Site Health and Safety Management Plan in accordance with ITB 16.1

Other Documents in accordance with ITB 11.2(g) of Section 2-Bid Data Sheet, as under:

- (i) Quality Control Methods for Concrete Work & Pipes
- (ii) Health & Safety management plan.
- (iii) Environment safety plan.
- (iv) Bidders are encouraged to submit colored photographs of project sites as optional.

Personnel

Form PER – 1: Proposed Personnel

Bidder should provide the details of the proposed personnel and their experience record in the relevant Information Forms below for each candidate:

1.	Title of position*
	Name
2.	Title of position*
	Name
3.	Title of position*
	Name
4.	Title of position*
	Name
5.	Title of position*
	Name
6.	Title of position*
	Name
etc.	Title of position*
	Name

-- Note --

* As listed in Section 6 (Employer's Requirements).

Form PER – 2: Resumé of Proposed Personnel

The Bidder shall provide all the information requested below. Use one form for each position.

Position		
Personnel information	Name	Date of birth
	Professional qualifications	
Present employment	Name of employer	
	Address of employer	
	Telephone	Contact (manager / personnel officer)
	Fax	E-mail
	Job title	Years with present employer

Summarize professional experience in reverse chronological order. Indicate particular technical and managerial experience relevant to the project.

From	To	Company/Project/Position/Relevant Technical and Management Experience

Equipment

Form EQU: Equipment

The Bidder shall provide adequate information and details to demonstrate clearly that it has the capability to meet the equipment requirements indicated in Section 6 (Employer's Requirements), using the Forms below. A separate Form shall be prepared for each item of equipment listed, or for alternative equipment proposed by the Bidder.

Item of Equipment	
Equipment Information	Name of manufacturer
	Model and power rating
	Capacity
	Year of manufacture
Current Status	Current location
	Details of current commitments
Source	Indicate source of the equipment <input type="checkbox"/> Owned <input type="checkbox"/> Rented <input type="checkbox"/> Leased <input type="checkbox"/> Specially manufactured

Omit the following information for equipment owned by the Bidder.

Owner	Name of owner
	Address of owner
	Telephone
	Contact name and title
	Fax
	Telex
Agreements	Details of rental / lease / manufacture agreements specific to the project

Site Organization

[Note: *Evaluation of the Bidder's Site Organization will include an assessment of the Bidder's capacity to mobilize key personnel for the Contract consistent with its proposal regarding work methods, scheduling, and material sourcing in sufficient detail and fully in accordance with the requirements stipulated in Section 6 (Employer's Requirements).]*

Method Statement

The bidder shall provide detailed Method Statement of executing the project.

- In case of a JV, the Method Statement shall include clear delineation of activities / role to be performed by each JV partner consistent with the indicated JV share in the JV Agreement

Mobilization Schedule

Construction Schedule

[Note: *Evaluation of the Bidder's Construction Schedule will include an assessment of the Bidder's technical capacity to mobilize equipment for the Contract consistent with its proposal regarding work methods, scheduling, and material sourcing in sufficient detail and fully in accordance with the requirements stipulated in Section 6 (Employer's Requirements).*

Bidders must provide their Construction Schedule on Primavera / MS project or equivalent by allocating the equipment and other resources, critical activities must be identified.]

COVID-19 Specific Site Health and Safety Management Plan (in accordance with ITB 16.1)

[NOTE: *The bidder should demonstrate in the Plan the health and safety measures they will put in place on site in relation to COVID-19 prevention and controls, including but not limited to, PPE requirements, site set up, training, induction and mobilization of new personnel, equipment and plants cleaning and other hazard management measures while undertaking site work activities, site visitors health and safety protocols, as well as the approach to the monitoring and reporting of the Plan. The Plan should be fit for purpose for the particular construction works of this*

contract and be aligned with any relevant government regulations and guidelines on COVID-19 prevention and controls, as well as workplace safety requirements, or in the absence thereof, to international good practice guidelines such as World Health Organization 2020. Considerations for public health and social measures in the workplace in the context of COVID- 19 Geneva available here: <https://www.who.int/publicationsdetail/considerations-for-public-health-and-social-measures-in-the-workplacein-the-context-of-covid-19>.

Bidders Qualification

To establish its qualifications to perform the contract in accordance with Section 3 (Evaluation and Qualification Criteria) the Bidder shall provide the information requested in the corresponding Information Sheets included hereunder.

Form ELI - 1: Bidder's Information Sheet

Bidder's Information	
Bidder's legal name	
In case of a Joint Venture, legal name of each partner	
Bidder's country of constitution	
Bidder's year of constitution	
Bidder's legal address in country of constitution	
Bidder's authorized representative (name, address, telephone number(s), fax number(s), e- mail address)	
<p>Attached are copies of the following documents.</p> <p><input type="checkbox"/> 1. In case of a single entity, articles of incorporation or constitution of the legal entity named above, in accordance with ITB 4.1 and ITB 4.2.</p> <p><input type="checkbox"/> 2. Authorization to represent the firm or Joint Venture named above, in accordance with ITB 20.2.</p> <p><input type="checkbox"/> 3. In case of a Joint Venture, a letter of intent to form a Joint Venture or Joint Venture agreement, in accordance with ITB 4.1.</p> <p><input type="checkbox"/> 4. In case of a government-owned enterprise, any additional documents not covered under 1 above required to comply with ITB 4.5.</p>	

Form ELI - 2: Joint Venture Information Sheet

Each member of the Joint Venture and Specialist Subcontractor must fill out this form separately.

Joint Venture / Specialist Subcontractor Information	
Bidder's legal name	
Joint Venture Partner's or Specialist Subcontractor's legal name	
Joint Venture Partner's or Specialist Subcontractor's country of constitution	
Joint Venture Partner's or Specialist Subcontractor's year of constitution	
Joint Venture Partner's or Specialist Subcontractor's legal address in country of constitution	
Joint Venture Partner's or Specialist Subcontractor's authorized representative information (name, address, telephone number(s), fax number(s), e-mail address)	
<p>Attached are copies of the following documents.</p> <p><input type="checkbox"/> 1. Articles of incorporation or constitution of the legal entity named above, in accordance with ITB 4.1 and ITB 4.2.</p> <p><input type="checkbox"/> 2. Authorization to represent the firm named above, in accordance with ITB 20.2.</p> <p><input type="checkbox"/> 3. In the case of a government-owned enterprise, documents establishing legal and financial autonomy and compliance with commercial law, in accordance with ITB 4.5.</p>	

A Specialist Subcontractor is a specialist enterprise engaged for highly specialized processes that cannot be provided by the main Contractor.

Form LIT - 1: Pending Litigation and Arbitration

Each Bidder must fill out this form if so required under Criterion 2.2 of Section 3 (Evaluation and Qualification Criteria) to describe any pending litigation or arbitration formally commenced against it.

In case of a Joint Venture, each Joint Venture Partner must fill out this form separately and provide the Joint Venture Partner's name below:

Joint Venture Partner: _____

Pending Litigation and Arbitration			
<p>Choose one of the following:</p> <p><input type="checkbox"/> No pending litigation and Arbitration.</p> <p><input type="checkbox"/> Below is a description of all pending litigation and Arbitration involving the Bidder (or each Joint Venture member if Bidder is a Joint Venture).</p>			
Year	Matter in Dispute	Value of Pending Claim in \$ Equivalent	Value of Pending Claim as a Percentage of Net Worth

Form FIN - 1: Historical Financial Performance

Each Bidder must fill out this form.

In case of a Joint Venture, each Joint Venture Partner must fill out this form separately and provide the Joint Venture Partner's name below:

Joint Venture Partner: _____

Financial Data for Previous Years [USD Equivalent]		
Year 1:	Year 2:	Year 3:

Information from Balance Sheet

Total Assets (TA)			
Total Liabilities (TL)			
Net Worth = TA – TL			
Current Assets (CA)			
Current Liabilities (CL)			
Working Capital = CA - CL			

Most Recent Working Capital		To be obtained for most recent year and carried forward to FIN - 3 Line 1; in case of Joint Ventures, to the corresponding Joint Venture Partner's FIN – 3.
------------------------------------	--	---

Information from Income Statement

Total Revenues			
Profits Before Taxes			
Profits After Taxes			

- Attached are copies of financial statements (balance sheets including all related notes and income statements) for the last three years, as indicated above, complying with the following conditions:
- Unless otherwise required by Section 3 of the Bidding Document, all such documents reflect the financial situation of the legal entity or entities comprising the Bidder and not the Bidder's parent companies, subsidiaries, or affiliates.
 - Historical financial statements must be audited by a certified accountant.
 - Historical financial statements must be complete, including all notes to the financial statements.
 - Historical financial statements must correspond to accounting periods already completed and audited (no statements for partial periods shall be requested or accepted).

Form FIN - 2: Average Annual Construction Turnover

Each Bidder must fill out this form.

The information supplied should be the Annual Turnover of the Bidder or each member of a Joint Venture in terms of the amounts billed to clients for each year for work in progress or completed, converted to US dollars at the rate of exchange at the end of the period reported.

In case of a Joint Venture, each Joint Venture Partner must fill out this form separately and provide the Joint Venture Partner's name below:

Joint Venture Partner: _____

Annual Turnover Data for the Last Years (Construction only)			
Year	Amount Currency	Exchange Rate	USD Equivalent
Average Annual Construction Turnover			

Form FIN – 3: Availability of Financial Resources

Bidders must demonstrate sufficient financial resources, usually comprising of Working Capital supplemented by credit line statements or overdraft facilities and others to meet the Bidder's financial requirements for

- (a) its current contract commitments, and
- (b) the subject contract.

In case of a Joint Venture, each Joint Venture Partner must fill out this form separately and provide the Joint Venture Partner's name below:

Joint Venture Partner: _____

Financial Resources		
No.	Source of financing	Amount (USD equivalent)
1	Working Capital (to be taken from FIN - 1)	
2	Credit Line ^a	
3	Other Financial Resources	
Total Available Financial Resources		

^a To be substantiated by a letter from the bank issuing the line of credit. The bidder shall provide dedicated line of credit from the issuing bank by clearly indicating the name of this project.

Form FIN- 4: Financial Requirements for Current Contract Commitments

Bidders (or each Joint Venture partner) should provide information on their current commitments on all contracts that have been awarded, or for which a letter of intent or acceptance has been received, or for contracts approaching completion, but for which an unqualified, full completion certificate has yet to be issued.

In case of a Joint Venture, each Joint Venture Partner must fill out this form separately and provide the Joint Venture Partner's name below:

Joint Venture Partner: _____

Current Contract Commitments						
No.	Name of Contract	Employer's Contact (Address, Tel, Fax)	Contract Completion Date	Outstanding Contract Value (X) ^a	Remaining Contract Period in months (Y) ^b	Monthly Financial Resources Requirement (X / Y)
1						
2						
3						
4						
Total Monthly Financial Requirement for Current Contract Commitments						USD

^a Remaining outstanding contract values to be calculated from 28 days prior to the bid submission deadline (USD equivalent based on the foreign exchange rate as of the same date).

^b Remaining contract period to be calculated from 28 days prior to bid submission deadline.

Form FIN - 5: Self-Assessment Tool for Bidder’s Compliance to Financial Resources (Criterion 2.3.3 of Section 3)

This form requires the same information submitted in Forms FIN - 3 and FIN - 4. All conditions of “Available Financial Resources Net of CCC ≥ Requirement for the Subject Contract” must be satisfied to qualify.

Form FIN - 5A: For Single Entities

For Single Entities: (A)	Total Available Financial Resources from FIN – 3 (B)	Total Monthly Financial Requirement for Current Contract Commitments (CCC) from FIN – 4 (C)	Available Financial Resources Net of CCC D = (B - C)	Requirement for the Subject Contract (E)	Results: Yes or No [D must be greater than or equal to E] (F)
_____ (Name of Bidder)				

Form FIN - 5B: For Joint Ventures

For Joint Ventures: (A)	Total Available Financial Resources from FIN – 3 (B)	Total Monthly Financial Requirement for Current Contract Commitments (CCC) from FIN – 4 (C)	Available Financial Resources Net of CCC D = (B - C)	Requirement for the Subject Contract (E)	Results: Yes or No [D must be greater than or equal to E] (F)
One Partner:					
_____ (Name of Partner)				
Each Partner:					
_____ (Name of Partner 1)				
_____ (Name of Partner 2)				
_____ (Name of Partner 3)				
All partners combined	Σ D = Sum of available financial resources net of current contract commitments for all partners		Σ D = _____	

Form FIN – 5 is made available for use by the bidder as a self-assessment tool, and by the employer as an evaluation work sheet, to determine compliance with the financial resources requirement as stated in 2.3.3. Failure to submit Form FIN - 5 by the Bidder shall not lead to bid rejection.

Form EXP – 1: Contracts of Similar Size and Nature

Fill out one (1) form per contract.

Contract of Similar Size and Nature		
Contract No of	Contract Identification	
Award Date	Completion Date	
Total Contract Amount	\$	
If partner in a Joint Venture or subcontractor, specify participation of total contract amount	Percent of Total	Amount
Employer's name Address Telephone number Fax number E-mail		
Description of the Similarity in Accordance with Criterion 2.4.1 of Section 3 (Evaluation and Qualification Criteria)		
<p>Participation as a contractor, Joint Venture partner, or Subcontractor, in at least one contract that has been successfully or substantially completed within the last ten (10) years and that is similar to the proposed works, where the value of the Bidder's participation in the contract exceeds the amount mentioned in "Para 2.4.1, Section 3". The similarity of the Bidder's participation shall be based on details/characteristics as described in Section 6 "Employer's Requirements" which require experience in execution of Waste Water Treatment Plant Projects.</p>		

Form EXP - 2: Construction Experience in Key Activities

Fill out one (1) form per contract.

Contract with Similar Key Activities		
Contract No of	Contract Identification	
Award Date	Completion Date	
Total Contract Amount	\$	
If partner in a Joint Venture or subcontractor, specify participation of total contract amount	Percent of Total	Amount
Employer's name Address Telephone number Fax number E-mail		
Description of the Key Activities in Accordance with Criterion 2.4.2 of Section 3 (Evaluation and Qualification Criteria)		
a. Mechanically compacted earthwork (<i>17 Million CFT minimum</i>) b. Reinforced Concrete Works (<i>0.3 Million CFT minimum</i>)		

Schedules

Schedule of Payment Currencies

For.....insert name of Section of the Works

Separate tables may be required if the various sections of the Works (or of the Bill of Quantities) will have substantially different foreign and local currency requirements. In such a case, the Employer should prepare separate tables for each Section of the Works.

	A	B	C	D
Name of Payment Currency	Amount of Currency	Rate of Exchange to Local Currency	Local Currency Equivalent $C = A \times B$	Percentage of Net Bid Price (NBP) $\frac{100 \times C}{NBP}$
Local Currency		1.00		
Foreign Currency #1				
Foreign Currency #2				
Foreign Currency #3				
Net Bid Price				100.00
Provisional Sums Expressed in Local Currency		1.00		
BID PRICE				

- Note -

- The rates of exchange shall be the selling rates 28 days prior to the deadline for submission of bids published by the source specified in BDS 15.
- The bidder is required to substantiate and rationalize the justification of the Foreign Currency Component.
- The Foreign Currency Component shall be payable on actual expenditures.
- Actual expenditures and receipts may include but not limited to:
 - (a) For Equipment and Spare Parts: Lading / L. C. Papers, sale-purchase documents. Evidence of mobilization of equipment at project site etc.
 - (b) For Staff: The master payroll, evidence of presence of staff at project site. Payment / withdrawal of salary i.e. cross-check-bank account details.

Table(s) of Adjustment Data

Table A - Local Currency

Sr. No.	Description	Unit	Weightages	Applicable Index
1	2	3	4	5
(i)	Fixed Portion	-	0.35	-
(ii)	High Speed Diesel	Litres	0.15	Pakistan State Oil
(iii)	Labour Unskilled	Day (Per Day)	0.15	MRS Govt. of Punjab, Pakistan
(iv)	Cement (Ordinary Portland Cement)	Bag	0.09	MRS Govt. of Punjab, Pakistan
(v)	Iron Bar (M.S. Bar)	Metric Ton	0.26	MRS Govt. of Punjab, Pakistan
	Total		1.00 (Sum of Weightages from S. No. (ii) to (v) shall not exceed 0.65)	

Note:

1. Base prices of Specified Materials shall be as of actually prevailing on the base date notified by the Engineer with the approval of the Employer after the award of works. As per GCC 1.1.3.1, "Base Date" means the date 28 days prior to the deadline for bid submission".
2. The basic prices are meant to be ex-factory prices and inclusive of all kinds of taxes and duties that can be levied at source.
3. Adjustment of increase / decrease shall only be admissible for the materials listed above.
4. Value of work done for price adjustment purpose shall be value of permanent works (Excluding Bill for General Items & Provisional Sums).
5. All Amounts in Pak Rupees only.
6. If weightages proposed by the bidder exceed the limit/acceptable range specified above, it shall not be a cause bid rejection however the coefficients will be finalized before contract award after justifications by bidder.

Table B - Foreign Currency

Name of Currency:

Insert name of currency. If the bidder wishes to quote in more than one foreign currency, but in no case more than three, this table should be repeated for each foreign currency.

To be entered by the bidder						
Index Code	Index Description	Source of Index	Base Value and Date	Bidder's Currency in Type/Amount	Equivalent in FC1	Bidder's Proposed Weighting
	Nonadjustable	—	—	—		A: 0.15 _____ B: _____ C: _____ D: _____ E: _____
Total						1.00

- Note -

As per GCC 1.1.3.1, "Base Date" means the date 28 days prior to the latest date for submission of the bid.

Tables of Adjustment Data shall only be included if prices are to be quoted as adjustable prices in accordance with ITB 14.5.

List of Materials for Payment (Reference GCC/PCC 14.5)

Sr. No.	Type of Material	Limit for Payment*
1	Steel Reinforcement (Grade 60)	PKR 30 Million
2	Cement (OPC)	PKR 10 Million

* prescribes upper limit for net amount of payment, at any time, which shall not exceed in any certification by the Engineer against Contractor's Statement in accordance with GCC 14.3(e); the Engineer shall, however, make sure that the quantities stored and accepted for payments do not exceed their consumption requirements for execution and completion of Works particularly when the Works are in advanced stage / nearing completion.

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 as 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. 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. The units and rates in figures entered into the Bill of Quantities should be typewritten or if written by hand, must be in print form. Bill of Quantities not presented accordingly may be considered nonresponsive.
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 descriptions of works and materials are not necessarily repeated not summarized in the Bill of Quantities. Reference to the relevant sections of the Contract documentation shall be made before entering prices against each item in the priced Bill of Quantities
7. Provisional sums if 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 the Conditions of Contract.
8. The "Ref Specs" mentioned in the Bill of Quantities indicates the Technical Specifications section number(s) which are to be followed during execution of item of work in accordance with the applicable drawings.
9. Arithmetic errors will be corrected by the Employer as follows:
 - (a) If there is a discrepancy between the unit price and the total price that is obtained by multiplying the unit price and quantity, the unit price shall prevail and the total price shall be corrected, unless in the opinion of the Employer there is an obvious misplacement of the decimal point in the unit price, in which case the total price as quoted shall govern and the unit price shall be corrected.
 - (b) If there is an error in a total corresponding to the addition or subtraction of subtotals, the subtotals shall prevail, and the total shall be corrected.
 - (c) If there is a discrepancy between the bid price in the Summary of Bill of Quantities and the bid amount in item (c) of the Letter of Bid, the bid price in the Summary of Bill of Quantities will prevail and the bid amount in item (c) of the Letter of Bid will be corrected.

(d) If there is a discrepancy between words and figures, the amount in words shall prevail, unless the amount expressed in words is related to an arithmetic error, in which case the amount in figures shall prevail subject to (a), (b), and (c) above.

10. Unless otherwise stated in the text of the priced Bill of Quantities, the quantities have to be measured and paid in accordance with the Measurement and Payment Clauses given in the relevant Technical Specifications or in accordance with implied meaning of the specifications. Any special method of measurement stated in the text of priced Bill of Quantities is limited to the concerned items only.
11. Note: The bid price is inclusive of all Environmental, Health and Safety management and compliance cost.

B. Work Items

1. The Bill of Quantities are separately attached as **Annexure-A**
2. **All rates and amounts are in Pakistani Rupees. For the purpose of clarity, it is elaborated that serial no. 03 of Preamble to this Bill of Quantities, the Contractor is expected to consider all applicable, provincial and federal, direct and indirect taxes, in accordance with the relevant laws of Pakistan, in their rates against each item of the Bill of Quantities for example: Punjab Sales Tax (PRA), General Sales Tax (GST), Duties, Levies etc.**



Punjab Intermediate Cities Improvement Investment Program

Priced Bill of Quantities

CONSTRUCTION OF WASTEWATER
TREATMENT PLANT IN NORTH ZONE,
SAHIWAL (STAGE -1)

CONSTRUCTION OF WASTEWATER TREATMENT PLANT IN NORTH ZONE, SAHIWAL (STAGE -1)

BILL OF QUANTITIES

SUMMARY OF COST

Bill NO.	Description	Amount (Rs.)
1.1	ANAEROBIC AND FACULTATIVE PONDS	
1.2	INLET/OUTLET CHANNELS & COLLECTION/ DISTRIBUTION CHAMBERS	
1.3	EXTERNAL ELECTRICAL WORKS (WWTP AREA LIGHTING)	
1.4	OFFICE/ LABORATORY BUILDING	
1.5	STAFF BUILDING	
1.6	PROVISIONAL SUM	20,000,000
1.7	ENNVIRONMENTAL MANAGEMENT PLAN (EMP) IMPLEMENTATION	13,294,500
TOTAL COST		

Prepared by: 
 For and on behalf of
 National Engineering Services
 Pakistan (Pvt.) Ltd. (NESPAK)

CONSTRUCTION OF WASTEWATER TREATMENT PLANT IN NORTH ZONE, SAHIWAL (STAGE -1)
BILL OF QUANTITIES

BILL NO. 1.1: ANAEROBIC AND FACULTATIVE PONDS

Sr. No.	Description	Unit	Quantity	Rate (Rs)		Amount (Rs)
				in Figure	in words	
1	Jungle clearance and removing within 100ft (30m). (As approved by the Engineer). a) light b) thick	1000 Sft. 1000 Sft.	5,227.00 3,485.00			
2	Earthwork in excavation of drains, irrigation channels through excavator / drag lines in all kind of soil and conditions(dry, slush,daldal and under water) including its disposal and preparation of working pad for operation of machinery. (Rates includes 100 ft lead)	1000Cft	28,780.00			
3	b) Dressing of earthwork (done by machinery and left undressed) to designed section.	100Sft.	64,744.00			
4	Compaction of earthwork with power road roller, including ploughing, mixing, moisturing earth to optimum moisture content in layers, etc, complete:- i) 95% to 100% maximum modified AASHO dry density.	1000Cft	27,696.00			
5	Providing and laying dry brick pavement /soling in streets or roads, etc. sand groundted, laid in proper camber, including preparation, watering, compaction of bed to proper camber, and sand cushion.	100Cft	2,933.00			

Prepared by:



For and on behalf of
National Engineering Services
Pakistan (Pvt.) Ltd. (NESPAK)

**CONSTRUCTION OF WASTEWATER TREATMENT PLANT IN NORTH ZONE, SAHIWAL (STAGE -1)
BILL OF QUANTITIES**

BILL NO. 1.1: ANAEROBIC AND FACULTATIVE PONDS

Sr. No.	Description	Unit	Quantity	Rate (Rs)		Amount (Rs)
				in Figure	in words	
6	Providing and fixing barbed wire fencing, with 4 horizontal and two cross wires, with R.C.C. 1:2:4 posts, 5.5"x6"x9" (1.68mx150mmx225 mm) at 8 ft. (2.45 m) centre to centre, reinforced with 4 No. 3/8" (10 mm) dia vertical bars and 1/8" (3 mm) dia stirrups 12" (300 mm) centre to centre, complete in all respects. ii) in cement concrete 1:4:8 base of size 12"x12"x21" (300x300x525 mm).	100Rft.	120.00			
7	Making and fixing steel grated doors, complete with locking arrangement, angle iron frame 2"x2"x3/8" 50x50x10 mm) and 3/4" (20 mm) square bars 4" (100 mm) centre to centre.	Per Sft.	192.00			
8	Transportation of earth all types when the total distance, including the lead covered in the item of work, is more than 1000 ft. (300 m) (This is provisional quantity and will be paid as per actual lead chart to be approved by the Engineer) a) upto 1/4 mile (400 m). b) for every 330 ft. (100 m) additional lead or part thereof, beyond 1/4 mile (400 m) upto one mile. (1.6 Km.) (Item rate is for total lead of 1200m from 400m to 1.6km.) c) for every 1/4 mile (400 m) additional lead or part thereof, beyond one mile (1.6 Km.) upto 5 mile (8 Km.). (Item rate is for total lead of 6.4Km. from 1.6km. to 8Km.)	1000 Cft. 1000 Cft. 1000 Cft.	32,893.00 1,597.00 2,397.00			

Prepared by:



For and on behalf of
National Engineering Services
Pakistan (Pvt.) Ltd. (NESPAK)

**CONSTRUCTION OF WASTEWATER TREATMENT PLANT IN NORTH ZONE, SAHIWAL (STAGE -1)
BILL OF QUANTITIES**

BILL NO. 1.1: ANAEROBIC AND FACULTATIVE PONDS

Sr. No.	Description	Unit	Quantity	Rate (Rs)		Amount (Rs)
				in Figure	in words	
9	<p>d) for every 1/2 mile (800 m) additional lead or part thereof, beyond 5 mi les (8 Km). (lead 15 Km) (item rate is for total lead of 7Km. from 8km. to 15Km.)</p> <p>INTERCONNECTION STRUCTURES Earthwork excavation in open cutting upto 1.5m depth for storm water channels, drains, sullage drains, in open areas, roads, streets, lanes, including under pinning of walls and shoring to protect existing works, shuttering and timbering the trenches, dressed to designed levels and dimensions, trimming, removal of surface water from trenches, backfilling and surplus excavated material disposed of and dressed within 15m lead:- i) ordinary</p>	1000 Cft.	2,397.00			
10	<p>Earthwork excavation in open cutting 1.5m to 3m depth for storm water channels, drains, sullage drains, in open areas, roads, streets, lanes, including under pinning of walls and shoring to protect existing works, shuttering and timbering the trenches, dressed to designed levels and dimensions, trimming, removal of surface water from trenches, backfilling and surplus excavated material disposed of and dressed within 15m lead:- i) ordinary</p>	1000 Cft	30.94			
		1000 Cft	23.95			

Prepared by:



For and on behalf of
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 Pakistan (Pvt.) Ltd. (NESPAK)

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BILL OF QUANTITIES

BILL NO. 1.1: ANAEROBIC AND FACULTATIVE PONDS

Sr. No.	Description	Unit	Quantity	Rate (Rs)		Amount (Rs)
				in Figure	in words	
11	Cement concrete plain including placing, compacting, finishing and curing complete (including screening and washing of stone aggregate). (h) Ratio 1: 3: 6	100 Cft	51.92			
12	Providing and laying reinforced cement concrete (including prestressed concrete), using Ordinary Portland Cement / Sulphate resisting cement / Slag cement as may be required; coarse sand and screened graded and washed aggregate, in required shape and design, including forms, moulds, shuttering, lifting, compacting, curing, rendering and finishing exposed surface, complete (but excluding the cost of steel reinforcement, its fabrication and placing in position, etc.);- (a) (i) Reinforced cement concrete in roof slab, beams, columns, lintels, girders and other structural members laid insitu or precast laid in position, or prestressed members cast insitu, complete in all respects. (1) Type A (nominal mix 1:1:2) (a)(iii) Reinforced cement concrete in slab of rafts / strip foundation, base slab of column and retaining walls; etc other structural members other than those mentioned in 5(a) (i) above not requiring form work (i.e. horizontal shuttering) complete in all respects:- (1) Type A (nominal mix 1: 1: 2)	Per Cft	13,115.49			
		Per Cft	7,482.25			

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BILL NO. 1.1: ANAEROBIC AND FACULTATIVE PONDS

Sr. No.	Description	Unit	Quantity	Rate (Rs)		Amount (Rs)
				in Figure	in words	
13	Fabrication of mild steel reinforcement for cement concrete including cutting, bending, laying in position, making joints and fastenings, including cost of binding wire and labour charges for binding of steel reinforcement (also includes removal of rust from the bars):- c) Deformed Bars	100 Kg	840.39			
14	Carriage of 100 Cft. (2.83 cu.m) of all materials like stone aggregate, spawl , kankar lime (unslaked), surkhi , etc. or 150 Cft. (4.25 cu.m) of timber, by truck or by any other means owned by the contractor. Lead From nearest quarry (230km)	100 Cft	222.23			
15	Providing and laying R.C.C. pipe sewers, moulded with cement concrete 1:1½:3 conforming to ASTM Specification C-76-79, Class IV, Wall B, including carriage of pipes from factory to site of work, lowering in trenches o correct alignment and grade, jointing with rubber ring, cutting pipes where necessary, testing, etc. complete: - vi) 690 mm (27") I/d	Rft	720.00			
16	Bitumen coating to plastered or cement concrete surface:- i) 20 lbs. per 100 Sft. (9.07 Kg per Sq.m)	100 Sft.	294.66			
17	Extra for every 50 ft. (15 m) additional lead or part thereof :-- i) for earthwork soft, ordinary, hard and very hard. (This is provisional quantity and will be paid as per actual lead chart to be approved by the Engineer)	1000 Cft.	59,300.00			

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BILL NO. 1.1: ANAEROBIC AND FACULTATIVE PONDS

Sr. No.	Description	Unit	Quantity	Rate (Rs)		Amount (Rs)
				in Figure	in words	
18	<p>Providing, laying to designed section and compacting (to at least 90% of the maximum modified Proctor dry density) clay as liner (source to be approved by the Engineer), complete in all respects., Liner material should be compacted in layers not exceeding 6"(150mm). Liner material should be compacted slightly wet of optimum. Scarify the top of already compacted liner layer to a minimum depth of 1.0 inch before placing the next layer. Clods more than 5.0 mm size must be present in liner material, these must be pulverized before placing. (both in bed & slope)</p> <p>The material suitable to be used for compacted soil liner shall meet the following specifications: Vertical in-situ hydraulic conductivity in compacted state $\leq 1 \times 10^{-7}$ cm/sec Fines (particles passing 0.075 mm sieve) ≥ 30 % Plasticity index = 8 – 30 % Gravels (particles passing 75 mm sieve and retaining 4.75 mm sieve) ≤ 20 % Maximum particle size ≤ 10 mm (Item rate include lead from any source up to WWTP)</p>	Cft	12,473.062			
Total						

**CONSTRUCTION OF WASTEWATER TREATMENT PLANT IN NORTH ZONE, SAHIWAL (STAGE -1)
BILL OF QUANTITIES**

BILL NO. 1.2: INLET/OUTLET CHANNELS & COLLECTION/ DISTRIBUTION CHAMBERS AND OUTFALL STRUCTURE

Sr. No.	Description	Unit	Quantity	Rate (Rs)		Amount (Rs)
				in Figure	in words	
1	Earthwork in excavation of drains, irrigation channels through excavator / drag lines in all kind of soil and conditions (dry,wet slush,daidal and under water) including its disposal and preparation of working pad for operation of machinery. (Rates includes 100 ft lead)	1000Cft	10,580.40			
2	Cement concrete plain including placing, compacting, finishing and curing complete (including screening and washing of stone aggregate). (h) Ratio 1: 3: 6	100 Cft	404.60			
3	Providing and laying reinforced cement concrete (including prestressed concrete), using Ordinary Portland Cement / Sulphate resisting cement / Slag cement as may be required; coarse sand and screened graded and washed aggregate, in required shape and design, including forms, moulds, shuttering, lifting, compacting, curing, rendering and finishing exposed surface, complete (but excluding the cost of steel reinforcement, its fabrication and placing in position, etc.);:- (a) (i) Reinforced cement concrete in roof slab, beams, columns lintels, girders and other structural members laid in situ or precast laid in position, or prestressed members cast in situ, complete in all respects:- (1) Type A (nominal mix 1:1:2)	Per Cft	151,065.80			

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BILL OF QUANTITIES**

BILL NO. 1.2: INLET/OUTLET CHANNELS & COLLECTION/ DISTRIBUTION CHAMBERS AND OUTFALL STRUCTURE

Sr. No.	Description	Unit	Quantity	Rate (Rs)		Amount (Rs)
				in Figure	in words	
4	(a)(iii) Reinforced cement concrete in slab of rafts / strip foundation, base slab of column and retaining walls; etc and footing beams, other structural members other than those mentioned in 6(a) (i)& (ii) above not requiring form work (i.e. horizontal shuttering) complete in all respects:- (1) Type A (nominal mix 1: 1: 2) Fabrication of mild steel reinforcement for cement concrete including cutting, bending, laying in position, making joints and fastenings, including cost of binding wire and labour charges for binding of steel reinforcement (also includes removal of rust)	Per Cft	250,103.20			
5	(c) Deformed bars (Grade-60) Providing and embedding 10" (250mm) wide PVC water stopper in expansion joints of RCC structures (Retaining walls, water tanks, Slabs) complete in all respect. i) 10" wide 6 mm thick	100 Kg	16,381.70			
6	Carriage of 100 Cft. (2.83 cu.m) of all materials like stone aggregate, spawl , kankar lime (unslaked), surkhi , etc. or 150 Cft. (4.25 cu.m) of timber, by truck or by any other means owned by the contractor. Lead From nearest quarry (230km)	Per Rft.	28,854.00			
7	Bitumen coating to plastered or cement concrete surface:- i) 20 lbs. per 100 Sft. (9.07 Kg per Sq.m)	100 Cft	3,753.22			
		100 Sft.	1,365.00			

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BILL NO. 1.2: INLET/OUTLET CHANNELS & COLLECTION/ DISTRIBUTION CHAMBERS AND OUTFALL STRUCTURE

Sr. No.	Description	Unit	Quantity	Rate (Rs)		Amount (Rs)
				in Figure	in words	
8	Preparing surface and painting with Matt/ Glossy high chemical resistant/hard wearing Polyurethane paint (Epoxy Paint) by sprayer/ Brush i/c the cost of Primer coat , all material and labour complete in all respects as approved and directed by the Engineer Incharge. (i) Priming Coat (ii) Each and subsequent Coat	Per Sft Per Sft	280,522.00 280,522.00			
9	Providing and fixing 6" thick R.C.C. manhole cover with tee shaped C.I. frame of 22" l/d (frame weighing 37.324 Kg. or one maund as per Standard Drawing STD/PD No. 6, of 1977, complete in all respect.	Each	10.00			
RESTORATION OF ROAD						
10	Dismantling and removing road pavement, etc., including screening and stacking of byproducts upto one chain lead (30 metre).	100Cft	630.00			
11	Rehandling of earthwork: a) Lead upto a single throw of Kassi, phaorah or shovel.	1000Cft	56.00			
12	Compaction of earthwork with power road roller, including ploughing, mixing, moisturing earth to optimum moisture content in layers, etc, complete:- i) 95% to 100% maximum modified AASHO dry density.	1000Cft	56.00			

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BILL OF QUANTITIES**

BILL NO. 1.2: INLET/OUTLET CHANNELS & COLLECTION/ DISTRIBUTION CHAMBERS AND OUTFALL STRUCTURE

Sr. No.	Description	Unit	Quantity	Rate (Rs)		Amount (Rs)
				in Figure	in words	
13	a) Providing and laying sub-base course of stone product of approved quality and grade, including placing, mixing, spreading and compaction of sub-base material to required depth, camber, grade to achieve 100% maximum modified AASHO dry density, including carriage of all material to site of work except gravel and aggregate. ii) Crushed stone aggregate. b) Subsequent carriage of crushed stone aggregate.	100Cft 100Cft	37.00 37.00			
14	a) Providing and laying base course of crushed stone aggregate of approved quality and grade, and supply and spreading of stone screening, including placing, mixing, spreading and compaction of base course material to required depth, camber and grade to achieve 100% maximum modified AASHO dry density, including carriage of all materials to site of work except gravel and aggregate. b) Subsequent carriage of crushed stone aggregate.	100Cft 100Cft	185.00 185.00			
15	Providing and laying bituminous priming coat, using 10 lbs. kerosene oil and 10 lbs. binder per 100 Sft. or 0.5 Kg kerosene and 0.5 Kg binder per square metre	100 Sft.	555.00			
16	a) Providing and laying plant premixed bituminous carpet, including compaction and finishing to required camber, grade and density. iv) 4.5% Bitumen (Rate for 2"thick) b) Subsequent carriage of crushed stone aggregate/bajri,	100 Sft. 100Cft	555.00 94.00			


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BILL NO. 1.2: INLET/OUTLET CHANNELS & COLLECTION/ DISTRIBUTION CHAMBERS AND OUTFALL STRUCTURE

Sr. No.	Description	Unit	Quantity	Rate (Rs)		Amount (Rs)
				in Figure	in words	
17	Transportation of earth all types when the total distance, including the lead covered in the item of work, is more than 1000 ft. (300 m) (This is provisional quantity and will be paid as per actual lead chart to be approved by the Engineer) a) upto ¼ mile (400 m). b) for every 330 ft. (100 m) additional lead or part thereof, beyond ¼ mile (400 m) upto one mile. (1.6 Km.) (Item rate is for total lead of 1200m from 400m to 1.6km.)	1000 Cft.	301.00			
18	Providing and fixing motorized operated penstock gate (including gear and automatic switch) as per B.S.S 7775 of below mentioned size with CI shutter and frame/channel with interior brass channel on bottom and two sides through which gate travels i/c non-magnetic SS spindle with square thread CI head stock and wheel etc complete in all respect as per drawing and directed by the engineer incharge. Penstock Gate Size with clear opening (3'-9" x 3'-9") Penstock Gate Size with clear opening (8'-0" x 6'-0") Penstock Gate Size with clear opening (10'-0" x 7'-9") Penstock Gate Size with clear opening (10'-6" x 5'-0")	1000 Cft.	301.00			
		Each	9.00			
		Each	1.00			
		Each	1.00			
		Each	2.00			

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**CONSTRUCTION OF WASTEWATER TREATMENT PLANT IN NORTH ZONE, SAHIWAL (STAGE -1)
BILL OF QUANTITIES**

BILL NO. 1.2: INLET/OUTLET CHANNELS & COLLECTION/ DISTRIBUTION CHAMBERS AND OUTFALL STRUCTURE

Sr. No.	Description	Unit	Quantity	Rate (Rs)		Amount (Rs)
				in Figure	in words	
19	Supply and fixing Malleable Iron rungs (weight not less than 7.5 kg each) of approved shape, size and section including carriage, embedded in concrete according to correct lines and levels.	Each	62.00			
20	Extra on Earth work excavation if shuttering of wooden vertical planks, struts and beams are to be used at site. Contractor will submit design and drawings for review and approval of the Engineer prior to execute the work. i) 0 ft. to 7.0 ft. depth ii) 7-01 ft. to 15.0 ft.	1000 Cft 1000 Cft	304.00 34.00			
21	Reused of existing Road Pavement Material as sub-Base.	100 Cft	333.00			
Total						

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**CONSTRUCTION OF WASTEWATER TREATMENT PLANT IN NORTH ZONE, SAHIWAL (STAGE -1)
BILL OF QUANTITIES**

BILL NO. 1.3: AREA LIGHTING WORKS OF THE WWTP PLANT SITE

Sr. No.	Description	Unit	Quantity	Rate (Rs)		Amount (Rs)
				in Figure	in words	
	Design, supply, transportation, storage, installation, testing and commissioning of the following items of work, including all material, labour, tools and accessories etc. required for proper completion of each item as per specification, drawings and/or as directed by the Engineer.					
	<u>Road / Street Lighting Poles and Foundations</u>					
1	12m high single arm octagonal shape electric street light pole, made of hot dipped 4.5 mm thick (7 SWG) galvanized steel, tapered from 225 mm at bottom to 100 mm at top, with 1500 mm x 60 mm x 4 mm thick dia. arm for luminaire installation, duly G.I. welded with 470x470x20 mm base plate with the help of 4 no triangular stiffeners 100x350x20 mm of GI sheet, with built in junction box with shutter & one (01) no. 2A SP MCB 10kA breaker, i/c the cost of nuts & J-rag bolts, duly fixed in pre-laid concrete foundation, foundation will be paid additionally as approved and directed by the Engineer Incharge.	Each	45			
2	Road/Street Lighting Pole Foundations including 04 nos. of dia 25mm J-Bolts, PVC long Bends Class (3000 Psi- cylinder strength) concrete, 60 grade reinforced steel, Excavation, Blinding Concrete, Common Backfilling & Bitumen Coating etc. as shown on drawing. Complete in all respect.	Each	45			

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BILL OF QUANTITIES**

BILL NO. 1.3: AREA LIGHTING WORKS OF THE WWTP PLANT SITE

Sr. No.	Description	Unit	Quantity	Rate (Rs)		Amount (Rs)
				in Figure	in words	
3	<p>LED Road Light Fixtures</p> <p>Road Lighting LED Cobra-head Luminaries of 120W and 120 lm/W conforming to IP 66 & IK 08 or above Philips/Osram/Thorn or equivalent with corrosion resistant die casted Aluminum housing, silicon gasket in special groove, UV stable & scratch resistant synthetic materials, thermally hardened glass complete with LED Chip (Philips Lumiled/Cree/Nichia/Osram make or equivalent), programmable LED driver (Harvard/TCI/Lumotech/Philips/VOSSLOH/Schwabe/Lightech make or equivalent), minimum 10kV surge protection rating i/c the cost of all accessories/components required for proper operation, fully flexible for future upgradation and easy replacements for maintenance purposes, bucket elevator charges as approved and directed by the Engineer Incharge.</p>	Each	45			
4	<p>Conduits / Pipes</p> <p>PVC pipe/conduit Class-B 100 mm dia with accessories suitable for laying multi-core cables from pole to pole in trenches/directly burried including excavation.</p>	Rft.	15000			
5	<p>PVC pipe/conduit Class-D 100 mm dia with accessories suitable for laying multi-core cables in trenches/directly burried on road crossings including excavation.</p>	Rft.	1750			

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BILL OF QUANTITIES**

BILL NO. 1.3: AREA LIGHTING WORKS OF THE WWTP PLANT SITE

Sr. No.	Description	Unit	Quantity	Rate (Rs)		Amount (Rs)
				in Figure	in words	
6	Power Cables					
	Supply and erection of copper conductor cables for service connection, in pre-laid pipe/G.I. wire/trenches, etc. (rate for cable only)					
	PVC insulated, PVC sheathed 4 core, 600/1000 volt non armoured cable					
	25 mm (19/0.052")	Rft.	16,500			
	50 mm sq (19/0.072")	Rft.	5,000			
7	Supply and erection of single core PVC insulated copper conductor cables, in pre-laid PVC pipe/M.S. conduit/G.I pipe/wooden strip batten/wooden casing an capping/G.I. wire/trenches (rate for cables only)					
	450/750 volts, PVC insulated:					
	16 mm sq (7/0.064")	Rft.	16,500			
	25 mm sq (19/0.052")	Rft.	5,000			

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Sr. No.	Description	Unit	Quantity	Rate (Rs)		Amount (Rs)
				in Figure	in words	
8	3 Nos. 1 core 2.5 mm ² Cu/PVC 450/750 Voltage grade cable (stranded conductor) (Imported copper shall be used. Verified documentary evidence for source of copper & PVC shall be furnished prior to manufacturing) from junction box to the fitting through the hollow of pole.					
i-	For 12m Pole Design, supply, transportation, storage, installation, testing and commissioning of the following items of work, including all material, labour, tools and accessories etc. required for proper completion of each item as per specification, drawings and/or as directed by the Engineer.	No.	45			
9	<u>Lighting Control Panels</u> Road lighting control panel (LCP) with angle iron frame clad 16 SGW, sheet steel enclosure having high quality powder coated paint. The LCP shall be complete with incoming and outgoing MCCBs, Cu busbars, magnetic contactors, photo-electric switches, meters, indication lights, 16 SWG sheet steel construction with IP 43 protection class, door, locking arrangement etc. and all other accessories as required for quality work.	Each	2.0			

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BILL OF QUANTITIES**

BILL NO. 1.3: AREA LIGHTING WORKS OF THE WWTP PLANT SITE

Sr. No.	Description	Unit	Quantity	Rate (Rs)		Amount (Rs)
				in Figure	in words	
-	LCP Description 1 No. incoming 63 Amp.(adjust.) TP, MCCB, 25 kA, Icu=100%Ics 4 Nos. outgoing 16 Amp. TP MCCBs, 18 kA, Icu=100%Ics 2 No. spare 16 Amp. TP MCCBs, 18 kA, Icu=100%Ics 4 No. 26 Amp. magnetic contactor, AC-3 2 No. spare 26 Amp. magnetic contactor, AC-3 3 No. photo-electric switches a) 1 No. ammeters 0-40 Amp., with selector switch (04 position) and CT of 50/5 Amp b) 09 Nos. indication lights c) 1 No. voltmeter with fuse and 7 position selector switch. d) 3 Ph, N & Earth copper busbars e) Internal wiring & line-up terminals etc. f) Brass cable glands/accessories g) 3 Nos. Auto-Manual-OFF (3 position switches for operation in auto (with photocell) and normal (manual mode- photocell override) h) Panel steel grid painted alongwith locking arrangement i) IP =44/54 panel shall be weather proof, dust proof with studded and shade arrangement on top.					


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BILL NO. 1.3: AREA LIGHTING WORKS OF THE WWTP PLANT SITE

Sr. No.	Description	Unit	Quantity	Rate (Rs)		Amount (Rs)
				in Figure	in words	
10	<u>Earthing Rod</u> Earth point comprising of 10 ft. 5/8" dia. (16 mm dia) copper coated M.S. rods driven in ground near each lighting control panel. The earthing rods shall be completed with fixing clamps etc.	No.	4.0			
Total						

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CONSTRUCTION OF WASTEWATER TREATMENT PLANT (WWTP) IN NORTH ZONE, SAHIWAL (STAGE-1)
BILL OF QUANTITIES

BILL NO 1.4 OFFICE/ LABORATORY BUILDING

Sr. No.	Description	Unit	Quantity	Rate (Rs)		Amount (Rs)
				in Figure	in words	
1	CIVIL WORKS Excavation in foundation of building, bridges and other structures, including dagbelling, dressing, refilling in layers around structure with excavated earth, watering and ramming lead upto one chain (30 m) lift upto 5 ft (1.5m) 1) By Manual ii) Ordinary soil	1000 Cft.	10.92			
2	Spraying termite proofing by using liquid FMC/ Biflex/ Terminex Exin/ Ms Hextar or equivalent @ specified suspension concentrate (SC), Mixing Ability- HEXTAR with Ratio (1:250) =540 Sft or equivalent approved liquid applying with shower and certificate will be provided by the contractor for 10- years complete in all respect. as approved by the Engineer Incharge	Sft	7,139.56			
3	Cement concrete plain including placing, compacting, finishing and curing complete (including screening and washing of stone aggregate). (f) Nominal mix Ratio 1: 2: 4 (h) Nominal mix Ratio 1: 3: 6	100 Cft. 100 Cft.	0.63 3.50			
4	Pacca brick work in foundation and plinth i) Cement, sand mortar Ratio 1 : 3	100 Cft.	11.55			

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BILL OF QUANTITIES**

BILL NO 1.4 OFFICE/ LABORATORY BUILDING

Sr. No.	Description	Unit	Quantity	Rate (Rs)		Amount (Rs)
				in Figure	in words	
5	Providing and laying damp proof course of cement concrete 1:2:4 (cement, sand, shingle), including bitumen coating. (b) with 2 coats of bitumen: i) 1½" thick (40 mm)	100 Sft.	2.83			
6	Providing and laying vertical damp proof course with cement sand plaster and bitumen coating:- (a) with one coat of bitumen and one coat of polythene sheet 500 gauge: ii) Ratio 1:3 b) ¾" thick (20 mm)	100 Sft.	2.33			
7	Pacca brick work in ground floor:- i) cement, sand mortar Ratio 1:3	100 Cft.	19.61			
8	Providing and laying reinforced cement concrete (including prestressed concrete), using Ordinary Portland Cement / Sulphate resisting cement / Slag cement as may be required; coarse sand and screened graded and washed aggregate, in required shape and design, including forms, moulds, shuttering, lifting, compacting, curing, rendering and finishing exposed surface, complete (but excluding the cost of steel reinforcement, its fabrication and placing in position, etc.):-					

CONSTRUCTION OF WASTEWATER TREATMENT PLANT (WWTP) IN NORTH ZONE, SAHIWAL (STAGE-1)
BILL OF QUANTITIES

BILL NO 1.4 OFFICE/ LABORATORY BUILDING

Sr. No.	Description	Unit	Quantity	Rate (Rs)		Amount (Rs)
				in Figure	in words	
9	(a) (i) Reinforced cement concrete in roof slab, beams, columns lintels, girders and other structural members laid in situ or precast laid in position, or prestressed members cast in situ, complete in all respects:- (2) Type B (nominal mix 1: 1½: 3) (a)(iii) Reinforced cement concrete in slab of rafts / strip foundation, base slab of column and retaining walls; etc and other structural members other than those mentioned in 5(a) (i) above not requiring form work (i.e. horizontal shuttering) complete in all respects:- (2) Type B (nominal mix 1: 1½: 3)	Per Cft	734.24			
10	Fabrication of mild steel reinforcement for cement concrete, including cutting, bending, laying in position, making joints and fastenings, including cost of binding wire and labour charges for binding of steel reinforcement (also includes removal of rust from bars):- (c) Deformed bars (Grade-60) Carriage of 100 Cft. (2.83 cu.m) of all materials like stone aggregate, spawl , kankar lime (unslaked), surkhi , etc. or 150 Cft. (4.25 cu.m) of timber, by truck or by any other means owned by the contractor. Lead From nearest quarry (230km)	100 kg	29.41			
11	Cement plaster 1:4 upto 20' (6.00 m) height:- a) 3/8" (10 mm) thick	100 Cft. 100 Sft.	14.66 40.63			

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CONSTRUCTION OF WASTEWATER TREATMENT PLANT (WWTP) IN NORTH ZONE, SAHIWAL (STAGE-1)
BILL OF QUANTITIES

BILL NO 1.4 OFFICE/ LABORATORY BUILDING

Sr. No.	Description	Unit	Quantity	Rate (Rs)		Amount (Rs)
				in Figure	in words	
12	Cement plaster 3/8" (10 mm) thick under soffit of R.C.C. roof slabs only, upto 20' height. c) 1:4	100 Sft.	13.68			
13	Filling, watering and ramming earth under floors:- (i) with surplus earth from foundation, etc. (ii) with new earth excavated from out side, lead upto one chain (30m)	1000 Cft.	1.27			
14	Extra for every 50 ft. (15 m) additional lead or part thereof	1000 Cft.	0.35			
15	i) for earth work soft, ordinary, hard and very heard (up to 1000 ft)	1000 Cft.	7.00			
16	Supplying and filling sand under floor; or plugging in wells. (Provisional as Slect Fill)	100 Cft.	50.39			
17	Dry rrammed brick or stone ballast, 1 1/2" to 2" (40 mm to 50 mm) gauge. Providing and laying superb quality Porcelain glazed tiles flooring of MASTER brand of specified size in approved design,Color and Shade with adhesive/bond over 3/4"thick (1:3) cement plaster i/c the cost of sealer for finishing the joints i/c cutting grinding complete in all respect as approved and directed by the Engineer Incharge. a) Full body Glazed tiles (ii) 600mmx 600 mm	100 Cft.	1.35			
		Per Sft	375.07			

**CONSTRUCTION OF WASTEWATER TREATMENT PLANT (WWTP) IN NORTH ZONE, SAHIWAL (STAGE-1)
BILL OF QUANTITIES**

BILL NO 1.4 OFFICE/ LABORATORY BUILDING

Sr. No.	Description	Unit	Quantity	Rate (Rs)		Amount (Rs)
				in Figure	in words	
18	Providing and laying superb quality Porcelain glazed tiles of Master brand, skirting/dado of specified size, Color and Shade with adhesive/ bond over 1/2" thick (1:2) cement plaster i/c. the cost of and sealer for finishing the joints, cutting grinding complete in all respect as approved and directed by the Engineer Incharge. a) Full body Glazed Tile (ii) 600mm x600 mm	Per Sft	255.19			
19	Single layer of tiles 225 x 113 x 40 mm laid over 100mm earth and 25mm mud plaster without bhoosa grouted with cement sand 1:3 on top of RCC roof slab provided with 1.72kg/sq.m bitumen coating sand blinded.	100 Sft.	12.94			
20	Supplying and laying polythene sheet over D.P.C under floors and on roofs, etc. (i) 300 gauge (0.003" thick)	Per Sft.	1,294.00			
21	Khuras on roof 2'x2'x6" (600 x 600 x 150 mm)	Each	1.00			
22	Bottom Khuras of brick masonry in cement mortar 1:6, 4'x2'x4 1/2" (1200x600x113 mm) over 3" (75 mm) cement concrete 1:4:8.	Each	1.00			
23	Dry brick on edge paving, sand grouted, including preparation of bed by watering, ramming & bringing the same to proper camber, by 1/2" (13 mm) thick mud plaster.	100 Sft.	0.50			

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CONSTRUCTION OF WASTEWATER TREATMENT PLANT (WWTP) IN NORTH ZONE, SAHIWAL (STAGE-1)
BILL OF QUANTITIES

BILL NO 1.4 OFFICE/ LABORATORY BUILDING

Sr. No.	Description	Unit	Quantity	Rate (Rs)		Amount (Rs)
				in Figure	in words	
24	Grouting 4½" (113 mm) dry brick work with cement mortar ratio 1: 5	100 Sft.	0.50			
25	Providing and fixing 1-1/2" thick G.I sheet forged door comprising of G.I pressed double skin pannelled sheet of 22 SWG in specified width of rails, Styles and panels pressed on both sides of fillet (Honey Comb paper), duly fixed in chowkat with Archtrative on one side, with heavy duty 4 No. steel hinges i/c M.S Tower bolt 9" long, M.S Sliding bolt 12" long, Rowel bolt for Hold Fast, duly powder coated paint and punching of required holes as approved and directed by the Engineer Incharge .					
26	Providing and fixing sliding bolt to doors:- iii) brass sliding bolt, 10" (250 mm) long	Per Sft.	28.00			
27	Providing and fixing 1½" (40 mm) thick hollow flush doors and windows with commercial ply (3 ply) on both faces of deodar wood shutter frame 1¼" (30 mm) thick and partial wood braces at about 3" (75 mm) apart and deodar wood lipping 1½"x3/8" (40 mmx10 mm) fixed with M.S. chowkat (frame) including chromium plated fittings, etc. complete in all respects (without sliding bolt or lock):-	Each	5.00			
		Per Sft.	112.00			

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**CONSTRUCTION OF WASTEWATER TREATMENT PLANT (WWTP) IN NORTH ZONE, SAHIWAL (STAGE-1)
BILL OF QUANTITIES**

BILL NO 1.4 OFFICE/ LABORATORY BUILDING

Sr. No.	Description	Unit	Quantity	Rate (Rs)		Amount (Rs)
				in Figure	in words	
28	Providing and fixing 2" wide MS/ GI Chowkat singel/double rebate made of 16 SWG MS sheet pressed/ welded/ supported with M.S. flat 1- 1/4"x1/8" i/c 6"long M.S. Flat 1"x1/8"hold fasts (6-Nos) welded/ screwed, punching of lock hole covered with MS Box,coating with antirust paint including filling with cement sand mortar (1:8) and embedding hold fast in cement concrete (1:2:4) ,complete in all respect as approved and directed by Engineer Incharge.	Per Sft.	112.00			
29	(ii) 10.50 " wide Painting new surface:- c) Preparing surface and painting of doors and windows any type (including edges):- i) priming coat. ii) each subsequent coat of paint. (2 coats)	100 Sft.	2.24			
30	Providing and fitting all types of glazed aluminium windows of anodised bronze colour partly fixed and partly sliding using delux sections of approved manufacturer having frame size of 100 x 30 mm (4"x2 3/4") and leaf frame sections of 50 x 20 mm (2"x2 3/4"), all of 1.6mm thickness including 5 mm thick imported tinted glass with rubber gasket using approved standard latches, hardware etc., as approved by the Engineer in-charge.	Per Sft.	96.00			

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BILL OF QUANTITIES**

BILL NO 1.4 OFFICE/ LABORATORY BUILDING

Sr. No.	Description	Unit	Quantity	Rate (Rs)		Amount (Rs)
				in Figure	in words	
31	Providing and fixing M.S. flat 1/2"x1/8" (13mm x 3mm) grill including 3/4" x 1/8" (20 mmx3 mm) M.S. flat frame, in windows of approved design, including painting three coats, complete in all respects.	Per Sft.	96.00			
32	Priming coat of chalk under distemper.	100 Sft.	27.21			
33	Distemping (a) new surface ii) two coats	100 Sft.	27.21			
34	Cement pointing struck joints, on walls, upto 20' (6.00 m) height:- (external wall) a) ratio 1:2	100 Sft.	11.31			
	PLUMBING WORKS					
35	Providing and fitting glazed earthen ware wash hand basin 56x40cm, including bracket set, waste pipe and waste coupling, etc. ii) coloured, with pedestal	Each	1.00			
36	Providing and fixing stainless steel sink with drain board, size 120x60 cm (48"x24") including bracket set, waste pipe and waste coupling.	Each	1.00			
37	Providing and fixing chromium plated shower rose:- ii) 2x15 cm (3/4"x6")	Each	1.00			

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BILL OF QUANTITIES

BILL NO 1.4 OFFICE/ LABORATORY BUILDING

Sr. No.	Description	Unit	Quantity	Rate (Rs)		Amount (Rs)
				in Figure	in words	
38	Providing and fixing, chromium plated mixing valve, for wash hand basin, sink or shower.	Each	3.00			
39	Providing, laying, cutting, jointing, testing and disinfecting G.I. pipe line in trenches, with socket joints, using G.I pipes of B.S.S. 1387-1967 complete in all respects with specials and valves:- ii) Medium Quality b) ¾" i/d (20 mm) 2.65mm thick c) 1" i/d (25 mm) 3.25mm thick	Per Rft. Per Rft.	20.00 20.00			
40	Providing and fitting glazed earthen ware water closet, squatter type, combined with foot rest. ii) coloured	Each	1.00			
41	Providing and fitting plastic made low down flushing cistern 1363 liters (3 gallons) capacity, including bracket set, copper connection etc., complete. ii) coloured	Each	1.00			
42	Providing and fixing looking glass 55x40 cm size and 5mm thick, first quality	Each	1.00			
43	Providing and fitting i) Plastic Soap Dish ii) Plastic toilet paper holder iii) Plastic towel rail iv) Plastic shelf 60X13cm with bracket and railing	Each Each Each Each	1.00 1.00 1.00 1.00			

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BILL OF QUANTITIES

BILL NO 1.4 OFFICE/ LABORATORY BUILDING

Sr. No.	Description	Unit	Quantity	Rate (Rs)		Amount (Rs)
				in Figure	in words	
44	Providing and fixing chromium plated bib cock i) 2 cm (3/4")	Each	4.00			
45	Providing, fixing, testing and commissioning of μ -PVC (Unplasticized polyvinyl Chloride) Nikasi/ waste pipe Fittings make of Dadex /Popular/Beta or equivalent, conforming to code EN-1329 including the cost of Solvents complete in all respect as approved and directed by the Engineer Incharge.	Each	2.00			
46	b) Multi-Trap (i) 4" dia Providing and fitting gully trap, including cement concrete, cost of PVC grating 15x15cm and masonry chamber 30x30cm.	Each	2.00			
47	Providing, laying, testing and commissioning of POLYPROPYLENE RANDOM COPOLYMER (PPRC) water supply pipe (Dadex/ Popular/ Beta or equivalent)with specified pressure rating PN (PRESSURE NOMINAL) and conforming to DIN 8077. 8078 code i/c cost of solvent, specials, making jharries complete in all respect as approved and directed by Engineer Incharge.(Internal/External Diameters mentioned). c) PN-25 pipe (ii) (5/8") 25 mm (iii) (3/4") 32 mm	Per Rft Per Rft	70.40 16.00			

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BILL OF QUANTITIES**

BILL NO 1.4 OFFICE/ LABORATORY BUILDING

Sr. No.	Description	Unit	Quantity	Rate (Rs)		Amount (Rs)
				in Figure	in words	
48	Providing, fixing, testing and commissioning of μ -PVC (Unplasticized Polyvinyl Chloride) Nikasi/ waste pipe make of Dadex/ Popular/ Beta or equivalent, plain/ socket ended conforming to code EN-1329 of specified SDR (Standard Dimension Ratio) including the cost of specials and Solvents complete in all respect as approved and directed by the Engineer Incharge. Type (SDR 32.5/SN-8) (iv) 3"(85 mm) (v) 4"(110 mm) (vi) 6"(160 mm)	Per Rft. Per Rft. Per Rft.	20.00 12.00 15.00			
49	Providing, fixing, testing and commissioning of μ -PVC (Unplasticized polyvinyl Chloride) Nikasi/ waste pipe Fittings make of Dadex/ Popular/ Beta or equivalent, conforming to code EN-1329 including the cost of Solvents complete in all respect as approved and directed by the Engineer Incharge. a) P-Trap (i) 4" dia	Each	1.00			
50	ELECTRICAL WORKS WIRING AND ACCESSORIES					
50.1	Wiring of light or fan point from switch to the point with 7/0.74 mm mm (3/0.029") PVC insulated single core cables in PVC pipes concealed in walls, columns and slabs including accessories, PVC box, 10 Amp. gang switch 1 or 2 way as required, one for each light or fan and installed as in specifications.	Each	16.00			

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BILL OF QUANTITIES

BILL NO 1.4 OFFICE/ LABORATORY BUILDING

Sr. No.	Description	Unit	Quantity	Rate (Rs)		Amount (Rs)
				in Figure	in words	
50.2	Circuit wiring from MCBs board to gang switches board with 3x7/0.74 mm (7/0.029") PVC insulated single core cables in appropriate size PVC conduit.	Each	5.00			
50.3	The same as item No. 1.1 but from one light point to another light point.	Each	12.00			
50.4	5 Amp 2/3 pin universal flush mounting switch socket unit away from switch board and wired with 3x7/0.91mm (7/0.036") single core cable from nearest circuit available in PVC concealed conduits or trunking including all conduit accessories as required complete in all respect.	Each	4.00			
50.5	The same as item No.1.4 but wiring from one socket to another socket with 3x7/0.74 mm (7/0.029") single core cable	Each	4.00			
50.6	The same as item No. 1.4 but wiring of 15/20A, 3-pin flush mounting switch socket unit wired with 3x7/1.12mm (7/0.044") single core cable wires starting from D.B.	Each	4.00			

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BILL OF QUANTITIES

BILL NO 1.4 OFFICE/ LABORATORY BUILDING

Sr. No.	Description	Unit	Quantity	Rate (Rs)		Amount (Rs)
				in Figure	in words	
51.0	<u>Power Cables</u>					
51.1	Supply and erection of copper conductor cables for service connection, in prelaid pipe/G.I. wire/trenches, etc. (rate for cable only)					
(a)	PVC insulated, PVC sheathed 4 core, 600/1000 volt non armoured cable 10 mm (7/0.052")	Rft.	100.00			
51.2	Supply and erection of single core PVC insulated copper conductor cables, in prelaid PVC pipe/M.S. conduit/G.I. pipe/wooden strip batten/wooden casing and capping/G.I. wire/trenches (rate for cables only)					
(a)	450/750 volts, PVC insulated: 10 mm sq (7/0.052")	Rft.	100.00			
52.0	<u>Conduits / Pipes</u>					
52.1(a)	PVC pipe/conduit Class-B 100 mm dia with accessories suitable for laying multi-core cables from pole to pole in trenches/directly buried including excavation.	Rft.	80			

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BILL OF QUANTITIES**

BILL NO 1.4 OFFICE/ LABORATORY BUILDING

Sr. No.	Description	Unit	Quantity	Rate (Rs)		Amount (Rs)
				in Figure	in words	
53.0	<u>ELECTRIC FAN</u> Providing and fixing Copper winded Exhaust fan with louver and shutter made of Pak/Younas/G.F.C. i/c the cost of necessary cable and hardware for connection from ceiling rose complete as approved and directed by Engineer Incharge.	Each	2			
53.1	Plastic Body 12" dia Supply, transportation at site, storage, installation, testing and commissioning of the following items of work (unless specifically stated otherwise) including all material, labour, tools and accessories etc. required for proper completion of each item as per specification and drawings and/or as directed by the Engineer.					
54.0	<u>LIGHT FITTINGS AND FANS</u>					
54.1	Following LED Luminaries of suitable wattage make Philips, GE, Pierlite or approved equivalent suitable for the project requirements. Contractor to submit lighting design calculation to determine the adequacy of the wattage and should adjust the number of LEDs/wattage as per project lighting requirements. The fitting shall be approved by the Engineer.					

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BILL OF QUANTITIES**

BILL NO 1.4 OFFICE/ LABORATORY BUILDING

Sr. No.	Description	Unit	Quantity	Rate (Rs)		Amount (Rs)
				in Figure	in words	
(a)	Light Fixture Type LED Batten surface mounted, 18W complete in all respect with allied accessories make Philips, GE, Pierlite or approved equivalent. The fitting shall be approved by the Engineer.	Each	8.00			
(b)	Light Fixture Type LED Batten surface mounted, 10W above mirror in toilets complete in all respect with allied accessories make Philips, GE, Pierlite or approved equivalent. The fitting shall be approved by the Engineer.	Each	1.00			
54.2	Wall bracket Light Fixture Type LED 6W energy saving lamp with holder and complete in all respect with allied accessories make Philips, GE, Pierlite or approved equivalent. The fitting shall be approved by the Engineer.	Each	8.00			
54.3	20W LED Water tight light fixture IP 65 complete in all respect with all allied accessories or approved equivalent. The fitting shall be approved by the Engineer.	Each	6.00			
54.4	Light Fixture Type LED surface mounted down lighter, 6W complete in all respect with allied accessories make Philips, GE, Pierlite or approved equivalent. The fitting shall be approved by the Engineer.	Each	1.00			
54.5	56" ceiling fan sweep (Climax, Pak, Milliat) make or approved equivalent.	Each	2.00			

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BILL OF QUANTITIES

BILL NO 1.4 OFFICE/ LABORATORY BUILDING

Sr. No.	Description	Unit	Quantity	Rate (Rs)		Amount (Rs)
				in Figure	in words	
54.6	Wall Bracket fan 20" sweep make (Royal, Pak, GFC or approved equivalent) capacitor type, copper winding complete with all required accessories etc.	Each	2.00			
55.0	<u>DISTRIBUTION BOARDS</u> D.Bs with TP incoming adjustable moulded case circuit breaker and SP miniature outgoing circuit breakers, Panel box SWG 16 powder coated RAL colour 7032, IP class 44 and with all accessories. alongwith all installation and operational accessories as per specification or as shown on the drawings.	Each				
55.1	<u>D B- Operator Quarter</u> <u>MATERIAL</u> 01 No. 32 Amps (Adj.) MCCB TP, RC=25kA, Icu=100% 06 No. outgoing 10A, MCB, SP, RC=10kA, Icu=100%Ics 03 Nos.outgoing 20A, MCB, SP, RC=10kA, Icu=100%Ics 03 Nos. Spare 10/20A, MCB, SP, RC=10kA, Icu=100%Ics 02 Nos. Space for 10/20A, MCB Indication lights, push buttons, digital ammeter with selector switch, digital voltmeter with selector switch, Panel box SWG 16 powder coated RAL colour 7032, IP class 44 and with all accessories.	Each	1.00			

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BILL OF QUANTITIES**

BILL NO 1.4 OFFICE/ LABORATORY BUILDING

Sr. No.	Description	Unit	Quantity	Rate (Rs)		Amount (Rs)
				in Figure	in words	
56.0	<u>EARTHING AND BONDING</u>					
56.1	Earth point comprising of 10 ft. 5/8" dia. (16 mm dia) copper coated M.S. rods driven in ground. The earthing rods shall be completed with fixing clamps etc.	No.	2.00			
Total						

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CONSTRUCTION OF WASTEWATER TREATMENT PLANT (WWTP) IN NORTH ZONE, SAHIWAL (STAGE-1)
BILL OF QUANTITIES

BILL NO 1.5 STAFF BUILDING

Sr. No.	Description	Unit	Quantity	Rate (Rs)		Amount (Rs)
				in Figure	in words	
1	Excavation in foundation of building, bridges and other structures, including dagbelling, dressing, refilling in layers around structure with excavated earth, watering and ramming lead upto one chain (30 m)lift upto 5 ft (1.5m) 1) By Manual ii) Ordinary soil	1000 Cft.	4.21			
2	Spraying termite proofing by using liquid FMC/ Biflex/ Terminex Exin/ Ms Hextar or equivalent @ specified suspension concentrate (SC), Mixing Ability- HEXTAR with Ratio (1:250) =540 Sft or equivalent approved liquid applying with shower and certificate will be provided by the contractor for 10- years complete in all respect. as approved by the Engineer Incharge	Sft	3,073.55			
3	Cement concrete plain including placing, compacting, finishing and curing complete (including screening and washing of stone aggregate). (f) Nominal mix Ratio 1 : 2 : 4 (h) Nominal mix Ratio 1 : 3 : 6	100 Cft. 100 Cft.	1.04 3.64			
4	Pacca brick work in foundation and plinth i) Cement, sand mortar Ratio 1 : 3	100 Cft.	7.83			

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BILL OF QUANTITIES**

BILL NO 1.5 STAFF BUILDING

Sr. No.	Description	Unit	Quantity	Rate (Rs)		Amount (Rs)
				in Figure	in words	
5	Providing and laying damp proof course of cement concrete 1:2:4 (cement, sand, shingle), including bitumen coating. (b) with 2 coats of bitumen: i) 1½" thick (40 mm)	100 Sft.	1.80			
6	Providing and laying vertical damp proof course with cement sand plaster and bitumen coating:- (a) with one coat of bitumen and one coat of polythene sheet 500 gauge: ii) Ratio 1:3 b) ¾" thick (20 mm)	100 Sft.	1.45			
7	Pacca brick work in ground floor:- i) cement, sand mortar Ratio 1:3	100 Cft.	8.72			
8	Providing and laying reinforced cement concrete (including prestressed concrete), using Ordinary Portland Cement / Sulphate resisting cement / Slag cement as may be required; coarse sand and screened graded and washed aggregate, in required shape and design, including forms, moulds, shuttering, lifting, compacting, curing, rendering and finishing exposed surface, complete (but excluding the cost of steel reinforcement, its fabrication and placing in position, etc.);-					

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BILL OF QUANTITIES

BILL NO 1.5 STAFF BUILDING

Sr. No.	Description	Unit	Quantity	Rate (Rs)		Amount (Rs)
				in Figure	in words	
9	(a) (i) Reinforced cement concrete in roof slab, beams, columns lintels, girders and other structural members laid in situ or precast laid in position, or prestressed members cast in situ, complete in all respects:- (2) Type B (nominal mix 1: 1½: 3) (a)(iii) Reinforced cement concrete in slab of rafts / strip foundation, base slab of column and retaining walls; etc and other structural members other than those mentioned in 5(a) (i) above not requiring form work (i.e. horizontal shuttering) complete in all respects:- (2) Type B (nominal mix 1: 1½: 3) Fabrication of mild steel reinforcement for cement concrete, including cutting, bending, laying in position, making joints and fastenings, including cost of binding wire and labour charges for binding of steel reinforcement (also includes removal of rust from bars):- (c) Deformed bars (Grade-60)	Per Cft	430.63			
10	Carriage of 100 Cft. (2.83 cu.m) of all materials like stone aggregate, spawl , kankar lime (unslaked), surkhi , etc. or 150 Cft. (4.25 cu.m) of timber, by truck or by any other means owned by the contractor. Lead From nearest quarry (230km)	100 kg	15.02			
11	Cement plaster 1:4 upto 20' (6.00 m) height:- a) 3/8" (10 mm) thick	100 Cft	10.30			
		100 Sft.	27.35			

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BILL OF QUANTITIES**

BILL NO 1.5 STAFF BUILDING

Sr. No.	Description	Unit	Quantity	Rate (Rs)		Amount (Rs)
				in Figure	in words	
12	Cement plaster 3/8" (10 mm) thick under soffit of R.C.C. roof slabs only, upto 20' height. c) 1:4	100 Sft.	7.63			
13	Filling, watering and ramming earth under floors:- (i) with surplus earth from foundation, etc. (ii) with new earth excavated from out side, lead upto one chain (30m)	1000 Cft.	0.94			
14	Extra for every 50 ft. (15 m) additional lead or part thereof i) for earth work soft, ordinary, hard and very heard (up to 1000 ft)	1000 Cft.	1.73			
15	Supplying and filling sand under floor; or plugging in wells. (Provisional as Slect Fill)	100 Cft.	13.36			
16	Dry rrammed brick or stone ballast, 1½" to 2" (40 mm to 50 mm) gauge.	100 Cft.	2.23			
17	Providing and laying superb quality Porcelain glazed tiles flooring of MASTER brand of specified size in approved design, Color and Shade with adhesive/bond over 3/4" thick (1:3) cement plaster i/c the cost of sealer for finishing the joints i/c cutting grinding complete in all respect as approved and directed by the Engineer Incharge. a) Full body Glazed tiles (ii) 600mmx 600 mm	100 Sft.	625.44			

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BILL OF QUANTITIES

BILL NO 1.5 STAFF BUILDING

Sr. No.	Description	Unit	Quantity	Rate (Rs)		Amount (Rs)
				in Figure	in words	
18	Providing and laying superb quality Porcelain glazed tiles of Master brand, skirting/dado of specified size, Color and Shade with adhesive/ bond over 1/2" thick (1:2) cement plaster i/c the cost of and sealer for finishing the joints, cutting grinding complete in all respect as approved and directed by the Engineer Incharge. a) Full body Glazed Tile (ii) 600mm x600 mm	100 Sft.	219.86			
19	Single layer of tiles 225 x 113 x 40 mm laid over 100mm earth and 25mm mud plaster without bhoosa grouted with cement sand 1:3 on top of RCC roof slab provided with 1.72kg/sq.m bitumen coating sand blinded.	100 Sft.	7.28			
20	Supplying and laying polythene sheet over D.P.C under floors and on roofs, etc. (i) 300 gauge (0.003" thick)	Per Sft.	728.00			
21	Khuras on roof 2'x2'x6" (600 x 600 x 150 mm)	Each	1.00			
22	Bottom Khuras of brick masonry in cement mortar 1:6, 4'x2'x4 1/2" (1200x600x113 mm) over 3" (75 mm) cement concrete 1:4:8.	Each	1.00			

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**CONSTRUCTION OF WASTEWATER TREATMENT PLANT (WWTP) IN NORTH ZONE, SAHIWAL (STAGE-1)
BILL OF QUANTITIES**

BILL NO 1.5 STAFF BUILDING

Sr. No.	Description	Unit	Quantity	Rate (Rs)		Amount (Rs)
				in Figure	in words	
23	Providing and fixing M.S. sheet hollow pressed frame of doors, windows, C. windows, etc. (chowkat only) of 20 SWG welded with M.S. flat 6"x 1¼" x 1/8" (150 mmx30mmx3mm) M.S. holdfast 9"x1"x1/8" (225mmx25mmx3mm) welded/screwed 4" (100 mm) long iron hinges, including filling chowkat with cement sand mortar 1:8 and embedding holdfast in cement concrete 1:2:4, complete in all respects: a) single rebate b) double rebate	Per Sft. Per Sft.	91.00 21.00			
24	Providing and fixing 1½" (40 mm) thick hollow flush doors and windows with commercial ply (3 ply) on both faces of deodar wood shutter frame 1¼" (30 mm) thick and partial wood braces at about 3" (75 mm) apart and deodar wood lipping 1½"x3/8" (40 mmx10 mm) fixed with M.S. chowkat (frame) including chromium plated fittings, etc. complete in all respects (without sliding bolt or lock):- Dry brick on edge paving, sand grouted, including preparation of bed by watering, ramming & bringing the same to proper camber, by ½" (13 mm) thick mud plaster.	Per Sft.	112.00			
25		100 Sft.	2.19			
26	Grouting 4½" (113 mm) dry brick work with cement mortar ratio 1: 5	100 Sft.	2.19			
27	Providing and fixing sliding bolt to doors:- iii) brass sliding bolt, 10" (250 mm) long	Each	5.00			

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CONSTRUCTION OF WASTEWATER TREATMENT PLANT (WWTP) IN NORTH ZONE, SAHIWAL (STAGE-1)
BILL OF QUANTITIES

BILL NO 1.5 STAFF BUILDING

Sr. No.	Description	Unit	Quantity	Rate (Rs)		Amount (Rs)
				in Figure	in words	
28	Painting new surface:- c) Preparing surface and painting of doors and windows any type (including edges):- i) priming coat. ii) each subsequent coat of paint. (2 coats)	100 Sft.	2.24			
29	Providing and fitting all types of glazed aluminium windows of anodised bronze colour partly fixed and partly sliding using delux sections of approved manufacturer having frame size of 100 x 30 mm (4"x $\frac{3}{4}$ ") and leaf frame sections of 50 x 20 mm (2"x $\frac{3}{4}$ "), all of 1.6mm thickness including 5 mm thick imported tinted glass with rubber gasket using approved standard latches, hardware etc., as approved by the Engineer in-charge.	Per Sft.	96.00			
30	Providing and fixing M.S. flat $\frac{1}{2}$ "x1/8" (13mm x 3mm) grill including $\frac{3}{4}$ " x 1/8" (20 mmx3 mm) M.S. flat frame, in windows of approved design, including painting three coats, complete in all respects.	Per Sft.	96.00			
31	Priming coat of chalk under distemper.	100 Sft.	22.65			
32	Distemping (a) new surface ii) two coats	100 Sft.	22.65			
33	Cement pointing struck joints, on walls, upto 20' (6.00 m) height:- (external wall) a) ratio 1:2	100 Sft.	22.20			Prepared by:

CONSTRUCTION OF WASTEWATER TREATMENT PLANT (WWTP) IN NORTH ZONE, SAHIWAL (STAGE-1)
BILL OF QUANTITIES

BILL NO 1.5 STAFF BUILDING

Sr. No.	Description	Unit	Quantity	Rate (Rs)		Amount (Rs)
				in Figure	in words	
PLUMBING WORKS						
34	Providing and fitting glazed earthen ware wash hand basin 56x40cm, including bracket set, waste pipe and waste coupling, etc. ii) coloured, with pedestal	Each	1.00			
35	Providing and fixing stainless steel sink with drain board, size 120x60 cm (48"x24") including bracket set, waste pipe and waste coupling.	Each	1.00			
36	Providing and fixing chromium plated shower rose:- ii) 2x15 cm (¾"x6")	Each	1.00			
37	Providing and fixing, chromium plated mixing valve, for wash hand basin, sink or shower.	Each	3.00			
38	Providing, laying, cutting, jointing, testing and disinfecting G.I. pipe line in trenches, with socket joints, using G.I pipes of B.S.S. 1387-1967 complete in all respects with specials and valves:- ii) Medium Quality (Provisional) b) ¾" i/d (20 mm) 2.65mm thick c) 1" i/d (25 mm) 3.25mm thick	Per Rft. Per Rft.	26.40 20.00			
39	Providing and fitting glazed earthen ware water closet, squatter type, combined with foot rest. ii) coloured	Each	1.00			

Prepared by:



For and on behalf of
National Engineering Services
Pakistan (Pvt.) Ltd. (NESPAK)

CONSTRUCTION OF WASTEWATER TREATMENT PLANT (WWTP) IN NORTH ZONE, SAHIWAL (STAGE-1)
BILL OF QUANTITIES

BILL NO 1.5 STAFF BUILDING

Sr. No.	Description	Unit	Quantity	Rate (Rs)		Amount (Rs)
				in Figure	in words	
40	Providing and fitting plastic made low down flushing cistern 1363 liters (3 gallons) capacity, including bracket set, copper connection etc., complete. ii) coloured	Each	1.00			
41	Providing and fixing looking glass 55x40 cm size and 5mm thick, first quality	Each	1.00			
42	Providing and fitting i) Plastic Soap Dish ii) Plastic toilet paper holder iii) Plastic towel rail iv) Plastic shelf 60X13cm with bracket and railing	Each Each Each Each Each	1.00 1.00 1.00 1.00 1.00			
43	Providing and fixing chromium plated bib cock i) 2 cm (¾")	Each	4.00			
44	Providing and fixing floor trap of cast iron, including concrete chamber all round, and C.I grating: ii) 10x7.5 cm (4"x3")	Each	2.00			
45	Providing and fitting gully trap, including cement concrete, cost of PVC grating 15x15cm and masonry chamber 30x30cm.	Each	2.00			

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For and on behalf of
National Engineering Services
Pakistan (Pvt.) Ltd. (NESPAK)

**CONSTRUCTION OF WASTEWATER TREATMENT PLANT (WWTP) IN NORTH ZONE, SAHIWAL (STAGE-1)
BILL OF QUANTITIES**

BILL NO 1.5 STAFF BUILDING

Sr. No.	Description	Unit	Quantity	Rate (Rs)		Amount (Rs)
				in Figure	in words	
46	Providing, laying, testing and commissioning of POLYPROPYLENE RANDOM COPOLYMER (PPRC) water supply pipe (Dadex/ Popular/ Beta or equivalent) with specified pressure rating PN (PRESSURE NOMINAL) and conforming to DIN 8077 8078 code i/c cost of solvent, specials, making jharries complete in all respect as approved and directed by Engineer Incharge. (Internal/External Diameters mentioned). c) PN-25 pipe					
	(ii) (5/8") 25 mm	Per Rft	66.00			
	(iii) (3/4") 32 mm	Per Rft	20.00			
47	Providing, fixing, testing and commissioning of μ -PVC (Unplasticized Polyvinyl Chloride) Nikasi/ waste pipe make of Dadex/ Popular/ Beta or equivalent, plain/ socket ended conforming to code EN-1329 of specified SDR (Standard Dimension Ratio) including the cost of specials and Solvents complete in all respect as approved and directed by the Engineer Incharge. Type (SDR 32.5/SN-8)					
	(iv) 3" (85 mm)	Per Rft.	40.00			
	(v) 4" (110 mm)	Per Rft.	15.00			
48	Providing, fixing, testing and commissioning of μ -PVC (Unplasticized polyvinyl Chloride) Nikasi/ waste pipe Fittings make of Dadex/ Popular/ Beta or equivalent, conforming to code EN-1329 including the cost of Solvents complete in all respect as approved and directed by the Engineer. Incharge. a) P-Trap					
	(i) 4" dia	Each	1.00			

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CONSTRUCTION OF WASTEWATER TREATMENT PLANT (WWTP) IN NORTH ZONE, SAHIWAL (STAGE-1)
BILL OF QUANTITIES

BILL NO 1.5 STAFF BUILDING

Sr. No.	Description	Unit	Quantity	Rate (Rs)		Amount (Rs)
				in Figure	in words	
49	<u>ELECTRICAL WORKS</u> <u>WIRING AND ACCESSORIES</u>					
49.1	Wiring of light or fan point from switch to the point with 7/0.74 mm mm (3/0.029") PVC insulated single core cables in PVC pipes concealed in walls, columns and slabs including accessories, PVC box, 10 Amp. gang switch 1 or 2 way as required, one for each light or fan and installed as in specifications.	Each	17.00			
49.2	Circuit wiring from MCBs board to gang switches board with 3x7/0.74 mm (7/0.029") PVC insulated single core cables in appropriate size PVC conduit.	Each	5.00			
49.3	The same as item No. 1.1 but from one light point to another light point.	Each	12.00			
49.4	5 Amp 2/3 pin universal flush mounting switch socket unit away from switch board and wired with 3x7/0.91mm (7/0.036") single core cable from nearest circuit available in PVC concealed conduits or trunking including all conduit accessories as required complete in all respect.	Each	2.00			
49.5	The same as item No.1.4 but wiring from one socket to another socket with 3x7/0.74 mm (7/0.029") single core cable	Each	2.00			

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CONSTRUCTION OF WASTEWATER TREATMENT PLANT (WWTP) IN NORTH ZONE, SAHIWAL (STAGE-1)
BILL OF QUANTITIES

BILL NO 1.5 STAFF BUILDING

Sr. No.	Description	Unit	Quantity	Rate (Rs)		Amount (Rs)
				in Figure	in words	
49.6	The same as item No. 1.4 but wiring of 15/20A, 3-pin flush mounting switch socket unit wired with 3x7/1.12mm (7/0.044") single core cable wires starting from D.B.	Each	3.00			
50.0	<u>Power Cables</u>					
50.1	Supply and erection of copper conductor cables for service connection, in prelaid pipe/G.I. wire/trenches, etc. (rate for cable only)					
(a)	PVC insulated, PVC sheathed 4 core, 600/1000 volt non armoured cable					
	10 mm (7/0.052")	Rft.	100.00			
50.2	Supply and erection of single core PVC insulated copper conductor cables, in prelaid PVC pipe/M.S. conduit/G.I. pipe/wooden strip batten/wooden casing and capping/G.I. wire/trenches (rate for cables only)					
(a)	450/750 volts, PVC insulated:					
	10 mm sq (7/0.052")	Rft.	100.00			

Prepared by:



For and on behalf of
National Engineering Services
Pakistan (Pvt.) Ltd. (NESPAK)

CONSTRUCTION OF WASTEWATER TREATMENT PLANT (WWTP) IN NORTH ZONE, SAHIWAL (STAGE-1)
BILL OF QUANTITIES

BILL NO 1.5 STAFF BUILDING

Sr. No.	Description	Unit	Quantity	Rate (Rs)		Amount (Rs)
				in Figure	in words	
51.0	<u>Conduits / Pipes</u>					
51.1(a)	PVC pipe/conduit Class-B 100 mm dia with accessories suitable for laying multi-core cables from pole to pole in trenches/directly buried including excavation.	Rft.	80.00			
52.0	<u>ELECTRIC FAN</u>					
52.1	Providing and fixing Copper winded Exhaust fan with louver and shutter made of Pak/Younas/G.F.C. i/c the cost of necessary cable and hardware for connection from ceiling rose complete as approved and directed by Engineer Incharge.	Each	2.00			
	Plastic Body 12" dia Supply, transportation at site, storage, installation, testing and commissioning of the following items of work (unless specifically stated otherwise) including all material, labour, tools and accessories etc. required for proper completion of each item as per specification and drawings and/or as directed by the Engineer.					

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CONSTRUCTION OF WASTEWATER TREATMENT PLANT (WWTP) IN NORTH ZONE, SAHIWAL (STAGE-1)
BILL OF QUANTITIES

BILL NO 1.5 STAFF BUILDING

Sr. No.	Description	Unit	Quantity	Rate (Rs)		Amount (Rs)
				in Figure	in words	
53.0	<u>LIGHT FITTINGS AND FANS</u>					
53.1	Following LED Luminaries of suitable wattage make Philips, GE, Pierlite or approved equivalent suitable for the project requirements. Contractor to submit lighting design calculation to determine the adequacy of the wattage and should adjust the number of LEDs/wattage as per project lighting requirements. The fitting shall be approved by the Engineer.	Each	7.00			
(a)	Light Fixture Type LED Batten surface mounted, 18W complete in all respect with allied accessories make Philips, GE, Pierlite or approved equivalent. The fitting shall be approved by the Engineer.	Each	1.00			
(b)	Light Fixture Type LED Batten surface mounted, 10W above mirror in toilets complete in all respect with allied accessories make Philips, GE, Pierlite or approved equivalent. The fitting shall be approved by the Engineer.	Each	4.00			
53.2	Wall bracket Light Fixture Type LED 6W energy saving lamp with holder and complete in all respect with allied accessories make Philips, GE, Pierlite or approved equivalent. The fitting shall be approved by the Engineer.	Each				

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For and on behalf of
National Engineering Services
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**CONSTRUCTION OF WASTEWATER TREATMENT PLANT (WWTP) IN NORTH ZONE, SAHIWAL (STAGE-1)
BILL OF QUANTITIES**

BILL NO 1.5 STAFF BUILDING

Sr. No.	Description	Unit	Quantity	Rate (Rs)		Amount (Rs)
				in Figure	in words	
53.3	20W LED Water tight light fixture IP 65 complete in all respect with all allied accessories or approved equivalent. The fitting shall be approved by the Engineer.	Each	5.00			
53.4	Light Fixture Type LED surface mounted down lighter, 6W complete in all respect with allied accessories make Philips, GE, Pierlite or approved equivalent. The fitting shall be approved by the Engineer.	Each	2.00			
53.5	56" ceiling fan sweep (Climax, Pak, Millat) make or approved equivalent.	Each	2.00			
53.6	Wall Bracket fan 20" sweep make (Royal, Pak, GFC or approved equivalent) capacitor type, copper winding complete with all required accessories etc.	Each	1.00			
54.0	<u>DISTRIBUTION BOARDS</u> D.Bs with TP incoming adjustable moulded case circuit breaker and SP miniature outgoing circuit breakers, Panel box SWG 16 powder coated RAL colour 7032, IP class 44 and with all accessories. alongwith all installation and operational accessories as per specification or as shown on the drawings.					


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For and on behalf of
National Engineering Services
Private Limited (NESPAK)

CONSTRUCTION OF WASTEWATER TREATMENT PLANT (WWTP) IN NORTH ZONE, SAHIWAL (STAGE-1)
BILL OF QUANTITIES

BILL NO 1.5 STAFF BUILDING

Sr. No.	Description	Unit	Quantity	Rate (Rs)		Amount (Rs)
				in Figure	in words	
54.1	<p>D B- Staff Building</p> <p>MATERIAL</p> <ul style="list-style-type: none"> - 01 No. 25 Amps (Adj.), MCCB TP, RC=25kA, Icu=100% - 06 No. outgoing 10A, MCB, SP, RC=10kA, Icu=100%/lcs - 03 Nos.outgoing 20A, MCB, SP, RC=10kA, Icu=100%/lcs - 03 Nos. Spare 10/20A, MCB, SP, RC=10kA, Icu=100%/lcs - 02 Nos. Space for 10/20A, MCB <p>Indication lights, push buttons, digital ammeter with selector switch, digital voltmeter with selector switch, Panel box SWG 16 powder coated RAL colour 7032, IP class 44 and with all accessories.</p>	Each	1.00			
55.0	<p>EARTHING AND BONDING</p>					
55.1	<p>Earth point comprising of 10 ft. 5/8" dia. (16 mm dia) copper coated M.S. rods driven in ground. The earthing rods shall be completed with fixing clamps etc.</p>	No.	2.00			
Total						


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**CONSTRUCTION OF WASTEWATER TREATMENT PLANT IN NORTH ZONE, SAHIWAL (STAGE -1)
BILL OF QUANTITIES**

BILL NO. 1.6: PROVISIONAL SUM

Sr. No.	Description	Unit	Quantity	Rate per Unit (PKR)	Total Amount (PKR)
1	Providing, testing, commissioning and training of wastewater sampling and testing equipment for measuring wastewater pollution parameters like temperature, pH, BOD, COD, TSS, TDS, VSS, Oil & Grease, Turbidity and Alkalinity including all relevant instruments, meters and glass wares complete in all respects as per satisfaction of the Engineer. (PS Item)	PS	-	-	20,000,000
Total Amount					20,000,000

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**CONSTRUCTION OF WASTEWATER TREATMENT PLANT (WWTP) IN NORTH ZONE, SAHIWAL (STAGE-1)
SEWERAGE SYSTEM
BILL OF QUANTITIES**

Bill No. 1.7: Environmental Management Plan (EMP) Implementation

1	General Mitigation Measures	Unit	Quantity	Rate per Unit (PKR)	Total Amount (PKR)
a	Water Bowers for Water Sprinkling	Lumpsum			1,000,000
b	PPEs for Contractor Staff:				
b.i	Dust masks	Nos.	9600	20	192,000
b.ii	Safety Shoes	Nos.	200	3000	600,000
b.iii	Safety Helmet	Nos.	100	1800	180,000
b.iv	Safety Goggles	Nos.	200	500	100,000
b.v	Safety Jackets	Nos.	100	1000	100,000
b.vi	Gloves	Nos.	2400	300	720,000
b.vii	First Aid Box	Nos.	2	5000	10,000
b.viii	Ear Plugs	Nos.	800	100	80,000
2	Traffic Management Provision of Safety Signborads, safety cones, warning tapes etc.				100,000
3	Health and Safety Plan Implementation				
a	Medical screening for workers	Nos.	100	2000	200,000
b	Material Storage, handling and use	No.	1	50,000	50,000
c	Handling/ transportation of hazardous material	Months	24	20,000	480,000
d	Handling of solid waste	Months	24	20,000	480,000
e	Special measures for Covid Management	Lumpsum			300,000
f	Fire extinguishers in case of fire	No.	5	3,500	17,500
	i) DCP fire extinguisher	No.	5	10,000	50,000
	ii)CO2 fire extinguisher	No.	1	20,000	20,000
	iii) Fire alarm	No.	1	20,000	20,000
g	Provision for rental charges of Ambulance including fuel	Months	24	80,000	1,920,000
4	Environmental Monitoring Personnel	months	12	100,000	1,200,000
5	Environmental Laboratory Monitoring Costs <u>Refer table 1.</u>				
6	Capacity Development & Training Programme				
		Lumpsum			4,995,000
	Total				13,294,500

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Section 5 - Eligible Countries

This Section contains the list of eligible countries.

1. Afghanistan
2. Armenia
3. Australia
4. Austria
5. Azerbaijan
6. Bangladesh
7. Belgium
8. Bhutan
9. Brunei Darussalam
10. Cambodia
11. Canada
12. China, People's Republic of
13. Cook Islands
14. Denmark
15. Fiji Islands, Republic of
16. Finland
17. France
18. Georgia
19. Germany
20. Hong Kong, China
21. India
22. Indonesia
23. Ireland
24. Italy
25. Japan
26. Kazakhstan
27. Kiribati
28. Korea, Republic of
29. Kyrgyz, Republic of
30. Lao People's Democratic Republic
31. Luxembourg
32. Malaysia
33. Maldives
34. Marshall Islands
35. Micronesia, Federal States of
36. Mongolia
37. Myanmar
38. Nauru, Republic of
39. Nepal
40. Netherlands
41. New Zealand
42. Niue
43. Norway
44. Pakistan
45. Palau, Republic of
46. Papua New Guinea
47. Philippines
48. Portugal
49. Samoa
50. Singapore
51. Solomon Islands
52. Spain
53. Sri Lanka
54. Sweden
55. Switzerland
56. Tajikistan
57. Taipei, China
58. Thailand
59. Timor-Leste, Democratic Republic of
60. Tonga
61. Turkey
62. Turkmenistan
63. Tuvalu
64. United Kingdom
65. United States of America
66. Uzbekistan
67. Vanuatu
68. Viet Nam

Note: The list of current member countries is also available at <http://www.adb.org/about/members>

Section 6 - Employer's Requirements

This Section contains the Specifications, Drawings, Supplementary Information that describe the Works to be procured, Personnel Requirements, and Equipment Requirements.

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Personnel Requirements	6-Error! Bookmark not defined.
Equipment Requirements	6-6

Specifications

Attached as Annexure-B

NOTE:

The Contractor shall submit a Site-Specific Environmental Management Plan (SSEMP) and Site-Specific Health and Safety Management Plan (SSHSMP) in compliance with PCC, Sub Clause 4.18 and PCC, Sub Clause 6.7 respectively in Section-8.

Drawings

Attached as Annexure-C

Supplementary Information Regarding Works to Be Procured

The bidder shall be required to comply with relevant government regulations and guidelines on COVID-19 prevention and control issued by the Government of Pakistan (<http://covid.gov.pk/guideline>), or in the absence thereof, to international good practice guidelines, such as World Health Organization 2020, Considerations for public health and social measures in the workplace in the context of COVID-19, Geneva available here: <https://www.who.int/publications-detail/considerations-for-public-health-and-social-measures-in-the-workplace-in-the-context-of-covid-19>.

The IEE of the for the subject package is attached.

Initial Environmental Examination (IEE) / Environmental Management Plan (EMP)

Attached as Annexure-D

Personnel Requirements

S/No.	Position	No.	Total Work Experience [years]	Experience In Similar Work [years]
1	Project Manager (Civil Engineer with experience in Construction and management of Waste Water Treatment Plant)	01	15	07
2	Office Engineer	01	10	05
3	Construction Manager/Site Engineer (Civil Engineer)	02	10	05
4	Mechanical Engineer	01	10	07
5	Electrical Engineer	01	10	07
6	Material Engineer	01	15	05
7	Environmentalist /HSE Engineer	01	10	07
8	Planning Engineer	01	10	07
9	Contract Expert	01	15	10
10	Construction Supervisor (DAE-Civil)	02	07	05
11	Quantity Surveyor (DAE-Civil)	01	10	05
12	Surveyor (DAE-Civil)	02	10	05
13	Lab Technician (DAE-Civil)	01	07	05
14	Electrical Supervisor (DAE-Electrical)	01	07	05
15	Mechanical Supervisor (DAE-Mechanical)	01	07	05

Equipment Requirements

S/No.	Equipment Type and Characteristics	Minimum Number Required
1.	Mobile Crane e (50-100 Ton)	01
2.	Concrete Batching Plant	01
3.	Transit Mixer (06-08 Cum)	04
4.	Pneumatic Pump	03
5.	Testing Lab	01
6.	Steel Shuttering	10,000 square meter (m2)
7.	Dumpers	15
8.	Mini Roller	04
9.	Road Roller	08
10.	Vibrators	04
11.	Water Sprinkler and Water Tanker	08
12.	Excavator	06
13.	Tractor with Front Blade and Trolley	04
14.	Loader	06
15.	Jack Hammer	04
16.	Motor Grader	04
17.	Pneumatic Tyred Roller (PTR)	01
18.	Tandem Roller	01
19.	Vibratory Roller	03
20.	Generator 50 KVA	03
21.	Scaffolding	10,000 square meter (m2)
22.	Hydrostatic Test Apparatus	01

Section 7 - General Conditions of Contract

The Conditions of Contract comprise two parts, this Section 7 - General Conditions of Contract (GCC) and the following Section 8 - Particular Conditions of Contract (PCC).

The General Conditions shall be the Conditions of Contract for Construction for Building and Engineering Works Designed by the Employer, Multilateral Development Bank Harmonized Edition, prepared by the Fédération Internationale des Ingénieurs-Conseil, or FIDIC (FIDIC MDB Harmonized Construction Contract) available at [FIDIC MDB June 2010](#). The FIDIC MDB Harmonized Construction Contract is exclusive for the use of ADB Borrowers and their project implementing agencies as provided under the License Agreement dated 9 June 2005, between ADB and FIDIC, and, consequently, no part of this publication may be reproduced, translated, adapted, stored in a retrieval system or communicated, in any form or by any means, whether mechanical, electronic, magnetic, photocopying, recording or otherwise, without prior permission in writing from FIDIC, except by the Employer identified in the contract and only for the exclusive purpose of preparing bidding documents for ADB-financed contracts.

The standard text of the General Conditions chosen must be retained intact to facilitate its reading and interpretation by Bidders and its review by ADB. Any amendments and additions to the GCC, specific to the contract in hand, should be introduced in Section 8 (Particular Conditions of Contract), Part A (Contract Data) and Part B (Special Provisions). Clause numbers in the PCC correspond to those in the GCC. As per GCC 1.5 (Priority of Documents), the PCC takes precedence over the GCC.

Part A (Contract Data) of the PCC includes data to complement the GCC in a manner similar to the way in which the Bid Data Sheet (BDS) complements the Instructions to Bidders (ITB).

Part B (Specific Provisions) is to be used to introduce country- or project-specific provisions, if so required. Whoever drafts the Specific Provisions should be thoroughly familiar with the provisions of the GCC and with any specific requirements of the Contract. Legal advice is recommended when amending provisions or drafting new ones.

The Conditions of Contract have been prepared for an ad measurement (unit price or unit rate) type of contract and cannot be used for other types of contract.

APPENDIX

General Conditions of Dispute Board Agreement

1. Definitions

Each "Dispute Board Agreement" is a tripartite agreement by and between:

- (a) the "Employer";
- (b) the "Contractor"; and
- (c) the "Member" who is defined in the Dispute Board Agreement as being:
 - (i) the sole member of the "DB" and, where this is the case, all references to the "Other Members" do not apply, or
 - (ii) one of the three persons who are jointly called the "DB" (or "dispute board") and, where this is the case, the other two persons are called the "Other Members."

The Employer and the Contractor have entered (or intend to enter) into a contract, which is called the "Contract" and is defined in the Dispute Board Agreement, which incorporates this Appendix. In the Dispute Board Agreement, words and expressions which are not otherwise defined shall have the meanings assigned to them in the Contract.

2. General Provisions

Unless otherwise stated in the Dispute Board Agreement, it shall take effect on the latest of the following dates:

- (a) the Commencement Date defined in the Contract,
- (b) when the Employer, the Contractor, and the Member have each signed the Dispute Board Agreement, or
- (c) when the Employer, the Contractor and each of the Other Members (if any) have respectively each signed a dispute board agreement.

This employment of the Member is a personal appointment. At any time, the Member may give not less than 70 days' notice of resignation to the Employer and to the Contractor, and the Dispute Agreement shall terminate upon the expiry of this period.

3. Warranties

The Member warrants and agrees that he/she is and shall be impartial and independent of the Employer, the Contractor, and the Engineer. The Member shall promptly disclose, to each of them and to the Other Members (if any), any fact or circumstance, which might appear inconsistent with his/her warranty and agreement of impartiality and independence.

When appointing the Member, the Employer and the Contractor relied upon the Member's representations that he/she is

- (a) experienced in the work, which the Contractor is to carry out under the Contract;
- (b) experienced in the interpretation of contract documentation; and
- (c) fluent in the language for communications defined in the Contract.

4. General Obligations of the Member

The Member shall

- (a) have no interest, financial or otherwise, in the Employer, the Contractor or Engineer, nor any financial interest in the Contract except for payment under the Dispute Board Agreement;
- (b) not previously have been employed as a consultant or otherwise by the Employer, the Contractor, or the Engineer, except in such circumstances as were disclosed in writing to the Employer and the Contractor before they signed the Dispute Board Agreement;
- (c) have disclosed in writing to the Employer, the Contractor, and the Other Members (if any), before entering into the Dispute Board Agreement and to his/her best knowledge and recollection, any professional or personal relationships with any director, officer, or employee of the Employer, the Contractor or the Engineer, and any previous involvement in the overall project of which the Contract forms part;
- (d) not, for the duration of the Dispute Board Agreement, be employed as a consultant or otherwise by the Employer, the Contractor, or the Engineer, except as may be agreed in writing by the Employer, the Contractor, and the Other Members (if any);
- (e) comply with the annexed procedural rules and with Subclause 20.4 of the Conditions of Contract;
- (f) not give advice to the Employer, the Contractor, the Employer's Personnel or the Contractor's Personnel concerning the conduct of the Contract, other than in accordance with the annexed procedural rules;
- (g) not, while a Member, enter into discussions or make any agreement with the Employer, the Contractor, or the Engineer regarding employment by any of them, whether as a consultant or otherwise, after ceasing to act under the Dispute Board Agreement;
- (h) ensure his/her availability for all site visits and hearings as are necessary;
- (i) become conversant with the Contract and with the progress of the Works (and of any other parts of the project of which the Contract forms part) by studying all documents received, which shall be maintained in a current working file;
- (j) treat the details of the Contract and all the Dispute Board's activities and hearings as private and confidential, and not publish or disclose them without the prior written consent of the Employer, the Contractor, and the Other Members (if any); and
- (k) be available to give advice and opinions, on any matter relevant to the Contract when requested by both the Employer and the Contractor, subject to the agreement of the Other Members (if any).

5. General Obligations of the Employer and the Contractor

The Employer, the Contractor, the Employer's Personnel and the Contractor's Personnel shall not request advice from or consultation with the Member regarding the Contract, otherwise than in the normal course of the Dispute Board's activities under the Contract and the Dispute Board Agreement. The Employer and the Contractor shall be responsible for compliance with this provision, by the Employer's Personnel and the Contractor's Personnel

respectively.

The Employer and the Contractor undertake to each other and to the Member that the Member shall not, except as otherwise agreed in writing by the Employer, the Contractor, the Member, and the Other Members (if any),

- (a) be appointed as an arbitrator in any arbitration under the Contract;
- (b) be called as a witness to give evidence concerning any dispute before arbitrator(s) appointed for any arbitration under the Contract; or
- (c) be liable for any claims for anything done or omitted in the discharge or purported discharge of the Member's functions, unless the act or omission is shown to have been in bad faith.

The Employer and the Contractor hereby jointly and severally indemnify and hold the Member harmless against and from claims from which he is relieved from liability under the preceding paragraph.

Whenever the Employer or the Contractor refers a dispute to the Dispute Board under Subclause 20.4 of the Conditions of Contract, which will require the Member to make a site visit and attend a hearing, the Employer or the Contractor shall provide appropriate security for a sum equivalent to the reasonable expenses to be incurred by the Member. No account shall be taken of any other payments due or paid to the Member.

6. Payment

The Member shall be paid as follows, in the currency named in the Dispute Board Agreement:

- (a) a retainer fee per calendar month, which shall be considered as payment in full for
 - (i) being available on 28 days' notice for all site visits and hearings;
 - (ii) becoming and remaining conversant with all project developments and maintaining relevant files;
 - (iii) all office and overhead expenses including secretarial services, photocopying and office supplies incurred in connection with his duties; and
 - (iv) all services performed hereunder except those referred to in subparagraphs (b) and (c) of this Clause.

The retainer fee shall be paid with effect from the last day of the calendar month in which the Dispute Board Agreement becomes effective; until the last day of the calendar month in which the Taking-Over Certificate is issued for the whole of the Works.

With effect from the first day of the calendar month following the month in which the Taking-Over Certificate is issued for the whole of the Works, the retainer fee shall be reduced by one third. This reduced fee shall be paid until the first day of the calendar month in which the Member resigns or the Dispute Board Agreement is otherwise terminated.

- (b) a daily fee, which shall be considered as payment in full, for
 - (i) each day or part of a day up to a maximum of 2 days' travel time in each direction for the journey between the Member's home and the site, or another location of a meeting with the Other Members (if

- any);
- (ii) each working day on Site visits, hearings, or preparing decisions; and
 - (iii) each day spent reading submissions in preparation for a hearing.
- (c) all reasonable expenses, including necessary travel expenses (air fare in less than first class, hotel and subsistence, and other direct travel expenses) incurred in connection with the Member's duties, as well as the cost of telephone calls, courier charges, faxes and telexes: a receipt shall be required for each item in excess of five percent (5%) of the daily fee referred to in sub-paragraph (b) of this Clause;
- (d) any taxes properly levied in the Country on payments made to the Member (unless a national or permanent resident of the Country) under this Clause 6.

The retainer and daily fees shall be as specified in the Dispute Board Agreement. Unless it specifies otherwise, these fees shall remain fixed for the first 24 calendar months, and shall thereafter be adjusted by agreement between the Employer, the Contractor, and the Member, at each anniversary of the date on which the Dispute Board Agreement became effective.

If the parties fail to agree on the retainer fee or the daily fee, the appointing entity or official named in the Contract Data shall determine the amount of the fees to be used.

The Member shall submit invoices for payment of the monthly retainer and air fares quarterly in advance. Invoices for other expenses and for daily fees shall be submitted following the conclusion of a site visit or hearing. All invoices shall be accompanied by a brief description of activities performed during the relevant period and shall be addressed to the Contractor.

The Contractor shall pay each of the Member's invoices in full within 56 calendar days after receiving each invoice and shall apply to the Employer (in the Statements under the Contract) for reimbursement of one-half of the amounts of these invoices. The Employer shall then pay the Contractor in accordance with the Contract.

If the Contractor fails to pay to the Member the amount to which he/she is entitled under the Dispute Board Agreement, the Employer shall pay the amount due to the Member and any other amount which may be required to maintain the operation of the Dispute Board; and without prejudice to the Employer's rights or remedies. In addition to all other rights arising from this default, the Employer shall be entitled to reimbursement of all sums paid in excess of one-half of these payments, plus all costs of recovering these sums and financing charges calculated at the rate specified in Subclause 14.8 of the Conditions of Contract.

If the Member does not receive payment of the amount due within 70 days after submitting a valid invoice, the Member may (i) suspend his/her services (without notice) until the payment is received, and/or (ii) resign his/her appointment by giving notice under Clause 7.

7. Termination

At any time, (i) the Employer and the Contractor may jointly terminate the Dispute Board Agreement by giving 42 days' notice to the Member; or (ii) the Member may resign as provided for in Clause 2.

If the Member fails to comply with the Dispute Board Agreement, the Employer and the Contractor may, without prejudice to their other rights, terminate it by notice to the Member. The notice shall take effect when received by the Member.

If the Employer or the Contractor fails to comply with the Dispute Board Agreement, the Member may, without prejudice to his other rights, terminate it by notice to the Employer and the Contractor. The notice shall take effect when received by them both.

Any such notice, resignation and termination shall be final and binding on the Employer, the Contractor, and the Member. However, a notice by the Employer or the Contractor, but not by both, shall be of no effect.

8. Default of the Member

If the Member fails to comply with any of his obligations under Clause 4 (a)-(d) above, he shall not be entitled to any fees or expenses hereunder and shall, without prejudice to their other rights, reimburse each of the Employer and the Contractor for any fees and expenses received by the Member and the Other Members (if any), for proceedings or decisions (if any) of the Dispute Board which are rendered void or ineffective by the said failure to comply.

If the Member fails to comply with any of his obligations under Clause 4 (e) - (k) above, he shall not be entitled to any fees or expenses hereunder from the date and to the extent of the noncompliance and shall, without prejudice to their other rights, reimburse each of the Employer and the Contractor for any fees and expenses already received by the Member, for proceedings or decisions (if any) of the Dispute Board, which are rendered void or ineffective by the said failure to comply.

9. Disputes

Any dispute or claim arising out of or in connection with this Dispute Board Agreement, or the breach, termination, or invalidity thereof, shall be finally settled by institutional arbitration. If no other arbitration institute is agreed, the arbitration shall be conducted under the Rules of Arbitration of the International Chamber of Commerce by one arbitrator appointed in accordance with these Rules of Arbitration.

Procedural Rules

Unless otherwise agreed by the Employer and the Contractor, the Dispute Board shall visit the site at intervals of not more than 140 days, including times of critical construction events, at the request of either the Employer or the Contractor. Unless otherwise agreed by the Employer, the Contractor, and the Dispute Board, the period between consecutive visits shall not be less than 70 days, except as required to convene a hearing as described below.

The timing of and agenda for each site visit shall be as agreed jointly by the Dispute Board, the Employer, and the Contractor, or in the absence of agreement, shall be decided by the Dispute Board. The purpose of site visits is to enable the Dispute Board to become and remain acquainted with the progress of the Works and of any actual or potential problems or claims, and, as far as reasonable, to endeavor to prevent potential problems or claims from becoming disputes.

Site visits shall be attended by the Employer, the Contractor, and the Engineer and shall be coordinated by the Employer in cooperation with the Contractor. The Employer shall ensure the provision of appropriate conference facilities and secretarial and copying services. At the conclusion of each site visit and before leaving the site, the Dispute Board shall prepare a report on its activities during the visit and shall send copies to the Employer and the Contractor.

The Employer and the Contractor shall furnish to the Dispute Board one copy of all documents which the Dispute Board may request, including Contract documents, progress reports, variation instructions, certificates, and other documents pertinent to the performance of the Contract. All communications between the DB and the Employer or the Contractor shall be copied to the other Party. If the Dispute Board comprises three persons, the Employer and the Contractor shall send copies of these requested documents and these communications to each of these persons.

If any dispute is referred to the Dispute Board in accordance with Subclause 20.4 of the Conditions of Contract, the Dispute Board shall proceed in accordance with Subclause 20.4 and these Rules. Subject to the time allowed to give notice of a decision and other relevant factors, the Dispute Board shall

- (a) act fairly and impartially as between the Employer and the Contractor, giving each of them a reasonable opportunity of putting his case and responding to the other's case; and
- (b) adopt procedures suitable to the dispute, avoiding unnecessary delay or expense.

The Dispute Board may conduct a hearing on the dispute, in which event it will decide on the date and place for the hearing and may request that written documentation and arguments from the Employer and the Contractor be presented to it prior to or at the hearing.

Except as otherwise agreed in writing by the Employer and the Contractor, the Dispute Board shall have power to adopt an inquisitorial procedure, to refuse admission to hearings or audience at hearings to any persons other than representatives of the Employer, the Contractor, and the Engineer, and to proceed in the absence of any party who the Dispute Board is satisfied received notice of the hearing; but shall have discretion to decide whether and to what extent this power may be exercised.

The Employer and the Contractor empower the Dispute Board, among other things, to

- (a) establish the procedure to be applied in deciding a dispute;
- (b) decide upon the Dispute Board's own jurisdiction, and as to the scope of any dispute referred to it;

- (c) conduct any hearing as it thinks fit, not being bound by any rules or procedures other than those contained in the Contract and these Guidelines;
- (d) take the initiative in ascertaining the facts and matters required for a decision;
- (e) make use of its own specialist knowledge, if any;
- (f) decide upon the payment of financing charges in accordance with the Contract;
- (g) decide upon any provisional relief such as interim or conservatory measures; and
- (h) open up, review and revise any certificate, decision, determination, instruction, opinion or valuation of the Engineer, relevant to the dispute.

The Dispute Board shall not express any opinions during any hearing concerning the merits of any arguments advanced by the Parties. Thereafter, the Dispute Board shall make and give its decision in accordance with Subclause 20.4, or as otherwise agreed by the Employer and the Contractor in writing. If the Dispute Board comprises three persons:

- (a) it shall convene in private after a hearing, in order to have discussions and prepare its decision;
- (b) it shall endeavour to reach a unanimous decision: if this proves impossible, the applicable decision shall be made by a majority of the Members, who may require the minority Member to prepare a written report for submission to the Employer and the Contractor; and
- (c) if a Member fails to attend a meeting or hearing, or to fulfil any required function, the other two Members may nevertheless proceed to make a decision, unless
 - (i) either the Employer or the Contractor does not agree that they do so, or
 - (ii) the absent Member is the chairman and he/she instructs the other Members to not make a decision.

Conditions of Contract for Construction

MULTILATERAL DEVELOPMENT BANK HARMONISED EDITION

GENERAL CONDITIONS

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FEDERATION INTERNATIONALE DES INGENIEURS-CONSEILS
INTERNATIONAL FEDERATION OF CONSULTING ENGINEERS
INTERNATIONALE VEREINIGUNG BERATENDER INGENIEURE
FEDERACION INTERNACIONAL DE INGENIEROS CONSULTORES

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APPENDIX: GENERAL CONDITIONS OF DISPUTE BOARD AGREEMENT

General Conditions

1 General Provisions

1.1 Definitions

In the Conditions of Contract (“these Conditions”), which include Particular Conditions, Parts A and B, and these General Conditions, the following words and expressions shall have the meanings stated. Words indicating persons or parties include corporations and other legal entities, except where the context requires otherwise.

1.1.1 The Contract

- 1.1.1.1 “Contract” means the Contract Agreement, the Letter of Acceptance, the Letter of Tender, these Conditions, the Specification, the Drawings, the Schedules, and the further documents (if any) which are listed in the Contract Agreement or in the Letter of Acceptance.
- 1.1.1.2 “Contract Agreement” means the contract agreement referred to in Sub-Clause 1.6 [Contract Agreement].
- 1.1.1.3 “Letter of Acceptance” means the letter of formal acceptance, signed by the Employer, of the Letter of Tender, including any annexed memoranda comprising agreements between and signed by both Parties. If there is no such letter of acceptance, the expression “Letter of Acceptance” means the Contract Agreement and the date of issuing or receiving the Letter of Acceptance means the date of signing the Contract Agreement.
- 1.1.1.4 “Letter of Tender” means the document entitled letter of tender or letter of bid, which was completed by the Contractor and includes the signed offer to the Employer for the Works.
- 1.1.1.5 “Specification” means the document entitled specification, as included in the Contract, and any additions and modifications to the specification in accordance with the Contract. Such document specifies the Works.
- 1.1.1.6 “Drawings” means the drawings of the Works, as included in the Contract, and any additional and modified drawings issued by (or on behalf of) the Employer in accordance with the Contract.
- 1.1.1.7 “Schedules” means the document(s) entitled schedules, completed by the Contractor and submitted with the Letter of Tender, as included in the Contract. Such document may include the Bill of Quantities, data, lists, and schedules of rates and/or prices.
- 1.1.1.8 “Tender” means the Letter of Tender and all other documents which the Contractor submitted with the Letter of Tender, as included in the Contract.
- 1.1.1.9 “Bill of Quantities”, “Daywork Schedule” and “Schedule of Payment Currencies” mean the documents so named (if any) which are comprised in the Schedules.
- 1.1.1.10 “Contract Data” means the pages completed by the Employer entitled contract data which constitute Part A of the Particular Conditions.

1.1.2 Parties and Persons

- 1.1.2.1 “Party” means the Employer or the Contractor, as the context requires.

- 1.1.2.2 “Employer” means the person named as employer in the Contract Data and the legal successors in title to this person.
- 1.1.2.3 “Contractor” means the person(s) named as contractor in the Letter of Tender accepted by the Employer and the legal successors in title to this person(s).
- 1.1.2.4 “Engineer” means the person appointed by the Employer to act as the Engineer for the purposes of the Contract and named in the Contract Data, or other person appointed from time to time by the Employer and notified to the Contractor under Sub-Clause 3.4 [Replacement of the Engineer].
- 1.1.2.5 “Contractor’s Representative” means the person named by the Contractor in the Contract or appointed from time to time by the Contractor under Sub-Clause 4.3 [Contractor’s Representative], who acts on behalf of the Contractor.
- 1.1.2.6 “Employer’s Personnel” means the Engineer, the assistants referred to in Sub-Clause 3.2 [Delegation by the Engineer] and all other staff, labour and other employees of the Engineer and of the Employer; and any other personnel notified to the Contractor, by the Employer or the Engineer, as Employer’s Personnel.
- 1.1.2.7 “Contractor’s Personnel” means the Contractor’s Representative and all personnel whom the Contractor utilises on Site, who may include the staff, labour and other employees of the Contractor and of each Subcontractor; and any other personnel assisting the Contractor in the execution of the Works.
- 1.1.2.8 “Subcontractor” means any person named in the Contract as a subcontractor, or any person appointed as a subcontractor, for a part of the Works; and the legal successors in title to each of these persons.
- 1.1.2.9 “DB” means the person or three persons appointed under Sub-Clause 20.2 [Appointment of the Dispute Board] or Sub-Clause 20.3 [Failure to Agree on the Composition of the Dispute Board]
- 1.1.2.10 “FIDIC” means the Fédération Internationale des Ingénieurs-Conseils, the international federation of consulting engineers.
- 1.1.2.11 “Bank” means the financing institution (if any) named in the Contract Data.
- 1.1.2.12 “Borrower” means the person (if any) named as the borrower in the Contract Data.

1.1.3 Dates, Tests, Periods and Completion

- 1.1.3.1 “Base Date” means the date 28 days prior to the latest date for submission of the Tender.
- 1.1.3.2 “Commencement Date” means the date notified under Sub-Clause 8.1 [Commencement of Works].
- 1.1.3.3 “Time for Completion” means the time for completing the Works or a Section (as the case may be) under Sub-Clause 8.2 [Time for Completion], as stated in the Contract Data (with any extension under Sub-Clause 8.4 [Extension of Time for Completion]), calculated from the Commencement Date.
- 1.1.3.4 “Tests on Completion” means the tests which are specified in the Contract or agreed by both Parties or instructed as a Variation, and which are carried out under Clause 9 [Tests on Completion] before the Works or a Section (as the case may be) are taken over by the Employer.
- 1.1.3.5 “Taking-Over Certificate” means a certificate issued under Clause 10 [Employer’s Taking Over].

- 1.1.3.6 “Tests after Completion” means the tests (if any) which are specified in the Contract and which are carried out in accordance with the Specification after the Works or a Section (as the case may be) are taken over by the Employer.
- 1.1.3.7 “Defects Notification Period” means the period for notifying defects in the Works or a Section (as the case may be) under Sub-Clause 11.1 [Completion of Outstanding Work and Remedying Defects], which extends over 365 days except if otherwise stated in the Contract Data (with any extension under Sub-Clause 11.3 [Extension of Defects Notification Period]), calculated from the date on which the Works or Section is completed as certified under Sub-Clause 10.1 [Taking Over of the Works and Sections].
- 1.1.3.8 “Performance Certificate” means the certificate issued under Sub-Clause 11.9 [Performance Certificate].
- 1.1.3.9 “day” means a calendar day and “year” means 365 days.

1.1.4 Money and Payments

- 1.1.4.1 “Accepted Contract Amount” means the amount accepted in the Letter of Acceptance for the execution and completion of the Works and the remedying of any defects.
- 1.1.4.2 “Contract Price” means the price defined in Sub-Clause 14.1 [The Contract Price], and includes adjustments in accordance with the Contract.
- 1.1.4.3 “Cost” means all expenditure reasonably incurred (or to be incurred) by the Contractor, whether on or off the Site, including overhead and similar charges, but does not include profit.
- 1.1.4.4 “Final Payment Certificate” means the payment certificate issued under Sub-Clause 14.13 [Issue of Final Payment Certificate].
- 1.1.4.5 “Final Statement” means the statement defined in Sub-Clause 14.11 [Application for Final Payment Certificate].
- 1.1.4.6 “Foreign Currency” means a currency in which part (or all) of the Contract Price is payable, but not the Local Currency.
- 1.1.4.7 “Interim Payment Certificate” means a payment certificate issued under Clause 14 [Contract Price and Payment], other than the Final Payment Certificate.
- 1.1.4.8 “Local Currency” means the currency of the Country.
- 1.1.4.9 “Payment Certificate” means a payment certificate issued under Clause 14 [Contract Price and Payment].
- 1.1.4.10 “Provisional Sum” means a sum (if any) which is specified in the Contract as a provisional sum, for the execution of any part of the Works or for the supply of Plant, Materials or services under Sub-Clause 13.5 [Provisional Sums].
- 1.1.4.11 “Retention Money” means the accumulated retention moneys which the Employer retains under Sub-Clause 14.3 [Application for Interim Payment Certificates] and pays under Sub-Clause 14.9 [Payment of Retention Money].
- 1.1.4.12 “Statement” means a statement submitted by the Contractor as part of an application, under Clause 14 [Contract Price and Payment], for a payment certificate.

1.1.5 Works and Goods

- 1.1.5.1 “Contractor’s Equipment” means all apparatus, machinery, vehicles and other things required for the execution and completion of the Works and the remedying of any defects. However, Contractor’s Equipment excludes Temporary Works, Employer’s Equipment (if any), Plant, Materials and any other things intended to form or forming part of the Permanent Works.
- 1.1.5.2 “Goods” means Contractor’s Equipment, Materials, Plant and Temporary Works, or any of them as appropriate.
- 1.1.5.3 “Materials” means things of all kinds (other than Plant) intended to form or forming part of the Permanent Works, including the supply-only materials (if any) to be supplied by the Contractor under the Contract.
- 1.1.5.4 “Permanent Works” means the permanent works to be executed by the Contractor under the Contract.
- 1.1.5.5 “Plant” means the apparatus, machinery and other equipment intended to form or forming part of the Permanent Works, including vehicles purchased for the Employer and relating to the construction or operation of the Works.
- 1.1.5.6 “Section” means a part of the Works specified in the Contract Data as a Section (if any).
- 1.1.5.7 “Temporary Works” means all temporary works of every kind (other than Contractor’s Equipment) required on Site for the execution and completion of the Permanent Works and the remedying of any defects.
- 1.1.5.8 “Works” mean the Permanent Works and the Temporary Works, or either of them as appropriate.

1.1.6 Other Definitions

- 1.1.6.1 “Contractor’s Documents” means the calculations, computer programs and other software, drawings, manuals, models and other documents of a technical nature (if any) supplied by the Contractor under the Contract.
- 1.1.6.2 “Country” means the country in which the Site (or most of it) is located, where the Permanent Works are to be executed.
- 1.1.6.3 “Employer’s Equipment” means the apparatus, machinery and vehicles (if any) made available by the Employer for the use of the Contractor in the execution of the Works, as stated in the Specification; but does not include Plant which has not been taken over by the Employer.
- 1.1.6.4 “Force Majeure” is defined in Clause 19 [Force Majeure].
- 1.1.6.5 “Laws” means all national (or state) legislation, statutes, ordinances and other laws, and regulations and by-laws of any legally constituted public authority.
- 1.1.6.6 “Performance Security” means the security (or securities, if any) under Sub-Clause 4.2 [Performance Security].
- 1.1.6.7 “Site” means the places where the Permanent Works are to be executed, including storage and working areas, and to which Plant and Materials are to be delivered, and any other places as may be specified in the Contract as forming part of the Site.
- 1.1.6.8 “Unforeseeable” means not reasonably foreseeable by an experienced contractor by the Base Date.
- 1.1.6.9 “Variation” means any change to the Works, which is instructed or approved as a variation under Clause 13 [Variations and Adjustments].

1.1.6.10 "Notice of Dissatisfaction" means the notice given by either Party to the other under Sub-Clause 20.4 [Obtaining Dispute Board's Decision] indicating its dissatisfaction and intention to commence arbitration.

1.2 Interpretation

In the Contract, except where the context requires otherwise

- (a) words indicating one gender include all genders;
- (b) words indicating the singular also include the plural and words indicating the plural also include the singular;
- (c) provisions including the word "agree", "agreed" or "agreement" require the agreement to be recorded in writing;
- (d) "written" or "in writing" means hand-written, type-written, printed or electronically made, and resulting in a permanent record;
- (e) the word "tender" is synonymous with "bid" and "tenderer" with "bidder" and the words "tender documents" with "bidding documents".

The marginal words and other headings shall not be taken into consideration in the interpretation of these Conditions.

In these Conditions, provisions including the expression "Cost plus profit" require this profit to be one-twentieth (5%) of this Cost unless otherwise indicated in the Contract Data.

1.3 Communications

Wherever these Conditions provide for the giving or issuing of approvals, certificates, consents, determinations, notices, requests and discharges, these communications shall be:

- (a) in writing and delivered by hand (against receipt), sent by mail or courier, or transmitted using any of the agreed systems of electronic transmission as stated in the Contract Data; and
- (b) delivered, sent or transmitted to the address for the recipient's communications as stated in the Contract Data. However:
 - (i) if the recipient gives notice of another address, communications shall thereafter be delivered accordingly; and
 - (ii) if the recipient has not stated otherwise when requesting an approval or consent, it may be sent to the address from which the request was issued.

Approvals, certificates, consents and determinations shall not be unreasonably withheld or delayed. When a certificate is issued to a Party, the certifier shall send a copy to the other Party. When a notice is issued to a Party, by the other Party or the Engineer, a copy shall be sent to the Engineer or the other Party, as the case may be.

1.4 Law and Language

The Contract shall be governed by the law of the country or other jurisdiction stated in the Contract Data.

The ruling language of the Contract shall be that stated in the Contract Data.

The language for communications shall be that stated in the Contract Data. If no language is stated there, the language for communications shall be the ruling language of the Contract.

1.5 Priority of Documents

The documents forming the Contract are to be taken as mutually explanatory of one another. For the purposes of interpretation, the priority of the documents shall be in accordance with the following sequence:

- (a) the Contract Agreement (if any),
- (b) the Letter of Acceptance,
- (c) the Letter of Tender,
- (d) the Particular Conditions – Part A,
- (e) the Particular Conditions – Part B,
- (f) these General Conditions,
- (g) the Specification,
- (h) the Drawings, and
- (i) the Schedules and any other documents forming part of the Contract.

If an ambiguity or discrepancy is found in the documents, the Engineer shall issue any necessary clarification or instruction.

1.6 Contract Agreement

The Parties shall enter into a Contract Agreement within 28 days after the Contractor receives the Letter of Acceptance, unless the Particular Conditions establish otherwise. The Contract Agreement shall be based upon the form annexed to the Particular Conditions. The costs of stamp duties and similar charges (if any) imposed by law in connection with entry into the Contract Agreement shall be borne by the Employer.

1.7 Assignment

Neither Party shall assign the whole or any part of the Contract or any benefit or interest in or under the Contract. However, either Party:

- (a) may assign the whole or any part with the prior agreement of the other Party, at the sole discretion of such other Party, and
- (b) may, as security in favour of a bank or financial institution, assign its right to any moneys due, or to become due, under the Contract.

1.8 Care and Supply of Documents

The Specification and Drawings shall be in the custody and care of the Employer. Unless otherwise stated in the Contract, two copies of the Contract and of each subsequent Drawing shall be supplied to the Contractor, who may make or request further copies at the cost of the Contractor.

Each of the Contractor's Documents shall be in the custody and care of the Contractor, unless and until taken over by the Employer. Unless otherwise stated in the Contract, the Contractor shall supply to the Engineer six copies of each of the Contractor's Documents.

The Contractor shall keep, on the Site, a copy of the Contract, publications named in the Specification, the Contractor's Documents (if any), the Drawings and Variations and other communications given under the Contract. The Employer's Personnel shall have the right of access to all these documents at all reasonable times.

If a Party becomes aware of an error or defect in a document which was prepared for use in executing the Works, the Party shall promptly give notice to the other Party of such error or defect.

1.9 Delayed Drawings or Instructions

The Contractor shall give notice to the Engineer whenever the Works are likely to be delayed or disrupted if any necessary drawing or instruction is not issued to the Contractor within a particular time, which shall be reasonable. The notice shall include details of the necessary drawing or instruction, details of why and by when it should be issued, and the nature and amount of the delay or disruption likely to be suffered if it is late.

If the Contractor suffers delay and/or incurs Cost as a result of a failure of the Engineer to issue the notified drawing or instruction within a time which is reasonable and is specified in the notice with supporting details, the Contractor shall give a further notice to the Engineer and shall be entitled subject to Sub-Clause 20.1 [Contractor's Claims] to:

- (a) an extension of time for any such delay, if completion is or will be delayed, under Sub-Clause 8.4 [Extension of Time for Completion], and
- (b) payment of any such Cost plus profit, which shall be included in the Contract Price.

After receiving this further notice, the Engineer shall proceed in accordance with Sub-Clause 3.5 [Determinations] to agree or determine these matters.

However, if and to the extent that the Engineer's failure was caused by any error or delay by the Contractor, including an error in, or delay in the submission of, any of the Contractor's Documents, the Contractor shall not be entitled to such extension of time, Cost or profit.

1.10 Employer's Use of Contractor's Documents

As between the Parties, the Contractor shall retain the copyright and other intellectual property rights in the Contractor's Documents and other design documents made by (or on behalf of) the Contractor.

The Contractor shall be deemed (by signing the Contract) to give to the Employer a non-terminable transferable non-exclusive royalty-free licence to copy, use and communicate the Contractor's Documents, including making and using modifications of them. This licence shall:

- (a) apply throughout the actual or intended working life (whichever is longer) of the relevant parts of the Works,
- (b) entitle any person in proper possession of the relevant part of the Works to copy, use and communicate the Contractor's Documents for the purposes of completing, operating, maintaining, altering, adjusting, repairing and demolishing the Works, and
- (c) in the case of Contractor's Documents which are in the form of computer programs and other software, permit their use on any computer on the Site and other places as envisaged by the Contract, including replacements of any computers supplied by the Contractor.

The Contractor's Documents and other design documents made by (or on behalf of) the Contractor shall not, without the Contractor's consent, be used, copied or communicated to a third party by (or on behalf of) the Employer for purposes other than those permitted under this Sub-Clause.

1.11 Contractor's Use of Employer's Documents

As between the Parties, the Employer shall retain the copyright and other intellectual property rights in the Specification, the Drawings and other documents made by (or on behalf of) the Employer. The Contractor may, at his cost, copy, use, and obtain communication of these documents for the purposes of the Contract. They shall not, without the Employer's consent, be copied, used or communicated to a third party by the Contractor, except as necessary for the purposes of the Contract.

1.12 Confidential Details

The Contractor's and the Employer's Personnel shall disclose all such confidential and other information as may be reasonably required in order to verify compliance with the Contract and allow its proper implementation.

Each of them shall treat the details of the Contract as private and confidential, except to the extent necessary to carry out their respective obligations under the Contract or to comply with applicable Laws. Each of them shall not publish or disclose any particulars of the Works prepared by the other Party without the previous agreement of the other Party. However, the Contractor shall be permitted to disclose any publicly available information, or information otherwise required to establish his qualifications to compete for other projects.

1.13 Compliance with Laws

The Contractor shall, in performing the Contract, comply with applicable Laws. Unless otherwise stated in the Particular Conditions:

- (a) the Employer shall have obtained (or shall obtain) the planning, zoning, building permit or similar permission for the Permanent Works, and any other permissions described in the Specification as having been (or to be) obtained by the Employer; and the Employer shall indemnify and hold the Contractor harmless against and from the consequences of any failure to do so; and
- (b) the Contractor shall give all notices, pay all taxes, duties and fees, and obtain all permits, licences and approvals, as required by the Laws in relation to the execution and completion of the Works and the remedying of any defects; and the Contractor shall indemnify and hold the Employer harmless against and from the consequences of any failure to do so, unless the Contractor is impeded to accomplish these actions and shows evidence of its diligence.

1.14 Joint and Several Liability

If the Contractor constitutes (under applicable Laws) a joint venture, consortium or other unincorporated grouping of two or more persons:

- (a) these persons shall be deemed to be jointly and severally liable to the Employer for the performance of the Contract;
- (b) these persons shall notify the Employer of their leader who shall have authority to bind the Contractor and each of these persons; and
- (c) the Contractor shall not alter its composition or legal status without the prior consent of the Employer.

1.15 Inspections and Audit by the Bank

The Contractor shall permit the Bank and/or persons appointed by the Bank to inspect the Site and/or the Contractor's accounts and records relating to the performance of the Contract and to have such accounts and records audited by auditors appointed by the Bank if required by the Bank.

2 The Employer

2.1 Right of Access to the Site

The Employer shall give the Contractor right of access to, and possession of, all parts of the Site within the time (or times) stated in the Contract Data. The right and possession may not be exclusive to the Contractor. If, under the Contract, the Employer is required to give (to the Contractor) possession of any foundation, structure, plant or means of access, the Employer shall do so in the time and manner stated in the Specification. However, the Employer may withhold any such right or possession until the Performance Security has been received.

If no such time is stated in the Contract Data, the Employer shall give the Contractor right of access to, and possession of, the Site within such times as required to enable the Contractor to proceed without disruption in accordance with the programme submitted under Sub-Clause 8.3 [Programme].

If the Contractor suffers delay and/or incurs Cost as a result of a failure by the Employer to give any such right or possession within such time, the Contractor shall give notice to the Engineer and shall be entitled subject to Sub-Clause 20.1 [Contractor's Claims] to:

- (a) an extension of time for any such delay, if completion is or will be delayed, under Sub-Clause 8.4 [Extension of Time for Completion], and
- (b) payment of any such Cost plus profit, which shall be included in the Contract Price.

After receiving this notice, the Engineer shall proceed in accordance with Sub-Clause 3.5 [Determinations] to agree or determine these matters.

However, if and to the extent that the Employer's failure was caused by any error or delay by the Contractor, including an error in, or delay in the submission of, any of the Contractor's Documents, the Contractor shall not be entitled to such extension of time, Cost or profit.

2.2 Permits, Licences or Approvals

The Employer shall provide, at the request of the Contractor, such reasonable assistance as to allow the Contractor to obtain properly:

- (a) copies of the Laws of the Country which are relevant to the Contract but are not readily available, and
- (b) any permits, licences or approvals required by the Laws of the Country:
 - (i) which the Contractor is required to obtain under Sub-Clause 1.13 [Compliance with Laws],
 - (ii) for the delivery of Goods, including clearance through customs, and
 - (iii) for the export of Contractor's Equipment when it is removed from the Site.

2.3 Employer's Personnel

The Employer shall be responsible for ensuring that the Employer's Personnel and the Employer's other contractors on the Site:

- (a) co-operate with the Contractor's efforts under Sub-Clause 4.6 [Co-operation], and

- (b) take actions similar to those which the Contractor is required to take under sub-paragraphs (a), (b) and (c) of Sub-Clause 4.8 [Safety Procedures] and under Sub-Clause 4.18 [Protection of the Environment].

2.4 Employer's Financial Arrangements

The Employer shall submit, before the Commencement Date and thereafter within 28 days after receiving any request from the Contractor, reasonable evidence that financial arrangements have been made and are being maintained which will enable the Employer to pay the Contract Price punctually (as estimated at that time) in accordance with Clause 14 [Contract Price and Payment]. Before the Employer makes any material change to his financial arrangements, the Employer shall give notice to the Contractor with detailed particulars.

In addition, if the Bank has notified to the Borrower that the Bank has suspended disbursements under its loan, which finances in whole or in part the execution of the Works, the Employer shall give notice of such suspension to the Contractor with detailed particulars, including the date of such notification, with a copy to the Engineer, within 7 days of the Borrower having received the suspension notification from the Bank. If alternative funds will be available in appropriate currencies to the Employer to continue making payments to the Contractor beyond a date 60 days after the date of Bank notification of the suspension, the Employer shall provide reasonable evidence in his notice of the extent to which such funds will be available.

2.5 Employer's Claims

If the Employer considers himself to be entitled to any payment under any Clause of these Conditions or otherwise in connection with the Contract, and/or to any extension of the Defects Notification Period, the Employer or the Engineer shall give notice and particulars to the Contractor. However, notice is not required for payments due under Sub-Clause 4.19 [Electricity, Water and Gas], under Sub-Clause 4.20 [Employer's Equipment and Free-Issue Materials], or for other services requested by the Contractor.

The notice shall be given as soon as practicable and no longer than 28 days after the Employer became aware, or should have become aware, of the event or circumstances giving rise to the claim. A notice relating to any extension of the Defects Notification Period shall be given before the expiry of such period.

The particulars shall specify the Clause or other basis of the claim, and shall include substantiation of the amount and/or extension to which the Employer considers himself to be entitled in connection with the Contract. The Engineer shall then proceed in accordance with Sub-Clause 3.5 [Determinations] to agree or determine (i) the amount (if any) which the Employer is entitled to be paid by the Contractor, and/or (ii) the extension (if any) of the Defects Notification Period in accordance with Sub-Clause 11.3 [Extension of Defects Notification Period].

This amount may be included as a deduction in the Contract Price and Payment Certificates. The Employer shall only be entitled to set off against or make any deduction from an amount certified in a Payment Certificate, or to otherwise claim against the Contractor, in accordance with this Sub-Clause.

3 The Engineer

3.1 Engineer's Duties and Authority

The Employer shall appoint the Engineer who shall carry out the duties assigned to him in the Contract. The Engineer's staff shall include suitably qualified engineers and other professionals who are competent to carry out these duties.

The Engineer shall have no authority to amend the Contract.

The Engineer may exercise the authority attributable to the Engineer as specified in or necessarily to be implied from the Contract. If the Engineer is required to obtain the approval of the Employer before exercising a specified authority, the requirements shall be as stated in the Particular Conditions. The Employer shall promptly inform the Contractor of any change to the authority attributed to the Engineer.

However, whenever the Engineer exercises a specified authority for which the Employer's approval is required, then (for the purposes of the Contract) the Employer shall be deemed to have given approval.

Except as otherwise stated in these Conditions:

- (a) whenever carrying out duties or exercising authority, specified in or implied by the Contract, the Engineer shall be deemed to act for the Employer;
- (b) the Engineer has no authority to relieve either Party of any duties, obligations or responsibilities under the Contract;
- (c) any approval, check, certificate, consent, examination, inspection, instruction, notice, proposal, request, test, or similar act by the Engineer (including absence of disapproval) shall not relieve the Contractor from any responsibility he has under the Contract, including responsibility for errors, omissions, discrepancies and non-compliances; and
- (d) any act by the Engineer in response to a Contractor's request except as otherwise expressly specified shall be notified in writing to the Contractor within 28 days of receipt.

The following provisions shall apply:

The Engineer shall obtain the specific approval of the Employer before taking action under the following Sub-Clauses of these Conditions:

- (A) Sub-Clause 4.12: agreeing or determining an extension of time and/or additional cost.
- (B) Sub-Clause 13.1: instructing a Variation, except:
 - (i) in an emergency situation as determined by the Engineer, or
 - (ii) if such a Variation would increase the Accepted Contract Amount by less than the percentage specified in the Contract Data.
- (C) Sub-Clause 13.3: approving a proposal for Variation submitted by the Contractor in accordance with Sub Clause 13.1 or 13.2.
- (D) Sub-Clause 13.4: specifying the amount payable in each of the applicable currencies

Notwithstanding the obligation, as set out above, to obtain approval, if, in the opinion of the Engineer, an emergency occurs affecting the safety of life or of the Works or of adjoining property, he may, without relieving the Contractor of any of his duties and responsibility 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, despite the absence of approval of the Employer, 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 13 and shall notify the Contractor accordingly, with a copy to the Employer.

3.2 Delegation by the Engineer

The Engineer may from time to time assign duties and delegate authority to assistants, and may also revoke such assignment or delegation. These assistants may include a resident engineer, and/or independent inspectors appointed to inspect and/or test items of Plant and/or Materials. The assignment, delegation or revocation shall be in writing and shall not take effect until copies have been received by both Parties. However, unless otherwise agreed by both Parties, the Engineer shall not delegate the authority to determine any matter in accordance with Sub-Clause 3.5 [Determinations].

Assistants shall be suitably qualified persons, who are competent to carry out these duties and exercise this authority, and who are fluent in the language for communications defined in Sub-Clause 1.4 [Law and Language].

Each assistant, to whom duties have been assigned or authority has been delegated, shall only be authorised to issue instructions to the Contractor to the extent defined by the delegation. Any approval, check, certificate, consent, examination, inspection, instruction, notice, proposal, request, test, or similar act by an assistant, in accordance with the delegation, shall have the same effect as though the act had been an act of the Engineer. However:

- (a) any failure to disapprove any work, Plant or Materials shall not constitute approval, and shall therefore not prejudice the right of the Engineer to reject the work, Plant or Materials;
- (b) if the Contractor questions any determination or instruction of an assistant, the Contractor may refer the matter to the Engineer, who shall promptly confirm, reverse or vary the determination or instruction.

3.3 Instructions of the Engineer

The Engineer may issue to the Contractor (at any time) instructions and additional or modified Drawings which may be necessary for the execution of the Works and the remedying of any defects, all in accordance with the Contract. The Contractor shall only take instructions from the Engineer, or from an assistant to whom the appropriate authority has been delegated under this Clause. If an instruction constitutes a Variation, Clause 13 [Variations and Adjustments] shall apply.

The Contractor shall comply with the instructions given by the Engineer or delegated assistant, on any matter related to the Contract. Whenever practicable, their instructions shall be given in writing. If the Engineer or a delegated assistant:

- (a) gives an oral instruction,
- (b) receives a written confirmation of the instruction, from (or on behalf of) the Contractor, within two working days after giving the instruction, and
- (c) does not reply by issuing a written rejection and/or instruction within two working days after receiving the confirmation,

then the confirmation shall constitute the written instruction of the Engineer or delegated assistant (as the case may be).

3.4 Replacement of the Engineer

If the Employer intends to replace the Engineer, the Employer shall, not less than 21 days before the intended date of replacement, give notice to the Contractor of the name, address and relevant experience of the intended replacement Engineer. If the Contractor considers the intended replacement Engineer to be unsuitable, he has the right to raise objection against him by notice to the Employer, with supporting particulars, and the Employer shall give full and fair consideration to this objection.

3.5 Determinations

Whenever these Conditions provide that the Engineer shall proceed in accordance with this Sub-Clause 3.5 to agree or determine any matter, the Engineer shall consult with each Party in an endeavour to reach agreement. If agreement is not achieved, the Engineer shall make a fair determination in accordance with the Contract, taking due regard of all relevant circumstances.

The Engineer shall give notice to both Parties of each agreement or determination, with supporting particulars, within 28 days from the receipt of the corresponding claim or request except when otherwise specified. Each Party shall give effect to each agreement or determination unless and until revised under Clause 20 [Claims, Disputes and Arbitration].

4 The Contractor

4.1 Contractor's General Obligations

The Contractor shall design (to the extent specified in the Contract), execute and complete the Works in accordance with the Contract and with the Engineer's instructions, and shall remedy any defects in the Works.

The Contractor shall provide the Plant and Contractor's Documents specified in the Contract, and all Contractor's Personnel, Goods, consumables and other things and services, whether of a temporary or permanent nature, required in and for this design, execution, completion and remedying of defects.

All equipment, material, and services to be incorporated in or required for the Works shall have their origin in any eligible source country as defined by the Bank.

The Contractor shall be responsible for the adequacy, stability and safety of all Site operations and of all methods of construction. Except to the extent specified in the Contract, the Contractor (i) shall be responsible for all Contractor's Documents, Temporary Works, and such design of each item of Plant and Materials as is required for the item to be in accordance with the Contract, and (ii) shall not otherwise be responsible for the design or specification of the Permanent Works.

The Contractor shall, whenever required by the Engineer, submit details of the arrangements and methods which the Contractor proposes to adopt for the execution of the Works. No significant alteration to these arrangements and methods shall be made without this having previously been notified to the Engineer.

If the Contract specifies that the Contractor shall design any part of the Permanent Works, then unless otherwise stated in the Particular Conditions:

- (a) the Contractor shall submit to the Engineer the Contractor's Documents for this part in accordance with the procedures specified in the Contract;
- (b) these Contractor's Documents shall be in accordance with the Specification and Drawings, shall be written in the language for communications defined in Sub-Clause 1.4 [Law and Language], and shall include additional information required by the Engineer to add to the Drawings for co-ordination of each Party's designs;
- (c) the Contractor shall be responsible for this part and it shall, when the Works are completed, be fit for such purposes for which the part is intended as are specified in the Contract; and
- (d) prior to the commencement of the Tests on Completion, the Contractor shall submit to the Engineer the "as-built" documents and, if applicable, operation and maintenance manuals in accordance with the Specification and in sufficient detail for the Employer to operate, maintain, dismantle, reassemble, adjust and repair this part of the Works. Such part shall not be considered to be completed for the purposes of taking-over under Sub-Clause 10.1 [Taking Over of the Works and Sections] until these documents and manuals have been submitted to the Engineer.

4.2 Performance Security

The Contractor shall obtain (at his cost) a Performance Security for proper performance, in the amount stated in the Contract Data and denominated in the currency(ies) of the Contract or in a freely convertible currency acceptable to the Employer. If an amount is not stated in the Contract Data, this Sub-Clause shall not apply.

The Contractor shall deliver the Performance Security to the Employer within 28 days after receiving the Letter of Acceptance, and shall send a copy to the Engineer. The Performance Security shall be issued by a reputable bank or financial institution selected by the Contractor, and shall be in the form annexed to the Particular Conditions, as stipulated by the Employer in the Contract Data, or in another form approved by the Employer.

The Contractor shall ensure that the Performance Security is valid and enforceable until the Contractor has executed and completed the Works and remedied any defects. If the terms of the Performance Security specify its expiry date, and the Contractor has not become entitled to receive the Performance Certificate by the date 28 days prior to the expiry date, the Contractor shall extend the validity of the Performance Security until the Works have been completed and any defects have been remedied.

The Employer shall not make a claim under the Performance Security, except for amounts to which the Employer is entitled under the Contract.

The Employer shall indemnify and hold the Contractor harmless against and from all damages, losses and expenses (including legal fees and expenses) resulting from a claim under the Performance Security to the extent to which the Employer was not entitled to make the claim.

The Employer shall return the Performance Security to the Contractor within 21 days after receiving a copy of the Performance Certificate.

Without limitation to the provisions of the rest of this Sub-Clause, whenever the Engineer determines an addition or a reduction to the Contract Price as a result of a change in cost and/or legislation, or as a result of a Variation, amounting to more than 25 percent of the portion of the Contract Price payable in a specific currency, the Contractor shall at the Engineer's request promptly increase, or may decrease, as the case may be, the value of the Performance Security in that currency by an equal percentage.

4.3 Contractor's Representative

The Contractor shall appoint the Contractor's Representative and shall give him all authority necessary to act on the Contractor's behalf under the Contract.

Unless the Contractor's Representative is named in the Contract, the Contractor shall, prior to the Commencement Date, submit to the Engineer for consent the name and particulars of the person the Contractor proposes to appoint as Contractor's Representative. If consent is withheld or subsequently revoked in terms of Sub-Clause 6.9 [Contractor's Personnel], or if the appointed person fails to act as Contractor's Representative, the Contractor shall similarly submit the name and particulars of another suitable person for such appointment.

The Contractor shall not, without the prior consent of the Engineer, revoke the appointment of the Contractor's Representative or appoint a replacement.

The whole time of the Contractor's Representative shall be given to directing the Contractor's performance of the Contract. If the Contractor's Representative is to be temporarily absent from the Site during the execution of the Works, a suitable replacement person shall be appointed, subject to the Engineer's prior consent, and the Engineer shall be notified accordingly.

The Contractor's Representative shall, on behalf of the Contractor, receive instructions under Sub-Clause 3.3 [Instructions of the Engineer].

The Contractor's Representative may delegate any powers, functions and authority to any competent person, and may at any time revoke the delegation. Any delegation or revocation shall not take effect until the Engineer has received prior notice signed by the Contractor's Representative, naming the person and specifying the powers, functions and authority being delegated or revoked.

The Contractor's Representative shall be fluent in the language for communications defined in Sub-Clause 1.4 [Law and Language]. If the Contractor's Representative's delegates are not fluent in the said language, the Contractor shall make competent interpreters available during all working hours in a number deemed sufficient by the Engineer.

4.4 Subcontractors

The Contractor shall not subcontract the whole of the Works.

The Contractor shall be responsible for the acts or defaults of any Subcontractor, his agents or employees, as if they were the acts or defaults of the Contractor. Unless otherwise stated in the Particular Conditions:

- (a) the Contractor shall not be required to obtain consent to suppliers solely of Materials, or to a subcontract for which the Subcontractor is named in the Contract;
- (b) the prior consent of the Engineer shall be obtained to other proposed Subcontractors;
- (c) the Contractor shall give the Engineer not less than 28 days' notice of the intended date of the commencement of each Subcontractor's work, and of the commencement of such work on the Site; and
- (d) each subcontract shall include provisions which would entitle the Employer to require the subcontract to be assigned to the Employer under Sub-Clause 4.5 [Assignment of Benefit of Subcontract] (if or when applicable) or in the event of termination under Sub-Clause 15.2 [Termination by Employer].

The Contractor shall ensure that the requirements imposed on the Contractor by Sub-Clause 1.12 [Confidential Details] apply equally to each Subcontractor.

Where practicable, the Contractor shall give fair and reasonable opportunity for contractors from the Country to be appointed as Subcontractors.

4.5 Assignment of Benefit of Subcontract

If a Subcontractor's obligations extend beyond the expiry date of the relevant Defects Notification Period and the Engineer, prior to this date, instructs the Contractor to assign the benefit of such obligations to the Employer, then the Contractor shall do so. Unless otherwise stated in the assignment, the Contractor shall have no liability to the Employer for the work carried out by the Subcontractor after the assignment takes effect.

4.6 Co-operation

The Contractor shall, as specified in the Contract or as instructed by the Engineer, allow appropriate opportunities for carrying out work to:

- (a) the Employer's Personnel,
- (b) any other contractors employed by the Employer, and
- (c) the personnel of any legally constituted public authorities,

who may be employed in the execution on or near the Site of any work not included in the Contract.

Any such instruction shall constitute a Variation if and to the extent that it causes the Contractor to suffer delays and/or to incur Unforeseeable Cost. Services for these personnel and other contractors may include the use of Contractor's Equipment, Temporary Works or access arrangements which are the responsibility of the Contractor.

If, under the Contract, the Employer is required to give to the Contractor possession of any foundation, structure, plant or means of access in accordance with Contractor's Documents, the Contractor shall submit such documents to the Engineer in the time and manner stated in the Specification.

4.7 Setting Out

The Contractor shall set out the Works in relation to original points, lines and levels of reference specified in the Contract or notified by the Engineer. The Contractor shall be responsible for the correct positioning of all parts of the Works, and shall rectify any error in the positions, levels, dimensions or alignment of the Works.

The Employer shall be responsible for any errors in these specified or notified items of reference, but the Contractor shall use reasonable efforts to verify their accuracy before they are used.

If the Contractor suffers delay and/or incurs Cost from executing work which was necessitated by an error in these items of reference, and an experienced contractor could not reasonably have discovered such error and avoided this delay and/or Cost, the Contractor shall give notice to the Engineer and shall be entitled subject to Sub-Clause 20.1 [Contractor's Claims] to:

- (a) an extension of time for any such delay, if completion is or will be delayed, under Sub-Clause 8.4 [Extension of Time for Completion], and
- (b) payment of any such Cost plus profit, which shall be included in the Contract Price.

After receiving this notice, the Engineer shall proceed in accordance with Sub-Clause 3.5 [Determinations] to agree or determine (i) whether and (if so) to what extent the error could not reasonably have been discovered, and (ii) the matters described in sub-paragraphs (a) and (b) above related to this extent.

4.8 Safety Procedures

The Contractor shall:

- (a) comply with all applicable safety regulations,
- (b) take care for the safety of all persons entitled to be on the Site,
- (c) use reasonable efforts to keep the Site and Works clear of unnecessary obstruction so as to avoid danger to these persons,
- (d) provide fencing, lighting, guarding and watching of the Works until completion and taking over under Clause 10 [Employer's Taking Over], and
- (e) provide any Temporary Works (including roadways, footways, guards and fences) which may be necessary, because of the execution of the Works, for the use and protection of the public and of owners and occupiers of adjacent land.

4.9 Quality Assurance

The Contractor shall institute a quality assurance system to demonstrate compliance with the requirements of the Contract. The system shall be in accordance with the details stated in the Contract. The Engineer shall be entitled to audit any aspect of the system.

Details of all procedures and compliance documents shall be submitted to the Engineer for information before each design and execution stage is commenced. When any document of a technical nature is issued to the Engineer, evidence of the prior approval by the Contractor himself shall be apparent on the document itself.

Compliance with the quality assurance system shall not relieve the Contractor of any of his duties, obligations or responsibilities under the Contract.

4.10 Site Data

The Employer shall have made available to the Contractor for his information, prior to the Base Date, all relevant data in the Employer's possession on sub-surface and hydrological conditions at the Site, including environmental aspects. The Employer shall similarly make available to the Contractor all such data which come into the Employer's possession after the Base Date. The Contractor shall be responsible for interpreting all such data.

To the extent which was practicable (taking account of cost and time), the Contractor shall be deemed to have obtained all necessary information as to risks, contingencies and other circumstances which may influence or affect the Tender or Works. To the same extent, the Contractor shall be deemed to have inspected and examined the Site, its surroundings, the above data and other available information, and to have been satisfied before submitting the Tender as to all relevant matters, including (without limitation):

- (a) the form and nature of the Site, including sub-surface conditions,
- (b) the hydrological and climatic conditions,
- (c) the extent and nature of the work and Goods necessary for the execution and completion of the Works and the remedying of any defects,
- (d) the Laws, procedures and labour practices of the Country, and
- (e) the Contractor's requirements for access, accommodation, facilities, personnel, power, transport, water and other services.

4.11 Sufficiency of the Accepted Contract Amount

The Contractor shall be deemed to:

- (a) have satisfied himself as to the correctness and sufficiency of the Accepted Contract Amount, and
- (b) have based the Accepted Contract Amount on the data, interpretations, necessary information, inspections, examinations and satisfaction as to all relevant matters referred to in Sub-Clause 4.10 [Site Data].

Unless otherwise stated in the Contract, the Accepted Contract Amount covers all the Contractor's obligations under the Contract (including those under Provisional Sums, if any) and all things necessary for the proper execution and completion of the Works and the remedying of any defects.

4.12 Unforeseeable Physical Conditions

In this Sub-Clause, "physical conditions" means natural physical conditions and man-made and other physical obstructions and pollutants, which the Contractor encounters at the Site when executing the Works, including sub-surface and hydrological conditions but excluding climatic conditions.

If the Contractor encounters adverse physical conditions which he considers to have been Unforeseeable, the Contractor shall give notice to the Engineer as soon as practicable.

This notice shall describe the physical conditions, so that they can be inspected by the Engineer, and shall set out the reasons why the Contractor considers them to be Unforeseeable. The Contractor shall continue executing the Works, using such proper and reasonable measures as are appropriate for the physical conditions, and shall comply with any instructions which the Engineer may give. If an instruction constitutes a Variation, Clause 13 [Variations and Adjustments] shall apply.

If and to the extent that the Contractor encounters physical conditions which are Unforeseeable, gives such a notice, and suffers delay and/or incurs Cost due to these conditions, the Contractor shall be entitled subject to notice under Sub-Clause 20.1 [Contractor's Claims] to:

- (a) an extension of time for any such delay, if completion is or will be delayed, under Sub-Clause 8.4 [Extension of Time for Completion], and
- (b) payment of any such Cost, which shall be included in the Contract Price.

Upon receiving such notice and inspecting and/or investigating these physical conditions, the Engineer shall proceed in accordance with Sub-Clause 3.5 [Determinations] to agree or determine (i) whether and (if so) to what extent these physical conditions were Unforeseeable, and (ii) the matters described in sub-paragraphs (a) and (b) above related to this extent.

However, before additional Cost is finally agreed or determined under sub-paragraph (ii), the Engineer may also review whether other physical conditions in similar parts of the Works (if any) were more favourable than could reasonably have been foreseen when the Contractor submitted the Tender. If and to the extent that these more favourable conditions were encountered, the Engineer may proceed in accordance with Sub-Clause 3.5 [Determinations] to agree or determine the reductions in Cost which were due to these conditions, which may be included (as deductions) in the Contract Price and Payment Certificates. However, the net effect of all adjustments under sub-paragraph (b) and all these reductions, for all the physical conditions encountered in similar parts of the Works, shall not result in a net reduction in the Contract Price.

The Engineer shall take account of any evidence of the physical conditions foreseen by the Contractor when submitting the Tender, which shall be made available by the Contractor, but shall not be bound by the Contractor's interpretation of any such evidence.

4.13 Rights of Way and Facilities

Unless otherwise specified in the Contract the Employer shall provide effective access to and possession of the Site including special and/or temporary rights-of-way which are necessary for the Works. The Contractor shall obtain, at his risk and cost, any additional rights of way or facilities outside the Site which he may require for the purposes of the Works.

4.14 Avoidance of Interference

The Contractor shall not interfere unnecessarily or improperly with:

- (a) the convenience of the public, or
- (b) the access to and use and occupation of all roads and footpaths, irrespective of whether they are public or in the possession of the Employer or of others.

The Contractor shall indemnify and hold the Employer harmless against and from all damages, losses and expenses (including legal fees and expenses) resulting from any such unnecessary or improper interference.

4.15 Access Route

The Contractor shall be deemed to have been satisfied as to the suitability and availability of access routes to the Site at Base Date. The Contractor shall use reasonable efforts to prevent any road or bridge from being damaged by the Contractor's traffic or by the Contractor's Personnel. These efforts shall include the proper use of appropriate vehicles and routes.

Except as otherwise stated in these Conditions:

- (a) the Contractor shall (as between the Parties) be responsible for any maintenance which may be required for his use of access routes;

- (b) the Contractor shall provide all necessary signs or directions along access routes, and shall obtain any permission which may be required from the relevant authorities for his use of routes, signs and directions;
- (c) the Employer shall not be responsible for any claims which may arise from the use or otherwise of any access route;
- (d) the Employer does not guarantee the suitability or availability of particular access routes; and
- (e) Costs due to non-suitability or non-availability, for the use required by the Contractor, of access routes shall be borne by the Contractor.

4.16 Transport of Goods

Unless otherwise stated in the Particular Conditions:

- (a) the Contractor shall give the Engineer not less than 21 days' notice of the date on which any Plant or a major item of other Goods will be delivered to the Site;
- (b) the Contractor shall be responsible for packing, loading, transporting, receiving, unloading, storing and protecting all Goods and other things required for the Works; and
- (c) the Contractor shall indemnify and hold the Employer harmless against and from all damages, losses and expenses (including legal fees and expenses) resulting from the transport of Goods, and shall negotiate and pay all claims arising from their transport.

4.17 Contractor's Equipment

The Contractor shall be responsible for all Contractor's Equipment. When brought on to the Site, Contractor's Equipment shall be deemed to be exclusively intended for the execution of the Works. The Contractor shall not remove from the Site any major items of Contractor's Equipment without the consent of the Engineer. However, consent shall not be required for vehicles transporting Goods or Contractor's Personnel off Site.

4.18 Protection of the Environment

The Contractor shall take all reasonable steps to protect the environment (both on and off the Site) and to limit damage and nuisance to people and property resulting from pollution, noise and other results of his operations.

The Contractor shall ensure that emissions, surface discharges and effluent from the Contractor's activities shall not exceed the values stated in the Specification or prescribed by applicable Laws.

4.19 Electricity, Water and Gas

The Contractor shall, except as stated below, be responsible for the provision of all power, water and other services he may require for his construction activities and to the extent defined in the Specifications, for the tests.

The Contractor shall be entitled to use for the purposes of the Works such supplies of electricity, water, gas and other services as may be available on the Site and of which details and prices are given in the Specification. The Contractor shall, at his risk and cost, provide any apparatus necessary for his use of these services and for measuring the quantities consumed.

The quantities consumed and the amounts due (at these prices) for such services shall be agreed or determined by the Engineer in accordance with Sub-Clause 2.5 [Employer's Claims] and Sub-Clause 3.5 [Determinations]. The Contractor shall pay these amounts to the Employer.

4.20 Employer's Equipment and Free-Issue Materials

The Employer shall make the Employer's Equipment (if any) available for the use of the Contractor in the execution of the Works in accordance with the details, arrangements and prices stated in the Specification. Unless otherwise stated in the Specification:

- (a) the Employer shall be responsible for the Employer's Equipment, except that
- (b) the Contractor shall be responsible for each item of Employer's Equipment whilst any of the Contractor's Personnel is operating it, driving it, directing it or in possession or control of it.

The appropriate quantities and the amounts due (at such stated prices) for the use of Employer's Equipment shall be agreed or determined by the Engineer in accordance with Sub-Clause 2.5 [Employer's Claims] and Sub-Clause 3.5 [Determinations]. The Contractor shall pay these amounts to the Employer.

The Employer shall supply, free of charge, the "free-issue materials" (if any) in accordance with the details stated in the Specification. The Employer shall, at his risk and cost, provide these materials at the time and place specified in the Contract. The Contractor shall then visually inspect them, and shall promptly give notice to the Engineer of any shortage, defect or default in these materials. Unless otherwise agreed by both Parties, the Employer shall immediately rectify the notified shortage, defect or default.

After this visual inspection, the free-issue materials shall come under the care, custody and control of the Contractor. The Contractor's obligations of inspection, care, custody and control shall not relieve the Employer of liability for any shortage, defect or default not apparent from a visual inspection.

4.21 Progress Reports

Unless otherwise stated in the Particular Conditions, monthly progress reports shall be prepared by the Contractor and submitted to the Engineer in six copies. The first report shall cover the period up to the end of the first calendar month following the Commencement Date. Reports shall be submitted monthly thereafter, each within 7 days after the last day of the period to which it relates.

Reporting shall continue until the Contractor has completed all work which is known to be outstanding at the completion date stated in the Taking-Over Certificate for the Works.

Each report shall include:

- (a) charts and detailed descriptions of progress, including each stage of design (if any), Contractor's Documents, procurement, manufacture, delivery to Site, construction, erection and testing; and including these stages for work by each nominated Subcontractor (as defined in Clause 5 [Nominated Subcontractors]),
- (b) photographs showing the status of manufacture and of progress on the Site;
- (c) for the manufacture of each main item of Plant and Materials, the name of the manufacturer, manufacture location, percentage progress, and the actual or expected dates of:
 - (i) commencement of manufacture,
 - (ii) Contractor's inspections,
 - (iii) tests, and
 - (iv) shipment and arrival at the Site;
- (d) the details described in Sub-Clause 6.10 [Records of Contractor's Personnel and Equipment];
- (e) copies of quality assurance documents, test results and certificates of Materials;

- (f) list of notices given under Sub-Clause 2.5 [Employer's Claims] and notices given under Sub-Clause 20.1 [Contractor's Claims];
- (g) safety statistics, including details of any hazardous incidents and activities relating to environmental aspects and public relations; and
- (h) comparisons of actual and planned progress, with details of any events or circumstances which may jeopardise the completion in accordance with the Contract, and the measures being (or to be) adopted to overcome delays.

4.22 Security of the Site

Unless otherwise stated in the Particular Conditions:

- (a) the Contractor shall be responsible for keeping unauthorised persons off the Site, and
- (b) authorised persons shall be limited to the Contractor's Personnel and the Employer's Personnel; and to any other personnel notified to the Contractor, by the Employer or the Engineer, as authorised personnel of the Employer's other contractors on the Site.

4.23 Contractor's Operations on Site

The Contractor shall confine his operations to the Site, and to any additional areas which may be obtained by the Contractor and agreed by the Engineer as additional working areas. The Contractor shall take all necessary precautions to keep Contractor's Equipment and Contractor's Personnel within the Site and these additional areas, and to keep them off adjacent land.

During the execution of the Works, the Contractor shall keep the Site free from all unnecessary obstruction, and shall store or dispose of any Contractor's Equipment or surplus materials. The Contractor shall clear away and remove from the Site any wreckage, rubbish and Temporary Works which are no longer required.

Upon the issue of a Taking-Over Certificate, the Contractor shall clear away and remove, from that part of the Site and Works to which the Taking-Over Certificate refers, all Contractor's Equipment, surplus material, wreckage, rubbish and Temporary Works. The Contractor shall leave that part of the Site and the Works in a clean and safe condition. However, the Contractor may retain on Site, during the Defects Notification Period, such Goods as are required for the Contractor to fulfil obligations under the Contract.

4.24 Fossils

All fossils, coins, articles of value or antiquity, and structures and other remains or items of geological or archaeological interest found on the Site shall be placed under the care and authority of the Employer. The Contractor shall take reasonable precautions to prevent Contractor's Personnel or other persons from removing or damaging any of these findings.

The Contractor shall, upon discovery of any such finding, promptly give notice to the Engineer, who shall issue instructions for dealing with it. If the Contractor suffers delay and/or incurs Cost from complying with the instructions, the Contractor shall give a further notice to the Engineer and shall be entitled subject to Sub-Clause 20.1 [Contractor's Claims] to:

- (a) an extension of time for any such delay, if completion is or will be delayed, under Sub-Clause 8.4 [Extension of Time for Completion], and
- (b) payment of any such Cost, which shall be included in the Contract Price.

After receiving this further notice, the Engineer shall proceed in accordance with Sub-Clause 3.5 [Determinations] to agree or determine these matters.

5 Nominated Subcontractors

5.1 Definition of "nominated Subcontractor"

In the Contract, "nominated Subcontractor" means a Subcontractor:

- (a) who is stated in the Contract as being a nominated Subcontractor, or
- (b) whom the Engineer, under Clause 13 [Variations and Adjustments], instructs the Contractor to employ as a Subcontractor subject to Sub-Clause 5.2 [Objection to Notification].

5.2 Objection to Nomination

The Contractor shall not be under any obligation to employ a nominated Subcontractor against whom the Contractor raises reasonable objection by notice to the Engineer as soon as practicable, with supporting particulars. An objection shall be deemed reasonable if it arises from (among other things) any of the following matters, unless the Employer agrees in writing to indemnify the Contractor against and from the consequences of the matter:

- (a) there are reasons to believe that the Subcontractor does not have sufficient competence, resources or financial strength;
- (b) the nominated Subcontractor does not accept to indemnify the Contractor against and from any negligence or misuse of Goods by the nominated Subcontractor, his agents and employees; or
- (c) the nominated Subcontractor does not accept to enter into a subcontract which specifies that, for the subcontracted work (including design, if any), the nominated Subcontractor shall:
 - (i) undertake to the Contractor such obligations and liabilities as will enable the Contractor to discharge his obligations and liabilities under the Contract,
 - (ii) indemnify the Contractor against and from all obligations and liabilities arising under or in connection with the Contract and from the consequences of any failure by the Subcontractor to perform these obligations or to fulfil these liabilities, and
 - (iii) be paid only if and when the Contractor has received from the Employer payments for sums due under the Subcontract referred to under Sub-Clause 5.3 [Payment to nominated Subcontractors].

5.3 Payments to nominated Subcontractors

The Contractor shall pay to the nominated Subcontractor the amounts shown on the nominated Subcontractor's invoices approved by the Contractor 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 sub-paragraph (b) of Sub-Clause 13.5 [Provisional Sums], except as stated in Sub-Clause 5.4 [Evidence of Payments].

5.4 Evidence of Payments

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 this 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 Employer 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 Employer, the amount which the nominated Subcontractor was directly paid by the Employer.

6 Staff and Labour

6.1 Engagement of Staff and Labour

Except as otherwise stated in the Specification, the Contractor shall make arrangements for the engagement of all staff and labour, local or otherwise, and for their payment, feeding, transport and, when appropriate, housing.

The Contractor is encouraged, to the extent practicable and reasonable, to employ staff and labour with appropriate qualifications and experience from sources within the Country.

6.2 Rates of Wages and Conditions of Labour

The Contractor shall pay rates of wages, and observe conditions of labour, which are not lower than those established for the trade or industry where the work is carried out. If no established rates or conditions are applicable, the Contractor shall pay rates of wages and observe conditions which are not lower than the general level of wages and conditions observed locally by employers whose trade or industry is similar to that of the Contractor.

The Contractor shall inform the Contractor's Personnel about their liability to pay personal income taxes in the Country in respect of such of their salaries, wages, allowances and any benefits as are subject to tax under the Laws of the Country for the time being in force, and the Contractor shall perform such duties in regard to such deductions thereof as may be imposed on him by such Laws.

6.3 Persons in the Service of Employer

The Contractor shall not recruit, or attempt to recruit, staff and labour from amongst the Employer's Personnel.

6.4 Labour Laws

The Contractor shall comply with all the relevant labour Laws applicable to the Contractor's Personnel, including Laws relating to their employment, health, safety, welfare, immigration and emigration, and shall allow them all their legal rights.

The Contractor shall require his employees to obey all applicable Laws, including those concerning safety at work.

6.5 Working Hours

No work shall be carried out on the Site on locally recognised days of rest, or outside the normal working hours stated in the Contract Data, unless:

- (a) otherwise stated in the Contract,
- (b) the Engineer gives consent, or
- (c) the work is unavoidable, or necessary for the protection of life or property or for the safety of the Works, in which case the Contractor shall immediately advise the Engineer.

6.6 Facilities for Staff and Labour

Except as otherwise stated in the Specification, the Contractor shall provide and maintain all necessary accommodation and welfare facilities for the Contractor's Personnel. The Contractor shall also provide facilities for the Employer's Personnel as stated in the Specification.

The Contractor shall not permit any of the Contractor's Personnel to maintain any temporary or permanent living quarters within the structures forming part of the Permanent Works.

6.7 Health and Safety

The Contractor shall at all times take all reasonable precautions to maintain the health and safety of the Contractor's Personnel. In collaboration with local health authorities, the Contractor shall ensure that medical staff, first aid facilities, sick bay and ambulance service are available at all times at the Site and at any accommodation for Contractor's and Employer's Personnel, and that suitable arrangements are made for all necessary welfare and hygiene requirements and for the prevention of epidemics.

The Contractor shall appoint an accident prevention officer at the Site, responsible for maintaining safety and protection against accidents. This person shall be qualified for this responsibility, and shall have the authority to issue instructions and take protective measures to prevent accidents. Throughout the execution of the Works, the Contractor shall provide whatever is required by this person to exercise this responsibility and authority.

The Contractor shall send, to the Engineer, details of any accident as soon as practicable after its occurrence. The Contractor shall maintain records and make reports concerning health, safety and welfare of persons, and damage to property, as the Engineer may reasonably require.

HIV-AIDS Prevention. The Contractor shall conduct an HIV-AIDS awareness programme via an approved service provider, and shall undertake such other measures as are specified in this Contract to reduce the risk of the transfer of the HIV virus between and among the Contractor's Personnel and the local community, to promote early diagnosis and to assist affected individuals.

The Contractor shall throughout the contract (including the Defects Notification Period): (i) conduct Information, Education and Communication (IEC) campaigns, at least every other month, addressed to all the Site staff and labour (including all the Contractor's employees, all Subcontractors and any other Contractor's or Employer's personnel employees, and all truck drivers and crew making deliveries to Site for construction activities) and to the immediate local communities, concerning the risks, dangers and impact, and appropriate avoidance behaviour with respect to, of Sexually Transmitted Diseases (STD) - or Sexually Transmitted Infections (STI) in general and HIV/AIDS in particular; (ii) provide male or female condoms for all Site staff and labour as appropriate; and (iii) provide for STI and HIV/AIDS screening, diagnosis, counselling and referral to a dedicated national STI and HIV/AIDS programme, (unless otherwise agreed) of all Site staff and labour.

The Contractor shall include in the programme to be submitted for the execution of the Works under Sub-Clause 8.3 an alleviation programme for Site staff and labour and their families in respect of Sexually Transmitted Infections (STI) and Sexually Transmitted Diseases (STD) including HIV/AIDS. The STI, STD and HIV/AIDS alleviation programme shall indicate when, how and at what cost the Contractor plans to satisfy the requirements of this Sub-Clause and the related specification. For each component, the programme shall detail the resources to be provided or utilised and any related sub-contracting proposed. The programme shall also include provision of a detailed cost estimate with supporting documentation. Payment to the Contractor for preparation and implementation this programme shall not exceed the Provisional Sum dedicated for this purpose.

6.8 Contractor's Superintendence

Throughout the execution of the Works, and as long thereafter as is necessary to fulfil the Contractor's obligations, the Contractor shall provide all necessary superintendence to plan, arrange, direct, manage, inspect and test the work.

Superintendence shall be given by a sufficient number of persons having adequate knowledge of the language for communications (defined in Sub-Clause 1.4 [Law and Language]) and of the operations to be carried out (including the methods and techniques required, the hazards likely to be encountered and methods of preventing accidents), for the satisfactory and safe execution of the Works.

6.9 Contractor's Personnel

The Contractor's Personnel shall be appropriately qualified, skilled and experienced in their respective trades or occupations. The Engineer may require the Contractor to remove (or cause to be removed) any person employed on the Site or Works, including the Contractor's Representative if applicable, who:

- (a) persists in any misconduct or lack of care,
- (b) carries out duties incompetently or negligently,
- (c) fails to conform with any provisions of the Contract, or
- (d) persists in any conduct which is prejudicial to safety, health, or the protection of the environment.

If appropriate, the Contractor shall then appoint (or cause to be appointed) a suitable replacement person.

6.10 Records of Contractor's Personnel and Equipment

The Contractor shall submit, to the Engineer, details showing the number of each class of Contractor's Personnel and of each type of Contractor's Equipment on the Site. Details shall be submitted each calendar month, in a form approved by the Engineer, until the Contractor has completed all work which is known to be outstanding at the completion date stated in the Taking-Over Certificate for the Works.

6.11 Disorderly Conduct

The Contractor shall at all times take all reasonable precautions to prevent any unlawful, riotous or disorderly conduct by or amongst the Contractor's Personnel, and to preserve peace and protection of persons and property on and near the Site.

6.12 Foreign Personnel

The Contractor may bring in to the Country any foreign personnel who are necessary for the execution of the Works to the extent allowed by the applicable Laws. The Contractor shall ensure that these personnel are provided with the required residence visas and work permits. The Employer will, if requested by the Contractor, use his best endeavours in a timely and expeditious manner to assist the Contractor in obtaining any local, state, national or government permission required for bringing in the Contractor's personnel.

The Contractor shall be responsible for the return of these personnel to the place where they were recruited or to their domicile. In the event of the death in the Country of any of these personnel or members of their families, the Contractor shall similarly be responsible for making the appropriate arrangements for their return or burial.

6.13 Supply of Foodstuffs

The Contractor shall arrange for the provision of a sufficient supply of suitable food as may be stated in the Specification at reasonable prices for the Contractor's Personnel for the purposes of or in connection with the Contract.

6.14 Supply of Water

The Contractor shall, having regard to local conditions, provide on the Site an adequate supply of drinking and other water for the use of the Contractor's Personnel.

6.15 Measures against Insect and Pest Nuisance

The Contractor shall at all times take the necessary precautions to protect the Contractor's Personnel employed on the Site from insect and pest nuisance, and to reduce the danger to their health. The Contractor shall comply with all the regulations of the local health authorities, including use of appropriate insecticide.

6.16 Alcoholic Liquor or Drugs

The Contractor shall not, otherwise than in accordance with the Laws of the Country, import, sell, give, barter or otherwise dispose of any alcoholic liquor or drugs, or permit or allow importation, sale, gift, barter or disposal thereof by Contractor's Personnel.

6.17 Arms and Ammunition

The Contractor shall not give, barter, or otherwise dispose of, to any person, any arms or ammunition of any kind, or allow Contractor's Personnel to do so.

6.18 Festivals and Religious Customs

The Contractor shall respect the Country's recognized festivals, days of rest and religious or other customs.

6.19 Funeral Arrangements

The Contractor shall be responsible, to the extent required by local regulations, for making any funeral arrangements for any of his local employees who may die while engaged upon the Works.

6.20 Forced Labour

The Contractor shall not employ forced labour, which consists of any work or service, not voluntarily performed, that is exacted from an individual under threat of force or penalty, and includes any kind of involuntary or compulsory labour, such as indentured labour, bonded labour or similar labour-contracting arrangements.

6.21 Child Labour

The Contractor shall not employ children in a manner that is economically exploitative, or is likely to be hazardous, or to interfere with, the child's education, or to be harmful to the child's health or physical, mental, spiritual, moral, or social development. Where the relevant labour laws of the Country have provisions for employment of minors, the Contractor shall follow those laws applicable to the Contractor. Children below the age of 18 years shall not be employed in dangerous work.

6.22 Employment Records of Workers

The Contractor shall keep complete and accurate records of the employment of labour at the Site. The records shall include the names, ages, genders, hours worked and wages paid to all workers. These records shall be summarized on a monthly basis and submitted to the Engineer. These records shall be included in the details to be submitted by the Contractor under Sub-Clause 6.10 [Records of Contractor's Personnel and Equipment].

6.23 Workers' Organisations

In countries where the relevant labour laws recognise workers' rights to form and to join workers' organisations of their choosing without interference and to bargain collectively, the Contractor shall comply with such laws. Where the relevant labour laws substantially restrict workers' organisations, the Contractor shall enable alternative means for the Contractor's Personnel to express their grievances and protect their rights regarding working conditions and terms of employment. In either case described above, and where the relevant labour laws are silent, the Contractor shall not discourage the Contractor's Personnel from forming or joining workers' organisations of their choosing or from bargaining collectively, and shall not discriminate or retaliate against the Contractor's Personnel who participate, or seek to participate, in such organisations and bargain collectively. The Contractor shall engage with such workers' representatives. Workers' organisations are expected to fairly represent the workers in the workforce.

6.24 Non-Discrimination and Equal Opportunity

The Contractor shall not make employment decisions on the basis of personal characteristics unrelated to inherent job requirements. The Contractor shall base the employment relationship on the principle of equal opportunity and fair treatment, and shall not discriminate with respect to aspects of the employment relationship, including recruitment and hiring, compensation (including wages and benefits), working conditions and terms of employment, access to training, promotion, termination of employment or retirement, and discipline. In countries where the relevant labour laws provide for non-discrimination in employment, the Contractor shall comply with such laws. When the relevant labour laws are silent on non-discrimination in employment, the Contractor shall meet this Sub-Clause's requirements. Special measures of protection or assistance to remedy past discrimination or selection for a particular job based on the inherent requirements of the job shall not be deemed discrimination.

7 Plant, Materials and Workmanship

7.1 Manner of Execution

The Contractor shall carry out the manufacture of Plant, the production and manufacture of Materials, and all other execution of the Works:

- (a) in the manner (if any) specified in the Contract,
- (b) in a proper workmanlike and careful manner, in accordance with recognised good practice, and
- (c) with properly equipped facilities and non-hazardous Materials, except as otherwise specified in the Contract.

7.2 Samples

The Contractor shall submit the following samples of Materials, and relevant information, to the Engineer for consent prior to using the Materials in or for the Works:

- (a) manufacturer's standard samples of Materials and samples specified in the Contract, all at the Contractor's cost, and
- (b) additional samples instructed by the Engineer as a Variation.

Each sample shall be labelled as to origin and intended use in the Works.

7.3 Inspection

The Employer's Personnel shall at all reasonable times:

- (a) have full access to all parts of the Site and to all places from which natural Materials are being obtained, and
- (b) during production, manufacture and construction (at the Site and elsewhere), be entitled to examine, inspect, measure and test the materials and workmanship, and to check the progress of manufacture of Plant and production and manufacture of Materials.

The Contractor shall give the Employer's Personnel full opportunity to carry out these activities, including providing access, facilities, permissions and safety equipment. No such activity shall relieve the Contractor from any obligation or responsibility.

The Contractor shall give notice to the Engineer whenever any work is ready and before it is covered up, put out of sight, or packaged for storage or transport. The Engineer shall then either carry out the examination, inspection, measurement or testing without unreasonable delay, or promptly give notice to the Contractor that the Engineer does not require to do so. If the Contractor fails to give the notice, he shall, if and when required by the Engineer, uncover the work and thereafter reinstate and make good, all at the Contractor's cost.

7.4 Testing

This Sub-Clause shall apply to all tests specified in the Contract, other than the Tests after Completion (if any).

Except as otherwise specified in the Contract, the Contractor shall provide all apparatus, assistance, documents and other information, electricity, equipment, fuel, consumables, instruments, labour, materials, and suitably qualified and experienced staff, as are necessary to carry out the specified tests efficiently. The Contractor shall agree, with the Engineer, the time and place for the specified testing of any Plant, Materials and other parts of the Works.

The Engineer may, under Clause 13 [Variations and Adjustments], vary the location or details of specified tests, or instruct the Contractor to carry out additional tests. If these varied or additional tests show that the tested Plant, Materials or workmanship is not in accordance with the Contract, the cost of carrying out this Variation shall be borne by the Contractor, notwithstanding other provisions of the Contract.

The Engineer shall give the Contractor not less than 24 hours' notice of the Engineer's intention to attend the tests. If the Engineer does not attend at the time and place agreed, the Contractor may proceed with the tests, unless otherwise instructed by the Engineer, and the tests shall then be deemed to have been made in the Engineer's presence.

If the Contractor suffers delay and/or incurs Cost from complying with these instructions or as a result of a delay for which the Employer is responsible, the Contractor shall give notice to the Engineer and shall be entitled subject to Sub-Clause 20.1 [Contractor's Claims] to:

- (a) an extension of time for any such delay, if completion is or will be delayed, under Sub-Clause 8.4 [Extension of Time for Completion], and
- (b) payment of any such Cost plus profit, which shall be included in the Contract Price.

After receiving this notice, the Engineer shall proceed in accordance with Sub-Clause 3.5 [Determinations] to agree or determine these matters.

The Contractor shall promptly forward to the Engineer duly certified reports of the tests. When the specified tests have been passed, the Engineer shall endorse the Contractor's test certificate, or issue a certificate to him, to that effect. If the Engineer has not attended the tests, he shall be deemed to have accepted the readings as accurate.

7.5 Rejection

If, as a result of an examination, inspection, measurement or testing, any Plant, Materials or workmanship is found to be defective or otherwise not in accordance with the Contract, the Engineer may reject the Plant, Materials or workmanship by giving notice to the Contractor, with reasons. The Contractor shall then promptly make good the defect and ensure that the rejected item complies with the Contract.

If the Engineer requires this Plant, Materials or workmanship to be retested, the tests shall be repeated under the same terms and conditions. If the rejection and retesting cause the Employer to incur additional costs, the Contractor shall subject to Sub-Clause 2.5 [Employer's Claims] pay these costs to the Employer.

7.6 Remedial Work

Notwithstanding any previous test or certification, the Engineer may instruct the Contractor to:

- (a) remove from the Site and replace any Plant or Materials which is not in accordance with the Contract,
- (b) remove and re-execute any other work which is not in accordance with the Contract, and
- (c) execute any work which is urgently required for the safety of the Works, whether because of an accident, unforeseeable event or otherwise.

The Contractor shall comply with the instruction within a reasonable time, which shall be the time (if any) specified in the instruction, or immediately if urgency is specified under sub-paragraph (c).

If the Contractor fails to comply with the instruction, the Employer shall be entitled to employ and pay other persons to carry out the work. Except to the extent that the Contractor would have been entitled to payment for the work, the Contractor shall subject to Sub-Clause 2.5 [Employer's Claims] pay to the Employer all costs arising from this failure.

7.7 Ownership of Plant and Materials

Except as otherwise provided in the Contract, each item of Plant and Materials shall, to the extent consistent with the Laws of the Country, become the property of the Employer at whichever is the earlier of the following times, free from liens and other encumbrances:

- (a) when it is incorporated in the Works;
- (b) when the Contractor is paid the corresponding value of the Plant and Materials under Sub-Clause 8.10 [Payment for Plant and Materials in Event of Suspension].

7.8 Royalties

Unless otherwise stated in the Specification, the Contractor shall pay all royalties, rents and other payments for:

- (a) natural Materials obtained from outside the Site, and
- (b) the disposal of material from demolitions and excavations and of other surplus material (whether natural or man-made), except to the extent that disposal areas within the Site are specified in the Contract.

8 Commencement, Delays and Suspension

8.1 Commencement of Works

Except as otherwise specified in the Particular Conditions of Contract, the Commencement Date shall be the date at which the following precedent conditions have all been fulfilled and the Engineer's notification recording the agreement of both Parties on such fulfilment and instructing to commence the Work is received by the Contractor:

- (a) signature of the Contract Agreement by both Parties, and if required, approval of the Contract by relevant authorities of the Country;
- (b) delivery to the Contractor of reasonable evidence of the Employer's financial arrangements (under Sub-Clause 2.4 [Employer's Financial Arrangements]);
- (c) except if otherwise specified in the Contract Data, effective access to and possession of the Site given to the Contractor together with such permission(s) under (a) of Sub-Clause 1.13 [Compliance with Laws] as required for the commencement of the Works;
- (d) receipt by the Contractor of the Advance Payment under Sub-Clause 14.2 [Advance Payment] provided that the corresponding bank guarantee has been delivered by the Contractor.

If the said Engineer's instruction is not received by the Contractor within 180 days from his receipt of the Letter of Acceptance, the Contractor shall be entitled to terminate the Contract under Sub-Clause 16.2 [Termination by Contractor].

The Contractor shall commence the execution of the Works as soon as is reasonably practicable after the Commencement Date, and shall then proceed with the Works with due expedition and without delay.

8.2 Time for Completion

The Contractor shall complete the whole of the Works, and each Section (if any), within the Time for Completion for the Works or Section (as the case may be), including:

- (a) achieving the passing of the Tests on Completion, and
- (b) completing all work which is stated in the Contract as being required for the Works or Section to be considered to be completed for the purposes of taking-over under Sub-Clause 10.1 [Taking Over of the Works and Sections].

8.3 Programme

The Contractor shall submit a detailed time programme to the Engineer within 28 days after receiving the notice under Sub-Clause 8.1 [Commencement of Works]. The Contractor shall also submit a revised programme whenever the previous programme is inconsistent with actual progress or with the Contractor's obligations. Each programme shall include:

- (a) the order in which the Contractor intends to carry out the Works, including the anticipated timing of each stage of design (if any), Contractor's Documents, procurement, manufacture of Plant, delivery to Site, construction, erection and testing,
- (b) each of these stages for work by each nominated Subcontractor (as defined in Clause 5 [Nominated Subcontractors]),
- (c) the sequence and timing of inspections and tests specified in the Contract, and
- (d) a supporting report which includes:
 - (i) a general description of the methods which the Contractor intends to adopt, and of the major stages, in the execution of the Works, and
 - (ii) details showing the Contractor's reasonable estimate of the number of each class of Contractor's Personnel and of each type of Contractor's Equipment, required on the Site for each major stage.

Unless the Engineer, within 21 days after receiving a programme, gives notice to the Contractor stating the extent to which it does not comply with the Contract, the Contractor shall proceed in accordance with the programme, subject to his other obligations under the Contract. The Employer's Personnel shall be entitled to rely upon the programme when planning their activities.

The Contractor shall promptly give notice to the Engineer of specific probable future events or circumstances which may adversely affect the work, increase the Contract Price or delay the execution of the Works. The Engineer may require the Contractor to submit an estimate of the anticipated effect of the future event or circumstances, and/or a proposal under Sub-Clause 13.3 [Variation Procedure].

If, at any time, the Engineer gives notice to the Contractor that a programme fails (to the extent stated) to comply with the Contract or to be consistent with actual progress and the Contractor's stated intentions, the Contractor shall submit a revised programme to the Engineer in accordance with this Sub-Clause.

8.4 Extension of Time for Completion

The Contractor shall be entitled subject to Sub-Clause 20.1 [Contractor's Claims] to an extension of the Time for Completion if and to the extent that completion for the purposes of Sub-Clause 10.1 [Taking Over of the Works and Sections] is or will be delayed by any of the following causes:

- (a) a Variation (unless an adjustment to the Time for Completion has been agreed under Sub-Clause 13.3 [Variation Procedure]) or other substantial change in the quantity of an item of work included in the Contract,
- (b) a cause of delay giving an entitlement to extension of time under a Sub-Clause of these Conditions,
- (c) exceptionally adverse climatic conditions,
- (d) Unforeseeable shortages in the availability of personnel or Goods caused by epidemic or governmental actions, or
- (e) any delay, impediment or prevention caused by or attributable to the Employer, the Employer's Personnel, or the Employer's other contractors.

If the Contractor considers himself to be entitled to an extension of the Time for Completion, the Contractor shall give notice to the Engineer in accordance with Sub-Clause 20.1 [Contractor's Claims]. When determining each extension of time under Sub-Clause 20.1, the Engineer shall review previous determinations and may increase, but shall not decrease, the total extension of time.

8.5 Delays Caused by Authorities

If the following conditions apply, namely:

- (a) the Contractor has diligently followed the procedures laid down by the relevant legally constituted public authorities in the Country,
- (b) these authorities delay or disrupt the Contractor's work, and
- (c) the delay or disruption was Unforeseeable,

then this delay or disruption will be considered as a cause of delay under sub-paragraph (b) of Sub-Clause 8.4 [Extension of Time for Completion].

8.6 Rate of Progress

If, at any time:

- (a) actual progress is too slow to complete within the Time for Completion, and/or
- (b) progress has fallen (or will fall) behind the current programme under Sub-Clause 8.3 [Programme],

other than as a result of a cause listed in Sub-Clause 8.4 [Extension of Time for Completion], then the Engineer may instruct the Contractor to submit, under Sub-Clause 8.3 [Programme], a revised programme and supporting report describing the revised methods which the Contractor proposes to adopt in order to expedite progress and complete within the Time for Completion.

Unless the Engineer notifies otherwise, the Contractor shall adopt these revised methods, which may require increases in the working hours and/or in the numbers of Contractor's Personnel and/or Goods, at the risk and cost of the Contractor. If these revised methods cause the Employer to incur additional costs, the Contractor shall subject to notice under Sub-Clause 2.5 [Employer's Claims] pay these costs to the Employer, in addition to delay damages (if any) under Sub-Clause 8.7 below.

Additional costs of revised methods including acceleration measures, instructed by the Engineer to reduce delays resulting from causes listed under Sub-Clause 8.4 [Extension of Time for Completion] shall be paid by the Employer, without generating, however, any other additional payment benefit to the Contractor.

8.7 Delay Damages

If the Contractor fails to comply with Sub-Clause 8.2 [Time for Completion], the Contractor shall subject to notice under Sub-Clause 2.5 [Employer's Claims] pay delay damages to the Employer for this default. These delay damages shall be the sum stated in the Contract Data, which shall be paid for every day which shall elapse between the relevant Time for Completion and the date stated in the Taking-Over Certificate. However, the total amount due under this Sub-Clause shall not exceed the maximum amount of delay damages (if any) stated in the Contract Data.

These delay damages shall be the only damages due from the Contractor for such default, other than in the event of termination under Sub-Clause 15.2 [Termination by Employer] prior to completion of the Works. These damages shall not relieve the Contractor from his obligation to complete the Works, or from any other duties, obligations or responsibilities which he may have under the Contract.

8.8 Suspension of Work

The Engineer may at any time instruct the Contractor to suspend progress of part or all of the Works. During such suspension, the Contractor shall protect, store and secure such part or the Works against any deterioration, loss or damage.

The Engineer may also notify the cause for the suspension. If and to the extent that the cause is notified and is the responsibility of the Contractor, the following Sub-Clauses 8.9, 8.10 and 8.11 shall not apply.

8.9 Consequences of Suspension

If the Contractor suffers delay and/or incurs Cost from complying with the Engineer's instructions under Sub-Clause 8.8 [Suspension of Work] and/or from resuming the work, the Contractor shall give notice to the Engineer and shall be entitled subject to Sub-Clause 20.1 [Contractor's Claims] to:

- (a) an extension of time for any such delay, if completion is or will be delayed, under Sub-Clause 8.4 [Extension of Time for Completion], and
- (b) payment of any such Cost, which shall be included in the Contract Price.

After receiving this notice, the Engineer shall proceed in accordance with Sub-Clause 3.5 [Determinations] to agree or determine these matters.

The Contractor shall not be entitled to an extension of time for, or to payment of the Cost incurred in, making good the consequences of the Contractor's faulty design, workmanship or materials, or of the Contractor's failure to protect, store or secure in accordance with Sub-Clause 8.8 [Suspension of Work].

8.10 Payment for Plant and Materials in Event of Suspension

The Contractor shall be entitled to payment of the value (as at the date of suspension) of Plant and/or Materials which have not been delivered to Site, if:

- (a) the work on Plant or delivery of Plant and/or Materials has been suspended for more than 28 days, and
- (b) the Contractor has marked the Plant and/or Materials as the Employer's property in accordance with the Engineer's instructions.

8.11 Prolonged Suspension

If the suspension under Sub-Clause 8.8 [Suspension of Work] has continued for more than 84 days, the Contractor may request the Engineer's permission to proceed. If the Engineer does not give permission within 28 days after being requested to do so, the Contractor may, by giving notice to the Engineer, treat the suspension as an omission under Clause 13 [Variations and Adjustments] of the affected part of the Works. If the suspension affects the whole of the Works, the Contractor may give notice of termination under Sub-Clause 16.2 [Termination by Contractor].

8.12 Resumption of Work

After the permission or instruction to proceed is given, the Contractor and the Engineer shall jointly examine the Works and the Plant and Materials affected by the suspension. The Contractor shall make good any deterioration or defect in or loss of the Works or Plant or Materials, which has occurred during the suspension after receiving from the Engineer an instruction to this effect under Clause 13 [Variations and Adjustments].

9 Tests on Completion

9.1 Contractor's Obligations

The Contractor shall carry out the Tests on Completion in accordance with this Clause and Sub-Clause 7.4 [Testing], after providing the documents in accordance with sub-paragraph (d) of Sub-Clause 4.1 [Contractor's General Obligations].

The Contractor shall give to the Engineer not less than 21 days' notice of the date after which the Contractor will be ready to carry out each of the Tests on Completion. Unless otherwise agreed, Tests on Completion shall be carried out within 14 days after this date, on such day or days as the Engineer shall instruct.

In considering the results of the Tests on Completion, the Engineer shall make allowances for the effect of any use of the Works by the Employer on the performance or other characteristics of the Works. As soon as the Works, or a Section, have passed any Tests on Completion, the Contractor shall submit a certified report of the results of these Tests to the Engineer.

9.2 Delayed Tests

If the Tests on Completion are being unduly delayed by the Employer, Sub-Clause 7.4 [Testing] (fifth paragraph) and/or Sub-Clause 10.3 [Interference with Tests on Completion] shall be applicable.

If the Tests on Completion are being unduly delayed by the Contractor, the Engineer may by notice require the Contractor to carry out the Tests within 21 days after receiving the notice. The Contractor shall carry out the Tests on such day or days within that period as the Contractor may fix and of which he shall give notice to the Engineer.

If the Contractor fails to carry out the Tests on Completion within the period of 21 days, the Employer's Personnel may proceed with the Tests at the risk and cost of the Contractor. The Tests on Completion shall then be deemed to have been carried out in the presence of the Contractor and the results of the Tests shall be accepted as accurate.

9.3 Retesting

If the Works, or a Section, fail to pass the Tests on Completion, Sub-Clause 7.5 [Rejection] shall apply, and the Engineer or the Contractor may require the failed Tests, and Tests on Completion on any related work, to be repeated under the same terms and conditions.

9.4 Failure to Pass Tests on Completion

If the Works, or a Section, fail to pass the Tests on Completion repeated under Sub-Clause 9.3 [Retesting], the Engineer shall be entitled to:

- (a) order further repetition of Tests on Completion under Sub-Clause 9.3;
- (b) if the failure deprives the Employer of substantially the whole benefit of the Works or Section, reject the Works or Section (as the case may be), in which event the Employer shall have the same remedies as are provided in sub-paragraph (c) of Sub-Clause 11.4 [Failure to Remedy Defects]; or
- (c) issue a Taking-Over Certificate, if the Employer so requests.

In the event of sub-paragraph (c), the Contractor shall proceed in accordance with all other obligations under the Contract, and the Contract Price shall be reduced by such amount as shall be appropriate to cover the reduced value to the Employer as a result of this failure. Unless the relevant reduction for this failure is stated (or its method of calculation is defined) in the Contract, the Employer may require the reduction to be (i) agreed by both Parties (in full satisfaction of this failure only) and paid before this Taking-Over Certificate is issued, or (ii) determined and paid under Sub-Clause 2.5 [Employer's Claims] and Sub-Clause 3.5 [Determinations].

10 Employer's Taking Over

10.1 Taking Over of the Works and Sections

Except as stated in Sub-Clause 9.4 [Failure to Pass Tests on Completion], the Works shall be taken over by the Employer when (i) the Works have been completed in accordance with the Contract, including the matters described in Sub-Clause 8.2 [Time for Completion] and except as allowed in sub-paragraph (a) below, and (ii) a Taking-Over Certificate for the Works has been issued, or is deemed to have been issued in accordance with this Sub-Clause.

The Contractor may apply by notice to the Engineer for a Taking-Over Certificate not earlier than 14 days before the Works will, in the Contractor's opinion, be complete and ready for taking over. If the Works are divided into Sections, the Contractor may similarly apply for a Taking-Over Certificate for each Section.

The Engineer shall, within 28 days after receiving the Contractor's application:

- (a) issue the Taking-Over Certificate to the Contractor, stating the date on which the Works or Section were completed in accordance with the Contract, except for any minor outstanding work and defects which will not substantially affect the use of the Works or Section for their intended purpose (either until or whilst this work is completed and these defects are remedied); or
- (b) reject the application, giving reasons and specifying the work required to be done by the Contractor to enable the Taking-Over Certificate to be issued. The Contractor shall then complete this work before issuing a further notice under this Sub-Clause.

If the Engineer fails either to issue the Taking-Over Certificate or to reject the Contractor's application within the period of 28 days, and if the Works or Section (as the case may be) are substantially in accordance with the Contract, the Taking-Over Certificate shall be deemed to have been issued on the last day of that period.

10.2 Taking Over of Parts of the Works

The Engineer may, at the sole discretion of the Employer, issue a Taking-Over Certificate for any part of the Permanent Works.

The Employer shall not use any part of the Works (other than as a temporary measure which is either specified in the Contract or agreed by both Parties) unless and until the Engineer has issued a Taking-Over Certificate for this part. However, if the Employer does use any part of the Works before the Taking-Over Certificate is issued:

- (a) the part which is used shall be deemed to have been taken over as from the date on which it is used,
- (b) the Contractor shall cease to be liable for the care of such part as from this date, when responsibility shall pass to the Employer, and
- (c) if requested by the Contractor, the Engineer shall issue a Taking-Over Certificate for this part.

After the Engineer has issued a Taking-Over Certificate for a part of the Works, the Contractor shall be given the earliest opportunity to take such steps as may be necessary to carry out any outstanding Tests on Completion. The Contractor shall carry out these Tests on Completion as soon as practicable before the expiry date of the relevant Defects Notification Period.

If the Contractor incurs Cost as a result of the Employer taking over and/or using a part of the Works, other than such use as is specified in the Contract or agreed by the Contractor, the Contractor shall (i) give notice to the Engineer and (ii) be entitled subject to Sub-Clause 20.1 [Contractor's Claims] to payment of any such Cost plus profit, which shall be included in the Contract Price. After receiving this notice, the Engineer shall proceed in accordance with Sub-Clause 3.5 [Determinations] to agree or determine this Cost and profit.

If a Taking-Over Certificate has been issued for a part of the Works (other than a Section), the delay damages thereafter for completion of the remainder of the Works shall be reduced. Similarly, the delay damages for the remainder of the Section (if any) in which this part is included shall also be reduced. For any period of delay after the date stated in this Taking-Over Certificate, the proportional reduction in these delay damages shall be calculated as the proportion which the value of the part so certified bears to the value of the Works or Section (as the case may be) as a whole. The Engineer shall proceed in accordance with Sub-Clause 3.5 [Determinations] to agree or determine these proportions. The provisions of this paragraph shall only apply to the daily rate of delay damages under Sub-Clause 8.7 [Delay Damages], and shall not affect the maximum amount of these damages.

10.3 Interference with Tests on Completion

If the Contractor is prevented, for more than 14 days, from carrying out the Tests on Completion by a cause for which the Employer is responsible, the Employer shall be deemed to have taken over the Works or Section (as the case may be) on the date when the Tests on Completion would otherwise have been completed.

The Engineer shall then issue a Taking-Over Certificate accordingly, and the Contractor shall carry out the Tests on Completion as soon as practicable, before the expiry date of the Defects Notification Period. The Engineer shall require the Tests on Completion to be carried out by giving 14 days' notice and in accordance with the relevant provisions of the Contract.

If the Contractor suffers delay and/or incurs Cost as a result of this delay in carrying out the Tests on Completion, the Contractor shall give notice to the Engineer and shall be entitled subject to Sub-Clause 20.1 [Contractor's Claims] to:

- (a) an extension of time for any such delay, if completion is or will be delayed, under Sub-Clause 8.4 [Extension of Time for Completion], and
- (b) payment of any such Cost plus profit, which shall be included in the Contract Price.

After receiving this notice, the Engineer shall proceed in accordance with Sub-Clause 3.5 [Determinations] to agree or determine these matters.

10.4 Surfaces Requiring Reinstatement

Except as otherwise stated in a Taking-Over Certificate, a certificate for a Section or part of the Works shall not be deemed to certify completion of any ground or other surfaces requiring reinstatement.

11 Defects Liability

11.1 Completion of Outstanding Work and Remedying Defects

In order that the Works and Contractor's Documents, and each Section, shall be in the condition required by the Contract (fair wear and tear excepted) by the expiry date of the relevant Defects Notification Period or as soon as practicable thereafter, the Contractor shall:

- (a) complete any work which is outstanding on the date stated in a Taking-Over Certificate, within such reasonable time as is instructed by the Engineer, and
- (b) execute all work required to remedy defects or damage, as may be notified by (or on behalf of) the Employer on or before the expiry date of the Defects Notification Period for the Works or Section (as the case may be).

If a defect appears or damage occurs, the Contractor shall be notified accordingly, by (or on behalf of) the Employer.

11.2 Cost of Remedying Defects

All work referred to in sub-paragraph (b) of Sub-Clause 11.1 [Completion of Outstanding Work and Remedying Defects] shall be executed at the risk and cost of the Contractor, if and to the extent that the work is attributable to:

- (a) any design for which the Contractor is responsible,
- (b) Plant, Materials or workmanship not being in accordance with the Contract, or
- (c) failure by the Contractor to comply with any other obligation.

If and to the extent that such work is attributable to any other cause, the Contractor shall be notified promptly by (or on behalf of) the Employer, and Sub-Clause 13.3 [Variation Procedure] shall apply.

11.3 Extension of Defects Notification Period

The Employer shall be entitled subject to Sub-Clause 2.5 [Employer's Claims] to an extension of the Defects Notification Period for the Works or a Section if and to the extent that the Works, Section or a major item of Plant (as the case may be, and after taking over) cannot be used for the purposes for which they are intended by reason of a defect or by reason of damage attributable to the Contractor. However, a Defects Notification Period shall not be extended by more than two years.

If delivery and/or erection of Plant and/or Materials was suspended under Sub-Clause 8.8 [Suspension of Work] or Sub-Clause 16.1 [Contractor's Entitlement to Suspend Work], the Contractor's obligations under this Clause shall not apply to any defects or damage occurring more than two years after the Defects Notification Period for the Plant and/or Materials would otherwise have expired.

11.4 Failure to Remedy Defects

If the Contractor fails to remedy any defect or damage within a reasonable time, a date may be fixed by (or on behalf of) the Employer, on or by which the defect or damage is to be remedied. The Contractor shall be given reasonable notice of this date.

If the Contractor fails to remedy the defect or damage by this notified date and this remedial work was to be executed at the cost of the Contractor under Sub-Clause 11.2 [Cost of Remedying Defects], the Employer may (at his option):

- (a) carry out the work himself or by others, in a reasonable manner and at the Contractor's cost, but the Contractor shall have no responsibility for this work; and the Contractor shall subject to Sub-Clause 2.5 [Employer's Claims] pay to the Employer the costs reasonably incurred by the Employer in remedying the defect or damage;
- (b) require the Engineer to agree or determine a reasonable reduction in the Contract Price in accordance with Sub-Clause 3.5 [Determinations]; or
- (c) if the defect or damage deprives the Employer of substantially the whole benefit of the Works or any major part of the Works, terminate the Contract as a whole, or in respect of such major part which cannot be put to the intended use. Without prejudice to any other rights, under the Contract or otherwise, the Employer shall then be entitled to recover all sums paid for the Works or for such part (as the case may be), plus financing costs and the cost of dismantling the same, clearing the Site and returning Plant and Materials to the Contractor.

11.5 Removal of Defective Work

If the defect or damage cannot be remedied expeditiously on the Site and the Employer gives consent, the Contractor may remove from the Site for the purposes of repair such items of Plant as are defective or damaged. This consent may require the Contractor to increase the amount of the Performance Security by the full replacement cost of these items, or to provide other appropriate security.

11.6 Further Tests

If the work of remedying of any defect or damage may affect the performance of the Works, the Engineer may require the repetition of any of the tests described in the Contract. The requirement shall be made by notice within 28 days after the defect or damage is remedied.

These tests shall be carried out in accordance with the terms applicable to the previous tests, except that they shall be carried out at the risk and cost of the Party liable, under Sub-Clause 11.2 [Cost of Remedying Defects], for the cost of the remedial work.

11.7 Right of Access

Until the Performance Certificate has been issued, the Contractor shall have such right of access to the Works as is reasonably required in order to comply with this Clause, except as may be inconsistent with the Employer's reasonable security restrictions.

11.8 Contractor to Search

The Contractor shall, if required by the Engineer, search for the cause of any defect, under the direction of the Engineer. Unless the defect is to be remedied at the cost of the Contractor under Sub-Clause 11.2 [Cost of Remedying Defects], the Cost of the search plus profit shall be agreed or determined by the Engineer in accordance with Sub-Clause 3.5 [Determinations] and shall be included in the Contract Price.

11.9 Performance Certificate

Performance of the Contractor's obligations shall not be considered to have been completed until the Engineer has issued the Performance Certificate to the Contractor, stating the date on which the Contractor completed his obligations under the Contract.

The Engineer shall issue the Performance Certificate within 28 days after the latest of the expiry dates of the Defects Notification Periods, or as soon thereafter as the Contractor has supplied all the Contractor's Documents and completed and tested all the Works, including remedying any defects. A copy of the Performance Certificate shall be issued to the Employer.

Only the Performance Certificate shall be deemed to constitute acceptance of the Works.

11.10 Unfulfilled Obligations

After the Performance Certificate has been issued, each Party shall remain liable for the fulfilment of any obligation which remains unperformed at that time. For the purposes of determining the nature and extent of unperformed obligations, the Contract shall be deemed to remain in force.

11.11 Clearance of Site

Upon receiving the Performance Certificate, the Contractor shall remove any remaining Contractor's Equipment, surplus material, wreckage, rubbish and Temporary Works from the Site.

If all these items have not been removed within 28 days after receipt by the Contractor of the Performance Certificate, the Employer may sell or otherwise dispose of any remaining items. The Employer shall be entitled to be paid the costs incurred in connection with, or attributable to, such sale or disposal and restoring the Site.

Any balance of the moneys from the sale shall be paid to the Contractor. If these moneys are less than the Employer's costs, the Contractor shall pay the outstanding balance to the Employer.

12 Measurement and Evaluation

12.1 Works to be Measured

The Works shall be measured, and valued for payment, in accordance with this Clause. The Contractor shall show in each application under Sub-Clauses 14.3 [Application for Interim Payment Certificates], 14.10 [Statement on Completion] and 14.11 [Application for Final Payment Certificate] the quantities and other particulars detailing the amounts which he considers to be entitled under the Contract.

Whenever the Engineer requires any part of the Works to be measured, reasonable notice shall be given to the Contractor's Representative, who shall:

- (a) promptly either attend or send another qualified representative to assist the Engineer in making the measurement, and
- (b) supply any particulars requested by the Engineer.

If the Contractor fails to attend or send a representative, the measurement made by (or on behalf of) the Engineer shall be accepted as accurate.

Except as otherwise stated in the Contract, wherever any Permanent Works are to be measured from records, these shall be prepared by the Engineer. The Contractor shall, as and when requested, attend to examine and agree the records with the Engineer, and shall sign the same when agreed. If the Contractor does not attend, the records shall be accepted as accurate.

If the Contractor examines and disagrees the records, and/or does not sign them as agreed, then the Contractor shall give notice to the Engineer of the respects in which the records are asserted to be inaccurate. After receiving this notice, the Engineer shall review the records and either confirm or vary them and certify the payment of the undisputed part. If the Contractor does not so give notice to the Engineer within 14 days after being requested to examine the records, they shall be accepted as accurate.

12.2 Method of Measurement

Except as otherwise stated in the Contract and notwithstanding local practice:

- (a) measurement shall be made of the net actual quantity of each item of the Permanent Works, and
- (b) the method of measurement shall be in accordance with the Bill of Quantities or other applicable Schedules.

12.3 Evaluation

Except as otherwise stated in the Contract, the Engineer shall proceed in accordance with Sub-Clause 3.5 [Determinations] to agree or determine the Contract Price by evaluating each item of work, applying the measurement agreed or determined in accordance with the above Sub-Clauses 12.1 and 12.2 and the appropriate rate or price for the item.

For each item of work, the appropriate rate or price for the item shall be the rate or price specified for such item in the Contract or, if there is no such item, specified for similar work.

Any item of work included in the Bill of Quantities for which no rate or price was specified shall be considered as included in other rates and prices in the Bill of Quantities and will not be paid for separately.

However, a new rate or price shall be appropriate for an item of work if:

- (a) (i) the measured quantity of the item is changed by more than 25% from the quantity of this item in the Bill of Quantities or other Schedule,
 - (ii) this change in quantity multiplied by such specified rate for this item exceeds 0.25% of the Accepted Contract Amount,
 - (iii) this change in quantity directly changes the Cost per unit quantity of this item by more than 1%, and
 - (iv) this item is not specified in the Contract as a "fixed rate item";
- or
- (b) (i) the work is instructed under Clause 13 [Variations and Adjustments],
 - (ii) no rate or price is specified in the Contract for this item, and
 - (iii) no specified rate or price is appropriate because the item of work is not of similar character, or is not executed under similar conditions, as any item in the Contract.

Each new rate or price shall be derived from any relevant rates or prices in the Contract, with reasonable adjustments to take account of the matters described in sub-paragraph (a) and/or (b), as applicable. If no rates or prices are relevant for the derivation of a new rate or price, it shall be derived from the reasonable Cost of executing the work, together with profit, taking account of any other relevant matters.

Until such time as an appropriate rate or price is agreed or determined, the Engineer shall determine a provisional rate or price for the purposes of Interim Payment Certificates as soon as the concerned work commences.

12.4 Omissions

Whenever the omission of any work forms part (or all) of a Variation, the value of which has not been agreed, if:

- (a) the Contractor will incur (or has incurred) cost which, if the work had not been omitted, would have been deemed to be covered by a sum forming part of the Accepted Contract Amount;
- (b) the omission of the work will result (or has resulted) in this sum not forming part of the Contract Price; and
- (c) this cost is not deemed to be included in the evaluation of any substituted work;

then the Contractor shall give notice to the Engineer accordingly, with supporting particulars. Upon receiving this notice, the Engineer shall proceed in accordance with Sub-Clause 3.5 [Determinations] to agree or determine this cost, which shall be included in the Contract Price.

13 Variations and Adjustments

13.1 Right to Vary

Variations may be initiated by the Engineer at any time prior to issuing the Taking-Over Certificate for the Works, either by an instruction or by a request for the Contractor to submit a proposal.

The Contractor shall execute and be bound by each Variation, unless the Contractor promptly gives notice to the Engineer stating (with supporting particulars) that (i) the Contractor cannot readily obtain the Goods required for the Variation, or (ii) such Variation triggers a substantial change in the sequence or progress of the Works. Upon receiving this notice, the Engineer shall cancel, confirm or vary the instruction.

Each Variation may include:

- (a) changes to the quantities of any item of work included in the Contract (however, such changes do not necessarily constitute a Variation),
- (b) changes to the quality and other characteristics of any item of work,
- (c) changes to the levels, positions and/or dimensions of any part of the Works,
- (d) omission of any work unless it is to be carried out by others,
- (e) any additional work, Plant, Materials or services necessary for the Permanent Works, including any associated Tests on Completion, boreholes and other testing and exploratory work, or
- (f) changes to the sequence or timing of the execution of the Works.

The Contractor shall not make any alteration and/or modification of the Permanent Works, unless and until the Engineer instructs or approves a Variation.

13.2 Value Engineering

The Contractor may, at any time, submit to the Engineer a written proposal which (in the Contractor's opinion) will, if adopted, (i) accelerate completion, (ii) reduce the cost to the Employer of executing, maintaining or operating the Works, (iii) improve the efficiency or value to the Employer of the completed Works, or (iv) otherwise be of benefit to the Employer.

The proposal shall be prepared at the cost of the Contractor and shall include the items listed in Sub-Clause 13.3 [Variation Procedure].

If a proposal, which is approved by the Engineer, includes a change in the design of part of the Permanent Works, then unless otherwise agreed by both Parties:

- (a) the Contractor shall design this part,
- (b) sub-paragraphs (a) to (d) of Sub-Clause 4.1 [Contractor's General Obligations] shall apply, and
- (c) if this change results in a reduction in the contract value of this part, the Engineer shall proceed in accordance with Sub-Clause 3.5 [Determinations] to agree or determine a fee, which shall be included in the Contract Price. This fee shall be half (50%) of the difference between the following amounts:
 - (i) such reduction in contract value, resulting from the change, excluding adjustments under Sub-Clause 13.7 [Adjustments for Changes in Legislation] and Sub-Clause 13.8 [Adjustments for Changes in Cost], and
 - (ii) the reduction (if any) in the value to the Employer of the varied works, taking account of any reductions in quality, anticipated life or operational efficiencies.

However, if amount (i) is less than amount (ii), there shall not be a fee.

13.3 Variation Procedure

If the Engineer requests a proposal, prior to instructing a Variation, the Contractor shall respond in writing as soon as practicable, either by giving reasons why he cannot comply (if this is the case) or by submitting:

- (a) a description of the proposed work to be performed and a programme for its execution,
- (b) the Contractor's proposal for any necessary modifications to the programme according to Sub-Clause 8.3 [Programme] and to the Time for Completion, and
- (c) the Contractor's proposal for evaluation of the Variation.

The Engineer shall, as soon as practicable after receiving such proposal (under Sub-Clause 13.2 [Value Engineering] or otherwise), respond with approval, disapproval or comments. The Contractor shall not delay any work whilst awaiting a response.

Each instruction to execute a Variation, with any requirements for the recording of Costs, shall be issued by the Engineer to the Contractor, who shall acknowledge receipt.

Each Variation shall be evaluated in accordance with Clause 12 [Measurement and Evaluation], unless the Engineer instructs or approves otherwise in accordance with this Clause.

13.4 Payment in Applicable Currencies

If the Contract provides for payment of the Contract Price in more than one currency, then whenever an adjustment is agreed, approved or determined as stated above, the amount payable in each of the applicable currencies shall be specified. For this purpose, reference shall be made to the actual or expected currency proportions of the Cost of the varied work, and to the proportions of various currencies specified for payment of the Contract Price.

13.5 Provisional Sums

Each Provisional Sum shall only be used, in whole or in part, in accordance with the Engineer's instructions, and the Contract Price shall be adjusted accordingly. The total sum paid to the Contractor shall include only such amounts, for the work, supplies or services to which the Provisional Sum relates, as the Engineer shall have instructed. For each Provisional Sum, the Engineer may instruct:

- (a) work to be executed (including Plant, Materials or services to be supplied) by the Contractor and valued under Sub-Clause 13.3 [Variation Procedure]; and/or
- (b) Plant, Materials or services to be purchased by the Contractor, from a nominated Subcontractor (as defined in Clause 5 [Nominated Subcontractors]) or otherwise; and for which there shall be included in the Contract Price:
 - (i) the actual amounts paid (or due to be paid) by the Contractor, and
 - (ii) a sum for overhead charges and profit, calculated as a percentage of these actual amounts by applying the relevant percentage rate (if any) stated in the appropriate Schedule. If there is no such rate, the percentage rate stated in the Contract Data shall be applied.

The Contractor shall, when required by the Engineer, produce quotations, invoices, vouchers and accounts or receipts in substantiation.

13.6 Daywork

For work of a minor or incidental nature, the Engineer may instruct that a Variation shall be executed on a daywork basis. The work shall then be valued in accordance with the Daywork Schedule included in the Contract, and the following procedure shall apply. If a Daywork Schedule is not included in the Contract, this Sub-Clause shall not apply.

Before ordering Goods for the work, the Contractor shall submit quotations to the Engineer. When applying for payment, the Contractor shall submit invoices, vouchers and accounts or receipts for any Goods.

Except for any items for which the Daywork Schedule specifies that payment is not due, the Contractor shall deliver each day to the Engineer accurate statements in duplicate which shall include the following details of the resources used in executing the previous day's work:

- (a) the names, occupations and time of Contractor's Personnel,
- (b) the identification, type and time of Contractor's Equipment and Temporary Works, and
- (c) the quantities and types of Plant and Materials used.

One copy of each statement will, if correct, or when agreed, be signed by the Engineer and returned to the Contractor. The Contractor shall then submit priced statements of these resources to the Engineer, prior to their inclusion in the next Statement under Sub-Clause 14.3 [Application for Interim Payment Certificates].

13.7 Adjustments for Changes in Legislation

The Contract Price shall be adjusted to take account of any increase or decrease in Cost resulting from a change in the Laws of the Country (including the introduction of new Laws and the repeal or modification of existing Laws) or in the judicial or official governmental interpretation of such Laws, made after the Base Date, which affect the Contractor in the performance of obligations under the Contract.

If the Contractor suffers (or will suffer) delay and/or incurs (or will incur) additional Cost as a result of these changes in the Laws or in such interpretations, made after the Base Date, the Contractor shall give notice to the Engineer and shall be entitled subject to Sub-Clause 20.1 [Contractor's Claims] to:

- (a) an extension of time for any such delay, if completion is or will be delayed, under Sub-Clause 8.4 [Extension of Time for Completion], and
- (b) payment of any such Cost, which shall be included in the Contract Price.

After receiving this notice, the Engineer shall proceed in accordance with Sub-Clause 3.5 [Determinations] to agree or determine these matters.

Notwithstanding the foregoing, the Contractor shall not be entitled to an extension of time if the relevant delay has already been taken into account in the determination of a previous extension of time and such Cost shall not be separately paid if the same shall already have been taken into account in the indexing of any inputs to the table of adjustment data in accordance with the provisions of Sub-Clause 13.8 [Adjustments for Changes in Cost].

13.8 Adjustments for Changes in Cost

In this Sub-Clause, "table of adjustment data" means the completed table of adjustment data for local and foreign currencies included in the Schedules. If there is no such table of adjustment data, this Sub-Clause shall not apply.

If this Sub-Clause applies, the amounts payable to the Contractor shall be adjusted for rises or falls in the cost of labour, Goods and other inputs to the Works, by the addition or deduction of the amounts determined by the formulae prescribed in this Sub-Clause. To the extent that full compensation for any rise or fall in Costs is not covered by the provisions of this or other Clauses, the Accepted Contract Amount shall be deemed to have included amounts to cover the contingency of other rises and falls in costs.

The adjustment to be applied to the amount otherwise payable to the Contractor, as valued in accordance with the appropriate Schedule and certified in Payment Certificates, shall be determined from formulae for each of the currencies in which the Contract Price is payable. No adjustment is to be applied to work valued on the basis of Cost or current prices. The formulae shall be of the following general type:

$$P_n = a + b L_n / L_o + c E_n / E_o + d M_n / M_o + \dots$$

where:

“P_n” is the adjustment multiplier to be applied to the estimated contract value in the relevant currency of the work carried out in period “n”, this period being a month unless otherwise stated in the Contract Data;

“a” is a fixed coefficient, stated in the relevant table of adjustment data, representing the non-adjustable portion in contractual payments;

“b”, “c”, “d”, ... are coefficients representing the estimated proportion of each cost element related to the execution of the Works, as stated in the relevant table of adjustment data; such tabulated cost elements may be indicative of resources such as labour, equipment and materials;

“L_n”, “E_n”, “M_n”, ... are the current cost indices or reference prices for period “n”, expressed in the relevant currency of payment, each of which is applicable to the relevant tabulated cost element on the date 49 days prior to the last day of the period (to which the particular Payment Certificate relates); and

“L_o”, “E_o”, “M_o”, ... are the base cost indices or reference prices, expressed in the relevant currency of payment, each of which is applicable to the relevant tabulated cost element on the Base Date.

The cost indices or reference prices stated in the table of adjustment data shall be used. If their source is in doubt, it shall be determined by the Engineer. For this purpose, reference shall be made to the values of the indices at stated dates for the purposes of clarification of the source; although these dates (and thus these values) may not correspond to the base cost indices.

In cases where the “currency of index” is not the relevant currency of payment, each index shall be converted into the relevant currency of payment at the selling rate, established by the central bank of the Country, of this relevant currency on the above date for which the index is required to be applicable

Until such time as each current cost index is available, the Engineer shall determine a provisional index for the issue of Interim Payment Certificates. When a current cost index is available, the adjustment shall be recalculated accordingly.

If the Contractor fails to complete the Works within the Time for Completion, adjustment of prices thereafter shall be made using either (i) each index or price applicable on the date 49 days prior to the expiry of the Time for Completion of the Works, or (ii) the current index or price, whichever is more favourable to the Employer.

The weightings (coefficients) for each of the factors of cost stated in the table(s) of adjustment data shall only be adjusted if they have been rendered unreasonable, unbalanced or inapplicable, as a result of Variations.

14 Contract Price and Payment

14.1 The Contract Price

Unless otherwise stated in the Particular Conditions:

- (a) the Contract Price shall be agreed or determined under Sub-Clause 12.3 [Evaluation] and be subject to adjustments in accordance with the Contract;

- (b) the Contractor shall pay all taxes, duties and fees required to be paid by him under the Contract, and the Contract Price shall not be adjusted for any of these costs except as stated in Sub-Clause 13.7 [Adjustments for Changes in Legislation];
- (c) any quantities which may be set out in the Bill of Quantities or other Schedule are estimated quantities and are not to be taken as the actual and correct quantities:
 - (i) of the Works which the Contractor is required to execute, or
 - (ii) for the purposes of Clause 12 [Measurement and Evaluation]; and
- (d) the Contractor shall submit to the Engineer, within 28 days after the Commencement Date, a proposed breakdown of each lump sum price in the Schedules. The Engineer may take account of the breakdown when preparing Payment Certificates, but shall not be bound by it.

Notwithstanding the provisions of sub-paragraph (b), Contractor's Equipment, including essential spare parts therefor, imported by the Contractor for the sole purpose of executing the Contract shall be exempt from the payment of import duties and taxes upon importation.

14.2 Advance Payment

The Employer shall make an advance payment, as an interest-free loan for mobilisation and cash flow support, when the Contractor submits a guarantee in accordance with this Sub-Clause. The total advance payment, the number and timing of instalments (if more than one), and the applicable currencies and proportions, shall be as stated in the Contract Data.

Unless and until the Employer receives this guarantee, or if the total advance payment is not stated in the Contract Data, this Sub-Clause shall not apply.

The Engineer shall deliver to the Employer and to the Contractor an Interim Payment Certificate for the advance payment or its first instalment after receiving a Statement (under Sub-Clause 14.3 [Application for Interim Payment Certificates]) and after the Employer receives (i) the Performance Security in accordance with Sub-Clause 4.2 [Performance Security] and (ii) a guarantee in amounts and currencies equal to the advance payment. This guarantee shall be issued by a reputable bank or financial institution selected by the Contractor and shall be in the form annexed to the Particular Conditions or in another form approved by the Employer.

The Contractor shall ensure that the guarantee is valid and enforceable until the advance payment has been repaid, but its amount shall be progressively reduced by the amount repaid by the Contractor as indicated in the Payment Certificates. If the terms of the guarantee specify its expiry date, and the advance payment has not been repaid by the date 28 days prior to the expiry date, the Contractor shall extend the validity of the guarantee until the advance payment has been repaid.

Unless stated otherwise in the Contract Data, the advance payment shall be repaid through percentage deductions from the interim payments determined by the Engineer in accordance with Sub-Clause 14.6 [Issue of Interim Payment Certificates], as follows:

- (a) deductions shall commence in the next interim Payment Certificate following that in which the total of all certified interim payments (excluding the advance payment and deductions and repayments of retention) exceeds 30 percent (30%) of the Accepted Contract Amount less Provisional Sums; and
- (b) deductions shall be made at the amortisation rate stated in the Contract Data of the amount of each Interim Payment Certificate (excluding the advance payment and deductions for its repayments as well as deductions for retention money) in the currencies and proportions of the advance payment until such time as the advance payment has been repaid; provided that the advance payment shall be completely repaid prior to the time when 90 percent (90%) of the Accepted Contract Amount less Provisional Sums has been certified for payment.

If the advance payment has not been repaid prior to the issue of the Taking-Over Certificate for the Works or prior to termination under Clause 15 [Termination by Employer], Clause 16 [Suspension and Termination by Contractor] or Clause 19 [Force Majeure] (as the case may be), the whole of the balance then outstanding shall immediately become due and in case of termination under Clause 15 [Termination by Employer], except for Sub-Clause 15.5 [Employer's Entitlement to Termination for Convenience], payable by the Contractor to the Employer.

14.3 Application for Interim Payment Certificates

The Contractor shall submit a Statement in six copies to the Engineer after the end of each month, in a form approved by the Engineer, showing in detail the amounts to which the Contractor considers himself to be entitled, together with supporting documents which shall include the report on the progress during this month in accordance with Sub-Clause 4.21 [Progress Reports].

The Statement shall include the following items, as applicable, which shall be expressed in the various currencies in which the Contract Price is payable, in the sequence listed:

- (a) the estimated contract value of the Works executed and the Contractor's Documents produced up to the end of the month (including Variations but excluding items described in sub-paragraphs (b) to (g) below);
- (b) any amounts to be added and deducted for changes in legislation and changes in cost, in accordance with Sub-Clause 13.7 [Adjustments for Changes in Legislation] and Sub-Clause 13.8 [Adjustments for Changes in Cost];
- (c) any amount to be deducted for retention, calculated by applying the percentage of retention stated in the Contract Data to the total of the above amounts, until the amount so retained by the Employer reaches the limit of Retention Money (if any) stated in the Contract Data;
- (d) any amounts to be added for the advance payment (if more than one instalment) and to be deducted for its repayments in accordance with Sub-Clause 14.2 [Advance Payment];
- (e) any amounts to be added and deducted for Plant and Materials in accordance with Sub-Clause 14.5 [Plant and Materials intended for the Works];
- (f) any other additions or deductions which may have become due under the Contract or otherwise, including those under Clause 20 [Claims, Disputes and Arbitration]; and
- (g) the deduction of amounts certified in all previous Payment Certificates.

14.4 Schedule of Payments

If the Contract includes a schedule of payments specifying the instalments in which the Contract Price will be paid, then unless otherwise stated in this schedule:

- (a) the instalments quoted in this schedule of payments shall be the estimated contract values for the purposes of sub-paragraph (a) of Sub-Clause 14.3 [Application for Interim Payment Certificates];
- (b) Sub-Clause 14.5 [Plant and Materials intended for the Works] shall not apply; and
- (c) if these instalments are not defined by reference to the actual progress achieved in executing the Works, and if actual progress is found to be less or more than that on which this schedule of payments was based, then the Engineer may proceed in accordance with Sub-Clause 3.5 [Determinations] to agree or determine revised instalments, which shall take account of the extent to which progress is less or more than that on which the instalments were previously based.

If the Contract does not include a schedule of payments, the Contractor shall submit non-binding estimates of the payments which he expects to become due during each quarterly period. The first estimate shall be submitted within 42 days after the Commencement Date. Revised estimates shall be submitted at quarterly intervals, until the Taking-Over Certificate has been issued for the Works.

14.5 Plant and Materials intended for the Works

If this Sub-Clause applies, Interim Payment Certificates shall include, under sub-paragraph (e) of Sub-Clause 14.3, (i) an amount for Plant and Materials which have been sent to the Site for incorporation in the Permanent Works, and (ii) a reduction when the contract value of such Plant and Materials is included as part of the Permanent Works under sub-paragraph (a) of Sub-Clause 14.3 [Application for Interim Payment Certificates].

If the lists referred to in sub-paragraphs (b)(i) or (c)(i) below are not included in the Schedules this Sub-Clause shall not apply.

The Engineer shall determine and certify each addition if the following conditions are satisfied:

(a) the Contractor has:

- (i) kept satisfactory records (including the orders, receipts, Costs and use of Plant and Materials) which are available for inspection, and
- (ii) submitted a statement of the Cost of acquiring and delivering the Plant and Materials to the Site, supported by satisfactory evidence;

and either:

(b) the relevant Plant and Materials:

- (i) are those listed in the Schedules for payment when shipped,
- (ii) have been shipped to the Country, en route to the Site, in accordance with the Contract; and
- (iii) are described in a clean shipped bill of lading or other evidence of shipment, which has been submitted to the Engineer together with evidence of payment of freight and insurance, any other documents reasonably required, and a bank guarantee in a form and issued by an entity approved by the Employer in amounts and currencies equal to the amount due under this Sub-Clause: this guarantee may be in a similar form to the form referred to in Sub-Clause 14.2 [Advance Payment] and shall be valid until the Plant and Materials are properly stored on Site and protected against loss, damage or deterioration;

or

(c) the relevant Plant and Materials:

- (i) are those listed in the Schedules for payment when delivered to the Site, and
- (ii) have been delivered to and are properly stored on the Site, are protected against loss, damage or deterioration, and appear to be in accordance with the Contract.

The additional amount to be certified shall be the equivalent of eighty percent (80%) of the Engineer's determination of the cost of the Plant and Materials (including delivery to Site), taking account of the documents mentioned in this Sub-Clause and of the contract value of the Plant and Materials.

The currencies for this additional amount shall be the same as those in which payment will become due when the contract value is included under sub-paragraph (a) of Sub-Clause 14.3 [Application for Interim Payment Certificates]. At that time, the Payment Certificate shall include the applicable reduction which shall be equivalent to, and in the same currencies and proportions as, this additional amount for the relevant Plant and Materials

14.6 Issue of Interim Payment Certificates

No amount will be certified or paid until the Employer has received and approved the Performance Security. Thereafter, the Engineer shall, within 28 days after receiving a Statement and supporting documents, deliver to the Employer and to the Contractor an Interim Payment Certificate which shall state the amount which the Engineer fairly determines to be due, with all supporting particulars for any reduction or withholding made by the Engineer on the Statement if any.

However, prior to issuing the Taking-Over Certificate for the Works, the Engineer shall not be bound to issue an Interim Payment Certificate in an amount which would (after retention and other deductions) be less than the minimum amount of Interim Payment Certificates (if any) stated in the Contract Data. In this event, the Engineer shall give notice to the Contractor accordingly.

An Interim Payment Certificate shall not be withheld for any other reason, although:

- (a) if any thing supplied or work done by the Contractor is not in accordance with the Contract, the cost of rectification or replacement may be withheld until rectification or replacement has been completed; and/or
- (b) if the Contractor was or is failing to perform any work or obligation in accordance with the Contract, and had been so notified by the Engineer, the value of this work or obligation may be withheld until the work or obligation has been performed.

The Engineer may in any Payment Certificate make any correction or modification that should properly be made to any previous Payment Certificate. A Payment Certificate shall not be deemed to indicate the Engineer's acceptance, approval, consent or satisfaction.

14.7 Payment

The Employer shall pay to the Contractor:

- (a) the first instalment of the advance payment within 42 days after issuing the Letter of Acceptance or within 21 days after receiving the documents in accordance with Sub-Clause 4.2 [Performance Security] and Sub-Clause 14.2 [Advance Payment], whichever is later;
- (b) the amount certified in each Interim Payment Certificate within 56 days after the Engineer receives the Statement and supporting documents; or, at a time when the Bank's loan or credit (from which part of the payments to the Contractor is being made) is suspended, the amount shown on any statement submitted by the Contractor within 14 days after such statement is submitted, any discrepancy being rectified in the next payment to the Contractor; and
- (c) the amount certified in the Final Payment Certificate within 56 days after the Employer receives this Payment Certificate; or, at a time when the Bank's loan or credit (from which part of the payments to the Contractor is being made) is suspended, the undisputed amount shown in the Final Statement within 56 days after the date of notification of the suspension in accordance with Sub-Clause 16.2 [Termination by Contractor].

Payment of the amount due in each currency shall be made into the bank account, nominated by the Contractor, in the payment country (for this currency) specified in the Contract.

14.8 Delayed Payment

If the Contractor does not receive payment in accordance with Sub-Clause 14.7 [Payment], the Contractor shall be entitled to receive financing charges compounded monthly on the amount unpaid during the period of delay. This period shall be deemed to commence on the date for payment specified in Sub-Clause 14.7 [Payment], irrespective (in the case of its sub-paragraph (b)) of the date on which any Interim Payment Certificate is issued.

Unless otherwise stated in the Particular Conditions, these financing charges shall be calculated at the annual rate of three percentage points above the discount rate of the central bank in the country of the currency of payment, or if not available, the interbank offered rate, and shall be paid in such currency.

The Contractor shall be entitled to this payment without formal notice or certification, and without prejudice to any other right or remedy.

14.9 Payment of Retention Money

When the Taking-Over Certificate has been issued for the Works, the first half of the Retention Money shall be certified by the Engineer for payment to the Contractor. If a Taking-Over Certificate is issued for a Section or part of the Works, a proportion of the Retention Money shall be certified and paid. This proportion shall be half (50%) of the proportion calculated by dividing the estimated contract value of the Section or part, by the estimated final Contract Price.

Promptly after the latest of the expiry dates of the Defects Notification Periods, the outstanding balance of the Retention Money shall be certified by the Engineer for payment to the Contractor. If a Taking-Over Certificate was issued for a Section, a proportion of the second half of the Retention Money shall be certified and paid promptly after the expiry date of the Defects Notification Period for the Section. This proportion shall be half (50%) of the proportion calculated by dividing the estimated contract value of the Section by the estimated final Contract Price.

However, if any work remains to be executed under Clause 11 [Defects Liability], the Engineer shall be entitled to withhold certification of the estimated cost of this work until it has been executed.

When calculating these proportions, no account shall be taken of any adjustments under Sub-Clause 13.7 [Adjustments for Changes in Legislation] and Sub-Clause 13.8 [Adjustments for Changes in Cost].

Unless otherwise stated in the Particular Conditions, when the Taking-Over Certificate has been issued for the Works and the first half of the Retention Money has been certified for payment by the Engineer, the Contractor shall be entitled to substitute a guarantee, in the form annexed to the Particular Conditions or in another form approved by the Employer and issued by a reputable bank or financial institution selected by the Contractor, for the second half of the Retention Money. The Contractor shall ensure that the guarantee is in the amounts and currencies of the second half of the Retention Money and is valid and enforceable until the Contractor has executed and completed the Works and remedied any defects, as specified for the Performance Security in Sub-Clause 4.2. On receipt by the Employer of the required guarantee, the Engineer shall certify and the Employer shall pay the second half of the Retention Money. The release of the second half of the Retention Money against a guarantee shall then be in lieu of the release under the second paragraph of this Sub-Clause. The Employer shall return the guarantee to the Contractor within 21 days after receiving a copy of the Performance Certificate.

If the Performance Security required under Sub-Clause 4.2 is in the form of a demand guarantee, and the amount guaranteed under it when the Taking-Over Certificate is issued is more than half of the Retention Money, then the Retention Money guarantee will not be required. If the amount guaranteed under the Performance Security when the Taking-Over Certificate is issued is less than half of the Retention Money, the Retention Money guarantee will only be required for the difference between half of the Retention Money and the amount guaranteed under the Performance Security.

14.10 Statement at Completion

Within 84 days after receiving the Taking-Over Certificate for the Works, the Contractor shall submit to the Engineer six copies of a Statement at completion with supporting documents, in accordance with Sub-Clause 14.3 [Application for Interim Payment Certificates], showing:

- (a) the value of all work done in accordance with the Contract up to the date stated in the Taking-Over Certificate for the Works,
- (b) any further sums which the Contractor considers to be due, and

- (c) an estimate of any other amounts which the Contractor considers will become due to him under the Contract. Estimated amounts shall be shown separately in this Statement at completion.

The Engineer shall then certify in accordance with Sub-Clause 14.6 [Issue of Interim Payment Certificates].

14.11 Application for Final Payment Certificate

Within 56 days after receiving the Performance Certificate, the Contractor shall submit, to the Engineer, six copies of a draft final statement with supporting documents showing in detail in a form approved by the Engineer:

- (a) the value of all work done in accordance with the Contract, and
- (b) any further sums which the Contractor considers to be due to him under the Contract or otherwise.

If the Engineer disagrees with or cannot verify any part of the draft final statement, the Contractor shall submit such further information as the Engineer may reasonably require within 28 days from receipt of said draft and shall make such changes in the draft as may be agreed between them. The Contractor shall then prepare and submit to the Engineer the final statement as agreed. This agreed statement is referred to in these Conditions as the "Final Statement".

However if, following discussions between the Engineer and the Contractor and any changes to the draft final statement which are agreed, it becomes evident that a dispute exists, the Engineer shall deliver to the Employer (with a copy to the Contractor) an Interim Payment Certificate for the agreed parts of the draft final statement. Thereafter, if the dispute is finally resolved under Sub-Clause 20.4 [Obtaining Dispute Board's Decision] or Sub-Clause 20.5 [Amicable Settlement], the Contractor shall then prepare and submit to the Employer (with a copy to the Engineer) a Final Statement.

14.12 Discharge

When submitting the Final Statement, the Contractor shall submit a discharge which confirms that the total of the Final Statement represents full and final settlement of all moneys due to the Contractor under or in connection with the Contract. This discharge may state that it becomes effective when the Contractor has received the Performance Security and the outstanding balance of this total, in which event the discharge shall be effective on such date.

14.13 Issue of Final Payment Certificate

Within 28 days after receiving the Final Statement and discharge in accordance with Sub-Clause 14.11 [Application for Final Payment Certificate] and Sub-Clause 14.12 [Discharge], the Engineer shall deliver, to the Employer and to the Contractor, the Final Payment Certificate which shall state:

- (a) the amount which he fairly determines is finally due, and
- (b) after giving credit to the Employer for all amounts previously paid by the Employer and for all sums to which the Employer is entitled, the balance (if any) due from the Employer to the Contractor or from the Contractor to the Employer, as the case may be.

If the Contractor has not applied for a Final Payment Certificate in accordance with Sub-Clause 14.11 [Application for Final Payment Certificate] and Sub-Clause 14.12 [Discharge], the Engineer shall request the Contractor to do so. If the Contractor fails to submit an application within a period of 28 days, the Engineer shall issue the Final Payment Certificate for such amount as he fairly determines to be due.

14.14 Cessation of Employer's Liability

The Employer shall not be liable to the Contractor for any matter or thing under or in connection with the Contract or execution of the Works, except to the extent that the Contractor shall have included an amount expressly for it:

- (a) in the Final Statement and also
- (b) (except for matters or things arising after the issue of the Taking-Over Certificate for the Works) in the Statement at completion described in Sub-Clause 14.10 [Statement at Completion].

However, this Sub-Clause shall not limit the Employer's liability under his indemnification obligations, or the Employer's liability in any case of fraud, deliberate default or reckless misconduct by the Employer.

14.15 Currencies of Payment

The Contract Price shall be paid in the currency or currencies named in the Schedule of Payment Currencies. If more than one currency is so named, payments shall be made as follows:

- (a) if the Accepted Contract Amount was expressed in Local Currency only:
 - (i) the proportions or amounts of the Local and Foreign Currencies, and the fixed rates of exchange to be used for calculating the payments, shall be as stated in the Schedule of Payment Currencies, except as otherwise agreed by both Parties;
 - (ii) payments and deductions under Sub-Clause 13.5 [Provisional Sums] and Sub-Clause 13.7 [Adjustments for Changes in Legislation] shall be made in the applicable currencies and proportions; and
 - (iii) other payments and deductions under sub-paragraphs (a) to (d) of Sub-Clause 14.3 [Application for Interim Payment Certificates] shall be made in the currencies and proportions specified in sub-paragraph (a)(i) above;
- (b) payment of the damages specified in the Contract Data shall be made in the currencies and proportions specified in the Schedule of Payment Currencies;
- (c) other payments to the Employer by the Contractor shall be made in the currency in which the sum was expended by the Employer, or in such currency as may be agreed by both Parties;
- (d) if any amount payable by the Contractor to the Employer in a particular currency exceeds the sum payable by the Employer to the Contractor in that currency, the Employer may recover the balance of this amount from the sums otherwise payable to the Contractor in other currencies; and
- (e) if no rates of exchange are stated in the Schedule of Payment Currencies, they shall be those prevailing on the Base Date and determined by the central bank of the Country.

15 Termination by Employer

15.1 Notice to Correct

If the Contractor fails to carry out any obligation under the Contract, the Engineer may by notice require the Contractor to make good the failure and to remedy it within a specified reasonable time.

15.2 Termination by Employer

The Employer shall be entitled to terminate the Contract if the Contractor:

- (a) fails to comply with Sub-Clause 4.2 [Performance Security] or with a notice under Sub-Clause 15.1 [Notice to Correct],
- (b) abandons the Works or otherwise plainly demonstrates the intention not to continue performance of his obligations under the Contract,
- (c) without reasonable excuse fails:
 - (i) to proceed with the Works in accordance with Clause 8 [Commencement, Delays and Suspension], or
 - (ii) to comply with a notice issued under Sub-Clause 7.5 [Rejection] or Sub-Clause 7.6 [Remedial Work], within 28 days after receiving it,
- (d) subcontracts the whole of the Works or assigns the Contract without the required agreement,
- (e) becomes bankrupt or insolvent, goes into liquidation, has a receiving or administration order made against him, compounds with his creditors, or carries on business under a receiver, trustee or manager for the benefit of his creditors, or if any act is done or event occurs which (under applicable Laws) has a similar effect to any of these acts or events, or
- (f) gives or offers to give (directly or indirectly) to any person any bribe, gift, gratuity, commission or other thing of value, as an inducement or reward:
 - (i) for doing or forbearing to do any action in relation to the Contract, or
 - (ii) for showing or forbearing to show favour or disfavour to any person in relation to the Contract,

or if any of the Contractor's Personnel, agents or Subcontractors gives or offers to give (directly or indirectly) to any person any such inducement or reward as is described in this sub-paragraph (f). However, lawful inducements and rewards to Contractor's Personnel shall not entitle termination.

In any of these events or circumstances, the Employer may, upon giving 14 days' notice to the Contractor, terminate the Contract and expel the Contractor from the Site. However, in the case of sub-paragraph (e) or (f), the Employer may by notice terminate the Contract immediately.

The Employer's election to terminate the Contract shall not prejudice any other rights of the Employer, under the Contract or otherwise.

The Contractor shall then leave the Site and deliver any required Goods, all Contractor's Documents, and other design documents made by or for him, to the Engineer. However, the Contractor shall use his best efforts to comply immediately with any reasonable instructions included in the notice (i) for the assignment of any subcontract, and (ii) for the protection of life or property or for the safety of the Works.

After termination, the Employer may complete the Works and/or arrange for any other entities to do so. The Employer and these entities may then use any Goods, Contractor's Documents and other design documents made by or on behalf of the Contractor.

The Employer shall then give notice that the Contractor's Equipment and Temporary Works will be released to the Contractor at or near the Site. The Contractor shall promptly arrange their removal, at the risk and cost of the Contractor. However, if by this time the Contractor has failed to make a payment due to the Employer, these items may be sold by the Employer in order to recover this payment. Any balance of the proceeds shall then be paid to the Contractor.

15.3 Valuation at Date of Termination

As soon as practicable after a notice of termination under Sub-Clause 15.2 [Termination by Employer] has taken effect, the Engineer shall proceed in accordance with Sub-Clause 3.5 [Determinations] to agree or determine the value of the Works, Goods and Contractor's Documents, and any other sums due to the Contractor for work executed in accordance with the Contract.

15.4 Payment after Termination

After a notice of termination under Sub-Clause 15.2 [Termination by Employer] has taken effect, the Employer may:

- (a) proceed in accordance with Sub-Clause 2.5 [Employer's Claims],
- (b) withhold further payments to the Contractor until the costs of execution, completion and remedying of any defects, damages for delay in completion (if any), and all other costs incurred by the Employer, have been established, and/or
- (c) recover from the Contractor any losses and damages incurred by the Employer and any extra costs of completing the Works, after allowing for any sum due to the Contractor under Sub-Clause 15.3 [Valuation at Date of Termination]. After recovering any such losses, damages and extra costs, the Employer shall pay any balance to the Contractor.

15.5 Employer's Entitlement to Termination for Convenience

The Employer shall be entitled to terminate the Contract, at any time for the Employer's convenience, by giving notice of such termination to the Contractor. The termination shall take effect 28 days after the later of the dates on which the Contractor receives this notice or the Employer returns the Performance Security. The Employer shall not terminate the Contract under this Sub-Clause in order to execute the Works himself or to arrange for the Works to be executed by another contractor or to avoid a termination of the Contract by the Contractor under Clause 16.2 [Termination by Contractor].

After this termination, the Contractor shall proceed in accordance with Sub-Clause 16.3 [Cessation of Work and Removal of Contractor's Equipment] and shall be paid in accordance with Sub-Clause 16.4 [Payment on Termination].

15.6 Corrupt or Fraudulent Practices

If the Employer determines, based on reasonable evidence, that the Contractor has engaged in corrupt, fraudulent, collusive or coercive practices, in competing for or in executing the Contract, then the Employer may, after giving 14 days notice to the Contractor, terminate the Contract and expel him from the Site, and the provisions of Clause 15 shall apply as if such termination had been made under Sub-Clause 15.2 [Termination by Employer].

Should any employee of the Contractor be determined, based on reasonable evidence, to have engaged in corrupt, fraudulent or coercive practice during the execution of the work then that employee shall be removed in accordance with Sub-Clause 6.9 [Contractor's Personnel].

[For contracts financed by the African Development Bank]

For the purposes of this Sub-Clause:

- (a) "corrupt practice" means the offering, giving, receiving or soliciting of any thing of value to influence the action of a public official in the procurement process or in the Contract execution; and
- (b) "fraudulent practice" means a misrepresentation of facts in order to influence a procurement process or the execution of the Contract to the detriment of the Borrower, and includes collusive practice among Bidders (prior to or after bid submission) designed to establish bid prices at artificial non-competitive levels and to deprive the Borrower of the benefits of free and open competition.

[For contracts financed by the Asian Development Bank]

For the purposes of this Sub-Clause:

- (a) "corrupt practice" means the offering, giving, receiving, or soliciting, directly or indirectly, anything of value to influence improperly the actions of another party;
- (b) "fraudulent practice" means any act or omission, including a misrepresentation, that knowingly or recklessly misleads, or attempts to mislead, a party to obtain a financial or other benefit or to avoid an obligation;
- (c) "coercive practice" means impairing or harming, or threatening to impair or harm, directly or indirectly, any party or the property of the party to influence improperly the actions of a party;
- (d) "collusive practice" means an arrangement between two or more parties designed to achieve an improper purpose, including influencing improperly the actions of another party.

[For contracts financed by the Black Sea Trade and Development Bank and by the European Bank for Reconstruction and Development]

For the purposes of this Sub-Clause, the Bank defines, for the purposes of this provision, the terms set forth below as follows:

- (a) "corrupt practice" means the offering, giving, receiving, or soliciting of any thing of value to influence a person, or the threatening of injury to person, property or reputation, in connection with the procurement process or in contract execution in order to obtain or retain business or other improper advantage in the conduct of international business;
- (b) "fraudulent practice" means a misrepresentation of facts in order to influence a procurement process or the execution of a contract to the detriment of the client, and includes collusive practices among tenderers (prior to or after tender submission) designed to establish tender prices at artificial, non-competitive levels and to deprive the client of the benefits of free and open competition.

[For contracts financed by the Caribbean Development Bank:]

For the purposes of this Sub-Clause:

- (a) "corrupt practice" means the offering, giving, receiving or soliciting, directly or indirectly, of any thing of value to influence the action of a public official in the procurement process or in the Contract execution;
- (b) "fraudulent practice" means a misrepresentation or omission of facts in order to influence a procurement process or the execution of the Contract;
- (c) "collusive practice" means a scheme or arrangement between two or more bidders, with or without the knowledge of the Borrower, designed to establish bid prices at artificial, non-competitive levels;
- (d) "coercive practice" means harming or threatening to harm, directly or indirectly, persons or their property to influence their participation in the procurement process or affect the execution of a contract.

[For contracts financed by the Inter-American Development Bank]

For the purposes of this Sub-Clause:

The Bank requires that all Contractors adhere to the Bank's Policies for the Procurement of Works and Goods financed by the Bank. In particular, the Bank requires that all Borrowers (including grant beneficiaries), the executing agencies and contracting agencies, as well as all firms, entities and individuals bidding for or participating in a Bank-financed project, including, inter alia, applicants, bidders, contractors, consulting firms and individual consultants (including their respective officers, employees and agents) adhere to the highest ethical standards, and report to the Bank all suspected acts of fraud or corruption of which it has knowledge or becomes aware, during the Bidding Process and throughout the negotiation or execution of a Contract. Fraud and corruption are prohibited.

Fraud and corruption include acts of:

- (a) bribery,
- (b) extortion or coercion,
- (c) fraud, and
- (d) collusion.

The definitions of actions set forth below cover the most common types of corrupt practices, but are not exhaustive. For this reason, the Bank shall also take action in the event of any similar deed or complaint involving alleged acts of corruption, even when these are not specified in the following list. The Bank shall in all cases proceed in accordance with Sub-Clause 15.6.

In pursuance of this policy:

- (a) the Bank defines the terms set forth below as follows:
 - (i) "bribery" meaning the offering or giving of anything of value to influence the actions or decisions of third parties or the receiving or soliciting of any benefit in exchange for actions or omissions related to the performance of duties;
 - (ii) "extortion" or "coercion" meaning the act of obtaining something, compelling an action or influencing a decision through intimidation, threat or the use of force, where potential or actual injury may befall upon a person, his/her reputation or property;
 - (ii) "fraud" meaning any action or omission intended to misrepresent the truth so as to induce others to act in reliance thereof, with the purpose of obtaining some unjust advantage or causing damage to others; and
 - (iv) "collusion" meaning a secret agreement between two or more parties to defraud or cause damage to a person or entity or to obtain an unlawful purpose;
- (b) if the Bank, in accordance with its administrative procedures, demonstrates that any firm, entity or individual bidding for or participating in a Bank-financed project including, inter alia, applicants, bidders, contractors, consulting firms, individual consultants, borrowers (including grant beneficiaries), purchasers, executing agencies and contracting agency (including their respective officers, employees and agents) engaged in an act of fraud or corruption in connection with Bank-financed projects, the Bank may:
 - (i) decide not to finance any proposal to award a contract or a contract awarded financed by the Bank;
 - (ii) suspend disbursement of the operation if it is determined at any stage that evidence is sufficient to support a finding that an employee, agent or representative of the Borrower, Executing Agency or Contracting Agency has engaged in an act of fraud or corruption;
 - (iii) cancel and/or accelerate the payment of, the portion of a loan or grant earmarked for a contract, when there is evidence that the representative of the Borrower, or Beneficiary of a grant, has not taken the adequate remedial measures within a time period which the Bank considers reasonable, and in accordance with the due process guarantees of the Borrowing country's legislation;
 - (iv) issue a reprimand in the form of a formal letter of censure of the firm, entity or individual's behaviour;
 - (v) issue a declaration that an individual, entity or firm is ineligible, either permanently or for a stated period of time, to be awarded contracts under Bank-financed projects except under such conditions as the Bank deems to be appropriate;
 - (v) refer the matter to appropriate law enforcement authorities; and/or;

- (vii) may impose other sanctions that it deems to be appropriate under the circumstances, including the imposition of fines representing reimbursement of the Bank for costs associated with investigations and proceedings. Such other sanctions may be imposed in addition to or in lieu of other sanctions;
- (c) the Bank has established administrative procedures for cases of allegations of fraud and corruption within the procurement process or the execution of a contract financed by the Bank which are available at the Bank's website (www.iadb.org), as updated from time to time. To that effect any complaint shall be submitted to the Bank's Office of Institutional Integrity (OII) for the appropriate investigation. Allegations may be presented confidentially or anonymously;
- (d) payments are expressly conditional upon the claimant's participation in the procurement process conformed with all applicable Bank policies on Fraud and Corruption described in this Sub-Clause 15.5; and
- (e) the imposition of any sanction referred to paragraph (b) of this Sub-Clause will be public;

The Bank will have the right to require that a Contractor permit the Bank to inspect their accounts and records and other documents relating to the submission of bids and contract performance and to have them audited by auditors appointed by the Bank. The Bank will have the right to require that Contractors to:

- (a) maintain all documents and records related to the Bank-financed project for five (5) years after completion of the work; and
- (b) require the delivery of any document necessary for the investigation of allegations of fraud or corruption and the availability of employees or agents of the contractor with knowledge of the Bank-financed project to respond to questions from the Bank.

If the Contractor refuses to comply with the Bank's request, the Bank, in its sole discretion, may take appropriate action against the Contractor.

The Contractor represents and warrants:

- (a) that they have read and understood the Bank's prohibition against fraud and corruption and agrees to abide by the applicable rules;
- (b) that they have not engaged in any violation of policies on fraud and corruption described herein;
- (c) that they have not misrepresented or concealed any material facts during the procurement or contract negotiation processes or performance of the contract;
- (d) that neither they nor any of their directors, officers or principal shareholders have been declared ineligible to be awarded Bank-financed contracts or have been convicted of a crime involving fraud or corruption;
- (e) that none of their directors, officers or principal shareholders has been a director, officer or principal shareholder of any other company or entity that has been declared ineligible to be awarded a Bank-financed contract or has been convicted of a crime involving fraud or corruption;
- (f) that all commissions, agents' fees, facilitating payments or revenue-sharing agreements related to the Bank-financed contract or consulting agreement have been disclosed;
- (g) that they acknowledge that the breach of any of these warranties constitute a basis for the imposition of any or a combination of the measures described in this Sub-Clause.

[For contracts financed by the World Bank]

In pursuance of this policy, the Bank:

- (a) defines, for the purposes of this provision, the terms set forth below as follows:

- (i) “corrupt practice” is the offering, giving, receiving or soliciting, directly or indirectly, of anything of value to influence improperly the actions of another party;

In this context, “another party” refers to a public official acting in relation to the procurement process or contract execution]. In this context, “public official” includes World Bank staff and employees of other organisations taking or reviewing procurement decisions.

- (ii) “fraudulent practice” is any act or omission, including a misrepresentation, that knowingly or recklessly misleads, or attempts to mislead, a party to obtain a financial or other benefit or to avoid an obligation;

In this context, “party” refers to a public official; the terms “benefit” and “obligation” relate to the procurement process or contract execution; and the “act or omission” is intended to influence the procurement process or contract execution.

- (iii) “collusive practice” is an arrangement between two or more parties designed to achieve an improper purpose, including to influence improperly the actions of another party;

In this context, “parties” refers to participants in the procurement process (including public officials) attempting to establish bid prices at artificial, non competitive levels.

- (iv) “coercive practice” is impairing or harming, or threatening to impair or harm, directly or indirectly, any party or the property of the party to influence improperly the actions of a party;

In this context, “parties” refers to participants in the procurement process (including public officials) attempting to establish bid prices at artificial, non competitive levels.

- (v) “obstructive practice” is

(A) deliberately destroying, falsifying, altering or concealing of evidence material to the investigation or making false statements to investigators in order to materially impede a Bank investigation into allegations of a corrupt, fraudulent, coercive or collusive practice; and/or threatening, harassing or intimidating any party to prevent it from disclosing its knowledge of matters relevant to the investigation or from pursuing the investigation, or

(B) acts intended to materially impede the exercise of the Bank’s inspection and audit rights.

In this context, “party” refers to a participant in the procurement process or contract execution.

16 Suspension and Termination by Contractor

16.1 Contractor’s Entitlement to Suspend Work

If the Engineer fails to certify in accordance with Sub-Clause 14.6 [Issue of Interim Payment Certificates] or the Employer fails to comply with Sub-Clause 2.4 [Employer’s Financial Arrangements] or Sub-Clause 14.7 [Payment], the Contractor may, after giving not less than 21 days’ notice to the Employer, suspend work (or reduce the rate of work) unless and until the Contractor has received the Payment Certificate, reasonable evidence or payment, as the case may be and as described in the notice.

Notwithstanding the above, if the Bank has suspended disbursements under the loan or credit from which payments to the Contractor are being made, in whole or in part, for the execution of the Works, and no alternative funds are available as provided for in Sub-Clause 2.4 [Employer’s Financial Arrangements], the Contractor may by notice suspend work or reduce the rate of work at any time, but not less than 7 days after the Borrower having received the suspension notification from the Bank.

The Contractor’s action shall not prejudice his entitlements to financing charges under Sub-Clause 14.8 [Delayed Payment] and to termination under Sub-Clause 16.2 [Termination by Contractor].

If the Contractor subsequently receives such Payment Certificate, evidence or payment (as described in the relevant Sub-Clause and in the above notice) before giving a notice of termination, the Contractor shall resume normal working as soon as is reasonably practicable.

If the Contractor suffers delay and/or incurs Cost as a result of suspending work (or reducing the rate of work) in accordance with this Sub-Clause, the Contractor shall give notice to the Engineer and shall be entitled subject to Sub-Clause 20.1 [Contractor's Claims] to:

- (a) an extension of time for any such delay, if completion is or will be delayed, under Sub-Clause 8.4 [Extension of Time for Completion], and
- (b) payment of any such Cost plus profit, which shall be included in the Contract Price.

After receiving this notice, the Engineer shall proceed in accordance with Sub-Clause 3.5 [Determinations] to agree or determine these matters.

16.2 Termination by Contractor

The Contractor shall be entitled to terminate the Contract if:

- (a) the Contractor does not receive the reasonable evidence within 42 days after giving notice under Sub-Clause 16.1 [Contractor's Entitlement to Suspend Work] in respect of a failure to comply with Sub-Clause 2.4 [Employer's Financial Arrangements],
- (b) the Engineer fails, within 56 days after receiving a Statement and supporting documents, to issue the relevant Payment Certificate,
- (c) the Contractor does not receive the amount due under an Interim Payment Certificate within 42 days after the expiry of the time stated in Sub-Clause 14.7 [Payment] within which payment is to be made (except for deductions in accordance with Sub-Clause 2.5 [Employer's Claims]),
- (d) the Employer substantially fails to perform his obligations under the Contract in such manner as to materially and adversely affect the economic balance of the Contract and/or the ability of the Contractor to perform the Contract,
- (e) the Employer fails to comply with Sub-Clause 1.6 [Contract Agreement] or Sub-Clause 1.7 [Assignment],
- (f) a prolonged suspension affects the whole of the Works as described in Sub-Clause 8.11 [Prolonged Suspension],
- (g) the Employer becomes bankrupt or insolvent, goes into liquidation, has a receiving or administration order made against him, compounds with his creditors, or carries on business under a receiver, trustee or manager for the benefit of his creditors, or if any act is done or event occurs which (under applicable Laws) has a similar effect to any of these acts or events,
- (h) the Contractor does not receive the Engineer's instruction recording the agreement of both Parties on the fulfilment of the conditions for the Commencement of Works under Sub-Clause 8.1 [Commencement of Works].

In any of these events or circumstances, the Contractor may, upon giving 14 days' notice to the Employer, terminate the Contract. However, in the case of sub-paragraph (f) or (g), the Contractor may by notice terminate the Contract immediately.

In the event the Bank suspends the loan or credit from which part or whole of the payments to the Contractor are being made, if the Contractor has not received the sums due to him upon expiration of the 14 days referred to in Sub-Clause 14.7 [Payment] for payments under Interim Payment Certificates, the Contractor may, without prejudice to the Contractor's entitlement to financing charges under Sub-Clause 14.8 [Delayed Payment], take one of the following actions, namely (i) suspend work or reduce the rate of work under Sub-Clause 16.1 above, or (ii) terminate the Contract by giving notice to the Employer, with a copy to the Engineer, such termination to take effect 14 days after the giving of the notice.

The Contractor's election to terminate the Contract shall not prejudice any other rights of the Contractor, under the Contract or otherwise.

16.3 Cessation of Work and Removal of Contractor's Equipment

After a notice of termination under Sub-Clause 15.5 [Employer's Entitlement to Termination for Convenience], Sub-Clause 16.2 [Termination by Contractor] or Sub-Clause 19.6 [Optional Termination, Payment and Release] has taken effect, the Contractor shall promptly:

- (a) cease all further work, except for such work as may have been instructed by the Engineer for the protection of life or property or for the safety of the Works,
- (b) hand over Contractor's Documents, Plant, Materials and other work, for which the Contractor has received payment, and
- (c) remove all other Goods from the Site, except as necessary for safety, and leave the Site.

16.4 Payment on Termination

After a notice of termination under Sub-Clause 16.2 [Termination by Contractor] has taken effect, the Employer shall promptly:

- (a) return the Performance Security to the Contractor,
- (b) pay the Contractor in accordance with Sub-Clause 19.6 [Optional Termination, Payment and Release], and
- (c) pay to the Contractor the amount of any loss or damage sustained by the Contractor as a result of this termination.

17 Risk and Responsibility

17.1 Indemnities

The Contractor shall indemnify and hold harmless the Employer, the Employer's Personnel, and their respective agents, against and from all claims, damages, losses and expenses (including legal fees and expenses) in respect of:

- (a) bodily injury, sickness, disease or death, of any person whatsoever arising out of or in the course of or by reason of the Contractor's design (if any), the execution and completion of the Works and the remedying of any defects, unless attributable to any negligence, wilful act or breach of the Contract by the Employer, the Employer's Personnel, or any of their respective agents, and
- (b) damage to or loss of any property, real or personal (other than the Works), to the extent that such damage or loss arises out of or in the course of or by reason of the Contractor's design (if any), the execution and completion of the Works and the remedying of any defects, unless and to the extent that any such damage or loss is attributable to any negligence, wilful act or breach of the Contract by the Employer, the Employer's Personnel, their respective agents, or anyone directly or indirectly employed by any of them.

The Employer shall indemnify and hold harmless the Contractor, the Contractor's Personnel, and their respective agents, against and from all claims, damages, losses and expenses (including legal fees and expenses) in respect of (1) bodily injury, sickness, disease or death, which is attributable to any negligence, wilful act or breach of the Contract by the Employer, the Employer's Personnel, or any of their respective agents, and (2) the matters for which liability may be excluded from insurance cover, as described in sub-paragraphs (d)(i), (ii) and (iii) of Sub-Clause 18.3 [Insurance Against Injury to Persons and Damage to Property].

17.2 Contractor's Care of the Works

The Contractor shall take full responsibility for the care of the Works and Goods from the Commencement Date until the Taking-Over Certificate is issued (or is deemed to be issued under Sub-Clause 10.1 [Taking Over of the Works and Sections]) for the Works, when responsibility for the care of the Works shall pass to the Employer. If a Taking-Over Certificate is issued (or is so deemed to be issued) for any Section or part of the Works, responsibility for the care of the Section or part shall then pass to the Employer.

After responsibility has accordingly passed to the Employer, the Contractor shall take responsibility for the care of any work which is outstanding on the date stated in a Taking-Over Certificate, until this outstanding work has been completed.

If any loss or damage happens to the Works, Goods or Contractor's Documents during the period when the Contractor is responsible for their care, from any cause not listed in Sub-Clause 17.3 [Employer's Risks], the Contractor shall rectify the loss or damage at the Contractor's risk and cost, so that the Works, Goods and Contractor's Documents conform with the Contract.

The Contractor shall be liable for any loss or damage caused by any actions performed by the Contractor after a Taking-Over Certificate has been issued. The Contractor shall also be liable for any loss or damage which occurs after a Taking-Over Certificate has been issued and which arose from a previous event for which the Contractor was liable.

17.3 Employer's Risks

The risks referred to in Sub-Clause 17.4 [Consequences of Employer's Risks] below, insofar as they directly affect the execution of the Works in the Country, are:

- (a) war, hostilities (whether war be declared or not), invasion, act of foreign enemies,
- (b) rebellion, terrorism, sabotage by persons other than the Contractor's Personnel, revolution, insurrection, military or usurped power, or civil war, within the Country,
- (c) riot, commotion or disorder within the Country by persons other than the Contractor's Personnel,
- (d) munitions of war, explosive materials, ionising radiation or contamination by radio-activity, within the Country, except as may be attributable to the Contractor's use of such munitions, explosives, radiation or radio-activity,
- (e) pressure waves caused by aircraft or other aerial devices travelling at sonic or supersonic speeds,
- (f) use or occupation by the Employer of any part of the Permanent Works, except as may be specified in the Contract,
- (g) design of any part of the Works by the Employer's Personnel or by others for whom the Employer is responsible, and
- (h) any operation of the forces of nature which is Unforeseeable or against which an experienced contractor could not reasonably have been expected to have taken adequate preventive precautions.

17.4 Consequences of Employer's Risks

If and to the extent that any of the risks listed in Sub-Clause 17.3 above results in loss or damage to the Works, Goods or Contractor's Documents, the Contractor shall promptly give notice to the Engineer and shall rectify this loss or damage to the extent required by the Engineer.

If the Contractor suffers delay and/or incurs Cost from rectifying this loss or damage, the Contractor shall give a further notice to the Engineer and shall be entitled subject to Sub-Clause 20.1 [Contractor's Claims] to:

- (a) an extension of time for any such delay, if completion is or will be delayed, under Sub-Clause 8.4 [Extension of Time for Completion], and
- (b) payment of any such Cost, which shall be included in the Contract Price. In the case of subparagraphs (f) and (g) of Sub-Clause 17.3 [Employer's Risks], Cost plus profit shall be payable.

After receiving this further notice, the Engineer shall proceed in accordance with Sub-Clause 3.5 [Determinations] to agree or determine these matters.

17.5 Intellectual and Industrial Property Rights

In this Sub-Clause, "infringement" means an infringement (or alleged infringement) of any patent, registered design, copyright, trade mark, trade name, trade secret or other intellectual or industrial property right relating to the Works; and "claim" means a claim (or proceedings pursuing a claim) alleging an infringement.

Whenever a Party does not give notice to the other Party of any claim within 28 days of receiving the claim, the first Party shall be deemed to have waived any right to indemnity under this Sub-Clause.

The Employer shall indemnify and hold the Contractor harmless against and from any claim alleging an infringement which is or was:

- (a) an unavoidable result of the Contractor's compliance with the Contract, or
- (b) a result of any Works being used by the Employer:
 - (i) for a purpose other than that indicated by, or reasonably to be inferred from, the Contract, or
 - (ii) in conjunction with any thing not supplied by the Contractor, unless such use was disclosed to the Contractor prior to the Base Date or is stated in the Contract.

The Contractor shall indemnify and hold the Employer harmless against and from any other claim which arises out of or in relation to (i) the manufacture, use, sale or import of any Goods, or (ii) any design for which the Contractor is responsible.

If a Party is entitled to be indemnified under this Sub-Clause, the indemnifying Party may (at its cost) conduct negotiations for the settlement of the claim, and any litigation or arbitration which may arise from it. The other Party shall, at the request and cost of the indemnifying Party, assist in contesting the claim. This other Party (and its Personnel) shall not make any admission which might be prejudicial to the indemnifying Party, unless the indemnifying Party failed to take over the conduct of any negotiations, litigation or arbitration upon being requested to do so by such other Party.

17.6 Limitation of Liability

Neither Party shall be liable to the other Party for loss of use of any Works, loss of profit, loss of any contract or for any indirect or consequential loss or damage which may be suffered by the other Party in connection with the Contract, other than as specifically provided in Sub-Clause 8.7 [Delay Damages]; Sub-Clause 11.2 [Cost of Remedying Defects]; Sub-Clause 15.4 [Payment after Termination]; Sub-Clause 16.4 [Payment on Termination]; Sub-Clause 17.1 [Indemnities]; Sub-Clause 17.4(b) [Consequences of Employer's Risks] and Sub-Clause 17.5 [Intellectual and Industrial Property Rights].

The total liability of the Contractor to the Employer, under or in connection with the Contract other than under Sub-Clause 4.19 [Electricity, Water and Gas], Sub-Clause 4.20 [Employer's Equipment and Free-Issue Materials], Sub-Clause 17.1 [Indemnities] and Sub-Clause 17.5 [Intellectual and Industrial Property Rights], shall not exceed the sum resulting from the application of a multiplier (less or greater than one) to the Accepted Contract Amount, as stated in the Contract Data, or (if such multiplier or other sum is not so stated) the Accepted Contract Amount.

This Sub-Clause shall not limit liability in any case of fraud, deliberate default or reckless misconduct by the defaulting Party.

17.7 Use of Employer's Accommodation/Facilities

The Contractor shall take full responsibility for the care of the Employer provided accommodation and facilities, if any, as detailed in the Specification, from the respective dates of hand-over to the Contractor until cessation of occupation (where hand-over or cessation of occupation may take place after the date stated in the Taking-Over Certificate for the Works).

If any loss or damage happens to any of the above items while the Contractor is responsible for their care arising from any cause whatsoever other than those for which the Employer is liable, the Contractor shall, at his own cost, rectify the loss or damage to the satisfaction of the Engineer.

18 Insurance

18.1 General Requirements for Insurances

In this Clause, "insuring Party" means, for each type of insurance, the Party responsible for effecting and maintaining the insurance specified in the relevant Sub-Clause.

Wherever the Contractor is the insuring Party, each insurance shall be effected with insurers and in terms approved by the Employer. These terms shall be consistent with any terms agreed by both Parties before the date of the Letter of Acceptance. This agreement of terms shall take precedence over the provisions of this Clause

Wherever the Employer is the insuring Party, each insurance shall be effected with insurers and in terms acceptable to the Contractor. These terms shall be consistent with any terms agreed by both Parties before the date of the Letter of Acceptance. This agreement of terms shall take precedence over the provisions of this Clause.

If a policy is required to indemnify joint insured, the cover shall apply separately to each insured as though a separate policy had been issued for each of the joint insured. If a policy indemnifies additional joint insured, namely in addition to the insured specified in this Clause, (i) the Contractor shall act under the policy on behalf of these additional joint insured except that the Employer shall act for Employer's Personnel, (ii) additional joint insured shall not be entitled to receive payments directly from the insurer or to have any other direct dealings with the insurer, and (iii) the insuring Party shall require all additional joint insured to comply with the conditions stipulated in the policy.

Each policy insuring against loss or damage shall provide for payments to be made in the currencies required to rectify the loss or damage. Payments received from insurers shall be used for the rectification of the loss or damage.

The relevant insuring Party shall, within the respective periods stated in the Contract Data (calculated from the Commencement Date), submit to the other Party:

- (a) evidence that the insurances described in this Clause have been effected, and
- (b) copies of the policies for the insurances described in Sub-Clause 18.2 [Insurance for Works and Contractor's Equipment] and Sub-Clause 18.3 [Insurance against Injury to Persons and Damage to Property].

When each premium is paid, the insuring Party shall submit evidence of payment to the other Party. Whenever evidence or policies are submitted, the insuring Party shall also give notice to the Engineer.

Each Party shall comply with the conditions stipulated in each of the insurance policies. The insuring Party shall keep the insurers informed of any relevant changes to the execution of the Works and ensure that insurance is maintained in accordance with this Clause.

Neither Party shall make any material alteration to the terms of any insurance without the prior approval of the other Party. If an insurer makes (or attempts to make) any alteration, the Party first notified by the insurer shall promptly give notice to the other Party.

If the insuring Party fails to effect and keep in force any of the insurances it is required to effect and maintain under the Contract, or fails to provide satisfactory evidence and copies of policies in accordance with this Sub-Clause, the other Party may (at its option and without prejudice to any other right or remedy) effect insurance for the relevant coverage and pay the premiums due. The insuring Party shall pay the amount of these premiums to the other Party, and the Contract Price shall be adjusted accordingly.

Nothing in this Clause limits the obligations, liabilities or responsibilities of the Contractor or the Employer, under the other terms of the Contract or otherwise. Any amounts not insured or not recovered from the insurers shall be borne by the Contractor and/or the Employer in accordance with these obligations, liabilities or responsibilities. However, if the insuring Party fails to effect and keep in force an insurance which is available and which it is required to effect and maintain under the Contract, and the other Party neither approves the omission nor effects insurance for the coverage relevant to this default, any moneys which should have been recoverable under this insurance shall be paid by the insuring Party.

Payments by one Party to the other Party shall be subject to Sub-Clause 2.5 [Employer's Claims] or Sub-Clause 20.1 [Contractor's Claims], as applicable.

The Contractor shall be entitled to place all insurance relating to the Contract (including, but not limited to the insurance referred to Clause 18) with insurers from any eligible source country.

18.2 Insurance for Works and Contractor's Equipment

The insuring Party shall insure the Works, Plant, Materials and Contractor's Documents for not less than the full reinstatement cost including the costs of demolition, removal of debris and professional fees and profit. This insurance shall be effective from the date by which the evidence is to be submitted under subparagraph (a) of Sub-Clause 18.1 [General Requirements for Insurances], until the date of issue of the Taking-Over Certificate for the Works.

The insuring Party shall maintain this insurance to provide cover until the date of issue of the Performance Certificate, for loss or damage for which the Contractor is liable arising from a cause occurring prior to the issue of the Taking-Over Certificate, and for loss or damage caused by the Contractor in the course of any other operations (including those under Clause 11 [Defects Liability]).

The insuring Party shall insure the Contractor's Equipment for not less than the full replacement value, including delivery to Site. For each item of Contractor's Equipment, the insurance shall be effective while it is being transported to the Site and until it is no longer required as Contractor's Equipment.

Unless otherwise stated in the Particular Conditions, insurances under this Sub-Clause:

- (a) shall be effected and maintained by the Contractor as insuring Party,
- (b) shall be in the joint names of the Parties, who shall be jointly entitled to receive payments from the insurers, payments being held or allocated to the Party actually bearing the costs of rectifying the loss or damage,
- (c) shall cover all loss and damage from any cause not listed in Sub-Clause 17.3 [Employer's Risks],
- (d) shall also cover, to the extent specifically required in the bidding documents of the Contract, loss or damage to a part of the Works which is attributable to the use or occupation by the Employer of another part of the Works, and loss or damage from the risks listed in subparagraphs (c), (g) and (h) of Sub-Clause 17.3 [Employer's Risks], excluding (in each case) risks which are not insurable at commercially reasonable terms, with deductibles per occurrence of not more than the amount stated in the Contract Data (if an amount is not so stated, this subparagraph (d) shall not apply), and
- (e) may however exclude loss of, damage to, and reinstatement of:

- (i) a part of the Works which is in a defective condition due to a defect in its design, materials or workmanship (but cover shall include any other parts which are lost or damaged as a direct result of this defective condition and not as described in sub-paragraph (ii) below),
- (ii) a part of the Works which is lost or damaged in order to reinstate any other part of the Works if this other part is in a defective condition due to a defect in its design, materials or workmanship,
- (iii) a part of the Works which has been taken over by the Employer, except to the extent that the Contractor is liable for the loss or damage, and
- (iv) Goods while they are not in the Country, subject to Sub-Clause 14.5 [Plant and Materials intended for the Works].

If, more than one year after the Base Date, the cover described in sub-paragraph (d) above ceases to be available at commercially reasonable terms, the Contractor shall (as insuring Party) give notice to the Employer, with supporting particulars. The Employer shall then (i) be entitled subject to Sub-Clause 2.5 [Employer's Claims] to payment of an amount equivalent to such commercially reasonable terms as the Contractor should have expected to have paid for such cover, and (ii) be deemed, unless he obtains the cover at commercially reasonable terms, to have approved the omission under Sub-Clause 18.1 [General Requirements for Insurances].

18.3 Insurance against Injury to Persons and Damage to Property

The insuring Party shall insure against each Party's liability for any loss, damage, death or bodily injury which may occur to any physical property (except things insured under Sub-Clause 18.2 [Insurance for Works and Contractor's Equipment]) or to any person (except persons insured under Sub-Clause 18.4 [Insurance for Contractor's Personnel]), which may arise out of the Contractor's performance of the Contract and occurring before the issue of the Performance Certificate.

This insurance shall be for a limit per occurrence of not less than the amount stated in the Contract Data, with no limit on the number of occurrences. If an amount is not stated in the Contract Data, this Sub-Clause shall not apply.

Unless otherwise stated in the Particular Conditions, the insurances specified in this Sub-Clause:

- (a) shall be effected and maintained by the Contractor as insuring Party,
- (b) shall be in the joint names of the Parties,
- (c) shall be extended to cover liability for all loss and damage to the Employer's property (except things insured under Sub-Clause 18.2) arising out of the Contractor's performance of the Contract, and
- (d) may however exclude liability to the extent that it arises from:
 - (i) the Employer's right to have the Permanent Works executed on, over, under, in or through any land, and to occupy this land for the Permanent Works,
 - (ii) damage which is an unavoidable result of the Contractor's obligations to execute the Works and remedy any defects, and
 - (iii) a cause listed in Sub-Clause 17.3 [Employer's Risks], except to the extent that cover is available at commercially reasonable terms.

18.4 Insurance for Contractor's Personnel

The Contractor shall effect and maintain insurance against liability for claims, damages, losses and expenses (including legal fees and expenses) arising from injury, sickness, disease or death of any person employed by the Contractor or any other of the Contractor's Personnel.

The insurance shall cover the Employer and the Engineer against liability for claims, damages, losses and expenses (including legal fees and expenses) arising from injury, sickness, disease or death of any person employed by the Contractor or any other of the Contractor's Personnel, except that this insurance may exclude losses and claims to the extent that they arise from any act or neglect of the Employer or of the Employer's Personnel.

The insurance shall be maintained in full force and effect during the whole time that these personnel are assisting in the execution of the Works. For a Subcontractor's employees, the insurance may be effected by the Subcontractor, but the Contractor shall be responsible for compliance with this Clause.

19 Force Majeure

19.1 Definition of Force Majeure

In this Clause, "Force Majeure" means an exceptional event or circumstance:

- (a) which is beyond a Party's control,
- (b) which such Party could not reasonably have provided against before entering into the Contract,
- (c) which, having arisen, such Party could not reasonably have avoided or overcome, and
- (d) which is not substantially attributable to the other Party.

Force Majeure may include, but is not limited to, exceptional events or circumstances of the kind listed below, so long as conditions (a) to (d) above are satisfied:

- (i) war, hostilities (whether war be declared or not), invasion, act of foreign enemies,
- (ii) rebellion, terrorism, sabotage by persons other than the Contractor's Personnel, revolution, insurrection, military or usurped power, or civil war,
- (iii) riot, commotion, disorder, strike or lockout by persons other than the Contractor's Personnel,
- (iv) munitions of war, explosive materials, ionising radiation or contamination by radio-activity, except as may be attributable to the Contractor's use of such munitions, explosives, radiation or radio-activity, and
- (v) natural catastrophes such as earthquake, hurricane, typhoon or volcanic activity.

19.2 Notice of Force Majeure

If a Party is or will be prevented from performing its substantial obligations under the Contract by Force Majeure, then it shall give notice to the other Party of the event or circumstances constituting the Force Majeure and shall specify the obligations, the performance of which is or will be prevented. The notice shall be given within 14 days after the Party became aware, or should have become aware, of the relevant event or circumstance constituting Force Majeure.

The Party shall, having given notice, be excused performance of its obligations for so long as such Force Majeure prevents it from performing them.

Notwithstanding any other provision of this Clause, Force Majeure shall not apply to obligations of either Party to make payments to the other Party under the Contract

19.3 Duty to Minimise Delay

Each Party shall at all times use all reasonable endeavours to minimise any delay in the performance of the Contract as a result of Force Majeure.

A Party shall give notice to the other Party when it ceases to be affected by the Force Majeure.

19.4 Consequences of Force Majeure

If the Contractor is prevented from performing his substantial obligations under the Contract by Force Majeure of which notice has been given under Sub-Clause 19.2 [Notice of Force Majeure], and suffers delay and/or incurs Cost by reason of such Force Majeure, the Contractor shall be entitled subject to Sub-Clause 20.1 [Contractor's Claims] to:

- (a) an extension of time for any such delay, if completion is or will be delayed, under Sub-Clause 8.4 [Extension of Time for Completion], and
- (b) if the event or circumstance is of the kind described in sub-paragraphs (i) to (iv) of Sub-Clause 19.1 [Definition of Force Majeure] and, in sub-paragraphs (ii) to (iv), occurs in the Country, payment of any such Cost, including the costs of rectifying or replacing the Works and/or Goods damaged or destroyed by Force Majeure, to the extent they are not indemnified through the insurance policy referred to in Sub-Clause 18.2 [Insurance for Works and Contractor's Equipment].

After receiving this notice, the Engineer shall proceed in accordance with Sub-Clause 3.5 [Determinations] to agree or determine these matters.

19.5 Force Majeure Affecting Subcontractor

If any Subcontractor is entitled under any contract or agreement relating to the Works to relief from force majeure on terms additional to or broader than those specified in this Clause, such additional or broader force majeure events or circumstances shall not excuse the Contractor's non-performance or entitle him to relief under this Clause.

19.6 Optional Termination, Payment and Release

If the execution of substantially all the Works in progress is prevented for a continuous period of 84 days by reason of Force Majeure of which notice has been given under Sub-Clause 19.2 [Notice of Force Majeure], or for multiple periods which total more than 140 days due to the same notified Force Majeure, then either Party may give to the other Party a notice of termination of the Contract. In this event, the termination shall take effect 7 days after the notice is given, and the Contractor shall proceed in accordance with Sub-Clause 16.3 [Cessation of Work and Removal of Contractor's Equipment].

Upon such termination, the Engineer shall determine the value of the work done and issue a Payment Certificate which shall include:

- (a) the amounts payable for any work carried out for which a price is stated in the Contract;
- (b) the Cost of Plant and Materials ordered for the Works which have been delivered to the Contractor, or of which the Contractor is liable to accept delivery: this Plant and Materials shall become the property of (and be at the risk of) the Employer when paid for by the Employer, and the Contractor shall place the same at the Employer's disposal;
- (c) other Cost or liabilities which in the circumstances were reasonably and necessarily incurred by the Contractor in the expectation of completing the Works;
- (d) the Cost of removal of Temporary Works and Contractor's Equipment from the Site and the return of these items to the Contractor's works in his country (or to any other destination at no greater cost); and

- (e) the Cost of repatriation of the Contractor's staff and labour employed wholly in connection with the Works at the date of termination.

19.7 Release from Performance

Notwithstanding any other provision of this Clause, if any event or circumstance outside the control of the Parties (including, but not limited to, Force Majeure) arises which makes it impossible or unlawful for either or both Parties to fulfil its or their contractual obligations or which, under the law governing the Contract, entitles the Parties to be released from further performance of the Contract, then upon notice by either Party to the other Party of such event or circumstance:

- (a) the Parties shall be discharged from further performance, without prejudice to the rights of either Party in respect of any previous breach of the Contract, and
- (b) the sum payable by the Employer to the Contractor shall be the same as would have been payable under Sub-Clause 19.6 [Optional Termination, Payment and Release] if the Contract had been terminated under Sub-Clause 19.6.

20 Claims, Disputes and Arbitration

20.1 Contractor's Claims

If the Contractor considers himself to be entitled to any extension of the Time for Completion and/or any additional payment, under any Clause of these Conditions or otherwise in connection with the Contract, the Contractor shall give notice to the Engineer, describing the event or circumstance giving rise to the claim. The notice shall be given as soon as practicable, and not later than 28 days after the Contractor became aware, or should have become aware, of the event or circumstance.

If the Contractor fails to give notice of a claim within such period of 28 days, the Time for Completion shall not be extended, the Contractor shall not be entitled to additional payment, and the Employer shall be discharged from all liability in connection with the claim. Otherwise, the following provisions of this Sub-Clause shall apply.

The Contractor shall also submit any other notices which are required by the Contract, and supporting particulars for the claim, all as relevant to such event or circumstance.

The Contractor shall keep such contemporary records as may be necessary to substantiate any claim, either on the Site or at another location acceptable to the Engineer. Without admitting the Employer's liability, the Engineer may, after receiving any notice under this Sub-Clause, monitor the record-keeping and/or instruct the Contractor to keep further contemporary records. The Contractor shall permit the Engineer to inspect all these records, and shall (if instructed) submit copies to the Engineer.

Within 42 days after the Contractor became aware (or should have become aware) of the event or circumstance giving rise to the claim, or within such other period as may be proposed by the Contractor and approved by the Engineer, the Contractor shall send to the Engineer a fully detailed claim which includes full supporting particulars of the basis of the claim and of the extension of time and/or additional payment claimed. If the event or circumstance giving rise to the claim has a continuing effect:

- (a) this fully detailed claim shall be considered as interim;
- (b) the Contractor shall send further interim claims at monthly intervals, giving the accumulated delay and/or amount claimed, and such further particulars as the Engineer may reasonably require; and
- (c) the Contractor shall send a final claim within 28 days after the end of the effects resulting from the event or circumstance, or within such other period as may be proposed by the Contractor and approved by the Engineer.

Within 42 days after receiving a claim or any further particulars supporting a previous claim, or within such other period as may be proposed by the Engineer and approved by the Contractor, the Engineer shall respond with approval, or with disapproval and detailed comments. He may also request any necessary further particulars, but shall nevertheless give his response on the principles of the claim within the above defined time period.

Within the above defined period of 42 days, the Engineer shall proceed in accordance with Sub-Clause 3.5 [Determinations] to agree or determine (i) the extension (if any) of the Time for Completion (before or after its expiry) in accordance with Sub-Clause 8.4 [Extension of Time for Completion], and/or (ii) the additional payment (if any) to which the Contractor is entitled under the Contract.

Each Payment Certificate shall include such additional payment for any claim as has been reasonably substantiated as due under the relevant provision of the Contract. Unless and until the particulars supplied are sufficient to substantiate the whole of the claim, the Contractor shall only be entitled to payment for such part of the claim as he has been able to substantiate.

If the Engineer does not respond within the timeframe defined in this Clause, either Party may consider that the claim is rejected by the Engineer and any of the Parties may refer to the Dispute Board in accordance with Sub-Clause 20.4 [Obtaining Dispute Board's Decision].

The requirements of this Sub-Clause are in addition to those of any other Sub-Clause which may apply to a claim. If the Contractor fails to comply with this or another Sub-Clause in relation to any claim, any extension of time and/or additional payment shall take account of the extent (if any) to which the failure has prevented or prejudiced proper investigation of the claim, unless the claim is excluded under the second paragraph of this Sub-Clause.

20.2 Appointment of the Dispute Board

Disputes shall be referred to a DB for decision in accordance with Sub-Clause 20.4 [Obtaining Dispute Board's Decision]. The Parties shall appoint a DB by the date stated in the Contract Data.

The DB shall comprise, as stated in the Contract Data, either one or three suitably qualified persons ("the members"), each of whom shall be fluent in the language for communication defined in the Contract and shall be a professional experienced in the type of construction involved in the Works and with the interpretation of contractual documents. If the number is not so stated and the Parties do not agree otherwise, the DB shall comprise three persons.

If the Parties have not jointly appointed the DB 21 days before the date stated in the Contract Data and the DB is to comprise three persons, each Party shall nominate one member for the approval of the other Party. The first two members shall recommend and the Parties shall agree upon the third member, who shall act as chairman.

However, if a list of potential members has been agreed by the Parties and is included in the Contract, the members shall be selected from those on the list, other than anyone who is unable or unwilling to accept appointment to the DB.

The agreement between the Parties and either the sole member or each of the three members shall incorporate by reference the General Conditions of Dispute Board Agreement contained in the Appendix to these General Conditions, with such amendments as are agreed between them.

The terms of the remuneration of either the sole member or each of the three members, including the remuneration of any expert whom the DB consults, shall be mutually agreed upon by the Parties when agreeing the terms of appointment. Each Party shall be responsible for paying one-half of this remuneration.

If at any time the Parties so agree, they may jointly refer a matter to the DB for it to give its opinion. Neither Party shall consult the DB on any matter without the agreement of the other Party.

If a member declines to act or is unable to act as a result of death, disability, resignation or termination of appointment, a replacement shall be appointed in the same manner as the replaced person was required to have been nominated or agreed upon, as described in this Sub-Clause.

The appointment of any member may be terminated by mutual agreement of both Parties, but not by the Employer or the Contractor acting alone. Unless otherwise agreed by both Parties, the appointment of the DB (including each member) shall expire when the discharge referred to in Sub-Clause 14.12 [Discharge] shall have become effective.

20.3 Failure to Agree on the Composition of the Dispute Board

If any of the following conditions apply, namely:

- (a) the Parties fail to agree upon the appointment of the sole member of the DB by the date stated in the first paragraph of Sub-Clause 20.2, [Appointment of the Dispute Board]
- (b) either Party fails to nominate a member (for approval by the other Party), or fails to approve a member nominated by the other Party, of a DB of three persons by such date,
- (c) the Parties fail to agree upon the appointment of the third member (to act as chairman) of the DB by such date, or
- (d) the Parties fail to agree upon the appointment of a replacement person within 42 days after the date on which the sole member or one of the three members declines to act or is unable to act as a result of death, disability, resignation or termination of appointment,

then the appointing entity or official named in the Contract Data shall, upon the request of either or both of the Parties and after due consultation with both Parties, appoint this member of the DB. This appointment shall be final and conclusive. Each Party shall be responsible for paying one-half of the remuneration of the appointing entity or official.

20.4 Obtaining Dispute Board's Decision

If a dispute (of any kind whatsoever) arises between the Parties in connection with, or arising out of, the Contract or the execution of the Works, including any dispute as to any certificate, determination, instruction, opinion or valuation of the Engineer, either Party may refer the dispute in writing to the DB for its decision, with copies to the other Party and the Engineer. Such reference shall state that it is given under this Sub-Clause.

For a DB of three persons, the DB shall be deemed to have received such reference on the date when it is received by the chairman of the DB.

Both Parties shall promptly make available to the DB all such additional information, further access to the Site, and appropriate facilities, as the DB may require for the purposes of making a decision on such dispute. The DB shall be deemed to be not acting as arbitrator(s).

Within 84 days after receiving such reference, or within such other period as may be proposed by the DB and approved by both Parties, the DB shall give its decision, which shall be reasoned and shall state that it is given under this Sub-Clause. The decision shall be binding on both Parties, who shall promptly give effect to it unless and until it shall be revised in an amicable settlement or an arbitral award as described below. Unless the Contract has already been abandoned, repudiated or terminated, the Contractor shall continue to proceed with the Works in accordance with the Contract.

If either Party is dissatisfied with the DB's decision, then either Party may, within 28 days after receiving the decision, give a Notice of Dissatisfaction to the other Party indicating its dissatisfaction and intention to commence arbitration. If the DB fails to give its decision within the period of 84 days (or as otherwise approved) after receiving such reference, then either Party may, within 28 days after this period has expired, give a Notice of Dissatisfaction to the other Party.

In either event, this Notice of Dissatisfaction shall state that it is given under this Sub-Clause, and shall set out the matter in dispute and the reason(s) for dissatisfaction. Except as stated in Sub-Clause 20.7 [Failure to Comply with Dispute Board's Decision] and Sub-Clause 20.8 [Expiry of Dispute Board's Appointment], neither Party shall be entitled to commence arbitration of a dispute unless a Notice of Dissatisfaction has been given in accordance with this Sub-Clause.

If the DB has given its decision as to a matter in dispute to both Parties, and no Notice of Dissatisfaction has been given by either Party within 28 days after it received the DB's decision, then the decision shall become final and binding upon both Parties.

20.5 Amicable Settlement

Where a Notice of Dissatisfaction has been given under Sub-Clause 20.4 above, both Parties shall attempt to settle the dispute amicably before the commencement of arbitration. However, unless both Parties agree otherwise, the Party giving a Notice of Dissatisfaction in accordance with Sub-Clause 20.4 above should move to commence arbitration after the fifty-sixth day from the day on which a Notice of Dissatisfaction was given, even if no attempt at an amicable settlement has been made.

20.6 Arbitration

Any dispute between the Parties arising out of or in connection with the Contract not settled amicably in accordance with Sub-Clause 20.5 above and in respect of which the DB's decision (if any) has not become final and binding shall be finally settled by arbitration. Arbitration shall be conducted as follows:

(a) if the contract is with foreign contractors,

(i) for contracts financed by all participating Banks except under sub-paragraph (a) (2) below:

international arbitration (1) with proceedings administered by the arbitration institution designated in the Contract Data, and conducted under the rules of arbitration of such institution; or, if so specified in the Contract Data, (2) international arbitration in accordance with the arbitration rules of the United Nations Commission on International Trade Law (UNCITRAL); or (3) if neither an arbitration institution nor UNCITRAL arbitration rules are specified in the Contract Data, with proceedings administered by the International Chamber of Commerce (ICC) and conducted under the ICC Rules of Arbitration; by one or more arbitrators appointed in accordance with said arbitration rules.

(ii) for contracts financed by the Asian Development Bank:

international arbitration (1) with proceedings administered by the arbitration institution specified in the Contract Data and conducted under the rules of arbitration of such institution unless it is specified in the Contract Data that the arbitration shall be conducted under the rules of the United Nations Commission on International Trade Law (UNCITRAL) and if UNCITRAL Rules are so specified then the named arbitration institution shall be the appointing authority and shall administer the arbitration); or (2) if an arbitration institution is not specified in the Contract Data, with proceedings administered by the Singapore International Arbitration Centre (SIAC) and conducted under the SIAC Rules, by one or more arbitrators appointed in accordance with the said arbitration rules.

(b) if the Contract is with domestic contractors, arbitration with proceedings conducted in accordance with the laws of the Employer's country.

The place of arbitration shall be the neutral location specified in the Contract Data; and the arbitration shall be conducted in the language for communications defined in Sub-Clause 1.4 [Law and Language].

The arbitrators shall have full power to open up, review and revise any certificate, determination, instruction, opinion or valuation of the Engineer, and any decision of the DB, relevant to the dispute. Nothing shall disqualify representatives of the Parties and the Engineer from being called as a witness and giving evidence before the arbitrators on any matter whatsoever relevant to the dispute.

Neither Party shall be limited in the proceedings before the arbitrators to the evidence or arguments previously put before the DB to obtain its decision, or to the reasons for dissatisfaction given in its Notice of Dissatisfaction. Any decision of the DB shall be admissible in evidence in the arbitration.

Arbitration may be commenced prior to or after completion of the Works. The obligations of the Parties, the Engineer and the DB shall not be altered by reason of any arbitration being conducted during the progress of the Works.

20.7 Failure to Comply with Dispute Board's Decision

In the event that a Party fails to comply with a final and binding DB decision, then the other Party may, without prejudice to any other rights it may have, refer the failure itself to arbitration under Sub-Clause 20.6 [Arbitration]. Sub-Clause 20.4 [Obtaining Dispute Board's Decision] and Sub-Clause 20.5 [Amicable Settlement] shall not apply to this reference.

20.8 Expiry of Dispute Board's Appointment

If a dispute arises between the Parties in connection with, or arising out of, the Contract or the execution of the Works and there is no DB in place, whether by reason of the expiry of the DB's appointment or otherwise:

- (a) Sub-Clause 20.4 [Obtaining Dispute Board's Decision] and Sub-Clause 20.5 [Amicable Settlement] shall not apply, and
- (b) the dispute may be referred directly to arbitration under Sub-Clause 20.6 [Arbitration].

APPENDIX

A General Conditions of Dispute Board Agreement

1 Definitions

Each "Dispute Board Agreement" is a tripartite agreement by and between:

- (a) the "Employer";
- (b) the "Contractor"; and
- (c) the "Member" who is defined in the Dispute Board Agreement as being:
 - (i) the sole member of the "DB" and, where this is the case, all references to the "Other Members" do not apply, or
 - (ii) one of the three persons who are jointly called the "DB" (or "Dispute Board") and, where this is the case, the other two persons are called the "Other Members".

The Employer and the Contractor have entered (or intend to enter) into a contract, which is called the "Contract" and is defined in the Dispute Board Agreement, which incorporates this Appendix. In the Dispute Board Agreement, words and expressions which are not otherwise defined shall have the meanings assigned to them in the Contract.

2 General Provisions

Unless otherwise stated in the Dispute Board Agreement, it shall take effect on the latest of the following dates:

- (a) the Commencement Date defined in the Contract,

- (b) when the Employer, the Contractor and the Member have each signed the Dispute Board Agreement, or
- (c) when the Employer, the Contractor and each of the Other Members (if any) have respectively each signed a dispute board agreement.

This employment of the Member is a personal appointment. At any time, the Member may give not less than 70 days' notice of resignation to the Employer and to the Contractor, and the Dispute Board Agreement shall terminate upon the expiry of this period.

3 Warranties

The Member warrants and agrees that he/she is and shall be impartial and independent of the Employer, the Contractor and the Engineer. The Member shall promptly disclose, to each of them and to the Other Members (if any), any fact or circumstance which might appear inconsistent with his/her warranty and agreement of impartiality and independence.

When appointing the Member, the Employer and the Contractor relied upon the Member's representations that he/she is:

- (a) experienced in the work which the Contractor is to carry out under the Contract,
- (b) experienced in the interpretation of contract documentation, and
- (c) fluent in the language for communications defined in the Contract.

4 General Obligations of the Member

The Member shall:

- (a) have no interest financial or otherwise in the Employer, the Contractor or Engineer, nor any financial interest in the Contract except for payment under the Dispute Board Agreement;
- (b) not previously have been employed as a consultant or otherwise by the Employer, the Contractor or the Engineer, except in such circumstances as were disclosed in writing to the Employer and the Contractor before they signed the Dispute Board Agreement;
- (c) have disclosed in writing to the Employer, the Contractor and the Other Members (if any), before entering into the Dispute Board Agreement and to his/her best knowledge and recollection, any professional or personal relationships with any director, officer or employee of the Employer, the Contractor or the Engineer, and any previous involvement in the overall project of which the Contract forms part;
- (d) not, for the duration of the Dispute Board Agreement, be employed as a consultant or otherwise by the Employer, the Contractor or the Engineer, except as may be agreed in writing by the Employer, the Contractor and the Other Members (if any);
- (e) comply with the annexed procedural rules and with Sub-Clause 20.4 of the Conditions of Contract;
- (f) not give advice to the Employer, the Contractor, the Employer's Personnel or the Contractor's Personnel concerning the conduct of the Contract, other than in accordance with the annexed procedural rules;
- (g) not while a Member enter into discussions or make any agreement with the Employer, the Contractor or the Engineer regarding employment by any of them, whether as a consultant or otherwise, after ceasing to act under the Dispute Board Agreement;
- (h) ensure his/her availability for all site visits and hearings as are necessary;

- (i) become conversant with the Contract and with the progress of the Works (and of any other parts of the project of which the Contract forms part) by studying all documents received which shall be maintained in a current working file;
- (j) treat the details of the Contract and all the DB's activities and hearings as private and confidential, and not publish or disclose them without the prior written consent of the Employer, the Contractor and the Other Members (if any); and
- (k) be available to give advice and opinions, on any matter relevant to the Contract when requested by both the Employer and the Contractor, subject to the agreement of the Other Members (if any).

5 General Obligations of the Employer and the Contractor

The Employer, the Contractor, the Employer's Personnel and the Contractor's Personnel shall not request advice from or consultation with the Member regarding the Contract, otherwise than in the normal course of the DB's activities under the Contract and the Dispute Board Agreement. The Employer and the Contractor shall be responsible for compliance with this provision, by the Employer's Personnel and the Contractor's Personnel respectively.

The Employer and the Contractor undertake to each other and to the Member that the Member shall not, except as otherwise agreed in writing by the Employer, the Contractor, the Member and the Other Members (if any):

- (a) be appointed as an arbitrator in any arbitration under the Contract;
- (b) be called as a witness to give evidence concerning any dispute before arbitrator(s) appointed for any arbitration under the Contract; or
- (c) be liable for any claims for anything done or omitted in the discharge or purported discharge of the Member's functions, unless the act or omission is shown to have been in bad faith.

The Employer and the Contractor hereby jointly and severally indemnify and hold the Member harmless against and from claims from which he is relieved from liability under the preceding paragraph.

Whenever the Employer or the Contractor refers a dispute to the DB under Sub-Clause 20.4 of the Conditions of Contract, which will require the Member to make a site visit and attend a hearing, the Employer or the Contractor shall provide appropriate security for a sum equivalent to the reasonable expenses to be incurred by the Member. No account shall be taken of any other payments due or paid to the Member.

6 Payment

The Member shall be paid as follows, in the currency named in the Dispute Board Agreement:

- (a) a retainer fee per calendar month, which shall be considered as payment in full for:
 - (i) being available on 28 days' notice for all Site visits and hearings;
 - (ii) becoming and remaining conversant with all project developments and maintaining relevant files;
 - (iii) all office and overhead expenses including secretarial services, photocopying and office supplies incurred in connection with his duties; and
 - (iv) all services performed hereunder except those referred to in sub-paragraphs (b) and (c) of this Clause.

The retainer fee shall be paid with effect from the last day of the calendar month in which the Dispute Board Agreement becomes effective; until the last day of the calendar month in which the Taking-Over Certificate is issued for the whole of the Works.

With effect from the first day of the calendar month following the month in which the Taking-Over Certificate is issued for the whole of the Works, the retainer fee shall be reduced by one third. This reduced fee shall be paid until the first day of the calendar month in which the Member resigns or the Dispute Board Agreement is otherwise terminated.

- (b) a daily fee which shall be considered as payment in full for:
 - (i) each day or part of a day up to a maximum of two days' travel time in each direction for the journey between the Member's home and the Site, or another location of a meeting with the Other Members (if any);
 - (ii) each working day on Site visits, hearings or preparing decisions; and
 - (iii) each day spent reading submissions in preparation for a hearing.
- (c) all reasonable expenses including necessary travel expenses (air fare in less than first class, hotel and subsistence and other direct travel expenses) incurred in connection with the Member's duties, as well as the cost of telephone calls, courier charges, faxes and telexes: a receipt shall be required for each item in excess of five percent of the daily fee referred to in sub-paragraph (b) of this Clause;
- (d) any taxes properly levied in the Country on payments made to the Member (unless a national or permanent resident of the Country) under this Clause 6.

The retainer and daily fees shall be as specified in the Dispute Board Agreement. Unless it specifies otherwise, these fees shall remain fixed for the first 24 calendar months, and shall thereafter be adjusted by agreement between the Employer, the Contractor and the Member, at each anniversary of the date on which the Dispute Board Agreement became effective.

If the parties fail to agree on the retainer fee or the daily fee, the appointing entity or official named in the Contract Data shall determine the amount of the fees to be used.

The Member shall submit invoices for payment of the monthly retainer and air fares quarterly in advance. Invoices for other expenses and for daily fees shall be submitted following the conclusion of a Site visit or hearing. All invoices shall be accompanied by a brief description of activities performed during the relevant period and shall be addressed to the Contractor.

The Contractor shall pay each of the Member's invoices in full within 56 calendar days after receiving each invoice and shall apply to the Employer (in the Statements under the Contract) for reimbursement of one-half of the amounts of these invoices. The Employer shall then pay the Contractor in accordance with the Contract.

If the Contractor fails to pay to the Member the amount to which he/she is entitled under the Dispute Board Agreement, the Employer shall pay the amount due to the Member and any other amount which may be required to maintain the operation of the DB; and without prejudice to the Employer's rights or remedies. In addition to all other rights arising from this default, the Employer shall be entitled to reimbursement of all sums paid in excess of one-half of these payments, plus all costs of recovering these sums and financing charges calculated at the rate specified in Sub-Clause 14.8 of the Conditions of Contract.

If the Member does not receive payment of the amount due within 70 days after submitting a valid invoice, the Member may (i) suspend his/her services (without notice) until the payment is received, and/or (ii) resign his/her appointment by giving notice under Clause 7.

7 Termination

At any time: (i) the Employer and the Contractor may jointly terminate the Dispute Board Agreement by giving 42 days' notice to the Member; or (ii) the Member may resign as provided for in Clause 2.

If the Member fails to comply with the Dispute Board Agreement, the Employer and the Contractor may, without prejudice to their other rights, terminate it by notice to the Member. The notice shall take effect when received by the Member.

If the Employer or the Contractor fails to comply with the Dispute Board Agreement, the Member may, without prejudice to his other rights, terminate it by notice to the Employer and the Contractor. The notice shall take effect when received by them both.

Any such notice, resignation and termination shall be final and binding on the Employer, the Contractor and the Member. However, a notice by the Employer or the Contractor, but not by both, shall be of no effect.

8 Default of the Member

If the Member fails to comply with any of his obligations under Clause 4 (a) - (d) above, he shall not be entitled to any fees or expenses hereunder and shall, without prejudice to their other rights, reimburse each of the Employer and the Contractor for any fees and expenses received by the Member and the Other Members (if any), for proceedings or decisions (if any) of the DB which are rendered void or ineffective by the said failure to comply.

If the Member fails to comply with any of his obligations under Clause 4 (e) - (k) above, he shall not be entitled to any fees or expenses hereunder from the date and to the extent of the non-compliance and shall, without prejudice to their other rights, reimburse each of the Employer and the Contractor for any fees and expenses already received by the Member, for proceedings or decisions (if any) of the DB which are rendered void or ineffective by the said failure to comply.

9 Disputes

Any dispute or claim arising out of or in connection with this Dispute Board Agreement, or the breach, termination or invalidity thereof, shall be finally settled by institutional arbitration. If no other arbitration institute is agreed, the arbitration shall be conducted under the Rules of Arbitration of the International Chamber of Commerce by one arbitrator appointed in accordance with these Rules of Arbitration.

PROCEDURAL RULES

- 1 Unless otherwise agreed by the Employer and the Contractor, the DB shall visit the Site at intervals of not more than 140 days, including times of critical construction events, at the request of either the Employer or the Contractor. Unless otherwise agreed by the Employer, the Contractor and the DB, the period between consecutive visits shall not be less than 70 days, except as required to convene a hearing as described below.
- 2 The timing of and agenda for each Site visit shall be as agreed jointly by the DB, the Employer and the Contractor, or in the absence of agreement, shall be decided by the DB. The purpose of Site visits is to enable the DB to become and remain acquainted with the progress of the Works and of any actual or potential problems or claims, and, as far as reasonable, to endeavour to prevent potential problems or claims from becoming disputes.
- 3 Site visits shall be attended by the Employer, the Contractor and the Engineer and shall be co-ordinated by the Employer in co-operation with the Contractor. The Employer shall ensure the provision of appropriate conference facilities and secretarial and copying services. At the conclusion of each Site visit and before leaving the site, the DB shall prepare a report on its activities during the visit and shall send copies to the Employer and the Contractor.
- 4 The Employer and the Contractor shall furnish to the DB one copy of all documents which the DB may request, including Contract documents, progress reports, variation instructions, certificates and other documents pertinent to the performance of the Contract. All communications between the DB and the Employer or the Contractor shall be copied to the other Party. If the DB comprises three persons, the Employer and the Contractor shall send copies of these requested documents and these communications to each of these persons.

- 5 If any dispute is referred to the DB in accordance with Sub-Clause 20.4 of the Conditions of Contract, the DB shall proceed in accordance with Sub-Clause 20.4 and these Rules. Subject to the time allowed to give notice of a decision and other relevant factors, the DB shall:
 - (a) act fairly and impartially as between the Employer and the Contractor, giving each of them a reasonable opportunity of putting his case and responding to the other's case, and
 - (b) adopt procedures suitable to the dispute, avoiding unnecessary delay or expense.
- 6 The DB may conduct a hearing on the dispute, in which event it will decide on the date and place for the hearing and may request that written documentation and arguments from the Employer and the Contractor be presented to it prior to or at the hearing.
- 7 Except as otherwise agreed in writing by the Employer and the Contractor, the DB shall have power to adopt an inquisitorial procedure, to refuse admission to hearings or audience at hearings to any persons other than representatives of the Employer, the Contractor and the Engineer, and to proceed in the absence of any party who the DB is satisfied received notice of the hearing; but shall have discretion to decide whether and to what extent this power may be exercised.
- 8 The Employer and the Contractor empower the DB, among other things, to:
 - (a) establish the procedure to be applied in deciding a dispute,
 - (b) decide upon the DB's own jurisdiction, and as to the scope of any dispute referred to it,
 - (c) conduct any hearing as it thinks fit, not being bound by any rules or procedures other than those contained in the Contract and these Rules.
 - (d) take the initiative in ascertaining the facts and matters required for a decision,
 - (e) make use of its own specialist knowledge, if any,
 - (f) decide upon the payment of financing charges in accordance with the Contract,
 - (g) decide upon any provisional relief such as interim or conservatory measures, and
 - (h) open up, review and revise any certificate, decision, determination, instruction, opinion or valuation of the Engineer, relevant to the dispute.
- 9 The DB shall not express any opinions during any hearing concerning the merits of any arguments advanced by the Parties. Thereafter, the DB shall make and give its decision in accordance with Sub-Clause 20.4, or as otherwise agreed by the Employer and the Contractor in writing. If the DB comprises three persons:
 - (a) it shall convene in private after a hearing, in order to have discussions and prepare its decision;
 - (b) it shall endeavour to reach a unanimous decision: if this proves impossible the applicable decision shall be made by a majority of the Members, who may require the minority Member to prepare a written report for submission to the Employer and the Contractor; and
 - (c) if a Member fails to attend a meeting or hearing, or to fulfil any required function, the other two Members may nevertheless proceed to make a decision, unless:
 - (i) either the Employer or the Contractor does not agree that they do so, or
 - (ii) the absent Member is the chairman and he/she instructs the other Members to not make a decision.

Section 8 - Particular Conditions of Contract

The following Particular Conditions of Contract (PCC) shall supplement the General Conditions of Contract (GCC). Whenever there is a conflict, the provisions herein shall prevail over those in the GCC.

Part A – Contract Data

Ref. GCC	Subject	Data
1.1.2.2 and 1.3	Employer's name and address	Program Management Unit, (PMU), Punjab Intermediate Cities Improvement Investment Program (PICIIP), Local Government & Community Development Department, Punjab, Pakistan
1.1.2.4 and 1.3	Engineer's name and address	EPCM Consultant (NESPAK)
1.1.2.11	Bank's name	Asian Development Bank (ADB)
1.1.2.12	Borrower's name	Islamic Republic of Pakistan
1.1.3.3	Time for Completion	Seven Hundred and Thirty (730) days
1.1.3.7	Defects Notification Period	365 days.
1.1.5.6	Sections	Not Applicable
1.3	Electronic transmission systems	pmu.piciip@punjab.gov.pk
1.4	Governing Law	Law of Islamic Republic of Pakistan
1.4	Ruling language	English
1.4	Language for communications	English
2.1	Time for access to the Site	<u>28</u> days after Signing of the Contract Agreement.
3.1(B)(ii)	Engineer's Duties and Authority	See Section 8-B Particular Conditions of Contract Sub Clause 3.1.
4.2	Performance Security	The performance security will be in the form of an unconditional bank guarantee in the amount(s) of 10% (ten percent) of the Accepted Contract Amount. In case of JV, the performance security must be in the name of JV. "JV" means any joint venture, consortium or other unincorporated grouping of two or more persons as referred to in GCC 1.14.
4.8	Safety Procedures	After bullet point (b), add the following: "In particular, the Contractor is responsible for

		providing site workers with safe and healthy working conditions and establish an operating system to prevent accidents, injuries, and disease.”
4.18	Protection of the Environment	<p>At the end of the sub-clause in 4.18 Protection of the Environment, add the following paragraphs:</p> <p>“The Contractor shall comply with all applicable national, provincial, and local environmental laws and regulations.</p> <p>The Contractor shall also comply with all reasonable requests of the national and local authorities responsible for enforcing environmental controls. Within 28 days of the Commencement Date the Contractor shall submit a detailed Site Specific Environmental Management Plan (SSEMP) for the Engineer’s no objection showing how he/she intends to comply with environmental laws and regulations and other specific requirements prescribed in the Contract, addressing all the monitoring and mitigation measures set forth in the Environmental Impact Assessment (“EIA”) and the Environmental Management Plan (“EMP”) of the project attached in Section 6- Employer’s Requirements. Work shall not commence on the Site until the no objection of SSEMP has been obtained from the Engineer and is being implemented. Such acceptance by the Engineer shall not relive the Contractor of any of his obligations or responsibilities under the Contract.</p> <p>The Contractor shall (a) establish an operational system for managing environmental impacts, (b) comply with the approved SSEMP and any corrective or preventative actions set out in safeguards monitoring reports that the Employer will prepare from time to time to monitor the implementation of the project EMP through the SSEMP, (c) allocate the budget required to ensure that such measures, requirements and actions are carried out, (d) submit semi-annual reports on the compliance of such measures to the Employer.</p> <p>Where unanticipated environmental risks or impacts become apparent during the Contract, the Contractor is required to update the SSEMP to outline the potential impacts to site works and associated mitigation measures for the Engineer’s approval.”</p>
6.5	Normal working hours	8:00 AM to 5:00 PM inclusive of one-hour break.
6.7	Health and Safety	After the first paragraph of 6.7 Health and Safety,

		<p>add the following:</p> <p>“The Contractor is responsible for establishment of preventive and emergency preparedness and response measures to avoid, and where avoidance is not possible, to minimize, adverse impacts and risks of the construction site work to the health and safety of local communities.</p> <p>Within 28 days of the Commencement Date the Contractor shall submit a detailed Site Specific Health and Safety Management Plan (SSHSMP) for the Engineer’s no objection showing how he/she intends to comply with the local Health and Safety laws and regulations and other specific requirements prescribed in the Contract, taking into account the Supplementary Information in Section 6- Employer’s Requirements. Work shall not commence on the Site until the confirmation of no objection of the SSHSMP has been obtained from the Engineer and is being implemented. Such confirmation of no objection by the Engineer shall not relieve the Contractor of any of his/her obligations or responsibilities under the Contract.</p> <p>Where unanticipated health and safety hazards or risks become apparent during the Contract, the Contractor is required to update the SSHSMP to outline the potential impacts to site works and associated mitigation measures for the Engineer’s no objection.</p> <p>The Contractor shall comply with the approved SSHSMP and any corrective or preventative actions set out in safeguards monitoring reports that the Employer will prepare from time to time to monitor the implementation of the project EMP through the SSHSMP.</p> <p>In particular, the Contractor is required to provide all personnel on site including Employer’s Personnel and visitors with personal protective equipment, including protection for feet (safety boots), head, eyes, ears (safety helmets) and hands, etc. in accordance with the Contractor’s SSHSMP. The Contractor should ensure that his Subcontractors comply with the SSHSMP and provide all such necessary equipment to their personnel.</p> <p>The Contractor shall bear the costs to ensure that such measures, requirements and actions are carried out.</p> <p>The Contractor shall submit semi-annual reports on the compliance of such measures to the Employer.”</p> <p>Add after the third paragraph the following:</p>
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		<p>"In the event of a significant injury involving medical treatment or hospitalization and fatal accident the Contractor shall notify the Engineer immediately by verbal communication and submit a formal report as soon as practicable after its occurrence. For all accidents, whether fatal or not, the Contractor shall also notify the appropriate local authorities in accordance with the Laws of the Country."</p>
6.25	Respectful Work Environment	<p>The following sentence shall apply:</p> <p>The Contractor shall ensure that its employees and sub-contractors observe the highest ethical standards and refrain from any form of bullying, discrimination, misconduct and harassment, including sexual harassment and shall, at all times, behave in a manner that creates an environment free of unethical behavior, bullying, misconduct and harassment, including sexual harassment. The Contractor shall take appropriate action against any employees or sub-contractors, including suspension or termination of employment or sub-contract, if any form of unethical or inappropriate behavior is identified.</p> <p>The Contractor shall conduct training programs for its employees and sub-contractors to raise awareness on and prevent any form of bullying, discrimination, misconduct and harassment including sexual harassment, and to promote a respectful work environment. The Contractor shall keep an up to date record of its employees and subcontractors who have attended and completed such training programs and provide such records to the Employer or the Engineer at their first written request.</p>
8.7 & 14.15(b)	Delay damages for the Works	0.05% of the Contract Price per day, in the currencies and proportions in which the Contract Price is payable.
8.7	Maximum amount of delay damages	10% (ten percent) of the Contract Price.
13.5.(b)(ii)	Provisional Sums	12% (twelve percent)
13.8	Adjustments for Changes in Cost	The Contract Price is <u>Adjustable</u> during Contract Execution.

14.1	The Contract Price	The following sentence under Clause 14.1 shall <u>not</u> apply: <i>“Notwithstanding the provisions of subparagraph (b), Contractor’s Equipment, including essential spare parts therefor, imported by the Contractor for the sole purpose of executing the Contract shall be exempt from the payment of import duties and taxes upon importation.”</i>
14.2	Total advance payment	15% (fifteen percent) of the Accepted Contract Amount payable in the currencies and proportions in which the Accepted Contract Amount is payable.
14.2(b)	Repayment amortization of advance payment	25% (Twenty Five Percent)
14.3(c)	Percentage of Retention	5% (five percent) 5% (five percent) of the amount, to which the Contractor is entitled, is to be retained from each invoice till the amount so retained reaches the limit set-forth in Clause 14.3 (c) of PCC Part A.
14.3(c)	Limit of Retention Money	5% (five percent) of the Accepted Contract Amount.
14.5(b)(i)	Plant and Materials	NIL
14.5(c)(i)	Plant and Materials	Steel Reinforcement and Cement (OPC) (Refer to Schedule in Section 4 for applicable materials)
14.6	Minimum Amount of Interim Payment Certificates	3% (three percent) of the Accepted Contract Amount.
15.6	Corrupt and Fraudulent Practices	The following sentence shall apply: [For contracts financed by the Asian Development Bank] For the purposes of this Subclause: ADB’s Anticorruption Policy (1998, as amended to date) requires Borrowers (including beneficiaries of ADB-financed activity), as well as Contractors, Subcontractors, Manufacturers, and Consultants under ADB-financed contracts, observe the highest standard of ethics during the procurement and execution of such contracts. In pursuance of this policy, ADB (a) defines, for the purposes of this provision, the terms set forth below as follows: (i) “corrupt practice” means the offering, giving, receiving, or soliciting, directly

		<p>or indirectly, anything of value to influence improperly the actions of another party;</p> <p>(ii) “fraudulent practice” means any act or omission, including a misrepresentation, that knowingly or recklessly misleads, or attempts to mislead, a party to obtain a financial or other benefit or to avoid an obligation;</p> <p>(iii) “coercive practice” means impairing or harming, or threatening to impair or harm, directly or indirectly, any party or the property of the party to influence improperly the actions of a party;</p> <p>(iv) “collusive practice” means an arrangement between two or more parties designed to achieve an improper purpose, including influencing improperly the actions of another party;</p> <p>(v) “abuse” means theft, waste, or improper use of assets related to ADB-related activity, either committed intentionally or through reckless disregard;</p> <p>(vi) “conflict of interest” means any situation in which a party has interests that could improperly influence that party’s performance of official duties or responsibilities, contractual obligations, or compliance with applicable laws and regulations;</p> <p>(vii) “obstructive practice” means (a) deliberately destroying, falsifying, altering, or concealing of evidence material to an ADB investigation, or deliberately making false statements to investigators, with the intent to impede an ADB investigation; (b) threatening, harassing, or intimidating any party to prevent it from disclosing its knowledge of matters relevant to a Bank investigation or from pursuing the investigation; or (c) deliberate acts intended to impede the exercise of ADB’s contractual rights of audit or inspection or access to information; and</p> <p>(viii) “integrity violation” is any act, as defined under ADB’s Integrity Principles and Guidelines (2015, as amended from time to time), which violates ADB’s Anticorruption Policy, including (i) to (vii) above and the following: violations of ADB sanctions,</p>
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		<p>retaliation against whistleblowers or witnesses, and other violations of ADB's Anticorruption Policy, including failure to adhere to the highest ethical standard.</p> <p>(b) will reject a proposal for award if it determines that the Bidder recommended for award has, directly or through an agent, engaged in corrupt, fraudulent, collusive, coercive, or obstructive practices or other integrity violations in competing for the Contract;</p> <p>(c) will cancel the portion of the financing allocated to a contract if it determines at any time that representatives of the borrower or of a beneficiary of ADB-financing engaged in corrupt, fraudulent, collusive, coercive, or obstructive practices or other integrity violations during the procurement or the execution of that contract, without the borrower having taken timely and appropriate action satisfactory to ADB to remedy the situation; and</p> <p>(d) will impose remedial actions on a firm or an individual, at any time, in accordance with ADB's Anticorruption Policy and Integrity Principles and Guidelines, including declaring ineligible, either indefinitely or for a stated period of time, to participate in ADB-financed, -administered, or -supported activities or to benefit from an ADB-financed, -administered, or -supported contract, financially or otherwise, if it at any time determines that the firm or individual has, directly or through an agent, engaged in corrupt, fraudulent, collusive, coercive, or obstructive practices or other integrity violations.</p> <p>All Bidders, consultants, contractors, suppliers and other third parties engaged or involved in ADB-related activities have a duty to cooperate fully in any screening or investigation when requested by ADB to do so. Such cooperation includes, but is not limited to, the following:</p> <p>(a) being available to be interviewed and replying fully and truthfully to all</p>
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		<p>questions asked;</p> <p>(b) providing ADB with any items requested that are within the party's control including, but not limited to, documents and other physical objects;</p> <p>(c) upon written request by ADB, authorizing other related entities to release directly to ADB such information that is specifically and materially related, directly or indirectly, to the said entities or issues which are the subject of the investigation;</p> <p>(d) cooperating with all reasonable requests to search or physically inspect their person and/or work areas, including files, electronic databases, and personal property used on ADB activities, or that utilizes ADB's Information and Communications Technology (ICT) resources or systems (including mobile phones, personal electronic devices, and electronic storage devices such as external disk drives);</p> <p>(e) cooperating in any testing requested by ADB, including but not limited to, fingerprint identification, handwriting analysis, and physical examination and analysis; and</p> <p>(f) preserving and protecting confidentiality of all information discussed with, and as required by, ADB.</p> <p>All Bidders, consultants, contractors and suppliers shall ensure that, in its contract with its sub-consultants, Subcontractors, and other third parties engaged or involved in ADB-related activities, such sub-consultants, Subcontractors, and other third parties similarly undertake the foregoing duty to cooperate fully in any screening or investigation when requested by ADB to do so.</p>
17.6	Maximum total liability of the Contractor to the Employer	The product of 1.15 times the Accepted Contract Amount
18.1	Periods for submission of insurance: a. evidence of insurance. b. relevant policies	<p>The contractor shall be the insuring party under the contract.</p> <p>The Contractor shall provide the evidence of insurance and relevant policies within 28 days after Commencement Date.</p>

18.2(d)	Maximum amount of deductibles for insurance of the Employer's risks	<i>Pak Rupees 10 Million</i>
18.3	Minimum amount of third party insurance	USD 100,000 per occurrence
20.2	Date by which the Dispute Board shall be appointed	28 days after the Commencement.
20.2	The Dispute Board shall be comprised of	Three Members
20.2	List of potential Dispute Board sole members	None
20.3	Appointment (if not agreed) to be made by	Pakistan Engineering Council, Islamabad
20.6 (a)	International arbitration shall be administered by	See Section 8-B (PCC 20.6)
20.6	Place of Arbitration	Agreed place of arbitration shall be a neutral place/venue in case of foreign contractor which shall neither be in the Employer's country nor in the foreign contractor's country. See Section 8-B (PCC 20.6)

Summary of Sections of the Works

Section Name/Description (Subclause 1.1.5.6)	Time for Completion (Subclause 1.1.3.3)	Damages for Delay (Subclause 8.7)

Part B – Specific Provisions
PARTICULAR CONDITIONS OF CONTRACT
PART –B

The following “Particular Conditions”, include amendments and additions to the “General Conditions” which form part of the “**Conditions of Contract for Construction**”, Multilateral Development bank Harmonized Edition 2010 published by the Federation International des Ingenieurs-Conseils (FIDIC).

Clause-1: General Provisions

“1.1.2.6(a)

Add the following Sub Clause 1.1.2.6(a):

Employer's Representative

Employer's Representative means “**Program Director, Program Management Unit, Punjab Intermediate Cities Improvement Investment Program (PICIIP), Local Government & Community Development Department, Punjab, Pakistan**” or any other person appointed by the Employer and notified to the Engineer and Contractor from time to time.”

1.1.5.7

Add the following at the end:

Temporary Works

“e.g. the construction and maintenance of the Contractor’s camp, plant yard and Pre-cast yard etc.”

1.3

Add the following paragraphs at the end:

Communications

“Copies of all communications exchanged between the Employer and the Contractor in connection with the Contract, shall be submitted to the Engineer by the sender of such communications”.

1.5

Replace (a) to (i) with following:

Priority of Documents

- a. The Contract Agreement,
- b. The Letter of Acceptance,
- c. Letters of Tender,
- d. Particular Conditions of Contract (Part-A Contract Data, Part-B Specific Provisions),
- e. Conditions of Contract (General Conditions of Contract for Construction MDB Harmonized Edition-2010),
- f. Special Provisions (Specifications),
- g. Drawings,
- h. Schedules to Bid,
- i. Supplementary information as stated in Section 6 of Bidding Document,
- j. Any other documents forming part of the Contract, such as Initial Environmental Examination, Environmental Management Plan, Environmental Assessment and Review Framework and Land Acquisition, SEMP and Land Acquisition and Resettlement Plan.”

1.6 Contract Agreement The text of last sentence of the Sub Clause 1.6 is deleted and replaced with following text:

“The cost of stamp duties and similar charges (if any) imposed by law in connection with entry into the Contract Agreement shall be borne by the Contractor.”

1.9 Delayed Drawing or Instructions Add the following at the end of first paragraph of this Sub Clause:

“This notice shall be given not less than twenty eight (28) days prior to the requirement of such drawings or instructions required to be incorporated in the Works as per submitted Programme in accordance with Sub-Clause 8.3 [Programme].”

Clause-3: The Engineer

3.1 Engineer’s Duties and Authority Delete the second last paragraph and replace with the following:

“The Engineer shall obtain the approval of the Employer before taking action under the following Sub-Clauses of these conditions:

- a) Consenting to the sub-contracting of any part of Works under Sub-Clause 4.4;
- b) Certifying additional cost determined under Sub-Clause 4.12;
- c) Determining an extension of time under Sub-Clause 8.4;
- d) Suspending the progress of the Works under Sub-Clause 8.8 and certifying an additional cost under Sub-Clause 8.9;
- e) Issuing the Taking-Over Certificate under Clause 10;
- f) Issuing a Performance Certificate under Sub-Clause 11.9;
- g) Issuing a Variation under Clause 13 except in emergency situation as reasonably determined by the Engineer involving loss/damages to life, property and /or Works, and if such a Variation would not increase the Accepted Contract Amount;
- h) Adjustment of Contract Price under Clauses 13.7 and 13.8; and
- i) Proceeding under Sub-Clause 14.11 and issuance of Final Payment Certificate under Sub-Clause 14.13.”

“3.6 Management Meeting Add this Sub-Clause at the end of Clause 3:

The Engineer or the Employer may require the other to attend a management meeting in presence of the Contractor or otherwise, in order to review the progress with reference to the agreed programme and arrangements for future works. The Engineer shall record the business of management meeting and supply copies of the record to those attending the meeting and to the Employer. In the record, responsibilities for any actions to be taken shall be in accordance with the Contract.

No Traveling Allowance / Daily Allowance (TA/DA) or any other expenditure incurred by Contractor will be paid by the Employer to the Contractor in this connection.”

Clause-4: The Contractor

4.2

Performance Security

Insert following at the end of the second paragraph of this Sub-Clause:

“The Performance Security shall be issued either (a) By a reputable bank, which may include scheduled banks, located in the Country, or (b) by a reputable foreign bank, selected by the Contractor and acceptable to the Employer. If the bank issuing the Performance Security furnished by the Contractor is outside the Country, the issuer shall have a correspondent bank in the Country to make it enforceable in the Country. The Performance Security shall be in the form annexed to the Bidding Document.

The Performance Security of a Joint Venture shall be in the name of the Joint Venture.”

4.3

Contractor’s Representative

At the end of this Sub-Clause add:

“The Contractor’s Representative or the person to whom Contractor’s Representative delegates any power, functions and authority must be a qualified Professional Engineer (registered with Pakistan Engineering Council) in the relevant field.

In addition to the Contractor’s Representative, all engineers and foremen present at the Site, shall also be fluent in speaking Urdu or English Language, otherwise the Contractor shall provide sufficient interpreters at the Site to ensure adequate communication with the local personnel.”

4.8

Safety Procedures

Replace the first line with:

“The Contractor shall, at his own expense.”

4.12

Unforeseeable physical Conditions

Add the following at the end of Sub-Clause:

“In addition to notice of any Unforeseeable physical conditions, the Contractor shall provide the Engineer with a written notice of any unanticipated environmental or resettlement risks or impacts that arise during construction, implementation or operation of the Plant or Permanent Works, which were not considered in the initial environmental examination, the environmental management plan or the Land Acquisition and Resettlement Plan attached hereto as Appendix [] through Appendix []”.

4.13

Rights of Way and Facilities

Add the following at the end of Sub-Clause:

“The Contractor shall comply with (i) the measures and requirements relevant to the Contractor which are set forth in the Land Acquisition and Resettlement Plan (“LARP”) attached hereto as Appendix [], to the extent it concerns impacts on affected people during construction; and (ii) any corrective or preventive actions set out in safeguards monitoring reports that the Employer will prepare from time to time to monitor implementation of the LARP. The Contractor shall allocate a budget for compliance with these measures, requirements and actions”.

4.16

Add the following at the end of Sub-Clause by shifting the word “and” from after Para ‘b’ to after Para ‘c’ along with replacement of full stop at the end of

Transport of Goods

Para 'c' with semicolon:

“(d) The Contractor shall adequately record, in a video with date(s) which can not be altered, the topography including condition of roads, agricultural land and other infrastructure prior to starting to transport materials and construction.”

4.18**Protection of Environments**

Add the following paragraphs at the end of Sub-Clause:

“The Contractor shall exercise care to protect the natural landscape and shall conduct his construction operations as to prevent any unnecessary destruction, scarring or defacing of the natural surroundings in the vicinity of the Works, except where clearing is required for Permanent Works, approved Temporary Works and the excavation operations. All trees and native vegetation shall be preserved and shall be protected from damages, which may be caused, by the Contractor’s construction operations and equipment.

On completion of the Works all work area shall be smoothed and graded in a manner to conform the natural appearance of the landscape. Where unnecessary destruction, scarring damage or defacing may occur as a result of the Contractor’s operations, it shall be repaired, replanted or otherwise corrected as directed by the Engineer at Contractor’s expense.

Borrow areas if any, shall be located and operated so as not to detract from the future usefulness or value of the sites. Upon completion of operations borrow areas shall be left in a safe and slightly better conditions. No borrow areas shall be located within 500 meter from the right of way.

During the execution of the Work required under the Contract, the Contractor shall carry out proper and efficient measures as often as necessary to reduce the dust nuisance and to prevent dust originating from his operations. For waste water disposal the provision of septic tank alone for worker’s camp etc. will not be sufficient and may have to be supplemented with secondary treatment in form of gravel drains constructed wetland depending on the laboratory results of effluent from the septic tank.

The Contractor shall comply with all applicable national, provincial, and local environmental laws and regulations.

The Contractor shall (a) establish an operational system for managing environmental impacts, including preparation of a Site Specific Environmental management Plan based on the Environmental Management Plan which shall be finalized by the Employer and submitted for approval by ADB, (b) carry out all of the monitoring and mitigation measures set forth in the Initial Environmental Examination and the Environmental Management Plan attached hereto or available at <https://www.adb.org/projects/documents/pak-46526-007-rrp> as well as those set forth in the Site-Specific Environmental Management Plan, and (c) allocate the budget required to ensure that such measures are carried out. The Contractor shall submit quarterly reports on the carrying out of such measures to the Employer.

More particularly, the Contractor shall comply with (i) the measures and requirements set forth in the initial environmental examination and the environmental management plan attached hereto as Appendix or available at <https://www.adb.org/projects/documents/pak-46526-007-rrp> and (ii) any corrective or preventative actions set out in safeguards monitoring reports that the Employer will prepare from time to time to monitor implementation of the initial environmental examination and the environmental management plan.

The Contractor shall allocate a budget for compliance with these measures, requirements and actions.”

4.19

The entire text of Sub-Clause is deleted and substituted with the following:

Electricity, Water and Gas

“Except as otherwise stated in the Contract, the Contractor shall be responsible for the provision of all supplies of electricity, water, Gas and other services as are required for carrying out the Works at the Site. Any apparatus and equipment required for the use of these services shall be arranged by the Contractor, at its own risk and cost.”

4.21

Progress Report

In the second line of first paragraph after the word “Contractor” add the text “in the format acceptable to the Engineer/Employer”

In subparagraph (g), the word “and” appearing at the end is deleted.

In sub-paragraph (h) the full stop appearing at the end is substituted with a semi colon.

Add the following subparagraph at the end of Sub-Clause with continuing order:

- “(i) Planned programme for the execution of the Works for the next two (2) months to enable the Engineer to determine its programme of inspection and testing;
- (j) Monthly summary of daily job record indicating weather conditions, deployment of Contractor’s Equipment, labour employment (segregated by gender), local material procurement and material import, if any;
- (k) Salient contractual and project Information; and
- (l) Monitoring of obligations in Sub-Clauses 4.13, 4.18, 6.1, 6.4, 6.7, 6.20 & 6.21.”

Clause-6: Staff and Labour

6.1

Engagement of Staff and Labour

Add the following at the end of Sub-Clause:

“The Contractor shall not make employment decisions based upon personal characteristics unrelated to job requirements. The Contractor shall base the employment relationship upon equal opportunity and fair treatment, and shall not discriminate with respect to aspects of the employment relationship, including recruitment and hiring, compensation (including wages and benefits), working conditions and terms of employment or retirement, and discipline.

The Contractor shall (a) provide equal wages and benefits to men and women for work of equal value or type, (b) to the extent possible, employ women and local people, including disadvantaged people living in the project area, who meet the job and efficiency requirements for the Works, (c) provide and adequately equip first aid, health and sanitation, and personal hygiene and facilities for male and female workers at the Work sites, (d) maximize female training and employment, and (e) allow freedom of association and effectively recognize the right to collective bargaining.”

6.4 Labour Laws

The entire text of this Sub-clause is deleted and substituted with the following:

“The Contractor, its Personnel, and subcontractors shall comply with the following at all times during the period of the Contract (together, the **Labour Requirements**):

- (a) all the relevant Laws in force, in Pakistan, which are applicable to the Contractor and its Personnel, including but not limited to, Laws applying to their employment, health, safety, welfare, immigration and emigration, and shall allow them the exercise of all their legal rights, and Laws concerning the prevention of sexual harassment, abuse, assault and sexual exploitation of, or by, the Contractor’s Personnel at or in the vicinity of the Site, or any accommodation, amenities and facilities provided under Sub-clause 6.6;
- (b) (i) the Standard Operating Procedures as may be issued by the Employer (SOPs) to the Contractor with respect to the conditions of the place of employment, health and safety measures to be taken to protect the health, safety and welfare of the Contractor’s Personnel; and (ii) the core labor standards which prohibits the use child labor, discrimination of workers in respect of employment and occupation, the use of forced or compulsory labor, and allows the freedom of association and effectively recognizes the right to collective bargaining (CLS); and
- (c) the requirements on health and safety set out in Sub-clause 6.7.

If the Contractor or any of its Personnel or sub-contractors becomes aware of any breach, or suspected breach, of the Labour Requirements by the Contractor or any of its Personnel or sub-contractors (the **Labour Requirements Non-Compliance**), it shall immediately report it to the Employer’s Representative in writing, giving details of the nature of the breach and the time-frame within which such Labour Requirements Non-Compliance will be rectified. If the Employer becomes aware of any Labour Requirements Non- Compliance, the Employer’s Representative (or any other person nominated by the Employer) shall deliver a written notice to the Contractor’s Representative (**Employer’s Notice of Non-Compliance**), giving details of the nature of the breach and the time-frame within which such breach must be rectified by the Contractor. The notice shall also require the Contractor to explain in writing its response to the alleged finding of a Labour Requirements Non-Compliance. The Contractor shall be given 7 calendar days to submit its written response to the Employer’s Notice of Breach of Labour Requirements. If the Contractor fails to rectify the Labor Requirements Non-Compliance within the prescribed period, and if the Employer determines that the breach is of such materiality and gravity that in the opinion of the Employer (acting reasonably), it merits a stoppage of Works (as specified in the Schedule), the Employer shall

be entitled to declare a stoppage of Works for a period of time to be determined by the Employer. The Contractor shall not be entitled to an extension of time for, or payment or reimbursement for any costs incurred in, rectifying the Labour Requirements Non-Compliance. The Contractor shall be solely responsible and liable for all consequences and liabilities arising from such stoppage of Works and the Labour Requirements Non-Compliance. Any action taken by the Employer pursuant to an Employer's Notice of Non-Compliance shall be without prejudice to the Employer's rights under the Contract, including without limitation the Employer's rights to terminate the Contract under GCC 15.2."

6.6**Facilities for Staff and Labour**

The text of first paragraph is deleted and substituted with the following:

"Save insofar as the Contract otherwise provides, the Contractor shall provide and maintain suitable accommodation and amenities for all its staff and labour, employed for the purpose of or in connection with the Contract, including all fencing, water supply (both for drinking and other purpose), electricity supply, sanitation, fire prevention and fire fighting equipment, cooling system compliant with labour laws and acceptable to the Employer, refrigerator, furniture and other equipment in connection with such accommodation or amenities. The Contractor shall provide appropriate facilities for children of laborers in the construction Camp Sites. On completion of the Works, unless otherwise agreed the temporary camps/housing provided by the Contractor shall be removed and the Site be reinstated to its original condition, all to the approval of the Engineer.

Notwithstanding the above following completion of the Works in case the Employer require the Contractor not to remove/demolish the temporary-built camps/houses, then the relevant cost, as determined by the Engineer, shall be paid to the Contractor."

6.7**Health and Safety**

At the end of this Sub-Clause add:

"The Contractor shall ensure that all applicable Work safety standards are complied with during execution of Works. For the purpose of first and second paragraphs of this Sub-Clause the expenditure will be borne by the Contractor and not the Employer. If Contractor fails to comply the provisions stated therein, the Contractor will be fined at the rate of Rs.10,000 /day of delay in provision of these facilities. This fine shall be deducted from any payments due to the Contractor.

The Contractor shall conduct health and safety programs for workers employed under the project and to members of the local communities surrounding the Project area, particularly women, and shall include information and education campaign on the trafficking of women and the risk of sexually transmitted diseases, including HIV/AIDS in such programs.

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 or sanitary authorities for the purpose of dealing with and overcoming the same."The Contractor shall send details of any accident to the Employer's Representative as soon as practicable after its occurrence. The Contractor shall maintain records and make reports concerning,

health, safety and welfare of persons, damage to property, occurrence of any accidents, and breach or non-observance of any of the health and safety standards, as the Employer's Representative may reasonably require.”

Following text is added at the end of this Sub-clause:

“The Contractor shall conduct health and safety programs for workers employed under the project and to members of the local communities surrounding the Project area, particularly women, and shall include information and education campaign on the trafficking of women and the risk of sexually transmitted diseases, including HIV/AIDS in such programs. In the event of any outbreak of such illness of an epidemic nature, the Contractor shall comply with and carry out regulations, orders and requirements as may be made by the Government or the local or sanitary authorities for the purpose of dealing with and overcoming the same.”

The Contractor's failure to observe any of the health and safety standards prescribed in this clause shall constitute a breach of Labour Requirements in accordance with GCC 6.4 above.

6.8

Contractor's Superintendence

Add the following paragraphs at the end of Sub-Clause:

“The Contractor's superintending staff shall be qualified civil engineers or possess Diploma of Associate Engineer in Civil Engineering or civil technology depending upon the nature of assignment and have a working knowledge of English and Urdu, otherwise the Contractor shall arrange a sufficient number of competent interpreters available at the Site during all working hours.

The Contractor's superintending staff must be available at Site when ever the Engineer's assistants related to construction supervision are inspecting and testing the Works as per Contractor's daily inspection and testing schedule.”

6.10

Records of Contractor's Personnel and Equipment

Insert in second line after the word “Personnel”:

“along with their names, designation and their placing”

In second line after the word ‘Site’ insert the following:

“along with their location of work, make, model and registration number or the number allotted to the specific equipment by the Contractor and printed on the front or sides of the equipment”

At the end of this Sub-Clause add:

“In case of disagreement by the Engineer on the above said records, daily report as verified made by the Engineer will be considered authentic to ensure that there is no duplication of entry in the Contractor's daily report.”

6.15

Measures against Insect and Pest Nuisance

Add the following paragraph at the end of Sub Clause:

“The Contractor shall at all times take the necessary precautions to protect the Contractors Personnel employed on the Site from all pests and reduce the dangers to health and the general nuisance caused by the same. The Contractor shall provide his staff and labour with suitable prophylactics for the prevention of malaria and shall take steps to

prevent the formation of stagnant pools of water. The Contractor shall comply with all the regulations of the local health authorities in these respects and shall in particular arrange to spray thoroughly with approved insecticide all buildings erected on the Site. Such treatment shall be carried out at least once a year or as instructed by the Engineer. The Contractor shall warn his staff and labour of the dangers of wild and local animals and their habitat.”

6.19

Replace the whole text of the Sub-Clause with the following:

Funeral Arrangements

“The Contractor shall make any necessary arrangements for the transport to any place as required for burial, of any of his local or expatriate employees or members of families of expatriate employees who may die at the place of Works or in the Country of Works. The Contractor shall also be responsible, to the extent required by the local regulations, for making any arrangements with regard to burial of any of his employees who may die while engaged upon the Works.”

6.21

Replace the whole text of the Sub-Clause with the following:

Child Labor

“The Contractor shall not employ any child to perform work, including work that is economically exploitative or is likely to be hazardous to, or to interfere with, the child’s education, or to be harmful to the child’s health or physical, mental, spiritual, moral or social development. “Child” means a child below the statutory minimum age of Fourteen (14) years.”

Clause-7: Plant, Materials and Workmanship

7.4

At the end of this Sub-Clause add:

Testing

“The Contractor shall give 24 hours prior notice to the Engineer’s / assistant according to the procedure mutually agreed between them for inspection and testing of Works rather than the action to be initiated by the Engineer under fourth paragraph of this Sub-Clause.”

Clause-8: Commencement, Delay and Suspension

8.1 Commencement of Works The text of GCC, Sub Clause 8.1 (d) is replaced by the following paragraph:

“(d) receipt by the Contractor of the Advance Payment under PCC/GCC, Sub-Clause 14.2 [Advance Payment] provided that the corresponding bank guarantee has been delivered by the Contractor. If the Contractor does not furnish the advance payment guarantee within 28 days of the fulfillment of precedent conditions mentioned in GCC, Sub Clause 8.1 (a), (b) and (c) then this sub clause PCC/GCC, Sub Clause 8.1(d) shall not apply as precedent condition for Engineer’s notification to issue instruction to commence work.”

8.3

Programme

The following words shall be added after the words “...in accordance with this Sub-Clause” at the end of the 4th paragraph of GCC 8.3:

“promptly, and in any event within fourteen (14) days after the receipt of a notice from the Engineer”.

The following paragraphs shall be inserted as the fifth and onwards paragraphs of GCC

“The programme shall be submitted in the form of Primavera, MS Project or other similar software (3 Nos. hard and soft copies) by allocating the equipment and other resources. Moreover, the critical activities shall be identified. The Contractor shall include as part of its programme submitted, a detail forecasted cash flow for the contract in a format acceptable to the Engineer.

The programme shall include information on equipment for the Contract consistent with its proposal regarding work methods, scheduling, and material sourcing in sufficient detail as advised and approved by the Engineer.

The Contractor shall also have a licensed copy of the software from a reputed firm which shall be accessible to the Engineer as well as his assistants. The Contractor shall organize a training programme for the personnel of the Contractor as well as the assistants of the Engineer.

In case of delayed submission of the programme or the revised programme in accordance with this Sub-Clause, the Contractor shall pay a penalty of Rs. 25,000/- (Rupees twenty five thousand) for each day of delay in the submission of the programme or the revised programme. The maximum amount of penalty for delayed submission of the programme or the revised programme shall be Rs.5,000,000/-. Any penalty payable by the Contractor under this Sub-Clause shall first reduce the outstanding amounts due from the Employer to the Contractor (if any). Such penalty for delayed submission of the programme or the revised programme does not prejudice the Employer’s rights under the Contract, including without limitation the Employer’s rights to terminate the Contract under GCC 15.2.”

8.7

Delay Damages

Following new paragraph is added at the end of GCC, Sub Clause 8.7.

“If at any time the Contractor’s actual progress falls behind the schedule progress (8.3 Programme) for more than a quarter of an year consistently despite notices/instructions from the Engineer pursuant to Sub Clause 8.7, the Employer may by giving notice to the Contractor deduct interim delay damages @0.025% per day delay upto a maximum of 5% of Contract Price. In the event that the Contractor fail to take steps as are deemed necessary to meet the schedule performance and interim delay damages reaches the maximum amount, then the Employer may without prejudice to any other rights the Contractor posses under the contract proceed with taking action pursuant to GCC, Clause 15.2 (c) (i). In case the Contractor achieves the succeeding milestones or completion as per approved schedule, this amount of interim delay damages shall be reimbursed to the Contractor.”

Clause-10: Employer’s Taking Over

10.1

Taking Over of the Works and Sections

Delete the third paragraph and insert the following:

The Engineer shall, within 7 days of receipt of contractor’s application, advise the Employer to commence taking over proceedings. Within 7 days of the date of receipt of Engineer’s advice to commence such proceedings, the Employer shall constitute a committee comprising of

the Employer's representative, the Engineer/Engineer's representative and Contractor's Representative. The committee shall within fourteen (14) days of its constitution conduct a detailed inspection of the Works completed by the Contractor to ascertain the completion or the extent of completion and decide whether to:

- (a) issue the Taking-Over Certificate to the Contractor, including the date on which the Works or Section were completed in accordance with the Contract, except for any minor outstanding work and defects which will not substantially affect the use of the Works or Section for their intended purpose (either until or whilst this work is completed and these defects are remedied); or
- (b) reject the application, giving reasons and specifying the work required to be done by the Contractor to enable the Taking-Over Certificate to be issued.
- (c) The Employer may arrange for carrying out any specialized tests with the Engineer at the time of taking over of the Works for issuance of Taking-Over Certificate.

All tests be performed in presence of the Engineer / his assistants or for any specific situation a committee notified by the Engineer with prior approval of Employer.

After the certification by the committee, the Engineer shall, within 14 days, issue the Taking-Over Certificate or the rejection. In case of rejection, the Contractor shall then complete the required work before issuing a further notice under this Sub-Clause.

The text of "28 days" is replaced with "42 days" in the second line of the final paragraph of this Sub Clause.

Clause-11: Defects Liability

11.2

Add the following paragraph at the end of Sub Clause:

Cost of Remedying Defects

"Upon the completion of construction, the Contractor shall fully reinstate pathways, other local infrastructure, and agricultural land to at least their pre-project condition as recorded by the Contractor in consonance with its obligation in Clause 4.16."

11.9

Add the following paragraph before the first paragraph:

Performance Certificate

"At the time of fourteen (14) days before the completion of the Defect Notification Period, the Employer shall constitute a committee comprising of the Employer's representative, Engineer/Engineer's representative and the Contractor's Representative. The committee shall within fourteen (14) days conduct a detailed inspection of the Works to ascertain the issuance of Performance Certificate.

The Employer may arrange for carrying out any specialized testing with the Engineer or nominated Employer representative on the expiry of Defects Notification Period for issuance of Performance Certificate.

All tests be performed in presence of the Engineer / Employer representative or for any specific situation a committee notified by the Employer."

In middle paragraph of the GCC, replace the words “within 28 days after the latest of the expiry dates of the Defects Notification Period” with “within 28 days after the detailed inspection by the committee as required under this Sub-Clause.”

Clause-12: Measurement and Evaluation

- 12.3** “In subparagraph (a) (ii), replace “0.25%” with “1%”.
Evaluation In subparagraph (a) (iii), replace “1%” with “2%”.

Clause-14: Contract Price and Payment

- 14.7(a)** The respective reference to “42” and “21” shall be deleted and replaced with
Payment “56”
- 14.13** The respective reference to “28” in the first paragraph is replaced with
Issue of Final Payment “56”
Certificate

Clause-16: Suspension and Termination by Contractor

- 16.1** First paragraph, third line, replace the number “21” with “42”.
Contractor’s Entitlement In the second paragraph, fourth line the number “7” is replaced with “14”.
to Suspend Work
- 16.2** In first line of subparagraph (a) replace the expression “42” with “56”.
Termination by In second paragraph, first line, replace the expression “14” with “28”
Contractor In third paragraph, in last line, replace the expression “14” with “28”.
 Insert the following at the end of third paragraph:
 “The Employer shall provide notification within 7 days to the Contractor on ADB's suspension of the loan, and such notification shall state whether sufficient fund in appropriate currencies are expected to be available to the Employer to continue making payments to the Contractor beyond 42 days after the date of ADB's suspension of the loan.”

Clause-17: Risk and Responsibility

- 17.3** The word “and” at the end of subparagraph (g) is deleted.
Employer's Risk The full stop at the end of subparagraph (h) is replaced with comma.
 Add the following at the end:
- i. Ionizing radiations or contamination by radioactivity from any nuclear fuel, or from any nuclear waste from combustion of nuclear fuel, radioactive toxic explosive or other hazardous properties of any explosive nuclear assembly or nuclear component thereof, and
 - j. biological/bacterial terrorism.”

Clause-18: Insurance

18.2

Insurance for Works and Contractor's Equipment

Add following paragraphs at the end of Sub- Clause 18.2:
"The insurance shall also cover:

- a. The Employer and the Contractor against loss or damage from the first working day after commencement until the date of issue of the relevant Taking-Over Certificate in respect of the Works or any section or a part there of as the case may be; and
- b. The Contractor for his liability:
 - i. during the defects liability for loss or damages arising from a cause occurring after commencement of Defects Notification Period.
 - ii. caused by the Contractor in the course of any operations carried out by him for the purpose of compliance with the obligations under defect liability.

It shall be the responsibility of the Contractor to notify the insurance company of any damage in the nature and extent of the Works and to ensure the adequacy of the insurance coverage at all times during period of the Contract".

Clause-20: Claims, Disputes and Arbitration

20.6

Arbitration

Replace the subparagraphs (a) and (b) with the following paragraph:

"In case of a foreign Contractor, the arbitration shall be carried out in accordance with the Rules of Arbitration of the International Chamber of Commerce and it shall be administered by the ICC International Court of Arbitration. The place of arbitration shall be the place (city/country) acceptable to parties in case of foreign Contractor.

In case of a local Contractor, the arbitration shall be carried out in accordance with local Arbitration Act 1940 and the place of arbitration shall be "Lahore, Pakistan".

Add the following Clause after Clause 20:

Clause 21: Other Issues

"21.1

General Items

If the Contractor does not provide the items or fails to fulfill its obligations in respect of the general items related to the administrative nature other than the Permanent Works within the time frame specified in its Program for these activities, the Engineer shall instruct the Contractor to fulfill its obligations in respect of the mentioned items within 28 days, failing which the Employer shall incur the expenses by itself on these items. The Engineer shall deduct the amounts due to the Contractor from Interim Payment Certificates in accordance with clause 3.5 [Determination] to compensate the Employer against the expenditure incurred by the Employer in this respect including his administrative overheads etc. @12%".

Section 9 - Contract Forms

This Section contains forms which, once completed, will form part of the Contract. The forms for Performance Security and Advance Payment Security, when required, shall only be completed by the successful Bidder after contract award.

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Notification of Award

[on letterhead paper of the employer]

Letter of Acceptance

..... date.

To: *Name and address of the contractor*

Subject: *Notification of Award Contract No.*

This is to notify you that your Bid dated *date* for execution of the *name of the contract and identification number, as given in the Bid Data Sheet* for the Accepted Contract Amount of the equivalent of *amount in words and figures and name of currency*, as corrected and modified in accordance with the Instructions to Bidders is hereby accepted by our Agency.

You are requested to furnish the Performance Security within 28 days in accordance with the Conditions of Contract, using for that purpose the Performance Security Form included in Section 9 (Contract Forms) of the Bidding Document.

Authorized Signature:

Name and Title of Signatory:

Name of Agency:

Attachment: Contract Agreement

Contract Agreement

THIS AGREEMENT made theday of,, between *name of the employer*. (hereinafter “the Employer”), of the one part, and *name of the contractor*. (hereinafter “the Contractor”), of the other part:

WHEREAS the Employer desires that the Works known as *name of the contract*. should be executed by the Contractor, and has accepted a Bid by the Contractor for the execution and completion of these Works and the remedying of any defects therein.

The Employer and the Contractor agree as follows:

1. In this Agreement, words and expressions shall have the same meanings as are respectively assigned to them in the Contract documents referred to.
2. The following documents shall be deemed to form and be read and construed as part of this Agreement. This Agreement shall prevail over all other Contract documents.
 - (a) the Contract Agreement,
 - (b) the Letter of Acceptance,
 - (c) the Letter of Technical Bid,
 - (d) the Letter of Price Bid,
 - (e) the Variation Nos *insert variation numbers if any*.
 - (f) the Particular Conditions of Contract – Part A,
 - (g) the Particular Conditions of Contract – Part B,
 - (h) the List of Eligible Countries that was specified in Section 5 of the Bidding Document
 - (i) the General Conditions of Contract,
 - (j) the Specifications,
 - (k) the Drawings,
 - (l) the completed Schedules including Bill of Quantities, and
 - (m) any other documents shall be added here.¹
3. In consideration of the payments to be made by the Employer to the Contractor as indicated in this Agreement, the Contractor hereby covenants with the Employer to execute the Works and to remedy defects therein in conformity in all respects with the provisions of the Contract.
4. The Employer hereby covenants to pay the Contractor in consideration of the execution and completion of the Works and the remedying of defects therein, 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 in accordance with the laws of *name of the borrowing country*. on the day, month and year indicated above.

¹ Tables of Adjustment Data may be added if the contract provides for price adjustment (see GCC 13.8).

Signed by

Signed by

for and on behalf of the Employer
in the presence of

for and on behalf the Contractor
in the presence of

Witness, Name, Signature, Address, Date

Witness, Name, Signature, Address, Date

Performance Security

..... *Bank's name, and address of issuing branch or office*¹

Beneficiary: *Name and address of the employer*

Date:

Performance Guarantee No.:

We have been informed that *name of the contractor*. (hereinafter called "the Contractor") has entered into Contract No. *reference number of the contract*. dated with you, for the execution of *name of contract and brief description of works*. (hereinafter called "the Contract").

Furthermore, we understand that, according to the conditions of the Contract, a performance guarantee is required.

At the request of the Contractor, we *name of the bank*. hereby irrevocably undertake to pay you any sum or sums not exceeding in total an amount of *name of the currency and amount in words*² (*amount in figures*.) such sum being payable in the types and proportions of currencies in which the Contract Price is payable, upon receipt by us of your first demand in writing accompanied by a written statement stating that the Contractor is in breach of its obligation(s) under the Contract, without your needing to prove or to show grounds for your demand or the sum specified therein.

This guarantee shall expire, no later than the Day of , ³, and any demand for payment under it must be received by us at this office on or before that date.

This guarantee is subject to the Uniform Rules for Demand Guarantees, ICC Publication No. 458 (*or ICC Publication No. 758 as applicable*), except that subparagraph (ii) of Sub-article 20(a) is hereby excluded.⁴

.....
Signature(s) and seal of bank (where appropriate)

If the institution issuing the performance security is located outside the country of the employer, it shall have a correspondent financial institution located in the country of the employer to make it enforceable.

-
- ¹ All italicized text is for guidance on how to prepare this demand guarantee and shall be deleted from the final document.
 - ² The guarantor shall insert an amount representing the percentage of the contract price specified in the contract and denominated either in the currency(ies) of the contract or a freely convertible currency acceptable to the employer.
 - ³ Insert the date 28 days after the expected completion date. The employer should note that in the event of an extension of the time for completion of the contract, the employer would need to request an extension of this guarantee from the guarantor. Such request must be in writing and must be made prior to the expiration date established in the guarantee. In preparing this guarantee, the employer might consider adding the following text to the form, at the end of the penultimate paragraph: "The Guarantor agrees to a one-time extension of this guarantee for a period not to exceed [6 months][1 year], in response to the Employer's written request for such extension, such request to be presented to the Guarantor before the expiry of the guarantee."
 - ⁴ Or the same or similar to this clause specified in the Uniform Rules for Demand Guarantees, ICC Publication No. 758 where applicable.

Advance Payment Security

..... *Bank's name, and address of issuing branch or office*¹

Beneficiary: *Name and address of the employer*

Date:

Advance Payment Guarantee No.:

We have been informed that *name of the contractor*. (hereinafter called "the Contractor") has entered into Contract No. *reference number of the contract*. dated with you, for the execution of *name of contract and brief description of works*. (hereinafter called "the Contract").

Furthermore, we understand that, according to the Conditions of the Contract, an advance payment in the sum *name of the currency and amount in words*². (. *amount in figures*.) is to be made against an advance payment guarantee.

At the request of the Contractor, we *name of the bank*. hereby irrevocably undertake to pay you any sum or sums not exceeding in total an amount of *name of the currency and amount in words*³. (. *amount in figures*.) upon receipt by us of your first demand in writing accompanied by a written statement stating that the Contractor is in breach of its obligation under the Contract because the Contractor used the advance payment for purposes other than the costs of mobilization in respect of the Works.

It is a condition for any claim and payment under this guarantee to be made that the advance payment referred to above must have been received by the Contractor on its account number *Contractor's account number*. at *name and address of the bank*.

The maximum amount of this guarantee shall be progressively reduced by the amount of the advance payment repaid by the Contractor as indicated in copies of interim statements or payment certificates which shall be presented to us. This guarantee shall expire, at the latest, upon our receipt of a copy of the interim payment certificate indicating that ninety percent (90%) of the Contract Price has been certified for payment, or on the . . . day of ,⁴, whichever is earlier. Consequently, any demand for payment under this guarantee must be received by us at this office on or before that date.

This guarantee is subject to the Uniform Rules for Demand Guarantees, ICC Publication No. 458 (*or ICC Publication No. 758 as applicable*).

.....
Signature(s) and seal of bank (where appropriate)

If the institution issuing the advance payment security is located outside the country of the employer, it shall have a correspondent financial institution located in the country of the employer to make it enforceable.

¹ All italicized text is for guidance on how to prepare this demand guarantee and shall be deleted from the final document.
² The guarantor shall insert an amount representing the amount of the advance payment denominated either in the currency(ies) of the advance payment as specified in the Contract, or in a freely convertible currency acceptable to the employer.
³ Footnote 2.
⁴ Insert the expected expiration date of the time for completion. The employer should note that in the event of an extension of the time for completion of the contract, the employer would need to request an extension of this guarantee from the guarantor. Such request must be in writing and must be made prior to the expiration date established in the guarantee. In preparing this guarantee, the employer might consider adding the following text to the form, at the end of the penultimate paragraph: "The Guarantor agrees to a one-time extension of this guarantee for a period not to exceed [6 months][1 year], in response to the Employer's written request for such extension, such request to be presented to the Guarantor before the expiry of the guarantee."

**INDEMNITY BOND
FOR ADVANCE
AGAINST MATERIALS BROUGHT AT SITE [PCC/GCC, Sub Clause 14.5
(c)]**

(ON PAK RS.40 JUDICIAL STAMP PAPER)

This Deed of Indemnity is issued by M/s. _____
_____ (Name of the Contractor) in favor of Employer (....).

Whereas the (hereinafter called the Employer) has paid the Advance against the cost of Materials through any Bank or like agency by any other method by virtue of the terms of the Contract existing between the Parties. The details of the Materials and their price for which Advance is sought pursuant to PCC/GCC, Sub Clause 14.5 (c) for the period _____ till consumption of the Materials is as under:-

1. _____ at Rs. _____ per _____ = Rs.
2. _____ at Rs. _____ per _____ = Rs.

THEREFORE THIS DEED OF INDEMNITY WITNESSETH AS FOLLOWS:

I/We _____ of M/s _____ do hereby indemnify the Employer for all losses due to thefts, arson, pilferage, loss due to flood and inundation, shortage, deterioration and depreciation etc. through any act of Man or God or slump in the Market of any or all the Materials financed or paid by the Employer on our request for financing payment against Materials.

I/We _____ shall indemnify the Employer against any or all claims and damages arising out of or resulting to the said Materials.

I/We _____ further declare that we will faithfully abide by the above declaration and solemnly affirm that we will not remove, sell, pilferage any of the Materials against which the Employer has paid us such a Secured Advance and will not pledge the same with any Bank, Finance Corporation, Firm, Company, Individual or the like agency or create any charge whereon in any from what so ever, except incorporating in the Permanent Works under the Contract.

I/We _____ do hereby also declare that in the event of my/our infringement of the declaration made above the Employer will be entitled to forfeit all such Materials and also proceed against me/us according to the relevant clause pertaining to breach of Contract and further invoke the power or seek any remedies secured of any kind under the Contract signed with us or otherwise available under the Law.

Place _____ Dated _____

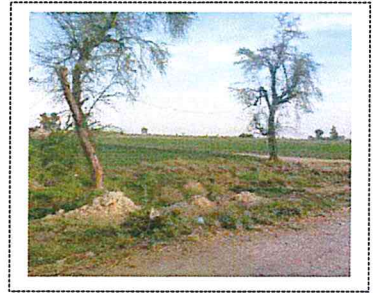
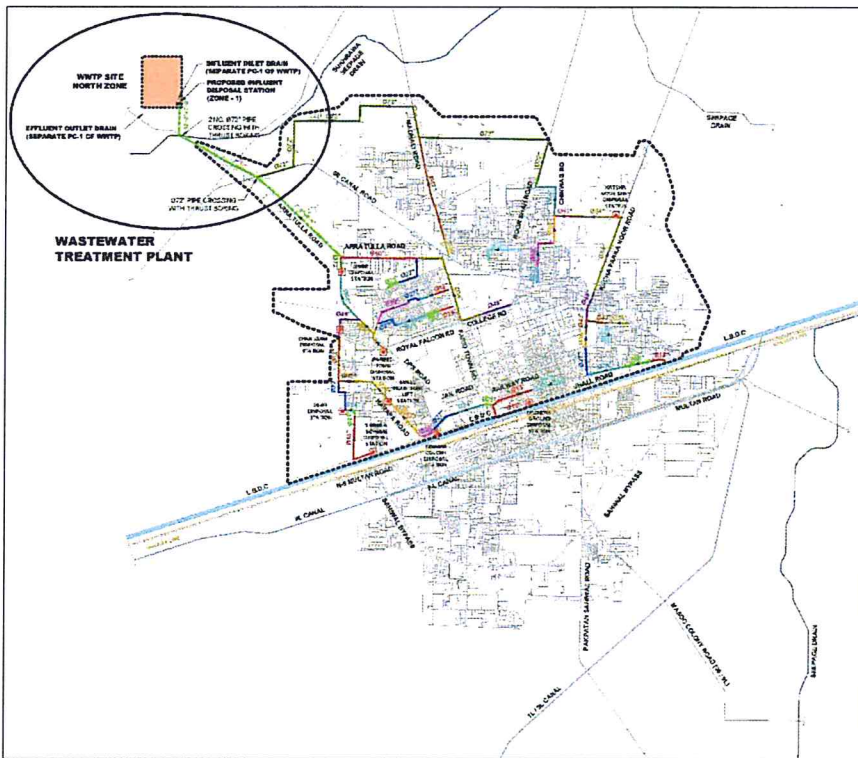
Contractor _____



**PROGRAM MANAGEMENT UNIT PICIIP
(LG&CD DEPARTMENT)**



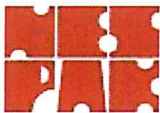
**PUNJAB INTERMEDIATE CITIES
IMPROVEMENT INVESTMENT
PROGRAM (PICIIP)**



**Construction of Wastewater Treatment
Plant (WWTP) in North Zone, Sahiwal
(Stage-1)**

**Engineer's Estimate
(Technical Specification)**

September 2023



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PUNJAB INTERMEDIATE CITIES IMPROVEMENT INVESTMENT PROGRAM (PICIIP)

CONSTRUCTION OF WASTEWATER TREATMENT PLANT (WWTP) IN NORTH ZONE, SAHIWAL (STAGE-1)

TECHNICAL SPECIFICATIONS

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PREAMBLE TO TECHNICAL SPECIFICATIONS

- Items of work provided in the BOQs are based on Market Rate System (MRS), Punjab issued by the Finance Department. Therefore, specifications as mentioned in the relevant MRS items and drawings shall be followed for execution of the Works. Specifications for items not covered in MRS are prepared and provided hereunder.
- In case Non-MRS Item is based on input rates of MRS (e.g. labour, carriage, material etc.), the specifications provided in MRS will prevail for those items. However, for items/material not provided in MRS, specifications provided hereunder shall prevail.
- Selection of Non-MRS items shall be preferably from approved manufactures if not then the manufacturer needs to be first approved after thorough testing and inspection by the Engineer. Similarly, all materials shall require prior approval by the Engineer.
- Health & Safety (H&S) and Environmental Management Plan (EMP) shall be followed by the Contractor.

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1 COMPACTED SOIL LINER

1.1 SCOPE

This specification set the minimum acceptable requirement of Compacted Soil Liner.

1.2 LIST OF ABBREVIATIONS

USCS	Unified Soil Classification System
AASHTO	American Association of State Highway and Transportation Officials
ASTM	American Society for Testing and Materials
SLER	Soil Liner Evaluation Report
QA/QC	Quality Assurance / Quality Control
BA	Borrow Area Sample
NSL	Natural Surface Level
LL	Liquid Limit
PL	Plastic Limit
PI	Plasticity Index
m	meter
cm/sec	centimeter/second
mm	millimeter
%	percentage


1.3 APPLICABLE STANDARDS AND CODES

ASTM D-421, 422	Grain Size Analysis
ASTM D4318	Atterberg Limits
ASTMD2434/ASTM D5084	Permeability Tests
ASTM D2216	Natural Moisture Content
ASTM D1556	Field Density Test (Sand Cone Method)
ASTM D2435	Consolidation Test
ASTM D1557	Laboratory Compaction Test
ASTM D2487	Unified Soil Classification System

1.4 MATERIAL REQUIREMENTS

The compacted soil liner shall be placed at the bottom and on side slopes of the ponds. The material suitable to be used for compacted soil liner shall meet the following specifications:

- Vertical in-situ hydraulic conductivity in compacted state $\leq 1 \times 10^{-7}$ cm/sec
- Fines (particles passing 0.075-mm sieve) ≥ 30 %
- Plasticity index = 8 – 30 %
- Gravels (particles passing 75-mm sieve and retaining 4.75-mm sieve) ≤ 20 %
- Maximum particle size ≤ 10 mm

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1.5 SOIL LINER CONSTRUCTION REQUIREMENTS

1.5.1 General

Constructed soil liners include those of over-excavated and recompacted in-situ soils and/or soils from a borrow source.

All relevant specification related to earthwork such as clearing & grubbing, compaction of natural ground, excavation etc. will be applicable where required or as directed by the Engineer. Unsuitable surplus earth (if any) from WWTP site will be disposed of nearest solid waste dump site to be further used as soil cover by MC Sahiwal.

1.5.2 Installation

Liners on side slopes of greater than a 3H: 1V slope angle (3 horizontal to 1 vertical) should not be constructed in parallel lifts due to both the inherent lack of stability of the compaction equipment on these steep slopes as well as the compaction inefficiency.

Placement of constructed liners must conform to these requirements:

- All liner subgrade areas should be properly scarified below liner base and prepared to receive the liner.
- The top of each lift should be roughened to a shallow depth prior to the placement of the next lift of soil for compaction.
- No loose lift should be thicker than the pads of the compactor or as directed by The Engineer so that complete bonding with the top of the previous lift is achieved.
- Equipment and safety limitations prohibit finish grades with slopes greater than 3H: 1V if the liner is constructed parallel to the surface. For an excavated wall with steeper than 3H: 1V side slopes, the sidewall liner must be constructed in successive horizontal lifts.
- The top surface of the completed soil liner must be proof rolled with a smooth-wheel roller prior to final liner thickness surveying when placement of a geomembrane liner is required.
- The surface of a soil liner be proof rolled when construction is shut down for more than 24 hours and also be done on a routine basis during the summer months at the end of each day's liner construction to mitigate the effects of desiccation cracking.
- The maximum clod size of the compacted soil liner shall be 10 mm in diameter. In all cases, reduce soil clods to the smallest size necessary to achieve the coefficient of permeability reported by the testing laboratory (or the maximum value of 1×10^{-7} cm/sec) and to destroy any macrostructure evidenced after the compaction of the clods under density-controlled conditions.
- The liner soil shall contain no rocks or stones larger than 75 mm in diameter or that total more than 20 % by weight. The final lift for composite liners should not contain any rocks or any other materials that can cause damage to the geomembrane.

1.5.3 Liner Tie-in



When a continuous trench (area fill) method of landfill development is in use, the leading twenty (20) feet of the floor liner shall not receive waste to facilitate tie-in with the next liner segment. Continuous floor liners shall not be constructed by “butting” the entire thickness of a new liner segment next to the previously constructed section of liner. The liner tie-ins are done using one of the following methods:

- **Stair-step method:** The edge of the old section of liner is cut back on off-set layers (stair-step) so that each unit thickness of the existing liner edge is tied to new construction without superimposed construction joints. The length of the tie-in area should be at least 5 feet per foot thickness of liner.
- **Sloped transition method:** The edge of the previously installed section of liner is cut back on a 5H: 1V slope, and is scarified as each successive lift is placed against the 5H: 1V slope. Compaction extends from the new liner onto the transition zone with placement of each successive lift, thereby adequately blending the new and old liners together.

1.5.4 Construction Timing

Soil liner construction and testing should be conducted in a systematic and timely fashion. Delays should be avoided in liner completion. The construction and testing of soil liners do not exceed 60 working days from beginning to completion. Reasons for any liner construction project delays should be fully explained in the SLER submittal.

1.5.5 Liner Protection

Constructed and tested liners for which a SLER has been submitted shall have sufficient surface-drainage controls to prevent the accumulation of both contaminated and non-contaminated water. Remove ponded water that accumulates on newly constructed liner surfaces promptly and appropriately. The surface of the completed soil liner must be kept moist prior to placement of geomembrane or other overlying materials to reduce shrinkage cracking, but saturation of these soils by ponding water is not an acceptable practice. Complete saturation of any portion of the liner and its protective cover compromises their structural integrity and increases the degree of shrinkage cracking in the event of drying

1.6 TESTING REQUIREMENTS FOR SOIL LINER

1.6.1 Borrow Source Materials

Quality Assurance and Quality Control (QA/QC) testing for all borrow source material used to construct the clay component of the liner system must conform to the tests, test methods, and testing frequencies. Borrow source material must be retested for the requirements listed in the following Table-a, if there is a change in borrow source material.



A soil classification system, such as the American Association of State Highway and Transportation Officials system, and the Unified Soil Classification System may be used to determine whether there is a change in borrow source material.

The liquid limit (LL) and plasticity index (PI) of the soil may also be used to determine if there is a change in borrow source material.

1.6.2 Testing Frequency for Soil Liners

Each in-situ or constructed liner sidewall and floor area developed as a separate segment (non-monolithically) must be considered as separately evaluated areas independent of each other for the purpose of calculating dimensions to determine the required number of samples. Those sidewall and floor areas constructed or excavated as a bowl (monolithically) may be added together for the determination of their testing frequency and locations.

Backfill all holes dug or created during any sampling or testing with a mixture of at least 20 percent bentonite-enriched liner soil and compacted by hand tamping or filled with an approved bentonite grout.

1.6.3 Constructed Soil Liner Testing Requirement

The tests, test methods, and testing frequencies outlined in the following Table-a must be used to perform QA/QC testing for constructed soil liners.

1.6.4 Thickness Verification

Thickness of constructed soil liners will be determined by instrument survey methods only. There should be a minimum of one verification point per 5,000 ft² of surface area. If the area under evaluation is less than 5,000 ft², a minimum of two reference points are required for verification. Reference locations will be noted on a drawing of the area evaluated. All elevation calculations necessary for the thickness determination will be attached as part of the supporting documentation to the SLER including any necessary corrections for the true thickness measured perpendicularly to sidewalls. Cross-sections at approximately 100 foot spacing showing true liner thickness for sidewall liners that are constructed in horizontal lifts should be provided if appropriate.

Thickness of in-situ soil liners should be determined by augering to a depth equal to the required liner thickness plus one foot if top foot is to be used as protective cover. The rate of verification should be at a minimum of one location for each 5,000 feet of surface area. Backfill each augered hole with a mixture of at least 20 percent bentonite by volume and parent soil material and, at a minimum, compacted by hand-tamping.

Table-10.1: Standard Tests for Soils

Soil Test Category	Type of Test	Standard Test Methods	Minimum Frequency of Testing *
	Unified Soil Classification	ASTM D2487	

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Soil Test Category	Type of Test	Standard Test Methods	Minimum Frequency of Testing *
Borrow Source Materials	Moisture/Density Relationship	ASTM D698 or D1557	One per 100,000 ft ³
	Sieve (gradation)	ASTM D422 or D1140	
	Atterberg Limits	ASTM D4318	
	Coefficient of Permeability	ASTM D5084 /ASTM D 2435	
Constructed Soil Liners	Field Density	ASTM D1556, D2167, or D6938	One per 8,000 ft ² per 6-inch parallel lift; one per 100 linear ft per 12-inch sidewall horizontal lift
	Sieve (gradation)	ASTM D422 or D1140	One per 100,000 ft ² per 6-inch parallel lift; one per 2,000 lineal ft per 12-inch sidewall horizontal lift
	Atterberg Limits	ASTM D4318	
	Permeability	ASTM D5084	
	Thickness	Registered Surveyor or Professional Engineer	One per 5,000 ft ² (parallel lifts); 50-ft cross sections (horizontal-lift sidewall liners)

* For liners, a minimum of one test must be conducted for each lift, regardless of liner area or length

1.7 PREPARATION OF MATERIAL

On-site soil below clay liner base, including any objectionable material (stumps, roots, bushes, debris, organic material, etc.), shall be removed from the area upon which waste stabilization ponds will be constructed. The exposed surface should then be ploughed and compacted to at least 90 percent of the maximum Standard Proctor dry density at 2 to 3 % wet of optimum moisture content. This is crucial because good subgrade preparation is necessary to provide a sound and stable base for liner construction.

Clods more than 10 mm size must not be present in the liner material; these must be pulverized before compacting by high speed rotary pulverizer.

Liner material must be free of topsoil/tree roots/organic matter.

1.8 PLACEMENT AND COMPACTION

The compacted soil liner shall be placed at the bottom and on side slopes of the ponds and shall have a minimum total thickness of 600 mm and shall meet the material specifications mentioned above. The soil liner shall be placed in layers with maximum compacted layer thickness of 150 mm and compacted to at least 90 percent of the maximum modified Proctor dry density at ± 2 % wet of optimum moisture content.



1.9 INSPECTION AND TESTING

After the placement of each layer, it shall be inspected and tested to ascertain compliance with specifications, including dry density, moisture content, hydraulic conductivity, etc. by an independent laboratory and Engineer's approval must be taken before laying the next layer. An effective bond should be created between successive layers. Prior to placement of each layer, the surface of the previous layer should be scarified and moisture conditioned if necessary, to bond the layers to prevent laminations at the layer interface. The final surface should be smooth and evenly graded.

The completed soil liner must be protected from damage caused by desiccation. Each completed layer of the soil liner, as well as the completed liner, must be protected.

1.10 METHOD STATEMENT BY CONTRACTOR

The Contractor shall prepare detailed Method Statements (MS) for all significant activities and submit these to the Engineer for approval prior to commencement of the work described by each MS. They shall describe in detail how the Contractor proposes to perform the different activities required to undertake the works whilst ensuring compliance with the specification and all appropriate laws, regulations and requirements of the relevant authorities.

The Contractor shall take full responsibility for the stability and safety of all operations carried out and all methods of work adopted. The Contractor shall also take full responsibility for stability and safety of all existing facilities, utilities, roads other infrastructure and property affected by the Contractor undertaking their work.

The Contractor shall be deemed to have inspected the work area(s) and their surroundings and to have satisfied themselves as to their nature, including sub-surface conditions, hydrological and climatic conditions, the extent and nature of the work, the materials necessary for the completion of the work and the means of access to all the work area(s). The Contractor shall be deemed to have obtained all necessary information related to the risks, contingencies and all other circumstances that may influence the work.

The Contractor shall, in connection with the work, provide and maintain all lights, safety barriers, fencing, watchmen and associate facilities required to undertake the works in a safe manner. They shall also comply with the requirements of Engineer and any relevant authority having jurisdiction over the works or the safety and convenience of the public or others. The Contractor shall adapt their method of work to suit any changing conditions on site in order to ensure that the works are undertaken in a safe manner. Such changes shall however be subject to approval by the Engineer.

1.11 METHOD OF MEASUREMENT

The quantities to be measured for shall be in "per cubic feet" units.

2 PENSTOCK GATE

2.1 SCOPE

The work covered by this section consists of providing and installing of manual and gear operated in strict accordance with this section of the specifications and the applicable drawings and as directed by Engineer-in-charge. The Contractor shall:

- A. Design, manufacture, furnish, deliver to the Site, install, test and commission the following equipment in accordance with specifications. The following gate equipment shall be installed on the disposal station.
 - i. C.I penstock gate (in accordance with B.S.S 7775) of size 700mm x 700mm and 3000 mm x 1500 mm comprising horizontal/vertical stiffener members, end members, seal base plates/retaining bars, lifting eyes/lugs etc. with provision of metallic bronze sealing complete in all respects
 - ii. Manual and gear operated stem rod type hoisting system for the gates comprising worm gear arrangement, gear reducer, pinion, coupling, cross shaft, indication device etc. complete in all respect.
 - iii. Hoisting platforms/supporting channels, access ladder, railings, chequered plates etc. complete in all respects.
 - iv. Embedded metal parts for the gates consisting CI frame channel with interior brass channel on bottom and two sides through which gate travels i/c non-magnetic SS spindle with square thread CI head stock and wheel complete in all respects.

2.2 CONTRACTOR'S DRAWINGS AND DATA

1. Before proceeding with the manufacture of Equipment, the Contractor shall submit general assembly drawings, subassembly drawings, detail drawings, calculations, design criteria, design data, catalog pages, specifications and similar engineering documents required to demonstrate fully that all parts will conform to the provisions and intent of these Specifications and to the requirements of their installation, operation, and maintenance.

2. Detailed Drawings

Detailed Drawings shall include the following:

- a. General arrangement drawings for embedded parts: These drawings shall show all final dimensions, tolerances, and details of field connections.
- b. General arrangement drawings for gates: These drawings shall show all final dimensions and tolerances, surface finishes, details of field connections and final weights.



- c. General arrangement drawings of the hoists for the Gate Equipment: These drawings shall show all final dimensions and tolerances, details of field connections, final weights, and loads on foundation bolts.
- d. Slot, top and sill beam details showing seal contact with the embedded sealing faces.
- e. Typical seal details.
- f. Seal splice and seal corner details.
- g. Structural detail drawings of each gate.
- h. Hoist platform and access ladder details.
- i. Details of the hoist gear box, hoist drum and couplings.

3. Mechanical Design Data


The calculations, design data, etc shall include the following:

- a. Required hoisting/operating force calculations
- b. Speed reduction and gear box calculations.

2.3 Standards

The standards under which work shall be performed or tested are given below:

Name	Abbreviation
American Gear Manufacturer's Association	AGMA
American Institute of Steel Construction, Inc.	AISC
American National Standards Institute	ANSI
American Iron and Steel Institute	AISI
American Society of Mechanical Engineers	ASME
British Standard	BS
American Society for Testing and Materials	ASTM

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American Welding Society	AWS
American Water Works Association	AWWA
Federal Specifications Board	U.S. Fed. Spec.
Technical Specifications for Gates and Penstocks	TSGP

2.4 Material specifications

1. a. for skinplate, main components of gate leaf. ASTM-A48, "Standard Specification for Gray Iron Castings"
- b. for embedded parts comprising seal bearing plates and guide plates and rails and supports etc.) ASTM-A48, "Standard Specification for Gray Iron Castings"
2. Corrosion-Resisting (or Corrosion Resistant) Steel (bars, bolts, nuts, and washers, etc.) (Symbol: "GP - CRES"). ASTM-A276, "Specification for Stainless and Heat Resisting Steel Bars and Shapes," Type: Series 316L.
3. Corrosion-Resisting (or Corrosion Resistant) Steel (pins and stem rods) (Symbol: "CRES") ASTM-A276, "Specification for Stainless and Heat Resisting Steel Bars and Shapes," Type: Series 403 or 410.
4. Bolts and Nuts ASTM-F593, "Standard Specification for Stainless Steel Bolts, Hex Cap Screws, and Studs" ASTM-A307, "Specification for Low-carbon Steel Externally and Internally Threaded Standard Fasteners," and ASTM-A325. "Specifications for High-Strength Bolts for Structural Steel Joints Including Suitable Nuts and Plain Hardened Washers,"
5. Permanent self - lubricating bearings and washers with rated coefficient of friction less than 0.15. "Lubrite" A cast bronze alloy (ASTM-B22, "Specification for Bronze Castings for Bridges



- | | | |
|-----|--|--|
| 6. | Bronze Bushings, Sleeve type Bearings and other Lubricated Wearing Parts | and Turntables," Alloy E) with self-lubricating inserts.
SAE Standard Specification No. 64 for Phosphor Bronze. |
| 7. | Steel Pipe | ASTM-A53, "Specification for Welded and Seamless Steel Pipe," Welded Grade. |
| 8. | Expansion Anchors | According to manufacturer's published data. |
| 9. | Concrete Anchor Studs | According to manufacturer's published data. |
| 10. | Gears and Speed Reducers. | AGMA Standard. |
| 11. | Bronze Strips and Bars | ASTM-B 103 "Specifications for phosphor Bronze Plate, Sheet, Strip and Rolled Bar". |

2.5 Test of Materials

Materials shall be new and of first-class quality, suitable for the purpose, free from defects and imperfections, and of the grades, classes and types listed herein, or their equivalents. However, while selecting the materials the Contractor shall keep in view water analysis results and may propose materials having better qualities to resist the chemicals present in the water/ All materials or parts used in the Gate Equipment shall be tested, in conformity with applicable methods prescribed by the ASTM, or such other organization. When requested, tests shall be made in the presence of the Engineer.

2.6 Design Criteria and Working Stresses

A. General

The design of Equipment shall be based on the guidelines of the U.S. Army Corps of Engineers and U.S. Bureau of Reclamation, American Water Works Association Standard AWWA C 501, AWWA C 560, British Standard BSS 7775 except as modified and supplemented by the design criteria described as follows.

B. Design Loads

The Gate Equipment shall be designed for the applicable loads described hereunder.

1. Dead Loads

The dead load shall include the weight of the components, machinery elements, equipment, protective devices and contained fluids. Eccentricity of loading shall also be taken into account.

2. Hydrostatic Loads

Components of Gate Equipment subject to water pressure shall be designed for hydrostatic loads corresponding to the maximum differential pressure expected during the life of the Project.

3. Friction

The friction forces considered in the design shall be based on the applicable coefficients of friction taken from the following table:

	Maximum	Minimum
Corrosion-resisting steel on carbon steel, non-lubricated	0.5	0.1
Corrosion-resisting steel on carbon steel, lubricated	0.18	0.08
Bronze on corrosion-resisting steel, non-lubricated	0.5	0.15
Bronze on corrosion-resisting steel, lubricated	0.2	0.07
Anti-friction bearings	As recommended by bearing manufacturer.	

4. Seismic Loads

All components of gates shall be designed to withstand safely the seismic forces computed by using the following seismic coefficients and design factors:

- OBE: An operating basis earthquake (OBE) equivalent to a horizontal ground acceleration equal to 0.2 g acting simultaneously with a vertical acceleration equal to 1/3 of horizontal acceleration.

5. Live Loads

The live loads on walkways and catwalks transmitted to the gates and hoists shall be taken as uniformly distributed loads (UDL) equal to 500 Kg/m² (100 lbs/ft²). In addition to this UDL, any superimposed concentrated loads likely to be placed on the walkway and catwalks shall be also considered.

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C Load Combinations and Conditions

The detailed design of Equipment shall be based on the most critical loading conditions applicable to major components. The manufacturer would be required to investigate the following loading conditions and load combinations for the final design of the Gate Equipment.

Normal Loading:

- For gate leaf assembly: Dead weight, friction, hoisting and maximum hydrostatic loads when the gate is resting on the sill, being lifted, partially opened or being closed, with maximum water pressure.
- For mechanical hoist/operating system: Dead weight, live, thermal, friction and rated hoist/ operating loads.

Exceptional loading:

- For Gate: Loading when the gate is jammed.
- For mechanical hoist / operating system: Normal loading plus seismic forces for OBE.

D. Working Stresses

1. Factor of Safety - Mechanical Components

A factor of safety not less than 5, based on the ultimate strength of material, will be used under normal loading.

2. Allowable Stresses:

Summary of allowable stresses is given here as under:

F_y = Yield Stress

F_u = Ultimate Stress

F_a = Allowable Stress

Type of Stress	Load Cases		
	Normal	Exceptional	Extreme
1. For structural members			
Bending	0.6 F_y	0.8 F_y	0.95 F
Shear	0.4 F_y	0.5 F_y	0.60 F_y
Tension	0.45 F_y	0.5 F_y	0.60 F_y
Bearing pressure (machined surfaces)	0.8 F_y	0.85 F_y	0.90 F_y
Combined stresses	0.75 F_y	0.95 F_y	No
Buckling			
- AISC value	1.0 F_a	1.3 F_a	1.4 F_a
Hertzian stresses (MPa)	5.35 BHN	5.86 BHN	6.38 BHN

Type of Stress	(BHN=Brinell Hardness No.)		
	Load Cases		
	Normal	Exceptional	Extreme
2. For all mechanical and electrical components	0.33 Fy OR 0.2 Fu whichever is less	0.67 Fy OR 0.4 Fu whichever is less	0.90 Fy OR 0.55 Fu whichever is less

3 Design Criteria for Gate Hoist

a) Loads

The loads used in hoisting system design shall include the following:

- Suspended weight of gate including weight of hoist, fittings and side seal friction.
- Load due to operating motor maximum torque. Maximum motor torque used for design purposes shall be the maximum torque which the motor can develop over its entire speed range with an impressed voltage equal to 110 percent of its rated voltage.

b) Efficiencies

For design calculation, efficiencies of operating machinery components shall be assumed as no greater than the following:

- | | |
|------------------------------------|------------|
| - Speed reducer with worm gear | 60 percent |
| - Speed reducer (triple reduction) | 70 percent |
| - Gear and pinion | 95 percent |
| - Bearings | 96 percent |

c) Operating Speed

The hoisting speed for the gates shall not be less than 100mm/minute for hand operated hoist. For motorized hoist the speed stem type hoisting systems shall not be less than 300mm / min. The operating force on handle shall not be more than 9 kg for manually operated hoist for single person.

d) Shafting

Shafting shall be designed in accordance with Clause D "Working Stresses". A shock or fatigue factor of 1.25 shall be used for shafting, except for speed reducers, which conform to applicable AGMA standards.

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- e) Gears
Gear design shall be in accordance with applicable AGMA standards.
- f) Walkways and Catwalks
Walkway flooring shall be designed for a uniformly distributed live load of 500 kg / m² (100 lbs / ft²) plus a superimposed concentrated load of the heaviest piece of hoisting equipment or sub-assembly. Stair treads and their fastenings shall be designed for a concentrated live load of 450 kg (1000 lbs).
- g) Hoist Platform
The platform shall be designed to suit the proposed equipment. All mechanical components supported directly on the structural members of the hoist platform. Platform shall be tied down to concrete structure by means of anchor bolts designed to resist all possible loading cases.

2.7 Minimum Dimensions

A. Material Thickness

- | | |
|--|-------|
| 1. Plate thickness on any structural member except webs of rolled shapes | 10 mm |
| 2. Webs of rolled shapes | 8 mm |
| 3. Embedded metal with exposed surfaces | 12 mm |
| 4. Completely embedded metal | 12 mm |
| 5. Diameter of bolts or screws on gate structures | 10 mm |
| 6. Diameter of anchor bolts for frame or embedded part | 16 mm |

B. Weld Size

- | | |
|------------------------------|------|
| Min. fillet weld, leg length | 6 mm |
|------------------------------|------|

2.8 Workmanship

A. General

Components and spare parts shall be interchangeable wherever possible. Surface finish of machined parts shall be adequate for their functional requirements.

B. Electric Welding

1. General

All welds shall be made continuous and watertight. All butt welds shall be full penetration welds welded from both sides.

2. Preparation of Base Material

Members to be joined by welding shall be cut to shape and size by mechanical means such as shearing, machining, grinding, or by gas or arc cutting, to suit the conditions. Design of welded joints and selection of weld filler metal shall allow thorough penetration and good fusion of the weld with the base metal.

3. Welding Qualifications

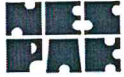
The qualification of welders for all welding, including weld repairs shall conform to the relevant AWS Standard Specifications. The Contractor shall furnish the facilities, all equipment, materials and other articles required to perform qualification tests of his welders and welding operators.

4. Weld Finish

Welds shall in general display good appearance and a surface. All welds, which require nondestructive examinations, shall be dressed by chipping and grinding as required for good interpretation by the selected weld examination methods.

C. Steel Castings

Castings shall be free from injurious defects and shall be satisfactorily cleaned for their intended use. Surfaces of castings, which do not undergo machining, shall be dressed for good appearance and painting. The location of existing defects shall be determined, and all defects, which impair the strength or utility of the casting, shall be removed. An excessive concentration of impurities or



separation of alloying elements at critical points in a casting shall make it liable for rejection.

D. Nondestructive Testing

1. General

Unless otherwise indicated, all nondestructive tests shall be in accordance with ASTM/ASME Standards.

2. Examination of Welds

All butt welds on skin plate and beam flanges, and all welds on other main components shall be given complete nondestructive examination by ultrasonic & magnetic particle methods, supplemented by radiographic examination. Supplemental radiographic examinations shall include examination of areas where interpretations by other methods is unclear or where the integrity of the weld is doubtful.

3. Examination of Castings

All major castings shall be given a complete ultrasonic examination and a radiographic examination insofar as practicable. Where radiographic examination is not practicable due to configuration or accessibility, the castings shall be examined by dye penetrant or magnetic particle methods in addition to the ultrasonic method.

E. Structural Work

Design and fabrication of structural parts shall conform to the applicable provisions of the AISC "Specification for the Design, Fabrication, and Erection of Structural Steel for Buildings," of the AISC "Code of Standard Practice for Steel Buildings and Bridges."

F. Machine Work

All tolerances, allowances, and gauges for metal fits between plain (nonthreaded) cylindrical parts shall conform to ANSI-B4.1. "Preferred Limits and Fits for Cylindrical Parts," for the class of fit. All drilled holes for bolts, which are intended to match other drilled holes, shall be accurately located and drilled from templates.

G. Tolerances

All tolerances shall be selected by the Contractor to correspond to the accuracy required for the proper operation of the equipment considering the nature and



function of the part. All tolerances shall be indicated on the Contractor's drawings and submitted for review. It shall be the Contractor's responsibility to establish finer shop tolerances, if necessary to meet the specified design or operational requirements or for interchangeability of spare parts.

2.9 Structures and Embedded Parts

A. Structures

The structure of each item of the Equipment and embedded parts shall basically be of welded steel construction. All welding shall be done in the shop, except welded field splices.

B. Sealing System

- a. Each Gate Unit shall be provided with a sealing system consisting of seals mounted on the gate with SS base plates and SS seal bearing plates embedded in the concrete structures. Seals shall not be mounted on embedded parts.
- b. The sealing system the gates shall consist of side, bottom and top seals of bronze whereas seal bearing plates shall be stainless steel. The sealing system shall be continuous providing a tight closed sealing line without gaps when the gate is closed. Seal bearing plates shall be of an adequate width to ensure that seals remain on seal plates under all possible working conditions. These working conditions shall cater for the most unfavorable combinations of all factors causing relative position change.

C. Guiding System

Guiding system shall perform one or more of the following functions:

- When the gate is handled above the working area, the guiding system shall ensure that the gate is in the required position and shall correctly engage the frame when lowered.
- When the gate is handled in its working area the guiding system shall ensure that the gate remains engaged with the frame.

D. System for Alignment and Anchorage of Embedded Parts

All embedded parts shall be aligned with studs/anchors adequately spaced and attached with wall thimble.



E. Embedded Parts for Gate Equipment

1. General

Embedded parts of the Equipment shall include all the metal parts, which are to be embedded in concrete or otherwise permanently attached to the civil structure.

Each set of embedded parts supplied and installed by the Contractor shall include the following:

Frame

A complete frame/guide channel shall include one sill beam, two side seal bearing plates and top seal bearing plates.

2. Seal Bearing Plates, Guide Plates

The side, top and sill seal bearing plates and guide plates shall be of CRES.

2.10 Installation

A. Installation of Embedded Parts

Each set of embedded parts shall be assembled, brought to line and grade within the applicable tolerances and firmly secured in place on the wall thimble with anchor bolts/studs. The anchor bolts/studs shall be located with care so that no subsequent bending or forcing is required to match them with the corresponding holes in the frame and guide members. Anchor bolts/studs shall be adjusted and firmly tightened to hold the frames and guides securely in position while concrete is being poured. Top seal bearing plate shall be so designed and installed that when the gate is lifted against full head, water shall not discharge from the top

B. Installation of Gates

The gates shall be installed the bottom of the gate when erected shall be in true alignment to ensure a tight even bearing of the seal on the embedded sill beams. The sides of the gate shall be in true alignment so that the seal when installed will have a tight and even bearing on the embedded sealing surfaces.

C. Installation of Gate Hoists

Each gate hoisting equipment complete with all accessories shall be assembled and installed as per approved shop drawings.

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D. Installation of Hoist Platform, Deck and Access Ladder

All hoist platform parts shall be accurately assembled and erected. All of the material shall be handled carefully so that no part will be bent, broken or otherwise damaged. At bolted connections, the bolts shall be drawn tight, and where required, the threads shall be burred or spot-welded so that nuts cannot become loosened. Where required, bolt holes shall be reamed in the field to provide a light-driving fit.

2.11 Inspection and Testing

1. All equipment, apparatus, material and supplies forming part of the Equipment shall be subjected to inspection and tests at the place of manufacture of the Contractor in the presence of a representative of the Engineer for conformity to the requirements of the Specifications. Field tests shall be conducted under the supervision of the Engineer. The Contractor shall submit a schedule of the specified testing programme to the Engineer for his approval.

2. **Records and Reports**

Records of all tests shall be kept by the Contractor. All test reports shall be signed by the Contractor and shall be in the format approved by the Engineer.

3. **Final Acceptance Tests**

After the entire Equipment has been completely assembled at the Site and placed in satisfactory operation, it shall be tested at or near full head by the Contractor to determine whether or not the requirements of the Specifications have been fulfilled. The gate shall be operated for complete opening and closing cycle.

2.12 Particular Details of Penstock Gate Equipment

General

Slide type penstock gate equipment with manual/motorized stem rod type hoisting system shall be provided.

Slide Type Penstock Gate Equipment

The gate equipment shall be complete with all parts and components required for installation and operation in accordance with the Specifications. The following equipment shall be provided.

- Slide type penstock gates.
- Electrically/manually operated Stem Type Hoists
- Hoisting Platforms, Access ladder and Railings.



- Embedded metal parts which shall consist of all embedded parts including guide channel, top & side seal bearing plates, sill beam, anchor bolts/studs with nuts and washers.

A. Skin-plate Structure

The gate shall be of welded construction and consist of upstream skin plate strengthened by horizontal and vertical stiffener plates all conforming to ASTM-A48. Special care shall be exercised in the fabrication of all parts affecting the strength, rigidity and water tightness of the gate.

Each gate leaf shall be completely assembled in the shop and be free of twists, bends and open joints. Pockets or depressions that may hold water shall be provided with effective drains. Connections between structural members for the gate leaf shall have continuous welds designed to develop full strength of the members. Sections of skinplate shall be connected by continuous welding all around.

B. Seals

Brass or bronze seals shall be attached to gate on downstream side with holding plates and bolts. Side, top and sill seals shall bear against stainless steel/CRES bearing surfaces. Sill beam steel strip, top and side seal bearing plates shall have hardness not less than 150 BHN. Complete leak proof seal corner blocks shall be provided.

C. Embedded Parts

1. General

The fixed wheel gate shall be provided with one set of embedded parts which shall include sill beam, stainless steel/CRES seal bearing plates for side & top and anchor bolts/studs with nuts and washers. The top edge of side seal bearing plates shall be tapered. Top seal bearing plate shall be so designed and installed that when the gate is lifted against full head, water shall not discharge from the top.

2. Guides

Gate side slots will act as guides for the gate. The width of the slots shall be such that it will provide ample clearance for gate movement. The guide will also restrict the lateral movement of the gate.

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D. Gate Hoist and Control

1. General

Manually/electrically operated stem type hoist shall be provided for gate. Each gate shall have an independent local control panel. The Contractor shall design the system and shall start fabrication after approval by the Engineer. The hoist shall consist of the following equipment:

a. Worm-gear Reducers

b. Stem Rods

Material of the stem rods shall be stainless steel with Square / acme thread should be accurately machined on the stem rods. Slenderness ratio (l / r) of stem rods shall not exceed 120. Intermediate brackets can be used to control the slenderness ratio of stem rods within specified limits. Stem nut shall be of copper alloy suitable for the purpose.

c. Drive Shafts

The lengths of the drive shafts will depend upon the length of the worm-gear output shaft.

d. Flexible Couplings

The flexible couplings shall be fully enclosed, dustproof, geared type, shall be bored for tight fits on the shafts and shall have torque ratings suitable for the load transmitted.

e. Lubricating Fittings

Lubricating fittings shall be provided for parts needing lubrication.

f. Bearings and Bearing Blocks

Bearings and bearing blocks shall be of standard well-known manufacturer like SKF or other equivalent known make.

g. Shafting

Shafting shall have provision for longitudinal movement. Lateral shaft deflections shall not be more than 0.25 mm (0.01 in) per foot length of shaft and angular shaft deflection shall not exceed 0.26 deg. per meter (0.08 deg. per foot).



E. Hoisting Platform

Hoisting platform shall be furnished for the gate to support the gate and all hoist loads. The hoisting platform shall be galvanized and shall consist of structural steel framework and chequered plate flooring and access step ladder.

F. Handrailing

Handrailing of DN 50 (2 in dia) schedule 40 galvanized steel pipe shall be provided along the opening side of all the hoist platforms, catwalks, walkways, piers and steps.

G. Gate Position Indicator, Gate Locking Arrangement and Limit Switches

A gate position indicator shall be provided and installed with the gate so that the operator, while working on the hoist, can easily see and read the position of the gate. Position indication shall be shown by a pointer on a 300 mm (12 in) diameter circular graduated scale. The Contractor shall design and provide required mechanism of speed reduction so that total travel of the gate can be calibrated on the scale. The Contractor shall also be required to provide a device to lock the gate at any position. Limit switches shall be provided for indication of full opening & closing of the gate during both operations i.e. manual & motorized.

2.13 METHOD OF MEASUREMENT

The quantities to be measured in Numbers.

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3 PLUMBING SPECIFICATIONS

3.1 SCOPE

This specification sets the minimum acceptable requirements for the work necessary for the complete execution (jointing, clamping, cleaning, painting etc. both above and underground and embedded in walls) and completion, including testing and commissioning of all systems of plumbing works as shown on the Drawings and/or as specified herein and/or as directed by the Engineer. The system include plumbing works as follows:

- Cold and Hot Water Supply
- Building Sewerage & Drainage
- Roof Drainage

All the above systems shall be completed in all respects including extension of these internal systems up to the specified limits outside the building as indicated on the drawings.

3.2 LIST OF ABBREVIATIONS

BS	British Standard
DIN	Deutsches Institut für Normung
ISO	International Organization for Standardization
PPR	Polypropylene
PS	Pakistan Standard

3.3 APPLICABLE STANDARDS

PPR Pipes	DIN 8077-8078, PN-20 and DIN 16962, PN-25 for fittings
G. I. Pipes	BS- 1387
C. I. Pipes	BS- 416 & 2494
uPVC Pipes	ISO- 3633 (Type B) SN-08, EN-1401 (For External) & BS- 4514/ 5255

3.4 SUBMITTALS & SHOP DRAWINGS

All the materials and equipment shall be of the specifications mentioned herein and the Contractor shall submit the sample, necessary catalogues, sketches, the name of manufacturer and guarantee if necessary, before installation. The system shall be installed after the Engineer approves it. All material and equipment shall be new and unused.

It is specifically intended and must be agreed to by each Contractor submitting a bid, that any material or labor which is usually furnished as a part of such equipment and which is necessary for its proper completion and best operation shall be furnished as a part of this Contract without any additional cost whether or not shown in detail on the drawings or described in detail, in the specifications.



Approval of material and equipment by the Engineer shall not absolve the Contractor of the responsibility of furnishing the same of proper size, quantity, quality and all performance characteristics to efficiently fulfill the requirements and intent of the Contract Documents.

Prior to commencement of works on site and at least 3 weeks in advance of all the drawing being required for actual execution the Contractor shall submit on larger scale as approved by Engineer, shop drawings in triplicate for approval to the Engineer. The Engineer shall review the drawing and (i) approve the drawing or, (ii) approve the drawing with comments or, (iii) disapproved the drawings with comments for rectification/revision of the drawing and resubmit 3 copies to the Consultant for approval. On a drawing being approved, the Contractor shall submit 6 copies for formal approval and distribution to relevant offices.

All drawings shall have plan and section and with sufficient details to clearly reflect the installation of the system. All material specifications shall be provided on the drawings. All information required for preparing suitable foundation, for providing suitable access to the system, for making openings in building structure, for coordination with electrical, air-conditioning and other designs etc., shall be clearly provided.

Installation shall not be allowed to commence unless approved shop drawings are in possession of the Contractor, for which purpose shop drawings shall be submitted by the Contractor to the Engineer sufficiently in advance of actual requirements to allow for ample time in checking and approval and no claim for extension of the contract time will be considered by reason of the Contractor's failure to submit the drawings on time.

Each shop drawing submitted by the Contractor shall include a certificate by the Contractor that all related conditions on site relevant to that particular installation have been checked and that no conflict exists.

Any expenses resulting from an error mistake or omission in or delay in delivery of the drawings and information mentioned above shall be borne by the Contractor.

Drawings approved shall not be departed from except on the instructions of the Engineer.

The approval by the Engineer for any submitted data, working drawings, performance curves, test certificates for any items, arrangements and/or layout shall not relieve the Contractor from any responsibility regarding the performance of the Contract. Such approval shall not also relieve the Contractor from responsibility of any error in the submitted data and workings, brought to light at any time subsequent to any approvals.

Relevant specified imported item, model cuts will be available with the authority concern for execution of work for contractor to check the models for fabrication or import.

3.5 PIPE MATERIALS

Polypropylene Random (PPR), Galvanized Iron (G.I), Unplasticized polyvinyl chloride (PVC-U) & C.I Pipes.

3.5.1 POLYPROPYLENE RANDOM PIPES AND PIPE FITTINGS

Providing, fixing, jointing and testing Polypropylene Random (PPR) pipes of approved make pressure pipe for cold and hot water as per DIN 8077-8078, PN-20 for pipes and DIN 16962, PN-25 for fittings (polyfusion welded joints) inside building including fittings and specials (sockets, tees, elbows, bends, crosses, reducers, adaptor, plugs and union etc.) supported on walls or suspended from roof slab or run in chases including pipe hangers, supports, cutting and making good the chases and holes, complete in all respects.

3.5.2 G.I. COLD, HOT WATER PIPES AND FITTINGS

The galvanized pipes shall be of medium grade and conform to British Standard Specifications 1387 for "Steel Tubes and Tubular suitable for screwing to BS 21 pipe threads".

All screwed tubes and sockets shall have BS pipes thread in accordance with BS 21. In order to prevent damage to the leading thread, the ends of the sockets shall be chamfered internally. A complete and uniform adherent coating of zinc will be provided for galvanized pipes.

Every tube shall be tested at the manufacturer's works to a hydraulic test pressure of 4.90 MPa and shall be maintained at the test pressure sufficiently long for proof and inspection. Tubes which are bundled shall be secured together by rope or soft iron or other suitable material.

The threads of all tubes shall be effectively covered with a good quality grease or other suitable compound, and each tube above 50 mm nominal bore shall have a protecting ring affixed to the unsocketed screwed end.

All pipe fittings up to 75 mm dia. shall conform to BS 21 and shall be of malleable cast iron. Pipe fittings above 75 mm dia. shall be of approved material and specifications as decided by the Engineer.

3.5.3 UPVC SOIL, WASTE, VENT & RAIN WATER DRAINAGE PIPES & PIPE FITTING

The material shall substantially consist of poly (vinyl chloride) (PVC) as per the requirements of aforesaid standard. Pipes and fittings shall be sufficiently stabilized against thermal ageing and ultraviolet (UV) light.

PIPES:

There are two types of pipes and fittings (type A and type B) as per ISO 3633 for drainage systems.

- Type A, which shall be used only for primary and secondary ventilation pipe work and internal rainwater applications.
- Type B, which shall be used for soil and waste discharge systems and may also be used for any type A application.



Unplasticized polyvinyl chloride (PVC-U) pipes and fittings for soil and waste discharge (low and high temperature) systems inside the buildings shall conform to *ISO: 3633: (1991(E)) type B*.

FITTINGS:

There are two types of fittings available as per ISO 3633:

- uPVC fittings with Solvent Cement (SC) socket joint conforming to ISO 3633:1991.
- uPVC fittings with rubber ring socket joint conforming to DIN 19560, which is compatible with ISO 3633/PS 3214.

RUBBER RINGS

The rubber rings may either be Synthetic or natural conforming to PS 1915:1987 & ISO 4633/1983 (E). UPVC pipes shall be used for domestic installation inside the buildings for soil and waste discharge, ventilation and drainage of rain water.

The material shall consist substantially of poly-vinyl chloride (PVC) to which may be added only those additives that are needed to facilitate the manufacture of pipes and fittings having good mechanical strength and opacity.

The pipes and fittings shall be tested mechanically and physically in accordance with the relevant Standards as and when directed by the Engineer, before and during installation.

3.5.4 CAST IRON SOIL, WASTE, VENT & RAIN WATER DRAINAGE PIPES & FITTING

The cast iron pipe shall conform to British Standard Specifications No.416 for "Cast Iron spigot and socket soil, waste and vent pipes and fittings with spigot and socket or hubless ends. The joint shall be lead caulked or elastomeric (Rubber rings) to BS- 2494. Cast iron pipes shall be centrifugally (SPUN) cast.

The quality of material shall be according to B.S.S. No.1452 for Grade 10. The contractor shall supply coated pipes and fittings. The coating composition shall be of tar basis or a mixture of natural bitumen with a suitable hardener and natural asphalt. The coatings shall be smooth, tenacious, sufficiently hard, not to flow when exposed to a temperature of 63 Degrees Celsius and not so brittle at zero degrees Celsius that it chips soft when scribed lightly with the point of a pen knife.

Every pipe shall be tested at the manufacturer's work to a hydraulic test pressure of 0.07 MPa. Every pipe and fitting shall ring clearly when tested for soundness by being struck all over with a light hammer.

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3.6 PLUMBING FIXTURES

3.6.1 General Requirements

Materials shall conform to the latest referenced standard specifications and other provisions stipulated herein and shall be new and unused. All fixtures shall be of the best quality and finish.

Prior to procurement of the materials, the Contractor shall be required to prepare and submit to the Engineer for his approval, a complete schedule of materials to be used in the works together with a list of the names and addresses of the manufacturers and the trade names of the materials. The schedule shall include diagrams, drawings and such other technical data as may be required by the Engineer to satisfy himself as to the suitability, durability, quality and usefulness of the material to be purchased.

Approval of the schedule shall not be construed as authorizing any deviations from the specifications unless the attention of the Engineer has been invited to the specific changes. If the material or equipment offered under this provision is, in the opinion of the Engineer, equal to or better than specified, it will be given consideration.

Plumbing fixtures shall have smooth impervious surfaces, be free from defects and concealed fouling surface. They shall be true to line, angles, curves and colour etc. Normally they shall be of local make and of the best quality available, provided.

All taps and cocks to be installed with plumbing fixtures shall be chrome plated (CP) and shall be of appropriate class to work without damage or leakage on the specified pressure of potable water system, which is 0.88 MPa (128 psi). The taps and cocks shall be of the best quality locally manufactured.

When any fixture is provided with an overflow, the waste shall be so arranged that the standing water in the fixture cannot rise in the over flow when the stopper is closed or remain in the overflow when the fixture is empty.

Plumbing fixtures shall be installed in a manner to afford easy access for cleaning. The space between the fixture and the wall shall be closely fitted and pointed so that there is no chance for dirt or vermin to collect.

When practical, all pipes from fixtures shall be run to the nearest wall. where fixture comes in contact with wall and floors, the joint shall be watertight.

Wall hung fixtures shall be rigidly supported by metal supporting members so that no strain is transmitted to the connections. Flush tanks and similar appurtenances shall be secured by approved non-corrosive screws or bolts.

Fixtures shall be set level and in proper alignment with reference to adjacent walls. No water closet shall be set closer than 400 mm from its centre to any side wall. No urinal shall be set



closer than 300 mm from its centre to any side wall or partition nor closer than 600 mm centre to centre. The supply lines or fittings for every plumbing fixture shall be so installed as to prevent backflow. All cuttings, making holes etc. and making it good shall be included in the work.

Other physical/chemical properties of the fixtures are as below:

S. No.	Physical/Chemical Properties	Pakistan Standards	European Standards
1	Water absorption	Less than 0.50%	Maximum 0.50%
2	Scratch Resistance	Maximum 5.5 MOH's scale	Maximum 5 MOH's scale
3	Resistance to Chemicals	Resistant to acids, alkalies, bases & other household cleaning chemicals	Resistant to chemicals.
4	Crazing Resistance	Crazing "NIL"	Crazing "NIL"
5	Warpage	Maximum 5.5-6mm	Maximum 6mm
6	Strength against bending	More than 700 kg/cm	450kg/cm - 700 kg/cm
7	Thermal shock	More than 10 cycles of thermal shock from hot to cold water 15°C-200°C	More than 2 cycles of thermal shock from hot to cold water 20°C-110°C
8	Durability	Permanently durable	Durable for ever

3.6.2 Vanity Wash Basins

Vanity Wash basin shall be vitreous China, best quality, of color, size and type as approved by the Engineer. It shall be installed as a complete unit including 15 mm mixer for hot and cold water supply (unless mentioned separate in BOQ), 15 mm stop-cocks, C.P brass chain with 32 mm rubber plug, C.P brass bottle trap for individual wash basin and C.P brass P trap for battery of wash basins as applicable, C.P brass strainer, heavy cast iron brackets with bolts, screws etc. approved water inlet connection pipe, waste pipe, joints jointing and sealing material, etc., with all other minor accessories required to complete the job in all respect.

3.6.3 Water Closets (European type)

European type water closet shall be best quality, of color, size and type as approved by the Engineer. It shall be installed as a complete unit including all accessories. Flush tank shall be of low level type - it shall be fitted with either single push button or double push button type. Double push button type flushing system is fitted with one 3 liter small button and one 6 liter large button. Trap shall be cast integral with pan. The seat shall be of smooth non-combustible non-absorbent materials like Bakelite and of the open front type fixed to the pan with hinges. The fittings shall also include approved water inlet connection pipe, nuts bolts, 15mm dia stop cock etc. required for complete installation.

3.6.4 Water Closets (Orissa)

Squatting (Asian/Orissa) type water closet shall be vitreous China, best quality, of color, size and type approved by the Engineer. It shall be installed as a complete unit including, 15 mm

CP stop cock, approved water inlet connection pipe, low level or high level Flush tank, as required. All fittings shall be installed at low level, or high level as required including interconnecting flush piping. Foot rests, cast iron P trap, joints, jointing and sealing materials, etc. with all other minor accessories for complete installation.

3.6.5 Kitchen Sink

Kitchen sink shall be stainless steel of best quality, of color, and type as approved by the Engineer, double deep-bowl with integral drain board, of at least 1800 X 600 mm size. It shall be installed as a complete unit with arrangement for both cold and hot water supply, 15 mm C.P. mixer for cold and hot water, approved water inlet connection C.P. brass strainer, waste outlet pipe, heavy cast iron brackets with bolts screws etc., joints jointing & sealing material etc., with all other minor accessories required for complete installation.

3.6.6 Urinals

Urinals shall be vitreous China of approved make and size and of wall hung type either with integral water seal trap or with separate brass P-Trap. The complete unit shall be installed including 15mm Tee-stop cock, plastic water inlet/outlet connections, cast Iron enamel painted flush tank of 4 liters capacity fitted with heavy duty CI brackets, bolts, screws, and all internal accessories or CP Flush Valve; CP steel flush pipe. CP steel waste pipe, joints, jointing and sealing materials etc. with all other minor accessories.

3.7 MISCELLANEOUS ITEMS

3.7.1 Taps, Cocks and Double Bib Cocks with Muslim Shower

All taps, cocks and double bib cocks with Muslim Shower shall be of brass, gun metal or other equally suitable corrosion resisting alloy conforming to BS 1010 and shall be of best quality. The nominal size specified shall be the nominal bore of the seating. Washers for cold water cocks shall be of specially selected leather, rubber asbestos composition or other equally suitable material. Washers for hot water cocks shall be of good quality fiber, rubber - asbestos composition or other equally suitable material. The muslim shower shall be connected to the double bib cock by means of a flexible connecting pipe. Every tap/cock shall be tested; complete with its component parts, to a hydraulic pressure of at least 1.96 MPa (284.4 psi). During tests it shall neither leak nor sweat.

3.7.2 Floor trap/MFT

Floor trap/MFT shall be of uPVC or of other anti-corrosive material, compatible with the material of pipe. They shall have minimum water seal of 40 mm and shall be provided with removable metal/uPVC strainers. The traps shall be of self-clearing type. The open area of the strainer shall be greater than the cross section area of the drain line to which it connects. Floor traps shall be well set in position so that there is no leakage at the joint between trap and the floor.



3.7.3 Shower Rose

Shower Rose shall be of brass, gun metal or other equally suitable corrosion resisting alloy conforming to BS 1010 and shall be of best quality including C.P. mixer for cold and hot water.

3.7.4 Roof Drains

Roof drains shall be of bitumen coated cast iron/ brass or uPVC or of other anti-corrosive material, compatible with the material of pipe. They shall have strainers extending at least 15 mm above the roof surface immediately adjacent to them, when installed on flat part. Bottom of strainer shall be flush with the roof surface, when installed on vertical part. Strainer shall have an available inlet area, above roof level, of not less than 1-1/2 times the area of the down-pipe to which the drain is connected.

The connection between roof and roof drain shall be made watertight by the use of proper flashing material.

3.7.5 Cleanouts

Cleanout shall be of the same nominal size as that of the pipe on which it is installed. Cast Iron Cleanout shall consist of tapped heavy duty cast iron ferrule caulked into cast iron fitting and heavy duty brass tapered even plug. UPVC cleanout shall consist of either two 45o bends or one long radius bend both with a removable end cap and other necessary fittings/material for complete installation in floor Cleanouts shall be turned up through floors by long sweep fittings, wherever the space so permits. Top finish of cleanout shall be flush with the floor by means of finished metal plate secured in position and screwed firmly to the plug. Cleanout shall be so installed that there is a clearance of at least 300 mm for pipes less than 75 mm diameter and at least 457 mm for pipes of 75 mm and larger diameter, for the purpose of Roding.


Pipe used with cleanout shall be measured and paid under pipe item. All other work of ferrule, plug, concrete work, frame and cover etc. shall be measured and paid under cleanout item.

3.7.6 Vent Cowel

All vent pipe terminating above the building shall be provided with best quality cast iron cowel and a stainless clamp for clamping of water proofing membrane as approved by the Engineer.

3.7.7 Ferrule Assembly

Ferrule assembly shall consist of brass ferrule assembly including corporation cock for disconnection of approved quality including C.I saddle, M.S strap and all other items related to make complete house connection.

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3.7.8 Bronze Gate Valve/ Sluice Valve

All valves of 100 mm diameter and smaller shall be of bronze unless otherwise specified conforming to BS 5154 and shall be of appropriate class for the working pressure of the system on which they are installed. Open and shut indicators shall be marked on the handle. The ends may be screwed or flanged.

3.7.9 Bronze Check Valve

Bronze check valves shall be swing type conforming to B.S. 5154. The direction of flow shall be permanently marked on the body of the valve. The end of valves shall be either screwed or flanged, as specified. Threads shall conform to B.S.21. Flanges shall conform to B.S. 4504. Valves and flanges unless otherwise shall be rated for a working pressure of 10 bars for potable water and 16 bars for fire water and shall be tested to 1-1/2 times the working pressure. Check valves shall be installed on horizontal or vertical pipes in the direction of flow.

3.7.10 Cast Iron Gate Valve/ Sluice Valve

All gate valves shall be of cast iron body and shall conform to B.S.5163 "Specifications for Double Flanged Cast Iron Wedge Gate Valves for Waterworks purposes". Body of the valve shall be tested to 1-1/2 times the service pressure and the seat shall be tested at maximum service pressure. No leakage shall be observed under the above tests. The material used shall be corrosion resisting, free from toxic substances and shall not foster microbiological growth or give rise to taste, odour, cloudiness or discolouration of water. Two sets of valves key suitable for opening all valves shall be provided to the Owner free of cost. The external surface of the valves shall be painted with a minimum of two coats of black bituminous enamel paint.

3.7.11 Cast Iron Check Valve

Check Valves shall conform to B.S. 5153 "Specifications for Cast Iron Check Valves for general purposes" the service rating shall be 10 bars for potable water and 16 bars for fire water. The direction of flow shall be permanently marked on the body of the valve. Body of the valve shall be tested to 1-1/2 times the service rating and seat shall be tested at the pressure of service rating. No leakage shall be permitted under the above tests. The check valves shall be swing type.

Ends of the valves shall be flanged to join with the standard fittings. Flanges shall be of appropriate class and material.

Valves shall be installed at positions shown on the detail drawings. The interior shall be cleaned of all foreign matter before installation. They shall be inspected to ensure that all the components are sound and in working condition. Valves shall be adequately supported, wherever required.

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3.7.12 Air Relief Valves

Each valve shall be provided with only a small orifice which shall operate in the same manner as that in a double acting air valve.

Valves with air intake or exhaust facilities shall have approved screening arrangements to prevent the ingress of air borne sand.

The nominal pressure shall be NP 10 for air valves on potable water lines and NP-16 for air valves on fire water lines.

Body ends shall be flanged with raised faces and drilled according to BS 10 for the nominal pressure specified or indicated in the Drawings.

The materials for the valves shall be as follows:

Cast iron body cover and bowl for small orifice, cast iron with gunmetal seat with rubber covered ball or other approved; for large orifice, cast iron with rubber seat and vulcanite covered ball or other approved.

3.7.13 Grease Trap / Interceptor

- a. The grease trap shall be of stainless steel of specified capacity with cover, baffles and strainers to separate grease from water effectively. The grease trap shall be of approved make or equivalent and installed in the position as shown on drawings or as specified by the Engineer.

Or

- b. The grease interceptor shall be built in masonry or reinforced cement concrete as per relevant drawings including excavation, RCC class "C", steel reinforcement, PCC class "E", 15mm thick cement sand plaster in 1:3 c/s, 15mm thick C.I. trap & plate having holes (screen) 25mm c/c of standard diameter, 20mm G.I. pipe for lifting trap, inlet & outlet connections, 600x600 mm C.I. cover with frame, 25mm legs for supporting screen system, painting three coats to steel works with synthetic enamel paint, nuts, bolts etc. complete in all respects as desired by the engineer.

3.7.14 Glass Mirror

The glass mirror shall be of specified size, 5 mm thick, securely fixed on hard board packing and of best quality Belgium make. The mirror shall be fixed on wall as shown on the drawing or as directed by the Engineer. All accessories required for complete fixing of mirror on wall shall be included in Contractor's scope of work.

3.7.15 Towel Rail, Toilet Paper Holder, Soap Trays, Mirror Trays

The towel rail, toilet paper holder, soap trays & mirror trays shall be of best quality. All accessories for complete installation of towel rail, toilet paper holder, soap tray and mirror tray shall be included in the Contractor's scope of work.

3.7.16 Gully Trap

Gully trap shall be of cast iron with specified size outlet. The inlet shall be provided with cast iron, medium duty grating. The open area of the grating shall be at least 1-1/2 times the area of the outlet. The trap shall be of P-Type with a minimum water seal of 50 mm.

3.7.17 Cast Iron Grating

Cast iron grating shall be of the specified size. The specified size shall mean the clear span. Cast iron grating shall be complete with frame. They shall be of Light/medium duty type to resist normal traffic loads, the casting shall be sound and free from all defects. The frame shall be set in place at the time of pouring of concrete. Openings in grating shall be in approved pattern.

3.7.18 Electric Water Cooler

Cabinet shall be of heavy gauge mild steel construction painted with non-corrosive paint from inside and with special hammer finish paint from outside.

Push button type water taps shall be chrome plated. Drain pot shall be made of hard plastic with stain-less steel tray. Back panel shall be easily removable for cleaning and servicing top cover shall be of scratch proof Formica.

Water storage tank shall be either of stainless steel or copper alloy, tinned inside and outside with present insulation to maintain water temperature, with special arrangement for cleaning the tank.

Condensing unit shall be heavy duty, hermetically sealed with thermal overload protection for refrigerant F-12 and capillary expansion with valves for easy gas charging. Thermostat and other control necessary for proper functioning of the unit shall be provided. The thermostat shall control the temperature of cooled water between + 110C & + 200C.

3.7.19 Water Filters

Water filters shall be installed on wall near the water coolers. They shall be of best quality local/foreign make. Each filter shall have a crystal housing of a durable material. The flow rate shall be 2 to 6 gpm with a maximum pressure of 0.483 M.Pa (70psi) and a temperature of 35°F to 100°F.

- Stage 1:- Stage 1 shall use a "poly propylene Yarn In-depth Sediment filter cartridge", for removal of dust, rust, silt, scale and unseen suspended particles. It shall have a filtration rating of 5-micron.
- Stage 2:- In this stage a "Granular Activated Carbon (GAC) cartridge" equipped with a post-filter of 1-micron is recommended, for removal of chemicals and unpleasant taste and odor.
- Stage 3:- This stage must provide 30,000 MW.sec/sq.cm energy to guarantee 100% sterilization and ensure effective control of microbiological contamination.



3.7.20 Electric Water Heaters

Water heater shall be of automatic storage type electrically operated, including all necessary fittings for complete installation & operation. The heater shall be of best quality, as approved by the Engineer.

The working and test pressure of the heater to be of 6 bar and 10 bar respectively and shall deliver water at 150 degree F. It shall be capable to reach the peak demand, storage capacity.

Heater shall be provided with following accessories.

- i) Thermostatic control
- ii) Temperature & pressure relief valve High limit Control.

Other specifications of Water Heater are as given below:

Inner tank shall be extra heavy gauge anti-rust G.I. sheet metal to hold maximum inside water pressure. As insulation, imported genuine glass wool shall be used to maintain the desired temperature that controls the lighting up of the burner. The outer body shall be made of requisite gauge M.S. sheet shaped into reinforced circumference. Flow and delivery pipes shall be of high quality G.I. pipes fabricated with heavy gauge anti-rust baffle plate. *The thermostat shall be of Robershaw (U.S.A) make.* Special anti-rust-baked primer-heavy coated stoved enamel paint with high gloss automotive shine shall be used on sheet metal.

3.7.21 Hot Water Boilers

Primary Heater is a stainless steel four or six pass serpentine bent tube design utilizing one-inch O.D.S.S tubes stainless steel plate headers and down comers, S.S socket ins and outs, each tube replaceable.

The Hot Water Boilers are provided with following standard supplies:

- Relief Valve
- Hi- limit Thermostat
- Auto Electric gas valve
- Low water cut-off
- Single stage firing
- Gas cock for main and pilot
- Draft Diverter
- Main and pilot gas PRV
- 100% shut off standing pilot
- 230/50/1 power
- Water temp controller
- 2" rockwool external insulation
- 1" ceramic wool insulation over tubes
- Individually replaceable tubular gas burner
- 16 gauge external jacketing
- Control panel with on/off switch, fuse, power on light, hi – temperature and low water lights with alarm bell and mute switch.



3.8 EXECUTION

The Contractor shall be responsible for his work until its completion and final acceptance, and shall replace any of those that may be damaged, lost or stolen without any additional cost.

All openings left in floor for passage of lines of water supply, soil, waste, vent, etc. shall be covered and protected.

All open ends of pipes shall be properly plugged to prevent any foreign material from entering the pipe. Misuse of plumbing fixtures to be installed under this Contract is prohibited during the currency of the contract.

All metal fixture trimmings shall be thoroughly covered with non-corrosive grease which shall be maintained until all work is completed.

Upon the completion of work, all fixtures and trimmings shall be thoroughly cleaned, polished and left in first class condition.

Before erection, all pipes, valves, fittings, etc. shall be thoroughly cleaned of oil, grease or other material.

All special tools for proper operation and maintenance of the equipment provided under this Contract shall be delivered at no additional cost.

The Contractor shall allow in his bid for cost of all cutting, making holes and subsequent making it good to the desired finish as per approval of the Engineer. No separate payment shall be made for this item.

The Contractor shall allow in his bid for the cost of providing protective painting or coating as specified in the relevant sections and no claim shall be entertained for this item.

All pipes shall be properly installed as shown on the drawings and/or as directed by the Engineer, and shall be as straight as possible forming right angles and parallel lines with the walls and other pipelines. The position, gradients, alignment and inverts shall be as shown on the drawings and/or as directed in writing and set out by the Engineer.

The arrangement, positions and connections of pipe fittings and appurtenances shall be as shown on the drawings. The Engineer reserves the right to change the location etc. Special precautions shall be taken for the installation of concealed pipes as shown on the drawings and/or as required. Should it be necessary to correct piping so installed, the Contractor shall be held liable for any injury caused to other works in the correction of piping? The Contractor shall closely coordinate with other works during the entire stage of execution.

A minimum distance between different services shall be maintained as shown on the Drawings and/or as approved by the Engineer.



Pipes should be installed in such a manner that minimum distance should always be maintained between pipe and wall, beams, columns, etc. Pipes shall be supported on hangers and brackets as shown on the drawings or as directed by the Engineer.

Waste-water outlet from each fixture shall be individually trapped. Each vent terminal shall extend to the outer air and be so installed as to minimize the possibilities of clogging and the return of foul air to the building.

When the roughing-in is completed, the plumbing system shall be subjected to test prior to concealing the roughing-in, in order to ascertain that all threads and connections are watertight.

Cast iron soil and drainage fittings for change in direction shall be used as follows:-

- Vertical to horizontal: short sweep or long-turn for diameter 75 mm and larger; long sweep or extra-long-turn for less than 75 mm. dia.
- Horizontal to vertical: quarter bend or short turn.

All fittings with hubs shall be aligned so that the hub faces upstream. No drainage or vent piping shall be drilled.

All exterior openings provided for the passage of piping shall be properly sealed with snugly fitting collars of metal or other approved rodent-proof material securely fastened into place.

Joints at the roof, around vent pipes, shall be made water-tight by the use of lead, copper, galvanized iron, or other approved flashing or flashing material. Exterior wall openings shall be made watertight.

Each length of pipe & each pipe fitting, trap, fixture, & device used in a plumbing system shall have cast, stamped or indelibly marked on it the maker's mark or name, the weight, type & classes of the product, when such marking is required by the approved standard that applies.

Where different sizes of pipes, or pipes and fittings are to be connected, the proper size increasers or reducers or reduced fittings shall be used between the two sizes.

Any fitting or connection which has an enlargement, chamber, or recess with a ledge, shoulder, or reduction of pipe area that offers an obstruction to flow through the drain pipe is prohibited. The vertical distance from the fixture outlet to the trap weir shall not exceed 600 mm. Each fixture trap shall have a water seal of not less than 50 mm and not more than 100 mm.

Full S, bell, crown vented traps and traps/depending for their seal upon the action of movable parts are prohibited. No fixture shall be double trapped. Where fixture comes in contact with wall and floors, the joint shall be water-tight. Piping in ground shall be laid on a firm bed for its entire length.

Piping in the plumbing system shall be installed without undue strains and stresses. Vertical piping shall be securely held to keep the pipe in alignment and carry the weight of the pipe and contents. Horizontal piping shall be supported to keep it in alignment and prevent sagging. Hangers and anchors shall be of metal of sufficient strength to maintain their proportional share of pipe alignments and prevent rattling. Hangers and anchors shall be securely attached to the building under construction. It must be clearly understood that the Contractor shall be fully responsible for hangers and supports and shall obtain prior approval of design as to the shape, material, dimensions, spacing etc.

Piping in concrete or masonry walls or footings shall be placed or installed in sleeves which will permit access to the piping for repair or replacement.

3.9 POLYPROPYLENE RANDOM PIPES AND PIPE FITTINGS

The run and arrangement of all pipes shall be as shown on the Drawings and as directed during installation. All vertical pipes shall be erected plumb and shall be parallel to wall and other pipes. All horizontal runs of piping shall be kept close to walls. If required to change the location etc. during the currency of the work, the Contractor will do so at no additional cost. Joints in PPR pipes shall be made perfectly tight, without the use of any filler except approved jointing compound or tape.

Furnish and install all pipe passing through floors and walls with sleeves of G.I. sheet, 18 gauge, the inside dia. of which shall be at least 12mm greater than the outside of the pipe passing through it. Sleeves in exterior walls and pits shall have anchor flanges and space between pipe and sleeve shall be caulked and sealed watertight. At waterproof locations, an approved water-proof type pipe sleeve shall be provided.

All embedded cold-water supply piping shall be wrapped with approved anti-corrosion polyethylene tape. All exposed piping shall be painted with two coats of enamel paint over a coat of red oxide.

3.9.1 Pipework Supports

All supports, clips, steels rods and hangers shall be of mild steel painted with two coats of approved metallic zinc primer.

All clips and brackets shall be equipped with 9 mm sectional rubber liners.

Pipe work supports shall be installed in order to allow free movement due to expansions and contraction. Supports shall be arranged adjacent to joints, changes of direction and branches. Single pipes hung from floor slabs shall be supported on rod hangers. Where two or more pipes are involved a channel or angle form shall be fitted to the underside of slab by two hangers and the pipes shall be supported from the channel iron by rod hangers and flat iron bands.

All hanger rods shall have double nuts and bevelled washers to allow the hanger rod to swing.



Multiple pipe runs along walls shall be supported on purpose made substantial angle and channel frames securely fixed to the wall, floor and ceiling as necessary. All pipes shall be arranged to slide on the steel supports and U-bolts shall be provided to form a rigid guide.

Exposed pipe work shall be supported on channel, angle iron or with U-bolts to form a rigid guide.

All U-bolts, except used as anchors, shall have a pair of nut and washers on each leg with the supporting steel flange clamped tight between the pair of nuts to form a rigid guide and allowing the pipe to slide axially,. U- bolts shall be provided on alternate pipe bracket.

Small pipework running along skirting shall be supported by standard built-in or screw-on type clips.

Pipes shall be individually supported. Pipes shall not hang from other pipes.

Points at which pipes pass through walls, floors, connections to plant, equipment and heat emitters, etc. do not constitute points of supports for the pipes.

Vertical pipes shall be supported at the base or at anchor points to withstand the total weight of the riser. Brackets from risers shall not be used as a means-of support for the riser.


Vibration isolators to be provided with the hangers as approved by the Engineer.

3.10 G.I. COLD AND HOT WATER PIPES WITH FITTINGS

The run and arrangement of all pipes shall be as shown on the Drawings and as directed during installation. All vertical pipes shall be erected plumb and shall be parallel to wall and other pipes. All horizontal runs of piping shall be kept close to walls. If required to change the location etc. during the currency of the work, the Contractor will do so at no additional cost. Screwed joints in G.I. pipes shall be made perfectly tight, without the use of any filler except approved jointing compound or tape. Wherever required to make flanged joints, they shall conform to BS 10 Table D.

Furnish and install all pipes passing through floors and walls with sleeves of G.I. sheet, 18 gauge, the inside dia. of which shall be at least 1/2" greater than the outside dia of the pipe passing through it. Sleeves in exterior walls and pits shall have anchor flanges and space between pipe and sleeve shall be caulked and sealed watertight. At waterproof locations, an approved water-proof type pipe sleeve shall be provided.

All embedded water supply piping shall be wrapped with approved anti-corrosion polyethylene tape. All exposed piping shall be painted with two coats of enamel paint over a coat of red oxide.

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3.10.1 Insulation

All hot water supply and return piping shall be insulated as specified herein. Prior to insulation the pipes shall be hydraulically tested and cleaned.

Nominal Pipe Dia. (mm)	Thickness of per-form Fiber glass pipe insulation. (mm)
15 (1/2")	25
20 (3/4")	25
25 (1")	25
32 (1-1/4")	25
40 (1-1/2")	25

Insulation shall consist of pre-formed fiberglass pipe insulation, with factory applied reinforced aluminum vapor barrier, single layer in semi-circular halves, consisting of long, fine glass fibers, bonded with a temperature resistant binder, free from shot or coarse fibers, damage resistant, light in weight, easy to handle, cut and fit. The product shall comply with the requirements of B.S. 3958: Part 4. The insulation shall be rotproof, odorless, non-hygroscopic, and shall not sustain vermin. The fiberglass insulation shall be covered with a layer of approved polyethylene tape in the field. Further reinforcement shall be provided by the use of 20 mm wide soft aluminum bands, generally spaced at 457 mm and on either side of elbows and tees. All butt joints shall be sealed with self-adhesive type of approved quality adhesive tape.

All trimmed sections shall be secured by wrapping of approved type of self-adhesive tape to form a complete waterproof seal. All work shall be done in a neat and workmanlike manner, and should reflect recommended practice.

All Hot water and Hot water return lines concealed in walls only, shall be provided with Glass wool blanket insulation.

3.10.2 Pipe work Supports

All supports, clips, steel rods and hangers shall be of mild steel painted with two coats of approved metallic zinc primer. All clips and brackets shall be equipped with 9 mm sectional rubber liners (shore-hardness A 40+5°).

Pipe work supports shall be installed in order to allow free movement due to expansions and contraction. Supports shall be arranged adjacent to joints, changes of direction and branches. Each support shall carry the overall weight of pipework and water to be borne by it. The intervals between pipe supports shall not exceed the following.



Dimensions of Support Materials

Nominal Dia mm	Flat iron bands mm	Support rods mm	U-bolts mm
10	25 x 3	6	6
15	25 x 3	6	6
20	25 x 3	6	6
25	25 x 3	6	6
32	40 x 5	10	10
40	40 x 5	10	10
50	40 x 5	10	10
65	50 x 6	12	12
80	50 x 6	12	12

Single pipes hung from floor slabs shall be supported on rod hangers. Where two or more pipes are involved a channel or angle iron shall be fitted to the underside of slab by two hangers and the pipes shall be supported from the channel iron by rod hangers and flat iron bands.

All hanger rods shall have double nuts and bevelled washers to allow the hanger rod to swing.

Multiple pipe runs along walls shall be supported on purpose made substantial angle and channel frames securely fixed to the wall, floor and ceiling as necessary. All pipes shall be arranged to slide on the steel supports and U-bolts shall be provided to form a rigid guide.

Exposed pipe work shall be supported on channel, angle iron or with U-bolts to form a rigid guide.

All U-bolts, except used as anchors, shall have a pair of nut and washers on each leg with the supporting steel flange clamped tight between the pair of nuts to form a rigid guide and allowing the pipe to slide axially. U-bolts shall be provided on alternate pipe bracket.

Small pipe work running along skirting shall be supported by standard built-in or screw-on type clips.

Pipes shall be individually supported. Pipes shall not hung from other pipes.

Points at which pipes pass through walls, floors, connections to plant, equipment and heat emitters, etc. do not constitute points of supports for the pipes.



Vertical pipes shall be supported at the base or at anchor points to withstand the total weight of the riser. Brackets from risers shall not be used as a means-of support for the riser.

Vibration isolators to be provided with the hangers as approved by the Engineer.

3.11 SOIL, WASTE, VENT & RAIN WATER DRAINAGE PIPES & FITTINGS

All cast iron soil pipes and fittings shall be installed to the lines and grades shown on the drawings or as directed by the Engineer. When required to be installed above ground floor level, suitable and substantial number of hangers and supports of approved type and make shall be provided. No piping shall be hung from the piping of other systems. Clamps shall be provided on not more than 1.5 meter centres or a minimum of one hanger per each length of pipe whichever is smaller. Where excessive numbers of fittings are installed, additional clamps will be provided.

All steel clamps, hangers and support etc. shall be given one coat of red oxide primer and two coats of synthetic enamel paint. All exposed C.I. soil/vent pipes shall be given two coats of synthetic enamel paint. Materials for painting shall be high quality product of well-known manufacturer and will be approved by the Engineer before using. The instructions of the manufacturer regarding all painting work shall strictly be adhered to. Pipes passing through walls, floors, etc. shall be provided with sleeves of approved design. All vent pipes to be installed in the system shall be provided with approved cowl and will rise at least 0.70 meter above the roof.

Caulked joints for cast iron bell-and-spigot soil pipe shall be firmly packed with oakum or kemp and filled with molten lead not less than 22 mm deep and not to extend more than 3 mm below the rim of the hub. Rubber ring joints shall also be allowed. No paint, varnish, or other coatings shall be permitted on the jointing material unit after the joint has been tested and approved.

Pipes passing through walls, floors, etc. shall be provided with sleeves of approved design. All vent pipe to be installed in the system shall be provided with approved cowl and will rise at least 0.70 meter above the roof.

Special requirements for uPVC pipes and fittings are as under:

Maximum Interval between Supports (m)
(Support centers for uPVC pipe work systems) *

PIPEWORKS

Nominal Diameter, d_e (mm)	Horizontal ($10x d_e$) (m)	Vertical (m)
40	0.40	1.2
50	0.50	1.5
80	0.75	2.0
100	1.10	2.0

* The values shown are for general installations only. Attention is drawn to special requirements that may be needed in more demanding applications.



All steel clamps, hangers, supports etc. shall be given one coat of red oxide primer and two coats of synthetic enamel paint.

All exposed uPVC pipes shall be given two coats of approved colour water-based emulsion paint (note that oil based paints must be avoided).

3.11.1 PRECAUTIONS

Following points describe how an uPVC must be cared of:

- a. The depth of concrete cover above uPVC pipe depends on the pipe gradient. However, a minimum of 1 (one) inch concrete cover must be provided.
- b. When using cemented joints, the adhesive should be given sufficient opportunity to harden before the pipe is concreted in.
- c. Horizontal lines that are concreted-in should be anchored against upward movement and should be adequately secured while the concrete is being poured.
- d. During the pouring and setting of concrete, necessary care shall be taken to prevent physical damage to the pipes.
- e. When using heated concrete or when steaming the concrete, the sensitivity of uPVC material to temperature changes should be borne in mind.
- f. Concrete mortar that is used before concreting-in shall include no sharp-edged material.
- g. Avoid excessive misalignment of the pipes.
- h. Avoid excessive tightness of joints.
- i. Provide sufficient expansion joints to allow thermal movement or regression.
- j. Use only allowed cleaning & de-scaling techniques for different situations & locations (as described in ISO/TR 7024-1985E) when a pipeline gets choked or blocked.

3.11.2 DELIVERY CONDITIONS

The internal and external surfaces of pipes and fittings shall be smooth and free from grooving, blistering and any other surface defect. The materials shall not contain visible impurities or pores. Pipe ends shall be cleanly cut, and the ends of pipes and fittings shall be square with the axis of the pipe

3.11.3 MARKINGS

Pipes, fittings and sealing rings shall be marked clearly and indelibly so that legibility is maintained for the life of products under normal conditions of storage, weather and use.

The markings may be integral with the product or on a label. The markings shall not damage the product.

3.11.4 PIPES

Pipes shall be marked with at least the following information:

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- a. Manufacturer's name or trade mark;
- b. Pipe material;
- c. Nominal diameter of pipe;
- d. Nominal wall thickness of pipe
- e. Manufacturing information, in plain text or in code, providing tractability of the production period to within the year and month and the production site if the manufacturer is producing at several national or international sites.
- f. The number of this International Standard.

Pipes with a nominal laying length up to and including z_2 meters shall be marked with at least once. Pipes with a nominal laying length greater than z_2 meters shall be marked at intervals of z_3 meters at the most. The values of z_2 and z_3 shall be as specified by the authorities in each country.

3.11.5 FITTINGS

Fittings shall be marked with at least the following information:

- a. Manufacturer's name or trade mark;
- b. Fitting material (may be given on packing only in the case of PVC, provided this information is not required on each article by national authorities);
- c. Nominal diameter of fitting;
- d. Classification (where applicable)
- e. Values of angles, if any;
- f. Manufacturing information, in plain text or in code, providing tractability of the production period to within the year and month and the production site if the manufacturer is producing at several national or international sites (may be given on packing only, provided this information is not required on each article by national authorities);
- g. The number of this International Standard (may be given on packing only, provided this information is not required on each article by national authorities).

3.11.6 SEALING RINGS

Sealing rings shall be marked with at least the following information:

- a. Manufacturer's name or trade mark;
- b. Nominal diameter of ring;
- c. Manufacturing information, in plain text or in code, providing traceability of the production period to within the year and month and the production site if the manufacturer is producing at several national or international sites.

3.12 TESTING AND COMMISSIONING

3.12.1 POLYPROPYLENE RANDOM PIPES AND PIPE FITTINGS

All water distribution system shall be tested whole or in part to 1 1/2 times the working pressure. The contractor shall pay for all device, materials, supplies, labour and power required for the test. The test will be run for two hours at the specified pressure and there



should be no leakage in the system. Defects revealed by the test shall be repaired and the whole test rerun until the system proves to be satisfactory.

After all the pipes and fixtures have been properly laid and tested, they shall be flushed clean with water and then disinfected with water solution of chlorine of at least 50 ppm strength for a contact period of 6 hours. The system will be finally flushed with clean water.

3.12.2 G.I COLD AND HOT WATER PIPES

All water distribution system shall be tested whole or in part to 2 times the working pressure with a minimum test pressure of 0.69 MPa (100psi). The contractor shall pay for all device, materials, supplies, labor and power required for the test. The test will be run for two hours at the specified pressure and there should be no leakage in the system. Defects revealed by the test shall be repaired and the whole test rerun until the system proves to be satisfactory.

After all the pipes and fixtures have been properly laid and tested, they shall be flushed clean with water and then disinfected with water solution of chlorine of at least 50 ppm strength for a contact period of 6 hours. The system will be finally flushed with clean water.

3.12.3 SOIL, WASTE, VENT & RAIN WATER DRAINAGE PIPES & PIPE FITTINGS

The entire system of drains, waste, and vent piping inside the building shall be tested by this Contractor under a water test. Every portion of the system shall be tested to a hydrostatic pressure equivalent to at least 3-meter head of water. After filling this Contractor shall shut off water supply and shall allow it to stand two hours, under test during which time there shall be no loss or leakage.

The Contractor shall furnish and pay for all devices, materials, supplies, labor and power required in connection with all tests. All tests shall be made in the presence of and to the satisfaction of the Engineer.

The Contractor shall also be responsible for the repair of this work & other trades work that may be damaged or disturbed by the tests. Defects disclosed by the tests repaired. Work shall be replaced with new work without extra cost to the Employer. Tests shall be repeated as directed, until all work is proven satisfactory. All fixtures shall be tested for soundness, stability, support and satisfactory operation.

3.13 METHOD OF MEASUREMENT

3.14 PPR COLD & HOT WATER PIPES

3.14.1 Measurement

Measurement for acceptably completed works of PPR cold and hot water pipes shall be made in running feet length. including earthworks, pipe fittings, jointing, hangers, clamps and brackets, sleeves, cutting and breaking concrete and then making it good, applying protective

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painting, coating, cleaning, testing and disinfecting etc. and the measurement will be for the full work specified herein.

3.15 G.I COLD & HOT WATER PIPE

3.15.1 Measurement

Measurement for acceptably completed works of supply and installation of G.I. cold and hot water pipes shall be in running feet length. No measurement shall be made for pipe fittings, jointing, hangers, clamps, brackets, sleeves, insulation, cutting and breaking concrete and then making it good, applying protective painting, coating, cleaning, testing and disinfecting etc. and the measurement will be for the full work specified herein.

3.16 UPVC AND C.I. SOIL, WASTE & VENT PIPES

3.16.1 Measurement

Measurement for acceptably completed works of supply and installation of uPVC & C.I. pipes, will be in running feet length and the work to be done shall include all pipe fittings, jointing, hangers, clamps, brackets, sleeves, cutting and breaking concrete and then making it good, applying protective painting, coating, cleaning and testing.

3.17 VALVES

3.17.1 Measurement

Measurement of acceptably completed work of gate and check valves will be made on the basis of actual number of valves provided and installed in position as shown on the drawing or as directed by the Engineer.

3.18 PLUMBING FIXTURES

3.18.1 Measurement

Measurement for plumbing fixtures will be made as per actual number acceptably installed. The Contractor's bid against these items shall include installation of complete unit as specified herein, inclusive of all work from inlet connection of water supply to outlet connection with the sanitary system, complete as per Contract Documents and/or as directed by the Engineer.

3.19 MISCELLANEOUS ITEMS

3.19.1 Measurement

Measurement for acceptably completed works of floor traps & floor drains, roof drains, cleanouts, glass mirror, towel rail, toilet paper holder, soap trays, mirror trays, water coolers, electric water heaters, gully trap, grease interceptor, hot water boilers etc. shall be made on the basis of actual number acceptably installed in position. The Contractor's bid against these items shall include installation complete as specified herein and/or as shown on the Drawings.



3.20 BASIS OF PAYMENT

3.21 PPR COLD & HOT WATER PIPES

3.21.1 Payment

Payment for acceptably measured quantity of works will be made at the unit rate per running feet length of PPR cold and hot water pipes as quoted in the Bill of Quantities. and shall constitute full compensation for all the works related to the item.

3.22 G.I COLD & HOT WATER PIPE

3.22.1 Payment

Payment for acceptable measured quantity will be made at the unit rate per running feet length of G.I. cold and hot water pipes quoted in the Bill of Quantities. The amount bid shall be the full payment for completion of the work in all respects as specified herein.

3.23 UPVC AND C.I. SOIL, WASTE & VENT PIPES

3.23.1 Payment

Payment will be made at the unit rate of bid per running feet length of pipe acceptably supplied and installed. The amount bid shall be full payment for the work specified herein.

3.24 VALVES

3.24.1 Payment

Payment will be made for acceptable measured quantity of gate, check, air relief valves on the basis of unit rate per number quoted in the Bills of Quantities and shall constitute full compensation for all the works related to the item.

3.25 PLUMBING FIXTURES

3.25.1 Payment

Payment for plumbing fixtures shall be made at the applicable unit price per number bid for the respective item in the Bill of Quantities. The amount bid shall be full payment for the work specified herein.

3.26 MISCELLANEOUS ITEMS

3.26.1 Payment

Payment for acceptably measured quantity of floor traps & floor drains, roof drains, cleanouts, glass mirror, towel rail, toilet paper holder, soap trays, mirror trays, water coolers, electric water heaters, gully trap, grease interceptor, hot water boiler etc. shall be made at the applicable unit rate per number quoted in the Bill of Quantities. The bid amount shall be full payment for the works specified herein and as shown on the Drawing.

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4 GENERAL SPECIFICATIONS FOR ELECTRICAL SYSTEMS

4.1 SCOPE OF WORK

The scope of this contract covers all operation and activities required for proper and complete construction of electrification works for Design and Construction of waste water disposal system of Multan Industrial Estate.

The works related to the Electrical systems that are included in the scope of this Contract are shown on the Tender Drawings, stated in the Bill of Quantities and explained in these Specifications. All the equipment & allied accessories and their installation shall also comply with General Specifications described here-under, with other relevant provisions of Tender Document and WAPDA/other utilities' latest Specifications/Standards. Electrical & Communication systems shall broadly include but not limited to the following:

- Design, manufacturing, supply, installation, testing and commissioning of Lighting fixtures/Luminaries
- Design, fabrication, manufacturing, supply, installation, testing and commissioning of the Low Voltage 415 Volt three phase and 250 Volt single phase switchgears.
- Supply, installation, testing and commissioning of the Low Voltage Single / Multi core PVC/PVC & PVC/SWA/PVC Copper conductor cables in Cable trenches, underground pipes, on cable trays.
- Design, fabrication, manufacturing, supply, installation, testing and commissioning of the 415 Volt 50Hz Diesel Generator sets
- Design, fabrication, manufacturing, supply, installation, testing and commissioning of the Type 11/0.415 kV 50 Hz Indoor/ Outdoor Transformers
- Supply, installation, testing and commissioning of the Earthing of Electrical system.

The scope shall include the continuing of the contractor to remain responsible for removal of defects detected in the works and for achieving satisfactory operation/functioning/service of the works during defect liability period.

The contract shall include furnishing of all construction equipment, tools, labour, supervisory staff, plants, transport, power, testing apparatus/arrangements and all construction materials as shall be required for satisfactory completion of works strictly in accordance with the Technical Specifications and Bill of Quantities forming part of these Tender Documents and as per levels and dimensions as shown on the drawings supplied with these tender documents and in drawings which may be supplied by the Employer from time to time under approved variation orders.

The Contractor shall also be responsible to supply any other equipment not specifically mentioned in these Documents but which is necessary for proper operation of the works/ system included in the scope of this Contract. The Contractor shall solely be responsible for ensuring proper functional requirements of various equipments. He shall also be responsible

for furnishing any additional piece of equipment and for making modification in the equipment as desired and/or approved by the Engineer to achieve proper co-ordination with various other equipment's offered in the bid and also with those installed by others.

4.2 RULES & REGULATIONS

The entire Electrical & Communication systems installation/work shall be carried out by licensed Contractor, authorized to undertake such work under the provisions of the Electricity Act 1910 and The Electricity Rules 1937 as adopted and modified up to date by the Government of Pakistan. All works shall be carried out in accordance with the latest edition of the Regulations of the Electrical Equipment of Buildings issued by the Institute of Electrical Engineers-London, 16th edition, NEC 1999, the Contract Documents, the Electricity Rules 1937 and bye-laws that are in force from time to time. Any discrepancy between these specifications and the standards/ regulations shall be brought to the notice of Engineer for his instructions and decision of the Engineer shall be final and conclusive. The Contractor shall be responsible for completing all formalities and submitting the test certificates as per prevailing rules and regulations, and shall have the installation passed by the Government Electric Inspector of that region. All requirements of the Electric Inspector and the utility company WAPDA shall be complied with.

4.3 AMBIENT CONDITIONS

All material and equipment supplied and installed shall be designed, manufactured and tested to meet the following ambient conditions unless specifically stated otherwise for any material/equipment.

Minimum indoor ambient temperature:	Zero Degree Celsius
Maximum indoor ambient temperature:	+35 Degree Celsius
Minimum outdoor ambient temperature:	Zero Degree Celsius
Maximum outdoor ambient temperature:	+45 Degree Celsius
Maximum Relative Humidity:	70 Percent
Minimum Relative Humidity:	40 Percent

The atmospheric conditions are tropical and arid.

4.4 MARKINGS

The Contractor shall provide "Danger Boards" and "Shock Charts", wherever required, to comply with the requirements of local Electricity Rules and according to normal practice.

4.5 SYSTEM DATA

Unless otherwise specified elsewhere, all equipment and material shall be designed to operate satisfactorily with the following minimum requirements with the specified tolerance without any derating.



a.	Voltage rating of equipments	MV15000V Three phase \pm 10%
b.	Voltage rating of equipments LT & DG Sets	500V Three phase \pm 10% 250V Single phase \pm 10%
c.	DC voltages	24V DC \pm 10% 12V DC & Others
d.	Frequency	50 HZ \pm 2 HZ

4.6 STANDARDS

The latest standards and codes of reputable organizations shall be applicable for the material and equipment specified herein and for installation work. Such organizations shall be British Standard Institution (BSS), International Electro technical Commission (IEC), IEEE and NEC. In case the Specifications laid down herein differ from those given in the standards, then the better specifications shall govern. Wherever applicable, the equipment shall also conform to the requirements of Pakistan Standards Institute (PSI) and Pakistan Telecom Authority (PTA).

4.7 MATERIALS & WORKMANSHIP

All materials, equipment, accessories, fixtures and fittings, under the scope of this Contract, shall be brand new and in accordance with the Tender Specifications and the specifications of the British Standards Institute and Pakistan Standards Institute. Samples and detailed manufacturers shop drawings (including dimensional plans, elevation, sections, line and wiring diagrams, foundation details, component characteristics and data etc.), shall be approved by the Engineer before purchase or fabrication. The Engineer shall witness routine tests at the manufacturer's work sites and a test certificate shall be provided to him. Three copies of the test certificates at the manufacturer's works shall be supplied. All workmanship shall be first class and undertaken by workman skilled in the particular type of craft.

4.8 DEVIATIONS

The entire design of the Electrical systems of the project has been carried out to fulfill the Users requirements. The design is based on International standards/norms and practices. Special considerations have been made for ease in operation and maintenance of electrical systems of the project. Deviation may be allowed for the works covered under present scope of work, with the approval of Engineer/Client

4.9 EQUIPMENT AND MATERIALS

The equipment/materials of the Electrical systems of the tender have been designed using the latest editions of International Standards/Codes such as BS, ICE, NFPA, CP as mentioned in article 6.0 above. In these Specifications certain types/makes of equipments/ materials have been specified for the purpose of general reference and guidance of the Bidder. However, names of certain manufacturers/suppliers of electrical equipments/materials have been recommended for this project.



The names and addresses of these recommended manufacturers/suppliers are given in Annexure "A" of the tender documents. The Contractor is bound to supply and install the required equipments/ materials only from the recommended manufacturers/ suppliers.

In case, if at a later stage in project, the contractor wishes to substitute the specified equipment or materials, he shall furnish complete details of equipment/substitute to materials.

The equipment/substitute equipments/materials will only be considered by the Engineer if he is satisfied that the equipment/substitute material have technically equivalent/better specifications. In case if the Engineer feels that the equivalent/substitute materials are of less cost compared to the specified materials then the contractor shall give comparative discount in the contract value of the BOQ items.

In case the cost of equivalent/substitute item is more the than the cost of BOQ item then no cost adjustment shall be made in the relevant BOQ item. Once the equivalent/substitute materials are recommended for approval by the Engineer the same shall be forwarded to the Employer/Client for their approval. The equivalent/substitute materials shall only be accepted after the Client's final approval.

All materials and equipments being provided by the Contractor & the Sub-contractor shall be interchangeable to the maximum extent with respect to makes, types, model etc.

4.10 DRAWINGS, AND DATA TO BE FURNISHED BY THE CONTRACTOR

4.10.1 Submittal

The contractor, after the award of work, shall submit for approval of the Engineer all drawings and cuts of equipment, appliances, fixtures and accessories that are to be furnished under the contract. After final approval, a sufficient number of copies as desired shall be furnished for distribution. Manuals, cuts, catalogues and drawings shall be clearly marked to indicate, the items furnished. Cuts of all fixtures, and not a few, shall be submitted.

4.10.2 Approval of Drawings and Data

The Contractor shall provide detailed electrical drawings, wiring diagrams, foundation details etc. for all electrical and other systems etc. for the Engineer's review and approval.

The manufacturing of electrical equipment shall be started only after the above-mentioned drawings and data are approved.

The time required for review and approval shall be considered included in the total time of completion of job.

Three sets of drawings and data for each equipment shall be furnished by the Contractor for the Engineer's approval before commencement of fabrication and manufacturing. The drawings to be supplied by the Contractor shall be as follows:

- Arrangements
- Dimensional plans, elevations and front view
- Foundation plan, anchors and configuration
- Incoming and outgoing cable termination positions
- Earthing arrangement
- Electrical Drawings showing:
 - Single-Line diagram
 - Detailed wiring diagram
 - All interconnections
 - Other electrical devices including meters, instruments and their wiring diagram.
 - Signal and alarm circuit

4.10.3 Shop Drawings

The locations, routing and installation heights of the equipment etc. which are given on the tender drawings, are approximate. These drawings depict only the position of various fixtures and outlets. All the detailed planning for electrical and communication systems including conduit routes etc. shall be carried out well in advance of the actual execution of work, by the Contractor to the satisfaction of the Engineer. For this purpose, the Contractor shall prepare shop drawings and obtain prior approval of the Engineer. Three prints of each shop drawings shall be submitted for obtaining approval. No piece of work shall be allowed to be executed at site without the availability of these approved shop drawings. These shop drawings shall clearly depict the load balancing chart of each distribution board. Time required for the preparation and approval of shop drawings shall be considered to have been included in the total time allowed for the completion of the work.

4.10.4 As-Built Drawings

Clearly annotated "As-Built" electrical drawings and diagrams shall be maintained up to date on site on completion of the Job. One reproducible and three prints of each drawing shall be submitted to the Engineer along with a recommended maintenance schedule chart and manuals/operating instructions for equipment supplied. The Contractor shall also provide complete detailed identifications of MV incoming and LV outgoing circuits, in the form of line drawings, for each pad mounted transformer. The line drawings shall be made on 20 SWG sheet metal work. The line drawings shall be clearly identified with permanent colors. The MV and LV circuits shall have different colors. The sheet metal work shall be of suitable dimensions so as to be fixed on the inside of the door of the LV compartment of the pad mounted transformers. The line drawing shall be fixed with the help of rivets for permanent installation.

4.11 PRODUCT DELIVERY, STORAGE AND HANDLING

All equipment shall be boxed, crated or otherwise enclosed and protected during shipment, handling, storage and after installation until final acceptance of the equipment. Electrical materials shall be delivered in manufacturer's original cartons or containers with seals intact,



as applicable. Large multi-component assemblies shall be delivered in sections that facilitate field handling and installation.

Unless designed for outdoor use, all equipment shall be kept dry, off the ground and covered from exposure to weather. Electrical equipment and equipment having anti-friction or sleeve bearings shall be stored in weather tight storage facilities. Heaters in equipment shall be connected and operated until the equipment is placed in operation. The Contractor shall prevent corrosion, contamination or deterioration of stored equipment.

Equipment and materials shall be handled in accordance with manufacturer's recommendations. Large or heavy items shall only be lifted from the designated points. Padded slings and hooks shall be used for lifting to prevent damage.

All equipment shall be protected until final acceptance and all factory surfaces must be protected from impact, abrasion, discolouration and other damage. All damaged equipment must be repaired or replaced before final acceptance.

4.12 MANUFACTURER'S INSTRUCTIONS

The Contractor shall supply to the Engineer Three (3) copies of manufacturer's instruction manuals in properly bound form for installation, testing, commissioning, operation and maintenance of the specified equipment including manuals of spare parts and tools of the equipment. One copy of the documents shall be submitted in original. The installation instructions shall be submitted four (4) weeks prior to commencement of installation of each equipment and operation & maintenance instructions at least two (2) weeks before the time of commissioning. If the contractor fails to provide the documents, the Engineer shall withhold issuance of requisite certificates and deduct suitable amount from the payments to the Contractor.

4.13 GUARANTEE

In addition to the Contractor's guarantee and liabilities for satisfactory operation of the works, wherever advised by Engineer, the Contractor shall also furnish written guarantee of the manufacturer or supplier with respect to satisfactory performance of each equipment. Guarantee shall be given for replacement and repair of part or whole of the equipment that may be found defective in material or workmanship. The guarantee shall as a minimum cover the duration of Maintenance Period as defined in the Conditions of Contract. This guarantee shall not relieve the Contractor of his obligations and he will be fully responsible for the repair or replacement of any defective material in time, so as not to cause any undue delay in carrying out the repairs and/or replacements.

4.14 INSTALLATION INSTRUCTIONS

The Contractor shall furnish all labor, materials, tools and equipment required to install, connect, test and commission all electrical equipment specified herein, whether or not such equipment is furnished by him or by others.

For all equipment to be installed by the Contractor, the Contractor shall supply and install all erection materials such as foundation bolts, washers, nuts etc. as required and without any additional costs.

The Contractor shall set out the works himself as per Specifications and Drawings and shall properly position the equipment on specified foundation/location. In general, the manufacturer's instructions for installation shall be followed.

Any defect or faulty operation of equipment due to the Contractor not following the manufacturer's instructions shall be corrected and repaired by the Contractor at his own cost as per these specifications and to the satisfaction of Engineer.

For any deviation from the working drawings that are deemed necessary by the Contractor due to site conditions, he shall submit the details and obtain the Engineer's approval before starting such works.

4.15 PRESHIPMENT INSPECTION AND TESTING

4.15.1 General

Equipments and materials covered in the scope of this contract are subject to pre-shipment inspection & testing at the manufacturer's factory/works. The Contractor, in coordination with the manufacturers of relevant materials shall arrange for the pre-shipment inspection & testing by the Engineer or his authorized Representative at the manufacturer's factory/works. The Contractor shall make all necessary arrangements and cater for all expenses in this regard for the traveling, boarding and lodging of the Engineer or his authorized Representative plus daily allowance @ Rs. 2,000 per day per person within Pakistan and US \$ 200 per day per person outside Pakistan for the pre-shipment inspection and to witness the tests at the manufacturer's factory/works.

4.15.2 Pre-shipment Factory Tests

i. MV & LV Switchgear, Generators, Transformers, Maintenance-Bypass Switch & Communication Systems Equipment

All type and routine tests on all equipment, materials and switchgear shall be performed at the manufacturer's works in the presence of the Engineer or his Representative. Type tests may be waived off in case test certificates, certified by an approved standard laboratory of international repute, approved by the Engineer, are submitted. But merely producing the type test certificates shall not relieve the Contractor and the manufacturer to carry out the required tests.

The Contractor shall obtain from the manufacturer and submit to the Engineer for approval, the complete details of tests to be performed describing the procedures, test observations and expected results.



The Contractor shall ensure availability of all tools, instruments, test equipments, materials, etc., and all qualified personnel required for the testing, setting and adjustment of all equipments and materials including putting the same into operation.

All tests shall be made with proper regard for the protection of the personnel and equipment and the Contractor shall be responsible for adequate protection of all personnel and equipment during such tests. The cost of any damages or rectification work due to any accident during the tests shall be the sole responsibility of Contractor.

The Contractor shall record all test values of the tests made by him on all equipment. Four (4) copies of all test data and results certified by the Engineer shall be given to the Engineer for record purposes. These shall also include details of testing method, testing equipment, diagrams etc.

The Contractor shall inform the Engineer about the place, date and time of test of each equipment at least, two (2) weeks in advance. The witnessing of test by the Engineer or his representative shall not absolve the Contractor from his responsibility for the proper functioning of the equipment, and for furnishing the guarantees referred to in Clause 8.0. All test results shall be supplied in quadruplicate.

ii. Insulation Resistance Test

Insulation resistance test shall be made on all electrical equipment by using a meggar of 500 volts for circuits up to 250 volts and meggar of 1000 volt for circuits between 250 and 500 volts. The Engineer shall advise the exact testing voltages. The insulation resistance values of cables, switchgear etc. shall be as per BSS, IEC, ICEA and Pakistan Electricity Rules.

4.15.3 Field Tests

i. General

Upon completion of the installation, the Contractor shall perform field tests on all equipment, materials and systems. All tests shall be conducted in the presence of the Engineer for the purpose of demonstrating equipment and system's compliance with Specifications. The Contractor shall submit for Engineer's approval complete details of tests to be performed describing the procedure test observations and expected results.

The Contractor shall furnish all tools, instruments, test equipment, materials etc. and all qualified personnel required for the testing, setting and adjustment of all electrical equipment and material including putting the same into operation.



All tests shall be made with proper regard for the protection of the personnel and equipment and the Contractor shall be responsible for adequate protection of all personnel and equipment during such tests. The cost of any damages or rectification work due to any accident during the tests shall be the sole responsibility of the Contractor.

The Contractor shall record all test values of the tests made by him on all equipment. Four (4) copies of all test data and results certified by the Engineer shall be given to the Engineer for record purposes. These shall also include details of testing method, testing equipment diagrams etc.

The witnessing of any tests by the Engineer does not relieve the Contractor of his guarantees for materials, equipment and workmanship or as any other obligations of contract.

ii. Insulation Resistance Test

Before making connections at the ends of each cable run or joint between cables, the insulation resistance test of each cable section shall be made. Each conductor of a multicore cable shall be tested individually with each of the other conductor of the group and also with earth. If insulation resistance test readings are found to be less than the specified minimum in any conductor, the entire cable shall be replaced and tests repeated on new cable. If cable joint is provided, then each cable section shall be tested and joint made only after the tests have been made satisfactorily. Finally, the completed cable length including the joints shall be tested.

All switchgear shall be given an insulation resistance test after installation, but before any wiring is connected. Insulation tests shall be made between open contacts of circuit breakers, switches and between each phase and earth.

If the insulation resistance of the circuit under test is less than the specified value, the cause of the low reading shall be determined and removed. Corrective measures shall include dry out procedure by means of heaters, if equipment is found to contain moisture. Where corrective measures are carried out, the insulation resistance readings shall be taken after the correction has been made and repeated twice at 12 hours interval. The maximum range for each reading in the three successive tests shall not exceed 20% of the average value. After all tests have been made, the equipment shall be reconnected as required.

iii. Earth Resistance Test

The Contractor shall make Earth resistance tests on the earthing system, separating and reconnecting each earth connection.



If it is indicated that soil treatment or other corrective measures are required to lower the ground resistance values, the Engineer will determine the extent of such corrective measures.

The electrical resistance of the ECC together with the resistance of the earthing leads measured from the connection with earth electrode to any other position in the complete installation shall not exceed one ohm.

Earth resistance test shall be performed as per Electrical Inspector's requirements. Where more than one earth electrodes are installed, the earth resistance test of each electrode shall be measured.

The complete lightning protection system shall be tested for continuity and earth resistance. The combined earth resistance at any point in the lightning protection system shall not exceed ten (10) ohms.

4.15.4 Completed Tests

After any equipment has been tested, checked for operation, etc., and is accepted by the Engineer, the Contractor shall be responsible for the proper protection of that equipment so that subsequent testing of other equipment does not cause any damage to the already tested equipment.

4.16 ASSOCIATED CIVIL WORKS

The cost of all civil works which are associated with any BOQ item are deemed to have been included in the respective items of Bill of Quantities unless specifically stated otherwise. The civil works shall include excavation, backfilling of earth, compaction of the earth, foundation pads, grouting, chiselling, making openings etc. Such works will also include repair of any damage to civil works caused by the Contractor during electrical installation.

4.17 EXPENSES TO BE BORNE BY THE CONTRACTOR

All expenses regarding travelling, boarding, lodging and witnessing of tests by the Engineer or his representative and/or the owner or his representative including costs for carrying out the required tests shall be borne by the Contractor and are deemed to have been included in the Tender Bid.

4.18 TEST CERTIFICATES TO BE FURNISHED BY THE CONTRACTOR

After all field tests have been carried at site, the Contractor shall furnish test certificates for the following equipments and materials as supplied and installed by the contractor;

- Lighting fixtures
- MV & LV Switch Boards & Distribution Boards
- MV & LV Power cables

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- Diesel Generator Sets
- Power Transformer (11/0.415kV)
- Earthing system

4.19 PAYMENT

No separate payment shall be made for work involved within the scope of this section, unless specifically mentioned in the respective items of Bill of Quantities.

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5 POLES FOR ROAD LIGHTING

5.1 SCOPE OF WORK

The work under this section consists of designing, manufacturing, supplying, installation testing and commissioning of the street lighting poles and accessories as specified herein, or as shown on the Tender Drawings and given in the Bill of Quantities.

The Contractor shall discuss the electrical layout with the Engineer and coordinate at site with other services for exact location and position of the electrical poles.

The poles with accessories shall also comply with the General Specifications for Electrical Works Section-8001 and with other relevant provisions of the Tender Documents.

5.2 APPLICABLE STANDARDS/CODES

The latest editions of the following standards/codes shall be applicable to the material specified within the scope of this Section:

ASTM A36	-	Steel for Pole and Base Plate
ASTM A307	-	Anchor Bolts
BS EN ISO 1461	-	Galvanization
ASTM A123 & A385	-	Galvanization

5.3 CONSTRUCTION OF POLES

The galvanized steel poles shall be of mild steel as shown on drawing from base plate to lantern connection, well proportioned and neatly finished. The height of the pole from the centre line of the spigot for lantern connection to the ground line and out-reach of each arm from the vertical centre line of the pole to the tip of the spigot for lantern attachment shall be as shown on Drawing. Approval of the Engineer shall be obtained before ordering the poles for manufacturing.

The pole (vertical portion) along with base plate shall preferably be in one piece. But if manufacturing in one length is not possible, it can be in two or three pieces with force fit lap joint.

The steel poles after fabrication shall be galvanized by hot dip process (inside and outside) as per applicable standards -Hot Dip Galvanized Coatings on Iron and Steel Articles'. The poles shall be prepared before galvanizing by removing grease, burs and slag etc. so that zinc coating is adherent, dense, smooth, continuous and uniform. The Contractor shall ensure before placing of order that the firm has adequate facility for hot dip galvanizing process as per standard practice. The steel used in the manufacture of poles shall be made by open hearth or electric furnace process.



The straight portion of the pole shall be truly vertical and no deviation more than 100 mm in the entire length shall be accepted.

Other tolerances shall be as follows:

- Outside diameter = +/- 1%
- Wall thickness = +/- 10%
- Overall length of pole = +/- 0.5%
- Weight = - 0.3% + not limited.

The pole and the bracket shall be so designed that when subjected to wind at a velocity of 160 km/hour on the full projected area of pole, bracket and the lantern a factor of safety of 3 on minimum tensile strength of the material shall be obtained. In addition, the temporary horizontal deflections at the lantern position shall not exceed 1/40 of the length of the pole above ground at aforementioned wind velocity.

The poles shall have a base compartment, designed to accommodate a loop-in services cut out for 4 core PVC/SWA/PVC cables of given sizes. A 8 mm stainless steel stud complete with nut and washers shall be provided in the base compartment of the pole for earthing purpose.

The edges of the door opening on the pole shall be reinforced with a 10 mm thick M.S. square bar to reinstate the strength of pole at this location. The opening cover shall consist of weather proof hinged door. The door shall be provided with a heavy duty non-rusting lock.

Flag brackets shall be fitted to poles if shown on the drawing and shall be as approved by the Engineer.

5.4 INSTALLATION

Lighting poles shall be handled/transported and erected in such a way so as to avoid any damages. Any damage to pole or galvanizing shall be made good to the satisfaction of the Engineer.

The lighting poles shall be stored clear of soil, ground water or other rust producing materials. The fixing of poles shall be carried out in accordance with manufacturer's instructions and good engineering practice.

The poles shall be erected in a true vertical position.

Where lighting poles are to be installed in the vicinity of overhead power lines, the Contractor shall inform the Engineer and act as directed. He shall maintain clearances as per WAPDA requirements from the power lines.



The Contractor shall number all the poles with high quality paint using stencil for 50 mm high lettering. The numbering shall be at 1200 mm from the bottom of pole towards the road. The numbering shall be in a manner as directed by the Engineer.

Earth backfill around pole foundation shall be done in 150 mm thick layers and shall be well ramed and compacted to provide full lateral support.

5.4.1 Data to be submitted

Before manufacturing, the Contractor shall submit for approval of the Engineer, the shop drawing of the pole anchor bolts, base plate and pole bracket together with details of the base compartment, cover and the means adopted for making it waterproof and tamperproof. Design calculation sheets for the poles from manufacturer shall also be submitted by the contractor to show that poles/foundations are safe for all specified stresses.

5.5 TESTS

5.5.1 General

The poles shall be tested and the results recorded for each test by the manufacturer in the presence of an authorized representative of the Owner or Engineer as stated below.

5.5.2 Inspection

Prior to inspection, checklist shall be submitted pertaining to fabrication of each pole lot duly filled in by the manufacturer.

The material, weight and dimensions of poles as specified shall be certified by the manufacturer. The poles shall be inspected and in case being found below the limits of tolerance as aforementioned, shall be rejected.

5.5.3 Sample Test

Sample of poles shall be selected at random basis from each lot of high masts and poles and shall be checked in accordance with the project specific requirements, BoQ, relevant construction drawings and applicable manufacturing standards. Factory routine test certificates shall be submitted by the manufacturer for each type of high masts/poles.

5.5.4 Galvanizing

Weight, uniformity of coating and other requirements shall be strictly inspected in accordance with applicable standards.

5.5.5 Service Cutouts

Each pole shall be provided with a waterproof and dust tight loop-in-service cutout accommodated in the base compartment of the pole.

The junction box shall comprise two (2) 2A MCB, for double arm poles and one (1) 2A MCB in accordance with IEC 60947 for single arm poles, a solid neutral link and an earthing terminal. It shall incorporate arrangements for looping "IN" and "OUT" for 4 core up to 25 mm² PVC/SWA/PVC cable having copper/aluminium conductor. The earth terminals, nuts and washers shall be adequately sized to take the earth continuity conductors with tight connections.

Dimensional drawings and details of the junction cutout box of pole shall be submitted for approval to the Engineer.

5.6 MEASUREMENT AND PAYMENT

5.6.1 Measurement

Measurement shall be made for the number of poles including all accessories and foundation block acceptably supplied and installed by the Contractor as shown on the drawing.

5.6.2 Payment

Payment shall be made for the number of units measured, as provided above, at the contract unit price each, and shall constitute full compensation for supplying, installing, connecting, testing and commissioning of each pole including junction cutout box.

The galvanized steel poles shall be of mild steel as shown on drawing from base plate to lantern connection, well proportioned and neatly finished. The height of the pole from the centre line of the spigot for lantern connection to the ground line and out-reach of each arm from the vertical centre line of the pole to the tip of the spigot for lantern attachment shall be as shown on Drawing. Approval of the Engineer shall be obtained before ordering the poles for manufacturing.

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6 LED LIGHTS

6.1 SCOPE OF WORK

The work under this section consists of manufacturing, fabricating, supplying, installing, earthing, testing and commissioning of all material with accessories and services for the complete LED fixtures as specified herein and as shown on the drawings and given 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 locations and positions of the LED fixtures.

The light fixtures with accessories shall also comply with the General Specifications as applicable for Electrical & Communications Works section- 8001 and with other relevant provisions of the Documents.

6.1.1 Type of Light Fixtures

A. Down Lighters

LED based fixture should be suitable for all indoor applications with different mounting provision of recessed & surface.

Luminaire should have color temperature options (3000K, 4000K, 6500K).

Color rendering index should be equal to or greater than 80 with different wattages 15W +/- 3W. Luminaire should have efficacy of more than 90lm/w with a lifetime span of 30000 hours @L70 +/- 5,000 hours and with a power factor not less than 0.85. Overall luminaire system efficiency should be more than 80%. Earthing provision should be given inside the luminaire with the ingress protection of at least IP20. Standard Deviation of Color Matching (SDCM) shall be less than 5. System efficiency shall be more than 85% and Light output ratio LOR shall not be less than 90%. Luminaire should comply with IEC standards (60598, 62471), EMC test reports and third party certifications and relevant applicable standards

B. Batten Lights

LED Batten light should be suitable for all indoor applications with mounting provision of surface. Luminaire should have color temperature options (3000K, 4000K, 6500K). Color rendering index should be equal to or greater than 80 with different wattages from 8 to 32W. Luminaire should have efficacy of more than 85lm/w with a lifetime span of 30000 hours @L70 +/- 5,000 hours and with a power factor not less than 0.85. Overall luminaire system efficiency should be more than 80%. Luminaire should comply with IEC standards (60598, 62471), EMC test reports and third party certifications and relevant applicable

standards. Earthing provision should be given inside the luminaire with the ingress protection of at least IP20

C. Bulk Head

LED Bulk Head light should be suitable for all indoor/outdoor applications with mounting provision of surface. Luminaire should have color temperature options (3000K, 4000K, 6500K). Color rendering index should be equal to or greater than 80 with wattages from 18W to 25W. Luminaire should have efficacy of more than 90lm/w with a lifetime span of 30000 hours @L70 +/- 5,000 hours and with a power factor not less than 0.85. Overall luminaire system efficiency should be more than 80%. Luminaire should comply with IEC standards (60598, 62471), EMC test reports and third party certifications and relevant applicable standards. Earthing provision should be given inside the luminaire with the ingress protection of at least IP20 for indoor and IP 65 for outdoor installations with IK 10.

D. In Ground Recessed Lights

LED Inground recessed lights shall be suitable for uplight effect applications with mounting provision of recessed type. The lifetime shall be within the range of 30,000 hours @L70 +/- 5,000 hours with an efficacy of more than 55 lm/w. Color rendering index shall be more than 80. Standard. Fixture power factor shall not be less than 0.80.

Fixture shall have different color temperature options ranging from 3000K to 5000K as per application requirements. System efficiency shall be more than 85% and Light output ratio LOR shall not be less than 90%. The fixture shall have ingress protection (IP) of at least 67 and Impact Resistance (IK) 09 or above. It shall comply with EN 60598 and any other international standards as applicable.

E. Post top Lights

LED Post top lights shall be suitable for mounting on poles of height (3m-5m) for area lighting. The lifetime shall be within the range of 30,000 hours +/- 5000 hours with an efficacy of more than 90 lm/w. Color rendering index shall be more than 70. Standard. Fixture power factor shall not be less than 0.80.

Fixture shall have different color temperature options ranging from 3000K to 5000K as per application requirements. System efficiency shall be more than 85% and Light output ratio LOR shall not be less than 90%. The fixture shall have ingress protection (IP) of at least 66 and Impact Resistance (IK) 09 or above. It shall comply with EN 60598 and any other international standards as applicable.

F. Bollard Lights

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LED Bollard lights shall be suitable for area lighting with height of 0.5-0.8m. The lifetime shall be at least 25,000 hours. Color rendering index shall be more than 80. Standard Fixture power factor shall not be less than 0.90.

Fixture shall have different color temperature options ranging from 3000K to 4000K as per application requirements. System efficiency shall be more than 70%. The fixture shall have ingress protection (IP) of IP-65 and Impact Resistance (IK) 08 or above. It shall comply with EN 60598 and any other international standards as applicable.

6.1.2 Optics

The fixtures for interior lighting shall have flexible optical systems for the wattage range in the respective group.

The fixture shall use high efficiency LED and optics system.

The Light Output Ratio (LOR) shall not be less than 90%.

The fixture shall offer a composite system efficiency not less than 85 lumen/Watt or as specified in the relevant fixtures.

The multilayer optics design shall ensure adequate luminance and illuminance uniformity in the unlikely event of an individual LED failure.

The fixture shall offer choice of different beam light distribution.

The optical lens system shall feature long life with no discoloration (UV protection), highest possible light transmission and white painted circuit board for high reflectivity for maximum light output.

6.1.3 Warranty/Maintenance

The LED manufacturer /authorized agent/assembler shall not only be responsible for 5 years of warranty but also during the warranty period maintenance of the fixtures including free of cost replacements of any/all defective components/parts against manufacturing defects with the genuine products/components through the manufacturer/authorized agents under the supervision of the contractor/ maintenance agency.

The involvement of the manufacturer/authorized agent for maintenance/replacement of components is considered important because the warranty of the manufacturer becomes void if genuine product/manufacture recommended methodology/components installation is not followed. In addition to this it is also necessary that genuine branded products those offered at

the time of supply with the fixtures are provided for the 5 years of warranty / component replacement period.

Undertaking in this regard shall be submitted by the contractor as well as manufacturer/authorized agent/assembler to the Client.

Further, if required, the manufacturer/authorized agent/assembler through contractor shall provide the proof of genuineness from the manufacturer for various components provided/installed in the fixtures after fulfilling the technical requirements

6.1.4 LED Driver/Electronic Control Gear for LED Modules

The LED driver shall be designed to operate luminaries LED with current controlled output through Class I electrical classification. The driver shall be suitable for nominal 230V, +10%, -15%, 50Hz mains supply. The LED driver shall have an efficiency of at least 85%. The relevant test report, as applicable shall be submitted by the manufacturer.

6.1.5 LED Chip

The LED chip shall be Philips Lumiled, Cree, Nichia, Osram, Samsung, LG make or equivalent in performance. (duly tested as specified and in full conformance to the technical requirements/specifications) as specified.

The LEDs shall:

- be designed for lumen maintenance of L_{70} or 70% at the end of useful life at ambient temperature of 35 deg C.
- have a useful life of (25000-35000 as specified for relevant fixture) burning hours.(± 5000 hrs)
- have a color rendering index (Ra) of 80 (+10/-10)and a color temperature 2700K-6500K.as per application requirements
- have a color consistency within 5 SDCM (standard deviation of color matching) as defined by MacAdam.
- LM 80 Report with TM21 extrapolation graph must be attached.

6.1.6 Thermal Management

Managing thermal properties in LED fixtures is most critical to ensure optimum performance of LEDs and reliability of the system.

The housing under the circuit board shall be specially designed to ensure perfect contact between the board and the fixture housing for efficient heat dissipation.

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PCBs shall be used to maximize heat transfer process and to offer reinforced electrical insulation via dielectric layer. The PCB shall be mounted on the housing using a highly efficient thermal interface material. Use of Silicon glue is not acceptable.

The housing over the driver chamber shall have ribs or any other mechanism with adequate surface area to ensure fast heat dissipation.

6.1.7 Photometrics

Fixtures shall have Illumination Engineering Society (IES) files of different distribution patterns.

LM-80 LED and photometric test reports and IES files from a third party testing laboratory shall be available.

6.1.8 Technical Data and Drawings

Technical and descriptive data and drawings to be submitted shall include but not be limited to the following:

- i) Technical data of fixtures and driver
- ii) IES photometric file
- iii) Customer testimonials
- iv) Factory ISO certificate
- v) Reports of other type tests stipulated in the respective standards/codes, if any applicable

6.2 INSTALLATION

The installation of LED light fixtures shall be in strict accordance with the manufacturer's instructions/recommendations and these specifications.

6.3 MEASUREMENT AND PAYMENT

- i) General



The Contractor's bid amount against each bill of quantities item as given shall include supply, installation, testing, commissioning and completion of all work specified herein and/or shown on the Drawings related to the LED light fixture.

ii) Measurement

Measurement shall be made as complete job for all related equipment such as power supply, driver etc. along with all accessories acceptably supplied and installed by the Contractor as a complete unit.

iii) Payment

Payment shall be made for the number of units measured, as provided alone, at the contract unit price and shall constitute full compensation for supplying installing, testing and commissioning along with all accessories.

6.4 LED PANEL LIGHT:

6.4.1 Product:

LED Panel light fixture (30 watts- 40 watts) recessed/suspended/surface mounted

6.4.2 Specifications:

The LED light fixture (Panel type) should be recessed/suspended/surface mounted and have capability deliver energy efficiency without sacrificing light quality in general lighting applications.

The system efficacy of the light fixture should at least 90 lm/W.

Luminaire must provide minimum 50% energy-saving compared with conventional Fluorescent light fixture. The system lumens output of the light fixture should not be less than 3500 lumens.

The Color Rendering Index of the fixture should be greater than >80 and SDCM of the light fixture <=5. The color temperature of the light fixture should be more than 5000K

The ambient temp for the light fixture is - 2°C < Ta < 40°C.

6.4.3 Housing:

The housing will include integrated heat sink and optical system. The housing will be made of Plastic frame in white color, & the heat sink will make of aluminium for better heat transfer.

The light cover made up of PCPS diffuser + PMMA light guide panel + PET reflector.



6.4.4 Luminaire Optics:

For the better UGR control one, the luminaire optics should fully comply with office lighting norms with UGR value (Unified Glare Rating) < 25.

6.4.5 Optical requirements:

The beam angle of the optic should be around 120°. The UGR25 version comes with a glare control ring to provide a comfortable light ambiance.

6.4.6 Mounting Type

The luminaire shall have provision of both Recessed, Suspended and surface mounting with dimension compatible to conventional florescent fixture 597 x 597 x 46mm. Suspension kit for suspended version must be available

6.4.7 Electrical requirements:

Power supply: Electronic LED gear for 220 V - 240 V/50~60Hz.

Power Factor of the light fixture >0.9

Electrical Classification Class I

6.4.8 LED:

The LED chip shall be Philips Lumiled, Cree, Nichia, Osram, make or equivalent (duly type tested as specified and in full conformance to the technical requirements/specifications).

The LEDs shall:

- Be designed for lumen maintenance of L70 or 70% at the end of useful life
- Have a useful life of 50,000 burning hours.
- Have a minimum color rendering index (Ra) of 70 (+10/-10) and a color temperature above 5000K .
- Have a color consistency within 7 SDCM (standard deviation of color matching) as defined by MacAdam.
- LM 80 Report with TM21 extrapolation graph must be attached.

6.4.9 LED Driver/Electronic Control Gear for LED Modules

The LED driver shall be designed to operate large array of high powered LEDs through current controlled output. The driver shall be suitable for 230V, +10%, -15%, 50Hz, single phase mains AC supply.

The LED driver shall have an efficiency of at least 85%.

The LED driver shall be of Harvard, TCI, Philips, VOSSLOH Schwabe Make or equivalent (duly type tested as specified and in full conformance to the technical requirements/specifications).

6.4.10 Applicable Standards and Codes

The luminaire should fully conform to the following standards (the supplier/contractors shall furnish the detailed type test reports for the luminaries being offered to establish conformance to the specified requirements) :

1. IEC 60598-1
2. IEC 60598-2-2– Electrical Insulation Class I
3. IEC62031: LED modules for general lighting – Safety specifications
4. LM-79
5. LM 80 Report with TM21 extrapolation graph must be attached.
6. IES Photometry file

All test reports and certificates must be from third party accredited laboratory.


6.4.11 LED Driver Specifications:

The LED driver shall be designed to operate luminaire LED array with current controlled output through Class I electrical classification. The driver shall be suitable for nominal 220V-240V 50/60Hz mains supply. The LED driver shall have an efficiency of at least 90%.

The LED Driver/fixture should fully conform to the following standards (the supplier/contractors shall furnish the detailed type test reports for the luminaries being offered to establish conformance to the specified requirements) :

1. EN 55015 : 2013 – Emission – Electrical lighting and similar equipment
2. EN 61547: 2009 – Immunity – Equipment for general lighting purpose
3. EN 61000-3-2 : 2009 – Limits for harmonic currents emissions.
4. EN 61000-3-3 : 2008 – Limits for voltage fluctuation and flicker.
5. IEC62471 2008 :Photo biological safety of lamps and lamps systems
6. IEC 62778
7. EN 62493 Assessment of lighting equipment related to human exposure to electromagnetic fields

All test reports and certificates must be from third party accredited laboratory.

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6.4.12 Warranties

The LED manufacturer /authorized agent/assembler shall not only be responsible for 5 years of warranty but also during the warranty period maintenance of the fixtures including free of cost replacements of any/all defective components/parts against manufacturing defects with the genuine products/components through the manufacturer/authorized agents under the supervision of the contractor/ maintenance agency.

The involvement of the manufacturer/authorized agent for maintenance/replacement of components is considered important because the warranty of the manufacturer becomes void if genuine product/manufacturer recommended methodology/components installation is not followed. In addition to this it is also necessary that genuine branded products those offered at the time of supply with the fixtures are provided for the 5 years of warranty / component replacement period.

Undertaking in this regard shall be submitted by the contractor as well as manufacturer/authorized agent/assembler to the Client.

Further, if required, the manufacturer/authorized agent/assembler through contractor shall provide the proof of genuineness from the manufacturer for various components provided/installed in the fixtures after fulfilling the technical requirements.

6.4.13 Technical and Descriptive Data and Drawings

Technical and descriptive data and drawings to be submitted shall include but not be limited to the following:

- Technical data of fixtures and driver
- IES photometric file
- All detailed type test reports to establish conformance to specified international codes and standards as stipulated above.
- LM-80 test report of LED used
- 3rd Party IEC 60598 test reports specific to the fixtures being offered..
- EMC test report
- Photo- biological safety test report
- Customer testimonials
- Factory ISO certificate
- Reports of other type tests stipulated in the respective standards/codes

6.4.14 International Independent Laboratories

For the specified requirements of type tests and type test reports by an independent authority/independent laboratory (specific to their status/approval for performance of specific



test(s) on the fixtures as defined in the project), the following laboratories shall be considered as independent laboratories:

- KEMA Labs, Holland.
- CESI Labs, Italy.
- CRIEPI Labs, Japan.
- Any other laboratory accredited by EA (European Co-Operation for Accreditation) or a member thereof.
- Any other laboratory accredited by ILAC (International Laboratory Accreditation Cooperation) or a member thereof.
- Any other laboratory accredited by IAF (International Accreditation Forum) or a member thereof.

Any other laboratory accredited by STL (Short-Circuit Testing Liaison) or a member thereof.

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7 CONDUITS AND PIPES

7.1 GENERAL

The work under this section consists of supplying, installing, and commissioning of all material and services of the complete conduits and pipes as specified herein, shown on the Tender Drawings and stated in the Bill of Quantities.

The Contractor shall discuss the layout with the Engineer and co-ordinate at Site with other services for exact route, location and position of the conduits and pipes for electrical lines.

The conduits and pipes with accessories shall also comply with the General Specifications for Electrical Works Section-1 and with other relevant provisions of the Tender Document.

The extent of work shown on the Drawings does not indicate the exact position of conduits and pipes. The Contractor shall ensure exact location and route of conduit and pipes in coordination with other services Drawings, as per site requirements and as directed by the Engineer.

7.2 APPLICABLE STANDARD/CODES

Latest editions of the following standards/codes shall be applicable for the materials in scope of this Section:

BS 6099	-	PVC conduits and accessories
BS 3595	-	PVC pipes & accessories
BS 4346	-	Cement Solvent for jointing

7.3 MATERIAL

7.3.1 PVC Conduits and Accessories

The heavy gauge PVC conduits and accessories conforming to BS6099 shall be generally used. The PVC conduits and accessories of light gauge may be used on the project with the concurrence of the Engineer.

The PVC bends, sockets, elbows, couplings etc. shall conform to the same specifications as for the conduits. The PVC bends shall have enlarged ends to receive conduit without any reduction in the internal diameter at joint. Manufactured smooth bends shall be used where conduit changes direction. Bending of conduits by heating or otherwise will not be allowed in any situation. The use of sharp 90-degree bends and tees will not be allowed for concealed wiring.



The round PVC junction boxes for ceiling light or fan points shall have minimum dimensions of 63-mm diameter and depth. The junction boxes for wall light points shall have minimum dimensions of 63-mm diameter and 38 mm deep. Round junction boxes shall be provided with one piece PVC cover plate fixed to the box by means of brass screws.

7.3.2 PVC Pipe and Accessories

The PVC pipe shall be rigid. All pipes shall be minimum Class D (Working pressure - 12 bar), unless otherwise stated on drawings or bill of quantities. The buried PVC pipe should be able to withstand the external load acting upon it by continuous movement of heavy duty vehicles such as trucks, cranes, forklift, etc. Where pipe changes direction, manufactured smooth bends shall be used. Bending of pipes by heating or otherwise will be allowed in special cases only. Bending of pipes by heating shall be carried out by first filling the pipe with sand inside and then immediately removing the sand. The use of sharp 90-degree bends and tees will not be allowed. The bends shall conform to same specifications as given for PVC conduits. For joining of pipe all precautions and procedures recommended by manufacturer shall be followed.

7.4 INSTALLATION

7.4.1 Concealed Conduits

Where concealed conduit system is to be installed as stated on drawings, the conduit shall be installed concealed in roof, wall, column, etc. Conduits shall be laid underfloor only where specifically stated.

When concealed, the conduit shall have a minimum of 32-mm cover of concrete measured from the top of conduit to finished surface. In the reinforced cement concrete (RCC) work the conduit shall be laid before pouring of concrete. Under no circumstances shall chases be made in the RCC structure for concealing conduit and Accessories after pouring of concrete. The conduit shall be supported on top of bottom reinforcement of slab. All outlet boxes shall be firmly supported and installed such that they finish flush with the soffit of slab or beam.

Where conduits have to be concealed in cement concrete (CC) work after concreting or in block masonry work, chase shall be made with appropriate tools and shall not be made deeper than required. The conduit shall then be fixed firmly in the recess and covered with cement concrete mixture. The work of cutting in the cement concrete work or block masonry work shall be coordinated with the civil work. The Contractor shall obtain approval from the Engineer before starting chasing and cutting.

The termination of conduits shall be at or near the equipment switchboard as shown diagrammatically on the Drawings. The exact locations of the termination shall be coordinated with the equipment/switchboard to be installed. Any extension of conduit to suit the site condition shall be made without any extra cost. Conduit ends pointing upwards or downwards shall be



properly plugged in order to prevent the entry of foreign materials. All openings through which concrete may leak shall be carefully plugged and boxes shall be suitably protected against falling concrete. At all terminations of conduit, sharp edges of conduit ends shall be prevented to avoid the cutting or damaging of wire or cables during pulling through the conduits.

Under floor conduit shall be installed at a minimum depth of 2 inches from the finished floor level or as shown on the Drawings. The conduits shall be installed empty before finishing of floor or in RCC work with a 18 SWG steel wire drawn through the conduit for pulling cable. No conduits shall be laid under floor in bathroom.

The entire conduit system shall be installed and checked before wiring as carried out. Any obstruction found shall be cleared before the installation of cable. Pull boxes and adaptable boxes shall be provided in conduit runs wherever required to facilitate pulling operation. The drawings are diagrammatic and do not indicate the position and spacing of pull boxes or adaptable boxes. However, these shall meet the following requirements.

- Pull boxes

For straight runs the spacing shall not be more than 180 feet

For runs with one 90 degree bend the spacing shall not be more than 90 feet

For runs with two 90 degree bends the spacing shall not be more than 40 feet

- Adaptable boxes

For conduit up to 1-inch dia. the boxes shall be 2 inch in depth

For conduit up to 1-1/2 inch dia. the boxes shall be 2-1/2 inch in depth

For conduit up to 2-inch dia. the boxes shall be 3-1/2 inch in depth

The rectangular inspection boxes or pull boxes shall be 18 SWG heavy gauge sheet steel of suitable design to receive conduits. The box shall be painted inside and outside with black enamel paint over a base coat of red oxide primer paint. The minimum length of inspection box shall not be less than four times the cable manufacturer's recommended bending radius of the cable. All concealed type pull boxes shall have a white plastic sheet of appropriate size fixed to the box by means of galvanized screws.

Adaptable boxes shall be 18 SWG sheet steel and painted and finished to the same quality as the Lighting distribution boards.

Wherever the conduit lengths cross the expansion joint either along the columns or slab, suitable arrangement shall be provided so that when the conduit lengths in the expansion joint are stressed the conduit shall not crack or break.

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7.4.2 PVC Pipe

Rigid PVC pipes shall be installed under roads and paved areas, at crossing with other services and at cable entering building as shown on the Drawings. The depth of the pipe shall vary according to the conditions at site, and approval of Engineer shall be obtained prior to installation. In general, the pipes shall be installed underground at the following depths measured from the top of the pipe:

- | | | |
|----|--|---|
| a) | Under roads and paved surface | 800 mm below the finished surface |
| b) | When crossing other services for the crossing length | 250-mm vertical clearance
500 mm horizontal clearance with CC protective cover |

The trench of required dimensions shall be excavated and the bottom of trench cleaned and levelled. A four-inch thick bed of fine sand shall be provided over which the PVC pipes installed after proper alignment. Where two or more pipes are installed in the same trench the clearance between pipes shall not be less than two inches. After laying of pipe the trench shall be backfilled with clean-screened earth in layer of four inches. Each layer shall be properly compacted. Where underground cables enter connection terminal boxes the PVC pipe shall be installed on surface by means of PVC clamps at a maximum interval of eighteen inches. After installation, the ends of the pipe shall be plugged with material impervious to water and chemicals. All joints shall be sealed adequately to prevent entry of foreign elements. The installation of pipes shall be completed in all respects including its fixing at terminations, before cabling work is started. All sharp edges and burrs shall be removed by using reamer or any approved device. The pipe shall be thoroughly cleaned of dirt and dust from inside. The pipes shall be installed in proper co-ordination with other works.

7.5 MEASUREMENT AND PAYMENT

7.5.1 General

The Contractor's bid amount against each Bill of Quantities item as given below shall include supplying, installation and completion for all work specified herein and as shown on the Tender Drawing related to the item.

7.5.2 PVC Conduits

i. Measurement

Measurement shall be made for the number of running metres of conduits acceptably supplied and installed by the Contractor as a complete unit.



ii. Payment

Payment shall be made for the total numbers of units measured, as provided above, at the Contract unit price each. The payment shall constitute full compensation for supplying, installing and completion of the laying of the conduits including jointing materials and accessories. The complete work wherever applicable shall include cutting/chasing of civil work for concealed conduit system, excavation and backfilling of ground for underground pipes, painting, plugging, bitumen coating, etc. as applicable for each type of work.

7.5.3 PVC Pipes

i. Measurement

Measurement shall be made for the number of running metres of pipes acceptably supplied and installed by the Contractor as a complete unit.

ii. Payment

Payment shall be made for the total numbers of units measured, as provided above, at the Contract unit price each. The payment shall constitute full compensation for supplying, installing and completion of the laying of the PVC pipes including jointing materials and accessories.

8 LOW VOLTAGE CABLE

8.1 GENERAL

The work under this section consists of supplying, installing, testing and commissioning of all material and services of Low Voltage cables and the accessories as specified herein or as shown on the Tender Drawings 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.

The LV cables with accessories shall also comply with the General Specifications for Electrical Works Section-1 and with other relevant provisions of the Tender Document and latest WAPDA specifications.

All single core PVC insulated cables for the following shall be of 600/1000 volt grade copper conductor cables;

- wiring of light circuits
- switch to point wiring
- light point to light point wiring
- wiring of circuits for 5 amps, 250 volt, 2&3 pin switch socket unit
- wiring between 5 amps, 250 volt, 2&3 pin switch socket units
- wiring of push buttons & between push buttons
- wiring of light circuits controlled by push buttons
- wiring between light circuits controlled by push buttons

All single core PVC insulated power cables for the following shall be copper conductor and of 600/1000 volt grade:

- wiring of circuits for 15 amps, 250 volt, 3 pin switch socket unit
- wiring of circuits for 20 amps, 250 volt, 3 pin switch socket unit

All multicore armoured/unarmoured control cables shall be copper conductor and of 300/500 volt grade. All multicore armoured/unarmoured power cables shall be copper conductor and of 600/1000 volt grade. All multicore armoured power cables shall be copper conductor and of 600/1000 volt grade.

8.2 APPLICABLE STANDARDS/CODES

The latest editions of the following standards and codes shall be applicable for the materials within the scope of this section:

- | | | |
|-----------------------|---|--|
| BS 6004
& lighting | - | PVC insulated cables (non-armoured) for electric power |
| BS 6346 | - | PVC insulated cables for electricity supply |

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BS 6746	-	PVC insulation and sheath of electric cables
BS 6360	-	Conductors for insulated cables
IEC 60228	-	Conductors for insulated cables
BS 6500	-	Insulated flexible cords

8.3 MATERIAL

8.3.1 General

The power, lighting and control cables shall be furnished and installed in accordance with the details shown on the Drawings. The general guide lines and criteria for reference is given below:

i. Phase Identification

All cables shall have phase identification colors on insulation of each core. The colour code for three phase circuits shall be;

- Red, Yellow and Blue for phase conductors
- Black for neutral conductor
- Green for earth conductor where PVC insulated cable is installed.

Single phase circuits shall have insulation of;


- Red colour for phase/line
- Black colour for neutral
- Green colour for earth conductor.

All DC circuits shall have insulation of;

- Red colour for positive conductor
- Black colour for negative conductor
- Green colour for earth conductor.

ii. Cable Accessories

All accessories shall be provided for the complete cabling and wiring systems. These shall include but not limited to items such as saddles, clamps, fixing channels, connectors, cable joints (where necessary and as approved by the Engineer), clips, lugs, tapes, solder, identification tags, bushes, glands etc.

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8.4 INSTALLATION

8.4.1 Conduit Wiring

The wiring through conduit shall be started only after the conduit system is completely installed and all outlet boxes, junction boxes etc., are fixed in position.

The wires shall be pulled in conduit with care, preferably without the use of any lubricant. Where necessary and after approval of Engineer, the cable manufacturer's recommended lubricant shall be used. Use of any kind of oil or soap will not be permitted. Where several wires are to be installed in the same conduit, they shall be pulled together along with the earth conductor. All wires of same circuit shall be run in one conduit.

The wires shall not be bent to a radius less than ten times the overall diameter of the wire, or more if otherwise recommended by the manufacturer.

The wiring shall be continuous between terminations and looping-in system shall be followed throughout. Any joint in wires shall not be allowed. The use of connectors shall only be allowed at locations where looping-in is rendered difficult. The consent of the Engineer shall be required for using connectors. The connector shall be of suitable rating having porcelain body, sunk-in screw terminals. The connector shall be wrapped with PVC insulation tape after its installation. A minimum of 150 mm extra length of cable/wire shall be provided at each termination to facilitate repairs in future.

8.4.2 Cables on Surface

All cables for installation on surface of wall, column, ceiling etc., shall be fixed to the surface by means of galvanized steel clips secured to a steel channel by means of suitable stud plate, nuts and washer. The distance between each cable clip shall be such, so as to support the entire weight of the cable and that distance between the cable and surface and also the vertical clearance between two adjacent cables at any point is 50 mm minimum. Common mounting channels are to be furnished for cable along the same route. The Engineer before commencement of installation shall approve alternate cable fixing arrangement, which the Contractor can offer.

8.4.3 Cables in Flexible/Rigid Conduits on Surface

All cables for 'on surface conduits' shall be installed through the conduits without the use of lubricants. The flexible/rigid conduits shall be fixed to wall/ceiling surface by means of cable clamps using rawl plays and galvanized screws.

8.4.4 Underground Cable

The cables to be installed directly underground shall be laid in trench in single tiers. The depth of cable underground, shall be three feet minimum, measured from the top of the largest cable to the general ground level. The burial depth may be increased as required due to site



conditions or when crossing other service pipes and roads. Burial depth less than three feet and more than five feet shall require Engineer's approval.

When cables cross road, paved area, other services or other cables they shall be laid in protective pipes of required size. Cables entering the buildings shall also be laid in protective pipes. The protective pipe ends, after installation of cables shall be plugged water tight by means of bituminised resin or equivalent method as approved by the Engineer. A minimum clearance of ten inches vertically and 20 inches horizontally shall be maintained between cables and other services.

Cable identification tags of corrosion resistant material shall be tied to cables with bronze wire at a maximum of 65 feet interval along the cable length for identification of cable and circuit. Above ground cable markers of 8 SWG (4 mm) sheet steel and 200 mm² shall be erected at 100 feet intervals along the straight trench, and at each bend and joint box for indication of presence of underground cable. For more than three feet wide trenches, cable markers shall be provided at both edges of the trench. The cable marker shall be finished in grey heavy enamel paint over two base coats of anti-rust red oxide paint, with the necessary instructions indicated in approved colours.

The Contractor shall furnish samples of cable marker for approval of Engineer before installation. The marker shall be welded to an angle iron fixed to the ground on a cement concrete base or as directed by the Engineer. The earth continuity conductor shall be laid in the trench with the cables. The Contractor shall submit to the Engineer for approval, schedule of cable markers showing location of marker and instructions on each.

The cable trench shall be excavated as per route and location shown on the Drawing. Before laying of cables in the trench, the bed of the trench shall be levelled and filled with a four inch thick layer of fine sand (1/32 inch diameter maximum particles size). The sand layer shall be levelled and the cables placed thereon, the cables shall be covered with a layer of fine sand four inch thick measured above the top of the largest cable.

The cable protective bricks placed above the top of sand cover shall be of Class - C cement concrete, minimum two inch thick and 12 inches x 12 inches square or as approved by the Engineer. The bricks shall be placed over the sand layer end to end to cover the entire length and breadth of the cable trench. After the concrete bricks are placed, the remainder of the trench shall be backfilled with earth in layer 16 inches thick. Each layer shall be thoroughly tamped and compacted.

Sufficient slack shall be left in cables for which purpose the cut lengths of cables shall be about 3% more in the measured lengths between terminations. At underground joint box, ample slack shall be left to prevent straining of cable joints due to settlement of the cable trench.

The cut lengths of cables wherever stated are only as a guide. The Contractor shall measure actual lengths between terminations of each circuit and if the discrepancy between measured lengths at site and where given on the Drawing differ by more than $\pm 10\%$, the Contractor shall report to Engineer and act as directed. Cables, whether installed underground or in cement

concrete trenches shall not be bent to a radius less than that recommended by the cable manufacturers.

8.5 MEASUREMENT AND PAYMENT

8.5.1 General

The Contractor's bid amount against each Bill of Quantities item as given below shall include supply, installation, testing, commissioning and completion for all work specified herein and/or as shown on the Tender Drawing related to the item.

8.5.2 Light Circuit Wiring

i. Measurement

Measurement shall be made for the total number of light circuit wiring from LV distribution board/LV switchboard to point/switch including wiring between switches on same circuit, acceptably carried out by the Contractor as a complete unit.

ii. Payment

Payment shall be made for the total numbers of units measured, as provided above, at the Contract unit price each. The payment shall constitute full compensation for supplying, installing, connection, testing, commissioning and completion of the circuit wiring from the LV switchboard/LV distribution board to point/switch including wiring between switches on same circuit complete with conduit, wire/cable, earth continuity conductor, accessories etc.

8.5.3 Light/Fan Point/Point to Point Wiring

i. Measurement

Measurement shall be made for each light point, wiring between the light point and switch, point to point, acceptably carried out by the Contractor as a complete unit.

ii. Payment

Payment shall be made for the total numbers of units measured, as provided above, at the Contract unit price each. The payment shall constitute full compensation for supplying, installing, connecting, testing, commissioning and completion of the wiring between light point to switch and point to point including required size of cable, conduit, earth continuity conductor, flexible cable, ceiling rose, accessories etc.

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8.5.4 Wiring of Lights Directly Controlled from Distribution Board/Local MCBs/Wiring of Push Buttons

i. Measurement

Measurement shall be made for wiring of each light point directly controlled from distribution board or local MCBs type switch and wiring of push buttons acceptably carried out by the Contractor as a complete unit.

ii. Payment

Payment shall be made for the total numbers of units measured, as provided above, at the contract unit price each. The payment shall constitute full compensation for supplying, installing, testing and commissioning of wiring of light points directly controlled from distribution boards or local MCB type switches and wiring of push buttons including required size of wire, conduit, earth continuity conductor, flexible cable, ceiling rose, accessories etc.

8.5.5 Wiring of 5 Amps, 250 Volt Combined 2 & 3 Pin Switched Socket Unit from LV Switchboard/Distribution Board

i. Measurement

Measurement shall be made for number of points for wiring of 5 Amps, 250 Volt, combined 2 & 3 pin switched socket unit acceptably carried out by the Contractor as a complete unit.

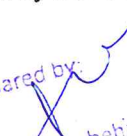
ii. Payment

Payment shall be made for the total numbers of units measured, as provided above, at the contract unit price each. The payment shall constitute full compensation for supplying, installing, connecting, testing, commissioning and completion of wiring for 5 Amps 250 Volt, combined 2 & 3 pin switched socket unit from LV switchboard/distribution board including specified size of single core PVC cables including conduit, ECC, PVC conduit, accessories etc. complete in all respects.

8.5.6 Wiring between 5 Amps, 250 Volt Combined 2 & 3 Pin Switched Socket Units

i. Measurement

Measurement shall be made for number of points for wiring between 5 Amps, 250 Volt, combined 2 & 3 pin switched socket unit acceptably carried out by the Contractor as a complete unit.

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ii. Payment

Payment shall be made for the total numbers of units measured, as provided above, at the contract unit price each. The payment shall constitute full compensation for supplying, installing, connecting, testing, commissioning and completion of wiring between 5 Amps 250 Volts, combined 2 & 3 pin switched socket unit including specified size of single core PVC cables including conduit, ECC, PVC conduit, accessories etc. complete in all respects.

8.5.7 Wiring of 15 Amps, 250 Volt 3 Pin Switched Socket Unit from LV Switchboard/Distribution Board/Bus Bars

i. Measurement

Measurement shall be made for number of points for wiring of 15 Amps, 250 Volt, 3 pin switched socket unit acceptably carried out by the Contractor as a complete unit.

ii. Payment

Payment shall be made for the total numbers of units measured, as provided above, at the contract unit price each. The payment shall constitute full compensation for supplying, installing, connecting, testing, commissioning and completion of wiring for 15 Amps 250 Volt, 3 pin switched socket unit from LV switchboard/distribution board/Bus Bars including specified size of single core PVC cables including conduit, ECC, PVC conduit, accessories etc. complete in all respects.


8.5.8 Wiring between 15 Amps, 250 Volt 3 Pin Switched Socket Units

i. Measurement

Measurement shall be made for number of points for wiring between 15 Amps, 250 Volt, 3 pin switched socket unit acceptably carried out by the Contractor as a complete unit.

ii. Payment

Payment shall be made for the total numbers of units measured, as provided above, at the contract unit price each. The payment shall constitute full compensation for supplying, installing, connecting, testing, commissioning and completion of wiring between 15 Amps 250 Volt, 3 pin switched socket units including specified size of single core PVC cables including conduit, ECC, PVC conduit, accessories etc. complete in all respects.

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8.5.9 Wiring of 20 Amps, 250 Volt 3 Pin Switched Socket Unit from LV Switchboard/Distribution Board

i. Measurement

- Measurement shall be made for number of points for wiring of 20 Amps, 250 Volt, 3 pin switched socket unit acceptably carried out by the Contractor as a complete unit.

ii. Payment

- Payment shall be made for the total numbers of units measured, as provided above, at the contract unit price each. The payment shall constitute full compensation for supplying, installing, connecting, testing, commissioning and completion of wiring for 20 Amps 250 Volt, 3 pin switched socket unit from LV switchboard/ distribution board including specified size of single core PVC cables including conduit, ECC, PVC conduit, accessories etc. complete in all respects.

8.5.10 LV Cables

i. Measurement

- Measurement shall be made for the number of running metre for each size and type of LV cable acceptably supplied and installed by the Contractor.

ii. Payment

- Payment shall be made for the number of running metre of each size of cable measured, as provided above, at the Contract unit price each and shall constitute full compensation for supplying, installing, connecting, testing and commissioning of the LV cables including all accessories.

8.5.11 Excavation of Cable Trench

i. Measurement

- Measurement shall be made for the number of cubic metres for excavation of each size of cable trench acceptably carried out by the Contractor.

ii. Payment

- Payment shall be made for the number of cubic metre of excavation for each size of cable trench measured, as provided above, at the Contract unit price each and shall constitute full compensation for excavation of the LV cable trench in ordinary soil and slightly rocky site.



8.5.12 Backfilling of Cable Trench

i. Measurement

Measurement shall be made for the number of cubic metres of backfilling for each size of cable trench acceptably carried out by the Contractor.

ii. Payment

Payment shall be made for the numbers of cubic metre of backfilling for each size of cable trench measured, as provided above, at the Contract unit price each. The payment shall constitute full compensation for four-inch thick sand bed, four inch thick sand cover, cable protective tiles/bricks, backfilling of already excavated earth, watering, compaction, consolidating etc. complete to the satisfaction of the Engineer.

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9 MEDIUM VOLTAGE (MV) CABLE

9.1 SCOPE OF WORK

The work under this section consists of supplying, installing, testing and commissioning of all material and services of Medium Voltage (15KV) cables and the accessories as specified herein or as shown on the Tender Drawings 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.

The MV cables with accessories shall also comply with the General Specifications for Electrical Works Section-8001 and with other relevant provisions of the Tender Document and latest WAPDA Specifications.

9.2 GENERAL

The cable shall be suitable for nominal service voltage of 11 kV, have copper conductor and be cross-linked polyethylene (XLPE), insulated, shielded, armoured and sheathed. It shall be suitable for indoor and outdoor use in the transmission and distribution of electrical energy.

9.3 APPLICABLE STANDARD/CODES

Latest editions of the following standards and codes shall be applicable for the materials within the scope of this Section:

IEC 183	-	Guide to the selection of HV cables.
IEC 502	-	Extruded solid electric insulated power cable for rated voltage from 1kV to 30 kV
IEC 540	-	Test methods for insulation and sheaths of electrical cables and cords.

9.4 MATERIAL

9.4.1 MV Cable

The cable shall meet the following specifications:

Nominal/System Voltage	-	11 KV
Frequency	-	50 HZ
System	-	3 phase
Conductor Size	-	Given in BOQ
Number of Cores	-	3 numbers
Rated Voltage	-	15 KV phase to phase 8.76 KV phase to ground
Continuous Operating		

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Temperature of conductor	-	90 degrees Celsius
Conductor material	-	Copper stranded
Insulation	-	Cross-linked polyethylene
Shielding	-	Copper tape
Jacket	-	PVC
Armouring	-	Galvanized wire
Over sheathing	-	Extruded PVC
Phase identification	-	Red, Yellow, Blue

i. Conductor Material

The conductors shall be of high conductivity electrolytic copper stranded in accordance with specified standard.

ii. Insulation

The insulation shall be cross-linked polyethylene extruded over the conductor. The insulation shall be laid to avoid any gap/air pockets between the conductor and insulation.

The insulation shall be easy to strip from individual conductors and to separate for jointing/termination purposes.

iii. Shielding

A layer of semi-conducting material applied directly over the insulation shall shield each core. A bare copper tape applied with suitable overlapping shall cover the semi-conducting insulation.

Phase identification tape of red, yellow, and blue colour shall be wrapped over the copper shield.

iv. Assembly

The three insulated conductors shall be assembled with PVC or any non-hygroscopic filler and bound with tape. The tape binder shall then be covered with extruded PVC jacket. The PVC jacket shall be padded with a suitable material before application of armour.

v. Armour

Armouring shall be provided with single layer of galvanized steel wire to provide cable protection and also act as a low resistance earth return path. The armouring shall be covered with binder tape. The armour shall be of appropriate size to carry the system fault current.



vi. Over sheath

The entire cable assembly shall be covered with a PVC jacket of thickness not less than 2.5mm. The colour of the jacket shall be black. In addition to any other marking proposed by manufacturer, the size of cable and voltage grade shall be given on the over sheath at every 3 meters interval.

9.4.2 Cable Reels

The cable shall be supplied in non-returnable, mechanically strong, sea/rail/road worthy, wooden or metallic cable drums, protected against weather. The cable drum should bear the markings for cable type, cable size, voltage grade, year of manufacture, name of manufacturer, direction of unreeling and any other additional marking normally provided by the manufacturer. Cable ends on cable reels shall be protected by means of suitable seal.

9.4.3 Factory Tests

Physical and electrical acceptance tests in accordance with applicable standard shall be carried out at the manufacturer works. Three copies of test reports will be furnished to the Engineer, which shall include brief description of tests, test records and results.

9.5 INSTALLATION

9.5.1 General

The Contractor shall furnish all installation material, labour, tools and accessories for cable installation. The cable and accessories shall be installed as described in accordance with the installation instructions given in the Section for Low Voltage Cable of these Specifications, drawings and in accordance with manufacturer's instructions. Prior to installation of jointing and termination kits, the cable lengths shall be checked and tested to ensure that the cables are in sound condition and no damage has been done during handling and installation. After the MV cable and jointing/termination kits are installed, it shall again be tested prior to commissioning and in accordance with recommendations of standard to which the cable is manufactured.

The Contractor shall confirm exact cut lengths for the cable by actual measurements at site prior to the commencement of manufacturing. The cable lengths where shown on the drawing are tentative and only for general guidance. The Contractor shall be solely responsible for furnishing correct lengths of cable to avoid joints in cable length except where necessary, after obtaining approval of the Engineer.

9.5.2 Underground Cables

The cables to be installed directly underground shall be laid in trenches in single tiers. Unless that shown specifically on the drawing the depth of cable below finished ground level shall be 900-mm minimum measured from the top of the largest cable to the general ground level. The

burial depth may be increased as required due to site conditions or when crossing other service pipes and roads. Burial depth less than 900mm and more than 1500mm shall require Engineer's approval.

When cables cross road, paved area, other services or other cables, they shall be laid in protective pipes of required size. Cables entering the buildings shall also be laid in protective pipes. The protective pipe ends, after installation of cables, shall be plugged water tight by means of bituminised resin or equivalent method as approved by the Engineer. A minimum clearance of 250mm vertically and 500mm horizontally shall be maintained between cables and other services.

The cable trench shall be excavated as per route and location shown on the drawing. Before laying of cables in the trench, the bed of the trench shall be levelled and filled with a 75mm thick layer of fine sand (1.3mm diameter maximum particles size). The sand layer shall be levelled and the cables placed thereon. The cables shall be covered with a layer of fine sand 75mm thick measured above the top of the largest cable. The cable protective bricks place above the top of sand cover shall be of class-A cement concrete, minimum 50mm thick and 300mm square. The bricks shall be placed over the sand layer end to end to cover the entire length and breadth of the cable trench. After the concrete bricks are placed, the remainder of the trench shall be backfilled with earth in layer 400mm thick. Each layer shall be thoroughly tamped and compacted.

Cable identification tags of corrosion resistant material shall be tied to cables with bronze wire at a maximum of 20 metre interval along the cable length for identification of cable and circuit. The earth continuity conductor shall be laid in the trench with the cables. The Contractor shall submit to the Engineer for approval, schedule of cable markers showing location of marker and instructions on each.

Sufficient slack shall be left in cables for which purpose the cut lengths of cables shall allow about 3% more in the measured lengths between terminations. At underground joint box, ample slack shall be left to prevent straining of cable joints due to settlement of the cable trench. The cut lengths of cables wherever stated are only as a guide. The Contractor shall measure lengths between terminations of each circuit and if the discrepancy between measured lengths at site and where given on the drawing differ by more than 5%, the Contractor shall report to Engineer and act as directed. Cables, whether installed underground, or in cement concrete trenches, shall not be bent to a radius less than that recommended by the cable manufacturers.

9.5.3 Cable Marker

Above ground, cable markers shall be erected at 30 metre intervals along the straight trench, and at each bend and joint box for indication of presence of underground cable. For more than one metre wide trenches, cable markers shall be provided at both edges of the trench. The cable marker shall bear the necessary instructions indicated in approved colours. The Contractor shall furnish samples of cable marker for approval of Engineer before installation.



The marker shall be welded to 50x50x4 mm angle iron fixed to the ground on a cement concrete base or as directed by the Engineer.

9.6 MEASUREMENT AND PAYMENT

9.6.1 General

The Contractor's bid amount against each item of Bill of Quantities as given below shall include supply, installation, testing, commissioning and completion for all work specified herein and/or as shown on the Tender Drawing related to the item.

9.6.2 MV Cable

i. Measurement

Measurement shall be made for the total number of running meters or running feet of MV cable acceptably supplied and installed by the Contractor and which has satisfactorily passed all the required tests prior to and after installation.

ii. Payment

Payment shall be made for the total number of running meters or running feet of the MV cable, as provided above, at the Contract unit price and shall constitute full compensation for supplying, installing, connecting, testing and commissioning of the MV cable including all accessories.

9.6.3 Excavation of Cable Trench

i. Measurement

Measurement shall be made for the number of cubic feet or cubic meters for excavation of each size of cable trench acceptably carried out by the Contractor.

ii. Payment

Payment shall be made for the number of cubic feet or cubic meters of excavation for each size of cable trench measured, as provided above, at the Contract unit price each and shall constitute full compensation for excavation of the cable trench in ordinary soil & slightly rocky site.

9.6.4 Backfilling of Cable Trench

i. Measurement

Measurement shall be made for the number of cubic feet or cubic meters of backfilling for each size of cable trench acceptably carried out by the Contractor.

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ii. Payment

Payment shall be made for the number of cubic feet or cubic meters of backfilling for each size of cable trench measured, as provided above, at the Contract unit price each. The payment shall constitute full compensation for four-inch thick sand bed, four inch thick sand cover, cable protective tiles/ bricks, backfilling of already excavated earth, watering, compaction, consolidating, etc. complete to the satisfaction of the Engineer.


9.6.5 Cable Marker

i. Measurement

Measurement shall be made for the number of each size and type of cable markers acceptably supplied and installed by the Contractor as a complete unit.

ii. Payment

Payment shall be measured for the number of units measured as above at the Contract price each and shall constitute full compensation for the supplying and installation of cable markers.

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10 MEDIUM VOLTAGE (MV) CABLE TERMINATION KITS

10.1 SCOPE OF WORK

The work under this section consists of supplying of Medium Voltage (MV) cable Termination Kits as specified herein and given in the Bill of Quantities.

10.2 GENERAL

The MV cable termination kits shall be suitable for MV 8.76/15 kV, XLPE copper conductors cables. It shall be suitable for indoor, outdoor and underground installations.

10.3 APPLICABLE STANDARD/CODES

The Latest editions of the relevant standards and codes shall be applicable for the materials within the scope of this Section.

10.4 MATERIAL

10.4.1 Termination Kits for 8.76/15 kV MV Cables

The termination kits shall be suitable for indoor, outdoor and underground installations. The termination kits shall be complete with all materials.

The MV termination kits shall be from special Silicon skirted or tubular EPDM rubbers.

The tubes shall be pre-stretched to avoid the use of torches or external heat sources.

The MV termination kits shall be supplied complete with stress control tape with a di-electric constant of 30 minimum.

The MV termination kits shall be supplied with all required mounting, installation and operational accessories.

10.4.2 Straight - Through Joint

The joint-boxes for the cable shall be suitable for indoor or outdoor installation in accordance with the system requirements.

The joint boxes shall be horizontal, straight through, split type. Where installed underground, these shall be suitably protected against corrosion and ingress of moisture. At least two venting holes with plugs shall be provided for compound filling and inspection. Ground straps shall be furnished on the inside of joint box for ground continuity of the cable armour.



10.4.3 Factory Tests

Physical and electrical acceptance tests in accordance with applicable standard shall be carried out at the manufacturer works. Three copies of test reports will be furnished to the Owner, which shall include brief description of tests, test records and results.

10.5 MEASUREMENT AND PAYMENT

10.5.1 General

The Contractor's bid amount against each item of Bill of Quantities as given below shall include supply, installation, testing, commissioning and completion for all work specified herein and/or as shown on the Tender Drawing related to the item.

10.5.2 MV Termination Kit and Straight through Joints

i. Measurement

Measurement shall be made for each type of MV termination kit/straight through joint acceptably supplied by the manufacturer/supplier as a complete unit.

ii. Payment

Payment shall be made for the number of units measured, as provided above, at the Contract unit price each and shall constitute full compensation for supplying of MV termination kits/straight through joints including all installation accessories, support for joint as required.

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11 LIGHTING CONTROL PANEL

11.1 DESCRIPTION

The lighting control/distribution panel shall be of 14 SWG sheet steel fabricated, cubical type, totally enclosed, dust tight and vermin proof. These 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. The panel with all components and accessories shall be suitable for front operation and shall;

- be provided with adequate clearance from live parts so that flashovers cannot be caused by switching, vermins, pests etc.
- have all components rated for insulation class of 600 Volt minimum.
- have the components mounted so as to facilitate ease of maintenance from the front.
- be suitable for mounting on concrete foundation.

The lighting control panel shall be complete with detachable steel base frame for embedding in concrete foundation on site.

11.2 MATERIAL REQUIREMENTS

The road lighting control box shall be of 14 SWG, G.I. sheet and equipped with the following:

- One-set of three phase, neutral and earth busbars of rating as specified (site rating).
- One incoming moulded-case circuit breaker, breaking capacity & rating as specified.
- Outgoing circuit breakers, breaking capacity & rating as specified.
- Magnetic contactors as per rating specified.
- Photo-electric cell switches dust and water proof type and as per BS 5972 or WAPDA Specifications P-102 with up to date amendments.

One photo electric cell unit shall be provided to switch ON/OFF every contactor for control of lights. Photo-electric unit shall include a delay device to prevent the switching of lamps during transient changes in voltage. Each lighting circuit shall be equipped with Auto/Manual selector switch and ON/OFF push buttons for maintenance purpose without interference with the photo cell and the whole to be enclosed in the dust and vermin proof case. Since the lighting control panel is installed on road side, therefore its outer cover shall be plain, without electrical components. A brass batten holder with ON/OFF switch and 60-watt incandescent lamp shall be provided at suitable location in the panel to facilitate maintenance during night time. Doors with hinges shall be provided so as to give maximum access for cabling and maintenance and shall be fitted with lock. Three sets of keys shall be supplied along with road lighting control box.

All necessary interconnecting wiring within the control panel shall be carried out in the factory. Cable glands and lugs shall be provided. Three sets for incoming outgoing 4-Core up to 35 mm² Copper conductor PVC/SWA/PVC cables.

A suitable earthing terminal shall be provided inside the box.

Crimping type lugs for incoming and outgoing copper cables shall be provided.

11.2.1 Moulded Case Circuit Breakers

Moulded Case Circuit Breakers shall be provided for each distribution feed circuit. The circuit breakers shall be in accordance with IEC 60947-2. The three-phase fault level shall be in accordance with the circuit requirements. The I_{cu} of all MCCBs shall be equal to 100% of I_{cs} . All MCCBs shall be capable of operating at 50 °C.

Each circuit breaker shall have integral thermal overload and magnetic type short-circuit trip devices. The thermal release shall provide inverse time overload tripping and the magnetic release shall provide instantaneous tripping or short time delay tripping where necessary, to achieve discrimination with downstream protective devices during short circuit conditions.

11.2.2 Magnetic Contractors

The contactors shall be triple pole, 400 V continuous duty type. The main contacts shall be silver tipped, but type with double break per pole. Each contactor shall be provided with 230 V AC single phase operating coil, and minimum two normally open and two normally closed auxiliary contacts wired up to terminals. But if a greater number of working auxiliary contacts are required then, these shall be provided according to the system requirements.

11.2.3 Indicating Lamps

Indicating lamps shall be suitable for flush mounting, complete with base and shall have rosettes of suitable colour.

11.2.4 Line-up Terminals

Line-up terminals wherever provided for control & power circuits shall be suitable for voltage and size of conductors as indicated on drawing.

The line-up terminals for controls shall be suitable for channel mounting. All necessary accessories such as end-plates, fixing clips, transparent label holder caps and label sheets with marking shall be provided.

11.2.5 Data to be Submitted

The Contractor shall submit the following for approval of the Engineer before execution;

- Manufacturer
- Country of Origin
- Catalogue with indication of equipment proposed
- Detailed Specification
- Construction drawings
- General arrangement and proposed foundation details.
- Details of materials used for weather and dust proofing.



11.3 CONSTRUCTION REQUIREMENTS

The road lighting control panel box shall be installed near transformer at location shown on the drawing. The Contractor shall ensure coordination with the civil contractor to avoid damage to the completed works. The Contractor shall provide foundation bolts and grout them in cement concrete with the approval of the Engineer. All installation material required for the satisfactory erection, such as bolts, nuts, washers, supporting steel etc. shall be provided and installed by the Contractor. The panel shall be installed upright and in level and shall be firmly and rigidly fixed on the concrete supports. Panel shall be erected as per manufacturer's instructions and as approved by the Engineer.

Loose parts dispatched by the manufacturer, shall be installed and connected as per assembly drawing. Any safety locking of metres, relays etc. provided by the manufacturer, for safe transport shall be released only after the panel is installed in position. The Lighting Control Panel shall be tested and commissioned in the presence of the Engineer.

Panel openings for cables shall be properly sealed with the water proof material "Plastic Polyurethane Foam" as per relevant ASTM standard to avoid rain water/animal entry to the panel. The contractor shall also provide the technical data of the sealant material before the execution of the work.

11.4 MEASUREMENT AND PAYMENT

11.4.1 Measurement

Measurement shall be made for each panel complete with all components and accessories as given in bill of quantities acceptably supplied and installed by the Contractor as completed job.

11.4.2 Payment

Payment shall be made for the number of panels measured as provided above at the contract unit price each and shall constitute full compensation for supplying, installing, connecting, testing and commissioning of panels including bolts, supporting steel base, nuts, washers, tapes and earthing etc.

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13 EARTHING

13.1 GENERAL

The work under this section consists of supplying, installing, testing and commissioning of all material and accessories of the complete earthing system as specified herein, as shown on the Tender Drawings and given 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 for Electrical Works Section-8001 and with other relevant provisions of the Tender Documents and latest WAPDA Specifications.

The earthing system consists of earth electrodes, earthing leads, earth connecting points, earth continuity conductors and all accessories necessary for the satisfactory operation of the associated electrical system.

13.2 APPLICABLE STANDARDS/CODES

The latest editions of following standards/codes shall be applicable for the materials in scope of this section :-

BS 951	-	Earthing Clamps
CP 1013	-	Earthing
BS 2874	-	Nuts, bolts, washers, screws & rivets fixing for use on Copper
BS 1433	-	Hard drawn bare copper conductor for earthing
BS 6346	-	PVC insulated cables

13.3 MATERIAL

13.3.1 Earth Electrode (Plate Type)

The earth electrode shall comprise two feet x two feet and 1/8 inch thick electrolytic copper plate. The surface of the plate shall be tinned for protection. The plate shall have four terminals for connecting of the earthing leads. Nuts, bolts and washers, shall be either of brass or tinned copper.

13.3.2 Earth Electrode (Rod Type)

The earth electrode shall comprise ten feet long, 5/16 inch dia. copper deposited steel rod having flat head at drive end and pointed conical tip at the driven end. The tip shall be hardened to facilitate driving. At the top of the pipe, a clamp for bolted connections shall be provided suitable for connection to the down conductor.



13.3.3 Earthing Lead

The earthing lead shall connect the earth electrode to earth connecting point on the high mast. It shall be round hard drawn bare electrolytic copper of size shown on the Drawings.

13.3.4 Earth Continuity Conductor

Earth continuity conductor (ECC) shall be hard drawn bare copper wire or single core PVC insulated copper conductor cable of sizes indicated on the Drawings.

The specifications for single core PVC insulated or PVC/PVC cables used as ECC shall be same as those in relevant sections of Technical Specifications.

13.3.5 Earth Connecting Point

Earth connecting points shall comprise tinned copper bar, rectangular in shape, having dimensions of 350 x 50 x 6 mm. At least, six terminals for connection shall be arranged on the bar, which can be increased or decreased as required by the engineer.

The terminals shall have brass or tinned copper bolts, nuts and washers for protection against corrosion. Two holes shall be provided off centre of the copper bar for fixing to the wall by means of 10 mm dia. nut and bolt and shall be insulated by means of rubber gaskets/washers.

13.4 INSTALLATION

13.4.1 General

Complete earthing systems as shown on the Drawing shall be installed by the Contractor. The earthing system shall have earth resistance, including the resistance of soil, earth leads and ECC of less than **One** ohm.

At all connections of earth continuity conductor to high mast or any other metallic body, proper size copper or brass sockets, thimbles or lugs shall be used to which the copper wire shall be connected by copper brazing. The soldering of copper wire at joints or terminations shall not be allowed. All tee-off connections shall be by copper brazing using suitable socket and clamps. After brazing, the jointed surface shall be protected by oxide inhibiting compound of low electrical resistance. For connections to metallic body, the surface shall be thoroughly cleaned before bolting the lug or socket.

The earth continuity conductor shall in general run in cable trench or in conduits/pipes as shown on the Drawings. For under floor runs, these shall be installed in pipe/conduit of appropriate sizes. Where laid along underground cables, these shall be laid directly underground in unpaved areas and in pipes under paved areas.

13.4.2 Earth Electrode (Plate Type)



The electrode plate shall be installed at a minimum depth of 15 feet from finished ground level or 3 feet below permanent water level whichever is less. The minimum horizontal distance between earth electrodes shall be 12 feet. Proper mixture of lime and charcoal shall be made and buried along with the copper plate in the ground to increase the soil conductivity. The earthing leads shall be installed in proper size G.I. pipes. The electrode shall be installed as per details shown on the Drawings.

13.4.3 Earth Electrode (Rod Type)

In case the soil conditions at site permit, the earth electrodes may be installed by hammering the electrode in soil, until the top of the rod is about 12 inches below the proposed ground level. If hammering down is not possible due to site conditions, a pit shall be first excavated in bare ground up to the required depth and electrode shall be installed upright in the pit. The excavated pit shall be backfilled in layers of 20 inches, each layer tamped and compacted. At the ground level an inspection chamber of cement concrete shall be constructed having dimensions as shown on the Drawings. The inspection chamber shall have a cover supported on angle iron frame. The cover shall be approved by the Engineer and shall finish flush with the ground level.

13.4.4 Earth Continuity Conductor

The earth continuity conductor of sizes shown on the drawing shall be installed all along the cable runs and connected to the earthing bar/terminals provided in equipment. The body of all switchboards shall also be connected to earth by specified size of ECC. All other metal work shall also be connected to earth by specified size of ECC. At any joint or terminations, the ECC shall be connected using proper accessories. No connection shall be made by twisting of earth conductors.


13.4.5 Earth Connecting Point

The earth connecting point shall be installed at locations shown on the drawings. It shall be fixed on wall surface by means of brass screws.

13.5 MEASUREMENT AND PAYMENT

13.5.1 General

The Contractor's bid amount against each Bill of Quantities item as given below shall include supplying, installation, testing and commissioning of all work specified herein, as shown on the Tender Drawing related to the item.

Prepared by: 
for and on behalf of
Engineering Services
(Pvt.) Ltd. (MESPAK)

13.5.2 Earth Electrode

i. Measurement

Measurement shall be made for each type of earth electrode acceptably supplied and installed by the Contractor as a complete unit.

ii. Payment

Payment shall be made for the total number of units measured, as provided above, at the Contract unit price each, and shall constitute full compensation for supplying, installing, testing, commissioning and completion of earth electrodes including earthing leads, excavation, backfilling, inspection chamber with cover, G.I. pipes for earthing leads, nuts, bolts, washers, lugs, brazing and all related civil works.

13.5.3 Earth Continuity Conductor

i. Measurement:

Measurement shall be made for the number of running metre for each size of earth continuity conductor (ECC) acceptably supplied, installed and tested by the Contractor.

ii. Payment

Payment shall be made for the total number of running metres of each size of ECC measured, as provided above, at the Contract unit price each and shall include full compensation for supplying, installing, connecting, testing and completing of ECC including all accessories, such as sockets, thimbles, lugs, bolts, nuts, brazing etc.

13.5.4 Earth Connecting Point

i. Measurement

Measurement shall be made for each earth connecting point acceptably supplied and installed by the Contractor as a complete unit.

ii. Payment

Payment shall be made for the total number of units measured, as provided above, at the contract unit price each and shall constitute full compensation for supplying, installing and completion of earth connecting point and all other associated accessories such as nuts, bolts, washers, lugs etc.

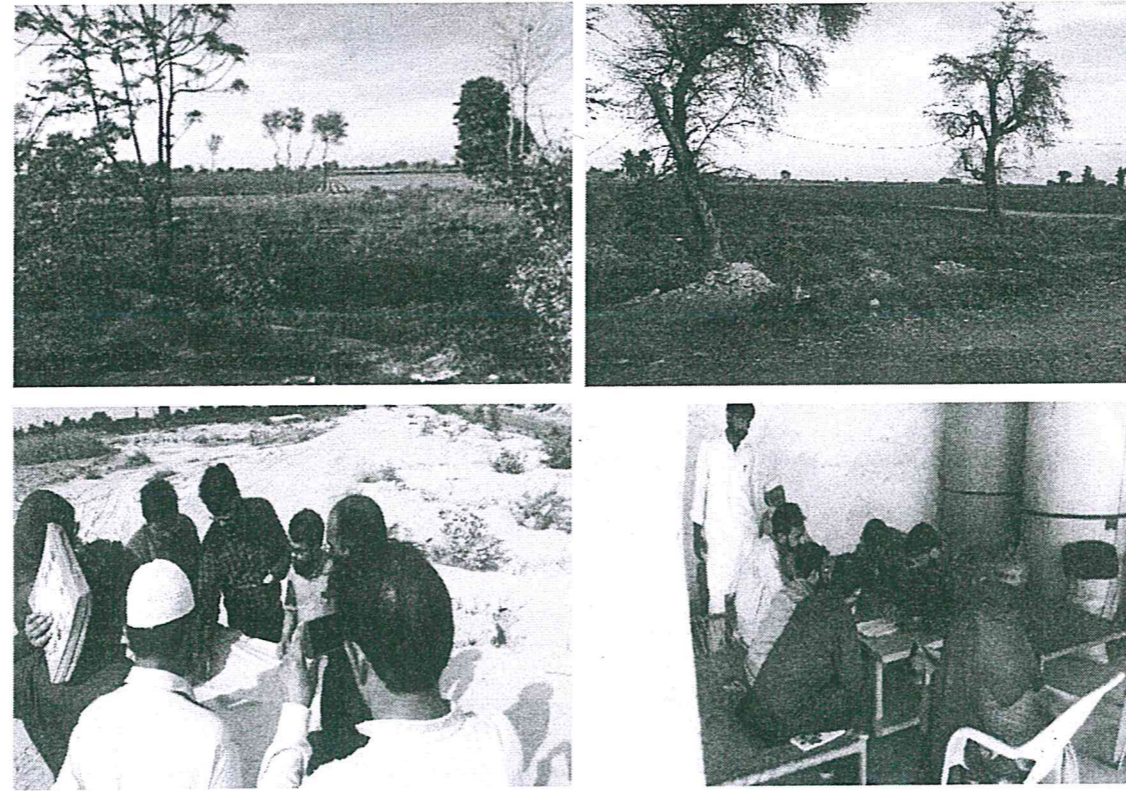
Prepared by:
For and on behalf of
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Pakistan (Pvt.) Ltd. (NEEPAN)



PROGRAM MANAGEMENT UNIT – PICIIP (LG & CD DEPARTMENT)



PUNJAB INTERMEDIATE CITIES IMPROVEMENT INVESTMENT PROGRAM (PICIIP)

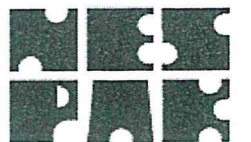


Construction of Wastewater Treatment Plant (WWTP) in North Zone, Sahiwal (Stage-1)

Engineer's Estimate

DRAWINGS

September 2023



PUNJAB INTERMEDIATE CITIES IMPROVEMENT INVESTMENT PROGRAM (PICIIP)
CONSTRUCTION OF WASTEWATER TREATMENT PLANT IN NORTH ZONE, SAHIWAL

APPENDIX-J: DRAWINGS

LIST OF DRAWINGS

S.NO.	DRAWING NO.	TITLE
GENERAL DRAWINGS		
01	3976/11/TD/2J100	GENERAL NOTES AND LEGENDS
02	3976/11/TD/2J101	PROJECT LOCATION PLAN
03	3976/11/TD/2J102	APPROVED SEWERAGE ZONES AS PER MASTER PLAN SAHIWAL CITY
04	3976/11/TD/2J103	LOCATION PLAN OF WASTEWATER TREATMENT PLANT
05	3976/11/TD/2J104	TOPOGRAPHIC SURVEY OF WASTEWATER TREATMENT PLANT (SHEETS 1 TO 8)
WWTP DRAWINGS (ANAEROBIC POND, FACULTATIVE POND & ALLIED STRUCTURES)		
06	3976/11/TD/2J106	WASTEWATER TREATMENT PLANT - LAYOUT PLAN (SHEETS 1 TO 3)
07	3976/11/TD/2J106	WASTEWATER TREATMENT PLANT - BLOWUP LAYOUT PLAN (SHEETS 2 TO 3)
08	3976/11/TD/2J106	WASTEWATER TREATMENT PLANT - INLET, TREATED EFFLUENT & BYPASS CHANNEL LAYOUT PLAN (SHEETS 3 TO 3)
09	3976/11/TD/2J107	WASTEWATER TREATMENT PLANT - PROCESS FLOW DIAGRAM (SCHEMATIC)
10	3976/11/TD/2J108	WASTEWATER TREATMENT PLANT - HYDRAULIC PROFILE (MODULE 01 TO 9)
11	3976/11/TD/2J109	ANAEROBIC AND FACULTATIVE POND - PLAN AND SECTION (MODULE 02 TO 9)
12	3976/11/TD/2J109A	ANAEROBIC(AP-01) AND FACULTATIVE (FP-01) POND - PLAN AND SECTION (MODULE - 01)
13	3976/11/TD/2J110	ANAEROBIC PONDS (AP-02 TO AP-9) PLAN AND SECTION
14	3976/11/TD/2J110A	ANAEROBIC PONDS (AP-01) PLAN AND SECTION
15	3976/11/TD/2J111	FACULTATIVE PONDS (FP-02 TO FP-9) PLAN AND SECTION
16	3976/11/TD/2J112	FACULTATIVE PONDS (FP-01) PLAN AND SECTION
17	3976/024/TD/7D01	DETAILS OF COMPOSITE LINER
18	3976/11/TD/2J113	COLLECTION CHAMBER - PLAN AND SECTION
19	3976/11/TD/2J114	INLET CHANNEL AND TREATED EFFLUENT CHANNEL - SECTION
20	3976/11/TD/2J115	TYPICAL X-SECTION OF TREATED EFFLUENT & BYPASS CHANNEL
21	3976/11/TD/2J116	INLET CHANNEL AND TREATED EFFLUENT CHANNEL - SECTION
22	3976/11/TD/2J117	INTER CONNECTION DETAIL IN BETWEEN ANAEROBIC POND AND FACULTATIVE POND
23	3976/11/TD/2J118	OUTLET STRUCTURE DETAIL FROM FACULTATIVE POND
24	3976/11/TD/2J119	DISTRIBUTION CHAMBER - PLAN AND SECTION
25	3976/11/TD/2J120	DETAIL OF OFFICE BUILDING AND LAB.
26	3976/11/TD/2J121	DETAIL OF STAFF BUILDING
27	3976/11/TD/2J122	BYPASS CHANNEL, OUTLET CHANNEL & TREATED EFFLUENT CHANNEL PROFILE (06 SHEETS)

S.NO.	DRAWING NO.	TITLE
STRUCTURAL DRAWINGS		
28	3976/037/TD/15G01	DISTRIBUTION CHAMBER CONCRETE OUTLINE & REINFORCEMENT
29	3976/037/TD/15G02	INLET CHANNEL AND OUTLET CHANNEL - SECTION - CONCRETE OUTLINE
30	3976/037/TD/15G03	OUTLET STRUCTURE DETAIL FROM FACULTATIVE POND - CONCRETE OUTLINE
31	3976/037/TD/15G04	COLLECTION CHAMBER - CONCRETE OUTLINE
32	3976/037/TD/15G05	INTER CONNECTION DETAIL IN BETWEEN ANAEROBIC POND AND FACULTATIVE POND - CONCRETE OUTLINE
ELECTRICAL DRAWINGS		
33	3976/161/TD/5E001	LEGEND, GENERAL NOTES LIGHTING FITTING SCHEDULE & EARTH DETAILS
34	3976/161/TD/5E002	OFFICE BUILDING & LAB ELECTRIFICATION - LAYOUT PLAN
35	3976/161/TD/5E003	STAFF BUILDING ELECTRIFICATION - LAYOUT PLAN
36	3976/161/TD/5E004	DETAILS OF 12M CONICAL OCTAGONAL LIGHTING POLE SINGLE ARM BRACKET
37	3976/161/TD/5E005	AREA LIGHTING OF THE WWTP PLANT SITE - LAYOUT PLAN

GENERAL DRAWINGS

LEGEND:

- DRAIN
- RAILWAY LINE
- PROJECT BOUNDARY
- CANAL
- PROPOSED DISPOSAL STATION
- EXISTING DISPOSAL STATION (TO BE ELIMINATED)

ABBREVIATION

- (AP) ANAEROBIC POND
- (FP) FACULTATIVE POND
- (MP) MATURATION POND
- D DIAMETER
- mm MILLIMETER
- NSL NATURAL SURFACE LEVEL
- FFL FINISHED FLOOR LEVEL
- FGL FINISHED GROUND LEVEL
- GL GROUND LEVEL
- DPC DAMP PROOF COURSE
- PCC PLAIN CEMENT CONCRETE
- C CONSTRUCTION DRAWING
- P PLANNING DRAWING

NOTES

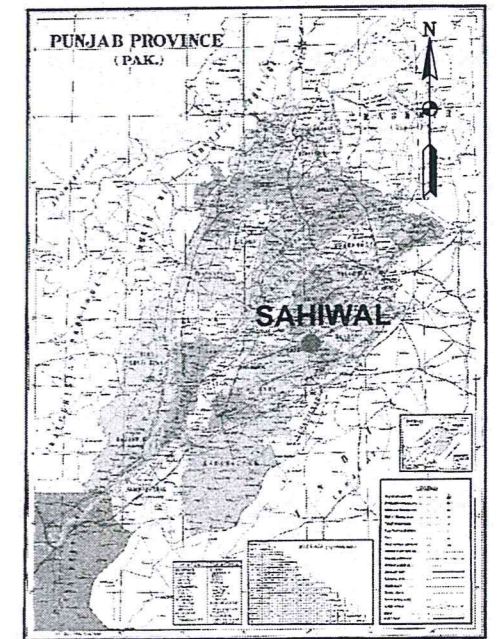
1. ALL DIMENSIONS AND LEVELS ARE IN FEET UNLESS OTHERWISE SPECIFIED.
2. ALL PIPE DIAMETERS ARE IN INCHES UNLESS OTHERWISE SPECIFIED.
3. THE CONTRACTOR SHALL ARRANGE FOR ALL REQUIRED PERMITS BEFORE THE EXECUTION OF THE WORKS.
4. THE CONTRACTOR SHALL CARRY OUT COMMISSIONING OF WWTP AS PER ENGINEERING STANDARDS TO MEET THE TREATED EFFLUENT QUALITY PARAMETER (PEQS/WHO) TO COMPLETE SATISFACTION OF THE ENGINEER.
5. THE CONTRACTOR SHALL PROVIDE TRAINING TO THE O&M AGENCY FOR REPAIR AND MAINTENANCE OF THE PROPOSED WWTP AND ASSOCIATED WORKS.
6. ALL MATERIALS, WORKMAN SHIP AND TESTING SHALL BE IN ACCORDANCE WITH ENGINEERING STANDARDS, MATERIALS, SPECIFICATION, DRAWINGS AS APPROVED BY THE ENGINEER.
7. STRICT COMPLIANCE TO HEALTH, SAFETY, ENVIRONMENTAL AND COVID MANAGEMENT PLANS SHALL BE OBSERVE BY THE CONTRACTOR.
8. THE CONTRACTOR SHALL SUBMIT SHOP DRAWINGS OF ALL ELECTRO-MECHANICAL COMPONENTS BEFORE EXECUTION FOR APPROVAL OF THE ENGINEER.
9. ANY DEFECT /SHORT COMING OR COMPLAINTS LODGED DURING DEFECT LIABILITY PERIOD OR INCLUDED IN THE PUNCH LIST SHALL BE RECTIFIED BY THE CONTRACTOR.
10. THE CONTRACTOR SHALL PREPARE AS-BUILT DRAWINGS OF THE COMPLETE WWTP & ITS ALLIED COMPONENTS ON AUTOCAD AND GIS SOFTWARES, (MENTIONING CONSTRUCTION/ INSTALLATION TIME, SIZES, THICKNESS, DIAMETER, MATERIAL, LENGTH, DEPTH ETC.) AND EDITABLE COPIES SHALL BE HANDED OVER TO THE ENGINEER, TO HIS ENTIRE SATISFACTION.
11. FOR TOPOGRAPHIC SURVEY, PLEASE REFER TO DRAWING NO. 3976/11/TD/2J104.

Prepared by:

For and on behalf of
National Engineering Services
Pakistan (Pvt.) Ltd. (NESPAK)

PROGRAM MANAGEMENT UNIT, PUNJAB INTERMEDIATE CITIES IMPROVEMENT INVESTMENT PROGRAM (PICIP), LOCAL GOVERNMENT AND COMMUNITY DEVELOPMENT (LG & CD) DEPARTMENT, PUNJAB			
CONSTRUCTION OF WASTEWATER TREATMENT PLANT IN NORTH ZONE, SAHIWAL			
GENERAL NOTES AND LEGENDS			
NATIONAL ENGINEERING SERVICES PAKISTAN (PVT.) LTD. LAHORE			
DESIGNER: NESPAK	RECOMMENDED:	VER./CKD.	APPROVED
FILED: SARFERAZ			
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REFERENCE DRAWINGS	REV.NO.	DATE	DESCRIPTION	BY	CKD	APPR



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SCALE 1"=3500'

PROGRAM MANAGEMENT UNIT, PUNJAB INTERMEDIATE CITIES IMPROVEMENT INVESTMENT PROGRAM (PICIP), LOCAL GOVERNMENT AND COMMUNITY DEVELOPMENT (LG & CD) DEPARTMENT, PUNJAB

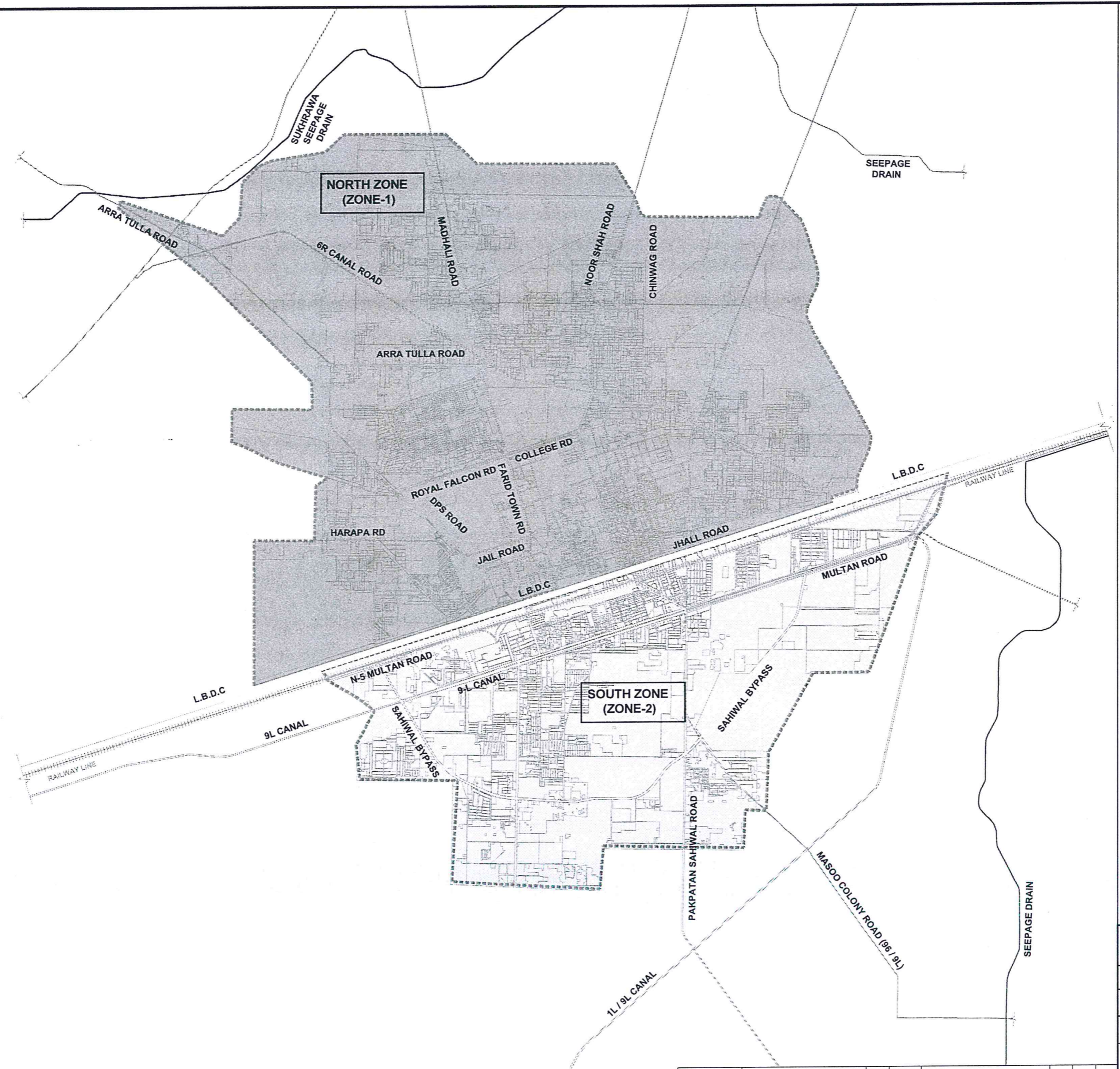
CONSTRUCTION OF WASTEWATER TREATMENT PLANT IN NORTH ZONE, SAHIWAL

PROJECT LOCATION PLAN

NESPAK NATIONAL ENGINEERING SERVICES PAKISTAN (PVT.) LTD. LAHORE

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- LEGEND:**
- RAILWAY LINE
 - CANAL
 - DRAIN
 - NORTH ZONE (ZONE - 1)
 - SOUTH ZONE (ZONE - 2)

Prepared by:
 For and on behalf of
 National Engineering Services
 Pakistan (Pvt.) Ltd. (NESPak)

SCALE 1"=4500'

PROGRAM MANAGEMENT UNIT, PUNJAB INTERMEDIATE CITIES IMPROVEMENT INVESTMENT PROGRAM (PICIP), LOCAL GOVERNMENT AND COMMUNITY DEVELOPMENT (L.G & CD) DEPARTMENT, PUNJAB

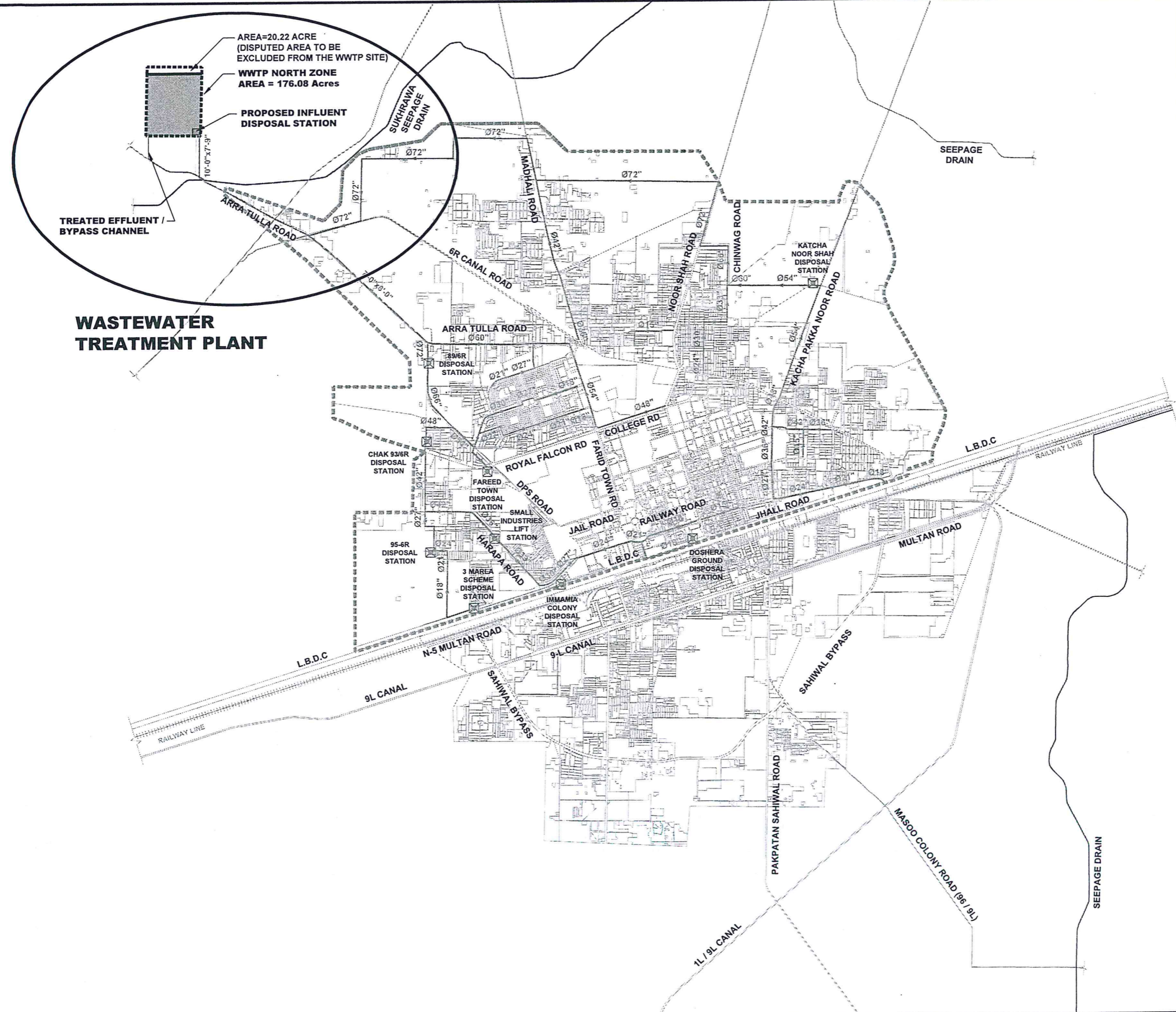
CONSTRUCTION OF WASTEWATER TREATMENT PLANT IN NORTH ZONE, SAHIWAL

APPROVED SEWERAGE ZONES AS PER MASTER PLAN SAHIWAL CITY

NESPak NATIONAL ENGINEERING SERVICES PAKISTAN (PVT.) LTD. LAHORE

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WASTEWATER TREATMENT PLANT

AREA=20.22 ACRE
(DISPUTED AREA TO BE EXCLUDED FROM THE WWTP SITE)

WWTP NORTH ZONE
AREA = 176.08 Acres

PROPOSED INFLUENT DISPOSAL STATION

TREATED EFFLUENT / BYPASS CHANNEL

LEGEND

- RAILWAY LINE
- CANAL
- DRAIN
- PROPOSED DISPOSAL STATION
- EXISTING DISPOSAL STATION (TO BE ELIMINATED)
- PROPOSED WASTE WATER TREATMENT PLANT

NOTE
Prepared by
FOR GENERAL NOTES AND LEGENDS SEE DRAWING NO. 3976/11/TD/2/100.

for and on behalf of
Engineering Services
(Pvt.) Ltd. (NESPAK)

SCALE 1"=4500'

PROGRAM MANAGEMENT UNIT, PUNJAB INTERMEDIATE CITIES IMPROVEMENT INVESTMENT PROGRAM (PICIP), LOCAL GOVERNMENT AND COMMUNITY DEVELOPMENT (LG & CD) DEPARTMENT, PUNJAB

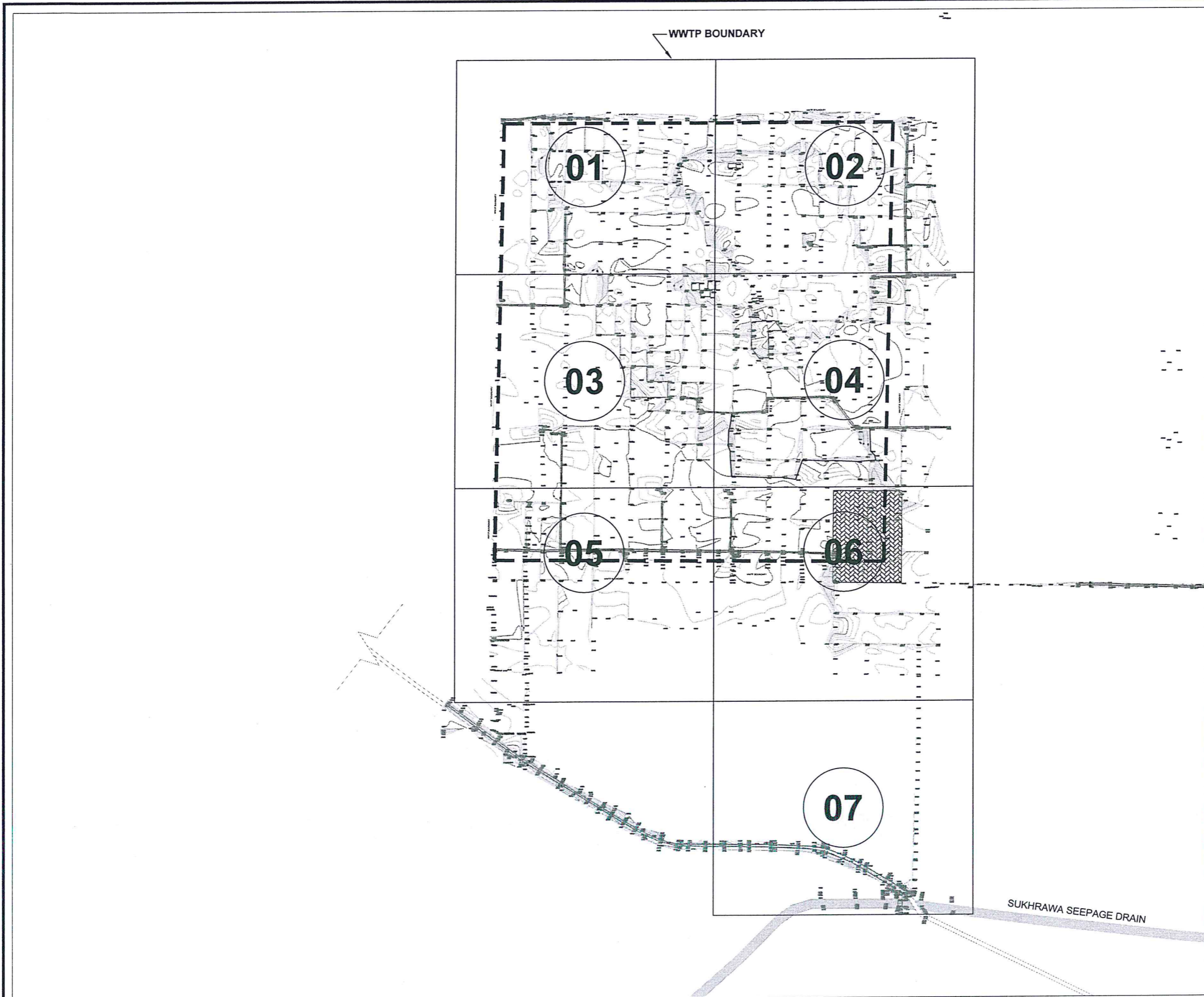
CONSTRUCTION OF WASTEWATER TREATMENT PLANT IN NORTH ZONE, SAHIWAL

LOCATION PLAN OF WASTEWATER TREATMENT PLANT

NATIONAL ENGINEERING SERVICES PAKISTAN (PVT.) LTD. LAHORE

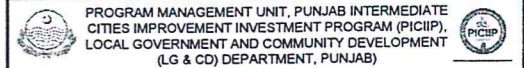
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SUBM.			

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SCALE 1"=550'



PROGRAM MANAGEMENT UNIT, PUNJAB INTERMEDIATE CITIES IMPROVEMENT INVESTMENT PROGRAM (PICIP), LOCAL GOVERNMENT AND COMMUNITY DEVELOPMENT (LG & CD) DEPARTMENT, PUNJAB

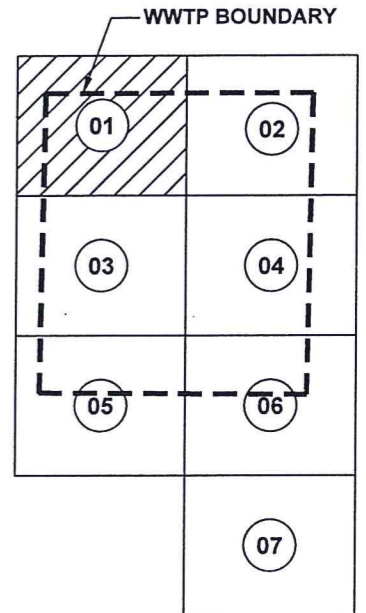
CONSTRUCTION OF WASTEWATER TREATMENT PLANT IN NORTH ZONE, SAHIWAL

TOPOGRAPHIC SURVEY OF WASTEWATER TREATMENT PLANT

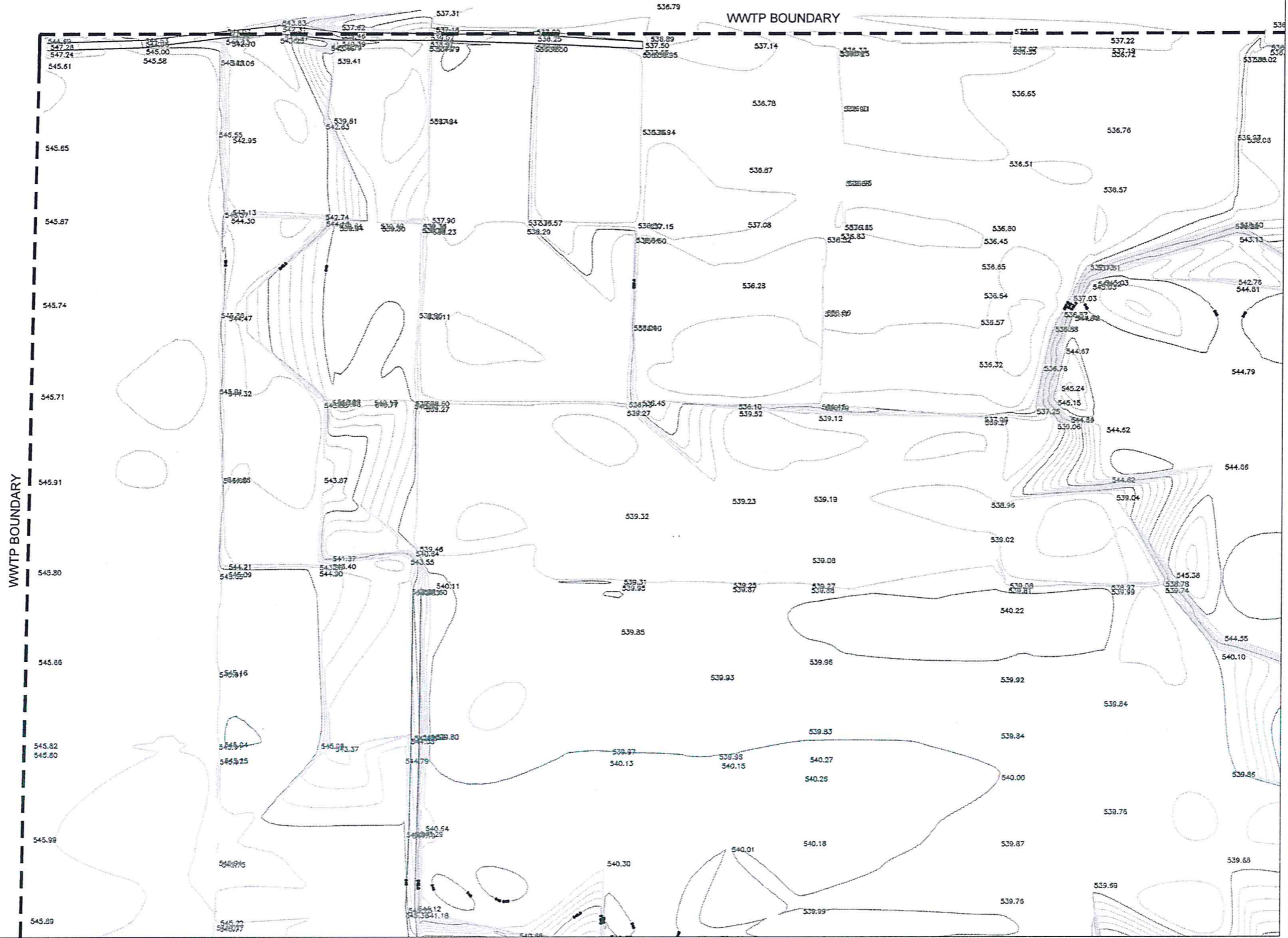
NESPAK NATIONAL ENGINEERING SERVICES PAKISTAN (PVT.) LTD. LAHORE

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REFERENCE DRAWINGS	REV.NO.	DATE	DESCRIPTION	BY	CKD	APPR



KEY PLAN



Prepared by: *[Signature]*
 For and on behalf of
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 Pakistan (Pvt.) Ltd. (NESPAK)

SCALE 1"=130' (SHEET 1 OF 7)

PROGRAM MANAGEMENT UNIT, PUNJAB INTERMEDIATE
 CITIES IMPROVEMENT INVESTMENT PROGRAM (PICIP),
 LOCAL GOVERNMENT AND COMMUNITY DEVELOPMENT
 (LG & CD) DEPARTMENT, PUNJAB

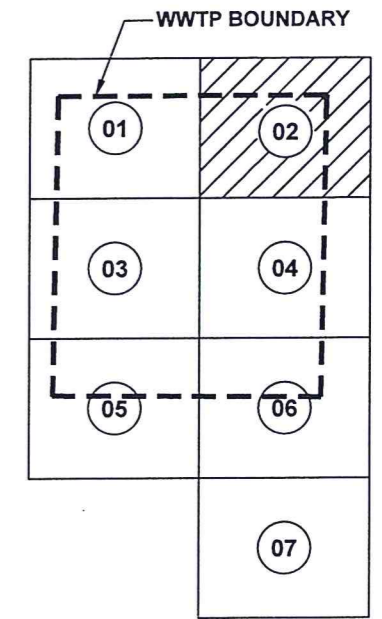
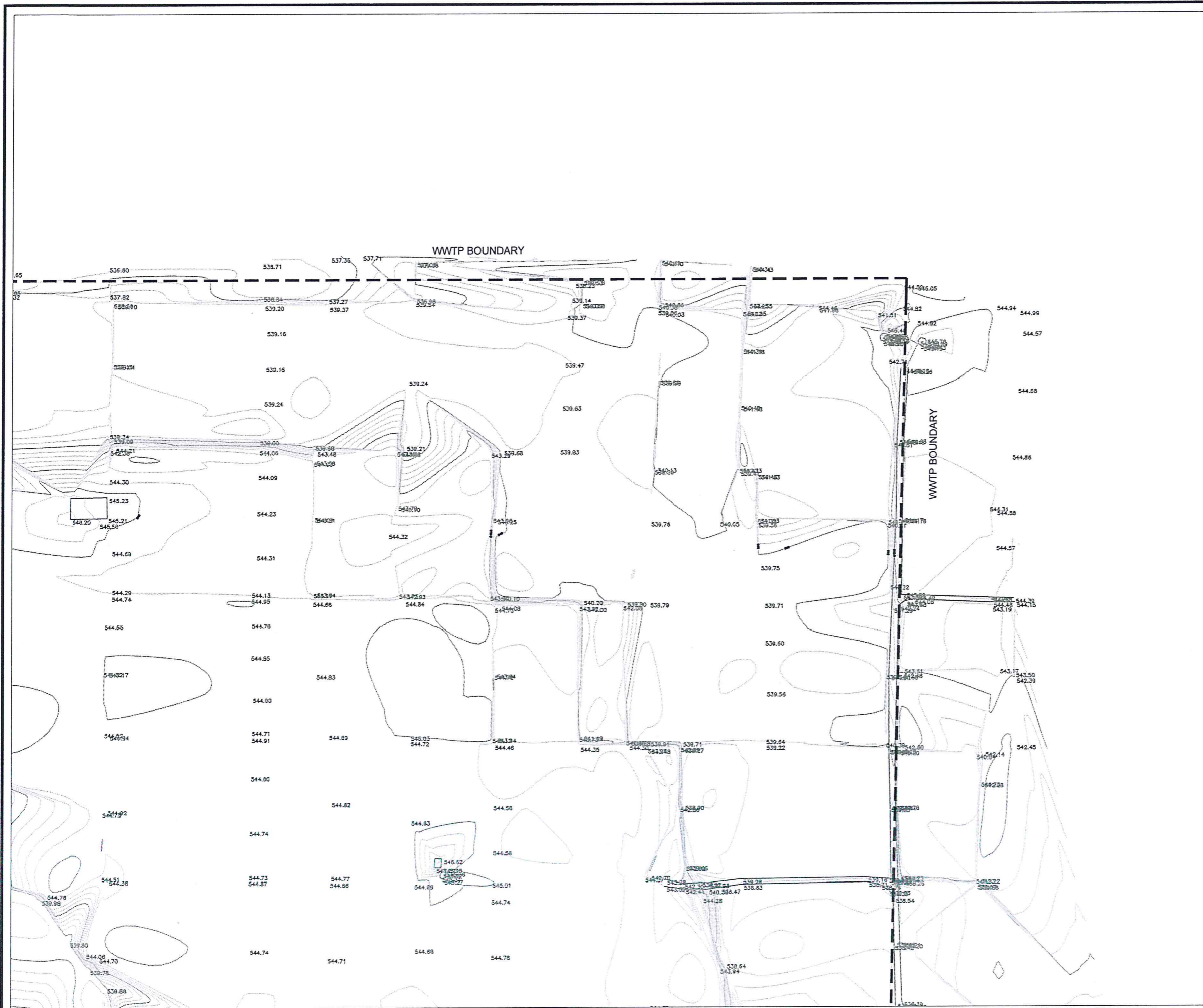
CONSTRUCTION OF WASTEWATER TREATMENT PLANT IN
 NORTH ZONE, SAHIWAL

**TOPOGRAPHIC SURVEY OF
 WASTEWATER TREATMENT PLANT**

NESPAK NATIONAL ENGINEERING SERVICES
 PAKISTAN (PVT.) LTD. LAHORE

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REFERENCE DRAWINGS	REV. NO.	DATE	DESCRIPTION	BY	CKD	APPR



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Prepared by: *[Signature]*
 For and on behalf of
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SCALE 1"=130' (SHEET 2 OF 7)

PROGRAM MANAGEMENT UNIT, PUNJAB INTERMEDIATE CITIES IMPROVEMENT INVESTMENT PROGRAM (PICIP), LOCAL GOVERNMENT AND COMMUNITY DEVELOPMENT (LG & CD) DEPARTMENT, PUNJAB

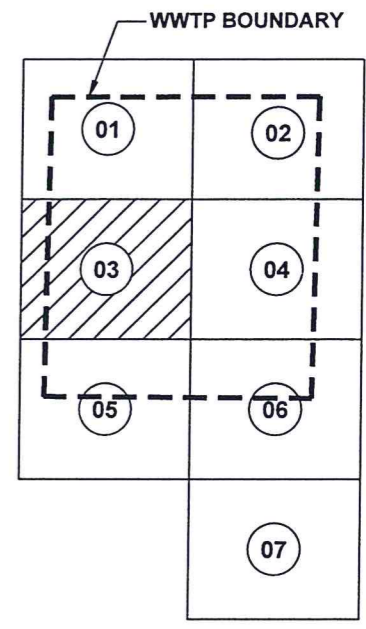
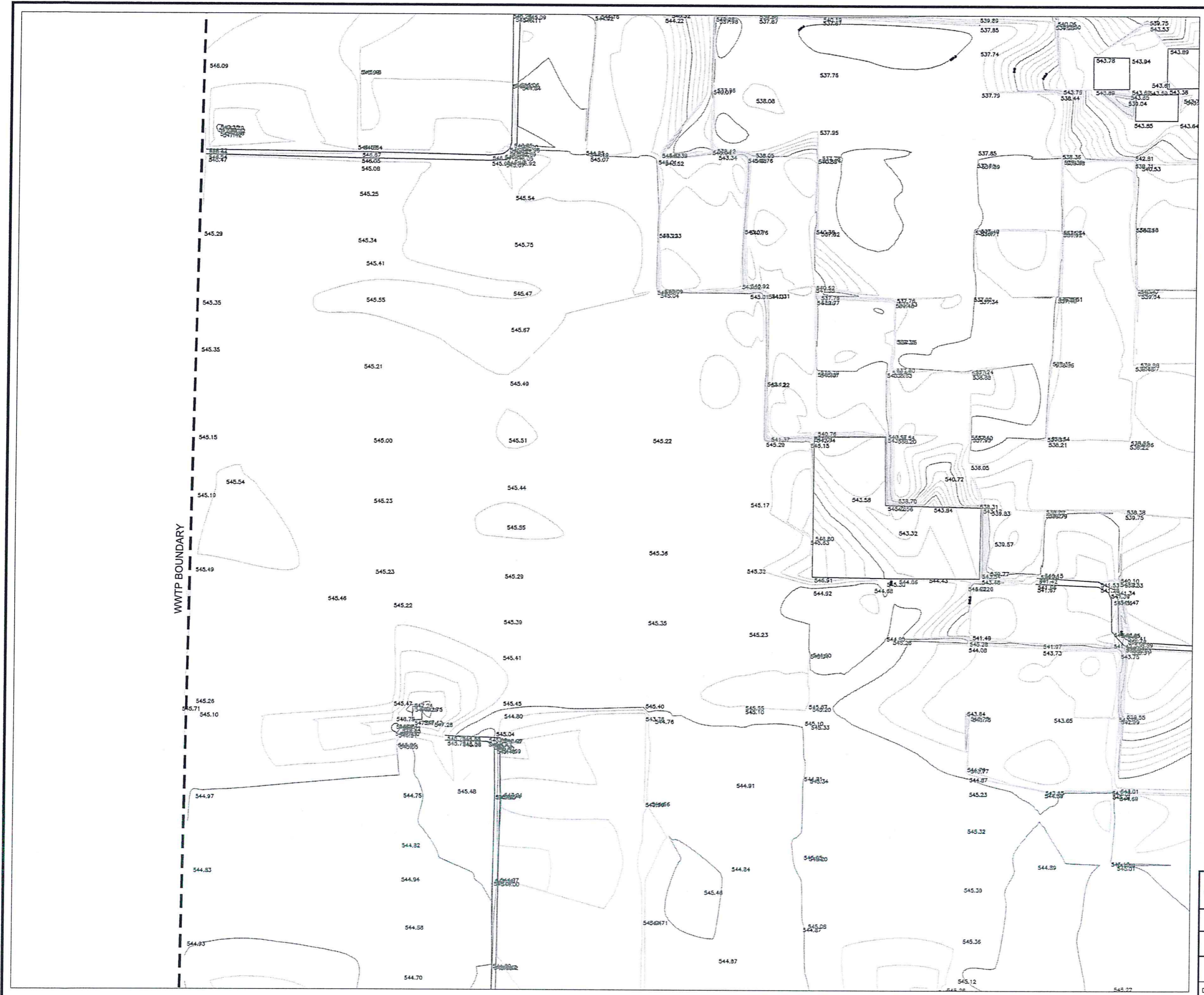
CONSTRUCTION OF WASTEWATER TREATMENT PLANT IN NORTH ZONE, SAHIWAL

TOPOGRAPHIC SURVEY OF WASTEWATER TREATMENT PLANT

NATIONAL ENGINEERING SERVICES PAKISTAN (PVT.) LTD. LAHORE


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REFERENCE DRAWINGS	REV. NO.	DATE	DESCRIPTION	BY	CKD	APPR



KEY PLAN



Prepared by:

 For and on behalf of
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SCALE 1"=130' (SHEET 3 OF 7)

PROGRAM MANAGEMENT UNIT, PUNJAB INTERMEDIATE CITIES IMPROVEMENT INVESTMENT PROGRAM (PICIP), LOCAL GOVERNMENT AND COMMUNITY DEVELOPMENT (LG & CD) DEPARTMENT, PUNJAB

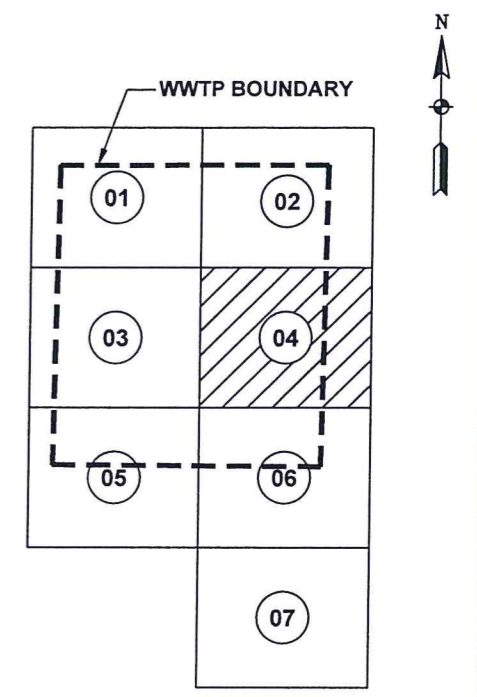
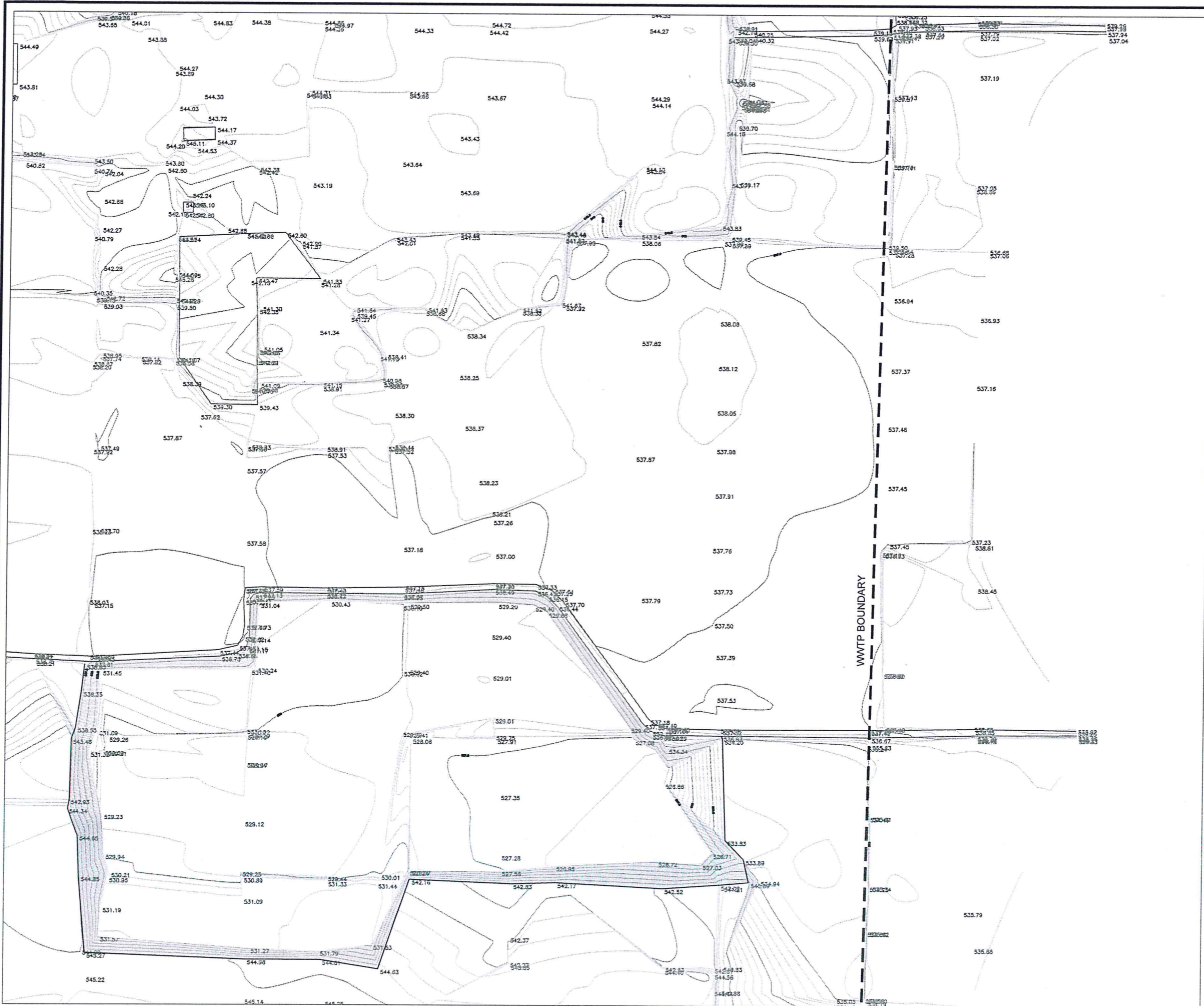
CONSTRUCTION OF WASTEWATER TREATMENT PLANT IN NORTH ZONE, SAHIWAL

TOPOGRAPHIC SURVEY OF WASTEWATER TREATMENT PLANT

NATIONAL ENGINEERING SERVICES PAKISTAN (PVT.) LTD. LAHORE

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SUBM: _____			REV. 0

REFERENCE DRAWINGS	REV. NO.	DATE	DESCRIPTION	BY	CKD	APPR



KEY PLAN

Prepared by: *[Signature]*
 For and on behalf of
 National Engineering Services
 Pakistan (Pvt.) Ltd. (NESPAK)

SCALE 1"=130' (SHEET 4 OF 7)

PROGRAM MANAGEMENT UNIT, PUNJAB INTERMEDIATE CITIES IMPROVEMENT INVESTMENT PROGRAM (PICIIIP), LOCAL GOVERNMENT AND COMMUNITY DEVELOPMENT (LG & CD) DEPARTMENT, PUNJAB

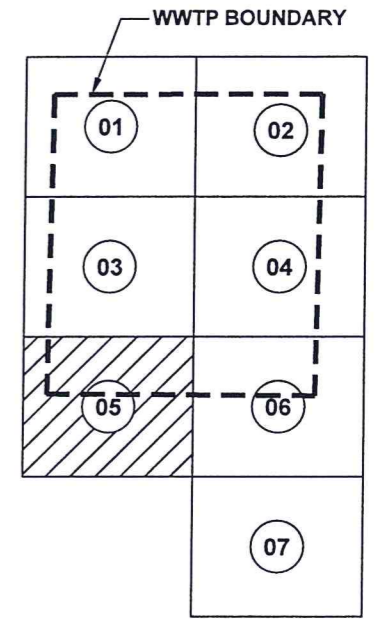
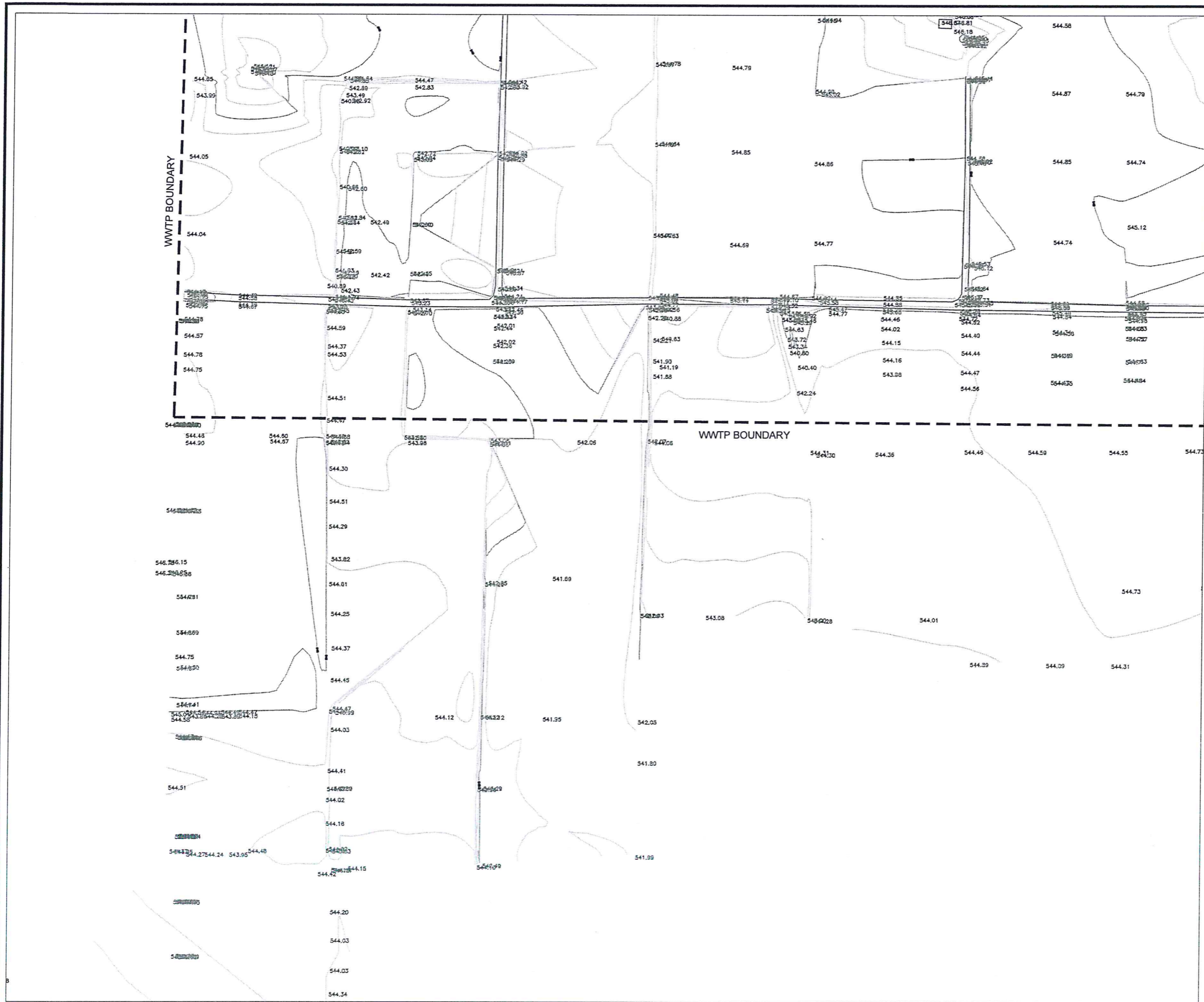
CONSTRUCTION OF WASTEWATER TREATMENT PLANT IN NORTH ZONE, SAHIWAL

TOPOGRAPHIC SURVEY OF WASTEWATER TREATMENT PLANT

NATIONAL ENGINEERING SERVICES PAKISTAN (PVT.) LTD. LAHORE

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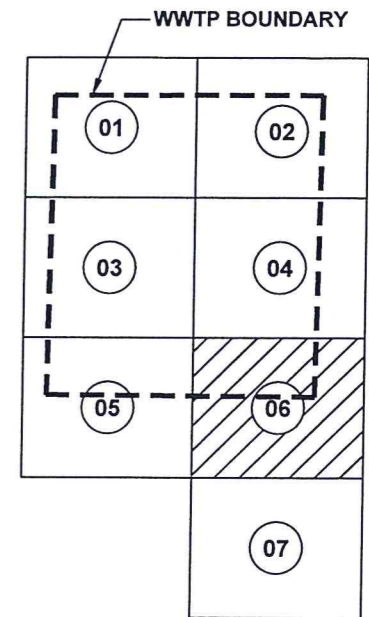
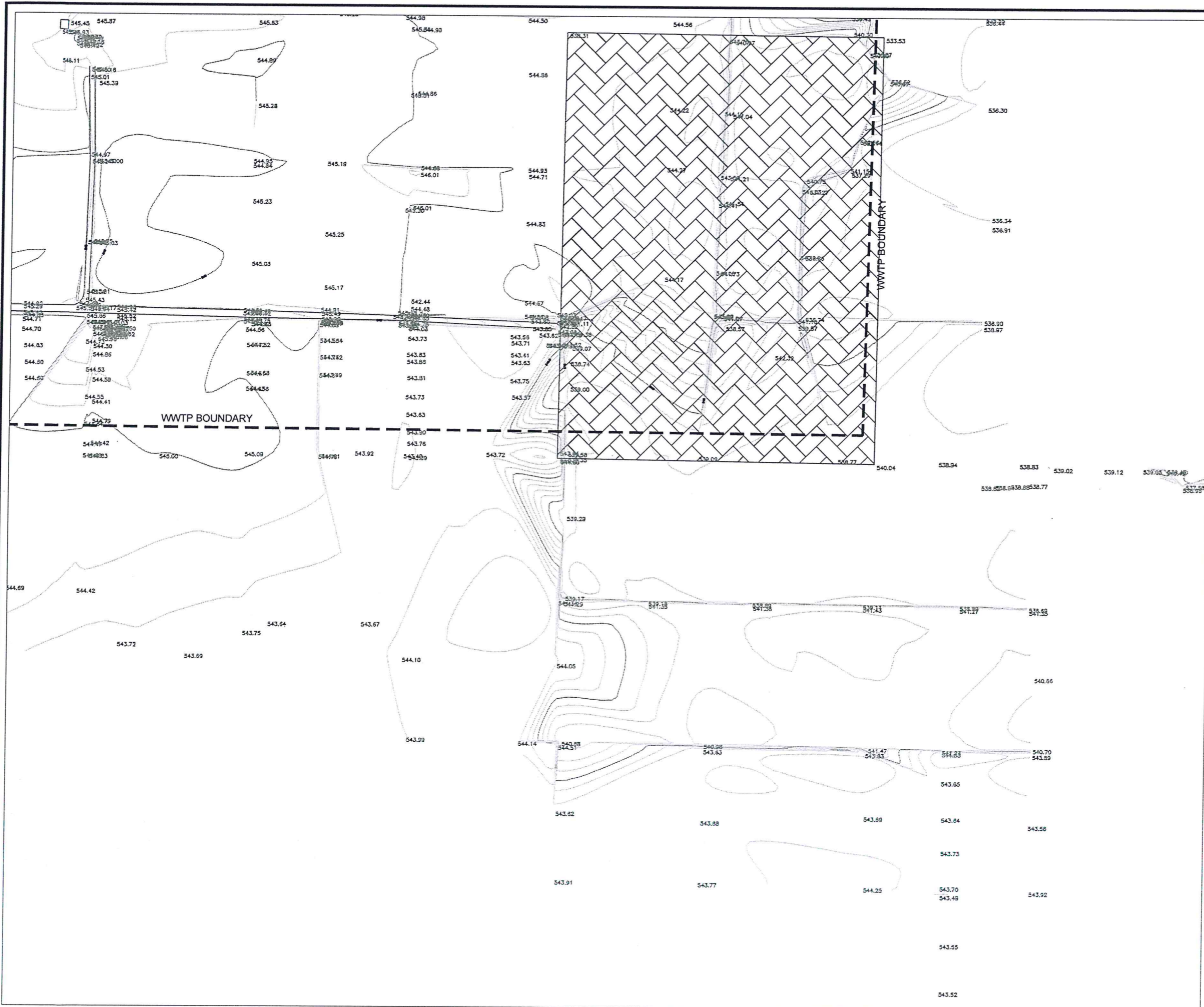
KEY PLAN

Prepared by: *[Signature]*
 For and on behalf of
 National Engineering Services
 Pakistan (Pvt.) Ltd. (NESPAK)

SCALE 1"=130' (SHEET 5 OF 7)

PROGRAM MANAGEMENT UNIT, PUNJAB INTERMEDIATE CITIES IMPROVEMENT INVESTMENT PROGRAM (PICIP), LOCAL GOVERNMENT AND COMMUNITY DEVELOPMENT (L.G & CD) DEPARTMENT, PUNJAB	
CONSTRUCTION OF WASTEWATER TREATMENT PLANT IN NORTH ZONE, SAHIWAL	
TOPOGRAPHIC SURVEY OF WASTEWATER TREATMENT PLANT	
NATIONAL ENGINEERING SERVICES PAKISTAN (PVT.) LTD. LAHORE	
DESIGNER: NESPAK	RECOMMENDED: VER./CKD. APPROVED
DWN. SARFRAZ	
FILE	DATE
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	SEP. 2023
	3976/11/TD/2J104
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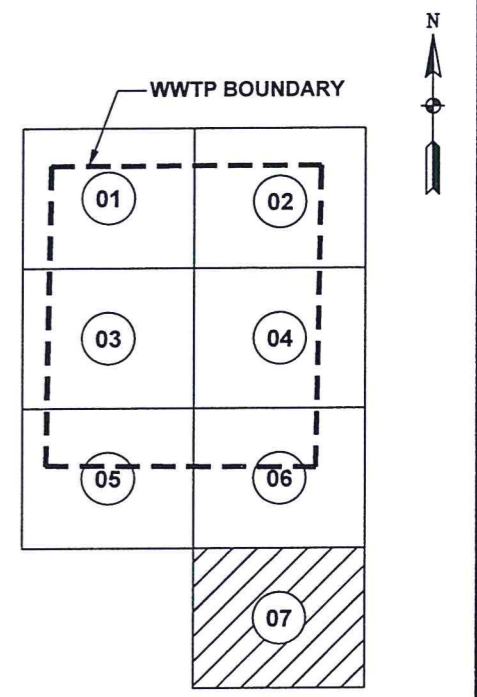
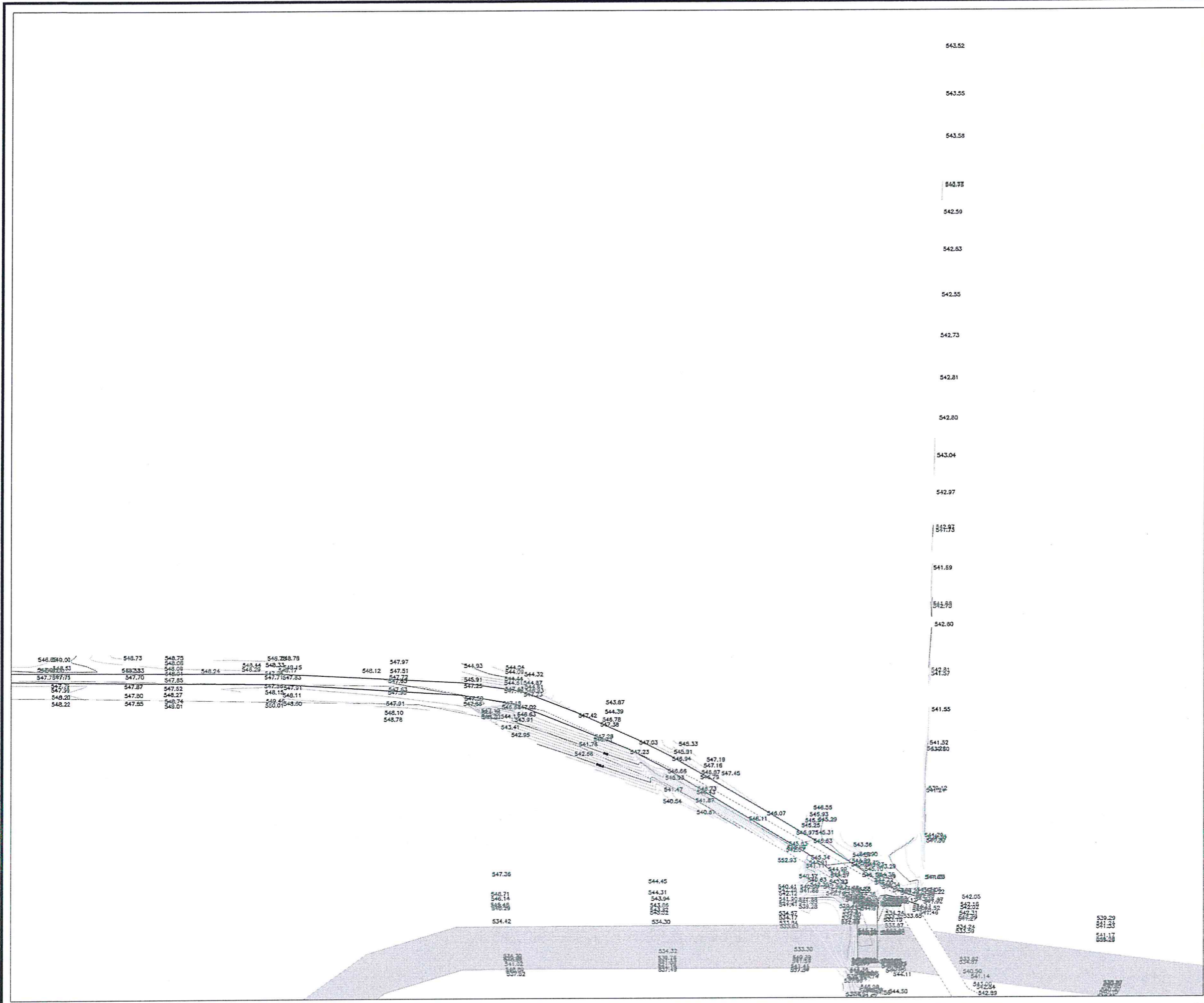


KEY PLAN

Prepared by *[Signature]*
 For and on behalf of
 National Engineering Services
 Pakistan (Pvt.) Ltd. Lahore

SCALE 1"=130' (SHEET 6 OF 7)

CONSTRUCTION OF WASTEWATER TREATMENT PLANT IN NORTH ZONE, SAHIWAL	
TOPOGRAPHIC SURVEY OF WASTEWATER TREATMENT PLANT	
DESN. NESPAK DWN. SARFRAZ	RECOMMENDED VER./CKD. APPROVED
FILE CKD. SUBV.	DATE SEP, 2023
REFERENCE DRAWINGS REV. NO. DATE DESCRIPTION BY CKD APPR	DRAWING NO. 3976/11/TD/2J104
	REV. 0



KEY PLAN

Prepared by: *[Signature]*
 For and on behalf of
 National Engineering Services
 Pakistan (Pvt.) Ltd. (NESPAK)

SCALE 1"=130' (SHEET 7 OF 7)

PROGRAM MANAGEMENT UNIT, PUNJAB INTERMEDIATE CITIES IMPROVEMENT INVESTMENT PROGRAM (PICIP), LOCAL GOVERNMENT AND COMMUNITY DEVELOPMENT (LG & CD) DEPARTMENT, PUNJAB

CONSTRUCTION OF WASTEWATER TREATMENT PLANT IN NORTH ZONE, SAHIWAL

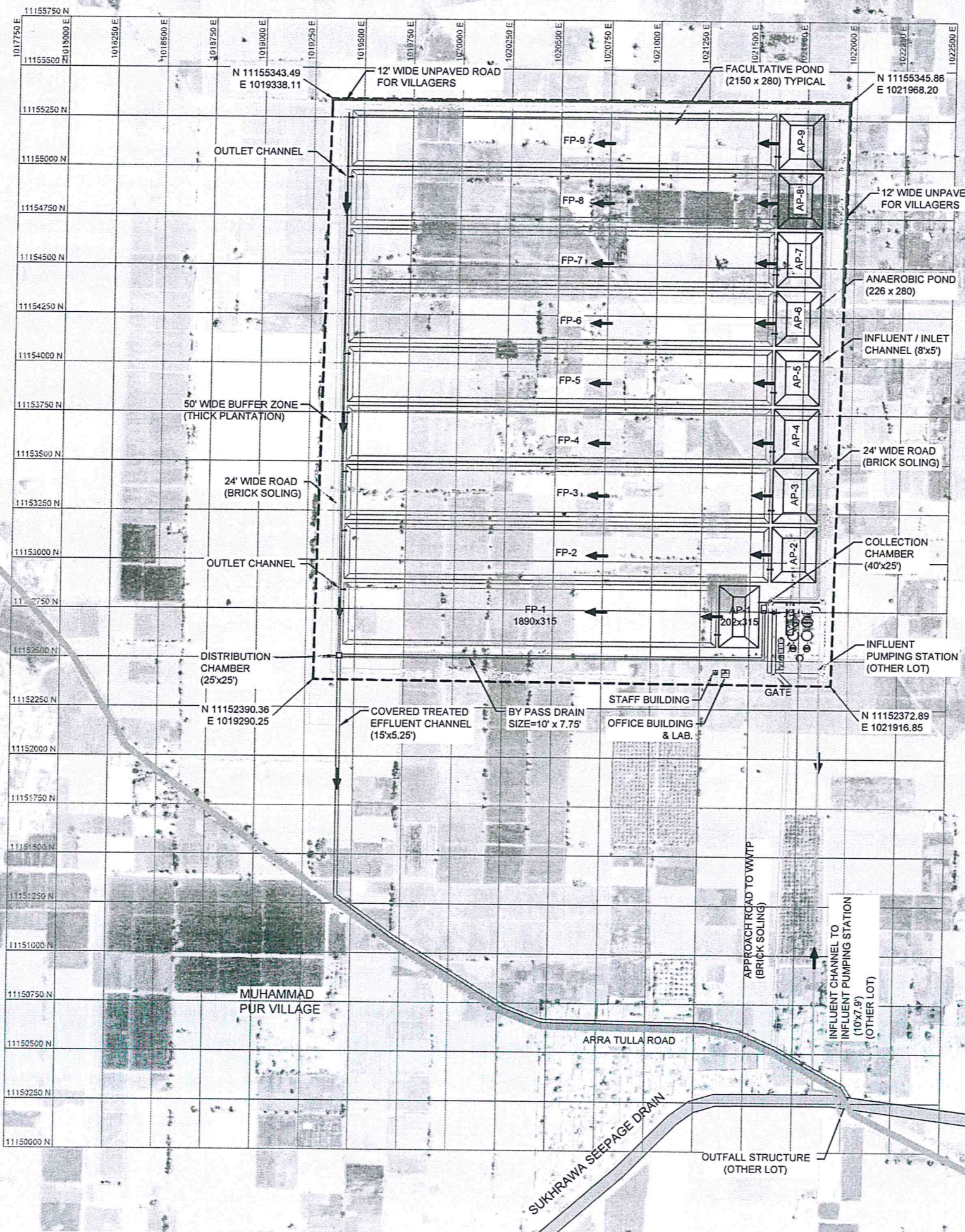
TOPOGRAPHIC SURVEY OF WASTEWATER TREATMENT PLANT

NATIONAL ENGINEERING SERVICES PAKISTAN (PVT.) LTD. LAHORE

DESIGN: NESPAK	RECOMMENDED	VER./CKD.	APPROVED
DWN.: SARFRAZ			
FILE	DATE	DRAWING NO.	REV.
CKD.	SEP. 2023	3976/11/TD/2J104	0
SUBM.			

REFERENCE DRAWINGS	REV. NO.	DATE	DESCRIPTION	BY	CKD	APPR

WWTP DRAWINGS




LEGEND

- STP BOUNDARY WALL
- ROAD
- TREATED EFFLUENT CHANNEL
- INFLUENT / INLET CHANNEL
- SUKHRAWA SEEPAGE DRAIN

NOTES

1. FOR GENERAL NOTES AND LEGENDS SEE DRAWING NO. 3976/11/TD/2J100.
2. READ THIS DRAWING IN CONJUNCTION WITH ALL OTHER RELEVANT DRAWINGS.

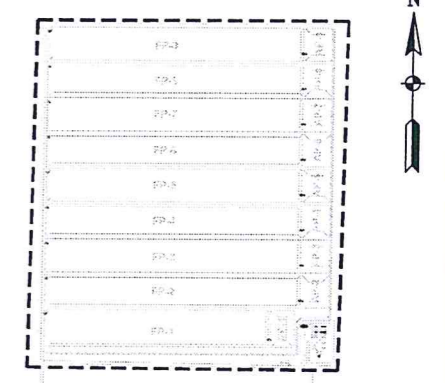
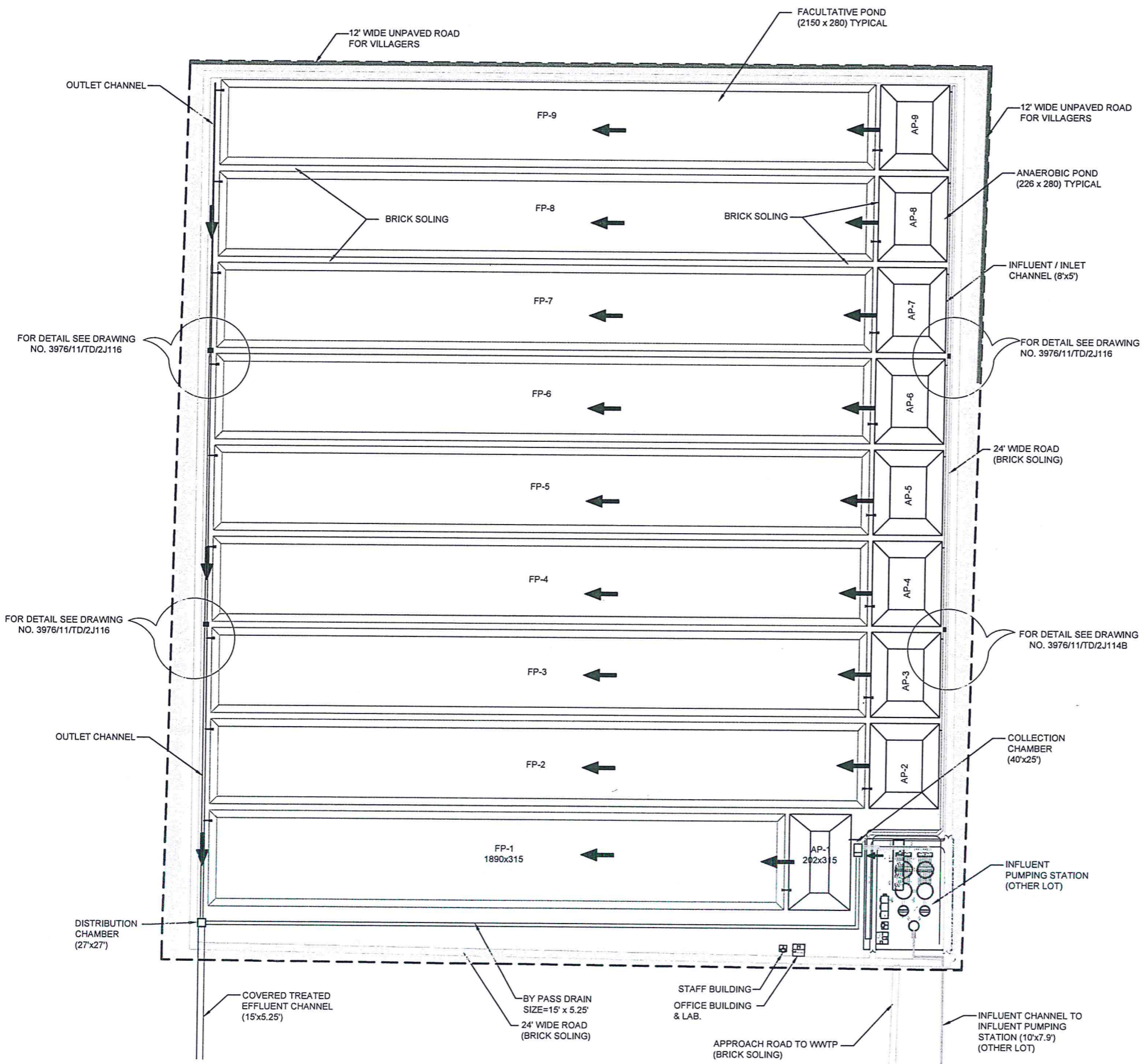
Prepared by: 

For and on behalf of
National Engineering Services
Pakistan (Pvt.) Ltd. (NESPAK)

SCALE 1"=600' (SHEET 1 OF 3)

			
PROGRAM MANAGEMENT UNIT, PUNJAB INTERMEDIATE CITIES IMPROVEMENT INVESTMENT PROGRAM (PICIP), LOCAL GOVERNMENT AND COMMUNITY DEVELOPMENT (LG & CD) DEPARTMENT, PUNJAB			
CONSTRUCTION OF WASTEWATER TREATMENT PLANT IN NORTH ZONE, SAHIWAL			
WASTEWATER TREATMENT PLANT LAYOUT PLAN			
 NATIONAL ENGINEERING SERVICES PAKISTAN (PVT.) LTD. LAHORE			
DESIGNER: NESPAK	RECOMMENDED	VER./CKD.	APPROVED
DRAWN: SARFRAZ			
FILE	DATE	DRAWING NO.	
CKD.	SEP. 2023	3976/11/TD/2J106	
SUBM.			REV. 0

REFERENCE DRAWINGS	REV. NO.	DATE	DESCRIPTION	BY	CKD	APPR



KEY PLAN

POND	LENGTH (ft)	WIDTH (ft)	WATER DEPTH (ft)
ANAEROBIC POND - 1	202	315	16.4
ANAEROBIC POND - 2 TO 9	226	280	16.4
FACULTATIVE POND - 1	1890	315	6.56
FACULTATIVE POND - 2 TO 9	2150	280	6.56
INFLUENT/ INLET CHANNEL	2738	8	3.5
TREATED EFFLUENT CHANNEL	4110	15	5.25
BYPASS CHANNEL	2383	10	8.5
OUT LET CHANNEL	2745	2.5 - 7.5	3.5 - 5.0

NOTES

- FOR GENERAL NOTES AND LEGENDS SEE DRAWING NO. 3976/11/TD/2J100.
- READ THIS DRAWING IN CONJUNCTION WITH ALL OTHER RELEVANT DRAWINGS.

For and on behalf of
National Engineering Services
Pakistan (Pvt.) Ltd. (NESPAK)

SCALE 1"=350' (SHEET 2 OF 3)

PROGRAM MANAGEMENT UNIT, PUNJAB INTERMEDIATE CITIES IMPROVEMENT INVESTMENT PROGRAM (PICIP), LOCAL GOVERNMENT AND COMMUNITY DEVELOPMENT (LG & CD) DEPARTMENT, PUNJAB

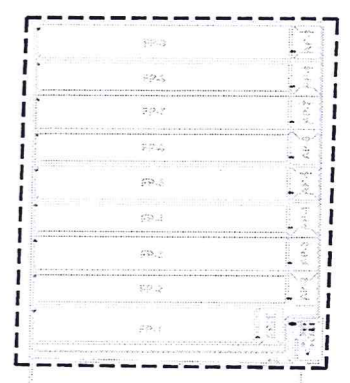
CONSTRUCTION OF WASTEWATER TREATMENT PLANT IN NORTH ZONE, SAHIWAL

WASTEWATER TREATMENT PLANT BLOWUP - LAYOUT PLAN

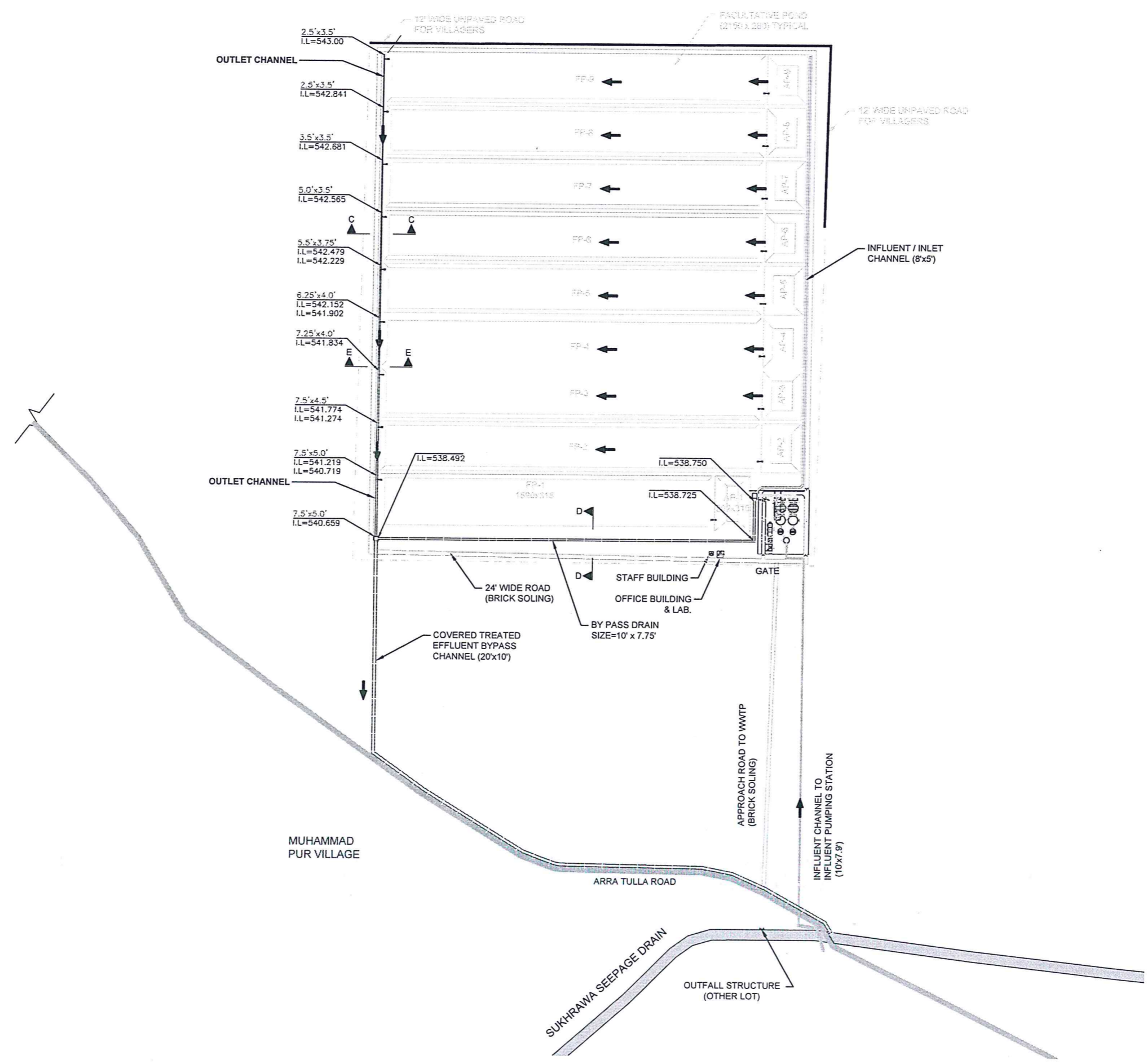
NATIONAL ENGINEERING SERVICES PAKISTAN (PVT.) LTD. LAHORE

DESIGNER: NESPAK	RECOMMENDED	VER./CKD.	APPROVED
DWN. SARFRAZ			
FILE	DATE	DRAWING NO.	
CKD.	SEP. 2023	3976/11/TD/2J106	
SUBM.			REV. 0

REFERENCE DRAWINGS	REV. NO.	DATE	DESCRIPTION	BY	CKD	APPR



KEY PLAN



NOTES

1. FOR GENERAL NOTES AND LEGENDS SEE DRAWING NO. 3976/11/TD/2J100.
2. READ THIS DRAWING IN CONJUNCTION WITH ALL OTHER RELEVANT DRAWINGS.

Prepared by: *[Signature]*
 For and on behalf of
 National Engineering Services
 Pakistan (Pvt.) Ltd. (NESPAK)

SCALE 1"=600' (SHEET 3 OF 3)

PROGRAM MANAGEMENT UNIT, PUNJAB INTERMEDIATE CITIES IMPROVEMENT INVESTMENT PROGRAM (PICIP), LOCAL GOVERNMENT AND COMMUNITY DEVELOPMENT (LG & CD) DEPARTMENT, PUNJAB

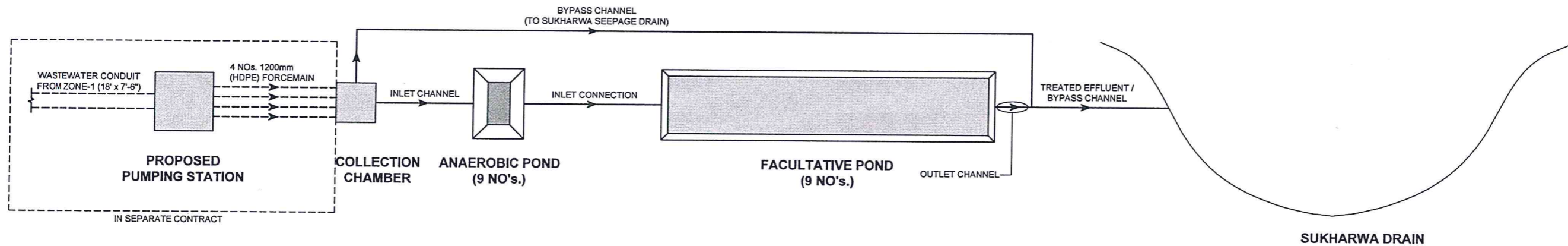
CONSTRUCTION OF WASTEWATER TREATMENT PLANT IN NORTH ZONE, SAHIWAL

WASTEWATER TREATMENT PLANT INLET, TREATED EFFLUENT & BYPASS CHANNEL LAYOUT PLAN

NATIONAL ENGINEERING SERVICES PAKISTAN (PVT.) LTD. LAHORE

DESIGNER: NESPAK	RECOMMENDED: _____	VER./CKD: _____	APPROVED: _____
DOWN: SARFRAZ	DATE: _____	DRAWING NO.: 3976/11/TD/2J106	REV.: 0
FILE: _____	SUBM: _____	SEP. 2023	

REFERENCE DRAWINGS	REV. NO.	DATE	DESCRIPTION	BY	CKD	APPR

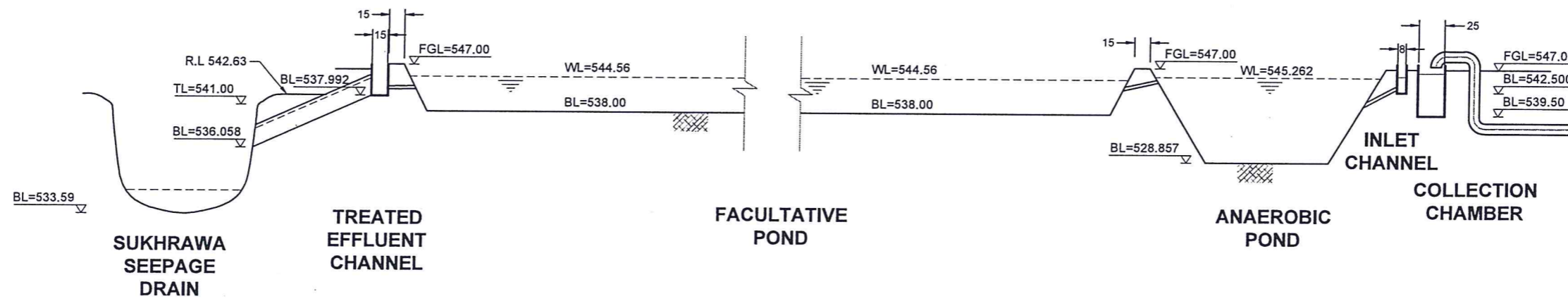


NOTES

1. FOR GENERAL NOTES AND LEGENDS SEE DRAWING NO. 3976/11/TD/2J100.
2. READ THIS DRAWING IN CONJUNCTION WITH ALL OTHER RELEVANT DRAWINGS.

For and on behalf of
 National Engineering Services
 Pakistan (Pvt.) Ltd. (NESPAK)

PROGRAM MANAGEMENT UNIT, PUNJAB INTERMEDIATE CITIES IMPROVEMENT INVESTMENT PROGRAM (PICIP), LOCAL GOVERNMENT AND COMMUNITY DEVELOPMENT (LG & CD) DEPARTMENT, PUNJAB	
CONSTRUCTION OF WASTEWATER TREATMENT PLANT IN NORTH ZONE, SAHIWAL	
WASTEWATER TREATMENT PLANT PROCESS FLOW DIAGRAM (SCHEMATIC)	
NATIONAL ENGINEERING SERVICES PAKISTAN (PVT.) LTD. LAHORE	
DESN. NESPAK DWN. SARFRAZ	RECOMMENDED VER./CKD. APPROVED
FILE CKD. SUBM.	DATE SEP. 2023
REFERENCE DRAWINGS REV. NO. DATE DESCRIPTION BY CKD APPR	DRAWING NO. 3976/11/TD/2J107
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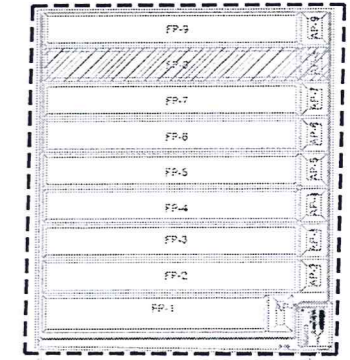
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1. FOR GENERAL NOTES AND LEGENDS SEE DRAWING NO. 3976/11/TD/2J100.
2. READ THIS DRAWING IN CONJUNCTION WITH ALL OTHER RELEVANT DRAWINGS.

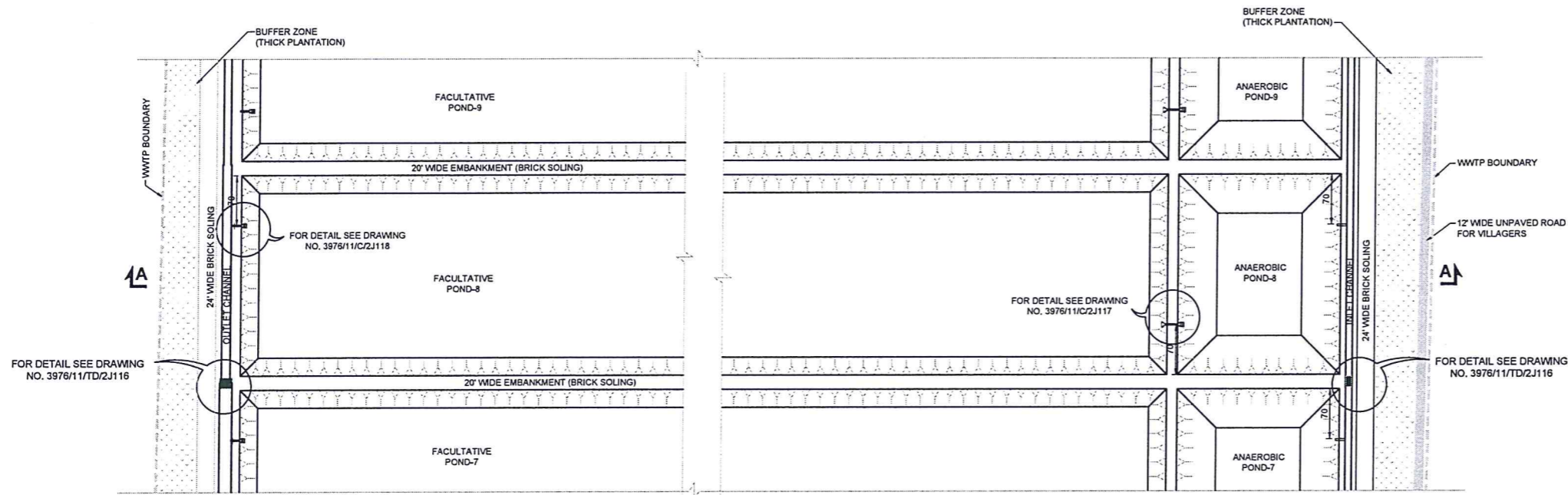
Prepared by: *[Signature]*
 For and on behalf of
 National Engineering Services

PROGRAM MANAGEMENT UNIT, PUNJAB INTERMEDIATE CITIES IMPROVEMENT INVESTMENT PROGRAM (PICIP), LOCAL GOVERNMENT AND COMMUNITY DEVELOPMENT (LG & CD) DEPARTMENT, PUNJAB			
CONSTRUCTION OF WASTEWATER TREATMENT PLANT IN NORTH ZONE, SAHIWAL			
WASTEWATER TREATMENT PLANT HYDRAULIC PROFILE (MODULE 01 TO 9)			
NATIONAL ENGINEERING SERVICES PAKISTAN (PVT.) LTD. LAHORE			
DESN. NESPAK DWN. SARFRAZ	RECOMMENDED	VER./CKD.	APPROVED
FILE CKD.	DATE SEP. 2023	DRAWING NO. 3976/11/TD/2J108	REV. 0

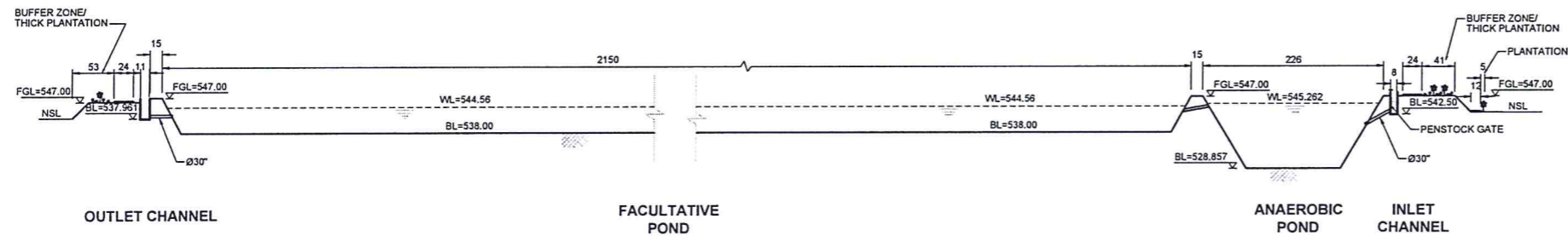
REFERENCE DRAWINGS	REV.NO.	DATE	DESCRIPTION	BY	CKD	APPR



KEY PLAN



PLAN



SECTION A-A

NOTES

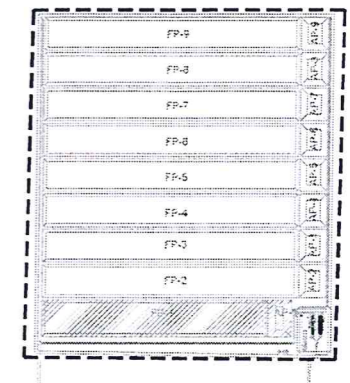
1. FOR GENERAL NOTES AND LEGENDS SEE DRAWING NO. 3976/11/TD/2J100.
2. READ THIS DRAWING IN CONJUNCTION WITH ALL OTHER RELEVANT DRAWINGS.

Prepared by: *[Signature]*
 For and on behalf of
 National Engineering Services
 Pakistan (Pvt.) Ltd. (NESPAK)

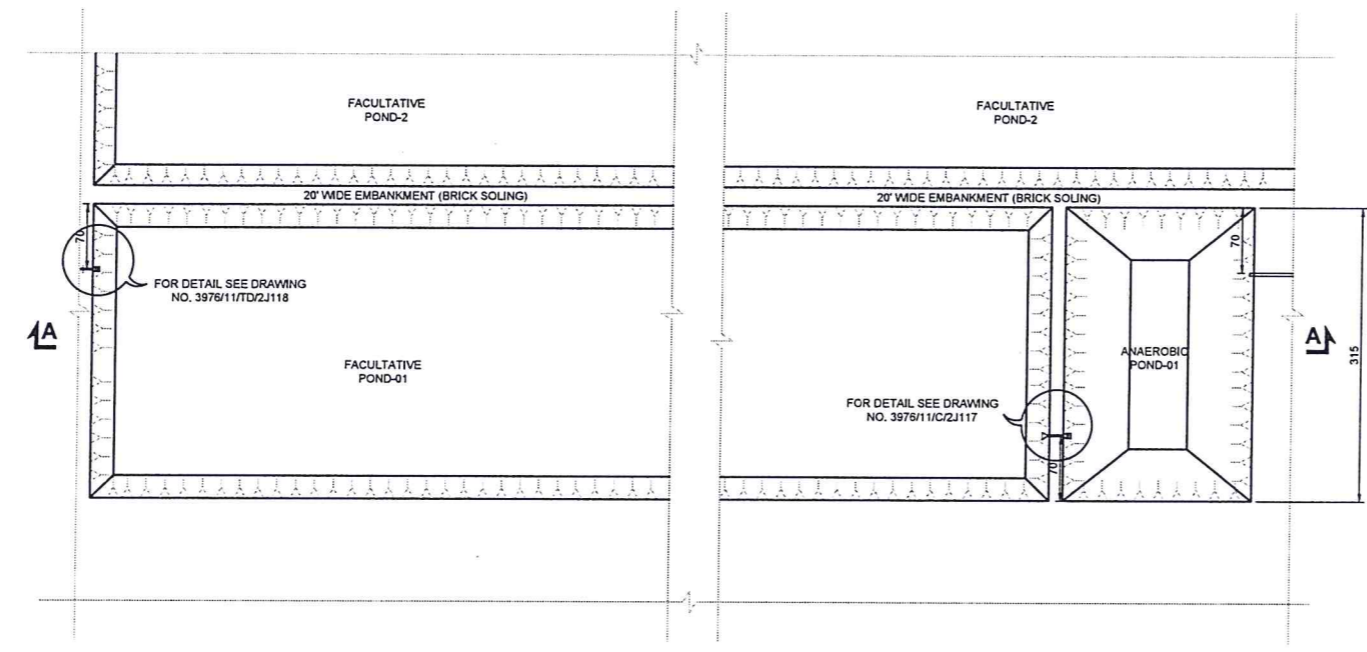
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PROGRAM MANAGEMENT UNIT, PUNJAB INTERMEDIATE CITIES IMPROVEMENT INVESTMENT PROGRAM (PICIP), LOCAL GOVERNMENT AND COMMUNITY DEVELOPMENT (LG & CD) DEPARTMENT, PUNJAB			
CONSTRUCTION OF WASTEWATER TREATMENT PLANT IN NORTH ZONE, SAHIWAL			
ANAEROBIC AND FACULTATIVE POND PLAN AND SECTION (MODULE 02 TO 9)			
NATIONAL ENGINEERING SERVICES PAKISTAN (PVT.) LTD. LAHORE			
DESN. NESPAK DWN. SARFRAZ FILE CKD. SUBM.	RECOMMENDED VER./CKD. APPROVED	DATE SEP. 2023	DRAWING NO. 3976/11/TD/2J109 REV. 0

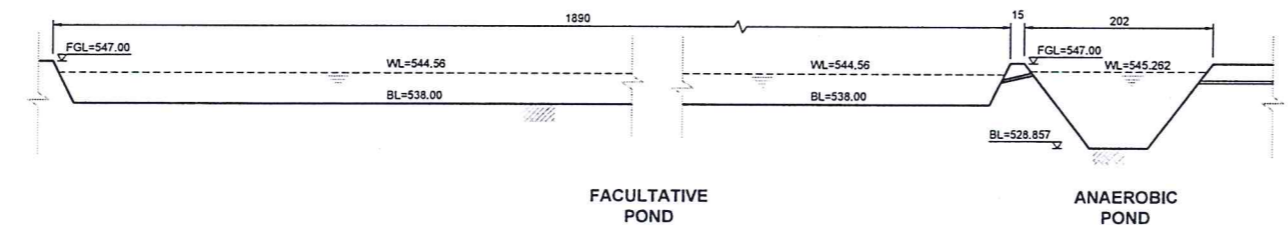
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KEY PLAN



PLAN



SECTION A-A

NOTES

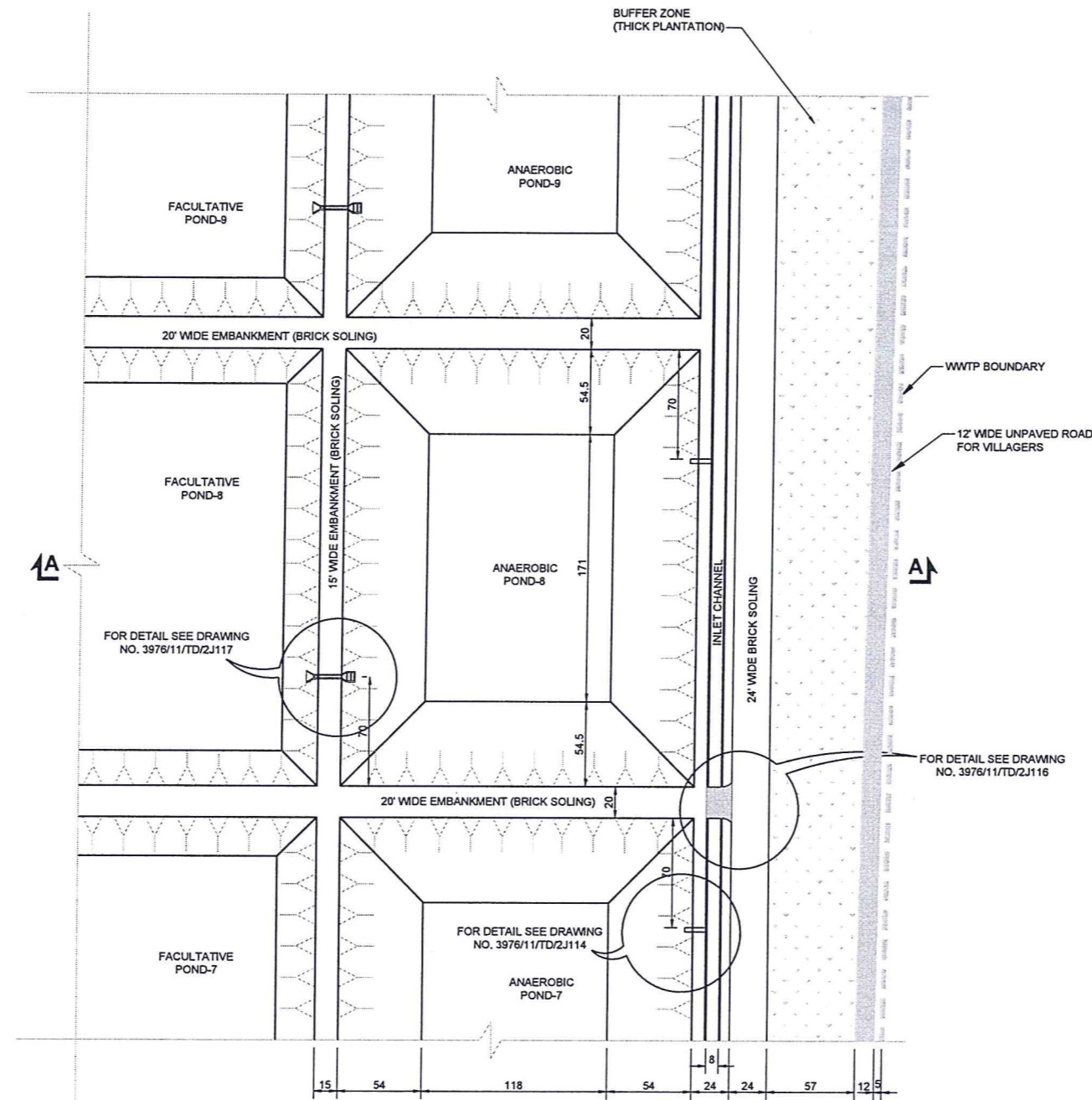
1. FOR GENERAL NOTES AND LEGENDS SEE DRAWING NO. 3976/11/TD/2J100.
2. READ THIS DRAWING IN CONJUNCTION WITH ALL OTHER RELEVANT DRAWINGS.

Prepared by: *[Signature]*
 For and on behalf of
 National Engineering Services
 Pakistan (Pvt.) Ltd. (NESPAK)

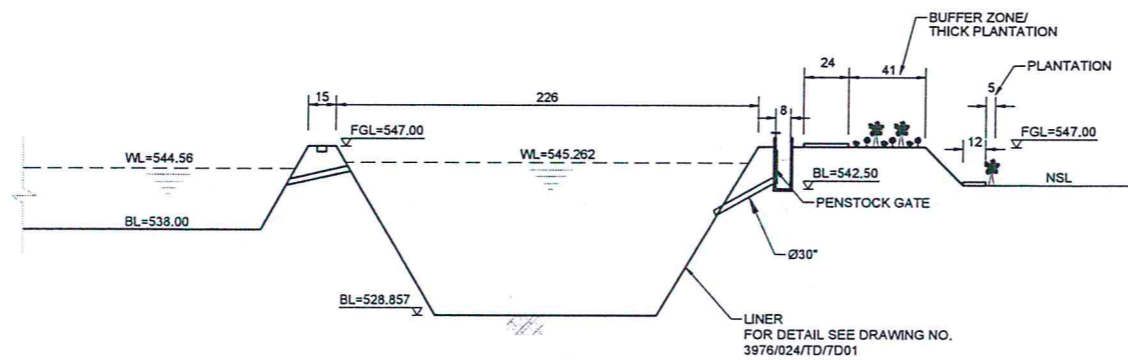
HOR: 1"=200'
 VER: 1"=40'

PROGRAM MANAGEMENT UNIT, PUNJAB INTERMEDIATE CITIES IMPROVEMENT INVESTMENT PROGRAM (PICIP), LOCAL GOVERNMENT AND COMMUNITY DEVELOPMENT (LG & CD) DEPARTMENT, PUNJAB	
CONSTRUCTION OF WASTEWATER TREATMENT PLANT IN NORTH ZONE, SAHIWAL	
ANAEROBIC(AP-01) AND FACULTATIVE (FP-01) POND - PLAN AND SECTION (MODULE - 01)	
NATIONAL ENGINEERING SERVICES PAKISTAN (PVT.) LTD. LAHORE	
DESN. NESPAK DWN. SARFRAZ	RECOMMENDED VER./CKD. APPROVED
FILE CKD. DATE SUBM.	DRAWING NO. 3976/11/TD/2J109A REV. 0

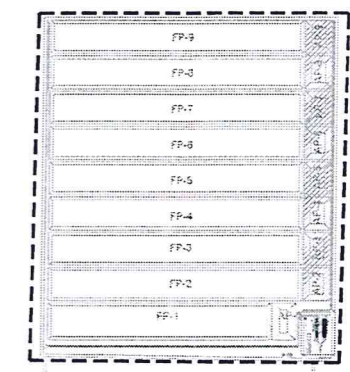
REFERENCE DRAWINGS	REV. NO.	DATE	DESCRIPTION	BY	CKD	APPR



PLAN



SECTION A-A



KEY PLAN

NOTES

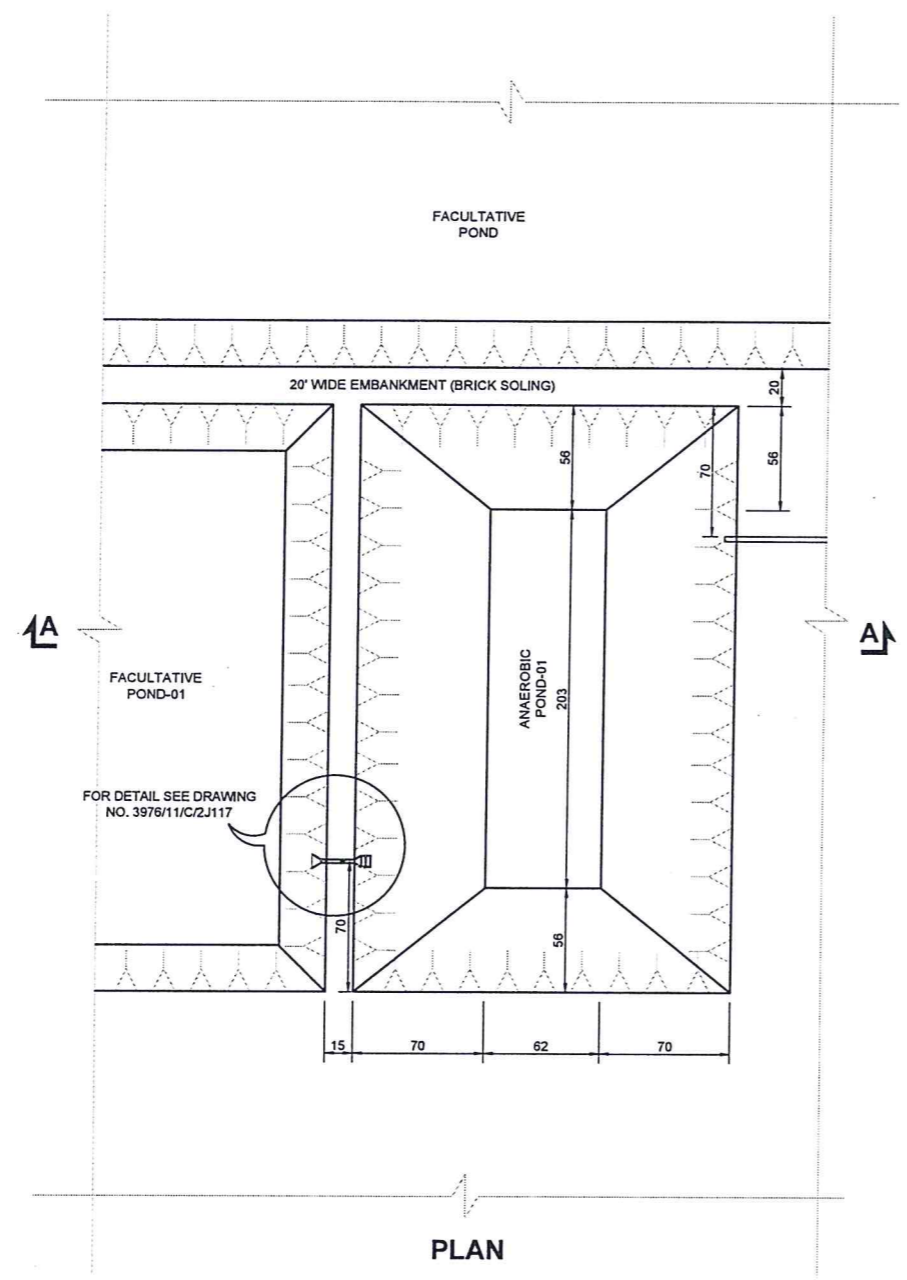
1. FOR GENERAL NOTES AND LEGENDS SEE DRAWING NO. 3976/11/TD/2J100.
2. READ THIS DRAWING IN CONJUNCTION WITH ALL OTHER RELEVANT DRAWINGS.

Prepared by: *[Signature]*
 For and on behalf of
 National Engineering Services
 Pakistan (Pvt.) Ltd. (NESPAK)

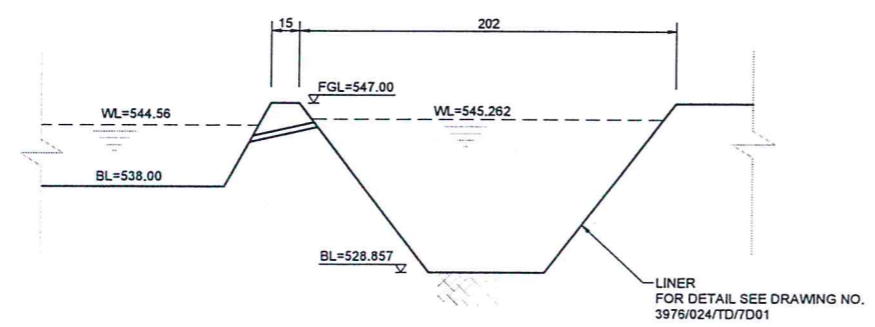
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 VER: 1"=20'

PROGRAM MANAGEMENT UNIT, PUNJAB INTERMEDIATE CITIES IMPROVEMENT INVESTMENT PROGRAM (PICIP), LOCAL GOVERNMENT AND COMMUNITY DEVELOPMENT (LG & CD) DEPARTMENT, PUNJAB			
CONSTRUCTION OF WASTEWATER TREATMENT PLANT IN NORTH ZONE, SAHIWAL			
ANAEROBIC POND (AP-02 TO AP-9) PLAN AND SECTION			
NATIONAL ENGINEERING SERVICES PAKISTAN (PVT.) LTD. LAHORE			
DESIGN: NESPAK	RECOMMENDED	VER./CKD.	APPROVED
DWN: SARFRAZ			
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CKD: _____	SEP. 2023	3976/11/TD/2J110	0
SUBM: _____			

REFERENCE DRAWINGS	REV. NO.	DATE	DESCRIPTION	BY	CKD	APPR



PLAN



FACULTATIVE POND

ANAEROBIC POND

SECTION A-A



KEY PLAN

NOTES

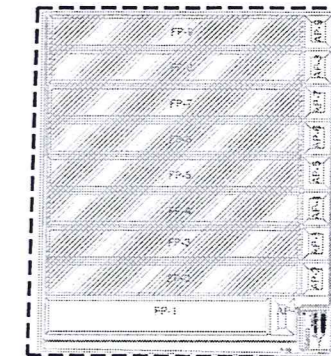
1. FOR GENERAL NOTES AND LEGENDS SEE DRAWING NO. 3976/11/TD/2J100.
2. READ THIS DRAWING IN CONJUNCTION WITH ALL OTHER RELEVANT DRAWINGS.

Prepared by: *[Signature]*
 For and on behalf of
 National Engineering Services
 Pakistan (Pvt.) Ltd. (NESPAC)

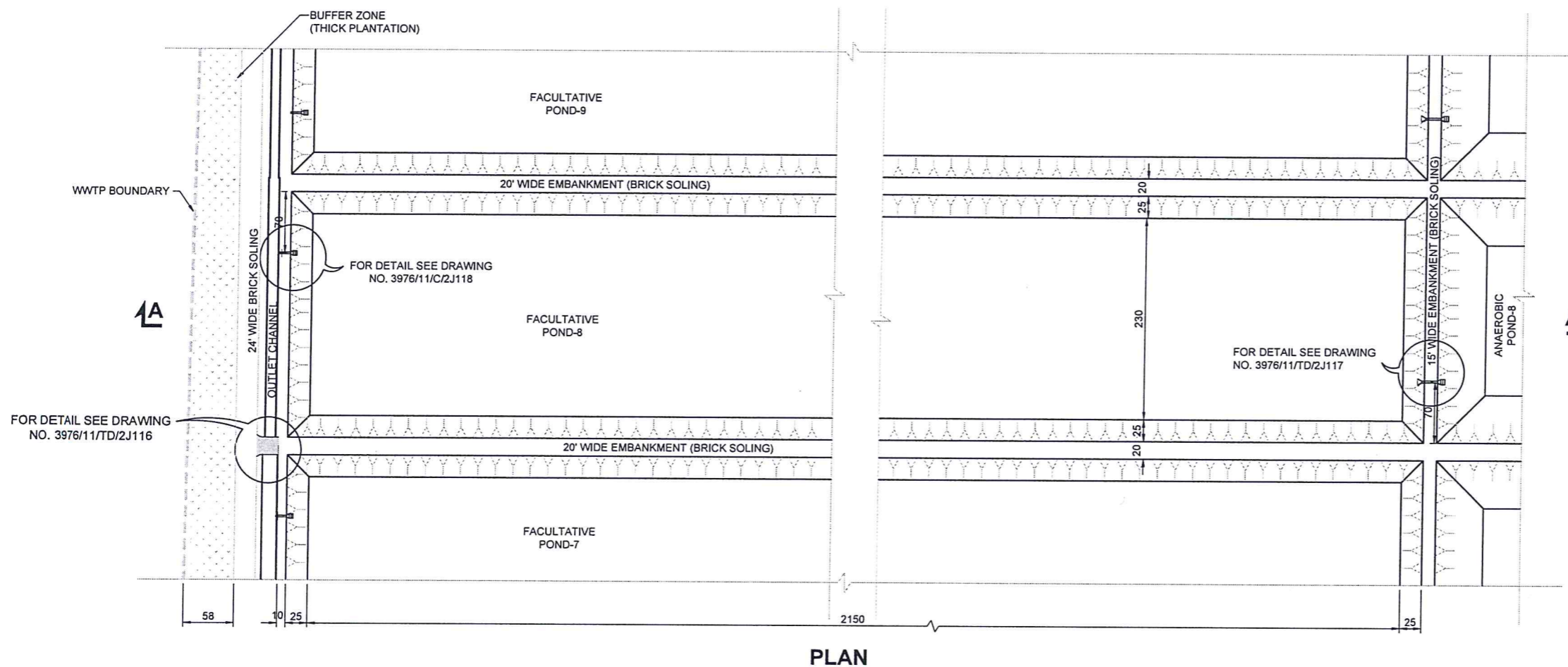
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CONSTRUCTION OF WASTEWATER TREATMENT PLANT IN NORTH ZONE, SAHIWAL	
ANAEROBIC POND (AP-01) PLAN AND SECTION	
NATIONAL ENGINEERING SERVICES PAKISTAN (PVT.) LTD. LAHORE	
DESN_ NESPAC DWN_ SARFRAZ FILE CKD SUBM	RECOMMENDED VER./CKD APPROVED DATE SEP. 2023
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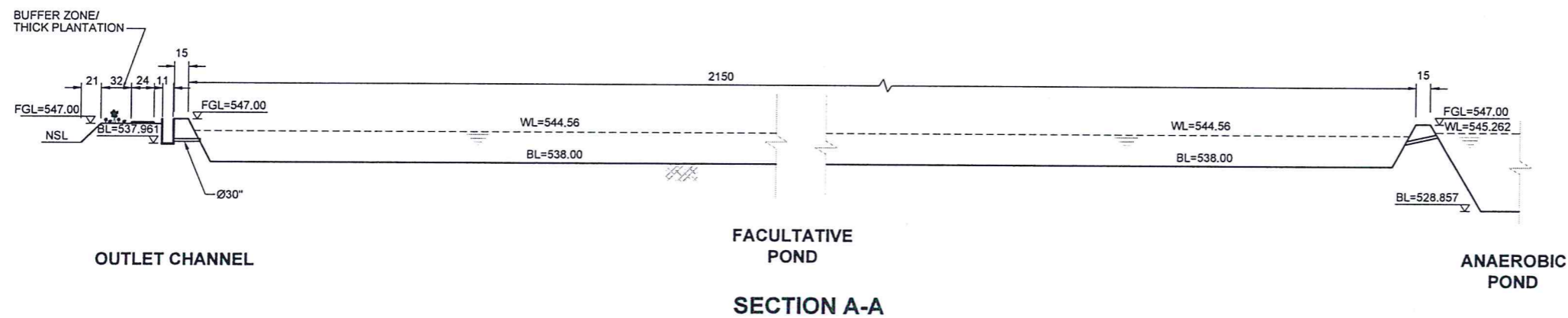
REFERENCE DRAWINGS	REV.NO.	DATE	DESCRIPTION	BY	CKD	APPR



KEY PLAN



PLAN



SECTION A-A

NOTES

1. FOR GENERAL NOTES AND LEGENDS SEE DRAWING NO. 3976/11/TD/2J100.
2. READ THIS DRAWING IN CONJUNCTION WITH ALL OTHER RELEVANT DRAWINGS.

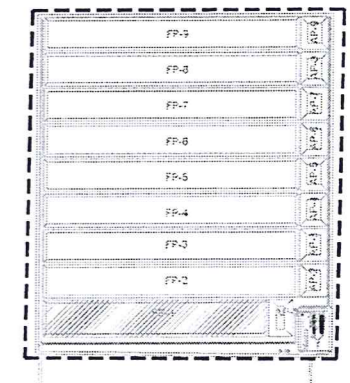
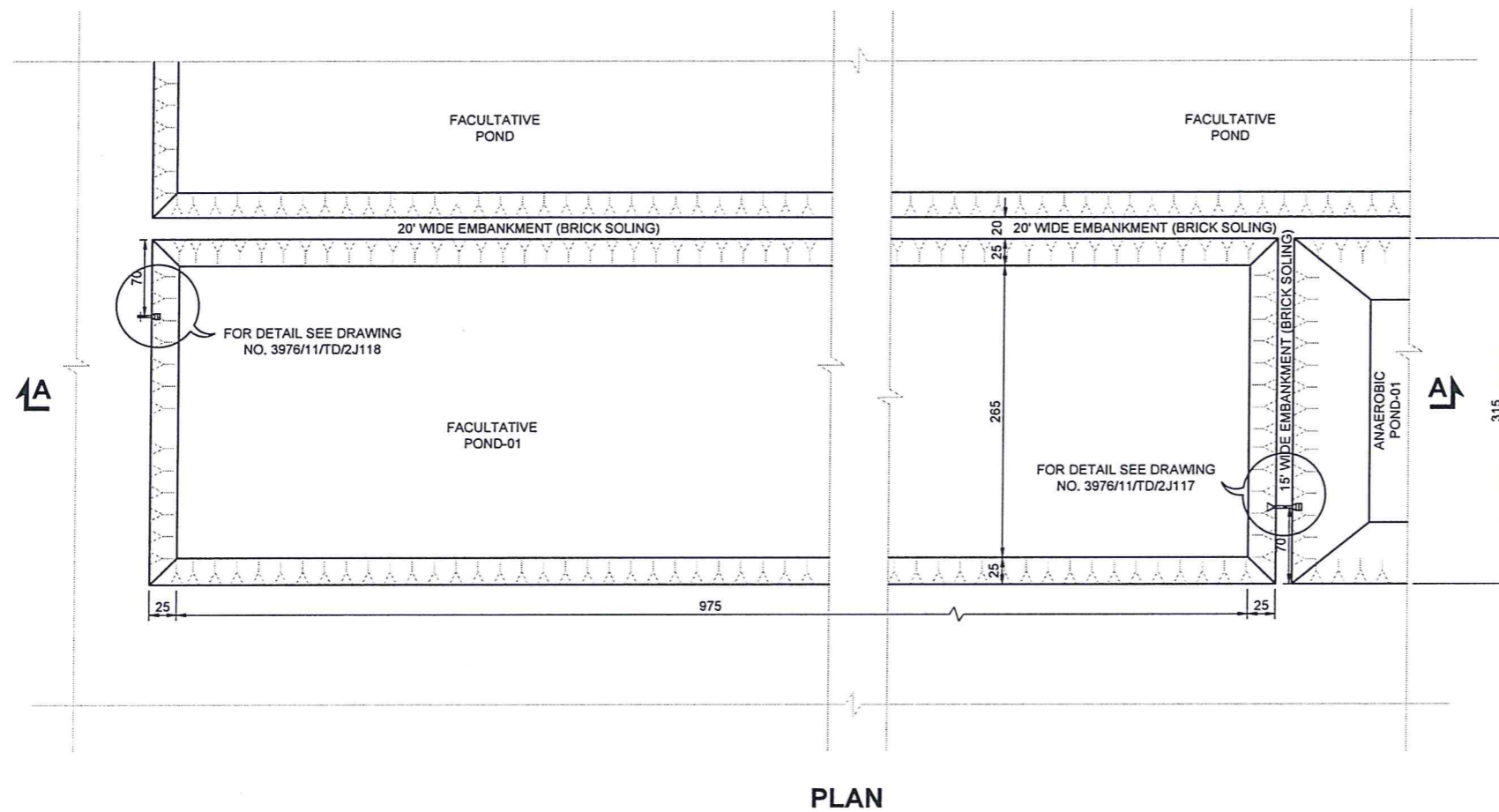
Prepared by: *[Signature]*

For and on behalf of
National Engineering Services
Pakistan (Pvt.) Ltd. (NESPAK)

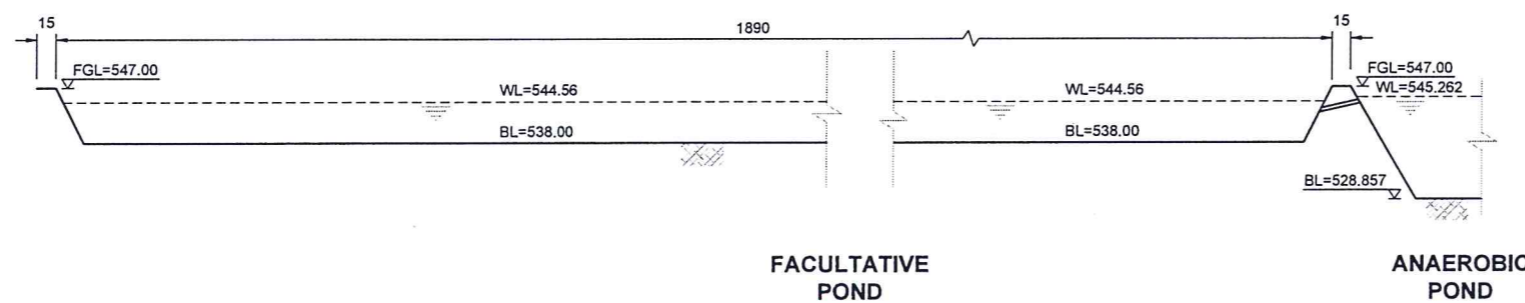
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PROGRAM MANAGEMENT UNIT, PUNJAB INTERMEDIATE CITIES IMPROVEMENT INVESTMENT PROGRAM (PCCIIP), LOCAL GOVERNMENT AND COMMUNITY DEVELOPMENT (LG & CD) DEPARTMENT, PUNJAB			
CONSTRUCTION OF WASTEWATER TREATMENT PLANT IN NORTH ZONE, SAHIWAL			
FACULTATIVE POND (FP-02 TO FP-9) PLAN AND SECTION			
NATIONAL ENGINEERING SERVICES PAKISTAN (PVT.) LTD. LAHORE			
DESIGNER: NESPAK	RECOMMENDED	VER./CKD.	APPROVED
DWN. SARFRAZ			
FILE	DATE	DRAWING NO.	REV.
CKD.	SEP. 2023	3976/11/TD/2J111	0
SUBM.			

REFERENCE DRAWINGS	REV. NO.	DATE	DESCRIPTION	BY	CKD	APPR



KEY PLAN



FACULTATIVE POND ANAEROBIC POND

SECTION A-A

NOTES

- FOR GENERAL NOTES AND LEGENDS SEE DRAWING NO. 3976/11/TD/2J100.
- READ THIS DRAWING IN CONJUNCTION WITH ALL OTHER RELEVANT DRAWINGS.

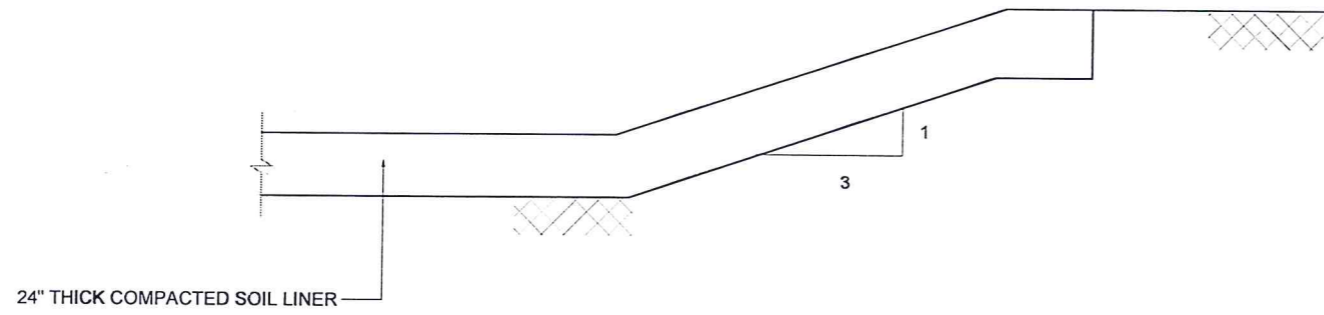
Prepared by: *[Signature]*

For and on behalf of
National Engineering Services
Pakistan (Pvt.) Ltd. (NESPAK)

HOR: 1"=150'
VER: 1"=30'


PROGRAM MANAGEMENT UNIT, PUNJAB INTERMEDIATE CITIES IMPROVEMENT INVESTMENT PROGRAM (PICIP), LOCAL GOVERNMENT AND COMMUNITY DEVELOPMENT (LG & CD) DEPARTMENT, PUNJAB			
CONSTRUCTION OF WASTEWATER TREATMENT PLANT IN NORTH ZONE, SAHIWAL			
FACULTATIVE POND (FP-01) PLAN AND SECTION			
NATIONAL ENGINEERING SERVICES PAKISTAN (PVT.) LTD. LAHORE			
DESN. NESPAK	RECOMMENDED	VER./CKD.	APPROVED
DWN. SARFRAZ			
FILE	DATE	DRAWING NO.	REV.
CKD.	SEP. 2023	3976/11/TD/2J112	0
SUBM.			

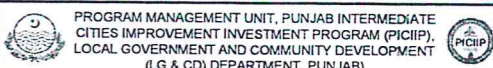


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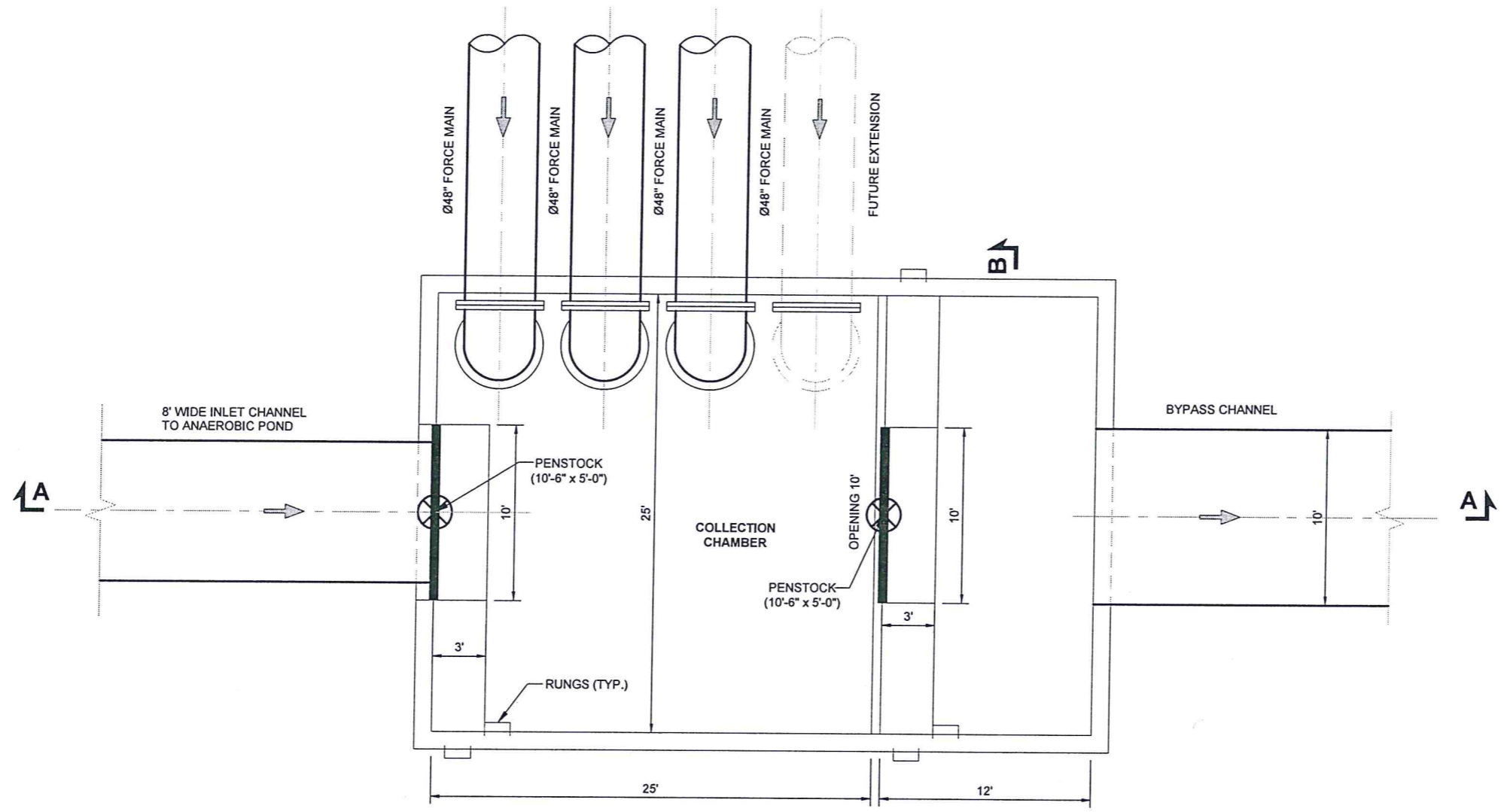
NOTES

1. ALL DIMENSIONS AND LEVELS ARE IN FEET UNLESS OTHERWISE SPECIFIED.
2. FOR LAYOUT PLAN AND X-SECTIONS, SEE DRAWING NOS. 3976/11/C/2J106 & 3976/11/C/2J108.
3. READ THIS DRAWING IN CONJUNCTION WITH ALL OTHER RELEVANT DRAWINGS.
4. COMPACTED SOIL LINER WITH A MINIMUM THICKNESS OF 24" SHALL BE PLACED AT THE BOTTOM AND ON SIDE SLOPES OF THE PONDS.
5. THE COMPACTED SOIL LINER SHALL BE PLACED IN LAYERS WITH MAXIMUM COMPACTED LAYER THICKNESS OF 150 mm & COMPACTED TO AT LEAST 90 % OF THE MAXIMUM MODIFIED PROCTOR DRY DENSITY AT ±2 % WET OPTIMUM MOISTURE CONTENT.
6. THE MATERIAL SUITABLE TO BE USED FOR COMPACTED SOIL LINER SHALL MEET THE FOLLOWING SPECIFICATIONS:
 - I) VERTICAL IN-SITU HYDRAULIC CONDUCTIVITY IN COMPACTED STATE $\leq 1 \times 10^{-7}$ CM/SEC
 - II) FINES (PARTICLES PASSING 0.075mm SIEVE) $\geq 30\%$,
 - III) PLASTICITY INDEX = 8 - 30%.
 - IV) GRAVELS (PARTICLES PASSING 75MM SIEVE AND RETAINING 4.75mm SIEVE) $\leq 20\%$,
 - V) MAXIMUM PARTICLE SIZE ≤ 10 mm.
7. THE ENVIRONMENTAL PROTECTION AGENCY (EPA) REQUIRES THE HIGHEST LEVEL OF SUPERVISION i.e. LEVEL-1 SUPERVISION FOR CLAY LINED WASTE STABILIZATION PONDS, THEREFORE ALL THE EARTH WORK OPERATIONS MUST BE CONTINUOUSLY SUPERVISED AND TESTED AS PER TECHNICAL SPECIFICATION BY AN EXPERIENCED/ SPECIALIZED ENGINEER IN SIMILAR WORKS.
8. THE CONTRACTOR SHOULD SUBMIT HIS METHOD STATEMENT PRIOR TO PLACEMENT OF CLAY LINER, HDPE LINER AND PROTECTIVE SOIL COVER. BEFORE EXECUTION OF WORK FOR THE APPROVAL OF THE ENGINEER.

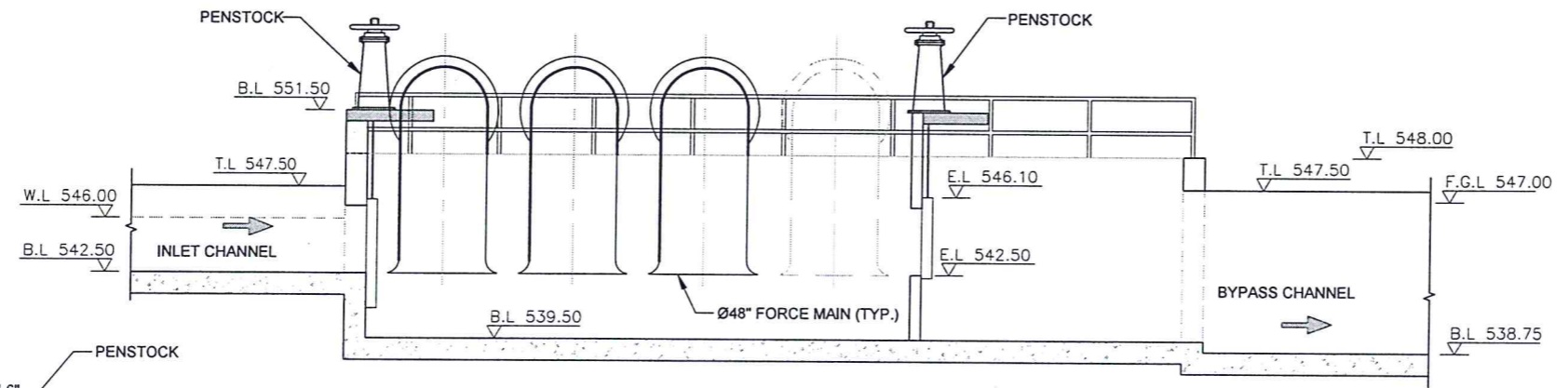
Prepared by: 
 For and on behalf of
 National Engineering Services
 Pakistan (Pvt.) Ltd. (NESPAK)

 PROGRAM MANAGEMENT UNIT, PUNJAB INTERMEDIATE CITIES IMPROVEMENT INVESTMENT PROGRAM (PICIP), LOCAL GOVERNMENT AND COMMUNITY DEVELOPMENT (LG & CD) DEPARTMENT, PUNJAB			
CONSTRUCTION OF WASTEWATER TREATMENT PLANT IN NORTH ZONE, SAHIWAL (STAGE-I)			
DETAILS OF LINER			
 NESPAK - ARTELIA JOINT VENTURE (JV)			
DESIGN	RECOMMENDED	VER./CKD.	APPROVED
DWN.			
FILE	DATE	DRAWING NO.	
CKD.			
SUBV.	SEP. 2023	3976/024/TD/7D01	REV. 0

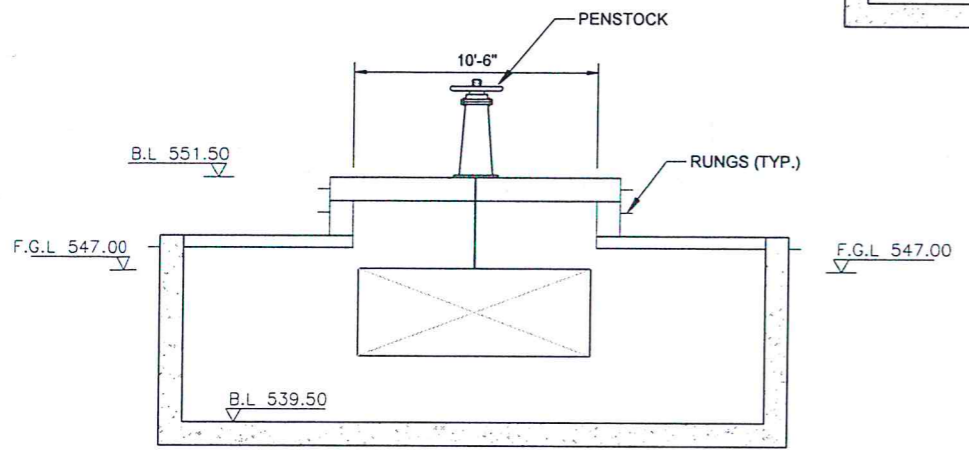
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PLAN



SECTION A-A



SECTION B-B

NOTES

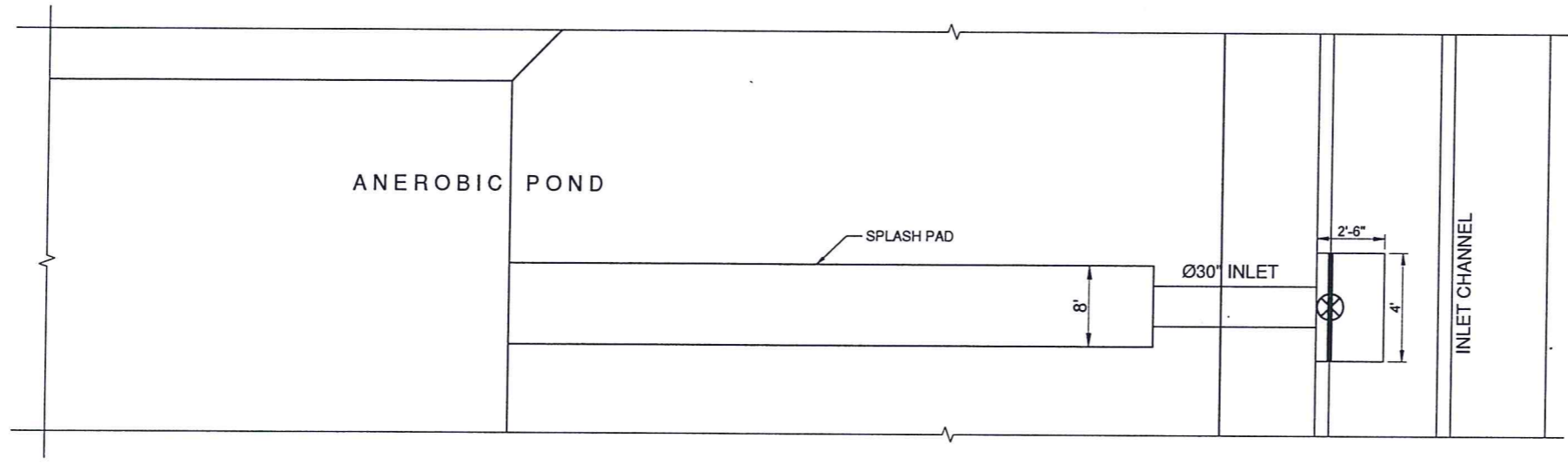
1. FOR GENERAL NOTES AND LEGENDS SEE DRAWING NO. 3976/11/TD/2J100.
2. READ THIS DRAWING IN CONJUNCTION WITH ALL OTHER RELEVANT DRAWINGS.
3. FOR CONSTRUCTION, REFER RELEVANT STRUCTURAL DRAWINGS.

Prepared by
 For and on behalf of
 National Engineering Services
 Pakistan (Pvt.) Ltd. (NESPAK)

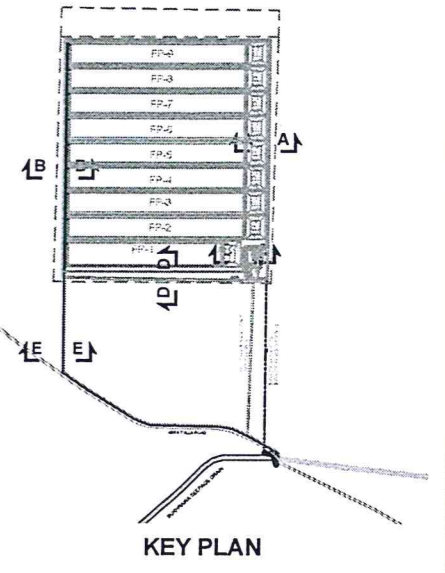
SCALE 1"=8'

CONSTRUCTION OF WASTEWATER TREATMENT PLANT IN NORTH ZONE, SAHIWAL			
COLLECTION CHAMBER PLAN AND SECTION			
DESIGNER: NESPAK	RECOMMENDED	VER./CKD.	APPROVED
DWN.: SARFRAZ			
FILE	DATE	DRAWING NO.	REV.
CKD.	SEP. 2023	3976/11/TD/2J113	0
SUBM.			

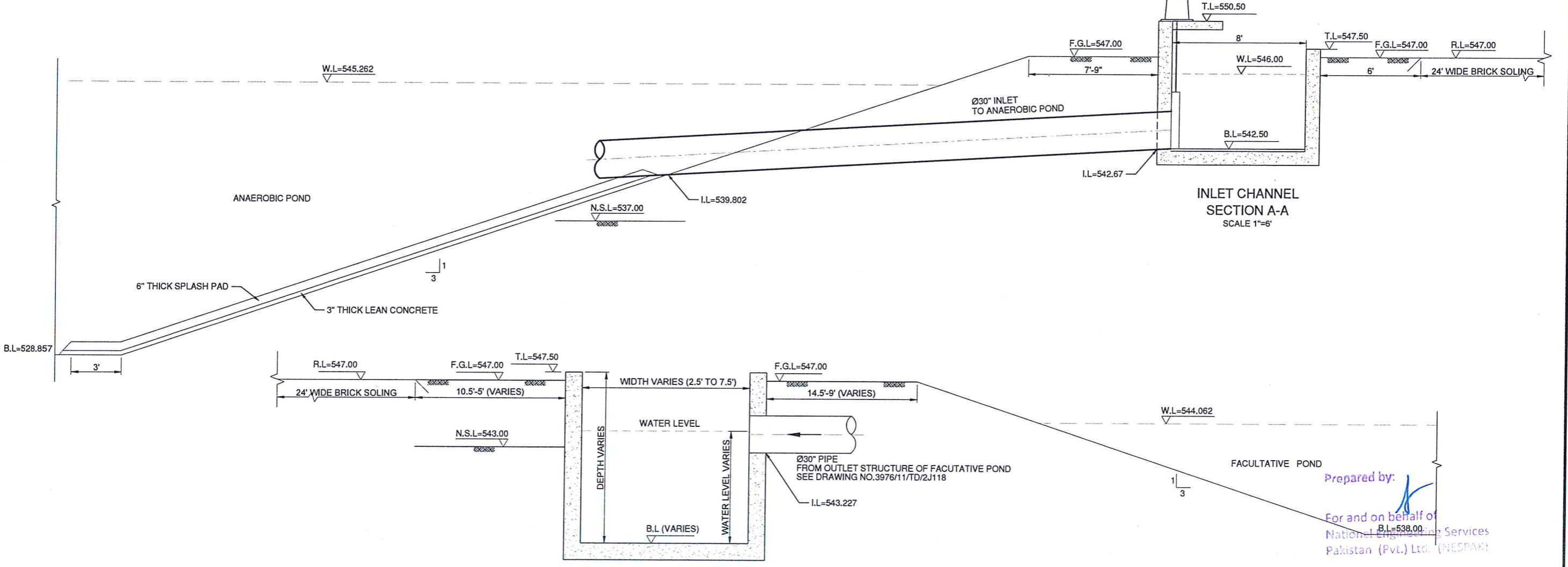
REFERENCE DRAWINGS	REV. NO.	DATE	DESCRIPTION	BY	CKD	APPR



PLAN
SCALE 1"=12'



KEY PLAN



TYPICAL X-SECTION OF
OUTLET CHANNEL (OPEN)
SECTION B-B
SCALE 1"=6'

INLET CHANNEL
SECTION A-A
SCALE 1"=6'

NOTES

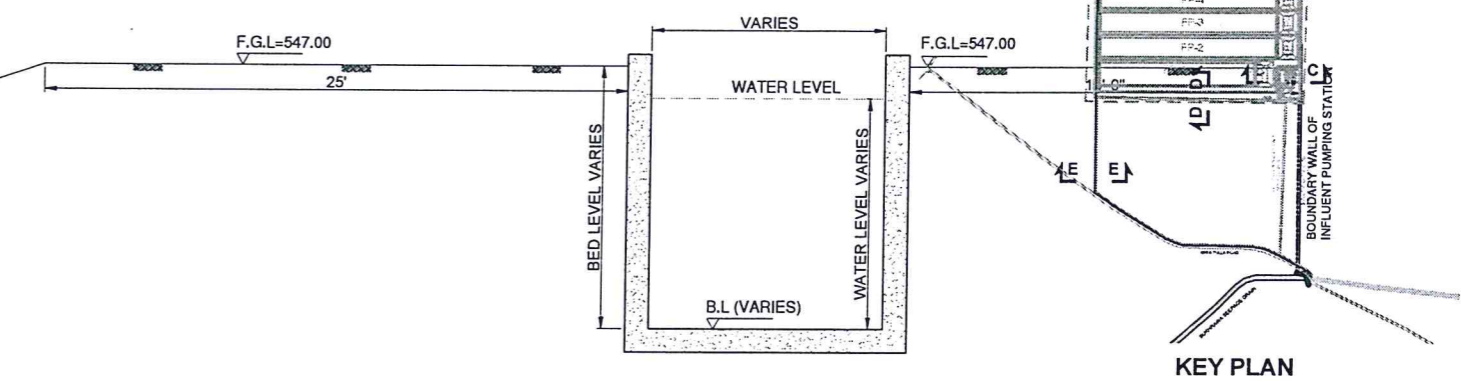
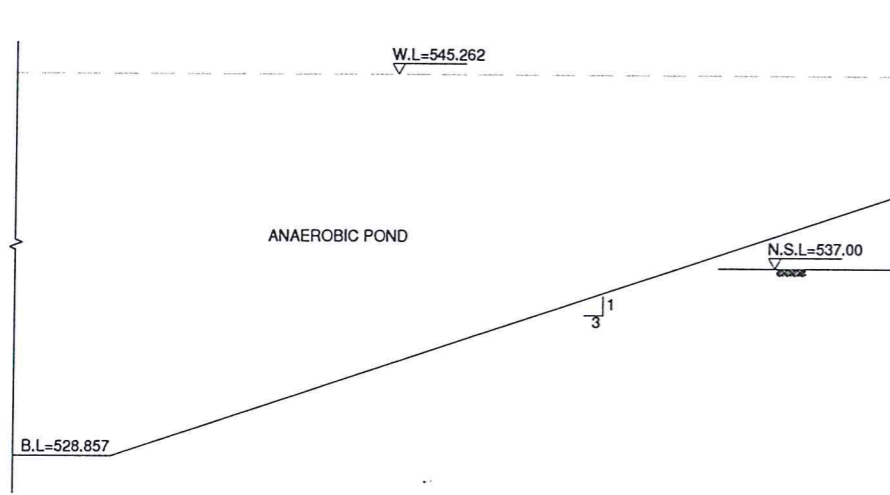
1. FOR GENERAL NOTES AND LEGENDS SEE DRAWING NO. 3976/11/TD/2J100.
2. READ THIS DRAWING IN CONJUNCTION WITH ALL OTHER RELEVANT DRAWINGS.
3. FOR CONSTRUCTION, REFER RELEVANT STRUCTURAL DRAWINGS.

SCALE AS SHOWN

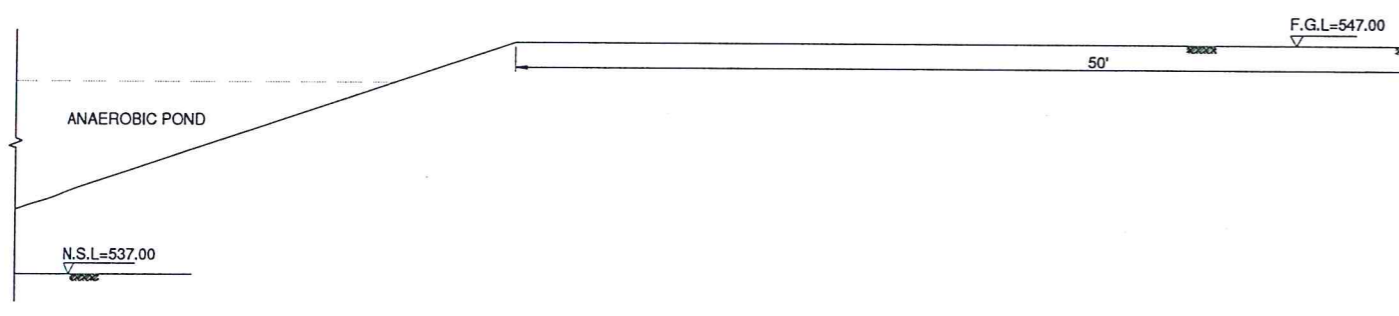
PROGRAM MANAGEMENT UNIT, PUNJAB INTERMEDIATE CITIES IMPROVEMENT INVESTMENT PROGRAM (P.C.I.P.), LOCAL GOVERNMENT AND COMMUNITY DEVELOPMENT (LG & CD) DEPARTMENT, PUNJAB			
CONSTRUCTION OF WASTEWATER TREATMENT PLANT IN NORTH ZONE, SAHIWAL			
INLET CHANNEL AND OUTLET CHANNEL - SECTION			
NATIONAL ENGINEERING SERVICES PAKISTAN (PVT.) LTD. LAHORE			
DESN. NESPAK DWN. SARFRAZ FILE CKD. SUBM.	RECOMMENDED DATE SEP. 2023	VER./CKD. DRAWING NO. 3976/11/TD/2J114	APPROVED REV. 0

REFERENCE DRAWINGS	REV. NO.	DATE	DESCRIPTION	BY	CKD	APPR

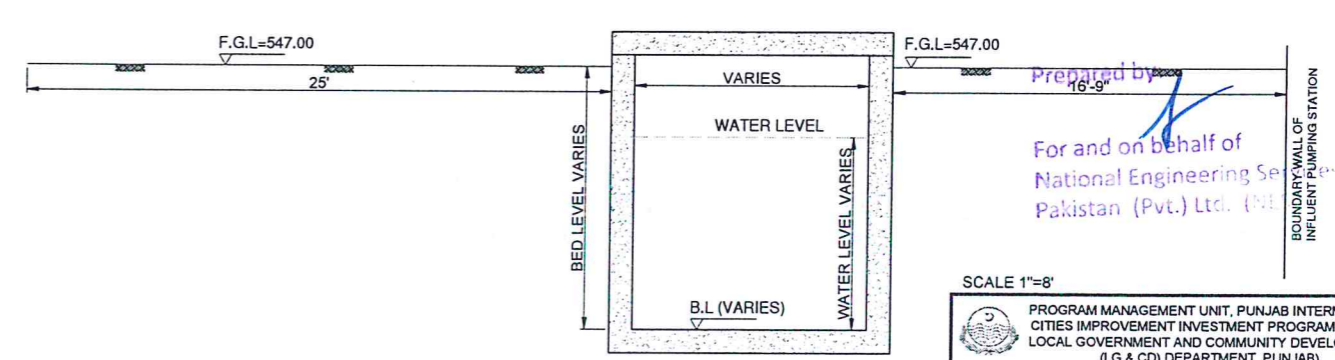
Prepared by:
[Signature]
For and on behalf of
National Engineering Services
Pakistan (Pvt.) Ltd. (NESPAK)



TYPICAL X-SECTION OF TREATED EFFLUENT CHANNEL SECTION C-C



TYPICAL X-SECTION OF BYPASS CHANNEL SECTION D-D



TYPICAL X-SECTION OF TREATED EFFLUENT CHANNEL (ROAD CROSSING) SECTION E-E

- NOTES**
1. FOR GENERAL NOTES AND LEGENDS SEE DRAWING NO. 3976/11/TD/2J100.
 2. READ THIS DRAWING IN CONJUNCTION WITH ALL OTHER RELEVANT DRAWINGS.
 3. FOR CONSTRUCTION, REFER RELEVANT STRUCTURAL DRAWINGS.

Prepared by
For and on behalf of
National Engineering Services
Pakistan (Pvt.) Ltd. (NESPAK)

SCALE 1"=8'

PROGRAM MANAGEMENT UNIT, PUNJAB INTERMEDIATE CITIES IMPROVEMENT INVESTMENT PROGRAM (PICIP), LOCAL GOVERNMENT AND COMMUNITY DEVELOPMENT (LG & CD) DEPARTMENT, PUNJAB

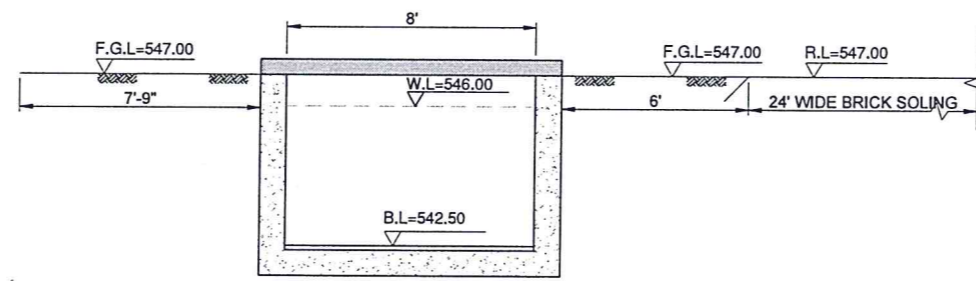
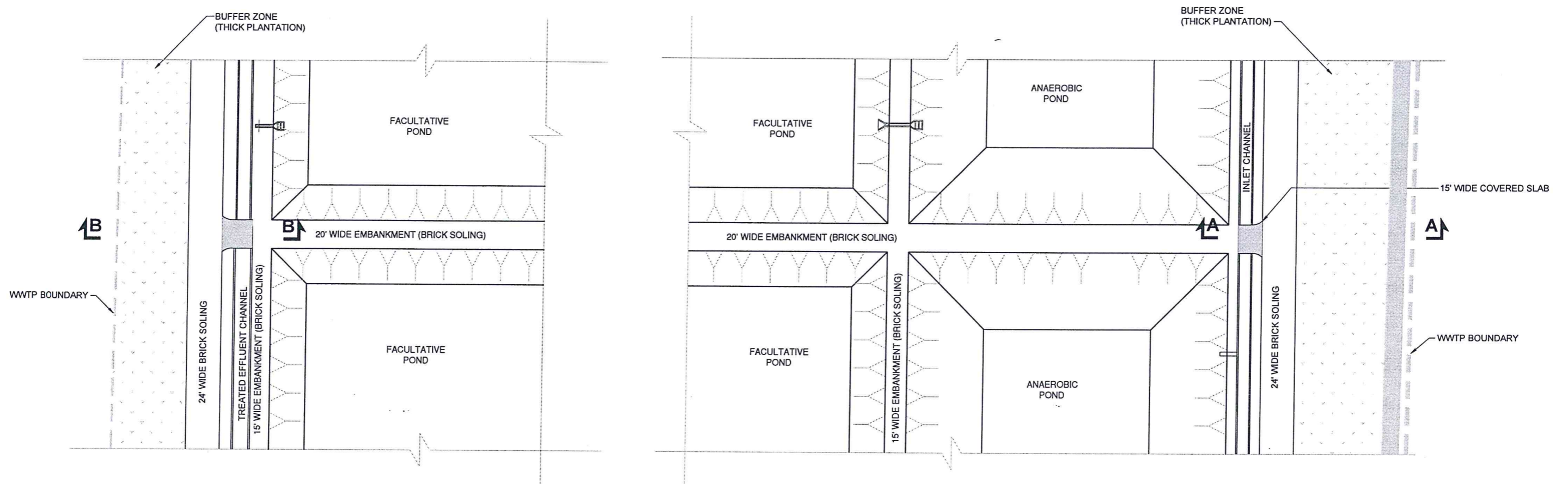
CONSTRUCTION OF WASTEWATER TREATMENT PLANT IN NORTH ZONE, SAHIWAL

TYPICAL X-SECTION OF TREATED EFFLUENT & BYPASS CHANNEL

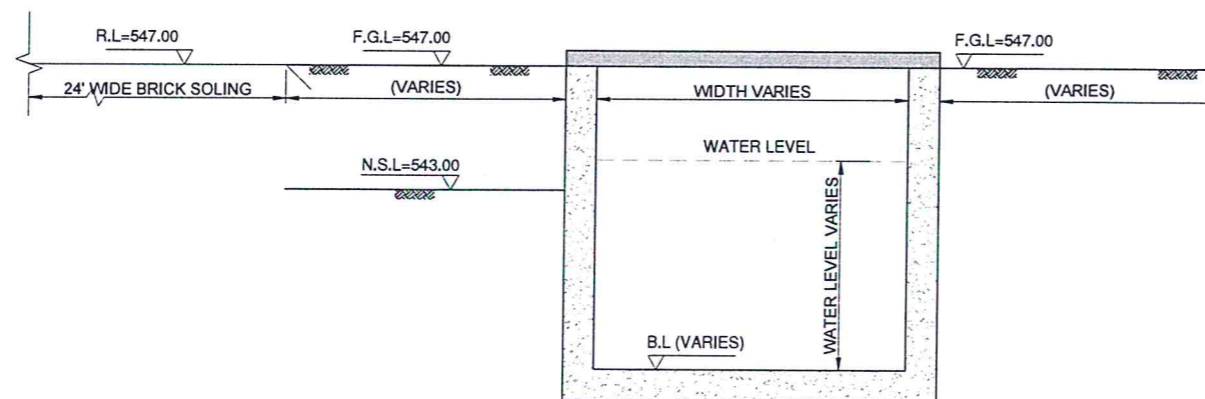
NATIONAL ENGINEERING SERVICES PAKISTAN (PVT.) LTD. LAHORE

DESIGNER: NESPAK	RECOMMENDED	VER./CKD.	APPROVED
DWN.: SARFRAZ			
FILE	DATE	DRAWING NO.	REV.
CKD.	SEP. 2023	3976/11/TD/2J115	0
SUBM.			

REFERENCE DRAWINGS	REV. NO.	DATE	DESCRIPTION	BY	CKD	APPR



INLET CHANNEL
SECTION A-A
SCALE 1"=6'



TYPICAL X-SECTION OF
OUTLET CHANNEL
SECTION B-B
SCALE 1"=6'

NOTES

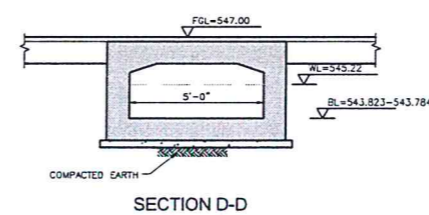
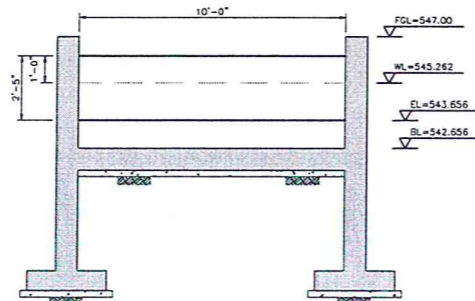
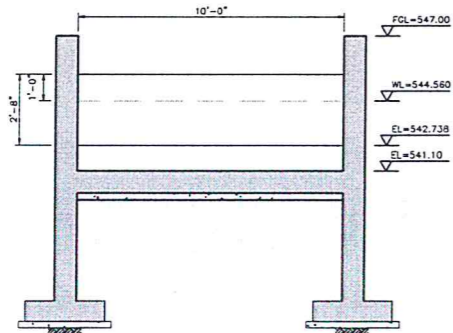
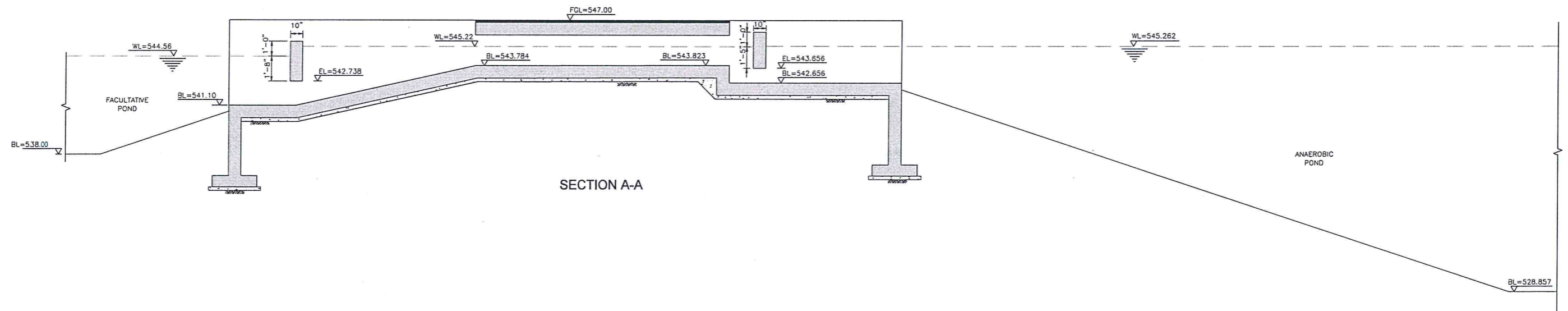
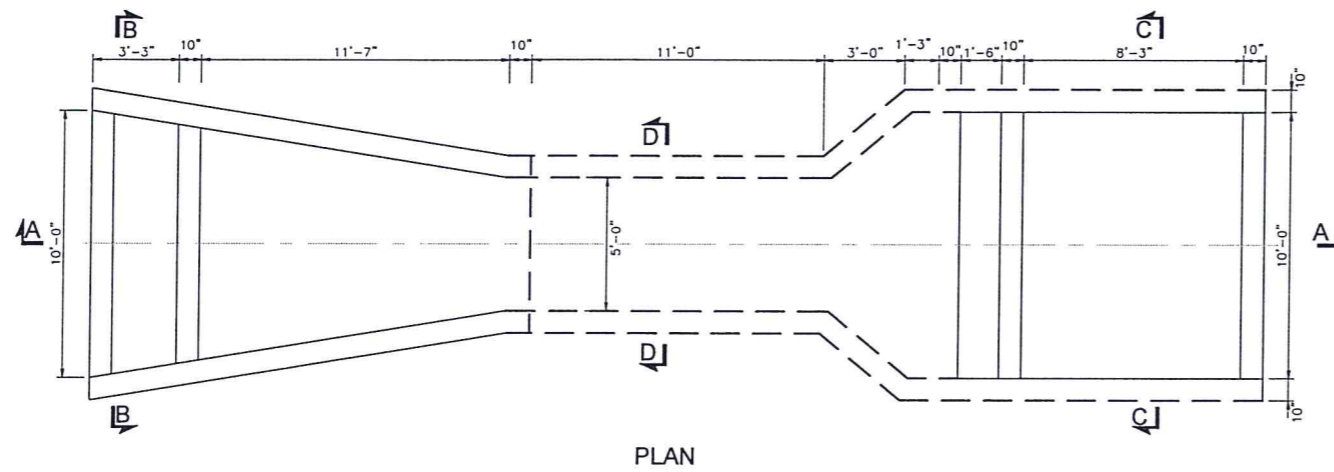
- FOR GENERAL NOTES AND LEGENDS SEE DRAWING NO. 3976/11/TD/2J100.
- READ THIS DRAWING IN CONJUNCTION WITH ALL OTHER RELEVANT DRAWINGS.
- FOR CONSTRUCTION, REFER RELEVANT STRUCTURAL DRAWINGS.

Prepared by
For and on behalf of
National Engineering Services
Pakistan (Pvt.) Ltd. (NESPAK)

SCALE AS SHOWN

		PROGRAM MANAGEMENT UNIT, PUNJAB INTERMEDIATE CITIES IMPROVEMENT INVESTMENT PROGRAM (PICIP), LOCAL GOVERNMENT AND COMMUNITY DEVELOPMENT (LG & CD) DEPARTMENT, PUNJAB	
CONSTRUCTION OF WASTEWATER TREATMENT PLANT IN NORTH ZONE, SAHIWAL			
INLET CHANNEL AND OUTLET CHANNEL - SECTION			
		NATIONAL ENGINEERING SERVICES PAKISTAN (PVT.) LTD. LAHORE	
DESN. NESPAK DWN. SARFRAZ FILE CKD. SUBM.	RECOMMENDED VER./CKD. DATE SEP. 2023	APPROVED DRAWING NO. 3976/11/TD/2J116	REV. 0

REFERENCE DRAWINGS	REV. NO.	DATE	DESCRIPTION	BY	CKD	APPR



NOTES

1. FOR GENERAL NOTES AND LEGENDS SEE DRAWING NO. 3976/11/TD/2J100.
2. READ THIS DRAWING IN CONJUNCTION WITH ALL OTHER RELEVANT DRAWINGS.
3. FOR CONSTRUCTION REFER RELEVANT STRUCTURAL DRAWINGS.

For and on behalf of
**National Engineering Services
 Pakistan (Pvt.) Ltd. (NESPAK)**

SCALE 1"=7'

PROGRAM MANAGEMENT UNIT, PUNJAB INTERMEDIATE CITIES IMPROVEMENT INVESTMENT PROGRAM (PICIP), LOCAL GOVERNMENT AND COMMUNITY DEVELOPMENT (LG & CD) DEPARTMENT, PUNJAB

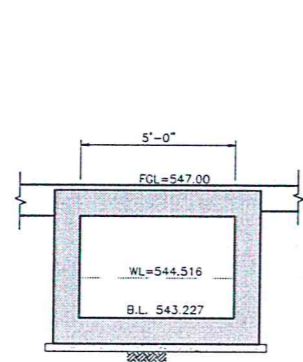
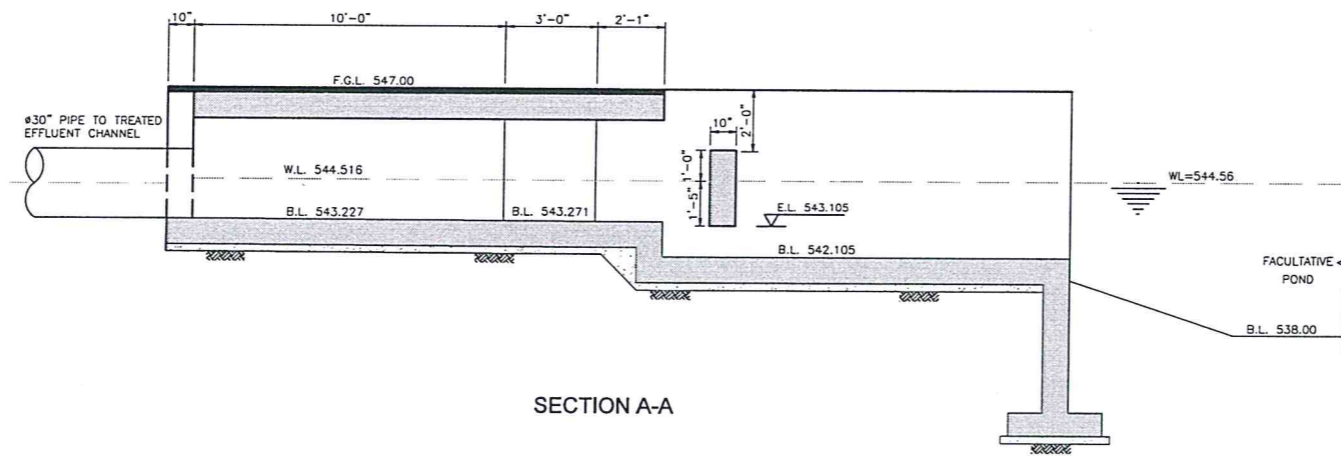
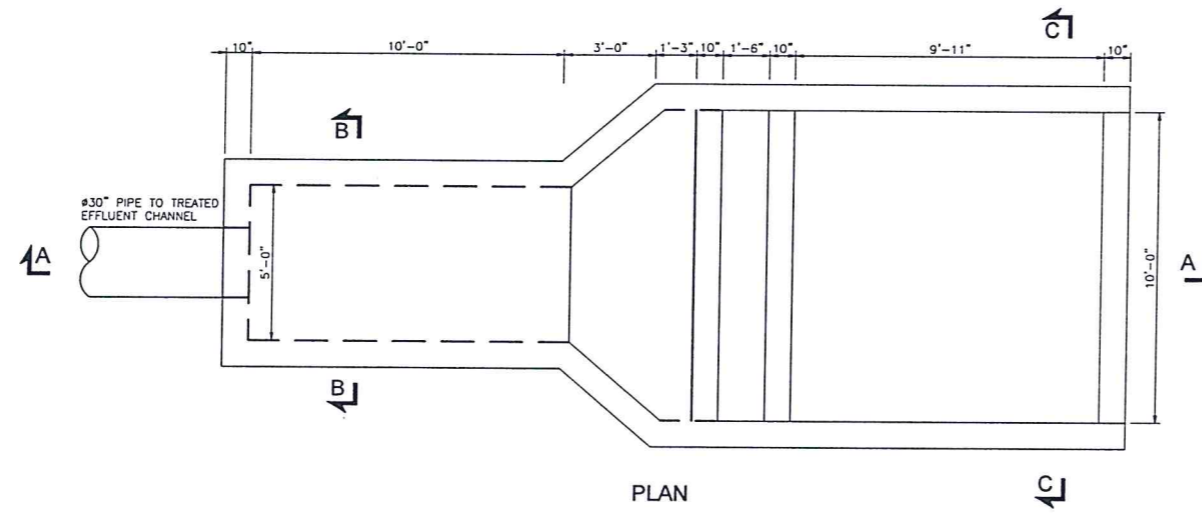
CONSTRUCTION OF WASTEWATER TREATMENT PLANT IN NORTH ZONE, SAHIWAL

INTER CONNECTION DETAIL IN BETWEEN ANAEROBIC POND AND FACULTATIVE POND

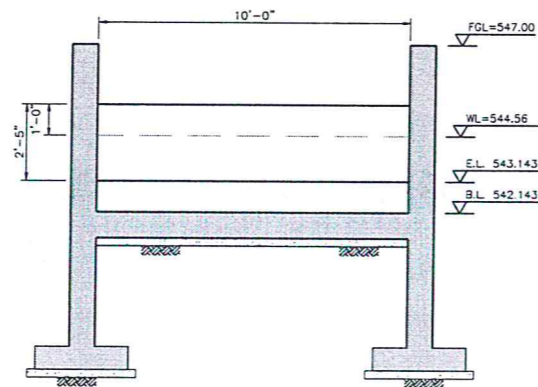
NATIONAL ENGINEERING SERVICES PAKISTAN (PVT.) LTD. LAHORE

DESIGNER: NESPAK	RECOMMENDED	VER./CHKD.	APPROVED
DRAWN: SARFRAZ			
FILE	DATE	DRAWING NO.	
CKD.	SEP. 2023	3976/11/TD/2J117	
SUBM.			REV. 0

REFERENCE DRAWINGS	REV. NO.	DATE	DESCRIPTION	BY	CHKD.	APPR.



SECTION B-B



SECTION C-C

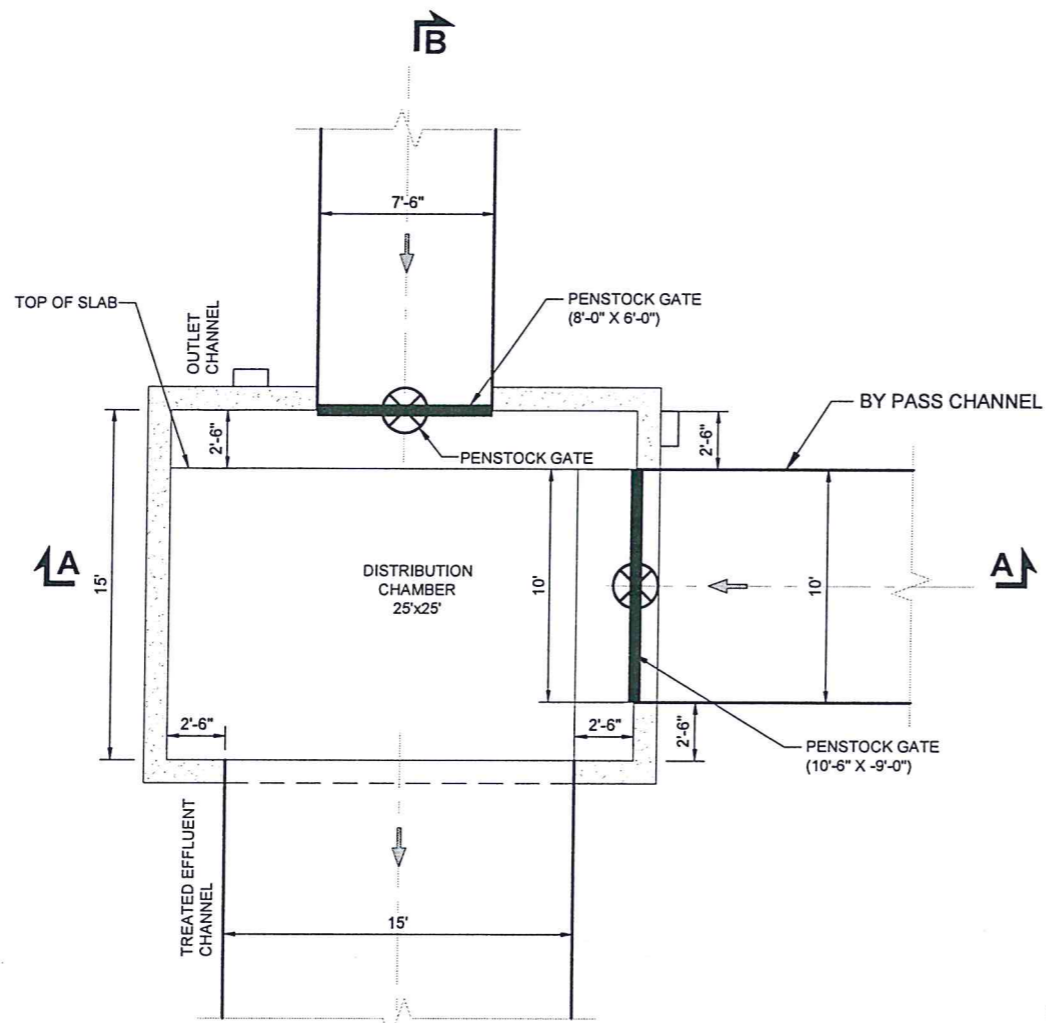
NOTES

1. FOR GENERAL NOTES AND LEGENDS SEE DRAWING NO. 3976/11/TD/2J100.
2. READ THIS DRAWING IN CONJUNCTION WITH ALL OTHER RELEVANT DRAWINGS.
3. FOR CONSTRUCTION, REFER RELEVANT STRUCTURAL DRAWINGS.

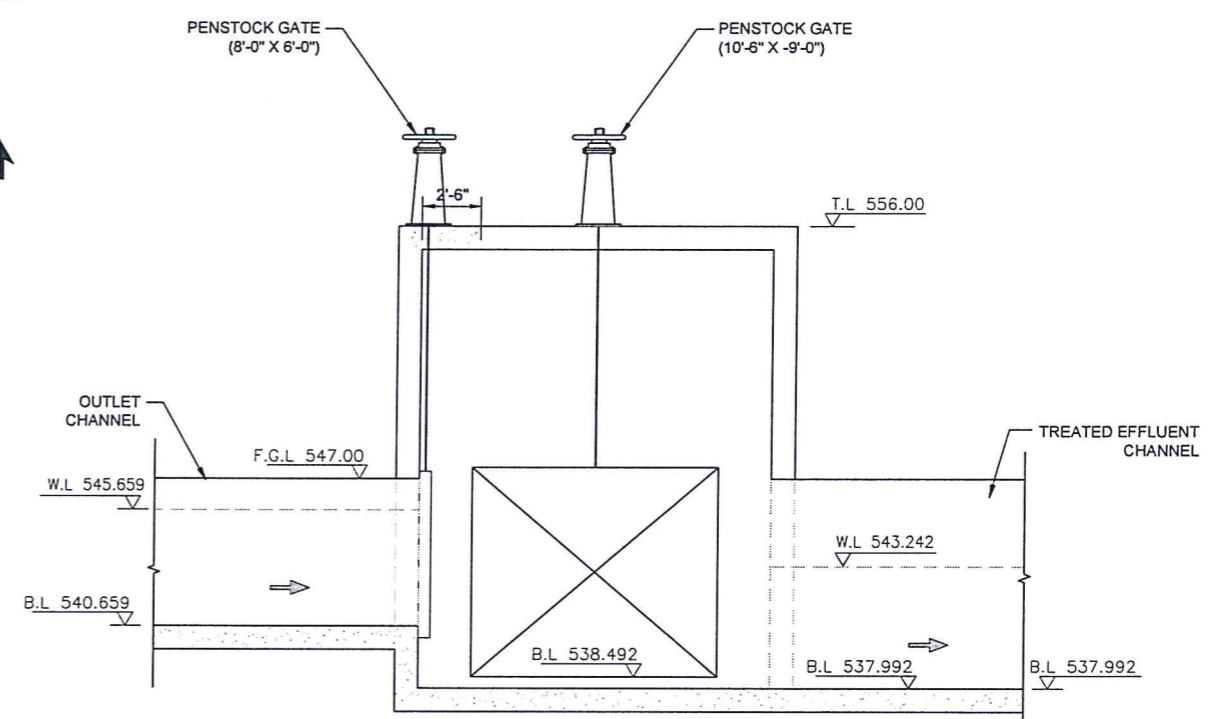
for and on behalf of
 National Engineering Services
 Pakistan (Pvt.) Ltd. (NESPAK)

SCALE 1"=6'

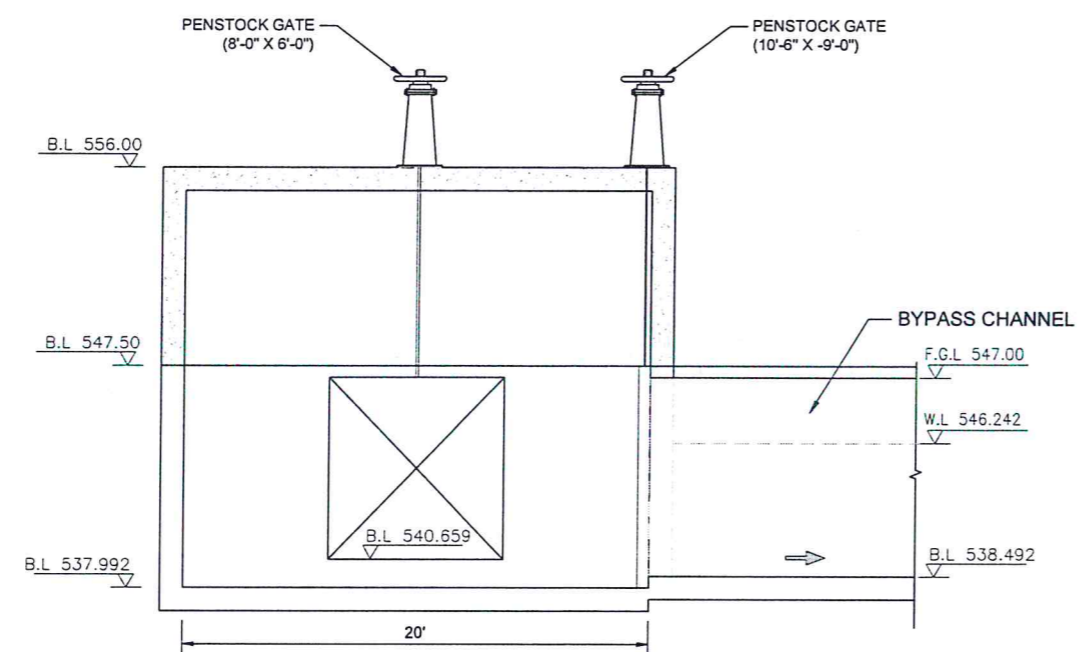
PROGRAM MANAGEMENT UNIT, PUNJAB INTERMEDIATE CITIES IMPROVEMENT INVESTMENT PROGRAM (PICIIP), LOCAL GOVERNMENT AND COMMUNITY DEVELOPMENT (LG & CD) DEPARTMENT, PUNJAB	
CONSTRUCTION OF WASTEWATER TREATMENT PLANT IN NORTH ZONE, SAHIWAL	
OUTLET STRUCTURE DETAIL FROM FACULTATIVE POND	
NATIONAL ENGINEERING SERVICES PAKISTAN (PVT.) LTD. LAHORE	
DESN. NESPAK DWN. SARFRAZ FILE CKD. SUBM.	RECOMMENDED VER./CKD. APPROVED DATE SEP. 2023
REFERENCE DRAWINGS REV. NO. DATE DESCRIPTION BY CKD APPR	DRAWING NO. 3976/11/TD/2J118 REV. 0



PLAN



SECTION B-B



SECTION A-A

NOTES

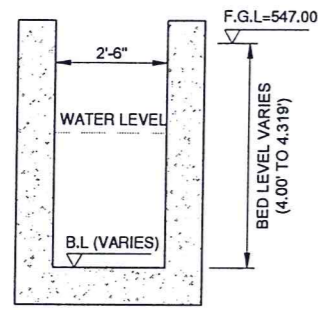
1. FOR GENERAL NOTES AND LEGENDS SEE DRAWING NO. 3976/11/TD/2J100.
2. READ THIS DRAWING IN CONJUNCTION WITH ALL OTHER RELEVANT CONSTRUCTION DRAWINGS.
3. FOR CONSTRUCTION REFER RELEVANT STRUCTURAL DRAWINGS.

For and on behalf of
National Engineering Services
Pakistan (Pvt.) Ltd. (NESPAK)

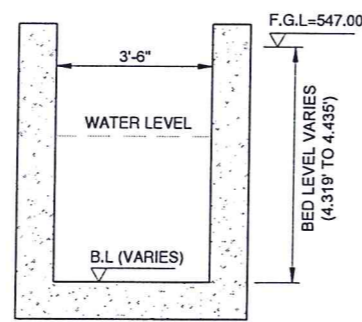
SCALE 1"=8'

CONSTRUCTION OF WASTEWATER TREATMENT PLANT IN NORTH ZONE, SAHIWAL			
DISTRIBUTION CHAMBER PLAN AND SECTION			
DESIGNER: NESPAK	RECOMMENDED	VER./CKD.	APPROVED
DWN. SARFRAZ			
FILE	DATE	DRAWING NO.	REV.
CKD.	SEP. 2023	3976/11/TD/2J119	0
SUBM.			

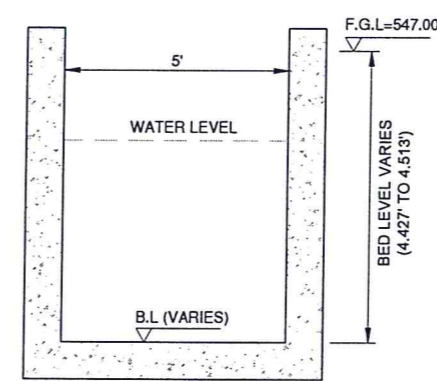
REFERENCE DRAWINGS	REV. NO.	DATE	DESCRIPTION	BY	CKD	APPR



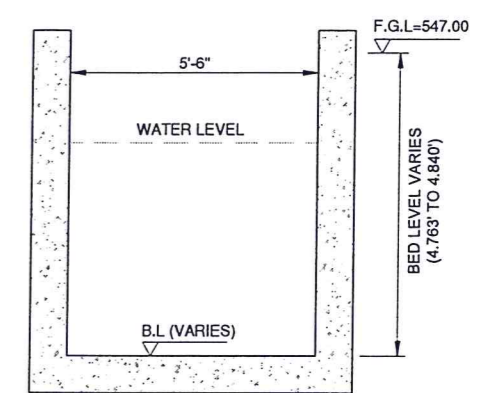
OUTLET CHANNEL (OPEN)
2.5' x 3.5'
(0 TO 600)



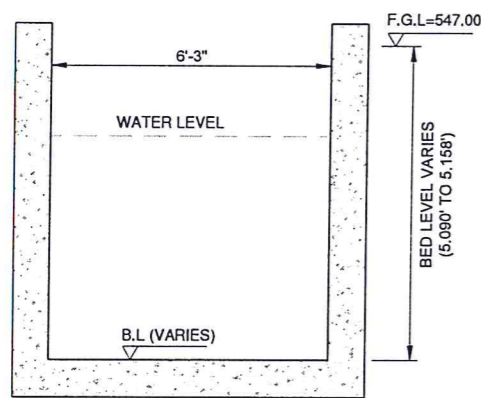
OUTLET CHANNEL (OPEN)
3.5' x 3.5'
(600 TO 900)



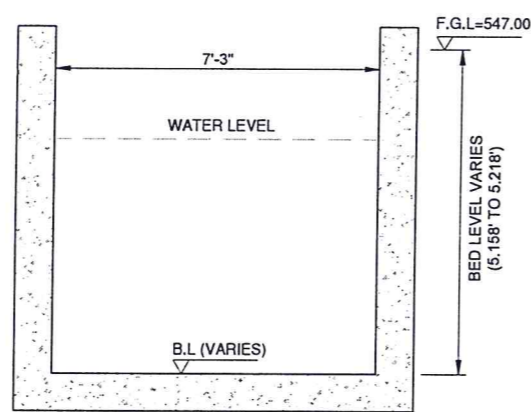
OUTLET CHANNEL (OPEN)
5.0' x 3.5'
(900 TO 1200)



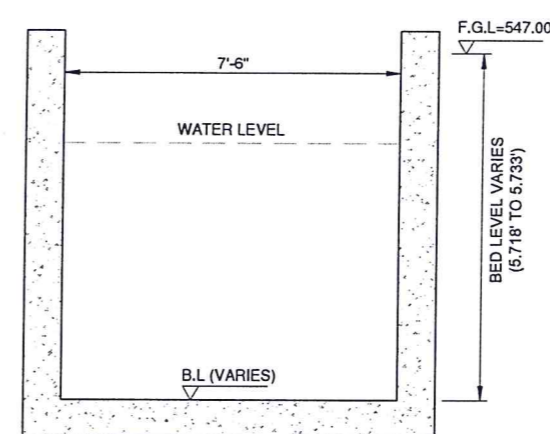
OUTLET CHANNEL (OPEN)
5.5' x 3.75'
(1200 TO 1500)



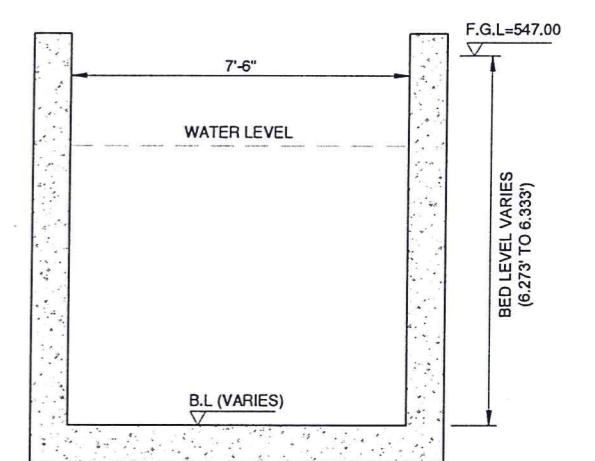
OUTLET CHANNEL (OPEN)
6.25' x 4.0'
(1500 TO 1800)



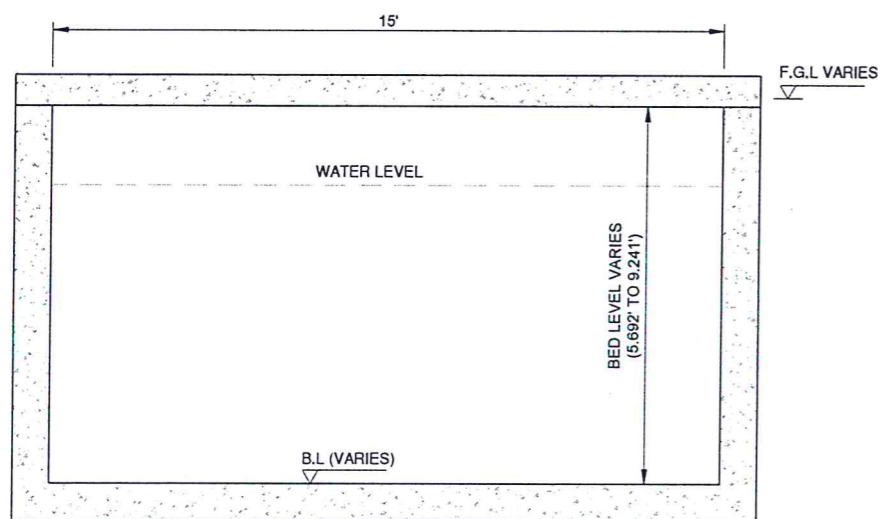
OUTLET CHANNEL (OPEN)
7.25' x 4.0'
(1800 TO 2100)



OUTLET CHANNEL (OPEN)
7.5' x 4.5'
(2100 TO 2400)



OUTLET CHANNEL (OPEN)
7.5' x 5.0'
(2400 TO 2745)



COVERED TREATED EFFLUENT CHANNEL
15.0' x 5.25'

NOTES

1. FOR GENERAL NOTES AND LEGENDS SEE DRAWING NO. 3976/11/TD/2J100.
2. READ THIS DRAWING IN CONJUNCTION WITH ALL OTHER RELEVANT DRAWINGS.

Prepared by: *[Signature]*

For and on behalf of
National Engineering Services

SCALE 1"=8' Pakistan (Pvt.) Ltd., (NESPAK)

PROGRAM MANAGEMENT UNIT, PUNJAB INTERMEDIATE CITIES IMPROVEMENT INVESTMENT PROGRAM (PICIP), LOCAL GOVERNMENT AND COMMUNITY DEVELOPMENT (LG & CD) DEPARTMENT, PUNJAB

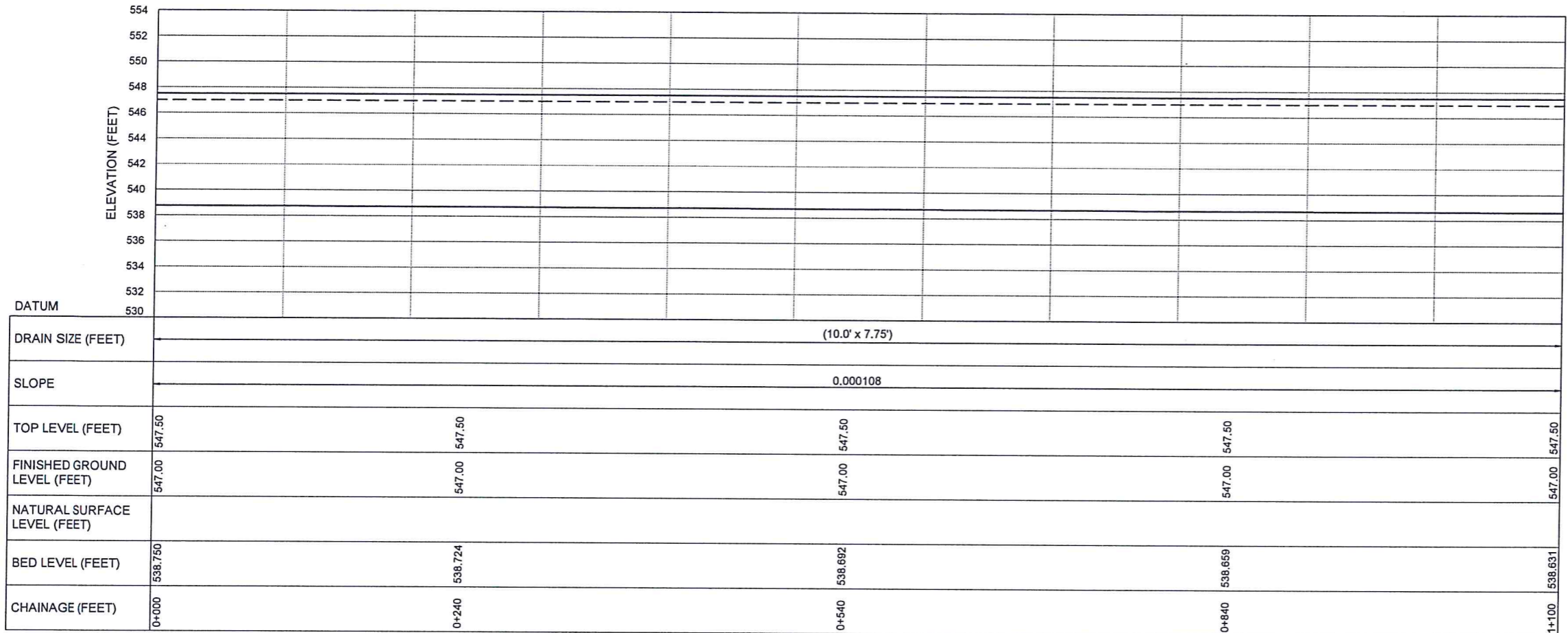
CONSTRUCTION OF WASTEWATER TREATMENT PLANT IN NORTH ZONE, SAHIWAL

OUTLET CHANNEL AND TREATED EFFLUENT CHANNEL X-SECTIONS

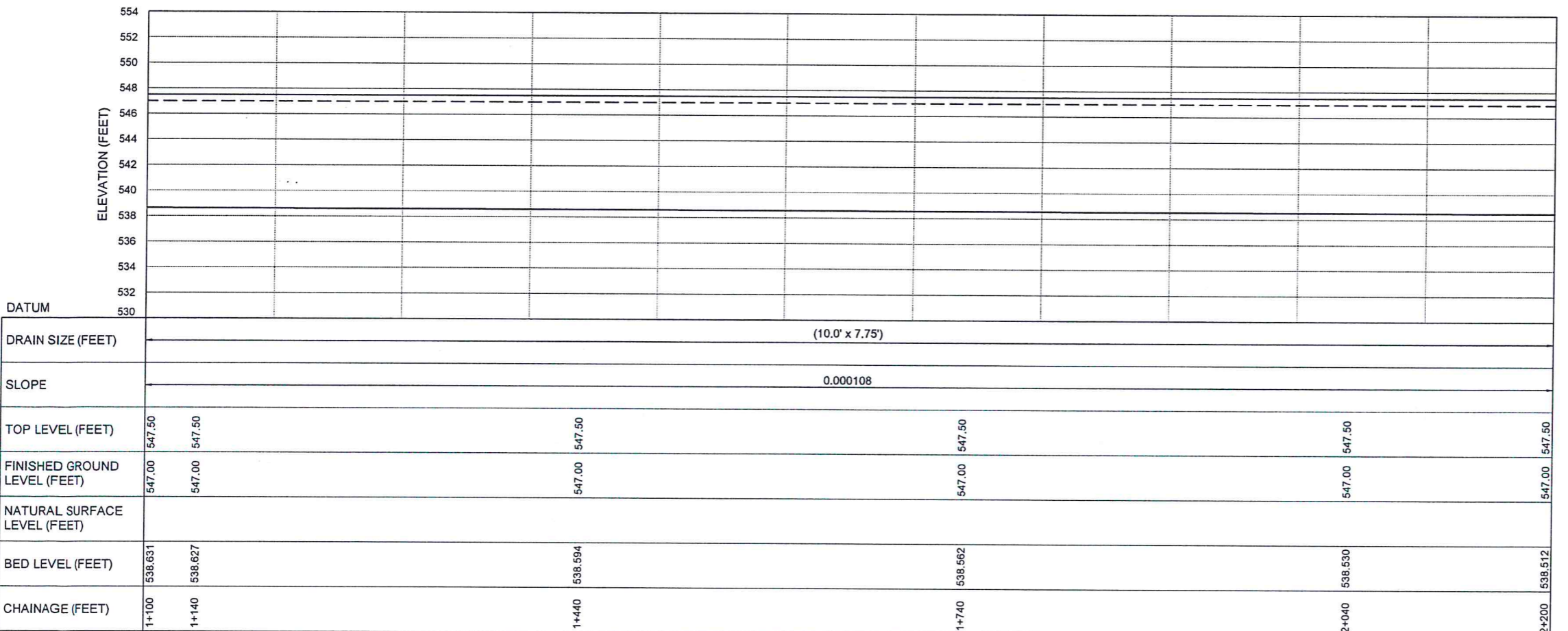
NATIONAL ENGINEERING SERVICES PAKISTAN (PVT.) LTD. LAHORE

DESIGNER: NESPAK	RECOMMENDED	VER./CKD.	APPROVED
DRAWN: SARFRAZ			
FILE	DATE	DRAWING NO.	REV.
CKD.	SEP. 2023	3976/11/TD/2J120	0
SUBM.			

REFERENCE DRAWINGS	REV. NO.	DATE	DESCRIPTION	BY	CKD	APPR



BYPASS CHANNEL PROFILE



BYPASS CHANNEL PROFILE

LEGEND:-

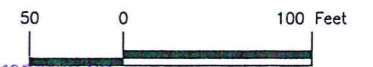
- TOP LEVEL _____
- FINISHED GROUND LEVEL/
NATURAL SURFACE LEVEL - - - - -
- BED LEVEL _____

NOTES:-


1. ALL LEVELS ARE IN FEET UNLESS OTHERWISE SPECIFIED.
2. ALL DIMENSIONS ARE IN FEET UNLESS OTHERWISE SPECIFIED.
3. READ THIS DRAWING IN CONJUNCTION WITH ALL RELEVANT DRAWINGS.
4. FOR LAYOUT PLAN, REFER TO DRAWING NO. 3976/11/C/2J106B.
5. FOR CONCRETE OUTLINE REFER TO DRAWING NO. 3976/033/C/15G03.
6. FOR REINFORCEMENT DETAIL REFER TO DRAWING NO. 3976/033/C/15G03A.
7. THE CONTRACTOR SHALL ARRANGE FOR ALL REQUIRED PERMITS BEFORE THE EXECUTION OF THE WORKS.
8. BEFORE EXECUTION AT SITE, CONTRACTOR SHALL CHECK/VERIFY RL/IL OF EXISTING NULLAH AND ROAD. IN CASE OF ANY DISPARITY IN LEVELS, IT SHALL BE INFORMED IMMEDIATELY TO THE ENGINEER FOR REVISION IN DRAWING.
9. AS BUILT DRAWINGS SHALL BE PREPARED/SUBMITTED BY THE CONTRACTOR AFTER COMPLETION OF THE WORK.

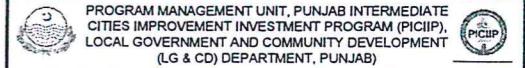
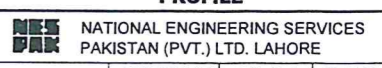


VER. SCALE 1"=10'-0"

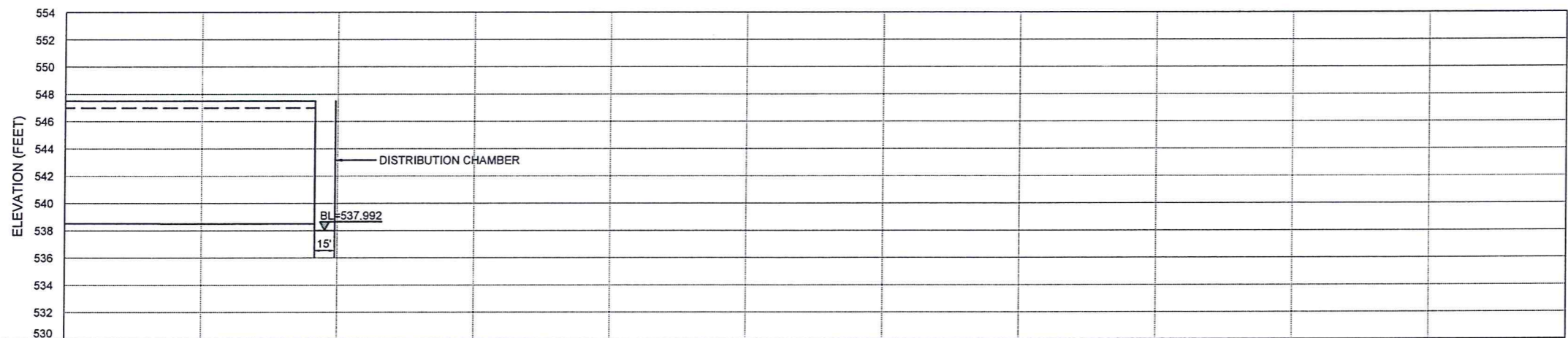


HOR. SCALE 1"=100'-0"

Prepared by:

 For and on behalf of
 National Engineering Services
 Pakistan (Pvt.) Ltd. (SHEET 1 OF 6)

	
PROGRAM MANAGEMENT UNIT, PUNJAB INTERMEDIATE CITIES IMPROVEMENT INVESTMENT PROGRAM (PICIP), LOCAL GOVERNMENT AND COMMUNITY DEVELOPMENT (LG & CD) DEPARTMENT, PUNJAB	
CONSTRUCTION OF WASTEWATER TREATMENT PLANT IN NORTH ZONE, SAHIWAL	
BYPASS CHANNEL PROFILE	
	
DESN. NESPAK DWN. SARFRAZ FILE CKD. SUBM.	RECOMMENDED VER./CKD. APPROVED DATE SEP_2023 DRAWING NO. 3976/11/TD/2J122 REV. 0

REFERENCE DRAWINGS	REV. NO.	DATE	DESCRIPTION	BY	CKD	APPR



DRAIN SIZE (FEET)	(10.0' x 7.75')		
SLOPE	0.000108		
TOP LEVEL (FEET)	547.50	547.50	547.50
FINISHED GROUND LEVEL (FEET)	547.00	547.00	547.00
NATURAL SURFACE LEVEL (FEET)			
BED LEVEL (FEET)	538.512	538.497	538.492
CHAINAGE (FEET)	2+200	2+340	2+383

BYPASS CHANNEL PROFILE

LEGEND:-

- TOP LEVEL _____
- FINISHED GROUND LEVEL/
NATURAL SURFACE LEVEL - - - - -
- BED LEVEL _____

NOTES:-

1. ALL LEVELS ARE IN FEET UNLESS OTHERWISE SPECIFIED.
2. ALL DIMENSIONS ARE IN FEET UNLESS OTHERWISE SPECIFIED.
3. READ THIS DRAWING IN CONJUNCTION WITH ALL RELEVANT DRAWINGS.
4. FOR LAYOUT PLAN, REFER TO DRAWING NO. 3976/11/C/2J106B.
5. FOR CONCRETE OUTLINE REFER TO DRAWING NO. 3976/033/C/15G03.
6. FOR REINFORCEMENT DETAIL REFER TO DRAWING NO. 3976/033/C/15G03A.
7. THE CONTRACTOR SHALL ARRANGE FOR ALL REQUIRED PERMITS BEFORE THE EXECUTION OF THE WORKS.
8. BEFORE EXECUTION AT SITE, CONTRACTOR SHALL CHECK/VERIFY RL/IL OF EXISTING NULLAH AND ROAD. IN CASE OF ANY DISPARITY IN LEVELS, IT SHALL BE INFORMED IMMEDIATELY TO THE ENGINEER FOR REVISION IN DRAWING.
9. AS BUILT DRAWINGS SHALL BE PREPARED/SUBMITTED BY THE CONTRACTOR AFTER COMPLETION OF THE WORK.



VER. SCALE 1"=10'-0"

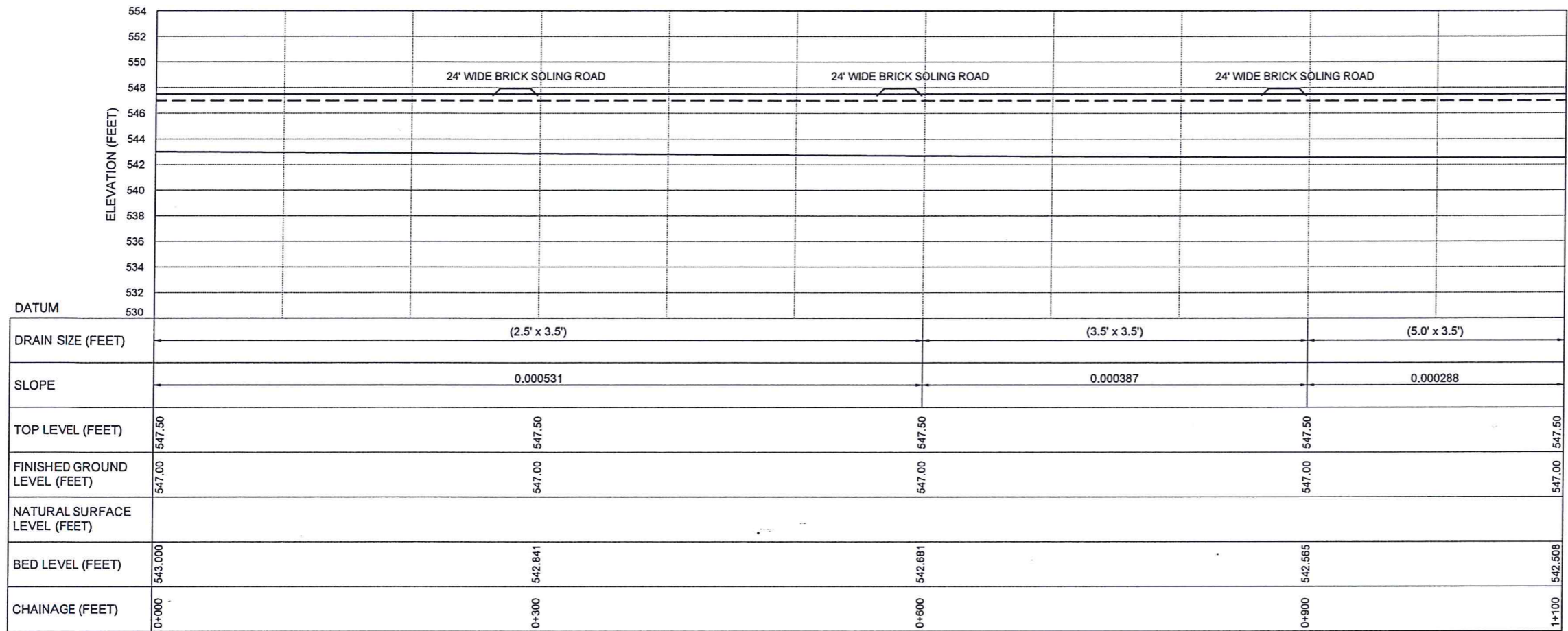


HOR. SCALE 1"=100'-0"

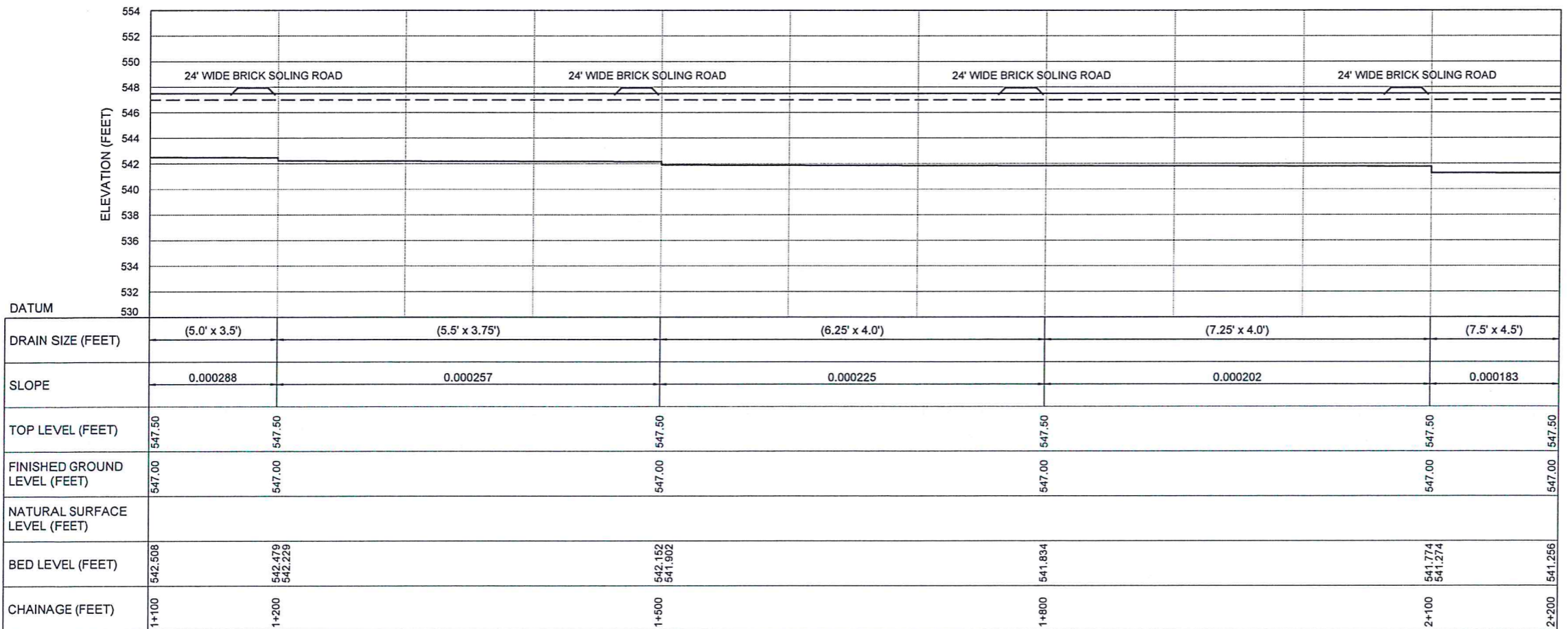
Prepared by
For and on behalf of
National Engineering Services
Pakistan (Pvt.) Ltd. (NESPAK)
(SHEET 2 OF 6)

PROGRAM MANAGEMENT UNIT, PUNJAB INTERMEDIATE CITIES IMPROVEMENT INVESTMENT PROGRAM (PICUP), LOCAL GOVERNMENT AND COMMUNITY DEVELOPMENT (LG & CD) DEPARTMENT, PUNJAB	
CONSTRUCTION OF WASTEWATER TREATMENT PLANT IN NORTH ZONE, SAHIWAL	
BYPASS CHANNEL PROFILE	
NATIONAL ENGINEERING SERVICES PAKISTAN (PVT.) LTD. LAHORE	
DESN. NESPAK DWN. SARFRAZ	RECOMMENDED VER./CKD. APPROVED
FILE CKD. SUBM.	DATE SEP. 2023
DRAWING NO. 3976/11/TD/2J122	REV. 0

REFERENCE DRAWINGS	REV. NO.	DATE	DESCRIPTION	BY	CKD	APPR



OUTLET CHANNEL PROFILE



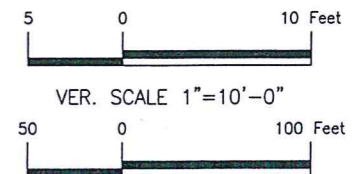
OUTLET CHANNEL PROFILE

LEGEND:-

- TOP LEVEL _____
- FINISHED GROUND LEVEL / NATURAL SURFACE LEVEL - - - - -
- BED LEVEL _____

NOTES:-

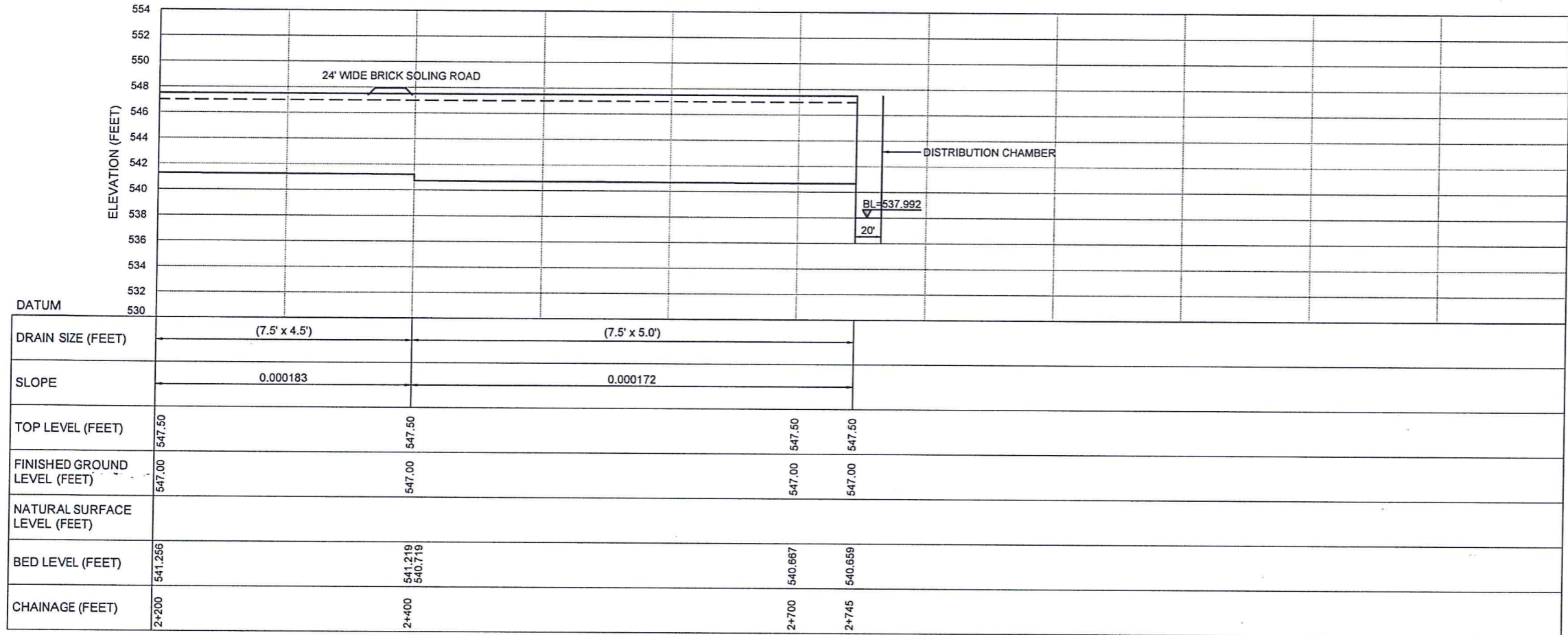
1. ALL LEVELS ARE IN FEET UNLESS OTHERWISE SPECIFIED.
2. ALL DIMENSIONS ARE IN FEET UNLESS OTHERWISE SPECIFIED.
3. READ THIS DRAWING IN CONJUNCTION WITH ALL RELEVANT DRAWINGS.
4. FOR LAYOUT PLAN, REFER TO DRAWING NO. 3976/11/C/2J106B.
5. FOR CONCRETE OUTLINE REFER TO DRAWING NO. 3976/033/C/15603.
6. FOR REINFORCEMENT DETAIL REFER TO DRAWING NO. 3976/033/C/15603A.
7. THE CONTRACTOR SHALL ARRANGE FOR ALL REQUIRED PERMITS BEFORE THE EXECUTION OF THE WORKS.
8. BEFORE EXECUTION AT SITE, CONTRACTOR SHALL CHECK/VERIFY RL/IL OF EXISTING NULLAH AND ROAD. IN CASE OF ANY DISPARITY IN LEVELS, IT SHALL BE INFORMED IMMEDIATELY TO THE ENGINEER FOR REVISION IN DRAWING.
9. AS BUILT DRAWINGS SHALL BE PREPARED/SUBMITTED BY THE CONTRACTOR AFTER COMPLETION OF THE WORK.



Prepared by: *[Signature]*
for and on behalf of
National Engineering Services
Pakistan (Pvt.) Ltd. (NESPAK)
(SHEET 3 OF 6)

PROGRAM MANAGEMENT UNIT, PUNJAB INTERMEDIATE CITIES IMPROVEMENT INVESTMENT PROGRAM (PICIP), LOCAL GOVERNMENT AND COMMUNITY DEVELOPMENT (LG & CD) DEPARTMENT, PUNJAB			
CONSTRUCTION OF WASTEWATER TREATMENT PLANT IN NORTH ZONE, SAHIWAL			
OUTLET CHANNEL PROFILE			
NATIONAL ENGINEERING SERVICES PAKISTAN (PVT.) LTD. LAHORE			
DESN. NESPAK DWN. SARFRAZ FILE CKD. SUBM.	RECOMMENDED DATE SEP. 2023	VER./CKD. DRAWING NO. 3976/11/TD/2J122	APPROVED REV. 0

REFERENCE DRAWINGS	REV. NO.	DATE	DESCRIPTION	BY	CKD	APPR



OUTLET CHANNEL PROFILE

LEGEND:-

- TOP LEVEL _____
- FINISHED GROUND LEVEL/ NATURAL SURFACE LEVEL - - - - -
- BED LEVEL _____

NOTES:-

1. ALL LEVELS ARE IN FEET UNLESS OTHERWISE SPECIFIED.
2. ALL DIMENSIONS ARE IN FEET UNLESS OTHERWISE SPECIFIED.
3. READ THIS DRAWING IN CONJUNCTION WITH ALL RELEVANT DRAWINGS.
4. FOR LAYOUT PLAN, REFER TO DRAWING NO. 3976/11/C/2J106B.
5. FOR CONCRETE OUTLINE REFER TO DRAWING NO. 3976/033/C/15603.
6. FOR REINFORCEMENT DETAIL REFER TO DRAWING NO. 3976/033/C/15603A.
7. THE CONTRACTOR SHALL ARRANGE FOR ALL REQUIRED PERMITS BEFORE THE EXECUTION OF THE WORKS.
8. BEFORE EXECUTION AT SITE, CONTRACTOR SHALL CHECK/VERIFY RL/IL OF EXISTING NULLAH AND ROAD. IN CASE OF ANY DISPARITY IN LEVELS, IT SHALL BE INFORMED IMMEDIATELY TO THE ENGINEER FOR REVISION IN DRAWING.
9. AS BUILT DRAWINGS SHALL BE PREPARED/SUBMITTED BY THE CONTRACTOR AFTER COMPLETION OF THE WORK.



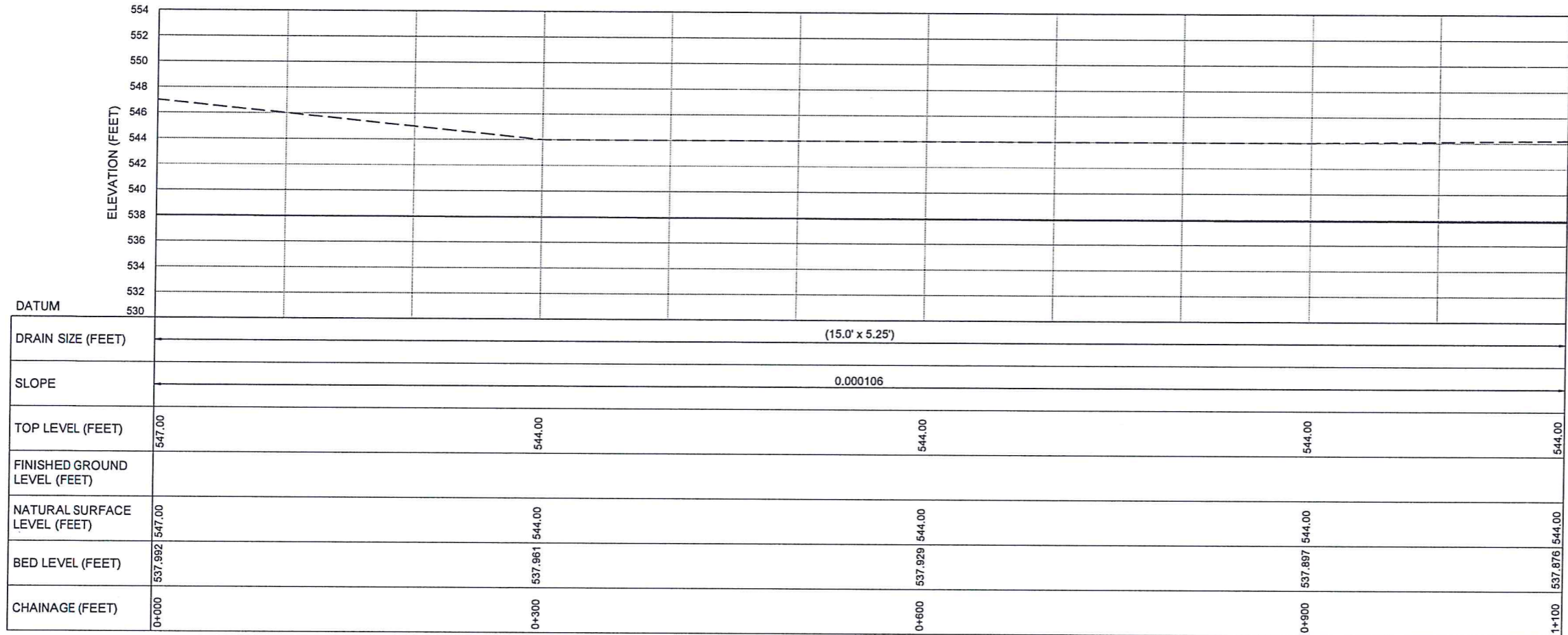
VER. SCALE 1"=10'-0"



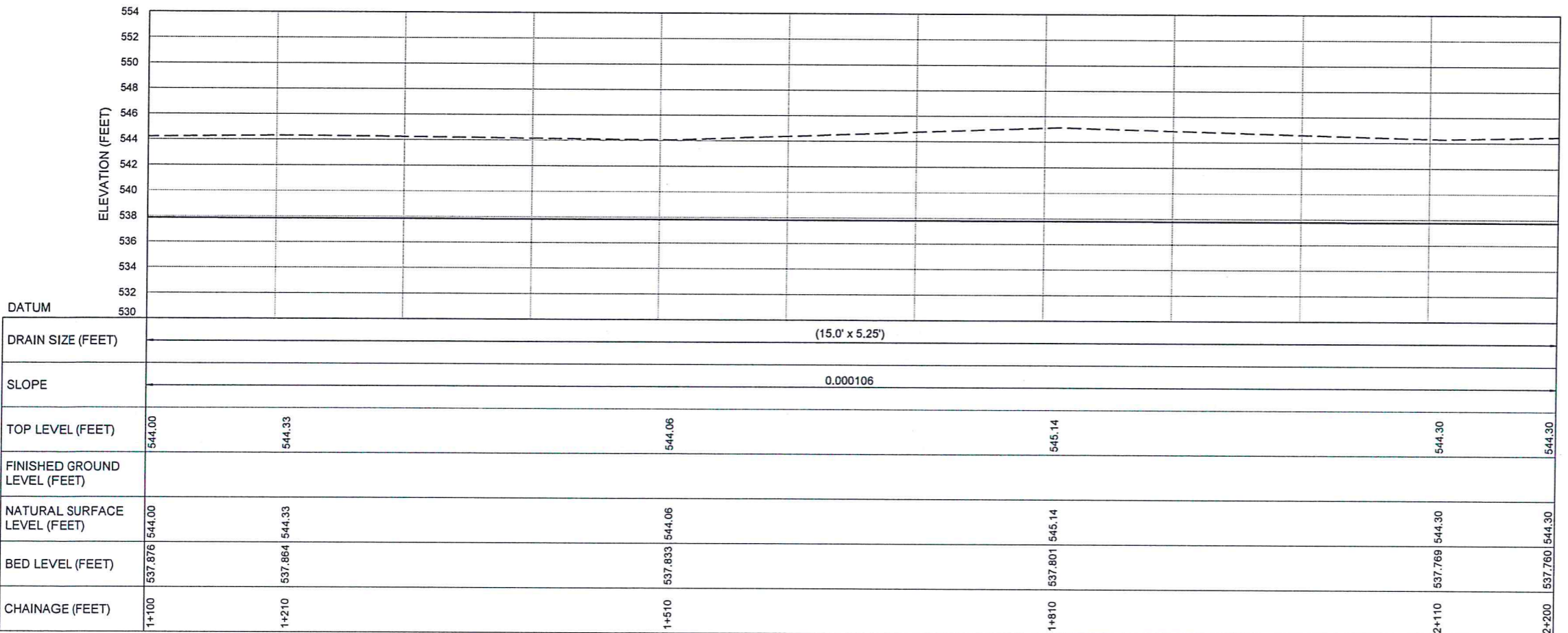
HOR. SCALE 1"=100'-0"

Prepared by: *[Signature]*
 For and on behalf of *[Signature]*
 National Engineering Services
 (SHEET 4 OF 6)

CONSTRUCTION OF WASTEWATER TREATMENT PLANT IN NORTH ZONE, SAHIWAL	
OUTLET CHANNEL PROFILE	
DESN. NESPAK DWN. SARFRAZ FILE CKD. SUBV.	RECOMMENDED VER./CKD. APPROVED DATE SEP. 2023
REFERENCE DRAWINGS REV. NO. DATE DESCRIPTION BY CKD APPR	DRAWING NO. 3976/11/TD/2J122 REV. 0



TREATED EFFLUENT CHANNEL PROFILE



TREATED EFFLUENT CHANNEL PROFILE

LEGEND:-

- TOP LEVEL _____
- FINISHED GROUND LEVEL/
NATURAL SURFACE LEVEL - - - - -
- BED LEVEL _____

NOTES:-

1. ALL LEVELS ARE IN FEET UNLESS OTHERWISE SPECIFIED.
2. ALL DIMENSIONS ARE IN FEET UNLESS OTHERWISE SPECIFIED.
3. READ THIS DRAWING IN CONJUNCTION WITH ALL RELEVANT DRAWINGS.
4. FOR LAYOUT PLAN, REFER TO DRAWING NO. 3976/11/C/2J106B.
5. FOR CONCRETE OUTLINE REFER TO DRAWING NO. 3976/033/C/15603.
6. FOR REINFORCEMENT DETAIL REFER TO DRAWING NO. 3976/033/C/15603A.
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9. AS BUILT DRAWINGS SHALL BE PREPARED/SUBMITTED BY THE CONTRACTOR AFTER COMPLETION OF THE WORK.



VER. SCALE 1"=10'-0"

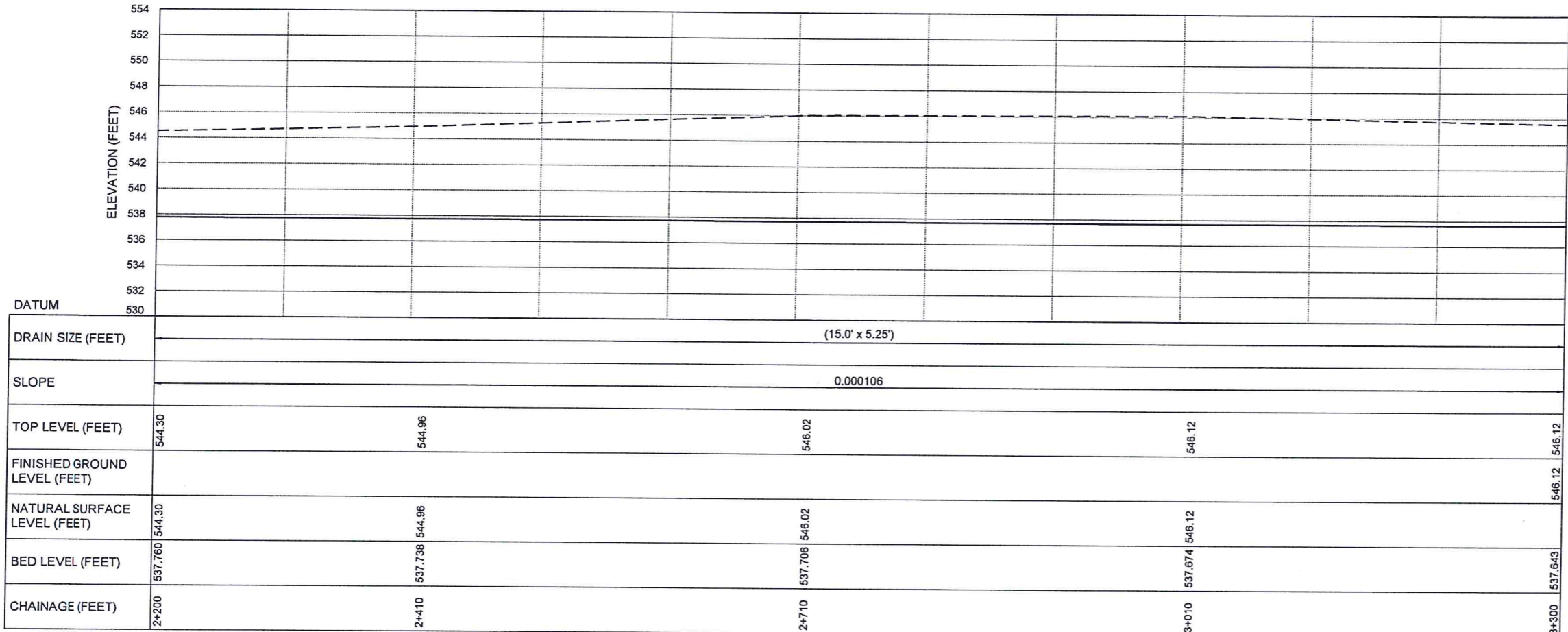


HOR. SCALE 1"=100'-0"

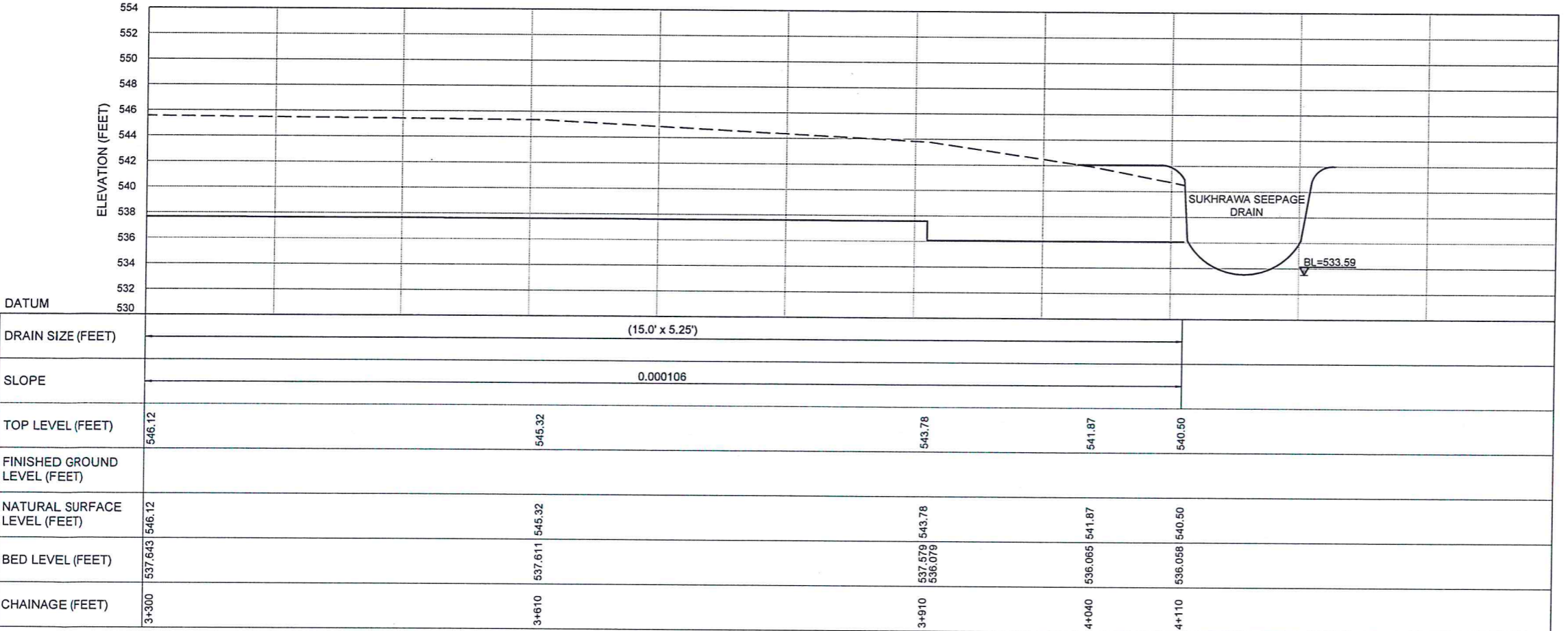
Prepared by
For and on behalf of
National Engineering Services
Pakistan (Pvt.) Ltd. (SHEET 5 OF 6)

PROGRAM MANAGEMENT UNIT, PUNJAB INTERMEDIATE CITIES IMPROVEMENT INVESTMENT PROGRAM (PICIP), LOCAL GOVERNMENT AND COMMUNITY DEVELOPMENT (LG & CD) DEPARTMENT, PUNJAB			
CONSTRUCTION OF WASTEWATER TREATMENT PLANT IN NORTH ZONE, SAHIWAL			
TREATED EFFLUENT CHANNEL PROFILE			
DESIGNER	RECOMMENDED	VER./CKD.	APPROVED
DWN. SARFRAZ			
FILE	DATE	DRAWING NO.	REV.
CKD.	SEP. 2023	3976/11/TD/2J122	0
SUBM.			

REFERENCE DRAWINGS	REV. NO.	DATE	DESCRIPTION	BY	CKD	APPR



TREATED EFFLUENT CHANNEL PROFILE



TREATED EFFLUENT CHANNEL PROFILE

LEGEND:-

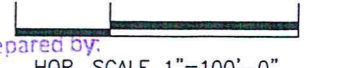
- TOP LEVEL _____
- FINISHED GROUND LEVEL / NATURAL SURFACE LEVEL - - - - -
- BED LEVEL _____

NOTES:-

1. ALL LEVELS ARE IN FEET UNLESS OTHERWISE SPECIFIED.
2. ALL DIMENSIONS ARE IN FEET UNLESS OTHERWISE SPECIFIED.
3. READ THIS DRAWING IN CONJUNCTION WITH ALL RELEVANT DRAWINGS.
4. FOR LAYOUT PLAN, REFER TO DRAWING NO. 3976/11/C/2J106B.
5. FOR CONCRETE OUTLINE REFER TO DRAWING NO. 3976/033/C/15603.
6. FOR REINFORCEMENT DETAIL REFER TO DRAWING NO. 3976/033/C/15603A.
7. THE CONTRACTOR SHALL ARRANGE FOR ALL REQUIRED PERMITS BEFORE THE EXECUTION OF THE WORKS.
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9. AS BUILT DRAWINGS SHALL BE PREPARED/SUBMITTED BY THE CONTRACTOR AFTER COMPLETION OF THE WORK.



VER. SCALE 1"=10'-0"



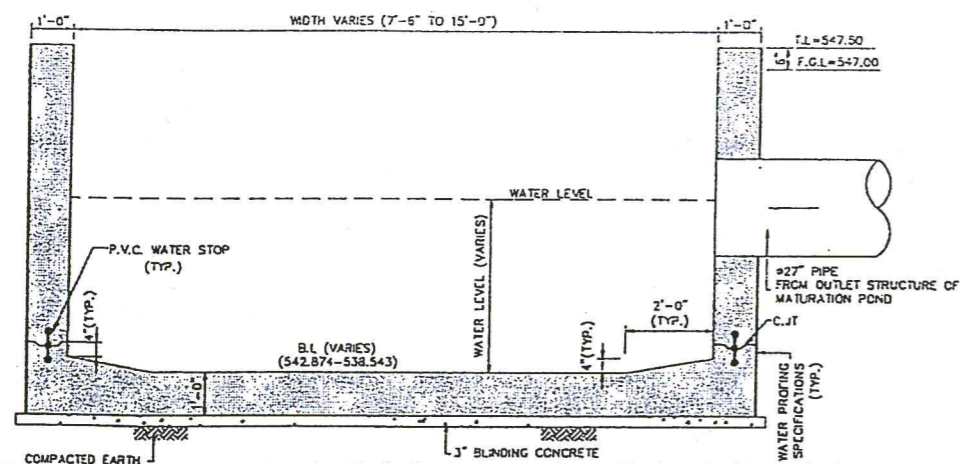
HOR. SCALE 1"=100'-0"

Prepared by:
 For and on behalf of
 National Engineering Services
 Pakistan (Pvt.) Ltd. (SHEET 6 OF 6)

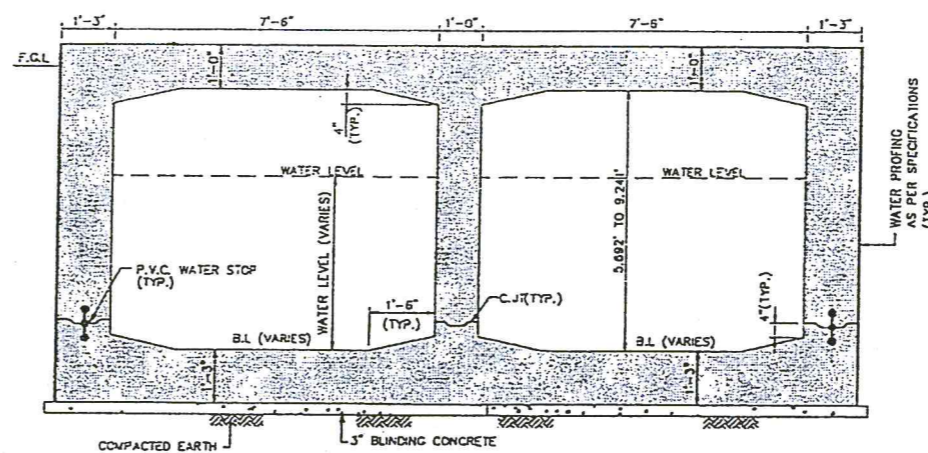
PROGRAM MANAGEMENT UNIT, PUNJAB INTERMEDIATE CITIES IMPROVEMENT INVESTMENT PROGRAM (PICIP), LOCAL GOVERNMENT AND COMMUNITY DEVELOPMENT (LG & CD) DEPARTMENT, PUNJAB	
CONSTRUCTION OF WASTEWATER TREATMENT PLANT IN NORTH ZONE, SAHIWAL	
TREATED EFFLUENT CHANNEL PROFILE	
NATIONAL ENGINEERING SERVICES PAKISTAN (PVT.) LTD. LAHORE	
DESN: NESPAK DWN: SARFRAZ FILE: _____ CKD: _____ SUB: _____	RECOMMENDED _____ VER./CKD. _____ APPROVED _____ DATE: SEP. 2023 DRAWING NO.: 3976/11/TD/2J122 REV.: 0

REFERENCE DRAWINGS	REV. NO.	DATE	DESCRIPTION	BY	CKD	APPR

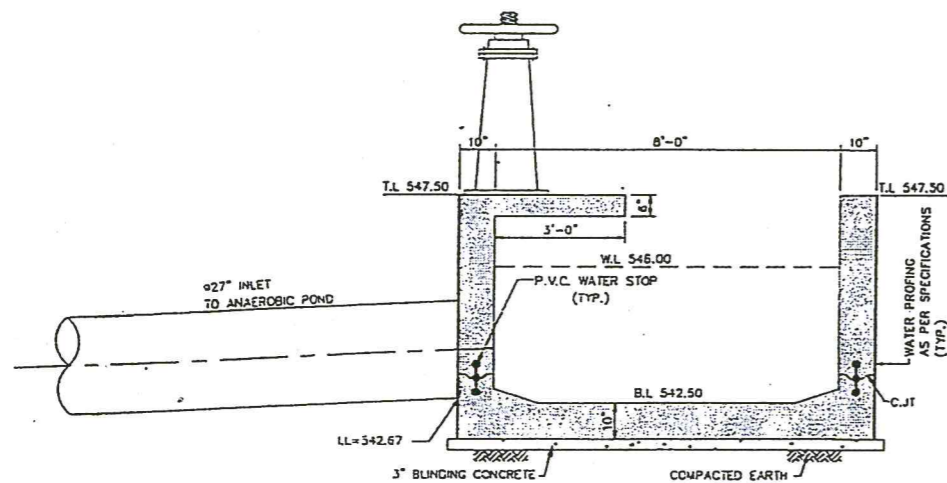
STRUCTURAL DRAWINGS



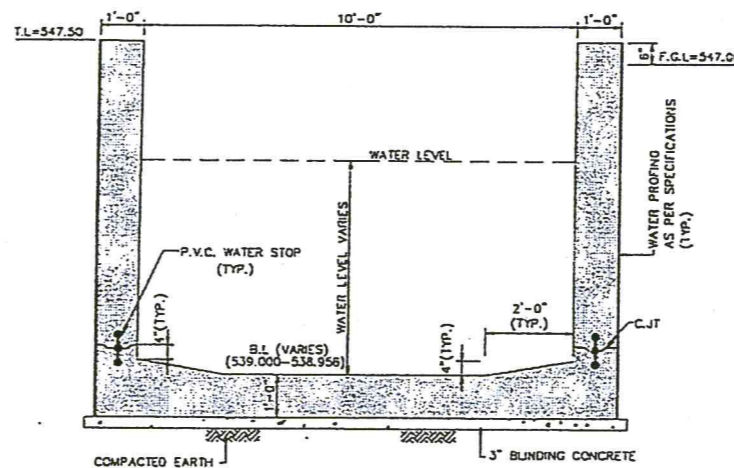
TYPICAL X-SECTION OF TREATED EFFLUENT CHANNEL (OPEN)



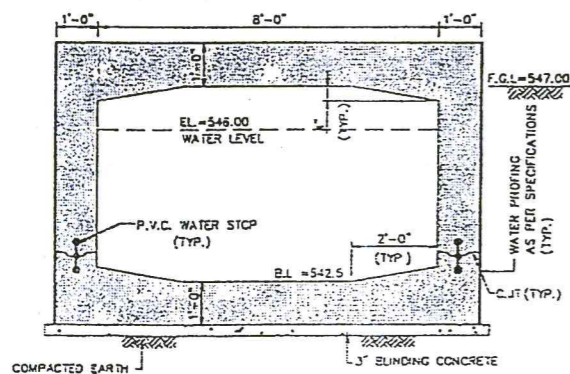
TYPICAL X-SECTION OF TREATED EFFLUENT / COVERED DRAIN



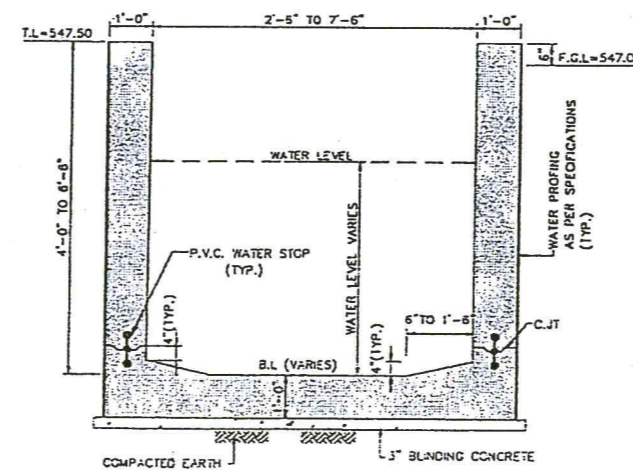
INLET CHANNEL



TYPICAL X-SECTION OF BYPASS CHANNEL



X-SECTION OF INLET CHANNEL (COVERED)



TYPICAL X-SECTION OF OUTLET CHANNEL / OPEN DRAIN

NOTES:

- FOR GENERAL NOTES REFER DRAWING NO. 3976/037/TD/C001.
 - ALL DIMENSIONS ARE IN FEET AND INCHES.
 - THIS DRAWING SHALL BE READ IN CONJUNCTION WITH ALL RELEVANT DRAWINGS.
 - FOUNDATION SHALL BE PLACED ON COMPETENT BEARING STRATA. IF ACCEPTABLE BEARING STRATA IS NOT FOUND AT INDICATED DEPTHS OF FOUNDATION, THE ENGINEER SHALL BE NOTIFIED IN WRITING FOR HIS INSTRUCTIONS.
 - THE BED OF FOUNDATION SHALL BE THOROUGHLY COMPACTED PRIOR TO LAYING FOUNDATION. IF A POCKET OF WEAK/SOFT SOIL IS ENCOUNTERED AT THE FOUNDATION BASE LEVEL, FURTHER EXCAVATION AND REPLACEMENT WITH SELECT MATERIAL IS RECOMMENDED. THIS MATERIAL SHOULD BE COMPACTED IN LAYERS APPROPRIATE TO THE SIZE AND TYPE OF THE EQUIPMENT TO AT LEAST 95% MODIFIED PROCTOR MAXIMUM DRY DENSITY.
 - BLINDING CONCRETE/P.C.C SHALL HAVE A MINIMUM COMPRESSIVE CYLINDER STRENGTH OF 1500 psi (1:3:6) AT 28 DAYS.
 - REINFORCED CONCRETE SHALL HAVE A MINIMUM COMPRESSIVE CYLINDER STRENGTH OF 4000 psi (1:1:2) AT 28 DAYS.
 - ALL REINFORCEMENT SHALL BE DEFORMED BARS CONFORMING TO ASTM A 615 GRADE 60 HAVING A MINIMUM YIELD STRENGTH OF 60,000 psi (414MPa)
 - THE FOLLOWING MINIMUM CLEAR CONCRETE COVER TO REINFORCEMENT SHALL BE PROVIDED, UNLESS OTHERWISE SPECIFIED ON THE DRAWING.
- | STRUCTURAL ELEMENT | COVER (INCHES) |
|--------------------|----------------|
| (i) TOP SLAB | 2" (50) |
| (ii) WALLS | 2" (50) |
| (iii) BASE SLAB | 2" (50) |
- UNLESS OTHERWISE STATED ON THE DRAWINGS, THE LAP LENGTHS SHALL BE 60 TIMES DIAMETER OF THE BAR SIZE UP TO #6 AND 72 TIMES DIAMETER OF THE BAR SIZE FOR #7 AND HIGHER BARS.
 - THE CONTRACTOR SHALL PREPARE THE BAR BENDING SCHEDULES AND SHALL SUBMIT FOR APPROVAL OF THE ENGINEER 15 DAYS PRIOR TO EXECUTION OF WORK AT SITE.
 - THE CONTRACTOR SHALL ENSURE THAT ALL THE EMBEDDED ITEMS ARE SECURED AND HELD IN POSITION BEFORE CONCRETING.
 - PVC WATERSTOP SHALL BE PROVIDED IN ALL CONSTRUCTION/CONSTRUCTION JOINTS THE SIZE OF WATERSTOP SHALL BE 9" (225)WIDE AND 1/4"(6) THICK HAVING TWO BULBS.
 - THE BITUMEN FOR WATERPROOFING SHALL BE AS APPROVED BY THE ENGINEER.
 - PROVIDE CONTRACTION JOINTS AT 40 FT.(12000) C/C.
 - BACKFILLING SHALL BE CARRIED OUT WITH THE MATERIAL APPROVED BY GEOTECHNICAL ENGINEER AND SHALL BE COMPACTED IN LAYERS APPROPRIATE TO THE SIZE AND TYPE OF THE COMPACTION EQUIPMENT TO AT LEAST 95% MODIFIED PROCTOR MAX. DRY DENSITY.

TENDER DRAWING
Prepared by:
NOT TO BE USED FOR CONSTRUCTION

SCALE: 1/4" = 1'-0" on behalf of 4 FEET
National Engineering Services
Pakistan (UNLESS OTHERWISE NOTED, SPAK)

PROGRAM MANAGEMENT UNIT, PUNJAB INTERMEDIATE CITIES IMPROVEMENT INVESTMENT PROGRAM (PICIP), LOCAL GOVERNMENT AND COMMUNITY DEVELOPMENT (LG & CD) DEPARTMENT, PUNJAB

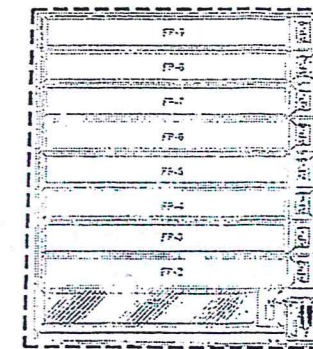
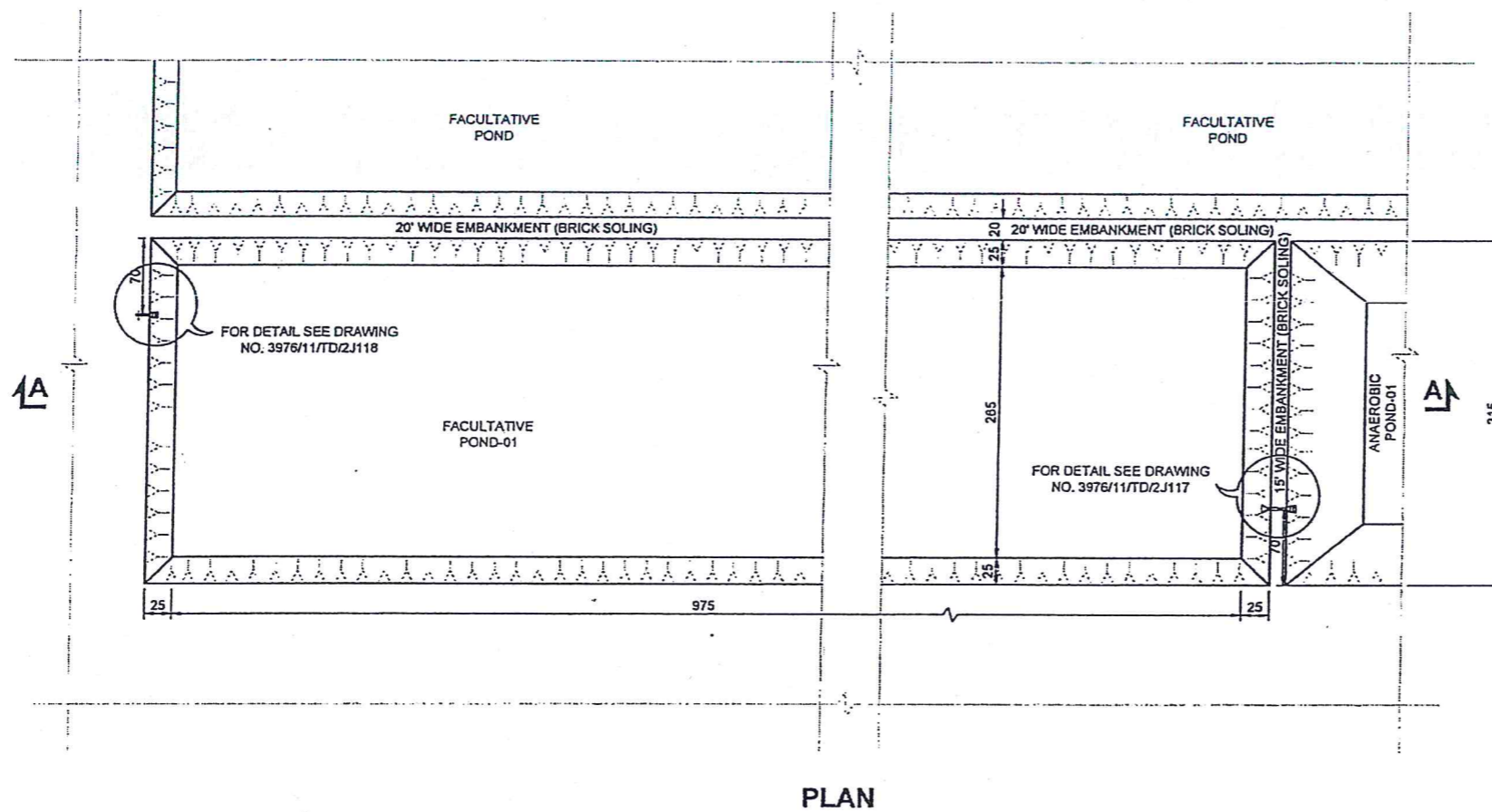
CONSTRUCTION OF WASTEWATER TREATMENT PLANT IN NORTH ZONE, SAHIVAL (STAGE-I)

INLET CHANNEL AND OUTLET CHANNEL - SECTION CONCRETE OUTLINE

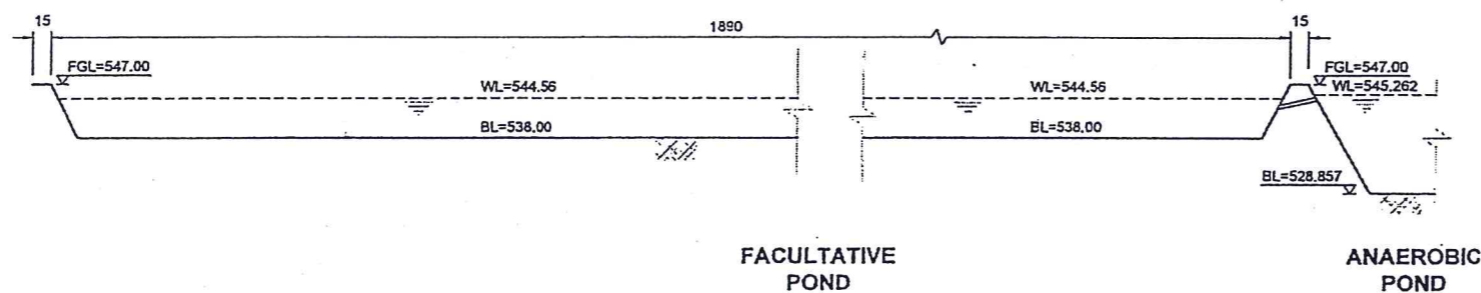
NESPAK -

DESIGNER: NESPAK	RECOMMENDED	VER./CHKD.	APPROVED
OWN: ASIM KASURI			
FILE	DATE	DRAWING NO.	REV.
CKD.	SEP 2022	3976/037/TD/15G02	
SUBJ.			

REFERENCE DRAWINGS	REVISED DATE	DESCRIPTION	BY	CHKD.	APPROV.



KEY PLAN



SECTION A-A

NOTES

- FOR GENERAL NOTES AND LEGENDS SEE DRAWING NO. 3976/11/TD/2J100.
- READ THIS DRAWING IN CONJUNCTION WITH ALL OTHER RELEVANT DRAWINGS.

Prepared by:

For and on behalf of
National Engineering Services
Pakistan (Pvt.) Ltd. Lahore

HOR: 1"=150'
VER: 1"=30'

PROGRAM MANAGEMENT UNIT, PUNJAB INTERMEDIATE CITIES IMPROVEMENT INVESTMENT PROGRAM (PICIP), LOCAL GOVERNMENT AND COMMUNITY DEVELOPMENT (LG & CD) DEPARTMENT, PUNJAB

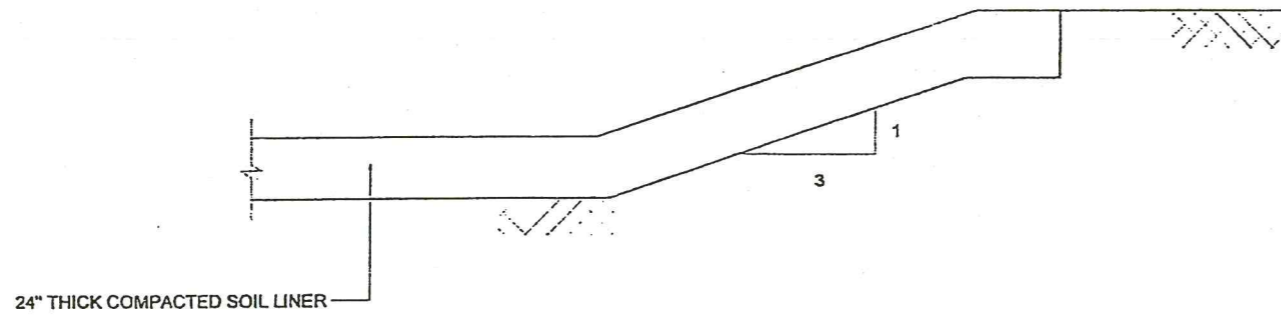
CONSTRUCTION OF WASTEWATER TREATMENT PLANT IN NORTH ZONE, SAHIWAL

FACULTATIVE POND (FP-01)
PLAN AND SECTION

NATIONAL ENGINEERING SERVICES
PAKISTAN (PVT.) LTD. LAHORE

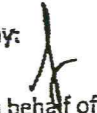
DESIGNER: NESPAK	RECOMMENDED	VER./CHKD.	APPROVED
DWN: SARFRAZ			
FILE	DATE	DRAWING NO.	
CHKD.	SEP. 2023	3976/11/TD/2J112	
SUBM.			REV. 0

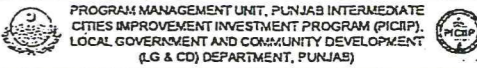
REFERENCE DRAWINGS	REV. NO.	DATE	DESCRIPTION	BY	CHKD.	APPR.



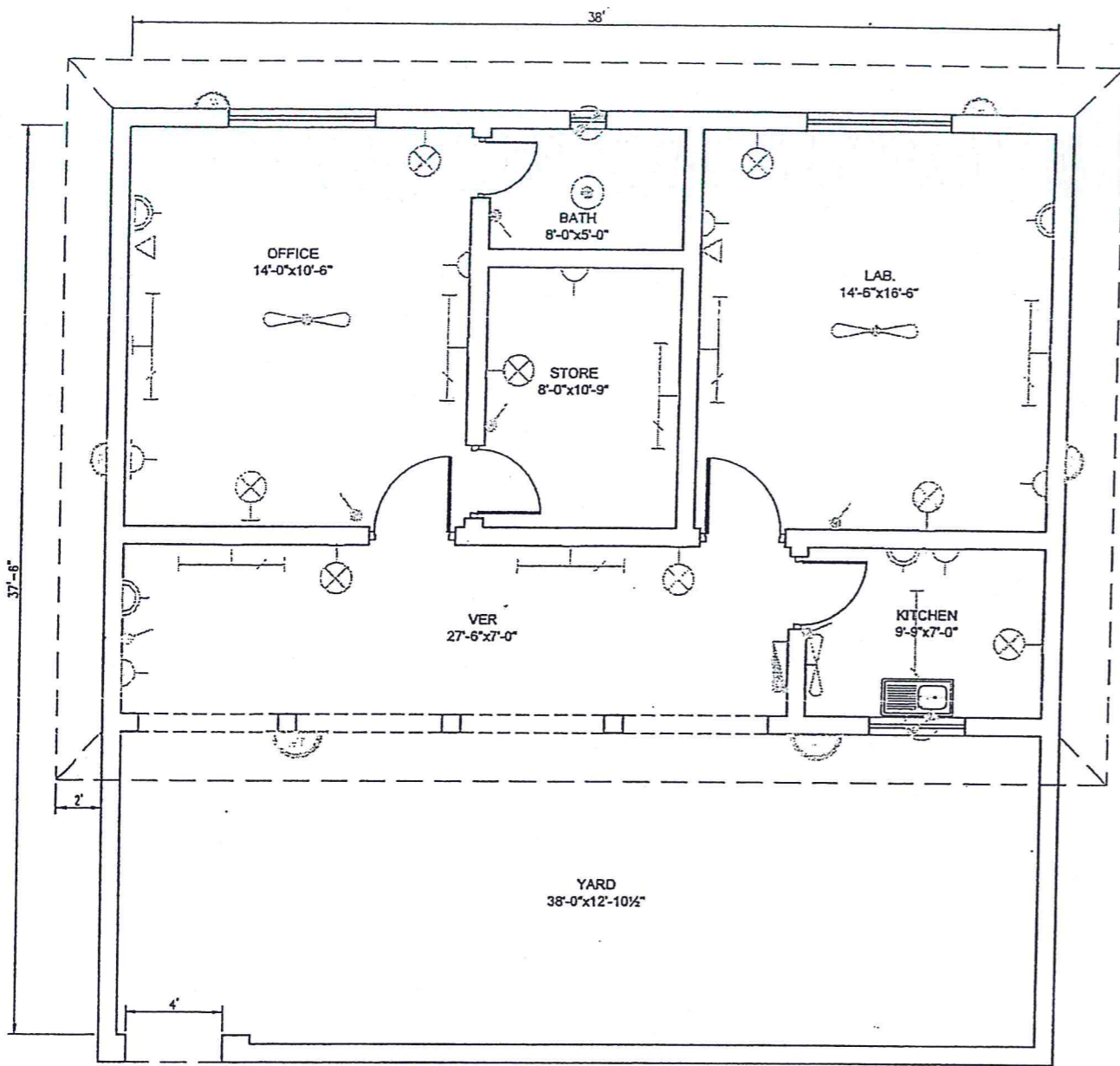
NOTES

1. ALL DIMENSIONS AND LEVELS ARE IN FEET UNLESS OTHERWISE SPECIFIED.
2. FOR LAYOUT PLAN AND X-SECTIONS, SEE DRAWING NOS. 3976/11/C/2J106 & 3976/11/C/2J108.
3. READ THIS DRAWING IN CONJUNCTION WITH ALL OTHER RELEVANT DRAWINGS.
4. COMPACTED SOIL LINER WITH A MINIMUM THICKNESS OF 24" SHALL BE PLACED AT THE BOTTOM AND ON SIDE SLOPES OF THE PONDS.
5. THE COMPACTED SOIL LINER SHALL BE PLACED IN LAYERS WITH MAXIMUM COMPACTED LAYER THICKNESS OF 150 mm & COMPACTED TO AT LEAST 90 % OF THE MAXIMUM MODIFIED PROCTOR DRY DENSITY AT ± 2 % WET OPTIMUM MOISTURE CONTENT.
6. THE MATERIAL SUITABLE TO BE USED FOR COMPACTED SOIL LINER SHALL MEET THE FOLLOWING SPECIFICATIONS:
 - I) VERTICAL IN-SITU HYDRAULIC CONDUCTIVITY IN COMPACTED STATE $\leq 1 \times 10^{-7}$ CM/SEC
 - II) FINES (PARTICLES PASSING 0.075mm SIEVE) $\geq 30\%$.
 - III) PLASTICITY INDEX = 8 - 30%.
 - IV) GRAVELS (PARTICLES PASSING 75MM SIEVE AND RETAINING 4.75mm SIEVE) $\leq 20\%$.
 - V) MAXIMUM PARTICLE SIZE ≤ 10 mm.
7. THE ENVIRONMENTAL PROTECTION AGENCY (EPA) REQUIRES THE HIGHEST LEVEL OF SUPERVISION i.e. LEVEL-1 SUPERVISION FOR CLAY LINED WASTE STABILIZATION PONDS, THEREFORE ALL THE EARTH WORK OPERATIONS MUST BE CONTINUOUSLY SUPERVISED AND TESTED AS PER TECHNICAL SPECIFICATION BY AN EXPERIENCED/ SPECIALIZED ENGINEER IN SIMILAR WORKS.
8. THE CONTRACTOR SHOULD SUBMIT HIS METHOD STATEMENT PRIOR TO PLACEMENT OF CLAY LINER, HDPE LINER AND PROTECTIVE SOIL COVER. BEFORE EXECUTION OF WORK FOR THE APPROVAL OF THE ENGINEER.

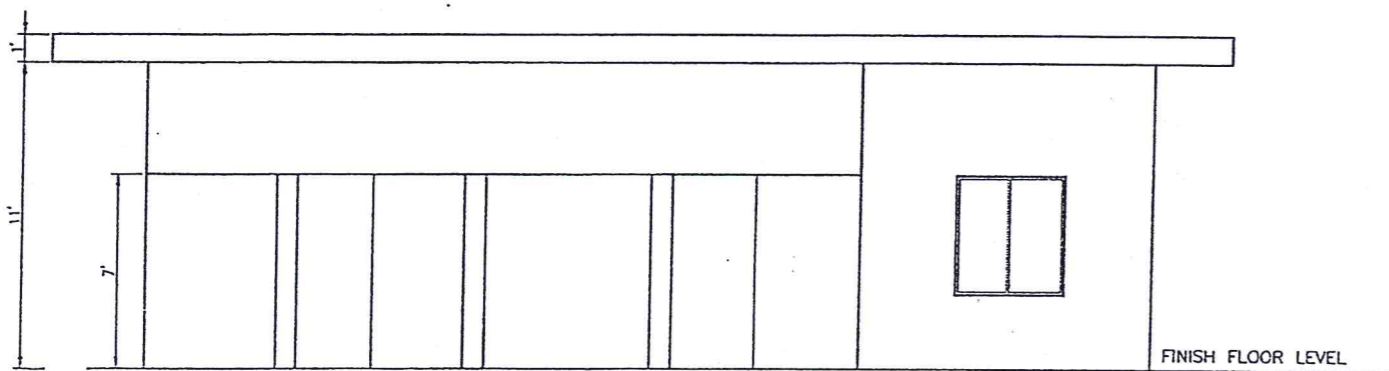
Prepared by: 
 For and on behalf of
 National Engineering Services
 Pakistan (Pvt.) Ltd. (NESPAK)

			
PROGRAM MANAGEMENT UNIT, PUNJAB INTERMEDIATE CITIES IMPROVEMENT INVESTMENT PROGRAM (PICIP), LOCAL GOVERNMENT AND COMMUNITY DEVELOPMENT (LG & CD) DEPARTMENT, PUNJAB			
CONSTRUCTION OF WASTEWATER TREATMENT PLANT IN NORTH ZONE, SAHIWAL (STAGE-I)			
DETAILS OF LINER			
NESPAK -			
DESIGN	RECOMMENDED	VER./CKD.	APPROVED
CHKD.			
FILE			
CKD.	DATE	DRAWING NO.	REV.
SUBV.	SEP. 2023	3976/024/TD/7D01	0

REFERENCE DRAWINGS	REV. NO.	DATE	DESCRIPTION	BY	CHKD.	APPR.



OPERATOR QUARTER

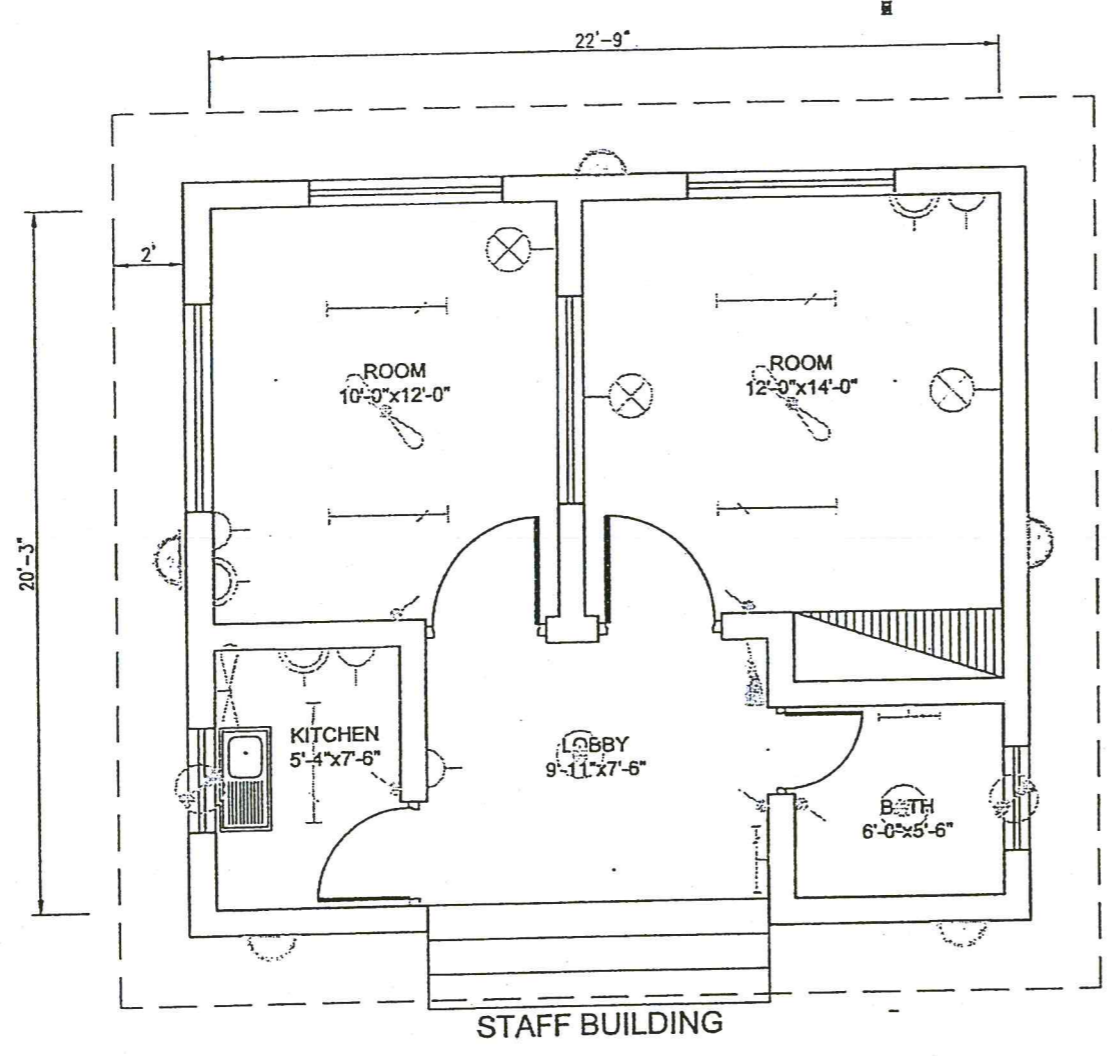


ELEVATION

Prepared by: *[Signature]*
 For and on behalf of
 National Engineering Service
 Pakistan (Private) Ltd.

PROGRAM MANAGEMENT UNIT, PUNJAB INTERMEDIATE CITIES IMPROVEMENT INVESTMENT PROGRAM (PICIP), LOCAL GOVERNMENT AND COMMUNITY DEVELOPMENT (LG & CD) DEPARTMENT, PUNJAB			
CONSTRUCTION OF WASTEWATER TREATMENT PLANT IN NORTH ZONE, SAHIWAL (STAGE-I)			
OFFICE BUILDING & LAB. ELECTRIFICATION LAYOUT PLAN			
DESIGNER: NESPAK	RECOMMENDED:	VERIFIED/CHKD:	APPROVED:
DWN: SA			
FILE:	DATE:	DRAWING NO.	
CKD:	SEP. 2023	3976/161/TTD/5E002	
SUBM:		REV.	0

REFERENCE DRAWINGS	REV. NO.	DATE	DESCRIPTION	BY	CHKD	APPR



Prepared by: *[Signature]*
 For and on behalf of
 [Illegible text]

PROGRAM MANAGEMENT UNIT, PUNJAB INTERMEDIATE CITIES IMPROVEMENT INVESTMENT PROGRAM (PICIP), LOCAL GOVERNMENT AND COMMUNITY DEVELOPMENT (LG & CD) DEPARTMENT, PUNJAB			
CONSTRUCTION OF WASTEWATER TREATMENT PLANT IN NORTH ZONE, SAHIVAL (STAGE-I), LOT-I			
STAFF BUILDING ELECTRIFICATION LAYOUT PLAN			
NESPAK -			
DESIGNER: NESPAK	RECOMMENDED:	VER./CKD.	APPROVED
DRAWN: SA			
FILE:	DATE:	DRAWING NO.	
CKD:	SEP, 2022	3976/161/TD/5E003	
SURV:		REV.	0

REFERENCE DRAWINGS	REV. NO.	DATE	DESCRIPTION	BY	CD	APPR.

ELECTRICAL DRAWINGS

GENERAL NOTES

- THIS DRAWING SHALL BE READ IN CONJUNCTION WITH ITEMS OF BILL OF QUANTITIES AND TECHNICAL SPECIFICATION.
- THIS DRAWING SHALL BE COORDINATED WITH OTHER DISCIPLINES WORKS FOR ROUTING, SPACING AND INSTALLATIONS.
- THE MINIMUM SIZE OF THE PVC CONDUIT SHALL BE 25mm (1") DIA.
- LIGHT CIRCUIT WIRING SHALL BE WITH 3x2.5 mm Sq (7.029) & LIGHT POINT WIRING 3x1.5 mm Sq (3.029).
- POWER SOCKETS (20Amp) SHALL BE WIRED WITH 3x6mm.Sq (7.044) LIGHT PLUG (10/13Amp) SOCKETS FIRST POINT SHALL BE WIRED WITH 3x4mm.Sq (7.036) & 10/13Amp. SOCKETS POINT TO POINT WIRED WITH 3x2.5mm. Sq (7.029) STRANDED CU. PVC CABLES.
- SINGLE CORE WIRES SHALL HAVE THE FOLLOWING COLOURS.
PHASE WIRES..... RED, YELLOW & BLUE
NEUTRAL WIRES.....BLACK
C.P.C.....GREEN/YELLOW (AS PER B.O.Q)
- THE WIRING SHALL BE STARTED ONLY AFTER THE CONDUIT SYSTEM IS COMPLETELY INSTALLED AND ALL OUTLET BOXES ETC. ARE FIXED IN THEIR POSITIONS.
- POWER/LIGHT PLUG SOCKETS WIRING SHALL BE SEGREGATED AND HAVE INDEPENDENT WIRES RIGHT FROM MINIATURE CIRCUIT BREAKERS IN DISTRIBUTION BOARD.
- ACTUAL LOCATION OF ALL OUTLETS MUST BE VERIFIED BY THE CONTRACTOR SITE ENGINEER BEFORE INSTALLATION COMMENCES
- THE MOUNTING HEIGHT OF THE SOCKET OUTLETS SHALL BE MINIMUM 300mm (FFL)
- THE MOUNTING HEIGHT OF THE LIGHTING SWITCHES SHALL BE MINIMUM 1100mm (FFL)
- NO LUBRICATION EXCEPT AS RECOMMENDED BY MANUFACTURER SHALL BE USED ON WIRES FOR REDUCING FRICTION. NO OIL OR SOAP OF ANY KIND WILL BE ALLOWED ON WIRES FOR THIS PURPOSE.
- THE CONTRACTOR SHALL SUBMIT CONDUITS LAYOUT PLAN BASED UPON THE ELECTRIFICATION DRAWINGS FOR THE APPROVAL OF ELECTRICAL ENGINEER, BEFORE POURING OF ROOF SLABS, WALL AND COLUMNS.
- THE ELECTRICAL WORKS SHALL BE EXECUTED IN STRICT ACCORDANCE WITH THE PROJECT SPECIFICATION
- THE ELECTRICAL EQUIPMENT/MATERIAL SHALL BE SUPPLIED FROM APPROVED MANUFACTURER AS PER APPLICABLE STANDARDS AND CODES

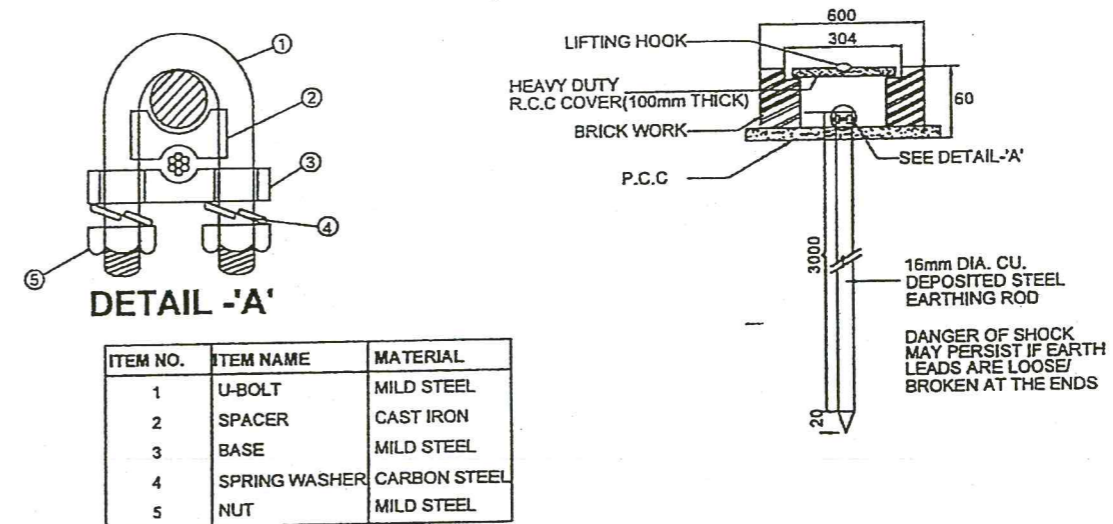
LEGEND:

SYMBOL	DESCRIPTION
	DISTRIBUTION BOARD (DB)
	MOULDED CASE CIRCUIT BREAKER (MCCB)
	VOLTMETER
	AMMETER
	SELECTOR SWITCH
	CEILING FAN
	WALL BRACKET FAN
	EXHAUST FAN
	SINGLE POLE 1-WAY SWITCH
	20 AMP 3 PIN SINGLE PHASE, NEUTRAL & EARTH SWITCH SOCKET UNIT (AWAY FROM SWITCH BOARD)
	10/13 AMPS 3 PIN SINGLE PHASE SWITCH SOCKET UNIT (AWAY FROM SWITCH BOARD)

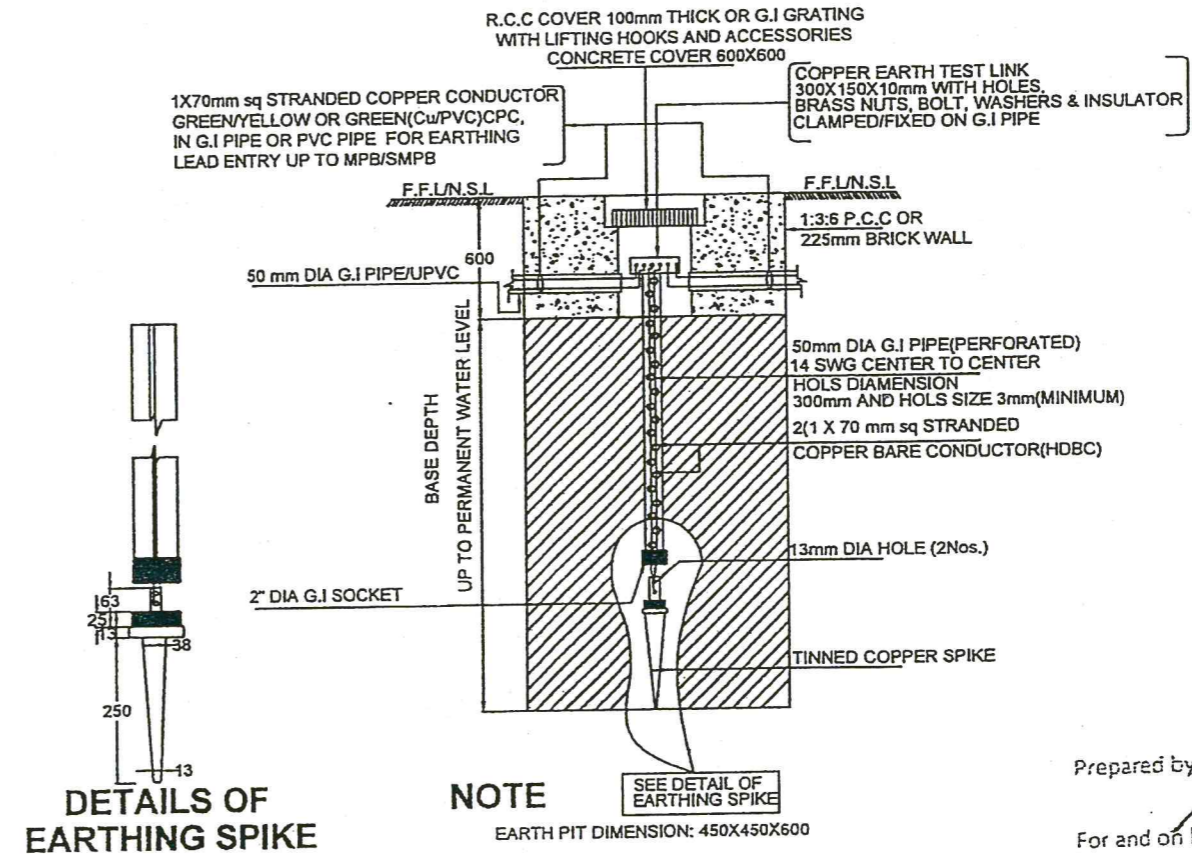
LIGHTING FITTINGS SCHEDULE:

SYMBOL	DESCRIPTION
	WALL BRACKET LED LIGHT 6W COMPLETE IN ALL RESPECT.
	LED BATTEN SURFACE MOUNTED 18W LED LIGHT COMPLETE IN ALL RESPECT. OR APPROVED EQUIVALENT
	LED BATTEN SURFACE MOUNTED 10W LED LIGHT COMPLETE IN ALL RESPECT. OR APPROVED EQUIVALENT
	HANGING LIGHT 100W HIGH BAY TYPE COMPLETE IN ALL RESPECT.
	20W LED WATER TIGHT LIGHT FIXTURE IP65 COMPLETE IN ALL RESPECT.
	LED LIGHT FIXTURE SURFACE MOUNTED 6W COMPLETE IN ALL RESPECT.

ROD TYPE EARTH POINT DETAIL FOR DB,S



BORE TYPE EARTHING DETAIL



NOTES

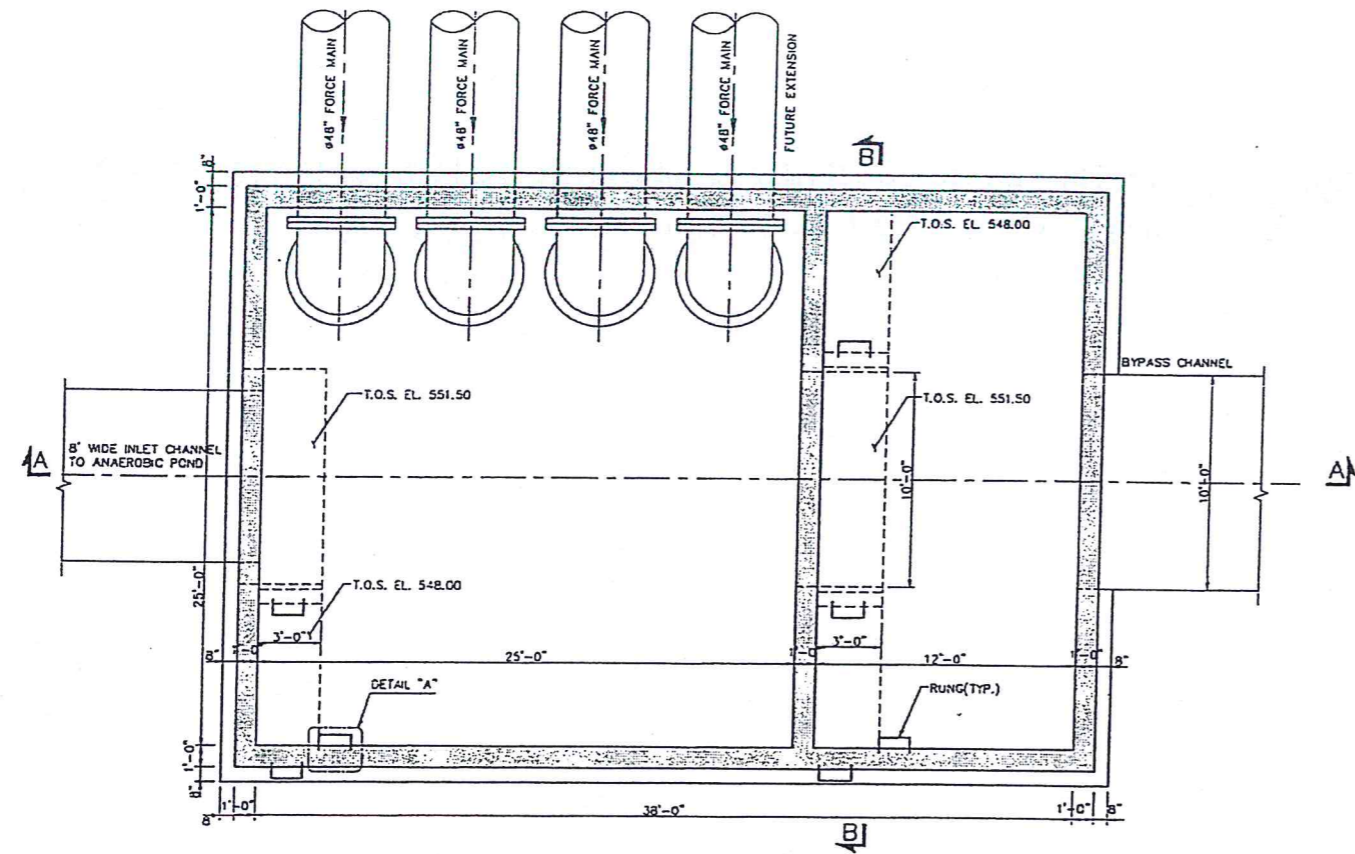
- ALL DIMENSIONS ARE IN MM AS SHOWN ON DRAWING.
- THIS DRAWING IS FOR INDICATIVE DESIGN MODEL AND SHOULD BE READ IN CONJUNCTION WITH SPECIFICATIONS AND ITEMS OF BILL OF QUANTITIES.
- EARTH BORE SHALL BE MADE AT 2000MM (2M) AWAY FROM FOUNDATION/STRUCTURE.
- DISTANCE BETWEEN TWO EARTH BORES SHALL NOT BE LESS THAN 3000MM (3M)
- CONNECTION SHALL BE BOLTED WITH THIMBLES, BRASS NUTS, BOLTS/WASHER ETC.
- CONTRACTOR SHALL MEASURE EARTHING RESISTANCE IN THE PRESENCE OF SITE ENGINEER, FOR FINAL ACCEPTANCE.
- THE VALUE OF EARTH RESISTANCE SHALL BE INCORPORATED IN FINAL AS-BUILT DRAWINGS.

Prepared by:

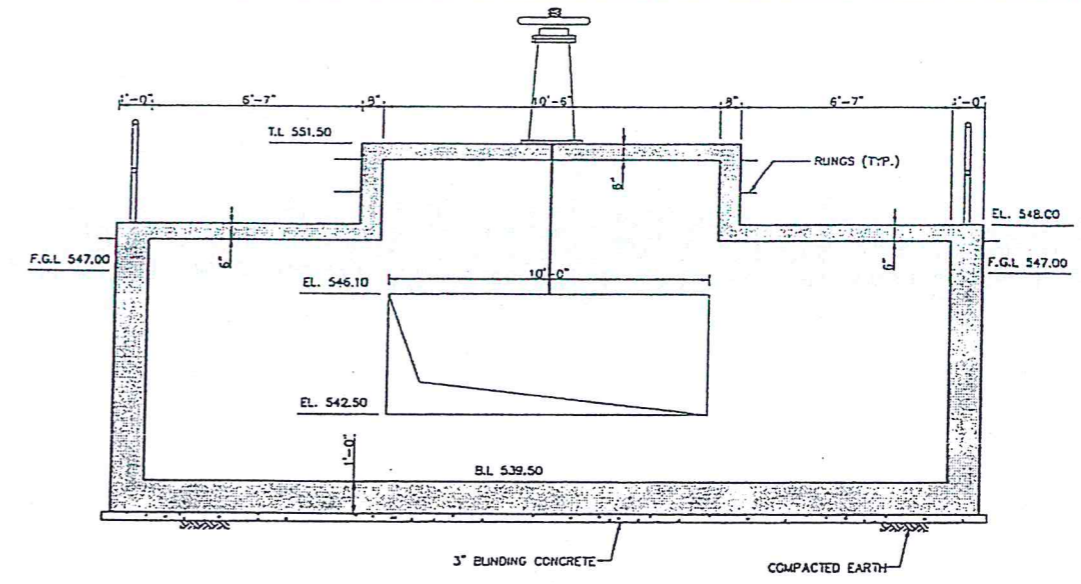
For and on behalf of
National Engineering Services
Pakistan (Pvt.) Ltd. (NESPAK)

PROGRAM MANAGEMENT UNIT, PUNJAB INTERMEDIATE CITIES IMPROVEMENT INVESTMENT PROGRAM (PICIP), LOCAL GOVERNMENT AND COMMUNITY DEVELOPMENT (LG & CD) DEPARTMENT, PUNJAB			
CONSTRUCTION OF WASTEWATER TREATMENT PLANT IN NORTH ZONE, SAHIVAL (STAGE-I)			
LEGEND, GENERAL NOTES LIGHTING FITTING SCHEDULE & EARTH POINT DETAILS			
NESPAK -			
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DRAWN: SA			
FILE:	DATE:	DRAWING NO.	
CHKD.:	SEP. 2023	3978/161/TD/5E001	
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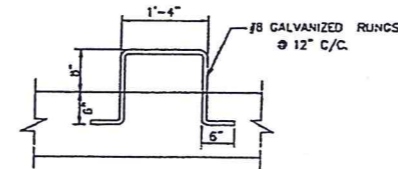
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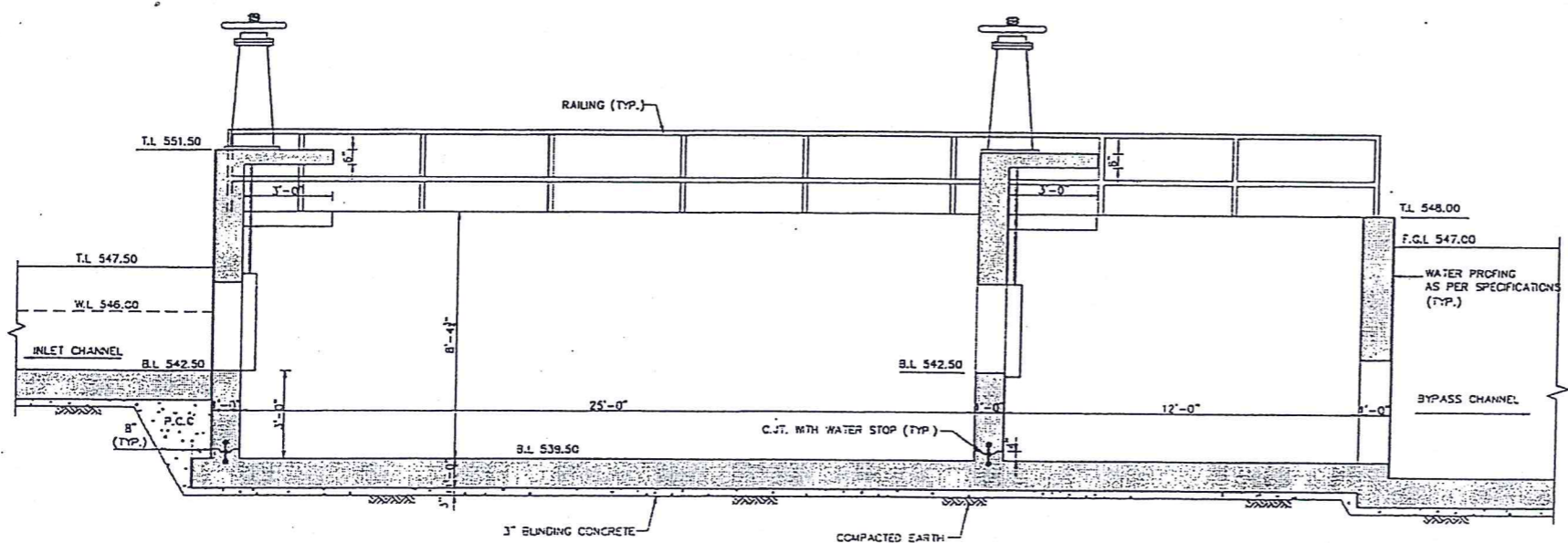
FOUNDATION PLAN
COLLECTION CHAMBER
(CONCRETE OUTLINE)



SECTION B-B
COLLECTION CHAMBER
(CONCRETE OUTLINE)
SCALE 3/8"=1'-0"



DETAIL "A"
RUNGS DETAIL
SCALE 3/4"=1'-0"



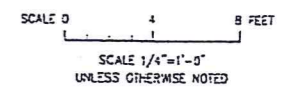
SECTION A-A
COLLECTION CHAMBER
(CONCRETE OUTLINE)
SCALE 3/8"=1'-0"

NOTES:

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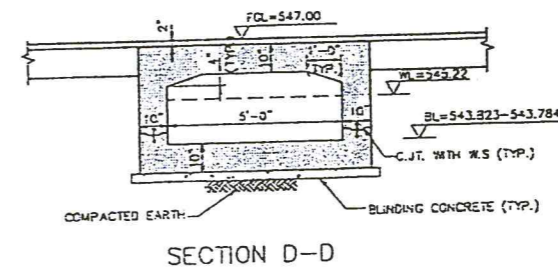
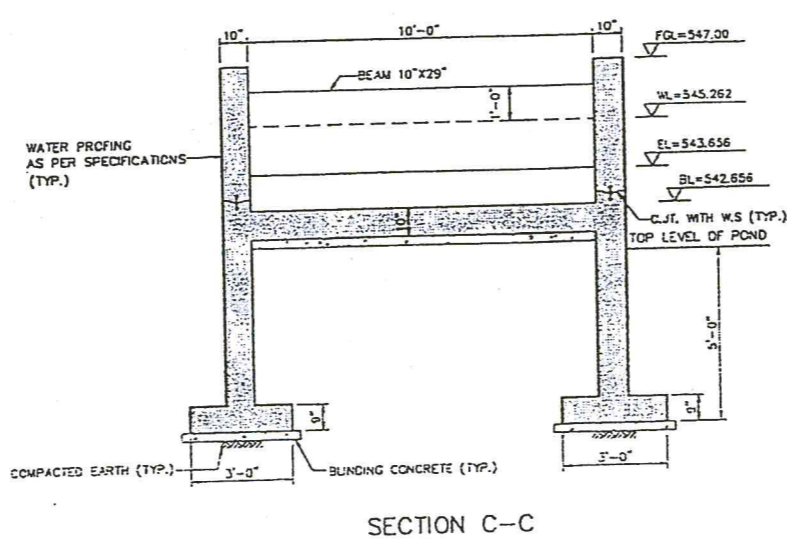
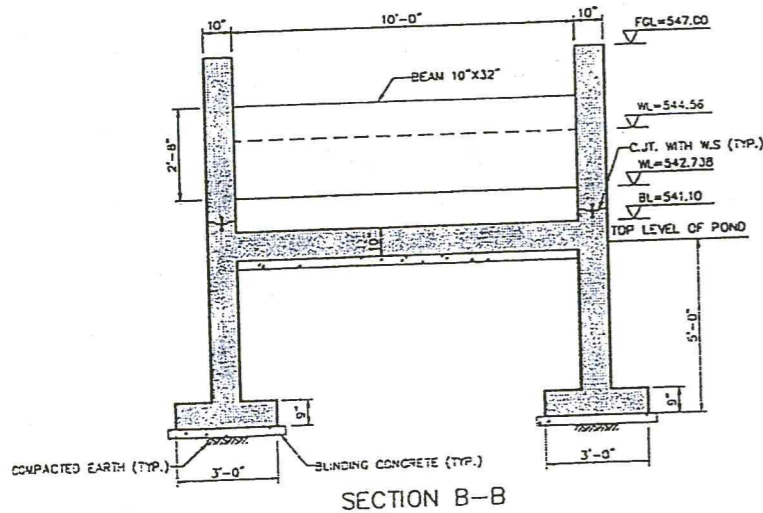
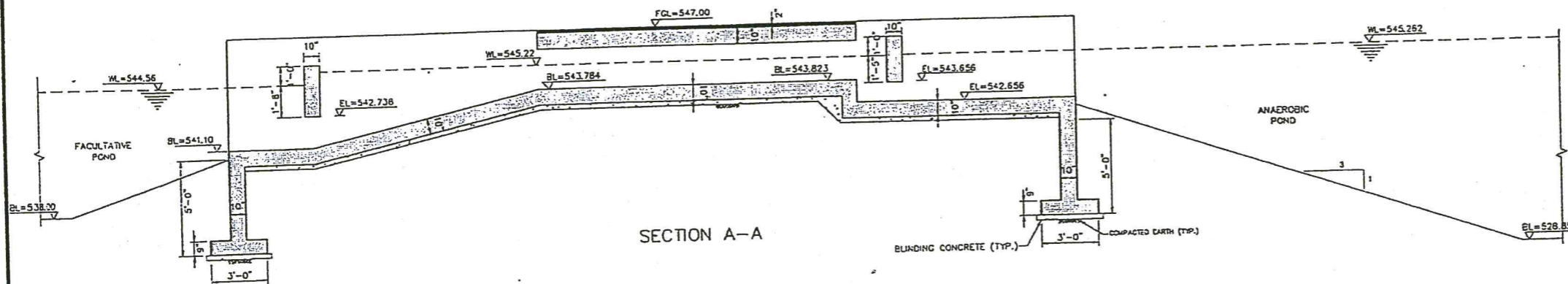
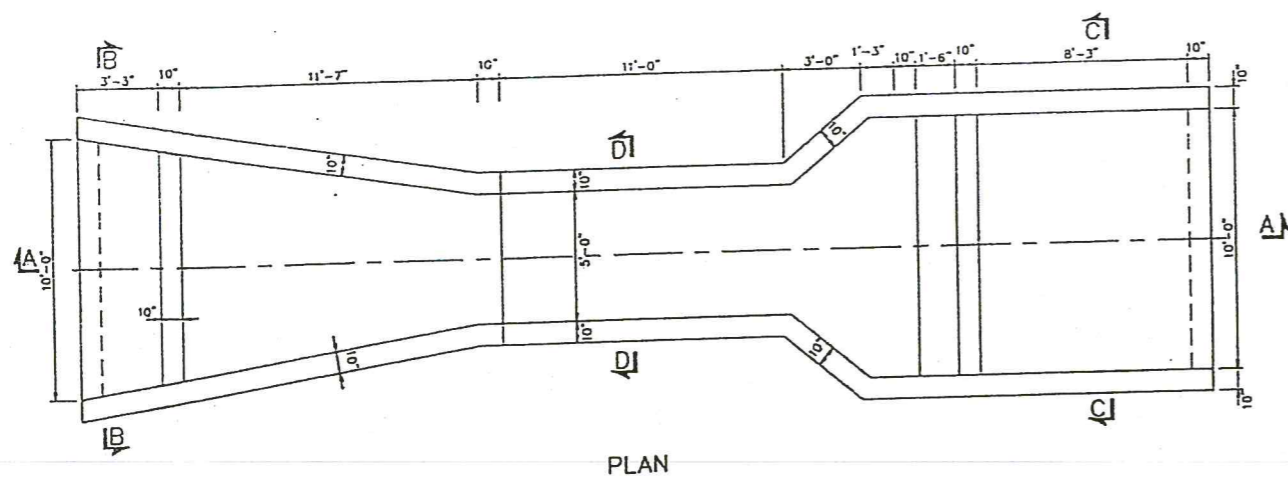
TENDER DRAWING
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Prepared by: *[Signature]*
for and on behalf of
Engineering Services

PROGRAM MANAGEMENT UNIT, PUNJAB INTERMEDIATE CITIES IMPROVEMENT INVESTMENT PROGRAM (PICIP), LOCAL GOVERNMENT AND COMMUNITY DEVELOPMENT (LG & CD) DEPARTMENT, PUNJAB			
CONSTRUCTION OF WASTEWATER TREATMENT PLANT IN NORTH ZONE, SAHIVAL (STAGE-I)			
COLLECTION CHAMBER CONCRETE OUTLINE			
NESPAC			
DESIGN: NESPAC	RECOMMENDED:	VER./CHKD:	APPROVED:
OWN: ASIM KASURI			
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0 5 10 Feet
SCALE 1" = 5'-0"
UNLESS OTHERWISE NOTED

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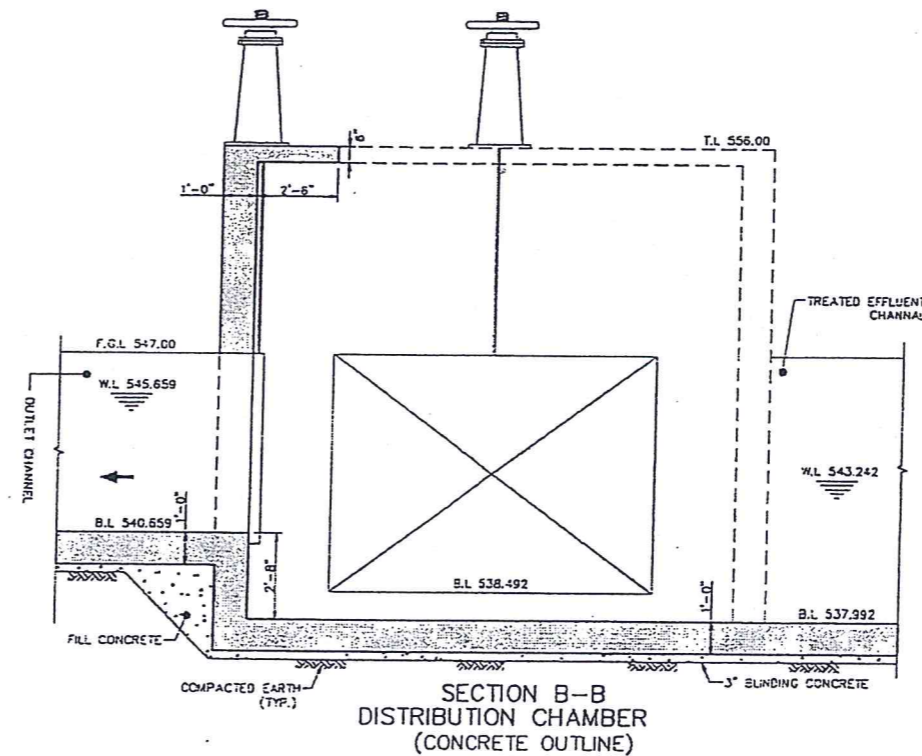
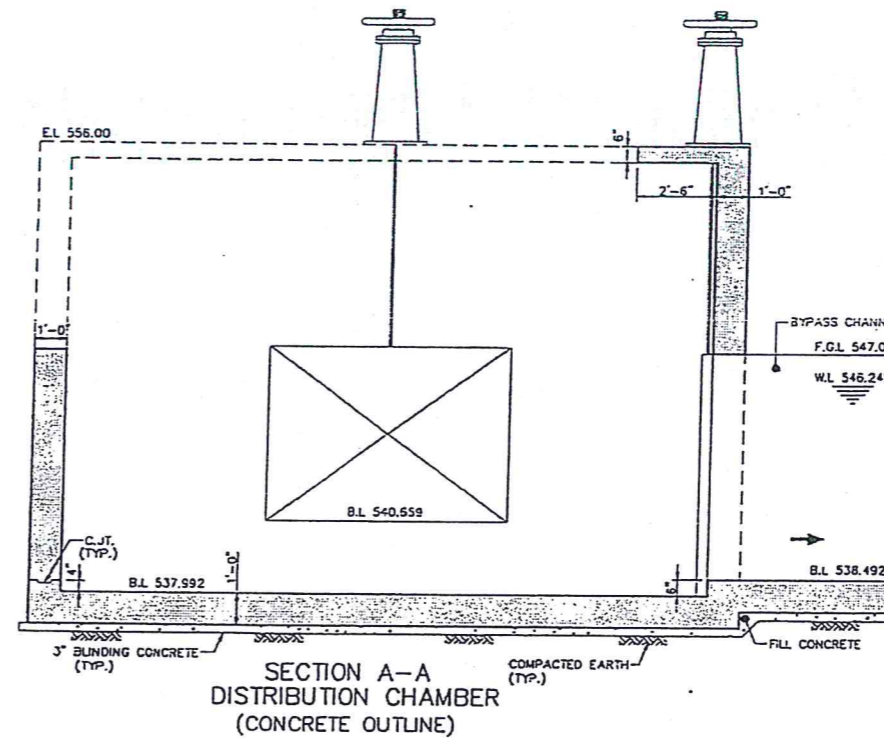
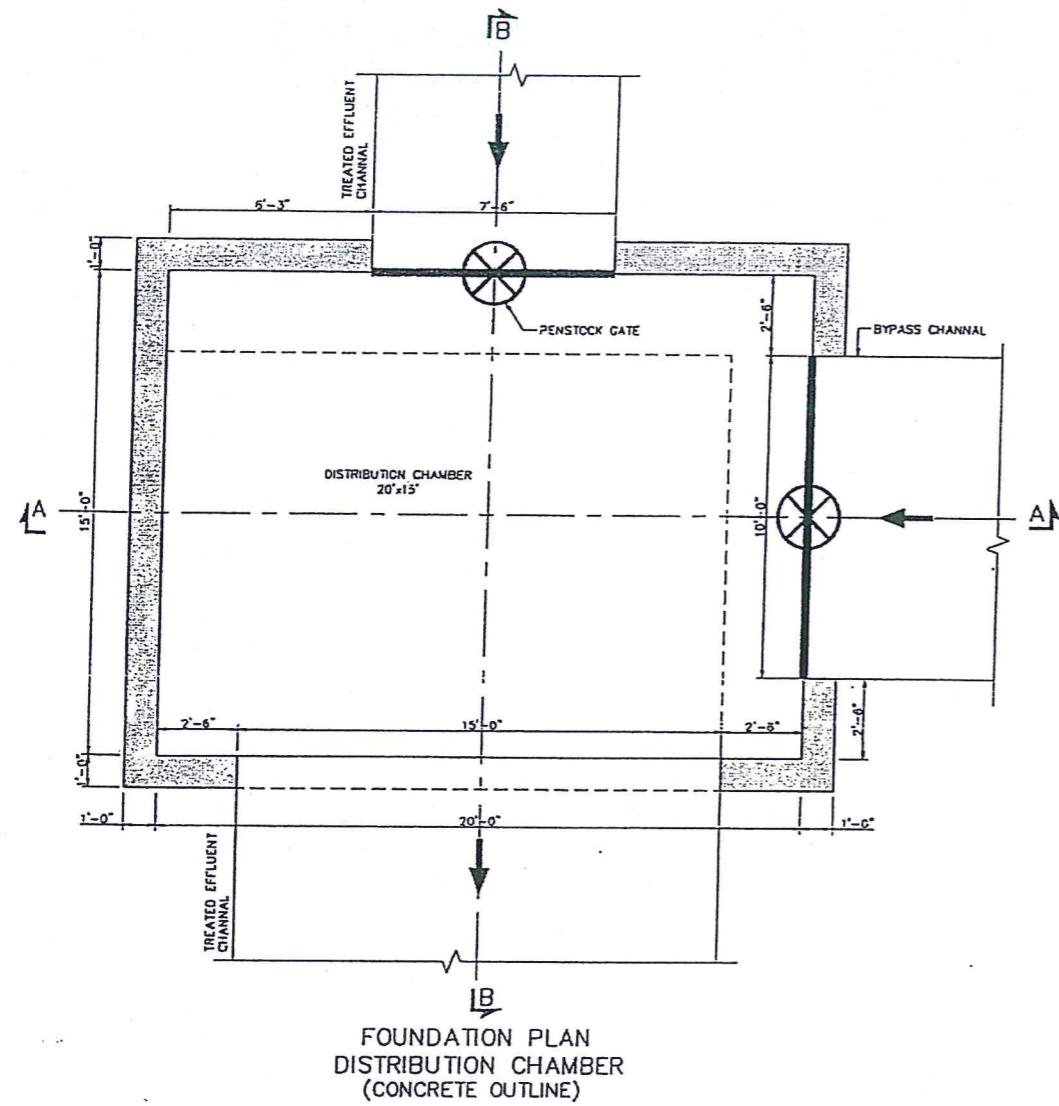
CONSTRUCTION OF WASTEWATER TREATMENT PLANT IN NORTH ZONE, SAHIVAL (STAGE-I)
INTER CONNECTION DETAIL IN BETWEEN ANAEROBIC POND AND FACULTATIVE POND - CONCRETE OUTLINE

NESPAK -

DESIGN	RECOMMENDED	VER./CHKD.	APPROVED
DWN.			
FILE	DATE	DRAWING NO.	REV.
CHKD.	SEP 2021	3976/037/TD/15G05	0
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Prepared by: *[Signature]*

For and on behalf of
M/s. NESPAC Engineering Services
Punjab (INDIA) (PVT. LTD.)

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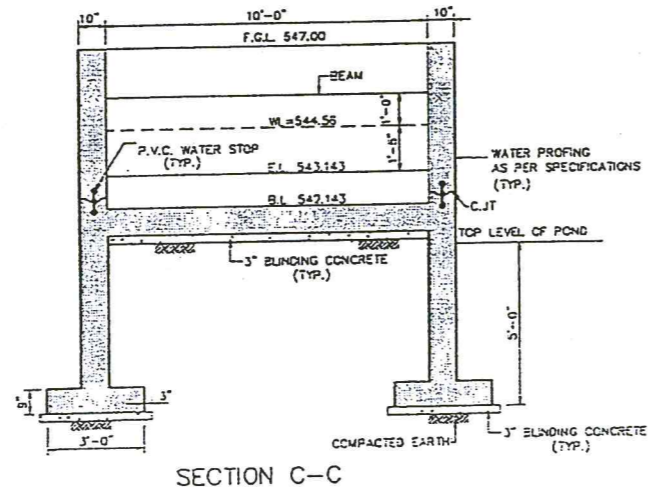
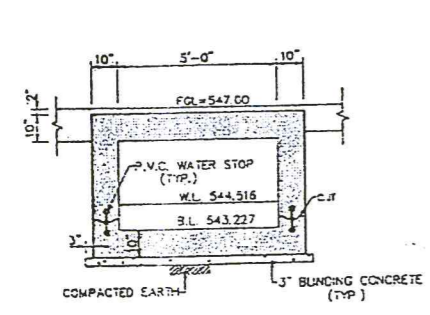
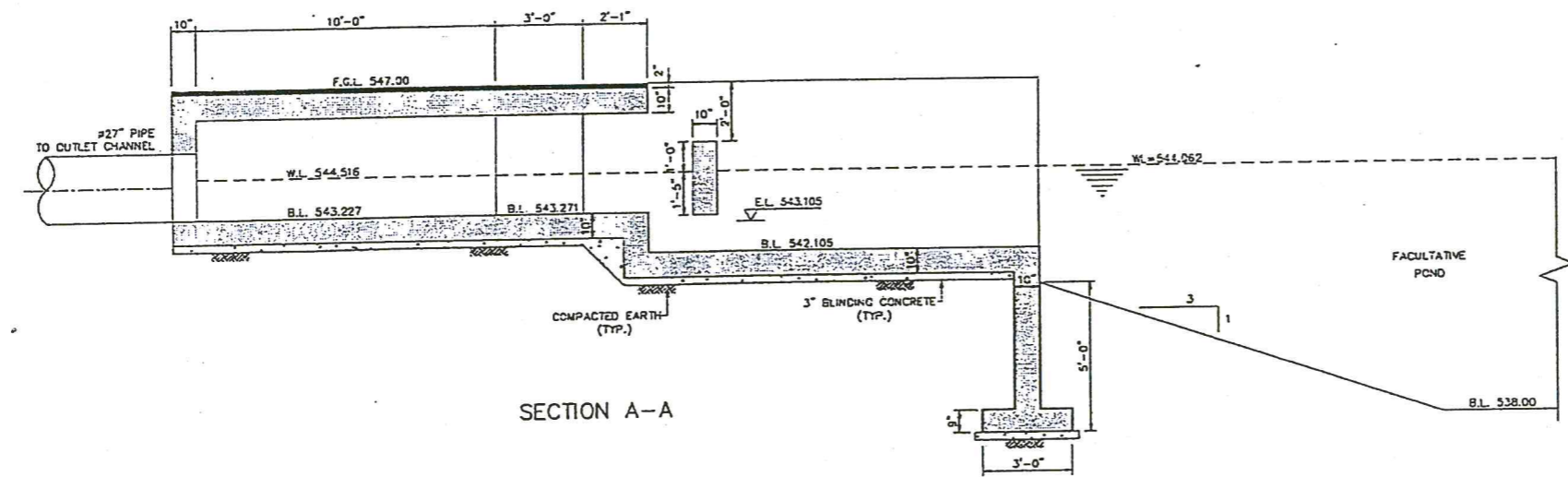
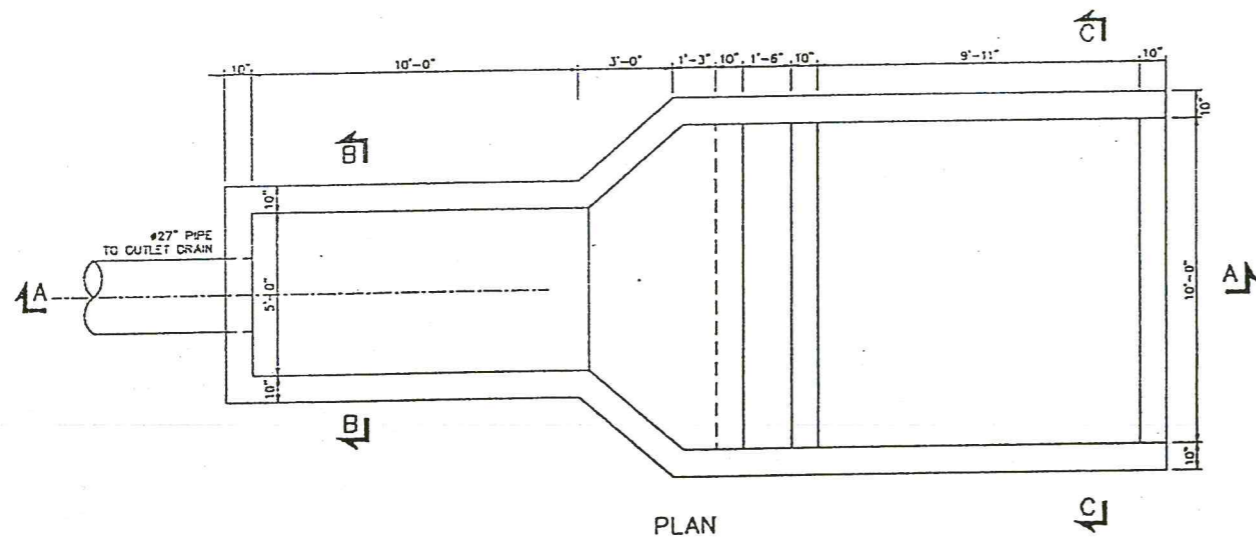
CONSTRUCTION OF WASTEWATER TREATMENT PLANT IN NORTH ZONE, SAHRAWAL (STAGE-I)

DISTRIBUTION CHAMBER
CONCRETE OUTLINE & REINFORCEMENT

NESPAC

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SCALE 0 1 2 3 4 5 FEET
for and behalf of
M. HONAI & SONS Services
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CONSTRUCTION OF WASTEWATER TREATMENT PLANT IN NORTH ZONE, SAHIVAL (STAGE-I)			
OUTLET STRUCTURE DETAIL FROM FACULTATIVE POND CONCRETE OUTLINE			
NESPAK -			
DESH: NESPAK	RECOMMENDED	VER./CKD	APPROVED
DWN: ASH KASURI			
FILE	DATE	DRAWING NO.	REV
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Initial Environmental Examination Report

Project Number: 46526-007
Loan Number: 3562-PAK
Date: July 2020

Punjab Intermediate Cities Improvement Investment Project

IEE for Sahiwal Wastewater Treatment Plant

Prepared by Project Management Unit of PICIIP, Government of Punjab, Pakistan



**Punjab Intermediate Cities Improvement
Investment Program (PICIIP)**

Sahiwal Component

TA 8683 (PAK)

Initial Environmental Examination

Part 2: Sahiwal Wastewater Treatment Plant

July 2020

Prepared by PMU - PICIIP for the Asian Development Bank (ADB)

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CURRENCY EQUIVALENTS

As of 26th July 2020 Currency Unit – Pak Rupees (Pak Rs.)
Pak Rs 1.00 = \$ 0.00595 US\$1.00 = Pak Rs. 168

CONVERSIONS

1 meter = 3.28 feet

1 hectare = 2.47 acre

Acronyms

ADB	Asian Development Bank
CIU	City Implementation Unit
CDIA	Cities Development Initiative for Asia
PICIIP	Punjab Intermediate Cities Improvement Investment Program
PMU	Project Management Unit
SPS	Safeguard Policy Statement
EA	Executing Agency
EIA	Environment Impact Assessment
EPA	Environmental Protection Agency
ESCF	Environment Screening and Categorization Form
EMP	Environmental Management Plan
IA	Implementing Agency
GoP	Government of Pakistan
IEE	Initial Environmental Examination
LAA	Land Acquisition Act (of 1984)
LARP	Land Acquisition and Resettlement Plan
Leq	Equivalent sound pressure level
NEQS	National Environmental Quality Standards
O&M	Operation & Maintenance
PC	Public consultation
PEPA	Punjab Environmental Protection Agency
PEPAct	Pakistan Environment Protection Act 1997
RP	Resettlement Plan
REA	Rapid Environmental Assessment
WATSAN	Water supply and Sanitation
WWTP	Wastewater treatment plant

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EXECUTIVE SUMMARY

Project Overview

1. This is the Initial Environmental Examination report (IEE) for the Wastewater Treatment Plant (WWTP) to be developed in the North zone of Sahiwal, Punjab province of Pakistan. A map of the project area is provided as **Figure ES-1**.
2. This document has been prepared as an update to the umbrella IEE assessment¹ prepared in July 2017, which covered all water supply and sanitation (WATSAN) works to be conducted in Sahiwal city. This document focuses solely on the proposed scope of works to be conducted under 2 Lots for development of the WWTP and contains the EMP, which shall be implemented by the Contractor to mitigate any potential impacts and shall be used by the PMU and ADB for compliance monitoring.

Project Need

3. At present, Sahiwal city is urgently in need of a WWTP as presently, no treatment plant is available for treatment of sewage in the project area of Sahiwal City. The raw sewage is being directly disposed of into the canals, seepage drain and in agricultural fields in outskirts of the city. This practice is environmentally unsafe and a violation of Punjab Environmental Protection Act;

Furthermore, the disposal of untreated wastewater into water bodies/ agriculture fields is causing contamination of the water and food chain and several associated environmental and health issues;

Study Methodology

4. Primary and secondary data has been collected and used to assess the environmental impacts of the proposed WWTP development. Extensive due diligence visits were conducted to the project area for the proposed works from April'20 to June'20 to examine the project area and to assess the baseline in order to evaluate whether there are any key receptors that will need to be considered during the project works to prevent any long term and irreversible impacts.
5. Detailed baseline monitoring in the project area to assess potential impacts on air quality and noise levels has been conducted and presented in this study. This IEE report highlights all potential environmental impacts associated with the WWTP project and recommends mitigation measures. Any environmental impacts

¹ <https://www.adb.org/projects/documents/pak-46526-007-iee-2>

associated with the project need to be properly mitigated, through the existing institutional arrangements described in this report.

6. The activities to be conducted under the two Lots in the North zone of Sahiwal city were screened for potential impacts at the design/pre-construction, construction and operation phases of the WWTP. This 'activity wise' screening enabled to obtain a clear picture of the expected level of impacts resulting from the different activities and helped identify required mitigation measures to mitigate them to within acceptable limits as per local and international applicable regulations. A detailed environmental management and monitoring plan was developed to ensure compliance to the proposed measures during the project development.
7. The screening matrices for the key issues that have been identified during the different project development stages across the two Lots are provided in the **Tables ES-1 to ES-3** below.

Public Consultation Process

8. Detailed and extensive consultations with different key stakeholders have been conducted to date, consisting of the local communities and local businesses located in the project area, different public sector line departments etc. and their comments/concerns/suggestions were obtained. The details of the persons consulted are provided as **Annexure A**.
9. The key comments and concerns raised as a result of the consultations are as follows:
 - Public safety should be on top priority during construction.
 - The traffic should be managed properly during the WWTP development.
 - As the existing water and sanitation is not in a good condition, so this sub-project should be executed on urgent basis with due diligence.
 - There should be awareness campaigns to guide public in a way that they may start discouraging the wastage of water and throwing the garbage in sewer lines.
 - The Contractor should comply with the mitigation measures proposed in the Environmental and Management and Monitoring Plan (EMMP) and HSE compliance policy.
 - Contractor's activities should be confined to minimize any inconvenience to the public.
 - Dust produced due to construction activities may create different health problems, therefore water sprinkling should be carried out regularly to suppress the dust emissions;
 - During construction, labour force movement should be controlled so that activities of the community are not disturbed;
 - The participants/representatives also stressed the need for timely completion of the project.

- The movement of the heavy machinery should be controlled to avoid harm to other associated properties/structures;
- Grievance redressal mechanism (GRM) at the PMU level should be formalized to address any complaints from the stakeholders at site.
- Awareness campaigns by using Print, Electronic and Social media are highly required to create civic sense among masses.

Analysis of Alternatives

10. A number of different alternatives were also assessed as follows:

- **‘No Project’ Option:** It was concluded considering the urgent need for the development of a wastewater treatment plant for Sahiwal city, the project must be developed and the ‘No Project’ option is not viable.
- **Selection of Wastewater Treatment Technology:**
- **Site Selection Analysis:**
- **Biogas Management Alternatives:**
- **Options for Use of Sludge:**
- **Options for Use of treated Effluent:**

Land Acquisition & Resettlement

11. The proposed project site for the WWTP development is located on publicly owned land and thus no land acquisition and/or resettlement will be required.

Conclusion & Recommendations


12. The implementation of the existing EMP in its true letter and spirit shall ensure any potential impacts are managed and no long-term significant impacts take place during the construction works at the WWTP site.
13. During the operation phase of the WWTP, mostly positive impacts are expected in order to effectively manage and treat the wastewater being generated from Sahiwal city while any potential impacts resulting from the operation of the WWTP will be managed by implementation of the proposed mitigation measures and conducting the required monitoring of the treated effluent quality being discharged into the Ravi River as well as the ground water quality in the project area.
14. As a result of this IEE study, it has been determined that any adverse or harmful impacts shall be effectively mitigated through implementation of necessary measures

and through regular monitoring. The project falls under the Category 'B' of ADB's Guidelines and thus an IEE has been prepared for the proposed WWTP project.

Table ES-1: 'Activity Wise' Screening of possible Impacts during Design/Pre-Construction phase

S/No.	Potential Impact	Likelihood (Certain, Likely, Unlikely, Rare)	Consequence (Catastrophic, Major, Moderate, Minor)	Risk Level (Significant, Medium, Low)
1	Lack of integration of IEE/EMP requirements into Construction bid documents	Likely	Moderate	Medium
2	Material Haul Routes	Likely	Moderate	Medium
3	Improper location of worker camps leading to improper disposal of solid waste and sewage and privacy issues for residents in project area.	Likely	Moderate	Medium
4	Contractor's Environmental Safeguards Capacity	Likely	Moderate	Medium

 Critical Risk Level

 Significant Risk Level

 Medium Risk Level

 Low Risk Level

Table ES-2: Screening of Possible Impacts during Construction Phase

S/No.	Potential Impact	Likelihood (Certain, Likely, Unlikely, Rare)	Consequence (Catastrophic, Major, Moderate, Minor)	Risk Level (Significant, Medium, Low)
1	Excavated Material (Earthworks) Disposal	Certain	Major	Significant
2	Degradation of air quality due to construction works	Certain	Major	Significant
3	Potential accidents and injuries to communities in project area during construction works	Likely	Major	Medium
4	Injuries to workers from lack of necessary training and/or not using PPEs etc.	Likely	Major	Medium
5	High noise levels from construction activities	Likely	Major	Medium
6	Improper handling and/or disposal of hazardous and non-hazardous waste	Likely	Moderate	Medium
7	Untreated disposal of effluent from worker camps and batching plant(s)	Likely	Moderate	Medium
8	Soil Erosion and Sedimentation	Likely	Moderate	Medium
9	Soil Contamination	Likely	Moderate	Medium
10	Employment Conflicts	Likely	Moderate	Medium
11	Communicable diseases	Likely	Moderate	Medium
12	Vegetation and Wildlife	Unlikely	Moderate	Low

	Loss			
13	Historical/Archaeological Sites	Unlikely	Moderate	Low

- Critical Risk Level
- Significant Risk Level
- Medium Risk Level
- Low Risk Level

Table ES-3: Screening of Possible Impacts during Operation Phase

S/No.	Potential Impact	Likelihood (Certain, Likely, Unlikely, Rare)	Consequence (Catastrophic, Major, Moderate, Minor)	Risk Level (Significant, Medium, Low)
1	Possible Emergencies and Plant Failure	Unlikely	Major	Medium
2	Odor generation	Likely	Major	Medium
3	Improper Disposal of Sludge	Unlikely	Major	Medium
4	Disease Vector Generation & Transmission	Likely	Major	Medium
5	Improvements in Public Health	Positive impacts expected		
6	Lower Loads on Ecosystem	Positive impacts expected		
7	Generation and use of byproducts i.e. Sludge for agriculture	Positive impacts expected		

- Critical Risk Level
-





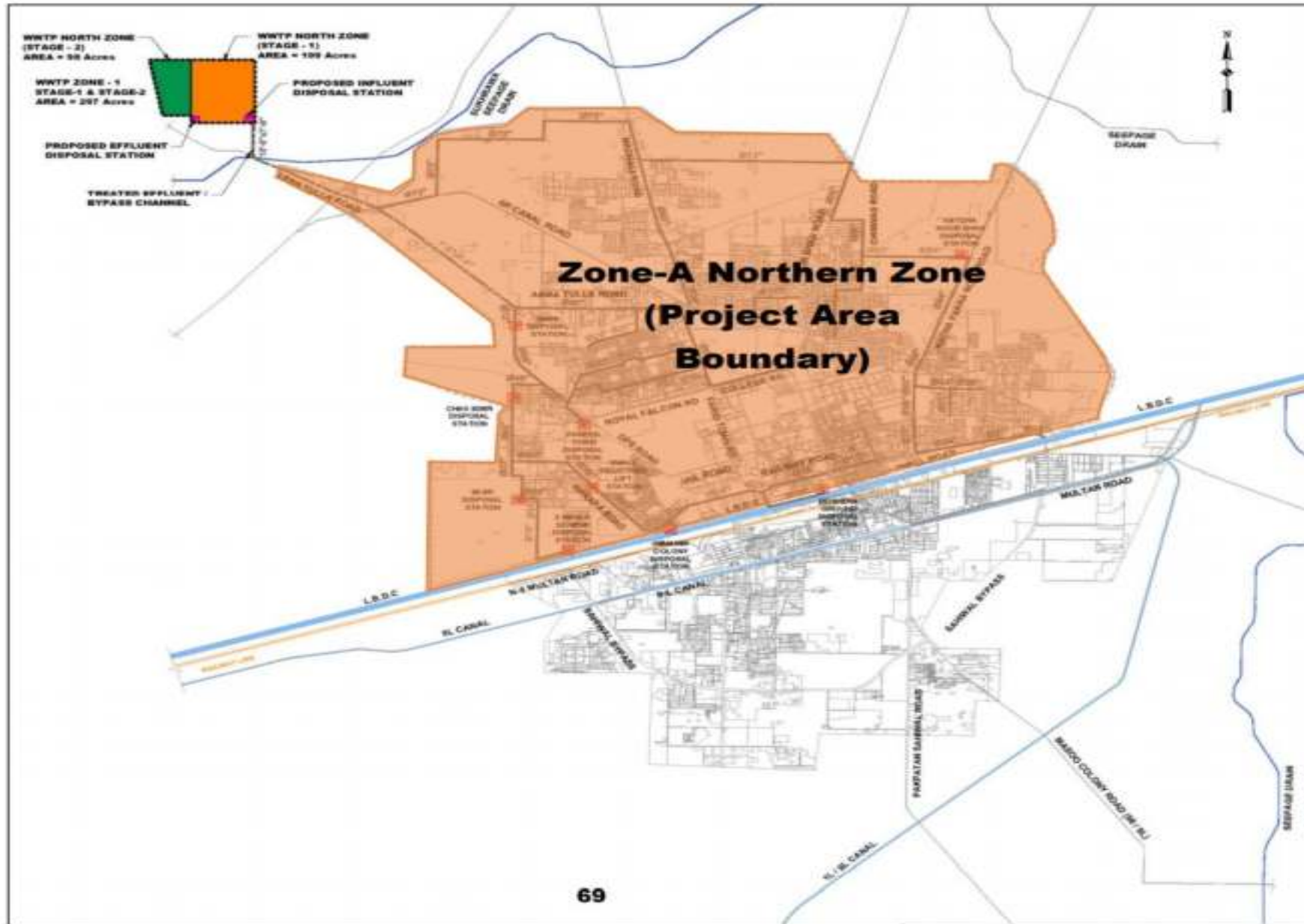
-  Significant Risk Level
-  Medium Risk Level
-  Low Risk Level
-  Positive Impacts

Figure ES-1: Project Area Map



1 Introduction

1.1 Overview

15. The Asian Development Bank (ADB) and the Cities Development Initiative for Asia (CDIA) are partnering with the Government of Punjab Province (GoPP), to undertake the Punjab Intermediate Cities Improvement Program (PICIIP).
16. The PICIIP aims to improve the quality of urban services available in selected cities in Punjab Province (city populations between 250,000 and 1,000,000). Urban infrastructure development is an important component of the PICIIP. The duration of the program will be six years. Funding will be accessed in phases. The PICIIP's overall budget is US\$500 million, to be disbursed in phases.
17. The first phase will fund investments in the intermediate cities of Sialkot and Sahiwal. Major projects planned for Sahiwal city are water supply improvement; sewerage and drainage improvement, sewage treatment plant, green spaces development and transport routes improvement.
18. This IEE document focuses solely on the scope of works of the Construction of Wastewater Treatment Plant (WWTP) in North Zone, Sahiwal and assesses any potentially significant impacts and proposes required mitigation measures, which shall be implemented by the Contractor and monitored by the PMU and ADB using the EMP.
19. This is the Part 2 i.e. WWTP development of the WATSAN landscape for Sahiwal with Part 1 consisting of the proposed water and sewage piping networks and associated infrastructure already covered under a separate IEE study.

1.2 Purpose, Scope and Context of IEE Study

20. The scope of works to be conducted under this activity consist of:

Lot –1: Construction of Wastewater Treatment Plant (up to Secondary Level Treatment)

21. Lot-1 will provide treatment up to secondary level to only meet the inland waters requirement of PEQS (excluding winter months) without considering reuse of treated effluent for irrigation purposes. In this case, the treated effluent from the WWTP will be directly discharged to Sukhrawa seepage drain which will act as just conveyance channel rather than a recipient body and ultimately discharge the treated effluent into River Ravi.

Lot –2: Tertiary Wastewater Treatment and treated effluent conveyance system for irrigation reuse

22. A summary of WWTP components in Lot-1 and Lot-2 is presented below as **Table 1.1**.

Table 1.1: WWTP Components – Lot 1 and Lot 2

Sr. No.	Components	LOT-1	LOT-2
1	Sewage Conveyance Work		
a)	Collection Chamber	1	
b)	Inlet Channel	1	
2	Sewage Treatment Works		
a)	Anaerobic Ponds	10	
b)	Facultative Ponds	10	
c)	Maturation Ponds		10
3	Auxiliary Facilities	1	
a)	Access/Internal Roads	1	
b)	Substation Building	1	
c)	Staff / Operator Quarter	1	
d)	Laboratory and Administration Building	1	
e)	Main Gate and Guard Room	1	
f)	Buffer Zone (Thick Plantation) all around WWTP	1	
4	Treated Effluent Collection and Conveyance Works		
a)	Treated Effluent Channel	1	
b)	Treated Effluent Pumping Station for reuse in Irrigation Network		1
c)	Treated Effluent Conveyance System		1

23. The proposed locations for conducting these works are shown in **Figures 1.1 to 1.3** below.
24. According to ADB's Safeguard Policy Statement (SPS) 2009, a Rapid Environmental Assessment (REA) Checklist was prepared for the proposed WWTP works. The Pakistan Environmental Protection Agency's "Guidelines for the Preparation and Review of Environmental Reports (2000)" were also consulted. Based on the limited scope of the works, this sub-project has been classified as Category 'B'.
25. The conditions (as per ADB SPS 2009) provided in the table below **MUST ALL BE** fulfilled if the WATSAN works are to be considered an Associated Facility (AF) to the proposed WWTP. The assessment is provided in the **Table 1.2** below.

Table 1.2: Assessment to determine Associated Facility

	Condition	Comment
1	Separately financed by the borrower or third party?	No, it is also being financed by ADB along with the other WATSAN works.
2	Viability and existence of the AF depends exclusively on the WWTP sub-project?	Yes, as the WWTP will be handling and treating the sewerage from the infrastructure to be developed through the WATSAN works.
3	Goods and services of AF are essential to successful operation of the WWTP sub-project	Yes, since without the WWTP, the sewerage being input into the WATSAN infrastructure cannot be treated and disposed off in an environmentally sustainable manner in accordance with applicable national guidelines.

26. Since all three conditions above have NOT been satisfied, thus it is concluded that the WWTP is not an associated facility to the proposed WATSAN sub-projects.

Figure 1.1: Location of Sahiwal City in District Sahiwal

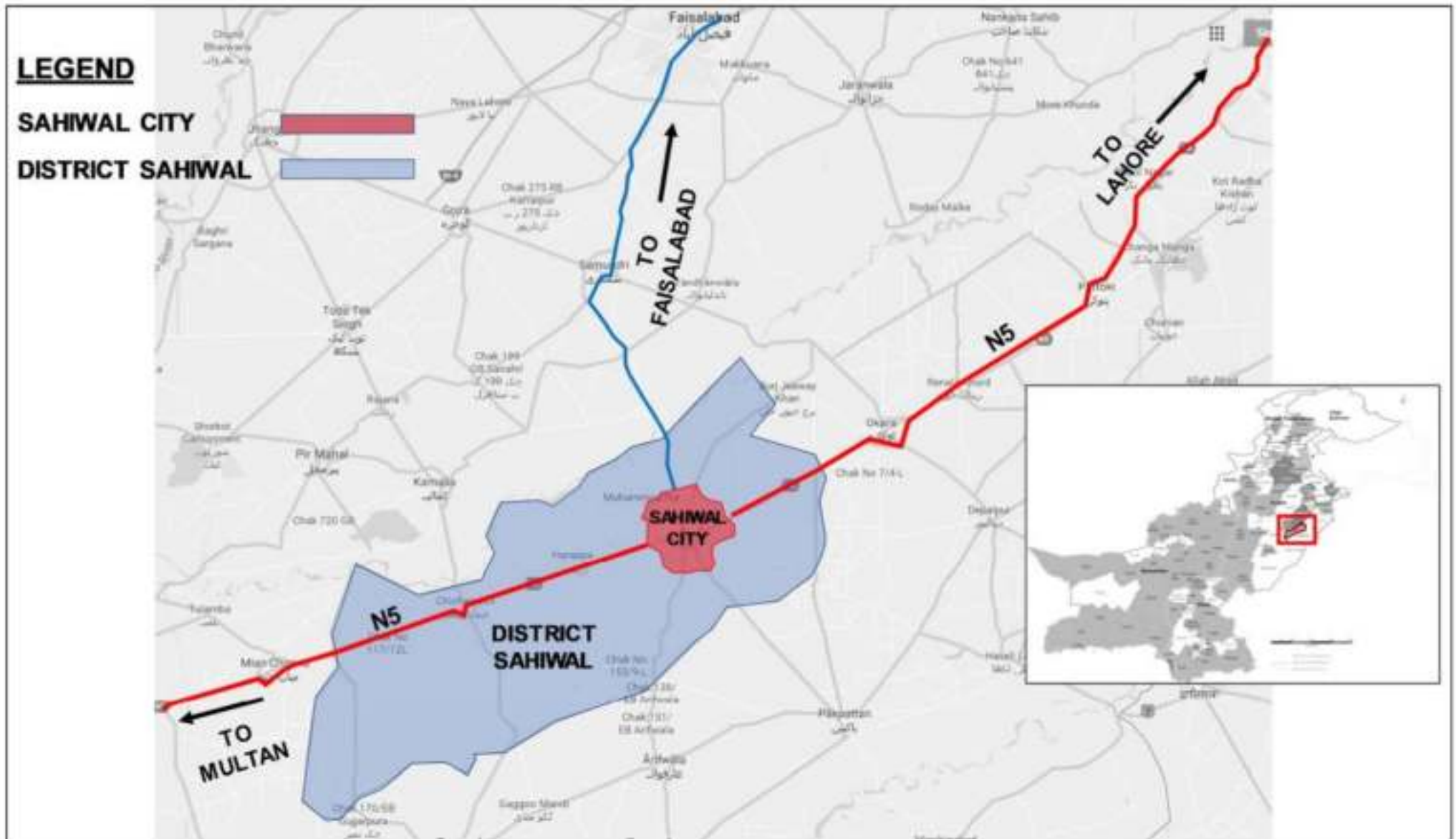


Figure 1.2: Location of Proposed WWTP

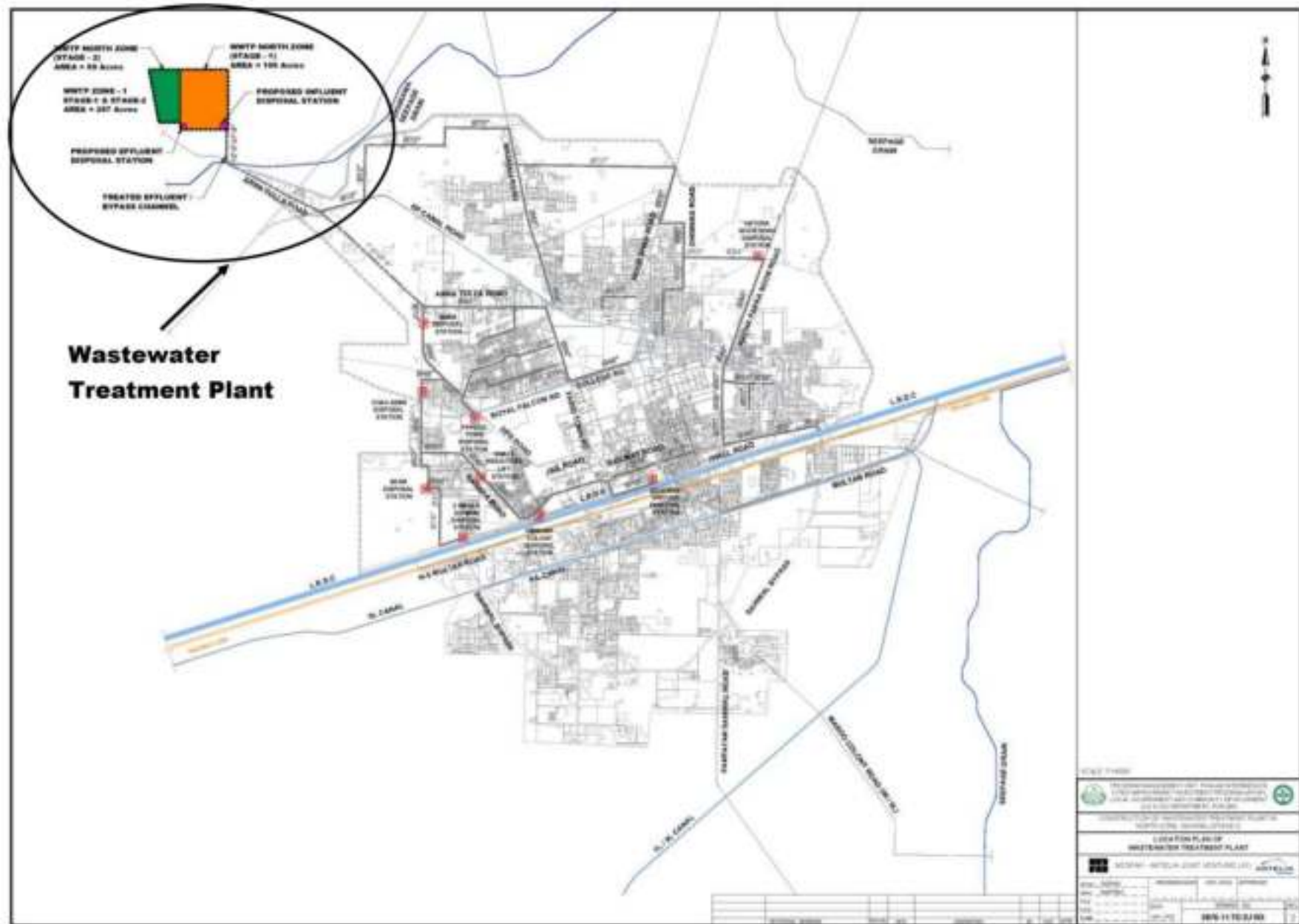
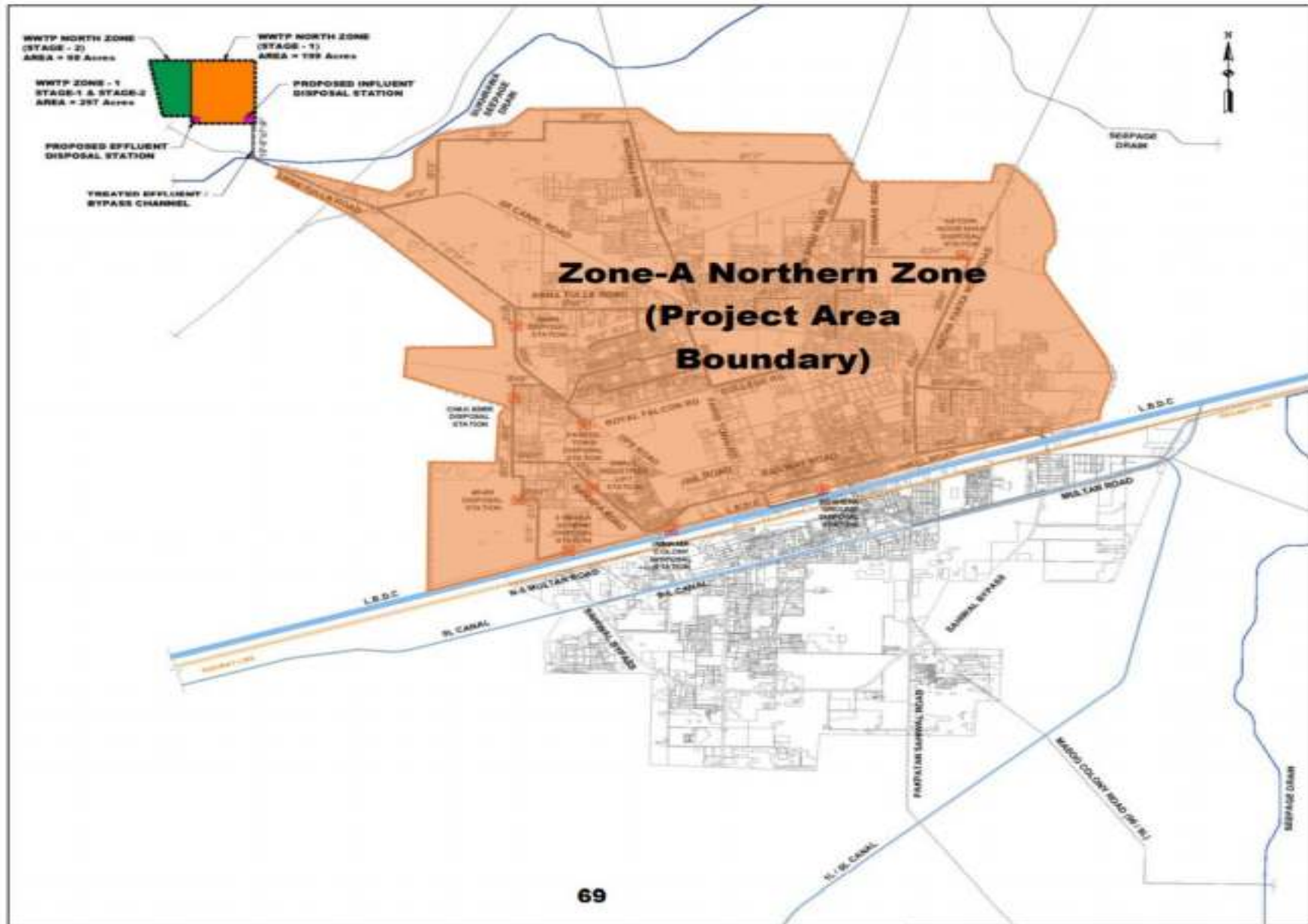


Figure 0.3: Another Location Map of the proposed WWTP



2 Policy and Legal Framework

2.1 General

27. This section provides an overview of the policy framework and national legislation that applies to the proposed WWTP in Sahiwal North zone. The project will comply with all national legislation relating to the environment in Pakistan, and will obtain all the regulatory clearances required from the financing agency, ADB.

2.2 National Policy and Legal Framework

28. The Pakistan National Conservation Strategy (NCS) that was approved by the federal cabinet in March 1992 is the principal policy document on environmental issues in the country (EUAD/IUCN, 1992). The NCS outlines the country's primary approach towards encouraging sustainable development, conserving natural resources, and improving efficiency in the use and management of resources. The NCS has 68 specific programs in 14 core areas in which policy intervention is considered crucial for the preservation of Pakistan's natural and physical environment. The core areas that are relevant in the context of the proposed WWTP development are pollution prevention and abatement and increasing energy efficiency while conserving biodiversity.
29. Prior to the adoption of the 18th Constitutional Amendment, the Pakistan Environmental Protection Act (PEPA) 1997 was the governing law for environmental conservation in the country. Under PEPA 1997, the Pakistan Environmental Protection Council (PEPC) and Pak EPA were primarily responsible for administering PEPA 1997. Post the adoption of the 18th Constitutional Amendment in 2011, the subject of environment was devolved and the provinces have been empowered for environmental protection and conservation.

2.3 Regulations for Environmental Assessment, Pakistan EPA

30. Under Section 12 (and subsequent amendment) of the PEPA (1997), a project falling under any category specified in Schedule I of the IEE/EIA Regulations (SRO 339 (10/2000), requires the proponent of the project to file an IEE with the concerned provincial EPA. Projects falling under any category specified in Schedule II require the proponent to file an EIA with the provincial agency, which is responsible for its review and accordance of approval or request any additional information deemed necessary.

2.4 Regulatory Clearances, Punjab EPA

31. In accordance with provincial regulatory requirements, an IEE/EIA satisfying the requirements of the Punjab Environmental Protection Act (2012) is to be submitted to Punjab environmental protection agency (PEPA) for review and approval, and subsequent issuance of NOC before the commencement of construction.

2.5 Guidelines for Environmental Assessment, Pakistan EPA

32. The Pak-EPA has published a set of environmental guidelines for conducting environmental assessments and the environmental management of different types of development projects. The guidelines that are relevant to the proposed sub-project are listed below:
- Guidelines for the Preparation and Review of Environmental Reports, Pakistan, EPA1997;
 - Guidelines for Public Consultations; Pakistan EPA May 1997;

2.6 National Environmental Quality Standards (NEQS) 2000

33. The National Environmental Quality Standards (NEQS), 2000, specify the following standards:
- Maximum allowable concentration of pollutants (32 parameters) in municipal and liquid industrial effluents discharged to inland waters, sewage treatment facilities, and the sea (three separate sets of numbers);
 - Maximum allowable concentration of pollutants (16 parameters) in gaseous emissions from industrial sources;
 - Maximum allowable concentration of pollutants (two parameters) in gaseous emissions from vehicle exhaust and noise emission from vehicles;
 - Maximum allowable noise levels from vehicles;
34. These standards apply to the gaseous emissions and liquid effluents discharged by construction machinery.

2.7 Other Environment Related Legislations

35. The national laws and regulations are provided in **Table 2.1** below.

Table 2.1: Environmental Guidelines and Regulations

Legislation/Guideline	Description
National Environmental Policy (2005) (NEP)	NEP is the primary policy of Government of Pakistan addressing environmental issues. The broad Goal of NEP is, "to protect, conserve and restore Pakistan's environment in order to improve the quality of life of the citizens through sustainable development". The

Legislation/Guideline	Description
	NEP identifies a set of sectoral and cross-sectoral guidelines to achieve its goal of sustainable development. It also suggests various policy instruments to overcome the environmental problems throughout the country.
The Forest Act (1927)	The Act empowers the provincial forest departments to declare any forest area as reserved or protected. It empowers the provincial forest departments to prohibit the clearing of forest for cultivation, grazing, hunting, removing forest produce, quarrying and felling, lopping and topping of trees, branches in reserved and protected forests. No protected forest is situated in the project area for the WWTP works.
Punjab Wildlife Protection Ordinance, 1972	It empowers the government to declare certain areas reserved for the protection of wildlife and control activities within in these areas. It also provides protection to endangered species of wildlife. As no activities are planned in these areas, no provision of this law is applicable to the proposed WWTP works.
The Antiquities Act (1975)	It ensures the protection of Pakistan's cultural resources. The Act defines "antiquities" as ancient products of human activity, historical sites, or sites of anthropological or cultural interest, national monuments, etc. The Act is designed to protect these antiquities from destruction, theft, negligence, unlawful excavation, trade, and export. The law prohibits new construction in the proximity of a protected antiquity and empowers the GOP to prohibit excavation in any area that may contain articles of archaeological significance. Under the Act, the subproject proponents are obligated to ensure that no activity is undertaken in the proximity of a protected antiquity, report to the Department of Archaeology, GOP, any archaeological discovery made during the course of the project.
Pakistan Penal Code (1860)	It authorizes fines, imprisonment or both for voluntary corruption or fouling of public springs or reservoirs so as to make them less fit for ordinary use.
NATIONAL ENVIRONMENTAL AND CONSERVATION STRATEGIES	
National Conservation Strategy	Before the approval of NEP, the National Conservation Strategy (NCS) was considered as the Government's primary policy document on national environmental issues. At the moment, this strategy just exists as a national conservation program. The NCS identifies 14 core areas including conservation of biodiversity, pollution prevention and abatement, soil and water conservation and preservation of cultural heritage and recommends immediate attention to these core areas.
Biodiversity Action Plan	The plan recognizes IEE/EIA as an effective tool for identifying and assessing the effects of a proposed operation on biodiversity.
INTERNATIONAL CONVENTIONS	
The Convention on Conservation of Migratory Species of Wild Animals (1981.21)	The Convention requires countries to take action to avoid endangering migratory species. The term "migratory species" refers to the species of wild animals, a significant proportion of whose members cyclically and predictably cross one or more national jurisdictional boundaries. The parties are also required to promote or cooperate with other countries in matters of research on migratory species. There are no endangered species of plant life or animal life in the vicinity of the proposed project areas for the WWTP works.
Convention on	The convention requires Pakistan to impose strict regulation (including penalization, confiscation of the specimen) regarding trade

Legislation/Guideline	Description
International Trade in Endangered Species of Wild Fauna and Flora (1973)	of all species threatened with extinction or that may become so, in order not to endanger their survival further.
International Union for Conservation of Nature and Natural Resources Red List (2000)	Lists wildlife species experiencing various levels of threats internationally. Some of the species indicated in the IUCN red list are also present in the wetlands of Pakistan.

2.8 ADB's Safeguard Policy Statement (SPS), 2009

36. The ADB's SPS 2009 requires that environmental considerations be incorporated into ADB funded projects to ensure that the project will have minimal environmental impacts and be environmentally sound. Occupational health & safety of the local population should also be addressed as well as the project workers as stated in SPS. A Grievance Redress Mechanism (GRM) to receive application and facilitate resolution of affected peoples' concerns, complaints, and grievances about the project's environmental performance is also established.
37. All loans and investments are subject to categorization to determine environmental assessment requirements. Categorization is to be undertaken using Rapid Environmental Assessment (REA) checklists, consisting of questions relating to (i) the sensitivity and vulnerability of environmental resources in project area, and (ii) the potential for the project to cause significant adverse environmental impacts. Projects are classified into one of the following environmental categories:
38. **Category A:** A proposed project is classified as category A if it is likely to have significant adverse environmental impacts that are irreversible, diverse or unprecedented. These impacts may affect an area larger than the sites or facilities subject to physical works. An environmental impact assessment (EIA) is required.
39. **Category B:** A proposed project is classified as category B if its potential adverse environmental impacts are less adverse than those of category A projects. These impacts are site-specific, few if any of them are irreversible, and in most cases mitigation measures can be designed more readily than for category A projects. An initial environmental examination (IEE) is required.
40. **Category C:** A proposed project is classified as category C if it is likely to have minimal or no adverse environmental impacts. No environmental assessment is required although environmental implications need to be reviewed.

41. **Category FI:** A proposed project is classified as category FI if it involves investment of ADB funds to or through a financial intermediary (FI).

2.9 ADB's Access to Information Policy (AIP) 2018

42. ADB's new Access to Information Policy (AIP), reflects the ADB's ongoing commitment to transparency, accountability, and participation by stakeholders. The policy contains principles and exceptions to information sharing with external stakeholders, led by a new overarching principle of "clear, timely, and appropriate disclosure."

2.10 ADB's Accountability Mechanism Policy 2012

43. The objectives of the Accountability Mechanism is providing an independent and effective forum for people adversely affected by ADB-assisted projects to voice their concerns and seek solutions to their problems, and to request compliance review of the alleged noncompliance by ADB with its operational policies and procedures that may have caused, or is likely to cause, them direct and material harm. The Accountability Mechanism is a "last resort" mechanism.

2.11 Implications of ADB's safeguard policies on proposed project

44. The objectives of ADB's safeguards are to:
- avoid adverse impacts of projects on the environment and affected people, where possible;
 - minimize, mitigate, and/or compensate for adverse project impacts on the environment and affected people when avoidance is not possible; and
 - help borrowers/clients to strengthen their safeguard systems.
45. ADB's SPS sets out the policy objectives, scope and triggers, and principles for three key safeguard areas:
- environmental safeguards,
 - involuntary resettlement safeguards, and
 - Indigenous Peoples safeguards.
46. The objective of the environmental safeguards is to ensure the environmental soundness and sustainability of projects and to support the integration of environmental considerations into the project decision-making process. ADB's policy principles are summarized in **Table 2.2** below.

Table 2.2: ADB Policy Principles

	Policy principle	Summary
1	Screening and categorization	Screening process initiated early to determine the appropriate extent and type of environmental assessment.
2	Environmental assessment	Conduct an environmental assessment to identify potential impacts and risks in the context of the project's area of influence.
3	Alternatives	Examine alternatives to the project's location, design, technology, and components and their potential environmental and social impacts, including no project alternative.
4	Impact mitigation	Avoid, and where avoidance is not possible, minimize, mitigate, and/or offset adverse impacts and enhance positive impacts. Prepare an environmental management plan (EMP).
5	Public consultations	Carry out meaningful consultation with affected people and facilitate their informed participation. Involve stakeholders early in the project preparation process and ensure that their views and concerns are made known to and understood by decision makers and taken into account. Continue consultations with stakeholders throughout project implementation. Establish a grievance redress mechanism.
6	Disclosure of environmental assessment	Disclose a draft environmental assessment in a timely manner, in an accessible place and in a form and language(s) understandable to stakeholders. Disclose the final environmental assessment to stakeholders.
7	Environmental management plan	Implement the EMP and monitor its effectiveness. Document monitoring results, and disclose monitoring reports.
8	Biodiversity	Do not implement project activities in areas of critical habitats.

9	Pollution prevention	Apply pollution prevention and control technologies and practices consistent with international good practices. Adopt cleaner production processes and good energy efficiency practices. Avoid pollution, or, when avoidance is not possible, minimize or control the intensity or load of pollutant emissions and discharges. Avoid the use of hazardous materials subject to international bans or phaseouts.
10	Occupational health and safety Community safety.	Provide workers with safe and healthy working conditions and prevent accidents, injuries, and disease. Establish preventive and emergency preparedness and response measures to avoid, and where avoidance is not possible, to minimize, adverse impacts and risks to the health and safety of local communities
11	Physical cultural resources	Conserve physical cultural resources and avoid destroying or damaging them. Provide for the use of “chance find” procedures.

2.12 IFC Sector Specific Guidelines on Water & Sanitation

47. The relevant clause applicable to discharge of treated wastewater from a centralized wastewater treatment facility is as follows:
48. “Design, construct, operate, and maintain wastewater treatment facilities and achieve effluent water quality consistent with applicable national requirements or internationally accepted standards and consistent with effluent water quality goals, based on the assimilative capacity² and the most sensitive end use of the receiving water.³”
49. A comparison of the PEQS water quality discharge standards for inland waters with the FAO guidelines for threshold levels of trace elements in the wastewater being discharged for use in crop production is provided as **Table 2.6** below. It is important to mention here that based on an extensive literature review, it has been concluded that major international institutions such as the WHO/IFC, USEPA etc. do not have

² The assimilative capacity of the receiving water body depends on numerous factors including, but not limited to, the total volume of water, flow rate, flushing rate of the water body and the loading of pollutants from other effluent sources in the area or region. A seasonally representative baseline assessment of ambient water quality may be required for use with established scientific methods and mathematical models to estimate potential impact to the receiving water from an effluent source.

³ <https://www.ifc.org/wps/wcm/connect/0d8cb86a-9120-4e37-98f7-cfb1a941f235/Final%2B-%2BWater%2Band%2BSanitation.pdf?MOD=AJPERES&CVID=jkD216C>

any standard set of pre-defined wastewater quality standards in place. Only guidance notes are provided in order to support the process of determining the applicable wastewater quality discharge parameters based on the specific operational modalities of the WWTP.

50. In the case of the proposed WWTP, the selection of the PEQS national standards for treated wastewater discharge from the WWTP into the River Ravi is based on the following factors:

- In the case of national approval, the PEQS will always be applicable and will be used as the applicable standard for treated wastewater discharge from the WWTP. However, the ADB SPS requires the use of ‘most stringent’ standards/guidelines between the national and international standards, with the IFC general and sector specific guidelines considered globally acceptable. As mentioned in Para 48 above, the first part of the IFC relevant guideline requires the use of: ‘...*applicable national requirements or internationally accepted standards...*’. Since there are no specific wastewater discharge guidelines available from IFC that would be applicable to the proposed WWTP, thus there is no other option but to use the national, PEQS, treated wastewater discharge standards for inland waters.
- Furthermore, the second part of the IFC applicable guideline mentions the ‘...*assimilative capacity and the most sensitive end use of the receiving water ...*’, which in this case will be the River Ravi. Based on the secondary data of water quality analysis of the River Ravi⁴, it can be concluded that it is significantly polluted with a high pollution load and key pollutant parameters exceeding at least four times the applicable limits based on samples taken from the river water body at different locations⁵. Thus, considering the present status of the assimilative capacity of the receiving water body in this case i.e. River Ravi, once the WWTP operation commences, the use of the national treated wastewater discharge standards i.e. PEQS is not expected to result in any adverse impact on the water quality and ecology of the River Ravi.
- The national PEQS standards for treated wastewater discharge can be achieved by using comparatively simple and low-cost wastewater stabilization pond technology. The application of EU and US standards is unfeasible due to unaffordable operation and maintenance cost, caused by using more advanced

⁴ https://www.deswater.com/DWT_abstracts/vol_85/85_2017_132.pdf

⁵ http://publications.muett.edu.pk/research_papers/pdf/pdf124.pdf

technologies. This rationale has been used for adopting a flexible approach during the process of selection of discharge standards as can also be observed based on projects developed in other countries, such as Vietnam.⁶

- Furthermore, the national PEQS standards on discharge 'Into Inland Waters' are considered sufficient for reusing the treated wastewater for irrigation purposes.

2.13 Comparison of International and Local Environmental Legislations

51. The ADB SPS requires application of pollution prevention and control technologies and practices consistent with international good practice, as reflected in internationally recognized standards. The SPS states that when host country regulations differ from these standards, the EA will achieve whichever is more stringent.
52. In order to select the most stringent standards applicable, a mix of local (NEQS) and international (IFC) regulations have been selected. The IFC Environmental, Health, and Safety (EHS) Guidelines, General EHS Guidelines: Environmental, Noise Management has noise level guidelines for daytime and nighttime, which are applicable. It shall be ensured that all necessary noise mitigation measures are implemented to minimize the noise levels in the project area.
53. The **Table 2.3** presents IFC workplace noise standards that are applicable to the construction workers. It should also be noted that IFC EHS guidelines advise that where existing ambient noise levels already exceed thresholds, the project should not result in an increase of more than 3 dB over existing ambient noise at the nearest receptor location off-site.
54. A comparison of applicable local and international guidelines for ambient air quality has been provided in **Table 2.4** below. In the case of most pollutants, the NEQS standards for ambient air quality are more stringent in comparison to USEPA and WHO/IFC standards. The applicable and most stringent parameters for each respective pollutant are highlighted in green.
55. Similar to the standards for air quality, the comparison of noise standards provided in **Table 2.5** clearly shows that NEQS standards for noise are more stringent in comparison to the IFC standards. The only exception is the daytime noise level standard for Industrial areas where the IFC standard is more stringent (70 dB(A)) in

⁶

<http://documents1.worldbank.org/curated/en/715941468320695559/pdf/ACS77120WP0P130360Box385206B00PUBLIC0.pdf>

comparison to NEQS (75 dB(A)) and so for this particular parameter, the IFC standard will be used. Apart from this one exception, the NEQS standards have been used for the proposed WWTP development project.

56. As far as regulations regarding other environmental parameters are concerned such as acceptable effluent disposal parameters, the local regulations i.e. NEQS take precedence over any other international regulations such as IFC.

Table 2.3: IFC Work Environment Noise limits

Type of Work, workplace	IFC General EHS Guidelines
Heavy Industry (no demand for oral communication)	85 Equivalent level $L_{eq,8h}$
Light industry (decreasing demand for oral communication)	50-65 Equivalent level $L_{eq,8h}$

Table 2.4: Comparison of International and local Air Quality Standards*

Pollutants	USEPA		WHO/IFC		Pak. NEQS	
	Avg. Time	Standard	Avg. Time	Standard	Avg. Time	Standard
SO ₂	3 hrs	0.5 ppm	24 hr	20 ug/m ³	Annual Mean	80 ug/m ³
	1 hr	75 ppb	10 min	500 ug/m ³	24 hrs	120 ug/m ³
CO	8 hrs	9 ppm (11 mg/m ³)	-	-	8 hrs	5 mg/m ³
	1 hr	35 ppm (43 mg/m ³)	-	-	1 hr	10 mg/m ³
NO ₂	Annual Mean	100 ug/m ³ (53 ppb)	1 yr	40 ug/m ³	Annual Mean	40 ug/m ³
	1 hr	100 ppb	1 hr	200 ug/m ³	24 hrs	80 ug/m ³
O ₃	8 hrs	0.07ppm (148 ug/m ³)	8 hrs	100 ug/m ³	1 hr	130 ug/m ³
TSP	-	-	-	-	Annual Mean	360 ug/m ³
					24 hrs	500 ug/m ³
PM ₁₀	24 hrs	150 ug/m ³	1 yr	20 ug/m ³	Annual Mean	120 ug/m ³

			24 hr	50 ug/m ³	24 hrs	150 ug/m ³
PM _{2.5}	Annual Mean	15 ug/m ³	1 yr	10 ug/m ³	Annual Average	15 ug/m ³
	24 hrs	35 ug/m ³	24 hr	25 ug/m ³	24 hrs	35 ug/m ³
					1 hr	15 ug/m ³

*: The standards highlighted in green for each respective pollutant are the most stringent based on a comparison between local and international regulations and thus shall be applicable for the proposed project.

* In instances where the airshed is significantly degraded and the pollutant levels are already exceeding the ambient pollutant concentrations provided in the table above, it shall be ensured that the project activities cause as small an increase in pollution levels as feasible, and amounts to a fraction of the applicable short term and annual average air quality guidelines or standards as established in the project specific environmental assessment.

Table 2.5: Comparison of International and Local Noise Standards

Category of Area/Zone	Limit in dB(A) Leq			
	NEQS		WHO/IFC	
	Day Time 06:00 – 22:00	Night Time 22:00-06:00	Day Time 07:00 – 22:00	Night Time 22:00-07:00
Residential area (A)	55	45	55	45
Commercial area (B)	65	55	70	70
Industrial area (C)	75	65	70	70
Silence zone (D)	50	45	55	45

*: The standards highlighted in green for each respective Area/Zone are the most stringent based on a comparison between local and international regulations and thus shall be applicable for the proposed project.

* In instances where baseline noise levels are already exceeding the standards above, it will need to be ensured that the project activities do not cause an increment of more than 3 dB(A) from the baseline noise levels.

Table 2.6: Environmental Quality Standards for Municipal & Liquid Industrial Effluents (mg/l - unless otherwise specified)⁷

S/No.	Parameter	PEQS Standards (Wastewater discharge Into Inland Waters)	FAO Guidelines for Threshold Levels of Trace Elements for Agriculture Use ⁸	EU Council Directive, 91/271/EEC, Urban Wastewater Discharge directive ⁹
1	Temperature or Temperature Increase	≤3°C	-	-
2	pH Value	6-9	-	-
3	BOD at 20°C	80	-	25
4	COD	150	-	125
5	TSS	200	-	35
6	TDS	3500	-	-
7	Grease and Oil	10	-	-
8	Phenolic compounds (as phenol)	0.1	-	-
9	Chloride	1000	-	-
10	Fluoride	10	1.0	-
11	Cyanide	1.0	-	-

⁷https://epd.punjab.gov.pk/system/files/Punjab%20Environmental%20Quality%20Standards%20for%20Municipal%20And%20Liquid%20Industrial%20Effluents%20final_0.pdf

⁸ <http://www.fao.org/3/T0551E/t0551e04.htm>

⁹ <https://www.adb.org/sites/default/files/project-document/60815/42408-033-aze-iee-05.pdf>

12	An-ionic detergents	20	-	-
13	Sulfate	600	-	-
14	Sulfide	1.0	-	-
15	Ammonia	40	-	-
16	Pesticides	0.15	-	-
17	Cadmium	0.1	0.01	-
18	Chromium (trivalent and hexavalent)	1.0	0.1	-
19	Copper	1.0	0.2	-
20	Lead	0.5	5.0	-
21	Mercury	0.01	-	-
22	Selenium	0.5	0.02	-
23	Nickel	1.0	0.2	-
24	Silver	1.0	-	-
25	Total Toxic Metals	2.0	-	-
26	Zinc	5.0	2.0	-
27	Arsenic	1.0	0.1	-
28	Barium	1.5	-	-
29	Iron	8.0	5.0	-

30	Manganese	1.5	0.2	-
31	Boron	6.0	-	-
32	Chlorine	1.0	-	-

1

3 Project Description

3.1 Project Description

57. The specific information on the proposed construction of WWTP in Sahiwal North zone (Stage-1) are provided below.
58. The sensitive receptor map for the proposed WWTP is provided as **Figure 3.1** below and the list of sensitive receptors and their respective distances from the project site is provided as **Table 3.17** below.
59. The proposed WWTP site consists of agricultural fields spread over an area of 199 acres. The natural elevation of the WWTP site varies from 525 to 544 feet. Also, the Sukhrawa drain is flowing on the southern side of the proposed WWTP site at a distance of about 1900 ft (about 0.6 km). This seepage drain is ultimately connected with the river Ravi.

3.2 Scope of WWTP Works

60. The general step wise sequence of activities to be conducted under each of the two Lots are described below. It shall be ensured that staging of activities takes place to manage any potential impacts, including traffic management issues.
 - **Site Preparation Works¹⁰**
61. In this step, the site is made level through earth works and filling, to ensure that a stable levelled surface is available for conducting the next steps of the construction activity.
 - **Access to Site through temporary road works**
62. If no suitable access roads are available to reach the proposed site, it shall be ensured that required access is created through necessary clearing and earth works, as necessary, to ensure that a clear access way to the site is available.
 - **Piling Work**
63. Pilling work for all structures will be carried out at ground elevation of EL ± 0.00 m. Concrete pile of 400 mm \times 400 mm (n = 6150), and 300 mm \times 300 mm (n = 10) are proposed for foundation of each facilities. Concrete pile shall be driven by diesel hammer.
 - **Excavation Work**

¹⁰ https://openjicareport.jica.go.jp/pdf/11650314_05.PDF

64. Excavation work shall be conducted mainly by backhoe. Clamshell shall be applied for excavation depth is more than GL - 5.00m. Excavated soil is transported by dump truck and kept in the treatment site. Excavated soil is also used for backfilling material.

▪ **Civil Works**

65. The civil works cover the substructure design and the architectural works cover the superstructure design. All structures are designed by reinforced concrete except the effluent pipe, whichh will be constructed by pre-cast concrete.

66. Structure work of the wastewater treatment plant is to construct reinforced concrete structures of treatment facilities.

67. Main facilities to be constructed are as follows:

- a) Lift Pumping Station
- b) Wastewater Treatment Plant
- c) Disinfection Tank
- d) Water Supply Facility
- e) Effluent Pipe
- f) Pipe Gallery
- g) Substructure of Main Building
- h) Substructure of Blower Building
- i) Substructure of Dewatering Building
- j) Gravity Thickener
- k) Compost Plant Facilities
- l) Connection Pipe
- m) Landscape Works
- n) Sanitary Sewer
- o) Conveyance Sewer
- p) Temporary Works

68. Concrete placing shall be conducted by concrete pump machine. Concrete structures shall be constructed in combination with mechanical and electrical equipment installation.

▪ **Mechanical Works**

▪ **Electrical Installation**

▪ **Storm Water Drainage**

▪ **WWTP Landscaping**

69. The cross-section drawings of the proposed WWTP is provided below as **Figures 3.3 to 3.5**.
70. Based on the geotechnical investigations conducted by the EPCM consultant, it has been recommended that composite liner shall be used for the construction of the WWTP to control leakage/migration of contaminants from the impoundment into underlying soil/groundwater. The components of the composite liner will be:
- Compacted soil liner
 - Geo-membrane (HDPE)
 - Protective soil cover
71. The recommendations regarding the composite liner for the proposed WWTP have been developed considering the sub-surface ground conditions. Generally, cohesion-less soils are present below the pond base level with GWT depth at around 12 meters (39 feet) below NSL.
72. It is pertinent to mention that in modern/robust practice, flexible membrane liner (FML) are specified in addition to clay liners as a fool proof system against leaching of waste and mixing to groundwater.
73. **Compacted Soil Liner** shall be placed at the bottom and on side slopes of the ponds. The material suitable to be used for compacted soil liner shall meet the following specifications:
- Vertical in-situ hydraulic conductivity in compacted state $\leq 1 \times 10^{-7}$ cm/sec
 - Fines (particles passing 0.075 mm sieve) ≥ 30 %
 - Plasticity index = 8 – 30 %
 - Gravels (particles passing 75 mm sieve and retaining 4.75 mm sieve) ≤ 20 %
 - Maximum particle size ≤ 10 mm
74. Soft soil/fill material, if encountered during construction of the WWTP, will be excavated and removed completely. The exposed surface will be compacted to at least 90% of the maximum modified Proctor dry density at ± 2 % of optimum moisture content.
75. The compacted soil liner shall be placed at the bottom and on side slopes of the ponds and shall have a minimum thickness of 600 mm (24 inches) and shall meet the material specifications mentioned above. The soil liner shall be placed in layers with maximum compacted layer thickness of 150 mm and compacted to at least 90

percent of the maximum modified Proctor dry density or 95 percent of the maximum standard Proctor dry density at 2 to 3 % wet of optimum moisture content.

76. **Geo-membrane (HDPE Liner):** High density polyethylene, HDPE Liner having minimum thickness of 60 mils (60/1000 inches) shall be placed over the compacted soil liner. HDPE liner must cover the entire area of earth material that would be in contact with the treated or stored effluent.
77. **Protective Soil Cover:** HDPE Liner is required to be covered immediately after placement. The HDPE Liner shall be covered by at least 300 mm (12 inches) thick cover of soil to prevent puncture by equipment and to protect it from degradation by ultraviolet light. The on-site / borrow area fine grained soils classified as ASTM class CL (Lean Clay), free of any objectionable material, will be used in the construction of the protective soil cover.
78. The protective soil cover shall be placed in layers with maximum compacted layer thickness of 150 mm (6 inches) and compacted to at least 90 percent of the maximum modified Proctor dry density at 2% of optimum moisture content. The protective soil cover will be placed within 24 hours after placement of the HDPE Liner to minimize the potential for damage from various sources, including precipitation, wind, and ultraviolet light exposure. Also, the Sides slope of pond embankments shall be constructed at 3H:1V slope for stability of sides.

3.3 Project Need

79. At present, Sahiwal city is urgently in need of a WWTP due to the following existing situation:
 - Presently, no treatment plant is available for treatment of sewage in the project area of Sahiwal City.
 - Raw sewage is being directly disposed of into the canals, seepage drain and in agricultural fields in outskirts of the city. This practice is environmentally unsafe and a violation of Punjab Environmental Protection Act;
 - Disposal of untreated wastewater into water bodies/ agriculture fields is causing contamination of the water and food chain and several associated environmental and health issues;
 - Many areas have no final disposal points. The disposal problem becomes more severe when the farmers do not need raw sewage for their crops(s) during raining season and certain period(s) of year when water is not required for crops.

80. Thus, the proposed scope of works need to be implemented on an urgent basis with the population projections over different time periods provided in the **Table 3.1** below.

Table 3.1: North Zone Projected Population¹¹

System	2019	2029	2035	2044
Population	322,662	472,599	590,296	740,840

81. As can be observed, the Stage 1 of the proposed WWTP, upto year 2029, will benefit upto 472,599 people in Sahiwal city.

3.4 Project Design Parameters

82. The degree of treatment in proposed wastewater treatment plant would be such that the treated effluent can safely be reused in fields for agricultural purposes as per WHO Guidelines and discharged into inland waters i.e. Rivers etc. as per PEQS. When water would not be required for agricultural use, in case of rainy season or when water would not be needed by the crops, it will be safely discharged in to the seepage drain (Sukhrawa drain), which is ultimately linked to River Ravi in the down stream and thus would resolve the issue of ultimate disposal of wastewater of Sahiwal city. The expected projections of wastewater flows in year 2029 is provided as **Table 3.2** below.

Table 3.2: Projected Wastewater Flows (Year 2029)¹²

S/No.	Parameter	Value
i.	Average Flow	
a	MGD	24.6
b	Cusec	45.7
c	m ³ /day	111,694
d	m ³ /sec	1.29
ii.	Peak Flow	
a	MGD	38.5
b	Cusec	71.5

¹¹ PC-1 for Sahiwal WWTP

¹² PC-1 for Sahiwal WWTP

c	m ³ /day	174,905
d	m ³ /sec	2.02

83. Based on the comparison of the wastewater monitoring report of pollution parameters with previous data of similar projects and international literature, the design concentrations for WWTP are provided as **Table 3.3** below.

Table 3.3: Design Concentration for WWTP¹³

S/No.	Parameters	Unit	PEQS Value	Design Value
1	pH	-	6-9	7.0
2	Biological oxygen Demand (BOD ₅)	mg/l	80	250
3	Total Suspended Solids (TSS)	mg/l	200	300
4	Fecal Coliform	MPN/100ml	-	1X10 ⁵

84. WWTPs are intended for the removal of common pollutant presents in the wastewater. The principal target pollutants shall be BOD, SS and fecal coliform. The objective of the treatment system shall be to bring the values of wastewater BOD, TSS and fecal coliform within the limits given in the PEQS for Municipal and Liquid Industrial Effluents, as promulgated under Punjab Environmental Protection Act and WHO Guidelines.

85. The **Table 3.4** below presents the design influent characteristics for BOD, SS and Coliform, applicable PEQS values, expected effluent concentrations and respective expected treatment efficiencies.

Table 3.4: Design Influent Characteristics¹⁴

Parameter	PEQS Value	Design Concentrations		Treatment
		Influent	Effluent	Efficiency (%)

¹³ PC-1 for Sahiwal WWTP

¹⁴ PC-1 for Sahiwal WWTP

BOD (mg/l)	80	250	≤80 (filtered)	68
TSS (mg/l)	200	300	≤150	50
Fecal Coliform (MPN/100ml)	≤1000	1X10 ⁵	≤1000	99.0

86. The design effluent concentrations for BOD and SS are in fact kept equal to those achievable, under normal operating conditions, in a typical well-designed aerobic treatment plant. These values are actually lower than the PEQS values. It is pertinent to mention that ideal operational conditions (i.e. growth of bacteria, algae, availability of nutrients and good process operation & control etc.) will be required to achieve the desired limits.
87. **Anaerobic ponds (APs)** have been designed on the basis of the volumetric loading rate. The design value of permissible volumetric BOD loadings and percentage BOD removal in the APs varies for different design temperatures as shown in **Table 3.5** below.

Table 3.5: Permissible Volumetric Loading Rates and & BOD Removal at Corresponding Temperatures¹⁵

Temperature (°C)	Volumetric Loading (g/m ³ .day)	BOD Removal (%)	Adopted
<10	100	100	-
10-20	20T - 100	20T - 100	YES
20-25	10T + 100	10T + 100	-
>25	350	350	-

88. **Facultative ponds (FPs)** are designed for BOD removal on the basis of a relatively low surface loading (100 - 400 kg BOD/ha. d) to permit the development of a healthy algal population as the oxygen for BOD removal by the pond bacteria is mostly generated by algal photosynthesis. The design parameters along with the variation in the hydraulic retention time due to the temperature change is provided in **Table 3.6** below.

¹⁵ PC-1 for Sahiwal WWTP

Table 3.6: Design Parameters for Facultative Ponds¹⁶

Parameter	Unit	Range	Adopted
Water Depth	m	1-2	2.5
Free Board	m	0.5-1	0.5
Length to Width Ratio	-	>1.5	7.0
Hydraulic Retention Time	Day		
a)For Temp <20°C	Day	>5	8
b)For Temp>20°C	Day	>4	-
BOD Removal Efficiency (filtered)	%	70-90	76.75
Side Slope	m	2-3	3.0

89. A comparison of area requirement and treated effluent BOD (filtered & unfiltered) at coldest month temperature (12.6°C) and adopted temperature (20°C) is presented in the **Table 3.7** below. As proposed for the project, wastewater flow is divided in to 10 parallel trains/modules. Each module will consist of one AP, one Facultative Pond (FP) and one Maturation Pond (MP) in series.

Table 3.7: Area Requirement and Treated Effluent BOD

Description	Temperature		Area Reduction (%)
	12.6°C	20°C	
No. of Modules	10	10	-
Ponds Area (acre)			
Anaerobic	2.0	1.4	30
Facultative	31.1	12.03	61.31
Maturation	5.64	2.22	60.6
Total Area (acre)	38.74	15.7	59.4

¹⁶ PC-1 for Sahiwal WWTP

Effluent BOD – Unfiltered (mg/l)	59	30-88	-
Effluent BOD – Filtered (mg/l)	17.7	17.7-26.4	-

90. Adopted design temperature of 20°C shall result in significant reduction in area requirement (more than 50% less) as well as capital cost of proposed WWTP. At adopted design temperature of 20°C, treated effluent BOD (unfiltered) may slightly exceed PEQS limits in winter months (December & January). However, in other months, it will remain within PEQS limits.
91. It is pertinent to mention that filtered effluent BOD, as internationally adopted practice, will remain within PEQS limits throughout the year, if WSP is properly operated and managed. Technical committee constituted by P&D department; Punjab for Lahore also recommended to adopt design temperature of around 20°C for waste stabilization ponds in order to make the system economical and reduce the land requirement by around 50% approximately.

3.5 Project Components

92. The proposed WWTP will be designed and constructed in the northern part of Sahiwal city in the following two stages:
- Stage-1: Design of WWTP up to year 2029 (covered in this IEE report)
 - Stage-2: Design of WWTP for year 2029 to 2044 (planned as a future investment, to be covered in a separate IEE report in the future)
93. The approximate area of land required till year 2029 (10 years design period) to meet irrigation standards for entire North zone will be 199 acres. In order to cater to the wastewater flow to be generated up to design year 2044, additional area of about 98 acres will be required in the North zone. Thus, the total area requirement upto design year 2044 will be 290 acres.
94. The flow of the WWTP will be monitored during operation of Stage-1 as it will be required in estimating Stage-2 investment, depending upon actual flows and future requirements. However, to cater future flows up to design year 2044, financial capability/strength of MC/district government Sahiwal in year 2029 or future years will not be capable to bear Capital and O&M cost of other treatment technologies. In such a scenario, it is proposed that same WSP technology would be adopted for future flows and additional areas would be acquired for North zone.

95. It is recommended that at the first stage i.e. for design year 2029, WWTP will be constructed based on waste stabilization ponds (WSP) treatment technology. The proposed WWTP will serve population of approximately 472,599 people of Sahiwal city. The geometry of the proposed site for entire North zone is rectangular and this site is proposed on private agriculture land with the topography of the proposed WWTP site being generally plain.
96. Key treatment facilities of the proposed WWTP for planning horizon of 2029 shall consist of the following components.
- 01 No. Collection Chamber (CC)
 - 01 No. Inlet Channel
 - 10 Nos Anaerobic Ponds (APs) will be constructed with capacity to collect 2.46 MGD sewage flow from inlet channel.
 - 10 Nos Facultative Ponds (FPs)
 - 10 No. Maturation Ponds (MPs)
 - 01 No. Outlet/Treated effluent Channel
 - 01 No. Treated Effluent Pumping Station
 - Treated Effluent Conveyance System for Irrigation Reuse
97. The design Consultant conducted 24 hour equal volume composite wastewater sampling and testing of various pollution parameters, through an EPD Punjab approved laboratory of major disposal stations in the North Zone of Sahiwal city. The wastewater samples were collected from the Collecting Tank and pump discharge points. The test results of disposal stations falling in the North Zone are provided as **Table 3.8** below.

Table 3.8: Wastewater Test Results of Project Area¹⁷

Parameters	Analysis Method	Unit	LOR	RESULT			PEQS
				Fareed Town	Small Industries	Kacha Pakka Noor	
CHEMICAL ANALYSIS							
Temperature	-	°C	-	20.0	21.0	19.0	-
pH	APHA-4500H+ B	pH unit	0.01	7.03	7.04	7.07	6-9
Total Dissolved Solid	APHA-2540 C	mg/l	1.0	1634.0	1708.0	1668.0	3500
Oil and Grease	USEPA-1664	mg/l	0.1	8.4	8.1	7.7	10
BOD (Raw)	APHA, 5210	mg/l	1.0	258.0	252.0	248.0	80
BOD (Filtered)	APHA, 5210	mg/l	1.0	71.0	52.0	41.0	80
BOD (Settable)	APHA, 5210	mg/l	1.0	75.0	56.0	49.0	80
COD (Raw)	APHA-5220-D	mg/l	1.0	799.0	806.0	764.0	150
COD (Filtered)	APHA-5220-D	mg/l	1.0	209.0	159.0	131.0	150
COD (Settable)	APHA-5220-D	mg/l	1.0	223.0	167.0	149.0	150
TSS (Raw)	APHA-2540-D	mg/l	1.0	291.0	348.0	197.0	200
TSS (Settled Sample)	APHA-2540-D	mg/l	1.0	232.0	119.0	121.0	200
Settable Solids	APHA-2540 F	mg/l	-	54.0	225.0	76.0	-
Chloride (Cl)	APHA-4500Cl- B	mg/l	0.24	359.88	329.89	299.90	1000
Cyanide (CN)	APHA-4500CN E	mg/l	0.01	<0.01	<0.01	<0.01	1.0
Anionic Detergents	APHA-5540 B	mg/l	-	1.0	1.2	1.4	20
Sulphate	APHA-4500-SO4C	mg/l	0.41	390.20	448.23	404.19	600
Sulphide	APHA-4500-S2-E	mg/l	0.2	1.6	1.6	3.2	1.0
Ammonia	APHA-4500-NH3-B	mg/l	0.002	2.8	2.6	3.0	40
Chromium	APHA-3500Cr B	mg/l	0.0054	0.48	0.56	0.52	1.0
Copper	APHA-3500Cu B	mg/l	0.0045	0.85	0.89	0.87	1.0
Lead	APHA-3500-Pb B	mg/l	0.013	0.16	0.22	0.12	0.5
Nitrite	APHA-4500NO2 B	mg/l	0.01	<0.01	<0.01	<0.01	-
Nitrate	APHA-4500NO3 B	mg/l	0.1	5.6	6.2	4.4	-
Phosphate	APH4500-P C	mg/l	0.002	0.12	0.14	0.073	-
Arsenic	APHA-3500As B	mg/l	0.01	0.28	0.39	0.22	1.0
Sodium Absorption Ratio	-	-	-	91.81	83.85	81.46	-
MICROBIOLOGICAL ANALYSIS							
Total Coliforms	APHA-9222 B	CFU/100ml	-	1600	2.2x10 ³	1600	-
Faecal Coliforms	APHA-9222 D	CFU/100ml	-	900	1600	900	-

98. An overview of the WWTP components is provided in the Table 3.9 below.

Table 3.9: Overview of WWTP Components

S/No.	Components	Numbers
1	Sewage Conveyance Work	
a	Collection Chamber	1
b	Inlet Channel	1
2	Sewage Treatment Works	
a	Anaerobic Ponds (AP)	10
b	Facultative Ponds (FP)	10

¹⁷ PC-1 of Sahiwal WWTP

c	Maturation Ponds (MP)	10
3	Treated Effluent Collection and Conveyance Works	
a	Treated Effluent Channel	1
b	Treated Effluent Pumping Station for reuse in irrigation network	1
4	Auxiliary Facilities	
a	Access/Internal Roads	1
b	Substation Building	1
c	Staff/Operator Quarter	1
d	Laboratory and Admin Building	1
e	Main Gate and Guard Room	1
f	Buffer Zone (Thick Plantation) all around WWTP	1

99. The AP-FP-MP configuration has been selected based on the following rationale:
- APs work as primary treatment to remove settleable solids and associated BOD and COD. Domestic sewage usually has appreciable amount of settleable solid and associated BOD and COD. Same is the case for Sahiwal wastewater.
 - FPs work as secondary ponds in order to remove colloidal and dissolved pollution loads.
 - MP work as tertiary treatment requires to kill coliform to make treated effluent water fit for reuse for irrigation purpose. For compliance of PEQS, maturation ponds are not necessary, however, on Direction of MC Sahiwal, MPs are added in the scheme.

Considering above aspects, the AP-FP-MP scheme has been selected.

Description of all components is given below.

➤ **Collection Chamber**

100. One (01) collection chamber (CC) will be provided to receive influent sewage/wastewater from force mains and convey it to inlet channel as per capacity. The design summary of the CC is provided below as **Table 3.10** below.

Table 3.10: Design Specifications of Collection Chamber

S/No.	Parameter	Unit	Value
1	Flows		
	Design Peak Flow (year 2044)	m ³ /sec	3.96
		Cusec	140
2	Collection Chamber (CC)		
	Number	No.	1
	Length	ft	25.0
	Width	ft	25.0
	Total Depth of Chamber	ft	8.4

➤ **Inlet Channel**

101. One (01) inlet channel has been proposed which shall carry sewage/ wastewater from distribution chambers to series of anaerobic ponds. The inlet channel is designed as the water retaining/distribution structure on the basis of hydraulic retention time. The purpose of the inlet channel is to uniformly distribute influent wastewater into the WSP modules. A summary of the design specifications of the inlet channel is provided in **Table 3.11** below.

Table 3.11: Design Specifications of Inlet Chamber

S/No.	Parameter	Unit	Value
1	Flows		
	Design Peak Flow (year 2044)	m³/sec	3.96
		Cusec	140
2	Inlet Channel		
	No. of Channel	No.	1
	Length of Channel	ft	3,420
	Width of Channel	ft	8.0
	Hydraulic Depth of Channel	ft	3.0
	Total Depth of Channel	ft	3.5

➤ **Anaerobic Ponds (APs)**

102. Anaerobic ponds shall be provided for primary treatment. Total ten (10) numbers of APs shall be provided in parallel for primary treatment of wastewater. Each AP shall receive equal sewage flow of 2.46 MGD from inlet channel. These ponds will receive high strength wastewater and will reduce BOD of the sewage/wastewater through anaerobic processes. A summary of the design specifications of the APs is provided in **Table 3.12** below.
103. The retention time for the APs has been estimated on the basis of temperature dependent empirical relationship as given in design literature. As per empirical formula at design temperature of 20°C, retention time comes out to be 0.83 days. According to minimum retention time criteria, 1 day retention time has been adopted for this project.
104. Desludging of APs is normally carried out after 2-3 years. Drying of sludge is proposed to be carried out inside anaerobic pond on periodic basis. During desludging period, flow to respective anaerobic pond will be closed. At one time, one aerobic pond will be dewatered and settled sludge at bottom of pond, allowed drying under sunshine. Once sludge drying process will be completed, dried sludge will be removed from the pond and transported to the proposed landfill site for disposal, to be developed and commissioned by 2024-25. The land for this proposed landfill has already been acquired by the GoP.
105. The designing of the APs has been conducted to ensure extra volume is provided to accommodate sludge for two years in the APs. Therefore, an approximate time frame of two years will be available to develop the landfill site after commencement of operation of the WSPs.

Table 3.12: Summary of Anaerobic Ponds (APs) of WWTP

S/No.	Parameter	Unit	Value	
			AP-1	AP-02 to AP-10
1	Total No. of Anaerobic Ponds	No.	01	09
2	Retention Time	Days	1.0	1.0
3	Volumetric Loading Rate	g/m ³ .d	300	300
4	Design	°C	20	20

	Temperature			
5	Influent BOD	mg/l	250	250
6	Effluent BOD	mg/l	90-100	90-100
7	BOD Removal Efficiency	%	60	60
8	Hydraulic depth of one pond	ft	16.4	16.4
9	Free Board	ft	1.64	1.64
10	Top length of one pond	ft	338	285
11	Top width of one pond	ft	180	205
12	Top area for one pond	Acres	1.4	1.38
13	Total area of 'n' No. of ponds	Acres	1.4	12.42

➤ **Facultative Ponds (FPs)**

106. Facultative ponds (FPs) shall be provided for secondary treatment. Total ten (10) FPs have been proposed in parallel for WWTP. Each FPs will receive a cumulative flow of 2.46 MGD wastewater flow one (01) APs. Treated effluent from the facultative ponds may be high in algal BOD because of presence of algae in the treated effluent. Algal BOD is usually different than non-algal BOD as algal produces more oxygen in natural water body than it consumes for respiration. A summary of the design specifications of the FPs is provided in **Table 3.13** below.

The removal rate of BOD in WSPs will depend upon the ambient temperature. In the summer months, the removal rate will be higher due to an increase in temperature, however, in winter months, the removal efficiency of the pond will be less. As per estimates, the unfiltered effluent BOD will remain in the range of 30-60 mg/l in the summer months (March to November), provided that the WSP will be properly operated and managed. However, in the winter months, it may slightly exceed from the PEQS limits and may range between 70-88 mg/l. However, it is estimated that

that the filtered effluent BOD will remain in the range of 17-27 mg/l throughout the year.

Table 3.13: Summary of Facultative Ponds (FPs) of WWTP

S/No.	Parameter	Unit	Value	
			AP-1	AP-02 to AP-10
1	Total No. of Facultative Ponds	No.	01	09
2	Retention Time	Days	8	8
3	Surface Loading Rate	kg/ha.d	253	253
4	Design Temperature	°C	20	20
5	Effluent BOD@ 20°C (unfiltered)	mg/l	≤80	≤80
6	Effluent BOD@ 20°C (filtered)	mg/l	≤50	≤50
7	BOD Removal Efficiency	%	60	60
8	Hydraulic depth of one pond	ft	6.56	6.56
9	Free Board	ft	1.64	1.64
10	Top length of one pond	ft	1572	1840
11	Top width of one pond	ft	338	285
12	Top area for one pond	Acres	12.22	12.22
13	Total area of 'n' No. of ponds	Acres	12.22	109.8

➤ **Maturation Ponds (MPs)**

107. For tertiary treatment, total ten (10) Maturation Ponds (MPs) have been proposed in parallel for WWTP. Each MP will receive a cumulative flow of 2.46 MGD wastewater flow from one (01) Facultative Ponds (FPs). A summary of the design specifications of the MPs is provided in **Table 3.14** below.
108. The removal rate of coliform in MPs will depend upon the ambient temperature. In the summer months, removal rate will be higher due to an increase in temperature, however, in the winter months, the removal efficiency of the pond will be less and the removal efficiency may be reduced.

Table 3.14: Summary of Maturation Ponds (MPs) of WWTP

S/No.	Parameter	Unit	Value
1	Total No. of Maturation Ponds	No.	10
2	Retention Time	Days	1
3	Design Temperature	°C	20
4	Hydraulic depth of one pond	ft	4.92
5	Free Board	ft	1.64
6	Top length of one pond	ft	340
7	Top width of one pond	ft	285
8	Top area for one pond	Acres	2.21
9	Total area of 10 ponds	Acres	22.14
10	Removal Efficiency in Summer months	%	99.0

➤ **Treated Effluent Channel**

109. One (01) Treated Effluent Channel shall be provided which shall carry treated effluent from series of MPs and transfer it to effluent pumping station which will convey it to irrigation water courses through force mains. In case, water is not required for irrigation purposes, treated effluent channel will discharge the treated effluent to Sukhrawa seepage drain and Sukhnaie Seepage drain under gravity by passing proposed effluent pumping station. A summary of the design specifications of the Outlet channel is provided as **Table 3.15** below.

Table 3.15: Summary of Outlet Channel of WWTP

S/No.	Parameter	Unit	Value
1	Flows		
	Design Peak Flow (year 2044)	m ³ /sec	3.96
		Cusec	140
2	Collection Chamber (CC)		
	Number	No.	1
	Length of Channel	ft	8550
	Width of Channel	ft	9.0-20.0
	Hydraulic Depth of Channel	ft	3.0-5.0

➤ **Treated Effluent Pumping Station**

110. One treated effluent pumping station shall be provided for WWTP for North zone. The main function of treated effluent pumping station shall be to receive treated effluent from MPs through treated effluent channel and transport it to irrigation network courses for irrigation of field crops. Proposed treated effluent pumping station is designed on average daily flows of design year 2044. A summary of the technical specifications of the Treated Effluent Pumping Station is provided as **Table 3.16** below.
111. One screen chamber, two wet wells and two dry wells have been proposed with four pumps, non-clogging, horizontal, centrifugal type, in each dry well. All civil structures of the treated effluent pumping station have been designed on an average wastewater flow of 2.02 m³/sec (71 cusec), estimated for year 2044. In the first stage, for design year 2029, pumping capacity of 60 cusecs will be provided with 33 percent standby pumping capacity. To cater treated effluent flow of year 2029, four pumps (3 operating, 1 standby) will be provided. Bypass engagement has also been proposed

to direct disposal of treated effluent into Sukhrava Seepage drain without introducing it to the pumping station.

Table 3.16: Summary of Treated Effluent Pumping Station of WWTP

S/No.	Parameter	Unit	Value
1	Design Average Flow (Year 2044)	m ³ /sec	2.02
		Cusec	71.5
2	Wet Well		
	No. of Wet Well	No.	2
	Detention Time	min	2
	Diameter of each Wet Well	ft	30.0
3	Dry Well		
i	No. of Dry Wells	No.	2
ii	No. of Pumps in each Dry Well (03 Working, 01 Standby)	No.	4
iii	No. of Pumps in Dry Well	No.	4
iv	Diameter of Dry Well	ft	30.0
4	Pumps (Design Year 2034)		
i	Total No. of Pumps	No.	4
ii	Working Pumps	No.	3
	a) No. of 20 cusec pumps	No.	2
	b) No. of 10 cusec pumps	No.	1
iii	Standby Pumps	No.	1
	a) Number of 10 cusec pumps	No.	1
5	Force Mains		
i	No. of Force Mains	No.	1
ii	Diameter of Force Mains	mm	1200

➤ **Treated Effluent Conveyance System for Irrigation Purposes**

112. As per requirement of MC Sahiwal, degree of treatment in proposed treatment plant would be such that the treated effluent can safely be reused in fields for agriculture purposes as per WHO and discharged into inland water i.e. Rivers as per PEQS. When water would not be required for agriculture use in case of rainy season or when water would not be needed by the crops, It can be safely discharged into the seepage drains available in the vicinity of WWTP sites. These seepage drains are ultimately linked to river Ravi and Sutlej in the down streams thus would also resolve the issue of ultimate disposal of wastewater of Sahiwal city.

3.6 Project Construction Schedule

113. The project construction phase is expected to last for a total of 2 years with the activity expected to commence in the second quarter of 2020 and completed by mid of 2023.

3.7 Construction Camps and Work Force

114. The construction activity has to span over approximately twenty-four months. There shall be a number of contracts for a variety of works. The selected Contractor shall have the option to select suitable site(s) located near the project sites to establish his labor camps. If private land is selected, the contractor shall enter into contract with the private owner.
115. Essential for the work bases is easy approach, availability of a suitable place for temporary storage of material and availability of water for construction in the vicinity. Presence of shade from trees close to the work bases can add to the comfort of the labor while taking rest during the hot season.
116. The location of storage materials and camps will be critical. Since the project contractor(s) will be responsible for identifying the suitable locations for storage and labor camps from the private sector, thus there will need to be clear guidelines for this process, which will need to be closely monitored by the implementing agency. As far as possible, the project design team shall be assigned the task to identify the suitable location(s) for storage of materials since inappropriate storage of materials may result disruption of the traffic movement.

3.8 Machinery Requirement

117. For storing materials, stocking equipment and parking machinery and vehicles, the Contractor shall require open and accessible sites close to the labor camps. The

Contractor, at his own expense, but keeping in view his contractual obligations to honor the applicable national and international guidelines regarding level of pollution, shall make the arrangements.

3.9 Climate Risks from Project

118. The biogas production in conventional APs is not collected and directly released into atmosphere due to the large pond area and this same practice has been adopted for the proposed WWTP project. In order to ensure collection and reuse of biogas, high rate anaerobic ponds are designed which have higher capital and operating expenses as compared to conventional APs. These systems are not considered for this proposed WWTP project.

119. It has been estimated that based on the WWTP's operational parameters, during the first stage, upto the Year 2029, approximately 16,600 tonnes/year CO₂e¹⁸ will be emitted from the WWTP plant operation as a result of the wastewater treatment processes.

18

https://www.researchgate.net/publication/7638191_A_Rational_Procedure_for_Estimation_of_Greenhouse-Gas_Emissions_from_Municipal_Wastewater_Treatment_Plants

Table 3.17: Sensitive Receptor Mapping

Distance of Sensitive Receptors from WWTP Site				
Sr. No	Type of Sensitive Receptor	Name	Coordinates	Distance from WWTP Site
1	Religious	Jamia Masjid Ghausia	30°43'7.02"N 73° 2'20.49"E	0.70 Km
2	Religious	Adda wali Masjid	30°42'1.07"N 73° 2'35.68"E	1.54 Km
3	Educational	Govt. High school Muhammad Pur	30 30°42'51.70"N 73° 1'0.05"E	0.61 Km
4	Health	Dispency	30°42'34.40"N 73° 1'14.53"E	0.24 Km
5	Public Building	UC 43 Office	30°42'47.26"N 73° 1'1.08"E	0.588 Km
6	Grave Yard	N/A	30°42'23.00"N 73° 1'23.49"E	0.35 Km

Figure 3.1: Sensitive Receptor Map of WWTP

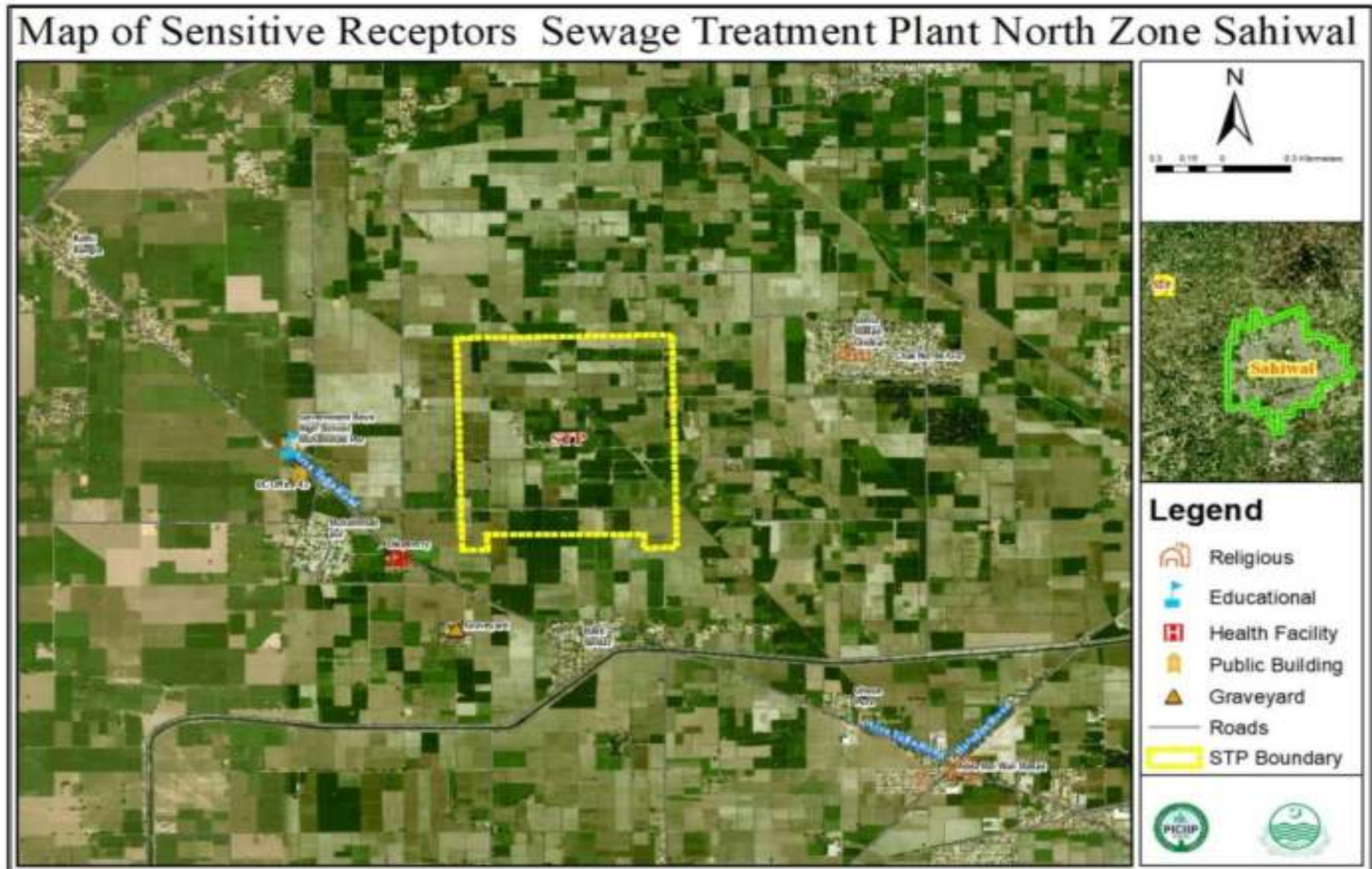


Figure 3.2: Proposed WWTP Site

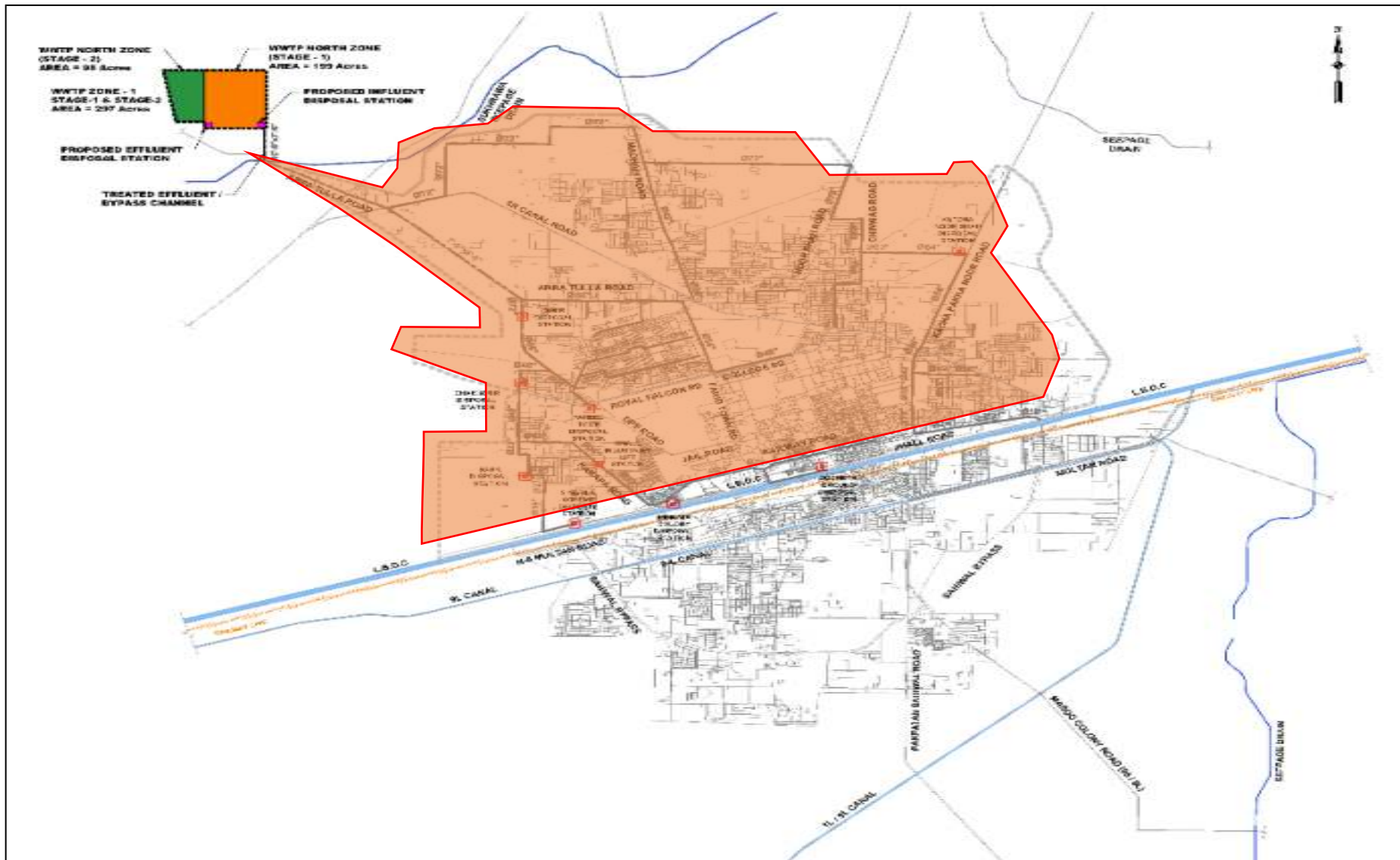
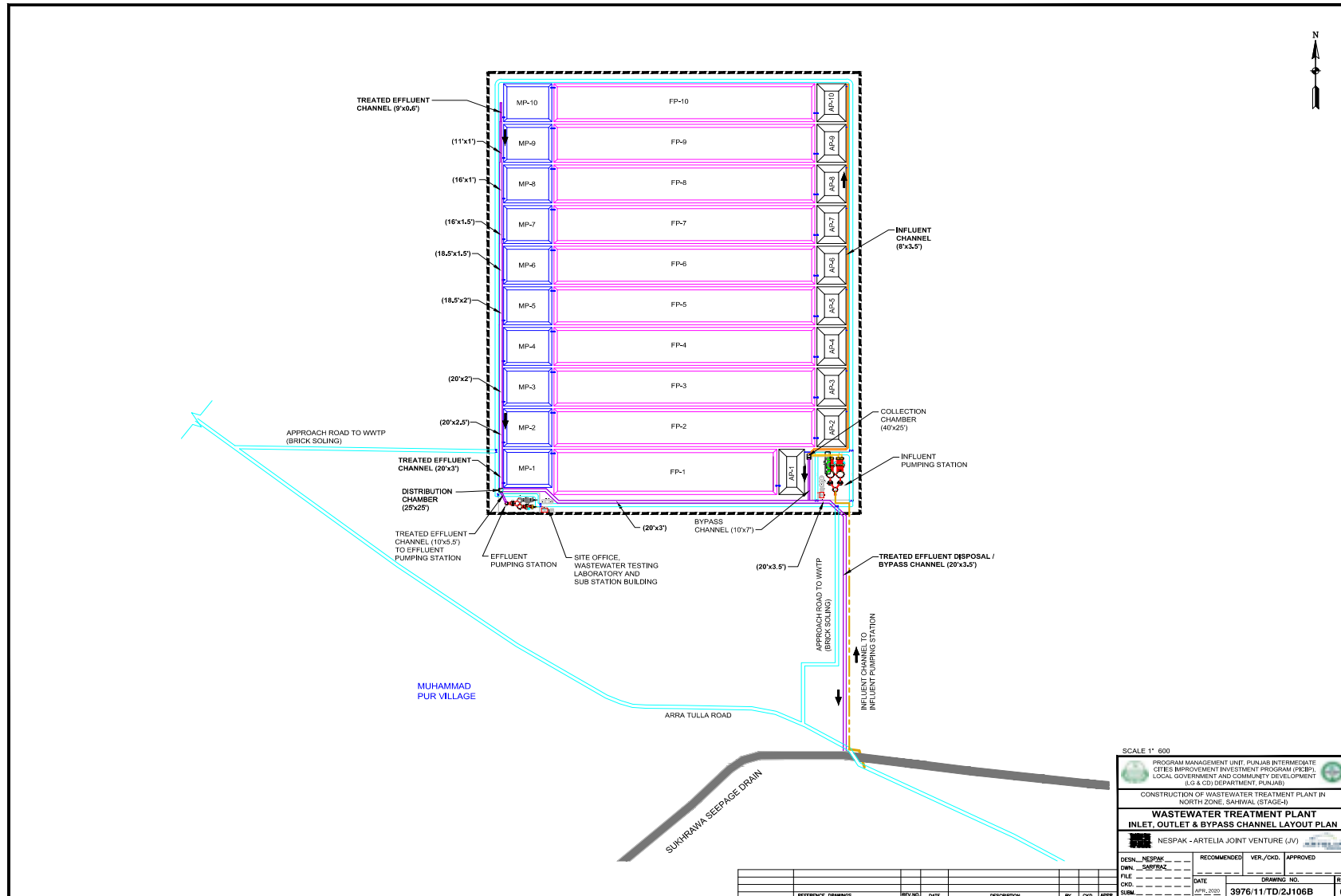


Figure 3.3: WWTP inlet, outlet, and bypass channel layout Plan



SCALE 1" = 800'

PROGRAM MANAGEMENT UNIT, PUNJAB INTERMEDIATE CITIES IMPROVEMENT INVESTMENT PROGRAM (PICIP), LOCAL GOVERNMENT AND COMMUNITY DEVELOPMENT (LG & CD) DEPARTMENT, PUNJAB

CONSTRUCTION OF WASTEWATER TREATMENT PLANT IN NORTH ZONE, SAHIWAL (STAGE-1)

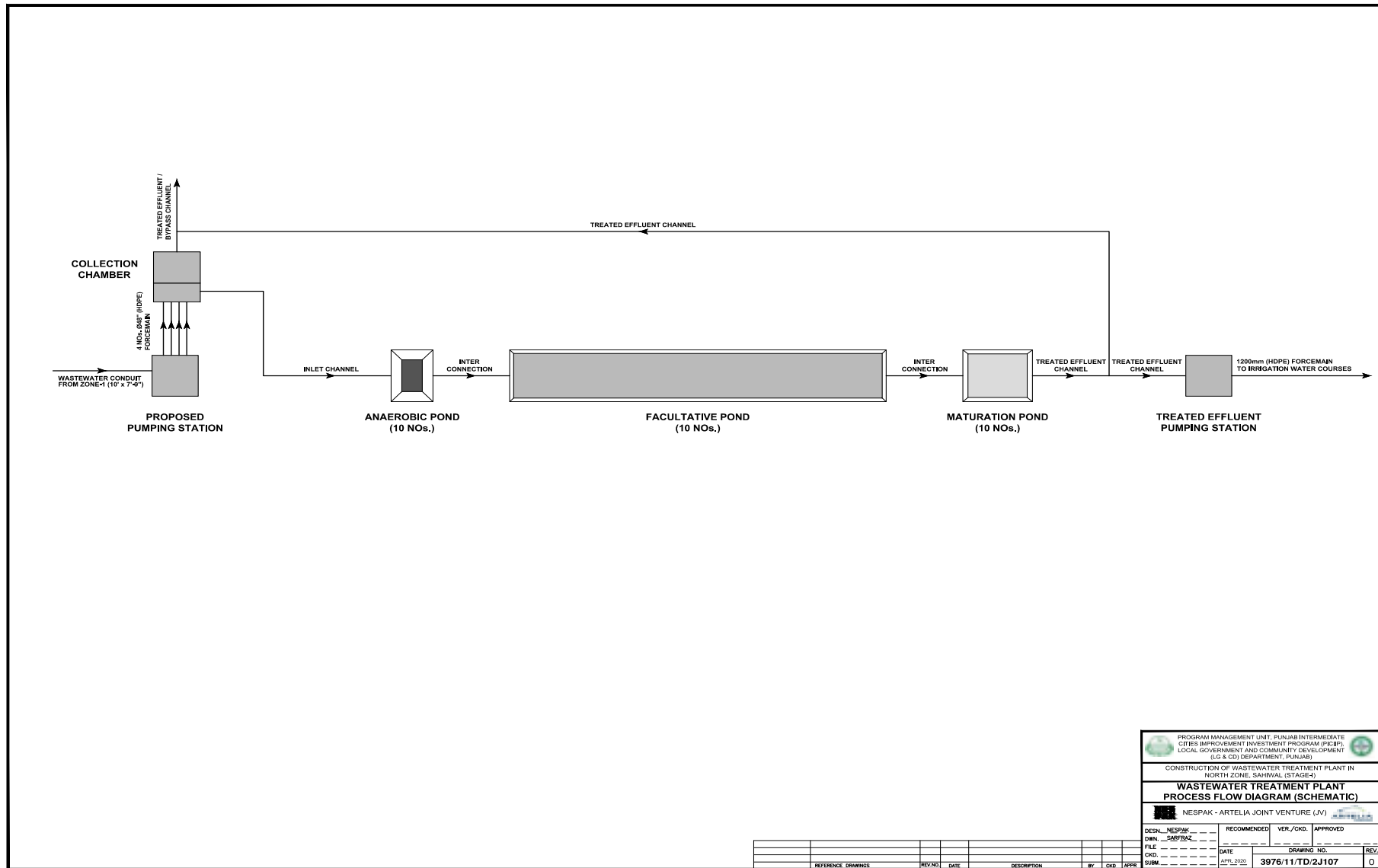
WASTEWATER TREATMENT PLANT INLET, OUTLET & BYPASS CHANNEL LAYOUT PLAN

NESPAK - ARTELIA JOINT VENTURE (JV)

DESIGN: NESPAK	RECOMMENDED	VER./CHKD.	APPROVED
DWN: SAH/RAZ			
FILE: _____	DATE: _____	DRAWING NO.:	REV:
CHKD: _____	DATE: _____	3976/11/TD/2/J106B	0
SUBM: _____	DATE: APR, 2020		

REFERENCE DRAWING	REV/NO	DATE	DESCRIPTION	BY	CHKD	APPR

Figure 3.4: WWTP Process Flow Diagram



PROGRAM MANAGEMENT UNIT - PUNJAB INTERMEDIATE CITIES IMPROVEMENT INVESTMENT PROGRAM (PICIP), LOCAL GOVERNMENT AND COMMUNITY DEVELOPMENT (LG & CD) DEPARTMENT, PUNJAB			
CONSTRUCTION OF WASTEWATER TREATMENT PLANT IN NORTH ZONE, SAHIWAL (STAGE-4)			
WASTEWATER TREATMENT PLANT PROCESS FLOW DIAGRAM (SCHEMATIC)			
NESPAK - ARTELIA JOINT VENTURE (JV)			
DESIGN: NESPAK	RECOMMENDED	VER./CHKD.	APPROVED
DRAWN: SAHIBRAZ			
FILE:	DATE:	DRAWING NO.:	REV.:
CHKD.:	DATE:	3976/11/TD/2J107	0
SUBM.:	DATE:		

REFERENCE DRAWINGS	REV. NO.	DATE	DESCRIPTION	BY	CHKD.	APPR.

Figure 3.5: WWTP Hydraulic Profile

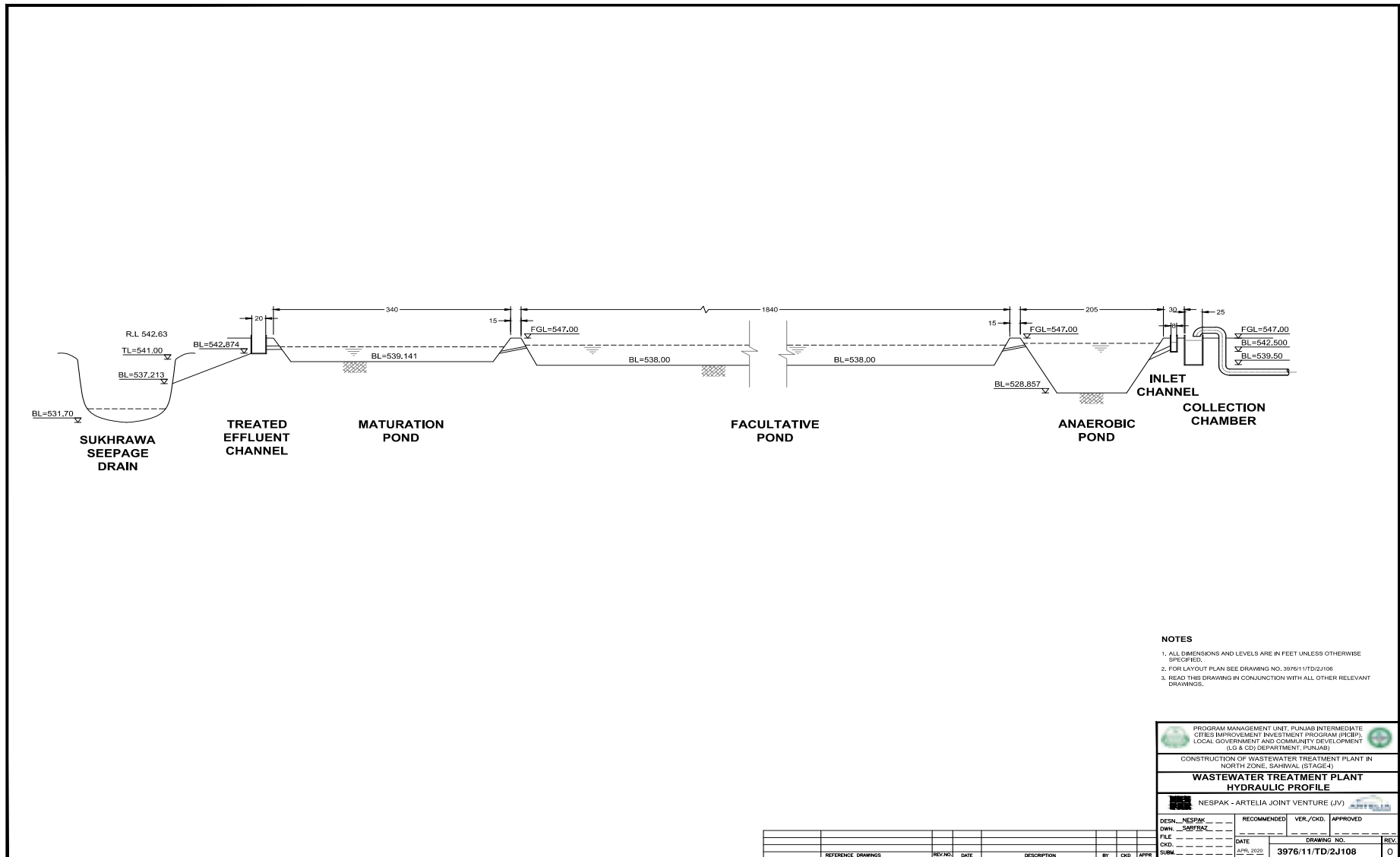


Figure 3.6: AP, FP & MP Plan and Section

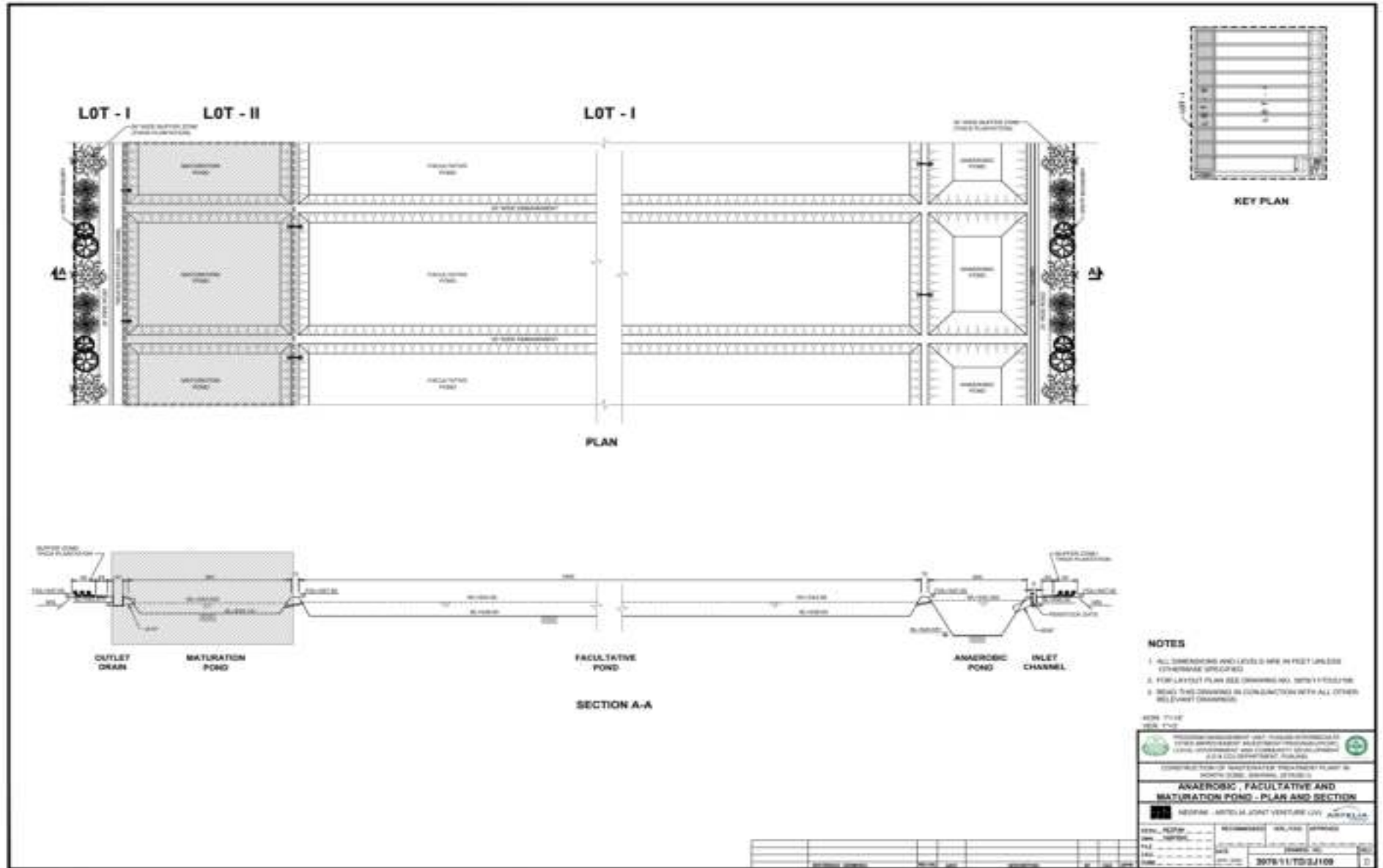


Figure 3.7: AP-01 & FP-01 Plan and Section

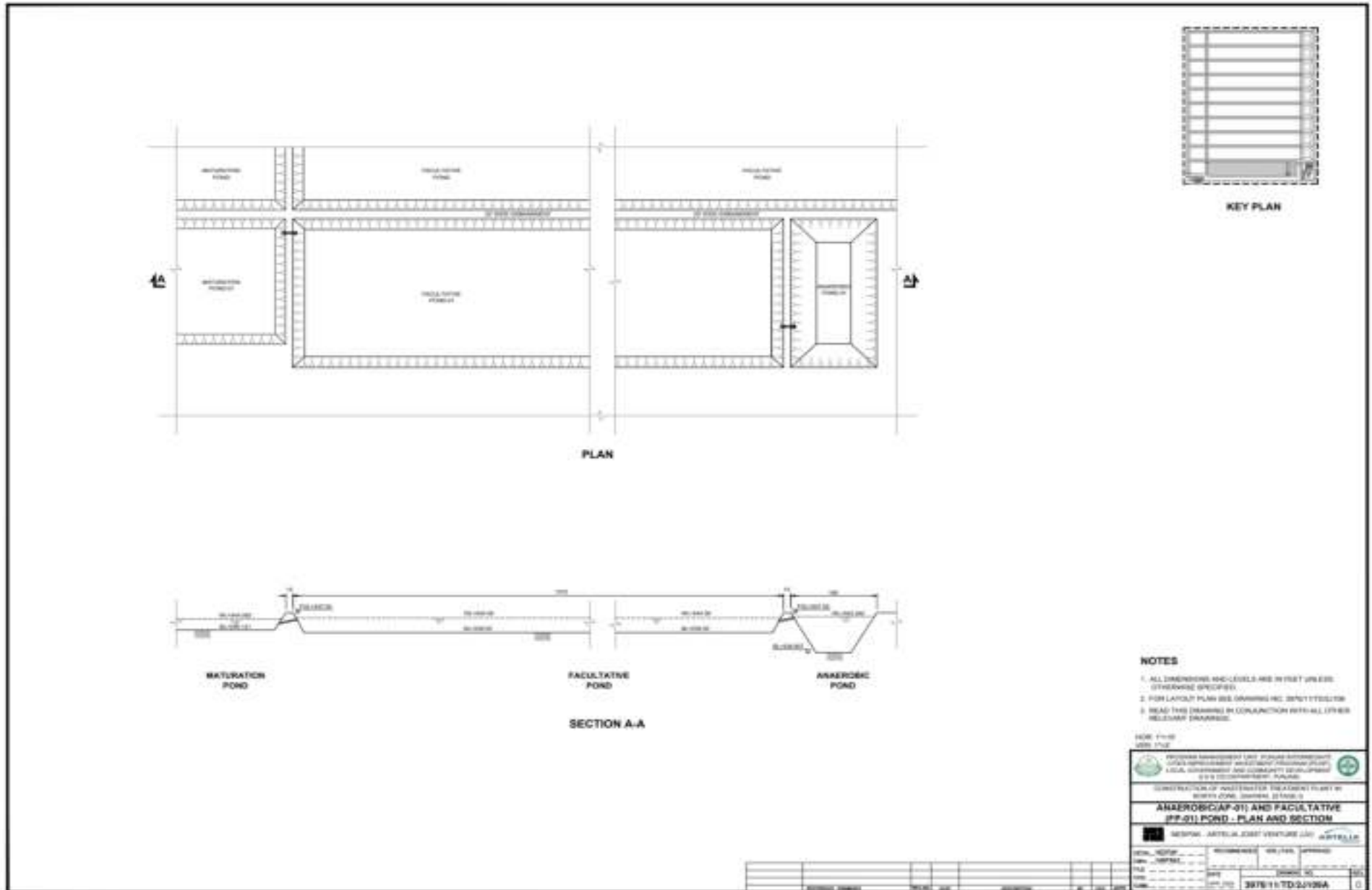


Figure 3.8: AP-02 to AP-10 Plan and Section

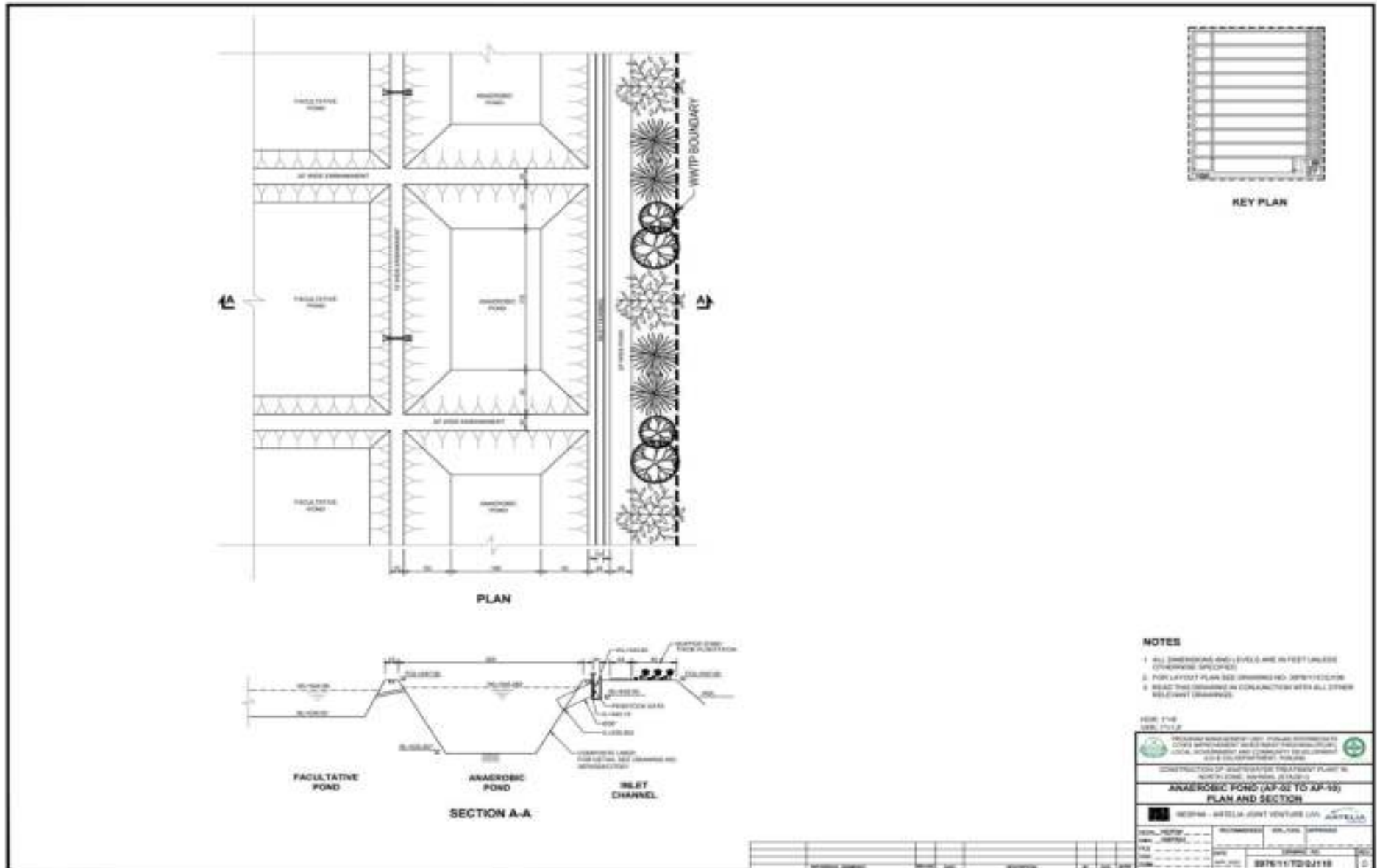


Figure 3.9: FP-02 to FP-10 Plan and Section

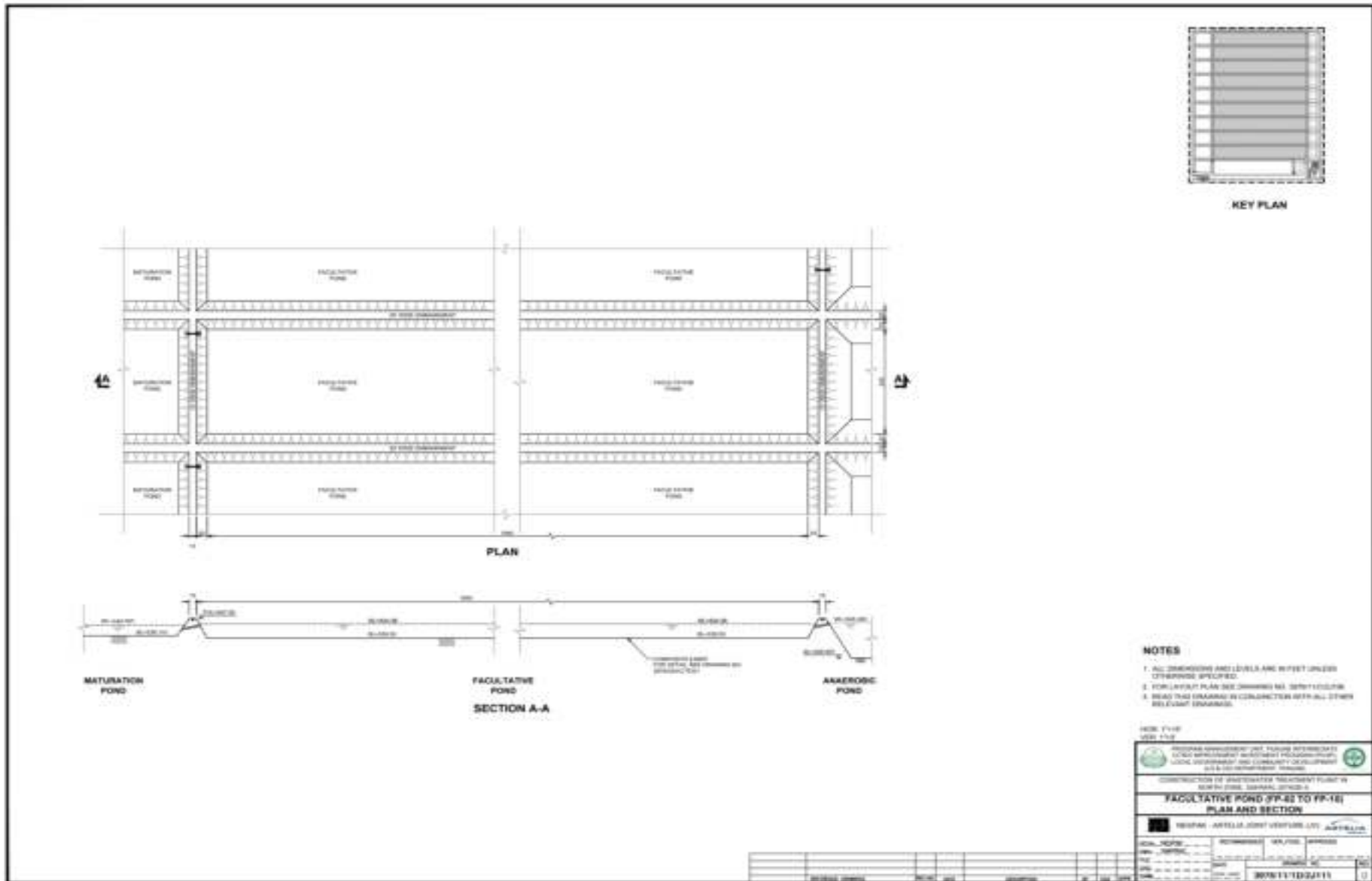


Figure 3.10: Collection Chamber Plan and Section

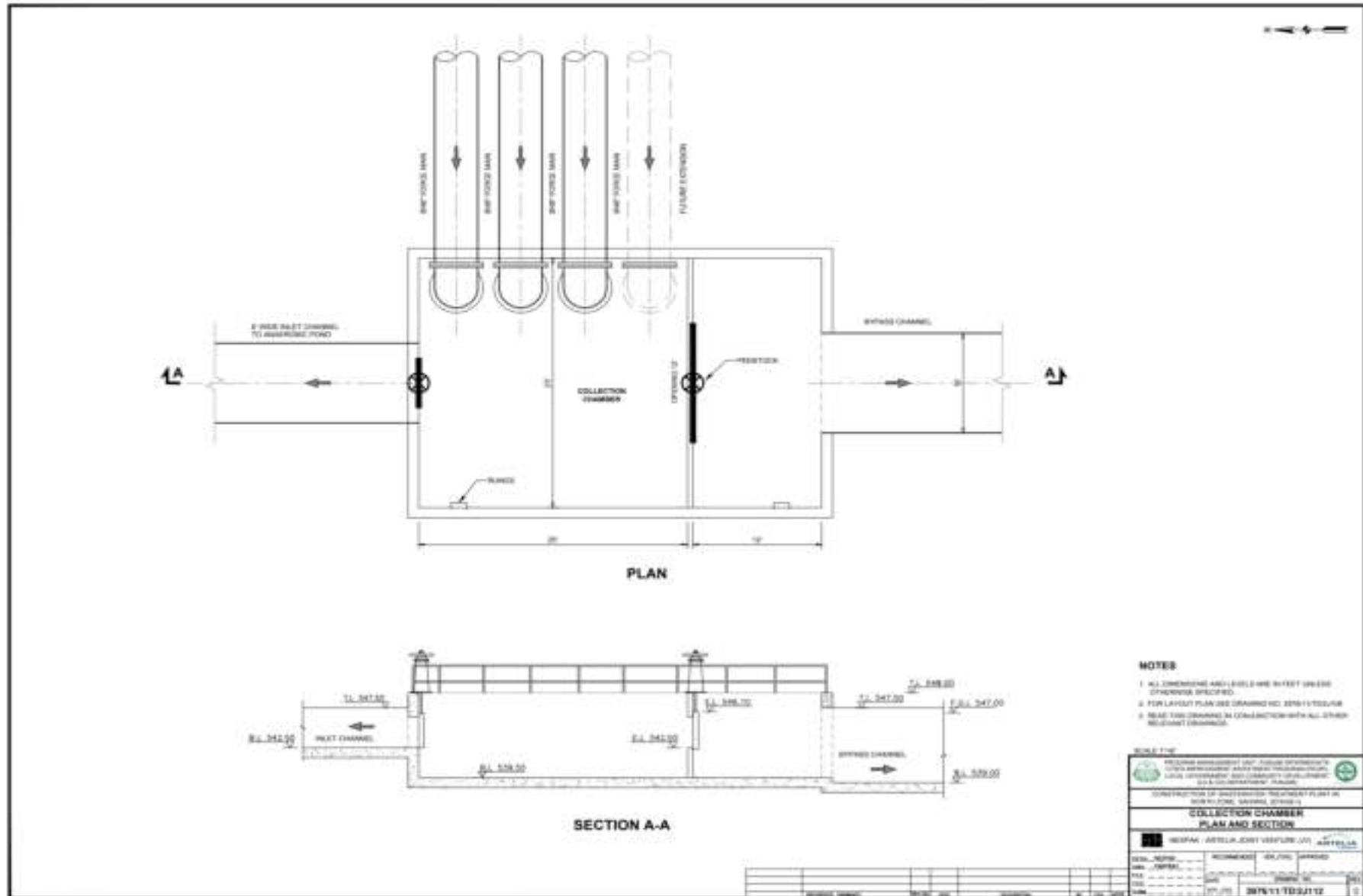


Figure 3.11: Inlet Channel and Outlet Channel - Section

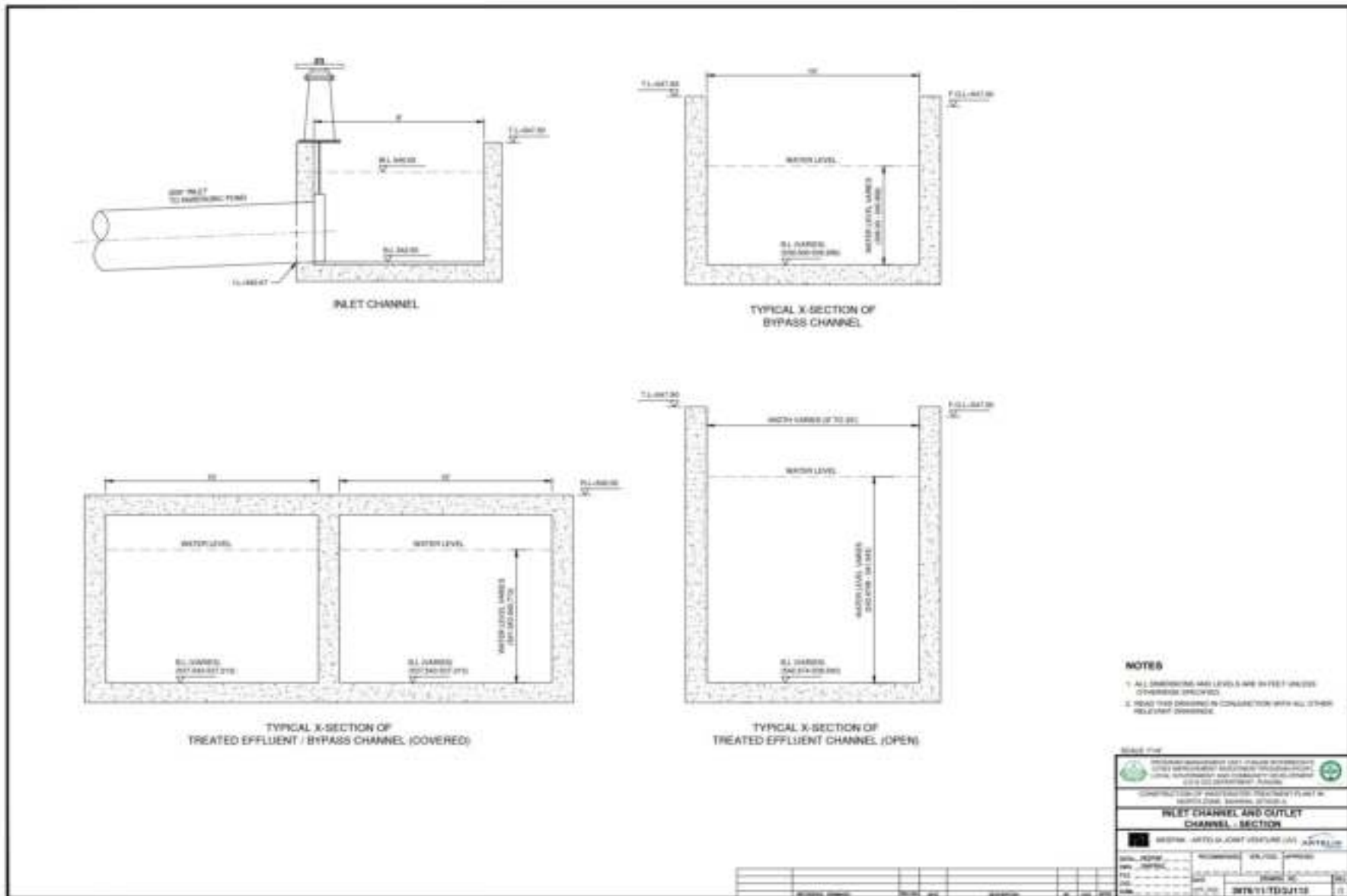


Figure 3.12: Interconnection detail between AP and FP

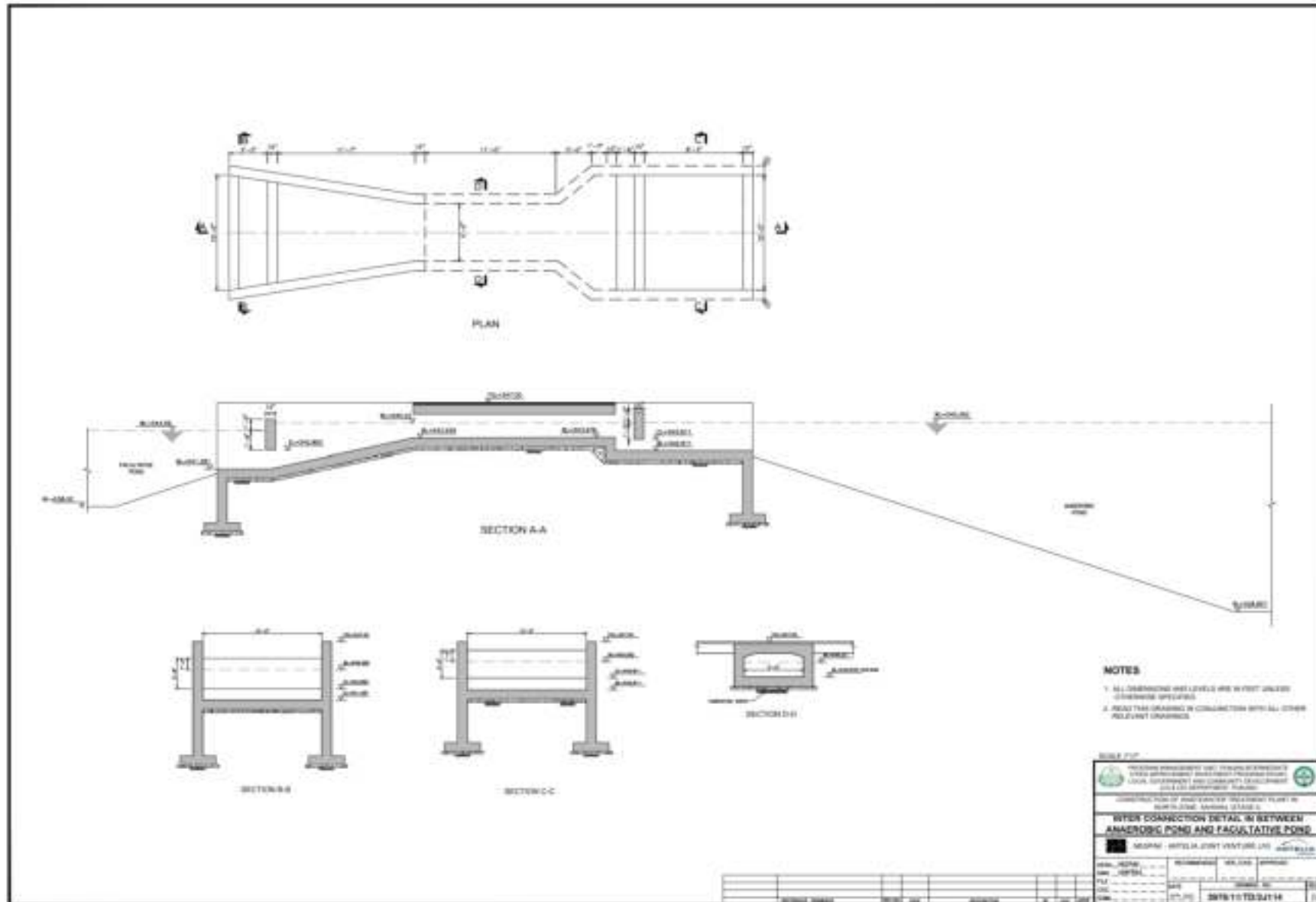
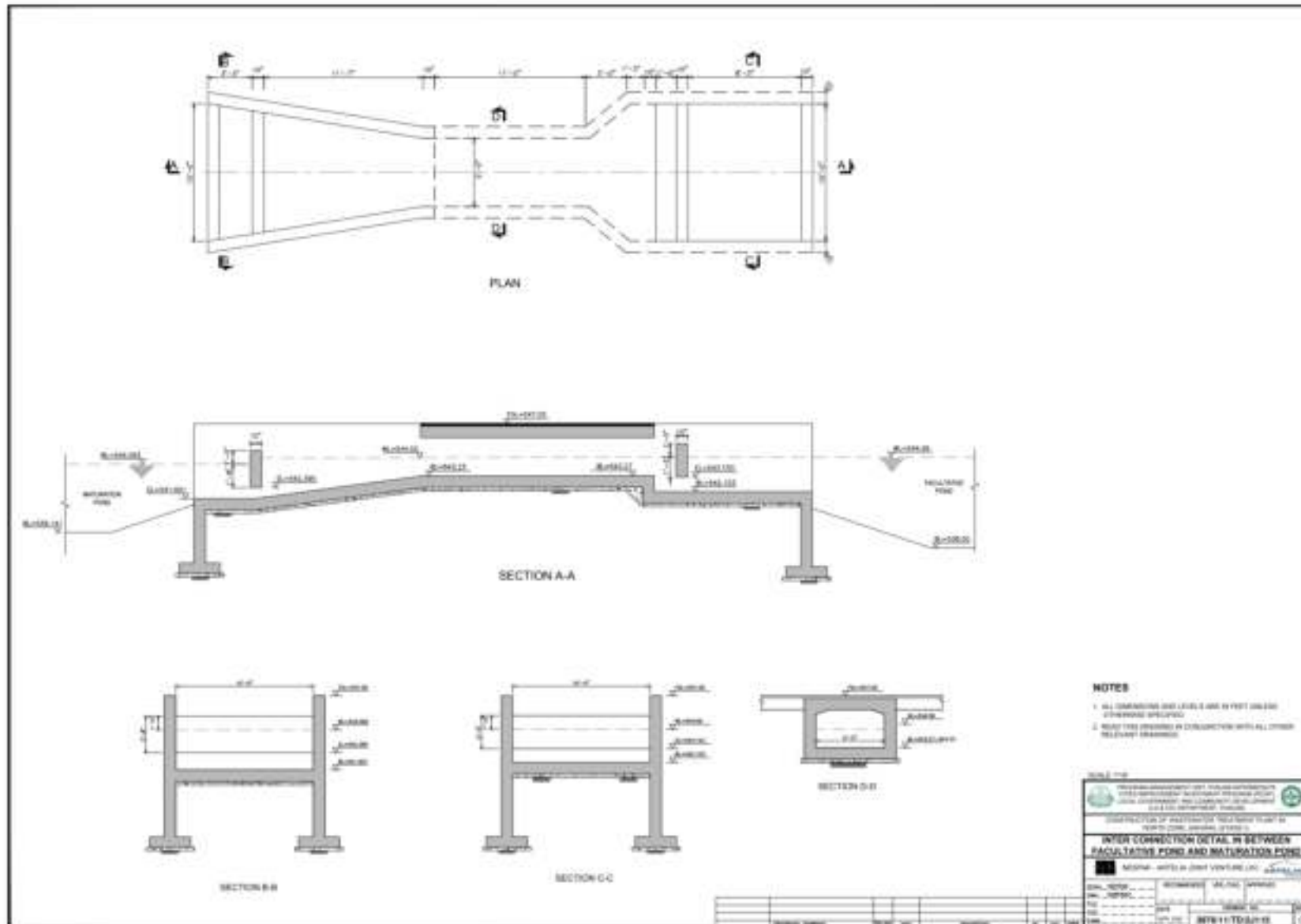


Figure 3.13: Interconnection detail between FP and MP



4 Description of Environment

120. This chapter describes the baseline environmental and social conditions of the project area for the proposed WWTP. The project area's environmental conditions will describe the various resources which could be affected by the economic development that takes place, i.e. physical resources (atmospheric conditions e.g. ambient air quality and climate, topography and soils, surface water and groundwater quality), ecological resources (fisheries, wildlife, forests, rare and endangered species, protected areas etc.) and social resources.
121. As mentioned in the previous Chapter of this report, the proposed WWTP site consists of agricultural fields spread over an area of 199 acres. The natural elevation of the WWTP site varies from 525 to 544 feet. Furthermore, generally, cohesionless soils are present below the pond base level with GWT depth at around 12 meters (39 feet) below NSL.
122. The hydraulic profile of the proposed WWTP site is also proposed as **Figure 3.5** which clearly shows the gradient/slope across the proposed site.

4.1 Physical Resources

4.1.1 Sahiwal City Geography

123. In 2014, the estimated population in Sahiwal district was 2.37 million. Of this 2.37 million, an estimated 1 million (42 percent) was urban while at an average provincial fertility rate of 1.93 percent, the district's projected population till 2035 is 3.5 million.
124. Sahiwal town is situated about 29 km from the left bank of the river Ravi, 187 km west of Lahore and 200 km east of Multan. The Grand Trunk Road and the main railway line pass through the town; they also connect Peshawar and Lahore with Karachi. The Lower Bari Doab Canal separates the town into two parts. Its approximate height is 152 m above sea level. Sahiwal lies at 30°39'52.16" N latitude and 73°6'30.54" E longitude.
125. Geologically, the area does not have any outstanding features. Saltpeter, which is made from saline earth called kallar, is found when the water table is high. In the east of the town, there can be found common salt mixed with a lesser quantity of sulfate of soda and a very small quantity of lime and magnesium salt.

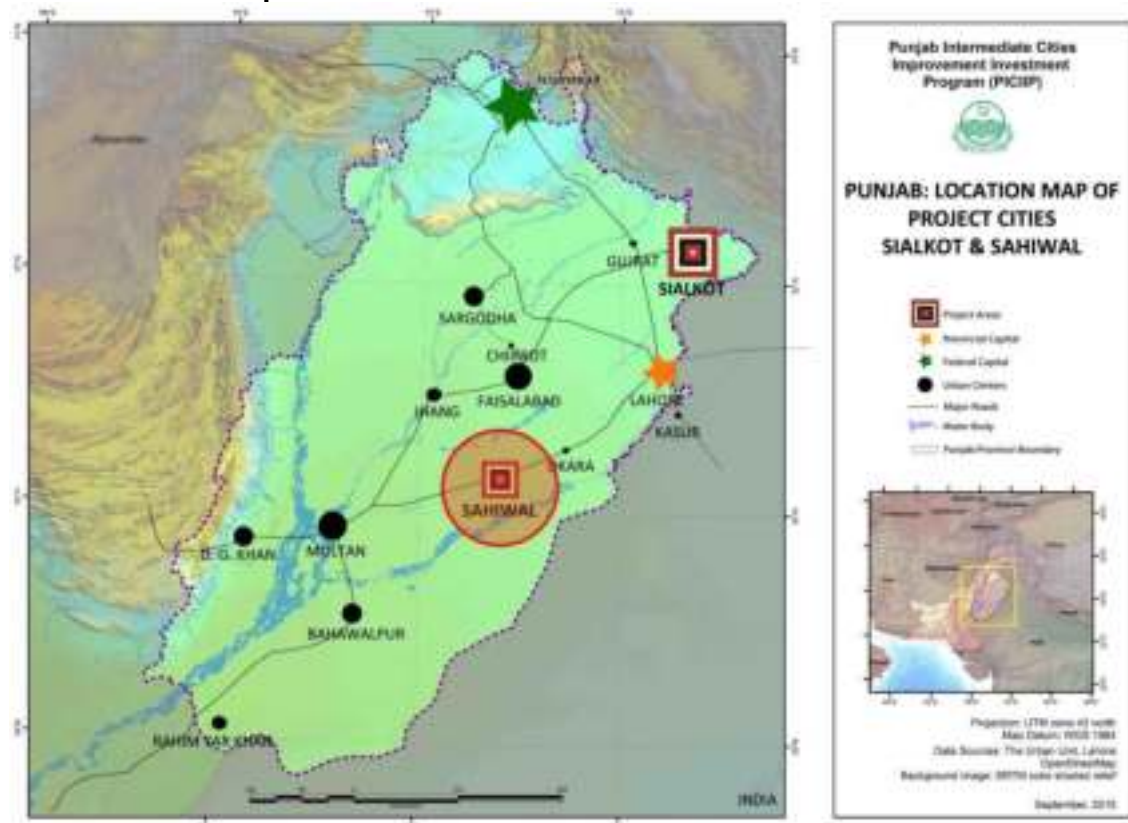
126. The topography of Sahiwal consists of a flat semi-arid plain that is fertilized using its extensive irrigation canal. The Lower Bari Doab is the main source of irrigation in the area and it is fed by a link from the Chenab river. From a topographical point of view, the semi-arid plain is remarkably homogeneous. The only noticeable relief is that of the flood plain bluffs and the belts of ravines and land that were formed by gully erosion along the Lower Bari Doab and its distributaries. Generally, the natural slope runs northeast to southwest. On the whole, the area is flat.

4.1.2 Natural and Climate Conditions of Sahiwal

127. In general, Sahiwal has the same basic natural and climatic conditions that prevail in Punjab. The climate in most of the area is arid to semi-arid, characterized by four distinct seasons in a year: winter from mid-November to February; spring from mid-March and April; summer from May to mid-September; and autumn from mid-September to mid-November.

128. Punjab's terrain is one of relatively low-lying plains, with several rivers that traverse the area from the northeast to the southwest and feed into the Indus river. The Ravi river is closest to Sahiwal, but it is still a distance of nearly 20 km. There is no history of the city being threatened by floods. The most challenging weather phenomenon in Sahiwal is the winds called 'Loo', which blow during the day in the predominately hot and dry summer.

Figure 4.1: Location Map of Sahiwal



129. The dust from the dry parched earth rises, the air becomes laden with it, and out-door work is difficult. Trees shed their leaves to avoid the loss of moisture and where there is no canal or well, the countryside presents a very dreary aspect. Occasionally, the hot weather is broken by thunderstorms and dust storms. The heavy rainfall, which the thunderstorms bring, and light rain, which follows the dust storm, produces a slight decrease in temperature. This temporary relief from the excessive heat is welcomed.

130. June is the hottest month with a mean daily maximum temperature of 42.4°C. January is the coldest month with the mean daily minimum temperature of 4.4°C. The **Table 4.1** shows the mean daily maximum and minimum temperatures of Sahiwal district.

Rainfall

131. Average annual rainfall ranges between 97 mm and 261 mm. The maximum rainfall (about 60 percent of the total annual rainfall) occurs during the monsoon season (July, August and September), while the period of minimum rainfall or drier period is October and November. The **Table 4.2** shows the mean monthly rainfall data for Sahiwal district.

Humidity

132. July, August and September are the most humid months in the area. May and June are the least humid. The **Table 4.1** shows the average monthly relative humidity in Sahiwal district.

Table 4.1: Mean Monthly Maximum and Minimum Temperature of Sahiwal district

Month	Mean Monthly Maximum (°C)	Mean Monthly Minimum Temperature (°C)
January	19.7	5.4
February	22.8	8.4
March	28.3	13.5
April	35.2	19.2
May	40.4	24.4
June	41.4	27.7
July	38.4	28.1

August	37.8	27.2
September	36.2	24.4
October	34.6	18.1
November	28.6	10.8
December	22.4	6.4
Annual	32.2	17.8

Table 4.2: Meteorological Data, Mean Monthly Precipitation of Sahiwal district

Month	Mean Monthly Precipitation (mm)
January	12.0
February	12.0
March	17.0
April	6.0
May	7.0
June	23.0
July	74.0
August	75.0
September	25.0
October	1.0
November	2.0
December	7.0
Annual	261.0

Wind Direction

133. Sahiwal is situated in southwest Punjab and is influenced by monsoon winds throughout the year. In winter, the wind blows from the north and heads east. In summer, the wind direction is southwest. However, these wind directions are usually disturbed by cyclones, which cause the temperature to drop and low-pressure systems to set in. This situation prevails in autumn. The Wind rose for Sahiwal is provided as **Figure 4.2** below.

4.1.3 Ambient Air Quality

134. Ambient air quality was continuously monitored for 24 hours at the Chak Muhammad Pur in Sahiwal. The pollutant concentration parameters being exceeded are SO₂, PM2.5 and PM10.

135. The ambient air quality in the project areas is presented as **Annexure H**. All the results are within the permissible levels.

4.1.4 Noise Levels

136. The ambient noise levels were also monitored at the same locations as ambient air quality i.e. Chak Muhammad Pur in Sahiwal. The results of the noise monitoring are provided in **Table 4.5** below. As can be observed, the averaged noise levels for the location resulted in daytime noise levels of 53.4 dB, which is within the permissible level of 65 dB. Also, the nighttime noise limit is not being exceeded with average nighttime noise levels monitored to be 41.3 dB. The detailed noise level results are provided as **Annexure H**.

Figure 4.2: Wind Rose for Sahiwal¹⁹

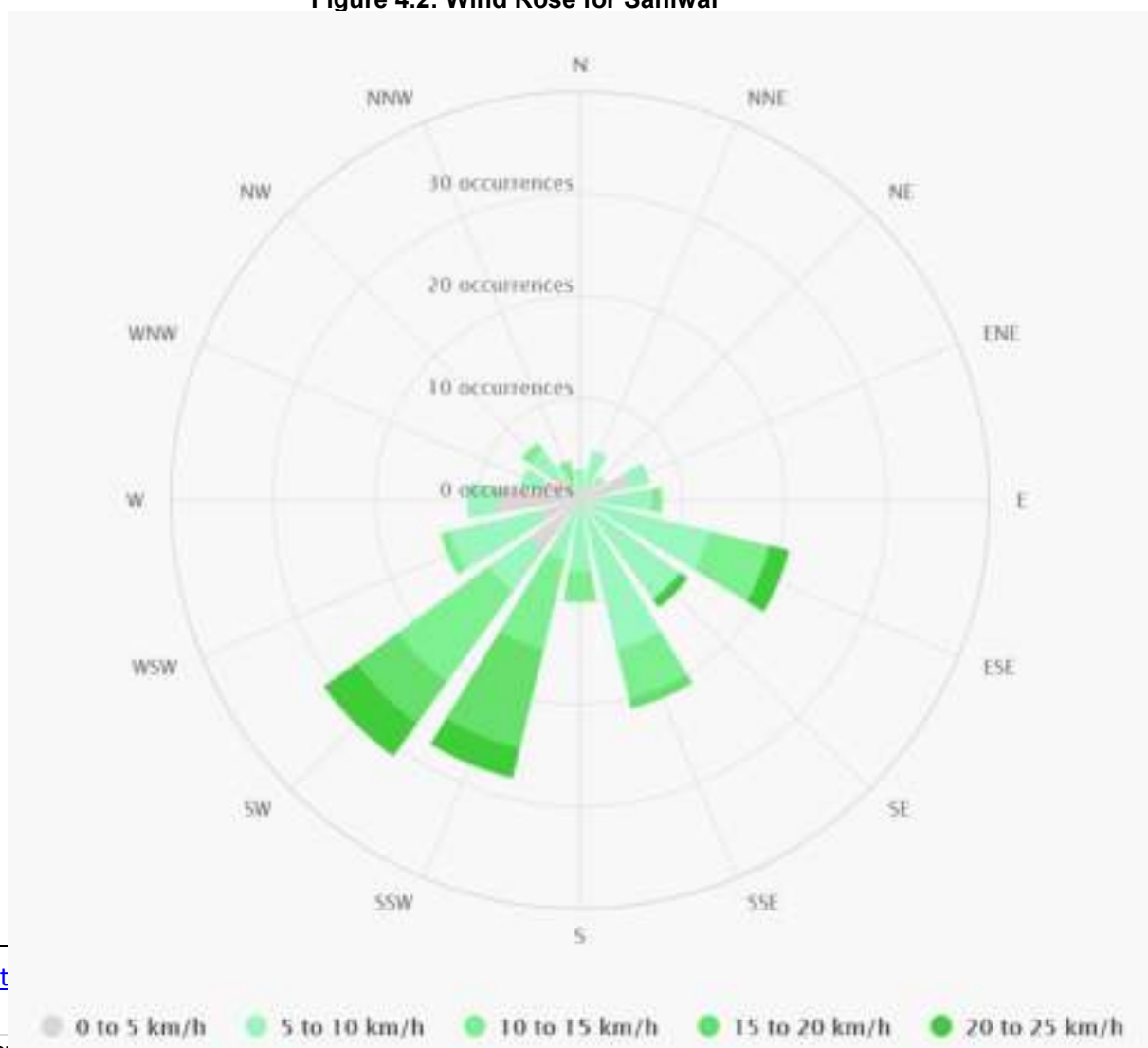


Figure 4.3: Map of Monitoring Location

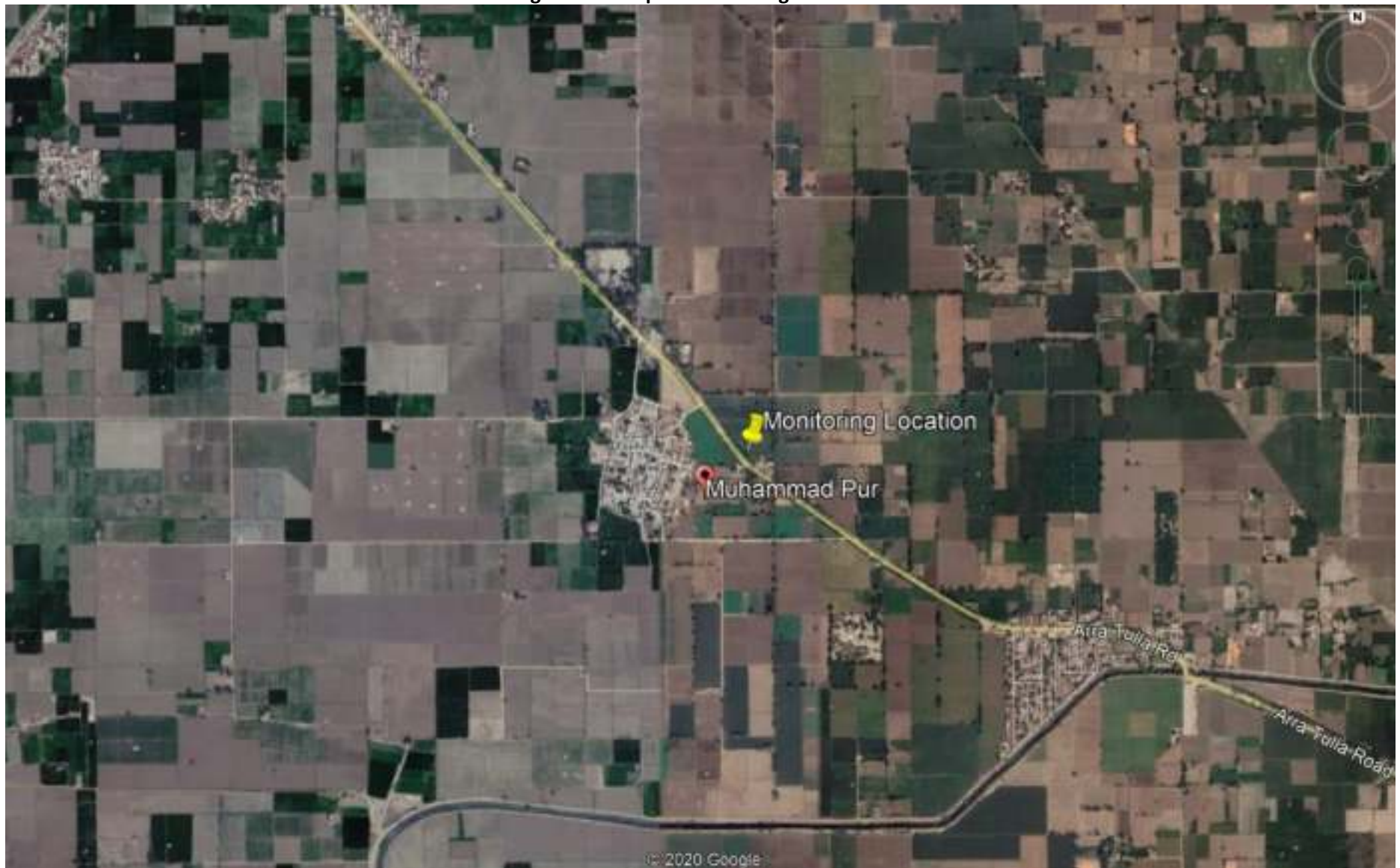


Table 4.3: Comparison of ambient air quality results versus applicable Air Quality standards

Monitoring Location	Parameter	NO (ug/m ³)	NO ₂ (ug/m ³)	CO (ug/m ³)	SO ₂ (ug/m ³)	NOx (ug/m ³)	PM _{2.5} (ug/m ³)	PM ₁₀ (ug/m ³)	TSP (ug/m ³)
Applicable Guideline (ug/m ³) for 24 hrs		-	80	-	20	-	25	50	500
Average of Both Locations	Average	10.15	18.55	0.69	22.07	28.7	30.76	127.91	279.97

 'Exceeding' applicable guidelines for acceptable pollutant levels  'Within' applicable guidelines for acceptable pollutant levels

Table 4.4: Ambient Noise Monitoring Results (24 hrs) in Project Area

Monitoring Location	Parameter	Noise Reading Results	Noise Guideline (Commercial Area)	Compliance Status for Commercial Areas
Day Time Readings (0600 to 2200)			Day time	
Chak Muhammad Pur	dB(A) Leq	53.4	65	
Night Time Readings (2200 to 0600)			Night time	
Chak Muhammad Pur	dB(A) Leq	41.3	55	
Average Noise Levels (24 hour average)	dB(A) Leq	47.3		

- Exceedance from applicable guidelines
- 'Within' applicable guidelines

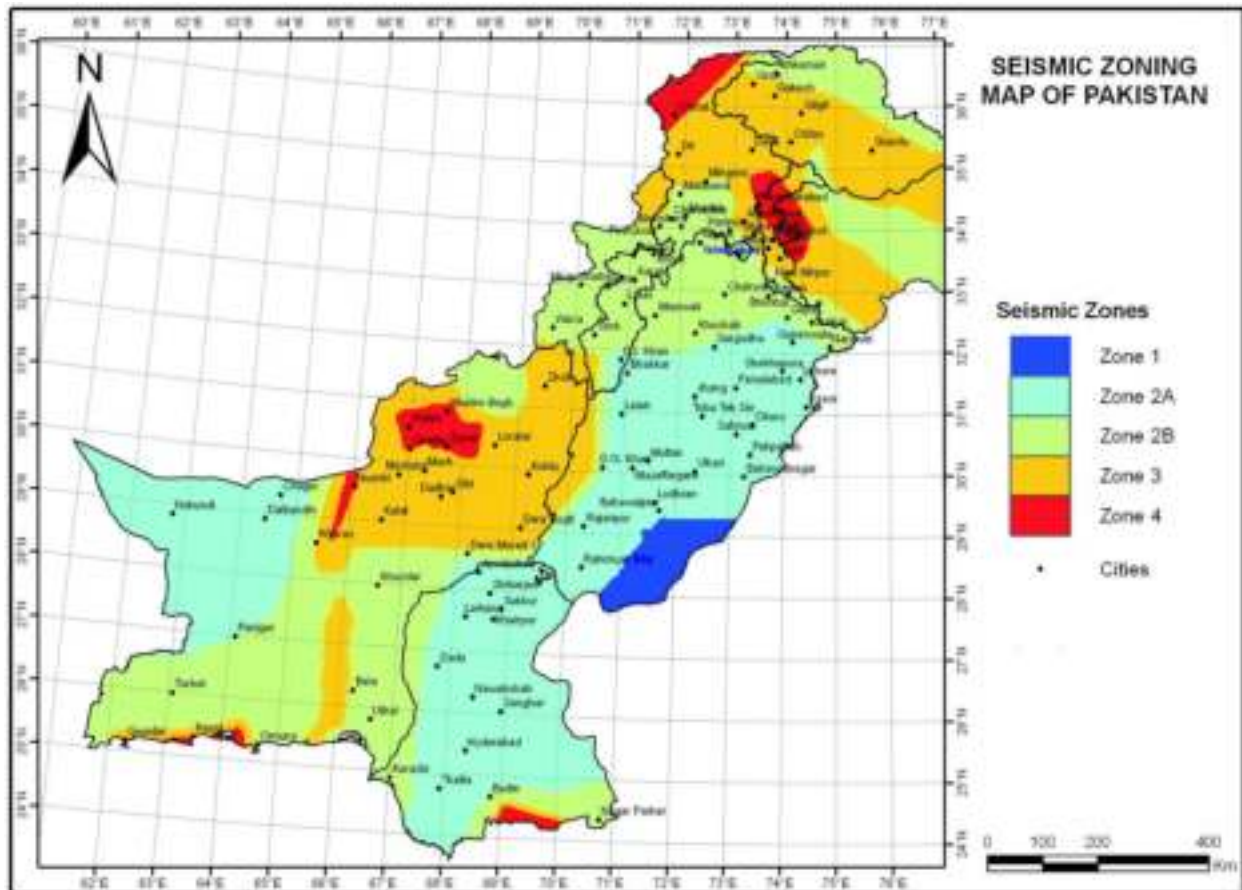
Table 4.5: Meteorological Data, Mean Monthly Relative Humidity

Month	Mean Monthly Relative Humidity (%)
January	62.3
February	56.3
March	51.6
April	40.0
May	33.2
June	39.9
July	56.0
August	59.7
September	56.3
October	51.6
November	61.4
December	66.6
Annual	52.9

4.1.5 Seismicity

137. Pakistan lies in a seismically active zone. Seismic observations indicate that hundreds of shocks occur in the region every year. According to the seismic zoning map of Pakistan, included in Pakistan Building Code Seismic Provisions (2007), the project area falls under seismic zone 2A, with a peak horizontal ground acceleration of from 0.08 to 0.16. The seismic zoning map of Pakistan is given as **Figure-4.3** below.

Figure 4.4: Seismic Zoning Map of Pakistan



4.1.6 Surface Water

138. The secondary data from water quality testing of the River Ravi is provided in the **Table 4.6** below. Since the treated wastewater from the WWTP will ultimately be discharged into the River Ravi, thus it is necessary that water quality testing of the water body of the River Ravi at the point of discharge of the treated effluent must be conducted prior to commencement of the WWTP operation, which will form the baseline as the pre-project scenario. Once the WWTP commences operation, monitoring of the effluent at the point of discharge into the River Ravi must be conducted on a quarterly basis to ensure that the PEQS standards for 'inland water' discharge are being met.

Table 4.6: Water Quality of River Ravi (Secondary Data)²⁰

S/No.	Parameters	Units	Test Results	PEQS Standards for Drinking Water	WHO Standards
1	Color	pH	Muddy brown	≤15 TCU	≤15 TCU
2	Odor	-	Odorless	Non-objectionable/ Acceptable	Non-objectionable/ Acceptable
3	pH at 25°C	pH unit	7.51	6.5-8.5	6.5-8.5
4	Turbidity	NTU	2.32	<5	<5
5	TDS	mg/L	91.0	<1000	<1000
6	TSS	mg/L	1.07	-	-
7	Conductivity at 25°C	uS/cm	241.0	-	-
8	Volume Settleable Solids	ml/L/Hr	0.1	-	-
9	Organic Carbon, Total (TOC)	ppm	2.7	-	-
10	Hardness, Total as CaCO ₃	mg/L	78.0	<500	-
11	Calcium Hardness as CaCO ₃	mg/L	50.0	-	-
12	Magnesium Hardness	mg/L	28.0	-	-
13	Carbonates	mg/L	65.0	-	-
14	Bicarbonates	mg/L	79.3	-	-
15	Calcium	mg/L	20.0	-	-
16	Magnesium	mg/L	6.72	-	-
17	Potassium	mg/L	4.0	-	-

²⁰ ESIA of Ravi Syphon, 2020

18	Sodium	mg/L	10.0	-	-
19	Alkalinity, Total as CaCO ₃	mg/L	1.3	-	-
20	Nitrate, NO ₃	mg/L	0.72	≤50	50
21	Nitrite, NO ₂	mg/L	ND	≤3	3
22	Chloride	mg/L	15.38	<250	250
23	Sulphate	mg/L	20.56	-	-
24	Fluoride	mg/L	0.29	≤1.5	1.5
25	Dissolved Oxygen (DO)	mg/L	8.43	-	-
26	Arsenic	mg/L	ND	≤0.05	0.01
27	Iron	mg/L	ND	-	-
28	Aluminium	mg/L	ND	≤0.2	0.2
29	Nickel	mg/L	ND	≤0.02	0.02
30	Copper	mg/L	ND	2	2
31	Cadmium	mg/L	ND	0.01	0.003
32	Chromium	mg/L	ND	≤0.05	0.05
33	Total plate count	cfu/ml	3.8 x 10 ³	-	-
34	Pseudomonas spp.	MPN/100ml	ND	-	-

ND: Not Detected

4.1.7 Groundwater

139. Groundwater is the sole source of potable water exploited in Sahiwal. The water table averages about 12 to 15 m below ground level and the upper levels produce limited quantities of mineralized water. At a depth of between 137 and 152 meters, greater quantities of good quality groundwater are available and this is where the city's supplies are abstracted from. In recent years, the water table has been dropping at a rate of 0.30 meter per year. This is because of pumping, and decreased rainfall and recharge. It is not clear whether the aquifer is being

overexploited but, in view of the wide dispersal of the tube wells, this is unlikely at the present level of abstraction.

140. The ground water was extracted and analysed to assess its suitability for drinking purposes. The detailed results of this monitoring are provided in **Annexure M**.

141. Samples of ground water were extracted from the following locations:

- **Peer Bukhari**
- **Grain Market**
- **Fareed town**
- **Shuhda Mosque**

142. Based on analysis of these water samples and their comparison with the applicable drinking water quality standards, the following observations were made:

- Water quality at Shuhda mosque had high levels of Total Dissolved Solids (TDS) and Arsenic while Total Coliforms and Fecal Coliform were also high and exceeding the permissible limits. All other parameters were observed to be within permissible limits.
- At Fareed Town, all parameters for drinking water quality were within the permissible limits apart from Total Coliforms and Fecal Coliform.
- At Peer Bukhari, all parameters are within permissible limits, except for Arsenic, Total Coliforms and Fecal Coliform.
- At Grain Market, all parameters are within permissible limits, except for Arsenic.

4.2 Ecological Resources

4.2.1 Flora of the Area

143. In Sahiwal district, the most important species of trees are Kikar (*Acacia Arabica*); Shisham or Tahli (*Delbergia sissoo*); Beri (*Zizyphus jujube*); Toot (*Morus alba*); Sharin (*Albizzia lebbek*); Dherek (*Melia azedarach*); Phulai (*Acacia modesta*); Pipal (*Ficus religiosa*); and Bohr (*Ficus bengalensis*), which are planted for shade. The trees in Rakhs mainly consist of three species: Jand (*Prosopis spicigera*); Karir (*Capparis aphylla*); and Wan (*Salvadora oleoides*). Occasionally, Rero (*Acacia ieucophloea*) and Farash (*Tamarix articulata*) are also found. The Pilchhi (*Tamarix dioica*) is found on moist sandy soils along riverbanks and is used for wicker work, and basket making, etc. Mesquite bushes and some Eucalyptus trees grow wild in

the areas along the canals, roads and barren land, but natural forest cover has been significantly reduced.

144. Sahiwal is a green and fertile town with 11,522 forested acres. The area's main crops are wheat, cotton, sugarcane, maize, sorghum forage and rice. Main fruits grown are citrus, mangoes and guava.

145. Sahiwal district of Indus basin plain, falls under Tropical Thorn forest type and has a hot semi-arid climate intermediating between Desert climate and Humid climate in ecological characteristics with agricultural potential. The climate tends to have hot, sometimes extremely hot, summers and mild warm winters. The soil and climatic characteristics support short or scrubby vegetation which can be termed as open and pronouncedly of xerophytic nature in which thorny leguminous species predominate. However, commonly found vegetation (Trees, Shrubs, Grasses) of project as well as study area include species given in the **Tables 4.6 to 4.8** below.

Table 4.7: Name of Trees

S. No.	Common Name	Scientific Name	IUCN Status
1	Kikar	<i>Acacia nilotica</i>	NA
2	Shisham	<i>Dalbergia sisso</i>	NA
3	Simal	<i>Bombax ceiba,</i>	NA
4	Sufeda	<i>Eucalyptus species</i>	NA
5	Frash	<i>Tamarix articulate</i>	NA
6	Neem	<i>Azedarachta indica</i>	NA
7	Jaman	<i>Syzygium cumini</i>	NA
8	Bakain	<i>Melia azedarach</i>	NA
9	Ber	<i>Zyziphus mauritiana</i>	NA
10	Toot	<i>Morus alba</i>	NA
11	Lasura	<i>Cordia myxa</i>	NA
12.	Sukh Chaen	<i>Pongamia glabra</i>	LC
13.	Mesquite	<i>Prosopis juliflora</i>	NA
14.	Date Palm	<i>Phoenix dactylifera</i>	NA

NA= Not Assessed LC= Least Concern

Table 4.8: Name of Shrubs and Herbs

S. No.	Common Name	Scientific Name	IUCN Status
1	Akk	<i>Calotropis procera</i>	NA
2.	Phog	<i>Calligonum polygonoides</i>	NA
3	Jantar	<i>Sesbania aculeate</i>	NA
4	Bathu	<i>Chenopodium botrys</i>	NA
5	Lana	<i>Suaeda fruticosa</i>	NA
6	Arind	<i>Ricinus communis</i>	NA
7	Piazi	<i>Asphodelus tenuifolius</i>	NA

NA= Not Assessed

Table 4.9: Name of Grasses

S. No.	Common Name	Scientific Name	IUCN Status
1	Khabbal	<i>Cynodon dactylon</i>	NA
2	Dab	<i>Desmotachya bipinnata</i>	NA
3	Khawi	<i>Cymbopogan jwarancusa</i>	NA
4	Kana	<i>Saccharum munja</i>	NA
5	Gorkha	<i>Elionorus hirsutus</i>	NA
6	Kai	<i>Saccharum spontaneum</i>	LC

NA= Not Assessed, LC= Least Concern

146. **Existing Trees:** The project area is flat agricultural land which supports trees of various species on the boundary of agricultural fields as well as individually scattered growth. Trees (girth 61 cm and above) and pole crop (girth 20 to 58 cm) standing within the project area were enumerated along with their kind of species. The detail of trees present in the project area is given in **Table-4.9** below.

Table 4.10: Species Wise Tree Distribution

Sr. No.	Species	No. of Trees		
		Poles (girth 20 to 58 cm)	Trees (girth 61 cm and above)	Total
1	Kikar	5	12	17
2	Shisham	8	10	18
3	Toot	7	13	20
4	Miscellaneous	5	7	12
	Total	25	42	67

Miscellaneous includes Sukh Chaen, Lasura, Jaman, Neem, Date Palm

4.2.2 Fauna of the Area

147. Most of the Punjab is under intensive irrigated cultivation. Livestock rearing is also extensively practiced, and milk animals are common. The use of chemical fertilizers and pesticides is also very common. Several species of wildlife have adapted to the changed habitat. These include, the jackal; jungle cat; Bengal fox; small Indian mongoose; shrew; hog deer; ravine deer; black buck; blue bull; wild hare; and rodent pests, including porcupine; fruit bats; and wild boar. The avifauna that has survived the modified habitat include doves; black partridge; cuckoos; koel; woodpeckers; parakeets; bulbuls; babblers; black drongo; bee eaters; finches; owls; hawks; and house sparrow. The reptilian species of this modified habitat include krait; cobra; saw scaled viper; rat snake; and monitor lizard.

148. In these modified habitats, due to the extensive use of pesticides in these areas, the winter bird species from the Himalayas have been reduced, since these species feed on the insects. These birds play an important role in controlling insects, particularly in the forests.
149. Scavengers, such as, jackals are attracted to garbage dumps and human faeces for food. House sparrows breed in houses. Bank mynas and cattle egrets feed on grasshoppers that are present in the rangelands that also support cattle and buffalos. Banyan and peepal trees still grow in the villages. Green pigeons and barbets feed in these trees.
150. Some of the oldest trees still stand in the old British-era colonies. Some rare species of birds, such as hornbills, green pigeons, and barbets still live on these trees. Large populations of pigeons breed in urban houses. Kites, crows, mynas, house sparrows and alexandrine parakeets breed in urban areas. Shisham and acacia trees are usually planted along the roads and canals. Doves mainly breed on these types of trees.
151. The extent of fauna presence is related to the availability of vegetative cover in an area. Since the project area is basically agricultural supporting chunk of land without any dense forested area nearby, it lacks richness in natural fauna. No conspicuous wildlife was observed in the area during field visit However, mammals and birds reported in the project area, are given in **Tables 4.10 to 4.12** below.

Table 4.11: Names of Mammals

S. No.	Common Name	Scientific Name	IUCN Status
1	Jackal	<i>Canis aureus</i>	LC
2	Fox	<i>Vulpus bengalensis</i>	NA
3	Porcupine	<i>Hystrix indica</i>	LC
4	Squirrel with strips	<i>Funambulus pennanti</i>	NA
5	Mouse	<i>Mus musculus</i>	LC
6	Mongoose	<i>Herpestes auropunctatus</i>	NA
7	Indian Hare	<i>Lepus nigricollis</i>	LC

NA= Not Assessed, LC= Least Concern

Table 4.12: Names of Reptiles

S. No.	Common Name	Scientific Name	IUCN Status
1	Cobra	<i>Naja naja</i>	NA
2	Spiny tailed Lizard	<i>Uromastyx hardwickii</i>	NA

3	Fringed Toed Lizard	<i>Acanthodactylus cantoris</i>	LC
4	Indian Krait	<i>Bungarus caeruleus</i>	NA

Table 4.13: Names of Amphibians

S. No.	Common Name	Scientific Name	IUCN Status
1	Common Frog	<i>Rana tigrina</i>	LC
2	Common Toad	<i>Bufo bufo</i>	LC

152. The area is comparatively dry and does not support wide variety of birds. The common species found in the project area are enlisted in **Table-4.13**.

Table 4.14: Names of Birds

S. No.	Common Name	Scientific Name	IUCN Status
1	House Sparrow	<i>Passer domesticus</i>	LC
2	Mynah	<i>Acridotheres tristis</i>	LC
3	House Crow	<i>Corvus splendens</i>	LC
4	Pigeon	<i>Columba livia</i>	LC
5	Koel	<i>Eudynamys scolopacea</i>	LC
6	Red-Wattled Lapwing	<i>Vanellus indicus</i>	LC
7	Gray Partridge	<i>Francolinus Pondicerianus</i>	LC
8	Quail	<i>Coturnix coturnix</i>	LC
9	Red Vented Bulbul	<i>Pycnonotus cafer humayuni</i>	NA
10	Little Bittern	<i>Ixobrychus minutus</i>	LC
11	Hoopoe	<i>Upupa epops</i>	LC
12	Ring Necked Dove	<i>Streptopelia decaocto</i>	LC
13	Little Egret	<i>Egretta garzetta</i>	LC

153. On account of anthropogenic interventions mainly agriculture, no habitat is left to support much of wildlife in the project area. None of the existing species of plants or animals, therefore, are of endangered category.

4.2.3 Protected areas / National Sanctuaries

154. In Pakistan, there are several areas where land is devoted to the preservation of biodiversity, through the dedication of national parks and wildlife sanctuaries. There is no

protected area or national sanctuary near the area of where work will take place on the sub-project.

4.3 Socio-Economic Development

155. Before the introduction of the canal system, Sahiwal was an area of barren land. However, owing to irrigation, it has become very fertile. The real achievement occurred when the Lower Bari Doab canal was constructed in 1913. Later, the Deepalpur and Pakpattan canals brought almost the entire district under irrigation. Now, the district is one of the most fertile areas of the province and a leading grower of cotton.
156. In the early days, the town had been declared a congested area. Due to an influx of refugees from India and also to recent industrialization, it has attracted a considerable number of people. Consequently, two new sub-towns have cropped up beside the old part of the town.
157. There is a new Abadi on the eastern side of the old town and a modern satellite town, known as Farid Town, on the northwestern corner. At the time of its establishment, the area of the original town of Sahiwal was small. However, it grew with the passage of the time, and is now its total area is about 19 square kilometers. The city's major growth took place during the post-1947 period. However, the trend of this growth, even during this period, has largely been in a northerly direction. The city could not grow to the south, perhaps due to the obstruction of Railway line, and the Lower Bari Doab Canal and its distributaries. The city has also spread out toward the east in what appears to have been the result of forced development.
158. Due to this industrial development and the land's fertility, the city began to flourish and emerged as a place that attracted in-migration. In short, Sahiwal became a place where people wanted to reside. During the decades of 1911-1921, and 1921-1931, the city attracted the highest ever percentage of people. During these decades, the population growth rate was 79.7 percent and 79.3 percent, respectively.
159. The city also became important from a business point of view. It is situated at the point from where all types of communication are available to connect it and its people with the rest of the province and with the larger country as well. A great change has occurred in its economic structure, as it transitioned from an agricultural to an industrial economy. The town is now a commercial one, with a shopping center that caters to both the town people and also to those living in nearby localities.

4.3.1 Land Use and Settlements Pattern

160. Land use includes residential, commercial, industrial, recreational, and institutional activities, among others. A suitable arrangement of the physical elements of land use ensures that a town offers convenience, health and a better quality of life. The city comprises buildings, transportation channels, utilities, social services, and also vacant land, which may be used for agricultural purposes.
161. In August, 1972, the Punjab's Housing and Physical Planning Department began a land-use study of Sahiwal city, which it completed in September the same year. Out of the total area surveyed, the largest portion of the city consisted of undeveloped area that accounted for 41.70 percent of the total area surveyed. The scattered pockets of development exist within the built up areas and also in open strips of land that were situated between various built-up belts of development that ultimately abutted the agricultural land around the city. Since the undeveloped area made up a substantial percentage of the city's surveyed area, it was considered desirable to not take this percentage into account when calculating the percentage of area given to various land uses in the city. Consequently, the survey only included the built up area, revealing that 31.31 percent was for residential use. The transportation system was second largest user of land, occupying 18.58 percent of the total built up area. Other uses include, industry (occupying 3.85 percent); open spaces (8.54 percent); commerce (1.76 percent), and health (0.74 percent). Other important users of land are canals, distributaries, transport terminals, and Government buildings, which occupy 9.64%, 7.07% and 5.28% of the built-up area, respectively.
162. As for the land use pattern, originally the city was designed to be a planned colony town, covering an area of only about 307 acres (1,242,429 m²). The city was designed with the oval as the main focal point. The road network radiated from its center toward a city space that consisted of a mixture of residential and commercial uses. Major bazaars and residences were established in the small streets that ran off the major arteries. Functions, such as administration, education, and transportation, were situated around the commercial and residential parts of the old town. After independence, the city further developed and emerged into a major administrative industrial and commercial town. Since no comprehensive plan was devised, land in the town was given to various uses, irrespective of its suitability. These uses were mostly based on expediency rather than the principals of the land development. Consequently, the present-day city is a mixture of various and, quite often, incompatible uses. Except for the new planned colony, there has been an intensive mixing of land use, particularly among small-scale cotton factories, etc.

However, for an overall pattern of land use, the city can be divided into following major zones:

Zone of Central Commercial Activities

163. This is limited to the old city and is surrounded by High Street, Railway Road, Hall Road, Masood Shaheed Road, the Deepalpur Bazar, and the few scattered roads that join this area. Development in this area is of a ribbon type, along with its major bazaars, i.e., Pakpattan, Sadder, Deepalpur Sori Galli, and Sua Bazars, and is further extended up to Jinnah Chowk. The development of the commercial activities within this area is mainly due to historical reasons rather than to any planned effort.
164. A variety of commercial activities take place here, namely wholesale, and large specialized retail, etc., which cater to the needs of the entire city and the surrounding rural and urban areas that are concentrated in this zone. The shops usually have residential quarters, either attached to or above them, where the owner might be living. There is hardly any exception to this practice. The areas between the main streets form pockets that are filled with residential uses but, even here, it is common to see small shopping facilities scattered here and there. These bazaars have developed, over the years, into their present form and will also retain this form in the future.

Zone of Mixed Land

165. The vegetable and fruit markets are also located in this area. They cause the usual nuisance to the residents and make it unattractive for living. The other uses are for restaurants, hotels, bus stands, and commercial offices. Among these, the bus stands, which cater to the needs of the city and the adjoining chaks (villages), create hindrances and chaos in the area.

Zone of Industrial Complexes

166. This zone is unlike those in the other cities of the Punjab, and is located on and across the Lahore Multan Quetta (LMQ) road. The majority of the large industrial units are found in this zone, however, a few small units are also scattered throughout the city. The reasons for setting up large-scale industry here, between the railway line and the LMQ road and across the LMQ Road, are neither deliberate nor due to any planning criteria. It is the result of the cheap rates for the land and the cheap communications that serve it. However, this development is also ribbon-like, similar to the development along the LMQ road, starting from chowk Pakpattan up to the Arifwala Chowk, and further up to new powerhouse and the grid station. The presence of a 9L water distributary has further helped this area develop for industrial purposes.

Zone of Administrative and Educational Buildings

167. This zone comprises the civil lines areas, the canal colony, the Government Boys College complex and the hospital. It further extends up to the Batala School and the Government Girls College. From its beginning, the civil-lines area is at the center of the administrative functions of the city, the district and the region. It extends up to the Boy's Degree College, and the canal colony, and covers a substantial part of the built up area of the entire city. In addition to being the center of administrative functions (almost all of the government offices are situated in this area), the city's main open spaces are situated in this zone, i.e., the stadium and the race course.

Zone of Planned Colonies

168. The zone of the planned colonies comprises the area of the satellite town known as "Farid Town." Its land-use character is very distinct and different from the old city. Comparatively, its residential density is very low. Both the planned colony and the canal colony were situated in their present locations due to the availability of government land.

169. To sum up, the land use of the city, as a whole, can be described as having developed out of sprawl and without any preconceived plan that could have coordinated the land of one area with that of another or with the transportation system. The result is the prevalence of chaos and unpleasant living conditions. The **Table 4.16** presents the areas and proportions of various land uses in Sahiwal:

Table 4.15: Land Use Distribution in Sahiwal

#	Land Use	Area		% of Total Area
		Acre	Sq. Km.	
1	Residential	1,143.14	4.63	36.1
2	Commercial	139.97	0.57	4.4
3	Agricultural	520.35	2.11	16.4
4	Public Buildings	357.86	1.45	11.3
5	Religious	23.32	0.09	0.7
6	Education	416.14	1.68	13.1
7	Health	18.72	0.08	0.6
8	Industry	55.97	0.23	1.8
9	Graveyard	53.34	0.22	1.7
10	Parks/Open Spaces	160.46	0.65	5.1
11	Vacant Area	175.70	0.71	5.6
12	Mixed Land use	99.97	0.40	3.2
Total Area		3,164.94	12.81	100

Source: Urban Unit data

4.3.2 Agriculture and Livestock

170. Agriculture is by far the main economic activity in the project area. The main crops, during Rabi, are wheat, gram, rapeseed, mustard, barley and oil seeds. During Kharif, crops include cotton, jawar, sugarcane, bajra, maize, and rice. In addition, there are subsidiary crops known as Zaid Rabi, such as Kharbooza, tobacco and potatoes, and also Zaid Kharif crops, such as potatoes and chilies. The main fruits grown are oranges, watermelon, muskmelon, guava, citrus, falsa, jaman, and pomegranate. When cultivation began, the inhabitants ate pilu and bair, the only wild fruits that grows, intermittently, in the region. With the introduction of canal irrigation, other fruits are now being grown on a commercial basis. However, wheat, cotton, sugarcane and rice remain the major crops.

171. Main Crops: Sugarcane, wheat, rice, maize and cotton are the main crops grown in the area. Besides guar seed, bajra, moong, mash, masoor, jawar, oil seeds are also grown in minor quantities in Sahiwal area. Average yield of important crops in the area of study is given below in **Table 4.15**.

Table 4.16: Average Yield of Agricultural Crops

Sr. No.	Crop Name	Average Yield/Acre (kg)
1	Cotton	1,000
2	Sugarcane	20,600
3	Maize (Spring)	3,400
4	Maize (Autumn)	2,800
5	Rice	800
6	Wheat	1,400
7	Potato	9,600

172. The vegetables are grown in abundance, as the water and soil are suitable for cultivation. Crops include potatoes, carrots, ladyfingers, chilies, onions and cauliflower. Bitter gourd, turmeric and garlic are also grown to meet public demand. Other vegetables include radish, tinda (apple gourd), and bringal.

173. Fruits: Citrus, guavas and mangoes are the main fruits grown in the district. Besides, pomegranate, litchi, falsa and banana are also raised on minor scale.

174. Livestock breeding is one of the main pursuits and means of livelihood among the rural and urban population in the project site. Common livestock are sheep, goats and cows, which serve as an important source of income.

175. Fisheries: Fishery sector is not rich in district Sahiwal on account of precious fertile land for agriculture production. Not much variety of fish is found in the LBDC and other

nearby water bodies, except Gulfam fish (*Cyprinus carpio*), which is basically cold-water species, but has adapted to harsh conditions. However, dependency of local people on fish as economic activity is very limited, because of the non-existence of large fish farms in the area.

4.3.3 Power

176. As with the rest of the country, Sahiwal does not have an adequate, reliable and uninterrupted 24/7 power supply. Interruptions are frequent, forcing industries, other businesses, and many of the residents who can afford it to rely on back-up diesel generators and uninterrupted power supply systems. These are costly, environmentally degrading and generally a poor second option. Power generation and primary distribution are generally beyond a single urban center's capacity, so it is necessary to rely on provincial and national government support. Any city with reliable power enjoys an immediate competitive advantage. Solar options for institutional and residential use are increasing in popularity, but the technology has not reached the stage where it can provide the major energy source for heavier industry.

4.3.4 Industrial Activity

177. There are three industrial sites in Sahiwal district, and more than 200 industries. There is also a small industrial estate, developed by the Punjab Small Industrial Corporation. It consists of 188 plots situated on about 52 acres land. Sahiwal is famous for its cotton ginning and pressing, its tannery, textiles, leather products, garments, pharmaceuticals, flourmills, and food industry. Sahiwal is also one of Pakistan's major multi-crop areas, and many pesticide companies do business here. Major industries include, Mitchell's Fruit Farms Limited; Engro Foods Limited; Beakers Land and Sweets Factory; Ittefaq Sugar Mills Limited; Baba Farid Sugar Mills Limited; Lackson Tobacco, Philip Morris Tobacco; Fauji Fertilizer Company; Habib Oil Mill; and Aziz Leather Craft, etc.

178. Most of the larger industries, such as Engro Food, Philips Morris Tobacco, dairy product plants, and other agro-based industries are situated along Multan Road, south of the canals, and along the ribbon developments outside the municipal limits.

179. The business community of Sahiwal district earnestly felt the need to establish a Chamber of Commerce & Industry, in Sahiwal. A group of traders and Industrialists succeeded in obtaining a license from the Government of Pakistan's Ministry of Commerce. After incorporation with Security Exchange Commission of Pakistan, under Companies Ordinance 1984, the Chamber became affiliated with the Federaton of Pakistan Chambers of Commerce & Industry.

180. The primary objective in establishing the Sahiwal Chamber of Commerce & Industry (SLCCI) was to provide businessmen in the area with an opportunity to strengthen the economic growth of Sahiwal, in particular, and the country, in general. Industry growth will certainly reduce unemployment in the area.

181. The prime objective of the SLCCI is to serve its members to their utmost satisfaction. The SLCCI acts as a bridge between the government and the business community. It plays an important role in policy formulation by maintaining a constant interaction with the relevant authorities.

4.3.5 Water Supply Service

182. The water supply is obtained from ground water and 46 tube wells. The water supply network covers 90 percent of the town and serves 90 percent of the total population. The distribution system consists of eight overhead reservoirs with a 450,000-gallon capacity. The distribution consists of a looped network made of different types of materials, including asbestos concrete, PVC, MS, and duct Iron pipes. Pipe sizes vary from 76 to 305 mm in diameter.

4.3.6 Sewerage System Service

183. The sewerage and drainage system covers 90 percent of the total area of Sahiwal through a 40 km sewerage network. Wastewater is disposed of in a nearby sewer system, which pollutes the surrounding environment and causes waterborne diseases. The residential areas are rapidly expanding to the north side of the town, and slower expansion is taking place toward the east, reducing the coverage of the facility to between approximately 20 and 30 percent.

184. Municipal wastewater is being used for irrigation purposes, according to farmers' demand, and the remaining wastewater is disposed of into rivers through drains and nullahs.

4.3.7 Solid Waste Management

185. The solid waste generation from Sahiwal city is overwhelmingly domestic and primarily organic in composition. Some industrial solid waste varies in different parts of the city. The main problems with refuse collection and disposal are old machinery, polythene bags, anti-social habits, lack of supervision, and the encroachment of open sewers.

186. Currently, there is no proper system of waste disposal in Sahiwal. Collected waste is dumped at designated dump sites, at Ratti Tibbi, without any environmental safeguards, such as segregating infectious hazardous waste produced by tanneries, slaughterhouses,

and hospitals. Presently, only 32 percent of solid waste is being collected and disposed of. However, with increasing economic activity in agriculture and manufacturing, the environmental and health situation will continue to worsen in the absence of proper disposal mechanisms.

187. The Sahiwal Municipal Corporation (SMC) manages Sahiwal's existing solid waste management system. The existing solid waste collection, in general, is divided into a primary and secondary system. Sahiwal city comprises of ten union councils, each of which has its peculiar characteristics in terms of land use the composition of waste generated. The amount of waste generated and the extent of pollution varies from union council to union council. The allocation of sanitary staff in the union councils does not commensurate with the workload, thereby resulting in huge heaps of waste piling up on the streets and in open places.

188. There is no available data on the composition of the waste generated in the city and there is no concept of the segregation of infectious/noninfectious and hazardous/nonhazardous wastes produced by industries, slaughterhouses and hospitals.

189. The SMC has prepared a PC-1 "Integrated Solid Waste Management System in Sahiwal, the estimated cost of which is Rs 135.68 million. The aim of this project is environmental improvement by enhancing institutional capacity and improving the collection, transportation, and disposal of the city's solid waste, hospital waste, and slaughterhouse waste.

190. Presently, the SMC's primary waste collection is carried out by the use of handcarts and is taken to open places of heaps on roadsides, followed by secondary collection through tractor trolley, and final dumping at the Ratti Tibbi dump side. Under the present scenario, only 32 percent of solid waste is being collected, transported and disposed of.

4.3.8 Transport

191. Sahiwal city has a total road length of 40 km, of which the regional road/highway is 10 km long. There are 12 km of major roads and 18 km of branch roads. In addition to that, there are numerous streets, which crisscross the city. Also there are about 11 important junctions in the network, out of which six are roundabouts and the remaining function as chowk.

192. Out of the total urban area of 1,652 hectares (16,515,870 m²), 55 percent offer good vehicular accessibility, 25 percent are fair, and 20 percent offer poor vehicular accessibility. Since the city is basically a planned town, numerous roads in the network are

fairly wide. About 9 percent of roads are 37 meter wide, 22 percent are 34 meter wide, 20 percent are 24 meter wide, and 49 percent are 18 meter wide or less.

193. The transport infrastructure in Sahiwal is generally adequate for its existing requirements; there are relatively few circumferential links. This results in extended journey times for many trips and the misuse of minor roads by through traffic. There is little provision for off-street car parking. There are no signals on any of the chowks and no available urban bus or van services. Mostly motorcycle rickshaws or auto rickshaws are being used as urban transport services on all roads.

Sahiwal in the Pak-China Economic Corridor

194. The Pakistan-China Economic Corridor (CPEC) is an ongoing mega project that aims to connect Gwadar Port in southwestern Pakistan to China's autonomous northwestern region of Xinjiang, via a network of highways, railways and pipelines that transport oil and gas. Other than the transport infrastructure, the economic corridor will provide Pakistan with telecommunications and energy infrastructure.

195. Sahiwal lies within this corridor and, thus, would be a direct beneficiary. In this corridor, two coal power plants are to be built in Qadirabad, which is located on Multan Road (N5), around 19 km from Sahiwal, in the direction of Lahore. Work on this project has already begun; it will generate 1,320 MW of electricity and be completed in 30 months, with China's assistance.

4.4 Social Resources

196. Sahiwal is a predominantly rural district, with only 16.9% (almost half of the provincial and national average) of the population living in an urban environment. Sahiwal City experienced rapid urban growth between 1951 and 1998, during which time the population increased from 50,185 to 208,778. The projected population in 2016 is 294,005. Migration from rural to urban areas has declined considerably in recent years.²¹

197. The majority of households (85%) own their own homes and the same percentage of houses are made of baked bricks with reinforced cement concrete (RCC) rooves. The city has 29 regularized katchi abadis (squatter settlements) comprising 8,697 houses. The three marla low-cost government housing project is only half constructed. Many new housing colonies were planned nearly 10 years ago, but development and construction have not yet begun. Sahiwal City is comprised of 10 urban union councils. With the establishment of the municipal corporation in the near future, this will increase to 12.

²¹ <https://www.urbanunit.gov.pk/Upload/ProjectDocument/PASDP%20Sahiwal.pdf>

198. Both public and private educational institutions exist in the city. The male literacy rate is 82% and the female rate is 71%. The primary school net enrolment ratio is 91 for boys and 82 for girls. Within the district, approximately 10.3% of children are not enrolled in school. Public and private sector health facilities are available in the city. According to one survey, 45% of household have a monthly income of PRs 30,000 or less. Unemployment is reportedly high, particularly for educated men. There are about 43 units in the small industries estate within municipal limits which provide employment to over 1500 workers.

199. Sahiwal district has witnessed poverty reduction in the past decade. Various studies report the percentage of the population below the poverty line as being in the range of 16% to 32% in urban areas of Sahiwal district. According to the Planning Commission of Pakistan, 30.8% of the population was facing multidimensional poverty in the district in 2015.

4.4.1 Employment and Unemployment

Unemployment

200. The unemployment rate is measured as the ratio of those laid off and seeking employment, and the total number of unpaid family helpers to the total number of those employed among the economically active population. This number is generally represented as a percentage. In 1998, the unemployment rate in the district was 20.6 percent, which was mainly due to unemployment among males, which represented 20.9 percent, while the female unemployment rate was only 2.8 percent, because of the small number of women active in the labor force. The unemployment rate was slightly low in rural areas, as compared to urban areas, representing 20.2 percent and 22.5 percent, respectively

Employment Status

201. The last formal, detailed employment statistics for Sahiwal date to the 1998. The population census is quoted in several publications, including the Sahiwal Urban Profile, 2010. A number of related and more current employment figures that are indicative of Sahiwal's urban situation include:

- **The labor force participation in Punjab of 55.4 percent, which is the highest of all four provinces.**
- **Industry engages 23.9 percent of the formally employed.**
- **In 2013, there were 220 reported factories in Sahiwal District, employing approximately 8,200 workers.**
- **Of these workers, 76.5 percent participated in the informal economy. Based on statistics of other employment sectors, this suggests that a proportion of those formally employed also engage in informal**

economic activity, a situation that is common in most emerging economies.

- **Approximately 26 percent were employed as service workers, in shops and as market sales workers.**
- **Another 27 percent were employed as in crafts and related trades.**
- **Approximately 14 percent were employed as unskilled workers.**
- **Just over 6 percent were employed as professionals.**
- **Another 6 percent were employed as plant machine operators.**

202. The main source of formal employment is 220 factories, of varying size, located in Sahiwal and its environs. These provide some 8,200 jobs. Agro-related industry is of particular importance as an employment generator.

4.4.2 Educational Services

203. Sahiwal has a number of higher post-secondary educational institutions, including:

- **Thirteen arts and science degree colleges have over 15,000 students enrolled, including the Sahiwal Medical College and the Government College of Technology**
- **Four vocational institutes have over 500 students enrolled.**
- **One technical/polytechnic institute has almost 3,000 students.**
- **Six commercial training Institutes have over 3,000 students enrolled.**

204. Additional institutes of higher education are always desired, particularly those directly targeting the employment needs of local industry. These also become important means of keeping youth from migrating to the major cities.

4.4.3 Health Facilities

205. Sahiwal district has nine hospitals, but with a total number of beds of slightly under 1,300. In addition, there are six regional health centers and 42 basic health units. As in most secondary urban centers, retaining qualified staff, in both the health and education sectors, is one of the challenges. Staff often migrates to a major city to take advantage of the amenities it offers. The better the overall urban environment, quality of life, and social and economic amenities, the more likely they are to stay.

206. The prevalence of hepatitis B and C is reported at 5%. The 2011 Millennium Development Goals (MDG) Report for Punjab indicated a prevalence of Hepatitis B at 2.4% and C at 7.1% in the district. Participants of all FGD indicated that hepatitis prevalence is highest in Sahiwal City because of water supply contamination. In their opinion, roughly one quarter of the city population was suffering from hepatitis

because of contaminated water, highly inadequate waste water disposal and inappropriate solid waste removal.²²

4.4.4 Harappa Archaeological Site as a Tourist Attraction

207. Harappa is one of the two main cities of the Indus culture, and is located about 20 km west of Sahiwal. It is a major tourist attraction and contains ruins of a fortified Bronze Age city. The city is believed to have had as many as 23,500 people living there as early as 2,500 BC, which can be considered a large population for that time.

208. The Harappa civilization was rediscovered in the 1920s. It was found to have had its own script, urban centers, and a diversified social and economic system. In 1857, the archaeological site at Harappa was partially damaged. Sadly, its current state is not satisfactory.

209. Harappa is generally characterized as having differentiated living quarters, flat-roofed brick houses, and fortified administrative or religious centers. Although copper and bronze were in use, iron was not yet employed. Cotton was woven and dyed for clothing; wheat, rice, and a variety of vegetables and fruits were cultivated; and a number of animals were domesticated, including the humped camel.

4.5 Socioeconomic Condition

210. This section covers the socio-economic conditions of the population that will be directly or indirectly affected by the project. The socio-economic profile focuses on the sources of livelihood, income levels, and accessibility to social services like health, education etc. The socioeconomic survey was divided into a settlement profile and a socio-economic household survey. Residents were interviewed with the help of semi structured questionnaire.

4.5.1 Settlements Profile

211. Social and Cultural Values: The existing community reflects rural culture with its characteristic norms and values. Women do all household work by themselves. Majority of the population follows Islamic tradition. Common food is wheat bread. Yogurt, Lassi and milk are also used. The common dress for males is Shalwar Qameez and for females Shalwar, Qameez and Dupatta/Chadar. Marriages are celebrated in traditional manners.

4.5.2 Conflict Resolution Mechanism

²² <https://www.urbanunit.gov.pk/Upload/ProjectDocument/PASDP%20Sahiwal.pdf>

212. The people of the area were found to be loving, caring and hardworking. They reported that for petty conflicts resolution, they involve the influential people, Nazim or Naib Nazim or Councilor of the village, who after listening statements of both the parties, tries to reach to an unbiased decision which is acceptable to the aggrieved. Generally, the people accept the decisions of the influential.

4.5.3 Public Health

213. The major diseases that afflicted the residents of the village are seasonal. There are no adequate health care facilities in the surveyed settlements. Rural Health Centre and Basic Health Unit (BHU) are 4 to 5 km away from settlement. There is no qualified doctor in the surveyed settlement. The only medical services in the village are provided by Lady Health Workers (LHW).

4.5.4 Cultural and Religious Resources

214. Religious sites include shrine, mosques, graveyards and historical buildings. There are ten mosques, one shrine, five graveyard, four imam bargah and three church in the area. Mosque has been built in the recent past and has no historical or architectural significance. Shrine is regarded as a sacred place and receive devotion from the locals of nearby populations but is not well known outside the area.

4.5.5 Religion

215. The main religious groups in the area are Muslims and Christians. The population of the surveyed settlement is predominately Muslims i.e., 98% followed by Christians 2%.

4.5.6 Language Spoken

216. Punjabi is the most common language spoken by majority of population in the area. Urdu is spoken as secondary language.

4.5.7 Castes and Minority Groups

217. The project area is inhabited by the people of various castes including Bhutta, Bhatti, Mughal, Rajpoot, Araen, Rae, Sayyed, Malik, Dogar, Rajpoot, Rana, Jat, Rehmani and Chaudhry. Among all these, Araen is the dominant caste. Reportedly, lower castes associated with hereditary menial professions are also the part of the village population.

4.5.8 Educational Status

218. Educational facilities in any area predict the educational level and the interest of the people towards the education. Educational status of the respondents of surveyed village is shown in **Table-4.18**. This table shows that 149 children having age group of 1-3 have been excluded. Out of remaining, majority of the respondents had middle level education. It is also obvious from the table that the ratio of the masters is very low as compared to those having education up to primary, middle and matriculation.

Table 4.17: Educational Level of the Respondents

Education Level	Male	Female	Male (%)	Female (%)
Primary	115	103	21	25
Middle	130	127	24	31
Matriculation	118	24	22	6
Intermediate	51	22	9	5
Graduation	34	16	6	4
Masters	08	14	2	3
Deeni Taleem	04	08	1	2
Illiterate	78	99	15	24

Source: Socio economic Survey, February 2017

4.5.9 Economic Conditions of the Study Area

219. Occupations and Employment: Various income generating activities are practiced in the village. Apart from the categories of housework and students, which mainly pertains to the house wives and children, the major earning occupations are business and private servant. Residents of the village are also engaged with the small industries as skilled or unskilled labor.

220. Based on the sample-based socio-economic survey of the project area, **Table-4.19** presents distribution of the household members by occupation.

Table 4.18: Distribution of Household Members by Occupation

Occupation/ Source of Income	Number	%age
Agriculture	33	03
Housewives	248	23
Domestic Work	33	03
Students	302	27
Wage labor	67	06
Business	77	07
Private Servant	69	06
Government Servant	62	06
Retired Servant	11	01
Unemployed	18	02
Overseas	37	03
None	11	01
Babies	132	12

Total	1,100	100
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Source: Socio economic Survey, February 2017

221. Income Levels: The **Table-4.20** shows the distribution of households with respect to their reported average monthly household income. It is evident from the table that the income level of most of the respondents is reasonable and economic conditions are well off.

Table 4.19: Distribution of Households by Average Monthly Household Income

Income Group	Number	%age
<10,000	11	08
10,001-20,000	52	35
20,001-30,000	30	20
30,000+	54	37
Total	147	100

Source: Socio economic Census Survey, February 2017

222. Housing Characteristics: Housing condition is an important indicator for determining the economic conditions of the population as it reflects the financial position and living standards of the inhabitants. Most of the houses in the study area are built with cement and bricks and permanent roofing structures. All the respondents (100%) are living in their own houses and none was found to live in the rented house. Nature of the housing conditions of the study area is shown in **Table-4.21**.

Table 4.20: Housing Type

Categories	Number	%age
Pucca (bricks, cement)	127	86
Katcha (bricks, mud)	-	-
Semi Pucca (bricks, cement, mud)	20	14
Total	147	100

Source: Socio economic Survey, February 2017

223. Livestock: In the surveyed settlement, livestock is normally raised for food and farming purposes. Livestock has market potential and is sold at the time of need. Major livestock of the area are cows, buffalos, goats, sheep, donkeys and poultry birds. Poultry birds are only kept for meeting the household's eggs and meat requirements.

5 Analysis of Alternatives

5.1 Overview

224. The scope of works for the proposed WWTP focused activities in North zone of Sahiwal city. consist of developing of a new WWTP. The installation of this infrastructure is based on detailed feasibility assessments focusing on assessing the city requirements with regards to wastewater and then determining the most suitable and effective alignment for laying the required infrastructure.

5.2 'No Project' Option

225. At present, Sahiwal city is urgently in need of a WWTP due to the following existing situation:

- Presently, no treatment plant is available for treatment of wastewater in the project area of Sahiwal City.
- Raw sewage is being directly disposed of into the canals, seepage drain and in agricultural fields in outskirts of the city. This practice is environmentally unsafe and a violation of Punjab Environmental Protection Act;
- Disposal of untreated wastewater into water bodies/ agriculture fields is causing contamination of the water and food chain and several associated environmental and health issues;
- Many areas have no final disposal points. The disposal problem becomes more severe when the farmers do not need raw sewage for their crops(s) during raining season and certain period(s) of year when water is not required for crops.

Thus, the proposed scope of works for development of the WWTP need to be implemented on an urgent basis and the 'No Project' option is not viable and cannot be considered further.

5.3 Selection of Wastewater Treatment System

226. The wastewater treatment facilities have been selected after taking due consideration of the pertinent technical, operational and economic factors, limitations and constraints. The key factors, which govern the choice of the treatment system, are listed and described below:

- **Nature and Strength of Wastewater**

227. The applicable physical, chemical and biological treatment processes are primarily governed by the nature of pollutants to be removed and their strengths in the wastewater. The treatment system selected shall ensure the required pollutant removal efficiencies.

- **Physical Constraints**

228. Physical constraints, principally being the area available and the topography of the plant site with reference to the system hydraulic requirement, govern the selection of the treatment technology.

- **Cost**

229. The system selected should be the least cost effective alternative, keeping in view both capital as well as operational costs, within the range of technically feasible options.

- **Operational Skills**

230. Skills required for the routine operation and maintenance of the treatment system should be available locally, with only a minimum of training. The proposed system shall have a relatively easy of operation and maintenance procedure.

- **Mechanical Equipment**

231. The selected system shall be such that minimum mechanical equipment needs to be provided. Unnecessary mechanical equipment should be avoided. The system should be designed such that maximum amount of mechanical equipment should be of local manufactured locally, where possible.

- **Nuisance**

232. The degree of colour, odor and noise shall be below the nuisance threshold, especially, with reference to the proximity of the treatment system to the build-up areas.

233. A detailed technical and financial analysis was carried out for the proposed WWTP by considering the different wastewater treatment technologies. The technologies that were considered were as follows:

234. The qualitative analysis and cost comparison of alternative treatment technologies is presented as **Table 5.1** below.

235. **Activated Sludge Process (ASP):** Activated sludge process is the biological treatment, in which aerobic microorganisms present in wastewater, use the colloidal and dissolved organic matter of the wastewater, for their multiplication and growth, with the help of oxygen thus converting them into readily settleable biomass. Generally, the required oxygen supplies are maintained by forced supply of air to the wastewater in the aeration tank. The aerated effluent is then allowed to pass through a secondary settling tank to separate the biomass or the "activated sludge". A part of the "activated sludge" is recycled to the aeration

tank to maintain optimum microorganism concentrations. The remaining secondary sludge is removed from the system periodically; dewatered and dried; and disposed of.

236. **Trickling Filter Process (TF):** In this process, the settled wastewater is allowed to trickle down over a circular deep bed of coarse aggregates filter. The microbial film, developed on the surface of aggregates over time, treats the wastewater. A part of this film, washed away by the hydraulic action of trickling wastewater, is separated in secondary clarifier, in form of humus sludge, disposed of after sludge treatment.
237. **Aerated Lagoons (AL):** Aerated lagoons are completely mixed basins, with detention periods, ranging from 2 to 6 days, in which wastewater is generally treated on flow through basis (without solids recycling), with forced aeration. The aerobic suspended biological flocs, responsible for the waste conversion, closely resemble to that of activated sludge process. Area requirements are in between those of the oxidation ponds and activated sludge process.
238. **Waste Stabilization Pond System (WSP):** Waste Stabilization ponds are large shallow basins, in which raw wastewater is treated entirely by natural processes, involving both algae and bacteria. They are the most important method of wastewater treatment in hot climates. However, since the rate of oxidation is slow so large areas are required for their construction. Their specific advantages are simple operation and no sludge management problem.

Table 5.1: Comparison of Alternative Treatment Technologies

S/No.	Parameter	ASP	TF	AL	WSP
1	Qualitative Comparison incl. Environment related Parameters				
a	Area requirement	Low	Moderate	Moderate	Large
b	Process Mechanical Equipment	Yes	Yes	Yes	No
c	Capital Construction Cost	High	High	High	Moderate
d	O&M Cost	High	Moderate	High	Low
e	Process Energy Requirement	High	Moderate	High	Nil
f	Operational Supervision & Control	High	High	High	Low
g	Quantities of Sludge produced	High	Moderate	High	Low
h	Daily Waste Sludge Disposal	Yes	Yes	Yes	No
2	Cost Comparison				
a	Capital Cost (incl. Land Cost) – Million PKR	11,550	10,164	9,240	2,400
b	Annual O&M Cost –	570	456	460	33

	Million PKR				
c	Area Requirement - Acres	70	91	100	199

Recommendation for Proposed Treatment Technology

239. In view of above technical and financial comparison of treatment technologies and availability of land in outskirts of Sahiwal City, Waste Stabilization Ponds (WSP) are recommended in Master Plan Report for the proposed WWTP.
240. WSPs are large earthen basins in which raw wastewater is treated entirely by natural process, involving both algae and bacteria. They are amongst the most important methods of wastewater treatment in hot climates. However, since the rate of oxidation is slow, large areas are required for their construction. Their specific advantages are simple operation and low operation & maintenance costs. Quantities of sludge produced are less, due to long stabilization periods and no daily waste sludge disposal is needed. The ponds need to be de-sludged after very long operational durations of the order of 2-3 years.
241. The proposed WSP system is recommended keeping in view the following key factors:
- It is established that local municipal bodies of Punjab, at present or in near future, would not be in a position to afford the high recurring operation & maintenance costs (mainly owing to high electric energy requirement), associated with the treatment systems other than waste stabilization ponds. Consequently, provision of any of the mechanized systems, would, ultimately lead to non-operation of these treatment plants and mere wastage of the capital investments made on this account.
 - Mechanized treatment systems invariably need a higher level of operational skill, responsibility, supervision and control, for their proper functioning, which under the prevailing conditions is envisaged to be difficult to be maintained by the local municipal bodies. Under these circumstances, the treatment systems, which are relatively easy to monitor, operate and maintain need to be adopted. Oxidation ponds are almost self-operating and do not need much operational intervention, for their proper functioning. Ease of operation, maintenance, monitoring and control are their principal characteristic.
 - Climatic conditions in the Punjab, in terms of high ambient temperatures and longer durations of intense solar radiation, which enhance microbial activity and photosynthetic production of algal oxygen, favour the selection of oxidation ponds.
 - In contrast with mechanized treatment systems, waste stabilization pond systems do not have any permanent structure, except for wastewater screening and pumping station and plant building, if any. Consequently, they offer a much higher degree of flexibility in terms of system change in future. If in the future, the conditions governing the selection

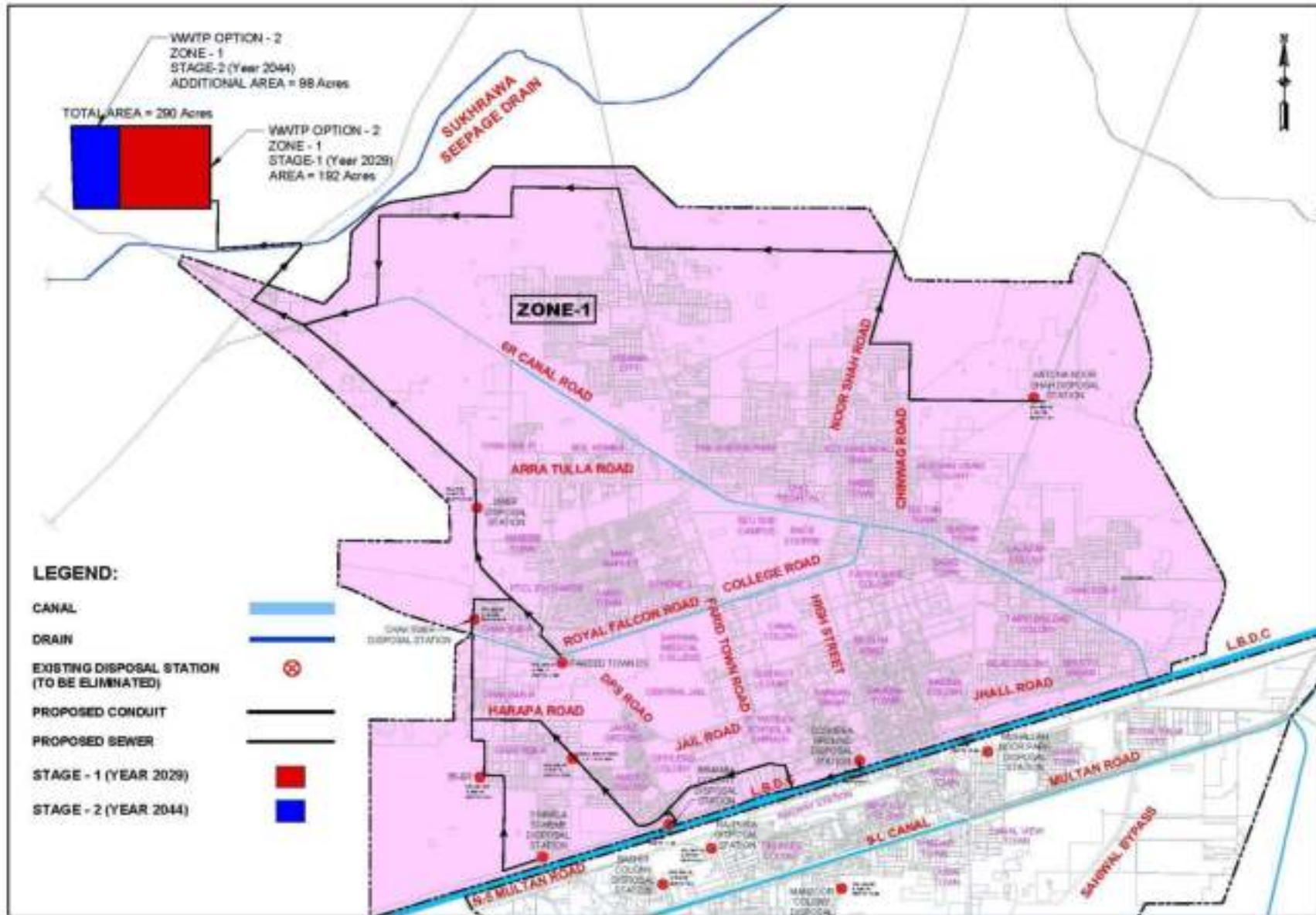
are changed, the land used for ponds can easily be reclaimed and put to other urban uses and a mechanized treatment system with much less area requirements can be installed in its place.

5.4 Site Selection for Proposed WWTP

242. A detailed site selection report for the proposed WWTP was prepared by the EPCM Consultant on the basis of preliminary technical, social and environmental parameters. These parameters have been considered based on thorough literature review and subsequent evaluation of identified sites against each parameter is made on the basis of observations made during site reconnaissance surveys.

243. Two site options were considered with their respective locations shown in the maps provided as **Figures 5.1** and **5.2** below.

Figure 5.2: Layout of proposed WWTP Site for Zone-1 (Northern Part) in Option 2



Option -1

244. In option -1, North Zone was further sub-divided into two sub zones i.e. Sub North Zone (A) and Sub North Zone (B).
245. Sub North Zone (A) comprises north eastern part of North Zone and mainly consist of residential areas including Bilal Colony, Tariq bin Zad colony, Lalazar Colony, Sadiq Town, Habib Town, Hussain Abad, Kot Khadim Ali Shah and Chak 82/6-R etc. This sub zone will accommodate about 40% of total estimated population of North Zone. In Master plan of the city, it is proposed that existing disposal station “Kacha Pakka Noor Shah” will be eliminated and wastewater/sewage from this subzone, collected through sewerage network, will be carried to proposed inlet pumping station from where it will be transported to proposed wastewater treatment plant of Sub North Zone (A) for treatment. Catchment area of Sub North Zone (A) and its proposed treatment Plant site. The proposed treatment plant site is located at north of the city, on left side of crossing of seepage drain and Noor Shah road.
246. Sub North Zone (B) comprises north western part of North Zone and mainly consists of residential areas as well as small industries area. Main areas of the subzone include Madina Colony, Fateh Sher Colony, Shadman Town, Canal Colony, Officers Colony, Farid Town, Central Jail, Small Industries Area, BZU Sub Campus and Jeewan City etc. In the master plan, it is proposed that all the existing disposal stations (Imaamia Colony, Fareed Town, 3 Marla Scheme, Dosehra Ground, 95/6R, 93/ R, 89/6R disposal stations) within the sub zone will be eliminated and wastewater/sewage from the subzone, collected through sewerage network, will be carried to proposed inlet pumping station from where it will be transported to proposed wastewater treatment plant Sub North Zone (B). Catchment area of Sub North Zone (B) and its proposed treatment Plant site. The proposed site for Sub North Zone (B) is located at north eastern side of the city after crossing Sukhrawa seepage drain.

Option-2

247. In Option-2, one combined treatment plant is proposed for complete North Zone. Wastewater from entire North Zone will be collected through sewerage network under gravity and will be carried to proposed new disposal station near proposed wastewater treatment plant site. In the master plan, it is proposed that all the existing disposal stations will be eliminated and wastewater/sewage will be transported to new proposed disposal station by gravity. The location of the proposed treatment plant will be same as of Sub North Zone (B), however, larger area will be required due to sewage of entire North Zone. However, land for WWTP Stage-1 (199 acres) along with land for approach roads is being acquired. Acquisition of land for WWTP Stage-2 will be acquired subsequently after deliberations with the stakeholders.

Comparison of Option-1 and Option-2 for proposed WWTP

248. Selection of the site for proposed WWTP was based on evaluation of the site on certain preliminary technical, financial, environmental and social parameters. The parameters were selected as a result of thorough literature review and the evaluation of sites was based on the observations made during site visits and site reconnaissance surveys. Comparison of above-mentioned Option-1 and Option-2 is provided as **Table 5.2** below.

Table 5.2: Comparison of Option 1 & 2 Sites

Sr. No	Parameters	Option-1	Option-2
A	Technical Parameters		
1	Area Requirement	<p>Approximate area requirement till year 2029 (10 years design period) to meet irrigation standards for Sub North Zone (A) and Sub North Zone (B) are 80 and 116 acres (Total area for both sub zones for year 2029 would be 196 acres).</p> <p>To cater to wastewater flow, to be generated up to design year 2044, additional areas of about 38 and 64 acres would be required for sub North Zone (A) and Sub North Zone (B) respectively.</p> <p>Total area requirement for design year 2044 would be to 118 and 180 Acres for sub North Zone (A) and Sub North Zone (B) respectively making total requirement of 298 Acres.</p>	<p>Approximate area requirement till year 2029 (10 years design period) to meet irrigation standards for entire North Zone will be 199 Acres.</p> <p>To cater wastewater flow, to be generated up to design year 2044, additional area of about 98 acres would be required North Zone.</p> <p>Total area requirement for design year 2044 would be to 297 Acres.</p>
2	No. of Disposal Station	<p>All existing disposal stations will be eliminated.</p> <p>Two (02) new disposal stations are proposed, one for each sub zone.</p> <p>Wastewater/sewage from each sub zone will be carried to proposed new disposal stations under gravity.</p>	<p>All existing disposal stations will be eliminated.</p> <p>One (01) new disposal station is proposed for entire North Zone.</p> <p>Wastewater/Sewage from entire North Zone will be carried to proposed new disposal station under gravity.</p>
3	Geometry of Land	Geometry of proposed WWTP Sites for both sub zones is almost rectangular.	Geometry of proposed WWTP Site for entire North Zone is rectangular.

		<p>Sites are proposed on private agriculture land.</p> <p>In case of future extensions, further land may also be acquired.</p>	<p>Site is proposed on private agriculture land. In case of future extensions, further land may also be acquired.</p>
4	Land Cost	Rs.1.50 – 2.0 Million per Acre according to verbal discussion with local population	Rs.1.50 – 2.0 Million per Acre according to verbal discussion with local population.
5	Topography	Topography of the proposed WWTP sites is generally plain.	Topography of the proposed WWTP site is generally plain.
6	Treated Wastewater Reclamation and Reuse	<p>The proposed sites are located in agriculture area. Sewage after required treatment can be used for agriculture purposes.</p> <p>For agriculture use, outlet pumping station will be provided which will transport the treated effluent to required area through force main (s). Two outlet pumping stations, one for each WWTP, will be required to transport the treated effluent at required places for irrigation purposes. It will result in more capital and O&M cost.</p> <p>As proposed sites are located at two different places, agriculture area at north eastern and north western sites will be irrigated.</p>	<p>The proposed site is located in agriculture area.</p> <p>Wastewater after required treatment can be used for agriculture purposes.</p> <p>For agriculture use, outlet pumping station will be provided which will transport the treated effluent to required area through force main (s).</p> <p>Only one outlet pumping station is required to transport the treated effluent at required places for irrigation purposes. It will result in less capital and O&M cost as compared to option-1.</p>
7	Receiving Body	<p>The proposed sites are located near Sukhrawa seepage drain which ultimately discharge to River Ravi.</p> <p>Wastewater after treatment from WWTP can be discharged to Sukhrawa drain under gravity for final disposal.</p>	<p>The proposed site is located near Sukhrawa seepage drain which ultimately discharge to River Ravi.</p> <p>Wastewater after treatment from WWTP can be discharged to Sukhrawa drain under gravity for final disposal.</p>
8	Transportation and Site Excess	The proposed sites are easily accessible through roads network. However, small length of approach roads may be required.	The proposed site is easily accessible through roads network. However, small length of approach road may be required.

9	Working Staff Requirement	In this option, two separate WWTPs proposed, therefore, separate teams of technical and support staff will be required for each WWTP thus will result in more staff requirement and increase in operation and maintenance expense.	In this option, working staff requirement is less as compared to Option-1.
B	Environmental Parameters		
1	Proximity to Ground water	<p>Near proposed site of Sub North Zone (A), ground water exists at depth of 11.0 – 11.50m.</p> <p>Near proposed site of Sub North Zone (B), ground water occurs at depth of 14.0 – 15.0m.</p> <p>Ground water at both sites are at safer depths.</p>	Groundwater depth at proposed site is about 14.0-15.0m.
2	Proximity to Populated Area	<p>Nearest populated area to WWTP site of Sub- North Zone A) is Chak Adda Shabeel which is about 650-700 m away from WWTP site.</p> <p>Other Nearest populated areas to WWTP site of Sub- North Zone (A) is Chak. No.56/GD and Chak Rati Tabi which are about 1,000m and 1,500m from the site.</p> <p>Chak. No.66/GD is located near north eastern corner of the WWTP site of Sub- North Zone (B) at a distance of about 200-300m.</p> <p>To avoid effect of WWTP to the populated area, buffer zone of dense trees vegetation will be provided all around the WWTP Sites.</p>	<p>Two small populated areas are situated near the proposed WWTP site.</p> <p>Chak. No.66/GD is located near north eastern corner of the WWTP at a distance of about 100-200m.</p> <p>Muhammad Pur is located at southern side of the proposed site at distance of about 480-500m from the WWTP site.</p> <p>To avoid effect of WWTP to the populated buffer zone of dense trees vegetation will be provided all around the WWTP Sites.</p>
3	Surface Water Contamination	<p>At present, wastewater of entire North Zone is being discharged into canal and seepage drain without any treatment, causing surface water contaminations.</p> <p>After treatment from WWTP, treated water will be used for irrigation purposes. In case,</p>	<p>At present, wastewater of entire North Zone is being discharged into canal and seepage drain without any treatment, causing surface water contaminations.</p> <p>After treatment from WWTP, treated water will be used for</p>

		water is not required irrigation, it will be discharged into seepage drain. Thus, it will result in removal of surface water contaminations.	irrigation purposes. In case, treated water is not required by irrigation, it will be discharged into seepage drain. Thus, it will result in removal of surface water contaminations.
4	Flora and Fauna	Proposed sites are located in agriculture area, there is no ecologically important vegetations and animals found in the area. However, existing flora and fauna in the proposed sites will be affected.	Proposed sites are located in agriculture area, there is no ecologically important vegetations and animals found in the area. However, existing flora and fauna in the proposed sites will be affected.
5	Sludge Disposal	In proposed waste stabilization ponds, desludging is carried out after 2-3 years. Usually, sludge is disposed of into landfill site. However, it can be used as manure for irrigation after drying within the ponds module wise. However, presently, no landfill site is available in Sahiwal City. The site being prepared under PICIIP project will be used for disposal of sludge.	In proposed waste stabilization ponds, desludging is carried out after 2-3 years. Usually, sludge is disposed of into landfill site. However, it can be used as manure for irrigation after drying within the ponds module wise. However, presently, no landfill site is available in Sahiwal City. The site being prepared under PICIIP project will be used for disposal of sludge.
6	Historic and Archaeological Sites	No archaeological site exists within/near the proposed WWTP sites. Harappa archaeological site is located at a distance of 25-35 km from the sites.	No archaeological site exists within/near the proposed WWTP site. Harappa archaeological site is located at a distance of 25 km from the sites.
C	Social Parameters		
1	Compatibility with Existing Land Use	The selected areas of proposed sites are currently being used for agriculture purposes. The treated wastewater will be used for irrigation in the nearby area. Therefore, the WWTPs are expected to be compatible with the existing landuse.	The selected area of proposed site is currently being used for agriculture purposes. The treated wastewater will be used for irrigation in the nearby area. Therefore, the WWTPs are expected to be compatible with the existing landuse.
2	Issues Regarding Acquisition of the Land	The proposed sites are located on agriculture land. The proposed are selected at such locations where land costs are relatively lesser. There are no permanent settlements, therefore no	The proposed sites are located on agriculture land. The proposed sites are selected at such locations where land costs are relatively lesser.

		substantial relocation costs.	There are no permanent settlements, therefore no substantial relocation costs.
3	Traffic disruption	<p>The proposed site for Sub North Zone (A) is located near Noor Shah Road. Construction of WWTP at the proposed site will result in increase of traffic on the Noor shah road. As Noor Shah Road is wide road, it is expected that it will cater the expected traffic for WWTP.</p> <p>For Sub North Zone (B), Arrat Ullah road leads towards the proposed Site. It is also a wide road and it is expected that it will also cater the traffic demand due to WWTP.</p> <p>In this option, WWTPs will affect traffic of Noor Shah road and Arrat Ullah Road.</p>	For WWTP for entire North Zone site is located near Arrat Ullah Road. It is a wide road and it is expected that it will also cater the traffic demand due to WWTP.

249. Comparison of technical, environmental and social parameters is presented in above Table. Both the options have advantages and disadvantages. The Option -2 to construct combined WWTP in North Zone has been selected based on the comparison of the technical, environmental and social parameters in the Table above.

5.5 Options of Reuse of Treated Effluent for Agriculture

250. For reuse of treated effluent for agricultural purposes, following options were considered:

- **Reuse in nearby Agriculture fields under gravity:** Option of direct reuse of treated effluent for irrigational purposes in nearby agriculture area under gravity by using hydraulic head available in WWTP has been evaluated. In the surrounding area of WWTP site, levels of topography decrease from north eastern direction to south western direction i.e. from Gogera branch to Sukhrawa drain. For analysis, a channel was marked which will transfer the treated effluent to the agriculture fields towards Sukhrawa drain considering natural topography. Water level in the treated effluent channel will be about 541.0 ft within premises of WWTP, whereas, ground levels in the surrounding areas of WWTP vary from 543-544 ft which are already higher than available hydraulic head in the treated effluent channel.

251. Therefore, treated effluent cannot reach to agricultural fields for irrigation under gravity. In view of above, to carry the treated effluent to agriculture fields, lifting of treated effluent through pumping will be required. Therefore, option of treated effluent reuse under gravity was not considered for the project.

- **Disposal into Sukhrawa Drain:** In this option, treated effluent channel will be used to finally dispose of treated effluent in to Sukhrawa drain, which ultimately joins river Ravi. The proposal of discharging treated effluent and bypassing the flows to Sukhrawa drain has been designed accordingly.
- **Treated Effluent Conveyance system for irrigation purposes:** As per requirement of MC Sahiwal, degree of treatment in proposed wastewater treatment plant would be such that the treated effluent can safely be reused in fields for agricultural purposes as per WHO Guidelines and discharged into inland waters i.e. Rivers etc. as per PEQS.

252. When water would not be required for agricultural use in case of rainy season or when water would not be needed by the crops, it will be safely discharged in to Sukhrawa seepage drain which is ultimately linked to River Ravi thus would also resolve the issue of ultimate disposal of wastewater. Treated effluent from Maturation Ponds of WWTPs will be carried to proposed effluent pumping station, from where it will be transferred to respective irrigation water courses off taking from irrigation canal (Mohga) in the vicinity of proposed WWTP through proposed forcemains. Ground level at treated effluent pumping station is about 543-544 ft and ground levels on forcemains routes along Gogera Branch vary from 544 to 564ft.

5.6 Options for Biogas Management

253. The possible options considered with regards to management of the biogas to be produced during the wastewater treatment process, particularly from the APs, are as follows:

- **‘Do Nothing Scenario’:** In this scenario, the biogas to be produced from the WWTP, primarily from the APs, would not be utilized and would be permitted to escape, resulting in the operation of the WWTP contributing to global warming through the emission of CH₄ emissions into the atmosphere as long as the plant will remain operational. In addition, the biogas produced would not be used for economic benefit by capturing it and utilizing it for some productive and economically viable use.
- **Biofuel production:** The biogas to be produced from the WWTP could be used for production of biofuel through purification of the biogas coming from the anaerobic

digestion of the sludge from the WWTP with the biofuel capable of being used later on in vehicles as fuel.

- **Combined Heat and Power (CHP) Utilization:** The biogas produced can be used to generate heat and power through installation of required infrastructure such as gas turbine to generate power which could be used for the auxiliary consumption at the WWTP with any excess power being sold to consumers.
- **Biogas Use for auxiliary and domestic consumption:** The biogas could be used for auxiliary consumption at the WWTP along with supplied to domestic consumers in the area for meeting their needs for natural gas with the added economic benefits resulting from sale of the produced biogas.

254. While the rationale to capture and use the biogas produced are indeed quite strong and worth considering, however, at present, due to the capital cost implications along with operating expenses associated with capturing the biogas produced and utilizing it for any of the options mentioned above, thus it has been agreed to proceed with the ‘Do Nothing’ Scenario and to permit the biogas to escape into the atmosphere.

5.7 Options for Sludge Use

255. The options that have been considered for utilization of the sludge to be produced as a by-product of the wastewater treatment process are provided below.

- **Agriculture**

256. Not only is sludge use on land the preferred option under the waste management hierarchy, but it is also usually the best practicable environmental option (i.e. objective balance of practicability, affordability, sustainability and acceptability).

- **Landfilling**

257. It is now widely accepted that landfill disposal of organic wastes, such as sludge, is not a sustainable option due to concern over gas and leachate emissions and the need to conserve landfill void for those wastes that cannot be reused or recovered. National measures vary but include limits on organic matter and the separation of municipal solid wastes. Ultimately, the only means of sludge disposal to landfill will be as ash resulting from its thermal destruction.

- **Incineration**

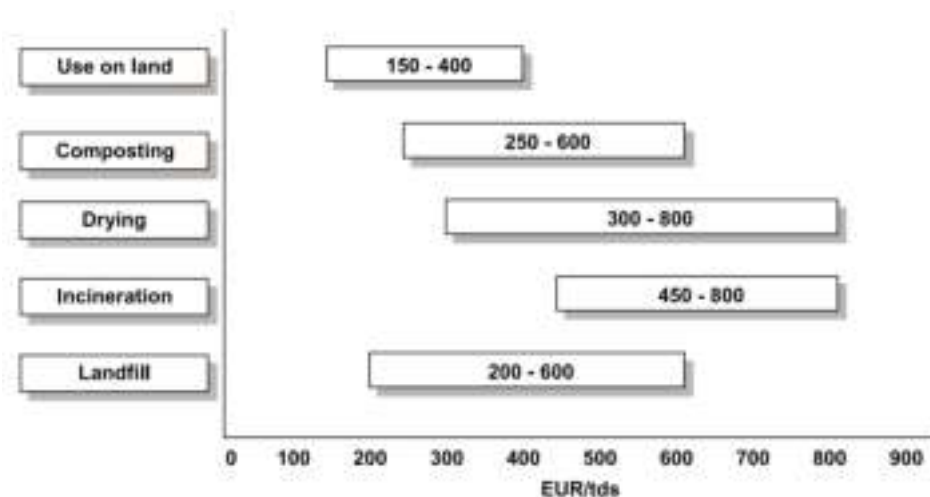
258. The main problem confronting the incineration process is how to reduce the high water content of the sewage sludge. Water reduction means energy demand. Raw as well as oxidised and digested sludges have a natural water content of between 92% and 99%, the sludge water being well combined with the solid particles. The separation process of the liquid and solid content can be facilitated by biological, chemical, physical and thermal means. Biological methods achieve the lowest and thermal methods the highest dewatering rates, though it should be borne in mind that the degree of dewatering depends on such factors as the type of energy (steam, electricity) used, processing pressure and reaction time.²³

- **Composting**

259. The conversion of sludge to compost is a time and resource intensive activity which requires the dehydration of the sludge and the formation of the wind rows in order to enable the composting process to take place. The composting process itself requires a large acreage of available land for the wind rows. The logistical aspects are also cost intensive with the sludge required to be transported to the composting facility and once the compost is ready and has been packaged, it needs to be delivered to any interested customers. The composting process also leads to disease vector generation and thus required good housekeeping in order to minimize generation of any vectors.

260. The indicative costs associated with implementing any of these options are shown in **Figure 5.3** below. It can be observed that directly using the Sludge for agriculture i.e. ‘Use on land’ is the least cost option.

Figure 5.3: Sludge treatment and disposal costs



²³ <https://ec.europa.eu/environment/archives/waste/sludge/pdf/workshoppart4.pdf>

261. Based on the rationale provided above, till now it has been decided to use the sludge to be produced from the WWTP for landfilling since it is the least technically complicated and least resource intensive option, particularly from an economic standpoint.

6 Potential Environmental Impacts and Mitigation Measures

262. The analysis of potential environmental impacts in the umbrella IEE study²⁴ is generic and does not present any impacts specific to the proposed WWTP in north zone of Sahiwal city. Thus, this chapter presents a description of the environmental impacts and the proposed mitigation measures to minimize the negative impacts, if any.

263. Impact-screening matrices during each of the project phases i.e. project design, construction and operation are presented below.

6.1 Methodology for impact screening

264. The methodology for assessing the risk level associated with each potential impact is presented below.

265. Risk is assessed as the likelihood that the activity will have an effect on the environment as well as the consequence of the effect occurring. It is often described like this:

$$\text{Risk} = \text{Likelihood} \times \text{Consequence}$$

Likelihood Scale

Likelihood	Definition	Scale
Certain	Will certainly occur during the activity at a frequency greater than every week if preventative measures are not applied	5
Likely	Will occur more than once or twice during the activity but less than weekly if preventative measures are not applied	3
Unlikely	May occur once or twice during the activity if preventative measures are not applied	2
Rare	Unlikely to occur during the project	1

Consequence Scale

Consequence	Definition	Score
Catastrophic	The action will cause unprecedented damage or impacts on the environment or surrounding communities	5

²⁴ https://www.adb.org/sites/default/files/project-documents/46526/46526-007-iee-en_0.pdf

Major	The action will cause major adverse damage on the environment or surrounding communities	3
Moderate	No or minimal adverse environmental or social impacts	2
Minor	No or minimal adverse environmental or social impacts	1

Risk Score Table

Likelihood	Consequence			
	Catastrophic	Major	Moderate	Minor
Certain	25	15	10	5
Likely	15	9	6	3
Unlikely	10	6	4	2
Rare	5	3	2	1

Risk: Significant: 15-25
Medium: 6-10
Low 1-5

266. Any 'Medium' to 'Significant' risk requires an environmental management measure to manage the potential environmental risk. Judgement will be required concerning the application of an environmental management measure to mitigate low risk situations.

6.2 Design/Pre-Construction Phase


Impact Screening Matrix

267. The 'activity wise' screening of potential impacts across the two Lots during the design/pre-construction phase is provided in **Table 6.1** below.

Table 6.1: 'Activity Wise' Screening of possible Impacts during Design/Pre-Construction phase

S/No.	Potential Impact	Likelihood (Certain, Likely, Unlikely, Rare)	Consequence (Catastrophic, Major, Moderate, Minor)	Risk Level (Significant, Medium, Low)
1	Lack of integration of IEE/EMP requirements into	Likely	Moderate	Medium

	Construction bid documents			
2	Material Haul Routes	Likely	Moderate	Medium
3	Improper location of worker camps leading to improper disposal of solid waste and sewage and privacy issues for residents in project area.	Likely	Moderate	Medium
4	Contractor's Environmental Safeguards Capacity	Likely	Moderate	Medium

 Critical Risk Level

 Significant Risk Level

 Medium Risk Level

 Low Risk Level

6.2.1 Lack of integration of IEE/EMP requirements into Construction bid documents

Impacts

268. The bidding documents must reflect the requirement to select a qualified and experienced Contractor from the perspective of ensuring implementation of required safeguards during project development.

Mitigation Measures

269. The proposed 'Safeguards unit' that should be developed at the PMU should be assigned the task to check that design and bid documents are responsive to key environmental, social and safety considerations, and that the proposed method of work reflects the boundaries defined in the EMP. The bid documents must include the EMP and its implementation cost must be reflected in the BoQ.

6.2.2 Material Haul Routes

Impacts

270. Hauling of material can have significant impacts on the community, public safety, traffic congestion, air quality and lifespan of the Sahiwal city road ways.

Mitigation Measures

271. The construction vehicles hauling materials along the Sahiwal city roads and anywhere where there are sensitive receptors such as hospitals, schools and/or roadside residences will be limited and the PMU in collaboration with the CIU will establish a route plan to minimize this disruption which shall be appended to the EMP.

6.2.3 Contractor's Environmental Safeguards Capacity

Impacts

272. The responsibility of the PMU in collaboration with the CIU is to review and finalize the documents relating to environmental issues. Contractors that do not possess the required capacity for safeguards management do not comply with workplace environmental, social and safety regulations.

Mitigation Measures

273. So far, local contractor firms in Pakistan working on large and medium scale environmentally sensitive projects have an unsatisfactory record for complying with workplace and environmental safety regulations. To address this, the contractor will be required to define an Occupational and Environmental Health and Safety procedure for all work, including work camp operation, management of cement dust, and use of Personal Safety Equipment. These procedures should be developed and approved by the PMU in collaboration with the CIU before the contractor commences any physical works on ground.

6.2.4 Identification of Locations for Labor Camps and ancillary facilities

Impacts

274. The duration of the construction activity for the WWTP development is expected to be 36 months and a considerable amount of work force will be engaged for development of the WWTP. As a result, worker camps will need to be developed and ancillary facilities will need to be provided such as electricity, washrooms for labor with suitable effluent and sewage disposal facilities as well as water for their everyday use for drinking and bathing etc.

Mitigation measures

275. In order to prevent a nuisance, specific locations shall be designated for development of the labor camps. All necessary facilities and amenities shall be provided in these camps such as electricity, sufficient supply of water, solid and liquid effluent waste disposal facilities etc.

276. The use of proper planning while identifying locations for the labor camps will ensure there is minimal disturbance to all key receptors and the traffic is not disrupted by labor camps being set up roadside next to the construction sites.

6.2.5 Cultural Heritage & Religious Sites, Social Infrastructure

Impacts

277. No temples or religious sites are in proximity to the works to cause a nuisance.

278. The sensitive receptors already identified in the project areas are all separated from the sub-project and there will be sufficient buffer distance between the works and these facilities such that no major significant impact would be expected from the works. However, consideration should be made not to construct at night, from 7 pm onwards till 6 am in the morning, to avoid nuisances.

Mitigation Measures

No mitigation measures are required.

6.2.6 Land Acquisition and Resettlement Impacts

Impacts

279. The proposed works for the WWTP will be conducted on publicly owned land and no land acquisition or resettlement is expected.

Mitigation Measures

No mitigation measures required.

6.3 Construction Phase


Impact Screening Matrix

280. The screening of potential impacts during the construction phase is provided in **Table 6.2** below.


Table 6.2: Screening of Possible Impacts during Construction Phase

S/No.	Potential Impact	Likelihood (Certain, Likely,	Consequence (Catastrophic,	Risk Level (Significant,
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		Unlikely, Rare)	Major, Moderate, Minor)	Medium, Low)
1	Degradation of air quality due to construction works	Certain	Major	Significant
2	Potential accidents and injuries to communities in project area during construction works	Likely	Major	Medium
3	Injuries to workers from lack of necessary training and/or not using PPEs etc.	Likely	Major	Medium
4	High noise levels from construction activities	Likely	Major	Medium
5	Improper handling and/or disposal of hazardous and non-hazardous waste	Likely	Moderate	Medium
6	Untreated disposal of effluent from worker camps and batching plant(s)	Likely	Moderate	Medium
7	Soil Erosion and Sedimentation	Likely	Moderate	Medium
8	Soil Contamination	Likely	Moderate	Medium
9	Employment Conflicts	Likely	Moderate	Medium
10	Communicable diseases	Likely	Moderate	Medium
11	Vegetation and Wildlife Loss	Unlikely	Moderate	Low
12	Historical/Archaeological Sites	Unlikely	Moderate	Low

 Critical Risk Level

 Significant Risk Level

 Medium Risk Level

 Low Risk Level

6.3.1 Air Quality

Impacts

281. The proposed WWTP development will involve large scale earth works and transporting and dumping large quantities of dry material. This will likely lead to an increase in SPM (Suspended Particulate Matter) in and around the construction zones.
282. Potential sources of particulate matter emission during construction activities include earthworks (dirt or debris pushing and grading), exposed surfaces, exposed storage piles, truck dumping, hauling, vehicle movement on unpaved roads, combustion of liquid fuel in equipment and vehicles, land excavation, and concrete mixing and batching.
283. Vehicles carrying construction material are expected to result in increased SPM levels near the haul roads. This can be of potential importance if the vehicles pass through the areas with a high concentration of sensitive receptors, such as schools and hospitals in this particular case.
284. At the construction yard, the dust levels are also expected to increase due to unloading of construction materials. It shall be ensured that most of the excavated material will be used within the project, with minimal cut and fill material to come from outside the site.
285. The quantity of dust that will be generated on a particular day will depend on the magnitude and nature of activity and the atmospheric conditions prevailing on the day. Due to the uncertainty in values of these parameters, it is not possible to calculate the quantity from a 'bottom-up' approach, that is, from adding PM10 emissions from every activity on the construction site separately. Typical and worst-case PM10 emissions from construction sites have been estimated²⁵ as 0.27 megagram per hectare per month of activity (Mg/ha-month) and 1.04 Mg/ha-month, respectively.

Fugitive Dust Control

286. The source wise fugitive control measures are provided in **Table 6.3** below.

²⁵ Gaffney, G. and Shimp, D. 1997. *Improving PM₁₀ Fugitive Dust Emission Inventories*. Sacramento, CA. California Air Resource Board. <www.arb.ca.gov/emisinv/pubs/pm10tmp.pdf>

Table 6.3: Control measures for Fugitive Dust emissions

Source	Control Measures
Earth Moving	For any earth moving that is to take place in the immediate vicinity from the site boundary, watering must be conducted as required to prevent visible dust emissions
Disturbed Surface Areas	Apply dust suppression measures (clear vegetation only from areas where work is to commence, plant or mulch areas that will not receive traffic, construct artificial wind breaks or wind screens) frequently to maintain a stabilized surface. Areas that cannot be stabilized, such as wind driven dust, must have an application of water at least twice a day
Inactive Disturbed Surface Areas	Apply dust suppressants (clear vegetation only from areas where work is to commence, plant or mulch areas that will not receive traffic, construct artificial wind breaks or wind screens) in sufficient quantity and frequency to maintain a stabilized surface
Unpaved Roads	Water all roads used for any vehicular traffic at least twice per day during active operations and restrict vehicle speed to 20 kmph.
Open Storage Piles	Apply water to at least 80 percent of the surface areas of all open storage piles on a daily basis when there is evidence of wind driven fugitive dust or install an enclosure all along the storage piles
Track-out Control	Wash down of construction vehicles (particularly tyres) prior to departure from site.

Mitigation Measures

287. The following mitigation measures will be adopted for preservation of the environment:

- At the WWTP site and the immediately adjoining areas, water will be sprinkled every three hours and at a higher frequency if felt necessary, at all construction sites to suppress dust emissions.
- All heavy equipment and machinery shall be fitted in full compliance with the national and local regulations.
- Stockpiled soil and sand shall be slightly wetted before loading, particularly in windy conditions.
- Fuel-efficient and well-maintained haulage trucks shall be employed to minimize exhaust emissions.

- Vehicles transporting soil, sand and other construction materials shall be covered with tarpaulin.
- Limitations to speeds of such vehicles as felt necessary. Transport through densely populated area should be avoided.
- Concrete plants to be controlled in line with statutory requirements and shall not be close to sensitive receptors.
- Stack height of generators will be at least 3 meters above the ground.
- Project traffic will maintain maximum speed limit of 20 km/hr on all unsealed roads within project area.
- A minimum distance of 300 meters will be ensured between batching plant(s) and the nearest community.
- The need for large stockpiles shall be minimized by careful planning of the supply of materials from controlled sources. Stockpiles should not be located within 50 m of schools, hospitals or other public amenities and shall be covered with tarpaulin when not in use and at the end of the working day to enclose dust. If large stockpiles (>25m³) of crushed materials are necessary, they should be enclosed with side barriers and also covered when not in use.

Vehicular & Equipment Emissions

288. It shall be ensured that the following measures are taken to control emissions from vehicles being used in the construction activity:

- Periodically check and conduct maintenance of the construction machinery and haul vehicles.
- Regularly change the engine oil and use new engines/machinery/equipment having good efficiency and fuel burning characteristics.
- Use of catalytic converters and low Sulphur fuels.
- The stack height of generators will be at least 3 meters above the ground.
- Training of the technicians and operators of the construction machinery and drivers of the vehicles.
- Air quality monitoring at the project site during the construction phase.

6.3.2 Community Health and Safety

Impacts

289. The WWTP development will involve the use of considerable heavy machinery at the project site along with posing the risk of community members falling into trenches. In addition, the risk to commuters on the road during the construction works will be significant and thus a number of precautionary measures will be necessary to minimize the risk of possible accidents.

Mitigation Measures

290. The following mitigation measures will be implemented:

- Work areas outside the project site, especially where machinery is involved, will be barricaded and will be constantly monitored to ensure that local residents, particularly children stay away while excavated areas being prepared for laying of pipelines and WWTP related infrastructure will also be cordoned off. Also, no machinery will be left unattended, particularly in running condition.
- Local communities in the project area will be briefed on traffic safety, especially women who are the main care providers to children.
- Speed limit of 20 km/hr will be maintained by all project related vehicles and nighttime driving of project vehicles will be limited where possible.
- Educate drivers on safe driving practices to minimize accidents and to prevent spill of hazardous substances and other construction materials during transport.

6.3.3 Occupational Health and Safety

Impacts

291. There is invariably a safety risk when construction works for the WWTP are conducted, and precautions will be needed to ensure the safety of the workers.

292. The major safety hazards expected during the proposed activities are as follows:²⁶

Accident Hazards

- Falls from height, especially when standing/working on ladders;
- Slips, trips and falls, especially while carrying heavy or bulky loads;
- Cuts and injuries caused by sharp instruments and tools;
- Hazard of suffocation from asphyxiant gases released in sewerage systems, or from oxygen deficiency, during maintenance and cleaning operations;
- Burns caused by hot parts of equipment, steam lines etc, by release of hot water or steam;
- Electric traumas, caused by defective installations and equipment, especially portable;
- Musculoskeletal injury (especially of back), resulting from lifting and moving of

²⁶ https://www.ilo.org/wcmsp5/groups/public/---ed_protect/---protrav/---safework/documents/publication/wcms_192256.pdf

heavy loads;

Physical Hazards

- Exposure to cold and/or heat stress, as a result of rapid movement between cold and hot areas;
- Exposure to UV radiation during welding operations;

Chemical Hazards

- Exposure to various chemicals, such as: adhesives, caulking compounds, fluxes (solder), hydrochloric acid, zind chloride, tar and solvents, various greases and inorganic lead;

Biological Hazards

- Exposure to parasites, such as hookworm, ascaris, and various mites, chiggers and ticks;

Ergonomic, psychosocial and organizational factors

- Psychological stress due to dissatisfaction at work due to issues with peers, superiors etc.;
- General ill feeling as a result of work in confined spaces and development of 'sick building syndrome';

Mitigation Measures

293. The Contractor will be required to take measures such as:

- Ensuring that all workers are provided with and use appropriate Personal Protective Equipment (helmet, hand gloves, boots, masks etc);
- Follow standard practices of safety checks as prescribed before use of equipment;
- Provide on-site Health and Safety Training for all site personnel;

294. The Contractor will be required to prepare and implement an effective Worker Health and Safety Plan that is supported by trained first aid personnel and emergency response facilities. Construction contracts will include standard Worker Health and Safety measures and contractors will be bound to implement these fully. This will include mandatory wearing of dust masks for any cement handling operations or at any area where cement dust is in the air.

295. Monitoring will be required to ensure that the health and safety plan based on contract specifications is followed. Cement feed hopper areas will be inspected daily to ensure compliance with the requirement of dust masks.

296. Based on the type of hazard applicable during the proposed works at site, the following mitigation measures as per IFC guidelines for Occupational Health and Safety (OH&S) must be implemented:²⁷

Physical Hazards

Rotating and Moving Equipment

297. Injury or death can occur from being trapped, entangled, or struck by machinery parts due to unexpected starting of equipment or unobvious movement during operations. Recommended protective measures include:

- Designing machines to eliminate trap hazards and ensuring that extremities are kept out of harm's way under normal operating conditions. Examples of proper design considerations include two-hand operated machines to prevent amputations or the availability of emergency stops dedicated to the machine and placed in strategic locations. Where a machine or equipment has an exposed moving part or exposed pinch point that may endanger the safety of any worker, the machine or equipment should be equipped with, and protected by, a guard or other device that prevents access to the moving part or pinch point. Guards should be designed and installed in conformance with appropriate machine safety standards.
- Turning off, disconnecting, isolating, and de-energizing (Locked Out and Tagged Out) machinery with exposed or guarded moving parts, or in which energy can be stored (e.g. compressed air, electrical components) during servicing or maintenance.
- Designing and installing equipment, where feasible, to enable routine service, such as lubrication, without removal of the guarding devices or mechanisms.

Noise

- No employee should be exposed to a noise level greater than 85 dB(A) for a duration of more than 8 hours per day without hearing protection. In addition, no unprotected ear should be exposed to a peak sound pressure level (instantaneous) of more than 140 dB(C).
- The use of hearing protection should be enforced actively when the equivalent sound level over 8 hours reaches 85 dB(A), the peak sound levels reach 140 dB(C), or the average maximum sound level reaches 110dB(A). Hearing protective devices provided should be capable of reducing sound levels at the ear to at least 85 dB(A).

²⁷ <https://www.ifc.org/wps/wcm/connect/1d19c1ab-3ef8-42d4-bd6b-cb79648af3fe/2%2BOccupational%2BHealth%2Band%2BSafety.pdf?MOD=AJPERES&CVID=ls62x8l>

- Although hearing protection is preferred for any period of noise exposure in excess of 85 dB(A), an equivalent level of protection can be obtained, but less easily managed, by limiting the duration of noise exposure. For every 3 dB(A) increase in sound levels, the 'allowed' exposure period or duration should be reduced by 50 percent.
- Prior to the issuance of hearing protective devices as the final control mechanism, use of acoustic insulating materials, isolation of the noise source, and other engineering controls should be investigated and implemented, where feasible.
- Periodic medical hearing checks should be performed on workers exposed to high noise levels.

Vibration

298. Exposure to hand-arm vibration from equipment such as hand and power tools, or whole-body vibrations from surfaces on which the worker stands or sits, should be controlled through choice of equipment, installation of vibration dampening pads or devices, and limiting the duration of exposure. Limits for vibration and action values. Exposure levels should be checked on the basis of daily exposure time and data provided by equipment manufacturers.

Electrical

299. Exposed or faulty electrical devices, such as circuit breakers, panels, cables, cords and hand tools, can pose a serious risk to workers. Overhead wires can be struck by metal devices, such as poles or ladders, and by vehicles with metal booms. Vehicles or grounded metal objects brought into close proximity with overhead wires can result in arcing between the wires and the object, without actual contact. Recommended actions include:

- Marking all energized electrical devices and lines with warning signs; ·
- Locking out (de-charging and leaving open with a controlled locking device) and tagging-out (warning sign placed on the lock) devices during service or maintenance;
- Checking all electrical cords, cables, and hand power tools for frayed or exposed cords and following manufacturer recommendations for maximum permitted operating voltage of the portable hand tools; ·
- Double insulating / grounding all electrical equipment used in environments that are, or may become, wet; using equipment with ground fault interrupter (GFI) protected circuits; ·
- Protecting power cords and extension cords against damage from traffic by shielding or suspending above traffic areas; ·

- Appropriate labeling of service rooms housing high voltage equipment ('electrical hazard') and where entry is controlled or prohibited; ·
- Rubber tired construction or other vehicles that come into direct contact with, or arcing between, high voltage wires may need to be taken out of service for periods of 48 hours and have the tires replaced to prevent catastrophic tire and wheel assembly failure, potentially causing serious injury or death;
- Conducting detailed identification and marking of all buried electrical wiring prior to any excavation work.

Eye Hazards

300. Solid particles from a wide variety of industrial operations, and / or a liquid chemical spray may strike a worker in the eye causing an eye injury or permanent blindness. Recommended measures include:

- Use of machine guards or splash shields and/or face and eye protection devices, such as safety glasses with side shields, goggles, and/or a full face shield. Specific Safe Operating Procedures (SOPs) may be required for use of sanding and grinding tools and/or when working around liquid chemicals. Frequent checks of these types of equipment prior to use to ensure mechanical integrity is also good practice. Machine and equipment guarding should conform to standards published by organizations such as CSA, ANSI and ISO. ·
- Moving areas where the discharge of solid fragments, liquid, or gaseous emissions can reasonably be predicted (e.g. discharge of sparks from a metal cutting station, pressure relief valve discharge) away from places expected to be occupied or transited by workers or visitors. Where machine or work fragments could present a hazard to transient workers or passers-by, extra area guarding or proximity restricting systems should be implemented, or PPE required for transients and visitors.
- Provisions should be made for persons who have to wear prescription glasses either through the use overglasses or prescription hardened glasses.

Welding/Hot Work

301. Welding creates an extremely bright and intense light that may seriously injure a worker's eyesight. In extreme cases, blindness may result. Additionally, welding may produce noxious fumes to which prolonged exposure can cause serious chronic diseases. Recommended measures include: ·

- Provision of proper eye protection such as welder goggles and/or a full-face eye shield for all personnel involved in, or assisting, welding operations. Additional methods may include the use of welding barrier screens around the specific work station (a solid piece of light metal, canvas, or plywood designed to block welding light from others). Devices to extract and remove noxious fumes at the source may also be required. ·

- Special hot work and fire prevention precautions and Standard Operating Procedures (SOPs) should be implemented if welding or hot cutting is undertaken outside established welding work stations, including 'Hot Work Permits, stand-by fire extinguishers, stand-by fire watch, and maintaining the fire watch for up to one hour after welding or hot cutting has terminated. Special procedures are required for hot work on tanks or vessels that have contained flammable materials.

Industrial Vehicle Driving and Site Traffic

302. Poorly trained or inexperienced industrial vehicle drivers have increased risk of accident with other vehicles, pedestrians, and equipment. Industrial vehicles and delivery vehicles, as well as private vehicles on-site, also represent potential collision scenarios. Industrial vehicle driving and site traffic safety practices include:

- Training and licensing industrial vehicle operators in the safe operation of specialized vehicles such as forklifts, including safe loading/unloading, load limits. ·
- Ensuring drivers undergo medical surveillance. ·
- Ensuring moving equipment with restricted rear visibility is outfitted with audible back-up alarms. ·
- Establishing rights-of-way, site speed limits, vehicle inspection requirements, operating rules and procedures (e.g. prohibiting operation of forklifts with forks in down position), and control of traffic patterns or direction. ·
- Restricting the circulation of delivery and private vehicles to defined routes and areas, giving preference to 'one-way' circulation, where appropriate.

Ergonomics, Repetitive Motion, Manual Handling

303. Injuries due to ergonomic factors, such as repetitive motion, overexertion, and manual handling, take prolonged and repeated exposures to develop, and typically require periods of weeks to months for recovery. These OHS problems should be minimized or eliminated to maintain a productive workplace. Controls may include: ·

- Facility and workstation design with 5th to 95th percentile operational and maintenance workers in mind. ·
- Use of mechanical assists to eliminate or reduce exertions required to lift materials, hold tools and work objects, and requiring multi-person lifts if weights exceed thresholds. ·
- Selecting and designing tools that reduce force requirements and holding times, and improve postures. ·
- Providing user adjustable work stations. ·

- Incorporating rest and stretch breaks into work processes, and conducting job rotation. ·
- Implementing quality control and maintenance programs that reduce unnecessary forces and exertions. ·
- Taking into consideration additional special conditions such as left-handed persons.

Working at Heights

304. Fall prevention and protection measures should be implemented whenever a worker is exposed to the hazard of falling more than two meters; into operating machinery; into water or other liquid; into hazardous substances; or through an opening in a work surface. Fall prevention / protection measures may also be warranted on a case-specific basis when there are risks of falling from lesser heights. Fall prevention may include:

- Installation of guardrails with mid-rails and toe boards at the edge of any fall hazard area. ·
- Proper use of ladders and scaffolds by trained employees. ·
- Use of fall prevention devices, including safety belt and lanyard travel limiting devices to prevent access to fall hazard area, or fall protection devices such as full body harnesses used in conjunction with shock absorbing lanyards or self-retracting inertial fall arrest devices attached to fixed anchor point or horizontal life-lines. ·
- Appropriate training in use, serviceability, and integrity of the necessary PPE. ·
- Inclusion of rescue and/or recovery plans, and equipment to respond to workers after an arrested fall.

Physical Hazards

Air Quality

305. Poor air quality due to the release of contaminants into the work place can result in possible respiratory irritation, discomfort, or illness to workers. Employers should take appropriate measures to maintain air quality in the work area. These include: ·

- Maintaining levels of contaminant dusts, vapors and gases in the work environment at concentrations below those recommended as TWA-TLV's (threshold limit value)— concentrations to which most workers can be exposed repeatedly (8 hours/day, 40 hrs/week, week-after week), without sustaining adverse health effects. ·
- Developing and implementing work practices to minimize release of contaminants into the work environment including:

- Direct piping of liquid and gaseous materials
- Minimized handling of dry powdered materials; o Enclosed operations
- Local exhaust ventilation at emission/release points
- Vacuum transfer of dry material rather than mechanical or pneumatic conveyance
- Indoor secure storage, and sealed containers rather than loose storage
- Where ambient air contains several materials that have similar effects on the same body organs (additive effects).

Fire and Explosions

306. Fires and or explosions resulting from ignition of flammable materials or gases can lead to loss of property as well as possible injury or fatalities to project workers. Prevention and control strategies include:

- Storing flammables away from ignition sources and oxidizing materials. Further, flammables storage area should be:
 - Remote from entry and exit points into buildings
 - Away from facility ventilation intakes or vents
 - Have natural or passive floor and ceiling level ventilation and explosion venting
 - Use spark-proof fixtures
 - Be equipped with fire extinguishing devices and self closing doors, and constructed of materials made to withstand flame impingement for a moderate period of time .
- Providing bonding and grounding of, and between, containers and additional mechanical floor level ventilation if materials are being, or could be, dispensed in the storage area. .
- Where the flammable material is mainly comprised of dust, providing electrical grounding, spark detection, and, if needed, quenching systems.
- Defining and labeling fire hazards areas to warn of special rules (e.g. prohibition in use of smoking materials, cellular phones, or other potential spark generating equipment). .
- Providing specific worker training in handling of flammable materials, and in fire prevention or suppression.

Corrosive, oxidizing, and reactive chemicals

307. Corrosive, oxidizing, and reactive chemicals present similar hazards and require similar control measures as flammable materials. However, the added hazard of these chemicals is that inadvertent mixing or intermixing may cause serious adverse reactions. This can lead to the release of flammable or toxic materials and gases, and may lead directly to fires and explosions. These types of substances have the additional hazard of causing significant personal injury upon direct contact, regardless of any intermixing issues. The following controls should be observed in the work environment when handling such chemicals:

- Corrosive, oxidizing and reactive chemicals should be segregated from flammable materials and from other chemicals of incompatible class (acids vs. bases, oxidizers vs. reducers, water sensitive vs. water based, etc.), stored in ventilated areas and in containers with appropriate secondary containment to minimize intermixing during spills.
- Workers who are required to handle corrosive, oxidizing, or reactive chemicals should be provided with specialized training and provided with, and wear, appropriate PPE (gloves, apron, splash suits, face shield or goggles, etc).
- Where corrosive, oxidizing, or reactive chemicals are used, handled, or stored, qualified first-aid should be ensured at all times. Appropriately equipped first-aid stations should be easily accessible throughout the place of work, and eye-wash stations and/or emergency showers should be provided close to all workstations where the recommended first-aid response is immediate flushing with water.

Biological Hazards

308. Biological agents represent potential for illness or injury due to single acute exposure or chronic repetitive exposure. Biological hazards can be prevented most effectively by implementing the following measures:

- If the nature of the activity permits, use of any harmful biological agents should be avoided and replaced with an agent that, under normal conditions of use, is not dangerous or less dangerous to workers. If use of harmful agents cannot be avoided, precautions should be taken to keep the risk of exposure as low as possible and maintained below internationally established and recognized exposure limits.
- Work processes, engineering, and administrative controls should be designed, maintained, and operated to avoid or minimize release of biological agents into the working environment. The number of employees exposed or likely to become exposed should be kept at a minimum.
- The employer should review and assess known and suspected presence of biological agents at the place of work and implement appropriate safety measures, monitoring, training, and training verification programs.
- Measures to eliminate and control hazards from known and suspected biological agents at the place of work should be designed, implemented and maintained in

close co-operation with the local health authorities and according to recognized international standards.

6.3.4 Noise

Impacts

309. The WWTP development will result in different construction equipment and machinery being used which will generate high noise levels at the project site and in the project area.
310. The detailed mapping of sensitive receptors has been conducted and the types of receptors and their respective distances from the work sites are provided earlier. However, any required mitigation measures that shall be proposed will be to control potential impacts on noise to prevent any long-term impacts within the project area.
311. The assessment of the noise impacts on the sensitive receptors that have been identified at various locations in the project area depend upon:
- Characteristics of noise source (instantaneous, intermittent or continuous in nature)
 - Time of day at which noise occurs, and
 - Location of noise source
312. Each construction phase has its unique noise characteristics due to use of different equipment items. The potential sources of noise during the preparation, construction, and worksite closure phases for the WWTP works include equipment, machinery, and transportation used for the construction activities. The equipment used for construction will be the major source of noise.
313. The construction activities will include use of generators, excavators, concrete mixing trucks and back up alarms, which can generate significant noise.
314. Since various modern machines are acoustically designed to generate low noise levels, any high noise levels that might be generated will only be for a short duration during the construction phase.
315. Depending on the construction equipment used and its distance from the receptors, the community and the workers may typically be exposed to intermittent and variable noise levels. During the day, such noise results in general annoyance and can interfere with sleep during the night. In general, human sound perception is such that a change in sound level of 3 dB is just noticeable, a change of 5 dB is

clearly noticeable, and a change of 10 dB is perceived as a doubling or halving of sound level.

316. Due to the various construction activities, there will be temporary noise impacts in the immediate vicinity of the project site. The movement of heavy vehicles, loading, transportation and unloading of construction materials produces significant noise during the construction stage. However, these increased noise levels will prevail only for a short duration during the construction phase.

317. The **Table 6.4** below represents typical noise levels from various construction equipment items. It should be noted that the values indicated in the table may differ depending on the brand and age of machinery provided/used by construction company.

Table 6.4: Construction Equipment Noise Ranges, dB(A)

Equipment	Peak Noise Range at 15 m	Typical Peak Sound Level in a Work Cycle ^a at 15 m	Typical 'Quieted Equipment' Sound Level ^b at 15 m	Construction Phase		
				Earthworks	Structures	Installation
Batching plant	82-86	84	81		Y	
Concrete mixers	76-92	85	82		Y	
Cranes	70-94	83	80		Y	Y
Excavators	74-92	85	82	Y		
Front loader	77-94	85	82	Y	Y	Y
Water bowsers	85-93	88	85	Y	Y	Y
Graders	72-92	85	82	Y		
Bulldozers	65-95	85	80	Y		
Pavers	87-89	88	80	Y		
Pumps	68-72	76	75	Y	Y	Y
Diesel generators	72-82	81	77		Y	Y
Drilling machines	82-98	90	87		Y	Y
Compressors	74-88	81	71		Y	
Dumpers	77-96	88	83	Y	Y	
Dump/flatbed Truck	75-85	80	77	Y	Y	Y

Sources: USEPA, 1971; <http://www.waterrights.ca.gov/EIRD/text/Ch11-Noise.pdf>;
http://www.lacsd.org/LWRP%202020%20Facilities%20Plan%20DEIR/4_6_Noise.pdf;
<http://newyorkbiz.com/DSEIS/CH18Construction.pdf>

Notes:

a. Where typical value is not cited in literature, mean of the peak noise range is assumed

- b. Quieted equipment can be designed with enclosures, mufflers, or other noise-reducing features. Where data is not available, a 3 dB reduction is assumed

318. Precise information on the type, quantity and location of equipment to be used during the construction phase is not available at this stage and will be dependent on the working methods of the selected contractors. However, preliminary calculations have been conducted to provide a general magnitude of the noise levels during various construction phases.
319. The mitigation measures listed below shall be implemented to minimize noise levels during the construction activity as far as possible.

Mitigation Measures

320. The following mitigation measures will be implemented:
- Equipment noise will be reduced at source by proper design, maintenance and repair of construction machinery and equipment. Noise from vehicles and power generators will be minimized by use of proper silencers and mufflers.
 - Excessive noise emitting equipment will not be allowed to operate and will be replaced.
 - Blowing of horns will be prohibited on access roads to work sites.
 - As a rule, the operation of heavy equipment shall be conducted in daylight hours.
 - Construction equipment, which generates excessive noise, shall be enclosed or fitted with effective silencing apparatus to minimize noise.
 - Well-maintained haulage trucks will be used with speed controls.

6.3.5 Hazardous and Non-Hazardous Waste Management

Impacts

321. In the absence of national or domestic regulations and a waste management system in the project areas, waste disposal of materials containing contents of both hazardous and non hazardous nature such as scrap wood, bricks, concrete, asphalt, plumbing fixtures, piping, insulation (asbestos and non-asbestos), metal scraps, oil, electrical wiring and components, chemicals, paints, solvents etc. can potentially become a serious environmental issue, particularly with the local contractors. To avoid any potential issue, the CIU in collaboration with the PMU will need to impose adequate internal controls.

Mitigation measures

322. A waste management plan will be developed prior to the start of construction. This plan will cater to sorting of hazardous and non-hazardous materials prior to

disposal, placing of waste bins at the project sites for waste disposal and an onsite hazardous waste storage facility.

323. Licensed waste contractors will be engaged to dispose off all non-hazardous waste material that cannot be recycled or reused.

324. Training will be provided to personnel for identification, segregation and management of waste.

6.3.6 Camp & Batching Plant Effluent

Impacts

325. The staff and labor camps for the construction of the proposed WWTP will be a source of wastewater generated from the toilets, washrooms and the kitchen. The wastewater will not meet the national environmental standards and will therefore need treatment prior to disposal.

326. The project sites where construction is being conducted must not be treated by the project staff and/or labor as a public toilet or for disposal of camp effluent.

Mitigation measures

327. It will be ensured that no untreated effluent is released to the environment.

328. A closed sewage treatment system will treat the effluent, which will then be disposed of in a soak pit or will be used for plantation. The sewage treatment plants will be installed at each respective labor camp based on the number of laborers residing at the respective camp.

329. Water being released from any batching plant(s) must be treated as per requirements of PEQS prior to release to sewerage system/any other water body.

6.3.7 Soil Erosion and Sedimentation

Impacts

330. The majority of the works proposed for development of the WWTP may result in soil erosion and sedimentation.

Mitigation measures

331. Any drainage structures, culverts or pipes crossing the project site may need to be modified or protected and the detailed designs must make provisions to protect or re-provision all infrastructure that may be affected by the construction works.

6.3.8 Soil Contamination

Impacts

332. During the project construction, spills of fuel, lubricants and chemicals can take place while transferring from one container to another or during refueling. Also, during maintenance of equipment and vehicles, through leakages from equipment and containers and as a result of traffic accidents.
333. Depending on the nature of the material, location of spill and quantity of spill, the soil can get contaminated.

Mitigation measures

334. It will be ensured that spill prevention trays are provided and used during refueling. Also, on-site maintenance of construction vehicles and equipment will be avoided as far as possible. In case on-site maintenance is unavoidable, tarpaulin or other impermeable material will be spread on the ground to prevent contamination of soil.
335. Regular inspections will be carried out to detect leakages in construction vehicles and equipment and all vehicles will be washed in external commercial facilities.
336. Fuels, lubricants and chemicals will be stored in covered bounded areas, underlain with impervious lining. Appropriate arrangements, including shovels, plastic bags and absorbent materials will be available near fuel and oil storage areas.

6.3.9 Employment Conflicts

Impacts

337. The proposed WWTP project is not likely to create any significant permanent job opportunities. Even unskilled and semi-skilled employment opportunities that are likely to be created will be for a short period, while the project is constructed. As persons with relevant skills may be available locally, people from the project area are likely to fill a significant number of the semi-skilled and skilled jobs.
338. This issue of provision of jobs can become particularly problematic if it is perceived by the local population that a significant number of construction-related jobs opportunities are not given to people from the local community. This can result in friction between local residents and construction workers from outside of the community.

Mitigation measures

339. The Construction Contractor will adopt a transparent hiring policy. Prior to the commencement of the construction activity, the local communities in the project area will be informed of the employment policy in place and number of people that can be employed for this project.

340. It will be ensured that maximum number of unskilled and semi-skilled jobs will be provided to the residents of the project area.

341. The PMU will ensure a balanced process of employment of the communities in the project area with preference given to those most directly affected by the project.

6.3.10 Communicable diseases

Impacts

342. Communicable diseases such as COVID-19 and HIV may be introduced due to the immigration of workers associated with the project.

Mitigation measures

343. A communicable diseases prevention program will be prepared for construction workers or residents near the construction sites.

6.3.11 Vegetation and Wildlife Loss

Impacts

344. The project consists of a semi-urban environment located in the outskirts of Sahiwal city with limited human settlements and activities and thus contains limited vegetation cover and limited wildlife of any significance as common in areas located close to urban centers.

345. No impact on vegetation and wildlife is expected since no trees are expected on the project site. There are only minor shrubs and bushes that will be cleared up, if felt necessary, during the site preparation stage of the project.

Mitigation measures

346. No hunting or killing of animals will be permitted.

347. No cutting down of vegetation or using vegetation or trees as firewood will be permitted.

6.3.12 Historical/Archaeological Sites

348. No historical/archaeological sites have been identified in the project area or project site.

Mitigation measures

349. If evidence of any archaeological remains is found during the construction activities, the excavation work will be stopped immediately, and necessary next steps taken to identify the archaeological discovery based on the 'Chance Find' procedures provided as **Annexure K**.

6.4 Impacts Associated with Operation of WWTP


350. The potential impacts from operation of the WWTP are provided as **Table 6.5** below.

Operation Phase

Table 6.5: Screening of Possible Impacts during Operation Phase

S/No.	Potential Impact	Likelihood (Certain, Likely, Unlikely, Rare)	Consequence (Catastrophic, Major, Moderate, Minor)	Risk Level (Significant, Medium, Low)
1	Possible Emergencies and Plant Failure	Unlikely	Major	Medium
2	Odor generation	Likely	Major	Medium
3	Improper Disposal of Sludge	Unlikely	Major	Medium
4	Disease Vector Generation & Transmission	Likely	Major	Medium
5	Improvements in Public Health	Positive impacts expected		
6	Lower Loads on Ecosystem	Positive impacts expected		
7	Generation and use of byproducts i.e. Sludge for agriculture	Positive impacts expected		

 Critical Risk Level

 Significant Risk Level

- Medium Risk Level
- Low Risk Level
-Positive Impacts

6.4.1 Possible emergencies and plant failure

Impacts

351. Operational difficulties may be experienced at plant start up or during periods when process equipment malfunctions, particularly the equipment providing aeration to certain process areas. Even under such scenarios, the effluent discharged would be of limited volume and would still be of better quality and an improvement over the existing condition where raw and untreated wastewater is being directly discharged into the different water bodies. Chlorination of the effluent could be increased under these conditions to kill pathogenic organisms if the need for chlorination is demonstrated.
352. The frequency of such incidents is likely to remain low as long as adequate training of operator personnel is maintained and supplies of spare parts are kept available and utilized as recommended to keep all units operational at close to design efficiency levels. The most likely impact scenario would be that large quantities of sludge would accumulate in the lagoons for an extended time period, leading to untreated wastewater needing to be discharged directly into the environment until the required technical issue has been resolved. This could lead to short term adverse impacts on the fish and other biota during the period of the release and for a period of time thereafter.

Mitigation measures

353. The steps laid out in the Emergency Response Plan, provided as **Annexure D** will be implemented.
354. Operator Personnel training on a pre-defined frequency, atleast once every quarter, shall be ensured to continue refreshing of the Standard Operating Procedures laid out in the Emergency Response Plan in case of possible emergencies and/or plant failure.
355. Preventive maintenance must be ensured on a pre-defined frequency with required spare parts available at the WWTP premises to ensure quick replacement of the faulty component(s) in order to resolve the technical issue and bring the plant back into operation at the earliest.

6.4.2 Improper disposal of Sludge

Impacts

356. The estimated amount of sludge to be produced would be about 15,000-19,000 m³/annum during year 2022 to year 2029 respectively. This sludge to be produced as a by-product of the operations of the WWTP must be disposed off in accordance with international good practices to ensure there is no environmental degradation and other unexpected impacts such as disease vector generation etc. resulting from the improper disposal of the sludge.

Mitigation measures

357. A detailed strategy will be developed on management and disposal of the sludge to be produced as a by-product of the operations of the WWTP.

358. Licensed third party vendors will be contracted on long term arrangements to manage the disposal of the sludge in an environmentally beneficial manner in accordance with international good practices.

6.4.3 Odor generation

Impacts

359. It is possible that the operation of the WWTP and particularly the wastewater as it will be transported to the APs and onwards to the next lagoons for remaining stages of treatment may result in certain odor emissions.

360. Due to anaerobic digestion of solids settling at the bottom of the APs, odor is mainly caused by production of H₂S gas. Hydrogen sulfide, formed mainly by the anaerobic reduction of sulfate by sulfate-reducing bacteria. However, in aqueous solution, hydrogen sulfide is present as either dissolved hydrogen sulfide gas (H₂S) or the bisulfide ion (HS⁻), with the sulfide ion (S²⁻) only being formed in significant quantities at high pH. As the pH values normally found in well design anaerobic ponds is usually around 7.5, most of the sulfide is present as the odorless bisulfide ion.

361. Odor is not expected to be a problem if APs are designed on recommended loading rates and sulfate concentration in wastewater is less than 500 mg/l. In wastewater characterization for Sahiwal city, sulfate concentration in raw wastewater is in the range of 380- 448 mg/l.

362. As APs are designed on recommended loading rate and sulfate concentrations are also within limits, it is anticipated that if APs are properly maintained and not overloaded, there will be minimum chances of nuisance being caused due to odor.

The Wind Rose for Sahiwal City (provided as **Figure 4.2**) shows that the predominant wind direction is from the South West (SW) and South South West (SSW) directions. As a result, the potential impact on the households from any airborne related impacts, particularly during WWTP operations, such as odor, would be minimal as can be seen in the Corridor of Impact provided as Figure 6.1 below. The only receptor to be potentially impacted from any airborne related impact would be village No.66 (Chak No. 66), but even that impact is expected to be minimal since the nearest boundary of the village to the WWTP boundary is over 700 meters (0.7 km) away.

Mitigation measures

363. As part of the existing detailed design, in order to address any potential odor issue, a buffer zone of 50 feet wide all around the WWTP site consisting of thick plantation will be ensured to save the surrounding population from any adverse nuisance due to odor. This boundary of plantation can also be observed in the WWTP layouts.
364. Furthermore, all possible measures must be implemented to curb and control the odor generation from the WWTP operations by using odor controlling equipment at the WWTP and keeping all odor generating processes in a controlled environment.

6.4.4 Disease Vector Generation & Transmission

Impacts

365. Considering the nature of the project with large volumes of wastewater being treated in the APs and subsequent ponds along with sludge being generated from the wastewater treatment process, there is a high risk of spread of different types of diseases due to disease vectors that could be generated from the stagnant water and the sludge, such as mosquitoes (including the specific mosquito responsible for spreading of dengue fever), flies, moths etc. that could carry the diseases to the receptors in the project area.
366. Workers and staff at the proposed WWTP facility and fields where treated wastewater or sludge will be applied, as well as operators of sludge collection vehicles, can be exposed to the many pathogens contained in sewage. Processing of sewage can generate bioaerosols which are suspensions of particles in the air consisting partially or wholly of microorganisms, such as bacteria, viruses, molds, and fungi. These microorganisms can remain suspended in the air for long periods of

time, retaining viability or infectivity. Workers may also be exposed to endotoxins, which are produced within a microorganism and released upon destruction of the cell and which can be carried by airborne dust particles. Vectors for sewage pathogens include insects (e.g., flies), rodents (e.g., rats) and birds (e.g., gulls).²⁸

Mitigation measures

367. The following measures must be implemented:

- Comprehensive plan must be developed and implemented to spray chemicals into the influent drains at different frequencies throughout the year based on the seasons;
- Minimize the sludge inventory present at the WWTP as far as possible to prevent breeding of disease vectors;
- Cover the sludge piles present at the WWTP as far as possible;
- Cover all influent drains leading to the APs and inject pesticides and/or chemicals as required to minimize/prevent breeding of disease vectors;
- Maintain good housekeeping in sewage processing and storage areas;
- Include in safety training program for workers, safe handling and personal hygiene practices to minimize exposure to pathogens and vectors;
- Use vacuum trucks or tugs for removal of fecal sludge instead of manual methods;
- Provide and require use of suitable personal protective clothing and equipment to prevent contact with wastewater (e.g., rubber gloves, aprons, boots, etc.). Especially provide prompt medical attention and cover any skin trauma such as cuts and abrasions to prevent infection and use protective clothing and goggles to prevent contact with spray and splashes;
- Provide areas for workers to shower and change clothes before leaving work and provide laundry service for work clothes. This practice also helps to minimize chemical and radionuclide exposure;
- Encourage workers at WWTP to wash hands frequently.

6.4.5 Improvements in Public Health

Impacts

368. The operation of the proposed WWTP will result in discharge of treated wastewater that will be meeting the PEQS standards and thus the different water quality parameters will be ensured to not exceed the pre-set threshold values.

²⁸ 3 U.S. Environmental Protection Agency, Environmental Regulations and Policy Control of Pathogens and Vector Attraction in Sewage Sludge (Including Domestic Septage) Under 40 CFR Part 503, EPA/625/R-92/013, Revised July 2003. <http://www.epa.gov/ord/NRMRL/Pubs/1992/625R92013.pdf>

369. This in turn will ensure that a number of the key toxic and hazardous chemical concentrations in the wastewater will be controlled and will not be allowed to enter the discharge water body. This is expected to result in an overall positive impact on the public health by preventing issues such as waterborne diseases, disease vector generation, groundwater aquifer contamination etc.

Mitigation measures

No measures required.

6.4.6 Lower loads on Ecosystems

Impacts

370. Wastewater effluent is a major contributor to a variety of water pollution problems. The poor quality of wastewater effluents is responsible for the degradation of the receiving surface water body. The release of raw and improperly treated wastewater onto water courses has both short and long term effects on the environment and human health. There is a significant adverse impact on the ecosystems in case untreated effluent is disposed into the environment, resulting in negative impacts on the aquatic ecology of the receiving body with indirect impacts also taking place on the terrestrial flora and fauna present in the areas in proximity to these water courses.

371. The WWTP operation will result in treated water within the PEQS standards being discharged into the environment and thus is expected to reduce the load on the aquatic and terrestrial habitats present in proximity to the receiving water bodies in the project areas and play a major role in improving the overall ecosystems of the project areas. Significant reductions in the existing nutrient loads from the untreated wastewater are expected with majority of the nitrogen-ammonia being converted via nitrification to nitrates. This is expected to reduce ammonia concentrations to levels below those that have been reported to be toxic to different marine life and is expected to retard potential eutrophication occurring in the different water courses in which the treated wastewater will be discharged.

Mitigation measures

No measures required.

6.4.7 Generation and Use of by-products i.e. Sludge for Agriculture

Impacts

372. The sludge to be generated as a by-product of the WWTP process is expected to be used in agriculture with the WWTP management engaging into long term contracts with third parties to develop value chains for removal of the sludge from the WWTP premises and transport in an environmentally sustainable manner in accordance with international good practices to the pre-identified vendors for use in agriculture.

Mitigation measures

No measures required.

6.5 Cumulative Impacts

373. No other infrastructure works are planned to be conducted in the WWTP project area while these project works shall be conducted. Thus, no cumulative impacts are expected.

6.6 Indirect and Induced Impacts

374. The potential impact of development of the WWTP in the project area has been examined, which indicated that the existing and planned infrastructure such as water supply, wastewater collection and treatment, municipal solid waste collection and disposal would be adequate to accommodate any potential population intake as a result of the proposed WWTP development. Impacts on the environment from air emissions, traffic and community noise, and treated effluent discharge have also been assessed and have found to be acceptable and within the carrying capacities of the environmental media.

375. Thus, negative indirect and induced impacts from the proposed WWTP works are not expected.

7 Environmental Management Plan & Institutional Requirements

7.1 Introduction

376. The Environmental Management Plan (EMP) is developed to eliminate and/or mitigate the impacts envisaged at the design, construction and operation stages.

377. The detailed EMP provided in this document as **Table 7.1** ensures that this sub-project has no detrimental effect on the surrounding environment. The Plan shall act as a guideline for incorporating environmental measures to be carried out by the contractors engaged for the proposed sub-project. It shall also be used for other parties concerned for mitigating possible impacts associated with each sub-project and will form part of the Contract documents to be considered alongside the specifications. This Plan shall act as the Environmental Management and Monitoring Plan during the construction phase of the sub-project and will allow for prompt implementation of effective corrective measures.

7.2 Environmental Management Plan (EMP)

378. The EMP attached with this report ensures the following:

- Delivery of the prescribed environmental outcomes during all phases of this sub-project;
- Formulating a system for compliance with applicable legislative requirements and obligations and commitments for this sub-project;
- Ensure that project design process incorporates best practice environmental design and sustainability principles to minimize potential impacts of construction on the environment and community.
- Ensure that the construction work procedures minimize potential impacts on the environment and community.
- Develop, implement and monitor measures that minimize pollution and optimize resource use.

7.3 Objectives of EMP

379. The EMP provides a delivery mechanism to address potential impacts of the project activities, to enhance project benefits and to outline standardized good practice to be adopted for all project works. The EMP has been prepared with the objectives of:

- Defining the roles and responsibilities of the project proponent for the implementation of EMP and identifying areas where these roles and responsibilities can be shared with other parties involved in the execution and

monitoring of the project;

- Outlining mitigation measures required for avoiding or minimizing potential negative impacts assessed by environmental study;
- Developing a monitoring mechanism and identifying requisite monitoring parameters to confirm effectiveness of the mitigation measures recommended in the study;
- Defining the requirements for communication, documentation, training, monitoring, management and implementation of the mitigation measures.

7.4 Environmental Management/Monitoring and Reporting

380. During the construction phase, the overall responsibility for the implementation and monitoring of the EMP rests with the City Manager – Sahiwal (CMS). The CMS, using the Project Management Consultant (PMC), will supervise the implementation of the proposed mitigation measures and monitor the implementation progress in the field.

381. The specific roles and responsibilities for environmental management and monitoring are provided in **Table 7.1** below. The expected costs for implementing any required mitigation measures are provided in **Table 7.7** below.

7.5 Institutional Arrangements

382. The environmental management plan will require involvement of the following organizations for its implementation:

i. Local Government and Community Development Department (LG&CDD)

383. The Local Government and Community Development Department (LG&CDD) of Punjab will be the executing agency (EA) of the project. Under the guidance of the Project Steering Committee, LG&CDD will be responsible for the overall execution of the project.

384. A Project Management Unit (PMU) has been established within LG&CDD to support LG&CDD.

ii. City Implementation Unit (CIU) - Sahiwal

385. The EA has established CIU in each of the two participating cities. The key role of the CIUs will be to support the cities in the implementation of the civil works components of the project.

7.5.1 Role of LG&CDD

386. The LG&CD Department, GoPb will:

- Act as the project executing agency (EA) for PICIIP;
- Establish a PMU, with adequate staff acceptable to ADB;
- Liaise with ADB to address any issues during design and implementation;
- Approve delegation of authorities to PMU and CIUs.

7.5.2 Role of PMU

387. The PMU will support LG&CD Department. The PMU will:

- Provide support to ADB missions;
- Coordinate activities with all stakeholders, review consultants, proposals, and provide overall guidance during various stages of project preparation;
- Act as a Secretariat to PSC headed by Chairman P&D Board;
- Manage and ensure safeguard due diligence and disclosure requirements including resettlement and environmental safeguards in accordance with ADB's Safeguard Policy Statement (2009) and government requirements;
- Manage and ensure effective implementation of the gender action plan;
- Ensure submission of all IEE requirements as per law by responsible entities; and
- Monitoring of activities in CIUs and the whole project.

7.5.3 Role of Municipal Corporation (MC)

388. The MC will:

- Facilitate land acquisition;
- Approve and implement all reforms related system, organizations, plans, and programs as required for the project including service delivery arrangements;
- Transfer assets and completed civil works to WSCs/USCs, as required for the projects and agreements; and
- Fill all vacancies in the MC, as per approved organogram and facilities required for CIU and Staff.

7.5.4 Role of City Implementation Unit (CIU)

389. The CIU will support the Municipal Corporations of Sahiwal in the following aspects:

- Conduct city level progress monitoring and reporting;
- Facilitate all monitoring requirements and reporting of GoPb and ADB;
- Ensure safeguard compliance and reporting in line with loan agreements;
- Monitor and ensure effective implementation of the gender action plan;
- Monitor city level activities for reporting and compliance.

7.5.5 Role of the ADB

390. The ADB will:

- Support the coordination and administration of the project;
- Provide guidance to LG&CD Department, PMU, MCs, and CIUs on implementation issues and project design;
- Disclose all safeguards documents, and monitor safeguards implementation;
- Monitor and report project performance;
- Conduct periodic review of the project;

7.5.6 Role of Project Contractor

391. The project contractor will be responsible for following items:

- Implementation of, or adherence to, all provisions of the IEE and EMP;
- Preparation of site specific EMPs (SSEMPs) as required.
- Contractor's environmental performance will rest with the person holding the highest management position within the contractor's organization. Reporting to their management, the contractor's site managers will be responsible for the effective implementation of the EMP.
- The Contractor will be required to have qualified Environmental Specialists in their team to ensure all mitigation measures are implemented during the different development phases of the project.

7.6 Monitoring Parameters

392. A monitoring plan for the construction phase of the project, indicating environmental parameters, frequency and applicable standards is provided below as **Table 7.3** below.

393. During the procurement/pre-construction period, the monitoring activities will focus on (i) checking the contractor's bidding documents, particularly to ensure that all necessary environmental requirements have been included; and (ii) checking that the contract documents' references to environmental mitigation measures requirements have been incorporated as part of contractor's assignment and making sure that any advance works are carried out in good time.

394. During the construction period, the monitoring activities will focus on ensuring that any required environmental mitigation measures are implemented to address possible impacts.

395. In general, the construction impacts will be manageable and no insurmountable impacts are predicted, provided that the EMP is implemented to its full extent as required in the Contract documents. However, experience suggests that some Contractors may not be familiar with this approach or may be reluctant to carry out some measures. For the proposed sub-project, in order that the Contractor is fully aware of the implications of the EMP and to ensure compliance, environmental

measures must be costed separately in the tender documentation and listed as BoQ items, and that payment milestones must be linked to environmental performance, vis a vis the carrying out of the EMP.

396. The effective implementation of the EMP will be audited as part of the loan conditions and the executing agency must be prepared for this. In this regard, the PMC will guide the design engineers and Contractors on the environmental aspects.

7.7 Environmental Training

7.7.1 Capacity Building and Training

397. Capacity building and training programs are necessary for the project staff in order to control the negative impacts resulting from the project construction and during its operation phase. They will also require trainings on monitoring and inspecting of such a project for environmental impacts and for implementation of mitigation measures.

398. The details of this capacity building and training program are presented in the **Table 7.7** below.

Table 7.1: Environmental Management Plan

Project Activities	Section	Impact	Mitigation Measures Recommended	Responsibility		Timing
				Execution	Monitoring	
Design/Pre-Construction Phase	1.1	Lack of Integration of IEE/EMP requirements into bidding documents	The proposed 'Safeguards unit' that should be developed at the PMU should be assigned the task to check that design and bid documents are responsive to key environmental, social and safety considerations, and that the proposed method of work reflects the boundaries defined in the EMP. The bid documents must include the EMP and its implementation cost must be reflected in the BoQ.	CIU	PMU	BC: during detailed designing of the sub-project
	1.2	Material Haul routes	The construction vehicles hauling materials along the Sahiwal city roads and anywhere where there are sensitive receptors such as hospitals, schools and/or roadside residences will be limited and the PMU in collaboration with the CIU will establish a route plan to minimize this disruption which shall be appended to the EMP.	CIU	PMU	BC: during detailed designing of the sub-project
	1.3	Identification of Locations for Labor Camps and ancillary facilities	<ul style="list-style-type: none"> In order to prevent a nuisance, specific locations shall be designated for development of the labor camps. All 	CIU	PMU	BC: during detailed designing of the sub-project

			<p>necessary facilities and amenities shall be provided in these camps such as electricity, sufficient supply of water, solid and liquid effluent waste disposal facilities etc.</p> <ul style="list-style-type: none"> ▪ The use of proper planning while identifying locations for the labor camps will ensure there is minimal disturbance to all key receptors and the traffic is not disrupted by labor camps being set up roadside next to the construction sites. 			
	1.4	Contractor's Environmental Safeguards Capacity	<p>So far, local contractor firms in Pakistan working on large and medium scale environmentally sensitive projects have an unsatisfactory record for complying with workplace and environmental safety regulations. To address this, the contractor will be required to define an Occupational and Environmental Health and Safety procedure for all work, including work camp operation, management of cement dust, and use of Personal Safety Equipment. These procedures should be developed and approved by</p>	CIU	PMU	BC: during detailed designing of the sub-project

			the PMU in collaboration with the CIU before the contractor commences any physical works on ground.			
Construction Phase	2.1	Air Quality	<ul style="list-style-type: none"> ▪ At the WWTP site and the immediately adjoining areas, water will be sprinkled every three hours and at a higher frequency if felt necessary, at all construction sites to suppress dust emissions. ▪ All heavy equipment and machinery shall be fitted in full compliance with the national and local regulations. ▪ Stockpiled soil and sand shall be slightly wetted before loading, particularly in windy conditions. ▪ Fuel-efficient and well-maintained haulage trucks shall be employed to minimize exhaust emissions. ▪ Vehicles transporting soil, sand and other construction materials shall be covered with tarpaulin. ▪ Limitations to speeds of such vehicles as felt necessary. Transport through densely populated area should be 	Contractor	PMC, CIU	DC

<p>Construction Phase (Continued...)</p>			<p>avoided.</p> <ul style="list-style-type: none"> ▪ Concrete plants to be controlled in line with statutory requirements and shall not be close to sensitive receptors. ▪ Stack height of generators will be at least 3 meters above the ground. ▪ Project traffic will maintain maximum speed limit of 20 km/hr on all unsealed roads within project area. ▪ A minimum distance of 300 meters will be ensured between batching plant(s) and the nearest community. ▪ The need for large stockpiles shall be minimized by careful planning of the supply of materials from controlled sources. Stockpiles should not be located within 50 m of schools, hospitals or other public amenities and shall be covered with tarpaulin when not in use and at the end of the working day to enclose dust. If large stockpiles (>25m³) of crushed materials are necessary, they should be enclosed with side barriers and also covered when not in use. 			
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			<p>It shall be ensured that the following measures are taken to control emissions from vehicles being used in the construction activity:</p> <ul style="list-style-type: none"> ▪ Periodically check and conduct maintenance of the construction machinery and haul vehicles. ▪ Regularly change the engine oil and use new engines/machinery/equipment having good efficiency and fuel burning characteristics. ▪ Use of catalytic converters and low Sulphur fuels. ▪ The stack height of generators will be at least 3 meters above the ground. ▪ Training of the technicians and operators of the construction machinery and drivers of the vehicles. ▪ Air quality monitoring at the project site during the construction phase. 			
	2.2	Community Health and Safety	<ul style="list-style-type: none"> ▪ Work areas outside the project site, especially where machinery is involved, will be barricaded and will be 	Contractor	PMC, CIU	DC

			<p>constantly monitored to ensure that local residents, particularly children stay away while excavated areas being prepared for laying of pipelines and WWTP related infrastructure will also be cordoned off. Also, no machinery will be left unattended, particularly in running condition.</p> <ul style="list-style-type: none"> ▪ Local communities in the project area will be briefed on traffic safety, especially women who are the main care providers to children. ▪ Speed limit of 20 km/hr will be maintained by all project related vehicles and nighttime driving of project vehicles will be limited where possible. ▪ Educate drivers on safe driving practices to minimize accidents and to prevent spill of hazardous substances and other construction materials during transport. 			
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	2.3	Occupational Health and Safety	<ul style="list-style-type: none"> ▪ Ensuring that all workers are provided with and use appropriate Personal Protective Equipment (helmet, hand gloves, boots, masks etc); ▪ Follow standard practices of safety checks as prescribed before use of equipment; ▪ Provide on-site Health and Safety Training for all site personnel; ▪ The Contractor will be required to prepare and implement an effective Worker Health and Safety Plan that is supported by trained first aid personnel and emergency response facilities. Construction contracts will include standard Worker Health and Safety measures and contractors will be bound to implement these fully. This will include mandatory wearing of dust masks for any cement handling operations or at any area where cement dust is in the air. 	Contractor	PMC, CIU	DC
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			<ul style="list-style-type: none"> Monitoring will be required to ensure that the health and safety plan based on contract specifications is followed. Cement feed hopper areas will be inspected daily to ensure compliance with the requirement of dust masks. 			
	2.4	Noise	<ul style="list-style-type: none"> Equipment noise will be reduced at source by proper design, maintenance and repair of construction machinery and equipment. Noise from vehicles and power generators will be minimized by use of proper silencers and mufflers. Excessive noise emitting equipment will not be allowed to operate and will be replaced. Blowing of horns will be prohibited on access roads to work sites. As a rule, the operation of heavy equipment shall be conducted in daylight hours. 	Contractor	PMC, CIU	DC

			<ul style="list-style-type: none"> ▪ Construction equipment, which generates excessive noise, shall be enclosed or fitted with effective silencing apparatus to minimize noise. ▪ Well-maintained haulage trucks will be used with speed controls. 			
	2.4	Hazardous and Non-Hazardous Waste Management	<ul style="list-style-type: none"> ▪ A waste management plan will be developed prior to the start of construction. This plan will cater to sorting of hazardous and non-hazardous materials prior to disposal, placing of waste bins at the project sites for waste disposal and an onsite hazardous waste storage facility. ▪ Licensed waste contractors will be engaged to dispose off all non-hazardous waste material that cannot be recycled or reused. ▪ Training will be provided to personnel for identification, segregation and management of waste. 	Contractor	PMC, CIU	DC

	2.5	Untreated disposal of effluent from worker camps and batching plants	<ul style="list-style-type: none"> ▪ It will be ensured that no untreated effluent is released to the environment. ▪ A closed sewage treatment system will treat the effluent, which will then be disposed of in a soak pit or will be used for plantation. The sewage treatment plants will be installed at each respective labor camp based on the number of laborers residing at the respective camp. ▪ Water being released from any batching plant(s) must be treated as per requirements of PEQS prior to release to sewerage system/any other water body. 	Contractor	PMC, CIU	DC
	2.7	Soil erosion and sedimentation	Any drainage structures, culverts or pipes crossing the project site may need to be modified or protected and the detailed designs must make provisions to protect or re-provision all infrastructure that may be affected by the construction works.	Contractor	PMC, CIU	DC
	2.8	Soil Contamination	<ul style="list-style-type: none"> ▪ It will be ensured that spill prevention 	Contractor	PMC, CIU	DC

			<p>trays are provided and used during refueling. Also, on-site maintenance of construction vehicles and equipment will be avoided as far as possible. In case on-site maintenance is unavoidable, tarpaulin or other impermeable material will be spread on the ground to prevent contamination of soil.</p> <ul style="list-style-type: none"> ▪ Regular inspections will be carried out to detect leakages in construction vehicles and equipment and all vehicles will be washed in external commercial facilities. ▪ Fuels, lubricants and chemicals will be stored in covered bounded areas, underlain with impervious lining. Appropriate arrangements, including shovels, plastic bags and absorbent materials will be available near fuel and oil storage areas. 			
	2.9	Employment Conflicts	<ul style="list-style-type: none"> ▪ The Construction Contractor will adopt 			

			<p>a transparent hiring policy. Prior to the commencement of the construction activity, the local communities in the project areas of Sahiwal city will be informed of the employment policy in place and number of people that can be employed for this project.</p> <ul style="list-style-type: none"> ▪ It will be ensured that maximum number of unskilled and semi-skilled jobs will be provided to the residents of Sahiwal city and adjoining areas. ▪ PMU will ensure a balanced process of employment of the communities in the project area with preference given to those most directly affected by the project. 			
	2.10	Communicable diseases	A communicable diseases prevention program will be prepared for construction workers or residents near the construction sites.	Contractor	PMC, CIU	DC
	2.11	Vegetation and Wildlife Loss	<ul style="list-style-type: none"> ▪ No hunting or killing of animals will be permitted. 	Contractor	PMC, CIU	DC

			<ul style="list-style-type: none"> No cutting down of vegetation or using vegetation or trees as firewood will be permitted. 			
	2.12	Historical/Archaeological Sites	If evidence of any archaeological remains is found during the construction activities, the excavation work will be stopped immediately and necessary next steps taken to identify the archaeological discovery based on the 'Chance Find' procedures	Contractor	PMC, CIU	DC
Operation Phase	3.1	Possible emergencies and plant failure	<ul style="list-style-type: none"> The steps laid out in the Emergency Response Plan, provided as Annexure D will be implemented. Operator Personnel training on a pre-defined frequency, atleast once every quarter, shall be ensured to continue refreshing of the Standard Operating Procedures laid out in the Emergency Response Plan in case of possible emergencies and/or plant failure. Preventive maintenance must be ensured on a pre-defined frequency with required spare parts available at the WWTP premises to ensure quick 	O&M Contractor	Sahiwal Waste Utility	DO

			replacement of the faulty component(s) in order to resolve the technical issue and bring the plant back into operation at the earliest.			
	3.2	Improper disposal of Sludge	<p>1. A detailed strategy will be developed on management and disposal of the sludge to be produced as a by-product of the operations of the WWTP.</p> <p>2. Licensed third party vendors will be contracted on long term arrangements to manage the disposal of the compost in an environmentally beneficial manner in accordance with international good practices.</p>	O&M Contractor	Sahiwal Waste Utility	DO
	3.3	Odor generation	<ul style="list-style-type: none"> As part of the existing detailed design, in order to address any potential odor issue, a buffer zone of 50 feet wide all around the WWTP site consisting of thick plantation will be ensured to save the surrounding population from any adverse nuisance due to odor. This boundary of plantation can also be 	O&M Contractor	Sahiwal Waste Utility	DO

			<p>observed in the WWTP layouts.</p> <ul style="list-style-type: none"> Furthermore, all possible measures must be implemented to curb and control the odor generation from the WWTP operations by using odor controlling equipment at the WWTP and keeping all odor generating processes in a controlled environment. 			
	3.4	Disease Vector Generation & Transmission	<ul style="list-style-type: none"> Comprehensive plan must be developed and implemented to spray chemicals into the influent drains at different frequencies throughout the year based on the seasons; Minimize the sludge inventory present at the WWTP as far as possible to prevent breeding of disease vectors; Cover the sludge piles present at the WWTP as far as possible; Cover all influent drains leading to the APs and inject pesticides and/or chemicals as required to minimize/prevent breeding of disease 	O&M Contractor	Sahiwal Waste Utility	DO

			<p>vectors;</p> <ul style="list-style-type: none"> ▪ Maintain good housekeeping in sewage processing and storage areas; ▪ Include in safety training program for workers, safe handling and personal hygiene practices to minimize exposure to pathogens and vectors; ▪ Use vacuum trucks or tugs for removal of fecal sludge instead of manual methods; ▪ Provide and require use of suitable personal protective clothing and equipment to prevent contact with wastewater (e.g., rubber gloves, aprons, boots, etc.). Especially provide prompt medical attention and cover any skin trauma such as cuts and abrasions to prevent infection and use protective clothing and goggles to prevent contact with spray and splashes; ▪ Provide areas for workers to shower 			
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			<p>and change clothes before leaving work and provide laundry service for work clothes. This practice also helps to minimize chemical and radionuclide exposure;</p> <ul style="list-style-type: none"> ▪ Encourage workers at WWTP to wash hands frequently. 			
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PMC : Project Management Consultant

BC : Before Construction

DC : During Construction

CIU : City Implementation Unit

DO : During Operation

Table 7.2: ‘Pre-Construction’ Environmental Monitoring Plan for Baseline Development

Parameter to be measured	Objective of Monitoring	Parameters to be Monitored	Measurements	Location	Frequency	Responsibility
Ambient Air Quality	To establish baseline air quality levels	CO,NO _x & PM ₁₀ (particulate matter smaller than 10 microns) concentration at receptor level	1-hr and 24-hr concentration levels	At three random receptor locations in the project area	Once	PMC

Ambient Noise	To establish baseline noise levels	Ambient noise level near receptors in project area	A-weighted noise levels – 24 hours, readings taken at 15 s intervals over 15 min. every hour, and then averaged	At three random receptor locations in the project area	Once	PMC
Water Quality of River Ravi	To establish baseline for surface water quality at discharge point of treated effluent into River Ravi	Water quality at discharge point of treated effluent into River Ravi	Water sample for comparison against PEQS parameters	At discharge point of treated effluent into River Ravi	Once	PMC
Groundwater Quality in vicinity of WWTP site	To establish groundwater quality in project area	Groundwater quality in project area	Water samples for comparison against PEQS parameters	At two locations around the WWTP site in the project area	Once	PMC

Table 7.3: Construction Phase Monitoring Requirements

Project Activity and Potential Impact	Objective of Monitoring	Parameters to be Monitored	Measurements	Location	Frequency	Responsibility
Noise Disturbance due to noise from construction activity	To determine the effectiveness of noise abatement measures on sound pressure levels	Ambient noise level at different locations in project area	A-weighted noise levels – 24 hours, readings taken at 15 s intervals over 15 min. every hour at 15 m from receptors, and then averaged	At three random receptor locations in project area	Quarterly basis on a typical working day	Contractor's Environmental officer, PMC
Air Quality Dust emissions from construction vehicles and equipment	To determine the effectiveness of dust control program on dust at receptor level	CO, NO _x & PM ₁₀ (particulate matter smaller than 10 microns) concentration at receptor level	1-hr and 24-hr concentration levels	At three random receptor locations in project area	Quarterly basis on a typical working day	Contractor's Environmental officer, PMC

Project Activity and Potential Impact	Objective of Monitoring	Parameters to be Monitored	Measurements	Location	Frequency	Responsibility
		Visible dust	Visual observation of size of dust clouds, their dispersion and the direction of dispersion	Construction site	Once daily during peak construction period	Contractor's Environmental officer, PMC
Safety precautions by Safety workers	To prevent accidents for workers and general public	Number of near miss events and accidents taking place	Visual inspections	Construction site	Once Daily	Contractor's Environmental officer, PMC
Soil Contamination	To prevent contamination of soil from oil and toxic chemical spills and leakages	Incidents of oil and toxic chemical spills	Visual inspections	At construction site and at vehicle and machinery refuelling & maintenance areas	Once a month	Contractor's Environmental officer, PMC
Solid Waste & Effluent disposal Insufficient procedures for waste collection, storage, transportation and disposal	To check the availability of waste management system and implementation	Inspection of solid and liquid effluent generation, collection, segregation, storage, recycling and disposal will be undertaken at all work sites in project area	Visual inspections	At work sites in project area	Once daily.	Contractor's Environmental officer, PMC

Table 7.4: 'Operation Phase' Environmental Monitoring Plan

Parameter to be measured	Objective of Monitoring	Parameters to be Monitored	Measurements	Location	Frequency	Responsibility
Water Quality of River Ravi	To assess quality of treated wastewater being discharged into River Ravi	Water quality at discharge point of treated effluent into River Ravi	Water sample for comparison against PEQS parameters	At discharge point of treated effluent into River Ravi	Bi-annual	PMC
Groundwater Quality in vicinity of WWTP site	To assess whether WWTP operation is causing any seepage into the groundwater aquifers in project area and contaminating it.	Groundwater quality in project area	Water samples for comparison against PEQS parameters	At two locations around the WWTP site in the project area	Bi-annual	PMC

Table 7.5: Capacity Development and Training Programme

Provided by	Organized by	Contents	No. of training events	Duration	Cost (PKR)
Pre-construction Phase Monitoring Consultants/Organizations offering specialized services in environmental management and monitoring	CIU & PMU	Short seminars and courses on: Environmental Management Plan and Environmental Monitoring Plan	Two seminars for Contractor management staff and project staff	1 day	100,000
Construction Phase Monitoring Consultants/Organizations offering specialized	CIU & PMU	Short seminars on Environmental risks associated with construction phase.	Two seminars for Contractor management staff and project	1 day	100,000

services in social management and monitoring		Development of Environmental Performance Indicators Occupational Health and Safety (OHS) issues	staff dealing in environment and social issues		
Total			200,000 (PKR 0.2 million)		

7.8 Environmental Management Costs

399. The **Table 7.7** below provides cost estimates for 'Pre-Construction phase' monitoring while **Tables 7.7** and **7.8** provides cost estimates for 'Construction phase' and 'Operation phase' monitoring of key environmental parameters.

400. The costs associated with implementation of the EMP and the necessary mitigation measures are provided as **Table 7.9** below. The **Table 7.10** below provides the 'Capacity development and training programme' for project contractors for the proposed project.

Table 7.6: Annual Cost Estimates for 'Pre-Construction Phase' Environmental Monitoring²⁹

Monitoring Component	Parameters	Quantity	Amount PKR	Details
Air Quality	CO, NO _x , PM ₁₀	3 (Once only at 3 locations)	90,000	3 readings @ PKR 30,000 per sample
Noise Levels	dB(A)	3 (Once only at 3 locations)	90,000	3 readings @ PKR 30,000 per reading
Contingencies			9,000	5% of monitoring cost
Total (PKR)			189,000	

Table 7.7: Annual Cost Estimates for 'Construction Phase' Environmental Monitoring³⁰

Monitoring Component	Parameters	Quantity	Amount PKR	Details
Air Quality	CO, NO _x , PM ₁₀	12 (Quarterly basis at 3 locations)	360,000	12 readings @ PKR 30,000 per sample
Noise Levels	dB(A)	12 (Quarterly basis at 3 locations)	360,000	12 readings @ PKR 30,000 per reading
Contingencies			36,000	5% of monitoring cost
Total (PKR)			756,000	

²⁹ For air quality monitoring: 'Passive samplers' such as test tubes can be used or 'Active samplers' with sorbent tubes can also be used.

For noise monitoring: sampling equipment with duration greater than 1 hour can be used.

Table 7.8: Annual Cost Estimates for 'Operation Phase' Environmental Monitoring³¹

Monitoring Component	Parameters	Quantity	Amount PKR	Details
Water Quality of River Ravi	PEQS	2 (bi-annual basis)	60,000	2 readings @ PKR 30,000 per sample
Groundwater Quality in vicinity of WWTP site	PEQS	4 (bi-annual basis @ 2 locations)	120,000	4 readings @ PKR 30,000 per reading
Contingencies			9,000	5% of monitoring cost
Total (PKR)			189,000	

Table 7.9: Estimated Costs for EMP Implementation

Item	Sub-Item	Estimated Total Cost (PKR)
Staff, audit and monitoring cost ¹	1 person for 24 months (@ 100,000 per month)	2,400,000
Monitoring Activities	Provided separately in Tables 7.7 and 7.8.	-
Mitigation Measures	As prescribed under EMP and IEE.	40,00,000
(i) Water sprinkling	To suppress dust emissions	800,000
(ii) Solid waste collection & disposal	From construction sites (based on initial estimates)	700,000
(iii) Plantation around project boundary to control odor levels	To plant vegetation all along the WWTP boundary to limit odor emissions	15,00,000
(iv) Chemicals/pesticides to prevent/minimize disease vector generation	Chemicals to be injected into the influent streams in order to minimize/prevent disease vector generation	10,00,000
Contingencies	5% of EMP implementation cost	320,000
Total Estimated Cost (PKR)		6,720,000

1: To cover staff cost and expenses of Environmental Specialist for Contractor

Table 7.10: Capacity Development and Training Programme for Project Contractor(s)

Provided by	Organized by	Contents	Target Audience	Venue	Duration
Pre-construction Phase PMC offering specialized services in environmental management and monitoring	CIU & PMC	Short seminars and courses on: Environmental Management Plan and Environmental Monitoring Plan	Contractor staff	CIU Office, Sahiwal	One day long training seminar
Construction Phase PMC offering specialized services in social management and monitoring	CIU & PMC	Short seminar on Environmental risks associated with construction phase. Development of Environmental Performance Indicators Occupational Health and Safety (OHS) issues	Contractor staff	CIU Office, Sahiwal	One day long training seminar

8 Public Consultation and Information Disclosure

401. Details on the public consultations conducted are provided below with the pictorial evidences and persons consulted provided as **Annexure B**.

8.1 Approach

402. The following approach was adopted for conducting due diligence to assess the potential impacts from the proposed works:

- Review of available information including SPS 2009, project design components;
- Field site visits along with the design team to identify and assess project impacts;
- Public consultations with the travellers, educational & health institutions in the proximity of project site to seek their views on the project and to discuss probable project impacts and mitigation measures.

403. Public consultations included meetings and interviews with the general public and other stakeholders. The consultation was carried out in accordance with the IR policy requirements of ADB's SPS 2009 and its outcome is discussed in the proceeding sections. Consultations were also held with the PMU, Local Government Board and the design consultants.

404. In this regard, eight (8) focus group discussions and ten (10) Interviews were conducted in nothern zones of Sahiwal;

405. There are two villages adjacent to WWTP area in the Northern Zone of Sahiwal listed below:

- Muhammad Pur and
- Chak#66GD

8.2 Information Disclosure and Consultation

8.2.1 Scope of Consultations

406. Discussions and consultations on social safeguard aspects of project were held with the educational, health institutions PMU team, CIU team, travelers, students, community in proximity of the project site, and design consultants during the month of May & June 2020. During the consultations, participants were requested to express their concerns with the proposed WWTP and suggestions or measures that can address potential consequences and enhance project benefits. During the consultation meetings, participants were informed about the WWTP, scope of the project and its various components. They were also informed about the stakeholder's involvement and their roles and responsibilities in this project. The

importance of Grievance Redress Mechanism (GRM) and the role of community in GRM was also the agenda of consultations.

8.2.2 General Response regarding construction of WWTP

407. The general response regarding WWTP can be summarized as follows:

- They considered this program of PICIIP as positive step for the development of the city as well as for uplifting the quality of life of the people.
- DPs of both villages were not agreed on the rates provided to them by the DPAC. They are ready to give their land if they get rates as per their desire.
- The Agricultural land is the only income source of DPs and where they will go in case of losing Land and also less compensate rate is provided to them.
- The project will cause pollution to the area.
- Compensation for Tube well and trees.
- DPs raised their concerns about the assessment of compensation for land and other assets and schedule for payment.
- They were keenly interested about the project and its interventions.

8.2.3 General Response regarding water Sanitation sector

408. The general responses regarding Sanitation sector can be summarized as follows:

- They considered this program of PICIIP as positive step for the development of the city as well as for uplifting the quality of life of the people.
- The sewerage system is very bad in city.
- Blockage of sewer lines is the routine matter in the city.
- Sewer water flows in the streets.
- Smell of stagnant sewer water is really very hazardous for the inhabitants of the city.
- In rainy season, the situation becomes worst when the rain water does not found any proper and timely drainage.
- The sewer water flows in streets and it results in disruption of traffic flow.
- This contaminated water gives rise to a number of harmful diseases.
- Silting of sewers/open drains is resulting in choking/blocking of the network in many places.
- Unplanned and haphazard sewers have been installed for the past many years resulting over flowing of the main sewers.
- Ponding problems in low lying areas during rainy season are evident.
- Non-operation/ non-function of existing disposal stations.

- Untreated sewage discharge into canals/drains and in open fields used for local and downstream irrigation may cause unhygienic conditions and potential health hazards.
- Non-availability of sewage treatment facilities.

8.2.4 Gender Responses/Issues

409. The issues discussed were as follows:

- Females also said that there should be a female in MC specifically to listen and register the complaints of females regarding the irregularity in any sewerage related issue. In this way they can easily go to MC to get the water services in a better way.
- Another opinion of females regarding the complaint registration system that it should be so smart that females can easily register their matters through online application by generating any software in this regard.
- It restricts the movements of the children outside as the parents don't let their children to play in streets spoiled with sewer water.
- Stagnant water is also causing bad and unhygienic breathing.
- They said that many infectious diseases are spreading due to the ponding of sewer water.
- They also agreed upon that people should not throw their garbage in sewer lines which ultimately resulted in blockage of sewer lines.
- Women consulted at the project site showed serious concerns about restricting their movement due to movement of labor force during construction.
- The construction contractor will make sure that the movement of the labor force is confined within the construction camp and walking/movement routes and passages of the passerby especially women/handicapped of the nearby localities are open and are not blocked.

8.2.5 Recommendations

410. The recommendations made by the stakeholders were as follows:

- Public safety should be on top priority during construction.
- The traffic should be managed properly during the execution of the Project.
- The pressure of the water should be adequate enough to accomplish all the household tasks with ease and simultaneously the sewer pipes should be capable enough to cater all the sewerage in an efficient manner.
- There should be arrangements for frequent tests to check the quality of water supply after the execution of the project so that reliability and validity of the water supply system will remain intact.
- There should be arrangements to properly segregate the water supply lines and the sewerage lines.
- As the existing water and sanitation is not in a good condition, so this sub-project should be executed on urgent basis with due diligence.
- The mechanism should be developed in such a way that the non availability of electricity should not affect the drainage system of sewerage.

- There should be awareness campaigns to guide public in a way that they may start discouraging the wastage of water and throwing the garbage in sewer lines.
- The contractor should comply with the mitigation measures proposed in the Environmental and Management and Monitoring Plan (EMMP) and HSE compliance policy.
- Contractor's activities should be confined to minimize any inconvenience to the public.
- Dust produced due to construction activities may create different health problems, therefore water sprinkling should be carried out regularly to suppress the dust emissions;
- During construction, labour force movement should be controlled so that activities of the community are not disturbed;
- The participants/representatives also stressed the need for timely completion of the project.
- The movement of the heavy machinery should be controlled to avoid harm to other associated properties/structures;
- Grievance redressal mechanism (GRM) at the PMU level should be formalized to address any complaints from the stakeholders at site.
- Awareness campaigns by using Print, Electronic and Social media are highly required to create civic sense among masses.

9 Grievance Redressal Mechanism

9.1 General

411. The ADB Policy (SPS 2009) requires establishment of a local grievance redress mechanism to receive and facilitate resolution of the Displaced/Affected Persons concerns and grievances regarding the project's social and environment performance. The measures have been identified to mitigate any potential environmental and social impacts to be caused due to implementation of the WWTP works.
412. However, in spite of best efforts, there is every chance that the individuals / households affected by the project or other stakeholders are dissatisfied with measures adopted to address adverse social impacts of the project. To address, such situation an effective Grievance Redress Mechanism (GRM) will be established to ensure timely and successful implementation of the project. It will also provide a public forum to the aggrieved to raise their objections and the GRM would address such issues adequately. It will receive, evaluate and facilitate the resolution of displaced persons' concerns, complaints and grievances about the social and environmental performance at the level of the project.
413. The GRM will aim to investigate charges of irregularities and complaints receive from any displaced persons and provide a time-bound early, transparent and fair resolution to voice and resolve social and environmental concerns link to the project.
414. The PIU shall make the public aware of the GRM through public awareness campaigns. The name of contact person(s) and his/her phone number, PMU contact numbers will serve as a hotline for complaints and shall be publicized through the media and placed on notice boards outside their offices, construction camps of contractors, and at accessible and visible locations in the project area. The project information brochure will include information on the GRM and shall be widely disseminated throughout the project area. Grievances can be filed in writing, via web-based provision or by phone with any member of the PIU.
415. **First tier of GRM.** The PIU is the first tier of GRM which offers the fastest and most accessible mechanism for resolution of grievances. The PIU staff for environment and social safeguards will be designated as the key officers for grievance redressal. Resolution of complaints will be completed within seven (7) working days. Investigation of grievances will involve site visits and consultations with relevant parties (e.g., affected persons, contractors, traffic police, etc.).

Grievances will be documented and personal details (name, address, date of complaint, etc.) will be included, unless anonymity is requested. A tracking number will be assigned for each grievance, including the following elements:

- Initial grievance sheet (including the description of the grievance), with an acknowledgement of receipt handed back to the complainant when the complaint is registered;
- Grievance monitoring sheet, mentioning actions taken (investigation, corrective measures);
- Closure sheet, one copy of which will be handed to the complainant after he/she has agreed to the resolution and signed-off.

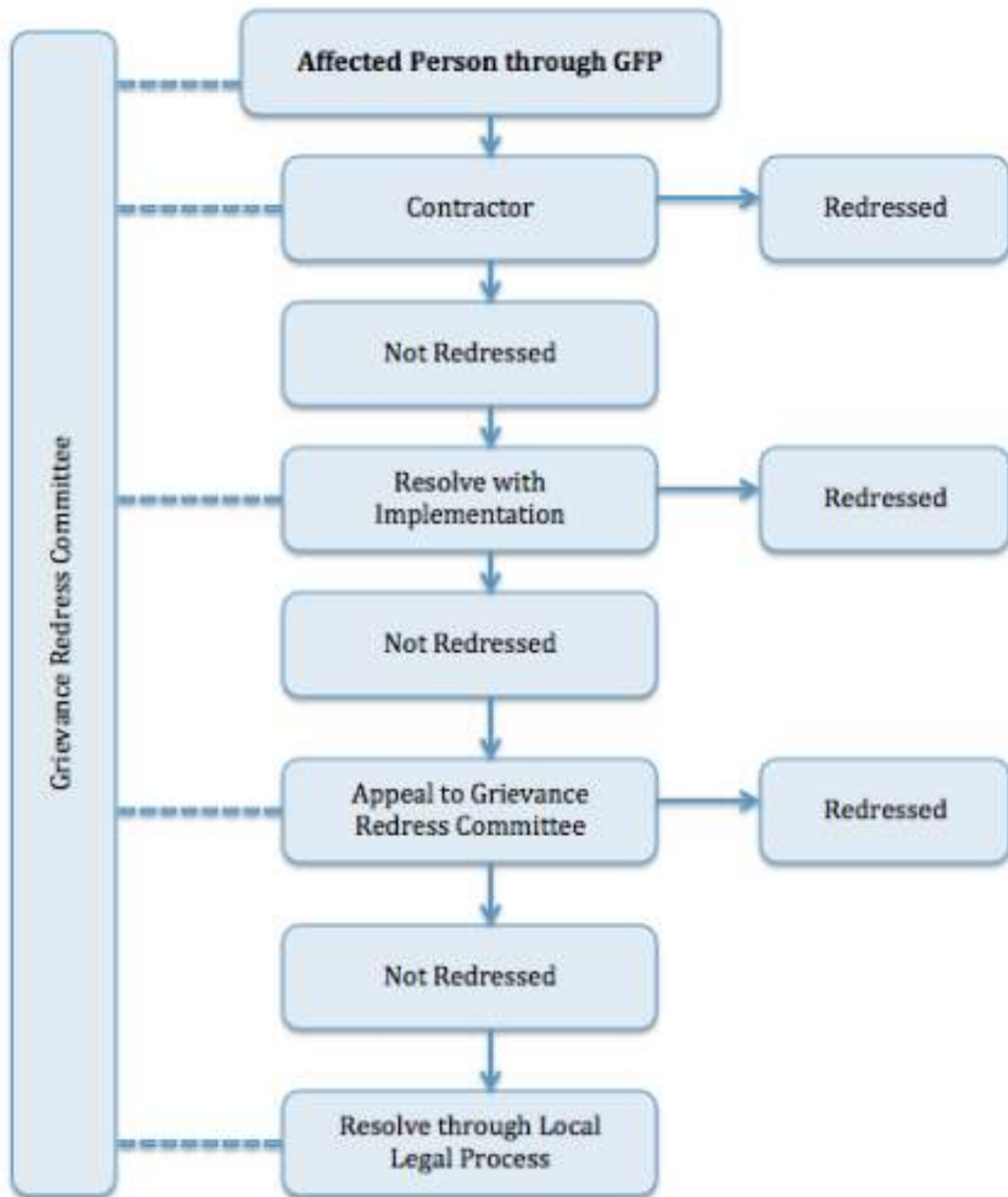
416. The updated register of grievances and complaints will be available to the public at the PIU office, construction sites and other key public offices in the project area. Should the grievance remain unresolved, it will be escalated to the second tier.

417. **Second Tier of GRM.** The PIU will activate the second tier of GRM by referring the unresolved issue (with written documentation) to the Sahiwal Waste Management Company (SWMC) who will pass unresolved complaints upward to the Grievance Redress Committee (GRC). The GRC will be established by SWMC before start of site works. The GRC will consist of the following persons: (i) Project Director; (ii) representative District; (iii) representative of the affected person(s); (iv) representative of the local Deputy Commissioners office (land); and (v) representative of the PEPA (for environmental-related grievances). A hearing will be called with the GRC, if necessary, where the affected person can present his/her concerns/issues. The process will facilitate resolution through mediation. The local GRC will meet as necessary when there are grievances to be addressed. The local GRC will suggest corrective measures at the field level and assign clear responsibilities for implementing its decision within fifteen (15) working days. The contractor will have observer status on the committee. If unsatisfied with the decision, the existence of the GRC will not impede the complainant's access to the Government's judicial or administrative remedies.

418. The functions of the local GRC are as follows: (i) resolve problems and provide support to affected persons arising from various environmental issues and including dust, noise, utilities, power and water supply, waste disposal, traffic interference and public **safety** as well as social issues and land acquisition (temporary or permanent); asset acquisition; and eligibility for entitlements, compensation and assistance; (ii) reconfirm grievances of displaced persons, categorize and prioritize them and aim to provide solutions within a month; and (iii) report to the aggrieved parties about developments regarding their grievances and decisions of the GRC.

419. The SWMC officers will be responsible for processing and placing all papers before the GRC, maintaining a database of complaints, recording decisions, issuing minutes of the meetings and monitoring to see that formal orders are issued and the decisions carried out.
420. **Third tier of GRM.** In the event that a grievance cannot be resolved directly by the PIU (first tier) or GRC (second tier), the affected person can seek alternative redressal through the district or sub-district committees as appropriate. The PIUs or GRC will be kept informed by the district, municipal or national authority. The grievance redress mechanism and procedure are depicted in the **Figure 8.1** below. The monitoring reports of the EMP and RP implementation will include the following aspects pertaining to progress on grievances: (i) Number of cases registered with the GRC, level of jurisdiction (first, second and third tiers), number of hearings held, decisions made, and the status of pending cases; and (ii) lists of cases in process and already decided upon may be prepared with details such as Name, ID with unique serial number, date of notice, date of application, date of hearing, decisions, remarks, actions taken to resolve issues, and status of grievance (i.e., open, closed, pending).
421. In order to provide greater clarity, the pictorial description of the GRM is provided in **Figure 8.1** below.

Figure 8.1: Grievance Redressal Mechanism



10 Conclusion and Recommendations

422. Due diligence visits were conducted to the project sites and to the project areas in general where the proposed WWTP works in North zones of Sahiwal city are to be conducted. Based on the findings of these visits, this IEE document in order to update the existing umbrella IEE report has been prepared.
423. Since the impact analysis presented earlier in the umbrella IEE report was quite generic and briefly covered all projects to be implemented in Sahiwal city, thus a comprehensive yet focused impact analysis and EMP specifically for the proposed WWTP works has been prepared as part of this IEE report.
424. The EMP contained within this IEE document is considered sufficient for issuance as part of the Contracts to the successful bidder(s) and for subsequent use during the project works for the two Lots. It should be mentioned that prior to the commencement of works, this EMP must be further updated by the Contractor for each of the two Lots into two site specific EMPs (SSEMPs) for review and approval of ADB. In these two SSEMPs, aspects such as a detailed traffic management plan, identification of locations for disposal of debris and spoil and any other details which shall become available later must be included for efficient implementation of all proposed mitigation measures and the subsequent monitoring of these measures.
425. This IEE document is considered sufficient to proceed with commencement of the required works.

ANNEXURES

Annexure A

Photographs of public consultations

GRC Meeting held under the chairmanship of CO MC, Sahiwal Dated 06-06-2020







PICIIP, CITY IMPELIMENTATION UNIT, SAHIWAL

ATTENDANCE SHEET

SUBJECT GRC - for Chak 66 G.D
Mohammad Pur AT 11:30 ON 6/6/22

Sr NO	NAME	DESIGNATION	CONTACT NO.	SIGNATURE
01	Zubair Hussain	C.C.O	9200157	
02	Mr. M. Asad Khan Baber	M.C SWL M.O (I)	9200135	
03	M. Umair Ali	City Head	9200173	
04	M. Jahangir Khan	Lambardar	Muhammad Pur	M. Jahangir Khan
05	Muhammad. Ghyas	patwari circle.		
06		Muhammad Pur.	66 G.D	
07		ایضاً جو ولد دین محمد - بیگم لبرتی سہیل		
08		66 G.D		
09		66 G.D		
10		66 G.D		
11				
12				

Sr. No	Name	Designation	Contact Number	Signature
12	66 6611) لشیر احمد دین صبر	زمیندار (ماہانہ)		لشیر احمد
13	ذیشان نذیر احمد ولد ندیم (فون)	محرر پور (زمیندار)	03009613353	ذیشان
14	ذرا بل کھنڈا (نٹائی)	Farmer	03016909721	Amir
15	دکار احمد خان	محرر پور (زمیندار)	03009530834	دکار
16	Jaweria Khalid	RA Center PIC IIP	0300-795444	Jaweria
17	Schöris Adisaf	R-A Social Safeguard	0308-427062	Schöris
18	Arshad Iqbal	Sub-Engineer CTU	0300-6567889	Arshad
19				
20				
21				
22				

Photographic view of the Meeting held on 5th June 2020 at CIU Office Sahiwal





PICUP, CITY IMPLEMENTATION UNIT, SAHIWAL

ATTENDANCE SHEET

SUBJECT Meeting with DPs of MPAs
index 2 200 AT 4.30 ON 05 Oct 2020

SR NO	NAME	DESIGNATION	CONTACT NO	SIGNATURE
01	<u>Mr Umar B</u>	<u>city dev</u>	<u>173</u>	<u>[Signature]</u>
02	<u>Ali Khan</u>		<u>03322786</u>	<u>[Signature]</u>
03	<u>Majid Ahmad</u>	<u>Council</u>	<u>0300788814</u>	<u>[Signature]</u>
04	<u>Sohail Adnan</u>	<u>R.A.S.S</u>	<u>0300788814</u>	<u>[Signature]</u>
05	<u>Jawad Khalid</u>	<u>R.A. Council</u>	<u>0300788814</u>	<u>[Signature]</u>
06	<u>Rajesh Lodhi</u>	<u>R.A. Engineer</u>	<u>9200123</u>	<u>[Signature]</u>
07				
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Photographic view of the consultation with DPs of WWTP(North Zone), Sahiwal held on 4th June 2020



PICIIP, CITY IMPLEMENTATION UNIT, SAHIWAL

ATTENDANCE SHEET

SUBJECT Consultation with DPs of
16 CAD related to STP AT 16 CAD ON 4-1-2020

SIR NO	NAME	DESIGNATION	CONTACT NO	SIGNATURE
01	<i>[Signature]</i>	DP of MW	0300 2690368	<i>[Signature]</i>
02	<i>[Signature]</i>	-	0301 6917323	<i>[Signature]</i>
03	Syed Naveen Abbas	AAO	0300-5522122	<i>[Signature]</i>
04	Jawaria Khalid	RA Member PICIIP	0300-7951111 190 9211133	<i>[Signature]</i>
05	Rifat Gulzar	RA Executive	0300-4177 112	<i>[Signature]</i>
06	Schroedh Abbas	RA (S.S)		<i>[Signature]</i>
07				
08				
09				
10				
11				
12				



PICIIP, CITY IMPLEMENTATION UNIT, SAHIWAL

ATTENDANCE SHEET

SUBJECT: Consultation with MAs of
M.PUR AT: M.PUR ON: 14-6-2020

Sr NO	NAME	DESIGNATION	CONTACT NO.	SIGNATURE
01				
02	<i>Waqar</i>		0306 6909700	<i>Waqar</i>
03	<i>Waqar</i>		0300 9695265	<i>Waqar</i>
04	<i>Waqar</i>		0300 9612591	<i>Waqar</i>
05	<i>Syed Nazam Abbas</i>		0300-3522122	<i>Syed Nazam Abbas</i>
06	<i>Jawaria Khalid</i>	RA Member, PICIIP	0300-7454424	<i>Jawaria Khalid</i>
07	<i>Rifat Lodhi</i>	RA Member	9200173	<i>Rifat Lodhi</i>
08	<i>Sahish Abbas</i>	RA (SS)	0308-427612	<i>Sahish Abbas</i>
09				
10				
11				
12				





PICHP, CITY IMPLEMENTATION UNIT, SAHIWAL

ATTENDANCE SHEET

SUBJECT: Consultation with DPs
at Sahiwal At 08:00 AM on 12-02-2020

Sl. No.	NAME	DESIGNATION	CONTACT NO.	REMARKS
01	<i>[Handwritten Name]</i>	<i>[Handwritten Designation]</i>		
02	<i>[Handwritten Name]</i>	<i>[Handwritten Designation]</i>	<i>[Handwritten Contact No.]</i>	
03	<i>[Handwritten Name]</i>		<i>[Handwritten Contact No.]</i>	
04	<i>[Handwritten Name]</i>			
05	<i>[Handwritten Name]</i>		<i>[Handwritten Contact No.]</i>	
06	<i>[Handwritten Name]</i>		<i>[Handwritten Contact No.]</i>	
07	<i>[Handwritten Name]</i>		<i>[Handwritten Contact No.]</i>	
08	<i>[Handwritten Name]</i>		<i>[Handwritten Contact No.]</i>	
09	<i>[Handwritten Name]</i>		<i>[Handwritten Contact No.]</i>	
10	<i>[Handwritten Name]</i>		<i>[Handwritten Contact No.]</i>	
11	<i>[Handwritten Name]</i>		<i>[Handwritten Contact No.]</i>	
12	<i>[Handwritten Name]</i>		<i>[Handwritten Contact No.]</i>	



Date: 3-1-2020

DPs of Chk#45C.D	DP Name	Phone Number	Address
...	DP #1	0307-6166794	...
...	DP #2	0300-2274214	...
...	DP #3	0300-4791251	M. Akram
...	DP #4	0307-6255004	...
...	DP #5	0307-6930929	R. M. Khan
...	DP #6	0302-4998062	M. Khalid
...	DP #7	0307-5327551	...
...	DP #8	0300-4193190	...
...	DP #9	0307-9165466	...
...	DP #10	0307-5327551	Faisal
...	DP #11	0300-4193190	...
...	DP #12	0307-5283932	...
...	DP #13	0300-7854489	...
...	DP #14	9200177	...
...	DP #15	7508-427001	...



D.P.s of M.P.W Dated 13-6-2020

4. شرکاء کی فہرست

سیریل نمبر	نام	عہدہ	شخصی کارڈ نمبر	موبائل نمبر	مستحقہ انگوٹھی کا نشان
1	Ali Murad	D.P M.P.W		0300-6920731	Ali
2	نور الحسن عثمانی	D.P M.P.W		0301-690972	Ali
3	عفتن علی	D.P M.P.W		0321-6902452	
4	امیر علی	"		03066 6924733	From him
5	دکتر احمد خان	"		0300-9558319	Wagari
6	ضیاء الحق	"		0301-6906665	Signature
7	محمد ساجد خان	"		0300-9695995	Signature
8	ذیشان گلبرگ	"		0300 6900274	ذیشان ?
9	شہیل خان	"		03132200786	Signature
10	Javeric Khalid	RA Center, PICP		0300-7964421	Signature
11	Rifqat Lodi	RA Environ. PICP		9200173	Signature
12	Scheerish Akhtar	R.P Social Signature		0308-4270802	Signature



Punjab Intermediate Cities Improvement Investment Program (PICIP)
ATTENDANCE SHEET

Subject: Consultation with DP of Sahiwal
Date: 21.1.2010 At Sahiwal

List of Participants:

Sr No.	Name	Designation	Cell No.	Signature
1	M. Masood Khan	D.P. Sahiwal	0301-6909721	
2	M. Shauq	"	0345-4768766	
3	Engr. Asim	"	0301-7676380	
4	Engr. Muneer	"	0312-9821800	
5	Ch. Nadeem	"	0304-8694424	
6	M. Akbar	"	0343-9067553	
7	Amanat Ali	"	0300-7951802	
8	Engr. M. Iqbal	"	0334-4226877	
9	Sahib M.	"	0300-7951802	
10	Sch. M. Khan	R.A (S-E)	0308-4270972	
11	Rifat Hadrat	R.A (Env)	0301-7483387	
12	Jamshed Khan	R.A (Grada)	0300-7954489	
13	Amanat Ali	D.P. Sahiwal	0300-7951802	
14	M. Akbar	D.P. Sahiwal	0343-9067553	
15				
16				
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PICUP, CITY IMPLEMENTATION UNIT, SAHIWALATTENDANCE SHEET

SUBJECT: Public Consultation with DPs in
AC office Regarding WWTP South Zone AT 12:30 PM ON THURSDAY
 1:30 PM

SR NO.	NAME	DESIGNATION	CONTACT NO.	SIGNATURE
01	SUFYAN DILAWAR	LAC/AC		
02	M. Umair ALI	City Head CID-SWL	040-9200173	
03	تمراز	66/ق-د	0300-7951802	
04	سید احمد	66/ق-د	03017676380	Bashir Ahmad
05	شاہد رفیق	66/ق-د	0345743245	shahid rafiq
06	نور مسرتعفی	66/ق-د	0303695506	نور مسرتعفی
07	سرفراز احمد	66/ق-د	03129821866	سرفراز احمد
08	سید امین احمد	66/ق-د	03009609257	سید امین احمد
09	سید امین احمد	66/ق-د	0307-5328551	سید امین احمد
10	A. Mural Khan	66/ق-د	030699721	A. Mural Khan
11	A. Mural Khan	M Pur	03006920761	A. Mural Khan
12	M. Ali Khan	M. Pur	03132200788	

Annexure B

Environment Screening & Categorization Forms (ESCF)

• **Punjab Intermediate City Improvement Investment Project (PICIIP)**

• **Environment Screening & Categorization Form (ESCF**

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- (i) The CIU staff may complete this form to support the environmental categorization of a project and submit to the ADB for verification and approval.
- (ii) This checklist focuses on environmental issues and concerns. To ensure that the Social dimensions are adequately considered, refer also to the Checklists on involuntary resettlement and Indigenous Peoples.
- (iii) This form is to be completed assuming the “without mitigation” case. The purpose is to identify potential impacts.

2. Project Name: Construction of North Zone Waste Water Treatment Plant (WWTP) Sahiwal

2. Project Scope of Work (list the major interventions): The north zone WWTP is proposed for north side of Sahiwal city. It is proposed that WWTP will be designed to cater for the sewerage generation up to 2044. There are two major components of WWTP. One is influent pumping station/ disposal station which will be constructed on 2.43 acres land from the territory of Muhammad Pura village of District Sahiwal while other component is construction of sewage treatment plant. Waste Stabilization Ponds (WSP) technology will be use in this sewage treatment plant to treat the sewerage water of north side of Sahiwal city. The degree of proposed treatment plant would be such that treated effluents can safely be reused for agriculture purpose as per WHO guidelines and discharge into inland water as per Punjab Environmental Quality Standards (PEQS). The total capacity of proposed WWTP is 24.6MGD.

3. Project Location: Chak No.66/ G.D and Chak Muhammad Pura, District Sahiwal

4. Total Project Cost (million PKR): 3128.27Million

5. Project GPS Co-ordinates² 30.717813"N 73.025188"E

6. The proposed project activity is NOT listed in the Prohibited Investment Activities List (PIAL) (please refer to Annexure I below).

YES No

Based on mapping of GPS Co-ordinates onto Google Earth (Annexure II), please respond to the following:

7. Is the project site(s) located adjacent to or within any environmentally sensitive areas (National Park, Protected Area, Buffer zone of Protected Area, Wetland, Mangrove?) If so, provide details and explain the potential risks to the sensitive areas from the proposed project activities:

S.No	Issues	Yes	NO
1.	Is the sub-project area adjacent to or within the cultural heritage site?		√
2.	Is the sub-project area adjacent to or within environmentally protected area?		√
3.	Is the sub-project area adjacent to or within Wetland?		√
4.	Is the sub-project area adjacent to or within the Forest?		√
5.	Is the sub-project area adjacent to or within Biodiversity hotspot?		√
6.	Is the sub-project area adjacent to or within Buffer zone of		√

¹ Required to assess categorization under Pak EPA guidelines

² In case of cluster of projects, please provide GPS Co-ordinates for each project location

Is project(s) located in a densely populated area ? NO

8. Use the satellite imagery to identify the numbers and types (as far as possible) of sensitive receptors (SR) below:

SR Type 1: School Approx. Number of SR1: 0

SR Type 2: Mosque Approx. Number of SR2: 0

SR Type 3: Hospital/Clinic Approx. Number of SR3: 0

SR Type 4: Public building Approx. Number of SR4: 0

SR Type 5: Grave yard Approx. Number of SR5: 0

9. Will the proposed project activity require dislocation of people? If so, please mention the estimated number of people to be displaced.

Yes

Total one hundred and forty seven (147) people will dislocate economically due to project activity. Agriculture is the source of income. The numbers of affected persons from Chak Muhammad Pura are one hundred and fourteen (114) while from Chak 66/GD is thirty three (33) in numbers.

10. Will any land acquisition be required for the proposed project activity? If so, please provide details.

Yes

The north zone WWTP has been proposed on a private piece of land. The project is proposed at Chak 66 /GD and Chak Muhammad Pura of Sahiwal district. Total 201 Acres, 03 Kanals and 12 Marlas land will acquire for proposed WWTP. The land is under the possession of private ownership of local community and was being used for agriculture purposes.

11. Please provide details of any significant expected impacts (“without mitigation” case) due to the proposed project activities on the identified sensitive receptors:

Sr. No	Type of expected impact	Details on Severity of expected impacts
1	Generation of high dust levels in sensitive areas during construction.	Medium
2	High noise levels in sensitive areas due to blasting and civil works.	Minimal
3	Occupational and community health and safety risks.	Medium
4	Impact on water bodies due to disposal of Chemicals/oils/lubricants and other hazardous/semi-hazardous substances.	Minimal

5	Risks to community health and safety caused by (any or all of the below) (i) Management and disposal of waste and/or (ii) Civil or electrical works and/or (iii) Accidental and natural hazards, particularly where structural elements or components of project are accessible to members of affected community and/or (iv) Fire, electric shock or failure of civil structures during operation.	Medium
6	Generation of disease vectors due to project activities.	Minimal
7	Depletion and/or Contamination of ground water reservoirs due to leaching of chemicals, oil, lubricants and other hazardous/semi- hazardous substances.	Medium
8	Improper sanitation and liquid waste disposal system.	Minimal
9	Degradation of land and ecosystem (e.g. loss of wetlands and wild lands, coastal zones, watersheds and forests).	NO
10	Road blocking and temporary flooding due to land excavation during rainy season.	Medium
11	Dislocation or involuntary resettlement of people.	Yes
12	Impacts on vulnerable groups such as the poor, women and children and indigenous peoples.	NO
13	Degradation of cultural property and loss of cultural heritage and tourism reserves.	NO
14	Impact on Flora and Fauna, particularly on any endangered species located in project area(s).	Endangered species are not present in project area.
15	Social conflicts	High
16	Interference with other utilities and blocking of access to building	Minimal

Project Category Recommendation

12. It is recommended that based on the available project information and subsequent analysis, the project should be placed in (please tick one):

Category 'A' Category 'B' Category 'C'

13. Please provide an explanation to justify the Categorization above:

There are no sensitive receptors at project site and severity of expected impacts as evident from above table are less adverse and few site specific impacts are irreversible and As per ADB Safeguard Policy, a proposed project is classified as category "B" if it is likely to have few site specific adverse environmental impacts. So Initial Environmental Examination (IEE) would be require.

Annexure C

Occupational Health and Safety Plan

Occupational Health and Safety covers all personnel working under the project and will be in line with the World Bank EHS guidelines on health and safety.

The Occupational Health and Safety program will aim to ensure that the workplace is safe and healthy by: addressing the hazards and risks at the workplace; outlining the procedures and responsibilities for preventing, eliminating and minimizing the effects of those hazards and risks; identifying the emergency management plans for the workplace or workplaces; and, specifying how consultation, training and information are to be provided to employees at various workplaces.

Some of the risks/hazards associated with workplaces are due to working close to or at sites associated with the various project construction activities. Other risks associated with the project construction phase include risk of increase of vector borne and other different diseases.

The following sections will be implemented during the construction phase to address and ensure workers' health and safety.

a. Screening and regular unannounced checking of workers.

As per the procedure for hiring workers, all contractors and labor agencies are required to make all prospective workers undergo medical tests to screen for diseases and sicknesses, prior to selection and employment of any worker. The contractor is also responsible for ensuring that no worker who has a criminal record is employed at the project site. It will be ensured that all workers undergo medical tests to screen diseases at source and at sites in consultation with the designated Health Officer.

In addition to this, the Project Management will also undertake sudden, unannounced checks on workers to look for diseases such as HIV, STDs, and hepatitis and take necessary steps as mandated by the Contractual agreement between the Contractor and the Worker(s).

b. Minimizing hazards and risks at the workplace.

To ensure safety at all work sites, the following will be carried out:

- i. Installation of signboards and symbols in risky and hazardous areas, to inform workers to be careful.
- ii. Construction of barricades around construction sites and deep excavated pits, to cordon off and deter entry of unauthorized personnel and workers into these areas.

- iii. Providing a safe storage site/area for large equipment such as power tools and chains, to prevent misuse and loss.
- iv. Proper Housekeeping: Ensuring that materials are all stacked, racked, blocked, interlocked, or otherwise secured to prevent sliding, falling, or collapse. Brick stacks will not be more than 7 feet in height and for concrete blocks they will not be more than 6 feet high.
- v. Removing all scrap timber, waste material and rubbish from the immediate work area as the work progresses.
- vi. Where scaffolds are required, ensuring that each scaffold or its components shall be capable of supporting its own weight and at least 4 times the maximum intended load applied or transmitted to it. The platform/scaffold plank shall be at least 15 inches wide and 1.5 inches thick. The rope should be capable of supporting at least 6 times the maximum intended load applied or transmitted to that rope. Pole scaffolds over 60 feet in height shall be designed by a registered professional engineer and shall be constructed and loaded in accordance with that design. Where scaffolds are not provided, safety belts/safety nets shall be provided;
- vii. Ensure that all ramps or walkways are at least 6 feet wide, having slip resistance threads and not inclined at more than a slope of 1 vertical and 3 horizontal.
- viii. Stacking away all excavated earth at least 2 feet from the pit to avoid material such as loose rocks from falling back into the excavated area and injuring those working inside excavated sites.
- ix. Constructing support systems, such as bracing to adjoining structures that may be endangered by excavation works nearby.
- x. Only a trained electrician to construct, install and repair all electrical equipment to prevent risks of electrical shocks and electrocution.
- xi. Install fire extinguishers and/or other fire-fighting equipment at every work site to prepare for any accidental fire hazards.

c. Provision of Personal Protective Equipment

Risks to the health and safety of workers can be prevented by provision of Personal Protective Equipment (PPEs) to all workers. This will be included in the construction cost for each Contractor. Depending on the nature of work and the risks involved, contractors must provide

without any cost to the workers, the following protective equipment:

- i. High visibility clothing for all personnel during road works must be mandatory.
- ii. Helmet shall be provided to all workers, or visitors visiting the site, for protection of the head against impact or penetration of falling or flying objects.
- iii. Safety belt shall be provided to workers working at heights (more than 20 ft) such as roofing, painting, and plastering.
- iv. Safety boots shall be provided to all workers for protection of feet from impact or penetration of falling objects on feet.
- v. Ear protecting devices shall be provided to all workers and will be used during the occurrence of extensive noise.
- vi. Eye and face protection equipment shall be provided to all welders to protect against sparks.
- vii. Respiratory protection devices shall be provided to all workers during occurrence of fumes, dusts, or toxic gas/vapor.
- viii. Safety nets shall be provided when workplaces are more than 25 feet (7.5 m) above the ground or other surfaces where the use of ladders, scaffolds, catch platforms, temporary floors or safety belts is impractical.

The specific PPE requirements for each type of work are summarized below.

Table C.1 PPE Requirement List

Type of Work	PPE
Elevated work	Safety helmet, safety belt (height greater than 20 ft), footwear for elevated work.
Handling work safety	Helmet, leather safety shoes, work gloves.
Welding and cutting work	Eye protectors, shield and helmet, protective gloves.
Grinding work	Dust respirator, earplugs, eye protectors.
Work involving handling of chemical substances	Dust respirator, gas mask, chemical-proof gloves. Chemical proof clothing, air-lined mask, eye protectors.

Wood working	Hard hat, eye protectors, hearing protection, safety footwear, leather gloves and dust respirator.
Blasting	Hard hat, eye and hearing protection.
Concrete and masonry work	Hard hat, eye protectors, hearing protection, safety footwear, leather gloves and dust respirator.
Excavation, heavy equipment, motor graders, and bulldozer operation	Hard hat, safety boots, gloves, hearing protection.
Quarries	Hard hat, eye protectors, hearing protection, safety footwear, leather gloves and dust respirator.

d. Procedures to Deal with Emergencies such as Accidents, Sudden Illness and Death of Workers

First aid kits will be made available at all times throughout the entire construction period by the respective contractors. This is very important, because most work sites will be at some distance from the nearest hospital. In addition to the first aid kits, the following measures should be in place:

- i. Provision of dispensaries by the individual EPC contractor.
- ii. A vehicle shall be on standby from the Project Office so that emergency transportation can be arranged to take severely injured/sick workers to the nearest hospital for immediate medical attention.
- iii. A designated Health Officer/worker for the Project will be identified as a focal person to attend to all health and safety related issues. This employee’s contact number will be posted at all work sites for speedy delivery of emergency services. The focal person shall be well versed with the medical system and facilities available at the hospital.
- iv. Communication arrangements, such a provision of radios or mobile communication for all work sites, for efficient handling of emergencies, will be made.

e. Record Maintenance and Remedial action

The Project Management will maintain a record of all accidents and injuries that occur at the work site. This work will be delegated by the contractor to the site supervisor and regularly reviewed every quarter by project management. Reports prepared by the contractor shall include information on the place, date and time of the incident, name of persons involved,

cause of incident, witnesses present and their statements. Based on such reports, the management can jointly identify any unsafe conditions, acts or procedures and recommend for the contractor to undertake certain mitigative actions to change any unsafe or harmful conditions.

f. Compensation for Injuries and Death

Any casualty or injury resulting from occupational activities should be compensated as per the local labor laws of Kyrgyz Republic. Where compensation is sought by the injured party, proper procedures for documentation of the case will be followed, including a detailed report on the accident, written reports from witnesses, report of the examining doctor and his/her recommendation for treatment. Each individual contractor will be responsible for ensuring compensation for the respective workers.

g. Awareness Programs

The Project management will undertake awareness programs through posters, talks, and meetings with the contractors to undertake the following activities:

- i. Dissemination sessions will clarify the rights and responsibilities of the workers regarding interactions with local people (including communicable disease risks, such as HIV/AIDS), work site health and safety, waste management (waste separation, recycling, and composting), and the illegality of poaching.
- ii. Make workers aware of procedures to be followed in case of emergencies such as informing the focal health person who in turn will arrange the necessary emergency transportation or treatment.

h. Nomination of a Health and Safety Focal Person

Within each site (especially if different sites are being implemented by different contractors), a Health and Safety Focal Person will be appointed. The Terms of Reference for the focal person will mainly be as follows:

- i. Function as the focal person/representative for all health and safety matters at the workplace;
- ii. Responsible for maintaining records of all accidents and all health and safety issues at each site, the number of accidents and its cause, actions taken and remedial measures undertaken in case of safety issues;

- iii. Be the link between the contractor and all workers and submit grievances of the workers to the contractor and instructions/directives on proper health care and safety from the contractors back to the workers;
- iv. Ensure that all workers are adequately informed on the requirement to use Personal Protective Equipment and its correct use;
- v. Also responsible for the first aid kit and making sure that the basic immediate medicines are readily available.

Annexure D

Emergency Response Plan

D.1 PURPOSE

The purpose of this Emergency Response Procedure is to provide measures and guidance for the establishment and implementation of emergency preparedness plans for the BNBR project. The aim of the Emergency Response Procedure is to:

- (i) Ensure all personnel and visitors to the office/job sites are given the maximum protection from unforeseen events.
- (ii) Ensure all personnel are aware of the importance of this procedure to protection of life and property.

D.2 EMERGENCY PREPARATION AND RESPONSE MEASURE SCOPE

The emergency management program is applied to all Project elements and intended for use throughout the Project life cycle. The following are some emergencies that may require coordinated response.

- (i) Construction Accident
- (ii) Road & Traffic Accident
- (iii) Hazardous material spills
- (iv) Structure collapse or failure
- (v) Trauma or serious illness
- (vi) Sabotage
- (vii) Fire
- (viii) Environmental Pollution
- (ix) Loss of person
- (x) Community Accident

D.3 RESPONSIBILITIES

The detailed roles and responsibilities of certain key members of the Emergency Response team available to assist in emergency are provided in **Table D.1** below.

Table D.1 Emergency Response Team

Action Group	Responsibility
Emergency Coordinator	<ul style="list-style-type: none"> ▪ Overall control of personnel and resources. ▪ The Emergency Coordinator will support and advise the Site Safety Supervision as necessary. ▪ Serves as public relations spokes persons, or delegates to some staff member the responsibility for working with news media regarding any disaster or emergency. Also assure proper coordination of news release with appropriate corporate staff or other designated people.
Site Safety Supervision (Emergency Commander)	<ul style="list-style-type: none"> ▪ Overall responsibility for activating emergency plan and for terminating emergency actions. ▪ Be alternative of emergency response chairpersons. ▪ Disseminates warnings and information as required to ensure all people in the immediate area have been warned and evacuated either by alarms or by word of mouth. ▪ Supervise the actions of the Emergency Response Team to ensure all persons are safe from the danger. ▪ Notify outside authorities if assistance is required. ▪ Carries the responsibility for coordinating actions including other organizations in accordance with the needs of the situation. ▪ Ensure maximum co-operation and assistance is provided to any outside groups called to respond to an emergency. ▪ Establish and appoint all emergency organization structure and team. ▪ Assures adequate delegation of responsibilities for all key positions of assistants on the Project to assist with any foreseeable emergency. ▪ Ensure resources available to purchase needed emergency response equipment and supplies. ▪ Assures that all persons on the Emergency Response Team aware and fully understand their individual responsibilities for implementing and supporting the emergency plan. ▪ Establish the emergency drill schedule of all identified emergency scenarios, track the status and evaluate the emergency. ▪ The Emergency Commander shall ensure that senior management personnel have been reported of the emergency as soon as practical after the event.
	<ul style="list-style-type: none"> ▪ Ensure that the exit route is regularly tested and maintained in good working order. ▪ Maintain station at the security gate or most suitable location to secure the area during any emergency such that only authorized

Security Team	<p>personnel and equipment may enter, prevent access to the site of unauthorized personnel.</p> <ul style="list-style-type: none"> ▪ Assist with strong/activation of services during an emergency. ▪ Ensure vehicles and obstructions are moved to give incoming emergency vehicles access to the scene, if ambulance or emergency services are attending the site, ensure clear access and personnel are located to direct any incoming emergency service to the site of emergency.
Rescue & Medical Team	<ul style="list-style-type: none"> ▪ Protect the injured from further danger and weather. ▪ Provide treatment to the victim(s) to the best of their ability by first aid and then transfer to hospital. ▪ Remain familiar with the rescue activities and rescue apparatus. ▪ Assist outside medical services personnel when they arrive
General Administration Team	Response to support any requested general facilities for assisting Emergency Response Team in their work.
Government Relation Team	<ul style="list-style-type: none"> ▪ Coordinate with local government on a matter of concerned in the emergency response plan to liaise with local officers in their affair for support Emergency Response Team. ▪ Coordinate emergency plan with the government authorities, local community.
Environment Team	In case of emergency related to the environmental pollution such as the chemical spill, oil spill into the ambient, the environment team will support the technical advice to control and mitigate the pollution until return to the normal situation.
Department Heads	<ul style="list-style-type: none"> ▪ Call up of personnel into the safe location for protective life and property. ▪ Take immediate and appropriate action while Emergency Response Team is being mobilized. ▪ Keep in touch with the Emergency Commander ▪ Control and supervise operators and contractors on the implementation of this procedure, with consultation with Safety Team as necessary. ▪ Provide and maintain emergency equipment of their responsible areas.
Other Staff and Employees	<ul style="list-style-type: none"> ▪ All other staff and employees will remain at their workstations or assembly point unless directed otherwise from Emergency Response Team. ▪ Each supervisor will ensure that all members of his work group are accounted for and keep in touch with each of their Department Head.

D.4 PROCEDURE

Emergency situation and injuries to person can occur at any time or place either on Project site or elsewhere. The most two common types of emergencies on site are fire and serious

accident.

Figure D.1 Emergency Procedure for Fire

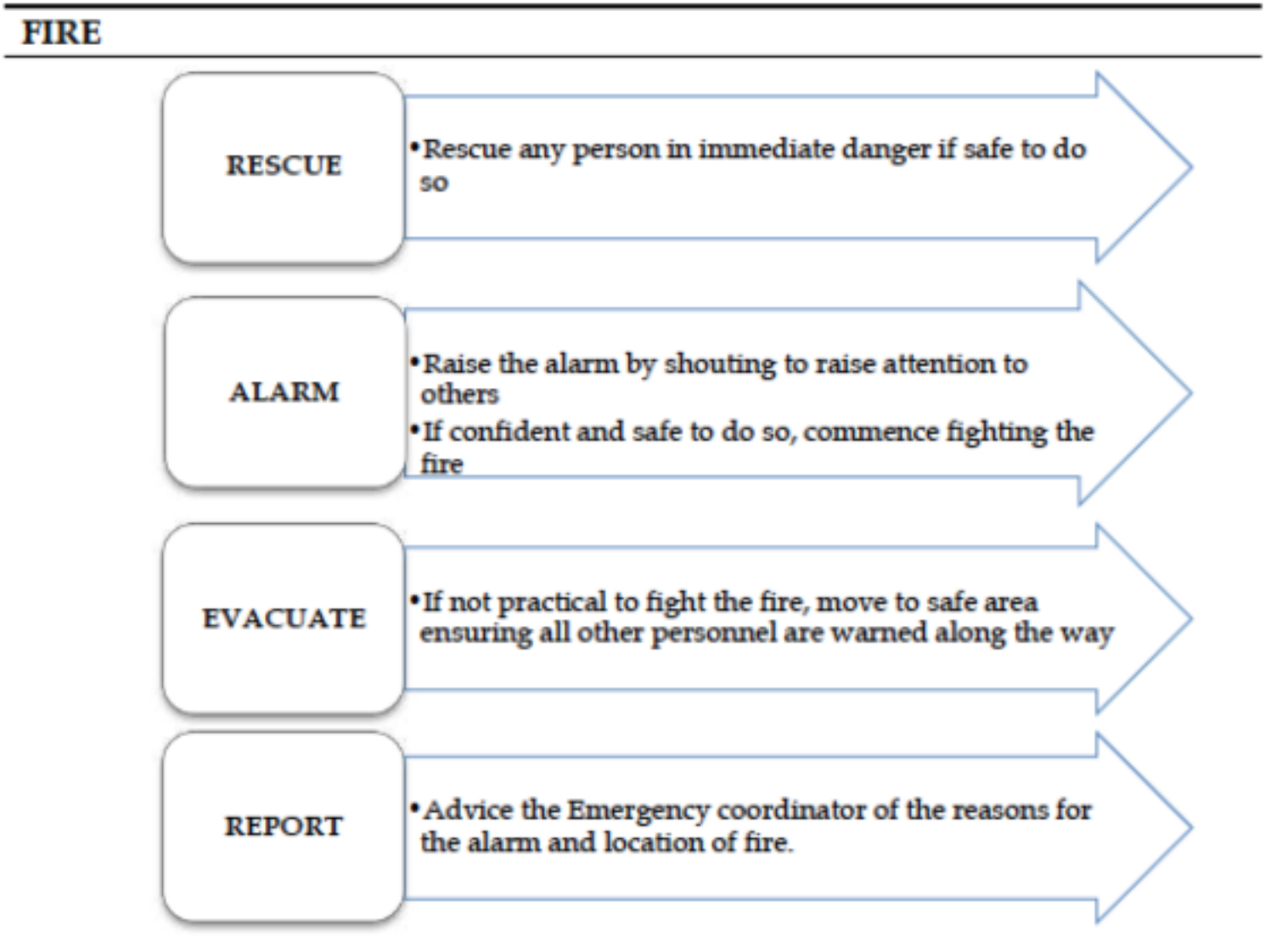


Figure D.2 Emergency Procedure for Serious Accident

ACCIDENT

In the event of injuries of persons, the first person on the scene should take the following action:

If a hazard exists consider your own safety then if possible remove the hazard or the injured person.

Assess the patient by checking for Airway, Breathing, Pulse and obvious

Report directly to First Aid or Security Centers, when raising the alarm you must clearly give the following information;

- Your name and the detail of accident**
- The location of the injured person(s)**
- The number of persons injured**
- The extent of the injuries, if known**
- What known hazards are in the area**

Make the injured person as comfortable as possible

Treat the obvious injuries

Reassure the injured person

D.5 COMMUNICATION WITH AUTHORITIES / PRESS AT SITE

In the event of an accident or incident, only senior staff is permitted to give factual information to the authorities for resource of liability exposure. The press must be avoided politely, at all costs, with the terse comment that “the matter is under investigation and relevant information when available will be provided by our Head Office” Do not ever give your opinion or story.

First Aid Persons

Upon advice of medical emergency, make immediate assessment to response required and if necessary, advise security to summon ambulance or medical assistance, the qualified first aid

attendant should also,

- Provide treatment to the victim(s) to the best of his/her ability.
- Ensure the safety of victims by ceasing any work activity in the area.
- Protect the injured from further danger and weather.
- Assist medical services personnel when they arrive.

General Administration Team

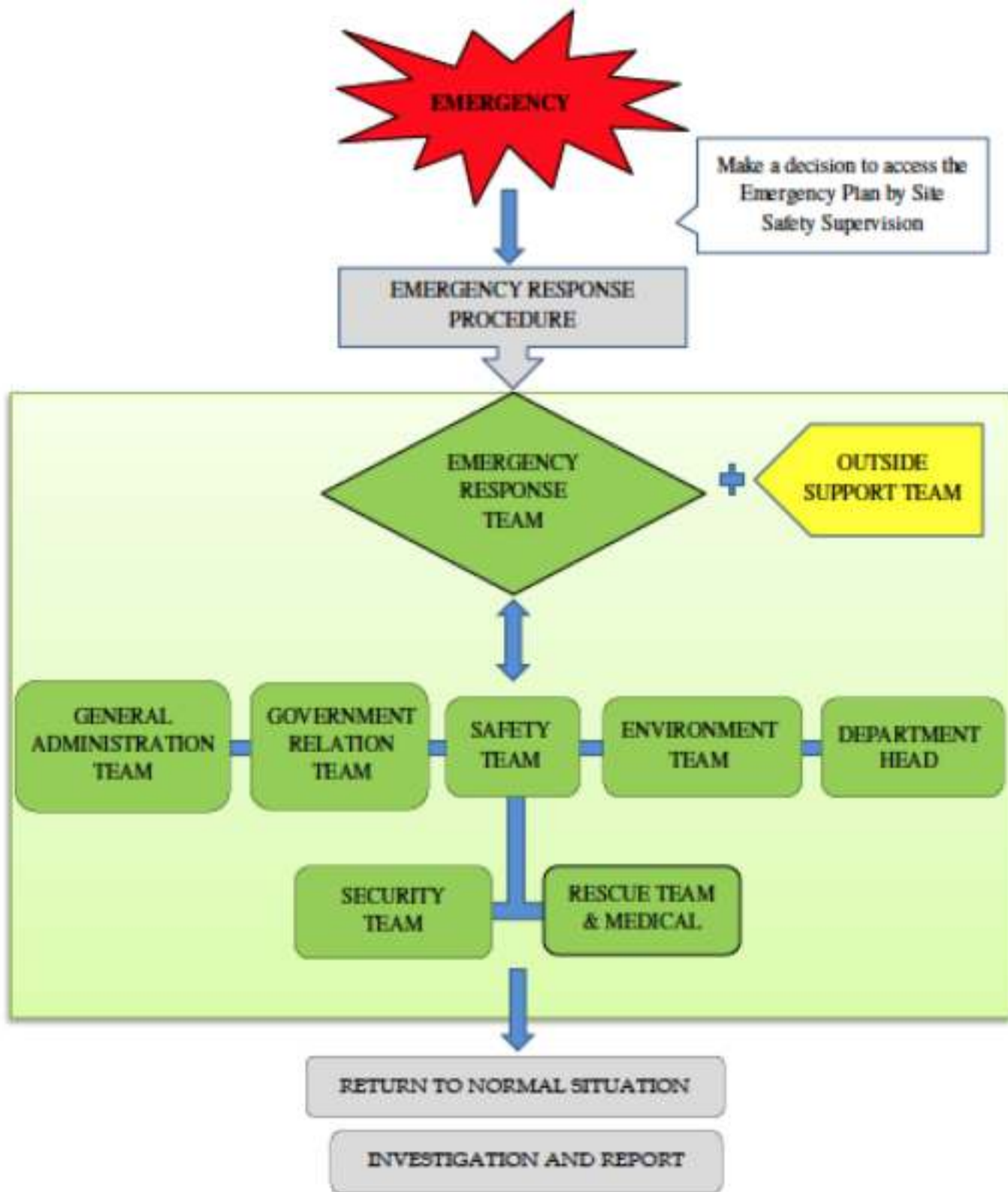
Upon advice of medical emergency, maintain contact with first aid personnel and summon ambulance if required.

Security Team

- If ambulance or emergency services are attending the site, ensure clear access and personnel are located to direct vehicle closest to the scene.
- Prevent access to the site of unauthorized personnel (press, etc.).

Emergency Coordinator

- The Emergency Coordinator shall assist emergency personnel at the scene as required through allocation of company resources.
- The Emergency Coordinator shall ensure next-of-kin are properly notified as soon as possible and give whatever company support and assistance is necessary to assist them bundle the situation
- The Emergency Coordinator shall ensure that senior management personnel are advised of the emergency as soon as practical after the event.



Note: Name of contact person and call number from Owner/ Contractor to be determined.

Section A: Identification Data										
Report No:	Date of Reported:				Reporter:	Sign:				
Job Title:					Company Name:					
Section B: Violence Rate										
Accident Violence: <input type="checkbox"/> 01-Death <input type="checkbox"/> 02-Serious Injury <input type="checkbox"/> 03-Lost Time Injury <input type="checkbox"/> 04-First Aid <input type="checkbox"/> 05- Not Injury <input type="checkbox"/> 06-Near Miss										
Property Damage Cost: <input type="checkbox"/> 1-2,000 USD <input type="checkbox"/> 2,001-10,000 USD <input type="checkbox"/> 10,001-50,000 <input type="checkbox"/> > 50,001										
Section C: Environmental Impact										
Affected area	<input type="checkbox"/> Construction area			<input type="checkbox"/> Public area						
Receptor	<input type="checkbox"/> None			<input type="checkbox"/> Workers			<input type="checkbox"/> Community			
Type of pollution	<input type="checkbox"/> Physical			<input type="checkbox"/> Chemical			<input type="checkbox"/> Biological			
Toxicity	<input type="checkbox"/> Non-toxic			<input type="checkbox"/> Low - toxic			<input type="checkbox"/> High - toxic			
Return to Normal	<input type="checkbox"/> 1 day			<input type="checkbox"/> 1 day to 1 week			<input type="checkbox"/> ≥ 1 week			
Cumulative impact	<input type="checkbox"/> Non-cumulative			<input type="checkbox"/> Cumulative						
Section D: Injured/Illness Employee										
1.Name:		Sex:	Date of Birth:			Age:	Regular Job Title:		Experience:	
		<input type="checkbox"/> Male <input type="checkbox"/> Female	Month	Day	Year				In this job title	In this Project
								Years	Weeks	Years
								Weeks		Weeks
Site:		Company:		Reference:			Phone No:		Social Security Number:	
Part of Body Injured or Affected:					Nature of Injury or Illness:					
<input type="checkbox"/> Head	<input type="checkbox"/> Hands	<input type="checkbox"/> Face	<input type="checkbox"/> Nose	<input type="checkbox"/> Laceration	<input type="checkbox"/> Amputation	<input type="checkbox"/> Puncture	<input type="checkbox"/> Fracture			
<input type="checkbox"/> Eyes	<input type="checkbox"/> Legs	<input type="checkbox"/> Teeth	<input type="checkbox"/> Neck	<input type="checkbox"/> Strain & Sprain	<input type="checkbox"/> Burns	<input type="checkbox"/> Contusion	<input type="checkbox"/> Dry Heat Friction			
<input type="checkbox"/> Trunk	<input type="checkbox"/> Toes	<input type="checkbox"/> Elbow	<input type="checkbox"/> Shoulder	<input type="checkbox"/> Hernia	<input type="checkbox"/> Foreign Body	<input type="checkbox"/> Chemical	<input type="checkbox"/> Contamination			
<input type="checkbox"/> Back	<input type="checkbox"/> Ankle	<input type="checkbox"/> Wrist	<input type="checkbox"/> Foot	<input type="checkbox"/> Skin (Occupationnel)	<input type="checkbox"/> Rash	<input type="checkbox"/> Irritation				
<input type="checkbox"/> Arms	<input type="checkbox"/> Thump	<input type="checkbox"/> Fingers	<input type="checkbox"/> Internal							
Remark:					Remark:					
2.Name:		Sex:	Date of Birth:			Age:	Regular Job Title:		Experience:	
		<input type="checkbox"/> Male <input type="checkbox"/> Female	Month	Day	Year				In this job title	In this Project
								Years	Weeks	Years
								Weeks		Weeks
Site:		Company:		Reference:			Phone No:		Social Security Number:	
Part of Body Injured or Affected:					Nature of Injury or Illness:					
<input type="checkbox"/> Head	<input type="checkbox"/> Hands	<input type="checkbox"/> Face	<input type="checkbox"/> Nose	<input type="checkbox"/> Laceration	<input type="checkbox"/> Amputation	<input type="checkbox"/> Puncture	<input type="checkbox"/> Fracture			
<input type="checkbox"/> Eyes	<input type="checkbox"/> Legs	<input type="checkbox"/> Teeth	<input type="checkbox"/> Neck	<input type="checkbox"/> Strain & Sprain	<input type="checkbox"/> Burns	<input type="checkbox"/> Contusion	<input type="checkbox"/> Dry Heat Friction			
<input type="checkbox"/> Trunk	<input type="checkbox"/> Toes	<input type="checkbox"/> Elbow	<input type="checkbox"/> Shoulder	<input type="checkbox"/> Hernia	<input type="checkbox"/> Foreign Body	<input type="checkbox"/> Contamination	<input type="checkbox"/> Chemical			
<input type="checkbox"/> Back	<input type="checkbox"/> Ankle	<input type="checkbox"/> Wrist	<input type="checkbox"/> Foot	<input type="checkbox"/> Skin (Occupationnel)	<input type="checkbox"/> Rash	<input type="checkbox"/> Irritation				
<input type="checkbox"/> Arms	<input type="checkbox"/> Thump	<input type="checkbox"/> Fingers	<input type="checkbox"/> Internal							
Remark:					Remark:					
Section E: Accidents/incident Details										
Date Accident/Incident Occurred:				Time Accident/Incident Occurred:				Exact Location of the Accident / Incident:		

Details of the actual Job Being done at the time:

Details of Accident / Incident / What actually happened?

Section F: Accident Cause (Basic cause mark X / Contributing cause, if any mark O)

UNSAFE CONDITIONS

- 1 Inadequately Guarded
- 2 Unguarded
- 3 Defective Tools, Equipment, or Substance
- 4 Unsafe Design or Construction
- 5 Hazardous Arrangement
- 6 Unsafe Illumination
- 7 Unsafe Ventilation
- 8 Unsafe Clothing
- 9 Insufficient Instruction
- 10 Lack of system of work

UNSAFE ACTS

- 1 Operating Without Authority / Training
- 2 Operating at Unsafe Speed
- 3 Marking SHE Device Inoperative
- 4 Using Unsafe Equipment or Equipment Unsafely
- 5 Unsafe Loading, Placing, Mixing
- 6 Taking Unsafe Position
- 7 Working on Moving or Dangerous Equipment
- 8 Distraction, Teasing, Horse Play
- 9 Failure to use Personal Protective Devices
- 10 Lack of effective instruction or supervision

Why was the unsafe act committed? _____

Why did the unsafe condition exist? _____

Section G: Guide to Corrective Action (Base on the cause checked above, I am taking the following corrective action)

UNSAFE ACT

- Stop the Behaviour
- Study the job
- Instruct (tell-show-try-check)
- Follow Up
- Enforce

UNSAFE CONDITION

- Remove
- Guard
- Warn
- Supervisory Training

If Supervisor can't handle, then recommend to

- Site Engineer, or
- Site Manager, or
- Project Manager, or
- Safety Committee

Detail below any immediate remedial actions that have been taken:

Detail below any corrective and preventative actions that could be taken to prevent future re-occurrence:

Responsible

Completion Date

Section H: Witness Statement			
Witness Name		Interviewer Name	
Section I: Reviewed & Recommend by			
Recommendation:			
Reviewed By:	Position:	Signature:	Date:
Remarks : If Accident or Incident happened with lost time injury and affected to the publicity must further report to Safety Department; : First Aid Cases will not applicable to this form; : The accident report shall submit to Safety Department within 3 days : Attached the photograph or sketch the location of accident / incident;			

Annexure E

Archaeological ‘Chance Find’ procedure

Background

The purpose of this document is to address the possibility of archaeological deposits becoming exposed during ground altering activities within the project area and to provide protocols to follow in the case of a chance archaeological find to ensure that archaeological sites are documented and protected as required.

Archaeological sites are an important resource that is protected for their historical, cultural, scientific and educational value to the general public and local communities. Impacts to archaeological sites must be avoided or managed by development proponents. The objectives of this 'Archaeological Chance Find Procedure' are to promote preservation of archaeological data while minimizing disruption of construction scheduling. It is recommended that due to the moderate to high archaeological potential of some areas within the project area, all on site personnel and contractors be informed of the Archaeological Chance Find Procedure and have access to a copy while on site.

Potential Impacts to Archaeological Sites

Developments that involve excavation, movement, or disturbance of soils have the potential to impact archaeological materials, if present. Activities such as road construction, land clearing, and excavation are all examples of activities that may adversely affect archaeological deposits.

Archaeological 'Chance Find' Procedure

If you believe that you may have encountered any archaeological materials, stop work in the area and follow the procedure below:

The following 'chance-find' principles will be implemented by the contractor throughout the construction works to account for any undiscovered items identified during construction works:

- (i) Workers will be trained in the location of heritage zones within the construction area and in the identification of potential items of heritage significance.
- (ii) Should any potential items be located, the site supervisor will be immediately contacted and work will be temporarily stopped in that area.
- (iii) If the site supervisor determines that the item is of potential significance, an officer from the department of Archaeology (DoA) will be invited to inspect the site and work will be stopped until DoA has responded to this invitation.
- (iv) Work will not re-commence in this location until agreement has been reached between DoA and IPIG as to any required mitigation measures, which may include excavation and recovery of the item.

(v) A precautionary approach will be adopted in the application of these procedures.

Detailed Procedural Steps

- If the Director, department of Archaeology receives any information or otherwise has the knowledge of the discovery or existence of an antiquity of which there is no owner, he shall, after satisfying himself as to the correctness of the information or knowledge, take such steps with the approval of the Government, as he may consider necessary for the custody, preservation and protection of the antiquity.
- Whoever discovers, or finds accidentally, any movable antiquity shall inform forth with the Directorate within seven days of its being discovered or found.
- If, within seven days of his being informed, the Director decides to take over the antiquity for purposes of custody, preservation and protection, the person discovering or finding it shall hand it over to the Director or a person authorized by him in writing.
- Where the Director decides to take over an antiquity, he may pay to the person by whom it is handed over to him such cash reward as may be decided in consultation with the Advisory Committee.
- The Director or any officer authorized by him with police assistance may, after giving reasonable notice, enter into, inspect and examine any premises, place or area which or the sub-soil of which he may have reason to believe to be, or to contain an antiquity and may cause any site, building, object or any antiquity or the remains of any antiquity in such premises, place or area to be photographed, copied or reproduced by any process suitable for the purpose.
- The owner or occupier of the premises, place or area shall afford all reasonable opportunity and assistance to the Director.
- No photograph, copy of reproduction taken or made shall be sold or offered for sale except by or with the consent of the owner of the object of which the photograph, copy or the reproduction has been taken or made.
- Where substantial damage is caused to any property as a result of the inspection, the Director shall pay to the owner thereof reasonable compensation for the damage in consultation with the Advisory Committee.
- If the Director after conducting an inquiry, has reasonable grounds to believe that any land contains any antiquity, he may approach the Government to direct the Revenue Department

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to acquire such land or any part thereof and the Revenue Department shall thereupon acquire such land or part as for a public purpose.

Annexure F

Dust Management Plan

The purpose of this plan is to describe the measures that the project shall take to ensure that the risk of emissions from dust generated by site operations during construction are minimized and that best practice measures are implemented.

Dust emissions from construction can cause ill health effects to Contractor staff along with nuisance and annoyance to members of the local community. Dust will be controlled through:

- Elimination
- Reduction/Minimisation
- Control

This dust management plan shall be implemented based on the measures already provided in the Environmental Management Plan (EMP) relating to controlling dust emissions.

Methodology

The following methodology will be undertaken for each project section:

Step 1 – Identify the dust generating activities

Construction activities that are likely to produce dust will be identified. The activities that will be taken into account are:

Haulage Routes, Vehicles and Asphalt/Concrete Batching Plant

- Roads, surfaces and public highways
- Static and mobile combustion plant emissions
- Tarmac laying, bitumen surfacing and coating

Materials Handling, Storage, Spillage and Disposal

- Storage of material
- Stockpiles
- Spillages
- Storage of Waste

Site Preparation and Restoration after Completion

- Earthworks, excavation and digging
- Storage of spoil and topsoil

Demolition

Construction and Fabrication Processes

Step 2 – Identify Sensitive Receptors

Sensitive receptors have already been identified. The nature and location of the sensitive receptors will be taken into account when implementing control measures.

Step 3 – Implement Best Practice Measures to Control

Based on the nature of the activity producing the dust, the likelihood of dust being produced and the possible consequence of dust based on the sensitive receptors, the most effective control measure will be identified and implemented.

Step 4 – Monitor effectiveness of control

Construction Supervision Staff (CSC) will have the responsibility to ensure that dust control measures are being implemented and are effective.

Step 5 – Record and report result of monitoring

All inspections, audits and results of monitoring will be recorded and kept as part of the site filing system.

Method Statements and Risk Assessments

The Contractor's Risk Assessments and Method Statements will be required to be approved by the CSC prior to commencing work and will be required to contain environmental aspects of the task, including dust control measures where required.

Where dust has been identified within the risk assessment as a significant issue, the method statement will be required to cover the following:

- Methods and materials that will be used to ensure that dust generation is minimized.
- The use of pre-fabricated materials where possible.
- Optimum site layout:
 - Dust generating activities to be conducted away from sensitive receptors
 - Supply of water for damping down.
- Good housekeeping and management

All employees will be briefed on the Risk Assessment and Method Statement before starting work.

Training

All Contractor staff will be required to attend training seminars as already mentioned in the EMP document. A site-specific induction will also be required before being allowed to work on site. These will include site-specific sensitive receptors and details regarding dust control measures to be taken. Toolbox talks on air pollution and minimizing dust emissions will be provided on a regular basis to Contractor staff.

Identification of Dust Generating Sources and Control Methods

Haulage Routes, Vehicles and Asphalt/Concrete Batching Plant	
Dust Source	Dust Control Methods
Major haul roads and traffic routes	Haul roads will be dampened down via a mobile bowser, as required.
Public Roads	Road sweeper will be used to clean public roads as required.
Site traffic management	<ul style="list-style-type: none"> ▪ Site traffic will be restricted to constructed access roads as far as possible. ▪ Site speed limit will be set at 10 mph as this will minimize the production of dust.
Road Cleaning	A mechanical road sweeper will be readily available and used.
Handling, Storage, Stockpiling and Spillage of Dusty materials	
Material handling operations	The number of times a material will have to be handled will be kept to a minimum to prevent double handling and ensure dusty materials are not handled unnecessarily.
Transport of fine dusty materials and aggregates.	Closed tankers will be used or sheeted vehicles.
Vehicle loading/unloading materials on to vehicles and conveyors.	<ul style="list-style-type: none"> ▪ Dusty materials will be dampened down ▪ Drop heights will be kept to a minimum and enclosed where possible.
Storage of Materials	
Bulk cement, bentonite etc.	This will be delivered in tankers and stored in dedicated enclosed areas.
Fine dry materials	These will be protected from the weather and by storing in appropriate containers and indoors, where necessary.
Storage location	Material will be stored in dedicated lay-down areas.
Storage of Stockpiles	
Stockpile location	Stockpiles will be placed so as to minimize double handling and facilitate the site restoration.

Building stockpiles	Stockpiles, tips and mounds will not be stored at an angle greater than an angle of repose of the material.
Small and temporary stockpiles	<ul style="list-style-type: none"> ▪ Where possible, stockpiles will be placed under sheeting. ▪ Dusty material will be damped down. ▪ Wind barriers (protective fences) of a similar height to the stockpile will be erected, if required.
Large and long term stockpiles	<ul style="list-style-type: none"> ▪ Long-term stockpiles will be vegetated and stabilized as soon as possible. ▪ Stock piles will be dampened down until stabilized, where necessary. ▪ Wind barriers (protective fences) of a similar height to the stockpile will be erected, if required.
Waste Material from Construction	
Disposal method	<p>A dedicated lay-down area will be available for waste.</p> <p>Waste will not be allowed to build up and will be disposed off at the designated locations as per EMP.</p>
Site Preparation and Restoration	
Earthworks, excavation and digging	These activity areas will be kept damp where required and if possible, will be avoided during dry and windy periods.
Completed earthworks	Surfaces will be stabilized by re-vegetation as soon as possible, where applicable.
Construction and Fabrication Process	
Crushing of material for reuse, transportation and disposal	<ul style="list-style-type: none"> ▪ Authorization will be obtained from IPIG and ADB before using any mobile plant on site for activities such as crushing and screening. ▪ Any crushing or screening activities will be located away from sensitive receptors.
Cutting, grinding, drilling, sawing, trimming, planning, sanding	<ul style="list-style-type: none"> ▪ These activities will be avoided wherever possible. ▪ Equipment and techniques that minimize dust will be implemented. ▪ Water will be used to minimize dust.
Cutting roadways, pavements, blocks	Water sprinkling to be used.
Angle grinders and disk cutters	Best practice measures will be used such as dust extraction.

Monitoring Arrangements

Monitoring will be conducted at sensitive receptor locations in the project area as provided in the EMP. Furthermore, at locations where PM levels are exceeding applicable guidelines, additional

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stringent measures will be implemented at the respective location(s) in the project area to ensure dust levels are controlled as far as possible.

ANNEXURE G

Site Specific EMP (SSEMP) Guide & Template for Guidance to Contractor

Guide for Development of SEMP

Step 1: Define Boundaries

Step 2: Identify Sensitive Receptors

Step 3: Specify construction activities

Step 4: Conduct Risk Assessment

Step 5: Assign Environment Management measures

Step 6: Prepare Site Plans

Step 7: Prepare Environment Work Plans (if required)

Step 8: Monitoring

Step 1: The project area needs to be clearly defined.

Step 2: The mapping of sensitive receptors has already been conducted and needs to be presented clearly in a map.

Step 3: The tentative construction activities to be conducted are as follows:

- **Site Surveying and Vegetation (Trees and plants) Clearance**
- **Establishment of Work Camp, Batching and Asphalt plant and access roads**
- **Dismantling of Asphalt and existing structures including Utilities**
- **Preparation of ground for Asphaltting**
- **Asphaltting**
- **Landscaping**

Step 4: The Risk Assessment matrix template is provided in the table below.

Risk is assessed as the likelihood that the activity will have an effect on the environment as well as the consequence of the effect occurring. It is often described like this:

$$\text{Risk} = \text{Likelihood} \times \text{Consequence}$$

Likelihood Scale

Likelihood	Definition	Scale
Certain	Will certainly occur during the activity at a frequency greater than every week if preventative measures are not applied	5
Likely	Will occur more than once or twice during the activity but less than weekly if preventative measures are not applied	3
Unlikely	May occur once or twice during the activity if preventative measures are not applied	2
Rare	Unlikely to occur during the project	1

Consequence Scale

Consequence	Definition	Score
Catastrophic	<p>The action will cause unprecedented damage or impacts on the environment or surrounding communities e.g.</p> <ul style="list-style-type: none"> extreme loss of soil and water resources and quality from stormwater runoff extreme pollution of soil and water resources including major contamination from hazardous materials widespread effects on ecosystems with deaths of fauna/flora widespread community impacts resulting in illness, injury or inconvenience loss or destruction of archaeological or historical sites <p>Occurrence will almost certainly result in the work being halted and a significant fine.</p>	5

Major	The action will cause major adverse damage on the environment or surrounding communities e.g. major loss of soil and water resources and quality from stormwater runoff major pollution of soil and water resources including contamination from hazardous materials significant effects on ecosystems with isolated deaths of non-vulnerable flora and fauna significant annoyance or nuisance to communities major damage to or movement required to archaeological or historical sites Occurrence may result in work being halted and a fine	3
Moderate	No or minimal adverse environmental or social impacts e.g. no measurable or noticeable changes in stormwater quality. Water quality remains within tolerable limits little noticeable effect on ecosystems no or isolated community complaints no or unlikely damage to archaeological or historical sites no likelihood of being fined	2
Minor	No or minimal adverse environmental or social impacts e.g. no measurable or noticeable changes in stormwater quality. Water quality remains within tolerable limits little noticeable effect on ecosystems no or isolated community complaints no or unlikely damage to archaeological or historical sites no likelihood of being fined	1

Risk Score Table

	Consequence				
	Catastrophic	Major	Moderate	Minor	
Likelihood	Certain	25	15	10	5
	Likely	15	9	6	3
	Unlikely	10	6	4	2
	Rare	5	3	2	1

Risk: Significant: 15-25

Medium: 6-10

Low 1-5

Any Medium to Significant risk requires an environmental management measure to manage the potential environmental risk. Judgement will be required concerning the application of an environmental management measure to mitigate low risk situations.

The higher the risk the more intensive the required mitigation measure will need to be; e.g. where site sedimentation is deemed to be low risk, then silt fences may be needed but as the risk increases, then sediment traps may be required. The selection of the appropriate mitigation measure will require judgement based on the level of risk and the specific site parameters.

Step 5: The Environmental Management measures are to be extracted from the IEE study for this project and should be added in the last column of the table below.

No.	Construction Activity	Hazards to Consider	Likelihood that the site or sensitive receptors will be affected?	Consequence of the site or sensitive receptors being affected?	Risk Score (consequence x likelihood)	Environmental Management Measures
i	Site Surveying & vegetation clearance	Damage to vegetation beyond project footprint				These can be taken from the EMP provided in the IEE report (If Risk Score is 6 or more)
		Erosion of exposed areas and sediment				
		Loss of topsoil				
		Dust generation				
		Noise				
ii	Establishment of Work Camp, Batching plant etc.	Soil deposited onto roads from tires				
		Stockpile erosion				
		Noise & Vibration				
		Traffic congestion				

		Fuel spills				
iii	Dismantling of Asphalt and existing structures including Utilities	Noise and vibration				
		Dust generation				
		Community safety				
		Worker safety				
		Traffic Congestion				
iv	Preparation of Sub-Base	Noise and vibration				
		Dust generation				
		Traffic Congestion				
v	Asphalting	Noise and vibration				
		Dust generation				
		Traffic Congestion				
		Community safety				

		Labor safety (PPEs)				
vi	Landscaping	Dust generation				
		Sediment runoff				
		Failure of vegetation to take root				

Step 6: The Site plans are a critical part of the SSEMP and will need to be prepared, otherwise the ADB will consider the document as incomplete.

The site plan will need to provide the following:

- **Indication of North and scale**
- **Existing and planned supporting infrastructure (e.g. access roads, water supplies and electricity supplies)**
- **Location of planned work**
- **Contours**
- **Drainage systems**
- **Locations of sensitive receptors**

Step 7 (if required)³²: The completed SSEMP provides details of all the environmental management requirements for all stages of the construction process. For individual work teams who are responsible for only a small part of the overall construction works it can be confusing as to what is required for their particular work component. For example, the work team responsible for stripping soil for the construction areas are not going to be interested in the requirements for pouring concrete for footings and foundations. However, it is essential that the soil stripping team knows exactly what to clear and what to leave and where to put stockpiles of soil for later use.

In situations where different work activities are required at different times or at different locations, environmental work plans can be prepared. These are similar to the work method statements that are often produced for major construction projects.

Step 8: A detailed monitoring plan will be provided along with frequency and responsibilities to ensure all key environmental parameters are monitored to ensure compliance with both national and ADB requirements.

Template for SSEMP

1. Introduction

1.1 Project Overview

³² ADB, Safeguards Unit for Central & West Asia Department, *Environmental Management for Construction Handbook*.

- 1.2 Scope of SSEMP
- 1.3 Objectives of SSEMP
- 2. Map of Sensitive Receptors**
- 3. Construction Activities**
 - 3.1 Activities
- 4. Risk Assessment**
 - 4.1 Risk Assessment Matrix & Mitigation Measures
- 5. Site Plan(s)**
- 6. Environmental Monitoring Plan**
 - 6.1 Instrumental Monitoring of Environmental Parameters by Contractor as per EMP
 - 6.2 In-house monitoring
 - 6.3 Third Party environmental monitoring
 - 6.4 Visual monitoring of Environmental Parameters by Contractor as per EMP
- 7. Responsibilities**
 - 7.1 Organizational Responsibilities and Communication
 - 7.2 Responsibility of EA
 - 7.3 Responsibility of Construction Supervision Consultant (CSC)
 - 7.4 Responsibility of Contractor
 - 7.5 Responsibility of EPA

ANNEXURE H

Ambient Laboratory Monitoring

Air Quality



Monitoring Location Chak Muhammad Pur



Page 1 of 6

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GROUND WATER ANALYSIS REPORT

Sample Detail			
Reference No.	AFS-070-LG/2020	Reporting Date	08-06-2020
Nature of Sample	Ground Water	Grab/Composite	Grab
Date of Sample Collection	02-06-2020	Date of Sample Receipt	04-06-2020
Sample Collected by/Sent By	AES	Temperature & Humidity	25°C & 54%
Sample ID	A2S-GW-25/2020	Sampling Location	Tap Water (Chak Muhammad Pur)
Project Name	Baseline Environmental Study Of Sewage Treatment Plant, Sahiwal		
Client Detail	Punjab Intermediate Cities Improvement Investment Program, Local Government and Community Development Department Govt Of Punjab		



Nitrate (NO ₃ ⁻)	APHA 4500 NO ₃ ⁻ B	≤ 50 mg/l	0.0	Optimal
Nitrite (NO ₂ ⁻)	APHA 4500 NO ₂ ⁻ B	≤ 3.0 mg/l	0.0	Optimal
Selenium (Se)	APHA 3114 B	0.01 mg/l	<0.01	Optimal
Residual Chlorine	APHA 4500 Cl ₂ B	0.5 mg/l	0.0	Optimal
Phenolic Compounds (as Phenols)	APHA 5510 D	NGVS	0.044	Optimal
Zinc (Zn)	APHA 3113 B	5.0 mg/l	0.056	Optimal
Microbiological Analysis				
Total Coliforms	APHA 9222 B	0/ 100 mL CFU	0	Optimal
Fecal Coliforms	APHA 9222 D	0/ 100 mL CFU	0	Optimal

Abbreviations:

PEQS = Punjab Environment Quality Standards APHA = American Public Health Association BDL = Below Detection Limit
 TCU = True Color Unit NGVS = No Guideline Value Set CFU = Colony Forming Unit
 NTU = Nephelometric Turbidity Unit

Report Disclaimer

The remaining portion of the sample(s) will be disposed off after 15 days after the issuance date of report from the laboratory unless otherwise instructed (Condition Apply).
 This report shall not be reproduced in part/whole.

Analyzed By



Reviewed By

 (TM)

Approved By

 (QM)

-----End of Report-----

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Date of Sample Collection	02-06-2020	Date of Sample Receipt	04-06-2020	
Sample Collected by/Sent By	AES	Temperature & Humidity	25°C & 54%	
Sample ID	AES-GW-25/2020	Sampling Location	Tap Water (Chak Muhammad Pur)	
Project Name	Baseline Environmental Study Of Sewage Treatment Plant, Sahiwal			
Client Detail	Punjab Intermediate Cities Improvement Investment Program, Local Government and Community Development Department Govt Of Punjab			



Ground Water Analysis Results				
Parameter	Analysis Method	PEQS	Result	Remarks
Field Analysis				
Temperature	APHA 2550 B	NGVS	23	Optimal
pH	APHA 4500 H ⁺ B	6.5- 8.5	7	Optimal
Lab Analysis				
Color	APHA 2120 C	≤ 15 TCU	0.0	Optimal
Taste	APHA 2160 C	Non- Objectionable	Non- Objectionable	Optimal
Odor	APHA 2150 B	Non- Objectionable	Non- Objectionable	Optimal
Turbidity	APHA 2130 B	< 5 NTU	2.45	Optimal
Total Hardness (as CaCO ₃)	APHA 2340 C	< 500 mg/l	443	Optimal
Total Dissolved Solids (TDS)	APHA 2540 C	< 1000 mg/l	580	Optimal
pH	APHA 4500 H ⁺ B	6.5- 8.5	7.14	Optimal
Aluminum (Al)	APHA 3111 B	≤ 0.2 mg/l	0.007	Optimal
Antimony (Sb)	APHA 3114 B	≤ 0.005 mg/l	<0.005	Optimal
Arsenic (As)	APHA 3114 B	≤ 0.05 mg/l	0.007	Optimal
Barium (Ba)	APHA 3113 B	0.7 mg/l	<0.005	Optimal
Boron (B)	APHA 3113 B	0.3 mg/l	0.02	Optimal
Cadmium (Cd)	APHA 3113 B	0.01 mg/l	<0.006	Optimal
Chloride (Cl)	APHA 4500 Cl ⁻ B	< 250 mg/l	45.5	Optimal
Chromium (Cr)	APHA 3113 B	≤ 0.05 mg/l	<0.003	Optimal
Copper (Cu)	APHA 3111 B	2.0 mg/l	0.164	Optimal
Cyanide (CN ⁻)	APHA 4500 CN ⁻ F	≤ 0.05 mg/l	0.0	Optimal
Fluoride (F ⁻)	APHA 4500 F ⁻ C	≤ 1.5 mg/l	0.0	Optimal
Lead (Pb)	APHA 3114 B	≤ 0.05 mg/l	0.05	Optimal
Manganese (Mn)	APHA 3113 B	≤ 0.5 mg/l	0.016	Optimal
Mercury (Hg)	APHA 3114 B	≤ 0.001 mg/l	<0.001	Optimal
Nickel (Ni)	APHA 3113 B	<0.02 mg/l	0.012	Optimal

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Ambient Air Monitoring Report

Monitoring Details					
Reference Number	AES-070-LG/2020	Reporting Date	08-06-2020		
Monitoring Coordinates	30°42'41.5"N 73°01'46.8"E	Date of Monitoring	01 & 02 Jun, 2020		
Project name	Baseline Environmental Study Of Sewage Treatment Plant, Sahiwal				
Parameters	Units	Monitoring Duration	LDL	Average Obtained Concentration	PEQS
Nitrogen Dioxide (NO ₂)	µg/m ³	24Hours	1.00	18.55	80.0
Nitrogen Oxide (NO)	µg/m ³	24Hours	1.00	10.15	40.0
NO _x	µg/m ³	24Hours	1.00	28.70	120.0
Sulphur Dioxide (SO ₂)	µg/m ³	24Hours	1.00	22.07	120.0
Carbon Monoxide (CO)	mg/m ³	24Hours	0.01	0.69	05.0
Particulate Matter (PM ₁₀)	µg/m ³	24Hours	1.00	127.91	150
Particulate Matter (PM _{2.5})	µg/m ³	24Hours	1.00	30.76	35
Suspended Particulate Matters (SPM)	µg/m ³	24Hours	1.00	279.97	500

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Abbreviation:
 LDL= Lower Detection Limit PEQS= Punjab Environmental Quality Standard µg/m³= Micro Grams per Meter Cube
 mg/m³= Mill Grams per Meter Cube



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Noise Levels



Noise Level Monitoring Report

Monitoring Details			
Reference Number	AES-070-LG/2020	Reporting Date	08-06-2020
Monitoring Coordinates	30°42'41.5"N 73°01'46.8"E	Date of Monitoring	01 & 02 Jun, 2020
Project name	Baseline Environmental Study Of Sewage Treatment Plant, Sahiwal		
Sr. No.	Time	Noise dB(A)	PEQS
1	09:00	53.4	
2	10:00	52.5	
3	11:00	53.9	
4	12:00	51.1	
5	13:00	50.3	
6	14:00	52.2	
7	15:00	53.5	Day Time 65
8	16:00	51.7	
9	17:00	49.1	
10	18:00	51.8	
11	19:00	48.9	
12	20:00	44.2	
13	21:00	43.1	
14	22:00	41.2	
15	23:00	42.2	
16	00:00	41.4	
17	01:00	39.5	
18	02:00	38.2	Night Time 55
19	03:00	42.1	
20	04:00	43.7	
21	05:00	41.3	
22	06:00	43.9	
23	07:00	42.1	Day Time 65
24	08:00	45.2	

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Lead Field Operations



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